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THE

# HISTORY

OF THE

# ROYAL SOCIETY of LONDON,

FOR IMPROVING OF

# NATURAL KNOWLEDGE,

FROM ITS FIRST RISE.

IN WHICH

The moſt conſiderable of thoſe Papers communicated to the SOCIETY, which have hitherto not been publiſhed, are inſerted in their proper order,

AS A SUPPLEMENT TO

THE PHILOSOPHICAL TRANSACTIONS.

By THOMAS BIRCH, D.D.
SECRETARY to the ROYAL SOCIETY.

VOL. III.

*Talem intelligo* PHILOSOPHIAM NATURALEM, *quæ non abeat in fumos ſpeculationum ſubtilium aut ſublimium, ſed quæ efficaciter operetur ad ſublevanda vitæ humanæ incommoda.* BACON de Augm. Scient. L. ii. c. 2.

LONDON:
Printed for A. MILLAR in the Strand.
MDCCLVII.

# THE HISTORY OF THE ROYAL SOCIETY of LONDON, FOR IMPROVING OF NATURAL KNOWLEDGE, FROM ITS FIRST RISE.

$167\frac{1}{2}$, *Jan.* 11. MR. ISAAC NEWTON was elected.

Sir FRETCHVIL HOLLES was propoſed candidate by the preſident.

Mention was made of Mr. NEWTON's improvement of teleſcopes by contracting them; and that that, which he had ſent to the Society of that kind to be examined, had been by the king, and conſidered alſo by the preſident, Sir ROBERT MORAY, Sir PAUL NEILE, Dr. CHRISTOPHER WREN, and Mr. HOOKE at Whitehall; and that they had ſo good opinion of it, as they concluded, that a deſcription and ſcheme of it ſhould be ſent by the ſecretary in a letter to Monſ. HUYGENS [a] then at Paris, thereby to ſecure this contrivance to the author, who had alſo written a letter to Mr. OLDENBURG from Cambridge, dated January 6, $167\frac{1}{2}$, altering and enlarging the deſcription of his inſtrument, which had been ſent him for his review, before it ſhould go abroad.

This deſcription was read, and ordered to be entere , together with the ſcheme, in the Regiſter-book [b]. Mr. NEWTON's letter was as follows [c]:

[a] Mr. OLDENBURG's letter to Monſ. HUYGENS was dated 1ſt January, $167\frac{1}{2}$, and entered in the Letter-book, vol. v. p. 92.

[b] Vol. iv. p. 123. It is publiſhed in the Philoſoph. Tranſact. vol. vii. n° 81.

[c] Letter-book, vol. v. p. 95.

" The deſcription of the inſtrument you ſent me is very well; only the ra-
" dius of the concave metal, which you put 14 inches, is more juſtly $12\frac{2}{3}$ or 13
" inches, and the radius of the eye-glaſs, which you put half an inch, is the
" twelfth part of it, if not leſs: for the metall collects the ſun's rays, at $6\frac{1}{3}$ inches
" diſtance, and the eye-glaſs at leſs than $\frac{1}{6}$ part of an inch diſtance from its vor-
" tex. By the tools alſo, to which they were ground, I know their dimenſions,
" and particularly meaſuring the diameter of the hemiſphærical concave, in which
" the eye-glaſs was ground, I find it the 6th part of an inch.

" Perhaps it may give ſome ſatisfaction to Monſ. HUYGENS to underſtand in
" what degree it repreſents things diſtinct and free from colours, and to know the
" aperture, by which it admits light. And after the words [—*verſus focum E re-*
" *flectatur*,] it may not be amiſs to add this note:

" Conferendo diſtantias foci iſtius á verticibus lentis & ſpeculi concavi, hoc
" eſt, EF $\frac{1}{6}$ dig. & ETV $6\frac{1}{3}$ dig. prodit ratio 1 ad 38, quâ judicatur objecta
" 38 vicibus circiter ampliari.

" And to this proportion is very conſentaneous the obſervation of the crown
" on the weather-cock, for the ſcheme repreſents it bigger by $2\frac{1}{2}$ times, when ſeen
" through this, than through an ordinary proſpective: and ſo ſuppoſing *that* to
" magnify 13 or 14 times (as by the deſcription it ſhould) *this* by experiment
" proportionably muſt magnify almoſt as much as I have aſſigned it.

" To the objection, that, with it, objects are difficultly found; I may an-
" ſwer, that that's the inconvenience of all tubes, that magnify much; and that
" after a little uſe the inconvenience will grow leſs; for I could readily enough
" find any day-objects, by knowing which way they were pointed from other ob-
" jects, that I accidentally ſaw in it; but in the night to find ſtars I confeſs it
" troubleſome enough: yet this may be eaſily remedied by two lights affixed
" to the iron rod, by which the tube is ſuſtained. And ſuch I once intended
" ſhould have been made before I ſent it away from me, but that I thought the
" defect would not be judged material. If ſuch ſights be not found a ſuffici-
" ent remedy, there may be an ordinary proſpective-glaſs faſtened to the ſame
" frame with the tube, and directed towards the ſame object, as DES-CARTES
" in his Dioptrics hath deſcribed for remedying the ſame inconvenience of his
" beſt teleſcopes.

" The plane ſide of the eye-glaſs is apt to be ſoiled with the duſt falling upon
" it; and therefore the little leading ring, put into the orifice of the bigger
" leaden barrel to moderate its aperture, muſt be ſometimes taken out, and the
" glaſs wiped with leather, done upon the ſmall end of a ſtick, or other ſuch
" like contrivance: but care muſt be taken, that the ſaid ring be not loſt, for
" without it objects appear very confuſed at the edges of the apparent ſpace. So
" if the concave metal contract any dullneſs, by moiſture or otherwiſe, it ought
" to be taken out and rubbed with gentle leather, but not with putty, or any
" thing that may wear the metal.

" I am

" I am very ſenſible of the honour done me by the biſhop of Sarum in pro-
" poſing me candidate, and which I hope will be further conferred upon me
" by my election into the Society. And, if ſo, I ſhall endeavour to teſtify my
" gratitude, by communicating what my poor and ſolitary endeavours can effect
" towards the promoting philoſophical deſign."

It was ordered, that a letter ſhould be written by the ſecretary to Mr. NEWTON to acquaint him of his election into the Society, and to thank him for the communication of his teleſcopes, and to aſſure him, that the Society would take care, that all right ſhould be done him with reſpect to this invention.

Mr. OLDENBURG acquainted the Society, that he had received from Mr. TENISON [c] an account of the practice of agriculture in Huntingdonſhire, in a letter written to him from Holywell, November 1, 1671; which relation was ordered to be joined to others of that nature.

Mr. OLDENBURG read a letter to him by Mr. VERNON from Paris, January 9, $167\frac{1}{2}$ [d], deſcribing the method obſerved by Monſ. PICART in meaſuring the earth, whereby it appeared, that he aſſigned 57060 Pariſian toiſes or fathoms, *numero rotundo*, to a degree, or ſeventy-three Engliſh miles, reckoning five thouſand feet a mile.

Mr. HOOKE was exhorted to purſue and finiſh his way of meaſuring a degree, which he promiſed to do, hoping to bring it to a greater exactneſs and nearneſs.

Mr. OLDENBURG produced alſo a letter to himſelf, from ſignor CASSINI, dated at Paris, January 9, $167\frac{1}{2}$ [e], concerning his obſervations lately made of a new planet near Saturn, the ſcheme whereof was delivered to Mr. HOOKE, to conſider it, and thereupon to make the like obſervations.

*January* 18. Sir FRETCHVIL HOLLES was elected.

JOHN TILLOTSON, D. D. was propoſed candidate by the lord biſhop of Saliſbury.

Mr. HORNECK preſented the Society with ſome African curioſities, lately brought by a friend of his from Fez, *viz.*

1. A fair fruit of Coloquintida.

2. Coloquintida ſeed.

3. An herb called *albenna*, held for a panacea by the people of the country.

4. Another herb, good againſt ſea-ſickneſs; the name of which plant was not known to him.

[c] Afterwards archbiſhop of Canterbury. [d] Letter-book, vol. v. p. 95. [e] Ibid. p. 118.

5. A kind of mineral eſteemed to be African lead-ore, of which ſome was given to Mr. BOYLE to examine it.

6. Some earth like fuller's earth, uſed there in waſhings before the people go into their temples.

Mr. OLDENBURG read a letter to him from Mr. LISTER, dated at York, January 10, 167½ [f], concerning veins in plants analogous to human veins. He was deſired to purſue his intentions of making farther obſervations on this ſubject.

Mr. NEWTON's new teleſcope was examined and applauded.

Mr. HOOKE made a propoſition of a highly conſiderable improvement of all ſorts of optic burning-glaſſes; which was this:

"The perfection of teleſcopes, microſcopes, ſcotoſcopes, and burning-glaſſes, "from lentes of figures as eaſily and perfectly made as plain and ſpherical, by "which the light and apparent magnitude of bodies may be moſt prodigiouſly "and regularly increaſed; and whatever almoſt hath been in notion and imagi-"nation, or deſired in optics, may be performed with great facility and truth."

The way of performing this he lodged in theſe characters:

| a | c | e | f | i | l | n | o | p | r | s | t | u | x |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 4 | 8 | 3 | 4 | 2 | 2 | 4 | 2 | 6 | 4 | 3 | 4 | 2. |

He received the thanks of the Society, and was deſired to impart the thing itſelf to the preſident for his lordſhip's peruſal.

*January* 25. Dr. TILLOTSON was elected.

There was produced a reflecting teleſcope of four feet long, of Mr. NEWTON's invention; which, tho' the metalline concave was not duly poliſhed, yet did pretty well, but was undercharged.

It was ordered to be perfected againſt the next meeting.

Sir ROBERT MORAY ſhewed the Society a ſmall piece of opaque glaſs made by Mr. BOYLE, to ſerve for reflecting concaves.

It was ordered, that Mr. BOYLE ſhould be aſked, whether larger pieces could be made of it for the uſe of Mr. NEWTON's teleſcopes.

Mr. OLDENBURG read a letter to himſelf from Mr. NEWTON, dated Cambridge, 18 January, 167½ [g], containing an intimation, 1. Of a way of preparing a fit

[f] Letter-book, vol. v. p. 123. It is printed in the Philoſ. Tranſact. vol. vi. n° 79. p. 3052. for January, 167½. [g] Letter book, vol. v. p. 142.

metalline

metalline matter for reflecting concaves. 2. Of a conſiderable philoſophical diſcovery, which he intended to ſend to the Society to be conſidered of and examined. It was as follows:

" Underſtanding by your laſt, that ſome of the fellows of the honourable Society, " in order to a bigger reflective teleſcope, are deviſing a fit metalline matter, let " me preſume to give them this caution, that whilſt they ſeek for a white, hard, " and durable metalline compoſition, they reſolve not upon ſuch an one, as is full of " ſmall pores, only diſcoverable by a microſcope: for tho' ſuch an one may, to " appearance, take a good poliſh, yet the edges of thoſe ſmall pores will wear " away faſter in the poliſhing than the other parts of the metal; and ſo however " the metal ſeem polite, yet it ſhall not reflect with ſuch an accurate regularity as " it ought to do. Thus tin-glaſs, mixt with ordinary bell-metal, makes it more " white, and apt to reflect a greater quantity of light; but withal its fumes raiſed " in the fuſion like ſo many aerial bubbles fill the metal full of thoſe microſcopical " pores: but white arſenic both blanches the metal, and leaves it ſolid, without any " ſuch pores, eſpecially if the fuſion hath not been too violent. What the ſtellate " regulus of Mars (which I have ſometimes uſed) or other ſuch like ſubſtance " will do, deſerves particular examination. Let me add further this intimation, " that putty, or other ſuch like powder, with which it is poliſhed, by the ſharp " angles of its particles fretteth the metal, if it be not very fine, and filleth it full " of ſuch ſmall holes as I ſpeak of. And therefore care muſt be taken of that " before judgment be given, whether the metal be throughout the body of it po- " rous or not.

" I deſire, that in your next letter you would inform me, for what time the " Society continue their weekly meetings; becauſe if they continue them for any " time, I am purpoſing them, to be conſidered of and examined, an account " of a philoſophical diſcovery, which induced me to the making of the ſaid tele- " ſcope; and I doubt not but will prove much more grateful than the communi- " cation of that inſtrument, being, in my judgment, the oddeſt, if not the moſt " conſiderable detection, which hath hitherto been made in the operations of na- " ture."

It was ordered, that Mr. Newton be thanked for his reſpect to the Society, and deſired to let them know the proportions of the ingredients mentioned by him in his letter, arſenic and bell-metal; as alſo to impart to them the intimated diſcovery, as ſoon as he conveniently could.

Mr. Oldenburg read an account of a method of reviving animals drowned, in a letter to him from Dr. Hierne, a member of the Society, dated at Paris [h]. It was as follows:

" Having the honour to be a member of the illuſtrious Royal Society, I think " myſelf highly obliged to contribute what I can (though that can be but very

[h] Letter-book, vol. v. p. 67.

" little)

" little) to the advance of their deſign. Though I have met with many curious " things, ſince my leaving England, yet I do not think them of importance " enough to preſent you with them; yet among them there is one thing, which " ſeems philoſophical enough and uſeful, if it could be brought to perfection and " into practice; that is, a way of reviving animals drowned, and that even after " they have been ſo, many hours. Here is one, that hath already made ſome " experiments concerning it. He made one, two or three months ago, which " ſucceeded in part. He took a dog, which having been drowned three days be- " fore, he made him to ſtir, though he brought him not quite to life again. It " was thought, that the reaſon, why he revived not altogether, was, becauſe the " dog had not been drowned in a river, but in a barrel, in which there was not " air enough to entertain life. This perſon maketh as yet a ſecret of his art; " but, I know, that in Finland and the neighbour countries it often comes to " paſs, that perſons, after they have been drowned two or three days, come " to life again. The main of the art conſiſts in the manner of drawing them out " of the water; about which I once diſcourſed largely with Monſ. LEYONBERG, " the reſident of Sweden. In ſhort, it is this; that as ſoon as they have found " the perſon drowned, they draw him up very gently towards the ſurface of the " water, yet without bringing him haſtily into the air, to the end, that the raw " and groſs air may not get into him impetuouſly, and mingle with the water, " that is yet in the lungs; and leaſt, when the circulation of the blood comes to " be made again, the blood does not burſt the pulmonic veins, and ſo by the " crudity of the water, the vital warmth of the heart be not extinguiſhed: " whence it is obſerved in almoſt all drowned perſons, that are not drawn up " with that care, that the blood iſſues out of their mouth; which alſo happened " to the dog above mentioned; and when that caſe happens, there is not any " hope left of recovery. Wherefore the Finlanders having found the drowned " body, they draw him gently towards the ſurface of the water, and pre- " ſently cover him with a thick cover, and carry him into a hot ſtove, " where they put him upon a tun, and roll him gently to and fro, beginning firſt " with a very gentle motion, and afterwards by degrees increaſing the agitation, " whereby the water comes out of the mouth, noſe, and other orifices. And the " water being come away, and the pores opened, they rub the patient with hot " linen cloths, and uſe other fomentations, and then he begins to live again little " by little; and after ſome days or weeks (ſome ſooner, ſome later, according to " the force and conſtitution of the patient) they often are revived. It is ob- " ſerved, that thoſe, which thus eſcape, have loſt much of their vivacity, and that " they are afterwards almoſt always very dull, and that their memory is much im- " paired; which doubtleſs happens, becauſe the blood hath been plentifully caſt " into the head, and ſo diſorders the functions of the brain and ſpirits: to which " alſo may much contribute the coldneſs of the water entering into the noſe and " ears. But to return to the Pariſian artiſt, I do not yet know the means he " uſeth. I know only thus much, that he maketh uſe of clyſters, the better to " evacuate the water out of the bowels, which is not practiſed in the countries I " ſpoke of. This I know alſo, that he puts aſhes over the body, which doubt- " leſs he doth in imitation of what happens to flies, which are revived being " put in warm aſhes, after they have been drowned. Perhaps the aſhes may open

" the

" the pores, and by their ſharpneſs may ſomewhat irritate the ſpirits, and bring " them into motion again, the which yet, I think, may be better done by rub- " bing with hot linen cloths.

" Before I conclude my letter and this account, I cannot but impart to you one " thing more relating to this matter: Monſ. OXHUWEN, a Swediſh gentleman, " very judicious and of great veracity, hath lately aſſured me, that ſome years " ago, in the pariſh of Botnare in Sweden, the place of his reſidence, ſituate " three leagues from Joukoping, a youth of fifteen or ſixteen years of age fell " into the water when he was fiſhing, whence he was not drawn up till the third " day after, and was recovered after the manner above deſcribed. And he added, " that the lad ſaid, he had lain in the water without any trouble, hearing what " was ſaid concerning him above water, and relating what his father had ſaid in " ſeeking him. But he lived but ſix months after this accident, and was quite " changed in his temper, being very melancholy; whereas before he was very " cheerful. Another Swede aſſured me likewiſe, that being at Upſal he fell alſo " into the river, whence he was drawn up an hour after, having heard, during " the time, all what had been ſaid on the river-ſide.

" I could tell you many more hiſtories of this nature, but I would not be tedi- " ous. You know what STIERNHELM, a Swediſh counſellor, one of the Royal " Society, wrote to you a year ago, of a gardener, that was fallen into the water " near that town, and how he was revived a good while after.

" I ſhall only add, that though thoſe, that are hanged and ſtrangled, die ſoon, " yet that is another thing, becauſe there wants not all air to a drowned animal, " as there doth to one that is ſtrangled. And although the lungs, by reaſon " of the abundance of water got in, cannot perform their function; yet ſince " the water cannot enter into the heart, nor the arteries and veins, the circu- " lation of the blood is not quite ſtopped, but only hindered; ſo that it cannot " be made but very ſlowly and inſenſibly, after the manner as in apoplexies or " hyſterical ſuffocations. If the paſſage of the nouriſhment is obſtructed, and " that the chyle cannot paſs, it is to be conſidered, that the vital heat alſo is " very weak in this caſe, and conſequently that the conſumption of the blood, " ſpirits, and nutriment is but ſmall, and in a manner the ſame as it is in the " bears of Lapland and Finland, which ſleep whole months without eating any " thing. Mean time, I acknowledge, that it is quite another thing, when per- " ſons fall into the ſea, or into foul and troubled waters, the pores whereof are " filled with other parts, and conſequently cannot contain ſo much air as freſh " and clear water doth."

It was ordered, that the phyſicians of the Society and other members ſhould be deſired to make experiments of this kind upon dogs.

Dr. BROWN preſented a remarkable kind of fine black, ſent to his father, Sir THOMAS BROWN, out of Iceland, ſeeming to agree with the *lapis obſidianus* men-

mentioned by PLINY, out of which the four elephants in the Temple of Concord, and the ſtatue of MENELAUS found by TIBERIUS in Ægypt, were made.

It was delivered to CHRISTOPHER COCKS the perſpective-maker, to try whether it would be fit for reflecting concaves.

Dr. BROWN produced likewiſe a ſort of ſmall black ſtones, ſeeming to be black pebbles, found upon the ground in many places of Iceland: as likewiſe a ſort of natural ſulphur digged out of the earth in the ſame iſland, found in ſeveral places there, and at great diſtances from the burning Hecla.

Dr. WREN intimated, that his highneſs Prince RUPERT had a way of making black lead run like a metal in a mould, ſo as to ſerve for black lead again.

The preſident being deſired to declare to the Society, whether he had conſidered of Mr. HOOKE's late propoſition of bringing teleſcopes and microſcopes, &c. to perfection, ſaid, that he had not yet had time to examine it well; but, by what he had ſeen, he could not but have a good opinion of it.

This was ſeconded by Dr. WREN, who had alſo been made acquainted with it by the inventor.

The Society urged the preſident and Mr. HOOKE, that ſomething might be undertaken in this matter, that might convince the world of the reality thereof.

Mr. HOOKE was put in mind of the experiment of forcing mercury and air through wood.

*Feb.* 1. The four foot teleſcope of Mr. NEWTON's invention was produced again, being improved ſince the laſt meeting. It was recommended to Mr. HOOKE, to ſee it perfected as far as it was capable of being.

Mr. HOOKE was put in mind to give, as ſoon as he could, a ſpecimen of his great propoſition of making teleſcopes, microſcopes, &c. in perfection.

A paper ſent to Dr. BROWN from his father, concerning a bulimia in a woman of one hundred and two years old, was read.

The experiments of reviving animals drowned were again recommended to the phyſicians of the Society, and particularly to Dr. TIMOTHY CLARKE, who promiſed, that he would do his part in making ſuch trials.

Mr. VERNON's letters to Mr. OLDENBURG from Paris, January 9, 27, and 30, 167½ [k], containing an account of the menſuration of the earth by Monſ. PICART, were read: as was alſo,

[k] Letter-book, vol. v. p. 99.

A let-

A letter of Mr. FLAMSTEAD to Mr. OLDENBURG, dated at Derby, 23 December, 1671, was read, containing his promiſed Appendix of the moon's appulſes to ſome of the Peleiades, to be obſerved in the year 1672 [l].

*Feb.* 8. Five letters to Mr. OLDENBURG were read:

1. Of Dr. WALLIS, dated February 5, 167½, intimating, that from ſeveral late obſervations of his he conjectured, that the moon's perigee and apogee might much influence the riſing and falling of the mercury in the barometer. This was recommended to thoſe members of the Society, who had bareſcopes, for further obſervation.

2. Of ſignor CORNELIO, in Italian, from Naples, of January 29, 167½ [m], declaring, that the ſtories related of the odd effects of the tarantula's ſtinging were in his opinion fictitious; and that, from many of his own obſervations, he was induced to believe, that without any preceding bite of that inſect, ſuch ſymptoms befal many of thoſe people who live in Apulia, a very dry country, and are often tormented with an exceſſive and long thirſt. He promiſed, within a ſhort time, to enlarge himſelf upon this ſubject, with many more obſervations [n].

3. Of Mr. ISAAC NEWTON from Cambridge, 6 February, 167½, concerning his diſcovery of the nature of light, refractions, and colours; importing, that light is not a ſimilar, but a heterogeneous body, conſiſting of different rays, which had eſſentially different refractions, abſtracted from bodies through which they paſs; and that colours are produced from ſuch and ſuch rays, whereof ſome, in their own nature, are diſpoſed to produce red, others green, others blue, others purple, &c. and that whiteneſs is nothing but a mixture of all ſorts of colours, or that it is produced by all ſorts of colours blended together.

It was ordered, that the author be ſolemnly thanked, in the name of the Society, for this very ingenious diſcourſe [o], and be made acquainted, that the Society think very much of it, if he conſent to have it forthwith publiſhed [p], as well for the greater convenience of having it well conſidered by philoſophers, as for ſecuring the conſiderable notions of the authors againſt the pretenſions of others.

It was ordered alſo, that this diſcourſe be entered into the regiſter-book [q]; and that the biſhop of Saliſbury, Mr. BOYLE, and Mr. HOOKE be deſired to peruſe and conſider it, and bring in a report of it to the Society.

[l] It is printed in the Philoſ. Tranſact. vol. vi. n° 79. p. 3061. for January, 167½.

[m] Letter-book, vol. v. p. 114.

[n] Mr. OLDENBURG, in his anſwer to ſignor CORNELIO, dated 9th February, 1671, inſerted in the Letter-book, vol. v. p. 159, requeſted him to impart his obſervations to the Royal Society.

[o] Mr. OLDENBURG's letter to Mr. NEWTON for this purpoſe is dated February 8, 167½, and entered in the Letter-book, vol. v. p. 157.

[p] It is printed in the Philoſoph. Tranſact. n° 80, p. 3075, for February, 167½.

[q] Vol. iv. p. 138.

4. Of Mr. FLAMSTEAD, dated at Derby, 5th February, 167½, containing some of his late observations concerning the satellites of Jupiter.

5. Of Dr. HANNEMAN, physician of Buxtchude in Germany, dated 3d January, 167½, expressing his great esteem of the Society, and desiring their judgment on the matter of sanguification, and how it is performed.

It was ordered, that he should be thanked for his respect to the Society, and made acquainted, that it is not their custom to be hasty in delivering their judgment in any philosophical matters; but that all things of that nature are committed by them to observations and experiments frequently and carefully made.

*Feb.* 15. The minutes of the last meeting being read, and there occurring Dr. WALLIS's observation about the more than ordinary hight of the mercury in the baroscope at the time of the moon's perigee, Mr. HOOKE mentioned, that by his observations that of the doctor did not hold, he having often remarked, that the quicksilver remained at almost one and the same hight for a long while, and even for months together in summer.

It was thought desireable, that this matter might be farther observed with care by those, who had baroscopes.

The business of tarantula's likewise being again mentioned, and some of the members remarking, that it would be hard to accuse of fraud or error Ferdinand Imperato and other good authors, who had delivered, from their own experience, so many mischievous effects of the bite of tarantula's, it was ordered, that the secretary should desire to know of Dr. CORNELIO, who denied such effects, what he could say to the writings of those famous men concerning this matter.

Mr. HOOKE's considerations upon Mr. NEWTON's discourse on light and colours were read. Mr. HOOKE was thanked for the pains taken in bringing in such ingenious reflections; and it was ordered, that this paper should be registred [r], and a copy of it immediately sent to Mr. NEWTON: and that in the mean time the printing of Mr. NEWTON's discourse by itself might go on, if he did not contradict it; and that Mr. HOOKE's paper might be printed afterwards, it not being thought fit to print them together, lest Mr. NEWTON should look upon it as a disrespect, in printing so sudden a refutation of a discourse of his, which had met with so much applause at the Society but a few days before.

Mr. HOOKE's paper was as follows:

" I have perused the discourse of Mr. NEWTON about colours and refractions,
" and I was not a little pleased with the niceness and curiosity of his observations.
" But, tho' I wholly agree with him as to the truth of those he hath alledged,

[r] Letter-book, vol. v. p. 155. [s] Register, vol. iv. p. 148.

" as

" as having, by many hundreds of trials, found them ſo; yet as to his hypo-
" theſis of ſolving the phenomena of colours thereby, I confeſs, I cannot ſee yet
" any undeniable argument to convince me of the certainty thereof. For all
" the experiments and obſervations I have hitherto made, nay, and even thoſe
" very experiments, which he alledgeth, do ſeem to me to prove, that *white*
" is nothing but a pulſe or motion, propagated through an homogeneous, uni-
" form, and tranſparent medium: and that colour is nothing but the diſturb-
" ance of that light, by the communication of that pulſe to other tranſparent me-
" diums, that is, by the refraction thereof: that *whiteneſs* and *blackneſs* are no-
" thing but the plenty or ſcarcity of the undiſturbed rays of light: and that
" the two colours (than the which there are not more uncompounded in nature)
" are nothing but the effects of a compounded pulſe, or diſturbed propagation
" of motion cauſed by refraction.

" But, how certain ſoever I think myſelf of my hypotheſis (which I did not take
" up without firſt trying ſome hundreds of experiments) yet I ſhould be very glad
" to meet with one *experimentum crucis* from Mr. NEWTON, that ſhould divorce me
" from it. But it is not that, which he ſo calls, will do the turn; for the ſame phæ-
" nomenon will be ſolved by my hypotheſis, as well as by his, without any man-
" ner of difficulty or ſtraining: nay, I will undertake to ſhew another hypotheſis,
" differing from both his and mine, that ſhall do the ſame thing.

" That the ray of light is as it were ſplit or rarified by refraction, is moſt cer-
" tain; and that thereby a differing pulſe is propagated, both on thoſe ſides, and
" in all the middle parts of the ray, is eaſy to be conceived: and alſo, that differ-
" ing pulſes or compound motions ſhould make differing impreſſions on the eye,
" brain, or ſenſe, is alſo eaſy to be conceived: and that, whatever refracting me-
" dium does again reduce it to its primitive ſimple motion by deſtroying the ad-
" ventitious, does likewiſe reſtore it to its primitive whiteneſs and ſimplicity.

" But why there is a neceſſity, that all thoſe motions, or whatever elſe it be
" that makes colours, ſhould be originally in the ſimple rays of light, I do not
" yet underſtand the neceſſity of, no more than that all thoſe ſounds muſt be in
" the air of the bellows, which are afterwards heard to iſſue from the organ-
" pipes; or in the ſtring, which are afterwards, by different ſtoppings and ſtrik-
" ings produced; which ſtring (by the way) is a pretty repreſentation of the ſhape
" of a refracted ray to the eye; and the manner of it may be ſomewhat imagined
" by the ſimilitude thereof: for the ray is like the ſtring, ſtrained between the
" luminous object and the eye, and the ſtop or fingers is like the refracting ſur-
" face, on the one ſide of which the ſtring hath no motion, on the other a vi-
" brating one. Now we may ſay indeed and imagine, that the reſt or ſtreight-
" neſs of the ſtring is cauſed by the ceſſation of motions, or coalition of all vi-
" brations; and that all the vibrations are dormant in it: but yet it ſeems more
" natural to me to imagine it the other way.



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" And I am a little troubled, that this ſuppoſition ſhould make Mr. NEWTON " wholly lay aſide the thoughts of improving teleſcopes and microſcopes by re- " fractions; ſince it is not improbable, but that he, that hath made ſo very good an " improvement of teleſcopes by his own trials upon reflection, would, if he had " proſecuted it, have done more by refraction. And that reflection is not the " only way of improving teleſcopes, I may poſſibly hereafter ſhew ſome proof " of. The truth is, the difficulty of removing that inconvenience of the ſplit- " ting of the ray, and conſequently of the effect of colours, is very great; but " yet not inſuperable. I have made many trials, both for teleſcopes and mi- " croſcopes by reflection, which I have mentioned in my Micrographia, but de- " ſerted it as to teleſcopes, when I conſidered, that the focus of the ſpherical con- " cave is not a point but a line, and that the rays are leſs true reflected to a " point by a concave, than refracted by a convex; which made me ſeek that by " refraction, which I found could not rationally be expected by reflection: nor " indeed could I find any effect of it by one of ſix foot radius, which, about ſe- " ven or eight years ſince, Mr. REEVE made for Mr. GREGORY, with which I " made ſeveral trials; but it now appears it was for want of a good encheiria " (from which cauſe many good experiments have been loſt) both which conſi- " derations diſcouraged me from attempting further that way; eſpecially ſince I " found the parabola much more difficult to deſcribe, than the hyperbola or el- " lipſis. And I was wholly taken from the thoughts of it, by lighting on divers " ways, which in theory anſwered all I could wiſh for; tho' having much more " buſineſs, I could not attend to bring them into uſe for teleſcopes; tho' for mi- " croſcopes I have for a good while uſed it. Thus much as to the preamble; I " ſhall now conſider the propoſitions themſelves.

" Firſt then, Mr. NEWTON alledgeth, that as the rays of light differ in re- " frangibility, ſo they differ in their diſpoſition to exibit this or that colour: " with which I do in the main agree; that is, that the ray by refraction is, as it " were, ſplit or rarified, and that the one ſide, namely that which is moſt refracted, " gives a *blue*, and that which is leaſt a *red*: the intermediate are the dilutings " and intermixtures of thoſe two, which I thus explain. The motion of light in " an uniform medium, in which it is generated, is propagated by ſimple and " uniform pulſes or waves, which are at right angles with the line of direction; " but falling obliquely on the refracting medium, it receives another impreſſion " or motion, which diſturbs the former motion, ſomewhat like the vibration of a " ſtring: and that, which was before a line, now becomes a triangular ſuperfi- " cies, in which the pulſe is not propagated at right angles with its line of direc- " tion, but aſcew, as I have more at large explained in my Micrographia; and " that, which makes excurſions on the one ſide, impreſſes a compound motion on " the bottom of the eye, of which we have the imagination of *red*; and that, " which makes excurſions on the other, cauſes a ſenſation, which we imagine a " *blue*; and ſo of all the intermediate dilutings of thoſe colours. Now, that the " intermediate are nothing but the dilutings of thoſe two primary, I hope I have " ſufficiently proved by the experiment of the two wedge-like boxes, deſcribed " in my Micrographia. Upon this account I cannot aſſent to the latter part of

" the propoſition, that colours are not qualifications of light, derived from refrac-
" tions, or refections of natural bodies, but original and connate properties, &c.

" The ſecond propoſition I wholly allow, not exactly in the ſenſe there meant,
" but with my manner of expreſſing it; that is, that part of the ſplit ray, which is
" moſt bent, exhibits a blue, that which is leaſt, a red, and the middle parts midling
" colours; and that thoſe parts will always exhibit thoſe colours till the com-
" pound motions are deſtroyed, and reduced by other motions to one ſimple and
" uniform pulſe as it was at firſt.

" And this will eaſily explain and give a reaſon of the phænomena of the third
" propoſition, to which I do readily aſſent in all caſes, except where the ſplit ray
" is made by another refraction, to become intire and uniform, again to diverge
" and ſeparate, which explains his fourth propoſition.

" But as to the fifth, that there are an indefinite variety of primary or original
" colours, amongſt which are yellow, green, violet, purple, orange, &c. and
" an infinite number of intermediate gradations, I cannot aſſent thereunto, as
" ſuppoſing it wholly uſeleſs to multiply entities without neceſſity, ſince I have
" elſewhere ſhewn, that all the varieties of colours in the world may be made
" of two. I agree in the ſixth, but cannot approve of his way of explicating
" the ſeventh. How the ſplit ray being made doth produce a clear and uniform
" light, I have before ſhewed; that is, by being united thereby from a ſuperfi-
" cial motion, which is ſuſceptible of two, to a lineary, which is ſuſceptible of
" one only motion; and it is as eaſy to conceive how all thoſe motions again ap-
" pear after the rays are again ſplit or rarified. He, that ſhall but a little conſider
" the undulations on the ſurface of a ſmall river of water, in a gutter, or the
" like, will eaſily ſee the whole manner curiouſly exemplified.

" The eighth propoſition I cannot at all aſſent to, for the reaſons above; and
" the reaſons of the blue flame of brimſtone, of the yellow of a candle, the
" green of copper, and the various colours of the ſtars, and other luminous bo-
" dies. I take to proceed from quite another cauſe, eaſily explained by my for-
" mer hypotheſis.

" I agree with the obſervations of the ninth, tenth, and eleventh, though not
" with his theory, as finding it not abſolutely neceſſary, being as eaſily and na-
" turally explained and ſolved by my hypotheſis.

" The reaſon of the phænomena of my experiment, which he alledgeth, is
" as eaſily ſolvable by my hypotheſis as by his; as are alſo thoſe, which are men-
" tioned in the thirteenth. I do not therefore ſee any abſolute neceſſity to be-
" lieve his theory demonſtrated, ſince I can aſſure Mr. NEWTON, I cannot only
" ſolve all the phænomena of light and colours by the hypotheſis I have for-
" merly printed, and now explicate them by, but by two or three other very dif-
" fering

" fering from it, and from this, which he hath described in his ingenious dif-
" courſe.

" Nor would I be underſtood to have ſaid all this againſt his theory, as it is
" an hypotheſis; for I do moſt readily agree with them in every part thereof, and
" eſteem it very ſubtil and ingenious, and capable of ſolving all the phænomena
" of colours: but I cannot think it to be the only hypotheſis, nor ſo certain as
" mathematical demonſtrations.

" But grant his firſt propoſition, that light is a body, and that as many co-
" lours as degrees thereof as there may be, ſo many ſorts of bodies there may
" be, all which compounded together would make white; and grant further,
" that all luminous bodies are compounded of ſuch ſubſtances condenſed, and
" that whilſt they ſhine, they do continually ſend out an indefinite quantity there-
" of, every way in orbem, which in a moment of time doth diſperſe itſelf to the
" utmoſt and moſt indefinite bounds of the univerſe; granting theſe, I ſay, I
" do ſuppoſe there will be no great difficulty to demonſtrate all the reſt of his
" curious theory: though yet, methinks, all the coloured bodies in the world
" compounded together ſhould not make a white body, and I ſhould be glad
" to ſee an experiment of that kind done on the other ſide. If my ſuppoſition
" be granted, that light is nothing but a ſimple and uniform motion, or pulſe
" of a homogeneous and adopted (that is a tranſparent) medium, propagated from
" the luminous body in orbem, to all imaginable diſtances in a moment of time,
" and that that motion is firſt begun by ſome other kind of motion in the lu-
" minous body; ſuch as by the diſſolution of ſulphureous bodies by the air, or
" by the working of the air, or the ſeveral component parts one upon another,
" in rotten wood, or putrifying fiſh, or by an external ſtroke, as in diamond, ſu-
" gar, the ſea-water, or two flints or cryſtal rubbed together; and that this
" motion is propagated through all bodies ſuſceptible thereof, but is blended or
" mixt with other adventitious motions, generated by the obliquity of the ſtroke
" upon a refracting body; and that, ſo long as thoſe motions remain diſtinct in
" the ſame part of the medium or propagated ray, ſo long they produce the ſame
" effect, but when blended by other motions, they produce other effects: and
" ſuppoſing, that by a direct contrary motion to the newly impreſſed, that ad-
" ventitious one be deſtroyed and reduced to the firſt ſimple motion; I believe
" Mr. NEWTON will think it no difficult matter, by my hypotheſis, to ſolve all the
" phænomena, not only of the priſm, tinged liquors, and ſolid bodies, but of
" the colours of plated bodies, which ſeem to have the greateſt difficulty. It
" is true, I can, in my ſuppoſition, conceive the white or uniform motion of
" light to be compounded of the compound motions of all the other colours,
" as any one ſtrait and uniform motion may be compounded of thouſands of
" compound motions, in the ſame manner as DESCARTES explicates the reaſon
" of the refraction; but I ſee no neceſſity of it. If Mr. NEWTON hath any
" argument, that he ſuppoſes an abſolute demonſtration of his theory, I ſhould be

" very glad to be convinced by it, the phænomena of light and colours being, in " my opinion, as well worthy of contemplation, as any thing elſe in the world."

Monſ. SCHROTER preſented for the repoſitory a glaſs, which by a metallic body he had tinged red, ſo as that it differs not from the antient red glaſs. He affirmed that this manner of tinging is neither difficult nor chargeable. His paper accordingly was ordered to be regiſtred [t], and was as follows:

" This red glaſs, made by the help of a metallic tincture, doth in its colour " or elſe not differ from the antient red glaſs, and is as good as the ſame, if " not better: then the colour of this glaſs can be heightened and made darker. " The manner of tinging it is not difficult, but it may be quickly prepared with- " out great labour or danger: the charges are likewiſe ſmall, ſo that, with a ſmall " quantity of tincture, much glaſs may be tinged; whether an hundred times more, " or a greater quantity, I cannot well ſay, for that I never took notice of very " accurately. As for the bigneſs of the glaſs, it is no matter of what bigneſs " it be; for a table of glaſs of that colour may be made, though it be ſome " feet long or broad, without an eſpecial furnace or fire."

Mr. HOOKE was put in mind of the ſix foot tube of Mr. NEWTON's invention, and of bringing in a ſpecimen of the effect of his own propoſition.

*February* 22. Mr. HOOKE made an experiment, to ſhew, that, beſides the flame and ſmoke of a candle, there is a continual ſtream riſing up from it, diſtinct from the air; concerning which, he ſaid, that he conceived, that as the action of the air upon the parts of the candle heated, or the diſſolution of them, was the flame; ſo the compoſition of the air, and the relict of the effluvia of the parts of the candle diſſolved thereby, made this ſtream, which continually aſcended, and kept itſelf diſtinct from the air.

Mr. NEWTON's letter to Mr. OLDENBURG, dated at Cambridge, February 20, 167$\frac{1}{2}$ [u], was read, promiſing an anſwer to Mr. HOOKE's obſervations upon his new theory of light and colour. It was as follows:

" I received yours February 17, and, having conſidered Mr. HOOKE's obſerva- " tions on my diſcourſe, am glad, that ſo acute an objector hath ſaid nothing that " can enervate any part of it: for I am ſtill of the ſame judgment, and doubt " not, but that upon ſeverer examinations, it will be found as certain a truth as I " have aſſerted it. You ſhall very ſuddenly have an anſwer.

" In Monſ. HUGENIUS's letter there are ſeveral handſome and ingenious " remarks: and what he ſaith concerning the grinding parabolical conoids by " geometrical rules, I do, with him, deſpair of; but I doubt not but that the " thing may be, in ſome meaſure, accompliſhed by mechanical devices."

[t] Regiſter, vol. iv. p. 125. [u] Letter book, vol. v. p. 166.

Signor

Signor MALPIGHI's letter of 1ſt February, 167½, from Bologna, was read, intimating, that he had tranſmitted a diſcourſe, and ſome ſchemes, concerning ſome late obſervations of his upon eggs, which he ſubmitted to the examination and cenſure of the Society.

This diſcourſe being opened, and read in part, it was found, that that philoſopher had, by very careful and diligent microſcopical obſervations, diſcovered that, in prolific eggs, before, as well as after, incubation, the firſt rudiments of the principal parts of the chick are actually contained; but that, in addle eggs, inſtead of ſuch a ſubſtance, there is only found a globous, aſh-coloured body, like a mola, &c. It was ordered, that this diſcourſe, and the figures thereunto belonging, being by the author ready fitted for the preſs, ſhould forthwith be committed to the printers of the Society to be printed; and that particular care ſhould be taken by the ſecretary, of having the ſchemes exactly ingraven by the beſt ingraver to be had in London: as alſo that ſolemn thanks ſhould be returned to the learned and obliging author for this ingenious piece, and for his ſingular reſpect to the Society.

The ſecretary having foreſeen, that ſuch an order would be given, and therefore drawn up proviſionally, a letter for that purpoſe, it was ordered to be read, and being approved of [x], to be ſent away by the firſt opportunity.

Mr. HOOKE was deſired to produce at the next meeting the experiment of repreſenting a blue and red colour in two wedge-like boxes.

*February* 29. The experiment exhibited at the laſt meeting, to ſhew the ſteam about the flame of a candle diſtinct from the ſmoke and air, was repeated, and proved ſatisfactory. Mr. HOOKE was ordered to give an account in writing of the manner of repreſenting this experiment.

He propoſed a way for a very ſpeedy conveyance of intelligence from place to place by the ſight aſſiſted with teleſcopes, to be employed on high places, by the correſpondents uſing a ſecret character, proportioned in bigneſs according to the diſtance at which they are to be ſeen, &c.

The paper of this propoſition, and the particulars of the manner of practiſing it, were read, but not left by Mr. HOOKE to be regiſtered, but taken away by him.

It was ordered, that ſome experiment ſhould be made of this propoſition at the next meeting; which Mr. HOOKE promiſed to do.

Signor MALPIGHI's diſcourſe concerning his new diſcoveries in the egg being again mentioned, Dr. CROUNE ſaid, that he had alſo found ſome ſuch thing as the rudiments of a chick in the egg before incubation.

[x] It was dated February 22, 167½, and entered in the Letter-book, vol. v. p. 167.

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The biſhop of Cheſter deſired, that notwithſtanding this, Signor MALPIGHI might have the honour of this diſcovery, ſince Dr. CROUNE had never brought into the Society an account, or a figure of this diſcovery, as Signor MALPIGHI had now ſent to them an accurate deſcription of this diſcovery, accompanied with many very neat, and laborious ſchemes.

The biſhop of Saliſbury moved, that the obſervations of both Dr. CROUNE and Signor MALPIGHI might be printed.

Dr. CROUNE gave an account of an embryo of ſix weeks old, of the bigneſs of a bee, which, being put into ſpirits of wine, the ſpirit did ſo penetrate the amnion, that the colliquamentum was thereby precipitated. He promiſed to produce this embryo at the next meeting.

Dr. WALTER NEEDHAM communicated a letter from Mr. JOHN TEMPLER, dated at Braybrook, 8th January, 167½ [y], giving an account of a dog rendered ricketty and dwarfiſh by waſhing him in brandy; and of another young dog, who having brandy given him to drink every morning, was brought to a violent and conſtant aſthma.

Mr. OLDENBURG read a letter to him from Mr. LISTER, dated at York, 24th February, 167½ [z], containing his ſenſe of what Signor CORNELIO had written from Naples, about the fictitiouſneſs of the ſtories recorded of the miſchievous effects of the biting of tarantulas. The letter was as follows:

" As for the further account concerning the tarantula of Signor CORNELIO at " Naples, I received it in Italian, as you was pleaſed to communicate it to me; " and ſince you deſire my thoughts upon this matter, I will briefly make ſome " reflexions upon ſome of the particulars, and explain thereby the quære, that " gave the occaſion.

" It is here affirmed, that the tarantula is a phalangium; which yet does not " plainly appear; poſſibly it may, when the author ſhall pleaſe to give us his " more particular obſervations, or tranſmit any of the animals themſelves. *To " be* *, *diverſly painted with diverſity of colours, to live in holes of the earth*; " are notes common to moſt ſorts of ſpiders, even with us. It is very neceſſary, " that great heed be taken of the characteriſtical notes we gave you, and by " which we know phalangia from all other tribes of ſpiders; for in this con- " ſiſts (at leaſt in my judgment) the diſcovery of the nature and effects of " the tarantula.

" We had, undoubtedly, been in the dark ſtill, but for that one chance note " of PLINY, lib 11. c. 24. viz. *aſſultim ingredi*; and had never known what the " antients had meant by their phalangia: and yet, having obſerved that ſkipping

[y] Letter-book, vol. v. p. 148. [z] Ibid. p. 172.

" motion in two or three ſorts of our Engliſh ſpiders, we found, that all thoſe, which " had that peculiar motion, agreed too in the ſenary number of eyes, not to mention " other diſtinguiſhing marks; thoſe two being enough to reduce them to order. " Now then, it being the ſole property of this tribe of ſpiders to move in going, " as though they danced, and therefore to be (for kind) thoſe, which the antients " called *phalangia*, and whoſe biting they ſo much dreaded; I thought it very " material to enquire, whether the tarantula was not one of them, that is, " whether the tarantulæ go by ſkips, and have ſix eyes only, &c.?

" To tell you the truth, I had ſome reaſon to queſtion this; not but that the " phænomena, or the effects of that miſchievous bite, if really true, did un- " doubtedly depend (in my thoughts) upon the nature of the animal; but that " I had ſeen the ſpider brought from Rome, by the name of tarantula, and yet " whoſe figure, as I remember, ſhewed it plainly to be of another tribe, and no " phalangium. Again, becauſe ſome late authors, that I had ſeen of this matter, " had given us the cut, or figure, of a *reticulum orbiculatum*, or wheel-net, with " a tarantula in it, which, in truth, is as an improper a thing (if a phalangium) as

" Delphinum Sylvis appingere ———

" this tribe having that in common with ſome other tribes of ſpiders, that they " ſcorn nets, and hunt openly, and take their prey by ambuſh and agility of " body. For an elegant deſcription of their hunting, I refer you to Mr. EVELYN " in Mr. HOOKE's Micrographia; where alſo I obſerve to you, by the by, that " that grey phalangium, there mentioned, is exceeding common all over England " (where I have been) as well as at Rome.

" We may well expect, from the ingenuity and diligence of Signor CORNELIO, " the full clearing of this matter; we being already beholden to him for that " other rarity of his native ſoil, *manna*, which he hath put beyond exception, to " be a ſpontaneous exudation of the aſh tree. See the experiment regiſtered, as " he himſelf penned it, in a letter to Mr. WRAY, *Catalog. Plant. Angl. in* " *Fraxino.* However, in the mean time, I may deſerve your pardon, if I pre- " poſſeſs you with my opinion. I agree with him, that the matter will probably, " when thoroughly examined, not prove, not only as the vulgar is perſuaded, " but not as authors write neither: and yet, he muſt excuſe me, if I think it " will prove more than a meer fiction, and that thoſe ſtrange accidents, which " the *attarantati* are ſaid to ſuffer, are not to be attributed to the great drought " of the country and thirſt only, but poſſibly to the bite of a certain animal too."

*March* 7. An experiment was made of the method propoſed by Mr. HOOKE at the laſt meeting, of conveying intelligence from place to place, which was performed from Arundel-houſe garden to a boat lying near the ſhore on the other ſide of the Thames, by letters of a foot long, and glaſſes of two feet long, the diſtance being about half a mile.

The

The contrivance was applauded as very ingenious, and the author desired to make more tryals of it at greater distances.

The president objected, that the use of it would be often hindered by hazy weather.

Others intimated, that the greatest difficulty in the practice would be in proportioning the glass and the letters, viz. at what distance a glass of such or such a length shall discover characters of such and such a bigness.

Dr. KING produced some galls of oak, seeming to him to be a fruit: but many of the members thought them to be excrescences caused by insects.

Sir ROBERT MORAY mentioned, that a whole kennel of dogs belonging to his Royal Highness the Duke of York, which had been bitten by a mad dog, were lately cured by a certain herb, called *stellaria*, or the star of the earth.

Mr. OLDENBURG produced a paper, importing, that Monsr. PECQUET had lately made a new discovery between the *ductus thoracicus* and the inferior *vena cava*; which was ordered to be read at the next meeting.

Mr. HOOKE promised to shew at the next meeting something having neither reflexion nor refraction, and yet diaphanous.

*March* 14. Dr. TILLOTSON was admitted fellow.

Mr. COCK was ordered to make, for the use of the society, a telescope of Mr. NEWTON's invention, of the length of four or five feet; which he promised to have ready within a fortnight.

He being put in mind of making a large burning concave, was advised to contract with the founder for one of a certain size, at a certain price, on condition of its being without fault: which he promised likewise to endeavour to do.

Mr. HOOKE brought in an account of an experiment shewn before the society, February 29, and designed to prove, that the substance of a candle, or lamp, is dissolved by the air, and the greatest part thereof reduced to a fluid of the form of air. This paper was ordered to be registered [a], and was as follows:

"I took a large concave reflecting glass, or a large convex refracting glass, and "so placed it in respect to my eye, that a candle set at a certain distance beyond "the refracting glass, or between the eye and the superficies of the reflecting "glass, enlightened the whole area of the said glasses in respect to the eye. "Then continuing to keep the eye in that place, where the area of the said

[a] Register, vol. iv. p. 126.

" glaſſes appeared to be wholly filled with the flame of the candle, I cauſed another " candle to be placed very near the ſaid glaſſes, between the eye and the glaſs; " or beyond alſo, if I made uſe of the refracting glaſs. Then looking ſtedfaſtly " at the flame of this laſt candle, it was very plain to be perceived, that the " flame thereof was encompaſſed with a ſtream of liquor, which ſeemed to iſſue " out of the wick, and to aſcend up in a continual current, or *jet d'eau*, to keep " itſelf intire, and unmixt with the antient air, notwithſtanding that it was a " conſiderable way carried above the aforeſaid flame. It was further very plain, " that the ſaid diſtinct fluid did make ſeveral turnings, whirlings, or vortices in the " ambient air, as it aſcended higher and higher, and by degrees mixed itſelf with " the ambient air. It was yet further obſervable, that the ſhining flame was " placed in the middle of this *jet d'eau*, at the lower end thereof; but that it " did not aſcend proportionally in height to the height of the jet d'eau; that, " where the tip of the flame ended, there aſcended up a ſmall line, of an opacous " body, or ſmoke, which, to a good height above the flame, kept the middle " of the ſtream. The manifeſtation of this phœnomena was from the differing " refractions of the body of the jet d'eau from that of the ambient air: for the " flame of the firſt candle being but ſmall, and placed at a conſiderable diſtance " from the refracting, or reflecting glaſs, the ſmalleſt variation in the refraction " of the medium between the firſt glaſs and the eye cauſed the darkneſs to inter- " mix with the light; ſo to exhibit the appearance of the heterogeneous jet d'eau. " This jet d'eau I ſuppoſe to be nothing elſe but the mixture of the air with the " parts of the candle, which are diſſolved into it in the flame; for the air being " (as I have elſewhere proved) the univerſal menſtruum, or diſſolvent, of all " ſulphurous bodies, and the action of diſſolution in moſt bodies producing heat " and light; it is manifeſt by the flame, that there is ſuch a ſolution, and it is " not probable that the body ſo intermixt, ſhould immediately ſo perfectly in- " termix itſelf with the reſt of the air, as not to appear, for a time, diſtinct " from it, though it doth afterwards intermix itſelf with the reſt of the air. " The reaſons why this mixt body (which certainly is otherwiſe heavier than " the air, and ſo ought to deſcend) doth, notwithſtanding, aſcend with great " ſwiftneſs, is firſt, from the aſcent of the flame in the middle; and next, from " the extraordinary rarefaction of the ſame, by the ſame nearneſs and centrality " of the flame and heat; whereby it is made much lighter than the ambient " air. A phænomenon not much unlike this may be produced by ſeveral bodies " diſſolved in oil of vitriol, wherein all the appearances, but light, are very " perfectly repreſented."

Mr. Hooke promiſed to exhibit at the next meeting, an experiment to ſhew a phænomenon not unlike this, to be produced by ſeveral bodies diſſolved in oil of vitrol.

He ſhewed a phænomenon in a bubble raiſed by water and ſoap, wherein there appeared ſomething on water which had neither reflection nor refraction, and yet was diaphanous. He was deſired to bring an account of this in writing, with his thoughts upon it.

Dr. CROUNE produced the little fœtus of ſix weeks old in ſpirit of wine, mentioned by him at the meeting of February 29; and it appeared, as if the ſpirit had penetrated the bag of this fœtus, and precipitated the colliquamentum thereof to the bottom of the bag.

He likewiſe gave in his Latin diſcourſe concerning the conformation of a chicken in the egg; which was ordered to be read at the next meeting, being too long to be read at the preſent.

Mr. OLDENBURG read the letter from Paris, produced by him at the preceding meeting, concerning a diſcovery lately made there by Monſ. PECQUET, of a communication between the *ductus thoracicus* and the inferior *vena cava* [b].

*March* 21. There was read a letter of Mr. HEVELIUS to Mr. OLDENBURG, dated at Dantzick, 9th March, 167½ [c], giving notice of a comet obſerved by him in Andromeda for ſeveral days, mornings and evenings, ever ſince the 2d of March; and mentioning that he had again ſeen the new ſtar under the head of the conſtellation of the Swan.

This letter having been communicated to Mr. HOOKE ſome days before this meeting, he ſaid, that he had not hitherto diſcovered any comet.

It was ordered, that notice ſhould be given of this phænomenon by the ſecretary, to ſome perſons in both the univerſities for obſervation, and particularly to Dr. WALLIS and Mr. NEWTON.

There was read a letter of Mr. NEWTON to Mr OLDENBURG, dated at Cambridge, March 19, 167½ [d], containing ſeveral particulars relating to his new teleſcope.

Mr. BOYLE communicated a paper of his, containing an account of nineteen obſervations made by himſelf on ſhining fleſh, both veal and pullet, eſpecially the former, in one piece of which he had reckoned diſtinctly above twenty ſeveral places, which all ſhone, more or leſs, without finding by the ſmell the leaſt degree of ſtink, whence to infer any putrifaction; which obſervations were ordered to be regiſtred [e].

This paper occaſioned ſome diſcourſe concerning obſervations made by others of the like phænomena, not only in fleſh, as in lamb-fleſh, mentioned by FABRICIUS AB AQUAPENDENTE, but alſo in oiſters, the ſea-water, &c.

[b] This paper was probably that printed in the *Journal des Sçavans* of Feb. 8, 1672. See Philoſ. Tranſact. vol. vii. n° 85. p 5007.

[c] Letter-book, vol. v. p. 182. It is publiſhed in the Philoſ. Tranſact. vol. vii. n° 81. p. 4017.

[d] It is printed in the Philoſ. Tranſact. n° 81. p. 4009.

[e] Regiſter, vol. iv. p. 130. They are printed in the Philoſ. Tranſact. vol. vii. n° 89. p. 5108, for December, 1672.

*March*

*March* 28, 1672. There were read the anſwers given in by the lord HENRY HOWARD of Norfolk, to the inquiries concerning Barbary, formerly recommended by the Society to his lordſhip, when he went ambaſſador from the king to the emperor of Morocco.

After this paper was read, his lordſhip declared to the Society, that he went not himſelf, for reaſons known, to Morocco; but that an ingenious perſon, one of his attendants in his voyage, Mr. BURGHILL, took care, by his order, to inform himſelf as well as he could, about the particulars contained in theſe inquiries; of which this was the reſult, which he deſired the Society to accept of.

The Society returned to his lordſhip many thanks for his great favour and care of their concerns; and ordered, that this account ſhould be entered in their Regiſter-book [f]: as alſo, that Mr. BURGHILL ſhould, in their name, be thanked by the ſecretary for his reſpect to the Society, in complying ſo carefully with their deſires.

This paper was as follows:

" Q. 1. What is the temperature of the air?

" A. It is ſo hot in the latter end of Auguſt, that it melted chocolate-cake, " and reſin of jalap; the latter being dried and groſsly powdered. And the air " is withal ſo groſs and hazy, that the ſun never ſhined out, whilſt we were there, " before nine in the morning, or after four in the evening, unleſs there had " been a briſk gale of wind the day before.

" Q. 2. What diſeaſes the inhabitants are moſt ſubject to?

" A. Fevers, (which they call calentures one with another) fluxes, and ſome " of them with blood, the king's-evil, the pox, and films over their eyes, both " very frequent.

" Q. 3. Whether it be true, that thoſe in Numidia, in the land of Dates, " live long, though they loſe their teeth ſoon; and that the negroes are ſhort- " lived, though their teeth continue ſound to their death?

" A. Long in the hilly parts, the air being better there; yet they loſe their " teeth by times, perhaps cauſed by the ſharp ſweetiſh juice of new dates, the great- " eſt part of their food; but they are ſhorter lived in the vallies, where the air is " groſs and very ſuffocating in hot weather.

" Q. 4. Whether the venereal diſeaſe be ſeldom found in Numidia and " Lybia?

" A. A diſtemper well known over all Barbary.

[f] Vol. iv. p. 174.

" Q. 5.

" Q. 5. Whether in Barbary the plague is every tenth or fifteenth year, and " in Numidia not once in a hundred years, and in the land of the negroes not " known at all?

" A. Not known there at all.

" Q. 6. What medicines they uſe, and what poiſons and antidotes are known " amongſt them? Whether granum Nubiæ will kill in a leſſer quantity than any " other known poiſon? Whether they have any poiſon, that kills by ſmell alone; " and if ſo, what that is?

" A. Athenna they eſteem an univerſal medicine for man and beaſt; if it fail- " eth, they cauterize both, as our farriers do horſes for the farcy. They have " ſeveral poiſons that kill, but not by the ſmelling to them. Granum Nubiæ is " not known at Morocco.

" Q. 7. What is the compoſition called lhaſhiſh, of which it is ſaid, that who- " ſoever takes an ounce of it, ſhall fall a laughing and ſporting, and be like one " half-drunk, and be never amorous?

" A. Lhaſhiſh is the tops of green hemp, made with honey into an electuary, " but not above half an ounce at one time to be taken?

" Q. 8. What kind of root it is they call tanzargent, ſaid to be an excellent " and laſting perfume?

" A. They have no perfume except muſk and civet, and that very rare.

" Q. 9. What are the variations of the weather, according to the ſeaſon of the " year, and the times of the day; what meteors the country is moſt wont to " breed, eſpecially what winds it is ſubject to; whether any of them be ſtated and " ordinary; whether in October and November there be ſuch ſnows betwixt " Mauritania and Numidia, that carts, horſes, and trees are covered therewith?

" A. The rain happens moſt commonly in December and January. There " often are very great winds and thunder; ſometimes they have rain in October, " which cauſes great plenty that year, and ſometimes they have no rain for three " years together, which want of rain is the conſtant forerunner of dearth, and of " locuſts in ſuch an abundance, that they devour whatever is green, which be- " ing eaten by the people, brings a mortality not unlike the plague. In ſum- " mer very ſtuffing heats with winds (much hotter than ſun-beams) which blow " up the duſt after the manner of thoſe ſpouts often ſeen at ſea: hail many " times of a prodigious bigneſs; falling ſtars in greater numbers than in Europe. " Levants only, which blow ſometimes ſo far into th e continent as Morocco.

" Q. 10

" Q. 10. What obſervables there are concerning Mount Atlas; what is its " hight; whether it runs north and ſouth, eaſt or weſt; what mines it affords; " whether it has any ſprings upon the higheſt parts; whether it be true, that " there are ſome ſprings adjoining Mount Atlas ſo cold, that if one's hands be " any while continued therein, they are in danger of gangrening; what plants " are upon and about it, and whether any cockle-ſhells are found upon it?

" A. The Leſſer Atlas, when it comes near Morocco, ſeems more inclining " to a circle than a right line; and runs rather north and ſouth, than any other " points of the compaſs: the top continually covered with ſnow, which for the " moſt part appears above the clouds; many ſprings: but whether it be ſo cold " on the top of the hill, I know not.

" Q. 11. What is the nature of the ſoil, what grains, fruits, and other ve- " getables, particularly what trees, whoſe wood is conſiderable, the country af- " fords; to bring over ſome of the plants and ſeeds peculiar to that country?

" A. Fruitful, beyond belief; of colours various, but for the moſt part in- " clining to red; the ſoil extraordinary deep, and free from ſtones, unleſs it be " where it is altogether rocky. The ſorts of grains are barley, wheat, Indian " wheat, both white and red; another ſort of grain they call tuff-ſoot, the ſtalks " as big as a cane, and higher than a man on horſeback, the ſeed about the ſhape " of a kidney, white and big, as a black-cockle growing in corn, with which " they feed cattle. There are alſo grapes, almonds, olives, pomegranates, oranges, " lemons, dates, very great figs, citrons, all plentiful and large, except the " olives and almonds, which are ſmall, but very good: moreover, peaches, " apples, and pears, which they keep as we do medlars, till they are rotten; " water-melons, both white and red, muſk-melons, ſome whereof keep all the " winter, all very large; cucumbers of a great length, and crooked like a hunt- " er's horn; calibaſh both white and yellow, coloquintida, and a purple fruit " like a ſmall pumpion; and pumpions, called bern-hena, of taſte, when boiled, " not unlike a Jeruſalem artichock, which they boil with their meat; wild dates, " that grow like our fern, all over the country, being the leaf of which the flag- " brooms are made, bearing a fruit of a kind of deep orange colour, of the " bigneſs of a ſmall green walnut, growing in bunches near the root, of a bit- " teriſh taſte, and much eaten by the Moors in their journies.

" The vegetables being too many to be obſerved in a ſpeedy journey, are " promiſed to be ſupplyed by Mr. BATAM. There is cork, oak, and cedar, " of a pleaſing ſmell; a tree called lirz, not unlike our fir in the grain, ſmelling " ſomewhat like cypreſs; tamareſk, growing commonly about the rivers in great " quantities.

" Q. 12. What minerals the country is ſtored with; what quarries it affords, " and how the beds of ſtone lye; what clays and earths it yields; whether any " medicated

" medicated earths; what ways they have of reducing their ores into metals; " to bring over a ſpecimen of their ores, earths, clays, &c.

" A. There is copper, iron, lead, tin, white marble in great quantity; a kind " of whetſtone between rag-ſtone and oil-ſtone rock; a ſmall ſandy ſtone, both red " and white; a kind of talc, very large; a black ſparkling ſtone, that they make " mill-ſtones of; (the beds whereof lie neareſt north and ſouth) blue and red " clay; and a kind of fullers earth, wherewith the Mooriſh women waſh them- " ſelves; no medicated earth. They reduce their ores into metal by charcoal.

" Q. 13. What is obſervable in their rivers; whether they carry any golden " ſand in them; what is the quality of their waters; what kind of fiſh they " breed; their ſtore, bigneſs, goodneſs, haunts, ſeaſons, &c. Whether the rivers " running from Atlas upon the Lybian ſands are dried up in their paſſage; and " whether the Numidian rivers be dry when no rain falls from Atlas?

" A. There are no gold ſands on this ſide Atlas; the rivers few, rapid, " rocky, and deep; the water very heavy toward Fez. Fiſhes are mullets, a " kind of ſalmon, tortoiſe, and divers other ſmall fiſh, very well taſted, but " differing from thoſe of Europe: we were not ſo far as Lybia; no gold ſands " here, but what comes from Gambo.

" Q. 14. What lakes ponds, ſprings, and eſpecially mineral waters there are; their kinds, qualities, virtues, and how examined?

" A. No lakes, ponds only artificial in great mens gardens; there is one " very great and ſalt water between Saphy and Morocco, which being dryed up " every year by the ſun furniſhes that part of the country plentifully with ſalt: " between Fez and Aliazer there are ſeveral ſprings, making divers ſmall brooks, " of ſalt water, cruſted on the ſides with white ſalt, in places where the ſun hath " power, and riſing out of ſalt rocks, of browniſh and white mixture, in veins, " ſharper than bay ſalt, and very heavy. One day's journey from Aliazar to- " wards Fez is a ſpring of green water, ſtinking like the pumping of a ſtench " ſhip, the ſtream cruſted with a ſalt green, as common copperas, towards the " head of the ſpring, iſſuing out from the north ſide of a high hill. Their " virtues neither known nor looked after by theſe poor, lazy, and ignorant " people.

" Q. 15. What animals the country is ſtored with, both wild and tame; what " beaſts of prey they have, and the manner of catching them; what dogs they " have, and what games they are inclined to?

" A. There are lions, leopards, tigers, wild boars, jackals, foxes, a beaſt not " unlike a lion in ſhape, but leſs, and cowardly, digging men and women, as the " Moors tell, out of their graves, antilopes, apes, porcupines, very large ſnakes, " adders, chameleons, lizzards very great ones, oſtriches, eagles, vultures,

" ſtorks, buſtards, cranes, falcons, kites, daws, pigeons, ringdoves, a ſort of " pigeons that ſtretch ſo exceedingly, that they are ready to fall backwards, and " ſome eat their meat behind them; Guinea-hens, partridges, heath-cocks, " ducks, curlews, teals, ox-eyes, larks, ſparrows, ſwallows, ravens, magpies; " but few camels, dromedaries, horſes, mules, aſſes, ſheep, and goats, which " they ſometimes ſhoot, and ſometimes hunt with curs and greyhounds with long " curled ears like ſpannels, and ſometimes ride them down. They play at cheſs " and draughts.

" Q. 16. Whether it be true, that the lions about Pietra Roſſa are ſo tame " as to go into the ſtreets and gather bones; and at Agla the lions ſo cowardly, " that they flie at the voice of a child?

" A. I can give no account of lions in theſe places in particular; but gene- " rally, the lions of Barbary are very great and fierce, coming often into the " ſtreets of towns ſeeking for prey, which they never do upon any dead body.

" Q. 17. Whether camels will travel many days without provinder and drink, " and ordinarily in travelling have no drink allowed them but once in three or " four days; and whether the camel called Ragnahill will travel 900 miles in " eight days; what manner of breeding their horſes?

" A. The camels upon neceſſity will travel three days without meat or water: " they ride horſes at a year old, handling them from their foaling; they tie them " by the forelegs with cords ſtaked down; they bring them water but once a " day; ther common food is ſtraw and barley; they teach them to ſtart, from " ſtanding ſtock ſtill, in a full career; they ſuffer them not to trot, but walk " very faſt, and ſtop ſuddenly, which they do with toſſing up their heads in the " air. Towards Fez, where the beſt and fleeteſt are, it is ſaid they feed them " only with milk, either of goat, aſs, cow, or camel. The breeding mares go " about with great about their necks, and are brought by night into " the d'warrs.

" Q. 18. Whether it be true, that there is ſuch a bird, that picks out the " worm from the crocodiles teeth, which having a little ſting in its head, cauſeth " the crocodile, when he would ſwallow it, to open his mouth and let it eſcape?

" A. No crocodiles in this part of Africa.

" Q. 19. Whether the dubb, a creature like a lizzard, about a cubit long, " and four inches broad, drinks no water at all, but dies, if water be poured into " his mouth?

" A. No ſuch beaſt as a dubb, only large lizzards, being in great plains, " where there was no water to be ſeen in many leagues of them; but we know " not whether they will die with water poured into their mouths.

I " Q. 20.

" Q. 20. Whether the chamelion dropping a ſlime on ſerpents heads kills " them?

" A. We could hear of no ſuch thing.

" Q. 21. What the oſtrich feeds upon? To get one dried.

" A. Beans principally, and any ſort of grain, fleſh, if given them, and bread; " they will ſwallow iron: they are rarities at Morrocco and Fez, brought for " preſents to the king only.

" Q. 22. As to the inhabitants, men and women, what are their inclina- " tions, diet, œconomy, conveniencies of life, their ſtrength, agility, and ſta- " ture, ſhape?

" Not anſwered.

" Q. 23. What is their way of educating their children?

" Q. 24. What arts, practices, and ſtudies they are given to; particularly, " what varniſhes they have amongſt them; and what ways of tempering their " iron and ſteel they uſe?

" A. The beſt are brought up to read and write, and ſome to underſtand " their laws, out of which they chuſe their prieſts and juſtices; the reſt illiterate " and idle, until fit for the plow or wars: they uſe no arts at all, few of them un- " derſtand, or practiſe any trade, but leave them lazily to the Jews, that are worſe " than their ſlaves. Varniſhes they have none. They temper Spaniſh ſteel after " our manner, but not ſo well; and for Damaſco ſteel, they underſtand it not " at all; nor can they harden iron, that we could ever learn.

" Q. 25. Whether at Morocco they keep ſtill their public arts of ſcholars; " and if ſo, what is therein performed?

" A. Their academies are but their prieſts teaching to read and write their " own language and law; thoſe places they call univerſities being guilty of no " other learning.

" Q. 26. Whether they have chemiſts among them; and if ſo, what are " their abilities?

" A. None at all, but Jews, and Chriſtian ſlaves, that diſtil brandy in jars.

" Q. 27. Whether any African writers give any account of the antient " Punic learning; and what books of geography, genealogy, hiſtory, alchemy, " medicine, magic, &c. are extant amongſt them; and, particularly, whether

" the Genealogies, ſaid by Leo Africanus to have been written by one Ivan " Racha, or Rachiock, and the Coſmography of one Bichri, mentioned by the " ſame author, are to be had; and whether one Margian, and another Jona " Caldin, have written ſtrange books concerning magick; and whether it be " true what the ſame Leo Africanus relates, that the fortune-tellers at Fez, by " pouring ſome drops of oil into a glaſs of water, can repreſent creatures, and " ſhew them to by-ſtanders, and ſpeaking to them, do receive anſwers by words " or ſigns?

" A. We can learn of no public libraries, or of bookſellers; what are, re- " main in private hands, and theſe are hiſtorical MSS. that we could ever learn " of. They uſe no fortune-telling, but by a kind of necromancy they pretend to " procure love or hatred.

" Q. 28. Whether there be any inſcriptions, or coins with characters, neither " Latin nor Arabic; and what coins, or rather inſcriptions are, or have been " found about Fez, and at Denſen; whether at Theleſſa there be many marble " pillars with ſentences and epigrams in Latin characters.

" A. We could hear of none, but at Fez have been found Roman coins long " ago. We never heard of Theleſſa.

" Q. 29. To inquire into any antient manuſcript, that may poſſibly have " been tranſlated out of the ancient Greek, either in geometry, aſtronomy, " phyſick, or chemiſtry.

" A. We could never get information of any ſuch.

" Q. 30. What manner of architecture they uſe? To make ſome deſigns " of their palaces and temples.

" A. Their buildings are generally mud-wall, about two feet thick, the roof " of the ſame, ſupported with ſmall rafters, and theſe covered ſometimes with " boards, ſometimes with canes, to ſuſtain the clay, without any other ceiling. " The houſes never exceed two ſtories, even in their cities; flat on the roof, " to walk on; the beſt built, for the moſt part, about a ſquare court; the " rooms about 30 feet long, between 8 or 9 feet over, 12 or 14 feet high; " having ſeldom any windows, or lights, but what comes in by the doors, that " are placed in the middle of each room, of 6 feet broad almoſt, to the roof, " opening with two leaves towards the court; the upper rooms, as theſe, only " opening to a narrow gallery, that goes round, ſupported with diſorderly, ex- " travagant pillars, made, when at beſt, of a whitiſh brick of near two inches " thick, and clay between every brick, thicker than the bricks, with which they " turn the arches of their doors, and intervals of their pillars. Their churches " are, for the moſt part, built of clay, ſome of ſtone, very low, with flat roofs,

" paved

" paved with green tiles, as the houſes with divers colours. The ſteeples for the " moſt part like ours, but built of mud, except which are of ſquare ſtone."

Mr. HOOKE brought in his written account of an experiment, made March 13, upon a bubble of water and ſoap, which was ordered to be regiſtered [f], and was as follows:

" By the help of a ſmall glaſs-pipe there were blown ſeveral ſmall bubbles out " of a mixture of ſoap and water; where it was obvious to obſerve, that at the " beginning to blow any of theſe bubbles, the orbicular film of water, which en- " compaſſed a globe of air, appeared white and clear, without any appearance of " colour; but after ſome time the film by degrees growing thinner, (part there- " of falling down, and part thereof evaporating and waſting into air) there ap- " peared upon the ſurface thereof all variety of colours, that may be obſerved in " a rainbow, beginning at firſt with a pale yellow, then orange, red, purple, " blue, green, and ſo onward, with other the ſame ſeries or ſucceſſions of colours: " in which it was farther notable, that the firſt and laſt ſeries of colours were " very faint, and that the middlemoſt order or ſeries was very bright and orien- " tal. After theſe colours had paſſed over their ſeveral changes, the film of the " bubble began to appear again white, and preſently up and down in this ſecond " white film there appear ſeveral holes, which by degrees increaſe and grow big- " ger, and ſeveral of them break into one another, till at length they become very " conſpicuous and big. It is ſtrange to obſerve, how thoſe holes will, by the " blowing or moving of the ambient air, be carried up and down upon the en- " compaſſed globe of air, and yet the bubble remain in its orbicular form with- " out falling. It is yet further ſtrange, that after this, when the bubble breaks, " its breaking is with a kind of impetus or crack, diſperſing the parts in a kind " of powder or miſt. It is yet further ſtrange, that thoſe parts of the bubble, " which thus appear like holes through it, by the moving up and down upon " the ſurface of the aerial globe will change its form, and from a circular " be made eliptical, or any other undulated or waved form, in the ſame man- " ner as any of the colours, that are viſible on the bubble. It is yet more ſtrange, " that though it is moſt certain, that both the incompaſſing and incompaſſed " air have ſurfaces, yet by no means, that I have yet made uſe of, will they " afford either reflection or refraction, which all the other parts of the incom- " paſſed air do. It is pretty hard to imagine, what curious net or inviſible body " it is, that ſhould keep the form of the bubble, or what kind of magnetiſm it " is, that ſhould keep the film of water from falling down, or the parts of in- " cluded and including air from uniting. The experiment, though at firſt thought " it may ſeem one of the moſt trivial in nature, yet as to the finding out the na- " ture and cauſe of reflection, refraction, colours, congruity and incongruity, " and ſeveral other properties of nature, I look upon it as one of the moſt in- " ſtructive: of which more hereafter perhaps."

[f] Vol. iv. p. 128.

He

He made an experiment of diſſolving ſal-nitre in common water, whereby was cauſed a ſtream compoſed of water and of the particles of nitre diſſolved therein; which ſtream was here deſcending, as in a former experiment a ſtream or fluid produced by a candle diſſolved by the air aſcended.

He was deſired to bring in the deſcription of it in writing.

There was read a letter of Mr. NEWTON to Mr. OLDENBURG, dated at Cambridge, 26th March, 1672 [g], containing ſome more particulars relating to his new teleſcope, eſpecially the proportions of the apertures, and charges for ſeveral lengths of that ſort of teleſcope.

Mr. OLDENBURG communicated a relation, lately printed at Paris, concerning the return of a great permanent ſpot in the planet Jupiter [h], making its periodical revolution with the greateſt regularity and ſwiftneſs hitherto known in the heavens; viz. in nine hours and fifty ſix minutes, obſerved by Signor CASSINI.

It was looked upon as a remark of conſiderable importance though it was at the ſame time taken notice of, that the ſame ſpot had been diſcovered by Mr. HOOKE in May 1664, before any thing was heard of it from abroad, as appeared from the Philoſophical Tranſactions, vol. i. part 1. p. 3. compared with n° 4. p. 78. n° 8. p. 143. n° 12. p. 209. and n° 15. p. 246.

It was thought very deſirable, that Signor CASSINI would communicate to the curious a table of this motion for a whole year, which might ſerve for obſervations in ſeveral diſtant places in the world. As alſo, that he would ſignify of what length the teleſcope was, which he employed in theſe obſervations.

There was read part of Dr. CROUNE's Latin paper, *De Formatione Pulli in Ovo*, agreeable to that of Signor MALPIGHI, lately ſent to the Society, importing chiefly, that the rudiments of a chick are actually exiſtent in the fæcundated egg, even before incubation.

The whole paper was as follows [i]:

" Cum aliquando de ortu animalium aliud, ut fit, ex alio cogitarem, venit in
" mentem experiri ea, quæ Cl. Harveus hac ſuper re ſcripto immortali in lucem
" edidiſſet. Non vero, ac ſi quæ vir iſte prope divinus ſcripſerat, aut recta non
" eſſe, aut non ſatis accurate expenſa vel minimum ſuſpicarer, ſed ut ipſa duntaxat
" eorum, quæ tradiderat, *αὐλοψία* animum oblectarem. Quoniam autem
" mihi per id tempus in rus quoddam ſuburbanum ſæpe commigrandum fuit,
" uſus ſum loci opportunitate, ad hanc rem maxime idonea; erat namque in vicinia
" paupercula quædam, quæ magnum gallinarum numerum ad quæſtum, ſive

[g] Letter-book, vol. v. p. 187. It is printed in the Philoſophical Tranſactions, vol. vii. n° 82. p. 4032, for April, 1672.

[h] It is printed ibid. p. 4039.

[i] Regiſter, vol. iv. p. 157.

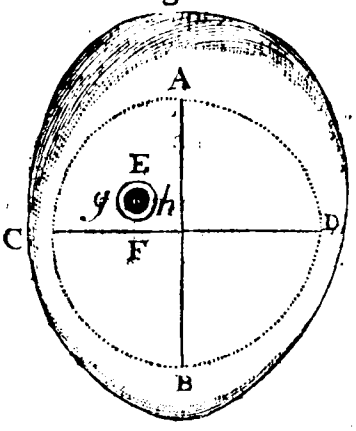
" ex

" ex ovis, ſive ex pullis faciendum, alebat: illa mihi ova omnis generis, tam " recens excluſa, quam ad dies quot volueram incubata, levi pretio obtulit. " Quæ dum inſpicio, ſummamque naturæ ſapientiam, in exigua iſta ovi mole " omnium animantium primordia collocantem, admiror, nata eſt mihi obſerva- " tio quædam maximi, ut poſt videbimus, in hoc negotio momenti, quæ non " ſolum diligentiſſimum naturæ indagatorem Harveum, ſed et alios, quos hac- " tenus viderim, omnes penitus effugit. Ex qua profecto conſtabit, eam eſſe " naturæ in divino hoc opere ſubtilitatem, ut ſerio nobis putandum ſit, unum " hoc omnium eſſe, cujus perfectam cognitionem aut nuſquam certe aut tar- " diſſime conſequamur. Obſervationem autem ipſam, quemadmodum a me facta " eſt, bona fide ſic enarrare aggredior.

## Observatio I.

" Mulier itaque iſta, quam dixi, cum forte ex importuno gallinæ ſtrepitu eam " ovum jam tum enixam eſſe comperiſſet, illud continuo ad me attulit; quippe " paulo ante monueram, velle me ovum inſpicere, cui gallina nondum incubuiſſet. " Accepto ovo, alteram quidem corticis partem ſecundum longiorem diametrum " abſtuli [k], quo, liberius effuſo fere omni albumine, vitellum & in eo cicatriculam " contemplari poſſem. Erat quidem hujuſce cicatriculæ diam. $\frac{1}{8}$ fere totius " tranſverſæ ovæ diametri. Quod ideo annotare viſum eſt, quia magnitudo ejus " non tam ab ipſa ovi magnitudine, quam a viribus ejuſdem ac vegeto intus " calore provenire videtur: Namque memini, videre me in ovo anſerino (quod " tamen alijs de cauſis infœcundum fuiſſe conjiciebam) cicatriculam multo mino- " rem quam quæ in omni ovo gallinaceo fere cernitur: imo hoc etiam vel ex eo " patet, quod quo longiori incubatu ovum fovetur, eo latior fit hæc macula atque " amplior. Circulus præterea cicatriculæ hujus, ſive limbus exterior albicans " E g F b in fig. I. ſumme aquabiliserat, exquiſiteque " ut ita dicam, tornatus: id quod etiam argumento " eſt, ovum hoc robuſtum fuiſſe, naturæque in eo " opus rite hucuſque et alacriter proceſſiſſe. Sequenti " etenim die aliud recentiſſime quoque excluſum " aperui, in quo cicatricula ejuſdem profecto dia- " metri erat; limbus autem iſte exterior laciniosus " omnino ac male contiunatus. Quinetiam et illa, " quæ in centro hujus circuli veluti nebula quædam " obſcure albeſcens ſemper viſitur, in ovo illo priori " ſuperficiei ambitum æqualiter undique termina- " tum, in hoc autem aſperum et interruptum obti- " nuit. Hæc quidem omnia in anteceſſum obſervaſſe " multum ex uſu erit; ut ſtatim vel ex ipſo Harveo " liquebit. Ad ovum itaque illud primum ut " redeam; cum cicatriculam hanc aliquandiu conſpexiſſem, imo et microſcopium " affabre elaboratum (quod tum forte ad manum erat) ad partes vocaſſem, ne

Fig. I.




[k] Vid. Fig. I.

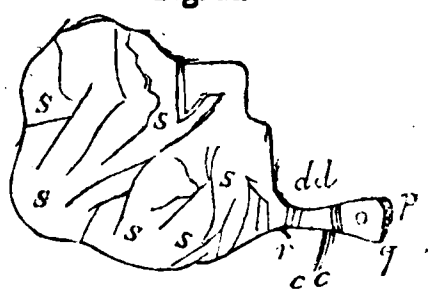
" hilum

" hiluin tamen proficere me ſenſi, nec quicquam ipſius ope oculis oblatum eſſe, quod
" abſque illo, licet forma minori, diſcernere nequibam. Equidem, ut verum fatear,
" nimium vellem aliquid vidiſſe, quod conceptam jampridem apud me ſententiam
" de inſtantanea animalium per metamorphoſin (ut loquuntur) productione con-
" firmare poſſet. Legeram ante biennium quæ in hanc rem attulerat vir doctiſs.
" Antonius Everhardi: Ac, ut nihil diſſimulem, ex iis, quæ ipſe ex Harveo,
" p. 75. adduxit, primo mihi anſa ſuſpicandi data eſt, aliquando aliquid in ovo
" repertum iri, quod hujus ſententiæ claram omnibus fidem faceret. Verun-
" tamen, ut initio dixi, tam parum mihi ſpei reſtabat (quod olim repetitis
" ſæpe plurimis experimentis fruſtra fuiſſem) ut cum primum ad ovum hoc
" inſpiciendum acceſſi, nihil minus quam hac de re cogitarem. Ut pergam
" vero; cum neſcio quid aliud acturo, ovum e manibus deponere neceſſum
" eſſet, illud non longe a foco collocavi, utique ut blandum duntaxat calorem
" inde acciperet; verebar enim, ne tempeſtas paulo inclementior (erat enim circa
" initium Martij hujus anni) efficeret, quo minus pulſationem ſeu motum aliquem
" in cicatricula tam pulchra animadvertere potuerim: cum ecce paulo poſt re-
" diens, video eam vitelli partem detumuiſſe, quæ cicatriculæ erat propinqua,
" foveamque adeo in ipſo factam, quæ piſi majoris hemiſphærium recipere poſſet.
" Ipſa quoque cicatricula penitus offuſcata erat; foveæ vero hujus margo,
" aliæque circum partes ipſi vicinæ, jam ad latitudinem fere ſemiunciæ undique
" indureſcere cœperant; quas quidem omnes facile a reliquo vitello forfice
" ſejunxi; ipſum autem vitellum cum albumine paulo ante effuſo famulæ ad
" uſus domeſticos ſervandum tradidi. Doluit vero, tam prope foco ovum
" admoviſſe, et pulchellam hanc cicatriculam ita temere corrupiſſe. Forte
" tum accidit, ut vaſculum aliquod aquæ tepidæ non procul eſſet; dumque
" hæc animo verſantur, particulam illam quam dixi vitelli calore ignis incruſ-
" tatam et a forfice adhuc pedentem, neſcio quo modo in id conjicio: ubi
" dum ſubinde agito, abſceſſit a lutei parte dura cuticula tenuiſſimæ nebulæ
" inſtar, eaque: ſubſidente luteo, natabat; hanc dum ſe in aqua varie explicantem
" atque evolventem proprius intueor, animadverti primo ipſam fibrillis fere
" innumeris, venularum in modum, undique ſcatere, ſacculumque prorſus re-
" ferre: poſt autem craſſiculum neſcio quid ſubtus latere videbatur, ac mem-
" branulam hanc valde tenuem et ſubtilem pondere ſuo deorſum ferre. Adhæ-
" rebat quidem alteri ejus extremitati, quam propterea forfice leniter ſuſtuli,
" ut quid tandem eſſet explorarem. Interea rem curioſius ſpectans viſus ſum
" mihi videre aliquid capiti fœtus pullive perſimile; quod certe non difficulter
" agnovi, quia anno ſuperiori in ovis jam triduum vel quatriduum incubatis
" fœtus hujuſmodi, ſed paulo provectiores, ſæpius vidiſſem: quorum unus aut
" alter in ampulla vitrea ſpiritus vini plena jam tum apud me erant: hinc avidis
" oculis totum quicquid eſt perluſtro, ac clare admodum diſtincteque bullulas
" iſtas duas grandiores, quæ oculi quidem ſunt, cum roſtro interjacente, con-
" ſpexi; coſtulas præterea coloris lactei, et prominula pedum rudimenta. Exta-
" bant etiam velut e ventre bina quidem filamenta non valde exilia, in extremis
" laciniata, ac ſi alicunde abrupta fuiſſent; hæc autem vaſa umbilicalia eſſe ex
" ſequente obſervatione conſtabit. Quæ cum ipſe paululum ſeorſim conſideraſ-
" ſem, aſtantibus quoque monſtravi, e quibus erant nonnulli, qui fœtus, quos

" comme-

" commemini, priores vidiſſent. Cæterum membranam hanc delicatiſſimam cum " appenſo ipſi fœtu, ea qua cernebatur magnitudine, rudi hac figura utcunque ex- " preſſi; quod niſi ſtatim feciſſem, periſſet mihi bona pars obſervationis hujus: nam " cum ipſam in ♀ (ubi etiamnum adſervo) indidiſſem, ut in eo per otium diutius " et magis particulatim ſingula contemplarer, dictu citius et pellicula iſta ac ſimul " fœtus craſſeſcere et albeſcere cœperunt, ſpeciemque ovi albuminis, diutius in " aqua cocti, præ ſe ferre; unde omnia momento mutata minus diſtincte explica- " cateque, apparuere. Fig. hæc eſt S S S mem- " branulam exhibent; *o p* duas bullulas, *q* roſ- " trum, *d d* coſtulas lacteas, *r* pedis rudimen- " tum; *c c* vaſa umbilicalia. Monendum eſt " autem, ut obſervatio hæc rite fiat, et ex " voto ſuccedat, ovum requiri robuſtum ac " valido calore intus præditum, cujuſque cica- " tricula latior, & circuli æquabiliter circi- " nati ſint; aliter enim (niſi ſumme etiam ca- " veas dum res adminiſtratur) tenellula pulli " corporatura facile diffluit et cum vitello " permiſcetur. Equidem haud potui mihi ipſi non gratulari, quod forte primus " pullum in ovo, non dico, antequam punctum illud ſaliens HARVEI appareat, " ſed etiam priuſquam ei gallina omnino incubuiſſet (aut ſaltem minima temporis " morula) viderim. Profecto HARVEUS ovum primi circiter quatridui incubatu " ad fœtum ait præparari; iſtum vero fœtum jam ante in ovo ſub cicatricula " (ut poſt patebit) latentem extitiſſe, hoc ipſi minime perſpectum fuit.

Fig. II.

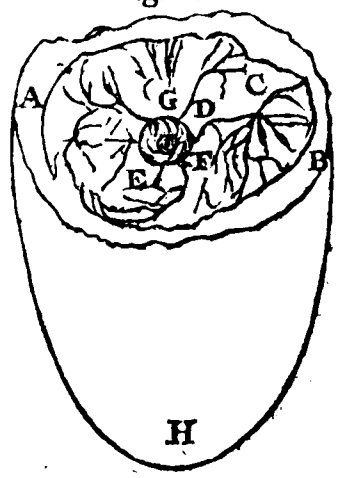



## OBSERVATIO II.

" Ac de prima hac obſervatione noſtra, præcipua quidem ea, &, ſi ita loqui " liceat, fundamentali, tantum eſt: ad ſecundam venio, quam idcirco attexere " volui, ut nonnulla paulo explicatius enarrem. In qua profecto mutationes " iſtæ, quas commemorat HARVEUS, contingere jam incipiunt; namque in prior " illa (quod ſane prænarraſſe opportuit) nihil quicquam aut in albumine aut " vitello mutatum reperi. De his tamen profiteor hic me nihil (niſi ὡς ἐν παρόδῳ) " dicturum, utpote quæ (ut ſuperius de ipſa pulli corporatura dixi) non definitis " admenſiſque temporibus, ſed, pro ovi indole ac vigore, maturius vel ſerius " eveniunt. Vicinam itaque noſtram rurſus adij, juſſique ovum, ſi quod forte jam " modo editum habuiſſet, gallinæ ſupponere. Annuit, ac poſtquam ad horas " plus minus 48. ſub gallina tepuiſſet, ad me perlatum eſt: effracto cortice " circa angulum ejus obtuſum diſrupi membranam illam duriorem, earumque, " quæ totum ovum involvunt, primam; deindeque ſecundam (quam inter & " priorem aer incluſus continetur) detraxi, unde exilis hæc corporatura cum toto " ſuorum vaſorum apparatu optime in conſpectum venit. Niſi vero membranam " hanc amoveris (quamvis ita perluceat, ut & vaſa ſanguinea & ipſum punctum

" ſaliens utcunque per eam cerni queant) ita tamen etiam in rugas plicaſque ob
" nimiam laxitatem contrahitur, ut ea non ablata nihil ſatis clare ac minutim
" videas: & hinc forte accidit, quod iſta, quæ jam allaturi ſumus, aliis in hoc
" tempore non comparuerint. Hæc autem membrana earum ſecunda eſt, quas
" in embryotomia comparata enumeravit eruditiſs. ac clar. vir. mihique amiciſs.
" D. D. NEEDHAM. Eſto in fig. appoſita A B albu-
" men turbidius ac flaveſcens, veluti liquamen quod-
" dam ex ipſius cum vitello permiſſione ortum (et
" revera tale eſſe ex ipſo poſtea HARVEO patebit;)
" in cujus ſuperficie jacet pellicula C (quæ tertia
" membrana eſt, quæ totum ovum inveſtit) vaſis
" undique ſanguineis (quæ umbilicalium ramifica-
" tiones ſunt) reſperſa; niſi quod media illius pars
" (ubi liquor iſta HARVEI clariſſime refulgens, quo-
" vis cryſtallino humore purior, hoſpitatur) nempe
" G D E F; omnino hodie ab iis immunis appa-
" ruit; quod certe mirum non eſt, cum in ovis
" octiduo incubatis duo tantum vaſa illa umbilicalia
" majoribus ramis e puriſſimi liquoris extremo ambi-
" tu erumpere videantur; totaque ipſius colliquamenti
" ſuperficies nullum proſus colorem ducat. In hoc
" liquore viſæ ſunt duæ parvæ maculæ, & circa illas

Fig. III.




" corporatura quædam albida, craſſitiei quidem inſignis, & in puriſſimo illo
" humore quaſi profundius demerſa: ſi attentius ſpectes, intra iſtam corporatu-
" ram rubedo quædam conſpicua eſt, ſed quæ alternis motibus interdum ſe
" veluti in ipſam condere, iterumque ex eademmet emicare videtur. Interea
" vaſa illa ſanguinea non ab hoc puncto rubro, verum ab ipſa colliquamenti
" margine originem trahere putes: quod quidem poſt longiorem incubationem
" luculentius patet, ut modo dixi: ſiquidem videre licet quaſi ex ipſo pulli ventre
" (non certe a puncto ſaliente, ut clare animadvertere potui,) vaſa aliquot ſan-
" guinea, ſed pauca, & reliquis, quæ in membranam ante dictam ſparguntur,
" majora, e medio colliquamenti verſus marginem inflexa, circa illam erumpere,
" & in ramos innumerabiles diſpeſci. Poſthæc, totum vitellum (quem albumen,
" ſed infra circa H minime eliquatum aut turbidum ſequebatur) effudi, reman-
" ſitque ſolummodo pellicula ante dicta, quam confeſtim in aquam tepentem
" indidi, ubi ſe in marſupij cujuſdam ſpeciem explicavit, qua deorſum verſa,
" apparuit illico pulli corpuſculum, huic membranæ incluſum, eique
" per funiculum umbilicalem appenſum hac fere forma ut in figura IV. Fig. IV.

" Totum quidem albicans ac pellucidum erat, dumque huc & illuc
" converto, nec minima jam ſanguinis gutta reſtaret, vidi in medio
" veluti hujuſce corpuſculi punctum quoddam lucidiſſimum valde
" exiguum, quaſi gemmulam aliquam varias luminis ſtricturas evibrantem; quod
" proculdubio cor erat. Duravit hæc ex ſyſtole & diaſtole facta micatio per
" quartam circiter horæ partem, poſtquam totam pelliculam jam a pulli cor-
" puſculo ſeparaſſem; & adeo á prima inſpectione, uti beneficio microſcopij cog-
" novi, per horas tres: quod certe jure mirari poſſumus, tantillam vitæ ſcintil-
" lulam

" lulam non citius extinctam fuiſſe. Aderant præterea duæ treſve bullæ circa " capitis regionem; macula quoque verſus medium corporis craſſior atque alba, " quam jecur vel lienem fuiſſe arbitror; alia vero prope caudam cernebatur, quæ " pedis erat exordium. Denique funiculus umbilicalis ſatis manifeſto comparuit; " cumque totum ſoli expoſuiſſem, coſtas admodum albas & dorſi carinam cla- " riſſime conſpicatus ſum: atque hactenus ſecunda obſervatio fuit.

## Ad Observ. I. & II.

" Cæterum ut ex allatis hactenus obſervationibus fructum aliquem colligamus, " manifeſte hinc liquet, maturius longe pullum in ovo aut formari quidem, aut " ipſius formationem inchoari ſaltem, quam harum rerum curioſiſſimus Harveus " Exerc. xiii. aliique ex eo exiſtimarint. Harv. certe clare innuit (quod a me jam " ſupra eſt annotatum) *ova nonnulla celerius mutari, ac tertio ab incubatione die fœtus* " *primordia* (hoc eſt, ut ipſe intelligit, ſanguinem & punctum ſaliens) *exhibere,* " *alia vero ad ſeptimum uſque diem nullum futuri pulli ſpecimen edere.* Liquet vero " mihi ex factis aliquoties obſervationibus fidenter aſſerere, nuſpiam ulla iſtiuſ- " modi primordia aut ſpecimina futuri (ut inquit) pulli apparere, quin ſimul to- " tus pullus jam præſens adſit, & ſub dicta ſæpius cicatricula deliteſcat: imo to- " tum (ut ex prima obſ. conſtat) pullum conſpexi, antequam ovum ullam pror- " ſus mutationem paſſum eſſet; niſi quod cicatricula paulo forte amplior ac ma- " gis æquabili circumductu prædita videretur. Quin adjicio inſuper, quando- " cumque aliqua ex iſtis mutationibus, quas ovum ex ſententia Harvei ordine " ſubit, contingit, integram ſimul pulli corporaturam exiſtere, ac modo prius in- " dicato reperiri poſſe; & in ovis generoſioribus ac ſpiritu plenis non tantum " ante ipſam gallinæ incubationem, ſed forte etiam ante ipſam e corpore ejuſdem " excluſionem. Hic vero magnopere advertendum eſt, me, etſi non dicam cum " Harveo *ovum pro vario ipſius robore tarde aut celeriter in pullum proficere* (quia " magis veriſimile arbitror, momento conceptionis totum ſimul ac ſemel confici) " fateri tamen, tenellum hoc corpuſculum omniaque adeo ipſius membra, pro " ratione virium in ovo, ac repetitis forte galli coitionibus, citius aut ſegnius " ab incubante gallina ad perfectionem educari. Quod idcirco monui, ne quis " forte me falſi inſimulet, quod ipſe eaſdem obſervationes facturus pullum ſimi- " liter ante gallinæ incubitum non ſtatim offenderim; namque mihi ſatis erit " tam fœlici fuiſſe, ut in tale ovum inciderim, ubi hunc oculis videre, manibus " tractare, aliiſque oſtendere licuerit. Hortor illos itaque ad experimenta ſæpius " facienda, ſi primum non ſucceſſerit; nec profecto abſque cauſa: etenim accepi " ab obſtetrice expertiſſima & fide digna, a qua fœtus humanos abortivos ali- " quando petieram, difficillimum eſſe cum paucarum adhuc hebdomadum ſunt, " cavere, ne cum aquis (ut vocant) erumpentibus evaneſcant, propter ſummam " nimirum teneritudinem ac mollitiem. Nec certe cuiquam hoc mirum videbi- " tur, cui lectum fuerit illud cl. Kerkringii in accurata fœtuum oſteogenia nuper " edita; ubi *totum* (ait) *corpus in embryonibus ex mera membrana videtur conſtare:* " & paulo ſupra, *in iis etiamnum, quæ duorum menſium ſunt, omnia capitis oſſa membra-* " *nea eſſe.* Accedit huc, quod eadem alias mihi retulit, ſe quandoque vidiſſe fœtus,

" qui unguem pollicis vixdum magnitudine æquabant, membris omnibus rite con-
" formatos, cuticula quoque nitenti & polita exornatos: alios autem ſpithamam
" totam longos, qui ſpeciem quandam gelatinæ potius informis, quam fœtus hu-
" mani, redderent. Cum hiſce conſentiunt, quæ de ovis ſive de abortibus hu-
" manis ſibi quoque contigiſſe narrat HARV. quorum in aliquibus fœtum quidem
" invenit, in aliis vero nullum: veriſimile autem eſt, in omnibus ſane fœtus ad-
" fuiſſe, ſed præ ſumma mollitie diſperditos non apparuiſſe. Porro ex hacte-
" nus allatis ſtatuendum omnino videtur, nullo adhuc experimento liquere, quo
" præciſe temporis momento aut pulli conformatio inſtituatur, aut quando pri-
" mum in ovo conſpici queat: longe autem a veritate aberrare maximum HAR-
" VEUM, dum totius hujus formationis hiſtoriam a puncto ſuo ſaliente ceu pri-
" mitus extructo, vel potius a ſanguinis apparitione orditur; cum aliunde certo
" conſtet, punctum illud ſaliens micationes ſuas celebrare non poſſe abſque ope
" cerebri ac nervorum; unde vel hac etiam ratione ſtatui poſſit, cerebrum ne-
" ceſſario exiſtere, quotieſcunque iſte cordis rythmus conſpicitur, etiamſi obſer-
" vationis fides non accederet. Atqui incertum adhuc ab experimentis eſſe quan-
" do primum cernatur pullus; cum in ovis generoſioribus id quidem ante qua-
" lemcumque gallinæ incubitum contingat, & forte antequam ab ipſa excluda-
" tur; in aliis vero, non niſi ab aliquot dierum fotu & incaleſcentia ſatis firmita-
" tis aut magnitudinis indipiſci, ut oculis intuentium pateat. Quod ſi hæc ita
" ſint (uti ſunt certiſſime) profecto plurima eorum concidant neceſſe eſt, quæ
" paulo fuſius quidem, ſed non abſque inſigni facundia, ab HARVEO diſſeruntur.
" Nolo autem ob ſummam clariſſimi viri authoritatem & reverentiam ſingula
" particulatim cenſere; verum ea duntaxat, quæ proprius ex obſervatis ad veri-
" tatem accedere videntur, exponam. Quantum itaque ex obſervationibus rite
" factis colligere poſſumus, illa potius ſententia recipienda eſt, quæ pullum uno
" quaſi ictu integrum conflari, omnibuſque ſuis partibus præditum eſſe, ipſo
" forte conceptus momento aſſerit. Cl. HARVEUS contrariam quidem opinio-
" nem, ex longa obſervationem ſerie deductam, tuetur: quare ut rem ipſam pe-
" netius inſpiciamus, neceſſarium erit, ipſius obſervationes aliquas cum iis, quas
" ſupra adduximus, conferre. Commemorat autem in prima ovi inſpectione vir
" cl; cicatriculam illam jam toties dictam a ſe primum pro origine pulli ha-
" bitam: equidem haud inficior, ipſum quid hæc macula eſſet, multo clarius ac
" diſtinctius explicare, quam quiſquam alius fecerat. PARISANUS tamen (ut ab
" HARVEO citatur) e macula ipſa pullum oriri agnovit, deque ea fortaſſe rectius
" quam putarat HARVEUS, ſenſit: facile enim crediderim e verbis iſtis, quæ ex
" ipſo attulit HARVEUS, eandem fere ipſi quæ mihi obſervationem, obtigiſſe:
" *priuſquam enim* (inquit PARISANUS) *rubor aliquis in fœtus corpore appareat, duæ*
" *extant in eo minimæ bullulæ; initio tamen rubore earum nulla prædita eſt.* Et hoc
" quidem recte, quod tamen pace cl. HARVEI dixerim; qui iſta continuo ſubjicit:
" Exerc. xvi. *At vero nec bullula aliqua conſpicua eſt antequam rubor ſanguineus appa-*
" *reat, &c.* Ego tamen (ut dixi) non modo bullulas duas (quas quidem male
" PARISANUS pro corde ac jecore habet, cum oculorum potius rudimenta ſint)
" verum etiam pullum integrum conſpexi, ut jampridem in obſ. prima dictum
" eſt. Equidem ex citatis PARISANI verbis haud ægre adducor ut credam, eum,
" dum hæc inveſtigaret, in hujuſmodi ovum incidiſſe, quod integram pulli cor-

" poraturam

" poraturam in colliquamento demerſam ipſi ſpectandum præberet. Sed cum quid
" eſſet neſciret, binas ſolummodo bullulas, utpote reliquis partibus conſpectiores,
" obſervaſſe, eaſque ex recepta tum fere apud omnes ſententia, pro corde & je-
" core habuiſſe. Cæterum, ut dixi, credibile eſt, eodem, quo fit conceptus, mo-
" mento pulli corporaturam formari: quid enim aliud eſt conceptus ve ipſi HAR-
" VEO, quam papula iſta, quæ oviparis ex ovario [1], viviparis ex utero erumpit? At-
" qui autem (ut vivipara in præſens omittam) papula iſta ovum eſt, ovum, inquam,
" integrum; non vitellus tantummodo, ut initio operis dixerat HARVEUS; ſed, ut
" alibi rectius, Exerc. xxxvii. *aliquid potius compoſitum, quod ambos liquores (albumen
" ſcilicet & vitellum) permixtos in ſe contineat: colore quidem vitellum refert, ſed conſiſten-
" tia ſua propius ad albumen accedit*, &c. Quid quod alias quoque dicat Exerc. xxvii.
" ovorum hæc primordia ceu papulas *propria anima vivere?* Denique verbis diſer-
" tis Exerc. xxviii; *galli & gallinæ fructus, ſive conceptus communis, eſt ovum:* paren-
" tis utriuſque virtutem referens. Quidni autem maculam quoque ovo huic ineſſe
" dicamus? Certe (fatente HARV. Exer. xxix.) ovum fœcundum eſt ſperma et ſemen
" genitale, plantarum ſemini analogon; ſed enimvero quod in plantarum ſemine
" eſt germen, id in ovo ſive animalium hoc ſpermate macula eſt, ſive id potius
" quod ſub macula latet, pulli nimium corpuſculum. Nec quenquam exterreat
" corpuſculi hujus veluti immenſa exilitas; namque, ſi ad calculum geometricum
" res exigatur, facili oſtendi poſſet, dari in rerum univerſalitate particulas actu
" minores, quam quæ hoc corpuſculum conſtituere debent. Præterea, cum re-
" ipſa conſtet, ovum nihil eſſet aliud quam talis materiæ ſtruem atque appara-
" tum, unde corpuſculum hoc ali atque augeri queat; cur, obſecro, putemus,
" apparatum hunc adeſſe, pullum vero alendum neutiquam adeſſe? Per appara-
" tum hunc, & ipſos liquores alimentares, & vaſa ad eos deferendos neceſſaria,
" & membranas, quæ vaſa iſta ſuſtentant, intelligo. Namque, ut diximus, te-
" nerrima iſta membrana, quæ in tepida natabat, innumeris ubique vaſis obſita
" erat; ut minime dubitarem, quin liquor aliquis in iis fuerit, & certe is ipſe, qui
" poſtmodum induta rubedine ſanguinis appellationem obtinet. Qualis fere, ex-
" empli gratia, in aſtacis aliiſque teſtaceis (quorum ſanguis ſemper albicat) videri
" ſolet. Sed ut eo unde diſceſſi redeam; *poſtquam ovum horas* 24. (inquit HARV.
" Exerc. xv.) *tepuit, vitellus, qui prius in albuminis centro hærebat, verſus cacumen
" obtuſum aſſurgit; ſitque ut vitellus cavitati per cicatriculam conjungi videatur.*
" Id quod hoc vel conſimili pacto evenire arbitror: dum gallina ovum incubat,
" calor ab ipſa proveniens aërem in ſuperiori ſive obtuſo ovi angulo, ad uſum re-
" ſpirationis (ut deinceps oſtendam) relictum, inſigniter rarefacit; unde is, quem-
" admodum in Thermoſcopio vulgari, liquores ſubditos premit. Cum autem vi-
" tellus, a chalazis utrinque ſuſpenſus, membranæ, albumen immediate obvolven-
" ti, aliquantulum hæreat, fit ut ipſum albumen facilius locum cedat, proinde-
" que deorſim comprimatur, & vitellum in eo libratum verſus ſuperiora attollat.
" Interim eadem opera membrana iſta ſecunda ſimul detruditur, unde vitelli macu-
" la cavitati veluti conjuncta apparet. Sed ad ſecundam jam inſpectionem accedа-
" mus; hic enimvero illud maxime animadverti, quod ipſe fateatur Exerc. xvi. *adeo
" tenuem eſſe ipſius colliquamenti membranam, ut, niſi ſummam curam adhibeas, fa-*

[1] Quod uteri tantum pars eſt ſuperior & craſſior.

" *cile diffiliat*, fontemque confuſione liquorum turbet. Idcirco minus mirandum " eſt, ſi ipſa etiam fœtus rudimenta, quæ juxta HARVEUM in medio hujus col- " liquamenti ſunt, leviſſimo momento elabantur, nec quæſita hoc tempore omni- " no compareant. Occaſione hujus colliquamenti addit HARVEUS, fœtum in " eo natantem, ex utero cervæ exemptum, regi CAROLO I. a ſe oſtenſum. Liceat " etiam mihi ſimiliter, hic fœtum humanum (eoque gratius naturæ ſpectaculum " & inſolentius) memorare; viro cl. ac doctiſs. D. D. CLARKE majeſtatis regiæ " medico, viſum eſſe, in ovo ſuo natantem, membris omnibus exquiſite inſtruc- " tum & conſummatum. Quinetiam jam apud me pullus in ♀ adſervatur, egre- " gia corporis albedine in colliquamento ſuo ſpectabilis, ſemunciam fere longus; " quem nonita pridem illæſa delicatiſſima iſta membrana ex ovo exemi. Videamus " inſpectionem tertiam, ubi optime monet Exerc. xvii; *ea quæ jam viſuntur ſic plerun-* " *queevenire, non enim* (inquit) *eſt hoc perpetuum, cum magna ſit in ovorum maturi-* " *tate diverſitas*, &c. Et paulo poſt, *quædam ova die quinto minus perfecta ſint* " *quam alia tertio.* Conſidera mihi, obſecro, an non hinc evenerit, ut ipſe pul- " lum ante qualemcunque gallinæ incubitum repererim? Iſtaque præterea cuncta " mihi fuerint oblata, quæ jam ſupra explicui? Ex quibus profecto conſequitur, " neſcire nos penitus quo præciſe temporis momento pullus formetur in ovo, ſeu " papula potius: illud certum eſt, non erraſſe peritum (ut eum vocat HARVEUS) " diſſectorem, VOLCHERUM COITER, qui globulos ſecundo poſt incubitum die vi- " dit; quod tamen negat HARVEUS. Prius vero quam ulterius pergam, non- " nulla de ipſa hæc macula ſive cicatricula annotare placet. *Primo*, inquit HARV. " Exerc. xv. *inſpectionis die dicta macula dilatatur, & in circulos diſpertitur, qui pun-* " *ctum album pro centro habent:* equidem unicolorem vidi, hoc eſt, totam albam, ſed " plerumque ſpatium quoddam fuſci coloris inter albeſcentem circulum & cen- " trum jam dictum interjacet, qui longiori incubatu amplior fit, imo in plures " circellos quaſi diffinditur; ipſumque tandem centrum evaneſcit; unde arbitror, " maculas haſce omnes principio unicolores eſſe; ſed ope caloris materia illa al- " bida (quæcunque fuerit) e qua conſtituitur, paulatim in circulos diſſilit, tan- " demque in omnem undique partem amota, purum illum cicatriculæ liquorem " detegit atque oſtendit. Fruſtra ergo quæſtionem hic agitat HARV. Exerc. xvii. " punctum hoc album, quod maculæ centrum eſt, in rubrum illud ſaliens poſtea " convertatur; nam ſi quis rem attentius penſitet, exiſtimabit potius, materiam " hanc albidam liquorem cryſtallinum obtexiſſe duntaxat, pullumque in ipſo, " ad cujus forte, dum molliſſimus eſt, defenſionem a natura comparata eſt. Cæ- " terum de quarta jam inſpectione dicamus; in qua nolo tam ſolicite veritatem " conſectari, ut in virum, omnium ſæculorum memoria dignum, quemque a lon- " ginquo venerari debeo, quicquam inverecundius admiſiſſe videar. Aio itaque, " ea, quæ ibi tam eleganter curioſeque deſcripſit, procul dubio veriſſima eſſe, at- " que ſic plane ipſi, dum per illæſum adhuc vitellum tranſpicere voluit, (ut " feciſſe eum non uno e loco hujus exerc. colligere poſſumus) apparuiſſe. Nam- " que pulli corpuſculum non eundemamet ſemper in liquore ſuo ſitum obtinet, " adeoque non iiſdem ſui partibus ſe videndum præbet, ut mihi ſæpius experto " conſtat: nec aliunde proveniſſe autumo, ut quæ ſuperius a nobis allata ſunt " viri perſpicaciſſimi diligentiam effugerint. Cum itaque apud me cogito nuſpiam

" viderii novo puctum saliens, aut lineam ullam sanguineam, quin tota pulli corpo-
" ratura reperiri queat, mirari subit ista verba Exerc. xvii: *certo constat, futuri fœtus*
" *nihil omnino hoc die apparere* (tertio scilicet) *præter sanguineas lineas & punctum sa-*
" *liens*. Fateor equidem sub finem exerc. xviii. dicere illum hæc; *immisso in aquam*
" *limpidam corporis rudimento, quid ejus factum sit, quid etiamnum desideretur, cogni-*
" *tu facile esse:* ita se omnino res habet, atqui id feciſſe se non meminit; at de-
" mus, feciſſe; forte semel vel bis: unde facile evenire potuit, ut in fœtu lacero
" ac læso, atque ex ovo fortasse imbecilliori desumpto, omnia non perviderit. Quod
" si experimentum hoc rite ac caute fuisset administratum, nequeo divinare quo-
" modo pullum non repererit. Sed quid si ipse viderit? imo vidit profecto, nec
" enim aliud sonant verba ista Exerc. xviii. *In provectioribus ovis aliquando sub finem*
" *quartidiei* (imo ut plurimum, & citius, si ova spiritu & vigore abundent) *nescio quid*
" *turbidi vesiculos pulsantes obumbrat, &c.* Preterea *nebulam hanc corporis rudi-*
" *mentum* diserte appellat; sed in eo minus cum veritate consentire videtur, dum
" *ex colliquamenti parte concoqui vult, & circa venarum principia concrescens effluvium*
" vocat. Alibi vero admodum prope ad ipsam accessit; ubi fatetur dubitare
" se, *numnam facta colliquamenti coagulatione una cum sanguine & puncto saliente*
" *hoc etiam corporis capitisque rudimentum statim existeret* (uti revera exiſtit) sed
" *tenue adeo & pellucidum* (pulchre omnino & veriſſime) *ut visum prorsus effugeret,*
" *donec in fibram & mucorem crassescens, albedinem induat qua percipiatur: dum in-*
" *terim sanguis crassior ac rutilans in colliquamento tam diaphano facile conspicitur.*
" Hæc etsi paulo longiora exscribere tamen volui, quia ratio hinc optima peti
" possit, cur non difficulter pulli corpusculum adesse concedamus, etsi quandoque
" fortassis inveniri nequeat. Etenim præcipue animadvertendum est, alias fœtus
" partes præ aliis magis conspicuas esse; imo eas magnitudine & crescendi veloci-
" tate cæteras antevertere, quæ usu præstatiores sunt, ac magis necessariæ; quales
" sunt cerebrum inprimis, quod proportione reliquas omnes excedit superatque;
" spina etiam seu carina dorsi; quippe ab his, omnem sensionem profluere mox
" ostendam, quicquid contra de cordis sive puncti salientis irritatione dicat HAR-
" VEUS Exerc. xvii. tum autem cor ipsum, quod intra nebulosum hoc corporis
" concrementum (ut ex obs. nostra secunda constat) systolas & diastolas suas vi-
" brans purpurei liquoris beneficio cernitur. Reliquis inspectionibus non immo-
" rabor, in quibus omnia adeo clara & perspicua jam sunt, tamque accurate ab
" HARVEO copioseque enarrantur, ut nulla super his contraversia exoriri queat.
" Cæterum hoc loco opportunum erit, ea quæ contra sententiam HARVEI dispu-
" tavit vir cl. ANTONIUS EVERHARDI paulisper despicere: quæ & observationes
" quidem nostras egregie confirmant. Enimvero vir iste eruditiss. eandem nobis-
" cum sententiam de instantanea animalium (ceu in proplasmate quodam) forma-
" tione complectitur; eamque ex [m] modo recensitis HARVEI verbis eruere velle vi-
" detur: argumento (inquit) *certissimo, corporis rudimentum, etiamsi præ exiguitate vi-*
" *sum fugiat, una cum cordis corpusculo delineari.* Postquam autem historiam suam
" de animalium ortu ab experimentis cuniculorum exstructam, absolvisset, hæc
" habet: p. 73. *sed mirabitur fortasse quispiam, quod in primis meis observationibus*
" *puncti sanguinei salientis & mentionem non fecerim; sed mox initio meminerim embryonis*

[m] Pag. 22. lin. 5, Ant. Ever. de Ort. An. p. 54. 76.

" *jam*

" *jam conſpicui rudimenti, &c.* & paulo poſt; *fateor* (inquit) *punctum ſaliens fi-*
" *braſque ſanguineas in ovo primum quidem apparerere* (in quem proculdubio errorem
" non incidiſſet, ſi, ut in cuniculis, de quibus ſummas ipſi gratias agimus, pa-
" riter in ovis experimenta feciſſet;) *ſed an eadem res ita ſe habeat in genera-*
" *tione viviparorum, valde dubito, aut vix credo.* Equidem vir cl. uti tu nos hac
" in parte ſublevaſti, ita nos tibi (uti ſperamus) facem aliquam in oviparis ac-
" cendimus; ut adeo ex iis, quæ jam es dicturus, ſumma iſta cognatio, ab ipſo
" HARVEO toties agnita, quæ viviparorum generationi cum oviparis intercedit, cla-
" rius percipiatur: namque ſic pergis p. 74. ; *In productione cuniculorum punctum ſan-*
" *guineum ſaliens, fibræque ſanguineæ, poſt factum futuri fœtus rude fundamentum mihi*
" *ſemper apparuere*; *& hoc non modo in generatione cuniculi, ſed ipſius etiam hominis*
" *obſervavi.* Ac pluſcula in utroque genere exempla profert, quæ apud ipſum au-
" torem inveneris. Profecto punctum hoc ſaliens rubrum primis quibuſque incu-
" bationis diebus potiſſimum cernitur in ovo: inſequentibus autem e conſpectu abi-
" re, *neque amplius extra moveri, ſed obtegi ac cooperire videtur*; ut optime (apud
" HARVEUM; Exer. xvii.) *Ulyſſes Aldrovandus annotavit: duo autem (ait) iſti meatus*
" *venoſi evidentiores conſpiciebantur, alter vero major altero.* Quiſque hoc facile
" experiri poterit; quocirca paulo durior in cl. virum hoc in loco eſt HARVEUS,
" dum falli ipſum aſſerit. Ut ſummatim dicam, haudquaquam dubito quin maxi-
" mus noſter HARVEUS fomationis partium pulli hiſtoriam veriſſime quidem ac-
" curatiſſimeque adornarit; licet non eo quo extiterunt ordine (omnes enim ini-
" tio ſimul co-exiſtunt,) ſed eo quo ipſi apparuerunt. Video autem, duo mihi
" hic monenda eſſe; nuſpiam fere eodem aut conſimili ritu pulli exordium in
" colliquamento cerni, ſed pro varia ejuſdem in illo ſitu variaque ovi indole, nunc
" hoc nunc alio modo, ſub obtutum cadere. Deinde ex ipſo HARV. aliud Exer. xx.
" (etſi jam ſupra idem dixerim;) *ova quædam præcocia & provectiora eſſe, omniaque*
" *explicata magis habentia*; *alia tardiora, membriſque (quod ſumme notandum eſt) mi-*
" *nus diſtincta apparere. Quanquam alias non parum ad hanc rem faciant anni*
" *tempus, locus, externa fomenta, diligens incubatio*, &c. Hæc autem ideo mo-
" nere neceſſum erat, ne quis forte, dum obſervationum noſtrarum experimenta
" capere aggreditur, eaque quæ dixi non continuo offendat, eas aut ſubleſtæ fidei,
" aut ſaltem hallucinatum me, eſſe arbitretur. Quoniam autem ex dictis eviden-
" ter liquet, longe aliter ſe habere formationem pulli in ovo, quam ab HARVEO
" exiſtimatum eſt; conſequitur profecto, eorum magnam partem, quæ ex hiſto-
" ria a ſe deſcripta deduxit, erroris haud immunem eſſe: uti ſunt ea, quæ exerc.
" li. de generationis ordine habet ac particula genitali prima; quaque exerc. lii.
" de dignitate ac præſtantia ſanguinis, ejuſque primo ortu; de ſenſione puncti
" ſalientis; nonnulla etiam, quæ de ovo tradidit, quod a ſola gallina abſque ullo
" uſpiam galli initu concipi poſſe ſæpius aſſerit; alias vero diſerte ſibi adverſa-
" tur exerc. xxviii. quicquid autem garriant aniculæ, hoc omni vere experientiæ
" repugnare certum eſt. Quin etiam de pulli in ovo nutritione, ob incognitum
" adhuc NEEDHAMI ac STENONIS ductum inteſtinalem, ac adeo de ejuſdem re-
" ſpiratione (cujus obſ. pulcherrimam nactus ſum,) dum intra ovum concluditur;
" ſed de his aliiſque, quæ huc attinent, uti de ſede libidinis in gallinis, earumque
" fœcunditate a galli coitionibus magis minuſve aucta, ubi plus otii erit, diſcep-
" tabo."

*April*

*April* 4. Mr. HOOKE made an experiment with two pieces of glaſs ſtiffly rubbed upon one another, to ſhew that there may be the ſame incidence of rays, and yet various colours. And he was ordered to bring an account of this experiment in writing at the next meeting, together with his conſiderations upon it; as alſo to draw up and give in an account of the experiment, made at the laſt meeting, with ſal-nitre diſſolved in common water.

Mr. OLDENBURG produced a printed ſheet in folio, dedicated to the Royal Society by Dr. JOHN SWAMMERDAM, a phyſician in Holland, concerning the ſtructure of the *uterus* and *ovarium* belonging thereto, &c. It was recommended to the conſideration of Dr. SMITH and Dr. BROWN, who were deſired to make a report to the Society at their next meeting, of what might be peculiar in it.

Mr. OLDENBURG communicated a letter to him from Mr. NEWTON, dated at Cambridge 30th March, 1672 [a], containing his anſwer to the difficulties objected by Monſ. AUZOUT againſt his reflecting teleſcope: as alſo the queries of Monſ. DENYS concerning it; together with Mr. NEWTON's propoſal of a way of uſing, inſtead of the little oval metal in that teleſcope, a cryſtal figured like a triangular priſm.

Mr. HOOKE was ordered to make ſuch a cryſtalline priſm for the deſign mentioned in Mr. NEWTON's letter, and to try the ſame.

There was read a paper of Dr. GREW, ſent to Mr. OLDENBURG from Coventry, 12 March, $167\frac{1}{2}$, containing ſome obſervations about ſnow; which was applauded as an ingenious diſcourſe, and ordered to be regiſtred [b].

Mr. HOOKE promiſed to bring in ſome other experiments of colours at the next meeting.

The reading of Dr. CROUNE's Latin diſcourſe, *De Formatione Pulli in Ovo*, was ordered to be continued when himſelf ſhould be preſent.

*April* 10. At a meeting of the COUNCIL were preſent,

Sir ROBERT MORAY vice-preſident,
The lord viſcount STAFFORD,
The lord HENRY HOWARD of Norfolk,
The lord biſhop of Cheſter,
Sir THEODORE des Vaux,
Dr. GODDARD,
Mr. COLWALL,
Dr. WALTER NEEDHAM,
Mr. CREED,
Mr. OLDENBURG.

[a] Letter-book, vol. v. p. 193. An extract of it is printed in the Philoſ. Tranſact. vol. vii. n° 82. p. 4034.

[b] Regiſter, vol. iv. p. 92. It is printed in the Philoſoph. Tranſact. vol. vii. n° 92. p. 5193, for March, 1673.

There was made a propoſal from Mr. EVELYN by Mr. OLDENBURG, for letting out Chelſea college to be a priſon-houſe during the war [p]; together with an intimation, that Mr. EVELYN hoped to procure a rent of one hundred pounds a year for it, beſides ſome neceſſary repairs of the houſe. Hereupon it was ordered,

That the preſident, the treaſurer, and the ſecretary, who officiates, ſhould have power to agree, in the name of the council, with Mr. EVELYN, about the matter propoſed, and conclude with him and his collegues, if the above-mentioned hundred pounds *per annum*, together with good repairs, could be obtained; and that upon the agreement concluded, they make a report to the council, in order to its paſſing under the ſeal of the Society: and that Mr. EVELYN be thanked for his care of the concerns of the Society:

It was propos'd by the lord HOWARD, that care might be taken to let out the the five acres of land lying about Chelſea-college, to ſome perſon or other, who would hedge it about, for any rent.

Sir ROBERT MORAY hereupon propoſed, that he would ſpeak with captain THORNHILL about letting that land.

It being mentioned by Mr. HOOKE, who was called into the council, that Sir JOSEPH SHELDON had ſpoken to him of fifty acres of land, which he believed to belong to Chelſea-college; it was ordered, that the preſident ſhould be deſired by the council to take notice of this information, and to confer with Sir JOSEPH SHELDON about it.

The biſhop of Cheſter propoſed Dr. GREW to be a curator to the Society for the anatomy plants for a year, upon ſubſcriptions, amounting to fifty pounds, to be made by ſuch members as ſhould be willing to contribute thereto.

The council approved of this propoſal, and ordered, that it ſhould be ſignified to the body of the Society at their next meeting, in order to actual ſubſcriptions.

It was moved by the vice-preſident, that whereas Thurſday proved inconvenient to divers conſiderable members of the Society to meet, that day might be changed again, and Wedneſday appointed for the weekly meeting-day, as it had been formerly.

The council approved of this change, and ordered, that it be ſignified to the Society at their public meeting, on the Thurſday following.

It was ordered, that the treaſurer pay one year's ſalary to Mr. HOOKE.

[p] With the States-General.

*April*

*April* 11. The Society did not meet.

*April* 18. Mr. HOOKE was ready to make an experiment by a prism, viz. to deſtroy all colours by one prism, which had appeared before through another: but there being no ſun, as was neceſſary, the experiment was deferred.

Several letters to Mr. OLDENBURG, concerning matters relating to the Society, were read.

1. From father PARDIES the jeſuit, profeſſor of mathematics in the college of Clermont in Paris, dated there April 9, 1672, N. S [q]. containing ſome objections againſt Mr. NEWTON's theory of light and colours.

2. A letter from Mr. NEWTON, dated at Cambridge April 13, 1672 [r], containing an anſwer to the objections of the ſaid jeſuit.

3. Another letter from Mr. NEWTON of the ſame date [s], anſwering ſome experiments propoſed by Sir Robert MORAY for the clearing of his theory of light and colours.

4. From Signor MALPIGHI, dated at Bologna April 5, 1672, N. S. [t], expreſſing his readineſs to comply with the Society's deſire, that he would continue his diligence in the anatomy of plants, and his obſervations on the formation of a chick in the egg.

Mr. COCK having produced a concave of ſteel for a reflecting teleſcope, which, he ſaid, he was not able to make all over of the ſame hue, it being in its greateſt part darker than in the reſt about the edges; he was ordered to poliſh it as it was.

Mr. HOOKE propoſed a way of making theſe reflecting concaves in great numbers, and poliſhed by the means of two dyes, one concave, the other convex, putting between them a plate of ſilver, and then ſtamping them with the mint-mill.

It was doubted by Mr. ROBERT MORAY, whether it would be poliſhed this way, and keep its figure. However, it was thought worth trying; and therefore it was ordered, that Mr. SLINGESBY ſhould be deſired from the Society to ſee this experiment tried for them.

There were read ſome obſervations concerning the voyage lately made to Eaſt Hudſon's Bay, and the ſtate of that country and its inhabitants, communicated

[q] Letter-book, vol. v. p. 204. It is printed in the Philoſoph. Tranſact. vol. vii. n° 84. p. 4087.

[r] Letter-book, vol. v. p. 218. It is printed in the Philoſoph. Tranſact. ubi ſupra p. 4091.

[s] Letter-book, p. 222. It is printed in the Philoſoph. Tranſact. n° 83. p. 4059.

[t] Letter-book, vol. v. p. 202.

to Mr. OLDENBURG upon his inquiries, by captain GUILLIAUME and Mr. BAILEY, two of the chief perſons employed in that voyage, who had wintered there. Theſe queries and anſwers were ordered to be regiſtered [u], and were as follow:

" 1. What time of the year they ſet out from hence, and when they arrived " at the place intended? Reſ. They ſet out June 5. and landed Auguſt 22. in " the bottom of Eaſt Hudſon's Bay, being fifty degrees and forty-five minutes " north latitude, and diſtinct from the weſt bay, the place of captain JAMES's " wintering, which was in fifty-two degrees and thirty minutes latitude.

" 2. In what degree of latitude they met with the firſt ice, and at what time of " the year? Reſ. In fifty-nine degrees; in the beginning of Auguſt, they met " with icy iſlands moving.

" 3. How far north they ſailed? Reſ. Firſt, to the entry of the ſtraits, that " let them into Hudſon's Bay, which entry is at ſix and an half degrees north " latitude, whence they run up higher to the latitude of ſixty-three degrees (the " moſt northward place they went to) and thence they run down again near three " hundred leagues due ſouth, to about the latitude of fifty-one degrees, and lon- " gitude about three hundred and ſeven degrees.

" 4. In what month the moſt northern parts, which they muſt make, are moſt " convenient to paſs? Reſ. In Auguſt and September; and they hope they " ſhall be able hereafter to go and come in one and the ſame ſummer, by ordering " their voyage ſo, as to be there about the middle of Auguſt, and by coming away " about the beginning of September, the commodities of the place lying, upon " agreement with the natives, ready to be ſhipped immediately upon their arrival.

" 5. What depth of water they had where their ſhip anchored, and they win- " tered? Reſ. About nine or ten foot, but in the ſtrait's mouth, it is ſo deep, " that they found no ground at three hundred fathoms; and all along within " thoſe ſtraits deep enough, though many iſlands every where.

" 6. What they obſerved as to the variation of the needle? Reſ. At fifty- " three degrees they reckoned no variation; about fifty-four degrees they reckoned " about one degree of variation, weſtward; and thence the variation increaſed " very conſiderably, ſo that, at the entry of the ſtraits in ſixty-one degrees and " an half of latitude at Cape Worſenam, the needle varied thirty-two degrees " weſtward, and at ſixty-three degrees at Digges's iſland, it varied about thirty-ſix " degrees; but running down to the ſouth for about three hundred leagues, to " the latitude of fifty degrees and forty-five minutes it varied twenty-ſix degrees. " Captain JAMES reckoned twenty-nine degrees variation where he wintered.

" 7. What obſervable about the tides? Reſ. In thoſe ſtraits there runs a con- " ſtant tide, eaſt ſouth eaſt, and weſt ſouth-weſt, but in the bay it runs north

[u] Regiſter, vol. iv. p. 190.

" and

" and ſouth; entering into the ſtraits a ſouth-eaſt and ſouth moon maketh a full " ſea; but further within the ſtraits a ſouth moon doth it; and where they " wintered a ſouth ſouth-weſt moon maketh a full ſea. The tides commonly " riſe not above eight foot perpendicular hight, though they are much governed " by the winds, which are very variable there, and being high from the north- " weſt, raiſe the tides to the hight of twelve foot in Rupert's River.

" 8. Whether the thick foggy air did make their compaſs move ſo dully, that " it would not traverſe? Reſ. This, they apprehend, would come to paſs, but " they prevented it by uſing Muſcovy-glaſs.

" 9. What kind of people the natives are where the wintered? Reſ. They " are tawny, living in tents, which they remove from place to place, according " to the ſeaſons of hunting, fowling, and fiſhing. Their arms are bows and ar- " rows; their meat is veniſon, wild fowl, (as geeſe, partridge) and rabbits, all " which are as white as ſnow, and in great abundance; the captain affirming, " that he had killed ſeven hundred ſuch white partridges. They have alſo ſtore " of fiſh, as ſturgeon, large pikes, ſalmon-trouts, taken by them with nets; " great fiſh they had ſeen none, but ſome ſea-horſes and ſeales, going into the " bay; no cod nor whales. As to their drink, they uſe much the broth of their " boiled veniſon, no crude water. Concerning their phyſic, they uſe chiefly " ſweating, not by taking any thing inwardly, but by making a kind of ſtove, " heating many ſtones red hot, in their tents, and then pouring water upon them, " whereby they are made to ſweat exceſſively, in which condition, when they " have ſat a while, they run out into the ſnow, whereby they ſay their pores " are preſently cloſed again, as they were opened by the heat, laughing at the " Europeans, that cauſe themſelves to be rubbed and dried with cloths. They " live many of them to a great age, to an hundred and twenty years. From the " ſouth-weſt of Carleton iſland, about fifty degrees latitude, there came many In- " dians to them, that were ſix foot nine inches tall, living among the freſhes, " and much upon fiſh, on the river Mouſibi, that is the river of elks, ſo called " from the ſtore of elks, that are to be found there.

" The commodities they delight in are coarſe cloth, iron, hatchets, hammers, " kettles, pins, needles, and ſuch like, very ready to exchange them for beavers.

" 10. What kind of ſoil it is, and what it produceth? Reſ. It is moſt clay " ground, plain, and very moſſy, bearing no grain at all, only vetches, gooſe- " berries, ſtraw-berries, cran-berries. It abounds in wood, eſpecially birch, wil- " low, and firr-trees, which laſt kind of tree hath an excellent turpentine (as " they call it) on its bud, which boiled in their beer they found very wholeſome, " and reſtoring them to ſtrength and vigor when they looked pale, and were ſick " and weak.

" 11. What animals the country affords? Reſ. Store of deer, hares, elks, " and beaver, all which are very good meat: for other beaſts, there are white " foxes,

" foxes, white bears, white cats, all yielding excellent furr, which is exceeding " thick.

" 12. What obſervable chiefly about beavers? Reſ. They ſaid, they had not " been up ſo far into the freſhes, (for upon them they only live) as to ſee them- " ſelves their manner of living and breeding; but they had been told by the " Indians, that they build their lodges two ſtories high, cutting pieces of wood " from the neighbouring trees, of that length and bigneſs, as is requiſite for their " purpoſe, and then meeting a competent number of them together, whereof the " one half place themſelves on one ſide of the piece to be ſhoved away, and thurſt " their tails under the wood to the other ſide, where the other half ſtanding ready, " do faſten their teeth into the tails of the other, and ſo ſhove away the wood " to the place deſigned to build in, where they raiſe two ſtories, to the end, " that when the water ſwells, they may go up to the other ſtory, in which they " alſo breed their young ones. Beavers live not upon fiſh, but rinds of trees.

" 13. How the captain of our ſhip and his company ordered themſelves as to " their manner of living, whilſt their ſtaying there? Reſ. When they came on " ſhore, they built themſelves a houſe of wood, and dug a cave ſome eight or " ten foot deep, into which they put ſome barrels of good beer, which at the " time of their coming away being taken up again, after it had remained there " eight or nine months, proved very excellent liquor. Mean time they brewed " all the winter long, of the proviſion of malt they had taken with them; " and for their meat they went a hunting, and with their guns killed ſtore of " deer and fowl.

" 14. What temper they found that country of in the months of May and June? " Reſ. The ſpring began in May, in June they found it pretty hot in the day- " time, and ſtore of muſkittos, but froſt in the night.

" 15. How they had their health there? Reſ. Reaſonably well; only in re- " turning they found ſome trouble of the ſcurvy, and that chiefly in their mouths.

" 16. What government and religion they have amongſt themſelves? Reſ. " They have ſome chief perſons that are above the reſt, yet working with them; " they found no quarrelling amongſt them; they love keeping one's word; are " very ſenſible of love and kindneſs; and they expreſs their hearty forgiveneſs, " by a geſture of throwing the arms behind their back, which when they do, " you may rely upon them as perfectly reconciled. They acknowledge ſome ſu- " preme power, which they call Maneto, and they have a Pawaw, by whom " they addreſs themſelves to their God, and acquaint him with their neceſſities, " which Pawaw returns them anſwer of help and relief, and that commonly " upon conditions of giving ſuch and ſuch commodities, among which tobacco " is one of the chief."

The

The Society was made acquainted with the two particulars lately paſſed in the council April 10, 1672: the one, that the day of the Society's weekly meetings was henceforth to be on Wedneſday again, as it had been formerly; becauſe Thurſday proved inconvenient to divers conſiderable members of it, who were aſſiduous at their meetings. Upon which it was ordered, that tickets ſhould be ſent to the members about London, who were not preſent at this meeting, to give them notice of this change. The other was, that the biſhop of Cheſter had propoſed Dr. GREW to be a curator to the Society for the anatomy of plants for a year, upon ſubſcriptions amounting to fifty pounds, to be made by ſuch members as ſhould be willing to contribute for the raiſing of that ſum; and that the council had approved of that propoſal, a form alſo being drawn up, and now ready for the ſubſcriptions of ſuch, as would freely contribute to ſo good a work.

It was ordered, that the thanks of the Society be returned to the lord biſhop of Cheſter for this propoſal, and to the council for their approbation of it: as alſo, that his lordſhip be deſired to take care of the ſubſcriptions.

Mr. HOOKE promiſed ſome experiments about colours at the next meeting.

*April* 24. Signor JOHN DOMINIC CASSINI and FRANCIS VERNON, Eſq; were propoſed candidates by Mr. OLDENBURG, they both having intimated their deſigns of being elected into the Society, in their letters from Paris of April 23, 1672, N. S. [x]

Mr. HOOKE ſhewed two experiments of colours with a couple of priſms. By the one it appeared, that one priſm took off the colours, which the other had produced: by the other, that ſeveral colours were made by ſeveral refractions. He was ordered to give in the particular deſcription of theſe experiments to be regiſtred.

Signor CASSINI's letter to Mr. OLDENBURG of 23d April, 1672, N. S. preſenting the Society with the printed deſcription of his late obſervations concerning the periodical motion of a great permanent ſpot in Jupiter, and the phænomena of the late comet, was read.

Mr. OLDENBURG read alſo the letter of thanks [y], ordered by the laſt meeting to be returned to Signor MALPIGHI, which was approved of, and ordered to be ſent away.

There was likewiſe read a Latin letter to Mr. OLDENBURG, from Dr. THOMAS CORNELIO, dated at Naples 5th March, $167\frac{1}{2}$, N. S. [z] expreſſing his great reſpect for the Society, and its inſtitution; accompanied with a letter of his in

[x] Signor CASSINI's letter is inſerted in the Letter-book, vol. v. p. 229, and Mr. VERNON's, p. 228.

[y] It is dated April 24, 1672, and is entered in the Letter-book, p. 231.

[z] Ibid. p. 179.

Italian

Italian, to JOHN DODDINGTON, Esq; the king's resident at Venice [a], containing divers particulars relating to the tarantula, and the relations of persons pretending to be stung by them.

*May* 1. Signor CASSINI and Mr. VERNON were again proposed candidates by Mr. OLDENBURG, upon the desire of both of them expressed in their letters of April 23, 1672. N. S.

Dr. WILLIS presented to the Society his book, intitled, *De Anima Brutorum Exercitationes duæ, prior Physiologica, altera Pathologica*, printed at Oxford, 1672, in 4to.

Mr. BOYLE shewed an experiment, importing, that water will easily pass where air will not. He was desired to give the contrivance of the whole, and his considerations thereupon in writing, to be registred.

Mr. OLDENBURG read a letter from Mr. LISTER to the archbishop of York, dated at York 10th April, 1672 [b], and by his grace communicated to the lord archbishop of Canterbury, who delivered it to Sir ROBERT MORAY, in order to be imparted to the Society. It contained an exact account of the excision of a stone from under the tongue of a man, where it had been breeding about eight years. It had visible impressions upon it of some capillary vessels, amongst which it grew; and it was scabrous and sand-like, though the substance was tophaceous.

Dr. KING affirmed, that he had found the like stone come away out of the tongue of a gentleman.

Mr. BOYLE remarked, that he had seen the like.

Dr. KING related on this occasion, that having opened a gentleman, who died upon strange swooning fits, he found, after long inquiry had been made of the seat of his disease, a small stone on the top on the inside of the *arteria venosa*, depressing the vessel, and thereby hindering the circulation. He was desired to give this relation in writing for the register-book.

There was read another letter from Mr. LISTER to JOHN BROOKE, Esq; dated at York 12th April, 1672 [c], containing an observation about the generation of hair-worms, and shewing, that such things, as are vulgarly thought animated hairs, are very insects, nourished within the bodies of other insects, as *ichneumones* are within the bodies of caterpillars.

[a] A translation of it is printed in the Philōsoph. Transact. vol. vii. n° 83. p. 4066.

[b] Letter-book, vol. v. p. 208. It is printed in the Philosoph. Transact. n° 83. p. 4062.

[c] Letter-book, vol. v. p. 215. It is printed in the Philosoph. Transact. vol. vii. n° 83. p. 4064.

There

The lord biſhop of Cheſter affirmed, that he had found the like; which was confirmed by an obſervation of Mr. Boyle.

There was read a letter of Richard Townley, Eſq; to Mr. Oldenburg, dated April 15, 1672 [c], containing an obſervation of his, that if two thermometers, which in his chamber correſponded exactly with each other, one being ſo placed in a coal-pit as not to be in the way of the current of air, was found by him to have kept above two months at a conſtant ſtation; whereas during that time the thermometer at home varied very much.

*May* 8. A book intitled, *A New Years Gift for Dr. Wittie*, by George Tonstal, M. D. was preſented from the author to the Society. It related to the controverſy between them concerning the Scarborough Spaw.

The minutes of the laſt meeting being read, and Mr. Liſter's letter concerning the production of hair-worms again taken notice of, Mr. Willoghby affirmed, that he had found in all ſorts of fiſhes and birds, which he had opened, as alſo in ſome quadrupeds, ſuch worms lying looſe in the cavity of the belly, without the guts. He promiſed to ſend to the Society the names of all thoſe animals, in which he had found them.

There was read a letter of Mr. Newton's to Mr. Oldenburg, written from Cambridge, May 4, 1672 [d], containing his judgment of Monſ. Cassegraine's teleſcope, like that of Mr. James Gregory, deſcribed in his *Optica Promota*, printed in the year 1663, with a hole in the midſt of the optic metal to tranſmit the light to an eye-glaſs placed behind it.

Mr. Cook produced a piece of ſteel poliſhed, to be uſed in the reflecting teleſcope.

Mr. Hooke was deſired to make tryal with it, though he ſaid it was falſely poliſhed.

Dr. Grew, the new curator for the anatomy of plants, being preſent, was deſired to produce ſome obſervations on that ſubject at the next meeting; which he promiſed to do. In order to which it was ordered, that Mr. Hooke ſhould deliver to him the Society's microſcope.

*May* 15. Dr. Grew made ſome obſervations about the ſecundine, or innermoſt cover of the ſeed in plants; of which he produced a deſcription in writing, which was ordered to be regiſtered [e]; as was alſo the ſcheme, which he gave in, containing the heads of the moſt conſiderable particulars concerning vegetables.

[c] Letter book, vol. v. p. 227.
[d] Letter-book, vol. v. p. 239. It is printed in the Philoſoph. Tranſact. vol. 5. n° 53. p. 4057.
[e] Regiſter, vol. iv. p. 187. It is publiſhed in his Anatomy of Plants, Edit. London, 1682, folio.

Mr. SMETHWICK brought in an inſtrument ſhewing the angles of refraction; and was deſired to draw the figure of it, and to deſcribe the conſtruction and uſes thereof.

Mr. HOOKE made ſome experiments relating to Mr. NEWTON's theory of light and colours, which he was deſired to bring in writing to be regiſtered.

*May* 22. Signor CASSINI was elected unanimouſly.

Mr. VERNON was likewiſe elected.

The ſecretary was ordered to ſignify to Signor CASSINI his election.

Dr. GREW ſhewed the Society, in a microſcope, the conformation of the pith in vegetables, viz. that the whole pith is nothing but a *rete mirabile*, or a wonderful complication of exceedingly ſmall fibres; of which he gave in a larger account in writing, which was ordered to be regiſtered [g].

He was deſired to proſecute this ſubject, in order to find out the uſe of the pith, and to conſider the variety and difference of the piths in ſeveral plants; as in bull-ruſhes, elder, cork, &c. their figures, whether circular or angular; as alſo whether they be always dry or juicy in young plants, &c. Farther, to cut the wood aſunder, and to cut the wood into the pith, to ſee how the plant will grow.

Sir ROBERT MORAY brought in an account of cocao-trees, their planting and culture, the way of curing them, the obſervables in their fruit, &c. tranſmitted to him by Sir THOMAS LINCH from Jamaica; which was ordered to be regiſtered [h].

Mr. HOOKE made ſome more experiments with two priſms, confirming what Mr. NEWTON had ſaid in his diſcourſe on light and colours, viz. that rays of the light being ſeparated by one priſm into diſtinct colours, the reflection made by another priſm doth not alter thoſe colours.

It was intimated by Mr. HOOKE, that theſe experiments were not cogent to prove, that light conſiſts of different ſubſtances or divers powders, as it were; but that theſe phænomena might be explained by the motion of bodies propagated.

Mr. BOYLE produced ſome of the plant *dutroa*, ſent him out of the Eaſt Indies; which is a kind of ſtramonium, and famous for ſo taking away the underſtanding of perſons, that, when they recover, they remember nothing of what they did, or was done before them, during that ſtupefaction.

[g] Mr. OLDENBURG's letter to Signor CASSINI for that purpoſe, was dated 27th May, 1672, and is entered in the Letter-book, vol. v. p. 251.

[h] Regiſter, vol. iv. p. 188. It is publiſhed in his Anatomy of Plants, b. 2. c. 5.

[i] It does not appear in the Regiſter.

He

He mentioned, that he intended to make ſome tryals with it upon dogs, and in particular, whether it be true, that that ſtupor can be taken away in a very ſhort time, and in what quantity it will kill.

The Society adjourned till June 5th, the Wedneſday following being the anniverſary of the king's birth and reſtoration.

*June* 5. The Society did not ſit: but there was produced before the members preſent, by Mr. CONYERS, a ſpeaking trumpet of a different faſhion from that of Sir SAMUEL MORLAND [k], by a pipe in a pipe rendering the voice by reflection.

He was thanked for the reſpect intended by him to the Society, and acquainted, that at their next meeting they were likely to recommend this contrivance to the examination of ſome of their members.

*June* 12. At a meeting of the COUNCIL were preſent

Sir ROBERT MORAY, Vice-Preſident,
Sir PAULE NEILE,
Sir THEODORE DE VAUX,
Mr. AERSKINE,
Mr. OLDENBURG.

It was ordered, that Signor MALPIGHI's book, intitled *Marcelli Malpighii Philoſophii & Medici Bononienſis Diſſertatio Epiſtolica de Formatione Pulli in Ovo*, be printed by the printer of the Society; and the form of the licenſe to be as follows;

"Junii 12, 1672.

"In concilio Regiæ Societatis Londini ad ſcientiam naturalem promovendam inſtitutæ.

"Tractatus, cui titulus *Marcelli Malpighii Philoſophii & Medici Bononienſis Diſſertatio Epiſtolica de Formatione Pulli in Ovo*, Regiæ Societati dicata, imprimatur a JOHANNE MARTYN, dictæ Societatis typographo."

At a meeting of the SOCIETY on the ſame day Mr. VERNON was admitted.

Dr. GREW ſhewed the Society in a microſcope thoſe *tracheæ* of a ſpiral form, deſcribed by Signor MALPIGHI to be in all vegetables: and of this he gave the deſcription in writing, which was read, and ordered to be regiſtered [l].

Mr. OLDENBURG preſented from the author a book of Dr. SWAMMERDAM, by whom it was dedicated to the Society [m], and intituled *Uteri Muliebris Fabrica, una*

[k] An account of his ſpeaking trumpet, with its uſe both at ſea and land, was publiſhed at London in 1671.

[l] It does not appear in the Regiſter.

[m] In the dedication Dr. SWAMMERDAM declares *neſcire ſe, quo factum ſit fato, ut, quemadmodum Chriſtianus orbis non minima religionis ſuæ incrementa Anglicæ genti debat, ita ultimis difficillimiſque his cum*

*cum Methodo nova Cavitates Corporis ita præparandi, ut ſuam ſemper genuinam faciem ſervent:* Printed at Lyden, 1672, in 4to.

It was ordered, that a letter of thanks be written to him [n], aſſuring him of the kind reception of his preſent, and reſpect.

Mr. OLDENBURG read a letter from Signor MAGALOTTI, dated at Florence, 20th May, 1672, N. S. [o] giving an account, accompanied with a ſcheme, of a Venetian project of a perpetual lamp made up in a cryſtal vial with ſpirit of wine and a wick of gold, ſo contrived, that ſuppoſing the ſpirit of wine converted from a liquor into ſmoke, and from ſmoke into vapour, will turn again into an inflammable liquor, there may be a perpetual circulation, and conſequently a perpetual lamp. But ſeveral of the members declared, that ſpirit of wine being once deſtroyed by the fire will not turn into ſpirit of wine again.

Signor MAGALOTTI had incloſed in this letter a relation of Dr. GORNIA, phyſician to the Grand Duke, when the latter was in England, concerning an antient man living in the mountains of Italy, out of whoſe leg, being ulcerous and neglected, a horn was grown of a conſiderable bigneſs.

Mr. OLDENBURG produced Mr. NEWTON's anſwer to Mr. HOOKE's conſiderations upon his diſcourſe on light and colours; which anſwer was read in part, and ordered to be copied for the peruſal of Dr. WREN and Mr. HOOKE, and then to be regiſtered [p].

Mr. HOOKE was put in mind to bring in at the next meeting ſome experiments, that do not depend on the ſhining of the ſun, together with thoſe that require ſun-ſhine.

*June* 19. Mr. HOOKE's account of ſome experiments on refractions and colours, lately made by him before the Society, was read, and ordered to be regiſtered [q], as follows:

"In order to examine, whether ſeveral colours, after the firſt refraction, would "have ſeveral refractions, I made ſeveral experiments; and the firſt was, I "took two priſms, and with the one I caſt the rays of the ſun upon a wall, at "a conſiderable diſtance; by which means the ſeveral colours of the rainbow "appeared in a line at right angles with that of the priſm, viz. red, yellow,

*temporibus apud eam inventa ſit ratio, quâ, miſſis inanibus ſcholaſticorum diſputationibus, bonæ artes & ſcientiæ in ſolido locentur. Quod ipſum, ut non poſtremam gloriæ Britannicæ partem abſolvit, ità in cauſâ eſt, ut in naturalis philoſophiæ negotio ad nullum aliud quam Regiæ Societatis tribunal provocare vel auſit vel debeat.*

[n] Mr. OLDENBURG's letter was dated 13th June, 1672, and is inſerted in the Letter-book, vol. v. p. 275.

[o] This letter was written in Engliſh, as appears from Mr OLDENBURG's anſwer of 13th June, 1672, Letter-book, vol. v. p. 271.

[p] It does not appear in the Regiſter, but it is printed in the Philoſoph. Tranſact. vol. vii. n° 88. p. 5084, for November 1672.

[q] Regiſter, vol. iv. p. 194.

"green,

" green, blue, and purple: then with a ſecond priſm, placed in a parallelism " with the aforeſaid line or order of colour, I a ſecond time refracted the rays " of the ſun, or the ſeveral-coloured rays, and thereby found, that all the ſaid " colours would be a ſecond time refracted, and yet keep their ſeveral colours " diſtinct in the ſame order, without very ſenſibly intermingling any other colours " with any of them. Moreover I found, that the ſeveral colours, though they " kept their former order, viz. the ſecond refracted red, yellow, green, blue, " purple, kept the ſame order and poſition with the firſt refracted red, yellow, " green, blue, purple; ſave only, that whereas I held the ſecond priſm in a " parallelism with the order or line of colours, the colours caſt upon the wall " by this ſecond refraction were not parallel, but aſkew, or oblique; and, upon " examining which was moſt bent from the parallelism by refraction, I found the " purple, and the reſt leſs, in their order: that is, that the purple was fartheſt " diſtant from the firſt line of refracted colours, and ſo conſequently, according " to the hypotheſis of the differing refraction of colours, purple had the greateſt " refraction, blue the next leſs, green leſs than that, the next yellow, and red " the leaſt of all; which ſeems at firſt much to confirm Mr. NEWTON's theory " of colours and light; but yet I think it not an *experimentuum crucis*, as I may " poſſibly ſhew hereafter.

" Next, I tried a ſecond experiment, by caſting with the firſt priſm the line or " order of colours upon the wall, and taking a black ſtick, and laying it exactly " parallel with the ſaid line, ſo as to touch the upper or under ſide of the ſaid " colours, if the colours were caſt in a horizontal poſture, or the right or left " ſide, if caſt in a perpendicular poſture: then taking a ſecond priſm, and hold- " ing it exactly parallel with the ſtick or the line of colours, and looking through " the ſame, I could plainly ſee the ſtick and the colours; and whereas, with my " naked eye the colours ſeemed juſt to touch the ſtick, and to be parallel there- " with, now they ſeemed to lye aſkew, and the ſtick to paſs through them; and, " which way ſoever the refraction of the ſecond priſm did bend the rays, that way did " the purple bend moſt, and the red leaſt; inſomuch, that I have often obſerved, " that when the colours of the firſt rainbow were caſt above the ſtick, by looking " on them thus, I could ſee them on the other; which at firſt ſeemed not a " little ſtrange.

" Thirdly, I caſt the colours by the firſt priſm upon the floor, or ceiling, or " wall, and with the ſecond priſm held exactly, or, as near as may be, parallel " with the firſt, I looked at thoſe colours, but by ſuch a ſide of the priſm as " refracted the rays quite contrary to their refractions in the firſt priſm; and it " was obvious to ſee, that by turning the ſecond priſm (whilſt in its parallel " poſition) round on its axis gently, the colours on the floor, wall, or ceiling, " would by degrees quite vaniſh and diſappear, and the rainbow (if I may ſo " call the breadth of colours) which before poſſibly was almoſt a ſpan breadth " upon the place, contracted itſelf by degrees to the breadth of the firſt priſm; " but if the ſaid rainbow was looked on through the ſecond priſm with a refraction

" the

" the ſame way with the refraction of the firſt, the breadth of the ſame was " very much ſtretched, and made a ſpan and a half, or two ſpans, broad.

" Fourthly, I took two thin pieces of glaſs well plained and poliſhed, the " thinner they are (ſo they do not break) the better; and putting them one " upon another, I preſt them hard together till there began to appear a red- " coloured ſpot in the middle; then continuing to preſs them cloſer, I could " plainly ſee ſeveral rainbows, (as I may ſo call them,) of colours, encompaſſing " the firſt plate; and continuing to preſs the ſame cloſer and cloſer, at laſt all " the colours would diſappear out of the middle of the circles, or rainbows, and " the middle would appear white; and if yet I continued to preſs the ſaid plates " together, the white would in ſeveral places thereof turn into black. The firſt " colour that appeared was red, then yellow, then green, then blue, then purple; " then red, then yellow, green, blue, purple; red, yellow, green, blue, purple, and " ſo onwards: ſo that I have numbered nine or ten ſeveral rainbows, or orders of " colours, one immediately within another, and the red immediately next to the " purple, and the laſt colour, that appeared before the white, was blue: ſo that it " began with red and ended with purple, and where there was no other colour pre- " ceded, the red had no purple; but where red was on the one ſide, and blue on " the other, there was purple; that way, that the red and the blue were dilated, " was yellow, ſky-colour, and green; and that way they were heightened was " purple: ſtill the ſaid rings, or rainbows, would vary their places, by varying " the poſition of the eye, by which they were obſerved, and not only their poſi- " tions, but their colours; ſo that the glaſſes remaining the ſame, that part, " which was red in one poſture of the eye, was blue to a ſecond, green to a " third, yellow to a fourth, and purple to a fifth, and other mixt colours to " other poſtures. Moreover, that, which gives one colour by reflection, gives " another by trajection, not much unlike the tincture of lignum nephriticum. " Of the explication of theſe phænomena by various hypotheſes more hereafter."

Mr. HOOKE was deſired to make more experiments of the ſame nature, for a farther examination of Mr. NEWTON's doctrine of light and colours; eſpecially ſuch as might make it out, that colours may be varied by divers poſitions of the eye; as alſo thoſe, that are made with plated bodies, ſhewing, that the ſame inclination and the ſame thickneſs will give various colours: and farther, thoſe, that ſhew in a dark room, that where there is no refraction nor reflection, there will be a ſucceſſion of colours; ſo that the rays paſſing only a hole, colours will appear.

Dr. GODDARD and Mr. CONYERS having brought in ſeveral figures for ſpeaking trumpets, and Mr. HOOKE having alſo drawn one for the ſame purpoſe, the operator was ordered to attend Dr. GODDARD, and to take directions from him for cauſing ſuch inſtruments of the produced figures to be made as the doctor ſhould appoint: and Mr. HOOKE was deſired to make alſo a tryal of his figure.

Dr. ISAAC VOSSIUS mentioned, that they had a way at Amſterdam of making bells give a much ſweeter ſound than ordinary, retaining the uſual bell form, but employing only half the quantity of the metal, and obſerving a great equality in caſting it.

Mr. OLDENBURG read a letter to him from Mr. HEVELIUS, dated at Dantzick, June 10, 1672 [r], giving notice, that he had printed a diſcourſe of the obſervations of the late comet, made by himſelf, and had ſent ſome copies of it by ſea, to be diſtributed here. This letter was accompanied with a printed ſcheme, repreſenting the motion of the ſaid comet.

*June* 26. Mr. HOOKE produced a new kind of ſpeaking trumpet figured bell-wiſe, repercuſſing and by degrees dilating itſelf; which being tried, and compared with that of Mr. CONYERS, was found to exceed it.

It was ordered, that againſt the next meeting, a pipe of the form of an ordinary trumpet ſhould be made, widening by degrees in the form of a cone cut off, furniſhed with a mouth-piece.

Dr. GREW ſhewed again in the microſcope the figure of the pith of a common thiſtle, and that of the tracheæ, or ſpiral fibres, of a burdock; of both which he had made a draught.

He was deſired to endeavour to diſcover, whether, whilſt plants are growing, there be a periſtaltic motion in them, as MALPIGHI thought there is; and for that purpoſe to take ſome of the bigger ſort of plants, wherein, if there be any ſuch motion, it is more likely to be found.

Mr. OLDENBURG preſented from Mr. BOYLE his *Eſſay about the origin and virtues of gems*, printed at London, 1672, in 8vo.

Dr. WALTER NEEDHAM produced a letter to him from Mr. TEMPLER, dated March 30, 1671 [s], concerning the ſtructure of the lungs, which from ſeveral experiments ſeemed to him to be a complication of a multitude of the ramifications of the bronchiæ and ſanguineous veſſels, &c.

This gave occaſion to diſcourſe of reſpiration, and of the principal uſe thereof, which Mr. HOOKE ſaid he thought to be, that by the air ſomething eſſential to life might be conveyed into the blood; and ſomething that was noiſome to it, be diſcharged back into the air: and he wiſhed, that means might be uſed to diſcover, whether there are not valves in the arteries, by which the air may paſs into all the parts of the blood. For which purpoſe it was ſuggeſted, that an injection might be made into thoſe veſſels, and particularly into ſome artery, with melted bees wax, mixed with tallow, and coloured, thereby to make the veſſels

[r] Letter-book, vol. v. p. 265.
[s] It is printed in the Philoſophical Tranſactions, vol. vii. n° 86. p. 5031, for Auguſt, 1672.

appear

appear round and full, to see what might be farther discovered in their structure. This was recommended to the physicians of the Society.

Mr. OLDENBURG produced and read a letter to him from Signor CASSINI, dated at Paris, 22d June, 1672, N. S. [t], containing his thanks to the Society for having elected him into their body; and accompanied with a written paper of two sheets in folio, giving an account of his endeavour for settling an hypothesis of the motion of Jupiter and his satellites.

This paper was committed to the perusal and consideration of Mr. HOOKE, who was desired to make a report of it to the Society at their next meeting, especially as the author expressed his desire of having the sense of the Society, or some members thereof, upon the said paper.

*July* 3. Dr. GREW was put in mind to see, what might be discovered of the peristaltic motion in plants, asserted by Signor MALHIGHI.

Mr. HOOKE was called upon for making a report concerning Signor CASSINI's paper concerning the satellites of Jupiter, and desired to give in writing what he had said upon it, that it might be without mistake imparted to Signor CASSINI, who had desired that favour in his letter.

The speaking trumpet ordered to be prepared for this meeting not being ready, Mr. HOOKE was ordered to take care of having it ready against the next.

Mr. OLDENBURG read three letters written to him, 1. from Signor MALPIGHI, dated at Bologna, 7th June, 1672 [u], containing his sentiments of the ovaria and ova in women, asserted by Dr. de GRAAF and others, whose assertions he thought lightly probable

2. From Dr. SWAMMERDAM, dated 5th July, 1672, giving notice of an anatomical present of some parts of an human body, sent by him to the Society.

3. From Monsr. HUYGENS, dated at Paris, 1st July, 1672 [x], containing his thoughts upon Monsr. SLUSIUS's last construction of the problem of ALHAZEN, with his own calculus of the same; as also concerning Mr. NEWTON's reflecting telescope, and applauding his new doctrine of light.

Mr. HOOKE upon occasion said, that he found, that a refracting object-glass collected more rays to a point than a reflecting one, both being of the same sphere. He was desired to shew this by an experiment.

*July* 10. Dr. GREW shewed the insertion of fibres running from the pith into the bark; the description of which he was desired to give in writing.

[t] Letter book, vol. v. p. 307. [u] Letter-book, vol. v. p. 365. [x] ibid. p. 282.

Mr.

Mr. HOOKE mentioned, that he had made a refracting object-glaſs upon the ſame ſphere with a reflecting one, and found, that it repreſented the object brighter, of the ſame charge and the ſame aperture with a reflecting one.

He was deſired to ſhew the experiment of it, by comparing two ſuch glaſſes together, of the ſame ſphere.

Mr. HOOKE gave an account of Signor CASSINI's paper, concerning the ſyſtem of Jupiter and his ſatellites, importing, that it was conſiderable, and deſerved to have good notice taken of it in the obſervations of the motions of thoſe ſtars.

The Society intending to make a receſs for ſome time, the members were deſired, that as many of them, as could conveniently, would meet on Fridays in the afternoon, at Greſham-college, to diſcourſe of philoſophical matters, and proſecute experiments; among which were recommended

1. Such, as might determine the queries lately ſent by Mr. NEWTON to the Society, which involve his theory of light.

2. Such, as might improve Mr. NEWTON's reflecting teleſcope; and particularly to ſee finiſhed a four-foot teleſcope of that kind, already recommended to Mr. COCK.

3. Such obſervations, as might confirm thoſe of Signor MALPIGHI about the exiſtence of certain tracheæ, or ſpiral fibres in vegetables, that contain air: as alſo to endeavour the finding out of that periſtaltic motion, which the ſame author affirmed to have been obſerved by him in plants.

The Society was adjourned by the preſident, till ſuch time as his lordſhip ſhould find a competent number of members in town to meet again.

*October* 30. The Society began to meet again, after their receſs ſince 10th July.

HENRY lord HOWARD of Caſtle-Riſing was propoſed by the lord biſhop of Cheſter, and, on account of his quality, was immediately put to the ballot, and elected unanimouſly, and admitted.

THOMAS HOWARD, Eſq; ſecond ſon to the earl Marſhall [y], was propoſed candidate by the lord biſhop of Cheſter.

Mr. ASHMOLE preſented to the Society his *Hiſtory of the Order of the Garter.*

[y] HENRY lord HOWARD was created earl of Norwich, and had, by the ſame patent, the grant of the office of earl Marſhall, 29th October, 1672.

There were also presented JOHANNIS HEVELII *Epistola de Cometa*, 1672, *mense Martio*.

MALPIGHI's *Dissertatio Epistolica de Formatione Pulli in Ovo*, Printed at London, 1672, in 4to.

Mr. HOBBES's *Lux Mathematica Collisionibus* JOHANNIS WALISII. *S.* TH. D. & THOMÆ HOBBESII *Malmesburiensis excussa; multis & fulgentissimis quæstionibus radiis, Authore R. R. adjuncta censura Doctrinæ Wallisianæ de Libra, una cum* ROBERTO HOBBESII. Printed at London, 1672, in 4to. And

JEREMIÆ HOROCCII *Angli Opera Posthuma; una cum* GARLÆ CRABTRÆI *Observationibus Cælestibus; necnon* JOH. FLAMSTEDII *de Temporis Æquatione Diatribæ numerisque Lunaribus ad novum Lunæ Systema Horroscii*. Printed at London, 1672, in 4to.

It was ordered, that Mr. HEVELIUS, Signor MALPIGHI, and Mr. HOBBES should be thanked by the secretary for their respect to the Society, with an intimation that their books were committed to the perusal of some of the members.

The examination of what had been done concerning the queries of Mr. NEWTON, to be determined by experiments, concerning his theory of light, was referred to the next meeting.

An account being demanded of what trials had been made for the improvement of the reflecting telescope of Mr. NEWTON, Mr. HOOKE said, that hitherto he had wanted a mould of a sufficient bigness for a speculum, designed by him, of fifteen inches diameter, for a tube of ten feet long; but that he hoped to have, in a week or fortnight, such a mould cast, wherein a speculum of that bigness might be well wrought and polished.

Since during the Society's recess there had been communicated to the members, who then met at Gresham-college, Monsr. HUYGENS's conjecture about the odd phænomenon of the mercury's standing top-full of well cleansed air, even to the hight of seventy-five inches; and since the president and Dr. WALLIS had suggested divers experiments determining the cause of that effect; it was inquired what had been done in this matter? Mr. HOOKE answered, that some trials had been made about it; and that he would bring in an account of them in writing against the next meeting.

Dr. GREW being called upon, for an account of the observations, which he had made in vegetables, produced a good number of such observations, made upon the roots of several plants, of which he exhibited the figures, both as the objects appeared to the naked eye, and by the microscope. He was desired to bring in a description of all these in writing, to be registred.

He was exhorted likewise to finish two or three plants, in all their parts, after this exact manner, to be printed early, before they were arrogated by strangers.

Two letters of Mr. LISTER to Mr. OLDENBURG, dated at York, one of the 10th of October, 1672, inlarging and correcting his former notes about kermes; and the other of 23d October, concerning land and fresh-water snails, with some queries relating to them, were read, and ordered to be inserted in the Letter-book [a].

*November* 6. Mr. THOMAS HOWARD of Norfolk was elected and admitted.

Mr. HOOKE read a discourse of his, containing his thoughts of the experiment of the quick-silver's standing top-full, and far above the hight of twenty-nine inches; together with some experiments made by him, in order to determine the cause of this strange phænomenon. He was ordered to prepare those experiments for the view of the Society.

There was also read a letter of Dr. WALLIS to Mr. OLDENBURG, dated at Oxford October 25th, 1672 [a], suggesting divers experiments for the elucidation of the same phænomenon: which letter was delivered to Mr. HOOKE.

Two other letters were likewise read, both written by Mr. HEVELIUS to Mr. OLDENBURG from Dantzick, dated September 16, and October 29, 1672, concerning the eclipse of the sun, on the 11th of August, N. S. and the phasis of Saturn on the 19th of October: as also the re-appearance of the new star in the neck of the Swan [b].

Mr. HOOKE produced two books, one intitled, *Ottonis de* GUERICKE *Experimenta nova Magdeburgica de vacuo spacio, &c.* printed at Amsterdam, 1672, in fol. and Dr. MORHOFF's *Epistola de Scypho vitreo per certum humanæ Vocis sonum rupto*, moving, that they might be bought by the Society for their libraries; which was agreed to.

He mentioned, that among Mr. GUERICKE's experiments there was one which he thought deserved to be tried before the Society, viz. that of a sulphur-ball having a considerable attractive power, and representing the properties of the earth.

Mr. LOCKE intimated, that himself had made some experiments with such a ball, and promised, that he would bring it to the Society at the next meeting.

[a] Vol. v. p. 348. and 351. The former of these letters is printed in the Philosoph. Transact. vol. vii. n° 87. p. 5059.

[a] Letter-book, vol. v. p. 389. An abstract of this and other letters of Dr. WALLIS's on that subject is printed in the Philosoph. Transact. n° 91. p. 5160, for February, 167⅔.

[b] Letter book, vol. v. p. 356.

There were read two letters more to Mr. OLDENBURG, the one from Mr. HENSHAW, dated at Copenhagen, July 6, 1672 [c], concerning his care of the philoſophical concerns of the Society in Denmark, and giving ſome account of OLAUS WORMIUS's book, *De Mure Norvagico*; the other of Dr. ERASMUS BARTHOLIN, dated likewiſe at Copenhagen, 4th Auguſt, 1672 [d], giving an account of the performances of Monſ. PICART, the Pariſian aſtronomer, in Denmark, and particularly in the iſle of Huenna, &c.

Mr. TOWNLEY's figure, repreſenting a thermometrical experiment of his, made at a conſiderable depth under ground, was ordered to be drawn large by the amanuenſis, againſt the next meeting.

*November* 13. At a meeting of the COUNCIL were preſent,

The preſident,
The lord viſcount STAFFORD,
Mr. AERSKINE,
Sir ROBERT MORAY,
Sir PAUL NEILE,
Sir THEODORE de VAUX,
Dr. GODDARD,
Mr. COLWALL,
Mr. OLDENBURGH.

A committee of the council, for auditing the treaſurer's accounts, was appointed, conſiſting of the preſident, Sir THEODORE de VAUX, Dr. GODDARD, Dr. WALTER NEEDHAM, and Mr. OLDENBURG.

It was ordered, that the treaſurer pay quarterly all the ſalaries payable by the Society till further orders: and that what copies of Signor MALPIGHI's diſſertation *De Formatione Pulli in Ovo*, the printer would not furniſh for the author gratis, ſhould be paid for by the Society, who had lately ordered thirty copies of it to be ſent to him to Bologna.

At a meeting of the SOCIETY the ſame day,

Sir ROBERT MORAY preſented to the Society, for the repoſitory, a bee-hive of a peculiar contrivance, ſent out of Scotland by Sir WILLIAM THOMSON, made up of ſeveral pieces, to take off one; whereby bees are kept from ſwarming, by adding a new box for every ſwarm.

The experiment about the high ſuſpenſion of quick-ſilver being called for, it was found, that it had failed. It was ordered, that thicker glaſſes ſhould be provided for the next meeting.

Mr. HOOKE having made a report concerning the experiments ſuggeſted by the preſident and Dr. WALLIS, it was ordered, that the preſident's experiments not being rightly made, nor that of Monſ. HUYGENS with a ſyphon, they ſhould both be made before the Society, as ſoon as poſſible:

[c] Letter-book, vol. v. p. 292. [d] Ibid. p. 367.

Mr.

Mr. Hooke propoſed a method of making the ſame experiment with a ſyphon in the open air, by double pipes, and by blowing them both into one ball. He was deſired to make uſe of this contrivance.

Mr. Locke being called upon for his ſulphur-ball, which he promiſed at the laſt meeting to produce at this, excuſed himſelf, that he had forgot it, promiſing to bring it at the next.

Mr. Hooke ſuggeſted, that it were worth trying, whether air be conſumed, or increaſed by burning. He was deſired to deviſe ſome experiments for determining this queſtion.

Mr. Boyle moved, that it might be tried, to make air of finer bodies than ordinary, ſuch as are diſtilled liquors, or chemical ſalts in diſtilled liquors, in order to find, whether or no ſuch air will be more compreſſed by force than common air.

He moved alſo, that it might be examined, whether, in making ſalt-petre by art, there is any air intercepted and compreſſed.

*November* 20. A committee was nominated and choſen for auditing the accounts, conſiſting of Sir John Lowther, Mr. Hoskyns, Mr. Hooke, Mr. Hill, and Mr. Locke; of whom three were to be a quorum. They agreed to meet at Arundel-houſe on that day ſe'nnight, ſome time before the ſitting of the Society.

An attempt was made of an experiment to diſcover, whether there be any air generated or conſumed by burning, or neither: which not ſucceeding, it was thought proper, that it ſhould be tried on the Saturday following, at Mr. Hooke's lodgings in Greſham-college, before ſuch members of the Society, as uſed to meet there, and the ſucceſs of it reported to the next public meeting.

An experiment was made, to ſhew, that water in a tube, open at both ends, will, when lifted up, ſtand at eight inches, before it begins to fall. Mr. Hooke was deſired to deſcribe the contrivance of this experiment, to be regiſtred.

Three letters to Mr. Oldenburg were read;

1. Of Mr. Flamstead, dated at Derby, 17th November, 1672, accompanied with his calculations of the appulſes of the moon and the other planets to fixt ſtars, for the year 1673 *.

* They are printed in the Philoſoph. Tranſact. vol. vii. n° 89. p. 5118. for Decem. 1672.

2. Of

2. Of Mr. LISTER, dated at York, 15th November, 1672 [f], concerning an uncommon kind of muſhroom, yielding a milky juice, much hotter upon the tongue than pepper.

3. Of Monſ. John HECKER, an aſtronomer of Dantzick, dated there 20th September, 1672 [g], expreſſing a ſingular eſteem of the inſtitution of the Society, and intimating his having ſent a written paper about a conjunction of Mercury with the ſun; which paper had not yet been received.

The preſident ſuggeſted upon occaſion, that Mr. HEVELIUS ſhould be aſked, when Mr. OLDENBURG wrote to him, whether he did not uſe a teleſcope with his quadrants and ſextants in lieu of lights?

It was moved, that Mr. LISTER might be deſired to ſend to the Society his opinion of the veins in plants, which he ſeemed willing to impart at the end of his letter of the 15th of November, in theſe words [h]: "The ſeaſon is almoſt "over, ſo that the account, which we can give of the veins in plants, muſt reſt "as it is, until farther opportunity. My ſenſe of theſe veins, according to the "experience I have yet of them, you may command. But what I chiefly aimed "at, I have found exceeding difficult to effect; that is, an ocular demonſtra-"tion of them: yet, in ſome meaſure, I have attained to that alſo."

Mr. HOOKE intimated, that the great tool for grinding the reflecting glaſs was now ready; and he was exhorted to put it to the trial, and to report the ſucceſs to the Society.

*November* 27. At a meeting of the COUNCIL were preſent

Sir ROBERT MORAY, vice-preſident,

| | |
|---|---|
| The earl Marſhal, | Sir THEODORE de VAUX, |
| The lord viſcount STAFFORD, | Mr. COLWALL, |
| Mr. AERSKINE, | Mr. CREED, |
| Sir PAUL NEILE, | Mr. OLDENBURG. |

The committee of the council for auditing the treaſurer's accounts made the following report:

"At a committee of the council of the Royal Society for auditing the trea-"ſurer's accounts, November 23, 1672, upon examination of Mr. DANIEL COL-"WALL's accounts we find he is debtor,

[f] Letter-book, vol. v. p. 395. It is printed in the Philoſoph. Tranſact. n° 89. p. 5116.

[g] Letter-book, vol. v. p 340.

[h] They are omitted in the copy printed in the Philoſoph. Tranſact.

"To

| | l. | s. | d. |
|---|---|---|---|
| " To the arrears due to the ſaid Society for their quarterly payments this 23d November, 1672 | 1957 | 12 | 0 |
| " To monies he hath received for admiſſions | 20 | 15 | 0 |
| " To the balance of his laſt account | 10 | 10 | 6 |
| | £ 1988 | 17 | 6 |

" We alſo find he is creditor

| | | | |
|---|---|---|---|
| " By monies he hath paid for the uſe of the Society, as by vouchers doth appear | 163 | 1 | 3 |
| " By arrears yet unpaid by the fellows of the Society | 1818 | 7 | 0 |
| " By balance reſting in caſh in his hand | 7 | 9 | 3 |
| | £ 1988 | 17 | 6 |

The council finding the vaſt arrears of many fellows of the Society, ordered, that once again a liſt ſhould be drawn up by the amanuenſis of thoſe, who are moſt behind in payment; and that thereupon ſuch perſons ſhould be ſollicited to pay by thoſe, who had propoſed them for candidates: and that this ſhould be done againſt the next meeting of the council.

At a meeting of the SOCIETY on the ſame day, Mr. BOYLE produced a ball of ſulphur melted in a glaſs ball, which, like electrical bodies, attracted ſeveral light ſubſtances, as alſo filings of fine copper. He ſhewed, that feathers being firſt attracted by this ſulphur-ball would leave this electrical body, and paſs to one not electrical, untouched, as to a glaſs-phial.

Mr. HOOKE produced and read a diſcourſe of his own, containing divers optical trials made by himſelf, which ſeemed to diſcover ſome new properties of light, and to exhibit ſeveral phænomena, in his opinion not aſcribable to reflection, or refraction, or any other till then known property of light.

He was deſired to purſue theſe experiments in a convenient ſeaſon, and to deliver in to the Society ſome account of what was done on this ſubject, to be regiſtered, to preſerve his diſcoveries from being uſurped.

He made an experiment to find out, whether air increaſes or decreaſes by burning: but the ſucceſs not proving ſatisfactory, he was deſired to repeat the experiment at the next meeting.

He being called upon concerning the large tool for grinding the reflex glaſs, ſaid, that he had tried the ſaid tool ſo far, as to find it pretty juſt.

Mr.

Mr. Boyle upon occaſion moved, that ſome true naphtha might be procured, to ſee, whether it would burn under water, he having found, that what is commonly brought to England for naphtha, does not ſo.

*November* 30. The report of the committee of the Society for auditing the accounts was made as follows:

" At a committee of the Royal Society for auditing the treaſurer's accounts, " November 27, 1672,

" We find Mr. Daniel Colwall, the treaſurer, debtor,

| | l. | s. | d. |
|---|---|---|---|
| " To monies he hath received on the quarterly payments of the Society from 21ſt November, 1671, to 23d November, 1672, | 139 | 5 | 0 |
| " To money he hath received for admiſſions - - - | 20 | 15 | 0 |
| " To balance of his laſt account of 21ſt November, 1671, - - | 10 | 10 | 6 |
| | £170 | 10 | 6 |

" We alſo find he is creditor,

| | | | |
|---|---|---|---|
| " By monies he hath paid for the uſe of the Society, as his vouchers make appear, - - - - - - - | 168 | 1 | 3 |
| " By balance reſting in his hands - - - - - | 7 | 9 | 3 |
| | £170 | 10 | 6 |

" J. Lowther, " A. Hill,
" John Hoskyns, " Robert Hooke."

The Society then proceeded to the election of a new council and officer, and there were continued of the council theſe eleven;

The Lord Viſc. Brouncker,
The Earl Marſhal,
The Lord Viſc. Stafford,
The Lord Biſhop of Salisbury,
The Lord Berkley,
Mr. Aerskine,
Sir Robert Moray,
Sir Paul Neile,
Dr. Goddard,
Mr. Colwall,
Mr. Oldenburg.

The ten members of the council were,

The Earl of Dorset,
Mr. Charles Howard,
Sir John Lowther,
Mr. Evelyn,
Mr. Hill,
Mr. Hoskyns,
Mr. Pepys,
Dr. Arderne,
Dr. Croune,
Mr. Locke.

For

For officers were choſen

| | | |
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| The Lord Viſc. BROUNCKER, Preſident, | Mr. EVELYN and Mr. OLDENBURG | } Secretaries. |
| Mr. COLWALL, Treaſurer, | | |

Of ten new members of the council were preſent and ſworn,

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| The Earl of DORSET, | Mr. HOSKYNS, |
| Mr. CHARLES HOWARD, | Mr. PEPYS, |
| Sir JOHN LOWTHER, | Dr. ARDERNE, |
| Mr. HILL, | Dr. CROUNE. |

Between this and the preceding anniverſary election, the Society had loſt three of its eminent members, MATTHEW WREN, Eſq; FRANCIS WILLUGHBY, Eſq; and JOHN WILKINS, D. D. lord biſhop of Cheſter.

MATTHEW WREN, Eſq; eldeſt ſon of Dr. MATTHEW WREN, biſhop of Ely, was born Auguſt 20, 1629, in Peter-Houſe, Cambridge [1], of which his father was then maſter. His firſt education was in that univerſity, whence he removed to that of Oxford, where he was a ſtudent, not in a college or hall, but in a private houſe [k]. In 1657 he publiſhed at London, in 8vo, *Conſiderations on Mr.* HARRINGTON's *Commonwealth of Oceana, reſtrained to the firſt part of the Preliminaries.* Mr. HARRINGTON anſwered this diſcourſe in the firſt book of his *Prerogative of Popular Government*, printed at London in 1658, 4to, in which he reflects on Mr. WREN as one of thoſe virtuoſi, who then met at Dr. WILKINS's lodgings at Wadham-College, the ſeminary of the Royal Society, and deſcribes them as an aſſembly of men, who *had an excellent faculty of magnifying a louſe, and diminiſhing a commonwealth.* Mr. WREN replied, in his *Monarchy aſſerted: or, The State of monarchical and popular Government, in vindication of the* Conſiderations on Mr. HARRINGTON's Oceana; printed at London, 1659, in 8vo. Mr. HARRINGTON's rejoinder was an indecent piece of buffoonry, unworthy of his character, intitled *Politicaſter: or, a Comical Diſcourſe in anſwer to Mr.* WREN's *book intituled* Monarchy aſſerted, &c. London, 1659, in 4to. Sir EDWARD HYDE, in 1659, was very ſollicitous, that Mr. WREN would undertake an anſwer to Mr. HOBBES's Leviathan [l].

At the reſtoration he was elected burgeſs of St. Michael in Cornwall to ſerve in the parliament, which began at Weſtminſter, May 8, 1661, and was appointed ſecretary to the Earl of CLARENDON, lord high chancellor of England, who viſiting the univerſity of Oxford, of which he was chancellor, in September 1661, Mr. WREN was created there maſter of arts. He was one of the firſt members of the Society, when they began their weekly meetings at London, in

[1] Biſhop WREN's larger Diary, printed in the Parentalia: or Memorials of the Lives of MATTHEW WREN, biſhop of Ely, &c.

[k] Wood, Faſti Oxon. vol. ii. col. 145.

[l] Appendix to the Life of Dr. BARWICK. Letters of Sir EDWARD HYDE, of June 27, and July 25, 1659.

1660. After the fall of his patron, the Earl of CLARENDON, he became ſecretary to JAMES Duke of YORK, in whoſe ſervice he continued till his death, about the 11th of June, 1672. His body was interred in the ſame vault with that of his father, in the chapel of Pembroke-hall at Cambridge.

FRANCIS WILLUGHBY, Eſq; was deſcended of two very ancient families, both WILLUGHBYS, the one honourable, that of Ereſby in Lancaſhire, by the father's ſide; the other worſhipful, that of WILLUGHBY on the Woulds in Nottinghamſhire, on the mother's [m]. He was only ſon of Sir FRANCIS WILLUGHBY, knight, by the lady CASSANDRIA, daughter of THOMAS RIDGWAY, earl of Londonderry in Ireland, and was born about the year 1637 [n]. His education was at Trinity-college in Cambridge, under Dr. JAMES DUPORT, afterwards dean of Peterborough, who dedicated to him and to Mr. EDWARD CECIL, Mr. JOHN KNATCHHALL and Mr. HENRY PUCKERING, his *Homeri Gnomologia*, printed at Cambridge in 1660, in 4to. In September, 1660, he reſided at Oxford for the ſake of the publick library [o]. On the 20th of November the year following, he was propoſed candidate of the Royal Society by Dr. WILKINS, and being elected, was admitted on the 11th of December. He ſet out on his travels abroad in April, 1663, in company with NATHANIEL BACON, Eſq; and Mr. RAY, and viſited the Low Countries, Germany, Italy, France, and Spain, to which laſt country he went in Auguſt, 1664, his account of his travels there being printed at the end of thoſe of Mr. RAY in 1673. While he was young, his relations diſcovered in him moſt excellent gifts and abilities both of body and mind; and therefore nothing was ſpared by them to promote and enlarge them; and with theſe he enjoyed the advantage of a plentiful eſtate, to which he ſucceeded in 1665, on the death of his father. He had been from his childhood addicted to ſtudy; and when he came to the uſe of reaſon he was ſo frugal of his time, that he did not willingly loſe, or let ſlip unemployed, the leaſt part of it, deteſting no vice more than idleneſs, which he looked upon as the parent and nurſe of almoſt all others. And his application to his ſtudies, without any intermiſſion or diverſion, was thought by moſt of his friends to have impaired his health. He attained very great ſkill in all parts of learning, even thoſe of the moſt abſtruſe kind, eſpecially mathematical; in which ſcience he correſponded with his incomparable friend Dr. ISAAC BARROW, two of whoſe letters to him are publiſhed [p]. His knowledge of natural philoſopy, and particularly the hiſtory of animals, was ſuperior to that of moſt of his age: and his moral qualities of modeſty, ſobriety, juſtice, and generoſity, were no leſs eminent than his intellectual ones. He died July 3, 1672, aged 37 years, and left, by his wife EMMA, daughter of Sir HENRY BERNARD, knight, two ſons, FRANCIS, and THOMAS, afterwards created a baronet 7th April 1677; and in January, 1711, lord MIDDLETON; and a daughter, CASSANDRA, ſecond wife to JAMES duke of CHANDOS. His writings, beſides theſe printed in the *Philoſophical Tranſactions*, are *Ornithologiæ libri tres; in quibus aves omnes hactenus cognitæ in methodum naturis ſuis convenientem redactæ accurate*

[m] Mr. RAY's preface to Mr. WILLUGHBY's *Ornithology*, London, 1678, folio.

[n] He was 37 years old at his death in 1672.

[o] Wood, Faſti Oxon. vol. 2. col. 139.

[p] Philoſophical Letters of Mr. RAY, &c. p. 360, 362.

*deſcri-*

*deſcribuntur, deſcriptiones iconibus elegantiſſimis, & vivarum avium ſimillimis, æri inciſis illuſtrantur*: London, 1676, in folio, reviſed, corrected, and digeſted into order by Mr. JOHN RAY, who afterwards tranſlated it into Engliſh, and publiſhed it with an appendix, at London, in 1678.

*De Hiſtoria piſcium libri quatuor, juſſu & ſumptibus Societatis Regiæ, Londini editi. Totum opus recognovit, coaptavit, ſupplevit, librum etiam primum & ſecundum integros adjecit Joannes Rains e Societate Regia.* Oxford, 1686, folio.

JOHN WILKINS, D. D. lord biſhop of Cheſter, ſon of Mr. WALTER WILKINS, citizen and goldſmith of Oxford, was born at Fawleſly near Daventry in Northamptonſhire, in the houſe of his mother's father, Mr. JOHN DOD, the celebrated puritan miniſter, about the year 1614 [q]. Having been educated in grammar learning under Mr. EDWARD SYLVESTER, who taught a private ſchool in Allſaints pariſh in Oxford, he was entered a ſtudent in New-inn, in Eaſter term, 1627; and after a ſhort ſtay there was removed to Magdalen-hall, under the tuition of Mr. JOHN TOMBES [r], and as a member thereof, October 20, 1631, took the degree of batchelor of arts [s], and, June 11, 1634, that of maſter [t]. Upon entering into holy orders, he became chaplain to WILLIAM lord viſcount SAY and SELE, and afterwards to CHARLES elector Palatine, with whom he continued for ſome time. In 1638 he publiſhed at London, in 8vo. his *Diſcovery of a new World: or a Diſcourſe tending to prove, that it is probable there may be another habitable World in the Moon*; to which was added, *a Diſcourſe concerning the poſſibility of a paſſage to the World in the Moon.* In 1640, another performance of his was printed at London, in 8vo. under the title of *a Diſcourſe concerning a new planet; tending to prove, that it is probable our Earth is one of the Planets.* Theſe three diſcourſes were publiſhed without his name. His next work was printed at London, 1641, in 8vo. and intitled *Mercury: or the ſecret Meſſenger; ſhewing how a man may with privacy and ſpeed communicate his thoughts to a Friend at any Diſtance.* In 1646 he publiſhed at London, in 8vo. his *Eccleſiaſtes: or Diſcourſe of the Gift of preaching, as it falls under the rules of art*; and in 1648, his *Mathematical Magic: or the Wonders, that may be performed by mechanical Geometry*; London, in 8vo. Having, after the breaking out of the war between king CHARLES I. and the parliament, taken the covenant, he was, April 13, 1648, made warden of Wadham College in Oxford, in the room of Dr. JOHN PITT ejected by their authority, having been the day before created batchelor of divinity [u], as he was doctor, December 18, 1649 [x]. The ſame year he publiſhed at London in 12mo. his *Diſcourſe concerning the Beauty of Providence in all the rugged paſſages of it*; and, in 1653, at London, in 8vo. his *Diſcourſe concerning the Gift of Prayer, ſhewing what it is, wherein it conſiſts, and how far it is attainable by induſtry, &c.* About the year 1656, he married ROBINA, ſiſter of the protector, OLIVER CROMWELL, and widow of Dr. PETER FRENCH, canon of Chriſt church; which marriage being contrary to the ſtatutes of Wadham College, which prohibited the warden from marrying, he obtained a diſpenſation from the protector

[q] Mr. WOOD, Athen. Oxon. vol. ii. col. 505. ſays, that he was 13 years of age in 1627.
[r] Id. ibid.
[s] Id. Faſti Oxon. vol. i. col. 252.
[t] Id. ibid. col. 260.
[u] Id. Athen. Oxon. vol. ii. col. 505.
[x] Id. Faſti Oxon. vol. ii. col. 91.



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to hold the wardenſhip notwithſtanding. In the beginning of 1659, by the favour of RICHARD CROMWELL, the protector, he was preferred to the maſterſhip of Trinity-college in Cambridge, on the death of Dr. JOHN ARROWSMITH. But being ejected thence the year following about the time of king CHARLES II's reſtoration, he became preacher to the honourable ſociety of Grey's Inn [y], and rector of Cranford in Middleſex, December 10, 1661 [z], in the room of Dr. THOMAS FULLER, deceaſed, to which living Dr. WILKINS was preſented by GEORGE lord BERKLEY; as he was, April 11, 1662, to the vicarage of St. Laurence Jury in the city of London, by the king, on the promotion of Dr. SETH WARD to the biſhopric of Exeter [a]. March 11, 1663, he reſigned the rectory of Cranford; and was afterwards promoted to the deanry of Rippon in Yorkſhire, and made prebendary of Chamberlain-wood in the cathedral of St. Paul's, March 26, 1667 [b]. His excellent *Eſſay towards a real Character and a philoſophical Language* was printed at London 1668, in folio, with a dedication to the Royal Society. The ſame year he was advanced to the biſhopric of Cheſter, to which he was conſecrated, November 15. He had been one of that aſſembly of learned men, who met as early as 1645, and continued their meetings at London and Oxford, till they were formed into the Royal Society, of which he was nominated in the charter one of the two ſecretaries, and held that office till his promotion to the biſhopric of Cheſter. He died of the ſtone at the houſe of Dr. TILLOTSON in Chancery-lane, who married his wife's daughter, on the 19th of November, 1672, and was interred on the 12th of December following under the north wall of the chancel of the church of St. Laurence-jury, where his funeral ſermon was preached by his learned friend, Dr. WILLIAM LOYD, dean of Bangor, in which the biſhop's character is repreſented in a ſtrong and beautiful light. By his laſt will he left a legacy of two hundred pounds to the Royal Society, and his papers to Dr. TILLOTSON, who publiſhed from them a diſcourſe *of the Principles and Duties of natural Religion*, printed at London, 1675, in 8vo. and a volume of *ſermons*, fifteen in number, printed there in 1682, in 8vo.

*December* 4. The experiment to find, whether air increaſes or decreaſes, being called for, Mr. HOOKE affirmed, that he had found, that it neither increaſed nor decreaſed. A trial of this being made before the Society, it miſcarried, and was therefore ordered to be repeated at the next meeting.

Mr. OLDENBURG produced and read a letter to him from Mr. LISTER, dated at York, November 30, 1672, concerning veins and other curious obſervables in plants, and particularly of the liableneſs of all vegetable juices to be frozen, except the milky one.

It was ordered to be entered into the Letter-book [c], and to be communicated to Dr. GREW for his peruſal and conſideration, who was deſired to bring in his

[y] Id. Athen. Oxon. *ubi ſupra.*

[z] It is 1660 in NEWCOURT's Repertorium, vol. i. p. 596: but that muſt be a miſtake, ſince that rectory was not vacant till Dr. THOMAS FULLER's death, on the 5th of Auguſt, 1661.

[a] Ibid. p. 387.

[b] Ibid. p. 136.

[c] Letter-book, vol. v. p. 397.

remarks

remarks upon the ſame, and particularly to try in a convenient ſeaſon the freezing of vegetable juices.

Mr. HOOKE being called upon about the giving in the heads of his late diſcourſe concerning ſome new properties of light to be regiſtered, promiſed, that upon farther proſecution of that ſubject he would bring in the whole.

He gave hopes likewiſe, that he might be able to bring in the large reflex ſpeculum at the next meeting.

*December* 11. Dr. GREW brought in his remarks upon Mr. LISTER's letter of November 30, 1672, concerning the veins in plants; which remarks were ordered to be entered into the Letter-book [d], and to be formed into quæries to be communicated to Mr. LISTER for his farther conſideration.

Mr. SCHROTER produced two letters in Latin to the Society, delivered to him lately in Germany, by one Dr. SALOMON REISEL, archiater to FREDERIC CASIMIR count of Hanaw, the one dated 30th September, the other 1ſt October, 1672; the former containing a relation concerning many capital letters found in both ſides of a piece of beech-tree, cleft aſunder, between the pith and bark; the latter diſcourſing about ſome vulgar errors. Which letters were ordered to be entered in the Letter-book [e].

Mr. SCHROTER ſhewed the Society a human ſkull every where very curiouſly overgrown with moſs; as alſo two teleſcopes made in Germany, one of which conſiſting of two tubes connected, and lying parallel to one another, was to ſerve both eyes at once, yet ſo as to repreſent the object ſingle. Monſ. SCHROTER was deſired to bring them again to the next meeting, that they might be viewed by day-light.

*December* 18. At a meeting of the COUNCIL were preſent,

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| The preſident, | Mr. COLWALL, |
| The lord viſcount STAFFORD, | Dr. GODDARD, |
| Mr. CHARLES HOWARD, | Dr. CROUNE, |
| Sir JOHN LOWTHER, | Mr. PEPYS, |
| Sir PAUL NEILE, | Mr. LOCKE, |
| Mr. HILL, | Mr. OLDENBURG. |

Mr. LOCKE was ſworn as one of the council.

Mr. OLDENBURG mentioning Dr. GREW's deſire to be informed, whether the Society would farther employ him in the anatomy of plants upon the former terms, it was declared that the council and Society well approved of what he

[d] Vol. v. p. 405. [e] Ibid. p. 415. & 418.

had

had hitherto performed; and that the council would farther recommend him to the Society, to continue him another year, if the ſubſcribers would pleaſe to continue their contributions.

Sir PAUL NEILE repreſenting to the council the ſtrange neglect of Chelſea-college, and the reproaches thence falling on the Society, it was referred to Sir ROBERT MORAY, Sir PAUL NEILE, Dr. CROUNE, and any others of the council, who had opportunity, to diſcourſe with Dr. WREN, the ſurveyor-general, and others, about letting out the ſaid college to be built for a certain number of years.

It was ordered likewiſe, that Mr. HOSKYNS ſhould be deſired to ſatisfy the council about the nature of the land belonging to Chelſea-college, viz. whether it be Lammas-ground or not?

Sir PAUL NEILE moved anew, that conſidering the vaſt arrears due to the Society, the fellows thereof might by a legal tie be obliged to payment: and it being reſolved, that as good council, as could be had, ſhould be adviſed with, whether the obligation already ſubſcribed by the fellows did not amount to ſuch a legal tie? the lord viſcount STAFFORD offered, that he would undertake to inquire accordingly of the beſt lawyers, whom he knew, and thereupon ſatisfy this council at their next meeting.

His lordſhip's offer was accepted, with thanks, and Mr. OLDENBURG was ordered to cauſe a copy to be made of the ſaid obligation; and alſo of the ſtatutes concerning the payments in general terms included in that obligation, and to ſend that copy to his lordſhip.

The amanuenſis was ordered to go to the prerogative-court, and to copy out of the laſt will of the late Dr WILKINS, biſhop of Cheſter, what the legacy is, which he had bequeathed to the Society.

The council declared, that in the abſence of the preſident and vice-preſident at the public meetings, the members preſent ſhall nominate ſome of their number to take the chair.

*December* 18. Mr. HOOKE, the curator being abſent, by reaſon of ſickneſs, there were no experiments made at this meeting.

A letter of Monſ. SLUSIUS to Mr. OLDENBURG, dated at Liege, December 6, 1672 [r], in anſwer to one of Mr. OLDENBURG's of November 11. was read [s], concerning the optical problem of ALZAHEN; as alſo the ſuſpenſion of purged quick-ſilver at ſeventy five inches.

[r] Vol. v. p. 407. [s] Ibid. p. 359.

Mr.

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Mr. OLDENBURG produced an anatomical preſent to the Society from Dr. SWAMMERDAM, phyſician at Amſterdam, conſiſting of the following particulars:

1. An *uterus humanus*, prepared after the method of Dr. SWAMMERDAM, with all the other parts dried up, and the veſſels filled with yellow and red wax, very diſtinctly injected, after the manner deſcribed by the doctor, in his book accompanying his preſent, intitled, *De uteri muliebris fabrica*, dedicated to the Society.

2. *Pudendum Virgineum, cum Hymene.*

3. *Clitoridis Portiuncula.*

4. *Penis & Urethræ Portiuncula.*

5. *Urethræ Portiuncula.*

6. *Inteſtini jejuni Valvulæ conniventes, a* RUYSCHIO *obſervatæ, a* KERCKRINGIO *delineatæ.*

7. *Inteſtini Rajæ cochlea, a* STENONE *deſcripta.*

8. *Lymphaticum peculiare ex abdomine Gallinæ.*

9. *Arteria primi generis, ſeu pulmonalis in Piſcibus, per quam ſanguis ad branchias amandatur.*

10. *Arteria ſecundi generis in Piſcibus, per quam ſanguis e ramis branchialibus immediate per totum Corpus diſtribuitur.*

11. *Humani Lienis Arteriæ & Venæ.*

12. *Inſignes Arteriæ Hepaticæ Rami una cum Veſiculæ fellis.*

13. *Arteria Lienis vitalini.*

The Society being well-pleaſed with this preſent, ordered Mr. OLDENBURG, to write a letter to Dr. SWAMMERDAM [b], and to return him their ſolemn thanks, and to ſignify to him their high ſenſe of his regard, ſhewn to them by ſo valuable a preſent.

The Society adjourned to January 8 following, on account of the enſuing feſtival.

[b] Mr. OLDENBURG's letter to Dr. SWAMMERDAM, in Latin, dated at London, 19th December, 1672, is entered in the Letter-book, vol. v. p. 414.

1672-3, *January* 8. The *Philoſophical Tranſactions* for December, 1672, containing the predictions of Mr. FLAMSTEAD of the appulſes of the moon to the fixed ſtars for the year 1673, were delivered to Mr. HOOKE, in order that thoſe appulſes might be obſerved.

Mr. OLDENBURG read a letter to himſelf from Dr. FRANCIS de la BOE SYLVIUS, dated at Leyden, $\frac{17}{27}$ September, 1672, having been long detained by the perſon, who had been intruſted with it. It contained his requeſt of the Society's judgment, concerning his *Praxeos Medicæ Idea Nova*. It was ordered to be entered in the Letter-book [i].

Mr. OLDENBURG preſented likewiſe a copy of the ſecond edition of Dr. SYLVIUS's *Idea Medicinæ Practicæ*.

There was produced to the Society a diſcourſe of Dr. GREW, concerning his whole deſign with reſpect to vegetables, and the means of effecting it. Part of this diſcourſe was read, to the great ſatisfaction of the Society, who urged the publication of it [k]; and the reſt was ordered to be read at the next meeting.

Mr. HOOKE was deſired to prepare ſome experiments for the next meeting.

*January* 15. The ſecond part of Dr. GREW's deſign concerning vegetables was read, and he received the thanks of the Society for his care of improving that part of natural philoſophy, and was again encouraged to proceed to make it public.

The Society conſidering likewiſe, that this proſecution of the anatomy of plants was very ſuitable to their deſign, and that Dr. GREW was very fit to be farther employed therein, ordered, that Mr. COLLINS ſhould be deſired to attend the ſeveral ſubſcribers for a contribution to this work, and from the Society recommend to them the continuance thereof.

Mr. OLDENBURG read a letter to him from Mr. HENSHAW, dated at Copenhagen, 12th December, 1672, containing his obſervations of ſome curioſities met with in that place, and expreſſions of his care, in recommending the queries for Iceland, and the iſles of Fero.

*January* 22. Mr. COLWALL preſented a mathematical book, in folio, being the work of GREGORY de SANCTO VINCENTIO *De Quadraturâ Circuli*.

Mr. HOOKE produced an eſſay of a reflecting objective ſpeculum, being the ſegment of a ſphere of thirty ſix feet, which he hoped, when perfectly poliſhed, would perform as much as a refracting object-glaſs for an hundred feet tube. He was deſired to ſee it brought to perfection.

[i] Vol. v. p. 382.

[k] It was publiſhed at London in 1673, in 8vo, under the title of *An Idea of a phytological Hiſtory propounded*, &c.

Mr. Boyle ſent a liquor, which had the power of ſo hardening ſoft bread in two or three minutes, that the bread made the glaſs, wherein it was held, ring when hit againſt it.

It was ordered, that he ſhould be deſired to inform the Society, what kind of liquor it was.

Mr. Oldenburg produced a letter to himſelf from Signor Malpighi, dated at Bologna, 8th October, 1672 [1], accompanying a diſcourſe, containing his repeated obſervations upon eggs, whereby he partly confirmed and illuſtrated the former diſcourſe, and communicated further diſcoveries on that ſubject.

At this meeting was preſent Monſ. Leibnitz, the author of the printed diſcourſe, intitled, *Hypotheſis Phyſica Nova*, dedicated by him in 1671 to the Society. He now ſhewed them a new arithmetical inſtrument, contrived, as he ſaid, by himſelf, to perform mechanically all the operations of arithmetic with certainty and expedition, and particularly, multiplication, after ſuch a manner, that a whole ſeries of numbers, to be multiplied by other numbers, might be multiplied, if the multiplier be one number, by only one turn of the wheels of the machine; and if there be two numbers multiplicands, the operation ſhall be diſpatched by two turns, and the addition of the two products performed at the ſame time, and ſo on. And as for diviſion, that might be performed by determining the quotient without dividing.

He gave ſome proof of what he ſaid, but acknowledged the inſtrument to be imperfect, which he promiſed to get perfected, as ſoon as he ſhould be returned to Paris, where he had appointed a workman for it, whom he would order to make alſo a complete one for the ſervice of the Society, who returned him thanks for theſe expreſſions of his reſpect and generoſity.

*January* 29. Mr. Boyle being made acquainted with the Society's deſire, of knowing what liquor it was, which he had ſent to the laſt meeting, and which had hardened ſoft bread, ſaid, that it was fixt nitre reſolved *per deliquium*.

He was thanked for this communication; as alſo for another, which was a method of producing a colour by two limpid liquors mingled together, and that without precipitation; and of deſtroying the colour thus produced, without precipitation; of which he now ſhewed the experiment with the deſired ſucceſs.

He intimated, that this experiment might conduce to the clearing of the doctrine of diaphaneity and opacity.

He took occaſion to inform the Society, that he had lately ſeen a piece of an oſier-tree, which he had taken for a piece of whale-bone, both for blackneſs and bending: it was found in a little rocky uninhabited iſland near Barbadoes.

[1] Letter-book, vol. v. p. 422.

Mr. OLDENBURG read the following letters:

1. Of Dr. BEAL, incloſing one from Mr. BUCKLAND of Somerſetſhire, dated December 30, 1672, concerning a ſtrange froſt or freezing rain, which had lately deſtroyed abundance of orchards in the country about Briſtol [m].

2. Of Monſ. SLUSIUS, dated at Liege, 17th January, 167$\frac{2}{3}$, N. S. containing his ſhort and eaſy method of drawing tangents to all geometric curves, without the labour of calculation [n].

3. Of Dr. SWAMMERDAM, dated at Amſterdam, 24th January, 167$\frac{2}{3}$ [o], acknowledging the receit of Mr. OLDENBURG's letter of thanks from the Society, for the Dr.'s late anatomical preſent, and communicating ſome new diſcoveries made by himſelf in anatomy, viz.

1. Of ſome animals, which have lungs, and yet naturally want a *vena arterioſa*. 2. Of the teſticles of *ſcurabæus naſi-cornis*, that they exactly agree in their ſtructure with thoſe of a man, and do *ex unico, tantum funiculo longo, curvo, innumerabiliter flexo, atque (quod nondum*, ſays he, *in homine mihi viſum eſt) in principio ſeu apice ſuo cæco, conſtare.*

Mr. OLDENBURG was ordered, 1. To deſire Monſ. SLUSIUS to impart likewiſe his demonſtration of his method of tangents. 2. To deſire Dr. SWAMMERDAM to acquaint the Society, what animals they be, wherein he had found the *vena arterioſa* wanting.

Mr. BOYLE mentioned, that in a man executed ſome years before, the *foramen ovale* had been found open.

It was remarked hereupon, that the anatomical examination of amphibious creatures might make ſome good diſcoveries; and that therefore the phyſicians of the Society would do a conſiderable ſervice to anatomy, if they would examine ſuch animals more carefully than had been hitherto done.

Mr. HOOKE mentioned, that the reflecting ſpeculum, which he had produced at the laſt meeting, was farther publiſhed; and that he would endeavour to get it finiſhed in a ſhort time.

February 5. Mr. HOOKE produced again his objective ſpeculum for the reflecting teleſcope, which he affirmed to be now true, though not perfectly poliſhed; which he would procure to be done againſt the next meeting.

[m] It is entered in the Letter-book, vol. vi. p. 2. and publiſhed in the Philoſoph. Tranſact. vol. vii. n° 90, for January, 167$\frac{2}{3}$, p. 5138.

[n] Letter-book, vol. vi. p. 11. It is publiſhed in the Philoſoph. Tranſact. vol. vii. n°90. p. 5143.

[o] Letter-book, vol. vi. p. 25. Part of this letter is printed in the Philoſoph. Tranſact. vol. viii. n° 94. p. 6041. for May, 1673.

He

He mentioned, that he intended to have an arithmetical engine made, which ſhould perform all the operations of arithmetic, with great expedition and certainty, without making uſe of the rhabdology, and that much more ſimply than that of Monſ. LEIBNITZ, produced before the Society on the 22d of January. He was encouraged to make good his propoſition.

Mr. OLDENBURG produced a regiſter of obſervations, concerning winds and weather, left with him by Monſ. LEIBNITZ, by whom it had been brought from Paris, where the obſervations had been made with an inſtrument called OTTO GUERICKE's *little man*; which is a tube kept in that city by Monſ. DALANCE', containing a matter, which was held a ſecret by the author, who pretended by it to prognoſticate the winds and their force ten or twelve hours before they blew; as alſo fair and rainy weather. It was added, that by this regiſter, marking the ſeveral ſtations of the liquor, the ſignification, and the event, it appeared, that for the moſt part the event had anſwered the prediction, though ſometimes it had failed.

This gave occaſion to ſpeak of the weather-cock ſo often mentioned formerly, and ſo deſirable and uſeful: and it was ordered, that Mr. HOOKE do not fail to get ſuch a clock made as ſoon as poſſible; eſpecially ſince in France, Italy, and Germany, the curious were known to be ready to join their obſervations on the weather to thoſe made by the members of the Society. Mr. HOOKE propoſed to take care of this immediately.

Occaſion being given to ſpeak of petrifications, it was remarked by Mr. HOOKE, that he was credibly informed, that there was a ground in Bedfordſhire, which would in a twelvemonth's time turn wood and other matter, that was not ſtony, into ſtone, without vitiating the figure.

This was confirmed by Sir ROBERT MORAY, who added, that the king had expreſſed his intention of buying that ground, and walling it about, on purpoſe to make in it experiments touching petrifaction.

It was wiſhed, that his majeſty, when there ſhould be a proper opportunity, might be put in mind thereof, to command it to be done.

Sir ROBERT MORAY preſented a centre fiſh-petrified.

Mr. OLDENBURG produced ſome yellow amber, and a piece of *lignum foſſile*, given him by Mr. HENSHAW's clerk, Mr. TRIBOLET, lately arrived from Copenhagen, near which city it had been digged out of the ground, at the diſtance of three or four hundred paces from the ſea. Mr. HOOKE declared his opinion, that yellow amber was nothing but reſin petrified.

It was ordered, that Mr. HOOKE's objective ſpeculum ſhould be again produced and tried at the next meeting.

*February* 12. being Aſh-wedneſday, the Society did not meet.

*February* 19. There was preſented to the Society, from the Eaſt-India company, the whole ſkin of a muſk-deer; for which the thanks of the Society were returned by the meſſenger who brought it. And the vice-preſident, Sir ROBERT MORAY, was deſired to expreſs, upon occaſion, to the governor of that company, Sir John BANKS, the great ſenſe, which the Society had of their favour and kindneſs, in increaſing the ſtock of their philoſophical ſtore-houſe with ſo rare a preſent; which was delivered to Mr. HOOKE for the repoſitory.

Mr. OLDENBURG delivered likewiſe to Mr. HOOKE Dr. SWAMMERDAM's treatiſe, intitled, *Uteri muliebris Fabrica, una cum Methodo nova Cavitatis Corporis ita præparandi, ut ſuam ſemper genuinam faciem ſervent:* printed at London, 1672, in 4to, and preſented to the Society by the author.

Mr. OLDENBURG preſented alſo to the Society, from Signor FRANCISCO REDI, two books, the one printed at Florence, in 4to, intitled, *Eſperienze intorno alla Generatione degl' Inſetti, fatte da Franç. Redi*; the other more lately publiſhed under the title of *Eſperienze intorno a divorſe coſe naturali*, printed at Florence, 1671, in 4to. Thanks were ordered to be returned to the author, as alſo to Mr. DODINGTON, for his care in bringing theſe books with him out of Italy. The latter of them was delivered to Mr. OLDENBURG, in order to make an extract of it, to be exhibited at the next meeting.

Mr. BOYLE preſented a branch of a willow or oſier-tree, which he had made mention at the meeting of January 29, 1672, that it was found in a ſmall rocky uninhabited iſland near Barbadoes, and was like whalebone for blackneſs and bending.

Mr. OLDENBURG produced and read a letter in Latin, left with him by Monſ. LEIBNITZ, dated at London, $\frac{10}{20}$th February, $167\frac{2}{3}$ [p], containing his deſire of being received into the Society, and his engagement of ſerving them to the utmoſt of his power, in promoting the deſign of their inſtitution.

This gentleman having been lately preſent at ſeveral meetings of the Society, and at one of them having produced and ſhewed an ingenious arithmetical engine, and in other reſpects given teſtimony of his abilities, and of his great eſteem for the Society, Sir ROBERT MORAY having taken public notice hereof propoſed him as candidate.

Mr. HOOKE tried again the experiment formerly attempted, of finding, whether air increaſes or decreaſes by burning: but it miſcarrying again, he was deſired to fit it better for the next meeting.

Mr. REID of Herefordſhire having ſent ſome red-ſtreak grafts for the ſervice

[p] Letter-book, vol. vi. p. 34.

of

of the Society, it was ordered, that ſuch members, as had occaſion to propogate this cider-fruit, ſhould take their ſeveral proportion of theſe grafts.

There was produced a Bononian ſtone, which Mr. DODINGTON brought out of Italy and delivered to the ſecretary for the Society, and which was ſaid to have been duly prepared for ſhining.

It was ordered, that at the next meeting this ſtone ſhould be produced again, to make trial of its ſhining, there being now no ſun for ſuch a trial.

Mr. OLDENBURG produced ſeveral copies of Monſ. HECKERUS's printed admonition to aſtronomers, *De mercurii in ſolem incurſu:* which copies were, according to the author's deſire, diſtributed among the members of the Society.

*February* 26. The Society did not meet.

*March* 5. EDWARD BERNARD B. D. profeſſor of Aſtronomy in the univerſity of Oxford, was propoſed candidate by Mr. OLDENBURG.

Mr. HOOKE made an attempt again of the trial to find, whether air is generated or conſumed by burning; but the apparatus failing again, he was ordered to fit it with care.

He produced his arithmetical engine, mentioned by him in the meeting of 5th February, and ſhewed the manner of its operation, which was applauded. He was deſired to bring in the deſcription of it, that ſo it might the better appear how it differed from that of Monſ. LEIBNITZ, produced January 22. before the Society.

Mr. OLDENBURG gave an account of part of Signor REDI's book, intitled, *Experienze intorno a divorſe coſe naturali*; wherein occurred ſome particulars, thought not inconſiderable: as 1. Of waters diſtilled in a leaden bell, rendering all ſorts of natural waters turbid, when infuſed on them, except the conduit water of Piſa, which yet admits of a caution. 2. Of waters diſtilled in glaſs, ſometimes growing troubled when mingled with waters diſtilled in lead, ſometimes not. 3. Of cinnamon-water, which diſtilled in glaſs, and kept in glaſs, remains clear; but kept in cryſtal of Piſa grows turbid in a few hours, and milky, and in a few days yellow and bitter, though in cryſtal of Rome and Venice it does not become turbid till after two or three days; in cryſtal of Paris, not till after a much longer time. 4. Of the torpedo, ſtupifying only when touched and ſqueezed, not at a diſtance; together with a curious account of that fiſh diſſected.

Sir ROBERT MORAY preſented a pear grown out of a pear, each having a ſtalk of its own.

Mr. HOOKE promiſed to give the Society, at their next meeting, a lecture upon his weather-clock.

*March* 12. Mr. HOOKE read a diſcourſe of his upon the weather-clock; which being but a part of the whole intended by him, he promiſed to bring in the remainder, containing the deſcription of the engine, at the next meeting.

He was deſired to take care, that ſuch an engine be made with ſpeed.

Mr. OLDENBURG produced two papers, one of which was from EZRAEL TONGUE, D. D. about a way of multiplying divers ſorts of trees, with ſpeed, by tongue-grafting (as he calls it) their roots, and by covering the places ſo grafted with earth, about two inches deep. The other was a letter from Mr. RICHARD REED, dated 27th February, 167$\frac{2}{3}$, at Lugwardene in Herefordſhire [q], concerning two queries about planting, 1. Whether, in planting, the roots are to be ſet again at large, or pruned near to the trunk or body of the tree. 2. Whether early or late planting, both as to the living, and alſo the future thriving of the tree, be to be preferred; all benefits and inconveniencies of both ſeaſons being conſidered? Mr. REED declaring for planting with little root, and for planting in February and March rather than before winter, and giving reaſons for both.

There was preſented an human ſkull, altogether and very curiouſly overgrown with very fine moſs, which was ſaid to have grown ſince it was brought over, in a chamber of Monſ. SCHROTER, who preſented it, having procured it in Germany.

There was read a Latin letter of Dr. JOHN BAPTISTA GORNIA, phyſician to the grand duke of Tuſcany, dated at Florence, 3d January, 167$\frac{2}{3}$, and written to Sir THEODORE de VAUX, containing the writer's opinion concerning the diſeaſe, of which Dr. WILKINS biſhop of Cheſter died.

Mr. OLDENBURG preſented the ſeventh volume of the *Philoſophical Tranſactions*.

*March* 19. Mr. HOOKE read a diſcourſe of his, giving an account of the ſucceſs of this experiment, which, he ſaid, he had made, about the increaſe or diminution of air by burning; which was, that the air was diminiſhed one twentieth part.

He was deſired to proſecute theſe experiments, and to give the Society an account of them from time to time, and to beſpeak ſome members of the Society to aſſiſt at them.

He was put in mind to proſecute the invention of the weather-clock, and to haſten the making of it; and not to forget the finiſhing of the reflecting ſpeculum.

[q] Letter-book, vol. vi. p. 51.

Mr. OLDENBURG read a letter to himſelf from Dr. SWAMMERDAM, dated at Amſterdam 24th March, $167\frac{2}{3}$ [r], giving an account of and naming the animals, which have lungs, and yet want a *vena arterioſa*; as alſo a deſcription of the ſtructure of the genitals of a *ſcarabæus naſicornis*.

1673, *March* 26. Mr. HOOKE made an experiment of mingling oil of vitriol and common water together, thereby ſhewing, that theſe two liquors were ſo incorporated, by entering into the pores of one another, that they took up leſs room, when mingled together, than they did both being apart. Of the common water there were twenty-one meaſures; of the oil of vitriol three meaſures, which is twenty-four meaſures in all, and yet mixt together they made but twenty-three meaſures.

Mr. OLDENBURG read two letters, one to himſelf from Signor CASSINI, dated at Paris 25th March, 1673, N. S. [s] preſenting to the Society his obſervations of two new planets moving about Saturn, the one within the *ſatelles* of Monſ. HUYGENS, and therefore by the diſcoverer called *intimus*, making its periodical revolution about four days and an half; the other without the Huygenian *ſatelles*, and therefore called *extimus*, finiſhing its courſe in about eighty days [t].

The other letter was from Mr. GREGORY to Mr. COLLINS, dated at St. Andrew's, March 7, $167\frac{2}{3}$, about the effects of oblique reflection above thoſe of the direct; as alſo concerning the charges and apertures of teleſcopes with convex or concave ſpeculums, and of his notion concerning burning concaves, &c. This letter was as follows:

" I have received yours, dated February 20. together with Mr. NEWTON's anſ-
" wer, with which I am exceedingly ſatisfied. I am much engaged to you both,
" for the pains you have been at; I am almoſt convinced, that oblique reflection
" cauſeth more light than the direct; but I am not fully perſuaded, that it is more
" regular. I conceive, that the rudely poliſhed plate of metal, in an oblique
" poſition, cauſeth the image appear more different, becauſe the obliquity hideth
" the concavities, ſo that no rays come to the eyes, but from the tops of the
" little tubercula, which are certainly beſt poliſhed; the other rays, which con-
" fuſed the image, being kept away: but if the plate be exactly poliſhed (I
" ſpeak here as to ſenſe) the poſition muſt be ſo oblique, before the inſenſible con-
" cavities can be hid, that the planes fall always even, to the ſight, in a line,
" I grant, I have been miſtaken in that firſt advantage, which I mentioned;
" for the plane ſpeculum F, having certainly (as all human artifice hath) ſome
" errors in it, cauſeth greater prejudice by them, being remote from the focus,
" than being near to it, and in it there is none at all cauſed; where if it could
" be placed, and a near and direct aſpect had of it, this were certainly the beſt
" teleſcope of this ſort.

[r] Letter-book, vol. vi. p. 57. Part of this letter is printed in the Philoſoph. Tranſact. vol. viii. for May, 1673. n° 94. p. 6041.

[s] Letter-book, vol. vi. p. 69.

[t] See Philoſoph. Tranſact. vol. viii. n° 92. p. 5178. for March, 1673.

" It

" It is true indeed, that in teleſcopes with convex or concave ſpeculums to double " the charge, the length muſt be almoſt doubled; but to double is a great altera- " tion, and hardly ſufferable (as I ſuppoſe) in very good glaſſes, if the leaſt charge " be conſiderable: but I underſtand not how the charge can be altered at all, with " the ſame glaſſes, in Mr. NEWTON's teleſcopes; for I know nothing of that, which " was deſcribed to Mr. OLDENBURG. It is true, that the eye-glaſſes can be changed " in all teleſcopes, if they be at hand of the required depth. I think, there is no " great hazard in theſe teleſcopes of overcharging, ſeeing the charge of the glaſs " can be diminiſhed at pleaſure; neither upon this account needs the angle of viſion " be ſo ſmall, ſeeing it is equal to the angle of the eye-glaſs from its focus, its other " focus being the little ſpeculum; nor the darkneſs at all augmented, if the aper- " ture of the ſpeculum be proportional to the diameters of the ſpheres.

" But above all things, I deſire to know this, that ſeeing the image made by " the great ſpeculum may be eſteemed a ſmall viſible, and ſeeing Mr. NEWTON " in Tranſactions, p. 3080, thinketh it fitter to make a microſcope or tube to " behold a ſmall viſible of one concave ſpeculum and one eye-glaſs, rather than " with one ſingle eye-glaſs, and much rather than with one plane ſpeculum and " with one eye-glaſs: wherefore alſo to look to this ſmall viſible, the firſt alſo ſhould " not be preferred to the laſt. This image indeed is not capable of ſuch magnifica- " tion as a viſible is; yet I am hardly ſenſible, how this ſhould caſt the balance, " taking in the defects of a plane ſpeculum, together with other inconveniencies in " taking up this object. I ſaid indeed, that hyperbolic and elliptic glaſſes were " tried in vain; but I ſpake not ſo of ſpheric ſpeculums (as Mr. NEWTON's words " ſeem to imply, Tranſact. p. 4059;) for any thing I did, deſerves not the name " of a trial, ſeeing Mr. REEVE and Mr. COCK both know, that the great ſpecu- " lum was poliſhed only with a cloth and putty; neither, the truth is, thought " it worth the pains, at that time, to be ſerious about further inquiry in that bu- " ſineſs; for they undertook indeed to poliſh a leſs ſpeculum to me upon the " tool. I am not yet fully convinced, which of theſe two ways have the beſt " advantage, albeit I incline more to Mr. NEWTON's, eſpecially becauſe of the " ſmall diſtance betwixt the plane ſpeculum, focus and the eye; however, ex- " perience muſt determine all; neither am I concerned how it happen. I had " no intention, that my thoughts of theſe teleſcopes ſhould be printed: my deſign " was only before, as now, that, if you thought fit, otherwiſe not, you might ſend " them to Mr. NEWTON.

" I received thoſe letters you mention, as alſo that box, together with the " things contained, and particularly Horrox's Poſthuma, for which I muſt acknow- " ledge myſelf exceedingly engaged to you. I have peruſed him, and am ſatisfied " with him; it was a great loſs, that he died ſo young.

" Mr. NEWTON's diſcourſe of reflection puts me in mind of a notion I had of " burning-glaſſes ſeveral years ago, which appears to me more uſeful than ſub- " tile: if there be a concave ſpeculum of glaſs, the leaden convex ſurface having " the ſame center with the concave; or, to ſpeak preciſely, albeit perchance to little

" more

" more purpoſe, let the radius of the concavity be $a$, the thickneſs of the glaſs in " axis tranſitum $f$, the radius of the convexity equal to $\frac{90^2 + 18af + 5f^2}{9a + 5f}$) this " ſpeculum ſhall have the foci of both the ſurfaces in the ſame point; and not only " that, but all the rays, which are reflected betwixt the two ſurfaces, ſhall in their " egreſs come quam maxime to the common focus. The making of ſuch a ſpeculum " requireth not much more art than ordinary plane glaſs, ſeeing great ſubtilty is not " neceſſary here; ſo that, I believe, they, who make the plane mirror glaſſes, would " make one of theſe three foot in diameter for four or five pounds ſterling, or little " more; for I have ſeen plane glaſſes, almoſt of that bigneſs, ſold even here for leſs " money. Now ſeeing (as Mr. NEWTON obſerveth) that all reflecting metals loſe " more than one third of the rays, this concave glaſs, even *cæteris paribus*, would " have a great advantage of the metalline one; for certainly an exactly poliſhed " thin mirror glaſs, of good tranſparent matter, after a few reflections, doth not " loſe one fourth of the rays; and upon other accounts this hath incomparable " advantages; ſeeing it is more portable, free from tarniſhing, and above all " hardly one twentieth part of the value.

" The great uſefulneſs of burning concaves, this being ſo obvious, and yet (for " that I know) untouched by any, makes me jealous, that there may be in the " practice ſome fallacy. You may communicate this to intelligent perſons, and " eſpecially to Mr. NEWTON.

" P. S. If you pleaſe, let me hear with the firſt convenience, what may be " judged the reſult of this burning concave; for I am as much concerned to be " undeceived, if there be any inſuperable difficulty, as to be informed of a moſt " ſurpriſing ſucceſs. I have ſpoke of it to ſeveral here, but all were as ignorant " of it as myſelf. Several months by-paſt I have been ſo much buſied in ſome " private ſtudies, that I have forgot to pay my reſpects to you, which otherwiſe " my inclinations lead me to, upon which account I am more tedious now than " at other times. I deſire yet to be more particular in the matter of teleſcopes; " I ſuppoſe a four foot teleſcope to have the aperture of ſix inches; the little con- " cave having the aperture of three fourths of an inch may magnify eight times, " the radius being one foot: in this caſe the hole in the middle of the great con- " cave is only three fourths of an inch, which being filled with an eye-glaſs, equal- " ly convex on both ſides, amplifying the charge of the little concave twenty " four times, doth make a teleſcope magnify the object an hundred and ninety " two times, (which is no extraordinary charge, ſeeing Mr. NEWTON's table giv- " eth an hundred and ſeventy one and might be much leſs without inconvenience) " taking in an angle of viſion of above twenty degrees, and with this there is " not loſt one ſixtieth part of the rays. With the loſs of one thirty-ſixth part of " the rays, it might magnify not above an hundred and forty four times and take " in an angle of viſion of above twenty eight degrees. With all this the middle of " the object is illuſtrated with all the rays, which the aperture of the great concave " doth reflect. By theſe means, I think, that I keep off from thoſe two incon- " veniences mentioned by Mr. NEWTON, in the ſeventh particular of his conſide-

" rations. The event of theſe other conſiderations, as I ſuppoſe, can only be " determined exactly by experience."

It was ordered, that this letter ſhould be communicated to Mr. NEWTON, as the perſon moſt concerned in it.

*April* 2. There was preſented to the Society, from Mr. SAINT CROIX, his lately printed *Dialectica ad mentem* JOHANNIS SCOTI *eruta & elucidata.*

Mr. HOOKE made an experiment, by mixing oil of tartar and aquafortis together, to ſee how they would incorporate, and how much leſs ſpace they would take up when thus incorporated than both apart. The mixture cauſed a great ebullition, which laſted all the while that the Society ſat: but it ran over ſeveral times, and therefore Mr. HOOKE was deſired to make it again.

Mr. OLDENBURG read a letter to himſelf from Mr. FLAMSTEAD, dated at Derby, 17th February, $167\frac{2}{3}$[1], giving an account of his conſiderations upon Monſ. HECKERUS's printed admonition, *De Mercurii in Solem Incurſu obſervando anno* 1674, *menſe Maio.*

It was ordered, that Monſ. HECKERUS be made acquainted with the contents of this letter.

Mr. OLDENBURG read an account of ſome obſervations made by the prince of Conde, near Paris, about a well belonging to the houſe of the marquis of St. SIMON, of a moderate depth, and making an extraordinary noiſe, when the weather is to change from fair to foul, and the greater the noiſe, the worſe the weather will be; but none at all, when the weather is changing from foul to fair.

It was remarked, that an inquiry ſhould be made, whether the well was a dry one, or had water in it, and what was peculiar or remarkable in the ſituation of it, or ground about it.

*April* 9. Mr. EDWARD BARNARD and Monſ. LEIBNITZ were unanimouſly elected into the Society.

Mr. HOOKE made an experiment with aquafortis and a little piece of braſs wire, put into that liquor, marking where the liquor ſtood before the putting in of the braſs, and where, after it was put in: as alſo, how far it was raiſed upon its working upon the braſs, and how low it deſcended afterwards, which was almoſt an inch below the mark, at which it ſtood at the firſt putting in of the braſs.

He promiſed to bring in a full account in writing of this experiment, and of that made at the preceding meeting.

[1] Letter-book, vol. vi. p. 41.

Mr.

Mr. OLDENBURG read a letter to himſelf from Monſ. HUYGENS, dated at Paris, 14th January, $167\frac{3}{4}$ [u], containing ſome conſiderations upon Mr. NEWTON's theory of light; together with Mr. NEWTON's anſwer to them, dated at Cambridge, 3d April, 1673 [x].

Mr. OLDENBURG was deſired to communicate this anſwer to Monſ. HUYGENS.

He preſented to the Society from Mr. BOYLE his new book intitled, *Tracts, containing new Experiments touching the Relation betwixt Flame and Air, and about Exploſions, &c.* printed at London, 1672, in 8vo.

Mr. OLDENBURG gave notice, that Sir JOSEPH WILLIAMSON being to go to Aix la Chapelle, as one of his majeſty's ambaſſadors, offered his ſervice to the Society for inquiries after philoſophical matters in thoſe parts; and that himſelf, Mr. OLDENBURG, had already drawn up ſome directions and queries for that purpoſe.

This offer was accepted, and it was ordered, that Sir JOSEPH WILLIAMSON ſhould be thanked, and the queries read; which being done, and ſome other particulars ſuggeſted by ſome of the members preſent, Mr. OLDENBURG was deſired to digeſt and deliver them.

He read likewiſe a letter to himſelf from Dr. BEAL dated at Yeovil in Somerſetſhire, April 1673, recommending a certain pear, making an excellent drink, though the fruit be of ſo very diſagreeable a taſte, that even hungry ſwine would not eat of it.

Dr. BEAL was deſired to procure ſome grafts of it for Mr. CHARLES HOWARD, who would yet venture at this ſeaſon to ingraft them.

*April* 16. Mr. HOOKE being called upon for an experiment, and having none ready, he was ordered to proſecute thoſe lately begun about the incorporation of liquors, and to bring in a written account of thoſe, that had been hitherto made.

Sir ROBERT MORAY related an obſervation made of a liquor called *Goddard's drops*, exhaled in two years time to the half of it out of a glaſs hermetically ſealed, belonging to the lord archbiſhop of Canterbury.

This was confirmed by the lord biſhop of Saliſbury, who added, that it was ſo well ſealed up, that no ſmell at all could be perceived of the liquor within.

It was moved, that this glaſs might be deſired of the archbiſhop for making farther obſervations about it; and that, when obtained, it might be weighed, then

[u] Letter-book, vol. vi. p. 17. Part of this letter is printed in the Philoſ. Tranſact. vol. viii. n° 96. p. 6086. for July 1673.

[x] Letter-book, vol. vi. p. 19. It is printed in the Philoſ. Tranſact. n° 97. p. 6108.

broken, and immediately after weighed again, to find whether any conſiderable part of the liquor had been changed into vapours, and lodged in the empty part of the glaſs.

Mr. HOOKE obſerved, that ſpiritous liquors, though well cloſed up, would in time commonly loſe their virtue, and alſo their bulk, the particles of it paſſing into the pores of one another.

The preſident moved, that ſome of the ſame drops might be very carefully ſealed up, and then immediately weighed exactly, and after ſome time weighed again.

Mr. OLDENBURG read a letter written to him by Dr. SWAMMERDAM, dated April 21, 1673, from Amſterdam [y], accompanied with ſome anatomical obſervations of his about the pancreas and pancreatic juice of ſeveral fiſhes; as alſo of an human *fœtus* lately found at Rome between the *ovarium* and the *tuba*, contained with its uſual integuments; the deſcription and delineation whereof, he intimated, were then preparing at Rome.

*April* 23. An experiment was made with aquafortis and pulveriſed oiſter-ſhells in a bolt-head, tied cloſe about at the open end with a flaccid bladder, in order to ſee, what it would produce; and it was found after a little while, that the bladder was ſwelled. It was then ordered, that it ſhould be put, as it was, into the trunk of the Society, and left there, locked up till the next meeting, to ſee, whether theſe exhalations would prove permanent air.

Mr. BOYLE mentioned, that he had frequently made ſuch kind of experiments, and thereby produced true air, which laſted for ſeveral months together.

Dr. CHAMBERLAYNE preſented a piece of bark, which he ſaid had been ſent out of the Eaſt Indies to the lord HERBERT [z], with this account, that it had been unſeen and unknown in that very place from whence it was ſent, and that ſome Indians had brought it thither, concealing the place where they had it. The ſcent and taſte were very aromatical and pungent, eſpecially thoſe of the thin and innermoſt barks.

Dr. CHAMBERLAYNE was deſired to requeſt the lord HERBERT, that ſince he correſponded in the Eaſt Indies, he would endeavour to procure a greater quantity of it, and, if poſſible, an account of the place of its growth, it being very likely to be a very ſtomachic ſpice.

A letter of Mr. BERNARD, dated at Oxford, April 15, 1673 [a], returning to the Society his thanks for his election, was read.

[y] Letter-book, vol. vi. p. 91.
[z] CHARLES lord HERBERT, ſon of HENRY marquis of Worceſter.
[a] Letter book, vol. vi. p. 74.

There

There was produced a book belonging to Mr. HENSHAW, and ſent by him to Mr. OLDENBURG, intitled, *Olaus Wormius de Mure Norvagico* [b], with the following relation prefixed to it in Mr. HENSHAW's own hand; "Memorandum, "quod d. 14 Junii, 1672, excellentiſſimus dominus ULDORRICUS FREDERICUS "GULDENLOW, filius naturalis regis Daniæ, FREDERICI III. defuncti, prorex "Norvagiæ, affirmavit mihi cum juramento, aliquando in Norvagia aliquos ex "iſtis muribus, quos incolæ *Lemming* vocant, ſuper galerum ſuum depluiſſe; "quod ipſum & antea ſibi accidiſſe ibidem mihi affirmaverat dominus CROUS, "Telenorius regis Daniæ in Norvagia."

It was thought by ſome of the members, that ſuppoſing the matter of fact to be true, thoſe animals muſt have been carried by ſome very violent wind from an high ground into the air, and ſo fallen down; it having been obſerved from the relations in this book of WORMIUS, that as ſoon as ſuch animals had fallen down, there had been found in their bellies herbs yet undigeſted and corn; which could not be but that they muſt have been before in ſuch places, where ſuch herbs and grains grow.

*April* 30. The Society did not meet.

*May* 7. CHARLES lord HERBERT, eldeſt ſon of HENRY lord marquis of Worceſter, was propoſed candidate by Mr. HOSKYNS.

There was produced the bladder, which at the meeting of April 23, had been ſomewhat inflated with air produced by aquafortis and powdered oiſter-ſhells, and now much more ſwelled than at that time.

It was moved, that it ſhould be tried, whether this air thus produced would ſerve for burning; that is, whether a candle might be kept burning in it as in common air; and if ſo, whether for as long or a longer or ſhorter time: and that for this purpoſe this very air ſhould be conveyed into another veſſel, to burn bodies in it.

It was alſo ordered, that this experiment ſhould be tried with a mixture of other bodies, to ſee whether air could be produced fit for reſpiration.

It was likewiſe moved, that it might be conſidered, whether the aquafortis be conſiderably waſted; or what quantity of it is raiſed up into air: for which end it would be neceſſary to weigh it exactly before it be put in; as alſo the oiſter-ſhells.

Mr. HOOKE remarked, that it would be worth trying, what effect precipitation would have upon air by pouring certain liquors upon ſolutions to make precipitations.

He read a paper of his concerning arithmetical inſtruments, as well thoſe, that had been made upon the principle of the rhabdology, as that other ſhewn to the

[b] Printed at Copenhagen, 1653, in 4to.

Society,

Society, January 22, by Monſ. LEIBNITZ; and he promiſed one of his own invention of better performance. This paper was ordered to be regiſtered [b], as follows:

"The beſt way for addition and ſubtraction is by ſetting down the numbers on "paper, and proceeding as in common arithmetic; both theſe operations being "quicker and much more certainly done than by any inſtrument whatſoever; "for, firſt, the numbers may be writ down in half the time they can be ſet on "any inſtrument; and, ſecondly, they remaining altogether in view, may be "quickly added or ſubtracted, and the ſum or remainder ſet down; and if there "ſhould be any miſtake in the firſt, they can be preſently run over again (which "is not a quarter part of the trouble of the operation) whereas by an inſtrument "to examine an operation over again, the whole trouble of the operation is per-"formed; and a man is much more ſubject to miſs in putting the key into the "right number, than he is in ſetting down the figure to expreſs it; and there-"fore, for thoſe kinds of operations in arithmetic, an inſtrument is wholly in-"ſignificant, and at beſt will come ſhort of common counters.

"Next, the beſt inſtrument for ſquaring and cubing, or for extracting the "ſquare or cubic root, is by printed tables for that purpoſe, ſuch as BABINGTON "hath printed at the end of his fireworks, or Dr. PELL hath lately epitomiſed and "reduced to a leſſer volume: for by the help of printing a book of tables, which "will preſently reſolve queſtions of that kind to twenty or thirty places, will be "reduced into a leſs volume, and be purchaſed at a much cheaper rate than any "arithmetic inſtrument, that ſhall do the whole operation itſelf without ſkill: "and, if ſkill in arithmetic be allowed to be joined in the uſe of the inſtrument, "printing will furniſh us with tables, that will do all thoſe kind of operations with "much more certainty and ſpeed, than any arithmetical inſtrument yet known.

"Thirdly, as to multiplication and diviſion, the lord NEPER, in his Rhabdo-"logy, hath taught a very excellent facilitating method, by the help of ſmall rods, "which I take to be the plaineſt, ſhorteſt, and exacteſt method of uſing that help, "much better than that of Monſ. PETIT, of putting them on a cylinder, or any "other way of putting them on moveable wheels; that way taking up much leſs "room, being more eaſily changed and varied, and being capable of the advan-"tage of the preſs, which makes them much leſs chargeable and cumberſome, "for they may be printed on parchment, and cut into ſtrips, which may be "afforded very cheap, will take up very little room, and they may be made "uſe of to what number of places one will.

"Or, if one will avoid ſetting down the intermediate products, his com-"pound rhabdology may be made uſe of, by printing thoſe roads, or places, "on parchment, both for the figures and holes, by the help of which there is "no uſe of addition or ſetting down till laſt of all, or that the whole operation "be compleated.

[b] Regiſter, vol. iv. p. 197.

"As

" As for the arithmetical inſtrument, the model of which was produced here " before this Society, it ſeemed to me ſo complicated with wheels, pinnions, can- " trights, ſprings, ſcrews, ſtops, and truckles, that I could not perceive it ever " to be of any great uſe, eſpecially common uſe: firſt, becauſe the multitude " of the parts muſt vaſtly augment the charge and bulk thereof; ſo that it could " only be fit for great perſons to purchaſe, and for great force to remove and " manage, and for great wits to underſtand and comprehend: ſecondly, becauſe " the multitude of its parts muſt make it exceeding hard to be put into good " order, and extraordinary apt to be put out of it; beſides, I ſaw no means of " examining, whether the operation had been truly performed, without trying " it over again, which is intolerable. The deſign, indeed, is very good, which " is the only thing I was able to underſtand of it, which is to give the product " and quotient of a multiplication or diviſion, which Sir SAMUEL MORLAND's " Inſtrument is not at all adapted to. But I have an inſtrument now making, " which will perform the ſame effects with the German, which will not have a " tenth part of the number of parts, and not take up á twentieth part of the room, " that ſhall perform all the operations with the greateſt eaſe and certainty imagi- " nable; whereby in large numbers, for multiplication or diviſion, one man may " be able to do more than twenty by the common way of working arithmetic, " and, that without at all troubling his memory or ratiocination, and this by two " inſtruments quite differing in their principle and contrivances; the deſcription " of which I deſign to preſent to this honourable Society, after the model pro- " miſed by Monſ. LEIBNITZ to be ſent from Paris to this Society to be here ſeen " and examined."

Dr. GREW produced ſeveral roots of plants, as avens, primroſe, orchis, &c. to ſhew, that part of the trunk of thoſe roots deſcends, ſo, as that, which is root now, will rot off, and the ſuperior part next to it will ſupply its place: whence he concluded, that there was a double motion made in the trunk of the root; the one for receiving the juice for nouriſhment: the other for ſhooting downwards.

This ſeeming to ſome members to be a kind of muſcular motion, it was moved, that the ſtructure of the root ſhould be well examined.

Signor BOCCONE, a Sicilian gentleman, who was well ſkilled in plants and petrifications, being preſent at this meeting, produced a certain leafy ſtone, called by him, *lapis foſſilis, bitumen redolens, in montibus Hyblæis Siciliæ repertus*; as alſo a kind of *lapis bozoar mineralis*, found likewiſe in the ſame iſland, and there uſed in powder againſt fevers with good ſucceſs.

Sir ROBERT MORAY related from captain HERBERT, that about the iſlands of Majorca and Minorca they had found within a rock ſhell-fiſhes, good to eat, of the taſte of muſcles; and that he had taken abundance of them.

Farther, that in thoſe parts he had ſeen lying on the ſurface of the ſea a ſub- ſtance with motion, which being touched by him had retired within the water;

but a little after appeared again above water. Whereupon his curiosity had moved him to approach nearer to it, and to take it up out of the sea; which done, he had found it to be a kind of a living worm putting itself out and in, fastened in a substance like a plant as in a sheath.

Mr. OLDENBURG produced a book of Dr. de GRAAF, dedicated to the Society, intitled, *Regneri de Graaf Partium Genitalium Defensio*, together with a letter to Mr. OLDENBURG, dated at Delft in Holland, 28th April, 1673 [c], communicating some microscopical observations of Monsr. LEEWENHOECK [d]. The book was ordered to be examined by Dr. WALTER NEEDHAM, Dr. CROUNE, and Dr. KING, who were desired to give the Society an account of it.

Mr. OLDENBURG read a letter to himself from Mr. FLAMSTEAD, dated at Derby, 19th April, 1673, accompanied with a paper in Latin, containing some observations of his own about Jupiter's transit near some fixed stars [e], useful for the determining its inclination to the ecliptic. These observations were recommended to the perusal of Mr. HOOKE.

Mr. HOOKE desired, that Sir SAMUEL MORLAND's book, intitled, *the Description and Use of two arithmetic Instruments*, &c. printed at London, 1673, 12mo. might be purchased for the Society's library; which was ordered to be done.

*May* 14. Mr. BOYLE produced a liquor of his own preparing, which, though cold, and made seven or eight months before, yet in a minute gave a yellowish tincture to a silver sixpence at first, which afterwards turned to a blackish colour: which experiment was several times repeated with the like success.

He being asked, what other metals it had this effect upon, said, that upon brass it did very well; not so well upon steel, much less upon tin.

Dr. WALTER NEEDHAM being called upon to make a report concerning Dr. de GRAAF's book dedicated to the Society, and referred at the last meeting to his consideration jointly with Dr. CROUNE and Dr. KING, said, that he had looked it over, but not yet communicated it to the other physicians; and that he had found in general, that in this book there was first a dispute between the author and Dr. SWAMMERDAM about the priority of the discovery of the *ovarium & ova* in viviparous animals, and then a charge against Dr. SWAMMERDAM of several errors in anatomy committed by him: that he, Dr. NEEDHAM, having compared this book with that of Dr. SWAMMERDAM, dedicated likewise to the Society, was of opinion, that, as to the dispute about the said discovery of eggs in viviparous animals, the readers must be referred to the times, when the several claimants of that discovery published their books about it, and thence left to judge of the

[c] Letter book, vol. vi. p. 98.

[d] Print d in the Philos. Transact. vol. viii. n° 94. p. 6037. for May 1673.

[e] Letter-book, vol. vi. p. 84. The letter and observations are printed in the Philos. Transact. vol. viii. n° 94. p. 6033.

priority contended for. But as to the errors, which theſe two authors charged upon each other, he was of opinion, that in ſome things Dr. de GRAAF was in the right, and miſtaken in others, and *vice verſa* Dr. SWAMMERDAM; and that it would require ſome time to examine the particulars, in the doing of which it would be requiſite to make ſome obſervations to pronounce with the more certainty of theſe matters conteſted.

Dr. NEEDHAM received the thanks of the Society, and was deſired to proceed to that particular examination, and to adviſe with the other two phyſicians in it, according to the order of the preceding meeting; which he promiſed to do.

Mr. HOOKE made an experiment with the air, produced 23d April, in a bladder by the operation of aquafortis upon oiſter-ſhells, having firſt tried how long a ſlender white wax candle would burn with common air, which it did, in one glaſs, during the ſpace of ſometimes ſeventeen, ſometimes twenty or twenty-one vibrations of a pendulum of about a ſecond; in another bigger glaſs, during the ſpace of 55 vibrations: whereas the factitious air, being by a certain contrivance ſqueezed out into the larger glaſs, yet ſo that ſome of the common air remained in it, the ſaid wax-candle burnt in it only forty-five ſuch vibrations.

This experiment being not accurate enough, Mr. HOOKE was deſired to make another apparatus for a better trial.

It was moved again, that ſome experiments might be made to produce air fit for reſpiration; upon which occaſion Mr. BOYLE ſuggeſted, that the trial might be made with coral and vinegar.

*May* 21. There were viewed ſeveral curioſities concerning corals and ſtones belonging to Signor BOCCONE; and it was ordered, that he ſhould be thanked in the name of the Society for his reſpect and communications to them.

Three letters were read, one from Signor MALPIGHI to Mr. OLDENBURG, dated at Bologna, 10th May, 1673[f], ſignifying the continuance of his obſervations relating to the anatomy of plants; as alſo of his having ſeen ſtatutes and pictures ſhining in the dark with flaming blue and white colours.

The other two letters were from Monſ. LEIBNITZ to Mr. OLDENBURG, dated at Paris, the former April $\frac{16}{26}$[g], the other May $\frac{14}{24}$[h]; both containing philoſophical communications, and notice of his arithmetical engine being very near perfected.

*May* 28. The experiment of generating air with aquafortis and oiſter-ſhells powdered was made again; which being done, and a wax candle having burnt or the common air of a glaſs veſſel, ſometimes thirty-ſeven, ſometimes forty or forty-five vibrations of a pendulum of about three feet long, the ſame candle

[f] Letter book, vol. vi. p. 114. [g] Ibid. p. 101. [h] Ibid. p. 115.

put in the veſſel filled with the factitious air would not burn in it, but only an inch beneath the mouth of the glaſs, where the outward common air had ſome communication with the produced air; for, being put lower, it went out immediately upon ſeveral trials. It was obſerved, that the candle being gone out near the orifice, it would catch the flame again, when haſtily drawn up cloſe to the top. Beſides, it was taken notice of, that when this factitious air was driven out of the veſſel, the flaming candle held over it was preſently blown out by it.

Mr. JOHN TEMPLER, an ingenious gentleman, come out of the country, and upon his deſire admitted to be preſent at this meeting, produced a very fine bed of amethyſts brought from the Eaſt Indies, wherein ſome ſtones of that kind were very regularly ſhaped, and well tinged; others yet untinged, which were ſuppoſed to have not yet been pervaded by the tinging juice.

Mr. HOSKYNS produced a piece of ſilver ore, lent him by captain BERTUE, who had brought it out of Sweden, where, he ſaid, in the Swediſh Silverberg, as he had been informed, they throw in coal over night into the rocky mine, and having let it burn and calcine all night, ſlake it the next day; whereupon the ſtony part being waſhed out of the ore by the water, the metal appears, as in this piece, in long, thick, ſilvery ſtreaks.

Mr. OLDENBURG read a letter written to him by Mr. LISTER from York, 21ſt May, 1673 [1], containing divers conſiderable particulars about very aged perſons; ſudden appearances of vaſt troops of inſects; a ſtrange quantity of divers ſorts of worms found in the guts of dogs, and in the ulcerated ancle of a girl; the analogy betwixt the veins in plants and the nerves in animals: the actual paſſage of the chyle into the lacteal veſſels; together with the experiments made by him upon that ſubject; the reſult of which was, that, notwithſtanding all the injections made by him with tinged liquors into the guts of live animals, he could never find the leaſt diſcolouring of the chyle on the other ſide of the guts, that is, within the lacteal veins; but always white and uniform.

It was ordered, that Mr. LISTER ſhould be deſired to continue ſuch inſtructive experiments.

*June* 4. The lord HERBERT was elected into the Society.

Mr. HOOKE made an experiment with air produced out of bottled ale, putting it into a glaſs veſſel, in order to ſee, whether, and how long, a candle would burn in it; and it was found, that it would no more burn in this air, than it did in air generated out of aquafortis and pounded oiſter-ſhells.

It was propoſed, that ſomething might be thought upon for correcting this air, ſo as to make a candle burn or animals live in it.

[1] Letter book, vol. vi. p. 124. Part of it is printed in the Philoſoph. Tranſact. vol. viii. n° 95. p. 6060. for June 1673.

Mr.

Mr. Hooke ſaid, that he would conſider of it, and try, whether it might be corrected by precipitation.

Sir Robert Moray produced a paper, which was read, containing an account of ſome experiments made by Dr. Walter Needham, and Mr. Richard Wiseman, ſerjeant chirurgeon, with the liquor ſent out of France, where it was famous for ſtanching of blood in a little time, without any eſchar, ſuppuration, or cicatrice [k]. It proved ſucceſsful, though, in theſe trials, not in ſo ſhort a time, as the Pariſians ſaid they had found it.

Sir Robert Moray mentioned, that Sir Samuel Morland, bart. had given out, that he had invented a kind of a force-pump, which ſhould perform better than other pumps hitherto uſed; that it ſhould have no rubbing, but all impediments removed, and the whole ſtrength applied: and, that the king had referred it to the conſideration of the commiſſioners of the navy, in order to make uſe of this way in ſhips.

He related alſo, that Sir Samuel Morland had propoſed a method of weighing anchors with eaſe and ſafety. Whereupon Mr. Hooke affirmed, that he had ſeveral years ago invented a convenient method of doing the ſame thing; which having diſcourſed of ſomewhat in general, he was deſired to acquaint the Society with the particulars at another meeting.

Dr. Grew ſhewed the company two microſcopical obſervations upon a piece of fir, and another on oak-wood, a deſcription of which he promiſed to communicate in writing.

*June* 11. Dr. Grew ſhewed three microſcopical obſervations; the firſt, upon a piece of a wild olive-wood tranſverſely cut, in which the air-veſſels were ſeen to go round about the inner edge of the bark in a circle: the ſecond, upon a piece of vine, cut likewiſe tranſverſely; wherein the air-veſſels appeared to lie in a ſtrait line between the bark and the pith, and larger and more numerous than in olive-wood: the third, upon a piece of fir-tree, cut length-wiſe, wherein the ſap-veſſels were obſerved to be ſo many tubes made up of divers fibres as cluſters, and thoſe ſtitched together with other fibres running horizontally.

Dr. Grew was deſired to give an account of thoſe obſervations in writing, and to proſecute them.

Mr. Boyle propoſed the obſerving, 1. What difference there is between the ſtructure of fruit-bearing plants, and thoſe that bear no fruit? 2. Whether there be any difference in the air-veſſels of the ſame plant in winter and in ſummer? 3. Whether the veſſels below and above in a plant differ conſiderably in bigneſs; and in what part of the plant they are biggeſt? 4. Whether in the root the veſſels be conſiderably bigger than in the body of the tree? 5. Whether the

[k] This account is printed in the Philoſ. Tranſact. vol. viii. n° 95. p. 6052. for June 1673.

parts of a graft after ingrafting do retain the ſame pores and figures of the air-veſſels and ſap-veſſels, which they had before ingrafting, or upon the original tree: for inſtance, when an apricot is ingrafted upon a palm-tree, wherein, and in all other ingraftings, the ſap, which paſſed through one ſort of ſtrainer, viz. that of the ſtock, paſſes now in the graft through another ſort of ſtrainer? 6. Since ſome grafts agree well with ſome ſtocks, and not with others, what difference there is in the ſeveral pores and veſſels of ſuch diſagreeing plants? 7. The texture of all ſorts of reſinous trees.

Dr. GREW mentioned, that in reſinous trees the air-veſſels are very ſmall and few, and the ſap-veſſels large, as in fir, cypreſs, &c. whereas in other trees, as in oak, the air veſſels are very large, and the ſap veſſels ſtrait.

Mr. OLDENBURG read a Latin letter to the Society from Monſ. LEIBNITZ, dated at Paris, 1ſt June, 1673 [l], giving them thanks for his election into their body.

Dr. WALTER NEEDHAM made an experiment of the French liquor for ſtanching of blood, upon a dog [m]. He cut the crural artery quite croſs with an inciſion-knife: the blood guſhing out copiouſly, a lint dipped in the liquor, of which there was but a very ſmall quantity, was applied to the wound, and held upon it a little while, when, by reaſon of the great glut of blood, that could not be well wiped away for want of a ſpunge, the lint was changed for a freſh one dipped in the remaining liquor, and kept on about half an hour, and being then let looſe, the blood was found ſtanched: whereupon the dog being unbound, licked the wound, and walked away without any ligature, being committed to the care of Mr. HOOKE, to ſee, whether the wound would keep ſtanch.

*June* 13. Dr. BISTER, a phyſician of Hamburgh, was propoſed candidate by Mr. BOYLE.

Mr. BOYLE cauſed an experiment to be made with a liquor, which, though cold to ſenſe, did, by its emitted fumes, in a minute, firſt through double, and then through four-fold paper, tinge a copper half-penny without tinging the paper interpoſed.

Monſ. DENIS, a French phyſician, tried his blood-ſtanching liquor upon a dog [n], whoſe crural artery was opened by making a wide oblique orifice in it; to which his liquor being applied and held to it by a compreſs, the blood was ſtanched in ſeven minutes, and the dog was let go in five and twenty minutes, without any ligature, the compreſs being fallen off.

The Society thought fit to intermit their meetings from this day till the preſident ſhould ſummon them to meet again.

[l] Letter-book, vol. vi. p. 137.

[m] An account of this experiment is printed in the Philoſoph. Tranſact. vol. viii. n° 95. p. 6053.

[n] An account of this experiment is printed in the Philoſoph. Tranſact. n° 95. p. 6053.

ſtanched

*October* 9. At a meeting of the council were preſent,

The Preſident,

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|---|---|
| The lord viſcount STAFFORD, | Mr. COLWALL, |
| Mr. CHARLES HOWARD, | Dr. CROUNE, |
| Sir PAUL NEILE, | Mr. HILL, |
| Sir JOHN LOWTHER, | Mr. OLDENBURG. |
| Mr. PEPYS, | |

The preſident gave the council notice, that there had been lately with him a committee of the profeſſors of Greſham College, and another of the Mercers company, inviting the Royal Society to return to that college, and to keep their aſſemblies there, as formerly they did before the fire. To whom he had returned his thanks for this kind offer, and for their reſpect to the Royal Society; adding, that he would acquaint the council with it at their next meeting.

This being reported, the council thought good to have their hearty thanks returned to the ſaid committee for their kindneſs and reſpect, yet without ſaying any thing to them of acceptance or not acceptance; only, in caſe they ſhould give occaſion for ſaying more, that then it might be mentioned, that the buſineſs was under conſideration.

The perſons appointed to give theſe thanks were the lord viſcount STAFFORD, Sir PAUL NEILE, Sir JOHN LOWTHER, Mr. PEPYS, Mr. COLWALL, Dr. CROUNE, and Mr. OLDENBURG, or any three of them.

Whilſt this was doing, Sir THEODORE de VAUX came in, being ſent by the earl of Norwich, earl marſhal, to acquaint the council, that his lordſhip wondered, that they were not met in Arundel-houſe, as formerly, but yet hoped, that they would hereafter ſtill continue their meetings there, as formerly; and that if they ſhould remove to any other place, he could not but take it very unkindly.

Hereupon the preſident declared, that for this time he had cauſed the council to be ſummoned in this place for his particular convenience, his preſent occaſions not having permitted him to go far off. And his lordſhip, at the deſire of the council, returned their hearty thanks to the earl marſhal for his ſingular affection and reſpect to the Society.

This being done, the preſident intimated, that it was time to call upon Dr. TILLOTSON, dean of Canterbury, as executor of Dr. WILKINS, biſhop of Cheſter, for his legacy of four hundred pounds ſterling, bequeathed to the Royal Society: Whereupon it was thought good by the council, that Mr. COLWALL and Mr. HILL ſhould be deſired to ſpeak with the ſaid dean about this matter at their firſt conveniency.

Chelſea college being ſpoken of, and ſomething mentioned of pulling down the houſe, and ſelling the materials, it was thought fit by the council, that Mr. HOSKYNS

Hoskyns or ſome other lawyer ſhould be conſulted with, whether, notwithſtanding the clauſe in the charter of non-alienation, the ſaid houſe might be pulled down, and the materials ſold.

Mr. Oldenburg produced the report of the three phyſicians, Dr. Croune, Dr. Needham, and Dr. King, concerning the anatomical controverſies between Dr. Swammerdam and Dr. de Graaf, referred to the judgment of the Society; and he deſired to know, whether the ſaid report ſhould be tranſmitted immediately to the perſons concerned, or deferred till the Society ſhould meet again.

It was thought proper to ſend it away by the firſt poſt, conſidering that it had been long deferred already.

N° 97 of the Philoſophical Tranſactions was licenced by the council.

*October* 22. At a meeting of the council were preſent

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|---|---|
| The preſident, | Mr. Pepys, |
| The Earl Marſhal, | Mr. Colwall, |
| The lord viſcount Stafford, | Mr. Hill, |
| The lord biſhop of Saliſbury, | Mr. Hoskyns, |
| Mr. Charles Howard, | Dr. Croune, |
| Sir John Lowther, | Mr. Oldenburg. |

The council conſidering the neceſſity of ſecuring the weekly payments for carrying on the work of the Society, and having conſulted the treaſurer's book concerning the perſons, that may be looked upon as good paymaſters, they were found to be theſe:

| | |
|---|---|
| 1 The lord viſcount Brouncker, preſident, | 15 Mr. Ashmole, |
| 2 The Earl Marſhal, | 16 Sir John Banks, |
| 3 The earl of Angleſey, | 17 Mr. Barrington, |
| 4 The earl of Devonſhire, | 18 Mr. Brooke, |
| 5 The earl of Ayleſbury, | 19 Dr. Brown, |
| 6 The lord viſcount Stafford, | 20 Dr. Cotton, |
| 7 The lord biſhop of Saliſbury, | 21 Mr. Colwall, |
| 8 The lord biſhop of Cheſter *, | 22 Dr. Chamberlayne. |
| 9 The lord Berkley, | 23 Mr. Creed, |
| 10 The lord Brereton, | 24 Mr. Evelyn, |
| 11 The lord Howard of Caſtle-riſing, | 25 Dr. Gliſſon, |
| 12 Mr. Boyle, | 26 Dr. Goddard, |
| 13 Mr. Aerskine, | 27 Mr. Haak, |
| 14 Dr. Arderne, | 28 Mr. Hooke, |
| | 29 Mr. Hill, |
| | 30 Dr. Holder, |

* John Pearson, D. D.

31 Mr.

31 Mr. Hoskyns,
32 Mr. Charles Howard,
33 Mr. Edward Howard,
34 Mr. Thomas Howard,
35 Mr. Henshaw,
36 Mr. Le Hunt,
37 Dr. King,
38 Mr. Locke,
39 Sir John Lowther,
40 Mr. Lister,
41 Sir Paul Neile,
42 Dr. Walter Needham,
43 Mr. Oldenburg,
44 Mr. Parker,
45 Mr. Pepys,
46 Sir William Petty,
47 Mr. Smith,
48 Sir Robert Southwell,
49 Dr. Tillotson,
50 Sir Theodore de Vaux,
51 Dr. Wallis,
52 Dr. Ward,
53 Sir John Williams,
54 Sir Joseph Williamson,
55 Dr. Christopher Wren,
56 Sir Cyril Wyche,
57 Mr. Wylde.

This number being ſelected, there were ſome others found, whom the council thought fit to have aſked, whether they were willing to comply with the new regulation of the Society, by paying their arrears, and by aſſuring their payments for the future: and they were theſe;

Sir George Ent,
Dr. Thomas Cox,
Dr. Whistler,
Dr. Thruston,
Mr. Newburgh,
} To be aſked by Dr. Croune.

Earl of Dorſet,
Earl of Yarmouth,
} To be aſked by the Earl Marſhal.

Mr. Ricaut,
Mr. Povey,
Sir James Long,
Dr. James du Moulin,
} To be aſked by the lord viſcount Stafford.

Mr. Thomas Neile, To be aſked by Mr. Hoskins.

Dr. Willis,
Mr. Slingsby,
Sir Nicholas Steward,
Sir James Shaen,
Lord viſcount Ranelagh,
Lord Clifford,
} To be aſked by Mr. Oldenburg.

The Earl Marſhal propoſed, that the abſent in remote places might be conſidered.

The preſident ſuggeſted, that it was neceſſary to ſecure firſt of all the anniverſary elections, at which there muſt be preſent thirty-one fellows; and therefore ſuch a number of fellows to be fixed, as might be likely to afford ſuch a number of electors.

*October*

*October* 30. At a meeting of the council were preſent:

The lord biſhop of Saliſbury in the chair,

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|---|---|
| The Earl Marſhal, | Mr. HILL, |
| Mr. CHARLES HOWARD, | Mr. HOSKYNS, |
| Mr. COLWALL, | Mr. OLDENBURG. |
| Dr. GODDARD, | |

The Earl Marſhal reported, that the earl of Yarmouth had declared to him, that he would clear his arrears to the Society: and for Mr. POVEY, he had deſired, that his account with the Society, for whoſe ſervice in the buſineſs of the Savoy he had expended twenty pounds, might be ſtated; and that being done, he was willing to pay what ſhould be due from him above that ſum.

Hereupon Mr. OLDENBURG was ordered to ſearch in the Council-book what was formerly ordered by the council in this matter.

Concerning Mr. RICAUT, the Earl Marſhal offered to write to him to Smyrna about his arrears; and doubted not but they would be ſatisfied.

Upon this occaſion of Mr. RICAUT's abſence in remote parts, the Earl Marſhal propoſed, that ſuch members of the Royal Society, as were abroad, or ſhould go abroad, and continue abſent from England above three months, ſhould not be obliged to pay their weekly contribution after thoſe three months were expired; but every ſuch fellow ſhould be left at his own liberty to pay or not after that time, till he ſhould be returned to England.

This propoſition was unanimouſly agreed to by the council.

It was alſo ordered, that the fellows, who were in arrears, ſhould be allowed, if they made no preſent payment of them, to give a bond to the Society, to pay within, or at the end of, ſix months; and that Mr. HOSKYNS draw up a form for ſuch a bond.

Memorandum. That when the number of the fellows, who were, or were to be, ſhall be agreed upon, the form of a legal tie be preſented to every one of them to ſecure the weekly contributions.

It was mentioned, that as long as it was not known, how many would remain of thoſe, who were now of the Society, the number of the ordinary fellows could not be fixed.

The Society this day reſumed their weekly meetings.

Sir JUSTINIAN ISHAM, Bart. was propoſed candidate by Dr. WALTER NEEDHAM.

Mr. HOOKE being called upon for experiments, and particularly concerning the weather-

weather-clock, ſaid, that he would prepare ſome experiments for the next week, and take care of having the weather-clock made; as alſo of finiſhing his diſcourſe upon it.

Dr. WALTER NEEDHAM preſented for the repoſitory a jaw-bone of a lamb, ſent him by Mr. TEMPLER out of Northamptonſhire, which had all its teeth diſcoloured with a brazen colour.

Mr. CHARLES HOWARD produced ſuch another, which, he ſaid, was brought out of Sicily, where it had been affirmed to him, that generally the ſheep, which feed upon a certain mountain there, had teeth thus coloured.

Some of the members were of opinion, that this colour might proceed from herbs growing in ſuch ground, as had underneath it copperas mines; others thought that it might be artificial.

Mr. OLDENBURG preſented from Dr. HOBOKEN, a Dutch phyſician, his book, *De Anatomia ſecundinæ humanæ repetita & auctа*, printed at Utrecht in 1672; together with a letter from the author to Mr. OLDENBURG, dated 8th Auguſt, 1672, this letter and the book having been detained long in their way to England on account of the war.

Mr. OLDENBURG read likewiſe ſeveral other letters and papers, which came to his hands during the Society's receſs, as

1. A paper in Latin, ſent by Mr. HENSHAW from Copenhagen, in a letter, dated Auguſt 7, 1673 [p], which paper contains the anſwers of one LUCUS JACOBI DEBES chief miniſter in the iſles of Fero, to divers queries formerly propoſed to him [q].

The paper was as follows:

" Ad primas duodecim quæſtiones, nihil in promptu eſt, ex Fœrois, quod re-
" ſpondeatur: quoniam iis in terris aut nunquam aut raro intenſum aliquod eſt
" frigus.

" R. 13. Fulgura & tonitrua accidunt ibi ſemper hyberno, nunquam æſti-
" vo tempore: circa halones & irides nihil ſingulare adhuc obſervavi. Ignes fa-
" tui nunquam ibi apparent.

" 14. Frequentiores venti ſunt Africus & Zephyrus, inprimis vere & autum-
" no. Afferunt plerumque tempeſtatem pluvioſam: hæc autem ventorum effecta
" ſunt obſervata, quod ſæpius ei plagæ, a qua flat ventus, aërem afferant nu-
" biloſum; adverſæ autem ſerenum; id quod fieri exiſtimem propter excelſos in-
" ſularum montes, aeris liberum motum impedientes.

[p] Letter-book, vol. vi. p. 228. [q] Ibid. p. 229.

" 16. Refractionem, nec non diametrum ſolis & lunæ, ortus vel occaſus " tempore, curioſo non licuit obſervare, propter obſtantia montium juga. Pleia- " des omnes, quamvis obſcuræ, conſpiciuntur tamen cœlo ſereno. Luna ple- " rumque apparet tertio, interdum quarto, die a novilunio.

" 17. Eclipſes vix ibi poſſunt obſervari, propter aerem turbulentum, ea in " plaga frequentiſſimum.

" 18. De ſalis copia vix poſſum certo quid ſtatuere; ego ſemel, neceſſitate " adductus, ex viginti quatuor * * aquarum marinarum dimidiam ſalis co- " quendo mihi comparavi: mare tamen valde ſalſum eſſe indicio ſunt multi ma- " nipuli ſalium, qui colliguntur in ſcopulis & rupibus, ubi æſtas incidit calida " & ſerena. Lucet quidem & micat mare noctu, ſed non, niſi turbatur remis inter " remigandum. Si de currentibus cæteriſque maris affectibus eo ſpectantibus " referrem, volumen conſcriberem: quia vero de omnibus & ſingulis in libro meo, " jam in lumen prodeunte, (qui Fœroæ, vel Fœroa reſerata inſcribitur) fuſius " egi, ad eum curioſos remitto.

" 19. Ex mineralibus ſaltem invenitur talcum, perexiguæ tamen quantita- " tis; ex cæteris nihil.

" 20. Magnetis variatio eſt 13 gr. 19 min. occidentem verſus, uti obſervatum " eſt anno 1659, die 25 Decembris.

" 21. Ferrum opinione citius contrahit ferruginem, a qua ita arroditur, ut " tenue ferrum intra paucos annos non ſit uſibus humanis.

" 22. Nullæ feræ in Foerois habentur, ſed domeſtica tantum animalia: quæ- " nam circa ea, nec non aves & piſces, ſunt notanda, copioſe in mea Færoa " reſerata explicavi.

" 23. Inter vegetabilia, hæc occurrunt notabilia; radix Rhodia, quæ alibi " ſtudio in hortis colitur, ibi ubertim ſponte naturæ provenit, creſcens ſuper am- " nibus & mari, in præruptis montibus & promontoriis, qua ancillæ utuntur ad " capillos flavo colore tingendos: nec minor vis angelicarum naſcitur in monti- " bus, cœmiteriis, & hortis, quas incolæ non tantum in deliciis habent, ſed cau- " libus earum radicibuſque coctis famem propulſant, incidente annonæ caritate. " Tormentillarum incredibilis habetur copia, quarum radicibus, loco corticum, " utuntur ad coria præparanda. Varia antiſcorbutica ibi etiam inveniuntur; de " cæteris nihil relatu dignum. De viribus herbarum inhabitatores parum ſunt " ſolliciti; olera varia ibi creſcunt, quorum ſemina ex Dania afferuntur, quippe " raro ad tantam maturitatem perveniunt, ut ſemina ferant, præter braſſicam; " cujus ſemen tandem degenerat in rapas. Ex frumentis tantum ſeri poteſt hor- " deum; arbores nullæ creſcunt præter juniperum ſuper terram ſerpentem.

" 24. Equi & oves brumali tempore ſemper ſub dio vitam tolerant, quo- " niam tam hyeme quam æſtate aer eſt temperatus.

" 25. Vac-

" 25. Vaccæ & equi ſunt concolores cum aliis ejus generis in aliis regionibus: " ovium aliæ ſunt albæ, aliæ nigræ, aliæ rubræ, ſed pro loci diverſitate; in bo- " realibus inſulis pleræque albæ, in auſtralibus autem nigræ: ubi vero oves albæ " e borealibus inſulis transferuntur in auſtrales, pedetentim nigreſcunt; quo co- " lore inficiuntur primum circa pedes, dein circum femora, poſt ſub ventre, de- " nique ſuper dorſo: utrum hæc nigredo proveniat ex terræ nitro an ſulphure, " curioſitatis magiſtrorum cenſuræ atque judicio ſubmittitur.

" 26. Peſtis & febris Foerois exulant; interim afflictantur nonnulli lepra, " multi ſcorbuto, omnes catharro quotannis, vere ineunte. Ad ſcorbutum pel- " lendum, utuntur aut lacte ſolo recenti, aut cum cochleariis cocto. Ex catarrho " ita laborant, ut nonnulli ſint morti vicini, morteque pauci interdum defun- " gantur; adverſum quem morbum ſerum lactis vetuſtum, fere fervidum, bi- " bunt, idque feliciſſime. Alias conflictantur cum morbo quodam peculiari, quem " vocant Landfarſoot, febri militum caſtrenſi non abſimili; cui nullum adhibent " remedium, ſed eventum Deo committunt, quo etiam medico plerique conva- " leſcunt.

" 27. Plumulæ anatinæ, quas *Eiderdun* vocant, colliguntur ex certa quadam " ave marina, *Eider* nominata, quæ plumas illas ex proprio ſuo pectore, inter ex- " cludendos pullos, pro ovis fovendis evulſas in nido reliquit; unde excerptæ " colliguntur; quæ autem plumæ alio tempore vi evelluntur, propter pinguedinem " nulli ſunt uſui.

" 28. Monocerotes marini juxta littora Fœroarum nunquam viſi ſunt; va- " ria alioquin genera Cetorum mare Foeroanum frequentant, quos inter certi ge- " neris Cetus incolis eſt maxime moleſtus, quem nuncupant Troldhual, ad quem " repellendum, aut caſtoreum, in carina cymbæ incluſum, ſervant, aut lignum " juniperinum in mare projiciunt, quorum, vel iſtius fœtorem vel hujus odo- " rem olfaciens ad imum ſubſidet."

2. A letter from Mr. HEVELIUS to Mr. OLDENBURG, dated Auguſt 23, 1673[r], together with the title page of his book, called, *Machinæ cæleſtis pars prior, Organographiam Aſtronomicam exhibens, &c.* The letter intimated, that the ſecond part of this work, containing all the author's celeſtial obſervations, was alſo in the preſs.

3. A letter of Mr. LISTER to Mr. OLDENBURG from York, dated 2d September, 1673[s], ſignifying his own invention of a blood-ſtaunching liquor, at leaſt as good and efficacious as that of Monſ. DENYS, the French phyſician.

It was ordered, that Mr. LISTER ſhould be deſired to ſend to the Society, either a ſpecimen of his water for ſtanching of blood, or the preparation of it.

Sir THEODORE de VAUX read a paper, containing a narrative of the caſe of a

[r] Letter-book, vol. vi. p. 225. [s] Ibid. p. 263.

young woman, who had, according to the account of many credible witneſſes, and his own examination, lived without food for ſeveral years. He was deſired to give this account to be regiſtered, which he promiſed to do.

*November* 6. At a meeting of the COUNCIL were preſent

The lord biſhop of Saliſbury in the chair,

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|---|---|
| The earl marſhal, | Mr. COLWALL, |
| The earl of DORSET, | Mr. HILL, |
| The lord viſc. STAFFORD, | Mr. OLDENBURG. |
| Sir JOHN LOWTHER, | |

Mr. OLDENBURG reported to the council, what he had found upon the council-book, concerning Mr. POVEY's buſineſs ſpoken of at the laſt meeting, viz. that 18th May, 1664, there was an order made, that the treaſurer of the Society ſhould reimburſe to Mr. POVEY the expences, which he then alledged to have been at for the Society's ſervice.

Whereupon it was ordered, that Mr. COLWALL ſhould be deſired to ſtate Mr. POVEYS's arrears due to the Society, and ſubduct from them the ſum demanded by him, and receive from him the remainder of his arrears.

It was ordered alſo, that the treaſurer of the Society, Mr. COLWALL, do ſend to ſuch fellows of the Society, as were in arrears, to acquaint them with the new regulation, which the council is now making, for a firm eſtabliſhment of the ſaid Society: and that therefore the arrears due to the Society are to be forthwith collected; and alſo a legal obligation to be ſubſcribed by as many as ſhould deſire to continue fellows, for the better ſecuring the weekly contributions for the future. And that therefore every fellow being in arrears ſhall be deſired by the treaſurer either to ſend in, between this and St. Andrew's day next (being November 30, 1675) all his arrears, or at leaſt to give a ſufficient bond to pay the ſame within, or at the end of ſix months from the date of this order, and to declare withal, whether he will continue a member of the Society, and comply with the aforeſaid ſubſcription.

After this the earl marſhal was acquainted by the council with their thoughts of removing their weekly aſſemblies to Greſham College, and of beginning to meet there again upon the next anniverſary election-day; the council being moved thereunto, by conſidering the conveniency of making their experiments in the place where Mr. HOOKE, their curator, dwells, and that the apparatus is at hand; as alſo by the ſolemn invitation of the city of London, and the profeſſors of Greſham College; and likewiſe from the hopes, which they find grounds to entertain, of meeting with ſome conſiderable benefactors at that end of the city. To which was added, that though this Society ſhould thus remove their meetings, yet they were full of hopes, that his lordſhip would be ſo far from removing his favours and kindneſſes from them, that he would preſerve them in the ſame degree he had done all along, and eſpecially during the many years he had entertained them

them under his roof. To all which the council added this humble requeſt, that the earl marſhal would be pleaſed to give the council leave ſtill to meet upon occaſion in his lordſhip's houſe, there to enjoy the honour and advantage of his council and directions, which they had always found ſo affectionate and conſiderable to them.

Whereupon the earl marſhal very obligingly and generouſly declared, that though he always had eſteemed, and ſtill did eſteem it, a great honour to his houſe, that the Royal Society kept their aſſemblies there; yet underſtanding, that the council apprehended it really to be for the ſervice and good of the Society to return to Greſham College, he could not but give up his reaſon to the reaſon of the council; adding further, that he ſhould continue the ſame reſpect and concern for the Society, where-ever they met, and be glad to receive the council in his houſe upon any occaſion of their meeting.

Which declaration of his lordſhip was ſo deeply reſented by the council, that they unanimouſly deſired the lord biſhop of Saliſbury, in their name, to give the earl marſhal their very humble and hearty thanks for his extraordinary favour and bounty towards the Society, in receiving them ſo frankly and generouſly into his houſe, when upon the ſad calamity of the fire of London they were deſtitute of a place of meeting; as alſo in entertaining them afterwards, for ſo many years together, with all the nobleneſs imaginable; ſuperadding to all that his great munificence in giving them the Arundelian library, and heaping many other real expreſſions of generoſity upon them. To which the council added this farther order, that the lord biſhop of Saliſbury ſhould be deſired to acquaint the Society itſelf, now ready to meet, with this whole matter, that they, concurring with the council in this affair, might preſent themſelves in a body to the earl marſhal, and make the like acknowledgments with the council; which was done accordingly, as appears by the entry in the Society's Journal-book upon this very day.

At a meeting of the Society on the ſame day,

John Stafford Howard, Eſq; was propoſed candidate by his father the lord viſcount Stafford, and immediately elected.

Sir Justinian Isham, knight and baronet, was alſo elected.

Mr. Boyle prepared his book, intitled, *Several Tracts: of the ſtrange Subtilty, great Efficacy, and determinate Nature of Effluviums: of new Experiments to make the parts of Fire and Flame ſtable and ponderable: together with ſome additional Experiments about arreſting and weighing of igneous Corpuſcles; as alſo, a Diſcovery of the Perviouſneſs of Glaſs to ponderable parts of Flame: with ſome Reflections on it by way of Corollary:* printed at London in 1673, in 4to.

Mr. Hooke ſhewed an experiment of water ſpreading itſelf, by a peculiar contrivance of a pipe, into a canopy (not a parabola, as is the ordinary way) and revert-

reverting into the perpendicular, whence it came. Which figure he aſcribed to the water's tenacity.

Sir WILLIAM PETTY was of opinion, that the firſt impetus of the ſallying water being too ſtrong for the preſſure of the ambient, ſpread itſelf abroad in that figure of a canopy; but that afterwards, the firſt impetus being abated, the ambient was able, by its preſſure, to make the water return to its firſt perpendicular.

The lord viſcount STAFFORD upon occaſion mentioned, that he had kept mercury for ſix or ſeven years, in a bolt-head, upon the fire, in a ſand furnace, with a paper only on the top of it, and that it ſtill remained unaltered. He promiſed to give the Society a more particular account of this at their next meeting.

Dr. WALTER NEEDHAM mentioned ſomewhat like this done by himſelf; which he was deſired to give a fuller account of.

Sir WILLIAM PETTY ſuggeſted on this occaſion, that it would be worth while to make all ſorts of experiments with mercury. To which he added, that as mercurial experiments ſhould be one head for the Society's entertainment, ſo experiments of the magnet, of optics, and eſpecially of motion, ſhould make ſome of the other heads, that the Society ſhould take in hand and purſue conſtantly.

Mr. OLDENBURG began to read Dr. SWAMMERDAM's anſwer to the letter written to him by three of the phyſicians of the Society, Dr. CROUNE, Dr. WALTER NEEDHAM, and Dr. KING, containing their report to the Society, about ſome anatomical controverſy between Dr. SWAMMERDAM and Dr. de GRAAF [1]: but there not being time enough to make an end of it at this meeting, the reading of it was referred to the next. The letter was as follows:

" Illuſtriſſimæ Societati Regiæ
" S. P. D.
" GULIELMUS CROUNE,
" GUALTERUS NEEDHAM,
" EDMUNDUS KING.

" Quandoquidem ab illuſtriſſima Societate Regia nobis tradita eſt illa de vi-
" rorum clariſſimorum Drs. SWAMMERDAM & Drs. de GRAAF ſcriptis cognoſcendi
" provincia; ea, qua decuit obedientia, munus, alias & invidiæ & difficultatis ple-
" num, in nos ſuſcepimus.

" Primo itaque in loco, utrique ab illuſtr. Societate gratias deferri exiſtima-
" mus, quod (quum & ipſi per totam dudum Europam meritis ſuis inclaruerint,

[1] It is inſerted in the Letter-book, vol. vi. p. 241.

" &

" & etiam in Belgis ſibi notos & familiares habeant viros, uti in omni genere doc-
" trinæ, ita præſertim in anatome verſatiſſimos,) nos in hac controverſia ap-
" pellare maluerint, quam judices conterraneos, vel alios ubique celebres viros,
" quorum fama & in re-publica anatomica dignitas jus in hac lite dicendi autorita-
" tem ſibi vindicare videbatur.

" Id eo magis tantorum virorum candori tribuendum eſt, quod gliſcente licet
" inter nos & Belgas bello atrociſſimo, tamen eam philoſophiæ felicitatem per-
" mittunt, ut inter literatos bonarumque artium cultores amicitia vetus, tam ſo-
" lido fundamento innixa, neutiquam labefactetur. Controverſia vero hiſce li-
" bris agitata videtur ad duo potiſſima capita reduci poſſe. Quorum *illud* de
" inventorum authore agit; *hoc* de deſcriptionum & ſententiarum prolatarum
" veritate. De inventionis laude certantibus neſcimus quid ſatis appoſite a nobis
" reſponderi poſſit, quibus & res ipſa ſcitu ardua, & argumentum nimio nimis
" ingratum videbatur. Quem enim alium inventionis ordinem nos exhibere poſ-
" ſumus, quam quem dudum typothetæ exhibuerant? ut nempe poſt STENONEM
" GRAAFIUS, inde vero HORNIUS, tandem KERKRINGIUS, rurſum GRAAFIUS
" gemino tractatu, demum SWAMMERDAMIUS, & poſtremo RUISCH, vel de or-
" ganis generationi inſervientibus, vel de ovis viviparorum, ſcripta ſua evulga-
" rint.

" Quæ in libris illis tractentur argumenta, lectoribus obviam eſt: quibus vero
" artibus alter alterum prævenerit, illud nobis minime innoteſcit; qui in viris
" prædictis omnibus arcana philoſophica indagandi peritam admodum ſedulita-
" tem laudamus. Fieri interim poteſt, ut ſine omni plagii crimine, qui forte
" poſterior in inventum aliquod præclarum inciderit (de quo tamen hic nihil pro-
" nuntiamus) primus illud orbi literario exponat, & vel eo nomine diligentiæ ſuæ
" præmium ferat. Tales ſane ſegnitiei ſuæ pœnas luent anatomici apud noſ-
" trates non pauci, qui multa tum in hoc ipſo, tum in variis argumentis ana-
" tomicis apud ſe diu prefferunt, donec in aliis ſimilis inveniendi felicitas editione
" magis prompta & expedita nobilitata eſt.

" Quod vero ſententias ipſas utrinque prolatas attinet, illic, virorum clar. venia
" præfata, judicium noſtrum interponere audebimus.

" 1. [u] Itaque arteriam ſpermaticam virilem recte deſcripſiſſe Dom. GRAAFI-
" UM autoptæ aſſerimus, nec quæ ſit illa a naturali fabrica receſſio, cujus ipſum
" accuſat Dr. SWAMMERDAM, hactenus intelligimus. Deſcriptionem HORNIANAM
" a tauro ad hominem infeliciter transferri, ex utriuſque ſcriptis & ex reipſa
" conſtat: interim non negamus, naturam in exiguis arteriolis ita ludere, ut etiam
" ab his differre poſſint vaſa Dom. SWAMMERDAM obſervata. Quid enim fre-
" quentius in anatomia occurrit, quam varietas illa, qua in minoribus abundare
" ſolet?

" 2. [x] De tubulorum in teſticulo, qui in epididymidem deſinunt, deductione

[u] Mirac. Nat. p 5. Part. genit. defenſ. pag. 22. [x] Mirac. Nat. p. 8. Part. genit. defenſ. p. 25.

" affirmanti GRAAFIO aſſentiri cogit modeſtia, idque eo magis, quoniam & a Dom. " VANDER WYEL id factum allegat, tum quia e nobis unus idem frequenter præ- " ſtiterit, qui tamen affirmat, vaſa illa non ſemper eodem tenore & numero teſ- " ticulo exire, ut epididymidi jungantur; neque in ejuſdem generis ſubjectis duo " per omnia invicem conſentientia a ſe inveniri; neque revera multum refert, an " duobus vel pluribus ductibus teſticulo exeant hæc vaſa, quæ in unum epidi- " dymidem certo certius coiunt.

" 3. [y] De medio, per quod ſemen a ſanguine in teſticulo ſeparatur, difficile eſt " quicquam ſtatuere. Non fieri illud per aliquam vaſorum anaſtomaſin, ſuadere " videtur rei ratio & vaſorum in teſticulo ſtructura. Nempe arteria illuc immiſſa " eadem opera & tubulis ſeminalibus ſuccum ſuum & venis ſanguinem miniſtrat: " idque ita fieri credibile eſt, ut omnis arteriola capillaris, ut ut minutiſſima, " utrumque officium præſtet. Raro hujuſmodi ſecretionem perficit natura ſine " alterius corporis interventu. An vero glandulæ, ut ut exiguæ, interſint, an " ſolis membranulis, quæ hic frequentes ſunt, res perficiatur, aliis judicandum " relinquimus. Nemo noſtrum glandulas ibidem conſpexit. Determinationem " hujus quæſtionis doctorum virorum ulteriori diligentiæ commendamus.

" 4. [z] De veſicularum ſeminalium cum deferentibus communicatione, & de " ſuccorum ſeminalium numero, difficilior eſt controverſia. Etenim in homine, " antequam vas deferens urethræ inſeritur, dilatatio quædam eſt, ſive cloaca com- " munis utrique parti, viz. ſive epididymidi, ſive veſiculæ exonerandæ idonea. " Si hujuſce fabricam probe contemplemur, videbimus, nihil in tota illius loci " ſtructura impedire, quo minus vel hac vel illac profluat liquor, ſive a defe- " rente in cavitates veſiculæ, ſive etiam vice verſa, quo minus junctis viribus ſuc- " cos utrumque organon per eandem ſentinam ſimul & ſemel dejiciat. Hujus rei " determinatio ex aliorum animalium analogia petenda videtur.

" Veſicularum harum cum vaſis deferentibus ſchematiſmum, quatenus in ho- " mine ſe habent, ſatis fideliter expreſſit Dr. de GRAAF; a quo ſi in pauculis diſ- " ſentiat Dr. SWAMMERDAM, minoris illud nobis momenti videtur, & ad con- " ſuetos naturæ luſus referendum. Si quid ab accurata deſcriptione deſit illud prope " exitum vaſorum in urethram obſervamus, quo in loco vaſa deferentia utrinque " in * * * vel veſiculam exiguam dilatantur, quæ carunculæ in urethra appo- " ſitæ ſubjacet, adeo ut caruncula illa hujuſce portio videatur.

" Hoc interim certum eſt tum de homine tum de equo (quod genus anima- " lium homini quoad vaſa generationis proximum eſt in utroque ſexu,) quod ſtylus " vaſi deferenti immiſſus in urethram uſque protendi facile poteſt. Si vero aut " flatu aut liquore rem tentaveris, prius implebitur veſiculæ ſeminalis cavitas, " quam quicquam in fiſtulam urinarium exiverit. Latius nempe eſt & patentius " illud diverticulum, nec ulla valvula donatum, cujus beneficio motus liquoris, " quoquo verſum impulſi, ſiſteretur: cum interim vaſis differentis extremitas ca-

[y] Mirac. Nat. p. 9. Part. genit. defenſ. 25. [z] Mirac. Nat. p. 10. Part. genit. def. p. 26, 27.

" runcula

" runcula obturetur, quæ tum in viventibus extra coitum, tum in mortuis quo-
" que occluſa jacet, nec prius aperturam patitur quam impletis vicinis cellulis
" tota impellentis vis in illum ſolum dirigatur. Hinc fieri poſſe credibile eſt, quod
" in homine & equo ſi quid ſeminis extra coitum teſticulo effluat, in cellulam hanc
" concedere poteſt; donec illa quoque impleta tandem eruptio conſequitur, quæ,
" niſi œſtro venereo fiat, plerunque noctu in lecto calentibus contingit, & pollutio
" nocturna appellatur. In coitus vero tempore per quandam συμπραξίαν partium una
" eademque opera utramque partem ſimul exonerari credimus, quam ſententiam
" & GRAAFIUM privatis ad Dom. OLDENBURGIUM literis agnoviſſe intelligimus.
" Interim vero an veſiculæ illæ humanæ ſint mera ſeminis ita delati conceptacula,
" an non & aliquid de ſuo addant, etiamnum quæri poteſt? Certe conſimilis ei,
" quoad communionem cum deferentibus, veſicula equina in poſteriore ſua parte
" egregie glanduloſa eſt; nec videtur veſiculæ humanæ folliculus a glanduloſa na-
" tura abhorrere. Imo hanc partem vaſis varii generis copioſe inſtructam micro-
" ſcopium abunde detegit. Unde conjectare licet, iiſdem ſeparari humorem quen-
" dam uſui generationis inſervientem; idque eo magis, ſi alia animalium genera
" expendamus. Qui enim aprum, arietem, caprum, taurum, ſub cultro habu-
" erit, videbit quam evidentiſſime, vas deferens nullam omnino cum veſiculis
" ſeminalibus rem habere. Inſtantiam ponimus in apro, ubi veſiculæ ſeminales
" maximæ ſunt, & aliquot ſeminis libras in ſe continent. Quum harum ſuccus
" cum ſemine teſticulorum confertur, videbimus multis gradibus ab invicem diſ-
" tare; ut ille teſticulorum liquor ex albo flaveſcens florem lactis tum colore tum
" ſubſtantia commode repræſentat. Si vero guſtaveris ſaporem, exhibet inſigniter
" dulcem cum aſtrictione, qualem in ſaccharo Saturni agnoſcimus. Interim vas
" deferens, licet per veſicularum ſeminalium meditullium tranſeat, tamen ne mi-
" nimo quidem porulo in eaſdem hiat, ſed canalem ſuum in urethram recte aperit.
" Veſicularum interim ſuccus pellucidus eſt & coloris aluminoſi ex cryſtallino ſub-
" albicans. Sapit fere cremorem tartari, pauco alumine adulteratum. Exit in
" urethram per foramina veſiculis propria: neque ſtylo, injectione, aut flatu quo-
" libet, harum cum deferentibus communio detegi poteſt. Quod ipſum de reli-
" quis animalibus modo recenſitis veriſſimum.

" Ex dictis conjectura deduci videtur, quod numerus ſuccorum ſeminalium
" ſequitur organorum ipſorum numerum. In piſcibus nempe oviparis, & avibus,
" ſimplex eſt & unicus; in cane duplex, utpote cui deſint veſiculæ ſeminales;
" pene dixeramus in tauro duplicem eſſe, utpote cui tantum non deſunt proſtatæ,
" exiguæ enim ſunt & intra muſculos, penis directores, adeo abſconditæ, ut
" anatomicum mediocriter peritum fallere poſſent. In arietibus, capris, et apris,
" manifeſto triplex eſt. Idem de equo dicendum eſt, niſi inſignes glandulas (e qui-
" bus conſtat poſterior portio veſicularum ſeminalium) nihil excernere dicamus.
" Quidni & hominis eadem ſit ratio? Nos tamen nihil hic audacter aſſerimus, ve-
" rum ulteriori diſquiſitioni remittimus. Interim notandum eſt, duplicem ſaltem
" ſuccum etiam in homine concedere Cl. GRAAFIUM, viz. teſticulorum & proſta-
" tarum, quem tamen poſteriorem ſeminis appellatione non dignatur, ſed vehiculum
" ſeminis vocat, quod gratis dici videtur: ſaltem controverſiam ad logomachiam
" deducit. Interim optamus, ut periculum faciat vir doctiſſimus de excindendis ve-

" ſiculis ſeminalibus [a]; tum demum experiatur, an animalia hoc novo caſtrationis
" genere multilata generationi æque fere idonea futura ſint ac antea fuerunt. Nos
" majora de naturæ in conſtruendis organis ſolertia credimus [b]. Digniſſ. SWAMMER-
" DAM quadruplicem ponit materiam ſeminalem; quartum nempe ſuccum e vaſe
" deferente prope urethram glanduloſo petit. Iſte vero ſuccus videtur ipſis ductus
" hujus parietibus in illa confluentia liquorum (viz. teſticuli & veſiculæ) ungendis
" inſervire, ut liquoribus liberior tranſitus permittatur. Si tamen obtineat iſte
" cenſus, poſſumus nos in apro quintum aſſignare, non ex epididymide petitum,
" (ut per jocum vult GRAAFIUS) verum ex glandulis peculiaribus majuſculus,
" mediis veſiculis ſeminalibus [c] innaſcentibus, urethræ vero ſeorſim implantatis.

" 6 [d]. Penis impletionem a ſanguine infarcto pendere utrobique aſſeritur.
" Quæſtio eſt de rigiditate, quam GRAAFIUS potius animalibus ſpiritibus, corpo-
" rum nervoſorum tunicam diſtendentibus, tribuendam cenſet: idque ea ductus
" ratione, quod penis injectionibus utcunque impletus tamen minus rigidus eſt,
" quam in vivo animali apparere ſolet. Idem tamen (de viror organ. pag. 154.)
" ſcribit ſe in cadaveribus, aqua, beneficio ſyringæ, in corpora nervoſa per arte-
" rias propulſa, penem adeo extendiſſe, ut in vivis vix magis poſſet. Porro in
" canis pene, quem coitus tempore retro veſiculum firmiter ligaverat, præter
" ſanguinem floridum ſe nihil reperiſſe affirmat. Si quid hic a vivi penis rigi-
" ditate deficiat, nonne potius fibris in cadavere reſolutis tribuendum eſt, quam
" peculiari alicui ſpirituum animalium influxui deficienti? Fatemur quidem,
" ſpirituum acceſſione fieri, ut in vivis vigorem & tonum obtineant fibræ illæ,
" quæ in mortuis flacceſcunt: ſed hoc toti corpori cum pene commune eſt, neque
" peculiarem hic loci ſpirituum affluxum poſcit. Inſuper probabile eſt, ſangui-
" nem, a corde in vivo animali per vaſa naturaliter conſtituta in vivum & calen-
" tem penem impulſum, poros ejuſdem magis univerſaliter & adæquate implere,
" quam id aqua in defuncto fieri poteſt. Idque eo magis credibile eſt, quia arte-
" ria in mortuis inflata veram rigiditatem reſtituit [e].

" 7 [f]. At illa de emiſſione ſeminis quæſtio a neutro ſcriptorum ſolvi videtur.
" Dicit quidem Cl. HORNIUS, ex urethræ ſtructura facile intelligi, cur tam magna
" adſit in pene tenſio, & tam impetuoſa ſeminis per eundem jaculatio. Utinam
" illius ejaculationis rationem pluribus exhibuiſſet vir clariſſimus, & in re ſibi
" adeo perſpicua cæcitati noſtræ gratificatus fuiſſet. Etenim ſemen cum impetu
" proſilire conſtat. Quorum vero muſculorum ope vibretur, vel qua alia vi explo-
" datur, non adeo clarum eſt. Teſticulis quidem additos videmus cremaſteres;
" forte illi potius uſui deſtinatos, quam meræ teſtium ſuſpenſioni, quæ æque
" membrana peragi potuiſſet. Quid vero veſiculas ſeminales premit, & in
" œſtri venerei ὁρμῇ tam ſubitaneo motu exonerat? Quid glandulis proſtatis
" ſuccum ſuum exprimit? Quid in omnibus hiſce ſimultaneam eam συμπαθείαν
" excitat? Proſtatas quidam aprugnas muſculis validis donari agnoſcimus.
" Neque enim aliter exprimi potuit tam viſcidus liquor, qui in illo animali
" quovis glutine tenacior eſt. Verum veſiculæ ſeminales illic aliquot libras

[a] Part. Genit defenſ. p. 31.
[b] Mirac. Nat. 5. p. 11.
[c] Mirac. Nat. p. 13.
[d] Part. Genit. defenſ. p. 32.
[e] Mirac. Nat. p. 12.
[f] Part. Genit. defenſ. p. 6.

" con-

" continent humoris, non in unica aliqua cavitate fluctuantes, ſed in veſi-
" culis innumeris, ad methodum fere pulmonum MALPIGHIANORUM recon-
" diti. Nullo interim muſculo comprimuntur, neque quo pacto ſe emulgeri
" ſinant, facile comperimus. Quod ipſum de pleriſque ſaltem animalibus verum
" eſt. Solas talpas excipit doctiſſ. SWAMMERDAM, quorum et veſiculis ſeminali-
" bus & epididymidibus muſculos appendi aſſerit. Interim ſuam de ejaculatione
" ſeminis ſententiam addit [g], in qua primo affirmat, ſeminis motum a toto ſan-
" guine pendere, & non niſi tempore coitus excerni. At contrarium evincit
" aprugna diſſectio, ubi nunquam non multas uncias ſeminis invenies, licet in
" toto anno procedente non coiverit, nec ſui appropinquaverit. Secundo [h], univer-
" ſalem eo tempore muſculorum corporis omnium contentionem, præcipue vero
" eorum, qui ad partes ſeminales pertinent, aſſignat tanquam excretionis cauſam.
" At vero, quomodo motus ille comprimet veſicularum ſeminalium manticam a
" muſculorum horum tergo pendentem, & plerunque, ſi non ſemper, ſemine
" gravidam, doctiſſ. GRAAFIUS, deſcripta prius erectionis & compreſſionis ure-
" thræ ratione pergit dicere: *urethræ compreſſione* (viz. muſculorum ope) *e veſi-*
" *culis ſeminariis & vaſis deferentibus in urethram propulſum ſemen, ibique menſtruo*
" *ſuo* (ſc. e proſtatis affluo) *permixtum ulterius propelli poſſe.* Non libet integram
" hanc controverſiam evolvere; unicum tantum rogamus, nempe, conceſſo,
" quod ſemen, poſtquam fiſtulam urinariam intraverit, a muſculis penis vibratur
" & vi emittitur; quid demum eſt, quod ſemen illuc affert? Etenim tum teſti-
" culi, tum veſiculæ ſeminales, tum etiam glandulæ proſtatæ extra eorum muſ-
" culorum, ut & ipſius urethræ, poteſtatem collocantur.

" 8. Complura in ſchemate SWAMMERDAMIANO, quod cl. Dom. TULPIO dica-
" vit, culpat GRAAFIUS, forte non immerito: quæ tamen omnia ab authore ipſo in
" ſubſequentibus figuris poſtea editis emendantur.

" 9. De internis vero clitoridis cruribus (quæ Dr. SWAMMERDAM nonnunquam
" occurrere ait) aſſerit e nobis unus [i], ſe carnearum fibrillarum cylindrillos quoſdam
" reperiſſe, muſculis proxime adjacentibus diſtinctos, iis forte ſimiles, quos no-
" tavit author modo laudatus.

" 10. Porro notat idem, ligamenta uteri teretia non vaſa modo ſed & fibras
" muſculoſas obtinere, & motibus quaſi muſcularibus inſervire poſſe. Reliquæ
" inter hos duos viros agitatæ controverſiæ minoris momenti eſſe videntur quam
" ut cenſuram mereantur. Londini, d. 15 Auguſt, 1673."

The lord biſhop of Saliſbury reported the ſenſe of the council held this day to the Society, concerning their return to Greſham College, and repreſented what great obligations the Society had to the earl marſhal, for having received them ſo generouſly at firſt, and entertained them ſo nobly for ſo many years in his houſe, acquainting them withal, that the council had already expreſſed their deep ſenſe of ſuch great favours to his lordſhip.

Whereupon the Society, concurring with the council about the returning to

[g] Miracl. Nat. p. 14. [h] Ibid. [i] Dr. KING.



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Greſham College, reſolved that they would preſently in a body attend the earl marſhal likewiſe, and join their humble acknowledgments with thoſe of the council for his lordſhip's extraordinary favours and kindneſſes to them, deſiring the lord biſhop of Saliſbury, who was then in the chair, to be their mouth in this addreſs: and this was done accordingly.

*November* 13. At a meeting of the COUNCIL were preſent

The lord biſhop of Saliſbury in the chair;

| | |
|---|---|
| The earl marſhal, | Mr. COLWALL, |
| Sir JOHN LOWTHER, | Mr. HILL, |
| Sir PAUL NEILE, | Mr. OLDENBURG. |

It was ordered, that the following perſons, or three of them, of whom the preſident and Mr. OLDENBURG were to be two, be a committee for auditing the accounts of the treaſurer; and that they meet for that purpoſe on the Monday following, the 17th inſtant, about three of the clock in the afternoon, at the preſident's houſe; theſe perſons being the preſident, Sir JOHN LOWTHER, Dr. GODDARD, Mr. HILL, and Mr. OLDENBURG.

It was ordered alſo, that the following bond be ſhewn by the amanuenſis to Mr. LE HUNT; and upon his alteration, if he ſee cauſe for any, ſome copies be forthwith made and preſented, or ſent about by the treaſurer, to be ſigned by thoſe, who do not preſently pay their arrears in ready money: and that ſuch of the nobility, as ſhould make uſe of this bond, yet ſo as to order their ſtewards to ſign in their ſtead, ſhould be complied with in this particular.

The bond was as follows:

" *Noverint univerſi per præſentes me teneri & firmiter obligari*
" *præſidi, concilio, & ſodalibus Regalis Societatis Londini pro ſcientia naturali pro-*
" *movenda & ſucceſſoribus in libris bonæ & legalis monetæ Angliæ ſolvend.*
" *eidem præſidi, concilio, & ſodalibus, aut ſucceſſoribus ſuis, aut eorum certo attor-*
" *nato: ad quam quidem ſolutionem bene & fideliter faciend. obligo me, hæredes, exe-*
" *cutores, & adminiſtratores meos firmiter per præſentes, ſigillo meo, ſigillat. Dat.*
*anno regni Domini noſtri Caroli* II. *Dei gratia Angliæ, Scotiæ, Franciæ,*
" *& Hiberniæ Regis, Fidei Defenſoris, &c. viceſimo tertio, annoque Domini,* 1673.

" The condition of this obligation is ſuch, that if the above bounden
" his heirs, executors, adminiſtrators, or aſſigns do well and truly pay,
" or cauſe to be paid, unto the above named preſident, council, and fellows of
" the Royal Society, or their ſucceſſors, or aſſignee or aſſignees, the full ſum of
" of lawful money of England, it being his arrears due to the
" preſident, council, and fellows of the Royal Society aforeſaid, according to his
" engagement upon his admiſſion into the ſaid Society, on the day
" of next enſuing the date hereof, to the uſe of the ſaid preſident,
" council,

" council, and fellows, and their ſucceſſors; then this obligation to be void, or " elſe to remain in full force and virtue.

" Sealed and delivered,

" in preſence of

It was reſolved, that for want of time, the execution of that part of the order made at the late council of November 6th, which relates to the legal tie to be ſubſcribed for ſecuring the weekly contributions for the future, be deferred till after St. Andrew's day.

At a meeting of the Society on the ſame day,

Dr. WALLIS paid to the treaſurer forty ſhillings for Mr. BERNARD's admiſſion-money, having received orders ſo to do from Mr. BERNARD, whoſe occaſions would not yet permit him to appear in perſon at the Society.

Mr. OLDENBURG preſented to the Society, from Mr. BOYLE, his new book, intitled, *Tracts, conſiſting of Obſervations about the Saltneſs of the Sea: an account of a ſtatical Hygroſcope, and its Uſes; together with an Appendix about the Force of the Air's Moiſture: and a Fragment about the natural and præternatural ſtate of Bodies: by the honourable* R. BOYLE: *to all which is premiſed a Sceptical Dialogue about the poſitive or privative nature of Cold, by a member of the Royal Society:* printed at London, 1673, in 8vo.

Mr. HOOKE was called upon for his account of the experiment made November 6. of water ſpreading itſelf into a canopy, and reverting to the perpendicular. He excuſing himſelf, that he had not been able to make it ready, was deſired to prepare it for the next meeting.

He ſhewed an experiment concerning the ſpringineſs of glaſs, by applying to a ſlender glaſs-pipe a wax-light on all the ſides thereof, by which it appeared, that the light being held on the top of the pipe, the farther end of the pipe ſunk; held underneath, it roſe; held on the ſide towards the hand applying, it turned from him; held on the oppoſite ſide, it turned towards him.

The cauſe of this phænomenon was by ſome conceived to be the expanſion of the glaſs on that ſide, where the light is applied.

Sir WILLIAM PETY ſaid, that it was a deſireable thing to have a good theory of the ſpringineſs in bodies.

Mr. HOOKE mentioned, that formerly he had explained it, in a diſcourſe of his, brought in upon the occaſion of the odd phænomenon of the pipe of mercury ſtanding top-full far above the ordinary ſtation.

He was deſired, ſince that diſcourſe was not yet brought in by him, that he would bring it in; which he promiſed to do.

He

He promiſed alſo to bring in ſome experiment or other at the next meeting.

Mr. OLDENBURG read a paper of Mr. LISTER, containing an account of ſome of the parts of certain ſtones figured like plants, together with thirty-ſeven figures, curiouſly drawn to repreſent the ſame [1].

*November* 20. A committee was choſen by ballot, for auditing the treaſurer's accounts, conſiſting of Sir WILLIAM PETTY, Sir THEODORE de VAUX, Mr. CREED, Mr. HOOKE, and Mr. VERNON, three of whom were to be a quorum, and to meet on the Thurſday following, November 27. about two in the afternoon, at Arundel Houſe.

The lord biſhop of Saliſbury acquainted the Society, that thoſe eminent citizens of London, who had been formerly deputed by the city and the Mercer's company, to invite the Royal Society to return to Greſham College, viz. Sir JOHN LAURENCE, Sir RICHARD FORD, Sir THOMAS PLAYER, and Mr. ROWLAND WYNNE, had upon occaſion expreſſed, that they ſhould eſteem it as an honour to be elected into the Royal Society: whereupon his lordſhip now propoſed them all four as candidates, and deſired the Society to meet the next week, in ſuch a number as was requiſite to make an election.

Mr. ANDREW BIRCH was propoſed candidate by Sir THEODORE de VAUX.

Mr. HOOKE ſhewed a microſcope, with one only globule of glaſs, faſtened to an inſtrument with many joints, to turn every way, and ſo to ſhew the object on every ſide with greater diſtinctneſs than other microſcopes: which kind of microſcope, he ſaid, a German had brought over with him out of Holland, but that it had been long ſince hinted by himſelf in the preface to his *Micrographia*.

He was put in mind both of his account of the experiment made November 6, with water, and of his diſcourſe concerning elaſticity.

Mr. OLDENBURG preſented from Mr. HEVELIUS his book, intitled, *Machinæ Cæleſtis pars prior, Organographiam Aſtronomicam exhibens, &c.*

*November* 27. At a meeting of the COUNCIL of the Society were preſent,

The lord biſhop of Saliſbury in the chair,

| | |
|---|---|
| The earl marſhal, | Sir PAUL NEILE, |
| Mr. CHARLES HOWARD, | Mr. COLWALL, |
| Sir JOHN LOWTHER, | Mr. HILL, |
| Mr. AERSKINE, | Mr. OLDENBURG. |

The receit for the four hundred pounds, bequeathed by the late Dr. WILKINS, biſhop of Cheſter, deceaſed, to the Society, was ſigned and ſealed in coun-

[1] Letter-book, vol. vi. p. 371 and 339. It is printed in the Philoſ. Tranſact. vol. viii. n° 100. p. 6181. for January and February, 1673.

cil,

cil, and ordered to be delivered to Dr. TILLOTSON, dean of Canterbury; and Mr. COLWALL, the treaſurer, was deſired to keep the money in his cuſtody till farther order.

The committee of the council for auditing the treaſurer's accounts made their report [k].

At a meeting of the SOCIETY on the ſame day,

Sir JOHN LAURENCE, Sir RICHARD FORD, Sir THOMAS PLAYER, Mr. ROWLAND WYNNE, and Mr. ANDREW BIRCH were elected into the Society.

Mr. ELERS, a foreigner, ſhewed the Society a ſmall agate, of the ſize of a pea, having on the one ſide the perfect effigies of a face, reſembling naturally, as he affirmed, pope ALEXANDER VII. being compared with a medal of that pope, which Mr. ELERS had procured at Rome purpoſely for comparing the agate with it on this occaſion. On the other ſide appeared the face of the preſent emperor [l], if held one way, and another face, if held another way; beſides ſeveral other faces, which the owner of the agate imagined to be there, but which could not well be diſcerned by any of the Society.

He ſhewed likewiſe ſeveral patterns of ſtuff, which by the preſs had received the likeneſs of cloth of gold and ſilver; for the making of which manufacture in England, he ſaid, a certain German, then in Holland, intended to procure a patent.

The lord viſcount STAFFORD brought in an account in writing, of what he had related 6th November, concerning the unaltered quickſilver, notwithſtanding it had been on the fire for the ſpace of fifteen years: to which was added an account of the increaſe of weight in brimſtone by fire. It was ordered to be entered in the Regiſter-book [m].

Mr. HOOKE ſhewed an attempt of his, of making a veſſel ſo thin, that when evacuated of the air contained in it, it might ſwim in the air. He mentioned alſo, that a certain Italian clergyman, named LANA, had written upon this ſubject; whoſe book he thought had been formerly preſented to the Society by their ſecretary, but was ſtill in his hands.

*December* 1. St. Andrew's day, November 30. having this year fallen upon Sunday, the Society, by virtue of their charter, kept their anniverſary election upon this day; at which, were preſent five and fifty members.

Sir JOHN LAURENCE, Sir RICHARD FORD, Sir THOMAS PLAYER, Mr. ROWLAND WYNNE, and Mr. ANDREW BIRCH were admitted.

[k] This report was forgot to be entered in the Council-book, vol i. p. 225.

[l] LEOPOLD.

[m] It is not entered there.

The committee of the Society for auditing the treaſurer's accounts made their report, as follows:

" At a committee of the Royal Society for auditing the treaſurer's accounts, " November 27, 1673,

" We find Mr. DANIEL COLWALL debtor,

| | l. | s. | d. |
|---|---|---|---|
| " To monies he hath received on the quarterly payments of the So- " ciety from 23d November, 1672, to 13th ditto, 1673 | 142 | 19 | 6 |
| " To money he hath received for admiſſion | 2 | 0 | 0 |
| " To the balance of his laſt account | 7 | 9 | 3 |
| £ | 152 | 8 | 9 |

" We alſo find he is creditor,

| | l. | s. | d. |
|---|---|---|---|
| " By monies he hath paid to the uſe of the Society | 146 | 16 | 8 |
| " Balance reſting in caſh in his hand | 5 | 12 | 1 |
| £ | 152 | 8 | 9 |

" Signed,

" WILLIAM PETY, " FRANCIS VERNON,
" THEODORE de VAUX, " ROBERT HOOKE."

This done, the Society proceeded to the work of this day; and by their election there were continued of the council theſe eleven, viz.

The lord viſcount BROUNCKER,
The lord BERKLEY,
Mr. COLWALL,
Dr. GODDARD,
Mr. HILL,
Mr. HOSKYNS,
Sir JOHN LOWTHER [a],
The earl of Norwich, earl marſhal of England,
Sir PAUL NEILE,
Mr. OLDENBURG,
The lord biſhop of Saliſbury.

The new choſen members of the council were theſe ten, viz.

Mr. BOYLE,
Mr. BARRINGTON,
Mr. CREED,
Sir JOHN CUTLER,
Dr. WALTER NEEDHAM,
Sir WILLIAM PETY,
The earl of SHAFTESBURY,
Sir ROBERT SOUTHWELL,
Sir CHRISTOPHER WREN,
Mr. WYLDE.

Out of theſe were elected officers,

[a] This name is omitted in the Journal, vol. v. p. 48. but reſtored from the printed liſt of the Society for 1674.

The lord viſcount BROUNCKER, preſident,
Mr. COLWALL, treaſurer,
Mr. HILL, } ſecretaries.
Mr. OLDENBURG, }

Of the new members of the council were ſworn Sir WILLIAM PETTY and Sir ROBERT SOUTHWELL.

Before this annual election the Society had an important loſs by the death of

Sir ROBERT MORAY, who was deſcended of an antient and noble family in the Highlands of Scotland, and educated partly in the univerſity of St. Andrews, and partly in France, where he had afterwards a military employment in the ſervice of LEWIS XIII. [l], and gained ſo high a degree of favour with cardinal RICHELIEU, that few ſtrangers were ever ſo much conſidered by that great miniſter as he was [m]. He was raiſed to the rank of colonel in France, and came over to England [n] for recruits, when king CHARLES I. was in with the Scots army at Newcaſtle, where he grew into great eſteem with his majeſty, for whoſe eſcape, about December, 1646, he laid a deſign in the following manner [o]: Mr. WILLIAM MORAY, afterwards earl of Dyſert, had provided a veſſel by Tinmouth, and Sir ROBERT MORAY was to have conducted the king thither in a diſguiſe; and it proceeded ſo far, that his majeſty put himſelf in the diſguiſe, and went down the back ſtairs with Sir ROBERT: but apprehending, that it was ſcarce poſſible to paſs all the guards without being diſcovered, and judging it highly indecent to be taken in ſuch a condition, he changed his reſolution, and went back.

Upon the reſtoration of king CHARLES II. he was made one of the privy council to his majeſty in that kingdom. He was one of the firſt and moſt active members of the Royal Society, and as early as December 5, 1660, brought a meſſage from the king, that his majeſty had been acquainted with the deſign of their meeting, and well approved of it, and would be ready to give an encouragement to it [p]. March 6, 166$\frac{0}{1}$, he was choſen preſident of the Society [q], as he was again for another month on the 10th of April, 1661 [r]; and ſeveral times after [s]. In the firſt charter granted to the Society, of July 15, 1662, and the ſecond, of April 22, 1663, he was nominated one of the council to it. He died ſuddenly in his pavilion in the garden at Whitehall, July 4, 1673, and was interred at the king's charge in Weſtminſter-abbey near the monument of Sir WILLIAM DAVENANT [t]. Mr. WOOD affirms [u], that he was a *ſingle man*, and an *abhorrer of women*; but this is a groſs miſtake, for Sir ROBERT married the ſiſter of the lord BELCARRES [x]. He was univerſally beloved and eſteemed; and eminent for

[l] WOOD, Athen. Oxon. vol. ii. col. 370.
[m] BURNET, Hiſtory of his own Time, volume i.
[n] Mr. WOOD, *ubi ſupra*, ſays, that he had been general of the ordnance in Scotland againſt king CHARLES I. when the preſbyterians of that kingdom firſt ſet up their *covenant*.
[o] BURNET's Memoirs of the Dukes of Hamilton, l. 5. p. 307.
[p] See above, vol. i. p. 4.
[q] Ibid. p. 17.
[r] Ibid. p 21.
[s] Ibid. p. 85, 87.
[t] WOOD, *ubi ſupra*.
[u] Ibid.
[x] BURNET, Hiſt. of his own Time.

his piety, ſpending many hours a day in devotion in the midſt of armies and courts. He had an equality of temper in him, that nothing could alter, and was in practice a ſtoic, with a tincture of one of the principles of that ſect, the perſuaſion of abſolute decrees. He had a moſt diffuſed love to mankind, and delighted in every occaſion of doing good, which he managed with great zeal and diſcretion. His comprehenſion was ſuperior to that of moſt men. He was conſiderably ſkilled in mathematics, and remarkably ſo in the hiſtory of nature; and his genius reſembled that of the illuſtrious PEIRESKIUS, as deſcribed by GASSENDUS [y].

*December* 4. FRANCIS ROBARTES, Eſq; ſon of JOHN lord ROBARTES, and Col. GILES STRANGWAYS, were propoſed candidates by the lord biſhop of Saliſbury; as was likewiſe JOHN le GASSICK, M. D. by Sir WILLIAM PETTY.

The earl of Saliſbury, Mr. BOYLE, Mr. BARRINGTON, and Mr. CREED, were ſworn members of the council.

There was preſent at this meeting the abbé D'ANGEAU, brother to the marquis of that name, who had attended her royal highneſs the dutcheſs of York from Paris to London.

Mr. HOOKE ſhewed an experiment of the ſpringineſs of coal; which was, that one ſide of a piece of charked wood or coal being heated, that ſide did (as in the like experiment formerly made with glaſs) bend from the heat, as appeared by a long ſtick faſtened thereto, and the end pointing to a fixed mark.

It was alſo tried again with a glaſs pipe, as likewiſe with a braſs wire; which latter ſtirred but very little, and almoſt inſenſibly.

There was produced a microſcope of Mr. SMETHWICKE's contrivance, ſaid by him, as Mr. HOOKE reported, to have glaſſes not ſpherical, but of a conic ſection: which figure the author, as was ſaid, affirmed he could make and poliſh with certainty. Being tried, ſome of the members found it ſhew the object very diſtinctly without any colours, and magnify it very conſiderably.

It was thought neceſſary to compare it with ſome very good ones of a ſpherical figure.

*December* 11. FRANCIS ROBARTES, Eſq; Col. STRANGWAYS, and Dr. le GASSICK were elected.

Mr. HOOKE brought in an apparatus to ſhew by experiments the ſtrength of the loadſtone's attraction, and to find in what proportion it draws, at ſeveral diſtances.

He was ordered to fit this apparatus ſo, that the deſign of it might be well proſecuted.

[y] Idem, ibid.

Upon

Upon this occaſion Sir WILLIAM PETTY moved, that the Society would give orders, that there might be a conſtant apparatus of inſtruments ready for the making of ſeveral kinds of experiments depending on ſeveral heads; for inſtance, for experiments of motion, optical, magnetical, electrical, mercurial, &c. And that ſuch inſtruments, as had been formerly uſed by the Society, and were out of order, might be repaired, and all theſe put together in a room by themſelves, to be ready upon occaſion for ſtrangers, or for repetition and farther proſecution of the ſeveral ſorts of experiments.

Dr. GREW was deſired to produce ſome botanical obſervations at the next meeting; which he promiſed to do.

Mr. OLDENBURG read a letter in Latin, written at Roſtoch, 11th March, 1669 [z], addreſſed to the preſident and fellows of the Society, by Dr. SEBASTIAN WIRDIG, profeſſor of phyſic at Roſtoch, deſiring the Society to give their judgment of his book dedicated to them, and intitled *Sebaſtiani Wirdig, M. D. Nova Medicina Spirituum, &c.*

It was thought ſtrange, that the letter bore ſo old a date, and that there was ſuch a diſtance between that and the publication of the book; which was delivered to Sir WILLIAM PETTY, that he might peruſe it, and make a report of it to the Society.

Two letters of Signor CASSINI, dated 22d September, and 8th November, 1673, were read, containing ſome obſervations of his about the two lately diſcovered ſatellites of Saturn, and others concerning the diameter of the circumjovialiſts; together with an account of the charges and apertures of his glaſſes of thirty-five and twenty-one feet.

A letter of the lord HERBERT [a], returning thanks to the Society for his election, was read.

A letter of Monſ. JUSTEL to Mr. OLDENBURG, from Paris, 26th September, 1673 [b], was likewiſe read; containing a deſcription of the icy mountain, called Gletcher, in the canton of Berne in Helvetia.

Mr. BOYLE ſhewed the Society a little floating inſtrument of his, (called by him a *floating loadſtone*) which diſcovers, whether guineas, for example, be counterfeit or not, by putting the inſtrument with the piece of coin to be tried and faſtened to the bottom of it, into a tall glaſs or other veſſel of water; certain marks being ſo made on the ſlender metalline pipe, which makes the upper part of the inſtrument, that the hollow ball, which makes the lower part of it, will ſink much lower, at leaſt two inches) if the coin be true gold, than if it be not; and

[z] This is the date in the Journal, vol. v. p. 52. but in the Letter-book, vol. vi. p. 328, 329, the date is 1ſt March.

[a] Letter-book, vol. vi. p. 249.

[b] Ibid. p. 310. It is printed in the Philoſoph. Tranſact. vol. viii. n° 100. p. 6191. for January and February, 167$\frac{3}{4}$.

according as the water reaches to one or other of the aforeſaid marks, an eſtimate may be made, whether the piece of coin, if counterfeit, be made of tin, braſs, copper, ſilver, or lead. The ſame inſtrument may be applied to other gold coins; as alſo to ſilver coins, if they be of any conſiderable bulk.

The experiment was made ſeveral times by Mr. BOYLE's direction.

*December* 18. Mr. HOOKE produced again his inſtrument for determining the force of the loadſtone's attraction at certain diſtances: but the apparatus ſtill failing, he was deſired to fit it better for the next meeting.

Dr. GREW ſhewed two figures of two microſcopical obſervations, which he had made; one of the trunk of an aſh tree, the other of that of a berberis, explaining both wherein their ſtructure agreed, and wherein they differed. He promiſed to produce more obſervations of this kind at the next meeting.

Mr. OLDENBURG preſented to the Society from Dr. THOMAS WILLIS his new book, intitled, *Pharmaceutice rationalis, ſive Diatriba de Medicamentorum Operationibus in humano Corpore:* printed at Oxford, 1673, in 4to.

Dr. KING having already peruſed this book, gave ſome account of it to the Society, and mentioned particularly the author's deſcription of an artery and of its muſcular motion like that of the heart, promiſing, that he would bring in the ſcheme of an artery not added to Dr. WILLIS's book.

Mr. OLDENBURG delivered to the Society in the name of Signor PAUL BOCCONE, a Sicilian botaniſt, his collection of curioſities in three boxes, which, before his leaving England, he had deſired to be preſented to them for their repoſitory; containing the following particulars[c], tranſcribed out of a French paper left by the preſenter with Mr. OLDENBURG, viz.

" Memoire du cabinet, que Monſ. BOCCONE à preſentè a la Societé Royale " l'an. 1673.

" 1. Le fruit de la muſa, ou mauz de Proſper Alpinus.

" 2. *Papyrus Ægyptia penæ, ſive papyrus nilotica Gerardi.*

" 3. *Fucus typhoides Melitenſis coccineus.*

" 4. *Fucus ſive alga ſpiralis maritima.*

" Toutes plantes rares et eſtrangeres; et plus

" 5. Pieces qui monſtrent l'alteration et la petrification des heriſſons de mer;

[c] An account of part of them is printed in the Philoſoph. Tranſact. vol. viii. n° 99. p. 6158.

" ſçavoir *Echinus ovarius ſive eſculentus* dans le naturel, et petrifié: *Echinus ſpa-*
" *tagus* ou *Briſſa* d' Imperatus et de Rondelet, dans le naturel; par ou l'on peut
" examiner leur changemens: avec d' autres pieces et morceaux d' heriſſons de
" mer, appellé de l' Imperatus *iſtrice marino*.

" 6. Pieces, qui monſtrent la reſemblance, qu'il y a entre les dents du poiſſon
" carcharias, chien de mer, et ſemblables, avec les gloſſopetres, par ou l'on con-
" jecture le changement des dites dents en perre.

" 7. Pieces, qui monſtrent les parties, qui compoſent l' aſtroites ou la pierre
" eſtoilleé par le moien de quelques turſaux coralloides, per celuy de la millepore
" d' Imperatus; et par la ſtructure de la meme pierre, qui n'eſt autre choſe,
" qu'un aſſemblage de *topbus* ou d' argille endurcie enſuite comme des pierres.

" 8. Pieces et parties, qui compoſent la corne d'Ammon, laquelle eſt remplie
" de petites boules. Il faut prendre garde, que la corne d'Ammon d' Imperatus,
" appelleé par d' autres *ebur foſſile*, eſt tout autre choſe.

" 9. Pieces, qui monſtent, que la plus ſouvent les pierres, qui ont la figure de
" coquille, ne ſont autre choſe que de l'argille renfermeé entre deux couvercles.

" 10. Pierres appellées *conchæ lapideæ gibbæ*, leſquelles, quoi qu'elles ayent la
" figure de coquille, ſont neantmoins produites *per juxtapoſitionem* comme d' autres
" pierres ou des calloux: obſervation tres neceſſaire pour diſtinguer les precedentes
" pierres, qui ſont moulées par la compreſſion des veritabiles coquilles.

" 11. Pieces et parties du deſgorgement de Mont Ætna reduites en une matiere
" ferrugineuſée ſemblable au machefer, qu'on tire des fourneaux des forgerons:
" ſel armoniac blanc: ſel armoniac taché de ſaffron, et ſel armoniac taché d'une
" couleur de vert gris; leſquells on à tirè ſur la matiere embraſée apres que le feu
" à eſté eſtinct.

" 12. Figure de poiſſon, appellé cicerello à Meſſina.

" 13. *Sanguiſuga pinnata*, qui ſucce le ſang du poiſſon XIPHIAS, *peſce ſpada*,
" avec le poux et le capreoli, dans le naturel.

" 14. Pieces, qui monſtrent l' obſervation de corail rouge et blanc étré veritable,
" que le dit BOCCONE tient eſtre produit *juxtapoſitionem*, apres avoir eſloigné le
" corail de l'eſpece des plants, et dit, que le corail n'a point de ſemence. Il fait
" voir ſon principe ou ſa premiere impreſſion ſur un morceau de bois environné
" de corail vray et ſolide et d' autre tendre comme du tartel coraillin par ou il à
" conjecture que les degres du corail veritable de DIOSCORIDE ne ſont qu'une
" viſcoſité corailline, qui ſouvre et pouſſe des pores eſtoillées une eſpece de tartre,
" qui eſt couvert de la dite viſcoſité ou *fucus* rouge, et le corail perfait ſolide, et par
" ou on croit pouvoir faire voir, que la nature du corail s'approche a celle des
" pierres.

" 15.

" 15. Pieces et morceaux de *corallium album punctatum ſtellatum*, pour faire " examiner combien ces eſpeces de corail ſont eſloignées des plants.

" 16. *Lapis fiſſilis bitumen redolens, in montibus Hyblæis in Siciliâ repertus.*

" 17. Pierre bezoar mineral Sicilien."

*December* 22. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,

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| The lord biſhop of Saliſbury, | Dr. WALTER NEEDHAM, |
| Sir JOHN LOWTHER, | Mr. COLWALL, |
| Sir PAULE NEILE, | Mr. HILL, |
| Sir WILLIAM PETTY, | Mr. OLDENBURG. |

The council taking again into ſerious conſideration the neceſſity of collecting the arrears due to the Royal Society reſolved, that the following order ſhould be delivered to ſuch members of the Society, as were in arrears, viz.

" In purſuance of a former order of the council made the 6th of November, " 1673, it was this day ordered, that the earl of Dorſet, the earl of Ayleſbury, " the lord viſcount STAFFORD, Sir JOHN LOWTHER, Sir WILLIAM PETTY, Sir " PETER WYCHE, Sir CYRIL WYCHE, Sir THEODORE de VAUX, Sir CHRISTO- " PHER WREN, the treaſurer and the ſecretaries of the Royal Society, and Mr. " HOOKE, or any four or more of them, be deſired to apply themſelves to ſuch " members of the ſaid Society, as are in arrears, and to acquaint them, that this " council being now upon making a new regulation for a firm eſtabliſhment of " the ſaid Society; in order whereunto the arrears due to the ſame are to be forth- " with collected; every fellow being thus in arrear is deſired forthwith to pay " to the treaſurer, Mr. COLWALL, or his deputy, ſo much thereof, as was due " at Michaelmaſs laſt, or at leaſt to give a ſufficient bond for the doing thereof " within the ſpace of ſix months from the date of the aforeſaid order.

" It was likewiſe then declared, that ſuch of the fellows, as ſhall neither make " preſent payment of their reſpective arrears, nor give bond as aforeſaid, ſhall " be accounted to have deſerted the ſaid Society, and be provided againſt accord- " ing to the ſtatutes; and that the Society will proceed to a legal recovery of " the ſaid arrears."

This order was ſigned by

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| The preſident, | Sir WILLIAM PETTY, |
| SETH, lord biſhop of Saliſbury, | Mr. COLWALL, |
| Sir JOHN LOWTHER, | Mr. HILL, |
| Sir PAUL NEILE, | Mr. OLDENBURG. |

Dr. NEEDHAM went away before ſigning.

It was ordered likewiſe, that copies be made of the ſtatute for election, and of that for payment; as alſo of the obligation ſubſcribed by every fellow at his admiſſion; and that the committee named in the former order be furniſhed with ſuch copies, to be ſhewn upon occaſion to thoſe, whom they ſhall make application to:

That the ſaid committee be deſired to apply themſelves by letters to thoſe, who were in the country, and others, whom they could not have an eaſy acceſs to.

It was reſolved, that if any fellow ſhould be ejected on this occaſion, the cauſe of the ejection be recorded.

It was ordered, that Mr. BOYLE, Sir WILLIAM PETTY, Sir CHRISTOPHER WREN, Dr. GODDARD, Dr. GREW, and Mr. HOOKE, be deſired to draw up a liſt of conſiderable experiments to be tried before the Society, and to prepare an apparatus neceſſary for the exhibition of them upon all occaſions.

Sir WILLIAM PETTY was deſired to take a particular care of ſeeing the import of this order put into effect.

There being ſome members of the Society, the time of whoſe admiſſion did not appear upon the journal, as the earl of Angleſey, Sir JOHN BIRKENHEAD, Sir ROBERT HARLEY, and Mr. THOMAS HARLEY, it was ordered, that the printed yearly liſts of the Society ſhould be peruſed, to ſee what year thoſe members were printed the firſt time, and from thence a meaſure taken of ſtating their accounts.

After this it was thought convenient, that as many of this council, as conveniently could, ſhould meet in ſome other place, to avoid diſturbing the earl marſhal too long, and there make a diſtinction in ſeveral columns of the fellows of the Society, according as they conſtantly pay or not pay, and of ſuch, as are honorary, abſent, excuſed, or doubtful.

This was done accordingly by Sir JOHN LOWTHER, Sir WILLIAM PETTY, Mr. COLWALL, Mr. HILL, Mr. HOOKE, and Mr. OLDENBURG, who having found fifty-three fellows, who paid well, and ſeventy-nine, who did not, and fourteen abſent in the country, reſolved to apply themſelves with all poſſible ſpeed to the ſeventy-nine; and, in order to it, deſired, that the copies of the above-mentioned ſtatutes might be ſpeedily made, and the ſaid liſt of the ſeventy-nine fairly written out, together with the arrears due by every one of thoſe; as alſo that a letter might be drawn up by Mr. OLDENBURG, to be ſent by the committee to the abſent with all poſſible ſafety, acquainting them with the council's order of collecting the arrears, and deſiring thoſe, who were concerned, to give in their poſitive anſwer by the next poſt to the ſaid ſecretary.

*December* 25. being Chriſtmaſs-day, the Society did not meet.

1673. *January*

1674. *January* 1. The Society did not meet, it being New-year's-day.

*January* 5. At a meeting of the council were preſent

The lord biſhop of Saliſbury, vice-preſident, in the chair,

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| Sir JOHN LOWTHER, | Mr. CREED, |
| Sir WILLIAM PETTY, | Mr. COLWALL, |
| Sir ROBERT SOUTHWELL, | Mr. HILL. |

It was diſcourſed, whether if any perſon pay fifty pounds, he ſhall be accounted a benefactor, according to the ſtatute, though part of the ſaid ſum be already due from him for arrears?

It was ordered, that the treaſurer pay into the Mercers company of London four hundred pounds now in the cheſt of the Society, taking their bond for repayment, with ſuch intereſt as he could get for the ſame, not leſs than five per cent. and that the bond ſo taken be depoſited in the ſaid cheſt:

That the clerk give liſts of the perſons in arrears to the ſeveral members of the committee for demanding the arrears: And,

That the treaſurer give deputations to each of the ſaid committee to receive any ſum in arrear, and to give a ſufficient diſcharge for the ſame.

*January* 8. The Society did not ſit, there being but very few members preſent.

*January* 15. Mr. HOOKE made an experiment with a ruler divided into ſuch parts, as being placed at a certain diſtance from the eye, appeared to ſubtend a minute of a degree; and being earneſtly and curiouſly viewed by all the perſons preſent, it appeared, that not any one preſent, being placed at the aſſigned diſtance, was able to diſtinguiſh thoſe parts, which appeared of the bigneſs of a minute, but that they appeared confuſed. This experiment he produced, in order to ſhew, that we cannot by the naked eye make any aſtronomical or other obſervation to a greater exactneſs than that of a minute, by reaſon, that whatever object appears under a leſs angle, is not diſtinguiſhable by the naked eye; and therefore he alledged, that whatever curioſity was uſed to make the diviſions of an inſtrument more nice, was of no uſe, unleſs the eye were aſſiſted by other helps from optic glaſſes.

Mr. OLDENBURG produced a box containing ſome mineral concretes, together with a deſcription of them, preſented to the Society by Dr. LUCAS HODGSON of Newcaſtle upon Tine, as himſelf had collected them from the tops and ſides of the ſubterraneal chimnies, as he called them, of a coal-mine betwixt Benwell and Fenham, near the ſaid town of Newcaſtle, which had burnt continually for forty years paſt. The particulars contained in diſtinct papers, were as follow:

A. Sulphur, with ſome flowers.

B. Sal

B. Sal armoniac of various forms and figures, ſome of it yellow, by reaſon of the ſulphur.

C. The white maſs (mentioned in the large deſcription) after it had lain in the air.

D. The white maſs newly brought from the fire.

E. Sal armoniac in ſoft flowers.

F. A piece of the marcaſite, or lapis pyrites.

G. Sal armoniac in ſplendid cryſtals of various figures.

H. Sal armoniac ſublimed, after it was taken from the fire.

I. Sal armoniac ſublimed, amongſt burnt whins and furzes.

K. A bottle of the ſpirit of this ſal armoniac, as it was taken from the fire.

L. The ſalt of a Spaw near Newcaſtle.

It was ordered, that the hearty thanks of the Society be given by a letter of the ſecretary to Dr. HODGSON, for theſe curioſities; and that he be deſired to continue ſuch communications, as he ſhould find occaſion.

It being moved, that Dr. DANIEL COX having made many obſervations and experiments concerning the nature and figures of all ſorts of ſalts, might be deſired to impart them to the Society, he was deſired accordingly, and promiſed, that he would do ſo, after he had viewed and examined ſuch ſalts by ſuch a microſcope, as had been approved of for its goodneſs by the Society: and a microſcope being brought by Mr. COCK to be examined, the trial of it was referred to a fitter time, it being then candle-light.

*January* 22. Mr. HOOKE propoſed the making of a new kind of aſtronomical inſtrument of his own invention for the taking of hights, angles, and diſtances, of celeſtial bodies by one obſervation more exactly than ever was yet done, viz. to a ſecond. He added, that in this way the exactneſs of the inſtrument, as to diviſions, ſights, and perpendicularity, might, upon occaſion, be duly ordered by the aſtronomical obſerver, ſo as not to rely upon the credit or ſkill of the inſtrument-maker.

He being aſked, what the making of ſuch a quadrant would amount to, and anſwering, that he thought it could be made for leſs than ten pounds, it was ordered, that he ſhould cauſe one to be made of that price.

The experiment made at the laſt meeting, to ſhew, that with common ſights we are not capable to diſtinguiſh a minute, was repeated; and proved what it was deſigned for.

Mr. OLDENBURG read a letter to him from Mr. LISTER, dated 7th January, $167\frac{2}{3}$ [b], concerning an old *fungus ſubterraneus*, of a bituminous nature, found in a rocky lime-ſtone ground in Derbyſhire; as alſo an uncommon mineral liquor, white, reſembling cream, found at the bottom of a coal-pit, and in iron-mines, in great quantity.

It was ordered, that Mr. LISTER ſhould be deſired to ſend a ſpecimen of each of theſe curioſities, if he could ſpare any of them.

Mr. LISTER having formerly ſent ſome of his blood-ſtanching liquor, with a deſire, that trials might be made with it before the Society, it was ordered, that the operator ſhould provide a dog againſt the next meeting for that purpoſe.

*January* 29. The Society did not meet.

*February* 5. FRANCIS ROBERTES, Eſq; was admitted.

Mr. HOOKE produced a new kind of reflecting teleſcope of his own contrivance, differing from that of Mr. NEWTON in this, that the obſerver looked directly at the object erected. This was performed by a way propounded by MERSENNUS, and repeated in Mr. GREGORY's Optics; but was thought to have been never actually done before.

Dr. GREW ſhewed his microſcopical obſervations on the trunk of an oak and elm, much differing from one another in the poſition of their parts and veſſels. He was deſired to ſhew at the next meeting his obſervations of the trunks of ſome other trees.

Mr. AWBREY preſented ſome written obſervations concerning winds, their blowing down many hundreds of oaks at once, their blowing very differently in places little diſtant from one another, &c.

Mr. OLDENBURG read a Latin letter to himſelf from Monſ. CHRISTOPHER SANDIUS, dated at Hamburgh, 15th December, 1673 [c], giving notice of the manner of the generation of pearls, viz. that originally they are the eggs of a kind of oiſter, which ejects them to breed other oiſters of the ſame kind, but ſometimes keeps one or two of them ſticking to the ſides of its ſhell, where, to the trouble of the breeding fiſh, they grow and become pearls of different ſizes and ſhapes.

It was ordered, that the writer of this letter ſhould be thanked, and deſired to let the Society know what ground he had for the truth of the matter of fact.

Dr. KING, according to his promiſe, produced a piece of an artery of a bullock, as it is deſcribed by Dr. WILLIS, in his late book *De Medicamentorum Ope-*

[b] Letter-book, vol. vii. p. 2. It is printed in the Philoſ. Tranſact. vol. viii. n° 100. p. 6179. for January and February $167\frac{3}{4}$.

[c] Letter-book, vol. vi. p. 346. It is printed in the Philoſoph. Tranſact. vol. ix. n° 101. p. 11. for March 1674.

*rationibus*

*rationibus in humano corpore*, shewing the four several membranes, of which it consists, viz. the vasculous, glandulous, muscular, and that which is contiguous to the blood; asserting withal the doctrine of Dr. WILLIS, that the motion of an artery is muscular, and the same with that of the heart.

An experiment was made with Mr. LISTER's styptic liquor upon a dog, by opening one of his crural arteries lengthwise without cutting it asunder. The water was renewed three or four times, and at the end of about a quarter of an hour and a half the blood seemed to be stopped; whereupon the dog was set at liberty, and committed to the care of the operator.

*February* 12. At a meeting of the council were present

The lord viscount BROUNCKER, president,

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| Sir JOHN LOWTHER, | Mr. HILL, |
| Sir WILLIAM PETTY, | Mr. CREED, |
| Sir ROBERT SOUTHWELL, | Mr. OLDENBURG. |
| Mr. COLWALL, | |

It was ordered, that a discourse of Mr. ROBERT HOOKE about the stars be printed by JOHN MARTYN, printer of the Royal Society.

Sir WILLIAM PETTY and Sir CHRISTOPHER WREN were sworn vice-presidents of the Society by taking the oaths of allegiance and supremacy, according to the prescript of the additional charter.

Mr. COLWALL and Mr. HIEL acquainted the council, that the Mercers company had declared, that they had at present no occasion for taking of any money; but the first they had, they would take the four hundred pounds of the Society, and pay interest for it.

Hereupon it was ordered, that the members of this council should be desired to inquire about a speedy and safe way of disposing of the four hundred pounds to the best advantage, and to report to the council concerning it at the next meeting thereof.

Mr. COLWALL produced a note from Dr. GASPAR NEEDHAM to himself, importing, that he desired henceforth to be excused from his obligation to the Society.

At a meeting of the SOCIETY on the same day,

The Society inspected the dog, upon whom the experiment had been made at the last meeting with Mr. LISTER's styptic water, and found the dog very well, and the wound in a manner quite healed up.

It was ordered, that Mr. LISTER be acquainted with the success of this experiment by a letter from Mr. OLDENBURG.

Mr. HOOKE made ſeveral trials with a loadſtone, to find, whether the interpoſition of any body would hinder the power of its effluvia: and having by weight ſo poiſed a balance, fitted for this purpoſe, that the iron was made to hang at a certain diſtance from the loadſtone, ſo as to leave ſome room for divers bodies to be interpoſed, it was found, that though a ſilver crown, a piece of glaſs of about the ſame thickneſs, and four twenty ſhilling pieces of gold, called guineas, were ſeverally interpoſed between the iron and the magnet, yet the iron did not at all alter its diſtance, which at firſt it had by the poiſe.

It was ordered, that Mr. HOOKE ſhould be deſired to try by himſelf a good number of experiments upon this ſubject, and draw up an account of their ſucceſs, and to communicate it to the Society, that ſo they might call for ſuch of them as they ſhould think good to be ſhewn before them.

*February* 19. There were made ſome more experiments with the magnet; viz. a ſmall bar of ſteel, of about one inch in length, and about a quarter of an inch diameter, was ſo ſuſpended, that the lower end was diſtant from the pole of a very good loadſtone, and counterpoiſed by ſix grains. And by ſeveral trials it was found, that a plate of glaſs, ſix inches broad, and half an inch thick, a thin board of wood about the ſame bulk, a plate of ſpar about the ſame breadth and thickneſs, a cut of butter on a trencher, a pewter-plate, a ſet of braſs-weights, a burning deal-board, a red-hot tile, a bright burning coal, the ſame alſo blowed, each of them interpoſed between the ſteel and loadſtone, ſuſpended as aforeſaid, made no variation of the attractive virtue of the ſtone: nor did an onion, ſlit in two, and laid upon the ſame ſtone, nor the interpoſing of lead, glaſs, wood, ſilver and gold, all at once, make any manner of change, the attraction remaining conſtant.

Farther, by the interpoſing of a knife, the virtue of the loadſtone was much diminiſhed; but by interpoſing a little bar of iron, half an inch in length, endwiſe, it increaſed about a quarter of the ſtrength.

The bringing of iron any wiſe near the ſtone weakened the attraction.

Dr. GREW ſhewed ſome microſcopical obſervations made upon a piece of the ſtem of a holly, and upon that of a fig-tree, both very curiouſly repreſented.

He was deſired to produce ſome more obſervations of this kind, at the next meeting.

Mr. OLDENBURG read a letter to himſelf from Monſ. SLUSIUS, dated at Liege, 8th February, 167$\frac{3}{4}$ [d], N. S. containing an anſwer to the queries ſent him by Sir JOSEPH WILLIAMSON; which letter is as follows:

[d] Letter-book, vol. vii. p. 23.

"Nobi-

" Nobiliſſimo & Clariſſimo Viro

" D. HENRICO OLDENBURG, Societatis Regiæ Secretario

" RENATUS FRANCISCUS SLUSIUS.

" S. P. D.

" Quæſita tua philoſophica, vir clariſſime, miſit ad me nuper excellentiſſimus " legatus idemque vir humaniſſimus, quo ferme tempore tuas 29 Decembris da- " tas accepi. Ad illa nunc reſpondebo paucis, rem totam uberius executurus, ſi " mihi poſt hac vel fide dignorum relatione, vel proprio experimento plura ſcire " contigerit.

" Lapis calaminaris non circa Aquiſgranum modo, ſed & prope Namurcum " pluribuſque inter Sabim & Moſam locis effoditur. Nec ſoli Aquiſgranenſes ar- " tem æris eo tingendi vindicare ſibi jure poſſunt: eſt quippe hac in patria Dio- " nantum oppidum ad Moſam eo nomine & nunc, & olim (Cominæo teſte) ce- " leberrimum. De Thermis vero libellum edidit ab aliquot annis d. gallus " FRANCISCUS BLONDEL, qui Aquiſgrani medicinam exercet, & cujus diligen- " tiæ nihil modo eſt quod addam, pauca in hoc genere expertus. Didici tamen " a chemico experientiſſimo mihique amico, ex aquis thermalibus ſeparari com- " mune ſulphur magna copia: deinde ſalem, qui neque communis ſit, neque ni- " troſus, nec ulli illorum ſimilis, quibus nomen fecimus, ſed ſui generis; inſipi- " dus quippe & minime lixivioſus, &, ut ipſe aiebat, ſiccus. Idem retulit, aqua- " modice primum albeſcere, colorem deinde ex cæruleo ac viridi mixtum ins " duere. Cremorem, qui illis ſupernatat, nitroſum non eſſe, ſed potius fuliginis " æmulum.

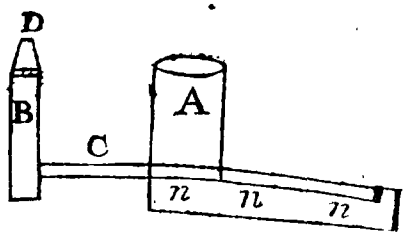
" Rectos ſopinarum noſtrarum carbonariarum puteos ad centum & ultra or- " gyiarum profunditatem deprimi, peritorum relatione mihi conſtat; atque inde " obliquo itinere ferme adhuc orgyias totidem deſcendere. Quod fortaſſe mirum " tibi videbitur V. C. cum 150 ulnarum profunditatem ad ſummum videaris " agnoſcere. Eſt autem orgyia (ſive toiſa) pugnorum viginti, ut loqui ſolent ope- " rarii, ſive pedum ſex.

" Aëris in fodinas deducendi (ſic enim loquuntur) hæc eſt methodus. Prope " rectum fodinæ puteum, fodiunt alterum multo minorem, aliquot orgyiarum " intervallo. Hunc æqualiter cum primo deprimunt; & eum ad 16 vel circiter " orgyias perventum eſt, cuniculum tranſverſum inter utrumque puteum aperi- " unt. Cum puteus major deprimitur, deprimunt & minorem, & obſtructo " priore cuniculo, alium inferiore loco ſubſtituunt; ita ut tum puteus uterque " tum cuniculi ſemper παραλληλισμὸν ſervent; & hoc quidem eouſque, dum puteus " rectus eſt: cum vero in obliquum vergit, canalem quadratum ex aſſeribus com- " pactum aptant ad os cuniculi, & undique obſtruunt, ne quid aëris niſi per cu- " niculum ingredi poſſit. Canalem hunc ad putei oblique deſcendentis latus ap-

" plicant,

" plicant, & pro ratione deſcenſus ſemper augent. Rudi ſchemate rem totam " tibi adumbrabo, quo me melius intelligas :

" A, eſt puteus major ; B, minor ; C, cuniculus " inter utrumque apertus ; *n*, *n*, *n*, canalis lig- " neus, quo aërem in fodinam obliquam du- " cunt.




" Solent autem puteo minori tugurioſum imponere, trunci conici figura, qua- " le eſt D. & ſuper clathris ferreis tranſverſis ad profunditatem aliquot orgyiarum, " ut in B, ignem accendere, quo aër, ut aiunt, fortius trahatur. Quod ſi aërem " excludi, ſive canalem obſtrui, contingat, maximum operariis ab igne pericu- " lum eſt : bituminoſæ nimirum ac ſulphureæ exhalationes denſantur ac concref- " cunt, & a candelis foſſorum concipiunt flammam, quæ mox miſeros amburit. " Ignem Græcum vocant noſtrates, non inepte ; eſt enim inter hunc & illum ſi- " militudo non exigua. Brevi deſinit, ſed malignus adeo remanet fœtor, ut " non minorem quam ipſa flamma noxam ſæpe inferat ; vitam enim aliquando " adimit. Non tamen in fodinis omnibus par periculum. In quibuſdam enim " nec adeo frequentes ſunt exhalationes, nec tam cito in flammam erumpunt, nec " ſi erumpant, fœtor adeo noxius ſequitur.

" Aquas ſubterraneas, a quibus æquale, ſi non majus quam ab igne periculum " eſt, (cum meminerim ad quadraginta una vice ſubmerſos) derivant in canales, " publico, & privatorum etiam, ſumtu conſtructos. Saltem ſi id fodinarum " ſitus altior concedat, quales ſunt in vicinis montibus, ex quibus fontes in hanc " urbem defluunt : ſin minus, vel ſitulis hauriunt, vel antliis, quales apud AGRI- " COLAM in lib. de *Re Metall.* videri licet.

" Venio nunc ad aquas Spadanas, quarum vires plurimum extulit *Spadacre-* " *nes* auctor, plurimum depreſſit HELMONTIUS, in quem idcirco invehitur al- " ter. Sed neuter, ut exiſtimo, modum ſervat. Negari enim non poteſt humores " viſcidos ac tartareos incidere, obſtructiones tollere, ac ſanare morbos, qui iis ori- " ginem ſuam debent ; preſertim ſi viribus non omnino dejectis, & ex medici " prudentis conſilio bibantur : ſed non æque conſtat, morbos omnes, quos enume- " ras, ab iis tolli, niſi forte κατὰ συμβεβηκός. Idem dictum puta de calculo labo- " rantibus ; teſtari enim poſſum a multis ejectos calculos minores per uretheres de- " lapſos, ſed neminem novi, qui a veſica calculo curatus fuerit. Militis illius " Itali hiſtoria refertur ab auctore *Spadacrenes*, & ætatem meam antecedit. " In toto illo tractu, qui apud nos vetus *Arduennæ* nomen retinet, homines " plerumque ſunt μακροβιοι, & minime morbis obnoxii. Scaturiunt etiam multis " in locis fontes Spadanorum æmuli, minoris quidem famæ, ſed virtutis, ut in- " tellexi, non minoris. An vero his ſanitatem & vitæ diuturnitatem debeant in- " colæ, an potius vivendi rationi, & ſoli naturæ, plane mihi incompertum eſt. " Parum enim fertilem terram colunt, & quæ ipſorum laboribus maligne reſpon- " deat ; delicias neſciunt, atque ab adoleſcentia duram & exercitam vivendi ratio-

" nem

" nem ſectantur. Ebrietatem aliquam potis aquis accidere, teſtari poſſum; ſæ-
" pius illam expertus, ſed levem, nec diuturnam. Idque aliquando mihi in me-
" moriam revocavit quod legeram apud ANTIGONUM Ἐν ἱστορίων παραδοξ. συναγωγῇ.
" de aquis acidis, quarum potores THEOPOMPUS auctor eſt ὡς ἐπὶ ζάν οἴνων
" ἀλλοιῦσαι. Comune quoque eſt omnibus, qui Spadanas bibunt, ſordes atro co-
" lore foedas deponere, ſed non vomere, niſi vel ſint κακοστομαχοι, vel ſupra mo-
" dum ſeſe ingurgitent, vel ex Geronſterio bibant; hic enim vomitum plerum-
" que movere ſolet. De cantu fontis Sanenirii nihil hactenus intellexi, ſed Deo, bene
" juvante, inquiram. Optimo FRAMBESARIO ſucum factum fuiſſe exiſtimo; nam
" experientia me docuit, aquas Sanenirii non minus quam cæterorum transferri
" poſſe. Inquiram pariter de fodinis Franchimontanis, quarum non niſi genera-
" lem modo notitiam habeo. De ſale, qui ex his aquis elici poteſt, vide, ſi pla-
" cet HELMONTIUM, qui illum, ſi recte memini, eſurinum appellat: paucus
" omnino eſt, nec credo ELICHMANNUM illo medelas ſuas, ut tibi relatum eſt,
" perfeciſſe. Celebrabantur hic quoque ante annos viginti catapotia ex aquarum
" Spadanarum ſale; ſed tandem reprehenſum eſt, nihil omnino illius continere.
" Et ſi tanti eſt, ecce illorum compoſitionem R. vitrioli martis ℥i tartari vitrio-
" lati ℥ß, ſucci liquiritiæ inſpiſſati q. s. addunt quidam ſcammon. præpar. ʒij ut
" cathartica fiant; nam, abſque eo, deobſtruunt tantum, non purgant: doſis
" eſt duo vel tria piſi mediocris magnitudine. Sed hæc ſunt alterius fori. Li-
" teris tuis reſpondere decreveram, verum jam epiſtolæ modum exceſſi. Vale
" itaque, vir nobiliſſime, meque tui ſemper obſervantiſſimum ama, ut ſoles, &
" cum ad clariſſimum WALLISIUM ſcribes, plurimam illi nomine meo ſalutem
" adſcribito. Dabam Leodii 8 Feb. 1674."

Mr. HOOKE produced a quadrant of four inches diameter, with teleſcopical ſights, to be made uſe of by two obſervers, and diſtinguiſhing to minutes.

He was put in mind of his other quadrant, whereby parallaxes, refractions, &c. may be obſerved in ſeconds by one obſerver.

*Febtuary* 26. At a meeting of the COUNCIL were preſent:

The lord viſcount BROUNCKER, preſident;

| | |
|---|---|
| Sir JOHN LOWTHER, | Mr. HOSKYNS, |
| Sir WILLIAM PETTY, | Mr. HILL, |
| Sir CHRISTOPHER WREN, | Mr. CREED, |
| Mr. COLWALL, | Mr. OLDENBURG. |

Mr. HOSKYNS was ſworn as a member of the council.

Sir JOHN LOWTHER having made a report of the ſums, which he had received, in ſoliciting the arrears of ſome of the fellows of the Society, and taken notice, that ſome had pretended, that they had been long abſent out of England; others, that they had been drawn into the Society contrary to their inclination; others, that they had been ignorant of the duty of weekly contributions; he therefore deſired to be inſtructed what anſwer to give to ſuch excuſes.

It was reſolved thereupon, that it ſhould be left to the diſcretion of the committee, how to proceed with ſuch perſons; and that they ſhould endeavour to get what they could of ſuch arrears. And in the mean time it was thought adviſeable to ſolicit thoſe firſt, who were moſt likely to pay the whole of their arrears, and then to take part from thoſe, who were unwilling to pay all.

It was ordered, that the council be ſummoned again, to meet the next day, at four in the afternoon, at Arundel Houſe, farther to adviſe with the earl marſhal, about ſoliciting the arrears of the lords, who were members of the Society; as alſo to conſider about putting into better order and uſe the library, which his lordſhip had beſtowed on the Society.

At a meeting of the SOCIETY on the ſame day,

Mr. HOOKE ſhewed an experiment of the inclination of the lines of direction to the axis of the terrella; which he performed by placing a terrella in an hemiſpherical hole cut in a round table, and ordering the terella ſo, that the axis lay level with the ſurface of it. Upon the ſurface of this table was placed a large ſkin of parchment, ſtretched on a hoop like a drum head, in the middle of which was cut a circular hole, juſt big enough to receive the terrella. Upon this parchment were ſifted fine filings of iron, which by the gentle vibration of the extended parchment ſoon ranged themſelves into magnetical orbs, which were thought to be all of an oval figure, and of ovals of one kind, but of different bigneſs, and all of them to touch the axis in the center of the loadſtone. But theſe being only conjectures, and not certainly verified, it was thought proper, in order to the clearer and more certain diſcovery thereof, that there ſhould be other methods attempted to make it out; which Mr. HOOKE propounded, and engaged to have at leaſt ſome of them ready againſt the next meeting.

He obſerved farther, that a loadſtone being moved to and fro under the parchment, on which the filings lay ſcattered, thoſe filings all roſe up, like ſo many briſtles, making an appearance, as if the loadſtone had been ſeen through the parchment.

He likewiſe applying a loadſtone cloſe to a ſmall piece of tin, the ſtone ſeemed to hold it both after it was rubbed, and without rubbing.

He ſuggeſted alſo the making of experiments with a capped and uncapped loadſtone, interpoſing a ſingle paper between it and a piece of tin.

He was deſired alſo to ſhew ſome of theſe experiments at the next meeting.

*February* 27. At a meeting of the COUNCIL at Arundel Houſe were preſent

The lord biſhop of Saliſbury vice-preſident, in the chair,
The earl marſhal,
Sir JOHN LOWTHER,
Sir PAUL NEILE,
Sir WILLIAM PETTY,

Sir ROBERT SOUTHWELL, Mr. CREED,
Mr. HILL, Mr. OLDENBURG.

It was ordered, that Mr. EDWARD BERNARD, Savilian profeſſor of aſtronomy at Oxford, having deſired by Mr. HOOKE the loan of a Diogenes Laertius, and of a Coptic Pſalter, out of the library beſtowed upon the Society by the earl marſhal, be accommodated with the ſaid book for the ſpace of a month, he giving bond of an hundred pounds to the Society, to reſtore thoſe books at the end of the ſaid month, to be accounted from the date of this order: and

That Mr. HOOKE take care of having the catalogue of the Arundelian library completed within a month, and to have a duplicate made thereof.

The earl marſhal took a liſt of ſome of the noblemen of the Society, who were deep in arrears, as the duke of Buckingham, marquis of Dorcheſter, earl of Dorſet, earl of Northampton, earl of Peterborough, earl of Carliſle, lord viſcount Yarmouth, lord CAVENDISH, and Mr. EDWARD HOWARD.

He named upon occaſion Mr. THOMSON and Mr. NELTHROP as very good men to put the four hundred pounds legacy to upon uſe at 6 per cent.

*March* 5. The preſident and all the vice preſidents being abſent, the Society did not ſit; yet Mr. HOOKE repeated the magnetical experiment, which had been made at the laſt meeting, and which ſeemed to confirm that phænomenon of the magnetical orbs ranging themſelves into elliptical figures.

There were alſo made ſome experiments with a loadſtone, capped and uncapped, viz.

The ſouth end of an uncapped magnet, with a ſingle paper between it, and a ſmall bar of ſteel ſuſpended, held the ſaid bar with four drachms and fifteen grains.

The ſame ſouth end capped, without paper, held the ſaid bar with ſeven ounces and one drachm.

The ſame ſouth end capped, with a ſingle paper interpoſed, held that bar, with one ounce, five drachms, and an half.

*March* 12. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER preſident,
The lord biſhop of Saliſbury, Mr. COLWALL,
Sir JOHN LOWTHER, Mr. HILL,
Sir WILLIAM PETTY, Mr. CREED,
Sir CHRISTOPHER WREN, Mr. OLDENBURG.

There was read a letter from the earl marſhal to Mr. OLDENBURG, wherein his lordſhip propoſed a method of well diſpoſing the four hundred pounds legacy to ſome conſiderable citizens, with whom his friends had lodged conſiderable ſums of money.

The council having debated this matter, thought proper to refer the determination thereof to another meeting of the council, ordering, in the mean time, that their hearty thanks ſhould be given to the earl marſhal for his care of the concerns of the Society.

At a meeting of the SOCIETY on the ſame day,

Mr. HOOKE endeavoured to ſhew a new way of making a loadſtone ſet itſelf north and ſouth; which was, by ſuſpending it by a ſtring faſtened to the two ears of a cap, like the cap of a magnetical needle, which was convertible upon the ſharp point of a needle. But the contrivance not proving tender enough, he was deſired to fit it better for the next meeting.

He intimated a theory for finding the loadſtone's variations all over the world, and promiſed to make an apparatus for it againſt the next meeting, and particularly a rete for the magnetical meridian.

The experiment about the inclination of the magnetical direction to the axis of the terrella being again made, and thoſe lines conſidered, ſeveral of the members doubted whether they were ovals of one kind. Mr. HOOKE was therefore deſired to contrive ſome method of determining this point.

Dr. GREW produced two intire microſcopical obſervations, about the texture of a piece of a trunk of a Walnut-tree, and of one of the trunks of a hazel-tree.

Mr. OLDENBURG preſented his 8th volume of the *Philoſophical Tranſactions* for 1673.

There were alſo preſented by Mr. OLDENBURG, from Mr. REID of Lugwarein in Herefordſhire, ſome red-ſtreak grafts, of which thoſe members of the Society, who had opportunity to propagate that cider-fruit, took what quantities they had occaſion for.

*March* 19. Mr. HOOKE gave an account of a theory for finding the variation of the magnetic needle all over the world; of which he ſaid, that he knew not, whether it was coincident with that of Mr. HENRY BOND, who many years before had pretended to know ſuch a theory *; whence he could likewiſe deduce the longitude.

* See an account of his undertakings on this ſubject, in the Philoſoph. Tranſact. vol. viii. n° 95. p. 6065, for June, 1673.

The

The ſubſtance of Mr. HOOKE's theory is, that the magnet hath its peculiar pole, diſtant ten degrees from the pole of the earth, about which it moves; ſo as to make a revolution in three hundred and ſeventy years: whence the variation hath altered of late about ten or eleven minutes every year, and will probably ſo continue to do for ſome time, till it begins to grow ſlower and ſlower, and will at length be ſtationary and retrograde, and in probability may return. But whether it be ſo or not, or whether it proceeds in a meridian, or in a parallel or great circle, or any other irregular curve, and if in a curve, whether its concave or convex ſides be towards us, more time and obſervations muſt make clear. But it ſeems moſt probable, by comparing ſeveral declinations, obſerved by capt. JAMES[f] and others, that the progreſs of this magnetical north pole is from weſt to eaſt beyond the north pole.

Mr. HOOKE propoſed the making of an eaſy and nice inſtrument, for obſerving exactly the variations of the needle in many different parts of the world; and he was deſired to procure it to be made.

Mr. OLDENBURG read two letters written to him; one in Latin from CHRISTOPHER SANDIUS, dated at Hamburgh 27th February, $167\frac{3}{4}$[g], containing the authority, which he had for aſſerting ſuch an origin of pearls, as in his former letter of 15th December, 1673, he had delivered.

The other was from ANDREAS MULLERIUS at Berlin, without a date, containing an offer of an anonymous perſon, of furniſhing a key of the Chineſe language, for a recompence; and that key to be learned with great eaſe and expedition, even by ordinary capacities.

It was ordered, that the writer of this letter be deſired to ſend the Society a ſpecimen of his performance by means of his invention.

1674, *March* 26. RENATUS FRANCISCUS SLUSIUS, canon of Liege, was propoſed candidate by Mr. OLDENBURG, upon a letter of his, dated $\frac{13}{23}$ March, $167\frac{3}{4}$[h].

Signor PACICHELLI, a Roman abbot, then at Colen, and highly commended by Mr. OLDENBURG, was propoſed candidate by Mr. BOYLE.

Mr. HOOKE repeated his diſcourſe made at the laſt meeting, concerning an hypotheſis for ſolving the phænomena of all the variations of the magnetical needle all over the world; as alſo his purpoſe of preparing an eaſy and accurate way, to be ſent abroad, for making exact magnetical obſervations.

He was deſired to begin himſelf, by making good obſervations of the needle's

[f] Captain THOMAS JAMES, whoſe voyage for the diſcovery of a north weſt paſſage into the South Sea, was printed at London, 1633, in 4to.

[g] Letter-book, vol. vii. p. 35. It is printed in in the Philoſoph. Tranſact. vol. ix. n. 101. p. 11.

[h] Letter-book, vol. vii. p. 49.

variation here; and, in order thereunto, to fix a certain meridian at Greſham College; which he undertook to do by the north ſtar.

Dr. DANIEL Cox's paper, concerning his way of extracting volatile ſalts and ſpirits out of vegetables, was read, and much applauded; and he being abſent, it was ordered, that Mr. OLDENBURG ſhould give him the hearty thanks of the Society; and that this diſcourſe ſhould not only be regiſtred [i], but likewiſe forthwith printed [k].

Mr. BOYLE remarked, that to his knowledge the Dr. had been maſter of this way eight years before.

*April* 2. Mr. HOOKE ſhewed ſome experiments, concerning the various ways, that the magnetical effluvia bend and inflect themſelves, by putting divers ſtrait ſteel bars in the pole of the magnet, ſome ſhorter, ſome longer, ſome cloſe to it, ſome at a diſtance, ſome in direction, ſome croſs-wiſe; the effect whereof was, that the filings of iron being ſtirred by gentle knockings of the extended parchment, ranged themſelves into oval or curve figures about the bars, but in a quite different form from what they would have received, had thoſe bars of iron been loadſtones of the like ſhape; that is, the poles ſeemed to lie in theſe, where the equinoctial would have been in a magnet, and the equinoctials of theſe would have been the poles of loadſtones of like ſhape.

He promiſed to proſecute theſe experiments, by applying bodies of iron of other figures to the terrella.

He mentioned alſo, that whereas a loadſtone would attract a red-hot iron, ſteel would not be at all affected by it.

Dr. GREW ſhewed his microſcopical obſervations on the trunks of apple, pear, and plum-trees, and promiſed to bring in an account of theſe and his former obſervations.

Mr. OLDENBURG read a letter to himſelf from Mr. LISTER, dated 12th *March*, $167\frac{3}{4}$ [l], giving an account of an obſervation of Dr. JOHNSON of Pontefract, concerning ſome ſtones of a perfect gold colour found in animals.

*April* 9. The Society did not meet.

*April* 16. The Society did not meet.

*April* 23. Mr. HOOKE ſhewed by a microſcope the inward texture of a bull-ruſh, conſiſting of pipes interwoven from one end to the other, in the manner of a hurdle, or reſembling looſe needle-work.

[i] It is not in the Regiſter.

[k] It is printed in the Philoſoph. Tranſact. vol. ix. n° 101. p. 4. for March, 1674.

[l] It is printed in the Philoſoph. Tranſact. vol. ix. n° 101, p. 9 for March, 1674.

He

He made an experiment for diſcovering, whether a bar of ſteel, touched by the immediate contact of a loadſtone would more ſtrongly move to it, than untouched. It was found, that the ſteel ſuſpended at a balance, and counterpoiſed, when thus touched, bore the ſame weight when untouched.

He likewiſe produced a quadrant with teleſcopical ſights, wherein appeared the pre-eminence of ſuch ſights above the common dioptra's.

Mr. OLDENBURG read a letter to himſelf from Mr. HEVELIUS, dated at Dantzick, 26th March, 1674 [m], giving an account of the manuſcripts of KEPLER, purchaſed by the ſaid HEVELIUS, with a defence of the dioptræ hitherto uſed by himſelf, and alledging ſome difficulties in the uſe of teleſcopical ſights. Further, giving notice, and ſending an epitome of a new aſtronomical theory, advanced by Dr. WASMUTH, profeſſor of the oriental languages in the univerſity of Kilo in Holſtein, who intended to publiſh a book of it, with this title, *Annales Cæli & Temporum perpetui; ſive Myſteria Aſtronomo-chronologica, a ſeculo abſcondita, nunc per Dei gratiam detecta & evidenter aſſerta libris tribus.* In this letter Mr. HEVELIUS deſcribes a phænomenon ſeen by himſelf about Marienburgh in Pruſſia, 5th February, $167\frac{4}{5}$, wherein the ſun appeared with a very long tail, and a mock-ſun directly under him [n].

Laſtly, He ſignified, that the French aſtronomers had obſerved the ſun to have no parallax at all.

To the laſt part of this letter Mr. HOOKE ſaid, that it was deſireable to know by what method the French aſtronomers had made that obſervation of the ſun's having no parallax at all; that he was perſuaded, that if the obſervations were made with teleſcopical ſights, ſome, though a very ſmall, parallax of the ſun would be found; and that by the naked eye, be the inſtruments never ſo accurate, one cannot obſerve to leſs than a minute; whereas that parallax will ſcarce perhaps amount to a quarter of a minute.

*April* 30. Mr. HOOKE excuſed himſelf, that his quadrant formerly promiſed was not yet ready.

He made an experiment, whether an iron ring would, by any magnetical virtue, be kept in a poſture encompaſſing the terrella at equal diſtance. And it was found, upon making ſeveral eſſays with the ſaid ring, that at length it reſted about the terrella unmoved, lying upon a board in water. This was tried, to ſee whether any thing could be found here below analogous to the circle about the planet Saturn.

It was moved, that experiments might be made, to find,

[m] Letter-book, vol. vii. p. 71. Part of it is printed in the Philoſoph. Tranſact. vol. ix. n° 102. p. 27. for April, 1674.

[n] Philoſoph. Tranſact. n° 102. p. 26.

1. Whether

1. Whether all parts of the terrella have an attraction directly towards its center?

2. Whether, if there be any such attraction, that attraction be in all places of the terrella of equal ſtrength; for inſtance, in the æquator as ſtrong as in the axis?

3. Having by trials found, what the approaches of magnetical bodies to the magnet are, according to the different poſition of the magnet, perpendicular, horizontal, and oblique; to endeavour to find out, ſince the approaches are made in a curve line, what kind of curve it is?

Mr. HOOKE ſuggeſted, that the beſt dipping-needles may be made in water, becauſe the water takes off the gravity; as alſo, that a pipe of iron ſhould be made of equal gravity with water dipping.

Mr. OLDENBURG read a copy of a letter written to Mr. HEVELIUS by Dr. WASMUTH *, importing, that the ſaid Dr. rejecting all the three famous hypotheſes of aſtronomy, had pitched upon another, of his own invention, viz. of ſolving all the irregularities and phænomena of the cœleſtial motions by a ſpiral line.

Mr. HOOKE intimated, that this hypotheſis was not new, the lord chanceſlor BACON having uſed it in his *Opuſcula*. And Mr. OLDENBURG added, that he had found the ſame in the *placita Philoſophica Quarini*, who had adopted and maintained the ſame theory.

There being many other very magnificent promiſes in this letter of Dr. WASMUTH, the ſenſe of the members preſent ſeemed to be, that he had promiſed too much to anſwer expectation.

*May* 7, 14, 21, and 28. there was no meeting of the Society.

*June* 4. Mr. OLDENBURG preſented to the Society four books; viz. 1. From Mr. BOYLE, intitled, *About the Excellency and Grounds of the mechanical hypotheſis ſome Conſiderations propoſed to a friend by* R. B. E. *Fellow of the Royal Society*, printed at London, 1674, in 4to. 2. *Navigation and Commerce, their Original and Progreſs; containing a ſuccinct account of Traffick in general, its Benefits and Improvements; of Diſcoveries, Wars, and Conflicts at ſea, from the original of Navigation to this day, with ſpecial regard to the Engliſh Nation; their ſeveral Voyages and Expeditions unto the beginning of our late Differences with Holland: in which his Majeſty's title to the Dominion of the Sea, is aſſerted againſt the novel and late pretenders: by* JOHN EVELYN, Eſq; F. R. S. printed at London, 1674, in 8vo. 3. *Icones & Deſcriptiones rariorum Plantarum Siciliæ, Melitæ, Galliæ, & Italiæ, Authore* PAULO BOCCONE, *Panormitano Siculo:* printed at Oxford, in 1674.

* Letter-book, vol. vii. p. 87. It is printed in the Philoſoph. Tranſact. vol. ix. n° 104 p. 74. for June, 1674.

4. *Re-*

4. *Recherches & Obſervations Naturelles*, by the ſame author: printed at Amſterſtam, 1674, in 8vo. With theſe two laſt books, there were preſented alſo from the author three curious pieces of coralline ſubſtances, for the repoſitory of the Society.

Mr. OLDENBURG read a diſcourſe of Dr. DANIEL COXE, concerning vitriol[p], tending to diſcover the nature of that ſubſtance, and to give farther light in the inquiry into the principles and properties of their minerals. This diſcourſe was highly applauded, and the author was deſired to continue his experiments and obſervations on that ſubject.

Mr. HOOKE being called upon for his new aſtronomical quadrant, ſaid, that he hoped, that it would be finiſhed very ſoon: and being deſired to acquaint the Society with the performances to be expected from this inſtrument, he anſwered,

That it was a quadrant ſo contrived, as to perform what could be required from any aſtronomical inſtrument; the particulars whereof he intended ſhortly to publiſh in print. He was deſired to haſten the finiſhing of ſo noble and ſo uſeful an inſtrument; and to get it ready, if poſſible, againſt the next meeting.

He was put in mind of preparing ſuch experiments as might determine thoſe particulars, which were ſuggeſted by him 30th April, 1674.

*June* 11. The Society did not meet.

*June* 18. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,

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|---|---|
| Sir CHRISTOPHER WREN, | Mr. HILL, |
| Sir ROBERT SOUTHWELL, | Mr. CREED, |
| Mr. COLWALL, | Mr. OLDENBURG. |

The preſident propoſed, that, conſidering the ſmall number of members, who attended the weekly meetings of the Society, by reaſon of the ſeaſon of the year, wherein many go into the country, the fixed meetings be adjourned till autumn: and that in the mean time the council might ſometimes meet, and conſider of a better way than hitherto had been uſed, to provide good entertainment for the ſaid meetings, by eſtabliſhing lectures grounded upon, and tending to experiments.

At a meeting of the SOCIETY on the ſame day,

The Society was adjourned till the preſident ſhould ſend out ſummons to return to their weekly meetings. In the mean time the council were to conſider of a method of proſecuting the work of the Society with more vigour than had been done of late.

[p] It is printed in the Philoſ. Tranſact. vol. ix. n° 103. p. 41. and n° 104. p. 66.

*August* 27. At a meeting of the COUNCIL were preſent

Sir WILLIAM PETTY vice-preſident, in the chair,
Sir JOHN LOWTHER, Sir PAUL NEILE,
Sir JOHN CUTLER, Mr. OLDENBURG.
Sir CHRISTOPHER WREN,

It was conſidered by this council, that to make the Society proſper, good experiments muſt be in the firſt place provided, to make the weekly meetings conſiderable, and that the expences for making theſe experiments muſt be ſecured by legal ſubſcriptions, for paying the contributions: which being done, the council might then with confidence proceed to the ejection of uſeleſs members.

*September* 29. At a meeting of the COUNCIL were preſent

Sir WILLIAM PETTY, vice-preſident, in the chair,
Sir ROBERT SOUTHWELL, Mr. COLWALL,
Dr. GODDARD, Mr. OLDENBURG.

It was ordered, that there ſhould be prepared a form of a legal ſubſcription, for paying fifty-two ſhillings a-year.

Sir WILLIAM PETTY propoſed, that there might be drawn up ſome thing, that might effectually tend to put new vigour into the meetings of the Society, and to bring in the arrears, by repreſenting, that the council having conſidered the preſent condition of the Society, ariſing from the want of good experimental entertainment at their meetings, and from the neglect of the members in paying their weekly contribution, had thought it neceſſary to fix a certain number of fellows, able and willing to entertain the Society every week with a conſiderable experimental diſcourſe; and for the defraying of the expence neceſſary for the making of experiments, to appoint a ſolicitor to call in their arrears, and to acquaint ſuch as are in arrears with the obligation, which they had ſubſcribed to upon their admiſſion, and with the Society's intention of proceeding to a legal recovery of their arrears againſt ſuch, as ſhould refuſe or delay the payment thereof.

*October* 7. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,
Sir JOHN LOWTHER, Dr. WALTER NEEDHAM,
Sir WILLIAM PETTY, Dr. CREED,
Dr. GODDARD, Mr. OLDENBURG.
Mr. COLWALL,

It was ordered, that as many of the fellows, as were willing to further the buſineſs of the Society, ſhould be deſired to advance a year's weekly contribution, for carrying on the work thereof with more vigour than hitherto; and that Sir WILLIAM

WILLIAM PETTY be desired to draw up a declaration to recommend the said advance accordingly:

That such of the fellows, as regard the welfare of the Society, should be desired to oblige themselves to entertain the Society, either *per se* or *per alios*, once a year at least, with a philosophical discourse grounded upon experiments made or to be made; and, in case of failure, to forfeit five pounds. And that Sir WILLIAM PETTY be likewise desired to draw up a form of such an obligation, as may bind in law: and

That Sir JOHN LOWTHER, Sir WILLIAM PETTY, and Mr. HOOKE do meet together, and consider of a safe and beneficial way of putting out the four hundred pounds, left by the late Dr. WILKINS, bishop of Chester.

Mention was made of finding out a fit person to call in the arrears, after that the meetings of the Society shall have been made more considerable by experimental entertainments: as also of thinking of a way to put Chelsea College and the land to some use.

*October* 15. At a meeting of the COUNCIL were present

Sir WILLIAM PETTY, vice-president, in the chair,
Dr. GODDARD, Mr. CREED,
Mr. COLWALL, Mr. OLDENBURG.

The two draughts of the declaration for restoring the Society, brought in by Sir WILLIAM PETTY and Dr. GODDARD were read, and the substance of both reduced into one paper, which the amanuensis was ordered to transcribe fair for farther consideration at the next meeting of the council.

It being represented, that the permitting of such, as are not of the Society, to be present at the meetings thereof, is both troublesome and prejudicial to the same, it was ordered, that the repeal of that statute, which allows such an admission, and which is the second of the fourth chapter, containing the statutes about the ordinary meetings of the Society, shall be propounded at the next meeting of the council.

It being likewise represented, that the liberty of divulging what is brought in to the meetings of the Society is also prejudicial to the same, and renders divers of the members thereof very shy of presenting to them what they have discovered, invented, or contrived; it was moved, that a form of a statute might be prepared, injoining secresy to the members of the Society in such matters, as shall be brought in, and by the president or vice-president declared to be kept secret, as the communicators desire.

A form to this end was proposed as follows:

" Every fellow of the Royal Society ſhall make a ſolemn promiſe before the " ſame, not to diſcover, directly or indirectly, to any perſon, not being of the " Society, ſuch obſervations, experiments, or other communications, as ſhall be " brought in to the meetings of the ſame, and there by the preſident or one of the " vice-preſidents declared to be kept ſecret, at the deſire of the communica- " tor."

The time of the ſummoning of the Society to return to their weekly meetings being ſpoken of, it was reſolved, that ſince the 29th of October [9], and the 5th of November, falling both upon a Thurſday, which is the Society's meeting-day, would prove inconvenient for their meetings, the ſaid ſummons ſhould be made for the 12th of November; and to the end that the fellows might have notice what of late had been conſidered and done by the council in order to put life into theſe meetings, it was concluded upon, that the form of theſe ſummons ſhould be as follows: viz.

" Theſe are to give notice, that the Royal Society intends to return to their " public meetings on Thurſday the 12th of November inſtant, 1674, in Greſham " College, at three of the clock; at which time the company will be entertained " with an experimental exerciſe by their preſident, the lord viſcount BROUNCKER, " or Dr. WALLIS. The like will be performed the next meeting-day, being the " 19th of November, by the honourable ROBERT BOYLE, and the 26th of the " ſame month by Sir WILLIAM PETTY, or, in the abſence of any of them, by " Mr. ROBERT HOOKE their curator by office; in order to a vigorous proſecu- " tion of the ends of their inſtitution; touching which the intentions of the coun- " cil of the ſaid Society will be farther declared on the day of their anniverſary " election, being the 30th of this inſtant November."

Memorandum: To conſider of the four hundred pounds legacy, and Chelſea College, at the next meeting.

*October* 19. At a meeting of the COUNCIL were preſent

Sir WILLIAM PETTY, vice-preſident, in the chair;
Sir ROBERT SOUTHWELL, — MR COLWALL,
Dr. GODDARD, — Mr. OLDENBURG.

The buſineſs of engaging the members of the Society to enter into a legal obligation, in reference to their weekly payments, and the declaration drawn up by Sir WILLIAM PETTY and Dr. GODDARD, and the form alſo for ſummoning the Society to return to their weekly meetings being again conſidered of, as the main things to be determined with all poſſible ſpeed; it was ordered, firſt, that Sir ROBERT SOUTHWELL ſhould be deſired to apply himſelf to the attorney-general [a], and to deſire his advice in drawing up ſuch a form, as might be binding in law:

[9] The day of the inauguration of the lord-mayor of London.
[a] Sir FRANCIS NORTH, afterwards lord keeper of the great ſeal.

Secondly,

Secondly, That the declaration and the form of ſummons be likewiſe read again, and conſidered of at the next council.

Mr. HOOKE acquainted the council, that Sir JONAS MOORE had been with him at Chelſea College, and made an overture of engaging a gardiner, a ſufficient man, to take a leaſe of the houſe and land about it, for a conſiderable number of years, on condition of repairing the houſe and wall in the land, and paying a yearly rent for it; allowing withal to the Society a power to make hortulan experiments there; as alſo to build an aſtronomical obſervatory; which latter Sir JONAS MOORE himſelf would undertake to do at his own charges, to the value of an hundred and fifty or two hundred pounds.

This propoſition was well accepted by the council, and Mr. HOOKE was deſired to proſecute the buſineſs, by urging Sir JONAS MOORE to proceed farther in this affair.

The legacy of the four hundred pounds being alſo again conſidered of, and Sir WILLIAM PETTY having made an overture of laying out that ſum upon a houſe of the late captain GRAUNT in Birchen Lane, the council deſired, that Sir JOHN LOWTHER, Sir WILLIAM PETTY, and Mr. HOOKE would meet together and ripen that buſineſs.

It was voted, that the ſecond ſtatute of the fourth chapter of the book of ſtatutes be repealed; and it was repealed and made void accordingly.

*October* 30. At a meeting of the COUNCIL were preſent

The lord biſhop of Saliſbury, vice-preſident, in the chair,
Sir JOHN LOWTHER, Mr. GODDARD,
Mr. COLWALL, Mr. OLDENBURG,
Mr. HOSKYNS,

The form of the ſummons to the Society for returning to their weekly meetings being read again, it was thought fit to omit the names of the perſons, who were to entertain the Society, and to let it be as follows:

" Theſe are to give notice, that the Royal Society intends to return to their " public meetings on Thurſday, being the 12th of this inſtant November, 1674, " in Greſham College, at three of the clock; at which time and the following " days of their meetings the company will be entertained with experimental ex- " erciſes, to be performed by ſeveral eminent members of the ſame, in order to " a more vigorous proſecution of the ends of their inſtitution; touching which " the intentions of the council of the ſaid Society will be farther declared on the " day of their anniverſary election, being the 30th of this inſtant November."

This was ordered to be forthwith committed to the preſs.

The form for a new ſubſcription, drawn up by the attorney-general, was read

and approved of; and it was ordered, that Sir ROBERT SOUTHWELL be thanked for his care in procuring it, and withal desired to acquaint the attorney-general with the acknowledgments of the council for this his favour.

The declaration drawn up by Sir WILLIAM PETTY and Dr. GODDARD was read again: whereupon it was mentioned, that Sir ROBERT SOUTHWELL had taken a copy of it, in order to shew it to the lord keeper *.

Mention was again made of two propositions, one made by Sir WILLIAM PETTY, relating to the putting out of the four hundred pounds legacy; the other by Sir JONAS MOORE, concerning the letting out of Chelsea-College.

Both being well accepted of, it was thought necessary, that both the proposers should be desired to put their respective propositions in writing, that so both the businesses, to which they related, might with the more certainty and vigour be put in execution.

A memorandum of business for the next meeting:

1. About printing the form of a new subscription.

2. Sending out one to call in money.

3. Renewing the order for the treasurer's deputation.

4. What to do with the declaration.

5. To think of more entertainers of the Society.

*November* 9. At a meeting of the COUNCIL were present

The lord viscount BROUNCKER, president,

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|---|---|
| Sir JOHN LOWTHER, | Mr. HILL, |
| Sir WILLIAM PETTY, | Mr. GODDARD, |
| Sir ROBERT SOUTHWELL, | Mr. COLWALL, |
| Mr. HOSKYNS, | Mr. OLDENBURG. |

The form of the new subscription was agreed upon, as follows:

"I A. B. do grant and agree to and with the president, council, "and fellows of the Royal Society of London for improving natural knowledge, "that so long as I shall continue a fellow of the said Society, I will pay to the "treasurer of the same for the time being, or to his deputy, the sum of fifty-"two shillings *per annum*, by four equal quarterly payments, at the four usual "days of payment, that is to say, the feast of the nativity of our Lord, the feast

* HERBAGE lord FINCH.

" of the annunciation of the bleſſed Virgin MARY, the feaſt of S. JOHN BAP-
" TIST, and the feaſt of St. MICHAEL the archangel, the firſt payment to be
" made upon the next enſuing the date of theſe preſents: and
" I will pay in proportion, viz. one ſhilling *per* week for any leſſer time, after
" any of the ſaid days of payment, that I ſhall continue fellow of the ſaid Soci-
" ety. For the true payment whereof I bind myſelf and my heirs in the penal
" ſum of twenty pounds. In witneſs whereof I have hereunto put my hand and
" ſeal this day of in the year

" Sealed and delivered in
" the preſence of

Mr. HOOKE's diſcourſe containing *Animadverſions on the firſt part of* Machina Cœleſtis *of the deſervedly famous aſtronomer*, JOHN HEVELIUS, &c. was licenſed for the preſs.

N° 107 of the *Philoſophical Tranſactions* was alſo licenſed.

Sir ROBERT SOUTHWELL redelivered to the council the declaration, which had been drawn up for the new regulating the Society, after he had read it to the lord keeper, who, he ſaid, well approved of it; and withal expreſſed his readineſs to ſerve the Society, and particularly in doing them good offices about his majeſty.

Sir ROBERT SOUTHWELL was thanked by the council, both for this care, and that other of procuring for them from the attorney general the legal form of ſubſcription, inſerted above; and he was deſired, in the name of the council, to aſſure the lord keeper and attorney general of the deep ſenſe, which the council had of their favour to the Society, and their regard to the welfare of the ſame.

Sir WILLIAM PETTY propoſed in writing ſeveral ways of diſpoſing the four hundred pounds legacy. One was the inheritance of about eighty pounds *per annum* rent in ground and houſes in Hog-lane near long-alley in Moor-fields, and about eight pounds *per annum*, at Erith in Kent, which was then under mortgage for three hundred and fifty pounds, with about fifteen pounds arrears of intereſt. There was a claim of a dower on the premiſes, which might be had for under one hundred and fifty pounds.

The other way was, a houſe, viz. the Seven Stars in Birchin-lane, in leaſe to RICHARD HUTSON, who paid ninety-five pounds fine, and fifty pounds *per annum*, of which leaſe nineteen years and a half were then unexpired; which houſe was a leaſe of thirty-eight years yet to come; one of which a ground-rent of fourteen pounds *per annum* was to be paid.

Mr. HOOKE was deſired againſt the next meeting of the council to view the place in Hog-lane, whether the houſes were in good repair, and likely to be tenanted.

Sir

Sir WILLIAM PETTY was desired to engage Mr. BARLOW, the picture-drawer, to collect the arrears due to the Society; and that the said Sir WILLIAM, and Mr. HOSKYNS, do join in taking good security from Mr. BARLOW; and this being done, to direct him to Mr. COLWALL, the treasurer, to receive such instructions, as shall be requisite to render this business effectual, and particularly, to furnish him, under his hand, with the power of collecting the arrears in his name, according to a former order of the council, bearing date 5th January, 167$\frac{1}{4}$; which order was this day renewed to the said Mr. COLWALL.

Memorandum, that at the next meeting of the council it be considered, what persons might be engaged to entertain the Society in the month of December following: And,

That those intentions of the council, mentioned in the summons of the Society to return to their meetings, were chiefly, that now there are a legal subscription and a declaration, both subscribed by the council and some other members of the Society.

It was ordered, that two hundred and fifty copies be forthwith printed of the new form of subscription, and this, if possible, against the Thursday following.

*November* 12. At a meeting of the COUNCIL were present

The lord viscount BROUNCKER, president,

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|---|---|
| The earl marshal, | Mr. COLWALL, |
| The lord bishop of Sarum, | Mr. HILL, |
| Sir JOHN LOWTHER, | Mr. HOSKYNS, |
| Sir WILLIAM PETTY, | Mr. OLDENBURG. |
| Sir ROBERT SOUTHWELL, | |

A committee was appointed for auditing the accounts of the treasurer, consisting of the president, the two secretaries, Dr. GODDARD, and Mr. HOSKYNS: and it was left to them to meet at such time and place, as should seem most convenient to themselves.

The new form of a legal subscription for the weekly payments being again spoken of, it was thought necessary to make a statute concerning the same to this effect:

*Every person continuing, or to be hereafter admitted, fellow of this Society, shall sign, seal, and, as his act and deed, deliver an obligation in the following words:*

I do grant, &c. [1].

It being put to the vote by the president, whether this draught now agreed

[1] See the form above in the minutes of the meeting of the council of November 9.

upon

upon by the council ſhould be read at another meeting, it was unanimouſly carried in the affirmative.

Memorandum. 1. To inquire of Sir WILLIAM PETTY, whether he had engaged and taken ſecurity of Mr. BARLOW the collector.

2. To inquire of Mr. HOOKE, whether he had viewed the houſe in hog-lane.

3. To ſecure more perſons for experimental diſcourſes after St. Andrew's day.

4. To mention Dr. PLOT's propoſal recommended by Dr. WALLIS to the council.

On the ſame day the SOCIETY reſumed their weekly meetings [t].

Dr. WALLIS preſented them with, and read before them, *a diſcourſe of gravity and gravitation grounded on experimental obſervations*, and having a reference to two books not long before publiſhed by an anonymous author [u], the one intitled *an Eſſay concerning Gravitation or Non-Gravitation of Fluids* [x]; the other, *Difficiles Nugæ: or ſome Obſervations touching the* Torricellian *Experiments, &c.* [y]. The doctor was thanked for this diſcourſe, which was ordered to be entered into the Regiſter-book [z].

It being, among other particulars in diſcourſe upon the reading of Dr. WALLIS's paper, remarked, that the explication of the cauſe of ſpringineſs would contribute very much to illuſtrate the nature of air, Mr. HOOKE ſaid, that he had conſidered that ſubject, and particularly to make a ſpringy body out of a body not ſpringy.

Mr. HOOKE was deſired by the preſident, that if he ſhould perform what he mentioned, he would preſent the Society therewith in a diſcourſe: and being aſked, whether he could promiſe to bring it in at the firſt meeting of the Society after the approaching holydays, he anſwered, that he would endeavour to do ſo.

Mr. OLDENBURG preſented two ſmall books, one in French from *Charles Drelincourt*, M. D. intitled, *La Legende du Gaſcon: ou la Lettre de Charles Drelincourt à Monſ. Porrée ſur la Methode, pretendüe nouvelle, de tailler la pierre: avec trois autres a Monſ. Vallot, premier Medecin de ſa Majeſté*, printed at Leyden, 1674, in 12°. The other from Dr. SCHRADERUS, intitled, *Obſervationes de Generatione Animalium & Anatomico-medicæ.*

Mr. OLDENBURG was deſired to produce Mr. LEEWENHOECK's obſervations concerning air, blood, &c.

[t] They met at Greſham College.
[u] Sir MATTHEW HALE, lord chief juſtice of the King's Bench.
[x] Printed at London in 1674, in 8vo.
[y] Printed there the ſame year in the ſame form.
[z] Vol. iv. p. 203.

*November*

*November* 19. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,
Sir WILLIAM PETTY, Mr. HILL,
Dr. GODDARD, Mr. OLDENBURG.
Mr. HOSKYNS,

The declaration was read, and ordered to be read again on the Monday following, November 23, for which time a meeting of the council was agreed to be ſummoned.

It being put to the vote, whether the draught of the bond, voted at the laſt meeting of the council to be read at another meeting, ſhould paſs into a law, it unanimouſly paſſed in the affirmative.

Mr. HOOKE was again deſired to view the houſes in Hog-lane propoſed by Sir WILLIAM PETTY for laying out the four hundred pounds legacy upon, and to make a report to the council at their next meeting.

Mr. BARLOW, the deſigned collector, preſenting himſelf to the council, was deſired to bring in ſecurity, which he promiſed to do.

Perſons to entertain the Society in December were pitched upon, viz. Mr. RAY, Mr. COLLINS, and Dr. SMITH; and Mr. OLDENBURG was ordered to ſpeak or write to others concerning the buſineſs, and particularly to deſire them to name their time, when they would be ready for ſuch exerciſes.

Dr. ROBERT PLOT's deſign of making a ſurvey of all England for compiling a hiſtory of nature and art in reference to that kingdom was well approved of; and Mr. OLDENBURG ordered to aſſiſt him in directing him to ſuch of his correſpondents in the country, as were likely to direct and inſtruct him in this undertaking.

Sir WILLIAM PETTY, Mr. HOSKYNS, and Mr. HOOKE, were ordered to take care of the propoſal for diſpoſing of the four hundred pounds legacy upon the houſes and land in Hog lane.

It was ordered likewiſe, that the obſervations and experiments regiſtered be ſorted and reduced to ſeveral lectures, to be read at the Society upon occaſion.

At a meeting of the SOCIETY on the ſame day,

Mr. BOYLE preſented to the Society by the hands of Mr. OLDENBURG his *Experimental notes of the mechanical origin or production of fixedneſs, as oppoſite to volatility*; which diſcourſe was read and ordered to be regiſtered [a] as follows:

[a] Regiſter, vol. iv. p. 234.

"The

" The qualifications, that conduce moſt to the fixity of a portion of matter, " ſeem to be theſe:

" Firſt, the groſſneſs, or the bulk, of the corpuſcles it cónſiſts of; for if theſe " be too big, they will be too unwieldy, and unapt to be carried up in the air " by the action of ſuch minute particles as thoſe of the fire, and will alſo be " unfit to be buoyed up by the weight of the air; as we ſee, that vapours, " whilſt they are ſuch, are ſmall enough to ſwim in the air, but can no longer " be ſuſtained by it, when they convene into drops of rain or flakes of ſnow. " But here it is to be obſerved, that when I ſpeak of the corpuſcles, that a " fixed body conſiſts of, I mean not either its elementary or its hypoſtatical " principles, as ſuch, but only thoſe very little maſſes, or cluſters of particles, of " what kind ſoever they be, that ſtick ſo firmly to one another, as not to be " diviſible and diſſipable by that degree of fire, in which the body is ſaid to be " fixed; ſo that each of thoſe little concretions, though it may itſelf be made " up of two, three, or more, particles of a ſimpler nature, is conſidered here " *per modum unius*, or as one intire corpuſcle. And this is one qualification " conducive to the fixedneſs of a body.

" The next is the ponderouſneſs or ſolidity of the corpuſcles it is made up " of; for if theſe be very ſolid, and (which ſolid and compact bodies uſually " are) of a conſiderable ſpecific gravity, they will be too heavy to be carried up " by the effluvia, or the action of the fire, and their ponderouſneſs will make " them as unwieldy and indiſpoſed to be elevated by ſuch agents, as the groſſneſs " of their bulk would make bigger corpuſcles, but of a proportionably inferior " ſpecific weight. On which account the calces of ſome metals as gold, ſilver, " &c. though by the operation of ſolvents, or of the air, or of both, reduced " to powders exceedingly ſubtil, will reſiſt ſuch vehement fires, as will eaſily " drive up bigger, but leſs heavy and compact, corpuſcles than thoſe calces " conſiſts of.

" The third qualification, that conduces to the fixity of a body, belongs to " the internal parts, not barely as they are of ſeveral parts of it, but as they " are aggregated or contexed into one body: for the qualification I mean is the " ineptitude of the component corpuſcles for avolation, by reaſon of their " branchedneſs, irregular figures, crookedneſs, or other inconvenient ſhape, " which intangles the particles among one another, and makes them difficult to " be extricated; by which means if one of them do aſcend, others, wherewith it " is complicated, muſt aſcend with it, and whatever be the account, on which " divers particles ſtick firmly together, the aggregate will be too heavy or un- " wieldy to be raiſed; which I therefore take notice of, becauſe, that though uſu- " ally it is on the roughneſs and irregularity of corpuſcles, that their coheſion " depends; yet it ſometimes happens, that the ſmoothneſs and flatneſs of their " ſurface make them ſo ſtick together as to reſiſt a total divulſion; as may be " illuſtrated by what I have ſaid of the coheſion of poliſhed marbles and the plates " of glaſs, and by the fixity of glaſs itſelf in the fire.

" From this account of the cauſes or requiſites of fixity may be deduced the " following means of giving or adding fixation to a body, that was before either " volatile or leſs fixed. Theſe means may be reduced to two general heads: " firſt, the action of the fire, as the parts of the body, expoſed to it, are thereby " made to operate variouſly on one another: and next, the aſſociation of the " particles of a volatile body with thoſe of ſome proper additament, which term " of *proper* I rather employ, than that one would expect of *fixed*; becauſe it " will e're long appear, that, in certain caſes, ſome volatile bodies may more " conduce to the fixation of other volatile bodies, than ſome fixed ones do: but " theſe two inſtruments of fixation being but general, I ſhall propoſe four or five " more particular ones. And firſt, in ſome caſes it may conduce to fixation, that " either by an additament, or by the operation of the fire, the parts of a body " be brought to touch each other in large portions of their ſurfaces: for that " from ſuch a contact there will follow ſuch a mutual coheſion, as will at leaſt " indiſpoſe the touching corpuſcles to ſuffer a total divulſion, may appear probable " from what we lately noted of the coheſion of pieces of marble and glaſs, and " from ſome other phænomena, belonging to the *hiſtory of firmneſs*; from which " we may properly enough borrow ſome inſtances, at leaſt for illuſtration, in the " doctrine of *fixedneſs*; in regard, that uſually, though not always, the ſame " things, that make a body firm, give it ſome degree of fixity, by keeping it " from being diſſipated by the wonted degrees of heat and agitation it meets with " in the air. But to return to the contact we were ſpeaking of, I think it not " impoſſible (though you may perhaps think it ſtrange) that the bare operation " of the fire may, in ſome caſes, procure a coheſion among the particles, (and " conſequently make them more fixed) as well as in others disjoin them, and " thereby make them more volatile. For, as in ſome bodies the figures and ſizes " of the corpuſcles may be ſuch, that the action of the fire may rub or tear off " the little beards, or hooks, or other particles, that intangle them, and ſo make " the more eaſy for the corpuſcles to be diſingaged and fly upwards; ſo in other " bodies the ſize and ſhape of the corpuſcles may be ſuch, that the agitation " cauſed by the fire may rub them one againſt the other, ſo as by mutual attrition " to grind, as it were, their ſurfaces, and make them ſo broad and ſmooth, if " not alſo ſo flat, as that the contact of the corpuſcles ſhall come to be made accord- " ing to a large portion of their ſuperficies: from whence will naturally follow " a firm coheſion; which I ſhall illuſtrate by what we may obſerve among thoſe, " that grind glaſſes for teleſcopes and microſcopes: for theſe artificers by long " rubbing a piece of glaſs againſt a metaline diſh or do by " this attrition at length bring the two bodies to touch one another in ſo many " parts of their congruous ſurfaces, that they will ſtick firmly to one another, " ſo as ſometimes to oblige the workmen to uſe violence to disjoin them. And " this inſtance, (which is not the ſole I could alledge) may ſuffice to ſhew, how " a coheſion of corpuſcles may be procured by the mutual adaptation of their " congruous ſurfaces; and if two groſſer corpuſcles, or a greater number of " ſmaller, be thus brought to ſtick together, you will eaſily believe their aggre- " gate will prove too heavy or unwieldy for avolation. And to ſhew, that the " fire may effect a lævigation in the ſurface of ſome corpuſcles, I have ſome- " times cauſed minium, and ſome other calces, that I judged convenient, to be

" melted for a competent time in a vehement fire conveniently adminiſtered; " whereby, according to expectation, that, which was before a dull and incoherent " powder, was reduced into much groſſer corpuſcles, multitudes of whoſe grains " appeared ſmooth, glittering, and almoſt ſpecular, like thoſe of fine litharge of " gold; and the maſſes, that theſe grains compoſed, were uſually ſolid enough, " and of difficult fuſion. And when I made glaſs of lead *per ſe* (which I elſewhere " teach you to do) it is plain, that the particles of the lead are reduced to a " great ſmoothneſs; ſince, whereſoever you break the glaſs, the ſurfaces produced " at the crack will not be jagged, but ſmooth, and conſiderably ſpecular: nor " do I think it impoſſible, that even when the fire doth not make any great " attrition of the corpuſcles of the body to be fixed, it may occaſion their ſtick- " ing together: becauſe by long tumbling them up and down in various man- " ners, it may at length, after multitudes of revolutions and differing occurſions, " bring thoſe of their ſurfaces together, which, by reaſon of their breadth, " ſmoothneſs, or congruity of figure, are fit for mutual coheſion; and when " once they come to ſtick, there is no neceſſity, that the ſame cauſes, that were " able to make them paſs by one another, when their contact was but according " to an inconſiderable part of their ſurfaces, ſhould have the ſame effect now " when their contact is full; though, perhaps, if the degree of fire were much " increaſed, a more vehement agitation would ſurmount this coheſion, and diſſi- " pate again theſe cluſters of coaleſcent corpuſcles.

" Theſe conjectures will perhaps appear leſs extravagant, if you conſider what " happens in the preparation of quick-ſilver precipitated *per ſe:* for there running " mercury, being put into a convenient ſhaped glaſs, is expoſed to a moderate fire for " a conſiderable time (for I have ſometimes found ſix or ſeven weeks to be too " ſhort an one.) In this degree of fire the parts were variouſly tumbled, and " made many of them aſcend, till convening into drops on the ſide of the glaſs, " their weight carrys them down again; but at length, after many mutual oc- " curſions, if not alſo attritions, ſome of the parts begin to ſtick together in the " form of a red powder, and then more and more mercurial particles are faſtened " to it, till at length all, or much the greateſt part, of the mercury is reduced " into the like precipitate; which, by the coheſion of the parts being grown more " fixed, will not with the ſame degree of heat be made to riſe and circulate as " the mercury would before; and yet, as I elſewhere note, I have found by trial, " that with a greater and competent degree of heat this precipitate *per ſe* would, " without the help of any volatizing additament, be eaſily reduced into running " mercury again. Chemiſts and phyſicians, who agree in ſuppoſing this precipi- " tate to be made without any additament, will, perchance, ſcarce be able to give " a more likely account of the conſiſtency and degree of *fixity*, that is contained " in the mercury; in which, ſince no body is added to it, there appears not to be " wrought any but a mechanical change. And though, I confeſs, I have not " been without ſuſpicions, that, in philoſophical ſtrictneſs, this precipitate may " not be made *per ſe*, but that ſome penetrating igneous particles, eſpecially ſaline, " may have aſſociated themſelves with the mercurial corpuſcles; yet, even upon " this ſuppoſition, it may be ſaid, that theſe particles contribute to the effect, that " is produced, but by facilitating or procuring, by their opportune interpoſition,



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" the mutual coheſion of corpuſcles, that would not otherwiſe ſtick to one " another.

" Perhaps it will not be altogether impertinent to add on this occaſion, that " for the generality of chemiſts, as well others as Helmontians, that aſſert the " tranſmutation of all metals into gold by the philoſophers ſtone, methinks, they " may grant it to be probable, that a new and fit contexture of the parts of a " volatile body may, eſpecially by procuring a full contact among them, very " much contribute to make them highly fixed. For, to omit what is related by " leſs credible authors, it is averred upon his own trial by HELMONT, who pre- " tended not to the elixir, that a grain of powder, that was given him, tranſmuted " a pound (if I miſremember not) of running mercury, where the proportion of " the elixir to the mercury was ſo inconſiderable, that it cannot reaſonably be " ſuppoſed, that every corpuſcle of the quick-ſilver, that before was volatile, was " made extremely fixed merely by its coalition with a particle of the powder; " ſince, to make one grain ſuffice for this coalition, the parts, it muſt be divided " into, muſt be ſcarce conceivably minute; and therefore each ſingle part not likely " to be fixed itſelf; or, at leaſt, more likely to be carried up by the vehemently " agitated mercury, than to reſtrain that from avolation: Whereas, if we ſup- " poſe the elixir to have made ſuch a commutation among the corpuſcles of the " mercury, as (having made them ſomewhat perhaps change their figure, and " expelled ſome inconvenient particles) to bring them to ſtick to one another, ac- " cording to very great portions of their ſurfaces, and intangle one another; it " will not be diſagreeable to the mechanical doctrine of *fixity*, that the mercury " ſhould indure the fire, as well as gold, on the ſcore of its new texture; which, " ſuppoſing the ſtory true, appears to have been introduced by the new colour, " ſpecific gravity, indiſſolubleneſs in aquafortis, and other qualities, wherein gold " differs from mercury; eſpecially malleableneſs, which, according to our notes " about that quality, uſually requires, that the parts, from whoſe union it re- " ſults, be either hooked, branched, or otherwiſe adapted and fitted to make " them take faſt hold of one another, or ſtick cloſe to one another. And ſince " in the whole maſs of the factitious gold, all, ſave one grain, muſt be materi- " ally the ſame body, which, before the projection was made, was quick-ſilver, " we may ſee, how great a proportion of volatile matter may, by an inconſide- " rable quantity of fixing additament, acquire ſuch a new diſpoſition of its parts, " as to become moſt fixed. And, however, this inſtance will agree much better " with the mechanical doctrine about *fixity*, than with that vulgar opinion of the " chemiſts, wherewith it will not at all comply, that if in a mixture the volatile " part do much exceed the fixed, it will carry up that, or at leaſt a good portion " thereof, with it; and on the contrary. But, though this rule holds in many " caſes, where there is no peculiar indiſpoſition to the effect that is aimed at; yet, " if the mechanical affections of the bodies be ill-ſuited to ſuch a purpoſe, our " philoſophical experiment manifeſtly proves, that the rules will not hold, ſince " ſo great a multitude of grains of mercury, inſtead of carrying up with them " one grain of the elixir, are detained by it in the ſtrongeſt fire. And thus " much for the firſt way of fixing volatile bodies.

" The

"The second way of producing *fixity* is by expelling, breaking, or otherwise "disabling, those volatile corpuscles, that are too indispoſed to be fixed themſelves, or are fitted to carry up with them ſuch particles, as would not without "their help aſcend. That the expulſion of ſuch parts is a proper means to make "the aggregate of thoſe that remain more fixed, I preſume, you will put me "ſeriouſly to prove; and we have a manifeſt inſtance of it in ſoot, where the "many active parts were, by the violence of the fire and current of the air, carried up together by the more volatile parts: yet when ſoot is well diſtilled in a "retort, a competent time being given for the extricating and avolation of the "other parts, there will at the bottom remain a ſubſtance, that will not now "fly away, as it formerly did. And here let me obſerve, that the receſs of the "fugitive corpuſcles may contribute to the fixation of a body, not barely becauſe the remaining matter is freed from ſo many fixed, if not alſo volatizing, "parts: but as it may often happen, that upon their receſs the parts or intervals, they left behind them, are filled up with more ſolid or heavy matter; "and the body becomes, as more homogeneous, ſo more cloſe and compact. "And whereas I intimated, that, beſides the expulſion of unfit corpuſcles, they "may be otherwiſe diſabled from hindering the fixation of the maſs they belong "to; I did it, becauſe it ſeems very poſſible, that in ſome caſes they may, by "the action of the fire, be ſo broken, as with their fragments to fill up the "pores or intervals of the body they appertained to, or may make ſuch coalitions with the particles of a convenient additament, as to be no impediment to "the fixity of the whole maſs, though they remain in it; which poſſibly you "may think may well happen, when you ſhall have peruſed the inſtances annexed "to the fourth way of fixing bodies.

"The third means of fixing or leſſening the volitility of bodies is, by preſerving that reſt among the parts, whoſe contrary is neceſſary to their volatiliſation. "And this may be done by preventing or checking that heat or other motion, "which external agents ſtrive to introduce into the parts of the propoſed body. "But this means tending rather to hinder the actual avolation of a portion of "matter, or at moſt procure a temporary abatement of its volatility, than to "give it a ſtable fixity, I ſhall not any longer inſiſt on it.

"The fourth way of producing fixity in a body is by putting to it ſuch an "appropriated additament, whether fixed or volatile, that the corpuſcles of the "body may be put among themſelves, or with thoſe of the additament, into a "complicated ſtate or intangled contexture. This being the uſual and principal "way of producing fixity, we ſhall dwell ſomewhat the longer upon it, and "give inſtances of ſeveral degrees of fixation: for, though they do not produce "that quality in the ſtricteſt acceptation of the word *fixity*, yet it is uſeful in "our preſent inquiry to take notice, by what means that volatility comes to be "*gradually* abated, ſince that may facilitate our underſtanding how the volatility "of a body comes to be *totally* abated, and conſequently the body to be fixed.

"And firſt, we find, that a fixed additament, if its parts be conveniently "ſhaped, may eaſily give a degree of fixity to a very volatile body. Thus,

"ſpirit

" ſpirit of nitre, that will of itſelf eaſily enough fly away in the air, having its ſa-
" line particles aſſociated with thoſe of fixed nitre or ſalt of tartar, will with the
" alkali compoſe a ſalt of a nitrous nature, which will endure to be melted in a
" crucible, without being deprived even of its ſpirits. And I have found, that
" the ſpirits of nitre, that abound in aquafortis, being concoagulated with the ſil-
" ver, they corrode, though one would not expect, that ſuch ſubtile corpuſcles
" ſhould ſtick faſt to ſo compact and ſolid a body as ſilver; yet cryſtal, produced
" by their coalition, being put into a retort, may be kept a pretty while in fuſion
" before the metal will let go the nitrous ſpirits. When we poured oil of vitriol
" upon the calx of vitriol, though many phlegmatic and other ſulphureous par-
" ticles were driven away by the excited heat, yet the ſaline parts, that combined
" with the fixed ones of the colcothar, ſtuck faſt enough to them not to be eaſily
" driven away. And if oil of vitriol be, in a due proportion, dropt upon ſalt of
" tartar, there reſults a tartarum vitriolatum, wherein the acid and alkalizate parts
" cohere ſo ſtrongly, that it is not an ordinary degree of fire will be able to
" disjoin them: inſomuch that divers chemiſts have (though very erroneouſly)
" thought this compounded ſalt to be indeſtructible. But a leſs heavy liquor than
" the ponderous oil of vitriol, may by an alkali be more ſtrongly detained than
" that oil itſelf; experience having aſſured me, that ſpirit of ſalt being dropt to
" ſatiety upon a fixed alkali, (I uſed either that of nitre or of tartar) there would
" be made ſo ſtrict an union, that having diſtilled the reſulting ſalt with a ſtrong
" and laſting fire, it appeared not at all conſiderably to be wrought upon, and
" was not ſo much as melted.

" But it is not the bare mixture or commiſtion of volatile particles with fixed
" ones (yea though the former be predominant in quantity) that will ſuffice to
" elevate the latter. For, unleſs the figures of the latter be congruous and fitted
" to faſten to the other, the volatile parts will fly away in the heat, and leave
" the reſt as fixed as before; as when ſand or aſhes being wetted, or drenched
" with water, they quickly part with that water, without parting with any de-
" gree of their fixity: but on the other ſide, it is not always neceſſary, that the
" body, which is fitted to deſtroy, or much abate, the volatility of another ſub-
" ſtance, ſhould be itſelf fixed. For, if there be a ſkilful or lucky coaptation of
" the figures of the particles of both the bodies, theſe particles may take ſuch
" hold of one another, as to compoſe corpuſcles, that will neither, by reaſon of
" their ſtrict union, be divided by heat, nor by reaſon of their reſulting groſſneſs
" be elevated even by a ſtrong fire, or at leaſt by ſuch a degree of heat, as
" would have ſufficed to raiſe more indiſpoſed bodies than either of the ſeparate
" ingredients of mixture. This obſervation, if duly made out, does ſo much fa-
" vour our doctrine, about the mechanical origin of *fixation*, and may be of ſuch
" uſe, not only to chemiſts, in ſome of their operations, but to philoſophers, in
" aſſigning the cauſes of divers phænomena of nature, that it may be worth while
" to exemplify it by ſome inſtances.

" The firſt whereof I ſhall take from an uſual practice of the chemiſts them-
" ſelves, which I the rather do, to let you ſee, that ſuch known experiments are
" too often overlooked by them that make them; but yet may hint or confirm
" theories

" theories to thoſe that reflect on them. The inſtance I here ſpeak of, is that " which is afforded by the vulgar preparation of bezoardicum minerale. For, tho' " the rectified butter or oil of antimony, and the ſpirit of nitre, that are put to- " gether to make this white precipitate, are both of them diſtilled liquors; yet " the copious powder, that reſults from their union, is, by that union of vo- " latile parts, ſo far fixed, that after they have edulcorated it with water, they " preſcribe the calcining of it in a crucible for five or ſix hours; which opera- " tion it could not bear, unleſs it had attained to a conſiderable fixation. This " diſcourſe ſuppoſes, with the generality of chemiſts, that the addition of a due " quantity of ſpirit of nitre is neceſſary to be employed in making the bezoardi- " cum minerale; but, if it be a true obſervation, which is attributed to the learned " GUNTHERUS BILLICHIUS (but which I had no furnace at hand to examine when " I heard of it) if, I ſay, it be true, that a bezoardicum minerale may be obtained " without ſpirit of nitre, barely by a ſlow evaporation, made in a glaſs-diſh, of " the more fugitive parts of the oil of antimony; this inſtance will not indeed " be proper in this place, but yet will belong to the ſecond of the foregoing " ways of introducing *fixity*. I proceed now to alledge other particulars in fa- " vour of the above-mentioned obſervation. If you take ſtrong ſpirit of ſalt, that " when the glaſs is unſtopt would ſmoak of itſelf in the cold air, and ſatiate it " with the volatile ſpirit of urine; the ſuperfluous moiſture being abſtracted, you " will obtain by this preparation (which, you may remember, I long ſince com- " municated to you, and divers others virtuoſi) a compounded ſalt, ſcarce, if " at all, diſtinguiſhable from ſal armoniac, and which will not, as the ſalt it con- " ſiſts of will do, before their coalition, eaſily fly up of itſelf into the air, but " will require a not deſpicable degree of fire to ſublime it. Of theſe ſemi- " volatile compoſitions of ſalt I have made, and elſewhere mentioned, others, " which I ſhall not here repeat, but paſs on to other inſtances pertinent to our " preſent deſign. I lately mentioned, that the volatility of the ſpirits of nitre " may be very much abated by bringing them to coagulate into cryſtals with par- " ticles of corroded ſilver; but I ſhall now add, that I gueſſed, and by trial " found, that theſe nitrous ſpirits may be made much more fixed by addition " of the ſpirit of ſalt; which, if it be good, will of itſelf ſmoke in the air. For " having diſſolved a convenient quantity of cryſtals of ſilver in diſtilled water, " and precipitated them, not with a ſolution of ſalt, but the ſpirit of ſalt, the " phlegm being abſtracted, and ſome few of the looſer ſaline particles, though " the remaining maſs were preſſed with a violent fire, that kept the retort red- " hot for a good while; yet the nitrous and ſaline ſpirits would by no means be " driven away from the ſilver, but continued in fuſion with it; and when the " maſs was taken out, theſe ſpirits did ſo abound in it, that it had no appear- " ance of a metal, but looked rather like a thick piece of horn.

" The next inſtance I ſhall name, is afforded us by that kind of turbith, which " may be made by oil of vitriol, inſtead of the aqua fortis employed in the com- " mon turbithum minerale. For, though oil of vitriol be a diſtilled liquor, and " mercury a body volatile enough, yet when we abſtracted four or five parts of oil of " vitriol from one of quick-ſilver, (eſpecially if the operation were repeated) and " then waſhed off as much as we could of the ſaline particle of the oil of vitriol;

" yet

" yet thoſe that remained, adhering to the mercury, made it far more fixed than " either of the liquors had been before, and enabled it, even in a crucible, to " endure ſuch a degree of fire, before it could be driven away, as I confeſs I " ſomewhat wondred at. The like turbith may be made with oil of ſulphur per " campanam. But this is nothing to what HELMONT tells us of the operation of " his alkaheſt, where he affirms, that that menſtruum, which is volatile enough, " being abſtracted from running mercury, not only congulates it, but leaves it " fixed ſo, that it will endure the brunt of fires actuated by bellows, *(omnem fol-* " *lium ignem.)* If this be certain, it will not be a ſlender proof, that fixity may " be *mechanically* produced; and however, the argument will be good in reference " to the Helmontian Spagyriſts: for if, as one would expect, there do remain " ſome particles of the menſtruum with thoſe of the metal, it will not be denied, " that two volatile ſubſtances may perfectly fix one another. And if, as HELMONT " ſeems to think, the menſtruum be totally abſtracted, this ſuppoſition will the more " favour the doctrine about *fixity*; ſince, if there be no material additament left " with the quick-ſilver, the fixation cannot reaſonably be aſcribed to any thing, " as to ſome new mechanical modification, and particularly to ſome change of " texture, introduced into the mercury itſelf.

" And that you may think this the leſs improbable, I will now proceed to ſome " inſtances, whereof the firſt ſhall be this, that having put a mixture, made of " two dry, as well as volatile bodies (uſually enough employed by ſpagyriſts) to " half its weight of common running mercury, and elevated its mixture three " or four times from it, the mercury, that lay in the bottom, in the form of a pon- " derous and ſomewhat purpliſh powder, was by this operation ſo fixed, that it " long endured a ſtrong fire, which at length was made ſo ſtrong, that it melted " the glaſs, and kept it melted, without being ſtrong enough to force out the " mercury; which, by ſome trials, not ſo proper to be here mentioned, ſeemed " to have its ſalivating and emetic powers extraordinarily infringed. But this " only upon the by: in all the other inſtances (wherewith I ſhall conclude theſe " notes) I ſhall employ one menſtruum, oil of vitriol, and ſhew you the efficacy " of it, in fixing ſome parts of volatile bodies with ſome parts of itſelf; by which " examples it may appear, that a volatile body may not only leſſen the volati- " lity of another body, (as in the lately mentioned caſe of our ſpirituous ſal armo- " niac) but that two ſubſtances, that apart were volatile, may compoſe a third, " that will not only be leſs volatile, but conſiderably (if not altogether) fixt.

" We mixed then by degrees about equal parts of oil of vitriol and oil of tur- " pentine; and though each of them ſingle, eſpecially the latter, will aſcend " with a moderate fire in a ſand furnace, yet after the diſtillation was ended, we " had a conſiderable quantity, ſometimes (if I miſremember not) a fifth or ſixth " part, of a caput mortuum, black as a coal, and whereof a great part was of a " ſcarce to be expected fixedneſs in the fire.

" To give a higher proof of the diſpoſition, that oil of vitriol has, to let ſome " of its parts grow fixed by combination with thoſe of an exceeding volatile ad- " ditament, I mixed this liquor with an equal or double weight of highly recti-

" fied

" fied ſpirit of wine, and not only after, but ſometimes without, previous di-
" geſtion, I found, that the fluid parts of the mixture being totally abſtracted,
" there would remain a pretty quantity of a black ſubſtance ſo fixed, as to afford
" juſt cauſe of wonder.

" And becauſe camphire is eſteemed the moſt fugitive of conſiſtent bodies, in
" regard that, being but laid in the free air, without any help of the fire, it will
" fly all away; I tried, what oil of vitriol, abſtracted from camphire, would do,
" and found at the bottom of the retort a greater quantity, than one would ex-
" pect, of a ſubſtance as black as pitch, and almoſt as far from the volatility
" as from the colour of camphire; though it appeared not, that any of the
" gum had ſublimed into the neck of the retort.

" From all which inſtances it ſeems manifeſtly enough to follow, that in
" many caſes there need nothing to make aſſociated particles, whether volatile or
" not, become fixed, but either to implicate or intangle them among themſelves;
" or bring them to touch one another, according to large portions of their ſur-
" faces; or by both theſe ways conjointly, or by ſome others, to procure the firm
" coheſion of ſo many particles, that the reſulting corpuſcles be too big or
" heavy, to be by the degree of fire, wherein they are ſaid to be fixed, driven up
" into the air."

It was propoſed, as convenient, that ſeeing it was not to be expected, that the members would preſently, upon hearing of ſuch diſcourſes as theſe give their thoughts of them, it would be proper to do it at the next meeting, after the reading of another lecture.

A committee was appointed for auditing the treaſurer's accounts, conſiſting of Mr. AERSKINE, Dr. WHISTLER, Dr. SMITH, Mr. HOOKE, and Mr. COLLINS.

Mr. OLDENBURG read a letter to himſelf from Dr. SWAMMERDAM, dated at Amſterdam, 9th October, 1674 [b], containing a deſcription and draught of a rupture of a meſentery, a rare caſe.

Mr. HENSHAW preſented the Society with ſeveral curioſities, which he had brought with him out of Denmark: viz.

1. A great piece of foſſil amber, found in the fortifying of Ranſburg in Holſtein, above ſix Engliſh yards under the earth, the place being twenty-five Engliſh miles from the Baltic, and above thirty-ſix Engliſh miles from the German ſea; which ſea alſo does not flow within twenty-one Engliſh miles of that town, as was atteſted by a letter written 7th December, 1672, by Mr. ODMAN, an eye-witneſs of the taking up of this amber.

[b] Letter-book, vol. vii. p. 108. It is printed in the Philoſ. Tranſact. vol. x. n° 112. p. 273. for March, 1675.

2. An *Alga Saccharifera*, of which OLAUS BORRICHIUS by his own hand writes thus: "Alga Saccharifera naſcitur in mari Iſlandico non procul a littore, "ejiciturque in littus, per tempeſtates, ubi ſimul ac emerſerit e mari, ſalſedinem "linguæ offert. Sed ubi aliquandiu in littore recubuit, ſenſim ſalſus ille ſapor "illi ab aqua marina perit, ejuſque loco pedetentim operitur alba "quadam veluti farina, quæ Saccharum dulcedine & colore imitatur, uſurpatur-"que incolis Sacchari loco. Mihi allata quæ fuit ex Iſlandia, ſapore & farina "illa adventitia diu carebat; ſed tandem in feneſtra aliquandiu quaſi neglecta ja-"cens eodem modo farina Saccharina cooperta fuit, maxime inferiori."

3. *Scarabæus Iſlandicus, qui adhæret, teſte eodem* BORRICHIO, *certo generi Aſellorum piſcium in mari Iſlandico, quod genus Aſellorum Danis appellatur* KUTLER. One of theſe being opened, it was found filled up with a gummous reddiſh ſubſtance, ſome part tranſparent, into which all the inner parts of this inſect ſeemed to have been converted.

4. A black ſubſtance, which ſeemed to be wood turned into jett, dug out of the ground in Denmark.

5. A piece of Iceland cryſtal (as it is vulgarly called) having a double refraction.

6. Some figured Icelandic ſtones.

7. Some pieces of ſilver, ſaid to be dug out of the mines of Norway.

8. Some white amber.

Mr. HENSHAW ſhewed alſo a very fine horn of a young horn-fiſh, not hollow; as likewiſe three pieces of fine amber, two whereof had inſects incloſed in them, the third a moveable bubble, which, he ſaid, would in a froſt congeal and become immoveable, and upon a thaw, or being put in a warm place, become moveable again.

Mr. OLDENBURG preſented to the Society three books: 1. Dr. WALLIS's *Grammatica Linguæ Anglicanæ* augmented. 2 ERASMI BARTHOLINI *ſelecta Geometrica:* printed at Copenhagen in 1674, in 4to. 3. DAVIDIS VONDER BECK, *Mindani, Experimenta & Meditationes circa Naturalium Rerum principia:* printed at Hamburg, 1674, in 8vo, and dedicated to the Royal Society.

*November* 23. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,

| | |
|---|---|
| The lord biſhop of Saliſbury, | Mr. COLWALL, |
| Sir JOHN LOWTHER, | Mr. HOSKYNS, |
| Sir WILLIAM PETTY, | Mr. HILL, |
| Dr. GODDARD, | Mr. OLDENBURG. |

It was ordered, that the declaration, with the form of the new bond annexed to it, be put to the preſs, ſo that a proof of it might be ready for the next meeting of the council: and

That Mr. BARLOW be taken for collector of the arrears, after he had given a bond of his own of one hundred pounds for ſecurity, and that he be allowed twelve pence in the pound: and that this be declared to him by the preſident, in the name of the council: which was done accordingly.

The members of the council, who were preſent, ſealed the new bond.

Mr. HOOKE being called upon to make a report of the view, which he had been deſired to make, of the houſes and lands in Hog Lane, propoſed by Sir WILLIAM PETTY for employing the four hundred pounds legacy; and he not having yet taken that view, was deſired again to do it againſt the next meeting of the council.

Memorandum. That thoſe, who were at the council, ſubſcribed the new obligation for paying fifty two ſhillings a-year, but with this reſerve, that in caſe the number of the ſubſcribers ſhould not amount to fifty, between that time and Lady day following, thoſe, who had actually ſubſcribed, ſhould be free from the ſaid obligation.

*November* 26. At a meeting of the council were preſent

The lord viſcount BROUNCKER, preſident,

| | |
|---|---|
| The lord biſhop of Saliſbury. | Mr. COLWALL, |
| Sir JOHN LOWTHER, | Mr. HOSKYNS, |
| Sir WILLIAM PETTY, | Mr. HILL, |
| Sir ROBERT SOUTHWELL, | Mr. OLDENBURG. |
| Dr. GODDARD, | |

The committee of the council for auditing the accounts made their report, which was approved of.

Mr. HOOKE gave the council ſome account of the houſes and lands in Hog Lane, propoſed by Sir WILLIAM PETTY, the conſideration whereof was referred to another meeting.

A proof of the declaration being ready, it was read again, and after ſome alterations ordered to be printed off, to the number of two hundred and twenty-five copies, to be committed to the cuſtody of the preſident.

At a meeting of the SOCIETY on the ſame day,

Mr. HENRY JENKES, profeſſor of rhetoric at Greſham College, was propoſed candidate by Mr. HILL.

Sir WILLIAM PETTY preſented to the Society his diſcourſe concerning the importance and uſefulneſs to human life of the conſideration of duplicate and ſubduplicate proportion: which diſcourſe was read and ordered to be regiſtered [c], and printed [d].

This diſcourſe was made out by the following inſtances, viz.

1. In the drawing or driving powers, which force ſhips or other bodies through the water, with reference to the reſpective velocities cauſed thereby.

2. In the ſhapes or ſharpneſs of bodies, cutting or dividing the water, through which they are driven or drawn, and in the different velocities ariſing from thence, where the bodies and forces are equal.

3. In the ſtrength of timbers, or other heterogeneous materials applied to buildings, to carts, or to any other machinaments intended for ſtrength; and how by a model to judge of the ſufficiency of ſuch engine as is repreſented by it.

4. In the effect of oars upon equal and alike veſſels, according to their numbers, length, blades, and motions with or againſt the ſtream or on even waters.

5. In the motion or travelling of horſes on their ſeveral paces, and with different burthens on them.

6. In the ſtrength and velocity of mills and their wheels.

7. In the effects of gun-powder.

8. In the diſtances at which ſounds may be heard.

9. In the diſtances at which odoriferous matters may be ſmelt.

10. In the diſtances at which the objects of ſight may be ſeen.

11. In the time of the returns made by vibrating pendulums.

12. In the lives of men and their duration.

13. In muſical and ſounding bodies, ſuch as ſtrings and bells.

14. In the effects and motions of fire and burning ſpirits.

15. In the riſing and falling of bodies, but eſpecially of water in pumps, over-ſhot mills, leaks in ſhips, the hights of rivers at their head above their fall into the ſea.

16. In bellows.

[c] Regiſter, vol. iv. p 246.

[d] It was printed at London, 1674, in 12°. A cenſure of it is publiſhed in the *Genuine Remains* of Dr. THOMAS BARLOW, biſhop of Lincoln, p. 151. Edit. London, 1693, in 8vo.

17. In

17. In the prices of ſeveral commodities, as maſts, diamonds, large timber, amber, load-ſtones, &c.

18. In mill-dams, ſea-brooks, and the bulwarks or walls of fortreſſes.

19. In the compreſſion of wool, and other elaſtic bodies, and of the air within diving veſſels; as alſo in the effects of ſcrew-preſſes upon ſeveral materials.

The appendix contains a new hypotheſis of ſpringing or elaſtic motions.

It was ordered, that an apparatus be made for trying experiments about ſpringineſs.

*November* 30. Mr. JENKES was elected.

Sir JONAS MOORE was propoſed candidate by the preſident.

The committee of the Society for auditing the accounts made their report, as follows:

" The committee of the Royal Society for auditing the treaſurer's accounts, " November 26, 1674,

" We find Mr. DANIEL COLWALL debtor,

| | *l.* | *s.* | *d.* |
|---|---|---|---|
| " To monies he hath received on the ſeveral quarterly payments of " the Society from 13 Novemb. 1673, to 19 Novemb. 1674, | 190 | 6 | 6 |
| " To monies he hath received for admiſſions | 15 | 3 | 0 |
| " To balance of his account of November 13th, 1673, | 5 | 12 | 1 |
| " To money more by a legacy of the late lord biſhop of Cheſter | 400 | 0 | 0 |
| | £609 | 1 | 7 |

" We alſo find he is creditor,

| | | | |
|---|---|---|---|
| " By monies he hath paid for the uſe of the Society by order | 183 | 5 | 0 |
| " By balance reſting in caſh in his hands | 25 | 16 | 5 |
| " And by money paid into the caſh cheſt of the Society | 400 | 0 | 0 |
| | £609 | 1 | 7 |

This done, the Society, at which forty-two members were preſent, proceeded to the election of a new council and officers.

Of the old council were continued

The lord viſcount BROUNCKER,
The earl marſhal,
The lord biſhop of Saliſbury,
Sir JOHN LOWTHER,

Sir

Sir WILLIAM PETTY,
Sir ROBERT SOUTHWELL,
Dr. GODDARD,
Mr. COLWALL,
Mr. HOSKYNS,
Mr. HILL,
Mr. OLDENBURG.

The ten new members of the council were

The earl of Aylesbury,
Sir JOSEPH WILLIAMSON,
Sir JAMES SHAEN,
Sir JOHN LAURENCE,
Sir JOHN BANKES,
Mr. HENSHAW,
Mr. PEPYS,
Dr. WHISTLER,
Mr. SMITH,
Dr. DANIEL COX.

The officers elected were

The lord viscount BROUNCKER, president,
Mr. COLWALL, treasurer,
Mr. HILL, Mr. OLDENBURG, } secretaries.

Of the ten new members of the council were sworn these three only, Sir JAMES SHAEN, Mr. PEPYS, and Dr. WHISTLER; the rest being absent.

*December* 3. At a meeting of the COUNCIL were present

The lord viscount BROUNCKER, president,
The lord bishop of Salisbury,
Sir JOHN LOWTHER,
Sir WILLIAM PETTY,
Sir ROBERT SOUTHWELL,
Dr. GODDARD,
Dr. WHISTLER,
Mr. COLWALL,
Mr. OLDENBURG.

It was resolved, that every member of the present council shall provide an experimental discourse for the Society to be made at some one public meeting within the year, either by himself or by some other member of the Society; or to pay forty shillings.

It was ordered, that Mr. OLDENBURG be desired to offer the new legal obligation for paying fifty-two shillings a year for the use of the Royal Society, to as many members of the same to sign and seal, as conveniently he can; and likewise shew them the statute made by the council to engage every fellow of the Society to such a subscription:

That there be forthwith made a catalogue of all the presents made by several persons to the Society; together with the names of the donors; and that duplicates thereof be made, the one to be kept by the keeper of the repository, and the other by the treasurer *pro tempore*:

That a catalogue be made of all the inſtruments or other apparatus of the Society, paid for out of the public treaſury; and that the inſtruments be looked out and kept together in the repoſitory for inſtruments:

That a table and catalogue be made of all the books, diſcourſes, letters, and accounts, brought into the Society; together with the names of the authors: and that all the ſaid books, diſcourſes, letters, and accounts, be kept in convenient preſſes under locks and keys, and that the preſident and ſecretaries *pro tempore* have the keeping of the ſaid keys: And,

That Mr. AUBREY and Mr. COLLINS be deſired to be aſſiſting in this buſineſs, and to make propoſals at the next meeting of the council on that day ſe'nnight, what they would expect for their aſſiſtance.

Memorandum, that it was propounded by Sir WILLIAM PETTY, that all the diſcourſes entered into the Society's Regiſter-books ſhould be divided into ſeveral ſections and chapters; and that this ſhould be taken into conſideration at the next meeting of the council.

At a meeting of the SOCIETY on the ſame day

Sir JONAS MOORE was elected and admitted.

Sir PAUL WHICHCOTE, Bart. was propoſed candidate by Dr. BROWN.

Mr. HOOKE read his diſcourſe concerning the conſtruction and uſes of his new quadrant for making remote obſervations with great exactneſs.

He was deſired to have this inſtrument perfected; and for trying the performance of it, the lord biſhop of Saliſbury, Sir WILLIAM PETTY, Sir CHRISTOPHER WREN, and Sir JONAS MOORE, were deſired to meet as a committee on the Tueſday following in the afternoon for that purpoſe.

Monſ. LEYENBERGH, envoy extraordinary from the king of Sweden, ſent a paper containing a liſt of ſome pretended new mechanical and geographical inventions by one ANDREW ALEXANDER, a German, viz.

1. *Anemometrum, h. e. inſtrumentum ad vires venti quovis tempore terra marique metiendas.*

2. *Machina tranſportatrix univerſalis ad res graves particulatim facili operâ & continuatione ſurſum vel deorſum, vel etiam via horizontali transferendas; cujus uſus potiſſimum architectura civili et militari nemque ad machinas hydraulicas.*

3. *Structura caminorum noviter inventa, qui optime fumum trahant; itemque correctio caminorum fumantium.*

4. *Supple-*

4. *Supplementum geographicum ad uſum mapparum longe expeditiorem; res quidem magni laboris, ſed ampliſſimæ perpetuæque utilitatis, hactenus a nemine tentata.*

5. *Cogitata ſuper præcipuo rei nauticæ problemate de inveniendis per mare longitudinibus ſive meridianis, ſub quibus navis verſetur.*

Sir JOSEPH WILLIAMSON, who ſaid he knew this perſon, and Sir WILLIAM PETTY were deſired, at their conveniency, to examine him about theſe particulars.

Sir JOHN LAWRENCE, Sir JOHN BANKES, and Mr. HENSHAW, were ſworn as members of the council.

*December* 10. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,

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|---|---|
| The lord biſhop of Sarum, | Mr. COLWALL, |
| Sir WILLIAM PETTY, | Mr. HILL, |
| Mr. HENSHAW, | Mr. OLDENBURG. |
| Dr. GODDARD, | |

It was ordered, that the Society having deſired Sir WILLIAM PETTY to print his diſcourſe made before them on the 26th of November laſt, it be printed by the printer to the Society.

The council having formerly charged themſelves to provide each of them an experimental diſcourſe for the Society at ſome one meeting within the year, it was reſolved, that a letter ſhould be written by the ſecretary, and ſigned by the preſident, to the fellows of the Society hereafter named, to deſire them to provide the like diſcourſes, and to name the day after the 14th of January next, when to bring them in.

The ſaid fellows were

| | |
|---|---|
| Sir CHRISTOPHER WREN, | Dr. SMITH, |
| Mr. EVELYN, | Dr. VOSSIUS, |
| Dr HOLDER, | Mr. WYLDE, |
| Dr. CROUNE, | Mr. BERNARD, |
| Dr. WALTER NEEDHAM, | Dr. KING, |
| Dr. BROWN, | Mr. COLLINS. |
| Dr. POPE, | |

The council nominated alſo thoſe perſons, to whom application ſhould be made for ſigning the new bond, viz.

| | |
|---|---|
| The earl of Angleſey, | The earl of Shafteſbury, |
| The earl of Strafford, | The lord biſhop of Cheſter, |
| The earl of Devonſhire, | The lord BRERETON, |

Sir

Sir CHARLES BERKLEY,
Sir KINGSMILL LUCY,
Sir GILBERT TALBOT,
Mr. THOMAS HOWARD,
Mr. JOHN STAFFORD HOWARD,
Mr. JOHN WILLIAMS,
Dr. TILLOTSON,
Mr. BARRINGTON,
Mr. SLINGESBY,
Mr. NEILE,
Dr. GLISSON,
Dr. THOMAS COX,
Mr. THOMAS COX,
Mr. LOCKE,
Mr. PACKER,
Mr. WYLDE.

At a meeting of the SOCIETY on the ſame day,

DANIEL MILLER, B. D. was propoſed candidate by the preſident.

Dr. GREW preſented and read his *diſcourſe concerning the nature, cauſes, and power of mixture*; which was ordered to be regiſtered *.

Several of the experiments mentioned in this diſcourſe were exhibited after it was read.

*December* 17. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,
The lord biſhop of Saliſbury,
Sir JOHN LOWTHER,
Sir JAMES SHAEN,
Sir JOAN BANKES,
Sir WILLIAM PETTY,
Mr. HENSHAW,
Mr. PEPYS,
Dr. GODDARD,
Dr. WHISTLER,
Mr. COLWALL,
Mr. OLDENBURG.

Dr. COX having promiſed to entertain the Society on the 7th of January, Mr. HOOKE undertook to do the like on the 14th of that month.

Sir JOHN LOWTHER, Sir JOHN BANKES, Mr. PEPYS, and Dr. GODDARD, were appointed a committee to conſider, whether the four hundred pounds legacy might not be beſt laid out upon fee-farm rents: and they were deſired to ripen this buſineſs for the 17th of January, and make their report to the council.

The preſident, Sir ROBERT SOUTHWELL, and Mr. PEPYS, were deſired to make application to his highneſs prince RUPERT, concerning the miſchief, which his glaſs-houſe does to Chelſea-college; and to ſuggeſt to the prince, that his highneſs may perhaps put it and the land to ſome good uſes, if he pleaſes to take it to himſelf, and to conſider the Society for it.

It was reſolved, that Sir JONAS MOORE be deſired to write a letter to the prince, and to acquaint him, that the houſe and land of Chelſea might have been well

* Regiſter-book, vol. iv. p. 271. It is printed in his *Anatomy of Plants*, b. iv. Lordon, 1682, in folio.

diſpoſed of for the benefit of the Society, if it had not been for the annoyance of the neighbouring glaſs-houſe.

The form of the letter drawn up by Mr. OLDENBURG to be written to divers members of the Society, to deſire them to provide diſcourſes for the public meetings, was reported by Mr. OLDENBURG to have been viewed and altered by the preſident, and by his lordſhip ordered to be thus iſſued:

" Sir,

" The council of the Royal Society conſidering with themſelves the great im-
" portance of having the public meetings of the ſaid Society conſtantly provided
" with entertainments ſuitable to the deſign of their inſtitution, have thought fit
" to undertake to contribute each of them one; not doubting but that many of
" the fellows of the Society will join with them in carrying on ſuch an under-
" taking. And well perſuaded of your approbation of this their purpoſe, ſo
" much tending to the reputation and ſupport of the Society, they deſire, that
" you would be pleaſed to undertake for one, and to name any Thurſday after
" the 14th of January next, ſuch as ſhall be moſt convenient for you, when you
" will preſent the Society at one of their ſaid public meetings by yourſelf, or
" ſome other of the fellows for you, with ſuch a diſcourſe, grounded upon or
" leading to philoſophical experiments, on a ſubject of your own choice. In
" doing of which you will benefit the Society, and oblige,

" Sir,

" Your humble ſervant,

" BROUNCKER, P. R. S."

Mr. HOOKE having propoſed to the council, that in order to the bringing in of ſeveral ſets of experiments, that would require an apparatus of inſtruments for the making of them, ſuch inſtruments might be ordered to be prepared, whilſt he was drawing up ſuch experiments; the council reſolved, that the ſets of experiments ſhould be firſt brought in before them; and that then they would conſider of and give order for ſuch inſtruments, as ſhould be neceſſary for exhibiting the ſame.

The council farther deſiring Mr. HOOKE to name a ſet of experiments to begin with, he named thoſe of the magnet.

At a meeting of the SOCIETY on the ſame day,

Mr. RAY's two diſcourſes, one on *the ſeeds of plants*, and another on *the ſpecific differences of plants*, were preſented from him by Mr. OLDENBURG; and read, and ordered to be regiſtered [f]; and were as follows:

" A diſcourſe on the ſeeds of plants.

" Nature obſerves not proportion of magnitude between ſeeds and the plants,

[f] Regiſter, vol. iv. p. 286, and 294.

" that

" that come of them; I mean ſo, as that the greater ſeed ſhould produce the " greater plant, and the leſſer ſeed the leſſer plant: for the ſeeds of ſeveral trees " are much leſs than the ſeeds of many herbs: as for example, the ſeeds of elm, " poplar, willow, birch, alder, than the ſeeds of beans, peaſe, lupines, and all " kinds of pulſe, pumpions, melons, and all kind of pomiferous herbs, not to " mention infinite others. This holds true, not only in plants of different kinds, " but even in thoſe of the ſame, as I have obſerved in oaks; the ſcarlet oak, " which ſeldom riſes higher than a ſmall ſhrub, bearing an acorn as big as our " Engliſh oak: and in honey-wort, the purple annual kind bearing a ſeed twice " as big as the great perennial mountain kind. The like difference may be ob- " ſerved between the ſeeds of muſtard and charlock, ſeveral ſorts of lotus, and " many others.

" Neither indeed in ovìparous animals doth nature always obſerve the ſame " proportion of magnitude between the eggs, that is, between the animals, al- " though of the ſame tribe or genus: for, though lobſters or crayfiſh be ſo like " one to the other, that one can find little difference between them, ſave only in " magnitude; yet are the eggs of the crayfiſh, which is the leſſer, bigger than " thoſe of the lobſter, which is the greater: and, in whole-footed birds, the eggs " of the duffin, auk, and guillemot (which lay but one egg at a time) are as " much bigger than ducks eggs, as the birds themſelves are leſs than ducks.

" Though in ſome plants, which run much by the root or wire, or that pro- " pagate themſelves by off-ſets, it be true, which ſome have obſerved, that they " ſeldom bring their ſeed to maturity, as if nature, intent upon thoſe ways of pro- " pagation, did neglect that by the ſeed: ſuch plants are colocaſia, horſe-radiſh, " periwinkle, Jeruſalem-artichoke; though, I ſay, this held true in ſome, yet " is it far from a general rule; there being many plants, which abundantly pro- " pagate themſelves by the root or wire, and yet yield plentiful ripe ſeed too, " as goutwort, mint, ſtrawberry, &c. But on the other ſide, I think, it may " paſs for a general truth, that plants, which bring little ſeed to maturity, do " abundantly ſpread or multiply themſelves ſome other ways; elſe nature might " ſeem to be wanting in means for the conſervation of ſuch ſpecies.

" The leſſer ſeeds are the moſt fertile; ſuch plants as bear the leaſt ſeed bringing " the greateſt plenty or abundance: as, for example, tobacco, which, for a plant " of that bigneſs, bears the leaſt ſeed of any I know, producing the greateſt " number of ſeeds; LAUREMBERGIUS counting from one plant an encreaſe of " three hundred and ſixty thouſand.

" Among the ſeeds of herbs I have obſerved, that the greateſt of all are ſuch " as come of annual plants, to wit, beans, peaſe, lupines, maiz, or Turkey- " wheat, &c. In theſe kinds (of pulſe and graſſes) the annual (though ſometimes " leſs plants) have greater ſeeds than the perennials; as for inſtance, the com- " mon peaſe than the everlaſting peaſe; but always, I think, it happens ſo in " theſe kinds, if the plants be of equal bigneſs, that the ſeeds of the annual " are larger than the ſeeds of the perennial.



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" It is worth the noting, that all thoſe ſeeds, that are uſed by mankind for food, " are ſeeds of annual plants, viz. wheat, rye, ſpelt, maiz, rice, barley, oats, mil- " let, panic, ſorgum; and of pulſe, beans, peaſe, lupines, kidney-beans, vetches, " lentils: the reaſon whereof, I ſuppoſe, is no other, than becauſe they are in their " kinds the greater, and have the more pulp. For I doubt not but many peren- " nial graſſes bear eſculent ſeed, as well as theſe annual ones, which we call " corns; and I believe ſome perennial pulſe too, though none ſo large as theſe " annual ones we uſe.

" The greateſt number of plants, that come of ſeed, ſpring at firſt out of the " earth with two leaves, which being for the moſt part of a different figure from " the ſucceeding leaves, are by our gardeners not improperly called the ſeed- " leaves.

" Theſe ſeed-leaves are for the moſt part entire or undivided, even in thoſe " plants, whoſe after-leaves are moſt finely or minutely diſſected, as in the um- " belliferous kind. For the moſt part, I ſay, for in ſome few they are indented; " as in radiſh with one indenture, in Indian-creſſe with two. In garden-creſſe " each ſeed leaf is divided into three ſegments.

" The ſeed-leaves are for the moſt part ſmooth, even in thoſe, whoſe after-leaves " are rough or hairy. In ſome few, as for example, the Roman nettle, and I " believe all other nettles, the ſeed-leaves alſo are rough.

" In all thoſe plants, which ſpring up with two-ſeed leaves, the whole pulp or " content of the ſeed is nothing elſe but the young plant perfectly formed, ma- " ture, and ready for excluſion: ſo that, if you carefully take off the teguments " of the ſeed, either while yet green, or well ſteeped when ripe, you may clearly " ſee and diſtinguiſh all the parts of the included plant, viz. the radicle or ger- " men of the root, and two ſeed-leaves in all, and in ſome the rudiment of the " ſtem and plant-leaves beſides, as in the common bean and kidney-bean: in " this laſt, the two firſt plant-leaves being perfectly formed.

" In the ſeeds of theſe plants, when mature, I could never obſerve any co- " heſion between the teguments and the included plant.

" Thoſe ſeeds, whoſe pulp is nothing elſe but the included plant, are of two " ſorts. 1. In ſome the two ſeed-leaves lie plain, ſmooth, and extended, with- " out plait or fold. 2. In others, the two ſeed-leaves, together with the ra- " dicle, are variouſly folded up.

" In the firſt kind, the ſeed-leaves are nothing but the two lobes of the ſeed " having their plain ſides clapt together, like the two halfs of a walnut; and " therefore are of the juſt figure of the ſeed, ſlit in ſunder flat-wiſe, as in pum- " pion and melon ſeeds, and many others.

" In

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" In theſe, though the whole pulp ſeems to be compounded of two lobes, yet " to him, that carefully views and examines it, the radicle alſo will eaſily appear, " inſerted into each lobe, and connecting both together like a couple or hinge.

" This union of the radicle to the lobes is either, firſt, at that end of the ſeed, " which coheres to the fruit or ſeed-veſſel, as in apple and pear kernels, ſun-flower " ſeed, melon and pumpion ſeed, and abundance more: or, 2dly, At a diſtance " from the place of coheſion, as in beans, lupines, and all ſorts of pulſe, &c. " or, 3dly, At the quite contrary ends, as in borage, bugloſs, and others of that " family.

" In ſuch, whoſe radicle is at either extreme, I have obſerved it to be at the " ſharper or more pointed one; ſo that if the ſharper end of the ſeed be that, which " coheres to the ſeed-veſſels, the radicle is always at that end, as in apple or pear " kernels, and the reſt before inſtanced in: but if the ſharper extreme be the " tip of the ſeed, or the end juſt oppoſite to the place of coheſion, the radicle " ſhall be at that end, as in acorns, almonds, &c. In both theſe kinds, the ra- " dicle muſt needs be ſhort.

" In ſuch ſeeds, wherein the connexion of the lobes is at a diſtance from the " place of coheſion, but not at the juſt oppoſite part or end, the radicle is longer " than in the two former kinds, and runs bending along the verge of the lobes, " till the the tip of it comes to point at the place of coheſion.

" This obſervation may be of ſome advantage in ſetting, at leaſt the larger ſort " of ſeeds; for it will certainly ſomewhat promote the ſpringing of the ſeeds, ſo " to ſet them, that the point of the radicle may be downwards, or at leaſt ſo as " they naturally lie, when fallen from their plants upon maturity. And it muſt " needs hinder their growth, to ſet the point of the radicle juſt upwards, the ra- " dicle in ſuch a caſe being forced to bend two right angles, or a whole ſemicircle, " before it come to run directly down again; and likewiſe, on the contrary ſide, " the ſtem to turn as much before it can mount up; ſo that the ſap will have a " double reflection before it get out of the root into the ſtalk.

" In the ſecond kind, that is thoſe ſeeds, wherein the ſeed-leaves and radicle lie " folded up, the pulp of the ſeed cannot properly be ſaid to be divided into two " lobes.

" In theſe the complication of the leaves and radicle is very different. In the " radiſh, turnep, and, I believe, all that come up with ſuch a faſhioned leaf, the " young plant is moſt elegantly folded up into a globular figure, viz. the ſeed- " leaves being clapt together, as in all others, firſt the radicle is turned up upon " them; then the two ſides of the ſeed-leaves are turned over the radicle, one " one way, the other the contrary, ſo embracing it. In the ſeed of the ſyca- " more-tree, the two ſeed-leaves clapt together as before are firſt bent backwards " upon themſelves, and then with the radicle rolled up into a round roll, as if " one ſhould double a ſhort and narrow ribband or thong of leather twice, and " then

" then roll it up. In the garden creſſe, the two lateral ſegments of each ſeed-
" leaf being laid cloſe on the back of the main, or end ſegment (as being toge-
" ther of the juſt breadth of it) the ſaid end ſegments clapt together are ſo in-
" cloſed in the teguments; the radicle being not turned up immediately upon the
" ſeed-leaves, but as it were firſt lying at length involved in the teguments, and
" ſo turned up upon the ſeed-leaves; as if one ſhould double or bend the ſeed
" together after it was incloſed in its coats; as may be evidently ſeen by any
" one, that will but take the pains carefully to view and heed the ſeed. The like
" bending or doubling together of the ſeed I have obſerved in *dames violet*. Be-
" ſides theſe, many other different ways there are of making up ſeeds in their
" teguments, which it would be tedious to deſcribe, and difficult to underſtand,
" unleſs illuſtrated by figures: only I cannot but take notice, that though the
" maple be a congenerous tree to the ſycamore, yet is the young plant in the ſeed
" differently folded up from that of the ſycamore in its ſeed.

" Of ſeeds, that ſpring out of the earth with leaves like the *ſucceeding*, and no
" ſeed-leaves, I have obſerved two ſorts. 1. Such as are congenerous to the firſt
" kind precedent; that is, whoſe pulp is divided into two lobes and a radicle.
" The only difference between them is, that theſe bring not up their lobes above
" ground in form of leaves, as the other do, though I doubt not but the lobes of
" the ſeed have the ſame uſe in theſe as in thoſe that bring them up. For in
" the ſame family of plants, ſome ſeeds bring up their lobes above ground, others
" do not, as in the legumina or pulſe kind, the common bean brings them not up,
" the kidney-bean doth; the peaſe again doth not, the lupine doth.

" 2. Such, which neither ſpring out of the ground with ſeed-leaves, nor have
" their pulp divided into lobes; of theſe I have obſerved two kinds. 1. Such,
" in which the included plane is but a ſmall part of the pulp of the ſeed; (in
" thoſe I have hitherto obſerved I think ſcarce a tenth.) 2. Such, in which the
" whole pulp is nothing elſe but the included plant. Of the firſt kind I have
" obſerved two ſorts: 1. Such, in which the young plant ſticks to that end of
" the ſeed, which grows to the ſeed-veſſel or mother-plant, in form almoſt of a
" bud, together with its ſcutcheon, clapt to the body or branch of a tree in
" inoculation. 2. Such, in which the embryon-plant is incloſed in the middle of
" the ſeed, as it were a pith or kernel.

" Of the firſt ſort are all corns; I mean cerealia, as contradiſtinct to legumina,
" and graſſes. All theſe have fibrous or ſtringy roots; that is, many ſmall ſtrings
" or wires, ſpringing altogether from the bottom of the plant, (by the bottom
" I mean the commiſſure of the ſuperficies, or part above ground and the root)
" and not one ſingle body of a root, divided afterwards into branches and fibres.
" In a barley-corn I have obſerved ſix of theſe fibres or ſtrings put forth before
" the blade began to ſtir.

" The pulp of theſe ſeeds ſerves for the nouriſhment of the young plant when
" tender, notwithſtanding it hath drawn root, as the yolk for the chicken's nou-
" riſhment for a while after it is excluded, notwithſtanding that it can feed itſelf

" by

" by the mouth. This may be evidently demonſtrated ſo to be in corn new-
" ly ſown: for if you pluck of it up at firſt ſpringing, you ſhall find the pulp in
" the grain almoſt entire; but afterwards plucking of it up from day to day, as
" it is older and older, you ſhall find ſtill leſs and leſs of the pulp remaining, till
" at laſt there be nothing left, but the empty huſk ſticking to the bottom of the
" plant. The pulp is, by the moiſture of the earth, ſtrained through the coats
" of the ſeed, diſſolved into a cremor like chyle or batter.

" In ſuch of theſe ſeeds, as are covered only with thinner teguments, as for ex-
" ample, wheat and rye, the leaf breaks the teguments, and comes forth at the
" ſame end with the roots: in others, that are covered with thick huſks, as barley
" and oats, the leaf creeps under the groſſer huſk to the oppoſite end, and there
" comes forth; notwithſtanding that the germen or young plant is made up
" alike and affixed to the ſame end of the grain; and the firſt ſhooting of both,
" leaf and root, be from the ſame point, as well in this kind as in the other.

" Of the ſecond ſort of ſeeds, in which the embryon-plant bears but a ſmall
" proportion to the pulp of the ſeed; viz. ſuch, in which it is incloſed in the
" middle of the pulp, as it were a pith, are 1. Pine-ſeeds, and I believe the ſeeds
" of all other coniferous and reſiniferous trees, in the kernels whereof you may
" find a young pine-tree, perfectly formed, ſtem and leaves, as it appears at firſt
" coming up out of the ground. 2. Aſh-ſeeds; in the middle of whoſe pulp you
" may find a little ſtem with two elegant leaves, not winged as the after-leaves
" are, but like two ſingle lobes of the after-leaves; ſo that this tree ſeems to be-
" long to the genus of thoſe, whoſe ſeed is divided into two lobes, and comes up
" with two ſeed-leaves, whereas really it doth not. 3. Flower de luce ſeeds.
" 4. Aſparagus ſeeds: in both theſe laſt the pulp of the ſeed, all but the embryon-
" plant, is of a griſtly ſubſtance; which, whether it ſerves for nouriſhment or
" defence of the young plant, I know not. Theſe ſeeds of this kind I have ob-
" ſerved, and queſtion not but there are many others of like nature.

" In theſe and the former ſort of ſeeds is true, what a great while ſince I pub-
" liſhed as a *general* obſervation; viz. that the ſeed at leaſt in moſt plants did
" contain, beſides the young plant, a convenient portion of nouriſhment for
" it while yet tender. But now I find in the moſt plants it holdeth not;
" for the far greateſt number of ſeeds contain nothing of nouriſhment for the
" young plant, more than the pulp of the lobes; which yet may, and moſt pro-
" bably doth, ſupply nouriſhment to the radicle, while it is ſhot forth, and comes
" to draw from the ground for itſelf, and reciprocally for them too. For the
" lobes or ſeed-leaves in moſt ſeeds, while yet included, are thick, pulpy, and
" brittle; and conſequently have little of fibre, and much of fleſh.

" Of the ſecond ſort; viz. thoſe, in which the included plant makes up the
" whole pulp of the ſeed, are (I ſuppoſe) all bulbous plants: for, that theſe have
" no ſeed-leaves, but come up with leaves like the ſucceeding, is evident; and
" at firſt ſpringing up upon their leaf, the huſk of the ſeed empty, it is moſt pro-
" bable, that there was nothing elſe in the ſeed but the young plant: for, had

" there

" there been any thing in the ſeed of nouriſhment for the young plant, moſt pro-
" bable it is, that the huſk being the veſſel containing ſuch nouriſhment, ſhould
" remain faſtened to the bottom of the plant, and not be brought up with the
" leaf. The next ſpring, I intend (God willing) by ocular inſpection to deter-
" mine this, and not to go upon probabilities.

" All ſeeds, when fallen from their plants on the earth, do at firſt draw their
" nouriſhment by the pores of their coats or teguments.

" There is great analogy between the nouriſhment and growth of the ſeeds of
" plants in the earth, and thoſe of viviparous animals in the womb. For, as
" the ſeed of a plant, when ripe, falls to the ground, and there lying looſe doth
" (as I ſaid) firſt receive its nouriſhment by the pores of its teguments, and after-
" wards ſtrikes root into the earth: ſo likewiſe the ſeed or egg of a viviparous
" animal, when ripened, as it were by the male, drops off one of the ovaria into
" the womb, where it lies for a while looſe and free, without any adheſion to, or
" connection with, the womb; drawing its nouriſhment through its involving
" membranes or ſecundines, and afterwards ſtriking, as it were, root into the womb,
" faſtens itſelf to it, and then probably draws at leaſt part of its nouriſhment
" that way: and in this reſpect, a man, as all other animals, may be ſaid to live
" firſt the life of a plant. By the ovaria, I mean the bodies uſually called teſtes
" fœminei, which whoſoever will but make uſe of his eyes, diligently to view in
" ſwine, and other multiparous and ſalacious animals, muſt needs acknowledge to
" be nothing elſe but maſſes or cluſters of eggs.

" Neither do the ſeeds, but I believe the roots of plants alſo, draw the greateſt
" part of their nouriſhment by the pores of their coats or barks, and but little
" by the extremities of their capillary fibres, which yet ſome have made to be
" ſo many oſcula or little mouths in plants, anſwering one great one in animals.
" That plants do draw by the pores of their barks, is evident from that manner
" of planting branches or ſlips of trees and ſhrubs mentioned by LAUREMBERGIUS.
" Firſt cut off the lower end of the ſlip to be planted, and having ſealed it cloſe
" up, put it into the ground bent, the middle of the bow being lowermoſt, and
" the lower or ſealed end inclining upwards, yet ſo as to remain ſtill covered with
" the earth, the upper end only appearing above ground. For in this caſe the
" nouriſhment can get in no way but by the pores of the bark, at leaſt if there
" be only one internodium covered.

" And now, that I have mentioned this way of planting by the ſlip, I ſhall add,
" that I cannot but think it would be worth the while to practiſe it in all ſorts
" of apple-trees, as well as in codlings and moyls; this being, of all others, if
" if it will ſucceed, the moſt eaſy and ſpeedy way of propagation. For, though
" a graft may bear fruit as ſoon as a ſlip, yet is the ſtock ſome years growing be-
" fore it be fit to graft on; and then, a ſlip growing much faſter will bear abun-
" dantly more fruit than a graft of its ſtanding. Now that it will ſucceed, I think
" moſt probable; there being no reaſon, why one tree of the ſame genus ſhould
" grow of the ſlip, and not another, though perchance with more difficulty. In
" this

" this opinion I was much confirmed by what I found in Mr. JOSSELYN's deſcrip-
" tion of New England, viz. That the inhabitants there do practiſe, with good
" ſucceſs, this manner of propagating all ſorts of fruit-trees. If it be ſaid, that
" trees thus planted will be ſhorter lived, and not laſt ſo long as thoſe that are
" grafted; I anſwer: 1. I doubt much, whether this hath been ſufficiently obſerv-
" ed, and not rather preſumed, and taken up on weak and inſufficient grounds.
" For there ſeems to me to be the ſame reaſon, why a graft ſhould be ſhort-lived,
" as why a ſlip, which I conceive is, becauſe both of them have already paſt their
" nonage, and are arrived at the age of fœcundity, being taken off branches al-
" ready fruitful; and therefore all the time ſpent from the ſpringing of the ſeed
" till its maturity is cut off from their lives, which is no diſadvantage to the
" planter, the ſeed-plants remaining all that time unfruitful. 2. Suppoſe it were
" ſo as is ſaid, the ſuddenneſs and copiouſneſs of their bearing will abundantly com-
" penſate the ſhortneſs of their duration. For thoſe, that laſt longer, are longer
" before they come to bear, and till that time they do unprofitably cumber the
" ground; whereas theſe are profitable ſoon after the time of their firſt ſetting;
" and when they come to be effete, they may then be cut down, and others
" planted in their room."

A diſcourſe on the ſpecific differences of plants.

" Having obſerved, that moſt herbariſts miſtaking many accidents for notes
" of ſpecific diſtinction, which indeed are not, have unneceſſarily multiplied be-
" ings, contrary to that well known philoſophic precept; I think it may not be
" unuſeful, in order to the determining of the number of ſpecies more certainly
" and agreeably to nature, to enumerate ſuch accidents, and then give my rea-
" ſons, why I judge them not ſufficient to infer a ſpecific difference.

" Firſt then, ſuch accidents are either of the whole plant or of the root, or
" of the ſtalk, or of the leaf, or of the flower, or of the fruit, or of the ſeed.

" 1. Of the whole plant, difference of magnitude from what is uſual: ſo in GE-
" RARD's and PARKINSON's herbals we find many plants put down for diſtinct ſpe-
" cies, which themſelves confeſs to differ in no other point, than being in all
" parts leſs or greater than others of their kind before deſcribed. To which I
" might add difference of ſcent and taſte, for which they make a ſort of worm-
" wood, different in kind from the common, calling it *abſynthium inſipidum &*
" *inodorum.*

" Accidents of the root miſtaken for notes of ſpecific difference are, firſt, di-
" verſity of colour; inſtances whereof we have in carrots, turneps, and radiſh;
" the root of the firſt, beſides the uſual colour, being found ſometimes of a dark
" red or purple, ſometimes white; that of the ſecond ſometimes yellow; that of
" the third, ſometimes white, and ſometimes black. Secondly, diverſity of figure
" obſerved in turneps; which are ſometimes long, though commonly round-
" root.

" 3. Differences of the ſtalk are its degenerating in many plants into a broad " and flat figure, or varying its number of angles, as in purple looſe-ſtrife.

" 4. Accidents of the leaf are 1. Variegation, painting, ſtriping, or gilding. " Few plants there are but their leaves will now and then happen to be thus " painted: but thoſe, that are moſt prized, and charily nurſed up in gardens, are " painted holly, alaternus, box, roſemary, bitterſweet, ſage, hyſop, mint, mar- " joram, tanſy, melilot. 2. Curling of the edges of the leaves, obſerved in " lettice, endive, mint, parſley, tanſy, garden-creſſe, hart's-tongue. Though in " this accident, I confeſs myſelf not fully ſatisfied, that it is not a note of ſpeci- " fic diſtinction.

" 5. Accidents of the flower are, 1. Variety of colour, as white or carnation, in " ſuch as are naturally blue, red, or purple: ſcarce any plant of ſuch a coloured " flower but is ſometimes found with a white one. Here by the by we may take " notice, that plants of yellow flowers ſeldom change colour, growing wild, tho' " in gardens ſometimes they do, as I found in my own garden, in yellow-flowered " moth-mullein, the ſeed whereof ſowing itſelf, gave me ſome plants with a white " flower. I never yet obſerved any one of the numerous family of hawkweeds " to vary the colour of the flower. Beſides theſe diverſities of colour common to " many flowers, there are other almoſt infinite varieties in July-flowers, tulips, " anemonies, lark-ſpurs, columbines, bears-ears, poppies, ſtock gilliflowers and " others.

" 2. Multiplicity of leaves, or doubleneſs of the flower; of which inſtances are " infinite. Yet ſome whole tribes of plants were never, that I know of, obſerved " to produce double flowers; as for example, the umbelliferous, verticillati and " papilionaceous kinds.

" 3. Gemination of the flower, in ſuch as we call hoſe in hoſe, which is a varie- " ty, for ought I know, peculiar to primroſes, cowſlips, and paigles.

" 4. Nakedneſs of the flower in ſuch as have it uſually radiate, as is ob- " ſerved in camomile, mayweed, feverfew, and the like.

" 5. Fiſtulouſneſs or hollowneſs of the flower-leaves in ſuch as have them " uſually flat, as is ſeen in the double-daiſy and African marygold.

" 6. Proliferouſneſs of the flower in childing daiſy, ſcabious and other plants " with a compound flower.

" 6. Accidents of the fruit are differences of magnitude, taſte, figure, colour " which are in apples, pears, and plums, almoſt infinite.

" Laſtly, accidents of the ſeed are variety of colour obſervable in the ſeed of " millet, which is found of a yellow and golden colour; of maiz or Indian " wheat,

" wheat, which is ſometimes ſpadiceous; of common beans, which are ſome-
" times red; and of kidney-beans, which are of many differing colours.

" Having now enumerated the accidents, it remains that I give my reaſons, why
" I judge them not ſufficient notes of ſpecific diſtinction.

" Firſt, as to the difference of magnitude; though I grant there are certain
" meaſures or bounds of littleneſs and greatneſs, which neither plants nor ani-
" mals of the ſame ſpecies can exceed or fall ſhort of; as, for example, a ſheep
" can never come to be ſo big as an elephant, or ſo little as a mouſe; nor a gooſe-
" berry-buſh ſo tall as an oak, or ſo low as millegrana: yet is there a very great
" latitude in point of magnitude between plants of the ſame ſpecies, of ten ſometimes
" to one, which yet is wholly to be imputed either to the richneſs or poverty of
" the ſoil, the moiſtneſs or drought of the ſeaſon, the coldneſs or heat of the cli-
" mate, or ſome other ſuch like external circumſtances, and not to the ſpecific
" nature of the plant: which is evident in that, if you take the ſeed of the ſmalleſt
" and pooreſt plant in its kind, provided it will admit culture, and ſow it in a
" rich ſoil, you ſhall ſoon get an offſpring ten times as great as the mother-plant.
" Nay, take the root of a perennial and removeable plant from off a cold barren
" mountain, and ſet it in a fat warm garden, it ſhall attain twice the ſtature and
" dimenſions, which it would have been confined to, had it remained in its na-
" tural place. No leſs difference is there, in this reſpect, between animals of the
" ſame ſpecies; we having in England of ſheep from five to fifty pounds a ſcore,
" and of beeves from three to twenty pounds a-head. And for horſes, I have
" ſeen many in New Wales, that for bigneſs did not exceed ſome dogs; and
" for price were rated at no more than half a crown or ten groats a-piece.

" 2dly, Variegation of leaves in gilded box, roſemary, and the like, is ſo far
" from being a mark of ſpecific difference, that it is only a ſymptom of a mor-
" bid conſtitution of ſuch plant, induced by the application of lime, rubbiſh, or
" other mixture to the root of it.

" 3dly, Diverſity of colour in the flower, or taſte in the fruit, is no better note
" of ſpecific difference in plants, than the like varieties of hair or ſkin, or taſte
" of fleſh in animals; ſo that one may, with as good reaſon, admit a blackmore
" and European to be two ſpecies of men, or a black cow and a white to be two
" ſorts of kine, as two plants, differing only in colour of flower, to be ſpecifi-
" cally diſtinct; ſuch varieties, both in animals and plants, being occaſioned either
" by diverſity of climate, and temperature of the air, or of nouriſhment and man-
" ner of living.

" 1. What influence diverſity of climate, place, or temperature of the air may
" have as to the alteration of theſe qualities, appears in many animals, which on
" the Alps and other high mountains, as alſo in thoſe cold and northern coun-
" tries, where the earth for more than half the year is continually covered with
" ſnow, are not rarely found white, though naturally of different colours: as for
" example, bears, foxes, hares, ravens, blackbirds. I know not, whether I ought

" to refer to this head, or that of the diverſity of nouriſhment, the difference " between Engliſh and Flemiſh horſes; and between our Engliſh Lancaſhire and " Suſſex beaſts, of which the former have fair and well ſpread horns, the latter " ſmall and crumpled; and, if out of Lancaſhire you tranſlate theſe cattle into " Suſſex, their race by degrees will degenerate, and come to be of the ſhape of " the natives.

" 2. The like, and greater, influence hath the diverſity and plenty of food, " and different manner of living, as is manifeſt in domeſtic animals; for example, " ſwine, ducks, and geeſe, which do frequently and almoſt infinitely vary their " colours; whereas the wild, of thoſe kinds, retain conſtantly the ſame, and not " their colours only, but alſo the taſtes of their fleſh; it requiring no very critical " pallate to diſtinguiſh by the taſte, of fleſh of tame and wild fowl: nay, it hath " been told me for a truth by perſons of good credit, that there is a paſture on " a hill called Haſelbedge, near Little Hucklow in the Peak of Derbyſhire, which " will turn the hair of all kine, that feed upon it, in three years time to a grey " colour. Of all other animals, dogs are by theſe circumſtances moſt diverſi- " fied, inſomuch, that many animals of different ſpecies differ not more in ſhape, " magnitude, colour, and ſeveral other accidents, than they do. Now, if diver- " ſity of food, climate, and ſuch like accidents, may effect ſuch differences " among animals of the ſame ſpecies, much more may they among plants, " which are leſs free in the choice of their nouriſhment, and conſtantly affixed " to the place where they chance to ſpring up.

" 4. I prove in general, that none of the forementioned varieties are diſtinct " ſpecies, becauſe they will ſpring frequently from the ſeed of the ſame indi- " vidual plant.

" 5. Becauſe by ſeed they will not propagate their kind, but give you plants " of the uſual figure and colour; the only ſure way to propagate ſuch plants " being by off-ſetts from the root, if they be bulbous, or by ſlips and branches, " if others.

" 6. Many of theſe varieties, if they ſtand long in one place without culture, " will by degrees degenerate, becoming of double, ſingle-flowered, and changing " from rare to common colours. I might add, as a further argument, that I " have obſerved on the ſame root, for example, of a ſtock gillyflower ſome " flowers ſingle and ſome double.

" But, becauſe theſe varieties of flowers, for their beauty and rarity, are highly " prized and deſired by the curious; and thoſe of fruits do no leſs gratify the " pallate than theſe the eye, it were deſirable to know certainly, how ſuch va- " rieties might be produced. Firſt, one means to advance plants from ſingle " to double flowered is by frequent removals. LAUREMBERGIUS ſaith [k], that " he hath often tried in julyflowers, and found, that ſingle ones, by being re-

[k] Horticul. lib. 1. cap. 28. § 3.

" moved

" moved first in the spring, then in the autumn, and afterwards again the spring " following, and not permitted to flower in the mean time, have all come to bear " double flowers. 2. One means to diversify the colour of the flower is, by wa- " tering them only with water deeply tinged with the colour you would have " the flower to be of. LAUREMBERGIUS, in several places of his book de Hor- " ticultura, inculcates this experiment, lib. 1. cap. 31. § 5. Item, cap. 19. " § 10. and cap. 13. § 6. he thus prescribes the manner of making it: Fill " a vessel of what size or fashion you please with very fat earth, dried in the " sun or sifted, and therein plant a slip or branch of a plant bearing a white " flower (for such only can be tinged;) use no other water to water it with, but " such as is tinctured with red, if you desire red flowers, with green, if green, " &c. With such coloured water water it twice a day, morning and even- " ing, removing it into a house by night, so that it drink not of the morning " or evening dew for three weeks space. You shall (saith he) experience, that it " will produce flowers tinctured, not altogether with that colour, wherewith you " watered it, but partly with that, partly with the natural.

" 3. The most sure and facil way to get plants different, either in colour or " multiplicity of flower, is to sow the seeds of those plants, of which you desire " such varieties, in a rich soil, or one different from what is natural to such " plants when wild. For, if you sow the seed, for example, of a single july- " flower in good ground, among many that bear single flowers, it shall give you " some roots, that yield double, and some of different colours, from the mother- " plant, which you may afterward propagate by the slip. The plants, that are " most apt to be thus diversified by sowing, are julyflowers, anemonies, lark- " spurs, columbines, bears ears, stocks, and wall-flowers, primroses and cow- " slips, tulips, crocuses, blue-bottles, daisies, hepaticas, and violets.

" As for fruits, the ready, and, I believe, only way to get new kinds is by " sowing their seeds, stones, or kernels, in rich ground, or, perchance, any " common ground, which will give you wildings, bearing fruit of a different " figure, colour, magnitude, or taste, from the tree of which they came, whose " tastes may be mended and improved by culture and insition. But that by in- " sitions only new species of fruits may be produced, is to me incredible, I " having hitherto embraced, as an undoubted maxim in planting, that the fruit " always follows the cyon.

" By this way of sowing may new varieties of flowers and fruits be still pro- " duced in infinitum, which affords me another argument to prove them not " specifically distinct; the number of species being in nature certain and deter- " minate, as is generally acknowledged by philosophers, and might be proved " also by divine authority, God having finished his works of creation, that is, " consummated the number of species, in six days."

Mr. HOOKE produced and explained his model for horizontal sails, being per- suaded, that he had improved that position of sails to the greatest perfection, of which

which it was capable; ſince thoſe ſails could not, in his opinion, be put in any poſture more advantageous than that, which he exhibited.

It being mentioned, that there would be a total eclipſe of the moon on the 1ſt of January next; and intimated withal, that Sir WILLIAM PETTY had erected a very convenient obſervatory at his own houſe; Mr. HOOKE was deſired to aſſiſt there in making obſervation of the ſaid eclipſe, and to provide inſtruments neceſſary for it.

1673. *January* 7. A letter from Dr. LISTER to Mr. OLDENBURG, dated at York, November 24, 1674, was read, concerning ſome obſervations and experiments, viz:

1. Of the efflorescence of certain mineral globes. 2. An odd figured iris. 3. Of a *gloſſopetra tricuſpis non ſerrata.* 4. Of certain *lapides Judaici*, for kind found in England. 5. Of the electrical power of ſtones in relation to a vegetable roſin. 6. Of the flower and ſeeds of muſhrooms. 7. Of the ſpeedy vitrifying of the whole body of antimony by cawk. This letter was ordered to be entered[z], and the author deſired to perfect and publiſh it. The ſeveral ſubſtances accompanying it were delivered to Mr. HOOKE for the repoſitory. And it being thought, that the vitrified antimony might ſerve for perſpectives, Mr. OLDENBURG was deſired to write to Mr. LISTER for ſome quantity of that cawk, employed in the vitrification.

Mr. OLDENBURG preſented from Mr. BOYLE his newly printed book, intitled *Tracts, containing,* 1. *Suſpicions about ſome hidden qualities of the air; with an appendix touching celeſtial magnets, and ſome other particulars.* 2. *Animadverſions upon Mr. Hobbes's* Problemata de Vacuo. 3. *A diſcourſe of the cauſe of attraction by ſuction:* printed at London, 1674, in 8vo.

Mr. OLDENBURG delivered to Mr. HOOKE three papers concerning Mr. HENSHAW's preſents lately made to the Society.

Dr. DANIEL COXE preſented the Society with a bottle full of the volatile ſpirit and ſalt of wormwood, extracted in the manner publiſhed by him; which liquor was as pungent as any volatile ſalt of hartſhorn or ſoot, &c. can be.

*January* 14. At a meeting of the COUNCIL were preſent

Sir WILLIAM PETTY, vice-preſident, in the chair,

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| The earl of Ayleſbury, | Dr. WHISTLER, |
| Sir JAMES SHAEN, | Mr. COLWALL, |
| Mr. HENSHAW, | Mr. HILL, |
| Mr. PEPYS, | Mr. OLDENBURG. |
| Dr. GODDARD, | |

[z] Letter-book, vol. vii. p. 112. It is printed in the Philoſ. Tranſact. vol. ix. n° 110. p. 221. for January, 1673.

The

The committee for diſpoſing of the four hundred pounds legacy upon fee-farm rents being called upon for a report, Mr. HILL reported from Sir JOHN LOWTHER and Sir JOHN BANKES, that they had found upon the books three fee-farm rents payable from Lewes in Suſſex (whereof one from the eſtate of the earl marſhal) amounting in all to twenty-four pounds *per ann.*

The conſideration of this was referred to the next meeting of the council.

No report was ready from the committee for conſidering of the diſpoſing of Chelſea-College.

Several members of the council named the reſpective days, when they would provide each a diſcourſe for the Society, viz.

The earl of Ayleſbury - - - - - - February 11, 167⅘.

Mr. HENSHAW - - - - - - - - - 18.

Sir JAMES SHARN the firſt meeting after Eaſter.

Mr. PEPYS the ſecond meeting after the next receſs, the preſident being ſaid by him to have named for himſelf the firſt meeting-day after the ſecond receſs.

Mr. EVELYN of the Society took the 1ſt of April, 1675.

Sir WILLIAM PETTY having propoſed Mr. BARLOW as a perſon fit to collect the arrears due to the Society, it was ordered, that the ſaid Mr. BARLOW be employed for that purpoſe, he giving his bond of one hundred pounds for his fidelity in delivering the monies by him collected to Mr. DANIEL COLWALL, as treaſurer to the Royal Society: and that he, the ſaid collector, do from time to time receive orders from Mr. COLWALL as to the perſons being in arrears, and the reſpective ſums due from them; and that he be allowed twelve pence per pound for all ſuch ſums, as ſhall have been collected and brought in by him.

At a meeting of the SOCIETY on the ſame day,

Sir PAUL WHICHCOTE, Bart. and Mr. MILLES were elected.

Mr. HOOKE read his obſervations of the late lunar eclipſe of January 1ſt, at which were preſent the preſident, Sir JONAS MOORE, and Mr. COLLINS. He was deſired to perfect this diſcourſe, and to publiſh it [h].

There was read out of the Regiſter Mr. BOYLE's diſcourſe of freezing, formerly given in by him [i].

[h] See Philoſoph. Tranſact. vol. ix. n° 111. p. 237.

[i] Probably that read before the Society, 23d November, 1671. See above, vol. ii. p. 492.

This gave occaſion to ſuggeſt ſeveral experiments to be made, as, 1. To exhauſt water, both boiled and raw, of air, in order to ſee, whether it would ſwell as much, as if not exhauſted. 2. To tinge ſeveral liquors both with vegetable tinctures and mineral ones, as with Roman vitrol, verdigreeſe, &c. 3. To mix burnt alabaſter and water together, to ſee the force of the extenſion of that mixture.

*January* 21. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,

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|---|---|
| Sir JOHN BANKES, | Dr. GODDARD, |
| Mr. HENSHAW, | Mr. COLWALL, |
| Mr. PEPYS, | Mr. HILL, |
| Mr. HOSKYNS, | Mr. OLDENBURG. |

Sir JOHN BANKES made a full report concerning the three fee-farm rents payable from Lewes in Suſſex; concerning which the council accepted of the propoſal, and reſolved to diſpoſe of the four hundred pounds legacy of the late Dr. WILKINS, biſhop of Cheſter, for purchaſing of them; and accordingly deſired Mr. HOSKYNS to take care of a legal conveyance of the ſame to the Royal Society and their ſucceſſors.

A report being made, that about ſixty fellows of the Society had ſigned and ſealed the new obligation, which was the number, that was thought fit to be aſſured of before the ſending about the printed declararions, it was reſolved upon, that a letter ſhould be drawn up by the ſecretary againſt the next meeting of the council, to accompany the ſeveral copies of the declaration, to be ſent to all ſuch, as were not excepted by the ſame: and that the ſubſtance of that letter be to deſire the reſpective members to conſider the contents of that declaration, and to return an anſwer thereunto within ſuch a time, as ſhould be limited by the preſident, who was to ſign both the letter and the declaration.

It being conſidered, that the forty ſhillings to be paid by thoſe members of the council, who ſhould fail of giving a lecture, would not be eſteemed a ſufficient recompenſe to him, who ſhould ſupply their place, it was agreed, that forty ſhillings ſhould be added thereto out of the ſtock of the Society.

Mr. OLDENBURG mentioned, that the earl of Ayleſbury being obliged to go out of town, could not take care of providing a lecture, as he thought to have done for the 11th of February, and had therefore ſent to him his forty ſhillings: which money was delivered to the treaſurer.

It was ordered, that a diſcourſe made before the Society, 10th December, 1674, by Dr. NEHEMIAH GREW concerning the nature, cauſes, and power of mixture, be printed by the printer of the Society.

At a meeting of the SOCIETY on the ſame day,

Sir

Sir ROBERT SOUTHWELL preſented to the Society for the repoſitory a very curious hammock made of the bark of a tree.

Dr. DANIEL COXE entertained the Society with a lecture concerning the analyſis of vegetables, dividing his ſubject into ſeveral heads, which, he ſaid, had furniſhed him with matter ſufficient for ſeveral lectures.

This lecture treated chiefly of the ſeveral methods of analyſing plants.

It gave occaſion of debating the queſtion, whether there were no alcaliſate ſalt but by burning? And, whether ſome particles of the air did not unite with ſome parts of the vegetables burned, precipitating themſelves with them, and ſo forming an alkali?

It gave likewiſe occaſion to debate Mr. HOOKE's notion of the nature of trees, viz. that it conſiſts in the diſſolution of bodies by air.

Mr. HOOKE intimated alſo upon occaſion, that he hoped he ſhould be able to make it out, that a body may be made ſpringy out of particles, that have no ſpring.

He was deſired to endeavour to prove this by experiment as ſoon as he could.

*January* 28. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,

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|---|---|
| Sir JOHN LOWTHER, | Mr. HENSHAW, |
| Sir JAMES SHAEN, | Dr. GODDARD, |
| Sir WILLIAM PETTY, | Mr. COLWALL, |
| Sir WILLIAM SOUTHWELL, | Mr. HILL, |
| Sir JOHN BANKES, | Mr. OLDENBURG. |

Sir JOHN BANKES produced the conveyance of the twenty-four pounds fee-farm rents yearly, payable from Lewes in Suſſex.

It was ordered, that the 400 pounds, being the legacy of the late Dr. WILKINS to the Society, ſhould be paid out to Sir JOHN BANKES for the ſaid conveyance: and that the preſident, treaſurer, and ſecretary be deſired to bring with them on the Thurſday following the three keys of the iron cheſt, which contains the money.

There was read a draught of a letter to be ſent to thoſe, who had not ſigned the new bond, whether in London, or abſent from it; together with a copy of the printed declaration. The time for an anſwer limited to thoſe, who were in London, was the 11th of February following; the time for the abſent was a month from the date of the reſpective letters to them.

It was ordered, that the amanuenſis make fair copies of this letter, firſt of all to the following perſons:

The lord ANNESLEY,
Sir ROBERT ATKYNS,
Sir CHARLES BERKLEY,
Sir JOHN BIRKENHEAD,
The lord BRERETON,
Mr. GILBERT BURNET,
Sir EDWARD BYSSHE,
Mr. CARKESSE,
The earl of Carliſle,
The lord CAVENDISH,
The lord biſhop of Cheſter,
Sir WINSTONE CHURCHILL,
The lord CLIFFORD,
Capt. COCKE,
Col. COLEPEPPER,
Dr. THOMAS COX,
The marquis of Dorcheſter,
The earl of Dorſet,
Dr. DOWNS,
Sir GEORGE ENT,
The lord viſcount FITZHARDING,
Mr. HOARE,
Dr. HOLDER,
Mr. LOCKE,
Sir JAMES LONG,
Dr. MERRET,
Mr. NOLTHROPE,
Sir THOMAS NOTTE,
The earl of Northampton,
Mr. OUDART,
Dr. SAMUEL PARRER,
Sir PETER PETT,
The earl of Peterborough,
Mr. POVEY,
Lord viſcount RANALAGH,
Mr. SLINGESBY,
Mr. SOAME,
Sir JOHN TALBOT,
Mr. WALLER,
Dr. WILLIS,
Dr. WOODFORD,
Dr. WOODROFFE,
Dr. THOMAS WREN,
Mr. WYNDE,
Lord viſcount YARMOUTH.

The preſident ſignified, that he would make his diſcourſe at the firſt meeting of the Society after the next receſs.

Mr. PEPYS offered to make his the next week after the preſident.

Sir WILLIAM PETTY the next after Mr. PEPYS.

Sir ROBERT SOUTHWELL took for his diſcourſe the 2d week in April, as Mr. EVELYN had done the firſt week in that month.

Mr. OLDENBURG having deſired the council's licenſe for the printing Dr. WALLIS's diſcourſe on gravity and gravitation, made before the Society the 12th November, 1674, it was

Ordered, that the ſaid diſcourſe be printed by the printer of the Society.

Mr. OLDENBURG having mentioned, that Mr. NEWTON had intimated his being now in ſuch circumſtances, that he deſired to be excuſed from the weekly payments, it was agreed to by the council, that he ſhould be diſpenſed with, as ſeveral others were.

At a meeting of the Society on the ſame day,

Dr. Edmund Castell was admitted.

Mr. Hooke read his diſcourſe concerning his new contrivance of a Helioſcope and divers other uſeful inſtruments [l]. The helioſcope was for obſerving the ſun without offending the tendereſt eye by the help of ſeveral reflecting-glaſſes weakening the ſtrokes of the ſun-beams.

It was ordered, that the helioſcope ſhould be fixed and tried on the firſt ſunſhiny-day.

It was intimated, that a good compoſition of metal for reflecting was very deſirable.

Mr. Oldenburg produced Signor Malpighi's philoſophical preſent concerning the anatomy of plants both in a manuſcript diſcourſe and very elegant figures ſent to him from Venice by ſea.

Signor Malpighi's letter to Mr. Oldenburg, dated at Bologna, 20th Auguſt, 1674 [m], accompanying this preſent, was read.

It was ordered, that a letter of ſolemn thanks to the author ſhould be drawn up [n]; and the council be deſired to conſider of a way of having it well printed.

A letter of Monſ. Huygens to Mr. Oldenburg, dated at Paris, 30th January, 167$\frac{4}{5}$ [o], was read, giving notice of a new invention of watches by himſelf, the ſecret of which he conceals in an anagram,

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 4 | 1 | 3 | 5 | 3 | 7 | 3 | 1 | 2 | 3 | 4 | 3 | 2 | 4 | 2 |
| viz. | a. | b. | c. | e. | f. | i. | l. | m. | n. | o. | r. | f. | t. | u. | x. |

*February* 4. Sir Philip Percival, Bart. was propoſed candidate by Sir Robert Southwell.

Dr. King preſented to the Society his diſcourſe, conſiſting of the following particulars:

1. That moſt, if not all, the parts of an animal body do conſiſt of tubes and liquors.

2. That all the veſſels of the body are chiefly made up of other veſſels.

[l] Mr. Hooke's *Deſcription of helioſcopes and ſome other inſtruments made by him*, was printed at London, 1675, in 4to.

[m] Letter-book, vol. vii. p. 100.

[n] Mr. Oldenburg's letter to Signor Malpighi was dated 26th February, 167$\frac{4}{5}$, and entered in the Letter book, vol. vii. p. 200.

[o] Ibid. p. 125.

3. That all veſſels and other tubular parts have their ſhare of carneous or other moving fibres, and act in their ſeveral ſpheres as the muſcles.

4. That all the contents of all tubular parts are carried about into all parts of the body, or out of it, according as they are ſeverally deſigned, by muſcular motion voluntary or involuntary.

5. That moſt diſeaſes, which our bodies are afflicted with, take their principal riſe from the impeded or irregular motion of the liquors and ſpirits, or their recrements left in the tubes or cavities.

6. Some obſervations upon the compoſition and motion of membranes.

7. The manner of the circulation of the blood, grounded upon the fabric of the heart and arteries.

He was deſired to leave his diſcourſe to be regiſtered with the reſt, which he promiſed to do, as ſoon as he had reviſed it [p].

Upon the occaſion given by this diſcourſe concerning muſcular motion Mr. Hooke declared, that he had made ſome diſcovery of the ſtructure of a muſcle by inſpection with a microſcope.

Dr. Grew ſuppoſing, that that diſcovery might have been the ſame with what he had ſome time ſince diſcovered, acquainted the Society, that he had ſometime ſince diſcovered, that the fleſhy part of a muſcle was divided into a ſort of long parallelopipeds by the croſs interweaving of ſmall membranes, and veſſels croſſing the ſaid fleſhy part.

Dr. Crounе ſuppoſed theſe fleſhy parallelopipeds to conſiſt of a chain of bladders, which being blown up by certain liquors ſhorten the ſaid ſprings, and ſo contract the muſcle.

But Mr. Hooke affirmed, that he could not diſcover any ſuch texture in the ſaid fleſhy part, but that his obſervation was, that the fleſhy part of a muſcle conſiſts of an infinite number of exceedingly ſmall round pipes, extended between the two tendons of the muſcle, and ſeem to end in theſe: which tendons in the muſcles of beef boiled would be eaſily ſtripped off from the ends of thoſe pipes, and ſo leave the ends of the round pipes very diſtinct. He ſaid, that the reaſon of the moving of a muſcle might be from the filling or emptying of thoſe pipes, whoſe ſides ſeem to be flexible like thoſe of a gut.

They were all deſired to make out their reſpective notions about the fabric of muſcles by occular demonſtration.

[p] It does not appear in the Regiſter.

*February*

*February* 11. Sir PAUL WHICHCOTE and Mr. DANIEL MILLES were elected.

Dr. CROUNE read his diſcourſe concerning the manner, how flying is performed by birds; ſhewing, in order thereunto, the ſtructure of a duck's wing and body, eſpecially of the muſcles and their inſertions into the humerus.

This diſcourſe was ordered to be regiſtered [q], though the doctor did not then leave it with the Society.

He having intimated a quite different ſtructure of the body of man from that of birds, and thence concluded his utter unfitneſs for flying, gave occaſion to ſome of the members to remark, that what nature had denied to the body of man, might be ſupplied by his reaſon and by art.

Mr. HOOKE intimated, that there was a way, which he knew, to produce ſtrength, ſo as to give to one man the ſtrength of ten or twenty men or more, and to contrive muſcles for him of an equivalent ſtrength to thoſe in birds. He hinted likewiſe, that a contrivance might be made of ſomething more proper for the feet of man to tread the air, than for his arms to beat the air.

Sir WILLIAM PETTY mentioned, that perhaps it might prove of uſe to conſider, whether gun-powder, being of ſo great and quick a force, might not be ſlackened to give a ſlower motion, as in the mortar-piece the ſhell is much more ſlowly carried through the air than a bullet out of a muſket.

Some ſaid, that it would be of real uſe to contrive ſomething for flying, if it were but to raiſe a man ſo high, as to fly over a wall, and the beſiegers of a town to carry and bring back intelligence.

Mr. OLDENBURG read a letter to him from Monſ. BULLIALDUS, dated at Paris, 6th February 167$\frac{4}{5}$ [r], concerning the obſervations of the royal academy of ſciences and his own of the lunar eclipſe of $\frac{1}{11}$ January preceding [s]; as alſo his opinion about teleſcopical ſights, declaring himſelf of that of Mr. HEVELIUS.

It was ordered, that the obſervations that eclipſe made in England ſhould be ſent to Monſ. BULLIALDUS, according to his deſire.

*February* 18. Mr. ISAAC NEWTON, JAMES HOARE, *junior*, Eſq; were admitted.

Sir PHILIP PERCIVAL was elected.

Mr. HENSHAW read his diſcourſe, giving an account of his obſervations made

q. It does not appear in the Regiſter.
r. Letter-book, vol. vii. p. 227.
s They are printed in the Philoſoph. Tranſact. vol. ix. n° 111. p. 238. for February, 167$\frac{4}{5}$.

in

in Denmark and in his voyage thither; which was ordered to be regiſtered [t], and is as follows:

My Lord,

" It being appointed me, this day, to entertain this learned meeting, with a " diſcourſe of ſome matters relating to experimental philoſophy, made me con- " ſider, that though from my childhood I have ever had a great affection and " inclination to the ſpeculations of Natural Philoſophy; yet the great troubles I " have had for many years, concerning my own private eſtate, have in a man- " ner wholly diverted me from making any conſiderable progreſs in that ſcience; " and ſince that my time hath been almoſt wholly taken up for near three years, " laſt paſt, by the duties of an employment in Denmark his majeſty was pleaſed " to honour me with: ſo that, inſtead of better digeſted notions my ſtudy might " have furniſhed me with had I had leiſure, I here adventure to offer you ſome " occaſional obſervations about natural things, I made in my voyage to Den- " mark, and during my abode in that country, which, I hope, will not be " thought to deviate much from the deſign of theſe weekly exerciſes; ſince in- " quiries into the hiſtories of all countries are part of your method for the ad- " vancement of ſcience; and, though I am ſure the obſervations I here preſent " you will be very crude, for the want I had of ſkill and leiſure better to concoct " them, yet they may ſerve for incitements to thoſe of greater ability and cu- " rioſity to perfect them.

" The firſt thing then, that I conſidered more heedfully than I had done in " any former voyage I had made, was, that when a ſhip of a conſiderable burthen " had ſailed from us little more than a league or three miles (as the ſeamen judged) " we loſt the ſight of almoſt all her hull or body, and in a ſhort time after could " ſee nothing but her maſts and ſails. I was ſtanding then on the quarter-deck " of a frigat of the king's, of fifty guns, called the Portland, where, as I gueſs, " my feet were about eighteen foot from the water, conſequently my eye five foot " higher, and the higheſt part of the body of the other ſhip was, as I judged, " about fifteen foot above the water. I had formerly, on the like occaſions, ſa- " tisfied myſelf, that it was the convexity only of the water, that thus took " away the ſight of a ſhip from us at ſo ſmall a diſtance; but at that time, conſi- " dering with myſelf, that if the circumference of this globe of earth and water " we inhabit, were but, as it is vulgarly reputed, twenty-one thouſand and ſix " hundred miles (though I did not give myſelf the trouble to try, whether I was " able to calculate what the ſinus verſus of an arch of three miles of that circum- " ference might come to) it was highly improbable, that the convexity of ſo " ſmall an arch could be ſo great, as wholly to intercept the body of a ſhip fifteen " foot high from an eye raiſed twenty-three foot above the water. Therefore hav- " ing in my cabin three perſpectives of Mr. Cock's making, fitted with day-glaſſes, " the one of two foot, the other of four, the third of ſix foot length; I was re- " ſolved to try what they could diſcover to me; and accordingly, getting them " in a readineſs, when the next ſhip ſailed by, juſt as, to my eyes, we loſt the " ſight of her hull, I applied the two foot tube, and found I did recover ſight of

[t] Regiſter, vol. v. p. 53.

" ſome

" ſome part of her hull, with the four foot tube more viſibly, and with the ſix " foot tube about half her hull, as near as I could gueſs. I made the trial two " or three times more, with much-what the ſame ſucceſs, to my apprehenſion; " which made me think, that if I had had a longer tube, I might yet have diſ- " covered ſome more of the hull, that before had diſappeared; but I could not re- " peat this experiment ſo oft as I deſired for my fuller ſatisfaction; for, what op- " portunity I had, was while we rid at an anchor wind-bound at the buoy in the " gunfleet; and after that, by reaſon the war was already begun between Eng- " land and Holland we ſcarce ſaw a ſhip but what ſailed in our company, till " we came to Denmark; ſo that, upon theſe ſmall trials I made, it ſeems to me " very probable, that the vaporous and thick air, that floats always above the ſur- " face of the ſea, intercepts the ſight of a ſhip at ſo ſmall a diſtance as a league, " much more than the convexity of the water. That, which perſuades me, there " are continually ſuch vapours hovering near the ſuperficies of the ſea, though " the air appears never ſo clear above, and they themſelves not perceptible to " us, unleſs we look through them on ſome object at a known diſtance, is, *firſt*, " thoſe trembling ſteams we ſee every where ariſe plentifully out of the earth, " in a bright day in ſummer, if we bring our eye near the earth, which we " do not at all diſcover, if we ſtand upright; whereas the ſea muſt needs ex- " hale them in greater abundance when warmed by the heat of the ſun, being " a body ſo eaſily diſſipable, that the very motion of the ſea is ſufficient to crowd " out continually ſome ſmaller particles of it; beſides what the winds conſtantly " ſhave off, when they move horizontally on the ſurface of it, as we may juſtly " conjecture by what they do on ways and wet linen, which dry ſuddenly in windy " weather. And that it is in the nature of vapours to ſlide, and play, and " hold longer together on a moiſt and ſmooth ſuperficies, but diſſipate and ra- " riſy when they get higher up into the air, may be evidenced by blowing tobac- " co on any liquor ſpilt on a table, eſpecially if the liquor ſtagnate with a con- " vexity.

" The next remarkable thing in our voyage was, that being driven by a ſouth- " weſt wind to near ſixty degrees of northern latitude, and coming to an anchor " on the of May, 1672, cloſe under the coaſt of Norway, though the " weather was very clear and calm, but cold, we ſaw the ſun three evenings to- " gether, near his ſetting, of a perfect elliptical or oval figure; which ſight, I con- " feſs, I was the more gratified with, becauſe I have very many times in Eng- " land attended on his ſetting at ſeveral ſeaſons of the year, to that purpoſe, " though I could never confidently ſay, I ſaw it of that figure till this time. The " firſt, that ever we read of, that took notice of this admirable phænomenon was " CHRISTOPHER SCHEINER, the jeſuit; who alſo firſt diſcovered the ſpots in the " ſun, who by chance found out this appearance at Ingolſtadt in Bavaria, in the la- " titude of forty-eight degrees and forty minutes, in the month of September, 1612, " as he was one evening at ſun-ſet endeavouring to diſcover ſpots in the ſun with " his bare eyes. He was ſo ſurpriſed with ſo ſtrange an appearance, that he could " hardly believe his own ſight, till he had verified it by many trials the winter " following, eſpecially by tranſmitting the appearance of the ſun through an op- " tic tube on a white paper in a dark room, the way he uſed to obſerve the ſpots

" in

" in the ſun by; but the greateſt difference he could diſcover, at any time between " the diameter of the ſun's longitude and that of his altitude, as he calls them " (though I think the perpendicular and horizontal diameters be more intelligible) " was ſeven minutes and forty-three ſeconds, reckoning the ſun's viſual diame- " ter at thirty-four ſeconds; whereas in this elliptical appearance of the ſun to us " in Norway, the perpendicular diameter ſeemed ſhorter to us than the horizon- " tal by at leaſt a fourth part, as was judged, not only by myſelf, but alſo by " ſeveral able ſeamen and others that obſerved it with me; that is, as far as we " could eſtimate it by our bare eyes; for we had no conveniency to try it SCHEI- " NER's way. At the beginning of March following, I obſerved the like ellipti- " cal appearance of the ſun for two evenings together, as I went to take the air " in my coach without the north port of Copenhagen, ſaving that then the per- " pendicular diameter ſeemed to me, and to two learned men that were in the " coach with me, to be but one fifth part ſhorter than the horizontal diameter, " and we were both times between the town and the ſun when it appeared; ſo that " nothing of the ſmoke of the city was concerned in it. SCHEINER was ſo taken " with this phænomenon, that he hath written a pretty large treatiſe in 4to con- " cerning it; wherein he endeavours to ſhew the reaſon of this appearance by an " oblique refraction of the light of a candle, through a glaſs, that has one ſuper- " ficies convex, the other concave, both ground on ſegments of the ſame ſphere: " but becauſe every man, that deſires that ſatisfaction, may find it in his book, I " ſhall forbear to give the particulars of his demonſtration; but if any one, here " preſent, deſires to ſave himſelf the trouble, I can tolerably make it out with a " glaſs in my pocket.

" After a tedious paſſage of ſix weeks at ſea by reaſon of calms, and contrary " winds, that is eaſterly winds, which commonly in this part of the world are " predominant for three months of the year, that is February, March, and April, " we arrived the 15th of May, 1672, at the town of Elſineur in Zealand, moſt " pleaſantly ſeated on that ſide, which has the greateſt command of the Sound; " for though the entrance is four Engliſh miles broad, yet the deepeſt and moſt " navigable part of it lies cloſe under the walls of the ſtrong caſtle of Croneng- " burg, ſituate at the upper end of the town. The weather was pretty warm " there, which made the channels of that town, which are not well contrived to " carry off their ſullage, ſtink ſo inſufferably, that our heads and ſtomachs were " much diſordered by the ſmell. To refreſh myſelf, as I hoped, I got ſome " company to walk with me toward the ſea ſhore, but there we were entertained " with a higher degree of the ſame ſtink, which came off the ſhore, and ſo we " found it almoſt all the way in our journey to Copenhagen, the high-way lying " almoſt all the way very near the ſea; it being otherwiſe the pleaſanteſt paſ- " ſage of tweny-five miles that ever I rode any where: and this ſmell is thus " troubleſome all the ſummer long, whenever the wind has ſat for three or four " days from the ſhore on the other ſide. I enquired of ſeveral, though I confeſs " no great philoſophers, what was the reaſon of that ſtink: they could only tell " me, that it was the nature of that ſea to ſmell ſo in the ſummer, but that I " quickly found was not ſo; for when the wind ſat north, ſouth, or weſt, there " was no ill ſmell at all; having, during the time of my abode there, very of-

" ten occaſion to paſs by that ſhore, I took notice, that almoſt all along great heaps " of ſea wrack, or a ſea-weed, called in England kelp, ſuch as they lay on the " top of barrels of oiſters, had been thrown up by the ſea in ſtormy weather. " This kelp, when there came no ſtink from the ſhore, I found was dry, and be- " ing taken up in my hand had ſcarce any ſmell at all, but when it ſtunk it was " always wet, the wind from the oppoſite ſhore having daſhed a great deal of ſea- " water into it, which in the ſummer did quickly putrify and ſtink. It may ſeem " ſtrange to thoſe, who have not been acquainted with the abominable ſmell of " ſea-water pumped out of a tight ſhip (which the ſcent of this ſhore did re- " ſemble) that ſalt-water ſhould be apt to ſtink; and it would have done ſo to " me too, had I not ſeen the experience of it here in England, that ſea-water " kept a while in a tub will ſtink ſooner and worſe than rain-water: for though " we find, that ſalt preſerves fleſh and fiſh, and ſuch like things from putrefaction, " becauſe it not only dries up their ſuperfluous moiſture, which would quickly " colliquate their parts, and lead them to putrefaction, but by entering into all " their pores it conſtipates and conſolidates their parts; yet ſalt in water be- " ing to perform neither of theſe offices, the heat, that is in ſalt, doth there co- " operate with the warmth of the ambient air to promote putrefaction.

" Denmark doth ſpontaneouſly produce beech-trees in as great plenty as Sweden " doth fir and birch-trees. In all the provinces of Denmark, where I have been, " I have obſerved not only fine groves, but goodly foreſts, conſiſting for the moſt " part of beech, and fairer trees of that kind than I have ſeen any where, which " is a kind providence, for ſo cold a country to be furniſhed with ſuch ſtore of " excellent fuel. The oaks in Zealand are but few, and for the moſt part crooked, " ſmall, and not fit for timber; though in Jutland there is pretty ſtore of them, " and many of them of ſtately growth. There hath formerly, it ſeems, been " greater plenty; for now oak-timber is a commodity prohibited under ſevere " penalties to be carried out of that king's dominions. Neither elms nor fir-trees " grow ſpontaneouſly in that kingdom, and very few aſhes; alders grow in moiſt " places there, but only to ſhrubs; nor have I ſeen an alder there big enough to " make a hop-pole. Some few maples there are, and thoſe but ſhrubs. There is " great plenty of hazel every where in that country, but eſpecially in the iſland " of Ween, or, as the Engliſh call it, the Scarlet Iſland; ſo that they lade ſeveral " barks in that country, at the time of the year, with nuts for Holland. I have " been three times in that iſland; the firſt time I went on purpoſe to ſee what " ruins were left of Urani-Burgum, or Tycho Brahé's aſtronomical palace, but " it is now razed to the ground, and only ſome rubbiſh of the foundation left. " The oaks there are ſtrangely ſubject to be ſpoiled by lightening more than ever " I obſerved in any other country. Where any oaks grow though encompaſſed by " beeches, I found a conſiderable number of them hollowed and burnt to a coal " within by lightening, though the outward ſhell grew, and bore branches, and " not any of the beeches about them touched by lightening, that I could ſee. The " ſame thing I found as I rode through great woods in Jutland too. At firſt I " thought they had been ſet on fire ſo by poor people or boys to warm them, " till I was aſſured the contrary, and found the like in every wood I came by. " Fruit-trees there are not many; yet, in the country, thoſe, that are, are planted

" by ſome few of the great men; the reſt by Germans and Hollanders, that are be-
" come inhabitants there, for ornament of their gardens; the reſt not being de-
" lighted with that curioſity, or loath to be at the charge, they having great plenty
" of apples brought to their markets by ſea, at cheap rates, from Meeklenburg
" and Pomerania; yet the apples, that do grow there, though they are not of very
" delicate taſte raw, yet ſerve very well for tarts, and keep very firm and ſound
" all winter; but the bergamot-pears that grow there are as good as thoſe of Hol-
" land, which in my opinion are ſomething more delicate than thoſe of England.
" Thoſe fruit-trees they have are wonderfully loaden with fruit in the ſeaſon, be-
" cauſe they never begin to bloſſom till the middle of May, when all froſts are
" over. Cherries grow there in reaſonable plenty, but ſcarce ever grow quite red,
" and are of a ſour taſte. Apricots grow there too, but are great rarities, be-
" cauſe they have no walls to their gardens; the king's own gardens being but
" fenced with deal-boards ſet up an end, but thoſe apricots are little bigger than
" a man's thumb, though pretty well taſted. Peach-trees I never ſaw any there;
" ſome few vines they have for ſhade of an arbor or porch, which bear leaves,
" but never blow toward fruit. Of wild ſtrawberry there is ſome plenty in the
" woods; but gooſeberries never ripen throughly, but ſerve well enough for tarts:
" the currants or ribes grow very fair there, they having their plants from Hol-
" land, but never come to due maturity. Damaſk or red roſes there grow none;
" but of province-roſes great ſtore, which flower from the middle of June to the
" middle of September; and in the ſeaſon great ſtore of pretty good tulips are
" brought to the markets; but the flowers, that moſt adorn and perfume their
" houſes in May and the beginning of June, are the lilly convallies, which grow
" in great plenty every where at that time. They have moſt ſort of herbs that
" are ſown every ſpring; but for mint, they are fain to content themſelves with
" horſe-mint, or cat-mint; for ſpear-mint will hardly grow there. For ſage they
" have only wormwood-ſage, ſuch as was brought hither of late years from Scot-
" land for a rarity. At the king's and queen-mother's gardens they keep in the
" ſtoves all winter among their exotic plants, as orange and lemon-trees, &c.
" (which with that care will hardly live three years) bays and roſemary-trees,
" gilly-flowers and ſtock gilly-flowers, our common ſage, and ſeveral other plants,
" that endure the winter abroad well with us, but are not proof againſt the ſharp
" long winters there; yet ſhort ſprigs of roſemary are common enough in the
" markets there, becauſe they ſow the ſeed every ſpring. But they have many
" ſorts of roots, as carrots, turneps, parſnips, ſkirrets, which were as good as
" any where in the world; but, above all, the cabbage of that country much
" exceeds that of more ſouthern climates. In all the king of Denmark's do-
" minions there grows no wheat, except (as I was told) a little in the iſland of
" Laland; but they have it ſupplied at eaſy rates from Germany and Poland. Of
" rye, barley, and oats, there is plenty, but the two latter, by reaſon of the
" early returns of wets and cold by the end of Auguſt, are commonly mowed
" before they are quite turned yellow; and ſome years they are fain to dry them
" in ovens. The ſheep of that country are moſt of them black, and the cattle
" almoſt all pied of ſeveral colours; their fleſh is ſold very cheap in the market,
" but it is for the moſt part lean, they having no good meadows in Zealand;
" there being but one brook in that great iſland, and never a river. There is

" little good freſh water in the iſland, there being but very few ſprings. The " city of Copenhagen is ſerved with water brought from a lake two miles off in " pipes of bored deal timber; but all the ſummer long it ſtinks ſo, and is ſo full " of worms, that it is loathſome to waſh one's hands and face in it; and yet " they have no other water to dreſs their meat with. Hay is there at reaſonable " rates, but not very good. Of hens and chickens and ducks there is plenty " enough, but all ſold lean in the markets; ſo of turkeys and geeſe (pretty fat) " I never ſaw greater plenty any where, but they ſell none young; no more do " they of their pigeons, and it is but of late years that they have killed any " calves. Rabbits there are none in the country, except a few tame ones, and " the Danes have a natural abhorrency for them, or elſe the country were very " proper to breed them. For freſh fiſh, beſide what the Baltic Sea brings almoſt to " their doors, as plaice, whitings, flounders, codlings, and excellent ſoles, and " great plenty of ſhrimps, the iſland of Zealand abounds with great lakes and " ſtanding pools, ſupplied with water by the rain falling from the higher grounds, " which afford them great plenty of carps, pikes, eels, the largeſt breams and " perches that ever I ſaw, fair tenches, which are eaten only by the poorer ſorts, " the reſt deſpiſing them, becauſe they have a tradition, that at ſome time of the " year they are ſcabby, and have inſects like lice found upon them; which " croſſes the Engliſh proverb, that ſays, *as ſound as a tench*. The crawfiſh of " that country are at leaſt twice as big as ours, and excellent meat: but the " choiceſt pond-fiſh they have is a fiſh they call karouſe, ſomewhat reſembling a " roach with his red fins, but it is near as big as the largeſt carps, but much bet- " ter meat. All the ſummer time, that country is full of wild fowls, as ſwans, " wild geeſe, duck, teel, widgeon, bald-coot, dive-dappers, ſheldrake, moor- " hen, wood-cock: the open grounds in September ſo full of green and grey " plovers, that they riſe in flocks of thouſands as we paſs by them; but by Mi- " chaelmas there is not one to be ſeen, they taking their flights, as I ſuppoſe, to " warmer countries; ſo that all the winter the king's huntſmen have much ado " to furniſh their maſter's table with a wild duck now and then; for at other " tables they are not ſeen till March, when they are out of ſeaſon, and ill meat. " The king's foreſts are full ſtocked with large red deer, which carry as fair " heads as any I have ſeen in England; the penalty being death to kill any of " them without the king's leave. The woods abound with roe-deer, which are " much bigger than thoſe of the north of England, and are rather larger than " prickets with us. Though they are very ſwift, they make no chace; for, being " hunted, they quickly endeavour to hide themſelves in a buſh, and the dogs " come and tear them to pieces; ſo the uſual way is ſhooting of them. Every " ordinary fellow there has the ſkill, with a leaf in his mouth, to make a call " for them; and, as ſoon as they hear the ſound, they will come four or five " jumping toward the noiſe, and as ſoon as they dicover the men, endeavour to " run away again. They are a prohibited game, but, having a placart from that " king to kill any roe or hare, I did now and then make bold with them. In " Jutland there are ſtore of wild boars, and in Zealand great plenty of hares; " in the Amaker iſland, which is joined to Copenhagen by a bridge, they are as " plentiful as in a hare warren. I have many times ſeen ten or a dozen of them " at one view: in the winter their flew is very grey, and thoſe that are then

" brought to the market from Schonen are perfect white, but both return to their " natural colour in the ſummer: they are larger much than our hares, but are " neither good to courſe or hunt. In Denmark they never eat any part of a " roe, hare, or fat ſtag, but the chine roaſted and larded; the reſt they give the " dogs. The heathy grounds of that country abound much with juniper and " whortleberries; and the blackbirds, thruſhes, and fieldfares, feeding on thoſe " berries and haws, are in the firſt part of winter the beſt and fatteſt meat that " country affords. The firſt part of their winter, though it begin ſomething " earlier than with us, is wet and cold, but at the rate it is then in England; " and any froſt that begins there before Chriſtmas ſeldom continues long. The " laſt winter, which was counted the ſharpeſt any man did remember, began but " on the 14th of January; by the 28th the Baltic Sea was frozen quite over, and " ſtore of people began to paſs from ſide to ſide with hay, corn, and oxen; but " the Sound, where there commonly runs a ſtrong current, between the two " caſtles, was not quite frozen over till the 8th of February, becauſe there con- " tinued a high wind moſt time of the froſt, which was the reaſon the great belt " between Zealand and Funen was not quite frozen over all that winter, though " all people accounted it a harder froſt than when the late king of Sweden paſſed " over that belt with his army of horſe, foot, cannon, and baggage. On the 19th " of February laſt I paſſed over on foot, between Elſenore and Elſenburg, with " a great deal of company with me, and met, not only people paſſing, as thick " as to a fair, with oxen, and waggons laden, but ſaw many ſoldiers dragging " of great ſtones of near a tun weight a-piece. They commonly making uſe of " that time of the year to place them under the walls of Cronenburg-Caſtle, to " help to break the force of the waves, which in ſtormy weather beats furiouſly " on them. In ſeveral places near the way where we paſſed, the country people " had made round holes in the ice of about four feet diameter; and, having ſet " up a ſkreen of reeds to keep the north wind off them, ſo ſpent the whole " day on the ice in fiſhing at thoſe holes, with lines let down into them with " hooks and baits at the end of them. I bought ſome good ſoles of them at " one of the holes; but that, which chiefly made me go out of my way to them, " was, to ſee the thickneſs of the ice they had thrown up, which made me won- " der, when I ſaw it was hardly ſix inches thick, that it could bear ſuch great " weights as paſſed over it: but I ſatisfied myſelf, that the water, being contigu- " ous to it, did help to ſuſtain it like a float. But, it ſeems, the froſt ſinks much " deeper into the earth, than it does into water; for, about the middle of that " great froſt, accompanying the body of an Engliſh woman, that was to be " buried in a church-yard, I aſked the grave-maker how deep he found the froſt " did uſually penetrate into the ground; he told me a Daniſh ell and a half, which " amounts to about three feet two inches and a half. But this church-yard was " in the city, and encompaſſed with houſes, where the cold air could not exerciſe " its utmoſt power; and, therefore, poſſibly in the country the froſt might ſink " yet deeper. However this penetration is remarkably deeper than with us about " London; for, in that great froſt, about five years ſince, not only my gardener, " but ſeveral labouring men beſides, did aſſure, that froſt did not pierce into " ground, that had been broken up, above ſix inches, and into graſs-ground, " much leſs. That the froſt is much more penetrating there than in England, I

" had,

" had, not only the teſtimony of my ſenſe, and the ſeeing ſo large a ſea cryſtal-
" lized, but having, in a room in my houſe above ſtairs, ſeveral baſkets of
" bottles of canary, claret, Nordown-ale; the claret froze firſt, then the Nor-
" down-ale, and at laſt the canary. Their corks were heaved by the ice out of all
" the bottles, and the ice was much more ſpungy than that of common water
" frozen in bottles; but in all thoſe bottles, there was ſome little part of the
" liquor left fluid, which, poured out, was much ſtronger than the drink whence
" it proceeded was at firſt, and when the reſt of the ice was melted by the fire, it
" proved almoſt as inſipid as water. I left all theſe liquors in their bottles, to be
" diſſolved by degrees, when the thaw came; but, after all, they were never
" worth drinking. I ſet bottles of French brandy into the air a whole night to
" freeze, but in the morning there was only ſome few icy particles floating in it:
" but I ſeveral times ſet ſome French brandy in a ſmall ſilver dram-cup to freeze
" in a north window: by morning it was frozen into a very ſpungy ice, and the
" ſpirit and ſtrength of it was gone; what remained being of a very ungrateful
" taſte. This froſt, without any intermiſſion, continued till the 12th of May; at
" what time, going to Elſineur to take order about ſending home my goods by
" ſea, I ſaw the Baltic full of floating iſlands of ice moving towards the Sound;
" and, in the woods I rode through, I could not perceive any thing green. But
" ſo briſk and vigorous is the approach of ſpring in that country, that at my
" return, three days after, the ice was all gone or melted, the trees were full of
" green tender leaves, and nightingales ſinging every where in the woods, which
" ſing there only in May, and not in April, as with us: and, at my firſt arrival
" there, it was a great ſurprizal to find nightingales, when in England I could
" never hear any above forty miles north of London; but yet, in my judgment,
" the nightingales there have not ſo great variety, nor ſuch ſweet notes, as with
" us in England. I ſuppoſe it is no news to any one here to tell them, that
" there is not the leaſt appearance of a tide in the Baltic Sea: but yet the king's
" ſhips of war ſuffer much by it; they never laſting half ſo long as ours, for
" want of a ſpring tide to bring them into a dock to repair them, they having
" no other way to do it but by careening them. But, perchance, every one here
" hath not heard, that, notwithſtanding ſo many freſh rivers empty themſelves
" into that ſea, it is not perceivable, that it hath any motion of its own out-
" ward toward the ocean. There is, it is true, for the moſt part, a ſtrong cur-
" rent, that ſets in or out at the Sound, which is the mouth, or entrance, of the
" Baltic, being, as I have ſaid already, not above four miles broad; but, that
" current is wholly guided and dependent on the courſe of the winds.

" This being what my memory could of a ſudden ſuggeſt to me concerning
" the natural hiſtory of Denmark, I ſhall ceaſe to be any further troubleſome at
" preſent to your lordſhip, and this honourable company."

Upon occaſion of what Mr. HENSHAW related of the motion of the Baltic Sea, viz. that notwithſtanding ſo many freſh rivers empty themſelves into that ſea, it is not perceivable, that it hath any motion of its own outwards toward the ocean: and that indeed there is for the moſt part a ſtrong current, that ſets in or out at the Sound, which is the mouth of the Baltic; but that current is wholly guided by

by the courſe of the wind: on occaſion of this remark, Sir WILLIAM PETTY aſked, whether that motion in or out was made with or againſt the wind. And it being anſwered, with the wind; Sir WILLIAM related what he had received from captain SHEERES concerning the motion of the Mediterranean, that for nine months of the year, viz. from about February to Allhollontide in November, the ocean ſets into the Straits' mouth, and that even when the Levant winds moſtly blow againſt that motion; and that for one month, viz. that of November, the ſea ſets out into the ocean, and for the remaining two months of December and January, it is, as it were, dead water.

Mr. OLDENBURG read a letter to him from Monſ. HUYGENS, dated at Paris, 20th February, 1675, N. S. [s] concerning a new pocket watch, which he affirmed to go as faſt as a pendulum, this letter being an explication of his anagram ſent 30th January, viz.

*Axis Circuli mobilis affixus in Centro Volutæ ferreæ* [t].

Mr. HOOKE ſaid, that divers years ago he had had ſuch an invention; and that actually watches had been made according to the ſame; for which he appealed to the Journal-books, to the *Hiſtory of the Society*, and to ſeveral members of it.

It was ordered, that Monſ. HUYGENS, notwithſtanding, ſhould be thanked for this communication, and informed what had been done here; and what were the cauſes of its want of ſucceſs.

There was ſhewn from prince RUPERT his emboſſed map of the Channel between Normandy, Bretagne, and England, and of both the ſhores.

There was preſented from Mr. LISTER ſome cauk for the vitrifying the whole body of antimony.

*February* 25. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,

| | |
|---|---|
| The lord biſhop of Saliſbury, | Mr. COLWALL, |
| Sir JAMES SHAEN, | Mr. HILL, |
| Sir WILLIAM PETTY, | Mr. OLDENBURG. |
| Mr. PEPYS, | |

The preſident enquiring what anſwers were come in to the printed declaration, Mr. HOOKE delivered a letter of Mr. OUDART, very civilly excuſing himſelf, and alledging reaſons for his late omiſſion, and promiſing compliance with the import of that declaration, as ſoon as he ſhould be able.

[s] Letter-book, vol. vii. p. 130. [t] See Philoſoph. Tranſact. vol. x. n° 118. p. 440. for October, 1675.

Mr.

Mr. OLDENBURG gave an account of what Sir JOHN TALBOT, Dr. HOLDER, Mr. WALLER, and Mr. BURNET had declared, viz. that the firſt would himſelf attend the Society as ſoon as he could, and ſee what his arrears were: the ſecond, that he would ſubmit to the import of the declaration, with great expreſſions of his reſpect to the Society: the third put it off with an expreſſion of merriment, that he thought it beſt to forget and forgive one another for what was paſt, and to begin upon a new ſcore: the fourth deſired by Mr. BOYLE the Society's patience till he was ſettled (which he thought he ſhould ſoon be) and then he would pay his arrears, and ſign the bond.

It was ordered, that Mr. WICKS [x] and Mr. SHORTGRAVE [y] carry copies of the printed bond to as many in and about London, as had not yet ſigned; and to deſire their poſitive reſolution for ſigning or not ſigning.

Mr. HOOKE read before the council Mr. HOSKYNS's letter of 26th January, 167⅓, importing, that he had made the conveyance from Sir JOHN BANKES, ſuch as he judged ſafe and ſufficient, of the fee-farm rents at Lewes in Suſſex; adding, that Sir JOHN BANKES and his truſtees muſt ſeal, and he or any one of them acknowledge it before a maſter in chancery, that it might be inrolled. That Mr. LILLY had ſince promiſed him, Mr. HOSKYNS, to have it ready engroſſed for the Thurſday following, and to bring to Mr. HOOKE an authentic copy of theſe records, that make out what is due, and out of what lands; that ſo, if occaſion be, the Society may be able to prove their title.

That he had alſo promiſed to make known to the council Mr. THOMAS HENSHAW of Clifford's Inn, who was the perſon that returned the rent from Lewes; and that Sir JOHN BANKES had promiſed to the council his conveyances, if they ſhould want them.

It was ordered, that ſir JOHN BANKES ſhould be deſired to extract out of his conveyances the particular parcels of the lands, out of which theſe fee-farm rents of twenty-four pounds per annum are payable.

It was ordered likewiſe, that Mr. HOOKE do, as ſoon as he could, remove the Society's repoſitory and library to the north gallery of Greſham College; and that being done, to perfect the catalogue of both, according to a former order.

Mr. HOOKE mentioning, that he had an invention for finding the longitude to a minute of time, or fifteen minutes in the heavens, which he would make out, and render practicable, if a due compenſation were to be had for it Sir; JAMES SHAEN promiſed, that he would procure for him either a thouſand pounds ſterling in a ſum, or an hundred and fifty pounds per annum.

Mr. HOOKE declaring that he would chooſe the latter, the council preſſed him to draw up articles accordingly, and to put his invention into act.

[x] The clerk of the Society. [y] The operator.

At

At a meeting of the SOCIETY on the ſame day,

Dr. GREW read his diſcourſes concerning the ſtructure of the cortical, ligneous and medullar part of trees, exemplifying it in ſeveral trees, and repreſenting the ſame by figures.

This diſcourſe was ordered to be regiſtred [z]; and the author was deſired to proſecute this ſubject.

Mr. HOOKE brought in an artificial head reſembling china, made in England, of Engliſh clay, ſo hard and ſolid, that he ſaid, that nothing would faſten on it, except a diamond; and that it received its poliſh in the fire.

Dr. DANIEL COXE ſent in a paper concerning the improvement of Cornwall by ſea-ſand; the reading of which was referred to the next meeting.

*March* 4. Mr. OLDENBURG preſented a manuſcript compoſed by Mr. JOHN WEBSTER, and dedicated to the Society, concerning *witchcraft*. The author's deſire being, that the Society would give their ſenſe of it, they appointed Sir WILLIAM PETTY, Dr. PELL, and Mr. MILLES, to peruſe it, and report their opinion.

Dr. VOSSIUS's two Latin diſcourſes were read; the one *De apparentibus in Luna Maculis*; the other *De ſpeculo Archimedeo*.

Mr. HOOKE gave his thoughts of both, ſaying, with reſpect to the former, that the author's opinion was very ingenious, but did not in all particulars ſeem to anſwer the phænomena. For though it ſhould be granted, that a *lens* did ſo invert the object beyond it, as to make a protuberancy appear hollow, and the right ſide the left, *& vice verſa*; and though we ſhould grant, that there is ſuch a propriety in the parts of the atmoſphere of the moon, extended over and about the ſides of the mountains, ſo as to be able to produce ſuch an inverſion; yet that would not ſuffice to make out the appearances: for in the coming on of the light and ſhadows upon thoſe ſpots, which Dr. VOSSIUS eſteemed mountains, but we believe cavities, the middlemoſt part of the ſpot being the moſt prominent is not firſt enlightened, as it ought to be, according to Dr. VOSSIUS's ſuppoſition; but the tops and ſides of thoſe circular ridges, that encompaſs the ſpot, and are next the ſun, are ſo; and the ſhadow is, as it ought to be, caſt regularly upon the other parts of the moon, according to the true rules of ſhadow: inſomuch that at the beginning the whole middle of the cavity is perfectly dark, as being overſhadowed by the ridge of the ſunny ſide: but as the ſun riſes higher, and enlightens the bottom of the cavity, one may in ſeveral of them diſcover, not only divers other leſſer cavities or ſpots, incompaſſed with ridges, as the greater, but alſo ſeveral ſmall hills or hillocks, ſuch as Dr. VOSSIUS would ſuppoſe inverted

[z] Regiſter, vol. iv. p. 324. It is printed in Dr. GREW's *Comparative Anatomy of Plants*, book iii.

by

by the refraction of the lunar atmosphere, which appear in their true shapes, and the light and shadow properly posited.

As to the appearance of Teneriffe [a], Mr. Hooke conceived, that it was no other than that the shadow of the Pike darkened the surface of the sea towards the west, and likewise that part of the vaporous air, that was above the sea, as it may be very often observed, when the air is hazy, the radiations between the clouds and the shadows of the clouds are plainly distinguished in the body of the air. And that this is so seems very probable from the ensuing circumstance in that history [b]; for, upon the rising of the sun a little higher, the said atmosphere thickened into clouds, that covered the surface of the sea and islands adjacent.

Concerning the latter paper of Dr. Vossius, treating of the burning-glass of Archimedes, Mr. Hooke declared, that he could not say, whether it were made in the manner described by the Dr. or not: but added, that he was sure, that a speculum made of a parabolical figure would much surpass one of the same size, made up of several specular plains: and that, both in the one and the other, the image of the sun would grow bigger and bigger, (and consequently fainter) according as the focus was farther distant from the said burning-glass: and that therefore, this did not solve that great question about burning-glasses, viz. how to make one of a determinate bigness, that shall burn at any distance assigned.

It was ordered, that Dr. Vossius be thanked for these two discourses, and that they be registered [c]; and that he be desired to give in, at his conveniency, those other matters relating to mechanics and physics, which he intimated in his letter accompanying these discourses.

Mr. Oldenburg produced a paper sent in by Dr. Daniel Coxe, concerning the improvement of Cornwall by sea-sand [d].

This discourse giving occasion to consider of the cause, that might render this sea-sand more fertilising than other sand, Mr. Hooke intimated, that the sand being made of the sea water, which in process of time was condensed, it seemed, that this sand not being yet quite fixed, might, by being exposed to the air, and mixed with the rain water, be resolved into sea-water, and so fertilise the ground.

*March* 11. The person, who should have made a discourse this day, being by urgent occasions detained from the Society, there was read out of the Register a discourse formerly given in by Mr. Boyle, about shining flesh.

This gave occasion to some hints for a general hypothesis for explaining the nature of light, concerning which Mr. Hooke gave his thoughts as follow:

[a] See the relation of the Pico Teneriffe in Sprat's Hist. of the Royal Society, p. 202,203.
[b] Ibid. p 203.
[c] They do not appear in the Register.
[d] It is printed in the Philosoph. Transact. vol. x. n° 113. p. 293. for April, 1675.

That light is a vibrating or tremulous motion in the medium, (which is thence called pellucid) produced from a like motion in the luminous body, after the ſame manner as ſound was then generally explained by a tremulous motion of the medium conveying ſound, produced therein by a tremulous motion of the ſounding body: and that, as there are produced in ſounds ſeveral harmonies by proportionate vibrations, ſo there are produced in light ſeveral curious and pleaſant colours, by the proportionate and harmonious motions of vibrations intermingled; and as thoſe of the one are ſenſated by the ear, ſo thoſe of the other are by the eye.

Mr. HOOKE intimating, that he had formerly brought in a paper concerning light, but not left it to be regiſtred, he was deſired to read it again at the next meeting.

He was alſo deſired to have ready for the next meeting, the apparatus neceſſary for the making Mr. NEWTON's experiments formerly alledged by him, for evincing the truth of his new theory of light and colours, eſpecially ſince Mr. FRANCIS LINUS had written another letter from Liege to Mr. OLDENBURG, dated 25th February, 167$\frac{4}{5}$, N. S. [e], containing aſſertions directly oppoſite to thoſe of Mr. NEWTON.

*March* 18. Mr. OLDENBURG read a letter to himſelf from Dr. BEAL, dated 8th *March*, 167$\frac{4}{5}$, concerning ſeveral ſorts of cider grafts ſent by him for the uſe of the Society; as alſo ſeveral curious ſtones.

It was ordered, that Mr. HOWARD, Mr. EVELYN, and Mr. PACKER be deſired to take care of ingrafting theſe grafts.

Mr. OLDENBURG preſented to the Society two books, one from Mr. BOYLE, concerning the *Poſſibility of the Reſurrection* [f], containing many philoſophical obſervations and experiments; the other the *Philoſophical Tranſactions* for the year 1674.

Mr. HOOKE read a diſcourſe of his concerning the nature and properties of light [g]; in which were contained ſeveral new properties of light, not obſerved, that he knew of, by optical writers: and thoſe were

1. That there is an inflection of light differing both from refraction and reflection, and ſeeming to depend upon the unequal denſity of the conſtituent parts of the ray, whereby the light is diſperſed from the place of condenſation, and rarified, or gradually diverged into a quadrant.

2. That this deflection is made towards the ſuperficies of the opacous body, perpendicularly.

[e] Letter-book, vol. vii. p. 202. It is printed in the Philoſoph. Tranſact. vol. x. n° 121. p. 499. for January, 167$\frac{4}{5}$.

[f] It is printed at the end of a diſcourſe publiſhed at London, 1675, in 8vo, intitled, *Some Conſiderations about the Reconcileableneſs of Reaſon and Religion. By T. E. a layman.*

[g] See his poſthumous works, p. 186—190.

3. That

3. That in this deflection of the rays, thoſe parts of diverged radiation, that are deflected by the greateſt angle from the ſtrait or direct radiations, are fainteſt: thoſe, that are deflected by the leaſt, are the ſtrongeſt.

4. That rays cutting each other, in one common foramen, do not make the angles *ad verticem* equal.

5. That colours may be made without refraction.

6. That the true bigneſs of the ſun's diameter cannot be taken with common ſights.

7. That the ſame rays of light falling upon the ſame point of the object will turn into all ſorts of colours, only by the various inclination of the object.

8. That colours begin to appear, when two pulſes of light are blended ſo very well, and near together, that the ſenſe takes them for one.

1675. *March* 25. At a meeting of the COUNCIL were preſent,

The lord viſcount BROUNCKER, preſident,

Sir WILLIAM PETTY,
Dr. WHISTLER,
Mr. COLWALL,
Mr. HILL,
Mr. OLDENBURG.

Dr. WHISTLER mentioned a propoſal to be made to the council for diſpoſing of Chelſea College.

He was deſired to receive the propoſal in writing for the next meeting of the council.

It was ordered, that the amanuenſis and the operator ſhould be urged to greater diligence and care in offering the printed bonds to thoſe, who had not yet ſigned, between that and the next meeting of the council; and that they ſhould deſire every one of thoſe, to whom they offered the bond, to give their poſitive anſwer, whether they would ſign or not.

At a meeting of the SOCIETY on the ſame day,

Dr. GREW made a diſcourſe concerning taſtes, obſerving their differences, and drawing ſome corallaries from thence.

He was deſired, both to give this diſcourſe to be regiſtered [b], and to print it.

It was particularly taken notice of, that Dr. GREW had in this diſcourſe inti-

[b] Regiſter, vol. iv. p. 340. It is printed in his *Anatomy of Plants*, p. 279, & ſeqq.

mated, how the ſpecifical virtues of plants might be diſcerned by their peculiar taſtes.

Mr. HOOKE remarked, that all bodies diſſolvable by the ſaliva are taſtable, and conſequently all bodies taſtleſs, that cannot be diſſolved by the ſaliva.

He ſaid farther, that any body, that is ſaporous, hath ſomething peculiar in its ſtructure, which gives it a peculiar taſte; and that there is probably as great a variation in taſte as there is in colours.

*April* 1. The SOCIETY did not ſit.

*April* 8. At a meeting of the COUNCIL were preſent,

The lord viſcount BROUNCKER, preſident,
The earl of Aylesbury, Mr. COLWALL,
Sir JOHN BANKES, Mr. OLDENBURG.
Dr. WHISTLER,

One Mr. HOLMES offered, in the name of a friend of his, that if the council would let him have a leaſe of the houſe of Chelſea College for thirty years, he would lay out four hundred pounds in repairing that houſe, and pay five pounds a-year for the firſt fifteen years, and ten pound a-year for the remaining fifteen years.

He being aſked, to what uſe it was to be employed, anſwered, that he had no authority from his principal to ſay any thing as to that. But the preſident replying, that the council was deſirous to know that, before they proceeded in the treaty, and that it ſhould go no farther than the council; he ſaid, that he would acquaint his principal therewith.

The preſident mentioned, that the officers of the ordnance intended alſo to make an overture to the council concerning the ſame houſe.

Sir JOHN BANKES delivered the indenture concerning the fee-farm rents of twenty-four pounds per annum in Lewes in Suſſex; which was delivered to Mr. COLWALL to keep.

At a meeting of the SOCIETY on the ſame day,

Sir ROBERT SOUTHWELL read his diſcourſe concerning water, and promiſed to give it in to be regiſtred [f], after he had written it fair. It was as follows:

" An excellent huſbandman or gardener is able to raiſe a livelihood for his " family out of a very little land; that is, out of about an acre to each head, as

[f] Regiſter, vol. iv. p. 309.

" is

" is ſeen in Holland and Zealand, and as is eſtimated to be in China: but one, " who hath no ſuch ſkill, and who muſt live by gathering of ſuch food as grows " wild, muſt range over perhaps a hundred times as much ground as the for- " mer, to procure a leſs ſplendid and commodious maintenance. In like man- " ner, thoſe of our Society, who have been long verſed in philoſophical diſquiſi- " tions, can, out of ſome few circumſtances of a ſingle experiment, make ſuch " an hour's diſcourſe, as ſhall both profit and pleaſe their hearers: but I, who " have no ſuch dexterity, am forced to take for my ſubject a whole element, a " quarter of the univerſe, and above half the ſurface of the habitable world, out " of which to pick up a coarſe meal, wherewith to entertain this company; and " therefore the matter of my preſent diſcourſe ſhall be *water*.

" If there be four elements, I am content, that water ſhould be one; ſince " the forming of the world (as it is deſcribed by MOSES) doth countenance that " opinion; ſince alſo many philoſophers teach us, that every thing may be diſ- " ſolved *in primam materiam liquidam*; and ſince we ſee ſeveral herbs will grow " and contract to themſelves a hard woody root out of water alone. But being " rather inclined to make but one common element, which is immutable atoms, " I am in the firſt place to conjecture, of what figures and motions thoſe atoms " are, which do make and conſtitute water; ſuppoſing, according to a late hypo- " theſis, that every atom (like the globe of the earth, like magnets, and indeed " the whole viſible world) hath in it three points conſiderable, namely, two in their " ſurface, which were called poles, and one within their ſubſtance, which hath " been called bias, which biaſſes have a tendency each to other, and to ſome com- " mon point without them.

The qualities of water are theſe:

" 1mo. Denſity; for that it is not eaſily compreſſed into a narrower place at one " time than at another.

" 2do. Fluidity; for that water poured out upon a level ſuperficies diffuſes it- " ſelf alſo, almoſt into a phyſical ſuperficies, or into a very broad body of little " thickneſs.

" 3tio. It is hardenable into ice, and in being ſo hardened dilateth itſelf with a " vaſt ſtrength.

" 4to. It is volatile; that is, eaſily diſſipated into inviſible parts by heat.

" 5to, Small drops of water are diſpoſed to form themſelves into a globular " figure.

" To ſolve all which phænomena, I humbly conceive, that the atoms, whereof " water is made, are globes or globular; that their polar motions are but faint; " that the motions of their biaſſes one towards another are a little, but not much, " ſtronger; and the tendencies of them towards the center of the earth, or ſpe- " cific gravity is not great.

" As

" As for denſity, I conceive, that globes cannot, by any art of laying or pack-
" ing them together, be ſtowed in leſs room one way than another; whereas even
" cubes, as they may be laid cloſer together than globes, ſo they may alſo be
" ſet edge-ways, and corner-ways, ſo as to admit many void ſpaces between
" them.

" As for fluidity, if a bag of globes, and another of cubical dyes, were poured
" out upon the like level tables, it is manifeſt, that the globes would run further,
" and lie leſs in heaps than the cubes, or than bodies of any other figure than
" globes.

" 3tio. As for volatility, no bodies have leſs coheſion than globes, which can
" touch each other but in points.

" 4to. If glaciation or freezing be a fixing and ſtaying of parts by wedges of
" nitre driven in amongſt them, when the atmoſphere is heavy; then it is plain,
" that no bodies will more eaſily admit wedges to be driven in amongſt them
" than globes: and ſuppoſe, into a veſſel full of globes an acute and long ſharp
" angled wedge were driven, that veſſel muſt needs dilate or break, with that
" force, which the ingreſs of wedges commonly maketh.

" 5to. Water hath no elaſticity, becauſe the motion of its poles is weak; for
" which reaſon alſo it doth not form itſelf ſpontaneouſly into any other figure
" than globes, becauſe globes by appoſition will make globes, but the globes, which
" water makes, are but ſmall, becauſe the motion of the biaſſes are, according to
" our hypotheſis, but weak, and ſuch as their motions towards the center of
" the earth doth tear aſunder, and hinder from conglomerating into very great
" globes.

" Having ſaid thus much concerning the prime qualities of water from atomi-
" cal principles and motion, we come next to the ſenſible differences between ſe-
" veral waters, and to the ways of diſcerning between water and water, and be-
" tween one liquor or fluid body and another, which are chiefly theſe.

" 1mo. Some water is heavier than others, viz. common water is heavier than
" ſpirit of wine, ſea-water heavier than common water; and ſpirit of vitriol,
" ſalts, &c. heavier than ſea water; and quick-ſilver the heavieſt of all waters
" or liquid bodies.

" 2do. Some waters are more volatile than others; that is to ſay, more eaſily
" diſſipable by heat, viz. quickſilver, though heavier than oil of vitriol, is yet
" more volatile than it, and ſpirit of wine is more volatile than ſaline ſpirits, in
" a far greater proportion than it is lighter.

" 3tio. Some waters, and commonly the lighter waters, are more impregnable
" with, and more ſuſceptive of the matter ſteeped in them than others: ſo light

" waters do make better beer than heavier, perhaps becauſe the light waters are " made of greater globes than the heavy and cloſe waters, and conſequently of " larger interſperſed vacuities; that is to ſay, ampler receptacles for other inter- " venient matter. Moreover, we ſee, that waters are the beſt menſtrua for im- " bibing the particles of other bodies; perhaps becauſe water conſiſting of " globes is on all ſides equally open, and fit for ſuch admiſſions.

" 4to. Some waters diſſolve more of the ſame ſalt than others, viz. more of " ſugar, allum, vitriol, common ſalt, &c.

" 5to. Some waters are more abſterſive than others; that is to ſay, mingle " themſelves more eaſily with ſaline, gummy, and unctuous ſubſtances than others; " for all ſorts of ſordes and abſtergenda are referrible to thoſe heads, eſpecially " ſuch as are made of the effluvia of mens bodies, and which are waſhed off " from linen. Wherefore ſoap, or rather abſterſive liquors are made of ſaline " aſhes of oils, and of gums or mucilages compounded together, for ſuch a com- " poſition will abſterge or cleanſe almoſt every thing; for we ſee, that water joins " itſelf with ſlimes and mucilages; oils join themſelves with greaſe; thin and hot " oils waſh away thicker and cold oils; as ſpirit of turpentine waſheth painters " colours; and acid liquors, as juice of lemons, waſheth the vitriol of ink from " linen, and the liquor of tartar waſheth away the blackneſs from ink itſelf.

" 6to. Some waters do harden the things, that are boiled in them, by ſtiffening " and reſtringing the parts of the ſame, and others ſoften and intenerate the matters " ſoaked in them.

" 7mo. Some waters coagulate milk, and cauſe ſeparation of heterogeneous " parts more than others.

" 8vo. Some diaphanous waters, by mixtures, loſe their tranſparency, and ſome " acquire colour without loſs of their tranſparency.

" 9. Some waters are apt to putrify and to produce animalcula more than " others.

" 10. Some waters are apt to ferment and precipitate more than others.

" 11. Some waters are more ſweet and nutritive.

" 12. Some waters promote the growth of plants more than others.

" 13. Fiſhes live and thrive better in ſome waters than in others, as ſome airs " do more favour the health of man than others.

" 14. Some waters break forth cold, ſome hot, out of the earth.

" 15. Some waters riſe higher into clouds by the exhalation of the ſun, than " others.

" 16. Some

" 16. Some waters are more diuretical and diaphoretical than others.

" 17. Some waters are more inflammable and ſpirituous than others.

" 18. Some are more ſtupifying, intoxicating, and inebriating than others.

" 19. Some are more apt to freeze, and the ice of ſome is more denſe and uniform than that of others.

" 20. Some waters have their peculiar and ſpecific qualities differing from others; of which (being infinite) I forbear to ſpeak.

" Having briefly touched upon the intrinſic conſtitution and ſenſible differences of waters, I ſhall next (perhaps with too great licentiouſneſs) paſs to the conſideration of other difference and diſtinctions of water, more groſs indeed, but not leſs uſeful in human affairs; to wit, I ſhall conſider the waters of the world, as divided into ſea and rivers, and the ſea divided into coaſts, ſhores, bays, roads, ports, havens, and creeks.

" 2do. I ſhall, in ſome meaſure, divide the ſeas into the ſeas of ſeveral countries, as diſtinct from one another, and from the ocean; by which I mean the ſea indifferently belonging to all countries and ſtates.

" As for the freſh waters, we ſhall divide them into lakes and rivers; and brooks and rivers into their heads, mouths, and ſources:

" For all theſe diſtinctions are of great uſe in political matters, if not in phyſical; and I hope you will ſuffer me, whoſe ordinary employment partakes more of the former than of the latter, to piece up my diſcourſe of both; for without ſuch licenſe and encouragement I could not have appeared at all in this undertaking.

" Wherefore I ſay, that water, viz. navigable water, is commonly divided into ſea and rivers, or rather into inland and outland, as well as into freſh and ſalt-waters. Therefore ſuppoſing the ſea did belong of right unto A, and the rivers unto B, it ſeems neceſſary, for the peace of mankind, that philoſophers ſhould aſſiſt the world, and particularly help A and B with ſuch definitions, as are neceſſary for ſuch their peace. In order whereunto I ſhall firſt premiſe the difficulties of that work itſelf; for although there be nothing more common than in talk to diſtinguiſh between ſeas and freſh water rivers, yet when we come to draw lines from one permanent and conſpicuous mark of the one ſide of ſuch waters, to the like mark on the other ſide of the ſame, I do not know, that there are any rules in nature for doing thereof, that is, ſuch as may oblige the whole world. Nor are there ſo much as ſtatutes and agreements of people for determining the ſame: nor hath ever the navigating nation of England ſet ſuch marks, ſo much as on our own two greateſt rivers, the Thames and the Severne. As for example, if we would diſtinguiſh the ſea from rivers by ſaltneſs,

" 1mo. We ſhall find no two taſtes to agree upon that ſign. 2. The ſalt " waters of the ſea intrude further upon the freſh rivers of the land at one time " than another. 3. There may be both ſalt, or ſaltiſh rivers, and alſo freſh ſeas " or lakes in the world, enough to diſable this means of a diſtinguiſhment, eſpe- " cially when matters of great value and importance ſhall depend thereupon.

" Again, if we endeavour this diſtinction by the limits of ebbing, and flow- " ing, accompting all waters, which have their reciprocal motion to be ſea, 1. " We ſhall find waters called ſeas, wherein thoſe motions are very obſcure and " ſmall. 2. Waters ebb and flow differently, according to wind and other ac- " cidents, beſides their monthly and annual differences; beſides thoſe more ſlow " changes, where the ſea gains on one ſhore, and loſes on the oppoſite.

" Laſtly, if we would go about this work by narrowneſs or depth, we ſhall find " very ſalt waters to paſs through very narrow fretums, and ſalt waters to be very " diffuſe and fordable; and on the other hand, there are waters perfectly freſh, " which be very broad and deep, beſides the differences of paſſableneſs, which " ariſe from the ſides and bottoms of the water in queſtion.

" Now, if we can find no rules in nature, but muſt fly to ſtatutes, charters, " and cuſtoms, the ſame can only oblige the few, which made and accepted them, " not the whole world; and conſequently cannot prevent wars and blood between " the ſeveral nations, that find it their intereſt to contend about it.

" Moreover, as it is uſual to talk of ſeas and rivers, as was diſtinguiſhed, ſo " Mare Hibernicum, Mare Britanicum, Mare Germanicum, frankly inferted; " and our laws do make mention of things done inter or intra quatuor maria. " We do alſo find mention of the Deucaledonian and Atlantic Oceans, &c. but " it appears not by the conſent of nations or princes. It is to be found on re- " cord remaining with all parties intended between each other, that there are " permanent and conſpicuous marks agreed upon on each ſide of the water, " between which, as the terminus a quo, and ad quem, where thoſe lines of de- " terminations ſhould be drawn, viz. from what viſible rock at Dover, to what " like mark about Calais, the line may be drawn, which divides the Britain from " the Germain Sea; from what point in Wales and Scotland, to what points in " the ſouth and north parts of Ireland reſpectively, the two lines ſhall be drawn, " which, with the ſhores on each ſide, doth incloſe the Mare Hibernicum. Much " leſs do I find, what lines diſtinguiſh the Britiſh Sea from the Weſtern Ocean, " or the German from the Deucaledonian, &c. or, if ſuch lines were fixed, can " I conceive how, out of the ſight of land, one could certainly know, when he is " within or without them, ſo as to determine the controverſy, whether a ſhip of " an hundred thouſand pounds value were prize or not, viz. if ſhe were prize " taken within, and not if taken without, the lines of fixed termination: for I " can think but of three ways of doing the ſame, the firſt whereof is by latitudes " and longitudes; the former whereof is not knowable at ſea within leſs than " about twenty Engliſh miles, and that too but when obſervations may be taken;

" and the latter is ſcarce knowable at all, otherwiſe than by running glaſſes, and " clocks, which do not yet go at ſea ſufficiently for that purpoſe.

" The ſecond way is by ſoundings, whereby the depth and nature of the ground " is diſcovered: but foraſmuch as there may be plains in the bottom of the ſea " of many miles in length, as alſo ſudden and frequent inequalities in the ſame, " no certainty can be hoped for from that help.

" The laſt is what men call the dead reckoning by rhombs and diſtances pro- " tracted on the card: but, foraſmuch as no man can ſteer nearer than to half a " point; (foraſmuch as every ſhip's courſe is diſturbed by tides, currents, and " leeward-way) foraſmuch as the log and line is no certain meaſure of diſ- " tances; and for that the variation of the needle is to be obſerved in ſailing of " long runs in ſeveral parts of the world; foraſmuch as charts are not enough, or " equally true; and laſtly, for that a long reckoning ſhall, by its accumulation " of errors, differ much in truth from a ſhort one: I ſay, for all theſe reaſons, " the dead reckoning is not to be relied upon, where an hundred miles is in " queſtion; for either part will appeal to blood and blows, rather than acquieſce " in the fineſt conjectures, when ſuch a wager lies at ſtake. It is true, ſuch con- " troverſies might be determined by the medium of the reckoning, made by " both parties; or by the real and true reckoning of the ſuperior party: but this " is not a rule in nature, but muſt depend upon conqueſt or conſent.

" We have ſaid, that neither ſeas from rivers, ſeas from ſeas, nor ſeas from " oceans, can be diſtinguiſhed by natural marks. We further ſay, that lands " from ſhores, and ſhores from coaſts, are not diſtinguiſhed by much more cer- " tain and ſatisfactory means: for, firſt, as for the ſhore, I take it to be ground " reciprocally ſhewing itſelf, and appearing both as land and ſea, that is to ſay, " a girdle of ground comprehended between the high and low water marks of " an ebbing and flowing ſea. Now, how this girdle ſtraitens and widens itſelf " every day, by the interpoſition of winds and land-floods, by the new and full " moon, by the ſeaſons of the year, by the firmneſs and looſeneſs of the earth " upon the ſhore, and from ſome obſtruſe cauſes alſo, is well known to every ob- " ſerver. Nevertheleſs, the limitation of ſhores is much more certain than that " of coaſts, where certainty is more deſirable and needful; for I take a coaſt to " be that part of the ſea without the low-water-mark to ſeaward, which by ſome " kind of natural right belongs to the paralelled and adjacent country waſhed by " it: as for example, our endeavour now is to anſwer the queſtion, how many " miles broad is the coaſt of England, or of any part of it, viz. of Dorſetſhire, " Devonſhire, &c.?

" To which queſtion I offer and propoſe the ſeveral following anſwers, viz. " 1. The coaſt of Dorſetſhire extends from low-water-mark unto half the ſhorteſt " line between the ſhore of Dorſetſhire and the ſhore of oppoſite France.

" 2. It is the diſtance from the ſhore, where the convexity of the ſea terminates the " ſight of one, that ſtandeth on the ground, or of an eye ſix feet above the ground.

" 3. The

" 3. The diſtances, at which the biggeſt ſhip (ſuppoſe of an hundred tuns) can " be ſeen from the ſhore.

" 4. The diſtances, at which, from the talleſt ſhip, the next land may be ſeen.

" 5. The diſtance, unto which an open boat of certain dimenſions dares ordina- " rily go a fiſhing into the ſea.

" 6. The diſtance from the ſhore into the ſea, at which the beſt gun can carry " or ſhoot with effect.

" 7. The like diſtance, with reſpect to a muſket, or the biggeſt killing inſtru- " ment, that the ſtrength of a man can wield or uſe.

" 8. The diſtance, at which from ſea a man, or other the biggeſt animal or " thing, can be ſeen to move on the ſhore.

" 9. The diſtance a man on horſeback can ride from low-water-mark into " the ſea, and throw a dart, ſhoot an arrow, or bullet, out of ſuch a gun as he " can carry thither.

" 10. The diſtance from the ſhore, until no ground can be ſtruck by an ordi- " nary deep ſea-lead, ſuppoſe of an hundred fathom; all which diſtances and " dimenſions of a coaſt will be longer and ſhorter, according to ſeveral accidents " and circumſtances eaſily conceivable without further mention.

" So what is meant by the ſhore or coaſt of France, upon which an Engliſh- " man may not fiſh without breach of peace, is unknown to me from any thing " I ever yet read or heard diſcourſed, even by perſons concerned as far as blood " in thoſe matters; and it is not yet clearly demonſtrable, were the caſe put " vice verſa. I have met with a paper ſeeming to be a declaration, or intended " declaration, from his late majeſty of bleſſed memory, made in council, as I " gueſs, between the years 1630, and 1640, wherein are theſe words, viz.

" *And therefore, to avoid all difficulties, and colour of controverſies, that may be* " *ſtirred concerning the bounds and extent, wherein his majeſty now profeſſeth to yield* " *peace and ſecurity to his friends and neighbours deſiring the ſame, his majeſty pur-* " *poſeth to ſend plats of thoſe limits to be affixed in the moſt public places of his* " *chiefeſt ſea-towns and harbours*, &c.

" Now, in the maps and plats above-mentioned, I ſuppoſe the difficulties here " lamented are remedied: wherefore I ſhall ſearch for the ſame plats, and, if to " be found, produce them; but if not, I ſhall then offer my thoughts to the " ſame purpoſe.

" I have here ſet forth the difficulties of diſtinguiſhing between navigable " waters, as aforeſaid: and now, by way of remedy, in caſe thoſe directive plats,

" laſt mentioned, intended at leaſt to be ſet forth by the beſt ſkill and authority, " ſhould not be found, I ſhall only offer, as an expedient for the preſent, the " following lemmas, viz.

" 1. That an encloſure may be made of thoſe four ſeas, which are com- " monly deemed part and parcel of the Engliſh empire, by ſenſible and prac- " ticable marks, for an inconſiderable charge, viz. for within one hundredth part " of the yearly charge, which the ſea forces of England have commonly coſt, " and that ſo, as no veſſel may go in and out of the ſame without notice, which, " in brief, is to ſay, that there is *mare clauſible*, if not *mare clauſum*.

" 2. That it is for the advantage of all princes and ſtates, who do pretend " to any ſhare in the dominion of the ſeas ſo incloſed, wholly to quit the ſame, " and transfer their whole pretences to ſome one of their number.

" 3. That the Engliſh Empire, beſides their ancient rights by cuſtom, con- " queſt, and conceſſions, are the beſt qualified, even in nature, to receive and " adminiſter this power; and that for the reaſons following, which, becauſe they " are natural, I here bring in, wholly declining the ſecond lemma, as purely " political, and ſuſpending the firſt till I find there is no better expedient already " extant; for, it being a matter of art, it might have fitted this preſence well " enough.

" I ſay, the natural reaſons for our ſovereignty of the ſeas are theſe, viz. 1. Sup- " poſing, for inſtance and illuſtration ſake, the *mare clauſum* we intend, to be the " ſeas comprehended within a line, beginning but even at the iſle of Scilly, and " paſſing thence to Cape Clear in Ireland, thence to the Durſyes, and thence " again to the north-weſtermoſt part of Ireland, thence by the Hebrides weſt- " ward to Scotland, thence to Cape Van Staten, then to the Naze of Norway, " thence to the next land of Jutland, thence to the Elb's mouth, thence by " Holland, Zeland, and Flanders, to Calais, thence to Heyſant in Britanny, and " thence to Scilly where we began: I ſay, Firſt, that the king of England hath " thrice as much ſhore, as the king of France, Spain, Denmark, the ſtates of " Holland, with the towns of Hamburg, Embden, and Bremen, put all toge- " ther, do poſſeſs; and, though the Baltic Seas were added to the incloſure laſt " mentioned (the Sinus Bodicus excluded, lying without the latitude of Cape Van " Staten) the king would have as much ſhore as all the princes and ſtates afore- " mentioned (adding the king of Sweden, with the elector of Brandenburg, the " towns of Lubeck and Dantick) alſo have: nay, if the Bay of Biſcay were alſo " added as a third encloſure to the other two, the king of England hath ſtill " more ſhore within all the ſaid three encloſures taken as one, than any two of " the aforementioned princes, who have the moſt within the ſame: all which " may be ſeen by the maps.

2. The iſles of Great Britain and Ireland do lie about the middle of the line of " trade, extending itſelf from Archangel in Ruſſia, round about by Ireland to " Tangier, and through the whole Mediterranean Sea to Conſtantinople. More- " over,

" over, Ireland ſtands in the face of the New American world, which doth al-
" ready, and will every day, more and more beget a vaſt trade; nor have France
" Spain, and Portugal, which alſo have the ſame aſpect to the new world, half
" ſo many ports and conveniencies for the new world's trade, as the king of
" England's countries have.

" 3. About three quarters of all ſhips of the ſeveral European nations trading
" to the Eaſt Indies, Guinea, the Streights, and America, muſt paſs, in their
" voyages thither, between Scilly and Heyſant, or between Scotland and Nor-
" way; all which paſſages we ſuppoſed may be encloſed as aforeſaid, and as ſhall
" hereafter be better explained. Moreover, the great magazine of naval provi-
" ſions, as timber, plank, boards, iron, hemp, pitch, maſts, and tar, as alſo of
" corn, muſt have vent through the ſame paſſages.

" 4. The great fiſheries of the old world, particularly that of herrings, (the
" Indies of the Hollanders) is within the chief of theſe three encloſures, and
" within the ſame is the greateſt market and conſumption of all the French
" bulky commodities, of wine, brandy, ſalt, paper, and their fruits. Moreover,
" againſt this encloſure are the greateſt fiſheries of the new world, namely about
" Newfoundland.

" And, laſtly, through the aforementioned paſſage muſt the Greenland and
" Muſcovy trade be managed.

" 5. The king of England and his ſubjects have already more ſhipping of war
" and trade, than any two of the princes aforementioned, the ſtates of Holland
" only excepted, who have little other wealth: but he hath four times as many
" ſubjects as that ſtate hath, who, when they find it their intereſt to look after the
" dominion of the ſeas, may alſo bear the ſame proportion to the Hollanders,
" even in naval ſtrength alſo.

" 6. It hath been ſhewn by a great obſerver, that the king of France is, or
" may be, ſuperior to the king of Spain in naval force; but, withall, the king-
" dom of France is under natural and perpetual impediments of ever being as
" powerful at ſea as either the Engliſh or Hollanders now are.

" 7. The ſituation of Denmark and Sweden is ſuch, in compariſon of Great
" Britain and Ireland, with reſpect to this dominion, that the Engliſh can do
" more towards it with two, than they can do with four. Nor are the Danes and
" Swedes any thing as to this matter, unleſs they could be always as one, which
" the likeneſs of their intereſt will ſeldom ſuffer them to be.

" 8. Great Britain and Ireland are under an abſolute neceſſity to be ſtrong in
" ſhipping and ſea ſoldiers, to defend themſelves from foreign invaſion; which
" ſoldiers are alſo held beſt for ſuppreſſing any domeſtic inſurrections amongſt
" themſelves. Now, ſixty thouſand men at ſea is near treble the force, that ever
" any enemy appeared with againſt England, and yet may be maintained with

" one

" one ſixteenth part of the expence of the king of England's ſubjects: the raiſ-
" ing of which one ſixteenth part can be no ſenſible calamity upon his ſubjects,
" ſince few can diſcern the quantity and quality of the commodities they ſpend
" and uſe, within one ſixteenth part of the ſame.

" Wherefore if, as it was before ſaid, it be the intereſt of all princes and ſtates,
" who have ſhare and ſhore within theſe encloſures, to transfer their power to
" ſome one of their number, to prevent *bellum omnium contra omnes* concern-
" ing the ſame: And, ſince the king of England hath already ſo fair, ſo pro-
" bable, and ſo ancient, a claim to this power, which neither he nor his ſub-
" jects will ever quietly part with; I conceive, that it is the intereſt of the ſaid
" princes, for the additional natural arguments above mentioned, to reſign and
" confirm the ſaid power and authority unto him, without further trouble, and
" eſpecially ſince his people, knowing their rights and intereſts therein, can other-
" wiſe, if occaſion were, compel them thereunto.

" We have hitherto ſpoken of the differences of navigable waters: we ſhall
" in the next place purſue to define and diſtinguiſh ſome other particulars relating
" to the premiſes, as followeth: in order whereunto we next ſay, that

" A river is a channel, whereby freſh waters riſing out of ſprings and collected
" rain waters, return into the ſea conſtantly and continually: whereas brooks are
" not only ſmall rivers, but rather channels, which run with waters, not con-
" ſtantly, but only at ſome times and ſeaſons. The mouth of a river is the
" place, where the river joins with ſea; and the head of a river is ſometimes
" taken for the ſmalleſt ſource and beginning of it; but ſometimes for ſome
" headland, even without the mouth of the ſame: as for example, an head-land
" near Havre de Grace in France is called the Seine head. Nor is it incongru-
" ous to ſay, that the head and the mouth ſhould be near, if not within, each
" other: whereas the beginning of that river and its head in ſome ſenſe is many
" leagues ſouthward of Paris. I mention this of names, becauſe it is of great
" concernment in the ſettling of new colonies in America, the boundaries whereof
" are, for the moſt part, rivers; and it is fit it be very clear what is meant by
" the head of river: as for example, there is now, or was very lately a con-
" troverſy depending upon this very point, whereby the Boſtoners in New Eng-
" land claim the provinces of Hampſhire and Mayne to be under the juriſdiction
" of their province, while yet there are two diſtinct colonies and goverments
" independent from Boſton, according to the various acception of the word *head*
" *of a river* in the reſpective patents, whereby they are granted; for, if the
" breadth of Boſton province be the diſtance between the two parallels paſſing by
" the ſmall inland beginnings of the two rivers, Charles and Merimac, then the
" three abovementioned province are but one.

" But if by *head* be meant certain points near the mouths of thoſe two rivers,
" then are they three; which is a vaſt difference, and toucheth eſtates, and might
" touch the lives of many concerned perſons.

" An

" An haven or harbour muſt have thoſe ſeveral following qualifications, viz. " 1. Stiff ground to hold anchors. 2. Free from rocks or ſharp ſtones, which cut " cables. 3. The ground ſoft and ooſy. 4. Either water enough to ride afloat " at low water, or elſe the ground to be of eaſy declivity, that when a veſſel " begins to ground upon the ebb, ſhe may be ſoon faſtened in ſhallower water, " and when a veſſel floats upon the flood, ſhe may be ſoon hauld out into deeper " water, to prevent knocking by the riſing and falling of the ſea waves; whence " it happens, that a ſhip becalmed on large flats, ſuch as are between Graveſend " and the Downs, is in the ſame danger, as if ſhe were taken with a ſtorm; for " not being able to move forward, ſhe muſt come aground in the ebb, and if the " ſea grow when ſhe comes to float again, ſhe may be beaten to pieces, having " no deep water to be hauled into.

" 5. A harbour muſt have head-lands to break the violent influences of the ſea, " with what wind ſoever they be forced in; and ſuch an one is called landlocked.

" 6. The lands muſt not be ſo ſituate for hight as to gather great quantities " or guſts of wind, called flaws, coming on a ſudden.

" 7. The water muſt not be too deep, perhaps not above eight fathom; for " in ſuch, the cable making an acute angle with the ground and ſurface of the " ſea, prevents the veſſel's head being pulled under water, as would be, where the " cable is more upright and perpendicular, and where the difference of the riſing " of the ſea is greateſt.

" A creek is a ſmall harbour, or harbour for ſmaller veſſels.

" A port is an harbour ſo ſituate, as that ſhips may be protected within, and " into which none can paſs in or out without leave of the land; and a place " within, which a ſmall boat may go a-ſhore at all times.

" A road is a kind of half harbour, where is good anchorage always, but not " protection from all winds at all times.

" What thoſe diſtricts and precincts of ſea be, which are commonly called the " king's chambers, appear not to be publickly aſcertained; but I gueſs them to " be a kind of ſegment of a circular ſpace, where the land is the arch, and the " chord is a line drawn between two head-lands within ken of each other.

" The principal uſe of the ſea and rivers is for eaſier carriage of commodities: " for we ſee, that a tun of twenty hundred of ſeacoal is brought near three " hundred miles for about four ſhillings; or at ſix ſhillings and ſix pence per " chalder, which is in weight about thirty-three hundred: but the land-carriage " of the ſame by waggon would be about fifteen pounds, viz. ſeventy-five times " as much, and on horſeback above an hundred times as much; horſe-carriage " being in proportion to wheel-carriage as three to two: therefore, we may ſafely " ſay, that the carriage of coals from Newcaſtle by wheels would be intrinſically

" ſixty

" ſixty times dearer than the preſent ſea-carriage; but the ſea-carriage of coals " from London to the Land's-End of England would be treble of what the ſame " is from Newcaſtle, viz. about twenty ſhillings per ton, from whence, by the " way, may be noted, that the freight of ſhipping ſwells chiefly from their at- " tendances and waiting on their trade, not on the very value of the labour, " and when they neither ſtay for loading or unloading. Wherefore, more com- " monly and practically ſpeaking, the ordinary proportion between ſhip and " wheel-carriage is about one to twenty; and of inland water-carriage to wheel- " carriage, as one to twelve. Wherefore we may generally ſay, that land to " water-carriage is as about ſixteen to one. Now, if the longeſt land-carriage " in England do coſt about three half-pence per pound, and the middle rate be " three farthings; and, that nine parts of ten of all goods imported and exported " is not worth four pence per pound, one with another, ſuch as ſalts, wines, " corn, ſtaves, timber, board, fruits, iron, lead, &c. it follows, that the diffe- " rence between land and water-carriage is greater, than the gain, which any " merchant hopes to make; and thence it comes to paſs, that the place, which is " moſt commodious for water-carriage, has vaſt advantages over all others for " gain by trade. And ſuch a country is Holland, whereof no part is one quarter " of a mile from ſome navigable water, navigable at all times and by many " ways, viz. by conts or poles within board, by draught of men or horſes from " the ſhore, by oars and ſails, without the impediments of tides or currents, " land-floods, &c.

" From theſe conſiderations we come to frame a ſcale or meaſure, whereby to " determine, how much any country is better, one than another, for water-car- " riage, ſuppoſing, that all the inlands are rivered alike: and this is done by " determining how far any country, and all its parts at a medium, are diſtant " from the ſea. In order to which, 1. compute the ſquares of a mile in ſide, " which the ſuperficies of any country doth contain: next, compute the miles of " the perimeter ſhore belonging to the ſame: then dividing the ſquares of the " ſuperficies by the miles of the ſhore, the quotient will give the breadth of the " oblong, or parallellogram, which the ſaid country is equal unto in point of " adjacency to the ſea; half which quotient, or breadth, is the middle diſtance " ſought for: a collection of which diſtances will make a ſcale, wherein the con- " veniency of each country for carriage may be computed, according to which " ſcale, as I remember, France is eighty-ſix, England twenty-four, and Ireland " fifteen, miles diſtance from the ſea.

" From hence alſo may be drawn another uſeful rule to know, of what ad- " vantage it is to plant or preſerve timber in England or Ireland or any where " elſe; for, in Ireland, for example, the price of timber can be, 1. but fifteen " miles land-carriage, or ten ſhillings per ton. 2. Freight of the ſame from the " place, where it grows moſt plentifully, ſuppoſe Norway, which may be from " twelve to twenty more ſhillings, together with the wood-leave, hewing and put- " ting on board, which ſeldom, in woody ſhores, amounts to ten ſhillings more: " from whence it follows, that timber in Ireland will never be but about forty ſhil- " lings per ton, even although not a ſtick grew in the country; and conſequently,

" this

" this being known, one may compute, whether the lands and labour of Ireland " can be applied to more advantage of other kind, than by the planting and " culture of timber.

" Theſe conſiderations force me to ſay ſomething of navigable rivers, and of " making way for more inland water-carriage, upon which account I briefly ſay:

" 1. That a perch of river five feet deep, and about ſixteen feet broad, may " be made at four pence per yard cube, for leſs than twenty ſhillings per perch, " where the ground is fit to hold water, and is not too contumacious by reaſon " of rocks and other impediments; ſo that a mile of ſuch excavation may be " had for about three hundred pounds.

" 2. That in moſt caſes it were better and cheaper to make new channels of " juſt depths and breadths, than even to bank the rivers already in being, and to " repair all the inequalities of them, making uſe of the water of the old natu- " ral rivers, which is to be let into the new ones. And hereunto we offer.

" 3. That theſe new channels need be no broader than that one boat may " paſs, which may be, if, at every quarter or half mile's end, a ſmall dock were " added to the ſide of the channel, into which, upon meeting of boats, which " cannot paſs by ſide by ſide, one of them might put in till the other be paſt by; " or, without theſe docks, the ſame thing may be performed by appointing " certain times for deſcending, and other like times for aſcending, of boats " to paſs.

" 4. Where the beginnings of rivers do lie higher one than another, or where " ſeveral rivers do riſe out of one great mountain in the ſeveral hights of it, " there muſt be fitting contrivances to join them, other than the locks and ſluices " now in uſe, which are impracticable, where the difference is above twenty feet, " or thereabouts: I ſay, proviſion may be made to comply with a difference of " about one hundred feet.

" 5. In order to the perfecting of this work, ſuch contrivances muſt be had, " as to furniſh any channels fit for the purpoſe, which of itſelf has no water at " all, with ſufficient water from elſewhere.

" 6. A neceſſary preparation to this work is a map of the country, expreſſing, " not only the plain or level thereof, but alſo all the inequalities and diverſities " of its ſurface as to figure and matter, with the mean quantity of water, which " is in every river of ſuch country, and with the mean quantity, which paſſes " through it in an hour, or any other aſſigned ſpace or time.

" 7. To know, whether navigabling of rivers would be a thing of profit, a " computation muſt be made, which is moſt eaſy, of the annual charge of land- " carriage to and from London, and between perhaps twenty other emporia of

" the kingdom; as alſo an eſtimate of the numbers travelling to and fro between " thoſe places.

" 8. There muſt be a law for purchaſing all ground fit for this purpoſe at " moderate rates, and for ſending all malefactors not deſerving death, and all idle " perſons, to this work.

" Having premiſed theſe eight particulars to encourage this work, I ſhall " bring one computation, which, without the others above mentioned, is of it- " ſelf ſufficient to ſupport this deſign; which computation conſiſts of theſe fol- " lowing branches, viz. 1. That but one year of three is time of war. 2. That " the intrinſic value of Newcaſtle coals is not above fifteen ſhillings per chal- " dron, under which rate, within theſe forty years, they have been boughtand " ſold at London. 3. That in time of war they are at a medium ſold for forty- " five ſhillings a chaldron. 4. That about three hundred thouſand chaldron are " yearly brought into the port of London.

" From all which it follows, that London in the years of war pays four hun- " dred and fifty thouſand pounds extraordinary for coals, that is, the one third " part of the ſame at a medium in times of war and peace, which is one hun- " dred and fifty thouſand pounds per annum. Now, if the purchaſing of a per- " petual convenience, worth one hundred and fifty thouſand pounds per annum, " be worth as many years purchaſe as land, the value of this convenience, at " fifteen years purchaſe, is worth two millions and two hundred and fifty thouſand " pounds.

" Moreover it is certain, that there are coals ſomewhere within one hundred " miles of London; and, if a navigable channel could be made, as aforeſaid, be- " tween ſuch place and London, at the rate of three hundred pounds per mile, " then the purchaſe of this conveniency would coſt but thirty thouſand pounds; " or, if you pleaſe to comprehend all accidents, ten times as much, viz. three " hundred thouſand pounds: yet ſuch charge is not the one ſeventh part of the " two millions two hundred and fifty thouſand pounds, above mentioned.

" The objection againſt this deſign is an opinion, that it is better for England " and London to fetch coals from Newcaſtle, than to have them at Blackheath. " Now, it becoming not this place to ramble too much out of the bounds of " natural philoſophy, I take the boldneſs to ſay, that ſuch aſſertion is abſurd, and " infers, that it were better fetch cinnamon from the Eaſt Indies to heat our " ovens in England, than to uſe furz or faggots for the ſame.

" To conclude this matter, I ſay, to the beſt of my underſtanding, that if one " thouſand miles of new navigable channels were made in fitting and paſſ- " able places of England, the conveniencies ariſing from the ſame could not " coſt three years purchaſe, beſides the employing and puniſhing of all idle " perſons.

" I

" I ſay further, that, if this were done, the ports of England would be fewer " and better, and the kingdom more ſecure from invaſion, and interruption of " trade, and alſo from the diſtractions and tumults, which may happen among " poor and mutinous people upon the want of commodities of neceſſary and " daily uſe. I am ſenſible, that what I have here ſaid is rambling and extrava- " gant, and a ſign of my want of natural philoſophy. I ſhall now therefore " return, as well as I can, and give you my thoughts of a few other miſcellany " matters relating to water, of which you are to expect no coherence.

" The firſt whereof is, that ſomewhere about Staffordſhire is the higheſt " ground of England, and the place, as many do think, of greateſt longevity. " That it is the latter, we muſt expect the proof from thoſe ſcales of ſalubrity " and longevity not long ſince propounded by a member of this Society; and as " to the former, which is the higherneſs of the land, it is viſible from the in- " ſpection of any map of England; for therein it will appear, that Glouceſter is " near of equal hight with the ſources of thoſe rivers, which make the Thames; " and that Glouceſter, ſituate towards the mouth of the Severn, is lower than " the ſources of the Severn, which are in Staffordſhire. 2. The ſources of the " Humber and Trent are not far from the ſame place. 3. The rivers, which " run from about the ſame place into the Iriſh Seas, are ſhort and ſwift, which " denotes the ſame aſſertion of the hight of that place.

" The next of my Miſcellanies ſhall be of land floods.

" We often find, that upon news of very ordinary rains, we withall hear now " and then of very great land-floods, where we little expect them; the reaſon " of which ſeeming wonder I take to be this; 1. Suppoſing rain or ſnow " (which is accumulate rain) to fall, not univerſally, but on ſome certain ſcope " or area of ground, ſuppoſe of four miles ſquare, or of four miles diameter; " it is apparent, that, if this rain or ſnow fall upon a concave piece of ground " of that dimenſion, of the ſhape of a baſon, or rather of a tunnel, having a vent " in its bottom, there muſt be a great flood, for that all the waters falling on " the whole muſt vent at ſome point-like place: whereas, if the ſame ſcope " of ground were a convex, the rain would fall and diſperſe itſelf every way, " and have a vent of twelve miles about, which, in the other caſe, was but a " point, or ſmall ſcope, perhaps of a quarter of a mile. The two caſes, which I " have put, are the two extreams of this notion; but as the ſhape of the land " partakes more of one or of the other of theſe extreams, ſo the effect will be. " Now, the ſudden thaws of great accumulations of ſnow, joined with great " rains, is but a common cauſe of land-floods: but what I have here ſaid is " intended to ſolve the anomalous appearing of land-floods, beſides expectation.

" And now, perhaps, it will not ſeem leſs wandering than the reſt of this " diſcourſe, if we get up into the air, and conſider the way of birds over great " ſeas, which is the 3d of my miſcellanies.

" 1. That birds do paſs over great ſeas, and do readily and ordinarily find " their way over them, is well known; nor is it doubted, that ſeveral birds, " whoſe eyes are but the hundredth part in magnitude to the eye of a man or " ox, can ſee much further than either; although we find, that long teleſcopes, " and microſcopes too, do beſt perform their ſeveral ends of viſion.

" 2. Birds, mounting themſelves higher into the air, can beſt evade the impe- " diments of ſight, depending upon the convexity of the earth: yet I do not " apprehend, how the betterneſs of their ſight, or the highneſs of their proſpect, " ſhould give them the advantages we admire, of finding their ways over ſeas " of many kens broad, counting a ken to be about fifteen miles: I ſay, of ſo " many kens as they can fly over, whilſt they can want ſleep, or ſuch food and " other neceſſaries, as the land only affords them. Wherefore, ſtating the caſe, " or ſuppoſing that birds can find their way over ſeas where they cannot ſee from " ſhore to ſhore, the queſtion is, by what marks they direct themſelves?

" In anſwer whereunto I firſt conclude, thoſe marks are permanent; for other- " wiſe they could not make uſe of them at certain ſeaſons, and when the air " through which they paſs may be under great variety of winds and clouds. " It cannot be by the ſea water alone, for that is liable to much variety. I " conclude therefore, that it muſt be by the ground or bottom of the ſea ap- " pearing through the water, and giving ſeveral colours to the ſame. For, firſt, " it is manifeſt, that deep waters have not the ſame colours as ſhallow; ſea water " in a baſon being without colour; but in its own proper place it is green. " Secondly, Coloured water in a conical glaſs hath various apparitions between " the baſe and vertex of the cone; that is, thick and thin bodies of water do not " ſhew alike. Thirdly, The ſea itſelf, when troubled and moved with ſand, is " not alike green, and all ſea water has ſand in it, for the white foam of the " ſea is ſmall ſand.

" 4. As a coloured varniſh ſpread over ſeveral-coloured grounds would ſhew " of ſeveral colours, ſo alſo the ſea water, which is ſuch a varniſh ſpread over the " bottom of the ſea, is of ſeveral colours, as the ſands and weeds there are; " and alſo their ſeveral diſtances from the ſurface will, and muſt, appear in ſe- " veral colours. 5. Being within the body of a cloud, or miſts, we ſee no dif- " ference of colours; but beholding clouds at a diſtance, we diſcern variety " enough of colour in them.

" 6. Hewers, who give directions to pilchard fiſhers, ſtanding on high places " over the ſea, do diſcern various colours in the ſea, which the pilchards make; " which colours are not diſcernable to the boats, which are amongſt the pilchards, " and at little diſtances from them.

" 7. I myſelf have taken notice, that a ſhoal ſea, looked upon from very high " land, doth appear of different colours: from all which I infer, that the ſea, ſeen " from ſuch hights, at which birds do uſually fly, doth appear in ſeveral reſpects " of diſtinct colours, of ſeveral ſhapes and dimenſions; all which put together,

" are

" are as good marks as can be desired. Now it is likely, that in all weathers the " colours are not wholly (though proportionably) alike, but in all times the shapes " and dimensions appear the same, or at least in the same situation and regards " one towards another, which is enough. For, if my direction be from a triangle " in the east, to a square in the west, lying within ken asunder, it is no matter, " whether their colours do now and then differ, or whether the corners of the " triangle and the square do shew now a little sharper, and at another time some- " what blunter. It is sufficient, that I see a triangle, suppose half as big as the " square, lying east and west from each other, and at about (suppose) three miles " distance; for the distance and position will not alter, and the difference in figure " and magnitude not very much: and, lastly, even the colour itself will change " according to such rules as may be known. Wherefore I conclude, that birds " crossing the sea have sufficient fixed marks for their direction.

" The fourth Miscellany is of the Mediterranean Sea.

" I remember, that long since I heard it agitated in this Society as an illustri- " ous problem to give the reason, why the Euxine and ocean both running into " the Mediterranean, as also many rivers, why the said sea doth not run over, " and by what ways it doth empty itself of what it doth visibly receive. Before " I advance further hereupon, I am to acquaint you, that one Mr. SHERES, who " hath long served his majesty at Tangier, hath an elegant piece ready for the " press concerning this subject, and that I had (though mediately) from him this " fuller account of the phænomenas following.

" 1. That the ocean runs into the Mediterranean at the Straits mouth about " nine months in the year, viz. from February to November.

" 2. That the water of the Mediterranean runs backward into the ocean for one " month in the year, viz. December, or about the winter solstice: that in No- " vember and January it ebbs and flows at the Strait's mouth about six foot.

" 3. That about the summer solstice, the current inward is so strong, as that a " boat of ten oars can but well stem it.

" 4. That the Levant wind blows there most part of the summer, and " that when that wind blows a storm outwards, there is a torrent inward of coun- " termoving water.

" 5. That there are but few and very small fresh rivers between the Nile and " the Strait's mouth, nor any considerable one between the Strait's mouth and " Cape Verd.

" 6. That the shore about the Mediterranean is bold and high land.

" 7. That the Mediterranean is in the middle of a vast continent, excepting " on the west side where the ocean enters it.

" 8. Spouts

" 8. Spouts are more frequent here than in any other ſeas. From theſe eight " phænomena he concludes, without ſubterraneous communication with the Caſ- " pian Lake, and without fancying that the water, which comes in at the top, goes " out again at the bottom, he concludes, (I ſay) and I concur with him, 1. That " the Mediterranean is exhaled by the power of the ſummer ſun exhaling its wa- " ters into vapours.

" 2. That thoſe vapours are the Levant wind ruſhing outwards, as through the " roſtrum of a limbeck placed eaſt and weſt.

" 3. That theſe exhalations fall down and condenſe without and beyond the " mountains, which as lips encompaſs this ſea; as appears by the paucity of " rivers falling into it, and conſequently this ſea, raiſed in vapours, is carried " into the ocean, where being condenſed, it ſwells the ſaid ocean, and from thence " is ſent back into its own ſinus, with a ſtrong current, becauſe the paſſage is but " narrow. Moreover, the exhalations aforementioned condenſing beyond the " ſaid lips, do furniſh water to many other rivers, which fall into the ocean, and " thence back into the Mediterranean.

" 4. When no vapours are raiſed or ſent out, as in December, the Mediter- " ranean ſets outwards; but when it doth neither ſet in or out, then the tides " play their parts as elſewhere. Upon this occaſion I put you in mind, that " you were told by Mr. HENSHAW, that in the narrow of the Baltic, near Cro- " nenburg and Copenhagen, the wind and ſeas, going the ſame way, do not " violently oppoſe each other, as in the Mediterranean, where, as was ſaid, a " ſtorm of wind outwards makes a torrent of water inwards.

" The fifth Miſcellany is, of the getting or loſing of the ſea, and of bold " ſhores.

" Where ſome winds are ſtronger than others, and blow more frequently, there " the ſhores muſt change; as at Dublin, the weſterly winds being far more fre- " quent and ſtrong, the water leaves the coaſt and impairs the harbour: and this " predominancy and ſouth-weſterly winds in the channel between England and " France may be a ſufficient cauſe, why the ſhores are bolder, and ports more " frequent, on the Engliſh than on the French coaſt.

" The ſixth Miſcellany relates to the ſaltneſs of the ſea.

" The water of the ſea is not ſalt, becauſe the ſun hath exhaled the freſh water " from it; for if thirty-nine parts of forty of freſh-water be evaporated, the " remainder will not be ſalt as ſea-water is: but ſuppoſing it were, then it muſt " follow, that there is ſomewhere or other forty times as much freſh water as " there is of ſalt-water in the ſea; and this thirty-nine parts of forty of freſh-water " muſt be ſomewhere between the ſea and the ſun. Now, if the ſea in the deep- " eſt,

" eſt place be three miles perpendicularly deep, we may ſuppoſe the ſea, one " place with another, to be half a mile deep. Wherefore there muſt be a body of " freſh water about twenty miles thick covering the whole globe of the earth; " and if this water be in vapour, the ſphere of vapours made of ten miles thick " of water muſt be ſome thouſand miles thick; whereas there are no clouds ten " miles high. Wherefore this opinion is very abſurd; for in no country of the " whole world does the freſh-water, which is viſible, ſeem to be $\frac{1}{10}$ of the ſalt or " ſea-water in and about the ſame. It is objected, that the ſea is freſh below " the ſurface: but we deny the fact, as not confirmed by experiment, and againſt " reaſon; for ſalt-water being $\frac{1}{43}$ part heavier than freſh, will not ſwim upon " it, but the contrary: nor doth the cryſtalizing of ſalt in ſalt-pans in the top " of them mend the matter; for the induration of brine into cryſtals is where " the greateſt heat is, viz. in the top of the pans, according to the common " experiment, that the bottom of a boiling iron or braſs-pot, taken off the fire, " may be ſafely touched with the flat of ones hand, whereas the top water will " ſcald vehemently.

" Wherefore, ſuppoſing ſea-waters were created freſh or ſalt, it ſeems a more " natural queſtion (becauſe there is more ſalt than freſh-water) to ſuppoſe all " were ſalt, and then to enquire, how rivers and other ſhallow inland waters come " to be freſh, rather than ſuppoſing all waters to have been originally freſh, to " ſeek why the ſea is ſalt; for that a little freſh-water may be made out of much " ſalt-water is moſt obvious by rains and the common diſtillations.

" But if one would know, why the ſea is ſalt, we muſt have recourſe to ſome greater " body than the ſea; that is, to the whole bulk of the earth, over part whereof the " deepeſt ſea is but a varniſh, the earth being above ſeven thouſand miles thick; " and the ſea no where three miles deep. Upon this method of enquiring, we " ſay, that every part of the earth contains ſalt of one kind or other; that every " plant yieldeth a fixt ſalt, not unlike common ſea-ſalt. We know there be " ſalt-ſprings and brine-pits riſing out of the earth, and that there be rocks of ſalt " in many places. Wherefore it is not to be wondered, if the waters, as well as " the earth, have their ſhare of ſalt alſo; for as in ſea-water about the forty or " fiftieth part is ſalt, ſo in many earths it is the ſame, and conſequently a thing " not to be wondered at. That ſome ſeas may be ſalter than others, may be " from the different quantities of ſubterraneous ſalt, which it meets with. That " freſh-water may be found in the bottom of ſalt-ſea is more difficult to conceive, " ſince the ſalter is heavier: but this is not difficult to him that conſiders, that " freſh waters may be ſhot by a fit ſpring through ſalt-water without much mix- " ture; nay, that fire may be ſhot through water without quenching; for a gre- " nado falling into a mill-pond has been ſeen to drive away all the water from " about it, and to burn for a little while as on dry ground. So a ſpring of freſh- " water, fed from a mountain much above the ſea, may, like garden-fountains " ſupplied from ciſterns on high turrets, boil up through a ſmall body of ſalt- " water. Parallel hereunto is the eruption of hot ſprings through cold waters, " which in many places have happened.

" The

" The ſeventh Miſcellany is of tides and currents.

" That the ſurfaces of agitated waters are not true levels is plain from experi-
" ments of all ſorts and ſizes; for water moved in a trough is not ſo: and the waters
" in the canal of St. James's Park, when the wind blows hard right up and down
" the ſame, are viſibly ſeen to accumulate on the leeward end; and when winds
" blow long into ſome capacious bays, then upon the ceaſing of ſuch winds, the
" water returning back towards its level makes a current, ſuch as are often met
" with in navigations. Hence it comes to paſs, that the tides riſe higher at ſome
" places than at others; as, for example, in ſome of the ſinuſes in the weſt of Ire-
" land, which have a near communication with the vaſt Weſtern Ocean, there the
" tides are neither rapid, nor is the difference between the hight of the water at
" full ſea and low water much: but in the Severne, where the ocean comes in,
" as into the wide end of a horn, ſtill ſtraitning itſelf, there the tide runs ſtronger
" and ſtronger, and alſo the further it goes up with the land, and the difference
" between high and low water at the bottom of ſuch indraughts, as at Chepſtow
" bridge, is above thrice what is in thoſe parts of Ireland above-mentioned.

" The eighth Miſcellany is of the various courſe or running of tides.

" The laſt thing I ſhall trouble you with, is the reaſon of the ſeeming whim-
" ſical and diſorderly motion of the waters at ſeveral ſtates of the tides. That
" water ſhould run or flow from north to ſouth till half flood, and then quite
" contrary, as may be ſeen about Angleſey, where the ſea comes in at one end of
" the iſland, but comes not in at the other end till it hath accumulated water
" enough to paſs ſome mighty bank, but then comes in with ſuch a violence, as
" doth repel the firſt more gentle motion of fewer and weaker waters. And
" what happens in diurnal tides, happens by parity of reaſon in neap and ſpring-
" tides: and this *luſus naturæ* is very great, and ſeems ſtupendous in ſome of the
" weſtern iſlands of Scotland, as I have heard that memorable fellow and friend
" of this Society, Sir ROBERT MORAY, deſcribe them.

" But there is nothing in this irregularity, which may not be mechanically ex-
" plained, and even repreſented to the eye upon ſuch figurations of the bottom
" and ſides of the ſea, as were not long ſince ſent to this Society by the favour of
" prince RUPERT."

Mr. OLDENBURG read a letter to himſelf from Mr. HEVELIUS, dated at Dantzick, 25th March, 1675 [k], concerning his obſervations of the laſt eclipſe of the moon, 11th January, 167$\frac{4}{5}$, N. S.

*April* 15. A deſcription of Monſ. LEIBNITZ's watch was read, wherein was explained the principle of the exactneſs of the pocket-watches of his invention [l].

[k] Letter-book, vol. vii. p. 133. It is printed in the Philoſoph. Tranſact. vol. x. n° 113. p. 289. for April, 1675.

[l] Letter-book, vol. vii. p. 213. See Philoſoph. Tranſact. vol. x. n° 113. p. 285. & Journal Des Sçavans de 25 Mars, 1675.

His letter to Mr. OLDENBURG concerning it, dated at Paris, 30th March 1675, contained likewiſe his remarks on ſeveral algebraical ſubjects relating to Mr. JAMES GREGORY, Mr. NEWTON, and Mr. COLLINS, together with the different ſentiments of the Pariſian aſtronomers concerning common and teleſcopical ſights.

Mr. OLDENBURG read a letter to himſelf from Dr. BEAL, dated 31ſt March, 1675, concerning ſome advantages, that may be made by ingrafting in roots, as it had begun to be tried by Mr. LEWIS, for the ſpeedy raiſing of an orchard and a grove, or a nurſery of mulberry-trees, and for the alteration or mixture of vegetables: and how to make one tree or ſtock bear many, much differing, kinds of fruit, as apples, pears, nuts, grapes, plums, and cherries.

Mr. OLDENBURG read a paper in Latin, of Dr. VOSSIUS, containing ſome conſiderations upon Mr. HOOKE's animadverſions on his former papers, concerning the ſpots of the moon and the Archimedean burning-glaſſes.

Mr. HOOKE remarked, that a good obſerver would ſee, that the tops and ſides of the circular ridges, that ſurround the ſpots in the moon, are enlightened *gradatim*, and not alike, and all together; which latter muſt be the caſe, if Dr. VOSSIUS's hypotheſis were true.

He appealed to the members preſent, whether parabolical ſpeculums were not better for burning than ſuch flat ones, as Dr. VOSSIUS inſiſted upon.

Dr. VOSSIUS's paper was ordered to be regiſtered [m].

*April* 22. Dr. WALLIS's printed diſcourſe concerning gravity, read before the Society 12th November, 1674, was preſented to it.

Mr. BOYLE's *Diſcourſe concerning the mechanical production of Taſtes* was read; wherein he proved by twelve experiments, that taſtes may depend upon the ſize, figure, and motion of the ſaporous particles, and altered or deſtroyed according as thoſe parts are by various conditions diverſified.

Theſe experiments were as follow:

1. To divide a body almoſt inſipid into two bodies of very ſtrong and very different taſtes.

2. Of two bodies, the one highly acid and corroſive, and the other alkalizate and fiery, to produce a body almoſt inſipid.

3. Of two bodies, the one extremely bitter, the other extremely ſalt, to make an inſipid mixture.

[m] It does not appear in the Regiſter.

4. Of two bodies, the one extremely ſweet, and the other ſalter than the ſtrongeſt brine, to make an inſipid mixture.

5. Of an inſipid body, and a ſour one, to make a ſubſtance more bitter than gall or aloes.

6. Of an inſipid body, and highly corroſive one, to make a ſubſtance as ſweet as ſugar.

7. Of obtaining, without addition from the ſweeteſt bodies, liquors corroſive enough to diſſolve metals.

8. To divide a body bitter in the higheſt degree into two ſubſtances, the one extremely ſour, and the other perfectly inſipid.

9. To produce variety of taſtes in one inſipid body, by aſſociating it with divers menſtruums.

10. To produce variety of taſtes with one menſtruum by aſſociating it with inſipid bodies.

11. Of two liquors, the one highly corroſive, and the other very pungent, and not pleaſant, to compoſe a body of a pleaſant and aromatic taſte.

12. To imitate by art, and ſometimes even in minerals, the peculiar taſtes of natural bodies, and even vegetables.

To this was added an excurſion concerning ſome changes made of taſtes by maturation.

It was ordered, that the hearty thanks of the Society be returned to the noble author of theſe experiments; and that he be deſired to publiſh them [a].

Mr. Hooke was put in mind to make trials with the quadrant, for which the Society had been at near fifteen pounds expence.

*April* 29. Sir Philip Percival, Bart. was admitted a fellow.

Mr. Evelyn read part of his *Philoſophical Diſcourſe of Earth, relating to the Culture and Improvement of it for Vegetation and Propagation of Plants*, deſcribing firſt, what he meant by earth; then enumerating the ſeveral ſorts and kinds of earth; and, laſtly, ſhewing how we may improve it to the uſes of the husbandman, the forreſter, and the gardener.

He gave, amongſt other things, an account of the microſcopical obſervations, which he had made of ſeveral ſorts both of earth and dungs, to ſee, if by thus examining the ſeveral earths and ſoils, he might detect what rudiments of the principles of vegetation there were lurking in them abſtractedly taken.

[a] They are printed at London, 1676, in 8vo. in his book intitled, *Experiments, Notes, &c. about the Mechanical Origin or Production of divers particular Qualities, &c.*

Having

Having proceeded to that part, where he treats of ſtercoration, or manuring the ground by compoſt; and that ſubject being of ſuch extent, as to require more time than was then remaining, he deſired to defer it till another time, viz. the 13th of May.

*April* 30. The COUNCIL was ſummoned, but did not meet.

*May* 6. At a meeting of the Society

Mr. OLDENBURG preſented ſeveral letters and papers lately come to his hands from his correſpondents.

Firſt, a letter from Mr. GREGORY, dated at Edinburgh 25th April, 1675 [o], giving an account of the inclinations and abilities of Sir GEORGE MACKENZIE of Tarbat for a philoſophical correſpondence; who had alſo ſent ſeveral letters, containing obſervations of remarkable particulars in the Highlands of Scotland [p], and promiſing more.

Secondly, a paper written by an anonymous author, containing a conjecture about the bladders of air, that are found in fiſhes, and the manner and organ, whereby fiſhes move to and fro in the water, from one depth to another [q].

Thirdly, a deſcription of a newly invented water-engine, which by the only weight of the falling water (without the force of man or beaſt, and without wind or wheels) ſhall raiſe as much water as you will, and to what hight ſhall be deſired; and requiring no more charges than the workmanſhip amounts to.

*May* 13. Mr. EVELYN continued to read his *Diſcourſe of Earth*, and explained what advancement of fertility might be expected from ſtercoration and manuring the ground by compoſts. He enumerated, what compoſts may be had from animals, vegetables, &c. and intimated, that what ſeems moſt apparently to cauſe fertility is ſalt; yet without determining, that it is only ſalt or ſpirituous nitre, which produces that effect: and by inquiring into the ſeveral kinds of compoſts and materials of improvement, he hinted the moſt genuine and true medicament of every ſoil for arable, paſture, or garden. He inſerted a deſcription of the beſt hot-bed, that he knew of: and after he had ſhewed, how to prepare, ripen, and apply the ſeveral compoſts, which are called the dry mixture, he deſcribed the liquid; and gave ſeveral conſiderable proceſſes of that kind, uſeful to render the earth fertile, and to multiply grain.

He was thanked by the Society for this uſeful diſcourſe, and deſired to publiſh it after it had been regiſtered [r].

*May* 20. Dr. SIMPSON was propoſed candidate by Sir WILLIAM PETTY.

[o] Letter book, vol. vii. p. 141.

[p] They are printed in the Philoſoph. Tranſact. vol. x. n° 114. p. 307.

[q] This paper is printed ibid. p. 310.

[r] Regiſter, vol. v. p. 5. It was printed at London in 1676, in 8vo.

There was read a diſcourſe concerning the ſeveral motions of the ſeas and winds; which was a tranſlation of part of Dr. VOSSIUS's Latin treatiſe, *De Motu Marium & Ventorum*, brought in by Mr. COLWALL.

The author was of opinion, that the ſun between the tropics beating perpendicularly upon the ſeas, raiſes thereby the waters, and ſo cauſes a deſcent and motion from eaſt to weſt; which motion, he ſaid, produces the variety of winds, and likewiſe of tides, according to the variety of coaſts, with which it meets.

Some of the members reflecting upon this hypotheſis, were of opinion, that though a hot body held over water would raiſe vapours from it; yet it would not raiſe the water itſelf.

Mr. HOOKE produced his teleſcope, which being directed to the ſun, rendered, by divers reflections, the beams of the ſun ſo weak, that one might look upon the ſun with as little inconvenience to the eye, as upon the moon.

*May* 27. Mr. OLDENBURG produced ſeveral relations, which he had received from his correſpondents.

The firſt was from Mr. LOCKE, dated 20th May, 1675[a], giving an account of ſome fiſhes, that are poiſonous, in New Providence, one of the Bahama iſlands; which account had been ſent to Mr. LOCKE from a friend in that iſland; viz. that the fiſh, that are there, are many of them poiſonous, cauſing a great pain in the joints of thoſe who eat them; yet do not kill any man, though they are fatal to cats and dogs: but with two or three days itching the pain in men wears off. It was added, that thoſe of the ſame ſpecies, ſize, ſhape, colour, and taſte, are ſome of them poiſonous, others not the leaſt hurtful; and thoſe, that are, only to ſome perſons, and not to others: and farther, that thoſe perſons, who have been once diſtempered by them, have, upon the firſt eating even of wholeſome fiſh, the poiſonous ferment in their bodies revived thereby, and their pain increaſed.

The ſecond paper was from captain RICHARD TAYLOR, commander of the ſhip Agnes and Grace, written 30th December, 1674, to Mr. BENJAMIN NEWLAND, merchant in London, concerning a ſword-fiſh, that had ſtruck his ſword through a three inch plank of that ſhip, and thereby rendered it ſo leaky, that both the pumps could ſcarce keep her from ſinking, &c.

The third was from Paris, 6th May, 1675, giving an account from Monſ. LEMERY, how mercury effects ſalivation, viz. by uniting itſelf with the ſaline or acid ferment of the morbific matter, and ſo by being actuated with the heat of the bowels, paſſing to the head, and ſwelling it, and overſpreading the inner part of the mouth with cancres, that make the patient feel a pain like that, which would be felt, if ſome corroſive ſublimate ſhould excoriate ſome part of the body. Monſ. LEMERY added, that the ſalival glandules of the mouth being pricked by

[a] Letter-book, vol. vii. p. 234. It is printed in the Philoſoph. Tranſact. vol. x. n° 114. p. 312.

this

this ſharpneſs are relaxed, and ſo come to ſalivate, which continues till the ſaliva has cleanſed all the piquant ſalts, that kept the veſſels open.

This hypotheſis was thought by ſome members unſatisfactory, becauſe the mercury will cauſe ſalivation in ſound bodies likewiſe. Upon which it was queried, whether to this mercurial ſalivation it be not always required, that the quickſilver be mixed with ſome ſaline particles or other?

Mr. HOOKE promiſed to bring in his helioſcope perfected; and likewiſe another experiment.

*June* 3. There was read out of the Regiſter a diſcourſe of Dr. JACKSON, a phyſician in Cheſhire, giving an account of the ſalt ſprings of that country.

Mr. HOOKE took occaſion from the mention made in that diſcourſe of an extraordinary hole, to relate, that he had been informed by a friend of his, living at Briſtol, that near that city there was a hole of an extraordinary depth, in which at a great diſtance from the ſurface of the earth there ran a river, which being ſounded was found of a vaſt depth. He ſaid, that he was promiſed a more particular account of the obſervables of that place.

Dr. DANIEL COXE made mention of a mountain in Braſil deſcribed by PURCHAS, which the people can go into at a hole in one ſide, and come out at another hole on the other ſide.

Mr. HOOKE related, that there was a place in Cheſhire belonging to the lord BRERETON, where men having dug to a great depth for water to make ſalt with, but having met with none, lighted at laſt upon a ſtiff clay ground, which when they had bored into about five or ſix feet, the ſalt water from underneath the ſaid bed of clay guſhed out with ſuch great violence, and in ſuch a great quantity, as to fill the well, which was ſome hundreds of feet deep, to the top.

This gave occaſion to ſpeak of the origin of ſprings and rivers; ſeveral of the members being of opinion, that they were cauſed by rain and ſnow.

Sir JAMES LONG promiſed to communicate to the Society the obſervations, which he had made of the natural curioſities in Wiltſhire, his own country, and particularly of the ſprings there, and the ſeveral ſorts of earths, eſpecially of a fine azure earth near Chippenham in Wiltſhire; as alſo of an extraordinary kind of periwinkle ſtones, ſhaped like ſcrews; and likewiſe the ſeveral improvements of land made there.

Sir WILLIAM PETTY remarked, that it would be worth inquiring, where and and in what grounds ſaintfoin and clover-graſs had ſucceeded beſt; and where it had failed moſt.

Sir JAMES LONG anſwered, that he knew one place near Chipping-Norton, called

called Haſtings, which had made the greateſt advantage by ſaintfoin of ay place he had heard of; and he had obſerved, that the ſaid ſeed did not thrive in a good conditioned, but in a cold, ſtony, clay ground: but that, on the contrary, clover required a good barley ground.

*June* 10. Mr. OLDENBURG communicated an account ſent to him from Paris concerning the origin of rivers [t]; in which the author being of opinion, with many others, that rain and ſnow were ſufficient to cauſe and to maintain them, had taken the pains for ſeveral years together, to obſerve the quantities of rain and ſnow, that had fallen, and reckoned them at a medium of about nineteeen inches and 2 $\frac{1}{7}$ lines; and thereupon compared the quantity of ſuch rain and ſnow with the quantity of water running away in rivers; having firſt laid down a way of meaſuring theſe two ſorts of water, not leaving unconſidered the velocity of the running of rivers and the extent of the land, on which the rain and ſnow, ſerving for the ſupply of rivers, do fall. The reſult of which eſtimate of his was, that the rain and ſnow waters are abundantly ſufficient to make rivers run continually.

Some of the members commended the attempt of this author.

Mr. HOOKE remarked, that the ſame had been performed and propoſed to the Society many years before Sir CHRISTOPHER WREN, who, by the contrivance of a rain-bucket, had taken an account of the water, that fell for a long time together, and by his weather-clock had, among other particulars, not only taken in the meaſuring the quantity of rain, that fell, but alſo the time, when it fell, and how much at each time: which gave occaſion to mention the important uſes to be made of that inſtrument, if put into practice; ſince it was, by ſome additions made thereunto by Mr. HOOKE, adapted to record the weight of the air; the drought and moiſtures, the heat and cold, of the weather; the quarters and ſtrength of the winds; the rain, ſun-ſhine, &c. and all this to be performed by one motion, driving all the parts of the inſtrument; which was the more conſiderable, for that itſelf records its own effects.

*June* 17. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,

| | |
|---|---|
| Sir JOHN LOWTHER, | Mr. COLWALL, |
| Sir JOHN BANKES, | Mr. HILL, |
| Sir ROBERT SOUTHWELL, | Mr. OLDENBURG. |

It was ordered, that a treatiſe intitled, *Franciſci Willughbeii de Middleton Armigeri; quondam e Societate Regia, Ornithologia*, be printed by JOHN MARTYN, printer to the Society: And,

That a diſcourſe made before the Society the 29th of April and 13th of May

[t] See Philoſ. Tranſact. vol. x. n° 119. p. 447. for November, 1675.

laſt,

laſt, by JOHN EVELYN, Eſq; concerning the improvement of earth for vegetation, be printed likewiſe by the ſaid JOHN MARTYN: And,

That a treatiſe, intitled, *Marcelli Malpighii Philoſophii & Medici, e Societate Regia, Anatome Plantarum: cui ſubjungitur Appendix repetitas ab eodem Auctore de Formatione Pulli in Ovo Obſervationes continens*, be printed by the ſaid JOHN MARTYN.

At a meeting of the SOCIETY on the ſame day,

Dr. JOHN FRANCIS PREISS, phyſician of the prince of Newburg, was propoſed candidate by the earl marſhal of England.

Dr. GREW brought in and read his diſcourſe concerning the trunks of plants, which he divided into ſeven parts;

1. Of the motion of the ſap in ſuch trunks.
2. Of the motion and courſe of the air in them.
3. Of the generation and ſtructure of the parts of a trunk.
4. Of the generation of liquors contained in them.
5. Of the ſeveral figurations of trunks.
6. Of the motion of trunks upwards, downwards, ſideways.
7. Of the ſeveral qualities, whereby trunks are fitted to divers mechanical uſes.

Dr. GREW had the thanks of the Society given him for this diſcourſe, and was deſired to give it to be regiſtered [t], and to publiſh it [u].

Sir WILLIAM PETTY took occaſion from this diſcourſe to propoſe it to conſideration, what might be deduced from the diſcourſe read for explaining the cauſe of the warping of wood; concerning which Mr. HOOKE ſaid, that there was a fermentation in the liquors of wood, which required a conſiderable time to do its work, which was by making the liquors work upon one another, to ſeparate the moiſture, without which there was no fermentation; and which being driven out, the wood was then ſeaſoned, and ſo warped not; ſo that by deſtroying the fermentative principle, the wood was preſerved, and made to retain its figure, and ſo kept from warping.

The aſcenſion of ſap in trees being alſo ſpoken of, there were mentioned ſeveral opinions concerning it. Dr. GREW alledged his opinion, delivered in the diſcourſe. Mr. HENSHAW ſaid, that he thought the ſun by force of its heat

[t] It does not appear in the Regiſter.

[u] It is printed at London, 1676, in 8vo. under the title of *The Comparative Anatomy of the Trunks of Plants*, &c.

thruſt up the moiſture of the ground into the roots of vegetables; and that being got up a little way, the night and cold coming on made it ſtop, till the ſun's heat of the next day returning drove up more moiſture; which being crouded in muſt needs force up the moiſture, that there was there before; and ſo on from day to day, till it came up to the top, and all the parts of the plant.

Mr. HOOKE added, that it was worth a more particular inquiry, whether there were not valves, or ſomething analogous to them, in vegetables.

Dr. GREW ſaid, that he had hitherto obſerved no ſuch thing as valves in the ſap-veſſels of plants.

Mr. OLDENBURG mentioned, that Signor MALPIGHI had explained this phænomenon of the riſing of ſap after the manner, that Mr. HENSHAW had diſcourſed of it; and that the ſame author, in his diſcourſe of the anatomy of vegetables, dedicated to the Society, had taken notice of ſomething like valves in plants.

*June* 24. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,
The lord biſhop of Saliſbury,
Sir JOHN BANKES,
Mr. HILL,
Mr. HOSKYNS,
Mr. OLDENBURG.

Mr. WILLUGHBY's *Ornithologia*, Mr. EVELYN's late diſcourſe on agriculture, and ſignor MALPIGHI's *Anatome plantarum*, were licenſed.

The council conſidering of the perſons, who deſerved to be expelled, thought fit to begin with the following:

Dr. LOWER,
Dr. DOWNES,
Sir EDWARD BYSSHE,
Mr. WALLER,
Mr. SLINGESBY.

Sir JOHN BANKES reported, that the committee of the Eaſt India company had given order to empty the weſt gallery in Greſham-College, and to deliver it again to the Mercers company, from whom they had received it.

At a meeting of the SOCIETY on the ſame day,

Mr. HOOKE produced again his helioſcope, which had three reflections; the firſt reflecting the fifth, the ſecond the twenty-fifth, and the third the hundred and twenty-fifth part of the direct light of the ſun to the eye.

It being aſked, whether by it he had obſerved any ſpots in the ſun, he anſwered, that at preſent there were none, that he could ſee.

Mr.

Mr. OLDENBURG brought in ſeveral earths ſent him by Dr. PLOT from Oxford, which the ſaid doctor had met with in his ſurvey of that ſhire, but knew not their names; which therefore he deſired might be ſent him from hence, he being then about digeſting and printing his obſervations made of Oxfordſhire.

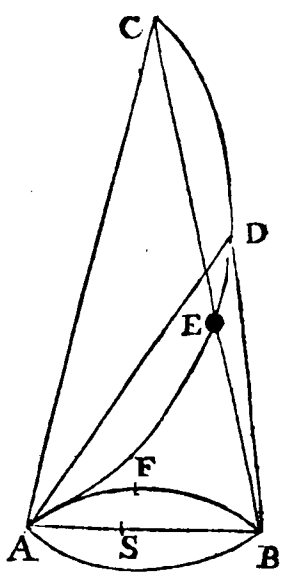
The particulars being viewed, it was thought fit, that Dr. PLOT ſhould be deſired to ſend greater quantities of them, and to add the ſeveral places, where they were found, and the beds, wherein they lay; whereupon they might be better examined, and their names returned with more certainty.

Mr. OLDENBURG communicated a letter to himſelf from Mr. GREGORY, dated at Edinburg, 8th June, 1675 [r], deſcribing a way of his to prove the motion of the earth, different from that of Mr. HOOKE publiſhed ſome time before; as alſo aſſigning the limits of a biquadratic æquation by the roots of a quadratic æquation.

Mr. GREGORY's letter is as follows:

" Sir,

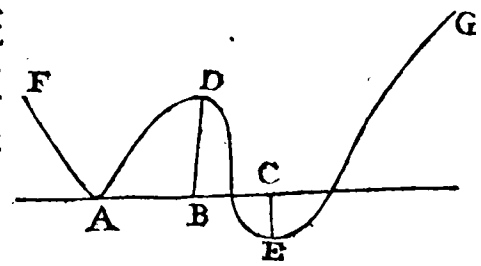
" By M. COLLINS his favour I have ſeen M. HOOKE's " excellent treatiſe for proving the motion of the earth; " and have had ſome thoughts thereon, which perchance, " if not too obvious, and already known to you, may be " of ſome conſequence. Let C D be two fixed ſtars; " S the ſun; C D B A a plain going through the three " points C D S, and cutting the orbs of the earth in A " and B; let a circle paſs through the points A C D, " cutting C B in E: the ſine of the angle C A D is to " the ſine of the angle C B D, as B D to D E; which " proportion may be pretty ſenſible, if the ſtar D be much " nearer than C; yea, ſometimes perchance ſo ſenſible, " that D may from B ſeem on the one ſide of C, and " from A on the other. The points A B in the orbs of " the earth may be with eaſe found out more preciſely " than is required for this buſineſs. My thoughts briefly " are theſe; if from A and B the angles C A D, C B D, " be obſerved and found unequal, from thence two things " may be inferred, hitherto queſtioned, viz. the motion " of the earth, and the unequal diſtance of the fixed ſtars. Secondly, theſe " angles (as to the inequality, if ſuch thing be) may be obſerved eaſily, becauſe " any two ſtars in the firmament, if they fall within one view of the teleſcope, " may be choſen for this effect; one of which may be a large ſtar of the firſt " magnitude, and conſequently by all probability near to us; and the other of " the ſixth, yea, perchance of the ſixtieth magnitude, and far from us: and, " which is moſt of all, this, without any conſiderable preparation, may be eaſily " and exactly obſerved by any ſort of micrometer; or (if D be ſeen on both ſides




[r] Letter-book, vol. vii. p. 241.

" of C, which may ſometimes fall out) with a ſimple teleſcope. If it be ob-
" ſerved, that from this only can be gathered, that the fixed ſtars have parallax,
" and not how much it is in this or that ſtar, albeit the main buſineſs be to prove
" they have parallax: yet from a third obſervation, as ſuppoſe at F, may be
" gathered geometrically the parallax of both C and D, if that be eſteemed *operæ*
" *pretium.*

" I lately received a letter from M. COLLINS; he deſires therein the limits of
" a biquadratic æquation by the rules of a quadratic æquation, which is as fol-
" lows: let the æquation be (ſeeing always the ſecond term can be taken away)
" $x4 - p2x2 + q3x - r4 = o$; and let $x = \frac{t^2}{3}$; the former æquation becomes
" $z4 - \frac{q3t^2z^2}{r4} + \frac{p2t4}{r4}z2 - \frac{x8}{r4} = o$: the limits of this biquadratic æquation are
" ſo determined; (and to this former all biquadratic æquations can be reduced
" after this manner.) Let the curve for this æquation be F A D E G, whoſe
" maxima and minima are A D E; for always in this caſe one of the limits falls
" in A, the beginning of the reckoning.
" Let ordinates from the limits be D B C E
" the points B C are ſo determined: multi-
" ply the terms of the laſt æquation in their
" exponents, and it becomes $z2 - \frac{3q \times 2}{4r4}$
" $z + \frac{p2+4}{2r4} = o$; here $z$ is found, which
" in this preſent æquation is A B or A C,
" viz: $z = \frac{\pm\sqrt{39q6t4 - 32p2t4r4 + 3q3t2}}{8\sqrt{4}}$; all this time $t$ is undetermined;
" for it may be put ad libitum; which ſhews that this may be done infinite ſeve-
" ral ways."




Mr. HOOKE ſaid, that he had made mention of this way likewiſe in his printed book; which he was deſired to ſhew.

Mr. OLDENBURG produced a printed ſcheme ſent him from Paris concerning a pear, that had brought forth another little pear at and through the head of it, and at the top of it ſome leaves; which fruit having been opened at Paris longways, and cut through in the middle, there was no core nor kernel found in it, but it had firm pulp throughout; and the ligneous fibres, which the ſtalk uſes to emit in the place, where it ſticks in the pulp, continued to paſs on through the whole middle of the pear, and ſo produced the ſmall branch and leaves above-mentioned. Beſides which it had been obſerved, that the pulp of the mother-pear was ſeparate from the pulp of the other infant-pear, which was not quite come out, but ſtill ſtuck faſt in the head of the mother-pear.

*June* 28. At a meeting of the COUNCIL were preſent

The

The lord biſhop of Saliſbury, vice-precident, in the chair,

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|---|---|
| Sir JOHN LOWTHER, | Mr. COLWALL, |
| Sir WILLIAM PETTY, | Mr. HILL, |
| Mr. HENSHAW, | Mr. OLDENBURG. |
| Dr. WHISTLER, | |

Inquiry being made, whether the weſt gallery in Greſham-College was emptied, it being found not to be ſo yet; Mr. HOOKE was ordered to call upon the officers of the Eaſt India company to remove their goods, according to the order of the committee of the ſaid company.

It was ordered, that the amanuenſis do from the council attend Mr. NELTHROPE, and demand the arrears of his quarterly payments due to the Society at Midſummer preceding, amounting to fourteen pounds nineteen ſhillings; acquainting him with the order, that whoſoever of the Society ſhall refuſe to pay their arrears due by their ſubſcriptions at their admiſſion into the Society, ſhall be proceeded againſt according to ſtatute.

*July* 1. At a meeting of the Society,

There were read ſeveral letters,

1. From Mr. FLAMSTEAD to Sir JONAS MOORE in Latin [a], containing his obſervations on the eclipſe of the Moon, 26th June, 1675.

2. From Mr. RAY to Mr. OLDENBURG, dated at Middleton, 26th June, 1675 [a], concerning the uſe of the ſwimming bladders in fiſhes, viz. to ſuſtain or keep them up in any depth of water: ſince, as it had been experimented, if the ſwimming bladder of any fiſh be pricked or broken, ſuch a fiſh ſinks preſently to the bottom, and can neither ſupport nor raiſe itſelf in the water.

3. From Mr. LISTER to Mr. OLDENBURG, dated at York, 27th June, 1675 [b], containing ſome obſervations ſent him by Dr. THOMAS TOWNE from Barbadoes about the temper of the air in that iſland, divers European plants growing there as well as in England; all ſprings being there near the ſea; the blood of negros being as black as their ſkin, &c.

4. From Signor MALPIGHI to Mr. OLDENBURG, dated at Bologna, 17th June, 1675, acquainting the Society with his endeavours of obſerving and delineating the ſtructure of the galls of trees, &c.

*July* 8. Mr. HOOKE ſhewed an experiment concerning the reſiſtance of air to a ball moved with and without an expanded area; of which he was deſired to bring in a particular account in writing.

[a] Letter book, vol. x. p. 252. It is printed in the Philoſoph. Tranſact. vol. x. n° 116. p. 371.

[a] Letter-book, vol. vii. p. 252. It is printed in the Philoſoph. Tranſact. n° 115. p. 349.

[b] Letter-book, vol. vii. p. 256. It is printed in the Philoſ. Tranſact. vol. x. n° 117. p. 399.

The Society was adjourned this day till the preſident ſhould think fit to ſummon them to meet again.

*October* 21. At a meeting of the COUNCIL were preſent,

The lord viſcount BROUNCKER, preſident,

Sir JOHN LOWTHER,
Sir JOHN BANKES,
Mr. COLWALL,
Mr. HILL,
Mr. OLDENBURG.

It was ordered, that the following perſons be ſent to for their poſitive anſwer, whether they would ſign the bond or not, viz.

Dr. AGLIONBY,
Sir CHARLES BERKLEY,
Dr. BRUCE,
Mr. CARKESSE,
Sir WINSTON CHURCHILL,
Col. COLEPEPPER.
Sir RICHARD CORBET,
Mr. CURTHOPE,
Sir FRANCIS FANE,
Mr. HAMMOND,
Mr. LAKE,
Dr. DU MOULIN,
Sir THOMAS NOTTE,
Mr. SOAME,
Mr. STANLEY,
Mr. WYNDE.
Mr. WOODFORD,
Mr. WOODROFFE,
Dr. WREN.

And it was thought fit, that thoſe, who were deep in arrears, and gave no hope of being of uſe to the Society, ſhould be all expelled.

It was ordered, that the Society ſhould be ſummoned to meet again on the 28th of October:

That MICHAEL WICKS do attend Sir JOHN BANKES the next day at the Eaſt India Houſe to receive the order for clearing the weſt gallery in Greſham-College: And,

That Dr. GREW's book, intitled, *The Comparative Anatomy of Trunks, together with an Account of the Vegetation of Trunks grounded thereupon, in two parts, the former read before the Royal Society, February* 25, 167$\frac{4}{5}$, *the latter June* 17, 1675, *the whole explicated by ſeveral figures in nineteen copper-plates, preſented to the Royal Society in the year* 1673, and 1674, be printed for WALTER KETTLEBY by the aſſignee of JOHN MARTYN, printer to the Royal Society.

*October* 28. The Society returned to their weekly meetings.

Dr. GREW read a lecture concerning the nervous liquor, its origin, nature, motion, and uſes in the body; as alſo the ſymptoms and diſtempers ariſing from it, when diſordered or vitiated.

He

He was desired to leave it to be registered [c], and to publish it.

Mr. OLDENBURG communicated two letters to himself: one was from JOHN CRUZADO, professor of the mathematics at Seville in Spain, dated there 20th August, 1675 [d]; in which was proposed a new place for the first meridian, which is a little island called *Abruxos* lying under the very equinoctial near Brasil; in which island there is said to be no inequality at all in the natural days. The writer of this letter likewise asserts a method of knowing the true place of the moon.

It was ordered, that he should be thanked for his communications [e], and acquainted, that the Society did not dislike the place assigned by him for the first meridian; but that they could not assent to his assertion concerning the equality of all natural days, nor to that which related to the method of knowing the true place of the moon.

The other letter was from Signor TRAVAGINO, dated at Venice, 26th June, 1675 [f], containing a description of a way used to fix quicksilver into silver; together with a piece of the metal thus fixed; which was produced before the Society, and there cut through to see how it looked in the middle, where it appeared as white as on the outside.

Mr. OLDENBURG related, that he had given some of it to Mr. BOYLE, to try it, who had assured him, that having tried it in a coppel, it had endured that trial as well as silver doth: but he having weighed it in water, it proved not so ponderous as silver, but wanted somewhat of the weight of tin. So that this seemed to be a new metal, having the whiteness, malleableness, and fixity of silver, but not the weight thereof.

It was desired, that a little of it might be given to the assay-masters of the mint for farther confirmation.

*November* 4. Mr. OLDENBURG produced a box, containing divers minerals sent from Oxford by Dr. ROBERT PLOT, who intended to compose a natural history of all England; of which particulars he desired to know the names and uses. The chief of them were, 1. Some earths resembling bolus's and *terra sigillata*. 2. Some stone, thought to contain *lapis calaminaris*. 3. Some slate, like mundick. 4. A substance like alabaster, which might, it was thought, be very fit to make good morter of. 5. Some fine powders, taken out of the veins of the earth. These and some others were found under ground in Oxfordshire.

Mr. HOOKE read a lecture, wherein he explained a mechanical contrivance to supply the pabulum of a lamp in the same degree it is consumed, or to keep the

[c] It does not appear in the Register.

[d] Letter-book, vol. vii. p. 272. It is printed in the Philosoph. Transact. vol. x n° 118. p. 425.

[e] Mr. OLDENBURG's answer to CRUZADO, dated 15th September, 1675, is inserted in the Letter-book, vol. vii. p. 290. and printed in the Philosoph. Transact. vol. x. n° 118. p. 429.

[f] Letter-book, vol. vii. p. 243.

surface

ſurface of any liquor, fit to feed the flame of a lamp, always at the ſame hight, till all be waſted.

Having both deſcribed and delivered one way of performing this, he promiſed to bring in divers other ways of effecting the ſame thing.

*November* 11. At a meeting of the COUNCIL were preſent,

The lord viſcount BROUNCKER, preſident,
Dr. WHISTLER, Mr. HILL,
Mr. COLWALL, Mr. OLDENBURG.

A committee was appointed for auditing the treaſurer's accounts, conſiſting of the preſident, Dr. WHISTLER, Mr. HILL, Mr. HOSKYNS, and Mr. OLDENBURG; three of whom were to be a quorum.

It was ordered, that the council be ſummoned to meet again on the Thurſday following November 18, at twelve at noon.

At a meeting of the SOCIETY on the ſame day,

Dr. GREW gave an account of that Subſtance, which Mr. HOARE had put into Mr. OLDENBURG's hands for examination; which ſeemed to be petrified wood. He ſaid, that he had viewed it with a microſcope, and found it to have been a piece of birch-wood, now perfectly ſtone, having three or four rings in it, the *veſtigia* of its former conſtitution.

Mr. OLDENBURG preſented to the Society from the printer *a deſcription of the iſlands and inhabitants of Feroe, &c. written in Daniſh by Lucas Jacobſon Debes, M. A. and provoſt of the churches there: Engliſhed by J. S. doctor of phyſic:* printed in 1675, in 12mo.

A letter in French to Mr. OLDENBURG by Monſ. JOLY of Dijon, dated there, 28 September, 1675 [z], was read; in which he offered to communicate his meditations upon the nature of motion, if the Society did not think that ſubject altogether exhauſted by Sir CHRISTOPHER WREN, Dr. WALLIS, and Monſ. HUYGENS.

The Society declared, that though thoſe perſons had written very well upon that ſubject, yet the meditations and labours of others would ſtill find place; and that therefore Monſ. JOLY ſhould be deſired to proſecute and finiſh his thoughts upon ſo important a ſubject.

The earl marſhal remarked, that he had in ſome land of his near Scotland at Grayſtock a river running from a mountain, reported to contain copper mines, out of which the cattle drinking got their teeth brazed over; as appeared from

[z] Letter-book, vol. vii. p. 157.

ſome of oxen and cows produced by his lordſhip, and left for the repoſitory, which teeth had a kind of copper-colour ſuperinduced upon them.

Some of the members deſired, that ſome of the cattle, which had drunk a while of that water, might be opened, to ſee whether any thing remarkable appeared within their bodies.

Mr. HOOKE read another lecture about divers ways of keeping the pabulum of a lamp always at the ſame hight with the bottom of the flame thereof, till all the liquor be conſumed. Of theſe methods he explained ſeven or eight more.

*November* 18. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,

| | |
|---|---|
| Sir JOHN BANKES, | Mr. HOSKYNS, |
| Mr. HENSHAW, | Mr. HILL, |
| Mr. COLWALL, | Mr. OLDENBURG. |
| Dr. WHISTLER, | |

It was ordered, that the following perſons be left out of the liſt to be printed for the approaching election-day, viz.

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|---|---|
| Dr. BRUCE, | Dr. LOWER, |
| Mr. CARKESSE, | Sir THOMAS NOTTE, |
| Col. COLEPEPPER, | Mr. SLINGESBY, |
| Dr. DOWNS, | Sir PETER PETT. |

The reaſon of omitting them was their not performing their obligation to the Society.

It was ordered, that the ſalary of the curator be not paid for the future by the treaſurer but by ſpecial order of the council.

At a meeting of the SOCIETY on the ſame day,

A committee was choſen by ballot for auditing the treaſurer's accounts, conſiſting of

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|---|---|
| Sir ROBERT REDDING, | Mr. HAAK. |
| Mr. BARRINGTON, | Mr. HOOKE. |
| Dr. CROUNE, | |

Three of theſe to be a quorum, and to meet as ſoon as the committee of the council had made their report to the council concerning the ſtate of the ſaid accounts.

Mr. OLDENBURG read an account of ſome experiments made in the air-pump by

by Monſ. PAPIN, directed by Monſ. HUYGENS. They were ſeveral mixtures of divers liquors, as aqua fortis and ſpirit of wine, aqua vitæ and ſpirit of wine, common water and aqua vitæ, to ſee what ebullitions they made *in vacuo*; and whether theſe ebullitions made new air; and the difference of the air formed by the mixture of aqua fortis and copper from that which was produced by the mixture of oil of tartar and oil of vitriol, of which two mixtures the former yielded an air always remaining, the latter not ſo.

Beſides theſe, there was an account of an experiment of a mixture of aqua fortis and aqua vitæ with bits of iron in it; ſome of which was put *in vacuo*, ſome not, together with the different effects of both. Likewiſe experiments with oil of olives with vinegar and with ſpirit of wine; alſo with water and lime, and with plaiſter of Paris ſlaked *in vacuo*; together with the conſiderably different effects of them *in vacuo*, and in the open air.

Mr. OLDENBURG was deſired to take care of entering theſe experiments in the Regiſter [h], and, if he had any more of that nature, to impart them.

It was ordered, that the exhauſting engine ſhould be put in order, for making more experiments in it; which was chiefly urged by Dr. CROUNE, who ſaid, that he intended to make ſome trials therein.

Mr. OLDENBURG communicated Mr. NEWTON's anſwer, dated at Cambridge, 13th November, 1673 [i], to Mr. LINUS's letter to Mr. OLDENBURG from Liege, 25th February, $167\frac{4}{5}$, N. S. [k], concerning an experiment relating to Mr. NEWTON's new theory of light and colours; which imports, that the experiment conteſted was made in a clear day; and that the priſm therein employed was placed cloſe to the hole; and that the coloured image was not parallel to the axis of the priſm, but tranſverſe to it: which three particulars being contradicted by Mr. LINUS, Mr. NEWTON, in this letter, directs his antagoniſt again very punctually, in what manner to try the experiment, to ſatisfy himſelf about his veracity in relating the ſame.

Mr. NEWTON offering, in the ſame letter, to ſend to the Society a diſcourſe of his about colours, when it ſhould be thought convenient, Mr. OLDENBURG was ordered to thank him for that offer, and to deſire him to ſend the ſaid diſcourſe as ſoon as he pleaſed.

*November* 25. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,
The earl of Ayleſbury,
The lord biſhop of Saliſbury,
Sir JOHN LOWTHER,
Sir ROBERT SOUTHWELL,

[h] They do not appear there, but are printed in the Philoſoph. Tranſ. vol. x. n° 119 p 443. for November, 1675.

[i] Letter-book, vol. vii. p. 275. It is printed in the Philoſoph. Tranſact. vol. x. n° 121. p. 500.

[k] Letter-book, vol. vii. p. 202. It is printed in the Philoſoph. Tranſact. n° 121. p. 499.

Mr.

Mr. HENSHAW,
Mr. COLWALL,
Dr. WHISTLER,
Mr. HILL,
Mr. HOSKYNS,
Mr. OLDENBURG.

It was ordered, that the preſident or his deputy be deſired to intimate to the Society on their approaching anniverſary election-day, that they could not but take notice of ſome perſons left out of the liſt: that this was done, becauſe they were found not to have performed their obligation to the Society: and that therefore the council intended to proceed againſt them according to ſtatute: and that the names of thoſe perſons ſhould be then publicly read, viz.

Dr. BRUCE,
Mr. CARKESSE,
Col. COLEPEPPER,
Dr. DOWNES,
Dr. LOWER,
Sir THO. NOTTE,
Mr. SLINGESBY,
Sir PETER PETT.

It was ordered alſo, that the preſident be deſired to give directions to the treaſurer, for demanding and receiving the rent of the twenty-four pounds due for the four hundred pounds legacy of the late Dr. WILKINS, biſhop of Cheſter.

At a meeting of the SOCIETY on the ſame day,

Dr. WALTER NEEDHAM made an experiment upon a dog, to ſhew, that the lymphatics of the liver inoſculate in the extremity of their trunks with the *pori bilarii*, which, he thought, could not be ſaid of any two diſtinct ſorts of veſſels, that carry diſtinct ſorts of liquors in them, throughout the whole body. The experiment was, that the injections of milk and water made into the *pori bilarii* filled not only the *vena cava*, but alſo the lympheducts, without mixing it with the blood.

He remarked, that he would have made another experiment upon the ſame dog, if he had been duly fed, which would have ſhewn, that the chyle poſſeſſes not only all the neceſſaries, but likewiſe all the other lympheducts and glands upon the iliac veſſels, and under the cava; and not only ſo, but that the whole maſs of ſuet, that is upon the loins, is likewiſe filled with it; in which place, he added, it ſeemed to be all extravaſated, and gathered up again afterwards into the veſſels, to be conveyed to the receptaculum. Of which extravaſation he mentioned this obſervable effect, that the fat of the loins differs in ſeveral animals, according to the difference of the milk and chyle. Where they are full of butter, and otherwiſe groſs, this fat is thick and ſolid, as in the ſuet of beeves, ſheep, and goats: but where they are thin, the fat is ſoft and greaſy, as may be ſeen in the leaf of a ſwine, in dogs, horſes, men, &c.

This experiment being made, Dr. NEEDHAM read a diſcourſe of his *on the ſerum of blood*, which he was deſired to leave with the ſecretary, in order to be regiſtered [1]; which he conſented to, after he had reviſed it. It was as follows:

[1] Regiſter, vol. v. p. 125.

" When I deſigned the analyſis of the liquors of the body, the firſt, that oc-
" curred to my conſideration, was the chyle, it being the firſt product of the nou-
" riſhment, and conſequently the firſt in order of concoction of all animal liquors.
" But when I came to inquire into that, I found it impoſſible to diſcover the na-
" ture of it, till I had before ſearched out the cauſes of its production; the two
" efficients of which ſeemed to me to be heat and a ferment; both which owing
" their origin to the maſs of blood, it proved neceſſary to examine the blood itſelf.

" What blood is, and what are the conſtituent parts of it, we find many ways
" delivered in authors, with great variety of opinions, too many and too long to
" be here recited. I, that deſigned the ſatisfaction of my ſenſes firſt, and my
" reaſon afterward, did reſolve to follow the moſt ſimple and natural way of ob-
" ſervation. And firſt conſidered the blood as it was let out into a porringer,
" where all the parts I could obſerve were two; viz. the grumous cake and the
" limpid ſerum. This I do mean of blood, that is pure, without either degene-
" ration of its parts from morbific cauſes, or recent mixture with chyle; ſo that
" the chyle itſelf unchanged appeareth in the porringer. Thoſe two caſes being re-
" moved, I ſay, that the viſible parts, which the blood doth naturally ſeparate itſelf
" into, are the two before-mentioned, viz. grumus and ſerum. Neither are theſe
" ſo very heterogeneous from each other, as upon firſt ſight they may appear;
" but upon diſtillation are found to conſiſt of the ſame parts, differing only in the
" variety of proportion.

" Indeed if we look into the firſt originals of blood, we ſhall find it in its in-
" fancy to be pellucid, nor to have any thing red in it; that red colour being
" the effect of a progreſs of digeſtion, by the addition of actual heat, either that
" of incubation in oviparous, or of the womb in viviparous animals. For the
" egg itſelf is limpid, eſpecially the cicatricula, and that ſo limpid, that it elud-
" eth the beſt endeavours of the microſcope, which might otherwiſe diſcover
" much more of the lineaments of the fœtus in it, than yet the diligence of the
" great wits of this age can attain to. But when in proceſs of time it doth
" grow red, and thick, and viſibly move in a completely organized body, then
" it giveth us a fuller view of itſelf, and better opportunity of ſatisfying our under-
" ſtandings. We then find the difference I have already mentioned, that appear-
" eth upon the effuſion of blood, and its coagulation in a porringer; and if we
" conſider it in its motions in the body, we find things much more obſervable.

" That I may begin with the firſt, we find two ſeemingly unlike parts of it,
" viz the grumus and ſerum; yet when we come to analiſe them by fire, we find
" them conſiſt of the ſame parts, viz. phlegm, ſpirit, if I may ſo call it, volatile
" ſalt, oil, fixed ſalt, and earth.

" Theſe, I ſay, are all to be found, but with this difference of proportion:
" in the example I choſe to work upon, which was bullocks blood, lib. iiij. of the
" *ſerum* of bullocks blood, drawn off in MB, yielded of phlegm lib. ij. of a groſs
" extract in the bottom lib. ij. This craſſamantum or groſs extract in the bottom
" yielded upon diſtillation in ſand, ſpirit lib. j. ℥ix oil ℥ij. volatile ſalt ʒij. ℈j.
gr.

" gr. vj. caput mortuum ʒiij. ʒij. This caput mortuum did yield of fixed ſalt " by calcination ʒij. gr. v. Of the *grumus* of the ſame bullock we took lib. 6. " which in MB gave us of phlegm ʒxiv. extract lib. v. ʒij. This lib. v. ʒij. of " extract drawn off in ſand, yielded of ſpirit lib. 4. oil ʒj. ʒj. volatile ſalt ʒj, ʒj. " the caput mortuum came to ʒx. This— upon calcination yielded of fixed " ſalt ʒj. ℈ij. gr. iv.

" Here we ſee a great difference of proportion, the *ſerum* being more than " half phlegm, the grumus leſs than a ſixth part; the ſpirit of the ſerum about a " fifth part, of the grumus more than two thirds of the whole.

" The oil of the ſerum but little, viz. ʒiij. in lib. iiij. nor that of the grumus " much greater in proportion, viz. ʒix. in lib. vj. The volatile ſalt of the gru- " mus triple in proportion to that of the ſerum; the fixed ſalt of it much leſs, " but that but in ſmall quantity in both places. However, that there is ſuch a " thing as fixed ſalt in the blood, and that obtainable by mere calcination and lixi- " viation, this inſtance doth ſufficiently ſhew: and indeed all the parts of a hu- " man body do yield it, though not in great abundance. I do remember a late " objection made in this place againſt this doctrine, which was taken from a burnt " hart's-horn, it being denied, that it yielded any fixed ſalt. This occaſioned me " to lixiviate ſome, that I bought ready calcined; it was done calcined, ſo that " I did nothing elſe to it but only powder and lixiviate it, of which operation this " ſalt was the product.

" Having made theſe trials in beaſts, I thought it good to make an eſſay upon " man, and out of a pint of *ſerum* found ʒv. ʒj. of phlegm, ſp. ʒvi, ſal fixum ℈ij; " but neither volatile ſalt nor oil. I queſtion, if the perſons had been examined, " from which the ſerum were taken, whether their diſeaſes might not give ſome " light to the reaſon of this difference. But of the *grumus* of this blood ʒx. yielded " phlegm ʒiv. extract ʒvj. out of which by retort in ſand I drew ſp. ʒiij. oil ʒ. " vol. ſalt. ʒij. the cap. mort. being ʒj. ʒij. yielded but gr. viii of fixed ſalt. I had " a deſign of further purſuing theſe experiments, but have been prevented by " important occaſions; ſo that I am fain to proceed upon what I have already " done.

" By the way let me obſerve, that as the proportions of the parts vary in theſe " two liquors, ſo do the other phænomena. For when you diſtil the *ſerum*, af- " ter the drawing off of the phlegm, you will find the extract pretty tough and " viſcid, much after the nature of other gellies; but the grumus, when diſtilled, " groweth very friable, unleſs it be in ſome places, where the ſerum hath been " detained in it. Alſo, if in ſeparating the ſerum from the grumus, you let any of " the red part accompany the grumus, which is hardly avoidable, unleſs you reſolve " to loſe much of your ſerum, then you ſhall upon diſtillation find that red part " gotten to the very bottom of the maſs, and there concreted by itſelf, as being " heavier than the other, and leſs miſcible than at firſt one would imagine.

" It is yet further obſervable, that this whole maſs is no longer to be kept

" mixed together than whilſt it is kept in that poſture by heat and motion; for " whenever it cooleth in the porringer it doth ſeparate: I ſay *motion* and *heat* " do concur to the preſervation of the mixture: either is ſufficient to do it; of " which we may give many inſtances. For a digeſtive heat alone hath kept blood, " that was ſealed up in a hermetical glaſs, in its uſual fluidity, a month together; " and in the body of a man alive, I have known the blood to be as cold as rock-" water; yet its circulation kept it fluid. Yet as complete as the mixture ſeemeth " to be in the veſſels, it is plain, that percolation maketh a ſeparation of its parts; " which is viſible in all the percolations in the kidneys, glandules, ſtomach, guts, " &c. and in all other places, where either nutrition or excretion is concerned; " which thing, if well weighed, may give us occaſion of conſidering the whole " doctrine of nutrition and of ſecretions that attend it, and conſequently of in-" quiring, what thoſe parts of the blood are, which do immediately contribute " to nutrition, and of what parts. We know the old diviſion of parts into ſan-" guineous and ſpermatic, the latter of which ſome of the ſpeculative of this " age would have to be nouriſhed only out of the nerves, others more probably " out of the ſerum of the blood, having an influence of the ſuccus nervoſus added " to it, but the ſanguineous parts e grumo ſanguinis. The occaſion of the diſ-" tinction was given by the redneſs, that appeareth in the viſcera and muſcles, and " the paleneſs, that happened in all the reſt; which notwithſtanding is but the ef-" fect of negligence in examination: for if we do carefully waſh any muſcle, or " the liver itſelf, by injections we ſhall find, that they are not red, and conſe-" quently make a probable conjecture, that they are not nouriſhed by that red " part of the blood. But on the other ſide, if that red part be not nutritious, " it will be hard to aſſign the uſe of it, whether it be the oily part and fuel for " the flame, that is by many ſuppoſed to be in the blood, or what elſe it may be " intended for. The notion of a flame being falſe in the foundation, as I have " elſewhere ſhewed, it will not be convenient to inquire further into it; but, ſince " I have at preſent undertaken the taſk, I ſhall be free in the delivery of my own " thoughts concerning this matter; which that I may do with the more advan-" tage, I ſhall take notice, that this redneſs is not in itſelf eſſential to blood, there " being many animals, that have it not, and are therefore called exanguious, " and the firſt formation of a body is probably complete before any redneſs ap-" pear in the fœtus; which if compared with what I ſaid of the viſcera, may " give cauſe of conjecture, that the red part is only the effect of the long digeſtion " of the blood, which boiling the ſalts and oil together doth produce the redneſs " we find, it being the extremity of coction in the blood; and being ſeparated " from the blood by the liver, proves the matter, out of which choler is made. " Now it is true, that choler is of a colour leſs ſaturated than this red blood; but " the reaſon of that is not hard to give: for the ſpleen, if we may believe MALPIG-" HIUS, doth ſupply a ferment, which being joined to the blood in the porta, " may diſpoſe it to that colour; and ſo much the rather, if the glandules, of " which the liver conſiſteth, do contribute any thing to it. It is worth our pains " to conſider, that the liver doth perform two diſtinct excretory offices, one by " the pori bilarii of choler, another by the lymphæducts of ſerum. The lym-" phatics are more copious here than in any other part of the body, and, which is " to me the moſt remarkable circumſtance, do in the extremity of their trunks

" inoſculate

" inoſculate with the pori bilarii; which cannot be ſaid of any two diſtinct ſort " of veſſels, that carry diſtinct liquors in them throughout the whole body: the " truth of which is eaſily manifeſted by injections, which, if caſt into the pori " bilarii, do not only fill the vena cava (which was SYLVIUS's obſervation) but " the lymphæducts alſo with the ſame liquor, viz. milk and water, &c. that is " injected without mixing it with the blood: whereas, if we inject into the ar- " tery or the porta, no ſuch thing will ſucceed; but it is alſo obſervable enough " without injections: the very lymphatics, after the death of a dog, if he lie twenty- " four hours, will turn yellow; and whereas in that animal the liquor of them " is ſour, it will grow bitter, a manifeſt ſign that they have received a tincture " from the bilious veſſels. A further inquiry into this matter, viz. how one and " the ſame liver maketh a double ſecretion, and by what glands or other colatory " veſſels theſe works are performed, will be the buſineſs of another diſcourſe, " when I ſhall treat of the bile profeſſedly. It is ſufficient here briefly to take " notice, what becometh of this red part of the blood, viz. that in the liver it " meets with ſuch ferments, whither lienous or lymphatic, as ſeparates it from " the blood into the veſſels of the gall. The remainder then will be the ſubject " of our preſent diſquiſition, which, in contradiſtinction to the red, I have called " ſerum; the quantity of which, if we well attend to it, we ſhall find to bear a " far greater proportion to the red than we have been hitherto aware; for of the " cake, that appeareth in it, a great part is ſerum, only impriſoned in the viſcous " tenacity, that ariſeth from the oil and ſalt, which in the craſſament, that re- " mains upon the drawing off of the phlegm in balneo, is very diſtinguiſhable; " as alſo by other circumſtances.

" This *ſerum* I know not to what more fitly to reſemble than to the materia " prima of ARISTOTLE; a thing that is actually nothing, but potentially all things. " VAN. HELMONT calleth it latex, and deſcribeth it to be *humor fatuus & inſipidus* " *& concurrens viarum ſocius*; an inſipid liquor, void, as he thought, of any noble " parts, only the companion, or rather vehicle of the blood, which ſerved to " dilute it in its motions, to ſwallow up and devour its ſalts, to waſh them off " from any part, where they were fixed and coagulated (which he gave for the rea- " ſon of humours and catharrs) and at length to carry them off by the kidneys, " and the pores of the ſkin. All this is true; but not all the truth: for this la- " tex, thus deſcribed, can mean no more than the phlegm of the ſerum, which is " firſt drawn off in balneo; whereas the ſerum, as we have contradiſtinguiſhed " it to the grumus, contains a great variety of parts, as hath been already ſhewed; " theſe parts being the products of the nouriſhment eaten, and the materials out " of which all the parts of the body, and all the excrements of the ſecond and " third concoction are made: nay, this ſerum is the proveditor-general of the " body, the inſtrument of all the concoctions in it. To explain which, I " ſhall firſt begin with the concoctions: the firſt being that of the ventricle, " I have elſewhere diſcourſed at large, and ſhewed that its chief inſtrument is, " firſt, the ſaliva, which is but part of the ſerum ſeparated into the mouth by " the ſalivary glands, and then the addition of freſh ſerum in the ventricle de- " rived into it from the glandulous coat thereof. Here the firſt ſolution is made, " which being a confuſed mixture of alimentary and excrementitious parts, want-

" eth both a further digeſtion, and alſo a ſeparation. To this end, we find ſtill " more ſerum thrown upon it in the guts, both by the great channel of the duc- " tus pancreaticus, and alſo by the leſſer oozings of all the ſpringy pores of the " glandulous tunicle of the guts, which promote the former, and alſo the addi- " tion of the bilis, which being mixed with this maſs, doth coagulate with what- " ſoever is acid, and maketh it a ſolid body; whilſt what is not acid evades its " efficacy, and keeping itſelf liquid, is ſqueezed up into the venæ lacteæ. This " remark obligeth me to take notice of a great miſtake of our modern hypothe- " ſis-mongers, who have unanimouſly imputed the concoction of the ventricle to " an acid juice; whereas it is notorious to a man, that well conſidereth it, that " this acidity is not the cauſe, but the effect of concoction, as it is viſibly the " effect of fermentation in any other liquors, where no acid body was ever added " to them, as we ſee not only in wines, beer, &c. where, by careful occluſion, " the liquors are preſerved long in the veſſels ere they come to it; but in barley " water or broth, or any mixed liquor, that is permitted to ferment of itſelf, it " will the ſooner fall out, if it be placed in a convenient digeſting heat. Now " it is moſt ſenſible to any man in health, that his ſaliva is inſipid, and ſo is the " ſuccus pancreaticus of a man, which indeed is in all animals proportionable to " the ſaliva. It is as ſenſible, that where the ſaliva is inſipid, the concocted maſs " of the ſtomach is acid, and yet not thin enough, nor otherwiſe fit by its mixture " with excrement to paſs much of it up the lacteæ of the ſtomach itſelf; yet that " ſome part paſſeth immediately even that way (viz. the moſt ſubtil and tenacious " particles of the nouriſhment) may be judged from the vaſa lactea, which do de- " ſcend from the back ſide of the ventricle down into the receptaculum by a ſhort " and ſtrait road; which veſſels, though not commonly acknowledged, have " been gueſſed at by many writers, and ſeen by myſelf; but the main bulk of it " paſſeth into the guts, where it meeteth with its two liquors aforeſaid; one of " the ſame nature with the ſaliva derived from the pancreas and glands of the " guts, the other from the veſica fellea. Theſe two liquors, how contrary ſoever " they have been repreſented to be by SYLVIUS, de GRAAF, &c. do not imme- " diately act upon each other, which is from thence demonſtrated, viz. that " they often in men, and alway in horſes and deer, do enter into the guts by one " and the ſame ductus, which, if they had ſo immediate operation upon each " other, would defeat all efficacy they might have upon the juices, for whoſe " ſervice they are deſigned. But, on the contrary, we find quite other phæno- " mena, viz. the preſent attenuation of all the juices in the duodenum, by the " copious addition of the ſuccus pancreaticus, which being yet ſweet, doth not " act upon the bile, or the bile upon it, but by degrees, as the acidities, which " are conſequent to concoction, do coagulate with that bile, and make a ſolid " excrement. But this is not all, that is performed upon this nutritious juice; for " the ſerum is yet again cohobated upon it, if I may uſe the expreſſion, in recep- " taculo chyli. The manner and method of which is very pleaſant to behold: " for it is a very true aſſertion of SYLVIUS, that the *ductus thoracicus*, commonly " ſo called, is rather to be termed *ductus lymphaticus*, it being perpetually filled " with lympha, and but ſometimes only with chyle. He might have as well ap- " plied it to all the lymphatics of the lower belly, which do all of them receive " chyle

" chyle at the time of the diſtribution of it, and at other times are found replete " with lympha; for, if you open a dog the fifth hour after his feeding, you will " find the chyle to poſſeſs not only all the meſaraics, but all the other lympha- " ducts and glands upon the iliac veſſels, and under the cava, and not only ſo, " but the whole maſs of ſuet, that is upon the loins, is likewiſe filled with it; " in which place it ſeems to be all extravaſated, and to gather up again afterwards " into veſſels to be conveyed to the receptaculum. There is an obſervable effect " of this extravaſation, viz. that the ſuet of the loins differs in ſeveral animals, " according to the difference of the milk and chyle: where they are full of but- " ter, and otherwiſe groſs, this fat is thick and ſolid, as in the ſuet of beeves, " ſheep, goats; but where they are thin, the fat is ſoft and greaſy, as may be " ſeen in the leaf of a ſwine, in horſes, dogs, men, &c. But whatever the muta- " tion is, that happens there, it deſcendeth at laſt to the receptacle, where it re- " ceiveth veſſels of good ſtore from the liver and elſewhere; ſo that, upon a full " imbibition of that, it is ſtill more and more fermented, and fitted to mingle " with the maſs in the veins. When it is once there, this ſerum, that goeth up " with it, and that of which the blood is principally compoſed, doth act upon it, " not making any ſuch momentary mutation of it, either in the heart, lungs, or " elſewhere, as ſome imagine; but gradually worketh it up into its own nature; " which being done, it becometh that nutritious body, whoſe parts have been " here repreſented to you in ſuch manner, as the fire doth explicate them. This " juice, as it hath been ſaid already, is indeed the main part of the whole maſs; " for I do not think the truly red grumus, if it could be actually ſeparated from " it, would be an eighth part of the whole. It is the matter, out of which all the " parts of the body, and all the juices of it, whether noble or ignoble, do re- " ceive their origin; which will be made more conſpicuous, if you follow it through " all the veſſels and organs; in all which it ſeemeth to me very conſpicuous, that " the red or groſſer part of the blood doth either by anaſtomaſes, or, (which " is tantamount to the) fitly adapted pores circulate round, preſerving the heat of " the body; but that, which enters into the minute pores, and is the true matter of " nutrition, is only the pellucid ſerum here mentioned. Of this I ſhall give you " many inſtances, and begin with the moſt noble, viz. the brain and nerves; " to both which what a great copia of large arteries and veins do tend, I have " elſewhere ſhewed, and many of this illuſtrious Society are well ſatisfied of by " their own obſervation. Theſe veſſels appearing large under the baſis of the brain, " and in the meninges, do ſend veſſels quite through both the cineritious cortex, " and alſo through the medullary white pulp of it, which may viſibly be found, " not only by injections of wax, ink, or the like, but alſo by the very tranſverſe " cutting of it, where the puncta ſanguinea do very manifeſtly diſcover them- " ſelves to be the ends of veſſels. Yet, after all this, theſe veſſels do not tranſ- " mit the leaſt drop of their red grumous part into it, or, if at any time it do, " it is death to the patient: from whence it is plain, that there are a ſecondary " ſort of veſſels or pores, call them what you will, which do percolate from it " that ſerous matter, out of which all the juice is made. It is true, that the cor- " tex hath a little yellowiſh ſtain, which intimates to us a faint tincture from the " red; but it is ſo ſmall, that the diluteneſs of it ſufficiently argueth, that the " maſs of blood doth not paſs through it. The like may be ſaid of the medulla " ſpinalis

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" and the nerves; all which have copious and large veſſels every where playing " about them, to give a copious ſupply of ſuch juices, as are largely expended in " them, for the uſe of both motion and nutrition, and other actions of life: but " there alſo, unleſs it be the cineritious part, which in the ſpinal marrow is hid- " den as it were in the center, there is not the leaſt tincture of blood, much leſs " in the nerves themſelves. But the caſe is every whit as evident in the glandules, " which how copiouſly they do ſeparate ſerum from the maſs of blood, he muſt " be a novice in anatomy that doth not know; yet it is as plain, that they have " not the leaſt tincture of red blood; and though the ſanguineous veſſels do in " ſome places copiouſly inſert themſelves with large branches into them, as it is " moſt viſible in the glandulous coat of the ſtomach and guts, yet, by a great ar- " tifice of nature, the communications are ſo commodiouſly contrived, that no- " thing of the red grumus doth extravaſate into them, but is readily carried off " by the veins leaving only its ſerum behind it. The moſt noble inſtance, that I " find of this kind, is that of the moſt noble of glandules, I mean the teſticle, " where ſo elaborate a ſeparation of ſerum is made, and improved into ſo noble " a juice, that even here alſo, how carefully the red grumus is avoided by nature, " and what a great miſchief it is to it when it happens, I leave to all experi- " enced men to judge. Nay, we ſee, that in the gonnorhæa itſelf, when there " is ſo copious an expence of ſerum, no blood uſually entereth the gland, or, if " by the overweakneſs or diſtention of the veſſels, it chance to be admitted, we " ſee what inflammations and dangerous tumours it doth produce. To ſay the " truth, if we well conſider the nature of a gonnorhæa, we ſhall find it to be the " ſame thing to the teſticle, that a diabetes is to the kidneys, viz. a fluor of the " ſerum ſanguinis being by the venereal infection made thinner and ſharper, which " copiouſly venteth itſelf that way. If it were any nobler juice, it were impoſ- " ſible, that the ſtrength of nature could bear it, where the flux is ſo large and " long continued; whereas we find, that many men bear great gonnorhæas to " ſome ſpace of years, without any great diminution of ſtrength. The parallel " diabetes is but the ſame thing in another place; only in that diſeaſe the ex- " pence is ſo very copious, that the treaſure of the blood is too much exhauſted " by it, and conſequently perpetually afflicteth the patient with weakneſs and " fainting, becauſe the brain, nerves, and other parts are defrauded of their due " ſupplies. Yet in all this there is no expence of the red grumus, but a mere per- " colation of pellucid ſerum.

" As to the other viſcera, the liver ſeemeth very ſuſpicious, as being ſo deeply " dyed with red, which the rather happens, becauſe it is the place, where the red " maſs is principally brought, and where it is concocted into bilis. But as to the " parenchyma of that alſo, if it be duly examined, we ſhall find, that in all " young animals it is pale, till too much paſſage of the red hath ſtained it, and " in the oldeſt body, a good ſyringe and fair water will waſh off all that ſtain, " and ſhew it to be what it is, viz. a glandulous body made out of the ſerum of " the blood, and copiouſly ſeparating ſerum from it.

" The ſame dilution by a ſyringe will ſhew the ſame thing as to the muſcles of " the body; all of which in young things are pale, and in a calf white; which

" could

" could not be, if it were made of red blood; but when by degrees the frequent " circulation of the blood through the greater pores hath ſtained it, will, by the " means aforeſaid, be brought to itſelf, and ſhew, that the parts of it are all a " confection out of the ſerum. For it is not the paſſage of the blood through " the greater pores, that immediately nouriſheth; but the depoſiting of a ſubtile " juice in the minuter pores, into which the main blood never entereth. This " the ancients called cambium, ros, & gluten; and, if I were at leiſure to con- " ſider the whole hiſtory of nutrition, I could, from the nature of the ſerum, thus " conveyed into the pores, and of the fibres themſelves, in which thoſe pores " are excavated, give you a ſatisfactory account of the growth, ſtatus, and de- " cay of animals; of which I have already ſaid ſomething briefly in another " place.

" The only ſuſpicious part in the body is the ſpleen, which doth appear at " the firſt ſight a grumous body; but even that alſo is upon much dilution found " to conſiſt chiefly of ſerum, if not totally; and if any thing of the red be ſpent " upon it, it is a peculiar caſe, in order to a peculiar ferment, which is after- " wards to be exerciſed in the liver for the ſeparation of gall.

" The bones, membranes, griſtles, ligaments, tendons, which are the only " remaining parts of the body, are out of diſpute.

" I have thus far treated of the ſerum, both as the efficient cauſe of concoction, " and as the material cauſe of nouriſhment in all the parts of the body. The next " thing to be attempted is, to explain the manner of its converſion into nutri- " ment of parts, where the ſalts, ſulphurs, &c. will be conſidered, and the man- " ner of its ſeparating excrements; as alſo the ſeveral degenerations of it in mor- " bid caſes."

Dr. NEEDHAM was deſired to purſue the work, which he had preſcribed himſelf.

With his diſcourſe he left with Mr. HOOKE eighteen glaſſes for the repoſitory, containing the phlegm, ſpirits, ſalts, and oils of the *ſerum* and *grumus* of the blood, as he had analyſed them himſelf.

Mr. OLDENBURG produced and read a letter in French to himſelf, from Monſ. CONSTANTINE HUYGENS ZUYLICHEM, ſenior, dated at the Hague $\frac{16}{26}$ November, 1675 [m], accompanied with a little book in 8vo, in Low Dutch, by HERMAN BUSSCHOFF concerning the gout [n], preſented to the Society by Monſ. HUYGENS. It contained a new method of curing the gout by a factitious ſubſtance called *moxa*, prepared out of a dried herb, not named in the book; but

[m] Letter-book, vol. vii. p. 277.

[n] An Engliſh tranſlation of this book was publiſhed at London, 1676, in 8vo, under the title of *Two Treatiſes; the one medical of the Gout by* HERMAN BUSSCHOFF, &c. See Philoſ. Tranſact. vol. xi. n° 125. p. 621.

this prepared ſubſtance was ſaid to be at Utrecht, at the houſe of the brother of the ſaid BUSSCHOFF.

Mr. OLDENBURG was deſired to procure ſome of this *moxa*, and to get the book tranſlated into England as ſoon as poſſible, and to give the Society an account of the contents of it at their next meeting.

*November* 29. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,

| | |
|---|---|
| Sir JOHN BANKES, | Mr. COLWALL, |
| Sir WILLIAM PETTY, | Mr. HOSKYNS, |
| Sir ROBERT SOUTHWELL, | Mr. HILL, |
| Mr. HENSHAW, | Mr. OLDENBURG. |

It was ordered, that Sir JOHN BANKES, Sir JONAS MOORE, Dr. CROUNE, Mr. COLWALL, Mr. HILL, and Mr. HOOKE, or any two or more of them, whereof Mr. COLWALL to be one, do take care to get the poſſeſſion of the weſt or white gallery in Greſham College, to fit it for a repoſitory, and to remove thither with all poſſible ſpeed what is in the repoſitory of the Society: and

That it be recommended to the care of Dr. KING, to ſolicit the executors of the late Dr. WILLIS for the payment of his arrears to the Society, amounting to twenty pounds and eleven ſhillings, as appeared from the treaſurer's book.

The committee of the council for auditing the treaſurer's accounts made their report to the council *.

*November* 30. being the anniverſary election of the Society, there were fifty members preſent.

Before they proceeded to election, the lord biſhop of Saliſbury, who was then in the chair, as vice-preſident, the preſident being prevented from attending by an unexpected impediment, propoſed for candidate GEORGE lord viſcount HALIFAX, who by reaſon of his quality was immediately put to the ballot, and unanimouſly elected.

Then the committe of the Society for auditing the treaſurer's accounts made their report, as follows:

" At a committee of the Royal Society for auditing the treaſurer's accounts " November 30, 1675, we find Mr. COLWALL the treaſurer Debtor.

| | *l.* | *s.* | *d.* |
|---|---|---|---|
| " To monies he hath received on the ſeveral quarterly payments of " the Society from 19th November, 1674, to 25th November, " 1675. - - - - - | 184 | 7 | 6 |

* That report is omitted in the Council-book.

" To

| | l. | s. | d. |
|---|---|---|---|
| " To monies received more of Dr. WALLIS in part of his arrear, " paid by my lord BROUNCKER, in consideration of a lecture he " read at the Society for his lordship, 12th November, 1674 | 5 | 17 | 0 |
| " To monies more of my lord BROUNCKER for a lecture read by " Dr. GREW for his lordship, 28th October, 1675. - - | 4 | 0 | 0 |
| " To money received of the earl of AYLESBURY, for a lecture to be " read - - - - - - | 2 | 0 | 0 |
| " To money received of Sir JOHN LOWTHER for the like purpose - | 2 | 0 | 0 |
| " To money received for admissions - - - | 6 | 0 | 0 |
| " To monies he received out of the chest - - | 400 | 0 | 0 |
| " To balance of his last account, ending 30th November, 1674 | 25 | 16 | 7 |
| £ | 630 | 1 | 1 |

" We find him creditor

| | l. | s. | d. |
|---|---|---|---|
| " By the monies he hath paid to the use of the Society, as by the exa- " mination of his vouchers doth appear - - - - | 595 | 3 | 8 |
| " By balance resting in cash in his hands - - - | 34 | 17 | 5 |
| £ | 630 | 1 | 1 |

" Signed ROBERT REDDING,
" THEODORE HAAK,
" ROBERT HOOKE."

This being done, there was read an order, lately made by the council, concerning the leaving some members out of the list printed for this election-day; which order was as follows:

" November 20th, 1675.

" Ordered,

" That the president or his deputy be desired to intimate to the Society, on the " approaching anniversary election-day, that they could not but take notice of " some persons left out of the list; that this was done, because they were found " not to have performed their obligation to the Society: and that therefore the " council intended to proceed againk them according to statute."

These persons were

Dr. BRUCE,
Mr. CARKESSE,
Dr. DOWNS,
Col. COLEPEPPER,
Dr. LOWER,
Sir THO. NOTTE,
Mr. SLINGESBY,
Sir PETER PETT:

After this the Society proceeded to election, by which there were continued of the council for the year enſuing

The lord viſcount BROUNCKER,
The earl marſhal,
The earl of Ayleſbury,
The lord biſhop of Saliſbury,
Sir JOSEPH WILLIAMSON,
Sir JOHN BANKES,
Sir ROBERT SOUTHWELL,
Mr. HENSHAW,
Mr. COLWALL,
Mr. HILL,
Mr. OLDENBURG.

The ten new members of the council were

The lord biſhop of Cheſter,
Sir PAUL NEILE,
Sir CYRIL WYCHE,
Sir JONAS MOORE,
Dr. PELL,
Dr. HOLDER,
Dr. WALTER NEEDHAM,
Dr. CROUNE,
Dr. GREW,
Mr. MILLES.

Out of the council were elected for officers

The lord viſcount BROUNCKER, preſident.
Mr. COLWALL, treaſurer.
Mr. HENSHAW, Mr. OLDENBURG, } ſecretaries.

Several months before this election died a very conſiderable member of the Society, JONATHAN GODDARD, M. D. who was ſon of Mr. HENRY GODDARD, a ſhip carpenter at Deptford in Kent, and born at Greenwich in that county, in the year 1617 [p]. In the beginning of the year 1632, at fifteen years of age, he was admitted commoner of Magdalen Hall in Oxford, where continuing till he was of ſtanding for the degree of batchelor of arts, he left that houſe, and travelled abroad [q] for his improvement in the ſtudy of phyſic [r]. After his return to his own country, having taken the degree of batchelor of phyſic at Chriſt's College in Cambridge, November 7. 1640, he promiſed to obey the laws and ſtatutes of the college of phyſicians in London. He proceeded doctor of phyſic at Catharine Hall in Cambridge, January 20th, $164\frac{2}{7}$ [s], at which time he was a practitioner at London [t]: and December 22 following admitted candidate of the college of phyſicians, of which he was choſen fellow, November 4, 1646, and appointed to read the anatomy lecture there March 4. $164\frac{6}{7}$ [u]. At that time he had lodgings in Woodſtreet, in the city of London, where Dr. WILKINS, Dr. ENT, Dr. GLISSON, Dr. WALLIS, and other eminent men, met, to cultivate and improve the new philoſophy, and laid the firſt foundation of the Royal Society [x]. Dr. GODDARD was

[p] He was fifteen years old in 1632, according to WOOD. Athen. Oxon. vol. ii. col. 537.
[q] Id. ibid.
[r] WARD's Lives of the Profeſſors of Greſham College. p. 270.
[s] Ibid.
[t] WOOD, ubi ſupra.
[u] WARD, ubi ſupra.
[x] Dr. WALLIS's Account of his own life, printed

phyſician to the army raiſed by the parliament, and afterwards to OLIVER CROMWELL, whom he attended both into Ireland and Scotland. December 9. 1651, he was appointed by the parliament warden of Merton College in Oxford, upon the reſignation of Sir NATHANIEL BRENT; and January 14. following was incorporated Dr. of phyſic in that univerſity [y]. In 1652, CROMWELL, then in Scotland, being chancellor of the univerſity of Oxford, did by an inſtrument, dated October 16. conſtitute Dr. GODDARD, together with Dr. JOHN OWEN, dean of Chriſt Church, Dr. WILKINS, warden of Wadham College, Dr. THOMAS GOODWIN, preſident of Magdalen, and PETER FRENCH, B. D. canon of Chriſt Church, or any three or more of them, to act as his delegates in all matters relating to grants or diſpenſations which required his aſſent [z]. In 1653 Dr. GODDARD was choſen ſingly to repreſent the univerſity of Oxford in parliament, and ſoon after appointed one of the council of ſtate [a]. He was elected profeſſor of phyſic in Greſham College, November 7. 1655, in the room of Dr. THOMAS WINSTON then lately deceaſed [b]. He held the wardenſhip of Merton College till after the reſtoration, when he was removed by a letter from his majeſty, dated July 3, 1660, who claiming the right of ſupplying that headſhip in the vacancy of the ſee of Canterbury, appointed Dr. EDWARD REYNOLDS, one of his chaplains, warden, as ſucceſſor to Sir NATHANIEL BRENT, no notice being taken of Dr. GODDARD [c]. After this Dr. GODDARD ſettled himſelf in Greſham College, and was continued a fellow of the college of phyſicians by their new charter in 1663 [d]. Having been one of the earlieſt members of the Royal Society, he was appointed one of the council of it by the firſt charter of July 15, 1662, and the ſecond of April 22, 1663, being extremely zealous and active in promoting the deſign of its inſtitution. For being an accurate chemiſt, he employed his laboratory at the college in trying many experiments for the uſe of the Society, as well as for making his own medicines. He died ſuddenly of an apoplexy, which ſeized him at the end of Woodſtreet in Cheapſide, as he was returning from the company of ſome of his philoſophical friends at the Crown Tavern in Bloomſbury, at eleven at night, March 24. 167⅓; and was the third day after interred in Great St. Helen's Church in Biſhop's-gate-ſtreet [e], on the north ſide of the chancel, near the rails of the communion-table, without any monument or inſcription [f]. He was maſter of a very curious and valuable library of books elegantly bound, which he deſigned to have given to the Royal Society, but, he dying without a will, they fell to his heir at law, his ſiſter's ſon, a ſcholar of Caius College in Cambridge [g]. His character is repreſented to great advantage by Dr. SETH WARD, in the dedication to him of his book, intitled, *In Iſmael. Bullialdi Aſtronomiæ Philolaicæ Fundamenta Inquiſitio brevis*, printed at Oxford, 1653, in 4to. in which dedication he is highly commended for his extenſive learning, ſkill in his profeſſion, knowledge of public affairs, generous diſpoſition, candor, affability, and benevolence to all good and learned men;

in Mr. HEARNE's Preface to his edition of LANGTOFT's Chronicle, vol. i. p. 161.

[y] WOOD and WARD, ubi ſupra.

[z] WOOD, Faſti Oxon. vol. ii. col. 98.

[a] Id. Athen. Oxon. ubi ſupra.

[b] WARD, ubi ſupra.

[c] Regiſter of Merton College, cited by biſhop KENNET, Regiſter and Chronicle, p. 1 7. and WARD, p. 270, 271.

[d] GOODALL's Royal College of Phyſicians of London, p. 70.

[e] WOOD, Athen. Oxon. vol. ii. col. 538.

[f] WARD, p. 271.

[g] WOOD, Athen. Oxon. col. 538.

and

and for being the firſt Engliſhman who made teleſcopes. The like complements were paid him by Mr. EDMUND DICKENSON, fellow of Merton-College, in the dedication to him of his *Delphi Phœnicizantes*, printed in 1655. And Dr. WALLIS, in 1657, dedicated to him, and to Dr LANGBAINE, Dr. WILKINSON, and Dr. WILKINS, his *Matheſis univerſalis*. Beſides thoſe writings of his, which were communicated to the Royal Society, he publiſhed at London, in 1668, in 8vo. *A Diſcourſe concerning Phyſic, and the many Abuſes thereof by Apothecaries*; and in 1669, in 4to. *A Diſcourſe ſetting forth the unhappy condition of the Practice of phyſic in London.* He left likewiſe at his death his *Lectures read at Chirurgeons-Hall*, and other pieces, in two volumes in 4to. prepared by him for the preſs [e]; together with *Arcana Medicinalia*, publiſhed at the end of the ſecond edition of *Pharmacopœia Bateana*, by JAMES SHIPTON, apothecary, at London, 1691, in 8vo.

*December* 2. The lord viſcount HALLIFAX was admitted.

HENRY HALL, Eſq; was propoſed candidate by Mr. Le HUNT.

Mr. Le HUNT produced and left with Mr. HOOKE for the repoſitory an iron ſtone, of which, he ſaid, there were great numbers to be found in Brecknockſhire in the pariſh of Llhanelthy, yielding more iron than any common iron-ore.

Mr. OLDENBURG read the preface of the Dutch book lately publiſhed, ſent over by Monſ. de ZUYLICHEM, concerning the gout; which preface he has tranſlated into Engliſh, containing the occaſion, deſign, and import of that book.

He was deſired to ſend for ſome of the remedy for the gout out of Holland, where it was ſaid to be had; and to inquire particularly at what intervals of time the author of the book, who had been cured by that medicine, had been troubled with gouty fits, before he made uſe of this remedy.

Mr. HOOKE was of opinion, that the ſubſtance concealed by this author was a kind of ſpunk.

Mr. OLDENBURG read a letter to himſelf from Mr. FRANCIS JESSOP of Broomhall in Yorkſhire, dated 18 November, 1675 [f], containing a farther account of the fulminating damps in the mines of Wingernorth, of which he had ſent ſome relation [g]; together with an anſwer to ſeveral queries, that were ſent him on that occaſion.

Mr. HOOKE mentioned hereupon, that there were two ſorts of damps; the one of a moiſt and groſs nature, falling downwards; the other ſpirituous and very apt to catch fire and to flame: adding, that heretofore in a well on Banſtead-downs about three hundred feet deep, he had let down a candle burning to the depth of two hundred feet; but that letting it down deeper, the candle went out.

[e] Idem, ibid. [f] Letter-book, vol. vii. p. 174. It is printed in the Philoſ. Tranſact. vol. x. n° 119. p. 450. for November, 1675. [g] Ibid. n° 117. p. 391.

Mr. Hooke produced one of his contrivances of lamps formerly diſcourſed of by him, which he explained to the Society, ſerving to keep water as well as food for lamps at the ſame hight, and being uſeful to keep a conſtant degree of heat for hatching of eggs; as alſo to vary the degrees of heat, and to anneal glaſs for toughneſs, and likewiſe to anneal iron to the ſoftneſs of lead, &c.

*December* 9. There was produced a manuſcript of Mr. Newton, touching his theory of light and colours, containing partly an hypotheſis to explain the properties of light diſcourſed of by him in his former papers, partly the principal phænomena of the various colours exhibited by thin plates or bubbles, eſteemed by him to be of a more difficult conſideration; yet to depend alſo on the ſaid properties of light.

Of the hypotheſis only the firſt part was read, giving an account of refraction, reflection, tranſparency, and opacity; the ſecond part explaining colours being referred to the next meeting.

The firſt was as follows [h]:

" Sir,

" I have ſent you the papers I mentioned, by John Stiles. Upon reviewing " them, I find ſome things ſo obſcure, as might have deſerved a further explication " by ſchemes; and ſome other things, I gueſs, will not be new to you, though al- " moſt all was new to me when I wrote them. But as they are, I hope you will accept " of them, though not worth the ample thanks you ſent. I remember, in ſome " diſcourſe with Mr. Hooke, I happened to ſay, that I thought light was re- " flected, not by the parts of glaſs, water, air, or other ſenſible bodies; but by " the ſame confine or ſuperficies of the æthereal mediums, which refracts it, the " rays finding ſome difficulty to get through it in paſſing out of the denſer into " the rarer medium, and a greater difficulty in paſſing out of the rarer into the " denſer; and ſo being either refracted or reflected by that ſuperficies, as the " circumſtances they happened to be in at their incidence make them able or " unable to get through it. And, for confirmation of this, I ſaid further, that " I thought the reflection of light, at its tending out of glaſs into air, would not " be diminiſhed or weakened by drawing away the air in an air-pump, as it ought " to be, if they were the parts of air that reflected: and added, that I had not " tried this experiment, but thought he was not unacquainted with notions of " this kind. To which he replied, that the notion was new, and he would the " firſt opportunity try the experiment I propounded. But upon reviewing the " papers I ſend you, I found it there ſet down for tried; which makes me recol- " lect, that about the time I was writing theſe papers, I had occaſionally obſerved " in an air-pump here at Chriſt's-College, that I could not perceive the reflection " of the inſide of the glaſs diminiſhed in drawing out the air. This I thought " fit to mention, leaſt my former forgetfulneſs, through having long laid aſide " my thoughts on theſe things, ſhould make me ſeem to have ſet down for cer- " tain what I never tried.

[h] Regiſter, vol. v. p. 65.

" Sir,

" Sir, I had formerly purpoſed never to write any hypotheſis of light and " colours, fearing it might be a means to engage me in vain diſputes: but I hope " a declared reſolution to anſwer nothing, that looks like a controverſy, unleſs " poſſibly at my own time upon ſome by-occaſion, may defend me from that " fear. And therefore conſidering, that ſuch an hypotheſis would much illuſtrate " the papers I promiſed to ſend you; and having a little time this laſt week to " ſpare, I have not ſcrupled to deſcribe one, ſo far as I could on a ſudden recol- " lect my thoughts about it; not concerning myſelf, whether it ſhall be thought " probable or improbable, ſo it do but render the papers I ſend you, and others " ſent formerly, more intelligible. You may ſee, by the ſcratching and inter- " lining, it was done in haſte; and I have not had time to get it tranſcribed, " which makes me ſay I reſerve a liberty of adding it; and deſire, that you would " return thoſe and the other papers when you have done with them. I doubt " there is too much to be read at one time, but you will ſoon know how to " order that. At the end of the hypotheſis you will ſee a paragraph to be in- " ſerted as is there directed: I ſhould have added another or two, but I had not " time, but ſuch as it is, I hope you will accept it. Sir, I am, &c.

Is. NEWTON.

" An Hypotheſis explaining the Properties of Light, diſcourſed of in my ſe- " veral Papers.

" Sir,

" In my anſwer to Mr. HOOKE, you may remember, I had occaſion to ſay " ſomething of hypotheſes, where I gave a reaſon, why all allowable hypotheſes " in their genuine conſtitution ſhould be conformable to my theories; and ſaid " of Mr. HOOKE's hypotheſis, that I took the moſt free and natural application " of it to phænomena to be this [1]: that the agitated parts of bodies, according " to their ſeveral ſizes, figure, and motions, do excite vibrations in the æther of " various depths or bigneſſes, which being promiſcuouſly propagated through that " medium to our eyes, effect in us a ſenſation of light of a white colour; but, " if by any means thoſe of unequal bigneſſes be ſeparated from one another, the " largeſt beget a ſenſation of a red colour; the leaſt, or ſhorteſt, of a deep " violet; and the intermediate ones, of intermediate colours: much after the " manner that bodies, according to their ſeveral ſizes, ſhapes, and motions, ex- " cite vibrations in the air of various bigneſſes, which, according to thoſe big- " neſſes, make ſeveral tones in ſound, &c. I was glad to underſtand, as I ap- " prehend, from Mr. HOOKE's diſcouſe at my laſt being at one of your aſſem- " blies, that he had changed his former notion of all colours being compounded " of only two original ones, made by the two ſides of an oblique pulſe; and " accommodated his hypotheſis to this my ſuggeſtion of colours, like ſounds, " being various, according to the various bigneſs of the pulſes. For this I take " to be a more plauſible hypotheſis than any other deſcribed by former authors, " becauſe I ſee not how the colours of thin tranſparent plates or ſkins can be " handſomely explained, without having recourſe to æthereal pulſes: but yet I

[1] Tranſact. n° 88. p. 5088.

" like

" like another hypotheſis better, which I had occaſion to hint ſomething of in the " ſame letter in theſe words [k]:

" *The hypotheſis of light's being a body, had I propounded it, has a much greater* " *affinity with the objector's own hypotheſis, than he ſeems to be aware of; the vibra-* " *tions of the æther being as uſeful and neceſſary in this as in his. For, aſſuming the* " *rays of light to be ſmall bodies emitted every way from ſhining ſubſtances, thoſe,* " *when they impinge on any refracting or reflecting ſuperficies, muſt as neceſſarily ex-* " *cite vibrations in the æther, as ſtones do in water when thrown into it. And, ſup-* " *poſing theſe vibrations to be of ſeveral depths or thickneſſes, accordingly as they are* " *excited by the ſaid corpuſcular rays of various ſizes and velocities; of what uſe* " *they will be for explicating the manner of reflexion and refraction; the production of* " *heat by the ſun-beams; the emiſſion of light from burning, putrifying, or other ſub-* " *ſtances, whoſe parts are vehemently agitated; the phænomena of thin tranſparent* " *plates, and bubbles, and of all natural bodies; the manner of viſion, and the dif-* " *ference of colours; as alſo their harmony and diſcord; I ſhall leave to their conſi-* " *deration, who may think it worth their endeavour to apply this hypotheſis to the* " *ſolution of phænomena.*

" Were I to aſſume an hypotheſis, it ſhould be this, if propounded more ge- " nerally, ſo as not to determine what light is, farther than that it is ſomething " or other capable of exciting vibrations in the æther: for thus it will become " ſo general and comprehenſive of other hypotheſes, as to leave little room for " new ones to be invented. And therefore, becauſe I have obſerved the heads " of ſome great virtuoſos to run much upon hypotheſes, as if my diſcourſes want- " ed an hypotheſis to explain them by, and found, that ſome, when I could not " make them take my meaning, when I ſpake of the nature of light and colours " abſtractedly, have readily apprehended it, when I illuſtrated my diſcourſe by " an hypotheſis; for this reaſon I have here thought fit to ſend you a deſcrip- " tion of the circumſtances of this hypotheſis as much tending to the illuſtration " of the papers I herewith ſend you. And though I ſhall not aſſume either this or " any other hypotheſis, not thinking it neceſſary to concern myſelf, whether the " properties of light, diſcovered by me, be explained by this, or Mr. Hooke's, " or any other hypotheſis capable of explaining them; yet while I am deſcrib- " ing this, I ſhall ſometimes, to avoid circumlocution, and to repreſent it more " conveniently, ſpeak of it, as if I aſſumed it, and propounded it to be believed. " This I thought fit to expreſs, that no man may confound this with my other " diſcourſes, or meaſure the certainty of one by the other, or think me obliged " to anſwer objections againſt this ſcript: for I deſire to decline being involved " in ſuch troubleſome and inſignificant diſputes.

" But to proceed to the hypotheſis: Firſt, it is to be ſuppoſed therein, that " there is an æthereal medium much of the ſame conſtitution with air, but far " rarer, ſubtler, and more ſtrongly elaſtic. Of the exiſtence of this medium " the motion of a pendulum in a glaſs exhauſted of air almoſt as quickly as in

[k] Tranſact. n° 88. p. 5087.

" the open air, is no inconſiderable argument. But it is not to be ſuppoſed, " that this medium is one uniform matter, but compounded, partly of the main " phlegmatic body of æther, partly of other various æthereal ſpirits, much after " the manner, that air is compounded of the phlegmatic body of air intermixed " with various vapours and exhalations: for the electric and magnetic effluvia, " and gravitating principle, ſeem to argue ſuch variety. Perhaps the whole " frame of nature may be nothing but various contextures of ſome certain æthe- " real ſpirits, or vapours, condenſed as it were by precipitation, much after the " manner, that vapours are condenſed into water, or exhalations into groſſer ſub- " ſtances, though not ſo eaſily condenſible; and after condenſation wrought into " various forms; at firſt by the immediate hand of the Creator; and ever ſince " by the power of nature; which, by virtue of the command, increaſe and " multiply, became a complete imitator of the copies ſet her by the protoplaſt. " Thus perhaps may all things be originated from æther.

" At leaſt, the elaſtic effluvia ſeem to inſtruct us, that there is ſomething of " an æthereal nature condenſed in bodies. I have ſometimes laid upon a table " a round piece of glaſs about two inches broad ſet in a braſs ring, ſo that the " glaſs might be about one eighth or one ſixth of an inch from the table, and " the air between them incloſed on all ſides by the ring, after the manner as if " I had whelmed a little ſieve upon the table; and then rubbing a pretty while " the glaſs briſkly with ſome rough and raking ſtuff, till ſome very little fragments " of very thin paper, laid on the table under the glaſs, began to be attracted and " move nimbly to and fro; after I had done rubbing the glaſs, the papers would " continue a pretty while in various motions; ſometimes leaping up to the glaſs " and reſting there a while; then leaping down and reſting there; then leaping " up, and perhaps down and up again, and this ſometimes in lines ſeeming per- " pendicular to the table; ſometimes in oblique ones; ſometimes alſo they would " leap up in one arch and down in another, divers times together, without " ſenſibly reſting between; ſometimes ſkip in a bow from one part of the glaſs " to another without touching the table, and ſometimes hang by a corner, and " turn often about very nimbly, as if they had been carried about in the midſt " of a whirlwind, and be otherwiſe variouſly moved, every paper with a diverſe " motion. And upon ſliding my finger on the upper ſide of the glaſs, though " neither the glaſs, nor incloſed air below, were moved thereby, yet would the " papers, as they hung under the glaſs, receive ſome new motion, inclining this " way or that way, accordingly as I moved my finger. Now, whence all theſe " irregular motions ſhould ſpring, I cannot imagine, unleſs from ſome kind of " ſubtil matter lying condenſed in the glaſs, and rarefied by rubbing, as water is " rarefied into vapour by heat, and in that rarefaction diffuſed through the ſpace " round the glaſs to a great diſtance, and made to move and circulate variouſly, " and accordingly to actuate the papers till it return into the glaſs again, and be " recondenſed there. And as this condenſed matter by rarefaction into an æthe- " real wind (for by its eaſy penetrating and circulating through glaſs I eſteem it " æthereal) may cauſe theſe odd motions, and by condenſing again may cauſe " electrical attraction with its returning to the glaſs to ſucceed in the place of " what is there continually recondenſed; ſo may the gravitating attraction of the

" earth

" earth be cauſed by the continual condenſation of ſome other ſuch like æthereal " ſpirit, not of the main body of phlegmatic æther, but of ſomething very " thinly and ſubtilly diffuſed through it, perhaps of an unctuous or gummy, " tenacious, and ſpringy nature, and bearing much the ſame relation to æther, " which the vital aereal ſpirit, requiſite for the conſervation of flame and vital " motions, does to air: For, if ſuch an æthereal ſpirit may be condenſed in " fermenting or burning bodies, or otherwiſe coagulated in the pores of the earth " and water into ſome kind of humid active matter, for the continual uſes of " nature, adhering to the ſides of thoſe pores, after the manner that vapours " condenſe on the ſides of a veſſel; the vaſt body of the earth, which may be " every where to the very center in perpetual working, may continually condenſe " ſo much of this ſpirit, as to cauſe it from above to deſcend with great celerity " for a ſupply; in which deſcent it may bear down with it the bodies it pervades " with force proportional to the ſuperficies of all their parts it acts upon; nature " making a circulation by the ſlow aſcent of as much matter out of the bowels " of the earth in an aereal form, which, for a time, conſtitutes the atmoſphere; " but being continually buoyed up by the new air; exhalations and vapours riſing " underneath, at length (ſome part of the vapours, which return in rain, excepted) " vaniſhes again into the æthereal ſpaces, and there perhaps in time relents, and is " attenuated into its firſt principle: for nature is a perpetual worker, generating " fluids out of ſolids, and ſolids out of fluids, fixed things out of volatile, and " volatile out of fixed, ſubtil out of groſs and groſs out of ſubtil; ſome things " to aſcend, and make the upper terreſtrial juices, rivers, and the atmoſphere; and " by conſequence, others to deſcend for a requital to the former. And, as the " earth, ſo perhaps may the ſun imbibe this ſpirit copiouſly, to conſerve his ſhin- " ing, and keep the planets from receding further from him. And they, that " will, may alſo ſuppoſe, that this ſpirit affords or carries with it thither the ſolary " fewel and material principle of light: and that the vaſt æthereal ſpaces between " us and the ſtars are for a ſufficient repoſitory for this food of the ſun and " planets. But this of the conſtitution of æthereal natures by the by.

" In the *ſecond* place, it is to be ſuppoſed, that the æther is a vibrating medium " like air, only the vibrations far more ſwift and minute; thoſe of air, made by " a man's ordinary voice, ſucceeding one another at more than half a foot or a " foot diſtance; but thoſe of æther at a leſs diſtance than the hundred thouſandth " part of an inch. And, as in air the vibrations are ſome larger than others, " but yet all equally ſwift (for in a ring of bells the ſound of every tone is heard " at two or three miles diſtance, in the ſame order that the bells are ſtruck;) ſo, " I ſuppoſe, the æthereal vibrations differ in bigneſs, but not in ſwiftneſs. Now, " theſe vibrations, beſide their uſe in reflexion and refraction, may be ſuppoſed " the chief means, by which the parts of fermenting or putrifying ſubſtances, " fluid liquors, or melted, burning, or other hot bodies, continue in motion, are " ſhaken aſunder like a ſhip by waves, and diſſipated into vapours, exhalations, " or ſmoke, and light looſed or excited in thoſe bodies, and conſequently by " which a body becomes a burning coal, and ſmoke, flame; and, I ſuppoſe, " flame is nothing but the particles of ſmoke turned by the acceſs of light and " heat to burning coals, little and innumerable.

" *Third'y*, as the air can pervade the bores of ſmall glaſs pipes, but yet not ſo " eaſily as if they were wider; and therefore ſtands at a greater degree of rarity " than in the free aereal ſpaces, and at ſo much a greater degree of rarity as the " pipe is ſmaller, as is known by the riſing of water in ſuch pipes to a much " greater hight than the ſurface of the ſtagnating water, into which they are " dipped; ſo I ſuppoſe æther, though it pervades the pores of cryſtal, glaſs, " water, and other natural bodies, yet it ſtands at a greater degree of rarity in " thoſe pores, than in the free æthereal ſpaces, and at ſo much a greater degree of " rarity, as the pores of the body are ſmaller. Whence it may be, that the ſpirit " of wine, for inſtance, though a lighter body, yet having ſubtiler parts, and " conſequently ſmaller pores, than water, is the more ſtrongly refracting liquor. " This alſo may be the principal cauſe of the coheſion of the parts of ſolids and " fluids, of the ſpringineſs of glaſs, and bodies, whoſe parts ſlide not one upon " another in bending, and of the ſtanding of the mercury in the Torricellian " experiment, ſometimes to the top of the glaſs, though a much greater hight " than twenty-nine inches. For the denſer æther, which ſurrounds theſe bodies, " muſt croud and preſs their parts together, much after the manner that air " ſurrounding two marbles preſſes them together, if there be little or no air be- " tween them. Yea, and that puzzling problem; *By what means the muſcles are* " *contracted and dilated to cauſe animal motion, may receive greater light from hence* " *than from any means men have hitherto been thinking on.* For, if there be any " power in man to condenſe and dilate at will the æther, that pervades the " muſcle, that condenſation or dilation muſt vary the compreſſion of the muſcle, " made by the ambient æther, and cauſe it to ſwell or ſhrink accordingly. For " though common water will ſcarce ſhrink by compreſſion, and ſwell by relax- " ation, yet (ſo far as my obſervation reaches) ſpirit of wine and oil will; and " Mr. BOYLE's experiment of a tadpole ſhrinking very much by hard compreſ- " ſing the water, in which it ſwam, is an argument, that animal juices do the " ſame. And as for their various preſſion by the ambient æther, it is plain, " that that muſt be more or leſs accordingly as there is more or leſs æther with- " in, to ſuſtain and counterpoiſe the preſſure of that without. If both æthers " were equally denſe, the muſcle would be at liberty, as if preſſed by neither: " if there were no æther within, the ambient would compreſs it with the whole " force of its ſpring. If the æther within were twice as much dilated as that " without, ſo as to have but half as much ſpringineſs, the ambient would have " half the force of its ſpringineſs counterpoiſed thereby, and exerciſe but the " other half upon the muſcle; and ſo in all other caſes the ambient compreſſes " the muſcle by the exceſs of the force of its ſpringineſs above that of the ſpring- " ineſs of the included. To vary the compreſſion of the muſcle therefore, and " ſo to ſwell and ſhrink it, there needs nothing but to change the conſiſtence " of the included æther; and a very little change may ſuffice, if the ſpring of " æther be ſuppoſed very ſtrong, as I take it to be many degrees ſtronger " than that of air.

" Now for the changing the conſiſtence of the æther; ſome may be ready to " grant, that the ſoul may have an immediate power over the whole æther in " any part of the body, to ſwell or ſhrink it at will: but then how depends the

" muſcular

" muſcular motion on the nerves? Others therefore may be more apt to think " it done by ſome certain æthereal ſpirit included within the *dura mater*, which " the ſoul may have power to contract or dilate at will in any muſcle, and ſo " cauſe it to flow thither through the nerves. But ſtill there is a difficulty, why " this force of the ſoul upon it does not take off the power of its ſpringineſs, " whereby it ſhould ſuſtain, more or leſs, the force of the outward æther. A " third ſuppoſition may be, that the ſoul has a power to inſpire any muſcle with " this ſpirit, by impelling it thither through the nerves. But this too has its " difficulties, for it requires a forcible intending the ſpring of the æther in the " muſcles, by preſſure exerted from the parts of the brain: and it is hard to " conceive, how ſo great force can be exerciſed amidſt ſo tender matter as the " brain is. And beſides, why does not this æthereal ſpirit, being ſubtil enough, " and urged with ſo great force, go away through the dura mater and ſkins of " the muſcle; or at leaſt ſo much of the other æther go out to make way for " this, which is crouded in? To take away theſe difficulties is a digreſſion; but " ſeeing the ſubject is a deſerving one, I ſhall not ſtick to tell you how I think " it may be done.

" Firſt then, I ſuppoſe, there is ſuch a ſpirit; that is, that the animal ſpirits " are neither like the liquor, vapour, or gas of ſpirit of wine; but of an æthereal " nature, ſubtil enough to pervade the animal juices, as freely as the electric, or " perhaps magnetic, effluvia do glaſs. And to know, how the coats of the " brain, nerves, and muſcles, may become a convenient veſſel to hold ſo ſubtil " a ſpirit, you may conſider, how liquors and ſpirits are diſpoſed to pervade or " not pervade things on other accounts than their ſubtilty. Water and oil per- " vade wood and ſtone, which quickſilver does not; and quickſilver metals, " which water and oil do not: water and acid ſpirits pervade ſalts, which oil " and ſpirit of wine do not; and oil and ſpirit of wine pervade ſulphur, which " water and acid ſpirits do not. So ſome fluids, as oil and water, though their " parts are in freedom enough to mix with one another, yet by ſome ſecret " principle of unſociableneſs they keep aſunder; and ſome, that are ſociable, may " become unſociable, by adding a third thing to one of them, as water to ſpirit " of wine, by diſſolving ſalt of tartar in it. The like unſociableneſs may be in " æthereal natures, as perhaps between the æthers in the vortices of the ſun and " planets; and the reaſon, why air ſtands rarer in the boxes of ſmall glaſs-pipes, " and æther in the pores of bodies, than elſewhere, may be, not want of ſub- " tilty, but ſociableneſs. And on this ground, if the æthereal vital ſpirit in a " man be very ſociable to the marrow and juices, and unſociable to the coats of " the brain, nerves, and muſcles, or to any thing lodged in the pores of thoſe " coats, it may be contained thereby, notwithſtanding its ſubtilty; eſpecially if " we ſuppoſe no great violence done to it to ſqueeze it out; and that it may not " be altogether ſo ſubtil as the main body of æther, though ſubtil enough to " pervade readily the animal juices, and that, as any of it is ſpent, it is continu- " ally ſupplied by new ſpirit from the heart.

" In the next place, for knowing how this ſpirit may be uſed for animal mo- " tion, you may conſider, how ſome things unſociable are made ſociable by the

" mediation

" mediation of a third. Water, which will not diſſolve copper, will do it, if " the copper be melted with ſulphur: aqua fortis, which will not pervade gold, " will do it by addition of a little ſal armoniac, or ſpirit of ſalt: lead will not " mix in melting with copper, but if a little tin or antimony be added, they mix " readily, and part again of their own accord, if the antimony be waſted by " throwing ſaltpeter or otherwiſe: and ſo lead melted with ſilver quickly per- " vades and liquefies the ſilver in a much leſs heat than is requiſite to melt the " ſilver alone; but, if they be kept in the teſt till that little ſubſtance, that re- " conciled them, be waſted or altered, they part again of their own accord. And, " in like manner, the æthereal animal ſpirit in a man may be a mediator between " the common æther and the muſcular juices, to make them mix more freely; " and ſo, by ſending a little of this ſpirit into any muſcle, though ſo little as to " cauſe no ſenſible tenſion of the muſcle by its own force; yet, by rendering the " juices more ſociable to the common external æther, it may cauſe that æther to " pervade the muſcle of its own accord in a moment more freely and copiouſly " than it would otherwiſe do, and to recede again as freely, ſo ſoon as this medi- " ator of ſociableneſs is retracted. Whence, according to what I ſaid above, " will proceed the ſwelling or ſhrinking of the muſcle, and conſequently the ani- " mal motion depending thereon.

" Thus may therefore the ſoul, by determining this æthereal animal ſpirit or " wind into this or that nerve, perhaps with as much eaſe as air is moved in open " ſpaces, cauſe all the motions we ſee in animals: for the making which motions " ſtrong, it is not neceſſary, that we ſhould ſuppoſe the æther within the muſcle " very much condenſed or rarified by this means, but only that its ſpring is ſo " very great, that a little alteration of its denſity ſhall cauſe a great alteration in " the preſſure. And what is ſaid of muſcular motion, may be applied to the mo- " tion of the heart, only with this difference, that the ſpirit is not ſent thither, " as into other muſcles, but continually generated there by the fermentation of " the juices, with which its fleſh is repleniſhed, and as it is generated, let out by " ſtarts into the brain through ſome convenient ductus to perform thoſe motions " in other muſcles by impreſſion, which it did in the heart by its generation. " For I ſee not, why the ferment in the heart may not raiſe as ſubtil a ſpirit out " of its juices, to cauſe theſe motions, as rubbing does out of a glaſs, to cauſe " electric attraction, or burning out of fewel, to penetrate glaſs, as Mr. BOYLE " has ſhewn, and calcine by corroſion metals melted therein.

" Hitherto I have been contemplating the nature of æther and æthereal ſub- " ſtances by their effects and uſes; and now I come to join therewith the conſi- " deration of light.

" In the fourth place therefore, I ſuppoſe light is neither æther, nor its vibrating " motion, but ſomething of a different kind propagated from lucid bodies. They, " that will, may ſuppoſe it an aggregate of various peripatetic qualities. Others " may ſuppoſe it multitudes of unimaginable ſmall and ſwift corpuſcles of various " ſizes, ſpringing from ſhining bodies at great diſtances one after another; but " yet without any ſenſible interval of time, and continually urged forward by a " principle

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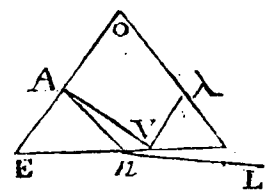
" principle of motion, which in the beginning accelerates them, till the reſiſtence " of the æthereal medium equal the force of that principle, much after the " manner that bodies let fall in water are accelerated till the reſiſtance of the wa- " ter equals the force of gravity. God, who gave animals ſelf-motion beyond " our underſtanding, is, without doubt, able to implant other principles of mo- " tion in bodies, which we may underſtand as little. Some would readily grant " this may be a ſpiritual one; yet a mechanical one might be ſhewn, did not I " think it better to paſs it by. But they, that like not this, may ſuppoſe light " any other corporeal emanation, or any impulſe or motion of any other medium " or æthereal ſpirit diffuſed through the main body of æther, or what elſe they " can imagine proper for this purpoſe. To avoid diſpute, and make this hypo- " theſis general, let every man here take his fancy: only, whatever light be, I " ſuppoſe, it conſiſts of rays differing from one another in contingent circum- " ſtances, as bigneſs, form, or vigour; like as the ſands on the ſhore, the waves " of the ſea, the faces of men, and all other natural things of the ſame kind " differ; it being almoſt impoſſible for any ſort of things to be found without " ſome contingent variety. And further, I would ſuppoſe it diverſe, from the " vibrations of the æther, becauſe (beſides, that were it theſe vibrations, it " ought always to verge copiouſly in crooked lines into the dark or quieſcent " medium, deſtroying all ſhadows; and to comply readily with any crooked pores " or paſſages, as ſounds do,) I ſee not how any ſuperficies (as the ſide of a glaſs " priſm, on which the rays within are incident at an angle of above forty de- " grees) can be totally opake. For the vibrations beating againſt the refract- " ing confine of the rarer and denſer æther muſt needs make that pliant ſuper- " ficies undulate, and thoſe undulations will ſtir up and propagate vibrations on " the other ſide. And further, how light, incident on very thin ſkins or plates " of any tranſparent body, ſhould, for many ſucceſſive thickneſſes of the plate " in arithmetical progreſſion, be alternately reflected and tranſmitted, as I find " it is, puzzles me as much. For, though the arithmetical progreſſion of thoſe " thickneſſes, which reflect and tranſmit the rays alternately, argues, that it de- " pends upon the number of vibrations between the two ſuperficies of the plate, " whether the ray ſhall be reflected or tranſmitted: yet I cannot ſee, how the " number ſhould vary the caſe, be it greater or leſs, whole or broken, unleſs " light be ſuppoſed ſomething elſe than theſe vibrations. Something indeed " I could fancy towards helping the two laſt difficulties, but nothing which I ſee " not inſufficient.

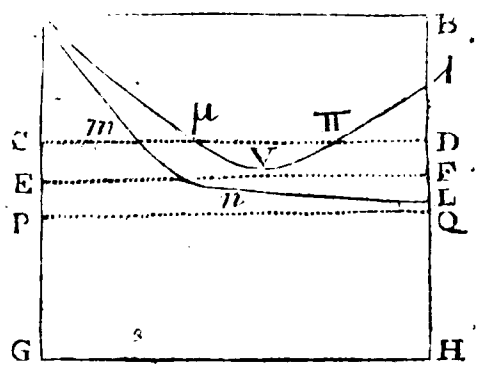
" Fifthly, it is to be ſuppoſed, that light and æther mutually act upon one " another, æther in refracting light, and light in warming æther; and that the " denſeſt æther acts moſt ſtrongly. When a ray therefore moves through æther " of uneven denſity, I ſuppoſe it moſt preſſed, urged, or acted upon by the me- " dium on that ſide towards the denſer æther, and receives a continual impulſe or " ply from that ſide to recede towards the rarer, and ſo is accelerated, if it move " that way, or retarded, if the contrary. On this ground, if a ray move " obliquely through ſuch an unevenly denſe medium (that is, obliquely to thoſe " imaginary ſuperficies, which run through the equally denſe parts of the me- " dium, and may be called the refracting ſuperficies) it muſt be incurved, as it

" is

" is found to be, by obſervation in water [1], whoſe lower parts were made gradu-
" ally more ſalt, and ſo more denſe than the upper. And this may be the ground
" of all refraction and reflexion: for as the rarer air within a ſmall glaſs-pipe,
" and the denſer without, are not diſtinguiſhed by a meer mathematical ſuper-
" ficies, but have air between them, at the orifice of the pipe, running through
" all intermediate degrees of denſity: ſo I ſuppoſe the refracting ſuperficies of
" æther, between unequally denſe mediums, to be not a mathematical one; but
" of ſome breadth, the æther therein, at the orifices of the pores of the ſolid body,
" being of all intermediate degrees of denſity between the rarer and denſer æthe-
" real mediums; and the refraction I conceive to proceed from the continual
" incurvation of the ray all the while it is paſſing the phyſical ſuperficies. Now,
" if the motion of the ray be ſuppoſed in this paſſage to be increaſed or dimi-
" niſhed in a certain proportion, according to the difference of the denſities of the
" æthereal mediums, and the addition or detraction of the motion be reckoned
" in the perpendicular from the refracting ſuperficies, as it ought to be, the ſines
" of incidence and refraction will be proportional according to what DES CARTES
" has demonſtrated.

" The ray therefore, in paſſing out of the rarer medium into the denſer,
" inclines continually more and more towards parallelism with the refracting ſu-
" perficies; and if the differing denſities of the mediums be not ſo great, nor the
" incidence of the ray ſo oblique, as to make it parallel to that ſuperficies before
" it gets through, then it goes through and is refracted; but if, through the afore-
" ſaid cauſes, the ray become parallel to that ſuperficies before it can get through,
" then it muſt turn back and be reflected. Thus, for inſtance, may be obſerved
" in a triangular glaſs-priſm O E F, that the rays A *n*,
" that ſend out of the glaſs into air, do, by inclining
" them more and more to the refracting ſuperficies, emerge
" more and more obliquely till they be infinitely oblique;
" that is, in a manner parallel to the ſuperficies, which hap-
" pens when the angle of incidence is about forty degrees;
" and then, if they be a little more inclined are all reflected,
" as at A V λ, becoming, I ſuppoſe, parallel to the ſuperficies before they can get
" through it. Let A B D C repreſent the rarer medium; E F H G the denſer,
" C D F E the ſpace between them, or re-
" fracting phyſical ſuperficies, in which the
" æther is of all intermediate degrees of
" denſity, from the rareſt æther at C D,
" to the denſeſt, at E F; A *m n* L a ray,
" A *m* its incident part, *m n* its incurvation
" by the refracting ſuperficies, and *n* L its
" emergent part. Now, if the ray A *m* be
" ſo much incurved as to become at its
" emergence *n*, as nearly as may be, paral-
" lel to C D, it is plain, that if that ray
" had been incident a little more obliquely,




[1] See Mr. HOOKE's Micrographia, where he ſpeaks of the inflexion of rays.

" it

" it must have become parallel to C D, before it had arrived at E F, the further " side of the refracting superficies; and so could have got no nearer to E F, but " must have turned back by further incurvation, and been reflected, as it is re- " presented at A $\mu$ V $\lambda$. And the like would have happened, if the density " of the æther had further increased from E F to P Q; so that P Q H G might " be a denser medium than E F H G was supposed; for then the ray, in pass- " ing from $m$ to $n$, being so much incurved, as at $n$ to become parallel to C D " or P Q, it is impossible it should ever get nearer to P Q, but must at $n$ be- " gin by further incurvation to turn back, and so be reflected. And because, if " a refracted ray, as $n$ L, be made incident, the incident, A $m$, shall become the " refracted; and therefore, if the ray A $\mu$ V, after it is arrived at V, where I " suppose it parallel to the refracting superficies, should be reflected perpendicu- " larly back, it would return back in the line of incidence V $\mu$ A. Therefore " going forward, it must go forward in such another line, V $\pi\lambda$, both cases be- " ing alike, and so be reflected at an angle, equal to that of incidence.

" This may be the cause and manner of reflection, when light tends from the " rarer towards the denser æther: but to know, how it should be reflected, " when it stands from the denser towards the rarer, you are further to consider, " how fluids near their superficies are less pliant and yielding than in their more " inward parts; and, if formed into thin plates, or shells, they become much " more stiff and tenacious than otherwise. Thus, things, which readily fall in " water, if let fall upon a bubble of water, they do not easily break through it, " but are apt to slide down by the sides of it, if they be not too big and heavy. " So, if two well polished convex glasses, ground on very large spheres, be laid " one upon another, the air between them easily recedes, till they almost touch; " but then begins to resist so much, that the weight of the upper glass is too " little to bring them together so as to make the black, mentioned in the other " papers I send you, appear in the midst of the rings of colours: and, if the " glasses be plain, though no broader than a two-pence, a man with his whole " strength is not able to press all the air out from between them, so as to make " them fully touch. You may observe also, that insects will walk upon water " without wetting their feet, and the water bearing them up; also motes fal- " ling upon water will often lie long upon it without being wetted: and so, " I suppose, æther in the confine of two mediums is less pliant and yielding " than in other places, and so much the less pliant by how much the mediums " differ in density: so that in passing out of denser æther into rarer, when there " remains but a very little of the denser æther to be past through, a ray finds " more than ordinary difficulty to get through; and so great difficulty, where the " mediums are of very differing density, as to be reflected by incurvation, after " the manner described above; the parts of æther on that side, where they are " less pliant and yielding, acting upon the ray much after the manner that they " would do were they denser there than on the other side: for the resistance of " the medium ought to have the same effect on the ray, from what cause soever " it arises. And this, I suppose, may be the cause of the reflection of quick- " silver, and other metalline bodies. It must also concur to increase the reflective " virtue of the superficies, when rays tend out of the rarer medium into the

" denſer: and, in that caſe therefore, the reflection having a double cauſe, ought " to be ſtronger than in the æther, as it is apparently. But in refraction, this ri- " gid tenacity or unpliableneſs of the ſuperficies need not be conſidered, becauſe " ſo much as the ray is thereby bent in paſſing to the moſt tenacious and rigid " part of the ſuperficies, ſo much it is thereby unbent again in paſſing on from " thence through the next parts gradually leſs tenacious.

" Thus may rays be refracted by ſome ſuperficies, and reflected by others, be " the medium they tend into, denſer or rarer. But it remains further to be ex- " plained, how rays alike incident on the ſame ſuperficies (ſuppoſe of cryſtal, glaſs, " or water) may be at the ſame time ſome refracted, others reflected. And for ex- " plaining this, I ſuppoſe, that the rays, when they impinge on the rigid reſiſt- " ing æthereal ſuperficies, as they are acted upon by it, ſo they react upon it and " cauſe vibrations in it, as ſtones thrown into water do in its ſurface; and that " theſe vibrations are propagated every way into both the rarer and denſer me- " diums; as the vibrations of air, which cauſe ſound, are from a ſtroke, but yet " continue ſtrongeſt where they began, and alternately contract and dilate the æther " in that phyſical ſuperficies. For it is plain by the heat, which light produces in " bodies, that it is able to put their parts in motion, and much more to heat and " put in motion the more tender æther; and it is more probable, that it com- " municates motion to the groſs parts of bodies by the mediation of æther than " immediately; as for inſtance, in the inward parts of quickſilver, tin, ſilver, " and other very opake bodies, by generating vibrations, that run through them, " than by ſtriking the outward parts only, without entering the body. The ſhock " of every ſingle ray may generate many thouſand vibrations, and by ſending " them all over the body, move all the parts, and that perhaps with more mo- " tion than it could move one ſingle part by an immediate ſtroke; for the vi- " brations, by ſhaking each particle backward and forward, may every time " increaſe its motion, as a ringer does a bell by often pulling it, and ſo at length " move the particles to a very great degree of agitation, which neither the ſimple " ſhock of a ray, nor any other motion in the æther, beſides a vibrating one could " do. Thus in air ſhut up in a veſſel, the motion of its parts cauſed by heat, " how violent ſoever, is unable to move the bodies hung in it, with either a trem- " bling or progreſſive motion: but if air be put into a vibrating motion by beat- " ing a drum or two, it ſhakes glaſs-windows, the whole body of a man, and " other maſſy things, eſpecially thoſe of a congruous tone: yea I have obſerved it " manifeſtly ſhake under my feet a cellared free-ſtone floor of a large hall, ſo as, " I believe, the immediate ſtroke of five hundred drumſticks could not have done, " unleſs perhaps quickly ſucceeding one another at equal intervals of time. Æthe- " real vibrations are therefore the beſt means by which ſuch a ſubtile agent as " light can ſhake the groſs particles of ſolid bodies to heat them: and ſo ſup- " poſing that light, impinging on a refracting or reflecting æthereal ſuperficies, puts " it into a vibrating motion, that phyſical ſuperficies being by the perpetual ap- " pulſe of rays always kept in a vibrating motion, and the æther therein conti- " nually expanded and compreſſed by turns; if a ray of light impinge upon it, " while it is much compreſſed, I ſuppoſe it is then too denſe and ſtiff to let the ray

" paſs

" paſs through, and ſo reflects it; but the rays, that impinge on it at other times, " when it is either expanded by the interval of two vibrations, or not too much " compreſſed and condenſed, go through and are refracted.

" Theſe may be the cauſes of refractions and reflections in all caſes; but, for " underſtanding how they come to be ſo regular, it is further to be conſidered, " that in a heap of ſand, although the ſurface be rugged, yet if water be poured " on it to fill its pores, the water, ſo ſoon as its pores are filled, will evenly over- " ſpread the ſurface, and ſo much the more evenly, as the ſand is finer: ſo, al- " though the ſurface of all bodies, even the moſt poliſhed, be rugged, as I con- " ceive, yet where that ruggedneſs is not too groſs and coarſe, the refracting æthe- " real ſuperficies may evenly overſpread it. In poliſhing glaſs or metal, it is not " to be imagined, that ſand, putty, or other fretting powders, ſhould wear the " ſurface ſo regularly, as to make the front of every particle exactly plain, and " all thoſe plains look the ſame way, as they ought to do in well poliſhed bodies, " were reflection performed by their parts: but that thoſe fretting powders ſhould " wear the bodies firſt to a coarſe ruggedneſs, ſuch as is ſenſible, and then to a finer " and finer ruggedneſs, till it be ſo fine that the æthereal ſuperficies evenly over- " ſpreads it, and ſo makes the body put on the appearance of a poliſh, is a very na- " tural and intelligible ſuppoſition. So in fluids, it is not well to be conceived, that " the ſurfaces of their parts ſhould be all plain, and the plains of the ſuperficial parts " always kept looking all the ſame way, notwithſtanding that they are in perpetual " motion. And yet without theſe two ſuppoſitions, the ſuperficies of fluids could " not be ſo regularly reflexive as they are, were the reflexion done by the parts them- " ſelves, and not by an æthereal ſuperficies evenly overſpreading the fluid.

" Further, concerning the regular motion of light, it might be ſuſpected, whe- " ther the various vibrations of the fluid, through which it paſſes, may not much " diſturb it: but that ſuſpicion, I ſuppoſe, will vaniſh, by conſidering, that " if at any time the foremoſt part of an oblique wave begin to turn it awry, " the hindermoſt part, by a contrary action, muſt ſoon ſet it ſtraight again.

" Laſtly, becauſe without doubt there are, in every tranſparent body, pores of " various ſizes, and I ſaid, that æther ſtands at the greateſt rarity in the ſmalleſt " pores; hence the æther in every pore ſhould be of a differing rarity, and ſo " light be refracted in its paſſage out of every pore into the next, which would " cauſe a great confuſion, and ſpoil the body's tranſparency. But conſidering that " the æther, in all denſe bodies, is agitated by continual vibrations, and theſe vi- " brations cannot be performed without forcing the parts of æther forward and " backward, from one pore to another, by a kind of tremor, ſo that the æther, " which one moment is in a greater pore, is the next moment forced into a leſs; " and on the contrary, this muſt evenly ſpread the æther into all the pores not " exceeding ſome certain bigneſs, ſuppoſe the breadth of a vibration, and ſo make " it of an even denſity throughout the tranſparent body, agreeable to the middle " ſort of pores. But where the pores exceed a certain bigneſs, I ſuppoſe " the æther ſuits its denſity to the bigneſs of the pore, or to the medium within " it; and ſo being of a diverſe denſity from the æther that ſurrounds it, refracts



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" or reflects light in its ſuperficies, and ſo make the body, where many ſuch in-
" terſtices are, appear opake."

Some of the members taking particular notice, among other things, of an experiment mentioned in this hypotheſis, deſired, that it might be tried; viz. that having laid upon a table a round piece of glaſs, about two inches broad, in a braſs ring; ſo that the glaſs might be one third part of an inch from the table; and then rubbing the glaſs briſkly, till ſome little fragments of paper laid on the table under the glaſs began to be attracted, and move nimbly to and fro; after he had done rubbing the glaſs, the papers would continue a pretty while in various motions, ſometimes leaping up to the glaſs, and reſting there a while, then leaping down, and reſting there, and then leaping up and down again, and this ſometimes in lines ſeeming perpendicular to the table, ſometimes in oblique ones; ſometimes alſo leaping up in one arch, and leaping down in another divers times together, without ſenſibly reſting between; ſometimes ſkipping in a bow from one part of the glaſs to another, without touching the table, and ſometimes hanging by a corner, and turning often about very nimbly, as if they had been carried about in the middle of a whirlwind; and being otherwiſe variouſly moved, every paper with a different motion. And upon ſliding his finger upon the upper ſide of the glaſs, though neither the glaſs nor the incloſed air below were moved thereby, yet would the papers, as they hung under the glaſs, receive ſome new motion, inclining this or that way, according as he moved his finger.

This experiment Mr. NEWTON propoſed to be varied with a larger glaſs placed farther from the table, and to make uſe of bits of leaf gold inſtead of papers; thinking, that this would ſucceed much better, ſo as perhaps to make the leaf gold riſe and fall in ſpiral lines, or whirl for a time in the air, without touching either the table or glaſs.

It was ordered, that this experiment ſhould be tried at the next meeting; and Mr. HOOKE promiſed to prepare it for that meeting.

Mr. OLDENBURG was deſired to enquire by letter of Mr. NEWTON, whether he would conſent, that a copy might be taken of his papers, for the better conſideration of their contents.

Mr. OLDENBURG preſented from Mr. MARTYN, the printer to the Society, Mr. WILLUGHBY's *Ornithologia*, printed at London, 1676, in fol.

*December* 16. Mr. NEWTON's experiment of glaſs rubbed to cauſe various motions in bits of paper underneath, was tried, but did not ſucceed in thoſe circumſtances, with which it was tried. This trial was made upon the reading of a letter of his to Mr. OLDENBURG, dated at Cambridge, 14th December, 1675 [m], in which he gives ſome more particular directions about that experiment.

The letter was as follows:

[m] Letter-book, vol. vii. p. 280.

The

" The notice you gave me of the Royal Society's intending to ſee the experi-
" ment of glaſs rubbed, to cauſe various motions in bits of paper underneath,
" put me upon recollecting myſelf a little further about it; and then remembring,
" that, if one edge of the braſs hoop was laid downward, the glaſs was as near
" again to the table as it was when the other edge was laid downward, and that
" the papers played beſt when the glaſs was neareſt to the table; I began to ſuſ-
" pect, that I had ſet down a greater diſtance of the glaſs from the table than I
" ſhould have done; for in ſetting down that experiment, I truſted to the idea I
" had of the bigneſs of the hoop, in which I might eaſily be miſtaken, having
" not ſeen it of a long time. And this ſuſpicion was increaſed by trying the ex-
" periment with an object glaſs of a teleſcope, placed about the third part of an
" inch from the table; for I could not ſee the papers play any thing near ſo well
" as I had ſeen them formerly. Whereupon I looked for the old hoop with its
" glaſs, and at length found the hoop, the glaſs being gone; but by the hoop I
" perceived, that, when one edge was turned down, the glaſs was almoſt the
" third part of an inch from the table, and when the other edge was down,
" which made the papers play ſo well, the glaſs was ſcarce the eighth part of an
" inch from the table. This I thought fit to ſignify to you, that, if the expe-
" riment ſucceed not well at the diſtance I ſet down, it may be tried at a leſs
" diſtance, and that you may alter my paper, and write in it the eighth part of an
" inch inſtead of $\frac{1}{4}$ or $\frac{1}{7}$ of an inch. The bits of paper ought to be very little,
" and of thin paper; perhaps little bits of the wings of a fly, or other light ſub-
" ſtances, may do better than paper. Some of the motions, as that of hanging
" by a corner and twirling about, and that of leaping from one part of the glaſs
" to another, without touching the table, happen but ſeldom; but it made me take
" the more notice of them.

" Pray preſent my humble ſervice to Mr. BOYLE, when you ſee him, and thanks
" for the favour of the converſe I had with him at Spring. My conceit of tre-
" paning the common æther, as he was pleaſed to expreſs it, makes me begin
" to have the better thoughts on that he was pleaſed to entertain it with a ſmile.
" I am apt to think, that when he has a ſet of experiments to try in his air-pump,
" he will make that one, to ſee how the compreſſion or relaxation of a muſcle will
" ſhrink or ſwell, ſoften or harden, lengthen or ſhorten it.

" As for regiſtring the two diſcourſes, you may do it; only I deſire you would
" ſuſpend till my next letter, in which I intend to ſet down ſomething to be al-
" tered, and ſomething to be added in the hypotheſis."

It was ordered, that Mr. OLDENBURG ſhould again write to Mr. NEWTON, and acquaint him with the want of ſucceſs of his experiment, and deſire him to ſend his own apparatus, with which he had made it: as alſo to enquire, whether he had ſecured the papers being moved from the air, that might ſomewhere ſteal in.

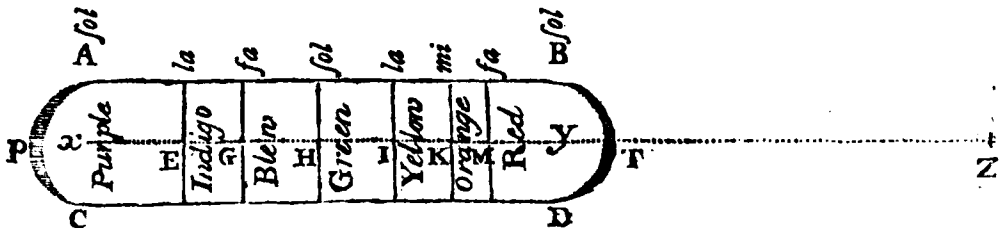
Hereupon the ſequel of his hypotheſis, the firſt part of which was read at the preceding meetings, was read to the end.

" Thus

" Thus much of refraction, reflection, tranſparency, and opacity; and now to " explain colours; I ſuppoſe, that as bodies of various ſizes, denſities, or ſenſa- " tions, do by percuſſion or other action excite ſounds of various tones, and " conſequently vibrations in the air of various bigneſs; ſo when the rays of " light, by impinging on the ſtiff refracting ſuperficies, excite vibrations in the " æther, thoſe rays, whatever they be, as they happen to differ in magnitude, " ſtrength or vigour, excite vibrations of various bigneſs; the biggeſt, ſtrongeſt, " or moſt potent rays, the largeſt vibrations; and others ſhorter, according to " their bigneſs, ſtrength, or power: and therefore the ends of the capillamenta of " the optic nerve, which pave or face the retina, being ſuch refracting ſuperfi- " cies, when the rays impinge upon them, they muſt there excite theſe vibra- " tions, which vibrations (like thoſe of ſound in a trunk or trumpet) will run " along the aqueous pores or cryſtalline pith of the capillamenta through the " optic nerves into the ſenſorum (which light itſelf cannot do) and there, I ſup- " poſe, affect the ſenſe with various colours, according to their bigneſs and mix- " ture; the biggeſt with the ſtrongeſt colours, reds and yellows; the leaſt with " the weakeſt, blues and violets; the middle with green, and a confuſion of " all with white, much after the manner, that in the ſenſe of hearing, nature " makes uſe of aereal vibrations of ſeveral bigneſſes to generate ſounds of divers " tones; for the analogy of nature is to be obſerved. And further, as the " harmony and diſcord of ſounds proceed from the proportions of the aereal vi- " brations, ſo may the harmony of ſome colours, as of golden and blue, and the " diſcord of others, as of red and blue, proceed from the proportions of the æthe- " real. And poſſibly colour may be diſtinguiſhed into its principal degrees, red, " orange, yellow, green, blue, indigo, and deep violet, on the ſame ground, " that ſound within an eighth is graduated into tones. For, ſome years paſt, the " priſmatic colours being in a well darkened room caſt perpendicularly upon " a paper about two and twenty foot diſtant from the priſm, I deſired a friend " to draw with a pencil lines croſs the image, or pillar of colours, where every " one of the ſeven aforenamed colours was moſt full and briſk, and alſo where he " judged the trueſt confines of them to be, whilſt I held the paper ſo, that the ſaid " image might fall within a certain compaſs marked on it. And this I did, partly " becauſe my own eyes are not very critical in diſtinguiſhing colours, partly be- " cauſe another, to whom I had not communicated my thoughts about this mat- " ter, could have nothing but his eyes to determine his fancy in making thoſe " marks. This obſervation we repeated divers times, both in the ſame and di- " vers days, to ſee how the marks on ſeveral papers would agree; and comparing " the obſervations, though the juſt confines of the colours are hard to be aſſigned, " becauſe they paſs into one another by inſenſible gradation; yet the *differences* " of the obſervations were but little, eſpecially towards the red end, and taking " means between thoſe differences, that were, the length of the image (reckoned " not by the diſtance of the verges of the ſemicircular ends, but by the diſtance of " the centres of thoſe ſemicircles, or length of the ſtrait ſides as it ought to be) " was divided in about the ſame proportion that a ſtring is, between the end and " the middle, to ſound the tones in the eighth. You will underſtand me beſt " by viewing the annexed figure, in which A B and C D repreſent the ſtrait " ſides, about ten inches long, A B C and B T D the ſemicircular ends, X and

" Y

" Y the centres of thoſe ſemicircles, X Z the length of a muſical ſtring double to



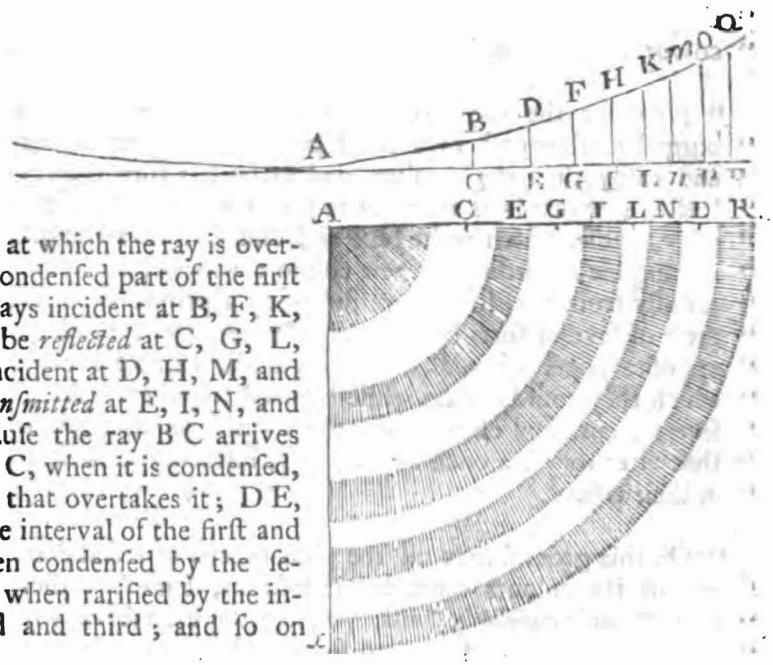

" X Y, and divided between X and Y, ſo as to ſound the tones expreſſed at the " ſide (that is X H the half, X G and G I the third part, Y K the fifth part, " Y M the eighth part, and G E the ninth part of X Y) and the intervals between " theſe diviſions expreſs the ſpaces which the colours written there took up, every " colour being moſt briſkly ſpecific in the middle of thoſe ſpaces.

" Now for the cauſe of theſe and ſuch like colours made by refraction, the " biggeſt or ſtrongeſt rays muſt penetrate the refracting ſuperficies more freely " and eaſily than the weaker, and ſo be leſs turned awry by it, that is, leſs re- " fracted; which is as much as to ſay, the rays, which make red, are leaſt refran- " gible, thoſe, which make blue and violet, moſt refrangible, and others otherwiſe " refrangible according to their colour: whence, if the rays, which come promiſ- " cuouſly from the ſun, be refracted by a priſm, as in the aforeſaid experiment, " theſe of ſeveral ſorts being variouſly refracted, muſt go to ſeveral places on an " oppoſite paper or wall, and ſo parted, exhibit every one their own colours, " which they could not do while blended together. And, becauſe refraction only " ſevers them, and changes not the bigneſs or ſtrength of the ray, thence it is, " that after they are once well ſevered, refraction cannot make any further changes " in their colour.

" On this ground may all the phænomena of refractions be underſtood: but to " explain the colours made by reflections, I muſt further ſuppoſe, that, though " light be unimaginably ſwift, yet the æthereal vibrations, excited by a ray, move " faſter than the ray itſelf, and ſo overtake and outrun it one after another. And " this, I ſuppoſe, they will think an allowable ſuppoſition, who have been in- " clined to ſuſpect, that theſe vibrations themſelves might be light. But to make " it the more allowable, it is poſſible light itſelf may not be ſo ſwift, as ſome are " apt to think; for, notwithſtanding any argument, that I know yet to the con- " trary, it may be an hour or two, if not more, in moving from the ſun to us. " This celerity of the vibrations therefore ſuppoſed, if light be incident on a thin " ſkin or plate of any tranſparent body, the waves, excited by its paſſage through " the firſt ſuperficies, overtaking it one after another, till it arrive at the ſecond " ſuperficies, will cauſe it to be there reflected or refracted accordingly as the con- " denſed or expanded part of the wave overtakes it there. If the plate be of ſuch " a thickneſs, that the condenſed part of the firſt wave overtake the ray at the ſe- " cond ſuperficies, it muſt be reflected there; if double that thickneſs, that the " following rarified part of the wave, that is, the ſpace between that and the next

" wave,

" wave, overtake it, there it muſt be tranſmitted; if triple the thickneſs, that the " condenſed part of the ſecond wave overtake it, there it muſt be reflected, and " ſo where the plate is five, ſeven, or nine times that thickneſs, it muſt be *reflected* " by reaſon of the third, fourth, or fifth wave, overtaking it at the ſecond ſuper- " ficies; but when it is four, ſix, or eight times that thickneſs, ſo that the ray " may be overtaken there by the dilated interval of thoſe waves, it ſhall be *tranſ-* " *mitted*, and ſo on; the ſecond ſuperficies being made able or unable to reflect " accordingly as it is condenſed or expanded by the waves. For inſtance, let " A H Q repreſent the ſuperficies of a ſpherically convex glaſs laid upon a plain " glaſs A I R, and A I R Q H the thin plane-concave plate of air between them, " and B C, D E, F G, H I, &c. thickneſſes of that plate, or diſtances of the " glaſſes in the arithmetical progreſſion of the numbers 1. 2. 3. 4. &c. whereof




" B C is the diſtance, at which the ray is over- " taken by the moſt condenſed part of the firſt " wave: I ſay, the rays incident at B, F, K, " and O, ought to be *reflected* at C, G, L, " and P, and thoſe incident at D, H, M, and " Q, ought to be *tranſmitted* at E, I, N, and " R; and this, becauſe the ray B C arrives " at the ſuperficies A C, when it is condenſed, " by the firſt wave that overtakes it; D E, " when rarified by the interval of the firſt and " ſecond; F G, when condenſed by the ſe- " cond wave; H I, when rarified by the in- " terval of the ſecond and third; and ſo on

" for an indeterminate number of ſucceſſions; and at A, the center or contact of " the glaſſes, the light muſt be *tranſmitted*, becauſe there the æthereal mediums " in both glaſſes are continued as if but one uniform medium. Whence, if the " glaſſes in this poſture be looked upon, there ought to appear at A, the contact " of the glaſſes, a black ſpot, and about that many concentric circles of light and " darkneſs, the ſquares of whoſe ſemidiameters are to ſenſe and arithmetical pro- " greſſion. Yet all the rays, without exception, ought not to be thus reflected or " tranſmitted: for ſometimes a ray may be overtaken at the ſecond ſuperficies, " by the vibrations raiſed by another collateral or immediately ſucceeding ray; " which vibration, being as ſtrong or ſtronger than its own, may cauſe it to be " reflected or tranſmitted when its own vibration alone would do the contrary. " And hence ſome little light will be reflected from the black rings, which makes " them

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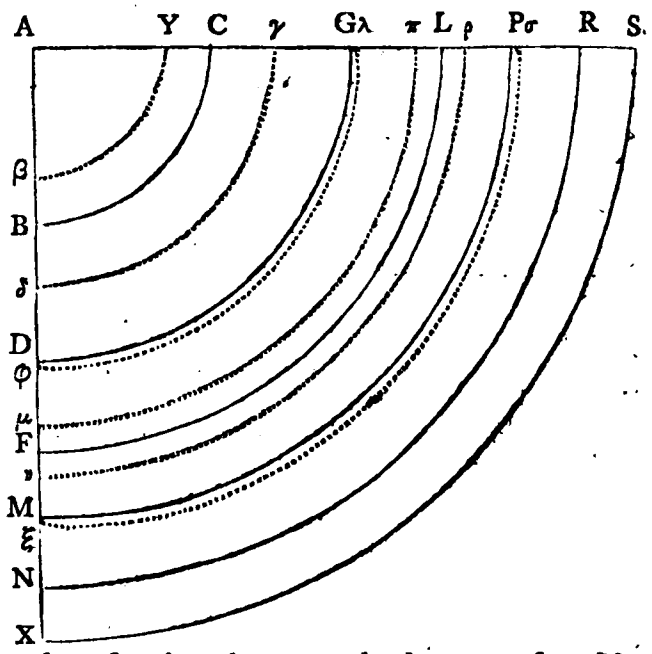
" them rather black than totally dark; and ſome tranſmitted at the lucid rings, " which makes the black rings, appearing on the other ſide of the glaſſes, not ſo " black as they would otherwiſe be. And ſo at the central black ſpot, where the " glaſſes do not abſolutely touch, a little light will be reflected, which makes the " ſpot darkeſt in the middle, and only black at the verges. For thus I have ob- " ſerved it to be, by tying very hard together two glaſs priſms, which were ac- " cidentally (one of them at leaſt) a very little convex, and viewing by divers " lights this black ſpot at their contact. If a white paper was placed at a little " diſtance behind a candle, and the candle and paper viewed alternately by re- " flection from the ſpot, the verges of the ſpot, which looked by the light of the " paper as black as the middle part, appeared by the ſtronger light of the candle " lucid enough, ſo as to make the ſpot ſeem leſs than before; but the middle part " continued as abſolutely black in one caſe as in the other, ſome ſpecks and ſtreaks " in it only excepted, where I ſuppoſe the glaſſes, through ſome unevenneſs in " the poliſh, did not fully touch. The ſame I have obſerved by viewing the ſpot " by the like reflection of the ſun and clouds alternately.

" But to return to the lucid and black rings, thoſe rings ought always to ap- " pear after the manner deſcribed, were light uniform. And after that manner, " when the two contiguous glaſſes A Q and A R have been illuſtrated, in a dark " room, by light of any uniform colour made by a priſm, I have ſeen the lucid " circles appear to about twenty in number, with many dark ones between them, " the colour of the lucid ones being that of the light, with which the glaſſes were " illuſtrated. And if the glaſſes were held between the eye and priſmatic colours, " caſt on a ſheet of white-paper, or if any priſmatic colour was directly trajected " through the glaſſes to a ſheet of paper placed a little way behind, there would " appear ſuch other rings of colour and darkneſs (in the firſt caſe between the " glaſſes, in the ſecond, on the paper) oppoſitely correſponding to thoſe, which " appeared by reflection: I mean, that, whereas by reflected light there appeared " a black ſpot in the middle, and then a coloured circle; on the contrary, by tranſ- " mitted light there appeared a coloured ſpot in the middle, and then a black circle, " and ſo on; the diameters of the coloured circles, made by tranſmiſſion, equall- " ing the diameters of the black ones made by reflection.

" Thus, I ſay, the rings do and ought to appear when made by uniform light; " but in compound light it is otherwiſe. For the rays, which exhibit red and " yellow, exciting, as I ſaid, larger pulſes in the æther than thoſe, which make " blue and violet, and conſequently making bigger circles in a certain propor- " tion, as I have manifeſtly found they do, by illuminating the glaſſes ſucceſſively " by the aforeſaid colours of priſm in a well darkened room, without changing " the poſition of my eye or of the glaſſes; hence the circles, made by illuſtrating " the glaſſes with white light, ought not to appear black and white by turns, as " the circles made by illuſtrating the glaſſes; for inſtance, with red light, appear " red and black; but the colours, which compound the white light, muſt diſplay " themſelves by being reflected, the blue and violet nearer to the center than the " red and yellow, whereby every lucid circle muſt become violet in the inward " verge, red in the outward, and of intermediate colours in the intermediate

" parts, and be made broader than before, ſpreading the colours both ways into " thoſe ſpaces, which I call the black rings, and which would here appear black, " were the red, yellow, blue, and violet, which make the verge of the rings, taken " out of the incident white light, which illuſtrates the glaſſes, and the green only " left to make the lucid rings. Suppoſe C B, G D, L F, P M, R N, S X, re- " preſent quadrants of the circles made in a dark room by the very deepeſt priſ-




" matic *red* alone; and Y β, γδ, " λ Φ, π μ, ρ ν, σ ξ, the qua- " drants of like circles made " alſo in a dark room, by the " very deepeſt priſmatic *violet* " alone: and then, if the glaſ- " ſes be illuminated by open " day light, in which all ſorts " of rays are blended, it is ma- " nifeſt, that the firſt lucid " ring will be Y β B C; the ſe- " cond γ δ D G, the third, " λ Φ F L, the fourth π μ M P, " the fifth ρ ν N R, the ſixth " σ ξ X S, &c. in all which " the deepeſt violet muſt be " reflected at the inward edges " repreſented by the pricked " lines, where it would be re- " flected were it alone, and the deepeſt *red* at the outward edges repreſented by " the black lines, where it would be reflected, were it alone; and all intermediate " colours at thoſe places, in order, between theſe edges, at which they would be re- " flected were they alone; each of them in a dark room, parted from all other " colours by the refraction of a priſm. And becauſe the ſquares of the ſemidia- " meters of the outward verges A C, A G, A L, &c. as alſo of A Y, A γ, A λ, " &c. the ſemidiameters of the inward are in arithmetical progreſſion of the num- " bers 1, 3, 5, 7, 9, 11, &c. and the ſquares of the inward are to the ſquares " of the outward (A Y$^9$ to A C$^9$, A γ$^9$ to A G$^9$, A λ$^9$ to A L$^9$, &c.) as 9 to 14, " (as I have found by meaſuring them carefully and often, and comparing the " obſervations:) therefore the outward *red* verge of the ſecond ring, and inward " *violet* one of the third, ſhall border upon one another (as you may know by com- " putation, and ſee them repreſented in the figure) and the like edges of the third " and fourth rings ſhall interfere, and thoſe of the fourth and fifth interfere more, " and ſo on. Yea, the colours of every ring muſt ſpread themſelves ſomething " more both ways than is here repreſented, becauſe the quadrantal arcs here de- " ſcribed repreſent not the verges, but the middle of the rings made in a dark " room by the extreme violet and red; the *violet* falling on both ſides the pricked " arches, and *red* on both ſides the black line arches. And hence it is, that " theſe rings or circuits of colours ſucceed one another continually, without any

" intervening black, and that the colours are pure only in the three or four firſt " rings, and then intervening and mixing more and more, dilute one another ſo " much, that after eight or nine rings they are no more to be diſtinguiſhed, but " ſeem to conſtitute an even whiteneſs; whereas, when they were made in a dark " room by one of the priſmatic colours alone, I have, as I ſaid, ſeen above twenty " of them, and without doubt could have ſeen them to a greater number, had I " taken the pains to make the priſmatic colour more uncompounded. For by " unfolding theſe rings from one another, by certain refractions expreſſed in the " other [1] papers I ſend you, I have, even in day-light, diſcovered them to above " an hundred; and perhaps they would have appeared innumerable, had the light " or colour illuſtrating the glaſſes been abſolutely uncompounded, and the pupil " of my eye but a mathematical point; ſo that all the rays, which came from " the ſame point of the glaſs might have gone into my eye at the ſame obliquity " to the glaſs.

" What has been hitherto ſaid of the rings, is to be underſtood of their appear- " ance to an unmoved eye: but if you vary the poſition of the eye, the more " obliquely you look on the glaſs, the larger the rings appear. And of this the " reaſon may be, partly that an oblique ray is longer in paſſing through the " firſt ſuperficies, and ſo there is more time between the waving forward and back- " ward of that ſuperficies, and conſequently a larger wave generated, and partly, " that the wave in creeping along between the two ſuperficies may be impeded and " retarded by the rigidneſs of thoſe ſuperficies, bounding it at either end, and ſo " not overtake the ray ſo ſoon as a wave, that moves perpendicularly croſs.

" The bigneſs of the circles made by every colour, and at all obliquities of the " eye to the glaſſes, and the thickneſs of the air, or intervals of the glaſſes, " where each circle is made, you will find expreſſed in the other papers I ſend " you; where alſo I have more at large deſcribed, how much theſe rings inter- " fere, or ſpread into one another; what colours appear in every ring, where " they are moſt lively, where and how much diluted by mixing with the colours of " other rings; and how the contrary colours appear on the back ſide of the glaſſes " by the tranſmitted light, the glaſſes tranſmitting light of one colour at the ſame " place, where they reflect that of another. Nor need I add any thing further of " the colours of other thinly plated mediums, as of water between the aforeſaid " glaſſes, or formed into bubbles, and ſo encompaſſed with air, or of glaſs blown " into very thin bubbles at a lamp furnace, &c. the caſe being the ſame in all theſe, " excepting that, where the thickneſs of the plate is not regular, the rings will not " be ſo; that in plates of denſer tranſparent bodies, the rings are made at a leſs " thickneſs of the plate (the vibrations, I ſuppoſe, being ſhorter in rarer æther than " in denſer) and that in a denſer plate, ſurrounded with a rarer body, the colours " are more vivid than in the rarer ſurrounded with the denſer; as, for inſtance, " more vivid in a plate of glaſs ſurrounded with air, than in a plate of air ſur- " rounded with glaſs; of which the reaſon is, that the reflection of the ſecond ſu- " perficies, which cauſes the colours, is, as was ſaid above, ſtronger in the for-

[1] Obſ. 24.

" mer caſe than in the latter: for which reaſon alſo the colours are moſt vivid, " when the difference of the denſity of the medium is greateſt.

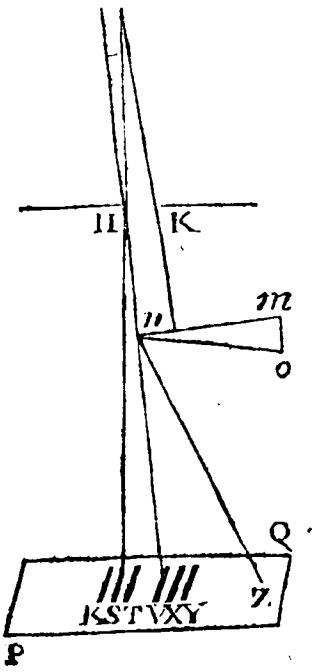
" Of the colours of natural bodies alſo I have ſaid enough in thoſe papers, ſhew- " ing how the various ſizes of the tranſparent particles, of which they conſiſt, is " ſufficient to produce them all, thoſe particles reflecting or tranſmitting this or " that ſort of rays, according to their thickneſs, like the aforeſaid plates, as if they " were fragments thereof. For, I ſuppoſe, if a plate of an even thickneſs, and " conſequently of an uniform colour, were broken into fragments of the ſame thick- " neſs with the plate, a heap of thoſe fragments would be a powder much of the " ſame colour with the plates. And ſo, if the parts be of the thickneſs of the " water in the black ſpot at the top of a bubble deſcribed in the ſeventeenth of " the obſervations I ſend you, I ſuppoſe the body muſt be black. In the pro- " duction of which blackneſs, I ſuppoſe, that the particles of that ſize being diſ- " poſed to reflect almoſt no light outward, but to refract it continually in its paſ- " ſage from every part to the next; by this multitude of refractions, the rays " are kept ſo long ſtraggling to and fro within the body, till at laſt almoſt all " impinge on the ſolid parts of the body, and ſo are ſtopped and ſtifled; thoſe " parts having no ſufficient elaſticity, or other diſpoſition to return nimbly enough " the ſmart ſhock of the ray back upon it.

" I ſhould here conclude, but that there is another ſtrange phænomenon of " colours, which may deſerve to be taken notice of. Mr. HOOKE, you may re- " member, was ſpeaking of an odd ſtraying of light, cauſed in its paſſage near the " edge of a razor, knife, or other opake body in a dark room; the rays, which " paſs very near the edge, being thereby made to ſtray at all angles into the " ſhadow of the knife.

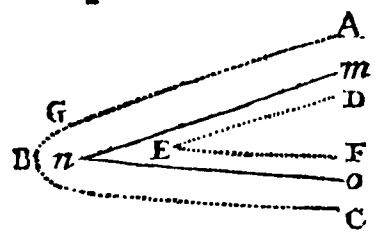
" To this Sir WILLIAM PETTY, then preſident, returned a very pertinent query, " Whether that ſtraying was in curve lines? and that made me, having heard " Mr. HOOKE ſome days before compare it to the ſtraying of ſound into the qui- " eſcent medium, ſay, that I took it to be only a new kind of refraction, cauſed " perhaps by the external æther's beginning to grow rarer a little before it " came at the opake body, than it was in free ſpaces; the denſer æther without " the body, and the rarer within it, being terminated not in a mathematical " ſuperficies, but paſſing into one another through all intermediate degrees of " denſity: whence the rays, that paſs ſo near the body, as to come within that " compaſs, where the outward æther begins to grow rarer, muſt be refracted by " the uneven denſeneſs thereof, and blended inwards toward the rarer medium of " the body. To this Mr. HOOKE was then pleaſed to anſwer, that though it " ſhould be but a new kind of refraction, yet it was a new one. What to make " of this unexpected reply, I knew not; having no other thoughts, but that a " new kind of refraction might be as noble an invention as any thing elſe about " light; but it made me afterwards, I know not upon what occaſion, happen to " ſay, among ſome that were preſent to what paſſed before, that I thought I had " ſeen the experiment before in ſome Italian author. And the author is HONO- " RATUS FABER, in his dialogue De Lumine, who had it from GRIMALDO;

" whom

" whom I mention, becauſe I am to deſcribe ſomething further out of him, which " you will apprehend by this figure: ſuppoſe the ſun ſhine through the little hole " H K into a dark room upon the paper P Q, and with a wedge M N O intercept " all but a little of that beam, and you will ſee " upon the paper ſix rows of colours, R, S, T, " V, X, Y, and beyond them a very faint light " ſpreading either way, ſuch as rays broken, like " H N Z, muſt make. The author deſcribes it " more largely in divers ſchemes. I have time " only to hint the ſum of what he ſays.




" Now for the breaking of the ray H N Z, ſup- " poſe, in the next figure M N O be the ſolid " wedge, A B C the inward bound of the uniform " rarer æther within, between which bounds the " æther runs through all the intermediate degrees; " and it is manifeſt, that, if a ray come between " B and N, it muſt in its paſſage there bend from " the denſer medium towards C, and that ſo much " the more, by how much it comes nearer N. Fur- " ther, for the three rows of colours V X Y, thoſe " may perhaps proceed from the number of vibra- " tions (whether one, two, or three) which over- " take the ray in its paſſage from G, till it be about " the mid-way between G and H; that is, at its " neareſt diſtance to N, ſo as to touch the circle " deſcribed about N, with that diſtance; by the " laſt of which vibrations, expanding or con- " tracting the medium there, the ray is licenſed " to recede again from N, and go on to make the " colours; or further bent about N, till the inter- " val of the next wave overtake it, and give it li- " berty to go from N, very nearly in the line it is " then moving, ſuppoſe toward Z, to cauſe the faint light ſpoken of above, you " will underſtand me a little better, by comparing this with what was ſaid of the " colours of thin tranſparent plates, comparing the greateſt diſtance that the ray " goes from G B H towards N, to the thickneſs of one of thoſe plates. Some- " thing too there is in Des Cartes's explication of the rainbow's colours, which " would give further light in this. But I have no time left to inſiſt further upon " particulars; nor do I propound this without diffidence, having not made ſuffici- " ent obſervation about it."




After reading this diſcourſe, Mr. Hooke ſaid, that the main of it was contained in his *Micrographia*, which Mr. Newton had only carried farther in ſome particulars.

The Society adjourned till December 30.

*Decem-*

*December* 30. There was read a letter to Mr. OLDENBURG from Mr. NEWTON, dated at Cambridge 21ſt December, 1675 [1], in anſwer to what had been written to him by Mr. OLDENBURG concerning the want of ſucceſs of his experiment made with a glaſs rubbed, &c. This letter was as follows:

" Upon your letter I took another glaſs four inches broad, and one fourth of " an inch thick, of ſuch glaſs as teleſcopes are made of, and placed it a one ſixth " part of an inch from the table. It was ſet in ſuch a piece of wood, as the ob- " ject-glaſſes of teleſcopes uſe to be ſet in: and the experiment ſucceeded well. " After the rubbing was ſtill, and all was ſtill, the motion of the papers would " continue ſometimes while I counted a hundred, every paper leaping up about " twenty times more or leſs, and down as often. I tried it alſo with two other glaſſes " that belong to a teleſcope, and it ſucceeded with both; and I make no queſtion " but any glaſs will do that, if it be excited to electric virtue, as I think any may. " If you have a mind to any of theſe glaſſes, you may have them; but I ſup- " poſe, if you cannot make it do in other glaſs, you will fail in any I can ſend " you. I am apt to ſuſpect the failure was in the manner of rubbing; for I have " obſerved, that the rubbing variouſly, or with various things, alters the caſe. At " one time I rubbed the aforeſaid great glaſs with a napkin, twice as much as I " uſed to do with my gown, and nothing would ſtir; and yet preſently rubbing " it with ſomething elſe, the motions ſoon began. After the glaſs has been " much rubbed too, the motions are not ſo laſting; and the next day I found the " motions fainter and difficulter to excite than the firſt. If the Society have a " mind to attempt it any more, I can give no better advice than this: to take a " new glaſs not yet rubbed (perhaps one of the old ones may do well enough after " it has lain ſtill a while) and let this be rubbed, not with linen, nor ſoft nappy " woolen, but with ſtuff, whoſe threads may rake the ſurface of the glaſs, ſup- " poſe tamerine, or the like, doubled up in the hand, and this with a briſk mo- " tion as may be, till an hundred or an hundred and fifty may be counted, the " glaſs lying all the while over the papers. Then, if nothing ſtir, rub the glaſs " with the finger ends half a ſcore of times to and fro, or knock your finger- " ends as often upon the glaſs; for this rubbing or knocking with your fingers, " after the former rubbing, conduces moſt to excite the papers. If nothing ſtir " yet, rub again with the cloth till ſixty or eighty may be counted, and then " rub or knock again with your fingers, and repeat this till the electric virtue of " the glaſs be ſo far excited as to take up the papers, and then a very little rubb- " ing or knocking now and then will revive the motions. In doing all this, let " the rubbing be always done as nimbly as may be; and if the motion be circu- " lars, like that of glaſs-grinding, it may do better. But if you cannot make it " yet ſucceed, it muſt be let alone till I have ſome opportunity of trying it be- " fore you. As for the ſuſpicion of the papers being moved by the air, I am ſe- " cure from that; yet in the other, of drawing leaf-gold to above a foot diſtance, " which I never went about to try myſelf till the laſt week, I ſuſpect the air might " raiſe the gold, and then a ſmall attraction might determine it towards the glaſs; " for I could not make it ſucceed."

[1] Letter-book, vol. vii. p. 284.

It

It was ordered, that Mr. NEWTON's directions in this letter ſhould be obſerved in the experiment to be made at the next meeting of the Society.

Mr. OLDENBURG read a letter to himſelf from Mr. JOHN GASCOIGNE, dated at Liege, 15th December, 1675 [u], acquainting him with the death of Mr. LINUS of the epidemical diſeaſe, which then raged through ſo many countries, and with the reſolution of Mr. LINUS's diſciples, to try Mr. NEWTON's experiment concerning light and colours more clearly and carefully, and before more witneſſes, according to the directions given them by Mr. NEWTON's laſt letter: intimating withal, that if the ſaid experiment be made before the Royal Society, and be atteſted by them to ſucceed, as Mr. NEWTON affirmed, they would reſt ſatisfied.

It was ordered, that when the ſun ſhould ſerve, the experiment ſhould be made before the Society.

Mr. AUBREY preſented the Society with his obſervations made in Wiltſhire, which being read, he was deſired to endeavour to procure ſome of the iron-ore of Sein in that county, ſaid to be ſo rich, that the ſmith could melt it in his forge: as alſo to procure from Eaſton-Peires in Malmeſbury hundred, ſome of the blu clay, free from ſand, and almoſt of the colour of ultramarine; which clay Mr. DOIGHT ſuppoſed to be very fit for porcelane.

The Society adjourned till the 13th of January following.

*January* 13. Captain HENRY SHEERES, JOHN MAPLETOFT, M. D. [x], and Signor FRANCESCO TRAVAGINI were propoſed candidates, the firſt in the name of Sir JOSEPH WILLIAMSON, the ſecond by Mr. HOOKE, and the third by Mr. OLDENBURG.

Mr. NEWTON's experiment of glaſs rubbed, to cauſe various motions in bits of paper underneath, being made according to his more particular directions, ſucceeded very well. The rubbing was made both with a ſcrubbing bruſh, made of ſhort hog's briſtles, with a knife, the haft of the knife made of whalebone, and with the nail of one's finger. It appeared, that touching many parts at once with a hard and rough body, produced the effect expected.

It was ordered, that Mr. NEWTON ſhould have the thanks of the Society, for giving himſelf the trouble of imparting to them ſuch full inſtructions for making the experiment.

Mr. OLDENBURG produced and read a Latin letter of Mr. FLAMSTEAD to Sir JONAS MOORE, dated at Greenwich, 24th December, 1675 [y], containing an account of his obſervations made of the late eclipſe of the moon on the 21ſt December, *p. m.*

[u] Letter-book, vol. vii. p. 282.
[x] Profeſſor of phyſic at Greſham College.
[y] It is printed in the Philoſoph. Tranſact. vol. x. n° 121. p. 495.

It

It was ordered, that Mr. OLDENBURG should be desired, according to the motion made by Mr. FLAMSTEAD, to impart these observations to Signor CASSINI at Paris, and to desire him to communicate to the Society his observations on the same eclipse.

Mr. OLDENBURG produced likewise some papers of Mr. AUBREY, containing his observations of the county of Surry. But the time being elapsed, these papers were referred to the next meeting.

*January* 20. Mr. AUBREY's papers of observations on Surrey were read.

There was also read the beginning of Mr. NEWTON's discourse, containing such observations, as conduce to further discoveries for completing his theory of light and colours, especially as to the constitution of natural bodies, on which their colours or transparency depend: in which he describes first the principal of his observations, and then considers and makes use of them.

At this time there were read the first fifteen of those observations as follow *:

"I suppose you understand, that all transparent substances (as glass, water, "air, &c.) when made very thin by being blown into bubbles, or otherwise "formed into plates, do exhibit various colours, according to their various thin- "ness, although at a greater thickness they appear very clear and colourless. In "my former discourse about the constitution of light, I omitted these colours, "because they seemed of a more difficult consideration, and were not necessary for "the establishing of the doctrine, which I propounded; but because they may con- "duce to further discoveries for compleating that theory, especially as to the "constitution of the parts of natural bodies, on which their colours or transpa- "rency depend, I have now sent you an account of them. To render this dis- "course short and distinct, I have first described the principal of my observations, "and then considered and made use of them. The observations are these:

"Obs. 1. Compressing two prisms hard together, that their sides (which by "chance were a very little convex) might somewhere touch one another, I found "the place, in which they touched, to become [a] absolutely transparent, as if they "had been there one continued piece of glass; for when the light fell so ob- "liquely on the air, which in other places was between them, as to be all re- "flected, in that place of contact it seemed wholly transmitted; insomuch that "when looked upon, it appeared like a black or dark spot, by reason of no sen- "sible light was reflected from thence, as from other places; and when looked "through, it seemed, as it were, a hole in that air, that was formed into a thin

* Register, vol. v. p. 89.

[a] "Note, that there is some light reflected from "those parts of this black spot, where the glasses, "by reason of their convexity, and some little un- "evenness of their surfaces, do not come to abso- "lute contact. For by viewing the sun, by re- "flection from this spot, not only the verges of "it became lucid, but divers lucid veins, as specks, "appeared in the midst of the blackness: but yet "some parts of the spot seemed still as black as "before, which parts I take to be those, where "the glasses touched.

" plate by being compreſſed between the glaſſes; and through this hole objects, " that were beyond, might be ſeen diſtinctly, which could not at all be ſeen through " other parts of the glaſſes, where the air was interjacent. Although the glaſſes " were a little convex, yet this tranſparent ſpot was of a conſiderable breadth, " which breadth ſeemed principally to proceed from the yielding inwards of the " parts of the glaſſes by reaſon of their mutual preſſure; for by preſſing them very " hard together, it would become much broader than otherwiſe.

" Obſ. 2. When the plate of air, by turning the priſms about their common " axis, became ſo little inclined to the incident rays, that ſome of them began to " be tranſmitted, there aroſe in it many ſlender arcs of colours, which at firſt were " ſhaped almoſt like the conchoid, as you ſee them here delineated. And by continuing " the motion of the priſms, theſe arcs increaſed and bended more and more about " the ſaid tranſparent ſpot, till they were " compleated into circles or rings incompaſſing it, and afterwards continually " grew more and more contracted.

Fig. I.

" Theſe arcs, at their firſt appearance, were of a violet and blue colour, and " between them were white arcs of circles, which preſently became a little tinged " in their inward limbs with red and yellow, and to their outward limbs the blue " was adjacent; ſo that the order of theſe colours from the central dark ſpot, " was at that time white, blue, violet, black, red, orange, yellow, white, blue, " violet, &c. but the yellow and red were much fainter than the blue and violet.

" The motion of the priſms about their axis being continued, theſe colours " contracted more and more, ſhrinking towards the whiteneſs on either ſide of " it, until they totally vaniſhed into it; and then the circles in thoſe parts appeared black, and white, without any other colours intermixed; but by further moving the priſms about, the colours again emerged out of the whiteneſs, " the violet and blue at its inward limb, and at its outward limb the red and yellow; ſo that now their order from the central ſpot was white, yellow, red, " black, violet, blue, white, yellow, red, &c. contrary to what it was before.

" Obſ. 3. When the rings or ſome parts appeared only black and white, they " were very diſtinct and well defined, and the blackneſs ſeemed as intenſe as that " of the central ſpot; alſo, in the borders of theſe rings, where the colours began " to emerge out of the whiteneſs, they were pretty diſtinct, which made them viſible to a very great multitude. I have ſometimes numbered above thirty ſucceſſions (reckoning every black and white ring for one ſucceſſion) and ſeen more " of them, which by reaſon of their ſmallneſs I could not number. But in other " poſitions of the priſms, at which the rings appeared of many colours, I could " not diſtinguiſh above eight or nine of them, and the exterior of thoſe too " were confuſed and dilute.

" In theſe two obſervations, to ſee the rings diſtinct, and without any other colour " but black and white, I found it neceſſary that I held my eye at a good diſtance " from them. For by approaching nearer, although in the ſame inclination of " my eye, yet there emerged a bluiſh colour out of the white, which by dilating " itſelf more and more into the black, rendered the circles leſs diſtinct, and left " the white a little tinged with red and yellow. I found alſo, that by looking " through a ſlit or oblong hole, which was narrower than the pupil of my eye, " and held cloſe to it parallel to the priſms, I could ſee the circles much diſtincter " and viſible to a far greater number than otherwiſe.

" Obſ. 4. To obſerve more nicely the order of the colours, which aroſe out of " the white circles, as the rays became leſs and leſs inclined to the plate of air; I " took two object-glaſſes, the one a plane-convex for a fourteen foot teleſcope, " and the other a large double convex for one of fifty foot; and upon this lay- " ing the other with its plane ſide downwards, I preſſed them ſlowly together, " to make the colours ſucceſſively emerge in the middle of the circles, and then " ſlowly lifted the upper glaſs from the lower, to make them ſucceſſively vaniſh " again in the ſame place, where being of a conſiderable breadth, I could more " eaſily diſcern them. And by this means I obſerved their ſucceſſion and quan- " tity to be as followeth.

" Next to the pellucid central ſpot made by the contact of the glaſſes, ſuc- " ceeded violet, blue, white, yellow, and red. The violet and blue were ſo very " little in quantity, that I could not diſcern them in the circles made by the " priſms; but the yellow and red were pretty copious, and ſeemed about as much " in extent as the white, and four or five times more than the blue and violet. " The next circuit or order of colours immediately encompaſſing theſe was vio- " let, blue, green, yellow, and red. And theſe were all of them copious and " vivid, excepting the green, which was very little in quantity, and ſeemed much " more faint and dilute than the other colours. Of the other four the violet " was leaſt, and the blue leſs than the yellow or red. The third circuit or order " was alſo purple, blue, green, yellow, and red, in which the purple ſeemed more " reddiſh than the violet in the former circuit, and the green was much more " conſpicuous, being as briſk and copious as any of the other colours except the " yellow; but the red began to be a little faded, inclining very much to purple. " After theſe ſucceeded green and red: the green was very copious and lively, in- " clining on the one ſide to blue, and the other to yellow. But in this fourth " circuit there was neither violet, blue, nor yellow, and the red was very imper- " fect and dirty. Alſo the ſucceeding colours became more and more imperfect " and dilute, till after three or four more revolutions they ended in perfect white- " neſs.

" Obſ. 5. To determine the interval of the glaſſes, or thickneſs of the interja- " cent air, by which each colour was produced; I meaſured the diameter of the " firſt ſix rings at the moſt lucid part of their orbits, and ſquaring them I found " their ſquares to be in arithmetical progreſſion of the odd numbers, 1. 3. 5. 7. " 9. 11. And ſince one of the glaſſes was plane and the other ſpherical, their

" intervals at thoſe rings muſt be in the ſame progreſſion. I meaſured alſo the " diameters of the dark or faint rings between the more lucid colours, and found " their ſquares to be in arithmetical progreſſion, of the even numbers 2, 4, 6, " 8, 10, 12; and it being very nice and difficult to take theſe meaſures exactly, " I repeated them divers times, at divers parts of the glaſſes, that by their agree- " ment I might be confirmed in them; and the ſame method I uſed in deter- " mining ſome others of the following obſervations.

" Obſ. 6. The diameter of the firſt ring, at the moſt lucid part of its orbit, " was $\frac{58}{1000}$ parts of an inch, and the diameter of the ſphere, on which the double " convex object-glaſs was ground, was an hundred and two foot, as I found by " meaſuring it; and conſequently the thickneſs of the air, or aereal interval of the " glaſſes at that ring, was $\frac{1}{1431}$ of an inch. For as the diameter of the ſaid ſphere " (an hundred and two foot, or twelve hundred and twenty-four inches) is to " the ſemidiameter of the ring $\frac{29}{1000}$, ſo very nearly is that ſemidiameter to $\frac{1}{1431}$, " the ſaid diſtance of the glaſſes. Now, by the precedent obſervations, the " eleventh part of this diſtance ($\frac{1}{10009\frac{1}{2}}$) is the thickneſs of the air at that part " of the firſt ring, where the yellow would be moſt vivid, were it not mixed " with other colours in the white; and this doubled gives the difference of its " thickneſs at the yellow in all the other rings, viz. $\frac{1}{100047}$, or, to uſe a round " number, the eighty thouſand part of an inch.

" Obſ. 7. Theſe dimenſions were taken, when my eye was placed perpendicu- " larly over the glaſſes, in or near the axis of the rings; but when I viewed " them obliquely, they became bigger, continually ſwelling as I removed my eye " farther from their axis; and partly by meaſuring the diameter of the ſame " circle at ſeveral obliquities of my eye, partly by other means; as alſo by mak- " ing uſe of the two priſms for very great obliquities, I found its diameter, and " conſequently the thickneſs of the air at its perimeter in all thoſe obliquities, to " be very nearly in the proportions expreſſed in this table.

| Incidence on the air. | | Refraction into the air. | | Diameter of the ring. | Thickneſs of the air. |
|---|---|---|---|---|---|
| gr. | min. | gr. | min. | | |
| 00 | 00 | 00 | 00 | 10 | 10 |
| 6 | 26 | 10 | 00 | $10\frac{1}{13}$ | $10\frac{2}{13}$ |
| 12 | 45 | 20 | 00 | $10\frac{1}{3}$ | $10\frac{2}{3}$ |
| 18 | 49 | 30 | 00 | $10\frac{3}{4}$ | $11\frac{1}{2}$ |
| 24 | 30 | 40 | 00 | $11\frac{2}{5}$ | 13 |
| 29 | 37 | 50 | 00 | $12\frac{1}{2}$ | $15\frac{1}{2}$ |
| 33 | 58 | 60 | 00 | 14 | 20 |
| 35 | 47 | 65 | 00 | $15\frac{1}{4}$ | $23\frac{1}{3}$ |
| 37 | 19 | 70 | 00 | $16\frac{4}{5}$ | $28\frac{1}{2}$ |
| 38 | 33 | 75 | 00 | $19\frac{1}{6}$ | 37 |
| 39 | 27 | 80 | 00 | $22\frac{6}{7}$ | $52\frac{1}{2}$ |
| 40 | 00 | 85 | 00 | 29 | 84 |
| 40 | 11 | 90 | 00 | 35 | $122\frac{1}{2}$ |

" In the two first columns are expressed the obliquities of the rays to the plate " of air; that is, their angles of incidence and refraction. In the third column, " the diameter of any coloured ring of those obliquities is expressed in parts, of " which ten constitute that diameter, when the rays are perpendicular. And in " the fourth column the thickness of the air at the circumference of that ring is " expressed in parts, of which also ten constitute that thickness, when the rays " are perpendicular.

" Obs. 8. The dark spot in the middle of the rings increased also by that " obliquation of the eye, although almost insensibly. But, if instead of the " object-glasses, the prisms were made use of, its increase was more manifest, when " viewed so obliquely, that no colours appeared about it. It was least, when the " rays were incident most obliquely on the interjacent air, and increased more and " more, until the coloured rings appeared, and then decreased again, but not so " much as it increased before. And hence it is evident, that the transparency " was not only at the absolute contact of the glasses, but also where they had some " little interval. I have sometimes observed the diameter of that spot to be be- " tween half and two fifth parts of the diameter of the exterior circumference of " the red in the first circuit or revolution of colours, when viewed almost per- " pendicularly; whereas, when viewed obliquely, it hath wholly vanished, and " become opake and white, like the other parts of the glass. Whence it may " be collected, that the glasses did then scarcely, or not at all, touch one ano- " ther; and that their interval of the perimeter of that spot, when viewed per- " pendicularly, was about a fifth or sixth part of their interval at the circum- " ference of the said red.

" Obs. 9. By looking through the two contiguous object-glasses, I found, that " the interjacent air exhibited rings of colours, as well by transmitting light as " by reflecting it. The central spot was now white, and from it the order of " the colours were yellowish, red, black, violet, blue, white, yellow, red; " violet, blue, green, yellow, red, &c. but these colours were very faint and " dilute, unless when the light was trajected very obliquely through the glasses; " for by that means they became pretty vivid, only the first yellowish red, like " the blue in the fourth observation, was so little and faint as scarcely to be dis- " cerned. Comparing the coloured rings made by reflection with these made by " transmission of the light, I found, that white was opposite to black, red to blue, " yellow to violet, and green to a compound of red and violet; that is, those " parts of the glass were black when looked through, which when looked upon " appeared white, and on the contrary; and so those, which in one case exhibited " blue, did in the other case exhibit red; and the like of the other colours.

" Obs. 10. Wetting the object-glass a little at their edges, the water crept in " slowly between them, and the circles thereby became less, and the colours " more faint; insomuch that, as the water crept along, one half of them, at which " it first arrived, would appear broken off from the other half, and contracted " into a less room. By measuring them I found the proportion of their diameters " to the diameters of the like circles made by air, to be about seven to eight;

" and

" and conſequently the intervals of the glaſſes at like circles, cauſed by theſe two " mediums, water and air, are as about three to four. Perhaps it may be a general " rule, that if any other medium, more or leſs denſe than water, be compreſſed " between the glaſſes, their interval at the rings, cauſed thereby, will be to their " interval, cauſed by interjacent air, as the ſines are, which meaſure the refrac- " tion made out of that medium into air.

" Obſ. 11. When the water was between the glaſſes, if I preſſed the upper " glaſs variouſly at its edges to make the rings move nimbly from one place to " another, a little bright ſpot would immediately follow the center of them, " which, upon creeping in of the ambient water into that place, would preſently " vaniſh. Its appearance was ſuch, as interjacent air would have cauſed, and it " exhibited the ſame colours; but it was not air, for where any aereal bubbles " were in the water they would not vaniſh. The reflection muſt rather have been " cauſed by a ſubtiler medium, which could recede through the glaſs at the " creeping in of the water.

" Obſ. 12. Theſe obſervations were made in the open air. But further, to " examine the effects of coloured light falling on the glaſſes, I darkened the " room, and viewed them by reflection of the colours of a priſm caſt on a ſheet " of white paper; and by this means the rings became diſtincter, and viſible to " a far greater number than in the open air.

" I have ſeen more than twenty of them, whereas in the open air I could not " diſcern above eight or nine.

" Obſ. 13. Appointing an aſſiſtant to move the priſm to and fro about its " axis, that all its colours might ſucceſſively fall on the ſame place of the paper, " and be reflected from the circles to my eye whilſt I held it immoveable; I " found the circles, which the red light made, to be manifeſtly bigger than " thoſe, which were made by the blue and violet; and it was very pleaſant to ſee " them gradually ſwell or contract, accordingly as the colour of the light was " changed. The interval of the glaſs at any of the rings, when they were made " by the utmoſt red light, was to their interval at the ſame ring, when made " by the utmoſt violet, greater than three to two, and leſs than thirteen to eight. " By the moſt of my obſervations it was as nine to fourteen. And this pro- " portion ſeemed very nearly the ſame in all obliquities of my eye, unleſs when " two priſms were made uſe of inſtead of the object-glaſſes: for then, at a " certain great obliquity, the rings made by the ſeveral colours ſeemed equal; " and, at a greater obliquity, thoſe made by the violet would be greater than the " ſame rings made by the red.

" Obſ. 14. While the priſm was turned about uniformly, the contraction or " dilatation of a ring made by all the ſeveral colours of the priſm ſucceſſively " reflected from the object-glaſſes, was ſwifteſt in the red, ſloweſt in the violet, " and in intermediate colours it had intermediate degrees of celerity. Comparing " the extent, which each colour obtained by this contraction or dilatation, I found,

" that the blue was ſenſibly more extended than the violet, the yellow than the " blue, and the red than the yellow. And, to make a juſter eſtimation of their " proportions, I obſerved, that the extent of the red was almoſt double to that " of the violet, and that the light was of a middle colour between yellow and " green at that interval of the glaſſes, which was an arithmetical mean between " the two extremes; contrary to what happens in the colours made by the re- " fraction of a priſm, where the red is moſt contracted, the violet moſt expanded, " and in the midſt of them is the confine of green and blue.

" Obſ. 15. Theſe rings were not of various colours, like thoſe in the open " air, but appeared all over of that priſmatic colour only, with which they were " illuminated: and, by projecting the priſmatic colours immediately upon the " glaſſes, I found, that the light, which fell on the dark ſpaces, which were be- " tween the coloured rings, was tranſmitted through the glaſſes without any va- " riation of colour. For, on a white paper placed behind, it would paint rings " of the ſame colour with thoſe, which were reflected, and of the bigneſs of their " intermediate ſpaces. And from hence the origin of theſe rings is manifeſt, " namely, that the aereal interval of the glaſſes, according to its various thick- " neſs, is diſpoſed in ſome places to reflect, and in others to tranſmit, the light " of any colour; and, in the ſame place to reflect one colour, where it tranſmits " another.

Theſe obſervations ſo well pleaſed the Society, that they ordered Mr. OLDENBURG to deſire Mr. NEWTON to permit them to be publiſhed, together with the reſt; which, they preſumed, did correſpond with thoſe, that had been now read to them.

Beſides, there was read a paſſage of Mr. NEWTON's letter to Mr. OLDENBURG, of 21 December, 1675, ſtating the difference between his hypotheſis and that of Mr. HOOKE. Which paſſage was as follows:

" As for Mr. HOOKE's inſinuation, that the ſum of the hypotheſis I ſent you " had been delivered by him in his Micrography, I need not be much concerned " at the liberty he takes in that kind: yet, becauſe you think it may do well, " if I ſtate the difference I take to be between them, I ſhall do it as briefly as I " can, and that the rather, that I may avoid the favour of having done any " thing unjuſtifiable or unhandſome towards Mr. HOOKE. But, for this end, I " muſt firſt (to ſee what is his) caſt out what he has borrowed from DES CAR- " TES, or others, viz. that there is an æthereal medium; that light is the action " of this medium; that this medium is leſs implicated in the parts of ſolid " bodies, and ſo moves more freely in them, and tranſmits light more readily " through them, and that after ſuch a manner, as to accelerate the rays in a cer- " tain proportion; that refraction ariſes from this acceleration, and has ſines " proportional; that light is at firſt uniform; that its colours are ſome diſtur- " bance or new modification of its rays by refraction or reflection; that the co- " lours of a priſm are made by means of the quieſcent medium, accelerating " ſome motion of the rays on one ſide, where red appears, and retarding it on

" the

" the other ſide, where blue appears; and, that there are but theſe two original
" colours, or colour-making modifications of light, which by their various de-
" grees, or, as Mr. HOOKE calls it, dilatings, produce all intermediate ones.
" This rejected, the remainder of his hypotheſis is, that he has changed DES
" CARTES's preſſing or progreſſive motion of the medium to a vibrating one, the
" rotation of the globuli to the obligation of pulſes, and the accelerating their
" rotation on the one hand, and retarding it on the other, by the quieſcent me-
" dium, to produce colours, to the like action of the medium on the two ends of
" his pulſes for the ſame end. And having thus far modified his by the Carte-
" ſian hypotheſis, he has extended it further, to explicate the phænomena of thin
" plates, and added another explication of the colours of natural bodies, fluid
" and ſolid.

" This, I think, is in ſhort the ſum of his hypotheſis; and in all this I have
" nothing common with him, but the ſuppoſition, that æther is a ſuſcep-
" tible medium of vibrations, of which ſuppoſition I make a very different uſe;
" he ſuppoſing it a light itſelf, which I ſuppoſe it is not. This is as great a dif-
" ference as is between him and DES CARTES. But beſides this, the manner of
" refraction and reflection, and the nature and production of colours in all caſes
" (which takes up the body of my diſcourſe) I explain very differently from
" him; and even in the colours of thin tranſparent ſubſtances, I explain every
" thing after a way ſo differing from him, that the experiments I ground my
" diſcourſe on, deſtroy all he has ſaid about them; and the two main experi-
" ments, without which the manner of the production of thoſe colours is not to
" be found out, were not only unknown to him, when he wrote his Microgra-
" phy, but even laſt ſpring, as I underſtood, in mentioning them to him. This
" therefore is the ſum of what is common to us, that æther may vibrate; and
" ſo, if he thinks fit to uſe that notion of colours, ariſing from the various big-
" neſs of pulſes (without which his hypotheſis will do nothing) *his* will borrow
" as much from my anſwer to his objections, as that I ſend you does from his
" Micrography.

" But, it may be, he means, that I have made uſe of his obſervations, and of
" ſome I did; as, that of the inflection of rays, for which I quoted him; that
" of opacity, ariſing from the interſtices of the parts of bodies, which I inſiſt
" not on; and that of plated bodies exhibiting colours, a phænomenon, for the
" notice of which I thank him. But he left me to find out and make ſuch ex-
" periments about it, as might inform me of the manner of the production of thoſe
" colours, to ground an hypotheſis on; he having given no further inſight to it
" than this, that the colour depended on ſome certain thickneſs of the plate;
" though what that thickneſs was at every colour, he confeſſes in his Microgra-
" phy, he had attempted in vain to learn; and therefore, ſeeing I was left to
" meaſure it myſelf, I ſuppoſe he will allow me to make uſe of what I took
" the pains to find out. And this I hope may vindicate me from what Mr.
" HOOKE has been pleaſed to charge me with."

The reading of the reſt of Mr. NEWTON's diſcourſe was referred to the next meeting.

*January*

*January* 27. Mr. OLDENBURG produced from his highneſs prince RUPERT a piece of marble, having ſeveral pictures of boys and trees painted upon it in ſuch a manner, that all the out-lines of the pictures were exactly defined without any flowing of the colours abroad, and the colours fixed by the fire, and afterwards ſo poliſhed, that they would be permanent, and laſt as long as the marble.

This was acknowledged by the members to be a very great improvement of what had been done at Oxford by a certain ſtone-cutter there; and that all, that had been performed before in this art, was not comparable to this degree of improvement.

Mr. HOOKE remarked, that he conceived, that there were but two colours in this piece; and that he had a method of doing it with moſt colours, and to paint with them upon marble almoſt as curiouſly as with a pencil.

Mr. NEWTON's letter of January 25, 167$\frac{5}{6}$ [c], in which he acknowledged the favour of the Society in their kind acceptance of his late papers; and declared, that he knew not how to deny any thing, which they deſired ſhould be done: but he requeſted, that the printing of his obſervations about colours might be ſuſpended for a time, becauſe he had ſome thoughts of writing ſuch another ſet of obſervations for determining the manner of the production of colours by the priſm: which obſervations, he ſaid, ought to precede thoſe now in the Society's poſſeſſion, and would be moſt proper to be joined with them.

There was alſo read a letter of Mr. PASCALL of Somerſetſhire to Mr. AUBREY, dated 18 January, 167$\frac{5}{6}$, containing ſome natural obſervations of that county, viz. concerning the nature of the lead-mines in Mendip-Hills; a well reſembling the ſulphur-well near the Spaw in Yorkſhire; a ſpring petrifying far more than the dropping-well at Knareſborough in the north; the motion of ſome underground waters in the pariſhes of Zoylande, formerly recovered from the ſea, &c.

It was ordered, that the reading of Mr. NEWTON's obſervations about colours be continued at the next meeting.

*February* 3. There was preſented from Dr. WALLIS his edition of ARCHIMEDES's *Arenarius*, with a new tranſlation of his and notes, printed at Oxford, in 1676.

The reading of Mr. NEWTON's obſervations on colours was continued, viz. that part, wherein he explains by the ſimpleſt of colours the more compounded; as follows:

" Obſ. 16. The ſquares of the diameters of theſe rings, made by priſmatic " colour, were in arithmetical progreſſion, as in the fifth obſervation. And the " diameter of the ſixth circle, when made by the yellow, and viewed almoſt perpendicularly, was obout $\frac{58}{100}$ parts of an inch, agreeable to the ſixth obſer- " vation.

[c] There are no letters entered from the beginning of the year 167$\frac{5}{6}$ till July 1677.

" perpen-

" The precedent obſervations were made with a rarer thin medium terminated " by a denſer, ſuch as was air or water compreſſed betwixt two glaſſes. In " thoſe, that follow, are ſet down the appearances of a denſer medium thinned " within a rarer; ſuch as are plates of Muſcovy-glaſs, bubbles of water, and " ſome others thin ſuſtances terminated on all ſides with air.

" Obſ. 17. If a bubble be blown with water, firſt made tenacious by diſſolv- " ing a little ſoap in it, it is a common obſervation, that after a while it will " appear tinged with a great variety of colours. To defend theſe bubbles from " being agitated by the external air (whereby their colours are irregularly moved " one among another, ſo that no accurate obſervation can be made of them) as " ſoon as I had blown any of them, I covered it with a clear glaſs, and by that " means its colours emerged in a very regular order, like ſo many concentric " rings incompaſſing the top of the bubble. And as the bubble grew thinner " by the continual ſubſiding of the water, theſe rings dilated ſlowly, and over- " ſpread the whole bubble, deſcending in order to the bottom of it, where they " vaniſhed ſucceſſively. In the mean while, after all the colours were emerged " at the top, there grew in the center of the rings a ſmall, round, black ſpot, " like that in the firſt obſervation, which continually dilated itſelf, till it became " ſometimes more than one half or three fourths of an inch in breadth, before the " bubble broke. At firſt I thought there had been no light reflected from the water " in that place; but obſerving it more curiouſly, I ſaw within it ſeveral ſmaller, " round ſpots, which appeared much blacker and darker than the reſt, whereby " I knew, that there was ſome reflection at the other places, which were not ſo " dark as thoſe ſpots. And by further trial I found, that I could ſee the images " (as of a candle or the ſun) very faintly reflected, not only from the great black " ſpot, but alſo from the little darker ſpots, which were within it.

" Beſides the aforeſaid coloured rings, there would often appear ſmall ſpots of " colours aſcending and deſcending up and down the ſide of the bubble, by rea- " ſon of ſome inequalities in the ſubſiding of the water; and ſometimes ſmall black " ſpots generated at the ſides, would aſcend up to the larger black ſpot at the " top of the bubble, and unite with it.

" Obſ. 18. Becauſe the colours of theſe bubbles were more extended and " lively than thoſe of air thinned between two glaſſes, and ſo more eaſy to be " diſtinguiſhed, I ſhall here give you a further deſcription of their order, as they " were obſerved in viewing them by reflection of the ſkies, when of a white " colour, whilſt a black ſubſtance was placed behind the bubble: and they were " theſe; red, blue, red, blue; red, blue; red, green; red, yellow; green, blue, " purple; red, yellow, green, blue, violet; red, yellow, white, blue, black.

" The three firſt ſucceſſions of red and blue were very dilute and dirty, eſpe- " cially the firſt, where the red ſeemed in a manner to be white. Amongſt theſe " there was ſcarcely any other colour ſenſible, only the blues (and principally the " ſecond blue) inclined a little to green.

" The fourth red was alſo dilute and dirty, but not ſo much as the former " three: after that ſucceeded little or no yellow, but a copious green, which at " firſt was inclined a little to yellow, and then became a pretty briſk and good " willow green, and afterwards changed to a blueiſh colour; but there ſucceeded " neither blue nor violet.

" The fifth red at firſt was very much inclined to purple, and afterwards be- " came more bright and briſk, but yet not very pure. This was ſucceeded with " a very bright and intenſe yellow, which was but little in quantity, and ſoon " changed to green; but that green was copious, and ſomething more pure, " deep, and lively, than the former green. After that followed an excellent blue " of a bright ſky colour; and then a purple, which was leſs in quantity than the " blue, and much inclined to red.

" The ſixth red was at firſt of a very fair and lively ſcarlet, and ſoon after " of a brighter colour, being very pure and briſk, and the beſt of all the reds. " Then, after a lively orange, followed an intenſe, bright, and copious yellow, " which was alſo the beſt of all the yellows; and this changed, firſt to a greeniſh " yellow, and then to a greeniſh blue; but the green between the yellow and " blue was very little and dilute, ſeeming rather a greeniſh white than a green. " The blue, which ſucceeded, became very good, and of a fair, bright, ſky-colour; " but yet ſomething inferior to the former blue: and the violet was intenſe and " deep, with little or no redneſs in it, and leſs in quantity than the blue.

" In the laſt red appeared a tincture of ſcarlet next the violet, which ſoon " changed to a brighter colour, inclining to an orange: and the yellow, which " followed, was at firſt pretty good and lively, but afterwards it grew more and " more dilute, until by degrees it ended in perfect whiteneſs: and this whiteneſs, " if the water was very tenacious and well tempered, would ſlowly ſpread and " dilate itſelf over the greateſt part of the bubble, continually growing paler at " the top, where at length it would crack, and thoſe cracks, as they dilated, " would appear of a pretty good, but yet obſcure and dark, ſky-colour; the " white between the blue ſpots diminiſhing, until it reſembled the threads of an " irregular net-work, and ſoon after vaniſhed and left all the upper part of the " bubble of the ſaid dark blue colour; and this colour, after the aforeſaid man- " ner, dilated itſelf downwards, until ſometimes it hath overſpread the whole " bubble. In the mean while, at the top, which was of a darker blue than the " bottom, and appeared alſo of many round blue ſpots, ſomething darker than " the reſt, there would emerge one or more very black ſpots, and within thoſe, " other ſpots of an intenſer blackneſs, which I mentioned in the former obſerva- " tion; and thoſe continually dilated themſelves until the bubble broke.

" If the water was not very tenacious, the black ſpots would break forth in " the white, without any ſenſible intervention of the blue: and ſometimes they " would break forth within the precedent yellow, or red, or perhaps within " the blue of the ſecond order, before the intermediate colours had time to diſ- " play themſelves.

" By

" By this deſcription you may perceive, how great an affinity theſe colours " have with thoſe of air, deſcribed in the fourth obſervation, although ſet down " in a contrary order, by reaſon that they begin to appear, when the bubble is " thickeſt, and are moſt conveniently reckoned from the loweſt and thickeſt part " of the bubble upwards.

" Obſ. 19. Viewing, at ſeveral oblique poſitions of my eye, the rings of " colours emerging on the top of the bubble, I found, that they were ſenſibly " dilated by increaſing the obliquity, but yet not ſo much by far, as thoſe made " by thinned air in the ſeventh obſervation. For there they diſtended ſo much, " as, when viewed moſt obliquely, to arrive at a part of the plate more than " twelve lines thicker than that where they appeared, when viewed perpendicu- " larly; whereas in this caſe the thickneſs of the water, at which they arrived " when viewed moſt obliquely, was, to that thickneſs, which exhibited them by " perpendicular rays, ſomething leſs than eight to five. By the beſt of my ob- " ſervations, it was between fifteen and fifteen and a half to ten, an increaſe " about twenty-four times leſs than in the other caſe.

" Sometimes the bubble would become of an uniform thickneſs all over, ex- " cept at the top of it near the black ſpot, as I knew, becauſe it would exhibit " the ſame appearance of colours in all poſitions of the eye; and then the co- " lours, which were ſeen at its apparent circumference by the obliqueſt rays, " would be different from thoſe, that were ſeen in other places by rays leſs " oblique to it. And divers ſpectators might ſee the ſame part of it of differing " colours, by viewing it at very differing obliquities. Now, obſerving how " much the colours at the ſame place of the bubble, or at divers places of equal " thickneſs, were varied by the ſeveral obliquities of the rays, by aſſiſtance of " the fourth, fourteenth, ſixteenth, and eighteenth obſervations, as they are " hereafter explained, I collected the thickneſs of the water, requiſite to exhibit " any one the ſame colour at ſeveral obliquities, to be very nearly in the propor- " portion expreſſed in this table.

| Incidence on the water. | | Refraction into the water. | | Thickneſs of the water. |
|---|---|---|---|---|
| degr. | min. | degr. | min. | |
| 00 | 00 | 00 | 00 | 10 |
| 15 | 00 | 11 | 11 | $10\frac{1}{4}$ |
| 30 | 00 | 22 | 1 | $10\frac{4}{5}$ |
| 45 | 00 | 32 | 2 | $11\frac{4}{5}$ |
| 60 | 00 | 40 | 30 | 13 |
| 75 | 00 | 46 | 25 | $14\frac{1}{3}$ |
| 90 | 00 | 48 | 35 | $15\frac{1}{3}$ |

" In the two firſt columns are expreſſed the obliquities of the rays to the " ſuperficies of the water; that is, their angles of incidence and refraction; " where, I ſuppoſe, that the lines, which meaſure them, are in round numbers, " as three to four, though probably the diſſolution of ſoap in the water may a- " little alter its refractive virtue. In the third column the thickneſs of the bubble,



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" at which any one colour is exhibited in thoſe ſeveral obliquities, is expreſt in " parts, of which ten conſtitute that thickneſs, when the rays are perpendicular.

" I have ſometimes obſerved of the colours, which ariſe on poliſhed ſteel by " heating it, or on bell-metal and ſome other metalline ſubſtances, when melted " and poured on the ground, where it may cool in the open air, that they have, " like thoſe of water-bubbles, been a little changed by viewing them at divers " obliquities; and particularly, that a deep blue or violet, when viewed very " obliquely, hath been changed to a deep red. But the changes of theſe colours " are not ſo ſenſible as of thoſe made by water; for the ſcoria, or vitrified part " of the metal, which moſt metals, when heated or melted, continually protrude " to their ſurface, where, by covering them in form of a thin glaſſy ſkin, it " cauſes theſe colours, is much denſer than water, and I find, that the change " made by the obliquation of the eye, is leaſt in colours of the denſeſt thin ſub- " ſtances.

" Obſ. 20. As in the ninth obſervation, ſo here, the bubble by tranſmitted " light appeared of a contrary colour to that, which it exhibited by reflection. " Thus, when the bubbles, being looked on by the light of the clouds reflected " from it, ſeemed red at its apparent circumference, if the clouds at the ſame " time, or very ſuddenly, were viewed through it, the colour at its circumfe- " rence would be blue. And, on the contrary, when by reflected light it ap- " peared blue, it would appear red by tranſmitted light.

" Obſ. 21. By wetting plates of Muſcovy-glaſs, whoſe thinneſs made the like " colours appear, the colours became more faint, eſpecially by wetting the plates " on that ſide oppoſite the eye; but I could not perceive any variation of their " ſpecies. So that the thickneſs of a plate requiſite to produce any colour, de- " pends only on the denſity of the plate, and not of the ambient medium. " And hence, by the tenth and ſixteenth obſervations, may be known the thick- " neſs of bubbles of water or plates of Muſcovy-glaſs, or of any other ſubſtan- " ces, which they have at any colour produced by them.

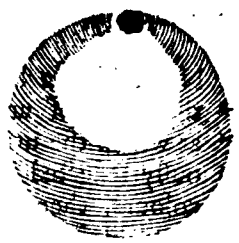
" Obſ. 22. A thin tranſparent body, which is denſer than its ambient me- " dium, exhibits more briſk and vivid colours than that, which is ſo much " rarer; as I have particularly obſerved in air and glaſs: for, blowing glaſs " very thin at a lamp furnace, thoſe plates encompaſſed with air did exhibit co- " lours much more vivid than thoſe of air made thin between two glaſſes.

" Obſ. 23. Comparing the quantity of light reflected from the ſeveral rings, " I found it was moſt copious from the firſt or inmoſt, and in the exteior rings be- " came gradually leſs and leſs. Alſo the whiteneſs of the firſt ring was ſtronger than " that reflected from thoſe parts of the thinned medium, which were without the " rings, as I could manifeſtly perceive by viewing at diſtance the rings made by " the two object glaſſes; or by comparing two bubbles of water blown at diſtant " times, in the firſt of which the whiteneſs appeared, which ſucceeded the colours, " and the whiteneſs, which preceded them, in the other.

" Obſ. 24. When the two object-glaſſes were laid upon one another, ſo as to " make the rings of colours appear, though with my naked eye I could not " diſcern above eight or nine of thoſe rings, yet, by viewing them through a " priſm, I have ſeen a far greater multitude, inſomuch, that I could number " more than forty, beſides many others, that were ſo very ſmall and cloſe toge- " ther, that I could not keep my eye ſo ſteady on them ſeverally as to number " them: but by their extent I have ſometimes eſtimated them to be more than " a hundred. And, I believe, the experiment may be improved to the diſcovery " of far greater numbers; for they ſeem to be really unlimited, though viſible " only ſo far as they can be ſeparated by the refraction, as I ſhall hereafter " explain.

" But it was but one ſide of theſe rings, namely, that, towards which the re- " fraction was made, which by that refraction was rendered diſtinct; and the " other ſide became more confuſed than to the naked eye, inſomuch that there I " could not diſcern above one or two, and ſometimes none of thoſe rings, of " which I could diſcern eight or nine with my naked eye. And their ſegments, " or arcs, which on the other ſide appeared ſo numerous, for the moſt part ex- " ceeded not the third part of a circle. If the refraction was very great, or the " priſms very diſtant from the object-glaſſes, the middle part of thoſe arcs be- " came alſo confuſed, ſo as to diſappear and conſtitute an even whiteneſs, whilſt " on either ſide their ends, as alſo the whole arcs fartheſt " from the center, became diſtincter than before, appearing " in the form you ſee them here deſigned.

Fig. II.



" The arcs, where they ſeemed diſtincteſt, were only white " and black ſucceſſively, without any other colours in- " termixed. But in other places there appeared colours " whoſe order was inverted by the refraction, in ſuch man- " ner, that, if I firſt held the priſm very near the object- " glaſſes, and then gradually removed it farther off towards " my eye, the colours of the ſecond, third, fourth, and following rings ſhrunk " towards the white, that emerged between them, until they wholly vaniſhed into " it at the middle of the arcs, and afterwards emerged again in a contrary or- " der: but at the end of the arcs they retained their order unchanged.

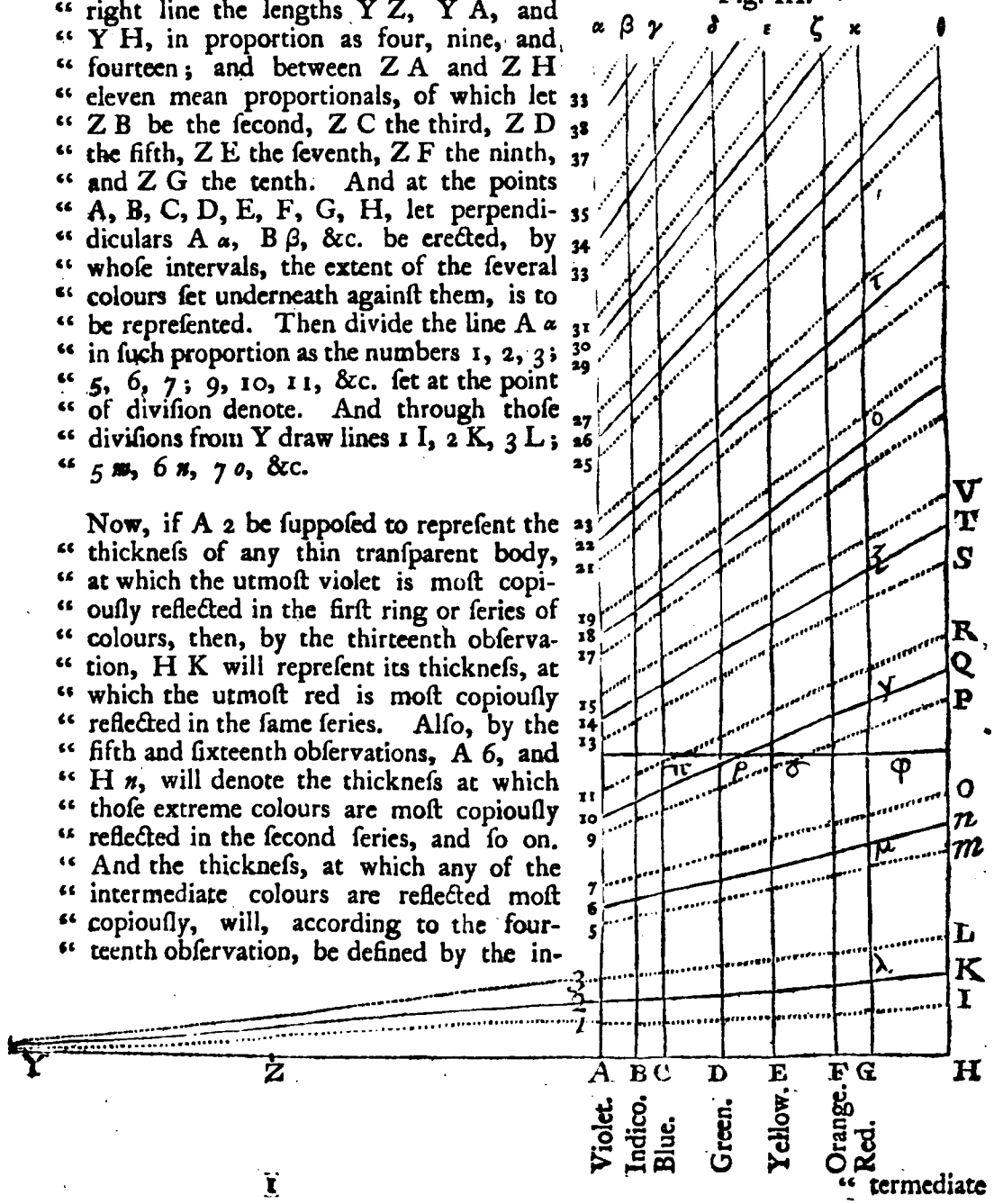
" I have ſometimes ſo laid one object-glaſs upon the other, that, to the naked " eye, they have all over ſeemed uniformly white, without the leaſt appearance " of any of the coloured rings; and yet, by viewing them through a priſm, great " multitudes of thoſe rings have diſcovered themſelves. And, in like manner, " plates of Muſcovy glaſs, and bubbles of glaſs blown at a lamp-furnace, " which were not ſo thin, as to exhibit any colours to the naked eye, have " through the priſm exhibited a great variety of them, ranged irregularly up " and down, in the form of waves. And ſo bubbles of water, before they be- " gan to exhibit their colours to the naked eye of a by-ſtander, have appeared, " through a priſm, girded about with many parallel and horizontal rings; to pro- " duce which effect, it was neceſſary to hold the priſm parallel, or very nearly paral- " lel, to the horizon, and to diſpoſe it ſo, that the rays might be refracted upwards.

" Having

" Having given my obſervations of theſe colours, before I make uſe of them " to unfold the cauſes of the colours of natural bodies, it is convenient, that, by " the ſimpleſt of them, I firſt explain the more compounded; ſuch as are the " ſecond, third, fourth, ninth, twelfth, eighteenth, twentieth, and twenty-fourth.

" And firſt, to ſhow how the colours in the fourth and eighteenth obſervations " are produced, let there be taken in any " right line the lengths Y Z, Y A, and " Y H, in proportion as four, nine, and " fourteen; and between Z A and Z H " eleven mean proportionals, of which let " Z B be the ſecond, Z C the third, Z D " the fifth, Z E the ſeventh, Z F the ninth, " and Z G the tenth. And at the points " A, B, C, D, E, F, G, H, let perpendi- " diculars A α, B β, &c. be erected, by " whoſe intervals, the extent of the ſeveral " colours ſet underneath againſt them, is to " be repreſented. Then divide the line A α " in ſuch proportion as the numbers 1, 2, 3; " 5, 6, 7; 9, 10, 11, &c. ſet at the point " of diviſion denote. And through thoſe " diviſions from Y draw lines 1 I, 2 K, 3 L; " 5 m, 6 n, 7 o, &c.

Fig. III.




Now, if A 2 be ſuppoſed to repreſent the " thickneſs of any thin tranſparent body, " at which the utmoſt violet is moſt copi- " ouſly reflected in the firſt ring or ſeries of " colours, then, by the thirteenth obſerva- " tion, H K will repreſent its thickneſs, at " which the utmoſt red is moſt copiouſly " reflected in the ſame ſeries. Alſo, by the " fifth and ſixteenth obſervations, A 6, and " H n, will denote the thickneſs at which " thoſe extreme colours are moſt copiouſly " reflected in the ſecond ſeries, and ſo on. " And the thickneſs, at which any of the " intermediate colours are reflected moſt " copiouſly, will, according to the four- " teenth obſervation, be defined by the in-

" termediate parts of the lines 2 K, 6 *n*, &c. againſt which the names of thoſe " colours are written below.

" But farther, to define the latitude of theſe colours in each ring or ſeries, let " A 1 deſign the leaſt thickneſs, and A 3 the greateſt thickneſs, at which the " extreme violet in the firſt ſeries is reflected; and let H I and H L deſign the " like limit for the extreme red, and the intermediate colours be limited by the " intermediate parts of the lines, 1 I and 3 L; againſt which the names of thoſe " colours are written. And in the ſecond ſeries, let thoſe limits be the lines " 5 M and 7 O; and ſo on: but yet with this caution, that the reflections be " ſuppoſed ſtrongeſt at the intermediate ſpaces, 2 K, 6 N, 10 R, &c. and to " decreaſe gradually towards theſe limits, 1 I, 3 L; 5 M, 7 O, &c. on either " ſide, where you muſt not conceive them to be preciſely limited, but to decay " indefinitely. And whereas I have deſigned the ſame latitude to every ſeries, I " did it, becauſe, although the colours in the firſt ſeries ſeem to be a little broader " than the reſt, by reaſon of a ſtronger reflection there; yet that inequality is ſo " inſenſible as ſcarcely to be determined by obſervation.

" Now, according to this deſcription, conceiving, that the rays, in which ſeve- " ral colours in here, are by turns reflected at the ſpace 1 K, 3 L, 5 M, O 7, " 9 P, R 11, &c. and tranſmitted at the ſpaces A H I 1, 3 L, M 5, 7 O, " P 9, &c. it is eaſy to know what colour in the open air muſt be exhibited " at any thickneſs of a tranſparent thin body. For, if a ruler be applied paral- " lel to A H, at that diſtance from it by which the thickneſs of the body is " repreſented, the alternate ſpaces 1 I, L 3, 5 M, O 7, &c. which it croſſeth, " will denote the reflected original colours, of which the colour exhibited in the " open air is compounded. Thus, if the conſtitution of the green in the third " ſeries of colours be deſired; apply the ruler, as you ſee, at $\tau \rho \sigma \varphi$, and by its " paſſing through ſome of the blue at $\tau$, and yellow at $\sigma$, as well as through the " green $\rho$, you may conclude, that green, exhibited at that thickneſs of the " body, is principally conſtituted of original green, but not without a mixture " of ſome blue and yellow. By this means you may know, how the colours " from the center of the rings outwards ought to ſucceed in order, as they were " deſcribed in the fourth and eighteenth obſervations: for, if you move the ruler " gradually from A H through all diſtances, having paſt over the firſt ſpace, " which denotes little or no reflection to be made by thinneſt ſubſtances, it will firſt " arrive at 1, the violet, and then very quickly at the blue and green, which, to- " gether with that violet compounded blue, and then at the yellow and red, by " whoſe further addition, that blue is converted into whiteneſs, which white- " neſs continues during the tranſit from I to 3; and after that, by the ſucceſſive " deficience of its component colours, turns firſt to compound yellow, and then " to red, and laſt of all the red ceaſeth at L. Then begin the colours of the ſecond " ſeries, which ſucceed in order between 5 and O, and are more lively than be- " fore, becauſe more expanded and ſevered. And, for the ſame reaſon, inſtead of " the former white, there intercedes between the blue and yellow a mixture of " orange, yellow, green, blue and indico, all which together ought to exhibit " a dilute an imperfect green. So the colours of the third ſeries all ſucceed in

" order

" order; first the violet, which a little interferes with the red of the second or-
" der, and is thereby inclined to a rediſh purple; then the blue and green, which
" are leſs mixed with other colours, and conſequently more lively than before,
" eſpecially the green. Then follows the yellow, ſome of which towards the
" green is diſtinct and good; but that part of it towards the ſucceeding red, as
" alſo that red, is mixed with the violet and blue of the fourth ſeries, whereby va-
" rious degrees of red, very much inclining to purple, are compounded. The
" violet and blue, which ſhould ſucceed this red, being mixed with, and hidden
" in it, there ſucceeds a green; and this at firſt is much inclined to blue, but
" ſoon becomes a good green; the only unmixed and lively colour in this fourth
" ſeries: for as it verges towards the yellow, it begins to interfere with the
" colours of the fifth ſeries, by whoſe mixture the ſucceeding yellow and red are
" very much diluted, and made dirty, eſpecially the yellow, which being the
" weaker colour, is ſcarce able to ſhew itſelf. After this the ſeveral ſeries inter-
" fere more and more, and their colours become more and more intermixed, till
" after three or four revolutions (in which the red and blue predominate by
" turns) all ſorts of colours are in all places pretty equally blended, and com-
" pound one even whiteneſs.

" And ſince, by the fifteenth obſervation, the rays indued with one colour are
" tranſmitted, where thoſe of another colour are reflected, the reaſon of the co-
" lours made by the tranſmitted light, in the ninth and twentieth obſervations, is
" alſo from hence evident.

" If not only the order and ſpecies of theſe colours, but alſo the preciſe thick-
" neſs of the plate, or thin body, at which they are exhibited, be deſired in parts
" of an inch, that may be alſo performed by aſſiſtance of the ſixth or ſixteenth
" obſervation. For, according to thoſe obſervations, the thickneſs of the thinned
" air, which, between two glaſſes, exhibited the orange or bright red of the
" ſixth order, was $\frac{1}{178584}$ parts of an inch. Now, ſuppoſe this thickneſs be
" repreſented by G $\pi$, and the eleventh part of it, G $\lambda$, will be about $\frac{1}{1600000}$ of
" an inch. And ſo G $\mu$, G V, G $\xi$, G o, will be $\frac{3}{1600000}$, $\frac{5}{1600000}$, $\frac{7}{1600000}$,
" and $\frac{9}{1600000}$. And this being known, it is eaſy to determine what thickneſs
" of air is repreſented by G $\varphi$, or any other diſtance of the ruler from A H.

" But further, ſince, by the tenth obſervation, the thickneſs of air was to the
" thickneſs of water, which between the ſame glaſſes exhibited the ſame colour,
" as four to three; and, by the twenty-firſt obſervation, the colours of thin
" bodies are not varied by varying the ambient medium; the thickneſs of a
" bubble of water exhibiting any colour will be three fourths of the thickneſs of
" air producing the ſame colour. And ſo, according to the ſame tenth and twenty-
" firſt obſervations, the thickneſs of a plate of glaſs, whoſe refraction is meaſured
" by the proportion of the fines thirty-one to twenty, may be $\frac{20}{31}$ of the thickneſs
" of air producing the ſame colours: and the like of other mediums. On theſe
" grounds I have compoſed the following table; wherein the thickneſs of air,
" water, and glaſs, at which each colour is moſt intenſe and ſpecific, is expreſſed
" in parts of an inch divided into ten hundred thouſand equal parts.

" The

| | | The thickneſs of Air | Water | Glaſs |
|---|---|---|---|---|
| The colours of the firſt order | Black | 2 | 1 1/4 | 1 1/4 or leſs. |
| | Blue | 2 2/7 | 2 | 1 3/4 |
| | White | 5 1/7 | 4 | 3 1/2 |
| | Yellow | 8 | 6 | 5 1/4 |
| | Orange | 9 | 6 3/4 | 5 4/7 |
| | Red | 10 | 7 1/2 | 6 1/2 |
| Of the ſecond order | Violet | 12 | 9 | 7 3/4 |
| | Indico | 13 1/4 | 9 11/12 | 8 1/2 |
| | Blue | 14 3/4 | 11 | 9 1/2 |
| | Green | 16 | 12 | 10 1/2 |
| | Yellow | 17 1/2 | 13 1/2 | 11 1/2 |
| | Orange | 19 1/4 | 14 1/2 | 12 2/3 |
| | Bright red | 20 | 15 | 13 |
| | Scarlet | 21 1/4 | 16 | 13 2/3 |
| Of the third order | Purple | 23 | 17 1/4 | 14 4/7 |
| | Indico | 24 | 18 | 15 3/7 |
| | Blue | 25 1/2 | 19 | 16 1/4 |
| | Green | 27 1/2 | 20 2/3 | 17 1/2 |
| | Yellow | 29 1/2 | 22 | 19 |
| | Red | 31 | 23 1/4 | 20 |
| | Bluiſh red | 33 1/2 | 25 | 21 1/2 |
| Fourth order | Bluiſh | 36 | 27 | 23 1/4 |
| | Green | 37 2/3 | 28 1/4 | 24 1/3 |
| | Yellowiſh green | 39 1/3 | 29 1/2 | 25 1/2 |
| | Red | 44 | 33 | 28 1/2 |
| Fifth order | Greeniſh blue | 50 2/3 | 38 | 32 2/3 |
| | Red | 57 1/3 | 43 | 37 |
| Sixth order | Greeniſh blue | 64 | 48 | 41 1/2 |
| | Red | 70 2/3 | 53 | 45 2/3 |
| Seventh order | Greeniſh blue | 77 1/3 | 58 | 50 |
| | Red or White | 84 | 63 | 54 1/2 |

" Now, if this table be compared with the third ſcheme, you will there ſee " the conſtitution of each colour, as to its ingredients, or the original colours, " of which it is compounded, and thence be enabled to judge of its intenſeneſs " or imperfection, which may ſuffice in explication of the fourth and eighteenth

" obſervations, unleſs it be further deſired to delineate the manner, how the " colours appear, when the two object-glaſſes are laid upon one another: to do " which let there be deſcribed a large arc of a circle and a ſtrait line, which " may touch that arc; and parallel to that tangent ſeveral occult lines at ſuch " diſtances from it, as the numbers ſet againſt the ſeveral colours in the table " denote. For the arc and its tangent will repreſent the ſuperficies of the " glaſſes, terminating the interjacent air, and the places, where the occult lines " cut the arc, will ſhow at what diſtances from the center, or point of the con- " tact, each colour is reflected.

" There are alſo other uſes for this table; for by its aſſiſtance the thickneſs " of the bubble, in the nineteenth obſervation, was determined by the colours, " which it exhibited. And ſo the bigneſs of the parts of natural bodies may be " conjectured at by their colours, as ſhall be hereafter ſhown. Alſo, if two " or more very thin plates be laid one upon another, ſo as to compoſe one plate, " equalling them all in thickneſs, the reſulting colour may be hereby determined. " For inſtance, Mr. HOOKE, in his Micrographia, obſerves, that a faint yellow " plate of Muſcovy glaſs, laid upon a blue one, conſtituted a very deep purple. " The yellow of the firſt order is a faint one, and the thickneſs of the plate ex- " hibiting it, according to the table, is $5\frac{1}{4}$, to which add $9\frac{1}{2}$, the thickneſs ex- " hibiting blue of the ſecond order, and the ſum will be $14\frac{3}{4}$, which moſt " nearly approaches $14\frac{4}{7}$, the thickneſs exhibiting the purple of the third " order.

" To explain, in the next place, the circumſtances of the ſecond and third " obſervations, that is, how the colours (by turning the priſms about their com- " mon axis the contrary way to that expreſſed in thoſe obſervations) may be con- " verted into white and black rings, and afterwards into colours again in an " inverted order; it muſt be remembered, that thoſe colours are dilated by obli- " quation of rays to the air, which intercedes the glaſſes; and that, according " to the table in the ſeventh obſervation, their dilatation or reflection from the " common center is moſt manifeſt and ſpeedy when they are obliqueſt. Now, " the rays of yellow being more refracted by the firſt ſuperficies of the ſaid air " than thoſe of red, are thereby made more oblique to the ſecond ſuperficies, " at which they are reflected, to produce the coloured rings; and conſequently, " the yellow in each ring will be more dilated than the red; and the exceſs of " its dilatation will be ſo much the greater, by how much the greater is the obli- " quity of the rays, until at laſt it become of equal extent with the red of the " ſame ring. And, for the ſame reaſon, the green, blue, and violet, will be " alſo ſo much dilated by the ſtill greater obliquity of their rays, as to become " all very nearly of equal extent with the red; that is, equally diſtant from the " center of the rings. And then all the colours of the ſame ſeries muſt be coinci- " dent, and by their mixture exhibit a white ring; and theſe white rings muſt " have black or dark rings between them, becauſe they do not ſpread and inter- " fere with one another as before; and, for that reaſon alſo, they muſt become " diſtincter, and viſible to far greater numbers. But yet the violet, being

" obliqueſt,

" obliqueſt, will be ſomething more dilated in proportion than the other colours;
" and ſo very apt to appear at the exterior verges of the white.

" Afterwards, by a greater obliquity of the rays, the violet and the blue be-
" come ſenſibly more dilated than the red and yellow; and ſo being further
" removed from the center of the rings, the colours muſt emerge out of the white
" in an order contrary to that which they had before, the violet and blue at the
" exterior limbs, and the red and yellow at the interior. And the violet, by
" reaſon of the greateſt obliquity of its rays, being, in proportion, moſt of all
" expanded, will ſooneſt appear at the exterior limb of each white ring, and
" become more conſpicuous than the reſt. And the ſeveral ſeries of colours, by
" their unfolding and ſpreading, will begin again to interfere, and thereby render
" the rings leſs diſtinct, and not viſible to ſo great numbers.

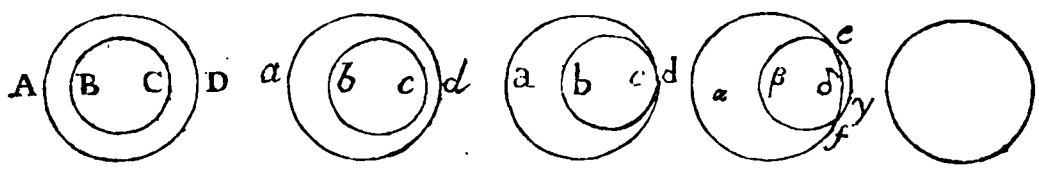
" If, inſtead of the priſms, the object-glaſſes be made uſe of, the rings, which
" they exhibit, become not white and diſtinct by the obliquity of the eye, by
" reaſon, that the rays, in their paſſage through that air, which interceded the
" glaſſes, are very nearly parallel to themſelves, when firſt incident on the glaſſes;
" and conſequently, thoſe indued with ſeveral colours are not inclined one more
" than another to that air, as it happens in the priſms.

" There is yet another circumſtance of theſe experiments to be conſidered;
" and that is, why the black and white rings, which, when viewed at a diſtance,
" appear diſtinct, ſhould not only become confuſed by viewing them near at
" hand, but alſo yield a violet colour at both the edges of every white ring:
" and the reaſon is, that the rays, which enter the eye at ſeveral parts of the
" pupil, have ſeveral obliquities to the glaſſes, and thoſe, which are moſt oblique,
" if conſidered apart, would repreſent the rings bigger than thoſe, which are the
" leaſt oblique. Whence the breadth of the perimeter of every white ring is ex-
" panded outwards by the obliqueſt rays, and inwards by the leaſt oblique. And
" this expanſion is ſo much the greater, by how much the greater is the difference
" of the obliquity; that is, by how much the pupil is wider, or the eye nearer
" to the glaſſes: and the breadth of the violet muſt be moſt expanded, becauſe
" the rays, apt to excite a ſenſation of that colour, are moſt oblique to the
" ſecond or further ſuperficies of the thinned air, at which they are reflected;
" and have alſo the greateſt variation of obliquity, which makes that colour
" ſooneſt emerge out of the edges of the white. And, as the breadth of every
" ring is thus augmented, the dark intervals muſt be diminiſhed, until the neigh-
" bouring rings become continuous, and are blended, the exterior firſt, and
" then thoſe nearer the center; ſo that they can no longer be diſtinguiſhed a-part,
" but ſeem to conſtitute an even and uniform whiteneſs.

" Amongſt all the obſervations there is none accompanied with ſo odd circum-
" ſtances as the twenty-fourth. Of thoſe the principal are, that in thin plates,
" which, to the naked eye, ſeem of an even and uniform tranſparent whiteneſs,
" the refraction of a priſm ſhould make the rings of colours appear; whereas it
" uſually makes objects to appear coloured only, where they are terminated with

" ſhadows, or have parts unequally luminous; and that it ſhould make thoſe " rings exceedingly diſtinct and white, although it uſually renders thoſe objects " confuſed and coloured. The cauſe of theſe things you will underſtand by " conſidering, that all the rings of colours are really in the plate, when viewed " by the naked eye, although, by reaſon of the great breadth of their circum- " ferences, they ſo much interfere, and are blended together, that they ſeem to " conſtitute an even whiteneſs. But, when the rays paſs through the priſm to " the eye, the orbits of the ſeveral colours in every ring are refracted, ſome more " than others, according to their degree of refrangibility; by which means the " colours on one ſide of the ring become more unfolded and dilated, and on the " other ſide more complicated and contracted. And where, by a due refrac- " tion, they are ſo much contracted, that the ſeveral rings become narrower " than to interfere with one another, they muſt appear diſtinct, and alſo white, " if the conſtituent colours be ſo much contracted as to be wholly coinci- " dent: but on the other ſide, where every ring is made broader by the further " unfolding its colours, it muſt interfere more with other rings than before, and " ſo become leſs diſtinct.

" To explain this a little further; ſuppoſe the concentric circles, A B and " C D, repreſent the red and violet of any order, which, together with the in " termediate colours, conſtitute any one of theſe rings. Now, theſe being " viewed through a priſm, the violet circle, B C, will, by a greater refraction, be " further tranſlated from its place than the red, A D, and ſo approach nearer




" to it on that ſide towards which the refractions are made. For inſtance, if " the red be tranſlated to *a d*, the violet may be tranſlated to *b c*, ſo as to ap- " proach nearer to it at *c* than before; and, if the red be further tranſlated to " a d, the violet may be ſo much further tranſlated to b c, as to convene with " it at c, and, if the red be yet further tranſlated to $\alpha\,\delta$, the violet may be ſtill " ſo much further tranſlated to $\beta\,\gamma$, as to paſs beyond it at $\gamma$, and convene with it " at *e* and *f*. And this being underſtood, not only of the red and violet, but of " all the other intermediate colours; and alſo of every revolution of thoſe co- " lours, you will eaſily perceive, how theſe of the ſame revolution or order, by " their narrowneſs at *c d*, and $\delta\,\gamma$, and their coincidence at *c d*, *e* and *f*, ought " to conſtitute pretty diſtinct arcs of circles, eſpecially at *c d*, or at *e* and *f*, and " that they will appear ſeveral at *c d*, at c d exhibit whiteneſs by their coinci- " dence, and again appear ſeveral at $\delta\,\gamma$, but yet in a contrary order to that " which they had before, and ſtill retain beyond *e* and *f*. But, on the other " ſide, at *a b*, a b, or $\alpha\,\beta$, theſe colours muſt become much more confuſed by " being dilated, and ſpread ſo as to interfere with thoſe of other orders. And " the ſame confuſion will happen at $\delta\,\gamma$ between *e* and *f*, if the refraction be

" very

" very great, or the prism very distant from the object-glasses; in which case no " parts of the ring will be seen, save only two little arcs at *e* and *f*, whose distance " from one another will be augmented by removing the prism still further from " the object-glasses. And these little arcs must be distinctest and whitest at their " middle; and at their ends, where they grow confused, they must be coloured; " and the colours at one end of every arc must be in a contrary order to those " at the other end, by reason that they cross in the intermediate white; namely, " their ends, which verge towards $\delta$ $\gamma$, will be red, and yellow on that side next " the center, and blue and violet on the other side. But their other ends, which " verge from $\delta$ $\gamma$, will, on the contrary, be blue and violet on that side towards " the center, and on the other side red and yellow.

" For confirmation of all this, I need alledge no more, than that it is mathe- " matically demonstrable from my former principles. But I shall add, that they, " which please to take the pains, may by the testimony of their senses be assured, " that these explications are not hypothetical, but infallibly true and genuine: " for in a dark room, by viewing these rings through a prism, by reflection of " the several prismatic colours, which an assistant causes to move to and fro " upon a wall or paper, from whence they are reflected, whilst the spectator's " eye, the prism, and object-glasses (as in the thirteenth observation) are placed " steddy, the position of the circles, made successively by the several colours, " will be found such, in respect of one another, as I have described at *a b c d*, or " a b c d, or $\alpha$ $\beta$ $\gamma$ $\delta$. And by the same method the truth of the explications of " the other observations is to be examined.

" By what hath been said, the like phænomena of water-bubbles and thin " plates of glass may be understood. But in small fragments of those plates, " there is this further observable, that, if they, lying flat upon a table, be turned " about their center, whilst they are viewed through a prism, some of them ex- " hibit waves in one or two positions only; but the most of them do in all posi- " tions exhibit those waves, and that for the most part appearing almost all over " the glass. The reason is, that the superficies of such plates are not even, but " have many cavities and swellings, which, how shallow soever, do a little vary " the thickness of the plate; and by the several sides of those cavities there " must be produced waves in several postures of the prism. Now, though it " be but some very small and narrow parts of the glass, by which these waves " for the most part are caused, yet they may seem to extend themselves over the " whole glass, because from the narrowest of those parts there are colours of several " orders confusedly reflected, which by refraction of the prism are unfolded, and " dispersed to several places, so as to constitute so many several waves as there " were divers orders of the colours promiscuously reflected from that part of the " glass.

" These are the principal phænomena of thin plates or bubbles, whose expli- " cations depend on the properties of light, that I have heretofore delivered: " and these, you see, do necessarily follow from them, and agree with them even " to their very least circumstances; and not only so, but do very much tend to

" their

" their proof. Thus, by the twenty-fourth obſervation, it appears, that the " rays of ſeveral colours, made, as well by thin plates or bubbles, as by the re- " fractions of a priſm, have ſeveral degrees of refrangibility, whereby thoſe of " each order, which, at their reflection from the plate or bubble, are intermixed " with thoſe of other orders, are ſeparated from them by refraction, and aſſoci- " ated together, ſo as to become viſible by themſelves, like arcs of circles. For, " if the rays were all alike refrangible, it is impoſſible, that the whiteneſs, which " to the naked ſenſe appears uniform, ſhould by refraction have its parts tranſ- " poſed, and ranged into thoſe black and white arcs.

" It appears alſo, that the unequal refractions of difform rays proceed not " from any contingent irregularities, ſuch as are veins, an uneven poliſh, or for- " tuitous poſition of the pores of glaſs, unequal motions in the air or æther, " ſpreading, breaking, or dividing the ſame ray into many diverging parts, or " the like. For, admitting any ſuch irregularities, it would be impoſſible for " refractions to render thoſe rings ſo very diſtinct and well defined, as they do " in the twenty-fourth obſervation. It is neceſſary therefore, that every ray have " its proper and conſtant degree of refrangibility connate with it; according to " which its refraction is ever juſtly and regularly performed, and that ſeveral " rays have ſeveral of thoſe degrees.

" And what is ſaid of their refrangibility may be underſtood of their reflexi- " bility; that is, of their diſpoſitions to be reflected, ſome at a greater, and others " at a leſs thickneſs of thin plates or bubbles, namely, that thoſe diſpoſitions are " alſo connate with the rays, and immutable, as may appear by the thirteenth, " fourteenth, and fifteenth obſervations, compared with the fourth and eigh- " teenth.

" By the precedent obſervations it appears alſo, that whiteneſs is a diſſimilar " mixture of all colours, and that light is a mixture of rays endowed with all " thoſe colours. For, conſidering the multitude of the rings of colours in the " third, twelfth, and twenty-fourth obſervations, it is manifeſt, that, although " in the fourth and eighteenth obſervations there appear more than eight or nine " of thoſe rings, yet there are really a far greater number, which ſo much inter- " fere and mingle with one another, as, after thoſe eight or nine revolutions, to " dilute one another wholly, and conſtitute an even and ſenſible uniform white- " neſs. And conſequently, that whiteneſs muſt be allowed a mixture of all co- " lours, and the light, which conveys it to the eye, muſt be a mixture of rays " endued with all thoſe colours.

" But further, by the twenty-fourth obſervation it appears, that there is a con- " ſtant relation between colours and refrangibility, the moſt refrangible rays being " violet, the leaſt refrangible red, and thoſe of intermediate colours having pro- " portionally intermediate degrees of refrangibility. And, by the thirteenth, " fourteenth, and fifteenth obſervations, compared with the fourth or eighteenth, " there appears to be the ſame conſtant relation between colour and refrangi- " bility; the violet being on equal terms reflected at leaſt thickneſs of any thin " plate

" plate or bubble; the red at greateſt thickneſs, and the intermediate colours at " intermediate thickneſſes: whence it follows, that the colorific diſpoſitions of " rays are alſo connate with them, and immutable; and by conſequence, that all " the productions and appearances of colours in the world are derived, not from " any phyſical change cauſed in light by refraction or reflection, but only from " the various mixtures or ſeparations of rays, by virtue of their different refran- " gibility or reflexibility. And, in this reſpect it is, that the ſcience of colours " becomes a ſpeculation more proper for mathematicians than naturaliſts.

This being read, occaſion was taken to diſcourſe of Mr. NEWTON's theory itſelf, and to debate, whether the rays of light, which, though alike incident in the ſame medium, yet exhibit different colours, may not reaſonably be ſaid to owe that exhibition of different colours to the ſeveral degrees of the velocity of pulſes, rather than, as Mr. NEWTON thought, to the ſeveral connate degrees of refrangibility in the rays themſelves?

Mr. HOOKE was of opinion, that the former of theſe ways was ſufficient to give a good account of the diverſity of colours.

*February* 10. Dr. MAPLETOFT was elected and admitted.

Capt. SHEERES, Mr. HALL, and Signor TRAVAGINO were elected.

Mr. BERCHENSHAW preſented himſelf to the Society, and ſhewed them his ſcale of muſic, wherein were contained,

1. A table of all conſonant and diſſonant intervals ſuitable to muſical harmony, which are practicable, and may be expreſſed by the voice and other inſtruments. To theſe reſpective intervals apt and proper numbers were aſſigned, by which their ratio's and proportions were demonſtrated.

2. A ſyſtem of all the keys, by which the aforeſaid intervals were completed; of which keys ſome were natural; ſome intended to the firſt degree of acuteneſs; ſome remitted to the firſt degree of gravity; ſome twice ſpiſſated; ſome twice aſperated.

3. In this ſcale the magnitude, dimenſion, and proportion of the ſaid keys were exactly demonſtrated according to the proportional parts of a chord, the chord being ſuppoſed thirty-ſix inches long.

If it were demanded, whether there was any thing in this table and ſyſtem, that was not to be found in the ſcales and writings of other muſicians? he anſwered,

1. That the intervals in this table were perfect and complete. There was not one too many, nor one wanting, which might conduce to the making of harmony.

2. That

2. That the ſounds or muſical numbers contained in this ſyſtem aroſe out of the uniſon, and from one another, according to the reaſon of figurate, not ſimple numbers, (as, he ſaid, he could demonſtrate by numbers aſſigned to the reſpective intervals in the table) for that ſo the reaſon of the ſtate of muſic required.

3. That there are neither more or leſs keys in this ſyſtem, than would complete the aforeſaid intervals.

4. That in this ſcale all the tones are of the ſame ratio, and that ſo are all the ſemitones, ſemiditones, ditones, and other intervals.

5. That the true magnitude and dimenſion of every one of the ſaid keys are demonſtrated according to the proportional parts of a chord.

6. That the natural, genuine, and true reaſon of the excellency and fullneſs of the harmony of three, four, five, ſix, and ſeven parts, may clearly be diſcerned by the ſyſtem of ſeven parts.

He added, that many other things were to be found in this table and ſcale, of which little or no mention is made in the ſcales and writings of either modern or antient muſical authors; which, he ſaid, he intended to diſcover, and to write of them at large, as he ſhould be enabled thereunto.

He was exhorted to finiſh this work, or at leaſt to publiſh this ſyſtem with an explanation thereof.

After this was read the laſt part of Mr. NEWTON's *obſervations*, wherein he conſidered in nine propoſitions, how the phænomena of thin tranſparent plates ſtand related to thoſe of all other natural bodies: of which bodies having before mentioned, that they appear of divers colours, according as they are diſpoſed to reflect moſt copiouſly the rays indued with theſe colours, he now inquires after their conſtitutions.

Here, among many other conſiderable things, he ſhews, how the bigneſs of the component parts of natural bodies may be conjectured by their colours: as alſo, that the cauſe of reflexion is not the impinging of light on the ſolid and impervious parts of bodies, as was commonly ſuppoſed.

This laſt part was as follows:

" I am now come to the laſt part of this deſign; which is, to conſider, how " the phænomena of thin tranſparent plates ſtand related to thoſe of all other na- " tural bodies. Of theſe bodies I have already told you, that they appear of di- " vers colours, accordingly as they are diſpoſed to reflect moſt copiouſly the rays " endued with thoſe colours. But their conſtitutions, whereby they reflect ſome rays

" more copiouſly than others, remains to be inquired after. And this I ſhall en-
" deavour in the following propoſitions.

" Prop. 1. Thoſe ſuperficies reflect the greateſt quantity of light, which have
" the greateſt refracting power; that is, which interceeds mediums, that differ moſt
" in their refracting denſities; and in the confines of equally denſe mediums there
" is no reflection.

" The analogy between reflection and refraction will appear by conſidering, that
" when light paſſeth obliquely out of one medium into another, which refracts
" from the perpendicular, the greater is the difference of their denſity, the leſs
" obliquity is requiſite to cauſe a total reflection; becauſe as the ſines are, which
" meaſure the refraction, ſo is the ſine of incidence, at which the total reflection
" begins, to the radius of the circle; and conſequently that incidence is leaſt,
" where there is the great difference of the ſines. Thus in the paſſing of light out
" of water into air, where the refraction is meaſured by the ratio of the ſines, 3 to
" 4, the total reflection begins, when the angle of the incidence is about forty-
" eight degrees and thirty-five minutes. In paſſing out of glaſs into air, where
" the refraction is meaſured by the ratio of the ſines 20 to 31, the total reflection
" begins, when the angle of incidence is forty degrees and ten minutes: and ſo,
" in paſſing out of cryſtal, or more ſtrongly refracting mediums, into air, there
" is ſtill a leſs obliquity requiſite to cauſe a total reflection. Superficies therefore,
" which refract moſt, do ſooneſt reflect all the light, which is incident on them,
" and ſo muſt be allowed moſt ſtrongly reflective.

" But the truth of this propoſition will further appear, by obſerving, that in
" the ſuperficies, interceeding any two of thoſe mediums, air or water, or other
" liquors, common glaſs, cryſtal, and metalline glaſſes, the reflection is ſtronger
" or weaker accordingly as the ſuperficies hath a greater or leſs refracting power.
" Thus, when other mediums are contiguous to air, the reflection is ſtronger
" in the ſuperficies of glaſs than of water, ſtill ſtronger in the ſuperficies of cryſ-
" tal, and ſtrongeſt in the ſuperficies of metalline glaſs. So, in the confine of
" water and common glaſs, the reflection is very weak, but yet ſtronger than in
" the confine of water and oil, or almoſt any other two liquors, and ſtill ſtronger
" in the confine of water and cryſtal, or metalline glaſs: accordingly as thoſe
" mediums differ more or leſs in denſity, ſo in the confine of common glaſs and
" cryſtal there is a weak reflection, and a ſtronger reflection in the confine of
" common and metalline glaſs: but in the confine of two glaſſes of equal den-
" ſity, there is not any ſenſible reflection, as was ſhewn in the firſt obſervation.
" And the ſame may be underſtood of the ſuperficies of two cryſtals or liquors,
" or any other ſubſtances, in which no refraction is cauſed: whence it comes to
" paſs, that uniform mediums have no ſenſible reflexion but in their external ſu-
" perficies, where they are adjacent to their mediums of a different denſity.

" Prop. 2. The leaſt parts of natural bodies are in ſome meaſure tranſparent;
" and the opacities of thoſe bodies ariſe from the multitude of reflections cauſed
" in their internal parts.

" That this is ſo, will eaſily be granted by them, that have been converſant with " microſcopes: and it may be alſo tried by applying any ſubſtance to a hole, through " which the light is emitted into a dark room; for how opake ſoever that ſub- " ſtance may ſeem in the open air, it will, by that means, appear very manifeſtly " tranſparent, if it be of a ſufficient thickneſs: only metalline bodies muſt be ex- " empted, which, by reaſon of their exceſſive denſity ſeem to reflect almoſt all the " light incident on their firſt ſuperficies.

" Prop. 3. Between the parts of opake or coloured bodies are many interſtices, " repleniſhed with mediums of other denſities, as water between the tinging cor- " puſcles, wherewith any liquor is impregnated; air between the aqueous globules " that conſtitute clouds or miſts; and for the moſt part ſpaces void of both air " and water; but yet perhaps repleniſhed with ſome ſubtiler medium between " the parts of hard bodies.

" The truth of this is evinced by the two precedent propoſitions: for by the " ſecond propoſition there are many reflections from the internal part of bodies, " which by the firſt propoſition would not happen, if the parts of thoſe bodies " were continued without any ſuch interſtices between them, becauſe reflections " are cauſed only in ſuperficies, which interceed mediums of a different denſity.

" But further, that this diſcontinuity of parts is the principal cauſe of the opa- " city of bodies, will appear by conſidering, that opake ſubſtances become tranſ- " parent by filling their pores with any ſubſtance of equal, or almoſt equal denſity " with their parts. Thus paper dipped in water or oil, the oculus mundi ſtone " ſteeped in water, linen-cloth oiled or varniſhed, and many other ſubſtances ſoaked " in ſuch liquors, as will intimately pervade their little pores, become by that " means more tranſparent than otherwiſe. So, on the contrary, the moſt tranſ- " parent ſubſtances may, by ſeparating their parts, be rendered ſufficiently opake; " as glaſs, by being reduced to powder, or otherwiſe flawed, water by being form- " ed into many ſmall bubbles, either alone in the form of froth, or by ſhaking " it together with oil of turpentine, or ſome other convenient liquor, with which " it will not incorporate, and horn by being ſcraped.

" To the increaſe of the opacity of theſe bodies it conduces ſomething, that by " the twenty third obſervation, the reflections of very thin tranſparent ſubſtances " are conſiderably ſtronger than thoſe made by the ſame ſubſtances of a greater " thickneſs. And to the reflection of ſolid bodies it may be further added, that " the interſtices of their parts are void of air. For that for the moſt part they " are ſo, is reaſonable to believe, conſidering the ineptitude, which air hath to " pervade ſmall cavities, as appears by the aſcenſion of water in ſlender glaſs- " pipes, paper, cloth, and other ſuch like ſubſtances, whoſe pores are found too " ſmall to be repleniſhed with air, and yet large enough to admit water; and by " the difficulty, wherewith air pervades the pores of a bladder, through which " water find ready paſſage. And according to the eleventh obſervation, the ca- " vities thus void of air will cauſe the ſame kind of effects as to reflection, which " thoſe do, that are repleniſhed with it; but yet ſomething more manifeſtly, be-

" cauſe

" cauſe the medium in relation to refractions is rareſt, when moſt empty of air, " as Mr. Hooke hath proved in his Micrographia; in which book he hath alſo " largely diſcourſed of this and the precedent propoſition, and delivered many " other very excellent things concerning the colours of thin plates, and other na- " tural bodies, which I have not ſcrupled to make uſe of ſo far as they were for " my purpoſe.

" Prop. 4. The parts of bodies and their interſtices muſt not be leſs than " of ſome definitive bigneſs, to render them opake and coloured; for the opakeſt " bodies, if their parts be ſubtilly divided (as metals by being diſſolved in acid " menſtruums, &c.) become perfectly tranſparent. And you may alſo remem- " ber, that in the eighth obſervation there was no reflection at the ſuperficies of " the object-glaſſes, where they were very near one another, though they did not " abſolutely touch. And in the ſeventeenth obſervation, the reflection of the " water-bubble, where it became thinneſt, was almoſt inſenſible, ſo as to cauſe the " apparitions of very black ſpots.

" On theſe grounds I conceive it is, that water, ſalt, glaſs, ſtones, and ſuch " like ſubſtances, are tranſparent; for, upon divers conſiderations, they ſeem to " be as porous as other bodies, but yet their pores and parts too ſmall to cauſe " any opacity.

" Prop. 5. The tranſparent parts of bodies, according to their ſeveral ſizes, " muſt *reflect* rays of one colour, and *tranſmit* thoſe of another, on the ſame " grounds, that thin plates or bubbles do reflect or tranſmit thoſe rays: and this " I take to be the ground of all their colours.

" For, if a thinned or plated body, which being of an even thickneſs appears " all over of one uniform colour, ſhould be broken into fragments of the ſame " thickneſs with the plate, I ſee no reaſon, why a heap of thoſe fragments ſhould " not conſtitute a powder of the ſame colour, which the plate exhibited before it " was broken. And the parts of all natural bodies, being like ſo many fragments " of a plate, muſt on the ſame grounds exhibit the ſame colours.

" Now, that they do ſo, will further appear by the affinity of their proper- " ties: as that the infuſion of nephritic-wood, and many other ſubſtances reflect " one colour, and tranſmit another, like thin bodies in the ninth and twentieth " obſervations. That the colours of ſilks, cloaths, and others ſubſtances, which " water or oil can intimately penetrate, become more faint and obſcure by being " emerged in thoſe liquors, and recover their vigour again by being dried, much " after the manner declared of thin bodies, in the tenth and twenty-firſt obſer- " vations: and that ſome of thoſe coloured powders, which painters uſe, may have " their colours a little changed, by being very elaborately and finely ground. " Where I ſee not, what can be juſtly pretended for thoſe changes, beſides the " breaking of their parts into leſs parts by that contrition, after the ſame manner " that the colour of a plate is changed by varying its thickneſs. For which rea- " ſon alſo it is, that many flowers, by being bruiſed, become more tranſparent

" than before, or, at leaſt, in ſome degree or other, change their colours. Nor " is it much leſs to my purpoſe, that, by mixing divers liquors, very odd and " remarkable productions and changes of colours may be effected, of which no " cauſe can be more obvious and natural, than that the ſaline corpuſcles of one " liquor do variouſly act upon, or unite with, the tinging corpuſcles of another; " ſo as to make them ſwell or ſhrink (whereby not only their bulk, but their " denſity alſo may be changed) or to divide them into ſmaller corpuſcles, or make " many of them aſſociate into one cluſter; for we ſee how apt thoſe ſaline men- " ſtruums are to penetrate and diſſolve ſubſtances, to which they are applied; and " ſome of them to precipitate what others diſſolve. In like manner, if we con- " ſider the various phænomena of the atmoſphere, we may obſerve, that when " vapours are firſt raiſed, they hinder not the tranſparency of the air, being di- " vided into parts too ſmall to cauſe any reflection in their ſuperficies: but when, " in order to compoſe drops of rain, they began to coaleſce and conſtitute glo- " bules of all intermediate ſizes, thoſe globules, when they become of a conveni- " ent ſize to reflect ſome colours, and tranſmit others, may conſtitute clouds of " various colours, according to their ſizes. And I ſee not what can be rationally " conceived, in ſo tranſparent a ſubſtance as water for the production of theſe " colours, beſides the various ſizes of its parcels, which ſeem to affect a globular " figure moſt; but yet perhaps not without ſome inſtability in the ſmalleſt of " them, by reaſon that thoſe are moſt eaſily agitated by heat or any trembling mo- " tions in the air.

" Prop. 6. The parts of bodies, on which their colours depend, are denſer than " the medium, which pervades their interſtices.

" This will appear by conſidering, that the colour of a body depends not only " on the rays, which are incident perpendicularly or its parts, but on thoſe alſo, " which are incident at all other angles. And that, according to the ſeventh " obſervation, a very little variation of obliquity will change the reflected colour, " where the thin body or ſmall particle is rarer than the ambient medium, in " ſomuch that ſuch a ſmall particle will, at diverſly oblique incidents, reflect all " ſorts of colours, in ſo great a variety, that the colour, reſulting from them all " confuſedly reflected from a heap of ſuch particles, muſt rather be a white or " grey, than any other colour, or at beſt it muſt be but a very imperfect and " dirty colour; whereas, if the thin body or ſmall particle be much denſer than " the ambient medium, the colours, according to the nineteenth obſervation, are " ſo little changed by the variation of obliquity, that the rays, which are re- " flected leaſt obliquely, may predominate over the reſt ſo much, as to cauſe a " heap of ſuch particles to appear very intenſly of their colour.

" It conduces alſo ſomething to this propoſition, that, according to the twenty- " ſecond obſervation, the colours exhibited by the denſer thin body within the " rarer are more briſk than thoſe exhibited by the rarer within the denſer.

" Prop. 7. The bigneſs of the component parts of natural bodies may be " conjectured by their colours.

" For ſince the parts of theſe bodies, by propoſition 5. do moſt probably exhibit the ſame colours with a plate of equal thickneſs, provided they have the ſame refractive denſity; and ſince their parts ſeem for the moſt part to have much the ſame denſity with water or glaſs, as by many circumſtances is obvious to collect: to determine the ſizes of theſe parts, you need only have recourſe to the precedent tables, in which the thickneſs of water or glaſs exhibiting any colour is expreſſed. Thus, if it be deſired to know the diameter of a corpuſcle, which being of equal denſity with glaſs, ſhall reflect green of the third order; the number $17\frac{1}{2}$ ſhows it to be about $\frac{17\frac{1}{2}}{100000}$ parts of an inch.

" The greateſt difficulty is here to know, of what order the colour of any body is; and for this end we muſt have recourſe to the fourth and eighteenth obſervations, from whence may be collected theſe particulars.

" *Scarlets*, and other *reds*, *oranges* and *yellows*, if they be pure and intenſe, are moſt probably of the ſecond order. Thoſe of the firſt and third order alſo may be pretty good; only the orange and red of the third order have too great a mixture of violet and blue.

" There may be good *greens* of the fourth order, but the pureſt are of the third: and of this order the green of all vegetables ſeems to be, partly by reaſon of the intenſeneſs of their colours, and partly becauſe when they wither, ſome of them turn to a greeniſh yellow, and others to a more perfect yellow or orange, or perhaps to red; paſſing firſt through all the aforeſaid intermediate colours, which changes ſeem to be effected by the exhaling of the moiſture, which may leave the tinging corpuſcles more denſe, and ſomething augmented by the accretion of the oily and earthy part of that moiſture. Now the green, without doubt, is of the ſame order with thoſe colours, into which it changeth, becauſe the changes are gradual, and thoſe colours, though uſually not very pure, yet for the moſt part are too pure and lively to be of the fourth order.

" *Blues* and *purples* may be either of the ſecond or third order; but the beſt are of the third. Thus the colour of *violet* ſeems to be of that order; becauſe their ſyrup, by acid liquors, turns red, and by urinous and alkalazite turns green. For ſince it is of the nature of acids to diſſolve or attenuate, and of alcalis to precipitate or incraſſate, if the purple colour of the ſyrup was of the ſecond order, an acid liquor by attenuating its tinging corpuſcles would tinge it to a red of the firſt order, and an alcali, by incraſſating them, would change it to a green of the ſecond order; which red and green, eſpecially the green, ſeem too imperfect to be the colours produced by theſe changes. But if the ſaid purple be ſuppoſed of the third order, its change to red of the ſecond and green of the third may, without any inconvenience, be allowed.

" If there be found any body of a deeper and leſs reddiſh purple than that of violets, its colour moſt probably is of the ſecond order. But yet there being no body commonly known, whoſe colour is conſtantly more deep than theirs,

" I have

" I have made uſe of their name to denote the deepeſt and leaſt reddiſh purples, " ſuch as manifeſtly tranſeend their colour in purity.

" The *blue* of the firſt order, though very faint and little, may poſſibly be the " colour of ſome ſubſtances; and particularly the azure colour of the ſkies " ſeems to be of this order. For all vapours, when they begin to condenſe and " coaleſce into ſmall parcels, become firſt of that bigneſs, whereby ſuch an azure " muſt be reflected, before they can conſtitute clouds of other colours. And ſo " this being the firſt colour, which vapours begin to reflect, it ought to be the " colour of the fineſt and moſt tranſparent ſkies, in which vapours are not ar- " rived to that groſſneſs requiſite to reflect other colours, as we find it is by ex- " perience.

" Whiteneſs, if it be intenſe, is either that in the firſt order of colours, of " which ſort perhaps is the colour of white lead; or elſe it is a mixture of " thoſe ſucceeding the third or fourth order, ſuch as is the colour of paper, " linen, and moſt white ſubſtances. If corpuſcles of various ſizes, exhibiting the " colours of the ſecond and third order, be mixed, they ſhould rather conſtitute " an imperfect whiteneſs or grey, of which I have already ſpoken: but yet it ſeems " not impoſſible for them to exhibit an intenſe whiteneſs, if they be diſpoſed to " tranſmit all the light, which they reflect not, and do not retain and ſtifle much " of it. For thus I told you, that froth at a diſtance hath appeared very white, " and yet, near at hand, the ſeveral bubbles, of which it was conſtituted, were " ſeen tinged all over with rings of colours of the four or five firſt orders.

" Laſtly, for the production of *black*, the corpuſcles muſt be leſs than any of " thoſe, which exhibit colours. For at all greater ſizes there is too much light re- " flected to conſtitute this colour. But if they be ſuppoſed a little leſs than is re- " quiſite to reflect the blue of the firſt order, they will, according to the fourth, " eight, ſeventeenth, and eighteenth obſervations, reflect ſo very little light as " to appear intenſely black, and yet may perhaps variouſly refract it to and fro " within themſelves ſo long, until it happen to be ſtifled and loſt; by which " means they will appear black in all poſitions of the eye without any tranſpa- " rency. And from hence may be underſtood, why fire, and the more ſubtil " diſſolver, putrefaction, turn ſubſtances to black; why ſmall quantities of black " ſubſtances impart their colour very freely and intenſely to other ſubſtances, to " which they are applied; why glaſs ground very elaborately, on a copper-plate, " till it be well poliſhed, makes the ſand, together with what is worn off from " the glaſs, and copper, become very black; why black ſubſtances do ſooneſt of " all others become hot and burn, which effect may proceed, partly from the " multitude of refractions in a little room, and partly from the eaſy commo- " tion of ſo very ſmall corpuſcles; and why blacks are uſually a little inclined to " a bluiſh colour. For that they are ſo, may be ſeen by illuminating white " paper by reflection from black ſubſtances, which will uſually appear of a bluiſh " white. And the reaſon is, that black borders on the obſcure blue of the firſt " order, deſcribed in the eighteenth obſervation, whence the corpuſcles of black " ſubſtances are moſt apt to reflect that colour.

" In

" In theſe deſcriptions I have been the more particular, becauſe it is not impoſ-
" ſible, but that microſcopes may at length be improved to the diſcovery of
" corpuſcles of bodies, on which their colours depend. For if thoſe inſtruments
" could be ſo far improved, as with ſufficient diſtinctneſs to repreſent objects five
" or ſix hundred times bigger than at a foot diſtance they appear to our naked eyes.
" I ſhould hope, that we might be able to diſcover ſome of the greateſt of thoſe
" corpuſcles. And by one, that would magnify three or four thouſand times, per-
" haps they might all be diſcovered but thoſe, which produce blackneſs. In the
" mean while, I ſee nothing material, that rationally can be doubted of, except-
" ing this poſition, that tranſparent corpuſcles of the ſame thickneſs and denſity
" with a plate do exhibit the ſame colour. And this I would have underſtood
" not without ſome latitude, as well becauſe thoſe corpuſcles may be of irregular
" figures, and many rays muſt be obliquely incident, and ſo have a ſhorter way
" through them than the length of their diameter; as becauſe the ſtraitneſs of
" the medium, pent in on all ſides, may a little alter its motions, or other qua-
" lities, on which the reflexion depends. But yet I cannot much ſuſpect the laſt,
" becauſe I have obſerved of ſome ſmall plates of Muſcovy-glaſs, which were of
" an even thickneſs, that through a microſcope they have appeared of the ſame
" colour at their edges and corners, where the included medium was terminated,
" which they appeared of in other places. However, it would add much to our
" ſatisfaction, if thoſe corpuſcles could be diſcovered with microſcopes, which if
" we ſhall ever attain to, I fear it will be the utmoſt improvement of this ſenſe;
" for it ſeems impoſſible to ſee the more ſecret and noble works of nature within
" thoſe corpuſcles, by reaſon of their tranſparency.

" This may ſuffice concerning the conſtitution of natural bodies, on which their
" colours depend. But for further underſtanding the nature of reflections, I
" ſhall add theſe two following propoſitions.

" Prop. 8. The cauſe of the reflection is not the impinging of light on the
" ſolid and impervious parts of bodies, as is commonly ſuppoſed.

" This will appear by the following conſiderations: firſt, that in the paſſage of
" light out of glaſs into air, there is a reflection as ſtrong or ſtronger than in its
" paſſage out of air into glaſs, and by many degrees ſtronger than in its paſſage
" out of glaſs into water. And it ſeems not probable, that air ſhould have more
" reflecting parts than water or glaſs. But if that ſhould poſſibly be ſuppoſed, it
" will avail nothing; for the reflection is as ſtrong, if not ſtronger, when the air
" is drawn away from the glaſs (ſuppoſe in the air-pump invented by Mr. BOYLE)
" as when it is adjacent to it. Secondly, if light in its paſſage out of glaſs into
" air be incident more obliquely than at an angle of forty or forty-one degrees,
" it is wholly *reflected*; if leſs obliquely, it is in great meaſure *tranſmitted*. Now
" it is not to be imagined, that light at one degree of obliquity ſhould meet with
" pores enough in the air to tranſmit the greater part of it, and at another degree
" of obliquity meet with nothing but parts to reflect it wholly; eſpecially conſi-
" dering, that in its paſſage out of air into glaſs, how oblique ſoever be its
" incidence, it finds pores enough in the glaſs to tranſmit the greateſt part of it.

" If

" If any man ſuppoſe, that it is not reflected by the air, but by the utmoſt ſu-
" perficial parts of the glaſs, there is ſtill the ſame difficulty; beſides, that ſuch
" a ſuppoſition is unintelligible; and will alſo appear to be falſe, by applying wa-
" ter behind ſome part of the glaſs inſtead of air. For ſo in a convenient obli-
" quity of the rays, ſuppoſe of forty-five or forty-ſix degrees, at which they are
" all *reflected*, where the air is adjacent to the glaſs, they ſhall be in great meaſure
" *tranſmitted*, where the water is adjacent to it; which argues, that their reflection
" or tranſmiſſion depends on the conſtitution of the air and water behind the
" glaſs, and not on the parts of the glaſs.

" Thirdly, if the colours made by a priſm, placed at the entrance of a beam
" of light into a darkened room, be ſucceſſively caſt on a ſecond priſm placed
" at a great diſtance from the former, in ſuch manner that they are all alike in-
" cident upon it; the ſecond priſm may be ſo inclined to the incident rays, that
" thoſe, which are of a blue colour, ſhall be all reflected by it; and yet thoſe of a
" red colour pretty copiouſly tranſmitted. Now if the reflection be cauſed by
" the parts of air or glaſs, I would aſk, why at the ſame obliquity of incidence
" the blue ſhould wholly impinge on thoſe parts ſo as to be all reflected, and yet
" the red find pores enough to be in great meaſure tranſmitted. Fourthly,
" where two glaſſes touch one another, there is no ſenſible reflection, as was de-
" clared in the firſt obſervation; and yet I ſee no reaſon, why the rays ſhould not
" impinge on the parts of glaſs, when contiguous to another glaſs, a smuch as
" when contiguous to air. Fifthly, when the top of a water-bubble (in the ſe-
" venteenth obſervation) by the continual ſubſiding and exhaling of the water
" grew very thin, there was ſuch a little and almoſt inſenſible quantity of light
" reflected from it, that it appeared intenſely black; whereas, round about that
" black ſpot, where the water was thicker, the reflection was ſo ſtrong as to make
" the water ſeem very white. Nor is it only at the leaſt thickneſs of thin plates
" or bubbles that there is no manifeſt reflection, but at many other thickneſſes
" continually greater and greater. For in the fifteenth obſervation, the rays of the
" ſame colour were by turns tranſmitted at one thickneſs, and reflected at another
" thickneſs, for an intermediate number of ſucceſſions. And yet in the ſuperfi-
" ficies of the third body, where it is of any one thickneſs, there are as many
" parts for the rays to impinge on, as where it is of any other thickneſs.

" Laſtly, if reflection were cauſed by the parts of reflecting bodies, it would
" be impoſſible for thin plates or bubbles, at the ſame place to reflect the rays of
" one colour, and tranſmit thoſe of another, as they do according to the thirteenth
" and fifteenth obſervations. For is is not to be imagined, that at one place the
" rays, which, for inſtance, exhibit a blue colour, ſhould have the fortune to daſh
" upon the *parts*, and thoſe, which exhibit a red, to hit upon the pores of the
" body; and then at another place, where the body is either a little thicker, or a
" little thinner, that on the contrary the blue ſhould hit upon its *pores*, and the
" *red* upon its *parts*.

" Prop. 9. It is moſt probable, that the rays, which impinge on the ſolid
" parts of any body, are not reflected but ſtifled and loſt in that body.

" This

" This is conſentaneous to the precedent propoſition, and will further appear " by conſidering, that if all the rays ſhould be reflected, which impinge on the in- " ternal parts of clear water or cryſtal, thoſe ſubſtances ſhould rather have a cloudy " than ſo very clear tranſparency.

" And further, there would be no principle of the obſcurity or blackneſs, which " ſome bodies have in all poſitions of the eye. For to produce this effect, it is ne- " ceſſary, that many rays be retained and loſt in the body, and it ſeems not pro- " bable, that any rays can be ſtopped and retained in it, which do not impinge on " its parts."

*February* 17. Mr. OLDENBURG produced and read divers experiments made in the air-pump at Paris, by Monſ. HUYGENS and Monſ. PAPIN, upon divers inſects, and upon the lungs of animals: as alſo upon gun-powder, to find what quantity of air there is in that body, and to what degree it was compreſſed therein, &c.[e]

Of theſe experiments it was ordered, that the lungs of a lamb, newly killed, ſhould be kept for the next meeting, and tried in the exhauſting engine, after the manner obſerved by Monſ. HUYGENS.

*February* 24. The experiment ordered for this meeting was tried, viz. the lungs of a lamb, after they had been put in water, and found to float, were blown up, and then put into the air-pump together with a gage; where, upon the firſt ſuctions, they ſwelled to a certain degree, and the air being well exhauſted, ſo continued on, during the ſucceeding motions of the engine. Then the air being ſuddenly admitted again, the lungs preſently contracted into a ſmall bulk, and being taken out looked redder; and being thrown into water, ſunk to the bottom. This was tried twice with the like ſucceſs, though the ſecond time they ſunk not ſo deep as the firſt.

Monſ. HUYGENS affirmed, that lungs having been put between two plates, with a conſiderable weight thereon, he had not been able ſo to expreſs the air out of them, as to make them ſink in water, though upon the exhauſting of the air in the engine, and the admitting it again upon the lungs, they ſunk.

The reaſon of this being enquired into by the members, Dr. CROUNE alledged, that the air, by its ſubtilty, was able to get every where equally to all the parts, inward and outward, of the lungs, and by an equal and univerſal preſſure on them, lay flat and cloſe all the veſicles thereof, which a weight laid only on the ſuperficial parts of the lungs was not able to do.

It was ordered, that at the next meeting this experiment ſhould be made of putting lungs between two plates, with a weight thereon, to ſee, whether it would not compreſs them ſo as to make them ſubſide in water.

[e] Theſe experiments are publiſhed in the Philoſoph. Tranſ. vol. x, n° 122. p. 542.



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Mr. OLDENBURG read a paper ſent to him from Dr. ERASMUS BARTHOLIN, profeſſor of mathematics at Copenhagen, containing the anſwers of a biſhop of Iceland, named GISLAVUS THORLACUS, to ſeveral queries formerly ſent thither by order of the Society [f].

" Ad Quæſ. 1. Omnes liquores tenues, aquoſi, & ſeroſi, hic congelantur: me-
" rus ſanguis etiam congelatur, forſitan ob terreſtrem ſui partem majorem. Vi-
" na quæ novimus dilutiora, hic quidem congelantur, ſed fortiora vix id paſſura
" puto; ſic nec lixivia ſaponariorum fortia, nec ſpiritus mercurialis ſalium rec-
" tificatos (ut vocant) neque ſulphureos ex vino.

" De argento vivo frigori expoſito num aliquam mutationem recipiat, non
" ſatis compertum habeo, veriſimile tamen eſt, aliquo modo condenſari.

" Olea pura potius incraſſari & condenſari, quam in glaciem converti, ex-
" iſtimo.

" Ad 2. Frigus terram ad ſex vel ſeptem pedum, aquam vero ſtagnantem ad
" trium circiter pedum profunditatem, hic penetrare putatur.

" Ad 3. Horologiorum artificialium apud nos nullus eſt uſus.

" Ad 4. Colores frigore ſummo concentrari poſſe, nullus dubito.

" Ad 5. De alteratione virium magnetis & ſuccini per acre gelu nondum
" compertum habeo.

" Ad 6. Omnia metallica & lapidea fragiliora redduntur ab acri gelu, &
" tepefactione habent opus, quo redeant ad priorem naturam.

" Ad 7. Anatomicorum (qui nulli hic ſunt) obſervationibus prorſus deſti-
" tuimur.

" Ad 8. Omnes grumi glaciales, qui ad hanc inſulam ex Gronlandia vi ma-
" ris & ventorum deferuntur, fiunt ex aqua dulci maris, & continuis accrementis
" nivium, quorum nonnulli ad trecentarum ulnarum vel ſexcentorum pedum al-
" titudinem ſurgunt; tertia tantum parte ſupra aquam exiſtente.

" Ad 9. Fontes in Iſlandia calidi reperiuntur quam plurimi, nullam gla-
" ciem tolerantes, quorum nonnulli adeo fervent, ut omne munus ignis focalis
" explere poſſint; puta tingendis pannis & coquendis cibis, etiam craſſiſſimis,
" ut carnibus, piſcibus, &c.

" Ad 10. Figuram nivis non exacte obſervavi, grandinis autem figura fere
" rotunda eſt, & granum piperis magnitudine ſua rarius excedit.

[f] Letter-book, vol. vii. p. 182.

" Ad

" Ad 11. Corpora quædam reſervari poſſe nive, ut ova, crudas carnes, piſces " recentes, &c. colore vel ſapore non multum variante, non diffido, ſed hume- " fieri potius quam contrahi exiſtimo.

" Ad 12. Circa fulgura, tonitrua, aliaque meteora, nihil notabile habeo, niſi " quod tonitrua etiam hyberno tempore hic nonnunquam exaudiantur, idque " in meridionali potiſſimum inſulæ parte, ubi etiam terræ motus fiunt fortiores, " & frequentiores.

" Ad 13. Venti ſeptentrionales apud nos frequentiſſimi ſunt, & poſt hos " etiam meridionalis, cæteri autem rariores. Effecta autem eorumdem variant " juxta varium locorum ſitum ; etenim occidentales venti, in occidentali Iſlandia " ſunt aquoſi, qui in orientali inſulæ parte ſunt ſicci, & contra in orientali Iſlan- " dia ; orientales venti ſunt humidi, in occidentali autem ſicci. Eadem eſt ra- " tio de ſeptentrionalibus ventis in meridionali & ſeptentrionali inſulæ parte.

" Ad 14. Mons Hecla, qui annos jam quadraginta circiter ſiluit, neque " ignem vel flammam tanto temporis ſpatio emiſit, nihil fere notabile habet, ne- " que tempeſtatum mutationem præſagit, pumices potiſſimum ſuppeditat.

" Ad 15. Refractio in aere a nullo adhuc, quantum exiſtimo, accurate ob- " ſervata eſt : diameter ſolis & lunæ longior hic apparet quam in Dania, & in " aliis meridionalibus regionibus. Pleiades quinque tantum ſtellas hic habet ; " luna altero poſt conjunctionem die ut plurimum conſpicitur.

" Ad 16. Ecclipſium obſervationem quantum poterimus pollicemur.

" Ad 17. Non adeo curioſe notatum eſt hactenus, quanta copia ſalis ex coc- " tione aquæ marinæ exire poſſit, cum a nullo, quod ſciam, hic tentata ſit, " niſi tantum a ſpectatiſſimo viro Gislavio Magni filio, qui triceſimam vel qua- " drageſimam aquæ partem in ſalem converti exiſtimat.

" Ad 18. De tempore autem æſtuum marinorum, in diverſis portubus, item " de altitudine, tempore, ac duratione, ejuſdem æſtus marini, ut & de mineralibus, " glebis, aliiſque foſſilibus his provenientibus (de quibus quæſt. 18.) aliquod vo- " lente Deo, addam, poſtquam de his certius edoctus fuero.

" Ad. 19. Declinationem acus magneticæ, Nolæ, quæ ſedes eſt epiſcopalis, " in Boreali Iſlandia obſervavi quindecim circiter graduum, latitudo ejuſdem loci " eſt 66, 43.

" Ad 20. Ferrum ferruginem citiſſime hic contrahit, præſertim in meridionali " & maritima inſulæ parte.

" Ad 21. De animalibus tam feris, quam domeſticis videri poteſt diſputa- " tio M. Theodori Thorlacii de Iſlandia, Sect. 4. Theſſ. 6.

" Ad 22. Herbarum & fruticum plurimas ſpecies terra Iſlandica producit, " arborum autem præter betulam nullas.

" 23. Jumenta cum ovium caprarumque grege tempore hyberno ſolo foeno " paſcuntur, æſtate autem gramine viridi.

" Ad 24. Colores animalium hic diverſi ſunt, ſed frequentiſſimus eſt albus.

" Ad 25. Morbus præcipuus, quo laborant Iſlandi, eſt epidemicus, noſtra " lingua (Landfarſootts) quo morbo laborantes capitis dolores cum pluritide præ- " cipue ſentiunt.

" Ad 26. Plumæ, quas *edardun* vulgo vocant, colliguntur ex nidis avium " quarumdam marinarum, quas *edur* appellant Iſlandi, & plumulas tales a pro- " riis pectoribus avellunt: avis eſt ex anatum genere, anate major, ſed minor " anſere.

" Ad 27. De monocerote marino (quod piſcis genus hic admodum rarum eſt) " non nihil dictum eſt, quoad ſtaturam & nomenclaturam, in diſſertatione de " Iſlandia. Theſ. 6. Sect. 4."

Sir WILLIAM PETTY taking particular notice of the quantity of ſalt or brine, which in theſe anſwers was ſaid to be contained in ſalt-water, and noting alſo what was ſaid of the icy mountains being congealed only or moſtly of freſh-water, ſuggeſted, that froſt might ſerve to make ſtrong brine, the freſh-water mingled with the ſalt-water being frozen, and ſucceſſively taken off, and the remainder expoſed again to freeze, till there remained nothing but a mere brine.

It was ordered, that a ſolemn letter of thanks ſhould be returned to this biſhop of Iceland, and that he be deſired to favour the Society with an experimental anſwer to thoſe queries, which in this paper were anſwered only from his conjectures.

*March* 2. Sir RICHARD EDGECOMBE was propoſed candidate by Sir ROBERT REDDING.

Dr. CROUNE gave an account of the experiment ordered at the laſt meeting; which was, that though no lungs had been tried to be ſqueezed together with a weight, yet the operator had laboured to do it with both his hands as forcibly as he could, but had not been able thereby ſo to preſs out the air, as to make the lungs ſink.

After this there was tried this experiment before the Society by Dr. CROUNE, viz. the lungs of a ſucking rabbit were taken out by him as carefully as he could, and having ready a wide-mouthed glaſs filled with water, and a lead faſtened to the lungs, he blew them up under the water, and ſtopped the quill, which was faſtened in the trachea, with cement; and then being kept ſtill under the water by the lead, the

lungs, glaſs, and all were put under a receiver, and ſo the pump was plied: whereupon the lungs preſently expanded, and, as before, continued to do ſo at a certain degree for ſome time, a train of bubbles breaking out at firſt, as it ſeemed, out of the ſide of the lungs, yet without any hurt or wound on that ſide. Afterwards they appeared to break out round about and every where out of the lungs. At length many bubbles roſe alſo from the bottom of the water; and withal a vaſt number of very ſmall bubbles continued to riſe every where round the lungs, as if they ſprung out of its natural pores. All this while the lungs in the water looked as white as any lungs do, that are blown up. Then letting in the air ſuddenly, the lungs ſoon became much leſs in bulk, and preſently ſunk to the bottom, and when taken out appeared conſiderably red.

Mr. Hooke mentioned, that there had been lately with him a perſon, who had ſuggeſted to him ſome new notions concerning the loadſtone, viz. that the motions of it would vary and change far otherwiſe than hitherto had been taken notice of, ſo as that the variation of it would be for a quarter of a year to the eaſt, and the next quarter to the weſt of the north; and particularly that the twenty-ninth of of February preceding it would be four degrees to the eaſtward. Mr. Hooke added, that he intended to obſerve it, having already made a meridian for that purpoſe, and to give the Society an account of the reſult of his obſervations.

Mr. Oldenburg moving, that now the ſun and ſeaſon being likely to ſerve for the making of Mr. Newton's experiment called in queſtion by Mr. Linus, an apparatus might be prepared for that purpoſe; Mr. Hooke ſaid, that he had an apparatus ready to make the experiment, when the Society ſhould call for it.

*March* 6. At a meeting of the Council were preſent

The lord viſcount Brouncker, preſident,

The lord biſhop of Cheſter,
Mr. ſecretary Williamson,
Sir Paul Neile,
Sir John Bankes,
Sir Cyril Wyche,
Sir Robert Southwell,
Dr. Holder,
Dr. Pell,
Mr. Henshaw,
Mr. Colwall,
Mr. Milles,
Dr. Croune,
Dr. Grew,
Mr. Hill,
Mr. Oldenburg.

The preſident moved, that it might be conſidered how to provide for the weekly meetings of the Society a ſufficient number of experiments to be made from time to time, and to pitch upon ſuch perſons, as might be depended upon for the exhibiting of them.

After ſome debate it was ordered, that Sir John Bankes, Sir Cyril Wyche, Sir Jonas Moore, Mr. Colwall, Dr. Croune, Dr. Grew, Mr. Hill, or any three or more of them (whereof the treaſurer, Mr. Colwall, to be one) and as many

many more of the council, as ſhould pleaſe to join themſelves with them, be a committee for conſidering of perſons, members of the Royal Society, fit to entertain the ſaid Society at their weekly meetings from time to time with experiments, and diſcourſes upon them, to be left in writing, in order to be regiſtered: and having found ſuch perſons, as were able, and would engage in this work, to offer to them for every ſuch experimental exerciſe performed before the Society, and delivered in writing, a ſum of money not exceeding the value of four pounds, beſides the charges requiſite to make the reſpective experiments: and this committee to meet in the Society's repoſitory on Thurſdays, at three o'clock preciſely, and to make a report of their progreſs in this matter to the council.

A propoſal concerning Chelſea College was made by Mr. OLDENBURG from a perſon, who would not yet be named, deſiring a leaſe of the houſe and land then in poſſeſſion for thirty-one years, at thirty pounds *per annum*, or for fifty years at thirty-five pounds *per annum*, and in both caſes to make the houſe tenantable with all convenient ſpeed.

The council declared hereupon, that it was a fair propoſition to treat upon; and that they would appoint a committee to do ſo, when they ſhould underſtand, that the propoſer was returned from Cambridge, whither, they were informed, he was gone.

Some of the council moved, in the mean while, that the propoſer might be obliged not to put the houſe to any other uſe than had been now named by Mr. OLDENBURG, which was to practiſe chemical operations, to make a phyſic-garden, and a repoſitory for natural curioſities, without obtaining leave from the council: otherwiſe the leaſe to be void.

There was then read a propoſal for encouraging the preſs of Oxford, recommended by Sir JOSEPH WILLIAMSON, ſecretary of ſtate, to the council, viz. to fix upon ſome good book or books to be printed there at a reaſonable rate, at ſuch time as five hundred ſubſcribers ſhould be obtained.

The council declared, that they would conſider of ſome books to be printed accordingly, and thereupon offer and recommend the paper produced to particular perſons of their number for ſubſcriptions, and to do the like to the body of the Society.

After this, the committee for managing the repoſitory of the Society made a report to the council of what they had done in that affair, viz. that they had removed the particulars thereof out of the rooms, where they had hitherto been, into the gallery at the weſt end of Greſham College, and there ranged them in order: and that it now remained only for the council to order an inventory or catalogue to be made both of thoſe curioſities and the books, and to appoint perſons to have the cuſtody of the ſame.

Whereupon it was ordered, that Sir JOHN BANKES, Sir CYRIL WYCHE, Sir

JONAS MOORE, Mr. MILLES, Mr. DANIEL COLWALL, Dr. CROUNE, Dr. GREW, Mr. HILL, or any or more of them (whereof Mr. COLWALL to be one) be a committee for conſidering of perſons, who might be fit to make an inventory or catalogue, not only of the natural curioſities and books of the Royal Society, but alſo of all the goods and chattels belonging to the ſame, and to cauſe all thoſe particulars to be entered in a book: and likewiſe to fix upon a truſty perſon to be keeper of all the things above-mentioned, and to repreſent the reſult of all to the council.

The treaſurer moving, that for the future he might not pay any ſalary to the reſpective officers of the Society without an order from the preſident, it was ordered,

That for the future, the treaſurer, do not pay any ſalary to any officers of the Society without an order from the preſident.

Mr. HENSHAW deſiring to borrow for the uſe of ſome learned friends of his out of the Arundelian library given to the Society, the MS. of St. CYPRIAN, for the reſtoring of which he would engage himſelf by a note under his hand; it was ordered, that Mr. HOOKE ſhould deliver to him, as ſoon as conveniently he could, the ſaid MS. Mr. HENSHAW giving to Mr. OLDENBURG a note under his hand to reſtore it ſafe and undamnified, within the ſpace of ſix months from the date hereof: and that this order be ſigned by the preſident.

N° 122. of the *Philoſophical Tranſactions* was licenſed.

*March* 9. At a meeting of the SOCIETY,

An experiment was made, upon Mr. BOYLE's ſuggeſtion, with a bolt-head glaſs ſealed up hermetically, put in water and in a receiver in the engine, to ſee whether the bubbles, which at the laſt meeting were ſeen to riſe very copiouſly and preſently about the lungs, would do the like about the glaſs. It was found, that they roſe about it very ſoon after the pump was begun to be plied, and in good numbers, yet not ſo great by far, as they did about the lungs. And here the bubbles ſettled themſelves copiouſly upon the glaſs round about it, but by little and little broke off from it.

Mr. OLDENBURG produced a paper, ſent to him in a letter from Sir PHILIP SKIPPON, being a relation of Virginia, and containing a ſhort natural hiſtory of that country [s], viz. the geography of it, a deſcription of the rivers there, together with the ſeveral ſorts of fiſhes, which they afford; as alſo of the mountains of Virginia, and the attempts made to diſcover, whether on the back of them were any rivers running into the South Sea: likewiſe of the mines, ſoil, herbs, timber, and fruit-trees, cattle, deer, wild beaſts: and, laſtly, of the Indian

[s] It was drawn up by Mr. THOMAS GLOVER, a chirurgeon; and is printed in the Philoſoph. Tranſ. vol. xi. n° 126. p. 623. for June, 1676.

inhabi-

inhabitants themſelves, their ſmall numbers, their way of cloathing, building, hunting, fiſhing, divine worſhip, money, diſeaſes, way of phyſic, and manner of planting and ordering tobacco.

*March* 16. There was read a large letter to Mr. OLDENBURG from Mr. FRANCIS VERNON, dated at Smyrna, 10th January, 167$\frac{5}{6}$, giving a ſummary account of the obſervations made by him in his travels from Venice through Iſtria, Dalmatia, Achaia, Morea, and the Archipelago to Smyrna [h], and taking notice of Monſ. De la GUILLIETIERE's deſcription of Athens, as containing many miſtakes and falſities, though plauſibly written.

Divers members expreſſed their deſires, that this letter of Mr. VERNON might be printed.

Occaſion being given of diſcourſing about the cauſe of the aſcent and deſcent of the ſpirit of wine in ſealed thermometers, and that being aſcribed by ſome of the members to particles of air interſperſed in the liquor, it was ordered, that at the next meeting ſome ſpirit of wine ſhould be put into the air-pump, and the air of it exhauſted, and thereupon ſuch purged ſpirit be preſently ſealed up in a fit and well-wrought glaſs-cane, and another ſuch cane of the ſame ſize and ſhape every way be ready to be filled with ſpirit of wine unexhauſted, in order to ſee the manner and difference of their working together.

It was ordered alſo, that Mr. NEWTON's experiment, queſtioned by Mr. LINUS, ſhould be made at the next meeting, if the weather ſhould prove favourable for it.

Mr. OLDENBURG preſented to the Society his tenth volume of the *Philoſophical Tranſactions* for the year 1675.

*March* 23. There was no meeting of the Society.

1676, *March* 30. There was no meeting of the Society on account of the Eaſter holy-days.

*April* 6. Mr. OLDENBURG delivered the box formerly ſent to the Society by Dr. SWAMMERDAM, containing an uterus, and the neighbouring parts thereof, ſo prepared with wax ſyringed into the veſſels thereof, that the parts of their connection might be diſtinctly ſeen; together with the arteries and veins of a human ſpleen and thoſe of a calf, part of the *inteſtini jejuni valvulæ conniventas*, part of the *portiuncula* of a *penis & urethra*, and a *lymphaticum peculiare ex abdomine gallinæ:* beſides, upon a paper delineated, the *arteria primi generis ſeu pulmonalis in piſcibus, per quam ſanguis ad branchias amandatur*, and the *arteria ſecundi generis in piſcibus, per quam ſanguis e ramis branchialibus immediate per eorum corpus diſtribuitur.*

[h] It is printed in the Philoſoph. Tranſact. vol. xi. n° 124. p. 575. for April, 1676.

Mr.

Mr. OLDENBURG read a letter to himſelf from Mr. HEVELIUS, dated at Dantzick, 11th March, $167\frac{5}{6}$, complaining of the animadverſions made by Mr. HOOKE upon his *Machina cœleſtis*, and intimating his reſolution to anſwer them; ſending alſo an obſervation of his of a phænomenon of Saturn made 14th Auguſt, 1675. wherein the body of that planet appeared beneath the ring; together with his obſervation of the ſolar eclipſe of 23d June, 1675 [i].

A committee, conſiſting of Sir JONAS MOORE, Dr. CROUNE, Mr. HILL, Dr. GREW, and Mr. HOOKE, was appointed to try Mr. NEWTON's experiment controverted by Mr. LINUS; and it was ordered, that after the trial of it by that committee, it ſhould be made before the Society.

*April* 13. There was read a letter in Latin from Signor TRAVAGINO, dated at Venice, 24th March, $167\frac{5}{6}$, addreſſed to the Society, returning them thanks for his election into their body.

Dr. GREW preſented the Society with an experimental diſcourſe, in purſuance of one part of his former lecture, concerning mixture, ſuch a branch of philoſophy, as might give great light into the nature of bodies. The deſign of this diſcourſe, and the experiments attending it, was to obſerve the luctation, that ariſes from the mixture of ſeveral liquors with vegetable, mineral, and animal ſubſtances; the author undertaking in that diſcourſe vegetables and minerals, and reſerving animal ſubſtances for another time, and diſtinguiſhing the ſeveral ways and effects of this luctation, viz. ebullition, elevation, crepitation, effervescence, and exhalation. The liquors employed were eight or nine, viz. ſpirit of ſal armoniac, ſpirit of hart's-horn, ſpirit of ſcurvy-graſs, ſpirit of wine, ſpirit of nitre, ſpirit of ſalt, oil of ſulphur, oil of vitriol, aquafortis. The materials, upon which theſe liquors were infuſed, were about an hundred.

It was deſired, that this diſcourſe might be regiſtered [k], and, when finiſhed, printed [l].

*April* 27. The experiment of Mr. NEWTON, which had been conteſted by Mr. LINUS and his fellows at Liege, was tried before the Society, according to Mr. NEWTON's directions, and ſucceeded, as he all along had aſſerted it would do: and it was ordered, that Mr. OLDENBURG ſhould ſignify this ſucceſs to thoſe of Liege, who had formerly certified, that if the experiment were made before the Society, and ſucceeded according to Mr. NEWTON's aſſertions, they would acquieſce, as appears by Mr. GASCOIGNE's letter to Mr. OLDENBURG of 15th December, 1675.

The experiment was thus: a priſm was taken, and ſo held, that its axis was perpendicular to the ſun's rays (it being a very clear ſun-ſhine day) and in this

[i] Both theſe obſervations are printed in the Philoſoph. Tranſact. vol. xi. n° 127. p. 660, 661, for July, 1676.

[k] Regiſter, vol. v. p. 186.

[l] It is printed in his Anatomy of Plants, lecture 2. p. 238.

poſture it was placed in a darkened room, as cloſe as might be to the hole, through which the ſun ſhined into the dark room; which hole was about the bigneſs of a pea. Then the priſm was turned ſlowly about its axis, and the colours were ſeen to move upon the oppoſite wall, firſt towards that place, to which the ſun's direct light would paſs, if the priſm were taken away; and then back again. When the colours were about the middle of theſe two contrary poſitions, that is, when they were neareſt to that place, to which the ſun's direct rays tended, there the experimenter ſtopped, the rays being then equally refracted on both ſides the priſm. In this poſture of the priſm, the figure of the colours being obſerved, it was found not round, as Mr. LINUS contended, but oblong; the colours red, yellow, green, blue, purple, ſucceeding in order, not from one ſide of the figure to the other, as in Mr. LINUS's conjecture, but from one end to the other, and the length of the figure being not parallel, but tranſverſe to the axis of the priſm.

Dr. CROUNE gave an account of the experiment of exhauſting the air out of ſpirit of wine, and of comparing it then with ſuch ſpirit unexhauſted, to ſee the difference of its working in ſealed thermometers. He ſaid, that that ſpirit thus exhauſted was more ſluggiſh by a fourth part than that, which was not exhauſted.

The preſident ordered, that it might be tried again before him, being of opinion, that the difference of the working would be greater, if the air were more exhauſted.

Dr. CROUNE took notice of an experiment made and publiſhed by Monſ. HUYGENS, in 1672, viz. whether the effect of a ſyphon of unequal legs, by which the water of a veſſel is made to run over, is aſcribed to the weight of the air preſſing upon the water in the veſſel. He, Monſ. HUYGENS, made the water of the ſyphon run, after the recipient was exhauſted of air; and found alſo, that with water purged of air it produced the like effect as well as without the recipient; he affirming withal, that the recipient was well exhauſted of air, he having aſſured himſelf of that, as well by finding, that there came not more air through the pump, and by other more ſure marks: which experiment he took for a confirmation of his opinion, that there is, beſides the air, a preſſing matter more ſubtil than the air.

Mr. HOOKE hereupon affirmed, that he could do the ſame with quickſilver, and make it run out of a ſyphon after the air was well exhauſted.

The preſident deſired to ſee that experiment.

Mr. OLDENBURG preſented the Society with a manuſcript of Monſ. JOLY of Dijon, containing a body of mechanics, in which he pretended to have found and demonſtrated an univerſal principle to explain the effects of the moving powers in engines, deſiring the Society's judgment thereof. Upon which the preſident, Sir CHRISTOPHER WREN, Sir JONAS MOORE, Dr. WALLIS, Dr. PELL, Dr. CROUNE,

CROUNE, and Mr. HOOKE, were desired to read it over, and consider it, and make a report to the Society.

The president informed the Society, that a bitch of his, that was unspleened some years ago, had been opened the other day; and nothing of any succedaneum found in the place of the spleen.

*May* 4. being Ascension-day, the Society did not meet.

*May* 11. There was made before the Society by WILLIAM COLE, M. D. an observation about the intestines of animals, viz. that the structure of their fibres is not annular, as had been before generally received, but spiral.

The observation was shewn in the colon of a sheep, and the discoverer's written account thereof [m] read. But because the meeting was very thin, and neither the president nor vice-president in the chair, it was thought proper to repeat both the observation and discourse at a fuller meeting for farther examination; the author being desirous to have the judgment of the Society upon both.

*May* 18. Mr. HALL was admitted fellow.

Dr. GREW produced an account of a woman breeding stones in great quantities of different sorts, and voiding them, partly by vomit, partly by the urinary passages; some great, some little, whereof the little ones looked like small white pebbles; others friable like gritty stones, and of the colour of fullers earth.

He remarked, that having poured spirit of nitre upon both sorts of these stones, he found, that it wrought upon the greater stones, but not upon the pebbles: whence he conjectured, that since it was not likely, that in one and the same body should be bred stones of so different natures, as all other stones observed by him make an effervescence with some acid or other; it might be, that this woman by an irregular appetite had chewed and eaten one sort of these stones, which afterwards by some viscous matter were concreted together in the body; by virtue of which viscous matter mixed with the stones alone it was, that those stones thus concreted made the said effervescence.

Mr. OLDENBURG produced several papers communicated to him; one from Dr. BEAL, containing two instances of something remarkable in shining flesh [n]: the second from Monsr. LEIBNITZ, concerning sparks seen in an old baroscope upon agitation: the third from Dr. COLE, concerning the spiral, instead of the hitherto supposed annular structure of the fibres of the intestines.

As to the first, it being mentioned, that a warm and moist air might contribute to the production of such a phænomenon, the president said, that since we were

[m] It is printed in the Philosoph. Transact. vol. xi. n° 125. p. 603. for May, 1676.

[n] This paper is printed in the Philos. Transact. vol. xi. n° 125. p. 599.

maſters of ſuch a cauſe, it were worth trying, whether ſuch a phænomenon could be raiſed from it.

As to the ſecond, the preſident intimated, that he would exhauſt all the air out of the mercury, and make a mercurial tube ſtand top-full, and then make it fall down, and ſo obſerve, whether any ſuch light appeared.

For the third, the operator was ordered to boil the colon of a ſheep's gut on the Thurſday following four hours immediately preceding the Society's meeting, that ſo it might be produced there for making the obſervation of Dr. COLE.

Mr. AUBREY acquainted the Society, that he had received from Sir FRANCIS ROLLE ſome manuſcripts of Mr. FOSTER *, for their peruſal. It was only deſired, that the Society would give aſſurance to ſee them returned, when they had done with them, to Mr. OVERTON, from whom they had been obtained by the ſollicitation of Mr. ANDREW PASCALL, rector of Chedſey in Somerſetſhire.

Hereupon the Society ordered, that Mr. COLLINS ſhould be deſired to peruſe theſe manuſcripts, and make a report of them to the Society: and that they ſhould be faithfully returned to Mr. OVERTON, as ſoon as the Society had done with them.

The titles of the MSS. as taken out of Mr. PASCALL's letter to Mr. AUBREY, dated at Chedſey, 7th April, 1676, were as follows:

1. *Motuum & eclipſium ſolis & lunæ computatio trigonometrica juxta hypotheſes Lanſbergii ad commodiorem calculi formam reducta; cui præfigitur problematum etiam primi motus (quæ ad eclipſes ſpectant) ſolutio.*

2. *Kepleri præceptum 25 illuſtratum, demonſtratum, refutatum.*

3. A general inſtrument deſcribed, and the uſe declared in the working of proportions of eight ſeveral kinds, i. e. of, 1. Numbers or equal parts. 2. Equal parts and ſuperficies. 3. Equal parts and ſolids. 4. Equal parts and tangents. 5. Sines with ſines. 6. Sines with verſed ſines. 7. Sines with equal ſines. 8. Sines with tangents.

4. A lecture about the ſun's motion; *delineatio Procli de* * *

5. *Explicationes in tabularum Rudolphinarum capita quatuordecem.*

6. *Horologiorum ſciatericorum deſcriptiones variæ.*

7. *Ad commentarios ſectoris & radii, ut & eminentiſſimarum propoſitionum paralipomena.*

* Mr. SAMUEL FOSTER, profeſſor of aſtronomy in Greſham college, who died in July, 1652. Dr. WARD's Lives of the Profeſſors of Greſham College, p. 85.

8. Part of Mr. GUNTER's book explained, of the ſector.

9. The firſt book of geometry of problems, in the ſtructure whereof only circles and right lines are uſed.

10. The ſecond book of geometry, of the nature of crooked lines: and the third of the conſtruction of problems, that are ſolid.

The preſident nominated and appointed the lord biſhop of Cheſter, Sir JONAS MOORE, Dr. JOHN PELL, and Dr. WALTER NEEDHAM to be vice-preſidents of the Society.

*June* 1. Sir THOMAS CLUTTERBUCK was propoſed candidate by Mr. OLDENBURG.

Mr. SMETHWICK gave an account of the ſun's eclipſe obſerved by him that morning, as follows [p]:

*Initium defectionis Weſtmonaſterii* - - - - *h.* 7 50′ } *Poſt meridiem veterem*
*Finis* - - - - - - - - 9 54¾ } *Junii* 1, 1676.
*Totius eclipſis duratio horæ* 2 4′¾.

The obſervation was made by a ſecond pendulum corrected by two days obſervations, and a tube of ſeven feet and a half.

According to this obſervation the eclipſe began ſooner by 4′, and ended ſooner by 8′, than Mr. FLAMSTEAD had predicted in the Royal Almanack.

It was ordered that Mr. FLAMSTEAD's and Mr. STREET's obſervations ſhould be inquired after.

One Mr. BOWLAND, who had lived at Tangier for ſix or ſeven years, ſhewed the Society ſome obſervations about the tides and current of the Straits, viz. that there is in the Straits mouth not only a current, but alſo a conſtant flux and reflux following the motion of the moon, concerning which he promiſed to give the Society his particular obſervations proving the matter of fact.

Mr. OLDENBURG read a letter written to him from Dublin, dated 10th May, 1676, by Mr. HENRY NICHOLSON, relating [q] a ſtrange effect of thunder upon a magnetic ſea-card, whoſe north and ſouth points had changed poſitions in ſuch a manner, that though the maſter of the ſhip had with his finger brought the flower de lys to point directly north, it would as ſoon as at liberty return to the new unuſual poſture. Beſides, upon examination it was found, that every compaſs in the ſhip was of the ſame humour. Capt. GROFTON of New England

[p] It is printed in the Philoſoph. Tranſact. vol. xi. n° 126. p. 637.

[q] It is printed in the Philoſ. Tranſact. vol. xi. n° 127. p. 647.

was

was ſaid to be the maſter of the ſhip, to which this accident happened; and Mr. HOWARD, maſter of ſeveral ſhips, and a man of good credit, was the relater of this accident.

It was ordered, that theſe perſons be inquired after and examined concerning the truth of this relation.

Dr. GREW entertained the Society with his diſcourſe concerning the operation of ſpirit of nitre and oil of vitriol upon animal bodies, both of the exterior and interior parts of them. The exterior were hairs, nails, hoofs, and horns, ſhells, ſhelly inſects, teeth and other bones, fleſh, and all the viſcera, blood, muſk, civet, ſperma ceti, gall, wine, ſalt of blood, of hartſhorn, of wine, tartar of wine, ſtones, as of the bladder, of the gall, bezoar, weſtern and oriental, of ſtones extraordinary voided by a woman in Hereford.

He was thanked for his diſcourſe, and deſired to give it to be entered [r] and printed [s] with his former diſcourſe.

*June* 8. Three letters were read,

1. Written at Liege, 27th May, 1676, by Mr. LUCAS, ſucceſſor in the mathematical profeſſorſhip there to Mr. ANTHONY LINUS, containing partly an account of the ſucceſs of Mr. NEWTON's experiment there; partly ſome new objections againſt Mr. NEWTON's theory of light and colours [t].

This letter was ordered to be copied, and the copy to be immediately ſent to Mr. NEWTON at Cambridge for his anſwer thereto.

2. A letter from Mr. BOUCHIER to Mr. EDMUND HALLEY from Jamaica, 10th March, $167\frac{5}{6}$, communicated by the latter to Mr. OLDENBURG, giving an account of divers remarkable particulars in that iſland, its ſalubrity, productions, and fitneſs for aſtronomical obſervations, there being ſcarce two cloudy nights in a whole year.

3. A letter from Mr. HENRY NICHOLSON, dated at Dublin, 20th May, 1676, relating a ſtrange effect of thunder upon a magnetic ſea-card, its north and ſouth points having changed poſitions irrecoverably; and containing likewiſe ſome obſervations about the alteration of the temperature of Ireland and other countries; as alſo the contrivance of an hygroſcope; together with an experiment propoſed for diſcovering the uſe of reſpiration; and ſome obſervations concerning the American flying hart, and the ſtrong muſky ſcent of the animal called muſk-quaſh [u].

There was alſo read Mr. COLSON's obſervation of the late ſolar eclipſe of June 1, made at Wapping [x].

[r] Regiſter, vol. v. p. 147.
[s] It is printed in his *Anatomy of Plants*, p. 242.
[t] This letter is printed in the Philoſ. Tranſact. vol. xi. n° 128. p. 692.
[u] This letter is printed in the Philoſ. Tranſact. n° 127. p. 647 & ſeqq.
[x] Ibid. n° 126. p. 637.

*June*

*June* 15. There were read two letters, the one written by Mr. HENRY HALL to Mr. OLDENBURG out of Glouceſterſhire, giving an account of the iron and coal mines in the foreſt of Dean.

The other letter was from Mr. NEWTON, dated at Cambridge, 13th June, 1676, containing partly a general anſwer to Mr. LUCAS's letter [y], with a promiſe of a particular one; partly ſome communications of an algebraical nature for Monſ. LEIBNITZ, who by an expreſs letter to Mr. OLDENBURG had deſired them [z].

*July* 18. At a meeting of the COUNCIL were preſent

Sir JONAS MOORE, vice-preſident, in the chair,

| | |
|---|---|
| Sir ROBERT SOUTHWELL, | Mr. COLWALL, |
| Dr. CROUNE, | Mr. OLDENBURG. |

It was ordered, that n° 127 of the *Philoſophical Tranſactions* with two tables of cuts be printed by the printer of the Society.

*October* 3. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,

| | |
|---|---|
| Sir JONAS MOORE, | Dr. GREW, |
| Dr. HOLDER, | Mr. MILLES, |
| Mr. COLWALL, | Mr. OLDENBURG. |

It was ordered, that n° 128 of the *Philoſophical Tranſactions* with two tables of cuts be printed by the Society's printer.

The preſident was put in mind of giving order for ſummoning the Society to meet again; which his lordſhip ſaid he would do on the firſt Thurſday in the approaching term, October 26.

*October* 12. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,

| | |
|---|---|
| Sir PAUL NEILE, | Mr. COLWALL, |
| Dr. PELL, | Mr. HILL, |
| Dr. CROUNE, | Mr. OLDENBURG. |
| Dr. GREW, | |

It was ordered, that the Society's printer, Mr. MARTYN, be required to give notice in the *Philoſophical Tranſactions* next to be printed, of what the council was

[y] See Philoſoph. Tranſact. vol. xi. n° 128. p. 698.

[z] This part of Mr. NEWTON's letter was ſent to Mr. LEIBNITZ at Paris, 26th June, 1676, together with a MS. of Mr. COLLINS, containing extracts of Mr. JAMES GREGORY. See *Commercium Epiſtolicum*.

informed

informed he had declared, viz. that the tract called *Lampas* [a], made by R. Hooke, fellow of the Royal Society, and lately printed by John Martyn, printer to the said Society, to which is annexed *a postscript*, reflecting on the publisher of the *Transactions* [b], was printed without the leave or knowledge of the council of

[a] It was printed in 4to, and intitled *Lampas: or Descriptions of some mechanical Improvements of Lamps and Waterpoises. Together with some other physical and mechanical Discoveries. With a Postscript in reply to* Mr. Oldenburg.

[b] The dispute between Mr. Hooke and Mr. Oldenburg began on the following occasion: Mr. Hooke, soon after the restoration, shewed the movement of a watch, regulated by a spiral spring applied to the arbor of the balance, and designed for discovering the longitude, to some of his friends, through whose interest in the year 1663 he might have had a patent for the invention; but not liking the conditions, the matter was laid aside. The year following he read several of his Cutlerian lectures upon that subject in the reading-hall at Gresham College, and caused several of the said watches to be made. [See his Life by Mr. Waller prefixed to his *posthumous works*, p. 5.] Some account of this invention was afterwards given in the *History of the Royal Society*, p. 247, (though not so full as Mr. Hooke could have wished) where among other inventions, are recounted "several new kinds of pendulum "watches for the pocket, wherein the motion is "regulated by springs." Thus continued the affair till Monsr. Huygens sent a letter to Mr. Oldenburg, dated 30th January, 167⅘, N. S. acquainting them with an invention of his of very exact pocket watches, the nature and contrivance of which he imparted to Mr. Oldenburg in an anagram, which in a subsequent letter, of 20th February, N. S. he explained by a full description; for which the Royal Society returned him thanks on the 18th of that month, O. S. at which time Mr. Hooke said, that divers years before he had such an invention, and that actually watches had been made according to the same; for which he appealed to the Journal Books of the Royal Society, to the *History of the Society*, and to several members. Upon which the Society ordered, that Monsr. Huygens should be informed, what had been done here; and what were the causes of its want of success. Not long after came over from Paris in the *Journal des Sçavans*, for 25 February, 167⅘, a printed description of Monsr. Huygens's invention, with a delineation of its figure; an extract of which *Journal* was printed 12th March following, in the *Philosophical Transactions*, vol. xi. nº 112. p. 272. This gave offence to Mr. Hooke; who in a *postscript* to his *Description of Helioscopes*, printed in 1675, complained of Mr. Oldenburg, the publisher of the extract, for omitting to take notice, that "this in-"vention was first found out by an Englishman, "and long since published to the world;" and he called this *unhandsome proceedings*. And at the same time he said, that as to the models, which he had yet produced, he was unwilling to add any of the better applications of the springs to them, waiting for an opportunity more to his advantage. Mr. Oldenburg answered to this in the *Philosoph. Transact.* nº 118. p. 440. for October, 1675, that Mr. Hooke both saw and copied the figure of Monsr. Huygens's watch before the extract of the *Journal des Sçavans* was made. And as he knew that both would be published in one of the *Transactions*, had he given to the editor of them the least intimation, that he desired, that notice might be taken at the same time of his invention of the like kind, it would have certainly been done, as it had been before on other occasions. But Mr. Oldenburg seeming to resent it, that he should be charged with *unhandsome proceedings* on this account, in return he said, that "though Mr. Hooke had "some years before caused some watches to "be made of this kind, yet without publish-"ing to the world a description of them *in print*; "and it is certain, that none of those watches "*succeeded*." In reply to this, Mr. Hooke in the *postscript* to his *Lampas*, blamed Mr. Oldenburg for affirming "what he could not know with re-"gard to the *success* of his watches, whom, as he "said, he had not acquainted with his inven-"tions, since he looked on him as one, who "made *a trade of intelligence*." And as to his not having himself published them to the world *in print*, he said, "they were publicly read of in "Sir John Cutler's lectures, shewn to thousands "both English and foreigners, written of to several "persons absent, and published *in print* in the "*History of the Royal Society*." Whether Mr. Hooke's watches were *unsuccessful* or not, Mr. Waller says, (Life of Dr. Hooke, p. 7.) he "could not learn, but was inclined to think that "expression of Mr. Oldenburg proceeded from "passion, the invention and principle of Mr. "Hooke's and Monsr. Huygens's being both "the very same, as are now used." Mr. Oldenburg took no farther notice of this reply of Mr. Hooke than to publish the following *advertisement* at the end of the *Transaction* for August and September, 1676. "The publisher of this tract in-"tends to take another opportunity of justifying "himself

of the Royal Society, and that the ſaid printer had ſeen nothing of the poſtſcript thereof before it was printed off, nor knew any ground for the aſperſions contained therein: and in caſe the ſaid printer ſhould refuſe to obey this order, that then the new printer, whom the preſident hath power to conſtitute in his room, be required to ſignify to the public in print, that Mr. MARTYN was removed for diſobeying this order of the council.

It was ordered, that Mr. COLWALL and the ſecretary do prepare for the next meeting of the council a liſt of thoſe, who had not yet ſealed the bond, nor paid their weekly contributions.

*October* 26. The SOCIETY reſumed their weekly meetings.

Dr. GREW made a diſcourſe on the anatomy of ſome roots of vegetables and of their leaves [c], exhibiting at the ſame time very curious figures of what he had thus diſcourſed of.

The Society was very well pleaſed with his performance, and declared the diſcourſe and the ſchemes very well worth the publiſhing [d].

Mr. OLDENBURG preſented to the Society from Mr. BOYLE his new book, intitled, *Experiments, Notes, &c. about the mechanical Origin of divers particular Qualities: among which is inſerted a Diſcourſe of the Imperfection of the Chemiſts Doctrine of Qualities: together with ſome Reflections upon the Hypotheſis of* Alkali *and* Acidum.

The preſident remarked, that having read this book of Mr. BOYLE, he thought it very well worth the reading of philoſophical men.

*November* 2. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,

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|---|---|
| Sir JONAS MOORE, | Dr. CROUNE, |
| Mr. HILL, | Mr. COLWALL, |
| Dr. HOLDER, | Mr. OLDENBURG. |

Upon the debate concerning a ſcandalous *poſtſcript* annexed to a book called *Lampas*, it was ordered, that it be referred to Dr. CROUNE and Mr. HILL, to preſent a draught to the council of what they conceived might be fit for the council to publiſh in the next *Tranſaction* in behalf of Mr. OLDENBURG's integrity and faithfulneſs to the Royal Society.

" himſelf againſt the aſperſions and calumnies of " an immoral poſtſcript put to a book called *Lam-* " *pas*, publiſhed by R. HOOKE, till which time, " it is hoped, the candid reader will ſuſpend his " judgment."

[c] This diſcourſe on the anatomy of leaves is entered in the Regiſter, vol. v. p. 157.

[d] They are printed in his *Anatomy of Plants*, b. 4. p. 145. *& ſeqq.*

At the ſame time leave was given to Mr. OLDENBURG to print that part of Monſ. HUYGENS's letter to him, 20th February, 167⅘, which devolves on the Royal Society his right of deſiring in England a patent for his watches [e].

Mr. HENRY HUNT being propoſed to ſucceed in Mr. SHORTGRAVE's place, the council having heard the ſeveral good teſtimonies given him of his abilities and honeſty, received him to be operator to the Society, *quamdiu ſe bene geſſerit*; and he was ſworn at the ſame time.

At a meeting of the SOCIETY on the ſame day,

Mr. OLDENBURG read a letter of Dr. LUCAS HODGSON, a practitioner of phyſic at Newcaſtle, dated there, 15th May, 1676, giving an anſwer to ſeveral queries formerly ſent to him by Mr. BOYLE concerning the ſubterraneal fire, that had been burning in a coal-mine very many years near Newcaſtle [f]: which letter was accompanied with a box, containing ſome of the ſal armoniac, as it was gathered there from fire; together with ſome of the ſpirit of that ſal armoniac diſtilled from quick lime; as alſo ſome white ſalts ſublimed from the ſaid natural ſalt.

Mr. HOOKE mentioned a new ſanative ſpring lately diſcovered in Staffordſhire, healing divers diſeaſes, as the dropſy, ſcurvy, &c. adding, that a book was printed concerning it.

It was ordered, that the lord BRERETON ſhould be written to by Mr. OLDENBURG, and deſired from the Society to peruſe the ſaid book, and give them an account how far the real effects anſwered the particulars mentioned in it: as alſo to learn henceforward what kind of perſons repair to thoſe waters, and what effects they have upon them.

Mr. OLDENBURG preſented from Sir ROBERT SOUTHWELL for the repoſitory a paper of gold ſand brought over by him from Portugal, and taken out of a river near Coimbra, having yielded ſome ſmall grains of good gold.

Mr. OLDENBURG read a paper ſent to him from Paris about an odd kind of grain, called by the writer corrupted rye, growing in certain years in ſeveral provinces of France, and being ſo corrupted, that thoſe, who eat of the bread having much of this grain in it, are ſeized by a gangrene in one part or another, the gangrene not being preceded by any tumour, inflammation, or conſiderable pain, and the gangrened parts falling off of themſelves ſo as that there is no need to ſeparate them by any remedies or inſtruments: and it being given to ſeveral animals, they died [g]. Some members thought, that it was very well worth making a chemical analyſis of this corrupted rye, and to compare it with the like chemical reſolution of good rye, Others ſuggeſted, that ſome good rye might

[e] Mr. OLDENBURG publiſhed that part of Monſ. HUYGENS's letter in the Philoſ. Tranſact. vol. xi. n° 129. p. 749.

[f] This letter is printed, n° 130. p. 762.

[g] This account is printed in the Philoſoph. Tranſact. n° 130. p. 758.

be

be planted in the ground, where this corrupted rye uſes moſt to grow, in order to ſee how that would prove.

*November* 9. Mr. CHARLES HOWARD produced a parcel of wheat grown here of wheat brought from Tangier.

He produced alſo ſome red-ſtreak and red red-ſtreak apples, grown at Darking, of ſome of the grafts, which formerly were diſtributed by the Society, to whom they had been ſent by Mr. REED out of Herefordſhire.

Dr. GREW read a diſcourſe concerning flowers, accompanied with many elegant and curious ſchemes in preſenting the particulars diſcourſed of [h].

He had the applauſe of the Society, who declared the diſcourſe and figures very well worth publiſhing [i].

Mr. BALLE brought in two pieces of amber, ſent from Capt. SILAS TAYLOR to the Society for their repoſitory, and ſaid by him to have been taken up in Suffolk at Tangirsford, not far from Harwich.

*November* 16. Mr. OLDENBURG read a long letter to himſelf from Mr. JOHN BEAUMONT, junior, of Stony Eaſton in Somerſetſhire, dated 17th June, 1676, containing a diſcourſe about rock-plants and their vegetation, together with an account of thoſe various figures, that are found among minerals [k].

Mr. OLDENBURG read likewiſe a letter to himſelf, dated 9th July, 1676, from Mr. LISTER, concerning the black reſin formerly communicated by him to the Society, concerning which he intimated the difficulty of finding out a menſtruum to diſſolve it; affirming in the mean time, that what he had ſent was purely natural, and had never yet come near the fire, and was made much after the manner, in which indico is made, except that here the plant is bled, or its veins being cut it is dropped into cold water, the ſediment of which liquor, he ſaid, was this black reſin ſent by him, without any further proceſs upon it. He added, that it was a totally inflammable reſin; and that it would not be brought to diſſolve or give its tincture by any means hitherto uſed by him, which, he obſerved, had not been a few.

Mr. OLDENBURG communicated a third letter to himſelf from Signor CASSINI, dated at Paris 24th October, 1676, acquainting the Society with ſome of the aſtronomical obſervations made in 1672, by Monſ. ROCHER at Cayenne in America, whither he had been ſent by the Royal Academy of Sciences at Paris, on purpoſe to make ſuch obſervations.

*November* 20. At a meeting of the COUNCIL were preſent

[h] It is inſerted in the Regiſter, vol. v. p. 168.

[i] It is printed in his *Anatomy of Plants*, b. 4. p. 163.

[k] This letter and a former on the ſame ſubject, dated 7th April, 1676, are printed in the Philoſ. Tranſact. vol. xi. n° 129. p. 724. & *ſeqq.*



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The lord viſcount BROUNCKER, preſident,

| | |
|---|---|
| Sir PAUL NEILE, | Mr. MILLES, |
| Dr. CROUNE, | Mr. HILL, |
| Dr. GREW, | Mr. OLDENBURG. |
| Mr. COLWALL, | |

A committee of the council was appointed for auditing the treaſurer's accounts, conſiſting of the preſident, Dr. CROUNE, Mr. MILLES, Mr. HILL, and Mr. OLDENBURG.

Upon a debate how to proceed with thoſe members of the Society, who had not yet ſealed the bond, nor paid their arrears, it was ordered,

That the bond for payment of the weekly contributions to the Society be offered by Mr. WICKS, their clerk, to every member, who had not yet ſealed it; and that in caſe any perſon ſhould refuſe to ſeal the ſaid bond, his final anſwer be by the ſaid clerk reported to the council, that ſo they might know, whether they ought to look upon ſuch perſon any longer as a member of the ſaid Society, or not.

It was ordered, that Dr. MEIBOMIUS's two books, *de Triremium fabrica*, and *de Proportionibus*, be bought for the library of the Society.

Dr. CROUNE and Mr. HILL brought in their report concerning the *poſtſcript* annexed to the *Lampas*, viz.

" Whereas the publiſher of the *Philoſophical Tranſactions* hath made complaint " to the council of the Royal Society of ſome paſſages in a late book of Mr. " HOOKE, intituled *Lampas*, and printed by the printer of the ſaid Society, re- " flecting on the integrity and faithfulneſs of the ſaid publiſher in his manage- " ment of the intelligence of the ſaid Society: the council hath thought fit to " declare in behalf of the publiſher aforeſaid, that they knew nothing of the " publication of the ſaid book: and further, that the ſaid publiſher hath carried " himſelf faithfully and honeſtly in the management of the intelligence of the " Royal Society, and given no juſt cauſe for any ſuch reflections."

This report was approved, and ordered to be printed in the *Philoſophical Tranſactions*[1].

*November* 23. At a meeting of the COUNCIL were preſent,

The lord viſcount BROUNCKER, preſident,

| | |
|---|---|
| Mr. COLWALL, | Dr. GREW, |
| Dr. CROUNE, | Mr. OLDENBURG. |

[1] It is printed there, nº 129. p. 749.

It

It was ordered, that n° 129 of the *Philoſophical Tranſactions* for the months of October and November, 1676, together with a declaration of this council at their laſt meeting, ordered to be printed in the next *Tranſaction*, be printed acordingly.

At a meeting of the SOCIETY on the ſame day,

Mr. JOHN KING, profeſſor of rhetoric in Greſham-College, was propoſed candidate by Mr. HILL.

Mr. OLDENBURG read a relation tranſmitted from Paris concerning a corrupted kind of rye; growing in ſome parts of France; as alſo a narrative of ſome uncommon effects of tempeſtuous thunder and lightening near Soiſſons in France [m].

He read an extract of a letter from Florence concerning a prodigious fire, that appeared there the 31ſt of March, 1676, ſent to the Abbe de la ROQUE at Paris, together with an account ſent to Signor CASSINI of the ſame phænomenon ſeen at Rome, Genoa, Bologna, Imola, and other places, the ſame day, and about the ſame hour, that it appeared at Florence [n].

*November* 30. Sir RICHARD EDGECOMBE was elected and admitted.

Sir THOMAS CLUTTERBUCK and Mr. KING were elected.

A committee was choſen of the Society for auditing the accounts, which could not be done before, by reaſon of the preſident's abſence and indiſpoſition, and that no vice-preſident was preſent, when this committee ſhould have been choſen. The committee now choſen were Mr. BARRINGTON, Mr. AUBREY, Mr. HAAK, Mr. HOOKE, and Mr. COLLINS.

Theſe went preſently apart to examine the ſaid accounts, and both the committee of the council and this committee made their report as follows:

"At a committee of the Royal Society for auditing the treaſurer's accounts, November 30, 1676,

"We find the treaſurer debtor,

| | *l.* | *s.* | *d.* |
|---|---|---|---|
| "To monies he hath received on the ſeveral quarterly payments "of the Society, 30th Nov. 1675, to 30th Nov. 1676, | 155 | 1 | 0 |
| "To money he hath received for admiſſions | 9 | 0 | 0 |
| "To one year's rent for the fee-farm of the priory of Lewes, due "at Michaelmaſs, 1675, | 24 | 0 | 0 |
| "To the balance of the laſt account | 34 | 17 | 5 |
| | £222 | 18 | 5 |

[m] This account is printed in the *Journal des Sçavans*, for May, 1674.

[n] Theſe accounts are printed in the ſame *journal*.

"We,

" We find him alſo creditor,

| | l. | s. | d. |
|---|---|---|---|
| " By monies he hath paid for the uſe of the Society, as appears by " by examination of the vouchers - - - - - - | 192 | 7 | 8 |
| " By balance reſting in caſh in his hands, thirty pounds ten ſhil- " lings and nine pence, - - - - - - - | 30 | 10 | 9 |
| | £222 | 18 | 5 |

After this Mr. HENSHAW deſired, that notice might be taken, that Mr. HOOKE acknowledged to have received the MS. of St. CYPRIAN which Mr. HENSHAW had formerly borrowed out of the Society's library in Arundel-Houſe; and that the engagement, which he had given for it, being in the hands of Mr. OLDENBURG, might be returned to him.

This being done, the Society proceeded to their anniverſary election, and continued the following perſons in their council for the year enſuing, viz.

The lord viſcount BROUNCKER,
The earl marſhal,
The lord biſhop of Saliſbury,
Sir JOSEPH WILLIAMSON,
Sir JONAS MOORE,
Mr. HENSHAW,
Mr. COLWALL,
Mr. MILLES,
Dr. CROUNE,
Mr. HILL,
Mr. OLDENBURG.

The new members of the council elected were

The lord BERKLEY,
Sir JOHN LOWTHER,
Mr. AERSKINE,
Sir CHRISTOPHER WREN,
Sir JOHN HOSKYNS,
Mr. PEPYS,
Mr. EVELYN,
Dr. WHISTLER,
Dr. MAPLETOFT,
Mr. CREED.

Of this council were elected

The lord viſcount BROUNCKER, preſident,
Mr. COLWALL, treaſurer,
Mr. HENSHAW, } Secretaries.
Mr. OLDENBURG, }

Of the new elected members of the council were ſworn Sir JOHN LOWTHER, Mr. AERSKINE, Sir CHRISTOPHER WREN, Mr. PEPYS, Mr. EVELYN, Dr. WHISTLER, Dr. MAPLETOFT.

*December* 7. Mr. HOOKE ſhewed ſome magnetical experiments *.

* The particulars were omitted to be entered in the Journal.

It was ordered, that theſe experiments be proſecuted; and that the committee formerly appointed to take care of the repoſitory be deſired to have a good inclinatory needle made, and ſuſpended in the Society's repoſitory, to ſee what change there would be in it in tract of time; as alſo to obſerve, whether this dipping needle anſwers the latitude from the pole of the world.

Mr. OLDENBURG read a letter from Signor GREGORIO LETI at Genoa to the Society, accompanied with another from him to Mr. OLDENBURG, dated 8th July, 1676, and with four copies of his book, intitled *Italia Regnante*, in four tomes, the fourth of which was dedicated to the Society. One copy of all the four tomes was now preſented bound; the other three copies in quires, Mr. OLDENBURG ſaid, ſhould be produced at the next meeting.

It was ordered, that a letter of thanks to Signor LETI ſhould be drawn up by Mr. OLDENBURG.

*December* 14. At a meeting of the COUNCIL were preſent,

The lord viſcount BROUNCKER, preſident,

| | |
|---|---|
| The lord biſhop of Saliſbury, | Mr. COLWALL, |
| The lord BERKLEY, | Mr. HILL, |
| Sir JOHN LOWTHER, | Mr. CREED, |
| Sir CHRISTOPHER WREN, | Mr. OLDENBURG. |
| Sir JOHN HOSKYNS, | |

Mr. OLDENBURG read a letter to himſelf, dated at Amſterdam, 1ſt December, 1676, from a merchant named ELIAS SANDRA, junior, deſired to be communicated to the Royal Society, containing an offer made by the ſaid merchant of diſcovering to the Society ſuch places, where great plenty of ambergriſe is to be found; which diſcovery he would make upon certain conditions and articles accompanying this offer.

The council upon the debate of the whole reſolved, that the ſecretary ſhould return an anſwer to this offer, viz. that the articles appearing to them to be ſuch, as required perſonal conferences between the parties contracting for the better underſtanding of one another's minds, the council would treat with him, if he thought fit to come over: and farther, that they were of opinion, that in caſe they could agree with him in the reſt, they ſhould not differ with him as to his demanded third, nor the import of the firſt and eighth articles, provided firſt, that, when he had made the diſcovery, it ſhould not be found a thing already known; and then that the places of finding the propoſed plenty of ambergriſe be not ſubject to ſome juriſdiction or other of either the Engliſh or Dutch Eaſt India company, or any other, that might juſtly oppoſe or hinder the execution of the deſign.

N° 130 of the *Philoſophical Tranſactions* was ordered to be printed by the Society's printer.

At

At a meeting of the SOCIETY on the ſame day,

Mr. HOOKE, upon account of the preſence of Sir JOSEPH WILLIAMSON, one of the principal ſecretaries of ſtate, repeated his ſuggeſtions, made at the laſt meeting, concerning the dipping needle, viz. that it was very difficult to find what the inclination of the needle ſhould be; and there being no certain way of knowing the needle's inclination, there could be no certainty of knowing the longitude thereby.

He ſaid, that, according as the needles are longer or ſhorter, they have different inclinations; and that it is not known what diſtance the dipping needle muſt have from the magnet for ſuch or ſuch a latitude.

He added, that if we have but the true variations of two places, whoſe longitudes are exactly known, that will give us the magnetical pole: and then if the variation be true, and the pole given, we need no dipping-needle, becauſe we ſhall then be able to tell where the needle muſt dip.

*December* 21. A motion being made, that the Regiſter and Letter-books of the Society might be reviewed, in order to ſee what might be fit to be be publiſhed; it was ordered, that Dr. WHISTLER, Dr. CROUNE, Mr. HILL, Mr. OLDENBURG, and Mr. HOOKE, or any three of them, be a committee for that purpoſe; and that they acquaint the preſident with the particulars, which they ſhall have thus ſelected.

Dr. GREW read his lecture concerning the eſſential and marine ſalts of vegetables[1], wherein he aſſerts, that there is no generation of bodies unorganical but what it is in the power of art, by mixing or unmixing, to make or imitate. Several inſtances whereof were formerly given by him, and the artificial productions in imitation of thoſe of nature viewed and tried before the Society; one of which was a marine or common ſalt, made out of the lixivial ſalt of a vegetable; and becauſe this ſeemed to be doubted of more than the reſt by ſome learned perſons then preſent, he thought it requiſite to proſecute the experiment, that, if poſſible, it might become clear and unqueſtionable. And becauſe the former method was imperfect, and required a long time (three quarters of a year at leaſt) for the experiment, he ſaid that he had bethought himſelf of another way, which proved better and much more expeditious, and which withal afforded him not only a true and perfect marine ſalt out of the ſalt of a plant, but alſo a third kind of ſalt different from both; which may not be improperly called, the eſſential ſalt or nitre of plants. The hiſtory or manner of the production he gave an account of in his lecture.

$167\frac{6}{7}$, *January* 4. Mr. OLDENBURG produced a preſent, ſent by a gentleman of Germany, named CHRISTIANUS ADOLPHUS BALDUINUS, to the king, as founder of

[1] It is inſerted in the Regiſter, vol. v. p. 178. and printed in his Anatomy of Plants, lecture 4. p. 261.

the Royal Society, and to the Society jointly, viz. a ſtony ſubſtance or paſte, which being expoſed a little while to the day-light, or flame of a candle, will ſo imbibe the light, as to ſhine in the dark like a glowing coal.

There being a letter ſent with it, dated 1ſt September, 1676, it was read and ordered to be regiſtered [m], and the preſenter to be ſolemnly thanked by a letter to be drawn up by Mr. OLDENBURG, who propoſed him candidate for election into the Society.

The experiment with this ſhining ſtone was tried, and ſucceeded pretty well, but not ſo well as was expected, it being almoſt night, and very dark weather.

*January* 11. The ſtone ſhining in the dark was tried again, and fully anſwered the import of the letter of the preſenter.

It gave occaſion of diſcourſe to the Society, whether this ſubſtance gained the light by imbibition; or whether the light was cauſed by a communication of the motion of the ſun's or candle's light, &c.

Dr. CROUNE mentioned, that Mr. BOYLE having publiſhed many experiments, ſhewing, that divers ſubſtances being expoſed to the fire increaſed in weight thereby, it ſeemed worth while to obſerve, whether ſome of thoſe bodies would not ſo receive light, as to render it in the dark.

There was read part of a letter of Dr. BEAL, dated at Yeovil, 27th December, 1676, giving an account of his thermometrical and baroſcopical obſervations in the laſt ſharp froſt; the ſum whereof was, that he never ſaw the liquor in the ſcaled thermometer deſcend near ſo low as it was from December 15 to December 20; and that the barometer ſtood at a more than ordinary hight in the extreme froſt; but deſcended a quarter of an inch a-day before the alteration appeared, and was on the 27th of December at the higheſt again.

*January* 18. Dr. Grew entertained the Society with a lecture concerning experiments in conſort upon the diſſolution of ſalts in water [n].

In this diſcourſe he examined and ſhewed before the Society, that water having been fully impregnated with one kind of ſalt, ſo as to bear no more of that kind, it will yet bear or diſſolve ſome portion of another, and ſo of a third: the doing of which having brought into his mind divers other experiments relating thereto, he delivered them likewiſe in this diſcourſe: as

1. With what difference this ſuper-impregnation may be made upon the ſolution of different ſalts.

[m] It is printed in the Philoſoph. Tranſact. vol. xi. n° 131. p. 788.

[n] It is inſerted in the Regiſter, vol. v. p. 188. and printed in his *Anatomy of Plants*, lecture 7. p. 296.

2. Whether the ſolution of a ſmaller quantity of ſeveral ſalts is not conſiſtent with the non increaſe of the bulk of the water.

3. What quantity of the ſeveral kinds of ſalt may be diſſolved ſeverally in the ſame quantity of water.

4. Whether by diſſolving a ſalt in water, there be any ſpace gained or not; that is, whether the bulk of the water be greater before the ſalt lying in it be fully diſſolved, than afterwards.

5. Whether the ſpace be equally gained by an equal increaſe of the ſame ſalt.

6. Whether upon diſſolution of the ſeveral kinds of ſalts be gained ſo many ſeveral quantities of ſpaces.

7. What that juſt ſpace may be, which any ſalt gains with reſpect to itſelf or its own bulk.

8. What that juſt ſpace may be, which any ſalt gains with reſpect to the bulk of the water.

The experiments of all which he explained in the diſcourſe itſelf.

It was ordered, that the experiment of diſſolving ſeveral ſalts, one after another, in water, as common ſalt, nitre, alums, ſal armoniac, ſhould be tried before the Society at their next meeting.

Mr. HENSHAW preſented from Sir JOHN CLAYTON a piece of the Bononian ſtone.

Mr. OLDENBURG read a letter from Dr. MURALTUS, a phyſician of Zurich, dated 20th December, 1676, concerning the generation of cryſtal.

*January* 25. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident.

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| Mr. AERSKINE, | Mr. MILLES, |
| Sir JOHN LOWTHER, | Mr. HILL, |
| Mr. HENSHAW, | Mr. CREED, |
| Mr. COLWALL, | Mr. OLDENBURG. |

Mr. HENSHAW was ſworn vice-preſident of the Royal Society.

Mr. OLDENBURG acquainted the council from the earl marſhal, that his lordſhip was deſirous, that the library at Arundel Houſe given by him to the Royal Society might be better looked after: as alſo, that he ſhould be glad to have thoſe books of that library delivered to him, which he had reſerved out of it to himſelf at the time of the donation thereof, viz. books of heraldry and genealogy.

It

It was ordered hereupon, that Sir JOHN HOSKYNS, Mr. EVELYN, Mr. HILL, and Mr. OLDENBURG, or any two or more of them, ſhould be a committee to attend the earl marſhal, to deliver to his lordſhip ſuch books as he had reſerved to himſelf out of the Arundelian library; as alſo to ſecure that library from damage.

It was ordered likewiſe, that the apothecary's bill for the laſt ſickneſs of the late Mr. SHORTGRAVE [o], amounting to about five pounds, be paid by the treaſurer, Mr. SHORTGRAVE's widow having firſt delivered up to Mr. HUNT all the inſtruments, utenſils, &c. belonging to the Society, ſo that ſatisfaction be given in this matter to the committee appointed for taking care of the repoſitory.

N° 131 of the *Philoſophical Tranſactions* for January, $167\frac{6}{7}$, was licenſed.

Mr. HUNT was ordered to take a copy of the picture of the late Dr. WILKINS, lord biſhop of Cheſter.

It was ordered, that the aſtronomical inſtruments belonging to the Society, and being in their repoſitory at Greſham College, be lent to the obſervatory at Greenwich, for making aſtronomical obſervations; and that Mr. HOOKE's new quadrant be forthwith finiſhed at the charges of the Society.

Mr. OLDENBURG read a letter from Mr. ELIAS SANDRA, junior, merchant at Amſterdam, dated 22d January, $167\frac{6}{7}$, being a return to the anſwer ſent to him from the council upon his firſt letter, concerning the propoſition of diſcovering a great plenty of ambergriſe: the ſubſtance of which letter being, that he deſired to know the thoughts of the council with regard to the reſt of the articles formerly propoſed by him, the council cauſed thoſe articles to be read; and ordered thereupon, that as to the articles for ſecrecy, they could not be kept ſecret from thoſe, whom the council ſhould make uſe of in this matter. As to the fifth article, it would be the concern and intereſt of the council to oblige thoſe, who ſhould go out upon the deſign, to follow Mr. SANDRA's directions relating to the place, where the ſaid plenty of ambergriſe is to be found. As to the ſixth article, the diſcoverer's third part ſhould be brought free and without any expence to him into England. As to the eighth article, the council would not be tied to ſecrecy of a general but a particular diſcovery.

At a meeting of the SOCIETY on the ſame day,

Mr. OLDENBURG read a letter of Mr. HEVELIUS, dated at Dantzick, 2d January, $167\frac{6}{7}$, N. S. [p] concerning his late obſervations of the new ſtars *in collo ceti & pectore cygni*; together with ephemerides of the ſeveral phænomena of theſe ſtars from the very firſt time of their appearance.

It was ordered, that Mr. HEVELIUS be deſired, in the name of the Society,

[o] The Society's operator.

[p] Supplement to the Letter-book, vol. iv. p. 176. It is printed in the Philoſoph. Tranſact. vol. xii. n° 134. p. 853. for April, 1677.

to finiſh his catalogue of the fixed ſtars, and that an intimation be given to him of the agreement of Mr. FLAMSTEAD's obſervations concerning the diſtances of many of thoſe ſtars with his obſervations, of which he would, before it was long, ſee ſomething in print: and farther, that what Mr. HOOKE had publiſhed againſt him, was done without any approbation or countenance from the Society.

It was moved, that the making of the inclinatory needle formerly ſpoken of[q], ſhould be haſtened by Mr. HOOKE, in the exacteſt manner, that could be.

Dr. GREW began to make the experiment, appointed at the laſt meeting, of impregnating water fully with one kind of ſalt, ſo as that it would bear no more of that kind; and then to diſſolve ſome portion of another, and ſo of a third.

The preſident ſuggeſted, that one ſort of ſalt being mixed with water, in ſuch a quantity, as that no more of it would be diſſolved thereby, the glaſs ſhould be ſealed up, and ſo ſet by till the next meeting; and then the ſame water to be impregnated with another kind of ſalt, and ſuffered to ſtand ſtill again another week, and ſo on.

Mr. OLDENBURG read two letters written by Mr. CHOLMONDELEY, put into his hands by Sir JOHN WERDEN, concerning little cruſtaceous live animals, found by the ſaid Mr. CHOLMONDELEY himſelf, both floating upon mercury in a barometer, and at the bottom of the ſame.

This being looked upon as extraordinary, that ſuch creatures ſhould be bred in mercury, it being ſuppoſed, that they were rather bred from the wooden box, wherein the ſtagnant quickſilver was; it was ordered, that the obſerver ſhould be deſired to try with the ſame quickſilver in a glaſs-cane turned up, and to ſee, whether he could then find any ſuch animal in it.

*February* 1. There was read part of a very long letter of Mr. LEEWENHOECK to Mr. OLDENBURG, dated at Delft, 9th October, 1676, which had not been produced before, becauſe it could not be ſooner tranſlated into Engliſh out of the Low Dutch language, in which it was written. The contents thereof were a great number of obſervations made by Mr. LEEWENHOECK with his microſcope, concerning certain little animals found by him in vaſt quantities in common water, ſnow-water, well-water, and ſuch water, wherein ſeveral ſorts of ſpices had ſtood infuſed, both whole and pounded[r].

It was ordered, that the ſequel of theſe obſervations ſhould be read at the next meeting; and that the author be deſired to communicate his method of obſerving.

There was alſo read part of a printed paper, intitled, *Noctiluca volans & per vices fulgurans*, compoſed by Dr. KIRCHMAYERUS, profeſſor at Wittemberg in

[q] December 7 and 14, 1676.

[r] Theſe obſervations are printed in the Philoſ. Tranſact. vol. xii. n° 133. p. 821. for March, 1677.

Germany;

Germany; and containing a relation of the author of this ſubſtance, and of its performances.

It was ordered, that the author of this book ſhould be deſired to ſend a ſpecimen of this ſubſtance, for a trial, as Dr. BALDUINUS had done of his ſhining ſtone.

*February* 8. Sir GEORGE CROOKE was elected and admitted.

Dr. BALDUINUS, who had preſented the king and Society with the ſtone ſhining in the dark, was elected.

Mr. JOHN FLAMSTEAD was elected, Sir JONAS MOORE and Mr. DANIEL COLWALL affirming, that he had been formerly propoſed, though it appeared not upon the Journal, that he had been ſo.

Dr. GREW read a lecture, beginning the comparative anatomy of animals, of which he had opened eight of the ſmaller kind, viz. a weaſel, a polecat, an urchin, a ſquirrel, a ſpaniel-bitch, a rabbet, a fox, and a ſheep: of all which he diſcourſed [t], and ſhewed their entrails.

The Society being very well pleaſed with this deſign, and this beginning of the execution thereof, exhorted Dr. GREW to perſue this argument with all poſſible care and expedition and to leave in the repoſitory thoſe parts, which he ſhould from time to time produce upon occaſion of his lectures.

Mr. HENSHAW preſented to the Society from Sir JOHN CLAYTON a piece of the Bononian ſtone, which ſhines, when duly prepared, in the dark; together with Dr. MENTZELIUS's book concerning the method of preparing it.

It was ordered, that Dr. MAPLETOFT and Dr. CROUNE take care of the preparation of this ſtone, in order to make it ſhine in the dark.

*February* 15. The glaſs of water impregnated with common ſalt a fortnight before was produced, and the water having left undiſſolved a conſiderable quantity of the ſaid ſalt, it was by order of the Society poured off, and five drachms of nitre put in the ſame, and ſo ſealed up.

Mr. OLDENBURG produced the ſequel of Mr. LEEWENHOECK's letter concerning the great plenty of very little animals obſerved in rain, well, ſea, and ſnow-water; as alſo in water, in which pepper had lain infuſed.

The remainder of this paper was referred to another meeting; and the ſecretary was again deſired to procure from Mr. LEEWENHOECK his method of obſerving, that

[t] His diſcourſe is entered in the Regiſter, vol. v. p. 195. The ſubſtance of it is publiſhed in his *Comparative Anatomy of Stomachs and guts begun*; ſubjoined to his *Muſeum Regalis Societatis*, printed at London, 1681, in folio.

by

by making uſe of the ſame, the Society might be enabled to confirm his obſervations.

One Mr. WYNNE produced an inclinatory needle, which being tried and found imperfect, the artiſt was ſolicited to endeavour to make an exact one; which he promiſed to do.

An extract of a letter of Dr. WALLIS, dated at Oxford 30th January, 1676/7, was read, concerning the meteor ſeen 20th September, 1676, in and near Oxford, and in many other parts of England [u].

*February* 22. Sir JOHN LOWTHER produced the figure of a gooſe-egg, with another within it, which had been both of them hard, and were laid at Brougham in March 1676/7. They were ſaid to have been, in every reſpect, like other eggs, except the ſize of the outermoſt, which had been ten inches about breadthwiſe, and fourteen inches length-way; and after the yolk and white of the outer egg was poured out at a little hole, the inner egg moved up and down within it.

The third part of Mr. LEEWENHOECK's obſervations concerning living creatures in water, in which pepper had been infuſed, was read.

The glaſs, wherein at the laſt meeting was put ſome nitre, being produced, and the nitre found to be all diſſolved, more of the ſame nitre was put in, to ſee, whether it would diſſolve this likewiſe.

*March* 1. Another inclinatory needle was tried, and proved to be better than the former. However, the artiſt was ſtill preſſed to try to make another yet more exact.

Mr. HENSHAW ſhewed the Society a magnetical experiment, of taking a bar of iron, and holding it perpendicularly to the horizon, and upon applying to the lower end of the iron a needle touched with a loadſtone, the ſouth pole of the needle turned to the lower end of the iron; but upon applying the needle to the upper end of the iron, the north pole of the needle turned to that end of the iron, which was uppermoſt. Again, upon applying the needle ſuddenly to the middle of the iron ſo erected, neither pole of the needle would turn to the iron, but the needle turned its ſide only, and ſtood due north and ſouth. So likewiſe, if he held the iron parallel to the horizon, and applied the eaſt or weſt ſide of the dial to the iron, neither pole of the needle would regard the iron, but the needle ſtood due north and ſouth. But that, which was moſt ſtrange, was, that to either end of the iron (if it had not been touched with a loadſtone) turn it downward or upward as nimbly as you can, the needle will as nimbly turn its north pole, when it is erected, and its ſouth pole, when it is depreſſed; and either end of the ſame iron produces the like effect.

[u] This letter of Dr. WALLIS, and one of the 20th of January, 1676/7, and another of 8th May, 1677, are printed in the Philoſoph. Tranſact. vol. xii. n° 135. p. 863. & ſeqq.

This

This experiment was ordered to be regiſtered, when Mr. HENSHAW ſhould have fully delivered it in writing, which he was deſired to do.

*March* 8. The African company ſent by Mr. CRISPE to the Society for a preſent an uncommon horn, thought to be an elephant's tooth, which was wreathed in an extraordinary manner, affirmed to have been brought by a captain of a ſhip from the river Gambia.

Dr. GREW read a lecture concerning the proportion of the fixed ſalts of one plant, or part of a plant, to the fixed ſalt of another, and to all the other principles in any one plant [x], as

1. What proportion the fixed ſalt of the pith, or pithy part of a plant bears to that either of the fibrous or woody part; or whether there be a fixed ſalt always found in either of them?

2. Whether the bark or the wood of the ſame tree yields the greateſt quantity of fixed ſalt?

3. Whether the bark of the body or the bark of the root; and ſo whether the wood of the body, or the wood of the root of the ſame tree, yields moſt fixed ſalt?

4. Whether trees, herbs, and buſhes, quantity for quantity, *& cæteris paribus*, yield the moſt fixed ſalts?

5. Whether of two plants of the ſame kindred, one growing in the field, the other on the ſea-coaſt, that near the ſea doth not yield a greater quantity of fixed ſalt?

6. Whether a plant yields more ſalt, being only dried and then calcined, or being firſt diſtilled, and then calcined?

7. What different quantities of ſalt the tartars of ſeveral ſorts of wine do yield; as of whites, claret, Rheniſh, &c? whence partly the ſtrength and nature of wines may be judged.

8. How far the proportion of ſalt is different, according to the different taſtes of plants? inſtanced in ſeven ſeveral taſtes.

9. How far the proportions of the fixed ſalts of plants vary according to their faculties; and firſt, thoſe, that are only alterative and opening; next thoſe, that are thoracics, antiſcorbutics, antihyſterics, ſtomachics, cephalics, diuretics?

[x] It is inſerted in the Regiſter, vol. v. p. 206. and printed in his *Anatomy of Plants*, lecture 3. p. 255.

10. How far the proportions of the ſalts of plants do vary according to their cathartic faculties?

11. How far gums and reſins obtain a different proportion of ſalt, according to their different virtues? as of reſin, maſtic, olibanum, aſa fœtida, gum Arabic, euphorbium, myrrh, opium, aloe, gum guaiacum, ſcammony, and gutta Gamba.

From which he collected, that there is no purging gum without ſome portion, more or leſs, of a fixed alcali: ſo that it ſeems, that the fixed alcali, as it is combined with the other principles, ſome way or other, has ſome intereſt in the buſineſs of purgation. 2. That conſidering the doſe of any purging gum, the quantity of the fixed alcali muſt needs be extremely ſmall in compariſon with the volatile parts of the gum, wherein therefore its purgative power principally conſiſts. 3. That of theſe volatile parts the purgative force lies neither in the ſulphur, nor in the ſalt alone, but in both, as intimately united one to another, and to their alkali into one body, as appears from the calcination.

*March* 15. Mr. WYNNE produced two other inclinatory needles, both which ſtood true, before they were touched, at any degrees, where they were put. And one of them being touched on both ends ſtood at ſeventy-three degrees one way and ſeventy-four and an half the other way, tried ſeveral times. The other being touched firſt at one end only, ſtood at ſeventy-two degrees and one fourth one way and ſeventy-three degrees the other way; but when afterwards it was touched at both ends, it ſtood at ſeventy-three degrees and three fourths one way, and ſeventy-three degrees and one fourth the other way.

Mr. OLDENBURG produced a letter ſent to him by an anonymous member of the Society, concerning Mr. HENRY BOND's book, intitled, *Longitude found*[y]; which being read, it was ordered, that Mr. COLWALL ſhould be deſired to aſk Mr. BOND, how he came to know the difference of longitude between London and Waygatz to be fifty-eight degrees.

Sir ROBERT SOUTHWELL ſent for the repoſitory an odd leg of an human body, which he had brought with him out of Ireland; in which leg there ſeemed to have been an extraordinary ulcer, which had ſwelled the ancle-bones.

Mr. HILL gave for the repoſitory a cone, ſaid to be the dried fruit of a cedar-tree of Lebanon.

*March* 22. There was read an account communicated by the earl marſhal, of the diamond-mines in the Eaſt-Indies, their number, variety, manner of working them, together with the ſeveral ſizes and prices of diamonds: which account was ordered to be printed in the *Philoſophical Tranſactions*[z], if leave ſhould be given by his lordſhip.

[y] Printed at London, 1676, in 4to. See Philoſoph. Tranſact. vol. xi. n° 130. p. 774.

[z] It is printed there, vol. xii. n° 136. p. 907. for June, 1677.

Mr.

Mr. OLDENBURG read a letter to himſelf from Dr. WALLIS, dated at Oxford, 14th March, $167\frac{6}{7}$ [a], concerning a new muſical obſervation, viz. that whereas it hath long ſince been obſerved, that if a viol or lute-ſtring be touched, another ſtring on the ſame or another inſtrument not far from it, if an uniſon to it, or an octave, will at the ſame time tremble of its own accord; it hath been farther noted, that not the whole of that other ſtring doth thus tremble, but the ſeveral parts ſeverally, according as they are uniſons to the whole or to the parts of that ſtring: and beſides, that the ſame ſtring being ſtruck in the midſt, each part being uniſon to the other will give no clear ſound at all, but very confuſed, &c.

This experiment was in part tried, and found to anſwer the import of the letter.

1677. *March* 29. Mr. POVEY produced a model of the ſepulchre of our Saviour at Jeruſalem, ſaid to have been made upon the place by the Maronites.

It was ordered, that Mr. HENSHAW's account of the magnetical experiment, made before the Society on the 1ſt of that month of March, be entered into the Regiſter [b].

Mr. OLDENBURG read a letter writen to himſelf from Mr. GEORGE GARDEN, dated at Aberdeen, 17th February, $167\frac{6}{7}$ [c], concerning a man in thoſe parts of a dottrel quality, naturally imitating whatever he ſaw others do, and not being able to forbear ſuch imitation: as alſo concerning a woman, who had voided a ſtone of more than five inches about one way, and four inches the other way; together with an offer of ſending the ſtone to the Society: which offer was accepted.

*April* 5. Mr. OLDENBURG produced a piece of a pig's gut, in which an inciſion had been made, whilſt the pig was alive, by opening its belly, and pulling out the guts, and giving it a cut lengthwiſe, and then applying Monſ. REBEL's vulnerary water, and ſo putting it in again. Whereupon the pig growing well again, and being fattened for brawn, it was at length killed for that purpoſe; and this gut being looked after, was found perfectly and ſtrongly healed up again. This gut being ſent by his highneſs prince RUPERT, who had himſelf cauſed the ſaid inciſion to be made, it was ordered, that the humble thanks of the Society ſhould be returned to him, and that it be intimated, that it would be worth while to try, whether ſuch an inciſion would not heal of itſelf without the application of any thing.

Mr. BOYLE ſent in by Mr. OLDENBURG the propoſal of a magnetical experiment, to obſerve, whether the virtue of a loadſtone would be diminiſhed or increaſed by ſeveral accidents.

[a] It is printed in the Philoſoph. Tranſact. vol. xii. n° 134. p. 839. for April, 1677.

[b] It does not appear there.

[c] It is printed in the Philoſoph. Tranſact. n° 134. p. 842.

It was ordered, that the apparatus ſhould be made ready for trying the propoſed experiment; which apparatus was recommended by Mr. BOYLE himſelf after this manner:

Apply to the caps of a loadſtone a thin ſmooth plate of ſteel of ſmall breadth and convenient length; from the midſt of which plate ſhould reach downward a little moveable hook, at which a light ſcale might be ſo hung, that when it is laden, the centre of gravity of the weight or weights, together with the plate, may hang moſt conveniently for the ſuſtentation of the whole by the loadſtone. Into this ſcale, by little and little, ſmall weights are to be put in, till the addition of a very little more, as of a grain or two, or leſs, is able to draw down the plate. Then this plate and the annexed ſcale being again applied in the convenienteſt manner to the caps of the loadſtone, the whole is to be kept ſuſpended in a very quiet place, to obſerve, whether the changes of the moon (diurnal or menſtrual) the tides, the ſeaſons of the year, the apogeum or perigeum of the ſun, the generation of the ſolar ſpots, boiſterous and laſting winds, great variations of the atmoſphere's weight, conflagration of buildings, &c. will ſeparate the plate from the loadſtone, or enable it to ſuſtain a greater weight. The like trials may be made of the diſpoſitive or attractive power of the loadſtone, by a needle placed juſt at ſuch a diſtance, as may be looked upon to be the utmoſt in the ſphere of the activity of the magnet.

It was mentioned, that Mr. GREATERIX had affirmed of the great loadſtone of the lord viſcount BALTIMORE, that it would take up leſs in froſt than in warm weather.

It was alſo remarked, that it would be worth trying, whether a needle being well touched at a loadſtone, the ſtone would thereby loſe any thing of its weight.

A letter of Mr. LEEWENHOECK to Mr. OLDENBURG, dated at Delft, 23d March $167\frac{6}{7}$, was read, giving ſome account of his obſerving live animals in water [d].

It was ordered, that Dr. GREW ſhould be deſired to try what he could obſerve in the like waters; and that for this purpoſe an extract ſhould be given him by Mr. OLDENBURG of Mr. LEEWENHOECK's obſervations formerly read to the Society.

*April* 12, 19, 26, the SOCIETY did not meet.

*May* 3. Dr. GREW read a diſcourſe concerning his obſervations and experiments on the colour of plants: which diſcourſe had three general heads:

1. Of the ſeveral colours, as they appear in the plants themſelves.

[d] It is printed in the Philoſoph. Tranſact. vol. xii. n° 134. p. 844.

2. Of

2. Of theſe colours, as they appear upon infuſion into ſeveral ſorts of liquors.

3. Of the colours, as they appear upon the mixture of thoſe infuſions, or any of them, with ſome other liquors, and particularly with oil, ſpirit of wine, and water.

The ſum of what he diſcourſed of the cauſes of vegetable colours, was, that when the ſulphureous and ſaline principles, though ſwimming together, yet are not yet united into one precipitate, no colour reſults from them, but the liquors are white or limpid, as uſually in the root, and many other parenchemous parts.

When they are mixed, and the alkali is predominant, they produce a green: when the ſulphur and the alkali are more equal, they produce a tawny: when the ſulphur, acid, and alkali are more equal, then yellow: when the ſulphur is predominant, and the acid and alkali equal, then a purple: when the ſulphur is predominant to the alkali, and the acid to them both, then a ſcarlet: when the acid is predominant to the alkali, and the ſulphur to them both, then they yield a blood red, which is the higheſt and moſt ſulphureous colour in nature.

This diſcourſe was ordered to be entered into the Regiſter-book [e].

*May* 10. There was read a relation ſent by RALPH BATHURST, M. D. dean of Wells, concerning very unuſual damps, and their odd effects in a coal-mine in Flintſhire [f], communicated by ROGER MOSTYN, Eſq; of the Inner-Temple, who, at Dr. BATHURST's requeſt, had obtained it from his father's ſteward and overſeer of his coal-works, who was upon the place, when the thing happened; Mr. MOSTYN being alſo aſſured of it from his father Sir ROGER MOSTYN, lord of the manor, and from ſeveral others, who were eye-witneſſes.

*May* 17. There were read three letters ſent to Mr OLDENBURG from foreign parts, concerning the late comet, one from Mr. HEVELIUS, dated 1ſt May, 1677, N. S. [g]: the ſecond from Signor CASSINI, dated at Paris, 9th May, 1677. N. S. [h]; and the third from Dr. ERICUS MAURICIUS, dated at Spire, 26th April, 1677.

Mr. FLAMSTEAD's letter to Mr. OLDENBURG, dated at Greenwich, 18th May, 1677, containing his obſervations on that comet [i], was likewiſe read.

Mr. OLDENBURG produced a letter to himſelf from Mr. LEEWENHOECK, dated at Delft, 14th May, 1677, concerning the obſervations made by him of the carneous fibres of a muſcle, and the cortic and medullary part of the brain; as alſo of *moxa* and cotton [k].

[e] It does not appear there: but it is printed in his *Anatomy of Plants*, lecture 5. p. 269.

[f] It is printed in the Philoſoph. Tranſact. vol. xii. n° 136. p. 895. for June, 1677.

[g] It is printed in the Philoſoph. Tranſact. vol. xii. n° 135. p. 869.

[h] Ibid. p. 868.

[i] Ibid. p. 873.

[k] Ibid. n° 136. p 889.

Part of this letter was read, and the reſt ordered to be read, as ſoon as it could be tranſlated into Engliſh from the Low Dutch.

Mr. OLDENBURG read a letter to himſelf from Monſ. LEIBNITZ, dated at Hanover, *May* $\frac{3}{13}$, 1677, giving an account of a ſubſtance, which carried its light perpetually within itſelf, and needed not to be expoſed to imbibe light.

There was likewiſe read a letter of Dr. WALLIS's to Mr. OLDENBURG, dated at Oxford, 8th May, 1677 [l], giving a fuller account than his two former letters of 20th and 30th January, of an unuſual appearance, September 20, 1676, at Oxford, and in many other parts of England; which the Dr. was inclined to think to be rather a comet, than a meteor, for the reaſon delivered in this letter.

*May* 24. There was produced a printed book in French, intitled, *La Duplication du Cube, la Triſection de l'Angle, & l'Inſcription reguliere d'un Heptagon dans un cercle: par Monſ.* COMIERS.

Mr. OLDENBURG mentioned, that he had ſhewn this book to the preſident, who having examined it, affirmed, that the author had performed what he had undertaken. Dr. WALLIS being preſent, was deſired to conſider it likewiſe, and to report his ſenſe of it to the Society.

A ſecond letter of Mr. HEVELIUS to Mr. OLDENBURG concerning the late comet, dated at Dantzick, 13th May, 1677, N. S. [m], was read.

Mr. OLDENBURG produced Signor CASSINI's printed diſcourſe concerning a new theory of the moon invented by him: which being read, Mr. FLAMSTEAD was deſired to take it with him, and to conſider it.

Mr. OLDENBURG ſhewed the Society the ſcheme of an engine called *machina metereo-poetica*, together with an explication of it; which was read, but not thought ſatisfactory.

*May* 31. [n] Read Monſ. LEEWENHOECK and Dr. WALLIS's account of the duplication of cubes, and of the inſtant motion of light.

Captain FISSENDEN preſented two rarities, a ſea fungus coralloides, and the ſhell of an echinus, matrix of helmet-ſtones.

*June* 7. Of a ſalt of Centaurium minus, which being kindled maketh as great noiſe as gun-powder.

[l] It is printed in the Philoſoph. Tranſact. n° 135. p. 864.

[m] Ibid. p. 871.

[n] The minutes of this and the two following meetings are from the ſhort ones of Mr. OLDENBURG, taken at thoſe meetings, which notes he did not draw out to their due length; for which reaſon they were not tranſcribed into the Journal-books of the Society, vol. v.

The

The ſame ſpake of another ſalt made of a vegetable, which he names not, which is alſo a gun-powder, and ſhoots a bullet with almoſt the ſame ſtrength that gun-powder does, and with the ſame noiſe.

Of a white loadſtone found in a cabinet of a curious perſon, which hath the ſame power with the beſt magnet of the ordinary colour.

Anatomical obſervation, that the cuticula in ſome animals hath no pores: that RIOLAN and ſome others affirm, women have none; but they ſweat as well as men: but that it is true in dogs and cats, who never ſweat, what labour ſoever they be put to.

Blue bottle beaten with its involucrum, and infuſed twenty-four hours in ſnow-water, communicates ſo great a virtue to this water, that, when diſtilled with a moderate heat of ſand, it not only removes all the inflammations of eyes, but alſo clears and fortifies and preſerves the ſight, eſpecially of aged perſons: whence the French call it *caſſe-lunette*: put only ſome drops of it in the eye.

Abroad, ſtudying to recover the way of making that ſort of fire, which they called Greek-fire, which increaſed its force in the water; ſo called, becauſe the Greeks made uſe of it, which was about the end of the ſeventh age. Of which they find it recorded in hiſtory, which is newly inſerted in the *Hiſtory of the Cruſades*, written by the jeſuit MAIMBOURG [*], that it was invented by an engineer of Heliopolis in Syria, called CALLINICUS, who made ſo good uſe of it in the battle, which the naval army of the emperor CONSTANTINE POGONATUS delivered to the Saracens near Cyzicum in the Helleſpont, that the Chriſtians burned their whole fleet conſiſting of thirty thouſand men, which were all conſumed in the midſt of the water, together with their ſhips. This fire was compoſed of brimſtone, naphtha, pitch, and ſome gum drawn out of certain trees, and of a bitumen infuſed in a fountain-water of a peculiar make, and of ſome other ingredients capable to produce that effect. And this fire had this particular quality, that it faſtened ſo cloſe to people, and to things, that were to be burnt, that it could not be removed but with vinegar mingled with wine and ſand; and, which is much ſtranger, oil itſelf, which ſerves for food to other fires, and makes them more vigorous, ſerved to extinguiſh that fire.

To make experiments, whether ſeveral needles will mark the ſame magnetical meridian.

Four needles of ſeveral lengths would not vary in ſhewing the true magnetical meridian. Of 2, 4, 6, 8 inches, two of the ſame length will mark alike.

The needles with two different loadſtones ſhew different meridians. Needles not touched.

[*] Printed at Paris, 1676, in 4to.

*June*

*June* 21. [p] Horſes gut thirty-ſeven yards long.

Uſes: gullet and its parts, dog more muſcular, bones.

Ventricle: all quadrupeds carnivorous ſmall ſtomach.

Sheep and oxen very large ſtomach.

Horſe and hare no great ſtomach, becauſe they much labour and run.

The ſtomach of carnivorous animals of . . . ſingle.

Granivorous animals have double ſtomachs.

Method of rumination very fine: the nervous papillæ have a taſte and diſcern.

To diſcontinue the meeting till a new ſummons.

*September* 13. At a meeting of the COUNCIL were preſent

Mr. HENSHAW, vice-preſident, in the chair,
Sir JOHN HOSKYNS,
Sir CHRISTOPHER WREN,
Sir JOHN LOWTHER,
Mr. COLWALL,
Mr. HILL.

It was reſolved, that at the next meeting of the council, the ſtatute now propoſed for taking notes by a balloting-box be read, viz.

"For the more free and private giving of notes at the council of the Royal "Society, be it ordered, and it is ordered, that henceforth all votes in paſſing "queſtions at meetings of the council ſhall be taken by a balloting box."

It was ordered, that Mr. BERNARD have two Arabic Pſalters out of the Arundel library, giving ſecurity, ſuch as Mr. HOOKE ſhall approve, for returning them within ſix months, provide the earl marſhal conſent:

That Mr. BOYLE, Sir JOHN HOSKYNS, and Mr. HILL, or any two of them, do at ten of the clock the next morning go to the widow of Mr. OLDENBURG, Eſq; late ſecretary of the Society, and demand, receive, or take order for ſecuring, for the uſe of the Society, all ſuch goods, books, and writings belonging to the Society, as were or had been in the poſſeſſion of her, or of her late huſband: and

That Mr. HOOKE agree with Mr. FORSTER for making the catalogue of the Arundel library: and that what he ſhall agree for, be paid by the treaſurer.

*September* 24. At a meeting of the COUNCIL were preſent

[p] The minutes of this day are the heads of Dr. GREW's lecture publiſhed in his *Comparative Anatomy of Stomachs and Guts*, p. 12—27.

Mr. HENSHAW, vice-president, in the chair,

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| Sir JOHN HOSKYNS, | Mr. COLWALL, |
| Mr. AERSKIN, | Mr. HILL, |
| Sir JONAS MOORE, | Dr. CROUNE. |

This council met by order of Mr. HENSHAW, who on the 21st instant, in the absence of the president, ordered Mr HUNT to summon a meeting of the council on this day.

Upon reading the case of Mr. OLDENBURG's children and Sir RICHARD LLOYD's opinion thereupon, it was ordered, that MICHAEL WICKS [1], and HENRY HUNT [2], be named commissioners on behalf of the Society: and that Mr. HUNT give notice hereof to Mr. BOYLE; and that the persons in possession of the house [3] be desired to keep possession, unless demanded with Mr. BOYLE's consent.

It was ordered, that when any letters concerning the Society be directed to the secretary, what concerns the Society shall be read at the meeting of the Society next after the receit of such letters:

That all papers and books concerning the Society be kept in the repository or library of the said Society: and that if any thing be to be transcribed, it be done there:

That the officiating secretary taking short notes of all that passes at the Society or Council, before the rising thereof, read the said notes, in order to see, that they be rightly taken: And,

That the notes so taken be fairly entered by the next meeting-day respectively.

The statute for taking votes at the council by ballot propounded at the last meeting was passed as a statute.

The council adjourned till the Thursday following September 27, at three in the afternoon.

*September* 27. At a meeting of the COUNCIL were present

Mr HENSHAW, vice-president, in the chair,

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| Sir CHRISTOPHER WREN, | Mr. HILL, |
| Sir JOHN HOSKYNS, | Dr. WHISTLER, |
| Mr. COLWALL, | |

It was ordered, that Mr. HILL desire Dr. POPE not to dispose of his lodgings till the council have notice.

Adjourned till that day fortnight, October 11:

[1] The clerk. [2] The operator. [3] Inhabited by the late Mr. OLDENBURG.

*October*

*October* 15, 1677. The Society met again at their uſual place in Greſham-College upon ſummons ſent for that purpoſe by the preſident.

The preſident not coming, the vice-precident Mr. HENSHAW and the reſt of the Society deſired, that an experiment might be ſhewn; which was accordingly done by Mr. HOOKE; the effect of which was to ſhew a very eaſy but exceedingly curious way to examine the comparative weight of liquors, and that to ſo great a niceneſs, as very ſenſibly and manifeſtly to exhibit ſuch weight of two liquors, though they differed from one another but a thouſandth part of their weight. This was performed by the help of a large glaſs of a pear-like form, equalling in bulk about three pounds of water, which by that included in it was made almoſt equiponderant to the water, but yet ſomewhat heavier, that it might ſink to the bottom; but by the fineſt hair tyed to the ſtalk could be ſuſpended in the water. This hair was tyed to the ſcale of a beam, and this poiſe by a counterpoiſe in the other ſcale was made to ſwim in the water ſo, as neither to touch the bottom nor the top; and when ſo poiſed, it was found, that a fifth part of a grain added to or taken from the ſcale would make the glaſs-pear riſe to the top or ſink to the bottom. Whence it was evident, that the whole glaſs weighing about four pounds, which amounts to 22040 grains, or 220400 tenth parts of a grain, one ſingle tenth part of a grain would turn it. And the glaſs, when ſuſpended, being always equal to equal bulk of water, if that might be altered, the poiſe muſt be altered; and conſequently by help of the ſcales be made ſenſible. This experiment and the nicety thereof being underſtood by the members preſent, it was deſired, that trials might be made at the next meeting upon ſeveral ſorts of water, as pump water, New River water, Thames water, and rain water, that ſo they might be experimentally ſatisfied of the exactneſs of this new inſtrument; which was new upon this account, that it had not been taken notice of by any of thoſe, who had written of this ſubject, ſuch as, GHETALDUS, SEVINUS, PASCAL, &c. they having only taken the comparative weight of ſome ſmall counterpoiſe within and out of the ſame liquor, which they had always performed with the ſame ſcales; which are no ways fit for exhibiting the niceneſs and curioſity of this experiment. Several objections were made and anſwered, and Dr. WHISTLER explained ſome things in it, which ſeemed a little difficult [1].

This debate being over, it having been concluded in ſome foregoing * * the vice-preſident Mr. HENSHAW with the reſt of the members deſired Mr. HOOKE, Mr. OLDENBURG having died ſince the laſt receſs, to take his place at the table, and to take an account of ſuch conſiderable matters, as ſhould be ſhewn or diſcourſed of at the meetings of the Society; which he accordingly did.

Sir JOHN HOSKYNS, Mr. HENSHAW not being then preſent, propoſed Mr. THOMAS SMITH, chaplain to Sir JOSEPH WILLIAMSON, one of the principal ſecretaries of ſtate, as a candidate for election into the Society, being ſeconded by Dr. HOLDER, and others.

[1] The deſcription of this water-poiſe is publiſhed in the Philoſoph. Tranſact. n° 197. p. 639.

Mr.

Mr. Hooke acquainted the Society with a new ſort of leather found out at Paris, and made impervious to air and water; ſo that therewith had been made all ſorts of riding and wearing apparel to keep out wet, cups and borachio's to hold or carry liquors, beds to lie on, and floats to ſwim with, which hold air like a bladder, covers of tents, coaches, ſedans, mails, &c. floors to tread on dry in marſhy places, boots to wade in, &c. And he preſented from Mr. Boyle a cup made of the ſame leather, which, he affirmed, held water ſix days without ſoaking through the leather, though as thin as a Corduban glove; and alſo ſupple.

Mr. Packer remarked, that it was fit for hat-caſes, ſtockings, &c.

Mr. Hooke mentioned, that he conceived it to be done only by ſoaking the leather in a mixture made with ſalad oil, and well boiled together. He was deſired to make trial of this way againſt the next meeting.

Mr. Hooke ſhewed a ſort of Portugal onion, which he had received from Dr. Whistler, who called it viviparous; the ſaid root ſending up a ſtalk, upon the top of which grew, inſtead of ſeed, a cluſter of very ſmall onions exactly like the root; each of which put into the ground would increaſe and produce ſuch another bunch of ſmall onions. An account was ordered to be taken of it, none of the like having been ſeen before by any of the members preſent; and the onion was returned.

Mr. Packer informed the Society, that though a patent had lately been obtained for an engine for grinding and preſſing of cider by the help of cylinders toothing one into another; yet he appealed to their Regiſter, to prove, that he had ſome years before ſuch patent propounded it to the Society: and that the Society had accordingly ordered Mr. Shortgrave to make trial of ſuch indented cylinders.

Upon this much diſcourſe aroſe concerning cider. Mr. Packer affirmed, that by grinding and preſſing out of the juice of the apple at once, a cider might be made as clear as rock-water, which neither would have any lees, nor turn brown: and that Mr. Fettyplace of Batterſea had made ſuch juice, and kept it clear fifteen days: but if the pulp were ſuffered to lie after it were beat ſometime before it be preſſed, the juice would both turn brown, and yield abundance of lees. This was ſuppoſed to come from a kind of putrefaction begun in the fibres of the apples before they were preſſed. Others ſuppoſed it a kind of fermentation; and there was much ſaid to ſhew, that fermentation differs from corruption; and that they were the working of different parts one upon another, and that performed different ways. For it was obſerved, that the ſubſtances, whilſt together in the apple, would rot; but when ſeparate in the juice or liquor, they would ferment. It was wiſhed, that trial might be made, what kind of ſpirit would be produced by diſtillation of mellow apples more than of the green ones and freſh gathered. Dr. Grew affirmed, that odoriferous plants would yield a ſpirit without fermentation. But it was anſwered, that though they yielded an

odoriferous ſubſtance, yet that could not properly be called a ſpirit: at leaſt it was not of the nature of a ſpirit made by fermention, which was called a vinous or burning ſpirit. The other odoriferous ſubſtance might more properly be called the tranſpiration or ſweat of the plant, very analogous to that of animals, by which they are diſtinguiſhed one from the other plainly by the ſmell.

About fining of liquors Sir JOHN HOSKYNS affirmed, that thick and muddy cider may be clarified by very fine ſtrainers. Others remarked, that fiſh-glew or iſinglaſs diſſolved with ſome of the liquor, and then mingled with it, would do the ſame thing; as alſo whites of eggs beaten and broken with ſome of the cider, and then mingled with the whole.

Mr. HOOKE read a letter, which had been delivered him by Mr. HENSHAW, to whom it was ſent by the preſident, in which Mr. LEEWENHOECK underſtanding, that Mr. OLDENBURG was dead, deſired to know, to whom he might addreſs his letters for the future; incloſing ſeveral teſtimonials of his former experiments, and an account both in Dutch and Latin of ſome new obſervations.

The conſideration of this was adjourned to the next meeting. And in the mean time Mr. HOOKE was deſired to make a microſcope after a way, which he propoſed as very likely to do as much, if not in the ſame manner as that of Mr. LEEWENHOECK.

Mr. HOOKE produced an ephemerides of twelve eclipſes of Saturn by the moon, together with the tranſit of through the ſun, and a calculation of eclipſes for the two ſucceeding years; one of which was omitted in HECKER, which was incloſed in a letter to him from of Hamburgh; ſome copies of which he promiſed to deliver to ſome aſtronomical obſervers.

Mr. HOOKE related, that had affirmed, that by raſping his apples with a bread grater he was able to make almoſt a third part more of cider than by the common way. He mentioned likewiſe an expedient of raſping thoſe apples much eaſier by help of a cylinder covered with tin plates made of the form of a grater. Mr. PACKER objected, that though by that means a third part more of liquor was obtained, yet the quantity of lees after ſettling would be ſo great, that little more clear cider would be made that way than by the common.

*November* 1. Mr. HENSHAW, vice-preſident, in the chair,

There were produced a great many exceedingly ſmall and thin pipes of glaſs of various ſizes, ſome ten times as big as the hair of a man's head; others ten times leſs. Theſe were made, in order to try a conjecture of Mr. HOOKE propounded to the Society, that the diſcoveries, affirmed to be made by Mr. LEEWENHOECK, were made by help of viewing with a good microſcope ſuch ſmall pipes containing the liquor or water, in which thoſe multitudes of exceedingly ſmall inſects or animals wriggling among each other are diſcovered; for that he alledged, that the ſaid pipes being filled with liquors became themſelves as it were magnifying glaſſes,

glaſſes, augmenting ſuch bodies, as ſwim in the ſaid liquor, on thoſe parts of the ſaid pipes, which are fartheſt from the eye-glaſs; for the pipes themſelves being looked on by the help of a very good microſcope, are made very large and conſpicuous; and they again augmenting the oppoſite parts by the refraction on their cylindrical ſurfaces double the effect of a ſingle microſcope, as was very evident. But notwithſtanding this there was no diſcovery made in the liquor, that was made uſe of, which was only common pump-water, of any ſuch minute animals. It was therefore ordered, that againſt the next meeting pepper-water ſhould be provided, and ſome better microſcope than that made uſe of, that the truth of Mr. LEEWENHOECK's aſſertions might, if poſſible, be experimentally examined, of which he had produced ſo many teſtimonies from ſuch, as affirmed themſelves to be eye-witneſſes.

After this Mr. LEEWENHOECK's papers, which had been produced at the preceding meeting, were read; four of which were teſtimonials of two miniſters, a public notary, and other perſons of good credit to the number of eight, of the truth of his former aſſertions concerning the almoſt incredible number of ſmall animals wriggling in pepper-water; ſome of whom eſtimated, that they ſaw ten thouſand, others thirty thouſand, others forty-five thouſand little animals in a ſingle drop of water as big as a millet-ſeed. The two other contained an account of ſome farther obſervations made by him with his microſcope; one written in Dutch, and the other the ſame tranſlated into Latin by him; the particulars of which were, 1. That the cauſe of the blackneſs of Ethiopians is from the conſtitutions of the pores, that will not admit light. 2. Of young eels found in eels, and of other leſſer within thoſe young ones. 3. That the blood of eels conſiſts of ſmall long ſharp pipes; whence he conceived to proceed the noxious qualities of eels blood to the eyes. 4. Of the eggs and manner of generation of , their ſhapes in the eggs, and their manner of excluſion, how he differs from SWAMMERDAM, &c. 5. That he had ſent over the atteſtation of eight ſeveral credible perſons, who had atteſted the truth of his aſſertions.

After the reading of theſe papers, Mr. HOOKE was ordered to return the Society's thanks to Mr. LEEWENHOECK, and to endeavour to procure farther diſcoveries from him by holding correſpondence with him. And upon this occaſion much diſcourſe aroſe concerning inſects bred in water. Mr. HENSHAW affirmed, that he in May had often taken up with a China comb out of ſtanding water great numbers of ſmall inſects not viſible but by the help of a microſcope, which were thereby found to be like a perch.

Sir CHRISTOPHER WREN affirmed, that he had often ſeen and taken out of ſtanding water a certain ſmall inſect conſiſting of about twelve rings with horns before and behind, after the manner of earwigs. He remarked alſo, that, as to the generation of eels, he had near twenty years before, upon the diſſecting of eels found them to be viviparous, having ſeveral times taken the young ones out alive.

Sir JOHN HOSKYNS produced a bottle of ſtinking ſulphureous water, which he



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had received from Dr. CARTER, who had a veſſel of it brought from a very ſtrong ſulphureous well at Queen's near Bath, in order to the farther examination thereof. For this purpoſe this, together with a bottle of Willow-bridge water formerly brought in by Sir JOHN HOSKYNS, was recommended to the care of Dr. MAPLETOFT, who was deſired to put the ſame in wide veſſels well covered to keep off the duſt, and in a warm air to be ſuffered to corrupt and putrify, and then to be evaporated, to ſee what ſediment would be left. This putrefaction was deſired, in regard, that, as Mr. HENSHAW affirmed, many liquors without putrefaction will wholly evaporate, which after putrefaction will leave a very great ſediment behind; putrefaction, as it were, letting looſe or unlocking the parts one from another.

Mr. HOOKE produced a piece of leather, which he had made in imitation of the impenetrable leather of the French. This was more ſupple than the French leather; and it was judged, that the French had more wax in its compoſition than this now produced; and by the ſmell the French ſeemed to be made of ſome ingredients of a more pleaſing ſmell than this of Mr. HOOKE, which ſmelled more ſtrongly of the boiled ſalad oil and bees-wax boiled together for an hour or two. This leather, though very limber, was found to hold water for ſome time without being wet through: but whether it would hold ſo well as the French, farther trial was to be made; as alſo of ſome other compoſition for ſoaking the ſkins in, that they might ſmell more like thoſe from France.

After this the third experiment was ſhewn by Mr. HOOKE to verify the truth of his former aſſertions concerning the exceedingly great curioſity of the new contrived poiſe for examination of the comparative weight of liquors even to the hundred thouſandth part of their bulk: and it was before the whole Society evidently ſhewn, that the eighth part of a grain would manifeſtly turn that ſcale, and make it preponderate, in which it was put; and ſo move a body, that was about four pounds in weight, either upward or downward. Now there being in four pounds weight 176320 eight parts of a grain, it thence follows, $\frac{1}{176320}$ part of the weight of the water was thereby diſcovered; which is almoſt beyond imagination. And it was farther aſſerted, that this niceneſs might be as much farther augmented, as ſhould be deſired, or was neceſſary for any manner of curious trials, which was done by making the poiſe ſo much larger; and that in ſuch trials, where great quantities of liquors would be troubleſome to obtain, it was demonſtrated how a receptant-veſſel ſhould be contrived, that with ſome ounces of liquor the examination might be made of a poiſe of ten, twenty, or more pounds in weight, even to the accurateneſs of the tenth part of a grain. And to make it evident, that a ſmall alteration of the water would be made ſenſible by this poiſe, about the quantity of two grains of ſalt was put into about two gallons of water; and it was apparent to all the ſpectators, that the poiſe grew very remarkably lighter. The ſame was alſo repeated; and by a ſecond trial with the like effect the ſame was verified. Some further trials would have been made; but it being late, the Society roſe, and left the farther proſecution of theſe experiments to ſome other time.

*November*

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*November* 8. The Society met at four in the afternoon, and the preſident being abſent, Mr. HENSHAW, vice-preſident, took the chair.

The firſt thing exhibited was the experiment charged on Mr. HOOKE at the laſt meeting, of examining pepper-water with better microſcopes and thinner and ſmall pipes. The fabric of the microſcope for holding ſuch pipes was new and more convenient and expeditious for ſuch examinations than the uſual forms, conſiſting wholly of pieces, which ſlid any ways very eaſily, and would ſtand fixed and ſteady in any poſture, and admit light to the object every way: by the comparing of which various ways of inlightening the object one might the more eaſily and certainly diſcern the true ſhape and conſtitution of any body. But notwithſtanding the pepper-mixture was very ſtrong, being made of rain-water and whole black pepper ſteeped in it for two or three days; and notwithſtanding the microſcope was much better than that ſhown at the laſt meeting; yet nothing of Mr. LEEWENHOECK's animals could be ſeen. Mr. HENSHAW conjectured with a good deal of reaſon, that it was very likely, that it might not now be a proper ſeaſon for their generations: and he was ſeconded by other obſervations, that the inſects in water, from which gnats are bred, and ſuch like, were obſerved to be generated only at certain ſeaſons: and it was farther added, that a perſon, who had ſeen theſe animals in Holland the preceding ſummer with a microſcope of his own, could not within a fortnight paſt find any ſuch in pepper-water made here.

Dr. WHISTLER conjectured, that theſe ſmall imagined creatures might indeed be nothing elſe than the ſmall particles of the pepper ſwimming in the water, and no inſects. But Dr. MAPLETOFT anſwered, that Mr. LEEWENHOECK affirmed, that he had ſhewn them both alive and dead; dead, when he put vinegar to the pepper-water. However Mr. HOOKE upon examining the ſaid water in the pipe with a microſcope found a vaſt quantity of ſmall duſt of pepper moving up and down in the water.

He then ſhewed a way of meaſuring the bigneſs of any object ſeen through the microſcope, which was by opening the other eye, and ſeeing ſome other object with the left eye, whilſt the right eye ſees the object through the microſcope: and it was evident, that a pipe not bigger than a pig's briſtle appeared a cylinder of about three inches diameter: and it was ſuggeſted, that there was ſome hope of producing at the next meeting a microſcope, that would magnify much more, and make the parts of the object more diſtinct.

Mr. HOOKE produced a ſecond trial, which he had made upon leather, for rendering it impervious to water. This was a piece of waſhed leather well ſoaked in a compoſition of wax and oil of turpentine boiled together. This was found very limber, and yet very cloſe and impervious to water, the water, which was put into it, ſlipping from it like quickſilver on paper without ſinking into or adhering to it. And it was conjectured, that this might perform much the ſame effect with that of the French invention. Mr. HENSHAW conceived, that ſperma ceti, white wax, and pomatum being mixed with the compoſition abovementioned might conſolidate and toughen the ſaid mixture.

Upon reading what diſcourſe had paſſed in the meeting of October 24, about cider and clarifying liquors, ſeveral ſuggeſtions were added to the former.

Mr. HENSHAW affirmed, that there was a wine made by the juice flowing from the ripe grapes without expreſſion, which was delicious and very clear, and therefore called *l'oeil de perdrix*, or the patridge-eye; but that it would not laſt long, but was for preſent ſpending, and preſently fit for drinking.

Dr. CROUNE gave a deſcription of *vin de goutte* to be much the ſame.

Mr. HENSHAW affirmed, that moſt of thoſe ſmall wines, though they were very pleaſant at firſt, yet were not of any long continuance, few of them outlaſting Eaſter: but that thoſe, which were more harſh and unfit for drinking at firſt, were the laſting wines. Theſe were made ſo by the bruiſing and preſſing of the ſtone, and the ſteeping in them the huſk. That it was this ſteeping of the huſk, that gave the redneſs to clarets; and that the juice of the grape alone without ſteeping was white and clear.

Dr. CROUNE ſuggeſted, that wines clarified with milk, the lees being thereby precipitated, would not keep; but that vintners draw them off for preſent ſpending; as alſo that vintners in their wines obſerve to leave in them a flying lee, as they call it, being not perfectly clear, becauſe thereby the wines will drink quicker, and keep better.

Upon mentioning Mr. LEEWENHOECK's obſervation about the generation of eels and inſects, it was related by Sir CHRISTOPHER WREN, that the young eels, which he had formerly taken out of eels, were about the length and bigneſs of ſmall pins.

Dr. CROUNE affirmed, that he had obſerved a ſlow-worm vivaparous:

That carps diſſected at Swallowfield near Reading in Berkſhire were found to be oviparous; but the eggs with perfect young carps.

Sir CHRISTOPHER WREN ſaid, that he had taken out of a lobſter's eggs a lobſter perfectly ſhaped with claws, &c. and that water diſſected at the proper ſeaſon of the year have young perfectly formed within them.

Dr. GREW remarked, that ſilk-worms eggs had the worm within them to be ſeen through the ſhell.

Mr. HOOKE affirmed, that he had ſeen them come out of them alive, and the reſt of the ſhell remaining to ſtick to the place, where it was firſt laid.

Mr. HENSHAW obſerved, that all worms in nuts proceed from without by eating a way into the kernel; which way in a ſhort time cloſeth up, but leaves behind it a kind of cicatrix. The like was affirmed of the worms in galls, oak-apples,

apples, and ſeveral other excreſſencies of plants. It was obſerved, that all have either a hole in them, by which the worm hath eaten its way out; or elſe the worm itſelf may be found in the middle of it.

Dr. CROUNE remarked, that the chicken might be ſeen formed in the cicatricula of the egg, by the help of the microſcope. He was deſired to ſhew this, as ſoon as he could conveniently, at a meeting of the Society. He complaining of the defect of microſcopes for ſuch uſes, Mr. HOOKE ſuggeſted ſome farther improvement of that inſtrument by making uſe of the convexity of the ſurface of the liquor itſelf (put upon the plates of Muſcovy glaſs) for augmenting the body within the liquor; as alſo for augmenting the body beyond it. The ſame might be done by ſmall drops of fluids, that fall on the leaf of coleworts or any oiled or greaſed ſurface; as alſo by the ſmall drops at the end of ſmall pipes, or ſticking on ſmall threads of glaſs or a ſingle clue of ſilk, the ſaid globular tranſparent bodies being viewed by the help of good microſcopes. Upon this occaſion Mr. HOOKE mentioned again his way, which he had formerly acquainted the Society with, of making microſcope-glaſſes with ſmall drops of glaſs made by melting up the ends of threads in the flame of a candle into a globular figure, and then grinding all away upon a flat except a very ſmall ſegment of the ſpherule; and ſo made uſe of as of a plane common glaſs, either for a ſingle or compound microſcope. He was deſired to ſhew ſome ſpecimen of this at the next meeting.

Dr. GREW produced a piece of palmetto or cabbage-tree of Barbadoes, conſiſting of a great number of cylindrical coats inwrapping one another, but looſe from each other. He was deſired to examine it, and ſee, what information might be learned from it of the nature of vegetables.

Mr. HOOKE promiſed to endeavour to procure ſome of the wood of that tree from Mr. HART.

Dr. CROUNE, by the recommendation of Mr. BOYLE, propoſed Mr. OLIVER HILL as candidate; as Dr. BROWN did Dr. MUNCKHAUSEN, doctor of law and a native of Dantzick; and Mr. HOOKE did Mr. GEORGE ENT, ſon of Sir GEORGE ENT.

Upon a diſcourſe, which aroſe concerning the water-poiſe, Sir CHRISTOPHER WREN deſired, that there might be drawn up a catalogue of experiments, that might be tried with that inſtrument; and conceived, that it might be very uſeful alſo for examining of metals; but he did not mention the method of doing this.

Dr. CROUNE made an objection from ſome aſſertions of GALILEO, in his book *De Inſidentibus Humido:* but upon diſcourſing the matter it was found not to contradict any thing, that was aſſerted by Mr. HOOKE concerning the ſame, but appertained to ſome diſputes about the quantity of water raiſed by the ſinking of the poiſe.

*November* 15. Mr. HENSHAW, vice-preſident, took the chair.

The

The firſt experiment there exhibited was the pepper-water, which had been made with rain-water and a ſmall quantity of common black pepper put whole into it about nine or ten days before. In this Mr. HOOKE had all the week diſcovered great numbers of exceedingly ſmall animals ſwimming to and fro. They appeared of the bigneſs of a mite through a glaſs, that magnified about an hundred thouſand times in bulk; and conſequently it was judged, that they were near an hundred thouſand times leſs than a mite. Their ſhape was to appearance like a very ſmall clear bubble of an oval or egg form; and the biggeſt end of this egg-like bubble moved foremoſt. They were obſerved to have all manner of motions to and fro in the water; and by all, who ſaw them, they were verily believed to be animals; and that there could be no fallacy in the appearance. They were ſeen by Mr. HENSHAW, Sir CHRISTOPHER WREN, Sir JOHN HOSKYNS, Sir JONAS MOORE, Dr. MAPLETOFT, Mr. HILL, Dr. CROUNE, Dr. GREW, Mr. AUBREY, and divers others; ſo that there was no longer any doubt of Mr. LEEWENHOECK's diſcovery. Notice was ordered to be taken of this diſcovery, and further trial was deſired to be made upon rain-water alone; and upon rain-water, in which had been ſteeped, wheat, barley, and other ſeeds and grains: as alſo that blood and ſeveral other liquors ſhould be after the ſame manner examined. The ſhape of the microſcope and the manner of examining the * * *.

At a meeting of the COUNCIL [z],

Mr HENSHAW, Mr. JONAS MOORE, Sir JOHN HOSKYNS, Dr. GREW, and Mr. HOOKE were named a committee of the council for auditing the treaſurer's accounts for the year paſt.

It was ordered, that Sir JOHN HOSKYNS, Mr. HENSHAW, Mr. BOYLE, Mr. HILL, and Mr. HOOKE, or any three of them, be deſired to go to the adminiſtratrix of Mr. OLDENBURG, and make demand of the books and papers belonging to the Royal Society in her cuſtody, eſpecially thoſe, which were already laid aſide and ſealed up in a trunk as ſuch: and they were hereby impowered to repay ſuch reaſonable charges, as the ſaid adminiſtratrix had diſburſed on the Society's account; and to give her a diſcharge for what they ſhould ſo receive.

*November* 30. At the anniverſary election of the Society,

The eleven members continued of the council were

| | |
|---|---|
| The lord viſcount BROUNCKER, | Mr. HENSHAW, |
| The lord biſhop of Saliſbury, | Mr. HILL, |
| Mr. COLWALL, | Mr. HOSKYNS, |

[y] The entry of the minutes of this meeting in the Journal-book, vol. vi. p. 11. breaks off abruptly here: nor is there any entry of the minutes of any following meetings till that of December 6, 1677.

[z] The date of which is omitted in the Council-book, vol. i. p. 282.

Sir

Sir JOHN LOWTHER,
Sir JONAS MOORE,
Dr. WHISTLER,
Sir JOSEPH WILLIAMSON,
Sir CHRISTOPHER WREN.

The ten new ones elected into the council were

THOMAS BARRINGTON, Esq;
Dr. GREW,
HENRY HALL, Esq;
Dr. HOLDER,
Mr. HOOKE,
Mr. CHARLES HOWARD,
Dr. KING,
Dr. WALTER NEEDHAM,
Sir PAUL NEILE,
Sir ROBERT SOUTHWELL.

Out of these the following officers were chosen:

Sir JOSEPH WILLIAMSON, president,
ABRAHAM HILL, Esq; treasurer,
Dr. GREW, Mr. HOOKE, } Secretaries.

Three eminent members of the Society died before this anniversary election, HENRY OLDENBURG, Esq; FRANCIS GLISSON, M. D. and FRANCIS VERNON, Esq;

HENRY OLDENBURG, Esq; who sometimes wrote himself Grubbendol, was a native of Bremen in Lower Saxony [y], and for several years agent [z] for that republic in England with the long parliament, and the protector OLIVER CROMWELL. In the year 1656 he went to Oxford for the advantage of prosecuting his studies [a], and in June was entered as a student by the name and title of *Henricus Oldenburg, Bremensis, nobilis Saxo* [b]; at which time he was, according to Mr. WOOD, tutor to HENRY lord O'BRIAN eldest son of HENRY earl of Thomond; as he appears likewise to have been to Mr. RICHARD JONES, son of the lord viscount RANALAGH by CATHARINE sister of Mr. ROBERT BOYLE. He continued at Oxford till April, 1657 [c]; and soon after attended Mr. JONES to Saumur in France [d], where they resided till the end of March, 1658 [e]. They were at Paris in May, 1659, and in March, 1660 [f]; and at Leyden in August, 1661 [g], but returned to England soon after, Mr.

[y] WOOD Fasti Oxon. vol. ii. col. 114.

[z] In the letters to him from MILTON, printed among the *Epist. Familiares* of the latter, *Epist.* 14 and 18, he is stiled *Orator Bremensium.*

[a] MILTON in his letter to him from Westminster, June 25, 1656, *Epist.* 18, has this passage: *Secessum istum tibi, quamvis mihi fraudi sit, tamen queniam tibi est voluptati, gratulor, tum illam quoque felicitatem animi tui, quem ab urbano vel ambitione vel otio ad sublimium rerum contemplationem tam facile potes attollere. Quid autem secessus ille conferat prætor librorum copiam, nescio; & quos illic nactus et studiorum socios, eos suopte ingenio potius quam disciplina loci tales esse existimem, nisi forte ob desiderium tui iniquior sum isti loco quia te detinet. Ipse interim recte animadvertis nimis illic multos esse, qui suis inanissimis argutiis tam divina quam humana contaminent, ne plane nihil agere videantur dignum tot stipendiis, quibus pessimo publico aluntur. Sed tu ista melius per te sapis.*

[b] WOOD, *ubi supra.*

[c] BOYLE's works, vol. v. p. 299.

[d] Ibid. & MILTONI Epistol. Famil. Epist. 24 & 25.

[e] BOYLE's works, vol. v. p. 301.

[f] Ibid. p. 301, 302.

[g] Dr. WORTHINGTON's letter to Mr. HURTLIT, Sept. 5, 1661, printed among his *Miscellanies*, p. 271.

JONES, on the 11th of September, being admitted into the Society as a fellow, and ſubſcribing the obligation. In the firſt charter granted to the Society, July 15 h, 1662, and in the ſecond, of April 22d, 1663, Mr. OLDENBURG was appointed one of the two ſecretaries, Dr. WILKINS being the other; which office the former executed till his death. He began to publiſh the Philoſophical Tranſactions on Monday the 6th of March, 166$\frac{6}{7}$ [h], and continued them to the end of June, 1677, without any intermiſſion except for about four months from July 3d to November 6th, in the year 1665, when the Society was diſperſed on account of the plague; during which he ſtaid at his houſe in Pallmall Weſtminſter, and carried on a correſpondence by letters with Mr. BOYLE [i], whoſe *Hiſtory of Cold* he was then tranſlating into Latin [k]. The ſame year SPINOSA began a correſpondence with him [l], and ſeveral of his letters to Mr. OLDENBURG are printed in his *Opera Poſthuma*.

In September 1666 the neceſſity of his circumſtances, and his diſappointment in the profit of the ſale of the *Philoſophical Tranſactions*, on account both of the late plague and fire of London, made him ſollicitous of procuring ſome place for the ſupport of himſelf and his family; for which reaſon he applied to Mr. BOYLE, that he in conjunction with the lord viſcount BROUNCKER and Sir ROBERT MORAY would recommend him for the poſt of Latin ſecretary to the king, if it ſhould become vacant [m]; upon which application the lord viſcount BROUNCKER as well as Mr. BOYLE ſhewed a great deal of zeal for his intereſt, which he had neglected for the ſake of ſerving the Society, having declined ſeveral advantageous offers of travelling with young noblemen abroad [n].

In 1667, probably in the month of Auguſt, he was committed priſoner to the Tower of London; of which he gives the following account in a letter to Mr. BOYLE, dated at London, September 3, 1667 [o], "I was ſo ſtifled by the priſon-"air, that as ſoon as I had my inlargement from the Tower, I widened it, and "took it from London into the country, to fan myſelf for ſome days in the good "air of Crayford in Kent. Being now returned, and having recovered my ſto-"mach, which I had in a manner quite loſt, I intend, if God will, to fall to "my old trade, if I have any ſupport to follow it. My late misfortune, I fear, "will much prejudice me, many perſons, unacquainted with me, and hearing "me to be a ſtranger, being apt to derive a ſuſpicion upon me. Not a few "came to the Tower merely to inquire after my crime, and to ſee the warrant, "in which when they found, that it was for dangerous deſigns and practices, "they ſpread it over London, and made others have no good opinion of me. "*Incarcera audaciter; ſemper aliquid adhæret.* Before I went into the country, I "waited on my lord ARLINGTON, kiſſing the rod. I hope I ſhall live fully to "ſatisfy his majeſty and all honeſt Engliſhmen of my integrity, and of my real "zeal to ſpend the remainder of my life in doing faithful ſervice to the nation "to the very utmoſt of my abilities. I have learned, during this commitment,

[h] See above, vol. ii. p. 18.
[i] BOYLE's works, vol. v. p. 332 & *ſeqq.*
[k] Ibid. p. 332, 336.
[l] Ibid. p. 338, and 341, 342.
[m] Ibid. p. 357.
[n] Ibid. p. 358.
[o] Ibid. p. 364.

"to

" to know my real friends [p]. God Almighty bleſs them, and enable me to " convince them all of my gratitude. Sir, I acknowledge and beg pardon " for the importunities I gave you at the beginning." The ſtraitneſs of his circumſtances obliged him to lay before Mr. BOYLE, in a letter of December 17. following [q], the ſmallneſs of the conſideration, which he had for the many ſervices, which he performed to the Society, his correſpondents foreign and domeſtic being no leſs than thirty at that time, and his income ariſing from the *Philoſophical Tranſactions*, which was never more than forty pounds a year, now falling to thirty-ſix. And in March, 166$\frac{7}{8}$, Dr. WARD, biſhop of Saliſbury, expreſſed to him great earneſtneſs to ſee him provided for with a recognition for his labours for the Society, which his lordſhip ſaid he would move in the council, being aſhamed for his own part, that he had been ſo long neglected, who had for ſo many years ſpent all his time and pains in the Society's buſineſs, without any conſideration for it [r]. Accordingly on the 27th of April, 1668, he had a preſent made him by the order of the council; and on the 3d of June, 1669, a ſalary of forty pounds a year allowed to him.

In 1671, he publiſhed in 8vo. an Engliſh tranſlation from the Latin original, printed in Italy, of *A Prodromus to a Diſſertation concerning Solids naturally contained within Solids: laying a foundation for the rendering a rational Account both of the frame and the ſeveral Changes of the Maſs of the Earth: as alſo of the various Productions of the ſame: by* NICOLAUS STENO. In 1675 and 1676, he was attacked on account of the *Philoſophical Tranſactions* by Mr. HOOKE, but was juſtified by a declaration of the council of the Society [s]; to which his correſpondences in various parts of the world were of the utmoſt importance. The method, which he uſed, to anſwer the great number of letters, which he received every week on a variety of ſubjects, was to make one letter anſwer another; and never to read a letter before he had pen, ink, and paper ready to anſwer it immediately: ſo that the multitude of them never cloyed him, or lay upon his hands [t]. He died ſuddenly in September, 1677 [u], at Charleton near Greenwich in Kent, and was interred there [x]. His wife, daughter and only child of Mr. JOHN DURY, a divine well known for his attempts to reconcile the Lutherans and Calviniſts, brought him a portion of four hundred pounds [y], and an eſtate in the marſhes of Kent worth ſixty pounds per annum [z]; and died before September, 1666 [a]. At his death he left two children by her, a ſon named RUPERT, from his god-father prince RUPERT; and a daughter SOPHIA [b]; to each of which children he left a paper of excellent admonitions and directions for their conduct in life [c]; as likewiſe a third, intitled,

[p] In a letter to Mr. BOYLE of December 24, 1667, printed in BOYLE's works, vol. v. p. 377. Mr. OLDENBURG mentions, that Dr. SYDENHAM was the only man, that he had heard of, who, " when I, *ſays he*, was ſhut up, thought fit (God " knows without cauſe) to rail againſt me; and " that was ſuch a coward, as afterwards to diſown " it, though undeniable. I confeſs, that with ſo " mean and unmoral a ſpirit I cannot well aſſoci- " ate."

[q] Ibid. p. 375, 376. [r] Ibid. p. 378.

[s] See above.

[t] Dr. LISTER's journey to Paris, p. 78, 79.

[u] Life of the honourable Mr. BOYLE, p. 114, edit. London, 1741, 8vo.

[x] WOOD, *ubi ſupra*.

[y] BOYLE's works, vol. v. p. 358.

[z] WOOD, *ubi ſupra*

[a] BOYLE's works, p. 358.

[b] WOOD, *ubi ſupra*.

[c] Thoſe to his daughter are dated Pallmall, October 16, 1672.

*Some Conſiderations left and recommended by* H. OLDENBURG *to his dear Wife* DOROTHEA CATHARINA OLDENBURG: which ſeveral pieces are ſtill extant in manuſcript. His ſon was living in 1717, when the council of the Royal Society, on the 28th of March, ordered him a preſent of ten guineas, in conſideration of his father's ſervices to it. The minutes of the council-book of September 13, 1677, mention Mr. OLDENBURG's widow, and thoſe of a ſubſequent council ſtile her his adminiſtratrix.

FRANCIS GLISSON, M. D. was ſecond ſon of Mr. WILLIAM GLISSON of Rampiſham in Dorſetſhire, ſecond ſon of Mr. WALTER GLISSON of the city of Briſtol [d]. He was educated in Gonvil and Caius College in the univerſity of Cambridge, where he took the degrees of batchelor of arts, in 1620, and that of maſter, in 1624 [e], and became fellow of his college. October 25, 1627, he was incorporated maſter of arts in the univerſity of Oxford; and having taken the degree of doctor of phyſic in 1634, was afterwards appointed regius profeſſor of phyſic in that of Cambridge, in the room of RALPH WINTERTON, M. D. Auguſt 1, 1634, he was admitted candidate of the college of phyſicians in London, and in September 30, the year following, fellow of it, and in 1639 was choſen lecturer of anatomy in it [f]. During the war between the king and parliament he practiſed phyſic at Colcheſter, where he reſided during the ſiege of that town in 1648 [g], being an inhabitant of the pariſh of St. Mary at the Walls [h]; but afterwards removed to London. In 1654, he publiſhed in London in 8vo. his *Anatomia Hepatis: cui præmittuntur quædam ad rem anatomicam univerſe ſpectantia: & ad calcem operis ſubjiciuntur nonnulla de lymphæductibus nuper repertis.* This work, which was formed from his lectures read at the College of Phyſicians, contains a more exact deſcription of the liver and its ſeveral veſſels, than had been given by any anatomiſt before: and beſides the diſcovery of the *capſula communis* or *vagina portæ*, and an excellent account of ſanguification, acquaints us how by the continual concoction of the blood the bile is neceſſarily produced and ſeparated from the blood, with the reaſons of its bitter taſte. In the piece *de Lymphæductibus* ſubjoined, Dr. GLISSON gives an admirable account of them and of the *ſuccus nutritius*, with the manner of its conveyance, and conjectures about the uſe of the ſpleen and glands. In 1655, he was choſen one of the elects of the College of Phyſicians, and afterwards preſident thereof, in which poſt he continued ſeveral years [i]. He was one of the earlieſt members of the Royal Society, being propoſed February 13, and elected on the 6th of March, 166$\frac{7}{8}$. His *Tractatus de Naturæ ſubſtantia energetica, ſeu de vita naturæ ejuſque, tribus primis facultatibus*, was printed at London, 1672, in 4to. as his *Tractatus de Ventriculo & Inteſtinis: cui præmittitur alius de partibus continentibus in genere, & in ſpecie de iis abdominis*, was at Amſterdam, 1677, in 4to. He publiſhed likewiſe in conjunction with Dr. GEORGE BATE and Dr. AHASUERUS REGEMORTER, the treatiſe

[d] WOOD, Faſt. Oxon. vol. i. col. 238, 2d edit. London, 1721.

[e] From the Regiſter of the univerſity of Cambridge.

[f] From the Regiſter of the college of phyſicians.

[g] The hiſtory and antiquities of Colcheſter: by PHILIP MORANT, M. A. b. 1. p. 63.

[h] Ibid. b. 2. p. 4.

[i] Dr. GOODAL's epiſtle dedicatory to his *Hiſtorical Account of the College of Phyſicians, &c.* edit. London, 1684, in 4to.

*de Rachetide ſive Morbo puerili, qui vulgo* the rickets *dicitur:* printed at London, 1650, in 8vo. He died in a very advanced age in the pariſh of St. Brides in London [k], October 14, 1677 [l]. Several of his original manuſcripts are in the library of Sir HANS SLOANE, Bart. now part of the *Britiſh Muſeum.*

FRANCIS VERNON, Eſq; was deſcended from a good family in Worceſterſhire, and born near Charing-Croſs in the pariſh of Saint Martin's in the Fields in the city of Weſtminſter about the year 1637. He was educated at Weſtminſter-School, and thence elected to Chriſt-Church in Oxford, in 1654 [m], where he took the degree of batchelor of arts, January 28, 165⅞ [n], and that of maſter, July 17, 1660 [o]. His abilities in Latin poetry are evident from a poem of his intitled *Oxonium Poema*, printed at Oxford in 1667, in 4to. but incorrectly on account of his abſence. He was ſecretary to Mr. RALPH MONTAGU, afterwards duke of Montagu, when the latter was ſent, in 1669, ambaſſador extraordinary to LEWIS XIV. of France. During his reſidence in France Mr. VERNON was very ſerviceable by his correſpondence to the Royal Society, to which he was propoſed as a candidate by Mr. OLDENBURG on the 24th of April, 1672, and elected on the 22d of the month following, and admitted on the 12th of June upon his return from France. A ſtrong diſpoſition, which he had very early to travelling, led him to undertake a voyage into the eaſt in 1675; whence he wrote a letter to Mr. OLDENBURG, dated January 10th, 167⅝, giving a ſhort account of ſome of his obſervations in his travels from Venice through Iſtria, Dalmatia, Greece, and the Archipelago to Smyrna, whence this letter was written, which was ſoon after publiſhed in the *Philoſophical Tranſactions* [p]. In another letter written from Athens to JAMES CRAWFORD, Eſq; the Engliſh reſident at Venice [q], he mentioned, that he had well examined the ruins of the temple of Delphi and all that was remarkable at Thebes, Corinth, Sparta, Athens, &c. and had clambered up moſt of the mountains celebrated by the antients, as Helicon, Parnaſſus, &c. That he had ſpent ſome time on the banks of the river Alpheus, where he ſearched with much diligence for the Stadium Olympicum, but could not find any veſtiges of it; but that the pleaſantneſs of that river was a ſufficient reward for his pains: that Athens had about ſix thouſand inhabitants, and Sparta five thouſand; but that at Corinth there was nothing but utter deſolation, except the caſtle, which was of a prodigious bigneſs, built on a hill above the city, which then ſcarce deſerved the name of a village: that he had particularly obſerved that place of the iſthmus, where a communication between the two ſeas had been intended to be made: that his fellow-traveller Sir GILES EASTCOURT died on the plains of Solona, as they went to Lepanto, which place Sir GILES could not reach; for his fever growing more violent with an unquenchable thirſt, and he having nothing but water to drink, died on the third day after he fell ſick. Mr. VERNON's

[k] WOOD, *ubi ſupra.*

[l] From a MS. note of Dr. WALTER CHARLETON on the liſt of the members of the college of phyſicians in the Pharmacopœia Londinenſ. printed at London, 1677, in fol.

[m] WOOD Athen. Oxon. vol. ii. col. 599.

[n] Id. Faſti Oxon. vol. ii. col. 115.

[o] Id. ibid. col. 128.

[p] Vol. xi. n° 124. p. 575. for April 1676.

[q] Mr. CRAWFORD gave an account of this letter in one to Mr. OLDENBURG, dated at Venice, January 17, 167⅝, and inſerted in the ſupplement to the Letter-books, vol. ii. p. 427.

journal

journal of his travels is extant among the papers of the Royal Society, being found among thoſe of Dr. HOOKE, as appears from a letter of Dr. RICHARD MEAD to the Revd. Mr. EDMUND CHESHULL [r]. This journal, which contains only ſhort and imperfect notes, but a great number of inſcriptions, begins at Spalatro, July 8, 1675, and ends at Iſpahan, September 14, 1676. The advantage, which Mr. VERNON's travels might have been of to the public, was prevented by his unfortunate death near Iſpahan in Perſia in a conteſt with ſome Arabs about an Engliſh pen-knife, which he refuſing to give them, they fell upon him and cut him to pieces. His body being conveyed to that city was interred there [s].

*December* 6. Sir JOSEPH WILLIAMSON, preſident, in the chair.

The minutes of November 22, having been read gave occaſion of much diſcourſe concerning the hydroſtatical experiment, which had been ſhewn at that meeting, viz. in order to the clearing of ſome doubts and anſwering objections; and further experiments after another method had been made at this meeting, if the apparatus, which was ready, had not been accidentally broken at the ſitting down of the Society, which was therefore to be prepared anew againſt the next meeting.

Mr. HOOKE then ſhewed two microſcopical experiments, which he had promiſed at the preceding meeting.

The firſt was a farther improvement of the compound microſcope, whereby he ſhewed thoſe ſmall inſects in pepper-water very much more magnified and more clear than they appeared the day before; which was done by making the object-glaſs of a much ſmaller ſphere than the laſt, which was viewed by ſeveral of the perſons preſent.

The ſecond was a new ſort of ſingle microſcope, wherewith he exhibited to the preſident himſelf, and afterwards to moſt of the members preſent, the ſame little creatures ſwimming to and fro in the pepper-water contained in the ſmall cane; and made them ſo viſible, that all, who looked through the ſaid microſcope, though they had not been accuſtomed to the uſe of glaſſes, yet diſcovered them ſo plainly, as to be able to diſcover their figures, magnitudes, and motions. And all concluded the appearance this way to be much more clear and diſtinct, than it was the other way by the double microſcope, though that was one of the beſt of that kind.

Mr. HOOKE did not now give a deſcription of his ſingle microſcope, as having ſome farther improvements thereof to exhibit in ſome of the following meetings, undertaking to make the ſame to magnify objects a thouſand times more than this; though this, conſidering the clearneſs, magnified about a thouſand times more than the common microſcopes. He was deſired to proſecute theſe improvements

[r] Dated Crutched Fryars, July 15, 1709. [s] WOOD, Athen. Oxon. col. 600.

with

with what expedition he could, and to prepare a letter to Mr. LEEWENHOECK againſt the next meeting.

Mr. WINDHAM formerly propoſed by Sir JOHN HOSKYNS was put to the ballot, and choſen without any negative, there being twenty-four fellows preſent.

Sir PETER COLLETON was propoſed candidate by Sir PETER WYCHE: And,

GEORGE WHEELER, Eſq; by Mr. CHARLES HOWARD.

Dr. THOMAS GALE, Dr. ROBERT PLOTT, THOMAS SMITH, B. D. being without, were called in, and having ſeverally read and ſubſcribed the engagement in the Charter-book, were by the preſident admitted fellows.

Dr. GREW read ſome parts of a diſcourſe, which he had compoſed concerning flowers; and ſhewed the delineation of things taken notice of by him for that purpoſe.

It was moved, that he would print this diſcourſe; and Dr. WALLIS mentioned, that it was proper to print all of that kind in quarto, that they might be bound together.

A letter from Paris to Mr. BERNARD, and by him communicated to and tranſlated by Mr. HOOKE, was read, containing ſeveral remarkable informations concerning philoſophical, mechanical, and other ſubjects of learning [1].

Capt. LANGFORD's paper about hurricanes preſented to the Society by Sir ROBERT SOUTHWELL was read, wherein he gave an account, firſt of the occaſion of his coming to the knowledge of foretelling hurricanes; which was his kindneſs to an Indian, whom he had in his power, and who afterwards died in South * *. Secondly, of the ſigns and prognoſtics of hurricanes, and the great benefit, which he had thereby of preſerving ſhips at ſea, and goods at land. Thirdly, his conjectures concerning the reaſons and cauſes of theſe wonderful and violent ſtorms.

Sir ROBERT SOUTHWELL having deſired, that the Society would furniſh him with ſome farther queries pertinent to that purpoſe, Sir JOHN HOSKYNS, Mr. HILL, and Mr. HOOKE, were deſired to draw up ſuch as they could think of for that inquiry.

Dr. WALLIS remarked, that in the earthquake, which happened at Oxford in the year 1665, he had obſerved a very conſiderable and ſudden fall of the baroſcope, though he himſelf did not obſerve the concurrent accident of the earthquake.

Mr. HOOKE affirmed, that he had for fifteen or ſixteen years paſt conſtantly

[1] Letter-book, vol. viii. p. 10.

obſerved

obſerved the baroſcope, and that he had always found, that in the ſaid inſtrument the quickſilver was always exceedingly low, and fell to that ſtation very ſuddenly, whenever any conſiderable ſtorm of wind and rain had happened in that time. And that whenever the quickſilver was obſerved to fall ſuddenly very low, it had always been a forerunner of a very great ſtorm ſuddenly to follow, ſometimes within twelve hours; and therefore he hoped, that this inſtrument might be of very good uſe at ſea, in order to the foreſhewing an enſuing ſtorm.

He alſo mentioned, that he had an hypotheſis, by which the phænomena of the baroſcope would be more clearly and diſtinctly made out than by any, which he had hitherto heard of; viz. of dividing and diſtinguiſhing the two principles or cauſes, which actuate the ſaid inſtrument, from which diſtinction it would be eaſy to ſhew the reaſon, why at different times the ſame hight of the quickſilver foreſhews different conſtitutions of the weather.

Dr. WALLIS obſerved, that it would vary with keeping; but Mr. HOOKE was of a different opinion.

Mr. HOOKE upon this occaſion acquainted the preſident and Society, that he had a baroſcope making, which would make the alteration of the preſſure of the air as evident, as ſhould be deſired; and that inſtead of two inches or thereabouts, which was the difference, that is uſually obſerved between the higheſt and loweſt altitude of the upper ſurface of the quickſilver above the lower, he could by this make that difference two feet, or two yards, or two fathoms, or more, if it ſhould for any uſe be found neceſſary.

Dr. CROUNE related, that Sir PETER COLLETON had taken care to ſend ſeveral baroſcopes to Barbados, in order to examine, whether they would be of any uſe for the foretelling the ſeaſons and mutations of the weather, as they are found to do in England, eſpecially concerning hurricanes.

Mr. OLIVER HILL made ſome queries concerning the uſe of quickſilver and ſpirit of wine in the making of the baroſcope; and it was anſwered, that quickſilver was made uſe of by reaſon of its great weight, and ſo diminiſhing that inſtrument from thirty-five feet to thirty inches: and ſpirit of wine, by reaſon both of its eaſineſs and readineſs of expanſion, and alſo of its exemption from freezing. But he not thinking theſe ſufficient reaſons explained a theory, which he had of their uſefulneſs in that inſtrument deduced from ſome chemical principles of his own, whereby he endeavoured to ſhew the reaſon of all the appearances.

Mr. ABRAHAM HILL queried, from what cauſe it was, that the quickſilver and tube being well purged of air, and the experiment being made with great care, the quickſilver had been found to ſtand to the hight of ſeventy inches, contrary to the received theory of the gravitation of the air.

To which Mr. HOOKE anſwered, that though by ſuch diligence and care as he had mentioned, he had made the quickſilver to ſtand at that hight; yet even then,

then, if any conſiderable jog or ſhake were given to the tube, in which the quick-ſilver was ſuſpended, the quickſilver would leave the top of the tube, and fall to the hight of thirty inches, or thereabouts, according as the ſtandard of the quick-ſilver was at that time: and he added, that this ſecond ſuſpenſe depended upon a ſecond cauſe, which he had formerly explained in a diſcourſe to the Society.

Mention was made, that Dr. WALLIS had formerly ſaid ſomething on this ſubject; and it was deſired, that inquiry might be made concerning it.

The preſident inquiring what experiments were deſigned for the next meeting, Mr. HOOKE undertook to have the hydroſtatical experiment ready; as alſo a farther improvement of the microſcope.

It being late, the Society roſe, and waited on the preſident to his own houſe.

*December* 13. The preſident in the chair.

Mr. BARRINGTON and Mr. HALL were ſworn of the council.

Dr. GREW was ſworn ſecretary.

Sir PETER COLLETON was elected by the ſuffrages of twenty-ſix members without a negative.

JOHN HERBERT, Eſq; propoſed candidate at the laſt meeting by Dr. WHISTLER, was elected.

The minutes of the laſt meeting were read; whereupon a debate aroſe concerning the cauſe of the phænomena of the barometer: and whether the ſame hight of the quickſilver always foreſhews the ſame conſtitution of weather.

Dr HOLDER related, that Dr. VOSSIUS had endeavoured to give a reaſon of of thoſe appearances from the different natures of the air blowing from the ſea or from the land; and that the former were light and the latter heavy.

Mr. HOOKE explained the manner how the air at ſometimes preſſed more, ſometimes leſs; and that was from the real acceſs and accretion of vapours raiſed up in the form of air; which, whilſt intimately mixed with the air, might augment the bulk, as alſo the ſpecific gravity of the air ſo long, till by a ſecond ſort of vapours all thoſe others become precipitated or condenſed into the form of water, whereby the air, out of which they are ſeparated, become lighter in ſpecie; and alſo the altitude of the aereal cylinder becomes lower: for the gravitation of any fluid upon an equal bottom of the containing veſſel is always in a proportion compounded of the ſpecific gravity of the fluid itſelf; and ſecondly, of the perpendicular altitude of the ſaid gravitating fluids. This he affirmed he had made out formerly to the Society by many experiments, as their Journal-book would ſhew.

To this Sir JONAS MOORE agreed, and explained the ſame in a tun filled with liquor, wherein the gravitation or preſſure againſt the bottom; or any part thereof, was always equal to the weight of a cylinder, equal to the bottom of that liquor, where it touches the body.

Upon this Dr. WHISTLER made ſeveral objections; but upon the farther explication of the manner of making the experiments, he was ſatisfied with the theory.

Dr. GREW alledged, that he had formerly propoſed a theory of his own, of explaining the preſſure of the air by the diſſolution of ſalts, wherein his ſuppoſition was, that the ſaid ſalts before diſſolution weighed more (that is, augmented the preſſure of the air) and after diſſolution leſs (that is, diminiſhed the preſſure of the air.) This was not debated, becauſe he promiſed to bring in his theory, as he had formerly read it in the Society, at the next meeting.

Whilſt this was diſcourſing, Mr. WHEELER was put to the ballot, and elected by the ſuffrages of thirty members without a negative.

Sir JONAS MOORE related, that Mr. TOWNLEY had made obſervations of the barometer at Townley in Lancaſhire for ſeveral years, and that the ſame alterations had happened, which at the ſame time had been obſerved at London.

He remarked likewiſe, that he had himſelf obſerved the ſame at Tangier for a whole year, and had not found the difference of altitude more than one inch all that time in that place; whence the greater conſtancy of the weather of that place was argued, and that the preſſure of the air was not the ſame in all parts of the earth, but in ſome places always more, in ſome always leſs.

Sir CHRISTOPHER WREN, upon the diſcourſing of the various preſſure of the ſea and land-winds, propounded Bermudas as a very convenient place to have trials made of the mutations of the barometer, the ſeaſons there being very temperate, and the iſland lying encompaſſed on every ſide with the ſea, and very far from any land.

Mr. HOOKE related, that he had been informed by Sir JONAS MOORE, that obſervations were then making in another iſland more conveniently ſituated for that purpoſe, viz. in St. Helena, on the other ſide of the line.

Sir JONAS MOORE confirmed this; and added, that the hight of the mercurial cylinder there had not exceeded ſix inches.

The preſident thought upon the whole matter, that it was very proper, that obſervations of this kind ſhould be made in as many parts of the world as could be procured; and that all experiments of this kind whereſoever made, and by whatſoever contrivance, whether by mercury, water, or any other liquor, and whether by a plain or a wheel barometer, or by any other more compounded, inſtrument

ment invented for that purpoſe, ſhould be reduced to one ſtandard of inches and parts: and that, together with ſuch obſervations, care ſhould be taken to obſerve and regiſter the various conſtitutions and mutations of the air, that happen at thoſe places; viz. the quarter and ſtrength of the wind, the tranſparency and opacity of the air; as alſo its preſent conſtitution as to heat and cold, dryneſs and moiſture, cloudineſs and clearneſs, and the like; that ſo from the comparing of theſe ſeveral obſervations together, a theory might be made of the ſaid mutations grounded upon obſervations and experience, the ſure guides in all inquiries of this nature.

And whereas Mr. HOOKE had read in the minutes of the laſt meeting, that he had contrived a barometer, by which an infinite number of ſmall mutations of the air might be diſcovered, which would be wholly inviſible, and inſenſible by the more common air-poiſes, the preſident adviſed him, that whatever the contrivance was, he ſhould reduce it to a certain ſtandard of inches and parts, as decimal, centeſimal, or thouſandth parts of inches.

Upon this it was affirmed, that Sir JONAS MOORE had kept an account for ſome time of theſe mutations; as Mr. TOWNLEY had alſo done for a longer time.

Dr. CROUNE affirmed, that he had alſo made ſome obſervations of this kind, and kept an account thereof.

The like was affirmed by Mr. HOOKE.

It was likewiſe aſſerted, that Dr. WALLIS, and ſeveral other members of the Society had done the like; which obſervations, it was hoped, would in time be all collected into the regiſters of the Society as the proper place, where all matters of this kind might be kept upon record.

Mr. OLIVER HILL thought, that it was going very much about to begin with experiments and with theory, and affirmed, that he had, upon what had paſſed at the laſt meeting made ſeveral animadverſions, whereby he had, from a theory, of which he was maſter, of the nature of the air and of mercury, and from principles of his own invention, plainly ſhewed the reaſon of all the experiments, which had been exhibited and diſcourſed at that meeting, and why things happened ſo and not otherwiſe; and that by his ſaid theory, he could not only explain thoſe there produced, but all others whatſoever of that kind; particularly thoſe about the animals in pepper-water, and the experiments of the water-poiſes: and that, if the Society thought fit, he would, at the next meeting, bring in and read his ſaid animadverſions and theories: which the preſident deſired him to do, although he was acquainted, that the method and buſineſs of the Society were very different from thoſe which he propounded; it being their aim rather to be directed by the operations of nature, duly obſerved, than by theories not built upon a ſufficient and unqueſtionable foundation of obſervations and experiments.

Mr. Hooke then ſhewed the experiments appointed for this meeting; and the firſt was an improvement of the ſingle microſcopes, by which the little animals were exhibited much more magnified and very much plainer, though to ſome perſons they ſeemed not ſo plain; the reaſon of which was to be aſcribed to ſome otherwiſe imperceptible defects of the eye.

His ſecond experiment was of a water-poiſe, whereby the difference of the ſpecific gravity of liquors was manifeſted by the ſinking of the neck of a poiſe into the fluid examined, not at all making uſe of ſcales, as in the former experiments. And the niceneſs and curioſity of this inſtrument was ſhewn to proceed from the very great difference between the bulk of the poiſe under the fluid, and the ſmallneſs of the ſenſible part of the neck, which might be made as one thouſand, or ten thouſand, or an hundred thouſand to one; and conſequently that the difference or alteration of the ſpecific gravity of any liquor examined thereby might be diſcovered, though it were altered but 1,000, or 10,000, or 100,000 part of it.

Dr. Croune conceived, that the ſame thing might be diſcovered by the help of a large beam weighing a great quantity of ſuch a fluid. But it was ſhewn, that it was wholly impoſſible to come any thing near that exactneſs with any ſuch beam, though ever ſo curiouſly made, becauſe the great weights, that muſt be put into the ſcales of the ſaid balance, would, if the edges of the middle pin of the beam were very ſharp, not only flatten them, but ſink an impreſſion into the holes thereof; and that whereas half an ounce poſſibly would be requiſite to turn the moſt exact beam, when charged with two hundred weight at an end, in this half a grain would produce the ſame effect.

Dr. Croune alſo urged, that this was the ſame with the common water-poiſe. But Mr. Hooke ſhewed wherein it differed; namely, that whereas the moſt exact of that kind, that he had hitherto ſeen, would not diſtinguiſh to a much ſmaller quantity than about an hundredth part of the bulk, this would do to an hundred thouſandth; which was a thouſand more exact. And, ſecondly, that whereas that did it only indeterminately, and without any reſpect to the ſpecific gravity by uncertain diviſions; this was deſigned to define and determine that alſo, by giving the proportion, that the ſaid alteration had to the whole.

This was the third inſtrument of this kind, which had been produced to the Society by Mr. Hooke. And the reaſon, which he gave of his ſo doing, was, that it was not his deſign or intention to load or trouble the Society at their meetings with a confuſed enumeration of experiments of one kind, which might be made with every one of the ſaid inſtrument; that being only the work of a labourer or operator to perform, when once the inſtruments were contrived, and the method chalked out. But his deſign was rather to improve and increaſe the diſtinguiſhing faculties of the ſenſes, not only in order to reduce theſe things, which are already ſenſible to our organs unaſſiſted, to number, weight, and meaſure, but alſo in order to the inlarging the limits of their power, ſo as to be able to do the ſame things in regions of matter hitherto inacceſſible, impenetrable, and imperceptible by the ſenſes unaſſiſted. Becauſe this, as it inlarges the empire of

of the ſenſes, ſo it beſieges and ſtraitens the receſſes of nature: and the uſe of theſe, well plied, though but by the hands of the common ſoldier, will in a ſhort time force nature to yield even the moſt inacceſſible fortreſs.

And of this kind were all thoſe inſtruments, which he had ſince the laſt meeting of the Society endeavoured to explain and ſhew to them. Such were the microſcopes, which he had there exhibited, which would as much exceed the common ones, as they did the naked eye; and conſequently were an improvement of that ſenſe, which is the moſt ſpiritual of all the five. Such were the water-poiſes newly explained: and ſuch was the barometer, which he was now preparing; for that thereby multitudes of mutations of the preſſure of the air, which were wholly imperceptible to the common barometer, would by it be diſcovered. And to ſhew, that this was not purely conjectural, he affirmed, that by an inſtrument of this kind he had diſcovered ſuch mutations and motions in the atmoſphere, as were very ſurpriſing and very ſignificant; ſuch as the tremulous motion of the ſaid barometer before a great ſtorm enſuing, which could in no reſpect be aſſigned to any ſhaking of the houſe from wind, or the paſſage of carriages near the place, which was purpoſely taken notice of.

The experiment propounded by Mr. Hooke for the next meeting was in order to explain the phænomena of the gravitation of the air, and the differences thereof cauſed by the riſing of vapours from the earth; concerning which he affirmed, that he had ſhewn ſeveral experiments, and he ſuppoſed, that they were in the Regiſter-books of the Society: but notwithſtanding there having been much debate concerning that matter, and ſeveral perſons there preſent not being well ſatisfied concerning the manner, reaſons, and ſignification thereof; it was judged convenient, that it ſhould be prepared by the operator.

*December* 19. At a meeting of the Council were preſent

Sir Joseph Williamson, preſident,
Sir John Lowther,
Sir Paul Neile,
Sir Robert Southwell,
Sir Christopher Wren,
Sir Jonas Moore,
Sir John Hoskyns,
Mr. Charles Howard,
Dr. Holder,
Dr. Whistler,
Dr. King,
Mr. Henshaw,
Mr. Hill
Mr. Hall,
Dr. Grew,
Dr. Walter Needham,
Mr. Colwall,
Mr. Hooke.

It was ordered, that what experiments ſhall be undertaken by the curators ſhall be propounded a fortnight before the ſhewing thereof, that objections, anſwers, and confirmations may be timely thought of: and

That the curators or any other perſon ſhewing an experiment to the Society ſhall explain the ſame, and ſhew the deſign and uſefulneſs of it.

A debate about making collections out of the Regiſter and Journal-books, in order to print them, was ordered to be reſumed, when the papers and books are recovered by the Society.

Both the ſecretaries were ordered to be employed in taking the minutes at the meetings; but theſe minutes to be drawn up fair for the amanuenſis to enter by one, who is alſo to read them.

It was ordered, that a common letter be drawn up by the ſecretaries againſt the next meeting of the council: that all letters to the ſecretaries be for the future incloſed in a paper to the preſident, Sir JOSEPH WILLIAMSON, his majeſty's principal ſecretary of ſtate: and

That all letters received be paſted into a book, as they are received; and that ſuch of them as ſhall be thought fit, ſhall be fairly copied out into the Letter-book for that year.

*December* 20. Mr. HENSHAW, vice-preſident, in the chair.

The minutes of the meeting of the 13th inſtant were read; and the vice-preſident deſired, that the experiment of the ſmall animals in pepper-water might be ſhewn to the lord HALIFAX [a], then preſent, who plainly diſcovered them ſwimming up and down in the liquor.

Mr. OLIVER HILL was called upon for his diſcourſe, which he had promiſed at the laſt meeting, upon ſeveral matters, that had been ſhewn to the Society: to which he made an apology, for his not bringing in his thoughts of the baroſcope, by reaſon that he could not obtain what obſervations had been made by Dr. WALLIS and others, which he had called for of Mr. HOOKE, but they were not in his cuſtody. He made ſome objections to what was entered as his ſenſe at the laſt meeting; and ſaid, that though he did maintain, that we ought to be ruled by a theory in the making all our experiments, yet he would be underſtood to have the theory founded upon previous experiments. Upon ſuch a theory as this he affirmed to have found the cauſe of the little animals abovementioned; and that was, that the ſkin of the pepper being very porous, and full of ſmall * * was the cauſe of the receiving the ſpirit of the air, which is there as in matrixes, and by the heat and dryneſs of pepper hatched into animalcules: that theſe little creatures were actually alive in the pores of the ſkin of the black pepper; and that they were by water to be waſhed off from the ſurface of them. When it was objected, that it did not ſeem ſo probable, that theſe animals ſhould be in the pores of the ſkin of the pepper, ſince it had been obſerved, that creatures not much unlike had been found in the ſteeping of oats, wheat, barley, peaſe, and divers ſteepings, and even in rain-water itſelf, he affirmed, that the ſame principles would make it out; for wherever there was a fit matter, the ſpirit would operate, and produce an animal.

[a] Sir GEORGE SAVILE.

The

The vice-preſident alledged, that REDI had found particular animals adherent to particular bodies; whence it was probable, that theſe animals, if they had been produced by the pepper, would not have been produced in theſe other waters, in which oats, wheat, barley, &c. had been ſteeped: and therefore it was more probable, that theſe little creatures were originally in the water; and that the infuſion of black pepper had only afforded them a better food, wherein they increaſed more plentifully; and that their ſeeds or eggs were diſpoſed in the water, and not in the pepper.

To this Mr. OLIVER HILL replied, that there was no need of any ſuch thing as a ſeed or egg, ſince there was a ſpirit of nature, which was every where; and where it found fit matter to work upon, there it produced an animal.

When it was objected, that there had never yet been any certain experiment or obſervation of the production of an animal, where there might not be ſhewn very good reaſon to believe, that there was a ſeed or egg for its cauſe: he anſwered, that he could eaſily ſhew an experiment, that would plainly confute that aſſertion; which was, that he could take May dew, and put it into a glaſs, and ſeal it up hermetically; and then by ordering the glaſs in ſuch a way, as he well knew, he could in time produce therein an animal ſix inches long; which ſhould continue to grow to that bigneſs, and that the ſaid animal ſhould in longer decay and vaniſh again.

And when it was enquired of him, whether he could do it with May dew diſtilled, he ſaid not; becauſe that was ſpirit of May dew, and not May dew.

The vice-preſident obſerved, that he had formerly had a creature produced in May dew; but that the glaſs was neither ſtopped nor hermetically ſealed; but that it was rather ſuppoſed, that it had come in by the mouth of the glaſs. He added, that May dew might well be ſuppoſed to be a body full of the ſeeds of living creatures, ſince it was gathered at a proper time of the year, upon wheat and other vegetables; and ſince the animal could not be produced, when any operation had been done upon the ſaid dew, that might deſtroy the ſeminal principles ſwimming in it, as Mr. OLIVER HILL had before confeſſed, that there could be no concluſion drawn from that argument.

When Mr. OLIVER HILL farther urged, that he would ſhew an experiment, that he could, by waſhing black pepper with diſtilled water, waſh out the ſaid animals from their cells in the rine of the pepper: it was deſired, that he would againſt the next meeting provide ſome ſuch pepper and ſuch water, as ſhould be needful, though it was believed, that the effect would in no wiſe follow ſuch an operation.

After this diſcourſe, Mr. OLIVER HILL read a written diſcourſe of his, about the method, which the Society ought to take in their proceedings, much different from what they then followed.

Mr.

Mr. GEORGE ENT presented the Society with the printed catalogue of the Bodleian library.

Mr. HOOKE shewed an hydrostatical experiment mentioned at the last meeting, which was in order to explain how the mutations of the baroscope were occasioned by the different pressure of the air; which pressure was sometimes greater, sometimes less, according as the exhalations or vapours raised up into the same augment the specific gravity of it, and the bulk also or perpendicular altitude thereof. This he made appear by means of a very high body of glass filled with water, into which was let down a standard of pressure made by a bended tube of glass, in which mercury was put; which, as it descended deeper into the water, and consequently the pressure encreased, was raised on one leg, and depressed in the other leg thereof. Then a bladder was tied to the end of another glass-cane, and by the breath, after it was sunk down into the water, was blown up; by which the fluid was increased, though not the specific gravity; and thereby the perpendicular altitude of the pressing fluid was increased, and consequently the pressure upon the mercury in the standard. The same was verified by a farther trial made with a large bottle of quicksilver close stopped and let down into the body of the said water: and it was alledged by Mr. HOOKE, that the same effects would follow from whatever body it were, that was thus put into the fluid, and augmented the bulk thereof, without at all altering the specific gravity of the same.

Dr. CROUNE remarked, that the same liquor, by being put into different cylinders, and so different postures, much augmented the pressure of the same quantity of fluid upon the respective bottoms.

But Mr. HOOKE observed, that the same quantity of a fluid body, by being put into ever so much different cylinders, the whole pressure of the said fluid upon the whole bottom of the one would be equal to the whole pressure of the other upon the whole bottom of the second; because the gravity of the fluid must be the same in all postures, and the space possessed by the same would also be equal; for as the base of the bigger is to the base of the less, so the perpendicular altitude of the less is to the perpendicular altitude of the bigger.

To this Dr. CROUNE could not assent, but alledged, that he would make out the contrary by experiment.

The experiments propounded by Mr. HOOKE for the next meeting were the prosecution of the hydrostatical experiment, and a farther improvement of the microscope.

The Society then adjourned on account of the approaching festival to Thursday January 3.

$167\frac{7}{8}$, *January* 2. At a meeting of the COUNCIL were present

Sir JOSEPH WILLIAMSON, president,

Sir

Sir JOHN LOWTHER,
Sir JOHN HOSKYNS,
Sir PAUL NEILE,
Sir CHRISTOPHER WREN,
Sir ROBERT SOUTHWELL,
Mr. CHARLES HOWARD,
Mr. HENSHAW,
Mr. HILL,
Dr. HOLDER,
Dr. WHISTLER,
Dr. KING.

It was ordered, that the former committee be desired to visit Mr. BOYLE, and to desire his assistance in recovering the books and papers of the Society yet remaining in Mrs LARDEN's hands [b]: and

That care be taken to have the oaths of Dr. PELL and the administratrix made in chancery, that all the papers belonging to the Society had been delivered; and that they knew of none else.

The common letter to be sent to all the correspondents was read, and altered; and somewhat of return for encouragement of the correspondence was ordered to be added.

The correspondents named were, MALPIGHI, HUYGENS, JUSTEL, CARCAVI, SLUSIUS, HENELIUS, P. LANA, BULLIALDUA, STUZOUT, LEIBNITZ, Sir WILLIAM PETTY, Mr. LISTER, and Mr. NEWTON.

It was ordered, that all letters received by the secretaries should be produced at the next weekly meeting; and if the Society should think fit, be read; and that that the secretaries take the directions of the Society for the speedy answering them, at least so far as to the acknowledging the receit: and

That Dr. ROBERT PLOT, in consideration of the promise he hath made the Society, in accommodating them with natural curiosities, and accounts of such other particulars, as would be pertinent to their design, which he might meet with in his survey of England, be excused from his weekly payments.

Mr. HENRY HUNT, the operator, was appointed the treasurer's deputy to receive such arrears of the members, as he should receive directions from the treasurer so do from time to time:

It was ordered, that all acts of the council be entered fairly into the council-book:

That there be prepared once a-year a collection of all such matters, as have been handled that year, concerning four, five, or more subjects, which have been well prosecuted, and completed; which may be printed in the name of the Society against the anniversary election-day:

[b] Mr. HOOKE, in a letter to Mr. LISTER, 5th January, 167⅞, (Supplement to Letter-books, vol. iv. p. 369) observes, that all the papers of the Society could not yet be retrieved from Mr. OLDENBURG's executrix's custody.

That the Regiſter-books of the Society be peruſed; and that what ſhall be thought fit by the council to be publiſhed, be drawn out and printed accordingly: and

That liſts of the ſeveral perſons in arrear to the Society, and of their reſpective arrears, recommended to ſeveral of the council, be made and delivered to them as a memorandum of what they had undertaken.

*January* 3. At a meeting of the SOCIETY,

Mr. HENSHAW, vice-preſident, in the chair.

Mr. WHEELER was admitted fellow.

The minutes of December 20 were read; which occaſioned much diſcourſe concerning the conſtitution of the air as to its tranſparency and opacity, gravity and preſſure, fogs miſts, rains and wind; concerning which it was debated, whether an opake, foggy, or miſty air were heavier than a clear tranſparent air; and it was concluded, that the tranſparency or opacity of the air does not at all contribute to the gravity or preſſure thereof; though on the other ſide the extraordinary gravity of it might ſometimes be the cauſe of its opacity. And the reaſon was alledged, becauſe ſometimes, when the preſſure of the air hath been greateſt, it hath been obſerved, that the air hath been as tranſparent and clear as at any other time whatſoever; and at other times, when the air hath been exceedingly light, fogs and miſts have been taken notice of: and that it was ſuppoſed, that the tranſparency and opacity of the air proceeded only from the uniformity of the parts of the air, and the opacity from the diſformity and incongruity of them. That it was thus explained by Mr. HOOKE, that the æther, which incompaſſes the earth, is the grand or univerſal menſtruum, which diſſolved takes up into itſelf, and ſuſpends all ſorts of vapours and exhalations whatſoever; viz. all thoſe bodies in the atmoſphere, which make up or conſtitute that body, which hath a very great ſpringineſs in it; and which will not pervade the pores of glaſs, but can be confined and included by it, much after the ſame manner as water diſſolves ſalt, ſugar, or the like into itſelf, and keeps it ſuſpended and intimately mixed with it, that ſo long as the vapours and exhalations remain thus diſſolved and perfectly mixed and united with it, they appear perfectly tranſparent. But when, by the mixture of different ſorts of vapours they either unite with them, and leave the æther; or thoſe other being more congruous to the æther unite and coaleſce with, and joſtle out theſe, and ſo make them a diſtinct body, theſe vapours or exhalations become as it were opake; that is, though really they are *in minimis* as tranſparent as formerly, yet by being diſunited with the air, and having a different refraction, they make the air ſeem opake and foggy. That theſe changes are often wrought from tranſparency to opacity, and from opacity to tranſparency; and yet the gravitation of the air not at all altered, by reaſon, that the ſame bodies remain ſuſpended in the ſame part of the atmoſphere; and conſequently their gravitation cannot be at all taken away. And whereas the vice-preſident objected, that what was alledged was but hypothetical; and that it was not very evident,

that

that there was any ſuch thing as an æther, much leſs was it underſtood what it was, and what properties it had; or that the air conſiſted of ſuch parts, as was alledged; Mr. HOOKE anſwered, that by multitudes of experiments he could make it very evident, firſt, that there was ſuch a body: ſecondly, what many of the properties of that body were: thirdly, how very conſiderable and powerful thoſe properties were in producing multitudes of effects aſcribed to other cauſes generally: fourthly, how thoſe properties might be examined and aſſayed and reduced to a ſtandard, viz to number, weight, and meaſure; and conſequently, that he could make it a ſubject fit to be farther inquired into by the Society, whoſe buſineſs it is to be directed by the great ſchoolmiſtreſs of reaſon, experience; and not to be ruled by groundleſs fancies and conceits.

By theſe ways he explained the phænomena of the great gravity of the air upon the long blowing of an eaſtwardly, and the lightneſs of it upon the blowing of a ſouthwardly wind; the air in the one coming over a vaſt tract of land, and ſo taking up into itſelf great quantities of exhalations, which remain ſuſpended and mixt with it by reaſon of their congruity; and the other blowing over a great ſpace of ſea, which affords a leſs quantity of parts diſpoſed to make air.

He alſo farther explained the reaſon of the ready converting of vapours into water by the cold of the air, thoſe watery parts being more eaſily precipitated or ſeparated from the air by the want of heat to keep them agitated; as was inſtanced in the appearing of one's breath in cold weather, and the eaſy converſion of the wind produced by water heated in an Æolopile into water again by the want of that heat and agitation.

Wherefore the gravity of the air ariſing only from the quality of thoſe gravitating parts, which were ſuſpended in the form of air, the greater the one is, the greater alſo muſt conſequently be the other.

Mr. OLIVER HILL then coming in affirmed, that there was no ſuch thing as gravity in the air; but that air was poſitively light; and that all, who believed otherwiſe, were miſtaken, and in a great error, as he would preſently make appear both by reaſons and experiments; and to this purpoſe alledged many things, which he affirmed he had more at large explained and better digeſted in a diſcourſe, which he had then about him on that ſubject; and that he had drawn it up on purpoſe for that meeting; and that he would read it, if the Society thought fit, and continue thoſe his diſcourſes, if they met with entertainment worthy of them.

After which he read his paper, a copy of which he promiſed to deliver to the ſecretary, between that and the next meeting, that an account thereof might be taken by the ſecretary.

At the ſame time alſo he delivered in a copy of his diſcourſe, which he had made at the laſt meeting, about the worms in pepper-water; intitled, *Reflections on the Tranſactions of the Royal Society in their meeting on Thurſday, December* 6, 1677.

Sir JAMES LANGHAM was propoſed candidate by Mr. HORNECK:

And Dr. THEODORE KERCKRINGIUS by the vice-preſident at the deſire of the preſident.

Mr. HOOKE acquainted the Society, that he had met with a diſcourſe of optics newly publiſhed by Pere CHERUBIN, containing deſcriptions of ſeveral ſorts of binocular teleſcopes and microſcopes; and of an inſtrument of taking the figure of things at a diſtance by the help of a teleſcope. He was ordered to procure that book for the Society's library.

The epitome of ſix papers from Mr. HEVELIUS to the ſecretary was read. The firſt marked A, was a letter about ſeveral particulars.

The ſecond marked B, contained an account of the occultation of Saturn by the moon, which he would have obſerved, but that the weather prevented him [c].

C was concerning the tranſit of Mercury through the ſun [d].

D a catalogue of the diſtances and poſitions of Saturn to the moon.

E a ſcheme or draught of the ſame obſerved through a twelve and twenty foot teleſcope.

F farther obſervations of the changes of the ſtar *in Collo Ceti* continued to December 6. 1677. N. S [e].

Part of a letter of Dr. SWAMMERDAM to Mr. OLDENBURG, dated at Amſterdam, 10th September, 1677 [f], was read, containing an account of a diſcovery made by him of a ſort of ſnails, that are viviparous.

*January* 10. Sir CHRISTOPHER WREN, vice-preſident, in the chair.

The minutes of the laſt meeting were read: upon which a diſcourſe aroſe concerning the æther, which Mr. HOOKE affirmed to be the menſtruum, vehicle, or moſt fluid part of the air, into which the exhalations or vapours, which compoſe the atmoſphere, are diſſolved or taken up, after the ſame manner as ſalt, ſugar, or any other tinging body, are diſſolved or taken up by water or other diſſolving liquors.

That the atmoſphere or air, that gravitates on the quickſilver in the barometer, is only that part, which was thus diſſolved and taken up; and that the other part or æther readily and freely pervades the parts of glaſs; whence glaſs becomes as

[c] Letter book, vol. viii. p. 12, 15, and 18.
[d] Ibid. p. 15, 18.
[e] Ibid. p. 25.
[f] Ibid. p. 2.

it were a ſtrainer to ſeparate between the æther and the groſs parts of air. That according to the quantity of theſe vapours or exhalations raiſed up and ſuſpended thus by the æther in the atmoſphere, ſo was the preſſure of it upon the mercury in the barometer: that the rarefaction and condenſation of theſe vapours did not at all alter the preſſure, provided the ſame quantity of the ſaid vapours were in both the ſaid conditions the ſame.

The vice-preſident doubted, whether there were any ſuch thing as that æther, which Mr. HOOKE had hypothetically ſuppoſed; and ſaid, that he would gladly ſee ſome experiment, that would make it evident, that there is ſuch a body mixed with the air.

To this Mr. HOOKE replied, that he could by hundreds of experiments evidence the reality of ſuch a body; and that from theſe experiments he was able to collect the ſeveral properties of that body; and how many and how very conſiderable effects it produced in bodies. He farther added, that he had a catalogue of ſuch experiments, which he thought he ſhould have occaſion ſhortly to make in order to the elucidating a theory, which he deſigned to make public hereafter.

The vice-preſident farther inquired, whether the dryneſs or moiſture of the air did not cauſe an alteration of the gravitating power upon the earth.

Mr. HOOKE, in anſwer to this, affirmed, that the dryneſs or moiſture of the air contributed not at all to the gravity or levity thereof; but only the greater or leſs quantity of the vapours held ſuſpended by the æther in that form; and that whether it were in perfect air, or condenſed into ſmall globules of water, which yet remained ſuſpended, it was the ſame thing, provided they remained ſuſpended.

He farther added an explication of what he meant by air ſaid to be lighter or heavier *in ſpecie*, viz. that that air, which had a greater quantity of exhalation in the ſame extenſion was the air, that was heavier *in ſpecie*, and that, which had a leſs quantity, a lighter *in ſpecie*: and that the condenſation or rarefaction of the air added not at all, nor took from its gravity, the ſame quantity of exhalations in the whole cylinder.

The vice-preſident inquired farther, whether the air could be made heavier *in ſpecie* by any other cauſe than cold? To which Mr. HOOKE anſwered, that not only forcible condenſation, but ſeveral fumes, ſmokes, and vapours, which may be raiſed up into the air, may produce that effect; but that it is very difficult to make it ſenſible by the barometer [s].

*January* 17. The preſident in the chair.

[s] The reſt of the minutes of this meeting were omitted in the Journal-book, vol. vi. p. 37, 38. where a blank is left, which cannot be ſupplied, as the original minutes are not extant.

The

The minutes of the laſt meeting were read; to ſome parts of which ſome amendments were deſired, viz.

Dr. WALTER NEEDHAM, upon the mention of worms found in the heads and brains of ſome creatures, added, that thoſe were not found any where in the head, but in the cavities of the os frontis, which in ſheep and kine extends under the horns. Dr. GREW affirmed the ſame from his own obſervations.

Sir JOHN HOSKYNS remarked, that he knew a perſon, who by looking upon the wheat, whilſt in the blade, knew, which would prove ſmutty, and which not; and it was ſuggeſted, that Dr. PLOT had a theory of that accident, by which he knew how to prevent it in the choice of his ſeed before ſowing.

Upon ſome farther diſcourſes about the barometer Mr. HOOKE ſuggeſted, that he had already brought in and ſhewed the Society ſeveral of his experiments, in order to elucidate a theory, which he had on that ſubject; and that he had as yet divers others behind, which he deſigned, as faſt as conveniently he could, to bring in likewiſe; and when they had been all ſhewn, to ſet down the theory of that matter, as he had conceived it.

Mr. OLIVER HILL affirmed, that the experiment, which upon trial at the laſt meeting had not ſucceeded, by reaſon, as he ſaid, that the air was then moiſt and foggy, and conſequently, according to his notion, had no elaſticity, upon his making trial of it ſince, had ſucceeded as he expected.

Sir JAMES LANGHAM and Dr. KERCKRINGIUS were elected into the Society.

WALTER CHETWYND, Eſq; was propoſed candidate by the preſident:

JOSEPH LANE, Eſq; by Mr. HOOKE:

GEORGE ENT, Eſq; by FOSTER:

EDMUND DICKENSON, M. D. by Dr. KING: And,

FRANCIS ASTON, Eſq; by Dr. BROWN.

Mr. HOOKE produced a letter from Mr. LEEUWENHOECK, mentioned by him at the laſt meeting to have been received; part of which being tranſlated from Dutch into Engliſh was now read by Mr. HOOKE, containing Mr. LEEUWENHOECK's thanks to the Society for their ſo kind acceptance of his laſt communications, and his compliance with their invitation ſent him by Mr. HOOKE to communicate ſuch other diſcoveries, as he ſhould make, viz. a farther account of divers obſervations made by him with his microſcope ſince his laſt letter of 2d January, 1676, N. S which he had ſent to the lord viſcount BROUNCKER, concerning the receit of which he was very ſolicitous to be informed. He informed the

Society in this laſt letter of his farther obſervations on milk, phlegm, &c. [h]: and that thoſe pipes formerly mentioned by them were found in his own as well as in eels blood: that the globules of the blood contained ſix leſſer within them: that both the one and the other were extenſible into a great length, and would afterwards return into a globular form: that the greater were all of equal ſize; but the globules of milk were all of different magnitude, ſome ſmaller, ſome greater. He mentioned alſo an experiment of Dr. DE GRAAFF of injecting milk into the veins of a dog, and explained the whiteneſs of milk by a ſort of milky ſubſtance made by a gum diſſolved in ſpirit of wine, and precipitated with water; which would be filled with ſmall globular atoms, and look white.

Dr. GREW remarked, that himſelf had aſſigned the ſame cauſe of the whiteneſs of vegetable milks in his diſcourſe on the *anatomy of trunks*.

Mr. LEEWENHOECK's letter added, that the globules of phlegm were the ſame with thoſe of the blood, but tougher and greener, &c.

Part of this letter not being yet tranſlated was referred to the next meeting.

The preſident preſented the Society with a curious horn, commonly called an unicorn's horn, being very intire and in length almoſt eight feet, wreathed and tapered to a ſharp point. It was at the greater end hollow like an elephant's tooth for about ſeven inches in length. The biggeſt part of it was about one foot from the hollow end, where it was eight inches about. It had eight wreaths in the length, and was not perfectly ſtrait, but a very little bent, which might be perceived, if it were looked upon end-way. Its ſubſtance was pretty white, and of about the ſame hardneſs with ivory.

Sir JOHN HOSKYNS mentioned, that there was lately printed a book concerning theſe kinds of horns; as alſo it was remarked, that OLAUS WORMIUS, in his *Muſeum*, had given a deſcription of one, and of the fiſh, out of whoſe ſnout it grows.

Dr. CROUNE mentioned a relation of Dr. HAMEY, that * * [i]

Mr. HOOKE mentioned the relation, which he had received from Mr. NEWLAND, of the like accident, which happened to a ſhip, wherein he was concerned, in its voyage from the Streight's mouth to Alicant, from a ſword-fiſh, of which the Society had received an account formerly.

Mr. HOOKE produced his experiment, in order to explain the preſſure of the air upon the mercury in the barometer; which was a large tube of glaſs about three feet long ſealed at one end, and opened at the other. This was filled with water pretty near the top: then a glaſs made of the form of an inverted ſyphon,

[h] Mr. HOOKE's Lectures and Collections, part 2.

[i] This minute is imperfect in the Journal-book, vol. vi. p. 41.

and

and containing at the bottom a pretty quantity of mercury. This tube being gradually ſunk down into the water, it was very obvious, how the preſſure of the water upon the mercury in that part of the ſyphon, which was open to the water, depreſſed it, and raiſed the ſame in the other part, which was open to the air, and excluded the water. And it was plainly ſhewn, that the cylinder of mercury kept up by the preſſure of the water was always about a fourteenth part of the length of the water-cylinder between the ſurface of the quickſilver and the top of the water. It was farther explained by him, and ſhewed, that the air and water in this repreſented in all circumſtances material in this trial the æther and air in the common barometer; that the mercury was common in both: for, as it was ſuppoſed, that the barometer at the top of the cane admitted the æther and excluded the air, ſo in this it admitted the air and excluded the water.

He farther ſhewed how the alteration of the ſpecific gravity of the air alters the preſſure, though the cylinder or altitude of the preſſing atmoſphere were the ſame: to make which more plain by an experiment, the freſh water, with which the great glaſs was filled, was poured out, and was filled with a very ſtrong ſolution of ſalt, care being firſt taken to obſerve the exact comparative hight of the mercurial cylinder to the freſh water cylinder: and it now appeared very plain, that the ſame altitude of ſalt-water kept up a cylinder of mercury much higher than the freſh water.

Here by the way Mr. Hooke ſhewed how the preſſure of the air decreaſed, as by aſcending a mountain approach is made nearer to the top of the air. And he mentioned, that he had formerly brought in to the Society divers diſcourſes and experiments; by which he had ſhewn, that the preſſure of the air actually decreaſes in gravity, according as the experiment was made farther from the centre of the earth, after the ſame manner as the decreaſe of the preſſure of the water was very viſible in this inſtrument. He added, that he was preparing an inſtrument for ſome trials to that purpoſe, which he would ſhortly ſhew. Theſe were two other inſtruments of the like nature with thoſe other, which he had produced ſince the laſt receſs of the Society: which inſtruments were not deſigned to ſhew one or two ſingle experiments and no more, but to be conſtant and ſtanding inſtruments, whereby all the phænomena of gravitation and preſſure may be explained by hundreds of experiments.

Farther, when a query was made, why the longer end of the ſyphon was not ſealed up, but remained open; which was otherwiſe in the barometer, Mr. Hooke explained the ſame, and ſhewed, that it was by reaſon, that the ſpring of the air, that was included, would vary its preſſure upon the riſing or falling of the cylinder of mercury, which being left open, the weight of the air did not any more than the other did in the barometer.

Upon this ſome queries being made concerning the ſpring of the air, Mr. Hooke explained that theory, and ſhewed, that, as the preſſure of the water in the greater cylinder increaſed, it raiſed the mercury in the oppoſite leg; and as that

that roſe, ſo the air thus included would be condenſed into a leſs room, and conſequently have ſo much the ſtronger ſpring.

Dr. WHISTLER objected, that though the air was more condenſed, yet he conceived, that the ſpring of it did not increaſe proportionably; explaining his ſuppoſition by the inſtance of a fleece of wool, which would only ſpring ſo much, and no more.

To which Mr. HOOKE anſwered, that though that might ſeem a little to explain what is meant by the ſpringineſs of the air, yet it was no way fit to make out all the appearances of the ſpringineſs of it: for that, as he had alſo formerly proved in the Society, the ſpring of the air is always condenſible and rarifiable, which the wood is not: and that the force of the very ſpring is always proportionate to the condenſion of its bulk.

The preſident hereupon deſired, that ſuch an experiment might again be ſhewn at the next meeting, which Mr. HOOKE promiſed to take care of and contrive accordingly. He promiſed likewiſe, at the preſident's deſire, to ſhew hereafter his theory of ſprings in general, having ſeveral years before ſhewed it to the king.

Upon this ſeveral queries were made, whether the air near the earth were not of very different degrees of ſpecific gravitation; and whether the preſſure was the ſame. To which Mr. HOOKE anſwered, that the parts of the air, as to their expanſion, vary very much, according to divers circumſtances attending them, viz. preſſure, heat, &c. That oftentimes the parts of the air near the earth might be much lighter *in ſpecie* than thoſe at a conſiderable hight above it: that though in the experiments of rarefaction of the air, it were ſhewed, that the higher parts muſt always gradually grow lighter and more rarified, yet in the atmoſphere it did not always happen ſo, but that ſometime the rarefaction and condenſation went *per ſaltus*, and by very great leaps. As an argument of this he urged the ſwimming of the clouds in the air; which ſeem to be upon the ſmooth ſurface of ſome fluid underneath them, all the under ſides of them being perfectly defined, ſmooth, and horizontal; whereas all the upper ſides of them are undefined and in heaps. Hereupon Mr. HOOKE ſaid, that he had an inſtrument for examining the ſpecific gravity of the air, which was diſtinct from ſpring or preſſure.

Dr. HOLDER mentioned, that ſomewhat like this was alſo to be obſerved in ſmoke, which will run along, and ſpread itſelf a great way, keeping as it were the ſame diſtance from the ground.

Dr. KING inſtanced, that a gentleman, who was a patient of his, could two or three miles off from London diſcover when he entered into the ſmoke of London.

Upon this ſome diſcourſe aroſe about the reaſon, why ſome chimnies ſmoke,

that is, do not convey the ſmoke from the fire up the funnel, but ſuffer it to ſpread into the room.

Dr. WHILTLER remarked, that there were four ways uſed for curing chimnies, according to their different cauſes of ſmoking:

1. By pipes added to the top, where the funnels being too ſhort was the cauſe.

2. By a ſmall pipe in the chimney, if the room be too little to ſupply a conſtant current of air.

3. By a cover turning like a weathercock, where a free exit of the ſmoke is deſired.

4. By leſſening the chimney, and making a chimney within a chimney, when the latter is too big.

Mr. HOOKE gave a reaſon, why in this experiment the mercury would of itſelf riſe higher in a greater, and lower in a leſs pipe: and why water would do the quite contrary; which by the experiment then ſhewn was plainly made appear to be ſo. He ſhewed, that this was the ſame with what he had long before publiſhed.

He added, that theſe and all other experiments, that had been formerly made by the Society for the examination of the nature and properties of the air, though they had been hitherto the opprobrium of the Society from ſuch perſons, as thought themſelves maſters of all knowledge *a priori* and by revelation; and deſpiſed all ſuch, as was acquired by experimental inquiry; yet there is no ſubject in nature more proper for the Society's examination and exerciſe. For whatever may be ſaid, that the weighing of the air, and the exhauſting and condenſing it in æther-veſſels, and the like, are trivial and impertinent tricks; yet he doubted not to make it evident, that an exact and thorough knowledge of that is of more concern to mankind than all the other phyſical knowledge in the world. For it is by that we continually ſubſiſt, and without it we cannot live one tenth part of an hour. It is from that proceed the cauſes of infinite diſeaſes; and it affords as many remedies for thoſe diſtempers. It is that, in which we continually reſide: it is the cauſe *ſine qua non* of all vegetables and animals upon the land; and influences even the fiſh in the ſea. Infinite and unſpeakable are the uſes of it to the huſbandman, the merchant, the tradeſman, the mechanic, &c. And that age will be deſervedly famous, which ſhall perfect the theory of it.

*January* 24. The preſident and vice preſident being abſent, Mr. EVELYN at the earneſt deſire of the members preſent took the chair.

The minutes of the laſt meeting were read, and ſome amendments were made about

about the relation [k] concerning the worms in the cavities of the *os frontis:* upon which occaſion Dr. CROUNE added, that he had obſerved, that the cavities of the *os frontis* and the little cells of the noſe having in them a kind of gelly or ſlime, are often filled with worms in ſheep and other cattle; and that he had obſerved the ſame thing in a human ſkull: but he conceived, that theſe little worms were engendered in the man's head, which he had anatomized after the death of the perſon, he having found them ſeven or eight days after that perſon's death. He was of opinion alſo, that the tickling of theſe kinds of worms under the horns of ſtags, the ſaid cavities extending under them, was the cauſe of the ſtags rubbing their horns. He cited QUELFER for the firſt author of this obſervation.

Dr. WALTER NEEDHAM added, that the gelly, which countrymen take out of the heads of cattle troubled with the ſtaggers, &c. was cut out of thoſe cavities.

Upon the mention of Dr. PLOT's way of preventing ſmutty corn, it was ſuggeſted, that it was in the ſkill of chooſing the ſeed before ſowing, and in nothing elſe.

Upon the diſcourſe, that was about the inſtrument propoſed at the laſt meeting for examining the different preſſure of the air at different hights above the ſurface of the earth, Mr. HILL ſuggeſted, that it was very deſirable, that a liſt of inquiries and experiments might be made for that purpoſe.

Dr. CROUNE mentioned, that Monſ. PASCAL at Paris had upon making this experiment found, that there was five inches difference in the altitude of the mercurial cylinders in the barometer at the top and bottom of the mountain, on which it was tried; and that one inch of altitude in the mercurial cylinder anſwered to about a thouſand feet of altitude in the atmoſphere or air.

Mr. HOOKE remarked, that this proportion of the two cylinders of mercury and air was not at all times alike, by reaſon that the ſpecific gravity of the air alters from many cauſes; as does alſo the ſpecific gravity of the mercury: but that by this inſtrument, which he was preparing, that inequality would be diſcovered.

Mr. HOOKE produced two experiments, which he had promiſed at the laſt meeting, being thoſe which were mentioned in the firſt part of Mr. LEEWENHOECK's letter; viz. concerning the conſtituent parts of blood and milk; which were very plainly to be ſeen by making uſe of a ſmall piece of looking-glaſs plate (inſtead of the uſual foot of the microſcope) which was very ſmooth and clear; and by ſpreading a little of the blood and milk on the top of it, and looking againſt the flame of a candle. From whence it appeared, that the blood conſiſts of two ſubſtances, the one a containing liquor undetermined and undiſtinguiſhable as to its

[k] In the minute, which is left imperfect in the Journal book.

parts, flowing about and incompaſſing the other, which conſiſts of an infinite number of exceedingly ſmall parts, which were plainly perceived to be globular: all which parts were very equal as to bigneſs, and were ſeen upon the turning of the microſcope to move to and fro very ſwiftly and very freely, they ſeeming to croſs one another very much, and to move confuſedly, though all tending the ſame way.

In milk the like ſubſtances were very viſible, only with this difference, that whereas the globular parts of the blood were all of very equal magnitudes, thoſe of milk were extremely different. Theſe were exceedingly white like little pearls, whereas thoſe of the blood were red.

The latter part of Mr. LEEWENHOECK's letter was then read, wherein he gave an account of his obſervations ſhewn on flegm, in which he had diſcovered the ſame globules, as in the blood; but that the veſicles, as he conceived, of them had received ſome kind of corruption and greenneſs.

He added alſo his obſervations of ſome exceedingly ſmall animals in pepper-water not one thouſandth part ſo thick as an hair, but three or four times as long as thick. Theſe ſhot very nimbly through the water, and the length of their ſhoot was about half a hair's breadth. In old pepper-water likewiſe he had found eels no thicker than the former, and but one hundredth part of the length of an eel in vinegar.

*January* 31: Mr. HENSHAW, vice-preſident, in the chair.

Upon reading the minutes of the laſt meeting the vice-preſident related, that the ſmuttineſs of wheat proceeded from a certain mildew or honey-dew falling upon the ſtanding corn in the night; which, when the ſun riſes, is dried and fixed upon the wheat, and hinders the growth; whereby the corn becomes withered and corrupted: and that this is the reaſon is probable from the method of ſecuring corn from ſmut, by two mens taking a rope between them, and walking along the furrows on each ſide the corn, and carrying the rope ſtiff and ſtrained, ſo as to bruſh off the mildew from the ears and blades of the corn. An account of this was given by Sir JAMES LONG, as likewiſe by Sir HUGH PLATT in his book.

Some of the members were of opinion, that mildew is an exudation from a plant, and not a moiſture precipitated out of the air, by reaſon that it was found more upon ſome plants than upon others; and that it ſeemed to participate ſomewhat of the nature of the plant: that mildew and honey-dew are the ſame: that the true name is meldew or honey-dew: and that it falls or is found ſticking much upon the aſh.

Sir JOHN LAURENCE mentioned, that he had obſerved, that the trees about Tunbridge afforded ſuch a kind of ſweet dew; and that if it drops upon any thing, it was of ſuch a nature, as that it left a ſtain behind not to be gotten out.

Dr. MAPLETOFT conceived, that manna is nothing elſe but ſuch a dew gathered from the leaves of the fraxinus and ornus chiefly; and he affirmed, that JOHANNES NARDIUS was of the ſame opinion in his book [l]; as alſo Mr. RAY and JOHN BAUHIN.

Dr. MAPLETOFT remarked, that Dr. THOMAS CORNELIUS in Mr. RAY's catalogue [m] gives an account of the way of gathering manna.

Mr HENSHAW mentioned, that the extract made by the bees from plants and flowers was nothing but this *mel* or honey-dew, which he conceived to be partly a dew and partly an exudation: that the bee with its long tongue licks up this ſubſtance, and fills with it a place within its body: but that what is more properly the gum of the plant, is the wax, which the bee diſpoſes upon its thighs on the outſide.

Mr. HOOKE then exhibited the experiments of the laſt meeting, to ſhew the great fluidity of one part of the blood and milk above the other; whereby it plainly appeared by the very free, ſwift, and confuſed motion of thoſe exceedingly ſmall globules through the body of the liquor, in which they ſwim, that it muſt be very fluid and yielding.

Mr. HOOKE produced and read a letter ſent to him from Mr. JAMES YOUNG of Plymouth, containing an account of an accident, which happened to one Mr. ANTHONY WILLIAMSON of L** in Cornwall upon ſwallowing bullets, one of which ſlipped aſide, and went down his wind-pipe, and produced very ſad and fatal ſymptoms, which ended with his life. This letter mentioned what Mr. YOUNG had obſerved in the body upon opening it after death; and that he had found the bullet in the left branch of the trachea, where it lay without being altered in its figure, or having made any impreſſion on the trachea, though the lungs were corrupted beyond it.

Sir CHRISTOPHER WREN mentioned, that a relation of the lord WENMAN, upon ſwallowing a bullet down into his lungs, had been freed from the ſame not long after by a perſon, who turned him with his heels upwards, and ſhook him, and thereby making him cough occaſioned the bullet to fall back into his epiglottis, and from thence by the cough to be thrown out with great violence, and ſo he had no farther miſchief thereby.

Mr. HILL related, that * * [n]

Dr. related, that Dr. MILLINGTON had tried the ſame.

Dr. ALLEN added * * [o]

[l] *Diſquiſitio phyſica de rore*, printed at Florence in 1642.

[m] Catalogus Plantarum Angliæ, p. 118. edit. Londini, 1670.

[n] This minute is left thus imperfect in the Journal-book, vol. vi. p. 48.

[o] This minute is left likewiſe imperfect.

Mr.

Mr. COLDWALL presented for the repository two glasses, one containing a large locust, a cricket, a very large spider, &c. the other containing a flying fish, two or three very small fishes, and some other small fishes.

A letter was read directed to the Society from Mr. EDWARD SMITH dated from his house without the south gate of Chichester, 22 January, 167$\frac{7}{8}$, containing a discourse about the explication of the table of HERMES, and the grounds of his philosophy. It being late, the discourse itself could not be read; but Mr. OLIVER HILL was desired to peruse it, and to communicate his thoughts concerning it at the next meeting; which he promised to do.

Mr. CHETWYND, Dr. DICKENSON, and Mr. LANE were elected.

Mr. HOOKE produced a book of *Jean Jordan*, intitled *Deux Machines jusques ici inconnues, &c.* printed at Leyden in 1677, sent by one MAGNUS HESENTSALERUS, directed to Mr. OLDENBURG. This book having been perused by Mr. HOOKE, was found not to contain any description of the instruments, but to relate only what the machines would perform, which was thought impracticable, if not impossible.

Mr. HOOKE produced likewise a book published by MATTHEUS CAMPANI, intitled *Horologium solo Naturæ Motu Temporis momenta metiens, & Circinus sphæricus Lentibus poliendis, &c.* of which he gave the following account: that this writer, who was rector of a parochial church, and seemed from some passages in his book to be brother to that CAMPANI, who made glasses in Rome, endeavoured to make himself the author of two inventions, which had been long before published and shewn to the Society by one of their own members. The first, of two pendulums rectifying one another was shewn by Mr. HOOKE, 2 January, 166$\frac{6}{7}$, as appeared from the Journal, and from the testimony of many, who could not have forgotten it. The second, called by CAMPANI *circinus sphæricus*, for making of glasses, was the same with that published by Mr. HOOKE in his *Micrographia*, in 1664; who did not doubt but that this pretended inventor was aware of it, since otherwise he would not have endeavoured to antedate it so much as he had by making it prior to the 6th of October, 1664, citing a letter of Monsr. HUYGENS for his voucher, though the words quoted by him assert no such thing. But upon a perusal of the book it was plain, that CAMPANI could be the author of neither of the inventions, since he seemed not to understand either mathematics or mechanics enough to know, whether the things were true, when done; and therefore it was very improbable, that he was the inventor of either. Nor did he at all explain how either of the inventions may be performed either mathematically or mechanically, as any one upon perusal would easily find.

*February* 7. Mr. HENSHAW, vice-president, in the chair.

Upon reading of the minutes of the last meeting concerning mildews, Mr.

[r] See above, vol. ii. p. 137.

HENSHAW

HENSHAW related, that his gardiner had ſhewed him a ſubſtance, which fell upon his hat from the clear ſky in an evening in the month of December: that upon examining it, he had found it taſteleſs and of a ſubſtance like the white of an egg: and that therefore it ſeemed probable, that many of thoſe dews and glutinous ſubſtances, which were taken upon the leaves of plants, were dropt upon them out of the air. Others were of opinion, that they might proceed from the exudation, tranſpiration, or ſweating of the plant. To this purpoſe Mr. HOOKE mentioned the great tranſpiration, that is obſervable in all plants, and particularly in ſuch, as have been nouriſhed by water kept in glaſſes: for whoever ſhall examine the conſumption of the water, in which a plant is nouriſhed, and compare it with the ſame quantity of water kept in a glaſs by it, and ſhall alſo compare the weight of the plant to obſerve its increaſe, will find, that a very great quantity of the ſame is eaten up as it were by the plant; and the greateſt part of that is again caſt out by tranſpiration. And poſſibly from ſome unnatural or unſeaſonable blaſt of wind, the natural tranſpiration being ſtopt, that water might thicken into a kind of ſweat, which ſticking on the ſurface produced the mildew.

Upon the mention of the microſcopical experiments Dr. KING related, that he had with his microſcope examined ſeveral ſubſtances, to ſee, whether he could diſcover thoſe differences of parts, which had been found in blood and milk: but he affirmed, that he could not obſerve any ſuch in clarets or red wines or in any other wines. But that he had obſerved in an infuſion of wheaten bran in common water, and alſo in an infuſion of ginger, a great multitude of thoſe exceedingly ſmall animals; and in this latter a particular ſort of very ſmall eels moving much like thoſe of vinegar.

He remarked likewiſe, that he had examined the ſerum of blood and rain-water, but could not diſcover any animals in either of them.

It was deſired, that it ſhould be tried, whether white pepper ſteeped in water would produce any ſuch ſmall creatures.

Mr. HOOKE mentioned, that he had found great quantities of thoſe worms in rain-water; and that he ſuppoſed them to be generated therein from ſmall inviſible creatures flying up and down in the air, after the ſame manner as other ſorts of inſects in the ſummer-time had been obſerved by Mr. HENSHAW to be bred in rain-water from gnats, and to be converted into them again at laſt: that he had obſerved them alſo in river-water and well-water, though not ſo plentifully: that though the pepper-water, in which theſe animals were ſwimming, were frozen into a lump of ice; yet letting it alone to thaw of itſelf he had found it again very full of thoſe living worms, as if the froſt had not done them any harm at all: that he had found alſo a ſort of flat animals, which would contract and dilate their bodies ſomewhat like a leech; and that their motion in the water was different from that of any other creatures, which he had ever ſeen in the water, viz. a motion of writhing their bodies in the ſame manner as a board does, when it is ſaid

ſaid to be out of winding; and that thereby they guide themſelves, and ſhoot through the water with great ſwiftneſs.

Dr. MAYOW [q] was propoſed candidate by Mr. HOOKE.

Mr. HOOKE ſhewed an experiment to prove the ſtrength of the expanſion of the air to be in proportion to the quantity of the air contained in the ſame ſpace; ſo that half the quantity had half the ſtrength, and double the quantity double the ſtrength. This was ſhewed by a glaſs-cane ſunk down into another filled almoſt to the top with quickſilver. The firſt was open at both ends, but the other hermetically ſealed at the bottom. In the firſt was left about three inches of its length filled with air, and the top of it was ſtopped with ſoft wax, that no air might enter in or go out through. Then this cane was lifted up ſo far, as till the air was expanded into twice its dimenſions, and the quickſilver under it was obſerved to riſe only to half the hight of the ſtandard. When by lifting it higher, it had acquired four times its firſt dimenſions, the cylinder under it was found to riſe but three fourths of the ſtandard; which plainly evidenced one part of the former theory, viz. that the force of the ſpring of the air was diminiſhed in proportion to the expanſion; and that half the quantity had but half the ſtrength.

The other part of it was deſigned to be exhibited by another apparatus, which was made ready for this trial; but upon examination it was found, that a little part of the top of the glaſs for that trial was flown off; and therefore the expeperiment was deferred till the next meeting.

Upon diſcourſing of the hight of the mercurial ſtandard, Sir CHRISTOPHER WREN propounded, that the meaſure thereof might be reduced to the univerſal ſtandard, viz. the length of a pendulum moving a ſecond of time, which was between thirty-nine and forty inches long; and which was the ſame all over the world, and would ever be ſo in all ages.

Mr. OLIVER HILL being called upon for his report of the diſcourſe of Mr. SMITH of Chicheſter, which had been delivered to him at the laſt meeting to be peruſed, returned this account, which remained annexed to that diſcourſe,

*Dignus, digniſſimus, qui nunquam imprimatur; ſed Monſieur Harpocrati aſſervandus mandetur, ne ullius manibus conteratur libellus.*

*February* 14. Sir JONAS MOORE, vice-preſident, in the chair.

The minutes of the laſt meeting were read, and ſome parts diſcourſed of: after which

An experiment to prove the force of the compreſſed air was ſhewn by Mr.

[q] Probably JOHN MAYOW, M. D.

HOOKE,

Hooke, by which it evidently appeared, that the force neceſſary to condenſe the air was always proportionate to the condenſation. Which was verified by ſeveral trials of ſeveral degrees of condenſation; that is, to condenſe the air twice, required twice the ſtrength, and thrice, three times the ſtrength, &c. that is, if the ſame quantity be condenſed, then the force or weight of the power, that makes the condenſation, ſhall always be reciprocal to the dimenſion: but if the dimenſion be the ſame, then the force ſhall be always proportional to the quantity of air contained in that ſpace. This was experimented in a tube of glaſs about ten feet long; the one end of which was ſealed up hermetically, and turned or bent back again in the form of a ſyphon reverſed; in which reverſed part there being left ten inches of air, quickſilver was poured into the other part, till the weight thereof had condenſed the ſame into five inches ſpace; the hight of which cylinder of quickſilver was found to be about thirty inches. Then the pouring in of quickſilver was continued till the ſame air was condenſed into two inches and a half, and the hight of the cylindrical mercury was found to be ninety inches. And the ſame proportions were obſerved to be in other compreſſions.

Sir Jonas Moore preſented the foot of a ſea-fowl for the repoſitory.

He gave likewiſe a large hornet's neſt brought from the Weſt Indies, which was ſeveral large combs faſtened upon the twig of a bough and very thick covered with a ſort of leaves or rather cloth of the make of the hornets: which being looked upon with glaſſes was found to be made up of abundance of ſmall threads, and appeared much like the texture of paper. With theſe the whole ſtructure of combs was cloſely inwrapped on every ſide, as if deſigned to ſhelter and incloſe the neſt of the young from the injuries of the air and weather, being a kind of natural hive.

The vice-preſident mentioned, that he had a letter from Mr. Halley from Saint Helena mentioning his obſervation of the laſt viſible conjunction of the ſun and Mercury.

*February* 21. Sir John Henshaw, vice-preſident, in the chair.

The minutes of the laſt meeting were read; and by the way, upon the mention of the hornet's neſt, Sir John Hoskyns remarked, that Mr. Wheeler had ſeen the way of bee-hives.

Mr. George Ent preſented to the Society for their library the new *Pharmacopœia Londinenſis*, reprinted and amended by the care of his father Sir George Ent.

Mr. Hooke produced an inſtrument to examine and ſhew at all times the ſpecific gravity of the air, in which it is placed, without any reſpect to the heat or cold, preſſure or ſpring of the air: but the ſaid property of the air was not ſhewed ſingly by any other inſtrument; nor was it proper or capable to ſhew any

other quality of the air, as ſome had thought, except only the ſpecific gravity of the air. This inſtrument was firſt propoſed by Mr. Hooke to the Society as appears from the Regiſter-book; but the experiment and inſtrument itſelf was not before this time exhibited at the meetings of the Society.

This inſtrument made to demonſtrate the ſaid property of the air was a very large and thin ball of glaſs ſealed up hermetically. It was ſuſpended at the end of an exact beam (which would eaſily turn either one way or the other) and was counterpoiſed by a ſmall weight of lead or braſs; but lead was beſt for that purpoſe. Then Mr. Hooke explained the ſame, and ſhewed the reaſon, why the ball would riſe when the air, in which it hung, was heavier, and ſink when it was lighter; and that it depended upon the ſame ground with the improvement of Archimedes's experiment by Ghetaldus.

He alſo explained the difference between the preſſure and the ſpecific gravity of the air. Whereupon Sir John Hoskyns added, that this was properly the barometer, and not the inſtrument ſo called.

Sir John Lowther demanding, whether this inſtrument now produced was exact enough to make the ſmall mutations in the air viſible, Mr. Hooke anſwered, that he did not exhibit this for any other uſe than to ſhew the ground and a reaſon of the thing, and as a ſenſible object, upon which to reaſon and diſcourſe, and for the more plain demonſtration and explanation of all material doubts, that might ariſe; becauſe without ſuch a pattern or model of the thing deſigned, the propounder of ſuch experiment or invention is for the moſt part not ſo readily underſtood, and very often miſtaken or miſapprehended by the auditors: nor can objections be pertinently made where the like model is wanting, eſpecially in all mechanical ſubjects.

Dr. Whistler objected, that this model itſelf was not ſatisfactory, but that experiment ought to be made with ſuch an inſtrument, as both the ball and counterpoiſe might be immerſed in the water; and when ſo immerſed, ſalt might be added to make the ſpecific gravity of the water greater: that then it might appear, which would ſink, whether the ball, or the counterpoiſe, to which it was annexed.

Sir John Lowther anſwered, that the matter was the ſame, and appeared as plain, whilſt the bells hung in the air, as if they were ſuſpended in water; for as the weight of any body ſuſpended in water was always made ſo much lighter as the weight of a quantity of water equal to it in bulk weighed, and conſequently the heavier the water, the more it would take off from the weight of the ball, the ſame thing muſt neceſſarily follow in air.

However, becauſe in the experiment of weighing, that had been made, both the ball and the counterpoiſe had not hung in the ſame medium, it was deſired, that an experiment ſhould be ſhewn to verify that aſſertion, which Mr. Hooke promiſed to give order for againſt the next meeting.



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Mr. HOOKE then ſhewed the *Journal des Sçavans* in which was contained the obſervation of Mercury in the ſun made by Monſ. GALLET at Avignon[r], the manner of which he in ſhort explained to be very ingenious, proper, and accurate; and that ſeemed not to be defective in any material circumſtance neceſſary to be taken notice of in the obſervation: that Monſ. GALLET had remarked ſeveral immerſions of Mercury, taking the declinations and right aſcenſions of it in every one of thoſe places by a method very exact; and that thence he had deduced by trigonometrical calculation the longitude and latitude of Mercury in thoſe ſeveral places, and the inclination of the orb and the true time of the conjunction: that he had taken notice, that the body of Mercury was oval, whoſe longeſt diameter was parallel to the equinoctial; and that at the emerſion of it out of the eaſtern ſide of the ſun it ſeemed to ſpread itſelf as it were upon the limb of that ſun, appearing four times as big in diameter.

Mr. HOOKE acquainted the Society with the contents of a letter of Mr. HALLEY from Saint Helena directed to Sir JONAS MOORE giving an account of the ſame obſervation made by him in that iſland: but the letter was reſtored to Sir JONAS MOORE.

From either of theſe obſervations ſingly the theory of Mercury would be very much rectified, and from the comparing of them both together the parallax and diſtance both of the ſun and Mercury would be experimentally verified.

Dr. ALLEN preſented to the Society for their repoſitory a natural bee-hive from Virginia faſtened upon the twig of a tree, and very thick inwrapped round with ſuch teguments, as are uſual about a hornet's neſt, which it very much reſembled.

Mr. HOOKE promiſed, beſide the experiment of weighing air, to have ready ſome microſcopical obſervation.

*February* 28. Mr. HENSAW, vice-preſident, in the chair.

The minutes of the laſt meeting were read by Mr. HOOKE.

In proſecution of what was deſired at the laſt meeting Mr. HOOKE ſhewed an experiment to elucidate farther the theory of the air-poiſe produced at the preceding meeting, viz. to prove, that a large and very light ball of glaſs ordered, as it was at the laſt meeting, would, upon change of the ſpecific gravity of the fluid, in which it was ſuſpended, riſe and fall with ſuch a motion, as would make ſuch alterations viſible. In order to which, becauſe ſuch alterations were difficult to make in the air, and becauſe the laſt inſtrument was only deſigned to ſhew the groſs mutations, and not the minuter ones, he having, as he affirmed, another way different from what was exhibited for producing that effect, which would be ſomewhat more chargeable to produce; therefore a glaſs ſealed up as in the

[r] On the 7th of November, 1677, N. S. See Journal des Sçavans du Lundy, 20 December, 1677.

former experiment was ſuſpended at the end of a beam, and ſo ordered, that a counterpoiſe to it, when both under the water, was hung into a veſſel of fair water, which was taken notice of. Then into that water was put a ſmall quantity of ſalt, that ſo by the diſſolution thereof the water might be made heavier *in ſpecie*, and thereby the bigger body, which was the ſealed glaſs, ought to be made lighter than its counterpoiſe, every new fluid taking off ſo much more or leſs of the weight of the body contained in it, than was taken off by a former fluid, as a quantity of it equal in bulk to the ſaid contained body weighs heavier or lighter than the like quantity of fluid, in which it was laſt ſuſpended. Whereupon it was immediately very manifeſtly verified; for the glaſs-ball immediately upon the putting in of the ſalt grew very ſenſibly lighter, and the counterpoiſe preponderated; whereby all the objections and ſcruples, that were made concerning the former theory, were removed. And when inquiry was made, whether it could not be ordered ſo, as to make the minute variations more ſenſible, Mr. HOOKE affirmed, that he had a way, by which he could make them as ſenſible, as ſhould be deſired; and that inſtead of varying an inch, he could make it vary ten, twelve, or more feet: The only inconvenience of which inſtrument was duſt, becauſe that ſettling upon the ſurface of the glaſs would augment the weight thereof: but for prevention of this, he ſaid, that a glaſs cover and caſe might be ſo ordered, as to prevent all thoſe inconveniences, and yet not at all hinder the air within from being ſenſible and compatible with the air without in the room, in which it was placed.

Mr. HOOKE then produced an animadverſion of Signor CASSINI upon the obſervation of Monſ. GALLET of the paſſage of Mercury under the ſun; wherein he compared that obſervation with thoſe of GASSENDUS in 1631, and that of Mr. HEVELIUS in 1671, from which he made ſeveral concluſions concerning the motion of the node and the inclination of the plane of Mercury to that of the ecliptic.

Upon this occaſion ſeveral reflections were made upon the obſervation of Monſ. GALLET of the oval figure of Mercury appearing in the ſun. Mr. HENSHAW ſuppoſed, that it might proceed from the refraction of an atmoſphere about Mercury. Mr. HOOKE conceived, that the body itſelf of Mercury might be of ſuch a figure; and that it might proceed from the velocity of its whirling round upon its axis, he ſuppoſing, that the axis of its vertiginous or diurnal motion lies north and ſouth, or at right angles with the ſeeming motion of it parallel to the : that a very ſwift vertiginous motion on that axis made the body of Mercury ſomewhat of the ſhape of a turnep or of a ſolid made by an ellipſis turned round upon its ſhorter diameter; and he explained this hypotheſis of his by the ſhape, that a hollow globe of glaſs will readily run into, if the pantillion or pipe, at the end of which it is faſtened, be whirled round very ſwiftly. And the reaſon, which he conceived, why it muſt needs be turned round very ſwiftly, was on account of its nearneſs to the ſun, whereby the ſuperficial parts would be burnt, if it were not for the ſwiftneſs of its motion.

Here by the bye Mr. HOOKE explained his way, which he had formerly delivered

livered to Mr. OLDENBURG, of making uſe of glaſſes of any length without a tube: which was as follows:

A rope was ſo ordered, as to join the two ends together, and ſo to make a round rope. This was put through the pulley both at the top and bottom, and a large ſquare or round board containing the object-glaſs, which was faſtened within a frame, ſo as to make it inclinable towards the eye, where-ever poſited; which was done by the means of certain ſtrings faſtened from the ends of the ſaid board, and extended from it to the cell of the eye-glaſs.

After this, upon a further diſcourſe concerning the appearance of Mercury in the ſun, there was much ſaid concerning the penumbra of ſhadows caſt by the body of the earth and by the atmoſphere thereof; and it was explained by experiments and reaſons, what part of the light of the moon in an eclipſe, eſpecially that of the darkened parts, was to be aſcribed to the penumbra or partial light from the ſun, and what to the light caſt on it by the refraction of the ſame in the atmoſphere: and it was ſhewn, that that undefinedneſs of light or ſhadow, which was obſervable in eclipſes of the moon, where part is ſhadowed, part inlightened, is to be aſcribed to the penumbra or partial light of the ſun: but that that light, which made the moon viſible in a central eclipſe, where no direct ray from the ſun can come at it, muſt be aſcribed to the refraction of the ſaid rays by the atmoſphere of the earth.

Mr. HOOKE promiſed to produce at the next meeting ſome microſcopical experiments, and particularly on ſome part of a muſcle.

*March* 7. Mr. HENSHAW, vice-preſident, in the chair.

The minutes of the laſt meeting being read by Mr. HOOKE, upon the mention of the air poiſe, and the experiment, in order to prove it, of weighing two bodies in water, it was very much doubted; though by the experiment of weighing in water the inſtrument became ſenſible, ſo as to turn by putting a little ſalt in the water: yet whether the very ſmall changes of gravity of the air could be made ſenſible by ſuch an inſtrument, was ſtill a queſtion. Mr. HOOKE affirmed it, and that in order thereunto he would provide a glaſs blown large and light on purpoſe, and ſo order it, as that its variations or differences ſhould be ten or twenty feet, if it were neceſſary; and conſequently that it would be capable of diſcovering the ſmalleſt alterations of the air.

He added, that he would ſhortly bring in a new inſtrument for the diſcovering of ſome properties of the atmoſphere not yet known or taken notice of, and hitherto altogether inſenſible to us, though by the ſaid inſtrument they would be made evident, and their natures diſcovered and determined.

Upon mentioning the particulars taken notice of by Monſ. GALLET, of the oval figure of Mercury, that ſubject was farther diſcourſed of, and Mr. HOOKE's hypotheſis was objected to, viz. that though ſuch an oval figure would be cauſed by the whirling round of a fluid body; yet it was probable, that the body of Mercury

Mercury is ſolid; and conſequently this whirling could have no effect upon it. To which Mr. HOOKE anſwered, that though it might probably be now a ſolid body, yet that at the beginning it might have been fluid enough to receive that ſhape: and that though this ſuppoſition ſhould not be granted, yet it was probable, that there might be about Mercury ſome fluid body, ſomewhat of the nature of the ſea here upon the earth; and if this muſt be granted, it would be probable enough, that it would readily run into that ſhape, and make the ſame appearance: and that it is not improbable, but that the water here about the earth might do it in ſome meaſure, by the influence of the diurnal motion, which compounded with that of the moon he conceived to be the cauſe of the tides. But there were ſome other way of explaining thoſe appearances, which, when he had time, he deſigned to draw up in writing.

Some objections having been made againſt the way of making uſe of long teleſcopes without tubes, Mr. HOOKE farther explained the way, and anſwered all thoſe objections, and particularly that of Sir JONAS MOORE, who ſuppoſed it only theory, and that it had never been practiſed or made uſe of, Mr. HOOKE affirming, that he had done it, and found it convenient enough in a glaſs of twenty-eight feet; and therefore he conceived, that it might be as conveniently practiſed in a glaſs of any other length.

Mr. HILL deſired, that the deſcription of it might be fairly entered in the Regiſter, that ſo ſuch, as had occaſion, might there receive inſtructions how to provide it, if they thought fit to uſe it.

The vice-preſident likewiſe moved, that the apparatus might be prepared, in order to ſhew the experiment of it at ſome meeting of the Society.

Upon a further diſcourſe about the penumbra in eclipſes, the vice-preſident ſaid, that Mr. HEVELIUS had affirmed that penumbra to ariſe from the atmoſphere about the earth. But Mr. HOOKE aſſerted that to be a miſtake, ſince the penumbra viſible in eclipſes of the moon proceeds from nothing elſe than the partial inlightning of ſuch parts of the moon, as were in the penumbra, by the light of the ſun; for thoſe parts, which are in the middle of the penumbra, are inlightened but by one half of the ſun, the other half being ſhadowed by the body of the earth, which by an experiment with the candle, and an explication of ſchemes, was made ſo plain, that there were no farther objections made againſt it.

Dr. ALLEN preſented to the Society for their repoſitory a *Locuſta Marina*, which had this remarkable circumſtance, that the horns thereof were covered with a ſhell, ſo thickly ſet with very ſmall and exceedingly ſharp points, that it might readily defend and keep off all ſuch creatures, as ſhould come between them to offend it.

Mr. HENSHAW obſerved, that the cock-lobſter, which Sir GEORGE ENT had ſhewed at Arundel-Houſe, had a double inſtrument of generation, as the female had alſo a double receptacle.

He

He remarked likewiſe, that the bony ſubſtances in the ſtomach of the lobſter, commonly called the lady of the lobſter, were nothing elſe than the teeth, by which the food was chewed and preſſed, doing the office of grinders, or *dentes molares*.

Dr. GREW added, that there were muſcles and other bones, by which their motion was commanded and regulated.

Mr. GEORGE ENT preſented to the Society for their library the Life of Mr. THOMAS HOBBES, compoſed by himſelf in Latin verſe [a], and written with his own hand.

Mr. HOOKE attempted to ſhew a microſcopical experiment of the exceeding ſmallneſs of the parts of the tendon of a muſcle, viz. that it was not above a twentieth part of the bigneſs of a hair in diameter; and conſequently that a hair was four hundred times bigger than one of theſe. But upon making trial thereof, the tendon was grown ſo dry, that thoſe minute parts could not be diſcovered, tho' the ſame were plainly viſible in the morning. It was deſired therefore, that the apparatus ſhould be provided againſt the next meeting; and that the tendon ſhould be provided freſh and fit for this experiment.

Mr. HOOKE then ſhewed ſeveral ſorts of animals, produced in the ſteeping of anniſeeds, coffee, &c. in water. Theſe were much ſmaller than thoſe of pepper, and had a quite contrary motion.

*March* 14. Mr. HENSHAW, vice-preſident, in the chair.

Upon reading the minutes of the laſt meeting, wherein it was ſuppoſed, that the oval figure of Mercury might be cauſed by the velocity of its turbinated or diurnal motion upon its own axis, Mr. HENSHAW objected, that if it were ſo, why did it not always appear of that oval figure, when it was ſeen at its greateſt elongation, as well as when it was in conjunction with the ſun? To which Sir JONAS MOORE added, that Mr. FLAMSTEAD was of opinion, that it was cauſed by the refraction or defect of the glaſs, and proceeded from miſtake, and not from any real appearance, ſince he could eaſily make it appear ſo with any glaſs: and that there were many other miſtakes in the ſaid obſervation, which therefore could not be relied upon.

Mr. HOOKE anſwered to both theſe objections, that the figure of Mercury might really be always ſo oval, as Monſ. GALLET had affirmed that he obſerved it; and yet through the inadvertency of others it might not be taken notice of, and that poſſibly for want of as good glaſſes as his, it might not have been viſible before. To confirm which, Mr. HOOKE ſaid, that Monſ. GALLET had noted, that even in this obſervation through the three feet glaſs it appeared round. Secondly, that the reaſons, why it may not appear oval in its greateſt elongation, may be

[a] It was printed at London in 4to, about three weeks after Mr. HOBBES's death, which happened 4th December, 1679. It is reprinted at the end of *Vitæ* HOBBIANÆ *Auctarium*.

three.

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three. 1. That it is very ſmall and far diſtant, and very bright, all which circumſtances make it very difficult, unleſs with very good glaſſes, to ſee any figure at all of its body, but only a radiating point. 2. That being ſeen only part inlightened, and never in oppoſition to the ſun, the whole ſurface of it ſeen by us is never all inlightened, but only ſome parts of it; which is a ſufficient reaſon to make it appear round, though the body of it be really oval, as is ſuppoſed; a part of this oval being really not ſeen, whereby the oval is changed into a circle. For it muſt be a very good glaſs, by which one is able to diſcover the true figure of Mercury, when half inlightened, by reaſon of its ſmallneſs and radiation; and it ought to be a very much better one to diſcover the figure of Mercury. 3. The figure of a dark body in a light medium is much better diſcovered than the figure of a light body in a dark medium, by reaſon of the radiation.

Next, as to Mr. FLAMSTEAD's ſuppoſition, Mr. HOOKE ſaid, that it was no ways probable, that a man, who had made the whole obſervations with ſo much care, and with ſo many witneſſes, and beſides had ſo ingeniouſly and knowingly contrived the apparatus for obſerving it, could either be deceived himſelf, or endeavour to deceive others; and therefore, till there were better arguments than conjectures or hypotheſes produced againſt theſe circumſtances of the obſervation, it ought not to be rejected or condemned.

Upon the mention of uſing long teleſcopes without tubes, ſeveral objections were made, as the bending of the lines, the difficulty of raiſing and fixing it, and the like. But Mr. HOOKE affirmed, that he had actually done it: and that he had tried Mr. HEVELIUS's ſixty feet glaſs without a tube, though it were afterwards tried alſo with a tube by Mr. COCK at Mr. OLDENBURG's deſire.

Hereupon it was deſired, that a trial might be made of it with a pole of ten feet long, that thereby the Society might be ſatisfied of the practicableneſs thereof; which Mr. HOOKE undertook to do.

Several diſcourſes were made likewiſe about the penumbra, the reſult of which was, that it was concluded to ariſe from the partial inlightening of the parts in the penumbra, ſome parts of the luminous body being hid from them, whilſt they were ſhined upon by other.

Mr. HOOKE then read a diſcourſe of Signor CASSINI, concerning his farther proſecuting of the diſcovery of the diurnal motion of Jupiter upon its axis by the ſpot obſervable in one of the belts; wherein were ſeveral very remarkable circumſtances and diſcoveries; that the ſame ſpot ſometimes appeared for a certain ſpace, and then diſappeared again for a certain ſpace: that the belts changed; and the two belts appeared like two rivers overflowing their banks, and running into one large one, with only ſome ſmall ſpots or iſlands as it were between them: that the turbinated motion of Jupiter was ſometimes ſwifter and ſometimes ſlower, according as it more or leſs approached the ſun: that he had ſtated the epoch thereof, and given the rule how to calculate for the future; that thereby the time of its coming to the middle of the diſk might be obſerved to ſome few minutes

of

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of time: that from the greater number of revolutions Signor CASSINI had divided the whole ſpace from the firſt to the laſt by the ſaid number, and found it to be ſometimes 9 hours, 55′, 53″ ½, ſometimes 9 hours, 55′, 52″, and 6″.

Dr. CROUNE produced a phoſphorus, the ſame with that of BALDUINUS, which he affirmed to have been made in England by an Engliſhman, altogether as good as that ſent hither by BALDUINUS himſelf.

Mr. HAAK affirmed, that he had another of the ſame kind; and that he had obſerved, that it appeared white, if it were expoſed to the light in the evening, when the ſun was almoſt ready to ſet.

Mr. HOOKE read a diſcourſe of his own, being an account of his obſervations, which in proſecution of Mr. LEEWENHOECK's diſcoveries he had made of the ſmall worms in pepper-water, and in the ſteeping of ſeveral other liquors, as of barley, wheat, oats, anniſeeds, coffee, &c. as alſo of ſugar, alum, blood, milk, fat, ligaments, muſcles, &c. and together herewith he diſcovered the ſeveral ways and contrivances by which he made thoſe obſervations; and therein ſhewed, how eaſily and apt ſuch perſons are to be deceived by the appearances of theſe tranſparent bodies through a microſcope, who are not aware of certain properties of tranſparent bodies, eſpecially ſuch as are peculiar to ſubſtances of ſuch ſmall bulk. And for the avoiding and preventing all theſe inconveniences, he ſhewed ſeveral ways and expedients, without which no true diſcovery could be made, and by the help of them they were very eaſily made. Some of thoſe mentioned by him were glaſs plates, and plates of Muſcovy-glaſs, particular kinds of light, the immerſing the bodies in waters and other liquors, the ſqueezing bodies between two glaſs-plates, the ſtretching and ſqueezing others with a kind of tongues, &c. whilſt they are looked upon in a convenient light by the eye. After which he ſhewed the method, by which he made two ſorts of microſcopes, and the conveniences and inconveniences of both theſe.

The firſt was a ſingle microſcope made by a ſmall globule of glaſs, by means of which, with very little or no difficulty, any object might be prodigiouſly magnified.

He alſo explained how the globule was made out of a thread of glaſs, and how that glaſs thread and ſmall glaſs-canes were made.

The ſecond was a double microſcope conſiſting of two glaſſes, whereby many obſervations might be more conveniently made than with the ſingle one. He then explained how, by the help of theſe, the parts of a muſcle, fibre, tendon, ligament, &c. might be examined: and to verify this by experiment, he produced a ſmall part of the ligament of the neck of a ſheep, and ſhewed it to conſiſt of an infinite number of exceedingly ſmall threads, four hundred of which would ſcarce make the bigneſs of one ſingle hair of a man's head. But as to the fibres of a muſcle, he affirmed them to be very different, which he would ſome other time produce.

Dr. CROUNE ſhewed a ſtone, on which a piece of alga was growing.

*March* 21. The preſident and vice-preſident being abſent, Mr. DANIEL COLWALL was deſired to take the chair.

After the minutes of the laſt meeting were read, a diſcourſe aroſe about BALDUINUS's phoſphorus; concerning which it was affirmed, that the ſame was then made in England as good as that, which was brought from beyond ſea: and it was deſired, that one of them might be procured to be examined at the Society at their next meeting: which Mr. HOOKE ſaid he would endeavour to do.

Mr. HOOKE read a letter and relation, which he had received from the preſident, being both ſent him from captain RICHARD ROLLAND from Tangier, 13th February, 167$\frac{7}{8}$, containing an account of his trials made in the deeps of the ſea; wherein he obſerved, that having, according to Mr. BOYLE's directions, lowered by the deep ſidge line a bottle of oil of anniſeeds, and two other bottles only filled with air, into eight fathom water, and there ſuffered them to ſtay a quarter of an hour, the oil was congealed, and the cork driven into the bottle; but the ſtopper had leaked through its pores, through which the ſame upon pulling up endeavoured to get back, making a noiſe and ſmoke.

The ſecond experiment was with three bottles in an hundred fathoms water. The two bottles ſtopped with lignum vitæ were broken by the preſſure of the water drawing them into the neck: the other ſtopped with cork was taken up whole, but the cork driven into the bottle, and the bottle filled with water; which being taſted, ſeemed ſomewhat freſher than the reſt.

Upon this, a diſcourſe aroſe about more exact ways of making theſe kinds of trials in the ſea and other deep places. And Mr. HOOKE affirmed, that he had a way to examine the preſſure to any depth with the greateſt eaſe imaginable; and that was by a cane of glaſs, with which there had been ſeveral trials made near Sheerneſs, of which there is an account in the Regiſters of the Society. That he had alſo other ways for examining the heat and cold of thoſe ſubmarine regions; and to fetch up the water from any depth; as alſo the earth, ſand, &c. from the bottom: that he would give directions for the making of ſuch an apparatus, if there were proper perſons appointed to make trial with them.

Hereupon mention was made of great depths of waters within land, as of that of the lake of Geneva many hundred fathoms deep.

Dr. MAPLETOFT related, that cardinal D'ESTREES had cauſed the lake de Aqua by Padua to be ſounded, but could find no bottom with a whole boat-full of line.

Mr. HILL mentioned, that the ſea was ſo very deep at Meſſina, that the admiral of Spain could ride cloſe to the key, and no bottom could be found by ſounding-lines.

Mr. THOMAS SMITH related, that by Mr. JOHN GREAVES's experiment no bottom could be found at the Straits at a thouſand fathom depth.

Mr. WHEELER affirmed, that there was a pool or lake in Wales, of which no bottom could be found.

Mr. HILL ſuppoſed, with good reaſon, that in trials of this kind, the lightneſs and buoyantneſs of the rope might at length keep the weight from ſinking any farther; and ſo much more line might be taken into the ſea than was neceſſary to meaſure the depth. It was thought alſo, that the motion of the under-parts of the water might bend the line very much.

Upon this mention mas made of the bending of the line of a pendulum hung from the top of St. Paul's before the fire; as alſo of ſome other experiments about trying the particular gravitation of bodies near to and at a diſtance from the ſurface of the earth; of which there are ſeveral accounts in the Society's Regiſters.

Dr. CROUNE moved, that there might be made an univerſal index to the Regiſters.

Mr. HOOKE ſhewed in the microſcopes the manner how tallow coagulates, in order to explain the expanſion of water upon freezing: and

The manner of the ſhooting of ſugar diſſolved in water upon the glaſs-plate of the microſcope.

1678. *March* 28. Sir CHRISTOPHER WREN, vice-preſident, in the chair.

Upon reading the minutes of the laſt meeting, a diſcourſe was occaſioned concerning the ways then ſpoken of for ſounding the depth of the ſea by the help of a long pipe of glaſs, the lower end of which was perfectly ſealed up hermetically, and the upper end ſo ordered, as upon its deſcending to admit of the water to enter in, according as the preſſure of the water was greater and ſtronger upon the incloſed air; and upon pulling up again of the ſame pipe, and ſo as the preſſure of the water decreaſing, the air expanded itſelf, and found its way out without forcing out again the water, which had been admitted in its deſcent.

Sir CHRISTOPHER WREN objected to this, that the compreſſion of the air might be occaſioned by the cold as well as the preſſure of the water; and ſo it could not be diſtinguiſhed which part of the admitted air was to be aſcribed to the cold, and which to the preſſure.

Mr. HOOKE anſwered to this, that it was neceſſary, that there ſhould be other inſtruments let down with the ſaid pipe, in order to find the degree of coldneſs in the water at ſeveral depths below the ſurface; and that the ſaid experiment was not leſs inſtructive than the other: for the performing of which he alledged

that he had a contrivance, by which the ſame might be certainly examined, and thence the degrees both of the one and the other might be defined.

Some other objections were made, that the depth might be examined by the help of a line, as well as by the degree of preſſure. To which it was anſwered, that as for the meer finding the depth of the ſea, the line and plummet were not ſufficient, becauſe in great depths the line would be buoyant, and ſo not be ſtrained ſtrait: and where there was a motion of the water, the line would be often much ſloped, and ſometimes much bended. But beſides the examination of the depth, this tube ſerved alſo to inquire into the degree of preſſure at certain depths: which was another uſeful inquiry, and likewiſe helpful for the finding the qualities of thoſe lower regions as to heat and cold; which was a third inquiry worthy to be examined.

Sir CHRISTOPHER WREN ſeconded Dr. CROUNE's deſire of having an univerſal index made to the Regiſter-books.

He alledged, that he had not heard any real objection againſt the wooden balls for ſounding the depths of the ſea. To which it was anſwered, that theſe balls being ordered, as was directed in the *Philoſophical Tranſactions*, would certainly perform the effect, if care were taken to obſerve exactly when the balls appeared again above water; which was eaſy to be taken notice of in ſmall depths, and where the water was without motion. But where the water or the ſhip were in motion, ſo that the ball did not aſcend again into the ſame place, where it deſcended, and where the depth was very great, there the obſerving of the moment, and the place where it appeared again after it had been ſunk to the bottom, was very difficult, and hardly practicable. But as to the way of ordering the ball and weight, which was preſented by RICCIOLUS, it was very fallacious, the ball frequently letting go the weight before it came to the bottom; and at other times being detained altogether at the bottom without ſeparating from the weight, as had been found by trial; of which an account was entered in the Regiſter-book.

Mr. HOOKE ſhewed an obſervation of the figure of the ſmall and imperceptible parts of a muſcle, which he had diſcovered by the help of a microſcope. The muſcle, which he had made choice of for examination, was that of a lobſter's claw, the fabric of which was ſuch, that all the motion muſt neceſſarily be made in the fibrous part thereof; ſince firſt the tendon is nothing elſe but a bone, and ſo not capable of ſhrinking or ſtretching; and ſecondly, the other end thereof is faſtened immediately to the inſide of the ſhell.

In this obſervation notice was taken, that the ſmall fibres ſought for, though as much magnified and inlightened as was neceſſary, did not appear till by the adding a ſmall drop of water the irregular refractions on the outſide of the fibre were removed; after which it was very plainly viſible, that the whole fibrous part of the muſcle examined conſiſted of an indefinite number of exceeding ſmall ſtrings extended ſtrait between the inſide of the ſhell and the tendinous bone in the middle; which

which were ſo ſmall, that five hundred of them would ſcarce exceed the bigneſs of an hair.

Each of theſe ſmall fibres or ſtrings was conceived to be ſeen of the ſhape and figure of a wreathed pillar, or a ſtick naturally grown wreathed by the twiſting of a ſtring of ivy. Others ſuppoſed it of other ſhapes. But the determination thereof was left till another time.

Mr. Moses Pitt, bookſeller, having made a propoſal to the Society of his deſign of printing an Atlas, or deſcription of the parts of the earth, ſea, and heavens, contained in about ſix hundred copperplates or maps, and about nine hundred printed ſheets; and deſiring the aſſiſtance and encouragement of the Society for the more exact performance, and the better carrying on of this work; it was referred to Sir Christopher Wren, Sir John Lowther, Mr. Hill, Mr. Haak, Mr. Hooke, Dr. Grew, and Mr. Collins to conſider farther of this propoſal, and to report their thoughts of it at the next meeting of the Society; and the time of this committee's meeting was appointed on the Tueſday following, at ſix o'clock in the evening.

*April* 4. The preſident in the chair.

The minutes of the laſt meeting being read, Mr. Henshaw, upon the mention of the ways of ſounding the depth of the ſea, aſſerted, that in cardinal Cusanus there was another way of ſounding it, different from thoſe which had been deſcribed by Mr. Hooke, both by the help of a pipe, and alſo by the deſcent of a ball ſunk by a weight; which weight leaving the ball when it came to the bottom, the ball aſcended with the ſame velocity upwards, with which the weight and ball together deſcended to the bottom.

Hereupon Mr. Hooke explained the peculiar contrivance of the application of the leaden weight to the ball, which he had invented and made uſe of, being the ſame, which was entered in the Society's Regiſter. As alſo he ſhewed the uncertainty and inconvenience of the other contrivance, he having experimentally found, that it would often fail of performing the deſired effect, either by leaving each other before they came to the bottom, or not ſeparating at all when they came thither.

The preſident, Mr. Henshaw, and Mr. Hill made ſeveral objections againſt the way of ſounding the depth of the ſea by the aforeſaid contrivance with a ball ſunk by a weight: the chief of which were founded upon the ſuppoſition of Galileo, that deſcending bodies accelerate their motion continually in a duplicate proportion to the time of their deſcent; and therefore it ſeemed hard to conceive, how the theory propounded by Mr. Hooke would hold true, viz. that the time of the deſcent and aſcent of the ball is always in the ſame proportion with the depth of the ſea, be it more or leſs, provided it were about two fathoms deep. The reaſon of which he alledged to be, that by paſſing about two fathoms in the water,

water, the ball both in aſcending and deſcending would arrive to its greateſt degree of velocity.

The preſident farther urged, that GALILEO, GASSENDUS, and MERSENNUS had all affirmed the ſame thing, that all deſcending bodies accelerate their motion in proportion to the ſquares of the times of their continued deſcent: and that they had, upon this ſuppoſition, been at the trouble to calculate the time, that a body would ſpend in deſcending to the center.

Mr. HOOKE anſwered, that thoſe calculations had been made upon a theory, and not upon experiment; for that experiment would evidence the contrary. And though in a vacuity of water, air, or any other groſs fluid, thoſe proportions would hold very near; yet in a medium, wherein there was a reſiſting fluid body, it would not hold in any wiſe, eſpecially in thoſe, which had a conſiderable proportion of ſpecific gravity to that of the deſcending body. Hence he ſaid appeared the reaſon, why a down-feather being let fall in the air would deſcend therein, if it were not diſturbed, by an equal degree of velocity. But on the contrary, if the ſaid feather were let fall in a medium, whence all the air was exhauſted, and nothing but a fluid æther left, he affirmed, that it would fall therein, as to ſenſe, with the ſame accelerated velocity, that a ſtone would do in the open air. This, he obſerved, he had formerly ſhewed to his majeſty at Whitehall. But that upon admitting the air into the ſpace, through which the feather was to deſcend, it was plainly ſeen to deſcend with an equal degree of velocity the whole ſpace, which was all the way very ſlow. He added, that *in vacuo* the deſcent of all bodies was equally ſwift, increaſing continually its velocity by a duplicate proportion to the time of continuance; but that in all gravitating mediums ſomewhat of that proportion is impeded. Hence he affirmed, that in the experiments tried from the top of St. Paul's ſteeple it was very plainly viſible, that a leaden ball would deſcend faſter than one of the ſame bigneſs of wood, and that of wood faſter than one of cork; inſomuch that the heavieſt would in that deſcent get near thirty feet before the other to the bottom. He further added, that even of bullets of the ſame ſubſtance the bigger would manifeſtly outrun the leſs in their deſcent.

As alſo, that all mediums whatſoever had ſome reſiſtance to the motion of bodies through them, and that even thoſe, which had leaſt, had yet a very conſiderable oppoſition to a motion, that was proportionably accelerated. Hence it was, that birds were able to ſuſtain themſelves in the air; and that one might break the ſtrongeſt oar by ſwiftly ſtriking it again the water.

And farther, that in the thinneſt medium, though the acceleration were pretty near what was ſuppoſed by the aforeſaid authors; yet that it was in none mathematically true, but that there would be in all mediums a certain degree of velocity, which the ſame deſcending body would never exceed, though other deſcending bodies might, and ſome others would never arrive to: after which degree was attained, the progreſs of the body would always be made by equal ſpaces in equal times,

times, though ever ſo far continued, provided the gravitating powers remained the ſame.

Notice alſo was taken, that GALILEO had ſuppoſed, that the motion of a common pendulum was iſochrone; but that it was afterwards experimented by MERSENNUS, that this aſſertion would not hold; though the other problem of GALILEO of the iſochrone deſcent of a body upon the inclined plains within the circumference of a circle were mathematically and mechanically true:

That Monſ. HUYGENS was the firſt, that found out, that the motion of the weight of a pendulum in a cycloid would make all its excurſions iſochrone; but that he was not the firſt, who applied the pendulum to a clock for the regulating thereof.

Sir JOHN LOWTHER queried, who it was, that firſt found out, that the motion of the deſcent of heavy bodies was not the ſame with what GALILEO had aſſerted.

Dr. CROUNE ſuppoſed, that it was Monſ. MONCONYS; and that he had it from a Jeſuit in France. But Mr. HOOKE thought, that this was diſcovered long before; and did not remember the mention of it in the travels of Monſ. MONCONYS; but remarked, that the Jeſuit RICCIOLUS had mentioned it long before in his *Almageſt*.

Dr. CROUNE added, that DE CHALES in his *Curſus* had ſaid much concerning it both from his own experiments and thoſe of others.

Mr. HOOKE ſhewed an experiment of the compreſſion of the water in a glaſs-pipe, in order to the exhibiting the experiment of examining the depth of the ſea. And it was very viſible, that the effect anſwered to what was aſſerted concerning it, viz. that the compreſſion was proportionate to the depth of the glaſs below the ſurface.

*April* 18. Sir JONAS MOORE, vice-preſident, in the chair.

The minutes of the meeting of 4th April were read, which gave occaſion to diſcourſe concerning ſeveral ways of ſounding the depth of the ſea.

Sir JONAS MOORE related, that he had made many trials with the ball and weights of lead for the ſounding the depth of the ſea: and that he had found it exceedingly difficult to determine any thing by them, by reaſon that it was almoſt impoſſible to diſcover them certainly at their firſt appearing above water, though they would often leap into the air to a conſiderable hight; and that was becauſe they would often riſe two hundred fathoms from the place, where they were let down into the water. That of twelve, which he had tried at the Straits mouth, not one was found at its firſt appearance. He therefore conceived, that they would be of very little uſe in the ocean, though they might be of uſe in very deep lakes, ſuch as that of Geneva, &c.

Here-

Hereupon a farther diſcourſe was occaſioned concerning the motion of aſcending light bodies; and whether bodies aſcending from a greater depth would not move much ſwifter towards the latter end, and poiſe higher than thoſe, which came from a leſs depth. And it was alledged, that a ball of ſuch a poiſe as thoſe made uſe of for ſounding the depth of the ſea, would in its aſcending acquire a conſiderable velocity. But that degree being acquired it would not be more accelerated, though it aſcended ever ſo much farther.

Dr. CROUNE moved, that a theory of this matter might be brought into the Society.

Sir JONAS MOORE alledged, that in ſhooting granados he had found, that the greateſt random was below forty-five degrees of inclination. And that ſhooting at twenty degrees would fly much farther than ſhooting at ſeventy: the reaſon of which was the denſity and reſiſtance of the air to the body paſſing through it, whereby that, which was ſhot at ſeventy degrees, paſſing through a greater quantity of air, received a greater impediment and hindrance from moving exactly in a parabolical line, than that which was ſhot at twenty.

Sir JONAS MOORE farther obſerved, that the different denſity of the air at one time more than at another would cauſe a greater impediment and deviation of the bullet at that time more than at another: that the motion of the air or wind would often bend the bullet conſiderably out of its directed way: that the hollowneſs of the ſhell would many times make it paſs in a curve and not in a ſtrait line; for that he had ſeveral expanded canvaſſes ſet up all exactly in a ſtrait line; and that upon ſhooting directly in the line he had obſerved, that a bullet had paſſed through the firſt and laſt, and yet miſſed all the intermediate ones by deflecting either to the right or left ſide of them.

It was then moved, that ſome experiments ſhould be made at the column [t] on Fiſh-ſtreet hill, of the velocity of the deſcent of heavy bodies, and what the reſiſtance of the air is to that motion.

Mr. HOOKE affirmed, that he had a deſign to make ſeveral experiments concerning that and other matters at that place; of which he would give the Society an account; as he had formerly done of thoſe made at St. Paul's before the fire of London. He took notice, that there were in RICCIOLUS's *Almageſtum Novum* a great number of ſuch experiments made at Bologna at the tower of the Aſinels.

Dr. CROUNE alledged, that Monſ. DE CHALES in his *Curſus* had given a theory of the reſiſtance of the air to bodies moved through it, together with a great number of experiments to that purpoſe.

Sir JONAS MOORE related, that a hurricane blowing off the ball from the top of the ſteeple at Durham, the ball had acquired ſo great a velocity in its fall from

[t] The Monument.

ſo

ſo great a hight, that it ſunk itſelf at leaſt four feet into the ground; which he ſuppoſed to have been occaſioned by its great bulk and the great hight of the place whence it fell.

Mr. Hooke moved, that for the examination of the deſcent of heavy bodies trial ſhould be made with granados ſhot directly upwards, as near as might be, at Blackheath; in which trials obſervation ſhould be made of the time of their aſcent and deſcent; which might be very eaſily done, this being very viſible at a diſtance.

Mr. Hill alledged, that in Ricciolus there is an account of an experiment of ſhooting a bullet perpendicularly upwards; and that it had always been found to fall to the weſtward of the place, whence it was ſhot.

He added, that by many experiments tried at Dover Caſtle it had been found, that no gun in that place would ſhoot above a mile and an half into the ſea: the reaſon of which was ſhewn to be the proportion between the velocity of the horizontal and perpendicular motions.

Mr. Hooke ſhewed the microſcopical figure of the fibres of a muſcle, and explained the reaſon of their motion by a wreathed helical gut and a ſtrait ſtring, whereby upon blowing up the gut, and filling it with wind, the ſtring became helical and ſhortened, being twiſted about the gut: but when the gut was ſuffered to empty itſelf of the air, the ſtring lengthened and became ſtrait, and the gut twiſted about it in a helical figure.

Mr. Hooke propoſed alſo an experiment for the next meeting, to ſhew how the motion of the muſcle might be explained, ſuppoſing the ſaid fibres to be (like a necklace of hollow glaſs-beads, which it repreſented) a ſtring of ſmall bladders joined together by the necks.

Monſ. Papin, who was admitted to be preſent, ſhewed an experiment of a wind-gun of his own making and contrivance.

*April* 25. Sir Christopher Wren, vice-preſident, in the chair.

The minutes of the laſt meeting being read gave occaſion to diſcourſe concerning the reſiſtance of the air to bodies moved through them; and particularly concerning the figure, in which a granado is moved; how near it approaches to a parabola; and in what it varies from it: that in the motion of leſſer bodies in leſſer ſpaces the figure is ſo near a true parabola, that it is not poſſible, by any inſtrument yet known, certainly to deſcribe one nearer to the truth.

Sir Christopher Wren alledged, that he had by many trials found, that he was able by binding and fixing faſt his barrel, to ſhoot three ſhots in five into the ſame holes.

Sir JOHN HOSKYNS mentioned, that Sir JONAS MOORE had affirmed, that he had done much the ſame thing with a croſs-bow fixed faſt to a reſt, and ſhooting an arrow.

It was alledged, that thoſe guns carried trueſt and ſureſt, which were exactly bored and poliſhed within, and that had a bullet exactly fitted into it; or that was forced through it by the ſtrength of the powder.

After this a diſcourſe was occaſioned concerning the motion and fabric of muſcles. And Mr. HOOKE ſhewed an experiment in order to the explanation thereof, which was a chain of ſmall bladders faſtened together, ſo as that by one pipe the whole ſeries might be filled; which they would be ſucceſſively, one after another, that, which was next the pipe, being firſt filled, and then the next ſucceſſively. Now it was ſuppoſed, that the globules of the fibres of the muſcles, which ſeemed like a necklace of pearl, might be ſome fabric, as this of bladders, in which might be included a certain portion of air or other very agile matter; which air being included in ſo exceedingly ſmall and very thin ſkins, was very eaſily wrought on by heat and cold, and other agitating properties of the liquors, that paſs between them; and thereby they might be preſently filled by the ſaid included air being rarified and emptied by the condenſation of the ſame from the want of that heat continued: and ſo by the ſucceſſive rarefaction and condenſation of the ſame air included in the aforeſaid chain of bladders the ſtring thereof was made either ſhorter or longer, each of which was ſo much the more, by how the rarefaction or the condenſation was the greater.

Upon this an occaſion was taken, to diſcourſe of the cauſes of the motion of the muſcles; and how far the air taken in by the lungs might contribute towards muſcular motion. And it was thought, that it was of great neceſſity for that very purpoſe.

Dr. KING was of opinion, that the motion of the muſcles proceeded from the liquor of the nerves, and alledged the exceeding minuteneſs of the divarications thereof; inſomuch that with a microſcope it was poſſible to trace them till they were much ſmaller than the hair of a man's head, and yet might be found to divaricate and to cleave into more and ſmaller ramifications. He remarked, that he had tried theſe ſmall divarications into the very middle of the body of theſe muſcular fibres. It was judged, that both might be neceſſary to produce that motion.

Mr. HENSHAW objected, that the divers for ſpunges and corals at Samos could hold their breath three quarters of an hour. Upon this alſo he mentioned his deſign of diſſecting an otter, in order to inquire into Monſ. DES CARTES's aſſertions concerning the *foramen ovale*, by which the blood of otters was ſuppoſed to paſs from one ventricle of the heart to the other, without paſſing through the lungs: and thence it was ſuppoſed, that there was leſs need of the motion of the lungs or breathing, ſince it was thought, that the great uſe of the motion of the lungs was for the making the blood paſs through them.

But

But against this he alledged, that in his opinion the otter had no *foramen ovale*; which Sir CHRISTOPHER WREN positively asserted, having dissected and examined an otter for that purpose.

Dr. KING affirmed, that an otter could not continue under water without breathing above four minutes, and then must of necessity come up and breath. And so long almost any man in cold weather was able to abstain from breathing.

Sir CHRISTOPHER WREN related, that the seal, that was in St. James's Park, had muscles, by which it could * * up the nostrils, and so sink itself, and lie at the bottom of a pool made for him, for a great while together; and that it would eat its food at the bottom of the water.

Then the discourse of muscular motion was farther prosecuted: and it was supposed, that those chains of globules might be filled with other liquors as well as with air. But Mr. HOOKE alledged, that the spirit of wine and divers other spirituous liquors were pretty suddenly susceptible of the degrees of heat and cold; yet in comparison with the exceeding sensibility of the air they were very slow and dull: and in order to explain this he promised to produce at the next meeting a glass, which should experimentally verify it.

Sir JOHN HOSKYNS objected, that the motion of the muscle could not be from the swelling or shrinking of the air; for that Dr. GODDARD had, by an experiment made in a vessel of tin, in which a man's arm was included, proved, that the arm took up no more room in the water, when the muscles were intented and made use of to pull, than when they were suffered to lie still without straining. To which Mr. HOOKE answered, that that experiment was not at all sufficient to prove or disprove the swelling or shrinking of the muscle; for that there being always some muscles, which counterbalance the other, and that as much as the one swells, the other shrinks; and so the same space is always filled by the two antagonist muscles together.

Sir CHRISTOPHER WREN supposed, that the swelling and shrinking might proceed from a fermentative motion arising from the mixture of two heterogeneous fluids.

Some difficulties occurred in this hypothesis, how the motion of some muscles should continue so long after they were cut off from the body of the animal. Mention was made of the muscles of the skin in flaying a dead animal; of the parts of eels cut asunder; of frogs stirring after the heart, lungs, and entrails were taken out.

Mr. HOOKE affirmed, that he had observed the heart of a monk-fish to beat many hours after it was cut out of the body.

*May* 2. Mr. HENSHAW, vice-president, in the chair.

The minutes of the laſt meeting being read, wherein mention was made of the parabolical figure deſcribed by a bullet, and inquiry being made concerning the figure proper to each inclination, it was ſhewn, that the figure deſcribed by a bullet ſhot with any inclination whatſoever is a parabola.

Upon occaſion of a diſcourſe about reſpiration, Dr. CROUNE mentioned an experiment made by Dr. MERRET of keeping young puppies a long time without reſpiration, by ſuffering them to remain in their ſecundine after they were taken out of the dam. This obſervation was confirmed by Mr. HOOKE from his own trial; and he added, that he had found the heart of one of them beat the next morning, which he had taken from the dam the night before.

Dr. CROUNE hinted, that a creature might be ſtifled before the *foramen ovale* could be cloſed.

The vice-preſident anſwered to this, that it was a queſtion, whether the *foramen ovale* might not be cloſed before the birth; becauſe it had been obſerved to be cloſed immediately after the birth; and therefore it was not probable, that it could be done ſo ſuddenly.

Dr. CROUNE ſuppoſed, that there were other uſes of the *foramen ovale* than had yet been aſcribed to it; for that he had obſerved, that the blood circulated throughout the lungs, as well after the exhauſting the air by the wind-pump out of them as before: ſo that he ſuppoſed alſo, that even before the child had breathed, there might be made a circulation of the blood even through the lungs of the fœtus.

Upon this occaſion much was diſcourſed about the fabric of the lungs, and how the air might be clean drawn out of them by the wind-pump, though it could not be expreſſed out of them by preſſing them without breaking the little bladders.

Mr. HOOKE explained the reaſon, why this effect might be performed the one way and not the other: and that was, that the little bladders, out of which the lungs were compoſed, were joined to the branches of the aſpera arteria like leaves to the ſprig of a tree: that the holes, by which the aſpera arteria and each of theſe bladders communicated, opened and cloſed according as the bladders were more or leſs expanded: but that they became perfectly cloſed up, when the bladders were not bigger than ſuch a determinate magnitude.

Mention was made of divers, who refreſhed themſelves by the help of ſponges dipped in oil. This was taken notice of upon Mr. HILL's mentioning, that MERSENNUS had related, that a diver could hold his breath, and continue under water for an hour and a half without coming up to fetch breath: but that he had retracted this relation in another book, and acknowledged himſelf to have been miſinformed.

Mr. HENSHAW added, that the ſeal in St. James's Park uſually received its food

at

at the top of the water and upon the land, and then dived to the bottom and eat it there.

It was diſcourſed, that the ſpecifical uſe of the air or reſpiration was difficult to gueſs it; for ſome experiments had proved, that there might be a circulation without the motion of the lungs; and that a man might be ſtifled, though he moved his lungs and breathed, if it were not freſh air. This was thought a good argument to prove what Mr. Hooke had aſſerted, that air was the pabulum of the animal ſpirits, and that, which was the principal cauſe both of the heat and animal motion; for that the blood was in the lungs both impregnated with freſh air, and ſo received an inlivening florid arterial colour, and alſo diſcharged great quantity of ſteams and fuliginous matter, that was contained in it.

This gave occaſion to diſcourſe of the reaſon, why ſeveral creatures leave a ſcent behind them, where they paſs; ſo that dogs are able to follow them thereby a good while after they had paſſed along.

Mr. Hill obſerved, that in hunting a deer, the dogs would not always take the ſcent from the ground, but ſometimes alſo from the boughs of trees, or any other thing, whereon the breath of the deer might ſettle.

Upon this diſcourſe it was farther obſerved, that there were continual ſteams iſſuing from animal bodies, not only by the lungs, which vented the greateſt quantity, but even from all the other parts of the body. And it was remarked, that if a man in cold weather ſtands with his ſhoes upon a marble ſtone, he would preſently leave an impreſſion behind him upon the ſtones, though his ſhoe-ſoles were perfectly dry, as was preſently experimented. It was judged, that by ſome ſuch ſteams as theſe left on the ground, upon which a man walks, a dog might be able to follow him by the ſcent.

It was hereupon obſerved, that the vapours, that perſpire through the ſkin, make a kind of atmoſphere about a man and other creatures; and thence in cold weather thoſe vapours being condenſed into water become viſible, as was more viſible in the breathing of a man or other creature. Hence it was conjectured, that the wearing of an oiled caſe upon a hat would make the hat within very wet; as alſo the wearing of cap of ſalve or lead.

Hereupon it was ſuggeſted by Mr. Hooke, that probably the healing of plaiſters might be from nothing elſe than the keeping of the air from preying upon the tender wounded part, and from keeping in the moiſture to keep it tender and ſupple.

The uſe of the ſkin of an egg for healing of freſh wounds was alſo mentioned: as likewiſe that this was the reaſon, why a dog heals his wound by licking it, keeping it thereby clean and moiſt.

Mr. Colwall related, that though the egg ſkin might be good for healing of green wounds, yet that it is not ſo for healing of old ones; for that he knew a perſon, who by wrapping up his finger in it, had mortified it.

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By the bye mention was made of the foot of a bear, which by Sueno was obſerved to be much fuller of glands than that of other creatures: and this was ſuppoſed to be the reaſon, why bears were obſerved to ſuck their feet ſo much in cold weather, as containing a liquor laid up by nature: and it was obſerved, that thereby the fat of the bear waſted.

Mr. Hooke read a diſcourſe and relation of a voyage made by a gentleman to the top of the pike of Teneriffe, and of the remarkable particulars obſerved there by him; of the water and ice in the cave: of the heat and ſulphur of the caldron at the top: of the cold and penetrating winds: of the clear proſpect of an iſland at a good diſtance: of the continuing of the taſte of wine and ſtrong waters: of the reputed hight, and of the vaſt ſtones, that ſeemed to have rolled down from the top.

An experiment was exhibited, to ſhew how exceedingly ſenſible the air is of the alteration of the degrees of heat and cold. And it was made uſe of to explain how the motion of the muſcles might be effected, ſuppoſing them to conſiſt of an infinite number of ſuch ſmall bladders ſtrung together, as had been ſhewn at the laſt meeting by the microſcope in the muſcle of a crab.

*May* 4. At a Council held at Sir Christopher Wren's were preſent

Sir Christopher Wren, vice-preſident,
Sir Paul Neile, Mr. Henshaw,
Mr. Hill, Mr. Hooke.

It was ordered, that the iron cheſt in the gallery of Greſham-College be opened on the Thurſday following in the preſence of a vice-preſident and any two of the council; and that an inventory be taken of what was contained in it; and that Mr. Hunt provide forthwith convenient padlocks for it:

That Mr. Hooke treat with Mr. Lem concerning Chelſea-College, and give an account of his proceedings at the next meeting of the council:

That an index be made of all the material things contained in the Council-book by the advice of the ſecretaries; and that a reaſonable allowance be made to a fit perſon to do the ſame: And,

That Mr. Henshaw, Mr. Hill, and Mr. Hooke, be deſired to go to Chelſea College, and to get a ſurvey of it ſometime before the Thurſday ſev'nnight following.

*May* 9. At a meeting of the Society, Mr. Henshaw, vice-preſident, in the chair.

The minutes of the laſt meeting being read gave occaſion of much diſcourſe concerning reſpiration, and of what uſe the air might be for continuing ſenſe, motion, and life.



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Sir JOHN HOSKYNS was of opinion, that the uſe of the lungs might be to alter, prepare, and diſpoſe the air ſo, as to ſeparate a part thereof, and make it fit for mixing with the blood, as it paſſed through them, ſomewhat analogous to thoſe operations, which are performed by other viſcera upon other juices of the body; and for ſeparating alſo at the ſame time apart from the blood, as the liver ſeparates the gall, the kidneys the urine, &c.

The vice-preſident was of opinion, that a principal uſe of the lungs is for the promoting of the circulation of the blood.

It was objected to this, that the motion of the lungs was not at all neceſſary to the circulation, becauſe a dog could live, though his lungs were kept motionleſs, by being continually blown up and kept extended by a pair of bellows: that a dog would be kept alive, though the lungs were not kept fully extended, provided there were a continual blaſt of air, that paſſed through them: and farther, that a creature would be ſtifled and die, though his lungs moved, if it did not breath freſh air.

It was therefore concluded, that the principal uſe of reſpiration is for the mixing the nitrous part of the air with the blood; which part of the air being once ſpent and ſeparated from it, the remaining part thereof is altogether uſeleſs for that purpoſe.

To this it was objected, that if there were ſuch a conſtant and continual neceſſity of freſh air, how comes it, that the fœtus included in the ſecundine, as had been lately mentioned, would continue to live, though it had no freſh ſupply of freſh nitrous parts of the air from the lungs, which would not move at all?

And Mr. HENSHAW mentioned the perſon in Sweden, of whom there is a fuller account in the books of the Society, who being drowned and frozen up in ice for a conſiderable time, was afterwards dug out, thawed, and brought to life again, and had been ſeen by many in Sweden, with whom Mr. HENSHAW had ſpoken.

Mr. COLLINS cited upon this occaſion PECHLINUS's hiſtory.

It was farther ſuppoſed, that the greateſt tranſpiration of the body was made by the lungs; and that ſome creatures ſcarce ſweat at all. Whereupon Dr. AGLIONBY ſuggeſted, that the drivel of a dog heated with running is not ordinary ſaliva, but ſeems to be the ſweat of the dog mixed with it.

Upon the mention of the relation, read at the laſt meeting, of the journey to the top of the pike of Teneriffe, ſeveral debates aroſe concerning the hight of the clouds and the nature of them.

Sir JOHN HOSKYNS obſerved, that according to this relation the clouds were

as high as the top of the pike; and that they ſometimes covered it, and made the earth very moiſt and clammy.

Dr. WALLIS and ſome others affirmed, that they had ridden through clouds at the tops of hills, which there appeared a miſt; but both before they entered it, and after they had paſſed it, it looked like a cloud, and was really nothing elſe.

After this a Latin letter was read from THEODORUS KERCKRINGIUS ſent to the preſident, and dated at Hamburgh, 4th February, 167⅞[a], returning his grateful acknowledgments for the honour and favour done him by his election into the Society, and declaring his deſire and readineſs to ſerve their deſign to the utmoſt of his power.

The experiment appointed for the next meeting was the trial of the mercurial experiment at the column on Fiſh-Street-Hill.

*May* 30. At a meeting of the COUNCIL were preſent,

Sir CHRISTOPHER WREN, vice-preſident,

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| Sir JONAS MOORE, | Mr. HALL. |
| Sir JOHN LOWTHER, | Dr. HOLDER, |
| Sir JOHN HOSKYNS, | Mr. HILL. |
| Sir PAUL NEILE, | Mr. HOWARD, |
| Mr. HENSHAW, | Dr. KING, |
| Mr. COLWALL, | Dr. WHISTLER, |
| Dr. GREW, | Mr. HOOKE. |

It was ordered, that Sir JOHN HOSKYNS, Mr. HENSHAW, Mr. HILL, Dr. GREW, Mr. HOOKE, or any two of them, be a committee to conſider of the beſt way of diſpoſing of Chelſea-College; and that they have full power to treat and agree concerning the diſpoſal of the ſaid intereſt to the beſt advantage of the Society in their opinion: and that Mr. HOOKE do from time to time appoint the meetings of the ſaid committee, and accordingly ſend notice thereof to the members of it.

At a meeting of the SOCIETY on the ſame day,

Mr. HENSHAW, vice-preſident, in the chair.

The minutes of the meeting of May 9, being read gave occaſion of diſcourſing concerning the reviving of perſons, who had been drowned for a conſiderable time: upon which ſubject it was alledged, that PECHLINUS[b] had written a long diſcourſe, of which the Society had received a particular account from Monſ. STIERNHELME the reſident of Sweden.

[a] Letter-book, vol. viii. p. 31.

[b] NIC. PECHLINUS, whoſe book *de Aeris & Alimenti defectu* was printed at Kilon in 1676.

Sir

Sir JONAS MOORE gave an account, that Mr. EDMUND HALLEY, who went to the iſland of Saint Helena, in order to obſerve the true places of the ſtars near the ſouth pole, was newly returned to England; and that he had completed his deſign by having taken the true places of above four hundred conſiderable ſtars: that the place of his obſervation was above a thouſand yards higher than the ſurface of the ſea: that by reaſon of that great hight there were there almoſt continual clouds and miſts, which paſſed very ſwiftly: that this miſtineſs and moiſture of the air diſſolved the glue of the tubes: that he obſerved, that theſe clouds and miſts aroſe immediately out of the ſea on one ſide, and paſſed over the iſland, and fell down on the other ſide: that this miſtineſs was only over the iſland, and not on the encompaſſing ſea: that the air was extremely temperate and helpful: and as an argument hereof he related, that a couple having gone over from England to inhabit there, the huſband being fifty-five years of age, and the wife fifty-two, the wife was big with child, and ready to be delivered when he came from thence: that the iſland afforded plenty of wild partridges and turkey hens: and that the whole iſland ſeemed to be one intire rock ſtanding in the middle of the ſea.

Sir JONAS MOORE undertook to diſcourſe Mr. HALLEY farther concerning his other obſervations, and to give the Society an account thereof.

Mr. HOOKE read part of a diſcourſe ſent him by Mr. JAMES YOUNG of Plymouth, containing a brief deſcription of the iſland of Mayo and of the bay in that iſland, from which ſalt is brought; together with his obſervations on a well dug in the ſand for the procuring of freſh water; which, though almoſt incompaſſed with the ſea, afforded notwithſtanding a good quantity of water pretty freſh.

With regard to the producing of water by this way, viz. by the ſtraining of ſalt water through the ſand, the vice prefident very much doubted of it, as being a thing hitherto not known; nor was there yet known any other way of filtration, that would make a ſeparation of freſh water from ſalt water.

Dr. WHISTLER obſerved, that all over Holland, Zealand, and Weſt Friſeland, where the country lies lower than the ſea, there could be no ſprings found by digging.

Mr. HOOKE then gave an account of ſome experiments, which he made with Mr. HUNT and Mr. CRAWLY at the Pillar on Fiſh-Street-Hill, concerning the difference of the preſſure of the air at the top and bottom of the column and at ſeveral intermediate ſtations: and he affirmed; that he had found the quickſilver in the tube to ſtand higher at the bottom of the column than at the top of it by near a third part of an inch; and that he had obſerved the ſame to aſcend by degrees, as near as he could perceive, proportional to the ſpaces deſcended in going down from the top of the column to the bottom: but becauſe the ſaid ſtations of the mercury were different from one another but very little, and ſo it was not eaſy to determine the certain proportions of the one to the other; there-

fore he propoſed againſt the next meeting an experiment to be tried at the ſame place with an inſtrument, which would determine that diſtance an hundred times more exactly: which inſtrument alſo he there produced, in order to explain the manner thereof, it being made upon the ſame principle with the wheel barometer, but more curiouſly wrought.

The experiments with his inſtrument were appointed to be tried at the column upon the Thurſday following at eleven o'clock in the morning.

*June* 6. At a meeting of the COUNCIL were preſent

Sir CHRISTOPHER WREN, vice-preſident,
Sir JOHN HOSKYNS,
Sir JOHN LOWTHER,
Mr. HENSHAW,
Mr. HALL,
Mr. HILL,
Mr. HOOKE.

It was ordered, that the treaſurer pay to Mr. HOOKE the ſum of forty-five pounds for his allowance as curator of the experiments of the Society for a year and half ending the 24th of that inſtant June.

It being mentioned by Mr. HOOKE, that Mr. JOSEPH LANE, comptroller of the chamber of London, lately elected a member of the Society, deſired to be excuſed from the uſual payments thereof, upon his allegation, that he would otherwiſe be ready to promote the deſign and good of the Society, and to be aſſiſtant to them in matters of law; it was thought fit and ordered, that he ſhould be excuſed from the ſaid payments upon his ſubſcribing the engagement to perform the other duties incumbent on a fellow of the Society.

It was ordered, that Mr. HOOKE be deſired to go to the library at Arundel-Houſe, there to meet Sir WILLIAM DUGDALE, garter king at arms, and to receive his propoſals concerning the books of that library, which concern heraldry and genealogy, or the hiſtory of the family of Norfolk, which his grace the duke of Norfolk had reſerved, when he formerly granted the reſt to the Society: and that Sir JOHN HOSKYNS, Mr. HILL, and Mr. HALL be deſired to accompany him on the Friday following at three in the afternoon.

At a meeting of the SOCIETY on the ſame day,

Sir CHRISTOPHER WREN, vice-preſident, in the chair.

Upon reading the minutes of the meeting of May 30th, a farther diſcourſe was occaſioned concerning the revival of ſeveral creatures after they had been drowned; as alſo concerning the reviving of ſwallows after they had been taken out in cluſters from under the ice: concerning which it was affirmed, that Sir GILBERT TALBOT having made particular inquiry into the truth of ſuch relations by ſpecial order from the king, he had confirmed thoſe relations.

There

There was read Mr. JAMES YOUNG's account of his obſervations in ſeveral parts of the world concerning the production of ſprings by the ſtraining of ſea-water through the ſands and pores of the earth; whereby he endeavoured to prove from ſeveral inſtances, that ſprings in all places could not have their origin from rain-water, as was ſuppoſed, but more probably ſeemed to be produced by the ſweetening of ſea-water.

This occaſioned a great debate concerning the cauſes of ſprings.

Sir JOHN HOSKYNS related, that the iſland of Walkerin was all of clay; and yet at the bottom of the hills there were great numbers of ſprings of freſh water.

He added, that it was not improbable but that a great quantity of the water flowing from the tops of hills was occaſioned by the frequent miſts there, when there were none in the valley underneath.

He conceived alſo, that one cauſe of the miſts on the tops of hills near the ſea-ſide is the paſſing of the air, which is near the ſurface of the ſea, over the top of the hills; and there by the cold, and the beating againſt the ſame, might be condenſed into water.

He mentioned alſo, that it was not improbable, that though there might not be a , that would ſtrain the water from the ſalt; yet there might be ſome, that might ſtrain the ſalt from the water; and he took notice of ſome unglazed pots of earth, through which it is commonly obſerved, that the ſalt would paſs through the ſides thereof, and ſtick in the form of ſalt on the outſides.

It was objected by Mr. HOOKE, that though it appeared in a dry form, yet that it paſſed through by the vehicle of the water, which being evaporated left the ſalt.

Mr. HENSHAW affirmed, that there was a known way of refining ſalt-petre by tranſudation through earthen pots in ſix hours.

Upon this Dr. CROUNE mentioned the tranſudation of water through the coats of the ſtomach, through which yet the air, which was more ſubtile, would not paſs.

Mr. HOOKE added, that the reaſon of this is from the congruity of the coats of the ſtomach to water, and their incongruity to air, of which there had been many experiments ſhewn to the Society.

He farther added, that there are very different ſalts; ſome, that are aerial, and have a congruity with the air, and would therefore eaſily mingle therewith, and leave the water: and there were other ſalts, that have a greater congruity to

water and other aqueous liquors. And of this nature ſeem to be volatile or urinous ſalts, which are readily taken up by the air, eſpecially if the air be aſſiſted by heat. So that if there were a way of rendering ſea-ſalt ſo volatile, the ſalt might be ſeparated by ſublimation from the water, as well as the water is now ſublimated or diſtilled from the ſalt.

Sir CHRISTOPHER WREN mentioned, that poſſibly there might be a way of ſeparating freſh water from ſalt water, by ſuffering it to ſtand and ſettle in veſſels; for that it had been obſerved, that the top of the water was very much freſher than the bottom; and that by pouring freſh water upon ſalt, it would remain a good while freſh at the top before the ſalt would riſe thither.

This was ſeconded by Mr. HOOKE, who affirmed, that he had upon that principle made ſeveral weather-glaſſes, viz. by poiſing certain bubbles or bottles of glaſs ſealed up hermetically, ſo as juſt to ſink in freſh water: and that by this means he had found, that by putting ſalt into ſuch water, or rather gently pouring water upon ſalt, and putting in the ſaid poiſed bubble, the ſame would not ſink to the bottom, but remain ſuſpended in the body of the water, at firſt pretty near the bottom; but at length it would riſe higher, according as the ſalt more and more diſſolved in the water, ſo as at laſt to float almoſt at the very top.

Sir JOHN LOWTHER related, that he had a town upon his eſtate, which was built upon a place, which was formerly ſea; notwithſtanding which, upon digging wells in the ſand (which is the ground, upon which the town ſtands) they find very good ſprings of freſh water at eight yards depth; at which place they come to a gravel: that there are antient hills, which may be ſuppoſed to ſupply the ſprings: that the manner of ſinking theſe wells into the ſand was this; firſt they make a kirb of wood or plank of the exact bigneſs, which they deſign the walls of the well: then they lay that upon the ſand; and upon that deſign begin to build a cylindrical wall of bricks two or three feet high: they then dig out the ſand from within the ſaid kirb; by which means the kirb and wall ſink downwards: then they build the round walls higher, and again undermine the ſame, till it be again even with the ſand; and then raiſe the walls again and ſink the kirb, proceeding in this manner till they have ſunk the ſaid kirb to the depth of the ſpring. He added, that under the ſaid town he had found a coal-mine: that in ſinking a well to this coal-mine they found theſe ſprings at four fathoms depth, which they endeavoured to keep out; but being not able, they endeavoured to free it from water by engines, and continuing to ſink farther till they came to a bed of clay at eight fathoms, they were ſo overpowered with water, that they were obliged to deſiſt from their proceedings to ſink it any farther: but that ſinking another well at in the ſame manner at ſixteen yards diſtance, they found the ſame ſorts of ground and clay as in the former, but without the annoyance of ſprings; the former well of eight fathoms depth having drained this perfectly dry, though it was full ſixteen fathoms deep; which was a ſucceſsful attempt of his own contrary to the opinion of the miners.

Mr. HALL remarked, that it was a known experiment to run or draw off the freſh

freſh water from the top of the ſalt water in the brine-pits after rain, the ſame remaining at the top of the brine without mingling therewith.

Dr. CROUNE related an experiment of his own trial, which was, that by putting a cruſt of bread on the top of ſalt-water, and pouring freſh water upon it he found, that they remained a long time diſtinct without mingling one with the other.

Mr. HOOKE ſuppoſed, that there might be a kind of precipitation or rather fixation of the ſalt out of the brine, by the ſtraining through the ſand; it finding therein ſomewhat of ſuch a nature, that might mix with it, after the ſame manner as oil of tartar doth with oil of vitriol; from the colluctation of which might be produced a kind of ſalt perfectly inſipid. And to make this the more probable, he related it as a known obſervation at the ſalt-urns, that the boiling of the aforeſaid brine (which had been made by the evaporation of ſea-water by the heat of the ſun in the brine-pans) conſtantly ſeparated from the ſame (though perfectly clear when put into the ſquare iron boiler) great quantities of pure inſipid white ſand at the four corners of the ſaid boiler. That the reaſon of this ſeparation here he ſuppoſed to be the avolation of that volatile ſalt, which kept the ſaid ſandy ſubſtance diſſolved and floating in the brine: that there was ſuch an avolation of volatile ſalt, he argued from the ſtrong ſmell of ſpirit of ſalt in the boiling-houſe.

Upon this Sir JOHN LOWTHER related, that in making ſalt in Lancaſhire upon the river Wy, they take the ſand, and ſteep it in water; by which means they diſſolve a great deal of ſalt out of the ſand; then ſeparating the ſaid water from the ſand, they boil it up into ſalt.

Mr. HENSHAW affirmed, that one might, by ſome drops of clear oil of tartar put into very clear ſpring-water, ſeparate a ſmall quantity of ſtony or earthy matter, ſometimes mud, ſometimes chalk, ſometimes earth and ſand.

Dr. CROUNE mentioned the keeping gold ſuſpended in aqua regia, and precipitating it with oil of tartar.

Sir CHRISTOPHER WREN ſuppoſed, that ſea-water might be made freſh by percolating the pores of ſea-plants. To which it was anſwered, that moſt of thoſe plants taſted of ſalt; and that there was not yet known any ſubſtance, that would retain the ſalt, and let the freſh water ſtrain through.

It was ſuggeſted, that trials might be made with ſeveral ſubſtances, to ſee whether there were any, that would make the water at all freſher.

Dr. CROUNE mentioned the experiment, which had been formerly made by Mr. BOYLE, of making the water riſe by filtration to a conſiderable hight above the ſurface of the water in the veſſel.

Upon which it was desired, that some experiments of that kind might be shewed at the next meeting.

A letter in Latin was produced, written by Dr. E. Leichner to Dr. Grew, secretary of the Society, written at Erfort, 18th May, 1678 [y]: but it being long, the reading of it was referred to the next meeting.

Mr. Hooke likewise produced a discourse of Mr. James Young of Plymouth, desiring a licence for printing the same; which was referred to another meeting.

Mr. Hooke mentioned an experiment for examining the gravitation of the air at several hights above the surface of the earth.

*June* 13. At a meeting of the Council were present

Mr. Henshaw, vice-president,
Sir John Hoskyns, Mr. Hill,
Sir John Lowther, Mr. Hall.

It was ordered, that Mr. Hall and Mr. Hooke attend the duke of Norfolk, and intreat him from the Society, that since his grace was then pulling down his house, he would be pleased to suffer the library, which he had bestowed on the Society, to be removed to Gresham-College, where there was a room provided for it; and that they also deliver to the duke the catalogue of that library: And,

That the tiles and timber of Chelsea-College be taken down, and secured in some place near the same; and that Mr. Henshaw be desired to direct some person to go about the pulling it down forthwith.

*June* 20. At a meeting of the Society,

Mr. Henshaw, vice-president, in the chair.

A letter in Latin from Monsr. Bullialdus to the Society, dated at Paris, 25th May, 1678, N. S. [z], was read, wherein was contained an account of his observations made of the occultation of Saturn by the moon, 27th February, $167\frac{7}{8}$, after sun-set; together with his calculation thereof from the Philolaic tables, by which he found, that those tables and the heavens differed nineteen minutes; and likewise his calculation of the same by the Rudolfine tables, by which he found, that it ought to have been begun then, when by his observation he found it to be quite past: which he ascribed partly to a fourth inequality of the moon, which he conceived not to be yet reduced to a theory; and partly t the discrepancy of the motion of Saturn from the theory of it; which was

[y] Letter-book, vol. viii. p 34.
[z] Letter-book, vol. viii. p. 42. It is printed in the Philosoph. Transact. vol. xii. n° 139. p. 969. for April, May, and June, 1678.

found

found to be ſlower than the Rudolfine tables not leſs than a degree and a half; and in his no leſs than one third of a degree. He mentioned his deſign of rectifying thoſe tables as ſoon as Mr. HEVELIUS ſhould publiſh his obſervation (which, he ſaid, would be within a year) if his life ſhould be prolonged, which was already advanced to the ſeventy-third year.

It was ordered, that this letter ſhould be anſwered, and the reſpects and kind acceptance of the Society ſignified therein; with a communication to him of what aſtronomical matters had occurred, and their deſire, that he would continue his correſpondence.

A letter in Latin of Signor FRANCISCO NAZARI to Dr. GREW, dated at Rome, 1ſt May, 1678, N. S. [a] was read, wherein he teſtified his extraordinary reſpect for the Society, and his earneſt deſire to be ſerviceable to it by his correſpondence, and ſending them an account of whatever ſhould occur relating to philoſophy.

A third letter in Latin was read from Monſ. HUYGENS to Dr. GREW, dated at the Hague, 6th June, 1678, N. S. [b] in anſwer to the Dr.'s letter, and expreſſing Monſ. HUYGENS's deſire to be informed of the inventions and proceedings of the Society, as he had formerly been by Mr. OLDENBURG, and promiſing in return to communicate to them whatever he ſhould think worthy of their notice. He added, that he had of late employed ſome thoughts about improving microſcopes; being prompted thereto by the diſcovery of thoſe animalcules *in ſemine animali* made, by one HAMMIUS, a ſtudent at Leyden, which animalcules he, Monſ. HUYGENS, had often ſeen.

It was ordered, that care ſhould be taken to anſwer this letter, and to continue this correſpondence with Monſ. HUYGENS.

The minutes of the laſt meeting being then read gave occaſion to diſcourſe farther concerning the nature of the air, and of the vapours raiſed up into it by heat.

Mr. HENSHAW related the manner of making the experiment of condenſing the ſaid vapours out of the air by putting ice and ſalt into a glaſs tapered downwards, and ending in a point, and then ſuſpending it in ſome place; where a conſiderable current of the air paſſes by. For by that means the vaporous parts of the air will be condenſed by the exceeding great cold of the veſſel, and trickling down by the ſides will drop into a receiver placed underneath the tapering end a pretty quantity of water in a little time.

This was confirmed by Dr. CROUNE and others.

Mr. HOOKE related an obſervation of the like nature, which he had made in the year 1665, in a deep well of one Mr. CLARKE near Banſtead Downs, of

[a] Letter book, vol. viii. p. 63. [b] Ibid. p. 50.

three

three hundred foot depth [c]: into which having, in the time of a very great froſt and exceeding cold wind, which happened about Chriſtmaſs, let down a bottle with ſpirit of wine ſo cooled by the air above, the ſame, when pulled up again, appeared all covered over with great drops of dew: beſides which a great many drops of water were obſerved to be run off from the bottle into the ſcale, in which it ſtood: which by him was attributed wholly to the warmth and vaporouſneſs of the air at the bottom of the well and the exceeding coldneſs of the bottle let down, which condenſed the vapours of that air into water.

Mr. HENSHAW and Dr. CROUNE mentioned the reaking of well-water in froſty weather, which was attributed to the warmth of the water and coldneſs of the air.

Mr. HOOKE conceived, that this was occaſioned partly by the coldneſs of the air condenſing the ſteams, which continually riſe not only from well-water, but likewiſe from all other water, when of ſuch a degree of heat; inſomuch that all water expoſed to the open air, when kept in ſuch a degree of heat, evaporates ſuch a quantity thereof in the ſpace of an hour, though it ſcarce becomes viſible unleſs in very cold or very hot weather; in very cold weather by the condenſation of the ſteams into a miſt; and in very hot by the playing or dancing of the air, as we commonly call the undulation of the riſing vapours over rivers.

This alſo was partly to be aſcribed to the keeping in of the vapours of the water in wells by the air of it; which being once ſatiated would take up no more vapours into it: whence as ſoon as this water was expoſed to freſh air, that was unſatiated, the vapours were taken up more copiouſly by it. This ſufficiently appeared from the damps of wells.

Againſt this continual evaporation of the air, Dr. CROUNE alledged an experiment of KIRCHER: and Sir JOHN HOSKYNS affirmed the ſame to be mentioned by BEREGARDUS in his *Circulus Piſanus*; by which it was evident, that water, though expoſed to the air, did not yet evaporate, though kept open for twenty years: which is an argument, that all water does not ſo evaporate, as was ſuppoſed.

To this it was anſwered, that though there might be ſuch an experiment made and obſerved, yet that this experiment did not overthrow the former ſuppoſition; eſpecially ſince one neceſſary circumſtance in the making this experiment was, that the neck of the veſſel, that contains this water, muſt be exceedingly long and high, and the hole ſmall, ſo that little or no change was made of the air next the water; which being once ſatiated would after that take up no more vapours into it.

Mr. HENSHAW mentioned the way of rectifying ſpirits and volatile ſalts by very high bodies and heads; to the top of which the ſpirits and volatile ſalts would riſe; but the watery and phlegmatic parts would not riſe near that hight: and that there were ſome volatile ſalts, which would riſe in a ſmall body ſooner and higher than ſpirit of wine.

[c] See above, vol. ii. p. 69.

Mr.

Mr. HENSHAW mentioned the way of refining ſalt-petre, by mixing with it alum or a quantity of wood-aſhes; by which means the ſea-ſalt, that is ſometimes found mixed with ſalt-petre, is ſeparated from it.

Upon the occaſion of Mr. HOOKE's deſiring a licenſe from the Society for printing an ingenious diſcourſe of Mr. JAMES YOUNG, about the uſe of oil of turpentine in green wounds, and ſtopping blood, &c. it was deſired, that ſome experiments might be made at the next meeting in the preſence of the Society.

*June* 27. Mr. HENSHAW, vice-preſident, in the chair.

Mr. WICKS [d] brought in and read a paper, delivered to him by ſome Quakers, concerning the great benefit, that would accrue to the nation by the ſetting up and encouraging ſeveral new manufactures, whereby to keep the poor at work. To which the Society returned for anſwer, that their addreſs was more proper to the parliament, the matter not properly lying before the Society.

The letters of Monſ. HUYGENS, Monſ. BULLIALDUS. and Signor NAZARI, read at the laſt meeting, were delivered to Dr. GREW to anſwer them againſt the next meeting.

Sir JOHN HOSKYNS deſired, that the correſpondence with MALPIGHI might be revived.

The minutes of the laſt meeting were read; upon which by the bye Mr. HENSHAW mentioned the thickening of wine upon the ſurrounding it with ſnow: alſo the condenſing of water on the outſide of a glaſs containing wine and ice. He remarked likewiſe, that miſts were obſerved to riſe more from meadows, that lay near rivers, ponds, &c. than from the rivers themſelves.

He farther obſerved, that the diſappearing of ſhips at ſea was often occaſioned by the thickneſs of the air near the ſurface of the ſea, and not by the roundneſs of the earth altogether: as alſo, that FRANCISCUS PATRICIUS had obſerved much the ſame thing upon the Lago di Coma, where by the thickneſs of the air near the water the ſight of a ſteeple on the other ſide of it was often intercepted; which was urged by him as an argument againſt the roundneſs of the earth, though, as Mr. HILL obſerved, very fallaciouſly. ⊙

Mr. HILL remarked, that the hundreds of Eſſex were much more healthy in a wet and cold year than in a hot and dry one: the reaſon of which he conceived to be from the more powerful operations of the ſun in thoſe hot and dry years, for the drawing up thoſe noxious vapours into the air, which in other years riſe not at all, but remain in the ground.

Mr. HENSHAW obſerved, that the heat of the ſun produces a much greater

[d] The clerk of the Society.

effect upon the ſurface of the earth than than upon the ſurface of the ſea: and that hence proceeded thoſe land and ſea-breezes in hot countries; the air and vapours over the land being every day more powerfully expanded, and every night more ſuddenly condenſed than over the ſea, the earth holds the heat longer, and exhales, when the water has given over.

Mr. HENSHAW added, that there was a volatile ſalt, which being mixed with the higheſt rectified ſpirit of wine would notwithſtanding riſe and ſublime from it before the ſpirit of wine would riſe.

Theſe diſcourſes were occaſioned by the queſtion concerning the hight of vapours above the ſurface of the waters.

Sir JOHN HOSKYNS remarked, that water in glaſſes, wherein plants, as mint, &c. had been ſet to grow, would in time grow muddy and foul.

Mr. HENSHAW ſuppoſed, that this might be occaſioned by the plant's caſting forth ſome excrement into the water; or elſe by the plant's ſtraining and ſucking away the clearer part, and by its leaving the groſſer and more feculent part behind; or by diſſolving ſome parts of the plant.

Mr. HOOKE then produced a new microſcope made after his directions by Mr. CHRISTOPHER COCK, whereby the objects were exceedingly magnified, and yet appeared very clear. This was viewed by moſt of the members preſent with great ſatisfaction; and the microſcope was ordered to be bought of Mr. COCK for the Society's uſe.

The experiments appointed for the next meeting were the trials upon blood with oil of turpentine, &c.

*July* 4. Mr. HENSHAW, vice-preſident, in the chair.

A letter in Latin from Mr. GEORGE HELD to Dr. GREW, dated at Hamburgh, 6th May, 1678 [e], was read, containing an account of the death of Dr. MARTIN FOGELIUS of that city, and accompanying a printed catalogue of his valuable library, which was to be ſold by auction.

A letter in Latin from Signor MALPIGHI to Dr. GREW, dated at Bologna, 21ſt June, 1678, N. S. [f] was read; giving notice of his ſending to the Society the ſecond part of his anatomy of plants.

A letter likewiſe from Mr. HEVELIUS to Dr. GREW, dated at Dantzick, 18th June, 1678, N. S. [g], was read, in which he inquired, whether four of his letters to Mr. OLDENBURG had been communicated to the Society; and whether his books ſent to that gentleman had been ſold; and he mentioned, that the ſe-

[e] Letter-book, vol. viii. p. 55. [f] Ibid. p. 49. [g] Ibid. p 51.

cond

cond part of his *Machinæ Cælestis*, viz. lib. 2, 3, and 4, would be published within three months.

Dr. GREW was desired to make an inquiry concerning the state of the account of the books of Mr. HEVELIUS, left in the hands of Mr. OLDENBURG's administratrix, and to give the Society an account thereof at their next meeting.

A fourth letter was read, written by JACOBUS PIGHIUS to Mr. HOOKE, and dated at Padua, 10th March, 1678 [a], wherein he expressed the high respect, which he had for the Royal Society, and his great desire of being known to them. He mentioned likewise his esteem for the English in general, and the favour done him by the English students at Padua, in choosing him their pro-syndic for the present year.

It was ordered, that answers to each of these correspondents should be prepared against the next meeting by the secretaries; and that care should be taken to give a brief account of each letter in the Journal-book, as had been done in the minutes of the 20th of June preceding.

Then the minutes of June 27th were read; which gave occasion of discoursing farther concerning plants growing in glasses filled with water.

Dr. CROUNE supposed, that plants would grow in such glasses, though they had no air, viz. though the ambient air were exhausted.

Mr. HOOKE supposed, that no plant whatsoever would grow *in vacuo*, howsoever ordered: and farther, that they would not grow very long in a glass perfectly stopped, though it contained both water and air, provided it had no communication with the outward air to refresh and renew the air: that a plant would be stifled in the manner of an animal, though not altogether so suddenly: but that length of time would make them grow pale, and sick, and die.

Sir JOHN HOSKYNS mentioned the way of whitening plants, by burying the stalks and leaves in the earth: as also that plants would wither and die, if they were kept in close air in a house.

Dr. CROUNE affirmed, that plants would grow in water, notwithstanding they were covered and kept from the air.

This occasioned some debate; and it was ordered, that Mr. HUNT should make trial thereof, whether a plant, from which the air was wholly excluded, would grow at all.

It was farther desired, that some other experiments should be made, whether plants would grow in a pent air.

[a] Letter-book, vol. viii. p. 32.

Mr. HOOKE mentioned an obſervation, which he had ſeveral times made, that ſome of thoſe plants, which had been ſet to grow in glaſſes of water, would after a certain time begin to pine and waſte, and at length be all over covered with ſmall inſects; which in a ſhort time would all be gone, and leave nothing but their huſks behind, ſticking all over the ſurface of the plant; and at the ſame time alſo the plant perfectly dead and withered, as if the plant had been nothing elſe but the nurſe or dam of thoſe inſects, and that the ſpirit or life of the plant had flown away in the inſects and had only laſted till it had brought forth that living animal offspring. He alſo mentioned, that he had obſerved ſeveral other things in plants of the like nature, which ſeemed to hint ſome ſuch theory.

Dr. PELL hereupon called to mind a certain fungus formerly given by him to the repoſitory, which in a ſhort ſpace was all converted into worms, nothing of the muſhroom being left but a little duſt.

This was confirmed by Mr. HOOKE, who had taken notice of that ſtrange metamorphoſis.

Dr. GALE mentioned, that plants would grow, though they were perfectly covered with water ſo, as no part touched the air.

It was further added, that there are ſeveral ſorts of ſea plants, which grow on the rocks at the bottom of the ſea at a good diſtance from the air.

Nevertheleſs it was ſuppoſed, that the air influences ſuch plants; and that thoſe plants would not grow, if they had not freſh air communicated to them by the water.

Hereupon it was obſerved, that plants would wither at the bottom of the river after a long drought, though they were ſtill covered with water: that fiſh would be ſtifled in water, if they were not expoſed to the freſh air, and often ſupplied with freſh water.

Dr. GREW mentioned, that it was common for a ſort of muſhrooms-mould or mother to grow in water cloſe ſtopped up in bottles.

Mr. HENSHAW mentioned alſo the obſervation of moſs growing upon the very ſubſtance of glaſs, and ſeeming to feed upon it, and eat into the very ſubſtance of it.

He likewiſe mentioned the way of making ſpunk out of brown paper by boiling it in ſalt-petre.

*July* 11. Mr. HENSHAW, vice-preſident, in the chair.

Mr. HOOKE gave an account of the trial of an experiment propounded at the laſt meeting by Dr. CROUNE to be made to ſee, whether a plant ſet in a glaſs

of water will grow *in vacuo*; and he related, that a plant being put into water upon the Tueſday preceding [1], by Mr. HUNT, and ſet into the receiver of the air-pump, he had endeavoured to keep the air exhauſted ever ſince by now and then drawing out by pumping what air might have gotten in; and that the plant, which was a blade of mint, was obſerved to be withered and dead.

Hereupon was occaſioned a diſcourſe about the uſe of air both to animals and vegetables, and what animals were obſerved to live longeſt in this evacuated ſpace. And upon this occaſion, vipers, bees, ſnails, &c. were mentioned. But the ſnail was mentioned as a creature the leaſt ſenſible of the alteration of the medium. Vipers were mentioned to live long in it, yet to be extremely ſwoln by the expanſion of the air in them.

Mr. HENSHAW gave ſome inſtances of the ſtrange ſtretching quality of their ſkins; which ſome of the members deſiring to ſee, Mr. HUNT was ordered to fit the engine, and to procure a viper for trial at the next meeting.

Dr. COX deſired, that a tortoiſe might be alſo tried, it being a creature, that will live buried in the earth a whole winter without air. Others mentioned ſnails, ſlugs, grigs, and bees. And Mr. HUNT was ordered to procure as many as he could againſt the next meeting.

Dr. COX queried about the ſlime of eels, whence it ſhould proceed?

Dr. GREW ſuppoſed it to be produced by certain glandules under the ſkin, after the ſame manner as the glands in the throat eject continually a ſlime.

Mr. HOOKE ſuppoſed it rather to proceed from the tranſudation of the vapours, or ſweat, or rather inſenſible tranſpiration the eels; which vapours coming into the water condenſe and convert that, which is contiguous, into a ſlimy ſubſtance after the ſame manner as the ſeeds of *oculus Chriſti* put into water condenſe the water about them into a gelly. And he mentioned, that he had a way of converting ſlime again into water.

Hereupon it was debated, whether the ſkin has diſtinct pores or not. Dr. GREW was of opinion, that it has diſtinct pores; which he ſaid he could make viſible; that they were placed after the form of ſpherical triangles; and that he could ſee the ſweat iſſue out of them.

Mr. HOOKE ſuppoſed the ſkin to have no diſtinct pores, but defined or rather deſcribed the ſkin to be a body conſiſting of two ſorts of ſubſtances, the one ſolid, the other fluid: the ſolid part a cloſe contexture of infinite ſmall fibres every way interwoven like the hairs of wool in a piece of cloth or felt. And this is the reaſon of the great aptneſs, which it had for ſtretching and ſhrinking any way; as may be alſo obſerved in a looſely woven piece of cloth.

[1] July 9.

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The other part is a fluid, which fills the interſtices of all theſe contexed fibres. The fluid is compounded of a more gummous ſubſtance and a more watery. The watery part is that, which coming to the outſide of the ſkin is exhaled into the air; by which means the gummous parts are thicker next the air than elſewhere; and if the cuticula be either by fire or other accidental cauſe thickened too much to hinder the watery part from mixing, and propelling through it, the watery part will gather behind it into a body, and make blifters; or otherwiſe throw it off in ſcurff.

The diſcourſe of eels produced another about fiſh living upon very little food. Dr. Cox affirmed, that he had kept a craw-fiſh in a ciſtern of lead, without any other food than the water, where it had increaſed and grown much bigger.

Sir JOHN HOSKYNS remarked, that it was uſual to feed craw-fiſh; but that there were ſome rivers, in which craw-fiſh would thrive better than in others; mentioning two rivulets in Ouſleworth in Glouceſterſhire, which ran both into one at that place. The one had the pebbles ſpotted with red, the other not. In the former of theſe both trout and craw-fiſh were found in great plenty; but in the other neither.

Dr. Cox affirmed, that craw-fiſh delighted in the ſhallow and gravelly parts of rivers.

Dr. HOLDER mentioned, that eels in Ely River were commonly made bigger and ſweeter, and fed fatter only by being kept in a box with holes, and hung into the Thames, without giving them any other food.

Mr. HENSHAW conjectured, that it might proceed from the fatneſs of the Thames water, which would yield a burning ſpirit after fermentation, as had been often found in ſea-voyages.

Other fiſhes were named, which were ſuppoſed to live upon a very ſmall quantity of food.

Dr. Cox mentioned the whale, which affords the ſperma ceti; that though it has a vaſt mouth and tongue, yet it has an exceedingly ſmall gula; and nothing is uſually found in its maw but ſome ſmall quantity of ſea-weed or alga.

Mr. HENSHAW remarked, that there are great variety of whales; and that the ſperma ceti whale is not found in the northern ſeas.

Mr. HILL took notice, that the anatomy and deſcription of that whale is to be found at the end of Sir THOMAS BROWN's diſcourſe *on Vulgar Errors*.

Dr. Cox mentioned, that he had obſerved, that in a ſcarlet fever the cuticula would peel and fall off much like the caſting of the ſkin of ſome animals.

Here-

Hereupon Mr. HILL affirmed, that ℈i of the Goa ſtone being given to a child ſick of a fever preſently recovered the ſaid child; but cauſed all his cuticula to grow hard like horn and peel off.

Query, whether it were the piedra de cobra?

Hereupon Dr. DANIEL COX mentioned the ſtrange virtue of the ophites or ſnake-ſtone in adhering to any inflamed part during the inflammation, and not falling off till the inflammation be allayed; and that he had ſeen this tried ſucceſsfully on a child the week before.

He related, that there was a certain herb, which being held in the hand only would cauſe a bleeding at the noſe to any quantity, forcing the efflux of blood ſo long, as the ſaid herb was kept in the hand.

Mr. HILL mentioned a certain bone, which held in the hand would preſently ſtop bleeding.

Mr. HENSHAW related, that there was a certain Iriſh plant, called by the Iriſh macambay, which being held in the hand only would provoke purging. This account was confirmed by others.

Dr. DANIEL COX related, that there was lately brought from Carolina in America a certain powder, which being ordered duly made a drink, called by the natives Caſſeni; which ſtrangely exhilerated thoſe, who drank it, and freed them from troubleſome fevers for twenty-four or thirty hours after: but that then they more ſunk. He deſcribed the manner of preparing this drink; but promiſing to bring ſome of it to the Society at their next meeting, and to ſhew the manner of making, the deſcription thereof was omitted in the minutes of the preſent meeting.

Upon this the ſtrange qualities of the herb deutroa were mentioned: as alſo thoſe of ſome other plants.

Dr. DANIEL COX related, that there was another ſnake-weed diſcovered, which was an infallible cure for the biting and poiſon of rattle-ſnakes.

Mr. AUBREY related, that there was an herb called terrara, brought over by Sir PETER COLLETON from Carolina, and that the ſame grew here in Mr. JOHNSON's garden; which herb was eſteemed the beſt antidote againſt all manner of poiſons; the virtue of it being kept amongſt the Indians as a great ſecret: but that it was procured by one, who married an Indian king's daughter. This was ſaid to be mentioned in the hiſtory of the Antilles, and called *herbe aux fleſches*.

Mr. HENSHAW remarked, that GARCILASSO de la VEGA in his hiſtory of Peru mentions how they make their poiſon for poiſoning their arrows and darts, viz. by ſticking them into human fleſh hung up till it be rotten and putrified.

He

He alſo gave an account of a boy, who thruſting his thumb into the corrupted fleſh of one executed, was like to have loſt his arm by a gangrene.

He alſo took notice of the ſtrange effects related of the poiſoned arrows of atchin; which by touching the blood without the ſkin would preſently turn it yellow: and this yellowneſs would ſpread; and if it get within the wound, would kill the perſon: by which it was known whether the poiſon was right.

Mr. AUBREY related, that dogs licking the ſanies of one hanged in chains near Kenſington were poiſoned and died; and that a man wearing the ſhoes, which had been taken off a malefactor's feet after he was rotten, had his feet rotted off.

Mr. HENSHAW related, that there was an arbutus, called in Spaniſh *madrones*, which was of the nature of deutroa; the fruit of which would make thoſe, who eat it, as it were mad or drunk for a time; and that the continuing to eat it would in time make them ſottiſh and fools.

Dr. DANIEL COX related, that BACON, who at his firſt going into America, had been very curious in making obſervations on animals as well as plants, had given to him a deſcription of certain animals, that were found in a very large plain or champaign country, lying between Hudſon's Bay and Calefornia, in vaſt numbers or herds. Theſe at a certain time of the year ſhed their wool or coats, in which was a very fine fur or wool; and the wind blowing gathered it together into great heaps or cakes. Theſe were ſuppoſed by Mr. HENSHAW to be a ſort of Indian goats, called by the Spaniards *vaccunces* or *quercanadoes*, and were deſcribed by De LAET. He added, that he was confident, that there was no north-weſt paſſage; and that he could demonſtrate that Hudſon's Bay and the South Sea were a thouſand miles diſtant.

Dr. DANIEL COX related an experiment and obſervation of his made upon ſnow-water, viz. that evaporating or boiling away about forty or fifty gallons to one, he found it of a lixivial colour. This he let ſtand for ſome months; after which the liquor began to ſhoot into *ſtiriæ*, which ſtuck all about the inſides of the glaſs in the form of ſtars, with many points of a greyiſh colour, though the ſnow was very pure. This, though in the form of a ſalt, was not ſalt, but a kind of a fibrous ſubſtance. He remarked alſo, that nitre received from ſpirit of nitre and alkali will ſhoot into hollow hexedrical figures more curious than common nitre, and form alſo ſtars of ſix points.

DAVID HANNISIUS, library-keeper to the duke of Hanover, and JOHN VANDE BEMDE, Eſq; were propoſed as candidates by Mr. HAAK.

Dr. GREW produced, as received from Mr. GEORGE HELD of Hamburgh, a catalogue of the library of Dr. FOGELIUS of that city; together with a printed ſheet, intitled, *Programma in funere nobiliſſimi viri D. Martini Fogelii, Phil. Med. Doct. & P. P. in Gymnaſio Hamburgenſi.*

*July*

*July* 18. Mr. HENSHAW, vice-preſident, in the chair.

An experiment was ſhewn, of putting an eel into the exhauſting engine; which being made ſtaunch, the animal preſently died.

Upon diſcourſing about the food of fiſhes, Dr. CROUNE related, that fiſhmongers never find any thing in the maws of ſalmon. And that a lady, who had been very inquiſitive in that kind, had obſerved the ſame: but that the contrary was obſerved in moſt other fiſh.

Dr. GREW remarked, that the guts in ſalmon placed round the ſtomach anſwering the *inteſtinum cæcum* in other animals were very full, though the ſtomach were empty.

Sir JOHN HOSKYNS related, that there was one ſort of whale towards the north, that was reported to feed upon flies; vaſt quantities of which had been found in the ſtomachs of thoſe whales: and that their fins ſeemed to ſerve for the ſtraining of the flies from the water.

Mr. HOOKE gave an account of the ſtructure of the mouth and fins of that whale, which was caſt on ſhore at Greenwich about twenty years before.

He alſo mentioned a late relation, which he had ſeen printed in Low Dutch, or a voyage to Spitzbergen or Greenland, wherein was a deſcription of that ſort of whale, together with pictures of them.

Mr. HENSHAW affirmed, that ſalmons feed upon flies.

The biſhop of Cheſter [k] remarked, that he had a diſh of fiſh, which had been taken very whole out of the maw of a large fiſh; that they eat very well; and that they were a ſort of flounders.

A diſcourſe was then occaſioned about poiſons.

The biſhop of Cheſter related, that Dr. HARVEY was of opinion, that a man might be ſaved, though ſhot with a poiſoned dart, if a very ſtrong ligature were made above the wound immediately, and the mortified part below the ligature were cut off preſently. But it was thought by others, that this means would not be effectual, if at leaſt the poiſon were ſo violent as was reported, unleſs a ligature were made before the perſon was wounded by the dart.

Sir ROBERT SOUTHWELL mentioned the trial of the Florentine experiment, viz. that of oil of tobacco, the black heavy oil, that ſinks to the bottom in diſtillation, upon a chicken, related by Sir JOHN FINCH; of which the Society had elſewhere an account, and had formerly made many trials.

[k] Dr. PEARSON.

Sir JOHN HOSKYNS related, that a good quantity of fair water was the beſt antidote to this poiſon of tobacco oil.

Dr. CROUNE related, that he had been informed of an Engliſh merchant, who had been told by the preſent king of Macaſſar, that neither himſelf nor his father knew any thing concerning ſuch poiſons, as they were related to know: but that he had been told, that his grand-father knew much of poiſons.

Dr. HOLDER related, that he had known the oil of tobacco made by blowing the ſmoke upon one's nail, or a knife, being put upon lint, and ſtopped into the hollow of a rotten tooth, to cure the tooth-ach.

Mr. HOOKE remarked, that Sir CHRISTOPHER WREN had formerly told him, that he knew a maid-ſervant by the uſe of that medicine caſt into convulſions, which had like to have coſt her her life.

Dr. CROUNE related, that he had been informed by Mr. WHITECHURCH, who had lived ſome time in India, that mountebanks * * [1].

Sir ROBERT SOUTHWELL obſerved, that he had been informed, that the beſt remedy againſt poiſoned arrows was preſently to eat human excrements.

Mr. HOOKE mentioned the odd effects, that were wrought upon the children of a poor woman, who uſed to gather phyſical herbs for Mr. DRINKWATER, by eating ſome henbane, which they had miſtaken for parſnips: that they all fell ſtark-mad, but were cured in ſome ſhort time by the ſaid Mr. DRINKWATER, by the taking of alexipharmics and ſweating.

CHARLES STEWART, Eſq; ſon of Sir NICHOLAS STEWART, was propoſed candidate by Dr. HOLDER.

Upon occaſion of a diſcourſe, which was about the breadth of the north part of America, and of the nearneſs of the South Sea to Hudſon's Bay, Sir ROBERT SOUTHWELL remarked, that in Sir WALTER RALEGH's time it was thought, that the South Sea was not above forty or fifty miles from the North Sea: and that he had ſeen it ſo deſcribed in a map; which was the reaſon, that in the patent of Virginia the king had granted the country from ſea to ſea.

*July* 25. Mr. HENSHAW, vice-preſident, in the chair.

Dr. GREW read ſeveral Latin letters, which he had prepared for anſwers to correſpondents.

The firſt was to Mr. HEVELIUS, in anſwer to a late letter of that gentleman, deſiring to be informed of the ſtate of the account between him and Mr. OLDEN-

[1] This minute was not completed.

BURG

BURG deceaſed, with relation to ſome books of the former ſent over to the latter.

The ſecond to Signor MALPIGHI, about the expectation of the Society of his farther diſcourſe on vegetables:

The third to Monſ. HUYGENS:

The fourth to Monſ. SLUSIUS:

The fifth to Monſ. BULLIALDUS:

The ſixth to Signor NAZARI: and

The ſeventh to Mr. HELD of Hamburgh.

It was ordered, that Mr. WICKS ſhould make copies of all theſe letters in the Letter-book [m].

A letter from Monſ. LEIBNITZ, dated at Hanover, was read; and Dr. GREW was ordered to prepare an anſwer to it againſt the next meeting.

Sir JONAS MOORE read part of a letter of Mr. TOWNLEY, ſent to him from Paris, containing an account of what BORELLI was doing, in order to the improving of teleſcopical object-glaſſes [n]: as alſo about ſeveral new experiments of changing colours by tranſparent liquors: of Dr. TABOR's ſucceſs in curing agues: and of the death of Monſ. DE CHALES, the author of the *Curſus Mathematicus*.

The minutes of the laſt meeting were then read; whereupon by the way Mr. HILL mentioned, that he had been informed by a fiſhmonger, that he had found the ſtomach and guts of a ſalmon full of graſs, and of another full of fiſh-bones.

The vice-preſident, upon the mention of whales, remarked, that there were reckoned by ſome authors near fifty ſorts of the cetaceous kind.

Upon occaſion of a diſcourſe about poiſons, Mr. HOOKE mentioned an account, which he had from a Virginia merchant, who had lived long in thoſe parts, and had been very curious and inquiſitive into all ſorts of natural curioſities; that the only certain cure of the venom of the biting of a rattle-ſnake was a certain ſubſtance found in the wild walnut-tree, called by the planters the hilcanes-tree, being a kind of ſpunk, but called by the planters punk. It grows within the body of the tree, and is found by a kind of black hole or navel in the tree; which the planters obſerving, they preſently cut down the tree, and take out the ſaid ſubſtance, and preſerve it with very great care, being of ſo ſovereign a virtue, beſides

[m] They do not appear in that book.

[n] See Philoſophical Tranſactions, vol. xii. n° 140. p. 1005. for July and Auguſt, 1678.

its other uſes for kindling fire, which it catches moſt readily. The way of uſing it is thus: as ſoon as a perſon finds himſelf bitten, he immediately takes his flint and ſteel, and ſome of this punk, which he always carries about him; and kindles it, and applies the burning punk to the place bitten; and there keeps it burning till he feels the fire (which he will not preſently do, becauſe the part bitten will immediately after grow mortified and ſenſeleſs;) and thus he continues it as long as he can endure it: which will certainly cure him without any other after-ſymptoms; which if the remedy be not preſently applied, are very terrible, and often fatal. In confirmation of which laſt circumſtance, the ſame perſon had informed Mr. HOOKE, that he knew a man, who had been bitten by one of thoſe rattle-ſnakes in his finger whilſt he was hunting a hare in the woods, having thruſt his hand into a hollow tree, where by the baying of his dog he ſuppoſed that a hare had ſheltered itſelf. He being bitten, immediately found his hand and arm extremely ſwoln, with great pain; and then the whole wood ſeemed to him to turn round; and preſently after to be all in a flame: upon which he fell down, and remembered nothing farther. Being within a ſhort ſpace of time after found by ſome of his friends by means of his dog, he was carried home on a ladder ſenſeleſs, and by means of a chirurgeon not far diſtant was ſo ordered, that he recovered without the loſs of his life; but it was three quarters of a year before he was well; and he loſt his hair and nails, and his ſkin peeled off, with many other dreadful ſymptoms.

Mr. HOOKE mentioned likewiſe, that he had been informed by Mr. HODGES of Moorfields, that he had known a man, who had cured himſelf of the pain and ſwelling of the gout, by applying upon the place quick lime-ſtones, while they were ſlacking.

Mr. HOOKE, upon this occaſion of the growing of the ſpunk within the body of a tree, ſaid, that it ſeemed ſomewhat to reſemble the rot in a tooth, which he had obſerved to have a certain black ſubſtance, which covered the ſurface of the hollowneſs thereof, which began generally from a ſmall hole in the outſide thereof, and ſo ſpread itſelf like a muſhroom into the more ſpungy ſubſtance within the outward hard cruſt.

Mr. HENSHAW ſuppoſed it to be rather a worm, which having corroded the outward cruſt continued to corrode the inſide thereof: and in confirmation of this he added, that he had ſeen a woman extract worms from a hollow tooth by the help of a ſharpened quill.

Others mentioned, that the ſame thing was done by the help of the fumes of henbane ſeeds taken into the mouth; whereby the ſaliva falling into a baſin of water held underneath, would diſcover ſeveral living worms, ſuppoſed to iſſue either from the gums or teeth.

Mr. MELLING produced a ſmall worm, which he had found in New River water, about ſix inches long, of the bigneſs of a horſe-hair. It was viewed by

several small single microscopes of his own making, and found to be alive, and to have a head somewhat like an eel.

*August* 1. The president, Sir JOSEPH WILLIAMSON, in the chair.

Dr. GREW read an answer to Monsr. LEIBNITZ; which answer was ordered to be copied by Mr. WICKS into the letter book [o].

Mr. HOOKE read the minutes of the last meeting; and then produced a piece of punk given him by the Virginia merchant, who had acquainted him with the former relation and description of it. It was a very light spungy substance, and seemed to be no other than the substance of a fungus or mushroom. The colour of it was brown; and it readily took fire, and would continue to burn till the fire was stifled, but seemed not to burn very fiercely.

Upon this occasion mention was made of the moxa of the East Indies, which cures the gout by the application of it burning to the part affected; and which seemed also to be a kind of spunk.

Sir CHRISTOPHER WREN remarked, that it was probable, that the cures of both might be effected by the heat of the fire, and not by any peculiar virtue in either the moxa or the spunk.

Another member supposed, that it was the heat also of the limestone, which had effected the cure of the gout mentioned in the minutes of the last meeting.

Some mention was likewise made of cures done by the natural heat of living bodies outwardly applied.

Sir CHRISTOPHER WREN observed, that the raising of a blister would cure the stinging of wasps.

It was also added, that the head of a red-hot iron would cure the biting of adders: and that there was a man, who sold adders, who had several times shewn the experiment, and would at any time do so to those, who were curious, for a reward in money.

Mr. HOOKE read a discourse of his, concerning the nature and power of springs and electrical bodies, giving not only an account of the nature and power of all sorts of springy bodies, and the several phænomena thereof, but likewise of the reasons and grounds of those phænomena; as would more at large appear in the discourse itself, which he designed speedily to publish [p].

[o] It is not inserted there.

[p] It was published at London, 1678, in 4to. under the title of *Lectures de potentia restitutivâ: or of spring, explaining the nature of springing bodies.*

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He then exhibited two experiments in order to prove his ſaid theory; the one with a tubical ſpring of braſs-wire, and the other with a ſpiral ſpring of ſteel, being the ſpring of a watch.

Mr. MELLING produced the hair-worm, which he had ſhewn at the laſt meeting, now preſerved in ſpirit of wine in a cylindrical glaſs-pipe hermetically ſealed, it having ſince died; wherein the head of it was plainly to be ſeen by the help of his ſmall ſingle microſcope.

*Auguſt* 22. Mr. HENSHAW, vice-preſident, in the chair.

Mr. HOOKE delivered to the Society an antient urn of glaſs, taken up in Spittle-fields upon digging cellars there, preſented by Sir CHRISTOPHER WREN for their repoſitory. There was this remarkable in it, that it ſeemed to be made after quite another manner than that uſed by the preſent workmen in that art, it having no place at the bottom thereof; nor any viſible ſign how it could be held, whilſt the lip and handle thereof were joined to the body.

Mr. HOOKE ſhewed the experiment of the ſpringing of a ſtring of braſs-wire, about thirty-ſix or thirty-ſeven feet long, extended by weights hung at the lower end thereof; and he made it evident, that the ſaid ſtring extended proportionably to the weight, that was hung to it at the bottom: that is, that one weight extended it one length, two extended it two, and three extended it three ſpaces or lengths.

At this meeting were preſent Monſ. EZEKIEL SPANHEIM, envoy from the elector Palatine, and his brother FREDERIC, profeſſor of divinity at Leyden.

After the exhibiting of Mr. HOOKE's experiment, Sir ROBERT REDDING addreſſed himſelf to the vice-preſident and the reſt of the Society preſent, acquainting them, that his grace the duke of Norfolk had deſired him to * * [q].

Mr. HOOKE then ſhewed to the envoy SPANHEIM and his brother, the ſmall animals diſcovered in pepper-water by the help of a microſcope.

*Auguſt* 29. The preſident in the chair.

His grace the duke of Norfolk being preſent at this meeting, renewed the declaration of his gift formerly made to the Society of the Arundelian library; and alſo gave his conſent and direction for the removal thereof into the poſſeſſion of the Society: and that they ſhould have liberty to exchange ſuch books thereof, as were duplicates, or which they ſhould think not ſo proper for their uſe, for others of equal value, which they ſhould judge more pertinent to their deſign. He declared likewiſe, that the books formerly reſerved by him concerning heraldry were the only books, which he ſtill excepted out of the ſaid donation, having

[q] The reſt of this minute is not entered in the Journal-book, vol. vi p. 124.

made

made a promiſe of them to the college of heralds. His grace added, that Sir WILLIAM DUGDALE had preſented him with a catalogue of ſuch books, as he in the name of the heralds had deſired for that purpoſe. But upon peruſal of the ſame finding many of them to be ſuch, as did not ſo properly belong to the buſineſs of heraldry, the duke was deſirous, that Sir ROBERT REDDING and Mr. EVELYN would peruſe the ſaid catalogue, and conſider what books therein mentioned were ſuch, as concerned heraldry, and were moſt proper for the uſe of the college of heralds, and what might be more proper for the uſe of the Society, and to moderate and adjudge the matter between the ſaid Society and college. But it was his grace's farther pleaſure and deſire, that in caſe the Society ſhould be diſſolved, (which it was his deſire and hope they never would be) the ſaid library might revert to his heirs.

The Society by the mouth of the preſident returned his grace their moſt humble and hearty thanks for this his truly noble preſent: and ordered Mr. HOOKE to take care, that the determination of the matter between them and the college of heralds might be made with all convenient ſpeed; and that thereupon the books ſhould be forthwith removed to Greſham College.

Mr. HENSHAW moved, that a fair catalogue of them might be made, to be delivered to the duke to remain in his grace's cuſtody:

As alſo, that all ſuch books, as ſhould be received in exchange for others of the ſaid library, ſhould have his grace's name ſtamped upon them, and kept with the reſt, and to be owned to be his grace's preſent.

Mr. HOOKE produced and read the preface of a book, which he had procured to be tranſlated out of High Dutch, containing a deſcription and natural hiſtory of Spitſbergen or Greenland, written by one * * of Hamburgh, who had been there himſelf, and, upon occaſion of queries ſent out of England, had made it his buſineſs to inform himſelf more particularly concerning all matters therein deſired; and by the help of Dr. FOGELIUS of Hamburgh, who had tranſlated and delivered thoſe queries to him, had compiled and methodiſed the ſame; and for the better illuſtration of all particulars, had added a great many copper cuts, containing the pictures of the moſt remarkable particulars, viz. of the whales and other fiſhes, together with thoſe of the animals, birds, plants, &c. Mr. HOOKE added, that he had delivered the ſaid book to a German, in order to have it tranſlated into Engliſh.

Sir ROBERT SOUTHWELL hereupon obſerved, that there was a kind of whale in the oil of which was ſo penetrating, that it was very difficult to find veſſels to hold it without leaking.

He mentioned alſo an experiment made upon a ſquare plate of glaſs, upon which a ſtring was ſtretched to a certain tone, which tone upon the application of heat was altered.

The

The duke of Norfolk mentioned, that the earl of Aylesbury had heard his child make a noise whilst in his lady's womb.

Sir ROBERT SOUTHWELL mentioned a relation of a woman of Lorraine, who having been a very long time with child without being delivered, had in despair killed herself. Whereupon being opened, it was found, that the child within her had been dead for a considerable time; and that one part of the body of the said child was found petrified by the waters in her womb.

Upon occasion of a discourse on freezing, Mr. HENSHAW mentioned, that upon freezing of wine, the part, which remained in the middle, would be very strong and spirituous; but that the other parts, that were frozen, would be watersh and almost tastless: and that the greatest part of the wine froze and swelled out of the bottles, thrusting out the cork before it.

Dr. CROUNE mentioned, that the time of freezing was almost instantaneous.

Mr. HOOKE related the experiment of producing the regular figures by freezing, by mixing snow and salt in the body of a glass vial, and then putting upon the outside of the same a small quantity of the spirit of urine.

Mr. HOOKE was ordered to make what haste he could with the weather-cock, which he designed; as also with a very accurate barometer.

*October* 31. The Society met again after their adjournment, and Mr. HENSHAW, the vice-president, took the chair.

The minutes of the last meeting were read; which gave occasion to some discourse concerning the petrifaction of human substances.

Dr. CROUNE mentioned that there had lately been a discourse on that subject published by * *; and that it had been answered by * *.

Mr. HENSHAW mentioned, that he had seen the arm of a man petrified at the house of cardinal MONTALTO, called *Villa Peretti*, it being part of the body of a man wholly petrified in the Alps.

Upon reading the remark concerning freezing, Mr. HENSHAW added, that having in Denmark set brandy to freeze in cups, he found, that all the spirituous part thereof was partly wasted, and partly converted into a spongy ice, of a very ill taste; and that it had lost all its strength.

Sir JOHN HOSKYNS related, that Dr. MERRET had assured him, that the strongest wine might be all frozen in the Florentine flasks: the reason of which was conceived to be the extreme thinness of them.

Mr. HOOKE read a letter directed to the two secretaries from Mr. MICHAEL BUTTER-

BUTTERFIELD, a mathematical inſtrument-maker at Paris, dated there, $\frac{5}{15}$th October, 1678.[r], expreſſing his deſire to correſpond with them concerning philoſophical, mathematical, and mechanical matters; and offering to communicate ſuch things, as he ſhould meet with there of that kind. He mentioned in that letter Monſ. HUYGENS's method of making ſmall globules of glaſs for microſcopes, by ſticking powdered glaſs on the point of a needle with ſpittle, and holding them in the flame of a lamp of ſpirit of wine, and afterwards rubbing them with a putty cloth: as likewiſe a level of his own invention, publiſhed the year before in the *Journal des Scavans*, together with a farther improvement of it by hanging it upon one point.

He took notice alſo of ſome other ſorts of levels invented by other conſiderable perſons: and added, that he was making a large ſilver planiſphere for the king, of the invention of Signor CASSINI, of two feet diameter: that he had lately made for Signor CASSINI an equinoctial dial of a foot diameter, with three circles, beſides the ſliding ring, and two halidades and four ſights: that there had been lately made at Paris a piece of clock-work to ſhew the motion of Jupiter's ſatellites; but that it was not much approved of: and that himſelf had not long before made a ſliding half quadrant, with a glaſs of eight inches ſemi-diameter, of very great uſe, and eaſy to be carried.

In this letter were incloſed two packets, one from Monſ. GALLET, provoſt of the church of St SYPHORIEN at Avignon, containing a letter in Latin to the Society[s] and three ſmall tracts; the firſt his account of the obſervation of Mercury in the ſun; the ſecond his obſervation of an eclipſe of the moon, 17th May, 1677; the third his obſervation of an eclipſe of the ſun 11th June, 1678; all three obſervations made at Avignon.

Monſ. GALLET's letter was read, wherein after profeſſing his great reſpect for the Society, he added his deſire of holding a correſpondence with them upon aſtronomical ſubjects, and promiſed to ſend ſuch other obſervations, as he had hitherto made, and not yet publiſhed, and eſpecially thoſe about the diameters of the ſun and moon, concerning which he gave ſome inſtances relating to the ſun's diameters.

Dr. CROUNE affirmed, that Mr. ROOKE had long before uſed the ſame way, for taking the diameters of the ſun, with that made uſe of by Monſ. GALLET, viz. by computing the time of the tranſit of its figure made by a forty foot glaſs.

Mr. HOOKE read a relation of a great eruption of fire, which happened in the preceding winter in the iſle of Palma, one of the Canaries, given him by a perſon, who had long reſided in the ſaid iſland, and who was there at the time of the ſaid eruption.

Mr. HENSHAW was of opinion, that hot baths were cauſed by ſubterraneous

[r] Letter-book, vol. viii. p. 59. It is printed in the Philoſoph. Tranſact. vol. xii. n° 141. p. 1026.

[s] Letter-book, vol. viii. p. 29. for September, October, and November, 1678.

fire, becauſe generally where there are ſubterraneous fires, there are many hot baths.

Sir PETER WYCHE acquainted the Society, that he was very ſpeedily to go to reſide at Hamburg, and profeſſed his deſire and readineſs to promote the intereſt and buſineſs of the Society in thoſe parts.

Mr. DETHLEVUS CLUVERUS was propoſed candidate by Mr. HAAK; and

Mr. WILLIAM PERRY [1] by Dr. MAPLETOFT.

*November* 7. Mr. HENSHAW, vice-preſident, in the chair.

The minutes of the laſt meeting being read, occaſion was given of diſcourſing of cold and freezing; and Mr. HENSHAW affirmed, that by experience he had found, that the coldeſt weather in Denmark would not freeze a whole bottle of ſack.

Mr. HOOKE ſhewed the planiſphere and deſcription of the ſtars of the ſouthern hemiſphere made by Mr. HALLEY. Whereupon Mr. HENSHAW was of opinion, that they would be very acceptable preſents to ſuch correſpondents abroad, as were lovers of aſtronomical matters, if the book and planiſphere were ſent to ſome of them from the Society: to which the Society agreed; and it was deſired, that the ſecretaries ſhould ſend one of theſe books to Monſ. GALLET, another to Mr. BUTTERFIELD, and a third to the Abbé de la ROCHE, in the name and at the charge of the Society.

Upon a further diſcourſe concerning hot baths, Mr. HENSHAW was of opinion, that they might proceed from ſome ſubterraneous fire, becauſe they are generally found near ſuch places, where thoſe ſubterraneous fires break out, as in Iceland, and one about Naples eſpecially. And whereas it was urged, that they appeared many times in places, that were far enough from ſuch burning mountains; he anſwered, that though there might be no appearance of fire, yet there might be ſome ſubterraneous fires concealed, that might be the cauſe of ſuch heat. Dr. CROUNE objected, that ſuch could ſcarce be ſuppoſed without having certain *ſpiracula* or breathing places near them; none of which being found near our baths, it was difficult to ſuppoſe, that there ſhould be any ſuch fire. It was added, that it was poſſible, that there might be ſuch *ſpiracula*, which we know not of; at leaſt we do not know what ſpace the ſubterraneous fire might poſſeſs; whether it might not ſpread ſome miles beſides juſt underneath the place, where the hollow fountains are; and whether there might not be ſubterraneous communications between volcano's at a great diſtance. Mr. HENSHAW added farther, that there were ſome hundred of ſuch volcano's in the Eaſt and Weſt Indies. Sir JOHN HOSKYNS ſubjoined, that the Dutch had noted about an hundred in their plantations.

Mr. HOOKE remarked, that it was very common to obſerve a miſt hanging about the tops of hills, when the air above, beneath, and round about was clear.

[1] M. A. and fellow of Trinity College, Cambridge.

He

He alſo conceived, that there was no earthquake without a ſubterraneous fire; and that many of thoſe ſubterraneous fires proceeded from parts very deep in the very body of the earth, and not only near the ſurface, like the coal mines in the north, which had been ſet on fire, and had continued ſo for many years.

Dr. MAPLETOFT affirmed, that he had ſeen a coal-mine, which had ſo burned and ſaid, that it was very ſhallow, and but a very little way, viz. about a fathom or two, below the ſurface: that it was not difficult to quench it: that it burnt very ſlowly forward: that he had alſo ſeen the burning fountain in Lancaſhire, near Wigan, and conceived it to be an exhalation ariſing from ſome coal-mine underneath.

Hereupon a diſcourſe was occaſioned, concerning the cauſe of the generation of ſubterraneous fires, and how they ſhould be continued without immediate communication with the air.

Mr. HOOKE mentioned ſome obſervations about the generation of fire by rain falling ſuddenly on a ſort of coals, called braſs lumps; as alſo on quick-lime lying againſt deal-timber; both which had cauſed fire. Mr. HENSHAW, Mr. PACKER, and Dr. CROUNE inſtanced in other ſubſtances, that would generate an actual fire, ſuch as hay wet, green graſs heaped up, malt, cotton-wool, roſe-flower leaves, and ſeveral other green leaves and plants.

Upon a diſcourſe concerning the well dug in the iſland of Mayo, Mr. HENSHAW was of opinion, that no freſh-water could be ſeparated from ſalt-water by ſtraining or any filtration; though mention was made of the cups of ivy, which, it was ſaid, would make ſome ſuch kind of ſeparation, viz. that upon mixing wine and water together in one of them, it would ſuffer the water to run through, but would ſtop the wine; which was thought to be the reaſon, why it was ſacred to Bacchus; though others ſuppoſed, that it might be from its uſe at the Bacchanalia for crowning the actors.

It was deſired, that one of thoſe cups might be provided againſt the next meeting, to ſee what might be effected thereby, and whether any thing extraordinary in filtration might be hoped from it.

*November* 14. Mr. HENSHAW, vice-preſident, in the chair.

Dr. CROUNE acquainted the Society, that the preſident had given him an account, that he had received from Signor MALPIGHI a piece of a plant, together with an account thereof, that he had thereby found out and demonſtrated the circulation of the juices of plants.

The vice-preſident propounded the five following members, viz. Sir JOHN LAURENCE, Dr. CROUNE, Dr. PLOT, Dr. GALE, and Mr. GEORGE ENT, who were accordingly choſen by ballot, to be a committee of the Society for auditing the treaſurer's accounts for the preceding year ſince the laſt St. Andrew's day.

Upon a diſcourſe concerning Bezoar ſtones, that vaſt multitudes of them were brought over into England, and that therefore many of them were probably counterfeit, ſince even in India and the places, where they were found, they were very ſcarce, and ſeldom found in thoſe goats, which produced them; Mr. COLWALL related, that there were many of them counterfeits; and that he had tried them by means of a needle heated red-hot; for upon thruſting into them a needle ſo heated, thoſe, which were counterfeits, would melt and fry; whereas thoſe, which were true, would not.

Hereupon was occaſioned a diſcourſe concerning the balls, which are often found in the ſtomachs of oxen; ſome of which are found covered with a calculous matter, after the manner of Bezoar ſtones; others only a great ball of hair very hard, and cloſely felted together, in a very regular order.

Mr. HOOKE related, that he had often taken the hair of oxen, when they had their coats, and rolling a handful or two of the ſaid hair between his hands, had thereby in a very little time felted them into a very hard and cloſe ball; and that the hairs thereof would naturally range themſelves into a moſt regular and uniform order.

Upon the diſcourſe concerning the eruption, which had lately happened in the iſle of Palma, and the river of fire, which ran down from the ſame, Dr. CROUNE related from Dr. PUGH, that the north ſide of the Pike of Teneriffe was made up of a matter, which plainly manifeſted it to have been ſuch a fiery river; it being all melted ſtones and minerals of that nature: which agreed exactly with the relation lately read at the Society.

Hereupon the burning fountain in Lancaſhire was mentioned; and Mr. HUNT ſaid, that he had been at the place; and that it would take fire by driving down a ſtake into the ground, and wriggling it to and fro.

Upon diſcourſing concerning the actual burning of ſeveral places under the ground continually, ſuch as the coal-mines and the burning mountains; Mr. HENSHAW related, that he had been at the Solfaterra in Italy, which lies between two mountains, where he had obſerved the fire to break out in many places; and that the earth would ſhake underneath them, and ſeemed to be all hollow and burning underneath the place where they walked, and had continued ſo for many ages.

Sir JOHN LOWTHER affirmed, that he had a coal-mine of his own, which was on fire; but it not lying very deep, he had put out the ſame by digging a deep trench in the ground round about it under ground.

He promiſed to procure the account of a coal-mine of Sir WILLIAM BLACKET.

The experiment of filtration through a cup of ivy was tried; but it proving ſo cloſe,

cloſe, that nothing would filtre or paſs through it, Mr. HUNT was ordered to procure another cup of ivy againſt the next meeting.

Upon occaſion of the diſcourſe concerning the *lupus marinus*, the teeth of which fiſh were ſuppoſed to be the toad-ſtones, Dr. PLOT related, that he had a toad-ſtone, which was not ſuch a tooth, but a real ſtone, which he had himſelf found in Oxfordſhire. But this was a ſofter ſtone, and would not poliſh as the other ſtone.

Dr. KING, upon occaſion of diſcourſing of pearls and bezoar-ſtones related, that he had often found pearls in the ſtomach of an oiſter; and conceived them to be generated as the bezoar-ſtones in the ſtomach of a goat.

Hereupon Mr. HENSHAW mentioned the way of cleanſing pearls, by dipping a foul pearl in aquafortis or ſpirit of wine; by which means the pearls would preſently look white; and then by rubbing it with a cloth all that white coat would come off, and the pearl underneath, if good, would look oriental and clear: but that by often repeating that operation all the ſhining part of the pearl might by degrees be taken off; and that uſually all foul pearls had in the middle of them an opake calculous matter.

He related alſo the way of making counterfeit pearls uſed at Bologna and Venice, by ſilvering or gilding alabaſter beads, and dipping them in a ſize made of fiſh glew.

Mr. HOOKE related, that he had done the ſame thing here, by taking ivory beads inſtead of alabaſter, and proceeding in the manner above-mentioned.

He ſhewed his experiments, which were divers ways of making very round and clear globules of glaſs for microſcopes with great eaſe.

*November* 21. Mr. HENSHAW, vice-preſident, in the chair.

He produced three pieces of ſtones or different ſubſtances; but all agreeing in this, that they were made of ſeveral ſorts of ſmall pebbles, which were cemented together by a petrified ſubſtance as hard as the peebles themſelves. They ſeemed to be of the ſame kind with ſome produced at the ſame time cut into hafts of knives, and poliſhed very well; which ſeemed as good as, if not to exceed, the Indian agates. Mr. HENSHAW reſolved to have them cut and poliſhed in the like manner, and promiſed then to ſhew them again to the Society; adding, that he knew where a very great quantity of the ſame ſtone might be procured, if there were occaſion, viz. in Hertfordſhire, not far beyond St. Alban's.

A note ſigned by Sir JONAS MOORE, vice-preſident, was directed and ordered to be ſent to the porter of Arundel Houſe, to deliver to the bearer Mr. HUNT the eleven books, which were left in the library of Arundel Houſe now pulled down.

Upon a farther diſcourſe concerning bezoar-ſtones, mention was made of a paſ-

ſage

ſage in Dr. PRIMROSE's book *De Erroribus Vulgi*, that pope SIXTUS QUINTUS had almoſt a cart-load of bezoar-ſtones ſent him; but that upon the examination of them by ſkilful phyſicians, not above three of them proved very good; moſt of the reſt being ſophiſticated.

Dr. CROUNE added, that the Indians found ſometimes a ſort of bezoar-ſtones in the maws of monkies, which they valued at ſo high a rate, as to eſteem them a fit preſent for the Great Mogul himſelf.

Mr. HENSHAW remarked, that there was mention made in LINSCHOTEN's voyages of another ſort of ſtones ſomewhat of the nature of bezoar, and eſteemed every way as good, which are found in the ſtomach of a porcupine, and thence called by the Portugueſe *piedra de puerco*; which are ſmaller, generally about the bigneſs of a gall, and of a dark brown colour. They are frequently made uſe of in feveriſh diſtempers, and have been uſed with good ſucceſs for the ſtrengthening the ſtomach. Being ſteeped ſome few hours in fair water, they yield a greeniſh tincture, which taſteth very bitter.

Hereupon mention was made alſo of a ſtone preſented to Sir ROBERT SOUTHWELL, called *piedra de cobra*, being one kind of ſnake-ſtones, which was ſuppoſed to do great cures by outward application for the biting of ſerpents. It is a factitious ſtone made by the Banians.

Upon a farther diſcourſe concerning the burning ditch in Lancaſhire, Sir JOHN LOWTHER gave a relation of that ſtrange phænomenon, and added ſome remarks not taken notice of before, which he was informed of by Sir ROGER BRADSHAIGH. The ſubſtance of which was, that there was underneath the ground a coal-mine; and that at the place, where the ſteam could be kindled, there were cracks and chaps in the earth; by which it was ſuppoſed, that the damps of the coal mine collected in the cavities thereof, and iſſuing continually from it, did by theſe crannies and chaps of the ground iſſue continually at that place; and thence whenever an actual flame or fire was brought to touch it, it preſently kindled and continued to flame till it was put out.

Mr. HOOKE took notice of the admirable effect, which had been obſerved in it, viz. that it took fire, though the ſteam itſelf were not before ſenſibly warm; which, he ſaid, was more than any other ſteam would do; and that therein ſeemed to be the greateſt rarity of it: whence he conjectured, that it might be the ſame kind of ſteam, which generates lightning. That this ſteam ſeems to be the very ſame with the fiery damp of mines, which will take fire much after the ſame manner, but often with more direful effects, by reaſon that a much greater quantity of the ſaid vapour is collected, and alſo becauſe it is impriſoned and ſhut in with very ſtrong ſides, and hath no poſſibility of venting and expending otherwiſe than by the mouth.

There was much debate concerning the firing of the ſteam and ſmoke of bodies, but there was no inſtance given, wherein ſteams would take fire, unleſs they

had been before heated to a very great degree of heat by an actual fire, and then kindled.

Sir JOHN LOWTHER conceived, that there was a difference between this and other ſubterraneous vapours in coal-mines; becauſe theſe flaſhed like lightning, whereas thoſe of the ditch continued burning. Sir JOHN HOSKYNS mentioned, that there was a ſort of earth near Green, * *, which being ſcraped, and ſtraw covered with it, would fire the ſtraw. Dr. ALLEN added, that there was alſo at the ſame place ſuch another burning fountain.

Sir JOHN LOWTHER mentioned a fire in the New Caſtle pit, that in the ſpace of forty years had burnt under ground about a mile in length, and a quarter of a mile in breadth.

He related the manner of working in coal pits ſo as to ſupport the earth over-head; which was, that they placed wooden props on each ſide in a row, as they proceeded; and that they often take up one as ſoon as they had fixed another, leaving the mine only of ſuch a breadth, as they had found by experience would ſuſtain the earth over-head without falling in; and that for the better keeping up of the earth over-head, they uſually leave about half a yard thickneſs of the coal untouched. The breadth of the ſpace, which they could thus truſt without wooden props in the Newcaſtle coal, was not more than three yards or nine feet; but the Scots coal being a ſtronger and greater coal, would ſupport at leaſt ſeven yards width; and thoſe places alſo ſupported only upon ſmall pillars of 1 ½ foot ſquare of the ſame coal.

He remarked farther, that Newcaſtle coal will decay and diſſolve with the air and rain, and loſe much of its ſtrength in burning.

He was of opinion, that it would be much for the intereſt of the Newcaſtlemen, if they would all join together, and work only one mine at a time, ſince it would be ſufficient to ſerve all England, and that the ſame charge would ſerve for draining that mine, which was to ſerve all, that is now expended upon the ſame, now it ſerveth but a ſixth part.

Mr. HENSHAW obſerved, that pearls were called uniones, from their likeneſs to an onion, which was called *unio* from the ſingle growing.

The experiment exhibited was of an ivy cup filled with wine and water; but upon ſtanding an hour and more, neither ſeemed to ſtream through, whereas it was expected that the water ſhould have ſtrained through, and the wine have remained behind.

Sir JOHN LOWTHER was deſired to inquire of the preſident concerning Signor MALPIGHI's letter; and to bring to the next meeting the piece of plant ſent

ſent by that gentleman: upon which was occaſioned a diſcourſe about the deſcending of the ſap by the bark; Dr. GREW denying, that it deſcends by that way.

*November* 28. Mr. HENSHAW, the vice-preſident, in the chair.

The ſtones produced at the laſt meeting by Mr. HENSHAW being ſince poliſhed were ſhewn, and appeared to be as hard, and bore as good a poliſh, as agates; and had a very beautiful variety of colours and ſpots in them.

There was alſo a farther diſcourſe concerning ſome expeditious way of cutting, drilling, turning, and poliſhing the ſaid ſtones into ſeveral ſhapes for various uſes.

Mr. HUNT made his report, that having been to inquire after the books left at Arundel Houſe, he was informed by Sir WILLIAM DUGDALE, that thoſe books were in the cuſtody of Mr. BURBERY, the duke of Norfolk's gentleman. And Dr. GALE reported, that he had ſpoken with Sir WILLIAM, who had propoſed, that as ſoon as he ſhould receive thoſe books, he would ſend the copy of Doomſday-book to the Society.

The minutes of the laſt meeting were read, which gave occaſion of diſcourſing farther concerning ſubterraneous ſteams and fiery damps.

Dr. ALLEN took notice, that there was mention made in Mr. RAY's *Travels*, of a burning fountain in Dauphiny in France, which being ſet on fire would burn very violently, and would ſerve both to fry and roaſt meat; and that the inhabitants near it made uſe of it for that purpoſe.

This gave occaſion to diſcourſe of bituminous ſubſtances. Mr. HENSHAW mentioned, that there was a kind of liquid bitumen, which ſwam upon the *mare mortuum*.

He remarked likewiſe, that ambergriſe ſeemed to be ſomewhat of that nature, ſince it had been often found to float on the ſea: but that amber or *ſuccinum* was of another nature, and was generally found at the bottom of the ſea.

He took notice alſo, that Mr. BOYLE had a method of including inſects in a clear colophony, made by the evaporation of turpentine, which being cold and hard would very much reſemble true amber, and preſerve any inſect put into it very intire.

Mr. HOOKE affirmed, that he himſelf had a way of incloſing an inſect, ſuch as a fly-worm, or the like, in amber artificially, which could ſcarce be diſtinguiſhed from a natural production of that kind.

He added, that he was of opinion, that amber was nothing elſe but the turpentine or reſinous gum of trees, which having lain a long while in the ſea or under

der ground was in proceſs of time petrified, or at leaſt hardened to that degree, in which it was found: which he was the more inclined to believe from the experiment, which Dr. DANIEL COX had tried upon the earth found ſome years before at Iſlington; the oil of that earth ſmelling perfectly like oil of amber, which was made to have that ſmell from the burying of colophony there by a chemiſt.

Mr. HENSHAW remarked, that the ſmell of yellow amber, when rubbed, was very much like that of roſemary.

Sir JONAS MOORE gave an account of the manner of the firing of a damp in a coal mine at Lumley, which was with ſo great a violence, that it ſhook the earth for a conſiderable way round about, and carried ſome miners, who were going down into it, a very great hight into the air, and blew up alſo aloft into the air all the building, that ſtood over and about the mouth of the mine.

Sir PAUL NEILE hereupon related the manner, in which the cure for theſe kinds of damps was found out accidentally; which, he ſaid, he had received from Sir WILLIAM LAMPTON, the owner of the abovementioned pits or mines; and which was to this effect. The miners having been above making merry, and being almoſt fuddled, began to throw firy coals at one another, ſome of which falling accidentally into the mouth of the coal-mine, ſet fire to the damp, and made it diſcharge with a very great noiſe, and ſhaking of the earth. Upon taking notice of this, and the cauſe of it, they after a little ſpace of time tried by deſignedly throwing down burning coals into the mouth of the mine; and preſently falling down flat on their bellies on the ground obſerved, that the mine again took fire, and blew up into the air with a great noiſe. This they repeated ſeveral times one after another, till they found, that it would fire no more: after which they ventured down into the mine without any ſueceeding injury from the ſaid mine for the remaining part of the day. But for fear leſt they ſhould be farther incommoded by the ſaid firy damps, they always in the morning, before they go down, endeavour to fire the ſaid damps, by throwing down lighted coals till the pit will fire no more.

Sir JOHN HOSKYNS, related, that there was a pit at Broſeley in Shropſhire, where, if a candle were held near to the ground, the ſteam or damp would take fire; but if the candle were held higher at a diſtance, the ſame effect would not follow.

*November* 30. the anniverſary election-day, there being preſent thirty-three members, and the preſident, Sir JOSEPH WILLIAMSON, in the chair,

Mr. HOOKE read the report of the committee appointed to audite the accounts of the treaſurer, Mr. HILL, for the preceding year[x].

After which the ſeveral candidates formerly propoſed were balloted for and elected,

[x] This report was omitted to be entered in the Journal, vol. vi. p. 138.



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1. FRANCIS ASTON, Eſq; propoſed by Dr. EDWARD BROWN, by twenty eight votes, no negative.

2. Dr. MAYOW propoſed Mr. HOOKE, twenty-ſeven votes, one negative.

3. Mr. DAVID HANNISIUS propoſed by Mr. HAAK, twenty-eight votes, no negative.

4. JOHN VANDE BEMDE, Eſq; propoſed by Mr. HAAK, twenty-eight votes, no negative.

5. Mr. WILLIAM PERRY, propoſed by Dr. MAPLETOFT, twenty-nine votes.

6. Mr. DETHLEVUS CLUVERUS, propoſed by Mr. HAAK, twenty-nine votes.

7. Mr. EDMUND HALLEY, formerly propoſed by Sir JONAS MOORE, thirty-one votes.

8. Mr. JOSEPH MOXON, propoſed by Mr. GEORGE ENT, twenty-ſeven votes, four negatives.

Mr. ASTON, Mr. BEMDE, Mr. PERRY, and Mr. MOXON were admitted.

The ſtatutes relating to the manner of proceeding in the elections of the council and officers being then read, the Society proceeded to it, Mr. HERBERT and Mr. AUBREY being firſt choſen to inſpect the proceedings of the ſecretaries.

Eleven members were continued of the council[y].

Mr. COLWALL,
Dr. GREW,
Mr. HENSHAW,
Mr. HILL,
Mr. HOOKE,
Sir JOHN HOSKYNS,
Sir JOHN LOWTHER,
Sir JONAS MOORE,
SETH lord biſhop of Saliſbury,
Sir JOSEPH WILLAMSON,
Sir CHRISTOPHER WREN.

Ten members were likewiſe choſen into the council.

Mr. AERSKINE,
Dr. ALLEN,
Dr. BROWN,
Mr. CREED,
Dr. CROUNE,
Dr. GALE,
Mr. HAAK,
Sir JOHN LAURENCE,
Dr. MAPLETOFT,
Sir THEODORE de VAUX.

The preſident, treaſurer, and ſecretaries were choſen again for the next year.

[y] Theſe names were omitted to be entered in the Journal, vol. vi. p. 139. but are partly ſupplied from the Council-book, and a liſt of the members for 1679.

Between

Between this and the next anniverſary election died a very learned member of the Society,

THOMAS STANLEY, Eſq; only ſon of Sir THOMAS STANLEY of Cumberlow Green in the county of Hertford, Knt. by MARY his ſecond wife, one of the daughters of Sir WILLIAM HAMMOND of St. Albans in Nonnington in Kent, Knt. by his wife ELIZABETH, daughter of ANTHONY AWCHER of Bourne, in Kent, Eſq; and of MARGARET his wife, daughter of Dr. EDWYN SANDYS, lord archbiſhop of York in the reign of queen ELIZABETH, and ſiſter to Sir EDWYN SANDYS of Bourne, Knt. and GEORGE SANDYS, the celebrated traveller and poet. Mr. STANLEY was born at Cumberlow Green, and educated in Grammar learning at his father's own houſe under Mr. WILLIAM FAIRFAX, ſon of EDWARD FAIRFAX of New-Hall, in the pariſh of Oteley in Yorkſhire, Eſq; the famous tranſlator of TASSO's *Godfrey of Bolloign*. He was afterwards ſent to Pembroke Hall in the univerſity of Cambridge, where he was entered as a fellow-commoner, and purſued his ſtudies of polite learning with great vigour and ſucceſs, not without the aſſiſtance of Mr. FAIRFAX, as well during his reſidence in the univerſity, as afterwards in his more advanced years. He took the degree of maſter of arts at Cambridge, in which he was incorporated at Oxford, in 1640. [z]. After his return from his travels abroad, he lived in the Middle Temple, where he entered into a near communication of friendſhip and ſtudies with his kinſman EDWARD, SHERBURNE, Eſq; afterwards knighted, who came thither about the ſame time from Oxford upon the ſurrender of it in June, 1646, to the parliament forces. The ſame year Mr. JOHN HALL of Durham dedicated to him his *poems* publiſhed at London, in 8vo. as Mr. STANLEY's own *poems* were in 1651, in 8vo. he having two years before publiſhed his tranſlation of and annotations upon the *Europa* of THEOCRITUS, *Cupid Crucified*, and *Venus's Vigils*, to the ſecond edition of which, in 1651, he added a tranſlation of, and notes upon, ANACREON, BION, and JOHANNES SECUNDUS's *Baſia*. In the ſame year 1651, Mr. SHERBURNE dedicated to him his *Salmacis, Lyrian, Sylvia, forſaken Lydia, the Rape of Helen, a Comment thereon, with ſeveral other poems and tranſlations*, printed at London, in 8vo. The firſt volume of Mr. STANLEY's great work, intitled, *The Hiſtory of Philoſophy, containing thoſe, on whom the Attribute of Wiſe was conferred*, was printed at London, in 1655, in folio, and the ſecond the year following, the third not being publiſhed till 1660. In 1662, his *Hiſtory of Chaldaic Philoſophy* was printed at London; and in 1663, his edition of ÆSCHYLUS at London, in folio, under the title of *Æſchili Tragœdiæ* vii. *cum ſcholiis Græcis omnibus, deperditorum Dramatum fragmentis, Verſione & Commentariis Thomæ Stanleii*. He was one of the early members of the Society, being propoſed a candidate June 26, 1661, and elected on the 21ſt of July, as he was again upon the grant of the ſecond charter of April 22, 1663. Beſides his works mentioned above, he publiſhed ſeveral tranſlations, 1. *Aurora Iſmenia* and *the Prince*, written by JUAN PFREZ DE MONTALVAN: London, 1650, the ſecond edition. 2. *Oronta, the Cyprian Virgin*, by Signor, GI-

[z] WOOD, Faſti Oxon. vol. i. col. 284.

ROLAMO PRETI, London, 1650, 8vo. 3. *A Platonic Diſcourſe of Love*, written in Italian by JOHN PICUS MIRANDULA: printed in 1651, in 8vo. 4. *Sylvia's Park*, by THEOPHILE, *Acanthus Complaint*, by TRISTAN, *Oronta*, by PRETI, *Echo*, by MARINO, *Love's Embaſſy*, by BOSCAN, *the Solitude*, by GONGORA; all printed with his own poems in 1651, in 8vo.

He married while he was young, DOROTHY, eldeſt daughter, and one of the coheirs of Sir JAMES ENYON of Flowre in the county of Northampton, Bart. by whom he had the acceſſion of a good eſtate to his own. He died at his lodgings in Suffolk-ſtreet, in the pariſh of St. Martin's in the Fields in the city of Weſtminſter, April 12, 1678, and was interred in the church there. He left behind him a ſon of both his names, educated in Pembroke Hall in Cambridge, who, when very young, tranſlated into Engliſh CLAUDIUS ÆLIANUS's *Various Hiſtories*.

*December* 5. Mr. HENSHAW, vice-preſident, in the chair.

Mr. HOOKE preſented to the Society a diſcourſe, which he had lately received from the preſident, written by Signor MALPIGHI concerning the anatomy of plants, being a farther proſecution of that excellent work of his formerly printed. It was dedicated to the Society, and contained, beſides a preface and concluſion, ſeven ſeveral heads or ſubjects of inquiry. 1. Concerning the vegetation or growth of ſeeds. 2. Of galls, or the round excreſcences growing on an oak. 3. Of the various tumours and excreſcencies of plants. 4. Of the hairs, down, and thorns of plants. 5. Of the claſps and the like binding parts of plants. 6. Of thoſe plants, which vegetate upon others. 7. Of the roots of plants. Each of theſe ſubjects was illuſtrated by a great number of ſchemes atd delineations moſt curiouſly drawn with diſtinction of black and red for the better explanation. After the reading of the dedication, which teſtified the author's great reſpect for the Society, it was ordered, that a letter of thanks ſhould be ſent by Mr. HOOKE to him; and that Mr. HOOKE ſhould alſo take care, that the diſcourſe be forthwith printed with all poſſible correctneſs; and that a good number of the printed copies be tranſmitted to the author.

The minutes of the meeting of November 28, being read, gave occaſion of diſcourſing further concerning the productions of our own country as to rich and precious ſtones. Mr. HOOKE affirmed it poſſible to make as good agate-cups as any brought from the Indies, out of certain flints and other ſtones plentiful enough in England: and that there was no difficulty of doing this, except the charge of the diamond-powder to cut them, which yet might, in ſome meaſure, be ſupplied by emery or other powders.

Mr. POVEY hereupon ſpeaking of ſtones full of a variety of figures, remarked, that he had a conſiderable number of ſuch ſtones, which he promiſed to preſent to the Society for their repoſitory.

He

He obſerved farther, that he had been attempting to make an urn clay like the the curious porphyry * * of the king; but that it would not bake of that thickneſs without breaking.

Mr. HOOKE mentioned, that there was a method of making very thick pieces of earth to be burnt, without breaking or chopping: that Mr. DWIGHT had made ſome heads of earth as big as the life: that his earth was as hard as porphyry: and that the excellency of China-earth was, that it would endure the greateſt fire without vitrification.

From this diſcourſe of ſtones and earth aroſe one concerning metals and minerals, and particularly about the way of making braſs. Mr. POVEY promiſed to bring in the whole method of making braſs, practiſed in the foreſt of Dean, where there were vaſt quantities of lapis calaminaris to be had. Dr. BROWN promiſed alſo to communicate his obſervations on that ſubject made by him in Hungary.

Mr. POVEY mentioned a ſort of ambergriſe, which had been taken upon Florida, and brought over with a king of that country: that this ambergriſe had not exactly the ſmell or conſiſtence of the true ambergriſe, but ſeemed rather to be ſomewhat more bituminous. He was deſired to bring ſome of it, that it might be ſeen and examined, which he promiſed to do.

He added, that he had a ſort of cotton-cod, which produced a down as fine as any ſilk, though it were but ſhort, and not much larger than that of a thiſtle; of which he promiſed alſo to produce a ſpecimen at ſome meeting of the Society.

Mr. WHEELER remarked, that ſcammony produced ſome ſuch cod and down, and promiſed to bring ſome of it to the Society.

Dr. BROWN diſcourſing of Hungary, mentioned, that Mr. BEMDE, a member of the Society, had ſeen a vine, in which ſome grains of gold were ſaid to be found growing: which Mr. BEMDE was deſired to ſhew to the Society: but he ſaid, that it was a miſtake, that he had any ſuch vine; but that count WALSTEIN had a bracelet of ſuch.

Upon diſcourſing on mercury, it was remarked, that it was brought over in copper-balls.

Mr. HOOKE produced part of his new weather-clock, which he had been preparing; and which was to keep an account of all the changes of weather, which ſhould happen, viz. 1. The quarters and points, in which the wind ſhould blow. 2. The ſtrength of the wind in that quarter. 3. The heat and cold of the air. 4. The gravity and levity of the air. 5. The dryneſs and moiſtneſs of the air. 6. The quantity of rain, that ſhould fall. 7. The quantity of ſnow or hail, that ſhall fall in the winter. 8. The times of the ſhining of the ſun. He was deſired to proceed to the finiſhing of this, which, he ſaid, he hoped to do within a month or ſix weeks.

He

He promiſed alſo to ſhew at the next meeting an experiment in the condenſing engine, which he had procured to be now mended and fitted for many experiments.

*December* 12. Mr. HENSHAW, vice-preſident, in the chair.

Mr. HOOKE produced the condenſing engine, which he had cauſed to be mended and made much more ſerviceable for trial of ſeveral experiments therein, of the effects of condenſed air.

An experiment was made to ſee the effect of condenſing the air in a gage or ſtandard, which was ſuſpended within the cavity thereof.

It was deſired by the Society, that it might be tried at the next meeting in the engine upon ſome animal, in order to ſee how much longer a creature would continue alive in the engine filled with condenſed air than when filled with common air.

It was ordered, that the rarifying engine might be put in order for the trial of the ſame animals in rarified air; to ſee how much ſooner an animal will expire in rarified air than in common air of the ſame extenſion.

Mr. POVEY preſented to the Society for their library a ſmall ſtitched book in 4to. containing an hiſtory of Chelſea College.

He preſented likewiſe for their repoſitory the claw of a Weſt India ſpider, very much reſembling the claw of a lobſter or crab; given him by the lord WILLOUGHBY of Parham as a preſent remedy againſt the tooth-ach.

He likewiſe produced ſome glaſs-drops, in order to ſhew the experiment of their violent burſting and diſcharging the parts of it upon the breaking of the ſmall end thereof. The ſmall end of one of theſe was broken by a pair of plyers, and the whole body of the glaſs flew aſunder and diſperſed its parts every way with great briſkneſs.

Mr. HOOKE mentioned, that the manner of the breaking of the body might be ſeen, if the ſame were dipped two or three times in very clear tranſparent glew; which, it was deſired, might be prepared accordingly againſt the next meeting for making the experiment.

Mr. HOOKE reported, that he had treated with Mr. MARTYN, the Society's printer, for the well printing Signor MALPIGHI's diſcourſe lately ſent to the Society; and that he had deſired Mr. MARTYN to print fifty copies extraordinary, to be ſent to the author as a preſent from the Society.

Mr. POVEY moved, that a letter of thanks might be written to Signor MALPIGHI

PIGHI from the Society; and that the ſaid letter, after it ſhould be read and approved by the Society, might be printed with the book.

Upon a diſcourſe about ſome ſorts of the leſſer precious ſtones, as agates, mocha ſtones, onyx's, &c. Mr. POVEY related, that the heliotropium was an excellent ſtone for ſtriking fire inſtead of a flint. Marcaſites were alſo mentioned as a ſort of ſtone, which afforded much fire upon ſtriking; and it was ſuppoſed, that the reaſon was, becauſe thoſe ſtones abound with ſulphur.

But it was farther diſcourſed, that the moſt conſpicuous ſparks, that fly from the ſtriking of a flint againſt a ſteel, were the ſmall parts of the ſteel cut off by the flint, and vitrified by the violent motion of the ſtroke, the ſulphur of the iron readily taking fire. For a proof of which, Mr. HOOKE ſhewed an experiment by throwing the filings of iron through the flame of a candle, which immediately kindled and ſparkled like gun-powder.

Mr. BEMDE related the way of collecting the golden ſands of the river Danube, which was by throwing the ſand with water upon a board laid a little aſlope, and cut with many notches like the teeth of a ſaw, with the teeth turned upwards, and againſt the ſlope: by which means all the particles of gold would lodge themſelves in theſe teeth or notches, whereas the lighter ſand, gravel, and dirt will all waſh away. He ſaid, that he had ſome of the ſaid powder here in England, which he had brought from the Danube; and he promiſed to produce ſome of it at the next meeting.

He remarked, that the people by this means of collecting and waſhing ſand would earn ſix or ſeven ſhillings a-day, though their gain thereby were inconſiderable in compariſon of the value of the gold, which they thus collected; the profit of which intirely belonged to the emperor, or thoſe, who farmed it of him.

Hereupon ſome opinions were mentioned about the original of gold.

Mr. HEWSHAW ſaid, that it was an inquiry worth conſideration, whence the ſeveral ſhapes of gold proceeded, viz. that found in the mines, and that waſhed out of the ſand of rivers; ſince they ſeemed to be very different, that found in mines being always found in thin planks imbodied in a hard ſtone; but that in rivers being of a quite different ſhape, like ſand. Hence he conceived it worth inquiry, whether it might not be generated out of the river itſelf.

Mr. HOOKE was of opinion, that the original place of gold lay extremely deep in the earth, as being a body heavier than any other yet known, and conſequently ought to lie lower than any in order: that had it not been for ſome former earthquakes and eruptions, it would have ſtill remained in thoſe inacceſſible receſſes, and ſo have never been known, as in all probability many other ſorts of ſtones, minerals, ores, and metals, which may lie below the ſeat of ſubterraneous fires, may remain concealed and unknown to this day: that by means of ſubterraneous fires, earthquakes, and other vapours, that cauſe thoſe effects, thoſe deeper

and

and inner parts of the earth may have been thrown up together with the other effect of the ſame cauſe, the very mountain: that that part of it, which is thrown up into the top or body of the mountain, may by the violence of the heat and diſcharge of the vapours be melted in the raiſing, and diſperſed and broken into a multitude of very ſmall globules, or ſuch like figure, and ſo be blended and mixed with the earth, ſand, &c. of the new eruption: that being thus mixed with the earth of the mountain, the rain falling on the upper part thereof, and deſcending, waſheth down into the rivers thoſe ſmaller particles of the gold, and ſo leave them in the bottom of their channels.

Mr. WHEELER produced and preſented for the repoſitory a cod of ſcammony mentioned at the preceding meeting, bearing a kind of down like ſilk, growing on the end of the ſeeds like thoſe of dandelion; by which they fly in the air like thoſe, and by the winds are diſperſed to a great diſtance.

Mr. POVEY, according to his promiſe at the laſt meeting, produced ſome papers, containing his obſervations about the method of making braſs, which had been formerly tried in England. Theſe papers were read by him, and delivered to Mr. HOOKE in order that they might be copied into the Regiſters of the Society[a].

In theſe papers were mentioned the proportions of tin and of lead to be mixed with copper, in order to make bells, guns, and pots.

Mr. POVEY read likewiſe another paper of Mr. ELSING concerning ſome copper manufactures.

Mr. HOOKE read a letter from Mr. JOHN LOCKE, dated at Padua, giving an account of the late total eclipſe of the moon obſerved there by an ingenious acquaintance of his, and offering his beſt endeavours for the ſervice of the Society in thoſe parts.

Mr. HOOKE was deſired to return the Society's thanks to Mr. LOCKE for this letter, and Mr. HENSHAW moved, that he might be deſired to procure the hiſtory of the making of verdigriſe with wax, and that of the kermes berry, both as to its growth, manner of gathering, preſerving, uſe either for phyſic, dying, or the like.

Monſ. EZEKIEL SPANHEIM, reſident from the elector Palatine, was propoſed candidate by Mr. HAAK.

*December* 19. Mr. HENSHAW, vice-preſident, in the chair.

The minutes of the laſt meeting were read; which gave occaſion of diſcourſing about pearls, and of the places of finding them: whereupon Mr. BEMDE related,

[a] No copy of them is inſerted in the Regiſters.

that many pearls were found in a river, which runs into the Danube near Paſſau: that theſe pearls were very good; and that they were found in the very mud of that river, and not in the ſhell of any fiſh: and thence it was ſuppoſed, that they were caſt by ſome fiſh out of their ſtomachs, ſince it had been obſerved by Dr. KING, that the pearl in oiſters is generated in the ſtomach of that fiſh.

There was alſo a farther diſcourſe about the manner of the production of metals in the bowels of mountains. Whereupon Mr. HENSHAW declared it as his opinion, that many metals, as gold, were generated and perfected in the ſuperficial parts, as well as in the body of them. But Mr. HOOKE endeavoured to explain how thoſe bodies might be original bodies belonging to a much lower region of the earth; and that they were not produced or generated a-new, but only by earthquakes and ſubterraneous eruptions thrown up from their more natural place, and by the violence of thoſe fires melted out of the minerals, in which they were there bedded; and that thence they came to be diſpoſed and ſcattered into ſmall grains and duſt, and found intermixed with very heterogeneous bodies.

Upon the mention of Mr. LOCKE's letter, Sir JOHN HOSKYNS gave an account of the manner of making verdigriſe with the huſks of grapes, after the expreſſion of their juice, and ſmall plates of copper thrown and buried amongſt them.

Sir JOHN HOSKYNS preſented to the Society for their repoſitory a branch of white coral, which he received from Mr. GORING BALL. It was ſingular in this, that the ends of the branchings were terminated with a kind of pearl, the ends being hollowed like a cup with ſix ſmall ribs within, each of which ended in a ſmall knob or pearl; and between each of theſe was orderly placed another ſmall knob, amounting to twelve in all.

Mr. BEMDE produced ſome of the ſand mentioned by him at the laſt meeting to have been taken up in the Danube; which was ſome of that, out of which the people ſeparated the golden duſt by waſhing. Some of it was delivered to Mr. HUNT for the repoſitory.

Mr. BEMDE preſented likewiſe a black ſtony ſubſtance, intermixed with a curious green, which he had taken up on the mountain Veſuvius. It had the appearance of a black and green glaſs; and thereupon it was tried with a coal, and the flame of a candle caſt on it with a ſoddering pipe, in order to ſee, whether it would melt; but upon trial it was found not to melt, but to be a real ſtone.

Mr. COLLINS preſented from Mr. MARTINDALE a propoſition or diſcourſe of compound intereſt or annuities, contained in three leaves of paper in 4to. to be printed, if the Society ſhould think proper, with ſome other papers.

Mr. ENT produced a root of barley, out of which grew thirty ſtalks, on each of which was an ear of barley.

Sir JOHN HOSKYNS produced ſome of the powder taken out of Dulwich well-water.

The experiments exhibited were in order to ſhew the uſe of air for the ſuſtentation of the life of an animal: upon which ſubject the query was, whether the ſame animal would continue to ſubſiſt in an incloſed air for a time proportionable to the quantity of air contained in the veſſel? Whether the ſaid air were free and under no extraordinary compreſſion or dilatation? Or whether it was either compreſſed or dilated by the force of the engines made for that purpoſe. In proſecution of this inquiry there were ſeveral birds provided, one of which was incloſed in a glaſs veſſel with common air: a ſecond in a receiver, out of which the air was afterwards exhauſted; and a third was to be incloſed in the condenſing engine, into which double the quantity of air was to be forced. The event was, that the bird in the exhauſting engine preſently died; but the other in the common air continued in the receiver till the Society roſe, without any ſenſible alteration: whence it was judged, that it would live a conſiderable time longer before it was ſtifled.

*December* 26. At a meeting of the COUNCIL were preſent

Mr. HENSHAW, vice-preſident, in the chair.

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| Sir JOHN HOSKYNS, | Mr. ALLEN, |
| Dr. GALE, | Dr. BROWN, |
| Mr. HILL, | Dr. GREW, |
| Mr. COLWALL, | Mr. HOOKE. |

It was ordered, that the treaſurer repay Mr. HOOKE the five pounds paid by him to Mr. CRAWLEY for workmanſhip about the weather-clock; as alſo his ſalary for half a year ending at Chriſtmas, voted by ballot.

Dr. GREW was put in mind to procure the Muſeums for the library of the Society, according to the deſire and direction of the preſident.

It was ordered, that the treaſurer give to Dr. GREW ten pounds as a gratuity for his ſervice to the Society as ſecretary, voted by ballot:

That the treaſurer pay Mr. WICKS one year's ſalary ending at Chriſtmas, 1677, voted by ballot:

That Dr. GREW have liberty to borrow ſuch of the natural rarities in the repoſitory, as he ſhall have occaſion to deſcribe; and that he leave a catalogue of the ſame with Mr. HUNT, till he return them; which is to be within one week: voted by ballot: And

That Mr. HOOKE be deſired for the future to keep the correſpondence of the Society; and that the ſame ſhall be continued by the help of a ſmall Journal of ſome particulars read in the Society: that the ſaid Journals ſhall not be ſent or ſold

ſold to any perſon but members of the Society, and to ſuch as correſpond with Mr. HOOKE by the Society's directions, and make conſiderable returns to him for the Society's uſe; all which returns ſhall be conſtantly brought into the Society, and read before them at the very next meeting after the receit thereof. And Mr. HOOKE was deſired to draw up a ſpecimen of the ſaid Journal propounded by him againſt the next meeting of the council: voted by ballot.

A paper brought in by Dr. GALE, containing rules for the keeping of the library, was read and approved; as follows:

"Orders concerning the government of the *Bibliotheca Norfolciana*.

"1. That the long gallery in Greſham College be the place for the library, if "it may be procured.

"2. That an inſcription in letters of gold be ſet up in ſome convenient place "in honour of the benefactor.

"3. That there be an exact catalogue of all the books of the *Bibliotheca Nor-* "*folciana* made apart, and alſo of all other books, which ſhall accrue.

"4. That for ſecuring the books, and to hinder their being embezzled, no book "ſhall be lent out of the library to any perſon whatſoever.

"5. That ſuch perſon or perſons, as ſhall deſire to uſe any book in the library, ſhall return it into the hands of the library-keeper entire and unhurt.

"6. That the library ſhall be ſurveyed once in the year by a committee choſen by the council to the number of ſix, any three of which to be a *quorum*."

It was ordered, that Mr. HOOKE do agree with Mr. BRADELL about two rooms, which he deſires of Dr. POPE's lodgings; but that he do not let them under five pounds *per annum*.

$167\frac{8}{9}$, *January* 2. Sir CHRISTOPHER WREN, vice-preſident, in the chair.

Dr. GREW read a letter in Latin to himſelf from CHRISTIAN MENTZELIUS, counſellor and archiater to the elector of Brandenburg, dated at Berlin, 31ſt July, 1678[b], expreſſing his kind acceptance of the offer, which had been made him of holding correſpondence with the ſecretary of the Society, and his deſire of continuing it, as he had formerly begun it with Mr. OLDENBURG; and more eſpecially concerning ſuch inquiries, as he had with great delight been much employed in, the nature, qualities, and ſpecies of vegetables. In the poſtſcript of this letter he makes mention of the eighth year of the Ephemerides *Naturæ Curioſorum* at Breſlaw, wherein was inſerted a tranſlation of Dr. GREW's *Anatomy of Vegetables*: and that

[b] Letter-book, vol. viii. p. 56.

JACOBUS BREYNIUS of Dantzick had that year publiſhed *Centuria Plantarum rariorum, præſertim ex promontorio Capitis Bonæ Spei deſumptarum, cum figuris æneis ſumma arte ad vivum inciſis*, in folio.

Dr. GREW read likewiſe a letter to himſelf from E. LEICHNER, dated at Erfurt, 15th November, 1678 [c], containing an inquiry after ſome things, which he had formerly ſent, and received no anſwer about; and alſo a printed half ſheet, intitled, *D. E. Leichneri excerpta Diatypoſis tractatûs de Phyſico-Medica Analyſi, in duos diſtincti libros:* by which he hoped, that natural philoſophy and phyſic might obtain its utmoſt felicity.

The minutes of the laſt meeting of December 19. being read, on the mention of the barley, that produced ſuch great increaſe, Mr. HENSHAW remarked, that there was a *triticum multiplex* firſt brought from Perſia, which would yield two thouſand for one. This was ſeconded by Sir JOHN HOSKYNS, who obſerved, that it would do the ſame in any other plant, he having found it upon trial to ſucceed. He added, that the ſtalk of it was not hollow like other wheat, but ſolid; and that it was much preyed on by birds.

Upon the mention of pearls, Mr. HENSHAW obſerved, that they were often found in freſh-water as well as in ſalt, viz. in a ſort of horſe-muſcles found in rivers.

Upon a diſcourſe about ſand gold, Sir CHRISTOPHER WREN remarked, that the figure thereof for the moſt part was ſhaped like * * or ſalts of regular flat ſides and angles; and that it was ſeldom found like ſmall particles of a melted metal: that he had ſeen bags of theſe ſands, the moſt part of which were thus ſhaped, and yet very pure gold.

Dr. PLOT, upon the diſcourſe of barley, made mention of a certain ſort of barley called Patney barley, from a place of that name in Wiltſhire. This barley, he conceived, would be of great uſe in cold countries, by reaſon that it will be thoroughly ripe in nine or ten weeks from the time of its ſowing; and conſequently come within the limits of the ſhorteſt ſummer. Of this he had given an account in his *Natural Hiſtory of Oxfordſhire*. By others it was called rare ripe barley.

Mr. HOOKE gave an account of the experiments, that had been ſhewn at the laſt meeting, and the deſign of them, and of the time and manner requiſite for the completing ſuch experiments: and he deſired, that there might be a committee appointed for the making ſuch trials, as could not be made within the time of the ſitting of the Society, ſince many experiments could not be made within ſo ſhort a ſpace.

Dr. PLOT left with the Society a printed ſheet of his inquiries, made in order

[c] Letter-book, vol. viii. p. 66.

8. to

to the writing of the natural hiſtory of all parts of England. This he did with a deſire, that it might be peruſed by the members, and ſuch alterations made therein, as they ſhould ſee reaſonable.

Mr. HOOKE ſhewed an experiment with gun-powder, in order to examine whether the burning thereof conſumes or produces more air. And upon trial thereof it was found, that [d].

*January* 9. The preſident, with Sir JOHN LOWTHER, Mr. HENSHAW, Mr. THYNNE, and ſeveral others, went up into Mr. HOOKE's turret, to ſee the farther progreſs, which had been made in the clock contrived by Mr. HOOKE for keeping an account of the ſeveral variations of the weather; which was well approved of by them.

The preſident took the chair.

The minutes of the laſt meeting of January 2. were read; whereupon mention was made by the preſident of continuing and promoting correſpondence with foreign parts; and it was deſired, that the propoſal made by Mr. HOOKE ſhould be farther conſidered of by the council, in order to the promoting of that deſign.

Upon the mention of gold-powder, &c. Mr. HENSHAW farther obſerved, that all gold, that was not found in rivers, was found imbodied in very hard ſtones, and ſo ſeemed to be generated in them. And that ſuch, as was found in rivers, was for the moſt part found in ſuch parts of them, where they made any conſiderable bend or turning or eddy.

The queſtion concerning the figure of duſt or ſand-gold was farther debated; and it remaining yet a doubt, whether it was found ſo figured, as had been ſuppoſed of regular figures, it was deſired, that Mr. HOOKE ſhould endeavour to get a ſight of ſome duſt gold, and examine the ſame with care, to ſee and deſcribe the moſt uſual figures thereof.

On a diſcourſe concerning the mineral of copper, Sir JOHN LOWTHER related, that there was a ſort of mineral found in Cumberland, which ſeemed to be a very rich copper ore; but that having ſent the ſame to be tried at London, it was found to burn and flame all away like brimſtone, and to yield no copper at all.

Mr. HOOKE remarked, that this might probably happen from the mixture and union of ſome ſalts and ſulphurs with the metal; and that if they were not by ſome other artifice ſeparated from the metal before the ſame come to be tried by the violence of the fire, without ſuch artifice or mixture, the ſulphur and ſalts would carry away the metal of the copper, and never ſuffer it to melt or ſeparate from them into a body. For confirmation of this he alledged, that he knew a way to make even the body of common copper commix again with ſuch heterogene-

[d] This minute was not completed.

ous

ous bodies, and being put into a fire to fly all away, and burn almoſt like common brimſtone; which copper ſo ordered might yet be again reduced ſo as to melt, and not fly away at all.

Mr. HENSHAW related a way of making a brimſtone out of copper.

Sir JOHN LOWTHER gave a deſcription of the copper-mines.

Mr. HOOKE gave an account of the deſign of the experiment about reſpiration, and moved, that there might be a committee appointed of the phyſicians and ſuch other members of the Society, as deſired to be farther ſatisfied concerning that inquiry, in order to make that experiment on ſome other day than that of the meeting of the Society, ſince that experiment could not be tried within the time of meeting: and he propoſed it as a very deſirable thing for the promoting the ends of the Society, that the committee formerly appointed for the trial and examination of ſeveral matters might be revived.

Hereupon a committee was appointed to make trial of this experiment of reſpiration, conſiſting of Dr. CROUNE, Dr. MAPLETOFT, Dr. ALLEN, Mr. HILL, and ſuch others of the Society, as ſhould deſire to be preſent at it.

Upon this a diſcourſe aroſe about reſpiration.

Dr. CROUNE was of opinion, that the ſteams from the breath and body were the occaſion of the death of ſuch animals, as were incloſed in a veſſel. Mr. HOOKE objected, that if this were ſo, then an animal included in condenſed air would be ſtifled by thoſe ſteams ſooner than one included in a veſſel, out of which a part of the air was exhauſted; whereas the quite contrary appeared by experiment. He added, that he rather conceived it to proceed from the ſatiating of the diſſolving part of the air, and ſo making the remaining part effete and uſeleſs for maintaining the life of animals, which ſeemed to have much the ſame nature with flame and fire, ſince the ſame effects ſeemed to happen to it. Hereupon Mr. HENSHAW mentioned the experiment, that had been formerly given to the Society; which the preſident deſired be again ſhewn at the next meeting,

*January* 16. The preſident in the chair.

The minutes of the laſt meeting being read, the preſident took occaſion to propound it as a matter deſirable, that an account ſhould be procured of the obſervations made of the quarters of the wind in the ſeveral parts of the kingdom; of which the letters from ſeveral parts gave an account.

He alſo inquired, whether Dr. GOAD [c] had perfected his theory of predicting the quarter and ſtrength of the winds from aſtronomy. To which Sir JONAS MOORE anſwered, that Mr. FLAMSTEAD had examined ſeveral of Dr. GOAD's

[c] JOHN GOAD, M. A. maſter of Merchant-Taylors ſchool in London. His *Aſtrometeorologia* was publiſhed in 1686.

predictions,

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predictions, but had not found one of them true. But Mr. HENSHAW had examined them continually for about two years about a month ſince, and had found not above one of four falſe.

The preſident then inquired, why the Society did not receive ſome account from Mr. FLAMSTEAD: to which Sir JONAS MOORE anſwered, that he would within a fortnight be ready to produce a book of his obſervations.

It was likewiſe inquired what was become of the inſtruments of the Society, that had been carried to Greenwich; and it was deſired, that they might be returned to the repoſitory, in order that they might be ready for the uſe of the Society.

The preſident inquired of Sir JONAS MOORE concerning an experiment, which he had been informed of, viz. of the throwing a copper farthing into a liquor, which being * * would prove good gold [d].

Mr. HENSHAW ſuppoſed, that it might be done ſomewhat after the manner of precipitating ſilver out of Æ. upon copper-plates.

Mr. HOOKE mentioned another experiment ſomewhat like it, whereby iron was ſaid to be turned into copper: and Mr. HENSHAW mentioned the chains ſaid to be turned from iron into copper by the mineral waters in Hungary brought from thence by Dr. BROWN.

Mr. EVELYN related, that ſalt of ſilver being diſſolved in water might by mercury put into that water, then evaporating it, and expelling the ſediment, be reduced to ſilver again.

Hereupon Mr. HENSHAW related, that the duke of Buckingham had a method of making mercury, which would grow hot by diſſolving gold. Dr. CROUNE added, that Mr. BOYLE had done the ſame thing; but had ſaid, that the experiment of making this mercury did not always ſucceed.

Mr. HENSHAW related a like experiment of augmenting gold made by Dr. KUFFLER *, which was made by an aquafortis made by the help of ſand taken out of the ballaſt of a ſhip; which experiment being tried with other ſand he found not to ſucceed.

Mr. HENSHAW farther gave an account of the manner, how Dr. KUFFLER hatched chickens by the help of furnaces, the proceſs of which he had ſeen; which was, that the doctor had a wire-grate placed over a balneum at a foot diſtance with a cover over, pulled up by a pulley; in which grate he ſet the eggs, and ſo turned them every day for eighteen days together: then he laid

[d] Sir JONAS MOORE's anſwer to this queſtion is not inſerted in the Journal, vol. vi. p. 151.
* In the minutes it is by miſtake *Kepler*.

them on a hair-cloth in a ſtove near the aſh-hole, where they hatched themſelves with their own bills; in which ſtove he kept them for three days, till they could feed themſelves, which was when the yolk was conſumed in their bellies. He added, that in Egypt they do this with camels dung.

Sir JONAS MOORE remarked, that Sir CHRISTOPHER HEYDON together with DREBELL long ſince in the Minories hatched ſeveral hundred eggs; but mentioned not the way; but that it had this effect, that moſt of the chickens produced that way were lame and defective in ſome part or other.

He added, that DREBELL had an art, by which he could produce a fly in an hour's time any where.

Dr. CROUNE related his own obſervations made with the eggs of a pullet, which, he was aſſured, had never been trod by a cock, and yet laid five or ſix eggs in a week. This he was aſſured of, as having kept the pullet in a coop from the time it was hatched, and never ſuffered any cock to come near her. Theſe eggs being ſet under a hen proved addle and effete; but being examined by him before they were ſitten upon, he found the cicatricula as in other eggs, and the body of a chicken formed in the cicatricula. Hereupon the doctor was deſired to proſecute this experiment yet farther, and to examine the cicatricula with a microſcope, and to ſhew it to the Society.

Sir JOHN LOWTHER promiſed to procure ſome of the copperas ore, in order to its being examined by Mr. HOOKE.

He deſired to be informed of the nature of the Swediſh * * and what quantity of copper it contained, and how it was ſmelted.

Sir JOHN HOSKYNS remarked, that GLAUBER had ſhewn the way how to extract a metal out of the pyrites.

Upon a diſcourſe concerning the ways of making ſalt, Mr. HOOKE related, that he had been newly informed by a doctor, who had lived in Ireland, that he had ſalt-works in the north-weſt parts of Ireland, where he boiled up the ſea-water into ſalt in iron-pans by the help of turf or peat to great profit or advantage.

Sir JONAS MOORE obſerved concerning peat-pits dug in the fens, that they will in a ſhort time fill again with good peat fit to be dug.

Sir JOHN HOSKYNS related, that he had obſerved the ſame thing in Bedfordſhire.

Sir JONAS MOORE mentioned, that there was at the top of Pendle-hill in Lancaſhire a plain about a quarter of a mile over, which being dug to the depth of about five or ſix feet, is found to contain great numbers of foſſile-trees, ſuppoſed to be fir.

He

He added, that this hill was a great receptacle of waters; and that there had had been ſeveral times obſerved great guſhings out of water from the ſides of it; which had happened at ſeveral times at the diſtance of about thirty years.

At the top of this hill grows the cloud-berry no where elſe found.

Dr. CROUNE mentioned ſome ſuch kind of obſervation of the ſprings about Epſom, which once in about ſeven years were obſerved to riſe and overflow the grounds and cellars thereabouts.

Mr. EVELYN upon this occaſion mentioned an inſtance of a hill, that was hollow underneath, and ſo muſt have a great receptacle of water; the river Mole ſinking under it on one ſide, and riſing out again on the other. This was Box-hill near Darking in Surrey, under which the Mole paſſes.

Mr. HENSHAW obſerved, that the river Guadiana in Spain is much of the ſame nature.

Mr. HOOKE ſhewed the experiment of putting fire into a tin box, and there keeping it blowed on with bellows, till it appears to have quite loſt its burning and ſhining: then admitting freſh air into the ſame, and blowing it with the ſame bellows, it preſently rekindled and burned and ſhined as before. This was thrice repeated to the ſatisfaction of the members preſent. But that ſome farther proof of his theory might be examined, he was deſired to ſhew ſome other experiment of this nature at the next meeting.

Dr. CROUNE read a letter of his to BORELLI, to invite him to ſend over his diſcourſe *De motu animalium*, ſince the Society would endeavour to procure it to be well printed here. The doctor was thanked by the Society for this letter, and deſired to ſend it as ſoon as poſſible.

Mr. HOOKE ſhewed a ſecond experiment, which was the flame of a candle ſo placed between the eye and a concave metalline ſpeculum, that the air, which incompaſſed the ſaid flame, by diſſolving the parts of it into itſelf, became of a different nature and different refraction from that, which was not ſatiated by the ſaid diſſolution.

This was plainly ſeen by the preſident and divers others of the members preſent to their ſatisfaction.

*January* 23. At a meeting of the COUNCIL were preſent,

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|---|---|
| Sir JONAS MOORE, | Dr. MAPLETOFT, |
| Sir JOHN HOSKYNS, | Dr. CROUNE, |
| Mr. HILL, | Mr. HAAK, |
| Dr. GALE, | Mr. CREED. |

It was ordered, that Mr. HILL do take care to collect the arrears due from the priory of Lewes, and employ whom he ſhall think fit for the collecting thereof: And,

That the paper brought in by Sir JOHN HOSKYNS, and here peruſed and amended, be forthwith fairly ingroſſed in parchment, and the inſtrument ſealed and carried to the preſident.

At a meeting of the SOCIETY on the ſame day, the preſident in the chair.

The minutes of the laſt meeting being read gave occaſion to inquire farther of Sir JONAS MOORE concerning Mr. FLAMSTEAD's obſervations: to which he anſwered, that a quantity of them were ready for the preſs; but the bookſellers were unwilling to undertake the printing of them: whereupon Mr. HOOKE was deſired to ſpeak with Mr. MARTYN [f] concerning it.

Sir JONAS MOORE likewiſe gave farther account, that Mr. FLAMSTEAD and Mr. HALLEY had newly made ſome obſervations in order to find out the parallax of Mars now achronical and retrogade; and that he had found from examining the obſervations by calculation, that the parallax of the ſun would not be more than 30″ nor leſs than 11″; which he conceived was much nearer than any perſon had hitherto certainly obſerved it.

Upon the mentioning the turning copper into gold by a liquor, Mr. POVEY related, that Sir THOMAS WILLIAMS had told him, that he had cut a copper farthing in two, and throwing into the liquor, it was diſſolved by it; and that upon evaporating the liquor, and expelling the remainder, he had found the ſame weight of the farthing in good gold. He added, that Mr. SLINGSBY ſuppoſed it to ariſe from the copper's precipitating the gold, that had been formerly taken up by the liquor.

The preſident related, that his majeſty had lately received a letter from Vienna, wherein were incloſed ſome curioſities relating to the way of making gold, conveyed by Mr. SCHROTER.

Upon an occaſional diſcourſe about teeth Mr. HENSHAW mentioned a relation, which he had met with, of artificially ſetting in new teeth in the place of old ones plucked out; adding, that it was obſerved, that if the new ones were preſently inſerted, as ſoon as the old ones were drawn out of the jaw bone, the gums would coaleſce and incloſe the teeth as firmly almoſt, as if they were the natural. He added, that one Monſ. DU PONT upon drawing out a wrong tooth, and finding his miſtake, had preſently clapt it into its place, and cloſed the gum, which thereupon remained as fixed, as if it had not been drawn.

He gave alſo a relation of a young lady, whoſe teeth being much rotted by

[f] The Society's printer.

eating

eating ſweet-meats, were drawn out, and the teeth of a young boy being ſet in their place had fixed there, and grown very well. This was done by Mr. GOSLING here.

Upon a farther query concerning chickens produced by ſtoves, whether they would be fruitful and produce eggs and chickens as others, that were hatched the natural way, Mr. HENSHAW affirmed, that they were abſolutely as fruitful in thoſe reſpects as the others.

Hereupon was occaſioned a diſcourſe about ſpontaneous generation. Mr. HOOKE related, that he had been informed by Mr. WYLDE, that he could order earth ſo, as that without ſetting or putting any peaſe at all into it, it ſhould produce peaſe: as alſo that the ſame Mr. WYLDE had told him, that Monſ. le FEBURE, the king's chemiſt, had aſſured him, that he having thrown out on a dunghill a pretty large quantity of the caput mortuum of fennel ſeeds, from which he had extracted the oil by diſtillation, had obſerved the following year, that the whole dunghill was overgrown with young fennel, as if it had been ſowed with fennel-ſeeds: concerning which it was conjectured, that the ſweepings of the laboratory, which were thrown to the ſame place, were more probably the cauſe of this great fruitfulneſs.

Upon a diſcourſe about the ſtrength of ſalt, it was conceived, that ſea-ſalt was much ſtronger than ſalt made by boiling, by reaſon that the extraordinary heat of the fire makes a conſiderable part of the ſalt riſe in fumes; whereas the natural heat of the ſun on that, which is made abroad, is not powerful enough to produce the like effect.

Sir JOHN LOWTHER added, that ſpring waters are much ſtronger than the ſea-water; ſo that they commonly yield a fourteenth part of ſalt, ſometimes an eighth; whereas ſea-water yields not above a two and fortieth part. He farther obſerved, that the lord LUMLEY's ſalt was accounted the beſt.

There was likewiſe a diſcourſe about making ſalt-water freſh by filtration; and the opinion was, that no filtration through ſand, earth, or the like, would make ſalt-water freſh.

Sir JOHN LOWTHER mentioned, that at the * * they ſaved the draining of the ſalt, and found, that that would very much contribute to the making of more ſalt by putting it to the brine, that was to be boiled: but on the other hand thoſe, who made ſalt out of ſea-water, uſually threw it away, as ſuppoſing, that it hindered the producing ſalt in the next boiling.

Mr. HOOKE obſerved, that the draining of ſalt from ſea-water was uſually very bitter and red, and was for the moſt-part thrown away; only ſome of it was uſed for the waſhing the ſores of ſheep and cattle, as being a great drier: and he farther conceived, that it was made by a diſſolution of the iron boiler, and therefore might be of another nature.

Mr. POVEY obſerved, that Sir ROBERT HOWARD had acquainted him, that in his part of a ſalt-work there was a ſubterraneous ſalt-river.

Mr. HOOKE ſhewed his experiments; the firſt of which was the ſetting a chafing-diſh of coals into the box, and ſuffering it to ſtay there till it went out, and ceaſed to ſhine: then by a hole at the top letting down into the air of the box a wax-candle, it would preſently be extinguiſhed, as if it were dipt in water; and that as ſoon as ever the air came to touch the flame of the candle. But that air being changed, and freſh air admitted into the box, the coals began to ſhine afreſh, and the candle let down into the box continued to burn and ſhine as in the open air.

His ſecond experiment was by putting in a box filled with lighted coals burning clear, when the air had been ſatiated, as abovementioned, by the coals, which had been ſet into it: which coals preſently ceaſed to burn, and looked as if they had been quite extinct; which very coals, as ſoon as ever the freſh air was admitted, preſently began to ſhine and burn as before.

The experiments for the next meeting were to proſecute this theory of Mr. HOOKE, that air is a menſtruum, that diſſolves all ſulphureous bodies by burning, and that without air no ſuch diſſolution would follow, though the heat applied were as great.

*January* 30. Being the anniverſary faſt for the death of king CHARLES I. the Society did not meet.

*February* 6. The preſident in the chair.

This meeting began with a diſcourſe about the barometer and preſſure of the atmoſphere, concerning which it was debated, what might be the reaſon, why the air ſhould preſs leſs in rainy than in dry weather. Mr. HOOKE ſuppoſed, that it might proceed from this, that the air at ſuch time, as it is heavy, takes up more of the heavy parts of other bodies, and keeps them ſuſpended; whereas in moiſt and ſtormy weather the air being of another nature could not be charged with ſuch vapours.

There was alſo a diſcourſe about what was fit to be publiſhed of the *Tranſactions* of the Society [s], and in what manner; but the determination of that matter was referred to the council.

The minutes of the meeting of 23 January were read; whereupon there were ſome other things added about drawing out and ſetting in teeth artificially.

[s] They had been diſcontinued from June, 1677, n° 136, upon Mr. OLDENBURG's death, till January $167\frac{7}{8}$, when Dr. GREW reſumed the publication of them, and continued it from n° 137 to n° 142, for the months of December 1678 and January and February $167\frac{8}{9}$: after which they were intermitted till January $168\frac{2}{3}$.

Sir JOHN HOSKYNS cited MALPIGHI for aſſerting, that teeth continually grow; that they have ſeveral coats or ſhells like teſtaceous ſubſtances; and that the outward coats wear off and wear out with uſing.

Mr. HENSHAW mentioned Monſ. du PONT's papers, which were in the hands of Mr. EVELYN, about the way of ſetting in new teeth artificially. He remarked, that ſea-horſe teeth afforded the beſt ſubſtance to make artificial teeth of: that theſe artificial teeth will ſtink in a little time, if they be not taken out of the gums and cleanſed: that they would alſo in time grow yellow and black: that the hard coat of teeth by rubbing will be worn out: and that thereupon the reſt of the tooth ſuddenly decays.

About the nouriſhing of teeth Mr. ARDERNE quoted * * opinion, that they are nouriſhed by the *ſuccus nutritius* from the nerve.

Upon reviving the diſcourſe about making ſea water freſh by filtration and diſtillation, it was generally concluded, that the freſh water of ſprings proceeds either from the rain, dew, or condenſation of the moiſt air on the tops of hills.

Monſ. SPANHEIM was elected.

THOMAS SHERIDAN, Eſq; was alſo elected.

Sir WILLIAM WALLER was propoſed candidate by the preſident and the earl of Aylesbury.

Mr. HOOKE ſhewed two experiments in order to illuſtrate his theory about fire.

The firſt was the letting down a lighted wax candle into a glaſs of air, which about ten days before had been ſatiated by a veſſel of live coals put into it, and ſuffered to remain till they were quite extinct: at which time the veſſel was cloſely ſtopped up, and had been kept ſo ever ſince. The effect of which was, that the candle put into it continued to burn a conſiderable time, as if it had been freſh air. It was conjectured, that upon the condenſation of the air upon cooling after the coals were gone out, the freſh air had made its way into the glaſs, and ſo refreſhed the air, and made it fit for burning. Others ſuppoſed, that the air might have recovered its former nitrous quality by letting fall thoſe parts of the coals, which it had formerly diſſolved. It was deſired, that this ſhould be farther and more carefully proſecuted.

The ſecond experiment was to ſhew, that a coal, though kept in a very great heat, would not be conſumed or burnt, unleſs there were an acceſs of freſh air. There was a charcoal included in a cylinder of glaſs, and ſo perfectly ſealed up hermetically: then this glaſs was put into a chafing diſh of live coals, and ſuffered to lie there a conſiderable time in a heat great enough to melt the glaſs, ſo that the glaſs ſhaped itſelf into the form of the coal: notwithſtanding which the coal remained unconſumed, and manifeſted the neceſſity of air for making an actual fire.

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The experiments for the next meeting were to be such, as ſhould farther demonſtrate the former theory.

*February* 13. Mr. HENSHAW, vice-preſident, in the chair.

Upon reading the minutes of the laſt meeting the Society again entered upon the debate concerning the cauſes and reaſon of the motion of the mercury in the barometer: and it was conceived, that it proceeded from the gravitation of the air, which at ſome times preſſed more and at other times leſs. This variety of preſſure was conceived to proceed from two cauſes; the one, that the air at ſuch time, as the quickſilver roſe higher, had a new acceſſion of air at the top thereof, which cauſed it to have a greater hight, and conſequently a greater preſſure. And the other was, that there were new acceſſions to the air from the earth, which made the ſame hight of air have different gravitation, and conſequently different preſſure; the former being explained by a cylinder of the air of the greater altitude, whoſe parts continued of the ſame gravitation; the other by a cylinder of the air of the ſame or poſſibly leſs altitude, but the parts thereof of greater gravity and more denſe. This was farther explained by ſhewing, that the heat and cold working upon the ſame quantity of the air, though it would make the ſame cylinder of a greater and a leſs altitude, according as the heat expanded it, and the cold contracted it; yet would not at all alter the preſſure thereof, there being in both the ſame quantity of gravitating parts.

Mr. HENSHAW moved, that the ſubſtance of this diſcourſe might be drawn up; and that the whole theory might be fully explained, as ſoon as poſſible; the barometer being become an inſtrument of general uſe, and the cauſes and reaſons thereof very commonly debated amongſt the learned.

Sir JONAS MOORE obſerved, that the barometer at Tangier had for near a year very little alteration, but continued always much about the ſame hight.

Previous to the experiment there was much diſcourſe upon thoſe of the laſt meeting concerning the cauſe of fire, and it was generally concluded, that the ſaid experiments farther explained and illuſtrated the theory of fire by the air's conſuming, diſſolving, or corroding the burning body.

Mr. SHERIDAN was admitted; as was alſo Mr. FLAMSTEAD, who had been formerly elected *.

Mr. HOOKE ſhewed an experiment, which he had mentioned at the laſt meeting; the deſign of which was to ſee, whether a coal heated to a degree ſufficient to melt the glaſs, that included it, would by that violence of heat be conſumed or made to ſhine and give light. To this end a piece of charcoal was included in a urinal glaſs ſo ordered by the means of wires, that the charcoal remained in the middle of the belly of the urinal without touching either the ſides or bottom.

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Then

Then this urinal was placed upon a chafing-diſh of clear burning coals, and ſo ſuffered to ſtand till the belly of the glaſs was red hot; at which time the mouth of the urinal was cloſe ſtopped with clay. Then the coals in the chafing-diſh were blowed upon very quick with bellows, whereby the lower parts of the urinal melted, and were thruſt inwards by the coals, on which it ſtood: notwithſtanding which great heat the coal in the middle of the glaſs did not burn or ſhine, or at all ſeem to conſume, till by taking off the clay, that ſtopped the mouth, and blowing in freſh air with the bellows into the body of the glaſs, the ſhining, burning, and diſſolution of the coal plainly appeared: and that coal, which before in a much greater heat had remained black, as if cold, now in a much leſs heat grew all over red, lighted, and preſently after the white aſhes covered its ſurface: which was judged an evident ſign, that the heat of a fire, though exceedingly hot, was not able to burn a combuſtible body without air; and that the air was the body, that wrought the effect upon the combuſtible body.

Mr. GEORGE ENT preſented to the Society for their library a book newly publiſhed by his father Sir GEORGE ENT, in anſwer to a diſcourſe of Dr. THRUSTON about reſpiration [1].

*February* 20. Mr. HENSHAW, vice-preſident, in the chair.

The minutes of the laſt meeting of the 13th being read gave occaſion to diſcourſe farther concerning the theory of the barometer, from what cauſes the alteration thereof might proceed.

Some were of opinion, that the cauſe thereof might proceed from the extraordinary hight of the air only ebbing and flowing as it were like a tide, but with unconſtant motions.

Mr. HOOKE was of opinion, that to this was to be joined the particular and ſpecific gravity of the body of the air, as being charged ſometimes with heavier, ſometimes with lighter vapours or bodies diſſolved into it, or taken up by it. He farther explained how different hights might produce the ſame preſſure, provided there were the ſame quantity of gravitating within the ſame cylinder: and he inſtanced, that a cylinder of the ſame air rarified into greater hight in ſummer could have no more preſſure, than when in the winter time it is condenſed into a much ſhorter. Farther to elucidate his theory of it he added, that he would at the next meeting produce ſome experiments.

Sir JONAS MOORE acquainted the Society, that he had by him ſome papers of Mr. TOWNLEY's obſervations on that ſubject; as alſo ſome late obſervations of Mr. FLAMSTEAD; and that he would produce them at the next meeting.

It was deſired, that the experiments formerly propounded by Mr. HOOKE to

[1] Dr. GEORGE ENT's book was printed at London in 8vo. under the title of ΑΝΤΙΔΙΑΤΡΙΒΗ, *ſive Animadverſiones in Malachiæ Thruſtoni, M. D. Diatribam de Reſpirationi uſu primario.*

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be tried at the column on Fiſh-ſtreet-hill might be anew prepared: and in order thereunto Mr. HOOKE was deſired to provide convenient glaſſes and other conveniencies for the perfecting that trial: and that then the trial might be made again with all the care and exactneſs neceſſary.

Hereupon it was queried, how this experiment of the different preſſure of the atmoſphere came firſt to be thought of; and it was related, that it was firſt propounded by Sir CHRISTOPHER WREN, in order to examine Monſ. DES CARTES's hypotheſis, whether the paſſing by of the body of the moon preſſes upon the air, and conſequently alſo upon the body of the water: and that the firſt trial thereof was made at Mr. BOYLE's chamber in Oxford.

Mr. HENSHAW deſired, that Mr. HOOKE would again ſhew this experiment, which he had formerly produced, in order to explain his hypotheſis of the reaſon of the alteration of the preſſure of the atmoſphere.

Dr. GREW deſired, that the hypotheſis, which he had formerly produced to the Society, might be conſidered of; for that he conceived that alone to be ſufficient to explain the whole theory. The ſubſtance of it was, that the preſſure of the air proceeds from the ſalts, that are diſſolved into the air: that theſe ſalts, when they are diſſolved, take leſs room; and ſo the air becomes leſs pent and crowded together, and conſequently preſſes leſs: but when the ſalts are undiſſolved, they take more room, and ſo croud the air more, and make it preſs more upon the ſtagnant quickſilver.

Dr. CROUNE explained alſo his hypotheſis of this phænomenon, which was to this effect [k]:

It was thought very deſirable, that queries ſhould be made concerning the different gravitation and preſſure of the atmoſphere in ſeveral parts of the earth, that by the comparing theſe together the theory might be thereby compleated.

Mr. HALLEY affirmed, that he had made obſervations of the hight of the mercury in the barometer at St. Helena; and that he had found the hight thereof but twenty-ſeven inches at the top of the hill, when it was twenty-nine inches at the bottom near the water-ſide.

Mr. EDWARD TYSON [l] was propoſed candidate by Mr. HOOKE, as being very curious in anatomy, and one who would be very uſeful to the Society in producing obſervations of that kind.

Upon reading the account of the experiments ſhewn at the laſt meeting for explaining the hypotheſis of fire, and particularly that of the ſaltpetre, Sir JONAS MOORE was very deſirous to know by what means he might certainly find what quantity of ſaltpetre any gunpowder, which he was to examine, contained.

[k] This minute is left thus imperfect. [l] He was then M. A. and afterwards M. D.

And

And he received for anſwer, that he might eaſily be reſolved in that inquiry, if he took a certain quantity of the powder, which he deſigned to examine, and ſteeped it in ſo much water, as would diſſolve all the ſaltpetre contained in the powder; then filtred the water through cap-paper, and gently evaporated the ſolution in a broad glaſs veſſel; for by the remaining ſalt after evaporation he would eaſily know what quantity of it each pound or barrel of gun-powder contained.

He remarked, that there was great difference in the goodneſs of ſeveral ſaltpetres: that the Dutch petre would waſte but four pounds in the hundred; but that Engliſh petre would waſte eighteen.

Sir WILLIAM WALLER was unanimouſly elected.

Mr. HOOKE produced two experiments in order to make his theory of fire more evident.

The firſt was a charcoal weighing an hundred and twenty-eight grains put into a box of iron with ſand enough to fill the cavity of the box not filled by the charcoal, and therein ſcrewed up very cloſe by an iron ſcrew-pin. Then it was put into the fire, and there for the ſpace of two hours kept very hot, viz. of a bright red hot. After which the iron was taken out of the fire and ſuffered to cool; then opened; and the coal being taken out and weighed, was found to have loſt but a grain and half of its weight; which was attributed to the moiſture, that might be in the ſaid coal when put in. It was farther remarkable, that the ſhape of the out-ſide of the coal was not altered, nor any way conſumed.

The ſecond experiment was the ſetting of a crucible full of nitre in a very hot fire; in which it was made red-hot, and the petre was found not to burn till a ſulphureous ſubſtance was put into it, ſuch as wood, coal, brimſtone, or the like, upon the injecting of any of which there were preſently produced a fire and flame, by which thoſe ſubſtances were conſumed. Whence Mr. HOOKE argued, that the nitrous part of the petre was that, which corroded the ſulphureous body, and thereby the alcalizate ſalt of the petre was left behind, and augmented by parts of the coal taken into itſelf.

*February* 27. At a meeting of the COUNCIL were preſent

Mr. HENSHAW, vice-preſident, in the chair,

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| Sir JOHN HOSKYNS, | Dr. MAPLETOFT, |
| Mr. HILL, | Dr. CROUNE, |
| Dr. GALE. | Dr. BROWNE, |
| Mr. ALLEN, | Mr. CREED, |
| Dr. GREW, | Mr. HOOKE. |

It was ordered, that Mr. COLWALL be deſired to ſpeak with Mr. CHENEY concerning Chelſea-College, and to know from him what farther intentions he has concerning that intereſt.



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The duty and obligation of the library-keeper was agreed upon under the following heads:

1. The library-keeper ſhall attend two days in the week, viz. on Tueſday and Thurſday; on Tueſday from nine to twelve; and on Thurſday from nine to twelve; and in the afternoon from two till the preſident takes the chair.

2. He ſhall not lend out any book without an order of the council, or the preſident or vice-preſident in the chair.

3. That he ſhall make a perfect catalogue of the printed and manuſcript books after the moſt uſual method.

4. That he ſhall uſe no fire nor candle in the library.

5. He ſhall be provided always of pen, ink, and paper.

6. He ſhall give ſuch ſecurity to the Society for the keeping of the books, as the council ſhall accept of.

It was ordered, that Mr. HOOKE have time till the Thurſday following to conſider of theſe propoſals, in order to return his final anſwer: And,

That upon his refuſal Mr. PERRY [m] have the offer of keeping the library.

At a meeting of the SOCIETY on the ſame day,

The minutes of February 20 being read gave occaſion of diſcourſing farther about the hypotheſis, by which the phænomena of the barometer might be explained: and particularly, whether vapours aſcending or rain deſcending through the air charge the preſſure of the air beneath them with their whole weight.

Upon the mention of ſaltpetre, Sir JOHN HOSKYNS related the manner of making it in the Eaſt Indies to be thus: the inhabitants of the bay of Bengal dig ſmall trenches in the earth; which being filled with water is impregnated with nitrous particles, which being ſuffered to evaporate in the ſun till all the moiſture be exhaled, there will be found about the bottom and ſides of the trench much ſaltpetre, which they rake together, and ſo keep them: and that much was ſcraped off from old walls.

Mr. HENSHAW obſerved, that in raking this nitrous ſalt after this manner, they rake together with the pure ſalt great quantities of the droſs and earth, which are uſually ſold with it: that there was ſome of this refined in India; but that for the moſt part it was brought unrefined; and that it was refined in England by the help of ſome alcalizate ſalts. Mr. HENSHAW was of opinion, that ſaltpetre of itſelf contains no alcali, but that it was produced by fire.

[m] WILLIAM PERRY, M. A. and F. R. S.

Mr.

Mr. HOOKE mentioned the way of making ſaltpetre with ſpirit of nitre and alcali ſalt mixed, whereby it appeared, that ſaltpetre might be compounded of an alcalizate and an acid ſalt mixed together, and ſo coaleſcing into ſaltpetre.

Mr. HENSHAW affirmed, that there was a way, by which the whole body of ſea-ſalt might be converted into an inſipid water, viz. by heating of it very hot, and ſuffering it to run *per deliquium*; then heating the remainder, the whole body of ſalt will at laſt be converted into inſipid liquor, much after the manner, in which Dr. DICKENSON had by long circulation converted the $\frac{1}{10}$ of the body of water into white earth.

Hereupon was occaſioned a diſcourſe about the cauſe of the ſaltneſs of the ſea, ſome being of opinion, that it proceeded only from the heat of the ſun upon the ſea in the Torrid Zone, though the greater part were of opinion, that it proceeded from the diſſolution of the ſalt minerals of the earth, either at the bottom or ſides of the ſea, or brought into it by ſalt ſprings made by the rain waters paſſing through ſalt mines.

Mr. HALLEY related two magnetical obſervations, which he had made in his voyage to Saint Helena:

The firſt was, that the dipping needle lay horizontal at about fifteen degrees on this ſide of the Æquinoctial line:

The ſecond was, that northward of that place an iron being held perpendicular, the lower end would attract the ſouth pole, and ſouthward of it the lower end attracted the north.

The reaſon of which Mr. HOOKE ſuppoſed to be, becauſe the northern magnetical pole (as he had formerly ſhewed at the Society from the examination of the variations obſerved in captain JAMES's voyage to Hudſon's Bay) was placed beyond the pole of the earth towards our horizon, and not between the pole of the earth and us, as Mr. BOND ſuppoſed; and becauſe the motion thereof was from weſt to eaſt contrary to what Mr. BOND ſuppoſed; which was, that it moved from eaſt to weſt: and becauſe that the ſaid pole was within the body of the earth, and not in the air, as Mr. BOND ſuppoſed.

The experiment ſhewed by Mr. HOOKE was to ſhew, that vapours preſs only according to their own gravity, and not according to the ſpace, which they take up in the atmoſphere. This was done by a bladder blown up under water: but the conſequences of it not being ſo evident to ſome of the members preſent, it was deſired, that ſome more convenient glaſſes ſhould be prepared for it againſt the next meeting.

*March* 6. At a meeting of the COUNCIL were preſent

Mr. HENSHAW, vice-preſident, in the chair,

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| Sir THEODORE DE VAUX, | Dr. MAPLETOFT, |
| Sir JONAS MOORE, | Mr. HILL, |
| Dr. CROUNE, | Mr. HAAK. |
| Dr. GREW, | |

It was ordered, that Mr. HOOKE ſhall employ ſuch perſon as he has propoſed or the writing letters, as he ſhall think fit.

At a meeting of the SOCIETY on the ſame day, Mr. HENSHAW, vice-preſident, in the chair.

The minutes of February 27, being read gave occaſion of diſcourſing farther of the nature of ſaltpetre.

Mr. HENSHAW was of opinion, that common nitre contains no alcalizate ſalt, till it is actually produced in it by heat; and that the heat alone without actual burning or inflammation would produce the ſame quantity of alcalizate ſalt, as would be produced from it by the burning it with charcoal, ſulphur, or the like.

Mr. HOOKE conceived, that nitre from its manner of production might be ſuppoſed to conſiſt of two kinds of ſalts united together into one *compoſitum*; the one a very volatile and aerial ſalt rarefied and flying in the air; the other an earthy fixed and alcalizate ſalt mixed with the earth, by the union of which with one another they become ſtrictly joined into one body, which compoſes a vitriolate ſalt.

Objections were made againſt the ſuppoſition, that the ſea receives its ſaltneſs from the parts of the earth contiguous to it: and it was ſaid, that there was known but one lake in the world, that yielded ſalt water, though it is moſt probable, that, were that the cauſe, there would be many more found to contain ſalt water.

The manner of the dipping or inclination of the magnetical needle below the level was explained from the ſuppoſion of the magnetiſm of the earth; and the reaſon was ſhewn, why the dipping needle lies horizontal within the Atlantic Ocean at fifteen degrees of northern latitude.

The experiment produced was to examine the gravitation of bodies mixed with the air, but not united perfectly with it. But Mr. HUNT the operator not being able to procure convenient glaſſes, it was not farther diſcourſed of till the next meeting.

A diſcourſe was held about gun-powder, aurum fulminans, & pulvis fulminans.

*March* 13. Mr. HENSHAW, vice-preſident, in the chair.

Monſ. SPANHEIM was admitted fellow.

The minutes of March 6th being read gave occaſion to diſcourſe farther about nitre, gun-powder, aurum fulminans & pulvis fulminans. And it was conjectured, that charcoal in gun-powder is of uſe chiefly upon the account of its containing a good quantity of alcalizate ſalt, and not ſo much on that of its being apt

apt to take fire; ſince it was obſerved, that pulvis fulminans, which was found to be much ſtronger, would be kindled without any mixture of charcoal or any other vegetable body. The like alſo was conceived to be the cauſe of the fulmination of aurum fulminans: and much was ſaid about the exiſtence of alcalizate ſalt in ſaltpetre. But there being no certain experiment alledged, that cleared that queſtion, it was referred to another occaſion.

In order to the better explaining the hypotheſis about fire, the experiment of the box for ſhewing the uſe of air in burning was again produced; and upon ſeveral trials with lighted coals ſet in an iron grate within the ſaid box, and blowed on with bellows ſhut up with them, ſo as only to make the included air circulate and work upon them, it plainly appeared, that the air, after it had been ſatiated by diſſolving and burning the lighted coals, was no longer able or fit to continue that diſſolution. But the coals ceaſed their ſhining and conſuming, and became black, without having any aſhes remaining on them: which farther ſhewed, that the uſe of bellows in blowing a fire is not the removing of thoſe aſhes, as was generally ſuppoſed; but the blowing upon the burning body a greater quantity of unſatiated air, which, like a new and hungry menſtruum, ſhould more powerfully work upon, conſume, and burn the heated body prepared thereby for that operation.

To make this theory yet more plain, another experiment, which had alſo been produced to the Society, was again ſhewn, viz. the putting a lighted wax candle through the top of the box into the ſatiated air within it. And it was by often repeating the experiment found, that the flame of the candle would immediately ceaſe as ſoon as the wick came within the body of the ſatiated air, and the ſteams of the candle aſcended without diſſolution or ſhining.

To make the matter yet plainer, the box was opened, after the coals ſeemed quite extinct, and the freſh air being blown upon the coals with the bellows, lying ſtill in their former poſture, they were immediately all of them again rekindled, and appeared to burn and ſhine as before, and the ſame candle being then again kindled without, and let into the ſame box, by the ſame hole as before, it was not extinguiſhed, but remained burning in the box, as if it had been in the open air.

Dr. GREW produced, &c. [a].

*March* 20. Mr. HENSHAW, vice-preſident, in the chair.

The minutes of March 13, were read, which gave occaſion to diſcourſe concerning the ingredients of gun-powder.

Mr. HOOKE conceived, that one great cauſe of the ſudden expanſion of the

[a] This minute is left thus imperfect in the Journal, vol. vi. p. 166.

powder

powder was the operation of the alcalizate ſalt in the charcoal, that ſerved to compound the powder.

Sir JOHN HOSKYNS doubted of this, querying by what means we are aſſured of there being alcali in coals; and whether it could be thence extracted without actually reducing it to aſhes. To which it was anſwered by Mr. HOOKE, that though poſſibly it could not be actually extracted in the form of an alcali ſalt, yet that it produced its effects as much as if it were reduced; as appeared from the effects of it upon iron and copper in reducing them into ſteel and braſs. Beſides that the effect thereof ſeems manifeſtly to be the very ſame with the alcali in the pulvis fulminans, which is made of nitre and ſulphur in the ſame proportions, as in gun-powder, and differs only from it in having an alcalizate ſalt mixed with the other ingredients inſtead of powder of charcoal: and that the ſudden expanſion in each of them was occaſioned by the ſalts working one upon the other in the way of diſſolution: that DES CARTES's hypotheſis of the turbinated motion of the nitrous parts is not ſufficient to account for the effect; nor was there any ground to believe ſuch a motion.

Sir JOHN HOSKYNS urged, that as there was very little alcali to be extracted out of a ſmall quantity of coal any way, and ſo it was not likely to be the cauſe of ſo great an effect, ſo that even of that, which was, a great part of it would be left behind, after the gun-powder was fired in a muſket-barrel or the like; ſo that it ſhould rather ſeem, that the alcalizate part is uſeleſs and inſignificant, it being none of the parts, that expand and fly away.

Hereupon it was mentioned, that ROGER BACON in a book of his called *De mirabili poteſtate Artis & Naturæ*, had manifeſted by an enigmatical deſcription thereof, that he well underſtood how to make gun-powder, or a compoſition, which ſhould perform the ſame effect: for in the edition of that book by ORONTIUS FINEUS in 1542, p. 44, he ſays: "Præter hæc vera ſunt alia ſtupenda naturæ; "nam ſoni velut tonitrua poſſunt fieri in aere, immo majore horrore, quam illa, "quæ fiunt per naturam: Nam modica materia adaptata ad quantitatem unius "pollicis ſonum facit horribilem, & coruſcationem oſtendit vehementem. Et hoc "fit multis modis, quibus omnis civitas & exercitus deſtruatur ad modum artificii "GIDEONIS, qui lagunculis fractis & lampadibus, igne ſaliente cum fragore ineſ- "fabili Mædianatarum deſtruxit exercitum cum trecentis hominibus. Mira ſunt "hæc, ſi quis ſciret uti ad plenum in debita quantitate & materia." And p. 52. "Item totum ſic; ſed tamen ſatis petræ LVRV Vo Ro Po Vir Can Vtriet "ſulphuris; & ſic facies tonitruum & coruſcationem. Sic facies artificium. Vi- "deas tamen utrum loquor in ænigmate vel ſecundum veritatem."

It was deſired by that Society, that as many books, as could be procured of the ſaid ROGER BACON, ſhould be peruſed; and it was wiſhed, that they were all collected and printed, as being ſuppoſed to contain very many curious and uſeful matters.

Dr. GALE affirmed, that he had collected as many of the works of this author, as

as he could procure; and that his copy was that of Dr. LANBAINE, who had been very diligent and curious in that reſpect. Dr. GALE remarked likewiſe, that the king had a book of ROGER BACON out of Dr. PRIDEAUX's library, called the *Opus Majus:* and that his book of the prolongation of life, which was ſuppoſed to be loſt, was affirmed by Dr. PLOT to be in the Bodleian Library; Dr. GALE adding, that he had the ſame book.

Dr. PLOT was deſired to inquire what other works there were of BACON beſides thoſe in the poſſeſſion of Dr. GALE, who affirmed, that his collection was full as good as that of Dr. MARSH at Dublin, whoſe copy of BACON's works was ſuppoſed to be the faireſt extant.

Dr. PLOT mentioned, that there was one book of ROGER BACON in the library of Univerſity-College at Oxford, which he thought to be no where elſe in the world: and that Dr. LANBAINE had made an epitome of all the contents of the works of that writer, as he had alſo of all the manuſcripts in the Bodleian Library.

Dr. GALE promiſed to lend his copy to Mr. HOOKE to peruſe, when he ſhould call for it.

After this the diſcourſe was about fire, flame, heat, &c. and ſeveral objections were made againſt Mr. HOOKE's hypotheſis of explaining it by the diſſolution of bodies by the air. It was ſuppoſed, that the fire went out when all the pores of the air were filled ſo, as there was no more ſpace left for the vapours and ſmoke to fly out of the coal. To which he anſwered, that the want of room could not be the cauſe of the extinction of fire, becauſe if the air were drawn out of the veſſel, wherein a candle or coal were burning, it would yet ſooner go out; whereas there was thereby manifeſtly made more room; and upon the forcing and compreſſing more air into a veſſel, the fire would continue ſo much the longer burning.

Dr. CROUNE ſuppoſed, that the ſpring of the air * * *.

Dr. HOLDER was of opinion, that the ſmoke is lighter than the air whilſt dry; but that meeting with the moiſture of the air it is precipitated down again, being made heavier.

The experiment of the ſand falling in water, in order to examine how much the preſſure of the water was altered thereby, was tried; but Mr. HUNT being unable to blow down to the bottom of the tube, it could not be certainly obſerved.

The ſame and another experiment were deſired to be ſhewn at the next meeting.

* This minute is left thus imperfect in the Journal, vol. vi. p. 168.

1679.

1679. *March* 27. Mr. HENSHAW, vice-preſident, in the chair.

The minutes of March 20 being read gave occaſion to diſcourſe farther concerning the works of ROGER BACON; and it was judged very deſirable, that all his works might be printed together: but that before this undertaking were begun, all imaginable care ſhould be uſed to inquire what parts of his writings may lie diſperſed in private libraries more than are to be found in the public; as his *Computus Naturalium* is in the library of Univerſity-College, and not in the Bodleian.

Mr. AUBREY affirmed, that Mr. WOOD in his Engliſh edition of the antiquities of Oxford [p] had given a more particular account of ROGER BACON's life, and had inſerted a catalogue of his works.

Mr. AUBREY was deſired to write to Mr. WOOD to ſend his catalogue of ROGER BACON's works.

He propoſed, that there might be a catalogue made of all the books and treatiſes written and publiſhed by any of the members of the Society; which might then be more eaſily done, than if it ſhould be omitted too long.

Dr. PLOT thereupon propoſed it as a thing very deſirable, that a general catalogue might be made of all the manuſcripts, that could be found in England, whether in public or private libraries.

Dr. GALE moved, that Mr. HOOKE might peruſe the epiſtle of ROGER BACON to Pope CLEMENT, and take notice of what was conſiderable about any invention ſuppoſed to have been the product of a much later age; ſince in that epiſtle, as Dr. GALE conceived, is the epitome of all his inventions mentioned elſewhere in his works: and that therefore Mr. HOOKE might ſoon ſee what might be expected.

Dr. PLOT was deſired to collate it with the Oxford manuſcripts.

He obſerved, that there was in ſome part of ROGER BACON's works mention made of a way of blowing up a ſhip, that had been ſunk; which was by conveying fire down to the bottom of a ſhip through a pipe filled with a compoſition like gun-powder, and ſo ſetting fire to it.

Mr. HENSHAW related an experiment of making a piece of iron red hot by hammering, which was, that a ſmall bar of iron about the bigneſs of one's finger forged to a ſmall point, and then very nimbly hammered on an anvil, would by the continuance thereof be made red hot without the help of any other heat.

Mr. HILL propoſed, that it might be tried, whether any thing either natural or

[p] This Engliſh edition was never printed.

artificial

artificial would burn in or under water. To which Mr. Hooke anſwered, that this effect might be performed with gun-powder.

*April* 3. ; Mr. Henshaw, vice-preſident, in the chair.

The minutes of March 27. were read, which gave occaſion to diſcourſe farther concerning the writings of Roger Bacon.

Dr. Gale produced a paper containing an account of an experiment pretended to be made by the ſaid Roger Bacon, with a hazel rod, as it was deſcribed out out of a part of his works, called *De Motu Naturali Mirabili*, viz. "Surculus "unius anni ſuſcipiatur, qui oritur juxta radices coryli, & ſecundum ejus longi- "tudinem dividatur, & ſeparentur partes diviſæ per ſpatium palmæ ſeu quatuor "digitorum; & unus teneat ex una parte extremitates duarum partium, & alius "ex alia parte ſimiliter; & ſemper teneat æqualiter & leviter, ita quod ſicut par- "tes in toto fuerant contra ſe poſitæ, ſic teneantur infra ſpatium dimidii millia- "ris; incipient partes virgæ ſibi appropinquare paulatim, ſed fortius in fine, ut "tandem omnino concurrant & ſint ſimul, extremitatibus tamen exeuntibus di- "verſis; quia per violentiam detinentium præpediuntur: & eſt hoc valde admi- "rabile."

Mr. Hooke was deſired to conſider of that paper, to ſee if he could explain the meaning thereof.

Mr. Aubrey was deſired to write to Mr. Anthony Wood, to underſtand from him what account he deſigned to publiſh of Roger Bacon in his hiſtory of the antiquities of Oxford, now printing in Engliſh.

Mr. Hill mentioned a manuſcript of Roger Bacon in the poſſeſſion of Dr. Windet [a], intitled, *De Dictis & Factis falſorum Mathematicorum & Dæmonum.*

The vice-preſident was of opinion, that the catalogue of his works was not proper to be printed, till a farther ſearch had been made.

Mr. Moses Reusden, recommended by Mr. Evelyn, ſent in to the Society a treatiſe of his of the nature of bees, intitled, *Monarchy founded in Nature, and proved by the Hiſtory of Bees; ſhewing their admirable natures and properties, their monarchical government, and their wonderful generation; with a diſcovery of improving them, by taking their honey without deſtroying the bees; with particular direction for keeping them in colonies. By Michael Reuſden, apothecary, bee-maſter to his majeſty; dedicated to the king's moſt excellent majeſty.*

The contents of the ſeveral chapters being read, the author was called in, to know what his deſires were, which he expreſſed to be, to have his treatiſe peruſed by the Society; and that, if they ſhould think fit, upon their ſcrutiny and exa-

[a] James Windet, M. D. author of the book *De Vita ſanctorum ſtatu.*

mination thereof, they would grant him a license for printing it. Being asked several questions, he answered concerning his experience, that he had made many observations and experiments on bees for four years past, after this new way: That the bees slept almost all the winter, and did not spend upon their stock. That he had read Mr. BUTLER, and divers other authors, about bees: and that in what particulars he differs from them, he assigns both his experiments and reasons for so doing. He was willing to leave his book with the Society for their perusal, and was appointed to come again at the next meeting, it being recommended to Dr. CROUNE to perufe the book, and to give his opinion of it.

A farther discourse was held concerning ROGER BACON, and Dr. GALE produced the following extract from his own manuscript, p. 684 of that writer, *in arte experimentali*, containing the description of gun-powder: "2. Quædam ex-"perimenta tantum terrorem visui incutiant, quod coruscationes nubium longè "minus & sine comparatione perturbant; & experimentum hujus rei capimus ex "hoc ludicro puerili, quod sit in multis mundi partibus, scilicet, ut instrumento "facto ad quantitatem pollicis humani ex violentia illius salis, qui sal petræ vo-"catur, tam horribilis sonus nascitur in ruptura modicæ rei, scilicet modici per-"gameni, quod fortis tonitrui sentiatur excedere rugitum, & coruscationem maxi-"mam sui luminis jubar excedat."

Mention also was made of his way of blowing up sunk ships.

Sir JONAS MOORE said, that the way of blowing up ships by gun-powder, to which fire was conveyed under water, by means of a pipe, and a train-match, is now frequently practised, as it was heretofore practised at Woolwich and Sheerness.

He related also an observation of his about red-hot bullets shot out of a gun, that the said bullets would continue as red-hot as they were shot till they fell; which he conceived to be caused by the swiftness of their motions through the air. This, he said, was observed at Hull.

Mr. HOOKE mentioned his observation of the melting of a small particle of steel struck off by the violence of the stroke of a flint; the heating of iron by filing, hammering, grinding, rubbing: that the dust thrown off from the grindstone in grinding knives, razors, and the like, are melted globules of the steel: that the particles of flints and other hard stones upon striking one against the other will grow red-hot and shine; as will also a tobacco-pipe clay, and several other clays and earths hardened by burning.

Mr. HENSHAW observed, that the iron heated red-hot by hammering must be small; otherwise the experiment would not succeed.

Sir JOHN HOSKYNS said, that Mr. AUBREY had lighted a pipe of tobacco by an iron so heated by hammering.

Mr.

Mr. Hooke related, that he had fired a gun-powder ſerpent, which had burnt under water, and came out again burning after it had paſſed through a good ſpace of water.

A diſcourſe then aroſe about ſubſtances burning in water, as camphire, naptha, petroleum, &c.

Dr. Holder related, that ſometimes rivers had been guarded by petroleum ſwimming upon the water; for that any part of it being fired, it would all of it preſently take fire, and ſet fire to the ſhips ſwimming in it: and that the king of Achin was ſaid to have made uſe of it.

Sir John Hoskyns related, that the ſteam of the varniſh uſed by cabinet-makers would ſometimes take fire, and had been obſerved to run along till it ſet fire to the varniſh in the veſſel.

Mr. Hooke related, that he had obſerved ſomething of this nature of oil of turpentine; which being mixed with an acid liquor, ſet it into a moſt violent fermenting, heating, and ſmoking, inſomuch that it could not be endured in the room: being ſet in the chimney corner, where a fire was, the ſmoke immediately caught fire, and burned with a blaze almoſt a yard high.

Mr. Slare preſented the Society with a phoſphorus of his own making, affirming it to be a compound ſubſtance, and not like the Bononian ſtone. This was examined by ſeveral preſent, and judged to be as good as any, which they had ſeen.

Mr. Haak preſented to the Society for their library five ſmall books ſent to him by Christopher Sturmius, profeſſor of mathematics and philoſophy at Altorf; viz. 1. *Diſ*** de Mathematicis.* 2. *De Authoritate interpretum Naturæ ac ſpeciatim Ariſtotelis.* 3. *De Clepſydrarum phænomenis & effectibus.* 4. *De Carteſianis & Carteſianiſmo.* 5. *De Viſionis Organo & Ratione.*

He preſented alſo to the Society for their repoſitory ſome papers of ſalts and ſulphurs, which Mr. George Trumball had taken up and brought from the top of the pike of Tenariffe.

Dr. Grew produced ſome ſalts, which he had extracted out of the waters about London.

He likewiſe communicated ſeveral anatomical obſervations, with the following account of them;

1. *Placenta Uterina Muliebris*, excarnated; that is, with the blood and ſmalleſt capillary veſſels cleanſed away: together with a certain glandulous ſubſtance of a yellowiſh colour being the true parenchyma, by the means of which the ſerum or lymphous part of the blood ſeems to be ſeparated into the membranes of the ſecundine.



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2. The uterus of a bitch, in which the os internum was of a very peculiar ſtructure, being a nervous caruncle opening with four little lips croſs-wiſe; that is, not horizontally, as in other animals, but perpendicularly; whereby the paſſage from the uterus is made more difficult. From which it may be, as from one cauſe, that a bitch is ſeldom or never known to bring an abortive birth.

3. The guts of a caſſiowary with the ſtomach and crop, or rather the gula; this and the rectum being bigger than in a horſe; the ſtomach on the contrary proportionably ſmall, and only membranous, not griſtly.

4. The diaphragm of a cat, divided into two muſcles by two narrow membranes, being two ſemidiameters, and having a third round one in the centre, all three anſwerable to ſo many tendons; by which upon every reſpiration the diaphragm is made to ſtand tenſed and tite like the parchment of a drum.

5. A cat's tongue, which is all over not only rough, but ſharp with bony thorns, ſtanding as the teeth or wires in a wool-card. So that a cat carries her curry comb in her mouth, only uſing her tongue to ſcrat withal, where a dog uſeth his teeth or claws.

6. The cryſtalline humour of a cat's eye, which in drying breaks every where from the centre of both convexities in regular triangles.

7. The foremoſt teeth of the upper chop of a rabbet, which are four. The two outmoſt are the *inciſores*, common to this and ſome other animals; but within theſe are two more very peculiar, which may be called the gage-teeth; becauſe they hinder the other teeth from ſtriking too far, ſo as either to diſlocate the chop, ſtrain the muſcles, or cut the gums; which might otherwiſe eaſily happen in this animal, becauſe the fore-teeth are ſo ſharp and chiſſel-wiſe, and becauſe it cuts or chops its meat ſo quick. And to ſerve the better for the ſame purpoſe, the ſaid teeth are not made ſharp, but flat-headed.

8. The fore and hinder-feet of a rat, together with thoſe of a mole; which being compared ſhewed the exactneſs of their contrivance for the uſe of thoſe animals, the hinder-feet of a rat being at leaſt three times as big as thoſe before; becauſe he often makes ſtrong and high leaps: thoſe of a mole three times leſs, becauſe he works only with his fore-feet.

9. The bony tendons of the leg of a cock, which are alſo in other fowls, being neceſſary to keep the ſtanding poſture more ſteady, as that, in which they keep, as well aſleep as awake.

Mr. Hooke ſhewed an experiment in mechanics; which was a way how to take notice of all the rain, that falls, and was deſigned as a part of the weather-clock. The contrivance of this invention was the ſuſpending the bucket, that was to receive the quantity of rain, that falls at any time (whether more or leſs) ſo that, according to the quantity therein contained, the place thereof ſhould either be

be higher or lower; but certainly determined. This was performed by a counterpoiſe to the ſaid bucket. The counterpoiſe was contrived two ways, either by a ſtring of leaden bullets ſo ordered, that when the bucket was quite empty, all the bullets reſted upon a table; but when there fell as much water into the bucket, as equalled the weight of one of the leaden beads, then the bucket deſcended one ſpace, and one bullet was lifted up; and when twice as much, two bullets, and when three times as much, three bullets were lifted, and ſo forward, till all the bullets were lifted up, and the bucket had deſcended to its place of emptying; whereupon the chain of bullets preſently deſcended and lifted up the bucket into its empty place. But becauſe this motion proceeded with jumps, and was not continually equal, therefore a ſecond contrivance was alſo ſhewn; which was this:

The counterpoiſe to the bucket, when empty, was a cylinder immerſed into water, mercury or any other fluid; which cylindrical counterpoiſe, according as the bucket received more and more water, was continually lifted higher and higher out of the water by ſpaces, always proportioned to the quantity of water, that was contained in the bucket. And when the bucket was filled to its deſigned fulneſs, it immediately emptied itſelf of the water, and the cylinder plunged itſelf into the water, and raiſed the bucket to the place, where it was again to begin its deſcent.

This contrivance here made uſe of was declared to be uſeful for making a new and uſeful beam for examining the weight of bodies without any trouble of adjuſting, the riſing of the cylinder immediately ſhewing the determinate weight of any body put into the ſcale without any farther trouble.

*April* 10. Mr. HENSHAW, vice-preſident, in the chair.

Upon reading the minutes of April the 3d, a diſcourſe was occaſioned concerning the time, when guns were firſt invented and brought into uſe: and it was obſerved by Mr. HENSHAW, that when they were firſt uſed, a bow was joined to the ſame ſtock, which ſerved for the muſket, and thence it was called by MENAGE *Arcubugio*. Theſe were uſed in the time of king HENRY V. which was long after ROGER BACON's time.

Hereupon it was debated, whether SWARTS were the firſt inventor of gun-powder, or only of the method of making uſe of it in guns; and whether he were not rather the inventor of guns than of gun-powder; ſince it was plain from ſeveral paſſages in ROGER BACON's works, that not only that writer was not ignorant of the way of making ſuch a powder, but that even the powder itſelf was very commonly known and commonly made uſe of for making fire-works, not only by boys here in England, but generally in moſt other places. It was therefore deſired, that inquiry might be made into the times of their living.

Mr. HOOKE remarked, that though they had not gun-powder, yet that by the help of great ſprings they were able to do very great things: that beſides divers

other

other ſpringy bodies, they knew the uſe of the ſpring of the air, as is evident in HERO's works, eſpecially in that mentioned by VITRUVIUS for the quenching of fire.

Dr. ALLEN mentioned, that CÆSALPINUS had given a good hint for the circulation of the blood, and was alledged by ſome, as if he had been the firſt diſcoverer. But his concluding his diſcourſe with a query, what became of the blood after it had come into the right ventricle of the heart, plainly ſhewed, that he underſtood not the true circulation of the blood ſince found out by Dr. HARVEY.

Mr. HENSHAW gave an account of ſome trials, which he had made with the phoſphorus preſented by Mr. SLARE. One of which was, that he had found, that it would receive a very briſk light from the evening light of the air, but a very duſky one from that of a candle, and none ſenſible from the rays of the moon. It was deſired, that he would try to increaſe the light of the moon by a burning-glaſs, to ſee whether it would produce any conſiderable effect.

Dr. CROUNE mentioned, that in BARTHOLINUS's *Acta Medica*, there was mention made of two liquors, which being put together produced flame.

Dr. ALLEN read a ſhort account of ſome extracts made by himſelf out of medicinal waters near London, viz.

" *Auguſt* 1, 1663. I diſtilled ſix gallons of Chigwell waters, out of which " I extracted of ſalt ʒx—ϑß, and there remained of calx ʒi. and ϑij.

" I extracted out of the like quantity of the * * waters by evaporation ʒxi. " and ϑi. of ſalt and ʒij. ß. of calx.

" There was of the ſaid ſalt extracted by evaporation cryſtalliſed ʒij. ß. I extracted out of three gallons of North Hall waters of ſalt ʒiij. of calx ʒij. and ϑij. " and from three gallons of Barnet water of ſalt ʒi. and ʒvii. ß. and of calx ʒiij. and ϑ. ß."

Mr. HENSHAW obſerved, that the beſt way of extracting a ſalt was by firſt putrifying the water, letting it ſtand by itſelf, and then diſtilling it.

He added, that ſome ſalts are extremely penetrating, ſo as to pierce through the ſubſtance of the pipkin: and that he had obſerved, that horſe-dung would ſend a volatile ſalt quite through a wall of four inches thick, which would ſhoot and grow on the other ſide into a kind of nitre.

Mr. HOOKE ſhewed his experiment, being an hygroſcope made of ſeveral ſhort gut ſtrings, or any other ſhrinking body ſenſible of the moiſture and dryneſs of the air. Theſe were united together by the means of iron wires made after the manner of beams, that the ſhrinking and ſwelling of every one of them was communicated to the laſt, which moved the index, by which means the leaſt muta-

tions of the air, as to dryneſs and moiſture, were made very ſenſible, and the contrivance of it was ſo ordered, that the leaſt degree of power, which it had to ſtretch or ſhrink the ſtring, would eaſily move and make a ſenſible alteration.

Some objected, that gut ſtrings would in proceſs of time loſe the power of ſhrinking and ſtretching, and ſo were unfit for ſuch a work. But it was anſwered, that thoſe ſtrings were not intended for a conſtant hygroſcope; but only for the preſent uſe, to ſhew the manner how to make uſe of theſe, or any other ſhrinking or ſwelling body for the ſhewing of the effect deſired: and that at the next meeting there would be one of another ſubſtance produced, that would not be liable to thoſe objections.

*April* 17. Mr. HENSHAW, vice-preſident, in the chair.

Dr. GALE produced ſome of Dr. PLOT's queries and other papers, which were diſperſed among ſeveral members of the Society preſent, who had not them before, and were deſired to conſider them, and promote the deſign as much as they could.

After which the minutes of April the 10th being read, and the Society diſcourſing farther concerning the time of inventing gun-powder and guns, Sir JOHN HOSKYNS mentioned the picture of an old muſket in the hangings of the prince's chamber near the houſe of lords, where one holds the gun while another gives fire to it. He added, that KIRCHER in his *Mundus Subterraneus* had collected moſt things concerning guns and gun-powder.

A book of ROGER BACON was produced, called his Epiſtle, which was publiſhed by Dr. DEE. It ſeemed to be on the ſame ſubject with his epiſtle to pope CLEMENT IV. but very much ſhort of that in the poſſeſſion of Dr. GALE. It was deſired, that that epiſtle in the hands of Dr. GALE might be peruſed, to ſee, whether it were fit to be printed, as preliminary to his other works, as ſeeming to contain an account of all his other writings, which were thought very conſiderable, and might prove an honour to the Engliſh nation; eſpecially as he appeared to be the firſt, who had begun experimental philoſophy. Dr. DEE remarked, that he lived about the year 1240: but Dr. CROUNE obſerved, that who was tutor to ROGER BACON lived in the time of king EDWARD I.

Dr. CROUNE gave an account of Mr. REUSDEN's book on bees, which he had peruſed; that the part of it about the education of bees contained many good obſervations well made and related; but that what the author ſaid about the king-bee and its ſperm, out of which he ſuppoſed the bees to be produced, appeared to be mere fancy, and was contrary to the opinion of other writers.

That as to the diſeaſes of bees, JOHNSON affirms, that they will fall into a diarrhæa, and wear away by it.

Mr. HOOKE ſhewed his experiment, which was a way of making an hygroſcope with pieces of elm cut acroſs the grain, the better to be able to be ſenſible of

of the changes of the air, ſo contrived as to make the ſame as much and large as ſhould be deſired. That produced by him conſiſted of twenty-four feet of the ſaid pieces, and might be made of an hundred or two hundred feet of the ſaid pieces, and yet ſo ordered, that the ſhrinking and ſwelling of every foot of it was made ſenſible, and accumulated all in the laſt. He was deſired to complete this invention for the weather-clock, which was now near finiſhed.

Dr. GREW read and delivered in a paper of the things, which he had ſhewn at the meeting of April 3. which paper was to be inſerted in the Journal-book of the Society.

*April* 24. This being Eaſter week very few of the Society met.

Dr. GREW having ſome part of his catalogue of the repoſitory fitted for the preſs, propoſed to read it at this meeting, which accordingly at the deſire of the members preſent he did, after the minutes of April 17th had been read.

Sir JONAS MOORE, the vice-preſident, took the chair; and as ſoon as Dr. GREW had read his obſervations *De Homine*, without at all entering into the debate of the matters, the Society roſe.

*May* 1. Mr. HENSHAW, vice-preſident, in the chair.

A letter from Sir PETER WYCHE, directed to Mr. HENSHAW, dated at Hamburgh, April 18, 1679, was read, giving an account of a packet of letters which he had received from Sir JOHN PAUL, and conveyed by one JOSHUA JOHNSON; offering likewiſe to ſerve the Society to the utmoſt of his power in thoſe parts.

The letter and packet of Sir JOHN PAUL being received and communicated to Mr. PITT was likewiſe produced.

The letter gave an account of his endeavour to procure from Mr. preſident RESEN his collection of new maps and deſcriptions of Denmark, deſired by Mr. HENSHAW, in order to their being inſerted in the firſt volume of *the Engliſh Atlas*, publiſhing by Mr. PITT.

With this letter came a packet from Mr. RESEN, containing firſt his letter, in which he gave an account of his whole undertaking in general, for the particulars whereof he referred himſelf to the other papers, which were then in Mr. PITT's hand, and declared himſelf willing to part with the whole work, now almoſt ready for the preſs, at the ſame rate, which it had coſt him, viz. two thouſand ſeven hundred rix dollars. It was deſired, that Mr. PITT ſhould be conſulted with on this affair, that ſo Mr. HENSHAW might return Mr. RESEN an anſwer ſuitable to the civility proferred in his letter.

Together with this letter were ſhewn two of Mr. RESEN's maps, the one of the iſland of Gothland, and the other of the iſland of Borringholm, both very particularly

ticularly and curiouſly deſcribed: as alſo the firſt ſheet of a diſcourſe of ERASMUS BARTHOLINE, in the preſs, intitled, *De Aere Hafnienſi Diſſertatio*, giving an account of the ſituation and air of Copenhagen.

Dr. GREW then read a part of his deſcription of the repoſitory, being his chapter about animals and animal ſubſtances therein kept.

Mr. HOOKE produced his new way of ordering pieces of elm for the making of an hygroſcope: upon which it was deſired, that there ſhould be one of this kind prepared to ſtand in the meeting-room of the Society: as alſo that a barometer, after Mr. HOOKE's way, ſhould be prepared for the ſaid room.

*May* 8. Mr. HENSHAW, vice-preſident, in the chair.

He returned the phoſphorus preſented by Mr. SLARE, and gave an account of ſome trials made therewith. Among many others it was very remarkable, that by ſeveral trials he could not perceive, that the light of the moon had any ſenſible operation upon it at all, though he had tried it to the beſt advantage. And Mr. HOOKE ſuggeſting, that poſſibly by collecting the radiation of that body by a burning-glaſs, it might have ſome ſenſible effect of the ſtone, it was deſired, that he ſhould make trial thereof between that and the next meeting, and give an account of it.

The maps and ground-plots of ſeveral towns in Denmark ſent by Mr. RESEN to Mr. HENSHAW were produced and ſhewn.

Dr. GREW read a ſection of his diſcourſe and deſcription of the repoſitory.

Mr. HENSHAW obſerved by the way, that rivers, which are much frequented by crocodiles, have their water made ſo offenſive by their muſky ſmell, that they cannot be made uſe of by the inhabitants for drinking.

Mr. CRISP related, that in ſome of the rivers of Africa, where the Gambia company trade, crocodiles are ſo frequent, that twenty or thirty ſometimes will follow a bait upon thoſe rivers.

Sir JOHN HOSKYNS mentioned an old ſtatue at Rome of the river Nile, wherein men were carved killing of crocodiles.

Several queries were made concerning the rattles of rattle-ſnakes, whether they were the epiphyſis of the tail-bone, or the end of the ſkin caſt off every year?

As alſo concerning the unicorn's horn, whether it were the horn or rather the tooth of the fiſh caught about Greenland?

Mr. HOOKE produced and read a paper, containing a deſcription of the way of flying, invented and practiſed by one Monſ. BESNIER, a ſmith of Sable in the

county of Mayne, the contrivance of which conſiſted in ordering four wings folding and ſhutting like folding *, to be moved by his hands before and legs behind, ſo as to move diagonally, and to counterpoiſe each other: by which he was, it was ſaid, able to fly from a high place croſs a river to a pretty diſtance.

Dr. CROUNE remarked, that in the Paris Gazette there was mention made of one, who had lately flown there from the top of a ſteeple to the ground at a conſiderable diſtance, and had lighted ſafe.

He obſerved likewiſe, that the bodies of fowls were made in all parts light and ſtrong, and particularly in their bones.

Mr. HOOKE produced a model of the contrivance of the wings made with paſtboard, whereby both the manner of the motion of them diagonally, and alſo of their opening and ſhutting, was explained; though he ſuppoſed that not to be the beſt way contrived for the performing that effect after that manner, but that the ſame ſort of wings might be much more advantageouſly made and uſed for that effect.

Sir JONAS MOORE related, that one Mr. GASCOIGNE had, above forty years before, made a contrivance for flying, by which he had been able to make a boy at Knareſborough fly a conſiderable way; but that he being frightned in his flight by the acclamations of the ſpectators, fell down before he deſigned to alight, and though not much hurt, would not attempt it any farther.

Mr. HENSHAW conceived, that by reaſon of the weakneſs of a man's arms for ſuch kind of motions, it would be much more probable to make a chariot or ſuch like machine with ſprings and wheels to move the wings, that ſhould ſerve to carry one or more men in it to act and guide it.

Several relations were mentioned of the ſtrength of the wings of fowls, and amongſt the reſt, Mr. HENSHAW took notice, that he had known a man of fifty years old beat down by the ſtroke of the wings of a ſwan.

Mr. DANIEL COLWALL preſented to the Society for their repoſitory the pizzle of an unicorn fiſh.

*May* 15. Mr. HENSHAW, vice-preſident, was preſent, but the Society did not ſit.

Monſ. ROMER of the royal academy of ſciences at Paris was admitted to be preſent, while Dr. GREW ſhewed ſome anatomical obſervations, and left the paper deſcribing them to be inſerted in the Journal.

1. The ſkin of a man's head, and part of that of the arm, both tanned, making almoſt as tough and firm leather, as that of any cow's hide.

Theſe

Theſe two pieces compared together ſhewed the thickneſs of the ſkin in the hinder part of the head and neck eſpecially above what it is in other parts, the better to ſecure the brain and ſpinal marrow from cold.

2. Part of the membranes of the abdomen of a flying ſquirrel, which is all the muſcles, which that animal hath there to make him the lighter for his high leaps and falls.

3. The prickles of a hedge-hog, the fibres of which give them their ſtrength and ſtiffneſs, ſtanding all round in the circumference as in a wheaten ſtraw; in the middle ſpungy like a quill or ſoft pith, for the greater lightneſs.

4. The foremoſt and hinder claws of a cat; the latter but four, the former in number five; the latter very blunt and broken-pointed; the former always as ſharp as needles, very like in ſhape to the claws of a tyger.

5. Part of the pia mater of a bull's brain duplicated between the cerebrum and the cerebellum, being half an inch thick.

6. The tongue of a trout, whereon there are four ſharp hooks, two on each edge, ſo that this fiſh may be ſaid to angle with his tongue.

7. The bony fibres of the chap-muſcles of a lobſter ſo made for greater ſtrength and ſteadineſs in apprehending the prey.

8. Stones out of a woman's gall, always angular, as here, and not round, as the bezoar is.

9. Two bones taken out of the heart of a cow, which ſeemed to be as hard and white, and therefore as full of volatile ſalt as thoſe in a ſtag's heart: of what ſpecial virtue it was no certain experiment had been made.

10. The weaſand of a caſſawary, together with the tongue.

This gave an ocular demonſtration of a miſtake of ALDROVANDUS, who affirmed, that this animal hath no tongue; and to whom Mr. WILLUGHBY alſo in his *Ornithologia* ſeemed to aſſent.

In this weaſand the rings were entire, but cartilaginous, and very ſoft.

At the bottom of it towards its diviſion into the two lobes of the lungs are two muſcles, one on each ſide, which ſerve to put it down, or draw it on one ſide or the other, according as there is occaſion to give way to the deſcending meat or the gorged ſtomach.

11. The weaſand of a Japan peacock.

At the lower end thereof are a pair of muſcles for the ſame purpoſe as in a caſſawary.

The rings are intire, and hard and bony.

At the upper end next the epiglottis is a ridged prominency in the middle.

12. The weaſand of a dog, wherein the rings are not intire, but their ends joined by a membrane, which runs through the length of the weaſand.

By theſe compared together it appeared whence in part theſe and other animals have either a tunable, that is, variable voice, or how a ſtrong one. That of a dog is variable, partly becauſe the rings of the weaſand not being intire are dilated or contracted, according as the dog's voice is bigger or ſmaller.

That of a Japan peacock is little variable, becauſe the rings being intire can neither be dilated nor contracted; yet it is very ſtrong and loud, becauſe the rings are not ſoft, but hard and bony, the prominency above-mentioned adding alſo to the ſhrillneſs of the ſound.

That of a caſſawary is neither variable nor loud, becauſe the rings are both intire and ſoft.

13. The kidnies of a cat in two figures: the former ſhewing the inoſculations of the veſſels or veins on the outſide, the coats being taken off; the other the inner part of the kidney, cut down the middle length, ſhewing the three diſtinct regions of the kidney, viz. the glandulous, the fibrous, and the middle, where the glands, fibres, and veſſels, all meet together; being a curious mechanical contrivance for the ſeparation of the ſaline ſerum of the blood from its oleoſe parts. For by the veſſels or arteries the blood is brought to the middle region, where the glands and fibres meet, and are mixed; the ſaline ſerous part is readily received or imbibed by the lean fibres, and by them carried off into the pelvis; the oleoſe and gummous part by the fat or unctuous glands, and by them is diſcharged back into the veins.

14. The ſkulls of a weeſel and polecat.

15. The ſkull of a fox.

16. The ſkull of an owl.

17. The ſkull of a rabbet.

In which, among other things, is obſervable the various opening of the ear. In a polecat and weeſel it opens level and forward, the concha being prominent juſt behind, as moſt proper for theſe animals, that ſeek their prey or food neither above nor below, but on the ground. In a fox it opens alſo forward, and the bone prominent behind, but obliquely downward, the better to caſt into the ear a ſound, that comes from above, proper for his watching of fowls, at rooſt. In an owl it opens

opens alſo forward, and is prominent behind, but obliquely upward; proper for his taking of any noiſe below him, as he ſits in a tree, or is pearched elſewhere. Contrary to all the reſt, a rabbet's ear opens backward, having a ſyphon or tubulary bone about a quarter of an inch long, reclinated or pitched obliquely backward on the entry of the tympanum, made proper for the animal to hear all noiſes, as he ſtands ready for flight. And it is obſerved, that a rabbet always hearkens with his breech towards you.

18. The ſkull of a cat, in which the hardneſs of the concha above what appears in the ſame bone of many other animals is obſervable; as alſo its thinneſs, whereby there is made a very ſtrong repercuſſion of the ſound, ſo that it ſeems, that this animal hath a quick ear.

The cranium of the cat is divided perfectly into two rooms, one for the cerebrum, the other for the cerebellum: whereby perhaps this animal's brain is more ſecure from turning, as we ſay; that is, the cerebellum preſſing on the cerebrum, as ſhe runs along very high and ſteep places.

The atlas of a cat hath a *proceſſus dentiformis* contained in the cavity of the next vertebra by a ſtrong tranſverſe ligament.

The bone over the cerebellum of a fox is like a curious canopy in the ſhape of a ſcollop ſhell. Here alſo is obſervable the amplitude of the temporal muſcles by the ſtanding out of the bones to give way to them.

The great and upper teeth alſo of a fox have a triple indenture; thoſe of a dog but a double one.

It is likewiſe obſervable, that the long teeth in a fox or dog are ſo placed, and the jaw ſo ſhaped, that the great ones only meet; theſe never, leſt upon the breaking of bones they ſhould break or looſen one another.

Mr. Hooke gave an account of his trials made with the phoſphorus of Mr. Slare, that having expoſed it for ſeveral minutes to the rays of the moon at full and near the meridian, he could not perceive the leaſt appearance of light, though carried into a very dark room; and that he was not able to find any effect of the light of the moon, tho' caſt upon the phoſphorus by a large reflecting burning glaſs: which agreed with the obſervations made of the ſame by Mr. Henshaw.

The experiment deſigned to be exhibited by Mr. Hooke being an experiment of light to be ſhewn by the rays of the ſun, could not be performed by reaſon that the afternoon proved cloudy.

*May* 22. Mr. Henshaw, vice-preſident, in the chair.

The minutes of May the 8th and 15th were read: whereupon the cauſe of the faintneſs of the beams of light reflected from the full moon were farther diſcourſed of,

of, upon the occaſion of their not producing any ſenſible effect upon the new phoſphorus.

Dr. GREW read the third part of his deſcription of the repoſitory, being about the flying animals there kept.

Dr. PLOT mentioned an invention made by a perſon in Kent, which was a kind of clock made by the paſſing of fine ſand through a ſmall hole ſomewhat after the way deſcribed by BELFORIUS.

Hereupon mention was made of divers other ways of making hour-glaſſes or clocks, viz. by the paſſing of the air, incloſed by an inſtrument, through a very ſmall hole.

A ſtranger being preſent, the weather-clock now finiſhed by Mr. HOOKE was omitted to be ſhewn till the next meeting, when it was to be carried to Mr. HUNT's lodging, that he might attend it and ſupply it with freſh papers.

Mr. HOOKE then had leave to introduce Monſ. PAPIN, a gentleman, who ſtaid in the outer room with an intention to ſhew an experiment to the Society, which was ſingular and new.

He being brought in, ſhewed a ſmall glaſs, which he had in his pocket, wherein were contained ſeveral ſmall pieces of hartſhorn, which he had ſoftened by a new way, that he had found out, of boiling them. Theſe pieces were examined by cutting and biting, and were found to be not much harder than a ſticky and ſeeded carrot-root.

He affirmed, that he had a method of ſoftening other bones alſo by boiling, and likewiſe ivory.

Being demanded, whether any of the ſubſtances ſo ſoftened would by keeping, or any other way, that he knew of, be again hardened? he anſwered, that he was not ſure of that effect; though he thought, that theſe ſubſtances, which were this way ſoftened, could ſcarce be reduced to their former ſolidity.

He was deſired to try what effect this kind of boiling might have upon barley, wheat, malt, or the like for making liquors: as alſo, to let the Society ſee an experiment of its effects upon other kinds of bony ſubſtances, and fleſh; which he promiſed to do.

*May* 29. Mr. HENSHAW, vice-preſident, in the chair.

Monſ. PAPIN, as he had been deſired at the laſt meeting, produced three glaſſes of liquors made by his trials upon wheat, barley, and malt, boiled after his new way, to ſee what effect it would have on liquors. They were found to be very ſtrong

ſtrong tinctures of thoſe ſubſtances; but being but ſmall quantities, and not fermented, little could be determined concerning them.

The minutes of May the 22d being read, Mr. HENSHAW produced a piece of the hartſhorn, which was ſo very ſoft at the laſt meeting, and was now hardened again to a very great degree, and very white: but upon ſcraping of it, it was obſerved to be much more brittle than common hartſhorn, the greateſt part of the glutinous gum thereof having been fetched out of it by the boiling. Nevertheleſs it was ſuppoſed, that this, as alſo ivory, might be very uſeful in mechanical matters, by reaſon of its eaſineſs to be carved and ſhaped when ſoft, and its hardening again ſo quickly to ſo great a degree with whiteneſs.

Query, whether it might not be dyed into various colours, when ſo ſoftened, or after it is again hardened.

Monſ. PAPIN then produced ſome calve's feet dreſſed after the ſame manner; which being examined, were found to have the bones thereof ſoftened, as the hartſhorn was at the laſt meeting, and the fleſh thereof was notwithſtanding very well taſted, and as firm as if boiled the common way. He was deſired to communicate to the Society what farther proſecution he made of this his new invention.

Dr. GREW produced and read two letters, the one from Dr. COLE, the other from Mr. RASTELL incloſed in the former, containing a deſcription of the way of making ſalt at Droitwich, in anſwer to the queries, which had formerly been ſent to Cheſhire; together with the quality, virtues, and uſes, of that ſalt, brine, and ſalt-ſpring.

Mr. HOOKE read a tranſlation of a chapter of the Italian book of father FRANCISCO LANA, intitled *Prodromo*, being an explication and demonſtration, as he ſuppoſed, of a way to make a veſſel to ſwim and float in the air, ſo as to carry in it one or more men with other heavy bodies, invented, as he ſays, by himſelf, in order to make flying practicable, which had before been thought impoſſible [a].

Mr. HILL produced from Mr. THOMAS CRISPE a parcel of grain gold, which Mr. HOOKE having examined with a microſcope, found to conſiſt of ſmall bulks of very irregular figures; but that moſt of them ſeemed to have been melted, all the angles of them being round and ſwelling, and not at all like the angles of ſand, which are ſharp; and it was conceived, that the ſame kind of figures would be produced, if the gold, when melted, were daſhed into a heap of ſand.

The Society then went to take a view of the new weather-clock, which was ſet up in Mr. HUNT's lodgings, made to keep an account of the quantity and time of all the changes, that happen in the air, as to its heat and cold, its dryneſs and moiſture, its gravity and levity; as alſo of the time and quantity of the rain,

[a] See Mr. HOOKE's Philoſophical Collections, n° 1. p. 18.

ſnow,

ſnow, and hail, that fall: all which it ſets down in a paper, ſo as to be very legible and certain.

*June* 5. Mr. HENSHAW, vice-preſident in the chair.

Mr. HOOKE mentioned, that he had ſeen a letter of Mr. HALLEY to Sir JONAS MOORE, written from Dantzick, giving an account of his ſafe arrival there; of his delivering his letters to Mr. HEVELIUS, and of the very kind acceptance of them and entertainment of him; of Mr. HEVELIUS's great eſteem and reſpect for the Royal Society: that he, Mr. HALLEY, had ſeen Mr. HEVELIUS's obſervations and inſtruments, and found them very extraordinary, but all with common ſights: that he had ſeen Mr. HEVELIUS make obſervations with thoſe inſtruments of the diſtance of two fixed ſtars, and that they were capable of making them to half a minute; but that he was not able to do this nearer than to a minute: that his contrivance for ſetting his inſtruments to the plane of the ſtars was very good: that he had publiſhed the ſecond part of his *Machina Cæleſtis*, containing his obſervations of the fixed ſtars; and that he had ſent ſome copies of that work to England.

Two letters of the ſecretary were read, the one to the Abbé de la ROCHE, the other to Monſ. JUSTEL, in order to begin a correſpondence with them concerning philoſophical ſubjects; which letters were approved of by the vice-preſident.

The minutes of May the 29th were read; which gave occaſion to diſcourſe farther about the ſoftening of the bones in fleſh boiled; and Monſ. PAPIN being preſent, he was aſked, whether he uſed water in that operation; which he denied, affirming, that he put no water to it in the boiling.

Mr. HOOKE propoſed it as a very uſeful mechanical operation for making of inlaid works with bones or ivory, to ſtain them with colours while ſoft, to ſee, if they would hold thoſe colours, when dry and hardened again: and he affirmed, that he knew a method of dying ivory as black as jet, and ſinking the colour into a conſiderable depth, ſo as to be very laſting, without ſoftening the ivory; but that he could not do the ſame thing with other colours.

Hereupon ſome diſcourſe was occaſioned about China ink, ſome ſuppoſing it to be made of burnt bones; others of very fine lamp black, though others thought it might be an inſpiſſated juice.

Mr. COLWALL mentioned a way of making very good ink, caſting a little upon a purple, which was with deep coloured claret, with galls and copperas, without gum.

Sir JOHN HOSKYNS ſuggeſting, that Monſ. PAPIN's way of ſoftening bones would be of good uſe for cooking of bony fiſh, which were troubleſome in eating, the latter added, that he had tried that effect, and found, that he could ſoften fiſh-bones as well as others.

The

The obſervations made at the laſt meeting on grain-gold were diſcourſed of; and it was obſerved by Mr. HENSHAW, that the firſt gold brought from Peru was grain-gold; but that afterwards the induſtry of the planters found out the mineral, from which it might be drawn by quickſilver.

Sir JOHN HOSKYNS ſaid from the report of ſome other perſon, that the lead-mines in Wales contained a greater proportion of ſilver than moſt other mines in Europe, and as much as moſt of the Spaniſh ſilver mines.

Mr. HOOKE read a farther diſcourſe of PADRE LANA concerning flying, which he had tranſlated; and added to it a diſcourſe of the impoſſibility of that attempt by that means; and alſo ſhewed wherein the author had been greatly miſtaken in the grounds and ſuppoſitions of his demonſtration, viz. in ſuppoſing the ſame thickneſs of metal to be ſufficient to reſiſt the preſſure of the air inward in a ball of twenty-four feet diameter as in a ball of one foot diameter: whereas on the contrary it is neceſſary to increaſe the weight of the ſhell more than according to the proportion of the ſolidity or capacity of the ball.

Dr. GREW read a paper of his concerning moſt of the mineral waters about London.

Mr. JOHN WHEELER was propoſed candidate by Sir JOHN HOSKYNS.

*June* 12. There being but a ſmall number of members preſent, the Society did not ſit, but were entertained with the examination of ſeveral experiments.

The firſt was the body of a mackarel boiled by Monſ. PAPIN after his new way; which being examined by ſeveral, it was found, that the fleſh was very ſolid, hard, and whole, and very well taſted, without any unuſual quality, except that all the bones of it were as ſoft almoſt as the fleſh itſelf.

The ſecond was a parcel of hartſhorn, which had been formerly ſoftened, and ſhewn to the Society, and kept ſince that time cloſe ſtopt in a glaſs. This being ſmelt, taſted and felt, ſeemed by all thoſe ſenſes to be old Chedder or Parmeſan cheeſe.

The third were the chips of oranges ſoftened by the ſame art, which were very whole, but made throughout very tender. This way of boiling was affirmed by Monſ. PAPIN to be very uſeful for making ſweet-meats.

The fourth was the tendril of a vine brought by Mr. THOMAS CRISPE; which being examined by Mr. HOOKE with a microſcope was found to have a good number of ſmall plants ſeeming a kind of moſs growing on it; the ſtalks whereof were about half an inch long, and as fine as the hair of a man's head; at the end of each of which grew a pod much like that of ſeeding moſs, but very much ſmaller.

*June* 19. There being but few members preſent, and Sir ROBERT VINER and Sir ROBERT CLAYTON being there were entertained by thoſe members with a ſight of the repoſitory, library, and weather-clock newly ſet up.

Monſ. PAPIN ſhewed a new kind of wind-fountain of his own contrivance.

*June* 26. Sir CHRISTOPHER WREN, vice-preſident, in the chair.

The minutes of the 5th and 12th of June were read: whereupon occaſion was given to diſcourſe farther about the China-ink; which ſome ſuppoſed to be an inſpiſſated juice; but Sir CHRISTOPHER WREN affirmed it to be only lamp-black very finely ground, and made up in cakes.

There was alſo a diſcourſe about the way of ſoftening bones by Monſ. PAPIN: concerning which Sir CHRISTOPHER WREN queried, whether the way of ſoftening them did not hint by a contrary proceſs a way of hardening either the ſame or other bones not ſoftened firſt. To which Monſ. PAPIN gave no poſitive anſwer, having not yet diſcovered to the Society his way of doing that operation.

Mr. HOOKE produced an intire cocoa-nut, which was newly brought from Barbados; and he cauſed it to be cut in ſunder, and poured out of the middle of it a glaſs full of liquor containing about a third part of a pint. This liquor was ſomething whitiſh, and taſted ſweetiſh and pleaſant like an emulſion. It was contained in the cavity of the kernel, which might be capacious enough to hold about a pint. The kernel was about three fourths of an inch thick, lining the inſide of the ſhell, which was about one eighth of an inch thick and very hard. The kernel was much of the ſame taſte with the liquor, but pretty hard and tough.

Dr. CLENCH being introduced by Dr. TYSON addreſſed himſelf to the vice-preſident, and preſented the Society with a certain root lately brought out of China, called ginſing, of great eſteem in China for its virtue in reſtoring conſumptive perſons, and thoſe emaciated with long ſickneſs, to their former health and ſtrength. It was valued in China at twice its weight in ſilver. It is ſhaped like a briony root, but is ſcarce ſo big as a ſkirret. It is white like a parſnip. Its taſte is very bitter and ſomewhat hot upon the tongue ſomewhat like gentian, and ſeems upon the ſame account to be a very good ſtomachic.

Dr. CLENCH delivered in ſome of it for the repoſitory wrapped up in Chineſe paper, together with a paper containing an account of ſome of his trials and experiments made with it in England.

Dr. GREW read a paper of his obſervations made on ſeveral medicinal waters, viz. from Gilſit-ſpaw, Sunning-hill, and Willow bridge in Staffordſhire; on a petrifying water from Oxfordſhire; on ſea-water from Sandwich; and on another kind of ſalt water from the Black Sea.

After

After the reading of this paper he ſhewed ſome of the ſalts exhauſted, and amongſt the reſt the ſalt of the Euxine-Sea water, which being taſted was found to be a perfect cauſtic, and exceedingly different from any other kind of ſea-ſalt.

Mr. Hooke produced the breaſt-part of a new ſort of armour made of ſilk well quilted together, which was able to reſiſt the ſhot of a piſtol or carbine. It was near three fourths of an inch thick, and very hard and pretty heavy. Whether it would perform what was pretended concerning it, the Society was not convinced by any experiment: only the gentleman, who owned it, ſhewed it with two bullets, which had been ſhot againſt it by the prince[a] in the king's preſence, which were very much battered and flatted againſt it without at all penetrating it.

*July* 3. At a meeting of the Council were preſent

Mr. Henshaw, vice-preſident,

| | |
|---|---|
| Sir John Lowther, | Mr. Hill, |
| Sir John Hoskyns, | Dr. Grew, |
| Mr. Colwall, | Dr. Mapletoft, |
| Dr. Croune, | Mr. Hooke. |

It was ordered, that Mr. Hooke ſhall have power to employ Monſ. Papin for the writing of all ſuch letters, as ſhall be ordered, to the correſpondents of the Society: and that all ſuch letters ſhall be tranſcribed into a Letter-book to be kept by the ſecretary of the Society: and that all the ſaid letters, when fairly written, ſhall be ſhewn to ſuch perſon of the Society, as the council ſhall appoint from time to time for viewing of them before they be ſent to the correſpondents, and after ſuch peruſal ſhall be ſent by the ſecretary as directed: and that for ſo doing the ſaid Monſ. Papin ſhall receive from the treaſurer of the Society the ſum of eighteen pence per letter, unleſs the letter ſhall exceed two ſides of a quarter of a ſheet of paper; for every of which he ſhall receive two ſhillings, he producing his bill of the number of ſuch letters ſigned and atteſted by the Secretary:

That the letters being approved of by any two of the council ſhall be ſealed and ſent as above:

That Mr. Hill the treaſurer pay Dr. Pope ten pounds for one year's rent for the uſe of his lodgings as aſtronomy profeſſor in Greſham-College, due February 23, $167\frac{8}{9}$: And,

That Mr. Hooke be deſired to publiſh (as he hath now declared he is ready to do) a ſheet or two every fortnight of ſuch philoſophical matters, as he ſhall meet with from his correſpondents; not making uſe of any thing contained in the Regiſter-books of the Society without the leave of the council and author.

At a meeting of the Society the ſame day, Mr. Henshaw, vice-preſident, in the chair.

[a] Rupert.



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One of the copies of Mr. HEVELIUS's ſecond part of his *Machina Cæleſtis*, containing the ſecond, third, and fourth books, newly ſent over by the author to ſeveral of his friends in England, was ſhewn to the Society by Sir JONAS MOORE; in which were found Mr. HEVELIUS's celeſtial obſervations for the ſpace of forty-nine years.

Sir JONAS MOORE mentioned, that Mr. HALLEY deſigned to viſit him in his return, and to take the latitude of that place.

The minutes of June 26th were read; which gave occaſion of diſcourſing farther about the milk or liquor contained in the cocoa nut. Dr. GREW was of opinion, that all that milk would by degrees, as the fruit ripened, thicken into a kernel; and conceived farther, that the young plant lay in that, and not in the ſubſtance of the hollow kernel.

Mr. HOOKE was deſired to examine PISO's natural hiſtory, to ſee, if any light touching this conjecture might be obtained.

It was farther related, that the palm-tree-wine was not this liquor of the cocoa nut, but the ſap of a tree got out of the body of the palm, by boring a hole in the tree, and putting a tap into it, much after the manner that birch-juice is procured.

Monſ. PAPIN was introduced by Mr. HOOKE to ſhew the Society ſome farther trials, which he had made of his invention of boiling, upon tortoiſe-ſhell and ivory. The firſt was obſerved to be very ſoft and pliable, but with a conſiderable toughneſs, much like wetted tanned leather. The ſecond had been boiled in ale or beer, and had thereby the parts of it extremely ſoftened, and remaining as it were looſe one upon another like rotten wood. He was deſired to proſecute ſome farther trials in that way by boiling ſome lobſters, oiſters, prawns, &c. to ſee whether they may be this way ſoftened.

Dr. GREW produced and read a paper of ſome obſervations made by him on ſome other waters in and about London.

Mr. HOOKE produced a packet of books, which were ſent to him directed for the Society; which being opened were found to be ſome catalogues of Dr. SWAMMERDAM's rarities, one of which was reſerved for the library, and the reſt diſtributed to ſeveral of the members.

There was ſome diſcourſe held concerning waters, whether thoſe, that were impregnated with alcalizate ſalts, would draw tincture more plentifully than freſh water. Dr. GREW was of opinion, that they would: but Mr. HOOKE conceived, that freſh water would draw a much ſtronger tincture from a plant before it was impregnated with ſalt than after; for which he alledged many reaſons, and inſtanced particularly in the way of drawing tinctures from ſenna, the one with fair

water, the other with water impregnated with ſalt of tartar; the firſt of which would be the ſtrongeſt, though the other appeared deeper.

Dr. SLARE was introduced by Mr. HOOKE to ſhew the Society the experiments of animals *in ſemine animalium*. He brought with him the liquor, which he had lately expreſſed out of the teſticle of a ſtone-horſe, which had been newly gelt. This liquor he took up in ſmall canes, and viewed them with a ſingle microſcope, whereby they were made viſible: but Mr. HOOKE putting ſome of the liquor upon the plate of his double microſcope, an infinite number of thoſe ſmall wriggling creatures might very plainly be diſtinguiſhed, and were diſcovered and obſerved by moſt of the members, who were preſent.

*July* 10. Mr. HENSHAW, vice-preſident, in the chair.

Mr. LAMB's propoſals about two celeſtial hemiſpheres[a] were ſhewn; but when it was underſtood, that they were not rectified by the late obſervations of Mr. HEVELIUS, they were neglected as imperfect.

Mr. JOHN VALENTINE SCHOLD of Strafburgh was preſent, and deſired to receive the commands of the Society, being ſoon to return home.

The minutes of July 3d were read, and Mr. HOOKE was deſired to examine PISO about the cocoa nut. Sir JONAS MOORE ſaid, that the Indians uſe to bore a hole in the palm-tree, and to roll up a leaf of the tree, and ſtick it into the hole for a ſpout for it to run by into a cup made of the ſhell of its own nut. They uſe to tap them in the morning before ſun-riſing.

Mr. HENSHAW obſerved, that the palm, that yields wine, is only in the Eaſt Indies, where they drink no other: and that the way uſed by the Indians for climbing up the palm-tree was by the help of a couple of ſhort ropes, the one tyed to their feet, the other about their arms, by the ſucceſſive ſliding up of which they will climb to the top of the ſmootheſt and ſtraiteſt tree.

Sir JOHN HOSKYNS remarked, that there was one palm in Guinea, the fruit whereof yielded a good quantity of oil uſed in thoſe countries inſtead of butter, though not ſo agreeable to the Europeans.

It was farther obſerved, that the wine of the palm will with keeping turn to very good vinegar, and being boiled preſently yields good ſugar, and being fermented makes a very good wine.

Monſ. PAPIN produced a piece of the tortoiſe ſhell, which he had ſhewn at the laſt meeting ſoft like wet tanned leather, now reduced to its former hardneſs and tranſparency, and retaining the poſture, which it had been put into, when

[a] See Mr. HOOKE's *Philoſophical Collections*, n° 1. p. 44.

ſoft.

ſoft. This, it was ſuppoſed, might be very uſeful for many mechanical works; and if the ſame effect could be performed upon horn, it was thought, that it might be very acceptable to divers mechanics.

Upon this ſeveral diſcourſes aroſe about tanned leather; and Mr. HOOKE urged, that the tanning of leather conſiſted only in the drawing out of the glutinous part of the ſkin, and the leaving the fibrous part; which was the reaſon why ſkins not well tanned being wet and dried again become ſtiff and hard, the remaining gummous parts glewing the fibres together; whereas tanned leather being wet and dried again becomes limber and ſupple as cloth, it having no gummous parts left. Whereupon divers diſcourſes were occaſioned about the ſeveral ways of tanning leather.

Sir JOHN HOSKYNS mentioned the way, that the Indians in Virginia and the northern parts of America uſe to dreſs their ſkins; which is by the means of the brain of the creature, which they kill, mixed with oil of walnuts called hickery nuts, and a wine made of oiſter-ſhells. With this they ſmear over the raw ſide of the ſkin, and by help of the fire preſently dreſs it with the hair on, that it equals, if not exceeds any way uſed in Europe.

Mr. HENSHAW conceived, that the Ruſſian and Turkey way of tanning their leather was with the bark of the birch and the ſaw-duſt of fir. He alſo ſaid, that they had a ſort of wooden cups in Ruſſia, which were as tough as leather, and might be turned inſide outward without breaking: and that they have a ſort of apples as tranſparent as a ripe white grape; ſo that the core and kernels may be plainly perceived from without.

Monſ. PAPIN produced a lobſter, which he had boiled after his new way, but the ſhell thereof was not much ſoftened; but the body thereof yielded a conſiderable quantity of liquor.

Mr. HOOKE read a tranſlation, which he had made of a letter of Mr. LEEWENHOECK formerly read by Dr. GREW, in which the writer gave an account of his obſervations made on the ſeed of animals, as of fiſhes, birds, and beaſts, in all which, he affirms, that he had diſcovered with his microſcopes vaſt quantities of living creatures exceedingly ſmall: to which he annexed a paper, in which he had calculated both the number of theſe animals in the milt of a cod fiſh, and the number of men at one time upon the habitable face of the earth, and concludes, that the number of the former exceeds the latter at leaſt ten times.

Dr. GREW ſhewed ſome draughts of the guts of ſome creatures, which he had formerly diſſected; of which he promiſed to bring in an account, but he did not leave the draughts.

*July* 17. Sir JONAS MOORE, vice-preſident, in the chair.

Sir THEODORE DE VAUX preſented two books ſent by the grand duke to the preſident

preſident and ſecretary of the Society by the hands of Signor TERERE, that prince's reſident in England, being two copies of STEPHANO LORENZINI's *Obſervaticni interno al'e torpedini*, printed at Florence in 1678.

Theſe were recommended to Sir JOHN HOSKYNS and Mr. HOOKE to be peruſed by them, who were deſired to give ſome account of the contents of that book at the next meeting.

Mr. POVEY inquired of Mr. FLAMSTEAD concerning the heat of Greenwich-Hill, who ſaid, that it was temperate. Whence was occaſioned ſome diſcourſe concerning the heating of the air by the beams of the ſun either direct or reflected; and it was argued, that the heat of the earth was one of the greateſt cauſes of warming the air near the ſurface; whereas the air at the top of hills being much in motion, and farther removed from the ſurface of the earth, was not ſo much heated.

Mr. HOOKE gave an account of his having peruſed PISO about the cocoa nut, and related, that this author affirms the young cocoa nut to be full of a pleaſant milky juice, but that when it is fully ripe, that juice is dried away, and there is only a hollow kernel left within the hard cocoa ſhell. Upon this occaſion mention being made of the Indians climbing thoſe palm-trees, Mr. HOOKE deſcribed the way of their doing it by the uſe of two ſhort ropes, the one faſtened to their feet, the other to their arms, by the help of which they could climb to the top of the ſtraiteſt, ſmootheſt, and higheſt trees.

Upon mentioning the Ruſſia apple, that was tranſparent, Mr. HILL mentioned, that there is in England ſuch an apple called the cucumber-apple, which is ſomewhat tranſparent in ſeveral of its parts and cells.

Mr. POVEY, upon the diſcourſe of the cocoa wine, affirmed, that there was no ſweet juice but what would turn to the ſoureſt vinegar; and that the palm-tree wine would accordingly do ſo.

Upon reading the relation of the way of tanning of Ruſſia leather Mr. POVEY propoſed, that Mr. CHARLES HOWARD's experiment of tanning might be tried by the Society; and that he was willing to communicate to them; and he undertook to procure the way, and to bring it in.

Mr. HILL affirmed, that all the Ruſſia leather brought into England was made of elk-hides. Thereupon a farther diſcourſe was occaſioned concerning the curious colour and laſting ſmell of Ruſſia and Turkey leather, and a farther inquiry concerning the materials, with which it was tanned: and Mr. POVEY mentioned, that the cuttings of Ruſſia leather being laid in a cheſt amongſt clothes was an infallible way of preſerving all within it from moths.

Sir THEODORE DE VAUX obſerved, that the lying on thoſe ſkins was very good for

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for ſuch, as were troubled with the ſtone. Others affirmed, that the lying on other leather would have much the ſame effect.

Sir JONAS MOORE related, that Mr. FLAMSTEAD had formerly given him a deſcription of the way and proceſs of making Derby malt, and promiſed to look it out, and bring it to the Society. He alſo added, that the people of that town had a way of cooling their ale very quickly, ſo as it blinketh it ſo, as they called it, that it grows clear and fit to drink preſently.

Several ways were mentioned of the clarifying of ale; the worſt of the alewives by putting a chamber-pot into it; another of a pewter-diſh, and another with a green oaken bough.

Mr. POVEY ſaid, that there was a way of making a very ſtrong and very pale ale with wheaten malt. Others remarked, that the ſame thing might be done with common malt by putting whole wheat into the ale.

Dr. GALE ſaid, that there was a way of making mulberry-ale or groot-ale preſently work, clarify, and be fit for drinking, by putting into it a kind of leven made of the yeaſt of empty caſks dried and made up into a ball: but that was not approved to be ſo pleaſant or ſo wholeſome.

Mr. POVEY promiſed to bring in a receipt of making very pleaſant, wholeſome and ſtrong ale, and as good as any.

Thereupon Sir THEODORE DE VAUX promiſed to bring in a dozen receipts, which had been experimented by Sir THEODORE MAYERNE for making of ales of ſeveral ſorts.

This occaſioned a diſcourſe about various ways of making wines and other pleaſant and wholeſome drinks of other ſorts.

Sir THEODORE DE VAUX promiſed to bring in the receipts of making divers of them, as with currants, water and ſugar, and with raiſins and water: and Mr. POVEY related, that the earl of Northumberland had made much uſe of this laſt wine; and that a diſtiller of Vaux-hall made ſpirits with ſuch wine. Others affirmed, that it was uſed alſo by ſeveral other diſtillers.

Hereupon much diſcourſe aroſe about making wine with cherries only, of which there is ſo great plenty in Kent and ſeveral other parts of England: and it was wiſhed, that that deſign might be promoted, ſince it would greatly ſave the expence of foreign wines, and much improve our own country.

Mr. EVELYN affirmed, that he had made wine with cherries, which kept very well two years; as alſo, that he had made an excellent drink of quinces.

Sir THEODORE DE VAUX mentioned a way of renewing and refreſhing palled and

and decayed wines by putting raiſins in it. And Mr. HOOKE ſaid, that he had known a merchant, who made uſe of the juice of Engliſh grapes to renew his wines.

Mr. POVEY promiſed to give an account of the gooſberry wine, which he had lately made.

Mr. EVELYN promiſed to communicate ſome of his ways of making cherry and ſome other Engliſh wines.

Dr. GREW was called upon to bring in his paper about the guts, which he had ſhewn at the former meeting.

Sir THEODORE DE VAUX related, that there was lately found at Acton a water, which was twice or thrice as ſtrong as Epſom water, being very bitter.

Dr. KING ſaid, that upon evaporating it, he had found above double the quantity of ſalt in it, that he had found in Epſom water.

He added, that it was an ill cuſtom to put common ſalt into ſuch waters to make them purge.

Dr. GALE obſerved, that it was an antient way uſed by phyſicians in Egypt and Greece.

Mr. HOOKE ſhewed two experiments: the firſt was the teſticle of a lamb, which being diſſolved, and the liquor contained in it examined in a microſcope, it was found not to have any live animals, but to be exceedingly full of the ſmall globules. Whether there had been any creatures in it, and were now dead, by reaſon that the lamb had been killed in the morning; or whether there were not as yet any living creatures in it, the lamb being not come to maturity for generation, could not be diſtinguiſhed. But farther trial in order to this inquiry was deſired to be made on a young lamb's ſtone, as ſoon as the creature ſhould be killed.

The ſecond experiment of Mr. HOOKE was with the exhauſting engine of Monſ. PAPIN: and that was with a long helical ſpring of braſs-wire extended by a weight hung at the lower end of it, the upper end of the ſame being faſtened to the top of a long glaſs cone. Out of this cone the air was well exhauſted, and the ſtation and length of the ſpring was curiouſly obſerved: then the air was let in, and the ſame obſervations were made with the ſame cone; and it was found, that the whole preſſure of the air did not in the leaſt alter the ſtiffneſs of the ſpring; which cleared that diſpute, whether the unequal motion of a watch does not proceed from the alteration made on the ſpring by the various preſſure of the air thereupon.

Monſ. PAPIN ſhewed his way of exhauſting ſmall glaſſes for preſerving * * and

keeping them tight by the help of a looking-glaſs-plate ground true upon the edge of the glaſs.

*July* 24. Sir JONAS MOORE, vice-preſident, in the chair.

The minutes of July 17th were read; whereupon Sir JOHN HOSKYNS was deſired to give the Society an account of the Italian book of LORENZINI on the torpedo; which he had undertaken to peruſe; and accordingly he gave the following account of it:

That the book was full of curious and new obſervations: that the author had very minutely and particularly deſcribed the torpedo and its parts: that it is of the ſort of the flat cartilaginous fiſhes: that there are two ſorts of it, a greater and a leſſer: that he had ſeen of the greater weighing twenty-five pounds, and of the leſs not above ſix ounces: that in the ſkin are ſeveral pores, which are the ends of double ductus's to bring ſlime to the ſkin to make it ſlippery: that one of theſe ductus's comes from the head, the other from the ſides of the back: that the brain touches the pia mater in the baſe only, being ſeparated elſewhere by water, in which it ſwims: that the heart has but one ventricle, and continues to move nine or ten hours after it is cut out, as the parts of the body, when ſeparated, will in four or five hours: that its ovarium is near the liver and double oviduct and womb, wherein the young ones ſwim free, and have no communication with the womb; the author by the by deſcribing the genitals of a lobſter and ſome other fiſhes, and ſhewing ſome errors of Dr. WILLIS: that the benumming quality is ſeated in two ſemicircular muſcles on each ſide of the thorax, conſiſting of fibres about the bigneſs of a gooſe-quill made up of bladders filled with a liquor, and they end in the back and belly: when the hand touches theſe, the fiſh contracts them, and ſqueezes out the liquor, which enters the ſkin at the fingers-ends, and cauſes the numbneſs like that of the elbow hit againſt a hard body; but the numbneſs and pain vaniſh in a ſhort time: that nothing but immediate contact will produce this effect: that this fiſh, as moſt others, has properly no tongue: that the ſtomach and guts are ſhort and large with few fibres, but abound with a copious diſſolvent, that conſumes the fiſh, which it ſwallows alive, into a chyle: that the fiſh takes in water by ſeveral holes near the ſtomach, and throws it out at the other end, waſhing in its way the bronchia: that the author often recommends experimental philoſophy and comparative anatomy.

Dr. CROUNE queried, whether the author had ſaid, that this benumming liquor is any colder than the reſt of the body: to which Sir JOHN HOSKYNS anſwered in the negative.

Mr. HILL related, that Mr. TORRIANO lately drinking the waters at Epſom found, that they paſſed well the three firſt days, but did not the fourth and fifth. Whereupon he ſoon after died, and being opened, his guts were found gangrened.

Monſ.

Monſ. PAPIN promiſed to communicate at the next meeting a method of keeping large veſſels exhauſted with eaſe, in order to boiling and diſtillation.

Mr. HAAK produced a book intitled *Propoſitions of Optic Glaſſes*, printed at the theatre at Oxford.

Mr. HOOKE, who had read ſomewhat of the book ſaid, that he had not found any thing in it, which was new; and that it contained ſome propoſitions about the place of the image, which were not true: that it came far ſhort of the theory of optics now well known, which he conceived to have been firſt well underſtood by KEPLER, and highly improved by DES CARTES.

Mr. HOOKE read a long paper, which he had tranſlated from the French, giving an account of the prodigious overflowing of a river in Gaſcoigne, written by a perſon, who had made it his buſineſs to inquire into the truth of the fact, and had likewiſe been inquiſitive after the cauſe, which he explained and illuſtrated by divers very convincing circumſtances, aſcribing it to the * * * * of ſome of the Pyrenean mountains into the ſubterraneous ciſterns within the bowels of them [d].

This occaſioned a diſcourſe of the effects of the like nature; and Sir JONAS MOORE and Mr. HOOKE mentioned ſome, that had happened at Pendel-Hill, of which an account had been given in a letter read to the Society.

Dr. GALE added, that there were many inſtances of the like nature in the mountains of the north, where guſhings out of the water from the hills made great gills, as they were called; that is, channels in the ſides of them, out of which the water guſhes from the mountain.

Dr. CROUNE read a letter from Mr. HEVELIUS in anſwer to that, which he had written to him, and ſent by Mr. HALLEY; wherein Mr. HEVELIUS teſtified his reſpect for the Society, and his eſteem of Mr. HALLEY.

Sir JONAS MOORE read a letter from Mr. HALLEY, giving a farther account of his reception and entertainment in aſtronomical matters by Mr. HEVELIUS.

Mr. HOOKE was deſired to get the Italian book [e] tranſlated into Engliſh, and printed; which he promiſed to endeavour to do.

Upon the diſcourſing of optics Sir JONAS MOORE having ſaid, that he had a piece of Mr. GOSSIGNEES in a Latin manuſcript on optics, as alſo divers papers of Mr. GASCOIGNE's on the ſame ſubject, he was much deſired to procure them to be printed; Mr. HOOKE, who had ſome years ſince ſeen that tract of in Mr. COLLINS's hands, judging it to be very good and fit for publication.

*July* 31. Mr. HENSHAW, vice-preſident, in the chair.

[d] This account is printed in Mr. HOOKE's *Philoſophical Collections*, nº 1. p. 9.

[e] Probably that of LORENZINI on the torpedo.

The minutes of the 24th inſtant were read, which gave occaſion for ſome additional obſervations, viz.

Sir JOHN HOSKYNS obſerved, that Signor MALPIGHI had obſerved, that the reaſon of the mobility of the parts of inſects, after they are cut aſunder, is from the brain and medulla ſpinalis.

Mr. HENSHAW conceived, that it might be partly from that, and partly from the ſlimineſs and toughneſs of the juice, in which the ſpirits moved in theſe creatures, which were obſerved to move after they were cut to pieces, this juice keeping the ſpirits, without ſuffering them preſently to evaporate.

Sir JOHN HOSKYNS conceived, that devouring animals knowing where to faſten on their prey ſo as to kill them immediately (as had been obſerved of a lyon griping a lamb and a dog to death at one bite) fiſhes likewiſe may have that inſtinct to bite the torpedo to the heart: whence nature ſeems to have furniſhed that part with the preventive, viz. the benumming quality, whereby, as it is ſuppoſed, the preying fiſh becomes immediately benummed, and the torpedo eſcapes.

Mr. HILL mentioned a perſon, who paſſing over a field in a very cold day found himſelf as it were ſtricken on one ſide of the belly by a cold blaſt with much pain; which pain continuing for two days killed him. Upon opening his belly it was found gangrened in that place. This kind of cold is called by the country-people the cold fire, and is very uſual in Ruſſia and other cold countries.

Sir JOHN HOSKYNS added, that CARPENTER [f] in his *Geography* had made mention of juſt ſuch an eruption of water out of the hills, as that in Gaſcoigne mentioned at the laſt meeting; as alſo of ſubterraneous fiſh.

Mr. POVEY preſented to the Society for their repoſitory from Mr. JOHN SHORT the draper the head of a turtle very large, the mouth of a ſhark, the heart of a tortoiſe, the nether part of an Indian crow's bill, the *piſcis quadrangularis*, the tuſk of a boar, a part of an Indian lo** in ſhape like that of the acacia.

Mr. HOOKE read a diſcourſe of his concerning the uſe, which he had found of convex glaſſes for helping ſhort-ſighted people to ſee objects at any diſtance very diſtinct and bigger than any one, which the naked eye can diſtinguiſh; which is a diſcovery of much benefit to ſhort-ſighted perſons [g]. He called his diſcovery *myopibus juvamen*, and obſerved, that by the uſe of ſeeing things inverted it became as natural as if they were ſeen erect; and he conceived, that if a perſon from his childhood were uſed to ſee things by this means inverted as we call them, though they were really erect in the eye, if they ſhould afterwards come to ſee them without the help of theſe glaſſes, they would conceive, that they ſaw

[f] NATHANIEL CARPENTER, D. D. fellow of Exeter-College in Oxford, and afterwards ſchool-maſter of the king's wards in Dublin. He died there in 1628.

[g] This diſcourſe is publiſhed in Mr. HOOKE's *Philoſophical Collection*, n° 3. p. 59.

them

them inverted, as they really are, at the bottom of the eye, as he ſaid was very viſible in a young cat's eye, which is almoſt tranſparent at the bottom.

Mr. COLWALL gave an account from Mr. FLAMSTEAD, that he had proſecuted the obſervation begun and invented by Mr. HOOKE of obſerving the parallax of the earth's orb among the firſt ſtars by a perpendicular teleſcope; and that he had certainly found what it is. It was hereupon moved, that Mr. HOOKE ſhould deſire the obſervation of Sir JONAS MOORE, and inſert it in the next *Tranſaction*.

Monſ. PAPIN produced an inſtrument, by which he could boil any thing *in vacuo*; and ſhewed the manner of exhauſting with his engine, and how he preſerved it from leaking, whilſt it boiled, by tin and ſcrews, &c.

Mr. HOOKE produced and examined the teſticles of a cock juſt killed, but could not perceive any of thoſe ſmall animals in its ſeed, that had been ſeen in that of a ſtone-horſe. It was conceived, that the reaſon was, becauſe the cock was very young, and poſſibly not fit for generation.

*Auguſt* 7. At a meeting of the COUNCIL were preſent,

Mr. HENSHAW, vice-preſident,

| | |
|---|---|
| Sir JOHN HOSKYNS, | Dr. BROWN, |
| Mr. COLWALL, | Dr. GREW, |
| Dr. GALE, | Mr. HOOKE. |
| Mr. HILL, | |

It was ordered and deſired, that Mr. HOOKE do, as ſoon as may be, print a relation of all the experiments, obſervations, and relations made and brought into the Society by himſelf ſince his firſt coming into it; and that he have leave to take his own method in the doing thereof.

It was left to him to print the *Tranſactions*, which he deſigned to publiſh, either once a month or once in a fortnight, or oftener.

It was ordered, that Mr. HOOKE ſhall proceed with the correſpondence, and ſend away ſuch letters, as are already written; and likewiſe take care to defray the charge of poſtage both outwards and inwards:

That Sir JOHN HOSKYNS, Sir JONAS MOORE, Mr. COLWALL, Mr. HILL, Dr. GALE, Dr. BROWN, Dr. GREW, Dr. MAPLETOFT, or any three of the council, do meet together, and go to Mr. CHENEY to diſcourſe with him concerning Chelſea-College: and that in the mean time Sir JOHN HOSKYNS be deſired to inform himſelf as fully as may be concerning the title of the Society to Chelſea-College; and in order thereunto get copies of ſuch records, as he conceives neceſſary and are wanting: and that they meet at Mr. COLWALL's houſe on Tower-hill on the Wedneſday following at three in the afternoon preciſely:

That all papers, that for the future ſhall be brought into the Society to be read, be returned to the perſon, who brings them, if he deſires the ſame: And,

That the following bills be paid,

| | *l.* | *s.* | *d.* |
|---|---|---|---|
| A bill of Dr. GREW for ſeven lectures - - - - - - | 9 | 0 | 6 |
| A bill of Mr. MARTYN for liſts, tickets, &c. - - - - | 5 | 4 | 0 |
| A bill of Mr. WICKS for expences ending at Chriſtmaſs 1678 - - | 5 | 5 | 0 |
| A bill of Mr. WICKS ending May 29, 1679, for writing, &c. - - | 16 | 0 | 0 |
| Mr WICKS's ſalary for 1 ¼ year ending midſummer 1679 - - | 15 | 0 | 0 |
| The ſtationer's bill to July 4, 1679, - - - - - - | 6 | 16 | 0 |

At a meeting of the SOCIETY on the ſame day, Mr. HENSHAW, vice-preſident, in the chair.

The minutes of the 31ſt of July were read. whereupon there was a farther diſcourſe about ſhort-ſighted perſons, and of the ways of viſion, from the aſſertion of Mr. HOOKE, that a man uſed to ſee things always inverted would in time judge, that he ſaw them as they are Dr. CROUNE queried, whence it ſhould come, that the conception ſhould imagine that object erect, which is repreſented at the bottom of the eye inverted. Dr. GREW ſuppoſed, that it might proceed from the of the optic nerves, which might cauſe a ſecond inverſion. Mr. HOOKE thought, that this could not be the cauſe, ſince it was not general in all creatures, and he conceived, that the inverſion of the optic nerve was in none obſervable: but that it rather proceeded from the mind's making compariſon of the ſenſation by the eye with the ſenſation made by the touch: or rather, that it is an idea or the rule of ſight implanted in the ſoul by nature.

Mr. HENSHHW mentioned the explanation given of it by DES CARTES, who compares the ſight to the feeling of an object by the medium of a ſtaff.

Mr. HILL mentioned, that a maid, who was blind from her infancy, and never ſaw any thing till Mr. STEPKINS cured her, upon the firſt recovering of her ſight, looked on the ſun, and thought, that ſhe could have reached it: whence it was inferred, that the mind judged of diſtances partly by circumſtances.

Mr. HENSHAW obſerved, that the ſun in Norway very often roſe and ſet in an oval figure. Mr. HOOKE affirmed, that it was likewiſe ſo here for the moſt part; which was cauſed by the refraction or rather inflection of the air, as he had elſewhere ſhewn.

Sir JOHN HOSKYNS remarked, that looking at the ſun or ſtars through a ſmall hole made in paper cauſed them to appear leſs than to the naked eye.

Dr. CROUNE gave the reaſon of the ſun's appearing bigger near the horizon from the dilating of the pupil; for that according as the pupil is dilated, the object appears bigger or leſs.

Mr.

Mr. Hooke affirmed, that if you look through a hole an hundred times leſs than the pupil, the object will appear the ſame that it does to the naked eye, when it ſees it diſtinctly: but in objects too ſtrong for the eye, it helps the eye by debilitating the rays, which otherwiſe make a falſe repreſentation.

Mr. Henshaw was of opinion, that the refraction of the air might cauſe the ſun to appear bigger; and that the vapours alſo might augment it. Dr. Croune was alſo of the ſame opinion, that the vapours might augment it rather than the refraction, becauſe the air conſiſts of parts very different from the æther. In favour of Mr. Henshaw's conjecture, Sir John Hoskyns affirmed, that at noon-day the ſun would appear much bigger, when ſeen through a very thick fog, which fog he conjectured was nothing elſe but an infinite number of exceedingly ſmall drops.

Mr. Hooke conceived, that the object, as the ſun, moon, &c. in all probability appeared under the ſame angle to the eye; but that the judgment or fancy imagined it to appear bigger or leſs according to the diſtance, at which it conceived it to appear: and therefore thoſe luminaries are uſually conceived bigger, becauſe they are ſeen to be farther off than the objects nearer of known magnitude: that the refraction is ſo far from augmenting them, that it rather diminiſhes them; for ſhould the whole horizon be raiſed to the Zenith, it muſt appear a point, and always the leſs, the more it is elevated upward, by reaſon of the contract of the Azimuth: that the imaginary bigneſs of a ſun through a fog ariſes from the opacity of the air, which is always * * with objects ſeen at a great diſtance, or through a great body of air; and by this landſcape painters deceive the eye, and make it imagine, that it ſees things at a diſtance, becauſe they are painted with faintiſh blueneſs: for a man ſeen in a fog appears of a gigantic bulk; becauſe, though he be very near, yet being ſeen through a thick air, the fancy imagines him at a much greater diſtance.

Monſ. Papin ſhewed his experiment of the quantity of the air compreſſed in his wind-gun; but the veſſel being ſomewhat too little, it could not be certainly meaſured, but was found to hold about fifty times the quantity of air, which it held before condenſation.

The Society adjourned for the enſuing vacation, not to meet again till ſummons given; but ſuch members as pleaſed to meet to diſcourſe in the mean time, might do ſo at the repoſitory or library on Thurſdays in the afternoon, where there would be ſome entertainment for them. Accordingly on the 14th of Auguſt, 1679, ſome of them met, when the body of a child, which had been twenty-ſix years in its mother's belly, and was ſuppoſed to have been alive for the ſpace of twenty of them, was exhibited, together with atteſtations of the truth of the relation, which was publiſhed in one of the monthly *Tranſactions*.

The members preſent, upon viewing the ſame, and taking notice of the remarkable particulars, judged it to be a very rare and wonderful production.

Mr.

Monſ. PAPIN made a farther trial with his wind-gun, and the glaſs recipient being now big enough, it was found, that the receptacle thereof, when charged with air ſo much as he was able to throw into it by his own ſtrength, contained ſixty-four times as much air as it did before it was charged.

*September* 22. At a meeting of the COUNCIL were preſent

Sir CHRISTOPHER WREN, vice-preſident,
Sir JOHN HOSKYNS,
Mr. COLWALL,
Dr. GALE,
Dr. ALLEN,
Dr. GREW,
Dr. BROWN,
Mr. HOOKE.

Upon debate about printing the next *Tranſaction* it was thought fit, that if Mr. MARTYN ſhould refuſe to print the ſame as uſually, the council ſhould be acquainted with it at the next meeting, to conſider of ſome other means of doing it.

Mr. HOOKE mentioning, that Monſ. PAPIN was ſuddenly going for Paris, and therefore deſired, that in conſideration of the time, which he had ſpent in entertaining the Society at their meetings, and in writing letters, he might be conſidered; it was ordered, that the treaſurer ſhould preſent him with five guineas; and that if Mr. HILL the treaſurer ſhould not return before Monſ. PAPIN's departure, Mr. HOOKE ſhould pay that money to Monſ. PAPIN, and receive it from the treaſurer.

It was farther ordered, that Mr. HOOKE ſhould propoſe to Monſ. PAPIN in the name of the Society twenty pounds a year certain; and that if there could be found a convenient lodging for him in Greſham-College, he ſhould be allowed it gratis; and that the Society would farther ſtudy to aſſiſt him:

That Sir CHRISTOPHER WREN, Sir JOHN HOSKYNS, Mr. COLWALL, Mr. HILL, and Mr. HOOKE do, as ſoon as poſſible, go to Mr. CHENEY, and view and take poſſeſſion of ſuch lands, as belong to the Society now lying about Chelſea; and that they give notice to the ſeveral tenants of the ſaid lands of ſuch their doings:

That Mr. HUNT take care to have all the inſtruments of the Society now in the cuſtody of Mr. FLAMSTEAD at Greenwich immediately removed to Greſham-College; and that Sir CHRISTROPHER WREN and Mr. HOOKE be deſired to go thither, and take what care they can in it; and that in the mean time Mr. HOOKE write to Mr. MOORE about the ſame, and deſire to have them carefully ſent home; and that the committee meet about this affair on the Friday following:

That Dr. GALE have the uſe of the manuſcript of the life of THOMAS BECKET for three weeks, he giving a note for the ſecure return thereof according to the orders of council made for that purpoſe: And,

That

That the treaſurer do pay to Mr. HOOKE five pounds for the ſalary of Mr. CRAWLEY for the laſt quarter ending the 18th of this month; and that the ſaid Mr. CRAWLEY be continued in the employment of the Society till the next meeting, when it was to be farther diſcourſed of.

*September* 29. At a meeting of the COUNCIL at Sir CHRISTOPHER WREN's were preſent

Sir CHRISTOPHER WREN, vice-preſident,
Sir JOHN HOSKYNS, Mr. COLWALL,
Mr. HAAK, Mr. HILL,
Dr. GREW, Mr. HOOKE.

It was ordered, that Sir CHRISTOPHER WREN be deſired to make the following propoſals to Monſ. FOUBERT concerning Chelſea-College, and to give an account thereof to the next meeting of the council, viz.

That the accommodations deſired ſhall be provided by Lady-day following:

That the leaſe ſhall be made for twenty-one years, the firſt rent to be paid at Michaelmaſs, 1680, for half a year:

That the College and ſix acres belonging to it ſhall be valued at forty pounds *per annum*:

That the tenant ſhall pay ten pounds per cent. for the charge of fitting it over and above the ſaid forty pounds *per annum*: and either pay in five hundred pounds (for which fifty pounds *per annum* ſhall be allowed him) or give good ſecurity for the rent.

*September* 30. At a meeting of the COUNCIL at Greſham-College were preſent

Sir CHRISTOPHER WREN, vice-preſident,
Sir JOHN HOSKYNS, Mr. HILL,
Mr. COLWALL, Mr. HOOKE.

It was ordered, that Mr. PERRY[h] forthwith ſpeak with Mr. EVERARD, executor of GEORGE ENT, Eſq; lately deceaſed, concerning the books left by the ſaid Mr. ENT to the Society, and take care to have the ſaid books removed to Greſham-College with all convenient ſpeed: and that Mr. PERRY's receit ſhall be a ſufficient diſcharge.

Mr. HOOKE reporting, that upon his making the propoſal of the council of the 22d inſtant to Monſ. PAPIN of twenty pounds a year certain for writing all letters for the Society, he had accepted the ſame, it was well approved of: but it

[h] Library-keeper to the Royal Society.

was farther thought fit, that articles ſhould be drawn up to expreſs the conditions expected by the Society to be performed by him, and to be ſubſcribed by him.

*October* 10. At a meeting of the COUNCIL were preſent

Sir CHRISTOPHER WREN, vice-preſident,

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|---|---|
| Sir JOHN HOSKYNS, | Mr. HILL, |
| Dr. GALE, | Mr. HAAK, |
| Mr. HENSHAW, | Mr. HOOKE. |

Upon debating the propoſals made by Mr. FAUBERT concerning Chelſea-College, it was thought fit and ordered, that the houſe and the five acres, whereon Chelſea-College ſtands, ſhall be let by leaſe for forty-one years to ſuch perſons, as ſhall be ready and engage to depoſite the ſum of money required, at the annual rent of thirty pounds: and that Mr. FAUBERT be made acquainted therewith.

Mr. FAUBERT being in the next room was called in, and acquainted with theſe propoſals, who readily concurred with them: and it was deſired, that care ſhould be forthwith taken to make this conveyance from the Society; and that Sir JOHN HOSKYNS would be pleaſed to conſult with * * council to that purpoſe.

It was farther ordered, that a letter ſhould be ſent to the preſident to acquaint him with this proceeding, and to deſire his concurrence and aſſiſtance.

It was farther deſired, that * * * endeavour to find among their acquaintance ſome perſons, who may advance the ſum of money requiſite to complete the work according as it ſhould be defined.

*November* 11. At a meeting of the COUNCIL were preſent

Sir CHRISROPHER WREN, vice-preſident,

| | |
|---|---|
| Mr. HILL, | Mr. EVELYN, |
| Mr. COLWALL, | Mr. CREED, |
| Dr. ALLEN, | Mr. HOOKE. |
| Mr. HENSHAW, | |

Mr. HOOKE was deſired to find a fit collector for the arrears due to the Society: And,

To get a paper fairly drawn of Mr. FAUBERT's deſign.

Mr. EVELYN was deſired to draw up a letter to be ſent to ſuch perſons as were much in arrears to the Society.

*November* 20. At a meeting of the COUNCIL were preſent

Sir

Sir CHRISTOPHER WREN, vice-preſident,

| | |
|---|---|
| Sir JOHN HOSKYNS, | Mr. HENSHAW, |
| Mr. HILL, | Dr. ALLEN, |
| Mr. COLWALL, | Mr. HOOKE. |

Sir CHRISTOPHER WREN read a letter drawn by himſelf to be ſent to ſuch perſon in arrears to the Society as ſhall be agreed upon by the council.

Mr. HOOKE was deſired to inquire after Mr. ROBERT REYNOLDS.

Sir CHRISTOPHER WREN, Mr. HENSHAW, Sir JOHN HOSKYNS, Dr. CROUNE, and Mr. HOOKE were nominated a committee to audit the treaſurer's accounts.

It was ordered, that the treaſurer pay to Mr. HOOKE the laſt quarter's ſalary ending at Michaelmaſs paſt.

At a meeting of the SOCIETY on the ſame day, Mr. HENSHAW, vice-preſident, in the chair.

The minutes of the laſt meeting of Auguſt 7th were read; which gave occaſion of farther diſcourſe about ſenſation and ſight, and was concluded, that ſenſation was performed by the help of the medium; and that the eye judged of the place of the object only by the impreſſion made on the eye by the end of the rays, which immediately touched the eye; and that the imagination always conceived thoſe rays to proceed in a direct line to the objects, and was not ſenſible of any refraction or reflection of thoſe rays without ſome other help to inform the judgment: that direct * * was much of the ſame nature with the feeling of different ſubſtances by the help of a ſtick, which is ſtrait; and ſo the blind man diſtinguiſhes the nature and poſition of thoſe things, which he touches with his ſtick by means of his hand; which directs and holds the ſtick faſt, ſo that any thing, that moves the end of the ſtick, moves alſo his hand: That the refracted or reflected ray is imitated by a ſtick variouſly bent, whereby the blind man not knowing of it ſuppoſes the ſubſtances touched by the end of it to be there, where that part of the end of his ſtick held in his hand directly points.

Mr. FLAMSTEAD related, that he had obſerved the refraction to be a whole minute at the hight of forty-five degrees; and that it was very conſiderable alſo at the hight of ſixty degrees.

Dr. CROUNE took notice, that it was a deſirable thing to have the barometer obſerved in ſeveral places, ſince it ſometimes varied very much in a ſmall diſtance of places: to confirm which he alledged, that by comparing the obſervations made at Paris with thoſe, which he had made in London, he had found them ſometimes to differ very much.

Mr. FLAMSTEAD conceived, that the barometer was only altered by the wind.



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Mr. HENSHAW was of opinion, that this alteration proceeded from the vapours in the air; and that the greateſt part of thoſe vapours were brought from between the tropics into theſe northern parts.

It was deſired, that Mr. HOOKE ſhould write to profeſſor STURMIUS at Altorf to requeſt him to keep an account there of the variations of the barometer; which Mr. HOOKE promiſed to do.

Mr. FLAMSTEAD affirmed, that he had compared the obſervations of Mr. TOWNLEY with his own, and found them much the ſame, and to differ very little.

It was obſerved, that the laſt rains were general throughout all Europe; and therefore it was conceived, that the alterations of the barometer extended likewiſe very far, and were almoſt univerſal.

Dr. CROUNE took notice, that the great thunder in * * extended alſo very far, though thunder often extends but a little way.

Mr. HOOKE gave an account of the trial, that had been made with Monſ. PAPIN's wind-gun for condenſing the air to a ſixty-fourth part of the ſpace, which it filled before compreſſion. It was deſired by the Society, that this experiment might be repeated at the next meeting.

HENRY PAMAN, M. D.[i] was propoſed candidate by Dr. CROUNE.

*November* 27. At a meeting of the COUNCIL were preſent

Sir CHRISTOPHER WREN, vice-preſident,

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| Sir JOHN HOSKYNS, | Dr. GREW, |
| Mr. HENSHAW, | Mr. CREED, |
| Dr. GALE, | Mr. HILL, |
| Dr. BROWNE, | Mr. HOOKE. |

It was ordered, that Sir CHRISTOPHER WREN be deſired to perfect the letter, which he had drawn up to be ſent to the members much in arrear; and that the copies of the ſaid letter be made to be ſent: And,

That Mr. PERRY be deſired to print his catalogue of the Norfolk library with an epiſtle to the Society making mention of the bounty of the duke of Norfolk [k].

At a meeting of the SOCIETY on the ſame day, Sir CHRISTOPHER WREN, vice-preſident, in the chair.

[i] He had been choſen profeſſor of phyſic in Greſham-college, 21 June, 1679, upon the reſignation of Dr. MAPLETOFT.

[k] This catalogue was printed in 1681, in 4to. at London.

The minutes of November 20th were read: whereupon it was farther debated, whence the alteration of the gravity of the air proceeds, whether from the greater hight of the air by a new influx of air from ſome other part of the world, whereby the perpendicular altitude was increaſed or diminiſhed, and conſequently the preſſure; or from the new acceſſion of ſteams, fumes, or ſaline ſubſtances, diſſolved and taken up by the air, in the manner of aquafortis taking up into itſelf ſilver, copper, iron, &c. and ſo is made heavier in ſpecie than it was before it was ſo impregnated: and thus, though it were not increaſed in bulk or hight, yet it might be increaſed in gravitation or preſſure.

Mr. Hooke was of opinion, that both theſe cauſes may concur to produce this effect; and that in order to the examination thereof he had contrived two kinds of barometers, which were firſt mentioned to the Society, as he conceived, about the year 1662, and lately alſo, viz. the laſt year. The firſt of which ſhould only ſhew the variations of the preſſure of the air cauſed by the alteration of the preſſure of the air from either or both cauſes: but the ſecond ſhould only ſhew the alteration of the preſſure of the air from the alteration of the ſpecific gravity.

Sir Christopher Wren was of opinion, that it proceeded moſt of all from the impregnating of the air by nitrous ſalts, which were continually raiſed up into it.

Dr. Croune mentioned, that Dr. Grew had formerly communicated an account of the ſolutions of ſalts by water, which would ſerve to explain this notion; which he conceived it would be proper to conſult.

Mr. Hooke alledged, that he had about eight years before ſhewn the Society at Arundel-houſe an experiment to prove the penetration of liquors one into another by putting oil of vitriol into water in a bolt-head of glaſs; whereby it manifeſtly appeared, that thoſe two liquors put together took up much leſs room than when they were ſeparated.

Dr. Croune was of opinion, that the air or water impregnated with ſalts become only heavier upon the account, that they were kept floating together, and a compound of water with an heavier body, as ſalt, the compound taking up as much room as the ſame bodies did apart: and there was no certain obſervation yet to the contrary of that in thoſe bodies; the compound body not weighing heavier than either of the compounding bodies.

Mr. Hooke alledged, that there were ſome inſtances, whereby it appeared, that bodies really penetrated into the texture of each other, and both together took up leſs room than they did before they were mixed, and ſo made a body, that was not only as heavy as it ought to be, ſuppoſing theſe bodies mixed together, but a body heavier than either of them; and conſequently there muſt be a penetration of the texture or dimenſions of each other. He alledged alſo, that there is the like penetration in oil of vitriol and water; and alſo in divers other bodies, which he could

could make evident. It was desired, that an experiment of this kind should be shewn at the next meeting.

Monſ. PAPIN produced his wind-gun charged with air, which he designed by a pipe fastened into it to discharge into a large glass filled with water, and inverted into a bucket of water. But upon making the experiment, the pipe being too much pressed by the mouth of the glass, was cracked, and consequently much of the air went not into the said glass; and therefore the certainty of the experiment could not be now examined; but it was desired, that it might be shewn at the next meeting. But Monſ. PAPIN having charged it again, shot a plug through an inch board at * * yards distance.

*December* 1. The Society met upon summons, in order to make their anniversary election of the council and officers for the year ensuing.

Sir CHRISTOPHER WREN, vice-president, took the chair, the president being absent on account of indisposition.

A sufficient number of members being present, the candidates, who had been formerly proposed, were put to the scrutiny by ballot, and these following were elected;

Mr. EDWARD TYSON,

HENRY PAMAN, M. D.

WILLIAM NAPPER, Esq;

Signor GIOVANNI AMBROSIO SAROTTI, son of the Venetian resident, who was proposed candidate by Mr. BOYLE.

Then the Society proceeded to their election, according to their usual manner, and the suffrages being collected, it was found, that the following members were continued of the council,

Sir JOSEPH WILLAMSON,
Dr. ALLEN,
Mr. COLWALL,
Dr. CROUNE,
Dr. GALE,
Dr. GREW,
Mr. HENSHAW,
Mr. HILL,
Sir JOHN HOSKYNS,
Mr. HOOKE,
Sir CHRISTOPHER WREN.

The new members chosen into the council were,

GEORGE earl of Berkley,
THOMAS BARRINGTON, Esq;
Mr. EVELYN,
Dr. HOLDER,
EDMUND KING, M. D.
PHILIP PARKER, Esq;
Mr. WILLIAM PERRY,
Sir WILLIAM PETTY,
THOMAS POVEY, Esq;
Sir ROBERT SOUTHWELL.

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The Society then made their election of officers, viz.

Sir JOSEPH WILLIAMSON, preſident,
Mr. HILL, treaſurer,
Dr. GALE, } Secretaries.
Mr. HOOKE, }

The earl of BERKLEY, Mr. EVELYN, Dr. HOLDER, Dr. KING, Mr. PARKER, and Sir ROBERT SOUTHWELL were ſworn of the council before the vice-preſident, Sir CHRISTOPHER WREN, according to the direction of the charter.

*December* 4. Before the meeting of the Society five of the council, viz. Mr. HENSHAW, Mr. HILL, Sir JOHN HOSKYNS, Sir JOHN LOWTHER, and Mr. HOOKE viewed the gallery, and appointed Mr. HUNT to ſet up a partition for the library at the weſt end next the door, to incloſe it for a library.

Mr. HENSHAW, vice-preſident, took the chair.

WILLIAM BRIDGEMAN, Eſq; was propoſed candidate by Mr. HENSHAW. Signor SAROTTI was admitted fellow.

The experiment propoſed at the laſt meeting by Mr. HOOKE, to ſhew, that copper and tin being melted together into one maſs, would make a compoſition extremely different from them both, was tryed and examined; and it was found, that equal parts of copper and tin melted together made a metal, which was exceedingly hard and very brittle, though the ingredients are both very ſoft and very malleable: and whereas copper is of a very brown red colour, this was extremely white, and, which was the principal property that it had newly acquired, the ſpecific gravity of it was found to exceed thoſe of both copper and tin; for whereas copper to water is as $8\frac{1}{7}$ to 1, and tin to water as $6\frac{4}{7}$ to 1, and thence the compoſition ought to have been to water as $7\frac{17}{70}$ to 1; it was found by weighing a part of this ſubſtance firſt in the air and then in the water, that the weight thereof to water was as $8\frac{192}{250}$, or $8\frac{3}{4}$ to 1; for it weighed in the air 2326 grains, and in the water 2060 grains.

Hereupon the cauſe of this was explained by Mr. HOOKE, and aſcribed to the penetration, which thoſe bodies made into one another; and it was illuſtrated by the experiment, that had been formerly produced before the Society, of the mixtures of water and oil of ſulphur or vitriol.

Theſe experiments were made in order to illuſtrate ſome theories about the preſſure of the atmoſphere, to ſhew how the air might be impregnated with other bodies; whereby the ſpecific gravity thereof might be augmented and altered, the hight thereof remaining the ſame.

Mr. FLAMSTEAD was of opinion, that the levity of the air proceeds only from the motion of the air, and the gravity thereof from its ſtanding ſtill; and that the

the ſame body moved does not preſs ſo much, as when it ſtands ſtill: upon which ſeveral things were debated.

Mr. HOOKE alledged ſeveral obſervations made by him, which were contrary to that ſuppoſition; for he had found, that after a long and ſtill rain, during all which the mercury had continued to fall, as ſoon as the air began to move, or the wind to blow, the mercury began to aſcend. It is true, that it often happens, that in great winds the mercury is very low: and ſo it is likewiſe when there is no wind at all ſtirring, as in great rains: and it is no new obſervation, that in ſtormy weather the air is light, the barometers being all ſo marked.

The minutes of November 27, and December 1, were read, and ſome matters thereof debated.

Mr. HENSHAW alledged, that antimony by calcining would increaſe in weight; and mentioned, that Mr. BOYLE had found the ſame thing. It was therefore ſuppoſed, that the gravity of the compoſition of the tin and copper might be cauſed by addition to it from the fire.

Mr. HOOKE alledged, that the compoſition did not weigh heavier than the two ingredients joined together; but rather that it weighed lighter than the ingredients together did before the melting, by reaſon, that ſome part of each of them was waſted by the heat; but that the ſpecific gravity of the compoſition exceeded the ſpecific gravity of the two joined together as one compound gravity; and not only ſo, but likewiſe the ſpecific gravity of the heavieſt of them. Beſides which he urged, that he had ſeveral times calcined antimony by the help of a burning-glaſs; and had always found it to grow conſiderably lighter by ſuch calcination.

Upon diſcourſe concerning foreign correſpondence, it was moved, and the Society deſired Mr. EVELYN, that he would endeavour to obtain from the ſecretaries of ſtate, that the Society might have the favour to ſend to, and receive their letters from their foreign correſpondents in the packet of the ſaid ſecretaries, as they formerly had in the time of Sir JOSEPH WILLIAMSON's being ſecretary of ſtate, which Mr. EVELYN engaged to endeavour.

Mr. HOOKE produced and read a letter of Mr. NEWTON to himſelf, dated 28th November, 1679, containing his ſentiments of Monſ. MALLEMONT's new hypotheſis of the heavens; and alſo ſuggeſting an experiment, whereby to try, whether the earth moves with a diurnal motion or not, viz. by the falling of a body from a conſiderable hight, which, he alledged, muſt fall to the eaſtward of the perpendicular, if the earth moved.

This propoſal of Mr. NEWTON was highly approved of by the Society; and it was deſired, that it might be tried as ſoon as could be with convenience.

Sir CHRISTOPHER WREN ſuppoſed, that there might be ſomething of this kind tried by ſhooting a bullet upwards at a certain angle from the perpendicular round every

every way, thereby to ſee whether the bullets ſo ſhot would all fall in a perfect circle round the place, where the barrell was placed. This barrell he deſired might be fixed in a frame upon a plain foot, and that foot placed upon a true plain every way, and the mouth of the gun be almoſt in the ſame point over the plain, which way ſoever ſhot.

Mr. FLAMSTEAD hereupon alledged, that it was an obſervation of the gunners, that to make a ball fall into the mouth of the piece, it muſt be ſhot at eighty-ſeven degrees; and that he knew the reaſon thereof; and that it agreed with his theory: and that a ball ſhot perpendicularly would never fall perpendicularly: and he mentioned the recoiling of a perpendicular jet of waters. But this was conceived to ariſe from ſome miſtake of the gunners, in not well taking notice of all circumſtances; ſince a body ſhot perpendicularly would alſo deſcend perpendicularly; and a body ſhot at eighty-ſeven degrees would fall conſiderably diſtant from the place where it was ſhot.

*December* 8. At a meeting of the COUNCIL, at the houſe of the preſident, were preſent,

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| Sir JOSEPH WILLIAMSON, | preſident, |
| Sir CHRISTOPHER WREN, | Dr. KING, |
| Mr. HENSHAW, | Dr. CROUNE, |
| Sir JOHN HOSKYNS, | Dr. GALE, |
| Sir ROBERT SOUTHWELL, | Mr. HOOKE. |
| Dr. HOLDER, | |

It was reſolved, that there ſhall be ſome one ſubject fixed upon for the Society to proceed upon for the enſuing time, as their main work, till they are ſatisfied concerning that ſubject:

That within ſome reaſonable time, as a year, or as ſoon as they ſhall be ſatisfied, that it is brought to perfection, ſomething concerning their progreſs ſhall be publiſhed:

That in purſuance of this deſign, ſome one experiment ſhall be appointed by the Society at every meeting, to be ſhewn at the next meeting in proſecution of that ſubject ſo made choice of.

That the ſeveral members preſent, when the experiment is appointed, be deſired againſt the next meeting to conſult ſuch authors, as have treated of the ſaid experiment or the ſubject in debate, and to deliver in what they ſhall meet with concerning it; and alſo to ſpeak their own opinion of it:

That the firſt thing done at every meeting ſhall be the reading over of the notes of what was done at the preceding meeting:

That a particular and diſtinct account and narrative of the experiments made at the preceding meeting ſhall be brought in fairly written by the curator at the following meeting, and be there read before the Society, in order to its being entered in the Regiſter, in caſe the Society think fit ſo to direct:

That whereas it is found, that ſeveral experiments made before the Society theſe late years have been only in the Journal-book, and not in the Regiſter; all ſuch experiments ſhall be forthwith tranſcribed out of the Journal-book, and being firſt made perfect and full by the curator, be then fairly entered in the Regiſter:

That whoever is in the chair the laſt Thurſday of the month do call to the ſecretary and amanuenſis, and ſee, if as well the Journal, as the particular experiments, &c. appointed to be entered in the Regiſter, be entered accordingly; and finding them to be ſo, that under the paper or Journal he write *Entered:*

That likewiſe at the ſame time he view the Letter-books, and ſee, that the letters appointed to be entered be entered accordingly:

That the ſecretaries take care to have a ſmall account of philoſophical matters, ſuch as were the *Tranſactions* by Mr. OLDENBURG, and under the ſame title, publiſhed once a quarter at leaſt: and that it be recommended to them to do it monthly, if it may well be; but at leaſt that it be done quarterly.

Mr. HOOKE being aſked concerning the undertaking this matter, anſwered, that he would ſee what he could do in it, but could not as yet undertake it abſolutely.

*December* 10. At a meeting of the COUNCIL, at the preſident's houſe, were preſent

Sir JOSEPH WILLIAMSON, preſident,
Mr. HENSHAW,
Sir ROBERT SOUTHWELL,
Sir JOHN HOSKYNS,
Mr. EVELYN,
Dr. HOLDER,
Dr. GALE,
Dr. CROUNE,
Mr. HILL,
Mr. HOOKE.

It was ordered, that Monſ. PAPIN ſhould be diſcharged, but that he be allowed for the time till he be diſcharged, and paid accordingly.

Mr. EVELYN reported, that he had ſpoken to the earl of Sunderland[1] about ſending the Society's letters in the packets of the ſecretaries of ſtate; and that his lordſhip had readily given his conſent thereto.

Mr. HOOKE was deſired to get ſeveral experiments ready againſt the next meet-

[1] Then ſecretary of ſtate.

ing, by reaſon that ſome ſtrangers would be preſent; and Mr. HUNT was ordered to ſummon ſeveral of the members to be preſent.

Dr. GALE was deſired to ſend a letter to the ſeveral perſons in foreign parts, who had formerly correſponded with the Society, and particularly to Mr. PULLEIN concerning Signor MALPIGHI, and to aſſure them of a conſtant correſpondence for the future.

Dr. GALE, Dr. CROUNE, Dr. ALLEN, Mr. HILL, and Mr. HOOKE were appointed a committee to ſee, that a partition be put up in the long gallery of Greſham college.

Dr. GREW mentioned, that Mr. MANWARING was going to the Indies, and undertook to have barometers ſent to the Indies and Barbadoes, with full directions for the uſe of them, and to procure an account from thence of what obſervations ſhould be made.

Dr. GALE promiſed to give the Society for their library all the works of SCOTUS.

Sir ROBERT SOUTHWELL promiſed to give WECKERUS *De Secretis Medicinæ*.

It was ordered, that a paper-book be forthwith provided, in which ſhall be entered all the tranſactions of the council:

That a particular book be provided for entering all ſuch letters, as are written by the ſecretaries to the ſeveral correſpondents at home and abroad; and another for copying all ſuch anſwers and returns, as come to the Society or ſecretaries, from abroad or from any part of England, Scotland, or Ireland.

That a committee be appointed to view the former Letter-books, to ſee how perfect the entries are; and to take an account of all looſe letters recovered from the adminiſtratrix of Mr. OLDENBURG, and of thoſe, that have come to the ſecretaries ſince; and to take care, that thoſe, that are not yet entered, be entered forthwith, and that the originals be with all care got together, in order to their being preſerved in ſuch way as the Society ſhall direct. Mr. HILL, Sir JOHN HOSKYNS, Dr. GALE, and Dr. CROUNE, or any two of them, were appointed of this committee.

That a particular preſs be provided to be placed in the gallery appointed for the library, for keeping of all the letters, papers, and books of entries, Journals, Regiſters, and all other written books of the Society under the cuſtody of the ſecretaries; and that a note or liſt be made of all ſuch, as then were or ſhould hereafter be in their keeping, to be for the future interchangeably ſigned between the preſident and the ſecretaries; and that thoſe letters be examined once a year, as at St. Andrew's day:

That ſome of the beſt and moſt entertaining experiments produced before the Society be ſet apart, and a liſt taken of them to be at hand, for the entertainment of any perſon of quality, &c. who ſhall viſit the Society: and

That a committee of experiments be appointed every year, 1. To make a liſt of what authors have written of phyſico-mathematical matters: 2. That they charge themſelves with one or more of the ſaid authors; and that it be recommended to others of the Society to take part of the reſt of ſuch authors for the reading them over, and extracting out of them the principal experiments therein mentioned. 3. That all ſuch experiments ſo extracted be brought into the committee for experiments, and by them conſidered of, in order to the preſenting to the Society ſuch of them, as they ſhall think fit to offer to the Society to proceed upon.

*December* 11. At a meeting of the SOCIETY, Mr. HENSHAW, vice-preſident, in the chair.

A foreign count was introduced by Mr. EVELYN, together with two other ſtrangers, who had before the ſitting of the Society been ſhewn the repoſitory, the library, and particularly the weather-clock, &c.

The minutes of December 4. were read and approved; and upon the mention of Mr. EVELYN's undertaking to ſpeak to the earl of Sunderland, he being preſent gave the Society an account, that he had accordingly ſpoken with his lordſhip concerning the conveyance of the letters of the Society to and from foreign correſpondents in his packet; to which the earl very freely and obligingly gave his conſent; for which favour the Society deſired, that their thanks might be returned to his lordſhip by Mr. EVELYN, who was likewiſe thanked by them for his great care and expedition in this affair.

Upon the mentioning of Mr. NEWTON's letter, and the experiment propoſed in it, Mr. HOOKE read his anſwer to him upon that ſubject, wherein he explained what the line deſcribed by a falling body muſt be ſuppoſed to be, moved circularly by the diurnal motion of the earth, and perpendicularly by the power of gravity: and he ſhewed, that it would not be a ſpiral line, as Mr. NEWTON ſeemed to ſuppoſe, but an excentrical elliptoid, ſuppoſing no reſiſtance in the medium: but ſuppoſing a reſiſtance, it would be an excentric ellipti-ſpiral, which, after many revolutions, would reſt at laſt in the centre: that the fall of the heavy body would not be directly eaſt, as Mr. NEWTON ſuppoſed; but to the ſouth-eaſt, and more to the ſouth than the eaſt. It was deſired, that what was tryable in this experiment might be done with the firſt opportunity.

Mr. HOOKE read an account, which he had procured from Mr. BEAUMONT, of ſeveral obſervations made by himſelf in divers ſubterraneous caverns in Somerſetſhire, viz. in Okey-hole, in a cavern near Chedder, and in the hill called Lamb,

above the pariſh of Harptry among Mendipp Hills; which account Mr. Hooke intended to print the firſt opportunity [m].

Hereupon much diſcourſe was maintained about the poiſonous nature of ſeveral mineral waters. Sir John Lowther mentioned an obſervation, which had been made by a friend of his, that upon the breaking out of water from a coal-mine, and running into places, where were ſtore of fiſh, all the fiſh were obſerved to be killed thereby.

Mr. Henshaw mentioned, that it was an uſual obſervation, that plumbers could not keep their cats from being killed by licking up the duſt of their lead.

Dr. King mentioned, that he living near the white lead works in Hatton Garden, had divers times patients of the labourers in them, ſometimes taken with convulſions, ſometimes with palſies, ſometimes with gripings in their guts, divers of them ſpeechleſs.

It was remarked likewiſe, that divers plumbers and gilders are obſerved to be paralytic, &c.

All which effects were aſcribed to the noxious ſteams proceeding from thoſe metals, upon which they wrought.

Mr. Hooke mentioned, that he had received a letter from Mr. William Balle, and another from Dr. Beal; but it being pretty late, the Society deſired to have an account of them at another time, and roſe to obſerve the experiments.

1. An account was given by Mr. Hooke of the experiment for examining the weight of tin, copper, and the mixture of tin and copper, and the way and reaſon thereof explained.

2. The experiments formerly in the Society were again exhibited for the entertainment of the foreign count then preſent, viz. thoſe for explaining the nature of fire; the firſt of which was that of a chafing-diſh of burning coals included in a box with bellows to blow the ſatiated air upon them: the ſecond was that of ſealing up a charcoal in a pipe of glaſs, and keeping it in a very hot fire for about an hour and an half; the effects of both which were the ſame with thoſe, that had been formerly ſhewn in the Society, and entered into the Journals.

Monſ. Papin produced a peach, which he had the laſt ſummer incloſed in a glaſs with artificial air condenſed, and on cutting the ſame, it was found very ſound and plump. He gave no farther account thereof, but that it was an experiment of Mr. Boyle, of which he was now printing an account, which would ſhortly be publiſhed.

[m] It is publiſhed in his Philoſophical Collections, n° 2. p. 1. at London, 1681. in 4to.

Monſ.

Monſ. PAPIN produced likewiſe his wind-gun made in a walking-ſtick, with which he ſhewed, firſt, the extraordinary condenſation of the air therein, by letting it leiſurely out into a glaſs filled with water; of which an account is made in the Journal-book:

And next he charging it again with condenſed air, ſhot a bullet with it in the gallery; the effect being much the ſame with thoſe of ſome other experiments in the ſame gun formerly made uſe of; accounts of which were entered in the Journal-books of this year.

Mr. THOMAS PIGOT, fellow of Wadham College in Oxford, was propoſed a candidate by Sir JOHN HOSKYNS.

*December* 17. At a meeting of the COUNCIL, at the preſident's houſe, were preſent,

Sir JOSEPH WILLIAMSON, preſident,
Sir ROBERT SOUTHWELL,
Sir WILLIAM PETTY,
Sir JOHN HOSKYNS,
Mr. HENSHAW,
Dr. HOLDER,
Dr. GALE,
Dr. CROUNE,
Dr. GREW,
Dr. KING,
Mr. HILL,
Mr. HOOKE.

Mr. HILL, Dr. GALE, Dr. CROUNE and Sir JOHN HOSKYNS were appointed a committee to meet at Mr. HOOKE's lodgings on the Monday following, to ſee the letters in his cuſtody.

It was ordered, that a liſt be made by the ſecretaries of all letters, that had come to their hands during the whole year; and that at the end of each year ſuch a liſt be delivered to the preſident.

Mr. HOOKE was deſired to continue the *Philoſophical Collections* [n].

Dr. GALE was deſired to undertake all foreign correſpondence, which he accordingly did; as alſo that he would forthwith write to Signor MALPIGHI, BORELLI, and Mr. PULLEIN; and that he would apologize to the correſpondents for the defect of returns; which ſhould have been made from hence.

[n] The firſt number was printed at London, 1679, in 4to, by Mr. MARTYN, printer to the Society, under this title: *Philoſophical Collections, containing an account of ſuch phyſical, anatomical, chymical, mechanical, aſtronomical, optical, or other mathematical and philoſophical experiments and obſervations, as have lately come to the publiſher's hands. As alſo an account of ſome books of this kind lately publiſhed.* The ſecond Number was printed at London, for MOSES PITT in 1681; the third for R. CHISWELL, and dated December 10, 1681, with an Advertiſement, that theſe *Collections* would for the future be publiſhed once a month at leaſt; wherein would be contained an account of all ſuch new diſcoveries of nature or art, as ſhould occur to the collector in the modern books or writings of learned men, either at home or abroad. The fourth Number is dated, January 10, 168$\frac{1}{2}$. the fifth, in February, 168$\frac{1}{2}$; the ſixth, in March, 168$\frac{1}{2}$, and the ſeventh and laſt in April, 1682.

Mr.

Mr. HOOKE propounding, that it was neceſſary for him to have a perſon, who might be conſtantly by him, and employed in the making and preparing of ſuch trials and experiments, as ſhould, when perfected, be ſhewn and repreſented to the Society at their meetings; it was ordered, that he ſhould have liberty forthwith to employ ſuch perſon, as he ſhould agree with; and that the Society would allow for the hire of ſuch perſon thirty-two pounds *per annum*.

*December* 18. At a meeting of the SOCIETY, Mr. HENSHAW, vice-preſident, in the chair.

WILLIAM NAPPER, Eſq; was admitted.

WILLIAM BRIDGEMAN, Eſq; and Mr. PIGOT were elected.

Mr. JOSEPH MOXON preſented to the Society one of his Engliſh globes, together with a book, containing the explication and uſe thereof [o], with a deſire, that it might ſtand in the meeting-room, to be ſeen at the meetings of the Society. And Mr. HUNT was directed to get a wooden caſe made for it to ſtand in the meeting-room.

Mr. HOOKE read his anſwer to Mr. NEWTON's former letter; as alſo another letter, which he had received from Mr. NEWTON, containing his farther thoughts and examinations of what had been propounded by Mr. HOOKE.

Mr: HOOKE gave alſo an account, that he had made three trials of the experiment propounded by Mr. NEWTON, and had found the ball in every one of the ſaid experiments fall to the ſouth-eaſt of the perpendicular point, found by the ſame ball hanging perpendicular. But the diſtance of it from the perpendicular point being not always the ſame, and the experiment having been made without doors, in the open air, nothing of certainty could be concluded from it. But he alledged, that he deſigned to make a trial of it within doors, where there would be leſs motion of the air; and he hoped to be able to do it before the next meeting of the Society.

Mr. HOOKE read a letter of ERASMUS BARTHOLINE, which he had received from the preſident, directed to Dr. GREW, and dated at Copenhagen, 23d February, 1679 [p]; in which the writer expreſſed his readineſs to correſpond, and incloſed a treatiſe of his nephew, CASPAR BARTHOLINE, *De Organo Olfactus*; which treatiſe was delivered to Dr. CROUNE to peruſe and give an account of it at the next meeting, in order that an anſwer might be ſent to the letter.

Mr. HENSHAW preſented the Society with a printed account of the great loſs ſuſtained by Mr. HEVELIUS in the late fire at Dantzick; which account was ſent from Hamburgh by Sir PETER WYCHE, to whom that account was dedicated.

[o] See Mr. HOOKE's Philoſophical Collections, n° 1. p. 43. [p] Letter-book, vol. viii. n° 68.

Mr.

Mr. HOOKE ſhewed a new book of Signor VIVIANI, ſent to himſelf by the author, containing ſeveral ſolutions of the problem propounded by Mr. CONYERS of triſecting an angle, and finding two mean proportionals. Two other copies were likewiſe ſent, one for the preſident, and the other for Mr. COLLINS, which were accordingly delivered.

Hereupon Sir ROBERT SOUTHWELL promiſed to preſent to the Society for their library Signor VIVIANI's book *De Maximis & Minimis*.

Mr. HENSHAW read a paper, which he had received from Dr. PLOT, copied from the Records in the Tower, containing an account of the ſtrange recovery of certain perſons a long time after their having been executed.

The experiments ſhewn were the trials with the box, in which the chafing-diſh of live coals were placed; and the time was obſerved, how long it continued there before the coals ſeemed quite extinct and black. Then the ſame chafing-diſh was again filled with live coals, and included, and the bellows were kept continually blowing upon them; and the time being alſo obſerved, how long it was before they alſo were quite extinct, it was found, that the times of continuance in both experiments were the ſame.

There were two other experiments ready, which the Society had not time to ſee tried, it being late; for which reaſon they were reſerved to the next meeting.

THE END OF THE THIRD VOLUME.

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