II. *The Croonian Lecture. On the existence of Nerves in the Placenta.* *By Sir* EVERARD HOME, *Bart. V. P. R. S.*

Read November 18, 1824.

IN the Lecture which I gave last year, I attempted to trace the structure of the human brain to as great a degree of minuteness as is consistent with accuracy, by observing its appearance in the field of the microscope. This I should not have ventured to do under any other circumstances, than being assisted by the eye of Mr. BAUER in examining the appearances, and in having correct representations of them under his hand, to lay before the Society.

Without these peculiar advantages, I should have been afraid of being led into error, either by the fallacies to which microscopical observations are liable in themselves, or those which so frequently occur when the same eye is not employed both in ascertaining the appearances, and in directing the pencil by which they are delineated.

As Mr. BAUER continues to indulge me with the same advantages, I shall employ them in the present Lecture in prosecuting my enquiry respecting the nerves; for as no anatomist before me has had the assistance of such an able coadjutor, it may never happen again; and I should feel myself undeserving of it, were I not to employ it in extending our researches in minute anatomy.

This I have now been enabled to do in no common degree,

by discovering nerves in both the fœtal and maternal portions of the placenta. This discovery, I am proud to say, was not the result of accident, but of a regularly arranged plan for that purpose.

In examining, at my desire, the structure of the horns of the fallow deer during their growth, while covered with velvet, Mr. BAUER found them abundantly supplied with nerves. The circumstance of nerves being met with, where sensibility is not only unnecessary, but even where the parts are unfitted for their office till the nerves are removed; which takes place as soon as the horns are full grown; makes it appear that nerves answer some other purposes in the animal œconomy, besides regulating the actions of the arteries; an office which, many years since, I not only considered them to perform, but illustrated my opinion by the effects of irritation on the parvagum and great sympathetic nerve on the carotid artery. Since that time, by considering the incubation of the chick, I have been led to believe that the arteries are indebted to the nerves for their formation; and so strong was the conviction on my mind of this being the case, that even the circumstance of the placenta, whose blood vessels are very numerous, having been suspected to have no nerves, did not induce me to abandon it; since until it is proved that the placenta is devoid of nerves, there is no argument against me. This was a point, of all others, that no one could so well determine as Mr. BAUER. I therefore most earnestly requested him to employ his microscopical observations on this subject, and supplied him with the placenta of a seal, in which the arteries and veins had been injected; and as in that animal the umbilical vessels are not

twisted, the nerves will be more exposed, and the parts having been in spirit, will have lost that transparency belonging to them in a recent state, by which they are less readily distinguished from blood vessels.

In this specimen, Mr. BAUER has shown that nerves are not only conspicuous surrounding the umbilical arteries, but has demonstrated them in the portion belonging to the uterus. For the appearance they put on, I must refer to the annexed drawing.

I may here remark, that in no communication which I have made to the Society, assisted by Mr. BAUER's labours, has any appearance been mentioned or represented, that I have not myself distinctly seen; for although I am not equal to the nice adjustment of the microscope, which indeed appears peculiar to Mr. BAUER, yet, when adjusted by him, the appearances before they were described had been rendered visible to me.

In looking at objects so much magnified beyond what they appear to the naked eye, it will not be unnatural for many of the Members to ask, how I am sure that these are really nerves, and not the secondary order of blood vessels, too small to carry red blood, and therefore, when their contents have been coagulated, appear to be chords? My answer to this question is, to recommend an inspection of the drawings; in which it will be seen, that these are not continuations of other branches, but form a trellis-work upon the arterial trunks, in a manner totally different from any thing met with either in the ramifications of arteries or veins; and when they are dried upon glass, they reflect the light with a degree of splendour like the human hairs when these

are quite white. When the nerves are very minutely examined, each fibre appears to consist of a row of small globules connected with one another.

At the time the nerves in the placenta were discovered, Sir STAMFORD RAFFLES (whose misfortune in having lost the most valuable collection in Natural History ever made in the East Indies by the ship taking fire, every one must feel for) brought me from Sumatra the pregnant uterus of the tapir of that country; and as in that animal the umbilical chord is connected with the chorion (there being no placenta), I examined the transparent portion of the chorion along which the branches of the funis pass, before they arrive at the spongy part, and there the nerves are so conspicuous, that Mr. BAUER's representation of them of the natural size is annexed.

The principal object of the present Lecture is to establish the fact of nerves existing in the placenta; and in these animals in which there is no placenta, in the floculent chorion, which is substituted for it; and it is a curious fact, that they should be largest in the latter.

This discovery places the placentular circulation in a new point of view, since, from the known influence of the nerves on the blood vessels, it is reasonable to believe that, during life, there are branches of communication between those of the uterus and fœtus, although too minute to be explored in the dead body. The erection of the penis cannot be produced after death by injecting the arteries, although when the nerves are excited the smaller branches give a ready passage to the blood. Having traced nerves from the fœtus to the maternal portion of the placenta, it will add to the value of this com-

munication, to give some general account of the course of the nerves which supply the uterus of the mother, more especially as these are little known in the different classes of animals, even to those who are well versed in comparative anatomy.

That some very important office is performed by the uterine nerves is evident from their number, the different sources from which they originate, and the various ganglia by which the filaments are connected with one another; and that such a complex system of nerves is required for the well doing of the fœtus in utero cannot be doubted, since they become enlarged during pregnancy. Mr. CÆSAR HAWKINS has very kindly made the dissections necessary for this purpose, and I shall give in his own words the account he has drawn up of the distribution of the nerves connected with the organs of generation of the female in the human species, in the quadruped, the bird, and the frog.

"The nerves of the human uterus are supplied from six different plexuses. The spermatic plexus within the abdomen, the great hypogastric plexus between the common iliac arteries, and four within the pelvis, two of which are situated on each side of the uterus. All of these have the peculiar appearance of the sympathetic nerves, and they are intimately connected with all the other nerves of the viscera.

"The uterine nerves in the dog, cat, rabbit, and guinea pig, so nearly resemble those of the human uterus, that a minute description of them is unnecessary. The spermatic plexus is formed by branches of the renal plexus and two nearest lumbar ganglia of the sympathetic nerve; it supplies the horns of the uterus, the ovaria, and apex of the urinary bladder.

" The common hypogastric plexus, after having supplied the body of the uterus, gives off a large nerve of considerable length, which dips down into the pelvis, and unites with numerous branches of the third sacral nerve, and smaller branches from the second and fourth; a remarkable plexus is thus formed which contains several distinct ganglia. It distributes nerves to the body of the uterus, the vagina, bladder, and rectum, the integuments of the upper part of the pubes, and the muscles of the inferior outlet of the pelvis. A few branches pass down to communicate with the fourth sacral nerve, where it gives origin to the pudic nerve. These nerves arise from the plexus in such a way as to resemble the ramifications of the venæ vorticosæ in the choroid membrane of the eye.

" The difference therefore between the nerves of the human uterus, and those belonging to the uterus in the quadruped, consists in the formation of only one lateral hypogastric plexus, and consequently in the existence of only four nervous centres in the latter. There appear also to be more ganglia in the plexiform distribution of the sympathetic nerve. In the seal, several large ganglia are found in the broad ligaments of the uterus.

" The nerves belonging to the female organs of birds are distributed as follows:

" The sympathetic nerve is found close to the origin of the spinal nerves, protected by the double heads of the ribs between which it runs. The spinal nerves that correspond to the lumbar and sacral nerves in quadrupeds emerge near each other, and as the sympathetic nerve communicates with each of them, and forms a ganglion immediately after their

appearance from the vertebral foramina, there is an almost uninterrupted ganglion of considerable length; from which numerous filiments go off to supply the oviducts. Others run upwards and are distributed on the ovaria.

"Near the termination of the oviduct in the cloaca a plexus is formed, nearly similar to the lateral hypogastric plexus in quadrupeds, which is distributed in a corresponding manner to the oviduct and cloaca. There is also a similar pudental nerve.

"Fewer ganglia are formed near the aorta than in quadrupeds, and scarcely any branches are sent from the common hypogastric plexus to the oviduct.

"In the frog, as there is no proper sympathetic nerve, the abdominal viscera are supplied directly from the spinal nerves. These soon after they emerge from the vertebral canal, become slightly enlarged: this does not deserve to be called a ganglion. From each of the spinal nerves in the lower part of the back and loins, a small nerve is given off, which takes a direction towards the centre of the bodies of the vertebræ, where they unite with each other, and with the corresponding nerves of the opposite side. By this union a flat nervous web is formed, which stretches across the aorta and extends downwards into the pelvis: this is analogous to the splanchnic plexus in hot blooded animals.

"From the upper surface of this plexus many branches run upwards towards the intestines and kidneys, but the greater number are distributed on the ovaria.

"The lumbar nerves on each side give off several branches, which pass at once into the oviduct. The last lumbar nerves pass down upon the surface of the psoæ muscles, and near

the pubes give off a branch, which takes a circuitous course towards the lateral portion of the bladder, and the extremity of the oviduct. The continuation of the aortic, or abdominal plexus, in union with some branches of the sacral nerves, forms on each side of the pelvis a kind of plexus, which distributes branches to the cloaca and lower portion of the oviducts.

" The nerves corresponding with those which have been described in the frog, run almost entirely in straight lines, instead of having the intricate reticulated texture of the visceral nerves in hot blooded animals. The ganglia are indistinct, and the fibres that compose them resemble those of the muscular, more than visceral nerves."

At the time I was appointed to give this Lecture, I had completed an investigation, in which was traced to its origin the formation of the brain and spinal marrow in the ovum of the frog, and intended, upon this occasion, to have laid my observations, illustrated by a series of drawings made by Mr. BAUER, before the Society, but having been so fortunate as to discover the nerves of the placenta, I did not hesitate in giving this discovery the preference, and taking the earliest possible opportunity of communicating it to the Society.

Now that it is known by the discovery of the nerves in the placenta that the brain of the child, as well as every part of its body, is connected by the medium of nerves with the brain of the mother, we are led to understand the degree of dependence in which the fœtus is kept during the whole time of utero gestation.

The small pox being in some instances communicated from the mother to the child, which has until now been consi-

dered as an extraordinary fact* and not to be accounted for, is readily explained, since absorption depends fully as much upon nervous influence as the action of the arteries: a child in utero having an ague, is in itself almost a proof of the placenta having nerves.†

A child being born without a brain is not to be marvelled at, the nerves of the child being connected with the brain of the mother.

The immediate division of the navel-string at the moment of the birth, in some particular instances having hazarded the life of the child, hinted at by Dr. DENMAN, shows the accuracy of his observations.

* There are several cases in the Philosophical Transactions of children having the small-pox in utero, and one that was read before the Society, but not published.

Two of these were in England; in both of them the child took the infection on or about the 14th day.

One was in Jamaica; and the infection was taken by the child on the 8th day. This difference appears to deserve being recorded.

† Dr. PATRICK RUSSEL states a case of ague occurring in a child in utero, in Aleppo.

In June, 1767, a healthy young woman, in the seventh month of her third pregnancy, was attacked by a tertian fever, and the fœtus in utero appeared to suffer a paroxysm distinct from the mother.

The fits in the mother returned regularly about noon, and terminated by a profuse sweat in less than ten hours.

About 8 in the morning of the odd days, the woman felt the child tremble with great violence; she also felt a weight and coldness in the womb; the coldness went off in less than 15 minutes, and was succeeded for more than an hour by a glowing heat; the child was at intervals restless, as she had felt in her other children during pregnancy, but the trembling she never before experienced.

After the sixth paroxysm the bark effected a cure.

Dr. RUSSEL, while at Aleppo, met with a few similar instances, but had attributed them to the effect of imagination, which in this woman he could not do, as she was remarkable for her cheerful disposition, and good sense. *Trans. of a Society for the Improvement of Medical and Chirurgical Knowledge*, vol. iii. p, 96.

Till this discovery was made, we had no mode of estimating the influence that could be produced upon the child by the affections of the mind, or the body of the mother; and therefore the instances that have occurred, were considered as idle stories or accidental occurrences, for which no satisfactory reason could be assigned; and this upon no better ground than that they do not always take place under similar circumstances, which nothing connected with nerves ever does.

That they do sometimes occur no one can be so hardy as to deny, and when they do, we cannot now be at a loss for a mode of accounting for their doing so.

With the following well authenticated instances of this kind that have come under my own observation, I shall close this Lecture.

The mare that in the first instance had a foal by a quagga, and afterwards three in succession by a Persian horse, all of which were marked like the quagga, can in no other way be explained than through the influence of the mother upon its young. In proof of the fact, paintings from life of all the individual animals have a place in the Royal College of Surgeons in London. There is also an account of the occurrence stated in the Philosophical Transactions, in which all the particulars are detailed communicated by the Earl of MORTON, to whom in the first instance the mare belonged.

A lady while pregnant with her tenth child, the former nine being perfectly formed, was robbed in the dusk of the evening near Woolwich by an artillery man who had a hare lip the fright occasioned by the alarm was so great: that she did not recover from it for several days; when brought to bed the child was found to have a hare-lip. I was called

upon to perform the operation. As the mother was very irritable and nervous, and the child unusually fractious, I used every means of soothing the child previous to the operation; but after it was performed, the child never ceased from crying for three days, and died at the end of that period.

A lady of an unusually nervous habit, who had several healthy children perfectly well formed, during a state of pregnancy, was opening the hall door of her house in the country, when a Newfoundland dog rushed upon her, and jumped up in play, putting his two fore paws upon her sides: the alarm and surprise was very great, but she soon recovered herself: when the child was born there was a claret mark upon the two parts of the belly that corresponded with the places on which the dog's paws had been placed. These I afterwards removed, and the parts readily recovered.

An Italian woman, twenty years of age, when by her reckoning three months and three weeks gone with her third child, was travelling in a caravan with the baggage of the Duke of Wellington's army, in the middle of the night, in a violent storm, while she was fast asleep, a small monkey with a long chain upon the roof of the caravan took refuge in it, crept under her loins, and fell asleep; she awoke, feeling uneasy from the pressure of the monkey, and put her hand down to scratch the part, but came upon the monkey's head, by which it awoke and bit her fingers, and in its alarm got fast hold of her loins. The woman went into fits, and was some minutes before she recovered herself: it was expected she would miscarry, but she went her full time. When the child was born it measured between seven and eight inches in height, and weighed one pound. This was in France. The child

was reared with great difficulty; it was carried afterwards to Ireland, and there was afflicted with a hacking cough; it was brought to England, in expectation of the cough being relieved, but died soon after, just before it completed its ninth year. I saw it before its death; at that time it was much emaciated, and measured exactly twenty-two inches. After death it was found that the fontinelle of the head had closed; no fat was any where met with but at the bottom of the orbits. The uterus was as small as in a fœtus between three and four months, not being at all developed, whereas in a new-born child it has acquired a considerable size; it was closely attached to the posterior surface of the urinary bladder, apparently by inflammation: the bladder was distended with urine, and the size of a turkey's egg. As the child had never passed its water freely from the time of its birth, this affection of the bladder must have taken place at the same time with the injury produced by the monkey's gripe upon the loins of the mother.

I examined an abortion, which was considered by Mr. CLARKE, Teacher in Midwifery, to be about three months and a half after impregnation; and on comparing the ovaria with those of the dwarf, they were nearly of the same size, but not quite so long; the difference however was scarcely observable.

The child when I saw it could walk alone, but not more confident in itself, or firm on its legs, than an healthy infant at sixteen months. Its sight was very quick, particularly in seeing bright objects; was delighted with every thing showy, much pleased with ornaments in its own dress, could speak in a very low tone and shrill voice, and had some taste for

music, but had few English words; appeared very sensible of kindness, and remembered perfectly those from whom it had received attention.

The mother has had a fifth child in Ireland, which, like her former children, was of the common size when born, and has nothing particular in its appearance.*

EXPLANATION OF THE PLATES.

PLATE II.

Fig. 1. A small portion of the placenta of the seal, exposing the chorion by which it is covered, through which are seen the arterial and venal branches injected with wax, magnified four diameters.

The folds of the chorion contain the branches of the nerves.

The cut edge of this portion exposes the structure of the placenta, which is more distinctly seen in Fig. 4.

Fig. 2. The same portion as Fig. 1. exposing the uterine surface, which appears to be a tissue of arteries, veins, and nerves, enveloped in a soft spongy coagulable lymph; magnified in the same degree as Fig. 1.

Fig. 3. A small portion of Fig. 2. magnified ten diameters, to show the tissue, and the parts of which it is composed

* Since this Lecture was read, two cases have been stated to me, in which I have the most implicit confidence. In one, a Lady in early pregnancy was frightened by a sailor with one arm, and her child was born under the same deformity. In another, this occurred late in pregnancy. No effect was produced on that child; but in her next child, although every alarm in her mind had subsided, the deformity was found to have taken place.

more distinctly; the broken off portions of nerves are shown projecting beyond the edges of the outline of the figure.

Fig. 4. A transverse section of the placenta magnified ten diameters, showing its structure: the nerves are so readily distinguished by their course from the blood vessels, as to require no explanation.

Fig. 5 and 6. A single floculus of the tissue separated, and magnified ten diameters, exposing the terminal branch of the umbilical artery (and its accompanying nerves), where it ends in pencilli of infinitely small ramifications.

A. The pencilli.

B. Surface of the chorion.

Fig. 7. The mode in which the arteries of the umbilical chord begin to ramify on the chorion, and dip down into the substances of the placenta, magnified two diameters; the nervous filaments are distinctly seen.

Plate III.

Fig. 1. A portion of the uterine surface of the chorion of the tapir; natural size.

Fig. 2. A very small portion of the same, magnified fifty diameters.

Fig. 3. Lateral view of a section of the same; magnified fifty diameters.

Fig. 4. A very small portion of the fœtal surface; magnified fifty diameters.

POSTSCRIPT.

Mr. BAUER and myself at the same time, unknown to each other, having detected nerves in the human navel-string and placenta, I beg to communicate this discovery to the Royal Society, as a valuable addition to the Croonian Lecture, to which I wish it to be annexed as a Postscript.

Mr. BAUER's delineation of these nerves makes it unnecessary to give any verbal description of them. They were found in a specimen belonging to Mr. BROOKS, which had been successfully injected, and preserved in spirit for forty years, which I borrowed for that purpose.

PLATE IV.

Fig. 1. A portion of the umbilical cord of the human placenta, in its natural form; magnified four diameters.

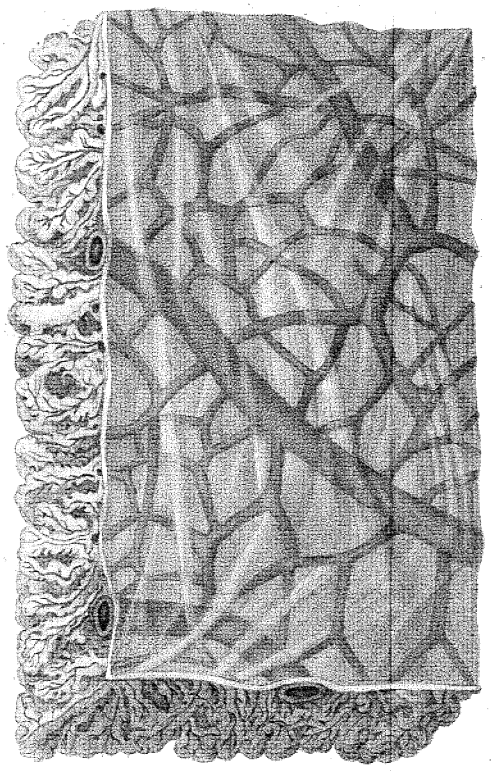
Fig. 2. The same portion unravelled, to show the situation of the nerves within it; magnified four diameters.

Fig. 3. A portion of the external membrane of the umbilical cord, with part of the cellular substance, and a nerve adhering to it; magnified four diameters.

Fig. 4. The same nerve shown separately; magnified ten diameters.

Fig. 5. A portion of the amnion, with a double branch of a nerve passing across it; magnified four diameters.

Fig. 1.



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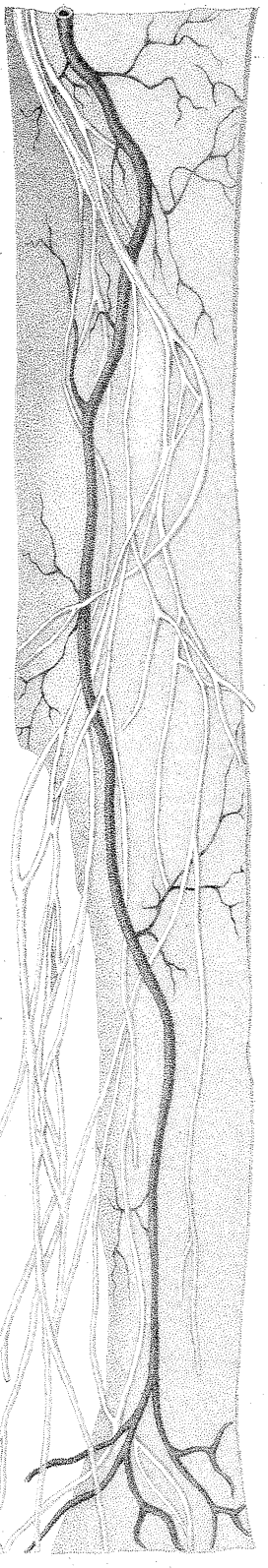

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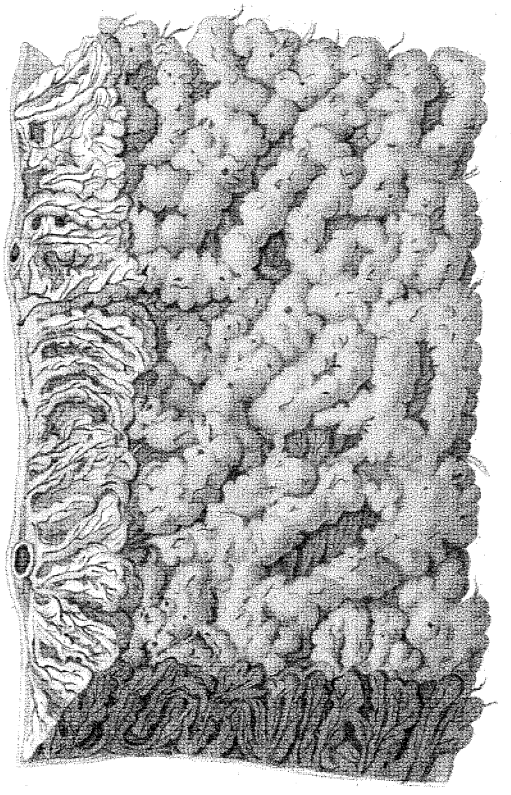

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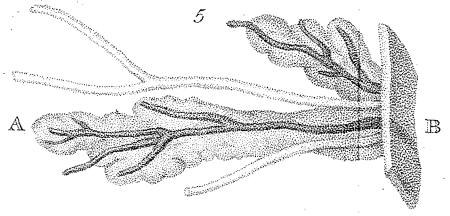

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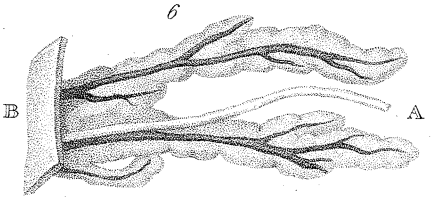

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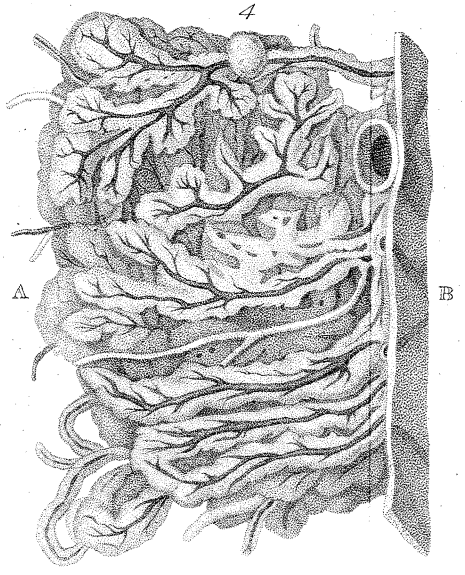

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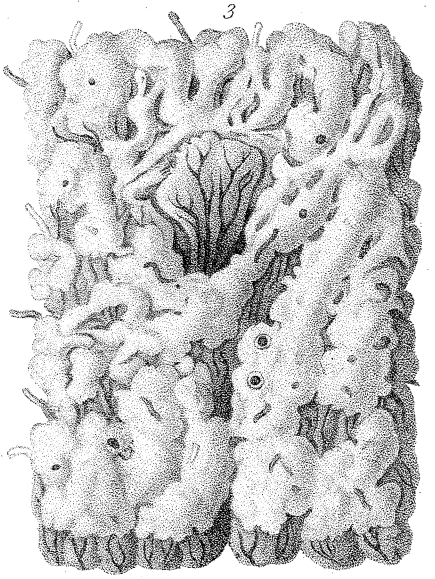

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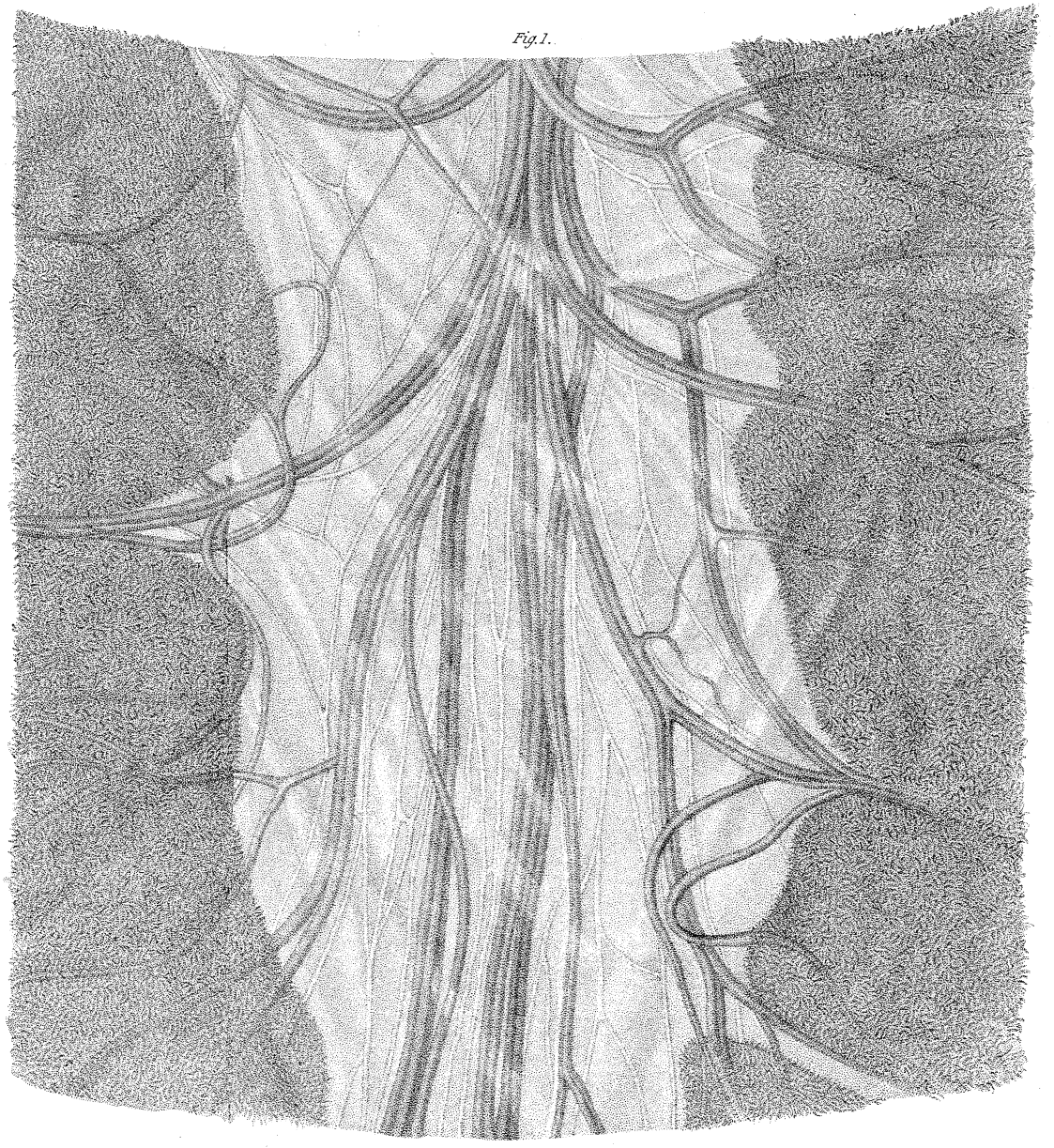

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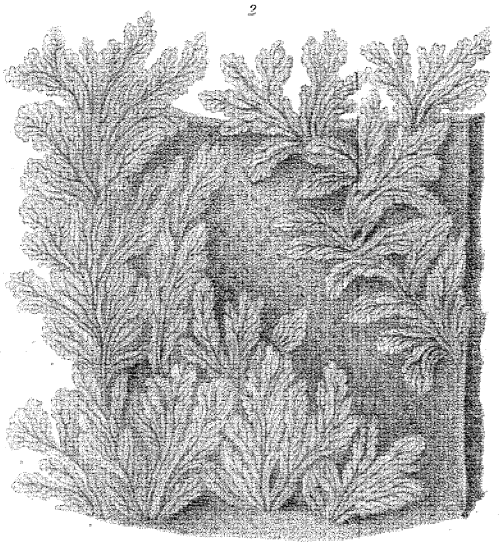

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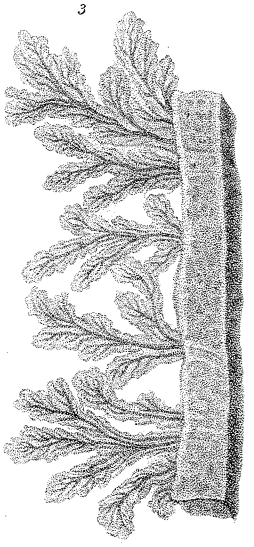

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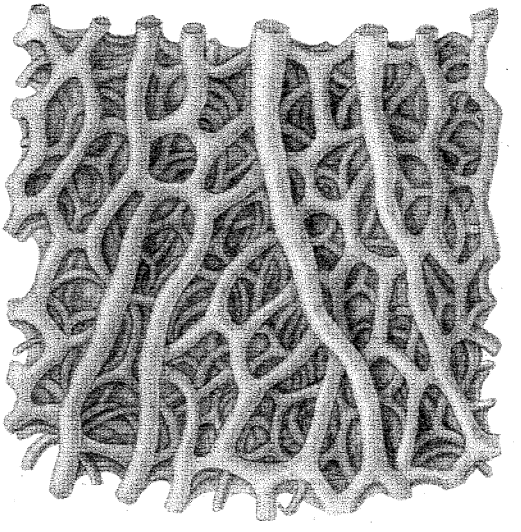

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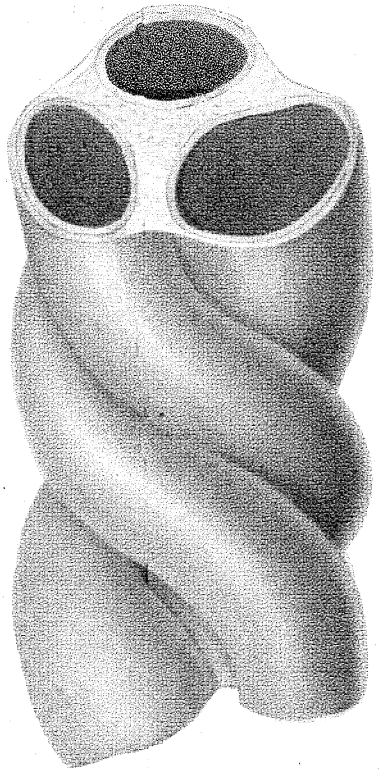
Fig. 1.



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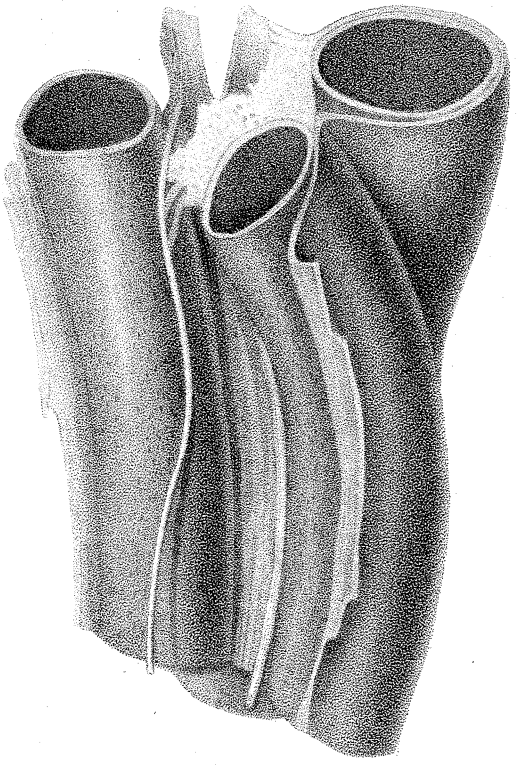

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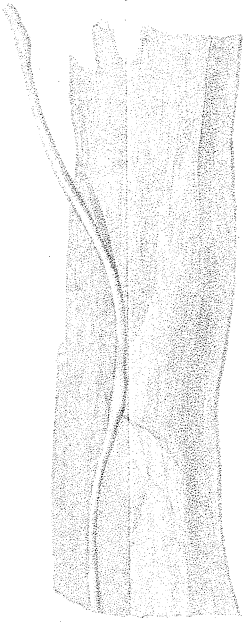

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