Contributions to a Knowledge of British Marine Turbellaria.

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With Plates XXXIX, XL, & XLI.

Contents.

I. Introductory.

1. Nature and Scope of the Paper.

It is usual to begin a faunistic paper on Turbellaria with the words of Oscar Schmidt, "Man braucht, wie es scheint, wo man will nur zuzugreifen und ist der Ausbeute sicher;" and although written forty years ago, they are still applicable to this group. In the northern European seas (and it was to these that Schmidt referred) many species may be found by careful examination of almost any portion of the littoral and laminarian zones. Yet, owing probably to their small size, inconspicuous appearance, perishable nature, and obscure

anatomy, few naturalists in this country have devoted much attention to them. When once a keen interest, however, is aroused, the number of new and morphologically important forms that may be found in a limited area is beyond anticipation. This has been well expressed by Jensen in the preface to his work on the Turbellaria of the west coast of Norway: "The new forms described here are only a very small part of those that occur on our coasts. A rich harvest remains behind. Indeed, one has no need to go far to find numbers of new species. Among seaweed they are frequently brought up at every haul. At greater depths, again, other new species are found; but as regards the occurrence of the smaller and more numerous forms, our fauna is still quite unknown."[1]

This quotation applies very appositely to the present case. As yet only a small portion of our coast has been explored. Extended observations are urgently needed. Still, from my own list, together with the records of other naturalists who have from time to time noted the occurrence of British forms, it appears that our fauna already includes fourteen Polyclads, two Triclads, and fifty-five Rhabdocœles—a total of over seventy species. It is to the description of these that I address myself. In doing so I shall try to indicate the distinctive points, structural and bionomical, that separate the various forms, reserving a more detailed account of the anatomy of new or partially known species to a future paper.

The specific descriptions (which largely confirm those of previous observers) are taken, except where otherwise stated, from my own observations.

One section of the group—the parasitic Turbellaria—is omitted. These forms undoubtedly occur on our coasts, but I have had no opportunity for their investigation.

[1] Preface: "De her beskrevne nye Former ere da kun en meget liden Brökdel af de ved vore Kyster forekommende. En rig Höst staar tilbage. Man behöver sandelig ikke at gaa langt for at finde en Mængde nye Arter. I Tangen i Fjæren kan man jevnlig drage saadanne op hvert Kast . . . . men Faunæn her, navnlig for de mindre og talrigste Arters Vorkommende, er endnu helt unbekjendt" (49). The numbers in brackets refer to the list of literature at the end of this paper.

2. Historical Account.

The history of British marine Turbellaria may be said to begin with the publication of Dalyell's octavo volume, "Observations on some Interesting Phænomena in Animal Physiology exhibited by Several Species of Planariæ" (1811 and 1814). Among the eight species there described, is a marine one, Planaria flexilis (now known as Leptoplana tremellaris), from the Firth of Forth. This animal, however, was not new. It had been discovered and carefully described by O. F. Müller, in his 'Vermium terrestrium et fluviatilium Historia,' nearly forty years before. While, therefore, Dalyell made no new discovery in Planaria flexilis, his study of its habits considerably increased our existing knowledge.

The merit of his work lies in the careful and patient observations, the accumulation of many years, which it records. The muddy haunts of the flexilis, its active behaviour when in search of food, its inordinate appetite after a period of starvation (illustrated by a case in which the bodies of three individuals burst and subsequently putrefied, owing to the quantity of food absorbed), the increase in bulk and changes of colour due to the contained nutriment, the mode of propagation by eggs laid in batches like those of molluscs, and the power of repairing serious injury,—all these points are graphically described and extended to seven fresh-water forms. In fact, this book contains even at the present time the best account that we possess of the bionomics of these animals, and well earned for Dalyell the dedication by v. Graff of his 'Monographie der Turbellarien.'

From 1814 to 1852 the work done on this group was confined, in this country, to the description of single forms, or to the records of their occurrence on our coasts. Montagu (7) in 1815 discovered Planaria vittata (Prostheceræus vittatus) on the south coast of Devonshire. In 1821 Fleming (8) found Planaria atomata, tremellaris, and vittata during a voyage round Scotland. Our knowledge of this part of the British fauna was further increased by a series

of papers by Dr. George Johnson, and Wm. Thompson, of Dublin. The former, under the title 'Illustrations of British Zoology' (11 and 12), described Planaria cornuta (Eurylepta cornuta) and Planaria subauriculata (Stylochoplana subauriculata) from the shores of Berwick Bay. These accounts suffice to enable us to identify the species referred to, but give little idea of their internal anatomy. The relations of the known forms to one another were as yet quite obscure. Thompson recorded forms from various Irish localities. Forbes and Goodsir found Polyclads in the Orkneys and Shetlands in 1839 (13), and in his later dredging reports Forbes frequently enters "Planaria sp.?" accompanied by a lament that so little is yet known of these forms.

If we turn to work done on the Continent during this period (1830—1850) we find that v. Baer and Dugès had independently discovered the internal anatomy and especially the generative organs of the fresh-water Planariæ, and had proposed a rough scheme of classification. The corresponding discovery of the anatomy of Polyclads was made by v. Mertens.[1] Ehrenberg (10) had found many new forms, some of which constituted his subdivision "Rhabdocœla." Oersted's most important paper (16) appeared in 1844,[2] containing a system which included all known species, and from which later attempts originate. Our knowledge of the histology and anatomy of the Rhabdocœles (the small size of which usually prevented an adequate investigation being made, on account of the necessity for high magnifying powers) was immensely increased by Max Schultze's 'Beiträge zur Naturgeschichte d. Turbellarien,' 1851. The accuracy of the descriptions and beauty of the copper plates are well known.

The following year (1852) Dalyell published the 'Powers of the Creator,' the second volume of which contains references to a considerable number of Turbellaria. Among these,

[1] "Untersuchungen ü. d. Bau verschiedener in d. See lebender Planarien," 'Mém. de l'Acad. Imp. d. Sciences d. St. Pétersbourg,' sér. 6me, t. ii, 1833.

[2] Reprinted with figures and additions from 'Kröyers Naturhist. Tidsskrift,' 1843.

Monotus lineatus and Convoluta paradoxa are interesting as being the first records of British Rhabdocœlida. The habits and reproduction are well described, but the anatomy is very far behind the knowledge of the time. For ten years (1852—1862) little work on these forms was done in this country, while Oscar Schmidt, Schultze, and Leuckart on the Continent were extending a monographic and systematic knowledge of the group. In 1859, however, Claparède spent August and September in the Hebrides, chiefly at Skye. In a most interesting paper (**35**) he describes Convoluta paradoxa (in which he determined successive hermaphroditism), Mesostomum marmoratum, Prostomum caledonicum, Vortex quadrioculata, Enterostomum fingalianum, and the Polyclads Centrostomum Mertensii and Eurylepta aurita. Similar researches (**36**) on the coast of Normandy showed what a varied Turbellarian fauna existed there. No one, however, was found in this country to advance our knowledge of the group on similar lines.

In 1865 the 'Catalogue of Non-parasitical Worms in the British Museum' appeared. The marine Turbellaria are taken from the works of Johnston, Thompson, and Dalyell, together with a few new records.

A year later Lankester (**39**) issued a list of the fauna of Firman Bay, Guernsey, containing Convoluta paradoxa, Leptoplana auricularis, L. flexilis, and Eurylepta cornuta. In 1875 McIntosh (**45**) published his 'Marine Invertebrates and Fishes of St. Andrews,' in which several Turbellaria are mentioned. The occurrence of Prostoma lineare, Oe. (Gyrator hermaphroditus, Ehrg.), in the sea, and a short description of Mesostoma bifidum, n. sp. (Pseudorhynchus bifidus), are specially noteworthy. v. Graff paid a visit to Millport, the results of which are incorporated in his great monograph ([**53**,] 1882, p. 437). Twenty-four marine species of this group were found and fully described. In the summers of 1884 and 1885, Koehler explored the Channel Islands. A list of the forms obtained may be found in the 'Annals and Mag. of Nat. Hist.,' fifth

series, vol. xviii, p. 362. The most important additions to the Turbellarian fauna are Oligocladus sanguinolentus and Proceros argus.

3. Nomenclature.

I wish in this section to discuss certain difficulties connected with the terminology of the complicated reproductive organs of the Turbellaria.

The stages exhibited by different members of this group, by which a simple organ, producing ova capable of manufacturing the necessary food-yolk, becomes differentiated into two parts, one furnishing ova, the other yolk, and the final separation of these two parts into two distinct organs, have been pointed out by Gegenbaur, Balfour, and others. Thus in the Acœla the organ is quite simple, the ova elaborating their own food-yolk. To such an organ I shall apply the term ovary. Certain Rhabdocœla—e. g. Prorhynchus—exhibit the first stage in complexity. The cells are still equivalent, but are not all equally capable of becoming ova; those that are not, form yolk-cells destined for the nutrition of the ovarian part of the organ. The secretion of yolk-granules by the yolk-cells surrounding the fertilised ova, which in this form does not take place until the ova have undergone segmentation, in the Cylindrostominæ and others occurs before the yolk is transferred to the ova. To such an organ, performing a double function, the Germans apply the term "Keimdotterstock," and as an equivalent I shall use "germ-yolk-gland," although, strictly speaking, the word "gland" should apply to the vitelline portion only.

In the great majority of Turbellaria the two parts become separate organs with distinct functions. For these I use the old terms germarium for the ovarian organ, and vitellarium or yolk-gland for the nutritive one. The term vagina I apply to that part of the female genital duct which forms a sheath for the penis during copulation. For the storage and nutrition of the spermatozoa various accessory organs are developed. For a single organ, serving to retain the sperm until

fertilisation is accomplished, the term spermotheca is a convenient equivalent for "bursa seminalis," used by v. Graff. In many cases (e. g. Vorticidæ) two organs are present, one of which receives the male products of another individual, and then passes it on to the second, from which fertilisation takes place. I retain the term bursa copulatrix for the former muscular structure, and receptaculum seminis for the latter. While the ova are being duly fertilised, provided with food-yolk, and surrounded by an egg-capsule, they are usually retained within the body of the parent during, and usually also a short time after, these changes. Consequently a certain amount of development is passed through. To the region in which this takes place the term uterus may be applied.

The testes offer no difficulties of terminology. Vasa efferentia may be applied to cases such as Polyclads, where a fine duct passes from each testis-follicle, and vasa deferentia to the paired canals formed by their union. These canals usually open into a vesicula seminalis. Accessory male glands are very commonly present, and possess fairly uniform histological characters. Hence the terms granule-gland, granule-duct, vesicula granulorum. The duct through which the male products reach the exterior is the ductus ejaculatorius, and any chitinous investment round it may be called a copulatory organ.

As regards the authors' names appended to the species, I have endeavoured to follow the British Association rules. Von Graff, in his 'Monograph,' has employed the name of that author who first used the definitive combination of genus and species. Thus Vortex balticus, M. S. Schultze, becomes Provortex balticus, v. Graff, whereas I write it Provortex balticus (M. S. Schultze).

The terminations of generic names have not hitherto been formed in an uniform way. Von Graff changed the terminations of all the older generic names, such as Acmostomum, to Acmostoma, whereas Lang retains the -um form. In the present paper I have followed these authors. It would, however, seem advisable in the future to adopt either one termina-

tion or the other, right through the group. Spengel's[1] Latinised form of "Alloiocœla" (Allœocœla) is adopted.

II. Systematic.

TURBELLARIA.

Sub-order 1.—RHABDOCŒLIDA.

A. *ACŒLA.*

A digestive cavity absent. Mouth ventral, leading indirectly through the pharynx into the parenchyma. A "frontal gland" and otolith present. Nervous system consisting of a brain and peripheral nervous sheath. Hermaphrodite. Testes follicular, rarely compact.

Family PROPORIDÆ.

Acœla with a common genital pore.

Genus 1.—Proporus, v. Graff (= Schizoprora, Schmidt, 28).

Proporidæ without spermotheca.[2]

1. Proporus venenosus (O. Schmidt, 28).

Length 1 mm. Body elongate, cylindrical, rounded at both ends. Colour bright yellow, due to diffused granular pigment. Epidermis ciliated, containing numerous rhabdites, some free, some grouped in formative cells. These pyriform groups are specially abundant towards the hinder end, giving a spinous appearance to the surface. The mouth lies just beneath the anterior end; circular at rest, it becomes slit-like during movement. The pharynx is a direct invagination of the anterior end (v. Graff, 'Acœla,' pl. x, fig. 5). It is long (one-fourth the length of the body), cylindrical, and

[1] 'Götting. gelehrte Anzeigen,' March 1st, 1884, p. 183, note.

[2] The definitions of families, sub-families, and genera are taken from v. Graff (53).

muscular. The otolith has a distinct central portion, and is radially striated. The two eyes are large, and provided each with a lens. The common genital pore lies at the hinder end of the body. It leads into a ciliated, muscular, narrow atrium, which is an invagination of the hinder extremity. Testes rounded, scattered. Vesicula seminalis spherical, opening into the pyriform muscular penis enclosed in its sheath. These organs lie at the front end of the genital atrium. The spermatozoa when mature are broad and thick, tapering at either end, the head filament shorter than the tail. Ova occur in two lateral rows, sometimes those of one side being more developed than those of the other (v. Graff).

Habitat. — This active yellow form is not uncommon between tide-marks in Plymouth Sound (F. W. G.). This is, I believe, the first record of its occurrence north of the Mediterranean.

Distribution.—Trieste, Naples, Messina (v. Graff), Lesina (Schmidt, 28), Sebastopol (Uljanin, 41).

Genus 2.—Monoporus, v. Graff (56)
(= Proporus, Schmidt, 28).

Proporidæ with spermotheca.

2. Monoporus rubropunctatus (O. Schmidt, 28).

Length 1 mm. Body ellipsoidal with rounded extremities. Colour white, the central parenchyma brown, owing to the presence of coloured vacuoles and food-particles. The epidermis contains clavate rhabdites, the thickened outer ends of which project beyond the surface. The mouth is mid-ventral, leading into a very short simple pharynx; the "terminal mouth" of earlier descriptions being, according to v. Graff (56, p. 57), the opening of the "frontal organ." The eyes lie right and left close to the anterior end. They are placed in the epidermis, and consist of polygonal pigment masses of a brilliant carmine colour. In his recent accounts

of the "Acœla" v. Graff gives some interesting additions to our knowledge of the genital organs. The genital pore is single. The testes are compact as in no other Acœlous form. The vasa deferentia are merely their posterior prolongations. The oviducts are continuous with the epithelial lining of the ovary, and unite to form a vagina. Opening into this vagina is a spermotheca, the duct of which is slightly chitinised.

Habitat.—Among littoral algæ, Plymouth Sound (F. W. G.).

Distribution.—Naples, Trieste, Dalmatian Islands (v. Graff, 55), Lesina (Schmidt, 28).

Family APHANOSTOMIDÆ.

Acœla with two genital apertures, the female pore placed in front of the male. A spermotheca present.

Genus 3.—Aphanostoma, Oersted (21).

Spermotheca unarmed.

3. Aphanostoma diversicolor, Oersted (21).

Length ·75—1 mm. Body somewhat fusiform, tapering gradually forwards from the posterior third, more rapidly backwards to the hinder end. The colour (which is variable in amount and intensity) is due to violet pigment-cells and yellow vacuoles in the parenchyma. These are usually disposed in a characteristic way. The yellow pigment is present at the anterior end, and extends a short distance backwards on each side, enclosing the violet pigment which occupies the median part of the body as far back as the limit of the anterior third. A small patch also occurs at the extreme hinder extremity. The violet pigment-cells are capable of altering their shape according to the state of contraction of

the body. Their most characteristic form is that of a U, the curved portion being much thicker than the long slender processes.

The mouth is almost mid-ventral. It leads into a funnel-shaped pharynx. Two genital apertures are present. The male pore lies a short distance in front of the hinder end, the female pore still further forward. The conical penis encloses a vesicula seminalis in its proximal part. The ovaries extend throughout the greater part of the body. A spermotheca, possessing intrinsic and extrinsic muscles, opens into the vagina. The epithelium of its duct (according to v. Graff) secretes a cuticle.

Habitat.—Among stones and seaweed at the base of the littoral zone, Plymouth, Port Erin, Isle of Man (F. W. G.); Millport (v. Graff).

Distribution.—Naples, Trieste, Roscoff (v. Graff); Denmark (Oersted, 21); in colonies among Laminaria and Fucus, a few feet below the surface, Bergen (Jensen).

4. Aphanostoma elegans, Jensen.

Length ·75 mm. Body colourless, with a lobate dark green spot in the centre due to coloured parenchymatous vacuoles. Form broadly rounded in front, tapering gently posteriorly. Eyes absent. The male genital aperture lies a short distance in front of the hinder end; the female pore close behind the green spot. According to Jensen the spermatozoa are long, filiform, thicker and spirally twisted anteriorly.

Habitat.—Among Ulva, between tide-marks, Plymouth (F. W. G.).

Distribution.—Alvœrström and Bergen (Jensen, 49).

Jensen's description reads, "Corpus utraque extremitate rotundatum in anteriore parte latius, retrorsum sensim an-

gustius." My specimen was certainly during active motion broader in front than behind, approaching Jensen's figure of A. rhomboides (49, pl. i, fig. 1).

Aphanostoma is a distinctly northern genus. The coast of Denmark and the western shores of Norway and Greenland have furnished the bulk of the existing records. The presence of A. elegans at Plymouth suggests that further search will reveal localities for the remaining species on our coasts.

Genus 4. Convoluta, Oersted (16), 1844.

Aphanostomidæ with a broad, flat body, the margins of which are in some forms capable of being flexed ventrally. Spermotheca with a chitinous mouth-piece.

5. Convoluta saliens, v. Graff, 1891.

1882. Cyrtomorpha saliens, v. Graff (53).

Length 1 mm. Body elliptical, the dorsal surface convex, ventral surface flat. Colour is absent except in the centre, where it is due to brown food-particles among the parenchyma. Locomotion is effected thus:—From the anterior end backwards for one-third of its length the margins of the body are capable of being gradually extended outwards, so that the greatest width of these animals when in motion is a short distance in front of the centre of the body. These lappets are then flapped inwards and downwards, the animal at the following instant leaping forward. When, however, contraction occurs, it is no longer possible to define the lappets. The anterior end is at a much lower level than the rest of the dorsal surface. As the change of level is abrupt the front end appears snout-like, especially when seen from the side. This snout is moved from side to side in a sensitive manner. Short cilia and slightly irregular rhabdites are present in the epidermis, and

are disposed in alternate longitudinal rows, which converge anteriorly towards the opening of the "frontal gland." Eyes are absent. The otolith is concavo-convex, with a central "nucleus." The two genital pores are posterior, the female in front of the male. Opening to the exterior through the former is the spermotheca. The curved penis receives the contents of the seminal vesicle.

HABITAT.—In tide-pools, Millport (v. Graff). Two specimens among Zostera and Corallina, Plymouth (F. W. G.).

6. CONVOLUTA PARADOXA, Oersted (16), 1844.

1777. PLANARIA CONVOLUTA, O. F. Müller (4).
1844. CONVOLUTA PARADOXA, Oersted (16).
1845. PLANARIA MACROCEPHALA, Johnston (20).
1853. „ HAUSTRUM, Dalyell (29).
1855. CONVOLUTA PARADOXA, Gosse (30).
1861. „ „ Claparède (35).
1865. „ „ Johnston (38).
1866. „ „ Lankester (39).

Length 1—3·5 mm. Schmidt (28) found specimens up to 9 mm. in length in the Faroe Islands and other northern localities; v. Graff records equally large examples from Millport. Specimens from more southerly places are usually much smaller, and it might therefore appear that this species attains a larger size in the northern than in the southern seas. Claparède, however (35), working on the north-west coast of Skye, examined a large number of specimens, none of which exceeded 2 mm. in length; while recently (55) v. Graff has found "giant specimens" at Roscoff. It seems more likely, as Claparède suggested, that this species attains a considerable size before the reproductive organs begin to develop. Thus he found individuals 1·5—2 mm. long without a trace of gonads, and I have myself observed the same thing.

The form of the body changes with different states of contraction and expansion. When freely swimming the form is

that of (53) pl. xi, fig. 15, the sides flexed ventrally, almost touching one another except in front, where they diverge. The hinder end is produced into a finely-pointed tail. The anterior end is truncate, the angles being frequently more or less produced. It is a most actively sensitive animal, especially during creeping movements, when the "head" is converted into a funnel-shaped structure which explores the surroundings.

The general colour varies from greenish-brown to a warm chestnut-brown, which is the usual tint. The anterior margin is paler than the rest. The brown pigment is deposited in the cell of a "symbiotic alga," the nature of which has not been thoroughly investigated. Transverse, narrow white bars, 1—2 in number (v. Graff has observed three, and Claparède [35, pl. vi, fig. 2] figures four such bands), are present in large individuals (1·75 mm. and upwards). They are the expression of a large number of very small irregular granules, insoluble in acids (v. Graff). Claparède has suggested that these bars may be a "caractère sénile." This view is supported by v. Graff, since he finds that the bars become more and more distinct with the increased size and age of the animal. The epidermis contains flagella, rhabdites, and pigment. The latter forms elongate masses of rod-like granules. The mouth, which is ventral and subcentral, leads into a very short pharynx. The eyes are constantly present in this species. They are red pigmented bodies, and occur right and left of the otolith. Poison-organs ("Gift-Organe") have been discovered by v. Graff (44) in this and other species of Convoluta (C. grœlandica, cinerea, flavibacillum, bimaculata). They consist in C. paradoxa of a pair of pyriform, transparent, muscular vesicles, provided with hollow chitinous tips, and are placed at the margin of the body in such a way that when this is flexed ventrally the tips are directed towards the mouth. The contents consist of small refractive granules. At each contraction of the muscular wall the tip is moved forwards, at the same time discharging some of its contents. This oral pair of poison-

organs is constantly present in sexually mature individuals. When the male products ripen (this species is a distinctly protandrous hermaphrodite) two other pairs (according to v. Graff) arise close to the male genital pore. They differ from the oral pair in three points—their time of appearance, their variability (the hinder pair may be absent), and their disappearance after the shedding of the male products (see v. Graff, 44, p. 61). The female genital pore lies slightly in front of the centre, the male pore halfway between it and the hinder end. The testes are dorsal in position. The penis is a narrow, cylindrical, muscular tube opening into the short genital atrium, surrounded by radiating accessory glands. The spermatozoa are long (·22 mm.), and consist of a finely granular central portion and hyaline borders, absent, however, on the distinct "tail." The ova are placed ventrally, and when mature are ovoid, ·07 mm. diameter, containing much yellow food-yolk, and surrounded by a delicate membrane. Thirty to forty fertilised eggs may be present at one time in a single example. A spermotheca is present. Its neck is produced forwards into a funnel-shaped expansion opening into the female atrium and backwards into the swollen basal portion containing spermatozoa. Round the neck chitinous plates are arranged one over another, the margins of which are thin and colourless, forming the "mouth-piece." Young specimens of Convoluta paradoxa differ from the adults, to which the foregoing description applies, chiefly in the absence of reflexed marginal lappets, and the small number (five to seven) of symbiotic algæ present.

Habitat.—A littoral species, occurring among seaweeds in tide-pools all round our coast. Berwick Bay (Johnston); Firth of Forth (Dalyell); among Ceramiæ, Weymouth (Gosse); Skye (Claparède); Guernsey (Lankester); St. Andrews (McIntosh); Millport (v. Graff); Plymouth, Port Erin, Isle of Man (F. W. G.).

Distribution.—Mediterranean, Adriatic and Black Seas, North Sea, North Atlantic, coast of Denmark.

7. Convoluta flavibacillum, Jensen.

Length 2—3 mm. Body stout, oval, pointed behind, dorsal surface convex, ventral surface flat. The margins are produced into thin lamellæ, flexed ventrally. Colour yellow, due to the prevalence of pigmented yellowish-green rods over irregular brown granules. Epidermis, flagella, and rhabdites are similar to those of C. paradoxa. Eyes two, reddish, placed on each side of the otolith. Female genital pore situated at one-third the length of the body from the hinder end; halfway between the latter and the pore is the male aperture. The chitinous mouth-piece of the spermotheca is cylindrical, and composed of a number of perforated plates placed one upon another. The spermatozoa are elongate, tapering at each end, with a granular central portion and clear lateral membranes. Penis cylindrical, muscular.

Habitat.—Among Laminaria, &c., Millport (v. Graff); among sand at base of Corallina officinalis in tide-pools, Port Erin, Isle of Man; Plymouth (F. W. G.).

Distribution.—Bergen (Jensen).

The stout form and yellow colour sufficiently serve to distinguish this species, which, in its anatomy, closely resembles Convoluta paradoxa.

B. *RHABDOCŒLA.*

Gut and parenchyma distinct. A spacious body-cavity usually present. Nervous and excretory organs present. Gonads hermaphrodite (except Microstoma and possibly Stenostoma). Testes usually compact, and ovaries, germ-yolk-gland, or separate vitellaria and germaria may be present; in all cases surrounded by a tunica propria. Pharynx present, variable. Otolith usually absent.

Family MICROSTOMIDÆ.

Rhabdocœla with sexual and asexual reproduction. Female accessory apparatus absent. Pharynx simple.

Genus 5.—Microstoma, O. Schmidt, 1848 ('Die rhabd. Turbellarien d. süssen Wassers').

Microstomidæ with separate sexes and compact testes. Body uniformly ciliated, provided with "ciliated grooves" and a pre-œsophageal gut-cæcum.

8. Microstoma grœnlandicum, Levinsen (51).

Length 1·75 mm. Body composed of about eight zooids, in colour resembling M. lineare. Eyes absent. Ciliated grooves small. Rhabdites well developed anteriorly, more sparsely behind. No sexual organs were observed.

Habitat. — Among Ulva, Plymouth Sound (F. W. G.); Millport (v. Graff).

Distribution.—Egedesminde, Greenland (Levinsen).

I place the Plymouth specimen here, for although it does not agree exactly with Levinsen's original description (the red spot at the anterior end is wanting), it does agree with a form described by v. Graff from Millport, and placed under this species.

Genus 6.—Alaurina, Busch (26).

Hermaphrodite Microstomidæ, with tactile anterior "proboscis." Usually with posterior setæ; paired lateral ones sometimes present.

9. Alaurina claparedii, v. Graff.

Length ·3 mm. Anterior end modified to form a tactile

proboscis provided with numerous circular folds. The base of the proboscis is marked off by a tuft of cilia on each side. A single posterior group of setæ at the hinder end. The posterior sixth of the body is marked off transversely (probably an indication of fission).

Habitat.—Coast of Skye (Claparède).

Claparède (35) described this form as a rhabdocœle larva, but it was referred to Alaurina by Metschnikoff (37). It is probable that this genus is not uncommon on our coasts.

Family MESOSTOMIDÆ.

Rhabdocœla with one or two genital apertures; yolk-glands and germaria distinct or united. Testes compact. Female accessory organs present. Pharynx ventral, rosulate (for the term "rosulate" see v. Graff, 'Monogr.,' p. 80).

Subfamily Promesostominæ.

Genus 7.—Promesostoma, v. Graff.

Mesostomidæ with two germaria and separate yolk-glands, and a common genital aperture. Female accessory organs absent. Testes small.

10. Promesostoma marmoratum (Schultze [27]). Pl. XXXIX, fig. 10; Pl. XL, fig. 16.

Length ·5—1·5 mm. Body elongate, cylindrical, broadly rounded in front, truncate behind. Anterior end used as a tactile organ. Colour very variable. The epidermis which furnishes the ground colour is colourless, bright yellow, or yellowish-red. Black reticular pigment is almost constantly present as a small patch between the eyes; elsewhere to a variable extent, and may be entirely absent. The epidermis on the inner side of the eyes contains immense numbers of rhabdites (fifteen to twenty in a single mother-cell), forming two well-defined tracks. Elsewhere they are few in number. The posterior end is provided with adhesive papillæ.

The pharynx lies just behind the centre of the body. The commencement of the gut (as v. Graff observed) is marked by active flagellæ. The genital aperture, provided with a muscular lip, is placed behind the pharynx. Testes two, oval. The connection between the two paired vasa deferentia has not actually been traced. From their point of union (behind the genital aperture) the single duct runs forward and expands into a vesicula seminalis, which is partly filled with sperm, partly with the granule-secretion. Both these products are conveyed to the exterior by a very curious copulatory organ. The most typical form which this chitinised ejaculatory duct assumes is that of a bishop's crosier, Pl. XL, fig. 16. The variations both in the number and form of the coils, and also in the form of the tip of the organ (straight, curved, forked), are great. The limits of variation in different directions would become of specific value if intermediate forms were not known to occur. The germaria and yolk-glands are paired and lateral. The egg-capsules are stalked.

Habitat.—This very active littoral species has been found at Millport (v. Graff); Kilmore, Skye (Claparède); Port Erin, Isle of Man (F. W. G.); Plymouth (F. W. G.). At Millport and Plymouth forms with "long" and "short" copulatory organs occur; at Trieste and Naples v. Graff found only forms with short ones. At Plymouth most of the specimens had little or no pigment.

Distribution.—Naples, Messina, Black Sea, Baltic, North Atlantic.

11. Promesostoma ovoideum (O. Schmidt, 28).

Length ·5 mm. Body oval. The dense black colour is due to reticular parenchymatous pigment, which forms a thick mesh-work round the internal organs. The epidermis contains large numbers of rhabdites, especially developed along the inner side of the eyes, which are reniform, and provided with a lens. v. Graff has observed trembling movements of the eyes.

I have described them as seen in Pr. solea. Pharynx in the posterior third of the body. Behind it lies the penis, which is pyriform, its upper part filled with spermatozoa. The duct is chitinous.

HABITAT.—This species is found rarely in 5—15 fms. Plymouth Sound (F. W. G.).

DISTRIBUTION. — Messina, Naples (v. Graff), Lesina (Schmidt), Egedesminde, Greenland (Levinsen).

12. PROMESOSTOMA SOLEA (O. Schmidt, 32).

Differs from the preceding species in two points. The reticular pigment is less dense, and the pigment-cup of the eye sends a hooked process over the outer surface of the lens. The latter point alone seems to me to be constant. The amount of reticular pigment varies greatly. Seen from the dorsal surface the eye has an appearance similar to a miniature pan or tobacco-pipe, the bowl being represented by the pigment-cup, and the stem or handle by the strip of pigment running over the lens. The vibratory movement of the eye is performed in the following way. Suppose the pan or pipe to vibrate through a small angle in its plane of symmetry, in such a way that the plane is horizontal, the bowl moving forwards and then backwards. The actual vibrations of the eye are of this kind. Apparently one eye commences, performs five or six vibrations in a second, and then stops; the other eye begins, and so on. I am not certain, however, that the movements are alternate for any length of time. Of the mechanism I am ignorant.

HABITAT.—This is a typical deep-water (8—20 fms.) Turbellarian. Only once have I taken it between tide-marks. When dredge-material is placed in sea water, dark oval specks (the present species) are often seen swimming actively at the surface. In a few hours they descend, and reappear only when the water begins to foul. Plymouth (F. W. G.).

DISTRIBUTION.—Naples (Schmidt and v. Graff), Messina (Graff), Sebastopol (Uljanin).

13. PROMESOSTOMA LENTICULATUM (Schmidt [28]). Pl. XXXIX, fig. 6; Pl. XL, figs. 13, 17.

Length ·65—·7 mm. (i. e. half that of Schmidt's specimen). Body broadly truncate and slightly convex in front, the antero-lateral margins produced slightly outwards. Behind these it becomes narrower, forming a "neck;" it then widens towards the middle, diminishing again to the posterior end. The general shape is, in fact, similar to Jensenia (see Jensen [49], pl. iii, figs. 1, 2), but more elongate. Colour to the naked eye scarlet; this is due to the contents of the extensive gut. Movements extremely active. Epidermis very transparent. Rhabdites few, scattered. Pharynx placed slightly in front of the middle of the ventral surface. Intestine large, corresponding to the shape of the body. The eyes are provided with a large conspicuous lens, which is easily detached from the pigment-cup. The genital aperture is a short distance behind the pharynx. The testes have the usual relations, and lead at their posterior ends into the vasa deferentia, which unite to open into the base of a most remarkable copulatory organ. This is cylindrical at its proximal end, provided distally with a series of triangular chitinous plates ranged round the terminal slit. The whole resembles the tool known as a "rose-bit" or "counter-sink," and used for embedding the heads of screws in wood or metal. The base of this organ is divided into spermatic and granule portions. The germaria are placed posteriorly. On one side the germarium was normal; on the other it was composed of lenticular masses, with difficulty separable optically from one another. The paired yolk-glands occupy the greater part of the sides of the body.

HABITAT.—Two specimens from a tide-pool among corallines, Port Erin, Isle of Man (F. W. G.).

DISTRIBUTION.—Faroe Islands (Schmidt).

This species has hitherto only been seen by Schmidt, who gave no account of the genital organs. He described the form and colour, the position of the pharynx, and the eyes. Excepting the difference in size (Schmidt's specimens measured 1·5 mm.) I have no reason for doubting the identity of my specimens with his.

As regards the systematic position of this species, my observations are not perfectly conclusive. It is possible that further investigations may prove that the organ R. S. is a receptaculum seminis, and B. C. a bursa copulatrix, the transverse markings I have noted being the subspiral muscles of Jensen. At present, however, from the nature of the protoplasm, I believe it to be an ovary, while the presence of a single genital opening is evidence for a position in the genus Promesostoma, where v. Graff has already placed it doubtfully.[1]

14. PROMESOSTOMA AGILE (Levinsen). Pl. XL, fig. 14.

Length ·5 mm. Body oval, rounded posteriorly, tapering forwards in front of the hinder third. Colour light red. Movements very active. Eyes placed close together, triangular, the apex being formed by the pigment-cup, directed inwards and backwards, the lens outwards and forwards. Pharynx subcentral. Intestine reddish, occupying the space between the pharynx and the lateral yolk-glands. The genital aperture is placed about halfway between the pharynx and the posterior end. The testes are two oval sacs behind the pharynx; they communicate by short ducts with the penis, the base of which is spherical, and contains the secretion of a granule-gland, while its distal portion is produced into a long, narrow, slightly curved copulatory organ. A pair of ovaries are placed at the posterior end of the body, their ducts running forwards to the genital aperture.

[1] A second genital pore might have easily been overlooked. If further examination should demonstrate a second aperture, the species would have to be transferred to the genus Byrsophlebs.

The yolk-glands are lateral, uniting behind the brain. A small muscular sac placed behind the penis appears to be a receptaculum granulorum.

HABITAT.—Two specimens among littoral weeds, Plymouth (F. W. G.).

DISTRIBUTION.—West coast of Greenland (Levinsen).

Levinsen's description (according to v. Graff) left this form indeterminate. The two pyriform bodies that he called "Samenblasen," and which v. Graff suggested might be local swellings of the vasa deferentia, I take to be the true testes. They have all the structure of such an organ, but occupy a more posterior position than usual. The ova did not appear to Levinsen to be distinguishable into two fairly distinct ovaries as in my specimens.

Subfamily BYRSOPHLEBINÆ.

Mesostomidæ with two genital apertures, the male in front of the female. Germarium single. Vitellaria distinct. Accessory organs absent or present. Testes small, rounded.

Genus 8.—BYRSOPHLEBS, Jensen (49).
(With the diagnosis of the subfamily.)

15. BYRSOPHLEBS GRAFFI, Jensen.

Length ·45 mm. Body cylindrical, tapering gradually posteriorly. Colourless, the gut brownish-yellow. Pharynx central, male genital aperture immediately behind it, female aperture close to the hinder end. Penis composed of a proximal cylindrical portion, strengthened by spiral and longitudinal muscles, and a distal chitinous funnel-shaped duct. The terminal aperture of this duct is provided with a short triangular projection on one side. Opening through the female genital aperture is a receptaculum seminis placed at the base of the ovary, and a muscular bursa copulatrix

at its side. Yolk-glands unbranched, lateral. (For further account with figures see Jensen (49), pl. ii, figs. 8—12.)

Habitat.—Among algæ, Drake's Island, Plymouth Sound (F. W. G.); among Ulva and Fucus, Millport (v. Graff).

Distribution.—Bergen and Sund, West Norway (Jensen).

16. Byrsophlebs intermedia, v. Graff.

Resembles the former species in most characters, differing in the arrangement of the genital organs. The penis is elongate, cylindrical, the spiral muscular fibres surrounding the united vasa deferentia. The chitinous portion is narrow, funnel-shaped, its tip partly surrounded by a curved process, similar to the "spur" in Macrorhynchus Nægelii. The yolk-glands are branched.

Habitat.—In tide-pools. Port Erin, Isle of Man (F. W. G.); Millport (v. Graff).

Subfamily Proxenetinæ.

Mesostomidæ with one common genital aperture and two germ-yolk-glands. Spermotheca provided at its blind end with chitinous appendages. Testes small, rounded. Copulatory organ complicated.

Genus 9.—Proxenetes, Jensen (49).

17. Proxenetes flabellifer, Jensen.

Length 1—1·5 mm. Body cylindrical, abruptly rounded in front, narrowing posteriorly to a short "tail," colourless. Flagella are everywhere present between the cilia. Long, sharply-pointed rods are present in great numbers in the epidermis, forming two well-defined tracks between the eyes and supplying the anterior end. Smaller rods occur over the rest of the surface. The hinder end is provided with adhesive cells. Pharynx large, placed in the posterior third. Between

it and the hinder end is the genital aperture. The large testes occupy the middle of the sides of the body. The vasa deferentia are swollen just before uniting at the base of the retort-shaped penis which receives the secretion of granule-glands. The copulatory organ is a complicated mechanism of chitinous pieces separating the granule-secretion from the spermatozoa. The nutrient part of the germ-yolk-gland extends along the sides of the body; the ovarian portion develops behind the pharynx. The two oviducts unite, and the common duct runs to the genital pore. Opening into the atrium, close to the pore, is the large spermotheca, which is directed forwards towards the pharynx, and then bends back upon itself. Its blind end receives chitinous ducts conveying granule-secretion. The point of connection with the genital atrium is armed with five to six triangular chitinous teeth, freely hinged at their bases. A further account of these structures will be found in v. Graff (pp. 277—279) and Jensen (49). The above are points I have verified myself.

Habitat.—Several feet below surface and in tide-pools. Millport (v. Graff); Plymouth (F. W. G.); common among Ptilota plumosa and other red and green algæ, low spring tide, Port Erin, Isle of Man (F. W. G.).

Distribution.—West coast of Norway (Jensen).

18. Proxenetes cochlear, v. Graff.

The four or five chitinous ducts of an accessory gland, which open into the blind end of the bursa in P. flabellifer, are, in this species, reduced to a single spiral one; the triangular "teeth," arming the duct of the bursa, being here represented by a series of small chitinous processes. The copulatory organ consists of three spoon-shaped pieces fitting into one another. The spaces between them constitute the passages for the seminal and granule fluids.

Habitat.—Millport, one specimen (v. Graff).

Subfamily Eumesostominæ.

Mesostomidæ with one common genital pore, a single germarium, two vitellaria and accessory organs. Testes long. Excretory vessels opening into the pharyngeal sheath.

Genus 10.—Mesostoma, Dugès.

Without otolith. Copulatory organ traversed throughout its entire length by the ducts of male secretions.

19. ? Mesostoma neapolitanum, v. Graff.

Length ·5 mm. Body flattened behind, bluntly pointed in front, white. Between the eyes are two tracks formed by masses of large curved rhabdites. Smaller ones are present elsewhere. Pharynx small, in front of the centre. Intestine large, filling up the greater part of the body. Eyes two, with lenses. Genital pore close to the hinder end. Testes lateral. The penis bears a funnel-shaped terminal portion which receives the contents of the vesicula granulorum, and in front of this lies the semi-lunar vesicula seminalis. The atrium did not appear to be so large as in v. Graff's specimen.

Habitat.—Among Fucus, Plymouth Breakwater (F. W. G.).

Distribution.—Naples (v. Graff).

I append a query to this species, since my observations were made on one specimen, and agreed more closely (but not entirely) with M. neapolitanum than with any other species. More specimens of this marine Mesostoma are greatly needed, as its position is not thoroughly defined.

Family PROBOSCIDÆ.

Rhabdocœla with tactile proboscis; one or two genital pores. Germaria and vitellaria distinct.

Testes compact. A spermotheca present. Mouth ventral. Gut discontinuous in the adult, owing to the development of the gonads. Copulatory organ complicated, chitinous (v. Graff, p. 315).

Subfamily Pseudorhynchinæ.

Proboscis without sheath or muscular cone. Retractors represented by short muscular bundles. Pharynx rosulate. One genital pore. Two germaria. Yolk-glands reticular. Testes paired, rounded.

Genus 11.—Pseudorhynchus, v. Graff.

20. Pseudorhynchus bifidus (McIntosh).

1875. Mesostomum bifidum, McIntosh (45).

Length 1·3 mm. Body convex dorsally, flat on the ventral surface, slightly expanded towards the posterior end, which is bifid. The conical anterior extremity (proboscis) is devoid of cilia. Colour pale orange with darker spots, the proboscis colourless. Rhabdites are well developed and of three kinds (Jensen)—straight, ovoid, and needle-shaped. Strong adhesive papillæ occur at the bifid hinder end. Pharynx subcentral. The genital pore is placed behind the middle. Testes small, rounded. Vasa deferentia unite in a vesicula, which opens, along with the ducts of "granule-glands," into the proximal swollen part of the penis. The distal portion is muscular, and contains the copulatory organ. The latter is a conical chitinous tube, the outer wall of which is produced into a series of spiral ridges running from the base to the apex in a screw-like manner. The usual direction appears to be "right-handed." von Graff notes an interesting "left-handed" variety. The germaria are large lateral oval sacs, placed opposite the centre, and directed forwards. The spermotheca is finger-shaped with muscular walls. It contains the granular secretion of a large number of glands.

Habitat.—On half-decayed Laminaria and Ulva, Millport

(v. Graff); under stones between tide-marks, St. Andrews (McIntosh, **45**); among decaying Ceramia, &c., Port Erin, Isle of Man (F. W. G.).

Distribution.—Egedesminde, West Greenland (Levinsen), Faroe Islands (Schmidt), Bergen (Jensen).

Sub-family Acrorhynchinæ.

Proboscis at the anterior end provided with a sheath opening in front, with muscular cone and four long retractors. Pharynx rosulate. Yolk-glands reticular (v. Graff [**53**], p. 318).

Genus 12.—Acrorhynchus, v. Graff.

Acrorhynchinæ with a common genital pore. Two germaria and elongate testes. Vesiculæ seminales and granulorum distinct, but enclosed in a common muscular penial sheath. The copulatory organ transmits both secretions (v. Graff, 'Monogr.,' p. 319).

21. Acrorhynchus caledonicus (Claparède).

1861. Prostomum caledonicum, Claparède (**35**).

Length 1—2 mm. Body bluntly pointed in front, gradually widening behind, and rounded posteriorly. Colour, proboscis white, the rest of the body greyish brown with light areas, indicating the positions of the more bulky internal organs. Rhabdites very small, numerous, evenly distributed. Proboscis well developed (for an account of its structure see v. Graff, 'Monographie,' pp. 119—124). Two very long retractor muscles extend from its base to the posterior end of the body. Pharynx before the middle, with a marginal "seam." According to von Graff, the base of the extended proboscis is enclosed in a nervous commissure proceeding from the brain. Eyes two, provided with a lens. The genital pore is placed just behind the centre. Testes lie at the sides

of the pharynx. The vasa deferentia unite in a sperm-vesicle, close to which is the granule-vesicle. The long muscular cylindrical penis receives both secretions, and is enclosed in an inner chitinous sheath and an outer muscular one. The armature is in the form of hooks with rounded basal ends. The hooks vary in size and shape, and are disposed as in v. Graff's pl. x, fig. 17, of his 'Monographie.' The genital aperture is surrounded by numerous glands. The germaria lie at the sides of the penis. The reticular yolk-glands are of considerable extent.

Habitat.—In tide-pools, and among Fucus and Laminaria below the surface of the sea. Kilmore, Skye (Claparède); Millport (v. Graff); Plymouth; Port Erin, Isle of Man (F. W. G.).

Distribution.—Bergen (Jensen), Heligoland (Metschnikoff).

The well-developed musculature of these forms enables them to resist compression without rupture. If a mature individual be treated in this way the various parts of the genital apparatus stand out with diagrammatic clearness.

This species, closely similar to the next in external appearance, can be distinguished by the presence of the common muscular envelope round the vesiculæ seminales and granulorum.

Genus 13.—Macrorhynchus, v. Graff.

Acrorhynchinæ with a common genital aperture, two germaria, and paired elongate testes. Vesiculæ seminales and granulorum distinct, the duct of the latter with a special chitinous tube ('Monogr.,' p. 321).

Von Graff divides this genus into two subdivisions:—i. Typici.—Those in which a poison-dart (Gift-Stachel) is absent; duct of the vesicula seminalis without chitinous armature. ii. Venenosi.—Those provided with a poison-dart;

a chitinous investment for both the duct of the seminal and granule-vesicles.

i. Typici.

22. Macrorhynchus Naegelii (Kölliker, 17). Pl. XXXIX, fig. 5; Pl. XL, fig. 15.

Length 2·2 mm. in my largest specimens; v. Graff states that he has not seen larger ones at Millport, while Mediterranean examples range up to 4 mm. Body similar to Acrorhynchus in shape, cylindrical, bluntly pointed in front, broader behind. Colour variable. Proboscis usually white, the rest of the body dusky brown, through which the testes, ovaries, and penis can be indistinctly perceived with a hand-lens. Claparède (36) has described a variety from St. Vaast-la-Hogue, which was white with a median dorsal yellow streak. A similar variety occurred at Plymouth (fig. 5). The colour was brown; at the base of the white proboscis and in the middle line was a yellow spot, visible in all positions of the animal; proceeding from this backwards along the mid-dorsal line was a bright yellow streak. These colours appear to be due to pigment in the parenchyma. Small rhabdites are plentifully developed in the epidermis, and the epithelium of the proboscis contains oval, highly refractive bodies, "Nematocysten entsprechenden Gebilde" (v. Graff, 'Monogr.,' p. 323). The histology and relations of the proboscis have been fully elucidated by v. Graff. The brain, bearing two eyes provided with lenses, is placed behind the proboscis, and behind this again is the spherical pharynx. The common genital pore lies behind the centre of the body. It leads into a very extensive atrium, the chitinous lining of which extends into the common passage receiving an anterior male subdivision and a posterior female portion. The testes occur at the sides of the body. The vasa deferentia unite with the contents of an accessory gland. The secretion of the granule-gland, however, is enclosed in a special sac, the lower part of which is chitinous. Its free edge is usually provided with a curved "spur," of variable form. This may

be absent. A remarkable variety is figured in Pl. XL, fig. 15. The ovaries, and between them the large spermotheca, lie posteriorly. One egg-capsule was present in many individuals at Plymouth in September. In November no adults could be found. They had probably died off.

HABITAT.—Similar to Acrorhynchus caledonicus. The two are, however, only occasionally found together. Plymouth Sound (F. W. G.); Millport (v. Graff, "Ich selbst habe in Millport niemals grössere Exemplare gesehen als Claparède's," p. 323, 'Monogr.').

DISTRIBUTION.—This is the commonest Rhabdocœle at Naples. Lesina, Messina, Trieste (v. Graff), Sebastopol (Uljanin), Black Sea (Czerniavsky), Madeira (Langerhans, MSS.).

23. MACRORHYNCHUS CROCEUS (Fabricius, 9).

Length 1·5 mm. Body reddish, swollen posteriorly, pointed in front, where it is nearly white. Proboscis very powerfully developed. Of the parts composing the genital apparatus, the most diagnostic is the copulatory organ. At its proximal cylindrical end it receives the secretions of the vesicula seminalis and granule-reservoir, which are contained in an elongate sac strengthened by spirally-arranged muscles. The distal portion is spirally twisted, and consists of two canals, each containing a part of the continuation of the proximal single cavity. The upper edge of this spiral is "toothed." The egg-capsule is stalked. Several points, such as the relations of the germ- and yolk-glands and the presence of a spermotheca, are not yet satisfactorily determined.

HABITAT.—Among Fucus and Laminaria below the surface of the sea. Millport (v. Graff); Plymouth (F. W. G.).

DISTRIBUTION.—Apparently abundant in the northern seas. West coast of Greenland (Levensen) and of Norway (Jensen), Faroe Islands (Schmidt), Denmark (Oersted), Wimmereux (Hallez).

Among the Macrorhynchus collected at Plymouth were two species apparently new. Since, however, my observations are incomplete, I will not further describe them than by saying that one species closely resembled M. mamertinus, v. Graff, in the form and position of its gonads. The pharynx was not so strongly developed.

ii. Venenosi.

24. Macrorhynchus heligolandicus, Metschnikoff (37).

Length ·5—1·5 mm. Body rounded at both ends, cylindrical, white, sometimes with brown spots. The proboscis is typical but small. The bilobed brain bears lenticulate eyes. The pharynx is rather small, placed as far in front of the centre of the body as the genital pore is behind it. The reproductive organs were first described by Jensen. The great variability of certain (especially the chitinous) parts, their complexity, and the presence or absence of certain accessory organs (spermotheca, &c.) according to the particular stage of development, render this perhaps the most difficult of all Turbellaria to elucidate. Personally I have found young specimens (·5—1 mm. in length) fairly intelligible. In these the yolk-glands form finger-shaped masses extending from the base of the pharynx to the genital pore. In the adult they become reticular and very bulky. The elongate, narrow germaria consist of a single row of ova for the greater part of their length. Behind their point of union is the large spermotheca. All these organs, the yolk-germ-glands and spermotheca, open into a single female genital canal. This canal is chitinised internally, and leads to the genital atrium. For an account of the male gonads with figures see v. Graff, 'Monographie,' pp. 330–1, pl. ix; and Jensen, 'Turbellaria Norvegiæ,' pl. iv. The most important fact is that in addition to a chitinous sheath for the "granule-secretion," there is a common one for both this and the terminal vas deferens (see v. Graff, 'Monogr.,' p. 166, woodcut, fig. 9, *G.*). The poison-organ consists of a hollow chitinous stylet.

enclosed at its proximal end by a muscular sheath containing the poison-glands. A strong retractor muscle passes from the blind end of this muscular sheath, and is inserted on the upper end of the granule-reservoir.

HABITAT.—At the commencement of the Laminarian zone, Millport (v. Graff); Plymouth; Port Erin, Isle of Man (F. W. G.). Young specimens abounded at the last locality in October, 1892.

DISTRIBUTION. — West Greenland (Levinsen), White Sea (Mereschkowsky, 48), Bergen (Jensen), Wimmereux (Hallez).

A most remarkable character of the Proboscidæ, as a family, is the discontinuity of the gut caused by the development of the various genital organs, and in no form is this more conspicuous than in Macrorhyncus heligolandicus. In young specimens the gut is a closed sac surrounded by the body-cavity. As the gonads develop, becoming more and more bulky, the gut gets squeezed into any unoccupied spaces. Thus the gut-cells become scattered, and accumulate chiefly along the mid-dorsal surface. This fact accounts for the absence of a definite intestine in adult specimens.

Genus 14.—GYRATOR, Ehrbg., 1831.

Acrorhynchinæ with two genital pores, of which the female is the anterior. Germarium single; testes elongate. Vesicula seminalis and granule-reservoir separate, the latter with a special chitinous duct (v. Graff, 'Monogr.,' p. 331).

25. GYRATOR HERMAPHRODITUS, Ehrbg. (10).

1875. PROSTOMA LINEARE, McIntosh (45).
1879. „ „ Hallez (50).

Details of McIntosh's specimens are not given. I append the following observations which I have made on specimens taken in the neighbourhood of Manchester.

Length 1 mm. Body in the highest degree contractile, colourless, cylindrical, tapering anteriorly. Proboscis very mobile. Brain, eyes, and pharynx as in Macrorhynchus.

The genital organs are distinguished by the presence of a poison-dart appended to the copulatory organ. Hallez has given a full account of this with figures (see 43, pls. xx—xxii). The use of this stylet as an offensive weapon has been seen by Schmidt ('Denkschr. math.-nat. Klasse,' Wien, 1857) and Hallez ('Arch. Zool. Expt.,' 1873). The animal bends the hinder end of its body towards the ventral surface when close to its prey (small Entomostraca), which it stabs repeatedly with its poison-dart.

Habitat.—In sea water this form is only known from St. Andrews under stones (McIntosh) and Madeira (Langerhans). It is widely spread over Europe in fresh water.

Subfamily Hyporhynchinæ.

"Proboscis small, behind the anterior end, its sheath opening on the ventral surface. Muscular cone present. Numerous short muscular fibres constitute retractors. Spermotheca with chitinous appendage. Vesicula seminalis and granule-reservoir not distinct. Their contents, however, issue through special chitinous ducts" (v. Graff, 'Monogr.,' p. 336).

Genus 15.—Hyporhynchus, v. Graff.

26. Hyporhynchus armatus (Jensen).

Length 1—1·5 mm. Body elongate, cylindrical, truncate at both ends, white. Hinder end provided with strong adhesive papillæ. The way in which these papillæ are used reminds one forcibly of a Monotus (see p. 487). The anterior end, beset with long flagella, is moved actively from side to side as it advances. Short rhabdites are present over the surface, modified on each side of the body behind the

middle into long vermiform bodies, in which Jensen perceived a central thread. The opening of the proboscis-sheath is ventral, and close to the anterior end. The proboscis itself is feebly muscular. The mouth is a transverse slit, surrounded by an arcuate transverse row of six adhesive papillæ. The eyes, two on each side, lie over the brain behind the proboscis. The genital pore is ventral, a short distance from the hinder end. The vasa deferentia are given off from the two rounded lateral testes. They unite along with the accessory secretion at the base of the spirally coiled ejaculatory duct. This consists usually of two coils and a terminal straight portion. The spermotheca is armed anteriorly with chitinous spines; posteriorly, according to Jensen, it communicates by a long narrow duct with the genital atrium. (For figures see Jensen's "Turbellaria Norvegiæ" [49], pl. iii, figs. 14—22.)

Habitat.—Among Zostera, Plymouth Sound; tide-pools, Port Erin, Isle of Man (F. W. G.).

Distribution.—Bergen (Jensen).

27. Hyporhynchus penicillatus (Schmidt, 32).

A young immature specimen that I refer rather doubtfully to this species measured ·6 mm. in length. Body of a bright yellow colour, the pigment being deposited in fine granules at the base of the epidermal cells. Rhabdites small, occurring in numbers over the surface. The aperture of the proboscis-sheath is triangular, ventral, close to the anterior end. The eyes were fairly large, and provided with lenses. The genital organs were not developed, hence the doubt attaching to this example, which, however, in all remaining characters agrees with H. penicillatus as described by v. Graff.

Habitat.—Among Zostera, Cawsand Bay, Plymouth (F. W. G.).

Distribution.—Lesina (Schmidt, 32), Messina, and Naples (v. Graff).

Family VORTICIDÆ.

Rhabdocœla with a common genital pore. Germaria and vitellaria united or distinct. Accessory female organs present. Uterus simple. Testes paired, compact. Mouth ventral, usually anterior. Pharynx dolioform.[1] Copulatory organ of various shapes (v. Graff, 'Monogr.,' p. 342).

Subfamily EUVORTICINÆ.

Pharynx and brain well developed. Germaria small. Body-cavity extensive. Parenchyma small in amount. Free-living.

Genus 16.—PROVORTEX, v. Graff.

Euvorticinæ with two germaria and two distinct, elongate, unbranched vitellaria. Testes rounded. Pharynx dolioform. Mouth in the anterior third. Vesicula seminalis enclosed by the penis. Copulatory organ traversed by the spermatozoa (v. Graff, ibid., p. 344).

28. PROVORTEX BALTICUS (Schultze, 27).

Length ·6—1 mm. Body cylindrical, truncate in front, the angles produced into blunt processes, widening towards the middle and tapering behind to a long "tail." Colour brown, due to scattered reticular pigment. Epidermis containing flagella interspersed between the cilia. Pharynx provided with a distinct seam, into which the pharyngeal retractor muscles are inserted. From the extended observations of von Graff and Jensen it appears that this species is divisible into macro- and micro-pharyngeal varieties. Eyes paired, reniform. The genital aperture is ventral, at the base of the "tail." The testes lie far forward at the sides of the pharynx, and lead into paired vasa deferentia. These unite along with the "granule-secretion" in the base of the copu-

[1] *I.e.* barrel-shaped. The term is, however, used in a technical sense, including certain structural peculiarities (see v. Graff, 'Monographie,' pp. 83–4).

latory organ. This organ is slightly variable in shape, and consists of a wide, cylindrical, tubular basal portion, opening through a narrow transverse slit, one edge of which is continued parallel to the axis of the cylinder, and then bends sharply at right angles. Germ- and yolk-glands lateral; near their point of union is a curved spermotheca.

Habitat.—This very active tiny animal occurred abundantly among Laminaria and also in brackish water at Millport (v. Graff). Abundant in tide-pools, Port Erin, Isle of Man; less commonly at Plymouth (F. W. G.).

Distribution.—West coast of Greenland (Levinsen), West Norway (Jensen), Copenhagen (Fabricius, 9).

29. Provortex affinis (Jensen).

Length ·6 mm. Body stouter than in Pr. balticus, tapering posteriorly from the anterior third. Pharynx not so moveable as in the previous species. It is, however, in the form of the copulatory organ that these species are most easily and certainly distinguished. This is elongate, funnel-shaped, the terminal part of the duct bending at an obtuse angle with the proximal portion. Opposite this angle is a triangular plate projecting outwards from the surface of the duct.

Habitat.—Along with Pr. balticus, Millport (v. Graff); Plymouth, along with Monoporus rubropunctatus (F. W. G.).

Distribution.—Copenhagen (Fabricius), Bergen (Jensen).

30. Provortex rubrobacillus, n. sp. Pl. XXXIX, fig. 8; Pl. XL, fig. 12.

Length ·75 mm. Body cylindrical, broadly rounded in front, tapering slightly posteriorly. Colour mottled brown to the naked eye. The effect is due to numerous rods of doubtful nature in the interior of the gut-cells. They were present in all individuals examined. Pharynx without a distinct "seam." The free margin is crenulate. Intestine extensive. The gut-cells contain 3—8 rods of reddish colour.

Whether they are zooxanthellæ (as described by v. Graff[1] in Enterostoma zooxanthellæ), or food-remains, is a moot point. Each eye possesses three lenses. The genital aperture is ventral, a short distance in front of the hinder end. A pair of testes lie at the sides of the pharynx; they lead by wide vasa deferentia into a vesicula seminalis. The penis contains proximally the separate granule-secretion and spermatozoa separated; distally it is converted into a chitinous copulatory organ, enclosing an inner muscular layer. The whole is bent into an S-shaped curve. As in Pr. balticus, one portion of the terminal margin is bent upon itself, and produced into an extremely fine, needle-like spine. Germaria and vitellaria as in Pr. balticus. A spermotheca is present near the genital pore.

Habitat.—Dredged off the "New Grounds," Plymouth Sound (F. W. G.).

C. *ALLŒOCŒLA.*

The following definitions are v. Graff's (**53**), as amended by Böhmig (**57**, pp. 464–5):

Alimentary canal and parenchyma generally sharply separated; a body-cavity absent in the adult. Nervous and excretory systems present. Testes follicular. Germ- and yolk-glands separate or united, paired; the latter irregularly lobed, rarely branched. Gonads contained in parenchymatous cavities without a membrana propria. Penis formed by folds of the genital atrium. No conspicuous chitinous copulatory organ.

Family PLAGIOSTOMIDÆ.

Allœocœla with pharynx variabilis (except Plag. bimaculatum, where it is a pharynx plicatus), the size and position of which is subject to variation. Genital pore single or double; sometimes combined with the mouth. An otolith absent.

[1] 'Zool. Anzeiger,' 1886, p. 338.

Sub-family Plagiostominæ.

Plagiostomidæ with a ventral and posterior genital aperture. Mouth anterior. Germaria and vitellaria distinct.

Genus 17.—Plagiostoma, O. Schmidt (28), 1852.

Without tentacles.

31. Plagiostoma dioicum (Metschnikoff, 37). Pl. XL, fig. 11.

Length ·6—·7 mm. Body cylindrical, tapering very slightly in front of the posterior third. Colour yellow-brown, lighter anteriorly and at the sides; eye-pigment reddish-brown. The epidermis contains a few small rods and numerous highly refractive vesicles. Böhmig (57, p. 408) has seen these in sections; they are possibly excretory. Flagella are present anteriorly and posteriorly. Mouth anterior, subterminal. The pharynx is ellipsoidal, and lies altogether in front of the brain. The intestine is extensive, and corresponds generally to the form of the body. The brain is reniform, the slight concavity being directed anteriorly. A pair of nerves from the anterior and also from the hinder angles are conspicuous; three other pairs occur (Böhmig, 57, p. 410). Two eyes are present, provided with lenses. The genital aperture is ventral, and placed a short distance from the hinder end. The testes are scattered in the parenchyma. A muscular vesicula seminalis is placed close to the genital pore. The female organs are of considerable interest, as no one has yet found any trace of the yolk-glands. Since, however, it is known that these organs develop late, it is possible that specimens presenting them in a mature condition have not yet been seen. If, on the other hand, yolk-glands are really not present at any stage, their absence would constitute a feature in which this species resembles the genus Acmostoma. The ovaries consist of a lateral row of clear spherical cells extending from the brain to the hinder end, and surrounded by refractive granules. I have not noticed the

accumulation of ova behind the brain to which Böhmig refers (loc. cit., p. 316).

HABITAT.—Among littoral weeds, Plymouth (F. W. G.).

DISTRIBUTION. — Heligoland (Metschnikoff, **37**), Trieste (Böhmig, **57**).

The specimens that I have seen appear to bear a close resemblance to Acmostoma Sarsii, Jensen. The form, colour, eyes, relations of the pharynx, character of the ova, testes, position of the vesicula seminalis, and apparent absence of vitellaria are almost identical in the two species. The presence of a narrow "creeping sole" in Acmostoma is, however, a distinguishing feature.

32. PLAGIOSTOMA SULPHUREUM, v. Graff. Pl. XLI, fig. 20.

Length 2 mm. Body very elongate, cylindrical, parallel-sided for the greater portion of its length, somewhat conical in front, tapering posteriorly. Colour to the naked eye orange, the extreme anterior end paler; two large black eyes are conspicuous. Movements active, the front end being moved about as a flexible and highly sensitive "lip." The tail is provided with strong adhesive cells, by which the animal is securely fixed at will. The epidermis contains numerous rhabdites of a bright yellow colour, to which the tint of the animal is due. Mouth below, pharynx behind the brain. The pharynx is very small, the musculature being slightly developed. Numerous glands surround it. The intestine occupies the central part of the body, and is enclosed anteriorly by spherical glands. The genital aperture lies a short distance from the hinder end on the ventral surface. The small testes are placed behind the centre of the body in the middle line. The spermatozoa have a very characteristic form. They are divisible into a broad head, and a narrow pointed tail. A dark transverse band separates the head end off as a pointed lid. Down the centre runs a spiral thread. The ova develop from a median cellular mass which, according

to Böhmig (57, p. 365), lies close to the brain. In compression preparations it is driven posteriorly (Pl. XLI, fig. 30). The developing ova lie at the sides of the gut. The yolk-glands are paired, large, lobed organs, more or less enclosing the intestine and uniting behind the pharynx.

Habitat.—In tide-pools among corallines, Port Erin, Isle of Man (F. W. G.).

Distribution.—Trieste (v. Graff and Böhmig).

33. Plagiostoma elongatum, n. sp.

Length 2 mm. Body cylindrical, stout, elongate, rounded in front, tapering rather suddenly posteriorly. Colour opaque white. Epidermis provided with cilia, which are longer anteriorly than elsewhere, and between which stiff flagella occur. Narrow oblong rhabdites are thickly scattered over the surface. They are homogeneous and highly refractive. The musculature is strongly developed, and this fact, combined with the opacity of the other organs, renders it a matter of difficulty to examine this species by compression. The mouth is subterminal. Pharynx large, barrel-shaped when at rest, situated behind the brain. It is very muscular, and can extend under and in front of the brain towards the mouth. The intestine is large, corresponding generally to the form of the body, slightly hollowed in front to receive the base of the pharynx. Two large irregular black eyes unite by strands of pigment across the brain. The genital pore is close to the hinder end. The male organs were not thoroughly developed in either of my two specimens, and the form of the mature spermatozoa remains unknown. The germaria lie at the sides of the posterior third of the body. The yolk-glands form narrow lobed masses at the sides of the gut, extending as far forward as the base of the pharynx.

Habitat.—From coarse sand at the bases of Corallina officinalis, Plymouth (F. W. G.).

34. Plagiostoma pseudomaculatum, n. sp.

Length 2 mm. Body elongate, pointed behind, the anterior end not distinctly separated off from the rest of the body; hence it may be distinguished from Pl. maculatum, which this species closely resembles in form and in many points of structure. Colour white, a violet patch of reticular pigment between the eyes. Mouth lies beneath the brain. Pharynx very muscular. The genital aperture is ventral, at the base of the tail. The germaria lie right and left behind the pharynx; behind these again the testes. The vasa deferentia are distinctly swollen before entering the cylindrical muscular penis.

Habitat.—This species, so far as my experience goes, belongs to a deep-channel fauna of Plymouth, characterised more especially by the presence of various Monotidæ, to be presently described. I have found it always associated with Polydora ciliata (Polychæta), which forms mud-tubes in hundreds on the muddy bottom of the Hamoaze.

This species differs from Plagiostoma maculatum in the absence of the red intestine and lateral head-grooves which characterise the latter.

35. Plagiostoma sagitta (Uljanin, 41).

Length 1 mm. Body elongate, conical in front, tapering gradually backwards from the middle. The tail not so long as in the preceding species. Colour opaque white with a slight yellowish tinge, due to the contents of the gut. Rhabdites, grouped in clumps, are present over the surface. Pharynx behind the brain, which is transversely elongate, deeply incised anteriorly. Two pairs of eyes are present, placed over the brain; the hinder pair is the larger, and is markedly reniform. Genital aperture at the base of the tail. The vesicula seminalis contains spermatozoa, which have a central rib, bearing broad triangular lateral membranes, exactly similar to the spermatozoa of Plagiostoma maculatum. Contrary to

Uljanin (41), I find two germaria present. They lie at the middle of the sides of the body.

HABITAT.—In 5 fms., among harbour débris, Plymouth (F. W. G.).

DISTRIBUTION.—Sebastopol (Uljanin).

36. PLAGIOSTOMA CAUDATUM, Levinsen (51).

Length 1·5 mm. Body when swimming cylindrical, tapering from the middle posteriorly, conical in front. Colour yellow, due to epidermal granules. Rhabdites few. Pharynx behind the brain. Eyes large, rhomboidal; between them a small mass of reticular pigment, with which, according to Levinsen, the pigment-cups of the eyes are sometimes connected. The genital aperture lies a short distance in front of the hinder end. The seminal vesicle leads by a narrow duct into the cylindrical muscular penis, surrounded by a double sheath, as in Pl. reticulatum.

HABITAT.—In 5½ fms., Plymouth Sound (F. W. G.).

DISTRIBUTION.—Egedesminde, west coast of Greenland (Levinsen).

37. PLAGIOSTOMA VITTATUM (Frey v. Leuckart, 23).

Length 1—2 mm. The latter size is that of individuals which have just laid their cocoons. v. Graff ('Monogr.,' p. 391) states that a length of 3 mm. is reached by specimens living on Laminaria below the surface. Jensen also (49, p. 58) finds larger specimens in such localities than at the surface. Townettings taken near shore at Plymouth yielded small examples. Body convex above, broadly rounded in front, tapering to a finely pointed "tail" behind. It is well figured by van Beneden (33), pl. v, figs. 1 and 2. Colour more variable than in any other species of Plagiostoma. The typical coloration is three transverse bands of violet reticular pigment on a white ground; one central, one across the head,

and the third across the tail. v. Graff, in his Monograph, pl. xviii, fig. 6, has figured eight different varieties of the arrangement of these bands, which he observed in a single gathering among Ulva at Millport; and this does not exhaust the possible cases. Small specimens (·5—1 mm.) with a yellow ground-colour (due apparently to the contents of the gut-cells) are not uncommon. Since the "key" for the determination of species of this genus in v. Graff's Monograph is largely dependent on the arrangement of the pigment, these varieties are at first very troublesome. Moreover Vorticeros auriculatum (which frequently occurs among Plagiostoma vittatum) with retracted tentacles, can be in no way anatomically distinguished from a common variety of Plag. vittatum, in which the pigment is present over the greater part of the dorsal surface. With regard to the internal anatomy I can confirm the accounts of v. Graff and Jensen (49). Van Beneden (33), the first to discover the stalked yellow-brown egg-capsules, found them attached to the abdominal feet of the lobster. At Plymouth they were abundant in September on the sides of a vessel containing several individuals.

Habitat.—Apparently more abundant on our northern than southern coasts. Millport, abundant (v. Graff); Plymouth; Port Erin, Isle of Man (F. W. G.).

Distribution.—Faroe Islands (Schmidt), Bergen (Jensen), Heligoland (Leuckart, 23), Walcheren, on coast of Belgium (Slabber),[1] Ostende (van Beneden), Wimmereux (Hallez).

38. Plagiostoma koreni, Jensen.

Length 1·4 mm. Body similar in shape to Plag. vittatum, but smaller, and rather narrower in front. The first half of the body is white, and behind this a broad transverse brown band (due to reticular pigment) over the dorsal surface and the sides. Behind this again are scattered brown spots. The brain, which bears two red eyes, is placed in front of

[1] 'Physikalische Belustigungen,' Nürnberg, 1775, pp. 31 and 36.

the spherical pharynx and mouth. The remaining anatomy has been investigated by Jensen (49), whose figures (pl. v, figs. 1—8) are highly characteristic.

HABITAT.—On the inner side of the Breakwater, and elsewhere among algæ between tide-marks, Plymouth Sound (F. W. G.); a specimen at Millport (v. Graff).

DISTRIBUTION.—Bergen (Jensen).

39. ? PLAGIOSTOMA SIPHONOPHORUM (O. Schmidt, 28).

Length ·9 mm. Body elongate, truncate in front with rounded angles, tapering posteriorly. Along the mid-dorsal line is a narrow band of reticular black pigment, which expands laterally behind the eyes and extends between and beyond them anteriorly. Böhmig has shown (57, pp. 208–9) that this pigment is present in the gut-cells and not in the parenchyma. The mouth lies beneath the brain. The pharynx, when extended through the mouth, is narrow, cylindrical, expanded slightly at the distal end. My observations on the genital organs are incomplete. The penis is pyriform, armed at its base with small chitinous spines.

HABITAT.—In 15 to 18 fms., Plymouth Sound (F. W. G.).

DISTRIBUTION.—Lesina (Schmidt), Trieste (v. Graff, Böhmig).

As ripe sperm was not seen, this species remains doubtful. But other characters agree with Pl. siphonophorum, so I refer my specimen to this form.

40. PLAGIOSTOMA GIRARDI (Schmidt, 32).

Length 1·75—2 mm. Southern examples range up to 3 mm. Body slightly depressed, rounded in front, tapering behind, broadest in the middle. v. Graff's figure ('Monogr.,' pl. xviii, fig. 12) does not represent the form well, whereas, as Böhmig has remarked, the figure of Pl. ochroleucum would

do so. Colour white. Movements sluggish. Rhabdites abundant over the surface. Pharynx small, opening through the mouth behind the brain. Eyes two, reniform, with lenses. According to Böhmig (57, p. 355), the "ciliated furrow" forms a transverse groove in front of the mouth, and does not correspond to a slight constriction which occurs behind the eyes. For the genital organs the accounts of v. Graff and Böhmig may be consulted. The spermatozoa consist of amidrib, bearing broad triangular hyaline membranes, and terminating in a short anterior and a longer posterior flagellum.

Habitat.—Not uncommon 6—15 fms., Plymouth Sound (F. W. G.).

Distribution.—Naples (v. Graff), where it is the most abundant Rhabdocœle; Trieste (v. Graff and Böhmig); Messina (v. Graff).

41. Plagiostoma ochroleucum, v. Graff.

Length 5·5 mm. Colour whitish yellow. Mouth subterminal. Pharynx very small, beneath and in front of the brain. Remaining anatomy similar to Pl. Girardi.

Habitat.—1½ fms. among Laminaria, Millport (v. Graff).

Genus 18.—Vorticeros, O. Schmidt (28), 1852.

Plagiostominæ with two tentacles at the anterior end.

42. Vorticeros auriculatum (O. F. Müller, 4).

Length 1·5 mm. Body produced anteriorly into a pair of long tentacles. Behind the eyes it is slightly constricted, and then expands towards the middle, tapering behind to a fine point. The tentacles are not often seen fully extended. At the slightest alarm they can be completely withdrawn, and the

animal may continue to swim about in this condition. The colour is variable, but usually consists of a broad band of dark carmine reticular pigment on the upper surface, leaving the side margins free, and continued on to the tentacles. The anatomy differs in no important particulars from that of the genus Plagiostoma.

HABITAT.—Among Ulva and other littoral weeds, Plymouth; Port Erin, Isle of Man (F. W. G.); Millport (v. Graff).

DISTRIBUTION.—Naples, Trieste, Messina (v. Graff), Wimmereux (Hallez), Norwegian coast (Müller).

43. VORTICEROS LUTEUM, v. Graff (53).

1852. VORTICEROS PULCHELLUM, O. Schmidt (28).
1879. „ „ var. LUTEUM, Hallez (50).

This species, established by v. Graff for the reception of a large specimen (8 mm. long), is distinguished from the preceding by its stouter appearance and uniform yellow colour. On two occasions at Plymouth an example measuring 2·5 mm. in length was taken. One was found among Bugula turbinata from 7 fms., the other among littoral weeds at a low spring-tide.

DISTRIBUTION.—Wimmereux (Hallez), Naples (v. Graff).

Subfamily ALLOSTOMINÆ.

Plagiostomidæ with one ventral and posterior genital aperture. Two germaria and two distinct vitellaria. Pharynx placed in the hinder half of the body, its mouth directed posteriorly.

This subfamily, as constituted by v. Graff, includes the genera Enterostoma and Allostoma. Concerning it our knowledge is in a most unsatisfactory condition. With regard to the former genus we do not possess a good description of any species, although these are abundant in northern and southern seas. Consequently the definition given above must

be considered provisional. Already Enterostoma striatum, v. Graff, has been investigated, with the result that Böhmig places it under the sub-family Cylindrostominæ (loc. cit., p. 469), and similar change in species hitherto considered as belonging to the Allostominæ may be expected to result from detailed investigations.

Genus 19.—Enterostoma, Claparède (35).

Allostominæ with uniformly ciliated body and without a circular "ciliated groove" on the head.

44. Enterostoma austriacum, v. Graff. Pl. XXXIX, fig. 7.

Length ·75 mm. Body rounded anteriorly, tapering to a blunt "tail" behind. Colour usually yellow, with a black spot (due to the intestine) in the centre; occasionally the general colour is white, the gut being yellow. The colour of the surface is due to the presence of yellow granules in the epidermis; that of the gut to its contents. The yellow epidermal granules are massed together in small heaps, which are not so conspicuous or large as figured by v. Graff (pl. xix, fig. 9, Monograph). Exceedingly small, slender rhabdites are present in groups in the epidermis. The pharynx is cylindrical, very muscular, and is inserted at the hinder edge of the extensive gut, which, following the outline of the body, reaches as far forward as the brain. The eyes are arranged in two pairs, an anterior and a posterior pair. The former are slightly the smaller, and their lenses are directed outwards and backwards; the lenses of the posterior pair face forwards and outwards. The genital aperture is a short distance from the hinder extremity. Round the brain are the developing testes. The pyriform muscular penis lies behind the pharynx.

Habitat.—In 4—18 fms., Plymouth and Port Erin (F. W. G.).

Distribution.—Trieste (v. Graff).

45. Enterostoma fingalianum, Claparède (35).

Length 1 mm. Body elongate, cylindrical, rounded at both ends. Colour white; the short, almost central gut reddish. The epidermis contains small fusiform rhabdites, figured by Hallez (50, pl. ii, fig. 25). Mouth at the commencement of the posterior third. Pharynx cylindrical, at the hinder margin of the intestine. Brain bilobed. Eyes fairly large, arranged as in Ent. austriacum. Genital pore between the mouth and the hinder end. Testes numerous, surrounding the brain. Vasa deferentia exhibit dilatations along their course. Penis pyriform, containing masses of accessory secretion in its basal portion; provided at its tip with small papillæ. Claparède's original description and figures are not sufficiently distinctive to enable us to determine whether the germ- and yolk-glands are distinct or not. In my specimen the yolk-glands form lateral masses uniting behind the brain, and again posteriorly behind the genital aperture. The germ-glands lie at the sides of the pharynx, and appear to be separate from the yolk-glands. As, however, only a single specimen was available, further observations are greatly needed on this and other points, such as the presence of a ciliated "head-furrow" (which Böhmig has demonstrated in other forms by the use of methylene-blue in cases where superficial observation had previously failed) and the possible connection of genital and oral apertures.

Habitat.—Skye (Claparède); among Balanus, 10 fms., Plymouth Sound (F. W. G.).

Distribution.—Wimmereux (Hallez).

46. Enterostoma cœcum, v. Graff.

Length 1·7 mm. Body gradually tapering forwards from the hinder end. Beneath the epidermis are yellowish-green granules, especially abundant at the sides. The pharynx is cylindrical, muscular, placed far posteriorly. The spermatozoa consist of a central rib bearing lateral membranes, and

produced into a fine flagellum in front and behind. Eyes absent. For further details and figures see v. Graff, 'Monogr.,' p. 404, and pl. xix, figs. 15—17.

Habitat.—A specimen at Millport in a tide-pool (v. Graff).

v. Graff described this form as the only blind Plagiostomid. I have, however, found a probably new species of Plagiostoma in which the eyes were wanting.

Genus 20.—Allostoma, van Beneden (33).

Allostominæ in which the "circular furrow" at the level of the brain is provided with long cilia.

47. Allostoma pallidum, van Beneden (33).

Length 2 mm. Body cylindrical, tapering slightly towards each extremity. The anterior sixth is sharply separated from the rest of the body by a transverse marking, the nature of which is not quite clear. It is probably due to the ciliated "circular furrow." Colour yellowish white. The epidermis contains numerous pseudo-rhabdites. Considering rhabdites as a condensed glandular secretion, pseudo-rhabdites are intermediate between the amorphous secretion and rhabdites. The mouth is posterior; the pharynx short, leading into an extensive gut. v. Graff has described the genital organs fully. Testes surround the brain. Vasa deferentia convey the sperm in balls to the base of a pyriform penis, in front of which lie the ovaries. The oviducts unite and open through the subterminal genital pore. Yolk-glands lateral, lobed. (See v. Graff, 'Monogr.,' pl. xix, figs. 12—14.)

Habitat.—Millport (v. Graff).

Distribution.—Ostende (van Beneden, v. Graff).

Van Beneden (33) has described the oval egg-capsules, which are very small, and extruded one at a time. The young when

hatched are without a definitive pharynx, gut, eyes, or brain. They become sexually mature in three weeks.

Subfamily Cylindrostominæ.

v. Graff's definition of this sub-family ('Monogr.,' p. 409) has been materially altered, owing to Böhmig's researches. It now reads thus (Böhmig, **57**, p. 469):

> Plagiostomidæ with a ciliated "circular groove." The oral and genital apertures combined. A germ-yolk-gland present. Spermotheca present, connected with the ovigerous cell-mass ("Keimlager").

Genus 21.—Cylindrostoma, Oersted (21).

The limits of this genus are not yet satisfactorily defined. v. Graff divided it into prosoporous and opisthoporous forms, according as the mouth was anterior or posterior. The latter have been excluded by Böhmig in his definition of the genus. v. Graff's original extension of the genus is, however, here adopted, pending a thorough examination of the Opistopora.

48. Cylindrostoma quadrioculatum (Leuckart, **23**).

Length ·5—·9 mm. Body colourless, somewhat depressed, rounded in front, tapering posteriorly to a long "tail" beset with adhesive cells. Mucus-rods ("Schleim-stäbschen"), of an irregular granular character, occur in the epidermis. Flagella are interspersed among the cilia in front and behind. At the level of the brain a pair of well-marked ciliated furrows are present. Mouth ventral, in front of the brain. Pharynx elongate, cylindrical, extending from the brain to the centre of the body; its anterior margin is crenulate, and provided with stout flagella. Brain almost cubical. The genital aperture is combined with the mouth. This remarkable discovery, made by Böhmig, corrects former mistakes due to misleading compression preparations. The testes form large follicular masses surrounding the brain. The different stages in the develop-

ment of the spermatozoa can be well observed. Behind the penis are a pair of short, wide vasa deferentia, which open into a highly glandular vesicula seminalis. The penis is a muscular, cup-shaped organ receiving both spermatozoa and granule-secretions from the vesicula, which it transmits through the genital atrium (underneath the pharynx), and so to the exterior. The spermatozoa are elongate, wider in front than behind. The central axis of the tail is markedly granular, and is continued forwards as a spiral thread, wound three times round the surface of the "head." The posterior end of the body is occupied by the large spermotheca. The germ-yolk-gland is composed of an anterior vitelline, and a posterior germinal portion.

Habitat.—Kilmore, Skye (Claparède); abundant in tide-pools, Millport (v. Graff); among Ptilota, Ceramium, and other algæ, Plymouth (F. W. G.).

Distribution.—Faroe, west coast of Norway (Claparède and Jensen), Heligoland (Leuckart), Ostende (van Beneden), Sebastopol (Uljanin).

49. Cylindrostoma inerme (Hallez, 50). Pl. XXXIX, fig. 4.

Length 1 mm. Body oval, broadly rounded in front, tapering behind, of a bright yellow colour. Opposite the level of the brain, right and left, are a pair of lateral grooves, bordered by long cilia. The epidermis contains masses of granular yellow pigment and rhomboidal rhabdites. Mouth ventral, behind the brain. The pharynx is cylindrical, with a crenulate anterior margin. The genital organs resemble those of Cyl. quadrioculatum very closely; a spermotheca, however, is absent.

Habitat.—Among fine red seaweeds, Plymouth (F. W. G.).

Distribution.—Wimmereux (Hallez).

This species exhibits very great similarity to Cyl. Klostermanni, Jensen, especially in form, colour, and general anatomy.

The chief points of distinction are the absence of calcareous bodies in the epidermis, and of a spermotheca.

50. CYLINDROSTOMA ELONGATUM, Levinsen. Pl. XLI, fig. 19.

Length ·6—·8 mm. Body very elongate, narrow, cylindrical, slightly tapering and rounded in front, pointed behind. An apparent groove was seen just above the level of the brain, separating off the portion of the conical head in front of it. Colour yellowish to the naked eye; a black spot (the intestine) lies in the centre. The epidermis bears specially long cilia at the extremities. Small mucus-rods are present in large numbers. Glands open at the anterior end in front of the brain. Mouth ventral, posterior. Pharynx attached to the hinder end of the gut, barrel-shaped, its free margin crenulate. The intestine has a very small longitudinal extent, not greatly exceeding the transverse diameter of the body. It contains yellow-green and reddish-brown remains (chiefly diatoms). Brain cuboidal, the angles rounded off, without fissures. Four eyes, the posterior pair being distinctly the larger. Genital aperture almost terminal, just under the anterior end. Testes eight to nine in number, in front and at the sides of the brain. Vasa deferentia lead to the base of the posteriorly-directed, pyriform penis. Numerous glands open at this point, and their secretions are arranged in a radiate way. The germ-yolk-glands are bulky, and lie at the sides of the gut; they unite behind the brain. Behind and at the sides of the pharynx is the ovarian portion of the gland.

HABITAT.—Among tide-pools, Wembury Bay, near Plymouth (F. W. G.).

DISTRIBUTION.—Egedesminde, Greenland (Levinsen).

Genus 22.—MONOOPHORUM, Böhmig, 1891.

Cylindrostominæ with united mouth and genital apertures. Pharynx directed backwards, the penis forwards. The spermotheca opens into the genital

atrium. The germinal portions of both germ-yolk-glands are fused together in the middle line dorsally.

51. MONOOPHORUM STRIATUM (v. Graff).

Length 1 mm. Body cylindrical, rounded in front, pointed behind. Colour carmine to the naked eye. Under the microscope, however, it is seen that the reticular pigment is well developed, leaving the margins of the body and the outer sides of the eyes almost free. The surface of the body has a characteristic "streaked" appearance, caused by the grouping of the longitudinal muscles into bundles of four to six. In the intervals small rhabdites are plentiful. The cilia are very strongly developed. Böhmig has discovered that the oral and genital apertures unite. The pharynx is very contractile. The spermatozoa are collected in a pair of vasa deferentia and transferred to the globular base of the penis, the terminal part of which is narrow and cylindrical. For a more detailed account see Böhmig (57), pp. 435—447.

HABITAT.—Dredged in 4 fms. off the Duke Rock, Plymouth Sound (F. W. G.).

DISTRIBUTION.—Trieste, among Ulva (v. Graff, Böhmig).

Family MONOTIDÆ.

Allœocœla with two genital apertures. A spermotheca present. Two germaria and two distinct vitellaria. Testes follicular, closely aggregated between the pharynx and the brain. Pharynx directed posteriorly. An otolith present. Elongate flat forms, with a narrow anterior end, and a broad posterior extremity furnished with "adhesive cells."

Genus 23.—Monotus, Diesing.[1]

Monotidæ in which the female genital pore lies in front of the male.

52. Monotus lineatus (O. F. Müller, 2).

1773. Fasciola lineata, O. F. Müller (2).
1853. Planaria flustræ, Dalyell (29).
1861. Monocelis lineata, Claparède (35).
1861. Monocelis agilis, Claparède (35).
1865. Typhloplana flustræ, Johnston (38).
1875. Monocelis rutilans, McIntosh (45).
1882. Monotus lineatus, v. Graff (53).

This synonymy refers merely to the works of authors who have described British examples of this species.[2] For a fuller list see v. Graff (53), p. 418.

Length 2—2·5 mm. Body very elongate, appearing to the naked eye as a fine white thread. The hinder end assumes the form of a disc when the animal contracts. By means of adhesive papillæ present on the surface of this "Haftscheibe" it clings very tenaciously to the substratum. Colour variable, sometimes absent, more frequently present in the form of brown or grey reticular pigment. The epidermis of the anterior end is markedly thicker than elsewhere, and bears numbers of well-developed sensitive flagella. This part of the body is constantly employed during life in active movements in all directions. Should it meet with an obstacle it retracts with amazing rapidity. The rhabdites are only feebly developed. Owing to the great contractility of the body the positions of the organs are difficult to define. Considering, however, the animal to be in a fully extended state, the mouth is a short distance behind the centre of the body. The pharynx is cylindrical, very muscular, its proximal end being almost central. The gut is extensive; when contracted it becomes distinctly sacculated. In the middle line anteriorly

[1] Diesing, K. M., "Revision d. Turbellaria, Rhabdocœlen," 'Sitzungb. d. Akad. Wien,' Bd. xlv, 1862, p. 211.

[2] A method adopted throughout this memoir.

is the otolith, composed of a vesicle containing a central concretion bearing two double lateral ones. Immediately in front of this is the single transverse brown "eye," and behind it the brain. The male genital pore lies at the commencement of the adhesive "tail;" the female pore between this and the pharynx. The testes are numerous. The vasa deferentia run back to a muscular vesicula which opens into a papilla surrounded by accessory glands. This soft papilla is the copulatory organ. The single pair of germaria lie at the base of the pharynx. The vitellaria occupy the sides of the body.

Habitat.—Hebrides (Claparède, **35**); Firth of Forth, "on Flustra hispida" (Dalyell, **29**); Millport (v. Graff); St. Andrews (McIntosh, **45**); Port Erin, Isle of Man; Plymouth (F. W. G.).

Distribution.—Very wide. West coast of Greenland (Levinsen), south and west coast of Norway (Claparède), Baltic (Müller, Schultze), North Sea (van Beneden), Madeira (Langerhans), Naples, Messina, Trieste (v. Graff), Black Sea (Uljanin, Czerniavsky).

This species is readily distinguished from M. fuscus by its unarmed penis.

53. Monotus fuscus (Oersted, **16**).

Length 1·5—3 mm. Form similar to M. lineatus. Colour very variable, usually brown, but white, purple, and even dark blue varieties have been recorded by Jensen and v. Graff. Examples 1 mm. in length are usually white and colourless. Larger specimens (2 mm.) are frequently carmine, gradually becoming brown as they grow older. The meaning of this change[1] in the reticular pigment is not understood. Similar changes in some Opisthobranchiate Molluscs are known (Aplysia, see Garstang, 'Journal Marine Biol. Assoc.,' N.S., vol. i. No. 4, p. 411); and in this case the change in colour appears to go hand in hand with a change of surround-

[1] Already remarked by v. Graff (**53**), p. 422.

ings. Pharynx, brain, otolith, and eye as in M. lineatus. The male pore is placed further forward than in the latter species. The vasa deferentia open into the neck of the very muscular vesicula seminalis. The copulatory organ is a hollow chitinous spine of variable shape, connected at its base by muscles to the wall of the seminal vesicle. Numerous accessory glands open at this level. The spermatozoa are whip-shaped, the handle being stout, the lash a very fine thread. Opening to the exterior through the female genital pore is the spermotheca, provided, according to v. Graff and Jensen, with secondary lobes. The remaining parts of the female genital apparatus do not materially differ from those of M. lineatus.

Habitat.—This species extends its range to the higher parts of the littoral zone. In consequence it is liable to be exposed to the air for some hours. Many of its devices for obtaining a moist position during ebb-tide have been described by Hallez and v. Graff. Thus the former observer collected Balani, the latter Chitons and Patellæ at low tide. After placing these in sea water, Monotus fuscus crept out of gills or thoracic limbs as the case might be. In the Isle of Man I have found them nestling among the appendages of Balani. Millport (v. Graff); Port Erin, and Plymouth (F. W. G.).

Distribution.—Faroe Islands (Schmidt, **24**), Bergen (Jensen, **49**), Dröback and Denmark (Oersted, **16**), Heligoland (v. Graff), Cuxhaven in the Baltic (Schultze), Ostende (van Beneden [**33**] and v. Graff), Wimmereux (Hallez, **50**).

54. Monotus albus, Levinsen (**51**).

Length 1·3 mm. (i. e. half that of Levinsen's specimen). Body elongate, narrow, the hinder end not expanded into a disc, colourless; the contents of the gut reddish. Ocular pigment absent. Pharynx posterior. A large spermotheca containing a refractive secretion opens to the exterior in front of the penis, which is armed with a shoe-shaped chitinous copulatory organ, bearing a couple of lateral teeth on the free margins.

Habitat.—One specimen in a tide-pool, Plymouth (F. W. G.).

Distribution.—Jacobshavn, West Greenland (Levinsen).

Genus 24.—Automolos, v. Graff (53).

Monotidæ in which the female pore lies behind the male.

55. Automolos unipunctatus (Oersted, 16).

1826.	Planaria unipunctata,	Fabricius (9).
1844.	Monocelis unipunctata,	Oersted (16).
1851.	„ „	Schultze (27).
1861.	„ sp. (? unipunctata,	Oe.), Claparède (35).
1875.	„ unipunctata,	McIntosh (45).
1878.	„ spinosa,	Jensen (49).

Length 1—1·5 mm. Body resembling Monotus fuscus in form, the hinder end, however, not expanded into an adhesive disc. Usually colourless. Ocular pigment is absent. Otolith with a pair of simple accessory concretions. The mouth, pharynx, and intestine resemble those of the preceding species. My specimens, as might be concluded from their small size (Jensen's were 3 mm., Schultze's measured as much as 6·6 mm.), were immature, and in consequence the genital ducts were not fully developed. According to the naturalists just named, the penis lies behind the male genital pore. It consists of a vesicula seminalis which conveys both spermatozoa and accessory secretions into the coiled ductus ejaculatorius, the terminal portion of which when extended is finger-like, and provided with small spines of variable shapes on its exterior. (See Schultze [27], pl. ii, and Jensen [49], pl. vi, fig. 9.) The two oviducts unite in the anterior region of the body, and the common duct runs back to the female genital pore, which also receives the duct of a vesicle—apparently spermotheca and uterus combined, since Jensen found sperm and ova in it.

Habitat.—Skye (Claparède); St. Andrews, under stones

between tide-marks (McIntosh); among littoral algæ, Plymouth (F. W. G.).

DISTRIBUTION. — Bergen (Jensen), coast of Denmark (Fabricius, Oersted), Greifswald (Schultze), Madeira (Langerhans), Black Sea (Uljanin, Czerniavsky).

56. AUTOMOLOS HORRIDUS, n. sp. Pl. XLI, fig. 21.

Length 1·5 mm. Body somewhat flattened. A slight constriction occurs at the level of the otolith, separating off an anterior conical portion. Behind this "neck" the body gradually increases in width, to the posterior third of its length which ends in a sharply pointed "tail." Pigment is absent, the gut alone giving a grey tinge to the otherwise white body. Flagella are present at each extremity, and also occur at intervals for a short distance behind the anterior end. Packets of rhabdites occur in large numbers on the surface of the body (fig. 21). Adhesive cells are present, although feebly developed, on the tail. The musculature is strong, enabling the animal to execute very active movements, and to flex the sides of the body ventrally towards the middle line. The mouth lies at the commencement of the posterior third. The pharynx, inserted into the gut at the centre of the body, is cylindrical and very muscular. The intestine lies chiefly in front of the pharynx. Its cavity is produced into about twelve cæca on each side, placed fairly symmetrically. The specimen under examination was starved, and in this condition the limits of the gut branches can be clearly defined. Brain placed behind the otolith, oval, the long axis coinciding with that of the body. An eye is absent. Testes in this specimen not well developed. They occur behind and at the sides of the brain. Vasa deferentia open behind the pharynx into a vesicula seminalis, surrounded by accessory glands. The penis is pyriform and muscular. The single pair of germaria lie opposite the base of the pharynx. Elongate yolk-glands are placed at the sides of the gut. An accident prevented the determination of the oviducts,

HABITAT.—One specimen dredged in 12 fms., Plymouth Sound (F. W. G.).

57. ? AUTOMOLOS OPHIOCEPHALUS (O. Schmidt). Pl. XL, fig. 18.

1861. MONOCELIS OPHIOCEPHALA, Schmidt (34).
1882. AUTOMOLOS OPHIOCEPHALUS, v. Graff (53).

Length 1·5 mm. Body of a pink colour, very slender, elongate, the anterior end broader than the rest of the body, and separated off by a slight constriction. The hinder end when freely moving tapers gradually to a point. During contraction it becomes thickened and widened. Flagellæ appear to be absent. The rods are accumulated in packets chiefly at the two extremities. Individual rhabdites are longer at the anterior, shorter at the posterior end—exactly the reverse of the case in A. hamatus, Jensen. Strong adhesive cells occur on the "tail." The pharynx is placed about the commencement of the posterior third. When extended the free end expands, the base becoming constricted. The intestine, which contains pinkish granules, is markedly sacculated. The pouches numbered about twenty on each side, and in compression-preparations appeared to be fairly definitely paired. Between successive gut-sacs were muscular dissepiments. Ocular pigment is absent. Testes occupy spaces in front and at the sides of the pharynx. The vasa deferentia lead to a vesicula seminalis, and this opens, along with the accessory glands, into the penis, a pyriform muscular organ, similar in position and form to that of A. hamatus. The pair of germaria lie at the base of the pharynx, the yolk-glands accompanying the gut-pouches and lying between them. The oviducts were not observed.

HABITAT.—Dredged in twenty fms., Plymouth Sound (F. W. G.).

DISTRIBUTION.—Corfu (O. Schmidt).

Schmidt's description of this species does not agree in all points with the diagnosis just given of my own specimen. The differences consist in the following details: the presence of

ocular pigment in front of the otolith, and the relations of the pharynx and ovaries. The latter, in his specimen, occupied a position behind and not in front of, the pharynx. The extreme contractility of the pharynx itself, and also of the body-wall, cause, especially during compression, marked changes in the position of the various organs. It is therefore possible that Schmidt's figure (**34**, pl. iv, fig. 3) may not represent the natural relations. v. Graff (**53**) does not mention the position of the ovaries, upon which Schmidt laid stress. For the present, therefore, and until more specimens are available, I place the Plymouth specimen under Schmidt's species, with which in almost all other points it appears to be identical.

Sub-order 2.—TRICLADIDA.[1]

Family PLANARIIDÆ.

Genus 25.—GUNDA, O. Schmidt (1860).

58. GUNDA ULVÆ (Oersted).

? 1768. HIRUDO LITTORALIS, Ström (**1**).
? 1776. PLANARIA LITTORALIS, Müller (**3**).
1844. „ ULVÆ, Oersted (**16**).
1857–8. PROCERODES ULVÆ, Stimpson (**32 a**).
? 1860. PLANARIA LITTORALIS, van Beneden (**33**).
1861. FOVIA LITTORALIS, Diesing, S. B., 'Akad. wiss. Wien,' Bd. xliv.
1861. PROCERODES ULVÆ, Diesing, loc. cit.
1865. PLANARIA ULVÆ, Johnston (**38**).
1870. „ „ Uljanin (**41**).
1878. PROCERODES ULVÆ, Jensen (**49**).
1880. PLANARIA ULVÆ, Czerniavsky (**52**).
? 1880. SYNHAGA AURICULATA, Czerniavsky (**52**).
1881. GUNDA ULVÆ, Lang, 'Naples Mittheil.,' ii.
1887. „ „ Iijima, 'Journ. Coll. Sci. Imp. Univ. Japan,' vol. i, part 4.
1889. „ „ Wendt, 'Archiv f. Naturgeschichte,' Bd. i, Heft 1.

Length 3—7 mm. Breadth ·4—1 mm. Body of uniform

[1] This sketch of the two marine Triclads of our shores will at least serve to show how much still remains to be done in the group. The synonymy is very difficult, and requires a thorough revision.

breadth. Anterior margin truncate, produced at the angles into a pair of distinct forwardly-directed auricles. Behind these a slight "neck" occurs. Posterior end broadly rounded or bifid. Colour variable. Young specimens are pale grey. In older examples the pigment is darker, and has a streaky appearance. On the dorsal surface just behind the eyes the pigment is arranged as a median and two lateral bands. The two latter cease behind the "neck." The median one runs forward between the eyes, and then dividing into 3—4 bands, it disappears. The modified strip of integument ('Tast-Organ,' which occurs among all groups of Turbellaria) is present. Pharynx inserted at the centre of the body. Two eyes are present anteriorly. They are placed in the white areas bounded by the pigment stripes. The genital pore lies slightly behind the commencement of the posterior third. Testes occur between the intestinal branches throughout the length of the body. The single pair of germaria are placed just behind the eyes and outside the lateral nerves. Vasa deferentia run at the sides of the pharynx and open into the peg-like penis, which is directed obliquely dorso-ventrally. The yolk-glands lie in the septa under the alimentary canal. The oviducts unite, and the common duct thus formed opens into the neck of the uterus, which is placed behind the genital atrium. The movements of this animal closely resemble the leech-like progression of fresh-water Planarians.[1]

Habitat.—Among roots of Laminaria, Berwick Bay (Johnston, **49**); in brackish water on west coast of Scotland (McIntosh, **45**).

Distribution.—Coast of Denmark, Holland, Belgium, Norway, Sweden, Black Sea, Baltic.

Genus 26.—Fovia, Stimpson (**32A**).

59. Fovia affinis, Stimpson. Pl. XXXIX, fig. 9.

1844. Planaria affinis, Oersted (**16**).
1853. „ hebes, Dalyell (**29**).

[1] This account is chiefly taken from Iijima, loc. cit.

1857-8. Fovia affinis, Stimpson (**32a**).
1865. Planaria affinis, Johnston (**38**).
1878. Fovia affinis, Jensen (**49**).

Length 4—6·5 mm. Body linear-oblong, convex above, flat beneath. The form of the anterior end is described by Johnston and figured by Dalyell as slightly enlarged and rounded. Oersted's (**16**) pl. i, fig. 6, probably represents this species. The explanation of the plate states it to be Planaria littoralis, which, however, is not the case, since the latter is synonymous with Planaria ulvæ. A specimen taken at Plymouth is figured on Pl. XXXIX, fig. 9. The anterior end tapers slightly, and when viewed "end on" presents two slight lobes, which are used in a vigorous sensitive way, as in the case of Convoluta paradoxa.

The colour varies from greenish-brown to wood-brown. An oval white spot in the hinder half of the body marks the pharynx. The two eyes lie each at the inner side of a white area, and from them a pair of dark parallel streaks of pigment run to the anterior margin.

The movements of the animal are very striking. The most usual method of locomotion is by arching the body and drawing the hinder end up to the anterior one. These "geometer" or leech-like movements are repeated with great rapidity. This kind of motion is chiefly effected on moist surfaces. When, however, the water is deeper, the usual gliding ciliary movement is adopted. The hinder part of the body is kept on the substratum, while the anterior extremity is raised up and constantly extended and retracted, the body as a whole partaking of the steady forward movement.[1]

Habitat.—Among algæ, Firth of Forth (Dalyell); Plymouth (F. W. G.).

Distribution.—Coasts of Denmark, Norway, and Sweden.

[1] Bergendal ("Studien ü. nordischen Turbellarien," 'Ofvers af Kongl. Vetensk-Akad. Förhandlingar,' 1890, No. 6) has described a species apparently synonymous with the present one, in which the uterus has a separate external opening. He defines a new genus, Uteriporus, containing the single species U. vulgaris, Berg. An accident prevented a re-examination of my specimen.

Sub-order 3.—POLYCLADIDA.

A. *ACOTYLEA.*

Family PLANOCERIDÆ.

[1] Mouth and pharynx subcentral. Main-gut rarely extends in front of or behind the pharyngeal sheath. Dorsal tentacles present. Eyes occur (1) on or round the bases of the tentacles; (2) as a double cephalic group; (3) on the body margin. Development usually direct.

Genus 27.—PLANOCERA, de Blainville,[2] 1826.

Body broad, leaf-like. Tentacles tapering, contracting into temporary pits. Brain and tentacles lie at the beginning of the second fourth of the body. Marginal eyes absent. Pharynx at rest lies completely folded in its sheath. Two genital apertures some distance from the hinder end.

60. PLANOCERA FOLIUM (Grube).

1840. STYLOCHUS FOLIUM, Grube (14).
1844. PLANOCERA FOLIUM, Oersted (16).
1856. „ „ Johnston (38).
1884. „ „ Lang (54).

Length 1·4 mm. Body extremely contractile, so that a definite shape cannot be stated. The ground-colour is pale yellow; the main-gut and its branches are brown, ending in marginal black spots. Small white spots (due to the underlying ovaries) are dotted over the dorsal surface. On this surface, nearly one fourth the length of the body from the anterior end, are the cylindrical tentacles, which are during life capable of being suddenly extended and as quickly retracted into pits. Round the bases of these tentacles are

[1] The definitions of families and genera of Polyclads are taken from Lang (54).

[2] de Blainville, 'Dictionnaire des Sciences naturelles,' art. "Planaire," t. xli, 1826.

clusters of eyes. The two genital apertures lie behind the mouth, the male pore in front of the female.

HABITAT.—The coralline region, Berwick Bay (Johnston).

DISTRIBUTION.—Palermo (Grube).

Genus 28.—STYLOCHOPLANA, Stimpson (32A).

Planoceridæ with a delicate body expanded anteriorly. Marginal eyes absent. Pharynx only slightly folded at rest. 6—7 pairs of secondary gut-branches. Genital apertures separate or united. Penis unarmed. Penial sheath serves as genital atrium. Vesicula seminalis opens into the vesicula granulorum, and this direct into the ductus ejaculatorius. Bursa copulatrix and accessory vesicle present.

61. STYLOCHOPLANA MACULATA, Quatrefages (18).

? 1836.	PLANARIA SUBAURICULATA, Johnston (12).
1845.	STYLOCHUS MACULATUS, Quatrefages (18).
? 1853.	PLANARIA CORNICULATA, Dalyell (29).
1863.	STYLOCHUS MACULATUS, Claparède (36).
? 1865.	LEPTOPLANA SUBAURICULATA, Johnston (38).
1866.	„ „ Ray Lankester (39).
1874.	„ „ McIntosh (45).
1884.	STYLOCHOPLANA MACULATA, Lang (54).

Length 12—16 mm. Body flat, elongate, increasing in width from the hinder end forwards, the anterior fourth expanded laterally. The general colour is warm brown, due to the underlying gut-branches. Along the mid-dorsal surface, pale areas indicate the position of the pharynx and the genital pores. A pair of dorsal tentacles are present. Mouth mid-ventral, leading into the pharynx, the walls of which are plaited. 5—6 eyes are borne by each tentacle, and 7—8 occur round their bases. The male genital pore lies at the commencement of the hinder fourth of the length of the body;

the female pore a short distance behind this. The penis is pyriform, and receives the contents of a vesicula seminalis and granule-gland. The uterus lies in front and at the sides of the pharynx; it opens to the exterior along with the spermotheca through the vagina.

HABITAT.—Berwick Bay (Johnston); Firth of Forth (Dalyell); Firman Bay, Guernsey (Lankester); St. Andrews (McIntosh); Jersey (Koehler).

DISTRIBUTION. — St. Malo (Quatrefages), St. Vaaste-la-Hogue (Claparède).

Family LEPTOPLANIDÆ.

Mouth and pharynx subcentral. Main-gut usually extends in front of, rarely behind, the pharyngeal sheath. Branches numerous. Male copulatory organ directed posteriorly. Tentacles absent. Eyes—(1) two lateral groups on the areas representing the tentacles of Planoceridæ; (2) double cephalic group; (3) marginal; (4) irregularly disposed over the head. Direct development.

Genus 29.—LEPTOPLANA, Ehrenberg (10).

Leptoplanidæ with elongate, delicate body. Pharyngeal sheath long. Lateral pouches numerous. Pharynx not completely folded. Genital apertures distinct. Granule-gland and vesicula seminalis separate. Marginal eyes absent. Eyes of group (1) larger than those of (2).

62. LEPTOPLANA TREMELLARIS (O. F. Müller).

1774. FASCIOLA TREMELLARIS, O. F. Müller (2).
1776. PLANARIA TREMELLARIS, O. F. Müller (4).
1814. „ FLEXILIS, Dalyell (6).
1840. „ TREMELLARIS, W. Thompson (15).
1844. LEPTOPLANA TREMELLARIS, Oersted (16).
1845. PLANARIA FLEXILIS, Johnston (20).

1845. POLYCELIS LÆVIGATUS, Quatrefages (18).
1849. PLANARIA FLEXILIS, Thompson (25).
1853. „ „ Dalyell (29).
1865. LEPTOPLANA TREMELLARIS, Johnston (38).
1866. „ FLEXILIS, Ray Lankester (39).
1874. „ „ McIntosh (45).
1886. „ TREMELLARIS, Koehler (55).
1886. POLYCELIS LÆVIGATUS, Koehler (55).

Length 12—25 mm. Body delicate, of variable shape, more or less elongate, broader in front than behind, the anterior margin semicircular; young specimens, as Dalyell has remarked, have the outline of a spherical triangle. The colour, if present, is brown; it is, however, extremely variable in amount and intensity: it is due partly to parenchymatous pigment, partly to the gut branches. In the middle line, not far from the hinder end, are two white areas; the foremost represents the male copulatory organ, the one behind it the "shell-gland." Between these and the brain a brown median area, surrounded by a clear whitish space, represents the main-gut and the uterus outside it. A V-shaped spot leading to the male pore is due to the underlying vasa deferentia. The ovaries appear (especially on a black ground) as white dots. From the white ventral surface the plaited pharynx and genital organs may be seen. Active swimming movements are produced by the expanded edges of the anterior end of the body. Between the male and female genital apertures is a depression, the lips of which are strongly muscular, and constitute a "sucker." The mouth is in front of the centre. It leads into the strongly puckered pharynx, lying in its sheath. From this the main-gut arises, and runs forwards towards the brain, and backwards to the commencement of the posterior third, giving off as it does so the numerous lateral branches, which in turn subdivide and end in fine cæca along the margin. The brain is distinctly bilobed. The lobes are oval, their long axes parallel to one another and to that of the body. Five anterior pairs of nerves supply the region in front and at the sides of the brain, and two lateral ones the rest of the body. The eyes

vary in number and arrangement. In front of the brain are usually two distinct patches of loosely arranged eyes at the bases of the nerves (corresponding to the eyes at the bases of the tentacles in Planoceridæ). Opposite the bases of the fifth pair of nerves is a compact group of larger, chiefly reniform eyes. In some specimens, however, the tentacular and cephalic groups of each side are continuous with one another. The genital apertures have already been noticed. From the numerous scattered testes, vasa efferentia arise. These gradually unite to form the pair of vasa deferentia which run at the sides of the pharynx, and before uniting at the base of the penis give off a posterior branch, which joins the one of the other side behind the female genital pore. The male copulatory organ consists of a ductus ejaculatorius, and the strongly muscular vesiculæ seminales and granulorum. The ova scattered throughout the body accumulate after fertilisation in the long uterus, which completely (in adult specimens) surrounds the pharynx and genital-apparatus. The uterus communicates with the exterior by a median duct, which in its lower portion is surrounded by the voluminous "shell-gland."

Habitat.—Firth of Forth (Dalyell); Cultra, Belfast Bay (W. Thompson); Rothesay (Johnston); Firman Bay, Guernsey (Ray Lankester); St. Andrews (McIntosh); Jersey, Guernsey, Herm (Koehler); Plymouth Sound and neighbourhood, from littoral zone to 20 fms. (W. Garstang, F. W. G.); Hilbre Island, mouth of the Dee, Port Erin, Isle of Man (F. W. G.); Aberystwyth (J. H. Salter).

Distribution.—Black Sea, Mediterranean, west coast of France, coast of Holland, Denmark, Baltic, North Sea, Red Sea.

The distinctive peculiarities of this species are the possession of a "sucker" and the simplicity of the female copulatory organ. Thus the "antrum femininum," or cavity into which the female genital pore leads directly, remains simple, while in

Leptoplana alcinoi and vitrea its walls are very muscular, and the organ becomes a bursa copulatrix. External form and colour, as Lang has forcibly stated (**54**, p. 482), afford no secure basis for the foundation of characters by which the species of Leptoplana may be distinguished.

63. Leptoplana Mertensii (Claparède).

1861. Centrostomum Mertensii, Claparède (**35**).

Length 18 mm. Body oval, white or yellowish. Two groups of eyes on the dorsal surface.

As no details as to the structure of the genital organs are given, it is impossible to satisfactorily assign a position to this species.

Habitat.—On Laminaria, Lamlash Bay, Arran (Claparède).

APPENDIX TO LEPTOPLANIDÆ.

64. Planaria atomata, O. F. Müller.

1777. Planaria atomata, O. F. Müller (**4**).
1823. „ „ Fleming (**8**).
1839. „ „ Forbes and Goodsir (**13**).
1844. Leptoplana atomata, Oersted (**16**).
? 1845. „ Dræbachensis, Oersted (**21**).
? 1853. Planaria maculata, Dalyell (**29**).
1865. Leptoplana atomata, Johnston (**38**).
1874. „ „ McIntosh (**45**).

Length 10—12 mm. Body oval, slightly wider in front than behind, rounded at both extremities. Colour variable, the ground-tint white or brown, spotted with reddish-brown, white beneath. Ova are seen as white dots over the upper surface. Two "tentacular" and two cephalic groups of eyes are present. The only known fact about the genital organs is that the penis has a bulbous base, and a transparent terminal duct which contains a hard stylet.

Habitat.—Coast of Scotland (Fleming); Orkneys and

Shetlands (Forbes and Goodsir); Firth of Forth (Dalyell); St. Andrews (McIntosh).

Distribution.—Naples (Delle Chiaje), coast of Holland, Germany, Denmark, Baltic (Dröback).

Planaria atomata has never been described in a sufficiently diagnostic way to render possible the identification of specimens with it. Consequently the above synonymy is very probably incorrect, but it is in no one's power to tell what the authors quoted did mean by their Planaria atomata. Thus Forbes and Goodsir, Fleming, Johnston, and McIntosh merely give the name and the record. Even those (as Müller and Oersted) who vouchsafe anatomical facts state the size, the form of the body, the position and arrangement of the eyes, and the form of the penis, and these do not by themselves, signalise a species of Leptoplana. Evidently a fresh and full description of a form is needed, which, if it differs from other existing species, may be called atomata, although its unity with the species of that name can only extend to the points mentioned. Comparisons with the new fully described atomata would henceforth be possible. Such a full account of a species agreeing in the form of the body, the position of the eyes, and the composition of the penis is to be found in Jensen's description of Leptoplana Drœbachensis.

The small differences that justified Oersted in separating these two species were the following :

	Leptoplana Drœbachensis, Oe.	Leptoplana atomata, O. F. Müller.
Oersted (21)	Length 4 lines.	Length 3—4 lines.
	Body "antice obtuso, dein sensim angustiore."	Body "subovali, postice angustiore."
	Eyes arranged in an anterior linear clump, and a posterior triangular one of 7.	Eyes arranged in four clumps. Those of the posterior ones are the larger.

With regard to the arrangement of the eyes, Jensen's specimens of L. Drœbachensis differ from Oersted's just as much or as little as does L. atomata. Oersted does not mention a hard penis in Drœbachensis, although he describes it in

L. atomata. Taking these facts into account, it may, perhaps, be said that Oersted's and Jensen's specimens have as much right to be classed in the same species as has Oersted's L. atomata.

For the future recognition of L. Drœbachensis I quote Jensen's diagnosis.

Length 10 mm. Breadth 4—5 mm. Body slightly narrowed posteriorly, rounded at both ends. Dorsal surface red with scattered darker spots, and with a longitudinal area, down the centre of which runs a broken white line. Ventral surface white. Four paired groups of eyes. Anterior groups placed longitudinally, hinder group directed outwards and backwards, composed of larger eye-specks. Mouth subcentral. Penis styliform, hardened at its apex or for its whole length. Vagina connected with the spermotheca by a long duct provided with a moniliform series of dilatations (Jensen [49], pl. vii, figs. 10—14).

B. *COTYLEA.*

Family EURYLEPTIDÆ.

Cotylea usually provided with marginal tentacles. Brain anterior, behind the tentacles. Mouth just behind, rarely in front of the brain. Pharynx directed forwards, cylindrical. Main-gut behind the pharyngeal sheath. Male copulatory organ simple, directed forwards, placed just behind or beneath the sheath of the pharynx. A hard stylet in the penis. Female genital pore between the penis and the sucker. Eyes (1) in or round the tentacles; (2) double cephalic group, sometimes greatly elongated.

Genus 30.—Prostheceræus, Schmarda.[1]

Body smooth, delicate. Pharynx bell-shaped. Main-

[1] Schmarda, L. K., 'Neue wirbellose Thiere, beobachtet und gesammelt auf einer Reise um die Erde, 1853—1858,' Bd. i, 1859.

gut extending to posterior extremity. Body around the pharynx and main-gut frequently thickened. Uterine glands corresponding to the number of the secondary gut-branches. Tentacles well developed, pointed, moveable. Two small cephalic groups of eyes. Brightly coloured forms.

65. PROSTHECERÆUS VITTATUS (Montagu).

1815. PLANARIA VITTATA, Montagu (7).
1823. „ „ Fleming (8).
1840. „ „ Thompson (15).
1845. „ „ Johnston (20).
1846. „ „ Thompson (22).
1857. „ „ Harvey (31).
1865. EURYLEPTA VITTATA, Johnston (38).
1884. PROSTHECERÆUS VITTATUS, Lang (54).
1886. „ „ Koehler (55).

Length 3·7—5 cm. Body elliptical, tapering towards both extremities. The tentacles are lamellar, broad at their bases, which enclose between them the extreme anterior tip of the body in such a way as to separate it off slightly from the margin. The general colour is yellow, the margins white. The median ridge is distinguished by a black line. Right and left of this a number of black lines (increasing in number and distinctness with the age of the individual) run from the brain towards the hinder end. Those near the median plane are almost straight; the peripheral run parallel with the body margin. The mouth lies behind the brain. The main-gut is long, and gives off large numbers of secondary gut branches, which anastomose freely. Eyes occur over the brain as a pair of small, clearly defined cephalic groups, on the anterior margin and in the tentacles. The sucker is subcentral. Halfway between it and the mouth is the male aperture, and behind this the female genital pore. The vesicula seminalis and granule-gland open independently into the ductus ejaculatorius.

Habitat.—Estuary of Kingsbridge, S. Devon (Montagu); coast of Scotland (Fleming); Strangford Lough (W. Thompson); between tide-marks at Roundstone, Connemara (W. Thompson); British coast (Harvey); Falmouth (J. Cranch, vide Johnston, 38); Jersey, Guernsey, Herm (Koehler); two specimens off Stoke Point, near Plymouth, 15 fms., on Diazona (J. T. Cunningham, MSS.); Plymouth Sound (W. Garstang).

Distribution.—Mediterranean, west coast of France, Scandinavia, Denmark.

66. Prostheceræus argus (Quatrefages).

1845. Proceros argus, Quatrefages (18).
1859. Prostheceræus argus, Schmarda, loc. cit.
1868. Eurylepta argus, Keferstein (40).
1884. Prostheceræus argus, Lang (54).
1886. Proceros argus, Koehler (55).

Length 6—10 mm. Body oval, bearing two short marginal tentacles separated by the anterior extremity. Dorsal surface somewhat convex, orange with white spots. The eyes are numerous: on each side of the middle line extending behind the brain, and continued forwards to the ventral faces of the tentacles. Thus the marginal, tentacular, and cephalic groups are continuous.

Habitat.—Between tide-marks at Grand Havre, Guernsey (Koehler).

Distribution.—St. Malo (Quatrefages, Keferstein).

Genus 31.—Cycloporus, Lang (1884).

Dorsal surface papillose. Pharynx short. Cells of main-gut almost filiform. About seven pairs of secondary branches. Uterine glands correspond to the number of the latter. The peripheral gut-branches open to the exterior through epithelial pores. Male pore close behind the mouth. Copulatory organ beneath and behind the pharyngeal sheath. Cephalic group of eyes not sharply defined. Tentacles small, sometimes rudimentary.

67. Cycloporus papillosus, Lang (54). Pl. XXXIX, fig. 2.

1880. Proceros tuberculatus, Schmidtlein, 'Mittheil. Zool. Stat. Neapel,' Bd. ii.
1881. „ „ Lang, ibid., Bd. iii.

Length 10—14 mm. Body elliptical with blunt extremities. In front the antero-lateral margins are produced to a variable extent as a pair of small, pointed tentacles. The dorsal surface is typically covered with small coloured papillæ—absent, however, in the variety lævigatus. Excepting the margins, the body is opaque. The ground-colour is yellowish-white. The main-gut and its six pairs of branches are brown, red, yellow, &c. In adult specimens they are largely concealed by the genital organs, but reappear on the margin, where their terminations are usually brightly coloured. The colour of the dorsal tubercles is variable and due to pigment in the epidermis. When the tubercles are absent their position is indicated by pigment-spots. Thus the colour is due partly to the contents of the gut, to pigment, and to the genital organs. Combinations of these three sources of colour account for the diversity between individuals of the same and of different ages, and appear to be correlated with the substratum (generally species of Leptoclinum and other Ascidians). Three to four black spots are present in specimens of the lævigatus variety, round the first pair of secondary gut-branches. (For good descriptions of the appearance of this animal at different stages of growth see Lang, 54, pp. 568—571.)

The mouth, just behind the brain, leads into a conical pharynx, the apex of which is directed backwards and is continued into the long main-gut. From this six lateral pairs of branches arise at right angles, which, after branching and anastomosing freely, end in terminal vesicles opening to the exterior through temporary epidermal pores at the moment of the expulsion of fæcal matter. The elongate cephalic group of eyes borders the white area produced by the pharynx, and extends forward beyond the brain. There is also a distinct group at the base and on the ventral surface of the tentacles.

The male genital pore lies close behind the mouth, the female aperture halfway between the anterior end and the subcentral sucker. The vesicula seminalis is very large. The uterus is a large lobed sac surrounding the main gut; the uterine glands are numerous (10—11 on each side). Surrounding the female pore is the very large radiate "shell-gland."

HABITAT.—On compound Ascidians and the sponge Hymeniacidon sanguinea, 5—15 fms., Plymouth (W. Garstang, F. W. G.); Port Erin, Isle of Man, 18 fms. (H. C. Chadwick). Var. lævigatus between tide-marks, Port Erin, and neighbourhood (W. J. Beaumont, F. W. G.).

DISTRIBUTION.—Naples (Lang).

This variable species may be easily mistaken for Stylostomum variabile. It is, however, recognisable by the presence of a continuous median gut-branch over the pharynx, whereas in Stylostomum the pharyngeal region appears as an uninterrupted white area, bordered laterally by the gut-diverticula.

Genus 32.—EURYLEPTA, Ehrenberg, 1831 (10).

Body smooth. Tentacles long, tapering. Usually five pairs of secondary gut-diverticula. The intestine is brightly coloured. Male genital pore beneath the hinder end of the pharyngeal sheath. One pair of uterine glands is present. Cephalic group of eyes extending posteriorly far beyond the brain.

68. EURYLEPTA CORNUTA (O. F. Müller).

1776. PLANARIA CORNUTA, O. F. Müller (3).
1831. EURYLEPTA CORNUTA, Ehrenberg (10).
1832. PLANARIA CORNUTA, Johnston (11).
1845. „ „ Thompson (19).
1845. „ „ Johnston (20).
1853. „ „ Dalyell (29).
1865. EURYLEPTA CORNUTA, Johnston (38).
1865. „ DALYELLI, Johnston (38).
1866. „ CORNUTA, Ray Lankester (39).

Length 1·5—3·75 cm. Breadth about half the length. Body elliptical during motion, almost circular at rest, broadly rounded behind. In front are two elongate tentacles. The somewhat convex dorsal surface is, with the exception of the margins, opaque, of a bright orange-red colour dotted with white, due to parenchymatous pigment, and to a greater extent to the contents of the alimentary canal. In front an elongated, oval, raised, white ridge represents the underlying pharynx. The ventral surface is of a pale reddish colour, and upon it the gut, male and female apertures, and sucker are visible. The mouth is one-third of the distance from the anterior end to the sucker, i. e. close behind the brain. The pharynx is well developed, cylindrical, extending almost as far back as the centre, in front of which it opens into the extensive main-gut. From this a median and 5—6 lateral pairs of branches arise, which after branching slightly end in marginal forked cæca. The minutely moniliform appearance of these is due to the presence of sphincter-muscles at the points of constriction. Each tentacle receives a branch of the intestine. Extending from the brain towards the hinder margin of the pharynx are two groups of eyes, which stand out very clearly against the white underlying pharyngeal region. Posteriorly they are divergent, and consist of small, loosely aggregated eye-specks, which become larger and crowded in front, the two groups converging towards the brain. Eyes are also present in the tentacles and around their bases. The sucker is well developed, and serves to attach the animal very firmly to the substratum. The male genital aperture lies under the hinder end of the pharynx. The vasa efferentia unite in a large expanded duct on each side, from which the two vasa deferentia arise. The ductus ejaculatorius receives the contents of the granule-gland and the large vesicula seminalis. Just in front of the sucker lies the female pore, surrounded by the extensive radiating shell-gland. The uterus lies at the sides of the main-gut. A single pair of uterine glands are present.

Habitat.—"On the coast of Berwickshire, in deep water on

corallines and shells" (Johnston, **11**); on Laminaria, 6—10 fms., Belfast Bay (W. Thompson); Firth of Forth (Dalyell); Firman Bay, Guernsey (Ray Lankester); Bordeaux (Koehler); Plymouth, in 2—6 fms., and between tide-marks (W. Garstang, F. W. G.).

DISTRIBUTION.—Naples (var. Melobesiarum, Lang), St. Malo (Keferstein), Dröback (Müller).

Genus 33.—OLIGOCLADUS, Lang (1884).

Body smooth. Tentacles long, capable of movement. Mouth in front of the brain. Pharyngeal sheath produced posteriorly into a closed diverticulum, which extends beyond the sucker. Pharynx cylindrical. Three to four pairs of secondary gut-branches. The main-gut apparently opens to the exterior at its hinder end. Male and female genital apertures lie under the pharyngeal sheath. Four pairs of uterine glands are present. The double cephalic eye-group sharply defined, not elongated behind.

69. OLIGOCLADUS SANGUINOLENTUS (Quatrefages). Pl. XXXIX, fig. 3.

1845. PROCEROS SANGUINOLENTUS, Quatrefages (**18**).
? 1864. „ „ Grube.[1]
1884. OLIGOCLADUS SANGUINOLENTUS, Lang (**54**).
1886. „ „ Koehler (**55**).

Length 8—11 mm. Breadth 3—4 mm. Body delicate, fairly transparent. Form elongate, parallel-sided, broadly rounded behind, produced in front into a pair of long, pointed, contractile tentacles, between which the extreme anterior end projects slightly. Colour white, especially marked along the margins. The mid-dorsal line is brownish or carmine, owing to the underlying main-gut and its median branch. The latter exhibits two conspicuous swellings, one at the point of origin, the other behind the brain. Three to four lateral diverticula

[1] 'Die Insel Lussin v. ihre Meeresfauna,' 1864.

arise on each side of the main-gut, and are of a brilliant carmine colour at first, becoming much less conspicuous towards the periphery. The pharynx and genital organs appear as white patches round the main-gut. The mouth is placed in front of the brain. The gut-branches do not anastomose. Eyes are present at the bases of the tentacles, and two sharply defined cephalic groups converge at the anterior end of the brain. The position of the genital apertures has already been mentioned. The male pore lies in front of the female.

Habitat.—Between tide-marks, Grève d'Azette, Jersey (Köhler); Plymouth Sound, 5—20 fms. (F. W. G.); Port Erin, Isle of Man, 12—15 fms. (W. J. Beaumont and F. W. G.).

Distribution.—Island of Lussin, Adriatic (Grube), Naples (Lang).

After much consideration I have referred several specimens dredged at Plymouth and elsewhere to this species. The distinguishing points are the position of the mouth in front of the brain; the male genital aperature underneath the anterior end of the pharyngeal sheath; and the short, sharply defined group of eyes over the brain.

70. Oligocladus auritus (Claparède).

1861. Eurylepta aurita, Claparède (35).
1884. Oligocladus auritus, Lang (54).

Length 18·5 mm. Body oval, transparent, white, the intestine bright reddish-brown. Mouth in front of the brain. Pharynx cylindrical. Main-gut gives rise to three pairs of secondary branches, which do not anastomose. Eyes are present in and round the bases of the tentacles, but, according to Claparède, are absent over the brain. The male genital pore occurs just behind the mouth; the female aperture is described by Claparède as almost central. Lang suggests that this author probably mistook the sucker for the pore. The vasa deferentia are scarcely so swollen as in O. sanguinolentus, and the vesicula seminalis rather larger than

in the latter. The granule-gland and copulatory organ agree exactly in both species. Claparède figures large rounded bodies which may possibly prove to be the accessory uterine glands (Lang).

HABITAT.—On Laminaria, Lamlash Bay, Arran (Claparède).

A more exact description of this species is necessary before the specific identity or difference of Oligocladus sanguinolentus and auritus can be regarded as proved. It appears fairly clear that they both possess the same generic characters —the subterminal mouth, position of the genital pores, and multiple uterine glands. No satisfactory points of difference can at present be determined. On the contrary, it is noticeable that it is just those organs which Claparède describes accurately—the mouth, pharynx, and intestine, and the male copulatory organ—which agree exactly with the corresponding structures in O. sanguinolentus.

Genus 34.—STYLOSTOMUM, Lang (1884).

Body smooth. Tentacles rudimentary. Oral and genital apertures open on a common depression immediately behind the brain. Main-gut with 5—6 pairs of secondary non-anastomosing branches. The median anterior branch is absent over the pharyngeal region. Male copulatory organ lies under the anterior part, the female organ under and behind the hinder part of the pharyngeal sheath. Two uterine glands. Cephalic eyes few in number.

71. STYLOSTOMUM VARIABILE, Lang. Pl. XXXIX, fig. 1.

? 1853. PLANARIA ELLIPSIS, Dalyell (29).
? 1865. LEPTOPLANA ELLIPSIS, Johnston (38).
? 1875. „ „ McIntosh (45).
1884. STYLOSTOMUM VARIABILE, Lang (54).
1884. STYLOSTOMUM ? ELLIPSIS, Lang (54).

Length 5—9 mm. Body elliptical, broadly rounded

behind, tapering slightly in front. The extreme anterior margin truncate. Tentacles more conspicuous in adults than in young specimens, where they form mere blunt marginal projections. Immature specimens derive their coloration from the white or yellowish-white ground-tint and from the branches of the intestine, which, owing to the transparency of the body, are clearly visible. The colour of the gut-branches is scarcely the same in any two specimens, and may be red, orange, brown, black, &c. In mature examples the genital organs conceal the greater part of the alimentary canal. The mouth lies immediately behind the brain. It leads into a cylindrical pharynx, which, lying in its sheath, appears from the dorsal surface as a white oval area. Bounding the sides of this are the first pair of gut-branches, a median branch being absent. In front of the pharynx these two branches unite and from this point a very short median branch runs to the anterior end. Eyes are present below and above the tentacle bases, and also as two divergent series over and slightly beyond the brain. Very characteristic are two pairs of eyes close to the hinder margin of the brain, and a pair on its outer and anterior angles. The relation of these eyes to those of the larva may be gathered from Pl. XXXIX, fig. 1, which represents a young specimen of the present species. The male genital pore is combined with the mouth behind the brain; the female pore lies in front of the centre, the sucker just behind it. Granule-gland and vesicula seminalis open into the penis. The vesicula receives the separate vasa deferentia. The uterus encloses the main-gut. A very extensive shell-gland surrounds the female genital pore.

Habitat.—Firth of Forth (Dalyell, **29**); not uncommon between tide-marks (McIntosh **45**); Falmouth, at low water (W. Garstang); Plymouth, in 4½ fms., along with young specimens; Port Erin, Isle of Man, in 12 fms. (F. W. G.).

Distribution.—Naples (Lang).

This species, closely similar to young smooth specimens of

Cycloporus papillosus, may be distinguished by the absence of a median gut-branch over the white pharyngeal region, by the presence of only 5—6 pairs of secondary branches (Cycloporus possesses 8—9) to the intestine, and by their non-anastomosing character.

I have included Planaria ellipsis of Dalyell and others under this species, since his figures agree exactly in the points just mentioned.

III. Summary.

1. British marine Turbellaria, as at present known, include about fifty-seven species of Rhabdocœlida, twelve of Polycladida, and two Tricladida, making a total of seventy-one species. The numbers represent the examination of a limited extent of our coast (Millport, St. Andrews, Skye, the Isle of Man, Plymouth, and Channel Islands) during about three months of the year (July to September).

2. The following twenty-eight species are added to the British fauna in the present paper.

Polycladida:

Cycloporus papillosus, Lang.

Acœla:

Proporus venenosus (O. Sch.).
Monoporus rubropunctatus (O. Sch.).
Aphanostoma elegans, Jensen.

Rhabdocœla:

Promesostoma ovoideum (O. Sch.).
„ solea (O. Sch.).
„ agile (Lev.).
„ lenticulatum (O. Sch.).
Byrsophlebs Graffi, Jensen.
Mesostoma neapolitanum, v. Graff.
Hyporhynchus armatus (Jensen).
? „ penicillatus, (O. Sch.).
Provortex rubrobacillus, n. sp.

ALLŒOCŒLA:

Plagiostoma dioicum, Metschnff.
„ sulphureum, v. Graff.
„ Girardi (O. Sch.).
„ pseudomaculatum, n. sp.
„ sagitta (Vlj.).
„ elongatum, n. sp.
„ caudatum, Lev.
„ (?) siphonophorum (O. Sch.).
Vorticeros luteum, v. Graff.
Cylindrostoma inerme, Halley.
„ elongatum, Lev.
Monoophorum striatum (v. Graff).
Monotus albus, Lev.
Automolus horridus, n. sp.
„ ? ophiocephalus (O. Sch.).

3. The relations of the Turbellarian fauna of our coasts with that of neighbouring seas cannot be determined with certainty until more extended observations are recorded than we possess at present. Mediterranean and Adriatic forms occur on our south-western stations (Plymouth, &c.). Thus seven Polyclads and sixteen Rhabdocœles (33 per cent. of our fauna) are common to Naples, Trieste, and Plymouth. A large proportion (about 70 per cent.) of Scandinavian forms occur on our coast.

IV. APPENDIX.

SYNOPSIS OF THE FAMILIES, SUB-FAMILIES, GENERA, AND SPECIES OF BRITISH MARINE TURBELLARIA.

I. RHABDOCŒLIDA.

Section A.—ACŒLA.[1]

1. With a single genital pore . . . Family **Proporidæ**.
a. Without spermotheca . . Genus PROPORUS.
Species:—*P. venenosus* (elongate, yellow, two eyes present, provided each with a large lens).

[1] For the definition accidentally omitted see p. 440.

b. With spermotheca . . Genus MONOPORUS.

Species:—*M. rubropunctatus* (eyes without lenses, composed of red pigment-masses placed in the epidermis).

2. With two genital pores, the female pore in front of the male . . . . . Family **Aphanostomidæ**.

a. Spermotheca with soft, non-chitinous mouth-piece . . . Genus APHANOSTOMA.

Species:—*A. diversicolor* (central part of the anterior end violet, extremities yellow). *A. elegans* (centre of the body with a lobate green spot).

b. Spermotheca with chitinous mouth-piece Genus CONVOLUTA.

Species:—*C. saliens* (with alternate longitudinal rows of cilia and rhabdites). *C. paradoxa* (with two eyes and "yellow cells" in the parenchyma). *C. flavibacillum* (dorsal surface very convex, no "yellow cells," sides of the body only slightly flexed ventrally).

Section B.—RHABDOCŒLA.[1]

3. With sexual and asexual reproduction. Female accessory organs absent . . . . Family **Microstomidæ**.

a. Sexes separate. Head with a pair of lateral grooves. A pre-œsophageal cæcum present Genus MICROSTOMA.

Species:—*M. grœnlandicum* (eyes absent, a red spot usually present anteriorly).

b. Hermaphrodite. Proboscis present. A posterior and sometimes lateral bundles of setæ Genus ALAURINA.

Species:—*A. Claparedii* (proboscis with numerous papillæ, and a pair of ciliary tufts at its base; posterior bundle of setæ only).

4. With one or two genital apertures. Male accessory

[1] See p. 448.

organs present. Pharynx usually mid-ventral, rosulate (i. e. rosette-like) . . . . Family **Mesostomidæ**.

I. A single genital aperture, two germaria, and two vitellaria. Accessory reproductive organs absent Sub-family **Promesostominæ**.

a. Characters of sub-family . Genus PROMESOSTOMA.

Species:—*P. marmoratum* (copulatory organ coiled, crosier-like). *P. ovoideum* (penis pyriform, pigment-cup of eye simple). *P. solea* (pigment-cup of eye with hook-like process over outer surface of lens). *P. lenticulatum* (copulatory organ provided distally with radial triangular ridges). *P. agile* (copulatory organ curved, simple).

II. Two genital apertures. The male pore in front of the female. Germarium single. Sub-family **Byrsophlebinæ**.

a. Characters of sub-family . Genus BYRSOPHLEBS.

Species:—*B. Graffi* (vitellaria unbranched; copulatory organ widely funnel-shaped, the terminal margin with a triangular projection). *B. intermedia* (vitellaria branched, copulatory organ elongate, the terminal margin entire, and with a curved chitinous spur).

III. A common genital aperture. Germ-yolk-glands present. Testes rounded. Spermotheca with chitinous appendages . . . Sub-family **Proxenetinæ**.

a. Characters of sub-family . Genus PROXENETES.

Species:—*P. flabellifer* (copulatory organ retort-shaped, complex; duct of the spermotheca with chitinous teeth). *P. cochlear* (copulatory organ composed of three spoon-shaped pieces).

IV. A common genital pore. One germarium. Female accessory organs present. Testes elongate Sub-family **Eumesostominæ**.

a. Copulatory organ traversed throughout its length by the ducts of male secretions . Genus MESOSTOMA.

Species:—*M. neapolitanum* (copulatory organ funnel-shaped, the margin with a spur; atrium very large).

5. The anterior extremity converted into a tactile proboscis, provided with a (usually complex) musculature

Family **Proboscidæ**.

I. Proboscis simple, with a sheath or muscle-cone. Short muscle-bundles serve as retractors

Sub-family **Pseudorhynchinæ**.

a. Characters of sub-family Genus PSEUDORHYNCHUS.

Species:—*P. bifidus* (hinder extremity bifid; copulatory organ conical, with a screw-like ridge on its outer surface).

II. Proboscis provided with a sheath opening in front, a muscle-cone, and four long retractors.

Sub-family **Acrorhynchinæ**.

a. Distinct seminal and granule vesicles, enclosed, however, in a common muscular sheath.

Genus ACRORHYNCHUS.

Species:—*A. caledonicus* (copulatory organ composed of small chitinous spines).

b. Duct of granule-vesicle with special chitinous investment . . . . Genus MACRORHYNCHUS.

Species:—*M. Naegelii* (copulatory organ tubular, with a curved spur longer than the tube). *M. croceus* (chitinous tube long, continued directly into the "spur"). *M. helgolandicus* (a chitinous investment enveloping granule-vesicle and vas deferens; a poison-dart present).

c. Two genital pores, the female in front of the male pore. Granule-vesicle with chitinous investment

Genus GYRATOR.

Species:—*G. hermaphroditus* (colourless; copulatory organ with a straight poison-dart).

III. Proboscis small, behind the anterior end, its sheath opening on the ventral surface. Granule- and seminal

vesicles not separate. Their contents, however, issue by distinct ducts . . Sub-family **Hyporhynchinæ**.

a. Characters of the sub-family

Genus HYPORHYNCHUS.

Species:—*H. armatus* (copulatory organ composed of two fused chitinous, spiral tubes; pigment not reticular; six papillæ round the mouth. *H. penicillatus* (copulatory organ composed of two spoon-shaped pieces).

6. A single genital aperture. Pharynx large, dolioform. A uterus and paired testes present . Family **Vorticidæ**.

I. Germaria small, body-cavity capacious, free-living

Sub-family **Euvorticinæ**.

a. Two germaria and two unbranched vitellaria

Genus PROVORTEX.

Species:—*P. balticus* (copulatory organ with a spirally-curved spur on the margin). *P. affinis* (copulatory organ slightly bent distally). *P. rubrobacillus* (with red rods in the gut-cells; copulatory organ with a finely pointed straight spur to the margin).

Section C.—ALLŒOCŒLA.

Gut and parenchyma, with one exception (Plagiostoma bimaculatum), distinct. Body-cavity absent in the adult. Testes follicular. Penis formed by a fold of the wall of the genital atrium. A conspicuous chitinous copulatory organ absent.

7. An otolith absent . . Family **Plagiostomidæ**.

I. Genital aperture single, ventral, posterior. Mouth anterior. Germaria present. Sub-family **Plagiostominæ**.

a. Without tentacles . . Genus PLAGIOSTOMA.

Species:—A. With four distinct eyes: *Pl. sagitta*.

B. With two eyes.

AA. Mouth terminal or subterminal: *Pl. dioicum* (1—5 mm. long, yellow, pharynx in front of

brain). *Pl. elongatum* (white, pharynx large, when retracted it lies behind the brain). *Pl. ochroleucum* (5·5 mm., pharynx subterminal).

BB. Pharynx and mouth behind brain.

a. Epidermis without pigment: *Pl. Girardi* (colourless, 2 reniform eyes). *Pl. siphonophorum* (with median longitudinal band of black reticular pigment). *Pl. pseudomaculatum* (violet pigment between the eyes, without distinct lateral grooves). *Pl. vittatum* (pigment variable, usually in the form of three transverse bands).

β. Epidermis pigmented: *Pl. sulphureum* (epidermis with yellow rods). *Pl. Koreni* (transverse band of parenchymatous pigment). *Pl. caudatum* (rhabdites few, head marked off by lateral grooves).

b. With two tentacles at the anterior end

Genus VORTICEROS.

Species:—*V. auriculatum* (violet reticular pigment over the greater part of dorsal surface). *V. luteum* (pigment uniformly yellow).

II. A single posteriorly-placed genital aperture. Two germaria and two distinct vitellaria. Pharynx directed backwards . . . Sub-family **Allostominæ**.

a. Without a circular ciliated groove on the head

Genus ENTEROSTOMA.

Species:—*E. austriacum* (four eyes; pigment in rounded yellow masses). *E. fingalianum* (pigment absent, colour due to food). *E. cæcum* (eyes absent).

b. With a circular ciliated groove at the level of the brain . . . . . Genus ALLOSTOMA.

Species:—*A. pallidum* (adults 2—3 mm. long; granular mucus-rods [pseudo-rhabdites] in the epidermis).

III. Circular ciliated groove on the head. Oral and genital apertures combined. A pair of germ-yolk-glands present . . Sub-family **Cylindrostominæ**.

a. With characters of sub-family

Genus CYLINDROSTOMA.

Species:—*Cyl. quadrioculatum* (pharynx directed forwards; body colourless). *Cyl. inerme* (epidermis yellow, containing rhabdites but no "calcareous bodies;" spermotheca absent). *Cyl. elongatum* (pharynx directed backwards; four eyes present).

b. Pharynx directed backwards, the penis forwards. Spermotheca opens into genital atrium.

Genus MONOOPHORUM.

Species:—*M. striatum* (pigment carmine, reticular; muscles grouped in longitudinal bundles).

8. With two genital apertures, two germaria, and two vitellaria. An otolith present . . . Family **Monotidæ**.

a. Female genital pore in front of the male

Genus MONOTUS.

Species:—*M. lineatus* (an eye present in front of the otolith; copulatory organ a soft papilla). *M. fuscus* (copulatory organ a chitinous tube). *M. albus* (penis, a boat-shaped, chitinous copulatory organ with a pair of lateral teeth near the "bows").

b. Female genital pore behind the male aperture

Genus AUTOMOLOS.

Species:—*A. ophiocephalus* (an eye usually present in front of the otolith; head expanded). *A. unipunctatus* (an eye absent; penis a spinous tube). *A. horridus* (head slightly marked off from the body; rhabdites giving a spinous appearance to the animal; penis soft, muscular).

II. TRICLADIDA.

A single (rarely double) genital aperture behind the mouth. Pharynx central or post-central . Family **Planariidæ**.

a. Penis directed dorso-ventrally. Uterus opens into genital atrium. Head truncate. Eyes wide apart Genus GUNDA.

Species:—*G. ulvæ* (the angles of the anterior margin produced into "lappets").

b. Head produced in the centre. Eyes approximated Genus FOVIA.

Species:—*F. affinis* (pharynx behind the middle).

III. POLYCLADIDA.

Section A.—ACOTYLEA.

1. Dorsal contractile tentacles present. Tentacular, cephalic, and marginal groups of eyes . . Family **Planoceridæ**.

a. Body leaf-like. Marginal eyes absent Genus PLANOCERA.

Species:—*Pl. folium* (tentacles placed behind commencement of second quarter of length; body yellow-brown).

b. Body distinctly enlarged in front. Tentacles placed well apart at end of first fifth of the body. Genus STYLOCHOPLANA.

Species:—*St. maculata* (two genital apertures).

2. Mouth subcentral. Main-gut extending in front of (rarely behind) the pharyngeal region. Tentacles absent Family **Leptoplanidæ**.

a. Body slightly enlarged in front. Marginal eyes absent . . . Genus LEPTOPLANA.

Species:—*L. tremellaris* (a "sucker" present between the male and female genital pores). *L. Mertensii* and *L. atomata* (doubtful species, see pp. 501–2).

Section B.—Cotylea.

3. Anteriorly-placed marginal tentacles usually present. Mouth just behind (rarely in front of) the brain. Penis with a hard stylet . . . . Family **Euryleptidæ**.

a. Brightly coloured. Body thickened over the main gut. Tentacles large, moveable. Two small cephalic eye-groups . . Genus Prosthecereæus.

Species:—*Pr. vittatus* (body yellow, with longitudinal thin black lines). *Pr. argus* (dorsal surface orange-coloured; length up to 10 mm.).

b. Dorsal surface usually papillose. Tentacles small. Peripheral gut-pores to the exterior

Genus Cycloporus.

Species:—*C. papillosus* (a median gut-branch over pharyngeal region).

c. Intestine brightly coloured. Tentacles long. Mouth behind brain. Cephalic eye-groups extending far behind brain . . . Genus Eurylepta.

Species:—*E. cornuta* (eyes not quite extending back to hinder edge of white pharyngeal region; body bright red).

d. Tentacles long. Mouth in front of brain. Pharyngeal sheath with a posterior cæcum

Genus Oligocladus.

Species:—*O. sanguinolentus* (body whitish, intestine usually carmine; a short cephalic eye-group). *O. auritus* (eyes absent over the brain [Claparède]).

e. Tentacles rudimentary. Oral and male genital apertures united behind brain. A median gut-branch absent over the pharyngeal region

Genus Stylostomum.

Species:—*S. variabile* (intestinal branches brightly coloured).

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DESCRIPTION OF THE FIGURES ON PLATES XXXIX, XL, & XLI,

Illustrating Mr. F. W. Gamble's paper on "Contributions to a Knowledge of British Marine Turbellaria."

Pl. I represents the living animals, Pls. II and III compression- and other preparations.

Alphabetical List of Reference Letters for all the Figures.

B. C. Bursa copulatrix. *BR.* Brain. *BS.* Spermotheca. *CH.* Chitinous portion of copulatory organ. *CI.* Cilia. *COP.* Copulatory organ. *D.* Intestine. *DO.* Vitellarium. *E.* Eye. *EI.* Ovum. *FL.* Flagella. *GER.* Germarium. *GO.* External genital aperture. *KD.* Granule-gland. *L.* Lens

of eye. *M.* Mouth. *ME.* Muscular envelope. *MR.* Mucous-rods. *N.* Nucleus of epidermal cells. *OT.* Otolith. *PA.* Packets of rhabdites. *PE.* Penis. *PH.* Pharynx. *RH.* Rhabdites. *RS.* Receptaculum seminis. *SE.* Spermatozoa. *SP.* Pharyngeal glands. *TE.* Testis. *V. D.* Vasa deferentia. *VG.* Vesicula granulorum. *VS.* Vesicula seminalis. *W.* Ciliated groove.

PLATE XXXIX.

FIG. 1.—Young Stylostomum variabile, Lang. Natural length 9 mm. The three pairs of eyes placed over the brain are very conspicuous, and persist in the adult (see p. 512). × 65.

FIG. 2.—Cycloporus papillosus, var. lævigatus, Lang. Natural size. This form exhibits almost complete similarity in colour, form, and consistency with the Ascidians on which it is usually found.

FIG. 3.—Oligocladus sanguinolentus, Quatref. Length 1·1 cm. ×6.

FIG. 4.—Cylindrostoma inerme (Hallez). Length 1 mm. The drawing is made from a specimen slightly compressed. Zeiss obj. C, oc. 4, cam. luc. × 55.

FIG. 5.—Macrorhynchus Naegelii, Köll. Length 2·2 mm. This is a colour variety similar to what Claparède observed at St. Vaaste (see p. 462). × 30.

FIG. 6.—Promesostoma lenticulatum (O. Sch.). Natural length ·5 mm. The carmine-coloured gut is visible. × 100.

FIG. 7.—Enterostoma austriacum, Grff. Natural length ·75 mm. The yellow colour is due to groups of pigment-granules, the black spot to the contents of the intestine. × 40.

FIG. 8.—Provortex rubrobacillus, n. sp. Natural length ·6 mm. The brown spots are due to the contents of the gut-cells. × 70.

FIG. 9.—Fovia affinis (Oe.) (probably Uteriporus vulgaris, Bergental). Natural length 4·5 mm. The figure is carefully drawn from a freely-moving specimen. The slight lobes of the anterior margin are seen when the animal is viewed from below and in front; this view also shows a slight median projection—similar, in fact, to what occurs in Convoluta paradoxa. × 8.

FIG. 10.—Promesostoma marmoratum (Schultze). Natural length 1·5 mm. × 20.

PLATE XL.

FIG. 11.—Plagiostoma dioicum, Metschff. Natural length ·6 mm. Compression-preparation. × 200.

FIG. 12.—Provortex rubrobacillus, n. sp. Natural length ·6 mm. Compression-preparation. × 150.

FIG. 13.—Promesostoma lenticulatum (O. Sch.). Compression-preparation. × 150. Concerning the organs marked R. S. and B. C. see p. 454.

FIG. 14.—Promesostoma agile (Lev.). Natural length ·5 mm. Compression-preparation. × 220.

FIG. 15.—Vesicula granulorum and its chitinous investment taken from Macrorhynchus Naegelii, Köll. The thickened margin is produced into two curved "spurs." As a rule only one is present. × 220.

FIG. 16.—Copulatory organ of Promesostoma marmoratum (Schultze) (partly after v. Graff). × 200.

FIG. 17.—Copulatory organ of Promesostoma lenticulatum. × 600.

FIG. 18.—Automolos (?) ophiocephalus (O. Sch.). The living animal fully extended. × 40.

PLATE XLI.

FIG. 19.—Hinder portion of Cylindrostoma elongatum, Lev., to show the relations of the genital apparatus. × 500.

FIG. 20.—Plagiostoma sulphureum, Grff. Natural length 2 mm. Compression-preparation. × 70.

FIG. 21.—Automolos horridus, n. sp. Natural length 1·5 mm. Compression-preparation. × 100.

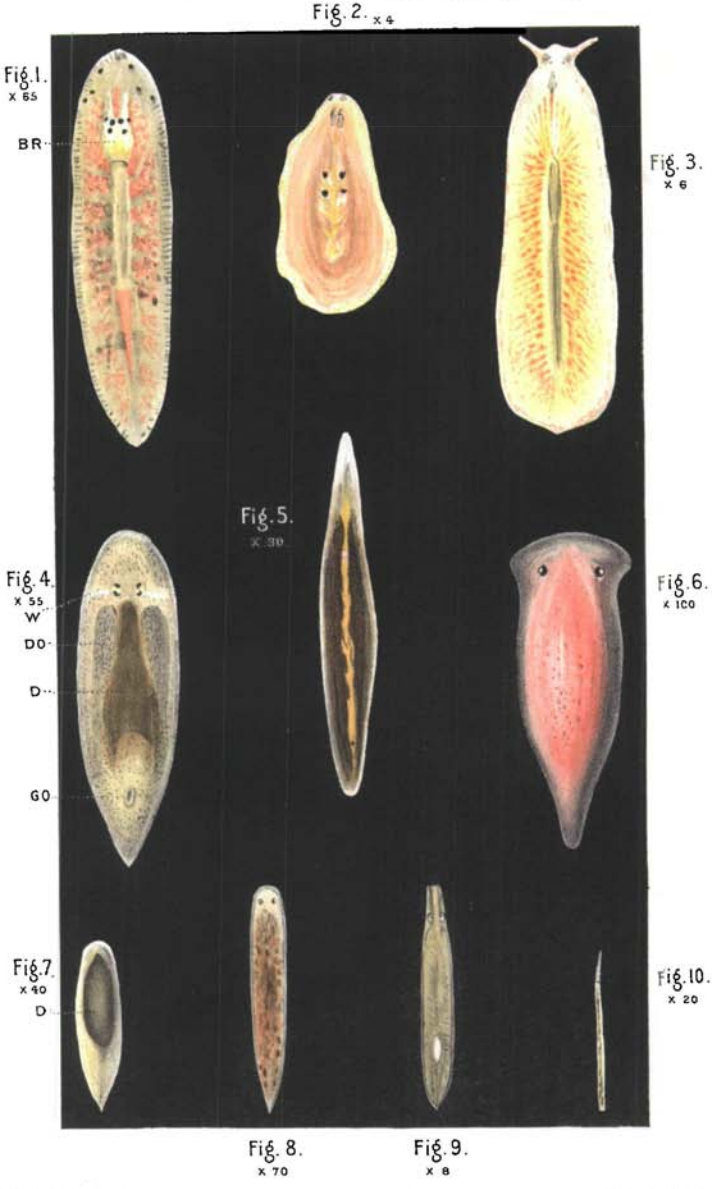
Fig. 2. x 4
Fig. 1.
x 65
BR
Fig. 3.
x 6
Fig. 5.
x 30
Fig. 4.
x 55
W
DO
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Fig. 6.
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Fig. 8.
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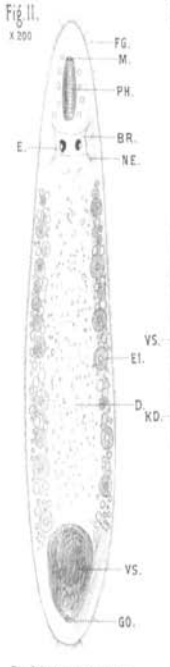
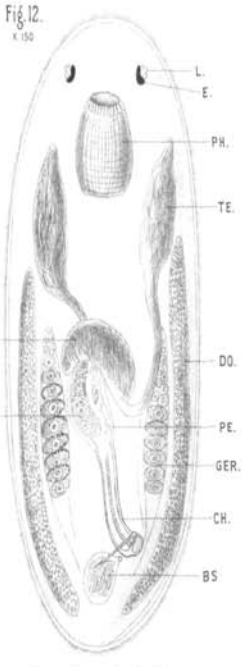
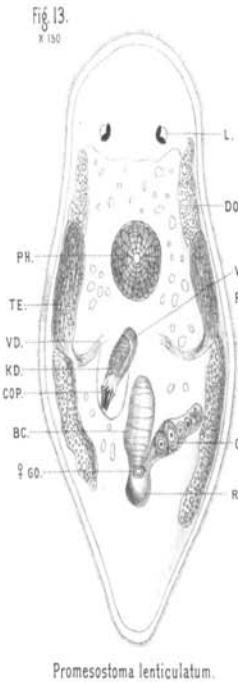
x 8
Fig. 10.
x 20



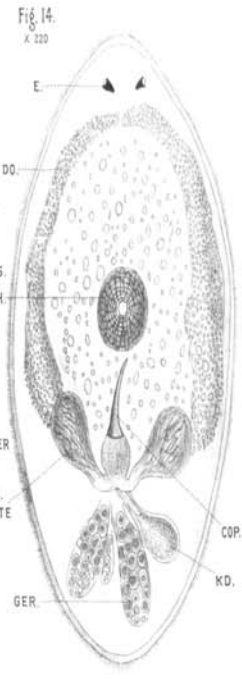
Plagiostoma dioicum.



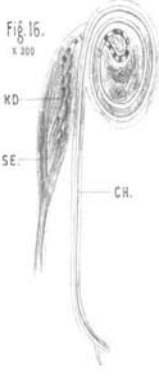
Provortex rubrobacillus, n. sp.

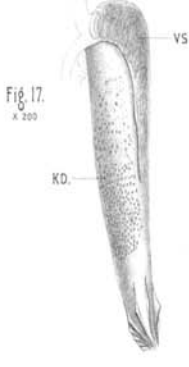


Promesostoma lenticulatum.



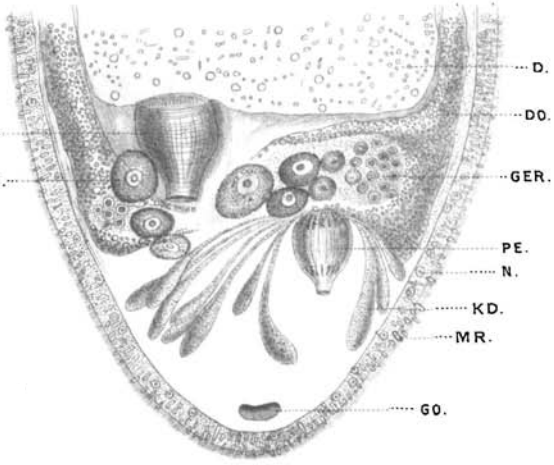
Promesostoma agile.





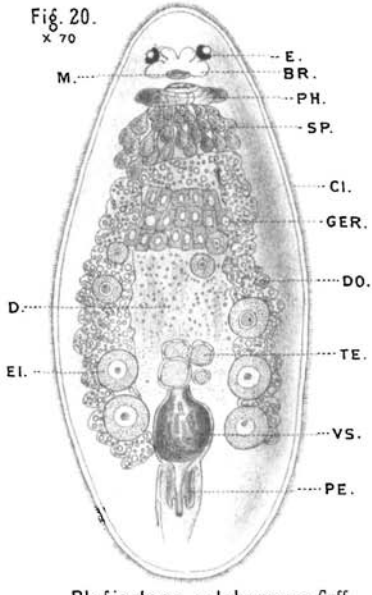
Automolos Rophiocephalus.

Fig. 19.
× 500



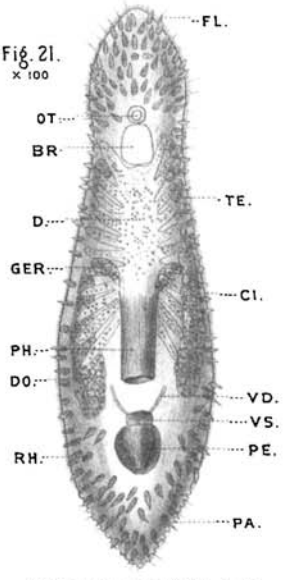
Cylindrostoma elongatum, Lev.

Fig. 20.
× 70



Plagiostoma sulphureum, Grff.

Fig. 21.
× 100



Automolos horridus, n.sp.