
A N
A P P E N D I X

To the FORTY-FOURTH VOLUME
OF THE

Philosophical Transactions,

Containing some Papers, which were not ready to be inserted in the Order of their Date.

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- I. *Observations upon several species of small water insects of the Polypus kind, communicated in a letter to the President, from Mr. Abraham Trembley F. R. S.*

Translated from the French.

Read May 21, and June 18, 1747. I HAVE, in a Paper printed in the 474th Number of the *Philosophical Transactions*, Art. X. taken notice of several species of small water-insects, all which have been ranged in the general class of the *Polypi*. It was during

during the summer of the year 1744, that the several observations related in that paper were made, and what results from those observations, concerning the figure of these little animals, and their manner of multiplying, is sufficient, if I am not greatly mistaken, to convince any observer, that they well deserve the attention of the curious. I have accordingly since, missed no Opportunity of pursuing my enquiries concerning these insects, and whilst I have been searching for them in different waters, I have occasionally discover'd several other sorts, to which I was before a stranger; but to which I have not been able to refuse some share of my application also. The relations I found these new species of *Polypi* had to those I was already acquainted with, and several particulars in which they greatly differed, equally determin'd me to observe them all, with as much care as I was able.

This undertaking by degrees became both difficult and extensive, yet as I was well persuaded, that if it could be sufficiently pursued, it would greatly contribute, both to rectifie and to enlarge our notions of Nature; I have often regretted both the want of leisure, and the want of assistance for carrying on the work. By assistance I mean the advantages I might have received from the diligence, from the abilities, and from the judgment, of such other observers, as should have been willing to joyn with me in such an undertaking.

The more minute the objects are, upon which we are to make observations, the more diffident should we be of those observations themselves. It is in these cases not sufficient to repeat such observations several times

times by one's self, but it is very proper, and frequently necessary that others should repeat them also, and should even sometimes hit upon the same themselves. And then it is, that by the means of these different observations carefully compared with each other, we may come to be better assured of the various facts we are enquiring about. Besides which it may be noted, that the number of objects, that should in this case be attended to, is really too great to be sufficiently observed by any one single person.

I believe it will not here be improper, to give the description of that *apparatus* I have made use of myself, and by which I have been enabled to make my experiments. This description will render what I have further to say the more intelligible; and will perhaps contribute to make others more capable of judging, what degree of credit should be given to the several facts, I may have occasion to relate. Those also who shall be willing to observe regularly themselves, either the small water-insects mention'd in this paper, or any others they may happen themselves to meet with, will not, I am persuaded, be displeas'd with the description of an *apparatus*, which they will frequently find serviceable to them in their enquiries.

The principal benefit I received from it myself was, that I was thereby enabled to observe with the several magnifiers of my microscope, small water Insects, whilst in a glass containing water sufficient to let them live therein, much in the same way as they would have done, had they still been in the ditches or other waters from whence they were first taken.

If one only proposes to one's self, to examine for some moments the figures and the motions of water-insects, one may content one's self barely with exposing such in the common way to the microscope in a few drops of water. But I dare safely assure, from divers repeated experiments, that it will often happen, with regard to several sorts of these insects, that the simple observation of them in a drop or two of water, will not be sufficient to discover all that is singular either in their shape or motion. It is therefore very proper than an observer should endeavour to examine such insects, when they are more at ease, and in a larger quantity of water. And this he will find still more necessary, if he is desirous regularly to pursue their history. For then the same insects ought to be regularly observed, for many days successively, and they ought themselves also to be as nearly as possible under the same circumstances they would have been, had they remained in the same waters, in which they naturally live.

I have accustomed myself to keep great numbers of the small insects I make observations upon, in large glasses, and it is by observing what passes in those glasses that I endeavour to discover the more general facts, relating to the natural history of these animals. After which, I have found by many repeated experiments, that it is necessary to remove into glasses of a lesser size, like that represented in *Fig. 1.* such of the insects as are to be set apart for more particular and curious microscopical observations. I put water into these glasses, from the same ditches, out of which the insects I am observing have themselves

selves been taken; and I shift this water more or less often as the circumstances may require.

It is easy to conceive, that to observe a small insect in one of these glasses, with a magnifier of a short *focus*, it is necessary that insect should be placed very near to one of the sides of the glass; and that it ought also to be kept steadily in the same place. The insect ought therefore to be either fixed to the side of the glass itself, or to some other body that may be conveniently so fixed. I chuse, for this purpose, substances that are slender and supple, such for example as the small branches or twigs of divers species of the *Equisetum palustre*, or water horsetail. The clustering *Polypi* are often found upon these twigs, and they may be made to settle upon them from elsewhere, as I shall take notice, by and by.

Now this is the way I take, to fix one of these twigs of horsetail against the side of my glass. Having chosen a small slip, upon which there is one or more of the clustering *Polypi* or the like, I take a piece of a peacock's feather, longer or shorter, according to the diameter of the glass I am then to use. From this piece of peacock's feather I cut away all the lateral branches or beards on both sides, excepting one at one of its extremitys; upon this one I make a knot near its insertion, but do not at first draw it close. I then bring this open knot to the small slip of the horsetail that is floating in the water of the glass, and I get one of its extremities into the knot, which I then draw close; and the slip of the horsetail is thus joyned to the piece of the feather. I next take hold of the feather, and bending it near the middle, I force its two ends (TAB. I. *Fig. 4.*) *b, f*, into the

glafs, I then let go the feather which I before held, and its elasticity forces its two ends againft the fides of the glafs *A*, by which means the fmall twig *dl* of the horfetail I have been fpeaking of, and which was already fixed to the extremity of the feather *fd*, becomes alfo fixed clofe to the fide of the glafs; the confequence of which is, that the *Polypus* that is flicking to the horfetail is obliged to remain in fuch a fituation, as to be within the reach of a magnifier that is but of a fhort *focus*.

Nothing more is now wanting, but to place the magnifier before the object: for it would be both difficult and very inconvenient to hold it like a reading-glafs in the hand. In the instrument *k, i, h, g, e*, I make ufe of, it is fcrewed into a ring fixed to a fmall branch *n, g*, which has a ball *g* at its other extremity; this ball fits a focket, and fo makes a joynt, by which the firft branch is joynted to a fecond *h, i*, and that again in like manner to a third *i, k*, or fourth, if there is occafion. The foot of the whole is fitted near the edge, into a fmall board or tablet that holds the whole *apparatus* (*Fig. 4.*). By the means of thefe joynts, the magnifier *e*, may be turned any way, and may be conveniently brought near to its proper diftance from the object, yet as the branch which holds it, cannot well be without fome fpring; it will be ftill difficult to adjust the object exactly to the *focus* of the magnifier when it is fhort, if only the magnifier was to be moved for that purpofe; and it will therefore be found eafier, when the magnifier is once right againft the object, to move gently the glafs in which that is contained, till it is found to be precifely in the *focus* of the magnifier :

magnifier : and for this purpose the small board upon which the glass is placed, ought to be well smoothed.

The light that comes in at a common window will be found sufficient, for observing in the water such objects as are to be seen with the bare eye, or with a hand magnifying glass ; but such as must be examin'd with a *lens* of a shorter *focus*, must be view'd by the light of a taper, placed beyond the glass, and whose flame is so order'd as to be upon the level with the object.

A magnifier thus once adjusted may remain in the same place before the object, for several days together, without being disorder'd ; so that, to observe the progress of the insect during all that interval ; no more will be necessary, than to place from time to time a taper behind the glass, and to apply the eye to the already fixed magnifier.

Several of these *apparatus's* may be placed upon one and the same board by one another ; and thus at the same time observations may be made and carried on upon different sorts of insects, or upon several insects of the same species ; in order to come sooner and with more certainty at the knowledge of the facts one is enquiring about.

could never have discovered the manner in which the clustering *Polypi* are multiplied, but by the help of the expedient I have just described : and before I had the use of that *apparatus*, I only knew in general the figures of those *Polypi*, and of the clusters that contained them. I had taken notice that those clusters grew, and I had reason to suspect, that a whole cluster came from a single *Polypus* ;

but I still wanted to see this increase, and to find the moment of their multiplication; for I had reason already to suspect, from what I had seen with a glass I held in my hand, that these clusters did not grow insensibly like plants; but that on the contrary, the operation I wanted to see was performed in a short portion of time. To come therefore at that moment, I resolved to observe regularly for some time *Polypi* of this sort with my Microscope, whilst they should remain in circumstances, nearly as easy and as natural to them, as those they were in in their proper habitation.

This it was that gave me the first thought of the above-described *apparatus*. And when I had prepared and fixed every thing, I set myself continually to watch for the moment of the multiplication of the clustering *Polypi*; and I then found this moment, which I had so much wished to discover, the very same morning that I began to make use of my *apparatus*.

It was, as has been seen in the paper above referred to, in that species of *Polypi*, some of which are represented in the 5th, 6th, and 7th figures of the 2d plate of the 474th number of the *Philosophical Transactions*, that I first discover'd the manner in which these small animals are multiplied: and it is indeed among several species that I am now acquainted with, one of those in which this fact is the most easy to be observed.

It is also in the same species easy to see that very odd motion, which they exhibit at their anterior extremity.

This same motion, which has also place in other species of clustering *Polypi*, is not in them so easy

to be remarked; both on account that they are lesser, and also on account that this motion itself is swifter, than in the sort above mention'd.

There is also to be observed at the anterior extremity of several other small insects, a sort of motion which has drawn the attention of all such as have happen'd to see it, and who have almost all been curious to enquire and satisfy themselves, whether those little wheels, which appear to turn with so swift and so regular a motion, are really wheels turning upon an axis or not. This has determin'd me now to mention that motion, tho it is not my design to treat fully of it in this place, or to determine very precisely what I think about it: as I shall be very cautious how I assert any thing positively upon so nice a matter, until I shall have repeated again several experiments I have already made, and until I shall have tried several others.

In order to discover what this motion might really be, I have apply'd myself not only to observe it in the same animal plac'd in different altitudes, but also in different species of water-insects in which it is seen, and I have compar'd the *Phænomena* of all these several motions one with another. These comparis'ns I have found in other cases to be of singular use, and the best means of preserving myself from those illusions, which very small objects, view'd in a microscope, especially whilst they are in motion, are but too apt to present.

All I have yet learn'd from these comparis'ns, and all the other observations I have made, seem to concur in proving to me, that there is some deception of the sight in the present case, and that
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the motion in question is not really what it at the first appears to be, a rotatory motion round an axis. And I even know some species of *Polypi*, in which this motion is, comparatively speaking, but slow: and in these it is distinctly seen, that this motion, tho' in general resembling that observed in the others, is not a revolving or rotatory motion: such, for example, is the motion which is taken notice of in that species of *Polypi*, which Mr *Leewenhoek* has described in the 295th Number of these *Transactions*. This is one of those insects whose motion is the most to be admired, and it is besides exceedingly curious upon many other accounts.

I have already said, in my paper above referred to, that the motion in question is very slow in the clustering *Polypi*, just when they are opening again after their division, and I am greatly mistaken, if it may not then be seen very plainly that this motion is not a rotation. The same remark may also be made on the tunnel-like *Polypus*, and that, almost during all the time that it employs in its separation.

I made use of an expedient, whilst I was observing the clustering *Polypi*, whereby I was able to retard the quickness of their motion. I poured by little and little a small quantity of spirit of wine into the glass wherein they were kept. This spirit of wine immediately either abated the velocity of their motion, or took it quite away, according to the quantity of it that I poured in. That which follows both in the one and in the other of these two cases, is of use, and gives light to the present question. Sometimes the spirit of wine forces the
Polypus

Polypus entirely to draw in its lips within its body, and at other times even to detach itself entirely from its pedicle also.

Another way to take off the celerity of this motion, is to remove the insects into a water which furnishes them much more sparingly with food; fasting probably weakens them, and from their weakness arises an abatement in the quickness of their motions. This last expedient is of use and convenience for the observing of this motion whilst it is slower, for several days consecutively. And afterwards upon returning the *Polypi* into water stocked with food for them, the motion will soon be restored to its former briskness.

I remarked also the last winter, that cold deadened the motion of the clustering *Polypi*: and these animals in all probability are less voracious, and eat less in winter than they do in summer.

When the motion in the clustering *Polypi* has been retarded, either by fasting or by the cold, they become whiter or of a paler colour than before, they also then cease to multiply.

I shall not here enter into the detail of the several observations I have made, on the feeding of these clustering *Polypi*, and on the relation I have found between that and their generation; as these are particulars more properly belonging to a regular and distinct account of their natural history.

But what I now propose, is to describe, in a few words, the manner in which the clusters are formed of a certain species of *Polypi*, which multiply in the main like those represented in the figures of the 474th number of the *Philosophical Transactions*,
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and which differ chiefly from them in the form of their clusters.

My chief end in describing here this species of *Polypi*, is to enable myself afterwards, to convey, by comparison, a distinct idea of a difference well deserving attention, that is to be observed between the manner of multiplying these, and that of another species of clustering *Polypi*, which I happened to discover the last year.

The reader will please to recollect what I have said in the foregoing paper, concerning the general manner in which clustering *Polypi* are multiplied. These little animals are nearly of a bell-like form. Their anterior extremity, in which is their mouth, and which may be looked upon as their head, is that which is hollowed inwards, and resembles the open end of the bell. Their other extremity terminates in a point, and to this point is fixed a stalk or pedicle.

The *Polypus*, when it is ready to divide, first draws in its lips into the body. It then by degrees puts on a round form, and presently after the little spherical body so formed, divides itself into two other like spherical bodies. These last in a few moments again insensibly open, they then lose their spherical form, and put on that of a bell, or of a *Polypus* as perfect and as compleat, as that by the division of which it was formed. This is the manner in which several species which I have observed of clustering *Polypi* are multiplied: the whole operation is performed by that sort, of which I have spoken in my former paper, in three quarters

quarters of an hour or an hour by those I am now going to speak of.

The *Polypi* of this sort are lesser and whiter than those others, which are represented greatly magnified in the above-mentioned figures. The cluster which they form rests upon a stem easie to be remarked: this stem is fixed to some other body at its lower extremity, and from its other arise branches, making obtuse angles with the stem itself, other branches again set out from these in different places, and from these last other new ones, and so on. At the extremity of each branch may be seen a *Polypus*: and as all these branches are not of an equal length, so neither is every *Polypus*, as in the other species, at the top of the cluster, or at an equal distance from the base of the stem, but on the contrary, there are here *Polypi* to be discovered at all heights in the cluster. The assemblage of all these branches forms, together with the *Polypi* at their extremitys, a very pretty cluster or groupe, much resembling a tuft or a garland of flowers.

The stem, which carries all the cluster, and every branch in it, is capable of a remarkable sort of motion. Each will contract suddenly when it is touched, when the glass containing the cluster is moved, and even sometimes when no reason is to be perceived for their so contracting (*Fig. 6. a*). The stem and the branches contract and shorten, by disposing themselves into spirals, all whose rings nearly touch each other. Every branch is by itself capable of contraction, independently of the rest: tho it but rarely happens that any one branch does contract itself quite alone, for commonly in the action of con-

tracting it happens to touch some other branch, and then that other immediately contracts with it. When the main stem, which bears the whole cluster contracts itself, then all the branches of the cluster contract together also; and the whole becomes entirely closed. A moment after, the branches and the stem again extend themselves, and the whole cluster thereby recovers its ordinary figure. But when the cluster is considerably advanced, the stem then ceases to contract itself any more.

I shall now attempt to describe the manner in which this cluster forms itself.

A single *Polypus* detaching from the cluster, swims about in the water till it meets with some proper body to fix itself upon. It then *has* a pedicle but which is not longer than the *Polypus* itself. In the space of 24 hours this stem becomes 8 or 9 times as long as it was at the first: and it is this pedicle which is to become the main stem of the new cluster. About a day after the *Polypus* has been thus fixed, it divides itself into two. Ten or twelve hours after, these two *Polypi* again divide themselves each into two more: they soon after put out branches, and thus retire to a greater distance from each other. It is now necessary to take notice, that when two of these *Polypi* are thus formed by the division of one, the one is ordinarily much larger than the other: this larger one remains at the extremity of the branch where it was, but which branch lengthens it self more, whilst the other puts out a new branch which seems to proceed from the first. The larger of these *Polypi* again divides it self generally before the other; and all I
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have been describing is reiterated several times. Thus a principal branch is formed, provided with several lateral ones. These lateral branches become principal, with regard to those which in their turn seem to spring from them, when the *Polypi* at their extremitys come to divide. All the *Polypi* of a cluster do not detach themselves from it at the same time: those which are nearest to the origin of the branches usually detach themselves first. And every *Polypus* so detached, goes and fixes itself elsewhere, every one thus becoming at last, if not prevented, the principal of a new cluster.

I have often kept *Polypi* of this sort, in glasses of the size of that which is represented in *Fig. 4.* And the first cluster I had placed in it to observe its growth and progress, continued still well provided with *Polypi*, when there were already numbers of other clusters formed in the same glass, all which owed their being to those that had detached themselves from the first cluster. I have seen sometimes, portions of the peacock's feather in the water, entirely covered with these clusters: and I was well assured that all these clusters came from the first I had lodged in the glass. Nay I have even carried my experiments so far as to be well assured, that every *Polypus* of a cluster, as soon as detached and fixed elsewhere, became the principal of a new cluster. I mention this fact particularly, because I shall make some use of it hereafter, when I come to take notice of a difference, between this species of *Polypi* I am now treating of, and another species I shall have occasion to say somewhat about by and by.

When a cluster is already in good part stripped of its *Polypi*, the branches are no longer able to contract with the same quickness and readiness as before. When there remain but a very few *Polypi*, none but those branches to which *Polypi* are still fixed continue to exert this power; which *they* also lose as soon as they are stripped of their few remaining *Polypi*, after which they shew no further capacity of moving.

From all which particulars it seems to result, that this motion in the stem and in the branches of a cluster, is entirely derived from the *Polypi*, which are fixed upon the branches. Notwithstanding which it must be acknowledged, that an observer, attending to the appearance only of this motion, can hardly help persuading himself at the first, that they are the branches, which draw and give motion to the *Polypi*.

The resemblance and the analogy, which the figure of a cluster of *Polypi* bears to the figure of a plant, would induce any observer, for some time to imagine, that the *Polypi* which he sees fixed to the branches of the cluster, do really proceed and spring from those branches, in the same manner as the leaves, the flowers, and the fruits of a vegetable, spring from the branches of the same.

It is nevertheless the contrary of all this, that is true. The branches, composing the clusters of the *Polypi*, spring from the *Polypi* which are at their extremities. These *Polypi*, which at the first appear to be the fruits of the clusters, may more properly be considered as their roots: and of the truth of this any one may easily satisfy himself, who will
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be at the trouble of examining regularly, and for some continuance, the whole progress of a cluster of these *Polypi*.

What further proves that these branches do really spring from the *Polypi*, and that they derive their nourishment from the same, is, that the branches constantly cease to grow, whenever the *Polypi* at their extremities are detached from them, either naturally or by any accident.

The *Polypi* of another species I am now going to speak about, form also a groupe resembling a cluster, or more properly an open flower. This flower or cluster is supported by a very distinct stem, which is by its lower extremity fixed to some of the aquatic plants or extraneous bodies that are found in the water. From the other extremity of this stem set out eight or nine branches, quite differently disposed from those of that species of *Polypi* I have been last describing. These eight or nine branches are perfectly alike, but it may be noted, that what I here call by the name of a branch, is indeed the assemblage of several other lesser branches, whose collective form much resembles that of a leaf. (*Fig. 4.*). Every one of these assemblages is composed of one principal branch or nerve, which makes with the main stem of the cluster an angle somewhat greater than a right one. From either side of this principal nerve others again set out, and these lateral ones are the less extended in length, the nearer their origin is to the extremity of their principal branch. There is a *Polypus* at the extremity of this principal branch, and another at the extremity of every one of the lateral twigs.
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There are others also on both sides of those lateral twigs, at different distances from their extremities, and these are more in number or fewer, in some proportion to the length of the twig itself. These *Polypi* are all exceedingly small, and of a bell-like figure, and they discover about their openings a quick motion, very difficult to be seen with any distinctness.

There may also be observed in several places, upon the branches of these clusters of *Polypi* (*Fig. 7.*) certain round bodies, which I at the first took for insects preying upon the *Polypi*, because I was acquainted with some such, nearly of that shape and size: but I shall presently give an account of what those round bodies really are.

Every cluster has, as I have said, eight or nine of these branches or leaves such as I have just described. They do not all of them set out from the same point; but the points from whence they do set out are not far asunder: each of these leaves is a little bent inwards, and they all form together a sort of a shallow chalice or cup. If the eye is placed right over the basis of this chalice, the appearance of the whole eight or nine branches is like unto that of a star with so many rays proceeding from the same center.

When the cluster is touched, and even frequently without it, all the branches fold together inwards, and then constitute a small round mass. The stem, which carries all the cluster, contracts also at the same time, folding it self up like a workman's measuring rule, that consists of three or four different joyns.

I saw

I saw for the first time the *Polypi* I have now been describing, on the 30th day of *May* of the last year 1746. They were upon a water-plant, which I had taken from a ditch, and disposed in one of my large glasses. They immediately struck me by their beauty, and I could not help being curious to know, in what manner such clusters were formed. The relation they bore to the species first above described, and to some other species which I had before observed, gave me reason to believe that the cluster must have sprung from a single *Polypus*, by the means of several successive divisions. I was not however contented with judging of them from analogy only; I was desirous to be actually an eye-witness of their operations; and the observations which I therefore made upon them, discover'd to me a new fact, which I should never have suspected, and which I could never have come to the knowledge of, if I had contented my self with the judgment I made of them from Analogy only.

I supposed, when I began to observe, that every cluster in question came from a single small *Polypus*, like to those with which the clusters were so plentifully provided. I therefore began by endeavouring to get one of these *Polypi* single, and fixed upon such a body as I could well dispose in my glass, so as to keep it within the reach of a magnifier of a short *focus*; and I pursued for this purpose my ordinary method.

I took some clusters of these *Polypi* well advanced, I put them apart in a glass filled with proper water to afford them sustenance; I put also into the same glass a slip of water horsetail, after I had
carefully

carefully examined it, and so assured myself that there was no *Polypus* upon it. I expected that some *Polypi* would soon detach themselves from the clusters, and that some of those *Polypi* would fix upon the horsetail, whereby I should be enabled to set them apart, and to observe in other glasses the progress of the clusters, which would, as I made no doubt, be soon produced from them.

It was on the 30th of *May*, that I set the clusters apart in the glass; on the 31st I could discover nothing new, and on the 1st of *June* I had no opportunity of observing; but on the 2d in the morning I found against the sides of the glass several small clusters of *Polypi*, of the species I am now treating of. I was surprized to find them so far advanced, for they could not have begun at the soonest before ten a clock at night, on the 30th of *May*. I saw on the 2d of *June* in the afternoon upon the slip of the horsetail, which I had placed in the same glass with the clusters of the *Polypi*, a small body, which, as I had all reason to believe was newly fixed upon it. I then took out the slip of the horsetail, and I lodged it with the small body that was upon it in another glass; after which I examined that small body with my microscope, by the help of the *apparatus* first above described.

I then found that this body was much larger than any of the *Polypi* of the present sort, and of a figure very different from them (*Fig. 8.*) This made me suppose that this body was not of the species of the *Polypi* now before us, and that it was not from any thing of this sort that I was to expect the production of a cluster of
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this species of *Polypi*. I resolved however to continue my observations upon this minute body ; which was oblong, and had a pedicle three or four times longer than it self.

It was on the second of *June* at 5 in the evening that I put it apart in a glafs, and at half an hour after 8 the same evening, I perceived that it began to split from the top towards the bottom. When the separation was accomplished, each of the two bodies, formed by this division, was nearly of the same shape as the first (*Fig. 6.*). I then thought, judging still by analogy, that it would be some time before either of these bodies would again be ready to divide ; but a very little after, I saw that they both became round, and that they disposed themselves precisely as if they were again going to separate. This novelty drew all my attention, and it again came into my mind, that this body which I had but just concluded not to contain the principle, from whence I was to expect the production of one of the clusters I was looking after, might possibly still be the very thing I was seeking for.

I now imagined that perhaps these bodys would again divide and subdivide themselves, till they should come both to the shape and to the size of the *Polypi*, which I had seen upon the clusters : I however looked upon this Idea but as a mere conjecture. The two little bodies did in effect divide presently after ; but the 4 which resulted from this division (*Fig. 7.*) had neither yet the form nor the minuteness of the *Polypi* in question. I now wanted to know whether these 4 bodies would again proceed to divide without interruption ; and I saw them a

little after again prepare for another division : this division was completed at 20 minutes after eleven, and at midnight the 8 bodies which were formed by this third division were again almost compleatly divided. The cluster was then composed of 16 *Polypi* ; and I from that moment no longer doubted, but these were clustering *Polypi* of the species I have been last describing. Among these 16 *Polypi*, there were some which had already the perfect form of those I had observed upon the more advanced clusters : and these were such as were nearest to the origin of the branches.

Few of these 16 *Polypi* were of an equal size, those which were the most distant from the origin of the branches, were the largest, and their form also was the least like to that of a bell. I found at three in the morning on the third of *June*, that the number of the *Polypi* in the cluster was considerably encreased ; they were 16 at midnight, and I could now tell 26, tho I could only see part of the cluster, the rest of it being beyond the *focus* of the microscope : and at half an hour after 7 in the morning, I counted at least 40 *Polypi*, in that same part which I could see of the cluster.

In order to judge with more certainty of the progress of the multiplication of these *Polypi* ; I counted also those of another cluster, which was so situated as to be entirely within the reach of one of my magnifyers. This cluster began to be formed about 8 in the evening of the 2d of *June* ; I mean that it was then, that the round body first began to split it self into two. At 11 the same night, that cluster consisted of 8 *Polypi*, at half an hour after 7 the

next

next morning of 64, and before night of 110 at the least. So that in about 24 hours there were formed, by repeated divisions of one single round body, no fewer than 110 *Polypi*.

The cluster I first spoke of continued to increase from the 2d of *June* at half an hour after 8 at night, when it first began to form fit self, till the 13th, when the *Polypi* began to detach themselves from it; and there remained no more upon the cluster on the 15th.

The *Polypi* which are at the extremitys of the principal branches are constantly the largest, they are those which divide themselves the most frequently, and one of the 2 *Polypi* resulting from this division is generally larger than the other. The largest remains at the end of the principal branch, whilst the lesser serves to form a lateral branch, and is it self the principal of all the *Polypi* which that lateral branch is to bear.

One can hardly now be without curiosity to know, what those round bodies really are; those sort of bulbs which contain in themselves the principle, from whence these whole clusters we are speaking of are to be produced. What gives origin to these bulbous bodies? Are they produced in the clusters by divisions and subdivisions, as the *Polypi* themselves are, which in other species are themselves the principles of the clusters? In these other species, every *Polypus* may become the principle of a cluster and of a groupe of *Polypi*, as soon as it has detached it self from the cluster where it had its origin. When one of these has once fixed alone any where and divided it self, it no ways differs either in shape

or in size, from any of the *Polypi* that were in the cluster it is now parted from, or from any of those others that will be formed in the cluster, it is by its own future division and subdivisions to produce. But how is it with the new species we are now considering? Does every *Polypus* among these, as soon as detached from the cluster, fix it self also elsewhere, and there give origin to a new cluster? Or are they only the bulbous bodies above mentioned, that have this prerogative, of being capable to produce a new colony?

These questions and doubts greatly raised my curiosity, from the time I first began to see the progress of a cluster of *Polypi*, formed by the division and the subdivisions of one of these round bulbous substances: and that which now follows, is what I have been able to collect from the various observations, and from the several experiments, which I made, whilst I was endeavouring to give my self some satisfaction with relation to the same doubts and questions.

To know, whether the *Polypi* which detach themselves from these clusters do each of them contain in themselves the principles of other new clusters, I took all the precautions I had taken in other cases, and such as I had found easily to succeed with the clustering *Polypi* of other sorts. But all was to no effect, and I could never find that any thing was produced by these *Polypi* so detached. I have therefore all reason to presume, that these *Polypi* do not contain the principles of new clusters, and it seems to me the most probable, that they all perish without ever producing any thing whatsoever.

When

When I first began to seek for the origin of the round bulbous bodies I have been speaking of, I immediately recollected those other round bodies I had before taken notice of, and which I at the first suspected to be insects preying upon these *Polypi*. I therefore again sought for them in the clusters already formed; I soon found several of them, and I perceived that they neither attacked the *Polypi* nor changed their situation. I then concluded that these round bodies were really the very bulbous ones in question, and whose origin I was now seeking for: I applied my self therefore to observe several of them, and these are the facts which I then discovered.

Some days after the clusters had begun to form themselves, I saw come out, not from the extremities of the branches, but from the bodies of the branches themselves in different places, small round buds, which grew very fast, and which arrived at their greatest size in two or three days. These bodies much resembled the galls which grow on the leaves of oaks; they were placed upon the branches of the clusters, just as those galls are usually placed upon the fibres of the leaves: and these bulbous substances do really contain the principles of the clusters.

Two or three days after these bulbs have begun to form, they detach themselves from the branches out of which they sprung, and go away swimming till they can settle upon some body, which they meet withall in the water, and to which they immediately fix themselves by a short pedicle. The bulbs are then nearly round only a little flatted on the
under

under side, the pedicles continually lengthen themselves by degrees for about 24 hours, and during the same time the bulbs also change their figure, and become nearly oval. There are in a cluster but few of these bulbs, in comparison of the great number of *Polypi* that are upon the same; neither do these bulbs all come out at the same time.

It is now easy to judge of the remarkable difference there is between the two sorts of clustering *Polypi* that are described in this paper.

The clusters of the first species of *Polypi*, and those of several others which I have also observed, do all come from *Polypi* detached from the clusters already formed. But the clusters of the *Polypi* of the second species here described, do not arise from *Polypi* detached from other clusters, but from round bodies or bulbs, larger than those *Polypi*, and of a form very different from them.

These bulbous bodies are not formed like the *Polypi*, by the division of others like themselves, but they spring from the branches of the cluster, as the flowers and the fruits of a tree spring from the branches of the same.

In diverse other species of *Polypi*, there are considerable intervals of time between their divisions. In the bulbous kind, if I may call it so, the first divisions are consecutive and follow hard upon each other, nor is there any interval of time between them, until the bodies which are to divide have already acquired the shapes of *Polypi*.

The clusters of the bulbous sort have an origin entirely different from those of the other sorts of clustering *Polypi*. Yet do these clusters enlarge, and the
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the *Polypi* upon them multiply, in the same manner as those of the other species which I am acquainted with.

As I relate facts that are new, and as I am also, if I may so speak, under the necessity of mentioning new relations and analogies, I find my self under great difficulties, to find proper terms to express those relations and analogies.

I shall not here enlarge upon the analogies which may be found, between the origin of the minute animals I have been speaking of, the origin of plants, and the production of those other animals we have been hitherto more acquainted with. We shall better be able to judge of those analogies, and to compare them together, when we shall come to know more both of plants and of animals, and when we shall have made observations upon greater numbers of them.

The new and the surprizing facts, which the study of natural history lays before us more and more every day, are fully sufficient to convince us, that the nature both of plants and animals is as yet but very imperfectly known to us, and indeed much more imperfectly than many have been apt to imagine. All we do know is but very little, in comparison of what yet remains to be known: and this consideration should prompt us, still more assiduously and more diligently, to enquire after truth; as it should at the same time also make us exceedingly circumspect, and very cautious how we venture to make judgments upon the nature of things, or how we form to our selves general rules, from so few principles as we are at present masters of.

Explanation

*Explanation of the figures in TAB. I. referred to,
in the foregoing Paper.*

The 4th figure in TAB. I. represents the necessary *apparatus*, for observing commodiously and regularly a *clustering Polypus* with the microscope. In the glass *A*, is the end of a peacock's feather *b, c, f*, bent at *c*, and whose extremities are by the spring of the feather, kept close against the sides of the glass. At one of the ends *f* of the feather one of its beards is left on, which is long enough to fasten to it in *m* a slip of water horsetail *dl*, upon which is a *Polypus*, which is by this means kept so close to the side of the glass, as to be within the reach of a magnifyer of a short *focus*, such as *e*. This magnifyer is screwed on to a ring whose arm *ng* has at its extremity *g* a ball playing in a socket so as to make a joynt; there are again other like joynts at *h* and *i*, and by the help of these the magnifyer may be moved every way, and be conveniently brought near to the object. The foot *ik* is stuck into the board upon which the glass is placed. The light of a window in the day-time is sufficient to observe an object so placed within the glass, either with the bare eye, or with an hand-magnifyer: but if a magnifyer of a short *focus* is necessary, the shutters must be closed, and a wax light must be placed behind the glass, at such a height as to have its light fall directly upon the object; and a magnifyer so placed may remain if there is occasion for several days in the same posture without any inconvenience.

The

The 5th figure exhibits a cluster of *Polypi*, of the first of the two species described in this paper, and which is here considerably magnified.

The 6th figure shews another cluster of *Polypi* of the same sort; the number of the *Polypi* here shewn is but small, because the cluster was drawn as it appeared within 2 or 3 days after it had first begun to form it self. One of the branches of this cluster is partly contracted, and they may be seen in this situation, when a branch after contracting it self is again expanding to its ordinary state. This cluster is yet considerably more magnified than that exhibited in the 5th figure.

The 7th figure represents one branch of a cluster of *Polypi* of the second species described in this paper. There may be seen upon this branch, besides the *Polypi* which are of a bell-like form, some of those round bodies from which the clusters of this kind of *Polypi* do first spring; and which remarkably distinguish it from many other species.

The 8th figure represents one of these round or globular bodies, after it has parted it self from the cluster, has fixed it self to some other body, and after that the globule it self and its pedicle have begun to lengthen. It was in this condition on the second day of *June* at 5 in the evening.

The 9th figure exhibits the 2 bodies, that were formed by the parting of that represented in the 8th figure. This parting began at half an hour after 8, and was completed at 9 the same evening.

The 10th figure represents the four bodies, which were formed from the 2 represented in the 9th figure; and these four bodies were also formed before 10 of the clock.

Fig. 1. p. 575.

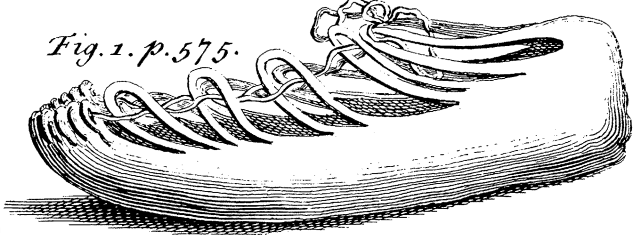


Fig. 2. p. 575.

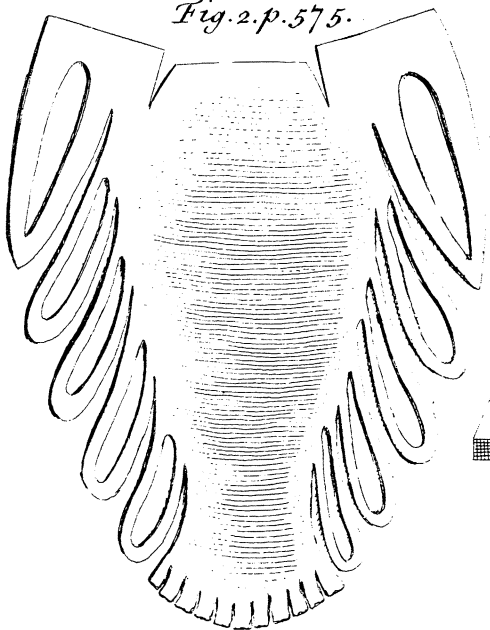


Fig. 3. p. 575.

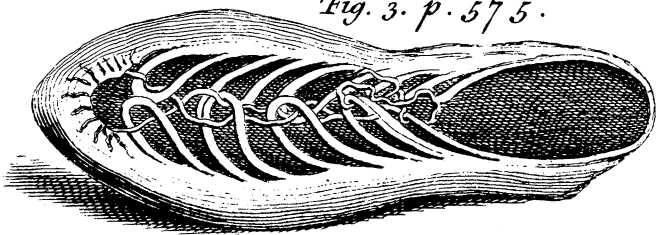


Fig. 4.
p. 630
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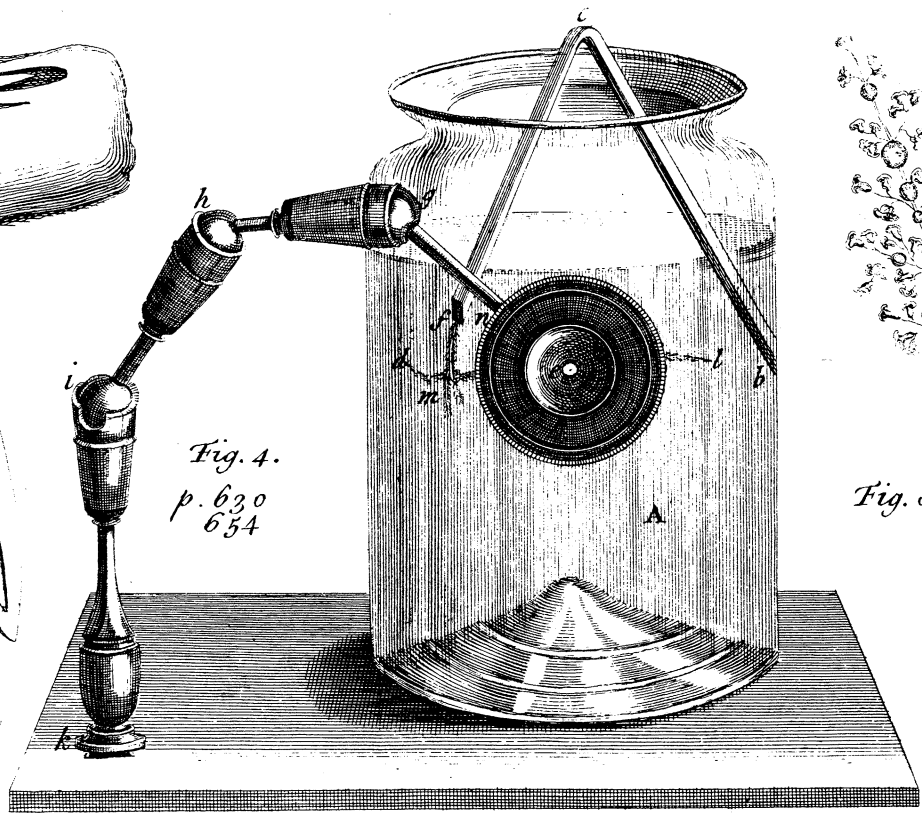


Fig. 7.

p. 644
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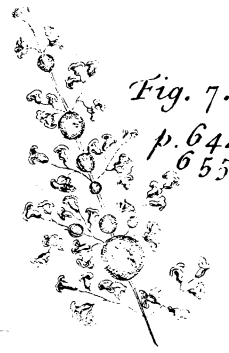


Fig. 8. p. 646
655

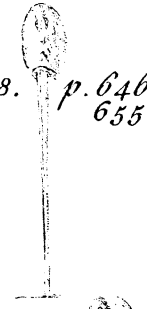


Fig. 6. p. 639. 655.

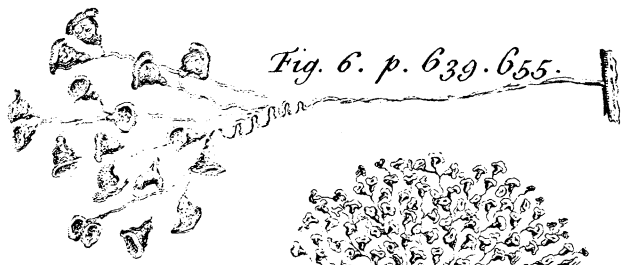


Fig. 9.
p. 655.



Fig. 5.
p. 655.

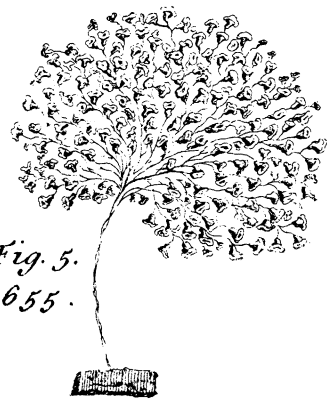


Fig. 10.
p. 655.