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Printed by *T. N.* for *John Martyn*, and
James Allestry, Printers to the *Royal Socie-*
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out *Temple-Bar*, and in *Duck-lane*, 1667.

FINIS

PHILOSOPHICAL
Transactions:
GIVING SOME
ACCOMPT
OF THE
Present Undertakings, Studies, and Labours
OF THE
INGENIOUS
IN MANY
CONSIDERABLE PARTS
OF THE
WORLD.

VOL. II.
For *Anno* 1667.



In the SAVOY.

Printed by T. N. for *John Martyn* at the Bell, a little
without *Temple-Bar*, Printer to the *Royal Society*.

PHILIPSON'S

Translations:

LIVING ZONE

ACCOMPY

OF THE

Principles of Agriculture, and the

OF THE

INCUBATION

OF THE

OF THE

OF THE

WORLD

OF THE

OF THE

OF THE

OF THE

OF THE

To the Right Honourable
WILLIAM Lord VISCOUNT BRONCKER,
CHANCELLOR to Her MAJESTY,
AND
PRESIDENT to the ROYAL SOCIETY, &c.

MY LORD,



After I had dedicated the First Volume of these Philosophical Occurrences to the R. Society, to whose service I have dedicated my self, I thought it my next duty to present the Second to your Lordship, who have for so many years with so high and universal an Applause presided in that Illustrious Assembly, and there given full proof both of the vast extent of your knowledg, and the incomparable solidity of your judgment in all the various Arguments and Matters there produced, observed, experimented and discoursed of. This, my Lord, though it deserves a far better Pen to be proclaim'd to the world, then mine; yet did I think, I might be suffer'd in this crowd to cast in my voice, and to deliver the truth and my persuasion thereof in these plain expressions. To which I shall add no more but my humble acknowledgments for your Lordships particular favour and goodness, in condescending on all occasions, to encourage these (though rude and undigested) Communications, and thereby to fortifie (against the obloquies of some singular men) the endeavours of the Authour for the improving and enlarging his Philosophical Commerce; which, being done, may perhaps be a means to render these Papers less inconsiderable for the future. I am,

My Lord,

Your Lordships

LONDON,

March 2. 1667

8

Very humble, and very much
obliged Servant,

Henry Oldenburg.

Soc. Reg. Secr.

A N I N D E X

FOR THE
PHILOSOPHICAL TRANSACTIONS.

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with Numb. 32.

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PHILOSOPHICAL TRANSACTIONS.

Monday, March 11. 1666.

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A P R E F A C E

To the Third Year of these Tracts.

HAVING, by Gods Assistance, finish'd my solicitations for the *Philosophical Transactions* of the two last years, I crave leave to reflect a little upon what hath past.

I think, I may safely assume, that in these *Fragments*, something hath been contributed, to sowe such seeds, as may somewhat conduce to the illustration and improvement of Philosophy, and of all Laudable and Useful Arts and Practices. And

I hope, our Ingenious Correspondents have examin'd all circumstances of their communicated Relations, with all the care and diligence necessary to be used in such Collections; not taking up old Fame, or flying Reports, upon too easie trust; not straining for other Kinds of Wonders, than the most wise Author of Nature hath allowed, but attending closely to the strict measures of *Natural Truth*, and to the useful Contrivances of *Art*. For some evidence whereof, I refer the *Reader* to the particulars, indicated in the *Tables* annexed to the *Tract* of *February*, lately past.

— And because well advised Histories of *Natural Productions*, and of *Artificial Contrivances*, are necessary to beget sound knowledge, and to *excite* profitable Inventions, some have furnisht us with accurate Instructions, under the *modest* Title of *Inquiries* and *Proposals*: And further Disquisitions are by the hands of many Accomplisht Persons severally, and often with joynt endeavours in a manner universally prosecuted.

Neither have we discouraged or refused the Essays of some famous Philosophers, learned Philologers and *Antiquaries*; whose Disquisitions, Readings, and Reasonings, have extended farther than their Experiences; since by such bold Excursions and Sallies many valuable Truths may be started out of their recesses. *Architects* do require some variety and store of Materials for the further satisfaction of their Judgment in the Choice: And the *Sculptor* must pare off somewhat of his richest Marbles, Onixes, Diamonds, &c. before he can perfect the Pourtraicture. Such liberty an exact Philosopher must claim in his Extracts from Men of much Learning.

In *Medicinals* we have now and then occasionally inquired after some rarities, medical applications and experiences; what the uses and performances are by *Phlebotomy*, *Frictions*, *Simples* or *Compounds* not ordinary, by *Diet* or *Chymical Operations* in some of the remotest parts of the *World*, particularly in the famous *China*.

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N. 8. p. 133. Swarms of In-
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Neither have we altogether omitted to commemorate those obvious reliefs, which the *Divine Bounty* has offered freely and in common, for distressed Mortals, by *Springs*, *Baths*, *Bolus's*, *Medicated Earths*, &c. And we have had a due

due care to erect a *Pharos* for a Caution against undiscern'd dangers.

By *Anatomy* we have sometimes enter'd into the Chambers and Cabinets of *Animal* Functions, to find many Meanders and changeable Varieties, and the immediate Organs and Conduits of Life and Sensation.

As for the Growth of *Arts* and *Inventions*, I think, it may justly be said, That these our Entries sometimes assist and promote their Improvements. And the same will hereafter remain faithful Records to shew, By what steps and degrees, and by what Effays, Emulations, and Encouragements these Noble Arts advanced to perfection. And a punctual information of these Gradual Processes, may be instructive to promote other Inventions. And the Wise will consider it, at what easie rates they obtained *Monethly Advices* of the Designs and Successes of Industrious and Eminent Persons, and by the same means came to know as much, as was purchased at *their* great charges and assiduous labour. Of which Arts as they are now improved, and still improving, I presume I need not spare to say, That they would have obliged an *Alexander*, or a *Solomon*, and I must avouch with confidence, That they would have raised Acclamations, Applauses, and Admiration of most, and have provoked them to refund full Rivers of Treasures in Just Rewards, and extraordinary Atchievements.

Neither is it much amiss, that there are yet some, who do prefer the darkness of old Heathenisme before the Noon-light. Otherwise, the next Age might hardly believe, that Men pretending to Wit, Prudence, and Learning, would ever make such strange Oppositions against their own great Emolument and Accommodations: And so the Vertuous might be deprived of a *fair beam* of the future Glory, due to their Memories for their unchangeable Resolutions, as unconcern'd in scoffing Discourses, and standing firm as Rocks against the dashes of foaming Disputants. And truly, they do much oblige us, in that they are pleased by their frets, and eager contentions, and by their fruitless and obstreperous Verbosity, to make themselves a foil, to set off the Serene Lustre of the real and obliging performances of the Experimental Philosophers.

And yet (in short to convince and reclaim as many as are hopeful) I dare, *without leave*, but with sincere affections in behalf of the Learned *Virtuosi*, undertake to joyn issue with them, and to offer fair proof, That, whereas they pretend to *Aristotle* as their *Grand Oracle*, we have a true and higher esteem for his true worth, than these Pretenders do effectually manifest.

We say, his *Logicks* and *Rhetoricks* are very valuable. His *Ethicks* and *Politicks*, for the most part, sound. His *Metaphysicks* in many Notions acute. But all these are generally overwhelmed and degraded by the swarms of Insectile Systemes and dilute Commentaries.

And as for the other more useful Volumes of *Aristotle*, his *Traacts* of *Animals* (which did cost *Great Alexander* so many *Talents* for the furniture, and an ample Salary for encouragements) his *Mathematical Discourses*, and *Mechanicks*, these they never salute. They weed out his onely defects, and animosities, his *Ventilations* with his Elders and *Compeers*, about *Atomes* and darker Principles; a *Matter*, which is *neque quid, neque quantum, neque quale*, a *Formal* and *Substantial* εὐταλῆχεια (a word too hard for *Cicero* to translate) and *Privation*, a *Principle* as good as the rest; his *Definitions* of *Causes* and *Affections*; his *Quaternion* of gross *Elements* and grosser *Mixtures*, and insipid *Compositions* and *Qualities*, less significant than the popular *Air*: All of them much fitter to beget *Eternal Controversies*, than to administer any satisfaction to a reasonable Understanding. These they gather up for the sweetest *Poesies* and fairest *Garlands*, wherewith to adorn their *Brows* and *Temples*; and so they take their leave of *Aristotle* at the very *Threshold*.

Thus they reject the *Harmony*, and waste all their time in tuning the *Instrument*, and are best pleased, even *ravish'd*, with those strokes, which glance below the *Bridge* by which they sharpen and turn their *Spirits* habitually, and set the teeth of their disciples on edge; and then

Quo semel est imbuta recens, servabit, &c.

We take leave to ask, Whether *Aristotle* did not illustrate his best Conceptions in his Works, with *Mathematical Demonstrations*? In this, *Blancanus* will initiate their Observations with sufficient indulgence. We ask further, Which of the *Philosophers*
of

of note, for any thing else but honest Moralities, did neglect the *Mathematicks*? What *free-born Child*, or yet what *slave*, of any promising hopes, was not entered into these Disciplines, before they could number ten yeares of their Age. If these men would addict their palats to the pure fountains, and not wander after every polluted stream, then they would find more leasure for better things, to do some good for themselves and others: Then they would taste the pleasure, and reap the profit of their old Rule,

Dulcius ex ipse fonte, &c.

And wital they would have better understood their best friends.

Certainly; If *Aristotle* had been so happy, as to have enjoyed our *Opticks*, and other Instruments of Arts, and such *Engins* as we now employ, He would have been quite of another spirit than these are; and would have acknowledged a greater variety and more curious contexture, and more brisk *Mechanicks* in the *Insectiles*, which were in those dayes *invisible*, than in all the Animals, that were then known, or than are yet to be found in a far wider circumference; and would have confest the productions of our *Pyrotechnical Furnaces* to excell all, that could be reasonably expected from his own vast *Fiery Region*.

We say heartily, Read *Aristotle*, read him in his own Stile; read him entirely and fully; not feeding onely on his Ulcers and Excrecencies; nor taking up your rest in his *Un-intelligible Heavens*, at their *Adamantine Gates*, or about their *Flaming Walls*: Embrace his calm rayes, and his dis-interessed Reasonings: chuse his best Vertues, examine and weigh all his Mathematical Illustrations, descend to his particulars: And then hasten to our *Christian* Philosophers, and they will forth-with acquaint you with the true Works and wonderful Contrivances of the Supreme Author, and with the Discoveries, which by his indulgent Providence and his benigne Inspirations have been in former and later Ages afforded, for the benefit, and the sincerely grateful acknowledgments of humane race.

'Tis our main business, as well to retriue all *valuable Antiquities*, as to supply *fresh Discoveries*: to recover good *old helps*, as well as to devite *New*. All our Artificers are designed, and appropriated, to unlock all the Repositories of Nature, To draw out her most concealed Operations and Rarities, To produce them
with

with their best Advantages, and in their fairest Ornaments, for all good occasions: And whatever we find excellent in old *Greece*, or *Rome*, or in more ancient *Monarchies*, or in any one more happy part of the *World*, *That* in due season to communicate all over the *World*, to as many, as have the Ingenuity to give them a hearty Entertainment.

After thus much of *Preface* (which the *Candid Reader* will interpret with the same affection, it was written) I return to my task. Where I think it not amiss,

First of all, to take notice of the late Enlargments of our *Philosophical Correspondencies* in both remote and neerer parts of the *World*; concerning which we are singularly obliged to several of the *Generous and Intelligent Citizens* of this *Famous Metropolis* of *England*, especially the *Eminent Governours* of the *East-India* and *Turky Companies*, besides those of the same *City*, that travelling into the *West-Indies*, have been very ready to receive, (and to promise good *Accounts* upon) such *Philosophical Instructions*, as were presented to them concerning many particulars, thought worthy to be further inquired into, in our *American Colonies*. To which we shall add, what we have procured, for this our purpose, by our *Commerce* with *Spain*, *Portugal*, and *Barbary*; as well as by our *Navigations* into *Greenland* and *Iceland*: and also what occasions we have before us, to enter into a confociation with *Germany*, *Bohemia*, *Hungary*, *Transilvania*, *Carinthia*, *Tyroll*, and with all the principal *Cities* of *Italy*: it appearing already by our former *Papers*, what interest we have, before now, establishd in *France*, and, by the assistance of the *Eminent Hevelius*, in all the *Countries* upon the *Baltick Sea*, and in *Poland*; which is therefore related here, that we may thence take occasion to invite all *Ingenious Men*, and such as consider the importance of *Cementing Philosophical Spirits*, and of assembling together *Ingenuities*, *Observations*, *Experiments* and *Inventions*, scattered up and down in the *World*; that they would be pleased partly to recommend themselves, as they have occasion, these *Kinds* of *Inquiries* to their *Ingenious Acquaintance*, either living upon, or travelling into such places, as are concerned; partly to joyn their *Symbola's*, and to send in their *Proposals*, and whatever shall occur to them worthy to desire information about, in those *Coun-*
tries

tries above-mention'd; and rest perswaded, that all possible endeavours shall be employed on our parts, to recommend all, what shall thus be propos'd by them, to *our* Correspondents, with the same earnestness we do our own Directions, suggested by several of our Curious Friends.

Inquiries for Suratte,

and other parts of the East-Indies.

Though these *Queries* have been already dispatcht for India, and some of them even received an *Answer*, yet, because 'tis altogether necessary, to have confirmations of the truth of these things from several hands, before they be relyed on, it was thought fit, rather to publish the *Inquiries* alone, for a more certain and full Information, than now to joyn such *Answers* thereunto.

The *Inquiries* are these; as the Relations publisht by *Purchas*, *Linschoten*, and others, concerning those parts, have given occasion to propose them.

1. Whether it be true, that *Diamonds* and other *Pretious Stones*, do grow again after three or four years, in the same places where they have been digg'd out?

2. Whether the *Quarries* of *Stone* near *Fettipore*, not far from *Agra*, in the *Mogol's* Dominions, may be cleft like *Loggs*, and sawn like *Planks*, to ceel *Chambers* and cover *Houses* therewith? Likewise, Whether about *Sadrapatan*, on the Coast of *Coromandel*, there be a *Stone* of the like nature, so as, setting a *Wedge* upon it, one may cleave it with a *Mallet* as thick and as thin, as one pleaseth?

3. Whether upon the same Coast of *Coremandel*, about *Tutucorin*; and upon that of *Ceylon*, at *Mañar*, and *Fasanapatan*, they fish *Pearls*, as good as those about *Ormuz*? Whether those *Pearls* are the better, the deeper they lie? What is the greatest depth, they are known to have been taken at? And whether it be true, that some of the *Natives* there, can stay under *Water* half an hour, without any *Art*?

4. Whether the *Iron* in *Pegu* and *Japan*, be far better than ours; and if so, what is to be observed in the melting, forging, and tempering of it?

5. Whether

5. Whether in *Sumatra* there be a fountain, running a very Sanative Oyl? And whether the ignivomous Mountain in the same Island, do burn continually, and cast out stones so eaten out by the fire, that they swim?

6. What is the Opinion of the more Inquisitive Men in those parts, of *Amber-gris*? And whether the greatest quantities and masses of it are found about the *Isle Mauritius*?

7. Whether it be Winter on the East-side of the Mountain *Gates*, which comes from the North to *Cape Comorin*, whilst it is Summer on the West-side, and so, *vice versa*?

8. Whether it be true, that upon the Coast of *Coromandel*, 16 deg. Northern Latitude, between *Paleacote* and *Maselupatan*, 50 Leagues in length (the hot winds blowing from the Land-ward from 8 in the Morning, till 4. in the Afternoon, with such a suffocating heat, that the Inhabitants are not able to endure it, without extraordinary helps and refreshments;) every one daily for his provision of drink, hangs his bottle, made of common pot-earth, and filled with Well-water, or other potable Liquor, upon some Post, Tree, or Wall, in places, where the Sun and Wind are most piercing; leaving it there all the day long in the scorching heat; and then taking it up about Evening at 4 of the Clock, the Drink is more cool, than any depth of Cellerage with us can make it? And whether, on the contrary, the Bottles being suffered to continue in the Air, as before, during the cool Sea-gales, which come in after the said hour, and continue all Night, till 8 in the Morning, to the refreshment of all Creatures, the Liquors grow hot and unfit for drink?

9. Whether the *Tyde* near *Mindanao*, going from the *Molucca's* to the *Philippina's*, are so swift, that neither contrary Winds nor Anchors, can save a Ship from being carried away by it; and that it rises but about 3 or 4 feet? And whether the like be observed in the Bay of *Cambaja*, and in that between *Martaban* and *Pegu*? And particularly, Whether in the said *Bayes*, the Tides come in with that impetuosity and swiftness about the *Quarters* of the *Moon*, that the Watch-men from high Towers must with their Trumpets give warning to the people to retire; and that a Horse in his swiftest course, when such a Tide comes upon him, cannot out-run it: as *Isaac Vossius* observes, Lib. *De Motu*

Marinum & Ventorum. c. 15. And what other particulars are observable upon all those Coasts, concerning the Tydes?

10. Whether there be any Discoveries newer, than the newest printed Maps, of the parts of the World North-east of *Fapan*? And whether *Fapan* be truly an Island, or no?

11. What is the true way of making and colouring *China-Dishes*; and how in *China* and *Fapan*, they make the *Black-vernish*?

12. With what Materials, and how they paint both upon Cloths, commonly call'd *Pintado's*, and likewise upon Canvas, &c?

13. Whether the *Lignum Aloes* be the Wood, or Root of a Tree? In what Countrey it is found? And how to know the best of the kind?

14. Whether the best *Tea* be that, which comes forth at the first of the Spring, and are the Top-leaves? In what manner 'tis dried; and whether the too hasty drying thereof hurts it?

15. Whether there grows a Wood in *Fava*, that naturally smells like humane Excrement? And if so, what kind of ground it grows in?

16. Whether in the *Molucque* Islands there be a *Red Wood*, which burns, sparkles, and flames, without being consumed; yet may be reduced to powder, by rubbing between ones fingers?

17. Whether near the Fort of *Ternate* there be a Plant, call'd by the Inhabitants *Catopa*, whence fall little Leaves, which are turned into Butter-flies?

18. Whether in *Pegu*, and other places of the *East-Indies*, they use a poison, that kills by smelling, and yet the poisonous smell is hardly perceived?

19. Whether it be true, that the onely Antidote hitherto known, against the famous and fatal *Macassar*-poison, is humane *Ordure*, taken inwardly? And what substance that poison is made of?

20. Whether there be such a Vegetable in *Fava*, call'd *Mangas bravas*, that is so poisonous, that it kills presently, and for which no remedy hath been yet found?

21. Where the best *Calamba-wood*, or *Palo d' Aquila*, grows? Whether the *Palo d' Aquila* be much inferiour to *Calamba*; and

how they are distinguisht? Whether the later be the *Pith* of the former? Whence the best sort comes? Whether it be stored with a rich and cordial Balme, and that be the cause of its great rate, being much used in cases of decay of Spirits, and the lameness and impotency of Nerves?

22. Whether they draw an *Oyl*, resembling *Oyl* of *Camphire*, from the Roots of *Cinamon*-trees; and if so, how they draw it?

23. Whether the *Camphire* of *Borneo* be not the Exsudation or Gum of a Tree?

24. Whether the *Indians* can so prepare that stupifying Herb, call'd *Dutroa* or *Datura*, that they make it lie several Dayes, Moneths, and Years, according as they design it, in a Mans Body, without doing him any hurt, and at the end kill him, without missing an hours time?

25. Whether the *Betele* hath such a contrariety to the *Durion*, that a few leaves of that, put to a whole Shop-full of *Durions*, will make them all rot suddenly? And whether those, that have surfetted on *Durions*, and thereby over-heated themselves, do, by laying a leaf or two of *Betele* upon their Breasts or Stomachs, immediately cure the Inflammations, and recover?

26. Whether the *Papayas*, which bear fruit like a Melon, do not bear, unless Male and Female (as the Vulgar distinguishes them) stand together?

27. Whether there be two sorts of the Tree, call'd *Arbor triste*, one, by the Name of *Triste di Die*, the other, *Triste di Notte*; whereof the former sheds his flowers at the Rising, the other, at the Setting of the Sun? And whether the distilled water thereof (call'd *Aqua di Mogli* by the Portugals) may not be transported into these parts?

28. Whether one of those Trees, call'd *Arbre de Rays*, propagates it self into a whole Forrest, by shooting up, and letting fall Roots from all its branches into the ground, that spring up again, and so on? And whether there be any single ones of these Trees, that are above 50. feet in Diameter, as some affirm?

29. What particulars are observable in any other Plants of those parts?

30. Whether

30. Whether those *Shell-fishes*, that are in *these parts* plump and in season at the *Full Moon*, and lean and out of season at the *New*, are found to have contrary Constitutions in the *East-Indies*?

31. Whether the Animal, that yields the true *Musk*, belike a *Dear*, hornless, found in the High-Country between *Pegu* and *China*? And whether the *Musk* grows in Baggs, Blisters, or Swellings, which the Beast rubs off against Trees; it being affirmed to have been found in the Woods by the Scent? Whether true Musk, is discerned from false by its yellowness, when rubb'd upon ones hand, and by its keeping that Colour and the Scent?

32. Whether there be two sorts of *Gum-lack*, one produced by an Insect, a certain winged Ant; the other, the Exsudation of a Tree?

33. To inquire after the Fish call'd *Caballa*, said to be very powerful in stanching of blood?

34. Whether about *Fava* there be Oysters, or other Shell-fishes, of that vast bigness, as to weigh 300. pounds?

35. Whether in *Malacca* there grows sometimes a stone in the stomach of a kind of *Porcupine*, call'd *Pedro Porco*, esteemed for its Cordial Vertue above *Bezoar*?

36. Whether there be found in the head of a certain Snake, a Stone, which laid upon a wound of any Venemous Creature, sticks fast to it, and draws away all the poison; then being put in Milk, voids its poison, and turns the Milk blue; and then applied again, draws out the rest of the poison, that may be behind, till the wound be perfectly cleansed?

37. Whether the *Rhinoceros* have such an Antipathy against Elephants, as is commonly related?

38. Whether in the Island of *St. Helena*, the Tide be at the same time round in the several Coasts of it; and what is the hour of Full Sea, and what the age of the Moon at the time of Observation?

Inquiries for Persia.

1. **W**Hat are chiefly the present Studies of the *Persians*; and what Kind of Learning they now excel in?
2. What other Trades or Practices, besides *Silk*- and *Tapistry*-making, they are skilled in?
3. Whether, there being already good Descriptions in *Words* of the Excellent Pictures and Basse Relieves, that are about *Persopolis* at *Chimilnar*, yet none very particular; some may not be found sufficiently skill'd, in those parts, that might be engaged to make a Draught of the Place, and the Stories there pictured and carved?
4. How they make that Plaister, wherewith in those parts and in *India* they line their *Tanks* or *Cisterns*, and which, when dry, shines like *Marble*, and is much harder?

Other *Queries*, concerning the Air, Waters, Minerals, Vegetables, Animals, &c. peculiar to *Persia*, may be taken out of those *General Heads* of Inquiries, for a *Natural History* of a *Country*, printed in *Numb. II.* and out of those *Articles* of Inquiries concerning *Mines*, publisht in *Numb. 19.* to which we refer the Reader.

As to the Inquiries proper for *Turkey*, they also are already publick. See *Numb. 20.*

Inquiries For Virginia and the Bermudas.

1. **C**ONCERNING the Varieties of *Earths*; 'tis said, there is one kind of a *Gummy* consistence, white and clear: Another white, and so light, that it swims upon water: Another, red, call'd *Wapergh*, like *Terra Sigillata*. Quære, what other considerable kinds are there? And to send over a parcel of each.
2. What considerable Minerals, Stones, Bitumens; Tinctures. Drugs?
3. What hot Baths, and of what Medicinal use?
4. What is the Original of those large Navigable Rivers, which

which empty themselves into the Bay of *Chesapeak*? And whether on the other side of that ridge of Mountains, from which they are supposed to proceed, there be not other Rivers, that flow into the *South-sea*?

5. How the Silk-grasse is prepared?

6. To give a full account of that Vulnerary Root, called *Wichacan*: Of *Pocone*, a Root of a red juyce. a good tincture: Of *Musquaspenn*, a Root of a red tincture: Of the Plant *Maricock*, whose fruit is said to be fashion'd like a *Lemmon*, exceeding pleasant to the taste; of a blossom most beautiful: Of the *Chincomen*-Tree, whose fruit is said to have a huske like a *Chestnut*, luscious and hearty meat, both raw and boiled.

7. Whether there be in the *Bermudas* a Poison-weed, like our *Ivy*, whose leaves do by the touch cause Blisters? And a Reed, whose juyce or infusion causeth Vomit?

8. What kind of Trees those Barkes are taken from, that are used in stead of Tile or Slate in the covering of their Houses, being cooler in Summer and warmer in Winter, than Stone?

9. To give a particular account of the Spider in the *Bermudas*, said to be large and beautiful for its colours; weaving a Web betwixt several Trees, which is affirmed to be for substance and colour like perfect raw Silk; so strong, that Birds, like Snites, are snared therein?

10. Whether Deer have there generally three or four Fawns at a brood? And whether any of the Cattle transported from hence, becomes there more fruitful, than they were here?

11. Whether the Relation be true, of a *Glue* made of Harts-Horn, that will not dissolve in Water; and if so, how made?

12. Whether at the bottom of the Bay of *Chesapeak* Northward, the Natives be still of such a Gigantick Stature, as hath been reported? And, whether there be another people, not far from these, Eastwardly, of a *Dwarfish* Stature?

13. Whether round about the Coast of the *Bermudas*, the *Tydes* keep the same time; and at what a clock precisely 'tis *High-water* on the *Dayes* of *Full* and *New Moon*; and how high the Water rises then? And the like on the Coasts of *Virginia* and *Florida*?

For Guaiana and Brasil.

1. **W**Hether about *Urraba* near *Oronoque*, some 8. degrees Northern Latitude, and about the Town *Darien*, Toads are presently produced, by throwing a kind of Moorish Water found there, upon the Floors of their Houses? *Linschoten*.

2. Whether it be true, that the Locust of *Brasil*, call'd *Caayara*, changeth in the Spring-time of that Countrey into a Plant, and withers away, like a Plant? and whether in the same Countrey, that kind of *Eruca*, call'd by the Portugals *Lagartas das Verias*, turns into a Bird, admirable for Colour and swift flying; the change thereof being made so leasurly, that one may for a while see half of the Insect, and the other half of the Bird, which the Natives call *Guainumbi*, the Portugals *Pegafrel*. *Piso*.

3. Whether upon the Leaves of that *Brasilian* Tree, call'd *Cereiba*, there is, in a Sun-shiny day, found a *White Salt* in that quantity, that one may gather as much from two or three Leaves, as will well salt a good pot of Broth? *Piso*.

4. Whether there be found about the mouth of the River of *Amazons*, a green *Argilla*, which, though very soft under water, yet, when exposed to the Air, grows almost as hard as a Diamond; in so much that the Natives make *Hatchets* of them, strong and sharp enough to cleave Wood, for which purpose also those *Indians* are said to have used it, before they got Iron-ones? And, whether this *Argilla*, become Stone, have a peculiar vertue against the *Epilepsy*, when carried by the Patient? *Pelleprat* in his Relation of the *Ilands* and *Terra-firma* of the *Southern America*.

5. Whether the *black Bees* in *Guaiana*, about the River *Oronoque*, make black Honey and Wax? And whether they have no Stings, as the same *Pelleprat* affirmeth?

The other Inquiries, ready for the other Countries above-named, are, to avoid tediousness, referred to another opportunity.

Of a considerable Load-stone digged out of the
Ground in Devonshire.

THis Stone was lately sent up out of the said County, and presented to the *R. Society* by the Reverend Arch-deacon, Doctor *Edw. Cotton*, with this description, that it weighs 60 pounds; and that, though it take up no great weight, yet it moves a Needle about nine Foot distant. Some part of it being broken off, he hath sent up also, because (*saieth he*) being put in its proper place, it adds much strength to it, but without that addition it moves not much more than seven Foot.

Care will be had, that Tryals be made of the Vertue of this Stone, both of the two pieces closed together, and of each piece separately, and that uncapped as well as capped.

Some Observables about Load-stones, and Sea-Compasses.

A Noble Person did upon a late occasion, affirm, That a Needle of a Sea-Compass, put in a good Iron-Mine (which, *he said*, yielded 23 pounds of Metal, out of 120 pounds of Ore) was not sensibly moved thereby.

Another Honourable Person desired, it might be observed, whether touched Needles move otherwise, when the Veines of Iron do not lie *North* and *South*, then when they do so?

It being inquired by a *Note* from forreign parts, Whether the Sea-Compasses in *England* were brought to a greater perfection, than in other *Countries*? Answer was made by intelligent persons here, That all the perfection of our Sea-Compasses, as yet, consisted in this, That the Needles be touched by good Load-stones, and well librated, and that the Variation be truly placed: Though it was suggested withal, that for the greater perfection of such Sea-Compasses, a way was contriving, to shew the Variation to *Minutes* and *Seconds*.

It was also propos'd, That it might be inquired into,

1. Whether a *Needle* may be so toucht upon any Magnet, as not to point to the true *North* and *South*, to be tried in such places where there is no Variation known?

2. Whether

2. Whether different Load-stones will give different Directions? And whether fainter or stronger touches upon one and the same Magnet, will cause any Variation in the Directions? For which purpose, as many Load-stones should be procured, as could be had, and a good number of Needles exactly made, of the same Metal, bigness, and figure?

P R O P O S A L S

*To try the Effects of the Pneumatick Engine exhausted, in
Plants, Seeds, Eggs of Silkworms.*

The Ingenious Dr. Beale did formerly suggest, as follows.

It would be, I think (*saieth he*) very well worth the tryal, to see what Effects would be produced on Plants, put into the Pneumatick (or Rarifying) Engine of Mr. Boyle, with the Earth about their Roots, and flourishing; whether they would not suddenly wither, if the Air were totally taken from them. And particularly to try in the Season, *Cherry-blossoms*, when partly opened, partly not opened, upon a Branch; to wit, whether the Air may be so attenuated as to blast. But it may be noted, that the Blossoms do not forthwith discover the blast: An old experienced Country-man having once given me notice of a blasty Noon, (it being then a Sultry weather, and somewhat gloomy with the thickness of Exhalations, almost like a very thick Mist) and within a day or two shewing the proof upon the *Cherry-Blossoms* then flagging, but not much altering their Colour till two dayes more were past.

The noble Mr. Boyle suggests as proper for the approaching Season; That it may be tryed,

1. Whether Seeds (especially such as are of a hasty growth; *vid. Orpin, Lettice, Garden-creff-seeds, &c.*) will germinate and thrive in the exhausted Receiver of the said engine?

2. Whether the Exclusion of Air from the *Sensitive Plant*, would be harmful to it?

3. Whether the Grafting of Pears upon *Spina Cervina* (the almost only *Purgative* Vegetable known in England) will produce the effect of communicating to the Fruit that purging quality, or not?

4. Whether *Silkworms* Eggs will be hatched in such an exhausted Receiver, in the Season proper for hatching?

To which may be added, the Trials of putting in a Vial full of water, some of those Herbs that will shoot and grow in water alone, including them in such a Receiver, and pumping out what Air you can, to see whether they will then shoot, or not ?

And though some of these *Proposals* have been formerly begun to be Experimented, yet ought they to be diligently prosecuted, to see how far the Air is necessary to Vegetation; and whether Plants do indeed live as much upon the Air, as the Earth; and the Branches of them are rooted (as it were) *in* and quickned by the Air, as their roots are planted and nourisht in and by the Earth ?

The Experiment heretofore made of this kind, was, That some Lettice-seed being sown upon some Earth in the open Air; and some of the same Seed at the same time upon other Earth in a Glass-Receiver of the above mention'd Engine, afterwards exhausted of Air; the Seed expos'd to the Air was grown up an inch and a half high, within eight days; but that in the exhausted Receiver, not at all. And, Air being again admitt'd into the said emptied Receiver, to see whether any of the Seed would then come up; it was found, that in the space of one week it was grown up to the height of two or three Inches.

OBSERVATIONS

Concerning *Emmets* or *Ants*, their Eggs, Production, Progress, coming to Maturity, Use, &c.

This was communicated by Doct^r Edmund King, Fellow of the R. Society, at the Instance of the Publisher, as followeth.

1. **T**Here have occur'd to my Observation but three sorts of *Ants*, commonly without Wings; *vid.* Very *Black*, *Dark*, *Brown*, and the third sort of near the colour usually call'd *Philemort*.

2. Each kind inhabit by themselves in their several Banks; two sorts seldom or never being found together; and if either of the other two sorts be put into the black *Ants* Bank, 'tis worth observing, what enmity there is betwixt these little Creatures, and with what violence the *Black* ones will seize on the *Red*, never leaving to pinch them on the head with their *Forceps* or *Claws*, till they have kill'd them upon the place: which done, they will car-

ry them dead out of the Field, from their Bank. But if you put *Black Ants* into a Bank of the *Red*, the Black seem to be so sensible of the strangeness of the place they are in, that there they will not meddle with the *Red*, but as if they were frighted, and concerned for nothing but self-preservation, run away.

3. Upon opening of these Banks, I observe first a *white substance*, which to the bare eye looks like the scatterings of fine white Sugar or Salt, but very soft and tender; and if you take a bit of it, as big perhaps as a Mustard-seed, and lay it on the Object plate of a good *Microscope*, you may by opening it with the point of a Needle, discern many pure, white and clear appearances in distinct Membrans, all figur'd like the lesser sort of Birds Eggs, and as clear as a Fishes Bladder. This same substance as it hath been just now described, I find in the *Ants* themselves, which I take to be the true *Ants Eggs*; it being obvious to observation, that where ever this is uncover'd, they make it their business to carry it away in their mouths to secure it, and will after you have scatter'd it, lay it on a heap again with what speed they can.

4. I observe they lie in multitudes upon this (if I may so call it) Spawn of theirs; and after a little time, every one of these small adherances is turn'd into a little Vermicle, as small as a Mite, hardly discerned to stir; but after a few days more, you may perceive a feeble motion of flexion and extension, and they begin to look yellowish and hairy, shaped very like a small Maggot; and so, keeping that shape, grow almost as big as an Ant, and have every one a black spot on them.

5. Then they get a *Film* over them, whitish, and of an Oval shape, for which reason I suppose they are commonly call'd *Ants Eggs*; which yet (to speak properly) they are not.

6. I have, to prevent mistakes, opened many of these vulgarly call'd *Ants Eggs*, I mean, the lesser sort, (for there are some as big as a Wheat-corn, others less than a Rye-corn) and in *some* I find onely a Maggot, to appearance just such as was described before: In *others*, I find a Maggot beginning to put on the shape of an Ant about the head, with two little yellowy specks where the Eyes are design'd: In *others*, a further progress, and furnisht with every thing to compleat the shape of an Ant, but wholly transparent, the Eyes onely excepted, which are then as black as black Bugles.

7. But

7. But when they have newly put on this shape, I could never discern the least motion in any one part of the little Creature, whereof the reason may perhaps be, the weakness of their Fibres; for after a little more time, when they begin to be brownish, they have strength to stir all their parts.

8. At last I met with some of these reputed Eggs, which being carefully open'd by me, I took out of several of them, every way perfect and compleat Ants, which did immediately creep about among the rest, no way differing from many other Ants, but by a more feeble motion of their Limbs. And this I took for a clear demonstration of what I designed, which was to know, That the Film does onely cover the Maggot, while she is transforming into an Ant, and fit to shift for her self.

9. The *black Speck* that is at one end of every such reputed Ants Egg, I suppose to be cast out of the Maggot in her transformation; since, after it puts on the shape of an Ant, the Speck is quite gone, and the whole body of the Ant pure clear; since also this Speck at the end of the said Egg, lies always close to the *Anus* of the included Ant.

10. As to their care for their *Young* (by which I mean all the sorts and degrees aforesaid, from the Spawn to the vulgarly call'd Eggs, in every one of which you'll find a young Ant) it is observable, How upon the breaking up of their Banks, they make it their business immediately to carry their Young out of sight again, laying the several sorts of them in several places and heaps: the which if you mingle again or scatter, you shall, laying but some bits of Slate, or the like, in any place they may come to and get under, after a few hours see all the Vermicles, and vulgarly call'd Eggs, laid in their several and distinct parcels, under such pieces of Slate, &c. Provided the place be not so cold as to chill their Limbs; which if it be, by being brought to the fire they will soon recover their strength, and fall to their business again, of securing their little Ones,

11. I have observed in Summer, That in the Morning they bring up those of their Young (that are vulgarly call'd Ants Eggs) towards the top of the Bank, so that you may from Ten in the Morning, until Five or Six Afternoon, find them near the top, especially about One, Two, or Three of the Clock, and later, if the Weather

be hot, when for the most part they are found on the South-side of the Bank: that towards Seven or Eight at Night, if it be cool, or likely to rain, you may dig a foot deep before you can find them.

They know all the sorts of their Young so well, that you cannot deceive them, though you may with fine Sugar, Salt, or the Crums of very white stale Bread, scatter'd in the Mould, where their first true Eggs are (as I call them) be mistaken your self, yet the Ants will not, nor touch a bit of what is not their own Off-spring.

13. I cannot pass by the *Use of Ants* in feeding young Pheasants and Partridges, they being the principal Food of these Birds, both wilde and tamed, for several weeks, as is well known to all that are versed in breeding them up. And a chief reason, why many find it so nice a thing to breed up the said Birds, is, that either they give them too sparingly of this Food, or let them fast too long, not knowing, that as soon 'tis day-light, they will seek it for their Break-fast and if they want it, will in a few hours be faint and weak, and some grow so chill for want of that supply of Nourishment, that it is no easie matter to recover them.

14. But (to add this by the by) Though these Insects be so good a Food to these Birds, whilest very young; yet when by ill ordering of those that should keep them sweet, and often shift their water, or by ill Diet, as musty Corn, &c. they grow sick; then Ants will not always recover them, though you give them never so many: And I have been forced to make use of other Insects to cure them, to wit, of *Millepedes* and *Earwigs*, either of which will do good, but both together, better; given in a good quantity, two or three times, at least, a day; but then those other things must be observed too, of keeping their House clean, and giving them sweet Corn, and shifting their water twice a day, keeping them within, till the Dew be from the ground, letting them bask in Sand, partly in the Sun, the place a little shaded, and putting them up in a warm house before Sun-set.

Which particular I thought not amiss to add for those that delight in breeding up *Pheasants* and *Partridges*, my self having lost many of both sorts, till I learned that Vertue of those Insects; after which, seldom any of them, by me intended, to be bred up, have died.

An Account

Of a small Book in French, Entituled
HISTOIRE DES JOYAUX.

E T

Des Principales Richesses de l' Orient & de l' Occident,
par le Sr. Chapuzeau.

THis History treats of Diamonds, Rubies, Emeralds, Pearls, Coral, Bezoar, Yellow Amber, Amber-gris, Indigo, &c. Of *Diamonds*, the Author shews:

1. The *Places*, whence they are taken; of which he finds but Five in all the *East-Indies*, whereof *two* are *Rivers*, vid. *Saccadan* in *Borneo*, and *Nage* in the Kingdome of *Bengala*; at the bottom of both which, he saith, the *Diamonds* are found among the sand, after the waters, that fall as great *Torrents* from the *Mountains*, are run off; and the three others are *Mines*, in the Kingdoms of *Decan Cuncan*, and *Golconda*. In this Relation he observes, that the *Diamonds* which are found at the bottom of those *Rivers*, have the best *Water*; but those, in *Mines*, have often *Flaws* (which he imputes to the violent knockings of the *Rock*) and *Blebs*, ascribed to the condition of the *Earth* or *Sand* they are found in, vid. when that is not pure, but fatty or black. He takes also notice, that *Diamonds* are the heaviest of precious *Stones*, as *Gold* is of *Mettals*.

2. The *Manner*, how they are found and separated; which is the same in substance, with that, described *Num. 18*.

3. The *Price* of them, according to the proportion of their weight; for which he gives this Rule. Take, saith he, a *Diamond* of 10 *Carats*: this number is to be squared (which makes 100) then, if the *Stone* be clean, each *Carat* according to its perfection, may be worth 40 to 60 *Crowns*; if it have no good water, or have a *Bleb* or *Flaw*, the *Carat* will not be worth but from 10 to 30 *Crowns*. So multiplying the said 100 by the number, which each *Carat* of such or such a *Stone* may be worth, the product is the price of the *Stone*.

For

For *Rubies*, he discourses also of the *Places*, where they are found, and of their *Price*. The *Places*, are, the Kingdom of *Pegu*, and the Isle of *Ceylon*; whence very few are suffered to be carried away. The *Price* is, that a good *Rubi* of the weight of 1 *Rati* (which is $\frac{7}{8}$ of a *Carat*) is esteemed at 20 old *Pagodes* in *India*, each *Pagode* being about 10 shillings *English*.

| <i>Ratis.</i> | <i>Pagodes.</i> |
|---------------|-------------------|
| Of 2 | is valued at 100. |
| Of 3 | ----- 250. |
| Of 4 | ----- 500. |
| Of 5 | ----- 900. |
| Of 6 | ----- 1500. |
| Of 7 | ----- 2300. |
| Of 12 | ----- 12000. |

Concerning *Turquois*, they are found in *Persia*, in the Province of *Champaquay*, North of *Ispahan*, in two Mines, called the *Old* and the *New Rock*. These of the *New*, are of an ill whitish Blew; but those of the *Old*, are not suffered to be digged out, but by the King of *Persia* himself.

Emeraulds are affirm'd by him, never to be found in the *East-Indies*, but in *Perou*, whence they were carried by that Trading-People to the *Moluccas*, even before *America* was discovered by the Europeans; and so they come from the Orient; of much less value, than they were formerly, by reason of their commonness. The Author notes, that *Emeraulds* grow in stones, just as *Chrystals*, forming a *Vein*, in which they are by little and little refined and thicken'd: and that some of them are seen, half white and half green; others, all white; and others all green and perfect.

To *Pearls* he assigns in the *Orient*, four places, where they are fish'd: The Isle of *Baharem* in the *Persian Gulf*: The Coast of *Arabia Felix*, near the Town of *Catiff*, over against *Baharem*: The Isle of *Ceylon* about *Manar*: The Isle of *Fapan*. The best at *Ceylon*, but small; the biggest at *Fapan*, but uneven. In the *West-Indies* they are fish'd in the *North-Sea*, in the Isles of *Marguerite*, *Cubagua*, *St. Marthe*; and at *Comana*, and *Comanagote*, near the Continent; and in the *South-sea*, near *Panama*: which

American

American fort, though they are much inferiour to the *Oriental*; in Lustre, yet they far excel them in bigness, amounting sometimes (saith this *Author*) to 42 *Carats*.

In this Relation 'tis mention'd, that sometimes 5. or 6. *Pearls* are found in one Oyster: That *Pearl-fishers* are fed with dry and roasted meat, to give them better breathing: That *Pearl-bearing* Oysters are not good to eat, being flat and hard of digestion, &c.

As to the *Price* of good *Pearls*, well fashion'd, he marketh it, as follows:

Such a Pearl of

| Grain. | Crowns. | Carats. | Crowns. |
|----------------|---------|----------------|---------|
| 1 | 1 | $4\frac{1}{4}$ | 289 |
| 2 | 4 | $4\frac{1}{2}$ | 324 |
| 3 | 9 | $4\frac{3}{4}$ | 361 |
| <i>Carats.</i> | | 5 | 400 |
| 1 | 16 | $5\frac{1}{4}$ | 441 |
| $1\frac{1}{4}$ | 25 | $5\frac{1}{2}$ | 484 |
| $1\frac{1}{2}$ | 36 | $5\frac{3}{4}$ | 529 |
| $1\frac{3}{4}$ | 49 | 6 | 576 |
| 2 | 64 | $6\frac{1}{4}$ | 625 |
| $2\frac{1}{4}$ | 81 | $6\frac{1}{2}$ | 675 |
| $2\frac{1}{2}$ | 100 | $6\frac{3}{4}$ | 729 |
| $2\frac{3}{4}$ | 121 | 7 | 784 |
| 3 | 144 | $7\frac{1}{4}$ | 841 |
| $3\frac{1}{4}$ | 160 | $7\frac{1}{2}$ | 900 |
| $3\frac{1}{2}$ | 196 | $7\frac{3}{4}$ | 960 |
| $3\frac{3}{4}$ | 225 | 8 | 1024 |
| 4 | 256 | | |

Of *Corals*, He taketh notice, where they are fished, and in what manner. The *Places*, he saith, to be Eight; Three upon the Coasts of *Corsica* and *Sardinia*, vid. at *Argueil* (where is the best) *Baza*, and near the *Ile* of *St. Peter*: One upon the Coast

of

of *Sicily*, near *Drepanum*: Two upon the Coast of *Africa*, near the *Bastion of France*, and at *Tabarca*: One more, upon the Coast of *Catalonia*, at the *Cape of Quiers*: And the last, about *Majorca*. Observing, that red Coral is not found, but in the *Mediterranean* alone, where 'tis fished from the beginning of *April*, till the end of *July*, employing commonly about 200 Boats. The manner of fishing them, is with two big beams of wood, laid cross-wise, with a good piece of Lead on the middle, to make it sink, casting about it course Hemp, carelessly twisted, and tying this Wood to two Ropes, whereof one hangs at the Sterne, the other at the fore-part of the Boat; and so letting this contrivance fall into the Current, along the Rocks, where the Hemp being turned about, and engaged in the Coral, there need sometimes many Boats to draw away the Instrument.

Bezoar he saith, is not onely found in *Golconda*, in the Province of *Renquery*, in the Maw of Goats, whereof some are at times furnisht with a dozen a piece; but also at *Macassar*, in the Isle of *Celebes*, in the Body of Apes; bigger than thote found in *Golconda*. He mentions; that the people in those parts, to find whether a Goat hath any of those *Bezoar-stones* in its Body, do beat his belly with their hands, and rub it, till all the stones in the Animal come together, and then they feel and tell them, as you do stones in a Bag, &c.

F I N I S.

In the SAVOY,

Printed by T. N. for John Martyn at the Bell, a little without Temple-Bar, and James Allestry in Duck-Lane, Printers to the Royal-Society, 1668.



Fig. 1.

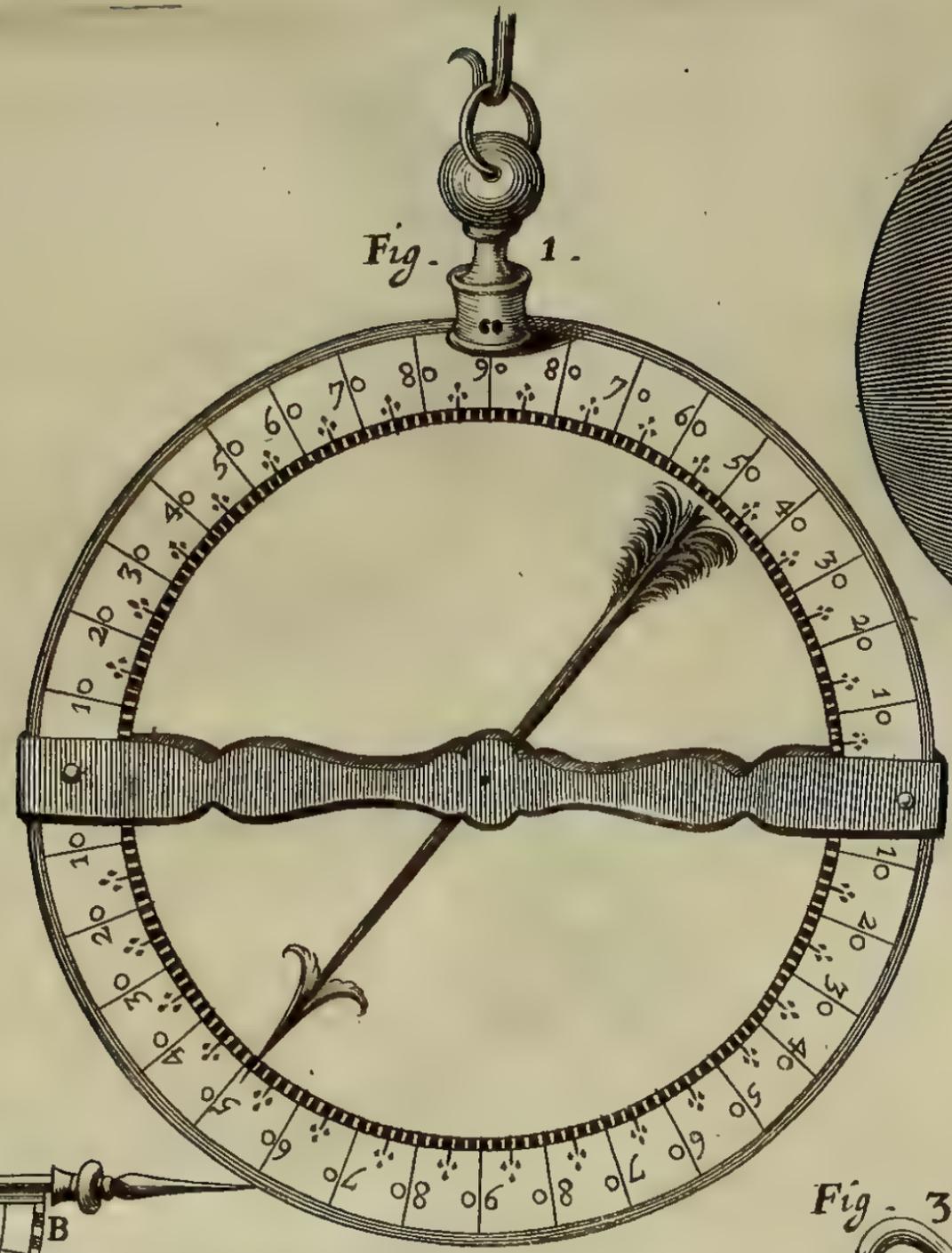


Fig. 2.

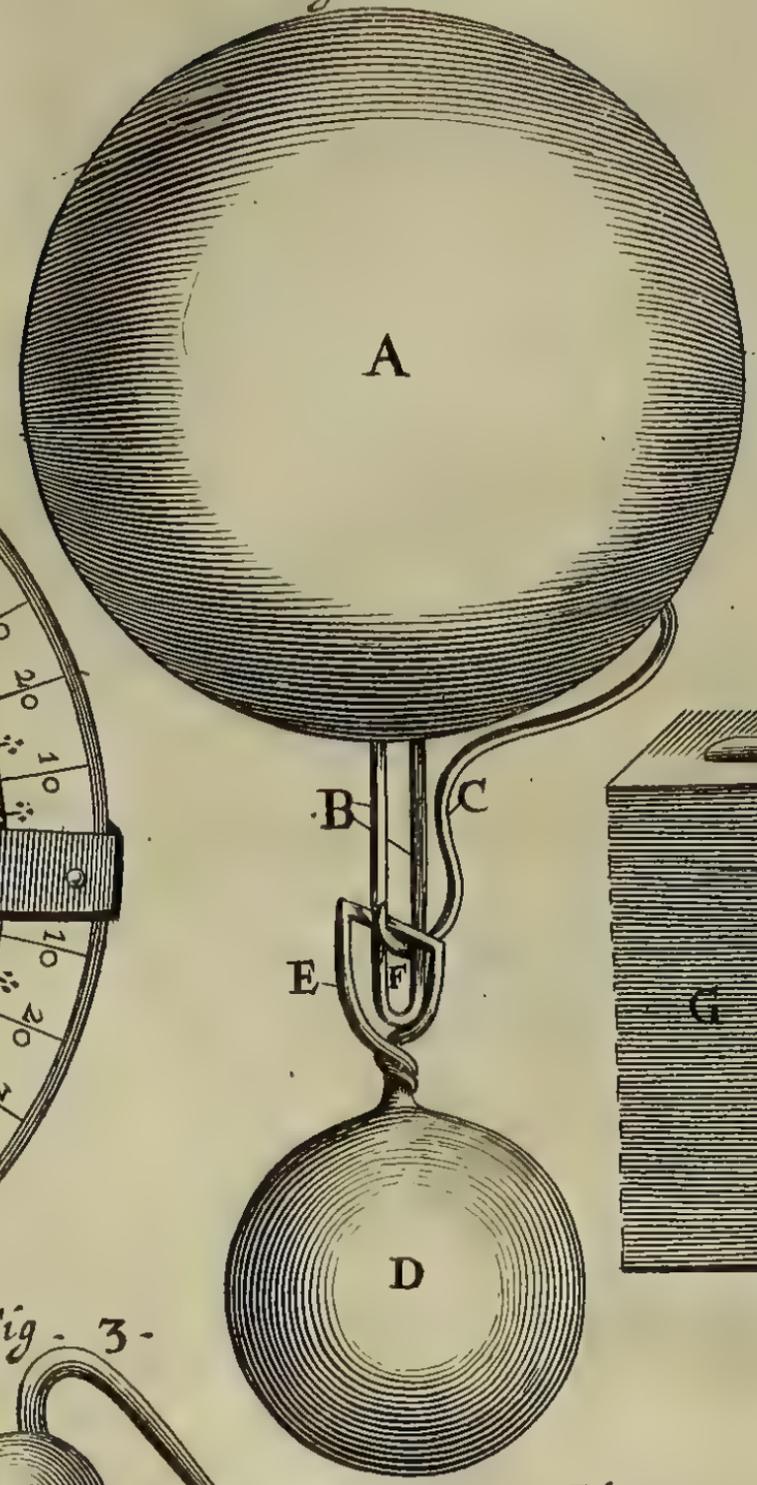


Fig. 8.

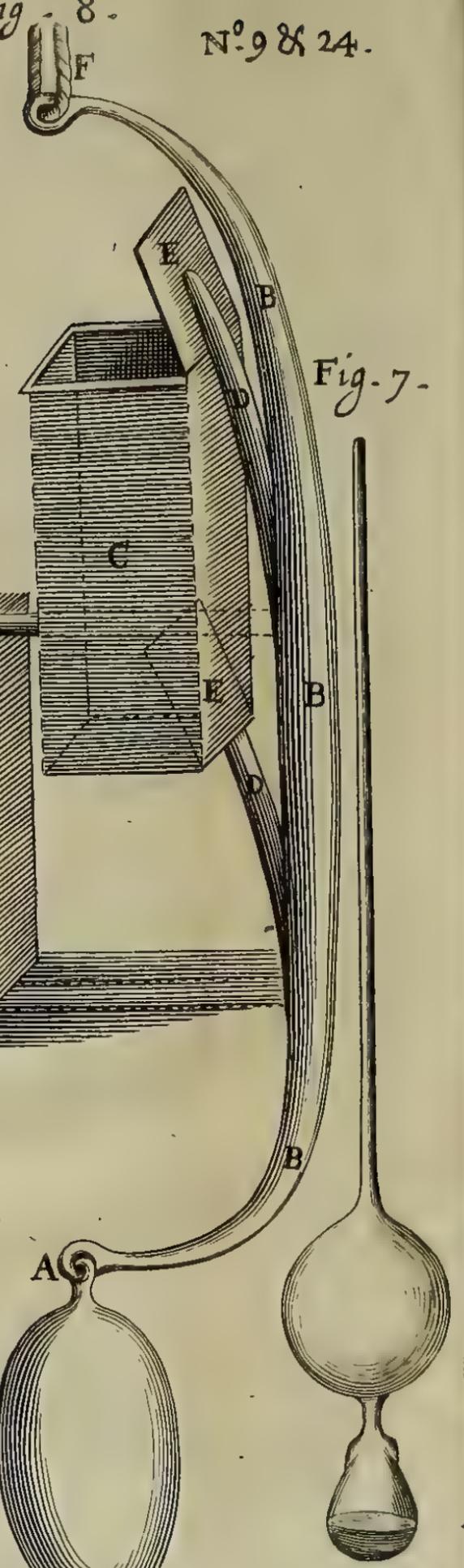


Fig. 7.

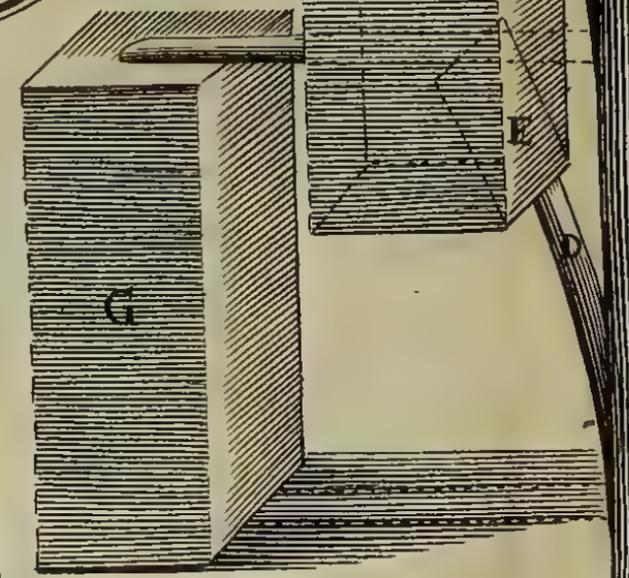


Fig. 6.

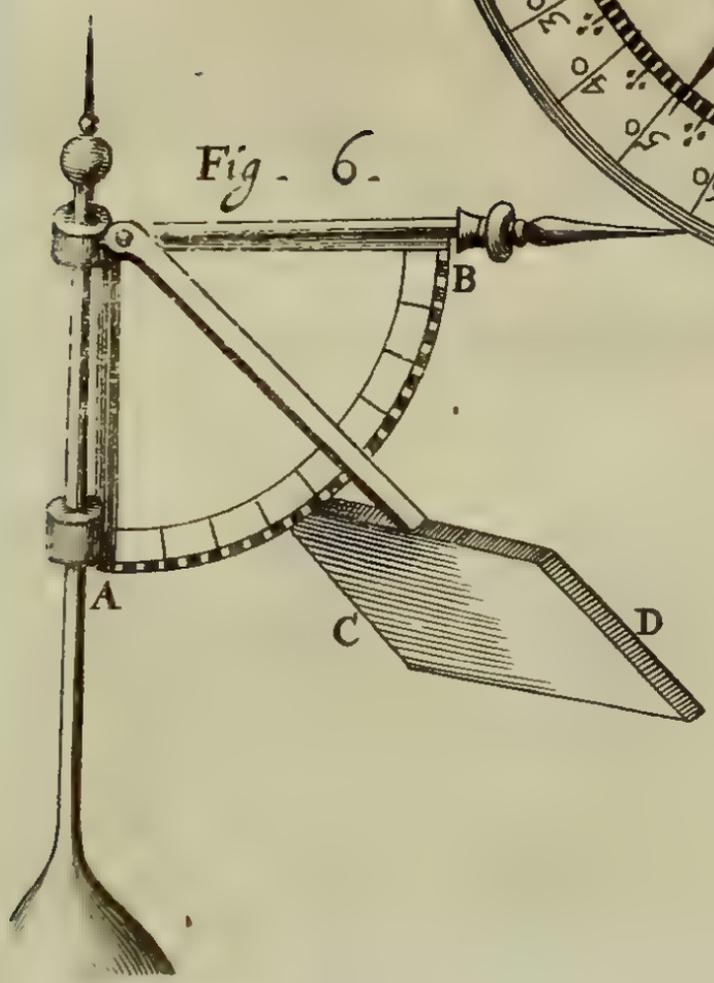


Fig. 3.

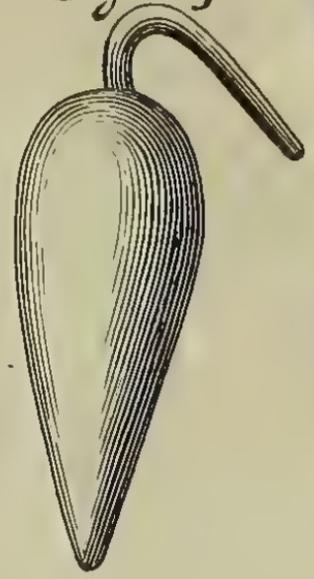


Fig. 4.

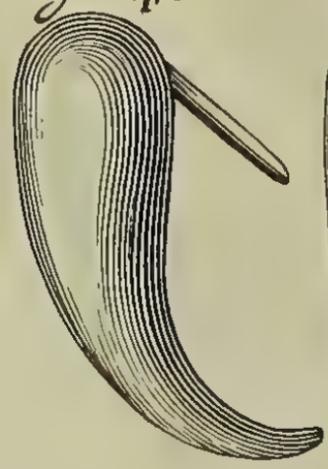
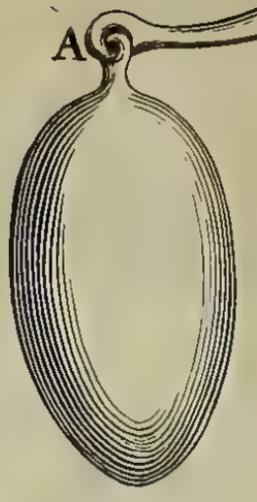
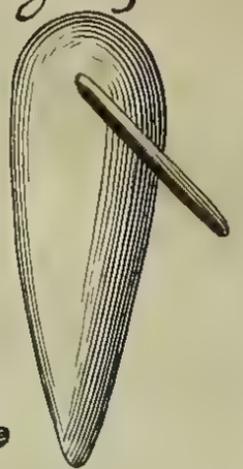


Fig. 5.



PHILOSOPHICAL TRANSACTIONS.

Monday, April 8. 1667.

The Contents.

Directions for Observations and Experiments to be made by Masters of Ships, Pilots, and other fit Persons in their Sea-Voyages: Printed with Enlargements and Explications of what was formerly publisht of this Kind, suggested partly by Sir R. Moray, partly by Mr. Rook; as, The several wayes of Observing, both at Sea and Land, the Declinations and Variations of the Needle: Some wayes of knowing the different Gravities of Sea-water: A Form of a Scheme, representing at one view, to the eye, Observations of the Weather for a whole Moneth, &c.

DIRECTIONS

For Observations and Experiments to be made by Masters of Ships, Pilots, and other fit Persons in their Sea-Voyages.

THough the Art of Navigation, one of the most useful in the World, be of late vastly improved, yet remain there many things to be known and done, the knowledge and performance whereof, would tend to the accomplishment of it: As the making of exact *Mapps* of all Coasts, Ports, Harbors, Bayes, Promontories, Islands, with their several Prospects and Bearings; Describing of Tydes, Depths, Currents, and other things considerable in the Seas: Turnings, Passages, Creeks, Sands, Shelves, Rocks, and other dangers: Nice Observations of the Variations

and Dippings of the Needle, in different places, and in the same place, at different times: The Winds, Weather, and Tempers of the Seasons every where: The great Depths, Ground, and Vegetables at the bottom of the Sea: The various Degrees of Saltness of the Sea-water, in several places, and at several Depths at the same place. If besides Astronomical things, to be hereafter lookt into, the following Experiments be carefully made, and Directions observed by as many Ingenious Persons, as have opportunity, it may fairly be hoped, that from multitudes of Experiments and Observations, such Rules may be framed, as may be of inestimable use for Seamen. To which purpose, the *Royal Society*, having some years ago, ordered that Eminent Mathematician Master *Rooke*, one of their Fellows, and *Geometry* Professor of *Gresham Colledge* (since deceased, to the great detriment of the Common-wealth of Learning) to draw up some Directions for Seamen, the better to capacitate them for making such Observations abroad, as might be pertinent and suitable to the purposes above-mentioned; such Directions were drawn up accordingly, and soon after printed in *Numb. 8.* of these *Transactions*. But, further to encourage and facilitate the Work of those, that shall be engaged to put them into practice, it was thought fit, that what of this Kind was heretofore but barely proposed, should now be published with ample and particular Explanations, and considerable Additions; which done, a good Number of such printed Copies is, by the Care, and at the Expences of the *R. Society*, to be lodged with the Master of *Trinity-House*, to be recommended to such, as are bound for far Sea-Voyages, and shall be judged fit for the performance: who are also to be desired, to keep an exact *Diary* of such Observations and Experiments, and deliver at their return a fair Copy thereof to the Lord High Admiral of *England*, his Royal Highness the *Duke of York*, and another to *Trinity-House*, to be perused by the said *R. Society*.

The Particulars themselves follow :

1. To observe the *Declinations and Variations of the Compass or Needle from the Meridian exactly, in as many Places as they can, and in the same Places, every several Voyage.*

AT *Land*, where by the help of good fixt *Dials*, and other fit Instruments, the precise *Meridian* of the place may be known, it is easie to find the *Variation* of the *Needle*, divers ways: As, by applying of the *Needle, &c.* to the *Shadow of a Thred* hanging perpendicular, when the *Sun* is in the *Meridian*; or to the *Meridian Line*; or the *Side of a fixt Horizontal Dial, &c.*

But at *Sea*, in regard the *Meridian* is not so easie to be found to any tolerable exactness, to know the *Variation of the Needle*, is much more laborious and difficult. The *Height of the Pole*, and the *Suns Declination* being known, a large *Ring-Dial*, truly wrought, having a *Box* with a *Compass or Needle* fixt to its *Meridian* below, may go as near as any other Instrument, to shew the *Variation* required. For, when it is set to the just hour and minute of the day, the *Meridian* of it stands just in its due place; and so shews how far the *Needle* varies from it, as exactly as the largeness of the *Card* will permit.

But because these *Dials* are so rarely just, &c. though they may be used and taken notice of, yet are they not to be relied on. The thing therefore is to be performed, as followeth:

Find out the *Suns Azimuthal Distance* from the *Meridian*, some hours *before*, or *after Noon*; and then its *Magnetical Azimuth*, or *Distance* from the *Meridian* pointed at by the *Needle*, and the *Difference* of these two *Distances*, is the *Variation* of the *Needle*.

To find the *Suns true Azimuth*, or by how many *Degrees, &c.* of the *Horizon* it is distant from the *Meridian*: its *Declination*, its *Altitude*, and the *Elevation of the Pole*, must all three be known.

For finding whereof, every Expert Mariner is instructed, or may be so, from his Sea-Books, and so it needs not here to be set down. Nor how by the help of these, the *Azimuth* required may, to Degrees, if not nearer, be found out upon a good *Globe* or *Planisphere*, (whereof there is a design to have one, that is, the *Analemma*, contrived into a form of Instrument for the use of the publick, and that ere long; which will with great facility perform all that the *Globe* can do, with much more exactness and conveniency) that being sufficiently known.

But to do it accurately, you must constitute a *Spherical Oblique-angled Triangle*, of the three Complements, of the *Suns Declination*, its *Altitude*, and of the *Height of the Pole*; the measures of all the Sides whereof are known; One from the *Zenith* to the *Pole*, another from the *Pole* to the *Point of the Suns Altitude*; and the third, from *that point to the Zenith*. Now by those you are to find out the Angle at the *Zenith*, which being found, subtract it from 180, and the remainder is the *Suns true Azimuth*, or Distance from the *Meridian* of the Place.

This Angle is to be found divers wayes, as by the *Tables of Sines, Logarithmes, &c.* the manners of doing whereof, are set down and demonstrated by *John Newton* in his *Institutio Mathematica*, Case II. and in other Books of *Trigonometry*.

And the true *Azimuth* of the *Sun* being thus found, and the *Magnetical Azimuth* of it, according to your Needle, observed, subtract the lesser Number from the greater, and the Remainder is the Variation of the Needle. If the *Magnetical Azimuth* be lesse than the other, then the Variation is towards the same side of the *Meridian*, where the *Sun* is; if greater, on the other.

To observe the *Suns Azimuth* by the Needle, and the Needles Variation to Degrees, any Needle, long enough to afford upon a Card under it, a Circle divided into Degrees, put in a Square Box, after the ordinary manner of *Clinatories*, will serve turn; by placing the Box so, as the *Sun* may shine upon any two opposite sides of it, at the same times that the *Suns Height, &c.* are taken: For then the Needles Distance from the Diameter of the Circle on the Card, that is parallel to those sides, is the *Magnetical Azimuth* required.

The same may be done with an ordinary *Sea Compass*, so it have a Circle towards the Limb of the Card, divided into Degrees, by fastening a small Thred, Lute-string or Wire (not of Iron) so upon it, as to pass just over the Center of that Circle; and placing a strait piece of Wood or Brass-wire perpendicular on the edge of the Box at the end of the Thred, and turning it to the Sun, till the Shadow of it fall just upon the Thred: then observe, what Degree of the Circle on the Card the Thred cuts, by looking plum upon it; and that is the Suns *Magnetical Azimuth*.

But to have the *Variation to Degrees and Minutes* (which is most desirable) then the Observation last mention'd must be made with a *Quadrant*, *Sextant*, or some such other Instrument, so large as to admit of the division of a *Degree* into *Minutes*; which will require the *Radius* to be about three foot; the larger the better. If a *Quadrant*, then, it being laid flat, and the Square Box with the Needle placed upon it, move the *Quadrant* to and again, till that side of it, on which the Box is placed, lie parallel to the Needle, when at quiet: Then the *Sight* of the *Quadrant* being slid along the Rimb of it, till the Sun shine on both its sides at the same time, the Mid-Line, that divides equally the *Sight*, when the Sun shines upon it thorow the slit, will mark the Degree and Minute of the Suns *Magnetical Azimuth*. All which is easie to be put in practice.

And if many such Observations be made by several persons at the same place, and by the same or other persons distant from one another, 1. 10. 20. or more Years; Not only will the *Compass* become more useful than formerly, even to be conducive possibly to the finding the *Longitude* at Sea, at least in some places: but the variation of the variation of the Needle being known in different places, all will be reduced to Rules, and so from hence, Philosophical or Natural Knowledge, will probably be enlarged by a happy discovery of the true cause of the *Variety*, or *Directional* faculty of the Loadstone; one of this *Noblest* and most *abstruse* *Phenomena*, that falls under the cognizance of humane Reason.

To find this variation by the Stars, is so easie, as every Master can do it; seeing there is no more requisite, than to find out the true *North*, that is, the *Meridian*, and compare the Needles position

on with it. By this means, the variation may be had well enough to degrees, half degrees, and some smaller parts; and if carefully and curiously prosecuted, even to Minutes too. But it will not be amiss, to do it both by the Sun and Stars, that the greater certainty may be attained.

2. To carry Dipping-Needles with them.

THe *Dipping-Needle* is to be used at least as frequently as the former Experiment is made, and in the same places, in order to the same purposes. All that needs be said of the Manner, is, that when the Dipping of the Needle is to be examined, the Circle, in which it moves, is to be hung perpendicular, and turned, till it be just in the *Magnetical Meridian*, where it dippeth most, and the degree of its depression under the *Horizon* is to be noted in a *Table*. See *Figure 1*.

3. To mark carefully the Flowings and Ebbings of the Sea, in as many places as may be.

THe Particulars here to be regarded, are, 1. The precise times of the beginnings of the Flood and Ebb, in all Rivers, Bayes, at Promontories, Capes, and in all Roads, Harbours, &c. 2. Which way Currents run in all places, with their Times, Changes, &c. 3. What perpendicular Distance there is, between the highest reach of the Tide, and lowest of the Ebb, both of all Spring-Tides and Neap-Tides, with their irregularities, &c. 4. What day of the Moon's age, and what times of the Year the highest and lowest Tides fall out: and all other considerable Accidents observable in Tides, chiefly in and near all Sea-ports, Harbours, Roads, Islands, &c. as *St. Helens Islands*, *Bermudas*. 5. The position of the Wind at every Observation of the Tides, &c.

4. To

4. To remark curiously the Scituation, Figures, &c. of all dangerous Rocks, Sands, Channels, Entries, and Courses of Rivers, and all difficult Passages and Courses in all places; to measure and describe the same Exactly, their distances, bearings, &c. As also the Prospects of remarkable Coasts, Promontories, Ports, Islands, &c. in the same manner; and make Draughts, Plots, and Maps of them, with their Longitudes, Latitudes, Scales, &c. and all Beacons, Buoyes, Landmarks, Light-houses, &c. which serve for directing the Course of Ships through narrow Channels, over Bars and Banks, into Rivers, Ports, Bayes, &c. And to sound Depths near all Coasts, in all shallow Places, Roads, &c.

5. To sound the deepest Seas without a Line, by the help of an Instrument, represented by Figure 2.

TO perform this, take a Globe of *Firr*, or *Maple*, or other light wood, as *A*, let it be well secured by Vernish, Pitch, or otherwise, from imbibing Water, then take a piece of Lead or Stone, *D*, considerably heavier, than will sink the Globe: Let there be a long

long Wire-staple B, in the Ball A, and a springing wire C, with a bended end F, and into the said Staple, press in with your fingers the springing Wire on the bended end: and on it hang the weight D, by its hook E, and so let Globe and all sink gently into the Water, in the posture represented in the said *Figure*, to the bottom, where the weight D touching first, is thereby stopt; but the Ball, being by the *Impetus* it acquired in descending, carried downwards a little after the weight is stopt, suffers the springing Wire to fly back, and thereby sets it self at liberty to re-ascend. And by observing the time of the Ball's stay under Water (which may be done by a Watch, having Minutes and Seconds; or by a good *Minute-Glass*; or best of all, by a *Pendulum*, vibrating Seconds; the which must be three foot, three inches, and one fifth of an inch long, *viz.* between the middle of the Bullet and the upper end of the Thred, where it is fastned, or held when it vibrates.) You may by this way, with the help of some *Tables*, come to know any depth of the Sea.

Note, That care must be had of proportioning the weight and shape of the *Lead*, to the bulk, weight, and figure of the *Globe*, after such a manner, as upon experience shall be found most convenient.

In some of the Trials already made with this Instrument, the Globe being of *Maple-wood*, well covered with Pitch, to hinder soaking in, was $5\frac{1}{2}$ inches in *Diameter*, and weighed $2\frac{1}{2}$ pounds; the Lead, of $4\frac{1}{2}$ pounds weight, was of a *Conical* (but is now used of a *Globous*) *Figure* $1\frac{1}{2}$ inches long, with the sharper end downwards, $1\frac{1}{2}$ at the bottom in *Diameter*. And in those Experiments made in the *Thames*, in the depth of 19 foot water, there passed between the Immersion and Emerision of the Globe, 6 Seconds of an hour; and in the depth of 10 foot water, there passed $3\frac{1}{2}$ Seconds, or thereabouts: From many of which kind of Experiments, it will likely not be hard to find out a method to calculate, what depth is to be concluded from any time of the like *Globes* stay under water: As for instance, if in the depth of 20 fathom, measured by the Line, the Globe stay under water 15 Seconds; then if the Ball stay 700 Seconds, the depth of the Sea is 933 fathom and 2 foot, if the Ball be found to move equal spaces in equal time.

In the same Trials made with this Instrument in the said River of *Thames*, it has been found, that there was no difference in time, between the submersions of the Ball at the greatest depth, when it rose two Wherry's length from the place where it was let fall (being carried by the Current of the Tyde) and when it rose onely a Yard, or so, from the same place, where it was let down: And that it must be so in great depths and stronger Currents, is as certain, as easie to be demonstrated.

And if it be alledged, that it must be known, when a *Light Body* ascends from the bottom of the Water to the Top, in what proportion of time it rises, it may be considered, that in this Experiment the times of the Descent and Ascent are both taken and computed together; so that, for this purpose, there needs not the nicety, which is alledged.

Other Experiments of this way of sounding without a Line, made by the Noble Lord Viscount *Brounker*, Sir *Robert Moray* Knight, and Mr. *Hook*, in the Channel at *Sheerness*; the following Account was given, *Vid.*

Weighed Ounc. Grains.

A Wooden Ball (A) ——— 32 $\frac{1}{8}$ 00

Another Wooden Ball (B) --- 30 22

A Lead (A) ————— 30 00

Another Lead (B) ——— 30 $\frac{3}{4}$ 00

The Ball (B) and the Lead (B) were let down at 16 fathoms, and the Ball returned in 48 single strokes of a *Pendulum*, held in the hand; vibrating 58 single strokes in a *Minute*.

A second time repeated with the same success; therefore, the motion was 4 foot every second.

Again the Ball (A) and the Lead (B) whose Nail was bended into a sharper Angle; the Ball returned in 39 strokes. A second time repeated with the same success at the same depth.

Ball (B) Lead (B:) in which trial the Line, not being clear, stopped a little the motion; the Ball returned in 47 at the same depth.

Ball (*A*) Lead (*A*) at 8 fathom and 1 foot, returned at 20 ; repeated at 8 fathom, returned at 19.

Tried the third time at 10 fathom and 4 foot, return'd at 28.

A fourth Trial, at the same depth, just the same.

A fifth, at 10 fathom, 5 foot, returned in 27.

A sixth Trial, just the same.

A seventh, at 12 fathom, 5 foot, in 37.

An eighth Trial, just the same.

Another Day, near the same place.

Note, That the *Pendulum* was this Day adjusted, and made a little shorter, there having been but 58 vibrations in a *Minute*, the other Day.

Ball (*A*) Lead (*B*) at 14 fathom, returned in $32\frac{1}{2}$.

A second Trial, a little after in the same place, returned in 33. In making of which Trial, the Vibrations were told aloud, and the Lead having been let down by a Line, was found to touch the bottom in just half the time, the Ball staid under water. By a second Trial, the Ascending and Descending was found to be in equal times. And by a third Trial with another Lead, the very same was found, *vid.* $16\frac{1}{2}$ descending, and $16\frac{1}{2}$ ascending. This Lead and Ball let down without a Line, the Ball returned in 13 vibrations; a sign it went not to the bottom.

A Trial made with a Lead, whose *Iron-Crook* was fasten'd at the top of it (like that in the *Figure 3.*) succeeded very well, and the Ball returned in 34. But by reason of the Current, the Experimenters could not perceive, when the Lead touched the bottom. This Lead being let down without a Line, the Ball returned in 32. The depth of the water was now found by the Ships Lead, to be 14 fathom.

Another Trial was made with a Line, bowing the point of the Lead (like that in the *Fig. 4.*) and the Ball return'd in 34. The same let down without a Line, the Ball return'd in 6 or 7 vibrations; a sign again, it went not to the bottom.

In a Trial with another Lead, the Ball return'd in 34.

Repeated again with the same success.

In a Trial with a Lead, whose Nail was fet awry (like that of the *Fig 5.*) the Ball returned in 34. After which Trial, the depth was found to be just 14 fathom.

The last Lead and Ball being let down without a Line, the Ball returned at 35.

In another Trial with a Lead that never failed, the Ball returned in 34, and the Lead toucht the bottom at 17.

By a Trial with another Lead, the same time was found exactly.

By a third Trial with this last, the very same.

These Trials were made near about High-water, at the depth of 14 fathom just by measure: And in them, the motions seem to be 5 foot every second.

In all these Trials, the greatest difficulty was, in the use of Conical Figures, with Iron Crooks, to bend the Iron, that it might be sure to carry down the Ball with it to the bottom, and when come thither, to let it go: for almost every one of these Leads failed in one of these requisites, till by several Trials they had been adjusted.

It is not to be omitted, That the last Trials being made near High-water, the Ball was found to rise (by the Boat, being permitted to drive) far off upon one side, out of the way, that any light thing, suffered to swim on the water, would be carried; which seemed to argue a motion of the under parts of the water, differing from that of the upper (a thing which is said to be at certain times of the Tydes, both at the mouth of the *Sound*, and of the *Streights*; which deserves to be further inquired into.) The Angle made by these different motions, seemed to be about 40 *Degrees*.

6. To keep a Register of all changes of Wind and Weather at all hours by Night and by Day, shewing the point, the Wind blows from, whether strong or weak: The Rains, Hail, Snow, and the like; the precise times of their beginnings and continuance: especially Hurricans, and Spouts; but above all to take exact care to observe the Trade-Winds, about what degrees of Latitude and Longitude they first begin, where and when they cease or change, or grow stronger or weaker, and how much; as near and exact as may be.

THE strength of the Winds is measured by an Instrument, such as is represented by *Figure 6*; which being exposed to the Wind, so as the flat side may be right against it, the number of Degrees upon the *Limb A B*, to which the Wind blows up, or raises, that flat side *C D*, shews the force or strength of the Wind, in proportion to the resistance of the flat side of the Instrument; and is to be recorded.

The

7. *To observe and record all Extraordinary Meteors, Lightnings, Thunders, Ignis fatuos, Comets, &c. marking still the places and times of their appearing, continuance, &c.*
8. *To carry with them good Scales and Glass Vials of a pint or so, with very narrow mouths, which are to be fill'd with Sea-water in different degrees of Latitude, and the weight of the Viol full of water taken exactly at every time, and recorded; marking withal the degrees of Latitude and Longitude of the Place, and the Day of the Moneth, and the Temperature of the Weather: And that as well of Water near the Top, as at a greater Depth.*

THE Viol is to be made with a very narrow Neck, and when it is almost full, water is to be dropt into it, drop by drop, till it can hold no more, drying well the Viol before it be weighed. The weight of the empty Viol is also to be recorded every time, weighing all to grains. And by evaporating gently the water, till the Salt be left dry on the bottom; they, who list, may have the satisfaction to know, what proportion the Salt of each water holdeth to its weight.

There is, among some other wayes of finding the different gravities of Water, a very pretty one, mentioned by some Authors, as *Johannes Toldenus* (a German Artist) *Cabeus*, and *Kircher* in his

his *Fundus Subterræ*, and improved and first brought into use here, divers years ago, by the Noble *R. Boyle*, who also, as himself informed the Publisher, hath in some of his Writings, yet unpublisht, set down a full Description thereof.

It is such a Glass-Tube as is represented by *Fig. 7.* blown at a Lamp, and poised in good common Water by putting *Quick-silver* into it, until it sink so low, that nothing appear above the Superficies of the Water, but the Top; which done it is to be seal'd up, and to be graduated on its side, into what parts you please; which may be done with a Diamond. And then, being put into any Water to be weighed, it will, by its more or less sinking into it, shew the differences of the Waters gravity.

9. To fetch up Water from any Depth of the Sea.

TO perform this, let there be made a *Square Wooden Bucket* (such as *C* in *Fig. 8.*) whose bottoms *EE* are to be so contriv'd, that the weight *A* do sink the Iron *B* (to which the *Bucket C* is fastned by two Handles *DD*, on the ends of which are the moveable bottoms or Valves *EE*) and thereby draws down the *Bucket*; the resistance of the Water keeps up the *Bucket* in the posture *C*, whereby the Water hath a clear thorow-passage all the while it is descending: whereas, as soon as the *Bucket* is pulled upwards by the Line *F*, the resistance of the Water to that motion, beats the *Bucket* downward, and keeps it in the posture *G*; whereby the included Water is preserv'd from going out, and the Ambient Water kept from getting in.

By the advantage of which Vessel, or such like, you may come to know the *Degrees of Saltness* of Sea-Water, according to its nearness to the Top or Bottom; or rather, the Constitution of the Sea-Water in several Depths of several *Climats*: Likewise, whether in some places of the Sea, there be any Sweet Water at the Bottom; the *Affirmative* whereof is to be met with in the *East-Indian-Voyages* of *Van Linschoten*, who pag. 16. of that Work, as 'tis *Englished*, records, that in the *Persian Gulph*, about the Isle of *Baharem*, they fetch up with certain Vessels (which he

de-

describes not) Water out of the Sea, from under the Salt-Water, four or five fathoms deep, as sweet as any Fountain-water. And since 'tis argued by some, that such Sweet-Water proceeds from certain Sweet Water-Springs, that were formerly on the Continent, at some distance from the Sea, and came afterwards to be covered by the Sea; it may be presumed, that in other places we may find the like. Besides, we know not, but that there may be in many parts, Eruptions of large Springs at the Bottom of the Sea, that were never taken in by any of its encroachments.

These Experiments are to be repeated every New Voyage, the multitude and frequency of them being necessary for finding out and confirming the truth of them; which as it will conduce exceedingly to the Enlargement of Natural Knowledge, so it may in time produce New and more accurate Sea-Maps and Cards, than hitherto have been published; and great helps and advantages to Navigation: especially those of the Variation, and Dipping of the Needle; the Depth and Saltness of the Water; the Nature of the Ground at the Bottom of the Sea; and indeed almost every one of the rest; there being a Design to consider all, and to draw out of them such Rules and Directions, as may bring no less Honour, than Benefit to the English Nation.

The Instruments, described and represented in these Papers, may be had from Mr. Richard Shortgrave, Operator to the R. Society, to be found at Gresham Colledge; who also will be ready, if there be occasion, to give more particular Directions for the use of the same.

A D V E R T I S E M E N T.

IT is desired by Christopher Merret M. D. to inform the Publick, that within the space of four Moneths, he shall re-publish his Pinax Rerum Naturalium Britannicarum, with many Additions, and in his proposed New Method; and that he wholly disclaims the Second Edition of that Book, as being printed and published without his knowledge.

In the S A V O Y,

Printed by T. N. for John Martyn at the Bell, a little without Temple-Bar, and James Allestry in Duck-Lane, Printers
to the Royal Society, 1667.

PHILOSOPHICAL TRANSACTIONS.

Monday, May 6. 1667.

The Contents.

An Account of an Easier and Safer Way of Transfusing Blood, vid. by the Veins onely. An Experiment of bleeding a Mangy, into a Sound Dog. An Extract of a Letter written by a French Philosopher, concerning the same Subject of Transfusion. Observations touching the Uniting of Barks of Trees cut, to the Tree it self. An Experiment of making Cherry-Trees, that have wither'd fruit, to bear good and full fruit. An Experiment on Aloe Americana Serratifolia weigh'd; seeming to infer a Circulation of the Sappe in Plants. An Extract of a Letter, about the Invention of Dividing a Foot into many thousand parts, for Mathematical purposes. More Wayes proposed, for the same purpose. Observations of the Star called Nebulosa, and of that in the Neck of the Whale. Extract of a Letter, concerning a New Discovery of the Communication of the Ductus Thoracicus with the Emulgent Vein. A Description of several sorts of Granaries, as those of London, Dantzick, Muscovy. Inquiries for Hungary, Transilvania, Egypt, Guiny.

An Account

Of an easier and safer Way of Transfusing Blood out of one Animal into another, viz. by the Veins, without opening any Artery of either.

THis Way was first practis'd (for ought we know) by Doctor Edmond King, and the success thereof in two Experiments, communicated by him to the Royal Society, as follows.

1. I took a Calf and a Sheep, both of the larger sort; and having prepared a Jugular *Vein* in each, I planted my Pipes and Quills, as is usual, both in the Jugular *Vein* of the Calf (designed to be the *Emittent*) and in that of the Sheep (intended for the *Recipient*.) Then I took out of the Sheep 49 ounces (*Haver de pois weight*) of blood, before any other blood was let in; about which time, the company concluding the Sheep to be very faint, and finding the blood to run very slowly, I stopp'd the *Vein* of the Sheep, and unstopp'd the Pipe in the Calf, letting run out 10 ounces into a Porringer, which was done in about 40 seconds of a Minute. Then I convey'd Pipes from the *Emittent* Calves *Vein*, into the *Recipient* Sheeps *Vein*, and there ran a good free stream of blood for the space of 5 minutes (though perhaps lesse swift than the first 10 ounces.) And not to be deceived in the running, I did often strike with my finger the upper part of the emitting *Vein*, and thereby easily felt every stroke answered on the *Recipient* *Vein*, just like a *Pulse*. And now supposing that by this time (*viz.* the lapse of 5 minutes) the Sheep had received as much, if not more blood, than it had lost, we stopp'd the current of blood from the Calf, and closed also the *Vein* of the Sheep, and then having untied her, and set her down in the room, she went about and appeared to have as much strength, as she had before the loss of her own blood. Then resolving to bleed the Sheep to death, we bound her the second time, and open'd the *emittent* part of the *Vein* again; whereupon having bled about 60 ounces, she fell into Convulsions; and after the loss of about 5 ounces more, she died upon the place: and being dress'd by the Butcher, there did not, in all the usual places, appear above 3 ounces of blood; and the whole Sheep look'd of a lovely white; and the meat of it (to the taste of those, that eat of it) was very sweet.

The Sheep being dead, we resolv'd likewise to see the Calf bleed to death; but he having bled 10 ounces, and then for the space of 5 minutes more into the Sheep, and rested a good while, the blood by that time began to coagulate in the *Vein*; which made me open the *Carotid Artery*, letting thence run out about 25 ounces of blood, of a very lovely and vivid colour, vastly exceeding

celling therein the blood of the Vein. The Calf, when dress'd, had, by the information of the Butcher, as little blood as the Sheep; and we saw him look whiter, than usually they do in the ordinary way of killing.

2. I took out 45 ounces and better, of blood, out of the *Fugular Vein* of a Sheep, of a lesser size than the former; by which time, the Spectators, as well as my self, found her exceeding faint, and some thought her pass'd recovery, without a supply of blood. Then I convey'd blood from the *Fugular Vein* of a Calf into that of the Sheep, for the space of 7 minutes, when we did believe, by the continuance of a good stream from the Calf, that the Sheep had already received more blood, than she had lost. Whereupon we set her free, and she had no sooner got her liberty, but seeing a Dog near her (which was a Spaniel, that had formerly suffered the transmission of Sheeps-blood into him) she butted with great violence at him three or four times; not appearing at all concern'd at what she had endured in the Experiment. We kept this Sheep alive, she being sent to grass again, and seeming hitherto very strong and lusty.

The Calf was much larger than the Sheep. We bled the Calf to death, and received from him six Porringers full of blood, after the Sheep had been suppleid; each Porringer containing 11 ounces of water. The Sheep lost four of the same measures full of blood; which being supply'd by that of the Calf, we reckon, that the Calf lost 10 such measures in all.

An Account Of another Experiment of Transfusion, viz. of Bleeding a Mangy into a Sound Dog.

This was made by Mr. Thomas Coxe, and imparted likewise to the Royal Society in manner following.

I procured an old Mungrell *Curr*, all over-run with the Mainge, of a middle size, and having, some hours before, fed him plentifully with Cheese-parings and Milk, I prepared the *Fugular Vein*,

as we use to do the *Carotidal Artery* of the *Emittent Animal*, not designing any thing further, than to determine by Experiment the Infection of the *Recipient's* blood. Then I made as strong a Ligature upon the Dogs Neck, as I durst, for fear of choaking him, to the end, that the *Venal* blood, which is much more sluggish in its motion and evacuation, than the *Arterial*, might be emitted with the greater advantage of *Impetus*.

Then I took a young *Land-Spaniel*, of about the same bigness, and prepared his Jugular Vein, as is usually done in the *Recipient Animal*; the *heart-ward* part of the Vein to receive the Maingy Dogs blood; and the *head-ward* part of it to discharge his own into a Dish.

Having thus prepared them both, and placed them in a convenient posture one to the other, I let slip the running knots, and by frequent compression of the Neck (besides the Ligature I had made) by reason of the tardy running of the *Venal* blood out of the *Emittent*, transfused about 14 or 16 ounces of the blood of the *Infected*, into the Veins of the *Sound Dog*, as near as I could guess by the quantity of blood, which ran into a Dish from the *Recipient*; supposing the *Recipient Animal* to lose near about the same proportion to what the *Emittent* supplies.

The effect of which Experiment was, no alteration at all, any way, to be observed in the *Sound Dog*. But for the Maingy Dog, he was in about 10 dayes or a fortnights space perfectly cured: which might with probability enough, I think, have been expected from the considerable evacuation, he made; (perhaps the quickest and surest remedy for the cure of that sort of disease, he was infected with, both in Man and Beast.)

Of another Experiment of Transfusing the Blood of an Infected Dog into a Sound Dog.

This was made by Mr. Thomas Cox, and imparted likewise to the Royal Society in manner following

An

I procured in the Morning, two, all of a kin with the former of a milted, and having kept them close, led him presently with a Chastising, till I perceived the veins to be

An Extract
Of a Letter of M. Denis Prof. of Philosophy
*and Mathematicks to M. * * * touching*
the Transfusion of Blood, of April 2.
1667.

This we English out of the 8th Journal des Scavans of 1667.
Viz.

Since the Experiments, of which I wrote to you the 9th of *March*, we have transfused the blood of three *Calves* into three *Dogs*, to assure our selves, what the mixture of two such differing sorts of blood might produce. I shall hereafter acquaint you at large with the particulars; at present I shall onely inform you, that the Animals, into whom the blood hath been transmitted, do all of them eat as well as before, and that one of these three *Dogs*, from whom the day before so much blood had been drawn, that he could hardly stir any more, having been supplied the next morning with the blood of a *Calf*, recover'd instantly his strength, and shew'd a surprizing vigor.

We have found new wayes of making this Transfusion with so much facility, that *M. Emmerez* undertakes to perform it *without any Ligature*, onely by pricking, like that, which is used in *Letting of blood*.

Observations

Concerning the Uniting of Barks of Trees cut,
to the Tree it self; made by Christopher
Merret M. D. and read before the Royal
Society January 9. 1666.

IN the midst of *March An. 1664*. I made a Section of the Rinds of *Ash*, and of the Tree, falsely called *Sycamore*. The first Section of each of the Rinds was square, whereof three sides were
cut,

cut, the fourth uncut. The success was, that the whole Bark did unite, by binding it with pack-thread, leaving a scar in each of the sides cut.

Then I cut off and separated entirely from the Tree, several parts of the Bark, some shallower, leaving part of the Bark on; others to the very wood it self, both in the Trunk and Branches; from an inch square to less dimensions; and some of them I bound close with pack-thread: all which were separated, a new Rind succeeding in their place. Some I cover'd over, beyond the place of Incision, with *Diachylon-plaister*, and tied them fast with pack-thread. All which, thus bound and plaister'd, did within the space of three weeks, firmly unite to the Tree, not without some shriveling of the outward skin of the Bark, and also with some shrinking in each side, where the Incision was made; where also appear'd in each of the Interstices a scar.

The like Experiment I made, some years before, about the same time of the year, and succeeded as before related. But tying the same about *Michaelmas*, and in the *Winter*-season, at neither of these times any Union could be made of the Bark to the Tree. I suppose, it was, because the Sappe mounted not so vigorously and in such plenty, as in the *Spring*-season.

Some Branches of the fore-mentioned Trees were decorticated round, and where no Union was, there certainly follow'd a withering of the Branch beyond the place, where the Section was made.

I also separated a Twig from the Branch, by cutting of it sloping, for the better fastning of it to the Branch again. This Twig I exactly fitted to the Branch, from whence 'twas cut, in the same posture, it before grew in: I firmly bound it, and cover'd it with *Diachylon-plaister*. The success was, that in 3 dayes time, the Twig, that was cut off, withered.

An Experiment

Of making Cherry-Trees, that have withered fruit, to bear full and good fruit; and of Recovering the almost withered fruit.

Communicated by the same, as follows :

A Nno 1665, I made the following Experiment with 3 *May-Cherry-Trees* (planted in a rich Mould) which lay to a South-wall, shaded 4 Winter-Moneths from the Sun by a high Building, so that the Sun came not on them, till the beginning of *March*, when being high, and shining somewhat fiercely upon them, the fruit constantly withered for some years before. Now this year, the season being very hot and dry, I bared the roots of *one* of them, by making a hole about it, and watered it every Morning and Evening with about a *Gallon* of water, for about a fortnight before the Cherries came to redness, and the fruit was full and good. The other *two* Trees, left without this ordering, had most of their fruit withered, having onely skin and stones. Now to try this Experiment farther, I made a hole round about *one* of the other Trees, and fed it with water daily, as the former: In a Weeks time, those that were quite withered, fell off, and the rest, that were not so, grew and increased exceedingly; the *other* Tree, that was not used after this manner, had not any of its fruit come to perfection.

An Experiment

On Aloe Americana Serrati-folia weighed; seeming to import a Circulation of the Sappe in Plants, by the same Dr. Merret.

A ugust 4. 1656. this Aloe weighed 21 Ounces, 6 Drams, 2 Grains. Its colour was of a pale-green, consisting of 11 Leaves; it was bound about with a red dry Cloth, and was hung up without Oil, as is usual, in the Kitchin.

August

| | | Weight. | | | | Lofs. | |
|----------|-----|---------|-----------------|--------|---------|-----------------|---------|
| | | Ounc. | Drams. | Scrup. | Grains. | Scruples. | Grains. |
| August | 19. | 21 | 3 | 0 | 24 | 3 | 27 |
| Septemb. | 6. | 21 | 1 $\frac{1}{2}$ | 0 | 0 | 1 | 14 |
| February | 20. | 21 | 1 | 0 | 12 | 0 | 11 |
| March | 16. | 21 | 0 | 2 | 0 | 0 | 32 |
| April | 8. | 21 | 0 | 0 | 0 | 0 | 40 |
| May | 1. | 20 | 7 | 0 | 0 | 1 | 0 |
| May | 28. | 20 | 5 $\frac{1}{2}$ | 0 | 0 | 1 $\frac{1}{2}$ | 0 |
| June | 12. | 20 | 4 | 0 | 4 | 2 | 26 |
| July | 1. | 20 | 1 | 0 | 8 | 2 | 18 |
| July | 20. | 19 | 6 | 0 | 1 | 3 | 7 |
| August | 4. | 19 | 3 | 0 | 12 | 2 | 49 |

So that in a whole year it lost 2 Ounces, 3 Drums, 24 Grains. The succeeding year being drier and hotter, it lost 3 Ounces, 2 $\frac{1}{2}$ Scruples, and more than double in the 6 colder, than the 6 hotter Moneths. I kept it about 5 years, and it decreased much about the same proportion. And in the year 1660, hanging it in a colder Garret, it perished.

These Observables I had about it, that every Year two of the greater Leaves first changed Colour, and wither'd; and in the Spring-time, there grew out two very fresh and green ones, never amounting to the bignes of any of the precedent; insomuch, that all this time I had the same number of Leaves. And then, these new Leaves were more fresh and green, and not serrated, and thicker also in proportion to their other Dimensions. Whence perhaps it may probably be infer'd, *vid.* from the growth of these latter Leaves, that there is a *Circulation* in this Plant of the *Succus nutritius*. For, how is it possible, that the Roots, continuing as firm and solid as at first, should supply so much nourishment, as to procreate new Leaves, unless it were from the return of the said *Succus*, from the old and decaying Leaves, into the Root, and there pretruded for the production of new ones? For, all *Bulbous* Roots, as Garlick, Onions, Tulips, and especially Squils, who protrude their Leaves, placed in a Shop or House, have their Roots lighter, and more spungy;

the

the Leaves being formed out of the substance of the Root, as a Chick out of the *Albumen*; in the mean while the whole decreasing in weight, as in the aforesaid *Aloe*; as 'tis manifest by many Experiments made by me.

An Extract
Of a Letter, written by Mr. Richard Towneley to Dr. Croon, touching the Invention of Dividing a Foot into many thousand parts, for Mathematical purposes.

Finding in one * of the last *Philosophical Transactions*, how much M. *Auzout* esteems his Invention of dividing a Foot into near 30000 parts, and taking thereby Angles to a very great exactness; I am told, I shall be look't upon as a great Wronger of our Nation, should I not let the World know, that I have, out of some scatter'd Papers and Letters, that formerly came to my hands of a Gentleman of these Parts, one Mr. *Gascoigne*, found out, That before our late Civil Wars, he had not only devised an Instrument of as great a power, as M. *Auzout*'s, but had also for some Years made use of it, not only for taking the Diameters of the Planets, and Distances upon Land; but had farther endeavour'd, out of its preciseness, to gather many Certainties in the Heavens; amongst which, I shall only mention one, *viz.* The finding the *Moons Distance*, from two Observations, of her *Horizontal* and *Meridional Diameters*: Which I the rather mention, because the *French Astronomer* esteems himself the first that took any such Notice, as thereby to settle the *Moons Parallax*. For, our Countrey-man fully consider'd it before, and imparted it to an Acquaintance of his, who thereupon propos'd to him the Difficulties that would arise in the Calculation; with considerations upon the strange Niceties, necessary to give him a certainty of what he desired. The very Instrument he first made I have now by me, and two others more perfected by him; which doubtless he would have infinitely mended, had he not been slain unfortunately in His late Majesties Service. He had a *Treatise*

* Vid. Numb.
 21. P. 373.

tise of Opticks ready for the *Press*; but though I have used my utmost endeavour to retrieve it, yet I have in that point been totally unsuccessful: But some loose Papers and Letters I have, particularly about this Instrument for taking of Angles, which was far from perfect. Nevertheless, I find it so much to exceed all others, that I have used my Endeavors to make it exact, and easily tractable; which above a Year since I effected to my own desire, by the help of an Ingenious and Exact Watchmaker in these Parts: Since which time, I have not altogether neglected it; but employed it particularly in taking the *Distances* (as occasion served) of the *Circum-jovialists*, towards a perfect settling their Motion. I shall only say of it, That it is small, not exceeding in weight, nor much in bigness, an ordinary Pocket-Watch, exactly marking above 40000 Divisions in a *Foot*, by the help of two *Indexes*; the one shewing hundreds of Divisions, the other, Divisions of the hundred; every last Division, in my small one, containing $\frac{1}{10}$ of an Inch; and that so precisely, that, as I use it, there goes above $2\frac{1}{2}$ Divisions to a *Second*. Yet I have taken *Land-Angles* several times to one Division, though (for the Reason mention'd by M. *Anzout*) it be very hard to come to that Exactness in the Heavens, *Viz.* The swift motion of the *Planets*. Yet, to remedy that Fault, I have devised a *Rest*, in which I find no small advantage, and not a little pleasing those persons who have seen it, being so easie to be made, and by the Observer manag'd without the help of another: Which second Convenience, my yet nameless Instrument hath in great perfection, and is, by reason of its smalness and shape, easily applicable to any Telescope. Sir, If you think this Invention, thus improv'd, worthy to be taken notice of by the Curious, you may * command a more perfect Description of it, or any of the Observations, either from M. *Townly*, M. *Gascoigne*, or my self have made with it.

* Care is taken, to get both this Description, and the Observations, from M. *Townly*.

More Wayes

For the same Purpose, Intimated by M. Hook.

I Have by me (saith Mr. H.) two or three several wayes of *Measuring the Diameters* of the Planets, whether *Horizontal, Perpendicular, or Inclined*, to the exactness of a *Second*, by the help of a *Telescope*: As also, of taking the *Position and Distance* of the *Small Fixt Stars* one from another, or from any of the less bright *Planets*, if the *Distance* be not above two or three *Degrees*.

The Particulars hereof, the Author refers to the next Opportunity.

Observations

Of the Star, called Nebulosa, in the Girdle of Andromeda; and of the Wondrous Star in the Neck of the Whale: made and communicated by Monsieur Bullialdus.

A *Nno 1667. in January*, when the *Cloudy and Misty* weather, which had continued for a good while, did permit us to observe, the *Star Nebulosa, in the Girdle of Andromeda* (which may well enough be seen by the bare Eye) appeared much obscurer than the Year before. In the Months of *February and March* I did not see it.

Anno 1667, January 20. at Night, h. 6. 30'. the Sky being pretty serene, the Star in the Neck of the Whale, did approach to the bigness of a Star of the Sixth Magnitude, and grew bigger afterwards.

February 12, h. 6. 30'. I saw the same again, equalling now a Star of the Fourth Magnitude at least.

February 24, h. 7. This Star was equal to those of the Third Magnitude, shining very bright.

February²⁶, The same appeared yet to increase; as also February 27. But after this time I could not see it, by reason of the ill weather.

The same Astronomer did subjoin the following Extract of a Letter he received from Monsieur Hevelius, March 15. 1667. concerning such another Star; viz.

I have watched the *New Star* in the *Neck of the Whale*, as often as the weather would give me leave, which it hath done but seldom this Winter. In *January*, the 3, 4, 5, 7, and 13 dayes, it did not yet appear. From this time, the Sky was continually overcast, till *January 23*. on which day, I found a little Star of the *Sixth* or *Seventh Magnitude*, about the same place where the said *New Star* uses to appear. But it then seemed to me not the genuine *New Star*, but another, to wit, preceding the *New*; whose *Longitude* hath been defined by me in *Mercurius in Sole visus in Aries*. gr. 25. 43'. 3". and the *Latitude* gr. 14. 41'. 32". South, Anno 1660. Then from *January 23*, to *February 2*, it was Cloudy weather again; but this *second of February*, it appear'd very bright, and that, when the Moon shone, of the bigness of that in the *Mouth of the Whale*, or *Nodo Lini*: from which time I alwayes observed it to grow bigger. *March 13*. I did still find it extremely bright, but could not by my naked Eye, because of the vivid *Crepuscle*, and the low site of the Star, accurately determine its Magnitude.

I have received (saith he further) your two *Monita ad Astronomos*; and the *Discourse* hath much pleased me, you having not much deviated from the Truth, in respect of the Appearance. Heretofore I had of this, and other *New Stars*, another *Hypothesis*; but I cannot thereby so accurately divine the Appearances, as you will read more largely in its due place.

See Numb. 22. of these Transactions, p. 381, 382. where an account is given of these two *Monita* of M. Bullialdus.

An Extract
 Of a Letter of *M. Pecquet* to *M. Carcavi*, concerning a New Discovery of the Communication of the *Ductus Thoracicus* with the Emulgent Vein: Taken out of the *Journal des Scavans*, N. VII. 1667.

I Cannot forbear longer to inform you of the Experiments, which *M. Perrault*, *M. Gayant*, and I, made last Night upon the Corps of a Woman, that died some few dayes after she was brought to bed.

Our Design was to continue the Discovery of the Vessels, that carry the Chyle to the Breasts, of which I have indicated the Way, pag. 134. of the *Second Edition* of my *Anatom. Experiments*, printed 1654. But the Body being not fit for that, we referred the search thereof to another time; and we have had the good fortune to make another Discovery, which may prove not less useful to *Physick*; it is the *Communication of the Milky Channel*, now call'd the *Ductus Thoracicus*, with the *Emulgent Vein*. The Experiments were these:

I. *M. Gayant* having discovered the *Ductus Thoracicus* upon the 7th and 8th of the *Vertebra's* descending from the Back, inserted a Quill into the said *Ductus*, and having tied it upon the Quill, he did blow into it: whereupon the *Ductus* was fill'd with wind from the Quill unto the *Subclavial Vein*. This wind issued at the *Ascending Cava*, which had been cut, when he, whose the Corps was, had lifted up the heart to make the demonstration of it, *M. Gayant* would tie this *Cava*, but it was cut so short, that the *Ligature* could not hinder the wind to issue out of it; which was the cause, that it could not be thrust as far as the Breasts. I would supply this defect, by compressing with my finger that place of the Vein, at which the wind came out (which was at about the third *Vertebra*, descending from the Back) and *M. Gayant* having blown

blown afresh into it, I compressed with my fingers the *Vena Cava* and the *Ductus Thoracicus* together, but the wind, that was thrust into this *Channel*, shewed us, that it had another way to escape. And indeed we saw as often as we did blow, that the *Emulgent Vein* was on the left side filled with wind, and that thereupon the body of the *Vena Cava* also filled it self from the *Emulgent* unto the *Iliacques*. This wind seem'd to us to come from the *Left Kidney*, and to insinuate it self into the *Emulgent Vein*, and thence into the *Cava*. The *Right Kidney* had been removed, so that we could say nothing of its communication with the said *Ductus*: That shall be for another time.

The Question was made, Whether the wind, that seem'd to enter into the *Emulgent*, and the *Cava*, did there enter indeed; or, whether it did not slide, betwixt the *proper* coat of this *Vein*, and that *common* one, which comes to it from the *Peritoneum*: This Question did oblige us to slit the *Cava* at the place of the *Emulgent*; and then blowing into the *Ductus Thoracicus*, we saw, that the wind, which had swelled the *Emulgent*, did escape at the opening, just now made in the *Cava*.

This Experiment made us judge, there was a communication of the *Ductus Thoracicus* with the *Left Kidney*, or at least with the *Emulgent Vein*, in the Body of this *Woman*. And to clear it the more, we made the following Experiment.

2. We lifted with the hand the *Lungs*, that filled the left Cavity of the *Thorax*, and having cleansed this Cavity with a *Sponge*, M. *Gayant* did blow into the *Ductus Thoracicus*, whilst I compressed the *Vein* and the *Ductus* with my fingers upon the third *Vertebra*, descending from the *Back*: And we saw the wind insinuate it self under the *Pleura*, by a trace, which raised it suddenly as often as we did blow. This trace appeared from the 4th *Vertebra* descending unto the *Diaphragme*, and made us conclude, that there was under the *Pleura* a *Channel* of Commerce coming from the *Ductus Thoracicus*, and passing to the *Emulgent Vein* by this Cavity of the *Thorax*. We could not doubt, but that this *Channel*, which passed under the *Pleura*, went as far as to the *Kidney*, because we saw, that the wind did get in on the side of the *Kidney* into the *Emulgent Vein*, and came out at the hole of
the

the *Cava*, that had been made in the first Experiment. We perceived, that this Channel of Communication came from the *Ductus Thoracicus*, at the place of the fourth *Vertebra* of the Back. But to be the surer of it, we made the following Experiment.

3. I compressed with my fingers the *Ductus* upon the *fifth* descending *Vertebra* of the Back; and M. *Gayant* having blown into the Quill, which was upon the *seventh*, the wind passed not to the *Kidney*, nor to the *Emulgent Vein*. Which made us conclude, that the Communication was not beneath the *fifth Vertebra*. Then I compressed with my fingers the *Ductus Thoracicus* and the *Vena Cava* upon the *third* descending *Vertebra*; and the *Emulgent* swelled, when M. *Gayant* blowed into the Quill: Which gave us more strongly to believe, That the place of the *Ductus Thoracicus*, whence goes the Channel of Commerce with the *Emulgent*, was between the third and *fifth Vertebra* of the Back, as the wind had informed us in the second Experiment.

To be yet more assured thereof, M. *Gayant* split the *Ductus Thoracicus* upon the *third Vertebra* of the Back, and having blown into it at the Quill, the wind came out at the *Axillary Vein*, and the *Ascending Cava*; but the *Emulgent* swelled not at all.

We made a *fourth* Experiment, which seemed very curious to us, and will not be miss to relate here, *viz.*

4. M. *Gayant* having blown into the *Aorta*, whereof all the branches, that had been cut, were tied up, it swelled immediately, and the *Emulgent Artery* grew tumid at the same time: but the wind, that was protruded thorow the *Emulgent Artery* into the *Left Kidney*, returned not into the *Emulgent Vein*; which taught us, that the *Blood* often passeth, where the *Air* does not.

We have an evident proof of it in the *Kidney*, since that the *Blood* of the *Emulgent Artery*, which goes to the *Kidney*, returns thorow the *Emulgent Vein* into the *Vena Cava*, pursuant to the Rules of the Circulation of the *Blood*; and that the *Air* propelled thorow the *Emulgent Artery* into the *Kidney*, comes not back thorow the *Emulgent Vein* into the *Vena Cava*.

We have yet another proof thereof in the *Lungs*, from the Experiment, we made of it in the Assembly upon the Corps of a Woman, that was there dissected in the beginning of *February* last; where we saw, that the *Air*, which was propelled thorow a Quill into the *Vena Arteriosa* (which is the *Artery* of the *Lungs*) returned not thorow the *Arteria Venosa* (which is the *Vein* thereof) into the *Left Ventricle* of the Heart; though, by the Circulation, the *Blood* pass there with ease, and even *Milk*, which having been let in by this *Vena Arteriosa*, returned easily thorow the *Arteria Venosa*, into the *Left Ventricle* of the Heart.

I draw no consequence from these Trials, as to the Channel of Communication, that passes from the *Ductus Thoracicus* into the *Emulgent Vein*; because one ought to infer nothing from one only Body. When we shall be certain, that this *Channel of Commerce* is found in *Men*, as well, as we have found it in this Woman, we shall then judge better of it. We are therefore going to make frequent Operations upon divers Animals, to see whether we shall there meet with any thing like it, to the end we may impart it to the Publick.

A Description Of several Kinds of Granaries, as those of London, of Dantzick, and in Muscovy.

Concerning the Granaries of London, the Inquisitive Dr. Merret, (who indeed occasion'd the Inquiry into the rest, as a thing, which many were desirous to be informed about, for the better Preservation of Grain, in times of its Plenty) gives this Account of them.

ALl the Twelve Companies of *London*, and some other Companies and Private Persons, have their Granaries at the Bridge-House in *Southwark* (where are a Justice of the Peace, a Steward, and two Masters.) These Granaries are built on two sides of an *Oblong*; one whereof stands *North* and *South*, and is near 100 yards long, whose Lettice-windows respect *North-East*, the other side may be about 50 yards long; the Windows look to the
North,

North, and the opposite sides have no Apertures. All the Windows are about a yard high, without any shutters, and run on in a continued *Series*, with very small partitions, sufficient onely to nail the Lettices to. Each of them is three or four Stories high. The Garret-windows are Jetty-wise, with a yards distance one from another, glazed out of the Tiles. The Ground or lowermost Story, 12 foot from the ground, is used onely for a Warehouse, &c. To settle the first Story upon strong Pillars, fortified with Spikes of Iron, that no Vermin might get up, would make that Story fitter for drying of Corn, and more perflatile; especially where there is no use of the lower Rooms. The other Stories, made for Granaries, are in breadth some 6 yards, and in height 6 foot or somewhat more. The uppermost or Garret-Granary to the Top or Angle, made by the raising pieces, much more. They have each in the midst from the sides at 8 or 9 foot distance, a strong Post; and all the Timbers made very strong, to support and bear the great weight of the Grain. The Boards best made of sound Oak, two inches thick, and close joynted. In some places they put, in all the inside of their Rooms, Iron-wire, of so narrow Mesches, that neither Rats nor Mice can get thorow them, two or three foot deep. Others erect, on all the sides, Boards of Timber, and fasten others to the top of the Perpendicular, one lying either parallel to the *Horizon*, or so that they make an acute Angle with the former, to the same purpose. For, besides the devouring of the Grain, the Excrements and Urin of that Vermine, moistning the Wheat or Rye, make them apt to corrupt and breed *Weivels*.

The two *main* Considerables in building these Granaries, are, *To make them strong*, and, *To expose them to the most drying Winds*.

The Ordering of their Corn is this, In *Kent*, to separate the dust and other impurities in it, when 'tis thrash'd, they throw it in Shovels from one side to the other, which the longer it is, the better: by which means all such impurities remain in the middle betwixt the two heaps of Corn; which they skreen, to part the Corn, that is good, from the said impurities; then, when they first bring the Grain into the Granaries, they lay it about *half a foot* thick, and turn it *twice a week*, and once in that time skreen

it; and this for two Moneths space. After that, they lay it a *foot* thick for two Months more, turning it *once* or *twice* a *Week*, and skreen it proportionably, according as the drying season is, seldomer or oftner. After 5 or 6 Moneths, they raise it to *two foot* in height, and turn it *once* a *Fortnight*, and skreen it once a Moneth, as occasion is. After a *Year*, they lay it *two and a half* or *three foot* deep, and turn it *once* in *three Weeks* or a *Moneth*, and skreen it proportionably.

When it hath lain *two Years* or more, they turn it *once* in *two Moneths*, and skreen it *once* a *Quarter*, and so on, as they find it in brightness, hardness and driness. The oftner these two things are done, the better the *Grain* proves.

They leave an empty space about a yard wide on all sides of the Room, and at *six foot* distance, thorow the whole *Area*, empty of *Corn*; into which empty spaces they turn the *Corn* as often as 'tis needful.

In *Kent* they make two square holes in both the ends of the Floor, and one round in the middle; by which they throw the *Corn* from the upper into the lower Rooms, & *contra*, to air and dry it the better.

The *Skreens* are made with two partitions, to separate the dust from the *Corn*; which falls into a *Bag*, and when sufficiently full, is cast away, the good *Corn* remaining behind.

Corn has been kept in *London-Granaries*, 32 Years; and the longer 'tis kept, the more flower it yields, in proportion to the quantity of the *Corn*; and makes the purer and whiter *Bread*, the superfluous humidity onely evaporating.

Dr. Pell mention'd at a Meeting of the *R. Society*, that they keep *Corn* at *Zurich* in *Helvetia*, 80 Years.

So far the Doctor.

As for the *Granaries* of *Dantzick* and *Moscovia*; some observing Merchants and Travellers give this short Account of them.

First, That those of *Dantzick* are generally *Seven Stories* high, some, *Nine Stories*; having each of them a *Funnel*, to let the *Corn* run down from one Floor to another; thereby chiefly saving the labour and charges of carrying it down. And then, that they

in that Town, are built altogether surrounded with water, whereby the Ships have the conveniency of lying close to them, to take in their Lading. No Houses suffered to be built near them, to be thereby secured from the casualties of Fire.

Secondly, That those of *Muscovy* are made *under Ground*, by digging a deep Pit, of almost the Figure of a Sugar-loaf, broad below, and narrow at the top; the sides well-plaster'd round about, and the top very close cover'd with Stone. The people of that Countrey are so very careful, to have the Corn well dried, before they put it into those Subterraneous Granaries, that, when the weather of that Northern Climat serves not to dry it sufficiently, they heat their Barns, by the means of great Ovens, and thereby very well drying their Corn, supply the deficiency of their short Summer.

Inquiries

For Hungary and Transylvania.

In prosecution of the Engagement, published Numb. 23. p. 414, 422. we now subjoyn some other Inquiries, and first these, that were very lately recommended to a studious and inquisitive Transylvanian, who from London returned to his Countrey, and promised to procure good Answers to the following particulars, Viz.

1. **W**Hat is observable in *Hungary, Transylvania*, and the Neighbouring parts, as to Minerals, Springs, Warm Baths, Earths, Quarries, Mettals, &c. (*Reference was here given to the Inquiries concerning Mines, printed Num. 19.*)

2. *Particularly*, To inquire into the several sorts of *Antimony*; or *Antimony-core*, to be found in *Hungaria*; and to inform us of the several places, whence they are digged, to the end, that they may be sent for:

3. To inquire, where the best *Hungarian Vitriol* is to be found, and the *Cinnabaris nativa*?

4. To give us a true account of the right *Gold*- and *Silver-Earth*- or *Ore*, said to be found at *Cranach* in *Hungary*; whence the *Gold* is called *Cranach-Gold*, first lighted upon by the care of the Emperour *Rudolphus*, and chymically wrought by his order and inspection?

5. To inquire after, and send over some of that kind of *Vitriol*, which by credible persons is affirmed to be found chrystallized in *Transylvania*: As also, after the *Vitriol* of *Tyrol*, said to yield *Gold*.

6. To inform us of the *Salt-pits* in *Transylvania*, said to yield two sorts of perfect *Salt*, the one being a *Sal Gemma*, the other, a common *Table-Salt*. To observe how deep these *Salt-mines* lie from the surface of the *Ground*: How deep they are digg'd hitherto; and what *Damps* are met with in them, &c?

7. To inquire after the *Veins* of *Gold* and *Quick-silver* at *Cremnitz* in *Hungary*; and the *Vein* of *Silver* at *Schemnitz* in the same *Kingdom*: And to send over some of the best *Ores* of them?

8. To inquire, Whether the *Waters* of the *Therma*, that pass by *Schemnitz*, depose a certain sediment, which in time turns into a yellow *Stone*?

9. Whether in the *Mines* of *Gold*, *Silver*, *Copper*, *Iron*, *Lead*, in *Hungary*, there be generally found *Quick-silver* and *Sulphur*?

10. Whether it be true, that in the *Copper-Mines* of the place called *Herren-ground* in *Hungary*, there be found no *Quick-silver* at all?

11. Whether it be true, that in some parts of the *Upper Hungary*, the *Ores* of *Copper*, *Iron*, and *Lead*, be sometimes so commixed, that there is often found in the upper part of the *Concrete*, matter of *Iron*; in the midst, matter of *Copper*. and in the lowermost, *Lead*: And that in other places of the same *Country*, *Copperish* fluors are mixed with *Leaden* ones?

12. Whe-

12. Whether it be true, what *Athau. Kircher* writes from Relation, That the *Ductus's* of *Mettals* do sometimes run *North* and *South*, sometimes *Cross-ways*?

13. Whether there be in *Hungary* such a River, as is mentioned in *Bushbekius*, whose water is so hot, and which is yet so full of Fish, that he saith, one would expect, that all the Fish drawn thence, would come out boyled?

14. Whether there be Springs about *Buda* or *Alba Regalis*, that rise at the bottom of the River so hot, that those, who go to bathe, dare not put their feet so low as the Sand, for fear of having them parboyled?

15. Whether there be in *Hungary* an *Avernus*, that exhalet almost alwayes such poysonous Steams, that Birds flying over it, do often-times fall down, either stupified, or quite dead?

16. Whether the *Iron*, that is said to be turned into *Copper*, by the *Vitriolate* Springs at *Cremnitz* or *Smolnitz* in *Hungary*, do after that *Transmutation* or *Precipitation*, contain a pretty deal of *Gold*?

17. Whether the Depth of the *Gold-Mines* of *Hungary* be 2400 feet?

18. Whether they find Trees, or any other Bodies in the solid Salt of their Salt-Mines.

19. Whether there be a great Lake in *Moravia*, whence of late years all the Waters were by accident drawn away, though formerly carrying Boats, and full of Fish?

20. Whether it be true, what is affirmed by Authors, That in some parts of *Hungary* near the *Gold-Mines*, the Leaves of the Trees have their lower superficies, if not their upper also, gilded over with yellowish Exhalations?

21. What is the way, said to be used in *Austria* and *Hungary*, of extracting the perfect *Mettals* out of their *Minera's* without *Lead*; performed by casting a Powder upon the *Minera*, which makes a quick and advantageous separation; Sulphur being supposed to be an Ingredient of it?

Inquiries

For *Ægypt*, by *Thomas Henshaw Esq;*

1. **W**Hether it rain there at any time, and if so, what time of the Year? Whether Rain make the Air wholsom, or pestilential, or otherwise unhealthful?

2. To consider the *Niter* that is commonly sold there, and what affinity there is betwixt *that*, and our *common Saltpeter*: to try by dissolving it in warm water, filtering it well, then boyling almost half away, and putting the remainder in an earthen Pan, and setting it in a cool place for two dayes, to see whether it will shoot into *Chrystals of Peter*. To send some quantity of it into *Europe*.

3. Whether the Earth of *Ægypt*, adjoyning to the River *Nilus*, preserv'd and weigh'd daily, keeps the same weight, till the 17th of *June*, and then grows daily heavier with the increase of the River?

4. Whether, if the *Plague* be never so great before, yet on the first day of the *Nile's* increase, it not only increaseth, but absolutely ceaseth, not one dying of it after?

5. To inquire particularly into the manner of *Hatching Eggs* in *Ægypt*; How the *Camel-dung* is prepar'd, wherein they are laid: how often the Eggs are turn'd: how cover'd? Whether they hatch in Twenty one dayes, as they do with us under a Hen? Whether the Chickens be as perfect as ours? If imperfect, Whether that may not happen to them by rough handling, while they are remov'd, being very tender, out of the place where they are hatch'd? To take the design of the manner, how by the Pipes the heat is convey'd into several Rooms. How they treat them betwixt the time of their hatching, and taking away by the Owners? Whether they do not also use to hatch Eggs under Hens?

6. To inquire, Whether the great quantity of *Yellow Amber*, which is sold at *Cairo*, be by reason that it is the *Gum* of a certain Tree growing in *Egypt*, or *Ethiopia*, as *Bellonius* after *Diodorus Siculus* affirms? And whether, besides several Animals that are found inclosed in that *Amber*, there is very frequently some part of the Bark of a Tree found sticking to it?

7. To inquire of a certain Tree, growing not far from *Cairo*, which bears a Fruit stuffed with Wooll, that is finer than Silk, of which the *Arabs* make Linnen that is softer than Silk, and whiter than Cotton?

8. Whether *Crocodiles*, that are found to be sometimes Thirty foot long, are hatched of an Egge, no bigger than a Turkeys?

9. Whether the *Ichneumon*, or *Egyptian Water-Rat* can kill a *Crocodile*, by skipping into his Mouth, and gnawing his way out, as Old Writers affirm?

10. Whether it be true, That the *Arabs* can Charm the *Crocodiles*; or, Whether there be on the *Nile's* side any *Talismans*, or *Constellated Figures*, beyond which the *Crocodiles* cannot pass, as some would make us believe?

11. To inquire at *Cairo* for several *Drogues*, which are common there, and much in use, yet not brought into *Europe*, as *Acacia*, *Calamus Odoratus*, *Amomum*, *Costus*, *Ben Album*, and divers such others.

12. Whether the *Female Palm-Tree* be not fruitful, unless she grow by the *Male*, as some would bear us in hand?

13. To inquire, Whether the Appearance of the Leggs and Arms of Men, related to stand out of the ground, to a great number, at a place five Miles from *Cairo*, on *Good-Friday*, do still continue? And how that Imposture is performed?

14. Whether Children born there in the *Eighth Month*, do usually

usually live, contrary to what is believed to happen in other Countries?

15. To take an Account of the *Wooden Locks* there, which are said to be made with as great Art, as those of *Iron*, with us.

16. To observe the Course of the Waters, both of the *Mediterranean*, and the *Red-Sea*?

Inquiries

For Guiny, by Abraham Hill Esq;

1. **V**Whether the River *Niger* overflows the Countrey yearly, like *Nilus*?

2. Whether the Rain, when it falls, be often very hot, rotting the Cloaths, if not presently dryed, and breeding Worms in them?

3. Whether the Gold there, be of very different fineness, and that which is uppermost in the Mine be the finest?

4. Whether the *Palm* affords them Wine, Oyl, Vinegar, Soap, Bread; and out of the Leaves they pick Threds, making thereof very curious Works?

5. Whether they have, besides their *Palm-Wine*, a Drink made of *Grain*, like our Ale? What Grain that is, and how prepar'd?

6. Whether their Arrows, they make, be poysonous? By what Tree, and how prepar'd?

7. Whether some People on the River *Gambra*, be only Tawny, as others very Black?

8. Whether the *Negroes* have such sharp sights, that they discover a Ship at Sea much farther off, than the *Europeans* can?

9. **V**What Reason there is to conclude, That the Common People being accustomed to drink **V**Water, is the cause, that they are troubled with **V**Worms in their Bodies, very painful to them, and difficult to get out?

F I N I S.

In the *SAVOY*,

Printed by *T. N.* for *John Martyn* at the Bell, a little without *Temple-Bar*, Printer to the *Royal Society*, 1667.

1851

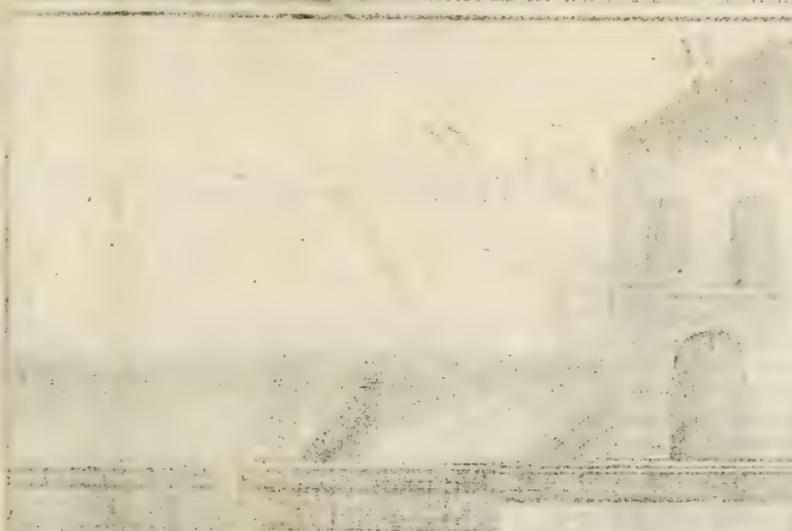


Fig. I.
A Bridge in China.

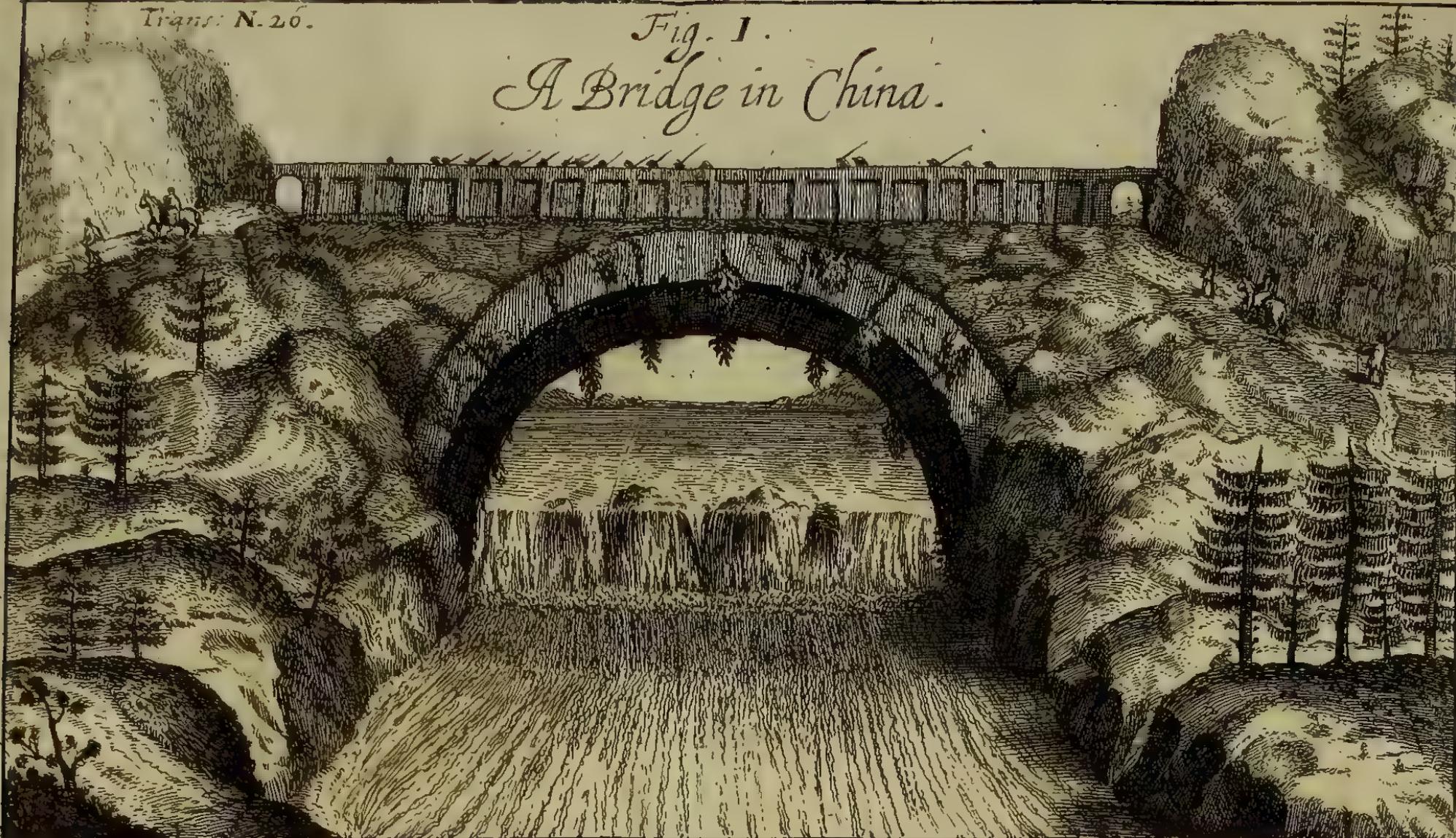
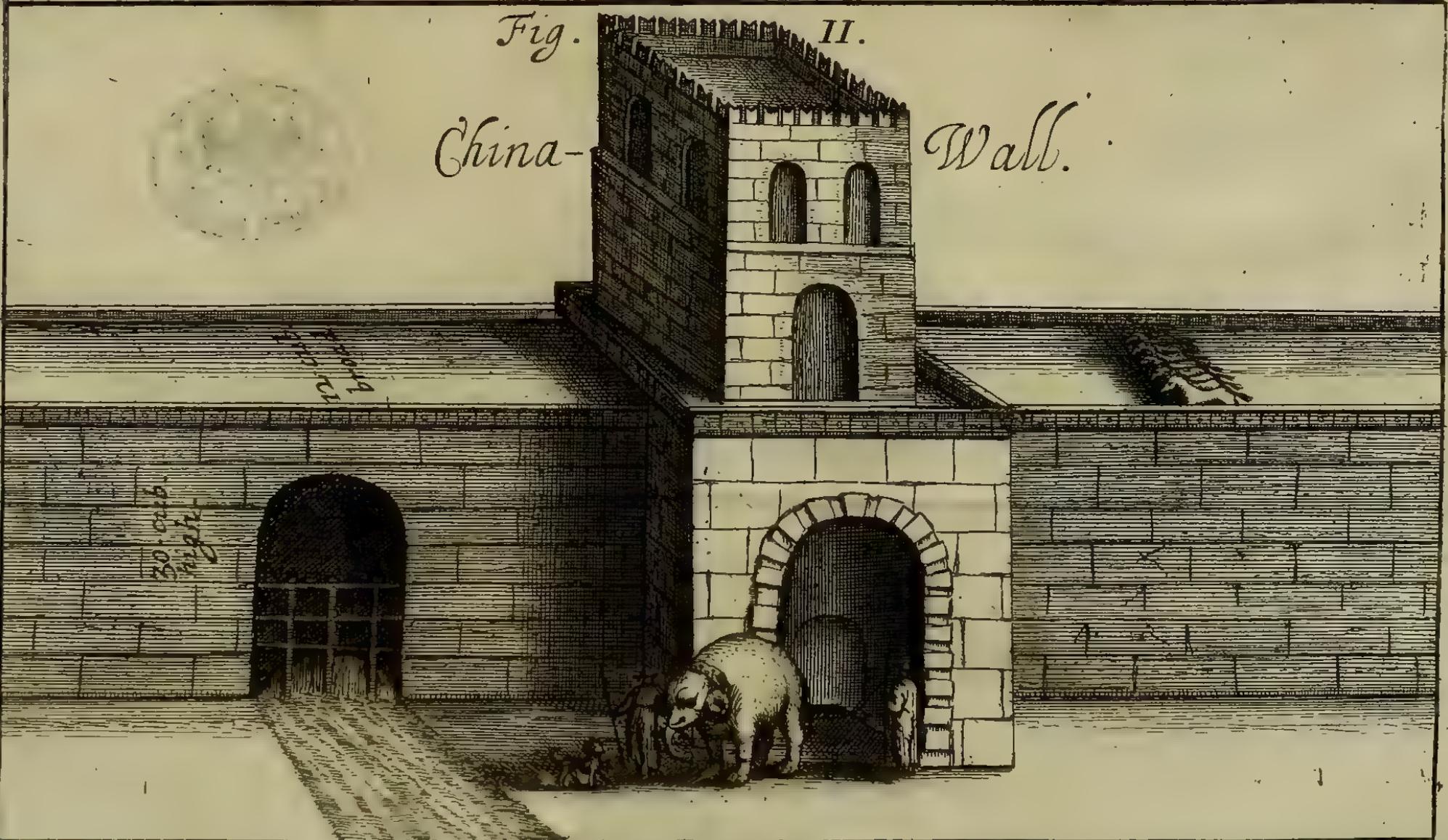


Fig. II.

China-

Wall.



30. cub. ft. high

20. cub. ft. high

PHILOSOPHICAL TRANSACTIONS.

Munday, June 3. 1667.

The Contents,

Experiments for Improving the Art of Gunnery; To find out the Point-blank distance; the Quantity of Powder, for the just Charge of any Peece; and what Gun shoots farthest. An Answer to some Magnetical Inquiries, formerly published in these Transactions. Extract of a Letter from Paris, containing an Account of some Effects of Bloud Transfused, and of two Monstrous Births, &c. A Relation of two other Monsters, not long since produced in Devonshire. Some Observations made in Mines, and at Sea, occasioning a Conjecture about the Origine of Wind. An Account of a great number of Stones, found in one Bladder. The Description of a Well and Ground, in Lancashire, taking Fire by a Candle applyed to it. An Account of Athanasii Kircheri
CHINA ILLUSTRATA.

Experiments for Improving the Art of Gunnery.

The better to determine the three Grand Desiderata, in the Art of Gunnery viz. 1. The Point-blank distance. 2. The Quantity of Powder for the just Charge of any Peece. 3. What Gun (for Size, Bore, Weight, Metal, &c.) Shoots Farthest: The following Experiments are proposed and directed, by Sr. Robert Moray; to give occasion to such as are Curious in this Art, to improve the same, as they shall have opportunity. Who we cannot but suppose will be so generous, as to impart the Successes and the Events of their Tryals of this kind to the Publisher of these Transactions; for further Improvement and Use.



TO Know, how Far a Gun Shoots Point-blank (as they call it) that is, so near the Level of the Cylinder of the Peece, that the difference is either not discernable, or not considerable: On

a fit plat-form, place and point the Gun at a Mark, as large as the Bullet, some 50. 60. or more Yards distant, so as the under-side of the Mark may be in the same Level or

A a a

Line

Line with the under-side of the Cylinder of the Peece. Then, between the Gun and the Mark at several places, place pieces of Canvas, Sheets of Paper pasted together, or the like, upon Stakes fixt in the ground, so as the under-side, being level with the Horizon, may just touch the Visual line, that passeth from the Eye to the upper-side of the Mark; when the Eye is placed in the Line, that passeth from it to the upper-side of the Cylinder of the Gun; the Canvas being so broad and long, that, if the Bullet pass through it two or three foot higher than the Level of the Mark, or of either hand, the hole it makes, may make it known, how much it flieth higher than the Level of that place. Such piece of Canvas, &c. may be placed; *one*, at half the distance between the Gun and the Mark; *another*, half-way between the first, and the Mark, &c. And if it be found, that even at so small a distance the Bullet falls lower than the Mark, if it touch not the Canvas, the Gun may be next time raised a little, and so on, till the Bullet hit the Mark, or as high as it: And if at first it fall as high as the Mark and cut the Canvas, the Mark and Canvas may be brought neerer the Gun, till it needs be done no more: Afterwards the Mark may be removed to greater and greater distances, till, to hit the Mark, it fly higher, than some or all the interposed Canvasses: And thus the Experiment is to be repeated and varied at pleasure.

II. To know, what *Quantity* of Powder, is the *just* Charge of any Peece, so as it maketh the farthest Shot, and fires totally.

1. Raise the Gun to a *mean* Random, as of 20 or 25 degrees, and Shoot with the *ordinary* Charge of Powder, in some convenient ground, where the fall of the Bullet may be easily seen, and having made a Shot, measure the distance with a Chain, between the hole made by the Bullet, and the Muzzle of the Gun.

2. Then, instead of a full Charge of Powder used in the first Shot, take $\frac{1}{2}$ part lesse, or some such proportion, for the next tryal, doing all things else as before.

3. For a third, fourth, or more tryals, diminish still the Quantity of Powder by $\frac{1}{16}$ at a time, till the Shot be considerably Shorter, than at first.

4. Then take $\frac{1}{16}$ more than the first Charge, and do all things else as before, and so continue more tryals, increasing still the Quantity of Powder in the same proportion, every new tryal, till you find the increase of the Charge does not make the Peece

Shoot

Shoot further : Only over-Charge not so far, as to endanger the Gun.

5. The right Charge found, the best Random is to be sought by trying all Randoms, by degrees at a time.

To know, *What Gun Shoots farthest* ;

III.

1. A Gun, to be prepared of *Culverin-Bore* (as being held the best for Shooting far,) but much longer (double the Ordinary length may do well ;) is to be placed as in the former Experiments, and charged with the Ordinary Charge of a *Culverin*, or rather with that Quantity, which by the former Experiments shall be found the best ; and being Shot, the fall of the Bullet is to be markt, and distance measured, as hath been suggested.

2. Then try less, and more Powder in her, as before.

3. Then cut off two inches of the Muzzle with a Saw, and try as before, doing every thing in the same manner : And so cut off still for new tryals, till the Shot begin to fall shorter than before.

4. The same may be done with Guns of different Bores.

Advertisements.

1. The way to accommodate the Canvas, &c. proposed for I. finding out the *Point-blank-distance* ; is, *first* to pitch two stakes of the just height of the upper-side of the Cylinder of the Peece, some 6 or 8 foot asunder, in the streight line between it and the upper-side of the Mark, by a long Ruler, having one end in the Peece, after the Peece is duly point at the Mark ; and then, by the Eye looking over the Stakes to the upper-side of the Mark, or rather by a *Telescope*, the Paper or Canvas interposed may be let down, or placed just so, as the undermost side may seem to touch the upper side of the Mark, to one that looks at it from the top of the first Stake.

2. If this way of Experiment be made for further distances and raisings of the Peece, as high as conveniently may be above the Level, and the distances measured as hath been intimated ; and then all Randoms above these likewise tryed and measured, the distance of an Object, to be Shot at, being known, and other necessary cautions, beneath to be mentioned, carefully observ'd, good Gunners may with great confidence undertake to hit the Mark, be the distance what it will, so it exceed not the reach of the Gun.

II.

1. The Experiments here proposed, are to be made in Guns of all Sizes, Bores, Weights, Metals, &c.

2. Three or more Shot to be made with every different Charge, and at every several tryal, that the certainty may the better appear.

3. The first Shot being Measured and marked, the rest may all be Measured from it, or from one another, to save labour.

4. The Gun is to be pointed, placed, and ordered every time in one and the same place and position, aiming still at the same Mark, or pointing still in the very same Line or *Azimuth*; that so all the Shot may fall in the same Line, as near as is possible.

5. The Powder must be *exactly* weigh'd, every time the Peece is charged, lest it having been weigh'd long before, the weight may be alter'd; though Experiment may be made with Cartridges and without.

6. The Powder and Bullet is to be rammed home *equally* at every Shot; though the looser the Powder lye, it fire the better.

7. When the *right* Charge of a Peece is found, that makes the farthest Shot in the ordinary and plain way of Charging, Monsieur *de Sons* contrivance of a *Wedge* may be tryed, to make it shoot farther; which is a piece of Board, so long, as being thrust home to the Breech of the Peece at one end, the other may reach farther out than the outside of the Bullet, being ramm'd up to its place; broad about an Inch, and thin so far as the Wadd before the Bullet reaches on the out-side; *there* it is to have a Shoulder, from which forward to the end, it is to be cut a slope like a *Wedge*, being of such thickness, as that at the place, where the Center of the Bullet is to be, it may make it stick so fast, that the Powder finding more resistance may at length drive it out with the greater violence.

8. Another of this nature is a *Wooden Tampion*, like a piece of a Cylinder, big enough to fill the hollow Cylinder of the Gun, the length somewhat more than the Diameter of it and hollow'd towards the Bullet, so as to fit it; and *either* flat, or (which is better) hollow likewise towards the Powder, and serving instead of a *Wadd*. These and such others will probably render the effect of the Powder greater, than otherwise it would be.

9. The *Strength* of the Powder must be examin'd by a *Powder-Tryer*, that raiseth a Weight, such an one as has been contrived by Mr. *Hook*, and is made by Mr. *Shortgrave*, Operator to the *Royal Society*.

10. The

10. The Powder used in a Set of these Experiments, ought to be all of the same goodness.

11. The same Bullet is to be made use of, if it can be had, till the Figure of it be marred; otherwise another as near of the *same* Size, Shape, and Weight, as is possible.

12. The strength of the Wind, is to be observed at *every* time of Shooting; which may be done by an Engine, made by the lately nam'd *Operator*.

13. Observe also the Position of the Wind, with a Fane and Compass at every Shot.

14. Note also, at what *Azimuth* the Mark stands from the Gun.

15. Take precise notice, what effect the Wind hath every time upon the Bullet, in carrying further, in hindering, or turning it aside.

16. Note the Figure, dimensions, and Weight of the Gun, Carriage and Wheels.

17. The plat-form to be very *Levell*.

18. The Wheels to be at every Shot placed in the very same place and position, to avoid inequalities.

19. Every thing to be *exactly* recorded in a Book, as also every Accident and Observation.

20. After all other Experiments are made, every Peece may be tryed with the right Charge of Powder, laying every time more and more Weight upon the Carriage; and at last fixing the Gun so, as it may not recoyle at all, observing every time how far the Bullet goes, and how much less Powder than the full Charge will serve to Shoot the Bullet, when the Peece is fixt, as far as the whole Charge does, when it recoyls freely.

21. Care is to be had, that the Experiments with the *Wedge*; *Tampion*, and the like, made for encreasing the force of the Powder, and the fixing of the Peece, do not endanger it.

1. The Long Guns are to be made without any *Ring* about III. the Muzzle.

2. The pieces cut of from the Muzzle, to be alwayes laid on the Carriage, when new shots are made, or their weight of Lead in a convenient Figure, that the recoyl may still be the same.

3. The Quantity of Powder, that Shoots furthest in an *Ordinary Culverin* being known, there needs no Variation of it in the Long one.

*Answer to some Magnetical Inquiries, proposed Numb. 23.
of these Transactions, Pag. 423, 424:*

The Queries were these.

1. Whether a *Needle* may be so toucht upon any Magnet, as not to point to the true North and South? &c.
2. Whether different *Load-Stones*, will give different directions? or, whether fainter or stronger touches, upon one and the same Magnet, will cause any Variation in the directions? &c.

To these the Industrious Mr. *Sellers* returns this Answer :

To the *First*; That he had often made tryal with many *Needles* touching them in each *Hemisphere* of the Stone, with all variety of wayes he could imagine, to find, if it were possible by that means to cause any of these *Needles* to vary in its direction but, that he alwayes found the contrary; all of them conforming to the *Magnetical Meridian*, and standing *North* and *South*, as other *Needles*, that were toucht upon the very *Pole* of the Stone. He adds, that some of these Experiments he tryed in *London*, when there was no Variation known.

To the *Second*; 1. That, upon frequent tryals of touching *Needles* upon different *Load-Stones*, of several bignesses, as also of different vertue; the several *Needles*, toucht upon these different Stones, gave all of them the same directions. This he thinks is confirm'd by all the *Needles* and *Sea-Compasses*, made in several parts of the World, and consequently toucht upon several Stones of several Countries, yet all agreeing in this *Magnetical* Harmony, that they all give the same directions. 2. That having sometimes drawn a *Needle*, only over the *Pole* of the Stone, within the Sphere of its vertue, without at all touching the Stone; it hath received the same directive quality from the Stone, as if it had been really toucht upon the Stone it self, though not altogether so strong, as if it had toucht the Stone. Again, that having toucht *Needles* upon the Stone, with faint strokes, and other *Needles* with stronger; all these *Needles* received the same effect from the Stone, both for strength and direction; he conceiving, that 'tis not the fainter or stronger touches upon the Stone, nor the multiplicity of Strokes, that varies the *Needles* strength or direction; but that the *Nature* of the *Steel*, whereof the *Needle* is made, and the *Temper* that is given thereunto,

thereunto, causeth different effects, as to the strength it receiveth from the Stone; himself as having tryed all sorts of *Steel*, that he could possibly procure, and all the different *Temper*s he could imagine, for the most powerful receiving and retaining the vertue from the *Load Stone*; wherein he affirms to have fully satisfied himself, so that he can infuse such vertue into a piece of *Steel*, that it shall take up a piece of Iron of two *Ounces* weight or more; and give also to a *Needle*, the vertue of conforming to the *Magnetical Meridian*, without the help of a *Load-Stone*, or any thing else, that hath received vertue therefrom.

Sofar this Answerer; whom as we cannot but much commend for his diligence in searching, and frankness of communicating; so we give these particulars to the publick, that further Tryals may be made by others, for more discovery; hoping withall, that the same Inquisitive person, that hath made these returns, will not scruple to add to them the wayes, he uses for infusing that *Magnetical* vertue into *Steel* and *Needles*, without the help of a *Load-Stone*, spoken of in the end of this his *Answer*.

Extract of a Letter, Written from Paris, containing an Account of some Effects of the Transfusion of Blood; and of two Monstrous Births, &c.

I was present, when *M Gayant* shew'd the Transfusion of the Blood, putting that of a Young Dog into the Veins of an Old, who, two hours after, did leap and frisk; whereas he was almost blind with age, and could hardly stirr before.

In the House of *M. Bourdelots* was shew'd a Monster in form of an Ape, having all over its shoulders, almost to his middle, a mass of flesh, that came from the hinder part of its head, and hung down in form of a little Cloak. The report is, that the Woman that brought it forth, had seen on a Stage an Ape so clothed: The most remarkable thing was, that the said mass of flesh was divided in four parts, correspondent to the Coat, the Ape did carry. The Woman, upon inquiry, was found to have gone five months with Child, before she had met with the accident of that unhappy sight. Many questions were on this occasion agitated: *viz.* about the Power of Imagination; and whether

whether this Creature was endow'd with a humane Soul; and if not, what became of the Soul of the Embryo, that was five months old.

A little after, another Monster was produced, which was an Infant come to maturity, having instead of a Head and Brains, a Mass of flesh like any Liver; and was found to move. And this *Fetus* occasioned a Question for the *Cartesians*, how the motion could be performed, and yet the *Glandula pinealis*, or *Conarium* be wanting; nor any Nerves visible, which come from the Brain? The marrow in the *Spine* was of the same substance. It liv'd four days, and then dyed: It was anotomized by *M. Emmerez* in presence of the Assembly.

There came a Letter from *Florence*, Written by *M. Steno*, which has also somewhat perplext the followers of *Des Cartes*. A Tortoise had its head cut off, and yet was found to move its foot three days after. Here was no Communication with the *Conarium*. As this seems to have given a sore blow to the *Cartesian* Doctrine, so the Disciples thereof are here endeavouring to heal the Wound.

An Account of two Monstrous Births, not long since produced in Devonshire; communicated by M. Colepresse.

1. One *Robert Cloak* a Joyner (whom I know) of *Clamick* in the Parish of *Beer-Ferris* in *Devonshire*, had on *Febr. 24.* last, a Monstrous black Ram-Lamb fallen with one Head, but two distinct Bodies, with eight Legs; which Bodies were joyned in the Neck: It had two Eyes, and as many Ears, in the usual places; and one extraordinary Eye in the Niddock, with one single Ear, about an inch distant from the Eye backwards: Its Dame, which was *White*, usually brought forth two Lambs every year, as she did this year also a *White* one, which with the Ewe remains alive. But whether this Monster was produc'd dead or alive, is not known, it being found dead by the hedge, and soon after put into the Earth. There were ten *White* Ews accompanied with three *White* Rams.

2. One *John Cauce*, Servant to *Mr. William Knighton* of *Lockridge*, likewise in *Beer Ferris*; had among his Sheep, on the seventeenth of *Febr.* last, a *White* Lamb fallen on a Common in the said Parish, with two distinct heads and Necks, Joyned at the Shoulders

shoulders, but one only Body, and that well form'd, yet having double entrals in all respects. The Ewe remains well. The Monster dyed, and is now in my Custody, after it hath been dried in an Oven, and by the Sun.

Some Observations made in Mines, and at Sea, occasioning a Conjecture about the Origine of Wind: Imparted by the same Mr. C.

One *John Gill*, a Man well experienced in Mineral affairs, discoursing with me about the Wind and its Origine; declared to me his thoughts concerning the same, as a result of twenty years Experience and Observations of his own.

First, He affirmed, that if in digging deep under ground, the Work-men meet with Water, they never want Air or Wind; but if they misse Water (as sometimes it happens, even at 12 or 16 Fathoms depth) they are destitute of convenient Air, either to breath in, or to make their Candles burn.

Next, When (as usual) there happens to be a great quantity of a Winters standing water, in a deep Mine, they commonly bring, or drive up an *Adit* for drawing away such water: But as soon as that part of the Level is made, that any of the standing Water begins to run away, the Men must secure themselves, as well as they can, from danger of being dash'd in pieces against the sides of the *Adit*: For the included Air or Wind in the standing Water, breaks forth with such a terrible noyse, - as *that* of a Peece of Ordnance, and with that violence, as to carry all before it, loosening the very Rocks, though at some distance in the Work or *Adit*.

Thirdly, he hath observed on several occasions, going to and fro, between *London* and *Plimouth*, by Sea, that being in a Calm, that way, which the Sea began to Loom or move, the next day the Wind was sure to blow from that point of the Compass, towards which the Sea did Loom the day before.

An Account of Hail-Stones of an unusual bigness, Communicated by D. Nath. Fairfax, with his Reflections on them.

This Account came but very lately to hand, though the thing hapned a while agoe; the Ingenious Author thereof, having but newly entred into a Philosophical Correspondence with the Publisher.

July, 17. 1666. About 10 in the Fore-noon, there fell a violent storm

storm of Hail about the Coast-Towns of *Suffolk*, tracing along *Seckford-Hall*, *Wood-bridge*, *Snape-bridge*, *Aldborough*, &c. more to the North-ward. The Hail was small near *Yarmouth*; but at *Seckford-Hall*, one Hail-stone was found by measure to be 9. *Inches* about. One of this Town (*viz. Wood bridge*) found one at *Melton*, 8. *Inches* about. At *Snape-bridge* a man affirm'd, that he lighted on one about 12. *Inches* about. A Lady of *Frisson-Hall*, putting one of them into a Ballance, found it weigh 12 *s.* 6 *d.* Several persons of good credit in *Aldborough* affirm'd, some Hail-stones to have been full as bigg as Turkeys-Eggs; (an ordinary Hens-Egg weighs but about 9 *s.*) *J. Baker* of *Rumborough*, driving a Cart on the Heath by *Aldborough*, had his head broken by the knocks of them through a stiff Country-felt: In some places his head bled; in others, bunnyes arose: The Horses were so pelted, that they hurried away his Cart beyond all command. They seem'd all *white*, smooth without, shining within. 'Tis somewhat strange, methinks, that their pillar of Air should keep them aloft, if they were not clapt together in the falling; especially at such a time of the year, when the Air is less thickned and its Spring weaker.

Account of a great number of Stones, found in one Bladder, by the same.

Mr. Goodrick Chirurgeon of *Bury St. Edmunds* affirm'd to me, that himself Cutting a Lad of the Stone (for which he hath a great name) took out thence, at one time, 96 small Stones, all of them of unlike shape, Size, Corners, Sides; some of which were so bestow'd as to slide upon others, and had thereby worn their flats to a wonderfull slikeness. He assur'd me also, that in the same place, another, when dead, had a Stone taken from him, almost as big as a new-born Childs head, and much of that Shape.

The Description of a Well, and Earth in Lanchashire, taking Fire by a Candle approached to it.

This was imparted by that Ingenious and Worthy Gentleman, Thomas Shirley Esq; an Eye-witness of the thing, now to be related in his own words; viz.

About the later end of *February 1659.* returning from a Journey to my house in *Wigan*, I was entertained with the relation of an odd Spring, situated in one *Mr. Hawkey's Ground* (if I mistake

stake not) about a mile from the Town, in that Road which leads to *Warrington* and *Chester*.

The people of this Town did confidently affirm, that the Water of this Spring did burn like Oyle; into which Error they suffered themselves to fall for want of a due examination of the following particulars.

For when we came to the said Spring (being five or six in company together) and applyed a lighted Candle to the surface of the Water; 'tis true, there was suddenly a large flame produced, which burnt vigorously; at the sight of which they all began to laugh at me for denying, what they had positively asserted: But I, who did not think my self confuted by a laughter grounded upon inadvertency, began to examine what I saw; and observing, that this Spring had its eruption at the foot of a Tree, growing on the top of a neighbouring Bank, the Water of which Spring fill'd a Ditch that was there, and covered the burning place lately mention'd; I then applyed the lighted Candle to divers parts of the Water, contained in the said Ditch, and found as I expected, that upon the touch of the Candle and the Water, the Flame was extinct.

Again, having taken up a dishfull of Water at the flaming place, and held the lighted Candle to it, it went out. Yet I observed that the Water at the burning place did boyle, and heave like Water in a Pot upon the Fire, though my hand put into it perceived it not so much as warm.

This boyling I conceived to proceed from the Eruption of some bituminous or sulphureous Fumes; considering, this place was not above 30 or 40 yards distant from the mouth of a Coal-pit there. And indeed *Wigan*, *Ashton*, and the whole Country, for many miles compass, is underlaid with Coal. Then applying my hand to the surface of the Burning place of the Water, I found a strong breath, as it were a Wind, to bear against my hand.

Then I caused a *Dam* to be made, and thereby hindering the recourse of fresh water to the Burning place; I caused that, which was already there, to be drained away; and then applying burning Candle to the surface of the dry Earth at the same place where the Water burned before; the Fumes took fire, and very bright and vigorous. The Cone of the Flame ascended six foot and a half from the Superficies of the Earth. The Basis

was of the Compass of a Mans hat about the brims. I then caused a Bucket-full of Water to be poured on the fire, by which it was presently quenched, as well as my companions laughter was stopped, who then began to think, the Water did not burn.

I did not perceive the Flame to be discolour'd, like that of sulphureous Bodies, nor to have any manifest *scent* with it. The Fumes, when they broke out of the Earth, and prest against my hand, were not, to my best remembrance, at all hot.

Account of Athanasii Kircheri *CHINA ILLUSTRATA*.

The *Author* by publishing this *Volume*, discharges the Promise, he had made some years ago, that he would do so. He acknowledges himself much obliged to *Martinus*, and his *Atlas Sinicus*; as also to *Michael Boim*, a *Polonian*; *Philippo Marino*, a *Jesuit* of *Genoa*; and two other of the same Society, *viz.* *Henry Roth* of *Ausburg*, and *John Gruber*, an *Austrian*; whereof the latter went A. 1656. over *Land* from *Rome*, through *Anatolia*, *Armenia*, *Persia*, *Ormus*, *Cambaja*, and *India*, to *Macao*, the famous Port of *China*, and thence to *Pekin*, the Court of that Empire; whence two years after, he came back to *Rome*, accompanied for a part of the way, by the *Jesuit* *Albert Dorville*; traversing by *Land* in a manner the whole breadth of *China*, and a great part of the confining *Tartary*, and so further, through the *Mogols* Dominions, to *Agra*, where the said *Dorville* dying, the above-mentioned *Henry Roth* supplied his place in accomplishing this Voyage.

The Book it self, a large *Folio*, is divided into 6. Parts.

The *three* first, and the *last*, being besides the design of these Tracts, we shall but glance at, taking only notice; *First*, That they pretend to perswade the Reader, that *Christianity* was spread over all *Asia* by *St. Thomas* the Apostle, and his Successors; and hath been there continued, though not without great *Eclipses*, to these very times. And here the *Chino-Chaldean Monument*, said to have been erected several hundred years since in *China*, and found out A. 1625. is with great labour asserted and interpreted. *Next*, That the Rise of the Idolatry, in those remote parts, and their different Ceremonies in Worship, is confronted with those Ancient ones of *Egypt*. *Lastly*, that a large Account is given of the *Chinese* Letters, their Figure, Power, &c.

But we hasten to the *Fourth* Book, as belonging to our Sphere. That

That undertakes to describe the *Curiosities* and *Productions* of *Nature* and *Art*, in *China*. Here, the Author having premised something of the advantagious Scituation of *China*, and its *Political* Government; Calculated also both the Number of its Inhabitants, (which according to him, amount to 200 Millions of Men, besides Women, Children, Officers, and Eunuchs;) and the *Annual* Revenue of the Emperour (which he makes to be 150 Millions of Gold-Crowns;) he relateth many considerable productions and works of Nature in that Country; As

1. *Mountains* very odd for shape, burning, and raising of Tempests.

2. *Iles*, to the number of 99. all turned into one, under the same extent of space they had, when they were divided by water.

3. *Lakes*, some changing Copper into Iron, and causing storms, when any thing is cast into them; and others, sprung up by Earth-quakes.

4. *Rivers*, whereof one is said to be of a *Blew* colour in Autumn, and for the rest of the year *Limpid*: Another, to be cold at the top, and very hot beneath.

5. *Fiery Wells*, serving to boyl meat over: Perhaps of the same Nature with that here in *England*, we described above.

6. *Plants*, as 1. some *Roses*, changing their Colour twice a day: Whence the *Author* takes occasion to speak of that Plant, which grows at *Rome*, in the Garden of one Signior *Corvino*, call'd *Viola Nocturna*, changing its colour sensibly, according to the degrees of the rising and declining of the Sun; destitute of all smell in the day-time, but having a very fragrant one in the night.

2. A *Farinaceous* or *Mealy Tree*, serving to make Bread of it.

3. *Leaves* of certain Trees, standing on the side of a Lake, which falling into the water, become like black *Birds*: which he ascribeth to the Seminal parts of some Eggs, broken on those Trees, fill'd with *Birds* nests.

4. *The*, and its wholesomeness, as to the suppressing of Vapours, and preventing the Stone.

5. A kind of *Wicker-Tree*, which, as if it were a Rope twisted by Nature, about an inch thick, creeps along upon the Earth, sometimes the length of 120 paces, much embarrassing the way; but serving for Cables to Ships, Seats, Hurdles, Beds, Matts; enduring no Vermin; and being cool and refreshing in hot Seasons.

6. The *Calamba-Wood*; that it is esteem'd by some to be a kind of *Len-*

tiscum,⁷ by others, a sort of *Terebinth*, but of a nobler rank, by vertue of that Climat: which makes the Author suggest, that care should be taken to have it brought into *Europe*, and carefully cultivated there. 7. *Rhubarb*; of which he observes, that, because the vertue of its Roots, if they be expos'd to dry hastily, soon evaporats; therefore the skilfull, lay them upon a Table within doors, and turn them several times a day, to incorporate and fix the Juyce the better, and then string them and expose them to the Wind, in a shade, altogether free from the Sunbeams. 8. *Pine-Trees*; of which he saith some are so big, that eight Men can hardly Fathom them. 9. *Canes*, so big, that they can make as many Barrels of them, as they have internodes or Joynts. 10. Trees, sweating a Gum, call'd *Cie*, like the droppings of *Turpentine*; which Gum, as long as tis not dryed, emits a very unwholsome and dangerous steam. To passe by the *Polo-nie* Tree, producing fruit without any blossoms, immediately out of its Trunk, as big as one man can well carry; and that kind of *Fig-Tree*, that bears Leaves as big as to wrap up a man in, &c.

7. *Animals*, Here he discourseth of the *Musk-Deer*, and the several Compositions of *Musk*: the *Sea-Horse*, and *Wild Men*: Of some *Birds*, no where seen but in *China* (as he thinks) and among them a *Wool-bearing Hen*: Of *Fishes*, in Summer flying out of the Sea, seeking their food, like *Birds*, and in Autumn returning to the Sea: particularly of a Fish of a very exquisite taste, called *Hoancio-yu*, or the *Croceous Fish*: Further, of *Sea-Cows*, going often ashore, and fighting with the *Land-Cows*: Of *Bats*, of a vast bigness, eaten by the *Chinese* as a delicious meat: Of the *Serpent*, that breeds the *Antidotal stone*; whereof he relates many experiments, to verifie the relations of its vertue: Which may invite the *Curator* of the *Royal Society*, to make the like tryal, there being such a stone in their *Repository*, sent them from the *East Indies*. Again, of *Silk Worms*, spinning *twice* a year, and yielding a double *Crop*.

8. *Fossils*, where occurs the Relation, 1. Of an odd *Specular stone*, representing the figure of the Moon in all her Appearances, when expos'd to Her. 2. Of an *Earth* called *Quei*, very *Cosmetick*, and absterfiv of all blemishes of the face. 3. A *Mineral cerusse*, blended of Lead and Antimony. 4. Of *Asbestus*, that can be drawn and spun; the way of which he affirms to have describ'd L. 12. *Mundi sui subterranei*. 5. The *Matter that makes Porcellan*, which he affirms to be nothing else but a transparent Sand, which

which they soak in water, and then reduce to a Masse or Dough, and so bake it. Not a word of the way of giving it the colour, which, it seems, they keep as a great secret. They have *Gold* and *Silver Mines*, but dig them not, pretending the danger and trouble in the work, and contenting themselves with the Filings and Dust of Gold, which they gather out of the Mud and Sand of Rivers and Fountains.

The *Fifth* Book contains an account of their Works of *Architecture*, and other ingenious Mechanick Arts. Where he speaks,
 1. Of their stupendious *Bridges*, one of 360 Perches long, and $1\frac{1}{2}$ Perch broad, without any Arch, standing upon 300 Pillars, with acute Angles on both opposite sides, all the stones being of an equal size and shape. Another, built from Mountain to Mountain by *one* only Arch, 400 cubits long, 500 cubits high (whence tis called *Pons volans*) from the surface of the *Saffrany* River, running under it. This is represented, for the satisfaction of the Curious, by *Figure I*.

Fig. I.

2. *Vast Towns*, but whose Houses are generally but one Story high, and good reason therefore, the Towns should be very big. They are, for the most part, built of Timber.

3. *Turrets* very artificiall, whereof one is all of *Porcellan*.

4. The *China Wall*, 300 German Leagues long; 30 Cubits high, 12 (in some places 15) Cubits broad, so that 12 Horses can very conveniently go in front on it; built 215 years before *Christ*, by the Emperour *Pius*, a brave and most Warlike Prince, and dispatcht in the space of five years; commonly it is defended by a Million of men. A Pattern of this also was thought fit to exhibit here, by *Figure II*.

Fig. II.

5. The *Channel*, that passeth from one extream of *China* to the other, having some 24 *Sluces*, to retain water, when tis necessary; a work of incredible industry and extraordinary advantage.

6. *Vast Bells*, one whereof, at *Pekin*, weighs 120000 pounds; whereas that of *Erfurd* in *Germany*, hitherto esteemed to be one of the biggest in the World, weighs but 25400. pounds.

As for their ingenious Inventions, this Author mentions chiefly,

1. Their *Vernice*, of which he sets down some *Receipts* both for the *Red* and *Black*, together with the way of their Use and Application, as he received them both from an *Augustinian* Fryar; affirming, that it differs not at all from that of *China*.

2. Their way of *Printing*, invented long before that in *Europe*, giving a large description of the same.

3. *Gur-*

3. *Gunpowder*, which he also saith, they had before the *Euro-peans*.

4. *Bell-founding*.

These are the principal Subjects treated of in this Book. We passe by severall Stories, which seem much to require confirmation. *E. g.* That of *Sugar-Canes*, eaten by an Elephant, and taking root in his stomach; that of Boys eating Serpents with as much greediness, as others eat Eels, or any good meat, &c.

Among the *Cutts* of this Volume, there is a *Map* of *Asia*, not un-instructive; delineating the way, the two *Jeuits* took in their Land-voyage from *Pekin* to *Goa*; as also that, which the *Musco-vian* Ambassadors, not many years since, took in travelling from their Countrey, through the vast Tract of the Northern *Tartary*, to *China*, arriving on the *North side* of the *China Wall* at *Pekin*: *Item*, The Land-passage, heretofore made by *B. Goes* (described by *Rigaultius*) from *Persia*, by *Labor* in the *Mogols* Empire, through the Kingdoms of *Cabul*, *Zancut*, &c. to *Cataya*, or (which is all one to this *Author*, as it is to several others) the Province of *Pekin* in *China*. *Item*, The passage of *Paulus Venetus* over Land, out of *Europe* into the same *China*: and lastly, That pretended one of *St. Thomas*, out of *Palestina*, through *Syria*, *Mesopotamia*, *Persia*, the *Mogols* Empire, the *Pen-insul* between the Bays of *Cambaya* and *Bengala*, to *Maliapur*, on the Coast of *Coromandel*, where the Name of the *Christians* of *St. Thomas* is still in request.

L O N D O N,

Printed by *T. R.* for *John Martyn*, Printer to the *Royall Society*, and are to be sold at the *Bell* a little without *Temple-Barr*, 1667.

PHILOSOPHICAL TRANSACTIONS.

For the Months of July, August, and September.
Monday, Septem. 1667.

The Contents.

An Advertisement concerning the Invention of the Transfusion of Blood.
An Account of some Experiments of Infusing Liquors into the Veins of Animals; As also of some new discoveries pretended to be made in the Brain and the Tongue. An Experiment upon Blood grown cold. Some Observations of Quicksilver found at the roots of Plants; and of Shells found upon in-land mountains; Other Observations made by a curious person in his Voyage from England to the Caribes, concerning the Rusting of Iron by the Sea-air; the Changes of Thames-water carried by sea; The Variety of the Colours of the Sea; The Burning of the same; the Night-winds in the Indies; The Relations of the Seasons of the year rectified; Observables about Tortoises; The condition of English bodies first coming to Jamaica; A way of preserving Ale as far as to the same Island. An Extract of a Letter concerning some Magnetical Experiments; and an Excellent Liquor made of Cyder-Apples and Mulberries. An Account of two or three Books; One, The HISTORY of the ROYAL SOCIETY: The other, DISQUISITIO DE FÆTU FORMATO, The third, MUSCULI DESCRIPTIO GEOMETRICA.

An Advertisement concerning the Invention of the Transfusion of Blood.

THE Author of these Papers returning now to his former Exercises, which by an extraordinary Accident he was necessitated to interrupt for some months last past, thought fit to comprise the *Transactions* of all the Months omitted in one *Tract*: In the very beginning of which he must inform the *Reader*, that if himself had published that *Letter*, which came abroad in *July* last, *Concerning a new way of curing sundry diseases by Transfusion of Blood*, written to *Monsieur de Montmor*, &c. by *F. Denis Prof. of Philosophy*, &c. he should then have taken notice, as he doth now, of what

is affirmed in that *Letter* about the *time* and *place* of the *Conception* of that *Transfusing* design; and intimated to the *Curious*, that how long soever that *Experiment* may have been *conceived* in other parts (which is needless to contest) it is notorious, that it had its *birth* first of all in *England*; some *Ingenious* persons of the *Royal Society* having first started it there, several years ago, (as appears by their *Journal*) and that dextrous *Anatomist*, *D. Lower*, reduced it into practice, both by contriving a method for the *Operation*, and by successfully executing the same: wherein he was soon overtaken by several happy *Trials* of the skilful hand of *D. Edmund King*, and others, encouraged thereunto by the said *Society*; which being notified to the world *Numb. 19.* and *20.* of these *Transactions*, *Print-Novem. 19.* and *Decemb. 17. 1666*; the *Experiment* was, soon after that time, heard of to have been tried in *foreign* parts, without hearing any thing then of its having been *conceived ten years ago*.

An account of some Experiments of injecting Liquors into the Veins of Animals, lately made in Italy by Signior Fracassati Professor of Anatomy at Pisa.

1. Having infused into the *Jugular* and *Cervical* Vein of a *Dog* some *Aqua fortis* diluted, the *Animal* died presently; and being opened, all the blood in the *Vessels* was fixed, but that in the *guts* not so well. It was also observed, that the *great vessels* were burst, perhaps by an effort of *Nature*; even as in the greatest part of those that die of an *Apoplexy*, the *vessels* of the *Lungs* are found broken. Upon which *Experiment* the *Author* maketh these *Reflections*: *First*, That an *Apoplexy* being often caused by a like *Coagulation* of the blood (as hath been observed by the opening, made of sundry persons, who died of that distemper) it might be cured by a timely infusing some *Dissolvent* into the *veins*. *Secondly*, That it is likely, that that useful secret, by which *Monfieur de Bills* dissected *Animals* without any effusion of blood, consists in some such *Infusion*.

2. There was afterwards infused into another *Dog* some *Spirit of Vitriol*, which had not so present an effect; for the *Animal* complained a great while, and foam'd like *Epilepticks*, and had its *respiration* very thick; and observing the beating of his *breast*, one might easily judge, the *Dog* suffered much: who dying at last, his blood was found fixed in the *veins*, and grumous, resembling *foot*.

3. Then there was injected into a *Dog* some *Oyl of Sulphur*: But he died not of it, though this *Infusion* was several times tried upon him. And

the wound being closed, and the Dog let go, he went into all the corners of the Room searching for meat, and having found some bones, he fell agnawing of them with a strange avidity, as if this Liquor had caused in him a great appetite.

4. Another Dog, into whose veins some *Oyl of Tartar* was injected, did not escape so well: For he complained much, and was altogether swoln, and then died. Being opened, the Spectators were surpris'd to find his blood not curdled, but on the contrary more thin and florid than ordinary; which seems to hint, that a too great fluidity of the blood, as well as its Coagulation, may cause death.

An Account of some Discoveries concerning the Brain, and the Tongue, made by Signior Malpighi, Professor of Physick in Sicily.

1. He pretends to have discovered, that the Exterior and softer part of the *Brain*, doth not cover only the *Corpus callosum*, as hath been believed hitherto, but is also inserted into it in many places. He hath also observed, That the *Corpus callosum* is nothing but a Contexture of small *Fibres*, issuing from the *Medulla Spinalis*, and terminating in the said Exterior part of the Brain. And these *Fibres*, he saith, are so manifest in the *Ventracles of Fishes* brains, that when they are looked through they represent the figure of an Ivory Comb.

2. The *Use*, which he ascribes to the Brain, is much different, he saith, from what hath been assigned to it hitherto. He pretends, that as half, or at least, a third of the blood of an Animal is conveighed into the Brain, where yet it cannot be consumed, the finest *Serum* of this blood is filtrated through the exterior part, and then entring into the *Fibres* of the brain, is thence conveighed into the *Nerves*: which he affirms to be the reason, that the Head is so often found full of water, when the Brain hath received a wound, or an alteration by some distemper.

3. He hath taken a particular care of examining the *Optique Nerve* in divers Animals, it being one of the most admirable productions in the Brain. Having therefore among other Fishes dissected the head of a *Xiphias* or *Sword fish*, who hath a very big eye, he hath not observed any considerable cavity in the *Optique Nerve*, nor any *Nervous Fibres*; but found, that the middle of this Nerve is nothing else, but a large Membrane folded according to its length in many doubles almost like a *Fan*, and invested by the *Dura Mater*. *Eustachio* a famous Anatomist, had written something of this before, but obscurely, and without mentioning the Animal, wherein he had made this observation.

4. The same *Malpighi* thought he should have met with the same thing in *Terrestrial Animals*; but he found, that *Fishes* alone have such a structure of the *Optique Nerve*: For that of an Ox, Pig, and other such Animals, is nothing but a heap of many small *Fibres* of the same substance with the Brain, wrapped about with the *Dura Mater*, and accompanied with many little vessels with blood. Hence he draws the decision of that great question among Anatomists; *Whether the Optique Nerve be hollow or not?* For, *saieth he*, it cannot be otherwise, but there must be many cavities in this Nerve; forasmuch as the small filaments, of which it is composed, cannot be so closely joyned, that there should not be some void space betwixt them.

5. Concerning the *Tongue*, the same *Author* hath discovered in it many little *Eminences*, which he calls *Papillary*, and believes to be the principal Organ of *Taste*. * But here is not to be omitted the Observation of *Fracassati*, importing, that as the *Tongue* hath towards its point many *Eminences*, by the means whereof it goes, as it were, to meet objects of *Taste*; so on the contrary, it hath many *cavities* towards its root, wherein it receives them. All which cavities terminate in *nerves*, and seem to serve for *Funnels* to convey the aliment into them. Which maketh the *Author* think it very probable, that the finest part of the aliment passeth immediately from the *Tongue* into the *Nerves*, whence it comes to pass, that Wine, being only taken into the mouth, restoreth vigour presently.

* See Num. 20. of the *Transactions*, pag. 366. where a large account is given of this discovery, from the Treatise of *Laur. Bellini, de Organo Gustus*.

An Experiment of Signior Fracassati upon Blood grown cold.

When any blood is become cold in a dish, that part which is beneath the *superficies* appears much blacker, than that on the top; and 'tis vulgarly said, that this black part of the blood is *Melancholy* blood, and men are wont to make use of this example to shew that the *Melancholy* humor as 'tis called, enters with the 3 others into the composition of the blood. But Signior *Fracassati* maintains, that this *blackish* colour comes from hence, that the blood, which is underneath, is not expos'd to the Air, and not from a mixture of *Melancholy*: to prove which he assures, that upon its being expos'd to the Air it changes colour, and becomes of a florid red.

An Experiment as easie to try, as 'tis curious.

Some Observations

Communicated by Signior Manfredus Septalius from Milan, concerning Quicksilver found at the roots of Plants, and Shells found upon In-land Mountains.

This *Italian* Virtuoso, famous for his knowledge and curiosity, as well as for his Hospitality to ingenious strangers, did in a late Letter of his to the Publisher, impart the following Particulars.

1. In the Valley of *Lancy*, which runs between the Mountains of *Turin*, grows a Plant like the *Doronicum*, (so also called by the Inhabitants and Botanists;) near the roots whereof you may find pure Quicksilver, running in small grains like Pearls; the juice of which Plant being expressed, and exposed to the Air of a clear night, there will be found as much *Mercury*, as there is lost of Juice. *

* This may be compared with those Relations, which acquaint us, that in *Moravia*, *Hungary*, *Peru*, and other parts; Mineral Juices concentered are found to stick to the roots of Herbs and Trees, some of those Juices tinging also the Leaves of Vegetables.

2. In a Voyage he made a few years since to *Genoa*, when he was to pass some mountains, he met with some Peasants, who digging on the sides of an Hill, had found and gathered very many *Cockle-shells* of divers kinds; which he wondring at, stopped his intended Journey, and went to the very place, where he was satisfied of the truth of the relation, finding great store of different shells, as the *Turbinets*, *Echini*, and some Pearl-shells, whereof one had a fair Pearl in it, which, he saith, he put into his *Repository*.

Observations Made by a Curious and Learned Person, sailing from England, to the Caribe-Islands.

These Observations shall be set down in the Authors own words, as they were obtained from him by Sir R. Moray; viz.

I Took notice at *Deal*, whence I set sail for *Famaica*, of the great difference in the rusting of *Iron*, in such houses, as front the Sea, in comparison of that effect in the Street immediately placed behind

that other, in which I made this observation. They told me that it rusted more at High-floods, than at Neap-tides; the height of the *Beach* hindring the *Saline* exhalations. This remark put me in mind of the vanity of the Argument of M. *Lignons* and others, *viz.* That the Air of the *West-Indies* was hot and moist, because of the *Rusting of Iron*; whereas it indeed arises from some other principle in the Air; for at the point of *Cagua*, where it scarce raineth 40 showers in a year, Iron rusts as much or more than any where; yet are there other parts of the *Island*, in which of 9 months not one passes without great Rains: besides, in *Jamaica* it rusts least in rainy Weather.

The Steams of the Sea are found of such a nature, that our sweet-meats rotted; Sugar of Roses, and other Lozenges grew moist; notwithstanding that there was no reason to attribute it to any rainy weather. And those Pies and Gammons of Bacon, which had kept well before, after they had been once exposed to the open Air, decayed more in a day or two, than in six weeks before.

On the point *Cagua*, the Iron Guns at the Fort were so corroded, that some were near become useles, being perforated almost like Honey-Combs: And I could at any time with 2 or 3 stroaks of a Hammer break off some pounds of Rusty Iron, which served for prepared *Steel*, and in *Salves*. But the Guns which lay in the Salt-water, were not much endamaged by Rust; as we found, upon taking up of some.

Many things receive damage by the Air: Not only *Iron* rusts, but even *Linnen* rots, and *Silks* once exposed to the Air do rot without losing their colour. If a *Lancet* be once exposed to the air it will rust, though you presently put it up again; but if it be never exposed to the Air, it will hardly rust.

At *Deal* a certain Ale-seller will warrant, that the Ale, as he orders it, shall be carried good to the *West* or *East-Indies*. His way to prepare it is this, as he told me himself, he twice mashes it with *Fresh-Malt*, and twice boils it well; yet all this kept it not from sowing; as I observ'd during my stay there. We bought of it to carry to *Jamaica*, and then he directed us thus. To every Rundlet of 5 Gallens, after it is placed in the ship, not to be stirred any more, put in two new-laid Eggs whole, and let them lie in it; he said that in a fortnight or little more, the whole Egg-shells would be dissolved, and the Eggs become like Wind-Eggs, inclosed only in a thin skin

skin; after this, the whole *White* would be prey'd on, but the *Yolk* would not be touch'd or corrupted. By this means we did preserve the Ale to *Jamaica*, and it was much better, than at *Deal*. I was told since by some others that the Experiment is usual with them, to keep Ale in *England* a quarter of a year: And if Eggs be thus put into *March-beer*, they preserve it from growing ever harsh. They must be put in, after the Liquor has done working.

Concerning the *Thames-water*, it is not only observable, that in eight months time it acquires a Spirituous quality, so as to burn like Spirit of Wine; and some *East-India* ships, I am informed, have run the hazard of firing by holding a Candle near the Bung hole at the first opening of the Cask;) but also that the stinking of it is no corruption, nor perhaps unwholesome; for we drank it all the way, so as to hold our Noses, yet had no sickness, but we had proportion of *Brandy* each week, which perhaps might correct it. If you take off the Bung from any Cask that stinks, and let the Air come to it, it will in 24 hours become sweet again. And if you take a Broomstick, and stir it about well, it will become sweet in 4 or 5 hours casting a black Lee to the bottom, which remixes with it, and so occasions a third or fourth fermentation, and stench; after which it stinks no more. But, though *Thames-water* upon stench do not putrifie, yet other Waters (as far as hath been hitherto observed) do become irrecoverable upon stinking, and dangerous to drink.

I observ'd at Sea, that though *Glauber* say, the water, as it grows *Salter*, becomes *Greener*, yet that is false. For, after we were out of the Narrow, the Sea grew *darkish*, and after perfect *Azure*, yet was it much more Salt, the farther we went: as I tried by a *Water-poise* of Glass, with Quick-silver at the one end, it rose about half an inch above the Sea-water in the *Downs*; and at 24 degrees more, 2 inches. But after that, I never observed any difference unto *Jamaica*, the Sea being probably so impregnated with Salt, as not to imbibe more; which crosses another observation, that the nearer the *Tropiques* and the *Line*, the *Salter* the Sea.

As to the *Colour* of the Sea, I conceive there is as great variety in it and its steams, as in Grounds at Land; which may occasion the sickness in some places more than in others: For the Sea smells differently in the *Narrow* and *Main*. And as to colour, it is of a Sea-green (and more sickly) in the *Downs*, than at *Torbay*, and on *Plymouth* coast more, than past the *Lands-end*; and in the *Bay* of *Biscay*, than

in the *Long-reach*. Something perhaps may be imputed to the difference of the waves, which are short, and make a Copling Sea in the *Bay of Biscay* (yet we came not within 80 Leagues of *Cape Finis Terra*:) in the *Long-reach* it is a long rolling wave, but never breaks. About *Florida, Virginia, and New-England* it is a great rolling wave, but breaks. And as the Sea coloureth from *green to darkish*, and so to *blue*; so in our return it colour'd from *blue to dark*, and so to *green*. When we were in the *Latitude of Barbadoes*, and had sailed so for two daies, and apprehended our selves to be within 70 or 80 Leagues, I observed the Sea was black and thick, not transparently blue, as before, and the foam against the Ship-sides was turbid, and of another consistence, than before. I had never seen the like before, yet was I willing to think the Sun not high enough, to give the water its due colour. I attended the Suns progress, but behold, it turn'd *Green*; whereupon I asked the Master, who told me, we were within 60 leagues of *Barbadoes*, and that the Sea was there soundable, whereas before it was not so. But at *Barbadoes* in the anchoring places, it was *Blue*; and as we row'd ashore, in the shallow it was *Whitish*: And so at *Jamaica* near the shore it is transparently *White*, but within three yards more, transparently *Blue*.

As to the *Burning of the Sea*, I could never observe so great a Light, as to perceive Fishes in the Sea of the Stern, though I frequently looked, as well as *M. Ligon*; yet was the light great, and at sometimes more than other. I suppose several subject Earths, Currents, and Winds do vary it. I observ'd, it burned more at *Deal* the night before we set sail, than ever in the Voyage: all the water ran off our Oars, almost like liquid fire; the wind was then *South-East*, and the Sea-men told me, that at *East* and *South*-winds it burned most. And it did never burn so much during our stay at *Deal*, as then; the wind having been alwaies *Westerly*. But in the *Harbour of Jamaica* I observ'd, that it did not burn equally there. As you pass the *Current* (which thwarts the middle of the *Harbour* with a motion, different from the water on both sides) the water scarce seems *white* at the stroak of an *Oar*.

I shall not trouble you with an account, how two contrary Winds poise each other, and make a Calm in the midst, ships at a distance sailing with contrary gales at the same time.

It is observable, that in the *Indies* such places, as have any high Mountains, have also every night a Wind, that blows from the Land,

Maugre

Maugre the *Levantine* Wind, which blows at Sea (but with a slacker gale all night; which seems to shew it depends not only on the motion of the Earth, but Sun.) Whence this Wind should come, may be considered; there is none at *Barbadoes* or *Saona*, but at all the other Islands. And in *Jamaica* every night it blows off the Island every way at once, so that no ship can any where come in by night, nor go out but early in the morning, before the *Sea-brise* come in. I have often thought on it and could imagine no other reason, but that those Exhalations, which the Sun hath raised in the day, make haste (after his strength no longer supports them) to those Mountains by a motion of *Similar Attraction*, * and there gather in Clouds, and break thence by their own force and weight, and occasion a wind every way. For, as the Sun declines, the Clouds gather, and shape according to the Mountains, so that old Seamen will tell you each Island in the afternoon towards Evening by the shape of the Cloud over it. And this *Attraction* appears further; not only from the Rain that gathers on the Tree in the Island of *Ferro*, spoken of by *J. Hawkins* in his Observations, and *Is. Vossius* upon *Pemponius Mela*, as also *Magnenus de Manna*; but also from the Rains in the *Indies*, there being certain Trees which attract the Rain, though Observations have not been made of the kinds; so as that if you destroy the woods, you abate or destroy the Rains. So *Barbadoes* hath not now half the Rains, it had, when more wooded. In *Jamaica* likewise at *Guanaboa* they have diminished the Rains as they extended their Plantations. But (to return to *Jamaica*) that this night-wind depends much upon the Mountain, appears by this, that its force extends to an equal distance from the Mountain, so that at *Portmorant*, which is the East-most part of the Island, there is little of Land-brise, because the Mountain is remote from thence, and the *brise* spends its force along the land thither. I shall further illustrate this kind of Attraction. In the harbor of *Jamaica* there grow many Rocks, shap'd like Bucks and Stags horns: there grow also several Sea-plants, whose roots are stony. Of these stone-trees (if I may term them so) some are insipid, but others perfectly Nitrous. Upon those other Plants with petrified roots there gathers a Lime-stone, which fixes not upon other Sea-fans, growing by them. It is observable also, that a *Monchinel-Apple*, falling into the

* Possibly it may be more plain, to say, That those Exhalations, condensed by the cool of the night and impelled downwards, fall by their weight, and then first of all meeting with the higher parts of the Earth, must needs gather and settle about the same, in clouds.

Sea, and lying in the water, will contract a *Lanugo* of Salt-peter : which is confirmed by the Author of the History of the *Antilles*. To conclude this particular, the Captain of our Ship ventured to give me a reason for these winds, which I will not conceal from you, since it may put you upon an Experiment, which he said he had often made : *viz.* That the Sun did heat the Air, and exhale the Vapours, which after did settle on those hills, and as they grew cold, took up more room than before, and so made a wind by their pressure ; as water, put hot into a Cask and closed, would, *he said*, as it cooled, break the Cask.

It is commonly affirmed, That the Seasons of the Year betwixt the *Tropicks* are divided by the Rains and Fair weather, and six Months are attributed to each Season. But this observation holds not generally true : For at the *Point* in *Jamaica* scarce fall (as was, on another occasion, hinted above) forty showers in a year, beginning in *August* to *October* inclusively. From the *Point* you may look towards *Port-morant*, and so along to *Ligonee*, six miles from the *Point*, and you'll scarce see, for eight or nine months, beginning from *April*, an afternoon in which it rains not. At the *Spanish Town* it rains but three Months in the Year, and then not much. And at the same time, it rains at *Mervis*, it rains not at the *Barbadoes*. And at *Cignateo* (otherwise called *Eleutheria*) in the Gulph of *Bahama* it rains not sometimes in two or three years, so that that Island hath been twice deserted for want of rain to plant in.

At the *Point* of *Jamaica*, where-ever you dig five or six foot, water will appear, which ebbs and flows as the Tide. It is not salt but brackish, unwholsome for men, but wholsome for Hogs. At the *Caymans* there is no water, but what is brackish also ; yet is that wholsome for men, infomuch that many are recovered there, by feeding on Tortoises, and yet drink no other water.

The *Bloud* of *Tortoises* is colder than any water, I ever felt there ; yet is the beating of their Heart as vigorous, as that of any Animal (as far as I have observed,) and their Arteries are as firm as any Creatures I know : Which seems to shew, It is not heat that hardens the coats of the Arteries, or gives motion to the Heart. Their Lungs lie in their belly below the Diaphragm, extending to the end of their Shell. Their Spleen is Triangular, and of a firm flesh (no Parenchyma) and floridly red. Their Liver is of a dark green, inclining to black, and Parenchymatous. In the *Oesophagus* are a sort of Teeth, with which they chew the grass, they eat in the Meadows, which there grow at the bottom of the Sea.

All the *Tortoises* from the *Caribes* to the *Bay of Mexico* and *Honduras*, repair in Summer to the *Cayman Islands*, to lay their Eggs and to hatch there. They coot for fourteen daies together, then lay in one night some three hundred Eggs, with white and yolk, but no shells: then they coot again, and lay in the sand, and so thrice. Then the Male is reduced to a kind of gelly within, and blind, and is so carried home by the Female. Their fat is green, but not offensive to the stomach, though you eat it as broth, stew'd. Your Urine looks of a yellowish green, and oily, after eating it.

There is no manner of Earth, but Sand, at the *Point*; yet I have eaten admirable *Melons*, Musk and Water-Melons, that have grown there. A great many trees also grow there, especially *Mangranes* and *Prickle-pears*. In other parts it is ordinary to ride through woods, that are full of very large Timber, and yet have nothing of Earth, only firm Rock, to grow in.

In some ground that is full of Salt-peter, your *Tobacco*, that grows wild, flasheth as it is smoked.

The fruit of Trees there of the same kind ripen not at one time: There is a Hedge of Plum-trees of two miles long, as you go to the *Spanish Town*; on it I have many times remarked some Trees in *Flower*, others with *Ripe*, others with *Green* fruit, and others to have done bearing, at the same time. The like I have observed in other Trees. *Jasmins* I have seen to blow before their leaves, and also after their leaves are fallen again.

The *Sower-sop*, a pleasant fruit there, hath a flower with three leaves; when these open, they give so great a crack, that I have more than once run from under the Tree, thinking it all to be tumbling down.

There is a Bird, called a *Pellican*, but a kind of *Cormorant*, that is of taste Fishy, but if it lie buried in the ground but two hours, it will lose that taste, as I have been told for certain.

I tried some *Analysis* of bodies by letting *Ants* eat them; and I found that they would eat *Brown Sugar White*, and at last reduce it to an *Inspid* powder. So they reduced a pound of *Salet-oil* to 2 drams of powder.

At our first coming there, we sweat continually in great drops for 3 quarters of a year, and then it ceaseth: During that space I could not perceive my self or others more dry, more costive, or to make less urine, than in *England*. Neither does all that sweat make us faintish. If one be dry, it is a thirst generally arising from the heat of the Lungs, and affecting the Mouth, which is best cool'd by a little *Brandy*.

Most Creatures drink little or nothing there, as Hogs; nay, Horses in *Guanaboa* never drink; nor Cows in some places of the Island for six months; Goats drink but once perhaps in a week. Parrots never drink, nor Parroquets; nor Civet-Cats but once a month.

The hottest time of the day to us, is Eight in the Morning, when there is no *Briſe*. I set a weather-glass in the window, to observe the weather, and I found it not to rise considerably at that time, but by two of the clock it rose two inches.

Venice-Treacle did so dry in a Gally-pot, as to be friable; and then it produced a Fly, called a *Weavil*, and a sort of white-worm. So did the *Pilula de Tribus* produce a *Weavil*.

I shall conclude with an Observation of a strange Quality of a piece of Land: There is in the midst of the Island a Plain, called *Magotti Savanna*, in which whensoever it rains (and the rain passes along the Island before it falls there) the rain, as it settles upon the seams of any garment, turns in half an hour to Magots; yet is that plain healthful to dwell in; and an hundred, that have seen the thing, assured me of it.

Infinite might the observations be, if I had alwaies enjoyed my health, for the speculative Philosophers; almost every thing there being new, and Nature being luxuriant in her Productions in those parts: But I shall not trouble you with imperfect Memorials, &c.

So far this curious observer; whose laudable Example may both quicken and direct other Travellers in the Particulars, to be taken notice of in their Voyages.

Extract of a Letter, written by Mr. Sam. Coleprens to the Publisher, containing an Account of some Magnetical Experiments; as also of an excellent Liquor made of Cyder-Apples and Mulberries.

Presuming, what e're tends to the farther discovery of the *Magnetick* vertue, will not be unwelcome to you, encouraged by a hint, given in pag. 423. of your *Phil. Transact.* I shall not scruple to relate to you two or three Experiments of mine own, performed in the presence of Sir *William Strode*.

1. I took a Loadstone unpolish'd, which attracted but meanly; and I heated a Lath-nail glowing hot, nimbly applying the North-pole of the said Magnet to it, which quickly took it up, and held it suspended a great while, till I put down both the Magnet and Nail.

2. I took the same stone, and cast it into the Fire, letting it remain there, till it was thorow hot, altering its colour from black to red, and being

being red-hot, I applied the North-pole to another Lath-nail cold, and untoucht before, which it took up but faintly, yet held it suspended for some time.

3. Two or three daies after, I took the same Loadstone, and found that it attracted then as strongly, as before it was cast into the Fire. Whence I inferr'd, that the Fire somewhat lessen'd its Attractive faculty, but did not deprive the Stone of it.

Cyder-season approaching, I know not how to conceal from the delicate and curious Cyder-drinker (though I my self find the pleasures of all liquors in one, even that of fountain water *) the notice of a liquor as commendable, as yet rare. It is a composition of the Juyces of good Cyder-apples and Mulberries, producing the best tasted and most curiously coloured liquor, that many ever saw or tasted. Of which the experiment may be easily made by those that are furnisht with Mulberry-trees, without any considerable cost.

* This Gentlemans constant drink is spring water.

An Account of some Books.

I. *The HISTORY of the ROYAL SOCIETY of LONDON, for the Advancement of EXPERIMENTAL Philosophy, by THO. SPRAT.*

IT was indeed highly sutable, that the *History of the Royal Experimenting Society* should be dedicated, as the *Candid Author* of it hath done, to that *King*, who is the *first* of all the *Kings of Europe*, that confirmed this Noble Design of *Experiments*, both by His own Example, and by a publick Establishment.

The Discourse it self, which is modest and elegant; is divided by the Author into these three general Heads:

The *First* gives a short view of the *Ancient and Modern Philosophy*; and of the most Famous Attempts that have been made for its *Advancement*, by the *Chaldeans, Egyptians, Grecians, Arabians, Romans*, of old; and then, by several *New waies of Philosophy*, in the compass of our memories, and the Age before us, representing what hath been attempted by the *Modern Dogmatists*, the *Revivers of ancient Sects*, the *late Experimenters*, the *Chymists*, and the *Writers of Particular Subjects*: All which he deduceth, to the end, that by observing, wherein others have *excell'd*, and wherein they have been thought to *fail*, he

might the better shew, what is to be expected from these new Undertakers; and what moved them to enter upon a way of Inquiry, different from that, on which the former have proceeded.

The *Second*, consists of the *Narrative* it self, in which the *Historian*, out of the *Registers* and *Journals* of the *Royal Society* (which he hath been permitted to peruse) relateth the *first Occasions* of their Meetings, the Encouragement, and *Patronage* they have received; their *Patent*, their *Statutes*, the whole Order and *Scheme* of their *Design*; the *Qualifications* of their *Members*; the *Largeness* of their *Number*; their *weekly Assemblies*; the *manner* of their *Inquiry*; their *way* of *Registering*; and their *Universal Correspondency*; together with a particular *Enumeration* of the *principal Subjects*, about which they have been employed since they were made a *Royal Corporation*, and this to silence that importunate demand, *What they have done all this while?* And here the *Historian* hopes, that all *reasonable men* will find satisfaction, when they shall consider, *First*, That, besides that this *Society* hath past through the first difficulties of their *Charter* and *Model*, and overcome all oppositions, which use to arise against the *beginnings* of *great things*; their *Aim*, and the nature of their *Design*, and the *Extent* of their task do admit of no violent and hasty dispatch. *Next*, That, though their work hath not been exposed to open view, yet their *Registers* are stored with a good number of *Particulars* they have taken pains about; As,

1. *Queries* and *Directions*, they have given abroad.

2. *Proposals* and *Recommendations*, they have made.

3. *Relations*, they have received.

4. *Experiments*, they have tried.

5. *Observations*, they have taken.

6. *Instruments*, they have invented or advanced.

7. *Theories*, that have been proposed.

8. *Discourses*, they have written or published.

9. *Histories* of *Nature*, and *Arts*, and *Works*, they have collected.

The *Particulars* upon which *Heads* are more numerous, and of greater moment and variety, than perhaps *Detractors* and *Cavillers* imagine or expect: they exceed indeed the number of 700; of which the *Experiments* and *Observations* both together amount to above 350; the *Relations*, to about 150; the *Queries*, *Directions*, *Recommendations*, and *Proposals*, to above 80; the *Instruments*, to about 60; the *Histories* of *Nature* and *Art*, to above 50; and the *Theories* and *Discourses* to as many.

To these he adds an *Account* of the *Library* and *Repository*, they have obtain'd

obtain'd by the bounty of two of their Members; and gives withall some *Examples* of their *Experiments*; *Histories* both of *Nature* and *Art*; *Queries* answered; *Proposals* recommended, &c. Which done, he concludeth, That if any shall yet think, they have not usefully employed their time, he shall be apt to suspect, that they understand not, what is meant by a *diligent* and *profitable labouring* about *Nature*; and that such men seem not capable of being satisfied, unless the Gentlemen of this *Society* immediately profess to have found out the *Squaring of the Circle*, or the *Philosophers Stone*, or some other such mighty *Nothings*; which only argues the extravagance of the Expectations of such men. Mean time, the *Author* esteems, that, since the *Society* promises no *Miracles*, nor endeavours after them, and since their Progress ought to be equal and firm, by *Natural* degrees, and thorow *small* things, as well as *great*, going on leisurely and warily, it is therefore fit, that they alone, and not others, who refuse to consider the *nature* of their *work*, and to partake of their *burthen*, should be Judges by what steps and what pace they ought to proceed.

The *Third Part*, is asserting both the *Advantage* and *Innocence* of this Design, in respect of all *Professions*, and particularly of *Religion*; and how proper, above others, it is for the present Temper of the *Age*, wherein we live: And this is done, to free it from the *Cavil* of the *Idle* and *Malicious*; and from the *Jealousies* of *Private Interests*; all which the *Author* shews to have nothing but *Humor*, or *Envy*, *Prejudice*, or *Mistake*, to bear themselves upon.

The promoting of *Experiments*, according to the *Model* of the *Royal Society*, will be so far from injuring *Education*, or from being dangerous to the *Universities*, that it will both introduce many things of greater concernment and benefit to supply the place of what may be laid aside; and be mainly conducive to recover that *Divine Dignity* of *Humane Nature*, which consists in the *Knowledge* of *Truth*, and the *Doing* of *Good*.

The *First years* of Men being secured by this new *Experimental* way; it is made out to all *Professions* and *Practical lives*, that they can receive no ill Impressions from it, but that it will be the most beneficial and proper study for their Preparation and Direction. Whereas other Learning is charged to consist in *Arguing* and *Disputing*; and to be apt to make our Minds lofty and *Romantick*; presumptuous and obstinate; averse from a practical Course, and unable to bear the difficulties of *Action*; Propense to things, which are no where in use

in

in the world; and careless of their own present times, by doting on the past: This *Experimental* Philosophy will turn men to Trials and Works; cure their minds of *Romantick* swelling, by shewing all things familiarly to them, just as large as they are; free them from *perversity*, by not permitting them to be too peremptory in their *Conclusions*: accustom their hands to things, which have a near resemblance to the business of life: and draw away the shadows, which either enlarge or *darken* humane affairs: And of the *Crafty*, the *Formal*, and the *Prudent* (the usual Titles, by which men of business are wont to be distinguished:) Our Author resembles the *Crafty*, to the *Emperick* in Philosophy; the *Formal*, to the meer *Speculative* Philosopher; but the *Prudent* man, to him, who proceeds on a constant and solid course of *Experiments*: the one in *Civil life*, rejecting neither the wisdom of *Ancient*, nor that of *Modern* times; the other in *Philosophy*, having the same reverence for *former* Ages, and regard for the *present*; both raising their *Observations* unto *Use* not suffering them to lie idle, but employing them to direct the *actions*, and supply the *wants of humane life*.

And as this *Experimental* way will afford much help to our *Publick duties*, and *Civil actions*, so it is proved to be very useful for the *Cure* of mens *Minds*, and the management of their *private motions* and *passions*, by keeping them from *idleness* with full and earnest *employments*, and by possessing them with innocent, various, lasting, and even sensible *delights*.

From hence our Author proceeds to make a defence of the *Royal Society*, and this new *Experimental Learning*, in respect of the *Christian Faith*; fully evincing, that as it is not at all dangerous to *Religion in general*, so it is not to the *Doctrine of the Gospel*, nor that of the *Primitive Church*, or of the *Church of England*.

This done, he declares, on what account the *Study of Experiments* is the most seasonable study for the present *Temper* of the *English Nation*; and then goes on to manifest the probable *Effects of Experiments*, in respect of all the *Manual Trades*, which have been heretofore found out and adorned. This Argument he dispatches in a clear Resolution of these *Four Questions*:

1. Whether the *Mechanick Arts* are still improvable by humane *Industry*?
2. If they be, whether they may be advanced by any others, besides the *Mechanick Artists* themselves?

3. Whether

3. Whether there be any ground of hope from *Experiments* towards this Work ?

4. Whether, if such *Arts* shall hereby happen to multiply, they are likely to prejudice those *Trades*, that are already settled ?

In these *Particulars* our Author doth so answer his *Readers* doubts, that it will easily be granted him, That it is not a vain or impossible Design, to endeavour the *increase* of *Mechanick contrivances* ; that the enterprize is proper for a *Mixt Assembly* of Experienced *Naturalists* and *Mathematicians* ; that the Course which the *Royal Society* observes towards it, will be effectual ; and the *Increase* of such *Operations*, inoffensive to others of the same kind, that have been formerly discovered.

Hence he proceeds to shew, That these *Experiments* are a proper study for the *Gentlemen* of this Nation, in which he finds them already well engaged : As also, that they will be beneficial to our *Wits* and *Writers*, who, if truly worthy men, will find in the *works* of *Nature* an inexhaustible Treasure for *Fancy* and *Invention*, which will be disclosed proportionably to the increase of their knowledge : Further, that they are advantageous to the Interest of the Nation, by enlarging the *Trade* and *Power* thereof.

Upon which and several other accounts (not possible to be contracted here) our *Historian* concludes his *Discourse*, with giving us a *Catalogue* of those, which at this present compose the *Royal Society*, amounting to near two hundred ; whereof the *Kings Majesty* is *Founder* and *Patron*. Among the *Fellows* are three of the Greatest Princes of *Europe*, his Royal Highness the *Duke of York* ; his Highness *Prince Ruper*, Count Palatine of the *Rhine* ; and his Highness *Ferdinand Albert*, Duke of *Brunswick* and *Lunenburg* : then, the two *Archbishops* of *England*, and four *Bishops* ; of *Dukes*, *Marquesses*, *Earls*, *Viscounts*, and *Barons*, *English* and *Scotch*, twenty nine ; of *Knights*, thirty five ; of *Doctors* and *Bachelors* of *Divinity*, fourteen ; of *Doctors* and *Candidates* of *Physick*, twenty one ; of *Esquires*, and other *Gentlemen*, and *Merchants*, sixty four ; of *strangers*, sixteen.

After the Enumeration of which, he recommends this *Undertaking* to the *English Nation* ; to the bravest people, the most generous Design, which at once regards the *discovering* of *New secrets*, and the *Parifying* and *Repairing* all the profitable things of *Antiquity* : and here he represents, that if now this *Enterprise* should chance to fail for want of *Patronage* and *Revenue*, the *World* would not only be frustrated of

their present Expectations, but have just ground to despair of any *future* Labours, towards the increase of *Practical* and *Useful* knowledge. But he hopes and presages, that the *English* Nation will lay hold on this opportunity, to deserve the Applause of *Mankind* for having encouraged and supported a *Work*, which, instead of barren *Terms* and *Notions*, is able to impart to us the *Uses* of all the *Creatures*, and to enrich us with all the Benefits of *Real* Knowledge, true *Honour*, great *Plenty*, and solid *Delight*.

II. *DISQUISITIO ANATOMICA DE FORMATO FOETU*: Authore Gualtero Necedham, M. D. Londini, in 8°

THis *Disquisition* consists of seven *Chapters*, full of the Learned and Ingenious Author, who was lately elected a Fellow of the *Royal Society*, his own Experiments and Observations.

In the *first* he inquires into the *Passages*, by which the *Nourishing Juice* is conveyed into the Womb of the Animal: where he examines the Assertion of *Everhard*, importing, that some of the *Lacteous* Vessels carry the said Juice to the *Uterus*; which vessels are pretended to have been seen by himself in the dissection of *Rabbets*. Which engaged our Author to take up again the Anatomical knife, and to dissect with all possible accurateness both some of the bigger Animals, as *Cows* and *Mares*, and some of the smaller kind, as *Rabbets*, which are instanced by *Everhard*.

But having spent all his labour and care herein in vain, and besides, evinced by *Ligatures*, that the pretended Vessels are neither those that are described by *Bartholin* under the name of *Lymphatick*, nor others, presumed to be known by *Everhard* alone, as immediately carrying the *Chyle* out of its *Receptacle* to the *Womb* and *Breasts*; he imputes the cause of this mistake to the *Trunk* of the *Lymphaticks*, running over the *Vena cava* into the *Receptacle* near the *Emulgents*, which *Ductus* he affirms to have often found filled with *Chyle* from the *Intestinum Rectum*, or the *Ileum* or *Cacum* a Dog having no *Colon*; but maintains withall, that by *Ligatures* it is manifest, that that *Ductus* goes to the *Receptacle*, and there deposits its liquor; which he proves to be alike true of all the *Milky vessels*, so that they carry nothing back and consequently are unfit to convey any thing to the Womb. This he illustrates by a Noble Experiment of that Learned and Expert Anatomist, Dr. *Lower*, using to open sometimes the right side of the *Thorax*,
and

and with his fingers to break the *Receptacle*; and sometimes on the left side the *Ductus Thoracicus*, a little under the *Subclaviar*; whereby it hath come to pass, that Dogs, well fed all the while, have thrown out all the Chyle into the opened part of the *Thorax*, and, though plentifully fed, were starved within three daies: there appearing mean time in the Veins opened a crass blood, destitute of *Serum*, but not any mixture of transmitted Chyle.

Having rejected the *Lacteous* and *Lymphatick* vessels from this office, he declareth, that we must rest in the Ancient Doctrine, which layeth the task of conveighing the *Succus nutritius*, to the *Breasts* and *Womb*, upon the *Arteries*; unless the *Nerves* be call'd in for aid, for conveighing some of the *Spirituos* Juyce, to be mixed with the *Nutritious*, to give life and vigour; And having proved this, he takes notice of the *Anastomoses*, remarkable in the womb of pregnant Creatures; and subjoyns a discussion of the way how the *Alimental Juyce* is in the womb severed from the mass of the *blood*: whether by *meer Percolation*, or by some *Ferment*, working upon the *Bloud*, and thence precipitating what is proper for the use of that part.

In the *Second Chapter* he treats of the *Placenta's* and *Glandules*, and shews, How many waies the *Juyce* is derived from the *Womb* to the *Fœtus*: First, simply from the *Membrane* of the *Uterus* to the *Membrane* of the *Fœtus*; as in all *Oviparous* Creatures; and among *Viviparous*, in a *Sow* all the time of her bearing; in a *Mare*, for half the time; and in a *Woman*, the first month only. *Secondly*, by a *Mass of flesh*, filtering the *Juyce*; as in all *Cake-bearing* (called by the Latines, *Placentifera*) and in all *Kernel-bearing* (called *Glandulifera*) or *Ruminating* Animals. Where he giveth a particular account of the double *Placenta* or *Cake*, to be found in *Rabbits*, *Hares*, *Mice*, *Moles*, &c. and examines the learned *Dr. Whartons* Doctrine, assigning a double *Placenta* to at least all *Viviparous* Animals, so as one half of it belongs to the *Uterus*, the other to the *Chorion*: shewing how far this is true, and declaring the variety of these *Phænomena*, together with a very ingenious assignation of the *Cause* of that variety. Where do occur many uncommon Observations concerning the *difference* of *Milk* in ruminating and other Animals; the *various degrees* of *thicknes* of the *Userin liquor* in *Oviparous* and *Viviparous* creatures; the property of the humour, turning into *Eggs*, with a hint of the cause of their being excluded, and not quickned and formed within; as also, of the cause of *Moles* in the womb, and of many kernelly and fleshy substan-

ces in other parts of the body : where he takes notice of a concretion seen by himself grown to the *Cone* of the Heart, of nine ounces weight in an healthy Body, that died of a violent death ; and of the like adhering to the *Spleen, Kidneys, Liver*, without any perceived trouble to the Animal ; yea, of some found *within the heart* it self.

He adds the *Number, Shape, and Use* of these *Placenta's* ; and first observes that those that are *Kernel-bearing Animals*, or chewing the Cud, have many ; and those that are *Cake-bearing*, have for the most part, one *Cake* for each *Fœtus* ; but a woman commonly but *one*, though she happen to have many *Embryo's*.

He annexes a particular description of the *Placenta* of a Woman, as the most considerable, and teaches, how it may be most conveniently severed from the *Vessels*, to render them conspicuous, which are a numerous off-spring of *Arteries, Veins, and Fibres* ; of the last whereof he inquires, whether they be the capillaries of the *Arteries, and Veins*, or nervous.

The *Shape* of that in a Woman is *Orbicular*, about a foot large, and two inches thick ; one of its *Superficies's*, convex, but uneven, the other concave, and every where sticking close to the *Chorion*.

The *Use* of the *Placenta's* is known to be, to serve for conveying the aliment to the *Fœtus*. The difficulty is only about the manner. Here are examined three opinions, of *Curvey, Everhard, and Harvey*. The two former do hold, that the *Fœtus* is nourished only from the *Amnion* by the Mouth ; yet with this difference, that *Curvey* will have it fed by the Mouth when it is perfect, but, whilst it is yet imperfect, by filtration only through the pores of the body, and by a kind of juxtaposition : but *Everhard*, supposing a simultaneous formation of all the instruments of nutrition together at first, and esteeming the Mass of blood by reason of its asperity and eagerness unfit for nutrition, and rather apt to prey upon than feed the parts, maintains, that the liquor is sucked out of the *Amnion* by the mouth, concocted in the stomach ; and thence passed into the *Milky Vessels*, even from the beginning. Mean time they both agree in this, that the *Embryo* doth breathe, but not feed, through the *Umbilical vessels*.

This our *Author* undertakes to disprove ; and having asserted the mildness of, at least, many parts of the blood, and consequently their fitness for nutrition, he defends the *Harveyan doctrine*, of the *Colliguation* of the *Nourishing Juice* by the *Arteries*, and its conveyance to the *Fœtus* by the veins.

In the *third* Chapter, the *Membranes* and *Humors* of *Embryo's* are considered, The *Membranes* are in some, three, in others, four, in an Egg, six. All *Placentiferous* Animals (if I may assume this word) he affirms to have three *Membranes*, and *Sows*, *Mares*, and *Women* also; but only two *Humors*, Again, *Bitches*, *Cats*, and *Conies*, four *Membranes*, and three *Humors*; so that the Number of the *Membranes* hath been hitherto observed alwaies to exceed that of the *Humors*.

Giving the History of both, he begins from *Sheep*, *Cows*, and other *Ruminating* Animals, describing first the *Chorion*, assigning its *Use*, and comparing it with that in *Deer*, *Sows*, *Mares*, *Women*, *Rabbits*, *Bitches*, and *Cats*, when with young. Then he proceeds to the description of the *Allantoides* (the Membrane immediately encompassing that skin, wherein the *Fœtus* is wrapped) and thence to that of the *Amnion*, wherein the *Embryo* it self lieth, swimming in its alimantal liquor. And lastly to that which is observed to be in *Bitches*, *Cats*, and *Rabbits*, and contains a very good and nourishing Juyce; which how it comes thither, is a difficult inquiry, as well as that other; how the liquor gets into the *Amnion*. To resolve both which our *Author*. having disproved the Filtration of the liquor, held by *Curvey* and *Everhard* out of the *Chorion* into the *Amnion*, and evinced, that the liquor in the *Allantoides*, interjected between these two is *Urinous*, he concludes, that the alimentary Juyce passes through the Umbilical Vessels by a proper *Artery*, depositing it in those *Membranes* we speak of, and reserving it there for the use of the *Fœtus*.

Concerning the *Humors*, he affirms, that all of them in all Animals are *Nutritive*, except that in the *Allantoides*. He observes also, that most of *Oviparous* Fishes have Eggs or Spawn, as to sence of one only colour, and but one humor; yet that the Spawn of a *Skate* hath a White and a Yolk. *Birds* have mostly three nutritious substances, that are visible, viz. a Yolk and a double White: to which upon incubation, comes a fourth, colliquated out of the former; the tender *Embryo* feeding upon the two Whites, till they being consumed, the Yolk of the Chick now to be hatcht, is shut up in the *Abdomen*, and thence by a peculiar *Ductus* conveighed into the guts; and so serves the young bird for breasts, it is fed by, until the twentieth day.

In *Viviparous* Creatures are found sometimes two, sometimes three humors, and in *Bitches*, *Cats*, and *Rabbits*, four; which perplexeth the Author, as to the giving a reason for it. These *Humors*, he saith, he hath examined, by concreting, distilling, and coagulating them; where he

furnishes the *Reader* with no vulgar Observations. He concludes this *Chapter* by observing, that there is also *Air* in the said *Membranes*; which besides other Arguments, he proves from the crying of Infants in the *Womb* (of which he alledges a memorable and well attested example in a Child of an English Lady in *Cheshire*, the Child being yet alive and in good health;) and from Chickens, often heard to peep in the Egg, both before the breaking of the shells, and after, the *Membranes* being yet entire; adscribing the production of this *Air* to the spirituous liquor in the *Membrane*, apt to ferment, and thereby causing store of exhalations.

The *fourth Chapter* discourses of the *Umbilical Vessels*; and observes *first*, that they differ in different Animals, and hold proportion to the *Membranes* and *Liquors*, so as those that have two *Liquors*, have four *Membranes*, and three *Liquors* have six: the *Oviparous* also being furnished with a *Ductus*, passing to the *Guts*, because they want breasts, and their yolk is shut up in the belly.

The *Umbilical Arteries*, belonging to the *Placenta*, and commonly said to be derived from the *Crurals*, are by him affirmed to proceed from the end of the *Aorta*. They are here described, and their several portions distributed for the *Chorion* and *Amnion*. Then an account is given of the *Hepatick Vein*, corresponding to the *Arteries*. It is in *Viviparous* Animals inserted into the *Vena Porta*, passing again with the remaining *Bloud* thorow the *Canalis Venosus* into the *Cava*, without percolation made in the *Liver*. In *Birds* it enters not into the *Liver*, but passes over its convexity into the *Cava*. A description is also made of the *Urachus*, found in all *Viviparous* Creatures, though by many *Writers* denied to be in *Man*, who notwithstanding hath need, as well as other such Animals, somewhere to lodge his *Urine*. The *Oviparous* want this *Umbilical funiculus*, but yet are furnished with fit sanguineous *Vessels*, which here also are explained; especially the *Ductus Intestinalis*, said to be omitted by *Dr. Harvey*, and to have been known to the *Author* long before *Mr. Steno* claimed the discovery of it; for which he appeals to the testimony of *Mr. Boyle*, and three worthy Physicians, *Willis*, *Millington*, and *Lower*; as also to that of two ingenious *Frenchmen*, *Guison*, and *Fiard*, to whom our *Author* affirms to have shewed *Anno 1659*, when they were going over into *Holland*, not only this *Ductus*, but also the *Ductus Salivales*, and the *Passages* of the *Nostrils*, published afterwards by the said *Steno*.

The use of this *Ductus Intestinalis* is esteemed to be the conveying of

of the *Tolk* into the *Guts* for a *second* coction, there made by the *Pancreatick* Juyce, acknowledged to be excellently handled by the Learned *Sylvius*, and his ingenious Scholar, *De Graeff*, from the former of whom our *Author* yet dissents, about the mixture of the Gall with the said juyce in the Heart refuting it by several Experiments.

The *fifth*, explains the Communion of Vessels in *Embryo's*: In whom, he saith, three *Anastomoses* are usually observed, which, as soon as the *Fœtus* is born, are closed. They are called *Foramen Ovale*, *Canalis Arteriosus*, and *Venosus*. The two former to be met with about the *Heart*; the last in the *Liver*. All three here described by the *Author*, who also compares, as *Harvey* does, the *Fœtus* yet in the Womb with the manner of operation of those Animals, that are provided but with one cavity in the Heart, and with no Lungs; the blood of the *Fruit*, as long as it is unborn, passing neither through the *Parenchyma* of the Lungs, nor that of the *Liver*. Lastly, the necessity of *Respiration* is explicated, and how the defect of the Lungs, and of one of the Ventricles of the *Heart*, is supplied in *Fishes*, viz. by comminuting and mixing the blood in the *Gills*. To which is annexed the manner of Respiration in *Amphibia's*, which are furnisht with Lungs and two Ventricles of the *Heart*, and yet, if *Bartholin* misinforms us not, keep the *Foramen Ovale* all their life time open; which yet our *Author* calls in question, alledging, to have seen no *Diving* Animals, which had not the said *Foramen* closed after their being born.

The *Sixth* makes a digression, to discourse of the *Biolychnium*, and the Ingress of the Air into the Blood, for the Generation of Spirits, and the pretended kindling of a *vital Flame*. But our *Author* can see nothing that may prove either the *existence*, or the *necessity* of such a *Flame*: On the contrary, he finds the Blood unfit for taking Fire, and judgeth it very difficult to assign either the place or the manner of this accension; which is not made in the Lungs, nor in the Heart, which he holds to be destitute of all ferment. To which he adds, *first*, that the Heat of the Blood is not sufficient to cause such an inflammation, seeing how much even good *Spirit of Wine* must be heated, before it will flame, which it doth not without the actual application of fire. *Next*, That Examples are very rare of Liquors kindled by ventilation. *Further*, That *Fishes* and *Frogs*, which yet have life, motion, and sense, are not thought to have this flame, as being actually cold. *Besides*, That the *Animal Spirits* are not found in the form of flame; which he endeavours to prove from the *Willisian* doctrine of the manner, in which they

they are in the Brain severed from the Blood. *Lastly*, That it is doubted by some, whether any Air at all is received into the mass of blood, which yet is not questioned by our *Author*, who only doubteth, whether through the *Lungs* there be a *high way* for the Air to the Blood.

After this, our *Author* gives his thoughts both of the true *Use of the Lungs*, and of *Sanguification*.

The *Lungs*, he saith, serve chiefly, by their constant agitation to comminute the blood, and so to render it fit for a due circulation; which office he thinks to be performed in *Fishes* by the continual motion of their *Gills*, a *Succedaneum* to *Lungs*.

Sanguification, according to him, is chiefly performed and perfected by the frequent pulsions of the Heart, and the repeated contractions of its left *Ventricle* at the passing of the Sanguinous liquor from thence into the *Aorta*.

The *Seventh* and *last* Chapter contains a Direction for the younger *Anatomists*, of what is to be observed in the dissection of divers *Animals* with young: and *first*, of what is common to all the *Viviparous*; then, what is peculiar to several of them, as a *Sow*, *Mare*, *Cow*, *Ewe*, *She-Goat*, *Doe*, *Rabbit*, *Bitch*, and a *Woman*: *Lastly*, What is observable in an *Egg*, *Skate*, *Salmon*, *Frog*, &c.

All is illustrated by divers accurate Schemes.

III. ELEMENTORUM MYOLOGIÆ Specimen; seu MUSCULI Descriptio Geometrica, Authore. NICOLAO STENONE.

THis Book is not yet come into *England*; only the Excellent *Septalio* having in his Letter above-mentioned given us notice of its being published and dedicated to the *great Duke of Tuscany*, we thought it not amiss to inform the Curious of it.

LONDON, Printed for John Martyn, Printer to the Royal Society, and are to be sold at the Sign of the Bell, a little without Temple-Bar, 1667.

A LETTER

Concerning a new way of curing sundry diseases by Transfusion of Blood, Written to Monsieur de MONTMOR, Counsellor to the French King, and Master of Requests.

By J: DENIS *Professor of Philosophy, and the Mathematicks.*

Munday July 22. 1667.

SIR,



THE project of causing the Blood of a healthy animal to passe into the veins of one diseased, having been conceived about ten years agoe, in the illustrious Society of *Virtuosi* which assembles at your houses; and your goodness having received M. *Emmeriz*, & my self, very favorably at such times as we have presum'd to entertain you either with discourse concerning it, or the sight of some not inconsiderable effects of it: You will not think it strange that I now take the liberty of troubling you with this Letter, and design to inform you fully of what pursuances and successes we have made in this Operation; wherein you are justly intitled to a greater share than any other, considering that it was first spoken of in your *Academy*, & that the Publick is beholding to you for this as well as for many other discoveries, for the benefits & advantages it shall reap from the same.

But that I may give you the reasons of our procedure and

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vince you that we are not culpable of the rashness wherewith we may possibly be charged: be pleased to permit me to relate to you in few words the reasons alledg'd by some persons, to oppose our design, and to compare the same with those which engag'd us to execute, and by certain degrees carry it on to that perfection wherein it is at present.

You have heard of the tryal we made about four moneths agoe upon Dogs, to transmit the Blood of the *Crural Artery* of one into the *Jugular Vein* of another. And being this operation even at the first attempt succeeded as happily as we could wish, according as it is more at large set forth in the *Journal des Sçavans*, of *March* last; we were encouraged to repeat the same several times both in publick and private, and we added so many circumstances to the manner of performing it, that its easiness seem'd to invite us not to neglect it, but to make abundance of Observations which might be of some benefit in Practice.

Accordingly, We afterwards made the Transfusion several waies, sometimes from an *Artery into a Vein*, sometimes from *one Vein into another*, both in those of the Neck, and those of the Leg; in Dogs both weak and strong, great and small; as also in such as had already either received or communicated blood in former transfusions. And not finding one of nineteen to die, but on the contrary alwaies observing some surprizing effect in all such as had received new blood, we were strongly perswaded that the transfusion would have no such dangerous consequences, as some people endeavor'd to presage.

Wherefore we resolv'd to drive the business yet a little further, and not contented to have seen it happen well in subjects of one and the same species; we thought good to try it in some of a different species, and accordingly we took a Calf and a Dog; because we conceiv'd the blood of these Creatures altogether dissimilar. In your presence we transmitted a *Calfs blood, into a Dogs Veins*, on the 28. of *March*; since which time we have also done the same upon other occasions, alwaies adding somewhat new towards the facility of the Operation.

ration. Yet in all these Experiments we never could observe any indisposition in the Dogs which receiv'd the Blood; whence we became confirm'd in the Opinion, that there was more ground to hope effects rather advantageous than hurtful to mankind, from this discovery of Transfusion of Blood.

Nevertheless, that we might vent nothing unadvisedly, we publisht these Experiments, and were well pleas'd to understand the judgment of the ablest Philosophers and Physitians, upon the matter we examin'd, whether any of them had reasons weighty enough to dissuade us from carrying on our trials even in Man; and I beseech you permit me to sum up the principal here which are come to my knowledge, and judge your self whether they ought to have stopt us, and whether we deserve praise or blame for having proceeded further. Some have attack'd this design by decrying it as Chymical & impossible. 1. Because the diversity of Complexions (which is founded in the Blood) supposeth so great a diversity in the several Bloods of different Animals, that 'tis impossible but one must be Poyson and Venome in respect of another. 2. Because Blood entravafated or remov'd out of its natural place, must necessarily corrupt, according to the dictate of *Hippocrates*. 3. Because the Blood issuing out of its proper Vessels, and being to pass through inanimated conveyances, such as are the Pipes or Tubes employ'd in the Transfusion; it must infallibly coagulate, and so coagulated descending to the heart must cause there a Palpitation, whereof death will be the speedy consequent.

These Reasons have not appear'd to us of great importance. For as to the first, we acknowledge that there are as many different complexions and various qualities in the blood, as there are Individuals in every Species: But we believe it not concludible from thence, that the Blood of one must be Poyson in respect of others; no more than it follows, that all the Meats wherewith we are nourisht, and whereof our Blood is only an Elixir or Quintessence, must corrupt and poison the same, because they are endu'd with qualities differing from

those of the Blood. On the contrary, as 'tis certain that cooling Meats or Medicaments serve to temper the heat of the Blood when it boiles in the Veines, and hot food or Physick excite new vigour in such blood, as old age or a Disease hath render'd torpid and coagulated in the Vessels; so 'tis as reasonable to infer, that great advantages will follow upon the mixture of different bloods, provided the same be directed and manag'd by the ordinary prudence of able Physitians; and that if a hot Blood can reinfuse new strength into that which languisheth with coldness, such blood as hath colder qualities, may also check the Ebullitions and Tumults of that which is overmuch chafed.

As for the authority of *Hippocrates*, who saith that extravasated blood corrupteth, It is no wise repugnant to our pretensions. For to save the honor of that great Person, his meaning must be rightly expounded, which is no more but this; that the Blood necessarily corrupteth when it is out of the Vessels, which preserve its heat, and which permit it a natural motion and free circulation, whereby it purifieth it self continually. For example, being extracted into a dish, wherein all its parts are stopt and coagulated, it must in a little time alter its constitution, as experience witnesseth. Nor doth this hinder but that it is also corrupted sometimes in its own place, contrary to that Aphorisme, *Quicquid corrumpitur, in loco alieno corrumpitur*: For if its motion be interrupted in the Veines either by some obstruction form'd therein, or some division occasion'd by a Wound or Contusion, it corrupteth in a short space and degenerateth into purulent matter. But in this Experiment of Transfusion, the Blood is communicated in such manner, and passeth out of one animal into another, that 'tis impossible its natural motion should be interrupted. 'Tis true it passeth through unnatural Conduits, but these being once warmed and admitting no air into their cavities, they cause no more alteration in the Blood than the Arteries and Veines themselves do.

Moreover, such as conceive that the blood Transfused, must

must needs coagulate by the way and afterwards cause some mortal palpitation; they foresee an accident which never happened to us, and against which I desire no other security than the experience we have had of all the animals hitherto employ'd by us, which are still living.

Others who have either been witnesses of some of our Transfusions, or have understood the same from credible relators, dispute not the possibility of the thing: but yet not to authorize appears new, they say, That whatsoever care and caution be us'd in the Transfusion, it can never be practis'd upon Man with success; and these are their principal Reasons.

First, The blood of a sound, and the blood of a diseased body having qualities very different, the one being pure, the other impure, a perfect mixture thereof cannot be effected; they are two contraries, which will be at perpetual feud, the issue whereof can be no other but the ruine and destruction of the subject on whom the experiment is attempted. I wish those that discourse thus, first understood but what they endeavour to perswade others of; and that they would explain to us what artifice they fancy in the Veins and Arteries, to give passage to one sort of blood & exclude another at the same time. For my part I confesse I cannot comprehend why the continual circulation and rarefaction made in the heart by the heat of its Ventracles, are not more than sufficient to make a perfect mixture there of these two sorts of blood, & the difficulty seems the greater in regard experience appears to flatter me into a contrary opinion. For having a few dayes agoe syring'd about a quarter of a pinte of Milk into the veins of an Animal, and having opened the same some time after, we found the Milk so perfectly mixt with the whole substance of the blood, that there was not any place wherein appear'd the least footstep of the whiteness of Milk, and all the Blood was generally more liquid and less apt to coagulate.

The second Objection of the same Author is, That should the pure Blood mingle with the impure, yet it would not
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long preserve its Purity and temperament; in regard that upon its Arrival at the Liver (which is the grand Organ of Sanguification wherein the blood receives all its qualities) it would infallibly lose all its goodness, and in an instant become like the whole Masse, which we suppose corrupted; and consequently can produce no benefit therein by its mixture.

But this Objection is ill enough grounded, since it supposeth the blood to be made in the Liver, and is contrary to experience which demonstrateth most evidently, both the existence of blood in Animals before the formation of the Liver, and also the Arrival of the Chyle, and at the heart, and conversion of the same into blood there, before it entreteth into the Veines which carry it to the Liver: wherefore I dismiss this reason and proceed to another, which seemeth stronger and is offer'd by persons more judicious.

'Tis not contested in this Objection in what place sanguification is perform'd, because 'tis held to be done in several parts of the body, namely by reiterated circulations in the heart, Veines and Arteries: But 'tis likewise maintain'd that all these parts come either by sickness or age, to a certain degree of intemperature and malignity, from which there is no possibility to recover them; and that in this state they have power to communicate their evil qualities to whatsoever approacheth them; whence consequently in a little time they corrupt the laudable blood, wherewith they are newly irrigated. Proof of this is afforded both by example and experience. The example is taken from a *Hoghead of Vinegar*, which being once thoroughly imbu'd with that *Liquor*, is no longer fit to contain any other, but every thing pour'd thereinto is immediately infected with sourness by contagion of the *Caske*. The experience consists in that which was lately publisht by an English Doctor, who transfusing the blood of a Mangie Dog into a sound one, to try whether the Mange would be communicated with the blood, found the Mangie Dog cur'd, and the other who had receiv'd his blood not to become Mangie,

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Now to answer to all this in order, I say in the first place, that such a great intemperature, from whence 'tis said the blood can never recover, is either rare or very common. If very rare, it requires not much consideration, and if the mixture of laudable blood suffice not to restore it to its due temperament, I would gladly learn other meanes to do it. But if such intemperature be ordinary in all diseases and in all declining old Ages, I demand to what end serve the aliments which *Physick* allows, or the *Medicaments* it prescribes in these occasions? Can these things enter into the body without mingling with the blood within an hour? And if by so mingling they contract the ill temperament of the blood, and impart not to the same any of their good qualities, is it not losse of time to study *Physick*, and to reduce into practice what we are taught touching the choice of all those things? For my part, I am so far from having such a thought, that I doubt not but the strength & goodness of the meats & drinks we take, is able to correct the ill temperament of the blood and render it better: If there be any impediment of this effect, I should not so much look for it in the blood it self, or in the parts which elaborate the same, as in those through which the aliments passe before they arrive at the heart. For 'tis sufficiently manifest that if there be any irregularity in the stomach, if the digestion be not well made, if the juyces of the Gall and Pancreas (which serve for Dissolvents in the Intestines) be not well temper'd, if there be any Obstruction or Abscesse in the Glandules of the Mesentery which strain the purer portion of the Chyle; the best and most excellent things become so transform'd before their mixture with the blood, that no good nourishment or refreshment to the sick can with reason be expected from them.

Now in this way of *Transfusion* all those inconveniences are avoided; the blood communicated is not made to passe through those many turnings and windings, where the least corruption of a part destroys in an instant whatever good the soundness of the rest can produce. The good blood enters

immediately into the Veins of the receiving Animal, and there mixing and circulating with the rest, carries good nourishment to the principal parts, which are not ordinarily indisposed in sickness and old age, but by the vitiosity and faultiness of the blood which humecteth them.

This is an Opinion which I see many Physitians embrace, and were any thing capable to make me renounce it, the *Barrel of Vinegar*, above mention'd must not be it. For if *sourness* be the last quality which Wine assumes, and (as I may say) its Death, since it is never recoverable from the same; I do not believe that a like quality is to be found in the blood; that is to say, which corrupts the blood in such manner that it can never be purifi'd, unlesse perhaps in some Diseases accounted incurable, which are not pertinent to the Question. But if comparisons be currant, let us rather consider Wine with all sorts of other qualities but sourness, and then our comparisons will in my opinion, fall more just. For as the roughest Wine may be sweetned, the fowlest clarified, the weakest become stronger, the Oylie rid it self of its fatness; in a word, that which is decay'd may be amended by mixture of certain liquors, known to those that have the secrets of them, and practise the same every day: In like manner, 'tis reasonable to conceive that blood too thick may be refined and subtilised, that too subtle be fixed and incrassated, that too hot be temper'd, that too cold be heated; and all this by the mixture of other sorts of blood, the particular qualities whereof are known to the Physitian who prescribes the *Transfusion*.

As for the Experiment of the *Dog*, which is said to have received the corrupted blood of another Mangie one without contracting his disease; many things of sufficient importance may be said to it. 1: Is there any assurance that the blood of the Mangie Dog was putrefied, and corrupted in his Veins? On the contrary might it not have been purified before, by discharging its impurities through the pores of the flesh, where the same was converted into Mange upon the Skin. That which confirms me the more in this particular, is, that very

very frequently Scabs divert a greater malady ; since if those impurities which cause the same, issued not out at the surface of the body, they would remain mixt with the substance of the blood, and falling upon some noble Part, produce very dangerous effects therein. 2. Supposing the blood of the Mangie Dog wholly corrupted in his Veins, is it necessary it should produce the Mange in him that receives it ? Is it not possible that vitious blood may be purified when it becomes mixt with better, and that the great heat which caused the extravasation in the one in order to production of the Mange, may be allayed by the coolness of the other wherewith it is mixt, and consequently not produce the same effects. Lastly, Is there any assurance that the Mangy Dogs blood hath not produc'd some evil effects in the body of him who receiv'd it ? He should have been open'd some days after, and perhaps the corruption which render'd not it self apparent outwards, might have been visible within.

Hitherto therefore I find not either Reasons or Experiments sufficient from the opinion I have conceived of the benefit of *Transfusion* ; and in the Discord I observe of Physicians, whereof some approve the Invention, and maintain that it may with prudence be prescrib'd for the care of divers Diseases, others respect it as a very useles Novelty ; and Lastly, others keep themselves undetermin'd, expecting what successe the Experiment will produce ; I willingly joya with the first, and resign my self to the ensuing reasons, until some body shall produce others to the contrary of greater weight.

1. The *Transfusion* of the blood of one Animal into another is sufficiently taught us by Nature it self, and it must be granted that if we ever practise the same, we shall do no more but imitate her ; since whil'st she cannot yet administer nourishment to the *Fetus* by the mouth, and his stomach is not fit for digestion, she makes a continual *Transfusion* of the Maternal blood into the Umbilical Vein of the Infant, therewith to nourish, vivifie and encrease all the parts of the same. Nor is it to be answered here, that the Mother and Child are in this state to be consider'd, but as one and the same Body and Substance. For it happens frequently enough, that the Paternal

Seed predominating above that of the Mother, the Constitution of the Fœtus is very different from her's that bears it, although nourisht by the transfusion of her blood.

2. The *Transfusion* of blood is but a very compendious way of the continual transfusion of our Aliments, which is also taught us by Nature after our birth. For, whereas the Meats which we eat for the reparation of our strength, and refreshment of the heated parts, have very many impurities mixt with their good juices, which must be concocted by the heat, and digested in the acid Liquor of the Stomach; which done, the purer portion of the same digested juices is converted into Chyle, that Chyle impell'd into the Veins, to be mingled with the Blood, convey'd therewith to the heart, and there receive its utmost perfection; The *Transfusion* of blood is made more speedily, and with much more effect, since thereby, in a very small time, a most elaborated Liquor is immittted immediately into the Veins, where it instantly redresseth such defects as it findeth in the internal parts, when they are distemper'd.

3. Physitians cannot deny, That the greatest part of our Diseases are but Results of the Distemper and Corruption of the blood; since the speediest and commonest remedy they have in Practice, is, to evacuate the same by Phlebotomy, or else refresh and cool it by Juleps. But they must also confess, That whilst they endeavour to draw out the Corruption, they at the same time diminish the strength and vigor; and that great Fevers by this means are oftentimes follow'd by Faintnesses and Dropsies: On which consideration, some Physitians spare bleeding as much as possibly they can. Moreover, it must be acknowledged, That Drinks passing through the Stomach and Intestines, before it arrive at the Veins and Arteries, to be mingled there with the blood, they may be alter'd a thousand waies by the Ferments occurring in the passage, or else they may cause some alteration in those parts by Ferments accompanying them, and so leave weakneses and dangerous Crudities behind them. But in *Transfusion* all these things are avoided, and all Physitians brought to agreement within a short time. They who are for blood-letting,

find the same practis'd in this Operation, the old and corrupt being first evacuated, to make room for new and pure. And those also that decry bleeding, as that which too much weakens the sick, will have no reason to complain, since the new blood conduceth to strengthen them more.

Lastly, Every one knows that many persons dye through loss of blood, and Hæmorrhagies not to be stopt, many are emacerated by them, and others precipitated into untimely old Age, by defect of blood and vital heat. Now who doubts but the *Transfusion* of a mild and laudable blood may preserve the one, and prolong the life of the others. A man may foresee some benefits and advantages from this Operation in *Pleurisies, the small Pox, Leprosies, Cancers, Ulcers, St. Antonies fire, Madnes, Dotage*, and other *Maladies* arising from the Malignity of the blood: But the success is rather to be expected in Experiments, which will be made within a little time. In the interim, give me leave to acquaint you with my Judgment concerning the Election of the Animal that is to communicate its blood.

Many have conceiv'd, That if ever the *Transfusion* of blood should come to be practis'd upon men, it ought to be done with blood of the same Species; and consequently, That it would be a very barbarous Operation, to prolong the life of some, by abridging that of others. But for my part, I am far from that Opinion, and I am perswaded that it will be much more expedient to make use of the blood of other Animals, than of that of men, for many reasons, the chief whereof are these.

I. 'Tis easie enough to judge, That the blood of Animals is less full of impurities, than that of men; because debauchedness and irregularity in eating and drinking, are so ordinary to them, as to us. Sadness, Envy, Anger, Melancholy, Disquiet, and generally all the Passions, are as so many causes which trouble the life of man, and corrupt the whole substance of the blood: Whereas the life of Brutes is much more regular, and less subject to all those miseries, which we ought to consider as sad consequences of the prevarication of our first Parents. And indeed Experience sufficiently shews us,

That if 'tis a rare chance to find its blood in the Veins of Beasts; 'tis almost impossible not to find some corruption in that of Men, how healthful soever they seem to be. Yea, even in Children yet sucking, it is not wholly unblamable; because, having been nourisht with the blood and milk of their Mothers, they have suckt corruption together with their nourishment.

2. If Physicians so successfully employ the milk of certain Animals, to which they oblige certain Patients for some whole years together: If we are very well nourisht with the flesh of some, during all our lives; and if their juices be so advantageous to us for repairing our natural strength; Why may we not hope greater advantages from the mixture of their blood with ours.

3. The Operation may be made more boldly, and with greater success by employing Brutes. For, being we design to take the best blood that is to be had; and least subject to coagulation, 'tis certain that the Arterial blood upon account of its heat and tenuity, possesseth both those qualities in much more perfection than the Venal. And the dangers and inconveniencies which would occur in opening the Arteries of a man are not considerable, when 'tis a beast on whom the Operation is made.

4. Beasts may be better fitted and prepar'd for this use than men. For I should advise those, that would employ this Experiment to the best advantage, to feed their Beasts for some daies before-hand with more care and exquisiteness than ordinary: since, if by the taste we can discern the flesh of Calves fed for some time, with Milk, and Yolks of Eggs to be much more pleasant than that of others; reason ought to perswade us that their blood is also meliorated according to their feeding.

All these Reasons joyn'd to the Experiments we have made, could not but induce us to give assurance to the publick of the little danger to be fear'd, and the considerable effects to be expected from this Operation. Yea, we imagin'd 'twere no rashness to make tryal of it upon men, and indeed divers persons of much gravity and prudence solicited us to beg some condemned Criminal, on whom to make the first Essay. But ha-

ving consider'd that a man in that condition, being already much disorder'd by the apprehension of death, might be further intimidated, by looking upon this transfusion as a new kind of death; and thus, conceit might possibly cast him into faintings and other accidents, which would undoubtedly be ascribed to the Experiment by such as decry it: We thought not fit to expose our selves to that danger, nor to importune his Majesty without any necessity; being perswaded that there would not be so much reason to fear the like events in persons whom we knew perfectly well, and who had some confidence in our words, we chose rather to wait till a favourable occasion offer'd us such a person as we wisht, than to hazard the loss of all by too much precipitation. This Resolution being taken we neglected nothing that prudence obliged us unto; and at length after some attendance we lighted upon a subject futable to our wishes. The particularities of our proceedings I here subjoyn in few words, they being as so many authentick confirmations of all that I have hitherto written.

On the 15 of this Moneth, we hapned upon a Youth aged between 15 and 16 years, who had for above two moneths bin tormented with a contumacious and violent fever, which obliged his Physitians to bleed him 20 times, in order to asswage the excessive heat.

Before this disease, he was not observed to be of a lumpish dull spirit; his memory was happy enough, and he seem'd chearful and nimble enough in body; but since the violence of this fever, his wit seem'd wholly sunk, his memory perfectly lost, and his body so heavy and drowfie that he was not fit for any thing: I beheld him fall asleep as he sate at dinner, as he was eating his Breakfast, and in all occurrences where men seem most unlikely to sleep. If he went to bed at nine of the clock in the Evening, he needed to be wakened several times before he could be got to rise by nine the next morning, and he pass'd the rest of the day in an incredible stupidity.

I attributed all these changes to the great evacuations of blood, the Physitians had been oblig'd to make for saving his life, and I perswaded my self that the little they had left him

was extremely incrustated by the ardour of the fever (which usually dissipates only the more tenuious part) and so stagnating in his vessels, he wanted the motion and heat necessary to volatilise the same, and to diffuse a sufficient activity into the Nerves and Muscles. Accordingly my conjecture was confirmed by our opening one of his Veins, for we beheld a blood so black and thick issue forth, that it could hardly form it self into a thread to fall into the porringer. We took about three ounces at five of the Clock in the morning, and at the same time we brought a *Lamb*, whose *Carotis Artery* we had prepar'd, out of which we imitted into the young mans Vein, about three times as much of its Arterial blood as he had emitted into the Dish, and then having stopt the orifice of the Vein with a little bolster, as is usual in other phlebotomies, we caus'd him to lie down on his Bed, expecting the event; and as I askt him now and then, how he found himself, he told me that during the operation he had felt a very great heat along his Arm, and since perceiv'd himself much eas'd of a pain in his side, which he had gotten the evening before by falling down a pair of staires of ten steps, about ten of the clock he was minded to rise, and being I observed him cheerful enough, I did not oppose it; and for the rest of the day, he spent it with much more liveliness than ordinary; eat his Meals very well, and shewed a clear and smiling countenance. He bled only 3 or 4 drops at the nose, about 4 a clock of the evening, and after he had supt very well, I caus'd him to go to bed about 9, and falling asleep at 10, he awakned at 2 after mid-night, and finding that he could not fall asleep again, he arose at 4 in the morning. All this day we observ'd his humor much more lively, and the agility of his body much greater than ordinary. The next day he slept a little more, and from that time he easily got the victory over his drowsiness, which before he had often attempted without successe; for now he never fails to rise very early without needing to be wakened. He executes nimbly whatever is appointed him, and he hath no longer that slowness of spirit nor heaviness of body, which before render'd him unfit for any thing. He grows fat visibly, and in brief, is a subject of amazement to all those that know him, and dwell with him.

Now

Now who sees not that all these admirable effects undoubtedly proceed from that little Arterial blood of the *Lamb*, which having been mixt with the mass of his thick blood, was like a ferment to it, to rarifie and attenuate it more than ordinary, whence follow'd the production of greater plenty of spirits, and a more nimble performance of the actions of the body.

This first Tryal thus succeeding engag'd us to make a second upon a stronger *Man*, aged 45 years. Now this Man having no considerable indisposition, we intended to make a larger Transfusion upon him, than on the former. But finding his vessels very low & not well fill'd with blood, we took from him only about 10 ounces, and afterwards immitted into him twice as much from the *Crural Artery* of a *Lamb* purposely provided for it, as well because the same is bigger and easier to come at than the *Carotis*, as for that we would put some difference between this second Experiment, and the first. The man abated nothing of his Jovial humor during all the time of the Operation, and amongst other reflections which he made concerning the placing of the *Lamb* near his *Arme*, he said merrily that there were strange waies in Physick to preserve life, that he knew not who had invented this of bleeding, but that he felt a very great heat from the Orifice of his Vein up to his arm-pit; which proceeded from the course of the new *Arterial* blood, passing up that way towards the heart.

When the Operation was ended, we advis'd him to lie down to rest; but being he found no indisposition in himself, 'twas impossible to prevail with him, and we could not keep him from falling to work with the poor *Lamb*, cutting his throat, and fleaing him, in which he is very dextrous, having exercis'd the same profession from his youth. Afterwards he declared his intention to return home, and promis'd us that he would take a mess of some comforting broth there, and lay himself to rest for the remainder of the day; but as soon as he went forth; he betook himself to find out his Comerades, and carryed them to the Tavern to drink part of the money given him for his daies business: at noon finding himself more hearty, (whether by the new blood he had received six hours before, or by the quantity of wine he had drank) he fell upon a sort of

work.

work so laborious to his whole body that it might almost tire a horse; thus he spent all the afternoon, and so kept us from making such observations upon him as we had intended. I met him the next day in the streets, and understanding from himself this behaviour, I was surpris'd at it, and blam'd him of imprudence. But he told me in excuse of himself, that he could not be at rest when he was in health, that he had felt no pain either during or after the operation, that he had eaten, drank and slept very well, that he had more strength than before, that if we were minded to repeat the same experiment at any time, he desired we would choose no other person for it but him, & that another time he would lie down to rest, and punctually behave himself as we should command him.

This is an account of our Experiments, which indeed have not yet proceeded very far; nevertheless I could not longer conceal them from your curiosity, knowing well that from these few observations you will foresee consequences and advantages enough. I have not described the manner of our making this Experiment upon man, which is very different from that which we use upon beasts: but the particular relation would be but tedious and useles to you, since you will behold it more plainly in an example when ever you shall find a convenience to command us to make the same before you. And I assure my self, you will therein admire the dexterity and sagacity of Mr. *Emmeret*, and confess that his industry renders him as happy in this operation as in many others of Chirurgery which are much more difficult; for indeed 'tis done with as much speed as an ordinary phlebotomy, and he that receives new blood complains not of any pain that he feels.

But I perceive that I abuse your patience, and that the length of my letter hath pass'd the bounds wherein the respect I have for the person ought to confine me, I beseech you pardon me this liberty, and be not displeas'd that I take this occasion to consecrate to you my most humble service, and to assure you that I am,

Sir, Your most humble and obedient servant,

Paris, June 25. 1667.

J. DENIS.

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PHILOSOPHICAL TRANSACTIONS.

Monday, October 21. 1667.

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An Account of more Tryals of Transfusion, accompanied with some Considerations thereon, chiefly in reference to its Cautious Practice on Man; together with a farther Vindication of this Invention from Usurpers. The Method of Transfusing into the Veines of Men. Answers to some of the Inquiries formerly publisht concerning Mines. An Extract of a Letter sent from Paris about the Load-stone; where chiefly the suggestion of Gilbert touching the Circumvolution of a Round Magnet, and the Variation of the Variation is examined. An Account of some Books and small Tracts: I. FREE CONSIDERATIONS about SUBORDINATE FORMS, by ROBERT BOYLE Esquire. II. JOH. SWAMMERDAM, M.D. de RESPIRATIONE & USU PULMONUM. III. OBSERVATIONS faites sur un RENARD MARIN, & un LYON, à Paris. IV. HISTORIA AMBRÆ GRISEÆ, Auth. JUSTO KLOBIO, D.

An Account

of more Tryals of Transfusion, accompanied with some Considerations thereon, chiefly in reference to its circumspect Practice on Man; together with a farther Vindication of this Invention from Usurpers.

THis Experiment, as it hath raised Disputes among the Curious, both here and abroad; so it hath put some of them upon considering such wayes, and giving such cautions, as may ren-

der the use of it safe and beneficial. Of the number of these seems to be that *French Virtuoso, Gasper de Gurye de Montpoly*, who in a late *Letter* of his to Monsieur *Bourdelot*, declares to the World, that this is a very Ingenious Invention, and such an one, as may prove very useful; but withall, that, in his opinion, it is to be used with much caution, as not being like to be practised innociously, if imprudent men do mannage it, and the concurrence of two differing sorts of Blood requiring many tryals, and a careful observation of many circumstances, to give assurance. He supposes, that the Blood of every Animal is endowed with its peculiar Temper, and contains in the Aggregate of its parts, different natures, principles, figures, and even a different Centre. Whence he concludes, that two Substances thus differing, and containing plenty of Spirits, are not reducible to one and the same Centre, nor to one and the same Body without *Fermentation*; and that this Operation may prove of danger to him, that shall have admitted into his Veins a strange Blood (wont to be free in its native vessels) without passing through those degrees, that must give it Impressions suitable to the temper and Functions of the Vitals of the *Recipient*. And taking for granted, that no considerat man will hazard a *Total Transfusion*, he acknowledges that a *Partial* one may be in some cases and sicknesses very useful, provided, it be practised circumpectly, upon a Body yet strong enough, and in a moderate quantity, so as the Spirits and Blood of the *Recipient* may be able to dissolve and master the transfused strange Blood, and convert the same into its own nature by a gentle *Ebullition*; to obtain by such a commixture a principle of motion, that may cause a better habit of Body. And he believes, that this *Ebullition* must alwayes happen in Bloods of differing parts and qualities; and that very hardly two Animals, of differing species's, ages and tempers, will be met with, that have Blood so like one another, as not to need *Fermentation*, to make a requisite mixture. He doubts not, that if a substance could be found so resembling that of our Spirits, as that it would immediately unite it self with them, not needing any alteration, the Transfusion of such a Substance would be capable to produce effects little less than miraculous, by relieving the prostrated forces

forces of Nature, and by fortifying in us the Spring of motion and life: In a word, by exciting that Principle of continual Motion, which, whilst it has strength enough, still subdues and gathers to its self whatever is proper to entertain it, and rejects what is not so. But such an Invention as this he sees cause to esteem very difficult, in regard that *different* Moulds cannot but Characterize things *differently*. Hence he proceeds to the Examples, wherein *Transfusion* hath been experimented, even upon *Men*; alledged in that known ingenious Letter of Monsieur *Denys*. And here he intimates, how much he was pleased to learn, that, according to his Conjecture, a *Moderate* Intromission of Blood had well succeeded, and the *Fermentation*, which he foresaw would be caused by the commixture of two Bloods, was made with advantage to the Patient: VVhich he judges did manifestly appear by his Bleeding at the Nose, (a signe of an *Ebullition* made in the Blood:) confirmed to him by this, that an expert Acquaintance of his, transfusing a great quantity of Blood into several Doggs, observed alwayes, that the *Receiving* Doggs pissed Blood.

And as to the other successful Experiment, made upon a healthy and robust man, he notes, that he being a lusty Fellow, stored with blood, and taking the Air, and working hard on the same day that the tryal was made upon him, his vigorous Blood, Spirits, and Constitution, and the strong motion of his Heart, were able to convert into the substance of his own Blood that of the *Lamb* received, and to impart thereto its own nature, and to mould it into Figures futable to the pores where it was to pass, and proper to the functions it was to performe.

But to these Reflections he subjoyns two other *Instances*, of an unlike success; whereof the one is afforded by a *Man*, the other by a *Dogg*. As to the *Man*, it ought to be related beforehand, to prevent wonder or misconstruction, that his Intestins, when he was opened after death, were found to be gangren'd, and consequently, that then he appeared to have been a subject altogether unfit for this Experiment, seeing it was naturally impossible for him to live with such a putrefaction. But to come to the tryal it self; this *Author* saith, that Baron *Bond*, Son to the first Minister of State to the King of *Sweden*, undergoing the

* It were to be wish-
ed the *Author* had ex-
pressed the Interval of
time, wherein these two
operations followed one
another; *that* seeming
to be a material circum-
stance in the Case.

Operation twice, appeared the first time to find new strength by it; but expired soon after the second Operation: * The Ebullition, it seems, of the corrupt Blood having mastered and enervated all the Blood he had in his Body: which, when open'd, no Blood at all was found in his Heart: probably, as the *Author* conjectureth, upon this account, that there being not left in the *Patient* Blood enough of his own, nor strength sufficient to turn a strange Blood into a substance homogeneous to *that*; the Heart was not capable to admit the Blood of the *Emittent*, as consisting of parts disproportionate to his own. But, as has been already observed, his Entrails were altogether vitiated by a *Gangrene*, and he therefore out of the reach of being relieved by this Experiment.

Concerning the other *Instance*, viz. of the *Dogg*, the *Letter* affirms, that that Tryal was made by Monsieur *Gayen* with great exactness, after this manner. He drew three great dishes of Blood from the Dog that was to receive, and weighed the other Dog that was to furnish; and, the operation being perform'd, he weighed him again, and found him weigh less than he did by *two* pounds; of which, having abated an *ounce* more or less, for the Urine, made by the Dog, and an *ounce* or *two* more for the Blood spilt in the Operation, there remained at least *one* pound and a *half* of Blood, that was transfused. But, the *Recipient*, though well dress'd, and well fed, died *five* dayes after, the *Emittent* being yet alive. Whence it seems evident to this *Writer*, that the *too large* Intromission of *new* Blood was predominant over the *Native*, and, as 'twere, overwhelm'd it. Whence he again inculcates the dangerousness of infusing *too much* Blood at once, in regard that such Blood being now separated from that Principle of life it had in the *Emittent*, and as yet destitute of the stamp necessary to live the life of the *Recipient*, it could not be moved and assimilated by the live Blood, which remained in the *Recipient*; and the *Fermentation*, that was made, passed rather to an Eagerness or Sowerness, than to such an one as precedes Digestion. And this kind of eager acidity *he intimates* was seen by the Spectators, and felt by the Receiving Animal, which

which fworded, and remained as dead for half a quarter of an hour : And when some alledged, that the Dog died, because he was wounded in the neck, where he could not lick himself, which rendred his wound incureable, answer was given, that Experiments had been made, wherein not only a Vein was opened, but also an Artery, yea, even the *Aspera arteria* cut of a Dog, that could not lick himself, and yet survived,

This whole Account is concluded with an Admonition, that all those, who have conveniency, would make frequent and exact trials of this Experiment on *Brutes*, and carefully observe *Weight* and *Measure*, and all other circumstances, before any thing be hazarded, that may damnify the publick, and depreciate the Invention.

Abundans cautela non nocet, is a Maxime very fit to be minded here; though several succesful Experiments have been made in *London*, of very plentiful Transfusions; and among others (to mention a signal one) that upon a *Bitch*, which lost in the operation near 30 ounces of blood, and was recruited accordingly. This animal does not only survive to this very day, but had another more severe Experiment soon after tryed upon her, by which her *Spleen* was cut out, without tying up the vessels, whence that *viscus* was separated : Since which time (even before the wound was healed up) she took dog, was with puppy, and brought forth whelps, and remains well and jocond, being kept for a piece of remarkable Curiosity in the House of a Noble-man, that is as severe in Examining matters of fact, as he is able in Judging of their consequences.

So that it is not too hastily to be concluded, that *large* Transfusions are dangerous; but rather frequent Experiments should be made, before any thing be therein determined, with great as well as smaller quantities, both upon sound and sickly Beasts, carefully observing, how either is endured in either, and what are the Effects following thereon.

Before we dismiss this *Subject*, something is to be said of the Cause, why the Curious in *England* make a demurre in practising this Experiment upon *Men*. The above-mentioned ingenious Monsieur *Denys* has acquainted the World, how this degree was ventured upon at *Paris*, and what good success it there met

with : And the *Journal des Sçavans* glorieth, that the *French* have advanced this Invention so far, as to trie it upon *Men*, before any *English* did it, and that with good success.

We readily grant, *They* were the first, we know off, that actually thus improved the Experiment; but then they must give us leave to inform them of this Truth, that the Philosophers in *England* had practised it long agoe upon *Man*, if they had not been so tender in hazarding the Life of *Man* (which they take so much pains for to preserve and relieve) nor so scrupulous to incur the Penalties of the Law, which in *England*, is more strict and nice in cases of this concernment, than those of many other Nations are.

The *Publisher* can assert *bonâ fide*, that several Moneths agoe he saw himself the *Instruments* ready, and heard the *Method* agreed on, thought proper to execute this Operation upon *Man*. And, for further proof thereof, he shall here insert the whole way, peculiarly contrived here for this purpose, by the Ingenious *Dr. Edmund King*, and by him communicated in a Letter; *Monfieur Denys* not having thought fit to describe the *manner* they used in *France* for *Men*; nor any body else, come to our knowledge.

The Letter is as follows,

SIR,

THe Method of Transfusing Bloud you have seen practised, with facility enough, from Beast to Beast; and we have things in a readiness to transfuse Bloud from the Artery of a Lamb, Kid, or what other Animal may be thought proper, into the Vein of a Man. We have been ready for this Experiment these six Months, and wait for nothing but good opportunities, and the removal of some considerations of a Moral nature. I gave you a view, you may remember, a good while agoe, of the Instruments, I think very proper for the Experiment, which are only a Silver Tube, with a Silver Stopper somewhat blunted at one end, and flatted at the other for conveniency of handling, used already upon Beasts with good success. The way

way is in short this. After the Artery is prepar'd in the Lamb, Kid, &c. let a Ligature be made upon the Arm, &c. of a man (hard enough to render the Vein turgid) in the place, you intend to insert the lesser end of the Silver pipe, which is so fitted, that the Silver Stopper, thrust into the Tube, reaches somewhat, by its blunt end, beyond one of the ends of that Tube. This done, divide the skin of the part in the same manner, that is us'd in cutting an Issue, just over the vein, to be open'd. Then with a fine Lance open the vein; or, if you please, in case the Vein lye fair and high (especially if the skin be fine) you may open both together, according to the usual way of letting blood. Which done, let an Assistant clap his finger, or a little bounlster, prepared beforehand, or the like, upon the Vein, a little below the Orifice, to hinder the blood from ascending. Keeping that position, insert the blunt-ended Tube upwards into the Vein; when 'tis in, hold it and the skin close together between your finger and thumb. Then pull out of the Tube the Stopper, and insert the Pipe, by which the Arterial blood is to be infused from the Emitter Animal; managing the remainder according to the known Method of this Experiment.

So far this Letter; which maketh the practicableness of this Method look so fair and easie, that nothing seems wanting to encourage the Trial, but the Direction and Assistance of discreet and skilful men, taking care, not to experiment it upon Subjects, that have their internal parts vitiated; for as much as it seems not reasonable to expect, that this Transfusion should cure *Cacoehymies*, or restore a depraved constitution of the *viscera*.

We would have said no more of this Argument at this time, were we not obliged to remove a mistake found in one of the late *French Journals*, affirming with confidence, that 'tis certain, the

French

French have given the *English* the first *thought* or notion of this Experiment. And why? because (say they) there are witnesses, that a *Benedictine Fryer*, one *Don Robert de Gabets*, discoursed of it at *Monfieur de Monmors*, ten years agoe. Surely, all ingenious men will acknowledge, that the *certain* way of deciding such Controversies as these, is a Publick Record, either written or printed, declaring the time and place of an Invention first proposed, the contrivance of the Method, to practise it, and the instances of the success in the Execution. All this appears in the field for *England*.

Numb. 7. of these *Transactions* (printed *An. 1665. in Decemb.*) acquaints the World, how many years since *Dr. Christopher Wren* proposed the Experiment of *Infusion* into Veins. And this was hint enough for the *R. Society*, some while after to advance *Infusion* to *Transfusion*; for the trial of which latter, they gave order at their Publick Meeting of *May 17. 1665.* as may be seen in their *Journal*, where 'twas registred by the care of their Secretaries, obliged by Oath to fidelity: The trials proving then lame, for want of a fit *apparatus*, and a well contrived *Method* of operation, the Learned Physician and Expert Anatomist, *Dr. Lower*, since found out such a Method, which is not only registred in the same Book, but also published in Print *Numb. 20.* of these *Tracts*; before which time it had been already practised by the said *Doctor* in *Oxford*, who was followed by several ingenious men at *London*, that successfully practised it by the Publick Order of the aforesaid *Society*.

It seems strange, that so surprising an Invention should have been conceived in *France*, as they will have it, ten years ago, and lain there so long in the womb, till the way of Midwiving it into the world was sent thither from *London*: To say nothing of the disagreement, there seems to be about the French Parent of this *fetus*, *Monsieur de Gurye* in the Letter above mentioned, fathering it upon the *Abbot Bourdelot*, but the Author of the *French Journals*, upon a *Benedictine Fryer*.

But whoever this Parent be, that is not so material, as that all that lay claim to this Child, should joyn together their endeavors and cares to breed it up for the service and relief of humane life, if it be capable of it; And this is the main thing aimed at and sollicitd in this Discourse; not written to offend or injure any,

any, but to give every one his due, as near as can be discerned by the *Publisher*.

Answers

To some of the Inquiries formerly publish'd concerning Mines.

That the *Quaries*, scattered up and down in these *Tracts*, may not seem lost, or left un-regarded, the *Publisher* intends to impart at convenient times such of the *Answers*, shall be sent in by observing men, as may be thought acceptable to the *Reader*.

He begins now with an *Account*, communicated to him by the Learned and Inquisitive Mr. *Joseph Glanvil*, who premises in a *Letter*, that he procured the following *Answers* from a Person living near the *Mendip-Mines*, and upon whose relations we may securely depend: Adding, that he does not by these few suggestions think himself absolved of his *Taske*, but shall pursue the matter farther, as soon as he has an opportunity of going into these *Parts*, whence he expects to be farther inform'd.

The *Reader* will be pleased to look back to the said several *Queries*, as they are extant in the *Number 19*; the following *Answers* respecting thither, and being accommodated to the *Mines of Mendip in Somerset-shire*, where the following *Observations* were made; *viz.*

To the 1, 2, 3 *Queries*. That all *Mendip* is Mountainous, yet the Hills not equal in height. That it is barren and cold, and rocky in some places. That the Ridges thereof run confusedly, but most *East* and *West*, and not in any *Parallel* one with another. That upon the *Surface* thereof it is Heathy, Ferny and Furzy; and the Cattle, it feeds, for the most part are Sheep, which go there all the year; and young Beasts, Horses and Colts at Spring and Fall. That the Sheep are not faire, but big-bellied, and will grow to no bigness, after they have been there fed; but will grow fat, if they are removed into better soyle, and so their Beasts and Horses.

To the 4, 5, 6, 7 *Queries*. That the Natives and Inhabitants

H h h

live

live neither longer or shorter, than ordinary, but live healthy, saving such, as are employed about melting of the Lead at the Mines; who, if they work in the smoak, are subject to a Disease, that will kill them, and the Cattel likewise that feed thereabout. The Smoak, that rests upon the ground, will bane them. And therefore the Inhabitants have keepers to keep them from it, for fear of the Infection. That the Country is not furnisht with many Rivers, and Waters, that rise upon the Hills: But from the bottom of the hills there are many Springs round about, both to the *North*, *South* and *West*; and those Waters are very wholesome, and produce Rivers, after they have run to some distance from thence. That the *Air* is moist, cold, foggy, thick, and heavy. That it is observed often covered with mists and fogs; and if any Rain be in the Country thereabout, it is surely there; and 'tis probable, it may arise from the Mineral and Subterraneous Steams. That the *Soyle* near the surface of the Earth is red and stony; and the stones that are drawn out thence, are either of the nature of *Fire-stones*, or *Lime-stones*, but no way *Clays*, *Marly* or *Chalky*.

To the 10, 11, 12, 13, 14, 15 *Queries*. That the *Trees*, growing thereon, have their tops burnt, and their leaves and out-sides discoloured, and scorched with the Wind, and grow to no bigness or stature. That the *Stones* and *Pebles*, that are washed with the Brooks and Springs, are of a *reddish* colour, and ponderous. That *Snow*, *Frost* and *Dew* stay upon *Mendip* longer, then upon any of the neighbouring grounds; but whether the *Dew*, falling upon the ground, will discolour Linnen, I have not observ'd.

To the 16, 17, 18, 19, *Queries*. That *Mendip* is more than ordinary subject to Thunder and Lightning, Storms, Nocturnal Lights and fiery *Meteors*. That the Mists arise out of the *Vales*; but whether they signifie, where the Minerals are, I cannot say. That the *Virgula divinatoria* hath not been known to have been seen used in these parts. That there are no *certain* signes above ground, that afford any probability of a Mine, to my knowledge.

To the *Querie* in the *fifth* Title, I can say little, save only, That the Ore upon *Mendip* lies in *Veines* as a *Wall*; in some places

places deeper, in some shallower; in some places narrower, in some broader; but lies altogether, and is *perfect Lead*, only in the Outside, covered with *reddish Earth*.

To the *Queries* in the *sixth Title*, I cannot say much; it must be resolv'd by them, that melt the Lead-Ore, with which I have not been much acquainted, save only, that they beat the Ore small; then wash it clean in a running stream; then sift it in Iron-Rudders; then they make of Clay or Fire-stone a Hearth or Furnace, which they set in the ground, and upon it build their Fire, which is lighted with Char-coal, and continued with young Oaken-gadds, blown with Bellows by Mens treading on them: And after the Fire is lighted, and the fire-place hot, they throw their Lead-Ore upon the Wood, which melts down into the Furnace; and then with an Iron-Ladle they take it out, and upon sand cast it into what forme they please.

So far this Account, which is hoped will be made in time more compleat, and succeeded with the like *Answers* from other places.

An Extract

Of a Letter, sent from Paris, about the Load-stone; where chiefly the suggestion of Gilbert touching the Circumvolution of a Globous Magnet, call'd Tertella; and the Variation of the Variation, is examined.

This Letter was written by the Intelligent and Experienced Monsieur Petir, Intendant of the Fortifications of his Most Christian Majesty, to the Publisher, as followes;

I Have received yours, wherein you desire to know my sentiment about the present Variation of the Needle, intimating withal, that an Artist in London affirms, that whereas heretofore the Declination was East-ward, 'tis now about one degree and a half to the West.

Nothing can be more welcome to me, than to have occasion given me to discourse of this Subject, especially to the Philosophers of England, whence the Philosophy of the Magnet

had its rise, and whence also the Principal Observations of the *Change* of its Declination are come to us; so that 'tis just that the Observations, made elsewhere concerning the same, should return thither, as to its source.

I shall therefore let you know, that having alwayes been Curious in the Doctrine of the *Load-Stone*, after I had made the Experiments, that are in *Gilbertus* and others, I made that of the Needles *Declination* on three different Meridian-Lines, which I traced *An. 1630.* in several places of *Paris*, and found, that the Needle declined 4¹/₂ degr. *North east*: which having publisht, and made known here to the Curious and to Artists, some of whom counted 9 or 10 degrees according to the Tradition and Writings of *Orontius Fineus*, and *Castelfranc*; others, 11¹/₂ degrees, following *Sennertus* and *Offusius*: all at first rejected my Observation; and as commonly Newthings meet with obstacles and contradictions, before they are establisht, those that could not contradict what they saw, pretended, that this Variety did perhaps proceed from the greater or lesser vigour in the Loadstones, employed to touch with; or from thence, that the Needles had been toucht nearer to or farther from their *Poles*; which might make them decline more or less from the *Meridian*, so as a Needle, being precisely toucht by the *Pole* of a good *Magnet*, might perhaps have no *Declination* at all.

All which conjectures were not without their probability; which was the greater, in regard that all the *Loadstones* I had seen, being rude and like *Flints*, with irregular surfaces, in bunches and cavities, their *Poles* were alwayes ill posited, and often within some of the Cavities, so that one could not be sure to strike the *Needle* thro' the *Pole* of the Stone. To remove which difficulty, and at the same time to find another quality (one of the excellentest of the World, if true,) viz, that which *Gilbert* had assigned to *Terrella's*; I resolv'd, to make the Experiment of it. And because I have not yet written of it, nor any man, I know, (Men having contented themselves with refuting this Error by Discourse only) you will perhaps not be displeas'd to be inform'd of the success thereof.

You

You know, that *Gilbert*, though the first, that has writ rationally of the *Magnet*, and began to say no follies of it, writes about the end of his *Book* (yet *without* being *positive*) that if a *Magnet* altogether round were placed on a *Meridian*, and its *Poles* so posited, as to answer to the *Poles* of the *World*, and consequently its *Axis* to the *Axis* of the *World*, the *Stone* would continually of its self turn round in 24 hours. Whence he inferrs, that the whole *Earth*, as a great *Magnet*, turns also round about its *Axis* in the same space of time.

To explore the truth of this *Proposition* (which I wish were true; since *then* we should have a perpetual motion without wheels, and a *Watch* yet juster than *Penanulums*) I found the means of causing two *Magnets* to be turn'd with the powder of *Emery*; the one whereof having been made *spherical* with all possible exactness, became very solid, plain, and without any visible pores, or diversity of matter, being $1\frac{1}{2}$ inch in *diameter*: the other, bigger, of $3\frac{1}{2}$ inches *diameter*. but of less vigour, porous also and uneven; which made me lay it aside as useless for this Experiment, because, though it had been perfectly *spherical*, as the lesser, I could not be assured, that its *Center of Magnitude* was the same with those of its *Gravity*, and *Strength*; which was requisite to make good *Gilbert's Proposition*.

But for the other smaller *Magnet*, that had no defect, and its three *Centers* were the same, with so much justness, that after I had exactly found the two *Poles* of this *Stone*, I caused two small holes to be made therein, to support it by two points of *Needles*, as by two *pivots*: which having put in a *Meridian* of *Brass*, and suspended the *Ball* betwixt them like a little *Globe*, it was so easily moveable, that I made it turn every way with a blast only of my mouth, and it stopp'd indifferently, now in one, then in another place, not any side of it prevailing by its gravity, nor descending, as it would have done, if any of them had been heavier than another.

This *Stone* thus prepared without any defect in virtue or figure, uniforme, homogeneous, equilibrated, being adjusted on its *Meridian* and a *Horizon*, so placed on its *Meridian-line*, that the *Poles* thereof answer'd to the *Poles* of the *Heavens* (as hath been said already;) the success was, that it had not any *Motion*,

and a small white mark, I had made upon this *Stone*, remained still in the same place, where I had put it, without turning at all: whence I thought the Proposition of *Gilbert* sufficiently re-
futed.

This *Stone*, having serv'd me for this Experiment, did, together with the greater *Stone*, (whereof the *Poles* were also well marked) serve me also to find out, whether the *Needles*, touch'd in different places, nearer to, or further from the *Poles*, had different Declinations. Which having tryed frequently with these, and with other *Stones*, I found no difference at all in the Declination of the *Needles*.

And now to return to the main subject of the Letter, I then observ'd, that all these *Needles* declined then from the *Meridian* 4¹ degrees from the *North* Eastward. And, as I did not suspect, that this declination would have changed, having found it to be the same in many places, from *Brest* in *Brittany* to the *Valto-line* among the *Alpes*, I believed, the *Antients* had ill observ'd, and that the want of their exactness, in respect either of the *Meridian-line*, or the fabrick of their *Needles*, or the division of their *Circles*, was the cause of this defect. But I was soon undeceived of my own Error, when I learned a little while after, by Letters from *England*, that Mr. *Burrows*, Anno 1580. had near *London* observ'd the declination of the *Needle* to be 11. degr. 11. min. as well as *Offusius* and *Sennertus*: And that Anno 1612. Mr. *Gunther*, Professor of the *Mathematicks*, had in the same place found that Declination much diminish'd, having then found but 6 degrees: And lastly, that Anno 1633. Mr. *Gellibrand* had found it but 4. degrees *North-east*, conformable to my Observations. Which did assure me, that those Declinations were not constant, but had varied.

And that I might be convinced by my self, I made from time to time Experiments in divers places, and found still more and more diminution; so that Anno 1660. in *Fune*, after I had very exactly traced a *Meridian* by many *Azimuths*, before and after noon, with a *Brass-Quadrant* of 6. foot diameter, and applyed good *Needles* upon it, the one of 7. the other of 10. inches long, I found that they declined but one degree, or thereabout: And

the last year * I found no more but 10 minutes on the same *Meridian*. Upon which having lately applied, since the receipt of the Letter, the same two *Needles*, me thinks, the *Declination* is yet less, than the last year. But this I can assure you, that the *Declination* is yet some *minutes* towards the *East*, at least at *Paris*. So that you may, upon my word, doubt * of the Observation of your friend, whom perhaps the *Meridian*, or the *Needle*, or the Construction and Division of his Compass may have deceived, to a *degree* and a *half* North-west, which he at the present assigns to the *Declination*. But I doubt not, but in 12 or 15 years it will be found true what he affirms, as I have prognosticated by my *Hypothesis*, which maketh the *Declination* to vary a *degree* every *seven* or *eight* years.

* This Letter was written this present year.

* By the favour of the *Author*, it is not conclusive, that because the *Declination* is yet somewhat towards the *East* at *Paris*, that therefore it must be so at *London*: Since 'tis known here, that even the *Variation* of *White-hall* differs from that of *Lime-house*; which two places are but 4 *English* miles, or thereabout, distant from one another.

This is, what I had to return to the Letter, which I wish might deserve to be presented to your *Illustrious Society*, and contribute something to the discovery of so many admirable vertues lodged in this Stone, and principally to the finding out of the *Cause* of this *Variation*; for which I have already made some attempt, and propos'd my thoughts in a *Dissertation de Latitudine Parisiensi & Magnetis Declinatione*, which *M. du Hamel* caus'd to be printed *Anno 1660*. with his *Astronomia Physica*. I shall be very glad, to learn the sentiment of your Learned Philosophers thereupon, and what cause they suspect there is of so singular an effect. I could discourse to you of other particulars touching the Proprieties of the *Load-stone*, and especially of a remarkable one, I have discover'd, and which, if I am not deceived, subverts that *Theory*, which undertakes to explicate all these effects by the *Particula striata*; but I reserve that for another occasion.

An Account of some Books.

II. FREE CONSIDERATIONS about SUBORDINATE FORMS; by the Honourable ROBERT BOYLE

THIS Tract is an *Appendix* to the Noble Author's *Examen of Substantial Forms*, published last year, and reprinted this. There hath been already given an Account of the principal Part, as appears by *Numb. II.* 'Tis very fit the like should be done now of this considerable *Appendix*.

First then it clears up and states the Doctrine about *Subordinate Forms*, as it is maintain'd by divers learned *Moderns*, especially *Sennertus*, who teacheth, that beside the *Specifick Form* (so called by him) there may reside in Animals and Plants, certain other Forms, so subject to the predominant *Mistress-Form*, that they deserve the Title but of *Subordinate Forms*, and during the Reign of the *Specifick*, are subservient to it; yet when *that* is deposed or abolisht, these *Inferiour Forms* may come to set up for themselves, *viz.*

This done, the Author tries, Whether the *Phænomena* and Effects of these pretended *Subordinate Forms* may not be as well as the principal ones, intelligibly explicated by the *Mechanical Principles*, *vid. Matter and Motion*, and the thence resulting *Shape and Texture*. Which that it may be done, is so happily made out in this *Tract*, that a Rational, Unprejudiced and Attentive Reader cannot but embrace the *Author's Doctrine*, and, according to it, be satisfied, that the portions of Matter, that are endowed with these pretended *Subordinate Forms*, cannot pay the presumed *Superintendent Form* any other obedience, then some such kind of one, as the parts of a *Clock* or *Engine* may be said to yield to one another. So that the whole matter may be well conceived to be nothing but this; That, when divers bodies of differing natures or *Schematisms* come to be associated so as to compose a Body of one denomination, though each of them be supposed to act according to its own peculiar nature, yet by reason of the coaptation of those parts, and the contrivement of the compounded Body, it will many times happen, that the
action

action or effect produced, will be of a *mixed* nature, and differing from that, which several of the parts consider'd as *distinct* Bodies or Agents, tended to, or would have perform'd ; As when in a Ballance, by putting in a weight into one of the Scales, the opposite Scale, though as a heavy body, it will naturally tend downwards, yet by virtue of the fabrick of the Instrument is made to mount upwards. So that those Actions, which Scholastical men attribute to the conspiring of subordinate *Forms* to assist the *specifick*, are but the resultant actions of several Bodies, which being associated together, are thereby reduced in many cases to act jointly, and mutually modify each others actions ; and that which they ascribe to the dominion of the *Presiding* Form, is to be imputed to the structure and connexion of the parts of the compound-ed Body.

This the Author confirms and illustrates by many very instructive Examples and Comparisons, taken from manual Arts and Practises, Physicks, Chymistry, &c. And applying his doctrine about these *subordinate Forms* to inanimate Bodies, he sums up the heads of all, and casts them into 9 distinct Propositions, which are ;

1. The word *Form* is of an indeterminate signification.
2. 'Tis not easie, to decide the *Nobleness* of Forms.
3. In divers Bodies the Form is attributed upon the account of some eminent *Property* or *Use* ; which if it be present and continue, though many other things supervene, or chance to be wanting, the matter is nevertheless lookt upon, as retaining its Form, and is wont to be allow'd its usual denomination.

4. By reason of the Conjunction or Connexion of the *parts*, that make up a *whole* (or, at least an Aggregat of Bodies, that for their connexion are looked upon as such) it will often happen, that several things will be perform'd by the joint or concurrent Action of these united or coherent parts.

5. We may yet in a *sound sense* admit, that in some Bodies there may be *subordinate Forms*.

6. The supervening of a new Form is often but accidental to the Pre-existent Form, and (*then*) does not at all destroy its nature, but modify its operations.

7. Besides the *Specifick* actions of a Body, that harbours *subordinate Forms*, there may be divers others, wherein some of the

Parts or Ingredients may act according to their particular and pristine nature.

8. In divers Bodies, that which is call'd or look'd upon as the *Specifick* Form, is often not so much as the *Presiding*, but only the *most eminent*.

9. The Forms discoursed of, seem to be rather *concurrent*, than *subordinate*.

To each of these *Propositions* are annexed short *Comments*, full of very pertinent and teaching Instances, Relations, Comparisons, &c. for which the *Reader* is referred to the Book it self.

II. *Joh. SWAMMERDAM, M. D. Amsterodamensis de RESPIRATIONE & VSV PVLMONVM.*

THis *Author* is of opinion, that all those *Philosophers*, who have hitherto inquired into the *Nature* and *Use* of *Respiration*, have only caught the shadow of it, nothing of the substance. And of this he gives this for the chief reason, because they have been too negligent in considering the first manifest motion of the Breast and Lungs in a *Fetus*; which particular being understood, he thinks it very easie to judge of the *Respiration* of *born* Animals. He scruples not to reprehend the immortal Doctor *Harvey*, for having excluded from the office of the Lungs the *Vse* of *Refrigeration*; which he pretends to have asserted himself by most evident Experiments, and uncontrolable Reasons.

To represent distinctly, what he undertakes to make out in this *Traкт*, we may take notice of these particulars:

1. He takes pains to refute the *Doctrine* of *Attraction*, and to substitute in its place the *Doctrine* of *Pulsions* or *Intrusion* of Air into the Lungs.

2. He endeavours to assert, that the Lungs do not *fall down*, but are by the Breast *contracted*.

3. He affirms, to have clearly shew'd, what is the proper function and work of the *Diaphragme*, and other *Muscles* serving for *Respiration*.

4. He pretends, to have experimentally evinced the *Genuine Use* of *Respiration*, and the *Benefit* thence resulting to the *Animal Life*.

In *short*, He makes *Respiration* to be a Motion of the *Thorax* and Lungs, whereby the Air is sometimes impelled by the Nose, Mouth and Wind-pipe into the Lungs; and thence again expelled; farther to elaborate the Blood, by *Refrigerating it*, and by Separating its *fuliginous steams*, and so raise it to its ultimate and highest perfection, for the Conservation of the Life of Animals.

Notice may be taken here by the by, that this *Author* in his *Preface* promises the publishing of a *Treatise* about *Insects*; in which he engages to shew many wonderful things in those little and seemingly contemptible Creatures, and in particular to demonstrate to the Eye the very method and manner how a *Caterpillar* is transmuted into a *Chrysalis* or *Aurelia*: By performing of which, he hopeth, he shall make the *Curious* bear more easily the loss of *Dr. Harvey's* *Treatise* on that Subject.

III. *Observations faites sur un GRAND POISON, & un LION, dissequés dans la Bibliothèque du Roy à Paris, le 24. & le 28. Juin, 1667,*

THis *Great Fish*, dissected by the *Parisian* Philosophers, was a *Vulpecula Marina* (a Sea-fox:) in which they observ'd; *First*, The length of his Tail, equalling very near the whole length of the rest of his body, (the whole Fish being 8 feet long) and fashioned after the manner of a Sithe, bowed and turned up toward the belly.

Secondly, His *Mouth* was armed with two sorts of Teeth; one sort in the upper Jaw, being pointed, hard and firme, and of one only bone, in the manner of a *Saw*: the other sort, found in the rest of the upper, and in the whole under-Jaw, were moveable, and fastned by fleshy membranes.

Thirdly, His *Tongue* did altogether adhere to the lower Jaw, and its skin was hard and covered with little shining points, which rendred it very rough and scabrous one way. The points viewed with a Microscope, appeared transparent like Chrystal.

Fourthly, His *Throat* was very large, and the *Oesophagus*, as large as his Maw; concerning which *Authors* say, that he hath the dexterity of disengaging himself from the swallowed hook, by casting it up together with his *Maw*, the inside of it turned out. They

found in his *Maw* the Sea-herb, *Varec*, 5. inches long, and a *Fish* of the like length without head, scales, skin and guts, all being wasted but the musculous flesh, which remained entire.

Fifthly, The superior part of his *great Gut* had this peculiar, that instead of the usual circumvolutions of *Guts*, the cavity of this was divided transversly by many partitions, consisting of the membranes of the *Gut* turned inwards, and in the figure of a *Vice*, like *Snail-shells*, or winding *Stairs*.

Sixthly, His *Spleen* was double; his *Liver* divided into two *Lobes*; the *Gall* found to have more of bitter than sower: the *Heart*, without a *Pericardium*, as big as a *Hens* egge; the *Head* almost nothing but a mass of *Flesh*, very little *Brains* in it, and that which was there, having very few meanders or windings: the *Eyes*, bigger than those of an *Oxe*, only half-spherical, flat before; the *Sclerotica* formed like a *Cup*, very thin, but very hard; the *Cornea* very tender and soft; the *ChrySTALLIN* perfectly spherical; the *Vuea* grayish; the *Choroides* of the same colour, and pierced, for the production of the *Retina*, by a very large hole: the bottom of this *Choroides* had that lustre of *Mother of Pearl*, which is found in *Terrestrial Animals*, but with less vivid colours: and the *Retina* was also streaked with very apparent sanguineous *Vessels*.

The *Observables* in the *Lyon* were,

In *general*, that for outward shape, and the constitution of many parts, as the *Claws*, *Teeth*, *Eyes*, *Tongue*, (besides the likeness of the *Viscera*) a *Lyon* resembles very much a *Cat*.

In *particular*, an admirable structure of his *Claws*; a peculiar shape and position of his *Teeth*; a very stiffe *Neck*; a mighty rough and sharp *Tongue*, having points like claws both for hardness and shape. *Eyes* very clear and bright, even after death, which without closing the *Eye-lids*, *Lyons* can cover with a thick and blackish membrane, placed towards the great *Angle*, which by raising it self and reaching towards the small *Angle*, can extend it self over the whole *Cornea*, as tis in *Birds*, but especially in *Catts*: The reverse of the anterior *Vuea*, where it lyes over the *ChrySTALLIN*, is altogether black: the *ChrySTALLIN* very flat, and its greatest convexity, which is not usual, in its anterior part, as tis in *Cats*: the *Aqueous* humour very plentiful, equalling almost the sixth part of the *Vitreous*, which plenty was judged to be the cause of the brightness, that remains in the *eyes* after death.

His

His *Throat* was not above an Inch and a half large: the *Stomach*, 6 inches large, and 18 inches long: all the *Guts* 25 foot long: the *Liver*, divided into 7 *Lobes*, as in *Cats*; its cavity under the *Bladder of Gall* was full of Gall, shed abroad in the substance of the *Liver*, and of the neighbouring parts; which was suspected by the Physicians, administering this operation, to have been the cause of this *Lyon's* death: the *Bladder of Gall* was 7 inches long, and 1½ inch large, of a peculiar structure: the *Spleen*, a foot long, 2 inches large, and ½ inch thick: the *Kidney* weighed somewhat above 7 ounces: the *Genitals* of a peculiar conformation, causing this Animal to cast his Urine backwards, and to couple like *Camels* and *Hares*.

His *Lungs* had 6 *Lobes* on the right side, and 3 on the left: the *Wind-pipe* had its annular Cartilages *entire*, excepting two or three; it was above four inches in compass, being very firme, and by this bigness and firmness enabling a *Lyon*, strongly to thrust Air enough through it, for his dreadful roaring.

His *Heart* was dry, and without water in the *Pericard*; much greater in proportion, than of any other Animal, being six inches long, and four inches large towards the *basis*, and terminating in a sharp point. It had very little flesh, and was all hollow; the *Ventricles* very large; the *Auricles* very small: the proportion of the branches, which the ascending *Aorta* casts out, was such, that the *Carotids* were as big, as the left *Subclavial* branch, and as the rest of the right *Subclavial*, whence they issue; Which is considerable, seeing the *Brain* is so small: For the *Brain* was but two inches big, of any dimension; the rest of the head being very fleshy, and consisting of very firm *Bones*. By comparing the little quantity of the *Lyon's Brain* with the plenty of that of a *Calf*, it was Judged, that the having but little Brain is rather a mark and a cause of a fierce and cruel temper, than want of wit. Which conjecture was strengthened by the observation formerly made in the *Sea-Fox*, in whom almost no Brains was found, though it be thought, that his craft and address hath occasioned men to give him that Name.:

IV. HISTORIA AMBRÆ, *Authore* JUSTO KLOBIO, D. *in Academ. Wittebergenfi.*

THis Author reckons up 18 Opinions concerning *Ambergrife*, and having examined every one of them, he embraces that, which holds, That it is the *Dung* of a *Bird*, (called in the *Madagascar* Tongue, *Aschibobuch*;) of which he gives the description out of *Odoardus Barbosa* and others; who affirm it to be of the bigness of a *Goose*, curiously feather'd, with a big head, well tufted. These *Birds* being found in great numbers in *Madagascar*, the *Maldives*, and other parts of the *East Indies*, are affirmed by *Authors* to flock together in great numbers, as *Cranes*; and frequenting high *Cliffs* near the *Sea-side*, and there voiding their *Excrement*, the *Sea* washes it thence, if it fall not of its self into it.

There is another opinion among the said 18, for which the *Author* hath a good inclination, but yet dares not embrace it; *viz.* that 'tis the *Excrement* of a certain kind of *Whales*. If this *Amber* were but in those other places, where there is good store of such *Whales*, it seems that would make the *Author* relinquish the former Opinion.

This puts us in mind of a *Relation*, to be met with in *Purchas*, which, giving an Account of a certain Commission for a Gentleman to go Factor into *Greenland* for the killing of *Whales* and *Morses*, takes notice, among other Particulars, of a sort of *Whales*, called *Trompa*, having but one Trunk on his head, whereas the *Sarda*, another kind of *Whales*, hath two. This *Trompa*, (saith that *Author*) hath teeth of a span long, and as thick as a mans *Wrist*, but no *Finns*. In his *Head* is the *Sperma Ceti*, saith he farther, and in his *Entrails*, the *Amber-greese*, being in shape and colour like *Cowes-dung*. Express order was given in the said Commission, that the person deputed should himself be present at the opening of this sort of *Whale*, and cause the residue of the said *Entrails* to be put in small *Casks*, and bring them along with him into *England*.

This will give occasion to increase our *Inquiries* for *Greenland*; which perhaps may be inserted in the *Book* of the next Month.

An Account

Of an Experiment made by M. Hook, of Preserving Animals alive by Blowing through their Lungs with Bellows.

This Noble Experiment came not to the Publisher's hands, till all the preceding Particulars were already sent to the Press, and almost all Printed off; (for which cause also it could not be mentioned among the Contents:) And it might have been reserved for the next opportunity, had not the considerableness thereof been a motive to hasten its Publication. It shall be here annexed in the Ingenious Author his own words, as he presented it to the Royal Society, Octob. 24. 1667. the Experiment it self having been both repeated (after a former successful trial of it, made by the same hand a good while agoe) and improved the week before, at their publick Assembly. The Relation it self follows;

I Did heretofore give this *Illustrious Society* an account of an Experiment I formerly tryed of keeping a Dog alive after his *Thorax* was all display'd by the cutting away of the *Ribbs* and *Diaphragme*; and after the *Pericardium* of the Heart also was taken off. But divers persons seeming to doubt of the certainty of the Experiment (by reason that some Tryals of this matter, made by some other hands, failed of success) I caus'd at the last Meeting the same Experiment to be shewn in the presence of this *Noble Company*, and that with the same success, as it had been made by me at first; the Dog being kept alive by the Reciprocal blowing up of his Lungs with *Bellows*, and they suffered to subside, for the space of an hour or more, after his *Thorax* had been so display'd, and his *Aspera arteria* cut off just below the *Epiglottis*, and bound on upon the nose of the Bellows.

And because some Eminent Physicians had affirm'd, that the *Motion of the Lungs* was necessary to Life upon the account of promoting the Circulation of the Blood, and that it was conceiv'd, the Animal would immediately be suffocated as soon as the Lungs should cease to be moved, I did (the better to fortifie my own *Hypothesis* of this matter, and to be the better able to judge of several others) make the following additional Experiment; *viz.*

The Dog having been kept alive, (as I have now mentioned) for above an hour, in which time the Tryal had been often repeated, in suffering the Dog to fall into *Convulsive* motions by ceasing to blow the Bellows, and permitting the Lungs to subside and lye still, and of suddenly reviving him again by renewing the blast, and consequently the motion of the Lungs: This, I say, having been done, and the Judicious Spectators fully satisfied of the reallity of the former Experiment; I caused another pair of Bellows to be immediately joyn'd to the first, by a contrivance, I had prepar'd, and pricking all the outer-coat of the Lungs with the slender point of a very sharp pen-knife, this second

pair of Bellows was mov'd very quick, whereby the first pair was alwayes kept full and alwayes blowing into the Lungs; by which means the Lungs also were alwayes kept very full, and without any motion; there being a continual blast of Air forc'd into the Lungs by the first pair of Bellows, supplying it as fast, as it could find its way quite through the Coat of the Lungs by the small holes prick'd in it, as was said before. This being continued for a pretty while, the Dog, as I expected, lay still, as before, his eyes being all the time very quick, and his Heart beating very regularly: But, upon ceasing this blast, and suffering the Lungs to fall and lye still, the Dogg would immediately fall into Dying convulsive fits; but be as soon reviv'd again by the renewing the fulness of his Lungs with the constant blast of fresh Air.

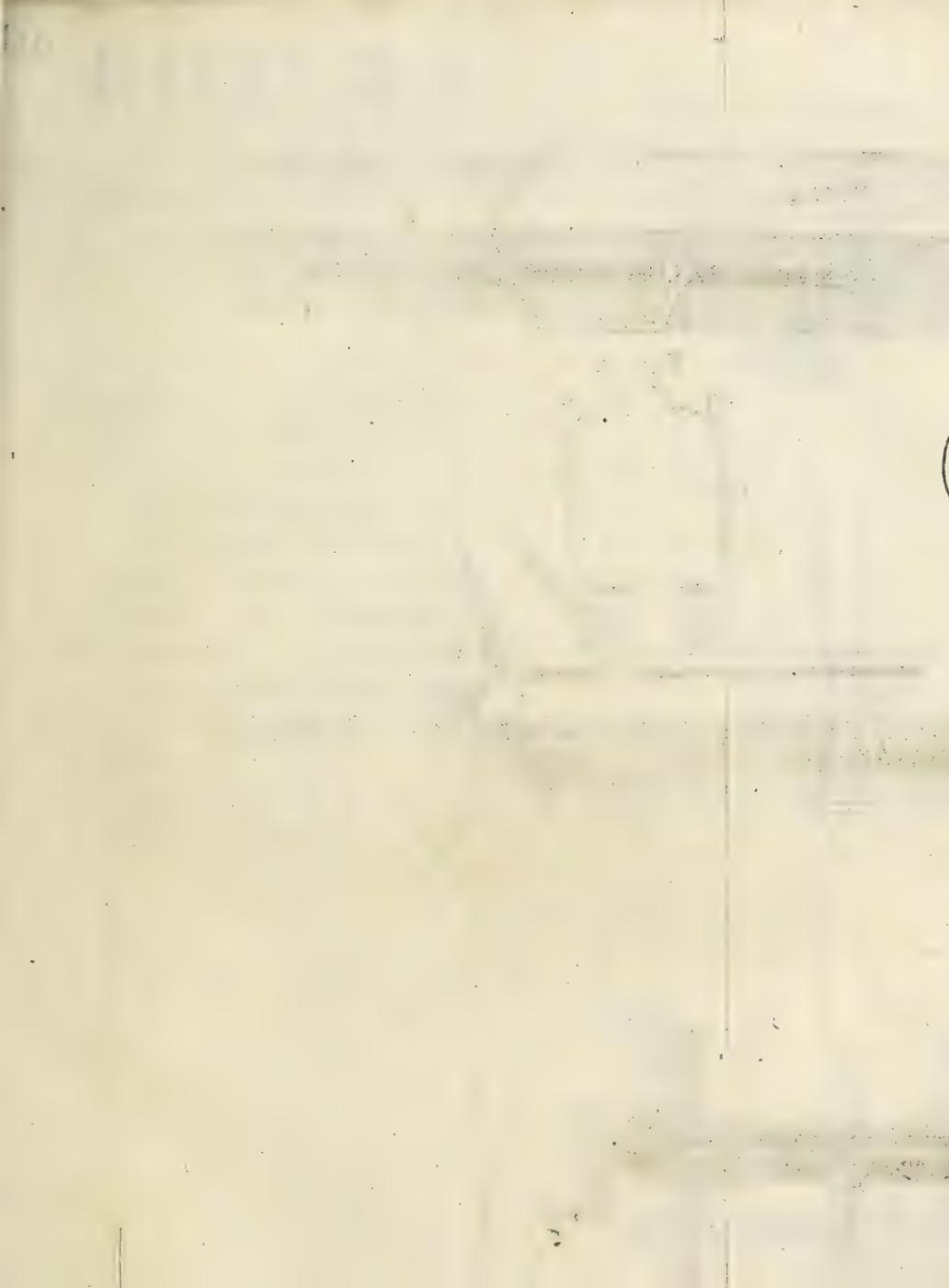
Towards the latter end of this Experiment a piece of the Lungs was cut quite off; where 'twas observable, that the Blood did freely circulate, and pass thro' the Lungs, not only when the Lungs were kept thus constantly extended, but also when they were suffer'd to subside and lye still. Which seem to be Arguments, that as the *bare* Motion of the Lungs *without fresh Air* contributes nothing to the life of the Animal, he being found to survive as well, when they were not mov'd, as when they were; so it was not the subsiding or movelessness of the Lungs, that was the immediate cause of Death, or the stopping the Circulation of the Blood through the Lungs, but the *want* of a sufficient *supply of fresh Air*.

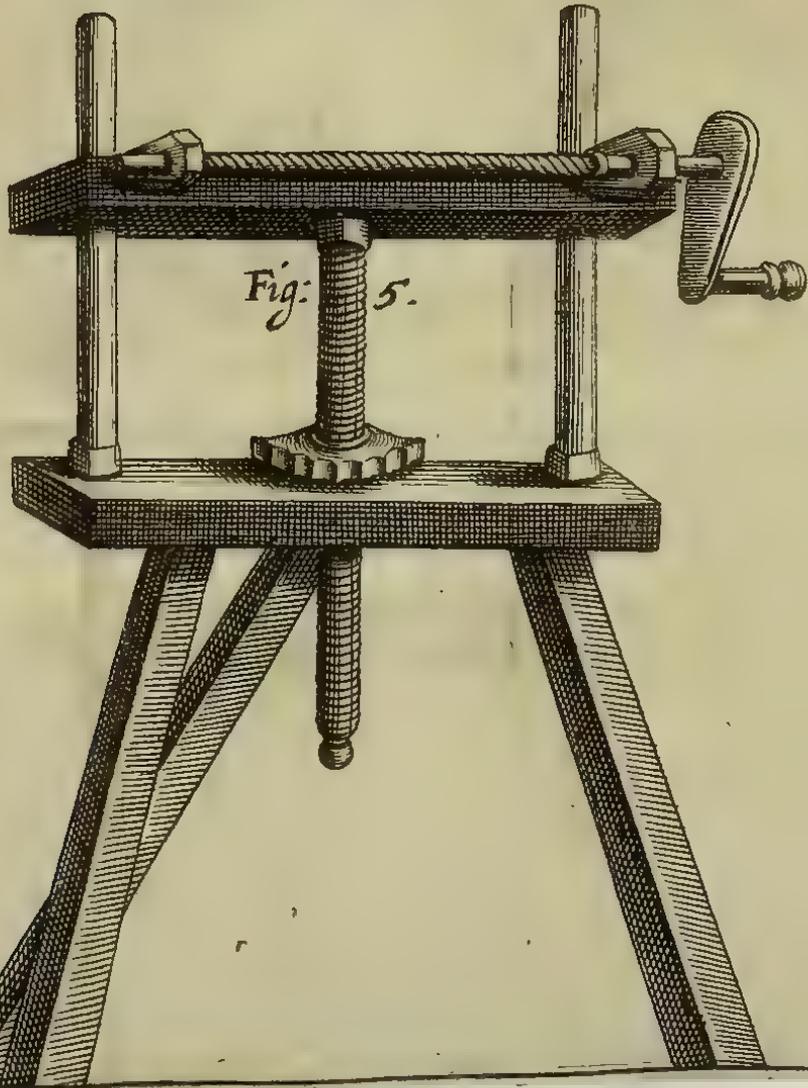
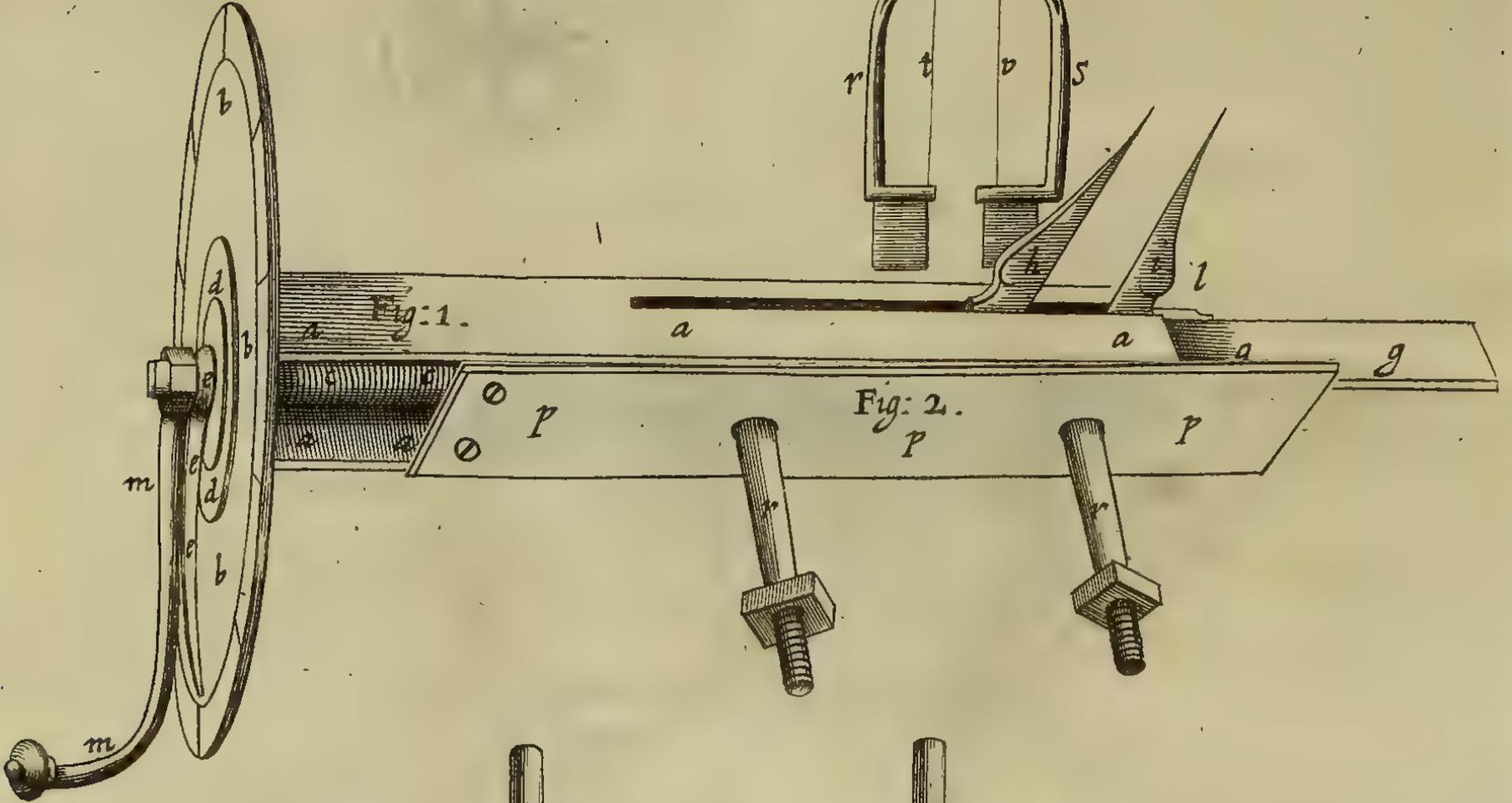
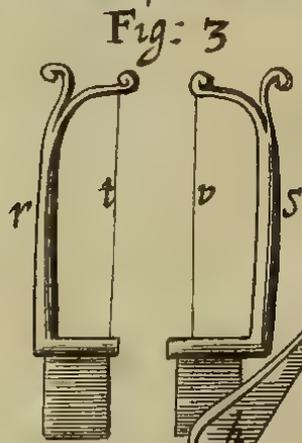
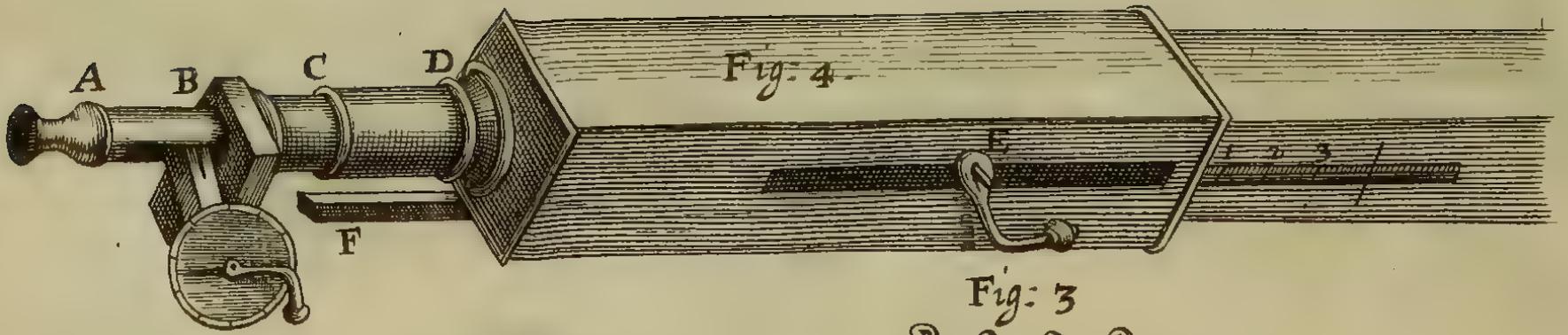
I shall shortly further try, whether the suffering the Blood to circulate through a vessel, so as it may be openly exposed to the fresh Air, will not suffice for the life of an Animal; and make some other Experiments, which, I hope, will thoroughly discover the *Genuine use of Respiration*; and afterwards consider of what benefit this may be to Mankind.

F I N I S.

In the SAVOY,

Printed by T. N. for John Martyn, at the Bell
a little without Temple-Bar, and Nathaniel Brooks at the Angel in Gresham-Colledge,
1667.





PHILOSOPHICAL TRANSACTIONS.

Monday, *Novemb.* 11. 1667.

The Contents.

A description of an Instrument for Dividing a Foot into many thousand parts, and thereby measuring the Diameters of Planets to great exactness, &c. as it was formerly promised. An account of making a Dog draw his Breath just like a Wind-broken-Horse. Divers Anatomical Observations on Humane Bodies. Several Instances of Peculiarities of Nature, both in Men and Brutes. A Confirmation of the Experiments, mentioned in Numb. 27. to have been made in Italy, by Injecting Acid Liquors into Blood. An Observation about the double Membrane call'd Epiploon, which covers the Entrals of Animals, and is fill'd with Fatt. Some Hortulan Communications, about the curious Engrafting of Orenge and Lemons or Citrons upon one anothers Trees, and of one Individual Fruit, half Orenge and half Lemon, growing on such Trees. An imitation of a way of preserving, in the more Northern Climats, Orenge-Trees all winter long, without any Fire. Inquiries for Greenland, An Account of the Synopsis NOVÆ PHILOSOPHIÆ & MEDICINÆ Francisci Travagini, Medici Veneti.

A Description.

Of an Instrument for dividing a foot into many thousand parts, and thereby Measuring the Diameters of Planets to great exactness, &c. as it was promised, Numb. 25.

If the residence of the worthy Promiser of this Instrument, Mr. Richard Townley, had not been so remote from London, nor

some other impediments interven'd, (after it was come to hand,) First on the Publisher's, then on the Engraver's side, the following Particulars concerning the same, promised some Moneths ago, had been imparted to the Publick a good while before this time. For the draught of the Figures, representing the New Instrument itself, and the Description of the same, we are obliged to the ingenuity of Mr. Hook.

THE 1. 2 and 3 Figures, do represent the several parts of this Instrument; the 4th Figure, part of the Telescope with the Instrument applied to it, and the 5th, the Rest, on which the whole reposeth.

The 1. Figure represents the Brass-boxe with the whole Instrument, (excepting onely the Moveable Cover.) and the Screws, by which it is fixt to the Telescope. In this Figure (a a a a) is a small oblong Brass-box, serving both to contain the Screws, and its Sockets or Femal Screws, and also to make all the several moveable parts of the Instrument to move very true, smooth, and in a simple direct motion. To one end hereof is screwed on a Round plate of Brass (b b b b) about 3 inches over; the extream Limb of whose outside is divided into a 100 equal parts, and numbered by 10. 20. 30. &c. Through the middle of this Plate, and the middle of the Box (a a a) is placed a very curiously wrought Screw of about the bigness of a Goose-quill, and of the length of the Box, the head of which is by a fixed Ring or Shoulder, on the Inside, and a small springing Plate, (d d) on the Outside, so adapted to the Plate, that it is not in the least subject to shake. The other end of this Screw is by another little Screw (whose small point fills the Center or hole made in the end of the longer Screw, for this purpose) rendred so fixt and steady in the Boxe, that there appears not the least danger of shaking. Upon the Head of this Screw without the Springing-Plate, is put on a small Index (e e) and above that a Handle (m m) to turn the Screw round, as often as there shall be occasion, without at all endangering the displacing of the Index; it being put on very stiff upon a Cylindrical part of the Head, and the Handle upon a Square. The Screw hath that 1/3rd of it, which is next the Plate, bigger than the other

other *two Thirds* of it, by at least as much as the depth of the *small Screw*, made on it: The *thread* of the *Screw* of the bigger *Third* is as small again, as that of the *Screw* of the other *two Thirds*. To the *grosser Screw* is adapted a *Socket* (*f*) fastned to a long *Barr* or *Bolt* (*g g*), upon which is fastned the *Moveable Sight* (*h*), so that every turn of the *Screw* promotes the *Sight* (*h*) either a *thread* nearer, or a *thread* farther off from the *fixt Sight* (*i*) The *Barr* (*g g*) is made exactly equal and fitted into two small *Staples* (*k k*) which will not admit of any shaking. There are 60 of these *threads*; and, answerable thereto, are made 60 *divisions* on the edge of the *Bolt* or *Ruler* (*g g*;) and a small *Index* (*l*) fixt to the *Boxe* (*a a a*) denotes, how many *threads* the *Edges* of the two *Sights* (*h*) and (*i*) are distant; and the *Index* (*e e*) shews on the *Circular Plate*, what part of a revolution there is more; every revolution, as was said before, being divided into 100 parts. At the same time that the *moveable Sight* (*h*) is moved forwards or backwards, or more *threads* of the *Courser Screw*, is the *Plate* (*pp*. in *Fig. 2.*) by the means of the *Socket* (*q*) to which it is screw'd, moved forward or backward, or more *threads* of the *finer Screw*: So that this *Plate*, being fixt to the *Telescope* by the *Screws* (*rr*. in *Fig. 2.*) so as the middle betwixt the *Sights* may lye in the *Axis* of the *Glass*, however the *Screw* be turn'd, the midst betwixt the *Sights* will always be in the *Axis*, and the *Sights* will equally either open from it, or shut towards it.

Figure 2. represents the *moveable Cover* containing the *Screws*, to be by the *Bookfeller* cut off, by the *pricked Line* (*xxx*) from the *Paper*, and to be fitly placed on *Figure 1.* according to the *pricked Line* (*yyy*) answering thereto; that by the taking off, as it were, or folding up of this *Cover*, the *inward* contrivance of the *Screws* and *Sights* may appear.

And because it is conceived by some ingenious men, that it will be more convenient, instead of the *Edges* of the two *Sights* (*h* and *i*) to employ two *Sights* fitted with hairs, therefore is added *Figure 3.* representing the two *Sights* (*r*. and *s*.) so fitted with *threads* (*t*. and *u*.) that they may be conveniently us'd in the place of the *solid Edges* of the *Sights* (*h*. and *i*.)

The 4th *Figure* represents, How the *Screws* are to be put on.

K k k 2

The

The *Tube A D* is divided into 3 lengths ; of which (as in ordinary ones) *BC* is to lengthen or contract, as the Object requires : But *A B* is here added, that at *A*. you may put such *Eye-glasses* as shall be thought most convenient, and to set them still at the distance, most proper for them, *Indexes* or *Pointers*, which here are suppos'd to be at *B*. which length alters also in respect of divers persons Eyes. *E*. is a *Screw*, by which the *Great Tube* can be fixt so, as by the help of the figures, any smaller part of it can immediately be found, measuring only, or knowing the *divisions* on *BC*, the distance of the *Object-glass* from the *Pointers*. *F*. is the *Angular* piece of wood, that lies on the *upper Screw* of the *Rest*. This *Rest* is represented by *Figure 5*.

As for a Description of the *Uses* of this ingeniously contrived and very curious *Engine*, the *Reader* is desir'd to look back to the before alledged *Numb. 25*.

An Account

Of making a Dogg draw his Breath exactly like a Wind-broken, Horse as it was devised and experimented by Dr. Richard Lower ; with some of his Instructive Observations thereon.

This Experiment was made before the R Soc. Octob. 17. 1667. after it had been tryed by the Author in private, some while before. The Account of it in his own words and as follows.

After I had often consider'd the *manner* and way of *Respiration*, and by many Observations been induc'd to believe, that the *Diaphragme* is the *chief Organ* thereof, I thought, there could be no way more probable to try it, then by breaking the *Nerves*, by which its Motion is perform'd: Which may be easily (as it was actually) done after the following manner ;

First, pierce the side of the Animal between the 6. and 7 *Ribb* in the middle of the *Thorax*, just over against the region of the Heart, with a small *Incision-knife*, passing the knife but just into the Cavity of the Breast. (which you may justly know by finding no resistance to the point of it ;) then take it out, and put in a *Director*, or a small *Quill* made like it, and thrust it in about an *Inch*, directing the end of it toward the *Sternum*, close to the inside of the Breast. Then cut upon it about an *inch* on the *Intercostal Muscles* ; by which you may be secur'd from touching the
Lungs

Lungs with the point or edge of your knife. This done, put in your finger, and with your nail separate the *Nerve*, which passeth along the side of the *Pericardium* toward the *Diaphragme*. Then put in a *Probe*, a little inverted at the end like a hook, and apprehend the *Nerve*, and pull it to the Orifice of the Breast, and cut it off, and sow the hole up very close. Do the same on the other side, and presently let the Dog loose, and you will plainly see him draw his breath exactly like a *Wind-broken Horse*: Which yet you will see plainer, if you run him a little in a string after he is cut. But that any one may perform this Experiment the easier, let him first take notice, how the *Nerves* of the *Diaphragme* pass along on each side of the *Pericardium* in a *dead Animal*, before the trial be attempted in a *Living* one.

The most obvious *Observations* from this Experiment, are:

1. That the whole *manner* of *Respiration* is quite alter'd. For, as in a *sound Animal*, in *Inspiration* the Belly swells by the lifting up the Bowels by the *Contraction* of the *Diaphragme*; and in *Expiration* the Belly falls by the *Relaxing* of the same: In a *wind-broken Dog* or *Horse* 'tis quite contrary. For in them it is to be seen plainly, that when they draw their breath, their Belly is drawn in very lank and small, and when they breath up, their Belly is relaxt and swells again.

2. It being certain, that the *Lungs* do not move of themselves at all, but wholly depend upon the *Expansion* of the *Thorax* by the *Intercostal Muscles*, and the *Diaphragme*; by this Experiment it doth appear, how much the *single* motion of either of them doth particularly contribute to *Respiration*. For, all *Inspiration* being made by the *Dilatation* of the *Thorax*, and that *Dilatation* being caused partly by the *Intercostal Muscles* drawing up the Ribs, and partly at the same time the *Diaphragme* by its *Contraction* drawing downward the lower small Ribs, to which 'tis joyned, and also lifting up the *Viscera* of the lower Belly, by which they do jointly make all the space, they can, for the Air to come in and distend the *Lungs*: It must hence necessarily follow, that the *Intercostal Muscles* and the *Diaphragme* being constituted for two distant Employments (though both to the same end) and neither being able to perform the others Office, where one ceaseth from it's work, the other for the exigence of Nature must take more pains to

supply the others defect. Which is very evident to be seen; for, the *Diaphragme* being made useless by loosing its *Nerves*, the *Intercostal Muscles* do dilate the Ribs much more than formerly, even to the utmost distance they can, when there is need for it; as, when you make the Dog run a little after he is cut, or when you gallop a *Wind-broken Horse*, doth manifestly appear.

3. The *manner* of Respiration being the same in a *Dog*, whose *Diaphragme-nerves* are cut, and in a *Wind-broken Horse*, 'tis more than probable, that the *Cause* may be as nearly the same, as the *Signes* are; and that, though there may be *other* faults found in the Lungs of such Creatures, yet 'tis very likely, they may be induced from the *weakness* of Respiration, but that they had their *Occasion* from the *Relaxation* or *Rupture* of the *Nerves* of the *Diaphragme* at first: which will seem more credible, if we remember, that by the streining of the *Midriff* too much (by which the *Nerves* may be quite broken or stretcht beyond their proper tone) most commonly that accident happens.

Anatomical

Observations on a Humane Body, dead of odd Diseases; as they were communicated by Dr. Nathanael Fairfax.

A Young Maid of *Rumborough* in *Suffolk*, when she was about thirteen years of age, took *Chalybeats* for the *Green-sickness*, and found some relief by it, but was after much pent in her wind. From 16. to 22. she much afflicted her self for the Death of her Father and Mother, and the misbehaviour of a Brother; during which time, she had every year an *acute* disease or two. At 18, she was very weakly, clogg'd in her Chest, and melancholy. If she went out in a windy day, she was fain to make hast in; for the wind, *she said*, was ready to choak her. She was a very slow Walker, going up-hill or up-stairs with much difficulty. She was now observed to be very *thirsty*, usually drinking at Bed-time, and in the night too, sometimes; else, *she said*, she should be choak't with drought. Between 21. and 22. of her age, going down stairs, she heard a frightful Jolking in her Breast; which she then made known to the rest of the house, who when she shew'd them the manner of it by shaking her Body, joyn'd all with her in the wonder, concluding (as most would have done by the noise) that her Breast was almost full of water. She took several

veral things of *Dr. Browne* and others at *Normich* for about six moneths time, without finding relief. Half a year after, toward *Michaelmas*, upon taking a slight cold, she was so stop't up, that she could only whisper; nor could she lie flat, but rear'd up with pillows. I being sent for, caus'd presently a Vein to be open'd, as an Expedient only to make way for a freer Circulation, and room for Nature to disburthen her self. Within less than an hour she got breath, and soon after grew as well as she was before. She affirm'd, she never swet in her life, nor could it be procur'd by ordinary Sudorificks. Being desirous to adde an Empirical remedy, I gave her three of *Matthews Pills*; which did sweat her lightly, but beyond what ever she remembred. Several daily doses of *Lockiers Pills*, 4. per dose, remov'd the Julking, as she said, lower to the Mid-riff: when she, fearing an *Hyper-catharsis*, laid them by for two or three daies, and then taking them up again, could find no further alteration by them. She could never lie on her left side. In the 23. year of her age, in Winter, she had a dangerous *Feaver*, with a *Diarrhaea*, but came off. In her 24. in Winter again, she got cold, was quite stop't up, after five or six daies fell into Convulsion ere she was bled, through want of care in those about her. By late bleeding she had present ease, and cheer'd up in the Evening, but died the next Morning.

I had leave from her self, whilst living, and from her Relations, when dead, to open her Body; which I did accordingly.

First therefore I cleav'd asunder the Brest-bone from the Cartilage, called *Ensi-formis*, to the neck; when, laying open the hollow of the *Thorax*, there steam'd out at first a very offensive smell, notwithstanding the sharp frost, there was at that time, it being about *Christmas*. Then making way to lay open either side of the *Sternum*, I was surpris'd to see (as I thought) almost the whole Cavity of the *Thorax* empty above, (as the Body lay supine) and fill'd with nothing but thick Milk beneath. But searching further, I found there was only all the right side of the Chest, and about a third part of the left, in that condition. It took up, in the part to the neck-ward a hand-breadth, and ran three fingers thickness to the left of the *Mediastinum*. The Liquor was like Cream, or rather like a size of *Spanish White*; having a cast of yellow, like *Beefings*. For, putting a spoon into it, from the bottom

bottom I took up a thick clammy matter, just like that *Spanish White*, that sinks to the bottom of its size. In quantity it might be about three *pints*, contain'd in a *Bag*, which was capable to hold as much more and better. The *bag* ran along from the left shoulder to the utmost of the right side of the *Mid-riff*: not streight along nor stiffly stretcht; but about a hand-breadth from its rise it went directly down to the *Midriff*, with which it closed all along. Its skin or coat was thicker than that of the stomach, as well as its capacity larger, in as much as the Flexures of the *Ribs* joyn'd with it, and made up above half the compass. Where it adher'd to the *Mid-riff*, 'twas near a finger thick: And in one place, where I endeavor'd to separate it from the *Mid-riff*, I hit upon a thinner *bag*, whence issued out 2 or 3 spoonfuls of shier water: How it got in, I found not. The *Mediastinum* was either wholly wasted, or else woven into the thickness of the *Bagg*, as was also the *Pleura*, as far as the *Bagg* reach'd. It lay loose and flapping from the left *Axillar* to the *Chest*, having been before fill'd and distended either with lenid or the *Liquor*. All the hollow was bedabbed with the wallowings of the liquor about, as is the *Ouse* by the Ebbings and Flowings of the *Tide* in a *Channel*. That *Lobe* of the *Lungs*, which should have been on the right-side, was gone, and that on the left, wasted to near a third part. In the *Lower Belly* all was well.

Dr. *Brown* saith, he hath met with the like in an *Italian* Author. His opinion was to salivate her. I had thoughts of a *Paracentesis*, or Tapping between the *Ribs*. For by the noise of the *Liquor*, and by her not enduring to lye on the left, I concluded it must be in a *Cystis* on the right. But if that had been done, the *Bagg* being too thick might have mortified. The *Jolking* was exactly like that of *Water* or *Milk*. This *Woman* was as *Flat-breasted* as a *Man*. Whether the *Liquor* proceeded from the falling down of the *Chyle* from the *Axillars*, is a *Quere*, but seems to carry in it somewhat of probability. But I must not reflect.

Two other Anatomical Observations, imparted, by the same hand.

1. A certain Serving-man about 27 years of age, dyed *Hydropical*, which Disease he was molested with, 4 years before his death. He was

was ever a listless, dull and melancholy fellow, never cheerful nor smiling, especially for ten years before he died. His words came from him as if forced, and speaking but a little, he would end with a sigh. When open'd, he was found to have the left *Lobe* of the *Lungs* almost quite wasted; but no Ulcer, nor ought preternatural appearing in the remaining part, except its wasting. The heads of the *Vessels* and *branches* of the *Wind-pipe* as big, as in the other *Lobe*. That *Lobe* of the *Liver*, which butts on the *Mid-riffe*, was black *outwardly* for about a hand-breadth, and about a thumbs-breadth within the *Parenchyma*. Other parts found.

2. The other day I took notice in the *Corps* of a *Felon*, that, whereas *ordinarily* the *Preparing Vessels* arise, on the *right* side, out of the *Cava*, as on the *left*, out of the *Emulgent*, his *right* *Vas preparans* sprang cleerly from the *right Emulgent*.

Divers Instances

Of Peculiarities of Nature, both in Men, and Brutes; Communicated by the same.

1. One Mr. *Morley* of *Bury St. Edmunds* in an *Asthmatick* distemper, was advised by some to take down a spoonfull of good English *Honey*; which being done, the *Patient* fell into an Universal swelling, as if he had swallow'd the worst of *Poysons*. Mr. *Goodrich* being hastily call'd in, to save life, prescribed him a common *Sudorifick*, which in competent time relieved him. They then made inquiry at the *Apothecary's*, Whether nothing were amiss in the *Honey*; and they protested, it was altogether right. But to be assur'd of it by *Experiment*, they afterwards got the like quantity at another place, which was given with the very same frightful event, and the Party was cured by the same *Chirurgion* (who is my *Author*) with the same kind of sweat*.

2. Mr. *Twisse*, a Minister of *Mettingham* in *Suffolk*, about forty years of age, having been accustomed for some time to drink *warm* or rather *hot* Beer,

which was then unknown to the *Chirurgion*, as was to the *Patient* the mixture; the place affected did soon after rankle, and grow so bad, that the *Lady* was constrained to send for him that had applied it, who being examined about the *Ingredients*, and declaring one of them to be *Honey*, the *Lady* soon acquainted him with her *Antipathy* to that substance: whereupon that Application was immediately removed, and another more proper for the *Patient* put in the place, with good success.

* The like Example hath been more than once related to the *Publisher* by a very credible person, of a Noble Lady in *Ireland*, who having received a small hurt on her Leg, and the *Chirurgion* mingling in the Application, he made to it, a little *Honey* (from which she hath an utter Aversion,

and coming from his House about Mid-summer to a house near *Rumburch-Church*, where he was offered a Cup of *cold Beer*, out of modesty, or a humor to prevent the being wondred at, took it off thus cold, after he had taken a Pipe of *Tobacco*. Which done, he presently took horse, and rode with other Company towards *Framlingham*. Coming at *Halesmith*, he found himself sick, his stomach much out of order. He lighted once or twice by the way and vomited, but coming at his Journeys end, his vomiting grew worse, and he was constrain'd to betake himself to his bed. Next day he grew yet worse, could find no help by *Physick*, but died the very next morning.

It may be worth noting (*adds the Author*) that one, who is wont to drink *cold Beer*, is not, for ought we know, endanger'd by a draught of *hot Beer*: But I cannot tell, whether it may be thence inferr'd, that *hot* things are more agreeable to the natural Tone of the Stomach, then *cold*. That it was not barely the coldness of particles, sensible to the Touch, appears, because the same Party could drink cold *Wine*, as I was inform'd from my own Father.

3. Madam *Mary Brook* of *Yoxford* hath such an Aversion to *Wasps*, that whilest their season of swarming about in Houses lasteth, she is forc'd to confine her self to a little close Chamber, and dares not then come out to Table, least their coming there should put her into such distempers, as *Cheese* doth those, who have an utter Antipathy against it.

4. Mrs. *Raymund* of *Stow-market*, when ever she hears *Thunder*, even a farr off, begins to have a bodily distemper seize on her. She growes faint, sick in her stomach, and ready to vomit. At the very coming over of it, she falls into a right down *Cholera*, and continues under a *Vomiting* and *Looseness*, as long as the Tempest holds, and that in a more violent way, than is commonly procur'd by such Medicaments as are usually exhibited for those very purposes. And thus it hath been with this Gentlewoman from a *Girl*.

5. I know a Woman in *Stow-market*, who, during her Green-sickness, was invited by her *Pica* or longing, to suck the *Wind* out of *Bellows*, which as often as she could she took into her Body with open mouth, forcing it in by blowing with her own hands, the

the Bellows inverted. I know another that was for crackling of *Cinders* under her feet. From which kind of *Instances* I am inclin'd to doubt, whether that Distemper begins at the *Depravation* of the *Acid liquor* in the *Stomach*, and not rather at the *Uterus*, which next infects the *Brain*, such kind of things gratifying the *Fancy* somewayes misled, more than the *Appetite natural* any wayes depraved.

6. Somewhat, like to this, is to be found in *Brutes*. In *May* last a *Grey-hound* Bitch at *Brightwell-Hall*, about five or six dayes before she cast her *Whelps*, had such a wild kind of *Hunger* (though she was fed sufficiently every day with usual food) that, finding another *Bitches* *Whelps*, she devour'd them all (4 or 5, as I remember) and fell next upon the Bitch her self, who made a shift to get from her as well as she could, being help'd. From this, and from *Sows* devouring whole *Litters* of *Pigs*, I am prone to think otherwise of the *Longings* of *Teeming-Women*, than is the common opinion.

A Confirmation

Of the Experiments, mention'd in Numb. 27, to have been made by Signor Fracassati in Italy, by Injecting Acid Liquors into Blood.

THE Honourable *Robert Boyle*, having seen the particulars inserted in *Numb. 27*, concerning some *Experiments* made by *Signor Fracassati*, and recollecting, what himself had experimented of that nature, several years ago, was pleased to give to the *Publisher* the following *Information* about it, by the favour of a *Letter*, written to him from *Oxford, Octob. 19. 1667. viz.*

Sir,

I Hinted to you in my last something about the Original of the *Experiments, made in Italy, by Injecting Acid Liquors into Blood: To explain which, I shall now tell you, That about this time three years * I mentioned at Gresham Colledge to the Royal Society an odd Experiment, I had formerly made (not by Chance, but De-*

* The *Journals* of the *Royal Society* being looked into by the *Publisher* (who, by the honour of his Relation to that *Illustrious Body*, hath the advantage of perusing them, as he by his Office hath the Care of seeing them faithfully managed) do fully agree with the Affirmation of this Noble Person, as well in the *Circumstance* of the *Time*, as the *Substance* of the *Matter* in questson; It being in the Month of *December* of *An. 1664.* when, what is now alledged in this *Letter*, was publicly related by its *Author.*

figne) upon Blood yet warm, as it came from the Animal, viz. That by putting into it a little Aqua fortis, or Oyl of Vitriol, or Spirit of Salt, (these being the most usual Acid Menstruums,) the Blood not only would presently loose its pure colour and become of a Dirty one, but in a trice be also coagulated; whereas if some fine Vrinous spirit, abounding in Volatil Salt, such as the Spirit of Sal Armoniack, were mingled with the warm Blood, it would not only not curdle it, or imbase its Colour, but make it look rather more florid than before, and both keep it fluid, and preserve it from Putrefaction for a long time.

This xperiment I devis'd, among other things to shew the Amicableness of Volatil spirits to the Blood. And I remember 'twas so much taken notice of, that some very Inquisitive Members of the Society came presently to me, and desired me to acquaint them more particularly with it; which I readily did, though afterwards I made some further Observations about the same Experiment, that I had no occasion to relate.

This having been so publickly done, though I shall not say, that Signor Fracassati may not have hit, as well as I, upon the Experiments published in his Name, yet there is so little difference between the warm Blood of an Animal out of his Veins and in them, that 'tis not very improbable, that he may have had some imperfect Rumor of our Experiment without knowing whence it came, and so may, without any disingenuity, have thence taken a hint to make and publish, what now is English'd in the Transactions. If it be thought fit, that any mention be made of what I related so long since, I think, I can send you some other Circumstances belonging to it. For I remember, I tryed it with other Liquors (as Spirit of Wine, Oyle of Tartar, Oyle of Turpentine,) and I think also, I can send you some remarks upon the Colour of the upper part of the Blood. And I shall on this occasion add in reference to Anatomical matters in general, that after I saw, how favourably the Usefulness of Experimental Philology was receiv'd, I was invited to enlarge it in another Edition; and for that, I provided divers Anatomical as well, as other Experiments, and design'd many more, so that I have by me divers things, that would not perhaps be unwelcome to Anatomists, &c.

An Observation

About the Epiploon, or the Double Membrane, which covers the Entrals of Animals, and is fill'd with Fat.

This Observation should have been added to those that were publish'd in Number

ber 27. and made by Fracassati and Malpighi. For it is contain'd in an Exercitation De Omento, annexed to the Tetras Anatomicarum Epitolarum Marcelli Malpighii and Caroli Fracassati de Lingua & Cerebro, printed in Bonna. Since it was then omitted, it was thought worth the inserting now, viz.

THe *Epiploon*, being look'd upon by a good *Microscope*, is like a great *Sack*, full of abundance of other small *Sacks*, which do inclose *Gatherings* of *Grease* or *Fat*. There are many *Vessels*, which may be call'd *Adipous* or *Fatty*, which issue out of this *Membrane*, and spreading themselves all over the *Body*, conveigh *Fat* to it; just as the *Arteries* carry the *Blood* all over the same. Wherever is *Fat* or *Grease*, there is found store of these little *Sacks*, wherein *that* is inclosed, whence it is, that in lean and emaciated *Bodies*, in stead of *Fat*, you find nothing but *skins*.

The structure of these *small Sacks* and of the *Adipous vessels* sufficiently sheweth, that the *Fatt* is not form'd accidentally out of the thick *Vapours* of the *Bloud*, as is the common belief. Nor is its chief *Use*, to foment the *Natural heat*; but it seems rather to conduce to the allaying of the *Acrimony* of the *Salts*, that are in the *Bloud* and the *Serosities*. And indeed (saith this *Author*) *Lean persons*, and those, whose *Epiploon* hath been cut, are more subject than others to *Rhumatismes*, *Lienteries*, and the like diseases that are caused by the *sharpness* of the *Humours*. And those that are *fatt*, are not so easily seized on by them, in regard the *Acrimony* of the *serosities* is corrected by the *Mixture* of the *Fatt*, just as the sharpest *Lixivium* will loose its force, if *Oyl* be mingled therewith.

Some Hortulan Communications about the curious Engrafting of Orenge and Lemons or Citrons upon one anothers Trees, and of one Individual Fruit, half Orenge and half Lemon, growing on such Trees, &c.

We have here *Orenge-trees*, (saith the *Intelligence* from *Florence*) that bear a fruit, which is *Citron* on one side, and *Orenge* on the other. They have not been brought hither out of other *Countreys*: and they are now much propagated by *Engrafting*.

2. This was lately confirmed to us by a very *Ingenious English Gentleman*, who asserted, that himself not only had seen, but bought of them *An. 1660.* in *Paris*, whither they had been sent by *Genoa-Merchants*; and that on some *Trees* he had found an *Orenge*

on one branch, and a *Lemon* on another branch; as also, (consonantly to the *Florentine* information) one and the same Fruit half *Orange* and half *Lemon*; and sometimes *three quarters* of one kind, and *one quarter* of the other.

3. A *Provencal* at *Paris* pretends to keep *Orange-trees* in that Town all the winter long *without any Fire*, though they remain in the Earth, and not be put in *Caisse*s or *Boxes*. This is thought to be effected by a peculiar sort of *Dung*, used for that purpose, and wrought deep into the Ground.

Q. *Why should not the Experiment of some such thing be made about London, whose Latitude is but so little more North-ward than that of Paris?*

Inquiries for Greenland.

To discharge our Promise made in the last Transactions, we shall subjoyn the following Queries, which we also purpose to recommend in due season, to some of those English Masters of Ships and other fit persons that shall sail into Greenland for the Whale-fishing: Intreating withal, as many as have conveniency, to assist us in these recommendations.

The Inquiries are

1. **W**Hat, and how much is the heat of the Sun there in the midst of the Summer, compar'd with the heat of it in *England*? to be observed with a seal'd Thermometer.

2. What is the most constant weather there in Summer, whether Clear, Cloudy, Rainy, Foggy? &c.

3. What weather is most usual at such and such times of the year?

4. What constancy or unconstancy there is of the Wind to this or that quarter of the *Horizon*, or to this or that part of the year?

5. What the Temperature of each particular Wind is observ'd to be? And particularly, whether the *North-wind* be the coldest? If not, what wind is? whether is the colder, the *East* or *West*, &c.

6. What wind is observ'd to bring most Ice, and what to make a clear water at Sea?

7. What *Currents* there are? How fast, and which way they sett? Whether those *Currents* are not stronger at one time of the *Moon* than at another? Whether they always run *one way*?

8. What is Observable about the *Tydes*, Spring or Neap?

How

How high the *High-water* mark is above the *Low-water*? Which way it floweth? which way it ebbeth? what time of the Moon the *Spring-tides* fall out?

9. Whether the Ice that floats in the Sea be of Salt-water or Fresh?

10. What *Rivers* there are in the Summer, and what fresh-water can be had?

11. What Fowl are found to live there, and what Beasts? How they are thought to subsist in Winter? How they breed and feed their young?

12. What *Vegetables* grow there, and whether they yield any Flowers or Fruits, &c.?

13. Whether there have been any *Thunder* or *Lightning* observed in those parts?

14. How deep the Cold penetrates into the Earth? whether there be any Wells, Pitts or Mines so deep, that the Cold does not touch the bottom thereof?

15. How the Land trends? and whither the Parts under or near the *Pole* be by those, that have gone furthest that way, thought to be *Sea* or *Land*? How near any hath been known to approach the *Pole*, & whether the Cold increaseth with the increase of *Latitude*?

16. To make, if possible, some Experiments and Observations about the *Magnet* or *Needle*; and particularly, How much the *Declination* is there? and whether they doe exactly observe the Degrees of *Declination* in their course? Likewise to make Observations about the *Height* of the *Sun* and other *Celestial Bodies*, and their *Diameter*, *Refractions*? &c.

17. What is their opinion concerning the *North-East* passage?

18. What Fish do most frequent those Seas, besides *Whales*? Anything observable in their Fishing; as the Usual or Unusual bigness, strength, and the several sorts of *Whales*; and particularly to observe whether that kind of *Whales* they call *Trompa*, have in their *Heads* the *Sperma Ceti*, and in their *Entrails* the *Ambergreese*, looking like *Cows-dung*, as was alledged out of *Purchas* in Numb. 28. pag. 538?

19. To give in an exact Relation of the *Whale fishing*, throwing the Harpoons, following the Fish, &c.

20. To describe the whole manner of making the *Oyl* of *Whales*.

An Account of the

SYNOPSIS NOVÆ PHILOSOPHIÆ & MEDICINÆ Francisci Travagini Medici Veneti.

SOME months since there were two *Letters* sent hither from *Venice*, from Signior *Francisco Travagino*, giving notice of a Treatise of his, ready for the Press, under the Title of *NOVA PHILOSOPHIA &*

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MEDICINA. Those Letters came accompanied with a *Synopsis* in Print, giving a brief Account of the Contents of the said Treatise, to this effect, *viz.*

That this *Author* hath compos'd a *System* of Natural Philosophy by Observations and Experiments, acomodated to the benefit of Humane Life, and subservient to *Physick* and other *subalternate Arts*, which *Philosophy* he pretends to have raised on *Principles*, that are certain Bodies drawn out of *Mixts*; which, though in themselves invisible and incoagulable, yet become, according to him, visible by their Contrariety and mutual Operation upon one another, and so do constitute the Temperaments of Concretes, and cause not only their Dissolution, but also their Redintegration.

These *Principles* he undertakes to prove to be *Two Salts*, call'd by him *Acidum* and *Salsum*; which, as they work more or less on one another, when blended, so they lose more or less of their Volatility, and the degrees of their contrariety: And from their various Complication (in which he places the whole business and moment of *Philosophy*) he holds, that that great Multiplicity of Concretes, which is in the *Universe*, does result.

In *Particular* he deduceth from the said *Principles* the cause of *Ferments* and their Variety, the nature of *Generations*, *Concretions*, *Putrefactions*, *Precipitations*, &c. and sheweth, how those *Principles* run through all *Minerals*, *Vegetables* and *Animals*, by their manifold combinations, and various ways of acting on one another.

He explains also the Mixtures of *Alkaly's*, *Virriols*, *Armoniaks*, *Sulphurs*, *Mercuries*, and explicateth the Properties of *Dissolvents*, as also *Tasts*, *O-dors*, *Colors*, &c. all from the same principles.

And having raised this Structure of his, as far as he judgeth it sufficient for *Subordinate Arts*, he proceeds to adapt it to the Art of *Physick*. And applying it to *Animal Bodies*, he thence draws the Diversity of Humors and Tempers, the Beginning and Duration of Vital Heat, the Motion of the Limbs, the Faculties of Entrals, and the Origin, Vitality and Properties of the Blood, and the various Fermentations therein; shewing the Distempers of the Ferments and Juyces in Animals, the nature of Coagulations, Dissolutions, Feavers and other Symptoms; as also the Original of Poysons in Animal Bodies; concluding with an Indication of the proper remedies (as he conceives) of many Diseases.

Whether this Philosophy be New, is easie to Judge.

A Note to be inserted above, pag. 544. after lin. 12.

THis Rest (by Mr. *Hook's* suggestion) may be rendred more convenient, if, instead of placing the Screw *Horizontal*, it be so contriv'd, that it may be laid *parallel* to the *Equinoctial*, or to the *Diurnal* motion of the Earth. For by that means the same thing may be perform'd by the single motion of one Screw, which in the other way cannot be done, but by the turning of both Screws: As will easly appear to those that shal consider it.

In the *S. AVOY*:
Printed by *T. N.* for *John Martyn*, Printer to the *Royal Society*, and are to be sold at the *Bell* a little without *Temple-bar*. 1667.

PHILOSOPHICAL TRANSACTIONS.

Monday, December. 9. 1667.

The Contents.

An Account of the Experiment of Transfusion, practis'd upon a Man in London. A Narrative of some Trials of Transfusion, lately made in France. Some New Experiments of Injecting medicated Liquors into humane Veins, together with some considerable Cures perform'd thereby. An Extract of a Letter written from the Bermudas, giving an Account of the Course of the Tides there; of Wells both salt and sweet, digg'd near the Sea; of the Whale-fishing there practis'd anew, and of such Whales, as have the Sperma Ceti in them. A Method for finding the Number of the Julian Period, for any year assign'd, the Number of the Cycle of the Sun, the Cycle of the Moon, and of the Indictions, for the same year, being given. An Account of some Books. I. PETRI LAMBECCII LIB. PRIMUS PRODROMI HISTORIÆ LITERARIÆ. II. THOMÆ CORNELII PROGymNASMATA PHYSICA. III. LES ESSAYS de PHYSIQUE du Sieur de LAUNAY. IV. FRANCISCI DU LAURENS SPECIMINA MATHEMATICA, duobus Libris comprehensa.

An Account Of the Experiment of *Transfusion*, practis'd upon a *Man in London.*

This was perform'd, Novemb. 23. 1667. upon one Mr. Arthur Coga, at Arundel-House, in the presence of many considerable and intelligent persons, by the management of those two Learned Physitians and dextrous Anatomists Dr. Richard Lower, and Dr. Edmund King, the latter of whom communicated the Relation of it, as followeth,

THE Experiment of Transfusion of Blood into an humane Veine was made by Us in this manner. Having prepared
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the *Carotid Artery* in a young Sheep, we inserted a Silver-Pipe into the Quills to let the Blood run through it into a Poring er, and in the space of almost a *minut*, about 12. ounces of the Sheeps-bloud ran through the Pipe into the Poring er; which was somewhat to direct us in the quantity of Blood now to be Transfus'd into the Man. Which done, when we came to prepare the *Veine* in the *Man's Arme*, the *Veine* seem'd too small for that Pipe, which we intended to insert into it; so that we employed another, about one third part lesse, at the little end. Then we made an incision in the *Veine*, after the Method, formerly publisht *Numb. 28*; which Method we observ'd without any other alteration, but in the shape of one of our Pipes; which we found more convenient for our purpose. And, having open'd the *Veine* in the *Man's Arme*, with as much ease as in the common way of *Venæ-section*, we let thence run out 6 or 7 ounces of Blood. Then we planted our silver-pipe into the said Incision, and inserted Quills between the two Pipes already advanced in the two subjects, to convey the *Arteriall* blood from the Sheep into the *Veine* of the Man. But this Blood was near a *minut*, before it had past through the Pipes and Quills into the *Arme*; and then it ran freely into the *Mans veine* for the space of 2. *minutes* at least; so that we could feel a *Pulse* in the said *veine* just beyond the end of the Silver-pipe; though the Patient said, he did not feel the blood hot (as was reported of the subject in the *French Experiment*) which may very well be imputed to the length of the Pipes, through which the blood passed, losing thereby so much of its Heat, as to come in a temper very agreeable to *Venal* Blood. And as to the quantity of Blood receiv'd into the *Man's Veine*, we Judge, there was about 9, or 10. ounces: For, allowing this pipe $\frac{1}{3}$ lesse, than that, through which 12. ounces pass'd in *one* minute before, we may very well suppose, it might in *two* minutes conveigh as much blood into the *Veine*, as the other did into the Poring er, in *one* minut; granting withall, that the Blood did not run so vigorously the second minut, as it did the first, nor the third, as the second, &c. But, that the Blood did run all the time of those two minutes, we conclude from thence; *First*, because we felt a *Pulse* during that time: *Secondly*, because when upon the *Man's* saying, He

He thought, he had enough, we drew the pipe out of his Veine, the Shaeps-bloud ran through it with a full stream; which it had not done, if there had been any stop before, in the space of those two minutes; the bloud being so very apt to coagulate in the Pipes upon the least stop, especially the Pipes being so long as three Quills.

The Man *after* this operation, as well as *in* it, found himself very well, and hath given in his own Narrative under his own hand, enlarging more upon the benefit, he thinks, he hath received by it, than we think fit to own as yet. He urged us to have the Experiment repeated upon him within three or four dayes after this; but it was thought advisable, to put it off somewhat longer. And the next time, we hope to be more exact, especially in weighing the Emittent Animal before and after the Operation, to have a more Just account of the quantity of Blood, it shall have lost.

A Relation
Of some Trials of the same Operation, lately made in
France.

1. *M. Denys*, Professor of the *Mathematicks* and *Natural Philosophy* at *Paris*, in a Letter of his to the *Publisher* relateth, That they had lately transmitted the Bloud of four *Weathers* into a *Horse* of 26. years old, and that this *Horse* had thence received much strength, and more than an ordinary stomach.

2. The same person was pleased to send to the same hand a Printed Letter, written to the *Abbot Bourdelot* by *M. Gadroys*, being an *Answer* to a Paper of one *M. Lamy*, and confirming the *Transfusion* of Blood by New Experiments. In this *Answer* the *Author* is vindicating the *Transfusion* from *Objections*; where first he takes notice, That, whereas the *Objector* undertakes to refute the Experiments made, by simple *Ratiocinations*, it ought to be considered, that the *Quodlibeticall* Learning of the *Schools* is capable enough to find Arguments for and against all sorts of Opinions, but that there is nothing, but *Experience*, that is able to

give the Verdict and the last Decision; especially in matters of *Natural Philosophy* and *Physick*: That a hundred years agoe, there were no Arguments wanting to prove, that *Antimony* or the *Vinum Emeticum* was poyson; the use of it being then forbidden by a *Decree* of the *Faculty* of *Physitians*; and that at this day there are no arguments wanting, to prove the contrary, and to assert, That it is a *Purgative* of great importance, follow'd with wonderfull effects; the same *Faculty* having Publisht a *Decree* the last year, by which it permits, and even *ordains* the use thereof. So that it ought to be said, that *Sole Experience* hath determin'd this matter, and that the Recovery of many persons, and amongst them, of the *Most Christian King* himself, hath more conduced to convince Men of its usefulness, than all the bare Ratiocinations, that could be employed to defend it. And so it is with all *Remedies*, there being not one, that is not approved by some *Physitian* or other, who thinks to have reason on his side, and disapprov'd at the same time by others of that Profession, who conceive to have it on theirs: Whereas *He* certainly is to be esteemed the most *Rational*, that in these matters is guided by good *Experience*. And since the *Transfusion* of *Blood* is a *New* thing, (unknown for ought we know) to all former Ages, Ingenious Men, and Lovers of the Increase of the Stock, serving for the relief and conveniencies of Human Life, do no more, in this particular, than propose and recommend it to Generous and Un-prejudicate *Physitians*, to Judge of its agreeableness to *Human* Bodies, and to make trials of it accordingly; themselves esteeming, that since it concerns the Health and Life of Man, it cannot be examined too severely; though at the same time they conceive, that 'tis unequal, to stand herein to the verdict of such Arrogant Men, who from a self-conceit of knowing all things already, are very impatient at any thing discover'd, which they have not thought on themselves: Those Men being the best advis'd and the most to be relyed on, who do not precipitate their Judgment, but stay for many Experiments, carefully made, to conclude themselves by. For which purpose, the *Author* wishes, that Persons in power would cause a good number of Experiments of this Invention to be made, and examine them either themselves, or give order to prudent and free-spirited *Physitians* and *Chyrurgions* to do so.

Among

Among the *Objections*, (which the Author finds to be generally grounded upon inconsiderations, mistakes, and a supposition, as if peremptory Affirmations touching the effects of this Transfusion were obtruded, whereas all is left to the success of Experiments faithfully made) there is one, directed against the *effects* of that operation, which appeared in the young Man, who (by Mr. *Denys's* Relation in his Printed *Letter* to Monsieur de *Montmor*) after he had received the Arteriall Blood of a Lamb, was cured of an extraordinary *Lethargy*, consequent to a violent Fever, wherein he had been let blood 20. times. And the *Objection* is, That the lively apprehension, the said young man had of a remedy so unusuall, and whereof the success could not but appear very dubious to him, and so render him exceedingly anxious, did so rouse his spirits, and put them into such motion, as to disengage them from that embarasment, which hindred their diffusion; upon which dis-entanglement follow'd all the other good effects, that are imputed to the Transfusion.

To this Conceit the *Answerer* replies, That, if the *Apprehension* could have cur'd this young Man, the cure would doubtless have been effected 24. hours before the *Transfusion*, because he then hapned to have a very great one, by falling down stairs; as was also observed in Mr. *Dennys* his *Relation* of this Experiment. Besides, that this Patient was noted to be so far from apprehending or fearing this Operation, that he did not so much as know, what the *Transfusion* was; but thought, the Lamb was onely applyed to his Arm, to suck from him his ill Bloud, as he was made to believe, after an ancient and usuall way.

To that *Objection*, wherein some put weight, *viz.* That there is a great difference between the *Flesh*, we eat for food, and the *Blood*, that is transmitted *immediately* into the *Veines*; the *former* undergoing a great Alteration, which the *latter* does not: Our *Author* replies, That of the three principall Digestions of the *Aliment*, that have been alwayes distinguisht by Authors, the *First*, which is made in the *Stomach*, is not considerable in comparison of the two others, which are made of the *Chyle* and the *Bloud*, in the *Heart*, the *Liver*, and generally in all the parts, that receive nutrition: Which he illustrates by this, that as the *Concoction*, which is made of the *Juyces* of the *Earth* in the *Root*
and

and Heart of the Trunk of a Tree, does not so much serve to the production of this or that Fruit, as the last *Filtration*, that is made of those Juyces in the small *Fibres* of the Grafts; so also all those Digestions, which are supposed to be made in the Stomack and the Heart or the Liver of Animals, do not so much serve to give the particles of the aliment those *Figures*, which they require to be converted into the substance of Man, as the *diversity* of pores, that straine them last of all, and differ in the Bones, Flesh, Cartilages, and other parts; in which the Ancients for this reason did admit as many different Assimilating faculties. Now, *saieth he*, though the New Bloud, which is given in the *Transfusion*, undergoes not the *first* Concoction, made in the Stomack, yet it suffers the two others, in making many Circulations together with the *native* bloud; and that therefore nothing hinders, but it may be fit to be changed into the substance of Man, without inconvenience.

The rest of the *Objections*, here alledged, seeming to be of no moment, though answer'd by our *Author*, we shall here pass by, and, for a generall answer to all, employ Experience, and the severall successfull Transfusions, he relates; as those of *Lambs-bloud* into *Dogs*, which, after the space of several moneths from the time of the Operation, do not onely live, but are very well, and some of them grown fatter, than they were before; and of *Kids-bloud* into a little *Spaniel-bitch*, of 12. years of age, which, a little while after the Operation, grew vigorous and active, and even proud in less than eight dayes. To which he adds a considerable Experiment, lately made upon a person, that had been for three weeks afflicted with the complicated distempers of an Hepatick Flux, a Lientery, and a bilious Diarrhæa, accompanied with a very violent Fever; and had been attended by four Physicians, who having blouded, purged, and clystered him, as much as they thought fit, he grew at last so weak, that he was unable to stir, lost his speech and senses, and vomited all he took: whereupon they altogether despairing of and abandoning the Patient, and declaring, that they did so, in the presence of divers persons of honor, consented to have the Experiment of Transfusion made upon the Patient, which his Relations had propos'd, as the last Refuge, very unwilling, to omit any thing, that might seem probable to rescue a dying Man.

man, *M. Denys* and *M. Emmerey* were besought to employ this last succours. But they, seeing the deplored state of the Sick, absolutely refused to make the tryal, alledging, that the Transfusion was not a means to restore either the solid parts, or to cure a Gangrene, which was apparently in his Intestins; they should have used it sooner, and at the very time, when the great evacuations of blood were made in the Patient. But, notwithstanding all this, they were exceedingly press'd, to comply with their desires, and not to let their friend dye without trying all means possible. They, being overcome by this importunity, and having secured their honor and safety, by the declaration above mentioned of the Physitians, and by their consent to the tryal of this Experiment, transfused into his veins a small quantity of *Calves*-blood in a morning; whereupon, though this Patient was already in a Lethargy, and convulsive, and had a very low and creeping pulse, yet, behold, an unexpected change hapned to him. His pulse grew higher in an instant, and became more vigorous; his Convulsions ceased; he look'd fixedly on the By-standers, spoke pertinently, and in divers languages to those, that spoke to him, and fell into a very quiet sleep. Awakening three quarters of an hour after, he took several broaths for the rest of the day, not vomiting at all, nor having any stool, although for three dayes before he could take nothing at the mouth, nor had had any intermission of his looseness since the very beginning of his sickness. Having thus remained for 24. hours, his forces began to diminish again, and his pulse to grow low, and the looseness to return. His friends then urged a second Transfusion, which being at last performed the next morning, the Patient indeed recover'd some vigour again, but that was of a short duration. For though then also he took his broath well, without vomiting, yet he voided still by stool, and at noon he began to decline, and about 5. at night he dyed, without the appearance of any convulsions. His Body being opened before the Physitians, the *Ileon* was found return'd into it self from the top to the bottom, and below that knot unto the *anus* the Bowels were all livid, gangren'd, and of an unsupportable stench. His *Pancreas* was extraordinarily hard, and so obstructed, that the *Pancreatick* Juice had no liberty to diffuse it self into the Guts.

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His *Spleen* was very thick, and his *Liver* big, and in some places livid. The *Heart* very dry, and, as 'twere, burnt. And having found the *Vein*, by which the Transfusion had been made, there was, from the place of the opening of the *Arm*, to the *Heart*, almost no blood found in it, no more than in the other *Veins*, nor in the *Ventricles* of the *Heart*, for as much as that little, he received, had been imbibed by his hot and drie *Flesh*. All which, this *Author* assures, can be attested both by a douzen persons of great veracity, who were present at this dissection, and confirmed by the *Certificats* given by the *Physitians* themselves, to be sent to the Parents of the deceased *Stranger*; who is the very same with him, of whom a less punctual account was given *Numb. 28. p. 519.*

Some New Experiments

Of Injecting Medicated liquors into Veins, together with the considerable Cures, perform'd thereby.

This was lately communicated in a Letter from Dantzick written by Dr. Fabritius, Physician in Ordinary to that City, which out of the Latin we thus English.

FOrasmuch as we had a great desire to experiment, what would be the effects of the Chyrurgerie of Injecting liquors into *Humane Veins*, three fit subjects presenting themselves in our Hospital, we thought good to make the Tryal upon them. But seeing little ground to hope for a manifest operation from only *Altering Medicines*, we esteemed, the Experiment would be more convenient and conspicuous from *Laxatives*; which made us inject by a Syphon about two drachmes of such a kind of Physick into the *Median-Vein* of the right *Arm*. The Patients were these. *One* was a lusty robust Souldier dangerously infected with the *Venereal Disease*, and suffering grievous Protuberatings of the bones in his *Arms*. He, when the purgative liquor was infed into him, complained of great pains in his *Elbows*, and the little valves of his *Arm* did swell so visibly, that it was necessary by a gentle compression of on's fingers to stroke up that swelling towards the Patients shoulders. Some 4. hours after, it began to work, not very troublesomely; and so it did the next day, in-somuch that the Man had five good stools after it. Without any
othe

other remedies those protuberances were gone, nor are there any footsteps left of the abovementioned Disease.

The *two* other Trials were made upon the *other* Sex. A married woman of 35. and a serving Maid of 20 years of age, had been both of them from their Birth very grievously afflicted with *Epileptick* fits, so that there was little hopes left to cure them. They both underwent this operation, and there was injected into their Veins a *Laxative Rosin*, dissolved in an *Anti-Epileptick* Spirit. The *first* of these, had gentle stools, some hours after the Injection, and the next day the fits recurring now and then, but much milder, are since altogether vanisht. As for the other, *viz.* the *Maid*, she went the same day to stool 4. times, and several times the next; but by going into the air, and taking cold, and not observing any diet, cast her self away.

'Tis remarkable, that it was common to all three, to vomit soon after the injection and that extremely and frequently; the reason whereof we leave to intelligent Physitians to assigne.

An Extract

Of a Letter, written from the Bermudas, giving an account of the Course of the Tides there, of Wells both Salt and Sweet, digg'd near the Sea; of the Whale-fishing there practis'd anew, and of such Whales, as have the Sperma Ceti in them.

This Letter was written June 18. 1667. by that Intelligent Gentleman, Mr. Richard Norwood, living upon the place, and relating as follows;

SIR,

I Received your Letter of *October 24. 1666.* but, whereas you mention another formerly sent, that never came to my hands: Neither had I, before the receipt of yours, the least intelligence of the Institution of the *R. Society*, founded by the King; but am very glad; that God hath put into the heart of his Majesty, to advance such a Noble designe, and should rejoyce, I were able to add my Mite for the furtherance of it. As to the particulars, you recommend to me, I shall answer to them, as I can, in the order, I find them

First, touching the Conjunction of Mercury with the Sun,

N n n

which

which you say you gave me notice of in your first, not received, and which happened *Octob. 25. 1664.* I had also notice of it from *Mr. Street*, and had provided in some measure to observe it; but the skie was so overcast, that the Sun could scarce be discerned all that day.

Next, concerning the *Tides*, I have only taken a general notice of them; as, that it is high water about 7. of the clock on the *Change-day* (in some Creeks an hour or two later.) The water riseth but little, as about 4. foot at a high water; but at the Spring-tides, it may be a foot more. The *Tides without* are very various in their setting. Sometimes the Tide of Floud sets to the *East-ward*, sometimes to the *West-ward*: but in fair, calm and settled weather the said Tide sets from the *South-east*, toward the *North-west*, as they say.

We digg *Wells* of *fresh-water* sometimes within 20 yards of the Sea or less, which rise and fall upon the Floud, and ebb as the Sea doth; and so do most of the Wells in the Country, though further up (as I am inform'd.) Wheresoever they digg Wells here, they digg till they come almost to a Level with the Superficies of the Sea, and then they find either *fresh-water* or *salt*. If it be *fresh*, yet if they digg 2. or 3. foot deeper, or often less, they come to *salt-water*. If it be a sandy ground, or a sandy crumbling Stone, that the water soaks gently through, they find usually *fresh-water*; but if they be hard *Lyme-stone-rocks*, which the water cannot soak through, but passeth in chinks or clefts between them, the water is *salt* or brackish. Yet (to mention that by the by) I never saw any sand in the Country such as will grind glasse, or whet knives, &c. as in *England*; but a substance like sand, though much softer; neither have we any *Pebble-stones* or *Flint*.

For the *killing* of *Whales*, it hath been formerly attempted in vain, but within these 2. or 3. years, in the Spring-time and fair weather, they take sometimes one, or two, or three in a day. They are less, I hear, than those in *Greenland*, but more quick and lively; so that if they be struck in deep water, they presently make into the deep with such violence, that the Boat is in danger to be haled down after them, if they cut not the rope in time. Therefore they usually strike them in shoal-water. They have

have very good Boats for that purpose, mann'd with six oars, such as they can row forwards or backwards, as occasion requireth. They row up gently to the Whale, and so he will scarcely shun them; and when the Harpineer, standing ready fitted, sees his opportunity, he strikes his Harping-Iron into the Whale, about or before the Fins rather than toward the Tail. Now the Harping-Irons are like those, which are usual in *England* in striking Porpoises, but singular good mettal, that will not break, but wind, as they say, about a mans hand. To the Harping-Iron is made fast a strong lythe rope, and into the Socket of that Iron is put a Staffe, which, when the Whale is struck, comes out of the Socket; and so when the Whale is something quiet, they hale up to him by the rope, and, it may be, strike into him another Harping-Iron, or lance him with Lances in staves, till they have kill'd him. This I write by relation, for I have not seen any kill'd my self. I hear not, that they have found any *Sperma Ceti* in any of these Whales; but I have heard from credible persons, that there is a kind of such as have the *Sperma* at *Eleutheria*, and others of the *Bahama-Islands* (where also they find often quantities of *Amber-greese*) and that those have great teeth (which ours have not) and are very sinewy. One of this place (*John Perin chief*) found one there dead, driven upon an Island, and, though I think ignorant in the business, yet got a great quantity of *Sperma Ceti* out of it. It seems, they have not much Oyl, as ours, but this Oyl, I hear, is at first like *Sperma Ceti*; but they clarifie it, I think, by the fire. When I speak with him (whom I could not meet with at present, and now the Ship is ready to set sail) I shall endeavour to be further informed; but at present with the tender of my humble service to the *Royal Society*, and commending your Noble Designe to the blessing of the Almighty, I take my leave, &c.

A Method

For finding the Number of the Julian Period for any year assign'd, the Number of the Cycle of the Sun, the Cycle of the Moon, and of the Indictions, for the same year, being given: together with the Demonstration of that Method.

IN these *Transactions*, N°. 18. p. 324. is a *Theoreme* for finding the Year of the *Julian Period*, by a new and very easie Method, which was taken out of the *Journal des Sçavans* N°. 36. as it had been propos'd and communicated by the Learned Jesuite *De Bill*

Multiply the $\left. \begin{array}{l} \text{Solar} \\ \text{Lunar} \\ \text{Indiction} \end{array} \right\} \text{Cycle}$ } by $\left. \begin{array}{l} 4845. \\ 4200. \\ 6916. \end{array} \right\}$ Then divide

The sum of the Products by 7980 (the *Julian Period*) the Remainder of the Division, without having regard to the Quotient, shall be the Year inquired after.

Some Learned Mathematicians of *Paris*, to whom the said *P. de Billy* did propose this Probleme, have found the Demonstration thereof, as the same *Journal* intimates.

There being no further Elucidation of the said *Theoreme* since publish'd, Mr. *John Collins*, now a Member of the *R. Society*, communicated what follows, *viz.*

That the *Julian Period* is a Basis, whereon to found *Chronology* not lyable to Controversie, as the Age of the *World* is: And 'tis the Number abovesaid, to wit 7980, which is the Product of 28 the

$\left. \begin{array}{l} 28 \text{ the } \\ 19 \text{ the } \\ 15 \text{ the } \end{array} \right\} \text{Solar Cycle.}$

$\left. \begin{array}{l} 19 \text{ the } \\ 15 \text{ the } \end{array} \right\} \text{Lunar.}$

$\left. \begin{array}{l} 15 \text{ the } \end{array} \right\} \text{Indiction.}$

Concerning this *Julian Period*, the late Arch-bishop of *Armagh*, *Usher*, in the Preface to his learned *Annals*, advertiseth, that *Robert Lotharing*, Bishop of *Hereford*, first observed the Conveniencies thereof: 500 years after whom it was fitted for Chronological uses by *Joseph Scaliger*, and is now embraced by the Learned, as such a limit to *Chronology*, that within the space of 7980. years, the Number of the *Sun's Cycle*, the *Prime*, and the Year of the *Roman Indiction* (which relates to their ancient Laws and

and Records) can never happen alike. And these remarques being given, the year of the *Julian Period* is by the former Rule infallibly found.

This *Period* is used by the said Arch-bishop in his *Annals*, and is by him accounted to exceed the Age of the *World* 709. years. Those, that desire further satisfaction about *Ara's*, *Epocha's*, and *Periods*, may repaire to many Authors, and among them to *Gregory's Posthuma*, in English, *Helvici Chronologia*, *Egidii Strauchii Breviarium Chronologicum*, who is one of the latest Authors.

Now as to the *Probleme* it self, it may be thus proposed.

Any Number of Divisors, together with their Remainders after Division, being proposed, to find the Dividend.

This thus generally proposed is no new *Probleme*, and was resolved long since, by *John Geysius*, by the help of particular Multipliers, such as those above-mentioned, and published by *Alstedius* in his *Encyclopaedia* in An. 1630, and by *Van-Schooten* in his *Miscellanies*.

We shall clear up, what Authors have omitted concerning the *Definition* and *Demonstration* of such fixed Multipliers, &c. And therefore say, that each Multiplier is relative to the Divisor, to which it belongs, and thus define it;

It is such a Number, as Divided by the rest of the Divisors, or their Product, the Remainder is 0, but Divided by its own Divisor, the Remainder is an Unit.

We require the Divisors proposed to be *Primitive* each to other, *i. e.* that no two or more of them can be reduced to lesser terms by any common Divisor. For, if so, the Question may be possible in it self, but not resolvable by help of such Multipliers, such being impossible to be found. The reason is; because the Product of an Odd and an Even Number is alwayes Even, and that divided by an Even Number, leaves either Nothing, or an Even Number.

| | | | | |
|----|---|--------------------------------------|---|------|
| 28 | } | The Multipliers relative thereto are | } | 4845 |
| 19 | | | | 4200 |
| 15 | | | | 6916 |

The *Definition* affords light enough for the discovery of these Numbers. To instance in the *first*: The Product of 19 and 15

is

is 285, which multiply by all numbers successively, and divide by 28, till you find the Remainder required. Thus twice 285 is 570, which divided by 28, the remainder is 10: Also thrice 285 is 855, which divided by 28, the remainder is 15. Thus if you try on successively, you'll find, that 17 times 285, which is 4845, is the Number required, the which divided by 28, the Remainder is an *Unit*. Hence then we shall find, that

$$\begin{array}{l} 4845 \\ 4200 \\ 6916 \end{array} \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{is equal to the Solid or Product of } \left. \begin{array}{l} 19, 15, 17. \\ 28, 15, 10. \\ 28, 19, 13. \end{array} \right\}$$

More easie wayes of performing this *postulatam*, are to be found in *Van Schootens Miscellanies*, and *Tacquet's Arithmetick*, which perchance are not so obvious to every understanding.

For Illustration of the *Rule* proposed, take this Example.

| | | | | | | | |
|----------------------|---------------------|----|------------------------|--------|-----------|--------|----------|
| | | | | | Products. | | |
| In the year 1668. | <i>Cyclus Solis</i> | 25 | } The Mul tipliers. | } 4845 | } 121125. | | |
| | <i>Cyclus Luna</i> | 16 | | | | } 4200 | } 67200. |
| | <i>Indictio</i> | 6 | | | | | |

The Sum of the Products—— 229821, the which divided by 7980, the remainder is 6381, for the Year of the *Fulian Period*; from which subtracting 709, there remains 5672, for the Age of the World, according to Arch-Bishop *Usher*.

For **DEMONSTRATION** of this *Rule* we thus argue:

1. *Each Multiplier Multiplied by its Remainder, is measured or divided by its own Divisor, leaving such a Remainder, as is proposed.*

For before, each Multiplier was defined to be a *Multiplex* of its own Divisor, plus an *Unit*. Wherefore Multiplying it by any Remainder, it doth onely render it a greater *Multiplex* in the said Divisor, plus an *Unit*, Multiplied by the Remainder; which is no other, than the Remainder its self; but if 0 remaine, that Product is destroyed.

2. *The Sum of the Products, divided by each respective Divisor, v e s, the Remainder assigned.*

For concerning the first Product, it is by the first *Section* mea-
sur'd

far'd by its own divisor, leaving the remainder proposed; and if we add the rest of the Products thereto, we onely add a *Multiplex* of its own Divisor, which in Division enlargeth the *Quote*, but not the *Remainder*.

Particularly the second Multiplier is 28 + 15 + 10 + Remainder, all which is but a *Multiplex* of 28.

And so the third Product is 28 + 19 + 13 + Remainder.

And what hath been said concerning the Sum of the Products, being divided by the first Divisor, and leaving the Remainder thereto assign'd, may be said of each respectively.

3. *The sum of the Products divided by the solid of the three Divisors, leaves a Remainder so qualified as the said Sum.*

For concerning the said Sum, 'tis evident by the *second* hereof, that it is no other, than the first Product, increas'd by adding a just *Multiplex* of the first Divisor, that thereby we did only enlarge the *Quote*, not alter the *Remainder*. By the like reason, the *subtracting* a just *Multiplex* thereof, doth only alter the *Quote*, not the *Remainder*; but the Solid of all three Divisors, multiplied here by the *Quote*, as there by the *Remainder*, is no other than a just *Multiplex* of the first Divisor. Wherefore the Remainder, after this Division is perform'd, is of the same Quality, as the sum of the Products, and divided by the first Divisor, leaves the Remainder proper thereto: And the like may be said concerning each Divisor.

AS in the Method hitherto deliver'd, we required the Divisors be *Primitive* to each other; so, if we take the *Probleme* as generally proposed, in the Preface to *Helvicus* his *Chronologia*, we are told, common Arithmetick failes in the Solution thereof, and *Tacquet* denies it to be performable by the *Regula Falsa*, and being unlimited; we must do it by *Tryals*. Wherefore,

When any two Divisors with their Remainders are proposed, Try the Multiplikes of one of them, increased by its Remainder, and Divide by the other: If you find such Remainders, as are not for the purpose, and that they are repeated, the Probleme is impossible.

| | | |
|-------------------|----|------------|
| | 6. | 3. |
| Example. Divisors | | Remainders |
| | 8. | 5. |

The Multiplices of 8, }
 increased by 5, are } 13. 21. 29. 37. 45. 53.
 Those divided by 6, the
 Remainders are ——— 1. 3. 5. 1. 3. 5.

Here you see 21. and 45. for the purpose, and take the Progression, adding the common difference 24 (which is the least Dividend measured by 6. and 8.) and you have 21. 45. 69. 93. 117. 141.

Admit, the Question had concerned these three Divisors.

6 ————— 3 }
 8 the Remainders being 5 } Then dividing the former Progression by
 9 ————— 6 } 9. the Remainders are 3. 0. 6. 3. 0. 6.

Wherefore I conclude, that the third and sixth of these Numbers are those sought, to wit 69. or 141; and so on progressively: Whereas, if you had propounded the Remainder of 9. to have been any other Number, than 3, 0, 6, the *Probleme*, as concerning all these, had not been possible.

Some easie Cases of the Probleme are these:

When the Remainder of some Divisor is 0, and of each of the rest of the Divisors, an *Unit*, or lesse by an *Unit*, then the Divisor.

In which Cases you are to find such a *Multiplex* of the Product or least Dividend measurable by those Divisors, that have Remainders, which, increased or diminish't by an *Unit*, may be a just *Multiplex* of that Divisor, that hath no Remainder. These Cases are handled by *Tacquet*, and *Bachet* in his *Problemes plaisans & delectables*.

PROBLEME.

To find the Year of the Julian Period for any Year of our Lord proposed.

It is necessary to be furnisht with the *Suns Cycle*, the *Prime Number*, and the Number of the *Roman Indiction*, which the industrious Mr. *Street* thus performs:

When

When 1. 9. 3. to the Year hath added been,
Divide by 19. 28, fifteen.

The Remainders are the Numbers sought. And hereby we found them for the year 1668. in the former Example.

The use of the *Prime* is, to find the *Epaet*, and thereby the *Moons Age*, Time of *High Water*, &c.

A farther Use of the *Suns Cycle* is, to attain the *Dominicall Letter*, and thereby to know the *Day* of the *Week*, on which any Day of any Month happens. But this is more easily and with less caution obtained, by finding, on what Day of the Week the first of *March* happens for ever, according to such *Rules* and *Verses*, as I have elsewhere published.

In brief thus:

To the Number _____ 2.

Add the Year of our Lord, suppose 1669.

An its Even fourth part, neglect- }
ing what remains, if any — } 417.

The Sum-- _____ 2088. Divide by 7. noting the Remainder, which shewes the Number of the Day of the Week, accounting *Sunday* first. If 0. remain, the first of *March* falls on a *Saturday*. In this Example there remains 2. shewing the first of *March* to fall on *Munday*.

If it were required, to performe this for years *preceding* our *Saviours Nativity*, then take this *Rule*;

To the Year adde its even fourth part; the Sum divide by 7, the Remainder shewes the Day of the Week, accounting *Sunday* first, *Saturday* second, and so backward.

PROBLEME.

To find what day of the Month in the first Week of each Month, happens to be on the same day of the Week, as the first of *March*.

Use the (plain) following *Verses*, in which the 12. Words relate to the 12. Months of the Year, accounting *March* the first;

Ask endless Comfort, God enough bestows,
From Divine Axioms Faith confirmed grows.

The Alphabeticall Number of the first Letter of the word, proper to the Month proposed, is the Answer;

Example.

If the Month were *April*, the word proper thereto is, *Endless*, and E is the fifth Letter in the Alphabet. Wherefore conclude, That the *first* of *March*, and *fifth* of *April* do for ever happen on the same day of the week; which for the year 1669. will be on *Monday*.

P R O B L E M E.

To find, on what day of the week the first day of each Month happeneth.

Supposing the first of *March* known, it might be reckoned from the former *Probleme*, but the following *Verse*, beginning with *March*, as the former, is more ready for the purpose:

*A Dreadful Fire, Beholders daily Gaze,
Chastized England. Ah cruel fatall Blaze!*

Explication.

In the Year 1669. the *first* of *March* is *Monday*: I would know, on what day of the week the *first* of *October* happens. The word proper to the Month is *England*; then count Alphabetically to E, viz. A. *Monday*, B. *Tuesday*, C. *Wednesday*, D. *Thursday*, E. *Friday*, which is the day sought. Whence conclude, that the 1st, 8th, 15th, 22th, 29th days of *October* are all *Fridays*. Thence it is easie to reckon, on what day of the Week, any day of that Month happened; and so for all other Months.

P R O B L E M E.

To find, on what Day of the Month the Sun enters into any sign of the Zodiack.

For this, *ex super abundantis*, we give the following Verse;

*Charles brought Content, divers effects ensue,
Envy, Fear, Dolour, Danger, bids adieu.*

Here again the 12. Words relate to the 12. Months, *March* being the first.

To the Number of the Letter of the *Alphabet*, the word begins with, add 7.

Example. *Feare* is the word for *October*, and F. the sixth Letter: VVherefore the Sun enters into the 8. Signe, to wit *Scorpio*, on the 13. of *October*.

An Account of some Books.

I. PETRI LAMBECHII LIB. PRIMUS PRODROMI HISTORIÆ LITERARIÆ, &c. —

THE Author of this Book is now the *Historiographer* and *Library-keeper* to the Emperour. He publisht this Volume some few years agoe at *Hamburg*, the place of his Birth, (whence an Exemplar was but lately sent to the *Publisher*.) He was excited to this VVork by the complaint made by the Illustrious Lord *Verulam*, (*Lib. 2. cap. 4. de Augm. Scientiarum*) of the want of a compleat *History of Learning*, that might give a *satisfactory Account* of the Rise, Progresse, Trans-migrations, Interruptions, Declinations, and Restauration of all kind of Learning, Sciences, Arts, and Inventions; together with the *Occasion* of inventions through all Arts; the *Method* of teaching, and the *Manner* of improving and advancing them: Adding the various *Seats*, and the most famous *Controversies* among the Learned; the *Encouragements*, they received; the chief *Writings*, they composed; their *Schooles*, *Academies*, *Societies*, *Colledges*, *Successions*, *Orders*, and whatever belongs to the *State of Learning*.

This Grand *Desideratum* our Author undertakes to supply the VVorld with; and in order thereunto hath given us the *First Book* of the *Prodromus* of this History, and with it the *Four first Chapters* of the *Second Book*, together with an *Appendix*, containing a *Summary* of the Chief *Persons* and *Things*, he intends more fully and accurately to treat of in the remaining 32. Chapters, designed for the same *second Book*: To which he subjoyns two *Tables of Vniuersall Chronography*, in the first whereof he exhibits the succession of all Ages from the Creation of the VVorld to the Beginning of the Common *Christian Account*; in the *other*, a Continuation of them from the Beginning of the said Account unto this present Ages; In which *Tables* he gives a generall *Idea* of the Connexion of all Ages, as they are computed in respect of the

Vulgar *Christian* Account, either by Ascending to the Creation of the World, or by Descending to our Age: He also for the sake of this Work acquaints the Reader that he betook himself to the Explication and Castigation of the *Bibliotheca Chronologica Classificorum Authorum* JOHANNIS JACOBI FRISII *Tigurini*; substituting, as he affirms, a true Calculation in the place of a false one; reducing the Authors, there enumerated, to the true time of their Age; distinguishing what is supposititious from genuin, and adding many things, that were unhappily omitted. Which done, he saith, he proceeded from this Account of the Succession of Illustrious Writers, to the History of the *Origin, Increase, Nature and Constitution* of all Professions, Sciences and Arts; chusing the *Eight Books* of POLYDORÉ VIRGIL *de rerum Inventoribus*; and DIOGENES LAERTIUS, *De Vitis, & Dogmatibus veteris Græciæ Philosophorum*; as also, the *Eight Books* of JOHANNES MIDDEN-DORPIUS *De Celebribus Vniuersi Orbis ACADEMIIS*.

He excuseth himself for having made no further progress in this Desirable Work, alledging the difficulty and trouble of the Undertaking, the unavoidable interruptions he hath met with, and the narrowness of a private Mans fortune to carry on so Chargeable an Attempt, requiring a Royall encouragement and Assistance.

II. THOMÆ CORNELII *Consentini* PROGYMNASMATATA PHYSICA.

This Author, a Friend to the *Cartesian* Philosophy, entertains the Curious in this Book with seven *Exercitations*, viz.

1. *De Ratione Philosophandi*: Where in the genuin Students of Naturall Philosophy he first requires the study of *Mathematicks*, to accustome their Minds to a fixed Attention, and to strict Reasoning; and next directs them to study Nature it self, and to labour after a true History of Nature: recommending lastly and particularly the Use of *Chymistry*, as an excellent key to open her Treasures, and the study of *Mechanicall* Principles, as nearly allyed to those of Nature.

2. *De*

2. *De Rerum Naturalium Initiis* : where he mentions the several *Hypotheses* and Principles of Philosophers, and approves of the *Cartesian*, esteeming, that none ever looked so like truth, as those; though he thinks them defective in this, that, how well soever they shew the production of things out of *Matter* variously modified; yet they seem not to have sufficiently accounted for the efficient power thereof.

3. *De Universitate* : where he seems to be in a Maze, and thinks, That the *Structure* of the *Universe* hath not been understood hitherto, nor will easily be hereafter.

4. *De Sole* : which *Luminary* he is inclin'd to believe to be a kind of Flaming Fire, appearing in a *Telescope*, like a Caldron full of boiling Metall: where also he discourses of the nature of *Light*, *Heat* and *Flame*; and affirms *Light* (as other *sensible Qualities*) to be not in the *Object*, but the *Sentient*; as *Pain* is not in the *Sword*, but in the *Animal* wounded by the *Sword*.

5. *De Generatione Hominis* : where, distinguishing between *Genitura* and *Semen*, and making the former to be that substance, which either Sex furnishes to the *Fætus*, and the latter, the Concrete of both Parents, He is of opinion, that that which he calls *Genitura*, consists of two things. *Vid.* a *Crasse liquor*, manifest to sense; and of a very subtle and refined substance, containing all the virtue of Generation, and lodged in the former as its receptacle. Which having established, he affirms, that grosser part of the *Geniture* not to be Blood elaborated, but a *Juyce*, secreted from the Blood, and being strained through the *Corpus varicosum* or *plexus pampiniformis* (wherein the seminal arteries are by innumerable *anastomoses* so combined and interwoven with veins, that very hardly any naked eye can discern a Vein from an Artery) it passeth into peculiar fit vessels, and is of a colour like that of the White of an Egg. As to the *Formation* of the *Fætus*, he esteems That, before the appearance of any Blood, or the framing of any member, there are form'd all the lineaments of the *Animal* to come, though indiscernibly; which he endeavours to make out very particularly, interweaving some *Animadversions* on Authors of differing sentiments, and mentioning several not-un-philosophical Hints.

6. *De Nutritione* : Here the *Author* observes some things in the

the *Structure* of the *Stomach*, which he thinks highly considerable for the understanding of the action and use of this *Viscus*, and hitherto not taken notice of by others, that he knows. Then he teacheth, that the Food is not digested in the *Stomach* by *Heat*, nor by *acid* dissolving *Juyces* only, but that, many causes concurring to that digestion, the *Aliment* is there fermented both by the warmth of the *Stomach* it self, and of the neighbouring parts, but especially by the acrimonious steams, that pass through the *Gastrick* and *Splenick* Arteries into the *Stomach*, which advances also it's concoction by it's compressing and relaxing motions, and is assisted by an apt liquor, bedewing, dissolving, and diluting the meat, and so converting it into a Pulse or Creme-like substance. Next, he teacheth, that the *Chyle* passeth not through the *Milky Veins* (so called by *Acellius*) to the *Liver*, nor all of it through the *Channel of Pecquet* to the *Heart*, but a great part of it, through the common veins of the *Stomach* and the *Mesentery*, to the *Liver*. Nor will he admit, that the *Sanguification* is performed in any one part of the *Animal*, as the peculiar Shop or Elaboratory of it, whether *Liver*, *Heart*, *Spleen*, &c. Nor that the parts are increased and nourished by the red part of the *Bloud*: but that, as to the former action, it is done by the means of a liquor, and by hot steams, giving the red colour to the *Chyle*, as *Chymists* use to change *white Juyces* into *red*, by the affusion of *Oyl of Sulphur*, or the like liquors; that redness being much advanced by the motion and agitation of the *bloud* in the *Veins* and *Arteries*. But as to the latter, *vid.* the *Nutrition*, it is perform'd by that whitish *Juyce*, which is mixed with the *Bloud*, and separated from it by the straining *Glanduls* of the *Body*.

To these particulars he adds several not un-considerable remarks touching the *Gall*, *Spleen*, *Lymphatick vessels*, &c. Observing also, that the whole kind of *Birds* is destitute of *Milky vessels*; and occasionally taking notice, that *Worms* are bred in almost all the parts of *Animal-bodies*; of which he alledges very odd Observations and Histories.

7. *De Vita*: This he affirms to consist in the continued Motion of the *Bloud*, depending from that of the *Heart*; yet so that this latter proceeds not from the *heat* of the *Bloud* (as *Des-*

Cartes would have it) but the moist steams and exspirations of the Heart.

As for *Respiration*, he thinks it a vain opinion, that *thereby* the Heat of the Blood is tempered and allay'd; but affirms, that it is therefore necessary, because that the Blood, which out of the *right Ventricle* of the Heart is propelled into the Lungs, in such Animals, as are furnisht with them, cannot pass into the *left*, unless the Air, breathed in, do swell and distend the small branches of the Wind-pipe; it being from thence, that the ramifications of the *Arterial Vein*, through which the blood must pass, are compress'd, and the blood, therein inclosed, is protruded into the branches of the *venal Artery*; For the proof of which, he alledges divers Observations: Adding withall, that, since Animals, whilst they are in the Womb, respire not, there being peculiar *ductus's*, by which the blood passeth into the *Aorta*, without passing through the Lungs, as it alwayes doth in Animals destitute of Lungs; he doubts not, but that with art and care those channels may be preserved un-abolisht, and made to grow and to be perfected with the other parts of the Animal, so that grown men may be brought to live the life of *Amphibious Creatures*. Nor doth he think this very difficult, in regard, that if their mouths and noses were from their very infancy often stopt every day, and their breath so long intercepted, whilst the blood passeth through those ductus's into the left ventricle of the Heart and the great Artery, the said passages would never be dried up: To confirm the possibility whereof, he alledges Examples of *Divers*, who from their childhood being given to swimming and diving, and so to the holding of their breath, did thereby so preserve those channels from being dried up, that upon occasion they could stay a great while under water, as *Amphibiums* use to do.

LES ESSAYS PHYSIQUES du Sieur DE LAV-
NAY, Liv. premier.

THis Learned Man having proposed to himself to go through the whole Body of *Natural Philosophy*, by the way of *Essays*, divides that *Systeme* into three Parts, whereof

The *First* being *General*, is to treat of what is common to all
Bodies,

Bodies, both *Superior* and *Inferior*; and is divided again into six Books; whereof the *first* considers the *Vniverse* in generall: the *second* is to discourse of *Place*, *Vacuum*, and *Time*, things as general as the *World*; the *third*, Of the material *Principles* of all Bodies: the *fourth*, of their *Efficient Cause*: the *fifth*, of their natural *Qualities*; and the *sixth*, of *Motion*, *Generation*, and *Corruption* of Bodies *Inanimat* and *Animat*.

The *second* part, is to examine the *Celestial Bodies*. The *Third*, shall treat of the *Terrestrial*, viz. the *Elements*, *Meteors*, *Minerals*, *Plants*, *Brutes*, *Men*.

Of this Work is now printed the *first Book* of the *first Part*, consisting of 5. *Dissertations*.

The *first* is about the *Preliminary Questions* of *Physiology*. The 2. inquireth whether the *Vniverse* is compounded of many *Worlds*. The 3. is of the *Systime* of the *World*, its *Magnitude* and *Figure*. The 4. examines, Whether the *World* be animated? The 5. Whether it hath been or could be from *Eternity*? The 6. is concerning the *End* of the *World*.

IV. FRANCISCI DV LAVRENS SPECIMINA MATHEMATICA, duobus Libris comprehensa.

Horum Prior, SYNTHETICUS, agit de Genuinis Matheseos Principiis in genere; in specie autem de Veris Geometriæ Elementis hucusque nondum traditis.

Posterior, ANALYTICUS, de Methodo Compositionis atque Resolutionis fusè differit, & multa nova complectitur, quæ subtilissimam Analyseos Artem mirum in modum promovent.

ERRATA, forgot to be corrected sooner.

IN N^o 28. Pag. 521. lin. 22, 23. r. She took dog (even before the wound was heal d up) was with puppy. p. 525. l. 8. r. Answers that shall. ibid. l. 20 r. Mineral Queries. p. 532. l. 18, dele, viz. p. 535. l. 2. r. impelled at the Nose, ibid. l. 15. r. Grand poisson.

In N^o 29. p. 541. l. 18. r. An intimation. p. 544. l. 5. r. from the Indexes. ibid. l. 22. dele, and as. p. 545. l. 21. r. breath out. p. 548. l. 18. r. with wind or,

In the S A V O Y,

Printed by T. N. for John Martyn, Printer to the Royal Society, and are to be sold at the Bell a little without Temple-Bar, 667.

PHILOSOPHICAL TRANSACTIONS.

Monday, January 6. 1667.

The Contents.

NEW Experiments, to the number of 16, concerning the Relation between Light and Air (in Shining Wood and Fish;) shewing, That the withdrawing of the Air from those and the like Bodies, extinguish's their Light, and the Re-admission of Air restores it. An Account of two Books: I. PATHOLOGIÆ CEREBRI & NERVOSI GENERIS SPECIMEN: in quo agitur de MORBIS CONVULSIVIS & SCORBUTO, studio THOMÆ WILLIS M. D. II. ALPHABETVM NATVRÆ. Authore F. M. B. V. HELMONT.

New Experiments

Concerning the Relation between Light and Air (in Shining Wood and Fish;) made by the Honourable ROBERT BOYLE, and by Him addressed from Oxford to the Publisher, and so communicated to the ROYAL SOCIETY.

SIR,

TO perform now the promise I made you the other day, I must acquaint you with what will perhaps somewhat surprize you, by giving you an Account of what I tried on Tuesday night last (Octob. 29. 1667.) and the two or three following nights, about the Relation between Air and Light, as this is to be found in some Bodies.

The Occasion of these Trials was this. Having, as you know, long since made some Notes, chiefly Historical, upon particular Qualities, and finding Light to be (how justly, I now dispute not) reckon'd by the generality of Philosophers among Qualities, I huddled together what Observations I had either made my self, or received from some Ingenious Travellers (to whom I recommended my Inquiries) about Shining Bodies; And had also prepared several Trials about them, to be made when I should have opportunity and requisite Instruments to put them in
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practise, which, as to some of those designed Experiments, have been long denied me. But having at length got hither one of my little Engines, and having also procured, after much enquiry, a few small pieces of Shining Wood, I began on the day above-mentioned to try with them an Experiment, I found in my List. And though the main Experiment be but one; I intended to set down what occur'd to me about it but as several Phænomena of it; yet finding it requisite, to acquaint you with some Trials, that are not so properly Parts of it, I shall for distinction sake, propose them as severall Experiments; the Narratives whereof are taken, for the most part, verbatim out of the Notes I set down for my own use, when the things to be registred were freshly done. Which advertisement I give you, both to excuse the carelessness of the Style, and to induce you not to distrust a Narrative, that was made only to serve my Memory, not an Hypothesis.

Experiment I.

TO try, Whether or no a piece of *Shining Wood*, being put into a *Receiver* of our *Pneumatick Engin*, would, upon the withdrawing and re-admitting of the *Air*, suffer such changes, as I have often observed a *Live Coal*, placed there, to doe; having at length procured a piece of such Wood, about the bigness of a *Groat* or less, that gave a vivid light (for *rotten Wood*) we put it into a middle-sized *Receiver*, so as it was kept from touching the *Cement*; and the *Pump* being set a work, we observed not, during the *five* or *six* first Exsuctions of the *Air*, that the splendour of the included Wood was manifestly lessened (though it never was at all increased;) but about the *seventh* suck, it seemed to grow a little more dim, and afterwards answered our expectation, by losing of its Light more and more, as the *Air* was still further pumped out; till at length about the *tenth* Exsuction (though by the removal of the *Candles* out of the room, and by black *Cloaths* and *Hats* we made the place as dark as we could, yet) we could not perceive any Light at all to proceed from the *Wood*.

Experiment II.

Wherefore we let in the outward *Air* by degrees, and had the pleasure to see the seemingly extinguish'd Light revive, so fast and perfectly, that it looked to us all, almost like a little flash of *Lightning*, and the splendour of the *Wood* seemed rather

rather greater, than at all lesse, than before it was put into the *Receiver*. But partly for greater certainty, and partly to enjoy so delightful a spectacle, we repeated the Experiment with the like success as at first. Wherefore being desirous to see how soon these changes might be produced, we included the Wood in a *very small* Receiver of clear glass, and found, That in this the Light would begin to grow taint at the *second*, or at least at the *third* Exsuction of the Air, and at the *sixth* or *seventh* would quite disappear. And we found by a Minute-watch, that the sending the Candles out of the room, the pumping out the Air till the Wood would shine no more, the re-admitting of the Air (upon which it would in a trice recover its Light) and the sending in for the Candles to consult the *Watch*, did in all take up but *six* Minutes.

Experiment III.

THe forementioned Experiment, without taking notice how long it lasted, being reiterated twice in this new Receiver, we had a desire to see, whether this Luminousness of our Wood would more resemble a *Coal*, or the Life of a *perfect Animal*, in being totally and finally extinguishd, in case the Air were kept from it a few minutes, or else the Life of *Insects*, which in our exhausted *Receiver* I had observed to lose all appearance of its continuing, and that for a much longer time than a few minutes, and yet afterwards, upon the restitution of Air, to recover presently, and shew manifest signs of Life: Wherefore having exhausted the *Receiver*, till the Wood quite disappeared, we stayed somewhat above a *quarter* of an hour in the dark, without perceiving, that the Wood had regained any thing of Light, though about the end of this time we made the place about it as dark as we could; and then it being too late at night to protract the Experiment, we let in the Air, upon whose admission the Wood presently recovered Light enough to be conspicuous at a distance; though it seemed to me somewhat less vivid than before: which yet may be either a weakness in my sight, or an effect of the steams of the Cement, unfriendly perhaps to the Luminousness of the Wood.

Thus far we proceeded yester-night, to which we this night added these Observations.

We put in a piece of Wood bigger than the former (this being above an inch long) and that shone very vigorously. And having by a few sucks quite deprived it of Light, we left it in the exhausted *Receiver* for full half an hour, and then coming into the dark room again, we found all had not continued so stanch, but that some small portion of *Air* had insinuated it self into the *Receiver*. This we concluded to be but a small portion of *Air*, because the Wood was but visible to an attentive Eye. And yet, that it was really some *Air*, which was got in, that caused the little glimmering light, which we perceived, may appear by this, that it did presently (as we expected) vanish at the first or second suck; and then the *Air* being let into the dark *Receiver*, the included Wood presently shone again as before: though I suspected, I discerned some little diminution of its brightness; which yet, till further Trials of the like kind, and for a longer time, have been made, I dare not affirm. Before the *Receiver* was sufficiently emptied at the beginning of the Experiment made with this greater piece of Wood, a small leak accidentally sprung, which, letting in a little *Air*, did sooner than we intended, recall the almost dis-appearing Light.

Experiment IV.

There is an Experiment of affinity with the former, which we thought it not altogether impertinent to try. For having observed on another occasion, That sometimes the Operation, which the withdrawing the *Air* hath upon a Body included in the *Receiver*, proves more considerable *some minutes* after we have ceased pumping, than *immediately* after the exercise is left off, I imagined, that even in such cases, where the Light is not made wholly to dis-appear (though it be made almost quite to do so) by the emptying of the Pneumatical glass, the suffering the Body to remain a while there, though without any pumping (unless now and then a very little to remove the *Air*, that might have stollen in in the mean time) the remaining Light of the Body might probably be further impaired, if not reduced quite to vanish. To examine this conjecture we put in a Body, that was not Wood, which had some parts much more luminous than the rest;

rest; and having drawn out the Air, all the others dis-appeared, and even the formerly brighter ones shone but faintly, when the Pneumatical glass seemed to be exhausted. But keeping the included Body a while in that unfriendly place, we perceived the parts, that had retained light, to grow more and more dim, some of them dis-appearing, and that, which was formerly the most conspicuous, being now but just visible to an attentive Eye, and that scarce without dispute. For, if we had not known beforehand, that a shining matter had been included in the *Receiver*, perhaps we should not have found it out. And he that had the youngest Eyes in the company could not at all discern it: (the Air being let in, the Body began to shine again.) But this being a single Trial, which the lateness of the night hindred us from reiterating, is to be further prosecuted, and in differing substances, before much be built upon it.

Experiment V.

THe *Rarefaction* or Expansion of the Air having so notable an operation upon our shining Wood, I thought it would not be amiss to try, what the *Compression* of the Air would do to it. For which purpose we included a piece of it in such a little Instrument to compress, which you may remember to have been devised and proposed by M. *Hook*. But though we impell'd the Air forcibly enough into the Glass, yet, by reason of the thickness requisite in such Glasses, and the opacity thence arising, we were not able *then*, to determine whether or no any change was made in the luminousness of the Wood.

Which I thought the less strange, because by some Experiments purposely devised (at one of which I remember you were present) I had long since observed, That even a great pressure from a fluid Body, which presseth more uniformly against all the Parts, it toucheth of the consistent Body, does work a far less manifest change even on soft or tender substances, than one would expect from the force wherewith it compresseth.

And were it not, that one contrary oftentimes minds us of another, I might have forgot, that I had divers thoughts about finding some good ways of Trying, whether any such change of Texture might be discovered to be made in the shining Wood by

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the absence and return of the Ambient Air, as might with any probability have the loss or recovery of the Woods splendour attributed to it. For I had formerly (if I were not mistaken) found by several circumstances, which I shall not now stay to name, That a slight (so it be an appropriated) variation of the Texture of this Wood, and which may seem mainly to respect the Pores (which perhaps ought to be of a determinate shape and size, and filled with a determinate matter) will have a great operation upon its splendour. And I formerly found by other trials, that even consistent Bodies, if soft ones, may have their Pores enlarged and vitiated, and their bulk, and consequently their texture (at least as to their pores) manifestly enough altered by having the Air withdrawn from about them (whereby the Aerial particles within them were enabled to expand themselves) and let in again, whereby, as to sense, they seemed pretty well restored to their former state. But the success of my endeavours either with *Microscopes* (through which a *vivid* piece of Wood will shine by its own light) or otherwise, was not considerable enough to deserve a particular account; especially in this Paper, where I am not to venture at matter of *Theory*.

Experiment VI.

THinking fit to try, Whether a *small* quantity of Air, without being ventilated or renewed, might not suffice to maintain this Cold fire, though it will not that of a Live Coal, or a piece of Match, we caused a piece of shining Wood to be *Hermetically* sealed up in a pipe of clear and thin glass: but though, carrying it into the dark, we found it had quite lost its light, yet imagining that that might proceed from its having been over-heated (being sealed up in a Pipe not long enough to afford it a due distance from the flame of the Lamp we employed to seal it,) we caused two or three pieces of fresh Wood, amounting all of them to the length of about two inches, to be sealed up in a slender pipe between four or five inches in length; which being warily done, the Wood retained its light very well, when the Operation was over: And afterwards laying it by my bed-side, when the Candles were carried away out of the room, I considered

dered it a while before I went to sleep, and found it to shine vividly.

The next morning when I awaked, though the Sun was risen, yet forbearing to draw open the Curtains of my bed, till I had looked upon the sealed Glass, which I had fenced with a piece of Cloth, held between it and the window, my Eyes having not yet been exposed to the day-light since the darkness they had been accustomed to, during the night, made me think the Wood shined brighter than ever. And this night after ten of the Clock, looking on it in a dark place, it appeared luminous all its length, though not so much so as in the morning.

The morning after, and the night after that, the same Wood did likewise manifestly, though not vigorously shine, especially one piece, whose light was much more vivid than the rest. And, for ought I know, I might have observed them to shine longer, if one of the sealed ends of the Glass had not been accidentally broken.

Experiment VII.

While the former Trials were making, I was wishing for a good *Bolonian Stone*, to try what effect the withdrawing of the Air would have upon it. For though I knew it might be objected, that the Experiments of Light performable in our *Engine* must be made in the night, whereas the *Bolonian Stone* gains its light by being exposed to the sun-beams, yet that objection did not hinder my wish, since the better sort of *Bolonian Stones* may be induced with a luminousness by the flame of fire, or of large Candles.

I also wished for such a *shining Diamond*, as is now in the hands that best deserve such a Rarity, our *Royal Founder's*. For you may remember, that in the Observations I made of that Stone, and annexed to the Conclusion of the *Book of Colours*, I show how it may several ways be brought to shine; so that by one or other of these ways, especially that of external Heat, I thought it very likely, I should be able to make the light continue four or five minutes, which would be long enough to try in a very small *Receiver*, exhaustible at a Suck or two, whether the withdrawing and restoring the Air would have any visible Operation on it?

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I also wisht for some of the *Glow-worms*, with which I formerly made other Trials. For though I forgot not, what operation the withdrawing of the Air, by our *Engine* is wont to have upon living creatures, yet that made me not forbear my wish; not only because of the different effect I have found the *Engine* to have on *Insects* in respect of other Animals, but because I am not of the opinion of those modern Writers, who will have the Light of *Glow-worms* depend altogether upon their Life, and end with it. But being not likely by my wishes to procure any new subject to make trials on, I thought fit at least to do what was in my power, and accordingly (to gratifie them, who, I presumed, would, if present, propose such a Trial) caused a piece of *Iron* to be forged, whose top was of the bigness of a Nutmeg; the rest being a stemm, of an inch, or an inch and a half long, for which we provided a little Candlestick of Tobacco-pipe-clay, which would not yield any smok to fill and darken the *Receiver*. Then having heated the *Iron* red-hot, and placed it in this Clay, so that the round part was clearly protuberant, we conveyed it into a *Receiver* of white Glass, which was so placed as to keep the sides at as good a distance, as we could, from the *Iron*, lest the excessive heat should (as we much feared it would) break the Glass. Then sending away the Candles, and making the Room dark, we hastily pumped out the Air, but could not perceive the withdrawing of it had any operation on the glowing *Iron*. And though it continued shining long enough to give us opportunity to pump out and let in the Air three several times, yet we could nor observe, that the Air had any manifest operation one way or other. For though upon the withdrawing of the Air the *Iron* grew dimmer and dimmer, yet that I attributed to the *cooling* of it: and the rather, because, having (to examine the conjecture) let in two or three times the Air, when the *Receiver* had been exhausted, there appeared no manifest increase of Light upon the sudden admission of it.

Experiment VIII.

HAVING formerly in our *Physico-Mechanichall* Experiments about the *Spring* of the Air observed, That the Air is thus (as a Vehicle of Sound, that a Body but faintly sounding, being placed

placed in our *Receiver*, gave a yet weaker sound, when the Air was withdrawn from about it, then when the *Receiver* was full of Air: I presumed, some curious persons would, if they had been present, desire to have a trial made, whether or no a small piece of *Shining Wood* being so included in the *Receiver*, as that the Pumping out of the Air should have no injurious operation upon the body of it, its Light would upon the withdrawing of the Air be manifestly diminish'd. And this I was the less backward to try, because (not to mention the *Relation*, which the former Experiments shew there may be in some cases between *Light* and *Air*) it did not readily occur to my memory, that by any *manifest Experiment* (for I know, there are probable Reasons to prove it) it appeared, that a Body more thin than Air will or can transmit Light, as well as other *diaphanous medium's*. And those modern *Atomists*, that think, there is in our *exhausted Receiver* very many times more *Vacuum* than *Body*, would, I presumed, be glad to be supplied with an Argument against the *Peripateticks*, to show, That the Motion of Bodies, *viz.* the Corpuscles of Light, may be freely made in *Vacuo*, and proceed without the assistance of a Vehicle.

Wherefore having *Hermetically* sealed up a small piece of *Shining Wood* in a slender Pipe, and placed it in a small *Receiver*, that was likewise made of clear Glass, we exhausted it of Air, and afterwards let in again that, which we had excluded. But by neither of the Operations could we perceive any sensible decrement or increase of the Light of the Wood, though by that very Observation it appeared, that the Glass had been well sealed, since otherwise the included Air would have got out of the Pipe into the *Receiver*, and have left the Wood without Light.

Experiment IX.

I Had also a mind to try, both what *degree* of *Rarefaction* of the Air would deprive the Wood of its splendour in such and such measures, and whether or no the self-same Air, which, when rarified, would not suffer the Wood to shine, would, when reduced to its former density, allow it to shine as much as before.

This I propos'd to do by putting some *Shining Wood* into a

clear and conveniently shaped Glass, that the long Stem or Pipe being so far filled with *Quicksilver*, as that there might be about half a spoonful of Air left at the closed End, where the Wood was placed, it might be inverted into a little Glass of *Stagnant Quicksilver*, and therewith conveyed into a slender *Receiver*, out of which as the *Air* should come to be pumped, that included in the Glass, which held the Wood, might be rarified, and afterwards upon the admission of the outward *Air* (which must impell up the *Quicksilver* to its former height) might be restored to its former state. But when we came to make trial of this, we had no *Receiver* conveniently shaped, that was so clear and thin, as that we could see the Wood shine through both the Glasses. And though we would for an Expedient have substituted a fine thin *Bladder*, wherein the Wood was to be put, and a convenient quantity of *Air* strongly tied up with it, yet for want of a *Bladder* fine enough for our turn, that Expedient also proved useles to us. But being desirous to make what trial we could by the least unfit means, we had in our power, we got an old, but thin Glass, sealed at one end, whose shape was pretty *Cylindrical*, and whose bore was about the bigness of a mans little finger, and whose length was about a foot or more. Into this Pipe near the sealed end we put a piece of Shining Wood, wedged in with a piece of Cork to keep it from falling; and having inverted the nose of it into another slender Glass, but not *Cylindrical*, wherein was pretty store of *Quicksilver*, we put them both into a long *Receiver*, shaped almost like a *Glass Churn*, and having pumped a while, that the *Air* included in the Pipe, expanding it self, might depress the *Quicksilver*, and so make escapes into the *Receiver*, as long as we thought fit; we then let in the outward *Air*, that the *stagnant Quicksilver* might be impelled into the cavity of the Pipe now freed from much of the *Air*, to the height requisite for our purpose.

This done, we plied the Pump again, and observed, That, as the *Air* in the Pipe did by its own *Spring* expand it self more and more, and grow thinner and thinner, the *Shining Wood* grew dimmer and dimmer, till at length it ceased to shine, the *internal Air* being then got a good way lower, than the surface of the *external Quicksilver*: whereupon opening the commerce between the cavity of the *Receiver*, and the *Atmosphere*, the *Quicksilver*

silver was driven up again, and consequently, the *Air* above it was restored to its former density; upon which the *rotten Wood* also recovered its light. What the greatest Expansion of this *Air* was, we could not certainly determine, because the Expansion raised the *external Quicksilver* so high, as to hinder us to see and measure it. But we guessed, that the *Air* reached to about a foot or more from the top of the Pipe to the surface of the *Quicksilver* near the bottom of it. But, when that rarified *Air* was impelled into its former dimensions, we measured it, and found, that the upper part of the Tube, unpossess'd by the *Quicksilver*, was about three inches; and the *Wood* being about an inch long, there remained two inches or somewhat better for the *Air*. But this Experiment is to be repeated, when exacter Instruments can be procured.

Experiment X.

THinking it fit to try as well, Whether *Stinking Fish*, that shines, be of the same nature as to Luminousness with *Rotten Wood*, that shines too; as, Whether the withdrawing of the *Air* will extinguish or eclipse the Light of a *considerable bulk* of luminous matter, as in the Experiments, hitherto made, we found it would do to a *small one*: We took a *Fish*, that we had kept, and caused to be watched, till 'twas almost all over Luminous; though much more in the *Belly* and some parts of the *Head*, than elsewhere: And having suspended him in a conveniently shaped *Receiver*, we found him to give so great a Light, that we suspected beforehand, that the withdrawing of the *Air* would hardly have its full operation upon a *Body*, whose *bulk* was considerable, as well as its *light* very vivid, and which had many luminous parts retired to a pretty distance from the *Air*. Accordingly having exhausted the *Receiver* as much as we were wont, it appeared indeed, especially towards the latter end of the operation, that the absence of the *Air* did considerably lessen, and in some places eclipse the light of those parts, that shone less strongly. But the *Belly* appeared not much less luminous than before: Wherefore supposing, that upon the turning of the *Stop-cock* the *Air* coming in much more hastily than it could be drawn out, we should have the best advantage to discern, what interest it had in the Luminousness

nousness of the Fish, we re-admitted it, and upon its rushing in, perceived the Light to be as it were revived, and increased, those parts of the Fish, that were scarce visible before, or shone but dimly, receiving presently their former splendour.

And not to leave un-prosecuted the remaining part of the Experiment, which was to try, Whether it was the *Kind* of the Luminous Body, or only the *Greatness* of the *bulk*, and the *Vividness* of *Light*, and, if I may so speak, the *Tenacity* of the substance it resided in, that made the difference between the *Fish* and the *Wood*; We put part of the Fish of another kind, that shone much more faintly, than *that*, hitherto spoken off, and but in some places; and by the withdrawing the *Air* we made some of the luminous parts disappear, and the others so dim, as scarce to be discerned; and yet both the one and the other regained their former light upon the return of the *Air*.

And to pursue the Experiment a little further, we put in such a piece of the first Fish, as though it were bright, was yet but thin and not considerably great, and upon pumping out the *Air*, we found it, according to our Expectation, quite eclipsed, though it recovered its Light upon the *Air*'s re-entry.

These, Sir, are the Experiments, I have lately made about Shining Bodies in our Engine. More I would have tried, notwithstanding the trouble we found in managing the Engine in the dark, if rotten Wood had not failed us, and if I were not in a place, where Glass-mens Shops are not near so well furnish'd as the Stationers.

I scarce doubt, but these Experiments will occasion among the Virtuosi several Quere's and Conjectures, according to the differing Hypotheses and Inquiries, to which men are inclined. And particularly 'tis probable, that some will make use of this Discourse to countenance their Opinion, That notwithstanding the Coldness (at least as to sense) of Fishes and other Animals, there may be in the Heart and Bloud a Vital kind of Fire, which needs *Air*, as well as those Fires that are sensibly hot: which may lessen the wonder, that Animals should not be able to live when robb'd of *Air*. And if I had now time, I could possibly furnish you with some other Trials, that seem much to favour the Comparison, though, as to the Opinion it self of a Vital flame I shall not now tell you my thoughts about it. And though not only the Cartesians will perhaps draw an argument from the past Phænomena in favour of their Theory of Light, but divers others will discourse upon them, and propose further Questions and perhaps Inquiries suitable to their several Hypotheses; yet I shall content my self at present to have faithfully delivered the Historical part of these Apparences, without making

making, at least at this time, any Reflexions on them. And the rather indeed, because I enjoyed so little health, when I was making the Experiments, that 'twas not fit for me to engage in Speculations, that would much exercise my thoughts, which, I doubt, have been more gratified, than my health hath been by the bare Trials, which are most seasonably made at hours unseasonable for one, that is not well.

P O S T S C R I P T.

Sent by the same Noble Author from the same place,
December 6. 1667.

MY condition in point of health being not much improved since I writ to you in October last, when I shall have added, that I have not these five or six weeks been able to procure any Shining Wood (except one single piece, which though large, was so ill conditioned, that it afforded me but one Trial) you will not, I hope, expect, that I should add much to the Experiments I formerly sent you about the Relation 'twixt Light and Air. But however, since the subject is New and Noble, and since your curiosity about other matters has been so welcome and useful to the Virtuosi, I shall not decline even on this occasion to comply with it, and the rather, because I half promised you some Additionals a good while since, and because too, that though, what I shall acquaint you with, may seem to be but a Confirmation of two or three of the former Experiments, yet, besides that 'tis of them, which most needed a Confirmation, these Trials will also afford some Circumstances, that will not, I think, be unwelcome.

Experiment XI.

TO examine then the Conjecture, mentioned in the last Experiment, That the durableness of the Light in the *Shining Fish*, in spite of the withdrawing the Air, might proceed in great part from the Vividness of it, and the beauty of the matter it resided in, rather than from the Extent of the Luminous Body in comparison of the small pieces of *Shining Wood*, I hitherto had made my Trials with; I put in, the above-mentioned piece of Wood, whose luminous superficies might be perhaps ten or twelve times as great, as that, which the Eye saw at once of the

the surface of such fragments of *Shining Wood*, as I was wont to employ: And though some parts of this large *Superficies* shined vividly (for the light was usually enough, for rotten Wood, inferior to that of our Fish) yet this great piece, being put into a convenient *Receiver*, was, upon the withdrawing of the Air deprived of Light, as the smaller ones had been formerly; the returning Air restoring its Light to the one, as it had done to the other.

Experiment XII.

BUT this is not the chief thing I intended to acquaint you with, *That* being the success of some Trials, which we made in prosecution of these two neighbouring Experiments.

In the *first* of these I told you, I had been able to try but for half an hour or a little more, that a *Shining* piece of *Wood*, deprived in our *Engine* of Light, would yet retain a disposition to be as it were re-kindled upon the fresh access of the Air. Wherefore, though I could have wished to have made a further Trial with the same kind of Bodies, yet being able to procure none, I substituted in their room small pieces of *Rotten Fish*, that shone some of them more faintly, and some of them more vividly, in reference to one another; but none as strongly, as some, that I could have employed: and having in a very small and clear *Receiver* so far drawn off the Air, as to make the included Body disappear, we so ordered the matter, that we kept out the Air for about 24 *hours*; and then allowing the Air to re-enter in a dark place and late at night, upon its first admittance the *Fish* regained its Light.

Experiment XIII.

THIS, compared with some of my former Observations about *Putrefaction*, put me upon a Trial, which though it miscarried, I shall here make mention of, that in case you, who are better furnished with Glasses, think it worth while, you may get reiterated by the *Society's* Operator. Considering then, how great an interest *Putrefaction* hath in the *Shining* of *Fishes*, and *Air* in the *Phænomena* of *Putrefaction*, I thought, it might be somewhat to the purpose, to take a Fish, that was, according to the common

mon course I had observed in Animals, not far from the state, at which it would begin to shine: and having cut out a piece of it, I caused the rest to be hung up again in a Cellar, and the expected piece to be put into a small and transparent *Receiver*, that we might observe, if a day or two, or more, after the Fish in the Cellar should begin to shine, that in the exhausted *Receiver* would either also shine, or (because that seemed not likely) would, notwithstanding the check, which the absence of the Air might be presumed to give the *Putrefaction*, be found to shine too, either immediately upon the admission of the Air, or not long after it.

But this Experiment, as I lately intimated, was *only* designed and attempted, not compleated; the *Receiver* being so thin, that upon the exhaustion of the *internal* Air, the *weight* of the *external* broke it; and we could ill spare another of that kind from Trials, we were more concerned to make: Notwithstanding which we made one Trial more, which succeeded no better than the former, but miscarried upon a quite differing account, *viz.* because neither the included piece of Fish, nor the remaining, though it were of the same sort with the Fishes I usuall employed, would shine at all, though kept a pretty while beyond the usual time, at which such Fishes were wont to grow luminous.

If this Experiment had succeeded, I had some others to try in prosecution of it, which I shall not now trouble you with the mention of. But that this *Paragraff* may not be useles to you, I'll take this occasion to give you a Couple of *Advertisements*, that may relate not only to this Experiment, but also more generally to those, whether precedent or subsequent, where *Shining Fish* are employed.

Advertisement I.

IN the first place then, I will not undertake, that all the Experiments you shall make with rotten Fish, shall have just the same success with these I have related. For as I elsewhere observed (in a Discourse written purposely on that subject) that the event of divers other Experiments is not always certain, so I have had occasion to observe the like about Shining of Fishes. And, besides what I lately took notice of at the close of the tenth Experiment, I remember, that having
once

Once designed to make Observations about the Light of rotten Fishes, and having in order thereunto caused a competent number of them to be bought, not one of them all would shine, though they were bought by the same person I was wont to employ, and hung up in the same place where I use to have them put, and kept not only till they began to putrifie, but beyond the time that others used to continue to shine; although a parcel of the same kind of Fishes, bought the week before, and another of the same kind, bought not many days after, shined according to expectation. What the reason of this disappointment was, I could not determine; only I remember, that at the time, it happened, the weather was variable, and not without some days of Frost and Snow. Nor is this the oddest Observation, I could relate to you about the uncertain shining of Fishes, if I thought it necessary to adde it in this place.

Advertisement II.

Notice must also be taken in making Experiments with Shining Fish, that their luminousness is not wont to continue very many days. Which Advertisement may be therefore useful, because without it we may be apt sometimes to make Trials, that cannot be soon enough brought to an issue; and so we may mistake the loss of Light in the Fish to be a deprivation of it caused by the Experiment, which indeed is but a cessation according to the usual course of Nature.

Experiment XIV.

I Know not whether you will think it worth while to be told of a Trial, that we made to save those Criticks a labour, that else might perhaps demand, Why 'twas not made. We put therefore a piece of Shining Fish into a wide-mouthed Glass, about half filled with fair Water, and having placed this Glass in a Receiver, we exhausted the Air for a good while, to observe, Whether, when the pressure of the Air was removed, and yet (by reason of the Water that did before keep the Air from immediately touching the Fish) the Exhaustion of the Receiver did not deprive the Fish of that contact of Air, which it had lost before; Whether, I say, in this case the absence of the Air would have the same influence on the shining Body, as in the former Experiments? And here,

here, as far as the numerous bubbles excited in the Water would give us leave to discern it (for they did, though not unexpectedly, somewhat disturb the Experiment, which inconvenience we might have prevented, if we had thought it worth while) we could not perceive, that either the absence or return of the Air had any great operation upon the Light of the immersed Body: which yet did not keep me from intending to make a somewhat like Trial with *Shining Wood* (when I can get any) fastened to the lower part of a clear Glass, and covered over, but not very deep, with *Quicksilver*. Of which practice I shall not now stay to give you the Reasons, having elsewhere fully enough expressed them.

And that this *Section* may acquaint you with something besides the (seemingly) insignificant Experiment related in it, I shall here inform you (since I perceive, I did not in the first Papers I sent you) that though, when I formerly put together some Notes about Luminous Bodies, I confined not my Observations to one or two sorts of Fishes, yet the Experiments, sent you since *October* last, were all of them (except a *Collateral* one or two) made with *Whitings*, which among the Fishes, I have had occasion to take notice of, is (except one sort, that I cannot procure) the fittest for such Trials, and consequently fit to be named to you, to facilitate their future ones, in case you think it requisite to make any upon such subjects.

Experiment XV.

THE other of the two neighbouring Experiments, I lately mentioned (*viz.* the ninth) I told you, when I sent it you, needed a reiteration to confirm it, since we had but once tried it (and that without all the conveniency we desired) that a Shining Body, which upon the first withdrawing the Air looseth *much*, but not *all* its Light, may be deprived of the rest by continuing in that unfriendly place, though the Air be no further exhausted. To prosecute therefore both the Experiments in one Trial, we took somewhat late at night a piece of rotten Fish, which we judged to shine too strongly, to be quickly deprived of *all* its Light, and having put it into a small and clear *Receiver*, we found (as we had foreseen) that the Light was much *impaired*, but nothing near

suppressed by the withdrawing of the Air. Wherefore having removed the *Receiver* into a convenient place, I caused it to be brought to me about midnight (after I was a bed) and having by close drawing the Curtains, and other means, made the place pretty dark, I perceived the included Body to continue to shine more vividly, than one would have expected, (and, if I mistake not, I saw it shining in the morning, whilst it was dark;) but the night after, coming to look upon it again, its light appeared no more: notwithstanding which, I made a shift to keep out the Air about 24 hours longer, and so after 48 hours in all, we opened the *Receiver* in a dark place, and presently upon the ingress of the Air were pleasingly saluted with so vivid an Apparition of Light, that the included Body continued to shine, when carried into a room, where there was both Fire and Candle, if it were but by a *Hat* screen'd from their beams.

Being encourag'd, as well as pleas'd with this success, we forthwith exhausted the Air once more out of the same *Receiver*, and having kept it about 4 hours longer, we lookt upon it again in a dark place, and finding no appearance of Light, let the Air in upon it, whereby it was made to shine again, and that vigorously enough, so that I caused the *Receiver* to be exhausted once more; but that it being *Sunday* night, I was unwilling to scandalize any, by putting my Servants upon a laborious, and not necessary work.

The suddenness, with which the included Body appeared to be, as 'twere, re-kindled upon the first contact of the Air, revived in me some suspicions I have had about the possible causes of these *short-liv'd apparitions* of Light (for I speak not now of *real* Lamps, found in Tombs, for a reason to be told you another time,) which disclosing themselves upon mens coming in, and consequently letting in fresh Air into Vaults, that had been very long close, did soon after vanish. These thoughts, as I was saying, occur'd to me upon what I had been relating, by reason of the sudden operation of the fresh Air upon a Body, that but a minute before disclosed no light. For, though the Lights reported to have been seen in Caves, quickly disappeared, which that of our Fish did not; yet that difference might possibly proceed from the Tenacity, or some other Disposition of the matter, wherein

wherein the Luminousness of the Fish resides. For I remembered, that I had more than once observed a certain glimmering & small Light to be produced in a sort of Bodies upon putting them out of their former *Rest*, and taking them into the Air, which sparks would vanish themselves sometimes within one minute, sometimes within a few minutes. But as these thoughts were but transient conjectures, so I shall not entertain you any longer about them, but rather contenting my self with the hint already given, take notice of what may be more certainly deduced from our Experiment, which is, That the Air may have a much greater interest in divers odde *Phenomena* of Nature, than we are hitherto aware of.

And for Confirmation of our Experiment I shall adde, that, having in another *Receiver* eclipsed a piece of Fish, that shone when 'twas put in more languidly than divers others that we had tried, I kept it about three days and three nights in a *Receiver*, which (*Receiver*) being somewhat like another, at first suggested to me, when I came to take it, some scruple, but afterwards, upon further examiaation, concluded it to be the same; wherefore I opened it in the dark, and upon letting in the Air on this Body, that shined but faintly at first, it immediately recovered its so long suppressed Light: and having included another piece that was yet more faint than this, when it was put into the *Receiver*, I thought fit to try at once the Experiment hitherto confirmed, and the *Converse* of it. And therefore having kept this piece also three days and three nights in the exhausted Glass, I let in the Air upon it, and notwithstanding the darkness of the place nothing of life was thereupon revived. But this being little other than I expected from a Body, that shined so faintly when 'twas put into the *Receiver*, and had been kept there so long, I resolved to exercise my patience a while as well as my curiosity, and try, Whether the Appulse and Contact of the Air would have that operation *after some time*, that it had not *at first*; and accordingly, after having waited a while, I observed the Fish to disclose a Light, which though but dim, was manifest enough; but having considered it for some time, I had not leisure to watch, whether 'twould increase, or how long 'twould continue.

I know not, *Sir*, whether you are weary with reading, but I am sure I am quite tired with making so many Experiments upon *one*

Subject; and therefore I shall here conclude this Paper, as soon as I have added this Confirmation, as well of what I last related, as of something that I observed before, That having included in small *Receivers* two pieces of *rotten Whitings*, whereof the one, before it was put in, scarce shone so vividly, as did the other after the *Receiver* was exhausted; and having ordered the matter so, that we were able to keep out the Air for some days, at the end of about 48 hours we found, that the more strongly shining Body retained yet a deal of Light. But afterwards looking upon them both in a dark place, we could not perceive in either any show of Light. Wherefore having let in the Air into that *Receiver*, whereinto the Body that at first shined the faintlier had been put, there did not ensue any glimmering of Light for a pretty while: nay, upon the rushing in of the Air into the other Glass (then also made accessible to the *Atmosphere*) the body that at first shone so strongly, and that continued to shine so long, shewed no glimmering of Light. But being resolved to expect the issue a while longer, our patience was rewarded within less than a quarter of an hour with the sight of a manifest Light in the Body last named, and a while after the other also became visible, but by a light very dimm. The more luminous of these Bodies I observed to retain some Light 24 hours after: and the hitherto recited Experiment had this peculiar Circumstance in it, That the two *Receivers* were un-interruptedly kept exhausted no less than 4 days, and as many nights*.

* *What method the Noble Author of these Experiments used in keeping out the Air for so long a time, will probably be made known ere long by himself.*

An Account of two Books.

I. PATHOLOGIÆ CEREBRI & NERVOSI GENERIS SPECIMEN: in quo agitur de MORBIS CONVULSIVIS & SCORBUTO, studio THOMÆ WILLIS, M. D.

WHAT this excellent *Author* formerly promised of the whole *Pathology of Brain and Nerves*, he gives in this *Book* a very considerable *Specimen* of. The knowledge of the Diseases which use to affect these parts, is esteemed very difficult and intricate, and particularly the true Causes of *Convulsions* are of a very deep research. For the clearing them up, this *Author* Philosophiseth

Iosophifeth after this manner. He teacheth, that there are indeed *Animal Spirits*, that they constitute the *Being* of the *Corporeal Soul*, and are also the *next* and *immediate* Instruments of all *Animal motions*, producing them by a kind of *Explosion* or *Shooting*; upon which *Elastick*, or *Explosive* power he establish's his whole *Doctrine of Convulsions*. To which he annexes a *Disquisition* of the *Scurvey*, as being near of kin to the same *Doctrine*, and grounded upon the same *Hypothesis*.

The First part consists of XII Chapters.

1. OF Convulsive Motions in *general*.
2. Of the *Epilepsy* or *Falling-Sickness*.
3. Of the differences of the *Epilepsy*, and the Causes of some of the *Symptoms* thereof; together with a *Daught* of the method of *Curing* this *Disease*.
4. Of the other kinds of *Convulsions*, and particularly of those in *Children*.
5. Of the *Convulsive fits* in *grown* and *aged* persons, proceeding chiefly from the vitiated *Origin* of the *Nerves*.
6. Of those *Convulsive Motions*, whose Cause lies about the *Extremities* of the *Nerves*, or within the *Plexus nervi*.
7. Of those that are caused by *Liquors*, bedewing the *nervous Bodies*, and irritating the whole processes of them into *Convulsions*: where are considered the *Cramps* that arise from *Poysons*.
8. Of the *Universal Convulsions*, that are wont to be caused in *Malign*, or *ill Judged*, and some *anomalous Fevers*: where are described the *Epidemical* and *Maligne Convulsive Distempers*, formerly reigning in some parts of *Germany*, as also that *Epidemical Fever*, which raged *An. 1661* in *England*, and did principally afflict the *Brain* and *Nerves*.
9. Of those that proceed from the *Scorbutick* Disposition of the *Nervous Juice*.
10. Of *Hysterick* passions, where he maketh the *Womb* plead *Not guilty*.
11. Of those Passions, that are vulgarly called *Hypochondriacal*, shewing, that they are chiefly *Convulsive*; where by the by he treateth of *Chalybeat Remedies*.
12. Of *Convulsive Coughs* and *Asthma's*, and their *Cure*.

The Second part contains XI Chapters.

1. A Description of the *Scurvy*; its internal and *next Cause* to be principally in the *Blood*, and sometimes in the depraved *Juyce* of the *Nerves*.

2. Of the *remoter Causes* of the *Scurvy*, and whence the *Mass* of the *Blood*, and consequently the *Nervous Liquor*, receive its depravation.

3. Of the *Differences* of the *Scurvy*, its *Signs* and *Symptoms*, and chiefly such, as arise from the *Blood* being tainted.

4. Of those *Accidents*, which happen in the *Scurvy* by reason of the *Brain* and the *Nervous Stock* being vitiated.

5. Of the *Symptoms* that arise from the conjoynd *Distempers* of the *Blood* and the *Nervous Juyce*.

6. Of the *Prognosticks* of the *Scurvy*; where he takes notice, that a *prevailing Scurvy* at last ushers in a *Dropsie* or a *Consumption*.

7. Of the *Cure* of the *Scurvy*; where, among other *Remedies*, he mentions several *Specificks* for this *Disease*.

8. Of such *Medicaments* as respect the *Scurvy*, caused in a *Hot Constitution*, and in a *Sulphury-salin Distemper* of the *Blood*.

9. Of the *Cure* of the various and urging *Symptoms* of the *Scurvy*; as, difficult *Respiration*, *Scorbutical Collick*, *Fluxes*, *Giddiness*, *Hemorrhagies*, loose and rotten *Gums* and *Teeth*, *Pains* in all the *Limbs*; besides the *Scorbutick Gout*, *Convulsions*, *Palsies*, *Atrophy*, *Feaver*; as also *Rheumatismes*, *Dropsies*, and the *Noise* in the *Bones*, which some are troubled with in this *Disease*.

10. Of the *Vital Indication*, declaring, by what method and *Medicines* either the fainting *Patient* may be supported, or his decayed *Forces* restored: Where he discourseth of *Cardiacal Opiat Medicines*, and of the *Diet* that is fit for *Scorbutical persons*.

11. Some rare and very considerable *Relations* and *Cases* of *Scorbutick Men* and *Women*.

II. ALPHABETUM NATURÆ, 1667. Authore F.M. B.V. HELMONT:

THIS small *Tract* (the Subject whereof seems to be New, not treated of hitherto by any we know of in Print) is publisht both in the *Latin* and *German* Tongue, but came to our hands in the *latter* only; a *Latin* Copy, designed

designed for us before, having miscarried at Sea, which we have not been able hitherto to get suppl'd, because of the scarcity of the Copies of that Edition, as it was signified to us from *Amsterdam*.

It is divided into three parts: The *First*, in Five Dialogues, treateth

1. Of the *Motions* and *Configurations* of the *Mouth* of Man; and how a Man, born deaf, and consequently dumb, may come to understand both them, and by them the Mind of him that forms them: Where 'tis observed, that a Man born deaf is not altogether destitute of all Motion of his Tongue, and that he may be taught to understand others by the *Motions* of their Mouth and Tongue, much after the manner as others are taught to read; but that this is much more easily practicable in those *wide-mouthed* Languages, which do remarkably expose to the Eye the *Motions* of the Tongue, Lips, Throat, &c. than in those that are *narrow-mouthed*, and require but very slight *Motions* of the Lips and the other Organs of Speech. To which is annexed a Method suitable to that principle, of teaching deaf and dumb Men to speak; together with an Example of a *Musician*, who being altogether deaf, and weak-sighted withall, was by the Author brought so far in the space of three weeks, that he was able to answer to all that was spoken to him, provided it were done slowly, and with a well-opened Mouth; who also afterwards by himself, as soon as he had by this very way learned to know the Letters, and to Read, did, by confronting only the *German* and *Hebrew* Bibles, learn in a short time the *Hebrew* Tongue so well, that now he understands the whole *Hebrew* Bible.

2. Of the *Proprieties* of the *Hebrew* Tongue. How the Letters thereof are meer representations of the *Motions* of the Mouth? How the *Hebrew Alphabet* may be described, (as 'tis done here) by representing the Letters thereof in the *Mouths* of so many pictured Mens heads? How this *Alphabet* is to be compared with other ways of Writing? To which is added a *Disquisition* concerning the true ancient manner of Writing, and the original of other ways, and how the true way may be found out; and how much the Names of the Letters conduce thereunto?

3. Of the Nature and Properties of the *Tongue* of Man. Where *first* is considered the Speech of young Children, how and in what order *that* is made: *then*, the requisiteness of the *Change* of *Tone* to Speech; and how by the various Openings of the Mouth and the Teeth, that change is caused. After which the Author proceeds to the description of the *Tongue*, *Wind-pipe*, *Larynx*, *Epiglottis*; where he not only shews, how by a peculiar use of the *Epiglottis* one may come to speak inwardly, as do the *Ventriloqui*, by attracting the Breath, and without Opening the Mouth; but annexeth also divers Rules concerning the *Motions* of the Tongue, observing especially the perpetual concord of the Mouth and Tongue in their *Motions*, and the *Representation* of the Tongue's Motion, requisite for every Letter, in the Image and Figure of such Letter.

4. Of the *Breath* of Man, its quality, and its necessity for the forming of the *Voyce*. Where he shews, How by inspiring, the *Breath* is distributed through the *Lungs* (the nature of which he also describes,) and how the same circulates through the whole *Body*.

5. Of the *Animation* of the *Voyce* of Man by his *Masculine* and *Generative* power. Where he discourses of the difficulty, found in little *Children*, to pronounce certain *Letters*; and also of the *Weakness* of the *Voyce* in *Children* and *Eunuchs*. *So much of the first part.*

The *second part*, in one *Dialogue*, gives an account, How the *Motions* and *Configurations* of the *Mouth*, and the *Framing* of the *Voyce* are represented in the *Hebrew Alphabet* (for, to this *Tongue* the *Author* confines himself; but with what reason, the *Intelligent Reader* of the *Book* it self may judge :) explaining the *Sound* of each *Letter*, the *Motion* of the *Tongue* accompanying the *Sound*, and the *Figure* of the *Letter*, resulting from thence; together with each *Letters* name, signification, and aptitude to form the next following *Letter*. Which done, he proceeds to shew, how the *Vowels* are formed by the *different Openings* of the *Mouth* and *Teeth*; so that to every *Vowel* belongs a peculiar dimension of *Wideness* in the *Mouth*: And according to the *shape* of the outward *Mouth*, the *Tongue* and *Breath* are conformably moved within. To which are added the *Names* of the *Vowels*, and their *Figures*; their absence in most ancient *Writings*, and the several places in the *Mouth* for their formation. All which is concluded partly with a deduction of the *Cause*, why the *Hebrew Tongue* is written from the *Right* hand to the *Left*? partly, with an *Explanation* of the method used to compose out of such *Letters* and *Language* a *Grammar*, viz. by comparing the *Consonants* with one another, and the *Vowels* as well with one another as with the *Consonants*; forasmuch as the nature of one being well considered with respect to the other, 'tis not difficult to judge, how they agree or disagree together: Whence *Rules* may be formed, how and why this or that *Letter* or *Vowel* is to be changed into another, &c.

The *Third part* treateth of the perfection of the *Hebrew Tongue*; where-in it consists, and how highly 'tis to be valued, To which is subjoyned first a *Disquisition* of reason, why the *Radical Words* in the *Hebrew Tongue* can consist of no more but three *Consonants*? Secondly, a *Discourse* touching the *Hebrew Accents*, shewing, that 'tis a *New Invention*, and that the *Ancient Art* of *Musick* being lost, and consequently to us unknown, the *Modern Hebrew Accents* cannot reasonably be said to have been the *Musical Notes* of the *Ancients*; since especially all sorts of *Hebrew Books*, and even their *Chapters* are marked therewith: though the *Author* acknowledges; that their newness deprives them not of the advantage of being useful.

In the S A V O Y,

Printed by T. N. for John Martyn, Printer to the Royal Society, and are to be sold at the Bell a little without Temple-Bar, 1667.

PHILOSOPHICAL TRANSACTIONS.

Monday, February 10. 1667.

The Contents.

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Observations and Tryals

About the Resemblances and Differences between a Burning Coal and Shining Wood.

These particulars were already in our hands, when we published the Experiments made on Shining Wood and Fish, in the last Papers, imparted then by the same Noble Author Mr. Boyle) that those were; but wanted then room enough to contain these, which now follow; as they were sent in a Letter from Oxford, Viz,

And now, *Sir*, seeing the want of *Shining Wood* hath kept me ever since I sent you the former Experiments from making any New ones on that subject, I shall, by way of amends, subjoin some of the Observations, that I heretofore intimated to you, I had made of the *Resemblances* and *Differences* between a *Live Coal* and a Piece of *Shining Wood*; in perusing of which you will easily discern, that to those Particulars, which my Memory and the former Observations, I had noted down about *Light* and *Luminous Bodies*, had suggested to me, I have added some, that have been afforded me by those late Tryals, made in my Engine, whereof I sent you an account.

Resemblances.

The things, wherein I observed a piece of *Wood* and a *Burning Coal* to agree or resemble each other, are principally these Five.

1. Both of them are *Luminaries*, that is, give *Light*, as having it (if I may so speak) residing in them, and not like *Looking-Glasses* or *White Bodies*, which are conspicuous onely by the incident beams of the *Sun*, or some other *Luminous Body*, which they reflect.

This is evident, because both *Shining Wood* and a *Burning Coal*, shine the more vividly, by how much the place, wherein they are put, is made the darker by the careful exclusion of the adventitious light. 'Tis true, that the *Moon* and *Venus* appear brightest at or about *Midnight*, and yet have but a borrowed light; but the difference between those *Planets* and the *Bodies* we treat off, in reference to the difficulty we are considering, is obvious enough. For, though the *Beholders* eye that looks upon those *Stars*, be advantag'd by being in the dark, which enlarges the *Pupill* of the *Eye*, yet the *Object* it self is freely exposed to the beams of the *Sun*, which if they were intercepted, those *Planets* would quickly be darkned, as experience manifests in *Eclipses*.

2. Both *Shining Wood* and a *Burning Coal*, need the presence of the *Air*, and are too of such a density, to make them continue shining.

This has been prov'd as to a *Coal*, by what I long since publish'd in my *Physico Mechanical Experiments*, where I relate, How quickly

quickly a Coal would be extinguish'd upon the with-drawing the Air from about it: And as to *Shining Wood*, the Experiments I lately sent you, make it needless for me to add any other proof of the requisiteness not only of Air, but of Air of such a thickness, to make its light continue. How far this is applicable to *Flame*, it is not necessary here to determine; though, when I have the satisfaction of seeing you again, I may tell you something about that *Question*, which perhaps you do not expect.

3. Both *Shining Wood* and a *Burning Coal*, having been deprived for a time of their light, by the with-drawing of the contiguous Air, may presently recover it by letting in fresh Air upon them.

The former part of this, particular Tryals have often shown you to be true, when kindled Coals, that seem to be extinguish'd in our exhausted Receivers, were presently reviv'd, when the Air was restored to them: And the latter part is abundantly manifest by the Experiments, to which this Paper is an *Appendance*.

4. Both a quick Coal and *Shining Wood* will be easily quencht by Water and many other liquors.

The truth of this, as to *Coals*, is too obvious to need a proof; and therefore I shall confirm it only as to *Wood*. For which purpose you may be pleas'd to take the following Transcript of some of my *Notes* about Light.

I took a piece of *Shining Wood*, and having wetted it with a little Common Water in a clear Glass, it presently lost all its light*.

The like Experiment I tried with strong *Spirit of Salt*, and also with weak *Spirit of Sal Armoniack*; but in both the light did, upon the *Woods* inbibing of the liquor presently disappear.

And least you should think, that in the Words, *Many other liquors*, I intended not to comprise any, that consist of soft and unctuous parts, or that are highly inflammable, I shall subjoyn a couple of *Notes*, that I find next to those just now transcribed.

* From hence you will easily gather the reason, why, when I lately told you of the Trial, I made with a piece of *Shining Fish* under Water in the un-exhausted Receiver, I did not propose to have the like Trial made with *Shining Wood* and Water; but for this Liquor substituted *Mercury*.

I made the like Tryal with rectified *Oyl of Turpentine*, with a not unlike success. The same Experiment I tried more than once with high rectifi'd *Spirit of Wine*, which did immediately destroy all the light of the Wood, that was immersed in it; and having put a little of that liquor with my finger upon a part of the whole piece of Wood, that shone very vigorously, it quickly did, as it were, quench the Coal as far as the liquor reach'd; nor did it in a pretty while regain its luminousness: (which whether it recovered at all, I know not; for this Trial being made upon my Bed, I fell asleep, before I had waited long enough to finish the Observation.)

5. *As a quick Coal is not to be extinguish'd by the Coldness of the Air, when that is greater than ordinary, so neither is a piece of Shining Wood to be deprived of its light by the same quality of Air.*

As much of this Observation, as concerns the *Coal*, will be readily granted, and for proof of the other part of it, I could relate to you more Trials, than one, but that I suppose, one may suffice, circumstanc'd like that, which I shall now relate.

I took a small piece of *Shining Wood*, and put it into a slender Glass-pipe, sealed at one end, and open at the other, and placed this Pipe in a Glass Vessel, where I caused to be put a strongly frigorifick mixture of *Ice* and *Salt*, and having kept it there full as long, as I thought would be requisite to freeze an Aqueous Body, I afterwards took it out, and perceived not any sensible Diminution of its light. But to be sure, the frigorifick mixture should not deceive me, I had placed by this Pipe another, almost filled with Water, which I found to be turn'd into *Ice*; and though I suffered the Wood to remain, a pretty while after, expos'd to so intense a Cold, yet when I took it out, it continued shining, and, if I much mistake not, it ceased not to do so, when I lookt on it, 24. hours after. But though the light of *Shining Fish* be usually (as far as I have observed) more vigorous and durable, than that of *Shining Wood*; yet I cannot say, that it will hold out against Cold so well, as the other. For, having ordered one of my servants to cut off a good large piece of the luminous *Whiting*, and bury it in *Ice* and *Salt*, when I call'd for it in less than half an hour after, I found it much stiffn'd

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by the Cold, and to have no light, that I could discern in a place dark enough. And for fear, that this effect may have proceeded not barely from the operation of the *Cold*, but also from that of the *Salt* (for which suspicion you would see reason enough, if I could shew you my Trials about *Shining Fish*) I caus'd another time a piece of *Whiting* to be put in a Pipe of Glass seal'd at one end, and having seen it shine there, I lookt upon it again, after it had steyed but a quarter of an hour, by my estimate, in a frigorifick mixture, which the Glass kept from touching the Fish; and yet neither I, nor a Youth, that I employ'd to look on it, could perceive in a dark place, that it retain'd any light; which *whether* the Cold had deprived it of by that great change of Texture, that the Congelation of the Aqueous Juyce of the Fish (which I have several times observed to be luminous) may be supposed to have made in the Body invaded by it; or whether the effect depend more principally on some other cause, I shall not now examine.

Differences.

1. *The first difference I observed betwixt a Live Coal and Shining Wood, is, That, whereas the light of the former is readily extinguishable by Compression (as is obvious in the practice of suddenly extinguishing a piece of Coal by treading upon it) I could not find that such a Compression, as I could conveniently give, without losing sight of its operation, would put out or much injure the light ev'n of small fragments of Shining Wood: One of my Trials about which I find thus set down among my Notes about Light.*

I took a piece of *Shining Wood*, and having prest it between two pieces of clear Glass (whereof the one was pretty flat, and the other convex) so that I could clearly see the Wood through the Glass, I could not perceive, that the compression, though it sometimes broke the Wood into several fragments, did either destroy or considerably alter the Light.

This Experiment I repeated, with the same success. But, what

what a stronger or more lasting Compression may do in this Case, I had not opportunity to try.

2. *The next unlikeness to be taken notice of betwixt Rotten Wood and a Kindled Coal, is, That the latter will in very few minutes be totally extinguish'd by the with-drawing of the Air, whereas a piece of Shining Wood, being eclipsed by the absence of the Air, and kept so for a time, will immediately recover its Light, if the Air be let in upon it again within half an hour after it was first with-drawn.*

The former part of this Observation is easily proved by the Experiments, that have been often made upon *Quick Coals* in the *Pneumatical Engine*; and the truth of the latter part appears by an Experiment about *Shining Wood* made by us in *October* last. Neither is it unprobable, that if I had had conveniency to try it, I should have found, that a piece of *Shining Wood* deprived of its light by the removal of the ambient Air, would retain a disposition to recover it upon the return of the Air, not onely for half an *hour* (which is all that I lately asserted) but for half a *day*, and perhaps a longer time.

3. *The next difference to be mention'd is, that a Live Coal being put into a small-close-Glass, will not continue to burn for very many minutes; but a piece of Shining Wood will continue to shine for some whole dayes.*

The first part of the Assertion I know you will readily grant, and the rather, because it contains matter of fact, without at all determining, whether the Coals not continuing to burn, proceeds from its being, as it were, stifled by its own smook and exhalations (which can have no vent in a small-close-Glass) or from the want of fresh Air, or from any particular cause, which I must not here debate; though I have sometimes made Experiments somewhat odd to facilitate that enquiry. The other part of our Observation may be easily made out by what I tried upon *Shining Wood*, sealed up Hermetically in very small Glasses, where the Wood did for several dayes (though I remember not precisely how many) retain its Light.

4. A fourth Difference may be this ; That , whereas a Coal, as it burns , sends forth store of Smoke or exhalations ; Luminous Wood does not so.

5. A fifth , flowing from the former , is , That , whereas a Coal in shining wastes it self at a great rate , Shining Wood does not.

These two unlikeneffes I mention together, not onely because of their affinity ; but because what concerns the *Coal* in both, will need no proof ; and as for what concerns *Rotten Wood*, it may be verified by an Observation , that I find by my *Notes* I made in a piece of it Hermetically sealed up in a small clear Glass ; where after it had continued luminous some dayes , I lookt on it in the day time to perceive , if any store of spirits or other steams had , during all that while , exhaled from the Wood , but could not find any on the inside of the Glass, save that in one place there appeared a kind of *Dew* , but consisting of such very small drops (if at least their Size were not below that name) that a multitude of them would go to the making up of one ordinary drop. But in pieces of *Shining Fish* I found the case much otherwise , as was to be expected.

6. The last Difference , I shall take notice of betwixt the Bodies hitherto compared , is , That a Quick Coal is actually and vehemently hot ; whereas I have not observed Shining Wood to be so much as sensibly luke-warm.

What is said of the *Coals* heat , being as manifest as its light , I shall need only to make out , what relates to the *Shining Wood*. To assist me wherein, I meet among my *Notes* that , whose transcript I shall subjoyn , when I have premis'd, that (if my memory do not deceive me) the piece of Wood to be mentioned was one , that shone so vividly , that waking in the Night some hours before I tryed it , and perceiving , as it lay near me on the Bed , how luminous it was , I was invited to reach out to a place near the Beds-head , where there stood several Books , and laying the Wood on that , which came to hand , I could discern by the light of it , that the Book was an Hebrew Bible , and that of the Page , I lighted on , the wrong end was turn'd upwards : To which intima-

tion having added, that the little Glass-Instrument, mention'd in the *Note*, is such an one, as you may find described in my *Preliminaries to the History of Cold*. save that part of this was a little bending inward at the *Basis*, that it may sometimes stand by it *self*, and sometimes receive a small body into the *dimple* at its *Basis*: Having, I say, premised this, and, that as *Shining Wood* did not feel at all warm to me, so I also found *Shining Fish* palpably cold, I shall conclude your trouble with the premised *Note*, which speaks thus:

[I put upon a large piece of Wood, which was partly shining, and, as near as I could, upon one of the most luminous parts of it, one of those *Thermoscopes*, that I make with a pendulous drop of Water. But as I had formerly try'd, that by laying the tip of my Nose or Finger upon it, when it shone vividly enough, to enable me to discern both the one and the other, at the time of contact I could not perceive the least of heat, but rather an actual coldness; so by this Trial I could not satisfy myself, that it did visibly raise the pendulous drop; though the Instrument were so tender, that by approaching one Finger near it, yet without actually touching of it, it would manifestly be impelled up, and upon the removal of my Finger, would presently descend again.]

And I remember, that having put such an Instrument upon a *Shining Fish*, that was pretty large, I could not thereby perceive, that it had any degree of heat, but rather the contrary. For, having divers times taken off the Glass, to apply it with the more advantage to several parts of the *Luminous Fish*, I divers times (for I remember not, whether 'twere always) took notice, that upon the removal of the Glass into the Air, the pendulous drop would manifestly rise a little, and subside again when the Glass was applied to the Fish. But whether this part of the Experiment will hold in all temperatures of the Air, I had not opportunity to try.

An Observation

Concerning a Blemish in an Horses Eye, not hitherto discover'd by any Author; which may be of great use in the Choice of an Horse to those who are Curious; made by Dr. Richard Lower at the Royal Society, January 23. 1667.

A MONG the many defects and distempers in the Eyes, the Eyes of Horses are peculiarly affected with one, which no Animal besides is troubled withall (as far as I have observ'd) neither do I remember any Author hitherto to have taken notice of it; and that is a *Spungy Excrescence* (commonly of a dark muske-colour) which grows out of the edge of that Coat of the Eye call'd the *Uvea*; which Spunge if it grow large or increase in number (as it frequently happens) it depraves the sight very much, or totally intercepts it. But that you may more easily conceive the manner, how it is done, you may remember, that the *Uvea* is a *musculous* part, the use of it being chiefly to contract and dilate it self for the admission of Objects with as much light, as the Eye can conveniently bear; so that, the brighter and more refulgent the light is, to which the Eye is expos'd, that Membrane contracts its self into a narrower compasse; and the more dark the place is, it delates it self the more, as you may see in a *Cats* eye more readily perform'd, than in any other *animal*, I have yet observ'd: So that, if that *spungy* substance, which growes out of the edge of the *Uvea*, be so great, or the number of them such, as that they grow in several places about the *pupill* of the Eye, where it contracts its self, the *pupill* or sight is very much (if not totally) obstructed, and consequently the Horse sees very little or nothing at all: As I have many times taken exact notice in some Horses, which being brought into the Sun-shine, could not see at all, but suffer'd me to touch the *sight* of their Eye with my finger without the least winking; which Horses being led back into the Stable, the *Uvea* in that obscure place dilating it self, they could see very well again, and would not suffer me to shew my finger near to the Eye without frequent closing their Eye-lids and tossing their heads. The same Horses I understood by the

Owners were very apt to stumble in the day-time, if it were bright and Sun-shine, but travel'd very well and securely in the evening and in dark cloudy Weather.

What the *cause* may be of that fungous Excreffence, or why Horses are peculiarly obnoxious to it, or what kind of Horses most, I have not considered. But, I cannot think, it comes from straining in great draughts, and races, or from hard travel, because I have seen very large *Spunges* (as I may call them) in young Horses eyes of 2 and 4 years old, before they were backed; which, after they have been taken up from grasse, and kept with dry meat, have very much abated, and afterwards being turn'd to grasse in the Spring to cleanse and cool their bodies, have increased again to the wonted bigness. But whether it were from their moist feeding, or holding down their heads to eat (whereby there might be a greater deflux of humors to that part) I cannot determine. But for as much as there are few Horses quite free from this evil, and many rendred very inconsiderable by it, I will recount the most remarkable Cases, which make Horses most useles and suspected;

1. The more and greater those *Excreffences* are, the more the *pupill* of the Eye or the Sight is in danger of being quite obstructed; which you may farther examine by turning the Horses Eye to the light, and observing, how much of the *pupill* they doe obstruct.

2. These *Spunges* on the upper edge of the *Uvea* are apt to grow the largest, and hinder the Sight most.

3. That which grows on the middle of the *Uvea*, does more hinder the sight by distracting the Object, than that, which grows in either Corner or angle of it.

As for the *Cure*, I suppose there can be none expected, but from a drying kind of dyet; though perhaps outwardly something may be devised to shadow the Eyes, and keep them from being nakedly exposed to the Sun, whereby the *pupill* will not be so closely contracted, and consequently the Sight not so much obstructed.

An Extract

Of a Letter written by Signor Cassini Professor of Astronomy in Bononia, to Monsieur Petit at Paris, and Englished out of the Journal Des Scavans; concerning severall Spots, lately discover'd there in the Planet Venus.

TO give you some Account of my present Studies, I shall acquaint you, that having been a good while very assiduous and carefull in making Observations of *Venus*, to see, whether that Planet did not turn about its *Axis*, by a motion like to that of *Jupiter* and *Mars*; I met at first with many difficulties; but at last considering, that I should succeed better in my Observations at a time, when *Venus* is at a good distance from the *Earth*, than when she is near thereto, I attentively observ'd, when she was risen somewhat high above the *Horizon*, and shined brighter, whether I could not discern in Her some part remarkable either by its brightness or obscurity, among the rest, especially about the middle of her *Diske*. And this I did not in vaine; for, I discover'd at last towards the middle of her Body a part clearer than the rest, by which one might judge of the Motion or the Rest of this Planet.

The first time I saw it, was *Octob. 14. 1666. h. 5. 45^l. p. m.* and then this bright part was very near the Center, on the *North-side*. And at the same time I observed *West-ward* two *obscure* spots, somewhat oblong. But I could not then see that resplendent part long enough, to conclude any thing from thence; nor was I able to see any thing well of those parts till *April 28. 1667;* on which day, a quarter of an hour before *Sun-rising* I saw again a *bright* part, situated near the *Section*, and distant from the *Southern Horn* 2 little more than $\frac{1}{4}$ of its Diameter. And near the *Eastern Ring* I saw a dark and somewhat oblong spot, which was nearer to the *Northern* than the *Southern Horn*. At the rising of the Sun I perceived, that this *bright* part was then no more so near the *Southern Horn*, but distant from it $\frac{1}{3}$ of its Diameter. This gave me great satisfaction. But

I was surpris'd at the same time to find, that the same Motion, which was made from *South* to *North* in the inferior part of the Diske, was on the contrary made from *North* to *South* in the superior part; whence the determination of the Motion may be better taken. For we have no example of the like motion, except it be in that of the *Libration* of the Moon.

The next day, at the rising of the Sun, the said *bright* part was not far from the *Section*, and distant from the *Southern Horn* $\frac{1}{4}$ of the Diameter. When the Sun was 4. deg. high, the same was situated near the *Section*, and remote from the *Southern Horn* $\frac{2}{3}$ of the Diameter. The Sun being high 6. d. 10^l. it seem'd to have been pass'd the Center, and that the *Section* of the Disk did cut the same. The Sun being 7. deg. high, it appeared yet more advanced North-ward, together with two *Obscure Spots*, seated between the *Section* and the *Circumference*, and equally distant from one another, and from each Horn on both sides. And the Sky being very clear, I observ'd the motion of the *bright* part for 1¹/₂ hours; which then seem'd to be exactly made from *South* to *North*, without any sensible Inclination *East*-or *West*-ward. Mean-time I perceiv'd in the motion of the *dark Spots* so great a Variation, that it cannot be adscribed to any reason in *Opticks*.

May 10. and 13. before Sun-rising, I saw still the *bright* part near the Center *North*-ward.

Lastly, June 5. and 6. before the rising of the Sun, I saw the same between the *Northern-Horn* and the Center of this Planet, and I noted the same irregular Variation in the *Obscure Spots*. But when *Venus* began to be further remov'd from the Earth, it was more difficult to observe these *Phænomena*.

I shall not presume to declare my sentiment touching these Apparances so boldly, as I did concerning the Spots formerly discover'd in *Jupiter* and *Mars*. For those spots I could very well observe for a whole night together, during the opposition of those Planets to the Sun: I could consider their Motion for the space of severall hours; and at last, seeing them return regularly to the same place, I could judge, whether they were the same spots or not, and in how much time they

they absolv'd their Relation. But it was not so here with the Apparences in *Venus*. For one sees them but for so small a time, that it is far more difficult, *certainly* to know, when they return to the same place.

Yet this I can say, (supposing that this *bright* part of *Venus*, which I have observ'd, especially this year 1667, hath always been the same) that in less than one day it absolveth its motion, whether of *Revolution* or *Libration*, so as in near 23 hours it returns about the same hour to the same scituation in this Planet; which yet happens not without some irregularity. Now to affirm, (supposing it to be always the *same* bright part) whether this Motion is made by an entire *Revolution*, or by a *Libration*, I dare not yet doe, in regard I could not see the Continuity of the Motion through a *great* part of the Arch, as I did in the other Planets. And for this very reason, *that* will always be difficult to determine.

An Extract.

Of a Letter, written by J. DENIS, Doctor of Physick, and Professor of Philosophy and the Mathematicks at Paris, touching a late Cure of an Inveterate Phrensy by the Transfusion of Blood.

This Letter was lately sent by the Author himself to the Publisher, as it was printed at Paris in French; the substance whereof is in English, as follows.

IT is now almost a twelve-month that I declared my self publicly in this matter of *Transfusion*, and after I had grounded my Conjectures upon divers reasons, and a number of Experiments which I made joyntly with *M. Emmerez*, I resolv'd to expect in the sequel a further confirmation, by carefully observing all that should happen in the severall Trialls, I intended to practise.

In this resolution we have since let slip no occasion, to improve this Operation, which hath been follow'd with good success, and I could here alledge some particular Relations, the circumstances of which would appear curious enough, if I did

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not rather choose to refer them to a Collection, which possibly I may send you within some time, to have the more room to enlarge in this Letter on the circumstances of a Story, whereof you will be very glad to learn the Event.

You have doubtless heard of a *Madman*, that hath been lately cured, and restored to his wits by the means of the Transfusion. Some spread a rumour that he died soon after the operation; others bore the people in hand, that he was relapsed into a greater madness, than that before, and in short, it hath been so diversely discoursed of up and down, and with such differing reflexions thereon, that I thought my self obliged, for the clearing up of what false rumours had darkned, to give you a faithful and exact account of the condition, to which this poor Man was reduced before the Transfusion; of what passed during that Operation, and the surprising effects, that have followed upon it hitherto.

The Patient is about 34 years of age. His Phrensy began first of all to appear 7 or 8 years agoe, and as far as can be judged, it was occasion'd by a disgrace he received a little before, in some Amours, where he hoped to find a very considerable fortune. This first fit of extravagance was very violent, and lasted 10. months without any good intervall: but returning afterward by little and little to his wits, and having given all the possible marks of a sound understanding, he was married to a young Gentlewoman, who was perswaded, that this madness of his was the relick of a Sickness he had before, and that there was no appearance he would ever relapse into it. But this was far from proving so, as was imagined, and even the very first year of his marriage ended not without his returning to his former Extravagancies.

Thus then he relapsed, and was several times restored these 7 or 8 years last past. But what is here chiefly to be observed, is, that the fit never lasted with him less than 8 or 10 moneths, without any respit, notwithstanding all the care and means used to relieve him. For it is also fit to take notice, that a person of quality, having once taken a purpose to attempt his Cure by all manner of wayes, caused him to be bled in his feet, armes, and head, even 18 times, and made him bath himself 40 times,

not to mention innumerable applications to his forehead, and potions. But instead of amendment, the distemper seem'd to be provoked by those remedies, and this poor creature fell into that rage, that there was a necessity to bind him up from doing mischief. His Madnes hath been alwayes *periodicall*, and never abated but by little and little, and that abatement hath be-falne him rather at such times, when nothing was done to him, than when he was tormented with medicins.

The last time, that he relapsed into his Extravagancy, was about 4. moneths since, in a place 12 leagues distant from *Paris*. And his Wife hearing of it, went immediately to him to relieve him. She soon shut him vp, and was even constrained to tye him for some time, because he was in such an extraordinary rage as to beat her. But for all her care, one time he got loofe stark naked, and ran away streight for *Paris*, no body knowing, how he could find his way in the dark night. His Wife had him searched for in all the neighbouring Villages, whilst he ran here in *Paris* up and down the streets, without finding any place to retire to, in regard that those, who had the charity of receiving him into their houses the first dayes, knew very well the danger they were in, of having their houses burnt over their heads.

He was not less outrageous in this last fit, than in the former. He hath spent 3 or 4 months without sleep, and his greatest divertisement during that time was, to tear the Cloaths, that were given him, to run naked abroad, and to burn in the houses where he was, whatever he could meet with. He moved to compassion all good people, that saw him, and especially those in the *Marais du Temple*, where he was known to most, and where he had been wont to be seen before this distemper as well cloathed and fashion'd, as any one of his condition could be.

Monsieur de *Montmor* among others was the person most touched with it, and resolv'd to employ his interest to procure him a place in one of the Hospitals. But first he thought on the Transfusion, and believed, there would be no danger in trying it upon this Man, being so perswaded by many Experiments, we had already made in his presence. He therefore had been taken up for that end, and having sent for Me and M. *Emmerex* to ask

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our opinion of the fitness of trying the Transfusion upon this man, we answer'd, that we could indeed give good assurance for his Life, and that this Operation was in it self not capable to cause the death of any one, if discreetly managed; but as to the Cure of such an Extravagance, as that appeared to us, we had not yet experience enough to dare to promise him *that*, and that our Conjectures went no farther, than to think, that the Blood of a Calf by its mildness and freshness might possibly allay the heat and ebullition of his Blood, being mixed therewith. The matter having been sufficiently examined, we resolv'd to carry this Man into a private house; and there we appointed for his Gardian that Porter, on whom we had already practis'd the Transfusion, 8 months agoe, both that the Thing might not appear so new to him, as it might do to others, that never had seen the Experiment before, and that he might serve us the more to assure our Patient, and others, who should be present at the Operation, that there was no danger in it at all.

Decemb. 19. we used what art we could to dispose the Fancy of our Patient to suffer the Transfusion, which we resolv'd should be tryed upon him that night about 6 a clock. Many persons of quality were present, together with several Physicians, and Chirurgions, too intelligent to suspect them of being capable of the least surprize. Mr. *Emmerez* open'd the *Crural Artery* of a *Calf*, and did all the necessary preparations in their presence; and after he had drawn from the Patient about 10 ounces of blood out of a Vein of the right Arm, we could give him no more again than about 5 or 6 ounces of that of the Calf, by reason that his constrained posture, and the crowd of the Spectators interrupted very much this Operation.

Mean time he found himself, as he said, very hot all along his Arm, and vnder the Armpits; and perceiving, that he was falling into a swoon, we presently stopped the blood running in, and closed up the wound. Yet he supped two hours after, and notwithstanding some dulness and sleepiness, he was in now and then, he yet pass'd that night with singing, whistling, and other extravagancies usual with him.

But yet next morning we found him somewhat less exorbitant, both in his actions and words; and that induced us to believe, that

that by reiterating the Transfusion once or twice, we might find a more remarkable change in him. We therefore prepar'd our selves to repeat it upon him the next *Wednesday* at six a Clock in the evening again, in the presence also of several very able Physicians, *Bourdelot, Lallier, Dodar, de Bourges,* and *Vaillant*. But in regard that this man appear'd very thin, and that it was not at all probable, that his blood was peccant in the quantity after three or four months continual watching, and after the hunger and cold he had suffered in running naked on the Streets without finding harbour at nights, we took but two or three ounces of blood from him, and having put him in a more convenient posture, we made this second Transfusion into his left arm more plentiful then the first. For considering the blood remaining in the Calf after the operation, the Patient must have received more then one whole pound.

As this second Transfusion was larger, so were the effects of it quicker and more considerable. As soon as the blood began to enter into his veins, he felt the like heat along his Arm and under his Arm-pits which he had felt before. His pulse rose presently, and soon after we observed a plentiful sweat over all his face. His pulse varied extremely at this instant, and he complain'd of great pains in his Kidneys, and that he was not well in his stomach, and that he was ready to choak unless they gave him his liberty.

Presently the Pipe was taken out that conveyed the blood into his veins, and whilst we were closing the wound, he vomitted store of Bacon and Fat he had eaten half an hour before. He found himself urged to Urine, and asked to go to stool. He was soon made to lie down, and after two good hours strainings to void divers liquors, which disturbed his stomach, he fell asleep about 10 a Clock, and slept all that night without awakening till next morning, was *Thursday*, about 8 a Clock. When he awakened, he shewed a surprizing calmness, and a great presence of mind, in expressing all the pains, and a general lassitude he felt in all his limbs. He made a great glass full of Urine, of a colour as black, as if it had been mixed with the soot of Chimneys.

Hearing of some of the company that we were in a time of Jubily, he asked for a Confessor, to dispose himself to be made participant of it. And he confessed himself accordingly to *M. de Veau* with that exactness, that the Confessor gave him the publick testimony of a sound understanding, and even judged him capable to receive the Sacrament, if he continued in that state and devotion.

He remained sleepy all the rest of that day, spake little, and prayed those that came to importune him with interrogatories, to give him rest. And he went on to sleep well also the whole night following. *Friday* morning he filled another Urinal with his water, almost as black as that of the day

before. He bled at the Nose very plentifully, and therefore we thought it proper to take 2 or 3 small Porringers of blood from him.

Saturday morning, the last day before *Christmas*, he desired ag ain to go to confes, and so to dispose himself for the Communion. Then one Mr. *Bonnet* examined him in hearing him confes, and after he had found him to have all the reason necessary to receive the Sacrament, he presently gave him the Communion. That same day his Urine clear'd up, and after that time it resumed by little and little its natural colour.

His Wife mean time, that had sought him from town to town, came to *Paris*, and having found him out, when he saw her, he soon expressed much joy to see her, and related to her with great presence of mind the several Accidents that had befallen him, running up and down streets; how the Watch had seized on him one night, and how Calfs-blood had been transfused into his veins.

This Woman confirmed yet more to us the good effects of the Transfusion, by assuring us, that at the season we were now in, her Husband should be outrageous, and very mad against her self, and that instead of the kindness he shewed to her at this *Full* of the *Moon*, he used to do nothing but swear, and beat her.

'Tis true, that comparing his calm condition, wherein he now was, with that, wherein every body had seen him before the *Transfusion*, no man scrupled to say that he was perfectly recover'd. Yet to speak the plain truth, I was not so well satisfied as others seem'd to be, and I could not persuade my self that he was in so good a temper as to stop there, but I was inclin'd to believe by some things I saw, that a third Transfusion might be requisite to accomplish what the two former had begun.

Yet in delaying the execution of these thoughts from day to day, we observed so great an amendment in his carriage, and his mind so clear'd up by little and little, that his wife and all his friends having assur'd us that he was restor'd to the same state he used to be in before his Phrenzy, we entirely quitted that resolution. I have seen him almost every day since; he hath expressed to me all manner of acknowledgment, and been also with *M. de Montmor*, thanking him very civilly for his goodness in recovering him out of that miserable condition he was in by a remedy which he should remember as long as he lived.

He is at present of a very calm spirit, performs all his functions very well, and sleeps all night long without interruption, though he saith he hath now and then troublesome dreams. He hath carried himself so discreetly in some visits he made this week, that divers Physicians, and other persons worthy of credit, that have seen him, can render an authentick testimony to all the circumstances here advanced by me, who shall not employ against evils and contradictions any other arguments than the experiment it self.

The

The last year I published my Conjectures and my Reasons. Of all those that have undertaken to combate them, there is not one that hath so much as touched the state of the Question. And this hath made me silent to them all. I have confined my self to the experiments alone; this, whereof I now send you the particulars, will perhaps open the eyes to some that are opiniatre. I would not relate the story but very plainly, without embarrassing it by any ratiocinations; not but that there was good matter to discourse upon, both during the time of the Transfusion, and after it. Some believed, that the vomiting came from the eating much Bacon, half an hour before the operation: Others, considering the pain in his Kidneys during the Transfusion, and the swelling of his Stomack, which was presently followed by evacuations above and below, do believe, that the new blood, entering in great quantity, caused a plenitude, and a fermentation in the great vessels, which could not but be followed by all those effects. To which may be added, that almost all those, into whose veins other liquors then blood have been *injected*, have found the same Accidents.

It is also not yet agreed on, what was the cause of the lassitude, that obliged this man to keep his bed for some whole dayes: Some say, it proceeded from the disorder consequent to the entry of new blood into his veins. Others have look'd upon it as the effect of a kind of *Rhumatisme* he had got, lying stark naked in the streets; and have thought that he became not sensible of those pains, but after the recovery of his reason, just as those that have a hot Feaver do never complain of weariness, but after the abatement of the Fitt.

There hath also been very differing Discourse of that *black* colour in his Urine some dayes after the Transfusion; some alledging, that it was caused by some veins, which having been opened from too great a fulness, discharged themselves into the Kidneys and Bladder: others, believing that it was a black choler, discharging it self by the veins, and which being retain'd before, sent up vapours to the Brain capable to trouble the functions thereof.

I shall here suspend my judgment, resolved not to declare my thoughts, till I have made many experiments more. For I know very well, that in so, we have made upon Brutes, we have found it but twice that the Recipient animal pissed blood after it, and as far as I can judge, I believe I have infallible wayes of preventing all such disorders; and I have propos'd to my self a manner of preparation and treatment, which the Patient may be made to observe both before and during the operation, to render it more beneficial. For 'tis not to be doubted, but measures are to be taken to dispose the body for Transfusion, as well as for all other operations to be undertaken with success. But we need not repent for not having observed them in this case; it appeared much better what the Transfusion all alone

could do, and no cause hath been given to prejudiced men to impute this cure to the *Preparation* rather, than to the *Operation* it self.

We hear of many other sick persons, who possibly may find relief from this Experiment. I shall not fail to let you know the success of it in good time.

An Exact Narrative of an Hermaphrodite now in London.

This was communicated by the ingenious Dr. *Tho. Allen* (now a Fellow of the R. Society) to a friend of his in a *Latine* Letter, in which as it was imparted to the said Society, so it was thought fit to publish it here for the view of the Learned, viz.

INter varios insolentesq; *Natura* lusus, dicam? an errores, quos apud eos, qui de Androgynis egerunt (quorum scripta sedulo deditaq; opera perlustravi) in lucem productos adhuc videre mihi contigit, vix alium quenquam notatu digniorem memini occurrere hoc ipso, quem tibi, Erudite Vir, impresentiarum exhibeo. Neq; enim hunc, quem jam descriptum eo, Hermaphroditum, aut spurcissimis illis feminis, qua apud Græcos *Telædes* audiunt, apud Egyptios vero frequentissime reperiebantur, annumerandum, aut cum descriptione quacumq; hactenus quod sciam evulgata, ullatenus quadrare existimo. Unde nec prorsus indignus mihi videtur, qui nativis depictus coloribus, absque omni verborum fuce, Illustrissima Lectissimæque Regiæ Societatis & tuis oculis usurpandus veniat.

Nomen ipsi est *Anna Wilde*; natus vero est (condonandus enim Hermaphrodito solacismus) Mense *Februario*, ipso *Purificationis* festo, Anno salutis, 1647. in pago non ignobili *Agri Hamptoniensis*, vulgo *Ringwood*. Sexto ætatis anno inter saltandum colluctandumq; cum pueris coætaneis (quos omnes viribus facile superabat) extuberationes duæ, *Herniarum Βεσωνωνδων* dictarum, primum emicere; quibus in ordinem redigendis (id enim illis animiserat) *Chirurgi* diu operam luserunt. *Testiculi* enim erant, qui jam præggrandes facti, *scrotis cutaneis*, corrugatis, pilisq; obstitis inclusi, non alio discrimine a *Virilibus* naturaliter se habentibus distinguuntur, quam quod singuli testes suo proprio divisq; ab invicem hic *scroto* gaudeant, ita tamen elongato, ut ex utrinq; productione confluantur labia *Vulvæ*.

In sinu *Muliebri* (ut jam a *Mercurio ad Venerem* transeamus) *Nymphæ* & *Carunculæ Myrtiformes*, integra satis se produnt: *Quin* & *membranula* quadam, a *Perinæo* sursum tendente, media pars *Vulvæ* tegitur. *Clitoris* non apparet. *Uterus* ejusq; *cervix* a communi sequioris sexus lege ne minimum quidem recedunt. Usq; ad tertium supra decimum ætatis annum pro *femella* habitus, & *femineo* vestitu indutus, munera illi *sexui* destinata inter *feminas* assidue obibat. Cum forte vero pani subigendo strenuam navaret operam, en
derepente

derepente Priapus, ad id temporis latens, magno cum impetu foras prorupit, accedente non levi ipsius Metamorosis stupore. Erectus penis quatuor circiter pollices aequat. Locum Virga virilis ipsissimum occupat; in glandem pariter definit; præputio, quod illi etiam franulo, ut in Viris fit, annectitur, instructum: sed Glans imperforata (ita tamen ut tenuis membranula eam obturans facile pertundi posse videatur) semini, per Urethram, seu potius Virga canaliculum viam affectanti, exitum negat; unde per pudendum muliebri (resuum forte) excernitur.

Cum annorum esset sedecim, Menstrua periodice & modo debito fluere ceperunt, atque per biennium perseveraverunt. Quo elapso, iisdem non amplius comparentibus pullulavit Barba, & exinde totum corpus pilosum conspicitur; Vox corporisq; habitus virilem amulantur. Crinis se habet virorum ad instar. Mammae nullae exsurgunt: papilla perquam exiguae. Pectus latum est. Ischia non ita diffusa. Nates quam sunt feminarum contractiores.

Se ad utrumque sexum comparatum asserit, sed feminis misceri præptare; quas etiam cum videt, & concupiscit, erigitur Penis, qui quoties Virum appetit, flaccidus manet.

Unum hoc, idque nec extra oleas putem, Coronidis loco subiectam; Quod nempe, cum nocte quadam, quam totam tripudiis, computationibus, caterisque, id genus lascivie incitamentis, cum aliquot ejusdem farinae congeronibus insumperat, oculos in virum quendam formae venustioris conjecerat, mox eum adeo deperibat, ut sequenti die, præ amoris astro, in passionem hystericam incidere; quam revera talem fuisse, non solum Elevatio abdominis, Cantus, Risus, Fletus, (notissima illius intemperici symptomata) sed & juvenia, satis liquido comprobantur: Applicato quippe Emplastro ex Galbano regioni Umbilici, exhibitisque, remediis hystericis ilico convalescit.

An Account of some Books.

I. NOUVEAUX ELEMENS DE GEOMETRIE:

Or a Mathematical Treatise, entituled, *New Elements of Geometry*, printed at Paris in quarto, Anno 1667.

Divided into 15 Books or Sections, containing

A New Method and Order, and new Demonstrations of the most common Propositions in Geometry,

New ways to discover what Lines are incommensurable.

New measures of Angles not hitherto considered.

New ways of finding out, and demonstrating the Proportion of Lines.

Wherein we observe, that the Author delivers by a new Method and Order of his own, grounded upon *Algebraical Elements*, divers new Demonstrations

monstrations of the more common Propositions, contained chiefly in the first six Books of *Euclid's* Elements, and without recourse to *Euclid*, or any other Geometrical Writer for proof of any thing asserted in those new Elements.

Whereto is added the solution of an *Arithmetical Probleme*, which the Author calls *Magick Squares*, viz.

A Square of Cells being given, even or odd, filled with Numbers, either in an Arithmetical or Geometrical Progression; so to dispose all those Numbers into another like Square of Cells, that all the Numbers of each band, whether to the right or to the left, upwards or downwards, or diagonally, the Numbers given being in an Arithmetical Progression, added together, do always make the same Summe, and those in a Geometrical Progression, multiplied into one another, do always make the same Product.

II. SYNOPSIS OPTICA, *Auth. HONORATO FABRI, Soc. Jesu, Lugduni Gall. in 4. An. 1667.*

This Author pretends to have comprised in this Treatise, containing 58 Propositions, besides many *Corollaries*, all what hath been hitherto discover'd in *Opticks*, and to have added thereto many curious and useful remarks, not mentioned in other Authours.

He begins with that part, which is the most simple, and considers the *Streight Ray*, call'd by the general name of *Opticks*: where he shews, what is the cause of those surprizing effects of the *Perspective*, which so pleasingly deceive the eye; examining there many curious Experiments.

In the *second part* (the *Catoptricks*, that have for their Object Rays *Reflected*) he gives an Account of all the Apparences in *Looking-glasses*, *Convex*, *Concave*, *Cylindrical*, &c.

In the *third* (the *Dioptricks*, that consider Rays *Refracted*) he treats largely of *Telescopes* of all sorts, *Spherical*, *Elliptical*, *Hyperbolic*; as also of *Microscopes*, and the effects of all of them. Where among many other particulars, he delivers and commends, as an invention of *Eustachio Divini*, the way of furnishing a *Telescope* with two *Eye-Glasses*, outwardly *flat*, and inwardly *convex*, so as that they touch one another in the center of their *convex superficies*.

In this part he explicates the Doctrine of *Refractions* and *Parallaxes*; annexing several Particulars concerning *Comets*, the *Ring of Saturn*, &c. and concluding all with an *Appendix*, wherein having refuted the *Spiral Hypothesis*, devised to support the *Ptolemaick* systeme of the world, he advanceth a new one, judged by him very futable to render an account of the Motion of the *Celestial Bodies* in the same systeme that supposeth the *Earths* immobility, which he seems unwilling to desert.

III. DE VI PERCUSSIONIS, *JOH. ALPHONS. BORELLI. Bononiae in 4. 1667.*

Whereas

Whereas in the doctrine of *Percussion* several things are to be accurately distinguish'd, as the *Force percussive*, the *Motion*, or the *Velocity* of the *Percussion*, and the *Resistance* of the *Body percussed*; and then an Estimate to be made of the *Proportion* of those three to one another: This Authour pretends to have both assign'd that *difference*, and demonstrat'd the *Proportion*; Adding, that 'though *Galilæo* saw and acknowledged (*vid.* at the End of his fourth Dialogue *De Motu Projectorum*) That the *Force of Percussion* was *Infinite*, or (rather) *unlimited*, yet he there referr'd discoursing upon that Argument to another opportunity; which not having been performed by him (for ought could be found by any of his writings, either Printed or Manuscript, which latter were purposely searched after his death to find such a discourse) our Authour pretends, that that Proposition concerning the *Infiniteness* of the force of *Percussion*, not having been yet demonstrat'd by any, he hath in this *Book* resum'd the whole matter concerning *Percussion*, and clearly demonstrat'd the true and genuine Nature of it, its Cause, Proprieties and Effects. In the doing of which, he taketh occasion to discourse also of *Gravity*, *Magnetisme*, *Tremor of Bodies*, *Pendulums*, &c. All which, whilst the *Reader* is considering, the Authour tells him, that he is making ready his other Books concerning the *Motions of Animals*.

IV. NIC. STENONIS MUSCULI DESCRIPTIO GEOMETRICA, Florentiæ in 4o. An. 1667.

The Author of this *Book* declareth, that his design in composing it was, to shew, that in a *Muscle* neither the *Parts* of it can be distinctly named, nor its *Motion* duely consider'd, unless the Doctrine thereof become a part of the *Mathematicks*. And he is of opinion, that there is no other cause of the many Errors, which spoil the History concerning the *Humane Body*, than that *Anatomy* hath hitherto disdain'd the *Laws* of the *Mathematicks*. And therefore inviteth those that are studious in that part of *Philosophy*, to consider, that our *Body* is an *Engine* made up of a thousand subordinate *Engins*, whose true knowledge whoever thinks that it can be investigat'd without *Mathematical* assistance, must also think, that there is matter without *Extension*, and *Body* without *Figure*.

Hereupon he shews, that the very *Fabrick* of the *Muscles* imposeth a kind of necessity upon considering Writers to explicate them *Mathematically*: In conformity whereunto he pretends to have found, that in every *Muscle* there is One *Parallelepiped* of *Flesh*, and Two *Tetragonal Prisms* of *Tendons*; defining a *Muscle* to be a *Body* composed of divers series's or ranks of *Fibers* equal, like, and parallel among themselves, and so immediately placed upon one another, that whole ranks are congruous to whole ranks. Here he explains the *Dimensions* of a *Muscle*, its *Contraction*, and *Strength*, and adds that the *Use* of this new discovery of the structure of the *Muscles*, is, to demonstrate, That they may swell in their *Contraction* without the *Accession* of new matter.

He subjoyns a Letter to Monsieur *Thevenot*, in which, among other things, he alleges several Experiments, to shew, that the *Motion* of the *Heart* is like the *Motion* of *Muscles*; and answers those, who pretend that the true *Fabrick* of the *Heart* hath already
been

been observed heretofore; and those likewise, who think that these new Observations of the Muscles are uncertain; concluding this Subject with an Enumeration of the particulars, yet remaining to be search'd into, in the *History of the Muscles*.

To all these things he adds Two Narratives; One of a dissected Head of a *Sharke* which he calls *Canis Caribaria*; where he delivers many curious Observations of the Skin, Eye, optick Nerves, Ocular Muscles, exceeding smallness of the Brain, as also of the Mouth, and strange Teeth of this Fish; examining withal, whether the *Glossopetrae* be the Teeth of this Creature, or Stones produced by the Earth: in which controversy he takes their part, who maintain that those and divers other substances, found in the Earth, are parts of the Bodies of Animals, and endeavours to prove, that such sorts of Earth may be the sediments of water, and such Bodies, the parts of Animals carried down together with those sediments, and in progress of time reduced to a stony hardness. *

* This Subject Mr. Hook hath also discoursed of at large in several of his publick Lectures, founded by Sir John Cutler; which Lectures he read about Two years since in Gresham Colledge, in the presence of many Learned and Curious persons; which also had been long since made publick, had not other indispensable affairs hindered him from taking care of the Press: where he hath not only shewn the Origin of these *Glossopetrae*, but of all other curiously figur'd Stones and Minerals, together with that of Mountains, Lakes, Islands, &c. though from a somewhat differing Hypothesis, of which the curious may shortly receive a further Account.

The other Narrative is of a Female *Dog-Fish*, dissected also by himself, where do occur no less remarkable observations, than in the former, both of the parts in the Head, and of those in the Body; as touching the small weight of the Brain of this Fish, compared to the weight of its Body; several little Fishes found in the Stomach, untouched by any Teeth; the *Ureters*, the *Ovarium*, and *Oviductus*, where he digresses, to shew, *Mulierum testes esse Ovario analogos*, and refers, for further proof of this to his intended Treatise, which is to give an account de *partium Genitalium Analogia*.

An Advertisement.

The Publisher hereof gives notice, that a Brief Index for the *Transactions* of this last year, beginning at Numb. 23. in March 1667. shall be Printed a part, for the use of such as desire to have all those Numbers together.

ERRATA.

What the Printer for want of room, did omit hitherto in the giving notice of an Error committed by him in Numb. 29. the Reader is now desired to observe here, viz. That in the said Numb. for want of Marks proper to express Multiplication, there was used pag. 571. l. 5. 7. the mark of plus or addition; which yet 'tis thought could hardly occasion any mistake in the Intelligent Readers, who might easily see the meaning of the Author by the lines 8. 9. 10. of the next precedent page 570.

In the SAVOY,

Printed by T. N. for John Martyn, Printer to the Royal Society, and are to be sold at the Bell a little without Temple-Bar, 1667.

Vol. 1-160
Dublin
1666



6

Physical Reflections

UPON A

LETTER

WRITTEN

By *J. Denis* Professor of PHILOSOPHY
and the MATHEMATICKS,

TO

Monfieur de Montmor Counsellor to the *French*
King, and Master of Requests.

Concerning a New way of Curing fundry Diseases

BY

TRANSFUSION of BLOOD.

BY *GEO. ACTON* a *Spagyricis Regiis in Ordinario.*

L O N D O N,

Printed, by *T. R.* for *J. Martyn*, at the Bell without
Temple-Barr, 1668.

