

PHILOSOPHICAL
TRANSACTIONS.

XII. *A Historical and Anatomical Description of a doubtful amphibious Animal of Germany, called, by Laurenti, Proteus Anguinus. By Charles Schreibers, M. D. of Vienna. Communicated by the Right Hon. Sir Joseph Banks, Bart. K. B. P. R. S.*

Read March 26, 1801.

THE singular and ambiguous animal of which I have the honour to give the following description, lives in a small lake in Carniolia, called, *Sitticher See*.

This country is celebrated for its lakes, and subterraneous caverns filled with water. One of its largest lakes is the famous lake of Czirknitz, which seems to be the source of all the others; at least there is no doubt that all of them have some connection with each other, by subterraneous, though still unexplored communications: this is ascertained by the repeated and reciprocal risings, and corresponding depressions of the water, in spring and autumn.

Notwithstanding this circumstance, the animal here spoken of

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has been found only in the lake above mentioned; from which it has always appeared to have been thrown out by the rising of the water. Although these overflowings generally happen once or twice in every year, yet, notwithstanding the frequent researches of fishermen, to whom these lakes afford a good subsistence, and of other people, who have made it their particular business to search for the animal during a space of several years, very few specimens have hitherto been discovered.

Several years ago, a specimen from thence came to the Museum of Natural Curiosities in the University of Vienna; and another, nearly at the same time, came into the possession of a naturalist (Baron HOHENWARTH) in Carinthia. In the year 1795, another specimen was sent to the present Professor of Natural History at Vienna, at his particular request, by Baron ZOIS, a liberal and zealous naturalist, settled in Carniola. I did not meet with any other specimens, during my tours in the years 1798 and 1799; though I visited most of the collections in the dominions of Austria, Germany, and a part of Italy. I know, however, that more than one came into the possession of the late Dr. SCOPOLI, who resided in Carniola for several years.

After that time, notwithstanding frequent and diligent researches, none could be discovered till the year 1799; when I was favoured by the same naturalist with two other specimens.

The first notice of this animal was given by the late Dr. LAURENTI, (in 1768,) in his *Synopsis Reptilium*. The short description he gave there, was made from the specimen before mentioned, preserved in spirit by Baron HOHENWARTH, in Carinthia. LAURENTI had no opportunity to examine the internal structure; and his description of the external parts is so

defective and erroneous, that I shall only add, that he considered it as a perfect animal, and called it *Proteus Anguinus*.

In the year 1772, Dr. SCOPOLI gave a more exact and circumstantial (but not anatomical) description of this animal, in his *Annus quintus Histor. Natural.* p. 75.

From the accounts of these learned naturalists, and from a drawing sent by the last mentioned one, LINNÆUS had notice of this animal; but, not being fully acquainted with its nature and characters, and observing that it very much resembled the larvæ of some lizards, he supposed it might be an imperfect animal. It is however noticed, with some others of a similar structure, in the new edition of his *Systema Naturæ*, by GMELIN. Tom. i. P. 3. p. 1056.

Since that time, nothing has been done to illustrate the nature of this curious animal, and to remove the doubts of naturalists, very few of whom have taken notice of it; however, J. HERMANN, (*Commentarius Tabulæ Affinitatum Animalium*, 1783, p. 256. note,) and the celebrated amphibologist, T. G. SCHNEIDER, (*Histor. Amphib. Fasc. 1. 1799, p. 40. &c.*) think themselves fully convinced of its being an imperfect animal: they ridicule the ideas of LAURENTI and SCOPOLI, and blame LINNÆUS for hesitating; though they have no sufficient foundation for their own opinion, which is formed merely from apparent analogy.

I should tire the patience of my readers, if I attempted to refute the arguments of these two naturalists, or to prove, by long deductions and comparisons, that neither they, nor the others, had sufficient ground for their conclusions; I shall therefore only give an accurate description of what I have observed in a careful anatomical dissection of it; in the per-

formance of which I have been guided by no partiality in favour of any particular opinion, but simply by the desire of knowledge; and shall not attempt to speak decisively upon the subject, until farther opportunities may afford me the means of ascertaining the nature of this interesting animal. As all attempts to send it alive to Vienna, (a distance of about 250 English miles,) have been in vain, I have had no opportunity of observing its nature and actions in the living state; I can, therefore, only communicate the few observations which Baron Zois had the opportunity of making, he having had the good luck to get some specimens alive, and to keep one of them so during several days. His observations were communicated to me, with the specimens, in the month of September 1795, in November 1799, and in January 1800.

In his first letter he says, he had some hopes of sending me the animal alive, as it seemed to take some nourishment, having thrown up from its stomach, the first days of his keeping it in the water of the lake, (in which it was brought to him,) a great many small shells of the genus *Helix*; but he soon found his hopes disappointed, as he saw that it would not take either these shells or any other food, and became from day to day more languid and weak. The seventh day it lay upon its back, and the skin became covered with a flaky glutinous slime, as is commonly observed on amphibious animals when dying. It seemed, when alive, very torpid, and moved but seldom; it swam however sometimes, with the help of its broad tail, very swiftly, in every direction. Twice he observed it touch one of those shells with the extremity of its beak, and fling it twelve inches distance, on the bottom of the vessel wherein it was kept. The first days it crept slowly on

the bottom, and seemed to look for food ; it often took a shell into its mouth, but gave it out again, swallowing none. Several times it rose to the surface, stretched its head out of the water, and took in air, but returned directly to the bottom. He never could find any traces of eyes, even with a magnifying glass. He assents, however, to Dr. SCOPOLI's opinion, that it is an animal in a perfect state, and *sui generis*.

In another letter he says, that he received the two specimens sent therewith alive ; but that they died in a few hours, being kept in common water.

In a third letter he says, in answer to some enquiries I made, that all the specimens he knows of were found in the months of August and September ; but that some have been seen by fishermen, so early as the month of July, when the season happened to be very rainy, and the lake overflowed.

He says the animal uses its feet in creeping on the bottom, and in ascending along the sides, of the vessel, if of wood ; that it creeps very slowly, or, to use his words, very deliberately. In this particular it differs from every other creeping animal, insomuch, that he is tempted to call this motion (which he says is amusing to behold) characteristic of the animal.

It often produces a hissing kind of noise, pretty loud, more so than one should expect from so small an animal, and resembling that produced by drawing the piston of a syringe. He once observed that, while doing so, it hung on the side of the vessel, with the fore part of the body out of the water. He suspects that two very small darkish spots, in a parallel direction on the forehead, might be the eyes : he discovered them by looking with a magnifier at the head, when out of the water ; the animal hanging quietly on the sides, where it continued

motionless for a considerable time, without appearing shy or timid.

It is of a light red colour, when alive; and the branchial appendages, on the sides of the head, are of a deep blood colour. In spirit, it soon loses all tinge of redness. Inactivity, and the above-described singular creeping motion, seem to be peculiar to this animal; and, although it came several times in the course of a day to the surface of the water, and even rose above it, it passed the greatest part of its time at the bottom. In ascending in the water, it seemed only to make use of the tail; ascending as slowly and smoothly as it creeps. Sometimes Baron Zois observed it to use a motion like that of fishes, throwing itself about in the water with considerable force and swiftness.

The five specimens which I saw, three of which were at my disposal, were of very different sizes; the largest was about thirteen inches long, and one inch in diameter; three others were between nine and ten inches long; and the smallest (apparently the youngest and most imperfect) was about eight inches long, and hardly the third part of an inch in diameter.

Notwithstanding this considerable difference in size, which evidently shewed a difference in age, they agreed in the general construction of the external, as well as internal parts. The following description was taken from the examination and dissection of the largest specimen, and compared with those of two others of a smaller size.

The head is one inch and three quarters long; its forepart somewhat resembles the bill of a duck, being flat and narrow, rather broader behind than the body, somewhat compressed, and rendered uneven by some smooth protuberances, occasioned by strong muscles. The upper jaw is somewhat larger than the

under one, and surrounds it with a thick folded skin, forming a considerable lip, and making the mouth itself larger and broader than it would be according to the size of the skull. It has no nostrils, external ears, or appearance of eyes.

This last circumstance occasioned the mistake of Dr. LAURENTI, and of all the other naturalists, who affirmed that the animal was really destitute of eyes. It is true, that there is no appearance of them after death, particularly when the animal has been kept in spirit; and indeed they are scarcely to be discovered even while it is alive; but, if the skin is removed from the front of the head, they may be seen at the base of the rostrum, beneath the foremost protuberances. They are very small, and black; seem to be very simple, and are not quite so globular as those of fishes, but more flat: they lie in a small cavity of the skull, and seemed to be somewhat attached, at least by some glutinous matter, to the skin itself; as, by removing the skin without sufficient care, they adhered to it, and came out of their cavity, along with a small thread, which I think was the optic nerve.

On the sides of the occiput are apertures, like those of fishes; and, over them, ramified branches of vessels or branchial appendages, similar to those of tadpoles or other larvæ of amphibious animals; which analogy has occasioned so many doubts and dissentions among the learned about this animal, as well as about the still ambiguous *Siren lacertina* of LINNÆUS. These appendages are formed by three very large branches of blood vessels, of which the uppermost is the largest, the next somewhat smaller, and the lowest the smallest: each of these is divided into smaller branches; which, lastly, are bordered on their under edge by many very small and thin ones. Their

direction is towards the body, almost parallel to it; and, upon removing them, the branchial apertures are seen directed to, and communicating with, the mouth, like the gills in fishes. Each of these apertures is divided by three thin simple membranes, (not vascular, as in fishes,) attached in like manner to three oblique cartilaginous bones, but leaving only two holes between them; in which circumstance, and in the red colour of the appendages during life, this animal differs materially from fishes, and from tadpoles or other larvæ.

Behind the appendages, the head becomes narrower, and forms a round neck, reaching from thence to the insertion of the fore feet, about half an inch long, and a little narrower than the body.

The body itself is round, equally thick throughout, and, from the insertion of the fore feet to that of the hind feet, about $6\frac{1}{2}$ inches long. The fore feet are about one inch long, consisting of the thigh and leg, and terminating in three toes, without nails, whereof the middle one is the longest. The hind feet are about one-sixth of an inch shorter than the fore feet; and terminate in only two ill shaped toes.

Behind these feet, the body grows narrower, and terminates in the tail, which is three inches and a half long, compressed on the sides, and very fleshy and strong in the middle; it grows narrower towards its end, which is almost pointed, and, as well as the edge above and underneath, is surrounded by a thin membrane, which gives it a considerable breadth. Underneath, rather lower than the hind feet, is the anus, an oblong aperture, surrounded by a strong wrinkled sphincter.

Upon opening the body by a longitudinal section, from the anus to the edge of the under jaw, I found the whole cavity

almost filled by the liver, which extended from the thorax down to the pelvis, so as to cover all the viscera, except the heart, the upper part of the lungs, the left half of the stomach, the gall-bladder, and the lower intestines.

The heart lies in the middle of the chest, or rather of the neck, above the insertion of the fore-feet: it is inclosed in an ample pericardium, formed by a simple thin membrane, attached to the upper part of the lungs, and to the surrounding muscles of the body.

On account of the width of the pericardium, the heart seems very large, and oval; it is, however, really small, and consists of a single ventricle, and a single auricle, as large as the ventricle, but a little flatter, finely serrated on its upper edge, and situated upon the upper part of the ventricle, a little towards the left.

I could distinguish only two considerable blood vessels in connection with the heart on its right side, where the auricle formed an angle with the ventricle. One of them, which was short, but pretty large, goes up perpendicularly, forming two enlargements, and divides, a little above the upper edge of the auricle, into two branches, which seem to take their direction towards the branchial appendages.

The other and longer vessel, which comes from the same part of the heart, below the former, goes straight down, turns in a little below the point of the heart, and forms there a considerable enlargement, just over and upon the lungs; then runs down in the middle of them, until it reaches the point of the liver, in the description of which, its farther course will be mentioned.

Besides these two vessels, (which by their size, as well as by their being filled with coagulated blood after the animal's death, seem to be veins,) I could not pursue the course of any others,

owing to the length of time the specimens had been kept in spirit.

On account of the connection of the parts, I shall proceed to describe the liver, leaving the respiratory organs at present.

The liver is the most considerable viscus of this animal, and is nearly five inches long, beginning about one inch below the heart, running down to the larger intestines, and terminating about two inches above the anus. Five lobes may be distinguished; the uppermost begins narrow and pointed, and is somewhat divided by a longitudinal ridge, just where the oesophagus terminates in the stomach.

This lobe is the longest and narrowest, is cylindrical, and runs down on the right side of the body, covering half the stomach, near the end of which it extends to the left, and forms the second lobe, which is throughout connected with the former, and with it fills up the whole cavity of this part of the belly. This second lobe terminates in a third, which lies deep in the left side, is of an oval form, with a pointed end, and has several incisions on its edges.

The fourth, a very small lobe, is formed on the under edge of the first, and only marked by two incisions, caused by the cavity in which the gall-bladder lies.

The fifth lobe is the broadest, as it fills up the whole breadth of the body: it is almost quadrangular; terminates in a point to the right, and goes off in an oblique direction to the left.

The upper surface of the liver is smooth and convex, the under one somewhat rough and concave. On the upper surface are transverse elevations like ribs; and a thin membrane runs from the pericardium, along with the blood vessel, to its beginning, and over the middle of the first lobe to the second,

fastening this part of it, like the ligamentum suspensorium in other animals, to the muscles of the body; a similar membrane connects the liver, underneath, with the parts contiguous to it.

The longer blood vessel mentioned in the description of the heart, after having formed the enlargement already spoken of, forms a double one on the upper part of the liver; then runs down on the right edge of that viscus, giving out some small branches to its substance, also one to the mesentery; and terminates upon the surface of the fifth lobe of the liver, in a great ramified branch. The colour of the liver is a dark bluish-grey, with numerous small black spots: its substance is glandulous and compact, more so than I have observed in other analogous amphibious animals, or fishes.

The gall-bladder is pretty large, so as to fill up the whole cavity formed by the lobes of the liver, to which it is, in some places, firmly attached, as it is, underneath, to the first intestine; thus having an immediate connection both with the liver and the intestines.

The œsophagus is a narrow canal, of about one inch in length: it runs down on the back; is strong, and internally full of longitudinal wrinkles, particularly as it approaches the stomach, at the orifice of which they form a perfect cardia.

The stomach is entirely distinct from the œsophagus and bowels, being infinitely wider. It forms a bag, about two inches long, of a strong and almost coriaceous appearance.* Its lower end terminates in a narrow duodenum, which continues nearly straight for about two inches, forming the small intestines, then making three considerable convolutions, and

* In the stomach of one specimen, I found the head and bones of a small fish.

terminating in the rectum, which is very strong, and wider towards the anus.

The internal surface of the stomach, towards the bowels, is very much wrinkled longitudinally, forming a perfect pylorus. These wrinkles continue throughout the whole length of the intestinal canal, and, in the large intestines, are very strong, forming serrated plicæ.

The stomach and intestines are very loose in the cavity, being connected with the neighbouring parts only by thin membranes. The rectum, however, at its termination, is firmly connected with the kidney underneath, and attached above to the ossa pubis. A little above this is a narrow viscus, about half an inch long, fastened by its lower end to the rectum, and, by a long slender membrane from its outer edge, to the muscles of the abdomen. It is hollow, of a very spongy substance, and opens into the lower end of the rectum, by means of a short narrow canal, through which I could pass a thin bristle. By its situation and structure, I suppose it to be the uterus; though I observed it in every one of the dissected specimens.

The spleen is flat and narrow, about one inch and a half long, fastened to the back of the stomach on the left, and also to the pancreas, with which it seems to be farther connected by three vessels: its substance is compact, and has a glandular appearance.

The pancreas is narrow, and about one inch long; it is attached to the back of the duodenum, and also to the gall-bladder.

The mesentery is a thin membrane, fastened strongly to the back of the intestinal canal on one side, and to the neighbouring parts on the other. It is full of blood vessels, two of which

are very conspicuous; one near the intestines, beginning from the under edge of the pancreas, and terminating on the rectum, after having sent off numerous branches to the bowels: the other is the above mentioned branch of the blood vessel of the liver; it runs on the opposite edge of the mesentery, parallel with the former, giving out numerous branches, some towards the bowels, (anastomosing with the former vessel,) others towards the neighbouring parts.

Upon the spine, and strongly fastened to it, lies a viscus, which originates in two thin membranous strings in the thorax: these strings soon unite into one; in the course of which, lower down, appears a glandulous substance, forming innumerable small and narrow convolutions, from which several blood vessels go off towards the spine. This glandulous substance, which is very thin and narrow about the middle of the body, grows sensibly larger in its course downwards, and terminates at last, a little above the beginning of the rectum, in an oblong flat viscus, of a glandulous appearance, divided in the middle by a shallow longitudinal ridge. It is a little broader than the rectum, under which it lies; it is fastened to the spine, and opens at its lower end into the rectum, by a short and narrow canal. Its situation and structure led me to suppose it to be the kidney.

There are still two other viscera, somewhat resembling the blind intestines in some fishes; they must not, however, be confounded with them, as they do not belong to the intestines, but appear evidently to be the ovaries. They are situated low in the belly, one on each side the spine, and seem to originate in a blood vessel which runs down the pneumatic bladders, (of which I am going to speak,) and a membrane connecting them

with the mesentery: these unite together, and terminate in a narrow hollow viscus, about half an inch long, and impervious at its broader end. Its substance seemed to be composed of small glands. In one of the specimens, it had the appearance of a transparent membranous bag, containing a mass of small glands, or little eggs, of the size of a grain of millet, conglutinated together.

Below the heart, in the thorax, there is a bag about one inch long, of a very simple and thin membrane, without any apparent vessel. The upper end of this bag is round and impervious: the lower end terminates in two ducts, of which the right, accompanied by a blood vessel, runs down under the liver, and is connected to its outer edge by a membrane, until it reaches the middle of the body, where it grows wider, and terminates in a small oval membranous bladder. In one specimen, this bladder was very small, and semilunar. The blood vessel accompanying the duct goes as far as the middle of this bladder, then separates from it, joining with the membrane of the mesentery; thus forming the beginning of the ovary on this side, after having received some small branches of the vessel coming from the liver to the mesentery. The bladder itself terminates in a sharp point. The duct on the left side runs down like the former, but under the stomach, to which it is fastened by a membrane: it runs lower down in the belly than that on the right, and terminates in an oblong bladder, of the same shape and structure as the former, but always considerably larger.

The blood vessel which comes to the bladder along with its duct, divides into two branches: one runs over the surface of the bladder, is very large, and divides into numerous branches

which seem to anastomose with the branches of a smaller vessel, probably an artery, running on the opposite side. The other branch goes, in the manner before described, to the ovary of the left side, which is likewise connected by a membrane with the mesentery.

Upon opening the pneumatic bag above mentioned, I found it quite simple, without any cellular structure, as in other amphibious animals; but there was an intermediate membrane, which separated it into two cavities, between which, however, a communication was left, at the upper end of the bag, by a large semilunar opening. The communication of these cavities, with their respective ducts and bladders, was plainly shewn by blowing air into them, which readily passed from one to the other: indeed the ducts, though very narrow, admitted water to be driven through them by means of a fine syringe, so that I was able to fill both bladders entirely. In the back of the upper part of the bag there is a small opening, which terminates, by a very narrow canal or trachea, in a small slit or glottis, at the bottom of the lower jaw; shewing very evidently, that these parts constitute the respiratory organs or lungs of this animal.

I shall not attempt to construct any hypothesis respecting the nature and manner of living of this animal, or make any deductions respecting the singular structure of these parts, so much deviating from the common organization. I shall only remark, that Mr. SCHNEIDER, in his work already quoted, mentions, though obscurely, and only in a few words, (p. 63, &c.) that he observed a similar structure of the respiratory organs, in what he supposes a larva of the *Lacerta palustris*. It seems extraordinary that he paid so little attention to

such a surprising organization. I have dissected many larvæ of water lizards, but never could discover any such structure.

The skin of this animal is very tenacious and coriaceous: by looking at it with a magnifier, there appears a quantity of minute glands under the epidermis, similar to those in water lizards, &c. It is strongly attached to the muscles underneath, in several places, by the cellular membrane, in which the above mentioned glands are dispersed, and which is filled, particularly upon the back, with a tough viscous matter. Of the muscular fibres, I observed three different layers, which however are very thin, but firmly connected with each other: the fibres of the two outer layers are very tender, and transverse; those of the middle layer are stronger, and longitudinal. On the under side of the lower jaw, are the following strata. Immediately under the skin is a thin stratum of transverse fibres; under this, in the middle, is a stratum of longitudinal fibres; there are also two very large and strong muscles on each side, of which the upper ones consist of fibres running obliquely from the middle outwards and downwards: the under ones are somewhat stronger, and consist also of oblique fibres, not running parallel to the first, but still more obliquely, and almost transverse. The forehead and the occiput are covered by five muscles; two in the middle of the forehead, very large, and composed of strong transverse curved fibres, divided only by a ridge from each other, and forming together the figure of a heart, with the point backwards: their fore part forms the declivity of the front to the rostrum, (which is only covered by a thin layer of longitudinal fibres,) and the two tubercles on the forehead, which Dr. SCOPOLI took for eyes. On each side of these muscles there is another muscle, composed of very

strong longitudinal fibres, narrow on the forehead, but very large on the occiput: in the middle of this there is a thin narrow stratum of straight longitudinal fibres, covering the occiput itself, and extending from the point of the heart-shaped muscle, over the neck and spine. By these very strong muscles, the head appears of a large size, and the rostrum is very conspicuous, which otherwise, according to the form of the bones, would be very flat, narrow, and almost cylindrical.

The skin is in some places firmly connected with the muscles of the head; but its strongest connection is on the outer edge of the rostrum, with the bone itself, (where it forms, by a duplicature, a large thick lip,) and on the sides of the occiput, where it forms the branchial appendages; these are a continuation of the epidermis, forming, or at least investing, blood vessels attached by a duplicature of the skin to the sides of the head. On the back, besides the cover of transverse fibres, is a stratum of strong longitudinal ones.

There is, in each jaw, a row of very minute sharp teeth.

The tongue is pretty large and fleshy; it is loose at the point, but attached by its root to the lower jaw, and fastened on both sides, by two muscular strings, to the os hyoides.

In the pharynx, above the œsophagus, there is a very small oblong slit, or glottis, (like that which, in fishes, leads to the swimming bladder by means of a canal,) without epiglottis; but, as it is situated between the longitudinal fibres at the beginning of the œsophagus, it contracts and shuts, when the œsophagus is longitudinally extended in swallowing the victuals.

On each side of the lower jaw appear the three branchial cartilages, to which, as is above mentioned, the membranes are attached.

The bones seem to be of the same conformation and nature as in salamanders. I could not construct a perfect skeleton; as the flesh was so strongly contracted and hardened by the spirit, that I was obliged to boil it some time, by which the bones were dissolved. However, I can assert, that there were no ribs, or sternum; but there were bones in the tail.

Though I shall not enter into a comparison of this animal with those which are analogous to it,* I must say something respecting its analogy with the famous Siren lacertina of LINNÆUS; with which it agrees in the most striking particulars, viz. in having gills and lungs, and therefore causes the same doubts about its being a perfect animal. The doubts respecting the Siren are not yet removed; but are rather increased, by different anatomical accounts, given by two equally renowned anatomists, HUNTER and CAMPER. In conformity to the opinion of the latter, who asserted that the animal was destitute of lungs, it has lately been removed from the class of amphibious animals, and transferred to that of fishes, under the name of *Muræna Siren*. The principal difference between the Siren and the animal here described, (besides the former having only two feet,) consists in the head and lungs. In the Siren, the head is short, having no rostrum, but a pointed small mouth, conspicuous eyes, and nostrils. The lungs, although constructed also of a simple membrane, without cellular subdivisions, and running down the whole length of the body on each side, are divided

By these I mean, the larvæ of Salamanders and of some water lizards, the Proteus Tritoneus of LAURENTI and SOELMANN, and the animal lately (but very imperfectly) described in the Transactions of the American Philosophical Society for the year 1799, as a new species of Siren. The latter, in shape, in size, and in the form and structure of the head and feet, is totally different from the animal described in this Paper, being much more analogous to the above mentioned larvæ.

from the beginning, and are throughout equally wide; neither forming the ducts, nor the remarkable bladders, described in this Paper. Notwithstanding this material difference, and many others of less consequence, there is no doubt that these two animals are nearly allied to each other.

Having thus given a faithful account of this ambiguous animal, and as perfect a one as circumstances enable me to do, I shall only express my hopes, that it will be considered as an interesting addition to the knowledge of natural history and comparative anatomy, whether the animal here described be supposed a perfect one, or whether it be considered as the larva of some unknown species. To those who may incline to the latter opinion, I shall only say, that notwithstanding the most careful researches during many years, and the frequent fishing in the lakes and caverns of the neighbouring country, at every season of the year, no animal has hitherto been detected, of which it can possibly be the larva.

EXPLANATION OF THE PLATES.

PLATE XVI.

The animal, apparently in its full grown state, in the act of swimming.

PLATE XVII.

Fig. 1. *The liver.*

- a*, Its beginning, with a rostriform point.
- b, b*, The first, and uppermost, narrow cylindrical lobe.
- c*, The second lobe, to the left, a continuation of the former.
- d, d*, The third lobe, a continuation of the second, quite in the left side.
- e*, The fourth lobe.
- f, f*, The fifth and largest lobe.
- g*, The connection of this lobe with the upper part of the liver, to the right.
- h*, Termination of the liver on the right side.
- i*, A cavity formed by the different lobes, for the reception of the gall-bladder.
- k*, A varicose dilatation of the blood vessel running from the heart to the liver.
- l*, Course of this blood vessel, on the outer edge of the liver, to the right.
- m*, Its double dilatation, on the upper corner of the liver.
- n, n*, Its farther course downwards.
- o, o*, Its branches going to the superficies of the liver.

p, Its termination, in a ramified branch, on the superficies of the fifth lobe.

q, q, q, A membrane originating from the pericardium, running longitudinally over the middle of the liver, as far as the third lobe, to the left, and attaching the liver to the muscles of the belly.

Fig. 2. *The intestines and organs of respiration.*

a, a, The pericardium laid open, the heart being removed.

b, The upper part of the air-bag, forming the beginning of the lungs.

c, c, The bag itself, formed by a thin and simple membrane, and divided into two cavities.

d, d, The right pneumatic duct, being a continuation of the right cavity of the air-bag.

e, The air-bladder in which this duct terminates.

f, f, A thin membrane, connecting the pneumatic duct with the outer edge of the liver, to the right.

g, g, The left pneumatic duct, running underneath the stomach, to the air-bladder.

h, The œsophagus.

i, i, The stomach.

k, The termination of the ventricle in the duodenum.

l, l, The small intestines.

m, m, m, The large convoluted intestines.

n, The rectum.

o, The anus.

p, A viscus attached to the rectum, probably the uterus.

q, q, A membrane connecting this viscus with the muscles of the belly.

r, A part of the spleen.

s, The gall-bladder.

t, t, The two ends of the pancreas.

u, u, The mesentery.

v, v, A blood vessel originating from the lower end of the pancreas, running down the mesentery, and sending branches to the intestines.

w, w, A branch of the blood vessel of the liver, running parallel to the former, with which it anastomoses.

x, Another branch, anastomosing with the blood vessel of the right pneumatic duct, and running to the ovary of that side.

y, y, The blood vessel of the right pneumatic duct, terminating in the ovary.

z, The supposed right ovary.

Fig. 3. *The same intestines and organs, on the opposite side.*

a, a, The œsophagus.

b, b, The stomach.

c, c, The small intestines.

d, d, d, The large intestines.

e, e, The rectum.

f, The viscus attached to it.

g, g, The spleen, attached to the stomach on the left.

h, h, The pancreas, attached to the duodenum.

i, The gall-bladder, attached on one side to the pancreas and the duodenum.

k, k, k, The mesentery.

l, l, The pancreatic blood vessel.

m, m, The hepatic blood vessel.

n, The right ovary.

- o*, The left ovary.
- p, p*, The air bag.
- q, q*, The left pneumatic duct, attached to the stomach by a membrane, and terminating in the air-bladder.
- r, r*, The left air-bladder.
- s, s*, The blood vessel accompanying this duct, and terminating upon the air-bladder in a large ramified branch.
- t, t*, The right pneumatic duct, terminating in its air-bladder.
- u*, The right air-bladder.
- v, v*, A membrane connecting the duct with the liver.

Fig. 4. *The viscus supposed to be the kidney.*

- a, a*, Its beginning in two membranous strings, in the thorax, upon the spine.
- b, b*, Its course while yet merely membranous.
- c, c*, The same, increasing gradually in size and substance, and being very much convoluted.
- d, d*, A membrane accompanying it, and attaching it to the spine.
- e, e, e*, Branches of blood vessels running from it, across the membrane, to the spine.
- f, f*, Termination of this viscus, under the rectum, in a flat, oblong, spongy body, divided superficially, by a longitudinal ridge, into two equal parts.

Fig. 5. *The head and upper jaw, with the skin removed.*

- a*, The bill-like prolongation of the forehead, covered by a thin stratum of longitudinal muscular fibres.
- b*, The thick upper lip.

c, c, The eyes.

d, d, The large muscles of the forehead, forming together the figure of a heart.

e, e, The strong lateral or temporal muscles, composed of oblique fibres.

f, The occipital muscle, composed of longitudinal fibres.

Fig. 6. *The inside of the under jaw.*

a, The under lip.

b, b, A row of teeth.

c, The tongue.

d, d, The muscles of the tongue.

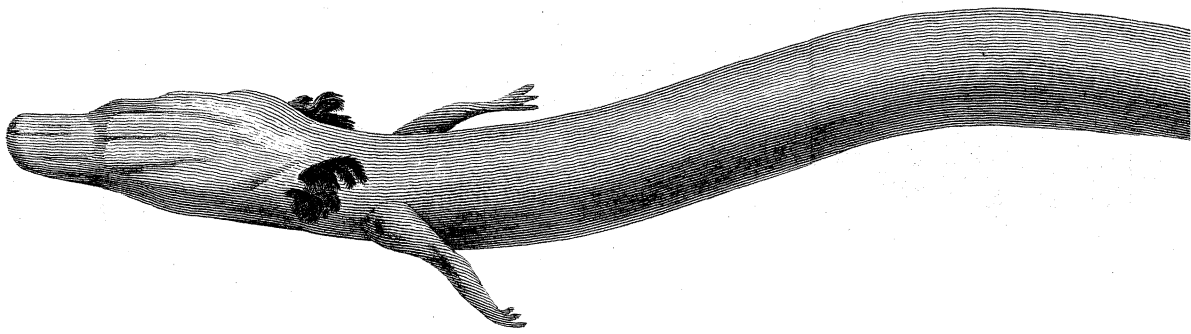
e, e, The muscles of the jaw.

f, The pharynx.

g, The small aperture of the trachea, or rima glottidis.

h, The beginning of the oesophagus.

i, i, i, The three branchial cartilages.



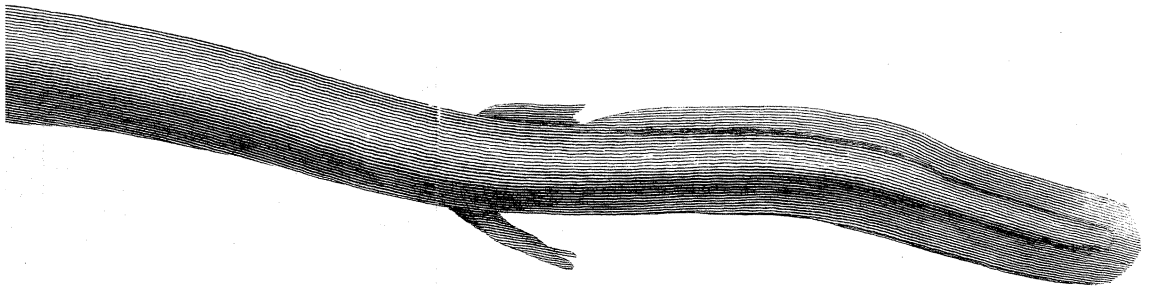


Fig. 1.

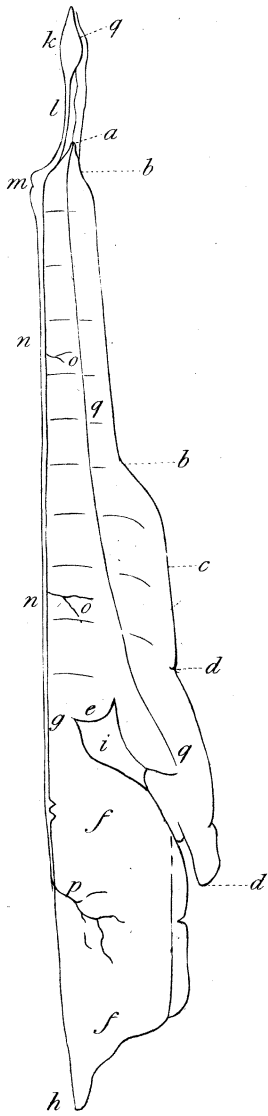


Fig. 2.



Fig. 3.

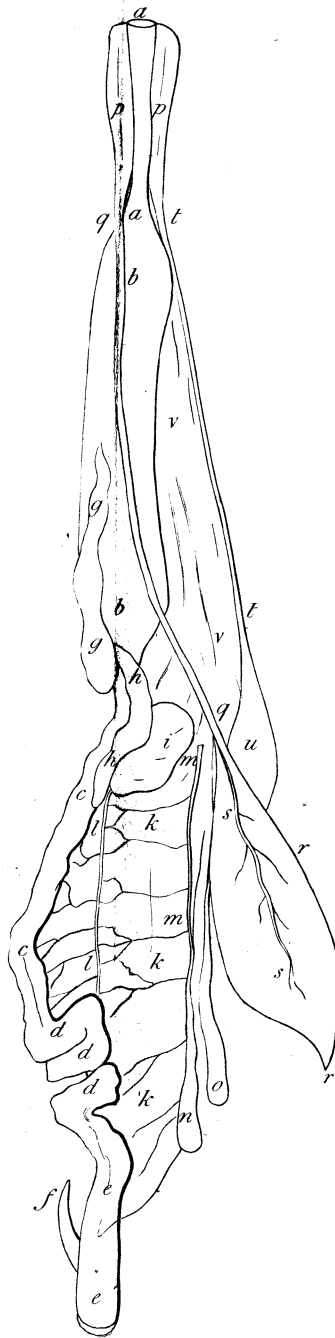


Fig. 4.

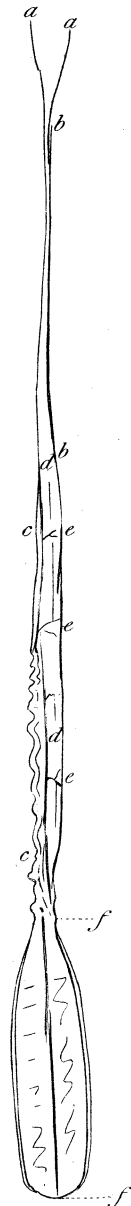


Fig. 5.

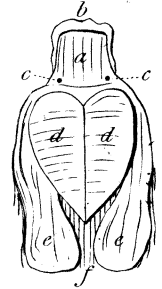


Fig. 6.



