Hand of a Man; insomuch that the Sparks, proceeding from those several Bodies, will also kindle the same Essence.

If such fluid Bodies, as are usually kindled by Flame, are not fine enough, they need only be warm'd a little in the Spoon: Or the Spirits may be lighted a little before, and blown out again, before they are brought to the electrical Body.

In this manner I have kindled, with the electrical Sparks, camphorated Spirits of Wine, coloured with Saffron, the common *Essentia vegetabilis*; and even *French* Brandy, and Corn-Spirits, only taking the Precaution of warming these Liquors a little before.

Even Oil, Pitch, and Sealing-wax, may be lighted by the electric Sparks, provided they are before heated to a Degree that is next to kindling.

X. *Translation of a Letter from Mr.* Abraham Trembley, *F. R. S. to the* President, *with Observations upon several newly discover'd Species of* Fresh-water Polypi.

SIR, *Sorgvliet, 6. Nov. 1744. N. S.*

Read Nov. 22. 1744. I HAVE herewith the Honour of transmitting to you the Particulars of several Observations I have made, during the Course of the last Summer, upon some Species of very minute Water-Animals; and which are the same I have already made some Mention of, in the third Paragraph of the 297th Page of the *Memoires pour servir à l'Histoire des Polypes à Bras en forme*

de Cornes. Mr. *De Reaumur* judges them all to belong to the general Claſs of the *Polypi*; and he has already diſtinguiſhed and diſtributed the ſeveral Species of them, to which he has given the reſpective Names that I have made uſe of in the incloſed Abſtract of my Obſervations.

I am very ſenſible, that ſome Paſſages of this Account will hardly appear ſufficiently intelligible, to ſuch as have not yet taken Notice of the little Creatures I am ſpeaking about: But this Inconvenience I could not entirely have avoided, without entering into too particular a Detail of Facts, which I have not yet proſecuted ſo far as I intend, and which I could not beſides have throughly explained, without the Aſſiſtance of a great Number of Figures.

I hope, notwithſtanding, that what I have ſaid will abundantly ſhew how ſingular the *Animalcula* in Queſtion are, and how well they deſerve Notice and Conſideration. I ſhall neglect no Opportunities of purſuing their Hiſtory; thereby to enable myſelf hereafter to give a more perfect Account of what I ſhall have further learned in my Enquiries. But this cannot be done immediately, as a conſiderable Time is required, for the making of accurate, repeated, varied, and well-connected Experiments.

In the mean time, as I have always made it my Pleaſure, I ſhall even look upon it as a Duty, to be at all Times ready to ſatisfy the Curioſity of ſuch as are Lovers of Natural Hiſtory, with regard to the ſeveral Particulars that may preſent themſelves, and that I may think worthy of their Attention.

I ſhall

I ſhall only add further, that I have already communicated theſe Obſervations to ſeveral Perſons of the greateſt Knowledge and Diſtinction, who have been pleaſed attentively to examine the ſame, and thereby given me the Satisfaction of having the beſt and moſt unexceptionable Witneſſes to all the principal Facts that are mention'd in the incloſed Account; which I now put into your Hands, and remain, with the trueſt Reſpect,

SIR,

Your moſt humble,

and moſt obedient Servant,

A. Trembley.

WE find, in divers Places, upon Water-Plants, and other Bodies in the Water, a whitiſh Subſtance, that looks at firſt only like a ſort of Mould: We ſometimes ſee Plants, Sticks of Wood, Snail-ſhells, and the like, that are entirely covered over with this Subſtance. But if we take any of theſe, put them into a Glaſs of clear Water, and then examine with a magnifying Glaſs what is upon them, we ſoon diſcover, in the little Bodies, that, by their Aſſemblage, form this whitiſh Subſtance, ſuch Motions as give ſufficient Reaſon to look upon them as living Animals; and this will appear yet more ſenſible, when they come to be obſerved with a Microſcope. We then find them to be minute Bodies, ſeverally fixed to the Extremities of ſmall Stems, or Pedicles, many

many of which are often ſo united, as to form together a Sort of Branches, or *Cluſters*; and this Sort of Appearance determined Monſieur *De Reaumur* to name the *Animalcula* that appeared ſo fixed, *cluſtering Polypi: des Polypes en bouquet.*

Theſe Cluſters are larger or leſſer, according to the Species of the *Polypi* that form them, and according to the Concurrence of many other Circumſtances.

To get a clear Idea of the Figure of theſe Animals, it is beſt to obſerve the ſmaller Cluſters; as, in the larger, the great Number of the *Polypi* upon the ſeveral Stems, are apt to hide one another.

There is a Caſe, I ſhall mention preſently, where the *Polypi* are ſingle; and it is proper to obſerve them in that Caſe; and the rather, becauſe that is the Way to diſcover how the Cluſters are formed.

I ſhall now deſcribe one of theſe ſingle *Polypi*, to give a general Idea of the Form of the Animal: and I ſhall herein chiefly endeavour the Deſcription of that Species which I have moſt particularly made my Obſervations upon.

Theſe are not in Length above the 240th Part of an Inch, and are of a Shape nearly reſembling that of a Bell: this may be ſeen in the Figure, where one of them is repreſented exceedingly magnified (Tab. II. *Fig.* 5.). The anterior Part, *ac*, generally appears open, when it properly preſents itſelf; the poſterior Part *b* is fixed to a Stem or Pedicle *be*; and it is by the Extremity *e* of this Pedicle, that the *Polypus* faſtens itſelf to any other Sort of Body. The *Polypus* of this Sort generally appears to the Microſcope of a browniſh Colour, excepting at its ſmaller End *b*, where it is tranſparent, as well as its Pedicle *be*. When the anterior Part *ac* is open, one may perceive

ceive about its Edges a very lively Motion; and when the *Polypus* preſents itſelf in a certain manner, it diſcovers, on either Side of theſe Edges of its anterior Part, ſomewhat very much reſembling the Wheels of a little Mill, that move with great Velocity.

Theſe *Polypi* are able to contract themſelves; and they do ſo often, and ſuddenly. They may be brought to contract at any time, either by touching them, or by moving the Body to which they are fixed. When they contract, the Edges of their anterior Parts are drawn quite into their Bodies; and when they reſume, which they do ſoon after, their former Poſture, one may diſtinctly ſee thoſe Edges come forth again, and put themſelves in Motion, as before.

When one looks about the anterior Parts of theſe *Polypi*, which are open, and whoſe Edges are in Motion, one may frequently have an Opportunity of remarking a Number of very minute Bodies ſwimming in the Water, that ſeem to be forced down with Velocity into theſe Openings of their anterior Parts, and that ſometimes are thrown out again from thence.

To make this Obſervation the moſt ſenſible, it is beſt not to look at a ſingle *Polypus*, but a Cluſter of ſome Numbers of them together.

I have taken notice, that the *Polypi* of the Sort in Queſtion, appear of a browniſh Colour when viewed with the Microſcope; I ſhould now add, that having left ſome of them for ſeveral Days in the ſame Water, they by degrees loſt their brown Colour, and became tranſparent; excepting only that a few Grains or Spots of Brown or Black, ſtill continued

nued to be diſcernible in their Bodies: But, having afterwards removed theſe *Polypi* into other Water, newly taken out a Ditch, they in a little time reſumed the ſame brown Hue which they had before.

It may commonly be obſerved, that when the *Polypi* are in Water newly put to them, there fall upon their anterior Parts far greater Numbers of the above-mentioned minute Bodies, than when they have been left for any time in the ſame Water.

It is very probable, that theſe minute Bodies are exceedingly ſmall Animalcules, upon which the *Polypi* feed; and that, conſequently, the Opening which they have in their anterior Part, ſerves them for the Purpoſes of a Mouth.

The *Polypi* that have become tranſparent, and that have been left ſome time without the Addition of ſuch Water as would make them recover their brown Colour, have alſo, at the ſame time, left off multiplying. But I have obſerved that others of them, to which I have afterwards given new Water from the Ditch, have ſoon after begun to multiply again.

Theſe *Polypi* are capable of ſwimming about; and when they ſwim, they are no longer in Cluſters, but always ſingle; and they do not then appear in the ſame Form as when they are fixed, and open at their anterior Ends. It is by Swimming that they leave the Place to which they firſt appeared fixed, and that they go and fix themſelves to any other Body that they find in their Way.

One ſhould begin to obſerve a *Polypus* ſoon after it has fixed itſelf ſingly, in order to ſee regularly in what manner the Cluſters form themſelves, and in what Way theſe ſmall Creatures multiply.

The

The Stem or Pedicle of a *Polypus* that is yet ſingle, and which has but lately fixed itſelf, is at firſt very ſhort, but it lengthens itſelf in a little time. After that, the *Polypus* multiplies; that is to ſay, it divides or ſplits itſelf into two lengthwiſe. One firſt obſerves the Lips to be drawn into the Body, whoſe anterior Part cloſes, and becomes round: the Motion that was to be ſeen before the Lips were drawn in, no longer appears; yet may one ſee, by looking with Attention, a ſlow Motion within the Body, during all the Time that the *Polypus* remains cloſed. The anterior Part of the *Polypus* flats itſelf afterwards by degrees, and ſpreads in proportion, becoming broader as it ſhortens; it then gradually ſplits down through the Middle, that is, from the Middle of the Head to the Place where the poſterior End joins to the Pedicle: ſo that, in a little while, there appear two ſeparate round Bodies joined to the Extremity of the Pedicle that juſt before ſupported but one.

The anterior Part of each of theſe Bodies then opens by degrees; and, as they open, the Lips of the new *Polypi* ſhew themſelves more and more. Then is the Time of obſerving theſe Lips with Attention, and of forming to one's Self an Idea of their true Form, and of their Motion already ſpoken of. This Motion is at the firſt very ſlow, it quickens as the *Polypi* continue to open; and, as ſoon as they have done, it becomes as ſwift as that which appeared in the Lips of the whole ſingle *Polypus*, before it began to divide: and then theſe new *Polypi* may be looked upon as entirely formed.

They are, at firſt, leſs than the *Polypus* from which they were formed; but they grow to the ſame Size in a very little time.

A *Polypus* is an Hour, or thereabout, dividing itſelf.

To have a tolerable Notion of this Operation, one muſt have ſeen it divers times, and in *Polypi* placed and ſituated in divers different Ways.

The Lips of theſe *Polypi* appear to be compoſed of four or five tranſparent Stripes, all which have an undulating Motion. Whilſt the *Polypi* are opening, and that the Motion of their Lips is yet but ſlow; one ſees on either Side, when they are in a certain Poſition, what one is inclined to take for the Wheels of a Mill, in the *Polypi* that are quite formed, and whoſe Lips move very faſt: but one now ſees, while they are opening I ſay, what may be rather taken for four or five Fingers on either Side of their Mouths; which alternately bend down and extend themſelves every Inſtant, and to which the tranſparent Stripes above-mentioned appear to be fixed.

This ſhould be obſerved often, and in as many various Attitudes as poſſible, to avoid being deceived by the taking of Appearances for Realities; which happens more or leſs to every Obſerver, more eſpecially when he firſt begins to obſerve. Before I venture to explain myſelf more particularly upon this laſt Article, I ſhall endeavour to repeat and to purſue further, if I am able, ſome Obſervations that I have at preſent only begun.

When the firſt *Polypus* is thus divided, and the two new ones produced by this Operation are thus completed; one ſees on one Pedicle two *Polypi*, joined

to

to its Extremity by their poſterior Ends, and that ſhew themſelves on the Sides of each other, as in TAB. II. *Fig.* 6.

The ordinary Proportion between the Length of the Body of one of theſe *Polypi*, and the Length of their Pedicle, is pretty exactly obſerved in the Drawings.

Soon after the Separation is compleated, each of the new *Polypi* begins to ſhew a Pedicle of its own.

I have often had Occaſion to take notice, that each of the new *Polypi* had, the Day after their Separation, a Pedicle of a tolerable Length; and that theſe new Pedicles united at the Extremity of the firſt Pedicle, as the Branches of a Tree unite at its Trunk.

Several of the *Polypi*, upon which I have made continued Obſervations, have multiplied at the lateſt 24 Hours after their firſt Separation. The new Cluſter has then conſiſted of 4 *Polypi*, each of which had its own Pedicle; as every one has alſo had, that was afterwards produced by a new Separation.

The next Figure repreſents a Cluſter of eight *Polypi*; and by this Figure it may be apprehended in what manner the Pedicles of the *Polypi* become diſpoſed, as their Numbers increaſe. Theſe ſeveral Pedicles become ſo many Branches of the Cluſter or Sprig. TAB. II. *Fig.* 7.

This Figure particularly repreſents a Cluſter, whoſe Progreſs I followed in the Month of *September* laſt, 1744. It conſiſted, on the 9th Day of that Month, but of one ſingle *Polypus*, which was placed as at *b*: this *Polypus* divided itſelf that Evening, and at half an Hour after Eight of the Clock, there were to be

diſcovered at *b* two perfect *Polypi*, whoſe Pedicles or Branches, *bd*, *bd*, continued lengthening till the Morning of the next Day, being the 10th of the ſame Month of *September*: at about a Quarter after Nine that Morning, theſe two *Polypi*, which were then at *d*, *d*, began alſo each to divide; ſo that at a Quarter paſt Eleven, there were at *d* and *d* four compleat *Polypi*, whoſe ſeveral Pedicles *di*, *di*, *di*, *di*, formed themſelves ſoon after. On the 11th of the ſame *September*, about half an Hour after Seven in the Morning, I found that theſe four laſt *Polypi* had already again divided themſelves; that is to ſay, that there were at *i*, *i*, *i*, *i*, eight diſtinct *Polypi*; and this Cluſter, ſo conſiſting of eight *Polypi*, is here repreſented as it appeared upon the 12th of the ſame Month, between Ten and Eleven in the Forenoon.

The *Polypi* are not always ranged as they are diſpoſed in this Figure; for it often happens, that the Pedicles and the *Polypi* are behind one another, ſo as to form a Groupe, in which ſome of the *Polypi* may chance to be hidden or covered by others, either entirely, or in Part.

This Figure repreſents the *Polypi* and Pedicles as magnified to the ſame Degree as thoſe already exhibited in the former Figures.

I have taken notice of Cluſters, the Numbers of whoſe *Polypi* have conſtantly gone on doubling, from 2 to 4, from 4 to 8, from 8 to 16, from 16 to 32: after which I have no longer been able to count exactly the Number of the *Polypi*.

I have ſaid enough, to ſhew how the Cluſters are formed, and how faſt theſe ſmall Animals multiply:

Indeed

Indeed the Number is prodigious of thoſe that are ſometimes found in the Water.

I have large Glaſſes by me at this time, *Nov.* 1. 1744. *N. S.* in which they have exceedingly multiplied; there is particularly, in one of them, a Cluſter compoſed of ſeveral leſſer united Cluſters, which is above an Inch over every way.

There detach themſelves from time to time ſingle *Polypi*, which go ſwimming about till they fix each upon ſome Body or other; and from theſe there again ariſe new Cluſters, in the manner above ſpoken of.

The Branches, from which *Polypi* have detached themſelves, ſtill remain fixed to the Cluſter, but they bear no more *Polypi*; and after all the *Polypi* of a Cluſter have thus detached themſelves from it, the Aſſemblage of the Branches ſtill ſubſiſts, but is of no further Uſe.

I know of four other Species of *Polypi*, that all increaſe in the ſame manner as thoſe I have been already ſpeaking of; that is to ſay, which ſplit and divide themſelves according to their Length.

Thoſe which come the neareſt to the firſt, are ſomewhat more ſlender, and the Branches of their Cluſters are tranſparent; yet do they appear, when there is a Number of them together, of a changeable Violet-Colour: the Cluſters of theſe bear a good Reſemblance to a Sprig or *Aigrette* of ſpun Glaſs.

When theſe laſt Animals are compleatly formed, it is not ſo eaſy to ſee diſtinctly in them the Motion of their Lips, as it is in the other Species beforementioned; yet may it be obſerved in theſe alſo, whilſt they are ſtill opening, and compleating their Formation: for at ſuch times, this Motion is

but ſlow, whereas it becomes afterwards very quick in thoſe that are entirely perfected.

The *Polypi* of the other Species that I have obſerved, are yet leſs than the laſt; they are ſhorter, but more open and hollow'd at their anterior Ends. Theſe have a Character that ſufficiently diſtinguiſhes them from all the other Species: their Stems and Branches have a Motion that is not to be found in thoſe of the other *Polypi*. Theſe Stems draw themſelves up, and ſhorten all at once, taking the Form of a ſpiral Wire or Screw; and a Moment after they again reſume their former Shape, ſtretching themſelves out ſtrait as before.

Theſe ſeveral Species of *Polypi* I have been ſpeaking of, all multiply in vaſt Abundance; but they have alſo Enemies that deſtroy immenſe Numbers of them, and that in a very little time.

I have alſo this Summer obſerved regularly other ſmall *Polypi*, of a different Sort from thoſe that are found in Cluſters. Theſe are nearly in Shape like a Tunnel, pretty long in proportion to the Opening of their larger Ends. For this Reaſon, Mr. *De Reaumur* has thought proper to diſtinguiſh them by the Name of *Tunnel-like Polypi*.

I am acquainted with three Species of theſe laſt *Polypi*, which are reſpectively, green, blue, and white.

Theſe muſt alſo be obſerved often, and in various Attitudes, in order to obtain a tolerably exact Notion of their proper Structure.

Their anterior End particularly, is of a far more compounded Shape, than one would at firſt imagine.

There

There may be diſcovered, round the Edges of this Part, a ſenſible Motion, much reſembling that of an indented Wheel, or rather of an endleſs Screw, that is turned very faſt about.

Theſe *Tunnel-like Polypi* form no Cluſters, like the others.

I have remarked, that the little Bodies, that paſs ſwimming near the anterior Parts of theſe Inſects, are in ſome manner drawn into the Mouths of their Tunnels; and I have ſometimes ſeen a conſiderable Number of very ſmall round *Animalcula* fall one after another into theſe Openings. Some of theſe were indeed afterwards let out again, at another Opening, which I am not yet able particularly to deſcribe: but I could plainly ſee, that many of theſe little round Bodies remain'd within the Bodies of the *Polypi*; and it is therefore apparent, that theſe little Bodies, ſo taken in, became their Food.

Theſe *Tunnel-like Polypi* do alſo multiply by dividing themſelves into two, but they divide themſelves otherwiſe than the *cluſtering Polypi:* they neither divide longitudinally nor tranſverſly, but ſloping and diagonal-wiſe. Of two *Tunnel-like Polypi*, juſt produced by the Diviſion of one, the firſt has the old Head and a new poſterior End; and the other the old poſterior End, with a new Head.

I ſhall call that which has the old Head, the *ſuperior Polypus*; and that which has the new Head, the *inferior* one.

The firſt Particulars obſervable in a *Tunnel-like Polypus* that is going to divide, are the Lips of the inferior *Polypus*; I mean thoſe tranſparent Edges that are ſo conſpicuous in the *Polypi* when entirely formed. Theſe new Lips firſt diſcover themſelves upon the

Poly-

Polypus that is going to divide, from a little below the old Lips, to about two Thirds of the Length of the *Polypus*, reckoning from the Head: but theſe new Lips are not diſpos'd in a ſtrait Line, according to the Length of the *Polypus*, but run ſloping near half-way round about. Theſe Lips are known by the Motion in them, but which Motion is at firſt very ſlow. That Portion of the Body of the *Polypus*, that is bounded by theſe new Lips, then gathers up itſelf, the new Lips inſenſibly draw together and cloſe; whereby there forms itſelf, at the Side of the *Polypus*, a Swelling, that is ſoon found to be the Head of the new one, bounded by the new Lips firſt diſcover'd. Before this Swelling is grown very remarkable, one begins to diſtinguiſh the two *Polypi* which are forming themſelves; and when that Swelling is conſiderably increaſed, the two *Polypi* will be diſcovered, no longer joined but by a ſmall Portion to each other. The *ſuperior Polypus* no longer adheres to the inferior one, but by its poſterior Extremity, which is ſtill fixed on one Side of the *inferior Polypus*: The *ſuperior Polypus* then begins to make Motions that ſeemingly tend to the ſeparating of him from the other; and in a little time he becomes quite detach'd, ſwims away, and fixes himſelf elſewhere. I have ſeen one come and fix at the Side of the *inferior Polypus*, from which he was juſt before ſeparated. The *inferior Polypus* remains fixed in the ſame Place, where the *Polypus* was that is now divided, and of which he was only the Half, before the Diviſion took place.

I am not, at preſent, able to enter into a further Detail of the Manner in which theſe *Tunnel-like Polypi* divide and multiply themſelves. I could not do

do it, without the Aſſiſtance of many Figures, nor without the Mention of ſeveral other Facts, that I have not yet ſufficiently ſatisfied myſelf about, nor obſerved ſo often as I think it neceſſary to do.

I ſhall alſo endeavour to carry on further the Natural Hiſtory of all the ſeveral *Polypi* of which I have yet ſpoken, and, perhaps, that of ſome other Sorts beſides; as I find, that the Experiments I make upon Inſects of one Species, facilitate in ſeveral Reſpects thoſe I have to make upon others; and that theſe laſt often throw a new Light upon Obſervations and Experiments already made.

As all theſe little Animals are exceedingly minute, I have hardly been able to obſerve any of the ſeveral Facts above-mentioned without the Aſſiſtance of the *Microſcope*; but, if I was to take ſuch ſmall Objects out of the Water, in order to expoſe them to my Glaſſes in the common Way, I ſhould both riſque the loſing of them, and hazard the putting them out of a Condition of performing their natural Operations. I am therefore forced to obſerve them with the Magnifiers of my Microſcope, without taking them out of the Glaſſes I keep them in. I, for this Purpoſe, contrive to get them ſo near the Sides of thoſe Glaſſes, that the *Foci* of my Magnifiers may reach them from without: I then fix, by the Sides of my Glaſſes, a jointed Arm I have fitted for that Purpoſe, into the Socket of which I can conveniently ſcrew the different Magnifiers of my Microſcope, and retain them fixed at their due Diſtances, by which I am able, with great Eaſe, to keep the *Animalcula* in Sight as long as I have Occaſion for them: and I uſe for the moſt part the Light of a wax Taper, to illuminate my Objects.

Philos. Trans. N° 474. TAB. II.

Fig. 1. *p.* 158.

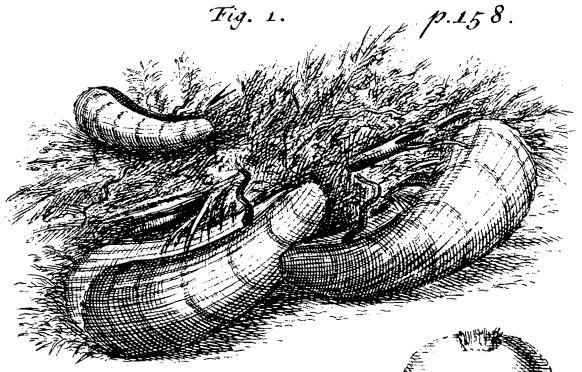
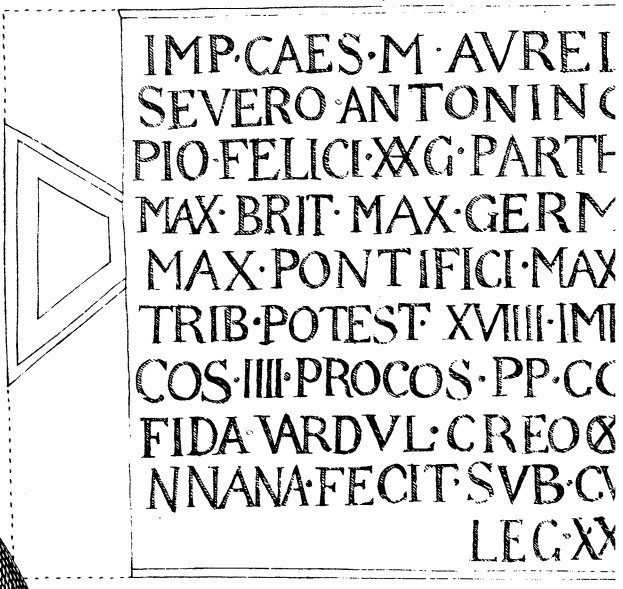


Fig. 2. p. 160.



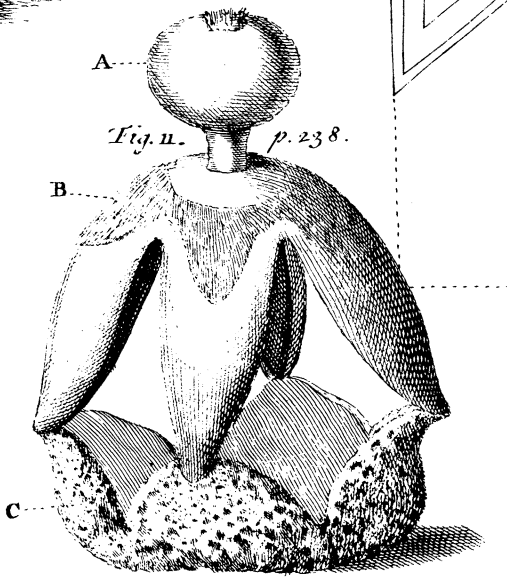


Fig. 11. p. 238.

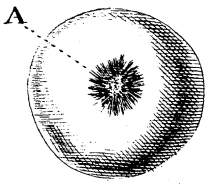


Fig. 12. p. 238.

Fig. 10. p. 208.

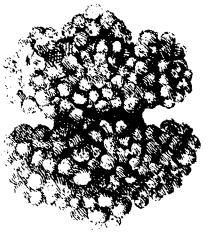


Fig. 8.
p. 195. 200.

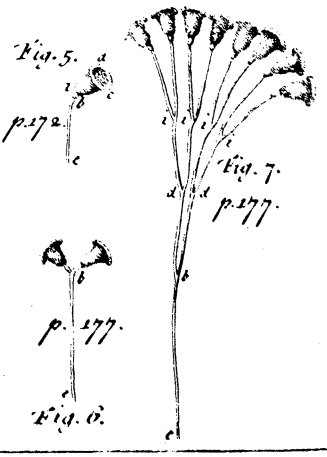


Fig. 3. p. 160.

MARTI
VICTORI
VLIVS LI
IVS TRIB
V·S·L·M.

Fig. 4. p. 160.

FORTVNAE
AVG
A E T
PROCVLINA
V S

Fig. 5 p. 201.

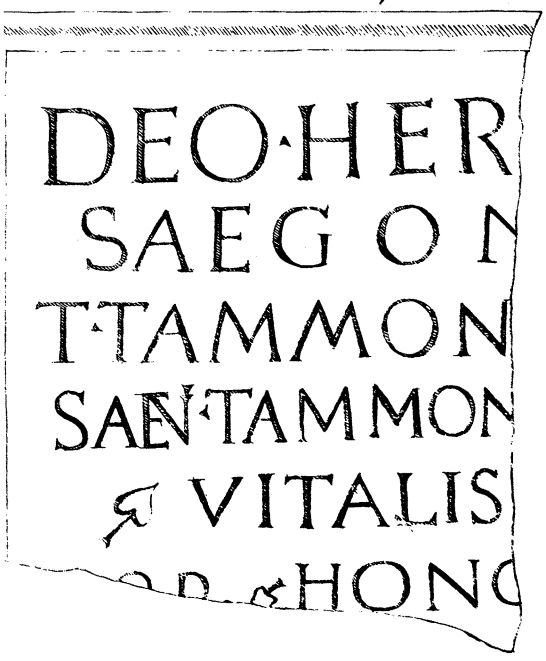


Fig. 1. *p.* 158.

Fig. 2. p. 160.

IMP·CAES·M·AVRELIO
SEVERO·ANTONINO
PIO·FELICI·XXG·PARTHIC·
MAX·BRIT·MAX·GERM·
MAX·PONTIFICI·MAXIM·
TRIB·POTEST·XVIIII·IMP·II·
COS·IIII·PROCOS·PP·COH·I·
FIDA·VARDVL·CREO⊗ANO
NNANA·FECIT·SVB·CVRA·ICO
LEG·XX·GR

Fig. 3. p. 160.

MARTI
VICTORI
VLIVS LI
IVS TRIB
V·S·L·M·

Fig. 4. p. 160.

FORTVNAE
AVG
A E T
PROCVLINA
V S

Fig. 11. p. 238.

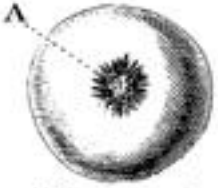


Fig. 11. p. 238.

Fig. 10. p. 208.

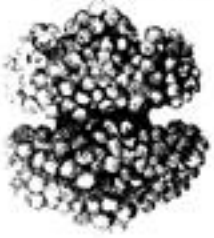


Fig. 9 p. 201.

DEO·HER
SAEG O N
T·TAMMON
SAEN·TAMMON
VITALIS
HONO

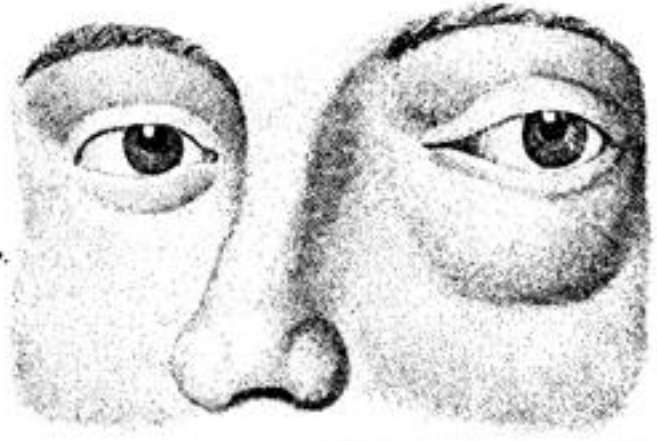


Fig. 8. p. 195. 200.