

SMITHSONIAN MISCELLANEOUS COLLECTIONS

VOLUME 98, NUMBER 17

POLYCLAD WORMS COLLECTED ON
THE PRESIDENTIAL CRUISE
OF 1938

SMITHSONIAN INSTITUTION
JUN 17 1939
OFFICE LIBRARY

BY

LIBBIE H. HYMAN

American Museum of Natural History
New York City



(PUBLICATION 3542)

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION
JUNE 17, 1939

SMITHSONIAN MISCELLANEOUS COLLECTIONS
VOLUME 98, NUMBER 17

POLYCLAD WORMS COLLECTED ON
THE PRESIDENTIAL CRUISE
OF 1938

BY
LIBBIE H. HYMAN
American Museum of Natural History
New York City



(PUBLICATION 3542)

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION
JUNE 17, 1939

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

POLYCLAD WORMS COLLECTED ON THE PRESIDENTIAL CRUISE OF 1938

By LIBBIE H. HYMAN

American Museum of Natural History, New York City

The material consisted of four vials of polyclads collected at various points along the shores of the Galápagos Islands and Old Providence and Clipperton Islands by Dr. Waldo L. Schmitt during the Presidential Cruise of 1938. Each vial contained a different species represented in three vials by a single specimen, in the fourth vial by two specimens. All of the worms were badly crumpled and folded and it was necessary to straighten them out forcibly before any work could be done on them. This has resulted in some distortion of parts and has produced folds and wrinkles in the body surface, but the material is adequate for the determination of the necessary points of anatomy. All of the specimens were stained as whole mounts with dilute acidified borax carmine and, after they were studied and drawn, the sexual region was removed in the case of three species and cut into sagittal serial sections. The study of the material has shown that it comprises two species of *Notoplana*, one of *Euplana*, and one of *Prosthiostomum*, all of which appear to be undescribed forms.

NOTOPLANA INSULARIS, n. sp.

Figs. 1-3

Description.—The single specimen, somewhat contracted and folded (fig. 1), is 9 mm. long and 3 mm. wide at the widest part, obviously much longer in life, of elongated oblong shape, tapering somewhat posteriorly. Color not determinable. Pharynx small with a few folds, embraced by the uteri which come to a point anteriorly behind the brain. Eyes (fig. 2) in paired elongated bands, tentacular clusters thus not separated from cerebral groups; tentacular groups evident as rounded group in each band at about the level of the middle of the brain. Eyes unusual in that cerebral eyes are of the same size as tentacular eyes. Posterior half of specimen made into serial sections. Copulatory apparatus (fig. 3) typical of the genus. Seminal vesicle oval, with thick muscular wall of fibers parallel to the surface contour. Ejaculatory duct curves backward and after a short course

enters the oval prostate vesicle, which is smaller than the seminal vesicle. This has a moderately thick muscular wall of fibers parallel to the surface contour, penetrated by the ducts of the extracapsular prostate glands. Ejaculatory duct projects into prostate vesicle for about three-fourths the length of the latter. No penis papilla. A relatively short stylet springs directly from the prostate vesicle; it lies in a moderately long tubular male antrum which curves gracefully ventrally and posteriorly to the male genital pore. Male antrum with a muscular wall of inner longitudinal and outer circular fibers. Female pore shortly behind male pore; canal leading in from surface probably artificial caused by straightening of the specimen. Vagina of moderate width with coating of circular muscle fibers; curves posteriorly and widens where it receives the uteri; beyond this, wide stalk of Lang's vesicle curves down, then posteriorly, and opens into the very long large Lang's vesicle.

Remarks.—*Notoplana insularis* does not closely resemble any of the known species from adjacent islands of the Caribbean and West Indies, but seems more nearly related to *N. stylifera* from Juan Fernandez, from which, however, it differs in several details, which will be apparent on comparison of my figures with those of Bock.

Differential diagnosis.—Tentacular and cerebral eyes in one band, cerebral eyes of same size as tentacular eyes, seminal vesicle larger than prostate vesicle, no penis papilla or penis sheath, penis stylet short, male antrum tubular, vagina widened at entrance of uteri.

Locality.—Shores, Old Providence Island. Collected by Dr. Waldo L. Schmitt, August 6, 1938.

Holotype.—Anterior half as whole mount; posterior half as sagittal serial sections, U.S.N.M. no. 20423.

NOTOPLANA CARIBBEANA, n. sp.

Figs. 4-8

Description.—One large specimen, 33 mm. long, 13 mm. wide at widest part, of elongated wedge form, widest anteriorly, tapering gradually to obtuse posterior end (fig. 4). Color not determinable. Eyes in paired bands in which the tentacular clusters are included (fig. 5). Some indications of tentacles in center of tentacular eye clusters; tentacular eyes obviously larger than cerebral eyes; cerebral eyes small, forming elongated group anterior to tentacular group and few scattered eyes behind tentacular group. Pharynx long, very narrow, with many small folds, embraced by uteri which come to a point in front of pharynx (fig. 4). Sexual region removed and cut into

sagittal serial sections. Male and female pores considerably separated, forming large oval openings. Crescentic seminal vesicle immediately behind posterior end of pharynx has very thin wall of muscle fibers paralleling its external contour. Seminal vesicle opens directly into large spherical chambered prostatic vesicle without the intervention of a duct; ejaculatory duct projects only a short distance into prostatic vesicle (fig. 6). Small penis papilla at beginning of male canal leading away from prostate vesicle. This canal, similar to penis pocket of other *Notoplanas*, is remarkably long and slender; runs backward above excessively muscular mass surrounding the male antrum and opens into posterodorsal angle of this antrum. Male antrum large with long anterior extension and lined by a tall epithelium filled with granules of glandular nature; male antrum surrounded by thick powerful muscle fibers running mostly lengthwise filling all space between antrum, prostate vesicle, and penis pocket. Posterior wall of antrum also muscular. Antrum opens below by large oval male genital pore.

Large oval female pore considerably behind male pore (relative positions shown in fig. 4). Pore opens into wide funnellike female antrum (fig. 7) with very folded walls; this appearance may be due to the straightening of the specimen. Tall lining epithelium of female antrum has glandular appearance. Vagina proceeds anteriorly from female antrum, makes sharp posterior bend, and some distance beyond the bend receives the uteri. Beyond uteri long slender stalk of Lang's vesicle runs backward and downward and opens into elongated oval Lang's vesicle. Vagina and stalk lined by ciliated epithelium, outside of which is a fibrous coat which does not appear to be muscular. Numerous cement glands open into vagina and beginning of vesicle stalk. Lang's vesicle lined by very tall epithelium, the distal two-thirds of which is filled with eosinophilous spherules (fig. 8). These suggest an eosinophilous secretion, but it is more probable that they are digesting material. Lang's vesicle probably serves to digest excess sex cells as well as for a seminal receptacle.

Remarks.—This species undeniably bears a very great resemblance in size, shape, and the details of the copulatory apparatus to *Notoplana binoculara* (Verrill) 1901 (syn. *Notoplana bahamensis* Bock 1913) of which Bock has given a good description, supplemented by some remarks in a recent paper of mine (Hyman, 1939). The similarity of *N. caribbeana* to *N. binoculara* is not surprising, in view of the proximity of Old Providence Island to the Bahamas, and there still remains a little doubt in my mind that I am justified in making a distinct species of *N. caribbeana*. The following differences may be

noticed between the two species. In *N. caribbeana* the cerebral eyes are much smaller than the tentacular eyes and on the same level, whereas in *N. binoculara* they are of nearly the same size as the tentacular eyes and so deeply buried that they were overlooked altogether by Verrill (whence the name *binoculara*). The seminal vesicle of *N. caribbeana* is much larger and thinner walled than that of *N. binoculara*, its male canal is longer and the male antrum is of different shape and lacks the two hillocks found in *N. binoculara* to which I have called attention. The female apparatus of the two species is very similar, but in *N. caribbeana* the vagina and stalk of Lang's vesicle appear to be longer than in *N. binoculara* (although these differences may depend simply on the size of the specimen) and the cement glands extend farther along the female apparatus than in *N. binoculara*. These differences seem to justify the separation of the forms as distinct species. Bock has placed *N. binoculara* in his group B, typified by *N. atomata*, but admits that it is not closely related to the members of this group. I suggest that *N. binoculara* and *N. caribbeana* be considered to constitute a separate group of the large genus *Notoplana*, characterized by the long male canal and the large extremely muscular male antrum.

Differential diagnosis.—*N. caribbeana* differs from other Notoplanas except *N. binoculara* in the long slender male canal, large male antrum with an anterior extension, and excessive muscularity of the anterior wall of the male antrum, whose muscle fibers fill all the space between antrum and seminal vesicle. Differences from *N. binoculara* are listed above.

Locality.—Shores of Old Providence Island. Collected by Dr. Waldo L. Schmitt, August 1, 1938.

Holotype.—Whole mount with sexual region removed; set of sagittal sections of sexual region, U.S.N.M. no. 20424.

EUPLANA CLIPPERTONI, n. sp.

Figs. 9-12

Description.—Two specimens, larger 17 mm. long, 7 mm. wide across widest part, not quite fully mature sexually, elongated, widest at about the level of the brain, tapering posteriorly, much folded and contracted, evidently much longer and more slender in life (fig. 9). Smaller specimen very young, 6.5 mm. in length, obovate, with no trace of sex organs. Color not determinable. With evident tentacular groups of eyes, consisting of 3 large eyes and 4-6 smaller ones (fig. 10). Cerebral eyes loosely arranged, scattered, radiating in a

linear arrangement along the principal nerve trunks (fig. 10). Of the cerebral eyes, there are two large ones close to the cerebral mass of granules characteristic of many Acotylea, and some large ones in a row along the bases of the main anterolateral nerve trunks (fig. 10). The smaller eyes are peripheral to the large ones, radiating along the nerve trunks. Small specimen (fig. 11) has same number and arrangement of large eyes as the larger specimen, but the smaller eyes have not yet appeared. Pharynx relatively small with small lateral folds. Sexual region of larger worm removed and sectioned. Conclusion from study of whole animal that sexual maturity had not quite been attained confirmed by study of sections, but essential parts appear to be present. Sexual apparatus close behind pharynx, far removed from posterior end of body. Sexual pores some distance apart (fig. 9). Male copulatory apparatus (fig. 12) typical of the genus, i. e., the male canal is not definitely divisible into seminal vesicle and prostatic vesicle, and may be considered to consist entirely of the seminal vesicle. Vasa deferentia enter separately the lateral angles of the seminal vesicle; seminal vesicle then turns dorsally, then bends posteriorly and extends as slender tube to penis papilla. Seminal vesicle has narrow lumen and thick muscular wall composed chiefly of circular fibers. No prostatic glands seen, probably because of immaturity of the specimen. Penis papilla small, rounded, armed with a short stylet in process of being secreted. Penis papilla lies in short penis pocket which forms a penis sheath where it joins the male antrum. Latter moderately large cavity, of moderate length. Female apparatus (fig. 12) has large genital pore, long muscular vagina bent into an S-shape, receiving cement glands along its course. Following entrance of uteri, female canal continues as a small Lang's vesicle, which may not yet be fully formed.

Remarks.—In an article on Atlantic coast polyclads (Hyman, 1939 b), I have shown that "*Prosthlostomum*" *gracile* Girard 1850¹ is not a *Prosthlostomum* at all, but fits into *Discoplana* Bock 1913. However, since Girard in 1893 himself removed this species from *Prosthlostomum* and created for it a new genus *Euplana*, *Discoplana* must become a synonym of *Euplana*. The copulatory apparatus of

¹In a recent publication Pearse (1938) has grossly misidentified *Euplana gracilis* (Girard) considering it a new species, type of a new genus, *Conjuguterus*. *Conjuguterus* becomes a synonym of *Euplana* and *C. parvus* a synonym of *Euplana gracilis*. Pearse's account of the male system of this species is also erroneous. These corrections are based on an examination of the type specimen of *C. parvus* and a number of other specimens labelled by Pearse with this name.

Euplana (= *Discoplana*) is very similar to that of the genus *Stylochoplana* and in fact it is difficult to distinguish between these two genera. The sole difference is that in *Euplana* there is no distinct prostatic vesicle, whereas one exists in *Stylochoplana*. *E. clippertoni* certainly resembles *Stylochoplana* in general external appearance, but has no definite prostatic vesicle and hence seems to fit better into *Euplana*. It differs from other known species of *Euplana* (= *Discoplana*) in the presence of a penis stylet. *Euplana gracilis* (Girard) is the most simplified member of the genus, having no penis papilla, stylet, or penis sheath.

Differential diagnosis.—Loosely arranged radiating cerebral eyes, small penis papilla, penis pocket, penis sheath and short stylet present, long muscular vagina with S-bend, small Lang's vesicle, genital pores well separated.

Locality.—Clipperton Island, under rocks to south of landing place. Collected by Dr. Waldo L. Schmitt, July 21, 1938.

Holotype.—Whole mount with sex region removed; set of sections of sex region, U.S.N.M. no. 20425. Young specimen on same slide with holotype.

PROSTHIOSTOMUM PARVICELIS, n. sp.

Figs. 13-15

Description.—One specimen, 6 mm. long, of usual slender shape typical of the genus, fully mature, bent in sexual region, part of anterior margin missing (fig. 14). Color not determinable. Eyes as usual in the genus, comprising paired cerebral groups, and band of eyes along anterior margin (fig. 13). Cerebral eyes consist of an irregular curved row of 7 eyes on one side, 8 on the other, with a single isolated eye lateral to the anterior end of the rows, on each side. Marginal row of eyes unfortunately imperfect because of missing anterior margin but obviously few in number compared to most other species of the genus, of about 2 rows in central part of band, thinning out around the sides to a few widely spaced eyes in a single row. Pharynx typical of the genus (fig. 14). Because of bend in body making good sagittal sections impossible, sexual apparatus was not sectioned. Because of eversion of the male apparatus, most of this apparatus can be seen in the whole mount. Male apparatus completely everted as in copulation (result of fixation?) (fig. 15). Inside the large cylindrical everted structure can be seen the oval seminal vesicle with thick muscular wall and Indian-club shaped lumen, the 2 spherical thick-walled accessory vesicles (of unknown function), and the

sinuous ejaculatory duct. The ducts of the accessory vesicles were not seen. At the distal end of the evert is the penis sheath; through its lumen extends the curved stylet typical of the genus, protruding from the penis end for about one-third of its length. The sperm form a club-shaped sharply defined mass in the lumen of the seminal vesicle and from this mass a stream of sperm can be followed along the ejaculatory duct and stylet and out of the tip of the stylet. The mode of entrance of the vasa deferentia into the seminal vesicle is shown in the figure.

Not much can be made out of the female apparatus in the whole mount; genital pore appears to lead into a cement pouch which receives the encircling cement glands (fig. 15).

The eversion of the male apparatus in this specimen is of great interest. It is undoubtedly normal since the same eversion was seen in a Bermuda *Prosthiostomum*, *P. cyclops* (Verrill) where, however, the specimen, through long preservation, was so dark and opaque that nothing could be discerned in the protruded apparatus. This Galápagos specimen indicates that in *Prosthiostomum* the entire male apparatus everts in copulation. This means that the male antrum must turn inside out, so that its lining becomes the surface epithelium of the evert, and the whole male copulatory complex, including the seminal vesicle and the 2 accessory vesicles, becomes pulled into the evert. It is further seen from figure 15 that the so-called penis sheath actually serves as penis papilla while the penis papilla remains inside and appears to function merely to anchor the stylet. One begins to wonder if these structures have not been misnamed and if the penis sheath should not be regarded as the penis papilla, and the projection at present considered the penis papilla should not receive some other name. Of course, many polyclads do not have a penis sheath. Whether it occurs only in those species with a stylet deserves investigation.

Remarks.—The species of the genus *Prosthiostomum* resemble each other so closely in external characters and details of the copulatory complex that separation into species is often difficult. As pointed out by Bock (1913) one must depend chiefly on the coloration and the eye arrangement. Some differences also appear to exist as regards the length and shape of the male antrum, shape of the seminal vesicle, and points of entrance of the vasa deferentia into the seminal vesicle. On the whole it is not advisable to omit the study of serial sections in determining the species of this genus. In the Galápagos specimen, the damage to the marginal set of eyes, the lack of data on the coloration in life, and the eversion of the male apparatus, preventing com-

parisons with other species where the male apparatus is known only in the resting condition, have increased the difficulties of deciding whether one is here dealing with a new species or not. The great resemblance, even almost the identity, of the eye arrangement of the present species with that of the common Mediterranean *Prosthiostomum*, *P. siphunculus* (Delle Chiaje) 1828, fully described by Lang, 1884, will not have escaped the notice of students of polyclads. On the other hand, it seems highly improbable that the same species would be found in two such widely separated localities as the Mediterranean and the Galápagos Islands. It further appears that *P. siphunculus* is very much larger than *P. parvicelis*. According to Lang, 1884, the former may reach a length of 30 mm. and the majority of the sexual individuals range from 12-18 mm. The specimen of *P. parvicelis* is already fully mature at a length which could not have been more than 8 mm. in the extended condition. The principal difference, however, between the two species, concerns the shape of the seminal vesicle and the points of entrance of the vasa deferentia. Lang, 1884, plate 30, figure 20, shows the seminal vesicle of *P. siphunculus* as curved, with a simple fusiform lumen and muscular wall of uniform width; the vasa enter at its proximal end. In *P. parvicelis* the wall of the seminal vesicle is very thick proximally and thins out distally, the lumen is of peculiar shape (fig. 15), and the vasa deferentia enter the sides and then turn proximally to join the beginning of the lumen. The shape of the cement pouch appears also to differ in the two forms. On these grounds I with some hesitation consider the Galápagos species distinct from the Mediterranean one.

Differential diagnosis.—Eye arrangement as in *P. siphunculus*; smaller than this species; seminal vesicle with thicker wall and small lumen proximally, thin wall and larger lumen distally, receiving the vasa deferentia into its sides.

Locality.—Sullivan Bay, James Island, Galápagos Islands, shore collecting. Collected by Dr. Waldo L. Schmitt, July 24, 1938.

Holotype.—One whole mount, U.S.N.M. no. 20426.

REFERENCES

BOCK, SIXTEN

1913. Studien über Polycladen. Zool. Bidrag, vol. 2, pp. 1-343.

1923. Polycladen aus Juan Fernandez. The Natural History of Juan Fernandez and Easter Island, vol. 3, pp. 341-372.

GIRARD, CH.

1893. Recherches sur les Planaires et les Nemertiens de l'Amerique du Nord. Ann. Sci. Nat., vol. 15, No. 7, pp. 145-310.

HYMAN, L. H.

1939a. Acoel and Polyclad Turbellaria from Bermuda and the Sargassum. In press.

1939b. Some Polyclads from the New England coast, especially from the Woods Hole region. *Biol. Bull.*, vol. 76, pp. 127-152.

LANG, A.

1884. Die Polycladen (Seeplanarien) des Golfes von Neapel und der angrenzenden Meeresabschnitte. *Fauna und Flora des Golfes von Neapel*, Monog. 11.

PEARSE, A. S.

1938. Polyclads of the east coast of North America. *Proc. U. S. Nat. Mus.*, vol. 86, pp. 67-98.

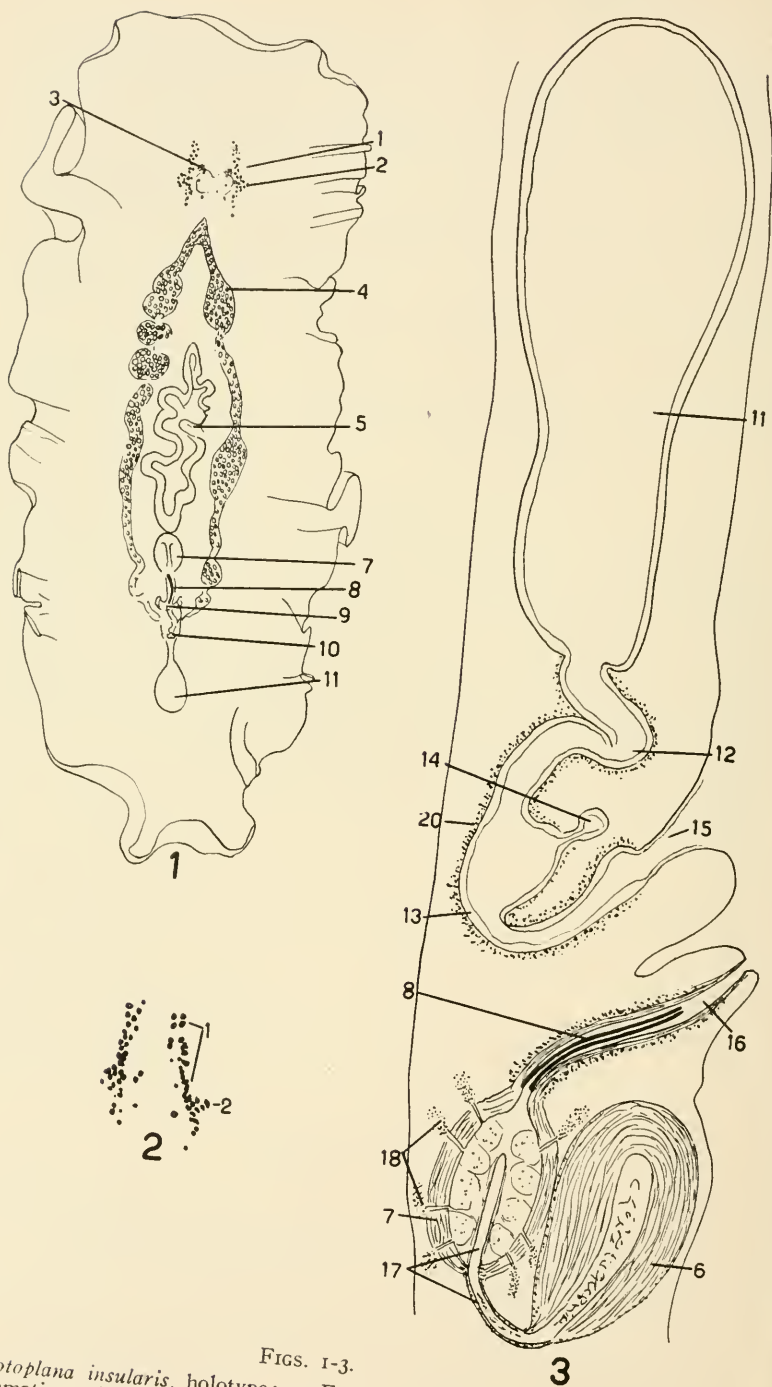
VERRILL, A. E.

1901. Addition to the fauna of the Bermudas from the Yale Expedition of 1901, with notes of other species. *Trans. Connecticut Acad. Sci.*, vol. 11, pp. 15-62.

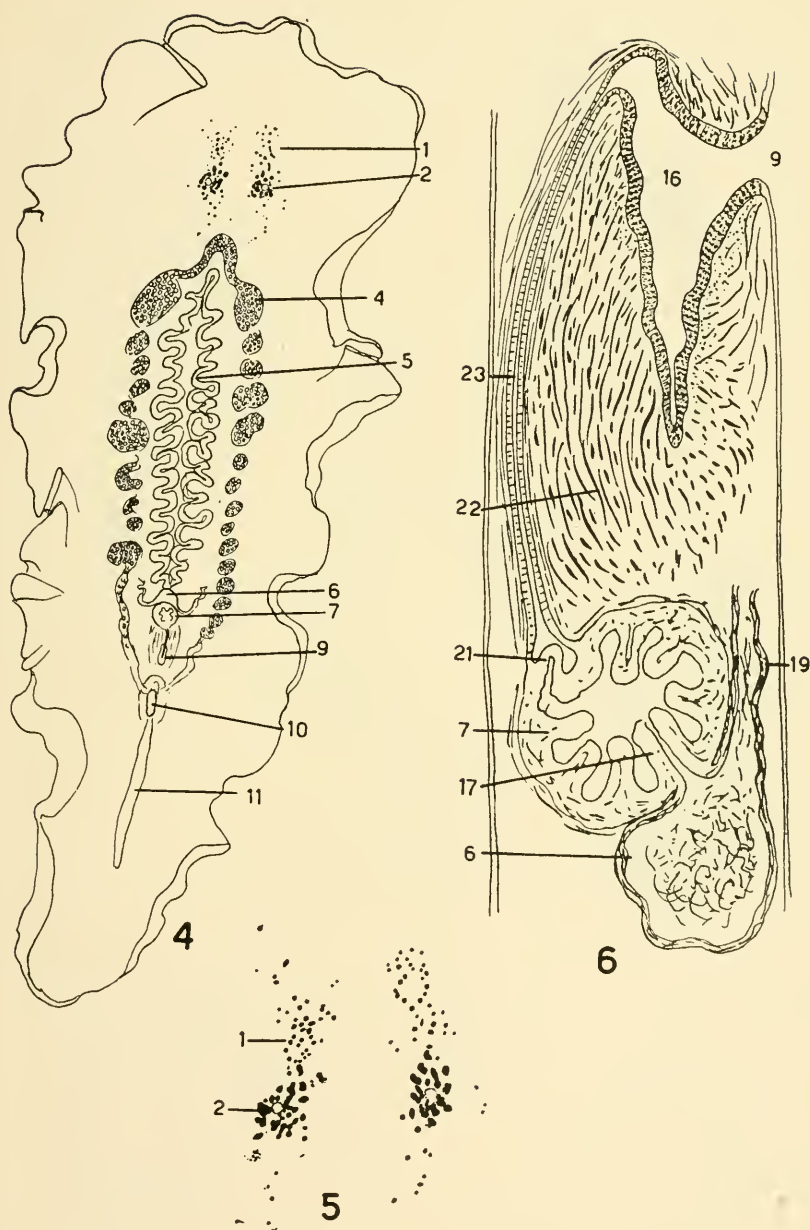
EXPLANATION OF NUMBERING OF TEXT-FIGURES

1, cerebral eyes; 2, tentacular eyes; 3, cerebral granule mass; 4, uterus; 5, pharynx; 6, seminal vesicle; 7, prostate vesicle; 8, stylet; 9, male genital pore; 10, female genital pore; 11, Lang's vesicle; 12, stalk of Lang's vesicle; 13, vagina; 14, entrance of uteri into vagina; 15, female antrum; 16, male antrum; 17, ejaculatory duct; 18, extracapsular prostate glands; 19, vasa deferentia; 20, cement glands; 21, penis papilla; 22, muscular wall of male antrum; 23, penis pocket; 24, penis sheath; 25, cement pouch; 26, accessory vesicles; 27, everted male organ; 28, sucker; 29, marginal glands; 30, sperm mass in seminal vesicle; 31, opening of prostate glands into penis pocket.

Whole mounts and figures of eyes drawn with the aid of the camera lucida; others free-hand.

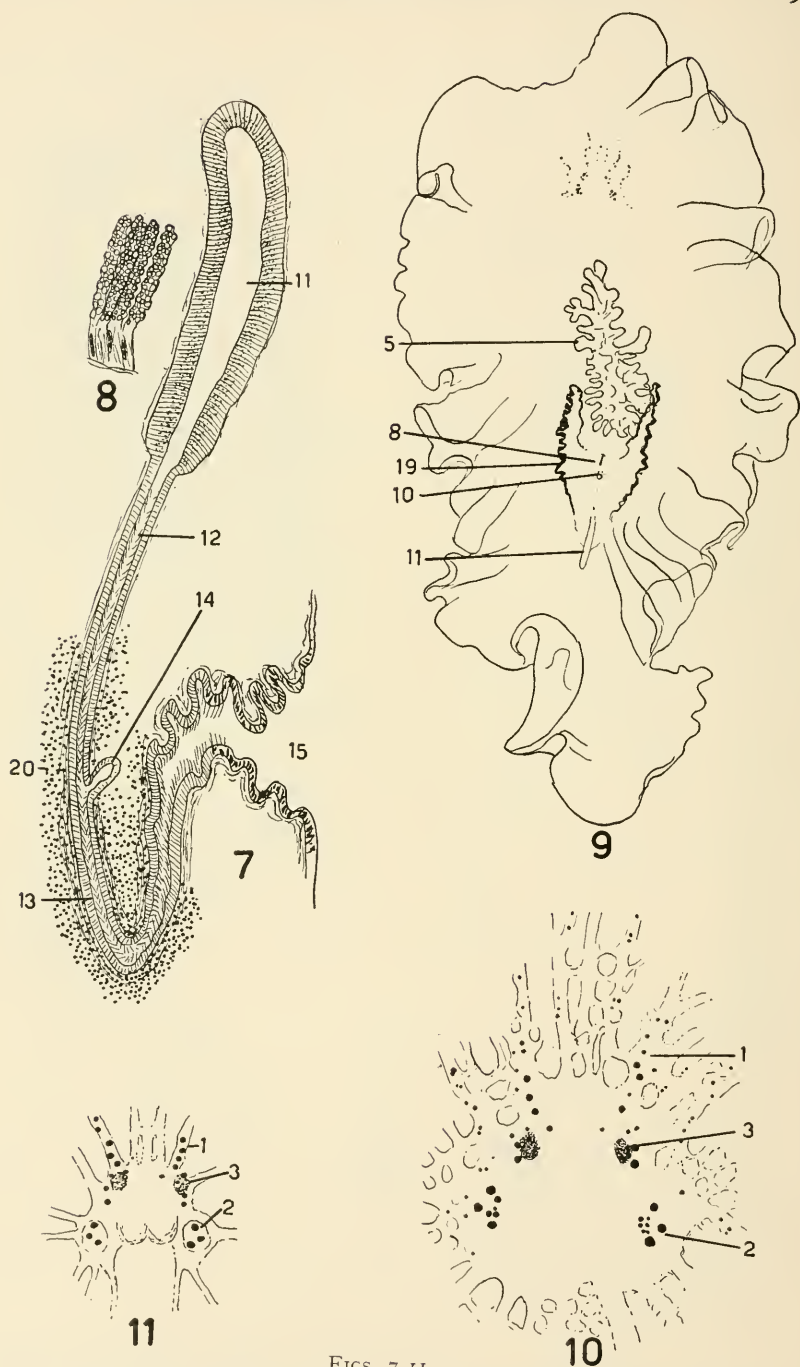


FIGS. 1-3.
 1, *Notoplana insularis*, holotype; 2, Eyes of *Notoplana insularis*; 3, Semi-diagrammatic sagittal view of the copulatory apparatus of *Notoplana insularis*, based on sagittal sections of the sexual region of the holotype.



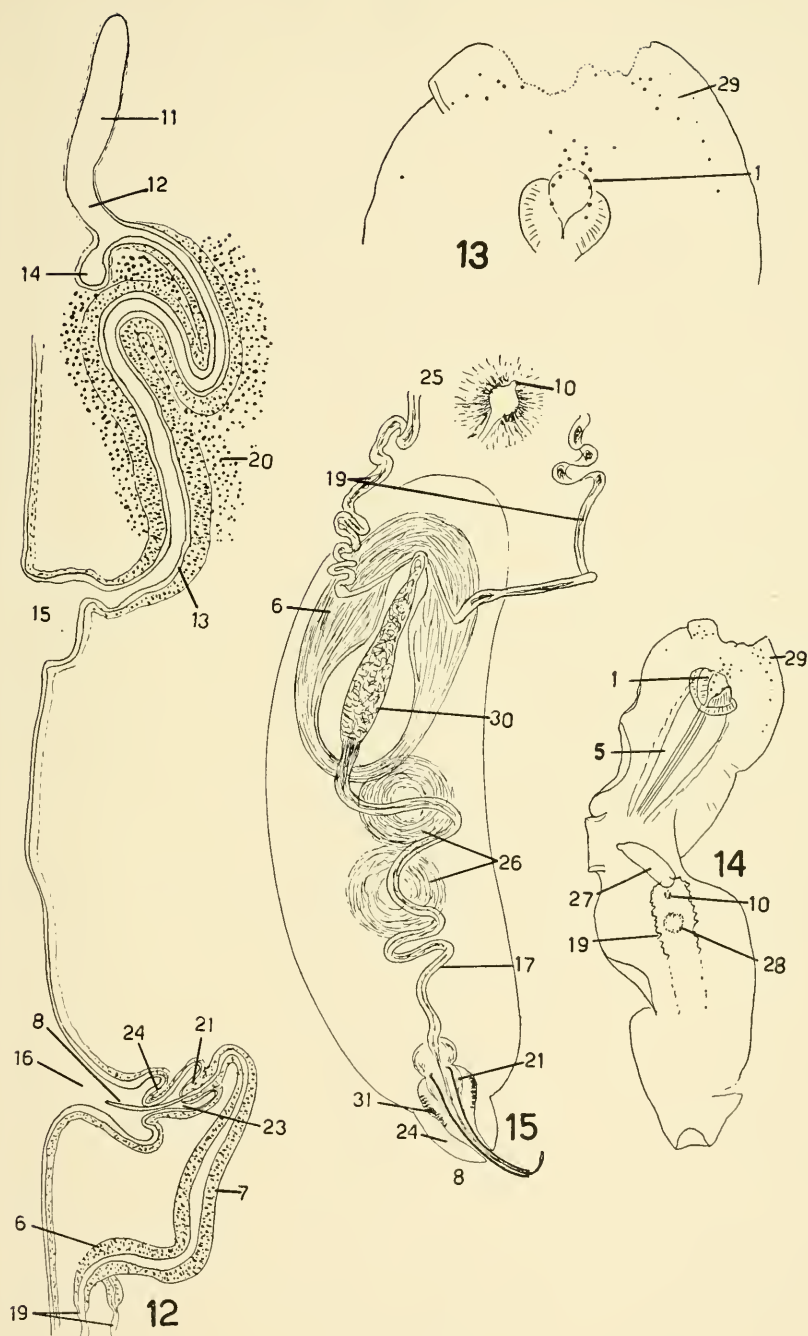
FIGS. 4-6.

4, *Notoplana caribbeana*, holotype; 5, Eyes of *Notoplana caribbeana*; 6, Semi-diagrammatic sagittal view of the male copulatory apparatus of *Notoplana caribbeana*, based on sagittal sections of the sexual region of the holotype.



FIGS. 7-11.

7, Sagittal view of the female apparatus of *Notoplana caribbeana*, from same set of sections as fig. 6; 8, A few cells from the lining epithelium of Lang's vesicle of *Notoplana caribbeana*, showing eosinophilous spherules; 9, *Euplana clippertoni*, holotype; 10, Eyes of *Euplana clippertoni*, holotype; 11, Eyes of a young specimen of *Euplana clippertoni*.



FIGS. 12-15.

12, Semidiagrammatic sagittal view of the copulatory complex of *Euplana clippertoni*, based on sagittal serial sections of the sexual region of the holotype; 13, Eyes of *Prosthiostomum parvicelis*, holotype; 14, *Prosthiostomum parvicelis*, holotype; 15, Everted male copulatory organ of *Prosthiostomum parvicelis* containing the male apparatus.