NOTES ON TREMATODE PARASITES OF FISHES.

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The following notes are based on two distinct collections:

A collection made by myself while enjoying the privileges of the scientific station of the United States Fish Commission at Woods Holl, Massachusetts, and a collection belonging to the United States National Museum.

While the notes make no claim whatever to be exhaustive studies of the species considered, it is hoped that, in most cases, the descriptions are full enough to render the work of identification easy to future workers.

Following are the names of species discussed in this paper, together with a list of the hosts:

No.	Parasite.	Host.	Plate.	Figure.
1	*Nitzchia elegans* Baer	*Acipenser sturio*		
2	*papillosa*, new species	*Gadus callarias*	XL	1–6
3	*Tristomum lævc* Verrill?	*Gymnosaida pelamys*	XL	7, 8
4	*coccineum* Cuvier	*Xiphias gladius*	XL	9
5	*rudolphianum* Diesing	*Mola mola*		
6	*Octoplectanum affine*, new species	*Paralichthys dentatus*	XL XLI	10–13 1–5
7	*Diplostomum cuticole* Diesing	*Lepomis auritus*, *Eupomotis pallidus*, *Chænobryttus gulosus*	XLI XLII	6–10 1–5
8	*Distomum tornatum* Rudolphi	*Coryphæna hippurus*	XLII	6–12
9	*ovcatum* Molin	*Pomatomus saltatrix*	XLII	13
10	*rufoviride* Rudolphi	*Roccus lineatus*	XLII XLIII	14 1–4
11	*lævc*, new species	*Macrourus bairdii*	XLIII XLIV	5–8 1
12	*monticellii*, new species	*Remora remora*	XLIV	2–8
13	*grandiporum* Rudolphi	*Anguilla chrysypa*	XLIV	9
14	*auriculatum* Wedl?	*Acipenser rubicundus*	XLV	1–7
15	*veliporum* Creplin?	*Raja lævis*		
16	*macrocotyle* Diesing	*Mola mola*	XLV XLVI	8–10 1–5
17	*graeile* Diesing	*Lepomis auritus*, *Eupomotis pallidus*	XLVI	6–8
18	*lageniforme*, new species	*Remora remora*	XLVII	1, 2
19	*simplex* Rudolphi?	*Microgadus tomcod*, *Hemitripterus americanus*	XLVII	3–7
20	*pallens* Rudolphi	*Alutera schœpfii*	XLVII	8, 9
21	*valdeinflatum* Stossich	*Alutera schœpfii*	XLVII XLVIII	10–14 1, 2
22	*contortum* Rudolphi	*Mola mola*	XLVIII	3–7
23	*nigroflavum* Rudolphi	*Mola mola*	XLVIII XLIX	8–11 1, 2

No.	Parasite.	Host.	Plate.	Figure.
24	*Distomum foliatum*, new species	*Mola mola*	XLIX	3–5
			L	1–3
			LI	1–4
25	*nitens*, new species	*Tylosurus caribbæus*	LI	5, 6
			LII	1
26	*tenue*, new species	*Roccus lineatus*	LII	2–8
27	*tenue tenuissime*, new subspecies.	*Morone americana*	LII	9–12
28	*species*	*Lagocephalus lævigatus*	LIII	1, 2
29	*rachion* Cobbold?	*Gadus callarias*	LIII	3–7
30	*clavatum* Rudolphi	*Xiphias gladius*	LIII	8–11
31	*species* (larva)	*Stizostedion canadense*	LIII	12, 13
			LIV	1
32	*Monostomum orbiculare* Rudolphi	*Lobotes surinamensis*	LIV	2–5

1. NITZSCHIA ELEGANS Baer.

Tristoma elongatum Nitzsch, Dujardin, Hist. Helm., p. 323.—Olsson, Lund's Univ. Årsskrift, IV, p. 17.

Nitzschia elegans Baer, Diesing, Syst. Helm., I, p. 426.—Van Beneden et Hesse, Rech., pp. 67, 68.

Body, reddish: length, 13 to 22.5 mm.; breadth, 4.5 to 7.8; oblong; contracted posteriorly, where there is present a large, almost globular sucker, with a crenulate border; anterior suckers marginal, linear, oblique; mouth triangular.

Found under the opercles and on the gills of the sturgeon.

Three specimens from gills of sturgeon (*Acipenser sturio*); Woods Holl, Massachusetts, August, 1884. Dimensions of alcoholic specimens: Length, 15 mm.; breadth, 3.5 to 5; diameter of posterior sucker, 4.5.

My specimens agree with the above synopsis of specific characters. The border of the posterior sucker is entire when expanded, crenulate when contracted.

2. NITZSCHIA PAPILLOSA, new species.

(Plate XL, figs. 1–6.)

Type.—No. 4874, U.S.N.M.; Woods Holl, Massachusetts, December 15, 1885, and fourteen specimens from cod (*Gadus callarias*) gills(?); Vinal N. Edwards, collector.

These specimens are all small.

These specimens differ from *N. elegans* in their very much smaller size, their papillose head, the absence of a crenulate border on the posterior sucker, and the proportionately more elongated body. They are mostly linear oblong, or narrowly linear lanceolate; body contracted posteriorly in front of a large sucker, which is a nearly circular disk when flattened out, with entire, thin border, radial and circular fibers evident; unarmed. There are no mature ova and the specimens are evidently young. A very long, filiform cirrus, everted, was made out in some instances (Fig. 4).

Dimensions of three alcoholic specimens of Nitzschia papillosa.

Measurements.	No. 1.	No. 2.	No. 3.
	mm.	*mm.*	*mm.*
Length	1.90	1.90	0.98
Diameter of posterior sucker	.45	.45	.23
Diameter in front of sucker	.32	.28	.16
Breadth of body, median	.55	.40	.22
Breadth of body, anterior	.30	.22	.16

3. TRISTOMUM LÆVE Verrill (?).

(Plate XL, figs. 7, 8.)

Tristomum lævе VERRILL, Amer. Jour. Sci., X, p. 40; gills of *Tetrapterus albidus;* Ann. Report, U. S. Fish Com., 1883, fig. 194.

I refer provisionally to this species a single *Tristomum* from the gills of *Gymnosarda pelamys,* taken by the United States Fish Commission schooner *Grampus,* south of Marthas Vineyard, Massachusetts, August 18, 1886. No. 4878, U.S.N.M.

The specimen was associated with numerous oval cysts, 3.5 and 2 mm. in the two principal diameters, in which I was unable to find any parasite.

Dimensions of alcoholic specimens: Length, 4.5 mm.; breadth, 4.75; diameter of posterior sucker, 2.8; transverse diameter of anterior suckers, 1.04; longitudinal diameter of same, 0.65; distance between edges of anterior suckers, 0.28.

Orbicular margin entire or faintly undulating, with a deep, narrow posterior emargination, minutely punctate below; posterior sucker large, prominent, with crenulate border, the seven radii confluent in a rather large central body; anterior suckers squarish oblong, transverse; anterior border of body reflected ventrally between the two anterior suckers.

4. TRISTOMUM COCCINEUM Cuvier.

(Plate XL, fig. 9.)

Tristomum coccineum DIESING, Syst. Helm., I, p. 429.—TASCHENBERG, Abhandl. Naturf. Gesellsch., Halle, XIV, pp. 296–314, pls. I, II, figs. 3–9.—MONTICELLI, Bull. Soc. Nat. Naples, 1st ser., V, p. 123.

From gills of Swordfish (*Xiphias gladius*); off Marthas Vineyard, Massachusetts, July 25, 1887. Thirty-seven specimens. No. 4877, U.S.N.M.

When first removed from the gills of their host they were nearly all vermilion red in color, but the color disappeared when dead—i. e., after a number of hours in water.

Body flattened broadly, and somewhat irregularly ovate, posterior entire, lateral borders crenulate, ventral periphery with low nodular papillæ; each papilla with opaque granules; dorsal surface covered posteriorly with sharp-pointed papillæ, which become scattering toward

the middle of the back and disappear altogether anteriorly except near the margins. Head marked off by two deep notches; squarish or retuse in front, with suborbicular anterior suckers on under side. Mouth between posterior margins of anterior suckers, transversely elliptical, appearing like a transverse slit. Posterior sucker (acetabulum) circular, with crenulate or ruffled membranous border, pedicelled, with seven, symmetrical rays radiating from a central ring, thus making, with the central space, eight loculi.

The marginal papillæ in one specimen were thirty-four in number. The first papilla, anteriorly, had one granule; the next three papillæ had two granules each; the following two papillæ had three granules each; the following nine papillæ had four granules each; the next seventeen papillæ had three granules each; and the last two papillæ had two granules each.

Dimensions of two living specimens of Tristomum coccineum.

Measurements.	No. 1.	No. 2.
	mm.	*mm.*
Length	15.0	16.0
Greatest breadth	10.0	14.0
Breadth at anterior end	7.0	8.0
Breadth opposite posterior sucker	6.0	11.5
Diameter of an anterior sucker	1.5	2.0
Diameter of posterior sucker	2.5	3.5
Breadth of head, projecting between anterior suckers	1.5	2.5

5. TRISTOMUM RUDOLPHIANUM Diesing.

Tristomum coccineum RUDOLPHI, Dujardin, Hist. Helm., p. 322.
Tristomum rudolphianum DIESING, Syst. Helm., I, p. 429.

Body flattened, suborbicular posteriorly emarginate, minutely pitted beneath. Anterior bothria suborbicular. Acetabulum (posterior sucker) with a plicate membranaceous border; length, 18 to 22 mm.

On *Mola mola;* Woods Holl, Massachusetts, July 13, 1881. Nineteen specimens. No. 4879, U.S.N.M.

Dimensions of two alcoholic specimens of Tristomum rudolphianum.

Measurements.	No. 1.	No. 2.
	mm.	*mm.*
Length	18.0	14.0
Breadth	19.0	14.0
Diameter of acetabulum	10.0	6.5
Diameter of anterior sucker	1.7	1.2

One specimen was 12.5 mm. in length and 14 in breadth; another was 14.5 in length and 12.5 in breadth. They are mostly orbicular, but the ratio of length to breadth varies with the state of contraction.

The specimens agree with the descriptions of this species given by Diesing and Dujardin. The plicated ruffle-like margin of the acetabulum is about 1 mm. deep. The posterior emargination is as much as 4.5 mm. deep.

6. OCTOPLECTANUM AFFINE, new species.

(Plates XL, figs. 10-13; XLI, figs 1-5.)

Body variable-spatulate in outline, consisting of three portions, an anterior broad appressed portion which may be round or long, oval, lanceolate, or even linear in outline, according to state of contraction; a median slender cylindrical portion of variable relative length, and a posterior palmate or rosette-like portion consisting of an elongated tubular enlargement of the posterior end of the slender middle portion, bearing eight digitate appendages, each consisting of a flexible pedicel surmounted by a flat, cup-shaped disk which is divided into four loculi and armed with a complicated set of chitinous bodies. The outer pair of loculi with fine parallel costæ; one of the others with an elevated, circular, muscular border. Anterior end broadly rounded, with two transversely elliptical suckers placed on either side of mouth and a little posterior to the mouth. The mouth is also transversely elliptical (in alcoholic specimens) and is, in life, subterminal and circular; reproductive aperture on median line a short distance back of mouth; cirrus armed with a circle of bifurcate hooks, fifteen in number. Ground color pale, very faintly tinged with yellowish-green, densely reticulated, with brown pigment spots; bothria transparent, bluish in reflected light, greenish-yellow in transmitted light; rosette and slender portion a dirty yellowish-green. Length of longest living specimen observed 28 mm. One alcoholic specimen with exceedingly long attenuated middle portion measured about 40 mm. in length.

Type.—No. 4876, U.S.N.M. Six specimens from mouth of common flounder (*Paralichthys dentatus*); Woods Holl, Massachusetts, September 2, 1887. Also two lots in United States National Museum collection (No. 4875), August 8, 1883; two perfect specimens and one fragment (No. 4875), one perfect specimen and one fragment; both lots from common flounder; Woods Holl, Massachusetts (Vineyard Sound), United States Fish Commission; R. S. Tarr, collector. This worm is very variable in life, but the alcoholic specimens are of rather uniform shape. Following are dimensions of a specimen preserved in glycerin: Length, 12 mm.; breadth (transverse diameter) of one of anterior suckers, 0.134; length of pharynx, 0.216; diameter of pharynx, 0.125; diameter of mouth, 0.086; diameter of circle of hooks of reproductive apparatus, 0.576; length of one of these hooks, 0.024.

Following is an abstract of notes made at time of collecting:

The pedicels are very changeable, becoming short, conical, and transversely wrinkled when contracted or, when elongated, slender and smooth, and capitate, the terminal organ (plectanum) not appearing to be susceptible of much diversity of form. My notes on the plectana of living specimens mention a character which does not appear in the one studied as an alcoholic specimen which is shown in Plate XLI, fig. 2. The difference is that instead of the two crescentic chitinous bodies,

which make the outer boundaries of the two outer sectors of the plectanum, there are four, each of the outer quarter circles being interrupted in the middle, so that the chitinous circumference is divided into six instead of four parts. Outside of the supporting ring there is a thin, transparent membrane which projects a little way in front and is entire in outline. The fine, parallel costæ which cover the surface of the two outer sectors (Plates XL, fig. 11; XLI, fig. 2) are of two kinds, long and short. The former cover the greater part of the surface and extend from the rib which separates the pair of outer sectors, while the short costæ extend from the ribs which separate the outer pair from the inner pair of sectors.

A large specimen had in life the following dimensions: Length, 28 mm. in repose, shortening to 20, lengthening proportionally; greatest breadth, 3.5; diameter of slender portion, 0.8; length of slender portion, 7; diameter of rosette, 3.5; length of pedicels, 1.4; diameter of pedicels, 0.6; diameter of mouth, 0.19; diameter of anterior suckers, 0.15. The slender portion was tubular, slightly appressed, and transversely wrinkled. It was not observed to change much in shape in any of the specimens except the smallest. A large specimen was observed to vary in length from 6 to 14 mm. The reproductive aperture as seen in a large living specimen was about the middle of the flat dilatable portion of the body and was apparently oblique.

In one specimen the digestive system was filled with the blood of its host. This was driven backward and forward by alternate contractions and dilations, making a kind of peristaltic motion. In the narrow middle portion the digestive system is reduced to two longitudinal channels which divide on the upper side of the rosette into a number of small branches, which supply the eight bothria. Under high power branches of uterus seen filling dilated part of body and filled with ova. Circulation observed in two large much-branching longitudinal channels and along each side, at least along dilated portion.

Mr. Tarr makes the following color note on one of his specimens: "The flat portion is minutely dotted with light reddish-brown dots, while the narrow part is white and the suckers flesh-colored."

The hooks seen in the genital aperture are arranged in a circle and at first were thought to be arranged in pairs. Subsequent study of them resulted in demonstrating the supposed pairs of hooks to be in reality single bifurcate hooks (Plate XL, fig. 12); of these there appear to be about fifteen. The ova are fusiform, with very long attenuated ends. The specimens which were sectioned did not have mature ova, but in those convolutions of the oviduct which were most remote from the germarium the characteristic shape of the mature ova was faintly foreshadowed in the developing ova.

The species is near *O. palmatum* Leuckart, in general appearance also resembles *O. lanceolatum* Leuckart, the hooks of the latter as figured by Dujardin bear a close superficial resemblance to those of *O. affine*. The fusiform ova resemble those of *O. denticulatum* Olsson.

7. DIPLOSTOMUM CUTICOLA Diesing.

(Plates XLI, figs. 6–10; XLII, figs. 1–5.)

Diplostomum cuticola DIESING, Syst. Helm., I, p. 306; Revis. d. Myzhelm, pp. 317–318; Archives de Medicine comparée, I, pp. 108–111, pl. IV, figs. 1, 2, 5.—LEIDY, Proc. Acad. Phil., VIII (1856), p. 45.

Body divided into two parts, anterior elongated, elliptical thin, excavated below, obtusely angular in front, much longer than posterior part, which is ovoid or ellipsoidal, with a terminal excretory pore. Anterior sucker small oval, with a cleft-like longitudinal aperture; pharynx oval; ventral sucker median, about posterior third of anterior excavated part, round, with varying aperture. Generative apertures, like a second ventral sucker in superficial appearance, behind ventral sucker. Known only in larval state, in which it exists in capsules under skin and especially under serous membrane of various fresh-water fishes.

I have two lots of these parasites, the first belongs to the National Museum collection (No. 4843) from *Lepomis auritus;* the second sent to me by Mr. N. A. Harvey, Kansas City, Missouri, January, 1894, from *Eupomotis pallidus* and *Chænobryttus gulosus.* (Nos. 4842, 4844, U.S.N.M.)

Mr. Harvey's collections consisted of the hearts and livers of several fish, whose serous coats were thickly studded with these parasites.

One of these larvæ removed from its cyst was measured with the following result: Length, 1.09 mm.; greatest breadth, 0.37; length of oral sucker, 0.07; breadth of oral sucker, 0.05; length of pharynx, 0.04; breadth of pharynx, 0.03; diameter of ventral sucker, 0.07.

There were also some exceedingly minute cysts on the bulbus arteriosus of one of the specimens, which appear to be younger specimens of this same trematode.

The National Museum specimens are also cysts or capsules on and about the heart. They are very numerous and in size vary from minute specks to capsules over 1 mm. in diameter.

The dimensions of the larval worms do not differ materially from those given above Most of the capsules are ellipsoidal and are usually fastened to the peritoneum by a slender pedicel. The specimens in Mr. Harvey's collection were found lying in capsules which were closely attached to the serous coat of the heart and liver.

The final host of this parasite is not known. It is probably some piscivorous bird.

8. DISTOMUM TORNATUM Rudolphi.

(Plate XLII, figs. 6–12.)

Distomum tornatum DUJARDIN, Hist. Nat. d. Helm., 1845, p. 421.—DIESING, Syst. Helm., I, 1850, p. 372.—COBBOLD, Synops. Dist., 1859, p. 28.—WAGENER, Arch. f. Naturg., XXVI, 1860, p. 176, pl. VIII, figs. 1–5.—STOSSICH, Dist. d. Pesc., 1886, p. 12.

Body unarmed, slender, whitish with the internal organs showing opaque white, yellow, or brown through the semi-transparent integument, which, in these specimens, is crossed with fine transverse lines.

Length up to 15 mm. [Rudolphi]. Anterior part cylindrical, obtuse in front truncated behind where an appendage with irregular, sometimes almost moniliform outline is protruded or retracted by invagination. The anterior sucker is directed downward; the ventral sucker is globular and prominent. The distance between the suckers may be but little more than the diameter of the ventral sucker. Space between the suckers much swollen in the vicinity of the genital orifices. The receptacle of the cirrus ends in a muscular sheath which is thickened and transversely striated. Testes globular, situated in front of the folds of the oviduct; ova very small and elliptical. No. 4868, U.S.N.M.

The above description, with which my specimens agree, is adapted from Dujardin.

Two individuals were obtained from the peritoneum of *Coryphæna hippurus*, 13.75 mm. and 8 in length, respectively. The oral sucker of the larger was 0.56 in diameter; the ventral sucker of the same was 0.65 in diameter, somewhat distorted by compression. Longer diameter of ova, 0.022; shorter diameter, 0.014.

The ova in the preserved specimens are amber yellow; in the fresh specimens they appear greenish, the vitellaria were brown while the general color of the worm was whitish.

Found in *Coryphæna hippurus*, Gulf Stream, August 13, 1885.

Among the National Museum entozoa sent to me for identification is a lot of distoma belonging to *D. tornatum;* also from the dolphin (*Coryphæna hippurus*). No. 4868, U.S.N.M. These were collected in 1883, by the United States Fish Commission steamer *Albatross.*

The longest of these specimens measured 9.5 mm., the shortest, 3.25 in length. Diameter of anterior sucker in one of largest specimens. 0.3; of ventral sucker, 0.5; length of pharynx, 0.15; and greatest diameter of body, at ventral sucker, 0.7. Long diameter of ova, 0.02; short diameter, 0.01. The body is transversely wrinkled, producing a serrate outline, best seen on dorsal surface. The cirrus, which was retracted in all my specimens, was seen, in sections, to be covered with minute papillæ. This agrees with description of *D. tornatum* given by Stossich.

9. DISTOMUM OCREATUM Molin.

(Plate XLII, fig. 13.)

Distomum ocreatum Olsson, Lund's Univ. Årsskrift, IV, p. 48, pl. v, figs. 96–98.—Stossich, Dist. d. Pesc., p. 12.

A single specimen, described below, agrees closely with Olsson's figures and description of *D. ocreatum* Molin, which species he, as I understand him, regards as a different species from *D. ocreatum* Rudolphi. The specimen does not agree with Monticelli's figures of *Apoblema ocreatum* Rudolphi,[1] nor with Molin's figures of *D. ocreatum* Rudolphi.[2] Von Linstow[3] refers *D. ocreatum* to *D. ventricosum.*

[1] Acad. Sci. Torino, XXVI, 1891.

[2] Denkschr. Wien, Akad., XIX, 1861, p. 209, pl. III, fig. 7.

[3] Compend., p. 269.

There is obviously a confusion of terms here, but I have not felt justified in referring this specimen to a new species.

No. 4859, U.S.N.M.

Body terete, elongated, transversely plicate; tail shorter, retractile. Acetabulum sessile, prominent, rather large, equaling the anterior sucker, or larger. Mouth subterminal, contiguous to pharynx. Œsophagus, none. Vitelline glands two, large, juxtaposed, one nearly simple, the other trilobed. Ovary globose, median, near anterior margins of vitellaria. Uterus not descending into the caudal appendage. Testes two, globose or elliptical, median, transversely oblique, each somewhat less than the ovary. Bursa of penis ovate, situated at the right-hand anterior margin of the acetabulum. Genital aperture almost in the middle of the neck. Cirrus thick, curved, beset with minute papillæ. Excretory vessel median, forked near testes, with branches confluent between mouth and pharynx; vesicle and foramen at apex of caudal appendage. Length $\frac{2}{3}$ to 5 mm. [Olsson.]

The following dimensions are of living specimens, side view, slightly flattened: Length, 3.20 mm.; breadth, anterior, 0.20; breadth, median, 0.42; breadth, posterior, 0.20; diameter of oral sucker, 0.20; diameter of ventral sucker, 0.20; distance between suckers, variable, 0.20; length of ova, 0.025; breadth of ova, 0.014.

The color was bluish-white with a golden-yellow center, due to the voluminous uterus filled with yellow ova.

Found in intestine of *Pomatomus saltatrix*. One specimen, Woods Holl, Massachusetts, July 9, 1887.

10. DISTOMUM RUFOVIRIDE Rudolphi.

(Plates XLII, fig. 14; XLIII, figs. 1–4.)

Distomum rufoviride Dujardin, Hist. Nat. d. Helm., 1845, p. 421.—Diesing, Syst. Helm., I, 1850, p. 372.—Molin, Sitzungsb. Wiener Akad., XXXVII, 1859, p. 844.—Cobbold, Synops. Distom., 1859, p. 22.—Wagener, Arch. f. Naturg., XXVI, 1860, p. 178, pl. VIII, figs. 6–10.—Molin, Denkschr, Wiener Akad., XIX, 1861, p. 205, pl. II, figs. 1, 2, 4, 5.—Olsson, Entozoa Skandin. Hafsfisk., III, 1868, p. 49; Bidr. till. Skandin, Helminthfauna, I, 1876, p. 20.—Stossich, Bull. Soc. Adriat. Trieste, VIII, 1883, p. 115.—Carus, Prodr. Faunæ Mediterr., I, 1884, p. 125.—Stossich, Bull. Soc. Adriat. Trieste, IX, 1885, p. 159.—Prenant, Recherches sur les Vers Parasites, Nancy, 1885, p. 19, pl. II, figs. 1–5.—Stossich, Dist. d. Pesc. Trieste, 1885, p. 13.—Sonsino, Estr. d. Pr. d. Soc. Tosc. d. Sci. Nat., 1890, p. 11.

I add the following synonymy on the authority of Stossich:

Distomum caudiporum Dujardin, Hist. Nat. d. Helm., p. 422.—Diesing, Syst. Helm., I, p. 342.—Cobbold, Synops. Distom., 1859, p. 22.—Wagener, Arch. f. Naturg., XXVI, p. 181.

Body unarmed, cylindrical, thick, subattenuate at the two extremities, more at posterior than anterior; neck more slender than body, excavate below; tail short and retractile; ventral sucker twice the size of the oral, globose or hemispherical, at the base of the neck.

Mouth subterminal, globose, the anterior lip prominent, and œsophagus very short, intestinal crura not extending to the caudal appendage.

Testes two at each side near the ventral sucker and behind it. Seminal vesicle large, ovate, on the left side; vitellaria voluminous tubular, mainly on left side; genital aperture behind oral sucker.

No. 4862, U.S.N.M. I have referred a lot of *Distoma*, from the striped bass (*Roccus lineatus*), containing seven specimens, to this species, although they fail to agree with the published descriptions of the species in all particulars. The specimens were studied only in their alcoholic condition, and since the very considerable contortions of the body which they assumed and retained in the preserving fluids make a comparison with descriptions difficult, and since they present so many characters which belong to *D. rufoviride*, I have thought it best to refer them to that species.

The points of disagreement are: The pharynx can not be characterized as "elongated," and although contiguous with the oral sucker is not "partly included in the oral cavity." The seminal vesicle is not situated "next the anterior margin of the acetabulum," but in the sectioned specimens does not extend quite so far forward as the anterior edge, while it extended posteriorly some distance beyond the posterior edge of the ventral sucker. The vitelline glands were exclusively on the left side of the body. The genital aperture instead of being in the "middle of the neck," was immediately behind the oral aperture.

The length agrees with Olsson's observations, and in life may exceed that, in which case it would come within the limits of the species i. e. 5–9 mm. (Stossich.)

Found in intestine of *Roccus lineatus;* Woods Holl, Massachusetts, September, 1884.

No notes were made at the time of collecting. The length of the longest (alcoholic) specimen is 5 mm., that of the shortest, 2.5; diameter of largest, maximum, 2. The bodies are variously contorted, but usually thickest about the middle of the body.

The following dimensions were obtained from measurements of sections which passed somewhat diagonally through the various organs, and are therefore not exact as longitudinal and transverse diameters: Length of oral sucker, 0.23 mm.; breadth, 0.20; length of pharynx, 0.14; breadth, 0.14; diameter of ventral sucker, 0.53; length of seminal receptacle, 0.62; breadth, 0.33; long diameter of ova, 0.021; short diameter, 0.12.

The ovary, 0.43 mm. in the greatest diameter noticed in sections, lies behind the testes, with the shell gland beside it (Plate XLIII, fig. 2). The vitellaria are tubular and lie behind the testes mainly on the left side; they are stained red in my carmine-stained sections, and thus differ from the corresponding organs in most of my other distoma sections, where the vitellaria are, as a rule, reddish-brown with carmine stain. Behind the ovary the body is to a great extent filled with the folds

of the uterus crowded with ova. Folds of the uterus also extend forward, lying dorsal to the ventral sucker. The anterior end of the uterus passes above the ventral sucker accompanying the vas deferens, but lying ventral to it, along the dorsal region of the neck, and opens with the vas deferens at the base of the cirrus behind the oral sucker. The vas deferens is surrounded by a prostate gland throughout its length (Plate XLIII, fig. 4).

The intestinal crura are distinct, with rather strong walls. They extend to near the posterior end of the body, although not as far as the very short retractile portion.

The excretory vessel was seen only near the caudal extremity, where it communicates as a simple vessel with the terminal pore.

11. DISTOMUM LAEVE, new species.

(Plates XLIII, figs. 5–8; XLIV, fig. 1.)

From *Macrourus bairdii*, United States Fish Commission Station 894. Twelve specimens 1.5 to 3.5 mm. in length.

Body roundish, elongated, attenuate both anteriorily and posteriorly from near middle of length, somewhat fusiform, smooth, with an attenuated retractile caudal appendage. Neck short, conical; ventral sucker much larger than oral, aperture nearly circular; mouth subterminal, aperture longitudinal; œsophagus, none; pharnyx, ellipsoidal; intestinal crura capacious, not extending into tail; cirrus bulb pyriform in front of ventral sucker; genital aperture near posterior end of pharynx. Vitelline glands two, dark-brown, conspicuous, subglobular, situated near or a little back of middle of post-acetabular region; ovary placed transversely immediately in front of vitellaria, and touching both. Testes, two, subglobular, lying side by side transversely in contact with posterior wall of ventral sucker. Anterior seminal vessel on dorsal side of ventral sucker, a posterior seminal vessel immediately behind vitellaria. Uterus long, convoluted, occupying much of the body cavity from ventral sucker to and even back of vitelline glands, filled with small elliptical ova, 0.026 and 0.012 mm. in the two principal diameters. Excretory vessel median, from posterior end, where it communicates with a large terminal vessel, to ventral sucker, where it divides into two branches, which pass forward and unite on the dorsal side of the pharynx. The excretory vessel is filled with minute granules, which appeared white in a specimen cleared up in oil of cloves and seen under reflected light.

The body wall, particularly on the neck where least obscured by the internal organs, shows beautiful longitudinal and transverse striæ when highly magnified. These striæ are about 0.002 mm. apart.

One specimen was seen which was irregularly crossed by transverse wrinkles in the middle region of the body. Others were entirely smooth.

Dimensions of a typical specimen follow: Length, 3.5 mm.; longitudinal diameter of oral sucker, 0.13; transverse diameter of same, 0.11;

longitudinal diameter of ventral sucker, 0.31; transverse diameter of same, 0.27; length of œsophagus, 0.09; diameter of œsophagus, 0.08; distance between suckers, 0.3; length of cirrus bulb, 0.19; diameter of cirrus bulb, 0.14; genital aperture, 0.16 in front of ventral sucker.

This species is near *D. appendiculatum*.

Type.—No. 4852, U.S.N.M.

12. DISTOMUM MONTICELLII, new species.

(Plate XLIV, figs. 2–8.)

Body slender, cylindrical, attenuate both posteriorly and anteriorly, but most in front, from region of ventral sucker; unarmed, often with fine transverse rugæ; tail retractile. Neck very versatile in life, sometimes elongated, linear, at others contracted until the two suckers are close together, frequently in alcoholic specimens sharply curved ventrally in form of a hook. Vitelline glands, a tubular-lobed body situated behind the ovary well toward the posterior end. Ovary globular, contiguous with vitelline gland. Testes, two, globular, placed close together obliquely about halfway between ventral sucker and ovary. Uterus long, its folds lying both dorsally and ventrally between testes and vitelline glands and extending forward dorsally to the genital aperture a short distance in front of ventral sucker, and posteriorly to or even behind vitelline gland filled with ova. Cirrus bulb and seminal receptacle at base of neck, dorsally placed, whence by contraction or compression they may be forced either to the right or the left of the ventral sucker. Crura of intestine long. Ventral sucker very prominent, much larger than oral sucker, aperture circular, with perforate contractile velum. Aperture of oral sucker oval, transverse in life, longitudinal in death. Oral sucker contiguous with pharynx, i. e., œsophagus practically none. Excretory vessel proceeding from the vicinity of the œsophagus in two branches which pass on either side of the ventral sucker, uniting behind that organ about halfway between it and the anterior testes, thence proceeding to the posterior end of the body. Length, 5.5 mm.

Types.—Nos. 4855, 4856, U.S.N.M.

I have found this parasite in the stomach of the sucker (*Remora remora*) at four different times, namely, August 1, 6, 10, 1887, and July 22, 1889, Woods Holl, Massachusetts. One fish was examined each time except the last, when two were examined. Numerous specimens of this worm were found in each fish, with one exception. One of the two examined in 1889 had no parasites.

The anatomy of this species bears a very close resemblance to Monticelli's[1] *Apoblema stossichii*, about the only material difference being the position of the cirrus bulb and seminal vesicle, which in *A. stossichii* is behind the ventral sucker. The caudal appendage in *A. stossichii*

[1] Atti della R. Accademia delle Scienze de Torino, XXVI.

is very short, while that of *D. monticellii* is moderately large. It is invaginated in most of my specimens, and furnishes a point of resemblance to *D. appendiculatum*. The body of *D. monticellii* is nearly smooth, fine transverse rugæ only being revealed under high magnification, while both *D. appendiculatum* and *A. stossichii* are transversely plicate.[1]

I append a few notes made at the time of collecting. The worms when first removed from their host and placed in sea water were quite active. The anterior part of the body could be elongated until the attenuated neck was equal in length to one-third the body. The distance between the suckers when at rest being about 0.5 mm., increased to over 1 mm. Dimensions of a typical living specimen: Length, 5.4 mm.; greatest diameter, 1 mm.; diameter of oral sucker, 0.1 mm; diameter of ventral sucker, 0.54 mm.

The color of some of the organs is quite different when seen by transmitted light from what it is under reflected light. One specimen presented the following colors: Oral sucker dull reddish-brown, afterwards yellow; ventral sucker light yellowish-brown, with reflected light golden yellow, with reddish-brown center; intestine grayish, faint purple with reflected light; seminal receptacle and cirrus pouch pale reddish-brown, light purple with reflected light; testes reddish-brown, dark purple with reflected light; uterus with ova golden yellow; ground color of body pale yellow, with faint reddish-brown tinge in the membranous mass at the posterior end of the body; excretory vessel dark brown, bright green by reflected light.

Another specimen which had been lying in sea water for a number of hours had a transparent bluish-white ground color, the uterus with ova was a beautiful golden yellow, the testes, suckers, pharynx, crura of intestine, cirrus pouch and terminal portion (invaginated ?) a little opaque; vitelline glands and excretory vessel dead opaque white.

Crura of intestines large, inflated, pulsating in life, sometimes so much inflated as to fill the body cavity back of vitelline glands. Posterior end of body usually occupied by an invaginated portion of the tail.

The ova in life measured 0.025 and 0.014 mm. in the two principal diameters; in alcoholic specimens, 0.018 and 0.011 mm. in the two diameters.

In alcoholic specimens the neck is short, conical, and curved ventrally. The ventral sucker is three times the diameter of the oral sucker. The body is of nearly uniform diameter from the ventral sucker to about the posterior third, whence it tapers gradually to the posterior end, which is truncate, the posterior end being, as a rule, invaginated. It was invaginated in all the fresh specimens examined.

The dimensions of an alcoholic specimen follow: Length, 5.12 mm.; diameter of oral sucker, 0.18 mm.; diameter of ventral sucker, 0.56

[1] Monticelli erects Dujardin's subgenus *Apoblema* into a genus.

mm.; distance between suckers, 1 mm.; diameter of pharynx, 0.1 mm.; maximum diameter of body, 0.75 mm.

In a living specimen, dorsal view, a small organ just behind the ovary was seen, in which there was active ciliary motion. The position of the organ would indicate that it is the shell gland.

The specimens were found in the stomach of their host in each case. In one instance a few specimens were also found in the gills of their host.

While the worms were active the pharynx could be seen expanding and contracting almost rhythmically and the fluid contents of the two branches of the alimentary tract was kept in motion by a kind of peristaltic action of their walls.

13. DISTOMUM GRANDIPORUM Rudolphi.

(Plate XLIV, fig. 9.)

Distomum grandiporum DIESING, Syst. Helm., I, 1850, p. 371.—MOLIN, Sitzungsb. Wiener Akad., XXXVII, 1859, p. 826, pl. II, fig. 5.—COBBOLD, Synops. Distom., 1859, p. 23.—OLSSON, Bidrag t. Skand. Helminthf., 1876, p. 20.—STOSSICH, Dist. d. Pesc., 1886, p. 14.

I refer to this species a single specimen (No. 5505, U.S.N.M.) from the stomach of the common eel.

The specimen is adult, and the very voluminous folds of the uterus are so crowded with ova that the other organs are thereby to a great extent obscured. Fig. 9 is from a sketch of the specimen much distorted by compression.

The following synopsis of the species is compiled from the synopses as given by Olsson and Stossich.

Body unarmed, terete oblong (when the tail is retracted), neck somewhat attenuate, excavate beneath. Ventral sucker larger than oral sucker (almost four times as large, *Stossich*) at base of neck, spherical, sessile, and prominent. Mouth subterminal, semiglobose. Pharynx contiguous with oral sucker; œsophagus none; intestinal branches narrow, extending to base of appendix (almost to apex of appendix, *Stossich*). Testes two, globose at each side behind the ventral sucker. (Each smaller than ovary, *Olsson*.) Seminal vesicle large, ovate, a little in front of the ventral sucker. Cirrus short, cylindrical, smooth. Vitellaria two, large, near together, immediately behind the ovary. Ovary large, globose, posterior. Uterus ample, gyri between testes and ovary, ova yellow. Male genital aperture in front of female in middle of neck. Length, 2–6 mm.

On account of the enormous development of the uterine folds and the lack of material for sectioning, the verification of all the above-named specific characters is not possible. The resemblance seems to be near enough, however, to make this identification probable. The dimensions of my specimens are: Length, 5.50 mm.; diameter of oral sucker, 0.26;

diameter of ventral sucker, 0.69; long diameter of ova, 0.017; short diameter of ova, 0.009.

Found in stomach of *Anguilla chrysypa:* Woods Holl, Massachusetts, September 2, 1885.

14. DISTOMUM AURICULATUM Wedl (?).

(Plate XLV, figs. 1–7.)

Distomum auriculatum WEDL, Sitzungsb. d. Kais. Akad., XXVI, 1857, p. 242, Pt. 4, pl. 1, fig. 2.—DIESING, Revis. d. Myzhelm, p. 343.—STOSSICH, Dist. d. Pesc., p. 18.

I refer these *Distoma* provisionally to *D. auriculatum.*

Body short, linear or lance-linear, flattened; posteriorly subattenuate, anteriorly broadly rounded; mouth subterminal, large, overlapped in front by two auricular flaps symmetrically placed and each prolonged laterally like a conical papilla; four other papillæ on head, one on each side and two dorso-lateral, making, with the tips of the auricular flaps, six wartlike papillæ in all. Ventral sucker about central, smaller than the oral sucker. Œsophagus none, pharynx ellipsoidal. Vitellaria voluminous, mainly lateral, extending from posterior end on each side nearly to the head. Ova rather large in a mass behind ventral sucker. Testes about midway between posterior edge of ventral sucker and posterior end of body. Cirrus pouch in front of ventral sucker, reproductive aperture halfway between suckers. The five specimens were 2.20, 1.91, 1.90, and 1.70 mm., respectively, in length.

The dimensions of the larger specimen are here given: Length, 2.2 mm.; breadth of head, 0.5; breadth of neck, 0.41; breadth of body, 0.6; longitudinal diameter of oral sucker, 0.42; transverse diameter of the same, 0.46; longitudinal diameter of ventral sucker, 0.28; transverse diameter of same, 0.32; length of pharynx, 0.16; diameter of pharynx, 0.11. Ova, 0.07 and 0.04 mm. in two principal diameters.

The apertures of the oral and ventral suckers in these (alcoholic) specimens are subcircular.

The ovary is situated on the right side and a little way back of the ventral sucker. The intestinal crura are rather small. The excretory vessel was first seen in serial sections as a single, dorsal, thin-walled vessel in the vicinity of the testes (Fig. 5). Behind the termination of the intestinal crura its walls become a little thicker and somewhat folded (Fig. 6). At the terminal pore the walls are thick and globular (Fig. 7).

Five specimens (No. 4845, U.S.N.M.) from intestine of the lake sturgeon (*Acipenser rubicundus*); J. W. Milner, collector.

15. DISTOMUM VELIPORUM Creplin (?).

Distomum veliporum DIESING, Syst. Helm., I, p. 347.—OLSSON, Lund's Univ. Årsskrift, IV, pp. 22–24; Bidrag., p. 13.

One specimen, a fragment, the posterior part of a distomum broken in two immediately in front of ventral sucker, agrees pretty well with

descriptions of the above species. Dimensions: Length, 20 mm.; breadth at ventral sucker, 3; thickness at ventral sucker, 2.75; maximum breadth, 3.2; diameter near posterior end, 1.5; longitudinal diameter of aperture of ventral sucker, 1.4; transverse diameter of same, 0.8.

Body elongated sublinear, depressed unarmed, transversely rugose, posteriorly attenuate. The neck had evidently been reflected dorsally nearly at right angles to body.

For about 6.5 mm. back of the ventral sucker the body was filled with the voluminous folds of the uterus, the latter crowded with ova.

Long diameter of ova, 0.076 mm.; short diameter, 0.052.

Fragment of large distomum from stomach of barndoor skate (*Raja lævis*). No. 4870, U.S.N.M.; Woods Holl, Massachusetts, November 4, 1887; Vinal N. Edwards, collector.

16. DISTOMUM MACROCOTYLE Diesing.

(Plates XLV, figs. 8–10; XLVI, figs. 1–5.)

Distomum macrocotyle Diesing, Revis d. Myzhelm, p. 342.—Olsson, Lund's Univ. Årsskrift, IV, p. 24, pl. v, figs. 100, 101.—Stossich, Dist. d. Pesc., p. 20.—Monticelli, Nat. Sicil. An., XII, 1893, p. 10 (extract).

Body unarmed, round, straightish, attenuate both posteriorly and anteriorly, linear-fusiform. Neck slender-conical, reflexed, sometimes arched. Mouth subterminal, aperture transverse, in alcoholic specimens, said to be circular in life. Ventral sucker very prominent, globose, sessile twice the diameter of the oral sucker, aperture longitudinally elliptical in alcohol, circular in life. Genital aperture in anterior part of neck near oral sucker. Testes two, large, behind ventral sucker, ventrally placed. Ovary about the middle of the post acetabular region of the body. Greater part of body filled with the folds of the uterus, which are crowded with small ova.

Sixteen of these worms (No. 4854, U.S.N.M.) were found in a lot of *Distoma* from the intestine of *Mola mola*, off Marthas Vineyard, Massachusetts, September 10, 1886; Vinal N. Edwards, collector.

Fig. 9 was made from the inner aspect of the left half of a specimen which had been split in two longitudinally. It reveals many folds of the uterus, both dorsally and ventrally placed, with an anterior prolongation dorsal in the neck. Some folds of the vas deferens are seen lying above the ventral sucker. The vitellaria are axially situated, extending from the ventral sucker to about the posterior fifth. The cirrus bulb is seen lying close behind the oral sucker.

One of the larger specimens yielded the following measurements: Length, 14 mm.; maximum diameter of body, 1.7; diameter of neck, 0.88; distance between suckers, 1.7; diameter of ventral sucker, 1.4; diameter of oral sucker, 0.65; transverse diameter of oral aperture, 0.35; longitudinal diameter of oral aperture, 0.11.

The ova measure 0.026 and 0.017 mm. in the two principal diameters.

Transverse and longitudinal series of sections were prepared and

compared with similar series of *D. nigroflavum* and *D. foliatum*. The vitellaria were found to be most strongly developed above and in front of the ventral sucker, extending through the neck dorsally and axially nearly as far as the oral sucker, sparsely scattered through the body as far back as the ovary. Doubtless in younger specimens the vitellaria are more conspicuous organs than in the sectioned individuals, the larger part of whose bodies was filled with ripe ova. The testes lie close together, one immediately following the other, the anterior one a little toward the left, the posterior one a little toward the right side of the body, and the former close behind the ventral sucker. They are ventrally placed and oval in shape. The anterior 1.07 and the posterior 1.04 mm. in length. The seminal receptacle lies in voluminous folds above and in front of the ventral sucker. The vas deferens traverses a large prostate gland and ends in a relatively small cirrus immediately behind the oral sucker. At the base of the cirrus the vas deferens is joined by the uterus, which traverses the ventral region of the neck. The ovary is subglobular in shape, about 0.84 mm. in diameter, lies about the middle of the post acetabular region; on its anterior border, and lying toward the right side of the body is the shell gland (0.37 mm. in diameter), not shown in fig. 9, which was made from the left side. The posterior part of the body in the sections is filled with the voluminous folds of the uterus, which are crowded with ova. The characteristic rami of the longitudinal vessels of the body proper, as well as those of the neck, are shown in Plates XLV, fig. 10; XLVI, fig. 1.

The vessels are peculiar in being variously branched. They are filled with finely granular material, as is the case in *D. nigroflavum* and *D. foliatum*. A few minute tetragonal crystals were observed in the contents of these vessels. The branching vessels of the posterior part of the body appear to communicate with a common posterior sinus which opens to the exterior by a terminal pore. I was unable in my sections to demonstrate any communication between these vessels and the pharynx. They certainly have their origin in front of that organ. They agree in structure with intestinal crura, but otherwise resemble excretory vessels.

17. DISTOMUM GRACILE Diesing.

(Plate XLVI, figs. 6–8.)

Clinostomum gracile Leidy, Proc. Acad. Phil., VIII (1856), p. 45.

Distomum gracile Diesing, Revis. d. Myzhelm, p. 336.—Wright, Contrib. to Amer. Helm., pp. 9, 10.

Body oblong-elliptical, in dorsal or ventral view, with slight constriction opposite ventral sucker, compressed; neck short, convex above, concave below. Head obliquely truncate, oral sucker situated at the bottom of a shallow depression and surrounded in front by a prominent border, from which a lip-like projection extends back over the anterior edge of the sucker; aperture of oral sucker circular; œsophagus none, pharynx oval. Ventral sucker globular, much larger than oral sucker,

with triangular aperture. Crura of intestines voluminous, sacculated, much inflated posteriorly. Testes two oblong masses placed transversely about midway between the ventral sucker and the posterior end, and separated from each other by what I take to be the rudimentary ovary, a portion of the seminiferous vessels and some of the uterine folds. What appears to be the cirrus pouch lies immediately in front of the anterior testes and a little to the right. A median vessel, with walls of cuboid nucleated cells, which appears to be an anterior prolongation of the developing uterus, lies along the median line from near the orifice of the cirrus pouch nearly to the ventral sucker. It receives a tube of similar appearance and histological structure, which originates between the testes and passes around the left end of the anterior testes. The vitellaria are indicated by granular clusters, which extend from the posterior end nearly to the ventral sucker.

These specimens, at least the one figured (Fig. 6), upon which the above description is based, appear to be further developed than Wright's specimens and confirm his conjecture as to the probable adult form of this species. The disposition of the reproductive organs here made out for *Distomum gracile* leaves little doubt that it is very closely related to *Distomum heterostomum*. Wright[1] describes and figures a distomum which he refers provisionally to *D. heterostomum* Rudolphi, and which he has found in the mouth of the American bittern (*Botaurus minor* Gmelin), that may indeed be the adult form of *D. gracile*.

I have found five specimens of the above *Distomum* in the National Museum collection (No. 4851, U.S.N.M.). The vial contained pieces of liver of the host *Lepomis auritus*, with numerous small, encapsuled trematodes (*Diplostomum cuticole*), and one leech (*Ichthyobdella* sp.). Three of the examples were encapsuled and two free. The encapsuled specimens were folded with the ventral surface out.

Another specimen (Fig. 7), No. 4850, U. S. N. M., was found in a vial containing leeches (*Ichthyobdella* sp.) from the gills, roof of the mouth, and under the pectoral fins of *Eupomotis pallidus* and *Chænobryttus gulosus;* collected by Mr. N. A. Harvey, Kansas City, Missouri.

This specimen, alcoholic, had the following dimensions: Length, 4.5 mm.; breadth at anterior sucker, 0.92; breadth at ventral sucker, 1.13; maximum breadth, 1.5; diameter of oral sucker, 0.27; diameter of ventral sucker, 0.75.

18. DISTOMUM LAGENIFORME, new species.

(Plate XLVII, figs. 1, 2.)

The following description is based on a single specimen from the body cavity of *Remora remora;* Woods Holl, Massachusetts, August 1, 1887.

The living worm (Fig. 1) was approximately 20 mm. in length and 6 in greatest breadth, long, oval in outline, neck nearly cylindrical at

[1] Contrib. to Amer. Helm., pp. 3–6, figs. 1, 2.

anterior end, body otherwise flattened but quite thick. The color at first was purplish merging into orange-red. When placed in sea-water it voided enough dark-colored material to color the water in a small dish dark-brown.

Having a quantity of more fragile material to examine, this specimen was left in water for a number of hours. Meantime it had contracted and assumed a very different appearance (Fig. 2). The body was now nearly globular, with large transverse wrinkles on anterior half, the neck protuding like the neck of a water bottle. In dorsal view the body appears somewhat two lobed on account of a shallow longitudinal median depression. Head and neck reddish-yellow in front, merging into a deeper orange-red at base; anterior part of body bright orange-red. Posterior part of the body rich brownish-yellow, neck conical, crossed by fine transverse lines. In ventral view neck concave in both longitudinal and tranverse direction, with fine transverse lines; mouth at anterior tip, but opening below, elliptical longest diameter longitudinal, border with radiating wrinkles. Aperture of ventral sucker irregularly circular, with puckered border, 0.75 mm. in diameter. Coloration beneath nearly like that above, head and neck light orange-yellow in front, merging into orange-red at base and on front of body, becoming light orange-red behind.

Type.—No. 4853, U.S.N.M.

The dimensions of the living specimen, after contraction: Length, 7.25 mm.; breadth of globular body, 6.75; breadth of head, i. e., at oral sucker, 1.5; breadth of neck at base, immediately in front of ventral sucker, .3; distance between suckers, centers, 2.6; thickness of body, 5.5.

The alcoholic specimen was cut in two by a median longitudinal, dorso-ventral section, and the following points noted: The muscular pharynx follows the oral sucker directly. The cirrus pouch is in the neck, anterior to the ventral sucker; the external opening of the cirrus is apparently just back of the mouth. Behind the ventral sucker the body is crossed by cavities which contain a black or very dark-brown granular substance. No ova were seen. The following dimensions in millimeters were obtained from the alcoholic specimen: Antero-posterior diameter of oral sucker, 1.21; dorso-ventral diameter, 0.93; antero-posterior diameter of ventral sucker, 2; dorso-ventral diameter, 1.4; length of pharynx, 0.74; dorso-ventral diameter of same, 0.63.

19. DISTOMUM SIMPLEX Rudolphi (?).

(Plate XLVII, figs. 3–7.)

Distomum simplex Dujardin, Hist. Nat. d. Helm., 1845, p. 466.—Diesing, Syst. Helm., I, 1850, p. 343.—Olsson, Lund's Univ. Årsskrift, 1868, IV, p. 34, pl. IV, figs. 81, 82.—Levinsen, Grönlands Trematodfauna, 1881, p. 18, pl. III, fig. 1.—Stossich, Dist. d. Pesc., 1886, p. 30.

Body unarmed, depressed, elongated linear, somewhat constricted in the vicinity of the testes, neck short, narrow in front, posterior end rounded. Mouth subterminal, aperture orbicular. Ventral sucker very prominent, twice the diameter of the oral sucker. (Esophagus equal

in length to the pharynx. Vitelline glands large, globose, extending laterally from the tail to the ventral sucker. Testes, two large, remote in the median line. Ovary in front of the testes trilobed on its posterior border. Seminal vesicle ovate immediately in front of ovary. Cirrus pouch behind ventral sucker. Genital aperture between pharynx and ventral sucker. Ova not numerous, large. Branches of intestine extending to posterior end. Excretory vessel single, opening by terminal pore. Length, 3.9 mm. [Various authors.]

Dujardin[1] gives the length 1.25 to 2 mm. for one and 3.6 for another, both of which he refers to this species.

A single specimen, No. 4847, U.S.N.M., from the intestine of a Tomcod (*Microgadus tomcod*), Woods Holl, Massachusetts, July 23, 1886, yielded during life the following measurements: Length, 1.8 mm.; breadth at anterior sucker, 0.14; breadth at ventral sucker, 0.34. The same specimen, after killing in corrosive sublimate and preservation in alcohol, when placed in acetic acid for examination yielded the following measurements in millimeters: Length, 2.45; diameter of oral sucker, 0.15; diameter of ventral sucker, 0.28; diameter of testes, 0.32. In both cases the specimen was subjected to some pressure and consequently more or less distorted. The ova in this specimen were few (sixteen), and measured 0.084 and 0.04 in the two principal diameters. Each in acetic acid showed a distinct nucleus near one end (Fig. 4).

I refer, also, to this species three lots of *Distoma* belonging to the United States National Museum collection, all from the sea raven (*Hemitripterus americanus*). Four specimens, No. 4863, U.S.N.M., Woods Holl, Massachusetts, October 12, 1887, V. N. Edwards; No. 4864, U.S.N.M., same locality and collector, December 1, 1887; 40 specimens, Casco Bay, 1873; United States Fish Commission.

In the first and third the largest specimens are about 2.5 mm. in length. One of these specimens, the second, measures 4.1 mm. in length. The ventral sucker, 0.34 mm. in diameter in one specimen, is very prominent, and in many of the specimens the neck is bent back dorsally, making an acute angle with the body. There is a great diversity of shape. The oral sucker, 0.17 mm. in diameter, has a posterior notch. Length of pharynx, 0.10; breadth, 0.07 mm. Vitellaria mainly lateral, but a few median lobes noticed in sections, on a level with the anterior border of the ovary.

20. DISTOMUM PALLENS Rudolphi.

(Plate XLVII, figs. 8, 9.)

Distomum pallens Dujardin, Hist. Nat. d. Helm., p. 457.—Diesing, Syst. Helm., I, p. 348.—Cobbold, Synops. Distom., p. 26.—Carus, Prodr. Faunæ Mediterr., I, p. 130.—Stossich, Dist. d. Pesc., p. 31; Bull. Soc. Adriat. Trieste, IX, 1887, (Extract) p. 4.

A single specimen, No. 4860, U.S.N.M., of a *Distomum* found in the intestine of *Alutera schoepfii*, and which I refer with some doubt to *D.*

[1] Hist. Nat. d. Helm., 1845, p. 166.

pallens Rudolphi, is here described as far as the very limited amount of material will permit.

Body subcylindrical, with somewhat rhombic-ovate outline, crossed with minute rugæ in anterior and median region. Neck short, conical, minutely papillose on dorsal side, near head. Mouth subterminal, aperture circular. Ventral sucker, red, nearly twice the diameter of the oral sucker, prominent, aperture transverse. Vitellaria lateral in posterior half, yellow in life. Testes situated about posterior fourth, opaque white. Uterus with rather numerous ova colored deep brown, and situated in a mass immediately behind the ventral sucker. Branches of intestine extend to near posterior end.

The following dimensions were obtained from measurements of the living specimen, slightly compressed: Length, 3.10 mm.; breadth, anterior, 0.40; breadth, median, 0.86; breadth, posterior, 0.60; diameter of oral sucker, 0.24; diameter of posterior sucker, 0.46; distance between suckers, centers, 0.68.

In the alcoholic specimen the dimensions of the suckers were unchanged from what they were in life and the pharynx measured 0.154 mm. in length and 0.168 in breadth.

The ova measure 0.067 mm. in length and 0.034 in breadth.

I find no mention of papillæ or rugæ in my notes made at the time of collecting. The alcoholic specimen, however, is crossed by minute rugæ and the anterior region is minutely and, at least opposite the oral sucker on the dorsal surface, densely papillose.

Found in *Alutera schœpfii;* Woods Holl, Massachusetts, July 24, 1887.

21. DISTOMUM VALDEINFLATUM Stossich.

(Plates XLVII, figs. 10–14; XLVIII, figs. 1, 2.)

Distomum valdeinflatum Stossich, Bull. Soc. Adriat. Trieste, VIII, 1883, p. 114, pl. 1, fig. 4.—Carus, Prodr. Faunæ Mediterr., I, 1884, p. 127.—Stossich, Dist. d. Pesc., 1886, p. 35.

Body terete, subspherical behind; neck long, cylindrical, covered with spines which are evanescent toward the posterior part of the body; os terminal; acetabulum sessile larger than oral sucker, at the base of the neck. Head cercinate, armed with a double crown of hooks, sixteen hooks in each, those of the anterior circle the stronger. No. 4869, U.S.N.M. Length, 2.5 to 3 mm.

I refer to this species certain *Distoma* found inclosed in globular capsules and attached, usually by a slender peduncle, to the peritoneum of the host, *Alutera schœpfii.*

The capsules consisted of an outer cyst of connective tissue containing a thin hyaline sac in which lay a larval *Distomum.* The posterior end of the latter was swollen and globular and when compressed, in a living specimen, was seen to be filled with white food-material (parenchyma), which was in communication with the posterior ends of the intestine.

In specimens which had been killed in corrosive sublimate and preserved in alcohol, the embryos were found to be surrounded by coagulated material, which easily separated from them. One case was noticed where the whole cyst had degenerated into tough, yellowish, concentric layers.

Two capsules (alcoholic) measured 1.75 mm. and 2.4 in diameter, respectively.

Body subcylindrical; neck short; densely covered with short, subtriangular spines. Oral aperture transverse, somewhat triangular, surrounded by oblong, stoutish spines. The latter are somewhat obscurely arranged in two rows; this is most evident at the anterior border. Of these oral spines the lateral are longest. Their number, in maturest specimens, is about thirty-four. The ventral sucker is larger than the oral; the pharynx is oblong-pyriform, muscular, nearer ventral than oral sucker; the branches of the intestine capacious.

The following measurements were made of an alcoholic specimen: Length, including terminal globular sac, 2 mm.; diameter of head, 0.38; diameter of neck, 0.28; diameter at ventral sucker, 0.60; diameter of ventral sucker, 0.30; breadth of oral aperture, 0.19; length of pharynx, 0.22; breadth of pharynx, 0.16; length of longest oral spines, 0.16. Transverse sections showed a cirrus in front of and dorsal to ventral sucker, which was 0.018 mm. in diameter near its extremity, and apparently about 0.11 in length. In sections, maximum diameter of ventral sucker, 0.43; other diameters of same, 0.25; diameter of oral sucker, 0.26.

These embryos bear much resemblance to adult *Distoma* found in *Roccus lineatus*, *D. tenue*, and may indeed be identical.

Found in peritoneum of *Alutera schœpfii*, numerous; Woods Holl, Massachusetts, August 5, 1889.

22. DISTOMUM CONTORTUM Rudolphi.

(Plate XLVIII, figs. 3-7.)

Distomum contortum DUJARDIN, Hist. Nat. d. Helm., 1845, p. 469.—DIESING, Syst. Helm., I, 1850, p. 394; Sitzungsb. Weiner Akad., XXXII, 1858, p. 353.—COBBOLD, Synops. Distom., 1859, p. 29.—OLSSON, Lund's. Univ. Arsskrift, IV, 1868, p. 39, pl. v, figs. 104, 105; Bidrag. t. Skandin. Helminthf., 1876, p. 17.—CARUS, Prodr. Faunae Mediterr., I, 1884, p. 126.—STOSSICH, Dist. d. Pesc., 1886, p. 40.—SONSINO, Proc. Verb. d. Soc. Tosc. d. Sci. Nat., 1890, p. 3 (extract).

Twelve specimens in the United States National Museum collection No. 4848. Name of host not given, probably *Mola mola*. The label in the bottle reads: "Station ?, 1886, U. S. Fish Commission."

I do not find any mention made of the very peculiar spines which characterize these specimens in any of the descriptions of *D. contortum* which I have read. For this reason alone I am in some doubt as to whether they should be identified as *D. contortum* or referred to a new species.

The twelve specimens were felted together in a single mass, the indi-

viduals holding on to one another by their ventral suckers. When separated from this tangled mass, they were found to be much distorted. Where a ventral sucker of one individual had been applied to the body of another, there was a knob-like protuberance which represented the portion that had been embraced by the sucker. Sometimes the bodies and sometimes the necks were strangulated to a slender filament where they had been compressed. Fortunately, two or three worms were found which had not been distorted in any other way than by contraction. The ventral suckers were globular, prominent, and in some cases decidedly pediceled. Those which were not distinctly pediceled showed by their wrinkled condition that they were capable of considerable extension.

Body cylindrical, transversely wrinkled (a contraction character), tapering from median region in each direction, but most posteriorly. Posterior end somewhat bluntly pointed; greatest diameter back of ventral sucker. Neck rather short, arcuate excavated on ventral surface, convex on dorsal surface. Dorsal surface and lateral margins armed with spheroidal tuberculate spines. Ventral sucker much larger than oral, aperture about twice the diameter of the mouth. Slight constriction back of oral sucker, making a rounded head. Oral aperture subterminal, with flat spines surrounding it on inner margin, with lip projecting anteriorly in a blunt point. The subglobose head with sparse spines on dorsal surface. Genital aperture immediately behind mouth. The dark-brown branching vitellaria show through the body wall along the sides, from a little in front of the posterior end to a point about halfway between the posterior end and the ventral sucker. The anterior portion of the body, including the ventral sucker and neck, yellowish white. The œsophagus opens by a conical papilla into the oral sucker. (Figs. 4, 6.) This papilla is 0.22 mm. in length, 0.14 and 0.08 in diameter at base and apex, respectively. There are twenty flat spines, more or less, on the inner margin of the oral aperture. The spines on the neck are spheroidal, with from four to six small round tubercles pointing posteriorly and postero-laterally. (Fig. 5.)

The specimens were so much distorted that the measurements obtained can not be of much service. One of the least distorted examples yielded the following measurements: Length, 8 mm.; diameter of head, 0.3; diameter of body at ventral sucker, 0.55; greatest diameter, 0.72; diameter at posterior end, 0.2; longitudinal diameter of oral sucker, 0.6; longitudinal diameter of ventral sucker, 0.7; diameter of oral aperture, 0.15; diameter of ventral aperture, 0.3; length of neck, to middle of ventral sucker, 1.6. Measurements made of specimen lying on its side.

Three ova measured 0.036, 0.033, and 0.030 mm., respectively, in length, and 0.020 in shorter diameter.

The longest of these specimens measured about 12 mm. in length, but had been capable, evidently, of much greater elongation.

Testes two, close together, one following the other, just back of the constriction of the body behind the ventral sucker. In the specimen sectioned they lay somewhat toward the left side. The ovary follows the posterior testis closely, lies rather more toward the right side of the body than the testes and dorsal. The shell gland is on its anterior border. The vitellaria are not very abundant in this (mature) specimen. They are for the most part lateral and dorsal, but are also scattered among the folds of the uterus, from the vicinity of the testes to near the posterior end. In younger stages of the worm these glands are probably very voluminous. They are reddish-brown in carmine-stained sections. The anterior tube of the uterus lies on the ventral side of the neck and joins the cirrus at its base. The vas deferens is very voluminous. Its convolutions lie dorsally and extend from the middle of the neck to near its base. The seminal receptacle is also very voluminous, lying at the base of the neck, and dorsal to the ventral sucker. The intestinal crura are very distinct, thick walled, and extend to near the posterior end of the body. The excretory vessels (Fig. 7) were seen only near the posterior end of the body, the two uniting in a single vessel, which lies between the terminal portions of the intestinal crura and ends in a terminal pore. The uterus, filled with ova, occupies the greater part of the body back of the ovary.

The musculature of the ventral body-wall back of the ventral sucker is very strongly developed.

23. DISTOMUM NIGROFLAVUM Rudolphi.

(Plates XLVIII, figs. 8–11; XLIX, figs. 1, 2.)

Distomum nigroflavum Dujardin, Hist. Nat. d. Helm., 1845, p. 469.—Diesing, Syst. Helm., I, 1850, p. 394; Sitzungsb. Wiener Akad., XXXII, 1858, p. 353.—Cobbold, Synops. Distom., 1859, p. 29.—Olsson, Lund's Univ. Arsskrift, IV, p. 25, pl. v, figs. 102, 103.—Carus, Prodr. Faunæ Mediterr., 1, 1884, p. 126.—Stossich, Dist. d. Pesc., 1886, p. 40.—Sonsino, Notizie di trematodi. Estr. d. Proc. Verb. Soc. Tosc. Sci. Nat., 1890, p. 4.

In a lot of *Distoma* (No. 4857, U.S.N.M.) from the intestine of the sunfish (*Mola mola*) I find three distinct kinds, which I have referred to the following species: *D. nigroflavum* Rudolphi, *D. macrocotyle* Diesing, and *D. foliatum* mihi. I have not had an opportunity of studying specimens in life, and therefore do not know what difference may exist in the living specimens. The alcoholic specimens possess a general superficial likeness, especially *D. nigroflavum* and *D. foliatum:* but while there is a very considerable variation of size and shape, the three species stand stiffly apart from each other.

Body cylindrical, linear, often much contorted in a dorso-ventral plane; neck short, cylindrical, usually reflected dorsally. Mouth terminal. Ventral sucker larger than oral, pedicellate: the pedicel sometimes narrow and contracted, sometimes swollen and containing folds of the uterus. Reproductive aperture about middle of under side of neck; cirrus, everted in several cases, rather stout with a swollen base. The

testes are two, elliptical, situated about the middle of the post-acetabular region. In one example they were contiguous; in others they were removed from each other by a space a little less than the length of a single testes. In the more mature specimens the testes are remote. The testes in one specimen measured 1.12 and 1.03 mm., respectively, and the ovary was about 1 mm. back of the posterior testis. The vas deferens and seminal receptacle lie in voluminous folds behind and above ventral sucker. The uterus is very long and occupies the greater part of the body from the ventral sucker nearly to the posterior end, and is crowded with ova, which are 0.03 and 0.02 mm. in their two principal diameters.

No spines of any kind were noticed either on the neck or on the lips of the ventral sucker. Since the spines of *D. nigroflavum* are said to be deciduous, this is a difference that must not be made too much of. The specimens were of various lengths: the largest measured 35 mm. in length and 1.12 in diameter. The specimens were variously contracted and distorted, especially about the anterior end.

The vitellaria are in slender thread-like folds, seen in transverse sections to be rather centrally situated, except where crowded to one side by the testes. They are reddish-brown, in sections stained with borax carmine, and lie between the anterior edge of the ovary and the ventral sucker.

The ovary, in sections, is seen to be made up of nucleated cells which appear to be polygonal, usually hexagonal, especially in the central portions. These cells are about 0.017 mm. in diameter.

The shell-gland is an oval body lying adjacent to the front edge of the ovary and is about one-third the diameter of that organ.

The lumens of the longitudinal vessels, especially in the anterior part of the body, are filled with a fine granular substance, brown in color, and, when highly magnified, is seen to have minute tetragonal crystals scattered through it. On account of the irregular contraction of the body and of the vessels themselves, the granular contents are in places gathered into masses of considerable relative size. Toward the posterior end of the body the vessels, in all individuals sectioned, were empty. Behind the ovary the body is largely occupied by the folds of the uterus.

Certain glandular bodies, which lie adjacent to the folds of the seminal receptacle behind the ventral sucker (Fig. 11) and contain numerous nucleated cells, appear to be continuous with the prostatic cells which surround the vas deferens, near the base of the cirrus pouch, at which place the uterus joins the vas deferens. These organs have the same relative arrangement as the corresponding organs in *D. macrocotyle*. (Plate XLVI, fig. 3.) The cirrus is relatively larger and not situated so close to the oral sucker; and the seminal receptacles are behind instead of above and in front of the ventral sucker.

Found in intestines of *Mola mola*, thirteen specimens; off Marthas Vineyard, September 10, 1886. Collected by Vinal N. Edwards.

24. DISTOMUM FOLIATUM, new species.

(Plates XLIX, figs. 3–5; L, figs. 1–3; LI, figs. 1–4.)

Type.—No. 4849, U.S.N.M. Body cylindrical, somewhat linear, but with constrictions and enlargements, much contorted in alcoholic specimens (not seen living). Neck usually arcuate, strongly reflected. Mouth ringent, aperture transverse directed downward, upper lip projecting. Dorsum of head and neck with crest of (six or eight) nodular eminences, which were white in alcoholic specimens; seen in sections to consist of strong muscular fibers, as in the pharynx and suckers. Ventral sucker consisting of four foliate flaps (Plates XLIX, fig. 3; L, figs. 1–3; pedicellate, the pedicel variable, usually greatly swollen and containing voluminous folds of the uterus, vitellaria, and seminal receptacle, in some cases separated by a constriction from the body. (Plate L, fig. 2.) In most cases there is a profound constriction of the body immediately behind the ventral sucker. The pedicel is sometimes directed forward, continuing the general direction of the axis of the body; in other cases it is at right angles to the body and continues the general direction of the axis of the neck. The specimens studied were all mature, and the very voluminous folds of the uterus filled the body from a short way behind the oral sucker to near the posterior end of the body. The uterus was crowded with small elliptical ova. The œsophagus is very short: the pharynx oblong, its length exceeding half the diameter of the oral sucker. The cirrus bulb is relatively small and lies near ventral surface of the neck, but a short distance back of the oral sucker, the genital aperture being on a leval with the anterior end of the pharynx. The anterior duct of the uterus along ventral side of neck; seminal receptacle in voluminous folds in pedicel and nearly whole length of neck. Testes two, large, lying a little in front of the postacetabular region of the body. Vitellaria distributed from a point just behind the oral sucker as far back as the ovary, most abundant in neck and in constricted part of body between ventral sucker and anterior testis, reddish-brown in carmine-stained sections.

Dimensions are not of much value in the identification of forms of such extremely variable contractile shapes, and the measurements here given must be expected to differ greatly from those of living specimens. The largest measured at least as much as 16 mm. in length.

A medium-sized specimen yielded the following measurements: Length, 12 mm.; length of neck, 2.54; length of oral sucker, 0.82; depth of oral sucker, side view, 0.65; diameter of neck, 0.85; maximum diameter of body, 1.28; minimum diameter of body, 0.6; diameter of ventral sucker, 1.9; length of œsophagus, 0.09; length of pharynx, 0.48. Average diameters of ova, 0.032 and 0.02 in the two principal directions.

An examination of a good series of transverse sections revealed many interesting details, the more important of which are here recorded. The connection between the œsophagus and the intestinal crura was not

demonstrated; what appeared to be a left branch of the œsophagus was traced for some distance, about half the length of the neck. In this minute vessel which leads back from the pharynx several nucleated cells, oval in shape, and about 0.01 mm. in length, were observed, which I take to be the red blood-corpuscles of the host. What are taken to be branches of the intestine in this species, and in the related species *D. nigroflavum* and *D. macrocotyle*, begin as two small lateral vessels on either side of the neck on a level with the pharynx but not communicating with it (Plate LI, fig. 3, *i. i.*); at least I was unable to demonstrate any communication in my sections. They are irregular in dimensions, becoming much enlarged in some portions of the body, so that the transverse sections of the two vessels constitute more than half the area of the entire section of the body. At such places they are filled with a finely granular substance, light brown in color, in carmine-stained sections. A few of the tetragonal crystals observed in the corresponding vessels of *D. nigroflavum* and *D. macrocotyle* were seen in these.

In addition to the very voluminous tubular seminal receptacle which extends from the pedicel of the ventral sucker to near the anterior end of the neck, a posterior seminal receptacle was observed between the shell-gland and the posterior testis. The vas deferens and uterus have the same general plan as in the two related species, but the prostatic gland traversed by the former is not so large as in *D. macrocotyle*.

The ovary in one specimen measured 0.43 mm. in diameter and was situated 0.28 mm. back of the posterior testis. The shell-gland was situated adjacent to the anterior edge of the ovary, toward the right side, and was 0.23 mm. in diameter. In another the ovary was 0.53 and the shell-gland 0.21 mm. in diameter. The ovary consisted of polygonal nucleated cells, as in *D. nigroflavum* and *D. macrocotyle*.

The testes in two specimens which were cut into series of longitudinal sections presented the following individual differences: In one specimen the length of the anterior testis was 1.02 mm., that of the posterior testis 0.74, the former situated toward the right and the latter toward the left side of the body. In the other specimen these conditions were reversed, i. e., the length of the anterior testes was 0.68, that of the posterior testes 0.80, while the former was situated toward the left and the latter toward the right side of the body. One must conclude from these facts that relative position of internal organs in these forms, within certain not too narrow limits, does not supply safe criteria for establishing specific differences.

Olsson represents, in a longitudinal section of the neck of *D. nigroflavum*, what he regards as glands of doubtful significance (Plate LI, fig. 2.) This structure is identical in position with the nuchal crest of *D. foliatum*.

Thirty specimens of this remarkable worm were found in a lot of distoma from the intestine of the sunfish (*Mola mola*), taken off Marthas Vineyard, September 10, 1886. Vinal N. Edwards, collector.

These forms have many points of resemblance with *D. nigroflavum* and indeed agree with the descriptions of that species in one or two particulars in which the specimens referred to that species fail to agree, notably in the prominent upper lip and the position of the genital aperture. Whatever may be the proper disposition of these two forms as to designation, there is no doubt in my mind as to their belonging to different species. The thirty specimens of *D. foliatum* and the thirteen specimens of *D. nigroflavum*, although presenting the greatest diversity among themselves, make two distinct groups with absolutely no hint of intermediate forms.

The *Distoma* of *Mola* would well repay a careful study. Either they constitute a number of distinct species related to each other in a remarkable way, or a few species capable of the most astonishing variation.

25. DISTOMUM NITENS, new species.

(Plates LI, figs. 5, 6; LII, fig. 1.)

Body terete, linear, moderately attenuate both posteriorly and anteriorly, neck about one-third entire length, conical, variable with state of contraction, armed with exceedingly minute bristle like spines; mouth subterminal, ventral sucker larger than oral, prominent with transverse aperture. Pharynx prominent, œsophagus short and broad. Cirrus pouch in front of ventral sucker and on right side inclosing a part of the vas deferens within its muscular walls; reproductive aperture between oral and ventral suckers. Vitellaria a number of roundish masses distributed laterally along the middle region of the body. Ovary not far back of ventral sucker, globular; testes two, rather large, situated side by side about the middle of the body or a little back of the middle. Uterus very voluminous, its folds filling all the posterior third of the body and the greater part of the middle third filled with small elliptical ova, about 0.033 and 0.018 mm. in the two principal diameters.

Type.—No. 4858, U.S.N.M.

Found in intestine of *Tylosurus caribbæus*, two specimens; Woods Holl, Massachusetts, July 27, 1886.

The following measurements were made on a living specimen: Length, 2.8 mm.; diameter anterior, 0.28; diameter behind ventral sucker, 0.6; diameter at posterior end, 0.1; diameter of oral sucker, 0.028; diameter of ventral sucker, 0.4; distance between suckers, 0.6.

The two specimens had been subjected to some pressure during the preliminary examination, during which they became much altered in dimensions from the foregoing. The sketch (Fig. 5) as well as the description given above was based on the distorted specimens. The alcoholic specimens measured 5 and 5.5 mm. in length, respectively. Other dimensions of the larger: Median breadth, 1.12 mm.; diameter of oral sucker, 0.47; diameter of ventral sucker, 0.66; diameter of pharynx, 0.41; distance between suckers, 1.04; diameter of ovary, 0.45;

length of testis, 0.65; length of cirrus pouch, 0.57; diameter of cirrus pouch, 0.26.

The thin-walled intestinal tracts extend to within about 1 mm. of the posterior end of a specimen 5 mm. in length.

26. DISTOMUM TENUE, new species.

(Plate LII, figs. 2-8.)

Head disciform, surrounded by a double row of spines; mouth terminal, triangular, at times appearing circular from invagination of its border; neck cylindrical attenuate in front of pharynx; neck and anterior part of body closely beset with short triangular spines, becoming sparse or even entirely wanting toward posterior end of body.

Body rather slender, linear-lanceolate, slightly depressed. Ventral sucker prominent, sessile at base of neck, much larger than oral sucker, with circular aperture. Pharynx large, remote from head, œsophagus of good length, rather slender, tubular, branches of intestine capacious. Genital aperture in front of ventral sucker. Testes situated toward posterior end of body. Folds of uterus mainly near center of body; ova rather large, elliptical.

The foregoing is a description of a species of *Distomum* found at two different times in the striped bass (*Roccus lineatus*). This species, it will be observed, possesses many characters common to *D. cesticillus* Molin, but is very much smaller than that species besides occurring in a very different host.

There appear to be twenty-one spines in each row surrounding the mouth, the spines of one row alternating with those of the other. These are conical and slightly recurved. In some specimens, kept in water over night, the part bearing these two rows of spines became invaginated so as to conceal them. The mouth in fresh specimens had three toothlike folds within the sucker. The spines on the body are short, triangular, appressed. Immediately back of the oral armature there is a brief interval which is without spines. The spines on the neck are arranged symmetrically in transverse rows. They become smaller in the vicinity of the ventral sucker, back of it they are still smaller, while the posterior part of the body is smooth, or very sparsely covered with minute spines.

Types.—Nos. 4866, 4867, U.S.N.M.

Length of oral spines, 0.051; breadth at base, 0.018 mm.; length of spines on neck, 0.025; breadth at base, 0.014; length of spines near posterior end, 0.007; breadth, 0.002. The first five or six transverse rows of spines on the neck are broken for a short interval on the ventral side. (Fig. 3.)

The œsophagus is pyriform, its larger end lying near the anterior margin of the ventral sucker; in one specimen, living, somewhat distorted by compression; the length of the œsophagus was 0.44, its maximum diameter 0.34 mm.

The vitellaria are voluminous, peripheral in posterior region. Genital aperture immediately in front of ventral sucker. The ova were not numerous in any of the specimens examined and comparatively large. They were for the most part seen lying close behind the ventral sucker, though a few were seen in the uterus near the reproductive aperture in front of that organ; long diameter of ova, 0.088; short diameter, 0.044 mm.; length of posterior testis, 0.27; length of anterior testis, 0.24; length of ovary, 0.12.

The following dimensions are of a living example slightly compressed: Length, 2.9; breadth, anterior, 0.28; at ventral sucker, 0.6; near posterior end, 0.54; diameter of oral sucker, 0.26; of ventral sucker, 0.38. In one lot the specimens in life varied from 1.4 to 3.6 mm. in length. They were very variable in shape.

Found in rectum of *Roccus lineatus;* Woods Holl, Massachusetts, August 18, 1887, and August 3, 1889; rather numerous.

27. DISTOMUM TENUE TENUISSIME, new subspecies.

(Plate LII, figs. 9–12.)

Body slender, linear or linear-lanceolate, slightly depressed; mouth terminal armed with spines, which appear to be evanescent; neck attenuate, somewhat concave below, crossed by fine transverse lines, with evanescent spines; pharynx large, nearer ventral than anterior sucker; ventral sucker nearly twice the diameter of oral sucker, both with circular apertures. Testes large, in posterior third of body, vitellaria voluminous, in posterior two-thirds of body, obscuring other organs; reproductive aperture in front of ventral sucker. Ova collected in mass near center of body, as much as 0.11 mm. in length and 0.06 in shorter diameter.

Type.—No. 4865, U.S.N.M.

Two specimens, 3.75 and 4.5 mm. in length, respectively, from the peritoneum of the white perch (*Morone americana*), while resembling *D. tenue* in many particulars do not admit of classification with that species. This most obvious difference is the much more slender habit of body of the specimens from *M. americana*. These specimens are mature and have nearly smooth bodies. They have lost some of the oral spines also. An examination of more abundant material might warrant the union of the two varieties in the species *D. tenue*.

The ova are rather numerous and very irregular in size, an average of several measurements made of ova from the largest specimen was, long diameter, 0.093, short diameter, 0.058 mm.; the smallest seen measured 0.04 by 0.026 in the two principal diameters. The ova in one of the specimens were observed to be undergoing segmentation.

The following dimensions are of an alcoholic specimen: Length, 3.15 mm.; diameter of oral sucker, 0.14; diameter of ventral sucker, 0.34; distance between suckers, 0.67; length of pharynx, 0.28; diameter of

pharynx, 0.14; maximum diameter of body, 0.52; diameter at posterior end, 0.22; length of oral spines (weak and indistinct), about 0.04.

Found in the peritoneum of *Morone americana;* Woods Holl, Massachusetts, September 2, 1885.

CYSTS WITH TREMATODE OVA.

Nos. 4865, 5503, U.S.N.M. Associated with the two *Distoma* from the white perch (*Morone americana*) were numerous minute cysts accompanied with patches of dark-brown pigment, on the serous covering of the liver, mesentery, etc. Upon examination there were found the remains of a distomum, little more than the convoluted uterus packed with ova. The latter were small, 0.018 and 0.012 mm. in the two principal diameters. Scattered through the serous membrane were numerous globular cysts, with thick walls of connective tissue, each containing one or more of these ova. Some of the cysts seem to have formed around a cluster of ova. One cyst containing two ova measured 0.048 and 0.04 mm. in its two principal diameters; another, globular, 0.053 mm. in diameter contained three ova; another with five ova was 0.06 in diameter; the walls of the cysts are relatively thick, in the last case being 0.017. One large cyst, containing approximately fifty ova, was 0.11 and 0.08 in its two principal diameters.

Some ova were found in the serous membrane without cyst, others with cysts just beginning, and others with well-developed thick-walled cysts. Some of the larger cysts contained black pigment patches associated with the ova. There were also patches of pigment in the serous membrane.

A diseased ovary of a white perch (*M. americana*), collected by Mr. S. E. Meek, Fulton Market, New York City, October 6, 1886, from a fish taken somewhere in Long Island, New York, may be noticed properly in this connection.

The center of the ovary is occupied by an elongated mass of waxy consistency and appearance. This mass is made up of the tissue of the ovary, ova, and connective tissue, and cysts containing parasites, which in most cases have undergone degeneration, but in a few cases revealed ova identical in size and appearace with those from the serous coat of the liver, etc., described above.

My conclusion is that these waxy masses (42 mm. long and 14 mm. thick) are caused by the presence of trematodes, whose ova not having been liberated and allowed to come under conditions where development would take place, have become encysted and given rise to this pathological condition of the ovaries.

28. DISTOMUM species.

(Plate LIII, figs. 1, 2.)

Body elliptical, or ovate oblong a little depressed, smooth. Oral sucker orbicular, squarish, situated a short distance back of anterior end. Ventral sucker a little less than oral sucker. Aperture of both

suckers circular. Testes two, large, close together, a little back of middle of body. Vitellaria filling body behind testes and extending forward along each side to and beyond the ventral sucker. Uterus lying in a few folds in front of anterior testis. Ova not very numerous.

One specimen (No. 5504, U.S.N.M.) was obtained from the intestine of *Lagocephalus lævigatus*, Woods Holl, Massachusetts (Narragansett Bay), July 22, 1887.

The alcoholic specimen was found to be in poor condition and these notes are made up from a few notes and an incomplete sketch made at the time of collecting.

The dimensions of the living worm: Length, 2.8 mm.; diameter of oral sucker, 0.24; diameter of ventral sucker, 0.24; distance between suckers, 0.41; breadth of body at oral sucker, 0.68; breadth at ventral sucker, 0.83; maximum breadth of body, 1.04. The ova were not measured in the living specimen. In the preserved specimen they were much collapsed, so that satisfactory measurements could not be obtained. The ova measured 0.066 and 0.051 in length, respectively, and 0.035 in shorter diameter; another which appeared to be surrounded by a thin pellicle measured 0.035 and 0.022 in the two principal diameters.

29. DISTOMUM RACHION Cobbold (?).

(Plate LIII, figs. 3–7.)

Distomum rachion Cobbold, Trans. Lin. Soc., XXII, p. 158, pl. XXXI, figs. 9, 10.—Stossich, Dist. d. Pesc., p. 43.

It has the following dimensions: Length, 3 mm.; diameter, anterior, 0.3; median, 0.55; posterior, 0.2; diameter of ventral sucker, 0.18; aperture, 0.09; diameter of oral sucker, 0.3; aperture, 0.16; length of pharynx, 0.2; diameter, 0.14; length of œsophagus, 0.1.

The specimen has about as many points of agreement with descriptions of *D. arcolatum* Rudolphi, as with those of *D. rachion*. It appears, however, to be nearer the latter than the former, and since its agreement with that species appears to be close I notice it under the name *D. rachion*. Further, *D. rachion* was found by Cobbold in the Haddok, while *D. areolatum* has its habitat in the *Pleuronectidæ*.

It is oblong linear, flattened, squarish in front, obtuse behind, maximum breadth near middle, whence it tapers gradually to the tail, narrowing scarcely at all anteriorly, laterally arcuate; posterior extremity emarginate with terminal pore; neck covered densely with squamose spines becoming sparsely scattered back of ventral sucker, and very few near posterior end. Back of the ventral sucker the spines are confined to the lateral regions. The spines appear flat and scale-like on neck and are uniformly disposed in close transverse rows; posteriorly they are slender. Diameter of squamose spines, 0.01 mm.; length about the same. Ova not numerous, about 30, lying behind ventral sucker, rather large, 0.07 and 0.04 mm. in the two principal diameters. Length of cirrus pouch, 0.21; greatest diameter, 0.16.

A single specimen belonging to the United States National Museum collection (No. 4861, U.S.N.M.), from the intestine of the cod (*Gadus callarias*), is referred provisionally to the species above named.

30. DISTOMUM CLAVATUM Rudolphi.

(Plate LIII, figs. 8–11.)

Distoma clavatum DIESING, Syst. Helm., I, p. 366; Nachtr. zur Revis. d. Myzhelm., p. 431.—WAGENER, Troschel's Archiv., XXVI, 1, p. 182, pl. VIII, figs. 11, 12.—COBBOLD, Jour. Linn. Soc., IX. pp. 200–205.—JOURDAN, Revue sc. Natur. Montpellier, 1881, II, pp. 438–449, pls. VII, VIII[Von Linstow, Compend. d. Helminth. and Nachtrag to Compend.].—CARUS, Prodr. Faunæ Mediterr., I, p. 131.—STOSSICH, Dist. d. Pesc., p. 46.

I refer a lot of distoma, ten in number, from the stomach of the sword-fish (*Xiphias gladius*), United States National Museum (No. 4846), to this species. The host was taken by the United States Fish Commission (1883) trawl lines, station 2091, steamer *Albatross*.

The specimens are all nearly of the same size. The largest specimen (alcoholic) presented the following dimensions: Length, 18 mm.; diameter of head, 1.75; diameter of body at ventral sucker, 4.5; diameter of body behind ventral sucker, 4.2; diameter of mouth, 1.75. Ventral sucker, 5.5 long and 4.5 broad; aperture of ventral sucker, 2.5 long and 1.8 broad; breadth of neck, 0.25.

The color is dark brown, approaching dark olivaceous in posterior half of body proper. Body and neck for most part transversely wrinkled, in some simply roughened, irregularly rugose in posterior region. Neck much more slender than body, not quite half the length of the body, strongly arched, cylindrical, more or less flattened or even concave on under side. Mouth circular with wrinkled or puckered margin, opening ventrally. Ventral sucker sessile, much larger than oral, irregularly corrugated, with deep cavity and oblong-elliptical aperture, its longer axis coinciding with the longitudinal axis of the body. Genital aperture about midway between oral and ventral sucker. Body proper nearly cylindrical or only slightly appressed, slightly arcuate, enlarging near its posterior third and ending in a blunt point in which there is a minute terminal pore, usually profoundly wrinkled transversely.

The mouth cavity is deep and communicates almost immediately with the pharynx. Testes two, lying close together and in specimen examined both touching posterior edge of ventral sucker, and together filling body cavity from dorsal to ventral wall. Behind the testes lie the folds of the uterus filled with minute golden-brown ova, which are 0.034 and 0.024 mm. in the two principal diameters. Several ova were noticed with a cap or opercle at one end. (Fig. 11.) In longitudinal median vertical section this organ looks like a sacculated lumen filled with dark granular material. In posterior transverse section the two lumens of the intestinal crura appear in the midst of the vitellaria, laterally

placed with reference to each other, with their walls, in section exposed, contiguous. The vitellaria also extend forward on each side of the uterine folds.

Transverse and longitudinal sections reveal the following facts with regard to the arrangement of the vessels of the excretory and digestive systems: A plexus of anastomosing vessels is seen in front of the pharynx (Fig. 8), from which the two lateral vessels of the intestine are soon differentiated. The pharynx follows the oral sucker immediately and opens into a short œsophagus (Fig. 10) which extends posteriorly for a short distance in a blind prolongation, anteriorly it communicates with the two intestinal vessels. (Fig. 9.) The remaining vessels of the plexus, which I take to represent the excretory system, continue as several vessels for some distance back of the pharynx, but appear as only two principal lateral vessels in sections about the anterior limit of the ventral sucker. In sections through the ventral sucker and testes the longitudinal vessels are much compressed and crowded against the body wall. In the posterior half of the body the intestinal tracts occupy the greater part of the space, are compressed laterally, and contain a very dark-brown or black food material. The walls of the intestine are very much folded, even amounting almost to distinct rami, and are beset with distinct villi, 0.041 mm. in depth. The excretory vessels are indistinct in sections of the middle of the body; there is, however, a very prominent posterior vessel which terminates in a distinct pore.

The vitellaria in the serial sections begin as small brownish-yellow tubular masses in the vicinity of the testes, where they are arranged laterally near the periphery. Behind the testes they are more abundant, but nowhere very voluminous.

The body wall is very thick and muscular, and the body cavity back of the testes mainly occupied by the very large intestinal vessels.

31. DISTOMUM species (larva).

(Plates LIII, figs. 12, 13; LIV, fig. 1.)

No. 4871. U.S.N.M. From pericardium of *Stizostedion canadense*, Washington, Pennsylvania (market), fish from Lake Erie; collected March 7, 1891.

These specimens are small, immature, in capsules, 0.35 to 0.85 mm. in diameter. Diameter of oral sucker, 0.094 mm.; diameter of ventral sucker, 0.055 mm. The specimens are too immature for identification.

Sections of a cyst with its contained embryo show that the outer half of the wall of the cyst is built up of concentric layers of connective tissue secreted from the tissues of the host; the inner half of the wall consists of an embryonic envelope, which communicates with the embryo by a special duct. The opening of this duct, as relates to the embryo, is ventral, and is situated a little way back of the ventral sucker.

32. MONOSTOMUM ORBICULARE Rudolphi.

(Plate LIV, figs. 2–5.)

Monostomum orbiculare Diesing, Syst. Helm., I, p. 320.—Parona, Intorno al Monostomum, Torino, 1887.

No. 4872, U.S.N.M. The description of this species given by Diesing is very brief, and, like Dujardin's[1] description, is taken directly from Rudolphi's brief account. I have not seen Parona's paper. The worm is described by the older helminthologists as being from 2 to 3 mm. in length, orbicular, convex above, concave or rarely plane below: oral aperture terminal oval oblong sometimes slightly projecting.

Specimens of *Monostoma*, 14 in number, from the intestine of *Lobotes surinamensis* (Woods Holl, Massachusetts, August 6, 1887), agree with the above synopsis of specific characters.

Measurements of a typical specimen, in life, yielded the following results: Length, 2.7 mm.; diameter of sucker, 0.26; breadth of body at sucker, 0.52; maximum breadth, 1; breadth near posterior end, 0.26; distance of sucker from anterior end of body, 0.04; diameter of reproductive aperture at posterior end, 0.1. Two other specimens were measured with very nearly corresponding results, the diameter of the sucker being exactly the same in each case. The measurements were made on specimens which were lying freely in water. The specimens present but little variety of form. They are ovate, broadest about the anterior third, tapering very little toward the anterior end, which is broadly rounded and usually marked with very fine transverse lines, making a finely serrate outline when flattened under the compressor. They taper gradually toward the posterior end, which is bluntly rounded and carries the aperture of the generative organs at its tip. The oral sucker is on the ventral side very near the anterior margin, its diameter equal to about one tenth the length of the body.

The uterus is voluminous and filled with small ova which are nearly globular. The folds of the uterus lie for the most part along the left side of the body, but there is a large mass of ova near the posterior end which lies mainly on the left side of the middle line. The testes are two, oval, and lie about the middle of the body on the right side. The ovary is a globular organ, also lying on the right side at about the anterior third. The vitellaria lie along both right and left sides of the anterior third and across the anterior end behind the sucker. In life they appear to be branched organs of a light purple color. The long, oval, muscular cirrus pouch lies near the median line, about the posterior third of the body, its aperture directed posteriorly and a little to the left. The muscular pharynx lies a little to the right of the median line and a little in front of the middle of the body. It presents the appearance of a strong globular bulb connected with a tubular anterior prolongation less muscular, apparently a part of the œsophagus. The

[1] Hist. Helm., p. 360.

œsophagus, from the mouth to the pharynx, was not very clearly shown. So far as it could be made out, it is as shown in the sketch. (Fig. 3, *ph.*)

The ova are nearly globular, 0.018 and 0.015 mm. in the two diameters in life, 0.17 and 0.15 in the two diameters in alcoholic specimens.

Ova were observed making their escape from the right side of the terminal pore of a living specimen.

The bodies of all the specimens were flat, depressed, and somewhat convex above.

EXPLANATION OF PLATES.

a. oral sucker.
c. cirrus.
c p. cirrus pouch.
ex. excretory vessel.
g. uterine gland.
i. intestine.
m. mouth.
o. ovary.
œ. œsophagus.
p g. prostate gland
ph. pharynx.
s g. shell gland.
s r. seminal receptacle.
t. testis.
u. uterus.
v d. vas deferens.
vd'. vitelline duct.
v g. vitelline gland.
v s. ventral sucker.

Sketches on which the enlargement is not otherwise noted were made with an Abbe camera lucida and Zeiss objectives and eye pieces, as indicated in the explanations. They were reduced about one-fourth in linear dimensions in the process of printing. Except where otherwise stated, all sketches are by the author.

PLATE XL.

Nitzschia papillosa, new species, from gills of *Acipenser sturio.*

Fig. 1. Sketch of alcoholic specimen, distorted, posterior third side view, anterior two-thirds ventral view. Enlarged about eighteen times.
2. Ventral view of another specimen, alcoholic. Enlarged about eighteen times.
3. Ventral view of head greatly enlarged. Enlarged about two hundred and twenty-five times; *m.* mouth; *b s*, buccal sucker.
4. Everted cirrus. Enlarged about two hundred and twenty-five times.
5. Transverse section through ovary. Zeiss 2/A, draw-tube open.
6. Longitudinal, horizontal section through ovary and testis. Zeiss 2/A, draw-tube open.

Tristomum lævе Verrill, from gills of *Gymnosarda pelamys.*

7. Dorsal view, alcoholic specimen. Enlarged about six times.
8. Ventral view, alcoholic specimen. Enlarged about six times.

Tristomum coccineum Cuvier, from gills of *Xiphias gladius.*

9. Ventral view of portion of anterior. Enlarged about six times; from sketch of living specimen by Margaret B. Linton.
b. s., buccal sucker; *p.*, granules of marginal papillæ; *v.*, vagina.

Octoplectanum affine, new species, from mouth of *Paralichthys dentatus.*

10. Ventral view of alcoholic specimen. Enlarged about three times.
11. Single plectanum of same. Zeiss 2/A, draw-tube open.
12. Hooks from genital atrium: *a*, Zeiss 2/D, draw-tube open; *b* and *c* still more highly magnified.
13. Ovum. Enlarged one hundred and eighty times.

PLATE XLI.

Octoplectanum affine, new species.

Fig. 1. Ventral view anterior end, alcoholic. Zeiss 2/A, draw-tube open; *b*, armature of genital atrium.
2. Ventral view of a single plectanum, life, much enlarged.
3. Dorsal view of posterior end, showing plexus of vessels; from sketch of living specimen by Margaret B. Linton.
4. Longitudinal vertical section through ovary. Zeiss 2/A, draw-tube open.
5. Developing ova from same. Zeiss 2/D, draw-tube open.

Diplostomum cuticole Diesing.

6. Ventral view of specimen removed from cyst; from *Eupomotis pallidus*. 2/A, draw-tube closed.
7. Specimen from *Lepomis auritus*. Enlarged about fifty times.
8. Ventral sucker of specimen shown in Fig. 6. Zeiss 2/D, draw-tube closed.
9. Ventral sucker of another specimen from *Eupomotis pallidus*. Zeiss 2/D, draw-tube closed.
10. Cyst with inclosed embryo, from *Eupomotis pallidus*. Enlarged about sixteen times.

PLATE XLII.

Diplostomum cuticole Diesing.

Fig. 1. Ventral view of specimen from *Lepomis auritus*. Enlarged about thirty times.
2. Cyst with inclosed embryo, from same. Enlarged about twenty-two times.
3. Oral sucker of embryo from same. Enlarged about two hundred and twenty-five times.
4. Oral sucker and pharynx of specimen from *Eupomotis pallidus*. Zeiss 2/D, draw-tube closed.
5. Heart of *E. pallidus*, with cysts. Enlarged three times.

Distomum tornatum Rudolphi, from *Coryphæna hippurus*.

6. Ventral view of alcoholic specimen. Enlarged eight times.
7. Side view of anterior part of body. Enlarged thirty times.
8. Side view of specimen, stained and mounted entire in Canada balsam. Enlarged about six times. *a*. Ova Zeiss 4/D, draw-tube open.
9. Longitudinal section, horizontal, through testes and ovary; anterior end to the right. Specimen from same lot as Nos. 6 and 7. Zeiss 2/A, draw-tube open.
10. Transverse section of specimen from same lot, through anterior testis and seminal receptacle. Zeiss 2/A, draw-tube open.
11. Transverse section of same specimen through posterior margin of ventral sucker. Zeiss 2/A, draw-tube open.
12. Longitudinal vertical section through specimen from same lot, showing cirrus. Zeiss 2/A, draw-tube open.

Distomum ocreatum Molin, from *Pomatomus saltatrix*.

13. Ventral view, alcoholic. Enlarged about thirty-two times.

Distomum ruforiride Rudolphi, from *Roccus lineatus*.

14. Section of anterior sucker and pharynx. Zeiss 2/A, draw-tube open.

PLATE XLIII.

Distomum rufoviride Rudolphi.

Fig. 1. Longitudinal vertical section through head. *l.* lip. Zeiss 2/A, draw-tube open.

2. Section through ovary and part of testis. Specimen somewhat distorted, and section not quite at right angles to axis of body. Zeiss 2/A, draw-tube open.

3. Transverse section through vas deferens, prostate gland, and uterus. 2/D, draw-tube open.

4. Diagram of cirrus, vas deferens, prostate gland, seminal receptacle, and uterus.

Distomum lacre, new species, from *Macrourus bairdii*.

5. Ventral view of specimen, alcoholic. Enlarged six times.

6. Side view of same. Enlarged six times.

7. Ventral view of anterior end. Enlarged about one hundred and eighty times.

8. Transverse section through ovary, vitelline glands, and posterior excretory vessel. Zeiss 4/A, draw-tube open.

PLATE XLIV.

Distomum lacre, new species.

Fig. 1. Dorsal view, partly diagrammatic. Enlarged forty times. *sr* anterior, and *sr'* posterior seminal receptacle, *er* posterior excretory vessel, *ex'*, *ex'*, anterior branches of same.

Distomum monticellii, new species, from *Remora remora*.

2. Ventral view of living specimen. Enlarged twenty times.

3. Diagrammatic side view of anterior end.

4. Cirrus pouch and seminal receptacle as seen through the wall of the body of a specimen made transparent with oil of cloves.

5. Transverse section of body through the posterior edge of the genital aperture. Zeiss 4/A, draw-tube open. *g. a.* genital aperture.

6. Transverse section through anterior half of ventral sucker. Zeiss 2/A, draw-tube open.

7. Transverse section through posterior part of ovary and anterior lobes of vitelline gland.

8. View of ventral sucker in life, showing velum.

Distomum grandiporum Rudolphi, from *Anguilla chrysypa*.

9. Sketch of specimen compressed, stained and mounted in Canada balsam. Enlarged twenty-seven times.

PLATE XLV.

Distomum auriculatum Wedl?, from *Acipenser rubicundus*.

Fig. 1. Ventral view of specimen in oil of cloves. Enlarged twenty-two times.

2. Same of another specimen. Enlarged twenty-seven times.

3. Dorsal view of head of same. Enlarged thirty times.

4. Transverse section of body near base of cirrus pouch. Zeiss 4/A, draw-tube open.

5. Transverse section of body through testis. Zeiss 4/A, draw-tube open.

6. Transverse section near posterior end of body. Zeiss 4/A, draw-tube open.

7. Transverse section of excretory vessel at terminal pore. Zeiss 2/D, draw-tube open.

Distomum macrocotyle Diesing, from *Mola mola*.

Fig. 8. Side view of alcoholic specimens, slightly enlarged.
9. Partial sketch of longitudinal vertical section of body. A specimen was cut, bisected longitudinally with a razor, and the inner aspect of the left half sketched. Enlarged about eight times.
10. Transverse section through neck, showing branches of the intestine, vas deferens, uterus, etc. Zeiss 2/A, draw-tube open.

PLATE XLVI.

Distomum macrocotyle Diesing.

Fig. 1. Transverse section toward posterior end of body. Zeiss 2/A, draw-tube open.
2. Longitudinal vertical section through posterior end of body, showing common longitudinal vessel; *i. e.*, the two vessels *i. i.* in Fig. 1, anastomose near the posterior end of the body.
3. Diagram of cirrus, vas deferens, uterus, etc.
4. Transverse section of uterus. Zeiss 2/D, draw-tube open.
5. Transverse section of vas deferens and portion of prostate gland. Zeiss 2/D, draw-tube open.

Distomum gracile Diesing, from *Lepomis auritus* and *Eupomotis pallidus*.

6. Ventral view of specimen from gills of *E. pallidus*. Enlarged thirty times, *u.* developing uterus. This is probably a younger stage of the adult which Wright found in the mouth of the American bittern and referred provisionally to *D. heterostomum*.
7. Ventral view of specimen from *L. auritus*. Enlarged fifteen times.
8. Side view of anterior end of same. Enlarged fourteen times.

PLATE XLVII.

Distomum lageniforme, new species, from *Remora remora*.

Fig. 1. Dorsal view, life. Enlarged three times. See text for color notes.
2. Ventral view of same after lying some time in water. Enlarged three times. This bears a strong superficial resemblance to *D. cymbiforme* Rudolphi, from Chelonia and Thalassochelys, but in view of the great difference of hosts it is not likely that the species are identical.

Distomum simplex Rudolphi ? from *Microgadus tomcod* and *Hemitripterus americanus*.

3. Ventral view of specimen from *Microgadus* made transparent with acetic acid. Enlarged forty-five times.
4. Ova of same, acetic acid. Zeiss 2/D, draw-tube open.
5. Ventral view of specimen from *Hemitripterus*. Enlarged twenty-two times.
6. Transverse section of body of specimen from same host through ovary. Zeiss 2/A, draw-tube open.
7. Longitudinal horizontal section of body of specimen from same host showing ovary, testis, etc. Zeiss 2/A, draw-tube open.

Distomum pallens Rudolphi from *Alutera schoepfii*.

8. Side view. Enlarged about five times.
9. Ventral view. Enlarged twenty-seven times.

Distomum valdeinflatum Stossich from *Alutera schœpfii*.

Fig. 10. Ventral view of living specimen. Enlarged twenty-seven times.
11. View of mouth with circumoval spines. Zeiss 2/A, draw-tube open.
12. Sketch of individual compressed. Enlarged twenty-seven times.
13. Spines from back of neck. Zeiss 2/D, draw-tube closed.
14. Single oral spine. Zeiss 2/D, draw-tube closed.

PLATE XLVIII.

Distomum valdeinflatum Stossich.

Fig. 1. Part of transverse section just behind the pharynx. Zeiss 2/A, draw-tube open.
2. Portion of body wall of neck. Zeiss 4/D, draw-tube open.

Distomum contortum, Rudolphi host not known, probably *Mola mola*.

3. Side view of alcoholic specimen. Enlarged fourteen times.
4. Side view of head of same showing oval sucker with pharyngeal papilla. Enlarged forty-six times.
5. Tuberculated spines of neck. Enlarged two hundred and twenty-five times.
6. Longitudinal vertical section of head showing cirrus. Zeiss 2/A, draw-tube open.
7. Transverse section near posterior end of body. Zeiss 2/A, draw-tube open.

Distomum nigroflavum Rudolphi, from *Mola mola*.

8. Side view, alcoholic specimen. Enlarged four and one-half times. This specimen has numerous folds of the uterus in the pedicel of the ventral sucker.
9. Side view of another specimen. Enlarged nine times. In this specimen the testes are juxtaposed.
10. Side view of a specimen with testes remote. Enlarged three times.
11. Transverse section of body a short distance back of ventral sucker, showing testis, seminal receptacle, prostate and vitelline glands, etc. Zeiss 2/A, draw-tube open.

PLATE XLIX.

Distomum nigroflavum Rudolphi.

Fig. 1. Longitudinal vertical section, showing posterior testis, ovary, shell gland, etc. Enlarged about thirty times. The granular contents of the longitudinal vessel showing a few of the characteristic crystals noted in text. The latter are greatly enlarged in the sketch.
2. Transverse section of body back of ovary. Zeiss 2/A, draw-tube open.

Distomum foliatum, new species, from *Mola mola*.

3. Side view, alcoholic. Enlarged nine times.
4. Longitudinal vertical section, enlarged about thirty times, showing testes, ovary, shell-gland, vitelline glands, uterus, etc.
5. Transverse section of vas deferens and prostate gland; enlarged from Fig. 3. cells partly diagrammatic. Zeiss 2/D, draw-tube open.

PLATE L.

Distomum foliatum, new species.

Fig. 1. Side view of specimen. Enlarged about twenty-six times.
2. View of neck from above. Enlarged about four and one-half times.
3. Front view of pedicel and ventral sucker. Enlarged about four and one-half times.

PLATE LI.

Distomum foliatum, new species.

Fig. 1. Part of section of ventral sucker as seen in a transverse section of the body. Zeiss 2/A, draw-tube closed.

2. Part of section of ventral sucker, from longitudinal vertical section of the body. Zeiss 2/A, draw-tube closed.

3. Transverse section of the neck through the pharnyx. *cr.* nuchal crest. Zeiss 2/A, draw-tube open.

4. Transverse section of neck a little farther back than fig. 3, *cr.* nuchal crest. Zeiss 2/A, draw-tube open.

NOTE.—The vessels *i i* in this and the preceding figure have been identified as intestinal rami, although the connection between them and the œsophagus could not be demonstrated from the sections. They originate in front of the pharynx as shown in Fig. 3, where they already have the characteristic structure of intestinal vessels. It is probable that in this and the preceding species, as well as in *D. macrocotyle*, the communication between œsophagus and intestinal rami is something like that demonstrated in *D. claratum*. Plate LIII, figs. 8–10.

Distomum nitens, new species, from *Tylosurus caribbæus*.

5. Lateral view, partly diagrammatic, specimen somewhat distorted by compression. Enlarged about twenty-three times.

6. Ova. Zeiss 2/D, draw-tube open.

PLATE LII.

Distomum nitens.

Fig. 1. Cirrus bulb as seen through transparent walls of body. *vd'* portion of vas deferens inclosed within muscular walls of cirrus bulb. Enlarged forty-five times.

Distomum tenue, new species, from *Roccus lineatus*.

2. Superficial view, life. Enlarged twenty-five times. Sketch by Margaret B. Linton.

3. View of same, compressed. Enlarged twenty-five times. Sketch by Margaret B. Linton.

4. Partial view of ventral sucker of same. Enlarged two hundred and twenty-five times. Sketch by Margaret B. Linton.

5. Sketch of alcoholic specimen, enlarged.

6. Ventral view of anterior end of same, more enlarged.

7. Ventral view of alcoholic specimen in acetic acid. Enlarged twenty-five times.

8. Transverse section of body through ovary. *t.* anterior edge of testis. Zeiss 2/A, draw-tube open.

Distomum tenue tenuissime, new subspecies, from *Roccus lineatus*.

9. Side view of alcoholic specimen. Enlarged twelve times.

10. Ventral view of another specimen. Enlarged twenty-four times.

11. Head of same, enlarged. Zeiss 2/A, draw-tube open.

12. Cysts of connective tissue of host containing ova.

PLATE LIII.

Distomum, species, from *Lagocephalus lævigatus*.

Fig. 1. Ventral view of specimen in oil of cloves. Enlarged twenty-two times.

2. Ovum of same. Zeiss 4/D, draw-tube open.

Distomum rachion Cobbold, from *Gadus callarias.*

Fig. 3. Ventral view of specimen. Enlarged twenty-seven times.
4. Squamose spines of neck. Enlarged two hundred and twenty-five times.
5. Outline of margin of neck. Enlarged two hundred and twenty-five times.
6. Margin of body near posterior end. Enlarged two hundred and twenty-five times.
7. Ovum. Enlarged two hundred and twenty-five times.

Distomum claratum Rudolphi, from *Xiphias gladius.*

8. Transverse section of body through anterior edge of pharynx. *x.* sections of vessels, which at this level have the same structure as the vessels *i. i.*, shown in the two succeeding figures to be the intestinal cruri. *n. n.* nerves? Zeiss 2/A, draw-tube closed.
9. Transverse section through middle of pharynx showing the anteriorly extending œsophagus in communication with the intestinal cruri. *n. n.* nerves? Zeiss 2/A, draw-tube closed.
10. Transverse section through the posterior edge of the pharynx, showing the communication of the œsophagus with the pharynx. *n. n.* nerves? Zeiss 2/A, draw tube closed.
11. Ova. Enlarged three hundred and seventy-five times.

Distomum species, larva encysted in *Stizostedion canadense.*

12. Longitudinal vertical section. *nd* nutrient duct. Zeiss 2/A, draw-tube open.
13. Longitudinal vertical section of posterior end through external aperture of the nutrient duct (*nd*). Zeiss 2/A, draw-tube open.

PLATE LIV. *Distomum* species.

Fig. 1. Section of cyst with contained embryo through communication of nutrient duct with surrounding food material. Zeiss 2/A, draw-tube open. *cy.* connective tissue cyst. *gr.* granular nutritive parenchymatose layer. *np.* nutritive pore of embryo.

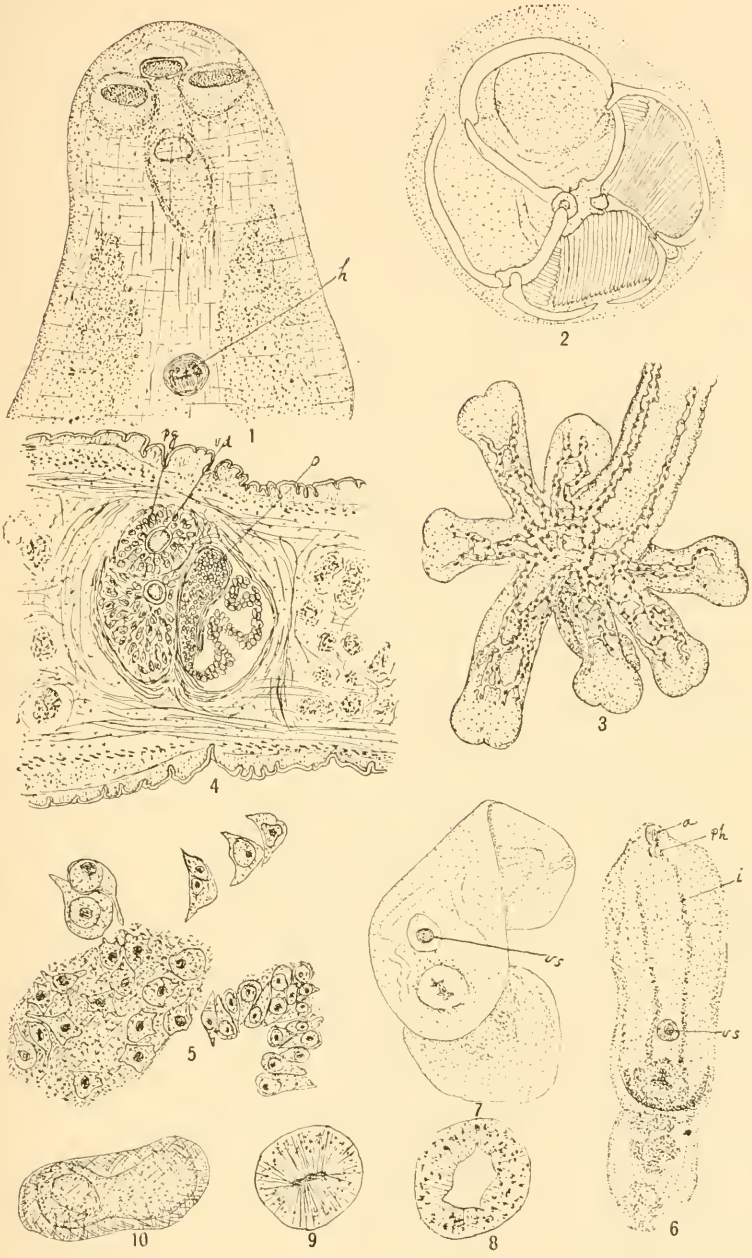
Monostomum orbiculare Rudolphi, from *Lobotes surinamensis.*

2. Ventral view. Sketched from living specimen by Margaret B. Linton. Enlarged forty-five times.
3. Ventral view of another specimen in oil of cloves. Zeiss 2/A, draw-tube closed.
4. Transverse section of body near posterior end. Zeiss 2/A, draw-tube open.
5. Ova. Zeiss 4/D, draw-tube open.

PARASITIC WORMS.

NITZSCHIA FROM STURGEON AND COD; TRISTOMUM FROM OCEANIC BONITO, SWORDFISH, AND SUNFISH (*Mola*); OCTOPLECTANUM FROM FLOUNDER.

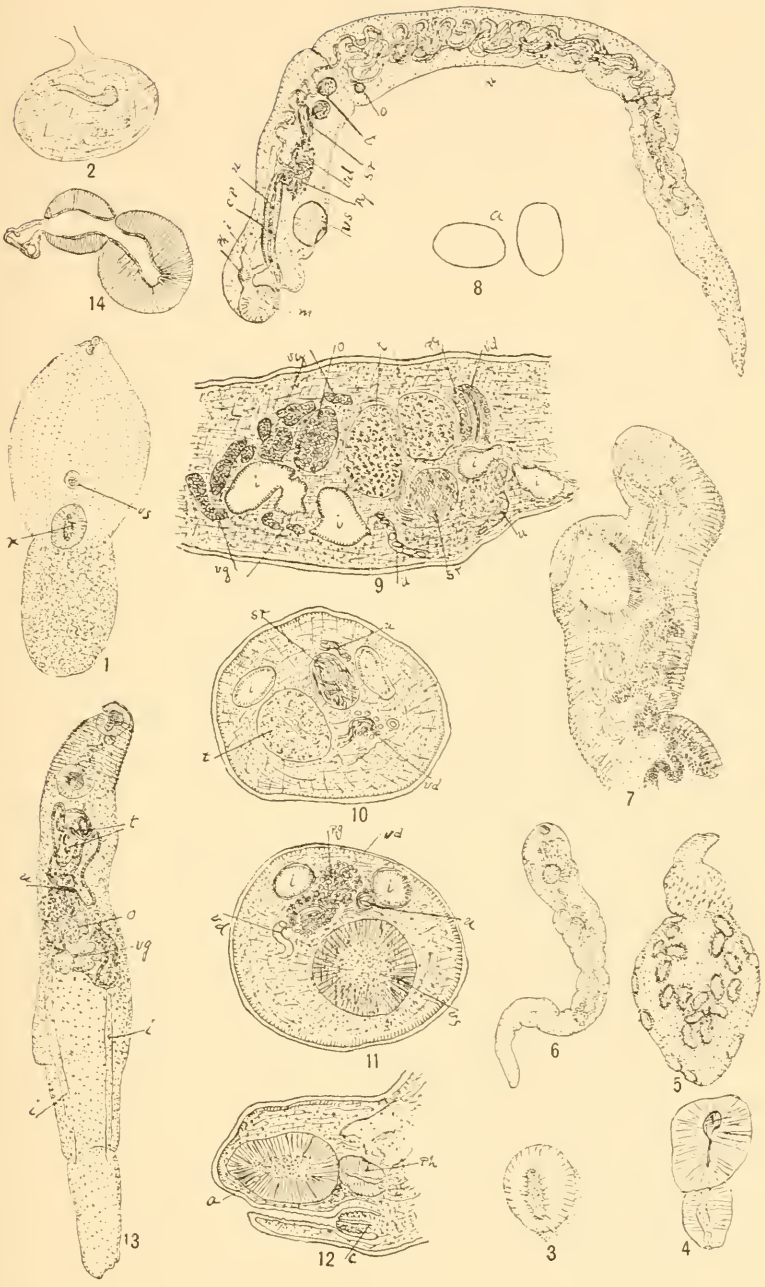
FOR EXPLANATION OF PLATE SEE PAGE 542.



PARASITIC WORMS.

OCTOPLECTANUM FROM FLOUNDER; DIPLOSTOMUM FROM BREAM, ETC.

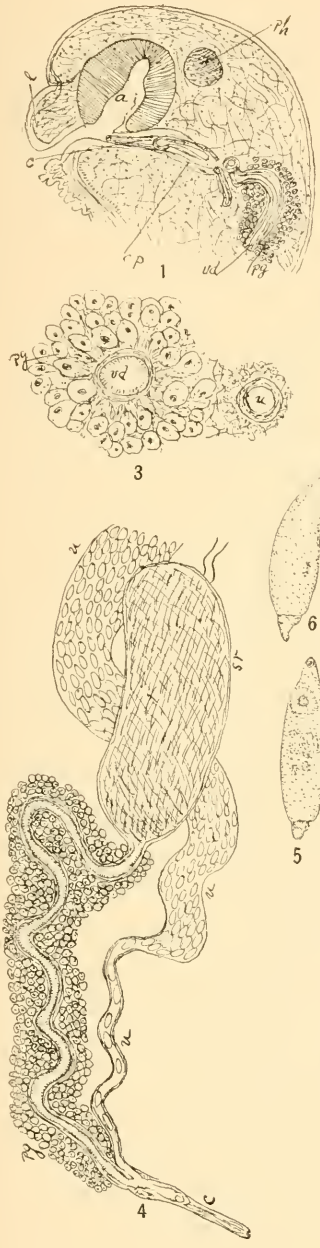
FOR EXPLANATION OF PLATE SEE PAGE 543.



PARASITIC WORMS.

DIPLOSTOMUM FROM BREAM, ETC.; DISTOMUM FROM DOLPHIN, BLUEFISH, AND STRIPED BASS.

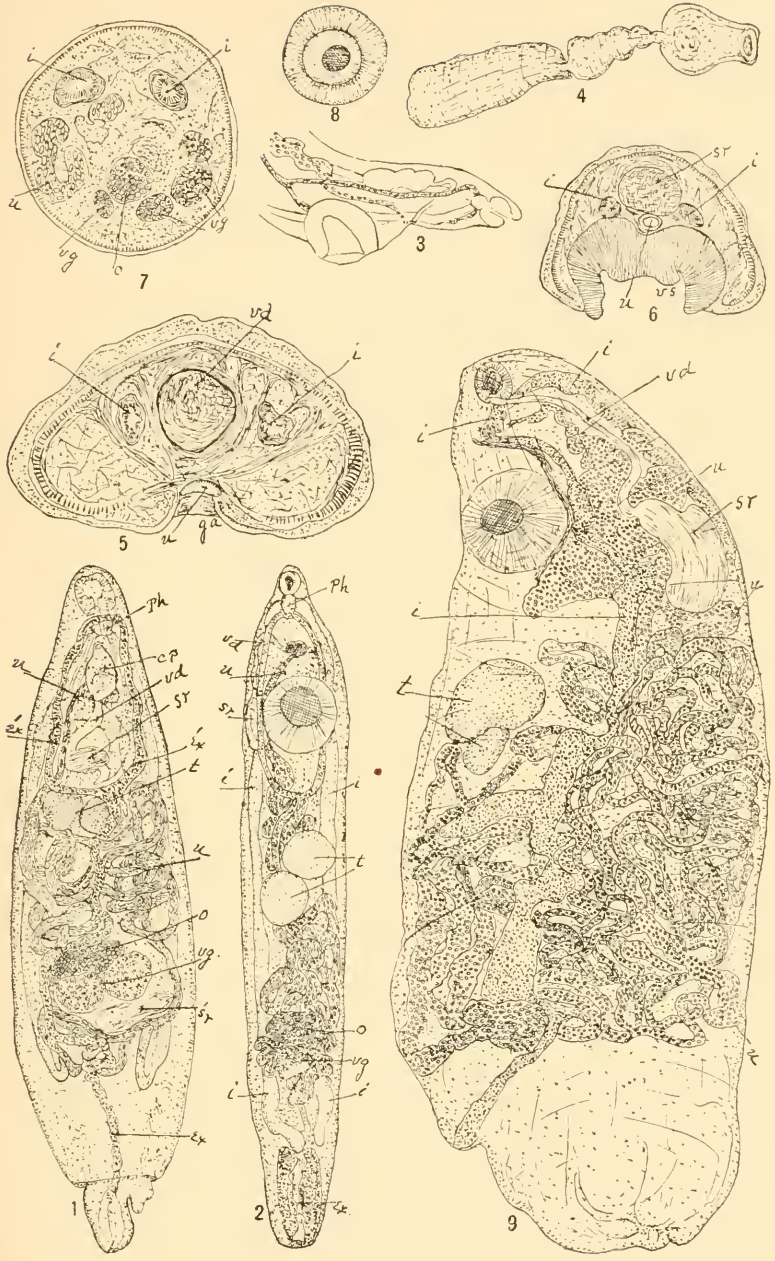
FOR EXPLANATION OF PLATE SEE PAGE 543.



PARASITIC WORMS.

DISTOMUM FROM STRIPED BASS AND MACROURUS.

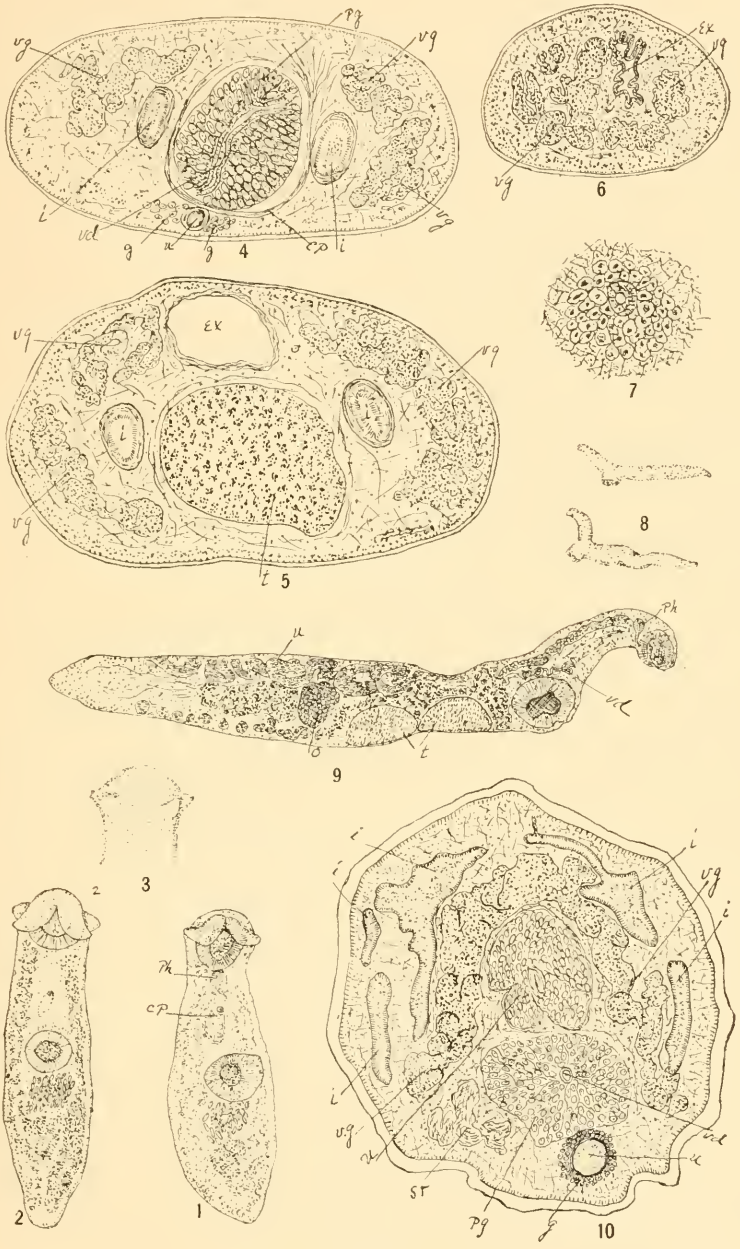
FOR EXPLANATION OF PLATE SEE PAGE 544.



PARASITIC WORMS.

DISTOMUM FROM MACROURUS, SUCKER (*Remora*), AND COMMON EEL.

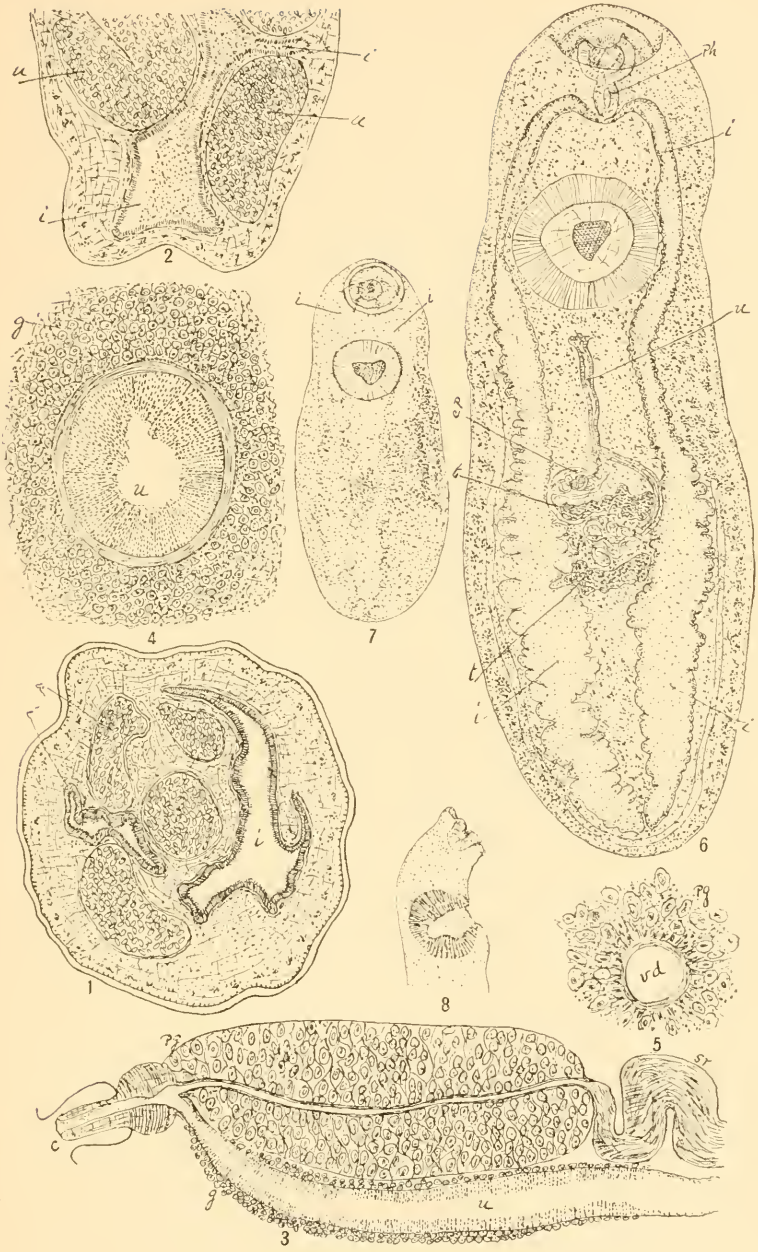
FOR EXPLANATION OF PLATE SEE PAGE 544.



PARASITIC WORMS.

DISTOMUM FROM STURGEON AND SUNFISH (*Mola*).

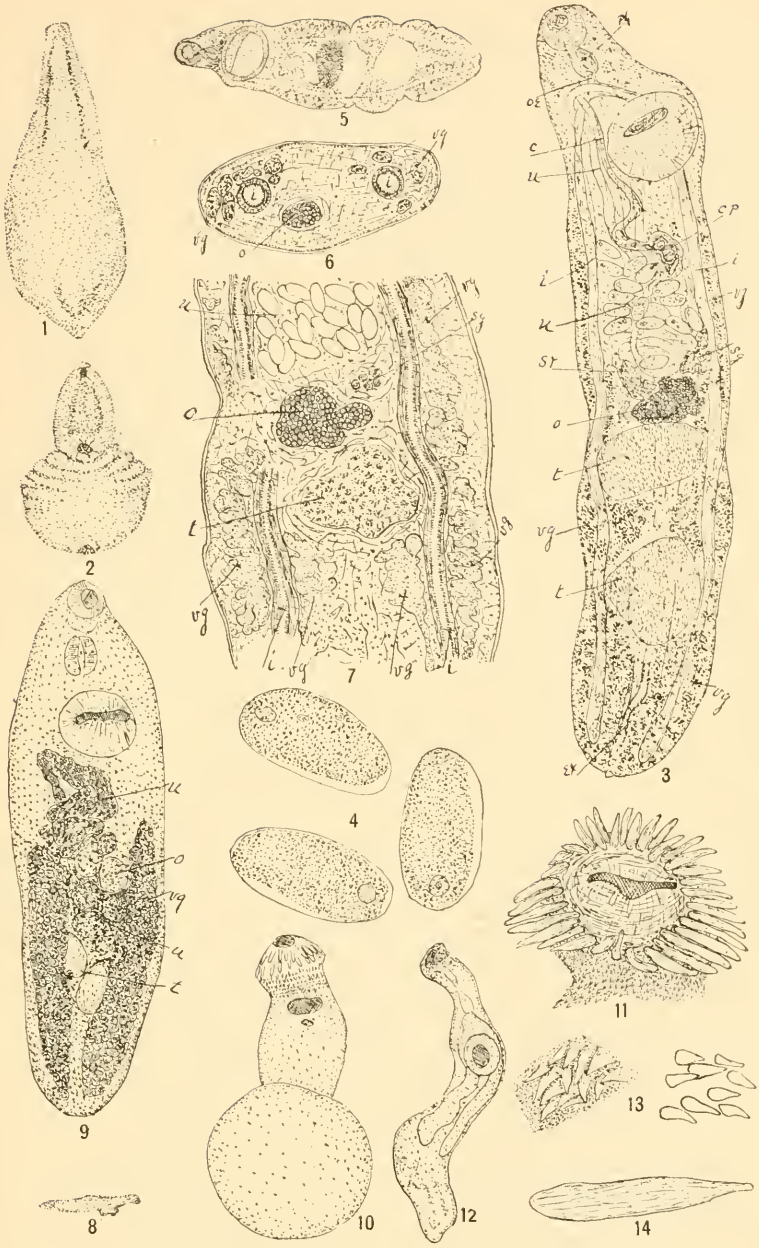
FOR EXPLANATION OF PLATE SEE PAGES 544, 545.



PARASITIC WORMS.

DISTOMUM FROM SUNFISH (*Mola*), BREAM, ETC.

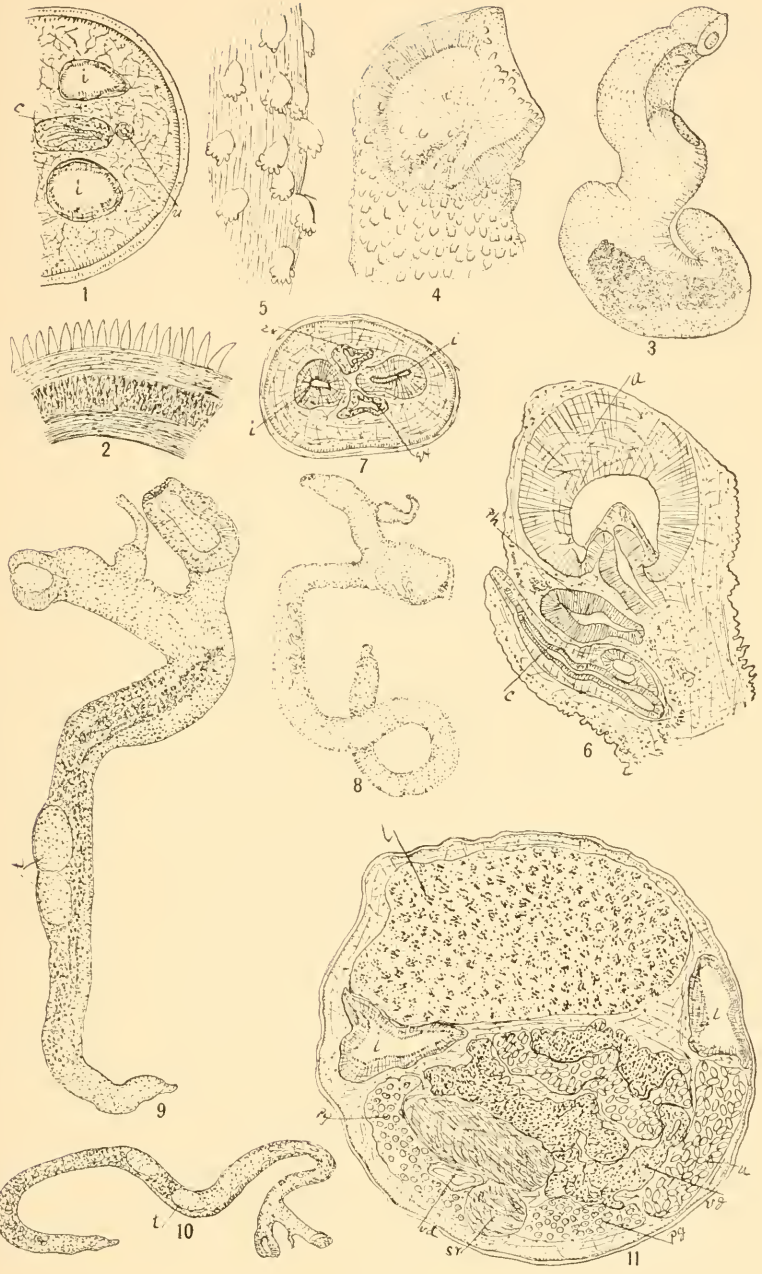
FOR EXPLANATION OF PLATE SEE PAGE 545.



PARASITIC WORMS.

DISTOMUM FROM SUCKER (*Remora*), SEA RAVEN, AND FILEFISH.

FOR EXPLANATION OF PLATE SEE PAGES 545, 546.



PARASITIC WORMS.

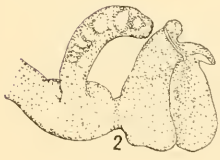
DISTOMUM FROM FILEFISH AND SUNFISH (*Mola*).

FOR EXPLANATION OF PLATE SEE PAGE 546.

PARASITIC WORMS.

DISTOMUM FROM SUNFISH (*Mola*).

FOR EXPLANATION OF PLATE SEE PAGE 546.



PARASITIC WORMS.

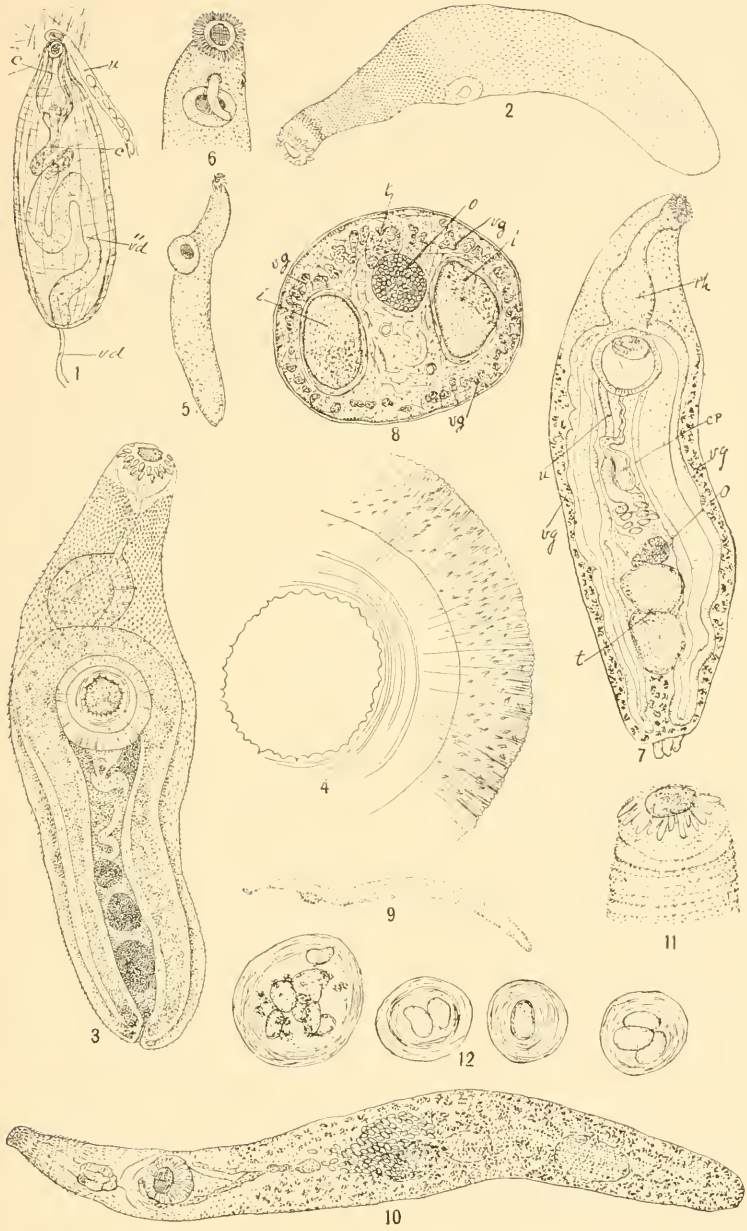
DISTOMUM FROM SUNFISH (*Mola*).

FOR EXPLANATION OF PLATE SEE PAGE 546.

PARASITIC WORMS.

DISTOMUM FROM SUNFISH (*Mola*) AND GARFISH (*Tylosurus*).

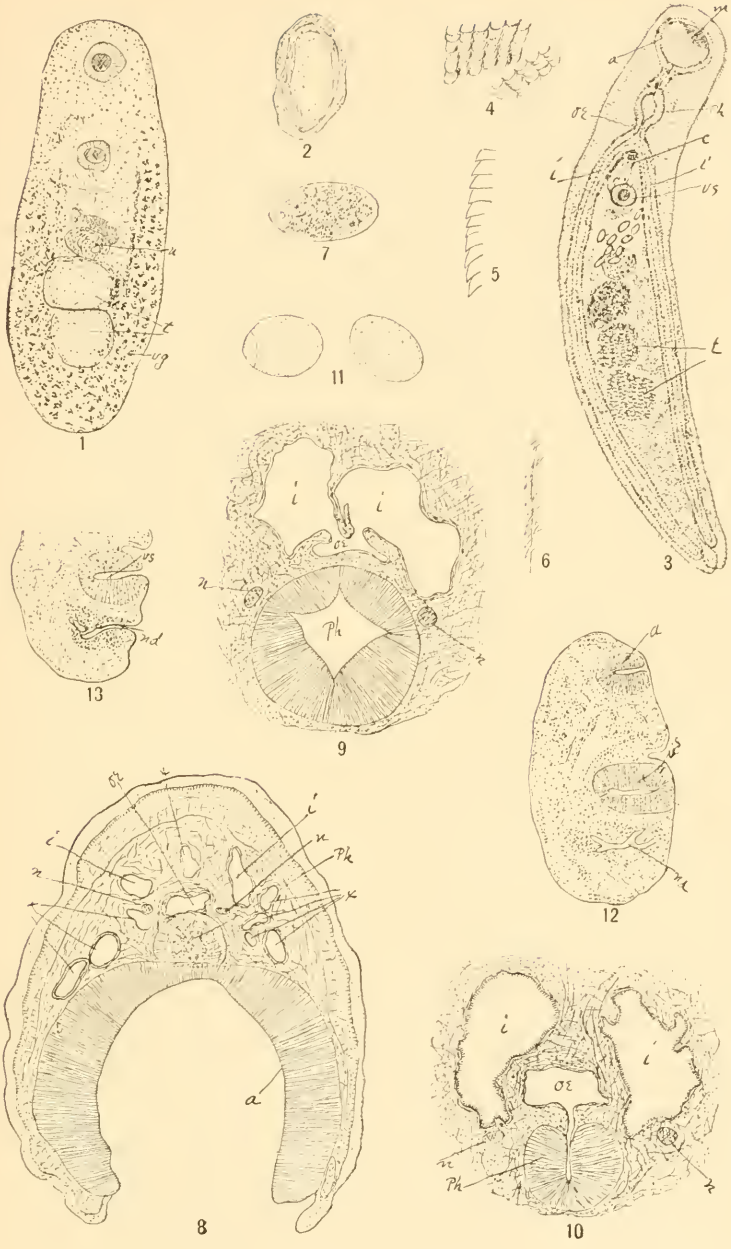
FOR EXPLANATION OF PLATE SEE PAGE 547.



PARASITIC WORMS.

DISTOMUM FROM GARFISH (*Tylosurus*), STRIPED BASS, AND WHITE PERCH.

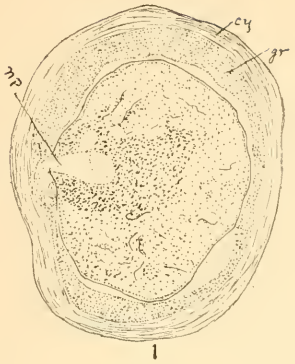
FOR EXPLANATION OF PLATE SEE PAGE 547.



PARASITIC WORMS.

DISTOMUM FROM SMOOTH PUFFER, COD, SWORDFISH, AND SAND PIKE.

FOR EXPLANATION OF PLATE SEE PAGES 547, 548.



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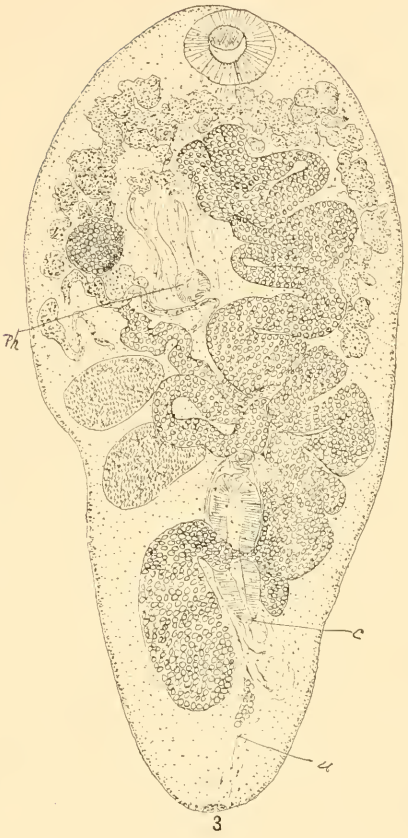
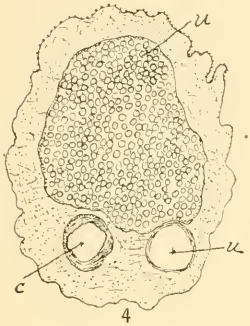
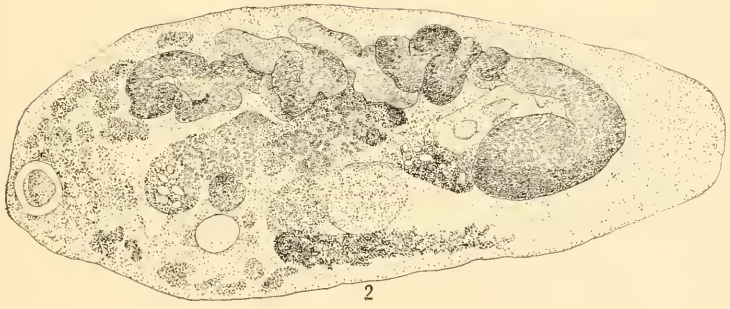


3



4

5



2

PARASITIC WORMS.

DISTOMUM FROM SAND PIKE; MONOSTOMUM FROM FLASHER (*Lobotes*).

FOR EXPLANATION OF PLATE SEE PAGE 548.