In addition, the two immature cestodes, *Taenia incognita* MacCallum 1921, belong in this genus. At present, MacCallum's type slide (U.S.N.M. Helm. Coll. No. 35582) is labeled "Acanthobothrium paulum L. sp. v. Sting Ray Dasybatus pastinacus Ap. 18/17." The total length of the hooks (Pl. 8, Fig. 8) is 0.13 mm., outer prong 0.04 mm., inner prong 0.05 mm., handle to bifurcation 0.078 mm., handle to bifurcation matrix cleared away, 0.048 mm.

Superfamily Lecanicephaloidea Southwell, 1930, emended

Scolex with an eversible, glandular, apical organ. Seminal receptacle absent. Ovary unilaminate or consisting of a number of lobes.

Family Disculicipitidae Joyeux et Baer, 1936, emended
(Discocephalidae Pintner, 1928)

Scolex does not bear suckers or hooks. It consists of an apical cushion beneath the surface of which are many unicellular glands. Vagina crosses vas deferens and opens anterior to opening of cirrus. Vitellaria concentric. Uterine duct opens into posterior end of uterus. Ovary unilaminate. Type genus: *Disculiceps* Joyeux et Baer, 1936a.

Genus *Prosobothrium* Cohn, 1902, emended

Acraspedote, hyperapolytic cestodes. Four glandular sucker-like discs directed anteriad on the globular scolex. Scolex embedded in mucosa of spiral valve of host. Zone of growth long. First proglottids broader than long, becoming longer than broad as they mature. Uterus dehisces early. Testes extend lateral to excretory vessels. Cirrus armed with large triangular spines. Longitudinal muscles a row of isolated fibers in subcuticula. Ova large, thick shelled. Type species: *Prosobothrium armigerum* Cohn, 1902.

Prosobothrium armigerum Cohn, 1902
(Pl. 8, Figs. 1, 10; Pl. 9, Figs. 1, 2, 3, 6)
(*Prosobothrium japonicum* Yamaguti, 1934, Wardle & McLeod, 1952)

Medium sized cestodes up to 110 mm. in length and 1.44 mm. maximum breadth and consisting of about 200 proglottids. Maximum width of strobila occurs in immature proglottid zone. Cuticle 0.009-0.012 mm. thick. Scolex barely visible to the naked eye, 0.31-0.36 mm. long by 0.51-0.65 mm. Glandular discs 0.22-0.33 mm. in diameter. Zone of growth and strobila densely covered with spines 0.024-0.030 mm. long, except anterior 0.5-1.0 mm. of zone of growth with very few spines; zone of growth separated from scolex by a groove, width at groove 0.25-0.36 mm., width immediately posterior to groove 0.43-0.52 mm. End proglottids 0.84-1.82 mm. long by 0.82-1.06 mm. Detached mature proglottids 0.90-3.37 mm. long by 0.93-1.41 mm.; free gravid proglottids 4.8-6.1 mm. long by 2.0-2.5 mm. wide. Genital atria alternate irregularly in posterior third of margin. Cirrus pouch bean-shaped 0.25-0.39 mm. long by 0.09-0.13 mm. wide in strobilar proglottids; 0.49-0.54 mm. long by 0.22 mm. wide in free proglottids. Cirrus 0.9-1.1 mm. long, armed with heavy triangular spines 0.009 mm. long; kinked and slightly coiled in pouch; everted cirrus with bulbar base 0.49 mm. long and 0.18 mm. in diameter. Ejaculatory duct 0.165 mm. in diameter, coiled, lined with long thin bristles. Vas deferens with many coils outside cirrus pouch, and no coils within, maximum diameter 0.21 mm. Testes numerous, over 100, 7-8 postporal; mature testes 0.075-0.105 mm. in diameter. Vagina without convolutions, rising anteriad from genital atrium to form a 45° angle at mid-line where it turns posteriad; enormously dilated when mature. Mehlis' gland 0.063-0.087 mm. long by 0.049-0.052 mm. wide. Ovary with short, narrow isthmus on either side of which it reaches its greatest anterior-posterior length, tapering marginad; anterior wings longest. Vitellaria extend from posterior end of proglottid to just anterior to uterus but not to anterior end of proglottid. Ova opaque, 0.21-0.24 mm. by 0.15-0.16 mm.

This species has been present in all of the *Prionace glauca* which have been examined.

P. armigerum has been reported from *Carcharias rondelettii* Mueller et Henle, by Wagener (1854), Orley (1885), and Mola (1903). Cohn (1902a and b) described the species from a vial of specimens in the Griefswald collection labeled "aus dem Magen von Squalus acanthias". Mola (1928) and Yamaguti (1934) reported the species from *Prionace glauca*. The latter author considered his specimens to belong to a new species which he named *P. japonicum*. Iwata (1939) listed this species in his checklist of Japanese cestodes without further comment. Yamaguti differentiated his species from that of Cohn on the small testes lying one above the other in the dorso-ventral field, and he drew specific attention to the fact that in his species, the vas deferens coiled anterior to the vagina. This last statement is interesting because Cohn made no mention of the course of the vas deferens, and the only place from which Yamaguti could have obtained his idea that the vas deferens did not extend anterior to the vagina in *P. armigerum* is from Cohn's (1902b) text figure 5 on page 59. This figure is not an optical section; it is a horizontal one showing fragments of a number of organs. Though the figure shows pieces of the vas deferens posterior to scattered bits of the vagina, as is to be expected in such a section, it does not indicate the complete course of the male sex duct.

Prosobothrium armigerum lives with its scolex buried in the mucosa of the spiral valve. If the worms are killed in situ, the four glandular disks have the appearance of pads projecting from the scolex (Pl. 8, Fig. 10). A number of unicellular glands open between the discs on the anterior surface of the scolex.

Only the ventral excretory vessels are present in the proglottids, although in sectioned specimens, small tubules occasionally arise from the ventral vessels and extend dorsal. Both a dorsal and a small ventral pair of vessels are present in the zone of growth and scolex. In the scolex the vessels lie beneath the corresponding glandular disc, i. e., the right dorsal vessel runs along the right dorsal disc etc. The dorsal and ventral vessels of each side unite with one another anterior to the brain, but the vessels of opposite sides do not fuse.

A toto mount bearing the U.S.N.M. Helm. Coll. No. 37420 has been deposited with the U. S. National Museum.

Prosobothrium adherens (Linton, 1924) n. com.

(Pl. 9, Figs. 4, 5)

(*Taenia* sp. Linton 1901, 1911, *Ichthyotaenia adherens* Linton, 1924, *Lintoniella adherens* Woodland 1927. Wardle and McLeod, 1952, *Prosobothrium armigerum* Joyeux et Baer, 1936b, *pro parte*).

Two specimens from the Linton collection were presented to me by Dr. D. H. Wenrich. They measured 50 and 52 mm. respectively. One free proglottid with a mature uterus was also present. The type specimen deposited in the U. S. National Museum was also examined to insure that the specimen deposited by Linton as the type was not *P. armigerum* which he apparently also collected under this name.

The following data is abstracted from the generalized description given by Linton (1924) for the specimens from *Cestracion zygaena* Linnaeus since the data for the ones from "*Galeus glaucus*" was concerned with *P. armigerum* as I have confirmed from an examination of the vial.

Length to 75 mm. Maximum breadth 1.92 mm. Strobila broadest at posterior end. Zone of growth 0.70 mm. long. End proglottids 1.92 mm. long by 1.47 mm. Scolex 0.45-0.56 mm. in diameter; glandular discs 0.14-0.21

mm. in diameter. Cirrus armed with spines 0.014 mm. in length. Testes 0.14-0.16 mm. in "longer" diameter. Eggs large with thick shells, ova 0.18 mm. in diameter, shell 0.012 mm. thick. Free ripe proglottids 8.5 mm. long by 2.5 mm.

To the above data, I wish to add the following pertinent information. Cuticle, a thin, unarmed membrane. Proglottids become longer than broad at about middle of strobila. Genital pores marginal, alternate irregularly, slightly anterior to middle of margin. Cirrus pouch 0.38-0.59 mm. long by 0.17-0.22 mm. wide. Cirrus bulb 0.45 mm. long by 0.24 mm. Ejaculatory duct strongly coiled. Testes numerous, *ca* 35 postporal; diameter of mature testes 0.075-0.09 mm. Vagina without convolutions; runs directly to midline and turns at 90° angle to continue posteriad. Lobes of ovary separated only by genital ducts. Ovarian lobes bluntly rounded marginal. Vitellaria extend from posterior to anterior end of proglottids enclosing all of the testes.

Material examined: *Type,* U.S.N.M. Helm. Collection No. 7693. Two specimens and a free proglottid from a vial labeled:

5/9 *Ichthyotaenia adherens, Sphyrna zygaena,* 2088c, Woods Hole 8/3-08

This species differs from *P. armigerum* in that the vagina runs horizontally to mid-line from the genital atrium, in the anterior position of the genital atrium, the complete anterior to posterior enclosure of the genital organs by the vitellaria, the much longer than broad posterior proglottids, the absence of spines on the strobila, and the shape of the ovary.

Species of Uncertain Systematic Position

Genus *Cylindrophorus* Diesing, 1863, emended

(*Platybothrium* Linton, 1890, 1901, 1911, 1924, Southwell, 1925, 1930, Wardle and McLeod, 1952).

Hyperapolytic cestodes with scolex bearing four sessile phyllidia each divided into three loculi; a pair of hooks, one bifid the other trifid, attached in upper rim of anterior loculus; a minute sucker above hooks. Large pyramidal spines on zone of growth and proglottids. Zone of growth begins immediately behind scolex. Vitellaria concentric. Ovary unilaminate. Testes extend lateral to excretory vessels. Longitudinal muscles a row of isolated fibers in sub-cuticula.

Type species: *Cylindrophorus typicus* Diesing 1863, from *Carcharias rondelettii* Mueller et Henle. The anatomy is not known.

Wagener (1854, Figs. 266-271) figured three species of cestodes under the name "*Tetrabothrium* aus *Carcharius rondelettii*" considering them to be developmental stages of a single species. Diesing (1863) was impressed with Wagener's idea, and named the worms *Cylindrophorus typicus* diagnosing adult and larval stages. Linstow (1878, 1889) maintained the name given by Diesing and as the figures given by Wagener showed spines on the strobila, Linstow placed the genus *Cylindrophorus* with the terarhynchs. Orley (1885) was the first helminthologist to study specimens corresponding to Wagener's figures. Though Orley's description is very general, he made some very significant statements. He was unable to find the hooks shown in Wagener's figures 270 and 271. Thus he concluded that Wagener had mixed two distinct forms under one name. He removed the worms from the tetrarhynchs and placed them among the phyllobothriids. Orley's material was of the genus *Prosobothrium.*

Cohn (1902) compared *P. armigerum* with Wagener's figures 267, but it was Mola (1903) who pointed out that figures 266, 267 and 268 belonged to a species of *Prosobothrium* and that figures 270 and 271 belonged to *Cylindrophorus typicus.* Later, Mola (1907) described *Cyatocotyle marche-*

settii from *Carcharias lamia* considering it to be the species of Wagener's figure 269. Thus, Wagener's "*Tetrabothrium* aus *Carcharias rondeletii*" is known today by three different generic names.

Cylindrophorus typicus is unknown except from Wagener's two figures. Investigators who named or discussed the genus had never seen it *per se*.

The confusion arose through Diesing's diagnosis in which he stated that the phyllidia were tubular. He obtained that idea from Wagener's figure, which is a dark lithograph of the scolex. The type of hooks found on the scoleces of cestodes has been used as a taxonomic character for many years, and recently, Jones (1945) has demonstrated that species grouped on the shape of the hooks not only show a morphological relationship, but also a genetic one.

Southwell (1925) placed the genus *Phoreiobothrium* Linton, 1889, as a synonym of *Cylindrophorus* on the basis of the phyllidial characters. This error has been perpetuated by Fuhrmann (1931) and Joyeux et Baer (1936). The four species of *Phoreibothrium*, however, are distinctive in that the pairs of hooks are all trifurcated. *Phoreiobothrium* is a valid genus, but requires further study of the internal anatomy before it can be satisfactorily placed. A restudy of the last mentioned genus may aid considerably in the placing of *Cylindrophorus*.

Cylindrophorus cervinus (Linton, 1890) n. com.

(Pl. 8, Fig. 5)

(*Platybothrium cervinum* Linton, 1890, 1901, 1911, 1924; Southwell, 1925, 1930, Wardle and McLeod, 1952)

Material examined: Type specimen, U.S.N.M., Helm. Coll. No. 7689. The type has destained to the extent that very little of the internal anatomy was discernable. Two specimens are mounted on the slide.

Small slightly craspedote cestodes reaching 67 mm. in length and consisting of about 100 proglottids. First proglottids indistinct, broader than long, becoming longer than broad as they mature; end proglottids 1.25-1.72 mm. long by 0.4-0.54 mm. wide. Maximum breadth of scolex 0.45-0.54 mm. Length of phyllidia 0.33-0.52 mm.; anterior loculus large, middle loculus 0.015 mm. long; posterior loculus 0.03 mm. long. Maximum breadth of pair of hooks on toto mounts 0.225-0.255 mm.; length of outer prong of bifid hook 0.09 mm., inner prong 0.09-0.10 mm.; length of inner prong of trifid hook 0.39-0.42 mm., middle prong 0.78-0.87 mm.; upper prong 0.81-0.90 mm. Tip of inner prong flares abruptly. Genital atria slightly posterior to middle of margin. Cirrus pouch 0.135-0.165 mm. long by 0.075 mm. 80-90 testes in each proglottid, 13-16 postporal.

Type host: *Carcharinus milberti* Mueller et Henle.
Type locality: Woods Hole, Mass.
Type specimen: U.S.N.M. Helm. Coll. No. 7689.

Cylindrophorus hypoprioni (Potter, 1937) n. com.

(Pl. 8, Fig. 6)

(*Platybothrium hypoprioni* Potter, 1937, Wardle & McLeod, 1952)

The type specimen U.S.N.M. Helm. Coll. No. 9061, and two cotypes U.S.N.M. Helm. Coll. No. 9062 as well as four specimens given to me by Dr. H. W. Manter were examined. All of the specimens had died before they were fixed and no information not already present in Potter's description could be obtained.

The species differs from *C. cervinus* in the absence of the bar between the hooks, the size and shape of the hooks, and the greater number of testes, especially of the postporal ones.

Cylindrophorus posteroporus n. sp.

(Pl. 8, Figs. 2-4, 9, 11)

(*Platybothrium cervinum* Linton, 1890, *p. p.*)

Small slightly craspedote cestodes reaching a length of about 40 mm. and consisting of 80-90 proglottids. Phyllidia of living worms 0.53-0.56 mm. long by 0.24-0.26 mm. wide, of toto mounts 0.42-0.46 mm. long by 0.12-0.17 mm. Ratio of anterior loculi to phyllidia length 5/7-7/9, of middle loculi 1/18, of posterior loculi 1/9. Maximum breadth of pair of detached hooks 0.285-0.300 mm., of hooks on toto mounts, 0.180-0.225 mm.; length of outer prong of bifid hook 0.084-0.089 mm., inner prong 0.081-0.089 mm.; length of inner prong of trifid hook 0.066-0.069 mm., middle prong 0.119 mm., outer prong 0.085 mm., bar 0.105 mm. long. Zone of growth 1.3-1.8 mm. long, 0.10-0.12 mm. wide at base of scolex, 0.18-0.23 mm. wide at first proglottid. Spines on zone of growth 0.016-0.019 mm. long. End proglottids pumpkinseed-shaped, 0.3-1.5 mm. long by 0.22-0.58 mm. wide. Free gravid proglottids 2.77-3.0 mm. long by 1.0-1.17 mm. wide. Genital pores alternate irregularly in posterior third of margin. Cirrus pouch directed anteriad at a 45° angle from genital pore; 0.240-0.264 mm. long by 0.090-0.120 mm. in mature proglottids. Cirrus long, coiled, armed with stout spines. 65-75 oval testes in each proglottid; mature testes 0.105-0.135 by 0.090 mm. No testes posterior to cirrus pouch on poral side. Vitellaria enclose posterior 3/5 of proglottid. Ovary butterfly-shaped, posterior wings longest; ovary in free proglottids 0.84 mm. long and 0.84 mm. in maximum width. Mehlis' gland 0.09 mm. in diameter. Uterine duct opens into uterus at level of genital pores. Uterus small, dehisces early. Ova 0.165-0.195 mm. long by 0.13-0.15 mm.

Type host: *Prionace glauca* (Linnaeus)

Type locality: Monterey Bay, Calif.

Type specimen: U.S.N.M. Helm. Coll. No. 37421.

This species has been discovered only in the type host. The sharks were invariably heavily infected. Linton's (1924) specimens of *P. cervinum* from *Galeus glaucus* have proved to be *C. posteroporus* on reexamination.

Cylindrophorus posteroporus differs from the other members of the genus in the absence of postporal testes. It is further differentiated from *C. cervinus,* which also has a bar between the members of a pair of hooks in the absence of the flared end on the inner prong of the trifid hook, in the proportional measurements of the hooks, and also in the size and position of the cirrus pouch.

Discobothrium fallax van Ben., 1871

(Pl. 9, Fig. 7)

Two specimens of this interesting tapeworm were found in a specimen of *Raja rhina* from Monterey Bay on October 7, 1948, and one was discovered previously in the spiral valve of a very small *Raja inornata* from the same general locality on September 22, 1946. The longest specimen was 56 mm. in length.

This species has been described in detail by Woodland (1927a) but Baer (1948) stated that the figures given by Woodland for scoleces of *D. fallax* and *Echeneibothrium variabile* van Ben., 1850, were probably reversed and that Woodland had confused the two species. The difficulty resulted from the absence of a description by Woodland of the histology of the apical organ. As pointed out by Baer, the apical organ of *E. variabile* is a myzorhynchus containing a huge sucker, while in *D. fallax,* the organ contains an eversible glandular pad. The pad is everted in one of my specimens and is 0.36 mm. thick by 0.99 mm. in diameter.

Woodland also failed to mention the well developed layer of internal longitudinal muscles in *D. fallax*. The bundles are discreet and separate a coarse external layer of parenchyma from the fine mesh medullary parenchyma.

Summary

1. On the basis of larval stages and the morphology of the female genitalia, the sub-class Cestoda of the class Cestoidea can be divided into two superorders, the Trixenidea with the orders Tetraphyllidea, Trypanorhyncha, and Pseudophyllidea, and the Dixenidea with the one order Cyclophyllidea.

2. The Tetraphyllidea of sharks and skates are contained in the superfamilies Phyllobothrioidea and Lecanicephaloidea. Species in both of these superfamilies are described in this paper.

3. In the family Phyllobothriidae of the Phyllobothrioidea, *Phyllobothrium* lactuca is reported from *Triakis semifasciata; P. radioductum* from *Raja binoculata, R. montereyensis,* and *R. rhina; P. tumidum* from *Lamna ditropis; Orygmatobothrium musteli* from *Rhinotriacis henlei* and *Triakis semifasciata; O. dohrnii* from *Hexanchus corinus; Anthobothrium laciniatum* from *Prionace glauca; Scyphophyllidium giganteum* from *Galeorhinus zyopterus; S. angustum* (Linton, 1889) *n. com.* from *Prionace glauca. Anthobothrium pulvinatum* Linton, 1890, is transferred to a new genus, *Inermiphyllidium* to which genus, a new species, *I. brachyascum* from *Aetobatus californicus,* is added. *Dinobothrium septaria* is reported from *Lamna ditropis,* and *D. planum* and *D. spinosum* from *Cetorhinus maximus.*

4. A new family, Echeneibothriidae is established to include species in which the phyllidia of the plerocercoids and adults are multiloculate. *Echeneibothrium octorchis* n. sp. from *Raja montereyensis, R. rhina,* and *R. binoculata; E. dolichoophorum* n. sp. from *R. rhina; E. macrascum* n. sp. from *R. montereyensis,* and *E. myzorhynchum* from *R. binoculata* are described. *Caulobothrium opisthorchis* n. sp. and *C. tetrascaphium* n. sp. are described from *Aetobatus californicus.*

5. In the family Onchobothriidae, the following species are described: *Acanthobothrium hispidum* n. sp. from *Tetronarce californica; A. maculatum* n. sp. from *Aetobatus californicus; A. brachyacanthum* n. sp. from *Raja montereyensis; Calliobothrium pellucidum* from *Mustellus californicus.* The genus *Pinguicollum* is erected with the following species, *P. pinguicollum* (Sleggs, 1927), *P. tortum* (Linton, 1916), *P. incognitum* (MacCallum, 1921).

6. Two lecanicephaloids are redescribed, *viz., Prosobothrium armigerum,* and *P. adherens* (Linton, 1924) n. com.

7. Some species still can not be adequately placed. Among these, the genus *Cylindrophorus* is discussed with a redescription

of *C. cervinus* (Linton, 1890); and *C. posteroporus* n. sp. is described from *Prionace glauca*. *Discobothrium fallax* is also difficult to place at present, and is mentioned from *Raja inornata* and *R. rhina*.

References Cited

Baer, J. G. 1948. Contributions a l'étude des cestodes de sèlaciens. Bull. Soc. Neuchatel. Sci. Natur., 71:63-122.

1954. Revision taxinomique et etude biologique des Cestodes de la famille des Tetrabothriidae parasites d'Oiseaux de haute mer et de Mammiferes marins. Mem. Univ. Neuchatel, s. 4 to, 1:123.

Baylis, H. A. 1950. A review of the species of *Dinobothrium* (Cestoda), with a description of a new species. Parasitology, 40:96-104.

van Beneden, P. J. 1849. Les helminthes cestoides consideres sous la rapport de leurs metamorphosis, de leur composition anatomique, et de leur classification. Bull. Acad. Roy. Sci. Belg., 16:269-282.

1850. Recherches sur la faune littorale de Belgique; les vers Cestoides consideres sous le rapport physiologique, embryogenique, et zooclassique. Mem. Acad. Roy. Sci. Belg., 25:1-199.

1871. Les poissons des cotes de Belgique, leurs parasites et leurs commensaux. Mem. Acad. Roy. Sci. Belg., 38:1-100.

1889. Deux cestodes nouveau de *Lamna cornubica*. Bull. Acad. Roy. Belg., ser. 3, 17:68-74.

Borcea, L. L. 1934. Note preliminaire sur les cestodes des elasmobranches ou selaciens de la Mer Noire. Ann. Sci. l'Univ. Jassy, 19:345-369.

Braun, M. 1900. Cestodes. Bronn's Klass. u. Ordnung Thierreichs, 4: 927-1731.

Carus, J. V. 1863. Handbuch der Zoologie. vol. 2. Leipzig.

Cohn, L. 1902a. Zur Kenntnis des Genus *Wageneria* Monticelli und anderen Cestoden. Centralbl. Bakt., 1, 33:53-60.

1902b. Helminthologische Mittheilungen. Arch. Naturg. Jahrg., 69: 47-68.

Diesing, K. M. 1854. Ueber eine naturgemaesse Verteilung der Cephalocotyleen. Sitzber. Akad. Wiss. Wien, Math. naturw. Klasse, Abt. 1., 9:171-185.

1863. Revision der Cephalocotyleen. Sitzber. k. Akad. Wein, 48:200-345.

Dollfus, R. Ph. 1942. Etudes critiques sur les l'etrarhynques du Museum de Paris. Arch. Mus. Nat. d'Hist. Nat. ser. 6, 19:1-466.

Fuhrmann, O. 1931. Dritte Klasse des Cladus Plathelminthes. Cestoidea. Handb. Zool. Kuekenthal u. Krumbach. 2:141-416.

Garman, S. 1913. The Plagiostomia. Mem. Mus. Comp. Zool. Harvard, 36:1-505.

Hart, J. F. 1936. Cestoda from fishes of Puget Sound. 3. Phyllobothrioidea. Trans. Amer. Micros. Soc., 55:488-496.

Heller, Anita F. 1949. Parasites of Cod and other marine fish from the Baie de Chaleur region. Canadian J. Res., D, 27:243-264.

Iwata, S. 1939. The classification list of Cestoidea in Japan. Vol. Jub. Prof. Sadao Yoshida, 2:225-247.

Jones, A. W. 1945. Studies in cestode cytology. J. Parasitol., 31:213-235.

Jordan, D. S. and C. H. Gilbert. 1883. Synopsis of the fishes of North America. Bull. U.S. Nat. Mus., 16:1-1018.

Joyeux, C. et J. G. Baer. 1936a. Notices helminthologiques. Bull. Soc. Zool. France, 60:482-501.

1936b. Cestodes. *Faune de France,* 30, 613 pp.

Kay, M. W. 1942. A new species of *Phyllobothrium* van Beneden from *Raja binoculata* (Girard). Trans. Amer. Micros. Soc., 61:261-266.

Klaptocz, B. 1906. Neue Phyllobothriden aus *Notidanus* (*Hexanchus*) *griseus* n. g. Arb. Zool. Instit. Wien, 16:325-360.

Koehler, E. 1894. Der Klappenapparat in den Excretionsgefaessen der Taenien. Zeit. Wiss. Zool., 57:385-401.

Linstow, O. von. 1878. *Compendium der Helminthologie.* 382 pp. Hannover.
1889. *Compendium der Helminthologie. Nachtrag. Die* Litteratur der Jahre 1878-1889. 151 pp. Hannover.

Linton, E. 1889. Notes on entozoa of marine fishes of New England. Rep. U. S. Comr. Fish., (1886):453-511.
1890. Notes on entozoa of marine fishes of New England with descriptions of several new species. Part 2. Cestodes. Rep. U. S. Comr. Fish., (1887):718-899.
1897. Notes on cestode parasites of fishes. Proc. U. S. Nat. Mus., 20: 423-456.
1900. Fish parasites collected at Woods Hole in 1898. Bull. U. S. Fish Com., (1899):267-304.
1901. Parasites of fishes of the Woods Hole Region. Rep. U. S. Comr. Fish., (1899):405-492.
1905. Parasites of fishes of Beaufort, N. C. Bull. U. S. Fish Com., (1904): 321-428.
1910. Notes on the distribution of entozoa of North American marine fishes. Proc. 7th Intern. Zool. Congress, pp. 686-696.
1911. A catalogue of the marine fauna of Woods Hole and vicinity. Cestoda. Bull. U. S. Bur. Fish., 31 (2):585-589.
1915. A new cestode from the maneater and mackerel sharks. Proc. U. S. Nat. Mus., 61 (2433):1-16.
1916. Notes on two cestodes from the spotted sting ray. J. Parasitol., 3:34-38.
1922. A contribution to the anatomy of *Dinobothrium,* a genus of selachian tapeworms, with descriptions of two new species. Proc. U. S. Nat. Mus., 60 (2401):1-13.
1924. Notes on cestode parasites of sharks and skates. Proc. U. S. Nat. Mus., 64 (2511):1-114.

Loennberg, E. 1889. Bidrag til kaennedomen om i Sverige forerekommande Cestoder. Bihang. Svensk. Vet. Akad. Handl., 14:1-69.
1892. Anatomische Studien ueber Skandinavische Cestoden. II. Zwei Parasiten aus Walfischen und zwei aus *Lamna cornubica.* Svenska Vetenskaps. Akad. Handl., 24:1-28.

Luehe, M. 1910. Cestoden. In, A. Brauer, *Die Suesswasserfauna Deutschlands.* 18:1-153.

MacCallum, G. A. 1921. Studies in helminthology. *Zoopathologica,* 1:137-284.

Masi, L. 1912. Sulla presenza del *"Dinobothrium septaria"* in una *"Selache maxima."* Boll. Soc. Zool. Ital., Roma, s. 3, 1:323-328.

Mola, P. 1903. Su di un Cestode del *Carcharodon Rondoletii* M. Hle. Arch. Zool. Napoli, 1:345-367.
1906. Di alcune species poco studiate o mal note di Cestodi. Annuar. Mus. Zool. Napoli, (n.s.), 2:1-12.
1907. Due nuove forme di Tetraphillidae. Boll. Soc. Adriat. Sci. Nat., 24:1-16.
1928. Vermi parassiti dell'Ittiofauna Italiana. Boll. Pesca, Piscicoltura e Idrobiol., 4:395-443.

Meggitt, F. J. 1914. The structure and life-history of a tapeworm (*Ichthyotaenia filicollis* Rud.) parasitic in the stickleback. Proc. Zool. Soc., London, 1:113-138.

Nybelin, O. 1914. Notizen ueber cestoden. 2. Noch ein Fall von *Dinobothrium septaria* v. Ben. aus *Selache maxima*. Zool. Bidrag Uppsala, 3:228-230.

Oerley, L. 1885. A Czapaknak es Rajaknak Belfergei. Termesz Fusetek, 9:97-126.

Olsson, P. 1866. Entozoa iakttagna hos Skandinaviska hafsfiskar. Act. Univ. Lund math. natur-vetensk., 4:1-59.

Pintner, T. 1928. Die sogennante Gamobothriidae Linton 1899. Zool. Jahrb. Anat., 50:55-116.

Potter, C. C. 1937. A new cestode from a shark (*Hypoprion brevirostris* Poey). Proc. Helm. Soc. Washington, 4:70-72.

Rees, Gwendolen. 1943. The anatomy of *Anthobothrium auriculatum* (Rud.) (Cestoda) from *Raja batis* L. Parasitology, 35:1-10.

1953. Some parasitic worms from fishes off the coast of Iceland. I. Cestoda. Parasitology, 43:4-14.

Riser, N. W. 1949a. Studies on the Tetraphyllidea. (unpublished dissertation, Stanford University).

1949b. Studies on the Tetraphyllidea. Stanford Univ. Bull., s. 8, 24: 96-97.

1949c. Observations on the nervous system of the cestodes. J. Parasitol., 35 Suppl., p. 27.

1950. Notes on toto-mount technique. Proc. Helm. Soc. Washington, 17:132-133.

1951. The procercoid larva of *Lacistorhynchus tenuis* (van Ben. 1858). J. Parasitol., 37 Suppl., p. 26.

Ruszkowski, J. S. 1932. Etudes sur le cycle evolutif et la structure des cestodes de mer. 3. Le cycle evolutif du tetrarhynque *Grillotia erinaceus* (van Beneden, 1858). C. R. Acad. Cracovie, no. 9, p. 6.

1934. Etudes sur le cycle evolutif et sur la structure des cestodes de mer. 3. Le cycle evolutif du tetrarhynque *Grillotia erinaceus* (van Beneden 1858). Mem. Acad. Polon., (B), no. 6:1-9.

Shipley, A. E. and J. Hornell. 1906. Cestode and Nematode parasites from the marine fishes of Ceylon. Herdman's Pearl Oyster Report, Pt. 5.

Sleggs, G. F. 1927. Notes on cestodes and trematodes of marine fishes of Southern California. Scripps Inst. Oceanog. Bull. Tech. ser., 1 (6):63-72.

Southwell, T. 1925. A monograph on the Tetraphyllidea with notes on related cestodes. Liverpool School Trop. Med. Mem., (n.s.), no. 2, 368 pp.

1927. On a collection of cestodes from marine fishes of Ceylon. Ann. Trop. Med. Parasitol., 21:351-373.

1930. *Cestoda. The Fauna of British India, including Ceylon and Burma.* Vol. 1. 291 pp. London.

and B. Prashad. 1921. A revision of the Indian species of the genus *Phyllobothrium*. Rec. Ind. Mus., 19:1-8.

Sproston, N. G. 1948. On the genus *Dinobothrium* van Beneden (Cestoda), with a description of two new species from sharks, and a note on *Monorygma* sp. from the electric ray. Parasitology, 39:73-90.

Stunkard, H. W. 1937. The physiology, life cycles, and phylogeny of the parasitic flatworms. Amer. Mus. Novitates, no. 908:1-27.

Subramaniam, M. K. 1939. Studies on cestode parasites of fishes. I. *Biporophyllaeus madrassensis* gen. et sp. nov., with a note on its systematic position. Rec. Indian Mus., 41:131-150.

Tower, W. L. 1900. The nervous system of *Monezia expansa*. Zool. Jahrb. Anat., 13:359-385.

Wagener, G. R. 1854. Die Entwicklung der Cestoden. Nov. Acta Leop. Carol, 24, suppl., 91 pp.

Wardel, R. A. and J. A. McLeod. 1952. *The Zoology of Tapeworms*. Univ. Minn. Press.

Woodland, W. N. F. 1927. A revised classification of the tetraphyllidean Cestoda with descriptions of some Phyllobothriidae from Plymouth. Proc. Zool. Soc. London, 3:519-548.

Yamaguti, S. 1934. Studies on the helminth fauna of Japan. Pt. IV. Cestodes of fishes. Jap. Journ. Zool., 6:1-113.

1952. Studies on the helminth fauna of Japan. Part 49. Cestodes of fishes II. Acta Med. Okayama, 8:1-76.

Yoshida, S. 1917. Some cestodes from Japanese selachians. Parasitology, 9: 560-591.

Young, R. T. 1954. Cestodes of sharks and rays in Southern California. Proc. Helm. Soc. Washington, 21:106-112.

Zschokke, F. 1888. Recherches sur la structure anatomique et histologique des cestodes. Mem. l'Inst. Nation. Genevois, 17:1-396.

EXPLANATION OF PLATE 1

All figures were drawn with the aid of a camera lucida. The scale to the left of figures 3 and 7 = 0.4 mm.; of figures 1, 4, 5, and 6 = 0.2 mm.; of figure 2 = 0.1 mm.

Fig. 1. Scolex of *Anthobothrium laciniatum* from a toto mount.

Fig. 2. Transverse section of a mature proglottid of *A. laciniatum* through the ovary, showing the vagina crossing from dorsal to ventral in the middle of the field, and the vitellaria lateral to the excretory vessels and ovary.

Fig. 3. Moderately relaxed scolex of *Phyllobothrium lactuca* from a toto mount.

Fig. 4. Transverse section of a mature proglottid of *P. tumidum* showing the dorsal ovary.

Fig. 5. Portion of a transverse section of a mature proglottid of *P. radioductum* showing the distribution of the vitellaria and muscles.

Fig. 6. Longitudinal section of two proglottids of *P. tumidum* showing the nerve commissures in the anterior ends of the proglottids.

Fig. 7. Scolex of *P. tumidum* from a living specimen.

EXPLANATION OF PLATE 2

The scale to the left of figure 3 = 1.0 mm.; of figure 8 = 0.4 mm.; of figures 1, 2, 4, 7, and 9 = 0.2 mm.; of figure 6 = 0.05 mm.; of figure 5 = 0.02 mm.

Fig. 1. Scolex of *Orygmatobothrium musteli* from a toto mount.

Fig. 2. Scolex of *Scyphophyllidium angustum* from a toto mount.

Fig. 3. Free ripe proglottid of *S. angustum*, all testes not figured.

Fig. 4. Portion of a transverse section of a mature proglottid of *Phyllobothrium lactuca* showing the distribution of the muscles and the vitellaria.

Fig. 5. Egg of *S. giganteum* laid in sea water.

Fig. 6. Egg of *S. angustum* laid in sea water.

Fig. 7. Organs of the interovarian space of *O. musteli* from a toto mount.

Fig. 8. Mature proglottids of *S. giganteum;* vitellaria not figured in top proglottid.

Fig. 9. End proglottid from strobila of *O. musteli.*

EXPLANATION OF PLATE 3

The scale to the left of figure 4 = 0.8 mm.; of fig. 5 = 0.6 mm.; of figs. 2 and 6 = 0.4 mm.; of figs. 1 and 7 = 0.2mm.; of fig. 3 = 0.02 mm.

Fig. 1. Scolex of *Scyphophyllidium giganteum* from a toto mount.

Fig. 2. Immature proglottid of *Dinobothrium septaria.*

Fig. 3. Egg of *"Diplobothrium simile,"* only yolk cells visible.

Fig. 4. Mature proglottid of *Inermiphyllidium pulvinatum.*

Fig. 5. Mature proglottid of *"Diplobothrium simile,"* all testes not visible.

Fig. 6. Mature proglottid of *Dinobothrium septaria.*
Fig. 7. Mature proglottid of *Inermiphyllidium brachyascum,* testes masked by vitellaria.

EXPLANATION OF PLATE 4

The scale to the left of figure 2 = 0.8 mm.; of figs. 1, 3, 5, 6, and 7 = 0.2 mm.; of fig. 4 = 0.02 mm.

Fig. 1. Scolex of *Caulobothrium opisthorchis* from a toto mount.
Fig. 2. Scolex of *C. tetrascaphium* from a toto mount.
Fig. 3. Portion of a transverse section of a ripe proglottid of *C. tetrascaphium* showing vagina beside dorso-lateral wall of uterus, and distribution of vitellaria around testes and excretory vessels.
Fig. 4. Biflagellate egg of *C. tetrascaphium.*
Fig. 5. End proglottid of *C. opisthorchis.*
Fig. 6. Transverse section of a mature proglottid of *Inermiphyllidium pulvinatum* showing dorsal excretory vessel lateral to ventral vessel.
Fig. 7. Transverse section of a mature proglottid of *Dinobothrium planum* showing distribution of vitellaria and short ovarian wings.

EXPLANATION OF PLATE 5

The scale to the left of all figures = 0.2 mm.

Fig. 1. Scolex of *Echeneibothrium octorchis* from a *toto* mount.
Fig. 2. Scolex of *E. dolichoophorum* from a *toto* mount.
Fig. 3. Scolex of *E. myzorhynchum* from a *toto* mount.
Fig. 4. End proglottids of *E. octorchis.*
Fig. 5. End proglottids of *E. dolichoophorum.*
Fig. 6. Scolex of *E. macrascum* from a *toto* mount.
Fig. 7. Gravid end proglottid of *E. myzorhynchum.*
Fig. 8. Transverse section of a mature proglottid of *E. macrascum* showing massive development of ovary.
Fig. 9. Mature proglottid of *Caulobothrium tetrascaphium;* all testes not visible.
Fig. 10. End proglottid of *E. macrascum.*

EXPLANATION OF PLATE 6

The scale to the left of figures 3, 4, 7, 8, 9, 10, and 11 = 0.2 mm.; of figures 2, 5, and 6 = 0.1 mm.; of figure 1 = 0.02 mm.

Fig. 1. Egg of *Acanthobothrium hispidum.*
Fig. 2. Hooks from scolex of *A. brachyacanthum.*
Fig. 3. Scolex of *A. brachyacanthum* from a toto mount.
Fig. 4. Scolex of *Calliobothrium pellucidum* from a toto mount.
Fig. 5. Hooks from scolex of *A. hispidum.*
Fig. 6. Hooks from scolex of *A. maculatum.*
Fig. 7. Scolex of *A. maculatum* from a toto mount.
Fig. 8. Organs of interovarian space of *A. hispidum.*
Fig. 9. Immature proglottid of *A. hispidum.*
Fig. 10. End proglottid of *A. brachyacanthum.*
Fig. 11. Mature proglottid of *A. maculatum.*

EXPLANATION OF PLATE 7

The scale to the left of figures 4, 5, and 7 = 0.2 mm.; of figures 1, 2, 3, and 6 = 0.1 mm.

Fig. 1. Scolex of *Acanthobothrium hispidum* from a toto mount.
Fig. 2. Pair of hooks from scolex of *Pinguicollum pinguicollum,* in matrix.
Fig. 3. Hook from scolex of *P. pinguicollum,* matrix cleared away.
Fig. 4. Contracted scolex of *P. pinguicollum.*
Fig. 5. Anterior view of scolex of *P. pinguicollum.*
Fig. 6. Organs of interovarian space of *P. pinguicollum.*
Fig. 7. Mature free proglottid of *Calliobothrium pellucidum.*

EXPLANATION OF PLATE 8

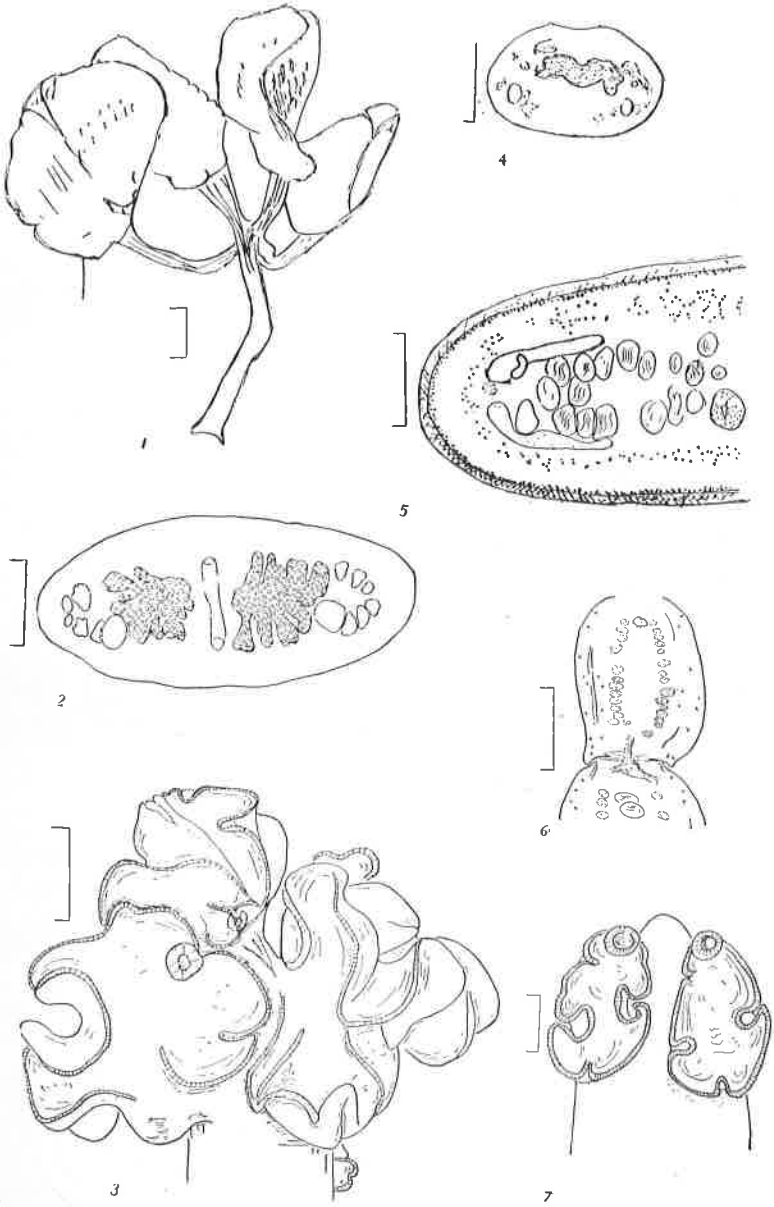
The scale to the left of figures 1, 2, 3, 4, 5, 6, 8, 9, and 10 = 0.1 mm.; of figures 7 and 11 = 0.2 mm.

Fig. 1. Egg of *Prosobothrium armigerum.*
Fig. 2. Egg of *Cylindrophorus posteroporus.*
Fig. 3. Transverse section through the region of the ovary of a mature proglottid of *C. posteroporus.*
Fig. 4. Pair of hooks from the scolex of *C. posteroporus.*
Fig. 5. Pair of hooks from the scolex of *C. cervinus.*
Fig. 6. Pair of hooks from the scolex of *C. hypoprioni.*
Fig. 7. Hook from the scolex of *Pinguicollum tortum.*
Fig. 8. Pair of hooks from the scolex of *P. incognitum.*
Fig. 9. Isolated trifid hook of *C. posteroporus.*
Fig. 10. Longitudinal section through scolex of *Prosobothrium armigerum* with glandular discs everted.
Fig. 11. End proglottid of *C. posteroporus.*

EXPLANATION OF PLATE 9

The scale for figure 5 = 0.4 mm.; for figures 1, 4, and 6 = 0.2 mm.; for figure 3 = 0.05 mm.; for figures 2 and 7 = 0.02 mm.

Fig. 1. Scolex of *Prosobothrium armigerum* from a toto mount.
Fig. 2. Cuticular spines from strobila of *P. armigerum.*
Fig. 3. Organs of the interovarian space of *P. armigerum.*
Fig. 4. Transverse section through the region of the ovary of a mature proglottid of *P. adherens.*
Fig. 5. Mature proglottid of *P. adherens* cut away on the right to show the arrangement of the internal organs.
Fig. 6. End proglottid of *P. armigerum* cut away on the right to show the arrangement of the internal organs and the development of vagina for the storage of spermatozoa.
Fig. 7. Egg of *Discobothrium fallax.*



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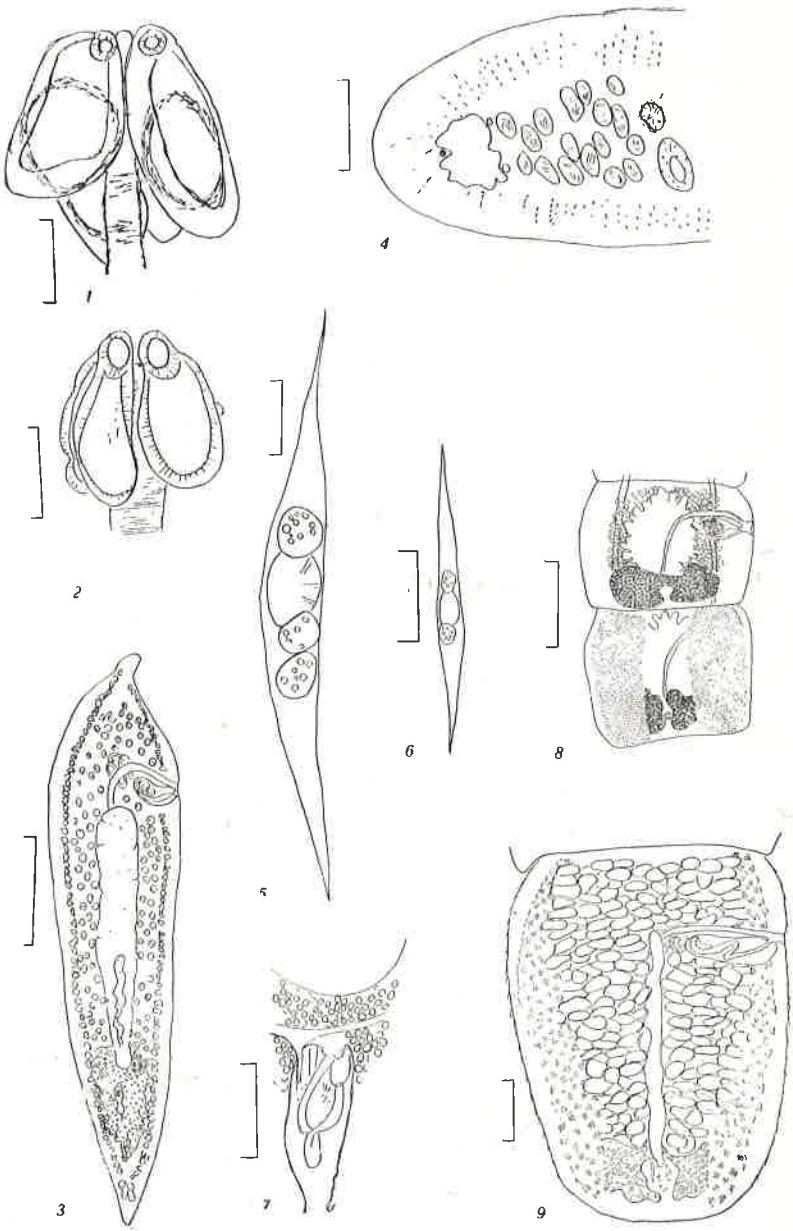

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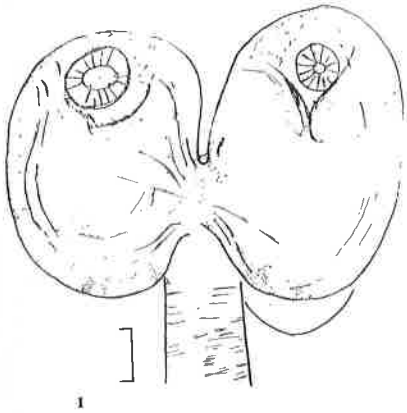

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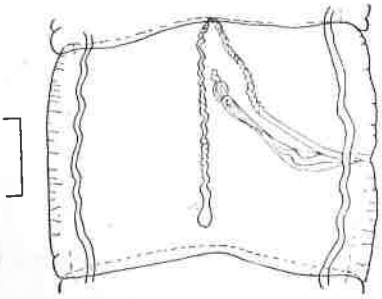

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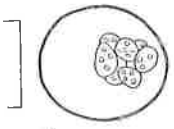

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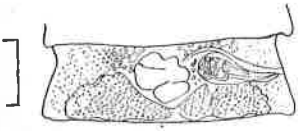

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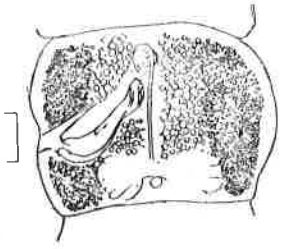

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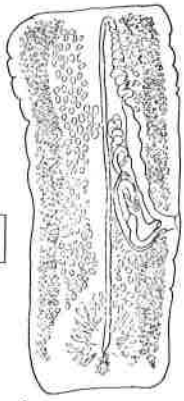

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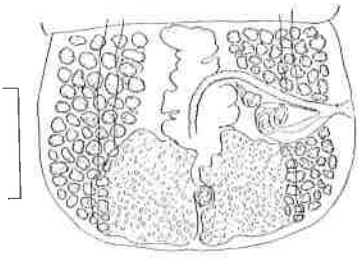

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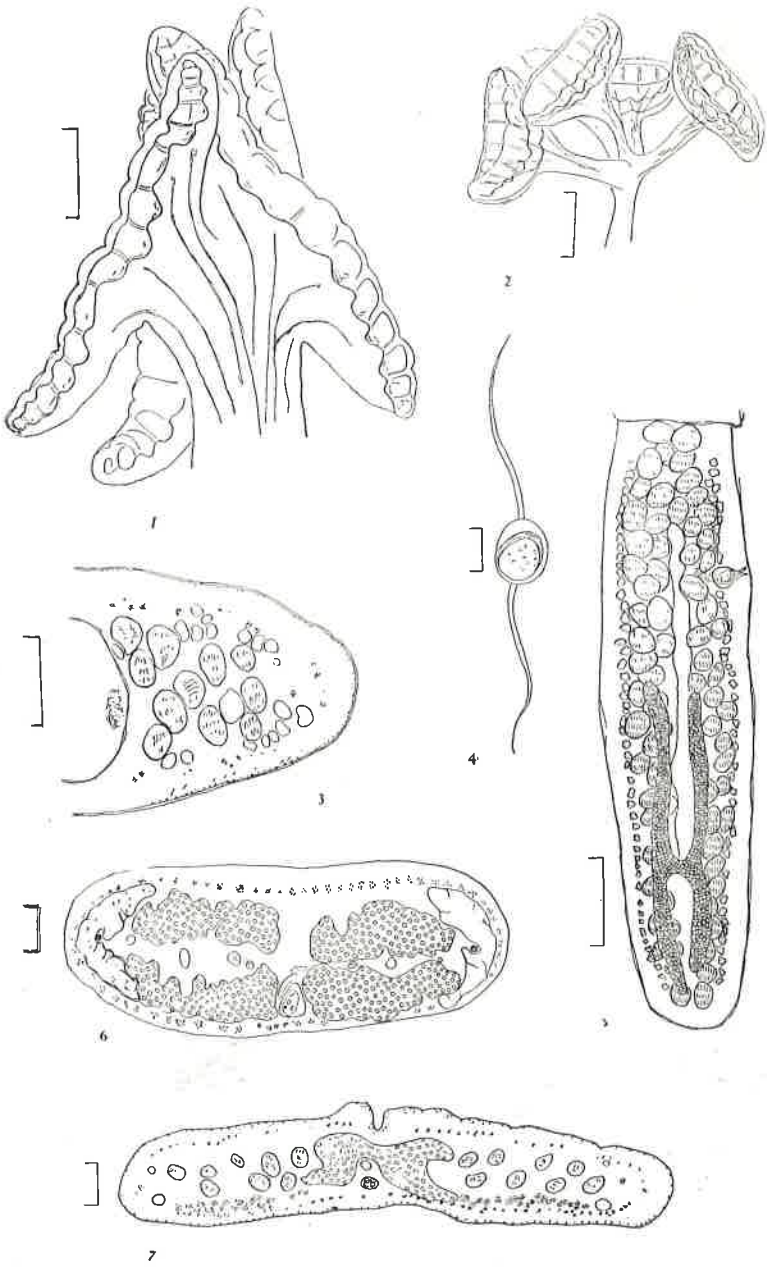
PLATE 3



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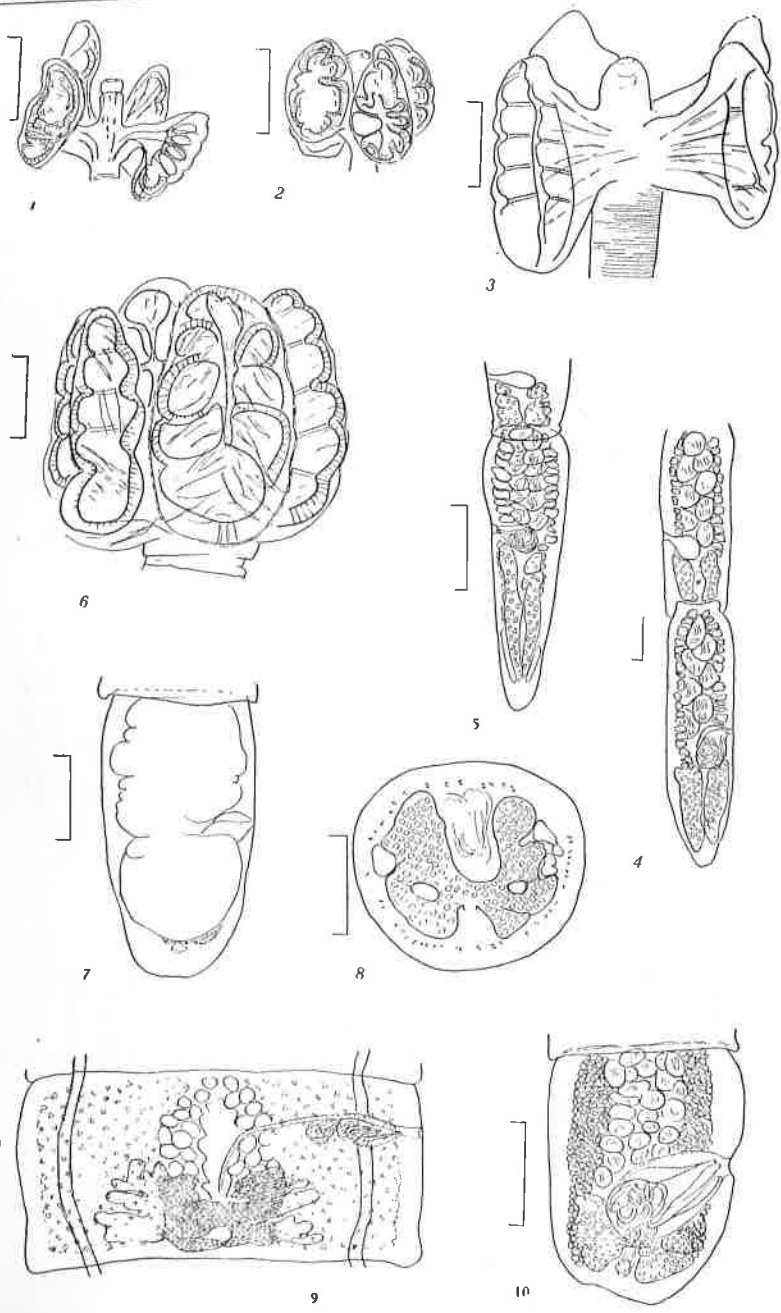

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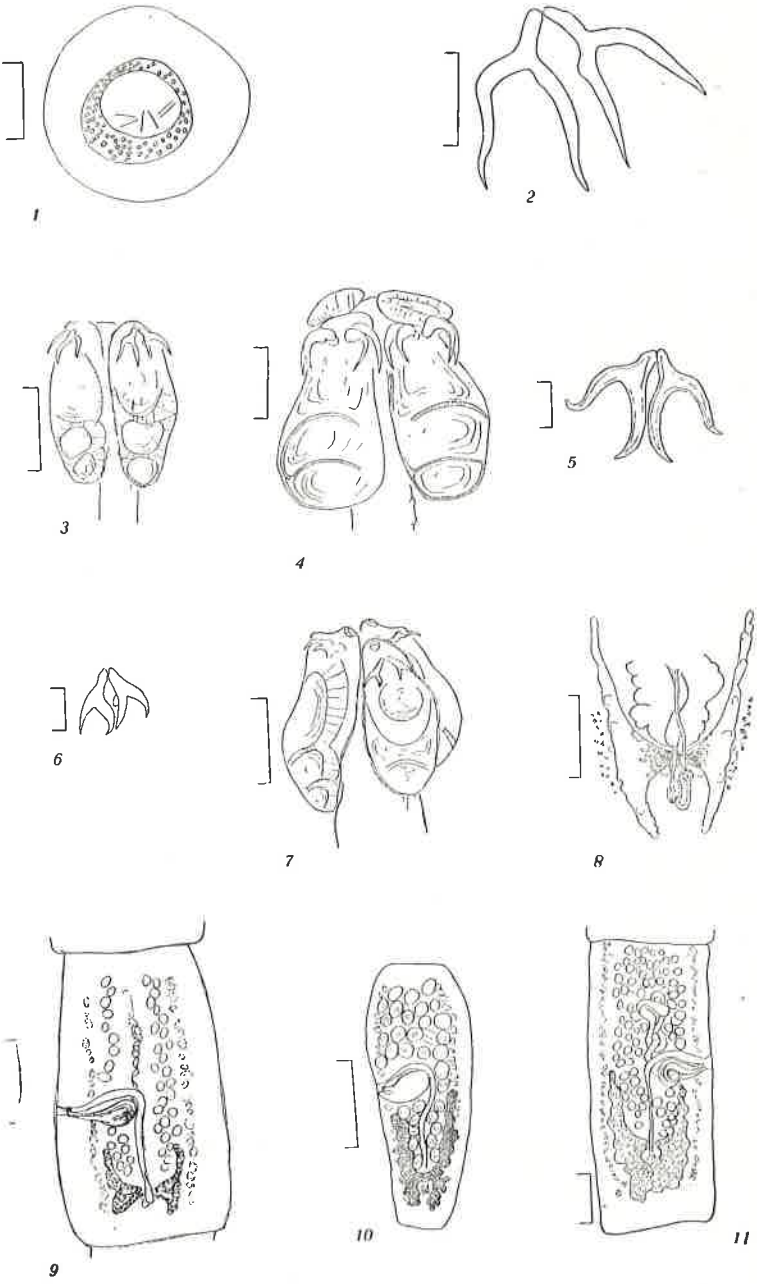

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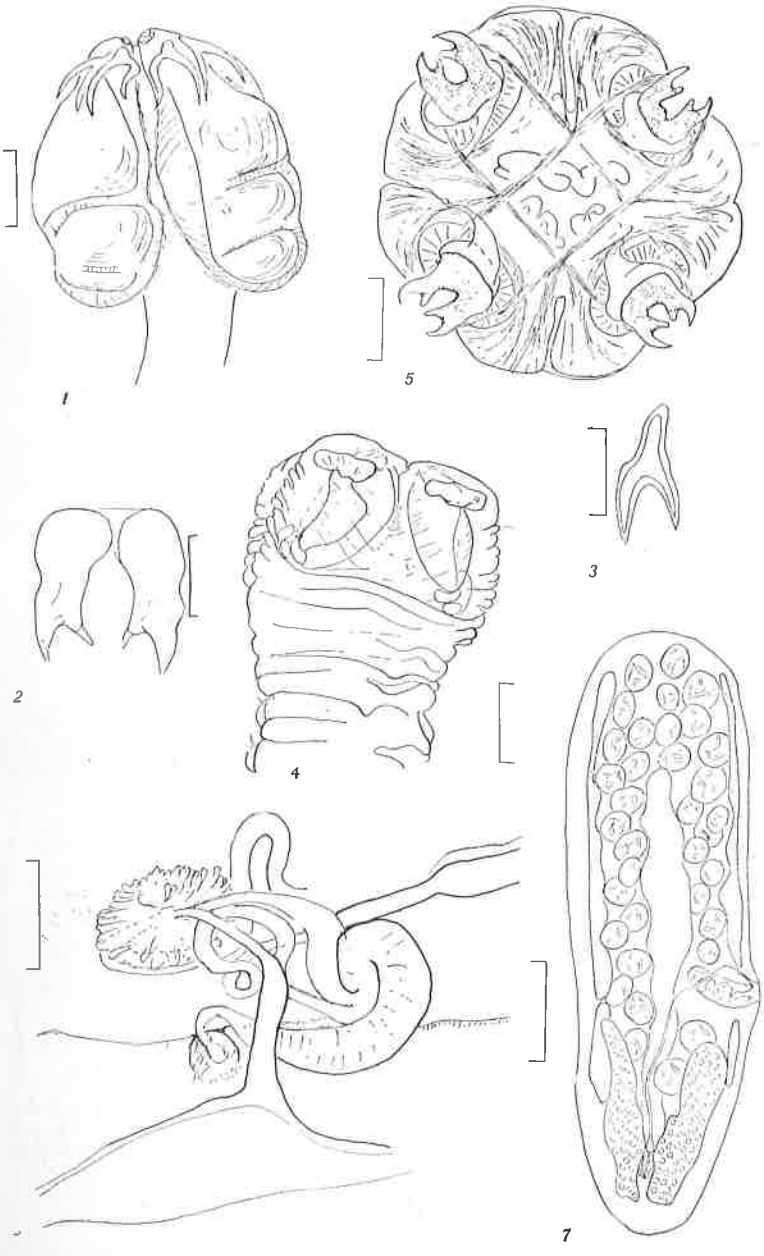

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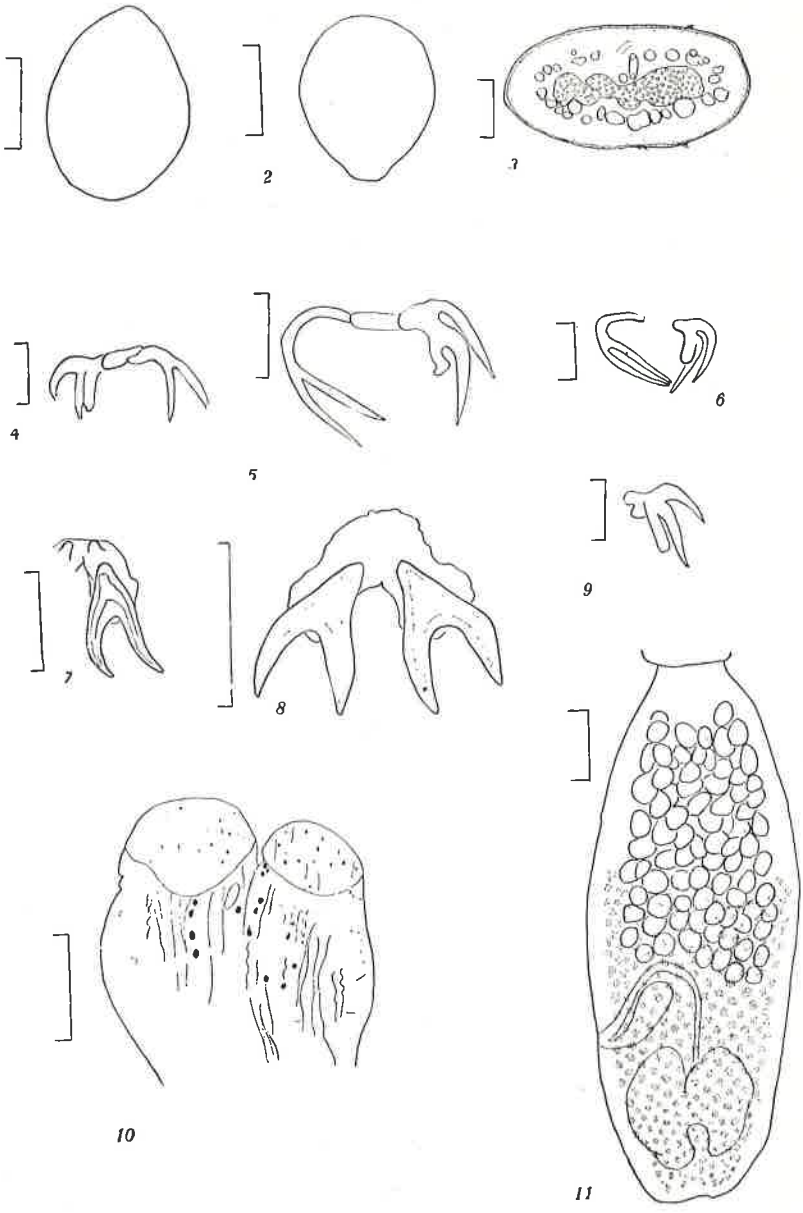

PLATE 8

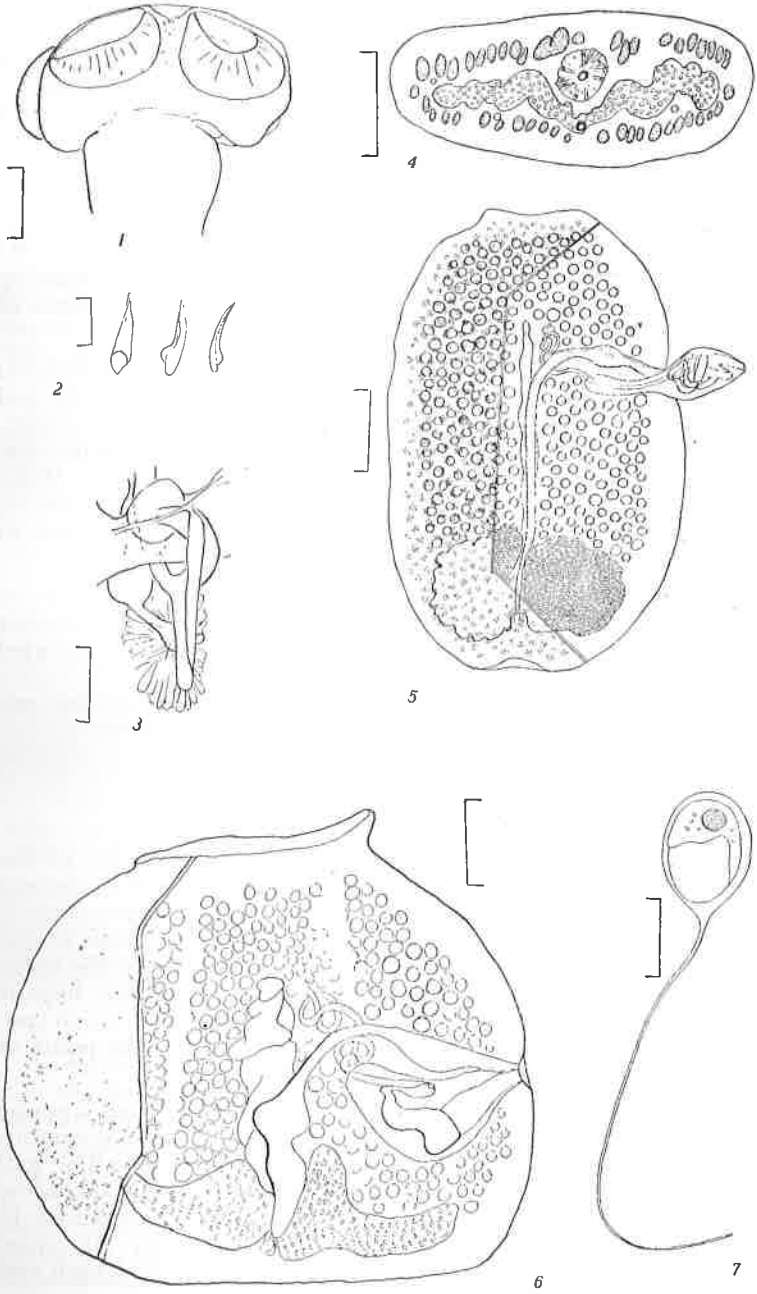

PLATE 9