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MISCELLANEA (pp. 275—280).

The original home of *Mus decumanus*—*W. C. Hossack*. Colour change in *Hylobates hoolock*, Harlan—*R. B. Sanyal*. Eggs of *Tylototriton verrucosus*—*N. Annandale*. The hosts of *Tachaea Spongillicola*, Stebbing—*N. Annandale*. A second species of *Dichelaspis* from *Bathynomus giganteus*—*N. Annandale*.

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XIII.—REPORT ON THE MARINE POLYZOA IN THE COLLECTION OF THE INDIAN MUSEUM.

By LAURA R. THORNELY.

INTRODUCTION.

The Polyzoa here described are derived from various sources, chiefly from the collections made by the Indian Marine Survey (R.I.M.S. "Investigator"), the late Mr. J. Wood-Mason, the late Dr. J. Anderson, and a few private donors. With the exception of a small number of specimens from Gaspar Straits and the Straits of Malacca, the whole of the material is from Indian seas.

The following is a list of the "Investigator" stations from which specimens are recorded :—

Station No.	Lat. N.	Long. E.	
58 .	16° 30'	72°	15 fathoms.
" " 59	6° 6' 30"	81° 23'	32 "
" " 61	14° 54' 30"	93° 51'	41 "
" " 77 .	Off Ganjam Coast	13 miles	
	E.S.E. Barwa		35 "
" " 79	Off Ganjam Coast	10 miles	
	E.S.E. Kawita		33 "
" " 90	Off Ganjam Coast	8 miles	
	E.S.E. Kalingapatam		28-30 "
" " 148			15-30 "
" " 197 ..	9° 26' 30"	75° 36' 30"	406 "
" " 255 .	9° 26' 30"	91° 56' 30"	869-913 "
" " 327 .	17° 7' 30"	94° 5' 30"	419 "
" " 331	11° 46' 30"	93° 16'	569 "
" " 333	6° 31'	79° 38' 45"	401 "
" " 346 .	26° 37' 30"	53° 3' 30"	47 "

There are 81 species represented, four of which (a *Scrupocellaria*, a *Canda*, and two species of *Mucronella*) I consider new to science, while the following twenty-four are new to Indian waters: *Ætea recta*, *Caberea lata*, *Bugula ditrupæ*, *Synnotum aviculare*, *Flustra*

dentigera, *F. rhizophora*, *F. pisciformis*, *Carbasea cribriformis*, *Cel-laria tenuirostris*, *Membranipora tenuirostris*, *M. tuberculata*, *M. radicifera*, *Thalamoporella smittii*, *Microporella malusii*, *Lagenipora socialis*, *Schizoporella tenuis*, *Smittia marmorea*, *Mucronella canali-fera*, *Retepora producta*, *R. monilifera*, *Adeonella platalea*, *A. dis-toma*, *Cellepora cylindriiformis*, *Bowerbankia caudata*. Many of these species have been found in Australian waters.

Two species (*Bifaxaria* ? and *Reteporella* ?) are doubtful ; while twenty-one have been already found in Indian seas. Of the latter, four were included in a list of fourteen species collected by Mr. Thurston in the Gulf of Manaar and described (*Madras Gov. Mus. Bull* , No. 3, 1905) by Mr. Kirkpatrick ; six were in the late Dr. J. Anderson's Mergui collection, named by Hincks in 1887 (*Journ. Linn. Soc. Zool.*, vol. xxi) ; six were identified by Hincks in a list of various collections from India, Singapore and Ceylon, recorded by him in his " Contribution towards a General History of the Marine Polyzoa " in the *Ann. Mag. Nat. Hist.*, series 5, vol. vi, and subsequent volumes ; while one, *Membranipora bengalensis*, was described by the late Dr. F. Stoliczka in the *Journ. Asiat. Soc. Bengal*, part 2, vol. xxxviii p. 55, 1869. All these species, with the exception of the last and of *Thalamoporella smittii*, were re-corded by me, with thirty-eight others, in my report on the Polyzoa collected by Professor Herdman off the coast of Ceylon in 1902 (Suppl. Report XXVI to Herdman's *Ceylon Pearl Oyster Fisheries*, pt. iv).

Order ECTOPROCTA.

Sub-order CHEILOSTOMATA.

Family ÆTEIDÆ.

1. *Ætea recta*, Hincks.

Ann. Mag. Nat. Hist., series 3, vol. ix, p. 25, 1862.

Locality.—Andamans, growing on *Tubucellaria cereoides*.

Family CATENARIADÆ.

2. *Catenaria lafontii*, Aud.

Localities.—Ye, Burma ; Marshall Channel, Andamans ; Stations 59 and 77, Indian Marine Survey.

Family CELLULARIADÆ.

3. *Scrupocellaria scrupea*, Busk.

Ann. Mag. Nat. Hist., series 2, vol. vii, p. 83, 1851.

Locality.—Off Mangalore, 26-31 fathoms (Indian Marine Survey).

4. *Scrupocellaria cervicornis*, Busk.

Brit. Mus. Cat. Mar. Pol., pt. i, page 24.

Locality.—Pedro Shoal, 25 fathoms (Wood-Mason).

There is very little of this lovely species, but the glassy texture, the antler-like spines and the tracery on the fornix, also the perforated oœcia, are all beautifully represented.

5. *Scrupocellaria diadema*, Busk.

Brit. Mus. Cat. Mar. Pol., pt. i, p. 24.

Localities.—Off Cheduba, 28-30 fathoms (Armstrong); Station 90, Indian Marine Survey.

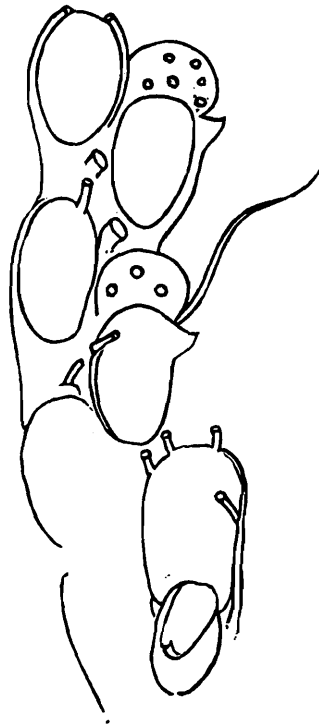
6. *Scrupocellaria gaspari*, sp. nov.

FIG. 1.—*Scrupocellaria gaspari*, sp. nov.

Zoœcium with oral aperture occupying two-thirds of its front wall, having a thick, smooth margin and four spines above. The open space below the aperture is narrowed downwards, supporting on one side a small, raised avicularium pointing outwards. This avicularium is replaced by a very large one on each of those zoœcia situated next below the fork of a branch. Lateral avicularia, small vibraculæ, no fornix. Oœcia perforated. Radical tubes serrated.

The present species resembles *S. ferox*, Busk (*Brit. Mus. Cat. Mar. Pol.*, pt. i) in the small lateral avicularia and the serrated radical tubes, but in *S. ferox* each zoœcium has a large avicularium below the aperture, while here they are small except on the zoœcia situated below the fork of a branch. Also; the zoœcia are armed, while those of *S. ferox* are unarmed.

Localities.—Gaspar Straits, Malay Archipelago; Andamans; Stations 59, 77, 90, Indian Marine Survey.

7. *Canda retiformis*, Pourtalès.

(*Cabera retiformis*) Smitt, "Floridan Bryozoa," pt. i, p. 16, in *Vetensk. Akad. Handl.*, vol. xi, 1872.

Localities.—Off Ceylon Coast, 32-34 fathoms; Andamans, 20-30 fathoms (Indian Marine Survey); Ye, Burma; Stations 59, 77, 148, Indian Marine Survey.

8. *Canda pecten*, sp. nov.

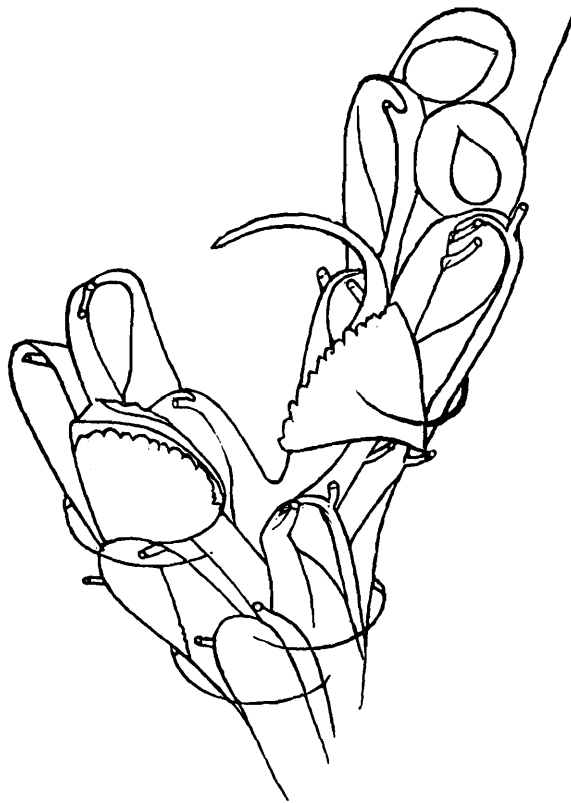


FIG. 2.—*Canda pecten*, sp. nov.

Zoecia oval, elongated, with thin, raised margin and a spine, rarely two, on either side above. Membranous area reaching half way down the front wall, a thin, calcareous, diagonal sheet covering the rest, no fornix or medium avicularium, except an enormous avicularium at the base of each fork of a branch which is raised on a large prominence, having frilled edges, and is long, narrow and pointed, directed downwards and inwards. Grooves of the vibracular reach beyond the edge of the zoecia, behind. The junction of the connecting fibres is seen below these, and there are serrated rootlets near the bases of the colonies as in *Scrupocellaria ferox* and *S. macandrei*. Oecia lie back on the median line of the stem, one above the other, alternately, from their positions rather to one side

of the top of the zoëcia to which they belong. They have a rounded, membranous portion in front and a sort of umbo, sometimes, above.
Localities.—Coast of Cheduba, 28-30 fathoms (Armstrong); Station 61, Indian Marine Survey.

9. *Caberea lata*, Busk.

Brit. Mus. Cat. Mar. Pol., pt. i, p. 39.

Locality.—Gaspar Straits (J. S. Gardner)

Family BICELLARIIDÆ.

10. *Diplœcium simplex*, Kirkpatrick.

Ann. Mag. Nat. Hist., series 6, vol. i, p. 73, 1888.

Locality.—Off Passage Island, Andamans, 17 fathoms.

11. *Bugula ditrupæ*, Busk.

Quart. Journ. Micro. Sci., old series, vol. vi, p. 261, 1858.

Locality.—Andamans, 35 fathoms.

12. *Bugula neritina*, Linn.

These specimens have avicularia as in those mentioned in my report on the Polyzoa from Ceylon (Suppl. Report XXVI to Herdman's *Ceylon Pearl Oyster Fisheries*, pt. iv).

Locality.—Ye, Burma (Indian Marine Survey).

13. *Bugula sinuosa*, Busk.

Voy. H.M.S. "Challenger", pt. xxx (vol. x), p. 39

Localities.—Eight miles S.E. of Cinque Island, 500 fathoms; Andamans, 780 fathoms.

Family NOTAMIIDÆ.

14. *Synnotum aviculare*, Pieper.

Hincks, *Ann. Mag. Nat. Hist.*, series 5, vol. xvii, p. 257, 1886.

Localities.—Marshall Channel, Andamans; Stations 59, 77, Indian Marine Survey.

Family FLUSTRIDÆ.

15. *Flustra dentigera*, Hincks.

Ann. Mag. Nat. Hist., series 5, vol. ix, p. 116, 1882.

A beautiful fan-shaped colony half an inch high by one and a quarter inches wide. Unfortunately no oëcia are present.

Locality.—Andamans (Wood-Mason).

16. *Flustra rhizophora*, Ortman.

Die Japanische Bryozoen Fauna.

As in Ortman's description, there are no internal or lateral denticles. There are two, rarely four, spines above. Avicularia have the long, pointed mandibles which lie along one side of the zoëcia, beneath which is the area they originate from. Oëcia with the usual calcareous bar across the front are present. There are only a few fragmentary tips of branches of this species; they resemble the palmate form of *F. foliacea*, measuring three-fourths of an inch across.

Locality.—Off Mangalore, 26-31 fathoms (Indian Marine Survey).

17. *Flustra pisciformis*, Busk.

(*Carbasea pisciformis*) *Brit. Mus. Cat. Mar. Pol.*, pt. i, p. 50.

This small colony agrees with Busk's description of the zoëcia and oëcia but has an occasional avicularium which has the same form as that of *F. securifrons*; the zoëcia are larger, however, than those of the British *F. securifrons*, and the species is altogether more like the description of *F. pisciformis*.

18. *Diachoris intermedia*, Hincks.

Ann. Mag. Nat. Hist., series 5, vol. viii, p. 133, 1881.

Localities.—Stations 59, 77, Indian Marine Survey.

19. *Carbasea cribriformis*, Busk.

Voy. H.M.S. "Challenger," pt. xxx (vol. x), p. 58.

There are only a few fragments of this species in the collection, so that the spiral growth at the bases of fenestra cannot be seen; otherwise the characters agree with Busk's description.

Localities.—Stations 59, 61, 77, (72, 15, 34 fathoms,) Indian Marine Survey.

Family CELLARIIDÆ.

20. *Cellaria tenuirostris*, Busk.

(*Salicornaria tenuirostris*) *Brit. Mus. Cat. Mar. Pol.*, pt. i, p. 17.

There is only one specimen of this form, measuring about one inch in height and being well branched. Avicularia have shorter mandibles mentioned by Busk (*Voy. H.M.S. "Challenger,"* pt. xxx (vol. x), p. 92). The internodes are swollen with the number of oëcia present, and the opening to these, above the orifice is oval with a spade-shaped operculum. The knots of radical tubes, alluded to by Smitt ("Floridan Bryozoa," pt. ii, p. 4, in *Vetensk. Akad. Handl.*, vol. xi, 1872), are to be seen where each branch is given off.

21. *Nellia oculata*, Busk.

Brit. Mus. Cat. Mar. Pol., pt. i, p. 18.

Localities—Gaspar Straits; Stations 59, 77, 90, Indian Marine Survey; Andamans (Wood-Mason).

Family TUBUCELLARIIDÆ.

22. *Tubucellaria cereoides*, Ellis and Sol.

MacGillivray, *Trans. Roy. Soc. Vict.*, vol. xxi, p. 107, 1884.

Localities.—Off Table Island, Andamans (Indian Marine Survey); Andamans, 130-250 fathoms; west coast Andamans (Wood-Mason).

Family MEMBRANIPORIDÆ

23. *Membranipora tenuirostris*, Hincks.

Ann. Mag. Nat. Hist., series 5, vol. vi, p. 70, 1880.

Locality.—Lat. 6° 1' N., Long. 81° 16' E., 34 fathoms (Indian Marine Survey); Andamans (Wood-Mason).

24. *Membranipora tuberculata*, Busk.

Quart. Journ. Micro. Sci., old series, vol. vi, p. 126, 1858.

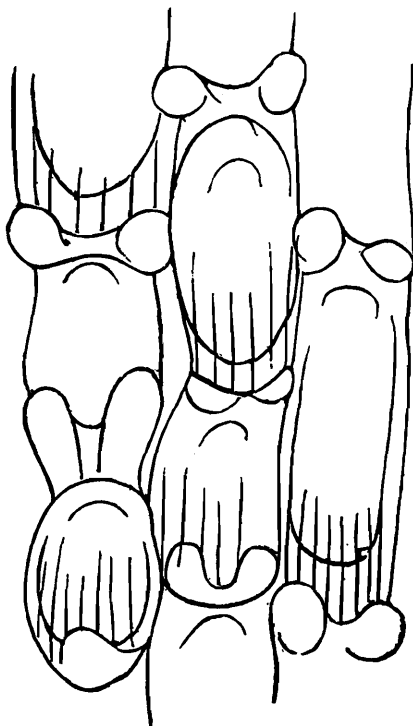


FIG. 3.—*Membranipora tuberculata*, Busk.

There is a point that makes me hesitate in considering this species to be *M. tuberculata*. The blunt tubercles are hollowed in a cave-like manner on the side nearest the basis of the zoecia, and the membrane of the front wall of the zoecium can be sometimes seen extending below the aperture, over the margin, which has become widened and attached to the tubercles above the hollowed portions. These tubercles with age become united to form a transversely elongated tubercle, as described by Busk for *M. tuberculata*. This species should probably be called *Amphiblestrum* instead of *Membranipora*.

Locality.—Station 327, Indian Marine Survey.

25. *Membranipora bengalensis*, Stoliczka.

Journ. Asiat. Soc. Bengal, vol. xxxviii, pt. 2, p. 55, 1869.

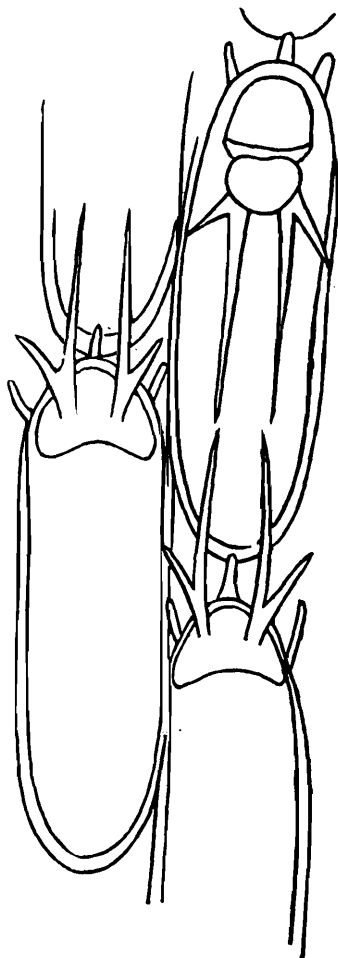


FIG. 4.—*Membranipora bengalensis*, Stol.

The spines described by Stoliczka as proceeding downwards from the lower lip are in these specimens situated on the operculum; they appear as if proceeding from the lower lip when the operculum is open, but stand upright when it is closed. There are no lateral spines present on these specimens, but on either side of the usual basal spine there is one not mentioned in the original description.

Locality.—Snod Island.

26. *Membranipora radicifera* var. *intermedia*, Kirkpatrick.

Proc. Roy. Dub. Soc., vol. vi, new series, p. 615, 1890.

Locality.—Cheduba, 6 fathoms.

27. *Membranipora coronata*, Hincks.

Ann. Mag. Nat. Hist., series 5, vol. vii, p. 147, 1881.

Localities.—Lat. 6° 1' N., Long. 81° 16' E., 34 fathoms; off Port Blair, 100 fathoms (Indian Marine Survey); Marshall Channel, Andamans (Indian Marine Survey).

28. *Membranipora delicatula*, Busk.

Hincks, *Ann. Mag. Nat. Hist.*, series 5, vol. vi, p. 86, 1880.

A small colony closely adhering to a stick.

Locality.—Off Mangalore, 26-31 fathoms.

Family MICROPORIDÆ.

29. *Steganoporella simplex*, Harmer.

Quart. Journ. Micro. Sci., vol. xliii, p. 253, 1900.

Locality.—Lat. 6° 1' N., Long. 81° 16' E., 34 fathoms (Indian Marine Survey).

30. *Steganoporella sulcata*, Harmer.

Quart. Journ. Micro. Sci., vol. xliii, p. 246, 1900.

Locality.—Off Table Island, Andamans (Indian Marine Survey).

31. *Thalamopore'la smittii*, Hincks.

Journ. Linn. Soc., vol. xxi, p. 123, 1889.

Locality—Pedro Shoal, 25 fathoms.

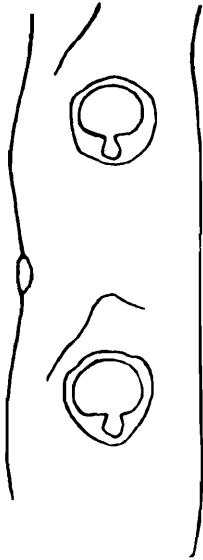
32. *Bifaxaria* ? sp.

FIG. 5.—*Bifaxaria* ? sp.

A fragment, measuring half an inch in height, probably belonging to this genus, has a continuous, branched, calcareous zoarium, composed of zoecia united back to back, divisions between them very indistinctly seen. Orifice rounded with a loop-shaped sinus deeply sunk, but its primary form continuous up to the surface of the zoarium. A few, scattered, rounded avicularia round the margins of the zoecia.

Locality.—Lat. 5° 56' N., Long. 91° 05' E., 1,590 fathoms (Wood-Mason).

33. *Cribrilina radiata*, Moll.

Localities.—Lat. 6° 1' N., Long. 81° 16' E., 34 fathoms; coast of Cheduba, 28-30 fathoms (Armstrong); Cheduba, 6 fathoms; Station 90, Indian Marine Survey.

Family MICROPORELLIDÆ.

34. *Microporella ciliata*, Pallas.

These specimens have the wing-like modification of the avicularia mentioned by Hincks (*Ann. Mag. Nat. Hist.*, vol. ix, p. 24, 1882) as having been found by Captain Cawne Warren on the coast of Ceylon.

Localities.—Stations 59 and 77, Indian Marine Survey.

35. *Microporella violacea* form *p'agiopora*, John.

Hincks, *Brit. Marine Pol.*, vol. i, p. 216.

Locality.—Cheduba, 6 fathoms.

36. *Microporella malusii*, Aud.

Locality.—Lat. 6° 1' N., Long. 81° 16' E., 34 fathoms (Indian Marine Survey).

37. *Chorizopora brongniartii*, Aud.

Localities.—Lat. 6° 1' N., Long. 81° 16' E., 34 fathoms; Cheduba, 6 fathoms.

Family PORINIDÆ.

38. *Lagenipora spinulosa*, Hincks.

Ann. Mag. Nat. Hist., series 5, vol. xiii, pp. 57 and 210, 1884.

Locality.—Andamans (Wood-Mason).

39. *Lagenipora socialis*, Hincks.

Ann. Mag. Nat. Hist., series 4, vol. xx, p. 215, 1877.

The colonies of this species are in the form of little caps which appear to have encrusted some round body and from which they are broken off. The zoœcia radiate from a hole in the centre which is occupied in some cases by the stem of a branching red coral. The tubular orifice of the zoœcium has often spinous processes behind. The specimens differ from Hinck's description in having a roughened instead of a smooth wall to the oœcia, and in having perforations scattered over the whole front wall of the zoœcium.

Locality.—Andamans.

40. *Lagenipora tuberculata*, MacGil.

McCoy, *Prodromus Zool. Vict.*, decade xvi, vol. ii, p. 209.

Locality.—Lat. 6° 1' N., Long. 81° 16' E. (Indian Marine Survey).

Family MONOPORELLIDÆ.

41. *Monoporella albicans*, Hincks.

Ann. Mag. Nat. Hist., series 5, vol. ix, p. 123, 1882.

There is a purplish tinge to these colonies, caused by the dark colour of the operculæ as in *Cellepora albirostris* (Smitt "Floridan Bryozoa," pt. ii, p. 70, in *Vetensk. Akad. Handl.*, vol. xi, 1872).

Locality.—Marshall Channel, Andamans (Indian Marine Survey).

42. *Monoporella lepida*, Hincks.

(*Haploporella lepida*) *Ann. Mag. Nat. Hist.*, series 5, vol. viii, p. 11, 1881.

Locality.—Lat. 6° 1' N., Long. 81° 16' E., 34 fathoms (Indian Marine Survey).

Family MYRIOZOIDÆ.

43. *Schizoporella tenuis*, Busk.

Voy. H.M.S. "Challenger," pt. xxx (vol. x), p. 165.

The present specimens must be much finer colonies than those described by Busk. The zoarium is free, forming hollow tubular branches which expand into funnel-shaped ends whose sides sometimes fall in, forming various convolutions, and as growth proceeds the branches meet and unite so as to make a confused, interlaced colony. These colonies are of very delicate texture and pearly white in early stages of growth, becoming more substantial and of a shiny, pinkish colour with age. Oœcia are present very large, each nearly covering the zoœcium above the one to which it belongs. The orifices of fertile zoœcia are about twice as large as those of ordinary zoœcia.

Localities.—Off Passage Island, Andamans, 17 fathoms; Marshall Strait, Table Island.

44. *Schizoporella nivea*, Busk.

Voy. H.M.S. "Challenger," pt. xxx (vol. x), p. 163.

Locality.—Andamans (Wood-Mason).

45. *Schizoporella aperta*, Hincks.

Ann. Mag. Nat. Hist., series 5, vol. ix, p. 126, 1882.

These specimens correspond with those brought by Professor Herdman from Ceylon and recorded by me (in Suppl. Report XXVI to Herdman's *Ceylon Pearl Oyster Fisheries*, pt. iv). They have two spines on the upper margin of the orifice not mentioned by Busk. Oœcia are present here, not in the Ceylon collection. The beaks of the large avicularia are not serrated as described by Hincks (*Ann. Mag. Nat. Hist.*, series 5, vol. ix).

Localities.—Coast of Cheduba, 28-30 fathoms (Armstrong); 8 miles E.S.E. Kalingapatam, 28-30 fathoms.

46. *Schizoporella spongitis*, Pallas.

Locality.—Pedro Shoal, 25 fathoms.

47. *Schizoporella incrassata*, Hincks.

Ann. Mag. Nat. Hist., series 5, vol. ix, p. 124, 1882.

The frontal, large avicularia have on this specimen forked mandibles instead of pointed. Other characters correspond with Hincks' description, but there are no oœcia to help in the identification of the species.

Locality.—Off Ceylon coast, 32-34 fathoms (Indian Marine Survey).

48. *Schizoporella cecilia*, Aud.

Hincks, *Brit. Marine Pol.*, vol. i, p. 269.

Locality.—Pedro Shoal, 25 fathoms.

49. *Rhyncozoon incisor*, Thornely.

Suppl. Report XXVI to Herdman's *Ceylon Pearl Oyster Fisheries*,
pt. iv.

Locality.—Lat. $6^{\circ} 1' N.$, Long. $81^{\circ} 16' E.$, 34 fathoms (Indian Marine Survey).

50. *Gemellipora glabra* form *striatula*, Smitt.

"Floridan Bryozoa," pt. ii, p. 37, in *Vetensk. Akad. Handl.*, vol.
xi, 1872.

Locality.—Cheduba, 6 fathoms.

Family ESCHARIDÆ.

51. *Lepralia cucullata*, Busk.

Brit. Mus. Cat. Mar. Pol., pt. ii, p. 81.

Localities.—Galle (Dr. J. Anderson) ; Cheduba, 6 fathoms.

52. *Lepralia fuegensis*, Busk.

(*Eschara fuegensis*) *Brit. Mus. Cat. Mar. Pol.*, pt. ii, p. 90.

Locality.—Marshall Channel, Andamans (Indian Marine Survey).

53. *Lepralia adpressa*, Busk.

Brit. Mus. Cat. Mar. Pol., pt. ii, p. 82.

Locality.—Lat. $6^{\circ} 1' N.$, Long. $81^{\circ} 16' E.$, 34 fathoms (Indian Marine Survey).

54. *Lepralia multidentata*, Thornely.

Suppl. Report XXVI to Herdman's *Ceylon Pearl Oyster Fisheries*,
pt. iv, p. 120.

Locality.—Lat. $6^{\circ} 1' N.$, Long. $81^{\circ} 16' E.$, 34 fathoms (Indian Marine Survey).

55. *Lepralia turrita*, Smitt.

"Floridan Bryozoa," pt. ii, p. 65, in *Vetensk. Akad. Handl.*, vol.
xi, 1872.

Locality.—Station 58, Indian Marine Survey

56. *Lepralia poissonii*, Aud.

Hincks, *Ann. Mag. Nat. Hist.*, series 5, vol. viii, p. 122, 1881.

Locality.—Andamans, 120 fathoms (Indian Marine Survey).

57. *Porella malleolus*, Hinck.

Ann. Mag. Nat. Hist., series 5 vol. xiii, p. 361, 1884.

Locality.—Pedro Shoal, 25 fathoms.

58. *Smittia marmorea*, Hincks.

Brit. Marine Pol., vol. i, p. 350.

Locality.—Coast of Cheduba, 28-30 fathoms (Armstrong).

59. *Smittia rostriformis*, Kirkpatrick.

Ann. Mag. Nat. Hist., series 6, vol. i, p. 80, 1888.

Locality.—Station 90, Indian Marine Survey.

60. *Smittia trispinosa*, Johnston.

Several varieties of this species.

Localities.—Kilakarai, Gulf of Manaar (Annandale); Station 90, Indian Marine Survey.

61. *Mucronella canalifera*, Busk.

Waters, *Voy. H.M.S. "Challenger,"* pt. lxxix (vol. xxxi), p. 24.

I have some hesitation in considering the present specimen to be *M. canalifera*. It has the characteristic features of upright zoëcia, with finely punctured surface, semiorbicular orifice, without a tooth, spines above and at the sides of the orifice, and a spout-like lower lip. This last is, however, not so prominent as in Busk's figure, the spines usually number four, sometimes five, but not six, and are jointed at their bases; also there are, here and there, large pointed avicularia not described by Busk. No oëcia are present.

Locality.—Marshall Channel, Andamans (Indian Marine Survey).

62. *Mucronella tubulosa*, Hincks.

Ann. Mag. Nat. Hist., series 5, vol. vi, p. 383, 1880.

Locality.—Marshall Channel, Andamans (Indian Marine Survey).

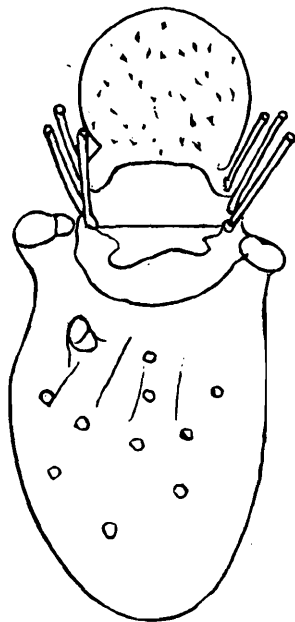
63. *Mucronella formidabilis*, sp. nov.

FIG. 6.—*Mucronella formidabilis*, sp. nov.

Zoarium incrusting, of a light brown colour. Zoëcia large, deeply divided, rising from the base to the orifice, coarsely and

regularly punctured. Orifice large, arched above, contracted near the base, with a point there on either side below the hinge of the operculum. Six to eight large, jointed spines above, six of which show in front of the oecium when present. Peristome rising below the orifice into a swollen hollow process with an avicularium on its inner aspect lying horizontally and having a tongue-shaped mandible. Numerous protuberances bearing small, rounded avicularia scattered over the front wall of the zoecium and round the margin of the orifice, sometimes reduced to two or three only. Oecia finely punctured, their sides prolonged downwards, leaving a square opening.

Locality.—N. Sentinel bearing N. 15 miles, W 18 miles, 250 fathoms; growing on the cast spine of a sea-urchin.

There are resemblances between this species and *Mucronella vultur* and *M. aviculifera*, but there is the great distinction here of no internal denticle to the orifice.

64. *Mucronella maculata*, sp. nov.

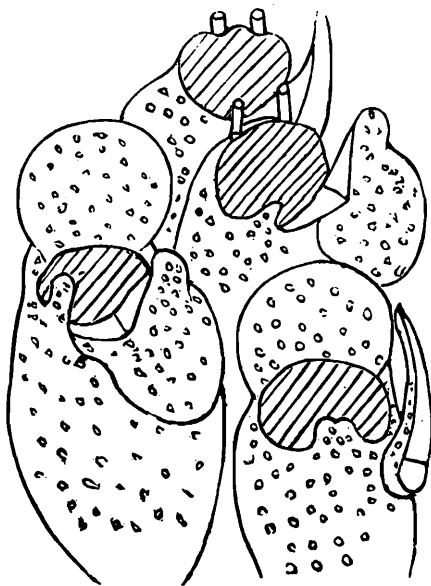


FIG. 7.—*Mucronella maculata*, sp. nov.

Zoarium incrusting, loosely attached to sea weed. Zoecia large, distinct, deeply divided. Surface finely granulated. Orifice rounded above, narrowing gradually to a point below, usually two spines above, a large mucro below, either in the centre or to one side according to the form of a prominence bearing an avicularium which is usually large and rounded, with a horizontally placed avicularium and occupying a large space rather to one side of the centre of the orifice pushing the mucro to one side; it is sometimes, however, produced into a narrow, curved process which stands straight up on one side of the orifice, the avicularium long and pointing upwards. There is sometimes a second similar avicularium on the other side of the orifice. When this form of avicularium is present the mucro holds its central position. A third form of

avicularium is borne on a spout-like protuberance of the front wall of the zoecium, and is an addition, not a substitute for the others. Oœcia are large and rounded and granulated, like the walls of the zoœcia.

Locality.—Pedro Shoal, 25 fathoms

65. *Retepora tubulata*, Busk.

Voy. H.M.S. "Challenger," pt. xxx (vol. x), p. 121.

In the "Challenger" report, one distinction given between this species and *R. philippinensis* is that the celluliferous surface of the zoarium is in the latter outside, instead of inside the tubular alveolæ. In the present specimen the first wide, vase-shaped fold of the zoarium has the celluliferous surface on its inside aspect, but the tubular branches, rising from this, have the celluliferous surface on their outside surface. Oœcia are plentiful and the forked avicularia is present at the bases of many of the fenestræ.

Localities.—Gaspar Straits (J. S. Gardner); Stations 59, 77, Indian Marine Survey; southern portion of Malacca Straits (S.S. "Sherard Osborne").

66. *Retepora producta*, Busk.

Voy. H.M.S. "Challenger," pt. xxx (vol. x); p. 108.

Locality.—Pedro Shoal, 25 fathoms.

67. *Retepora monilifera*, MacGil.

Trans. Roy. Soc. Vict., vol. xx, p. 105, 1883.

A fragment, which corresponds generally with MacGillivray's species, as described in McCoy's *Prod. Zool. Vict.*, vol. i, decade x, p. 19, has three very marked features. 1. The enormous avicularia, ending in sharp points, which are placed in front and at the bases of most fenestræ of the zoarium. They pass right through the opening, and the rostrum has a tooth on either side of where the point of the mandible rests. 2. The very prominent oœcia which stand up almost at right angles to the orifice of the zoœcia and end in a point, formed by the tip of the vertical portion of the beaded band on the front wall of the oœcium. 3. The large, raised avicularia with short, curved mandibles present on the front wall of some zoœcia. Of these features the long pointed avicularia agree with MacGillivray's form *Munita*, except that they are situated at the bases of, not above, fenestræ. In the forward bend of the vertical beaded line on the oœcia, there is a resemblance to form *Sinuata*. There appears to be no absolute agreement with any one form mentioned.

Locality.—Station 148, Indian Marine Survey.

68. *Retepora pocillum*, Thornely.

Suppl. Report XXVI to Herdman's *Ceylon Pearl Oyster Fisheries*, pt. iv, p. 125.

Localities.—Off the coast of Ceylon, 32-34 fathoms (Indian Marine Survey); Lat. $6^{\circ} 1' N.$, Long. $81^{\circ} 16' E.$, 34 fathoms (Indian Marine Survey).

69. *Reteporella*? sp.

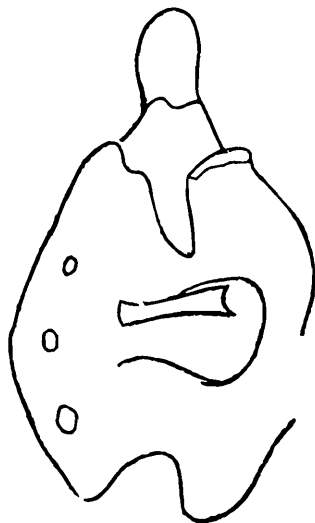


FIG. 8.—*Reteporella*? sp.

Zoarium branched, surface glistening, zoecia smooth, with large pores here and there round the margin. The front wall rising from the base upwards to rather prominent shoulder-like projections on either side of the orifice. Primary orifice with two teeth near the base, sometimes meeting and leaving a pore below them. Secondary orifice with a much raised peristome, cleft in front. A large avicularium ending in two points, raised on an eminence and lying across the front of some zoecia.

Locality.—Off west coast, Andamans, 290-238 fathoms (Carpenter).

There is a general resemblance between this species and Smitt's ("Floridan Bryozoa," pt. ii, p. 67) *Retepora marsupiata*, but the fragment in the present collection indicates a branched, possibly a reticulate zoarium but not fenestrated, and the characters of the primary orifice and of the avicularia do not agree with those of that species.

Family ADEONIDÆ.

70. *Adeonella subsulcata*, Smitt.

(*Porina subsulcata*) "Floridan Bryozoa," pt. ii, p. 28, in *Vetensk. Akad. Handl.*, vol. xi, 1872.

Localities.—Off Sentinel Island (?), 13 fathoms; Marshall Channel, Andamans (Indian Marine Survey).

71. *Adeonella platalea*, Busk.

Voy. H.M.S. "Challenger," pt. xxx (vol. x), p. 184.

Localities.—Ye, Burma coast; Gregory Island (Indian Marine Survey).

72. *Adeonella distoma*, Busk.

(*Lepralia distoma*) *Quart. Journ. Micro. Sci.*, old series, vol. vi, p. 127, 1858.

The present specimens are old, with thick calcareous walls the perforated area much sunk. There are more pores in some zoëcia than are described by Busk, and here and there on a separate area below the zoëcia there is a small avicularium, pointing downwards.

Locality.—Station 61, Indian Marine Survey

Family CELLEPORIDÆ.

73. *Cellepora cylindriiformis*, Busk.

Voy. H.M.S. "Challenger," pt. xxx (vol. x), p. 201.

The base of this specimen has evidently incrustated some cylindrical object. It has all the characters described by Busk, but is a much larger colony, rising free and branched to the height of half an inch.

Locality.—Andamans, 130-25 fathoms (Indian Marine Survey).

74. *Cellepora megasoma*, MacGil

(*Lepralia megasoma*) McCoy, *Prod. Zool. Vict.*, decade iv, vol. i, p. 33.

Localities.—Stations 59, 79, 90, Indian Marine Survey; Pedro Shoal, 25 fathoms.

75. *Cellepora cidaris*, MacGil

McCoy, *Prod. Zool. Vict.*, decade xvii, vol. ii, p. 245

There are large colonies of what I believe to be this form, although they have solid instead of hollow columnar processes as described by MacGillivray.

Localities —Off Ceylon coast, 32-34 fathoms (Indian Marine Survey); off Port Blair, 100 fathoms (Indian Marine Survey); Lat. 6° 1' N., Long. 81° 16' E. (Indian Marine Survey); Stations 59, 77, Indian Marine Survey.

Sub-Order CYCLOSTOMATA.

Family CRISIIDÆ.

76. *Crisia holdsworthii*, Busk.

Brit. Mus. Cat. Mar. Pol., pt. iii, p. 7.

Localities.—Off Ceylon coast, 32-34 fathoms (Indian Marine Survey); Lat. 6° 1' N., Long. 81° 16' E., 34 fathoms (Indian Marine Survey).

77. *Idmonea milneana*, d'Orb.

Locality.—Station 148, Indian Marine Survey.

Sub-Order CTENOSTOMATA.

Family VESICULARIIDÆ.

78. *Amathia distans*, Busk.

Voy. H.M.S. "Challenger," Pt. L (vol. xvii), p. 33.

Localities.—Coast of Cheduba, 28-30 fathoms (Armstrong); Andamans (Wood-Mason).

79. *Bowerbankia caudata*, Hincks.

(*Valkeria caudata*) *Ann. Mag. Nat. Hist.*, series 4, vol. xx, p. 215, 1877.

Locality.—Port Canning, Ganges Delta, incrusting bricks in brackish pool (Annandale).

80. *Farrella atlantica*, Busk.

Voy. H.M.S. "Challenger," Pt. L (vol. xvii), p. 37.

Locality.—Ye, Burma (Indian Marine Survey).

Family CYLINDRÆCIDÆ.

81. *Cylindræcium dilatatum*, Hincks.

Brit. Marine Pol., vol. i, p. 536.

These specimens have large, spinous dilatations at their bases, as described by Hincks for some of his specimens.

Locality.—Mangalore, 26-31 fathoms (Indian Marine Survey).

XIV.—THE FAUNA OF BRACKISH PONDS AT PORT CANNING, LOWER BENGAL

PART VI.—OBSERVATIONS ON THE POLYZOA, WITH FURTHER NOTES ON THE PONDS.

By N. ANNANDALE, *D.Sc.*, *Officiating Superintendent,*
Indian Museum.

Thanks to the kindness of Mr. D. Hooper, I am now able to give figures representing approximately the maximum and minimum salinity of the water of one of the ponds during the present year. A sample taken on May 25th (about three weeks before the beginning of the rainy season) from the pond in which the hydroid of *Irene ceylonensis* was found, contained 22·88 per thousand of saline residue, while one taken from the neighbourhood of the same pond on July 9th contained only 9·82 per thousand. At the latter date the whole area containing the ponds was flooded and the river embankment had broken down in their vicinity. It will be remembered that the water of the same pond contained 12·13 per thousand of saline constituents in December, and 20·22 per thousand in March. By an unfortunate mistake the former figure is misquoted as 0·22 per cent. on pp. 69 and 82 of pt. i of these "Records."

A factor in the distribution of the pond fauna to which attention was not paid in my preliminary account (pp. 35—43) is the bore on the Matla river. Mr. Hodgart, Zoological Collector in the Museum, tells me that at this time of year it is often so strong that people in the neighbourhood of breaks in the embankment are obliged to take refuge on its approach in the upper storey of the nearest brick house. The bore of course only affects the ponds when the embankment is broken and they are therefore put in communication with the river, but on such occasions it must bring into them many organisms from the neighbourhood of the open sea. Collections made in the ponds during the present month (July, 1907) include specimens of several forms not hitherto taken in the tanks, notably one of a species of the Sipunculid genus *Physcosoma*, which was found in the mud. They also include most of the forms already taken, notably *Metridium schillerianum* var. *exul* in great abundance and the Polyzoa *Victorella pavida* and *Bowerbankia caudata*, both in interesting stages; *Irene ceylonensis* was not seen.

POLYZOA.

Numerous statoblasts of *Plumatella* were found floating on the surface of the ponds in July, together with gemmules of *Spongilla alba*; but as a very careful search failed to reveal living colonies of Phylactolæmatous Polyzoa at any season in the ponds, it is probable that the statoblasts had been brought from freshwater tanks in the vicinity by wind or by flood. The only Polyzoa taken recently in the ponds in an active condition are Ctenostomes, *viz.*, *Victorella pavidata* and *Bowerbankia caudata*; but the type specimens of *Membranipora bengalensis*, which are still in the Indian Museum, were collected from brackish ponds in the neighbourhood by the late Dr. Stoliczka thirty-nine years ago. Miss L. Thornely (*Rec. Ind. Mus.*, i, p. 186) has recently examined specimens from Mergui, and I have nothing to add to her report, which is published in this number of the *Records of the Indian Museum*, except to say that I have been unable to identify in Stoliczka's types the "statoblasts" to which he refers (*Journ. Asiat. Soc. Bengal* (2), 1869, p. 58). It seems probable from his figures and description that what he saw were polypides in different stages of development from brown bodies, together with unripe gonads. In some species the gonads are well developed, after the formation of a brown body, while the new polypide is still in a very rudimentary condition.

Family PALUDICELLIDÆ.

Ctenostomes that die down in unfavourable conditions after the production of resting buds, which differ in form from the zoœcia and are enclosed in an impermeable substance resembling chitin. Zoœcia tubular, arising either directly from another zoœcia, or from tubular outgrowths from the sides of other zoœcia, or from a false stolon. The false stolon consists of tubular prolongations of the base of each zoœcium, neither the false stolon nor the tubular outgrowths being always present. Funiculus well developed; gizzard feebly muscular.

I follow Jullien (*Bull. Zool. Soc. France*, x, p. 174, 1885) in regarding *Paludicella* Gervais as the type of a family, to which, in my opinion, *Victorella* and, if it be generically distinct, *Pot-siella* also belong. I have, however, given a new definition of this family, in order to lay stress on the feature that seems to me most important, *viz.*, the production of the so-called hibernacula in unfavourable conditions. The term hibernacula is, however, misleading, for the structures it is intended to describe are formed in India in summer and spring. They do not appear to have been hitherto described in the case of *Victorella*, as the "winter buds" that several authors have noted in this genus are buds very much like the ordinary zoœcia. As regards the position of *Paludicella* and its allies, if they are to be regarded as a distinct family, they are intermediate between the Stolonifera and the astoloniferous families of the Ctenostomes. As I have already

indicated, their "stolon" is not a true stolon in the sense that the "rhizome" of a form such as *Bowerbankia* is one. It is not always distinguishable, and when it is definitely present is not sepa-

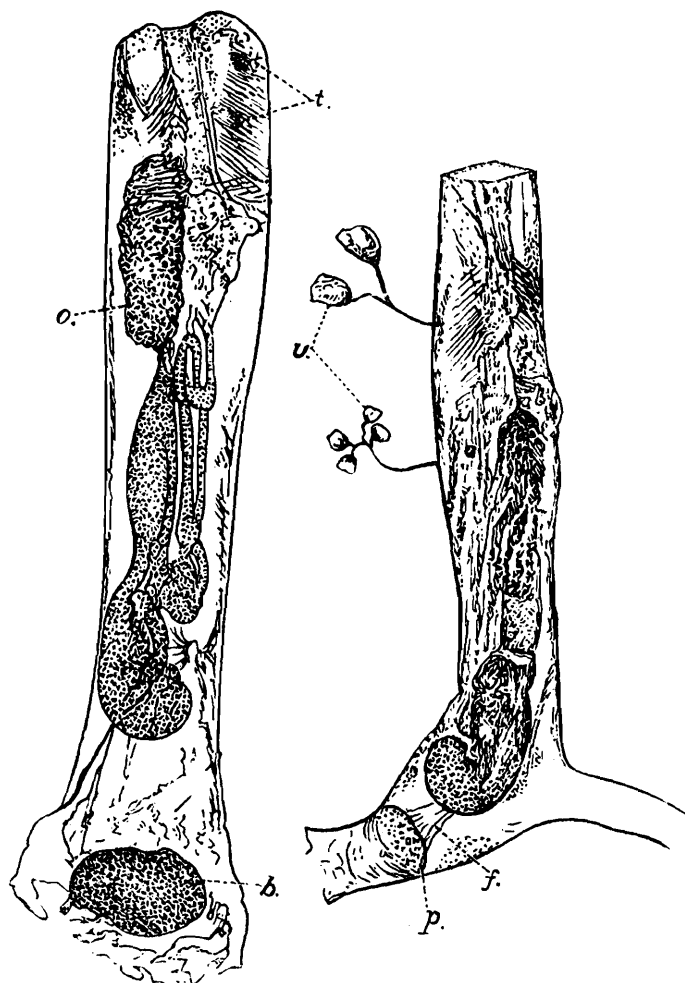


FIG. 1.

FIG. 2.

FIGS. 1 AND 2.—Zoecia of *Victorella pavida* from Port Canning at the end of winter, $\times 70$. (From preserved specimens.)

b = young resting bud ; *f* = funiculus ; *o* = ovary ; *p* = plate separating the zoecia ; *t* = testes ; *v* = vorticellids growing on the zoecia.

rated off from the cavities in which the polypides rest, but consists of prolongations of the base of the zoecia, the separating plate occurring in the false stolon at some little distance from the base of the polypide (fig. 2). This is really what is meant by the statement of several authors that in *Victorella* the zoecia arise from swellings in a creeping stolon ; it would be more accurate to say that the creeping stolon consisted of the base of the zoecia produced in two or four directions. A rudiment of just such a false stolon is sometimes found in *Hislopia* (the type of another family of fresh-water Ctenostomes) and apparently occurs in a fully developed condition in the Arachnidiidæ. The family most closely allied to the Paludicellidæ is probably the Cylindrocæciidæ, to which Pennington (in Bousfield, *op. post. cit.*, p. 406) thought that *Victorella* belonged.

The Paludicellidæ occur all over the world, but only in fresh and brackish water, in which they are exposed to the dangers of desiccation and violent changes of temperature. It is noteworthy, however, that the only other genus of Ctenostomes that occurs in fresh water in the Oriental Region, namely *Hislopia*, appears not to form resting buds and is capable of sexual reproduction at all times of year. This genus constitutes, according to Jullien, the type of a second family and appears to be sufficiently different from all other forms to merit this distinction. The family Hislopiidæ may be defined as follows:—

Perennial freshwater Ctenostomes in which the zoœcia are flat and recumbent and arise directly from other zoœcia in linear or ramifying series. The front of the zoœcium membranous, the sides and the rim of the aperture (which is more or less raised and tubular) thickened. Funiculus practically absent; gizzard furnished with thickened ridges internally.

The examination of numerous specimens of *Hislopia lacustris* from Calcutta, the United Provinces of Agra and Oudh,¹ and the Malay Peninsula convinces me that Jullien's *Norodonia sinensis* and *N. cambodgiensis* are merely phases or varieties of this species, which must therefore be widely distributed in the East. The form of the zoœcia and the method of budding would suggest a relationship with the Arachnidiidæ. Although *Hislopia* is not found in brackish water, the foregoing description and notes may be of use in distinguishing it from the Paludicellidæ.

Victorella pavida, Kent.

(*V. pavida*), Kent, *Quart. Journ. Micr. Sci.*, x, p. 34, 1870; Hincks, *Brit. Marine Polyzoa*, p. 559, pl. 79; Bousfield, *Ann. Mag. Nat. Hist.* (5), xvi, p. 401, 1885; Kraepelin, *Deutsch. Süßw. Bryozoen* (part i), p. 95, 1887.

It is unnecessary to give a formal description of this species, the anatomy of which has been described by Bousfield (*op. cit.*). Indian specimens agree fairly well with the descriptions of English ones, being readily distinguished from those of any other Ctenostome by their mode of budding. Possibly there are slight differences between the Bengal and the British races, but it is difficult to be sure that such differences are constant without examining a large number of examples from different localities, and this I have had no opportunity of doing. Bousfield refers to specimens he found in England in spring as having zoœcia that were "solitary, and semi-reptant, colourless, and in shape much like a violin with a straight elongated neck"; but he describes specimens he took in the same locality in the month of September in the following terms: "The polypidom consists of slender yellow or brownish tubes, on which at intervals are situated swellings in each of which

¹ See also Walton in *Rec. Ind. Mus.*, i, p. 177, 1907.

a zooid is developed

From each swelling arise two branches at right angles, and by the growth of these branches and the development of zoœcia, from which again other branches arise, the growth of the colony continues, always branching in a rectangular direction, so that a matted mass results."

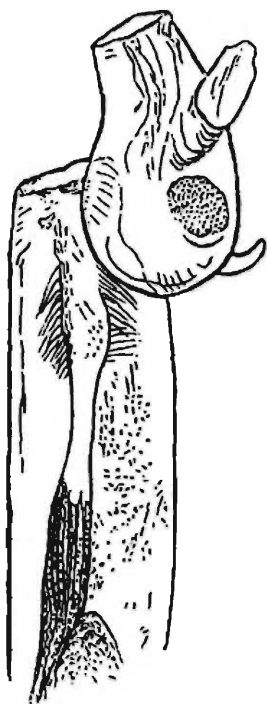


FIG. 3.

FIG. 3.—Distal extremity of zoœcium of *V. pavidum* from Port Canning, with bud, $\times 70$. (From preserved specimens.)



FIG. 4.

FIG. 4.—Resting buds (b) of *V. pavidum*, with remains of zoœcium, $\times 70$; Port Canning, July, 1907. (From preserved specimens.)

In the neighbourhood of Calcutta I have found specimens corresponding with both of the phases thus described. Specimens (fig. 1) obtained in winter from the ponds at Port Canning, represented a phase similar to that found in September in England, except that the whole of the zoarium was practically colourless. Many of the zoœcia bore lateral buds, which were situated in most cases near the distal extremity. From these buds (fig. 3) originated tubular outgrowths, which, in a few cases, gave rise to other zoœcia. I did not find, however, examples that could be compared in complexity with that figured by Kraepelin on plate iii, fig. 75, of the work referred to under his name. The buds in my specimens were, moreover, less distinctly cylindrical than those he describes, being shorter and more gradually rounded at the base. They were only produced on a relatively small number of zoœcia.

Other specimens, taken earlier in the season in a canal, the water of which was only slightly brackish, at Dhappa near Calcutta, had the zoœcia partially recumbent and of the same form as those of the specimens taken by Bousfield in England in spring. The

zoëcia were, however, closely packed together (the false stolon between them being very short) and in a few cases bore buds near the distal extremity. In these specimens, although the aperture was in most cases distinctly rectangular, it was occasionally almost circular. Kraepelin (*op. cit.*, p. 158, footnote) has described under the name *Paludicella mülleri*, a somewhat similar form, which he regards as intermediate between *Paludicella* and *Victorella*; but this form is stated never to produce buds on the distal part of the zoëcia, always to have this region circular in cross-section, and to possess a circular musculature.

Both the specimens from Dhappa and those from Port Canning that were taken in winter, bore ripe gonads, the testes and ovaries reaching maturity simultaneously in the same zoëcia. The ovary (fig. 1) consisted of a single mass, elongated in a vertical direction and situated on the inner wall of the zoëcium some little distance below the aperture. The testes, on the other hand, occurred as a number of small rounded bodies scattered over the greater part of the zoëcium, but particularly numerous near its distal extremity.

At the base of the zoëcia (fig. 1) of several colonies obtained from Dhappa and Port Canning during winter, small, mound-shaped masses of densely granular cells of a brownish colour were observed occasionally, taking the place of basal buds in the zoarium. In a few cases, in specimens taken both in November and January, these masses appeared to have secreted a thin chitinous investment, which was not, however, very distinct at the edges. In specimens taken in the ponds at Port Canning in July, shortly after the beginning of the rainy season, "resting buds" (fig. 4) were observed in the same position, and there could be no doubt that they represented a more perfect stage in the development of the same structures. The resting buds (fig. 4) were flattened, more or less oblong bodies of very variable size and outline, the upper surface being slightly arched and bearing a number of longitudinal ridges, which occasionally ramified; the sides were produced into several tubular projections, on which the chitinous coat was comparatively thin. The colour of the whole structure was dark brown. As a rule two resting buds were present at the base of each zoëcium that produced them, but sometimes there was only one and occasionally there were three; only a comparatively small number of zoëcia had produced them. Such zoëcia, and the majority of the others, contained at this season no polypides, but were either empty or contained brown bodies. Frequently even empty zoëcia retained their external form, except that the aperture was tightly closed and the adjacent region circular in cross-section, and in many cases the collar persisted as a wrinkled and pleated funnel-shaped membrane extended from the distal extremity of the zoëcium. A few polypides were active, some of them being long, thin and very transparent, while others were short and relatively stout; the latter occurring chiefly towards the periphery of the zoarium and being semi-recumbent. In a few cases it appeared that the long thin polypides had recently developed from resting buds at the base of

dead zoœcia, but none were found actually in the course of development. No sexually mature zoœcia were observed.

The form of the resting buds of *Victorella pavidā* is not without a certain systematic interest, for not only do they appear to exhibit very distinct differences from those of *Paludicella* and *Potsiella*, but their shape is not altogether dissimilar to that of the zoœcia of *Hislopia*. It is possible, judging from the analogy of other organisms found in stagnant water in Lower Bengal, that they are produced both at the end of autumn and the beginning of spring, both these seasons being critical periods in the life cycles of many of the lower invertebrates of the Calcutta tanks. If this is so, it is probable that they do not undergo further development in the one case until the cold weather is well established, and in the other until the rains have lowered the temperature very considerably. The dangers to be guarded against at the two periods are different. In spring the approach of the hot weather not only raises the temperature of the water but also, perhaps consequently, induces an enormous multiplication of aquatic bacteria. Whether these bacteria have any specific action on other organisms is not known, but their rapid increase is accompanied by a simultaneous disappearance or depauperation of many of the common aquatic invertebrates, while the scum they produce on the surface certainly prevents aëration of the water. In autumn, on the other hand, the risk of actual desiccation is great, for although evaporation is naturally more pronounced in summer, it is, at this season, to some extent counterbalanced by the heavy thundershowers that frequently fall; whereas in winter, during which there is usually very little rain, the temperature is quite high enough to evaporate the water of many of the smaller pools.

Family VESICULARIIDÆ.

The characters of this family have been discussed by all those who have dealt from a systematic point of view with the Ctenostomes as a whole, but the tropical species are still far from being well known. So far as they have been studied, they appear to be closely related to, or in many cases identical with European forms. In the East, as in Europe, members of certain genera are not averse to brackish water. It is worthy of note that *Victorella pavidā* was originally found in England in the same locality as *Bowerbankia imbricata*, a species allied to the one found with it in Lower Bengal.

Bowerbankia caudata, Hincks.

(*B. caudata*) Hincks, *Brit. Marine Polyzoa*, p. 521, pl. 75.

I am indebted in the first instance for the identification of this species to Miss L. Thornely. Mr. R. Kirkpatrick has also been kind enough to examine specimens and is of the opinion that they are identical with Hincks's species. A renewed search in the ponds has proved it to be at least as abundant as *Victorella pavidā*, the

two species frequently occurring together on the same stem or root and their zoaria being very closely interlocked. *B. caudata* is, however, generally more restricted as to the area it covers than *V. pavidus*, which as a rule surrounds it when the two are found in close contact. In such circumstances it is by no means easy, distinct as the species really are, to distinguish one from the other. The bases of the zoaria are almost invariably concealed by a dense growth of minute algæ and other organisms, and, except when buds are being produced on the zoœcia by *Victorella*, the distal ends of the zoœcia are extraordinarily alike. The basal portion of these structures, when it is visible or if it can be freed from external matter, affords the best means of diagnosis. The nature of this part of the organism has already been fully dealt with in the case of one species; in the other, *B. caudata*, the zoœcia adhere to the sides of the stolon and end in each case in a free conical "tail," which as a rule hangs down beneath the level of the stolon. This character is often to some extent obscured in old individuals, although very clear in some zoœcia of every zoarium.

If the polypides are alive and can be induced to expand their lophophores while under observation, the readiest way to distinguish *Victorella* from *Bowerbankia* is to note that whereas the gizzard is highly muscular in the latter, its walls are thin in the former. In living examples of the two forms this character is conspicuous when the tentacles are extruded, and can be detected with a little care even when they are retracted; but in preserved material it is often difficult to be sure as regards the nature of the gizzard, which is clearly present (as Bousfield noticed) even in *Victorella*.

My specimens of *B. caudata* agree fairly well with Hincks's figures, but the "tail" of the zoœcia is sometimes longer and occasionally forks at its free extremity, the alternate arrangement of the zoœcia is not quite constant, and the stolon is divided by partitions placed at irregular intervals. When the zoarium becomes much matted together, the "tails" appear to grow longer than is the case when the colony has plenty of room for expansion, and sometimes secondary adhesions are formed both between the "tail" and another loop of the stolon and between different parts of the stolon. When the tails adhere to the stolon in this way they do so either by their sides or by their tips.

The tentacles, which always number eight, bear at their base a long sensory bristle (which slopes backwards and downwards when the lophophore is expanded) and a series of three or four approximately horizontal, finer hairs on their external surface, as well as a bunch of still finer hairs at their tip.

Specimens taken during winter were sexually mature, the gonads closely resembling those of *Victorella*. In most cases, however, the testes became mature before the ovaries. Colonies kept through the hot weather in an aquarium in which the salinity of the water was maintained at an even level, continued to produce spermatozoa until the end of June and did not form brown bodies. I failed to observe the formation of ovaries in these circumstances. It is

evident, however, that in the ponds the polypides cease to be active and produce brown bodies during the hot weather. In colonies taken from their natural habitat in July, during the floods referred to at the beginning of this paper, only a few zoœcia were active, and these few appeared from their transparency to have recently been rejuvenated. In the majority of the zoœcia new polypides were in the course of development from brown bodies, the tentacles in most cases being already visible as short digitate processes. On the walls of zoœcia containing tentacles in this stage of rejuvenescence the gonads were already almost mature, both ovaries and testes being already far advanced and occurring together.

An interesting observation, possibly connecting the formation of brown bodies with that of the resting buds of the Paludicellidæ, was made as regards some of these zoœcia, namely that their walls were greatly thickened and had a brownish or greenish colour not due to the presence of minute organisms. Other zoœcia, however, in which the polypides were in exactly the same condition, resembled the empty zoœcia of *Victorella* at the same time of the year, having thin walls and the collar protruding from their distal extremity.

XV.—A THIRD NOTE¹ ON EARWIGS (*DERMAPTERA*) IN THE INDIAN MUSEUM,
WITH THE DESCRIPTION OF A
NEW SPECIES

By MALCOLM BURR, B.A., F.Z.S., F.G.S., F.L.S., F.E.S.

Genus *DIPLATYS*, Serville.

1. *siva* Burr. Bhim Tal, Kumaon, 4,500 feet, 19th to 22nd September 1906, "feeding on flowers of stinging nettles." Three larvæ, which I refer with some doubt to this species. Nos. $\frac{623}{15}$, $\frac{625}{15}$ and $\frac{728}{15}$ (N. Annandale).
2. *gladiator* Burr. Calcutta, 22nd November 1906, ♀, No. $\frac{1248}{15}$ (J Caunter).

Genus *FORCIPULA*, Bolivar.

1. *trispinosa* Dohrn. Nepal; Chitlong, Nos. $\frac{751}{15}$ and $\frac{752}{15}$, ♂ ♂; $\frac{746}{15}$ and $\frac{750}{15}$, ♀ ♀ (R. Hodgart); Pharping, No. $\frac{1241}{15}$, ♀; $\frac{1243}{15}$, ♂ (R. Hodgart). Calcutta, "at light," No. $\frac{594}{15}$, ♂, and $\frac{595}{15}$, ♀ (C. A. Paiva). Also the following larvæ and immature specimens are probably to be referred to this species: Bhim Tal, Kumaon, 4,500 feet, 19th to 22nd September 1906, No. $\frac{624}{15}$ (N. Annandale). Nepal; Pharping, Nos. $\frac{1240}{15}$ and $\frac{1244}{15}$ (R. Hodgart). Nepal; Soondrijal, October 1906, Nos. $\frac{1270}{15}$, $\frac{1271}{15}$, $\frac{1273}{15}$, $\frac{1276}{15}$, $\frac{1277}{15}$, $\frac{1278}{15}$, $\frac{1280}{15}$, $\frac{1281}{15}$, ♀ ♀; $\frac{1291}{15}$ to $\frac{1295}{15}$, very small and ill-developed ♂ ♂, $\frac{1288}{15}$, $\frac{1289}{15}$ and $\frac{1297}{15}$, larvæ (R. Hodgart).
2. *decolyi* Borm. Nepal; Soondrijal, Nos. $\frac{1272}{15}$ and $\frac{1274}{15}$, ♂ ♂ (R. Hodgart).

Genus *LABIDURA*, Leach.

1. *bengalensis* Dohrn. Siliguri, N. Bengal, No. $\frac{602}{15}$, ♀ Chandpur, District of Tipperah, No. $\frac{597}{15}$, 10th September 1906, ♀ (I. H. Burkill).
2. *riparia* Pall. Kathgodam, U.P., 3rd October 1906, No. $\frac{1246}{15}$, one larva (N. Annandale). Comilla, Bengal, two larvæ (Lefroy). Pusa (Lefroy²). Var. *inermis*, Pusa, ♂ ♂ (Lefroy).

¹ The two previous papers on the collection were published in the *Journ. Asiatic Soc. Bengal*, 1905, p. 27; and 1906, p. 387.

² This and other specimens recorded as collected by Lefroy belong to the collection of the Imperial Entomologist, Pusa.—ED.

3. *nepalensis* sp. n.

Parva, gracilis; pronotum angustum, longius quam latus, postice rotundatum; elytra granulosa, carina exteriori distincta, acuta; alæ longæ; pedes testacei, fusco-annulati; abdomen cylindricum, læve; segmentum ultimum ♂ rectangulare; pygidium ♂ ♀ haud perspicuum; forcipis brachia ♂ basi triquetra, margine interno per tertiam partem longitudinis fortiter laminato-dilatato, hac parte dente terminata; dehinc valde attenuata, gracilia, inermia, incurva.

	♂	♀
Long. corporis	7·5—9·75 mm.	8·5—11 mm.
„ forcipis	3	1·75—2

STATURE small and slender.

COLOUR dull black; last dorsal segment and forceps reddish black; antennæ greyish; feet testaceous, femora and tibiæ banded with blackish.

ANTENNÆ typical of genus; 21 segments.

HEAD smooth and convex; sutures obsolete.

PRONOTUM somewhat longer than broad, anterior border straight, posterior border rounded; prozona somewhat tumid; metazona flattened.

ELYTRA long, truncate, granulated, carina sharp and well defined; dull black.

WINGS long, same texture as elytra.

FEET slender, typical.

STERNUM brown, typical.

ABDOMEN dull chocolate black, with a pale sparse pubescence, which is denser and longer in the ♀; apparently smooth, exceedingly finely punctulated; no lateral tubercles.

VENTER dark brown, smooth, with fine yellowish pubescence.

PENULTIMATE VENTRAL SEGMENT ♂ obtusangular, truncate apically; ♀ rounded.

LAST VENTRAL SEGMENT almost hidden in both sexes, only the exterior angles visible.

LAST DORSAL SEGMENT: ♂ rectangular, reddish black, with a longitudinal median sulcus, and a blunt tubercle on each side at posterior border; ♀, attenuate, with median depression.

PYGIDIUM ♂ ♀ not apparent.

FORCEPS with the branches of the ♂ triquetre and stout at the base; inner margin depressed into a sharp flattened plate along one-third of its length; this part terminated with a small sharp tooth; the edges contiguous; then strongly attenuate, unarmed, gently incurved; on the underside each branch is deeply furrowed. In the ♀, simple, straight, conical.

HAB.—Nepal; Soondrijal, $\frac{1283-88, 98, 98, 99}{15}$, 3 ♂ ♂, 6 ♀ ♀; Pharping, $\frac{1245}{15}$, ♂ (Indian Museum, R. Hodgart).

Falls into the group of *L. lividipes* and *L. tenuicornis*, characterised by small size and slender build; this is a species at once distinguished by the dilated forceps, recalling typical *Forficula*.

4. *lividipes* Duf. Chakradharpur, Chota Nagpur, No. $\frac{9520}{14}$, ♀, 3rd to 6th March 1906 (N. Annandale). Siliguri, North Bengal, No. $\frac{600}{15}$, ♀; Calcutta, No. $\frac{599}{15}$ (C. A. Paiva).

Genus ANISOLABIS, Fieber.

1. *annulipes* Luc. Calcutta, 24th August 1906, No. $\frac{598}{15}$, ♂ (C. A. Paiva). Pusa (Lefroy).
 2. *annandalei*. Comilla, E. Bengal, Nos. $\frac{303}{15}$ and $\frac{306}{15}$, ♀ ♀; Dacca, E. Bengal, Nos. $\frac{354}{15}$ and $\frac{355}{15}$, ♀ ♀

These specimens are much redder than the type, which is probably bleached; the head and feet are uniform deep red.

Genus LABIA, Leach.

1. sp. (?).

This is probably a new species; there is a single female from Bhim Tal, Kumaon, at 4,500 feet, 19th to 22nd September 1906 (N. Annandale).

Genus CHELISOCHES, Scudder.

1. *melanocephalus* Dohrn. Pusa (Lefroy) ♂; Barisal, E. Bengal, ♀ (Lefroy); Munshiganj, Bengal (Lefroy).
 2. *simulans* Stål. Pusa (Lefroy), ♀, Calcutta; "at light," 14th November 1906 (N. Annandale).

Genus ANECHURA, Scudder.

1. *jeæ* Borm. Nepal; Chitlong, Nos. $\frac{734}{15}$ to $\frac{748}{15}$, 7 ♂ ♂, 8 ♀ ♀ (R. Hodgart). Naini Tal, Kumaon, 6,400 feet, 1st October 1906, No. $\frac{601}{15}$, ♂; $\frac{604}{15}$, ♀ (N. Annandale).
 2. *metallica* Dohrn. Bhim Tal, 4,500 feet, Kumaon, 19th to 22nd September 1906, "feeding on flowers of stinging nettles," Nos. $\frac{616}{15}$ and $\frac{629}{15}$, ♀ ♀ (N. Annandale). Nepal; Soondrijal, Nos. $\frac{1275}{15}$, ♂; and $\frac{1279}{15}$, ♀; Gowchar, Nos. $\frac{1300}{15}$, ♂; $\frac{1301}{15}$, ♀ (R. Hodgart); Nagorkoti, No. $\frac{1303}{15}$, ♀ (R. Hodgart).

Genus ALLODAHLIA, Verhoeff.

1. *coriacea* Borm. Bhim Tal, 4,500 feet, Kumaon, "feeding on flowers of stinging nettles," 19th to 22nd September 1906, Nos. $\frac{605}{15}$, $\frac{606}{15}$, $\frac{610}{15}$, ♀ ♀; $\frac{613}{15}$, $\frac{615}{15}$, $\frac{618}{15}$, $\frac{619}{15}$, $\frac{611}{15}$, $\frac{622}{15}$, $\frac{630}{15}$, ♂ ♂ and ♀ ♀ (N. Annandale).
 2. *ancylura* Dohrn. Bhim Tal, 4,500 feet, Kumaon, "feeding on flowers of stinging nettles," 19th to 22nd September 1906, No. $\frac{617}{15}$, ♂ (N. Annandale).

Genus APTERYGIDA, Westwood.

1. *bipartita* Kirb. var. *macrolabia*. Mussoorie, United Provinces, (Lefroy).
 2. *arachides* Yers. Bombay (Lefroy).

Genus FORFICULA, Linn.

1. *planicollis* Kirb. Sandakphu, Darjeeling—Nepal border, 11,900 feet, October 1906, "amongst firewood," Nos. $\frac{634}{15}$ and $\frac{635}{15}$, ♂, ♀ (I. H. Burkill). Bhim Tal, Kumaon, 4,500 feet, 19th to 22nd September 1906, "feeding on flowers of stinging nettles," No. $\frac{620}{15}$, ♀ (N. Annandale).
2. *acer* Burr. Mussoorie, United Provinces, ♂ (Lefroy).
3. *beelzebub* Burr. var. Katmandu, Nepal, Nos. $\frac{1238}{15}$ and $\frac{1239}{15}$, ♂ ♂ (R. Hodgart). Nepal; Chitlong, No. $\frac{753}{15}$, ♀ (R. Hodgart).

These specimens agree with the type in structure, except that they represent the cyclolabia form, and the colour is different; instead of being of a uniform dull black, the elytra are clear brick red, the head is claret-coloured, and the abdomen is deep reddish black; I cannot find a true specific distinction, and therefore, for the present at least, range them as a cyclolabious colour-variety of *F. beelzebub*.

4. sp. (?). Assam, Nos. $\frac{248}{15}$ and $\frac{249}{15}$, ♀ ♀

These are a distinct species, but I refrain from describing and naming them until the male is forthcoming.¹—April 14th, 1907.

¹ Since this paper was sent to the press Mr. Burr has published a revision of the Forficulidæ (*sensu stricto*) and the Chelisochidæ (*Trans Ent Soc.*, 1907 (1), p. 91). This revision may necessitate considerable alteration in the generic names of the species recorded above.—ED., 13-viii-07.

XVI.—NOTES ON ORIENTAL DIPTERA

III.—REVIEW OF THE ORIENTAL SPECIES OF *SEPEDON* LATR., WITH DESCRIPTIONS OF TWO NEW SPECIES.

By E. BRUNETTI.

Seven species of this genus were included in Van der Wulp's Catalogue (1896) of the Diptera of South Asia. Of these I believe I can identify four with specimens either in the Indian Museum collection or my own, and add two new ones taken by myself last year in Java. They all appear to be valid species and of four of them, *plumbellus*, *aënescens*, *ferruginosus* and a new species *sanguinipes*, I have examined a series of about a score of each. Two species I know from single specimens only (*crishna* Wlk. and *fuscinervis* mihi) and the remaining three I have not seen; these being *javanensis* Rob. Des. (figured in Macquart's "Diptères Exotiques"), *costalis* (1) Wlk., and *costalis* (2) Wlk., which latter, the name being preoccupied by the author himself in the same genus, I have renamed *batjanensis*.

Table of Oriental species of Sepedon.

- A Front coxæ grey or blackish,
with or without silvery
white shimmer; *never yellow*.
- B Abdomen *plumbeous*.
Long. $4\frac{1}{2}$ - $6\frac{1}{2}$ mm.
- C Apical half (or third) of wing
distinctly darker; antennæ
nearly or quite black
(except the reddish yellow
1st joint); posterior
femora generally with
the apical half reddish
Long. 5- $6\frac{1}{2}$ mm. *plumbellus* Wied.
- CC Wings uniformly light grey-
ish brown—rarely darkened
towards tip (if so only
very slightly); antennæ

- brown, (sometimes darker at tip); posterior femora always uniformly tawny
Long. $4\frac{1}{2}$ -6 mm. *aenescens* Wied.
- BB Abdomen tawny or ferruginous
Long. 6-10 mm.
- D Cinereous species; abdomen tawny; thorax with four indistinct lines
Long. 9 mm. *costalis* Wlk.
- DD Ferruginous species; abdomen ferruginous; thorax with two indistinct lines
Long. 10 mm. *batjanensis*, nom. nov. for *costalis* Wlk. (2) preocc.
- AA Front coxæ (generally all the coxæ) bright yellow or tawny (with little or no shimmer).
- E Thorax black or blackish.
- F Wings uniformly brownish; four anterior tarsi in ♂ enlarged
Long. 7 mm. *javanensis* R. Des.
- FF Wings not uniformly coloured; either apical part distinctly darker, or a suffusion along the veins; only the fore tarsi enlarged.
- G Apical part of wing distinctly darker
Long. 7-8 mm. *sanguinipes* Bru., sp. nov.
- GG Wing suffused along the veins
Long. 6 mm. *fuscinervis* Bru., sp. nov.
- EE Thorax ferruginous
- H Abdomen ferruginous
Long. 5-7 mm. *ferruginosus* Wied.
- HH Abdomen plumbeous
Long. 7 mm. *crishna* Wlk.

S. plumbellus Wied., 1830.

Ausser. Zweifl., ii, 577.

This species is fairly common in grass and weeds near water in and around Calcutta, probably occurring throughout Bengal. From Calcutta the Indian Museum possesses it showing dates from the end of January up to July. Dr. Annandale's collector took one ♀ early in May this year at Dharampur (5,000 feet) in the Simla hills. It differs from its close ally *aenescens* Wied. in several minor but generally consistent characters. Firstly, the wing is nearly always *distinctly* darker towards the tip, the basal

half often being quite clear, whereas in *aenescens* it is uniformly pale brown and *never* clear at the base. The second distinguishing character is the antennæ, which are (exclusive of the reddish 1st joint) always black, or very nearly so, in this species, but much lighter, and brown, in *aenescens*. In *plumbellus* the posterior femora are often reddish on the apical half (in which case the base is generally paler yellow than the other legs), whereas in *aenescens* they are *always uniformly brownish yellow*, and the tips never black, as is often the case in this species.

S. aenescens Wied., 1830.

Ausser. Zweifl., ii, 579.

Although the author says wing with a brownish tip, enclosing the cross vein, I feel sure that I have correctly identified this species, and think Wiedemann's specimen must have been an abnormal one. In one or two specimens out of the series of sixteen in the Indian Museum collection, there is a *slight* darkening towards the tip, which is absent in most specimens. His description of the shining lead front, and the femora being distinctly mentioned as *not* red, and the extreme tip of the posterior femora *not* being black, lead me to suppose the Museum specimens are this species. Wiedemann's line as to the posterior femora being more or less brown towards the tip, applies to an occasional specimen, but the specific character is uniformly brownish yellow femora, quite different from the distinct *reddish* tinge on the apical half of many specimens of *plumbellus*. The Indian Museum series is from Bangalore, but I have two examples taken by myself at Shanghai on April 16th and May 6th, 1906. Wiedemann originally described both *plumbellus* and *aenescens* from China; probably both species, with *ferruginosus* Wied. and my new species *sanguinipes* are all distributed throughout the East generally.

S. costalis Wlk., 1859.

Proc. Linn. Soc. Lond., iii, 110.

Walker has described two species separately under this name, but neither has been seen by me. The author described the present species (♂) from the Aru Islands. I have had to place it and the next species in my analytical table according to the somewhat short descriptions supplied. Thus I have assumed by "abdomen and legs tawny" that the coxæ are tawny also. That they are good species I have no doubt, from the four spots on the face and frons. Both species seem to possess this number, whereas in *ferruginosus* Wied. and *crishna* Wlk., the only others bearing spots on the face, there are only two, and in *crishna* the mark is a small streak, not a "dot" as Walker terms it. In size, too, both this and the following species exceed their allies by two to three millimetres.

S. batjanensis, nom. nov.

Nom. nov. for *S. costalis* Wlk. (1861) preoccupied

Proc. Linn. Soc. Lond., v, 291.

Walker's second species under the name of *costalis* was described from Batjan, and appears quite distinct. The author calls it "ferruginous" as differing from "cinereous" under which term he described his Aru Islands species. The type is a ♂. I fail to understand Walker's remark "allied to *S. duplicans*," not being able to trace any such species. Immediately following his description of *S. costalis* (1) is a new species of his, *Lauxania duplicans*, which he could hardly confuse, or compare with a *Sepedon*. I presume his "hind femora denticulated" (in his Aru Islands species) refers to the row of spines present in all the species.

S. javanensis R. Des., 1830.

Essai sur les Myodaires, 677.

Figured in Macquart's Dipt. Exot., ii, pt. 3, pl. xxiv, 2, 2a, 2b.

(Syn.) *S. javana*, Macq., *loc. cit.*, ii, pt. 3, 177.

This species must be allied to my *sanguinipes*. From Macquart's plate, the wings appear to be uniformly coloured, whereas in my new species *sanguinipes*, they are quite distinctly darker towards the tip, and yellowish towards the costa.

Moreover Macquart mentions that the *four* anterior tarsi are enlarged in the ♂, whereas in all the examples of *sanguinipes* that I have examined, this enlargement is confined to the fore pair only. The longish hair below the four anterior tarsi, which Macquart mentions and figures as an additional or overlooked character of the species, is replaced in *sanguinipes* by the ordinary short pubescence common to all the species. As regards the dilatation of the fore tarsi, I find this is also the case in *ferruginosus* Wied. ♂; in both sexes in *sanguinipes*; and likewise in the single example of *crishna* Wlk. that I have seen, which is a ♀; so that the character appears to be common to several species in the genus, and not confined to the ♂ sex. In fact Macquart in his supp. iii, pt. 3, p. 219, to his previously mentioned work mentions a ♀ *javanensis* R. Des. with enlarged anterior tarsi. Again, Macquart's figure shows the posterior femora of uniform colour, whereas in my species the contrast is strikingly distinct between the bright yellow and brilliant red, with the extreme tip distinctly black; none of which characters appear in Macquart's figure. Moreover mine is a larger species, and lastly, Macquart shows the thorax rather lighter than the abdomen, with two very distinct black stripes, whereas in *sanguinipes*, the thorax is unicolorous blackish with the abdomen, and (when present) the two dorsal darker stripes are very indistinct.

S. sanguinipes mihi, sp. nov.

♂ ♀, Sœrabaya, Java, long. 7-8 mm.

Frons depressed, yellow, becoming brownish above, and nearly black on vertex, with a silvery leaden reflection seen from behind. Face below antennæ bright yellow, unmarked, cheeks a little darker; antennæ, 1st joint reddish yellow, bare; 2nd joint black, with short stiff hairs; 3rd black, slightly pale at base on upper side, with dorsal white arista. Proboscis yellowish brown with a few hairs. Thorax dull black, dorsum smooth and bare; lower part of sides with silvery leaden reflections seen from behind. Abdomen blackish leaden, sometimes with brownish reflections; bare, a few short hairs at tip. Legs, fore coxæ yellow, four posterior coxæ yellowish brown, all the coxæ in certain lights showing silvery white reflections: fore femora red, with black tips; middle femora generally all reddish, but sometimes yellowish for a greater or less part from the base, tips black; posterior femora, basal two-fifths bright yellow, the rest brilliant red, tip black; fore tibiæ dark brown or black; four posterior tibiæ variable, brown, reddish brown or blackish; tarsi dark brown or black; the fore pair distinctly wider than the middle and posterior pairs in both sexes. Wings grey, blackish towards tip, and slightly yellowish on anterior margin; halteres yellowish white. Described from about 30 specimens in the Indian Museum collection (where the type ♂ and ♀ are deposited) and my own.

With the exception of one ♀ taken near Calcutta, May 27th, 1907, in the Indian Museum, all the examples referred to were collected by me in the East and they record the following data: Sœrabaya, Java, 16th to 25th July, 1906 (in woods); Rangoon (about) February 9th, 1906; Hong-Kong, 5th March, 1906; and Calcutta, 22nd January, 1907 (in grass near ponds).

S. fuscinervis mihi, sp. nov.

♀, Sœrabaya, Java, long. 6 mm. The single example of this species was taken by me in company with the preceding, July 25th, 1906.

It varies by the wings being pale grey; without any yellowish colour on the anterior part; with the three longitudinal veins widely suffused from the discal vein to the wing border. Although I have only seen this one specimen, the wing suffusions appear to make it quite a distinct species. In all other respects it agrees with *sanguinipes*. In my collection.

S. ferruginosus Wied., 1830.

Ausser. Zweifl., ii, 577.

A common species in Calcutta and Rangoon, probably extending over a considerable area in this region. Its uniformly light

ferruginous colour will distinguish it from all other species except *crishna* Wlk., which latter is easily separated by its leaden black abdomen. The coloration of the posterior femora is variable, the difference between the pale yellow basal half and bright tawny red apical half being sometimes very striking, whilst in some specimens the colour is almost uniformly tawny. In its yellow face it is allied to Walker's first species named *costalis* (from the Aru Islands), but *costalis* has four black spots on its face and four black lines on its thorax, whereas *ferruginosus* has only two black spots (which are on the frons) and only two narrow black thoracic lines, close together, which sometimes form one broad band by the intervening space being darkened.

S. crishna Wlk., 1861.

Proc. Linn. Soc. Lond., v, 291.

The only specimen that I have seen (a ♀ in the Indian Museum collection), and that I can identify with this species was captured by Dr. Annandale's collector at Matiana (8,000 feet), Simla hills, on 28th to 30th April, 1907. It agrees in every particular with Walker's description, except that he says the dorsum of the thorax is *black*, whereas in the present specimen it is uniformly light ferruginous with the rest of the body. I think Walker's specimen may have been discoloured, and that my identification is correct.

* * * * *

Two other species were described by Wiedemann, *senex* and *imbutus*; they are from unknown localities, and are in the Vienna Museum. I mention them because the author's other three species all occur in the East.

S. senex Wied. is grey haired, with blackish brown antennæ, the 3rd joint being whitish at the base; the face is yellow, frons reddish yellow with two brown streaks, thorax with two blackish lines on dorsum, and a white shimmer on the sides and front; abdomen brown, or in certain lights, blue; wings deep yellow with brown tips; legs reddish yellow, posterior pair rather reddish with pale base; the fore pair and the tibiæ black. ♂ long. 5½ mm.

The deep yellow coloured wings mentioned by the author readily distinguish this species. Locality?

S. imbutus Wied. is dull leaden, differing from *senex* in the reddish yellow base of the 3rd antennal joint; frons and face pearl bluish; wings very lightly yellow, tips distinctly brownish, the darker colour extending to and enclosing the middle cross vein. Minor differences as regards the colour of the legs are mentioned. ♂ long. 5 mm. Locality?

Either of these species may be found in the Oriental Region.

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## XVII.—DESCRIPTION OF A NEW SNAKE FROM NEPAL

By G. A. BOULENGER, F.R.S.

*Oligodon erythrogaster*, sp. nov.

Nasal undivided; portion of rostral seen from above nearly as long as its distance from the frontal; suture between the internasals shorter than that between the præfrontals; frontal much longer than its distance from the end of the snout, a little shorter than the parietals; no loreal, præfrontal in contact with the second upper labial; one præ- and two postoculars; temporals 2 + 2; six upper labials, third and fourth entering the eye; four lower labials in contact with the anterior chin shields; posterior chin shields two-thirds the length of the anterior. Scales in 17 rows. Ventrals 186; anal divided; subcaudals 45 (end of tail injured). Back pale brown, sides grey; two dark brown streaks, enclosing a yellowish vertebral streak, meeting on the tail, the prolongation extending to between the eyes; a dark streak and three narrow black lines on each side; a  $\wedge$ -shaped dark brown band across the snout, passing through the eye; a broad dark brown oblique band on each side of the head, from the supraocular to the throat; belly vermillion red in the middle, white on the sides, with two regular series of semicircular black spots, confluent into two stripes posteriorly.

A single specimen from Nagarkote, Nepal, altitude 6,000 feet, presented to the Indian Museum by Major J. Manners Smith, V.C., C.I.E., No. 15850, Reptiles, Indian Museum Register.

A very distinct species, allied to *O. venustus*, Jerd., but well distinguished by its undivided nasal, its longer tail, and the remarkable coloration.



XVIII.—NOTES ON A COLLECTION OF  
MARKETABLE FISH FROM AKYAB,  
WITH A DESCRIPTION OF A NEW  
SPECIES OF *LACTARIUS*

By R. E. LLOYD, M.B., B.Sc., Captain, I.M.S., Surgeon  
*Naturalist, Marine Survey of India.*

In February this year Mr. I. H. Burkill, Reporter on Economic Products to the Government of India, sent an agent to Akyab, on the Arakan Coast of Burma, to make a collection of the fish exposed for sale in the market. This collection, which includes no less than 69 different species, was handed over to the Indian Museum for investigation. Dr. Annandale, who looked through the specimens and identified some of the species, has invited me to complete the identifications and to publish the results.

The collection includes fish from both fresh and salt water, but even taking this fact into consideration, it is surprising to find so many different species of edible fish on sale in the market at one season. Their variety illustrates the great wealth of fish life in Indian waters.

Most of the species have been identified from Francis Day's admirable monograph on the fishes of India, and also by reference to his original collection, which is available for comparison in the Indian Museum. Several of the species show slight variations from Day's descriptions, and in one case it has been found necessary to describe a new species (*Lactarius burmanicus*).

The agent who collected the fish also gathered together information of various kinds about them, such as their Arakanese names, the season of the year at which they are common, the character of the water in which they are found, and their market value. Some of his statements are at variance with those of Day; but it must be remembered how difficult it is to obtain accurate information on such subjects. In the following list the statements in inverted commas are extracts from the notes of Babu Rajoni Kanta Das, who made the collection. All undefined references are to Day's *Fishes of India*. The classification adopted is that of Boulenger. The term "river fish" may here be taken to include all fish from water on the landward side of Akyab bar.

## ELASMOBRANCHIA (SELACHII).

## CARCHARIIDÆ.

1. *Carcharias gangeticus.*
2.     ,,     *laticaudatus.*

" Name *Nga man* ; common ; the fins are purchased by Chinamen for export ; white fins fetch as much as one rupee per lb."

## ELASMOBRANCHIA (BATOIDEA).

## PRISTIDÆ.

3. *Pristis cuspidatus.*

" Name *Nga man sway they.* Common from September to March ; fins exported."

## TRYGONIDÆ.

4. *Trygon uarnak.*

" Name *Lcik chout* ; common in the sea."

5. *Trygon walga.*

" Name *Phat shay* ; common in the sea ; a favourite food fish."

6. *Pteroplatea micrura.*

" Name *Htamancee* ; common in the sea from October to March ; highly esteemed as a food fish by the Arakanese."

## MYLIOBATIDÆ.

7. *Aëtobatis narinari.*

" Name *Swan shay* ; common in the sea from October to February ; esteemed as food by the Arakanese."

It is interesting to notice that three of these rays are said to be common only during the winter months. It is well known that many of the tropical sharks and rays are viviparous and are frequently caught pregnant during winter and spring (Alcock, *Journ. Asiatic Soc Bengal* (2) 1890, and other papers). Their frequent appearance in the market at that season is most probably due to the fact that they then come close to shore to produce their young, winter being the season of calms in the Bay of Bengal. This view accords with the well-established facts that the young of most shore fishes are to be found close to the shore, and that they migrate out to deeper waters as they grow larger (McIntosh, "Scientific Work on Sea Fisheries," Lecture 1, *The Zoologist*, 1907).

## TELEOSTII (MALACOPTERYGII).

## CLUPEIDÆ.

8. *Clupea variegata*.

There are 14 ventral spines in front of the pelvic fins and 12 behind. *C. variegata* is defined as having 10 in front and 10 behind, while *C. chapta*, a closely allied form, has 19 before and 9 behind.

"Name *Taymi*, or *Nga tha tout too* ; common during winter months in the river."

9. *Clupea ilisha*.

("Hilsa.")

"Name *Nga thalout* ; common in the river from January to March, rare in other months ; much esteemed as food ; salted for export."

10. *Clupea lile*.

"Name *Sha shari wat toung* ; common in the river during the rains."

11. *Engraulis taty*.

"Name *Nga pasha* ; common throughout the year both in river and sea."

12. *Engraulis breviceps*.

This specimen closely resembles *E. taty*, but the proportion of the head to the body is as 1 : 7, and the anal fin arises in advance of the dorsal. The Arakanese seem to recognize the difference.

"Name *Nga ba* ; generally taken from the sea ; grows to 14 inches."

13. *Engraulis* sp.

A small damaged specimen resembling *E. indicus* in many ways ; but the eye is much too large.

14. *Pellona indica*.

"Name *Myat san gyai* ; common throughout the year in sea and river ; its flesh is reputed a cure for fever, among the Arakanese."

15. *Coilia ramcarati*.

Typical except that the anal fin is somewhat short, containing only about 85 rays.

"Name *Nga lawa* ; common throughout the year in both river and sea."

16. *Megalops cyprinoides*.

"Name *Cha bouk han* ; only occurs in tanks."

Day also states that this fish, which is a true herring, occurs commonly in tanks, rarely in rivers.

## CHIROCENTRIDÆ.

17. *Chirocentrus dorab.*

This is an interesting specimen as it differs from the description somewhat in its proportions : head to body, 1 : 6 ; height to length, 1 : 6. Day gives these proportions as : head to body, 1 :  $6\frac{1}{2}$ — $7\frac{1}{4}$  ; height to length, 1 :  $6\frac{1}{2}$ —9. Bleeker divides the species into two, *C. dorab* and *C. hypselosoma*. The present specimen agrees with his *C. hypselosoma*.

"Name *Nga darhay* ; common in the sea throughout the year."

## NOTOPTERIDÆ.

18. *Notopterus kاپرات.*

This specimen resembles the type in having large scales on the cheeks, in having 105 rays in its anal fin, and in its proportions generally. It differs from the type in that the angle of the mouth is behind the centre of the eye, the dorsal profile is more convex than the ventral, and there is a slight concavity in the profile of the head. In these three points it approaches the type of *N. chitala*. It also has a wide scaleless flap of skin attached to the margin of the opercle. Such a flap is not mentioned by Day in the description of either species ; but it is figured in the case of *N. chitala* alone.

"Name *Nga phay* ; common in rivers from February to March."

## OSTERIOPHYSI.

## SILURIDÆ.

19. *Saccobranchus fossilis.*

"Name *Nga cray* ; common in rivers and tanks."

20. *Plotosus canius.*

Both dorsal and pectoral spines are quite smooth on the exposed edge though serrated on the other ; otherwise the specimen is typical.

"Name *Pin lay nga khoo* ; common in the sea, sometimes enters the river."

21. *Pangasius buehanani.*

"Name *Nga tan* ; common in the river during the rains ; grows two feet in length."

22. *Clarias magur.*

"Name *Nga khoo* ; a common tank fish."

23. *Arius cœlatus*.

Typical, except that the ventral fins are somewhat large, reaching nearly to the anal.

"Name *Nga soo* ; common in the river and sea during the winter months."

24. *Arius gagora*.

I have included two specimens in this species, one of them being referred to in the Babu's notes as *Nga moot*, the other as *Nga sook*. They do not entirely resemble one another in their proportions, nor is either quite typical of *A. gagora*. They both have a patch of globular palatine teeth on either side, so far back that they lie under the eye. The "*Nga sook*" is 10 inches long, the length of its eye is contained 7 times in the length of the head,  $2\frac{1}{2}$  times in the snout, and  $3\frac{1}{2}$  times in the interocular distance.

The "*Nga moot*" is 18 inches long, the eye diameter is contained 8 times in the head, 3 times in the snout, 4 times in the interocular distance. The head is somewhat flatter than that of the other specimen.

In both specimens the maxillary barbel is a little shorter than the head. They are both reported to be common in river and sea.

## APODES.

## ANGUILLIDÆ.

25. *Murænesox talabonoides*.

"Name *Thin bawhto* ; found only in the river, not common ; attains four feet in length."

26. *Ophichthys boro*.

"Name *Nga hout pru* ; common in the river during the rains."

## MURÆNIDÆ.

27. *Muræna macrura*.

"Name *Nga shing gra* ; river and sea, not common."

## HAPLOMI.

## SCOPELIDÆ.

28. *Harpodon nehereus*.

("Bombay Duck.")

"Name *Baraiga* ; common, taken from the river chiefly."

## PERSOCES.

## SCOMBRESOCIDÆ.

29. *Belone cancila*.

“ Name *Nga toung nhin* ; plentiful during the rains, in the river ”

## POLYNEMIDÆ.

30. *Polynemus tetradactylus*.

“ Name *Nga taya* ; uncommon, taken usually from the sea ; attains 3 feet in length.”

31. *Polynemus indicus*.

(“ Topsee Fish.”)

“ Name *Luckwa* ; common in the sea during the winter months ; attains 40 inches.”

32. *Polynemus paradiseus*.

“ Name *Musi rhay* ; common, usually taken at sea.”

## MUGILIDÆ.

33. *Mugil* sp.

## 34. „ sp.

These two species of mullet closely resemble one another, but I have not been able to identify either of them with any of Day's species of the genus, most of which are separated by small distinctions. The two specimens resemble one another in the following features :—

The greatest depth of the body is more than the length of the head, which is  $\frac{1}{5}$  of the total length ; the dorsal fin commences half way between the end of the snout and the base of the caudal ; the snout is equal to the diameter of the eye, which is half the interocular distance ; the mandibles meet at an obtuse angle ; both anterior and posterior eyelids are present.

They differ from one another in the following points :—

One specimen, which is called “ *Nga man*, ” is 8 inches long and is said not to exceed this length and to be common in river and sea. Its anal fin commences well in front of the second dorsal ; the pectoral is as long as the head ; the head is convex from side to side, and the specimen has a yellowish tint in spirit.

The other species, which is called “ *Nga cangying*, ” is said to be uncommon and never to be found in the sea ; it is also said to attain a length of 14 inches. The second dorsal and the anal commence at the same level ; the pectoral is not so long as the head, which is nearly flat.

These two forms seem to be different species. The smaller one is very like *M. dussumieri*, while the "*Nga cangying*" comes nearest to *M. planiceps*; but neither is quite typical of either species.

SPHYRÆNIDÆ.

35. *Sphyræna jello*.

"Name *Nga kyauk tying*; common in winter months in sea and river."

STROMATEIDÆ

36. *Stromateus sinensis*.

("Pomfret.")

"Name *Ruza na panat*; common in the sea; much esteemed."

37. *Stromateus cinereus*.

"Name *Ruzana*; common in the sea during the winter months; much esteemed as food; dried and exported."

OPHIOCEPHALIDÆ.

38. *Ophiocephalus striatus*.

"Name *Nga rin*; a common river fish."

ACANTHOPTERYGII.

SERRANIDÆ.

39. *Lates calcarifer*.

("Bekti.")

"Name *Nga tha dil*; common throughout the year in river and sea; attaining 3 feet in length; a favourite food fish."

40. *Serranus* sp.

An immature fish 4 inches long. Owing to the absence of colour in spirit certain identification is impossible.

"Name *Nga tout too*; sea and river; not common; grows to over 4 feet in length. The Chinese export the skin of this fish."

It is well known that the species of *Serranus* attain a very large size, and it is interesting to see that our Indian informant knows that this small fish grows to over 4 feet in length. It speaks well for his knowledge of fish. Apart from the mere difference in size, there is a considerable difference in general appearance between the young fish 4 inches long and a giant sea perch over 4 feet in length, for a *Serranus* of this size becomes very bulky and attains a great weight. There is a specimen of this genus in the Indian Museum that was over 7 feet in length and weighed 460 lb.

41. *Lutianus johnii*.

"Name *Nga wat pani*; found in the sea only, not common."

42. *Therapon jarbua*.

"Name *Sa ba sa*; river fish, common during the rains."

43. *Ambassis urotænia*.

"Name *Nga san zat*; river fish, common in the rains."

## SCIÆNIDÆ.

44. *Sciæna bleekeri*.

"Name *Nga pa thon*; sea and river fish, common in the winter months."

45. *Sciæna aneus*.

"Name *Ba sha*; common in river and sea throughout the year."

46. *Sciæna miles*.

"Name *Nga baragar*; common in the sea throughout the year."

47. *Otolithus maculatus*.

"Name *Taw ba la*; sea fish, not common; reaches 2 feet in length."

48. *Sciænoides pama*.

"Name *Wa marhi*; sea fish, common; said to attain a length of 12 inches only."

49. *Sciænoides microdon*.

"Name *Ro rhi*; common in the river; attains 4 feet in length."

These two forms, *Wa marhi* and *Ro rhi*, each represented by a single specimen, resemble one another very closely, but differ in the following points:—

The "*Wa marhi*" has ten spines in the first dorsal fin, and eight pyloric cæca; its præopercular edge has blunt, obscure crenulations, and the posterior angle of the maxilla falls behind the eye. This form agrees very closely with *S. pama*.

The "*Ro rhi*," on the other hand, has eight spines, four pyloric cæca, a finely serrated præopercular edge, and the posterior angle of the maxilla falling below the centre of the eye. This form agrees fairly well with *S. microdon*, which is defined, however, as having six pyloric cæca.

Our Indian informant says that the "*Wa marhi*" (*S. pama*) does not grow longer than 12 inches, while the "*Ro rhi*" attains a length of 4 feet. *S. pama*, however, according to Day, grows at

least 5 feet long, while *S. microdon* is a small species. There is evidently a mistake somewhere, but it is noteworthy that local observation has established the fact that one species outgrows the other, especially as it requires careful examination, aided by dissection, to distinguish between the two, at any rate when they are presented in the form of museum specimens.

Both specimens show the lateral line continued along the middle of the tail to its very tip. This feature, which is very conspicuous, is neither remarked in the text nor illustrated in the figures of Day's monograph, in which (pl. xlv, fig. 2) the lateral line is clearly shown as ending before reaching the tail in the case of *S. microdon*.

#### CHÆTODONTIDÆ.

##### 50. *Scatophagus argus*.

"Name *Bishat tara* ; common in the river and sea throughout the year ; esteemed as food " (in spite of its reputed habits).

#### DREPANIDÆ.

##### 51. *Drepane punctata*.

"Name *Swin ma rwat* ; common in the sea during winter."

#### SCORPIDIDÆ.

##### 52. *Psettus argenteus*.

"Name *Nga than zay* ; common in the sea in the winter months."

#### LOBOTIDÆ.

##### 53. *Datnioides polota*.

"Name *Nga pan lun gaing* ; taken usually from the river throughout the year, but not common."

##### 54. *Lobotes surinamensis*.

"Name *Kyauk nag pree* ; river fish, very uncommon."

#### LACTARIIDÆ.

##### 55. *Lactarius burmanicus*, sp. nov.

The single specimen differs so widely from *L. delicatulus*, the only other known species of the genus, that it has been necessary to describe it as a new species. The diagnosis is printed at the end of this paper.

"Name *Ah phying zar* ; common throughout the year in river and sea."

## SILAGINIDÆ.

56. *Sillago domina*.

"Name *Nga rwan nat* ; not common, taken occasionally in the river in the winter months."

## PRISTOPOMATIDÆ.

57. *Diagramma crassispinum*.

"Name *Kyauk nga wat* ; taken occasionally in the river during the winter months."

## SPARIDÆ.

58. *Chrysophrys datnia*.

"Name *Nga wat* ; common in the river during the winter."

## GERRIDÆ.

59. *Equula edentula*.

"Name *Nga wagy* ; common in river in winter months."

## ACANTHOPTERYGII (SCOMBRIFORMES).

## CARANGIDÆ.

60. *Caranx gallus*.

"Name *Nga bya byay* ; common in the river in the winter."

61. *Caranx sansun*.

"Name *Nga ohn* ; common in the sea in the winter months."

62. *Chorinemus lysan*.

"Name *Nga khin ba* ; common in the sea throughout the year."

## TRICHIURIDÆ.

63. *Trichiurus haumela*.

"Name *Nga tha rway mingya* ; common in the winter months in the sea ; its flesh is a reputed cure for fever ; attains 3 feet in length."

64. *Trichiurus muticus*.

"Name *Nga tharway* ; common throughout the year in river and sea ; a reputed fever cure."

## ZEORHOMBI.

## PLEURONECTIDÆ.

65. *Cynoglossus lingua*.

" Name *Khwa sha* ; common throughout the year in river and sea , esteemed by Europeans."

## GOBIIFORMES.

## GOBIIDÆ.

66. *Gobius viridipunctatus*.

" Name *Un doat ma tha* ; river fish, common in the rains."

67. *Gobioides rubicundus*.

" Name *Nga yit ni* ; common river fish."

68. *Boleophthalmus dentatus*.

" Name *Doung brout* ; common river fish."

## SCLEROPAREI.

## PLATYCEPHALIDÆ.

69. *Platycephalus insidiator*.

" Name *Nga prunkhat* ; river fish, not common."

DESCRIPTION OF A NEW SPECIES OF THE GENUS  
LACTARIUS.

*Lactarius burmanicus*, sp. nov.

B 7—D 7 1-22—P 16—A 3.28.

Ll. 85. Trv.  $\frac{11}{20}$  at widest point. P.C. 6.

The description has been drawn up after comparing the specimen with four examples of *L. delicatulus* (the only other known species of the genus) from Malabar. These examples agree with Day's figure and description of the species and with the earlier description of Cuvier and Vallance.

The new species differs from *L. delicatulus* in the following points :—

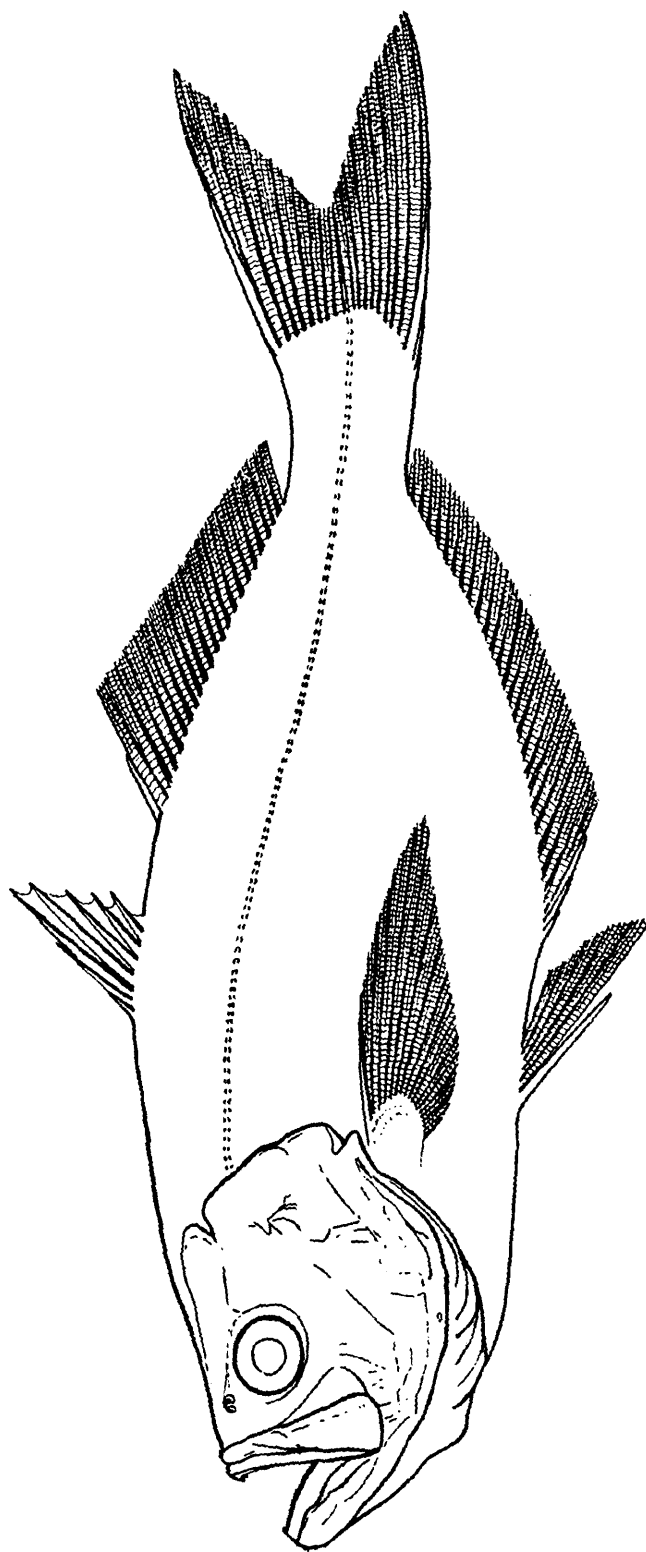
1. The diameter of the eye is  $\frac{1}{4}$  of the total head length ( $\frac{1}{3}$  in *L. delicatulus*), and the snout is longer than the eye.
2. The first dorsal fin is separated from the second by an interval at least as wide as the base of the first dorsal

measured between the first and last spines (in *L. delicatulus* it is considerably less).

3. The ends of the ventral fin just touch the first anal spine.
4. The pectoral fin is as long as the head.
5. Perhaps the most marked difference is in the teeth of the upper jaw. In examples of *L. delicatulus* I find that in addition to two well-marked canines, the upper jaw has a single series of small pointed teeth on the biting edge of the premaxilla in its front half. Posteriorly these pass into a wide band of minute villiform teeth, at least ten deep transversely, situated on the inner side of the premaxilla in its posterior half. Day only mentions the front or single series. In *L. burmanicus*, except for well-marked canines, the anterior half of the premaxilla is toothless, but on the inner side of this bone in its posterior half there is a wide band of very minute teeth. There are one or two minute teeth on the vomer, and a small band of teeth on either palatine. In the lower jaw there are 30 small teeth on either side and 3 canines close to the symphysis.

In all other points this species resembles *L. delicatulus*.

The type of *L. burmanicus* is 14 inches long, while Day says that *L. delicatulus* attains a length of 10 inches and Cuvier and Vallance one of 9 inches. The former species is said to be common in the river and sea at Akyab throughout the year, and to grow to 16 inches long.



*Lactarius burmanicus*, sp. nov.,  $\times \frac{3}{2}$



XIX.—DESCRIPTIONS OF TWO FRESH-  
WATER OLIGOCHÆTE WORMS FROM  
THE PUNJAB

By J STEPHENSON, *Major, I.M.S., Professor of Biology, Govern-  
ment College, Lahore.*

(1) *ÆOLOSONA*, sp.

The worm of which the following is a description is very common in and near Lahore; it inhabits standing water, and may often be found in large numbers in the foul-smelling sediment at the bottom, and also in and amongst algæ of various kinds. It lives well in small vessels in the laboratory; specimens were examined at various times during April 1907.

Examined with a lens when moving freely at the bottom of the vessel, they appear to glide smoothly forward in an extended condition, without the numerous twists, expansions, and contractions of parts of the body that are seen in the case of other small Oligochæta. On a slide and under a cover-glass they are seen to be extremely contractile, rapidly altering their shape, now short and contracted, now long and extended. They remind the observer somewhat of small Turbellarians.

The individuals vary very greatly in length, according to the degree of extension of the body, and also according to the particular phase of asexual reproduction in which they happen to be. A single individual showing no sign of approaching division may measure about 3 mm.; usually, however, specimens are longer, show one, two or more constrictions, and may reach 8 mm. There is a well-marked prostomium, followed by a narrower pharyngeal and œsophageal region; the region of the stomach is thicker again, and behind this the body is uniformly cylindrical to the posterior end. The whole body shows a large number of spherical, ovoid, or irregularly shaped green bodies scattered in the surface epithelium; their colour varies slightly; they may be a pure bright green, or green with a shade of brown, or a light yellowish-green; the latter shades were noticed more frequently, and the pure green less frequently, after the animals had lived for some time in the laboratory. I do not think that these bodies had themselves ever any tinge of blue; there appeared to be at times a bluish tinge in the other parts of the skin, due to smaller, less defined, somewhat refractile particles of a very faint blue colour, so faint as to be almost colourless.

*Segmentation.*—The prostomium is large, broad and somewhat shield-shaped (v. pl. viii, fig. 1). It is broader than the following segments, and is ciliated at its rim and on its ventral surface. No ciliated pits were seen, but ciliary action appeared sometimes to be especially well marked in two grooves leading to the angles of the mouth; possibly the grooves were not permanent. The smallest number of serial setal bundles met with in a complete animal was ten; and animals showing a larger number than this showed also, both by the arrangement of the bundles and by commencing constrictions, that they were preparing to divide (v. diagrams in text-fig. 1). The normal number of segments for a single individual is thus probably about eleven.

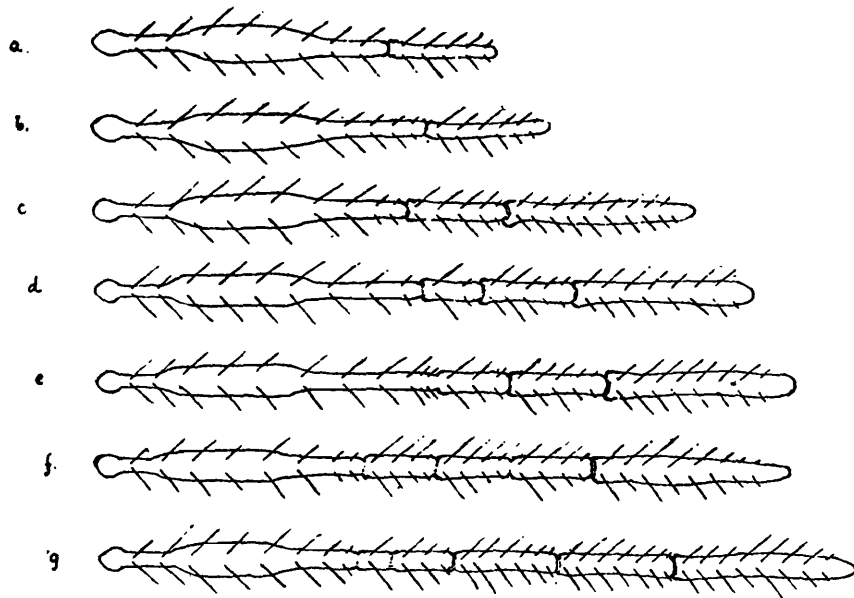


FIG. 1.—Diagrams illustrating various phases of asexual reproduction in *Æolosoma* sp.

*Asexual multiplication.*—Diagrams illustrating various phases are shown in text-fig. 1. It will be seen that the anterior, or original, animal of the chain bears eight, nine, ten or eleven serial setal bundles; but of these the last, or the last two or three, are evidently (as is indicated in the diagrams) of new formation. The zone of budding, therefore, seems to arise after the seventh or perhaps sometimes the eighth setal bundle, *i.e.*, after the eighth or ninth segment; and the intercalation of two or of three segments in this place and subsequent fission would give us the "normal" individual of eleven segments referred to above. In the hinder part of the chain the division into individuals seems to be much more irregular; thus in text-fig. 1 *f* we appear to have had the establishment of three zones of budding behind each of three originally successive segments.

*Setæ.*—Both dorsal and ventral setæ are of the same type,—long, smooth, straight, hair-like; in both dorsal and ventral bundles, however, shorter setæ may be present, sometimes alternating with the longer ones in their position in the bundle; but though

varying in length all are of the same type. The *ventral* bundles contain usually from four to six setæ; the *dorsal* bundles contain from two to six and are, on the average, somewhat longer than the ventral. The general length of the setæ may be said to be about equal to the diameter of the animal. Both groups of setæ begin in the second segment.

*Body-cavity.*—There are no lymph-corpuscles in the body-cavity. There is one very definite septum, at the sides of the pharynx, representing the division between first and second segments. Besides this there are a large number of connecting strands between the alimentary tract and the body-wall: they are fine and thin in the region of the pharynx, thicker posteriorly between the intestine and body-wall, where they have a granular protoplasmic appearance. At the site of a future division they are thicker and more numerous, the condition almost amounting to a fusion between intestine and body-wall. Numerous strands are inserted into the dorsal blood-vessel.

*Alimentary tract.*—The mouth is bordered ventrally by a prominent lip, mobile and ciliated. There is no buccal cavity separate from the pharynx; the œsophagus occupies the second and third segments and is of approximately uniform diameter throughout; bunches of oval or spherical granular cells may be seen attached to it in a grape-like fashion, especially posteriorly (v. pl. viii, fig. 3). The stomach occupies segments 4-7; it is not very sharply delimited from the intestine; it may contain in its wall a number of spherical colourless globules, or perhaps vacuoles, about the same size as the green bodies in the skin. The intestine, which follows, may also contain a number of particles in its walls; but these are more refractile, less regular in shape, somewhat smaller, of a faint bluish tinge, and are apparently of the same nature as the similar bodies described in the skin; they also occur in the wall of the dorsal blood-vessel. Antiperistalsis is frequently observed throughout the length of the alimentary canal as far forwards as, and sometimes including, the stomach; and a reversed ciliary action (postero-anterior) is constantly going on in the intestine. Diatoms and mineral particles are found in the stomach and intestine.

*Vascular system.*—The blood is colourless and contains no corpuscles. The dorsal vessel is contractile; it bifurcates in the prostomium in front of the mouth, and the branches unite to form the ventral vessel beneath the pharynx. There are no transverse commissures.

*Nephridia.*—The nephridia are coiled tubes, with small ciliated funnels lying unattached in the body-cavity. The first occurs behind the first setal bundle; seven may sometimes be distinctly counted, while at other times there are apparently only six. None appeared to be modified in any way.

*Nervous system.*—The cerebral ganglion appears under two shapes; sometimes as a simple, transversely placed oval mass, sometimes having in addition two lateral, posteriorly directed,

rounded cornua. It is much easier to see in some cases than in others, but is never very prominent. While the two forms shown in fig. 4 may certainly both be recognised in different animals, the difference may possibly be explicable, partly at any rate, by a difference in the degree of protrusion or retraction of the prostomium; the effect of protrusion might be to double back the ends of a normally oval-shaped, transversely-placed ganglion. I have, however, no observations to show whether this is so, as it is impossible to follow the shape of the ganglion during any movement of the animal. There are no pharyngeal commissures and no ventral cord. Fine hairs, perhaps sensory, are distributed over the whole body. On the under surface of the prostomium are certain cells which stain a deep blue on the addition of a little methylene blue to the water in which the animal is being examined; these may perhaps be special sense-cells.

No *genital organs* or clitellum were seen.

The above described species of *Æolosoma* appears to have most affinity with *Æ. headleyi*, Beddard, of which I transcribe the specific characters as given in Michaelsen's *Oligochæta*. "*Kopflappen breiter als die folgenden Segm. Oeldrüsen leuchtend grün, manchmal ins Bläuliche spielend. Borsten sämtlich lang, haarförmig, S-förmig geschweift. Gehirn hinten grade abgestutzt (?)*. 8-9 *Nephridien-paare, erstes hinter dem 1 Borstenbündelpaar. Mässig gross (L. ca. 2.5 mm. ?)*."

The question of colour and of the site of the element of blue in the species here described has been entered into above, and also the question of the shape of the cerebral ganglion, about which in *Æ. headleyi* there would appear, from Michaelsen's note of interrogation, to be some doubt; I do not, however, think that in any case its shape could, in the species now described, be said to be "cut off straight behind." A greater number of nephridia is given for *Æ. headleyi* than those I have been able to count. The length is perhaps not a very important point.

There remains only the question of the setæ. I cannot find that in this species there is any S-shaped curve; they may, of course, be temporarily curved through the resistance of the water or pressure of the cover-glass; but examined at rest, without a cover-slip, such a curve, if present at all, is of the very slightest, and is not S-shaped.

The general resemblance, however, of this form to *Æ. headleyi* would appear to be considerable, and it may be possible to unite the two under that name.

The above species will doubtless receive formal description and a specific name from Dr. Michaelsen in his Monograph on the Indian Oligochæta, soon to appear; as, however, it is difficult to be certain of details of internal anatomy in preserved specimens, it seemed worth while to give a description based on examination of the living animal; so that, although appearing before Dr. Michaelsen's work, the above notes are really supplementary and logically posterior to it.

## (2) CHÆTOGASTER PELLUCIDUS, n. sp.

The following interesting form was obtained in the tank in the pleasure-gardens at Shalimar, and was also found in fair numbers in the duck-pond in the Lahore Zoological Gardens. Specimens were under observation in the laboratory at various times during April 1907.

*External characters.*—The worm is much larger and thicker than *C. punjabensis*, recently described from Shalimar. The ordinary length is about 5 mm., but some of the longer chains, especially when extended, may reach 10 mm. Its general shape will be immediately understood by a reference to the figures in plates ix and x; fig. 1, however, was drawn from a somewhat contracted specimen, and the usual shape is more accurately expressed by some of the other drawings. The animal is very transparent.

It seems unnecessary to describe a prostomium, the mouth being large, obliquely placed ventro-anteriorly, and reaching to the anterior extremity of the animal. The pharyngeal region is beset externally with a large number of minute irregularities, probably small chitinous, or at least cuticular, elevations (*v.* fig. 1), mostly elongated in an antero-posterior direction; their shape and disposition are represented in text-fig. 2. The anus is terminal. The animal is very contractile, and may, in this condition, appear to be little more than half its normal length, and double its normal thickness. It moves largely by means of these contractions and extensions of the body assisted by its setæ; in backward progression the hinder end of the body may be first over-extended, then sharply flexed; the setæ, with their points directed forwards, are thus brought to impinge forcibly on any subjacent object, which serves as a point of resistance as the animal thus jerks itself backwards. In anterior progression the points of the setæ are directed backwards.

*Segmentation.*—The rudimentary nature of the prostomium has been mentioned; neither it nor any of the succeeding segments are marked off by any external annulation, and other means of delimiting the segments also fail us in the anterior part of the body. As elsewhere, the first group of setæ may be supposed to mark the second segment; but posterior to this there is a region of the body which is entirely achæitous, which possesses no nephridia, where the ventral nerve cord is not marked by distinct ganglia, and where the septa also are irregular or wanting. There can, however, be little doubt that the second group of setæ belongs to the sixth segment, since this is the rule in the genus *Chætogaster*, to which in other respects the present form shows a close correspondence. In *C. punjabensis*, for example, the segments can be counted by means of the septa; and there can be no doubt of the close relation between that species and the present form. The body is continued posteriorly to a variable length, the segments being marked throughout this extent by definite septa, by the setal bundles and by nerve ganglia. The shortest animal I have met with (text-fig. 2) showed in all eleven segments, and this may be taken as the normal length of a single individual.

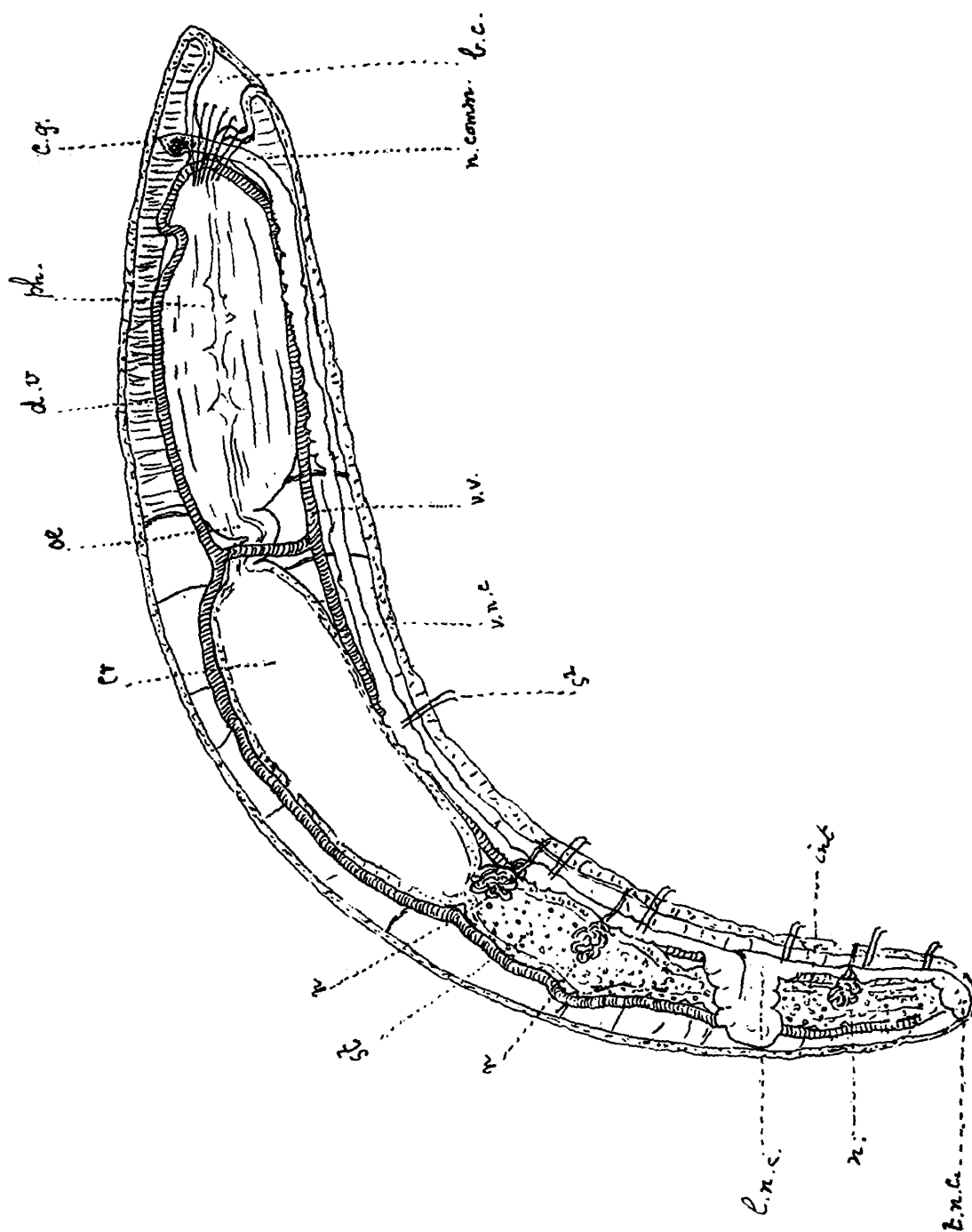


FIG. 2. — An animal of eleven segments; the lateral expansions of the nerve-cord are well seen. The blood-vessels are indicated by cross-shading. The nephridia here and in subsequent figures are diagrammatic.

*Asexual reproduction.*—The “normal single individual” is, however, very rarely met with; since in the large majority of cases indications of approaching fission are evident. Indeed, speaking strictly, I believe that such indications are always to be met with, and that even in the specimen represented in text-fig. 2, the arrangement of the nephridia and the lateral extension of the nerve-cord (here unusually evident) indicate preparations for renewed division.

Figure 3 shows a specimen which is slightly longer than the above, has an additional nephridium, and is producing new segments posteriorly, as indicated by the terminal minute new setæ. This—and the same applies to several of the figures referred to in the following few paragraphs—was drawn originally to illustrate other points; the nerve-cord is here not represented, but an irregularity of the septa about the ninth and tenth segments probably indicates the production of new segments at this place.

Figure 4 represents a considerably longer animal. A definite constriction divides it into two halves, of which the anterior is in exactly the condition of text-fig. 2; the posterior contains also three nephridia, with an interval between the second and third, where a lateral extension of the nerve-cord is beginning to grow dorsally. This posterior portion evidently only requires the elongation of its fore-part and the addition of the first setal bundles to bring it also into the stage of the animal represented in text-fig. 2.

Figure 5 shows this elongation and addition of the first setal bundles (directed from the first forwards, not perpendicularly outwards) as having taken place. But in this and the subsequent examples the two chief components of the compound animal have, before separation, developed further than the already separated individual of text-fig. 2, which seems to have become free at an unusually early stage. There seems here to be a slight irregularity in the development of the nephridia.

Figure 6 shows, as measured by the number of segments and the development of the nephridia, a more advanced stage than the last, though the actual division into two is apparently more remote. It shows a typical distribution of the nephridia; and a number of extremely minute, newly developing setal bundles, distinguishable only with the high power, afford a good demonstration of the various positions where new segments are being intercalated.

Figure 7 illustrates again the slight irregularities which may occur in the time of appearance of the nephridia. This specimen contains one nephridium less than the last, though the most anterior setal bundle of the posterior component is better developed, and the minute setæ at the zones of budding are—or were in the original specimen—rather more in evidence. In this, as well as figs. 5 and 6, it will be seen that attention has been paid to the irregularities of the skin surface at the sites of future division. Figure 1 shows a very similar stage.

The longest animal of which I have any note, was also the only one in which reproductive organs were seen. Sexual and asexual modes of reproduction do not, therefore, exclude each other. Here the two chief components each consisted of three portions.

so that the whole chain was composed of six individuals or their rudiments. As regards the posterior of the two chief components, its anterior section was sufficiently distinct, while a further subdivision in front of the sixth setal group, reckoned from behind, was evidenced by the constriction and absence of nephridia at this part. The corresponding subdivision in the anterior animal was less evident owing to the non-development, up to that time, of nephridia behind the level of the slight constriction.

We can now, I think, summarize the history of asexual reproduction in this species as follows: The normal single individual consists of about eleven segments, but, in the spring of the year at any rate, it is seldom found, and does not usually separate till it has attained a greater length than this. It contains, typically, two nephridia in the seventh and eighth segments; it also shows already a zone of budding behind the eighth segment; a nephridium, if present in the tenth segment, will ultimately become the first of a posterior animal. About eight segments are intercalated at the zone of budding, the three anterior of which belong to the anterior half, and the five posterior become the anterior five segments of the second animal; the setæ of the ninth original segment become the second setal bundle; *i.e.*, the setæ of the sixth segment, of the second animal. The posterior end of the whole animal produces three new segments, whereby we now have twenty-two in all, eleven for each half. The animal, however, seldom divides at this stage, the components remaining attached until at least a part of the above cycle has been repeated in each of them.

*Setæ.*—There are no dorsal setæ. The ventral setæ are slender, somewhat small compared with the size of the animal, slightly curved in an  $\int$  shape, with two unequal prongs and a small nodulus (*v.* text-fig. 3 A). Those of the second segment are directed

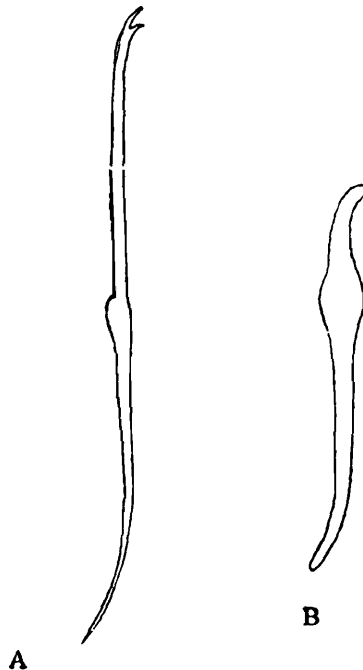


FIG. 3.—A, ventral seta of *C. pellucidus*; B, genital seta.

anteriorly, and when brought into use are spread out in a fan-shaped manner; they do not, at rest, reach the mouth, and I have not seen them used for prehension of food. The next bundle of setæ belongs (*v. ant.*) to the sixth segment, and is situated about the junction of the middle and posterior thirds of the crop. The two following bundles are placed in the region of the stomach; other bundles follow segmentally to the posterior end of the body.

The number of setæ in each bundle is very commonly five; or, in the second segment, six or seven; two, three and four are also met with.

In the only specimen met with which showed sexual organs, the setæ of the sixth segment were modified (*v. text-fig. 3 B*). They were shorter, stouter, with well-marked nodulus, not forked, and did not project. In another specimen which, however, had no sexual organs, these setæ were shorter than those of the next segment, and did not project as much; they had the usual two prongs.

The setal sacs are not conspicuous, the internal ends of the setæ appearing to be merely connected with a number of fine radiating contractile strands. The setæ may be rotated; the hooked free end pointing sometimes forwards and sometimes backwards, according to the direction of progression, except probably in the case of the first setal bundle.

*Body-cavity.*—The body-cavity is traversed by septa, of which the first is well-marked, thick and situated behind the pharynx; the second is thinner and is placed at the beginning of the crop; these two may be taken as delimiting the second and third segments posteriorly. The next definite septum is near the posterior end of the crop, and there is also a septum at the middle of the stomach; these show the extent posteriorly of the sixth and seventh segments: septa occur intersegmentally in the posterior part of the animal.

Besides the septa, there are a number of irregularly placed fine strands passing between alimentary canal and body-wall, especially numerous and perhaps contractile in the region of the pharynx.

On one occasion a number of corpuscles were observed in the body-cavity; these contained a number of colourless, refractile, oil-like globules, of different sizes, in their substance. Usually, however, the body-cavity is free from corpuscles.

*Alimentary canal.*—The mouth is large, circular, placed ventro-anteriorly, and reaching as far as the anterior tip of the animal. The buccal cavity (*v. text-fig. 4 C*) succeeds, with the nerve commissure round its sides; the pharynx is conspicuous, occupying the second segment, attached by strands to the body-wall, and having normally only a narrow lumen. The œsophagus (*text-fig. 2*, and *pl. ix, fig. 1*) is a narrow tube leading to the crop; it occupies almost the whole of the third segment. The crop is the dilated portion of the canal in the fourth, fifth, sixth and part of the seventh segments; it is usually empty, and its walls are clearer than is the case in the stomach and intestine. A constriction in the seventh segment separates the crop from the stomach, the latter being also distinguished from the crop by the number of yellowish, refractile,

oil-like globules in its wall: it frequently has a somewhat rhomboidal shape, owing to its being pulled out laterally by the attachment of the septum. The intestine follows, also dilated at the insertions of the septa; its walls are of the same character as those of the stomach. Ciliary motion may sometimes be detected in the intestine, but it is not of a conspicuous character, nor definitely in a postero-anterior direction, as is commonly the case in small aquatic Oligochæta.

These animals are carnivorous; on two occasions I found two specimens on a dead fly in the water; the stomach and intestine of others showed Paramœcia and other Ciliata, small Crustacea, Rotifers and Anguillulæ in their interior.

*Circulatory system.*—The dorsal vessel is contractile, the contractions progressing from behind forwards; it is attached to the dorsal wall of the intestine, stomach, crop and œsophagus, except at the angle between œsophagus and pharynx; it is again attached to the wall of the pharynx in its posterior part, and becomes free anteriorly before it divides. It is continued as two lateral vessels at the sides of the buccal cavity, immediately posterior to the nerve-commissures (*v. text-fig. 4 C*), which unite

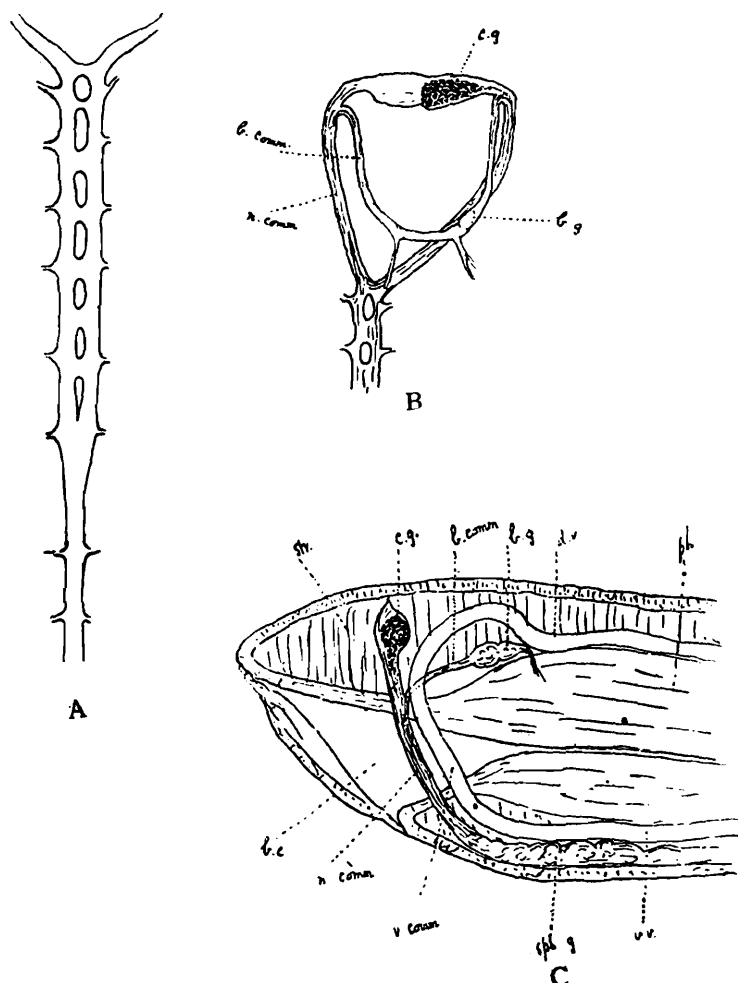


FIG. 4.—A, anterior part of ventral nerve cord of *C. pellucidus*, in the extended condition; B, cerebral and buccal ganglia and their commissures; C, anterior end of animal, from the side. (Reference letters as in Plates ix and x.)

ventrally in the ventral vessel. This is not contractile and is not attached to the wall of the alimentary canal. A pair of transverse connecting vessels (v. text-fig. 2) which are contractile are situated in the oesophageal segment in front of septum  $\frac{3}{4}$ . There is a capillary plexus in the wall of the crop similar to that described in *C. punjabensis* (v. pl. ix, fig. 10). The blood is colourless and contains no corpuscles.

*Nephridia*.—The nephridia are long, finely coiled tubes, not attached to the septa, and without funnels; no ciliary motion is visible within them. Their position has been described above, and may be seen in the various figures.

*Nervous system*.—The cerebral ganglion is situated dorsal to the buccal cavity; it is indistinctly bilobed, elongated transversely, and may appear somewhat nodular in outline. The commissures are continued from its antero-lateral angles. The ganglion frequently contains a quantity of granular opaque matter; this may be aggregated into an ovoid mass (text-fig. 5 A) in the

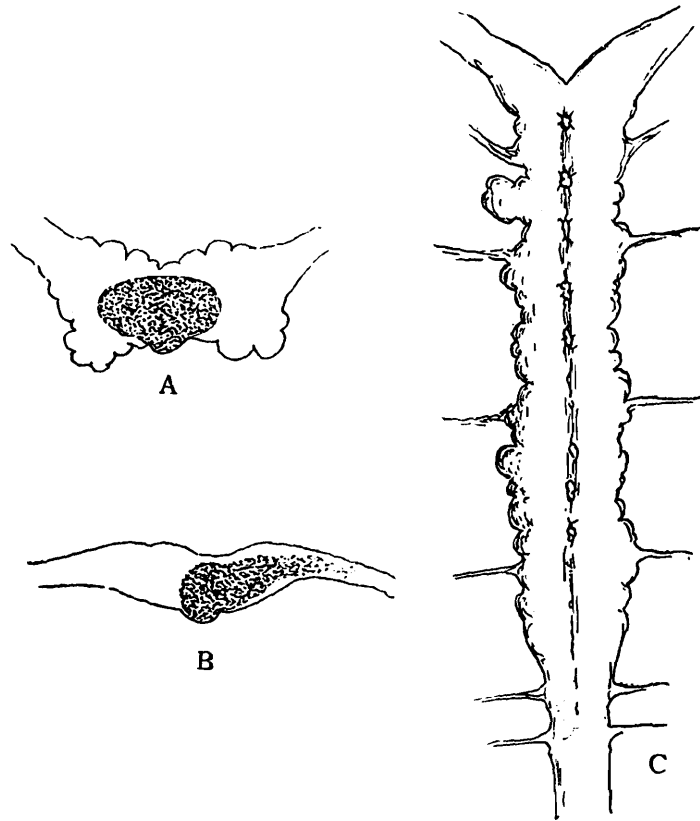


FIG 5.—A, cerebral ganglion of *C. pellucidus*, with symmetrical ovoid granular mass; B, the same, granular matter mainly unilateral; C, anterior part of ventral nerve-cord, in the usual somewhat contracted condition of the animal.

deeper and more posterior part of the ganglion; or it may extend as scattered granules some distance along the commissures; or it may be confined to the right (text-fig. 5 B) or left half of the ganglion; or it may be absent altogether. But even when most closely aggregated, the mass never has the bright shining appearance of the refractile particle in the cerebral ganglion of *C. punjabensis*, but is always dark and opaque.

The commissures lie at the sides of the buccal cavity and unite below; about one-third of their length from the cerebral ganglion they each give off a branch which proceeds in a posterior and dorsal direction; and curving inwards unites with its fellow in a loop dorsal to the pharynx; this loop shows two ganglionic swellings, one on each side, which are very evident in text-fig. 6,

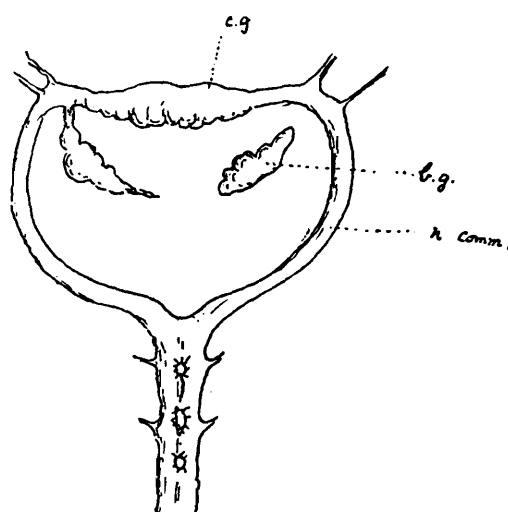


FIG 6.—Anterior part of nervous system of *C. pellucidus*: buccal ganglia obvious, buccal commissures indistinct. (Reference letters as in Plates ix and x.)

though the connecting strands were here scarcely discernible. The fibres appear to enter the loop from the ventral portion of the buccal commissure, not from the direction of the cerebral ganglion (*v.* text-fig. 4 B and C).

The ventral nerve-cord shows the longitudinal division into two in its anterior portion, which is characteristic of the genus. This is best seen when the animal is well extended; the separation between the halves then takes the form of elongated oval spaces with bridges passing from side to side between them. In the much more usual (under examination) somewhat contracted condition, the longitudinal division of the cord is much less marked, and appears as a series of small circular buttonholes with puckered margins (*cf.* text-figs. 4 A and 5 C); in this condition the outline of the cord is irregularly nodulated. This longitudinal division extends almost as far as the posterior end of the pharynx.

The ganglia are placed in each segment after the fifth at the level of the setal bundles. In the anterior part of the body they are not clearly distinguishable, though on a lateral view a slight thickening of the cord appears to exist anteriorly where it is formed by the union of the commissures, and again just behind the posterior limit of the pharynx. The first ganglion, however, that is clearly recognisable is that of the sixth segment; all are seen better in a lateral view than in one from the ventral surface.

The lateral expansions of the nerve-cord at the site of a future division of the animal have been already referred to, and are illus-

trated in text-fig. 2; the terminal expansion in this particular case probably denotes that the animal has recently divided. The expansions are quite similar to those I have already described in *C. punjabensis*; they are more marked on the posterior side of the actual line of constriction, where they appear to develop into the nerve-commissures of the posterior animal (*cf.* some examples in figs. 5 and 6).

*Sense organs.*—A few fine hairs are seen at the anterior end of the body. The granular matter in the cerebral ganglion doubtless corresponds to the refractile particle in the same situation in *C. punjabensis*.

*Reproductive organs.*—I found these organs only in one specimen (which was also dividing asexually), although within a few days of this I looked through a fair number of examples with a view to discovering others.

The male organs (*cf.* fig. 9) are situated opposite the middle region of the crop; a small spherical mass, in which no structure could be discerned, and seen only on one side, perhaps represents the testis; to its outer side lies a tube, straight or doubly bent, ending internally in a dilated portion, and externally on the surface at the level of the setæ of the sixth segment. A swollen part of this tube near its external aperture is occupied by an ovoid somewhat granular mass, and the external aperture itself is funnel-shaped. I could not distinctly see an internal opening at the other end of the tube, nor was ciliary motion anywhere visible. The genital setæ have already been described; there is a development of hairs around the aperture; and the skin is thickened here, so that seen laterally (fig. 10) there is a slight protuberance.

Scattered throughout the body, in the posterior as well as in the anterior of the two as yet undivided animals, were numerous sperm-morulæ; various stages in the development of these are represented in fig. 8, beginning with a small globular hyaline mass, in which the individual cells are but faintly visible with the high power of the microscope, and ending with a wisp of enveloped spermatozoa. The male products would therefore seem to ripen while floating free in the body-cavity.

The ovaries, of which one is shown in fig. 9, develop on the anterior face of septum  $\frac{6}{7}$ ; one ovum, in the figure referred to, is seen to be much larger than the rest; it had a clear refractile germinal vesicle which was enclosed by a zone of protoplasm somewhat clearer than that composing the mass of the egg. The receptacula seminis (as I take them to be) are two sacs, attached near their fundus to the septum at the anterior end of the crop (septum  $\frac{3}{4}$ ), and opening exteriorly as shown in fig. 9: they were of a hyaline appearance, and no distinct structure could be observed. No oviducts were seen. No clitellum was distinguishable.

The specimen whose reproductive organs are here described was examined on April 24th; the water containing it had then been kept in a vessel in the laboratory for a few weeks.

## GENERAL REMARKS.

The animal described above agrees in most points with the definition of the genus *Chætogaster* as given by Michaelsen. It differs, however, in not possessing a greatly elongated third segment, which is a characteristic of the genus as described by him; for though, as has been said, there is some difficulty in delimiting the anterior segments, still the third appears to be defined by septa on each side, and, as in *C. punjabensis*, to be practically commensurate with the œsophagus; and apart from this, whatever the exact limits of the first six segments may be, there is hardly room for any one of them to be "greatly elongated" without cramping some of the others almost out of existence. The receptacula seminis of this genus are also said to be in the fifth segment, while I have described them above as attached to the posterior face of septum  $\frac{3}{4}$ ; I would not, however, lay too much stress on the condition of the single, apparently not fully developed, specimen, in which these organs were found.

On the other hand, the resemblances between this form and the various species of the genus *Chætogaster* are many and evident; such, especially, are the absence of the dorsal and the arrangement of the ventral setæ, the single pair of lateral transverse blood-vessels, and the separation longitudinally of the anterior part of the ventral nerve-cord into two. It will be better, therefore, for the present to place this form in the genus *Chætogaster*, as was done with *C. punjabensis*, and as Annandale has done with the allied species recently described by him; and I propose the specific name *pellucidus* for it.

Besides the presence of the cuticular prominences on the head, the distribution of the nephridia, the details of the asexual mode of reproduction, and the co-existence of asexual with sexual reproduction, a few further points of interest present themselves for remark.

With regard to the granular matter contained in the cerebral ganglion, it is interesting to recall the crescentic refractile particle in *C. punjabensis*, the sense-organ (? otocyst) in the cerebral ganglion of *C. bengalensis* (Annandale, *Journ. Asiat. Soc. Beng.*, New Ser., vol. i, No. 4, 1905, p. 117), and the definite otocyst (a relatively large, globular, transparent cyst) of *C. spongillæ* (*ib. id.*, vol. ii, No. 5, 1906, p. 188). With this may perhaps be brought into connection the condition in *C. diastrophus* (Gruith.), a European species, in the definition of which Michaelsen says, "gehirn mit medianer Chitin (?) - Platte am Hinterrande." It seems possible that we have here a series of degenerative changes, from the fully-developed organ of *C. spongillæ*, through the doubtful otocyst of *C. bengalensis*, to the apparently solid aggregate in the brain of *C. punjabensis* and the chitin-like plate at the posterior part of the brain of *C. diastrophus* (*cf.* the position in *C. punjabensis*); finally we have the dispersal in granular form of this solid matter, as in most specimens of *C. pellucidus*, or its entire absence, as in other

specimens; the variability in amount and distribution of this granular matter being perhaps correlated with the fact of its being here a "rudimentary organ."

What may be called the "buccal nerve commissure" does not appear to have been described in other species of *Chætogaster*; but here again *C. diastrophus* shows a related condition, the œsophagus being surrounded at its middle by a ganglionic ring. In *C. crystallinus* (Vejd.) a similar ring surrounds the anterior end of the œsophagus; and the condition in *C. pellucidus* may be derived from this by supposing a still further forward shifting of this ring, which now takes origin from the commissures at the sides of the buccal cavity; as might be expected on the supposition of the homology of these structures, the fibres of the buccal commissure of *C. pellucidus* are derived from the ventral side, not from the cerebral ganglion.

The genital hairs and genital setæ seem worthy of note. The latter appear to be modified in a direction contrary to what is usual; they abort to some extent, and cease to project. Since in this form the normal setæ (and the same is the case in *C. punjabensis*) project ventrally in a vertical direction, with little or no lateral inclination, they could, if retained, only be a hindrance to copulation, and their abortion probably allows a closer apposition, necessary in the case of aquatic forms.

As to the segments in which the reproductive organs are contained, the ovary is evidently in the sixth segment; as, being at the level of the setæ of this segment, is also the opening of the vas deferens. The anterior portion of the vas deferens and the testis may, following the rule for the genus, be supposed to lie in the fifth segment, though there is here no means of fixing segmental limits. As previously said, the receptacula appear to be in the fourth segment; this is unusual in the Naididæ, and it may possibly be the case that the septa in front and behind the œsophagus are septum  $\frac{3}{4}$  and  $\frac{1}{5}$  respectively, not  $\frac{2}{3}$  and  $\frac{3}{4}$  as I have assumed; in this case the œsophagus would occupy the fourth, not the third segment, and the pharynx both second and third, there being then no septum between the second and third segments. My numbering of the anterior segments of *C. punjabensis* would also in this case require revision.

The absence of a clitellum, and the development of the spermatozoa while floating in the body-cavity are noteworthy.

#### ON THE INDIAN SPECIES OF THE GENUS CHÆTOGASTER.

Michaelsen (*Oligochæta*) in 1900 enumerates five species of *Chætogaster*, all from Europe. Annandale, in describing *C. bengalensis*, mentions that the genus has also been found in America, referring, perhaps, to *C. gulosus*, Leidy, 1852, which Michaelsen calls doubtful, and of which he gives no description. Within the last two years five species have been recorded from India, so that the extent of the genus has been doubled. The new species

are *C. bengalensis* and *spongillæ* from Calcutta, described by Annandale (*loc. cit.*) ; another species not yet fully described and referred to by Annandale, its discoverer, in his second paper as *C. sp.* ; and *C. punjabensis* and *pellucidus* from Lahore by me.

The literature of the European (and American) species is not accessible to me ; but they appear to form a well-marked, homogeneous group, which, while agreeing with the Indian species in its broad outlines are separated from these latter by the elongation of the third segment and the absence of sense-organs or their rudiments. As to the first of these points, whatever be the exact delimitation of the segments in the anterior part of the bodies of the Indian specimens, it can be seen by referring to the published figures (as has been already mentioned for *C. pellucidus*) that, taking the first setal bundle to belong to the second segment, and the second setal bundle to the sixth, there really is no room in any of them for a greatly elongated third segment. As to the second point, the chitinous (?) plate in the brain of *C. diastrophus* may represent a link of connection between the two groups. Another connecting link between the groups may be seen in the buccal nerve-commissure of *C. pellucidus* which, as stated above, may be compared with the circum-oesophageal ganglionic ring of two of the European species.

But whatever may be the case regarding these two geographical groups and their relationship, the Indian species appear to me to be closely related and to form a well-defined assemblage. Besides the characters already mentioned, which differentiate them from the European species, the conformation of the alimentary canal and, as I hope to show, the normal number of segments of the animal and the mode of asexual reproduction, agree in the various members. The small cuticular projections on the head of *C. pellucidus* are also to be compared with the longitudinal rows of minute irregular tubercles on the head of *C. spongillæ* and the small projections of the epidermis on the ventral surface of the anterior sucker of *C. bengalensis* ; and the peculiar shape of the nodule (the projection being one-sided and more abrupt distally) on the setæ of *C. bengalensis* and *pellucidus*—though it may be found not to be confined to these two species—seems worthy of note.

The mere reading of the descriptions of the alimentary tract would lead one to suppose that there was a marked difference between the Punjab and Bengal forms. For example, in *C. bengalensis* Annandale speaks of a narrow slightly coiled passage succeeding the pharynx, and leading into the œsophagus ; the œsophagus being a large sac (*v. fig. in text*) divided by a permanent constriction into two : to the œsophagus (which is thus the longest part of the alimentary tract) succeeds the intestine. The Punjab species, on the other hand, are described as having a small œsophagus, large dilated crop, stomach also considerably dilated, and lastly the intestine. It is, however, easy to see by referring to the figures that Annandale's "slightly coiled passage" is my œsophagus ; the first dilatation of the œsophagus corresponds to the crop, and

the second to the stomach. I had not seen Dr. Annandale's paper when I wrote my description of *C. punjabensis*; and in the above account of *C. pellucidus* I have followed my former nomenclature, since it still seems to me more convenient to have separate names for permanent and separate structures; and so long as such names are not taken to imply homologies I think they are unobjectionable. Dr. Annandale, having access to the literature of the subject, may have used his names in accordance with the practice of European writers on the genus; though it appears that in those species the œsophagus is small, and never longer than the pharynx. In any case, if the terms "crop" and "stomach" are rejected, I would suggest that the division between "œsophagus" and "intestine" be taken at the line between my "crop" and "stomach,"—not behind the "stomach"; the difference in character of the walls changes at this point, at least in the two species with which I am acquainted. Detailed descriptions of the alimentary tract of *C. spongillæ* and *C. sp.* are not given; but the same two dilatations, in the same relative positions, are seen in the figures of both; and in all five species the relation of the crop (or first dilatation of the œsophagus) to the setæ of the sixth segment (which occur about one-third the length of the crop from its posterior end), and of the stomach (or second dilatation of the œsophagus) to those of the seventh and eighth segments, is the same.

The above is merely a question of nomenclature; what follows has to do not merely with nomenclature, but also with a difference of interpretation, especially with regard to the appearances which Annandale describes in his three forms as the clitellum. It must always be dangerous to draw conclusions on *à priori* grounds by arguing from one form to another, however closely related; and I feel that my temerity is especially great when these conclusions conflict with the interpretations given by Dr. Annandale after his examination of the forms themselves. But I cannot help thinking that the appearances described and figured in his two papers as the clitellum of his three species are the same as those I have called the zones of budding; and that the clitellum is really the site of a future division of the animal, and is not concerned with sexual reproduction in any way.

Reference to Annandale's figures, and a comparison with those given in the present paper and those previously given in the account of *C. punjabensis*, will show that the clitellum corresponds in position to one of the sites of future division. Thus the clitellum is stated to occupy the tenth and eleventh segments in *C. bengalensis*; the figure of this species, which shows the clitellum as being behind the setæ of segment 10, may be compared with the anterior half of the as yet undivided animal shown in fig. 5 of the

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<sup>1</sup> Not strictly in the case of *C. bengalensis*, in which the setæ of the ninth segment also come into relation with the stomach; unless indeed (which I think possible) a second, less permanent, constriction towards the posterior end of the stomach in this form represents the division between stomach and intestine in the others; the relations of the setal bundles to the divisions of the alimentary tract would then be identical throughout.

present paper; they differ only in the fact of an extra, newly-developed group of setæ in front of the constricted zone in the latter specimen; or, if the figure of *C. bengalensis* is compared with the posterior part of fig. 5, the correspondence is only incomplete as regards the number of segments at the posterior end of the animal. Similarly the figure of *C. bengalensis* resembles the anterior half of fig. 7 of the present paper, with this difference, that very minute new setæ are beginning to form in the region under discussion in the latter.

The figures of *C. spongillæ* and *C. sp.* in Annandale's second paper may be compared with the present fig. 4; the bud in fig. 4 shows a few more segments than the buds in Annandale's figures, the clitellum, however, corresponds to the lateral expansion of the nerve-cord behind the eighth segment in fig. 4; the length of the interval between this and the next and more prominent constriction appears to be two fully developed segments in *C. spongillæ*, three in fig. 4, four in *C. sp.*

The nature of the change at this region also appears to correspond; the clitellum is not a specially protuberant region, as in other Naididæ, but appears to be somewhat, if only slightly, constricted, and the figures appear to give evidence of a slight superficial transverse wrinkling of the skin. This is comparable with what occurs at this situation in *C. pellucidus*. In Annandale's figures, again, the alimentary tract is somewhat blurred and indefinite at this region; I have found this to be the case on account of the lateral upgrowths of nervous matter, and also because of a closer connection between the tract and the body-wall.

The statement that the clitellum exists even in young animals just separated (in *C. bengalensis*) may be compared with what was stated above, that even the youngest free animal (*cf.* text-fig. 2 and pl. x, fig. 3) shows the commencement of formation of a zone of budding behind the eighth segment. The fact that the clitellum is achætous may be explained by a reference to fig. 7; the extremely minute newly developing setæ of this specimen would have been absent had it been examined a little earlier, and would not have been detected as it was, had not a high magnification been employed.

I have not, even in the sexual animal, noted a clitellum; the zone of budding, the nature of which is evident, occurs however in the same place. But I wish to guard against saying that a clitellum does not occur; it probably develops later; in *Nais* and *Pristina*, according to my observations, it is not present until the genital products are far more conspicuous than they are in the sexual *Chætogaster* above described. And I would mention, in conclusion, that the Limicolæ have (so far as known) the clitellum on the genital segments themselves; a clitellum in *Chætogaster* on the tenth and eleventh segments would be much posterior to the genital segments.

The above comparisons seem to me to show that the structures described by Dr. Annandale and myself in different ways are really

the same thing ; and if I am justified in interpreting his figures in the above manner we have, probably, throughout the Indian species, the development of a zone of budding behind the eighth segment, and consequently a normal length for the animal somewhat greater than this, though separation may be delayed and the typical single individual may possibly in some species never, or hardly ever, be met with in practice.

The chief differences exhibited by the Indian forms appear to be the following : The suckers of some forms are instances of adaptation ; anterior and posterior are described in *C. bengalensis*, anterior only in *C. spongillæ*. The number of setæ in a bundle is greater in *C. bengalensis* than in the other forms. The first pair of nephridia are larger than the others in *C. bengalensis* and *C. sp.* ; the first nephridium appears to be in the sixth segment in *C. bengalensis*, in the seventh in the others (not mentioned in the account of *C. spongillæ*). The nerve ganglia of *C. bengalensis* and *C. spongillæ* are described as being of a discrete nature, not corresponding in arrangement with the segmentation of the body ; while in the Punjab species the ganglia and segments correspond posteriorly at least ; if in *C. pellucidus* the lateral branches of the anterior portion of the cord be taken to represent the number of fused ganglia, then here also we have a larger number of nervous segments than of body-segments.

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## EXPLANATION OF PLATE VIII.

ÆOLOSONA, sp.

FIG. 1.—General view of the animal seen by transparency from the ventral surface. The blood-vessels are shown in their anterior portions only, and nephridia only on one side.

FIG. 2.—Side view of the posterior portion of a chain.

FIG. 3.—Head and œsophageal region, more highly magnified, seen by transparency from the ventral surface.

FIG. 4 *a* and *b*.—Two forms of the cerebral ganglion.

*An.*, Anus; *c.*, cells round œsophagus; *con.*, constriction between successive members of a chain; *d.v.*, dorsal vessel, seen through the superficial structures; *i.*, intestine; *l.*, lip; *m.*, mouth; *n*<sup>1</sup>, *n*<sup>2</sup>, *n*<sup>7</sup>, first, second and seventh nephridia; *n.g.*, nerve ganglion; *o.*, oil-cell; *œ.*, œsophagus; *ph.*, pharynx; *pr.*, prostomium; *s.*, setæ; *s.h.*, sensory hairs; *sp.*, septum; *s.s.*, setal sac; *st.*, stomach; *str.*, strands uniting intestine and body-wall; *v.v.*, ventral vessel, dividing to encircle pharynx.

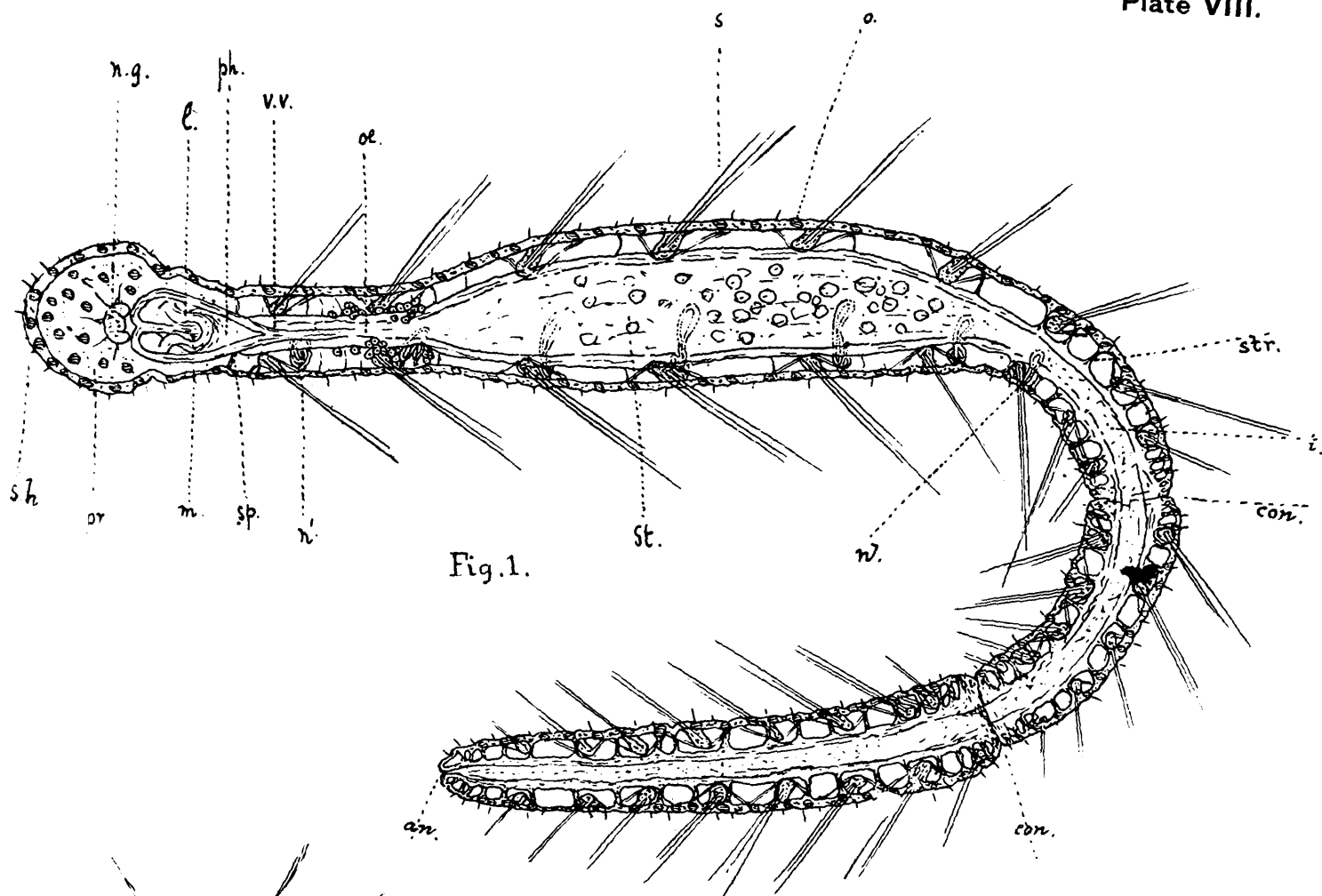
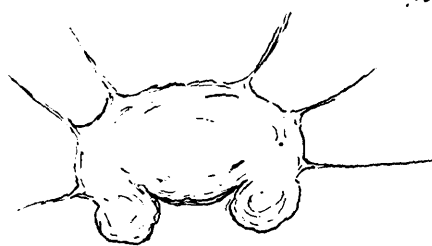
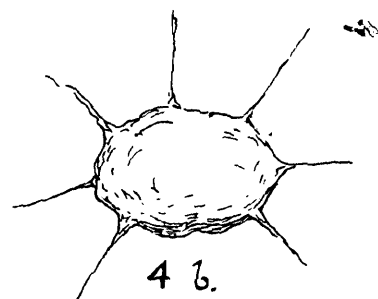


Fig. 1.



4. a.



4. b.

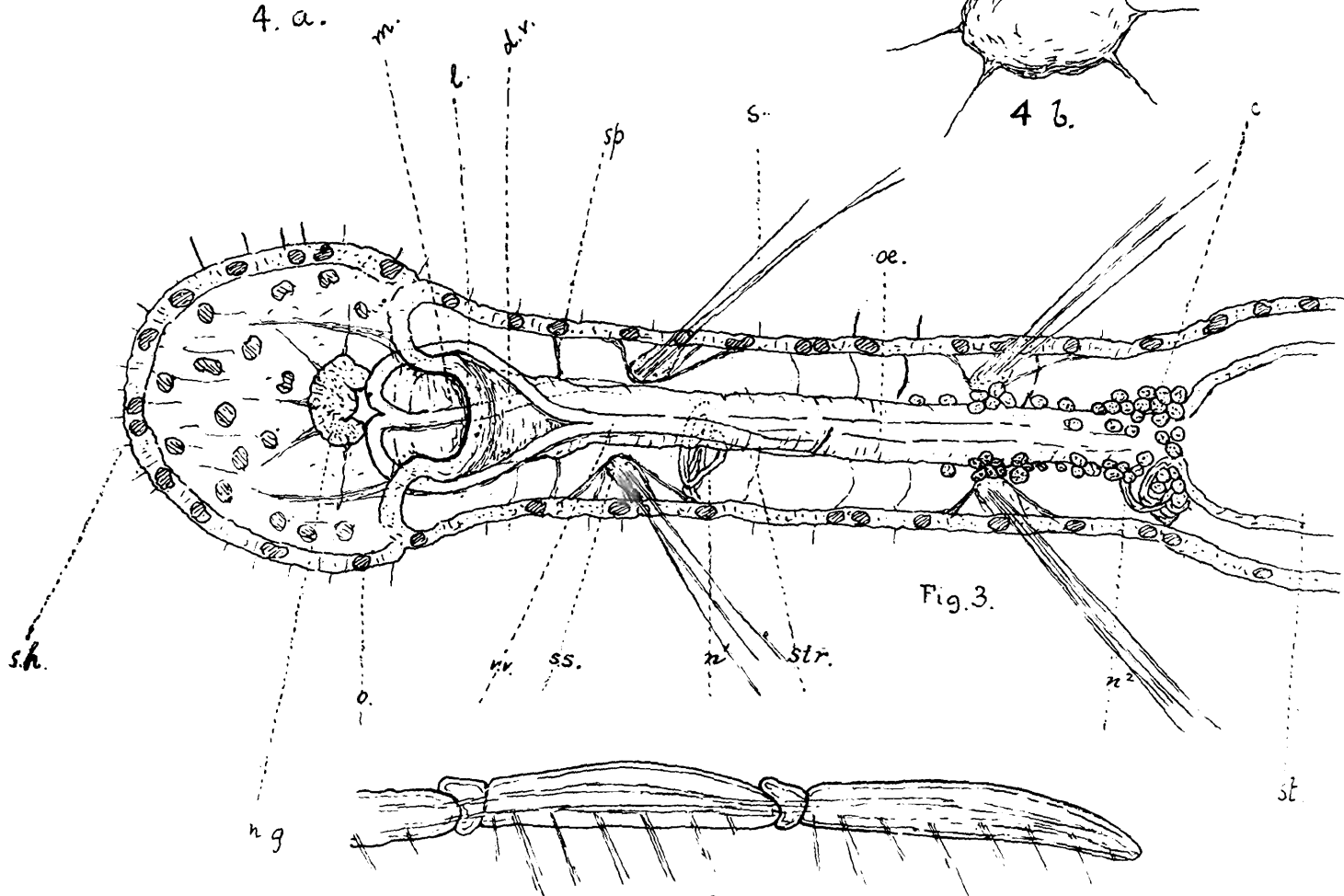


Fig. 2.

Fig. 3.



## EXPLANATION OF PLATES IX AND X.

### CHÆTOGASTER PELLUCIDUS, n. sp.

FIG. 1.—General view, seen (as are the others) by transparency.

FIG. 2.—(See text-fig. 2, p. 238.)

FIGS. 3, 4, 5, 6, 7.—Semi-diagrammatic representations of successive stages in the growth of the animal. The Roman numerals at the sides of the figures represent the numbering of the segments: it should be noted that the first bundle of setæ behind any constriction becomes the bundle of the sixth segment of the posterior animal. Hence in these figures vi is placed opposite such setæ, although the anterior five segments of the animal may not have yet grown so as to be recognisable.

FIG. 8 *a, b, c, d, e, f*.—Successive stages of development of the sperm-morulæ.

FIG. 9.—Region of crop, showing genital organs: ventral view.

FIG. 10.—The region of the male aperture: lateral view.

*An.*, anus; *b.c.*, buccal cavity; *b. comm.*, buccal nerve commissure; *b.g.*, buccal ganglion; *c.g.*, cerebral ganglion; *con.*, constriction, which will ultimately divide the animal; *cr.*, crop; *cr'*, crop of second animal; *d.v.*, dorsal blood-vessel; *g.s.*, genital setæ; *h.*, genital hairs; *int.*, intestine; *int'*, intestine of second animal; *l.n.c.*, lateral expansion of nerve-cord at sites of future division; *m.*, mouth; *n.*, nephridium; *n. comm.*, the nerve commissures; *œ.*, œsophagus; *œ'*, œsophagus of second animal; *ov.*, ovary; *r.s.*, receptaculum seminis; *ph.*, pharynx; *ph'*, pharynx of second animal; *s.*, first bundle of setæ (of second segment); *s'*, second bundle of setæ (of sixth segment); *s.m.*, sperm morulæ; *sp.*, septum; *sp<sup>1</sup>*, the first septum, *i.e.*, septum  $\frac{2}{3}$ ; *sp<sup>2</sup>*, the second septum, *i.e.*, septum  $\frac{3}{4}$ ; *sp.h. g.*, subpharyngeal ganglion; *st.*, stomach; *st'*, stomach of second animal; *str.*, strands of tissue between alimentary tract and body-wall; *s.s.*, small setæ, visible only with the high power at zones of budding; *t.*, testis; *t.n.c.*, terminal expansion of nerve-cord; *v. comm.*, vascular commissure in head; *v.d.*, vas deferens; *v.n.c.*, ventral nerve-cord; *v.v.*, ventral vessel;  $\sigma$ , male aperture with genital setæ.

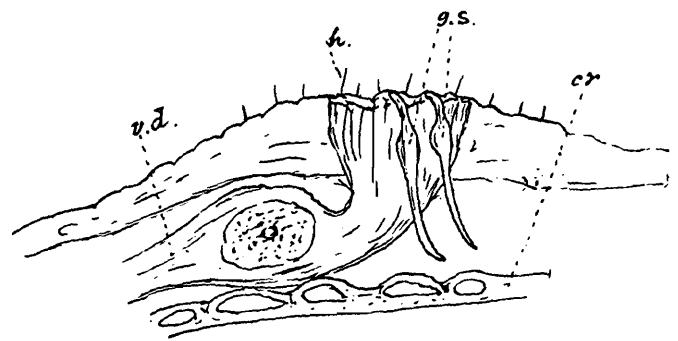
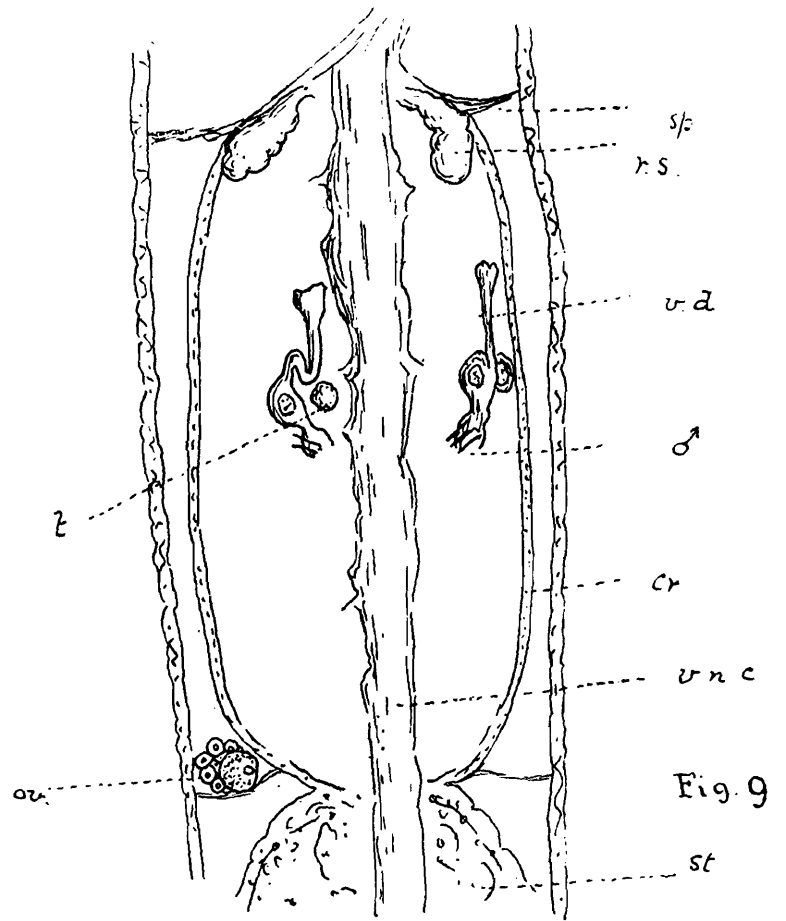
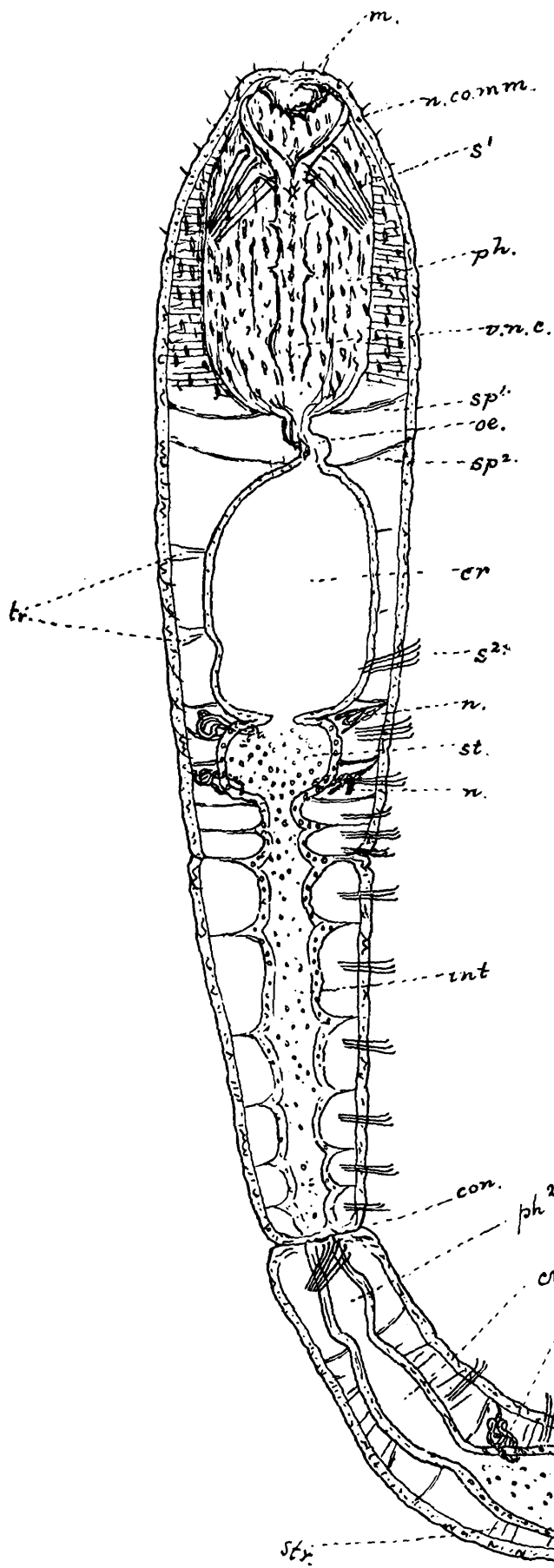


Fig 10.

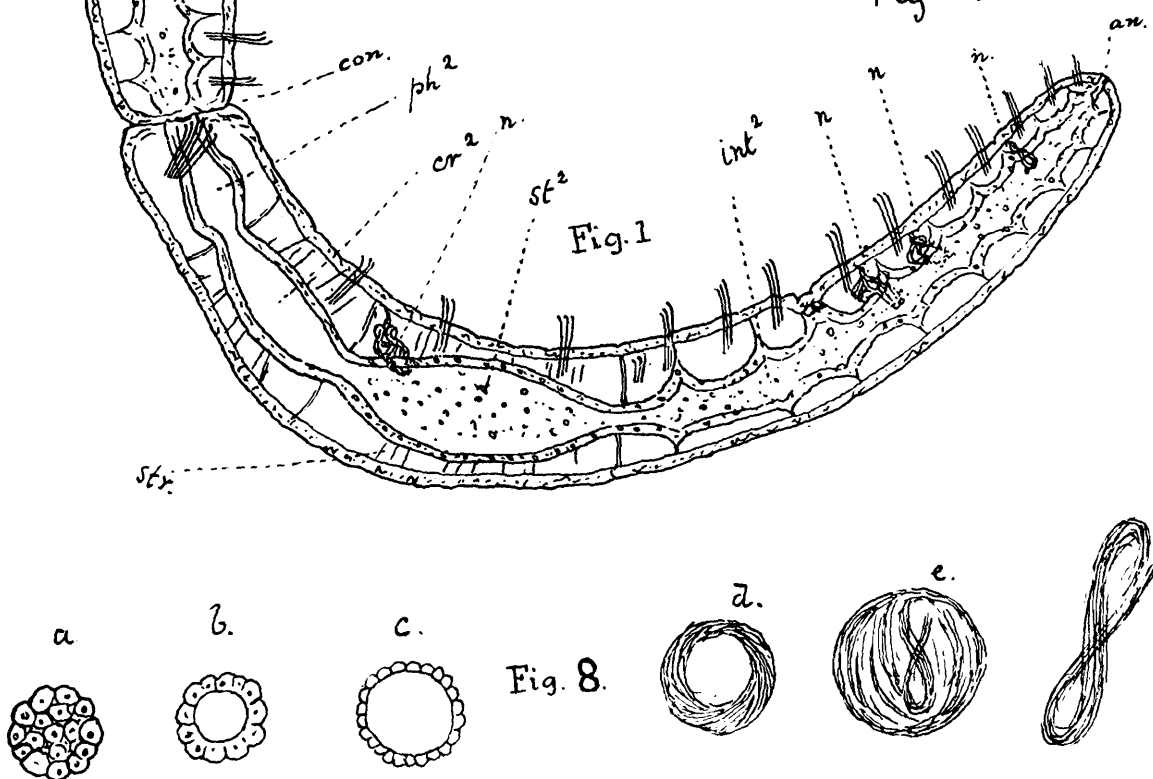
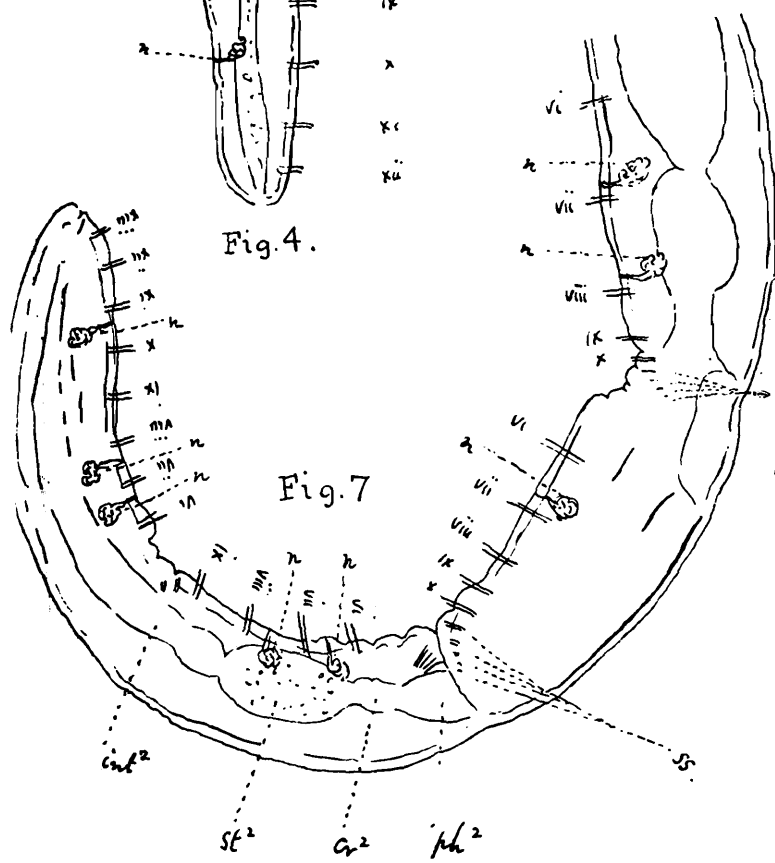
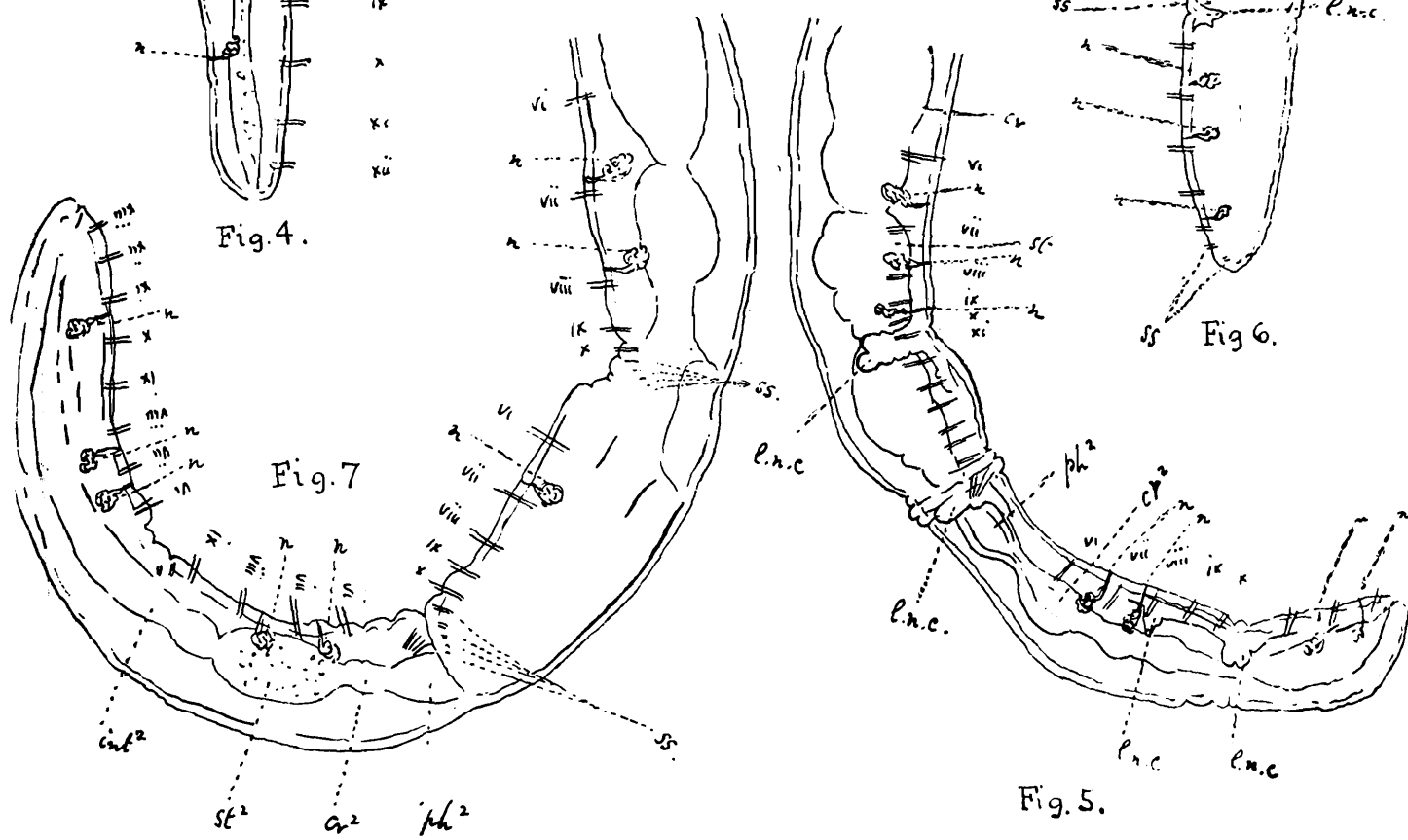
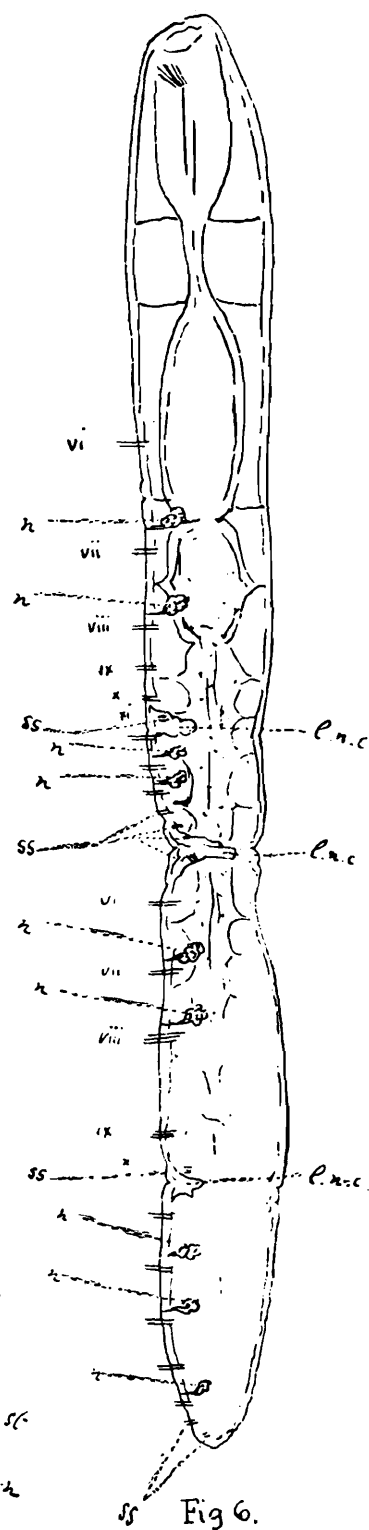
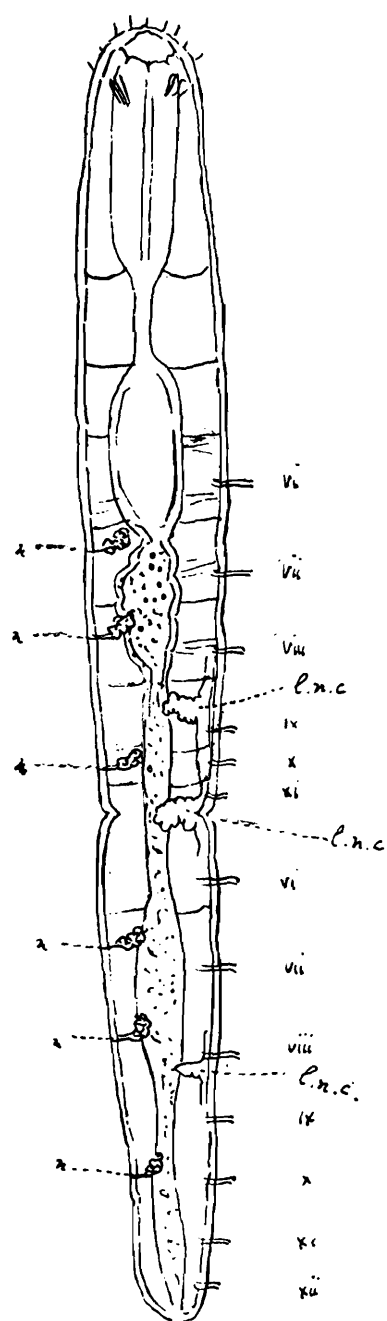


Fig. 8.







## XX.—NOTES ON PHOSPHORESCENCE IN MARINE ANIMALS

By R. E. LLOYD, M.B., B.Sc., Captain, I.M.S., Surgeon Naturalist,  
*Marine Survey of India,*

WITH

### A DESCRIPTION OF A NEW POLYCHÆTE WORM.

By A. WILLEY, D.Sc., F.R.S., Director, Colombo Museum.

Towards the end of 1905, the R.I.M. Survey Ship "Investigator" trawled five times in the shallow waters of the northern part of the Persian Gulf. On one of these occasions the trawl was lowered late in the afternoon, so that the process of preserving the specimens had to be carried out in the dusk of the evening. While depositing some of them in formalin, my attention was arrested by a fine display of illumination by one of them,—a certain active Polychæte.

Before dropping this worm into the solution, no phosphorescence was noticed, but under the stimulus of the irritant, two rows of brilliant points of light, one on either side of the animal's back, became visible, and remained so for several seconds before gradually fading away.

These points of light were circular in outline, and about the size of a small pin's head. It was noticed that they were separated by equal intervals, that they appeared less in number than the segments, that they were situated about the bases of the parapodia, and that they were very prominent.

The worm was soon identified as probably belonging to the genus *Lepidasthenia*, and was sent to Dr. Willey, of Colombo, who confirmed it in this genus, pronounced it without hesitation as a new and well-marked species, and kindly gave the description quoted verbatim at the end of this paper as the definition of the species.

In sending this definition Dr. Willey asked me to add my own observations and figures, and further remarked that the first pair of elytra required a special description. The first pair of elytra are about three times the size of the others, they are carried on peduncles which curve forwards and then inwards, so that the elytra of either side overlap, mid-dorsally, hiding the prostomium and the bases of the palps and antennæ. It will be noticed in fig. 1,

that the second elytron of the right side and the second cirrus of the left side and their peduncles are missing.

This Polychæte was obtained in 25 fathoms of water about 30 miles west of Bushire.

In regard to the source of the phosphorescent lights observed, there can be no doubt that they emanated from the small elytra, but to say that the elytra were actually seen to be luminous would not be quite a true statement. The observation of the exact source of a phosphorescent light in such a case is a matter of great difficulty: to see the elytra it is necessary to examine the animal in a light so strong that the phosphorescence is inappreciable. The nature and distribution of the points of light described above agree exactly with the nature and distribution of the elytra, which were examined after the death of the animal. For this reason it is safe to assume that the light actually emanated from the elytra, and it is possible that all species of the genus exhibit this interesting phenomenon which was observed in this case merely owing to the happy chance of the animal being consigned to formalin late in the evening.

In order to make further observations on the phosphorescence of marine animals, the trawl was used twice this year at night in deep water, once off North Andaman Island in 235 fathoms, and once off Dondra Head, Ceylon, in 605 fathoms. The results of these stations may be enumerated as follows:—

STATION 374, OFF NORTH ANDAMAN ISLE, 235 FATHOMS.

*Fish.*

|                         |   |
|-------------------------|---|
| Macrurus investigatoris | I |
| Coloconger raniceps     | 2 |
| Ateleopus indicus       | I |

*Crustacea.*

|                         |              |
|-------------------------|--------------|
| Nephrops andamanica     | I            |
| Aristeus semidentatus   | { I male.    |
|                         | { I female.  |
| Homola megalops         | I            |
| Pandalus alcocki        | { 3 females. |
|                         | { 2 males.   |
| Pandalus martius        | 3            |
| Munidopsis regia.       |              |
| Heterocarpus lævigatus. |              |
| Squilla sp.             |              |

*Mollusca.*

Xenophora pallidula.  
Verticordea eburnea.  
Two others unidentified.  
A Decapod Cephalopod.

*Hexactinellidæ.**Aphrocallistes beatrix.**Alcyonaria.**Pennatula pendula.*

STATION 375, OFF DONDRA HEAD, CEYLON, 605 FATHOMS.

*Fish.**Lamprogrammus niger.**Crustacea.**Heterocarpus alphonsi.**Polycheles phosphorus.**Nematocarcinus gracilis.**Mollusca.**Pleurotoma symbiotes with its symbiotic Epizoanthus**A small species of Dentalium.**Asterids.**A species of Hymenaster.*

Among these twenty-four species only three showed phosphorescence. These were the prawns *Heterocarpus alphonsi* and *Pandalus alcocki*, and the Alcyonarian *Pennatula pendula*. Of these the *Heterocarpus* gave the most striking display of its illuminating powers, which have been already noted by a former "Investigator" naturalist (Alcock, *Ann. Mag. Nat. Hist.*, vol. viii, 1891, page 16). We, too, were able to observe all that this author described. While the prawn was in water the light floated away from its oral region in two streams which became extinguished about two inches from their source.

The property which the secretion has of retaining its illuminating power after leaving the body was well illustrated by the following occurrence: When the prawn was taken out of the bucket, the water, dripping from the animal, was so highly luminous that a bright phosphorescent stream flowed down the antennæ (which were five inches long) and dripped from their ends in globules of light that did not become extinguished until they intermingled with the water in the bucket.

The other prawn which showed the same powers, but to a rather less marked extent, was one of the five specimens of *Pandalus alcocki*. The other four, whose tissues must have been quite dead, showed no light. This proves that negative evidence is of no value in such observations.

The third species which showed light was the Alcyonarian *Pennatulula pendula* (common in deep waters about the Andamans, but only recently described by Thompson and Henderson, *Investigator Alcyonarians*, part i).

This specimen merely showed faint evanescent light when disturbed, but when placed in formalin solution rows of brilliant light points at once appeared on its pinnules and remained in evidence for at least a minute before dying out. This brilliant display suggested the possibility of recording such phenomena by photography; and the idea of photography, involving as it does the use of a dark room, helped me to see that our dredging in the dark, a most inconvenient procedure, was also unnecessary. The same results could obviously be obtained by removing the specimens to a dark room, where any well-marked phosphorescence could be recorded by placing them in a bottle of formalin solution on which a camera with very sensitive plates had previously been focussed.

It is hoped that such experiments will be carried out in future. Nevertheless my thanks are due to Commander W. G. Beauchamp, R.I.M., for allowing trawling at night and for the skilful way in which it was carried out under his personal supervision.

#### DESCRIPTION OF A NEW POLYCHÆTE WORM.

##### Family APHRODITIDÆ.

##### *Lepidasthenia stylolepis*, Willey, sp. nov.

"All appendages glabrous except the palps, which bear rows of small blunt papillæ. Antennæ sub-equal, the median slightly longer than the lateral and less than one-third the length of the palps. Elytra very small, borne upon long peduncles, which are somewhat shorter than the parapodia. Notopodia obsolete, with acicula but without setæ. Neuropodial setæ (fig. 4) of the anterior segments (and perhaps of all when unworn) with filiform tips below which there is a deep bidentation, as well as subterminal serrulations. There are thirty-seven segments present in the specimen, which is incomplete behind. Segments with brownish transverse bands along the posterior border. Dorsum quite exposed, the elytra directed away from it, on their stalks. The first ventral cirrus as long as the parapodium, the rest very short. Dorsal cirri pigmented, some pale, some fallen off, borne upon long peduncles which are as long as the parapodia, the cirri being shorter than their peduncles.

Elytra on segments II, IV, V, VII, IX, . . . . XXI, XXIII, XXVI, XXIX, XXXII, XXXV.

Both cirriophores and elytriphores penetrated by a cæcal diverticulum of the gut arising from the latter by a very narrow pedicel, then widening out."

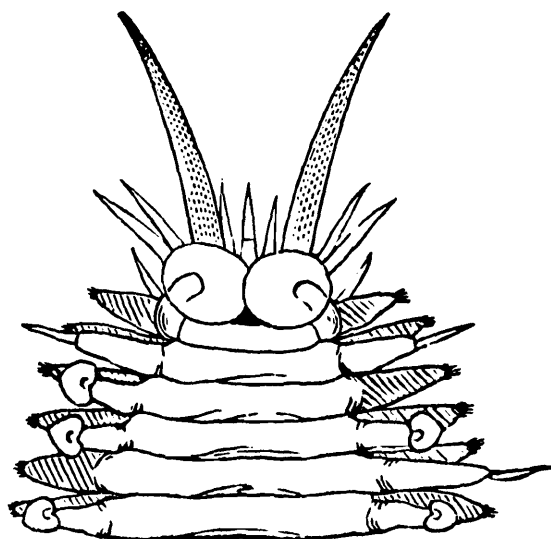


FIG. 1.—Anterior end of dorsal view of head and anterior segments. The left lateral antenna is shown too long.

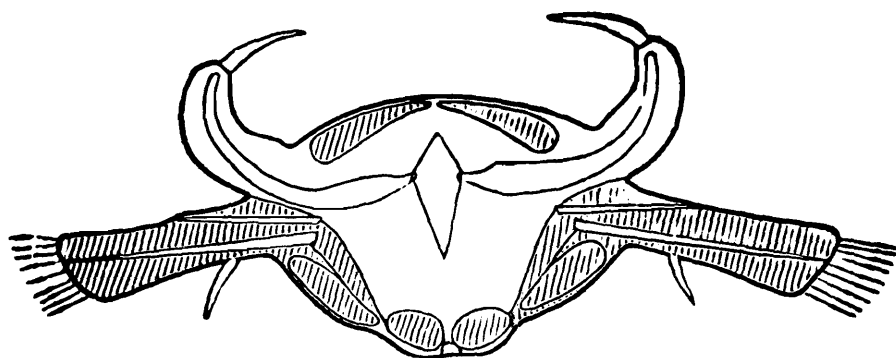


FIG. 2.—Segment bearing dorsal cirri.

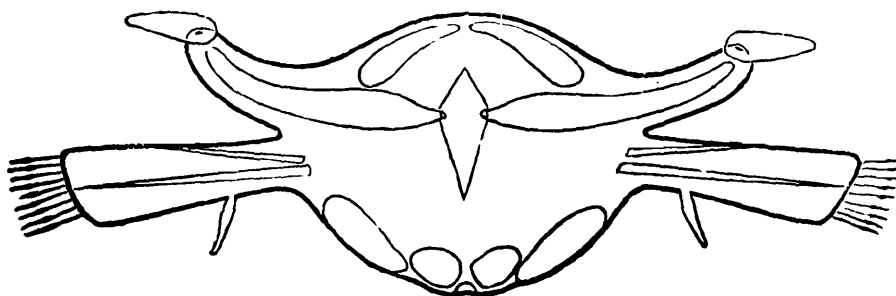


FIG. 3.—Segment bearing elytra.



FIG. 4.—Neuropodial seta.



## XXI.—NOTES ON THE RATS OF DACCA, EASTERN BENGAL

By C. A. GOURLAY, *Captain, I.M.S.*

I forward these notes to the Indian Museum as a small contribution to a subject of considerable importance at the present day.

During the month of April, 1907, an attempt was made to gauge the relative numbers of different species of rats in Dacca. During the investigation, 1,045 rats were examined and of these 1,041 were identified.

611 proved to be specimens of *Mus rattus*.

430    „        „        „        „        *Nesokia bengalensis*.

No other species of rat was found. Thus of the rat population of Dacca, it appears that about 59 per cent. are *Mus rattus* and 41 per cent. are *Nesokia bengalensis*.

These specimens were trapped in houses, “kutchha” (mud) and “pucca” (masonry), and in grain godowns and grocers' shops in various parts of the town.

|                                                      |      |   |      |                         |
|------------------------------------------------------|------|---|------|-------------------------|
| Of those trapped in “pucca” houses                   | 68   | % | were | <i>M. rattus</i> .      |
|                                                      | 32   | % | „    | <i>N. bengalensis</i> . |
| „                    „            “kutchha”        „ | 57·7 | % | „    | <i>M. rattus</i> .      |
|                                                      | 42·3 | % | „    | <i>N. bengalensis</i> . |
| „                    „            grocers' shops     | 55·3 | % | „    | <i>M. rattus</i> .      |
|                                                      | 44·7 | % | „    | <i>N. bengalensis</i> . |
| „                    „            grain godowns      | 44·5 | % | „    | <i>M. rattus</i> .      |
|                                                      | 55·5 | % | „    | <i>N. bengalensis</i> . |

Dacca is a city of over 90,000 inhabitants, with narrow streets, indifferent sanitation, a very imperfect system of surface drains, and only one short sewer. Many of the houses are “kutchha” throughout, and of the “pucca” houses many have earthen floors.

In all cases, measurements were taken in accordance with Hossack's instructions and the collection was divided into three series of about 350 specimens each. The first series is omitted from these observations as, presumably, the measurements (being those of a novice) are not so accurate as the later ones.

### *M. RATTUS.*

It was found impossible to distinguish the varieties of *M. rattus* according to the descriptions extant. All sizes show colour variations and the only point on which one can dogmatise, is that *M. rattus*—the black rat—does not appear to be black in Dacca.

The following table shows the variations in size and the proportionate measurements of *M. rattus* as found in Dacca. Judging by the breast development in female specimens, it appears that maturity is reached when the rat is about 14 cm. in length. Of 53 female specimens under 14 cm. only one was found to have developed breasts.

| Total length of head<br>and body in cm. | Number<br>of<br>specimens. | PERCENTAGE TO LENGTH OF HEAD<br>AND BODY OF |            |      |
|-----------------------------------------|----------------------------|---------------------------------------------|------------|------|
|                                         |                            | Tail.                                       | Hind foot. | Ear. |
| Under 13 cm.                            | 52                         | 125·9                                       | 24·8       | 16·8 |
| 13 and under 15 cm.                     | 67                         | 123·9                                       | 22·7       | 15·5 |
| 15 „ „ 16 cm. ..                        | 56                         | 123·1                                       | 21·3       | 14·3 |
| 16 „ „ 17 cm. .                         | 87                         | 122·4                                       | 20·1       | 14·1 |
| 17 „ „ 18 cm. ..                        | 70                         | 120·6                                       | 19·6       | 13·8 |
| 18 „ „ 19 cm.                           | 31                         | 117·3                                       | 18·6       | 13·1 |
| 19 cm. and over                         | 12                         | 114·6                                       | 18·2       | 12·4 |

An adult *M. rattus*, then, measures anything from 14 cm. to 20 cm. The largest specimens are old males, and are the only specimens with well-developed bristles in the fur.

*The tail* is almost always considerably longer than the head and body. The shortest tail in my collection is 102·37 per cent. of the body-length, and the rat measured 21·5 cm., so that it was a very old specimen.

*Hind foot.*—The sole is seldom uniformly purple. There is always some purple towards the “heel,” but the fore-part of the sole is generally flesh-coloured. The pads are always six in number, the proximo-external pad being well developed. The median pads are cordiform.

*Ear.*—By measurement, the ear does not appear to be appreciably longer than that of a *Nesokia bengalensis* of the same size, but the setting is characteristic. The ear is “prominent, standing out clearly from the head.”

*Breasts.*—In females, the usual distribution of the breasts is  $\frac{2}{3}$ . The most common variation (in 6 per cent. of the specimens) is  $\frac{3}{4}$ . When this occurs, the third pectoral breast bears the same relative position to the second pectoral as the third inguinal bears to the second inguinal. The first inguinal breast is about 1·25 cm. in front of the second and the second is about ·3 cm. in front of the third.

*Distribution.*—Of all specimens of *M. rattus*.—

|      |   |                  |                   |
|------|---|------------------|-------------------|
| 43·3 | % | were captured in | " pucca " houses. |
| 28·4 | " | "                | " kutchha " "     |
| 13·7 | " | "                | grocers' shop.    |
| 12·0 | " | "                | grain godowns.    |
| 2    | " | "                | streets, etc.     |

### NESOKIA BENGALENSIS.

The following table shows the variations in size and the proportionate measurements of *Nesokia bengalensis* as found in Dacca. In this case also, judging by the breast development, it appears that maturity is reached when the rat is 14 cm. in length. Of 28 female specimens under 14 cm. none have developed breasts.

| Total length of head and body in cm. | Number of specimens. | PERCENTAGE TO LENGTH OF HEAD AND BODY OF |            |       |
|--------------------------------------|----------------------|------------------------------------------|------------|-------|
|                                      |                      | Tail.                                    | Hind foot. | Ear.  |
| Under 13 cm.                         | 30                   | 79·3                                     | 23·56      | 16·6  |
| 13 and under 15 cm.                  | 39                   | 79·15                                    | 21·35      | 14·5  |
| 15 " " 16 cm.                        | 26                   | 81·6                                     | 20·1       | 13·6  |
| 16 " " 17 cm.                        | 40                   | 81·7                                     | 19·3       | 13·29 |
| 17 " " 18 cm.                        | 59                   | 80                                       | 18·6       | 13·1  |
| 18 " " 19 cm.                        | 43                   | 80·3                                     | 18·2       | 12·5  |
| 19 " " 20 cm.                        | 24                   | 76·5                                     | 17         | 12·23 |
| 20 cm. and over                      | 16                   | 74·8                                     | 16·5       | 11·25 |

The adult *N. bengalensis* measures anything from 14 cm. to 21 cm.

Bristles appear in the fur of adults at all stages.

*Colour.*—The colour is iron grey or greyish brown.

*Tail.*—The tail is from 75—80 per cent of the length of the head and body, though it may be shorter in old specimens.

*Hind foot.*—The hind foot shows a regular gradation of proportionate measurements with the increase of age. The sole is purple throughout. The pads number five fully developed ones, and one (the proximo-external) which is rudimentary. In 9 per cent. of 56 *N. bengalensis* examined with special care, the proximo-external pad was absent. The median pads are frequently cordiform though smaller than in *M. rattus*.

*Ears*.—The ears, though in actual measurement not appreciably shorter than those of *M. rattus*, are more closely set on the side of the head. These also show gradually diminished proportionate measurement as age advances.

*Breasts*.—The commonest distribution of breasts was found to be  $\frac{4}{4}$ . This arrangement was found in 61·5 per cent. of the female specimens with breast development. In only 8·3 per cent. was the arrangement  $\frac{4}{3}$  present. The arrangement is certainly much more variable than in *M. rattus*.

*Distribution*.—Of all specimens of *N. bengalensis*—

|      |   |                  |           |                 |
|------|---|------------------|-----------|-----------------|
| 29   | % | were captured in | " pucca " | houses.         |
| 29·3 | " | "                | "         | " kutcha "      |
| 15·5 | " | "                | "         | grocers' shops. |
| 21·2 | " | "                | "         | grain godowns.  |
| 5    | " | "                | "         | streets, etc.   |

Most of these observations agree with those of Hossack in Calcutta. They confirm (1) the impossibility of separating varieties of *M. rattus* by size.

(2) The size at which maturity is attained, namely 14 cm. in both species.

(3) The diminution in the proportionate measurement of hind foot and ear in both *Mus rattus* and *Nesokia bengalensis*, and of the tail in *Mus rattus*, as maturity is reached.

On the other hand, I do not find the distinction between cordiform median pads in *Mus rattus* and circular median pads in *Nesokia bengalensis* holds good. The essential point of difference appears to me to be the rudimentary condition of the proximo-external pad in the hind foot of *N. bengalensis*. Again, Hossack gives the usual breast arrangement of *Nesokia bengalensis* as  $\frac{4}{3}$ . I find it is  $\frac{4}{4}$ .



## XXII.—NOTES ON FRESHWATER SPONGES.

By N. ANNANDALE, D.Sc., *Officiating Superintendent,  
Indian Museum.*

### I.—THE BUDS OF *Spongilla Proliferens*, MIHL.

The buds that form so characteristic a feature of this species arise as thickenings of the strands of cells accompanying the primary spicule fibres of the skeleton, which project outwards from the surface of the sponge. These thickenings originate beneath the surface and contain, at the earliest stage at which I have as yet examined them, all the elements of the adult organism (*i.e.*, flesh spicules, ciliated chambers, efferent and afferent canals, parenchyma cells of various sorts) except skeleton fibres, gemmules, and a dermal membrane. A section at this period closely resembles one of an adult sponge, except that the structure is more compact, the parenchyma being relatively bulky and the canals of small diameter.

As the bud grows it makes its way up the fibre, pushing the dermal membrane, which expands with its growth, before it. The skeleton fibre does not, however, continue to grow in the bud, in which a number of finer fibres make their appearance, radiating from a point approximately at the centre of the mass. As the bud projects more and more from the surface of the sponge the dermal membrane contracts at its base, so as finally to separate it from its parent. No aperture is left when this occurs, the membrane closing up the gap completely. The newly liberated bud already possesses numerous minute pores, but as yet no osculum; its shape exhibits considerable variation, but the end that was farthest from the parent sponge before liberation is always more or less rounded, while the other end is flat. The size also varies considerably. Some of the buds float, others sink. Those that float do so either owing to their shape, which depends on the degree of development they have reached before liberation, or to the fact that a bubble of gas is produced in their interior. The latter phenomenon only occurs when the sun is shining on the sponge at the moment they are set free, and is due to the action of the chlorophyl of the green bodies so abundant in certain of the parenchyma cells of this species. If the liberation of the bud is delayed rather longer than usual, numbers of flesh

spicules are produced towards the ends of the primary skeleton fibres and spread out in one plane so as to have a fanlike outline ; in such buds the form is more flattened and the distal end less rounded than in others, and the superficial area is relatively great, so that they float more readily. Those buds that sink, usually fall in such a way that their proximal, flattened end comes in contact with the bottom or some suspended object, to which it adheres. Sometimes, however, owing to irregularity of outline in the distal end, the proximal end is uppermost. In this case it is the distal end that adheres. Whichever end is uppermost, it is in the uppermost end, or as it may now be called, the upper surface, that the osculum is formed. Water is drawn into the young sponge through the pores and, finding no outlet, accumulates under the dermal membrane, the subdermal space being at this stage even larger than it is in the adult sponge. Immediately after adhesion the young sponge flattens itself out. This process compresses the water in the subdermal space and apparently collects a large part of it at one point, which is usually situated near the centre of the upper surface. A transparent conical projection, formed of the dermal membrane, arises at this point, and at the tip of the cone a white spot appears. What is the exact cause of this spot I have not yet been able to ascertain, but it marks the point at which the imprisoned water breaks through the expanded membrane, thus forming the first osculum. Before the aperture is formed, it is already possible to distinguish, on the surface of the parenchyma, numerous channels radiating from the point at which the osculum will be formed to the periphery of the young sponge. These channels as a rule persist in the adult organism and result from the fact that the inhalent apertures are situated at the periphery, being absent from both the proximal and the distal ends of the bud. In the case of floating buds the course of development is the same, except that the osculum, as in the case of development from the gemmule in other species (see Zykoff, *Biol. Centralb.*, xii, p. 713, 1892), is usually formed before adhesion takes place.

The life of the individual is very short in *S. proliferens*, never lasting for more than a few weeks. So far as I have observed, sexual reproduction does not take place, but gemmules are produced in large numbers at the same time as the buds, often when the sponge is less than 100 sq. mm. in superficial area. A continuous succession of generations takes place throughout the year.

The above observations have been made chiefly on specimens in my aquarium in the Museum, but they have been corroborated, as far as possible, by a periodical inspection of others living in natural conditions in a pond.

Buds of a somewhat different nature are sometimes produced by *S. carteri* Bwk., and appear to be identical with the reproductive bodies described in *S. lacustris* by Laurent (*C. r.*, Sé. Ac. Sc. Paris, xi, p. 478, 1841) many years ago. With these I hope to deal on another occasion.

II.—GEMMULES OF *Trochospongilla phillottiana*, MIHL.

In my original account of this species (*Journ. Asiat. Soc. Bengal*, 1907, p. 22) I stated that the covering of the gemmule was thin. An examination of numerous specimens has shown me that this statement was incorrect as regards the majority of examples, in which the coating of granular substance is thick but unevenly distributed. Viewed from the external surface, the gemmules appear to be covered with little pits. These coincide with the position of the gemmule spicules and are in fact funnel-shaped passages leading from the external surface of the gemmule to the outer rotula of each spicule. So characteristic and so constant does this feature appear to be that I am inclined to think that in the type of the species the gemmules were not fully developed. In my description of these gemmules "cylindrical" is a *lapsus calami* for spherical.

III.—EMBRYOS OF *Ephydatia blembingia*, EVANS.

Dr. Richard Evans in his original description of this species (*Quart. Journ. Micr. Sci.*, 1901, p. 71) notices certain minute basket-shaped bodies lying in cavities in the sponge, and is inclined to regard them as examples of a parasitic species, although their spicules only differ from those of the adult *E. blembingia* in their small size. Dr. F. Harmer, of Cambridge, has recently sent me one of Dr. Evans's specimens, and I have been able, thanks to its excellent state of preservation, to examine these bodies. They appear to me to be embryos in different stages of development. The smallest consist of rounded masses of cells, which in some cases can be seen to be of two sorts, a number of smaller ones and several larger ones. The compressed form of the larger examples is probably due, as Dr. Evans himself suggests, to shrinkage in preservation. In their later stages the bodies lie in well-defined cavities in the sponge, each body being surrounded by a delicate membrane secreted by a layer of flattened cells that apparently belong to the parent sponge. The body itself consists of an external layer of columnar cells and of an internal mass containing a large cavity. The cavity is situated towards the narrower end of the body and is enclosed at this end by a thin layer of cells that mostly have a starlike outline. The main bulk of the mass is below the cavity and consists of cells of several kinds, amongst which may be distinguished spiculiferous cells bearing spicules that are smaller, as yet, than those of the adult sponge. In short, an optical section of the body, apart from the membrane in which it is enclosed, closely resembles the actual section of an embryo of *Spongilla lacustris* figured by Evans in fig. 9, plate xxxvi, vol. xlii of the *Quarterly Journal of Microscopical Science*, 1899. In his account of *Ephydatia blembingia* he says that he was unable to make out the exact structure of these bodies,

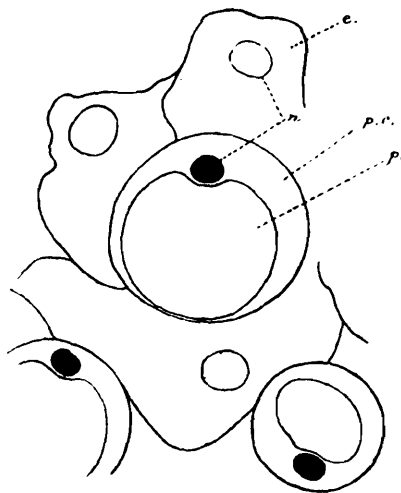
because none of his sections passed through them. If, however, a small piece of the sponge is teased up, stained with hæmatoxylin, cleared and mounted, it is not difficult to see the structures I have alluded to, although this method of observation does not permit of a minute examination of the cell anatomy. I have found closely similar embryos in *Spongilla carteri* both in summer and in spring, and also in an indeterminate sponge (probably an *Ephydatia*) taken by Mr. H. C. Robinson and myself at Biserat in the Siamese Malay States in autumn. I am indebted to Dr. Evans for the opportunity of re-examining, in a critical manner, the latter specimen, which I had handed over to him before I took up the study of the freshwater sponges myself.

#### IV.—THE NATURE OF THE PORES IN *Spongilla*.

The exact nature and origin of the external apertures of the inhalent canals in the Demospongia has been much disputed. Several authors claim to have established the fact that these apertures are intracellular and that the cells which contain them are porocytes homologous with those of the Calcarea. This view has been opposed by Minchin and others on theoretical grounds. An examination of fresh and well preserved specimens of the species of *Spongilla* occurring in Calcutta has convinced me that the structure of the pores is variable even within the limits of this genus. Two types can in fact be distinguished in the species examined, while from the descriptions of other species it seems probable that they also exemplify one or other of these types. Before describing the different forms of pores it will be as well to state the methods of investigation adopted. I find that in a tropical climate the best preservative for the dermal membrane is absolute or nearly absolute alcohol. The cutting of serial sections is not a satisfactory method of investigating this part of the sponge under any conditions, and in a climate such as that of Calcutta is almost impossible. If the dermal membrane does not adhere closely to the parenchyma, a piece of it may be detached with a pair of needles, floated off, stained—I find Ehrlich's acid hæmatoxylin an excellent stain—and mounted for examination. In many species, however, it is difficult to remove a large enough piece of the membrane in this way, and in such cases I find the best method is to shave the surface of the hardened sponge with a sharp razor. A portion of the parenchyma usually adheres to the membrane thus removed, but this does not very much matter, as sufficient clear spaces remain for the purposes of examination.

The first type of pore is found in those species (e.g., *S. carteri*) in which the subdermal space is small and the pores correspond in position more or less exactly with the distal extremities of the canals. Such species have comparatively large pores and as a rule there is no projecting collar round the osculum. The pores are simply gaps in the membrane, being surrounded by cells which

do not differ from the other epithelial cells of the membrane except that they are often slightly attenuated in a horizontal plane.



Outline of a small portion of the external surface of the dermal membrane of *S. proliferens*, showing flattened epithelial cells (*e.c.*) and pores (*p.*),  $\times$  about 1290. The membrane was taken from the edge of the sponge and stained with hæmatoxylin. The outline was drawn with a camera lucida and slightly enlarged. *n.* = nuclei; *p.c.* = pore cell.

In the majority of *Spongillæ* that occur in Calcutta, however, the pores can only be detected with the aid of a fairly high power of the microscope and open not directly into the termination of the afferent canals but into the subdermal space, their exact arrangement differing in different species. In such forms the subdermal space is often very large. Sponges which have this form of pore differ widely in other respects; those with which I am best acquainted are *S. crassissima* and *S. proliferens*. In such forms the pore is as a rule surrounded by a single cell. The actual hole is almost circular; the cell that surrounds it has a minutely granular cytoplasm and a small nucleus that stains very deeply. For the greater part of its circumference the cell is attenuated to a mere filament; at the point at which the nucleus is situated it swells out considerably in both planes, while it is most attenuated at the opposite extremity. In all cases, so far as my observations go, the cell completely surrounds the pore, if only one cell is present, without a sign of secondary fusion at any point; but the relative proportions of the cell and the pore differ considerably and in some cases the latter is nearly in the centre of the former. Without further information it would be impossible to escape from the conclusion that the pore was intracellular; but even were this the case, it would not be necessary to assume that the porocyte was homologous with that of the Calcareia. Indeed, there is one important difference, *viz.*, the pore-surrounding cell in *Spongilla* is not contractile, and cannot close the pore. In some cases, moreover—in *S. crassissima* at any rate—the pore is not surrounded by one such cell, but by two. In such cases each cell is bent into a semi-circle, having a crescentic outline, and the two adhere together

round the pore by their extremities. The nucleus and cytoplasm of such cells do not differ from those of cells that apparently contain an intracellular pore. I am inclined to believe, therefore, that even in the latter instance the pore is not really intracellular, but is surrounded by an originally crescent-shaped cell, the two ends of which have fused together. I have not been able to detect any trace of true porocytes in connection with the ciliated chambers in any species examined

V.—THE SYSTEMATIC POSITION OF *Ephydatia meyeri*,  
CARTER, AND *E. indica*, MIHL.

As these are the only species of the genus that I have been able to find in Calcutta, my conclusions as to their specific and generic identity, after examining a large number of specimens, may be useful to others studying the group. *E. meyeri* was described in 1849 by Carter, who in 1881 stated that he believed it to be a variety of the widely distributed *E. fluviatilis*. Weltner (*Archiv. f. Naturg.*, lxvi (1), p. 124, 1895), however, assigned it to *E. mülleri* (Liebk.). During the present season I have found a form that agrees closely with Carter's descriptions, growing in the Museum tank in Calcutta. Its gemmule spicules have long shafts with scattered spines, but their rotulæ are very irregularly serrated; as a rule the spicules surround the gemmules in two rows. The skeleton spicules are smooth and sharp, and although the skeleton is rather fragile, it is hard, and spongin webs can be detected at its nodes. An important character was necessarily passed over by Weltner, who had only examined a dry specimen of this form, viz., the presence of large numbers of vesicular cells in the parenchyma. These agree closely with Weltner's figure (*Archiv. f. Naturg.*, lix (1), pl. viii, fig. 14) of a cell of this kind from the parenchyma of *E. fluviatilis*, and as their presence is recognized to be diagnostic of *E. fluviatilis*, I believe that Carter was right in regarding *E. meyeri* as belonging to this species; it should therefore be called *E. fluviatilis* var. *meyeri*. Very possibly *E. robusta* (Potts) from North America is identical with this form.

*E. indica*, described by myself in 1907 (*Journ. Asiat. Soc. Bengal*, 1907, p. 20) is an interesting form as being to some extent intermediate between the genera *Ephydatia* and *Spongilla*. Even in the best developed specimens the rotulæ of the gemmule spicules are small and inconspicuous, consisting merely of a ring of spines but little differentiated from those that occur on the shafts. The spicules are arranged, however, in the upright position common in gemmules of *Ephydatia*, and the whole appearance not only of the gemmules but of the sponge itself resembles that of other species of this genus. Numerous specimens were obtained by Mr. R. Kirkpatrick and myself in a tank on the Calcutta maidan in May last. On examination these specimens proved to differ in several points from the types of the species. In the first place, the skeleton spicules were sharply pointed and distinctly inflated at the ends

and sometimes in the middle, closely resembling those of a form found by Hanitsch (*Irish Naturalist*, 1895, p. 128, pl. iv) in Ireland and provisionally referred by him to *E. crateriformis*, Leidy. The gemmule spicules, moreover, were not or barely birotulate; the majority of them ending in a sharp, stout, vertical spine surrounded by a ring of transverse spines barely to be distinguished from those on the shaft. The spicules were, however, placed upright in the coat of the gemmule, and although many of the latter were still immature, some of them appeared to be fully formed. Large numbers of similar spicules occurred scattered in the parenchyma, and I also found a few free spicules of an irregularly massive outline. In July I obtained fresh specimens from the same tank and submitted them to a careful examination. In these examples the majority of the gemmules were fully formed, their spicules being distinctly birotulate and agreeing with those of the type of the species. The skeleton spicules were no longer pointed and expanded at the ends, although their outlines were still rather irregular, but closely resembled those of the type. Numerous free birotulates were found in the parenchyma. From this I conclude that the specimens found in May were immature, and that their peculiarities were due to their immaturity. *E. indica* is, as I suggested in my original description, closely allied to *E. crateriformis*, but the aperture of the gemmule is situated on a distinct prominence and is not markedly crateriform.

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## MISCELLANEA

### MAMMALS.

THE ORIGINAL HOME OF *Mus decumanus*.—In a previous paper on the rats of Calcutta (*Mem. Ind. Mus.*, vol. 1, No. 1) I called attention to a paper by De l'Isle on the existence of a northern negroid race in the Brown Rat (*Ann. Sci. Nat.* (5), Zool., 1865, pp. 172-222). As my memoir was already in the press before I discovered this paper, I had to content myself with a brief note on the identity of the Indian and European forms of *Mus rattus*. A fact that caused me some doubt all through the writing of the descriptions of the rats of Calcutta was that *M. decumanus*, as observed by me in Calcutta and as exemplified by the collection of skins from different parts of India in the Indian Museum, is characterized by a distinct though variable paleness of the lower surface of the tail, whereas in Great Britain the whole tail is of one colour. De l'Isle puts forward a theory which, though it is open to objection on some points, seems to afford a satisfactory explanation of this observation of mine, and to throw light on the problem of the original home of *M. decumanus*. His theory, briefly, is that the original wild form of *Mus*, as exemplified both in *M. sylvaticus* and *M. alexandrinus*, has the underparts white or of a light colour and the tail bicoloured (although in the case of *M. alexandrinus* the tail is of a uniform pale brown); but that the corresponding parasitic forms, namely *M. musculus* and *M. rattus*, which have attached themselves to man and have therefore freed themselves from the necessity of protective coloration to some extent, have become dark below and have developed uniformly dark tails. The second part of his theory is that the change is also due in part to climate, and that under the grey skies of the north the clear and sharp differentiation between the upper and the lower surfaces tends to disappear, and a uniform coloration to be produced. The most marked instance of this is, he says, to be found in *M. rattus*, the northern offshoot of the Oriental wild parent form *M. alexandrinus*. In reference to the climatic change in *M. decumanus* he merely cites the deviation from type described as *M. hibernicus*, an occasionally black variety found in the British Isles. In reference to the change in this rat due to parasitism, he writes as follows :—

“A parasite like the rat (*M. rattus*) or the mouse (*M. musculus*), and like these species of Asiatic origin, the Brown Rat (“surmulot”), which was only introduced into France towards the middle of last century, already exhibits very evident traces of alteration in colour. Thus one frequently meets with individuals that have the

under-surface no longer whitish, but ash-coloured, with scattered blackish hairs, and the tail *not* of two colours, white below, as in the type of the species, but uniformly blackish grey."

Before discussing the pros and cons of De l'Isle's theory, it may be pointed out that he recognizes *M. decumanus* as a rat of eastern origin characterized by having a tail of two colours. Its most extreme departure from type, as found in the melanotic form known as *M. hibernicus*, he believes to be due to climatic environment; the minor alterations, shown mainly in the darkening of the under-surface of the tail, he credits, on the other hand, to the effects of parasitic life. Though this theory is a fascinating one, it is not to be accepted without reservations, and there are points in it to which exception may be taken, especially in view of the facts and observations recently collected. The strongest point in its favour is that what he describes as the "wild" type of coloration is almost universal in wild animals of every sort and is now well known to have great protective value. In favour of the climatic part of the theory is the fact that in Calcutta, although I have examined thousands of specimens, I have never come across one that showed a tendency to general melanosis, but have frequently noted the ashy grey belly which he quotes as an instance of the parasitic type of coloration. The strongest argument against the whole theory is that he assumes that the typical form of *M. alexandrinus* exhibits what he calls the "wild" type of coloration. This is probably far from being the case, for Liston has shown that no less than 20 per cent. of the rats of Bombay are black, while here in Calcutta, while black rats are rare, nearly half of the specimens I have collected have grey or orange-grey bellies. *Mus decumanus*, if of eastern origin, should be wild in the East, but I have come to the conclusion that it is even more strictly parasitic on the banks of the Hughli than it is on the banks of the Thames. In Bengal, and in India generally, it is hardly to be found except in seaports and, occasionally, on the banks of the great navigable rivers that debouch at these ports; in the interior of Bengal and Assam, as I learn from Capt. Gourlay, I.M.S., and others, it is practically unknown. Why should this be if it is living nearer to its original home than in Great Britain? Again, if reliance is to be placed on De l'Isle's theory of parasitic versus "wild" coloration, it might be expected that *Nesokia bengalensis*, which in Calcutta is a parasitic rat, would show a marked difference when living under purely natural conditions. So far as I know, it shows no such difference. Doubtless this is one of the points that will be taken up in the proposed survey of the rats of India. Another point worthy of investigation would be the question whether *Mus rattus* exhibits a greater tendency of "wild" coloration when living in trees than it does when living in human habitations.

W. C. HOSSACK.

COLOUR CHANGE IN *Hylobates hooiok*, HARLAN.—It is generally believed that the variation of colour to which this species is subject

is more distinctive of the female than of the male sex, and that age is the chief factor in colour change. These deductions are evidently based upon inadequate observations. Examples of black male and grey female hoolocks, or black males turning light-coloured on arriving at maturity are well known, but these facts prove nothing, as contrary cases of black female and grey male hoolocks are equally well known.

Observations on the numerous hoolocks (*H. hoolock*) obtained from Assam, Sylhet, Cachar, Manipur, the Chittagong Hill Tracts, the Irrawady Valley, and Arracan, and exhibited in the Calcutta Zoological Garden during the last thirty-one years and more show that, considered in relation to the variation of colour, the species may be divided into the four following groups :—

- (1) Light-coloured female hoolocks turning grey, or even white with age.
- (2) Black, or grey-coloured female hoolocks, becoming lighter grey or white with age.
- (3) Black female hoolocks never turning grey or white.
- (4) Light-coloured, or grey males, remaining always the same colour.

The following three specific cases may be mentioned in reference to groups 2, 3 and 4 respectively :—

1. "Maria," an adult black female, which had been for some years in captivity but had enjoyed very considerable liberty, was sent to the Garden in 1902. Her colour was not so intense at the time as that of some black individuals, and she has gradually become paler since it was necessary to cage her owing to her temper. At present (July, 1907) the hair on her back, on the outside of her limbs, on her face (except the eyebrows, which remain pure white) and on the inside of the forearm and lower leg is of a very pale, brownish grey colour, while the ventral surface of her body and the inside of the upper leg and arm is of a pale but rather warm purplish brown. The hair on the hands and feet is white. The pigment of the skin has not been affected.

2. An adolescent black female hoolock came into the possession of the Garden early in 1895, and was placed in the house usually occupied by the anthropoids. Accustomed as the animal was to a life of comparative freedom, it took to pining and became seriously ill. Careful nursing and treatment having failed to bring about any change for the better, it was set at liberty. The effect was marvellous, the animal soon recovered, and, having regained its usual cheerfulness, enjoyed life for the next seven years, roaming about far and near, but always returning to the Garden at the appointed hours of feeding. It never turned grey, not even light coloured.

3. In 1878, a young male of a greyish brown colour was acquired from Assam. The late Dr. John Anderson, F.R.S., then Honorary Secretary of the Garden, was particularly interested in the animal, as he was anxious to determine whether it became black as it grew older. It lived for several years in the Garden, and

died long after arriving at maturity, but never showed any sign of changing from grey to black.

The following extracts from a letter from Mr. E. Stuart Baker may throw further light on the subject of colour-changes in hoolock gibbons :—

“ Susan, a female gibbon got by me as a mature animal, was sent to Colonel Vaughan, I.M.S. Colonel Vaughan kept her for some time and then passed her on to a Captain (now Colonel) Johnstone, and he again to others, and when I saw her many years later she was still jet black. A very large adult grey ♀ belonged to a Mr. Lewis Jones in North Cachar. It was caught as a grey *butcha* (young one) and remained the same colour, in this case a dark grey, all the time I knew it. I have kept many black hoolocks, in one case from a few days old until it was seven or eight years old, and never have I seen any change of colour take place.”

Mr. Stuart Baker, who has considerable experience of Assam hoolocks in their wild state, has often seen the same small community of hoolocks to contain white, brown, and black specimens, and these seemed to him always to remain the same.

The late Mr. Louis Schwendler, who will always be remembered in connexion with the establishment of the Calcutta Zoological Garden, related to me the following facts about a pet hoolock of his, a *female of a jet black colour*. She broke her arm by a fall from a tree and had to be kept in close confinement for over six weeks. During this period of enforced captivity she lost her black colour, and became almost grey. Change of hue, brought about by illness or injury, has been known to occur in other species of monkeys—particularly in *Semnopithecus pileatus*, and *Macacus arctoides*.

R. B. SANYAL, *Rai Bahadur*.

## BATRACHIA.

EGGS OF *Tylototriton verrucosus*.—Mr. R. Hodgart, Zoological Collector in the Museum, while collecting Batrachia at Kurseong (5,000 feet) in the Darjiling district, recently (July, 1907) found several breeding females and eggs of this, the only Indian Urodele. Before describing the eggs I may notice a curious observation he made as regards the adult. He found that if it was grasped in the hand by the body it lashed about vigorously with its tail and drew blood from the hand. An examination of his specimens shows that the dorsal ridge is, at the base of the tail, exceedingly sharp and has a stiff and inflexible character. I have no doubt that this was the weapon used. Unfortunately the eggs, from one of which a larva is in the act of escaping, are not in a very good state of preservation, but the following particulars may be noted. They were found in small pools of rain water in an open wood and were attached together in pairs, each pair being separate from

the others and not fixed to any external object. The eggs appear to have measured about 10 mm. in diameter and are spherical ; they have an outer covering of comparatively loose jelly, the inner covering that contains the larva being more tenacious and having a greater density. The escaping larva measures 9 mm. in length—of which 3 mm. is occupied by the tail—and 1.75 mm. in greatest depth ; its body is rounded owing to the large amount of yolk held in the belly, but its tail is laterally compressed and has a lanceolate outline. The head is small and round, measuring 1.5 mm. in length ; the eyes are large but not protuberant ; they appear to be covered with skin, but the eyeball can be detected externally. There are four delicate external gills on either side, each set being arranged in a graduated series from above downwards. The mouth is open externally and is transverse and relatively large ; behind it there is a conspicuous fold of the body-wall. The anus is still imperforate. The belly is white, but the tail and the back and sides of the body are grey, with large black pigment-cells forming almost a reticulated pattern.

N. ANNANDALE.

#### CRUSTACEA.

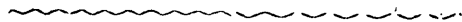
THE HOSTS OF *Tachæa spongillicola*, STEBBING.—This Isopod, recently described by the Rev. T. R. R. Stebbing (*Journ. Linn. Soc., Zool.*, xxx, p. 39, 1907) from Calcutta, was first found in small numbers in *Spongilla carteri*, but, owing to a misapprehension, the author of the species suggested in a footnote to his description that it might have come from a form of *S. lacustris*. This misapprehension was due to a letter of my own in which I intended to refer to a very different Isopod found in *Spongilla alba* at Port Canning. During the present summer, however, I have found numerous specimens of *Tachæa spongillicola* in *Ephydatia indica*, so that it is evidently not confined to one host. *Ephydatia indica* is a sponge often found on the bottom of tanks, growing most commonly on the roots of water-plants. Possibly this habit may explain the abundance of the Isopod in its canals ; as the latter is rare in *Spongilla carteri*, which generally grows near the surface but has very much wider apertures and canals than any other species common in Calcutta.

N. ANNANDALE.

A SECOND SPECIES OF *Dichelaspis* FROM *Bathynomus giganteus*.—The Indian Museum is fortunate in possessing a fine series of specimens of the giant deep-sea Isopod *Bathynomus giganteus*, Milne-Edwards, and Barnacles of the genus *Dichelaspis* occur on the pleopods in every case. I recently described examples of these Barnacles from a specimen from the Arabian Sea as the types of a new species, *D. bathynomi* (*Ann. Mag. Nat. Hist.* (7), xvii, p. 46), and others from specimens from the Andaman Sea and off the Madras coast agree with them. Those on another specimen, however, from off Ceylon, closely resemble *D. occlusa*, Lanchester,

a species described from *Thenus orientalis* from shallow water on the east coast of the Malay Peninsula (*Proc. Zool. Soc.*, 1902, p. 373). As my specimens are evidently immature, I am unable to decide whether they are merely a variety of this species or specifically distinct. The points in which they differ from Lanchester's specimens are the following: (a) the penis is extremely short; (b) the carina extends upwards a little further and is not so markedly produced at its lower extremity; (c) the tergum is larger, more nearly transverse and not so deeply notched at the point where the occludent segment of the scutum meets it; (d) the capitulum is more regular in outline and is not produced above the aperture into a lobe; (e) the valves are transparent and feebly calcified except immediately round the umbones of the scuta and terga; (f) no chitinous points are visible on the peduncle even under a high power of the microscope. Although these differences are numerous, the majority may be due to extreme immaturity on the part of the specimens from *Bathynomus*. The depth at which the latter was taken, viz., between 225 and 594 fathoms, is, however, very different from that at which Lanchester's examples were collected.

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