

## **Fish trematodes of the Northumberland coast / by Marie V. Lebour.**

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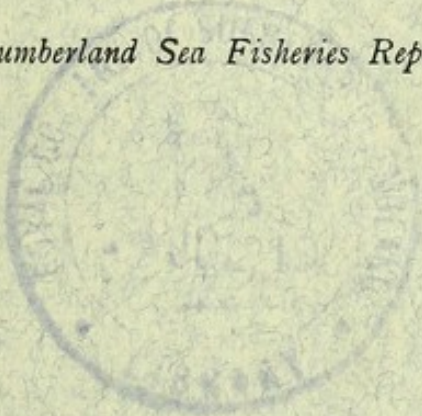
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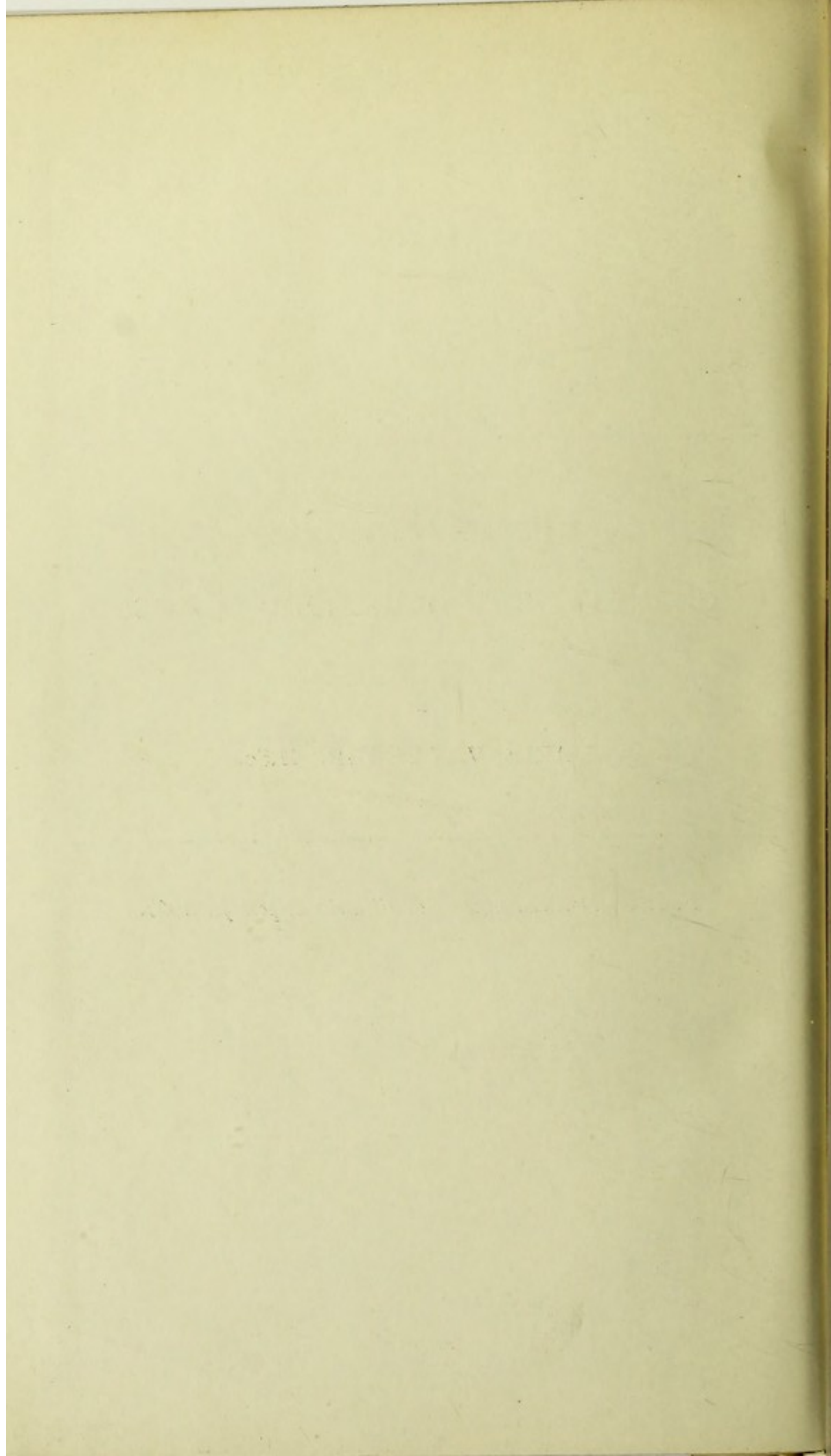
BY

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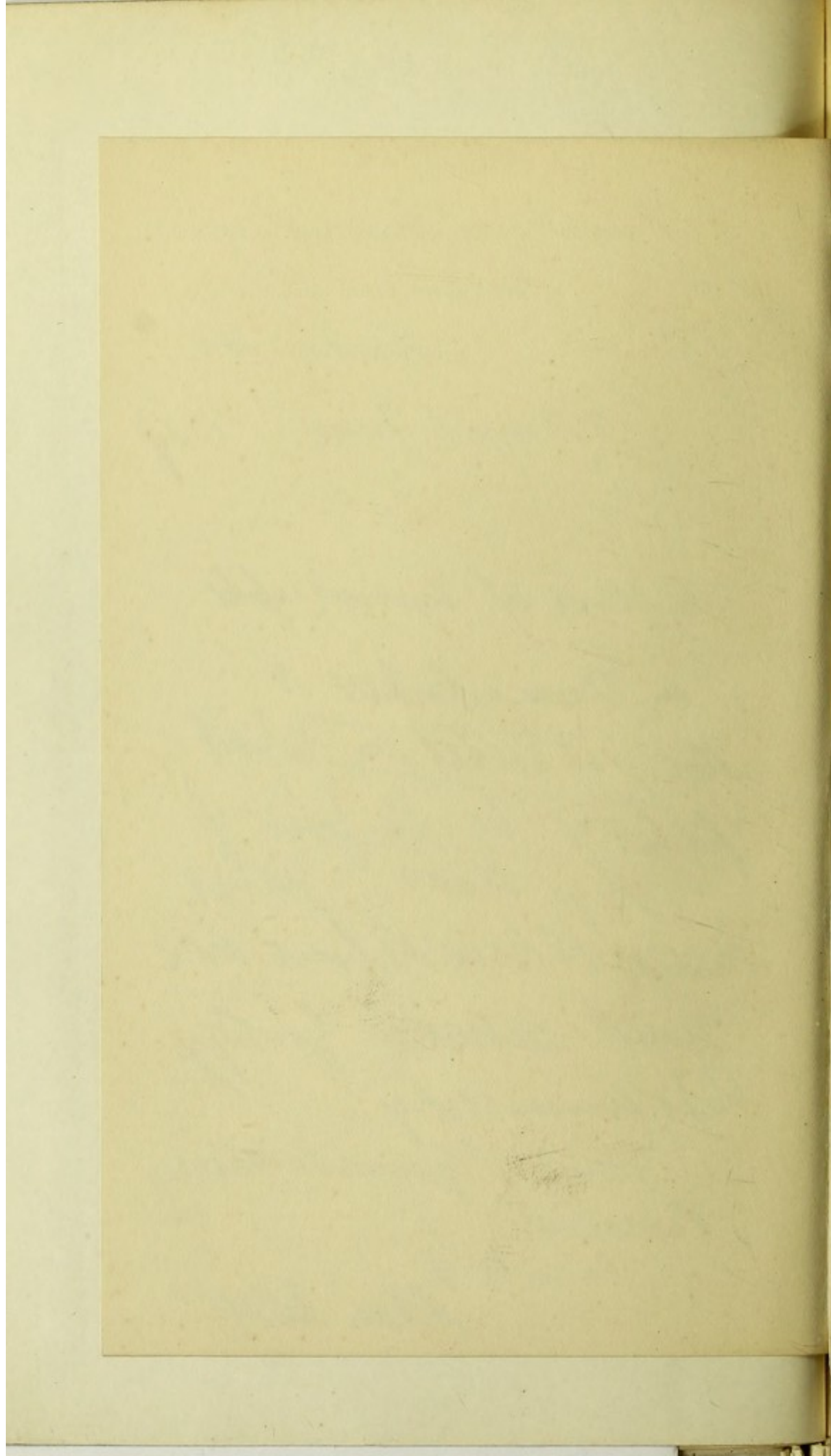
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A series of lectures  
on Trematodes &  
other parasites on edible  
fishes & on the food of  
fishes  
By Miss  
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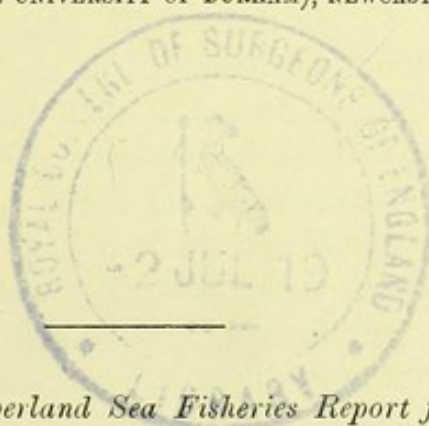


# Fish Trematodes of the Northumberland Coast.

BY

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*From the Northumberland Sea Fisheries Report for 1907.*

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# FISH TREMATODES OF THE NORTHUMBERLAND COAST.

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The following pages form an attempt at an investigation of the fish Trematode fauna of the Northumberland coast. Nothing has as yet been done in this way locally, and, as was to be expected, a large number of Trematodes has been found. These are all new to Northumberland, some new to Britain, and five are, I believe, new to science. The fish examined were almost entirely those commonly brought in by the fishing boats at North Shields, caught between Hartlepool and Newbiggin, 30 to 48 fathoms, with a few collected in the rock pools at Cullercoats. The food of the fish was always ascertained when possible, with a view to elucidating the life histories of the Trematodes, which are for the most part, unfortunately, still unknown. A list of the fish examined, with the food and the Trematodes found, is given here, also a table showing what little is known of the life histories of the Trematodes. The fish were examined in June, August, and from October to March. Much fewer Trematodes were found in the winter months, some fish (notably the Whiting and Cod) being then hardly at all infested. On the other hand, *Gasterostomum gracilescens* appears to inhabit the Angler all the year round, and *Steringophorus furciger* and *Zoogonoides viviparus* are generally to be found in the Dab. The scarcity of Trematodes in the winter is perhaps due to the fish feeding less, which certainly seems to be the case, the stomachs never being so full in the winter, and often quite empty.

I give here an original figure of each worm described (including the already well-known species), the aim being, as far as possible, to furnish a guide to the fish Trematodes of this coast, and bring all that is known together as a nucleus for future work. The figures were nearly all drawn from living worms under pressure. Much use has been made of Odhner's "Die Trematoden des Arktischen Gebietes," Fauna Arctica (1905), the outlines of his classification of the *Digenea* being here adopted. The *Monogenea* I have classified according to Monticelli's families as given in Bronn's "Thierreich." \*

\* Bronn, "Klassen und Ordnungen des Thierreichs," Bd. IV., Abt. 1 (1879-93), page 889.



I have, however, left all the genera of the Distomes in the family *Distomidae* and omitted all sub-families, these, in many cases, not being sufficiently characterised.

# LIST OF FISH EXAMINED WITH FOOD AND TREMATODES.

| Name of Fish.  | Number Examined. | Food.  | Trematodes.  |
|--|------------------|--|--|
| Bull Head ...<br><i>Cottus scorpius</i> , L.                     | 13               | <i>Crangon vulgaris</i> , <i>Carcinus mœnas</i> , and other Crustacea                | <i>Proserhynchus squamatus</i> (Odh.)<br><i>Podocotyle atomon</i> (Rud.)<br><i>Hemiurus communis</i> (Odh.)  |
| Grey Gurnard ...<br><i>Trigla gurnardus</i> , L.                 | 36               | <i>Crangon vulgaris</i> , other Crustacea, chiefly Amphipods, remains of Cephalopods | * <i>Plectanocotyle caudata</i> n. sp.<br><i>Lecithaster gibbosus</i> (Rud.)<br>* <i>Steringophorus triglae</i> n. sp.<br><i>Derogenes varicus</i> (O. F. Müller)            |
| Red Gurnard ...<br><i>T. cuculus</i> , L.                        | 1                | Remains of Crustacea   | No Trematodes  |
| Pogge or Armed Bull Head, <i>Agonus cataphractus</i> , L.        | 1                | .....  | No Trematodes  |
| Lump Sucker ...<br><i>Cyclopterus lumpus</i> , L.                | 1                | .....  | No Trematodes  |
| Montagu's Sucker ...<br><i>Liparis montagui</i> ,<br>Donov.      | 3                | Remains of Crustacea   | No Trematodes  |
| Mackerel ...<br><i>Scomber scombrus</i> , L.                     | 3                | Remains of Crustacea   | * <i>Distomum bacillare</i> (Molin)  |
| Greater Weaver ...<br><i>Trachinus vipera</i> ,<br>Cuv. and Val. | 1                | .....  | No Trematodes  |
| Angler...<br><i>Lophius piscatorius</i> ,<br>L.                  | 26               | Dab, Haddock, Whiting, and other fish remains, remains of Crustacea                  | <i>Gasterostomum gracilescens</i> (Rud.)<br><i>Steringophorus furciger</i> (Odh.)<br><i>Stephanochasmus bacatus</i> (Nicoll) juv.<br><i>Derogenes varicus</i> (O. F. Müller) |

## LIST OF FISH EXAMINED WITH FOOD AND TREMATODES (continued).

| Name of Fish.  | Number Examined. | Food.   | Trematodes.  |
|--|------------------|---|--|
| Catfish...<br><i>Anarrhichas lupus</i> ,<br>L.         | 12               | <i>Buccinum undatum</i> ,<br><i>Pecten tigrinus</i> , <i>Gib-<br/>bula cineraria</i> , <i>Tri-<br/>tonofusus gracilis</i> ,<br>other remains of<br>Mollusca, remains of<br>Crustacea, <i>Echinus</i><br>sp.   | * <i>Distomum fellis</i><br>(Odh.)<br>* <i>Allocreadium</i> sp.<br>* <i>Distomum</i> sp., with<br>cercaria   |
| Shanny ...<br><i>Blennius pholis</i> , L.              | 4                | Remains of Crustacea  | No Trematodes  |
| Gunnel ...<br><i>Centronotus gunnel-<br/>lus</i> , L.  | 6                | Remains of Crustacea  | No Trematodes  |
| Viviparous Blenny ...<br><i>Zoarces viviparus</i> , L. | 5                | Remains of Crustacea  | No Trematodes  |
| Cod ...<br><i>Gadus morrhua</i> L.                     | 46               | <i>Arcturus longicornis</i> ,<br><i>Pandalus annulicor-<br/>nis</i> , <i>Hyas coarcticus</i> ,<br><i>Carcinus mænas</i> , <i>Ne-<br/>phrops norvegicus</i> ,<br>and other remains of<br>Crustacea, <i>Nucula</i><br><i>nucleus</i> , and other<br>remains of Mollusca | * <i>Proisorhynchus gran-<br/>dis</i> n. sp.<br>* <i>Lepodora elongata</i> n.<br>sp.<br>* <i>Stephanochasmus</i><br><i>pristis</i> (Deslongch)<br><i>Gasterostomum gracil-<br/>escens</i> (Rud.)<br>(Larval stage)   |
| Haddock ...<br><i>G. æglefinus</i> , L.                | 28               | Remains of Crustacea,<br><i>Cardium edule</i>   | <i>Lepodora rachiæa</i><br>(Cobb.)<br><i>Gasterostomum gracil-<br/>escens</i> (Rud.)<br>(Larval stage)   |
| Saithe ...<br><i>G. virens</i> , L.                    | 8                | Remains of Crustacea  | No Trematodes  |
| Whiting ...<br><i>G. merlangus</i> , L.                | 68               | <i>Lumpenus lampetri-<br/>formis</i> , <i>Crangon vul-<br/>garis</i> , other remains<br>of Crustacea and<br>Mollusca  | * <i>Stephanochasmus</i><br><i>caducus</i> (Looss.)<br>* <i>S. rhombispinosus</i> n.<br>sp.<br><i>Lecithaster gibbosus</i><br>(Rud.)<br><i>Hemiurus communis</i><br>(Odh.)<br>* <i>Proisorhynchus</i><br><i>grandis</i> n. sp.<br><i>Octobothrium merlangi</i><br>(Kuhn.)<br><i>Gasterostomum gracil-<br/>escens</i> (Rud.)<br>(Larval stage)<br><i>Pharyngora retractilis</i><br>n. sp. |



## LIST OF FISH EXAMINED WITH FOOD AND TREMATODES (continued).

| Name of Fish.  | Number Examined. | Food.  | Trematodes.   |
|--|------------------|--|---|
| Hake ... ..<br><i>Merluccius vulgaris</i> ,<br>Cuv. (Head only)            | 2                | .....  | No Trematodes   |
| Ling ... ..<br><i>Molva vulgaris</i> , Flem.<br>(Head only)                | 6                | .....  | <i>Pterocotyle palmata</i><br>(v. Ben. and Hesse.)  |
| Five-Bearded Rockling<br><i>Motella mustela</i> , L.                       | 3                | Remains of Crustacea   | No Trematodes   |
| Four-Bearded Rockling<br><i>M. cimbria</i> , L.                            | 2                | Remains of Crustacea   | No Trematodes   |
| Long Rough Dab ...<br><i>Hippoglossus liman-</i><br><i>doides</i> , Bloch. | 60               | <i>Syndosmya prismatica</i> ,<br><i>S. alba</i> , <i>Natica catena</i> ,<br><i>Turritella communis</i> ,<br><i>Spirula elliptica</i> , re-<br>mains of Cepha-<br>lopods, <i>Pagurus</i> sp.,<br><i>Crangon vulgaris</i> ,<br>other remains of<br>Crustacea, <i>Ophio-</i><br><i>coma</i> sp. | <i>Steringophorus fur-</i><br><i>ciger</i> (Odh.)<br><i>S. ovacutus</i> (mihi)<br><i>Derogenes varicus</i><br>(O. F. Müller)<br><i>Zoogonoides viviparus</i><br>(Odh.)<br><i>Stephanochasmus bac-</i><br><i>catus</i> (Nicoll)<br>(Larval form) |
| Halibut ... ..<br><i>H. vulgaris</i> , Flem.                               | 1                | .....  | No Trematodes   |
| Plaice ... ..<br><i>Pleuronectis platessa</i> ,<br>L.                      | 3                | Remains of Crustacea,<br><i>Aphrodite</i>  | <i>Podocotyle atomon</i><br>(Rud.)<br><i>Steringophorus fur-</i><br><i>ciger</i> (Odh.)<br><i>Zoogonoides viviparus</i><br>(Odh.)   |
| Witch ... ..<br><i>P. cynoglossus</i> , L.                                 | 30               | Remains of Crustacea,<br>Annelids, and Mol-<br>lusca   | <i>Steringophorous fur-</i><br><i>ciger</i> (Odh.)<br><i>Stephanochasmus bac-</i><br><i>catus</i> (Nicoll)<br>(Larval form)   |
| Lemon Dab ... ..<br><i>P. microcephalus</i> ,<br>Donov.                    | 3                | <i>Crangon vulgaris</i> , other<br>remains of Crustacea  | <i>Steringophorus fur-</i><br><i>ciger</i> (Odh.)<br><i>Stephanochasmus bac-</i><br><i>catus</i> (Nicoll)<br>(Larval form)  |
| Dab ... ..<br><i>P. limanda</i> , L.                                       | 60               | <i>Cardium edule</i> , <i>Syn-</i><br><i>dosmya prismatica</i> ,<br><i>Pecten opercularis</i> ,<br><i>Turritella communis</i> ,<br><i>Natica catena</i> , <i>Pa-</i><br><i>gurus</i> sp., other re-<br>mains of Crustacea.<br><i>Ophiocoma</i> sp.   | <i>Steringophorus fur-</i><br><i>ciger</i> (Ols.)<br><i>Zoogonoides viviparus</i><br>(Ols.)<br><i>Derogenes varicus</i><br>(O. F. Müller)<br><i>Stephanochasmus bac-</i><br><i>catus</i> (Nicoll)<br>(Larval form)                              |

LIST OF FISH EXAMINED WITH FOOD AND TREMATODES (*continued*).

| Name of Fish.   | Number Examined. | Food.   | Trematodes.*   |
|---|------------------|---|--|
| Megrim ...<br><i>Lepidorhombus megastoma</i> , Donovan.         | 2                | .....   | No Trematodes  |
| Sand Eel ...<br><i>Ammodytes tobianus</i> , L.                  | 1                | .....   | <i>Hemiurus communis</i> (Odh.)  |
| Three-Spined Stickleback,<br><i>Gasterosteus aculeatus</i> , L. | 2                | .....   | No Trematodes  |
| Herring ...<br><i>Clupea harengus</i> , L.                      | 2                | .....   | No Trematodes  |
| Eel ...<br><i>Anguilla vulgaris</i> , Turt.                     | 2                | Remains of Annelids   | No Trematodes  |
| Conger Eel ...<br><i>Conger vulgaris</i> , Cuv.                 | 1                | .....   | No Trematodes  |
| Picked Dogfish ...<br><i>Acanthias vulgaris</i> , Rins.         | 7                | Remains of Fish ...   | <i>Onchocotyle appendiculata</i> (Kuhn)  |
| Sharp-nosed Skate ...<br><i>Raia alba</i> , Lacép.              | 6                | Remains of Crustacea  | No Trematodes  |
| Starry Ray ...<br><i>R. radiata</i> , Donovan.                  | 50               | <i>Scombrosox saurus</i> ,†<br><i>Lumpenus lampetris</i> -<br><i>formis</i> , remains of<br>Annelids, Cephalo-<br>pods, <i>Pagurus</i> sp.,<br><i>Crangon vulgaris</i> ,<br>and other Crustacea | <i>Calicotyle kroyeri</i> (Diesing)<br><i>Otodistomum veli-</i><br><i>porum</i> (Crepin) |

Those marked \* are new to Britain.

† It is interesting to note the presence of *Scombrosox saurus* and *Lumpenus lampetrisformis*, as these fish have only been found once before on this coast. See Reports for 1901 and 1903.



## ORDER—DIGENEA, van Ben.

SUB-ORDER—*Gasterostomata*, Odhner.FAMILY—*Gasterostomidæ*.GENUS—*Gasterostomum*.

*Gasterostomum gracilescens* (Rud.) (Plate I., figs. 1, 2, 3.)  
 Rudolphi, C. A., *Distoma gracilescens*. "Entozoorum Synopsis,"  
 page 409 (1819).

This well-known parasite of the Angler is very common on this coast. In every Angler examined the pyloric cæca and the stomach were much infested, and in a less degree, the whole of the remainder of the intestine. Cobbold\* first recorded this species from Britain, and since his writings I can find no further British record of the adult worm. It must, however, be very abundant, judging from the enormous numbers in each fish, certainly several hundreds, and so crowded together that the gut looks quite brown from the eggs contained in these worms. Olsson† estimates the number of worms in each fish to be 1,000—2,000.

My specimens (fig. 1) measure, on an average, about 6 mm. in length (Cobbold's specimens  $\frac{1}{2}$  inch). They are colourless, except for the brown eggs, and broader at the head than at the tail end, but are continually changing their shape when alive. The whole body is covered by minute spines. The anterior sucker is round, measuring 0.40 mm. across. The oral ventral sucker is 0.30 mm. across. The latter, which occurs at about the first quarter of the body, leads to a small sac-like intestine full of food granules. The excretory vesicle is a long and narrow sac reaching to nearly the centre of the intestinal region. It contains a highly refractive granular substance. The testes are ovate bodies lying obliquely one behind the other behind the intestine. From the inside of each a vas deferens is given off, and these unite in a single short canal leading to the vesicula seminalis enclosed in the cirrus sac. The cirrus sac is long and narrow, and lies in the posterior part of the body. In it are the somewhat triangular, simple and very small vesicula seminalis and the pars prostatica, the latter forming a narrow canal into which open the prostate cells. The whole of the space surrounding this, inside the cirrus sac, is a mass of gland cells. The male duct opens into the genital sinus, and the genital pore lies at the posterior end of the body. The ovary

\* Cobbold, T. S., "Observations on Entozoa, etc." Trans. Linn. Soc., London, XXII., page 161 (1859).

† Olsson, P., "Entozoa, iaktagna hos Skandinaviska Hafsiskar." Lunds. Univ. Årsskrift, tom. IV., page 55 (1868).



is a globular mass, smaller than the testes, lying between the foremost testes and the intestine, slightly on the right. A short oviduct arises posteriorly from the ovary and gives off a Laurer's canal, then curves forward and receives the vitellarian duct and the shell gland, after which it merges into the much convoluted uterus, the windings of which fill almost the whole of the posterior two-thirds of the body. The uterus finally runs down and opens into the genital sinus by the side of the male duct on the right. The eggs are exceedingly numerous, and golden brown in colour (0.026 mm. long). The vitellaria form a string of fairly large follicles at the anterior end, one on each side, extending from behind the anterior sucker to the posterior level of the intestine. The duct from each side curves in and joins with its fellow in a reservoir to the right of the ovary, which gives off the duct mentioned above.

This is one of the few Trematodes whose life history is known, though to a certain extent only, for we have no positive proof (although the evidence is very strong) that the different stages known belong to the same worm. The curious cercaria *Bucephalus haimeanus*, Lacaze Duthiers, is believed to be the larval form of *G. gracilescens*, although this has not been definitely proved. A well-known parasite of the oyster, this cercaria has also been found in the cockles *Cardium rusticum* and *Cardium edule*. I have found it on the Northumberland coast in *Cardium edule*\* from the Mussel Scaup, Holy Island. Two specimens of *C. edule* were found infested out of 100 examined. The whole of the animal in each case was riddled with the long thread-like sporocysts full of *Bucephalus* in various stages. As *Bucephalus haimeanus* certainly grows into a *Gasterostomum*, it seems most likely that it should grow into *G. gracilescens*, which is the only member of the genus known on this coast.

Dr. David Hilt Tennant† has conducted feeding experiments with the American *Bucephalus haimeanus*, and succeeded in infecting some fish with them. I cannot help thinking, however, that the adult Trematode which he provisionally calls *Gasterostomum gracilescens* is different from the British species. Dr. Tennant is of the opinion that most of the species of *Gasterostomum* described are physiological varieties of one form. It is impossible to say that

\* "Larval Trematodes of the Northumberland Coast," by the writer. Trans. Nat. Hist. Soc. Northbd., etc., vol. I., N.S., page 452 (1907).

† Tennant, D. H., "A Study of the Life History of *Bucephalus haimeanus*, etc." Quarterly Journal of Microscopical Science, vol. 49, N.S., page 635 (1906).



this is not so, but when he gives among the examples *G. gracilescens*, Wagener, and *G. armatum*, Molin, it is difficult to agree with him, for here we have two really different forms, so different that Odhner has instituted a new genus (*Proisorhynchus*) for the latter and its allies. I am more inclined to think that *G. gracilescens*, which is so abundant on this coast, and his *Gasterostomum* from the Gar *Tylosurus marinus* are different species and not physiological varieties, and although Dr. Tennant has practically proved by most interesting experiments that the American *Bucephalus* from the oyster is the larval form of his *Gasterostomum* and the intermediate host is the Silverside *Menidia menidia*, I do not think we can yet say with certainty that the *Bucephalus* from the American oyster is the same species as the British form, although they are much alike. The difference in size of the *Gasterostomum* from the Gar (1 mm.) and that from the Angler (6 mm.) is great. The vitellaria in the former occur in roundish clusters at the anterior end of the worm just behind the anterior sucker, whilst those in the latter are always in strings down the sides, reaching from the anterior end to beyond the intestine. The British form is altogether more elongated than the form Dr. Tennant describes.

The second stage of *G. gracilescens* is found encysted in the nerves of various gadoid fishes. The nerves are much swollen out, each swelling being a cyst containing a Trematode. These are the "Bodies of Munro" found by Maddox\* to be encysted Trematodes, and identified by him with *G. gracilescens*. No proofs have yet been given, but there seems little doubt that these worms from the nerves are the immature *G. gracilescens*. Olsson† found these cysts in the brains and nerves of several gadoids, and he also refers them to *G. gracilescens*. It is very common on this coast in the nerves of the Haddock, Cod and Whiting. It is most abundant in the Haddock, every specimen so far examined being infested along the spinal nerves, especially near the tail where they are crowded together, and also in the nerves of the brain, particularly the auditory nerve. In the Cod it is also common, but here it is not so often in the spinal nerves but frequently in the ear itself, where the capsules are seen attached to the thin membrane lining the auditory sac, and are also free in the fluid which fills the cavity. In the same position it is sometimes to be found in the Whiting,

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\*Maddox, R. L., "Some Remarks on the Parasites found in the Nerves, etc., of the Common Haddock." *Journal of Microscopical Science*, vol. 7, N.S., page 87 (1867).

† Olsson, op. cit., page 54.



and on one occasion I found a cyst in the mucus of the nostril of this fish. Johnstone\* has recorded these cysts from various gadoids from the Lancashire coast.

The worm when pressed out of the cyst corresponds in almost every particular with *G. gracilescens* (figs. 2-3), the reproductive organs, however, not being fully developed. This and the fact that the Angler is frequently seen with Haddock, Cod and Whiting in its mouth and stomach makes it almost certain that the encysted worms are the larval form of *G. gracilescens*. The cyst is thin-walled and measures 0.6 mm.; in it is curled up the larval worm which is quite colourless, the most conspicuous feature being the opaque excretory vesicle. The worm itself when pressed out of the cyst is about 2.5 m.m. long. Intermediate stages between this and the adult are found throughout the intestine of the Angler. The suckers, intestine and excretory vesicle are like *G. gracilescens*, also the testes and cirrus sac, which are well developed. The ovary is smaller, and a simply coiled uterus can be made out. In some specimens the beginning of the vitellaria is seen, but these are not usually developed. We are, I think, justified in taking the life history of *G. gracilescens* to be the following: First host, *Cardium edule*; intermediate hosts, Haddock, Cod and Whiting; final host, the Angler. All of these stages from the hosts quoted have been found on this coast, and the worm is extraordinarily abundant—the most abundant, certainly on this coast, of all the Trematodes known.

GENUS—*Prosorhynchus* (Odhner).

*Prosorhynchus squamatus* (Odhner). (Plate I., fig. 4.) Odhner, "Fauna Arctica," page 297.

This Trematode has been recorded by Nicoll† from St. Andrews in the Father Lasher, *Cottus bubalis*, and Montagu's Sucker. It is usually a parasite of the Bull-Head, living in the pyloric cæca, and before Nicoll's records it was the only host known, those found by Olsson‡ and Molin in the Conger Eel being now recognised by Odhner as different species. The worm occurred only once on this coast out of thirteen Bull-Heads examined, but several specimens were obtained (August).

\* Johnstone, J., "Internal Parasites and Diseased Conditions of Fishes." Rep. Liverpool Sea Fish. Inv. for 1904, page 101.

† Nicoll, W., "A Contribution towards a knowledge of the Entozoa of British Marine Fishes, Part I." Ann. and Mag. Nat. Hist., ser. 7, XIX., page 72 (1907).

‡ Olsson, P., "Bidrag t. Skandinaviens Helminthfauna, 1876."



Odhner distinguishes the genus *Prosorhynchus* from *Gasterostomum* by the anterior "rostellum," which is not like a true sucker, and has a sort of beak on its lower margin, the vitellaria forming a bow-shaped mass in the anterior part of the body, and the male organs also differing in several minute anatomical points.

*P. squamatus* measures 1—1.5 mm. in length, and is somewhat pear-shaped. The rostellum is 0.12 mm. broad, and 0.09 mm. long. The body is armed all over with spines. The mouth sucker (0.10 m.m. across) opens almost centrally, in my specimens slightly posterior to the centre, the intestine lying in the fore part of the body. The excretory vesicle is long and narrow, reaching to the level of the pharynx, and opening at the posterior end of the body. The testes are placed obliquely, one behind the other, foremost testis on the right near the mouth. A thin vas deferens is given off from each, which join the vesicula seminalis without uniting. Part of the long-looped vesicula seminalis lies outside the cirrus sac, and part (the looped part) within. The cirrus sac is long and narrow, and lies at the posterior end of the body; in its upper part is the loop of the vesicula seminalis, and after this is the pars prostatica forming a canal somewhat inflated in the middle into which open the prostate cells. The male duct opens into the genital sinus, which opens posteriorly in the genital pore. The remainder of the cirrus sac is made up of large gland cells. The ovary lies to the right in front of the foremost testes, giving off a short, somewhat swollen oviduct; there is a small Laurer's canal, and the oviduct then receives the vitellarian duct and shell gland and passes into the long winding uterus, the loops of which wander in and out in the posterior two-thirds of the body, and finally run down straight to open into the genital sinus by the side of the male duct. The eggs are very numerous, 0.026—0.03 mm. long, and pale yellow. Vitellaria anterior reaching behind on each side to the height of the ovary, not so far as the middle of the body. The duct from each side loops round and joins its fellow in a reservoir from which a single duct goes to the oviduct.

The life history of this species is not accurately known, but it seems very probable that the curious *Bucephalus* (*B. crux*) found by Levinsen\* in *Modiolaria discors* in Greenland is the young stage of *P. squamatus*. Odhner regards it as likely, as this is the only member of the genus known in the Arctic seas. *Modiolaria discors*

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\* Levinsen, G. M. R., "Bidrag til Kundskab om Grønlands Trematodfauna." Overs K. D. v. D. Selsk. Forh. (1881), page 80.



is common in fairly deep water on this coast; the Bull-Head, however, which contained the parasites was from the rock pools close to the shore. The encysted stage of *P. squamatus* was found by Levinsen in the skin and muscles and outside the pyloric cæca of the Bull-Head, so that there is probably no intermediate host. Remains of small crustacea was all the food found inside my specimens of the Bull-Head, but that it is an indiscriminate feeder is shown by the list of creatures forming its food which is given by Levinsen.

The life history of *P. squamata* is therefore possibly the following:—First host, *Modiolaria discors*; intermediate host, omitted; final host, *Cottus scorpius*.

*Prosorhynchus grandis*, n. sp. (Plate I., fig. 5). A species of *Prosorhynchus* very much like *P. squamatus* but constantly larger and also slightly differing in other particulars, occurs in the pyloric cæca of the Cod, always singly (June, August—November), and once was found in the Whiting (December), several specimens together in the pyloric cæca and pyloric portion of the intestine. The differences warrant, I think, its being regarded as a new species.

The worm measures 2—2·5 mm. in length; greatest breadth near the anterior end 0·7 mm. The rostellum measures 0·20 mm. broad and 0·12 mm. long. The mouth is central, with the oral sucker measuring 0·10 mm. across. The intestine, vitellaria, ovary and testes are like *P. squamatus*. The excretory vesicle reaches to the level of the centre of the intestine. The vesicula seminalis is broader than that of *P. squamatus*, especially the portion outside the cirrus sac. The eggs are numerous, measuring 0·033 mm. long, and are pale yellow.

This worm occurred in four Cod and in one Whiting.

The life history is unknown.

SUB-ORDER—*Prosostomata*, Odhner.

FAMILY—*Distomidae*, Mont.

GENUS—*Steringophorus*, Odhner.

*Steringophorus furciger* (Olsson). (Plate I., figs. 6—7.) Odhner, "Fauna Arctica," page 305.

This Trematode, which has been fully described by Levinsen\* and Odhner, is one of the commonest on this coast. It occurs in

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\* Op. cit., page 61.



great abundance in the Dab, one of Olsson's† original hosts in Sweden, also in the Long Rough Dab, the second of Olsson's hosts, the Witch,\* Lemon Dab,\* Plaice and Angler.\* Those marked \* are, I believe, new hosts. Levinsen and Odhner found it in other fish in Greenland, and Stafford‡ records it in several American fish. Nicoll§ records it from the Dab at St. Andrews, which is apparently the only previous British record of this species. It is to be found all the year round, and quite as abundantly in winter as in summer. It is most numerous in the Dab (in 85 per cent.), fairly numerous in the Long Rough Dab (50 per cent.), and not so common in the Witch (20 per cent.), Lemon Dab (in one out of three), Plaice (one out of 2), and Angler (one out of twenty).

The worm is spindle-shaped, 1·5—3·5 mm. long, with its greatest breadth at the ventral sucker. It is bright red when alive, with golden-brown eggs, the colour of the body fading directly after death. When moving, it is often pear-shaped, with the broad end foremost, and is very active and contractile. The suckers are both round, oral smaller than ventral in the proportion of about 3:5 (oral suckers in a specimen 3 mm. long, 0·2 mm. across; ventral, 0·35 mm.). Cuticle unarmed. There is a very small prepharynx, conspicuous pharynx, and œsophagus the same length as the pharynx. The intestinal lobes are narrow and reach a short way beyond the testes. The excretory vesicle is Y-shaped, the single stem forking between the testes, and the forks reaching to the level of the pharynx; the substance contained in the vesicle is highly refractive, and appears intensely black by transmitted light. The testes are globulo-ovoid, and are placed symmetrically one each side of the fork of the excretory system and ventral to the intestinal lobes. From each a vas deferens goes to the vesicula seminalis, which is divided into two portions and completely enclosed in the cirrus sac. The cirrus sac is large and oval, placed on the left side and in front of the ventral sucker, containing the vesicula seminalis, well developed pars prostatica, and very small cirrus. The male duct opens into the genital sinus, and the genital pore is almost median but slightly to the left, just below the intestine. The rest of the cirrus sac contains large gland cells. The ovary is lobed and placed behind and to the right of the ventral sucker, giving off posteriorly the oviduct.

† Olsson, op. cit. Lunds Univ. Årskrift (1868), page 26.

‡ Stafford, "Trematodes from Canadian Fishes." Zool. Anz., Bd. XXVII, 1904, page 484.

§ Op. cit., page 72.



Odhner affirms that no receptaculum seminis is present, and that what Levinsen took to be a receptaculum seminis is only an inflation of the Laurer's canal. In most of the specimens I have examined, however, there is an organ which appears to me to be undoubtedly a receptaculum seminis (fig. 7). In some cases it has an appearance of an inflation like Odhner's figure and contains no spermatozoa, but more usually it shows as a small, somewhat ovate organ full of rapidly moving spermatozoa given off by the oviduct, and having the Laurer's canal leading from it. It appears to me to be a true receptaculum seminis. The oviduct after receiving the vitellarian duct and shell gland passes into the long and winding uterus, the loops of which occupy the space between and behind the testes, and then run forward to open into the genital sinus by the side of the male opening. The eggs are numerous, golden brown, and of an oval shape; they measure 0.46 mm. by 0.019 mm. The vitellaria occur at the sides of the body, forming two masses of follicles reaching forwards as far as the centre of the ventral sucker, and backwards as far as the centre of the testes. Small ducts run from the follicles to unite in a single transverse duct each side, which join in the vitellarian receptacle near the ovary.

With regard to the habitat of this species, it is to be found throughout the intestine, but especially in the pyloric portion, which is the only true habitat according to Odhner's view. The other portion of the intestine may be, as he suggests, only occupied after the death of the host, the worms wandering in, but this is almost impossible to prove. All my fish were examined fresh the morning they were caught. Nicoll\* mentions the worm occurring at the end of the intestine of the Dab with *Zoogonoides viviparus*, and I have also found them together in that part.

My specimens from all the above-mentioned hosts agree with Odhner's typical examples, and have small eggs.

The life history is not known.

*Steringophorus ovacutus*, mihi.

As I have already briefly described this species elsewhere† and figured it, I shall not re-describe it here, more especially as I have as yet nothing more to add. It occurred rarely in the intestine

\* Op. cit., page 33.

† "Trematodes of the Northumberland Coast, No. II." Trans. Nat. Hist. Soc. Northbd., etc., vol. III., N.S., 1908, page 17.



of the Long Rough Dab in the summer and early autumn. I have not succeeded in finding it in the winter months.

*Distomum fellis* (Olsson). This Trematode occurred in the gall bladder of every specimen of the Catfish examined. I understand that Mr. Nicoll, of St. Andrews, is about soon to publish some work on this species, and also on a new species of *Allocreadium*, or a close ally of this genus, which also occurs in the Catfish of our coast, in four out of a dozen specimens. For this reason I shall not describe these species here.

GENUS—*Podocotyle* (Dujardin).

*Podocotyle atomon* (Rud.) (Plate I., fig. 8.) Odhner, "Fauna Arctica," page 320.

The synonymy of this species is discussed by Odhner at length. It appears to be not so common on the Northumberland coast as it is at St. Andrews, where Nicoll\* found it abundantly in the small fish of the rock pools. I have only found it in two fish, viz., the Bull-Head and the Plaice. Apparently it has not before been recorded from the latter fish, but only one specimen was present in it. The Bull-Head, *Cottus scorpius*, is, however, one of its commonest hosts in Greenland (Levinsen), Sweden (Odhner), and Britain. It has been recorded also from many other fish.

The worm occurred in the pyloric cæca and intestine of two specimens of the Bull-Head out of thirteen examined, several in one specimen (August), and one in the other (February).

The specimens varied from 1·9 to 3·5 m.m. in length, and agree very well with Odhner's description of *P. atomon* as restricted by that author. The body is elongated, colourless, very transparent and unarmed. The anterior sucker (in specimen 2·5 mm. long) measures 0·16 mm. across; ventral sucker, 0·3 mm. across, and placed far forward. There is a small prepharynx, a conspicuous pharynx, and an œsophagus rather more than double the length of the pharynx. The fork of the intestine is just in front of the ventral sucker, and the intestinal lobes reach to the posterior end of the body. The excretory vesicle is a simple long sac reaching to the ovary, where it widens slightly and gives off two lateral vessels. It lies dorsally, and terminates in a posterior pore. The testes are ventrally placed, one in front of the other, with a small space between, and some way from the posterior end. From each

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\* Op. cit., page 73.



a fine vas deferens runs up to the vesicula seminalis, which is enclosed completely in the somewhat club-shaped cirrus sac. The latter extends a little way behind the ventral sucker, and contains at its posterior end the vesicula seminalis, which is thick and slightly crumpled up at first, then forms a loop, and finally runs straight to a cirrus surrounded by large cells. A true pars prostatica is absent. The male duct opens into a very small genital sinus, the outer genital pore being to the left, between the pharynx and fork of the intestine. The ovary is ventral, and lies on the right in front of the foremost testis. It is three-lobed, and from its posterior end springs the oviduct, giving off a dorsal pear-shaped receptaculum seminis with a Laurer's canal on the left. The oviduct then receives the vitellarian duct and shell gland, and passes to the uterus, which winds in a few loops between the ovary and ventral sucker, and then runs up on the left side to a vagina which opens into the genital sinus to the left of the male opening. The eggs are not numerous (20—60),\* and measure 0.06 mm. to 0.08 mm. in length; they are a brownish yellow colour. The vitellaria are conspicuous, reaching ventrally from the extreme end of the body to the back of the ventral sucker, and stretching across the body behind the hindmost testis. They consist of small compact follicles, very numerous, and united by transverse canals giving off a transverse duct each side, which join in the vitellarian receptacle near the ovary.

Levensen† found the larval stage of *P. atomon* (= *Distomum simplex*, Rud. (?) Olsson) encysted in the amphipod *Themisto libellula* (Mandt), and also in the stomach of *Cottus scorpius*; with the half-digested remains of this crustacean he found free capsules containing this Trematode. The younger stages have not been found.

The life history of *P. atomon* therefore probably runs as follows:—First host, unknown; intermediate host, *Themisto libellula*; final host, *Cottus scorpius* and other fish.

*Distomum bacillare* (Molin). (Plate II., fig. 1.)

In a Mackerel examined in August two specimens of a Trematode were found in the intestine. Unfortunately, they were only examined superficially at the time and then put away, and the preserving medium has so spoilt them that they are now of no use for detailed examination. The following notes show, I think,

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\* Sixty eggs, found in one specimen, is a much larger number than usual; Odhner mentions twenty—twenty-five.

† Op. cit., page 67.



that the species is probably the hitherto little known *Distomum bacillare* (Molin). I have not given it a new generic name as the details were not sufficiently made out. It seems to me that it should be placed somewhere between the *Allocreadiinae* and the *Lepocreadiinae* as it agrees in many ways with both these sub-families as given by Odhner, who suggests that *D. bacillare* may belong to the latter sub-family.

The worms measured 1.86 mm. and 3.2 mm. respectively, the smaller specimen containing no eggs. The following measurements are from the larger specimen, which agree with Stossich's\* in size. Width between one-fourth and one-fifth of the length when contracted, much narrower when stretched out. Body covered with spines (*D. bacillare* is described as unarmed by previous authors). Oral sucker (0.02 mm. across) with very thick walls like a pharynx, closely resembling the Trematode which I have called *Pharyngora retractilis* (see below). Prepharynx usually hardly seen, but can be a good deal longer than the pharynx, which is conspicuous. Oesophagus a little longer than the pharynx when not much extended, branching just in front of the ventral sucker into two long intestinal lobes reaching nearly to the posterior end of the body. Ventral sucker, 0.015 mm. across, at the first quarter of the body. Excretory vesicle, a simple narrow sac reaching to the hind testis. Testes globular, placed one behind the other, with a small space between. Hind testis about 0.06 mm. from the posterior end. Vesicula seminalis completely within the cirrus sac, divided into two portions, the posterior oval and the anterior at first somewhat triangular, and then narrowing into a winding portion which leads to a straight ductus ejaculatorius. The cirrus sac containing this is 0.04 mm. long, and rather broadly club-shaped. The genital opening is on the left, on the level of the anterior end of the ventral sucker. Ovary, heart-shaped, placed in front of the foremost testis, with a small space between. Receptaculum seminis and Laurer's canal present, but their exact relations were not made out. Uterus with few loops; it appeared inflated behind, and by the side of the cirrus sac. Eggs not numerous, measuring 0.08 mm. by 0.04 mm.; pale yellow. Vitellaria well developed, not reaching forward beyond the level of the vesicula seminalis. They cover the intestinal lobes ventrally, and fill up the space behind the testes.

Life history unknown.

\* Stossich, M., "Brani di Elmintologia Tergestina." Boll. Soc. di Sci. Nat. Trieste, IX., 1887, page 3.



GENUS—*Lepodora* (Odhner).

*Lepodora rachiæa* (Cobb.) (Plate II., figs. 2—4.) Odhner, "Fauna Arctica," page 332.

This worm is common in the Haddocks of this coast, and occurs in about 75 per cent. of these. There are sometimes as many as six specimens in one fish, but usually only one or two. It inhabits the intestine. Nicoll\* records it from rather more than 50 per cent. of the Haddocks at St. Andrews. The first description of this worm was by Cobbold† from British specimens from the Haddock. Although this so far is the only British host yet discovered, Odhner mentions as additional hosts *Gymnocanthus ventralis*, *Gadus morrhua*, and *Merluccius vulgaris*.

The worm is pale yellow, rather solid and opaque, and covered all over the body with spines. It measures 2—4 mm. in length, the breadth being about one-fourth to one-fifth of the length. The oral sucker is large (in a specimen 3.5 mm. long); it measures 0.36 mm. across. The ventral sucker lies slightly in front of the middle of the body, and measures 0.20 mm. across. The mouth leads to a long prepharynx; the pharynx is conspicuous, 0.20 mm. long, and about the same across; and there is a very short œsophagus, shorter than the pharynx, leading to two thick intestinal lobes, reaching to the end of the body. The excretory vesicle is a short narrow sac reaching hardly to the hind testis. The testes are globular, placed in the middle of the body, and directly behind one another. They measure 0.26 mm. across; from each a thin vas deferens runs to the vesicula seminalis. The latter is divided into two parts, the posterior of which lies outside the cirrus sac, and is surrounded by a globular mass of cells of a glandular structure, with a thin membrane surrounding it. This occurs just behind and to the right of the ventral sucker. Following it is the fairly long cirrus sac which encloses the anterior looped portion of the vesicula seminalis, the pars prostatica, and the short cirrus, the male duct opening into a very small genital sinus. The genital pore is slightly to the left below the intestinal fork. The ovary is globular and ventrally placed just in front of the foremost testis; from it springs an oviduct giving off dorsally a pear-shaped receptaculum seminis and a Laurer's canal to the left; it then receives the vitellarian duct and shell gland, and runs

\* Op. cit., page 77.

† Cobbold, T. S. Trans. Linn. Soc., XXII., page 158 (1858).



forward as the little winding uterus to open into the genital sinus on the left of the male opening. The eggs are few in number, and are yellowish brown in colour. The vitellaria are well developed, and run up each side of the body from near the posterior end to between the ventral sucker and the fork of the intestine. They are composed of numerous follicles which extend across the body behind the testes, and transverse ducts unite in a vitellarian receptacle dorsal to the ovary.

The life history of this Trematode is not known, but I think it very probable that a larval form found by myself in *Cardium edule*\* may be the young of *L. rachiæa*. The cercariæ were contained in sausage-shaped sporocysts which riddled the soft part of the cockle, and contained both free and encysted cercariæ. The free forms mostly possessed tails, but some had thrown them off previous to encysting, and the tails were actively moving about inside the sporocysts. The cercaria measured about 0.2 mm. in length, was covered with spines, and was oval in shape. Oral sucker, 0.04 mm. across; ventral sucker much smaller; longish prepharynx, conspicuous pharynx, very short œsophagus leading to two broad intestinal lobes reaching to the end of the body. All these characters agree with *L. rachiæa*. The excretory vesicle is, however, different, as it is bilobed instead of simple, but there does not seem much difficulty in conceiving that the shape of this organ might change. No traces of reproductive organs were seen in the cercariæ. The cockle might very well be the host of the larval *L. rachiæa*, for it is one of the molluscs commonly eaten by the haddock and constantly found inside it. We may therefore suggest the following life history for *L. rachiæa*:—First host, *Cardium edule* (tailed cercariæ developed in sporocysts which also enclose the encysted forms); intermediate host, omitted; final host, the Haddock.

*Lepodora elongata*, n. sp. (Plate II., figs. 5—6.)

This may be the species mentioned by Odhner† but not described. I have found it in only two specimens of the Cod (June) in the intestine just beyond the stomach, only very few specimens occurring in one fish. It is much like *L. rachiæa*, but a good deal longer in proportion to the width. All my specimens were colourless and

\* "On Three Mollusk-infesting Trematodes." Ann. and Mag. Nat. Hist., Jan., 1907.

† Odhner, "Fauna Arctica," page 337.



fairly transparent, with the body covered with spines. Length 3.5 mm., breadth 0.54 mm. The oral sucker is nearly circular, but slightly flattened at the top, 0.10 mm. across, with a circular aperture. Ventral sucker circular, 0.12 mm. across, and placed well in front of the centre of the body. The prepharynx is 0.30 mm. long, pharynx 0.08 mm. long, and the œsophagus the same length as the prepharynx. In the length of the œsophagus it does not agree with the diagnosis of the sub-family *Lepocreadiinae* as given by Odhner, in which it is designated as very short. The intestinal lobes are rather thick, and reach to the posterior end of the body. The excretory vesicle lies dorsally, and is a narrow sac reaching almost to the front testis. The testes measure 0.36 by 0.30 mm., and are placed one in front of the other, with a small space between, their long axes being slightly inclined. From each a very thin vas deferens runs up to the vesicula seminalis. The portion of the latter lying outside the cirrus sac is considerably longer than in *L. rachiæa*, and is surrounded by a similar mass of cells, which is, however, not so globular, and follows the somewhat S-shaped form of the hind part of the vesicula seminalis. It is also slightly nearer the centre than in *L. rachiæa*, although still to the right side. Behind the ventral sucker the cirrus sac begins, surrounding the second part of the vesicula seminalis, which is looped as in *L. rachiæa*; from this the pars prostatica leads to a short cirrus, opening into a very small genital sinus. The genital pore lies to the left, some way behind the intestine, but in front of the ventral sucker. The ovary is circular, 0.24 mm. across; the oviduct gives off dorsally a pear-shaped receptaculum seminis and a Laurer's canal to the left; the proximal portion of the Laurer's canal is a good deal swollen. The oviduct then receives the vitellarian duct and shell gland, and passes into the uterus, which winds in not many loops, containing over 100 eggs, the eggs measuring 0.066 mm. by 0.036 mm.; they are more pointed at one end than at the other. The female duct opens with the male duct into the genital sinus. The vitellaria are well developed, and extend from the posterior end of the body to a little way behind the ventral sucker, here again not quite agreeing with the diagnosis of the sub-family *Lepocreadiinae*, in which the vitellaria reach at least to the ventral sucker.

The life history is not known.



GENUS—*Pharyngora*, n.g.

*Pharyngora retractilis*, n.g., n.sp. (Plate II., fig. 7.)

This worm, which, I think, must be regarded as the type of a new genus, is closely allied to the members of the sub-family *Lepocreadiinae* in many ways, although it does not fully agree with them, and certainly cannot be regarded as belonging to one of the known genera in this sub-family.

This Trematode was found once only in the upper intestine of a Whiting (December), several specimens being obtained. It is colourless, transparent, and very contractile when alive; so contractile is the neck part that frequently no prepharynx is seen, and hardly any œsophagus, when really these organs are quite long. The body is covered with spines, and is long and narrow; length 4–6 mm. when at rest, but it can extend to a much greater length. Greatest breadth about 0.50 mm. It is much the same breadth throughout, except at the neck part where it gradually tapers off, and at the posterior end it is slightly rounded. The anterior sucker measures 0.20 mm. across; it is slightly flattened at the top, and has strongly muscular side walls giving it the appearance of a pharynx, much in the same way as in *Distomum bacillare* (Molin). The prepharynx is long, it may be nearly three times as long as the pharynx or hardly apparent at all, according to state of contraction (in contracted specimens it appears to be partly telescoped into the pharynx-like oral sucker). The pharynx is 0.12 mm. long, and about half as broad. The œsophagus is long, 0.4 mm. to 0.8 mm., branching about a quarter of the way down the body into two fairly thick intestinal lobes reaching to the extreme posterior end. The excretory bladder is extremely small, about 0.2 mm. long, only reaching about a third of the way from the posterior end to the hind testis. The ventral sucker occurs a little way behind the intestinal fork, and measures 0.12 mm. across. The testes are oval and have rather an irregular outline; they measure 0.56 mm. by 0.30 mm., and lie one in front of the other, with a small space between, the posterior testis lying 0.6 mm. from the end of the body. Each gives off a very fine vas deferens, which runs up to join the vesicula seminalis. The latter is divided into two parts, the posterior of which is long and pear-shaped, and lies outside the cirrus sac and not surrounded by any gland cells. It thins out abruptly before joining the second part, which is spherical, and is enclosed in a cylindrical cirrus sac. The



cirrus sac runs up by the side of the ventral sucker, and contains besides the anterior portion of the vesicula seminalis a pars prostatica and cirrus. The male duct opens into a roomy, oval genital sinus. The outer genital pore lies in front of the ventral sucker; it sometimes appears median and sometimes on one side. The ovary is somewhat heart-shaped, and lies in front of the fore testis, but separated from it by a small space. A very large shell gland is present masking the other female organs, so that as I have not yet made any sections of the worm, their exact relations have not been made out. There is a long pear-shaped receptaculum seminis and a Laurer's canal. The vitellarian duct opens into the oviduct close to the shell gland. The uterus has few loops, and occupies the space between the ovary and the vesicula seminalis, then it runs forward as a rather inflated vagina to open by the side of the male duct into the genital sinus. The eggs are not numerous (20—40), and measure 0.10 mm. in length. The vitellaria are well developed, and reach from nearly the posterior end of the body to the level of the centre of the ventral sucker. They fill up the space between and behind the testes, and cover the intestinal lobes ventrally.

From the above description it will be seen that this worm conforms in most ways with the sub-family *Lepocreadiinae* as given by Odhner. However, it differs entirely from all the so far known members by pharynx-like oral sucker and its very largely developed shell gland. The long œsophagus is also at variance (as in my *Lepodora elongata*) with the *Lepocreadiinae*. At first sight it is very like *Distomum bacillare* (Molin), but differs from this little known species in several points, notably the vesicula seminalis, which in that worm is completely within the cirrus sac.

For this worm I suggest the new genus *Pharyngora*, which may be characterised as follows:—Long narrow worm, body covered with spines. Oral sucker formed like a pharynx. Small ventral sucker. Long and very contractile prepharynx and œsophagus. Intestinal lobes reaching to end of body. Excretory vesicle very small, sac-like. Testes globular, placed posteriorly one in front of the other. Vesicula seminalis divided in two, posterior portion outside, anterior portion inside the cylindrical cirrus sac. Genital pore in front of the ventral sucker. Ovary heart-shaped in front of testes. Receptaculum seminis and Laurer's canal present. Large shell gland. Uterus with few loops and fairly large eggs. Vitellaria well developed, reaching from the posterior end to the



level of the centre of the ventral sucker. Typical and so far only species *Pharyngora retractilis*.

GENUS—*Stephanochasmus* (Looss).

*Stephanochasmus pristis* (Deslongch). (Plate II., fig. 8.) Looss, A., "Ueber die Fascioliden Genera *Stephanochasmus*, etc.," Centralbl. f. Bakt., Bd. XXIX., 1901, page 595.

One specimen only of what I believe to be this worm was found in the pyloric cæca of the Cod (October). Unfortunately (as is very usual with the species of this genus when taken from their hosts, even a few hours after death), it was not in very good condition, so that one of the most important characteristics, the head spines, could not be made out. The details which could be seen, however, agree so well with the characters of *S. pristis* that there cannot be much doubt that it belongs to that species. It is long and very thin; length 7 mm., breadth 0·35 mm. It is like a thread, as Looss remarks. The oral sucker measures 0·13 mm. across. There is a long prepharynx, pharynx 0·10 mm. long, and a short œsophagus branching into two narrow intestinal lobes, reaching almost to the posterior end of the body, filled with a dark fluid. The ventral sucker measures 0·19 mm. across, and occurs just below the fork of the intestine. The testes are oval, 0·60 mm. by 0·40 mm., lying one in front of the other, with a space of about 0·5 mm. between; the posterior testis is situated about 1 mm. from the end of the body. The cirrus sac is curved, not reaching halfway between the ovary and the ventral sucker, containing a simple club-shaped vesicula seminalis, pars prostatica, and long cirrus, the sheath in which the cirrus lies being lined with irregularly placed spines, with their points projecting forwards. The male duct opens into a small genital sinus, and the outer genital pore lies just in front of the ventral sucker. The ovary is spherical, placed 1 mm. in front of the foremost testis. The uterus has few loops, and ends in a long vagina lined with spines similar to those in the cirrus sac, opening into the genital sinus by the side of the male duct. The eggs are not numerous, and measure 0·06 mm. long. The vitellaria are strongly developed, running from the extreme posterior end of the body to the posterior end of the cirrus sac, composed of many follicles filling up the spaces behind, between and in front of the testes and in front of the ovary, and connected by a longitudinal duct each side; the ducts only and not the follicles are present at the sides of the testes and ovary.



According to Looss, *S. pristis* bears thirty-six head spines, rather thick and strong, in two rows, and the body is covered with spines. My specimen was too far gone to show any spines. I think, however, that there cannot be much doubt that it is *S. pristis*. The already known hosts for this species are *Gadus euxinus*, *G. minutus*, and *Motella vulgaris*. The Cod, *Gadus morrhua*, is, therefore, a new host for it.

The life history is not known.

Looss examined Stossich's specimen of *S. pristis*, but does not mention that Stossich's\* figure shows the worm to have rhombic spines, and Stossich's description of the worm also mentions this fact. The figure given by Looss shows the spines to be of the ordinary shape and thickness. I have found in the Whiting, in the pyloric cæca, one specimen of another species of *Stephanochasmus* apparently undescribed, which has its head surrounded by two rows of very broad, flat rhombic spines, very like those in Stossich's drawing. I think, therefore, that it is very likely that two or three worms very closely allied were mixed together in Stossich's material (Looss has already found *S. caducus* with *S. pristis*), and that Stossich's figure and perhaps the description represented this other form to which I give the name of *Stephanochasmus rhombispinosus*.

*Stephanochasmus rhombispinosus*, n. sp. (Plate II., figs. 9—10.)

This worm is very like *S. pristis*, but the armature of the head is very different from Looss's figure as remarked above, and it also differs in other ways, so that, I think, this certainly represents a separate species. It occurred once only in the pyloric cæca of of the Whiting (December). It is a long, narrow worm, colourless, and transparent, 5—10 mm. long, and about 0·30 mm. broad, tapering anteriorly. The body is covered with spines to the extreme posterior end, and the head is provided with two rows of very flat, broad rhombic spines, such as are shown in Stossich's figure of *S. pristis*. The exact number could not be determined, but there appeared to be either thirty-six or thirty-eight. The oral and ventral suckers are of equal size, 0·16 mm. across. The prepharynx is 0·40 mm. long; pharynx 0·10 mm. long, 0·08 mm. broad; œsophagus short and broad, reaching to the posterior end of the body. The ventral sucker is just behind the intestinal fork.

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\* Stossich, M., "Brani di Elmintol. Tergestina III." Boll. Soc. Ad. Trieste, IX., 1886, tab. VIII., fig. 33.



The testes are oval, 0.40 mm. long, the hind testis distant from the posterior end about 0.8 mm. The cirrus sac is long and curved, reaching as in *S. pristis* not halfway between the ventral sucker and the ovary, containing a simple club-shaped vesicula seminalis, pars prostatica, and long cirrus, the part of the sac surrounding the cirrus being lined with spines as in *S. pristis*. The male duct opens into the genital sinus behind the ventral sucker. The ovary is round, placed in front of the foremost testis, and about 0.5 mm. from it. The uterus, with few loops, runs forward as a vagina, armed with spines like the male duct, to open by the side of it. The eggs measure 0.08 mm. in length, and are not numerous. The vitellaria are well developed, reaching from the posterior end of the body to about halfway up the thick portion of the vesicula seminalis, filling up the space between, behind and in front of the testes and in front of the ovary, composed of many follicles united by a longitudinal duct each side, the ducts only and not the follicles running up the sides of the testes.

The life history is not known.

*Stephanochasmus caducus* (Looss). (Plate III., figs. 1—2.) Looss, op. cit.

This species, as Looss points out, is very like *S. pristis*, and was found by him in the same host, *Gadus minutus*. My specimen (again only a single one) came from the intestine close to the pyloric cæca of the Whiting (June). It differs from *S. pristis* in the armature of the head, the relation in size of the suckers and general figure, the breadth of the present species being greater than in *S. pristis*, the worm therefore not looking so thread-like. Length 4.4 mm., breadth 0.34 mm. The body is covered with spines. Head spines, forty-eight in two unbroken rows of twenty-four each, the longer spines being the upper ones (upper spines 0.039 mm., lower spines 0.033 mm. long). The oral and ventral suckers are about the same size, 0.30 mm. across in my specimens, which is greater than Looss's (0.17 mm. in individuals, 4.02 mm. long). The mouth leads to a prepharynx, 0.34 mm. long, the pharynx is conspicuous, and œsophagus short, leading to two thin intestinal lobes reaching almost to the posterior end of the body. The testes are oval, 0.35 mm. long. The vesicula seminalis is club-shaped and contained in a rather long cirrus sac which does not reach halfway between the ovary and the ventral sucker; the cirrus sac also contains the pars prostatica and long protrusible



cirrus with its sheath lined with spines; these spines are very regularly placed in groups of threes, with their apices directed forwards. The cirrus was seen protruding some way from its sheath, and was unarmed. The male duct opens into the genital sinus, the genital pore being just in front of the ventral sucker. The ovary is round; uterus with few loops, containing eggs measuring 0.066 mm. by 0.036 mm. The vagina is long and lined with regularly arranged spines like the cirrus sac, and opens into the genital sinus by the side of the male duct. The vitellaria are well developed, reaching from the posterior end of the body to just beyond the posterior end of the vesicula seminalis, composed of follicles with longitudinal canals as in *S. pristis*. In my example, not very much extended, the follicles come to the sides of the testes.

The life history is not known.

*Stephanochasmus triglae*, n. sp. (Plate III., figs. 3—4.)

One specimen only of this Trematode was found in the pyloric caeca of the Grey Gurnard (February). It is probably the species mentioned by Odhner\* as occurring in the Grey Gurnard, *Trigla gurnardus*. Seen in a contracted state it is very like *S. baccatus* (Nicoll†) from the Halibut, but the armature of the head is different, and the relation of the sizes of the suckers. The present species is, however, evidently more nearly related to *S. baccatus* than to any other known *Stephanochasmus*.

The worm measures 3.2 mm. in length when contracted, and 4.8 mm. when extended; the breadth when contracted is 0.74 mm., when extended 0.50 mm. It was alive when first examined, but, unfortunately, the head spines were slightly damaged, so that their exact number could not be determined; there were, however, certainly much fewer than fifty-six and more than forty-two, and arranged in two rows not broken in the centre. The upper spines (length 0.04 mm.) slightly larger than the lower (0.36 mm.), and rather thick and heavy. The body is covered with fine spines so thickly clustered together at the anterior end that it gave the worm a hispid appearance. The oral sucker is 0.26 mm. broad, and 0.14 mm. long. Ventral sucker round, 0.28 mm. across. The prepharynx is very short in the contracted state, 0.60 mm. long when extended. This leads to a conspicuous pharynx, 0.20 mm. long, and a very short oesophagus branching into two long lobes

\* Odhner, "Fauna Arctica," page 332.

† Nicoll, op. cit., page 80.



reaching nearly to the end of the body. The excretory vesicle was not seen, but two conspicuous canals run up the sides of the body. The testes are oval, 0.52 mm. long. Two thin vasa deferentia run up to the vesicula seminalis, which is pear-shaped and very short, and enclosed in a short club-shaped cirrus sac, which only curves slightly. It reaches behind the ventral sucker for a distance of 0.3 mm., and encloses a very small pars prostatica and straight cirrus; the male duct opens into the genital sinus in front of the ventral sucker. The ovary is globular and separated from the anterior testis by a space of about 0.20 mm. From the ovary is given off anteriorly an oviduct which runs forward, curving slightly, and giving off a long winding Laurer's canal, which is pronouncedly swollen at its junction with the oviduct, the swelling looking like a receptaculum seminis. It, however, in this specimen contained no sperms. Looss states that a receptaculum seminis is absent in the genus. The uterus is rather broad, with few openings, and runs forward as a vagina, opening by the side of the male duct into the genital sinus. The eggs are few in number, and measure 0.099 mm. by 0.056 mm. The vitellaria are well developed, and reach from the posterior end of the body to the level of the hind part of the ventral sucker, running up the sides in two continuous bands, not leaving off at the sides of the testes, and filling up the space behind them.

*Stephanochasmus baccatus* (Nicoll). (Larval form.)

The encysted form of what is probably the above species, the adult of which was found by Nicoll in the Halibut at St. Andrews, has been described by Johnstone\* under the name of *Distomum valdeinflatum*, Stossich, and by myself as the young of *S. baccatus*.† It occurs encysted under the skin of the Dab, Witch, and Long Rough Dab very commonly on this coast.

The life histories of the species of *Stephanochasmus* are not known in any case completely. Several encysted species have been found by various workers in fish, so that in all probability a fish is the usual intermediate host for the species of this genus. No earlier stages have been recorded as far as I know, except a cercaria found by myself in the common limpet, *Patella vulgata*, which was described but not named.‡ It occurred only once in a limpet from

\* Johnstone, J., op. cit., page 98.

† Trematodes of the Northumberland Coast, No. II." Trans. Nat. Hist. Soc. Northbd., etc., vol. III., N.S., 1908, page 15.

‡ "On Three Mollusk-infesting Trematodes," by the writer. Ann. and Mag. Nat. Hist. 1907, page 105, plate VIII, figs. c, d.



the shores of Loch Ryan at Stranraer, and was contained in rediæ which were crowded together in the liver of that mollusk. The cercaria was tailed and was very like the cercariæ of the closely allied genus *Echinostomum*, but had two rows of spines round the head. The number of spines was not ascertained, but there was certainly a large number. There were no traces of eye spots in these cercariæ, a fact to be remarked, as Looss mentions that most of the species of the genus in the adult state still bear traces of the cercarian eyes. These are shown in his figures of *S. pristis* and *S. caducus*. This cercaria measures 0.50 mm. long without the tail, which is less than half the length of the animal. The ventral sucker is a good deal larger than the oral. The mouth leads to a rather long prepharynx; there is a small pharynx and a long œsophagus branching into two lobes reaching to the posterior end of the body. A small sac-like excretory vesicle gives off two branching canals, one each side of the body. This does not appear to agree with any of the above adult species; the large ventral sucker and the long œsophagus separate it. No trace of reproductive organs was seen.

GENUS—*Otodistomum* (Stafford).

*Otodistomum veliporum* (Creplin). (Plate III., fig. 5.) Stafford, "Trematodes from Canadian Fishes." Zool. Anz., Bd. XXVII., 1904, pages 482—3.

This old species, which has been known to so many Trematode specialists, has not yet been described in much detail. According to Stossich\* it is the *Distomum insigne* Diesing of Villot,† who studied its minute anatomy, without, however, giving any measurements. Stafford created the genus *Otodistomum* for it without diagnosing the genus. Looss,‡ in describing the genus *Azygia*, suggests *Dis'omum veliporum* is probably closely allied to it. My single specimen shows much affinity with *Azygia*, but I think with Stafford that it represents a distinct but nearly related genus. I have, therefore, adopted Stafford's name for it, and give a short diagnosis of the genus so far as I can from the specimen; but this is, unfortunately, far from complete, as it was not possible to see the exact relations of all the organs.

\* Stossich, M., "I Distomi dei pesci marini e d'acqua dolce." Programma del Ginnasio Comunale Superiore de Trieste, 1885-6, page 19.

† Villot, A., "Organisation et développement de quelques espèces de Trématodes endoparasites marins (I)." Ann. des Sci. Nat., sér. VI., tom. VIII., 1879.

‡ Looss, A., "Weitere Beiträge," page 569.



The worm was found attached by its large ventral sucker to the inside wall of the stomach of the Starry Ray. It is large and conspicuous, measuring 32 mm. in length, with a thick cylindrical body, somewhat flattened dorso-ventrally. The suckers are both globular, very muscular, with circular apertures, and capable of being protruded far. The ventral sucker shows dorsally as a circular indentation. The cuticle is unarmed, but thick and wrinkled. The breadth of body is about 2.6 mm., rounded off at each end. It is opaque white, except the eggs and intestine, the latter being pale yellowish-brown, and the former, from the colourless young ones, through pale yellow, deep yellow and brown, to deep purplish-brown according to age. The oral sucker measures 1.2 across, and is not quite at the anterior end but slightly ventral. The ventral sucker measures 2.4 mm. across, just twice the diameter of the oral sucker, and is placed far forward. There is no prepharynx. The pharynx measures 0.40 mm. long, and 0.35 mm. broad. There is a very short oesophagus branching into two long and broad lobes reaching to the posterior end of the body. These come forward anteriorly slightly before running downwards, and for the whole of their length have sinuous and irregular walls. The intestine contains a yellowish-brown fluid. The excretory bladder is Y-shaped, forking by the hind testis, the lobes reaching anteriorly to the level of the pharynx. The testes are placed one behind the other, and touching each other. They are roundish masses, the hind testis (1.50 mm. across) larger than its fellow (1.30 mm. across), and placed near the middle of the body, the front testis being at about the centre. From each is given off a vas deferens which runs up to join the vesicula seminalis without uniting with its fellow. The vesicula seminalis is small, somewhat club-shaped, and contained in an inflated cirrus sac in front of the ventral sucker and to the left side. The remainder of the male duct was not exactly seen, but the cirrus sac apparently narrows very considerably and finally opens into a roomy genital sinus on the right side, which opens in a central genital pore just by the pharynx. The ovary is in front of the foremost testis, to the right, and touches it. It measures 1.2 mm. across, and is globular, narrowing slightly anteriorly. Across it ventrally stretch the transverse vitellarian ducts, which unite in a receptacle from which a duct opens into the oviduct. The receptaculum seminis is absent, but there seems to be a Laurer's canal which I could not make out very clearly. The oviduct passes into a much winding uterus full



of eggs, the loops winding transversely between the ovary and ventral sucker. The uterus then passes up dorsal to the ventral sucker, makes a few more small loops in front of it, and passes by a thin vagina into the genital sinus. The latter contains many eggs. The eggs are thin-shelled, are a rather broad oval, and measure 0.06 mm. in length. The vitellaria are very much developed, and composed of many follicles, filling up the anterior half of the space behind the testes; at about 0.2 mm. behind the testes the vitellaria thin out and form two continuous bands up the sides of the body to about 0.2 mm. behind the ventral sucker.

The life history is not known.

The genus *Otodistomum* may be thus briefly described:—Large Trematodes with strongly muscular and unarmed bodies. Suckers well developed. No prepharynx, conspicuous pharynx, very short oesophagus, and irregularly sinuous intestinal lobes reaching to the posterior end of the body. Excretory vesicle Y-shaped, with forks reaching to the pharynx. Genital pore by the pharynx. Cirrus sac lying in front of the ventral sucker; vesicula seminalis simple; large genital sinus. Testes one behind the other, nearly in the centre of the body. Ovary in front of foremost testis to the right. Laurer's canal present (?); no receptaculum seminis. Vitellaria composed of numerous follicles, occupying the anterior half of that part of the body behind the testes, and running up the sides to a short way behind the ventral sucker. Uterus loops many, reaching between the lobes of the intestine from the ovary to in front of the ventral sucker. Eggs numerous, of moderate size (0.06 mm. Typical species, *Otodistomum veliporum* (Creplin), living in the stomachs of fish.

*Distomum*, sp. (Plate III., figs. 6—8.)

Here I will insert a brief description of a Trematode which I have not yet been able to work out thoroughly, but which is interesting on account of its life history, which can be almost completely traced from the larval stage to the adult. It probably represents a new genus, and it is difficult to suggest where it should be placed. Possibly it may be allied to *Acanthopsolus oculatus* (Levins), but it differs from that Trematode in many respects.

In a former paper\* I have described a cercaria contained in sporocysts in great abundance in a specimen of *Buccinum undatum*

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\* "Notes on Northumbrian Trematodes," by the writer. Rept. Northbd. Sea Fish. for 1905, page 6.



from Holy Island, off the coast of Northumberland (April). The cercaria was tailed, with a tail rather longer than the animal, and possessed two conspicuous eye spots. The oral and ventral suckers were about the same size; there was a prepharynx, a pharynx, and a very short œsophagus, the intestinal lobes reaching not quite to the posterior end of the body. The ventral sucker was almost central, and there was a conspicuous pear-shaped excretory vesicle. The body was covered with spines.

On examining the stomach of a Catfish in February I found a quantity of immature Trematodes almost exactly corresponding to these cercariæ. They were without tails, but otherwise agreed in every way with those from *Buccinum undatum*. Most of them still possessed eye spots, but a pair of testes was visible, one each side just above the excretory vesicle. Most of them were alive and very active. A further stage was found in another Catfish, in which vitellaria were well developed, and the genital pore was seen to the left of the pharynx, with a cirrus sac and vagina opening into it. The cirrus sac was in front of the ventral sucker, but details were not made out. The length of the body of the young stage was 0·3 mm.—0·4 mm., breadth 0·14 mm.—0·18 mm.; oral sucker 0·07 mm.; ventral sucker the same; prepharynx 0·033 mm. long, or longer according to the state of contraction; pharynx 0·052 mm.; œsophagus about 0·02 mm. long. The older examples measured 0·60—0·80 mm. in length.

The adults of these Trematodes were found in the upper intestine of the Catfish, close to the stomach. The largest measured 0·90 mm. in length, and exactly corresponded to the larval forms from the stomach, but with the addition of large yellow eggs, usually four in number. These take up a great deal of room in the body, and measure 0·099 mm. by 0·066 mm. The unusually large eggs hide most of the other organs in the body, and give the worm a most peculiar appearance. The vitellaria reach from the posterior end of the body nearly to the level of the pharynx. The body is covered with spines, and is quite colourless.

These Trematodes occurred in three out of twelve Catfish examined in November and February. The stomachs contain usually a great number of remains of *Buccinum undatum*, and it is most probable that an encysted stage is omitted, and there is no intermediate host. The life history is probably the following:—First host, *Buccinum undatum*; intermediate host, omitted; final host, *Anarrhichas lupus*.



I have not given this worm any name, as I hope to be able to investigate it more thoroughly first.

GENUS—*Zoogonoides* (Odhner).

*Zoogonoides viviparus* (Olsson). (Plate IV., fig. 1.) Odhner, T., "Mittheilungen zur Kenntniss der Distomen I.," Centralbl. f. Bakt., etc., XXXI., 1902, page 53.

This Trematode occurs frequently on this coast in the end part of the intestine of the Dab, Long Rough Dab, and Plaice. The Long Rough Dab appears to be a new host. It is recorded from the Dab, Plaice, and Turbot by Nicoll from St. Andrews. Like him I have often found it in the Dab with *Steringopherous furciger*.\* It is very small, my specimens measuring 1.1 mm. long, and are bright red when alive; the colour, however, soon fades. The ventral sucker is twice the size of the oral; oral sucker 0.12 mm. across, ventral sucker 0.24 mm. across, both circular, the ventral sucker being almost exactly at the centre of the body. The body is oval, somewhat pointed at both ends, and covered with small spines. Greatest breadth at the ventral sucker 0.40 mm. The mouth leads to a very short prepharynx, the pharynx measures 0.05 mm. long, and the œsophagus is about twice the length of the pharynx. The intestinal lobes reach to about the centre of the ventral sucker. The excretory vesicle is small and oval. The testes measure 0.01 mm. across; they are oval bodies placed one each side of the ventral sucker, sometimes extending behind it, sometimes almost on a level with the centre. A thin vas deferens runs from each to the two-lobed vesicula seminalis, which is entirely enclosed in the cirrus sac. The latter is sickle-shaped, and occurs just in front of the ventral suckers, and encloses in front of the vesicula seminalis a well-developed pars prostatica and a cirrus armed with spines. The duct opens into a very small genital sinus, from which the sinus is often seen projecting. The ovary is almost spherical, about 0.01 mm. across, and placed behind the ventral sucker on the right; from its posterior end runs the oviduct, giving off a receptaculum seminis and Laurer's canal, then turning and receiving the vitellarian duct. The uterus is long and winding, and contains no eggs with shells, but thin-walled capsules containing miracidium larvæ. The loops take up most of the posterior part of the body, and the uterus then runs forward and opens as a thin-walled vagina into the genital sinus. The miracidium is curled up

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\* Nicoll, op. cit., page 83.



inside the capsule (the capsule measuring 0.07—0.08 mm. in length), and many are very active and can be seen rushing about when pressed out. They are pointed at one end and bluntly truncate at the other, and are covered with constantly moving long cilia. The vitellaria are much reduced, and are in the form of a compact round mass to the left of the ovary, from which a duct is given off to the oviduct.

This worm occurs in 10 per cent. of the Dab and Long Rough Dab, and in one Plaice out of three examined.

The life history is unknown.

#### GENUS—*Lecithaster*.

*Lecithaster gibbosus* (Rud.). (Plate IV., fig. 3.) = *Distomum molissimum* (Lev.). Odhner, "Fauna Arctica," page 356.

This delicate species I have found twice in the intestine of the Whiting (June and October), and once in the intestine of the Grey gurnard. The latter fish is, I believe, a new host for this worm. Odhner says it is present in many northern fish. Nicoll obtained it once at St. Andrews from the Sand Eel, and Johnstone\* got it from *Belone vulgaris* on the Lancashire coast. I have always found it in numbers in its hosts. It is an exceedingly fragile species, and very transparent. The usual length is about 1.2 mm., the greatest breadth being about a third of the length. It is colourless, except the eggs, which are a pale greenish-brown, and the body is unarmed. The posterior end is slightly constricted off and sometimes looks like a short tail. The suckers are circular, oral sucker 0.10 mm. across, ventral sucker 0.20 mm. and placed in front of the centre of the body. There is no prepharynx, the pharynx measures 0.06 mm. long, and there is a very short œsophagus branching into two rather thin lobes, which reach nearly to the end of the body. The excretory system consists of a thin central stem branching near the middle of the body and uniting behind the pharynx. It is filled with a highly refractive contents. The testes are globular, somewhat dorsally placed a little way behind the ventral sucker, each giving off a short vas deferens, which goes to the vesicula seminalis without uniting with its fellow. The vesicula seminalis is large and spherical, placed at the left of the ventral sucker. In front of it is a long and well-developed pars prostatica accompanied by large gland cells, and this leads to a small cirrus sac, at the beginning of which the

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\* Johnstone, op. cit. (1906), page 185



vagina unites with the male duct. The genital pore lies in the median line at the fork of the intestine. The ovary is four-lobed, and from it comes a short duct giving off dorsally a large oval receptaculum seminis. It then receives the vitellarian duct, and curves up as a much winding uterus filled with small and very numerous eggs. The vitellaria are formed into a seven-lobed mass placed behind the ovary and visible as a conspicuous dark star posteriorly. The single duct runs forward to open into the oviduct close to where it gives off the receptaculum seminis.

The life history is unknown.

#### GENUS—*Derogenes*.

*Derogenes varicus* (O. F. Müller). (Plate IV., fig. 4.) Odhner, "Fauna Arctica," page 360.

This is, perhaps, the most universally distributed Trematode on this coast, although it does not occur in great numbers in each individual. I have found it in the Angler, Grey Gurnard, Ling, Long Rough Dab, and Dab. The most usual place in which I have found it is in the mouth of the Long Rough Dab, as I have already mentioned in a previous paper.\* I have generally found it in the stomachs of the other fish, and now and then in the intestines. Odhner states that about eighteen different fish are known to harbour this parasite. Nicoll found it at St. Andrews in the stomach, intestine, oral cavity, and œsophagus of various fish, and Johnstone found it in the Whiting on the Lancashire coast. It is evidently common in many parts.

This well-known species is easily seen by its bright golden yellow colour, due to the numerous eggs. The body is colourless and unarmed, but with sometimes an appearance of striation due to wrinkling of the skin. My specimens measure on an average about 4.5 mm. in length. The largest are from the mouth of the Long Rough Dab. The oral sucker measures 0.30 mm. across, and the ventral 0.6 mm. The latter is placed behind the centre of the body. There is no prepharynx; the pharynx measures 0.10 mm., and leads to a narrow œsophagus branching into two rather broad intestinal lobes which reach almost to the posterior end of the body. The excretory system consists of a narrow posterior stem branching just behind the ventral sucker, and running up to join dorsal to the œsophagus. The testes are globular, one each side of the ventral sucker, one, the left, usually in front of the other.

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\* "Trematodes of the Northumberland Coast, No. II." Op. cit., page 16.



A vas deferens runs from each to the oval vesicula seminalis, from which comes a long straight pars prostatica with a mass of large gland cells, after which is a small globular cirrus sac in which are the male and female ducts, these opening into the small genital sinus at the apex of a "papilla" which serves as a copulatory organ. The genital pore is just behind the fork of the intestine. The ovary is globular, behind and between the testes; the oviduct runs backwards, then turns and gives off a small oval receptaculum seminis with a short Laurer's canal, losing itself before reaching the outer wall. The oviduct then receives the vitellarian duct and shell gland, and running forwards forms the much winding uterus, filling the spaces between and behind the vitellaria, testes and ovary, and in front of the ventral sucker, and then runs forward as the vagina. The eggs are golden yellow, measuring 0.059 mm. by 0.033 mm., and are very numerous. The vitellaria are two oval masses, 0.4 mm. across, placed at a short distance in front of the posterior end of the body. A duct from each joins in a single one to the oviduct.

Levensen has found what he believes to be the young of *D. varicus* in the Polychæt *Harmothæ imbricata*. I have not succeeded in finding any of the larval stages.

#### GENUS—*Hemiurus*.

*Hemiurus communis* (Odhner). (Plate IV., figs. 5–7.) Odhner, "Fauna Arctica," page 351.

This is the only true *Hemiurus* that I have yet come across in the fishes of this coast. It occurred in four Whittings (December) in the stomach, in the intestine of one Bull-Head (February), and one Sand Eel (June). Not more than two or three examples were found together in the Whittings, and only single specimens were found in the Bull-Head and Sand Eel. According to Odhner, it is common in many different Scandinavian fish. Nicoll has recorded it from St. Andrews in the Haddock and Sand Eel.

The worm is long and narrow, length of soma\* about 2.8 mm. Abdomen when stretched out about two-thirds of the length of soma. Breadth of soma 0.5 mm., narrowing slightly anteriorly. The body is conspicuously striated. The oral sucker measures 0.14 mm. across, ventral sucker 0.28 mm. across, both circular, the ventral sucker being placed at about the first third of the soma. There is no prepharynx; the pharynx measures 0.08 mm. in

\* I have adopted Looss's suggested names "soma" and "abdomen" for the body and tail respectively. (Looss, "Zur Kenntnis der Distomenfamilie Hemiuridæ." Zool. Anz., bd. XXXI. (1907), page 585.)



length; the short œsophagus is about the same length as the pharynx, the intestinal lobes being rather thick and entering the abdomen more or less, according to the state of contraction. The excretory system consists of a single ventral stem, dividing in front of the ovary into two branches which join dorsally in front of the pharynx. The testes are placed one in front of the other, behind or to the right side of the vesicula seminalis, and behind but close to the ventral sucker. Anterior testis (0.08 mm.) smaller than the posterior (0.10 mm.), each giving off a short vas deferens which joins the vesicula seminalis without uniting with its fellow. The vesicula seminalis is placed directly behind the ventral sucker, and divided into two portions, both thin-walled and spherical, the hinder part slightly the larger. The anterior part is separated from the pars prostatica by a constriction. The pars prostatica is long and winding, with large gland cells; at about the level of the fork of the intestine it is joined by the uterus, and a cylindrical cirrus sac (0.26 mm. long) surrounds the common duct. This is striated for the first three-quarters of its length, and then covered with small papillæ. It opens ventrally by the side of the pharynx, or in front of it. The ovary is circular, and placed slightly behind the last third of the soma; posteriorly the oviduct gives off a globular receptaculum seminis. The uterus is winding, with many loops, and enters the abdomen in extended specimens, and the loops wind almost all over the body until they reach the ventral sucker, where the oviduct runs forward to join the male duct. The eggs are a clear greenish-yellow, very numerous, and measuring 0.26 mm. by 0.01 mm. The two vitellaria are globular, or more or less ovate, and are about the same size as the ovary, and immediately behind it. Each gives off a duct which unite and open into the oviduct near the receptaculum seminis.

The life history is not known. Odhner, however, suggests that Pratt's North American *Hemiurus appendiculatus*, the life history of which he has traced in a species of copepod,\* is likely to be this species, although the presence of a simple and not bilobed vesicula seminalis, as Odhner says, is against this. At any rate, it is some closely allied form, and indicates the direction in which to look for the life histories of other Hemiurids. In this paper Pratt gives a most interesting account of this larval Trematode which he proves to inhabit the copepod from its earliest larval stage up to its encysted condition, no intermediate host being involved.

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\* Pratt, H. S., "A Contribution to the Life History and Anatomy of the Appendiculate Distomes." Zool. Jahrb., bd. XI, haft. 3 (1898).



TABLE OF LIFE HISTORIES OF THE DIGENETIC TREMATODES  
IN THIS PAPER AS FAR AS IS AT PRESENT KNOWN.

(When authorities are not given the observations are the author's own, or have been confirmed by her.)

| Name of Trematode.                | First Host.  | Intermediate Host.                              | Final Host.             |
|-----------------------------------|--|---|-------------------------|
| <i>Gasterostomum gracilescens</i> | <i>Cardium edule</i><br>(Bucephalus larva)   | Haddock and other<br>Gadidæ                     | Angler.                 |
| <i>Proserhynchus squamatus</i>    | <i>Modiolaria discors</i> ?<br>(Levinsen)  | Unknown ...                                     | Bull-head, etc.         |
| <i>P. grandis</i> ...             | Unknown ...  | Do. ...   | Cod, etc.               |
| <i>Steringophorus furciger</i>    | Do. ...  | Do. ...   | Dab, etc.               |
| <i>S. Ovacutus</i> ...            | Do. ...  | Do. ...   | Long Rough Dab.         |
| <i>Podocotyle atomon</i>          | Do. ...  | <i>Themisto libellula</i> ?<br>(Levinsen)       | Bull-head, etc.         |
| <i>Distomum bacillare</i>         | Do. ...  | Unknown ...                                     | Mackerel.               |
| <i>Lepodora rachiæa</i> ...       | <i>Cardium edule</i> (?) ...   | Omitted (?) ...                                 | Haddock.                |
| <i>L. elongata</i> ...            | Unknown ...  | Unknown ...                                     | Cod.                    |
| <i>Stephanochasmus pristis</i>    | Unknown, but a<br><i>Stephanochas-</i><br><i>mus</i> cercaria was<br>found in rediæ<br>in <i>Patella</i><br><i>vulgata</i> | Do. ...   | Do.                     |
| <i>S. rhombispinosus</i> ...      |  | Do. ...   | Whiting.                |
| <i>S. caducus</i> ...             |  | Do. ...   | Do.                     |
| <i>S. triglæ</i> ...              |  | Do. ...   | Grey Gurnard.           |
| <i>S. baccatus</i> ...            |  | Dab, etc. ...                                   | Halibut (?)             |
| <i>Pharyngora elastica</i>        | Unknown ...  | Unknown ...                                     | Whiting.                |
| <i>Otodistomum veliporum</i>      | Do. ..   | Do. ...   | Starry Ray.             |
| <i>Distomum</i> , sp. ...         | <i>Buccinum undatum</i>  | Omitted ...                                     | Catfish.                |
| <i>Zoogonoides viviparus</i>      | Unknown ...  | Unknown ...                                     | Dab, etc.               |
| <i>Lecithasta gibbosus</i>        | Do. ...  | Do. ...   | Whiting, etc.           |
| <i>Derogenes varicus</i> ...      | Do. ...  | <i>Harmothoe imbricata</i> ?<br>(Levin-<br>sen) | Long Rough Dab,<br>etc. |
| <i>Hemiurus communis</i>          | Do. ...  | Unknown ...                                     | Whiting, etc.           |



ORDER—*MONOGENEA*, v. Ben.FAMILY—*Monocotylidæ*, Tschbg.GENUS—*Calicotyle*, Diesing.

*Calicotyle kroyeri* (Diesing). (Plate V., fig. 1.) Diesing, "Systema Helminthum," vol. I., page 419 (1850).

This fine species inhabits the cloaca of the Starry Ray. I have always found it in females contrary to other observers, who generally record it from the males. I have sometimes seen it also in the uterus and once on the gills of the Starry Ray. It occurred in five specimens out of sixty examined, usually several in each fish.

T. Scott\* has recorded this species for Scotland from the Starry Ray, *R. radiata*, and also from *R. clavata*, and A. Scott† has found it in rays in the Irish Sea. Its morphology has been minutely investigated by Wierzejski.‡

The worm is white or pale yellowish, very much flattened dorso-ventrally, and bearing posteriorly on its ventral surface a circular disc with seven rays, and armed with two curved spines at the hind end, by the aid of which it attaches itself. The length of my specimens is about 4—5 mm., the breadth being slightly less than the length, and the shape of the body somewhat triangular. The anterior oral sucker is almost circular, and measures 0.70 mm. across; it has a circular opening leading to a muscular pharynx (0.40 mm. long), and there is a very small œsophagus branching into gracefully curved intestinal lobes which end just above the posterior disc. The excretory system follows closely the course of the intestine (outside it), and is very difficult to see. The testes are a large group of cells occupying the hind part of the space which is almost enclosed by the intestinal lobes; from them a vas deferens runs up the left side, curving round to the right just below the intestinal fork as a thin vesicula seminalis, ending blindly on the left and leading to a triangular bulbous cirrus sac with a curved and sharply pointed penis. The common genital pore or birth pore is in the middle line, a little way below the intestinal fork. The ovary and oviduct form a sinuous mass arising from the left side in front of the testes; it runs trans-

\* Scott, T., "Twentieth Annual Report of Fishery Board for Scotland." Part III., page 299 (1902).

† Scott, A., "Some Parasites found on Fishes in the Irish Sea." Rept. Lancs. Sea Fish. Sci. Inv. for 1903, page 35.

‡ Wierzejski, A., "Zur Kenntniss des Baues von *Calicotyle Kroyeri* Dies." Zeitsch. f. wiss. Zool., 29 bd., 1877, page 550.



versely as far as the right limb of the intestine, then curves back and forms a central receptaculum seminis, then receives the vitellarian duct, and runs forward as a thick short uterus to the birth pore. From the distal end of the receptaculum seminis the paired vagina is given off ventrally. The latter consists of two lateral canals with glandular ends, each opening ventrally at the sides of the body. No eggs were seen. The vitellaria are much developed, occupying the sides of the body between the intestine and the outer wall, then unite in two main transverse ducts which run across the body just below the uterus to open into the oviduct. Strong muscles are present, especially by the oral sucker and posterior disc. The disc in my specimens measures nearly one-third of the body, which is larger than Wierzejski's figure of it.

FAMILY—*Polystomidæ*, Tschbg.

GENUS—*Octobothrium*, F. S. Leuckart.

*Octobothrium merlangi* (Kuhn). (Plate V., fig. 2.) Van Beneden, P. J., "Note sur l'*Octobothrium merlangi*, etc." Bull. de l'Accad. Roy. de Belg., tom. XXIII., 2, 1856 pages 502—8.

This Trematode occurs very commonly on the gills of the Whiting on this coast; it occurs on fully 75 per cent., and sometimes as many as six on one individual, usually, however, not more than two or three. They are to be found all the year round. T. Scott\* records it from the Whittings of the Firth of Forth, and A. Scott† records it from the Irish Sea.

The worm is pear-shaped, very much flattened dorso-ventrally, with the posterior broad and curled up and divided into eight short finger-like processes, each of which bears a chitinous sucker; with these it clings to the gills of its host. The head end is very narrow, and bears a circular oral sucker anteriorly with two very small additional suckers below, one on each side. The length is about 11 mm., and the greatest breadth (exclusive of posterior processes) about 4 mm. The body is very opaque and is a greyish colour, with brownish vitellaria obscuring all the organs. The mouth leads to a very short prepharynx, and there is a large muscular circular pharynx leading to a narrow œsophagus which branches into two sinuous intestinal lobes, very much obscured by the vitellaria. The genital pore lies just below the intestinal fork;

\* Scott, T., "Nineteenth Annual Report of the Fishery Board for Scotland." Part III., page 146 (1901).

† Scott, A., op. cit., page 36.



it is circular and armed with chitinous sickle-shaped hooks from twelve to fourteen in number, with their apices directed inwards. The ovary is an opaque mass almost at the centre of the body, from which runs a curving oviduct leading to a uterus. Like Van Beneden I have never seen more than one egg in the latter at a time. The egg is pale yellow, with a process at each end. On the right side of the ovary is a smaller mass—the testis according to Van Beneden—but I have not been able to follow the related parts. The vitellaria are much developed and occupy almost the whole of the body, even running into the posterior processes. A conspicuous longitudinal vitellarian duct runs down each side of the body, and a transverse duct from each side joins near the middle to open into the oviduct.

GENUS—*Pterocotyle* (v. Ben. and Hesse).

*Pterocotyle palmata* (Leuckart). (Plate V., fig. 3.). Van Beneden and Hesse, "Recherches sur les Bdellodes ou Hirudinées et les Trématodes marins," 1868, page 107.

This worm I found three times on the gills of the Ling; one specimen on each. It is recorded from the Scottish coast by T. Scott\* from the Ling.

The worm is 12·5 mm. long or longer, breadth about 2 mm., and expanding posteriorly into eight long finger-like processes, forming a sort of fan. Each process bears a chitinous sucker, with which the worm is attached to the gills of its host. The head end is narrow and bluntly rounded; at the extreme anterior end there is a small circular oral sucker leading to a thin prepharynx and bulbous pharynx, and on each side of the prepharynx is a small sucker. A thin œsophagus leads to two sinuous intestinal lobes, very much obscured by the vitellaria. The genital aperture is circular, placed just below the fork of the intestine, and bearing sixteen to seventeen chitinous hooks, with their apices directed inwards. The ovary is situated at about the first third of the body, and from it runs forward an oviduct leading to a winding uterus, expanding greatly at the anterior end, and full of yellow eggs (0·20 mm. by 0·08 mm.) without filaments. Almost the whole body is taken up by the much developed vitellaria, which are united by two conspicuous longitudinal canals and a transverse one, each side uniting anterior to the ovary to open into the oviduct.

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\* Scott, T., op. cit. Nineteenth Report, page 149,



GENUS—*Plectanocotyle* (Diesing).*Plectanocotyle caudata*, n. sp. (Plate V., figs. 4—7.)

This worm is very common on the gills of the Grey Gurnard, occurring in about 50 per cent., and often in numbers. Its anatomy is so like *Plectanocotyle lorenzi*, Monticelli,\* that, I think, I cannot be wrong in placing it in this genus; indeed, if it were not for the long posterior peduncle in the centre of the hind part of the body and its armature being slightly different, it might be the same species. Also, the six chitinous suckers surrounding the posterior margin in my specimens are on distinct though short peduncles or cupules, whilst those in Monticelli's figures are sessile; this, indeed, may be contraction due to the preservative. In many ways both *Plectanocotyle lorenzi* and the present species are like Van Beneden's and Hesse's *Phyllocotyle gurnardi*,† but here again the chitinous posterior suckers are sessile. I might hazard the suggestion, however, that *Phyllocotyle gurnardi*, *Plectanocotyle lorenzi*, and my specimens all represent the same species in various degrees of contraction. As it is impossible to prove this at present, I must describe my worm as a new species, as I cannot make it agree exactly with either of the other two forms. T. Scott‡ records both *Phyllocotyle gurnardi* and *Plectanocotyle lorenzi* from the Grey Gurnard, but they are so much alike that, according to Scott, one could easily be mistaken for the other, except for the peduncle. Scott's figure of *Phyllocotyle gurnardi* is apparently the species I am at present describing. Monticelli himself identified the *Plectanocotyle lorenzi* found by Scott. A. Scott§ records *Phyllocotyle gurnardi* from the Common Gurnard and Yellow Gurnard from the Irish Sea, but does not describe it.

The Trematode which I have called *Plectanocotyle caudata* is a very fragile species, from 4 to 6.5 mm. in length without the peduncle, which is about 0.7 mm. long. The greatest breadth is 0.80 mm. in the region of the ovary. The body gradually tapers at each end, and at the posterior end widens again and spreads out in a shield-shaped fan, about 1 mm. long and about the same width. At the hind end of the fan is a long slender peduncle bearing a round sucker, 0.20 mm. across, which is armed with small chitinous hooks. The fan itself is scalloped out, and bears

\* Monticelli, F. S., "Di una nuova specie del genera *Plectanocotyle*." Atti della R. Accademia del Scienze di Torino, vol. XXXIV., 1899, page 1045.

† Van Beneden and Hesse, op. cit., page 103.

‡ Scott, T., "Twenty-third Annual Report of Fishery Board for Scotland," pages 115-116.

§ Scott, A., "Some Parasites found on Fishes in the Irish Sea." Op. cit., page 36.



three short cupules each side, each bearing a complicated chitinous sucker. All my observations were taken from the living worm, and I have not been able to enter into the minute points of the anatomy. The head end bears a circular anterior mouth with a short prepharynx and muscular pharynx. On each side of the pharynx is a small circular sucker. The pharynx leads to a very short œsophagus branching into two intestinal lobes, which are hardly visible owing to the great development of the vitellaria, which are greyish-brown and completely mask most of the intestine. The testes are a large group of round masses situated at the posterior half of the body; they begin about 0.60 mm. from the fan, and reach nearly to the middle of the body. From their anterior part a vas deferens runs up the centre of the body, and curving round ends in a chitinous penis, the male genital opening being just below the fork of the intestine. The penis is composed of five slender chitinous rods each side, the two central rods being much shorter than the others, and terminated by small knobs. This apparatus is very like Van Beneden's description of the same organ in *Phyllocotyle gurnardi*, but does not agree so well with his figures. Behind the penis is a bilobed organ, the function of which I could not determine. The ovary is a curved sausage-shaped mass in front of the testes; from it runs forward the oviduct, which receives the vitellarian duct, and then continues as the uterus, the anterior part of which is dilated with eggs in some specimens, in others, is quite narrow all the way along. The uterus opens by the side of the male opening on the left. The eggs are oval, pale yellow, and bear a filament at one pole only; length of egg, 0.065 mm. without the filament. The vitellaria are well developed, and occupy the sides of the body for almost the whole length of the worm, even into the fan-like end portion. Transverse ducts join in a vitellarian receptacle about 0.2 mm. in front of the ovary, and a single duct enters the oviduct. The armature of the posterior peduncle consists of six suckers arranged on the posterior half of the small disc borne on the end. The outer pair are the largest, Y-shaped, the tail ending in a curved hook; the inner pair are similar but smaller, and in between the outer and the inner pairs are two very small hooks which seem to be anchor-shaped.

With regard to preservation of this worm I find that when preserved in formalin (about 3 per cent.) the posterior end retains the extended form.



GENUS—*Onchocotyle* (Diesing).

*Onchocotyle appendiculata* (Kuhn). (Plate V., figs. 9—12.) Taschenberg, E. O., "Weitere Beiträge zur Kenntniss ectoparasitischer marines Trematoden." Festschrift zur Feier des Hundert-jährigen Bestehens der Naturforschenden Gesellschaft in Halle, 1879, page 27.

I found two examples of this worm on the gills of the Picked Dogfish (January). T. Scott\* records it from the Grey Skate and Thornback Skate from Aberdeen, and A. Scott† records it from the Lancashire coast from various elasmobranch fishes.

The worm is pale yellowish, with a brown intestine and vitellaria. The body is very flat, long, and narrow; length 8 mm., breadth 1.8 mm. Posteriorly it bears an almost circular disc bearing six suckers and a curious median appendage sticking out dorsally. The suckers each bear a chitinous semi-circular armature, and the posterior appendage bears two oval suckers and two very small chitinous spines of a similar shape to those on the peduncle of *Plectanocotyle caudata* (see above). Strong muscle fibres go to the suckers and peduncle. The oral sucker measures 0.60 mm. across, and is rather broader than long, and flattened anteriorly. It leads to a pharynx, 0.20 mm. long, and this gives off an œsophagus of about the same length. The intestinal lobes are much swollen and very irregular, and full of brown contents. They enter the posterior disc and unite about halfway down it, sending off a shoot into the posterior appendage, and continuing into the posterior part of the disc. The vitellaria follow the intestinal lobes for the whole of their course, filling up the sides of the body and obscuring most of the other organs. The testes are a group of round masses occupying the posterior part of the body from just in front of the posterior union of the intestinal lobes to beyond the centre of the body. I was not able to see the vasa deferentia, but these, according to Taschenberg, are two thin ducts uniting in front of the ovary in a single thicker duct, which winding in transverse loops ends in the cirrus sac opening anteriorly just below the fork of the intestine. No seminal vesicle is present. The ovary is a lobed mass just in front of the testes, giving off, according to Taschenberg, an oviduct which almost immediately leads to a receptaculum seminis; from this the oviduct runs as a

\* Scott, T., "Nineteenth Annual Report." Op. cit., page 151.

† Scott, A., "Some Additions to the Fauna of Liverpool Bay." Trans. Liverpool Biol. Soc., vol. XV., 1901, page 344; and "Some Parasites found on Fishes, etc." Op. cit., page 36.



very thin winding tube, giving off a Laurer's canal and receiving the vitellarian duct and shell gland, and then runs forward as the uterus straight to a dilated portion full of eggs opening anteriorly by the side of the male opening. The oviduct and vitellarian duct are easily seen in the living state. The eggs are small, 0.30 mm. long, with a short process at each end. The vitellaria are brownish and very abundant, giving off transverse ducts just anterior to the ovary.

#### EXPLANATION OF PLATES.

The following letters apply to all the figures:—O.S., oral sucker; A.S., anterior sucker; R., rostellum; V.S., ventral sucker; P.PH., prepharynx; P., pharynx; ŒS., œsophagus; I., intestine; E., excretory system; E.P., excretory pore; T., testis; V.D., vas deferens; V.SEM., vesicula seminalis; P.P., pars prostatica; C.S., cirrus sac; C., cirrus; G.P., genital pore; O., ovary; O.D., oviduct; R.S., receptaculum seminis; L.C., Laurer canal; S.G., shell gland; V., vitellaria; V.R., vitellarian receptacle; V.D., vitellarian duct; E.G., eggs; U., uterus; V.G., vagina; M., miracidium; P.A., posterior appendage.

#### PLATE I.

- FIG. 1.—*Gasterostomum gracilescens* (Rud.) Length 6 mm. Adult, ventral view. From intestine of *Lophius piscatorius*.  
 „ 2.—*G. gracilescens*. Length 2.6 mm. Larval form pressed out of cyst. From nerves of *Gadus aeglefinus*.  
 „ 3.—*G. gracilescens*. Cyst with worm inside.  
 „ 4.—*Prosorhynchus squamatus*, Odhner. Length 1.5 mm. Adult, ventral view. From pyloric cæca of *Cottus scorpius*.  
 „ 5.—*Prosorhynchus grandis*, n. sp. Length 2.8 mm. Adult, ventral view. From pyloric cæca of *Gadus merlangus*.  
 „ 6.—*Steringophorus furciger* (Ols.) Length 3 mm. Adult, ventral view. From intestine of *Pleuronectes limanda*.  
 „ 7.—Ovary and connected female organs of *S. furciger*.  
 „ 8.—*Podocotyle atomon* (Rud.) Length 2.5 mm. Adult, ventral view. From intestine of *Pleuronectes platessa*.

#### PLATE II.

- FIG. 1.—*Distomum bacillare*, Molin? Length 3.2 mm. Adult, ventral view. From intestine of *Scomber scombrus*.  
 „ 2.—*Lepodora rachicæa* (Cobb.) Length 3.5 mm. Adult, ventral view. From intestine of *Gadus aeglefinus*.  
 „ 3.—Ovary and connected female organs of *L. rachicæa*. Dorsal view.



- FIG. 4.—Cercaria, perhaps larval of *L. rachiaea*. Length 0.19 mm. From *Cardium edule* encysted in sporocysts.
- „ 5.—*Lepodora elongata*, n.sp. Length 3.5 mm. Adult, ventral view. From intestine of *Gadus morrhua*.
- „ 6.—Ovary and connected female organs of *L. elongata*. Dorsal view.
- „ 7.—*Pharyngora retractilis*, n.g., n.sp. Length 4 mm. Adult, ventral view. From intestine of *Gadus merlangus*.
- „ 8.—*Stephanochasmus pristis* (Deslongch.) Length 7 mm. Adult, ventral view. From pyloric caeca of *Gadus morrhua*.
- „ 9.—*Stephanochasmus rhombispinosus*, n. sp. Length 5.1 mm. Adult, ventral view. From pyloric caeca of *Gadus merlangus*.
- „ 10.—Head of *S. rhombispinosus*.

## PLATE III.

- FIG. 1.—*Stephanochasmus caducus*, Looss. Length 4.4 mm. Adult, ventral view. From intestine of *Gadus merlangus*.
- „ 2.—Head of *S. caducus*.
- „ 3.—*Stephanochasmus triglae*, n. sp. Length 4.3 mm. Adult, ventral view. From pyloric caeca of *Trigla gurnardus*.
- „ 4.—Ovary and connected female organs of *S. triglae*.
- „ 5.—*Otodistomum veliporum* (Creplin). Length 29 mm. Adult, ventral view. From stomach of *Raia radiata*.
- „ 6.—Cercaria from stomach of *Anarrhichas lupus*. Length 0.3 mm.
- „ 7.—The same, later stage 0.6 mm. long.
- „ 8.—The same, adult, ventral view, 0.8 mm. long. From intestine near stomach of *A. lupus*.

## PLATE IV.

- FIG. 1.—*Zoogonoides viviparus*. Length 1.1 mm. Adult, ventral view. From intestine of *Pleuronectes limanda*.
- „ 2.—Miracidium of *Z. viviparus*.
- „ 3.—*Lecithaster gibbosus* (Rud.) Length 1.2 mm. Adult, ventral view. From intestine of *Gadus merlangus*.
- „ 4.—*Derogenes varicus* (O. F. Müll.) Length 4.5 mm. Adult, ventral view. From mouth of *Hippoglossus limandoides*.
- „ 5.—*Hemiurus communis* (Odh.) Length 4 mm. Adult, ventral view. From stomach of *Gadus merlangus*.
- „ 6.—Vesicula seminalis and terminal portion of genital apparatus of *H. communis*.
- „ 7.—Female genital organs of *H. communis*.



## PLATE V.

- FIG. 1.—*Calicotyle Kroyeri* (Diesing). Length 5 mm. Ventral view. From Cloaca of *Raia radiata*.
- „ 2.—*Octobothrium merlangi* (Kuhn). Length 11 mm. Ventral view. From gills of *Gadus merlangus*.
- „ 3.—*Pterocotyle palmata* (V. Ben. and Hesse). Length 11 mm. Ventral view. From gills of *Molva vulgaris*.
- „ 4.—*Plectanocotyle caudata*, n.sp. Length 6.4 mm. Ventral view. From gills of *Trigla gurnardus*.
- „ 5.—Eggs of *P. caudata*.
- „ 6.—One of the six chitinous suckers of *P. caudata*.
- „ 7.—Penis of *C. caudata*.
- „ 8.—Sucker on peduncle of *P. caudata*.
- „ 9.—*Onchocotyle appendiculata* (Kuhn). Length 8 mm. Ventral view. From gills of *Acanthias vulgaris*.
- „ 10.—Chitinous sucker of *O. appendiculata*.
- „ 11.—Spine from posterior process of *O. appendiculata*.
- „ 12.—Side view of *O. appendiculata*.
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The following is a list of the names of the persons who have been admitted to the membership of the Association since the last meeting of the Association, held on the 15th of December, 1876.

1. Mr. J. H. Smith, of New York.
2. Mr. W. B. Jones, of New York.
3. Mr. T. A. Brown, of New York.
4. Mr. C. D. White, of New York.
5. Mr. E. F. Green, of New York.
6. Mr. G. H. Black, of New York.
7. Mr. I. J. Grey, of New York.
8. Mr. K. L. White, of New York.
9. Mr. M. N. Black, of New York.
10. Mr. O. P. Grey, of New York.
11. Mr. Q. R. White, of New York.
12. Mr. S. T. Black, of New York.
13. Mr. U. V. Grey, of New York.
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11. Mr. Q. R. White, of New York.
12. Mr. S. T. Black, of New York.
13. Mr. U. V. Grey, of New York.
14. Mr. W. X. White, of New York.
15. Mr. Y. Z. Black, of New York.

The following is a list of the names of the persons who have been admitted to the membership of the Association since the last meeting of the Association, held on the 15th of December, 1876.

1. Mr. J. H. Smith, of New York.
2. Mr. W. B. Jones, of New York.
3. Mr. T. A. Brown, of New York.
4. Mr. C. D. White, of New York.
5. Mr. E. F. Green, of New York.
6. Mr. G. H. Black, of New York.
7. Mr. I. J. Grey, of New York.
8. Mr. K. L. White, of New York.
9. Mr. M. N. Black, of New York.
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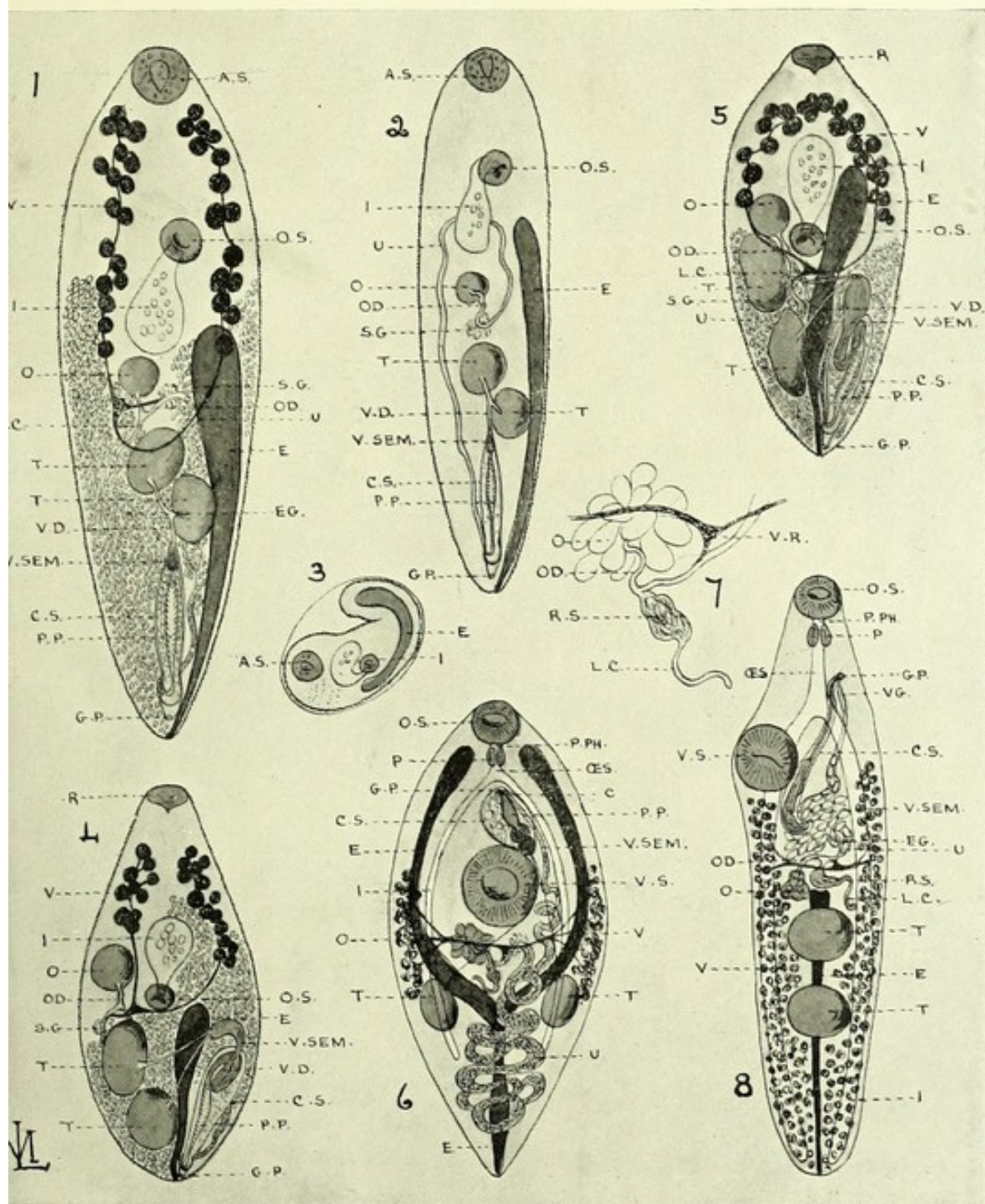


PLATE I.

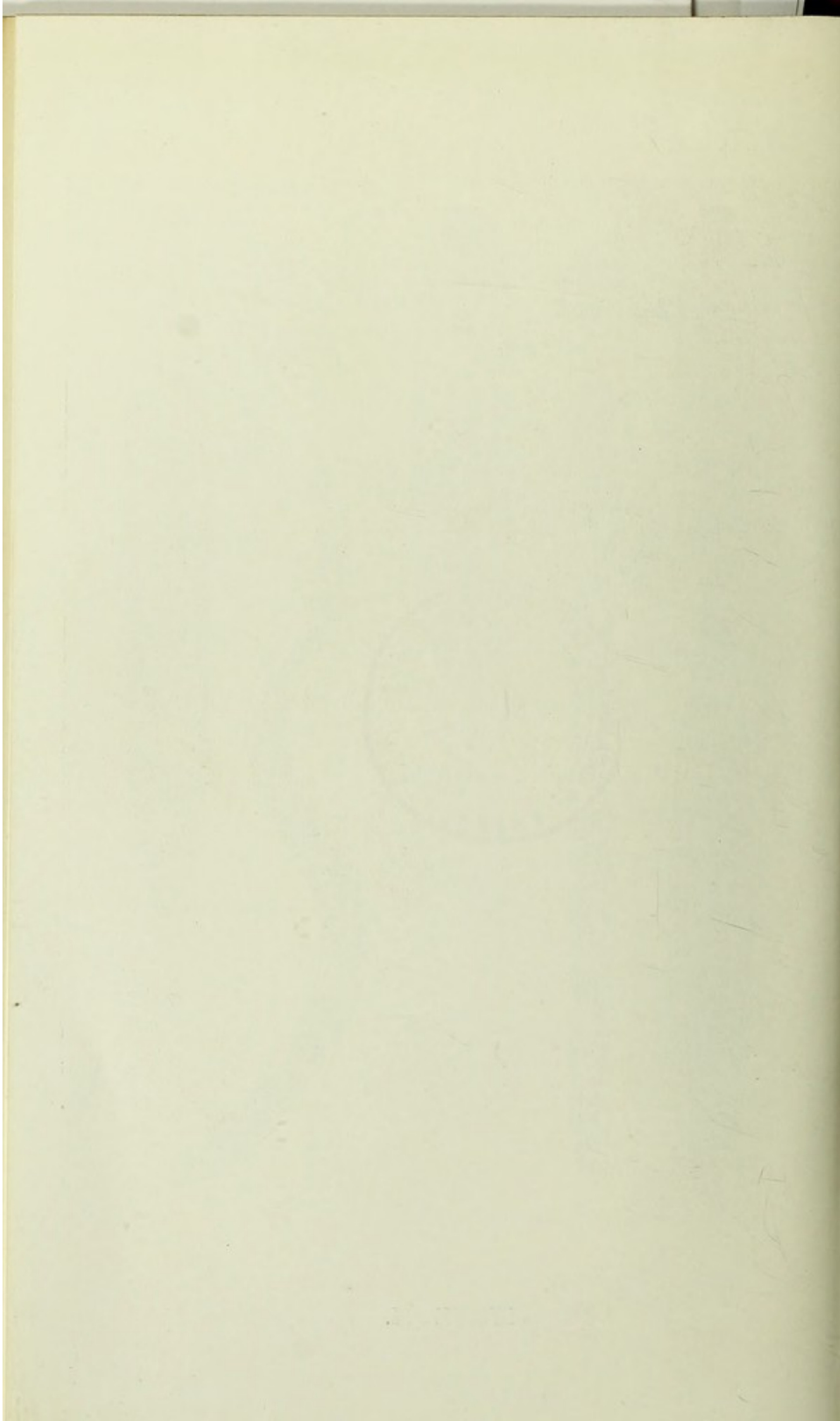














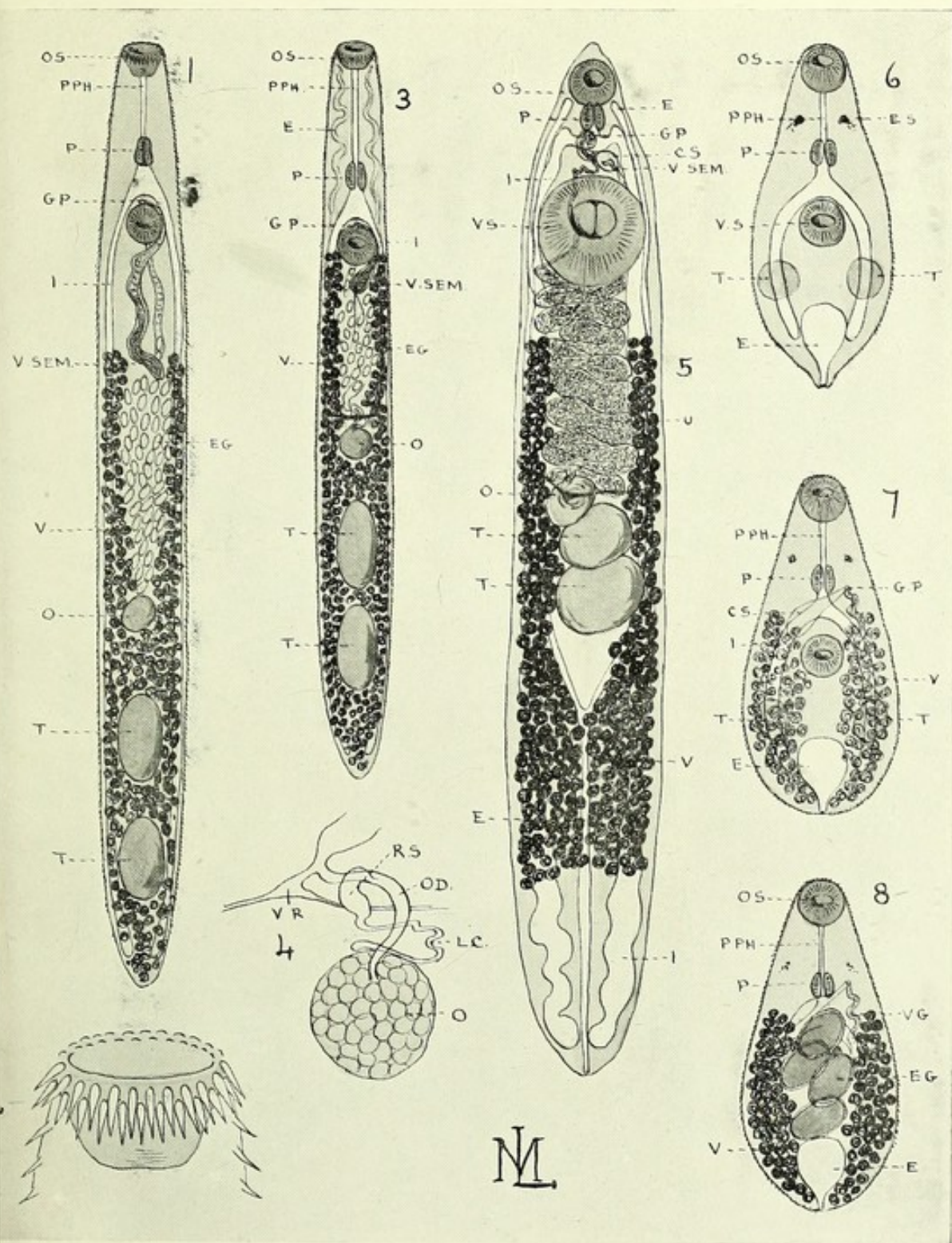
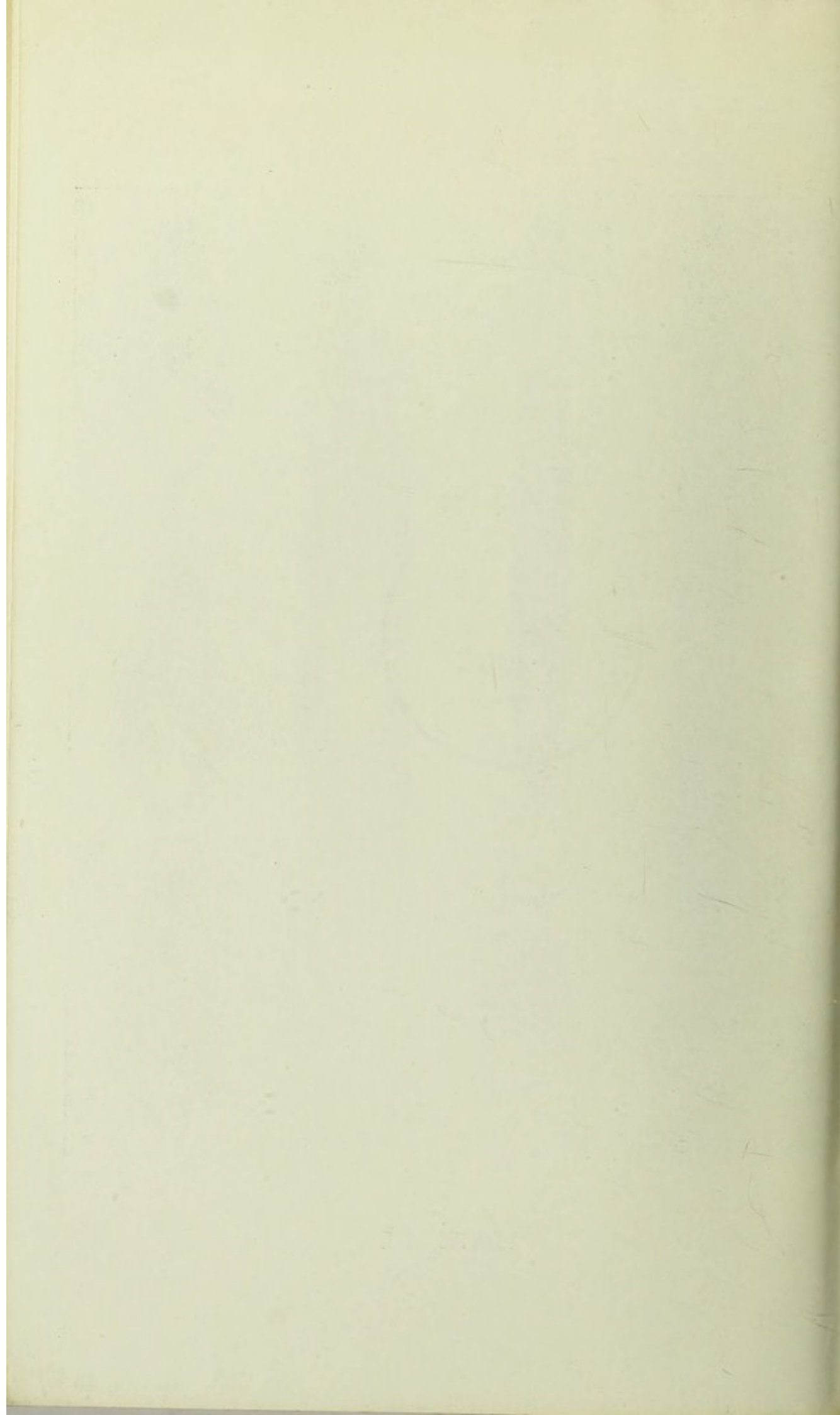


PLATE III.







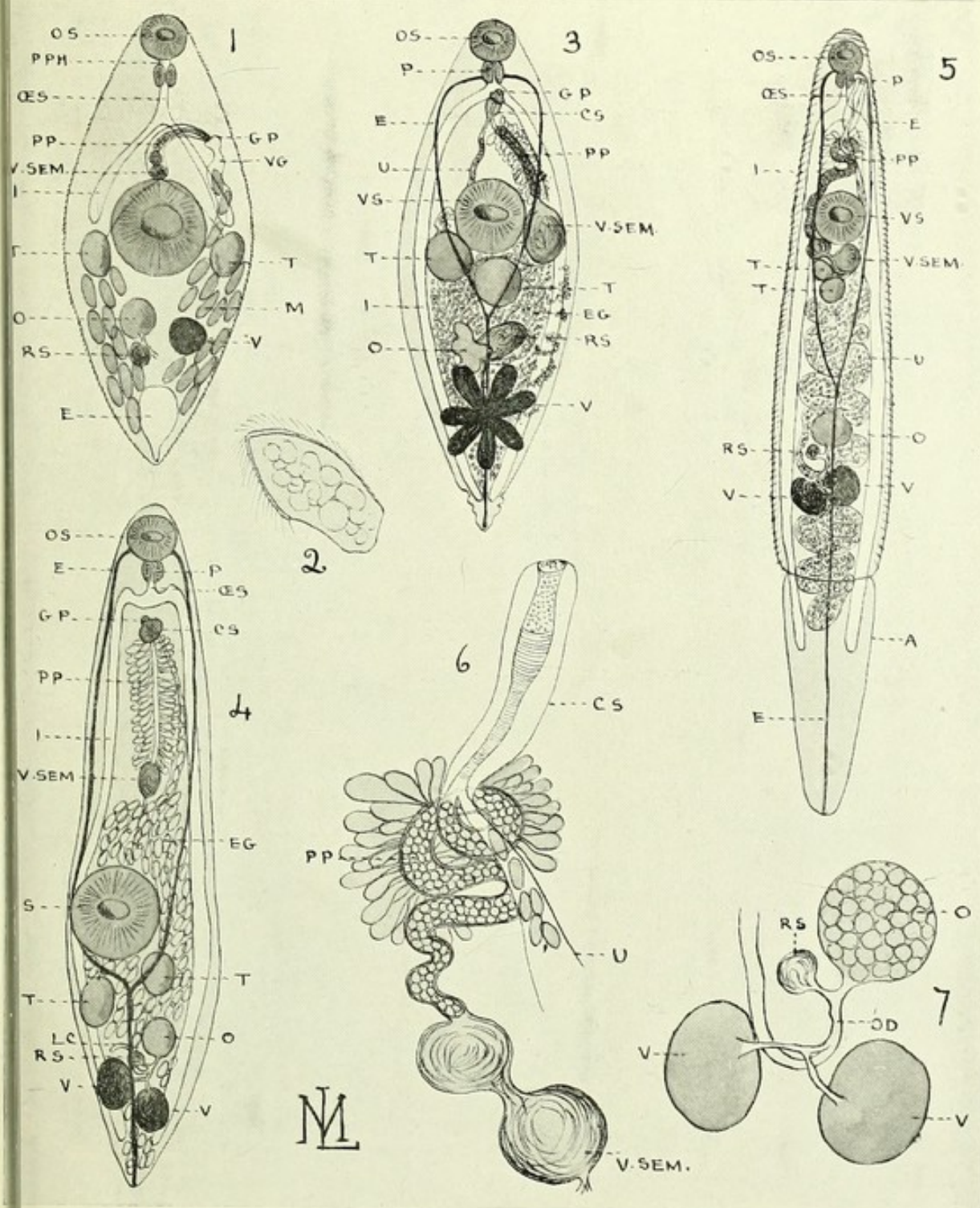
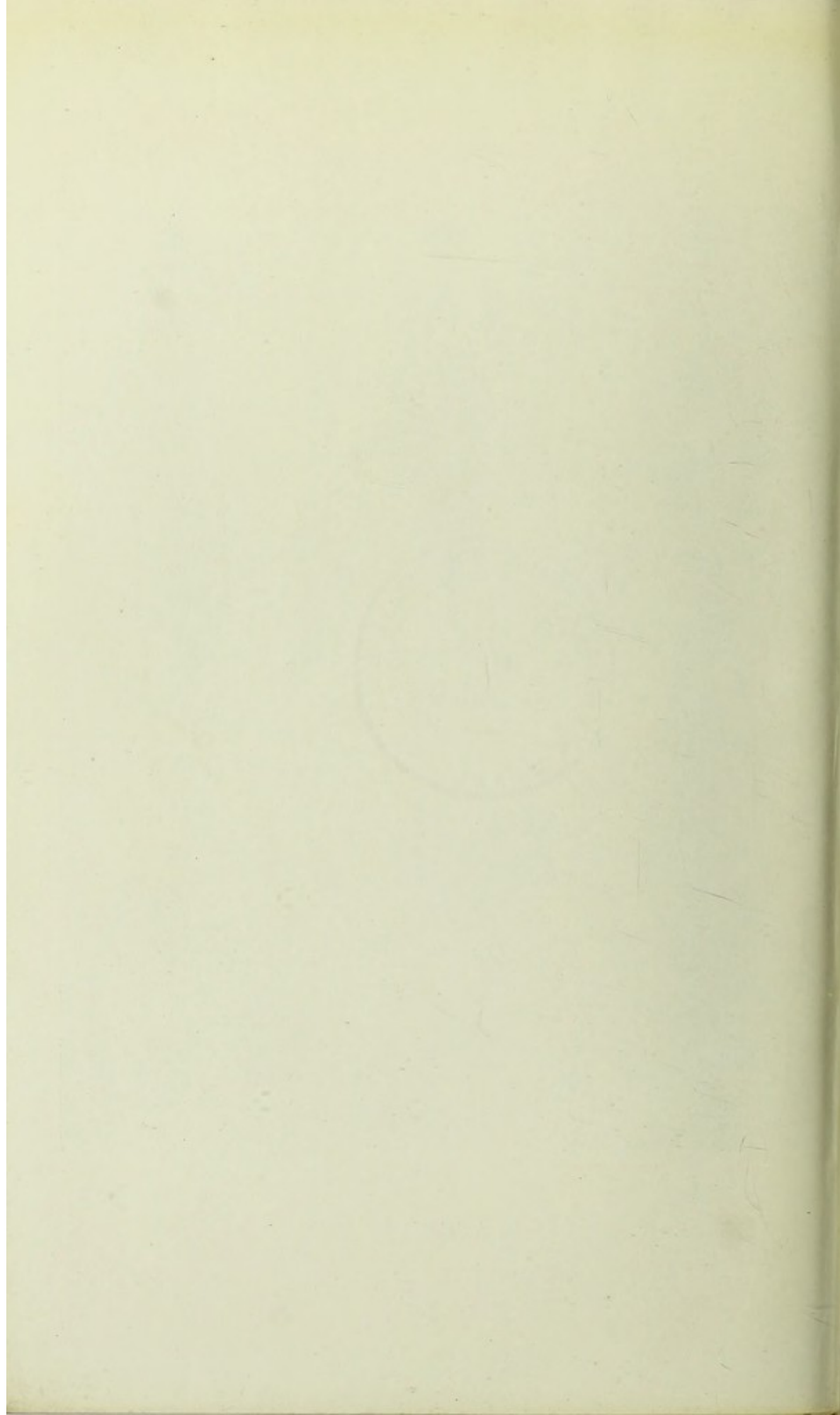


PLATE IV.







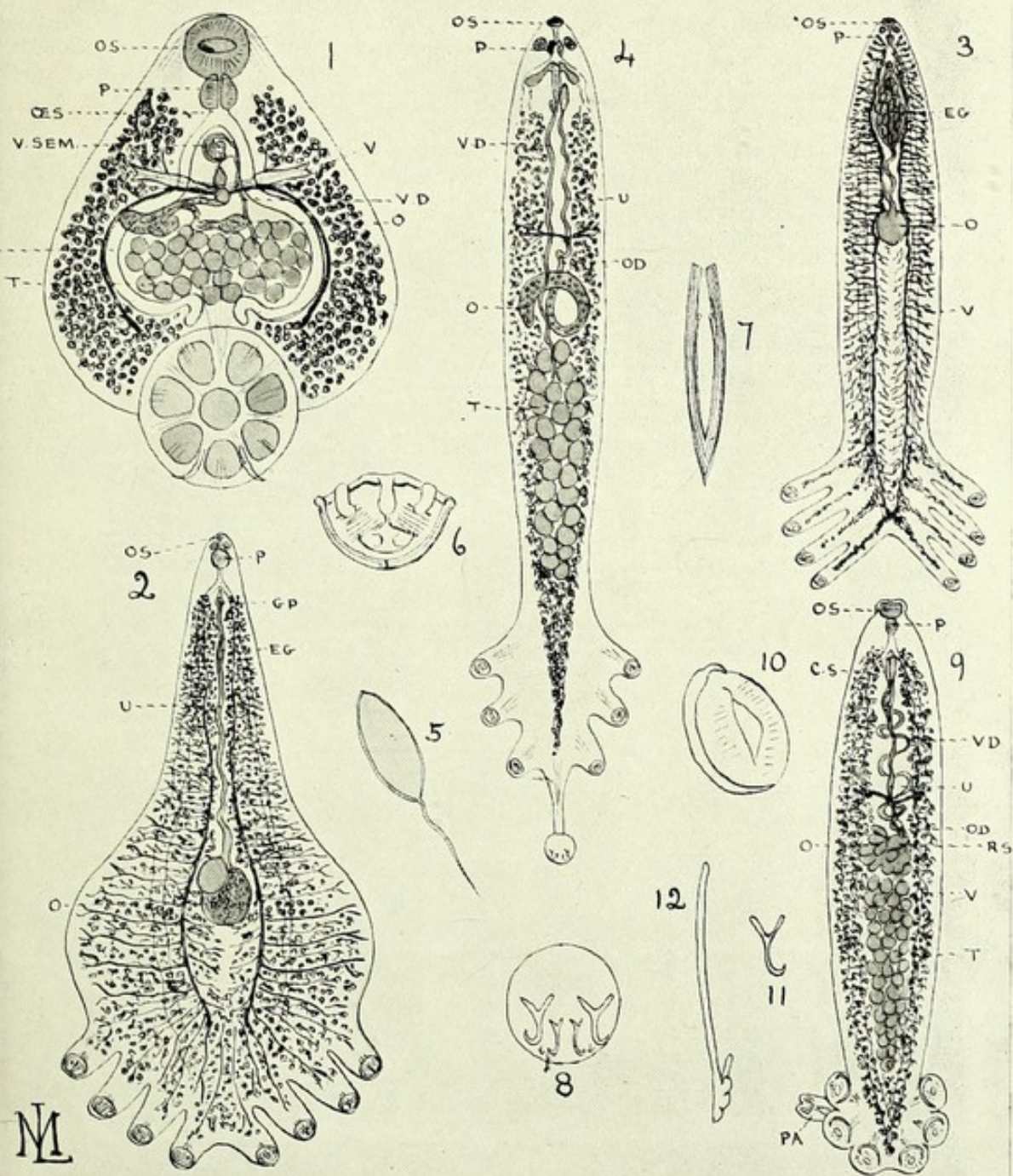


PLATE V.



