croſcope, D, and E F, Fig. 217. are their Repreſentatives. The largeſt of them reſembles the Silver Bag-pipe, each having crooked Heads, as at F; they have alſo two Motions, one ſtrait, and the other circular, ſlow enough to be eaſily obſerved.

Another Kind of fiſh-like *Animalcula* reſembling a *Carp*, is ſhewn at Fig. 218, its Motion was wrigling as the dotted Line a b c d.

In *January* a great Number of another Sort were found in this Infuſion of *Senna*, which ballance themſelves from Right to Left as they ſwim directly forwards. Another Time, after repleniſhing the Water, other minute Animalcules that do not ballance themſelves were found therein, and the ſame Day others alſo ſo exceeding ſmall that their Form could not be diſcerned. A few Days after another Sort ſhaped like Fig. 219, its Head terminated almoſt in a Point. After this Infuſion had ſtood a whole Year, another worm-like Animalcule was found therein, repreſented at Fig. 220, whereof A was its Mouth, which was round; from whence iſſued three Fibres to its forked Tail B B, two other Sorts, as repreſented by K L, Fig. 221, were alſo ſeen in this Infuſion.

SECT. VII.

Of the Water found in Oyſters.

A Dozen of *Oyſters* being opened, all their Liquor was put into a clean drinking Glaſs, which in the Space of two Hours appeared to be upon the Fret, and of a fine Pearl Colour, and its Smell like that of the Sea; on applying ſome of this Liquor to the Microſcope after it had ſtood four Days, a great Number of minute tranſparent *Oyſters* * in rapid Motion were obſerved therein. a b c d, Fig. 222, repreſents one of them, of which a is the Head, their Shape altered as they placed themſelves in different Poſitions before the Eye, their Motion was ſometimes direct, at others circular. The fifth and ſixth Day ſome of them ſeemed to be dead; but, on continuing to obſerve them, were afterwards found to move with a prodigious Swiftneſs, one going one Way, another the contrary, often rubbing and ſtopping againſt each other; then being diſturbed by others ruſhing ſtrongly againſt them, altered the State of their Rencounter, and directed themſelves to another Place; they ſtretch out and ſhorten themſelves conſiderably, and are often ſeen coupled as at a and c, Fig. 223, and Fig. 224. Moving together from a towards b, and from c towards d, they turn much ſlower than thoſe in Pepper-Water, and perform their circular Motion much as they do, turning ſometimes on their own Center, and ſometimes

* *Jobl. Obſerv. p.* 20.

on

on a Point near the Extremity of their Head. This Liquor being obſerved near eight Days, no other Animals than thoſe of the ſame Figure could be found therein.

In Freſh Oyſter Liquor diluted with common Water, were found Animalcules with two moving Horns in each of their Heads, which formed a kind of Creſcent as at e, in others as at d, Fig. 225, but the Horns are ſo tranſparent, that they muſt be viewed attentively, and that for ſome Time before they can be diſcovered.

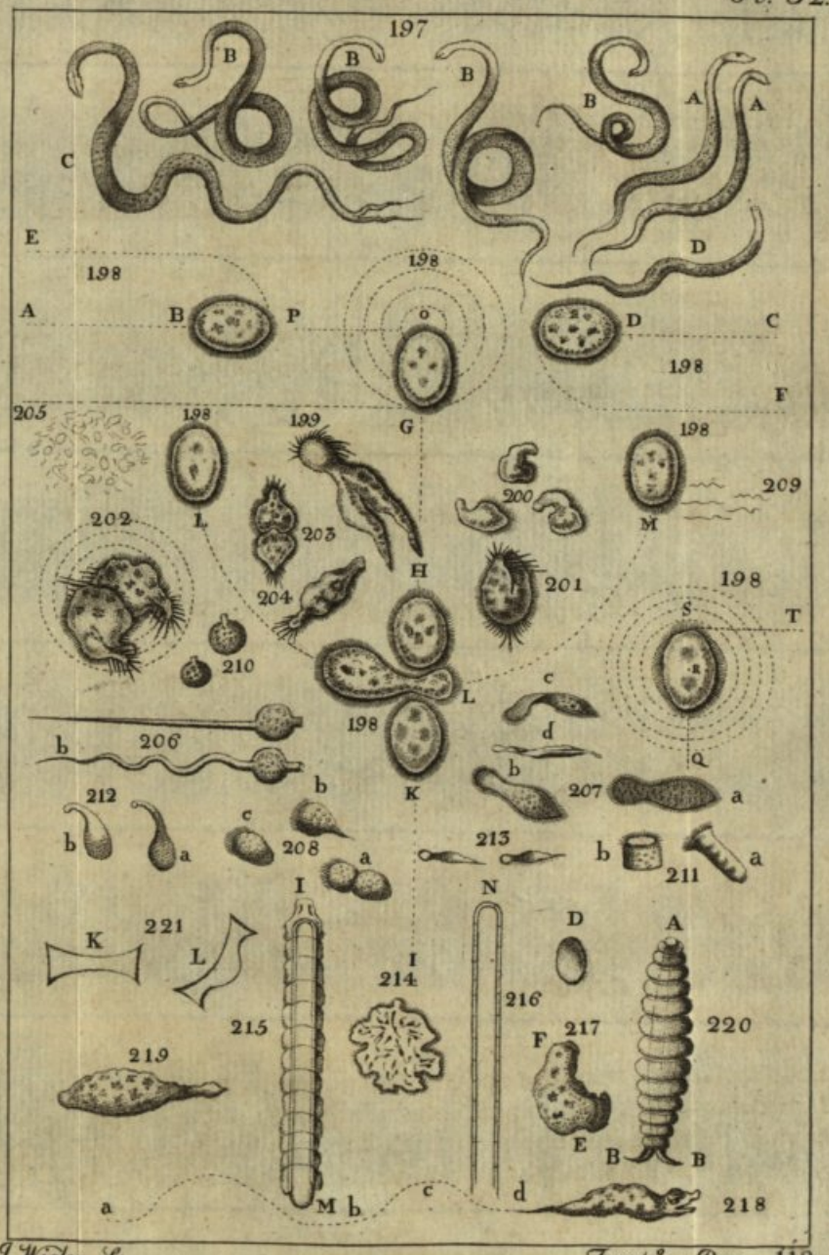
On putting the Liquor of ſix or ſeven *Oyſters* into a Glaſs Veſſel one Day at Noon, the next Day at Seven a Quantity of theſe minute *Oyſters* were found ſwimming therein, although the Veſſel was ſtopped: Whence it ſeems not improbable, but that theſe Animals were produced from the Eggs of the *Oyſters* themſelves, and that they do not proceed from other Animals that either fly or float in the Air. Six Days after two different Sorts of new *Animalcula* appeared in the ſame Liquor; the firſt are repreſented at Fig. 226, it ſtretches itſelf out and ſhortens itſelf alternately. The ſecond Sort is ſeen at Fig. 227, which moved ſo ſlow that the following Particulars were obſerved; it had four ſhort Legs near its Head, and five longer behind. In the ſame Liquor was alſo found another Sort repreſented at 228.

In other freſh *Oyſter* Liquor were alſo found different Animalcules, as repreſented at i, l, m, n, o, p, q, Fig. 229. m exhibits a Worm with a ſharp Head and round Tail. Thoſe at n and o ſhew two of the ſame Worms joined together, the ſtrongeſt dragging along the weakeſt. At p is ſeen one of another Figure, and at q are two ſmaller, holding each other by the Beak and ſwimming in Company.

SECT. VIII.

Of an Infuſion of Pinks made in common Water both cold and hot.

SOME *Pinks* not quite blown being ſteeped in cold Water, produced living *Animalcules*, which upon Examination with the Microſcope were found to be of the Shape repreſented by Fig. 230. On the ſixth Day appeared a larger Sort, but fewer, being very tranſparent, and ſtrewed with little Spots, Fig. 231. The eighth Day the larger Sort appeared finer and longer than before, and moved after a different Manner; in fifteen Days the Surface of the Liquor was covered with little white Worms, ſomewhat below which was a prodigious Number of minute *Animalcules*. The 28th Day a large Worm ſhewed itſelf under the Form of Fig. 232. The 48th ſome *Eels*, like thoſe in Vinegar. The 50th Day a little white Worm was taken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taken upon the Surface of this Water, * its Body ſo tranſparent, that ſeveral little white Fibres were diſcovered therein, the two middlemoſt of which being a little ſeparated, and proceeding from the Extremity of the Body, run parallel to each other, and are united by an Arch near the Head: It hath two black Eyes, and two Hooks in the fore Part of its Head, as repreſented at Fig. 233. At G of the ſame Fig. is ſeen another of a curious Form, found alſo in this Infuſion.

Some *Pinks* being infuſed in boiling Water, which in eleven Days Time ſwarmed with *Animalcules*, but very ſmall, and on the 15th Day were not to be found, only ſome Worms might be ſeen on the Surface thereof with the naked Eye.

SECT. IX.

Of a cold Infuſion made of a Noſegay, compoſed of Pinks, Roſes and Jeſſamin.

THIS Infuſion was made the 11th of *May*, and the *Noſegay* cut into Pieces for the better placing it in the Veſſel, and in about three or four Days a great Number of minute Animalcules, and ſome larger ones, were found therein; their Figures, Colour and Motions are ſo various, that it would be a Taſk too long to undertake a Deſcription thereof. Nevertheleſs I cannot paſs over in Silence, an Animalcule that was found in this Liquor on the Beginning of *September*. It conſiſted of three diſtinct Parts, Fig. 234. The firſt Part A is its Head, which advances and retires by Jerks. B, the Trunk of its Body, and C its Tail, it is of a tranſparent White, and often draws its Tail in, at the End of which are two black Hairs DD.

SECT. X.

Of an Infuſion of Blue-Bottles.

THE Stalks of a large Noſegay of *Blue-bottles* with ſome of the Flowers, were put into cold Water on the ſecond Day of *June*, and at the ſame Time ſome of the *Flowers* by themſelves were put into a Glaſs of Water; in 12 Hours Time the Microſcope diſcovered ſeveral Animalcules of the Form of Fig. 235, in a ſmall Drop of this Liquor. And the next Evening four other Sorts, very tranſparent, of an oval Figure, unequal in

* *Jobl. Obſerv. p.* 28.

Size,

Size, and different in their Motion. The 5th of the ſame Month, another Sort of the Shape of Fig. 236. appear'd therein; and on the Sixth a new Sort, A B C, Fig. 237. with an oval Head, and a Tail, which terminated in a Point, being five or ſix times longer than its Body. On the ſeventh Day, one of theſe laſt was obſerved to drag after it a Bunch of the Sediment of the Infuſion, which ſunk to the Bottom of the Concave, upon which the Drop of Liquor was placed for Obſervation. It is very pleaſant to behold ſo ſmall an Animal endeavouring to pull this Bunch about, which he is ſcarce able to move, as at I, drawing himſelf back, and wriggling its Tail, as at M. Sometimes five or ſix of theſe *Animalcules* may be ſeen faſtened by the Tail, to a great Bunch of this Sediment, that ſticks to the Bottom of the Object carrying Glaſs, drawing themſelves nearer to, and retiring farther from it by Turns. During this Exerciſe, they change their firſt Figure, and recover it again alternately; and as their Tail is naturally ſtrait, as at I, they endeavour to drag the Lump after them in a right Line.

It is remarkable, that extremely hot Weather kills them, and in five or ſix Days they are ſucceeded by others.

We have no Reaſon to doubt, but theſe minute *Animalcules* are furniſhed with Eyes, for two of the ſame Figure are often ſeen to approach each other without touching, and then turning with a prodigious Swiftneſs about their own Center.

Another Sort is ſometimes found in this Infuſion, whoſe Extremities are terminated by two plane Surfaces, parallel to each other, as at Fig. 238.

SECT. XI.

An Infuſion of Tea.

HAving put into the Tea-Pot, as much *Tea*, and a ſufficient Quantity of boiling Water, as would make ſix large Cups, on the 15th of *July*; the *Tea-Leaves* which remain'd after the hot Infuſion, were put into a large Glaſs Jar, filled with Spring-Water, and expoſed to the open Air for about ten Days; after which, in the leaſt Drop that could be taken up, when applied to the Microſcope, were found a Swarm * of exceedingly minute *Animalcules*, of a round Figure, moving ſlowly. Some Days after they were fewer in Number, but increas'd in Size, clearer, much more diſtinct, and of an oval Figure, as at Fig. 239. the Circumference of their Body appear'd black, but all the reſt perfectly white and tranſparent, and now ſwam with a ſurprizing Swiftneſs. Their Bodies were of ſo delicate

* *Job. Obſer. p.* 34.

a Con-

a Conſiſtence, as that their natural Figure was preſerved for the Space of two or three Minutes after they were dead.

The 23d of *September*, three other Sorts of more minute *Animalcules* were found in this Liquor, and ſome of the Eel-Kind alſo.

SECT. XII.

An Infuſion of Rasberry Stalks.

THIS Infuſion is one of them which does not cauſe a diſagreeable Smell, nevertheleſs it produces in about 24 Hours Time, the fineſt * *Animalcules* that are to be met with in Fluids, and in as great Numbers. Their Repreſentation is at o o, Fig. 240. they are at firſt very white and tranſparent, but more ſo in ſome Places than in others, with little Marks upon them, and at length this Whiteneſs changes into a tranſparent yellow Colour. They may be ſeen ſtretching out, and ſhortening themſelves from oval to round, by Means of Obſtacles, which they find in their Way. They are often ſeen to hold each other by the Beak, and in that Poſture they move exceeding faſt, without quitting their Hold, as at P. Another Sort of *Animalcule* was found in this Infuſion, of the Shape repreſented at Q; between the Middle of its Body, and the Head, was a tranſparent Subſtance, regularly beating, but ſo quick, that the Shape of it could not be diſcern'd.

SECT. XIII.

Infuſions of Fennel, Sage, Melon, ſour Grapes, Stalks, and Leaves of Marigolds.

Fennel, with its large and ſmall Stalks, was put into cold Water to infuſe, *Auguſt* 11. and on the 13th following, in the ſmalleſt Drop that could poſſibly be taken up, and placed upon the Object carrying Glaſs, might be ſeen a Swarm of an almoſt innumerable Quantity of little Animals, repreſented at Fig. 241. amongſt which were others of a round Figure, and about five or ſix times longer.

The 22d of *Auguſt*, ſome Sage Leaves were infuſed in cold Water, and retain'd their natural Smell all the Time of the Infuſion, which was about 12 Days; nothing was ſeen in this Liquor but ſome little *Animolcules* † that appear'd no bigger when magnified, than a Grain of Millet does to the naked Eye; and an infinite Number much ſmaller, that when magnified, appear'd no bigger than the ſmalleſt Dot that can be made upon Paper, with the fineſt Pen, and a little below the Surface of the Liquor, was found three very ſmall but white Worms.

* *Jobl. Obſ. p.* 35. † *Ibid. p.* 37.

The 28th of *September*, in a Drop of this Infuſion, was found two Sorts of minute *Animalcules*, repreſented at Fig. 242.

The 22d of *Auguſt*, ſome *Barberries* were put into cold Water, which produced *Animalcula* of the Shape of T, Fig. 243. in 24 Hours Time.

The 25th of the ſame Month, a Bit of the *Rind* of a *Melon*, with a little of the *Pulp*, and a few of its Seeds were put into cold Water; the next Morning appear'd ſome fine tranſparent *Animalcules*, whoſe Form is ſhewn at V, Fig. 243. Many little white longiſh Bodies were alſo found therein, whoſe Figures are ſeen at X; and other leſs Bodies marked T, without any ſenſible Motion.

Some *four Grapes* were alſo infus'd in cold Water, on the 14th of *Auguſt*, and on the 20th, a great Number of *Animalcules* appear'd therein, but ſo exceedingly minute, that their Shape could not be diſtinguiſhed; on the 25th two Sorts preſented themſelves, one as ſmall as the laſt; the other at Y, Fig. 244. The 4th of *September* theſe little *Animalcula* were exceedingly multiplied and increaſed in Size, ſome of them were join'd together in the Form of a Figure of 8, as at P, Fig. 244. and moved ſometimes circular and ſometimes in a right Line; on the 8th of *September* were found upon the Cruſt, which ſwarm upon this Infuſion, ſome minute Worms, and alſo in a Drop of the Liquor a conſiderable Quantity of other Eel-like *Animalcula*.

On the 25th of *Auguſt*, ſome of the Stalks and Leaves of *Marigolds*, were put to ſteep in cold Water, and eight Days after there was three Sorts of Animalcula found therein; the firſt is repreſented at Z, Fig. 245. the ſecond at R, of the ſame Figure; and the laſt, for which there was no Room in this Plate, were of the Eel-Kind, different from thoſe in Vinegar, and different alſo from thoſe in Paſte.

SECT. XIV.

Firſt Infuſion of new Hay in cold Water.

THIS Infuſion ſtood but 24 Hours before it was filled with Life, and at the End of five or ſix Days, in the moſt minute Drop of this Water, five or ſix Sorts of living Animalcula were diſcoverable; different in Colour, Size, Figure, and Motion.

The Smell of this Infuſion is very ſtrong in hot Weather, but decays as the Infuſion grows old, Animalcules are very rarely to be met with in any other Infuſion that are larger, finer, more tranſparent, or that live ſo long as thoſe found in this.

SECT.

SECT. XV.

The ſecond Infuſion of new Hay.

THE 4th of *October* ſome new Hay being put into cold Water in two different Veſſels, one of which was ſtopped cloſe with a Piece of Vellum, made very wet, and the other left open: Two Days after, three Sorts of Animalcula were diſcover'd in each Infuſion, and alſo a ſufficient Quantity of them: This Experiment is a Proof, that thoſe Animalcules were produced from Eggs, which had been depoſited by their parent * Animals upon the Hay, and alſo that they were not wafted thither in the Air.

The 10th of the ſame Month, more of theſe Animalcula were found in one Drop of that Infuſion, which had been covered, than could be ſeen in the like Quantity not covered.

SECT. XVI.

The third Experiment made upon the ſame Hay.

THE 13th of *October* ſome of the ſame *new Hay* was boiled in common Water, above a Quarter of an Hour, and an equal Quantity of it put into two Veſſels, nearly of the ſame Size, one of which was immediately cover'd, even before it was cold, and the other left open, in which was found ſome Animalcula, at the End of a few Days, and not one in the Infuſion, which had been covered; † after which great Care was taken to keep it cloſe for a conſiderable Time, to try if there were any living Animalcula therein, but none could be found, at length it was left open, and in a few Days, ſome Animalcules were found therein, which determined that theſe Animals proceeded from the Eggs of their parent Animals, wafted thither in the Air, ſince thoſe which had been brought there in the Hay, were totally deſtroy'd by its being boil'd in Water.

SECT. XVII.

A Compoſition of ſeveral Infuſions mixed together in one Veſſel.

TAKE equal Parts of an Infuſion of *Senna*, of *Raſberry Stalks*, and of *Hay*, &c. mix theſe all together, and half an Hour afterwards take as uſual a ſmall Drop of this Mixture, which being put upon the Object carrying Glaſs,

* *Jobl. Ob. p.* 39. † *Ibid. p.* 40.

and placed before the Microſcope, will give you the Pleaſure of ſeeing in this little Drop, the Animalcula of all the Infuſions you have mix'd together. * And here it is proper to take Notice, that all theſe different Animalcula cannot ſubſiſt long in this Mixture, each being deſirous to remain in its firſt Infuſion, therefore all Sorts of Infuſions are not proper to afford the Pleaſure of this Sight, for they ought to contain in them ſomething upon which the Animals can ſubſiſt.

SECT. XVIII.

An Infuſion of Rhubarb.

Rhubarb is a purgative Drug, and muſt be a long Time infuſed in Water, before any Animalcula can be found therein, or any diſagreeable Smell, for in about five Weeks there was found only one Sort of Animalcula, which does not merit a particular Deſcription; we ſhall only ſay that the Mixture of a Drop of this Infuſion, with as much of that of *Senna*, does not deſtroy the Animalcula in either; and that at the End of 15 Days the Animalcula in the Infuſion of *Rhubarb* † were all dead.

SECT. XIX.

Of an Infuſion of Muſhrooms.

A Large *Muſhroom* being infuſed in cold Water, produced from one Day to another an aſtoniſhing Multitude of infinitely ſmall Animalcules, of a round Figure, which appear'd in a Microſcope that magnified twenty-five thouſand times, of the ſame Size, that a Grain of Rape-Seed does to the naked Eye ‖.

The third Day ſome of a larger Size were found therein, with a crooked Neck, and very tranſparent; ſoon after a third Sort was diſcovered of an oval Figure, and fluttering Motion.

SECT. XX.

Of the little Flowers of different Colours that are found in Meadows.

IF ſome of theſe *Flowers*, when they are juſt blown, be put into cold Water, in a few Days a particular Sort of Animalcule will be found therein, reſembling the Sole of a Shoe, one of which is repreſented at Fig. 246. Its Mo-

* *Jobl. Ob. p.* 40. † *Ibid. p.* 48. ‖ *Ibid. p.* 48.

tion

tion is ſlow, and its Head directly under the Letter A; it inclines itſelf towards B and C, ſtretching itſelf out, and contracting alternately; ſometimes all its Body appears as round as a Bowl, at which Time the Surface thereof is uneven: Their Body is marked with longiſh Spots, and is ſo tranſparent, that all their Inteſtines, and the periſtaltick Motion may be diſtinguiſhed, which are a very agreeable Sight. * Theſe larger Sort appear at the Beginning of the Infuſion, but at the End of fifteen Days, a great Number of thoſe repreſented at Fig. 247. was ſeen therein, which is contrary to what generally happens in other Infuſions, where the ſmalleſt appear firſt.

SECT. XXI.

Of an Infuſion of ſweet Baſil, which ſmells like Citron.

THREE Sorts of Animalcules ſhew themſelves in a few Days after ſweet Baſil hath been infuſed in common Water; the firſt are ſeen at A, Fig. 248. the ſecond at B, and thoſe of the third Sort almoſt like that repreſented at C. This laſt ſwims in a ſpiral Line, folding and unfolding its Body every Way.

A, B, C, Fig. 249. repreſent the Animalcules found in the Infuſion of new Hay, the Colour of one, and Figure of the other, was the Occaſion of calling one golden, and the other ſilver Bag-pipe. That Sort repreſented at D E, are called Clubs; the Head whereof is ſeen at D. Theſe Animalcules extend and contract, twiſt and untwiſt themſelves ſeveral Ways.

SECT. XXII.

Infuſion of Blue Bottles.

FIG. 250. repreſents a new Sort of Animalcula found in this Infuſion of *Blue Bottles*. A ſhews the Head, B its Tail, C D its Breadth, which ſeems divided throughout its whole Length by a curved Line, drawn from B towards A, that Part of the Body marked C, ſeem'd to be filled with ſeveral little Globules, leſs tranſparent on this Side, than on that marked D; the Neck of this Animal, which is very long, ſhortens itſelf from Time to Time, as does alſo the hinder Part, marked B. † It ſwims extraordinary ſlow, and does not live upon the Object carrying Glaſs above 5 or 6 Minutes, but two of theſe were diſcovered in 5 or 6 Drops, and the ſecond, Fig. 251. was ſomething different from the firſt, for its Body B C was furniſhed with little Globules, that render'd it leſs tranſparent than the firſt was, at A B and C D.

* *Jobl. Ob. p.* 49. † *Ibid. p.* 51.

SECT.

SECT. XXIII.

Infuſion of old Hay.

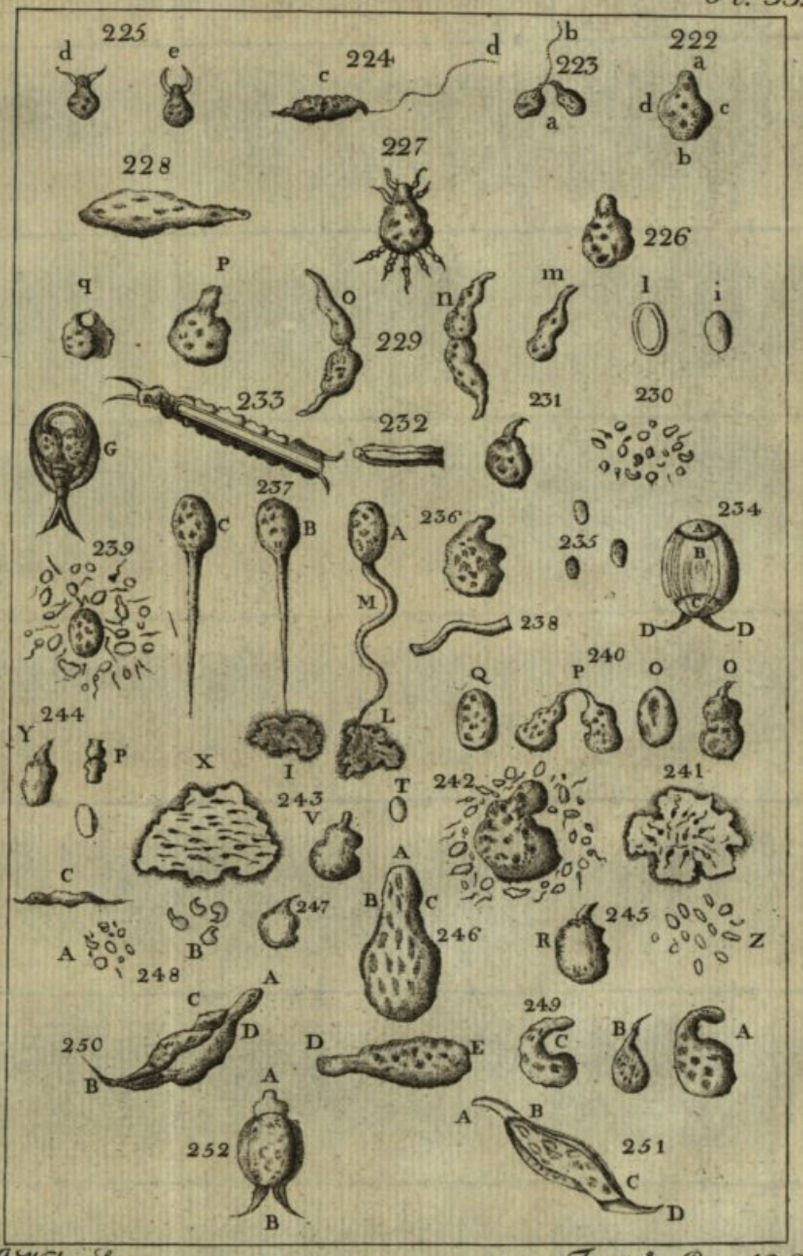
IN this Infuſion were two Sorts of Animalcules that merit a particular Deſcription. The leaſt is ſeen at Fig. 252. it was of a tranſparent White; A its Head, B its forked Tail, with which it puſhes itſelf forward; and it ſwims ſo ſteadily that no particular Motion of its Body can be diſcerned.

The ſecond Sort are more extraordinary and ſurpriſing, as well in Size as other Circumſtances; two of them are repreſented at Fig. 253 and 254, marked A, C, D B, and A C E F B; A ſhews the Head, B its forked Tail, C its Heart, which may be ſeen in a regular Motion, and D its Inteſtines. It is called an *aquatick Caterpillar*, there are two different Colours of them, one of a tranſparent White, the other of a pale Yellow. In moving on the Object carrying Glaſs, they firſt fix the Points B, and then extending their Body as much as poſſible, reſt the fore Part upon another Place, and draw up the hinder Part, and then again fix the Point B as before and ſo on; they alſo fix the Points of their Tail to the Object carrying Glaſs, and ſtretch out and retract themſelves by Jerks, and ſometimes turn round about upon the Point B, at other Times they ſpring forwards with a ſudden Jerk, and ſwim about for ſome Time.

When they reſt themſelves, they commonly open their Mouths very wide as at A, Fig. 254. its Lips alſo are furniſhed with Hairs, as expreſſed in the Figure, which move very quick; it is really ſurpriſing to ſee how haſtily they ſwallow down other ſmaller Animalcula that happens to be within the Reach of their Mouths. At certain Times all the Hairs at the hinder Part of their Body which ſtand upright, are ſeen to lie down from EF to B. The Circumference of the Body ſeemed indented like the Teeth of a Saw, which upon a cloſer Examination was diſcovered to be Ringlets lying one over another, coming out with a ſurpriſing Swiftneſs, and ſometimes even the nervous Fibres were viſible, extending from Head to Tail, ſwelling and contracting alternately as they crawled along.

A Mixture of the Infuſions of Hay and Celery, does no Hurt to either of the Animalcula of the two Liquors; but the leaſt Drop of this Mixture affords a very pleaſant Proſpect to the Spectator, who will in an Inſtant diſcover Variety of theſe fiſh-like Animalcules of different Sorts, moving in all Directions.

See alſo a Deſign of another aquatick Caterpillar at Fig. 255. it was fiſhed out of an Infuſion made of the Stalks of a Noſegay compoſed of Pinks, Jeſſamin, Tuberoſe and other Flowers; this differs from the foregoing: Firſt,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242
241
C
A
247
B
C
246
245
R
Z
248
A
C
D
250
B
249
C
B
A
D
E
A
B
252
251
C
B
D

J. Wigley. Sc.

firſt, in being longer; ſecond, that its Tail marked I, is compoſed of three Points inſtead of two; third, that it hath two little Arms L M, one on each Side its Heart a; fourth, that its Inteſtines marked b are without any viſible Separation; and laſtly, that neither Ringlets, ſaw-like Teeth, nervous Fibres, nor Hairs in the Length of its Tail could be diſcovered in this Animalcule, but in all other Reſpects it was the ſame as the foregoing *Caterpillar*.

SECT. XXIV.

An Infuſion of Citron Flowers.

IN *Auguſt* ſome of theſe Flowers were put into cold Water, in a few Days three Sorts of Animalcules were ſeen therein, which did not merit a figurative Repreſentation. But ſome Time after others appeared, called Tortoiſe, one of which is repreſented at Fig. 256. Its Head, though large, is very ſhort, and adorned with two Horns like thoſe of a Deer: Its Body ſeemed to be covered with Scales, its Tail very long, and ſwift in Motion.

SECT. XXV.

Infuſion of Animony.

NAture is pleaſed to diverſify all her Productions, and is ſurpriſingly admirable in all her Works, by continuing to give us Proofs thereof in this Infuſion of *Animony* prepared after the ordinary Manner with cold Water, which at the End of eight Days afforded a new Animalcule, repreſented at Fig. 257.*

All the Surface of its Back is covered with a very fine Maſk in Form of a *human Face* perfectly well made, as appears in the Figure. It hath three Feet on each Side, and a Tail coming out from under the Maſk.

SECT. XXVI.

Infuſions of three different Portions of Celery Stalks and Leaves, put ſeparately into different Glaſſes.

ON the 1ſt of *November* ſome of the Stalks of *Celery* were broke into little Pieces, and put into the firſt Glaſs, and common Water poured

* *Jobl. Ob. p.* 57.

thereon,

thereon, and alſo upon the green Leaves in the ſecond Glaſs, and in the third Glaſs ſome Pieces of the Stalks with ſome of their Leaves with Water.

Seven Days after theſe Preparations, ſome Animalcules were found in each of them, two Sorts in the firſt, and but one only Sort in both the other: But in about a Month's Time all the three Infuſions contained ten different Sorts both in Shape and Size.

Thoſe of Fig. 258, and 259, are the ſmalleſt; but in Number they exceed all the other, when coupled they reſemble a Figure of 8, as at a, Fig. 259. Theſe alſo are called *Bag-pipes*; they couple by the Beak, which is a little crooked and ſharp, and notwithſtanding this Coupling they ſwim very faſt, diving to the Bottom of the Drop of Liquor which is placed upon the Object carrying Glaſs, and riſing up again to the Top thereof alternately; they ſeparate from, and approach each other, without Intermiſſion. Theſe *Bagpipe-like* Animalcules are not entirely alike; but there is in theſe as in all other Animals, different Sorts of them.

Some of them ſwim alone with a ſurpriſing Rapidity, while others advance with a moderate Swiftneſs, ſome go very ſlow, and others reſt quiet for a long Time together; but the greater Part of them are in a perpetual Agitation, ſome of them are long, ſome ſhort, others as white as Silver, ſome of a golden Colour, and others brown.

It is a ſingular Curioſity to obſerve what paſſes upon the Surface and all around the Circumference of a Maſs of Matter which hath formed itſelf into a very little Bit of thin Skin, ſo ſmall, that the beſt Eyes are not able to ſee it without a Microſcope: They are found by Chance on the Surface of the Infuſion, and are generally faſtened to the End of the Stalks. If a Bit thereof be taken out with the Point of a Pin, and placed upon the Object carrying Glaſs before the Microſcope, there will be ſeen Swarms of all theſe Animalcules we have been ſpeaking of. There are ſuch great Numbers of them moving with ſo much Celerity, that it is troubleſome to turn the Eye upon a Sight ſo new and ſurpriſing. In certain Places thereof there are ſeen ſome differently coupled. Others alſo, that reſt themſelves, and keep the Watch as Soldiers do, which ſeem apprehenſive of being ſurpriſed; whilſt others go out a good Way from the Maſs as though they would make ſome Diſcovery, then they return again as if they had ſomething to relate to thoſe which kept the Watch, and this is ſeen all round the Maſs.

In another Drop, taken from another Place of the ſame Veſſel, has been often ſeen another new and curious Sight, *viz.* that Sort of Animalcula which are long and flat, called Soles, and are repreſented by A B C D, in Fig. 260. The Sides of this Animalcula is very ſharp; the Head and all the reſt of its Body is tranſparent, except a few brown Spots which appear within. The different Poſtures, and the Variety of Motions obſervable in theſe Animalcula, cauſe much Pleaſure in beholding them through a *Microſcope*,

croſcope, and afford much greater Satisfaction than can poſſibly be imagined by reading the moſt particular Deſcription of them.

In the Glaſs where only the Leaves were infuſed, there were amongſt others ſome Animalcules like thoſe expreſſed at E, F, G, Fig. 261, at one End of each of theſe Figures may be ſeen a conſiderable Opening which is their Mouth, and appears ſometimes round as at F, and ſometimes ovaliſh as at E and G; at other Times it is ſo firmly cloſed as not to be diſcovered. It ſwims by Jolts, and Ballancing from Right to Left, conducting itſelf in Appearance by a circular Motion of its Head. It alſo changes its Figure by folding, unfolding, and ſuddenly rolling itſelf up in the Form of a Ball, and then alternately ſtretching out again very quick into its natural State.

There is another Sort of Animalcula that appears to have neither Head nor Eyes, and are repreſented at H I K, Fig. 262. their Body ends in a long tranſparent Tail, and Motion generally very ſlow. They are frequently obſerved to have a Bit of the Skin (which is formed on the Surface of the Infuſion) ſticking to their Tail as at L, ſometimes they drag it after them, at other Times it happens to ſtick to the Object carrying Glaſs, at which Time they draw themſelves back on a ſudden towards it, and then ſtretch out again very ſlowly.

In the leaſt Drop that could be taken up from the third Glaſs, wherein the Leaves, Stalks, and Roots were mixed, was ſuch an infinite Number of thoſe little Animalcula repreſented at Fig. 258. that they could ſcarce find Room enough to paſs between each other.

There was alſo a large oval Animalcule, as at M N, Fig. 263. its Head could not be diſtinguiſhed.

In a ſecond Infuſion of the Leaves of Celery was a new Animalcule, repreſented at Fig. 264. its Head is ſeen at O, and is beſet with long Hairs that move alternately, its Motion is ſlow and Figure uncertain, appearing ſometimes under the Form of a Bag-pipe, and at others, under that of a Croſs.

Fig. 265. repreſents another Sort of Animalcule of a ſpheroidical Figure. Another Sort at Fig. 266. and others like Fig. 267. this laſt moves with a ſurprizing Velocity, and frequently turns itſelf upſide down.

Amongſt other Infuſions of Celery, was found an Animalcule in the Shape of a Bottle, as at Fig. 268. Fig. 269. exhibits another Sort of the Bagpipe-like Animalcules, two of which are ſeen at P, differently coupled from any of the foregoing.

Laſtly, at Fig. 270. is repreſented a moſt extraordinary Animalcule, almoſt round, its Body cover'd with Hairs and Motion circular.

SECT. XXVII.

Of Infuſions of Straw and the Ears of Wheat.

IN the Beginning of *March*, ſome wheaten Straw, and two Ears of Wheat were put into cold Water, the ſecond whereof produced Animalcules, of the Shape of Fig. 269.

Others alſo were found therein, repreſented at Fig. 271. its Mouth is ſeen at A, the Inſide of its Body was filled with a Quantity of little white and brown tranſparent Corpuſcles.

A third Sort is repreſented at Fig. 272. turning according to the Order of the Letters A B C, and moving ſlowly, its Colour like that of unpoliſhed Silver, ſtrewed with little brown Spots. Its Head is ſeen at A, Tail at B, and Back at C.

Another Sort of Animalcule is ſeen therein of an oval Form, and one called a golden Bottle, repreſented at Fig. 276. its Mouth is ſometimes fixed to a round Body, to which it ſtrongly adheres, as at Fig. 273.

Another Sort called *Soals*, contracting and ſtretching themſelves out as they ſwim along, which is very quick, are repreſented at Fig. 274.

See alſo another Sort, at Fig. 275. their Mouth is at A, which is ſometimes extended to a great Width. B C is the Tail.

Fig. 277. repreſents an Animalcule with a Swan-like Neck. A is its Head; B its Tail, and C its Body. They are of two Sorts, one very tranſparent, and the Inſide of the Body of the other browniſh. Their Inteſtines may be ſeen in Motion.

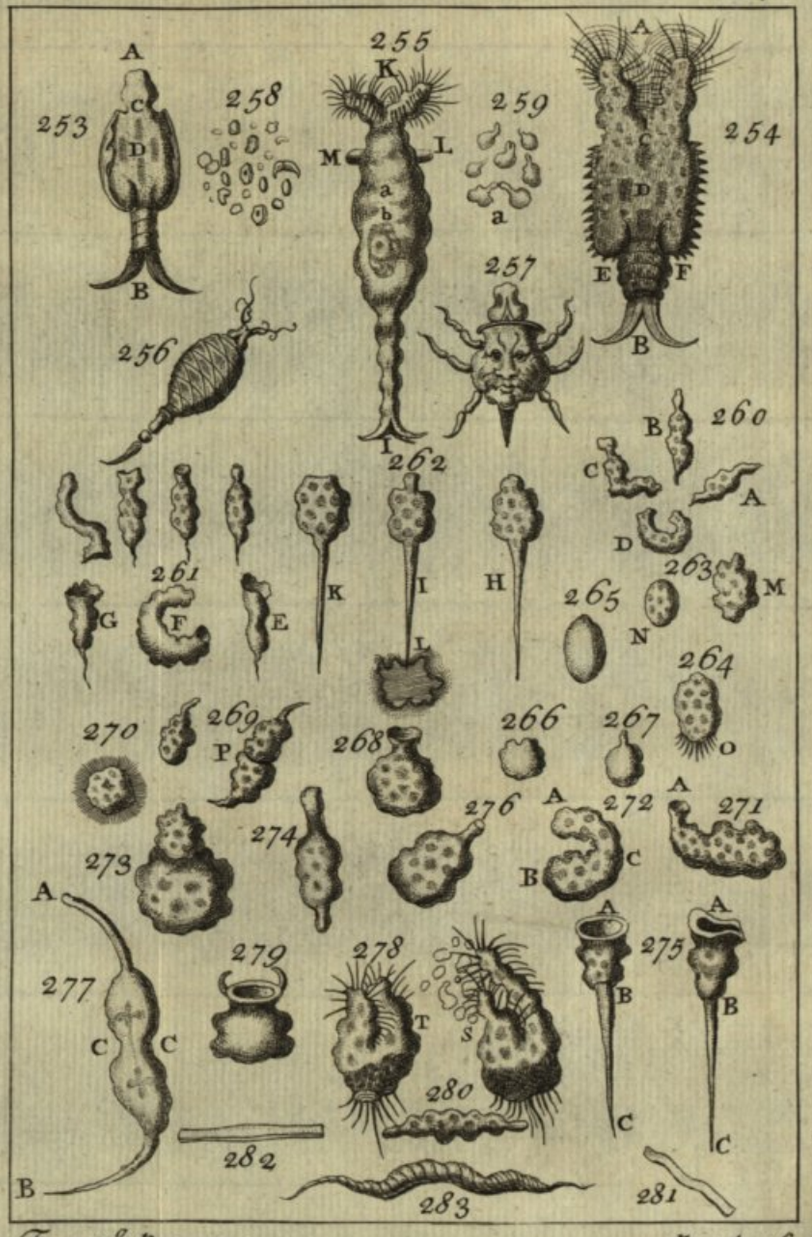
The Animalcula S and T, Fig. 278. are thoſe which were before call'd *Water-Spiders*, or rather *greedy Guts*, from the Quantity of other minute Animalcula they ſwallow.

That repreſented Fig. 279. is the only one of its Sort found in the Infuſion of wheaten Straw. Its Figure is like a Purſe, its Mouth large, and here repreſented open; but when it ſtretches itſelf out for ſwimming, it is ſo neatly ſhut, as to encloſe its Horns.

Fig. 280. exhibits an Animalcule, called a *little Soal*; and at Fig. 281, and 282. are two others that move extreamly ſlow; and are 1000 times ſmaller than an Hair *.

Fig. 283. repreſents a Worm-like Animalcule, compoſed of a great Number of very ſmall ſpiral Rings, whoſe Extremities are terminated in very long, and exceeding fine Points.

* *Jobl. Obſ. p.* 67.



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Bowles sc.

SECT. XXVIII.

Of aquatic Pomegranates.

THIS Name of *aquatick Pomegranates*, *crowned* and *bearded*, is given to the Animalcula, which are repreſented by the Figures 284, 285, 286, 287, 288, and 289, becauſe their Shape in ſome Meaſure reſembles that Fruit; * they were found in a ſmall Drop of an Infuſion of wheaten Straw, and ſeen with a Lens, $\frac{1}{8}$th of an Inch Focus.

They appear'd of a fine tranſparent amber Colour, which therefore affords a curious Sight of their Inteſtines, the ſeveral Forms under which this Animalcule appears, require a particular Deſcription, which take as follows:

In Fig. 284. under the Letters A B C D, are ſhewn four little Eminencies, adorned with Hairs, which remain but a ſhort Time in this Situation, for that marked B joins A, and C unites with D ſo cloſely, that they then appear as at A D, Fig. 285. Theſe increaſed Eminencies, form the ſeparated Lips of this Animalcule, and the regular Motion of the Hairs with which they are adorned, obliges all minute Bodies, at a ſmall Diſtance from theſe Lips, to enter into its Mouth. Part of which is alſo as ſtrongly repelled, as it was greedily ſwallowed.

All the Protuberances A, B, C, D, of Fig. 284. or the two of Fig. 285. contracting themſelves a little towards E, diſcover a Sort of Crown, with four Points, repreſented at Fig. 286. which are preſently cover'd again with theſe Eminencies, and then expoſed again, and ſo on.

In each of theſe Figures, at E, is ſeen a regular Pulſation, ſuppoſed to be its Heart; it ſeems to be embraced by two Lobes, that ſeparate and join alternately, which probably are the Lungs; from theſe proceed two little Ligaments at G, towards the Inteſtines, whoſe periſtaltick Motion is alſo very regular.

The Tail of this Animalcule appear'd ſometimes round and cloſe, at other Times open, when two little Points, as at H, Fig. 284. might be ſeen.

One of theſe Animalcules had four of thoſe ſharp Points, Fig. 287. placed two on each Side the Anus; between which a long Tail I L is protruded, and drawn in again with great Swiftneſs: The End L, in ſome of theſe Animalcules, appeared forked, as Fig. 285. the Tail can be entirely drawn into the Body, at which Time the Rings that compoſe it, ſlide one over the other, and cauſe it to become opake.

* *Jobl. Ob. p.* 68.

Their Eggs are frequently ſeen faſtened to their Breech by ſmall Threads; ſome of the Females carry but one, as at M, Fig. 289. others two, Fig. 285, and ſome others ſix, Fig. 286; but this is ſeldom, and then alſo they are ſmaller. They rub their Eggs with their Tail, which as it enters into, and goes out from the Body, turns from one Side to the other with a great deal of Pliableneſs; thoſe Eggs which are full, appear hanging down, and are very regular and bright, thoſe that are empty are ſeen quite flat, and of an oval Form, and more tranſparent than the others, and although empty, their Mothers carry them almoſt always faſtened to their Breech, as at Fig. 286. Two of theſe Eggs were ſeen in the Body of one of theſe Animalcules, and appeared as at G G, Fig. 288.

Theſe Animalcules are a delightful Object for the Microſcope, particularly when they tumble over Head and Tail, becauſe they do it dextrouſly. Some turn themſelves circularly, as much on one Side as the other, and about the Point F, which is the Center of Gravity of their Bodies.

SECT. XXIX.

Infuſion of the Bark of an Oak.

SOME of this Bark being put into cold Water, the 15th of *December*, and examined ſeveral Times for the Space of a whole Year, during which Time the following Animalcules were diſcovered. The firſt was called a Tortoiſe with an umbelical Tail, Fig. 290. This Inſect ſtretches out and contracts itſelf very eaſily, ſometimes aſſuming a round Figure, which it does not retain above a Moment; then opening its Mouth to a ſurprizing Width, forms nearly the Circumference of a Circle; its Lips are furniſhed with Hairs, whoſe Motion is very pleaſant, becauſe it obliges ſome of the adjacent little Bodies, to precipitate into its Stomach, where that which is fit for Food remains, while the other is repelled with great Velocity; its Motion is very ſurpriſing and ſingular.

Fig. 291. is another Sort of Animalcula with an umbelical Tail, differing only from the former in having its Mouth fixed, and Tail without any Separation.

Fig. 292. repreſents another of the ſame Sort, although under a Form ſomewhat different; the Top of its Head is double, and two Prominencies appear thereon under the Form of Horns, which were intirely covered in the other.

That repreſented at Fig. 293. is called a Water-Rat, its Head well ſhaped, and Lips adorned with long Hairs.

Another Sort at Fig. 294. is called a Crab's Claw, becauſe of its two crooked

crooked Beaks, whoſe Motion as well as that of its Body is very ſlow, its Body is adorned with a great Number of ſhining Globules.

Fig. 295. is called a Club, its Head large in Proportion to its Body, which ends in a Point, the Inſide of which is ſtrewed with little Grains both tranſparent and opake.

That Sort exhibited by Fig. 296. is called a Silk-worm's Bag, becauſe its Body is compoſed of ſeveral Rings and longitudinal Fibres, the Shape of its Head is ſo nearly like that of the Tail, that it can only be diſtinguiſhed by its Swimming.

The Animalcule, Fig. 297. is called a Spheroid, its Head is ſeen at A, a little below which may be ſeen its Heart regularly beating; and ſeveral round Bodies of different Sizes, which probably were its Eggs.

There are in this Infuſion ſeveral Sorts of Eels, different amongſt themſelves, and different alſo from thoſe found in Vinegar.

Fig. 298. repreſents one of them very thick with reſpect to its Length, which was ſtored with a conſiderable Number of exceeding ſmall Fibres, and others alſo that ran ſpirally from near its Head towards the Tail.

At Fig. 299. is exhibited another kind of Eel-like Animalcula of great Vivacity.

Another of a larger Size is alſo repreſented at Fig. 300. that had been dead for ſome Time, when by Chance a little Eel * was diſcovered fluttering very much to get out of the Belly of its Mother, but not being able to do it, at laſt died therein.

This Obſervation is a ſufficient Proof that the Eggs of theſe Eel-like Animalcula are hatched in their Mother's Body.

Fig. 301. repreſents an Animalcule, called a Weaver's Shuttle; it ſwims ſmoothly, having in the Middle of its Body ſeveral little Corpuſcles reſembling Eggs.

Fig. 302. is called the Beak of an Halbert, its Head ends in a Point; the other Extremity of its Body is like a Drop, and upon the Throat are ſeveral long Hairs.

Fig. 303. is called a Water-Spider, it is of a ſpherical Figure, with ſeveral brown parallel Lines; between which are ſome Spots browner than the reſt of their Bodies.

Fig. 304. is called a Drop, its Body uniform and tranſparent, its Neck long, but a little crooked.

Fig. 305. is called a Slug, its Head is round, Tail ſharp, Body large in Proportion to its Length, and becomes ſo ſhort in Motion as to appear pretty regular.

Fig. 306. is called a Water Caterpillar, they are found of different Sorts, and in ſeveral Infuſions of Plants it has been before obſerved, that the

* *Jab. Ob. p.* 76.

Hairs,

Hairs, of which we have elſewhere ſpoke, are planted on the two Lips of this Caterpillar, which ſeem to turn at certain Times like the Rowel of a Spur.

Fig. 307. is called the great aquatic Spider, its Figure ſomewhat ovaliſh, Mouth a little ſunk, which appears ſometimes to reach to the Middle of its Body, its Lips are adorned with Hairs in Motion, which ſeem to have a Communication with a little Part that probably may be the Heart, and Lungs ſurrounding it; its hinder Part is alſo furniſhed with Hairs that form a kind of Tail; a little above the Anus is a brown Spot, ſuppoſed to be the Excrement; the reſt of their Body is generally ſtored with little regular Corpuſcles.

This Sort of Animalcule is alſo found in Infuſions of *wheaten Straw*, in that of *Barley* mixt with ſome of the Ears; in *Turkey Corn*, *Indian Cane*, in the *Wood* and *Bark* of *Acaias*, or in that of *whole Pepper*, &c. All theſe different Sorts of Water-Spiders, have Hairs round their Body, inclining a little from their Head towards their Tail, and may be ſeen with a Lens of $\frac{1}{12}$ of an Inch Focus.

Fig. 308. is called great Mouth, becauſe its Mouth takes up about half the Length of its Body; its upper Lip is much longer than the lower, and are each adorned with little Hairs; its Inſide is filled with darkiſh Spots, and hinder Part terminated with a ſingular Tail.

Fig. 309, A B C, is named a Funnel, and is here repreſented under three different Forms, in the middle one the Mouth is open and round, the Inſide of its Lips are adorned with little Hairs, which have a quick Motion; the Inſide of its Body ſtrewed with many little irregular Spots, and its long Tail generally drags after it little Pieces of Skin faſtened to its Extremity. The ſecond is ſeen at A with its Mouth ſhut; and the third at C, whoſe Body is rounder, and its Tail at certain Times twiſted in the Form of a Cork-ſcrew.

Fig. 310. hath a Head like Clover Graſs, and a forked Tail; its Mouth very ſmall and round.

Fig. 311. is called a Sock, the Inſide of its Body is adorned with ſeveral tranſparent Spots, which appear like Eggs.

At the Time this Infuſion was intended to be thrown away, it was thought proper to put a Drop of it upon the Object carrying Glaſs, and to examine it by the Microſcope, whereupon one of the moſt particular of all the foregoing Animalcula was found therein. It is a kind of Water Caterpillar, and ſo ſcarce, that no more than ſeven or eight could be found in many Trials during three Days. Fig. 312. ſhews three Repreſentations of one of them; in that exhibited by A B, its Body is ſeen to be compoſed of ſeveral Ringlets, that enter one into the other, as the Animalcula contracts itſelf; it puſhes out of its Mouth a Snout compoſed of ſeveral Pieces ſheathed in each other, which are ſhewn at A C and D. The Extremity of this

this Snout appears to be perforated in ſome Poſitions as at D; it is ſometimes ſplit in two Parts, at other Times into three, as at A, where they form two or three little Protuberances. At L L are ſeen two Lips furniſhed with moveable Hairs. In other Poſitions not one Hair can be ſeen. While theſe Things were obſerving, a kind of Horn F, was ſuddenly protruded from its Breaſt: Its whole Length appear'd to be compoſed of ſeveral Furbelows of unequal Thickneſſes, which go one into another like the Drawers of a Pocket Teleſcope: At its Tail are two very ſharp Points as at B E, and in ſome particular Poſitions it appears in three Parts as at I.

SECT. XXX.

Infuſion of the Bark of a young Oak.

ABOUT the 25th of *December* ſeveral little Pieces of the Bark taken from off a Branch of young Oaks were put into cold Water, and in two Hours after ſome of thoſe Animalcules called Silver Bag-pipes was ſeen therein, and on the 15th of *January* in a very ſmall Drop was ſeen ſeveral new ones. Some of them Mr. *Joblot* called Caterpillars, others Stockings, Stirrup-Stockings, *&c.*

Thoſe repreſented at Fig. 313, are called golden Caterpillars, being of an Amber-colour, the longitudinal Fibres are ſeen from one End of its Body to the other, between which are little irregular Globules.

Fig. 314. is called a Stirrup-Stocking; at C is a great Opening which changed its Shape every Moment, and appeared to be its Mouth; the Lips were ſometimes ſo extended as to ſerve it for a Rudder to ſteer its Courſe, its Body was beſet with extremely ſmall Hairs.

That repreſented at Fig. 315, is in the Form of a Fiſhing-Net.

Fig. 316. is another, of which the Part G H reſembles an ill-ſhaped Leg, the Middle of its Body appeared to be tied with an inviſible Ligature.

Fig. 317, is called a Club, its Mouth intirely cloſe, and Body ſhaped like one, ſeveral little Globules were ſeen within-ſide, ſuppoſed to be Eggs.

Laſtly, at Fig. 318, is one of another kind of the Bottle Sort, which ſwam amongſt the preceding ones; and alſo a great Number of other Sorts which do not merit a Deſcription. The cold Weather increaſed ſo faſt, that in 15 Days Time all the *Animalcules* in this Infuſion were deſtroyed.

SECT. XXXI.

Of ſome other larger aquatic Animals.

THE *Waters* every where are ſtocked with Life, which makes the Subject endleſs for the Employment of the Microſcope, *Seas*, *Rivers*, *Ponds*, *Ditches*, and almoſt every *Puddle*, can preſent us with living Wonders; but as theſe Examinations have been very little attended too even by thoſe who are ſupplied with Microſcopes, I hope theſe Directions and the new *Univerſal Microſcope*, will be a Means to whet the Inclinations of the induſtrious Enquirer, the Difficulties in the Uſe of the common Inſtruments being here removed.

Mr. *Leeuwenhoek* found ſome ſurpriſing *Animalcules*, adhering to the *Lens Paluſtris* * or *Duck-weed*, which he examined in a Glaſs Tube filled with Water; one Sort of theſe were ſhaped like Bells, with long Tails, whereby they faſtened themſelves to the Roots of theſe Weeds. HM, Fig. 319, repreſents a ſmall Part of the Root as it appear'd in the Microſcope, ſuppoſed to be almoſt withered and over-grown, with a great many long Particles which are ſeen between K and L. The *Animalcula* repreſenting little Bells, † are ſeen at IST.

On ſeveral of theſe Roots were obſerved one, and ſometimes two Sheaths or Caſes of various Sizes, faſtened thereto by the ſmall End: The largeſt is exhibited at RXY, out of which Sheath appeared a little Animal, whoſe fore Part was roundiſh as at XYZ, from whence proceeded two little Wheels that had a ſwift Gyration always one and the ſame Way, and were thickly ſet with Teeth or Notches as at PQRS. When they have for ſome Time exerted their circular Motion, they draw the Wheels into their Bodies, and their Bodies wholly into their Sheath, and ſoon after thruſt themſelves out again and renew the aforeſaid Motion. Mr. *Leeuwenhoek* obſerved the Caſe of one of theſe *Animalcules* to be compoſed of round Bubbles, ‡ as is repreſented at N, O, T. When this Animalcule had thruſt that Part of its Body from O to P, out of its Sheath NO; it extruded at the ſame Time that ſurpriſing Wheel-work (which before was taken for two diſtinct little Wheels, and was here plainly ſeen to be but one and the ſame Circumvolution) that conſiſted of four round Parts PQRS, three of which were to be ſeen, the fourth being almoſt hid; its Motion was from P to Q, according to the Order of the Letters. Fig. 320, repreſents the Wheel-work by itſelf, and larger than it appeared to the Sight.

Mr. *Leeuwenhoek* found ſeveral Kinds of theſe Wheel-work Animalcula,

* *Phi. Tranſ. No.* 283, 295, 337. † *Ibid. No.* 283. ‡ *Ibid. No.* 295.

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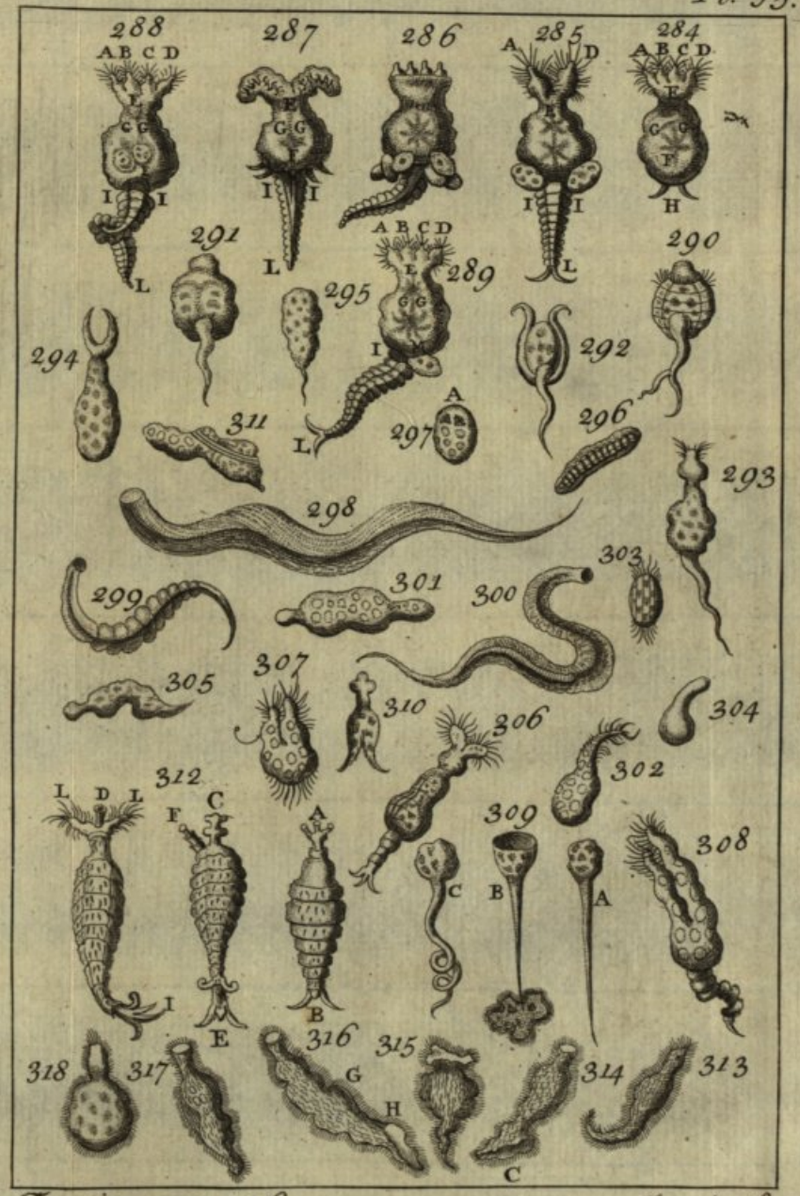

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Bowles sc.

in the ſlimy Matter which is to be found in leaden Pipes, or * Gutters, when the Water dries away they contract themſelves into an oval Figure, and a reddiſh Colour, and become fixed in the dry Dirt, which grows as hard as Clay; but if to this Dirt you put Water, in about half an Hour's Time they open, and by Degrees extend their Bodies and ſwim about; and this they did after ſome of this Gutter-dirt had been kept dry for 21 Months together: Whence he concludes, that the Pores of their Skin are ſo perfectly cloſed as to prevent all Perſpiration, by which Means they are preſerved till Rain falls, when they open their Bodies, ſwim about and take in Nouriſhment.

Fig. 321 and 322, repreſents two of them in different Poſitions, and Fig. 323 ſhews how they appear when dry and contracted.

Several Species both of cruſtaceous and teſtaceous Animalcules are to be found in the Waters of Ditches; two of the former Sort are repreſented in Fig. 324 and 325, in the Poſture they ſwim with their Backs next the Eye, their Legs are ſomething like thoſe of Shrimps or Lobſters, but of a Structure much more curious; they are leſs than a very ſmall Flea, are all Breeders † and carry their Spawn in two Bags, which hang from their Sides, or under their Tail, as in Fig. 325. Theſe Bags are ſometimes ſeen broke, and the Spawn ſcattered about the Water. There is a third Sort amongſt theſe as beautiful as the foregoing, but not near ſo large; its Shape nearly reſembles a Shrimp, and carries its Spawn as the Shrimp does. Theſe three Kinds of *Animalcula* have but one Eye, and that placed in the Middle of their Forehead; they are often to be found ſo tranſparent, that the Motion of their Bowels is very plainly diſcovered by the Microſcope, together with a regular Pulſation in a little Part, which we may ſuppoſe the Heart.

In the Summer-time it is common for the Water in Ditches to appear ſometimes of a greeniſh, and ſometimes of a browniſh Colour, which upon Examination by the Microſcope is found to conſiſt in infinite Numbers of *Animalcula*, blended together on the Surface of it, and giving it ſuch an Appearance; their Shape is oval, but the Middle either green or red, and ſeems to be compoſed of Globules, reſembling the Roes or Spawn of Fiſhes.

* *Leeuw. Arc. Nat. Tom.* II. *Epiſt.* 149. † *Phil. Tranſ. No.* 288.

CHAP. XXXIV.

Of the freſh Water Polipe, with Arms in Form of Horns.

SECT. I.

Of their Motion and Structure.

THE Nature of this Inſect is both extraordinary, and contrary to the general received Opinions of Animal Life, and requires the moſt convincing Proofs to perſuade many People into a Belief thereof. In order therefore to clear up this peculiar Affair, I ſhall lay before the Reader the following Obſervations, which were made by Mr. *Trembley*, and alſo aſſure him, that I have repeated the major Part of his Experiments on this Animal with the ſame Succeſs.

And firſt theſe Animals were not hitherto entirely unknown, for Mr. *Leeuwenhoek* gives a Deſcription of a ſurpriſing Sort of minute Animal, in the *Philoſophical Tranſactions*, Number 283. It is repreſented at Fig. 328, as it appeared faſtened to a Root of *Duckweed*, whilſt in the Water, and about three Times bigger than it appeared to the naked Eye; this was a large one of the Sort, and had eight Horns: At C is ſhewn a very ſmall *Animalcule* coming out of the other's Body, ſuppoſed at firſt to be faſtned thereto by ſome Accident; but on a cloſer Examination, was found to be a young one in the Birth, although it had at firſt but four ſmall Horns; after 16 Hours its Horns and Body was grown much larger, and in four Hours more was quite excluded its Mother's Body; againſt this on the other Side appeared a little round Knob, which gradually increaſed in Bigneſs, and in a few Hours was pointed as at D, Fig. 328; about 14 Hours after it was grown much larger, and had two Horns; three Hours after it alſo fell off from its Mother and ſhifted for itſelf.

An *Engliſh* Gentleman * diſcovered one of them in ſome clear Water taken out of a Ditch; but with the utmoſt Attention he could find no more therein. It appeared the firſt Day as at Fig. 326, but varied every Moment, and the Knob at a, looked like the Gut Cenum; two or three Days after he obſerved ſome white Fibres at the Extremity of the Knob; on the fourth it was extended at full Length, and appeared as Fig. 327; which then convinced him this Excreſcence was really an Animalcule of the

* *Phil. Tranſ. No.* 288.

ſame

ſame Species, having ſix Horns; next Day he found it ſeparated from its Mother; it is ſeen in its contracted State as delineated by this Gentleman at Fig. 329 and 330.

There is a near Agreement between the Obſervations of theſe two Gentlemen, both of them having diſcovered the moſt remarkable Property of the *Polypes*, that is to ſay, their *natural* Manner of *multiplying*. They have alſo given us their exterior Figure, and ſome of their Motions; but their more ſurpriſing Properties, were reſerved for the Diſcovery of the *inquiſitive* and *happy Genius* of Mr. *Trembley*. It was alſo known to ſeveral other Gentlemen before him, but none of them diſcovered this *remarkable Re-production*, which is found in the *different Parts* of a *Polype* after they are *ſeparated*, each diſtinct Piece becoming as perfect an Animal as that of *which* it was only a *Part*.

Mr. *Trembley* having taken Notice of ſome Plants, which he had taken out of a Ditch, and put into a large Glaſs full of Water, and employing himſelf in conſidering the Inſects therein contained, he caſt his Eye upon a *Polype*, which was fix'd to the Stalk of an aquatick Plant, and is repreſented at Fig. 331.

Their Bodies a b are very ſmall, and from one of their Extremities at a, proceed ſeveral Horns a, c, which ſerve them for Feet and Arms, and are much ſmaller than their Bodies. I call the Extremity a, *anterior*, becauſe it is the *Polype's* Head; and the oppoſite Extremity b *poſterior*.

The firſt Sort of *Polypes* Mr. *Trembley* found, were of a fine green Colour, and in the Poſture of thoſe repreſented by Fig. 331. The firſt Motion he obſerved in them was that of their Arms, which they extend and contract, bend and wind divers Ways; they alſo contract their Bodies upon the leaſt Touch, ſo ſhort that they appear only like a Grain of Matter. They conſtantly turn themſelves towards the Light; for if that Part of the Glaſs in which they are, be frequently turned from the Light, they will be found the next Day to have removed themſelves to the light Side of the Glaſs, the dark Side being quite depopulated.

For Mr. *Trembley* incloſed a great Glaſs well ſtored with green *Polypes*, in a *Paſte-board Box*, which had a Hole cut on one Side in the Form of a *Chevron*, that exactly anſwered to the Middle of the Glaſs in which the *Polypes* were: When this Hole was turned to the Light, it always happened, that the *Polypes* aſſembled themſelves together at that Side of the Glaſs, and alſo in the Form of the *Chevron*; although the Glaſs was turned ſeveral Times in this Box, yet at the End of a few Days the *Polypes* were always found ranged as before. To vary this Experiment, he turned the Chevron upſide-down, and notwithſtanding this, the Polypes always aſſembled themſelves together, and in the Form of the Chevron, whether *right* or *inverted*.

The 25th of *November* 1740, Mr. *Trembley* cut a *Polype* tranſverſly (for

the firſt Time) but the Head Part a little ſhorter than the Tail Part, and put the two Parts into a flat Glaſs, in which the Height of the Water did not exceed a quarter of an Inch, by which Means they might be eaſily obſerved with a pretty deep magnifying Glaſs.

In that Inſtant the *Polype* was cut, both Parts contracted, and ſunk to the Bottom of the Glaſs, like two little Grains of green Matter. Some few Hours after both the Parts ſtretched themſelves out, and were eaſily to be diſtinguiſhed from each other, the anterior End of the firſt being furniſhed with Horns, whereas the other had none at all.

The firſt Part moved its Arms, and the next Day he ſaw it change its Place in the Glaſs, and both were obſerved to extend and contract themſelves for ſeveral Days.

He only looked upon the Motion of theſe two Parts, as Signs of the weak Remains of Life, eſpecially with reſpect to the hinder Part, and therefore obſerved it only to know how long it would remain alive, not in the leaſt hoping to be the Spectator of this *ſo marvellous a Re production.*

But obſerving the cut Pieces on the 9th Day with a magnifying Glaſs, perceived three little Points coming out from the Edges of the anterior End of the ſecond Part, which had neither Head nor Arms. The next Day he was convinced they were Arms, and the Day following *two new Arms* came out, and ſome Days after *three more*; this ſecond Part had then *eight*, which in a little Time was as long as thoſe of the firſt Part, ſo that now there was no Difference between the ſecond Part and a *Polype* that had never been cut. They both appeared ſenſible, being each of them compleat *Polypes*, and performing all the known Functions of *ſtretching* themſelves out, *contracting* and *walking*.

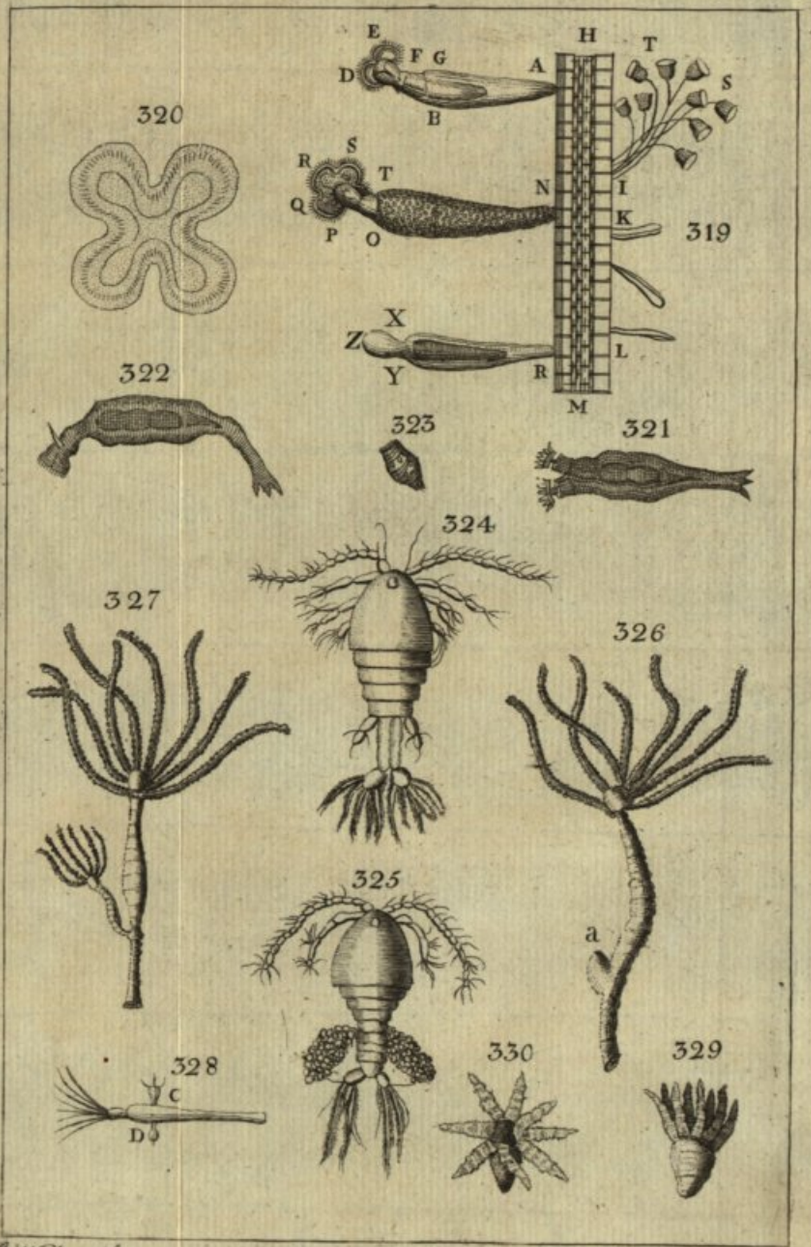
After this he diſcovered one in a great Glaſs he had by him, which was well ſtored with green *Polypes*, from which young ones began to ſhoot.

In the Month of *April* he found a new Sort of *Polypes*, repreſented at Fig. 332. and ſoon after ſaw them *eat* and ſwallow down *Worms longer than themſelves*, and to digeſt them and be nouriſhed therewith: Therefore this is a certain Proof of their being *Animals*.

They are to be found indifferently upon all Sorts of *aquatick Plants*, and other Bodies that are in the Water (upon which they fix themſelves by the *Tail)* at the Bottom of *Ditches*, and are ſuſpended upon the Surface of the Water, upon *Branches* of *Trees*, *Boards*, *rotten Leaves*, Bits of *Straw*, *Stones*, and many of them Mr. *Trembley* hath found on the Bodies of divers *Animals*, as on the Shells of Snails, *&c.*

The beſt Way to find them, is to take up theſe different Bodies and put them in Glaſſes full of Water, and if there are any *Polypes*, they will ſoon be perceived adhering to thoſe Bodies and moving their Arms.

Mr. *Trembley* hath alſo taken the Trouble of going often to the Sides of the *Ditch* in which he found them, at a Time when the Sun ſhone upon the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the *Bottom* of the *Water*, and choſe thoſe *Places where* the *Water* was *clear*, and that had an eaſy Declivity, and ſays, he hath diſtinctly ſeen them at the Bottom of the Water, on all the Bodies that were therein, and on its Superficies; by which Means he acquired thoſe Ideas concerning them, he could never have attained to without this Precaution.

The moſt common Poſture they are generally found in, whether in their ordinary Places of Abode, or in Glaſſes, is repreſented by the Figures 331, and 332. The *poſterior* End b, of the *Polype* a b, is fixed againſt a Plant e f, Fig. 331, or againſt a Straw g h, Fig. 332, the Body a b, and Arms a c, being extended in the Water.

The general Figure of the *Polype's* Body in this Attitude is not perfectly the ſame; in the three Kinds of Polypes here deſcribed, the Body of the green ones, Fig. 331. diminiſh from their *anterior* to their *poſterior* End, the Diminution being almoſt inſenſible.

That Sort repreſented Fig. 332, are the ſame; but thoſe of the third Sort, Fig. 333, differ from the two preceding ones in this Reſpect, that their Body does not diminiſh inſenſibly, but from the anterior Extremity a, to the Part d, and ſometimes even to two Thirds of the Length of their Body; as at d, Fig. 334, becoming from this Point much finer, and do not diminiſh from thence to the poſterior End. They wave their *Arms* in all Directions, as at a, i, k, Fig. 331, at a and e, Fig. 332. and at a, Fig. 333 and 334. The Number of their Horns in theſe three Sorts of *Polypes*, is generally at leaſt ſix, and at moſt 12 or 13, yet nevertheleſs there are ſome few of the ſecond Sort which have 18 Arms. They can contract their Bodies till they are not above the 10th of an Inch or thereabouts in Length: For Example, that repreſented at Fig. 333, could contract itſelf ſo as to become like thoſe two Repreſentations Fig. 335. They can alſo ſtop at any Degree either of Extenſion or Contraction, from the greateſt to the leaſt.

The green ones are generally about half an Inch in Length when ſtretched out. Thoſe of the ſecond and third Sort are moſt commonly between $\frac{1}{4}$ of an Inch and an Inch; but ſome may be found of both Sorts, whoſe Bodies are an Inch and half long.

They grow ſmaller as they extend, and increaſe in Bulk as they contract themſelves. The Figures 331, 332, and 333 repreſent the general and natural Size of theſe three Sorts of Polypes; and at Fig. 362. is an exact Repreſentation of one, as it appears in the Microſcope.

You may oblige them to contract more or leſs, in Proportion as they are touched, or as the Water in which they are, is agitated more or leſs. Every *Polype*, when taken out of the Water, contracts itſelf in ſuch Sort, as to appear like a mere Lump of Jelly on the Body it is faſtened to, as at Fig. 336. which Figure is ſo different from what it bears when ſtretched out, that it can ſcarce be known at firſt Sight, but when the Eye is once accuſtomed to it, they are eaſily diſtinguiſhed from all other Bodies that are out of the Water.

Heat

Heat and *Cold* hath the ſame *Effects* on the *Polypes*, as it hath upon all other *Land* and *Water Inſects*. *Heat* animates, and *Cold* benumbs, or makes them *faint* and *languid*; yet nevertheleſs it requires a conſiderable Degree of *Cold*, to reduce them to a *motionleſs State*, and that muſt be very near to that of *Freezing*. At which Time they are more or leſs contracted, and ſo remain; but as ſoon as the Water in which they are, acquires ſome Degree of Warmth, they ſtretch themſelves out, and move proportionably to the Heat thereof. It is not neceſſary that this Degree of Heat be very conſiderable, but is ſufficient for them, if the Water be of a *temperate Heat*, which is exactly ſhewn by the 48th Degree on *Farenheidt*'s Thermometer*.

The Arms of the green *Polypes* ſeldom excced the Length of their Bodies, as at Fig. 331. An Inch is commonly the Length of the Arms of the ſecond Sort, as at Fig. 332. tho' ſome are longer. The Arms of the third Sort are generally about eight Inches, Fig. 333. for which Reaſon Mr. *Trembley* calls them *long arm'd Polypes*.

The *Polype* can extend and contract its Arms, without extending or contracting its Body; and its Body, without any Alteration in the Arms, it can alſo extend and contract all or ſome of its Arms, independant of the others.

Its Body and Arms are alſo capable of bending in all poſſible Directions, ſome of which are repreſented by Fig. 337. in which Attitude they are ſometimes found; the Body and Arms can alſo twiſt themſelves, as at Fig. 338, and 334. It is likewiſe remarkable, that the Arms of the 2d and 3d Sorts of *Polypes*, generally bend at ſome Diſtance from their joining to the Body.

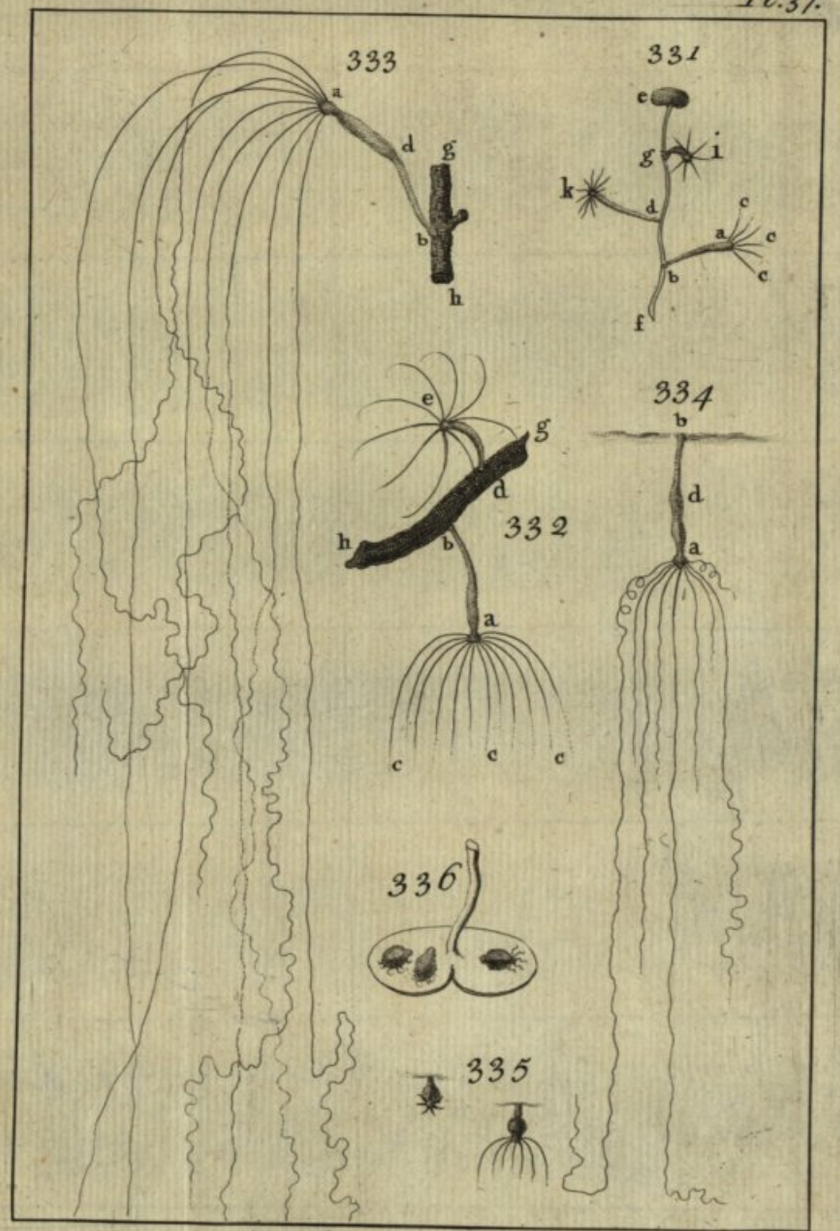
The third Sort, for the moſt Part, let their Arms hang down, making different Turns and Returns, as at Fig. 333. and ſometimes they direct ſome of them towards the Top of the Water.

Their progreſſive Motion is performed by Means of that Faculty they have of ſtretching out, contracting, and turning themſelves every Way. For let the *Polype* a b, Fig. 349. be fixed by its poſterior End b, having its Body a b, and Arms extended in the Water. In order to advance, it draws itſelf together, by bending its Body on whatever it moves; and then fixing its anterior End a upon this Body, ſometimes the anterior End only, at other Times ſome of its Arms, and at others the Arms and anterior End a, as at Fig. 350. When the anterior End is well fixed, it looſens the poſterior End b, and draws it to the anterior a, faſtening the End b, as at Fig. 351. after which it again looſens its anterior End a, and ſtretches it out, as at Fig. 352. Thus much for a general Deſcription of the common Steps a Polype makes in moving from Place to Place.

They walk very ſlow, and often ſtop in the Middle of a Step, diſpoſing of, and winding their Body and Arms every Way; as at Fig. 338.

* *Farenheidt*'s *Thermometers*, as well as thoſe of Sir *Iſaac Newton*, Mr. *Reaumeur*, *D'Liſle*, and others may be had at my *Shop*, made after the BEST *Manner*, and *graduated myſelf* from *actual Experiments*; at *Tycho Brahe*'s *Head*, in *Fleet-ſtreet*, LONDON.

Some-



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Sometimes they make an extraordinary Step, as follows, Let the *Polype* a b, Fig. 353. be fixed by its *poſterior* End b, and its Body and Arms extended in the Water. Firſt it bends its anterior End a, towards the Body upon which it moves, and fixes it at a, Fig. 354. after which it looſens its *poſterior* End b, and raiſes it up perpendicularly, as at Fig. 355. then bending its Body to the other Side, fixes the *poſterior* End b, as at Fig. 356. and looſening the anterior End a, raiſes it up again, as at Fig. 357.

The third Kind of Step the *Polype* makes, is in the following Manner, let the *Polype* a b, Fig. 358. be fixed by its *poſterior* End b againſt the Side of a Glaſs. Its Body, and moſt of its Arms being ſtretched out forwards, and one of its Arms a c, fixed againſt the Glaſs at c: When the *Polype* is in this Attitude, it looſens its *poſterior* End b, and contracting its Body, draws it up a little nearer to the Point c, and fixes it againſt the Glaſs at d, after which it repeats the ſame and fixes its *poſterior* End at e, and ſo on. All that is here ſaid of the *Polypes* progreſſive Motion equally reſpects the three Sorts.

They deſcend to the Bottom of the Water, and come up either by the Sides, or upon aquatick Plants, and often hang down from the Surface thereof, by their poſterior End, as at b, Fig. 334. and are often ſeen to ſuſpend themſelves by one Arm only, as at c, Fig. 339. They walk as well upon the Superficies of the Water, as upon thoſe Bodies juſt mentioned; and perform the ſame Motions in a Glaſs, as they do in greater Waters: They paſs over Plants or other Bodies; they go up the Sides of Glaſs, even to the Surface of the Water, and paſs either under or over it, and ſometimes reſt themſelves there; then they march to the oppoſite Side of the Glaſs, and ſo deſcend to the Bottom.

If you examine the Extremity of a *Polypes* Tail, while it is ſuſpended, as at b, Fig. 334. (from the Surface of the Water) with a magnifying Glaſs, it will be found a little out of the Water, ſomewhat concave and dry, as at b and c, Fig. 359. and to prove that this Circumſtance is abſolutely neceſſary to ſupport them at the Superficies of the Water, only wet the dry End with a Drop of Water, and the *Polype* will immediately fall to the Bottom.

When a *Polype* deſigns to paſs from the Sides of a Glaſs, to the Superficies of the Water, it need only put that Part out of the Water by which it would be ſupported, and give it Time to dry, which is what it always does, and what may eaſily be obſerved. If, for Example, a *Polype* is fixed againſt the Sides of a Glaſs, near the Superficies of the Water, (on which it intends to go) as at e f, Fig. 359. in order to convey itſelf thither, it raiſes up its *anterior* End, and puts it out of the Water, there letting it dry, then looſening its poſterior End f, from the Glaſs, draws it up, and puts it above the Water, where it alſo becomes dry in an Inſtant, and capable to ſupport the *Polype*, upon which it draws its *anterior* End under Water, and remains ſuſpended

from its Surface, as at c and b, often extending its Body and Arms.

It has been often found neceſſary, in the Courſe of theſe Experiments, to ſuſpend a *Polype* from the Surface of the Water, becauſe they are not always to be found ſuſpended there of themſelves. To effect which, take in one Hand an Hair-Pencil, and in the other a *pointed Quill*, or a *Tooth-pick*; with the *Pencil* looſen the *Polype* from the *Glaſs*, and gradually raiſe it near the Top of the *Water*, in ſuch a Manner, that the *anterior* End of the *Polype* be next the Point of the *Pencil*; then lift it out of the Water, and keep it ſo for a *Moment*, nay a Minute if you will; after which thruſt the Point of the *Pencil*, together with the *anterior* End of the *Polype*, by little and little under the Water, until no more than about half the Tenth of an Inch of the *Polype's Tail* remains above its Surface; at this Inſtant, with the pointed Quill, remove that Part of the *Polype* from the Pencil, which is already in the Water. And at the ſame Time blowing againſt the *Polype*, its Tail will be alſo looſen'd, and remain out of the Water.

A *Polype*, that is already ſuſpended, may be removed from a Glaſs of dirty Water, to a clean one with freſh Water, by endeavouring to place the Pencil parallel to the *Polype*, and in this Poſition to advance it gradually till it touches him, he will then apply himſelf againſt the Pencil, and on being drawn out of the Water, its Tail, which was dry before, will remain ſo; and it may be immediately put into the clean Water, by obſerving the foregoing Directions.

Polypes commonly fix their Tails to *Stones*, or *aquatick Plants*, &c. ſo faſt as to prevent their being drove away by the Stream, and are ſometimes fixed not only by their Tails, but by two or three of their Arms alſo, which they direct different Ways; and being thus fixed cannot be toſſed about by the Motion of the Water.

Two long armed *Polypes* ſuſpended from the Surface of the Water in a Glaſs, are repreſented exactly in the Poſition they were found, at a, b, and c, d, Fig. 359. One of them d c, had two of its Arms d, i, and d, k, fixed againſt the Bottom of the Glaſs, but on oppoſite Sides thereof, at i and k. The other a b had alſo one Arm a g, fixed againſt the Bottom of the Glaſs, at g, and its other Arm a h, fixed againſt the Side at h; they held themſelves ſo faſt in this Poſition, that the Glaſs was forcibly ſhaken before they quitted their Hold.

The *Polype*'s Mouth is ſituated at the anterior End of its Body, in the Middle between the ſhooting forth of the Arms. It is very often ſtretched out, at which Time it repreſents a little conical Nipple, as at a, Fig. 333, and Fig. 343. The Cone it forms appears ſometimes truncated, as at a, Fig. 362. At other Times no Nipple can be diſcovered, the Interval between the Arms being cloſed, as at a, Fig. 338, and 344. in other Circumſtances it is hollow, being open, and a little widen'd, as at i, Fig. 331. or at e, Fig. 332. and a, Fig. 362. it is not only open in this Circumſtance,

ſtance, for if it is obſerved with a magnifying Glaſs, when flat, or when it forms a truncated Cone, a little Hole is generally ſeen at the End thereof, which is repreſented, as it appears when magnified at a, Fig. 362.

The different Opening of the Mouth and Lips, are ſeen Fig. 343, 344, and 345.

The *Polype*'s Mouth opens into its Stomach, forming a Kind of Bag or Gut, from Head to Tail. The naked Eye may be convinced of this, but much better if it be armed with a Microſcope. It is exactly repreſented as it appears through the Microſcope at a b, Fig. 262.

Mr. *Trembley* not being ſatisfied that the *Polype* was perforated from End to End, by only obſerving it from without, cut one tranſverſly into three Parts, each Piece immediately contracted itſelf, and remained very ſhort, and being all three placed on the flat Bottom of a ſhallow Glaſs full of Water, and viewed through a Microſcope, from the upper End, the Bottom of the Glaſs was ſeen through the lower, ſo that all the three were viſibly perforated; they are repreſented as they appeared in the Microſcope, by the Figures 340, 341, and 342. Its Mouth was at the anterior End of one of theſe Parts a, Fig. 340. and was then wide open. The poſterior Extremity was at the End b of the third Part, Fig. 342. as this Piece was perforated thro', it plainly appears, that the Tails of the *Polypes* are alſo open.

This Perforation which is continued from one End to the other of the *Polype*, is called the Stomach, becauſe it contains and digeſts the Aliments, and the Skin which incloſes the Stomach, and forms this Bag, is the very Skin of the *Polype*. Therefore the whole Animal conſiſts but of one Skin, diſpoſed in the Form of a Tube or Gut, open at both Ends.

If a *Polype* be obſerved with the Microſcope, its whole Body appears like Shagreen, or as if it were ſtrewed with little Grains, as repreſented at Fig. 362. both when contracted or extended, it is more or leſs varied according to theſe or other Circumſtances.

If the Lips of a *Polype* be cut tranſverſly and placed upon the Object carrying Glaſs, in ſuch a Manner as that the cut Part of the Skin a, Fig. 341, may lie directly before the Microſcope, it will be found to conſiſt of an infinite Number of thoſe little Grains throughout the whole Thickneſs of the Skin: Therefore, in order to know whether the Inſide of the Stomach had any of the like Grains; Mr. *Trembley* opened ſeveral of them in the following Manner; by putting a *Polype* upon his Hand, he made it, by touching, to contract as much as poſſible, and then he introduced a very fine Point of a Pair of Sciſſars into its Mouth, and forcing it out at the Tail, and immediately cloſed the Sciſſars, which cut one Side of the *Polype's* Skin from the Top to the Bottom, and laying it open from one End to the other diſcovered the interior Superficies thereof, which is repreſented as it appeared in the Microſcope at Fig. 346; and this was alſo compoſed of as

great a Quantity of the ſame Grains as the exterior Superficies and the Edge a, of the cut Piece of Skin, Fig. 346. To examine theſe Particulars a little farther, a Bit of the Skin was laid upon the Object carrying Glaſs in a Drop of Water, and placed before the Microſcope, a, Fig. 347. and ſome of theſe Grains ſeparated therefrom, as at b, c, d, by preſſing them with the Point of a Pin, ſtriking them againſt the Glaſs, and endeavouring to tear them in Pieces; the Grains ſpread themſelves to all Parts of the Water, and at laſt remained in Heaps as at e and f.

If a *Polype* be carefully placed before the Microſcope, ſo as not to wound him, you'll ſeldom be diſappointed of ſeeing thoſe Grains ſeparate from ſome Part or other, and that in the moſt healthy *Polypes*; but when they ſeparate in large Quantities, it is a certain Symptom of a dangerous Illneſs. The Surface of the Polype from which they fall becomes irregular, and is no more terminated as before. The Grains fall off from all Sides, it contracts itſelf, the Body and Arms ſwell and loſe their ſhining Whiteneſs, and at laſt their Form, as at a, Fig. 348, and nothing is to be found in its Place but an Heap of Grains as at b.

The Structure of the *Polypes* Arms bears a near Reſemblance to that of its Body; and when obſerved with the Microſcope, we find their exterior Surface to appear ſhagreened alſo, Fig. 362, an Arm much contracted appears extremely ſo, and even much more ſo than the *Polype's* Body.

If a ſuſpended Arm that extends itſelf be obſerved, the Grains may be ſeen a little aſunder, which when contracted almoſt touch, but ſo that Intervals are left between them, as at Fig. 363. When at a certain Degree of Extenſion, its Surface ſeems only to be ſtrewed with Pimples as at Fig. 364, which continue ſtill to ſeparate, as the Arms extend, and are at laſt placed upon a Thread e e e, Fig. 365. Theſe Pimples are formed by the Re-union of many Grains, and at the firſt Glance appear like a String of Beads, Fig. 365.

The different States of a *Polype*'s Arm, may be obſerved at the ſame Time, in the ſame Arm, but at different Places thereof, by caſting the Eye, armed with a Microſcope from one End of the Arm to the other, and eſpecially if the ſeveral Portions thereof be carefully obſerved with a large Magnifier, they will appear as at Fig. 363. which repreſents that Part of the Arm ſtretched out, which is near the *Polype*'s Head, the Grains thereof being but little ſeparated, but are farther aſunder in Fig. 364. which is about the Middle of the Arm; and Fig. 365. ſhews the Grains as if they were ſtrung upon a Thread, as they are ſeen upon the Extremity of a *Polype*'s Arm.

This Extremity is often terminated by a Knob, and the Hairs marked e, e, e, Fig. 364, 365. are tranſparent, and may be ſeen with the firſt and ſecond Magnifiers.

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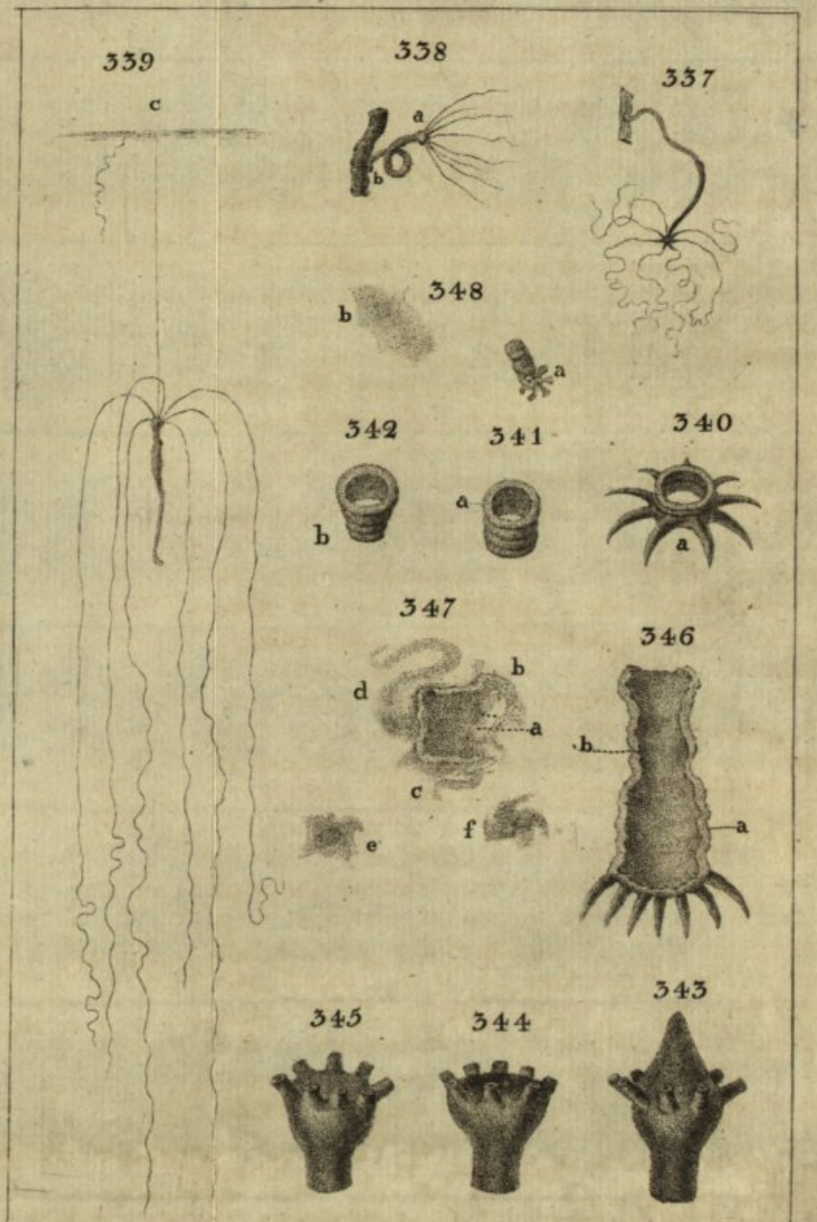
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J. Wigley. Sc.

The beſt Method to obſerve a *Polype*'s Arm, is to chooſe one that is fixed to the Side of a Glaſs, and near the Superficies of the Water; at which Moment, any one of its Arms being very well extended, take a Pair of Nippers in one Hand, and a Slip of Glaſs, about two or three Inches long, and half an Inch broad in the other, holding it at one End between the Finger and Thumb; then with the Nippers, or a pointed Quill, pull the End of the Arm gently out of the Water, and the reſt will follow. If it is not ſtretched enough, ſtretch it more, by drawing it out, the *Polype* ſtill remaining fixed to the Glaſs, put the Arm upon the Slip of Glaſs, and turn it under till it meets itſelf again; then giving it a Jirk, the Arm will break off on both Sides the Slip of Glaſs, one Part remaining with the *Polype*, and the other in the Forceps, and the middle Part will ſtick upon the Glaſs Slip, in which Manner it may be applied to the Microſcope, and preſerved for ſeveral Days, as well as when it is at firſt taken out of the Water, for when once dry it does not change for a conſiderable Time.

SECT. II.

Of the Polypes Food, and Manner of their ſeizing upon, and ſwallowing their Prey.

IT was ſome Time after the Diſcovery of the ſecond Sort of *Polypes*, before Mr. *Trembley* could find out a proper Food to nouriſh them, but the Water at that Time happen'd to be plentifully ſtored with a Sort of Millepedes, Fig. 360. ſmall enough, and about $\frac{3}{4}$ths of an Inch in Length. They are remarkable for a Horn, or fleſhy Dart, proceeding from the fore Part of their Head at d. Mr. *Reaumeur* hath called them darted Millepedes. They ſupport themſelves, and ſwim in the Water by Means of the ſeveral ſwift Inflections they make with their Bodies; they reſt themſelves, and creep upon all the Bodies they meet with, and are often found in great Numbers upon aquatick Plants, thoſe upon which the firſt *Polypes* of the ſecond Sort were found, were well ſtocked with theſe Millepedes, and were taken out of the Water together with them, and put into the ſame Glaſs without any Deſign.

A few Days after the anterior End a, of a *Polype*, Fig. 366. was obſerved, with one of theſe Millepedes partly within its Mouth, and the other Part yet without it at m, not knowing at firſt whether the *Polype* was eating the Millepedes, or whether the Millepedes had introduced itſelf voluntarily into the *Polype*'s Stomach, to be nouriſhed there, to lodge its Eggs, or depoſite its Young therein, but at laſt it was entirely enter'd into the *Polype*'s Body.

The long arm'd *Polypes* being the moſt remarkable in their feeding, &c.

for that Reaſon principally, Mr. *Trembley* thought proper to deſcribe theſe Experiments, upon that Sort, from which one may eaſily judge the ſame of the other two Sorts.

To ſee theſe Polypes ſeize their Prey with their Arms extended, they muſt be put into a Glaſs, 7 or 8 Inches deep, if the Polypes are fixed to the Top of the Glaſs, their Arms for the moſt Part hang down towards the Bottom. This is then the moſt convenient Situation to give them Food, and to obſerve how they manage it. To this End one might cauſe them to hang from the Surface of the Water, but this Expedient is not always beſt.

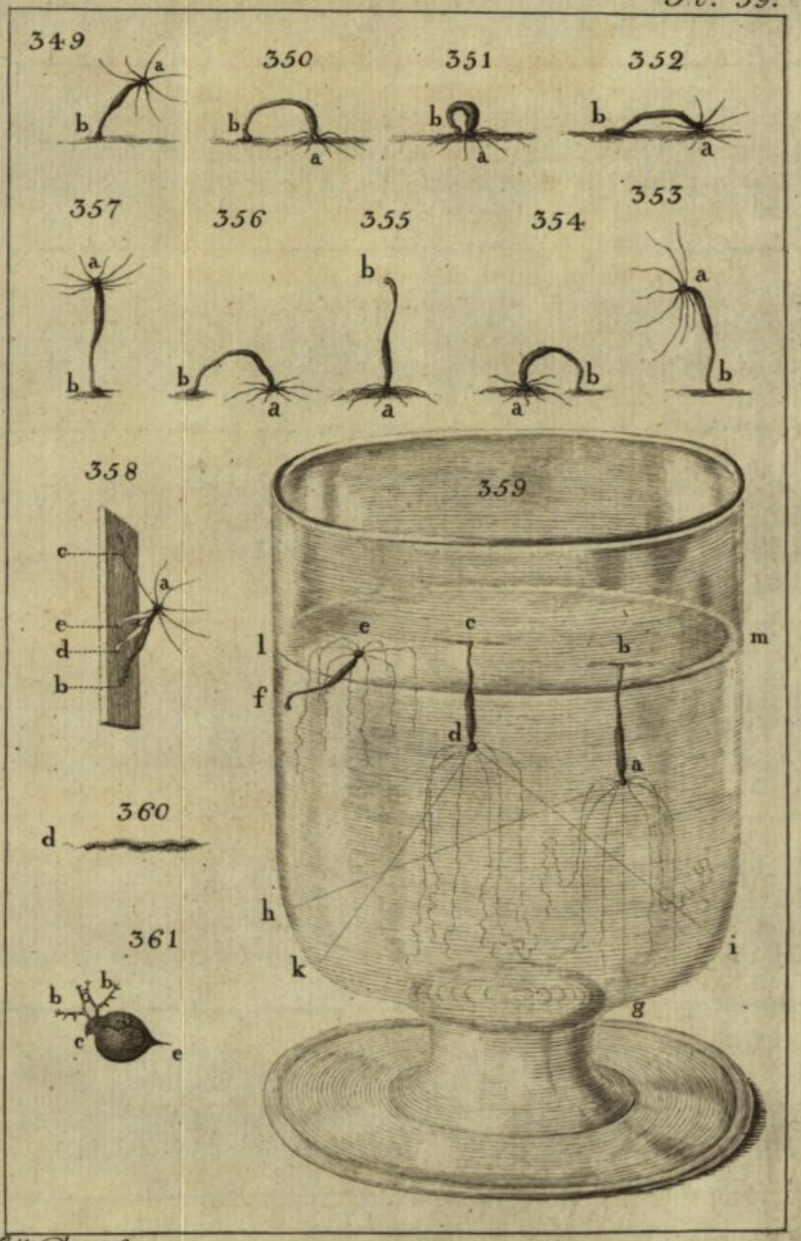
The Polypes we breed, and feed, are commonly infeſted with little Lice, it is therefore neceſſary to cleanſe them from theſe Tormentors, by rubbing them with an Hair Pencil, and if the Polypes ſuſpend themſelves from the Surface of the Water, it is ſcarce poſſible for them to be freed from theſe Lice. In that Caſe make the Polypes fix themſelves to a Packthread, or fix them to it, as at Fig. 367. at the Place b, letting the two Ends h f, and k g hang down over the Edges of the Glaſs. One may then ſtroke them even ſomething rudely, backwards and forwards, with an Hair Pencil, without pulling them off, and in changing the Water, only take hold of each End of the Pack-thread, draw it gently out of the Water, and put it immediately into another Glaſs, prepared for its Reception. If ſeveral of theſe Pack-thread Strings are put into a Glaſs well ſtored with Polypes, there will be always ſome that will fix * themſelves thereto.

When the Arms of the Polype are well extended, put a Millipedes, or any other Worm into the Glaſs, and with the Point of a Pencil, puſh it to one of the Arms, which it no ſooner touches, but it is ſeized, and when the Millipedes m, c, n, or Worm perceives itſelf taken, it endeavours by very quick and ſtrong Efforts to diſengage itſelf, often ſwimming and dragging the Arm a c, Fig. 367. from one Side of the Glaſs to the other; this violent Motion of the Millipedes, obliges the Polype to contract its Arm, in the Performance of which he often diſpoſes them in the Form of a Cork-ſcrew, o i, which alſo contributes to the ſhortening of it. The Millipedes by its continual Struggles, entangles itſelf in the Arm that holds it, m i n, and often meeting with other Arms, they alſo aſſiſt, and with a ſudden Pull, enable the Polype to contract himſelf, or to draw near his Prey, and in an Inſtant the entangled Millipedes is convey'd to the Mouth, againſt which it is held and ſubdued.

When a Polype hath nothing to eat, its Mouth is generally open, but that ſo ſmall that it cannot be ſeen without the Aſſiſtance of a magnifying Glaſs: Whereas, as ſoon as the Arms have conveyed a Prey to the Mouth, it opens itſelf more, and always in Proportion to the Size of the Animal

* *Hiſt. de Polyp. p.* 85.

that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T. Wigley. Sc.

that is to be devoured; its Lips gradually dilate, and preciſely adjuſt themſelves, to the Figure of their Prey.

All the Worms which are ſeized by the Polypes, do not preſent themſelves in the ſame Manner to their Mouth; for if the Worm preſents itſelf by one of its Extremities, it is not requiſite the Polype ſhould open its Mouth conſiderably, neither does it open otherwiſe, but preciſely to give Entrance to the Worm, Fig. 366.

If the Worm is not too long for the Stomach, it remains therein extended; but if longer, that End which firſt entered bends, and when it is entirely ſwallowed it may be ſeen folded within the Polype, Fig. 379.

When the Middle or any other Part of the Worm is preſented to the Polypes Mouth, it ſeizes this Part with its Lips, extending them on both Sides, and applying them againſt the Worm; at which Time its Mouth takes the Form of a Boat pointed at each End, Fig. 368, after which the Polype gradually cloſes the two Points of its Boat-like Lips, which doubles the Worm in that Part, and ſo it is ſwallowed, Fig. 369.

As ſoon as the Stomach is filled, its Capacity and the Skin thereof is augmented, and the Body becomes ſhort, Fig. 372. its Arms alſo are for the moſt part contracted. The Polype hangs down without Motion, and appears to be in a State of Numbneſs, and in Shape very different from that of its Extenſion, Fig. 367. As the Food digeſts, and it voids that which does not ſerve for Nouriſhment; its Body lengthens, and gradually recovers its natural Form.

Mr. *Trembley* finding theſe Millepedes a proper Food for the Polypes, he collected a great Quantity of them, to feed thoſe he kept in Glaſſes, and found them in Swarms at the Sides of Ditches, creeping on Plants, and all other Bodies that were in the Water.

Alſo on obſerving how voraciouſly the Polypes eat theſe Millipedes, he imagined it was not the only agreeable Food to them, and was therefore deſirous of finding out other Animals to nouriſh them withal, beſides the Trouble of getting a ſufficient Quantity of Millipedes from other Places took up too much Time; upon which he opened a Polype that was taken out of the Water, with its Belly full of Food; from whence came out little Inſects, which he calls *Pucerons* or *Fleas*, and amongſt theſe another Sort that multiply extremely, and are often eaſily to be procured in great Quantities; ſee the Fig. marked p, at the End of one of the Arms, Fig. 367, which repreſents one of theſe Fleas of its natural Size, and as it appeared in the Microſcope at Fig. 361: They are exactly deſcribed by *Swammerdam*, * and are remarkable for two branching Arms, which proceed from their Head, which ſerve them inſtead of Fins. The Arms inclined *Swam-*

* *Swam. Hiſt. de Inſect. p.* 86. *&c. Edit. de Leid.* 1737.

merdam

merdam to call them by the Name of *Puceron branchus*, they are continually ſkipping about the Water, and are generally ſomewhat reddiſh.

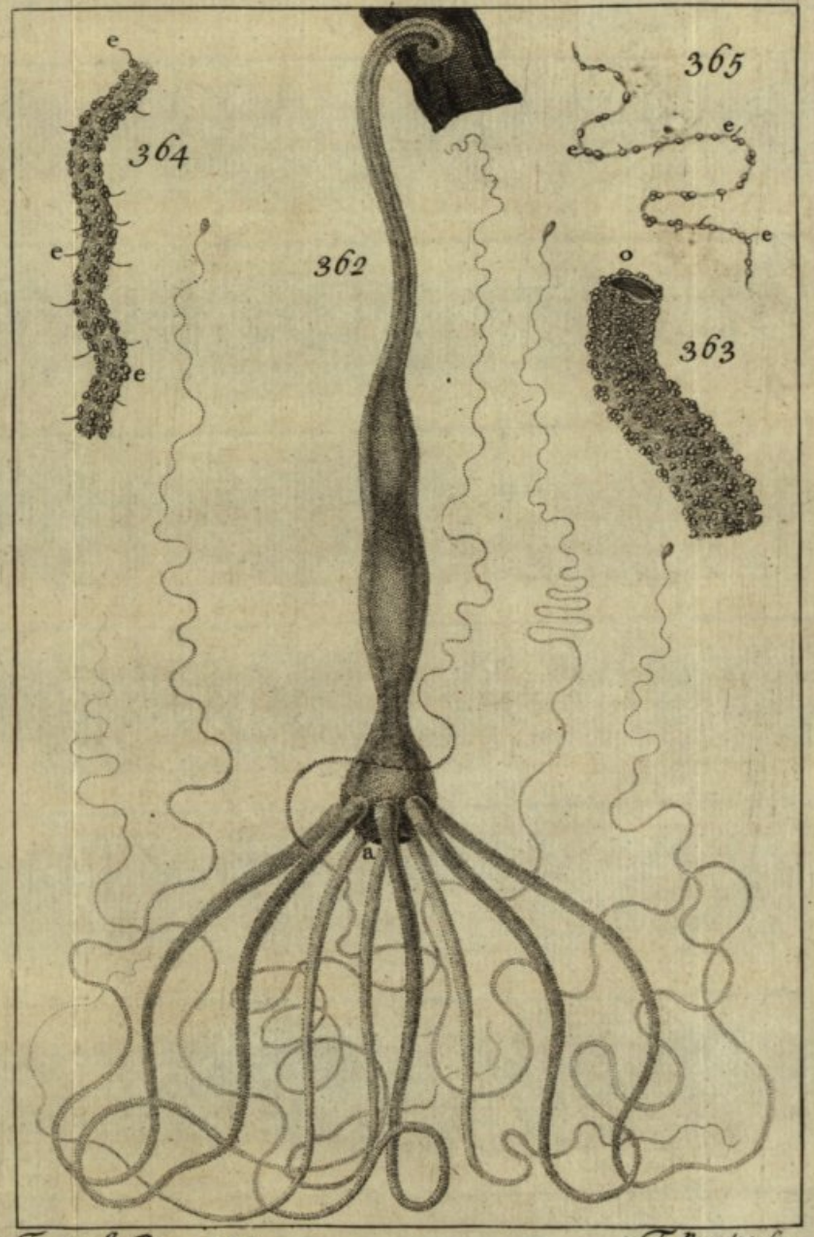
On putting ſome of theſe *Pucerons* into a Glaſs with Polypes, they preſently ſeized on ſome of them, and began to extend their Mouths, firſt in the Form of a Concave, in which Part of the *Flea* is lodged, as at a, Fig. 370. the Lips continue to enlarge, till they included the *Puceron*, and then entirely cloſe themſelves again.

The Polypes are not content with two or three of theſe *Pucerons*, but will continue to ſwallow them till the Sides of their Stomach are ſo increaſed, as to contain two of theſe *Fleas* in Breadth one by the Side of the other, as at Fig. 371. which was abſolutely full from Head to Tail. If it be one of the third Sort, the narrow Part of its Body b d, Fig. 372. generally remains empty, but ſometimes this alſo is forced to increaſe and receive ſome of thoſe *Fleas*. When the Polype hath ſwallowed no more of theſe *Fleas* than can be contained within its Stomach; its Body, in that Caſe, becomes very ſmall near the Head, and forms in that Place a Kind of remarkable Neck c, Fig. 373.

If a Number of theſe little *Fleas* be haſtily thrown into a Glaſs of hungry Polypes, their Arms are ſoon ſo loaded with them, that one can ſee nothing but a confuſed Maſs of theſe *Pucerons* gathered together, near the Polype's Mouth a, Fig. 375. which they ſwallow one after another till they are entirely full.

So long as theſe *Pucerons* could be procured, he fed his Polypes with nothing elſe: His Method of fiſhing them out of the Water, was with a ſmall Hoop, of about 8 or 10 Inches Diameter, made of Braſs, or Iron Wire, to which was faſtened a Pouch of Linen Cloth, and the whole tied to the End of a Stick. This being put ſlope-wiſe into the Water, where there is a Quantity of theſe Animals, may be eaſily moved to and fro, any Way you ſee Occaſion, by which Means the *Fleas* will be gathered together into the Hoop. You may then put them into a Glaſs of Water, which will ſwarm therewith from the Beginning of *June* to the End of *September*; theſe were eaſily to be procured, but when they began to fail, he was at a Loſs to find out other Nouriſhment for his Polypes.

He went ſeveral times a Day to the Water-ſide, which had before for a long Time furniſhed him with *Fleas*, and ſtooped down near the Surface of the Water, endeavouring to diſcover young ones, but all in vain; nevertheleſs in ſeeking theſe he ſaw ſeveral Places at the Bottom of the Water, with Worms all ſtanding an End, one End of which was in the Earth, and the other End out of the Earth in the Water, making continual Undulations, Fig. 376. He thought, as ſoon as he ſaw theſe Worms, they would ſerve to nouriſh the Polypes, and to make up for the *Fleas* he wanted, and the Millepedes which could at that Time be found only in ſmall Quantities; it was with a great deal of Trouble that he took up ſome of thoſe



Front.g Pag. 150.

T. Bowles sc.

Worms, which he gave to the Polypes who eat them. Therefore, to procure as many of theſe Worms as you may have occaſion for, you need only fix a Circle of Iron Wire, two or three Inches Diameter, to the End of a Stick, and putting this into the Water, and about half of it under the Earth, run it along a little Way, always holding it in the ſame Poſition, and that a little inclin'd; this will meet the Worms, and drag them along with it, and bring up a large Quantity thereof, which on ſhaking the Wire Circle in a Glaſs of Water, will all fall to the Bottom. If the Ditches where you fiſh for theſe Worms ſhould be cover'd with Leaves and Herbs, it is neceſſary firſt to cleanſe them with a Rake, before you put in the Iron Circle, otherwiſe you'll get but few Worms at a Time. There are alſo other Places ſo muddy, as to hinder the Wire from holding the Worms; in this Caſe it is expedient, that you throw upon the Mud ſome Inches of Sand, for as the Worms are obliged to keep Part of their Bodies above the Superficies of the Earth, they quit the Dirt, and paſs into the Sand, and remain near the Superficies thereof. They may be taken in very great Quantities, after preparing the Bottom of the Water in this Manner.

Theſe Worms are found in great Abundance in the Mud of the River *Thames*; when the Tide is out, they riſe in ſuch Swarms on the Surface thereof, that it appears of a red Colour.

You may give to each Polype a Worm much longer, and alſo a little thicker than the Polype is when extended; but then Care muſt be taken to let the Worm fall upon their Arms, otherwiſe they will miſs of them, becauſe they fall directly to the Bottom. Their Senſe of Feeling is ſo delicate, that if a Worm touches even the utmoſt Extremity of theſe very ſlender Arms, they immediately by claſping them about it, invelope and fetter it in ſo many Places, that it is ſoon render'd uncapable of ſtruggling to any Purpoſe, it eaſily yields, and at laſt is ſwallowed into the Polype's Stomach, Fig. 380. where it may be diſcern'd thro' the Polype's Skin.

Theſe Worms are the beſt Nouriſhment for the Polypes, eſpecially in the Winter, therefore if you gather a ſufficient Quantity of them in *November*, and put them into large Glaſſes full of Water, with three or four Inches of Earth at the Bottom, you will have a Supply for the Polypes all the Winter, and may fiſh them up out of theſe Glaſſes, as out of the River.

Sometimes a pretty thick red Worm, about half an Inch long, is taken up with the reſt, and is repreſented at c d, Fig. 382. It is the ſame as that deſcribed by Mr. *Reaumer*, in the *Firſt Memoir of the 5th Tome of his Hiſtory of Inſects. Page* 29.

Polypes may alſo be nouriſhed by theſe Worms, but they are more difficult for them to digeſt, and not at all fit Food for them in Winter.

Mr. *Trembley* hath alſo ſeen them eat a Worm, which he calls a tranſparent

rent *Tipula*, of which Mr. *Reaumer* ſpeaks in the 40th Page of the Memoir juſt cited.

Having in the Month of *June* taken a great Quantity of little Fiſh, about four Tenths of an Inch long, and given ſome of them to the Polypes, but the extreme Vivacity of this Fiſh, was almoſt too much for them to encounter with; however, all the Polypes that ſeized them, did ſwallow them, and the Tails of the long armed Sort were obliged to ſtretch open to receive the Fiſh: One of the ſecond Sort is repreſented at Fig. 377. which had ſwallowed one of theſe little Fiſh; and as its Skin a b, was ſo tranſparent, and flexible, it took the Form thereof, and appear'd like a Fiſh with long Whiſkers.

The *Polypes* eat the major Part of thoſe little Inſects that are found in freſh Water, they are very well nouriſhed with *Worms*, and the *Nymphs* of *Gnats*, and other *Flies*; they will alſo eat larger Animals if they are cut into little Pieces, as *Snails*, and other larger *aquatick Inſects*, and *Earth Worms*, the Entrails of *Freſh-Water Fiſh*, and *Butcher's Meat*, as *Mutton*, *Beef*, and *Veal*.

Mr. *Trembley* put into the Bottom of a Veſſel, ſome of the Earth taken out of a Ditch, imagining, that a great Number of little Inſects might be lodged therein, or at leaſt the Eggs of ſome; which Experiment ſucceeded very well, for from the End of *February* 1742. it was ſtored with various Sorts of little Animals; but particularly with one Sort, which is incloſed in a two-fold Shell; when this Shell was but a little opened, they put forth ſeveral minute Feet or Arms, that move exceeding quick, and by Means of this Motion they ſwim. Theſe Animals place themſelves upon all Bodies they meet with, and are about the Bigneſs of a Grain of Sand; ſome Polypes being put into this Veſſel, without taking any other Care of them, were nouriſhed therein, and multiplied for eight Months.

Whence it appears, that large Glaſſes or Pails, thus prepared with Earth, (at the Bottom of them) taken out of Ditches in the Summer-Time, will be a convenient Reſidence for the Polypes; for beſides thoſe Inſect Eggs that are contain'd in this Earth, may be very often ſeen (eſpecially if the Water in the Glaſs be expoſed to the Air) the Spawn and Nymphs of *Gnats*, and of *Tupula*, or *Water-Spiders*, &c. Theſe Veſſels may then be ſucceſsfully employed, and will ſave the Trouble of feeding the Polypes we intend to preſerve, and alſo of often changing the Water. But when it is not changed and cleanſed for ſome Time, it is generally filled with an Herb, as fine as Hairs, in which the Polypes entangle themſelves, and by which we are hinder'd from looking within-ſide, if the Veſſel be not made of Glaſs; however this Inconveniency is prevented by putting into each Veſſel a few *aquatick Snails*, more or leſs in Proportion to its Size; they will eat theſe Plants as faſt as they grow, whereby the Water, and the Sides of the Veſſel, will always remain clean.

Some-

Sometimes two Polypes ſeize the ſame Worm, and each begins to ſwallow its own End of the Worm, continuing to do ſo till their Mouths meet, Fig. 378. In this Poſture they remain for ſome Time, after which the Worm breaks, and each Polype hath its Share; but at other Times the Battle does not end there, for each of them continuing to diſpute the Prey, one of the Polypes opens its Mouth advantageouſly, and attempts to *ſwallow* the other Polype with its Portion of the *Worm*, which he effects in ſome Degree, and ſometimes almoſt entirely as at Fig. 380. Nevertheleſs this Combat ends more happily than we can at firſt believe, in Behalf of the devoured Polype; for the other gets the Prey entirely out of its Stomach, and the devour'd one comes forth again ſound and ſafe from the Body of its Enemy, after having been detain'd there above an Hour.

Polypes can eat a great deal at a Time, and they can faſt a great while; and they void their Excrements at their Mouth.

After a Worm is ſwallowed, the Tranſparency of the Polype's Skin will permit us to ſee it diſtinctly, as at Fig. 379. the Worm gradually loſes its Form, and is at firſt macerated in the Stomach of the Polype, the Juice nouriſhes, and being ſeparated, the Remains thereof are thrown out at the Mouth, as at Fig. 381.

It is alſo obſervable, that their Aliments are puſhed backwards and forwards, from one Extremity of the Stomach to the other, which contributes much to its Digeſtion; which Motion may be ſeen in the Microſcope, if you chooſe a Polype that is not too full. This Kind of periſtaltick Motion ſpreads the nouriſhing Juice all over the Stomach. But for an Obſervation of this Kind, it is beſt to feed the Polypes with ſuch *Aliments* as can beſtow a *lively colour'd Juice*; for Example, thoſe *Worms* whoſe Inteſtines are full of a *red* Matter, for by this Means we may ſee, that this alimental Moiſture is conveyed not only to the Extremity of the Body, but alſo into its Arms; whence it is plain, that a Polype's Arms are perforated, each of them forming a Kind of Gut, which communicates with that of the Body.

This was confirmed by examining a Polype, which had ſucked the red Matter contained in the Inteſtines of a flat Worm, Fig. 383. Its Body is of a tranſparent White, and Inteſtines extreamly viſible, and of a crimſon Red; Care muſt be taken to chooſe thoſe which are of a proper Size for the Polypes to ſwallow; they come out of the Polype's Body without being macerated, the red Matter which was in their Inteſtines being only extracted from them.

But this Experiment was yet better confirm'd on giving a Polype ſome Bits of the Skin of a little *black*, *flat Snail*, to be met with in great Abundance in *Ditches*. The Matter of this Skin was ſoon reduced in the Polype's Stomach to a Kind of Pap, principally compoſed of little black Fragments, and on examining their Motion attentively with the Microſcope, were ſeen to be drove about in their Stomach, and to paſs from Head to Tail,

and into their Arms, even to a Thread; and afterwards were ſent back into the Stomach, and chaſed from thence to the Extremity of the Tail, and were again repelled from thence towards its Mouth, and into the Arms, and ſo on continually.

Theſe Experiments were ſeveral Times repeated, and ſucceeded in the ſame Manner.

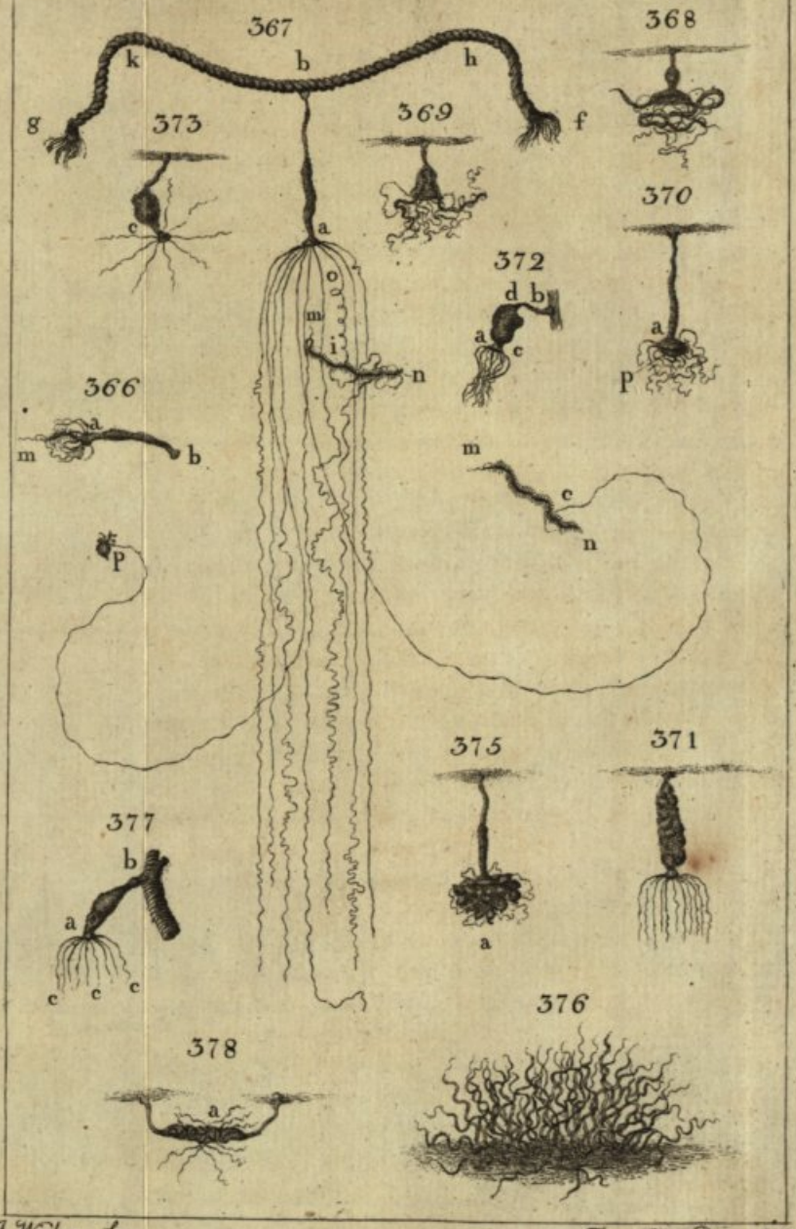
They are alſo a Proof of the Polype's Arms being tubular, and that they have an open Communication with the Stomach.

The Arms of the Polype are of the ſame Colour with its Body, and an Heap of the extravaſated Grains before ſpoken of, are of the ſame Colour alſo; it is therefore evident that the Colour of the Polype depends on the Colour of thoſe Grains which compoſe the Skin, (for when the Polype becomes white, they loſe thoſe Grains) and their Dependance is upon the nutritive Juice, drawn from the Aliments.

Theſe Grains, for Example, become red or black, if the Polype be fed with a red or black Juice; they are more or leſs tingid with theſe different Colours, in Proportion to the Strength and Quantity of the nutritive Juice. It is alſo obſervable, that they loſe their Colour, if not fed with Aliments of the ſame Colour to themſelves, and likewiſe that they will faſt a great while, but then they waſte proportionably to their faſting.

They are alſo ſubject to be infeſted with a Kind of aquatick Lice before ſpoken of, which are very common in expoſed Waters; they are of an oval Figure, and generally white; they run very ſwift upon the Polype's Body, and crowd about its Head more than any other Part, as at Fig. 385. Nevertheleſs they may be ſeen in great Numbers running over the Body a b, and Arms a c c. The preſent Figure is a Repreſentation of the Polype and Lice, as they appear in the Microſcope. If proper Care is not taken to keep them clean from theſe Animals, they will be devoured by them, their Arms will gradually diminiſh, and at laſt their Body, till there is nothing left. Fig. 386. repreſents one that had all its Head Part eat up, which after having been cleanſed, had a new Head, and new Arms, and became a very fine Polype.

Therefore the beſt Way to preſerve theſe Animals in Health, is often to change the Water, and that eſpecially after they have done eating. It is not enough to pour it off, but they muſt all be taken out, and the Bottom and Sides of the Veſſel rubb'd clean from the ſlimy Sediment adhering thereto, which is cauſed by the Fæces they diſgorge therein, which are converted into a Kind of Slime, fatal to them if not clear'd away. My Way is to looſen their Tails from the Sides or Bottom of the Glaſs, then I take them up one by one with a Quill, cut Scoop-faſhion, and place them in another Glaſs with clean Water; ſometimes they cling to the Quill in ſuch a Manner, as not eaſily to be diſengaged. The only Way then is to let the Quill remain a Minute or two in the Water, till they diſcharge themſelves,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ſelves, otherwiſe you'll be in Danger of breaking their Arms off, however when an Arm is broke, it is quickly repair'd again, but for ſome Days there appears a Swelling or Calloſity in the Place which wears off in Time.

River, or any other very ſoft Water, agrees beſt with them, or what is taken up clear, out of ſome Ditch or Pond; but that which comes from a Spring or Pump, or is in its own Nature hard or ſharp, prevents their thriving, and kills them in a few Days.

They are beſt kept in ſuch large Glaſſes as hold three or four Quarts of Water, for in a Glaſs of this Size, the Water need not be renewed ſo frequently, eſpecially if the Fæces are taken out from Time to Time, with the feather'd End of a Pen, to which it very readily adheres. Beſides the Trouble is in ſome Meaſure ſaved of feeding each particular Polype, for here you need only throw in a Parcel of Worms, and let them take their Chance, but then all of them are not conſtantly fed, nor any of them ſo often as in the ſmaller Glaſſes.

The Worms you feed them with, muſt alſo be well cleanſed from the Mud, and always remember to waſh them in clean Water, every Time you feed the Polypes therewith.

Polypes are to be ſought for in the By-Corners of *Ditches*, *Puddles*, and *Ponds*; for it is obſervable, that the Wind drives them together with the Plants, upon which they float into theſe Places; although we may ſearch for them in ſome Places without Succeſs, yet on coming there again, they may perhaps be found in great Abundance.

There are fewer of them in the Waters in Winter, than in the other Seaſons. About the Month of *April*, *Duck-Weed* begins to riſe above the Superficies of the Water, and to increaſe, and many other Plants alſo float upon the Water, the Warmth revives the Polypes, and they fix themſelves to theſe Plants in Queſt of Prey, at which Time they may be taken out of the Water with them.

SECT. III.

Of the Generation of Polypes.

WHEN a young Polype firſt begins to ſhoot, there only appears an Excreſcence, which terminates in a Point e, Fig. 387.

Some Time after that, when it appears cylindrical, its Arms alſo begin to ſhoot at its anterior End, c, i, Fig. 387. Its poſterior End is fixed to the Body of its Mother, and gradually grows narrower, till at laſt it only appears to adhere thereto by a Point b, Fig. 388. at which Time it is ready to be ſeparated; which they all perform in the ſame Manner. The Mo-

ther and young one fix themſelves to the Glaſs, or other Bodies upon which they are ſituated, with their Arms and Head, and this is their Preparative for a Separation; ſometimes the Mother gives a Twitch, at other Times the young one, and often both together.

A Polype a b, Fig. 389, with a young one c d, ready to be ſeparated, diſpoſes of its Body in an Arch of a Circle, a, b, d, againſt the Sides of the Glaſs. The young one being faſt to the Top of the Arch at d, and its Head fix'd againſt the Glaſs; the Mother only contracts her Body, which by that Means becomes ſtrait, as at a b, Fig. 390. which was before circular. While both its Extremities remain fixed againſt the Glaſs, the young one, which was alſo faſtened to the Glaſs, does not follow the Mother when ſhe withdraws, but remains in its Place, and its Tail d, by this Means is ſeparated from the Body a b of its Mother.

Young Polypes ſhoot in Proportion to the Warmth of the Weather, and Quantity of Food the Mother eats; ſome have been perfectly formed in 24 Hours, and others not till the End of 15 Days. The firſt ſhot forth in the midſt of *Summer*, and the other in a Seaſon when the Water in which the Polype was contained, made * *Farenheidt*'s *Thermometer* deſcend to 48 Degrees.

They ſhoot forth from the Side of their Parent as a Branch from the Trunk of a Tree; and the Excreſcence which is the Beginning of a Polype, is nothing but a Continuation of the Skin of its Mother, which is ſwelled and raiſed, nay even forms a Tube communicating with its Mother's Stomach, as appears from the following Experiment; for on chooſing a large Polype of the ſecond Sort, with a young one at its Side, which being placed upon a Slip of Paper in a little Water, the Middle of the young one's Body was cut, and the ſuperior End of that Part which remained to the Mother was then open; next cutting the Mother on both Sides of the young Shoot, it became a very ſhort Portion of a Cylinder open at both Ends, which being viewed through the ſuperior and open End of the young Polype, the Light was ſenſibly ſeen in the Stomach of the Mother; but leaſt there might yet be a Skin, which giving Paſſage to the Light, might nevertheleſs ſeparate the two Stomachs, the remaining cylindrical Portion of the Mother was cut Lengthwiſe, and the two oppoſite Parts to that from whence the young one came out, were opened; and on obſerving it with a Microſcope, not only the Hole t, of Communication, Fig. 391, was diſtinctly ſeen, but one might ſee quite through the End o, of the remaining Portion of the young one: Afterwards changing the Situation of theſe two Pieces of prepared Polypes, and looking through the laſt opening e, Fig. 392, the Day-light was ſeen through the Hole of Communication i.

* I muſt again remind the Reader, that theſe Thermometers are to be had at my Shop in *Fleet-Street*.

Mr. *Trembley* not being contented with making this Experiment once, repeated it ſeven Times, and met with the ſame Succeſs in five of them.

This Communication between the Mother and its Young may be ſeen on feeding them; for after the Mother a b, Fig. 393, had eaten, the Bodies of its young ones ſwelled, being fill'd with the Aliments as if they themſelves had been eating them at their own Mouths c d e i o.

In the long armed Polypes, the young ones do not ſhoot out from the Tail Part b c, but only from the Part a c, Fig. 396.

It is alſo remarkable, that Polypes do not only produce ſeveral little ones at the ſame Time, all remaining fixed to their Mother, but that even ſome of thoſe little ones at that very Time have two or three young ones alſo, of which ſome are perfectly formed, as at Fig. 396.

This Figure is ſufficient to ſhew with what Promptitude the Polypes increaſe and multiply. The whole Groupe formed by this Mother and her 19 young ones, was but an Inch and $\frac{1}{4}$ long, and one Inch broad *Dutch* Meaſure; the Arms of the Mother, and the little ones, for the moſt part were hanging down towards the Bottom of the Veſſel, whilſt the Polype was ſuſpended on the Surface of the Water. This Mother eat about a Dozen of the aquatick Fleas every Day, and the little ones, which were in a State to eat, devoured amongſt them about 20 every Day.

All the freſh Water Polypes, with Arms in Form of Horns, are Mothers, for each Individual of this Sort produce young ones.

Mr. *Trembley* ſays, he hath nouriſhed a thouſand Polypes, and never found one which did not multiply, after it had been well fed, and always obſerved their Motions very attentively, in order to diſcover if nothing paſſed between them analogous to Copulation in other Animals; but could never find any Thing like it.

He then put ſeveral Polypes of the ſecond Sort by themſelves, that he might be very ſure they never had ſince their Separation any Communication with other Polypes; and took none for theſe Experiments but thoſe which he ſeparated from their Mothers himſelf; or thoſe which being ſeparated of themſelves, were taken out of the Glaſs in which their Mothers were, before any other young one could be ſeparated, with which it might have been poſſibly coupled; yet notwithſtanding all theſe Precautions of cauſing theſe Polypes to live in a perfect Solitude, they all *multiplied*, *eat*, and continued to produce young ones, more and more in Proportion as they were fed.

Not only theſe which he firſt put alone have multiplied, but alſo many of their Deſcendants have alſo been put by themſelves, from Generation to Generation, even to the ſeventh, with the ſame Precautions. Whence it appears that Copulation is in no wiſe neceſſary to the Production of a Polype.

Mr. *Trembley* hath alſo made an Experiment to prove, that a young Polype

lype had in itſelf the Principles of Fecundity, before it could be thought to receive it from its Mother, or any other Polype: For on cutting off a young one which only began to ſhoot, and at that Time was only like a little Button, as e, Fig. 387. it is ſeen alone and of its natural Size after it was cut off, at Fig. 394, and as it appeared in the Microſcope at Fig. 395. it was put into a Glaſs by itſelf, and gradually increaſed, had Arms, and at laſt multiplied.

It is therefore very plain, that a young Polype, after being ſeparated from its Mother, does not want the Company of another Polype to multiply.

And that even before Separation it hath within itſelf the Principles of Fecundity, ſince from that Time it multiplies.

That if this Principle is communicated to it by the Mother while they are united, there is no Sort of Communication between the Head and Arms of either.

Neither is there any Communication after this Manner by another young one, that comes from the ſame Mother at the ſame Time with itſelf. And that if this Principle of Fecundity is within itſelf, it certainly is in an imperceptible Manner.

If we have not from hence diſcovered how the Polypes become fruitful, we have at leaſt learned, that in this Point they differ from the moſt part of known Animals, and by Conſequence have made an Exception to the general Rule, that ſays, *there is no Fecundity without Copulation.*

After Mr. *Trembley* had made the foregoing Obſervations, he was ſtill farther deſirous of finding out, whether there might not be ſome other natural Manner of their multiplying by Slips, as the Branches of a Tree; or if, on the contrary, this Manner of multiplying would ſucceed when they are cut in one or more Parts. Mr. *Trembley* hath ſeen Polypes which have divided themſelves into two Parts, after which each Portion became a compleat Polype; whereby the ſame Re-production was performed as we have before remarked on cutting theſe Animals in two.

What hath been already ſaid on this Head is ſufficient to ſhew, that Polypes bear a nearer Reſemblance to Plants than Animals, yet notwithſtanding it is evident that they are Animals, becauſe they eat and digeſt their Food.

SECT. IV.

Of cutting Polypes aſunder and their Reproduction.

THE moſt extraordinary Part in the Hiſtory of this Creature is this, that when cut into Pieces each Piece can repair itſelf and become a perfect Animal *.

* *Hiſt. de Polype. p.* 193.

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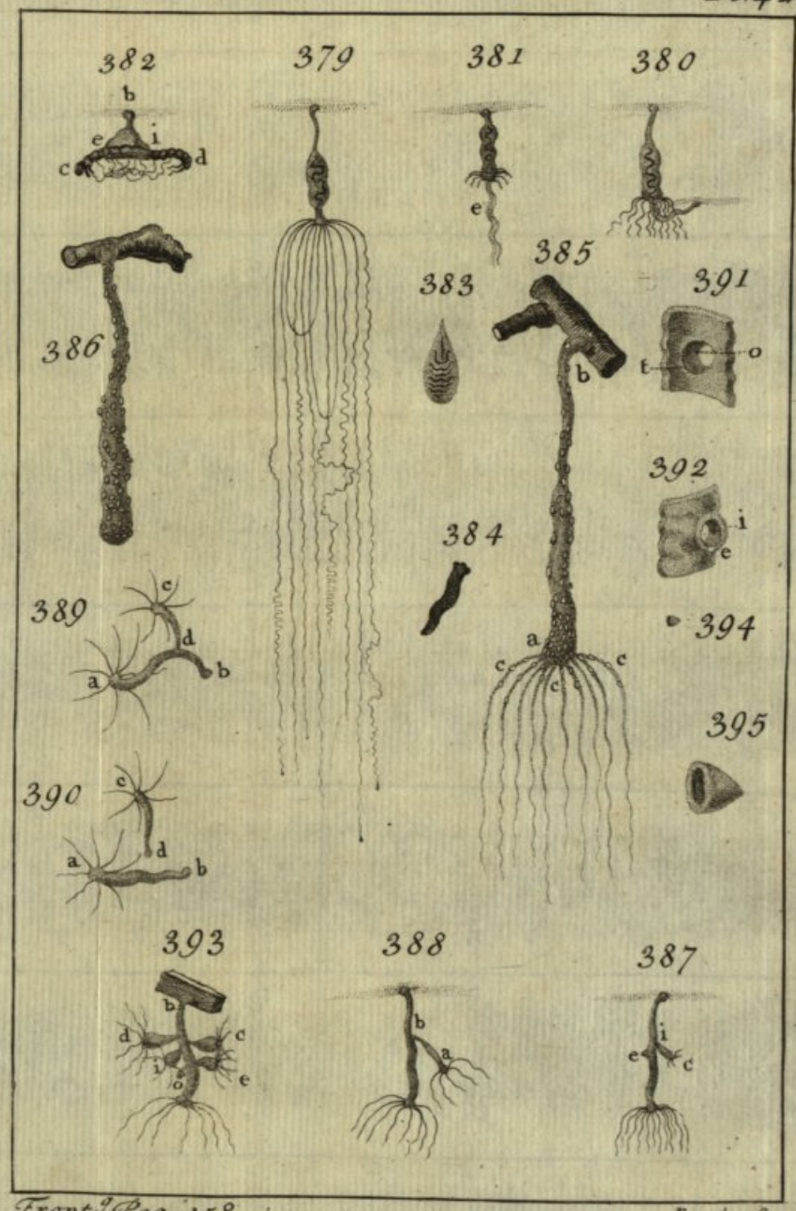

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To perform which put a little Water on a ſmall Piece of Paper, whereon place a Polype, and wait a little while till it extends itſelf; then with a Pair of ſharp Sciſſars cut it into two Pieces, Paper and all, and examine each Piece with a magnifying Glaſs, to judge the Succeſs of the Operation, putting each Portion into ſuch a ſhallow Glaſs as is repreſented Fig. 26. which does not contain above 3 or 4 Tenths of an Inch in Depth of Water, by which Means they may be always obſerved with a *magnifying Glaſs*, or in the *Microſcope*.

A, Fig. 397, repreſents the Head Part of a cut Polype, its poſterior End b, being a little larger than that in a common *Polype*, and is ſenſibly open. In the Summer-time this firſt Part often walks, and eats the ſame Day it is cut.

The ſecond Part, Fig. 398. hath its anterior End c more than ordinary open, and the Edges turned a little outwards, which afterwards folding inwards, cloſes the Aperture: The anterior End appearing then to be ſimply ſwelled, as at c, Fig. 399. This Part is never ſeen to change its Place before its Re-production is finiſhed; the Arms ſhot out from its anterior End as thoſe do in young Polypes, at firſt three or four Points begins to ſhoot, as at e, Fig. 400. and while theſe increaſe, others appear between them; before the Arms have done growing they can ſeize a Prey, and from that Time its Mouth is perfectly formed.

This *Re-production* is performed ſooner or later, as the Weather is more or leſs warm. In the Height of Summer the Arms will ſometimes begin to ſhoot in 24 Hours, and in two Days have been in a State to eat, but in cold Weather it will be 15 or 20 Days before the Head is formed.

If a Polype, having young ones, be cut tranſverſly, the young ones continue to grow after the Section.

It often happens, that the ſecond parts which have had no young ones at the Time of the Section, have had young Shoots before itſelf could eat, and before it had Arms.

In whatſoever Place a *Polype* was cut, whether at the Middle or near either End, the Experiment equally ſucceeded, and each Portion became a compleat *Polype*, which walked, eat and multiplied.

A *Polype* being cut cloſe under the Arms, as at Fig. 401. and though ſmall as it was, it became a compleat *Polype*, which at the Beginning was all Arms.

If a *Polype* be cut tranſverſly into three or four Pieces; the poſterior End of the firſt produces a Tail, the anterior End of the laſt a Head, and the intermediate Pieces acquire both Head and Tail.

To cut a *Polype* Lengthwiſe, it muſt be made to contract as much as poſſible, becauſe the more it is contracted the larger its Body is: Therefore put the Polype upon a Slip of white Paper in a ſmall Drop of Water, and when by touching, it is very much contracted, drain away the Water, whereby

whereby its upper and under Sides colapſe, and the Polype becoming ſpread in Breadth, remains fixed upon the Paper; then with a ſharp Pair of Sciſſars cut through both Paper and Polype, the divided Parts will adhere to the Paper like a Jelly, but may be removed therefrom to the Object carrying Glaſs with the Point of an Hair Pencil, firſt dipped in Water, upon which it may be applied to the *Univerſal Microſcope*; or if the Papers are thrown into a Glaſs of Water, the divided Pieces will ſoon fall from them.

The Sides of a Polype cut longitudinally, roll themſelves up different Ways, generally beginning from one of their Extremities, as at Fig. 402. and turns the Out-ſide of the Skin inwards; after ſome time it unrolls, and the cut Side forms itſelf into a Tube, whereof the Edges a b, and e i, Fig. 403. on both Sides meet each other, and re-unite themſelves; ſometimes they begin to join at the Tail End, at other Times they gradually approach all at once; when they begin to unite at one End, it is eaſy to diſtinguiſh that Portion which is joined c i b, from that which is not joined c a e, Fig. 404.

The Sides join ſo cloſe, that from the firſt Moment no Scar can be ſeen; after which they become compleat Polypes, but with a leſs Number of Arms, and that in an Hour's Time, and in 24 Hours will ſeize and devour a Worm; in a few Days other Arms ſhoot and become as long as the reſt.

Mr. *Trembley* cut a Polype into four Parts length-wiſe, as follows: After having cut it in two, in the Manner juſt ſhewn, he cut each of theſe into two alſo. Theſe four Portions of the ſame Polype, had each of them ſix Arms, within ſix Days after the Section; and ſeven in four Weeks, they all eat and multiplied.

When a pregnant Polype is cut length-wiſe, the young ones continue to grow after the Section.

He hath alſo cut a Polype length-wiſe, and directly after cut the ſame tranſverſly, and each of theſe four Quarters became compleat Polypes.

He likewiſe cut another, in Part length-wiſe, beginning at the Head, which became a Polype with two Bodies, two Heads, * and but one Tail. After having nouriſhed this two headed Polype, by feeding it at both Mouths; he alſo ſplit theſe Heads, and in a little Time it had four, and at laſt by cutting it after the ſame Manner, it had ſeven Heads, Fig. 405.

If a Polype be cut in Part length-wiſe, beginning at the Tail, it will ſoon have one Head and two Tails; and in this Manner the Number of Heads and Tails may be augmented by cutting, almoſt *ad infinitum*.

As all Sorts of theſe freſh Water Polypes form only a Tube or Gut, proceeding from one of its Extremities to the other, they may be turn'd Inſide out as one would turn a Sack, *viz.* give a Worm to the Polype you

* *Hiſt. de Polype, p.* 247.

would

would perform this Experiment upon, and when it is ſwallowed, put the Polype into a concave Glaſs, or into the Hollow of the Object carrying Glaſs, with a little Water; afterwards preſs it near the Tail with an Hair Pencil, ſtroking it towards the Polype's Mouth, that the Worm within its Stomach may be forced partly out, as at c e, Fig. 412. its hinder Part a, remaining empty. As the Worm goes out, the Stomach enlarges prodigiouſly, eſpecially if it goes out double, as is expreſſed in the Figure. When the Polype is in this State, make it contract as much as poſſible, which contributes much to the Enlargement of the Stomach. It muſt be here obſerved, that as the Worm is partly out of the Stomach, it keeps it open, then taking an Hog's Briſtle in the right Hand, puſh it againſt the Extremity of the Tail b, till it enters into the Stomach, continuing gradually to advance the Hog's Briſtle, till it hath quite turn'd the Polype. When it comes to the Worm which keeps the Stomach and Mouth open, it either puſhes that out, or paſſes by on one Side thereof, and at laſt goes out of the Mouth, as at a b, Fig. 414. Sometimes the Polype is entirely turn'd at firſt, and then it covers the End of the Briſtle a b, Fig. 413. In this Caſe the exterior Superficies of the Polype is become the interior, which now touches the Hog's Briſtle, however it ſeldom happens that the Polype is entirely turned, but moſt commonly the Tail Part a b is out of the Mouth b, Fig. 414. and at the ſame Time a Part thereof is not turned; that is, its anterior End a c, which being terminated by the Arms, is folded over the turn'd End. Then to finiſh the turning, take an Hair Pencil in your right Hand, and the End of the Hog's Briſtle in the left. Always holding the other End of the Briſtle together, with the Polype in the Water, and ſtroke the End a c, which is not turn'd, very ſoftly with the Hair Pencil, that Way which is neceſſary to turn it, that is to ſay, from a to c, Fig. 414. which is preſently performed, at which Time it appears as at a b, Fig. 413. Then holding it in the Water, puſh it from a to b, with the Point of an Hair Pencil, and it will fall to the Bottom of the Glaſs without being put out of Order.

When it is firſt turn'd, the Mouth cloſes, and the Lips a, incline a little inwards; the Arms a c appear to join in a Bundle, and to come out of the Middle of the Polype's Mouth, as at a, Fig. 415.

After the Polype is turned, extend it as much as poſſible with the Hair Pencil, then taking an Hog's Briſtle with a Knot near one End thereof, run the other End through the Polype's Body, near its Lips; at that Inſtant let the other End of the Briſtle e, drop into the Water, and with the Point of the Pencil, puſh the Polype to the Middle a, of the Briſtle, Fig. 416. then take out the Briſtle and Polype, and put them into a Glaſs, f, e, g, h, taking Care that it only touches the Glaſs by its two Extremities c and d, that the Polype may be a great Way from the Bottom and Sides thereof, and the Knot End towards the Bottom; that if the Polype ſhould

ſlide by its own Weight, it might not be able to diſengage itſelf. This Method is uſed to prevent the Polype from turning itſelf back into its natural State, which they ſometimes do in 24 Hours after they have ſuffer'd this Operation; and often after they have been turned, and ſpitted, to prevent them from returning, they have tore their Lips, and by that Means have formed two Heads.

Several young ones have been produced from theſe turn'd Polypes, which have alſo multiplied.

Sometimes they will eat in two Days after they have been turn'd, but generally not till 4 or 5 Days after.

Moſt of thoſe Mr. *Trembley* turn'd, endeavoured to return themſelves again, but could not entirely effect it, remaining like a Polype, partly turn'd, as at Fig. 406. the Skin of its anterior Part being applied upon the other, and forming a Kind of Pad at the anterior End a c, one Part thereof being turned, and the other not. Its Lips a, are no more at the anterior End, but are round that Part of the Body which is not turn'd back again, from whence alſo the Arms proceed, varying their Direction, ſometimes pointing towards the Tail, Fig. 406. and at others are bent over the Head, Fig. 407. their anterior Extremity c, Fig. 406. formed by the Edges of the reverſed Part c a, remain'd open, and ſome Days after began to cloſe; and on being attentively obſerved, new Arms began to ſhoot near the old ones, and ſeveral Mouths * were alſo formed near the Middle of the Bodies of theſe Polypes, that is to ſay near the Place where their Arms joined the Body at a, Fig. 406.

A Polype partly turn'd back again, remains but a little while in that Situation, as at Fig. 406. The Place a, to which this returned Portion a c, was fixed to the other Part a b of the Body, became a little ſtreighten'd, and the Portion a c formed a right Angle therewith, as is ſhewn at Fig. 408. where a c repreſents the returned Portion, and a b the other Part of the Body; the ſame Day another Head appear'd at e, and ſeveral Arms began to ſhoot, on one Side a o, of one Mouth a o n, which was formed on this Side; the other Side a n of this Mouth, being border'd by Part of the old Arms a d, a d. Next Day the Lips of the new Mouth was diſpoſed in Form of a conical Nipple, and the new Arms ſmaller than the old ones. The ſame Day the returned Portion a c, Fig. 408. which the Day before made the right Angle c a b, with the other Part a b, not returned, was drawn nearer to this laſt Part, and made an acute Angle therewith, as at Fig. 409. where a c repreſents the returned Portion, and a b that Portion not returned. The doubtful Part e, remain'd as before; a Worm being given to it, fell upon the old Arms, was ſeized, conveyed to the

* *Hiſt. de Polype, p.* 268.

new

new Mouth, and ſwallowed in an Hour's Time, and the Portions a c, a b, and a e, Fig. 409. were ſwelled with the Contents of the Worm.

Four Days after, its Form was much different, as appears by a Compariſon of the Figures 410, and 411, whereof a e repreſents the returned Part, and a b the Part not returned. Having now but one common Mouth a, Fig. 410. the new Arms are ſeen between a and t, the equivocal Part e as in the Figures.

This Form was changed but little in fifteen Days, as is ſeen on comparing the two foregoing Figures; the old Arms which were before between a and t being vaniſhed, and a Head at u, Fig. 411. which was at firſt taken for a young one, but remain'd in the ſame State above three Months. This Polype had two young ones, which proceeded one from g the returned Part, and the other from f, the Portion not returned.

Theſe Obſervations are ſufficient to ſhew the Nature of a Polype, that is, partly turn'd back again, and the different Revolutions made in theſe Animals, are ſeen in the Figures 406, 408, 409, 410, and 411. which repreſent the ſame Polype, and the return'd Part always a c, and that Part not returned a b.

Theſe Changes are not exactly the ſame in all Polypes, but vary conſiderably, ſeldom any two of a great Number being perfectly alike.

The Polype repreſented by Fig. 417. was turn'd, and the following Day returned Part of its Head, as at Fig. 407. which 7 Days after was formed into three Heads, as at Fig. 417. a b ſhews the Tail of the Polype, which remain'd turned. a d c g e, the Portion turn'd back again ſo conſiderably changed as to form three Heads d g e.

Fig. 418. exhibits the ſame Polype 14 Days older, a b the Portion which remain'd turn'd, a d c n g e o, the Portion turn'd back again, a d, n g, n e, its three Heads and Necks; marked d, g, e, in the foregoing Figure.

Fig. 419. is the ſame Polype 13 Days after it was in the State of Fig. 418. The Portion o c of Fig. 418. is parted from o to c, and the two Portions, b a c d o, and c n g e o, Fig. 419. are only faſtened to each other by a Thread o, a b is the turned Portion, a c and o c two Portions, which in the preceding Figure are re-united, and marked o c, a d, n g, n e, and are the three Heads with Necks, and are marked by the ſame Letters, Fig. 418.

The two Portions held by the Thread o, Fig. 419. are ſeen as they were ſeparated in Fig. 420. and 421. a b, Fig. 420. is the turned Part, and a d one of the Heads, n g, n e, Fig. 421. the two other Heads.

Mr. *Trembley* imagined, that if one Polype could be put into the Stomach of another, in ſuch a Manner, that the external Superficies of the Skin of the firſt, ſhould be applied to the internal Superficies of the Skin of the ſecond, they might ſtick together, and become but one Polype.

To introduce one Polype into another, firſt feed ſome of them, and when

they are ſwelled by the Aliments, their Mouths will be alſo extended. Take that Polype out of the Water, you would introduce into the Stomach of another, and put it upon your left Hand, making it contract as much as poſſible by ſtroking it with an Hair Pencil, in ſuch a Manner as to force the Aliments out of its Stomach, and thereby cauſe its Mouth to open; then taking an Hog's Briſtle in the right Hand, put the biggeſt End thereof into the Polype's Mouth, and thruſt it to the Bottom of its Stomach. When this is done, place the Polype upon your Hand, into which this is to be introduced, cauſing it to open its Mouth, as in the other Polype, and thruſt that which is upon the Hog's Briſtle, into the Stomach thereof, and dip it into a Glaſs of clean Water, that you may examine it with a magnifying Glaſs; then to prevent the inner Polype from extricating itſelf, ſpit them both together upon an Hog's Briſtle.

Fig. 422. repreſents two Polypes put one into the other, a b the exterior Polype, and c a, b d, the interior one; e f in all the Figures ſhews the Hog's Briſtle which run through both the Polypes at e.

Fig. 423. is the ſame Polype, a i b the exterior one, c a i d the interior one; the Part i d by bending having ript up the Part i b of the exterior *Polype*, and by this Means got out.

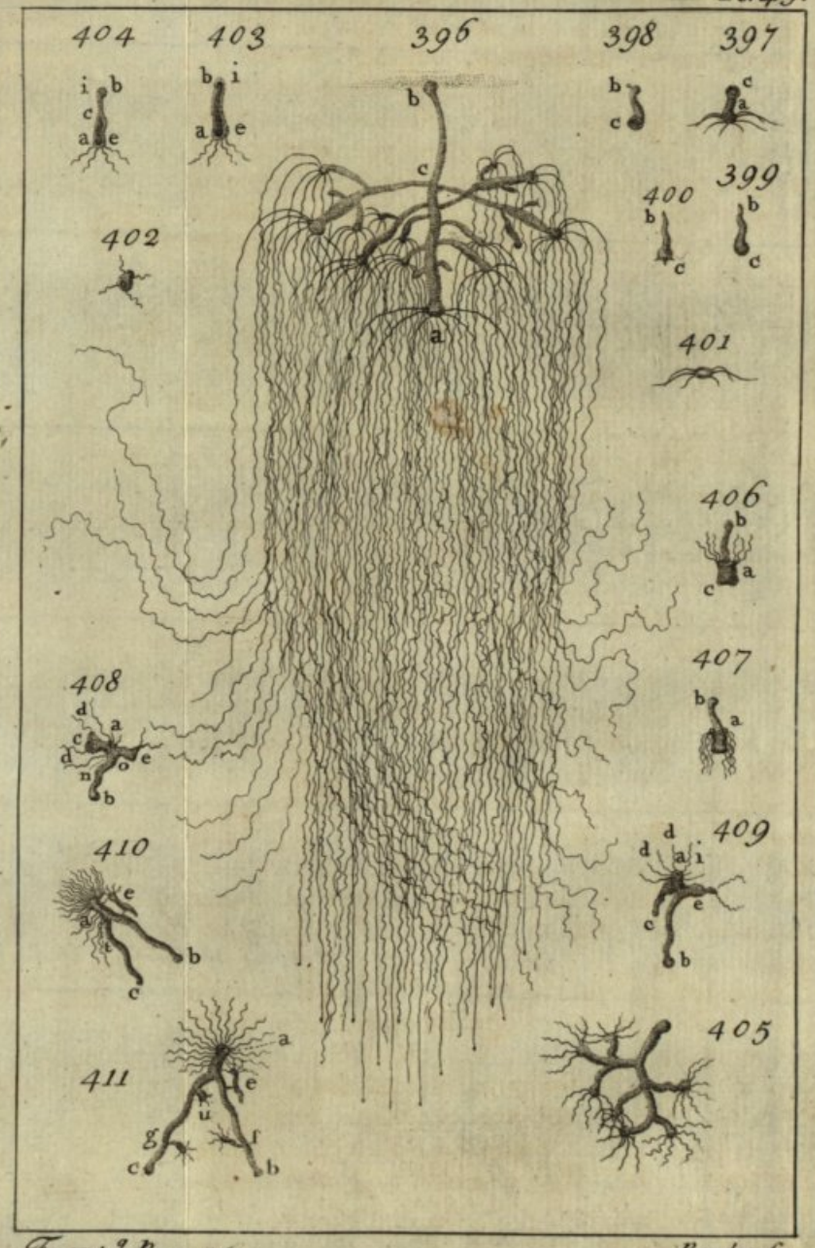
Fig. 424. ſhews the ſame two Polypes, whereof i d, of the interior, tore the Part i b of the exterior one farther up, even to e; where the Briſtle at firſt ran through both the *Polypes* together: But when in the State repreſented by this Figure it pierced the interior one c a i d at e, and the exterior one a i b at i.

Fig. 425. repreſents the ſame two *Polypes* after the interior one a e b, had tore up the Lips of the exterior one c e d, and came out therefrom; they were ſeparated in a few Days, and both of them did well.

Mr. *Trembley* hath given us a curious Drawing of an aquatick Animal which he calls a *plumed Polype*; it is repreſented as they appear in the Microſcope at Fig. 426. The Plume and Length of its Body taken together are about $\frac{2}{12}$ of an Inch in Length, its Body very ſmall, almoſt cylindrical, and Skin perfectly tranſparent. The Plume is a Continuation of this tranſparent Skin, very large in Proportion to its Body, and of a very remarkable Figure.

Its Baſe e a c is in the Form of an Horſe-ſhoe, from the Edges of which proceed the Arms a d, a d, a d, whoſe Extremity is a little turned outwards, and are ſo cloſe together, that each Plume contains 50 or 60. The Baſe e a c of this Plume ſerves the Animal for a Mouth; its Inteſtines may be diſtinctly ſeen through this tranſparent Skin at e b, f g, f a, and are of a brown Colour; after the Animal hath eaten, three principal Parts of their Inteſtines are viſible, the Gullet e b, the Stomach f g, and the ſtrait Inteſtine f a.

Theſe Animals withdraw themſelves into a Caſe i, k, l, B, I, m, that ſeems



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ſeems to be compoſed of the ſame tranſparent Matter with the Skin of the Body, which is faſtened by its inferior Extremity i b, I B, to the Orifice of the Caſe; ſo that whenever the Animal retires into the Caſe the Skin of the Body is reverſed. The Plume which is upon the Baſe c, enters with it, and appears, when all incloſed, like A B. After it is thus incloſed, it will ſoon come out again if it be left quiet.

When it is out of the Caſe, you may ſee a Tendon fixed by one End g, to the inferior Extremity of the Stomach; and the other at o, the Bottom of the Caſe. There is alſo another of theſe Tendons fixed to the Baſe of the Plume at a, and the other End of the ſame to the Bottom of the Caſe at o; it is by the Help of theſe two Tendons that the Animal draws itſelf into the Cell.

Theſe *plumed Polypes* are ſeldom alone, but many of them placed together one by the Side of the other; and there are ſeveral of them that come out of the ſame Caſe, but by different Orifices, which is the Way they multiply.

At firſt there is a little Elevation upon the Superficies of the Caſe of an old one, after which the Body and Plume s t begin to appear; or when a young one begins to ſhoot the Baſe of the Plume and Points of its Arms u u u, ſhew themſelves and increaſe as the Body enlarges.

They can only eat very ſmall Animals, but of theſe they devour great Numbers in a Day.

The quick Motion of the Plume, or rather the Feather-like Arms thereof, form a kind of Whirlpool, into which moſt of theſe little Animals that are ſwimming near it are precipitated.

Every Inſtant one or two of its Arms ſuddenly bend into the Plume, and immediately replace themſelves into their firſt Situation; the ſame Arm ſeldom bends twice together, nor do they touch the Prey but by their rapid and continued Motion cauſe a turning in the Water, which conducts thoſe minute Animals into the Plume, although they make ſeveral Efforts to eſcape, the ſudden Inflection of one Arm, adds a new Degree of Rapidity to the Torrent which hurries them into the Plume, where they are immediately ſwallowed, by the Mouth which is in the midſt thereof.

CHAP. XXXV.

Of Vegetables.

SECT. I.

THIS ſeemingly inferior Branch of the Creation, when carefully attended to, by the Aſſiſtance of the Microſcope, exhibits to us an ample

ample Scene of the *Creator's* Wiſdom, Curioſity and Art, in the wonderful Contrivance even of the moſt abject *Vegetables*, but more eſpecially in the Anatomy of them; wherein may be ſeen the admirable Proviſion made for the Conveyance of the *lymphatick* and *eſſential* Juices, in communicating the *Air* as neceſſary to *Vegetable* as *Animal* Life, and more particularly in the Generation and Make of the *Seed*, wherein the Lineaments of the parent *Vegetable* are incloſed in Minature; and wherein alſo we ſee that *God Almighty* has by one Act of his creating Power provided for all ſucceeding Ages; and the future Poſterity of each *Seed* does of Neceſſity produce its own Reſemblance: For the Preſervation of which, Nature hath endow'd ſome with light downy Wings, to be conveyed about by the Winds; others are laid up in elaſtick ſpringing Caſes, that upon burſting dart their Seed at convenient Diſtances, and others, *&c.* are planted by the Induſtry of the Huſbandman.

The *Seeds* of *Plants* are incloſed in different *Sheaths* or *Caſes*, till they are lodged in the *Earth*. Some are depoſited in the very Heart of the Fruit, as the Kernels of *Apples* and *Pears*, others grow in *Cods* or *Shells*, as *Peas*, *Beans*, *Lentils*, *Poppy Seeds*, and *Cocoa Nuts*; ſome in wooden Shells, *&c.*

The Farina of Flowers appears to the naked Eye a kind of mealy Powder, which is found on the pendant Tops of almoſt every Flower; its Colour various in different Flowers, but its Structure conſtantly the ſame in Plants of the ſame Species. Here alſo the *Microſcope* hath diſcovered ſurprizing Beauties, and hath ſhewn us, that this Powder is produced with the utmoſt Care in Veſſels wonderfully contrived to open and diſcharge it, when it becomes mature, and that there is a *Piſtil*, *Seed Veſſel* or *Uterus*, in the Center of the *Flower*, ready to receive the minute Grains of this *Powder*, either as they fall of themſelves, or are blown out of their little Cells. We are alſo taught by Experience, that the Fertility of the Seed entirely depends on this; for if the Farina Veſſels are cut off before they open and ſhed their Powder, the Seed is unprolifick *.

SECT. II.

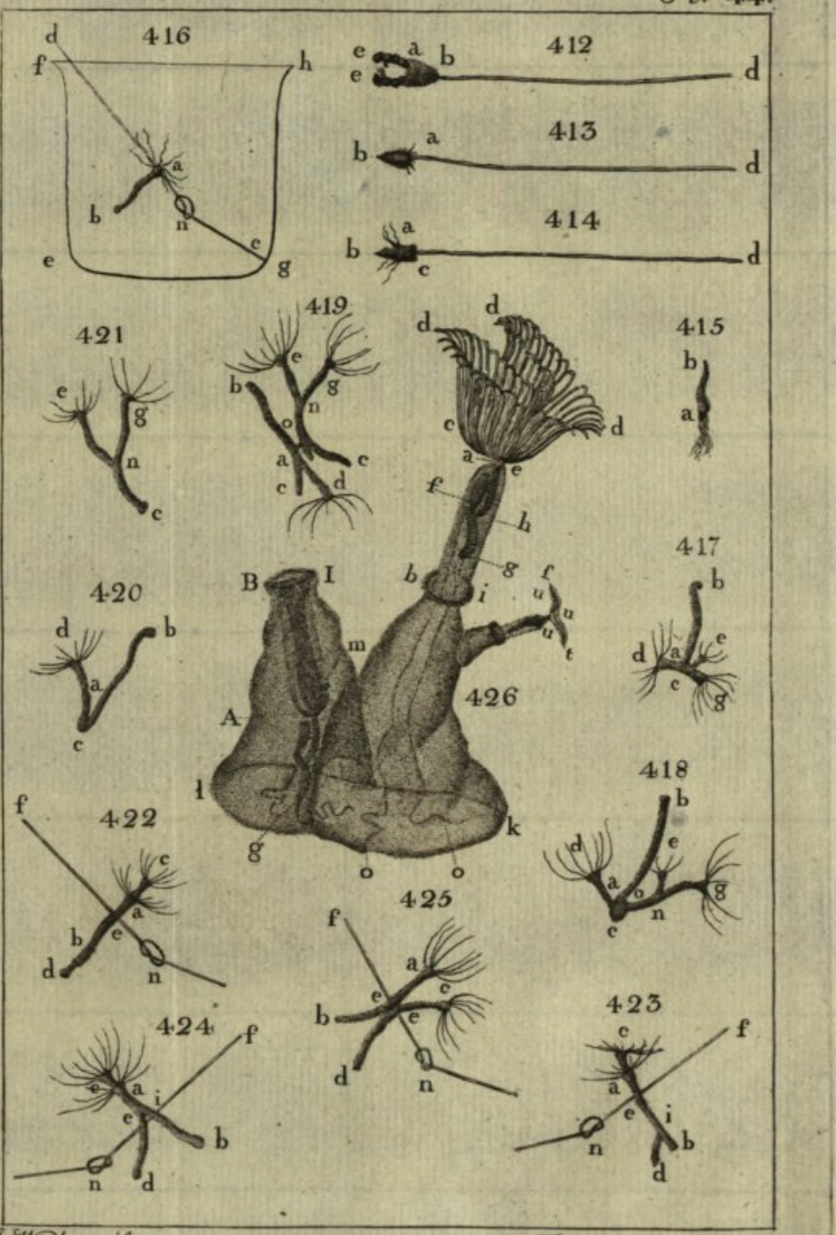
Of Seeds.

THE *Seed* is the laſt Product of a Plant whereby the Species are propagated; it is frequently the Fruit of the Plant, as is the Caſe in moſt Herbs: Sometimes it is only a Part incloſed in the Fruit, and that in Form either of *Grain*, *Kernel*, or *Berry*.

It is the natural Offspring of the *Flower*, and that for whoſe Production

* *Phil. Tranſ. No.* 207.

all



J. Wigley. Sc.

all the Parts of the Flower are intended; ſo that when this is once well formed, the ſeveral Parts of the Flower dwindle and diſappear.

It is produced from the *Farina* of the *Apices* let fall on the Head of the *Piſtil*, and thence forwarded to an *Uterus* at the Bottom thereof, divided into ſeveral Cells; where coming to receive the nutritious Juice of the Plant, it is firſt ſoftned, then ſwelled, increaſed both in Matter and Bulk, and at length comes to its State of Maturity.

By the Uſe of the *Microſcope* we diſcover in the *Seed* ſeveral Parts of the future Tree, only in Miniature; particularly a little Root call'd the *Radicle*, and the Stem call'd the *Plumule*.

I ſhall exhibit the curious and gradual Proceſs of Nature in the Vegetation of the Seed; and firſt, in that of the Garden Bean, repreſented by Fig. 427. by which a general Idea of all Seeds may be eaſily formed. It hath a ſmall Hole at a, that upon Diſſection is found to terminate againſt the Stalk of the *Plumule*; its End is apparent at a, in the tranſverſe Section of the Bean, Fig. 428. in which Figure the ſeveral Coats of the Bean appear, the innermoſt is every where twice, and in ſome Places thrice as thick as the outermoſt; and where it ſurrounds the Stalk of the Plume, it is ſix or ſeven Times as thick, as may be ſeen at b, Fig. 428.

The Hole a, Fig. 427. is not caſually made by breaking off the Stalk, but deſign'd for the Nurture of the young Plant, and may be ſeen in ſeveral other Kinds, as *Peas*, *Vetches*, *French beans*, *Lupines*, *Lentiles*, &c. in other Seeds alſo, *Medica Tornata*, *Fænugreek*, *Goats-rue*, &c. in ſeveral of theſe it is not diſcernable without the Aſſiſtance of the *Microſcope*; and in ſome not without cutting off Part of the Seed. When any of the above-named *Seeds* have been ſoaked in Water, ſeveral Bubbles will alternately break through this Hole on their being ſqueezed. All *Seeds* having thick and hard Covers, are alſo perforated in the like Manner; and thoſe lodged in Stones and Shells, though not viſibly perforated, yet the Stones and Shells themſelves always are; when the Coats of the Bean are ſtripped off, the Seed appears; its main Body is divided into two *Lobes*, joined together at the Baſe of the Bean, as at Fig. 429. In young Beans, eſpecially if boiled, theſe Lobes eaſily ſlip aſunder; but in dry Beans are very difficult to be ſeparated, unleſs they be firſt macerated for 24 Hours in Water. Some few Seeds are divided into more Lobes, as the Creſſes into ſix, and ſome not at all, as Grains of Corn, *&c.* moſt other *Seeds*, even the ſmalleſt, are divided exactly into two Lobes like the Bean; that which joins the two Lobes together is called the *Stem* or *Radicle*, out of which the *Root* is formed when the Seed vegetates. This *Stem* is found in all Seeds; in the Bean and ſeveral others, it is ſituated ſomewhat above the thick End, in *Oak Kernels*, commonly called *Acorns*, *Apple-Kernels*, *Almonds*, &c. it ſtands prominent juſt from the End.

The Plume or Bud iſſues out of this Stem, and is that which afterwards becomes

becomes the Trunk of the Plant, ſeparable in ſeveral already formed, tho' not diſplayed Leaves, which appear upon the ſprouting of the Seed, and may be ſeen in the Seed itſelf by the Aſſiſtance of the *Microſcope*.

The *Plume* is incloſed in a Cavity formed in the Lobes on purpoſe for its Reception, which may be ſeen at b, Fig. 429. it is almoſt of the ſame Colour with the Radicle, or little Root, on the Baſis whereof it is ſuſtained.

It is the firſt Part that appears out of the Earth; as in effect it is the firſt Part that appears out of the Membrane, or Cover of the *Seed*, there being a Hole over againſt it in the Membrane, through which it makes its Eſcape.

It is the Appearance of the *Plume* without the Cavity of the Grain, that makes what we call the *Bud* or *Germ* of a Plant.

In diſſecting a *Bean*, if you hold your Knife aſlope, and very gently bear upwards, an exceeding thin and tranſparent Skin will ſhew itſelf, juſt as the Knife enters; this Skin is not only ſpread over the Convex of the *Lobes*, but alſo upon the Flat thereof, and is extended both upon the *Radicle* and *Plume*, and ſo all over the Bean. This fine Skin vegetates imperceptibly, and the two Extremities of the Bag, which ſurround the Head of the Bud, expand and riſe with it in order to preſerve it, from all ſuch Frictions as may injure its tender and delicate Texture *. Next to this is the *Parenchyma*, conſiſting of an infinite Number of extremely ſmall Bladders, which may be ſeen in a very thin Slice of a Bean when applied to the *Microſcope*, and appears like Pith while ſappy in the *Roots* and *Trunks* of *Plants*; on cutting the *Radicle* tranſverſly in ſeveral Parts, another Body of a quite different Subſtance from the *Parenchyma* or *Pulp*, will be found, which is alſo conſpicuous in a tranſverſe Section of the *Lobes*, and appears there like ſeveral ſmall Specks, and of a different Colour from the *Pulp*: Theſe are the ſeveral Branchings of the Tubes proceeding from the Radicle, and forming but one intire Trunk till it riſes to a b, Fig. 430, from whence it iſſues forth into three main Branches, the middlemoſt directly into the Bud c, and the other two after a little Space, paſs from e e on either Side into the *Lobes*, where they divide into ſmaller Branches, and theſe again ſpread into other more minute Ramifications, and terminating near the Verges of each *Lobe*, become a perfect Root.

This ſeminal *Root* being ſo tender, is difficult to be diſcovered, but may be come at by a careful paring off the Parenchyma in thin Slices Lengthwiſe, in new Beans, or if old Beans are ſoaked a conſiderable Time in Water, the ſame may be effected.

The Specks that appear on cutting the Radicle and Plume tranſverſly are moſt viſible in the Bean and great *Lupine*.

The ſeminal Root hath not yet been diſcovered in *Apples*, *Plumbs*, *Nuts*,

* *Grew Ana. Plants, p.* 4.

&c.

&c. partly from their Colour, being the ſame with that of the Pulp, yet in the *Gourd Seed* the main Branches with their ſeveral Ramifications appear immediately on ſeparating the *Lobes*.

The *Parenchyma* of the *Lobes* is a kind of Meal intermingled with a nutritious Juice, or Sap of the Earth, forming a kind of Pap or lacteous Subſtance, which being filtered through the ſeveral Branchings of the ſeminal Root, are conveyed thro' the two ſmall Tubes a and b, Fig. 430, into the Bud, which is gradually repleniſhed therewith. When theſe ſeminal Roots have communicated all the Nouriſhment of the Lobes to the young Plant, they begin to wither, together with the Skin that covers them; the *Stem* or *Radicle* then alſo begins to take *Root* in the Ground for its future Subſiſtance.

SECT. III.

The Coats of the Seeds.

HOW it was in its State of *Vegetation* hath juſt been ſhewn; it remains then to enquire into its State of *Generation*; for what in the other State was not apparent, or intelligible, will in this occur; and here alſo we ſhall find a large Field for the Employment of the *Microſcope*.

The two general Parts of the *Seed* are its Covers and Body. The Covers in this State are uſually four; the outermoſt, which is called the *Caſe*, and is of various Forms, ſometimes a *Pouch*, as in *Naſturtium*, *Cochlearia*, &c. a *Cod*, as all Pulſe; ſometimes parted as *Sorrel*, *knotted Graſs*, &c. The two next are properly the *Coats*, in a *Bean* eſpecially, and the like; from whence the Denomination may run to the correſponding Covers of other *Seeds*; their Figures are ſometimes kidneyed as *Alcea*, *Behn*, *Poppy*; triangular, as *Polygonatum*, *Sorrel*, &c. ſpherically triangular, as *Mentha*, *Meliſſa*, &c. circular, in *Leucoium*, *Amaranthus*; globular in *Napus*, *Aſperula*; oval in *Speculum Veneris*, *Tithymalus*; ſemi-globular in *Coriander*, ſemi-oval in *Aniſe*, *Fennel*, pirimidal in *Geranium Althæafol*, with many other Differences.

Sometimes gliſtering, as in *Venus Looking-Glaſs*, rough caſt in *Catanance*, ſtuded in *Behen*, *Blataria*; favous in *Papaver*, *Antirrhinum*, *Lepidum*, *annum*, *Alcea-Veſicaria*, *Hyoſcyamus* and many more, * before the Seeds have lain long by; pounced in *Phalangium Cretæ*, *Lithoſpermum*; ramified in *Pentaphyllum fragiferum erectum majus*, reſembling the *Fibres* of the *Ears* of the *Heart*.

All *Seeds* have their outer Coats open, as in *Beans* and *Pulſe*, as before

* *Grew An. Plants*, p. 45.

ſhewn,

ſhewn, or elſe by breaking off the *Seed* from its Pedúncle or Stool, as in *Cucumber*, *Chicory*, &c. or by the Paſſage of a Branch or Branches, not only into the Concave near the Cone or Top of the Seed, but through the Cone itſelf.

The fourth or inmoſt *Cover*, is called the *Secondine*, a Sight of which may be obtained by cutting off the Coats of an Infant *Bean* in very thin Slices, at the Cone thereof, if not broke, it is tranſparent; if torn, it gathers up into the Likeneſs of a Jelly. In large old *Beans* it is not to be diſtinctly ſeen, but in moſt *Seeds* it may, even when full grown, as in *Cucumber*, *Colocynthis*, *Burdock*, *Carthamum*, *Gromwell*, *Endive*, *Mallows*, &c. though in theſe it is generally thin and difficult to be diſcovered, yet in ſome Kernels, as *Apricocks*, it is very thick, and remarkably ſo in ſome other Seeds.

The Concave of this Membrane is filled with a moſt tranſparent Liquor, out of which the Seed is formed, as appears on cutting an Infant Bean, or better in a young Walnut.

Through this Membrane, the lignous Body or Seed-Branches, in the inner Coat, ſhoot down in two ſlender Fibres, near the Baſe of the Radicle, one into each Lobe of the Bean, and there ſpread into a great many Ramifications, which convey the Juices on the Vegetation of the Seed, into the Radicle and Plume, as before deſcribed.

SECT. IV.

Of the Seed Caſes or membraneous Uterus.

THE Seed Caſe is a kind of fleſhy Uterus, growing more moiſt and pulpy as the Seed ripens, but the Caſe itſelf whether called Cod, Pod, or by any other Name, is a membraneous Uterus, which grows more dry and hard as the Fruit ripens. In ſome the Seed Caſe is originally open, in others it opens when the Seed is ripe, and in others not at all till the Seed is ſown.

Garden Radiſh-Seed breaks within as it ripens into ſeveral white dry Membranes, round about the Seed. Near the Sides of the Caſe run a Pair of vaſcular Fibres, from which branch forth ſeveral ſmaller Fibres, ſome towards the Sides of the Caſe for their Support, and others towards the Center thereof upon which the Seeds hang, Fig. 431.

Of thoſe which open as ſoon as the Seed is ripe, ſome open at the Top, as *Poppy Heads*, Fig. 432, others on the Side, as moſt Cods; and ſome at the Bottom as *Coded Arſmat*, Fig. 433. the *Poppy Head* is divided by eight or ten Partitions into as many Stalls, and on both Sides the Partitions hang a moſt numerous Brood of Seeds.

Of

Of thoſe which open on the Side, ſome open on one Side, ſome on both, others with three Sides, ſome more, and others horizontally, or round about.

The Cod of a *Garden Bean* opens on one Side, and hath a two-fold Parenchyma; in the outermoſt ſtands all the Veſſels in ſeveral Parcels, from one of which, being larger than the reſt, and at the Back of the Cod, ſhoots forth theſe leſſer Veſſels whereon the Beans grow; the inner Pulp is wholly compoſed of Bladders, in which many of thoſe Threads whereof the Bladders are wove, are ſo looſe, as to be eaſily drawn out to a conſiderable Length, and are very viſible when applied to the *Microſcope*.

The Seed Caſe a b c d, of *yellow Henbane*, Fig. 434, opens on both Sides, from its Top at a, grows a Stem, which diminiſhes as the Caſe ſwells, and at laſt falls off. On the Sides of the Caſe run two oppoſite vaſcular Fibres, and as the Caſe gradually increaſes, it as gradually ſeparates on both Sides in the Tract of the aforeſaid Fibres as at b. The Caſe is lined with a ſmooth thin Skin, in whoſe Center is a great Parenchymous Boſs c, being the Bed of the Seeds which lie all over as in a Strawberry; throughout this Bed the Veſſels d, for the Generation and Nouriſhment of the Seed are diſtributed, as may be ſeen in the tranſverſe Section thereof at d, in which a very ſmall Fibre, ſhooting from the direct Fibres obliquely into each Seed is plainly viſible.

The *Seed Caſe* of a *Tulip*, whereof a, repreſents the Caſe intire, b is a tranſverſe Section of it, and c the Caſe ſplit down. Fig. 435, it opens on three Sides, from the midſt of each proceeds a Partition, all meeting in the Center of the Caſe, and making ſix Diviſions for the Seed. The Veſſels are curiouſly diſpoſed after they riſe above the Stalk, being at firſt divided into three principal Branches, running along the three Angles of the Caſe, from which divers leſſer Branches tend horizontally, and meet at the Middle of each Side; whence they proceed through the Breadth of each Partition to their Edges, in the Center of the Caſe, where they are again diſtributed into very fine and ſhort Threads, whereon the *Seeds* hang.

The Seed of *Anagallis* or *Pimpernel*, Fig. 436, is a little Globe opening horizontally into two Hemiſpheres, the uppermoſt falls off when the Seed is ripe, and ſo the Wind ſows them.

The Seed-Caſe of *codded Arſmat*, Fig. 433, neither opens at the Top nor on the Sides, but at the Bottom, being compoſed of four Sides, in the Center of the Caſe is a Column a, upon which the Seeds hang looſely. From this Mechaniſm that violent Ejaculation of the Seed is intelligible, which is not a Motion in the Seeds themſelves, but contrived by the Structure of the Caſe, the Seeds hanging very looſely, not on the Sides of the Caſe, but on the Stem in the Center thereof, with their thickeſt Ends downwards, ſtanding ready for a Diſcharge; the Sides of the Caſe being lined with a ſtrong Membrane, they perform the Office of ſo many little Bows

remaining fast at the Top b, are let off at Bottom, and forcibly curl upwards and drive all the Seeds before them.

SECT. V.

Of the Number and Motions of Seeds.

NAture hath procured the Propagation of Plants several Ways, but chiefly by the Seed; for the Production of which the Root, Leaves, Flowers and Fruit do all officiate; and according as the Plant or the Seed it bears is more or less liable to be destroyed, Provision is made for the Propagation of either by a greater Number of Seeds, or otherwise; for Instance, the Seeds of *Strawberries* being gathered, or eaten by Vermin with the Fruit, the Plant therefore is easily propagated by Trunk Roots; the *white Poppy* being an annual Plant is highly prolifick, commonly bearing about four mature Heads, in each of which are at least ten Partitions, on both Sides whereof the Seeds grow, and on one fourth Part of one Side, about 100 Seeds, that is 800 on one Partition, which multiplied by 10 makes 8000, and this multiplied again by 4, the Number of Heads, gives 32,000 Seeds, the yearly Product of that Plant.

So also in Typha Major, the Seeds being blown off and sown with great Hazard, are prodigiously numerous, they stand altogether upon the Spike, and make a Cylinder at least six Inches long, and near $\frac{1}{8}$ of an Inch in Diameter. Nine of these Seeds set close together upon a Right Line make but the Eighth of an Inch, so that 72 make a Line of an Inch in Length; but because upon the Spike, the Hairs belonging to the Seed come between them, we will abate 10, and count but 62; to which if $\frac{3}{4}$ be added (abating the Fraction, *viz.* 46.) makes 108, for the Circumference of the Cylinder, which being six Inches long, there are 6 Times 62 for a Line the Length of the Cylinder, which is 372; which Number being multiplied by 108, produceth 40176, the Number of Seeds that stand upon one Stalk: Therefore upon three Stalks which one Plant commonly bears, there are in one Year 120,528 Seeds.

As soon as the *Seed* is ripe, Nature taketh several Methods for its being duly sown, not only in opening the *Uterus*, but also in the Make of the *Seed* itself; for first the Seed of many Plants which effect a peculiar Soil, as *Arum Poppy*, &c. are heavy and small enough without further Care to fall directly down into the Earth, and so to grow in the same Place where they had their own Birth. But if the Seeds are so large and light as to be exposed to the Wind, they are often furnished with one or more Hooks, to prevent their wandering too far from their proper Place, till by the Fall of Leaves or otherwise, they are safely lodged. The Seeds of *Avens* have one single

ſingle Hook, thoſe of *Agrimony* and *Gooſe-Graſs* many, both the former loving a warm Bank, and the laſt a Hedge for its Support; on the contrary, divers Seeds are furniſhed with Wings or Feathers, partly with the Help of the Wind to carry them when ripe from off the Plant, as thoſe of *Aſh*, *Maple*, *Orach*, &c. leaſt ſtaying thereon too long, they ſhould either be corrupted, or miſs their Seaſon, and partly to enable them to make their Flight more or leſs abroad; that by falling together, they may not come up too thick, and if one ſhould eſcape a good Soil or Bed, another may light thereon. The Kernels of *Pine* have Wings, not unlike thoſe of ſome Inſects, but very ſhort, in reſpect of the Weight of the Seed, they do not fly into the Air, but only flutter about upon the Ground; thoſe of *Typha*, *Dandelion*, and moſt of the papous Kind, with many more, have very long and numerous Feathers, by which they are wafted every where, and to any convenient Diſtance.

Some Seeds are ſcatter'd, not by flying abroad, but by being ſpurted away as *Wood Sorrel*, Fig. 437. which is effected by a white, thick and ſtrong Cover of Tendons of a ſpringy Nature, in which the Seed within its Caſe is incloſed. This Cover, as ſoon as it begins to dry, burſts open in an Inſtant on one Side, and is violently turned Inſide out, and ſo ſmartly throws off the Seed.

The Seeds of *Harts Tongue*, Fig. 439. and all that Tribe, are ſlung or ſhot away by a curious Contrivance in the Seed Caſe; as in *Coded Arſmart*, or other like Plants, only there the Spring moves and curls up inwards, but here it moves outwards; every Seed Caſe ſtands upon a little Pedicle, a a a, Fig. 439. being of a ſilver Colour, and of a ſpherical Figure; it is girded about with a ſtrong Tendon or Spring a, (whoſe Surface reſembles a fine Screw, of a golden Colour, which breaks the Caſe, immediately upon its becoming elaſtick enough) into two hemiſpherical Cups, as at b c, and by that Means ſling off the Seeds. Theſe Caſes grow in Furrows, d e, d e, d e, on the Back of the Leaf, as at Fig. 438. in one of which of an Inch long are more than 300 of the above-mentioned Caſes; and allowing 10 Seeds to every Caſe, makes 3000 Seeds; which multiplied by the Number of Furrows in one Leaf, with Allowance of the leſſer Furrows, and that Sum by the Number of Leaves commonly growing upon one Root, amounts to above a Million of Seeds,* the annual Product of this Plant. The Seed is of a tawny Colour, flat and ſomewhat oval; of theſe ten thouſand are not ſo big as a white Pepper Corn. Fig. 439. repreſents a few of the Seed Caſes magnified; they were cut out of the Furrow at f, in the Leaf repreſented by Fig. 438.

Divers notable Means of Semination are obſerved by other Authors; Mr. *Ray* tells us, that a Quantity of Fern Seed, laid in a Lump, on a Paper,

* *Grew. Ana. Plant, p.* 119.

the

the ſeminal Veſiculæ are heard to crackle, burſt, and, by the *Microſcope*, the Seeds are ſeen to be projected to a conſiderable Diſtance from each other.

Dr. *Sloane* obſerves, that the *Gentianella flore cæruleo*, or Spirit Leaf, requiring wet Weather to be ſown in, as ſoon as the leaſt Drop of Rain touches the End of the Seed Veſſels, with a ſmart Noiſe, and a ſudden Leap, it opens itſelf, and with a Spring ſcatters the Seed.

Other Plants ſow their Seeds by inviting Birds by their agreeable Taſte and Smell, to feed on them, ſwallow them, and carry them about; thereby alſo fertilizing them, by paſſing through their Bodies. In ſuch Manner are Nutmegs and Mizzletoe ſown and propagated.

SECT. VI.

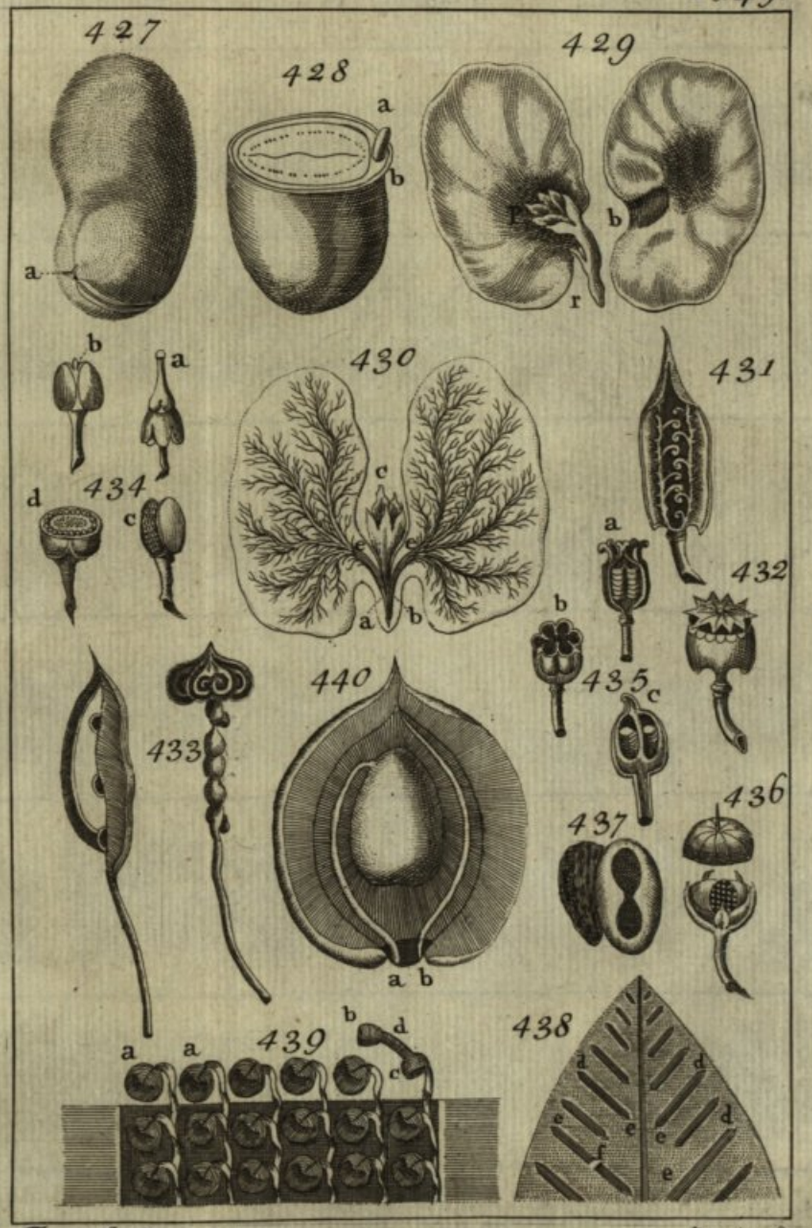
Of the Covers of the Seeds.

THE next Step which Nature takes, relates chiefly to the Growth of the *Seed*, when ſown, and for this Purpoſe the outer Covers are ſomewhere furniſhed with Apertures, ſufficient for the Reception of alimental Moiſture, to be received from the Ground, and for the ſhooting forth of the young Root into it; as in the Seed of a *Gourd* at the Bottom, in a *Bean* on the Side, and in a *Cheſnut* at the Top, in which Place the young Plant always lies, and puts forth in the ſaid ſeveral Seeds. The Seed of *Palmi Chriſti* falls to the Ground, not only in the uſual Covers, but alſo in the ſaid Caſe.

If the Cover of the Seed be ſtony, and very hard, it is divided into ſeveral Pieces, whereby they eaſily cleave aſunder: The Shell of a *Hazel Nut*, divides on the Edge, and the Cleft begins at the Point, where the Root ſtands and ſhoots forth; the Shells of ſome *Walnuts* cleave into four Parts, and the Stone of *Bellerick Myrobalan* into five: The Covers and Huſks of ſome Sorts of Grain, as *Millet*, are folded over each other, the better to give Way to their tender Sprouts.

The Covers of all, or at leaſt the far greater Number of Seeds, are three, and ſometimes four, even thoſe of ſtoned Fruits have three, beſides the Stone; in *Goſſipium* there are two under that lin'd with Cotton. The Seeds of *Cucumbers*, *Goat's Beard*, *Broom*, *Scabious*, *Lattice*, &c. although ſo ſmall, have plainly three Coats; in ſome of theſe, and in many more, only two are diſtinctly viſible, except in the State of Generation. In the upper Coat the Seed Veſſels are diſſeminated; the ſecond is at firſt a mere Pulp, which afterwards ſhrinks up, and ſticks cloſe to the upper. The third or inmoſt more denſe; and if it be thin, for the moſt Part tranſparent; whereby the Seed ſeems to be ſometimes naked while it lies therein, as in *Almonds*, *Cucumbers*, &c.

In



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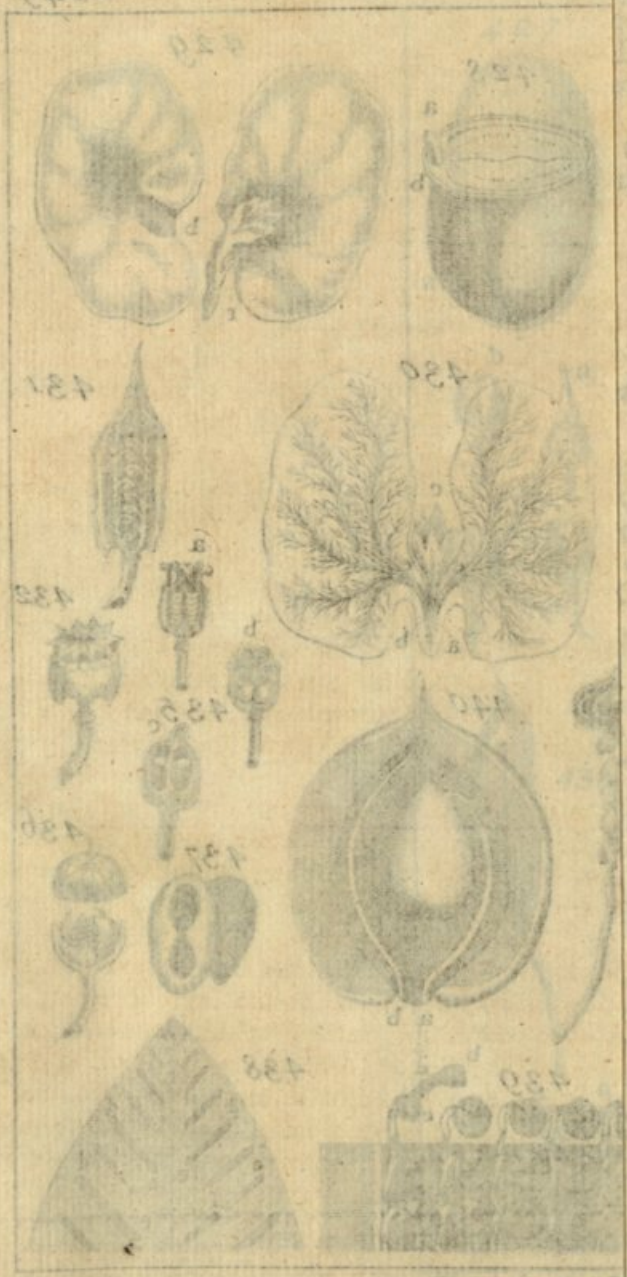


In *Meliſſa*, and ſome other Seeds, it comes finely off, on being ſoaked in warm Water.

SECT. VII.

Of the Fœtus, or true Seed.

AMong Seeds of the thinner Covers are thoſe of all Sorts of *Corn* and *Graſs*, different from that of moſt other Seeds. The main Body being of one entire Piece, doubled in the Form of a Pair of Lips. In the Seeds of *Dates*, and ſome other like Plants, that which is generally called the Stone, ſeems indeed to be the main Body of the Seed, doubled or folded up in the ſame Manner as Corn, to which that Part which becomes the Plant is annexed. In Corn it is placed in the Bottom of the main Body, but here in a ſmall round Cavity in the Middle of the Back.

For the moſt Part the main Body is divided into two Lobes, plainly to be diſtinguiſhed in moſt *Kernels*, and other large Seeds, and not difficult in many leſſer ones, as in *Viola-lunaris*, *Scabious*, *Doves-Feet*, &c. if ſlipped out of their Covers before they are full ripe; in *Hounds Tongue* they are of a circular Figure; in *Cucumbers*, oblong, with ſome viſible Branches of the ſeminal Root, *&c.*

In the foregoing Seeds, the Lobes lie flat one againſt another, but in *Garden Radiſh* they are folded up, ſo as to receive the Radicle into their Boſom. In *Holy-Oak* the Lobes are plaited over each other. In Cotton Seed they are very broad and thin, and their Folds curious and very numerous.

Many of the Seeds, with bulky Covers, are not divided into two Lobes, being in a Manner of one Piece, as all the bulbous Kind: In *Flag* it is above 20 times bigger than the Seed within it, and conſiſts of Bladders radiated towards the Seat of the Seed, and theſe diſpoſed in parallel Lines running lengthwiſe.

But the greateſt Number of Seeds with bulky Covers, are divided into two Lobes. In the *purging Nut* of *Angola*, if the Shell be taken off, the upper Covers, [dried and ſhrunk up] ſeem to be but one: In theſe the ſpermatick Veſſels are branched, and under them the thick and inmoſt Cover; which being cut down the Middle thereof, ſhews the true Seed, conſiſting of two veined Leaves, as white as Milk, joined together with the Stem or Radicle at their Baſe, and ſunk into a Hollow made in the Cover. The ſame is alſo obſervable in the *Barbadoe Nuts*, *Ricinus*, *Americanus*, and ſome other *Indian* Fruits.

In the foregoing Fruits, the Bulky is very ſoft, but in *Nux Vomica Officinarum*, it is nearly as hard as a *Date Stone*; in this, and the foregoing, the Seeds

Seeds are large, but in others are ſo ſmall, that they are ſcarce diſcernable without a *Microſcope*, as in *Staphiſagria*. The thick or inmoſt Cover is conical towards the Baſe, at whoſe Point is a little Cavity where the Seed is lodged; the Root thereof pointed, and Lobes rounded at the Top. In *Peony* the ſame Cover is ſoft, white, and of an oval Figure, the Part uſed for Medicine, is thought to be the Seed itſelf, but is near 200 times bigger than the true Seed; which lies in a little Cavity near the Bottom of the Cover, with a blunt Root, and two pointed Lobes.

In *Coffee-Berries*, the Seed lies in the inner Cover, near the Top; the Back of the Lobes are veined like two minute Leaves, and joined to a long Root.

The Seed of *Stramonium* is incloſed in a bulky Cover, which being ſoaked in Water, and carefully cut about the Edges with a ſharp Razor or Penknife, its Seed may be taken out entire, and examined by the *Microſcope*.

SECT. VIII.

Of the Buds of Seeds.

THE Stalk of the Plant riſes up from between the Lobes, which may always be ſeen, in ſome by the naked Eye, and in others by the *Microſcope*; in many Plants Nature ſees fit only to lay the Foundation thereof in a round Node, as in *Viola luniaria*, &c.

But in moſt Seeds is formed a true Bud, conſiſting of perfect Leaves, in ſome two, others four, *&c.* In *Bay-berry* only two, very ſmall, but thick, and finely veined; in the Seed of *Carduus Benedictus*, they are alſo two, pointed at Top, and ſituate a little Diſtance from each other, for the two next to riſe up between them.

In ſome Herbs, although the Bud conſiſts but of two perfect Leaves, yet they are very conſpicuous, not only in the larger Seeds, as *Phæſcolus*, or *French Beans*, but in ſmall ones two, if examined by the *Microſcope*, as in the Seed of *Hemp*. A B, Fig. 441. in which the two Leaves are plaited, and ſet Edge to Edge, c ſhews the other Part of the Seed which was ſeparated to lay the Bud fair to View. In the Seed of *Senæ*, the Bud hath four Leaves: In the Seed-Bud of an Almond C, D, Fig. 442. there are ſix or eight, and ſometimes more diſtinct Leaves viſible, if by a dextrous Separation of the Outer, the Innermoſt are laid open, they are folded inward one over the other, as appears at D, which repreſents them open, and at C the ſame Seed-Bud is ſeen ſhut.

The Lobes of the Seed, and ſo likewiſe the Stalk and Bud, conſiſt of a Skin, Parenchyma and branched Veſſels, as before deſcribed; all which are apparent to an Eye armed with a *Microſcope*.

The

The first Skin, as in *French-Beans*, may be easily separated from the Parenchyma, especially if the Bean be soaked in Water for some Days, it will slip easily off, and will be found to consist of Bladders, smaller than those of the Parenchyma, and intermix'd with a kind of lignous Fibres which give a Toughness to the Skin. The branched Vessels run through the Parenchyma, and compose the seminal Root in the Lobes, being no where extended to the Circumference of the Lobes, but are all inosculated together at a considerable Distance from it; all meeting therein in one solid Nerve, but in the Stalk are dilated into an hollow Trunk, filled with a Pith composed of Bladders, which in the Stalks of *French Beans* is very conspicuous; they consist of Sap and Air Vessels as the other Parts of a Plant, not running collateral, the latter being sheathed in the former, and are plainly visible in the *Microscope*.

SECT. IX.

Of the Generation of the Seed.

AS a *Garden Bean* was chose to shew the Manner of the Seeds Vegetation, so an Apricock is very fit to observe and represent the Method Nature takes in its *Generation*.

A proper Uterus is first prepared, both to keep the Membranes of the Fœtus warm and succulent, and to preserve and secure it afterwards till it takes Root in the Ground. For this Purpose both the Pulp and Stone of the Fruit are necessary; but first the Stone, the Pulp being only necessary to form the Stone, the petrifying of that Parenchyma which is the Ground of the Stone, being effected by the sinking of the Tartar * thereinto; for

It is evident on cutting a young *Apricock*, and then with a sharp Razor shaving off a thin Slice, and viewing it through the Microscope, that at first the Ground of the Stone is a distinct and soft Parenchyma, composed of Bladders, as the Pulp itself is, which Bladders, as it hardens into a Stone, fill up and disappear.

This Parenchyma takes its Rise from the Pith, as the Pulp does from the Bark, and composes the greatest Part of the Stone; its Inside is lined all over with a thin Skin, covering the Seed Branch on its first Entrance into the Hollow of the Stone; which Skin is also composed of exquisitely small Bladders, by which Means it soon becomes a very hard and dry Body.

The Stone being made hard and dry, could never be sufficiently softned (to give Passage for the Vegetation of the Seed) by lying under Ground, did it not easily cleave in two; for which Purpose the Skin of the Fruit is

* *Grew. An. of Plants, p.* 209.

immediately concerned; for in a tranſverſe Slice of a young *Apricock*, if it be cut with a ſharp Knife, this Skin may be ſeen (when applied to the Microſcope) fairly doubled inwards from the two Lips a b, a b, of the Fruit, Fig. 443 and 444, and from thence continued through the Pulp and Stone itſelf into the Hollow thereof, where it meets and is united with the Lining before-mentioned; and as it conduces towards the drying of the Stone, ſo alſo it renders it cleaveable in that Part where it runs through it.

Nature having thus provided a convenient Uterus, her next Care is about the Membranes of the Fœtus, theſe are three apparently diſtinct, and in many Reſpects different from each other.

The firſt of theſe, Fig. 443. repreſents a tranſverſe Slice of a young Apricock near the lower End, ſhewing the Duplicature of the Skin half Way through the Stone. Fig. 444. a tranſverſe Slice cut through the upper End, ſhewing the Duplicature of the Skin quite through the Stone; and at a b, Fig. 446. is ſhewn the Branches which run through the Stone to the Flower and Seed, in a well grown Apricock cut Lengthwiſe.

The outermoſt of theſe Membranes takes its Riſe from the Parenchyma, and ſurrounds the Seed Branch, and upon its Entrance into the hollow of the Stone is expanded into two Bladders, one within the other; whereof one becomes the Lining of the Stone, the other the outer Membrane, and is beſt ſeen on cutting a young Apricock when it is about half an Inch long through the Middle, or from the Seat of the Flower to the Stalk, between the two Lips a b, Fig. 443. At this Age the outer Membrane hath a full and firm Body, and is compoſed of Bladders, as may be plainly ſeen on its Application to the *Microſcope*.

The Veſſels contained in the Seed Branch, are diſtributed throughout this Membrane, beginning a little below its ſmaller End, and running round both Ways, meet in the Middle of the greater, where they are all inoſculated and form a kind of umbelical Node, as at a, Fig. 445. from whence they ſtrike deeper into it till they arrive at the middle Membrane, where they become inviſible; theſe Veſſels convey the Sap to the middle Membrane, whoſe Bladders are more angular and amplified towards the Center, being at leaſt two hundred * Times bigger than thoſe of the outer Membrane.

This middle Membrane is ſo called from the State and Condition it hath upon the Augmentation of the Seed, at which Time it obtains the Name of an Involucrum †, but originally is every where entire without any Hollow, filling up the Cavity of the outer Membrane like a ſoft and delicate Pulp. After a ſhort Time a ſmall Channel appears therein, running from the Bottom to the Top; at firſt no wider than to receive a human Hair, and then only viſible in a tranſverſe Slice, and that not without a *Micro-*

* *Grew. An. Plan. p.* 210. † *Ibid.*

ſcope;

ſcope; but when grown a little wider, may be ſeen if the Membrane be carefully cut Lengthwiſe, at which Time it is dilated into two oval Cavities, e f, Fig. 446. one at each End, into which a moſt pure Lympha continually owzeth, and is therein reſerved for the Nouriſhment of the Seed, and alſo paſſes freely from one to the other.

A few Days after this, the inmoſt Membrane begins to appear like a ſoft Bud growing out of the upper Cavity, being joined to its lower End by a ſhort and tender Stalk; from whence it is produced into a conical oval Figure, anſwerable to that marked g in the Cavity, Fig. 447. This Membrane, though ſoft and full of Sap, is compoſed of Bladders, three hundred Times ſmaller than thoſe of the middlemoſt, by which Means the Seed is ſo well guarded, as not to be ſupplied with any other Part of the Lympha but the pureſt, and that only but by ſlow Degrees.

If with a ſteady Hand this Membrane be pulled very gently upwards, it will draw a ſmall tranſparent String after it to the Bottom of the middle Membrane: This ſaid String, though for the greater Part parenchymous, is nevertheleſs ſtrengthned with ſome lignous Fibres, which ſeem to be a Portion of thoſe that are inoſculated at the Bottom of the outer Membrane, and thence produced through the middlemoſt under the Channel which joins the two oval Cavities, till at laſt they break forth into the upper Cavity, where they form this inner Membrane, which is originally as entire as the middlemoſt; but as it increaſes, becomes a little hollow near the Cone, and the aforeſaid lignous Fibres fetching their Compaſs from the Baſe, ſhoot forth into the Cone, and make a very ſmall Node therein, for the firſt Eſſay towards the Generation of the Seed, as at h, Fig. 448. which are ſpun out to the utmoſt Degree of Fineneſs for that Purpoſe. In this Figure the inmoſt Cover is laid open to ſhew the Seed itſelf.

When this Node is grown to about the Size of the fifth Part of a Cheeſe-Mite, it begins to be divided by a little Indenture towards the Top, as at k, Fig. 449. which gradually grows deeper till the Node is diſtinguiſhed into Lobes or thick Leaves; and as theſe increaſe, their Baſe is contracted into the Radicle, or that Part of the *Seed* which becomes the Root; at this Time the *Seed* is ſo extremely ſmall, that the Lobes cannot be ſeparated; but it is probable, that as ſoon as the Radicle is finiſhed, the next Step is the puſhing forth another Node between the Lobes, in order to the Formation of the Bud, and ſo the Perfection of the Seed.

This being done, or in doing, the Stalk of the Seed is more and more contracted at Bottom, and hangs at the inner Membrane only by an extremely ſmall and ſhort Ligament m, Fig. 450. which at laſt breaks; and then the Seed, as Fruits when ripe, falls off and lies looſe in the inner Membrane, which gradually ſhrinks up and becomes more hollow to make more Room for the farther Growth of the Seed.

In *Malpighi*'s Life was a Debate between him and Seignior *Triumphetti*,

Provoſt of the Phyſick Garden at *Rome*, whether the whole Plant be actually contain'd in the *Seed?* The Affirmative is maintain'd by *Malpighi* with cogent Arguments; among which this is one, that in a *Kidney Bean*, ere ſown, the Eye, aſſiſted with a *Microſcope*, eaſily diſcovers *Leaves*, a *Bud*, and even the Knots or Implantation of the Leaves on the Stem. The Stem itſelf is very conſpicuous, and plainly conſiſts of woody Fibres, and Series's of little Utricles. Whereas Seignior *Triumphetti* had objected, that by Poverty, Tranſplantation, *&c.* ſeveral Plants degenerate into others, particularly Wheat into Tares, and Tares again into Wheat; in Anſwer to this, which is one of the ſtrongeſt Objections againſt that Opinion, *Malpighi* replies, that he is not fully ſatisfied as to the Truth of the Objection; for that both himſelf and his Friends making the Experiment, no Metamorphoſis of the Wheat ſucceeded: But granting the Metamorphoſis, it is the Soil, or the Air, or the Culture is in Fault. Now, therefore, from a morbid, and monſtruous Condition of Nature, there is no inferring her genuine and permanent State.

That Experiment related in the following Section, of the Orange Kernel, which Mr. *Leeuwenhoek* made to germinate in his Pocket, is a plain Demonſtration, that the Plant and all that belongs to it, was actually in the Seed itſelf.

SECT. X.

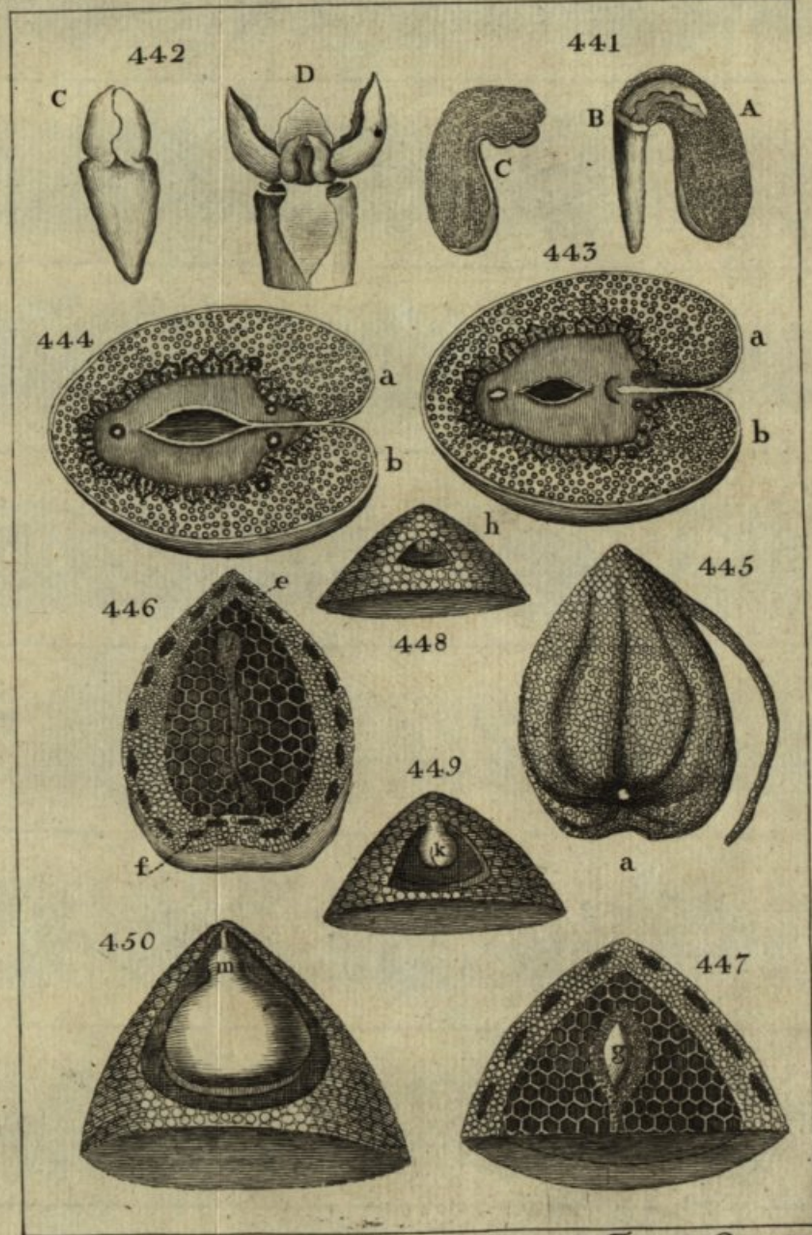
Of the Seed of Oranges.

THE Proceſs of Nature in the *Vegetation* of *Plants*, is very accurately deliver'd by Mr. *Leeuwenhoek*, to the Effect following, by an *Orange Kernel* which he made to germinate in his Pocket, *viz.*

The *Kernels* of *Oranges* being diveſted of their outer Membrane, will appear as Fig. 451. on one Side of which lies a String a, which cauſes a little Protuberance in the firſt Skin; from this String, not only the Seed, but alſo the Plant within it, receive their Increaſe and Nouriſhment, and to which through the ſecond Membrane, it extends its ſmall Veſſels to the Seat of the *Plant*. Mr. *Leeuwenhoek* was of Opinion, that this String does actually comprehend in itſelf, as many diſtinct Veſſels as are to be found in the *Orange-Tree* when arrived at its full Maturity *. For, ſays he, if all theſe Veſſels were not in the young Plant, whilſt it lies involved in the Kernels *Matrix*, whence could they afterwards proceed? Fig. 452. repreſents Part of the ſame String, cut a-croſs, and greatly magnified, which at K L M N, has Abundance of exceeding ſmall Veſſels, but very difficult to be

* *Phil. Tranſ.* No. 287.

perceived.



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perceived. About I H N M, they grow larger, and conſequently are more viſible. B, Fig. 453. repreſents a Seed diveſted of its Membranes, which ſeemed to have but one Plant within it, tho' often there is two, and ſometimes three diſtinct Seeds with their Plants contain'd under the Membrane of an *Orange Kernel*; theſe Seeds, with their incloſed Plants, are eaſily divided into two Lobes; which are framed by Nature, to nouriſh the tender Plant within, till it is able to ſtand alone, and draw its Subſiſtence from the Earth about it; having ſplit the Seed into two Parts, they are repreſented by C and D, Fig. 453. in the firſt, is Part of the Plant, which would have become a Tree, and is no bigger than a Grain of Sand to the naked Eye. The Counterpart of the ſaid Kernel is repreſented at D, with the Concave, in which Part of the Plant lay. Fig. 454. repreſents the laſt mention'd Plant, as it appear'd in the Microſcope, whereof Q L M is partly that which Nature intends for the Body and Root of the Tree; M N O P the Leaves with which the young Plant is already provided, O P that Part of the Leaves which is ſomewhat protuberant, by Reaſon of the ſmall incloſed Leaves, M N, and P Q ſhews the two Sides of the Plant torn off from the Kernel, to which it was united, and from which it received its Nouriſhment. Fig. 455. S T V, ſhews the ſame Plant a little turned about before the *Microſcope*, in order to repreſent the two largeſt Leaves, between which, according to all Appearance, a great many ſmall ones are ſhut up. If the Leaves be cut a-croſs, ſome of the included ones may ſometimes be diſcerned, and on cutting that Part of the Plant which is to be the Body and Root of the Tree, that which was deſigned for the Pith, and even the Wood itſelf may be diſcover'd.

Fig. 456. ſhews the Root when the Plant vegetates, T V and W X the two Halves of the Kernel, and Y that Part which is to become the Body of the Tree.

Fig. 457. repreſents the young Plant of 12 Days Growth, whereof A C D ſhews the Root, and F G that Part which is to be the Tree, D E the Seed or Kernel, which being ſurrounded with its Membrane, which was taken off the better to expoſe thoſe Parts to view, that ſerve for the Nouriſhment not only of the Root, but of the upper Parts of the Plant likewiſe, as alſo the ſhort String D. Thus we may ſee how ſmall a Particle, that is no bigger than a Grain of Sand, * as the Plant was at firſt, is increaſed in Bulk! and all this is brought about by Heat and Moiſture, it being rais'd to this Degree of Perfection, in ſome Sand firſt moiſtened, and then incloſed together with the Seed, in a Glaſs Tube, wore all Day in the Pocket, cloſe to the Body, and at Night, placed within a large Tin Bottle, filled with hot Water, which is a plain Demonſtration that the Plant, and all that belonged to it, was actually in the Seed; that is to ſay, not only the young *Plant*, its

* *Phil. Tranſ.* No. 287.

Body,

Body, *Root*, and *Fruit*, but even its *Seed* alſo, to perpetuate the Species; as hath been before obſerved.

Mr. *Leeuwenhoek* comparing the Animalcula in *Semine Maſculino*; and theſe Plants, computes them to be 1,000,000 times ſmaller than a Plant in an Orange-Kernel; and tho' we cannot make our Obſervations of the Growth and Increaſe of the ſaid Animalcula from Time to Time in their Mother's Matrix; yet we may certainly conclude, that the Laws which the *wiſe Creator* of all Things hath preſcribed to *himſelf*, in the *Production* both of *animate* and *inanimate* Creatures, are homogeneous and uniform; and that as the Earth is the common Matrix of Plants, ſo is the Fallopian Tube in moſt of thoſe Animals that are formed *Ex Semine Maſculino*; for as theſe receive their Nouriſhment, and increaſe by a String, till they are brought into the World; ſo are all Seeds (at leaſt as far as we know) ſupported and nouriſhed by a like String; and the Seeds thrown into the Ground, do again, by the ſame String, whereby they received their Increaſe, convey Nouriſhment to the Seed or Kernel.

SECT. XI.

Of the Seeds of Venus *Looking-Glaſs, or Corn Violets.*

FIG. 458. repreſents one of the Seeds of *Corn-violets*; the Seed is very ſmall, black, and ſhining, and to the naked Eye looks almoſt like a very ſmall Flea, but through the *Microſcope* appears to be covered with a tough, thick, and bright, reflecting Skin, very irregularly ſhrunk, and pitted, that it is almoſt impoſſible to find out two of them wrinkled alike, ſo great a Variety there is even in this little Seed.

SECT. XII.

Of the Seeds of Thyme.

THESE little Seeds, although they differ ſomewhat in Figure and Bulk, yet when looked at through the *Microſcope*, all of them exactly reſemble a dried Lemon, one of which is repreſented at Fig. 459. ſome of them are a little rounder, and of the Shape of an Orange. They have each of them a conſpicuous Part, by which they are joined to their little Stalks, they are a little creaſed or wrinkled, as is expreſſed in the Figure.

Sect. XIII.

Of the Seeds of Poppy.

Poppy Seeds, one of which is repreſented in Fig. 460. deſerve to be taken Notice of among the other *microſcopick* Seeds of *Vegetables*; both for their Smallneſs, Multiplicity, and Prettineſs, and alſo for their admirable ſoporifick Quality, although they grow in a very large Caſe, yet are they ſo ſmall, as not to exceed the Bulk of a very ſmall Nitt, being not above $\frac{1}{31}$ Part of an Inch in Diameter; whereas the Seed Caſe oftentimes exceeds two Inches, and is therefore capable of containing near two hundred thouſand of them. They are of a browniſh colour'd Red, curiouſly Honey-comb'd all over with a pretty Variety of Net-work, or a ſmall Kind of Emboſsment of very orderly raiſed Ridges.

Sect. XIV.

Of Purſlane Seed, &c.

THE Seeds of *Purſlane* ſeems of very notable Shapes, and appear through the *Microſcope* like *Porcelane* Shells, as at Fig. 461. It is coyled round in the Manner of a Spirial; at the greater End, which repreſents the Mouth or Orifice of the Shell, is a white, ſkinny, tranſparent Subſtance B, which ſeems to be the Place where the Stem was joined. Its whole Surface is cover'd with little Prominencies, orderly ranged in ſpiral Rows; one of theſe being cut aſunder with a ſharp Penknife, diſcovered the Shell to be of a browniſh Red, but ſomewhat tranſparent, and manifeſted the Inſide to be filled with a whitiſh green Pulp, the Bed wherein the ſeminal Principle lies *inveloped*.

Fig. 465. repreſents the Seed of *Ben*, it is ſomething like a Kidney, but hath its Circumference rais'd up into double Ridges, towards which ſeveral ſmall Ridges do in ſome Sort radiate from one Center.

Fig. 464. repreſents the Seed of *Chickweed*, this alſo is partly like a Kidney, and partly like a Retort, being rough caſt with ſmall Pieces, as if they were Inſects with little Feet.

Fig. 463. repreſents the Seed of *Bellis Tanaceti Folio*. It hath two triangular Sides, and the third conical; the two firſt have ſeveral Ridges running to the Baſe, the Head triangular with one Side convex, the other two ſtreight with a little Pinnacle in the Center.

Fig. 462. repreſents the Seed of *Wartworth*, or *Sun Spurge*, it is of a very complex

complex Figure, its Belly conſiſting of two *Planiconick* Sides, and back Sphericonick. The Baſe and Head are both flat, in the Middle of the former is a Peg, by which the Seed is faſtened, and of the latter a pointed Knob. The Belly-Sides is hollowed, ſo as to make a flat Rim of equal Breadth; and the Hollows filled up with Bladders, like thoſe of the parenchymous Parts of a Plant.

There are Multitudes of other *Seeds*, which imitate the Forms of divers Sorts of *Shells*; as Seed of *Scurvy-Graſs*, a Kind of *Purcelane Shell*; others repreſent ſeveral Sorts of larger Fruits, *Sweet* and *Pot Marjoram* repreſent *Olives*, *Carrot-Seeds* are like a Cleft of a *Cocoa Nut Huſk*. Others are like artificial Things, as *Succory Seeds* are like a Quiver of *Arrows*, the Seeds of *Aramanthus* are ſomewhat like an *Eye*, the Skin of the black and ſhrivell'd Seeds of *Onion*, are all over knobbed like a Seal Skin, and *Sorrel* has a black ſhining three-ſquare Seed. It is almoſt endleſs to reckon up the ſeveral Shapes of Seeds, they being ſo many and ſo various in their Forms. I ſhall therefore leave them to the further Examination of the curious Obſerver.

The Seed or Powder of the *Fungus Purverulentus*, or *Puff-Ball*, when cruſhed, appears like Smoak to the naked Eye, but when examined by one of the greateſt Magnifiers, is found to be infinite Numbers of little Orange colour'd Globules, ſomewhat tranſparent; in another Sort the Globules are of a darker Colour, each of them having a little Stalk or Tail, which are evidently ſo many minute *Puff-Balls*, * furniſhed with Stalks, to penetrate eaſily into the Ground, and the Miſchiefs they do the Eyes, is probably owing to the Sharpneſs of theſe Stalks,† which prick and wound that tender Organ.

CHAP. XXXVI.

Of the Roots of Plants.

SECT. I.

THE *Root* is that Part of a *Plant* which immediately imbibes the Juices of the Earth, and tranſmits them to the other Parts for Nutrition. It conſiſts of woody Fibres, cover'd with Bark, more or leſs thick, and ariſes from a little Point in the Seed called the Radicle.

We learn by the Aſſiſtance of the *Microſcope*, that Plants conſiſt of different Parts, Veſſels, *&c.* each of which is ſuppoſed to be the Vehicle of a different Humour, or Juice, ſecreted from the Maſs of Sap, which is conſider'd as the common Fund of them all.

* *Phil. Tranſ.* No. 284. † *Derham's Phyſ. Theo. p.* 418.

I muſt