ON THE MATURE MALE SEXUAL ORGANS OF THE CONGER-EEL (*Conger vulgaris*), WITH SOME OBSERVATIONS ON THE MALE OF THE COMMON EEL (*Anguilla vulgaris* Fleming).*

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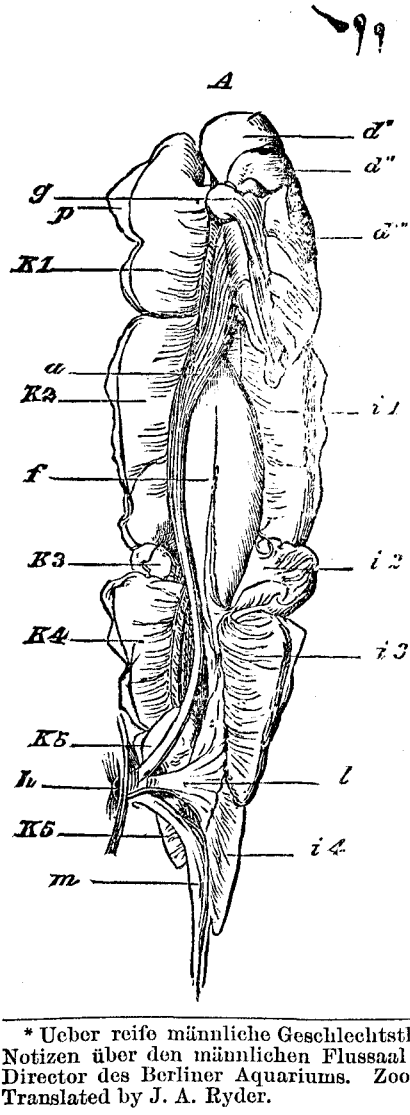
Since Syrski, in 1874, discovered the organs in *Anguilla vulgaris*, which have been named after him, and which have been regarded as the male reproductive organs by himself and most other zoologists, the discovery of a sexually mature male only remained to be made to finally settle the question of the sex. Up to the present time all the efforts made to attain this desired result have been fruitless. The histological investigations pursued by S. Freud upon the Syrskian lobulated organs, seemed indeed to lead with greater probability to the conclusion that they were testicular in nature, nevertheless the failure on all hands to find spermatozoa remained the missing link in the chain of evidence needed to confirm Syrski's discovery.



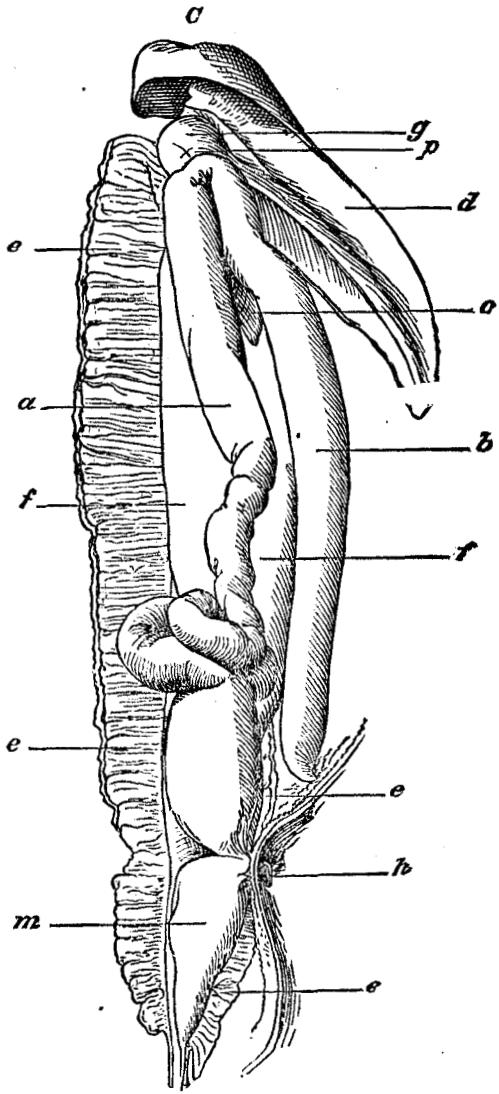
EXPLANATION OF FIGURE A, p. 126, AND F, p. 130.

A. Mature male reproductive organs of a specimen of *Conger vulgaris* 74cm long. One-half natural size; *a*, intestinal canal; *d'*, upper, *d''*, middle, *d'''*, lower portion of the liver, thrown over to left side; *f*, swimming-bladder; *g*, gall-bladder; *h*, anal opening; i_1, i_2, i_3, i_4, lobes of the left testicle; k_1, k_2, k_3, k_4, k_5, the five lobes of the right testicle; *l*, *bursa seminalis*; *m*, bladder; *p*, membranous border fringing the free edge of the testicle.

B. Spermatozoa.

* Ueber reife männliche Geschlechtstheile des Seeaals (*Conger vulgaris*) und einige Notizen über den männlichen Flussaal (*Anguilla vulgaris*). Von Dr. Otto Hermes, Director des Berliner Aquariums. Zoologischer Anzeiger, 1881, No. 74, pp. 39–44. Translated by J. A. Ryder.

The spermatozoa said to have been discovered in a male eel (*Anguilla bostoniensis*), according to Dr. A. S. Packard, jr.,* turned out to be an illusion. The announcement of this discovery was recalled in the *Zoologischer Anzeiger*, II, No. 26, p. 193, as follows: "The motile bodies were not spermatozoa but yolk particles." This correction was overlooked by Von Siebold's assistant, Dr. Paul,† as well as by S. Th. Cattie‡ of Arnheim, although the latter had read Jacoby's§ paper, in which, at page 44, the foregoing expression is mentioned, and which he himself has also cited in substance in the summary given by Jacoby.



EXPLANATION OF FIGURE C.

C. Undeveloped female reproductive organs of *Conger vulgaris* 84cm long. One-half natural size; *a*, stomach; *b*, cæcal appendix of stomach; *c*, spleen; *e*, right ovary; *e'*, left ovary; *f*, swimming-bladder; *g*, gall-bladder; *h*, anal opening; *m*, urinary bladder; *p*, base of the left ovary.

The reproductive organs of *Conger vulgaris* are very similar to those of *Anguilla vulgaris;* in the undeveloped condition they have the ovaries lying in the same position, in the form of a ruffle or frill-like band of relatively larger size. *Conger vulgaris* attains almost double the size of *Anguilla vulgaris;* examples measuring two meters (6 feet) are not uncommon. The ovaries also develop when the animal is in confinement, and I am convinced that this is often the cause of the death of the animal under such conditions. Upon opening some Conger eels

* Zoolog. Anzeiger, II, No. 18, p. 15.
† Oestetreichische Fischerei-Zeitung, 1880, No. 12, p. 90.
‡ Zoolog. Anzeiger, III, No. 57, p. 275.
§ Dr. L. Jacoby, Der Fischfang in der Lagune von Comacchio. Berlin, Hirschwald'sche Buchhandl., 1880.

which had died in the Berlin Aquarium, it was found that the ovaries were well developed, and a specimen which died in the aquarium in Frankfort burst in consequence of their extraordinary development. The weight of the ovaries of this animal, which weighed 22½ pounds, was 8 pounds and the number of eggs about 3,300,000. The absence in this case of the natural means by the help of which the animal could get rid of the eggs was apparently the cause of death. Male specimens of the Conger in an undeveloped condition I had not yet had an opportunity of examining. On this account, in the autumn of 1879, I obtained a number of Congers caught in the vicinity of Havre, the lengths of which would range from about 60 to 70 centimeters (or 2 to 2 feet 4 inches). These ate greedily and grew rapidly. But one individual was backward in its development; so that it was easily distinguished from the others. This specimen, the smallest in the aquarium, died on the 20th of June of the past year, and was examined by me on the same day. I was pleasantly surprised, as I found sexual organs very differently formed from those which I had always met with before. From a cut in the same a milky fluid escaped, which upon examination with a microscope enlarging 450 diameters, was found to contain a vast number of spermatozoa in the liveliest motion, which showed a head and tail very plainly. There was, therefore, no doubt about the fact that I had before me a sexually mature male of *Conger vulgaris*. Two portions of the milt or testes were cut off for the purpose of farther investigation, and the eel, 74 centimeters long, placed first in spirit, then in Wickersheimer's fluid. On the 24th of June, in company with Dr. Rabl-Rückhard, the anatomical discovery was confirmed.

The testes present to the eye the appearance of long, band-like compressed organs, attached along either side of the air-bladder by means of a fold of the mesentery, and extending the whole length of the abdominal cavity, and somewhat behind the vertical of the anal opening posteriorly. Each testicle ends in a tongue-like broader anterior and narrower posterior extremity, becoming thicker but narrower posteriorly, and is divided into a number of lobes of unequal size by a series of dorso-ventral emarginations. On the right side there are four emarginations and five lobes. The first of these measures longitudinally 45^{mm}, the second 70^{mm}, the third only partially distinguished from the fourth, 8^{mm}, the fourth 43^{mm}, the fifth 38^{mm}.

An exact enumeration of the lobes of the left testicle was not possible on account of the fact that a piece 5.5 centimeters had been removed for more extended study. The anterior part, including the space above named, is 98^{mm} long; then follows a lobe measuring 18^{mm}, and, lastly, a portion 80^{mm} long. The last is divided into three portions by two shallow oblique sulci, the portions measuring 15, 27, and 28^{mm} long, respectively.

The thickness of the above most developed left lobe was 9^{mm}, its breadth from its mesenteric attachment to its free border 18^{mm}. On the

left side the free tongue-like extremity of the testicle extends 12mm and on the right side 13mm beyond the attachment of the mesentery. The attachment of the mesentery begins on the right side 11mm farther forward than the left. The posterior extremity of the right testicle extends 4mm beyond the mesenteric attachment and 26mm beyond the vertical of the anus. The left testicle extends 38mm beyond the vertical of the anus, whilst its extremity scarcely extends beyond the mesenteric attachment. The free ventral border of both testes becomes gradually thinner, and forms a membranous border 4mm broad extending beyond the opaque parenchyma. This border is lobulated or crenulated owing to slight marginal incisions; it is very distinct at the anterior end of the left testicle, but is broader posteriorly where it is bent outwards, while at the same time it is more deeply notched or incised.

At the base of the testes lies the *canalis seminalis* or *vas deferens*, which opens into the *bursa seminalis;* and from the portion of testicle lying behind the vertical of the anus a similar canal leads to the *bursa seminalis*, from which the sperm is discharged through the *porus genitalis.*

If one compares this description and the figures* of the lobulated organ discovered by Syrski and called after him, there appears a striking similarity between the two. If it is borne in mind that in the first case we have to do with quite undeveloped and in the Conger with fully mature male reproductive organs, all doubts are put aside as to the sex indicated by the Syrskian organs. In the case of the *Conger* as in that of *Anguilla*, the fact remains, as upheld by Syrski, that the male is conspicuously smaller than the female.

As is well known, Von Siebold assumes that all the young eels which wander into streams develop into females, while the young males remain in the sea or at the mouths of the streams. This assumption should not be taken literally, however, for out of 250 eels caught in the vicinity of Cumlosen, measuring 28 to 42 centimeters, I found 13 males or 5 per cent. Cumlosen lies near Wittenberge, and is also not less than 25 miles distant from the mouth of the Elbe. What percentage of males is to be found nearer the mouth of the Elbe I have not been able to learn on account of a lack of material. Forty eels caught in the Havel at Havelberg were females without exception.

I found a remarkably large number of male eels in a lot of 137 caught in the bays joining the Baltic in the vicinity of Rügen, namely, 61 individuals or 44½ per cent., while amongst those taken at Wismar and the Danish coasts there was but 11 per cent.

Whether these facts have any relation or can give any clue to the position of the hitherto unknown spawning places of eels, it is hoped further investigation will show.

Although Cattie, in the paper already cited, gives it as an undoubted

*Abhandl. d. k. k. Akad. d. Wiss., April-Heft, 1874. The figure represents the liver of *Anguilla* as two-lobed. It has, however, a simple, tongue-like form, and is divided at its lower end into two lobules.

fact that eels migrate to the sea where in the course of six to eight weeks their sexual organs attain their full development when the old males as well as females die after having accomplished the reproductive act; there is no scientific ground, to the best of my knowledge, which would lend support to this assumption. What was considered as only probable by Von Siebold and Jacoby is, as it appears, assumed by Cattie to be proven.

Cattie further repeats Jacoby's suggestion, that perhaps as a consequence of an acquaintance with the experience of Günther referred to by Darwin, that in almost all fishes the male is smaller than the female, it occurred to Syrski to investigate the smaller eels. This assertion is without foundation. Syrski was led to his discovery without having had any hints from others. In his paper cited above he remarks as follows upon this point: "So I selected for my investigations the smallest eels I could possibly find, reflecting as I did so upon the fact that in many species of the animal kingdom the male is smaller than the female." Syrski writes me complaining bitterly that any one should compare this clear expression with the former and regard it the same, and that he knew nothing of the views of Günther and Darwin, with which he was moreover made acquainted only through Jacoby's paper.

Finally, as regards the distinction of the male from the female eels by external characters, those sent me from the Schleswig coast during the month of November presented such great differences in their coloration that the sender, the Royal Fish Inspector Hinkelmann, could indicate beforehand the number of each sex.

The males were distinguished by a striking bronzy metallic luster, while the females of the same size were of an almost uniform dull steel-gray color. Amongst the males a number of examples were found measuring 45 centimeters long, while Syrski found none over 43 centimeters in length. In Comacchio Jacoby was so fortunate as to find a specimen 48 centimeters long.

OFFICIAL PAPERS RELATING TO THE PROPOSED INTERNATIONAL FISHERIES EXHIBITION AT EDINBURGH IN 1882.

DEPARTMENT OF STATE,
Washington, August 1, 1881.

SIR: I inclose herewith, for your information, a copy of a dispatch of the 15th ultimo, from the vice-consul at Leith, with the inclosures, relating to the international fisheries exhibition to be held at Edinburgh, in April next. Any remarks you may deem proper to make for the information of the vice-consul will be communicated to him.

I am, sir, your obedient servant,

ROBERT R. HITT,
Assistant Secretary.

SPENCER F. BAIRD, Esq.,
Secretary of the Smithsonian Institution, Washington.