

I. *Two Letters from a Gentleman in the Country, relating to Mr Leuwenhoeck's Letter in Transaction, No. 283. Communicated by Mr C.*

June 21.

Dear Sir,

YOurs of the 10th instant found me at *W.* where I also met the *Transact.* No. 283. which you sent last. Finding something in it from *Mr Leuwenhoeck*, I greedily run it over, and must own that I was a little mortified to see in it an account of a Creature which I thought I had a sort of Propriety in, and of which I had made a Draught, with a design to present you and *Mr C.* with a rarity, which I believed nobody had met with but my self. However, *Mr L.'s* Picture of it being so small, I thought my Sketches would not be unacceptable, because they not only confirm his account, but may contribute to give you a more perfect Idea of so odd an Animal: I found it the beginning of this Month in some clear Water, which I took up in a Ditch at *W.* in which, with my utmost attention, I could discover no more than this one of the same kind. Fig. I. represents it in one of the postures it appear'd the first day (for it varies every moment) and the knob at *a*, which lookt like the Gut *cæcum*, was sometimes a little more lengthen'd; two days after I could perceive two or three white Fibres at the end of it, and on the fourth day, the Animal lying stretch'd at its full length, appear'd as in Fig. II. and I plainly saw, that what I thought an excrecence was a young one, with 5 horns coming out of the side of the old one, and the
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next day I found it in the Water entirely separated from the body, and was about one third of the length of the Parent. The formation of the horns are well figur'd by Mr *L.* and they issue (like *radij*.) not from the extremity, but quite round a small knob, which I take to be the Head. The Horns have a vermicular motion, and are extended or shorten'd both altogether and severally. The other end is flat at the extremity, and he often fix'd it (like a *Leech*) to the bottom or side of the Glas in which I kept him. He also contracts and dilates his body at pleasure, and especially, when touch'd or disturb'd, will bring both Body and Horns into a small compass, and has then the appearance of Fig. 3, and 4. The Horns are perfectly white, and the Body yellowish, and to a naked Eye not easily discernable in the Water, it being when extended no thicker than a good Horse-hair.

The small Plant mention'd in the same *Transact.* is the *Lens Palustris* or *Duck-meat*, which floats plentifully on our Ponds or Ditches. But I must dissent from Mr *L.* where he says it does not come originally from the bottom, for I very well remember that many years since, the late *W. Ch. Esq;* Chew'd me the manner of its springing out of the Mud; and we often observ'd, that when the Leaves were grown to a competent size, the force of the Water easily drew the minute single fibr'd Root, and rais'd the Plant to the surface. I own that the Leaves when floating do continue to grow, and may be increas'd after the manner he mentions, and I have often taken the young Plant which he pictures out of them, so that they may be call'd Seeds more properly than Leaves; and my opinion is, that toward the end of the year, upon their corruption, they sink to the bottom, and there take root, so as to continue the succession.

The *Animalcula* which Mr *L.* describes sticking to the Root of the Plant, I have often observ'd, not only in Water Plants, but adhering to the bodies of many sorts of
Water

Water Insects, which I have seen cover'd almost all over with Tufts of them, each Tuft being made up of many *Animalcula*, which appear not much unlike to the Flowers of a Lilly or *Fox-Glove*.

This Congeries of *Animalcula* will lengthen and contract themselves both altogether and severally, and I have observed them, when they lye at length, to put out some wonderfully minute Organs like small Feet (not easily discern'd even with my best Glasses) which by their quick agitation bring a current of Water from all sides toward them. But I was never so fortunate as to see that motion in them, which he says is like that of a Mill wheel; nor indeed can I perceive the possibility of such a Rotation of any Member in an Animal mechanism. But I think I can easily account for this mistake of Mr L. or rather of his Painter; for in the same Water wherein I have seen these Plants and *Animalcula*, I have observed a small round Creature, whose many Legs stand like *radij* all about its Body. This has a swift progressive motion, but will very often lye still (when only you can perceive those *radij*) and then turn very swiftly round like a Wheel, sometimes one way, and then stop and turn the other way, without stirring an hairs breadth forward. Now 'tis very probable that one of these might shew its tricks so very near to, or among a Tuft of the other fix'd *Animalcula*, that it might be very well taken for part of the same, and I am very confident this is matter of Fact.

These *Animalcula* are sometimes seen loose, but generally they are fix'd in clusters by their Tails to other Bodies, and perhaps cannot separate themselves; and I think it no mean instance of Providence, that many kinds of Water Insects which are so fix'd, and even some of which have but slow and irregular motions, are furnished with such Organs about their Head, the vibration of which, brings a constant current towards their Mouths, and with that, Food for their Support, otherwise they would be starv'd for want of Nourishment.

If you ask what Insects those are, on whose Bodies I have seen these *Animalcula*, I must tell you they are of divers sorts, and that I have observ'd no small variety in the water of our Ditches, not only of reptiles, and the Catterpillar kind, but of Eeles and perfect Shell fish, both Crustaceous and Testaceous, and have been so pleas'd with the Beauty of some of them, that I have kept them many weeks by me, as an agreeable entertainment for such as are curious; and farther design'd, if I could have met with a good hand in the Country, to have got some Figures of them, which I had attempted my self, but with no satisfaction. However, having preserv'd two tolerable Scetches of two sorts of the Crustaceous kind, I venture to send them you, since tho much to the disadvantage of their Beauty) they will give you a better notion of them than any thing I can write. Fig. V and VI shews them as they lye with their back towards you in a swimming posture, but the Members and Legs on the other side are so various, and so much more curiously form'd than those of Lobsters and Shrimps, that I despair'd of giving any tolerable representation of them in any other position. These are about the same size, the biggest being rather less than a very small Flea, and the least a little bigger than a Mite, but all are Breeders, and carry their Spawn at their Tayl, that of Fig. 5. in two Bags (one on each side) which are fasten'd about the 5th joynt, and the other in a single Bag or Film under the Tayl, and I have often seen these Bags broken, and the Spawn (which is globular and large in the proportion to the Fish) scatter'd through the Water. There is also among these a third sort of the same kind, not less elegant, tho far less in bulk, which is shap'd more like a Shrimp, and carries its Spawn like that, but I could never make any Figure of it worth preserving; one thing I had like to have forgot which is very remarkable, that all these three species (as also some other Water Insects) are certainly monoculous, and have their Eye exactly in the middle of their

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head, and I could never with my utmost application find so much as a dividing Line in it. Some of them, especially in some Waters, are dark and cloudy, but they are generally so transparent, that through the Shell I can see the peristaltick motion quite through their whole length, and a constant pulsation of a part, which I guess is the Heart, but I could never discover any course of Blood in them (nor even in Shrimps themselves which are as large as some thousands of these) tho I have seen it plainly in Creatures a little bigger, viz. the smallest new hatch'd Spiders, and in that Water Insect which is describ'd and pictur'd (tho not accurately) by *Swammerdam*, under the (very improper) name of *Pulex aquaticus*. But this is of the Testaceous kind, of which I have seen a greater variety (and not less curious) than of the Crustaceous; but 'tis too late to call a new Cause.

July 5. 1703.

Dear Sir,

Since my last, I have farther observ'd the *Lens palustris*, and am fully satisfy'd of the truth of its first springing from the bottom. I lately took up some on the shallow side of a Pond, and found the ends of the Stalks (most of which were at least 5 inches long, and as thick as a strong Horse-hair) manifestly radicated in the bottom, so that I could not take them up without raising the Mud with them, which also adhered very visibly to them. These Stalks or Roots are of a curious texture, and almost transparent, and I have seen their outside very prettily cover'd with a regular sort of Net-work. The Draught in the *Transact.* No 283. is very stiff, and ill represents them.

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In my observation of these Stalks, I often saw adhering to them (and sometimes separate in the Water) many pretty branches, compos'd of rectangular oblongs and exact squares, which were joyn'd together, as you may see in Fig. VII which I drew as exactly as I could from one of them. There are often twenty or more of these Figures in one branch, which generally adheres at one end to the Stalks of the Plant, and I think it remarkable that these rectangular parallelograms are all of the same size, the longest side not exceeds $\frac{1}{4}$ of an hairs breadth, and that the length is just double the breadth, the squares being visibly made up of two parallelograms joyn'd longwise. They seem very thin, and the texture of every one is nearly the same. To a very large Magnifier they appear as in Fig. VIII. I took these branches at first for Salts, but finding them always of the same size, and that there was no sensible encrease of their bulk while they continued in the Water, that after they had lain a day or two dry on a Glass Plate they alter'd not their Figure, and upon the addition of new Water (warm or cold) they had still the same appearance and cohesion, and that their adherence (tho touching only in the angular points) was so firm and rigid, that all mov'd together, and kept the same position in respect of one another, however, agitated by the Water; these considerations, I say, perswade me, that they may be rather Plants than Salts, but they being so very minute that no judgment can be made of 'em but by the Eye, I shall not determine any thing positively.

In some Water which I took out of a Pit, I found a small Water Newt, not an inch long, which I suppose was of this years hatch, and the Legs being so small as not readily to be discern'd at first view, and the body very clear, I took it at first sight for a Fish. This I kept by me (in lieu of Tadpoles) to shew the circulation of the Blood in its Tail. But that was not the only entertainment it gave me, for I found the course of the Blood in every part of its Body,

and particularly in every digit of the Feet, it was a curious sight to observe the Stream come to the extremity of the Toe in one Channel, and return by another. In this Newte just below the setting on of the head on each side are three little rugged fleshy branches, which he spreads like Fins, and which help to poise his Body. Observing these with the Microscope, I found each of them divided (something like a Leaf of Polipody) into a great many pointed branchings, in each of which (as in Toes) I can see the Blood come to the extrem point on one side, and return on the other; and this is the more entertaining, because 30 or 40 of these branchings will sometimes appear at one view, and the Blood seen distinctly circulating in all. For as Mr *Comper* rightly observes, the Globules of the Blood of these Creatures are very large, so that I can see the Circulation in them very well, even with the smallest Magnifiers, which take in a great *Area*. And from what has been said of this course of Blood, I am perswaded, that these Organs in the Newte are not only design'd to be serviceable in their Swimming, but (tho they have Lungs like a Frog) may be also Analogous to the Gills in Fishes.

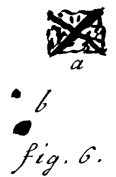
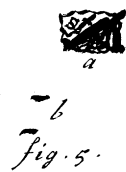
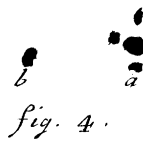
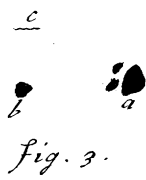
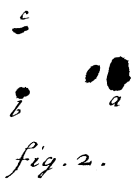
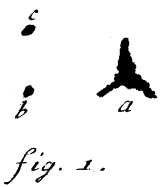
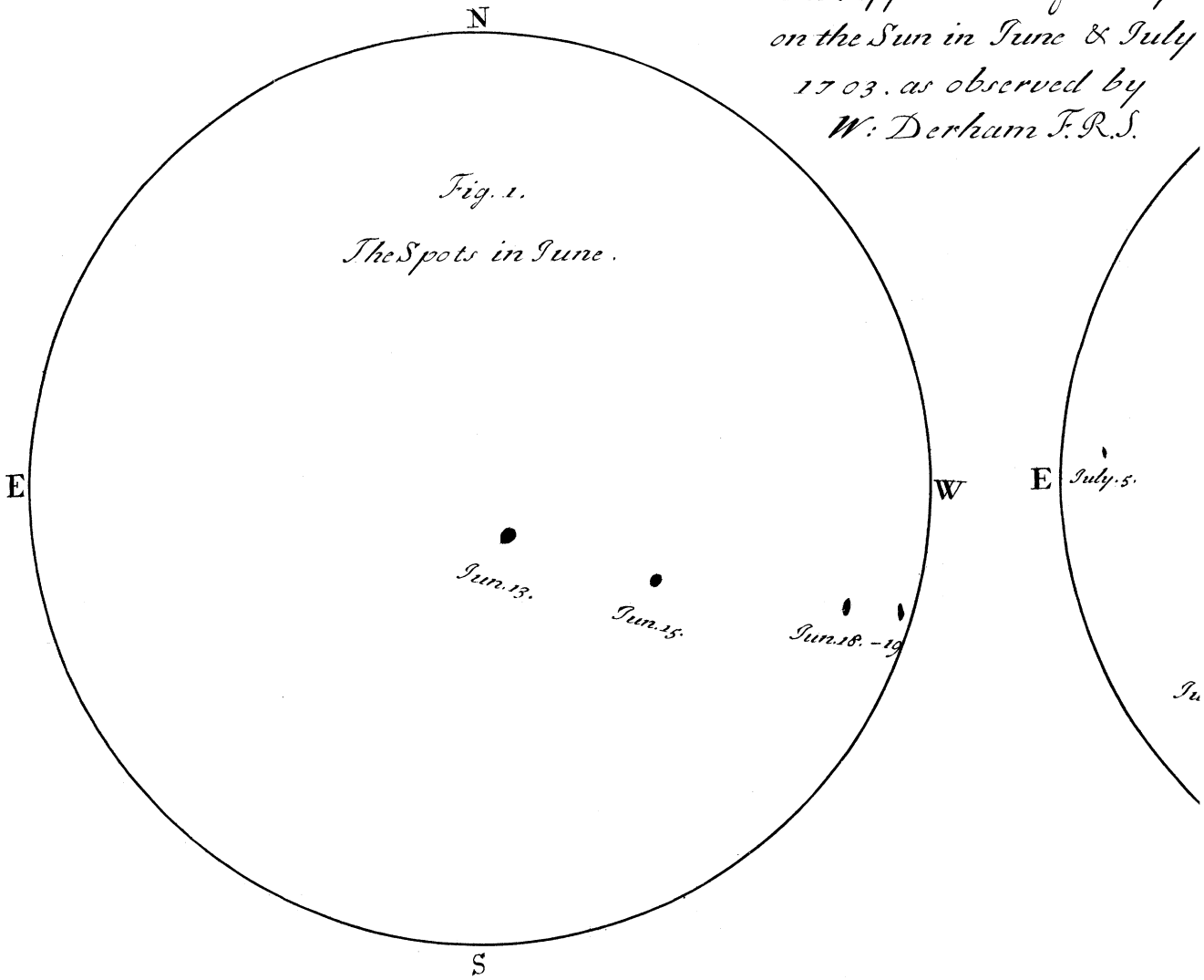
In my examination of the Waters of our Ditches (in which I daily find new varieties of *Animalcula*) I had the good luck to meet with great numbers of those round Bodies, mention'd by Mr *Leeuwenhoek* in the *Transactions*, No 261. *Anno* 1700. which are there so well described, that I should not have again spoke of them, only that I saw a very surprizing Phœnomenon while I was observing them. Each of these spherical Bodies (which are smaller than a Mustard Seed) have a constant progressive motion, and at the same time a slow revolution about their own axe, and contain within them other small Globules, some more, some less, but I never found above 10 in any one, and these I have seen move and change their position within the other, which Mr *L.* says he never observed. While I had one of these Bodies on a Glas plate before my Microscope, I saw

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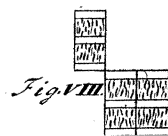
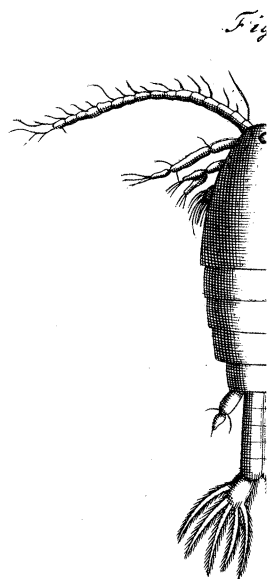
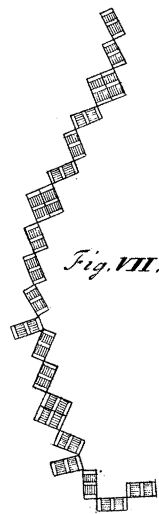
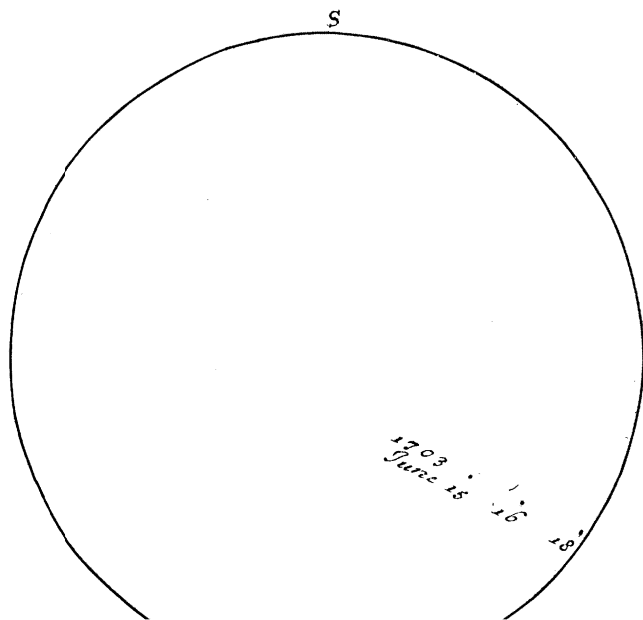
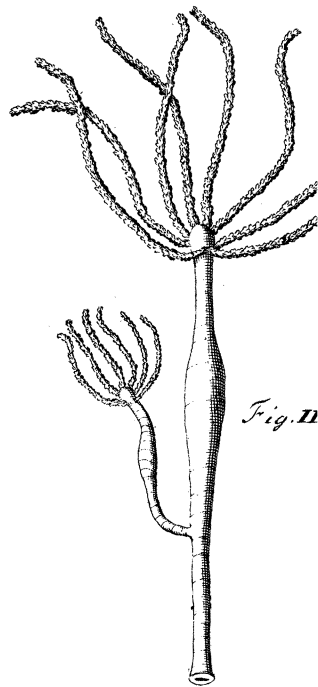
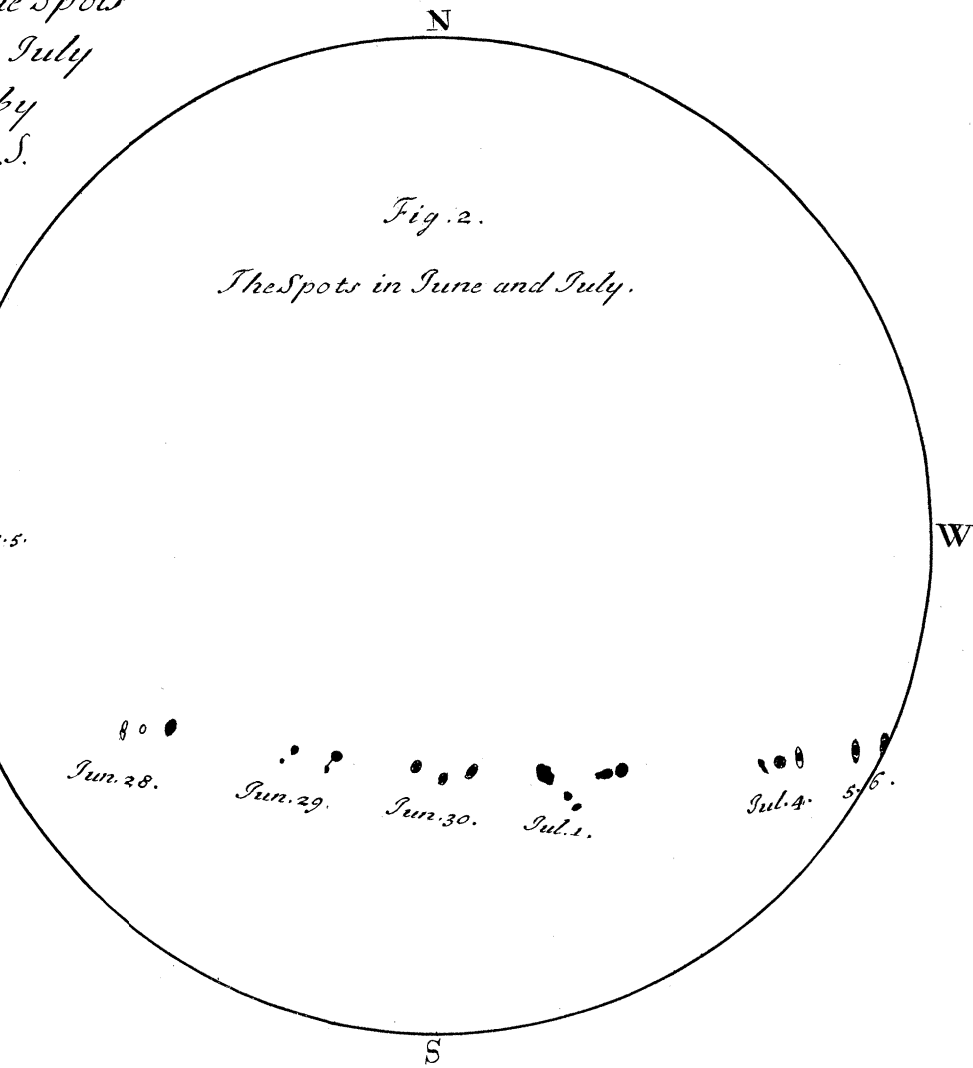
(as he describes it) one of the contain'd Globules slip out of it, and while the great one lay still, for want of sufficient depth of Water to float in, this little one that came out had immediately a very quick rotation on its axe; and what was most surprizing, at the same time it kept an equable revolution about the bigger Globe as the center of its Orbit, always very nearly at the same distance, tho I could not perceive any Vortex in the Water which bore it; and what is yet more remarkable, I saw it stop, and then make its revolution round the central Body the contrary way, the rotation on its own axe always continuing. And when the Water was so far evaporated that all lay at rest, by the addition of new Water the same motions were renew'd. This I thought a very pretty representation of the Planetary motions about the Sun, and I doubt not but a *Cartesian* Philosopher would not have been a little pleas'd, to see in Nature such an instance of such revolutions of an inanimate Body in such a medium as Water. Indeed I think it not easy to account for these motions of these Globules, nor will I to solve the difficulty say in contradiction to Mr *Leeuwh.* that I believe them Animate, tho I have formerly seen some not very unlike them both in shape and motion, which I am satisfy'd are Animals. But of those (among other things) I last year gave an account to Sir *Ch. Holt*, which I hear will shortly be publish'd in the *Transactions*.

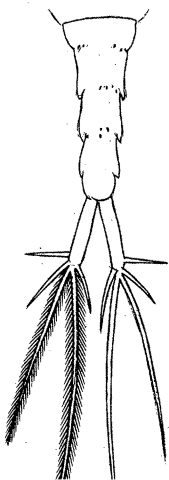
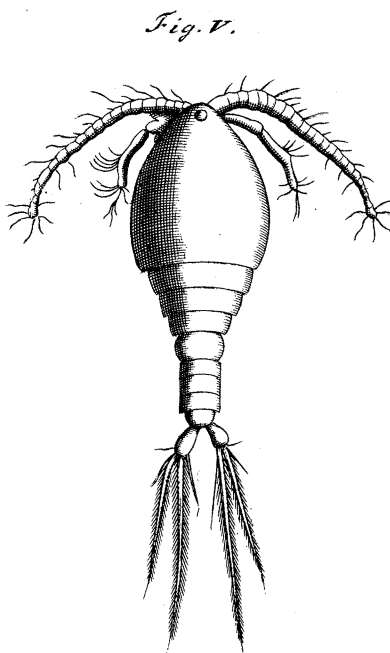
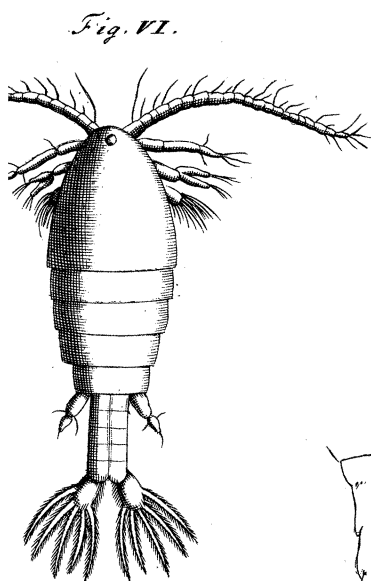
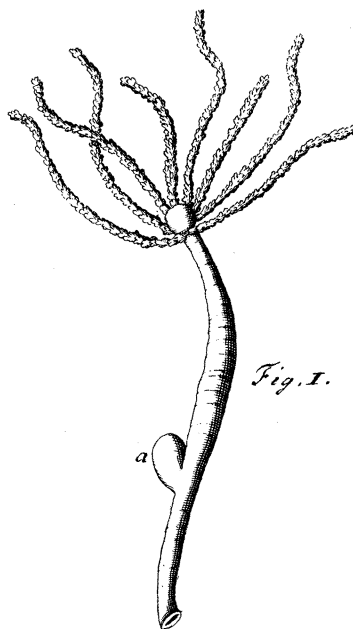
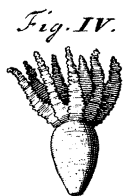
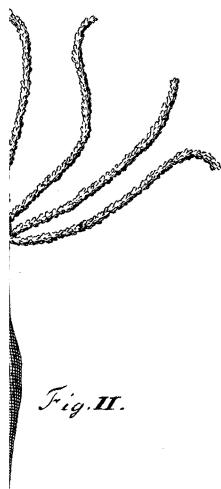
I can at present think of no other Observations of this kind to fill up my Paper, unless you should think it worth your notice, that I find all the Earwigs which I have examin'd by a Microscope, infested with great numbers of minute Insects, which stick like Lice on many parts of their Bodies, and especially just under the setting on of their Head. They are alike on all, and I never found the same on any other Animal, they are white and shining like Mites, but much smaller, are round back'd, flat bellied, and have long Legs, especially the two foremost.

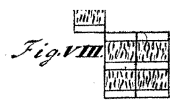
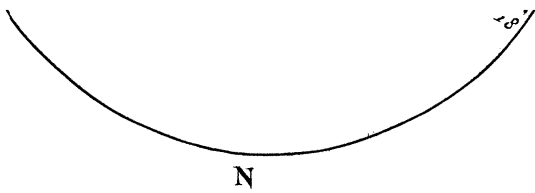
*The Appearance of the Spots
on the Sun in June & July
1703. as observed by
W: Derham F.R.S.*



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