

On Cellularine and other Polyzoa. By Sir SIDNEY F. HARMER, K.B.E., Sc.D., V.P.R.S., F.L.S., Director of the Natural History Departments of the British Museum*.

(PLATES 16-19.)

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I. INTRODUCTION.

THE collection of the Polyzoa made by the 'Siboga' in Malay waters is perhaps the most important one which has been obtained in any part of the world since the 'Challenger' Expedition, including as it does representatives of the shallow and deep water Fauna of a district rich in Polyzoa, but at present very imperfectly known. A study of the representatives of this group in the area in question is specially needed, in order to fill a conspicuous gap in our knowledge. The Polyzoa of parts of Australia have perhaps been more fully studied than those of any other part of the world, with the exception of the Atlantic and Arctic areas; particularly those of Victoria and New South Wales, thanks to the labours of Busk, Hincks, MacGillivray, Waters, and others. Those of Japan have been described, to some extent, by Ortmann, and are receiving attention from Yanagi and Okada. Hincks and Miss Robertson have described some of the Polyzoa of the Pacific coast of North America, but those of the Pacific in general have been very imperfectly investigated, although some information on the subject has been given by Miss Philipps. Waters has published two important papers on the Polyzoa of the Red Sea and East Africa, and Savigny's admirable figures of Egyptian species, some of which were obtained in the Red Sea, as well as a recent paper by Marcus on South African species, must be specially noticed. Hincks has described Polyzoa from the Indian Ocean, particularly from the Mergui Archipelago; and Miss Thornely and Miss Robertson have also made contributions to our knowledge of the Polyzoa of this Ocean.

In investigating the Cheilostomata of the Malay Archipelago, I have found it necessary to devote much attention to various questions which do not form a necessary part of the Report which is in preparation. I have been obliged in particular to study various genera, in order to attempt to decide their characters and the names which ought to be assigned to them.

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In dealing with these questions I have had the great advantage of being able to make use of the important type-specimens, particularly those of Busk, in the British Museum. Some of the results thus obtained are given in the present paper, which is intended to be preliminary to my fuller Report. The genera considered are those of the "Cellularine" series, together with others which have to be discussed in connection with these. For the purposes of this general survey I am obliged to give diagnoses of several new genera; but I restrict myself to those which are strictly necessary, believing as I do that the practice of publishing preliminary diagnoses which cannot be fully understood without adequate illustration is one to be avoided as much as possible. I devote special attention to species which have been included in the genus *Menipea*; and I venture to think that the grouping here suggested, in this and other genera, will give greater precision to certain questions of Geographical Distribution. I desire to acknowledge specially the valuable assistance I have received from my colleagues Mr. C. Davies Sherborn and Mr. R. Kirkpatrick. Mr. Sherborn has helped me particularly with regard to the dates of publication of various Memoirs, while his invaluable MS. list, at present in course of publication (Index Animalium, 1801-1850) by the Trustees of the British Museum, has been of special assistance in ascertaining that several genera in current use are preoccupied. Mr. Kirkpatrick, who is in charge of the Collection of Polyzoa in the British Museum, has given me much appreciated help in referring to the specimens, and in other ways. Special attention may be directed to Sect. III. (Internal avicularia) and Sect. IV. (Methods of bifurcation).

The present paper is divided into the following Sections:—

- I. Introduction.
- II. Literature and Nomenclature.
- III. Internal avicularia.
- IV. Methods of bifurcation of the colony.
- V. Characters of certain genera and species of *Scrupocellariidæ*.

II. LITERATURE AND NOMENCLATURE.

This Section includes a list of Memoirs to which shortened references are given throughout the paper; but full references are given, in their proper places, to many other works not included in the list. The Bibliography is followed by an alphabetical list of genera, in which I have endeavoured to establish the respective genotypes, where this has not already been done. In constructing this list I follow the example which has been given by Lang (1917, *Geol. Mag.*, Dec. vi, vol. iv. p. 169). I have also indicated, as far as possible, the names which appear to me synonymous with genera of earlier

introduction. The consideration of a number of genera at the same time has had great advantages, by enabling many cases to be discovered in which the conclusions drawn from the study of one genus by itself are modified by taking others into account. I have found it necessary to propose the following new genera and species in the present Section:—

Camptoplites, n. gen.

Didymozoum, nom. nov., to replace *Didymia*, pre-occupied.

Euoplozoum, n. gen.

Himantozoum, n. gen.

Onchoporella buskii, nom. nov., for *Onchoporella bombycina*, Busk.

Stirpariella, nom. nov., to replace *Stirparia*, pre-occupied.

The following new names are proposed in Sect. V. :—

Amastigia kirkpatricki (Levinsen, MSS.), n. sp.

Menipea vectifera, n. sp.

Notoplites, n. gen., and *N. rostratus*, n. sp.

I accept the main divisions of the Cheilostomata which were suggested by Levinsen (1909, pp. 88–90). The Order is divided into two Sub-Orders: (1) *Anasca*, in which the original frontal membrane persists, wholly or in part, in a membranous condition; (2) *Ascophora*, in which a compensation-sac is present (cf. Harmer, Q. J. M. S. xlv. p. 263). The *Anasca* are further subdivided into three Divisions: (i.) *Malacostega*, with the frontal membrane for the most part in its primitive, membranous condition; (ii.) *Coilostega*, with a considerable development of a calcareous layer, the cryptocyst, subjacent to the frontal membrane, and frequently pierced by foramina, the opesiules, traversed by the tendons of the depressor muscles, which are inserted into the frontal membrane; (iii.) *Pseudostega*, with peculiar, immersed ovicells and certain other characters, consisting mainly of the Family *Cellariidæ*.

The genera included in the following list are mainly the erect branching forms of the *Anasca*. I have included all Levinsen's Families of recent *Malacostega*, with the exception of the *Membraniporidæ* and *Cribrilinidæ*; the erect, branching genera of the *Coilostega*, but not the encrusting forms nor those with an *Escharine* habit; and the genera of recent *Pseudostega*. The Cellularine assemblage, with which I am principally concerned, consists of the branching, erect genera of the *Malacostega*. The branching *Ascophorous* genera, such as the *Catenicellidæ*, provided with a compensation-sac, are not included in my list, with one or two exceptions, in the case of names which have some bearing on the nomenclature of other genera under consideration.

A. LITERATURE.

Abbreviations:—

- A. M. N. H.—Annals and Magazine of Natural History.
 A. S. N.—Annales des Sciences Naturelles (Zoologie).
 J. L. S.—Journal of the Linnean Society (Zoology).
 P. F. T. C.—See under D'Orbigny.
 Q. J. M. S.—Quarterly Journal of Microscopical Science.

- AUDOUIN, V., 1826.—“Explication sommaire des planches de Polypes de l'Égypte et de la Syrie,” in Savigny's “Description de l'Égypte,” i. pt. 4.
 AUDOUIN, V., 1828.—*Ibid.*, 2^e Édition, xxiii.
 BLAINVILLE, H. M. D. DE, 1830.—Dictionnaire des Sciences Naturelles, lx., Zoophytes.
 BLAINVILLE, H. M. D. DE, 1834.—“Manuel d'Actinologie.”
 BUSK, G., 1852¹.—Polyzoa and Sertularian Zoophytes, in J. MacGillivray's Voyage of the ‘Rattlesnake,’ Vol. i.
 BUSK, G., 1852².—“Catalogue of Marine Polyzoa in the Collection of the British Museum,” Pt. i.
 BUSK, G., 1884.—“Report on the Polyzoa,” Pt. i., Challenger Reports, Part xxx. Vol. x.
 ELLIS, 1755.—“An Essay towards a Natural History of the Corallines.”
 ELLIS, J., & SOLANDER, D., 1786.—“The Natural History of many curious and uncommon Zoophytes.”
 FLEMING, J., 1828.—“A History of British Animals.”
 GRAY, J. E., 1843.—“Additional Radiated Animals and Annelides,” in E. Dieffenbach's “Travels in New Zealand,” Vol. ii.
 GRAY, J. E., 1848.—“List of the Specimens of British Animals in the Collection of the British Museum,” Pt. i. “Centroniæ or Radiated Animals.”
 HINCKS, T., 1880.—“A History of the British Marine Polyzoa.”
 JOHNSTON, G., 1847.—“A History of the British Zoophytes,” Second Edition.
 KLUGE, H., 1914.—“Die Bryozoen der deutschen Südpolar-Expedition 1901–1903,” pt. i., Deutsch. Südpolar-Exp. 1901–1903, xv. (Zool., Bd. vii.) pp. 601–678.
 LAMARCK, J. B. P. A. DE, 1801.—“Système des Animaux sans Vertèbres.”
 LAMARCK, J. B. P. A. DE, 1816.—“Histoire Naturelle des Animaux sans Vertèbres,” Vol. ii.
 LAMOUREUX, J. V. F., 1812.—“Extrait d'un Mémoire sur la Classification des Polypiers Coralligènes non entièrement pierreux,” Nouv. Bull. Sci. Soc. Philomat. iii. p. 181.
 LAMOUREUX, J. V. F., 1816.—“Histoire des Polypiers coralligènes flexibles.”
 LAMOUREUX, J. V. F., 1821.—“Exposition Méthodique des genres de l'Ordre des Polypiers.”
 LAMOUREUX, J. V. F., 1824.—In Encyclopédie Méthodique, xcv. Livr., T. ii., 1 Partie, Vers.
 LAMOUREUX, J. V. F., 1827.—*Ibid.* xcvi. Livr., T. ii., 2 Partie, Vers.
 LEVINSÉN, G. M. R., 1909.—“Morphological and Systematic Studies on the Cheilostomatous Bryozoa,” Copenhagen.
 LINNÆUS, C., 1758.—“Systema Naturæ,” 10th Ed., Vol. i.

- LINNÆUS, C., 1767.—“Systema Naturæ,” 12th Ed., Vol. i. pars 2.
- MARCUS, E., 1922.—“Südafrikanische Bryozoen aus der Sammlung des Gothenburger Museums,” Göteborgs K. Vet.- och Vitt.-Samh. Handl. (4) xxv. 3.
- OKEN, L., 1815.—“Lehrbuch der Naturgeschichte,” 3 Theil, Zool., 1 Abth.
- D'ORBIGNY, A., 1852 (referred to as A. S. N.).—“Recherches Zoologiques sur la Classe des Mollusques Bryozoaires,” Ann. Sci. Nat. (3) Zool. xvi. p. 292.
- D'ORBIGNY, A., 1852 (probably published later: referred to as A. S. N.).—*Ibid.*, Suite, Ann. Sci. Nat. (3) Zool. xvii. p. 273.
- D'ORBIGNY, A., 1851–1854 (referred to as P. F. T. C.).—“Paléontologie Française, Terrains Crétacés,” T. v.
 1851.—pp. 1–188.
 1852.—pp. 189–472.
 1853.—pp. 473–984.
 1854.—pp. 985–1192.
- PALLAS, P. S., 1766.—“Elenchus Zoophytorum.”
- PALLAS, P. S., 1787.—“Charakteristik der Thierpflanzen” . . . übersetzt von C. F. Wilkens und J. F. W. Herbst, i. Th.
- SCHWEIGGER, A. F., 1819.—“Beobachtungen auf Naturhistorischen Reisen,” Berlin.
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- SMITT, F. A., 1868.—“Kritisk Förteckning öfver Skandinaviens Hafs-Bryozoeer,” iii., Öfv. K. Vet.-Ak. Förh. xxiv. 1867, p. 279.
- WOODWARD, B. B., 1903–1922.—Catalogue of the Books, Manuscripts, Maps and Drawings in the British Museum (Natural History), vols. i.–v. and Suppl. (This work contains much valuable Bibliographical information with regard to dates of publication.)

B. NOMENCLATURE.

- Acamarchis*, Lamouroux, 1816, p. 132.—Genosyntypes, *A. neritina* (L.) and *A. dentata*, Lamx., n. sp. Genolectotype, *Acamarchis neritina* (*Sertularia neritina*, L., 1758, p. 815), a selection which may be considered to have been made by Schweigger, 1819, Tab. 8; 1820, p. 429; with erroneous citation as *neritina*. It may be noted that D'Orbigny (1852, P. F. T. C. p. 323) gives 1812 as the date of introduction of *Acamarchis*; but his synonymy on the following page shows that he referred to Lamouroux, 1816. I regard *Acamarchis* as a synonym of *Bugula*, Oken, 1815, in accordance with the practice of most modern authorities.
- Aetea*, Lamouroux, 1812, p. 184.—Genotype (the only species), *Aetea anguina* (*Sertularia anguina*, L., 1758, p. 816).
- Aeteopsis*, Boeck, 1862, Forh. Vid.-Selsk. Christiania, Aar 1861, p. 49 (also given as *Aetiopsis*).—Genotype (the only species), *Aeteopsis elongata*, Boeck, n. sp., which is regarded by Smitt, 1868, p. 280, as a synonym of *Aetea truncata*, Landsborough. Synonym of *Aetea*, Lamouroux, 1812.
- Aetiopsis*.—See *Aeteopsis*.

- Alysidium*, Busk, 1852², p. 13.—Genosyntypes, *A. parasiticum*, Busk, n. sp., and *Eucratea lafontii*, Audouin, 1826, p. 242; 1828, p. 74. Genolectotype, *Alysidium parasiticum*, see Norman, 1909; J. L. S. xxx. p. 295.
- Amastigia*, Busk, 1852², p. 40.—Genotype (the only species), *Amastigia nuda*, Busk, n. sp.
- Anderssonia*, Kluge, 1914, p. 617.—Genotype (the only species), *Anderssonia antarctica*, Kluge, n. sp. Synonym of *Amastigia*, Busk, 1852; but pre-occupied by *Andersonia*, Boulenger (Pisces), 1900, A. M. N. H. (7) vi. p. 528, and by *Anderssonia*, Strebel (Mollusca), 1908, Wiss. Ergebn. Schwed. Südpolar-Exp. vi. 1, p. 12.
- Anguinaria*, Lamarck, 1816, p. 142.—Genotype (the only species definitely mentioned), *Anguinaria spatulata*, Lmk., nom. nov. Lamarck gives *Sertularia anguina*, L. (1758, p. 816) as a synonym, from which it appears that the introduction of a new trivial name was unnecessary. Hincks (1880, p. 2) states that *Anguinaria* was mentioned, but not defined, by Lamarck in 1812; but on consulting this work (Extr. Cours Zool. Mus. Paris, p. 24) it is found that Lamarck did no more than mention the generic name in the French form "Anguinaire." Synonym of *Aetea*, Lamx., 1812.
- Angularia*, Busk, 1881, Q. J. M. S. xxi. p. 14.—Mentioned as an abyssal genus with a web-like expansion at the angle of most of the bifurcations. No species is indicated, and the genus does not seem to have been referred to by Busk in any later work.
- Avicella*, Van Beneden, 1848, Bull. Acad. roy. Belg. xv. 1, p. 74.—Genosyntypes, 5 species, all referable to *Bugula*, Oken, 1815. As this is the case, there seems to be no object in selecting a genotype, which it would be difficult to do in view of uncertainty as to the identification of some of the species described.
- Avicularia* (Thompson, MSS.), Gray, 1848, pp. 105, 146.—Genotype (the only species), *Avicularia flabellata* (Thompson, MSS.), Gray, n. sp. Synonym of *Bugula*, Oken, 1815; but pre-occupied by *Avicularia*, Lamarck (Arachnida), 1818, An. s. Vert. v. p. 107.
- Bactridium*, Reuss, 1848, Naturwiss. Abhandl. (Haidinger), ii. p. 55.—Genosyntypes, *B. hagenowi*, Reuss, n. sp., and 3 other fossil species. Genolectotype, selected by D'Orbigny, 1852, P. F. T. C. p. 363, and A. S. N. (3) xvii. p. 289, *Bactridium hagenowi*. This species does not seem to belong to the Cellularine assemblage, but the other three species described by Reuss were regarded by D'Orbigny as species of *Canda*.
- Beania*, Johnston, 1840, A. M. N. H. v. p. 272.—Genotype (the only species), *Beania mirabilis*, Johnst., n. sp. See also Johnston, 1847, p. 371.
- Bicellaria*, de Blainville, 1830, p. 423; see also 1834, p. 459.—Genosyntypes, 7 species, including "*B. ciliata*, Ellis" (*Sertularia ciliata*, L., 1758, p. 815). In his revision of genera, Gray (1848, p. 112) includes *B. ciliata* by itself in *Bicellaria*; and, although he gives no diagnosis, by placing *Sertularia ciliata*, L., at the head of his synonymy, he may fairly be considered to have indicated

Bicellaria ciliata as the genotype. Pre-occupied by *Bicellaria*, Macquart (Diptera), 1823, Rec. Trav. Soc. Amat. Sci. Lille, Années 1819-1822, p. 155, and replaced by *Bicellariella*, Lev., 1909 (*q. v.*). See also *Bugula*.

Bicellariella, Levinsen, 1909, p. 431.—Proposed to replace *Bicellaria*, de Blainville, 1830, pre-occupied (see *Bicellaria*), with genotype *Bicellariella ciliata* (see p. 110).

Bicellarina, Levinsen, 1909, p. 99.—Genotype (the only species), *Bicellarina alderi* (*Bicellaria alderi*, Busk, 1860, Q. J. M. S. viii. p. 213).

Bifrons, MacGillivray, 1860, Trans. Phil. Inst. Vict. iv. p. 163.—Proposed to replace *Dimetopia*, Busk, 1852, at Dr. Mueller's suggestion, on the ground that *Dimetopia* is used in Botany (Umbelliferae). The alteration is not required by the accepted rules.

Brettia, Dyster, 1858, Q. J. M. S. vi. p. 260.—Genotype (the only species), *Brettia pellucida*, Dyst., n. sp.

Bugula, Oken, 1815, p. 89.—Genosyntypes, *Cellularia neritina*, *Cell. ciliata*, and *Bugula avicularia* (authorities not cited). Linnæus (1758, p. 809) founded *Sertularia avicularia* primarily on the biserial species figured by Ellis (1755, pl. 20. fig. A), and to this species the Linnean name is now restricted; but he also included the pluriserial species of the same author (*t. cit.* pl. 38. fig. 7), though wrongly citing the Plate as 28. Gray (1848) made *S. avicularia* (*s. str.*) the genotype of a new genus, *Bugulina* (p. 114), while (p. 106) he described the pluriserial species of Ellis, whose Plate is wrongly cited as 58, as *Avicularia flabellata* (Thompson, MSS.), *A. flabellata* being the genotype. He appears to have overlooked the fact that Oken described *C. avicularia* as having its zoecia in 3 or 5 series, as he includes Oken's species in his synonyms of *Bugulina avicularia*, whereas it should properly have come under *Avicularia flabellata*. *B. neritina*, *B. avicularia*, and *B. flabellata* are congeneric, whatever the generic name adopted for them.

In 1819 Schweigger made *Sertularia neritina*, L., the genotype of *Acamarchis* (*q. v.*), to which *S. avicularia*, L., and *Avicularia flabellata* (Thompson, MSS.), Gray, might also be considered to belong. This would necessitate regarding *S. ciliata*, L., as the genotype of *Bugula*, a course which would introduce the greatest confusion into nomenclature. I regard this as an instance in which it is essential to disregard the strict application of the Rules of Nomenclature and to accept Hincks' selection (1880, p. 75) of *Bugula neritina* as the genotype of Oken's genus. As this species is also the genotype of *Acamarchis*, it becomes necessary to choose between the two genera. I give the preference to *Bugula*, partly because it antedates *Acamarchis* by a year, and partly because it has been universally accepted. As a further motive, it may be pointed out that *A. neritina*, in its typical form, is devoid of avicularia, and that certain writers have accepted *Acamarchis* as a genus differing from *Bugula* by the absence of these organs. See also *Bicellaria*.

Bugularia, Levinsen, 1909, pp. 99, 108.—Genotype (the only species), *Bugularia dissimilis* (*Carbacea dissimilis*, Busk, 1852², p. 51).

- Bugulella*, Verrill, 1879, Amer. J. Sci. Arts, (3) xvii. p. 472.—Genotype (the only species), *Bugulella fragilis*, Verr., n. sp., described as allied to *Bicellaria* and perhaps to *Brettia*.
- Bugulina*, Gray, 1848, p. 114.—Genotype (the only species), *Bugulina avicularia* (*Sertularia avicularia*, L., s. str.). The form indicated by Gray is the biserial species of Ellis (1755, p. 36, pl. 20. figs. *a*, A), to which the trivial name of Linnæus is now restricted. See *Bugula*, of which this genus is a synonym.
- Bugulopsis*, Verrill, 1880, Proc. U.S. Nat. Mus. ii. (1879), p. 190.—Genotype, selected by the author, *Bugulopsis peachii* (*Cellularia peachii*, Busk, 1851, A. M. N. H. (2) vii. p. 82). Synonym of *Tricellaria*, Fleming, 1828.
- Caberea*, Lamouroux, 1816, p. 128.—Genosyntypes, *C. pinnata* and *C. dichotoma*, Lamx., n. spp., both from "Australasie." Genoelectotype, *C. dichotoma*, see Schweigger, 1819, Tab. 9; 1820, p. 430; and Gray, 1848, p. 147.
- Caberiella*, Levinsen, 1909, pp. 134, 135.—Genotype (the only species), *Caberiella benemunita* (*Menipea benemunita*, Busk, 1884, p. 19). Synonym of *Amastigia*, Busk, 1852.
- Caberoïdes*, Canu, 1908, Ann. Paléont. iii. p. 87 (83, sep.).—Genotype, selected by the author, *Caberoïdes canaliculata*, Canu, n. sp. The genus is described as resembling *Caberea* and also members of the Lepralioid series (Hippoporinæ).
- Camptoplites**, n. gen.—Genotype, *Camptoplites bicornis* (*Bugula bicornis*, Busk, 1884, p. 40). I propose this genus for Sect. β of *Bugula* as given in Busk's 'Challenger' Report, 1884, p. 37, with the following diagnosis:—
- Zoarium stalked, the stalk prolonged basally into an attaching tuft of rootlets. Zoœcia biserial or pluriserial, narrow proximally, the opesia occupying most of the expanded distal portion. Proximal ends of the zoœcia not forked. Avicularia borne on long, flexible stalks, which usually exceed the head of the avicularium in length. Operculum distinguishable, ovicells well developed.
- The peculiarities of the avicularium and the absence of a forked proximal end in the zoœcia seem to justify generic separation for this assemblage of forms, which are characteristic of abyssal depths and of the Antarctic area. In addition to the type-species and *B. reticulata*, described by Busk in his original account, the following species are referable to *Camptoplites*:—*Bugula tricornis*, Waters, 1904, "Belgica" Bryozoa, p. 23; and the following species described by Kluge (1914):—*Bugula bicornis*, vars. (pp. 619–624), *B. areolata* (p. 627), *Bugula* sp., var. *variospinosa*, nov. (p. 628), *B. multi-spinosa* (p. 628), *B. retiformis* (p. 629), *B. lewaldi* (p. 630), *B. gigantea* (p. 630), *B. angusta* (p. 631), *B. abyssicola* (p. 632), and *B. lata* (p. 634), Kl., n. spp.
- Canda*, Lamouroux, 1816, p. 131.—Genotype (the only species), *Canda arachnoides*, Lamx., n. sp.

* *καμπτός*, flexible; *ὀπλίτης*, an armed man; in allusion to the long, flexible stalk of the avicularium. The genus is masculine.

Carbacea, Gray, 1848, pp. 105, 146.—The only species is *Carbacea papyracea*, but the synonymy includes the following species:—(1) *Eschara papyrea*, Pallas (1766, p. 56), from the Mediterranean, still known by Pallas' trivial name; (2) *Flustra carbacea*, Ellis and Solander (1786, p. 14), from Aberdeen and Edinburgh. By the rule of absolute tautonymy the genotype is *F. carbacea*, and this conclusion is confirmed by Gray's mention of specimens from Northumberland and Scarborough examined by him in the British Museum Collection. The genotype has been renamed *C. solanderi* by Norman (1903, A. M. N. H. (7) xi. p. 582), but there appears to be no valid reason for rejecting its original name, which should accordingly stand as *Carbacea carbacea* (Ell. and Sol.).

Caulibugula, Verrill, 1900, Trans. Conn. Acad. x. p. 593.—Genotype, selected by the author, *Caulibugula armata*, Verr., n. sp. Apparently a synonym of *Stirpariella* (*q. v.*).

Cellaria, Ellis and Solander, 1786, p. 18.—Genosyntypes, 18 species, referable to about 13 modern genera. Thirteen of these species are identical with species included by Pallas in *Cellularia* (*q. v.*), as is shown by the identical citations, by both authors, of the work of Ellis (1755). It has generally been assumed that *Cellaria* was a gratuitous alteration of *Cellularia*; but Ellis and Solander do not refer to Pallas, and it seems possible that their arrangement was an entirely independent one, based on the works of Ellis and Linnæus.

In 1801 Lamarck (Syst. An. s. Vert. p. 382) defined *Cellaria* nearly in its modern sense, including two species only:—(1) *C. salicornia*, with synonyms *C. farciminoïdes*, Ell. and Sol. and *Tubularia fistulosa*, L.; (2) *C. cirrata*, Ell. and Sol., which later became the genotype of *Menipea* (*q. v.*). He placed *C. salicornia* alone in the first Section of the genus, distinguished by having "Articulations couvertes de cellules dans tous les sens." Under *Cellaria* Lamouroux (1816, p. 125) moreover writes: "J'ai conservé le nom de Cellaire au groupe dont les Polypiers avoient pour type le *Cellaria Salicornia*."

I think this is a case in which the strict Law of Priority should be set on one side, in view of the undoubted inconvenience of reverting to the earlier name. Norman (1903, A. M. N. H. (7) xi. p. 577) suggested a return to *Cellularia*, pointing out that *Cellaria* is to be regarded as an absolute synonym of that genus. But, on the other hand, *Cellaria* had already acquired a definite signification, which it has since retained; and this cannot be said of *Cellularia*, which has been used in the most various senses, and should, in my opinion, be discarded. In this respect I am in agreement with the conclusions of D'Orbigny (1851, P. F. T. C. p. 27), Smitt (1868, p. 383), Hincks (1880, p. 104), Waters (1897, J. L. S. xxvi. p. 3), and others. The genotype is *Eschara fistulosa*, L., of which *C. farciminoïdes*, included in Ellis and Solander's original account, as well as *Cellularia salicornia* (*pars*), Pallas, selected by Lamouroux (1816) as the genotype, are synonyms.

The identification of the species to which the Linnean name *fistulosa* properly belongs requires further consideration, and the conclusion at which I have arrived is not the one ordinarily accepted. *Eschara fistulosa* was

introduced by Linnæus (1758, p. 804) in his 10th Edition, with references to Ellis (1755, p. 46, no. 1, pl. 23. fig. A), followed by citations of Bauhin, Ray, Plukenet, and Barrelierus. In his 12th Edition (1767, p. 1302) Linnæus describes the same species as *Tubularia fistulosa*, with one or two additional citations. Pallas (1766, p. 61), in introducing *Cellularia salicornia*, gives all the citations of Linnæus (1758), with others, but he includes two species under one name. Ellis and Solander (1786, p. 26) describe *Cellaria farciminoïdes*, with citations of Ellis (p. 46, pl. 23) and of *Tubularia fistulosa*, L., 1767. It is quite clear that the three trivial names, of Linnæus, Pallas (in part), and Solander, respectively, refer to one and the same species.

The examination of the original works cited by Linnæus in 1758 shows, however, that his synonymy is open to a good deal of criticism. The figures of Ellis refer unquestionably to a species of *Cellaria* as here understood. Bauhin and Cherler (1651, Hist. Plant. iii. p. 811) describe two forms, a coarser species, from the Adriatic, and a more slender "varietas," of which the locality is not given. The coarser species, to which Linnæus expressly limits his reference ("Corallina fistulosa fragilis crassior"), shows projections on the internodes which suggest the produced peristomes of *Tubucellaria*, to which genus I have little doubt that it belonged. The slenderer species was probably a *Cellaria*. Ray (1686, Hist. Plant. i. p. 65) quotes Bauhin and Cherler *verbatim*, without giving additional information. Plukenet (1696, Almagestum Botanicum, p. 118, pl. 26. fig. 2) also cites Bauhin and Cherler. His figure might refer to a *Cellaria*, but his collection is in the Sloane Herbarium at the British Museum (Natural History), and his specimen, preserved in Vol. 95, Fol. 194 of that Collection, is a Coralline Alga. Barrelierus (1714, Plantæ per Galliam, Hispaniam et Italiam observatæ, p. 121) quotes Bauhin and Cherler and Ray. He describes and figures a coarser and a slenderer form, but the coarser species may be an Alga, although the other is probably a *Cellaria*. In view of these discrepancies and uncertainties it is necessary to regard the citation of Ellis, the first on the list, as the one to which Linnæus' name really refers; and this conclusion is confirmed by the fact that he consistently made use of Ellis' admirable figures in describing branching Polyzoa, many of his species being introduced with a citation of Ellis and of no other author.

Ellis explicitly states that there are two species of his "Bugle Coralline," and he is equally definite in explaining that his figures *a*, *A*, *B*, and *C* belong to the "larger Bugle Coralline." *D*, the remaining figure on his Pl. 23, appears to belong to the same species, though this is not stated quite so definitely. The mere question of size indicates that Ellis' figured species is the one usually described as *Cellaria sinuosa*, and that Ellis' smaller species is the *C. fistulosa* of Hincks and of other modern authors.

C. sinuosa was introduced, as *Farcimia sinuosa*, by Hassall (1840, A. M. N. H. vi. p. 172, pl. 6. figs. 1, 2), who expressly states that it is larger than what he calls *F. salicornia* (Ellis' smaller species), and that it is distinguished by having its apertures in the upper third of the cell. This character is clearly

shown by Ellis in his figs. B and D. Hassall later (1843, A. M. N. H. xi. p. 112) altered the name of his species to *F. spathulosa*.

In regarding *Cellularia fistulosa* as the genotype of the genus I am obliged to accept the following synonymy:—

1. *CELLARIA FISTULOSA* (L.).

Larger Bugle Coralline, Ellis, 1755, p. 46, pl. 23. figs. *a*, A-D.

Eschara fistulosa, L. 1758, p. 804.

Cellularia salicornia (*pars*), Pallas, 1766, p. 61.

Tubularia fistulosa, L. 1767, p. 1302.

Cellularia farciminoides, Ellis and Solander, 1786, p. 26.

Tubularia salicornis (*fistulosa*) (*Cellaria salicornea*, Pall.), Esper, between 1805 and 1810, Pflanzenth. iii. p. 103, *Tubularia*, pl. 2. figs. 1-4 (figures poor, but Ellis cited in synonymy).

Salicornaria dichotoma, Schweigger, 1819, Tab. 8; 1820, p. 428.

Farcimia sinuosa, Hassall, 1840, A. M. N. H. vi. p. 172, pl. 6. figs. 1, 2.

Farcimia spathulosa, Hassall, 1843, A. M. N. H. xi. p. 112.

Cellaria sinuosa, Hincks, 1880, p. 109.

(nec *Cellaria fistulosa*, Hincks, 1880, p. 106; and of other authors.)

2. *CELLARIA SALICORNIA* (Pallas).

Cellularia salicornia (*pars*), Pallas, 1766, p. 61.

? *Cellaria salicornioides*, Lamouroux, 1816, p. 127.

Salicornaria farciminoides, Johnston, 1847, p. 355.

Cellaria fistulosa, Hincks, 1880, p. 106; *et auctt.*

Pallas divided *C. salicornia* into two Sections:—(α) the larger Bugle Coralline, as shown by his citation of Ellis, Pl. xxiii.; (β) a more slender form, characterized in his synonymy as “subtilior” and “tenuior,” in contrast with “crassior” of his first Section. He gives *Eschara fistulosa*, L., as a synonym of β, but this was not admissible, in view of Linnæus’ citations of Ellis’ figure of the larger Bugle Coralline and of the “*Corallina fistulosa fragilis crassior*” of Bauhin and Cherler, emphasizing the fact that he had the coarser form in mind. This conclusion is not modified by reference to Linnæus’ “*Fauna Svecica*,” 1761, no. 2232, which Pallas wrongly cites as 2234. Pallas includes Ellis “*Angl. Bugle Coralline*” at the end of his Sect. β, and this may be taken as the determining factor. As his trivial name is not applicable to the larger Bugle Coralline, it may be used for the smaller form. The adoption of *C. salicornioides* for this species would be open to some uncertainty, as though Lamouroux also had a slender species in view, the locality, presumably of specimens in his own collection, is given as Mediterranean. This suggests the possibility that his specimen, if it exists, may prove to belong to *C. (Nellia) johnsoni*, Busk (1858, Q. J. M. S. vi. p. 125), the typical locality of which is Madeira, and not to *C. fistulosa*, auctt.

Cellarina, Van Beneden, 1848, Bull. Acad. Roy. Belg. xv. 1, p. 70.—Genosyntypes, *C. gracilis* and *C. scabra*, Van Ben., n. spp., and *Crisia delilii*, Audouin, 1826, p. 242. Norman (1903, A. M. N. H. (7) xi. p. 579), who had examined a fragment of Van Beneden’s type-specimen of the first species, described it as

Menipea gracilis, but admitted its identity with *Cellularia ternata*, forma *gracilis*, Smitt (1868, p. 283). Whether *C. gracilis* is to be regarded as a species or as a variety, it clearly belongs to *Tricellaria*, Fleming, 1828; while the other two species are referable to *Scrupocellaria*, Van Beneden, 1845.

Cellarina, D'Orbigny, 1851, P. F. T. C. p. 181; see also 1852, A. S. N. (3) xvi. p. 336.—Genosyntypes, two fossil species. Pre-occupied by *Cellarina*, Van Beneden, 1848.

Cellularia, Pallas, 1766, p. 58.—Genosyntypes, 18 species, referable to about 12 genera. The name has been used by many modern authorities, but in the most various senses, and it has been impossible at present to come to any agreement as to the use which should be made of it. The selection of *C. scruposa* as the genotype, by Verrill (1880, Proc. U.S. Nat. Mus. ii. (1879) p. 190) is invalidated by the fact that this species was already the genotype of *Scrupocellaria*, Van Beneden, 1845. I consider it desirable to suppress *Cellularia* in favour of *Cellaria* (*q. v.*).

Cercaripora, Fischer, 1866, C. R. Acad. Sci. Paris, lxii. p. 987; Nouv. Arch. Mus. Hist. Nat. ii. p. 312.—Genosyntypes, *Anguinaria truncata*, Landsborough, 1852, Hist. Brit. Zooph. p. 288; *Aetea ligulata*, Busk², p. 31; and *Aetea argillacea*, Smitt, 1866, Öfv. K. Vet.-Akad. Förh. xxii. (1865) p. 29. The genus was placed in a different Family from that containing *Aetea*, which Fischer restricted to *Sertularia anguina*, L. (1758, p. 816); but later authors have regarded it as a synonym of *Aetea*, of which this species is the genotype.

Chaperia, Jullien, 1881, Bull. Soc. Zool. France, vi. pp. 163, 164.—Although the author mentions *Membranipora* (*Steganoporella*) *magnilabris*, Busk (1854, Brit. Mus. Cat. ii. p. 62), as belonging to *Chaperia*, the genotype selected by him on p. 164 is *Chaperia australis*, nom. nov., to replace *M. spinosa*, Q. and G., as quoted by Busk (1879, Phil. Trans. vol. 168, p. 195), in describing specimens from Kerguelen. Jullien gives a description of *C. australis*, from specimens obtained at the Cape of Good Hope. But Busk's citation was a mistake, the species described by Quoy and Gaimard (1824, Zool. Voy. Uranie et Physicienne, p. 605) from the Falkland Is. having been named by them *Flustre épineuse*, *Flustra acanthina*; see Waters, 1898, J. L. S. xxvi. p. 673; see also Marcus, 1922, Göteborgs K. Vet.- och Vitt.-Samh. Handl. (4) xxv. p. 6. Jullien's name *australis* was proposed on the ground that *spinosa* was pre-occupied; but if *C. australis* is synonymous with Quoy and Gaimard's species, the name of the genotype should be *Chaperia acanthina* (Q. and G.).

Chartella, Gray, 1848, pp. 104, 145.—Genotype (the only species), *Chartella papyracea* (*Flustra papyracea*, Ellis and Solander, 1786, p. 13).

Chaunosia, Busk, 1867, Q. J. M. S. (n. s.) vii. p. 241.—Genotype (the only species), *Chaunosia hirtissima*, Busk, n. sp. Although Busk expressly marks his species as "n. sp.," he adds that it is not unlikely to be identical with *Diachoris hirtissima*, Heller (1867, Verh. Zool.-Bot. Ges. Wien, xvii. Abhandl. p. 94). Synonym of *Beania*, Johnston, 1840.

Chlidonia, Lamouroux, 1824, p. 192.—Lamouroux states that Savigny's species (see below) appears to be the *Vorticella polyypina* "des auteurs," and the author he had specially in mind may well have been Esper, who uses this name in Th. ii. of the Forsetz. d. Pflanzenth., *Vorticella*, Pl. 1. figs. 1, 2. The text of this part of the "Fortsetzungen" ends with p. 48, and it contains no description of the plate in question. It was published in two Lieferungen, 9 and 10, in 1798 and 1806, respectively. The plate presumably appeared between 1798 and 1810, the date of Esper's death.

The name "Chlidonies" was used by Savigny (Description de l'Égypte), at the foot of his Pl. 13, in which figs. 3¹-3⁵ give admirable representations of what is almost certainly the same species as *Vorticella polyypina*, Esp. Audouin, in his "Explications" (1826, p. 243) of Savigny's plates, did not, however, accept Savigny's name, as he describes the species figured as *Eucratea cordieri*. Lamarck (1816, p. 140) introduced a new name, *Cellaria vesiculosa*, with *Vorticella polyypina*, Esp. as a synonym, but with a query; and Hammer (1829, in Esper, Pflanzenth. iii. Lief. 16, p. 255) uses *Eucratea vesiculosa* in describing Esper's plate. Lamarck's trivial name antedates Audouin's, but Bertoloni (1810, Rar. Ital. Plant., Decas Tertia, p. 112; see also 1819, Amoen. Ital. p. 273) had previously described the same species as *Cellaria pyriformis*, in both papers giving a recognizable description of *Chlidonia*, based on actual specimens. His 1810 synonymy refers to *Vorticella polyypina*, L. (1767, p. 1317), an Infusorian. In 1819 he cited Esper's figures, thereby making his descriptions more intelligible; while by rejecting his earlier synonymy he furnished a justification for the introduction, otherwise invalid, of a new trivial name in 1810.

The genotype thus appears to be *Chlidonia pyriformis* (Bert.), of which the other names indicated above are synonyms. *Chlidonia*, Lamx., 1824, antedates both *Chlidonia*, Hübner, 1825-1826* (Verz. bekannt. Schmetterl. p. 393) and *Chlidonia*, Herrich-Schäffer, 1838 (in Panzer, Deutschl. Insecten, Heft 157), two genera of Insects. *Chlidonias* was introduced by Rafinesque, 1822 (Kentucky Gazette, xxxvi. (8) p. 3), and this name is regarded as valid by Ornithologists. There seems to be no inconvenience in retaining *Chlidonia* for Polyzoa, in spite of its close resemblance to the name of a genus of Birds.

Cinetoscias, von Martens, 1879, Zool. Rec. for 1877, xiv. Molluscoidea, p. 94.—An emendation proposed by von Martens, in recording the introduction of *Kinetoscias* (*q. v.*). Although the name might have been thus spelt it is undesirable to alter the accepted original form.

Columnaria, Levinsen, 1909, p. 116.—Introduced for *Columnaria borealis*, n. sp., and all the species of *Farciminaria* described by Busk (1884, pp. 48-51), except *F. atlantica*. No genotype was selected, but this is of small importance, since the name is pre-occupied, in Anthozoa, by *Columnaria*, Goldfuss, 1826, Petr. German. i. pt. 1, p. 72 (for date of publication see Woodward, vol. ii. p. 692). I prefer not to suggest a new name without making a study of the species involved.

* For the date of publication see Proc. iv. Int. Congr. Zool. (Cambridge, 1898), 1899, p. 299.

- Cornucopina*, Levinsen, 1909, pp. 98, 109.—Levinsen states that this genus includes most of the species of *Bicellaria*, auctt., but the only species he definitely refers to it (pp. 110, 372) are *Bicellaria grandis*, Busk (1852¹, p. 374; 1852², p. 42) and *B. infundibulata*, Busk (1884, p. 33). Of these the latter is exceptional in certain characters, and I think it more convenient to select *Cornucopina grandis* as the genotype.
- Corynoporella*, Hincks, 1888, A. M. N. H. (6) i. p. 215.—Genotype (the only species), *Corynoporella tenuis*, Hincks, n. sp., described as allied to *Bugula*.
- Cothurnicella*, Wyville Thomson, 1858, Nat. Hist. Rev. v., Proc. of Societies, p. 141.—Genotype (the only species), *Cothurnicella dædala*, Wyv. Thoms., n. sp., a synonym of *Cellaria pyriformis*, Bert., the genotype of *Chlidonia*, Lamx., 1824.
- Craspedozoum*, MacGillivray, 1886, Trans. Proc. R. Soc. Vict. xxii. p. 131.—Genosyntypes, *Membranipora roborata*, Hincks (1881, A. M. N. H. (5) viii. p. 128); *C. ligulatum*, *C. spicatum*, MacG., n. spp., and *Flustra membraniporides*, Busk (1884, p. 54). As I regard this genus as a synonym of *Menipea*, Lamx., 1812, it seems unnecessary to select a genotype.
- Crepis*, Jullien, 1882, Bull. Soc. Zool. France, vii. p. 522.—Genotype (the only species), *Crepis longipes*, Jull., n. sp.
- Crisia*, Lamouroux, 1812, p. 183.—Genosyntypes, *Sertularia eburnea*, L. (1758, p. 810), a Cyclostome, and 5 species of Cheilostomes, including *Sertularia ciliata*, L. (1758, p. 815). Under *Eucratea* I suggest ignoring Schweigger's selection of *C. ciliata* as the genotype. If this proposal is accepted, it will be possible to consider that Fleming (1828, p. 540) selected *Crisia eburnea* as the genotype, by including it, with another species not appearing in Lamouroux's original account, in *Crisia* with an amended diagnosis.
- Crisularia*, Gray, 1848, pp. 111, 147.—Genotype (the only species), *Crisularia fastigiata* (*Sertularia fastigiata*, L. 1758, p. 815 = *Cellularia plumosa*, Pallas, 1766, p. 66). Synonym of *Bugula*, Oken, 1815.
- Dendrobeania*, Levinsen, 1909, pp. 99, 113.—Genotype (the only species), *Dendrobeania murrayana* (*Flustra murrayana* (Bean, MSS.), Johnston, 1847, p. 347. Synonym of *Bugula*, Oken, 1815.
- Diachoris*, Busk, 1852¹, p. 381.—Genotype (the only species), *Diachoris crotali*, Busk, n. sp. See also Busk, 1852², p. 54. Synonym of *Beania*, Johnston, 1840.
- Diachoseris*, Ortmann, 1889, Arch. f. Naturg. lvi. i. p. 25.—The name appears to be a misquotation of *Diachoris*, Busk, 1852. The following species are included:—*Diachoris magellanica*, Busk (1852², p. 54), *Diachoseris discodermia*, and *D. hexaceras*, Ortm., n. spp. Synonym of *Beania*, Johnston, 1840.
- Didymia*, Busk, 1852¹, p. 383.—Genotype (the only species), *Didymia simplex*, Bk., n. sp. See also Busk, 1852², p. 35. The genus being pre-occupied, in Hymenoptera, by *Didymia*, Le Peletier and Serville, 1825, Encycl. Méthod. x. (Entomologie), p. 574, I propose to replace it by *Didymozoum*, nom. nov., with the genotype *Didymozoum simplex* (Busk).

Didymozoum, nom. nov.—See *Didymia*.

Dimetopia, Busk, 1852¹, p. 384.—Genosyntypes, *D. spicata* and *D. cornuta*, Busk, n. spp. See also Busk, 1852², p. 35. In 1909 Prof. A. Billard submitted to me a specimen of *Dynamena barbata*, Lamx. (1816, p. 178), from Lamouroux' type-collection at Caen; and I convinced myself that *D. spicata*, Busk, was a synonym of this species (see Billard, C.R. Acad. Sci. Paris, 1909, cxlviii. p. 1064). In the apparent absence of an earlier selection I propose *Dimetopia cornuta* as the genotype. It appears to me preferable to select a species of which good figures were published by Busk, rather than to choose *D. barbata*, the identification of which with *D. spicata* rests merely on my own authority.

Dimorphozoum, Levinsen, 1909, pp. 96, 107.—Genotype (the only species), *Dimorphozoum nobile* (*Flustra nobilis*, Hincks, 1891, A. M. N. H. (6) vii. p. 288).

Diplodidymia, Reuss, 1869, Sitzb. Akad. Wiss. math.-nat. Cl. lix. i. Abth. p. 468.—Genotype (the only species), *Diplodidymia complicata*, Reuss, n. sp. Synonym of *Poricellaria*, D'Orbigny, 1852.

Dittosaria, Busk, 1866, Geol. Mag. iii. p. 301.—Genotype (the only species), *Dittosaria wetherelli*, Busk, n. sp., a fossil, from the London Clay, perhaps allied to *Sertularia loricata*, L., the genotype of *Eucratea* (*q. v.*).

Emma, Gray, 1843, p. 293.—Genotype (the only species), *Emma crystallina*, Gray, n. sp. Gray gave no generic diagnosis, but this was done by Busk, 1852¹, p. 372, and 1852², p. 27.

Epistomia, Fleming, 1828, p. 541.—Genotype, selected by the author, *Epistomia bursaria* (*Sertularia bursaria*, L., 1758, p. 814). See Gregory, 1893, Trans. Zool. Soc. xiii. p. 227. See also *Notamia*.

Erina, Canu, 1908, Ann. Mus. Nac. Buenos Aires (3) x. p. 273.—Genotype, selected by the author, *Erina patagonica*, Canu, n. sp., placed in Meliceritidæ. Pre-occupied by *Erina*, Swainson, 1833, Zool. Illustr. (2) iii. pl. 134 (Lepidoptera).

Eucratea, Lamouroux, 1812, p. 183.—Genosyntypes, *Cellaria cornuta* (*Sertularia cornuta*, L., 1758, p. 810) and *C. loricata* (*Sertularia loricata*, L., 1758, p. 815). In the same Memoir Lamouroux introduced the genus *Crisia* (*q. v.*). Each of these genera included one species, *S. cornuta* and *S. eburnea* respectively, belonging to *Crisia* as universally understood at the present time. It is unfortunate that Schweigger (1819, Tab. 8; 1820, p. 429) indicated *S. cornuta* as the genotype of *Eucratea*, and *S. ciliata* as the genotype of *Crisia*; both of Lamouroux' genera being regarded by him as subgenera of *Cellularia*. By adopting these selections *Bicellaria*, auctt., would become a synonym of *Crisia*, and *Crisia*, auctt., of *Eucratea*. These alterations would be so inconvenient and confusing that I feel justified in suggesting that Schweigger's selections should be ignored. If *Crisia* is to be maintained, its genotype must be *Crisia eburnea* (Linn.), and *S. cornuta* will fall within the same genus; *Eucratea loricata* (Linn.) thus remaining as the genotype of *Eucratea*. *S. chelata*, L. (1758, p. 816), which has usually been regarded as the genotype of *Eucratea*, has no claim to this position, as it was not included in *Eucratea* by Lamouroux until 1816 (p. 149).

Eucrateria, Fleming, 1828, p. 541.—Used by mistake for *Eucratea* (*q. v.*).

*Euoplozoum**, n. gen.—Genotype, *Euoplozoum cirratum* (*Cellularia cirrata*, Busk, 1884, p. 17).

Zoarium erect, attached by a basal tuft of rootlets. Branches biserial, the zoecia large and obliquely alternating, all facing in the same direction, their proximal portions narrow, their distal portions expanded, the frontal membrane occupying the entire surface of the expanded portion. Basal walls of zoecia strongly convex. Branches traversed by oblique joints, each zoecium being crossed by one joint near its proximal end and by another at the commencement of its expanded portion. Avicularia of two kinds, the smaller at the distal outer border of the zoecium, and a very large kind (present on only a few of the zoecia) arising from the inner border. Strong flexor zoecii muscles present, by which the branches are inflected. Ovicells very large. Bifurcation of type 6 (Pl. 16. fig. 6).

It can hardly be doubted that this very remarkable species, which was placed by Busk in a heterogeneous assemblage referred to *Cellularia*, deserves recognition as the type of a new genus. It was described recently, by the late Miss Alice Robertson (1921, Rec. Ind. Mus. xxii. p. 39), as *Kinetoskias arabianensis*, Roberts., n. sp.

Euthyris, Hincks, 1882, A. M. N. H. (5) x. p. 164.—Genosyntypes, *E. obtecta*, Hincks, n. sp., *Flustra bombycina*, Ellis and Solander (1786, p. 14) and *Carbasea episcopalis*, Busk (1852², p. 52). *C. episcopalis* is the genotype of *Euthyroides*, Harmer, 1902. *F. bombycina* Ell. and Sol. (*nec* Busk; see *Onchoporella*), which appears to be at present unrecognizable, is the genotype of *Semiflustra*, D'Orbigny, 1852. *Euthyris obtecta* is thus left as the genotype of *Euthyris*, but if *F. bombycina* could be recognized it would probably become necessary to regard *Euthyris* as a synonym of *Semiflustra* (*q. v.*).

Euthyroides, Harmer, 1902, Q. J. M. S. xlvi. p. 280.—Genotype, selected by the author, *Euthyroides episcopalis* (*Carbasea episcopalis*, Busk, 1852², p. 52).

Falcaria, Oken, 1815, p. 91.—Genosyntypes, *Cellularia falcata* (Pallas, 1766, p. 76), *s. cornuta* (*Sertularia cornuta*, L., 1758, p. 810), *C. eburnea* (*S. eburnea*, L., 1758, p. 810) and *C. anguina* (*S. anguina*, L., 1758, p. 816); the first two referable to *Crisia*, and the third to *Aetea*, two genera introduced by Lamouroux in 1812. Gray (1848, p. 136) selected *Falcaria cornuta* as the genotype. Synonym of *Crisia*, Lamx., 1812, and pre-occupied in Lepidoptera by *Falcaria*, Haworth, 1809, Lepid. Britann. p. 152; for date of publication of which see Woodward, vol. ii. p. 804.

Farcimia, Fleming, 1828, p. 534.—Genotype (the only species), *Farcimia fistulosa* (*Eschara fistulosa*, L., 1758, p. 804). There is no justification for including *Nellia oculata*, Busk (see *Nellia*) in this genus, as has been done by Waters (1887, A. M. N. H. (5) xx. p. 92) and others. Synonym of *Cellaria*, Ell. and Sol. 1786.

* εὖοπλος, well armed.

Farciminaria, Busk, 1852², p. 32.—Genotype (the only species), *Farciminaria aculeata*, Busk, n. sp.

Filicella, Searles Wood, 1844, A. M. N. H. xiii. p. 15.—Genotype (the only species), *Filicella anguinea*, S. Wood, n. sp., a Crag species, possibly the adnate part of a species of *Aetea*.

Fistulana, O. F. Müller, 1776, Zool. Dan. Prodr. p. 282.—In his *Corrigenda* (p. 282), Müller states that *Fistularia*, introduced in the same work, is to be changed to *Fistulana*, a course which was probably adopted because *Fistularia* was pre-occupied, in Pisces, by a Linnean genus (1758, p. 312) of the same name. *Fistularia* was introduced by Müller, without figures, on p. 254, with the genosyntypes *F. ramosa* (*Tubularia ramosa*, L., 1758, p. 804; 1767, p. 1302), *F. muscoides* (*T. muscoides*, L., 1767, p. 1302), *F. simplex*, *F. longicornis* and *F. multicornis*, Müll., n. spp. In 1780, Fabricius (Fauna Groenl. p. 441) uses *Fistulana* for *F. ramosa* and *F. muscoides*, quoting the diagnoses of Müller *verbatim*, in words identical with those of Linnæus, 1767. In 1789, Abildgaard (in Müller, Zool. Dan. iii. p. 15) describes and figures *F. multicornis*, quoting Müller's diagnosis, with additions.

Of Müller's species, the first two are Hydroids, while the diagnosis of *F. longicornis* suggests a Polychæte (Spionid). *F. simplex* may be a Ctenostome Polyzoon, while it seems probable, from Abildgaard's description and figures (pl. 90. figs. 1-3) that *F. multicornis* was also one of the Polyzoa. Smitt (1868, pp. 279, 280) suggests that it might be identical with *Aetea truncata*, Landsborough (see *Cercaripora*), but he points out, as an objection to this conclusion, that Müller had described the tentacles as 30 in number. This is not quite correct, as Müller described them as being "ultra viginti," and it was Abildgaard who stated that they were "ad triginta." In an earlier paper Smitt (1865, Öfv. K. Vet.-Akad. Förh. xxii. (1865), p. 13, pl. 3. fig. 4) had shown that *Aetea truncata* has 12 tentacles, and on this ground I think that *F. multicornis* cannot have been that species. Abildgaard's figures seem more likely to have been taken from a species of *Nolella*, Gosse (*Cylindroëcium*, auctt.; see Harmer, 1915, Siboga Rep. Polyzoa, i. p. 52). *Fistulana* should be disregarded for Polyzoa. The same name was introduced in other groups by Bruguière (1789) and Lamarck (1799); see Sherborn, Index Animalium, i. 1902.

Fistularia, O. F. Müller, 1776, p. 254.—See *Fistulana*.

Flabellaria, Gray, 1848, pp. 106, 146.—Genosyntypes, *Sertularia spiralis*, Olivi, 1792 (Zool. Adriat. p. 291, pl. 6. figs. 2, a, A) and *Flustra setacea*, Fleming, 1828 (p. 536), referable to *Caberea*. *Bugula murrayana* was given as a synonym of Olivi's species; but the occurrence of this northern form in the Adriatic seems to be very unlikely, and Olivi's species ought probably to be placed elsewhere in *Bugula*. Gray's genus thus appears to be unnecessary. It may be remarked that *Flabellaria*, Lamarck, 1816, p. 342, is used for certain calcareous Algæ.

Flabellaris, Waters, 1898, J. L. S. xxvi. p. 672.—Based on several recent species, but with no clear indication which of them are to be included. *Menipea flabellum* (on which the generic name is obviously founded) is specially mentioned; and a description is given of *Membranipora roborata*, Hincks (1881, A. M. N. H. (5) viii. p. 128), which is referred to the genus. One of these two species might be selected as the genotype, but it seems unnecessary to do so, since the species mentioned on pp. 672, 673 of Waters' paper, in addition to those referred to by him, as given in one of his earlier papers (1897, J. L. S. xxvi. p. 2), can all be placed in other genera which antedate *Flabellaris*.

Flabellina, Levinsen, 1902, Vid. Medd. naturh. Foren. Copenhagen, p. 21.—An emendation of *Flabellaris*, Waters, perhaps suggested because of the resemblance of this name to *Flabellaria*, Gray, 1848. The only species mentioned is *Flabellina roborata* (Hincks), 1881 (see *Flabellaris*); but the name is pre-occupied by *Flabellina*, Voigt, 1834, Das Thierreich, iii. p. 124, used for a Nudibranchiate Mollusc.

Flustra, Linnæus, 1761, Fauna Svecica, p. 539.—The history of this name has been given by Lang (1917, Geol. Mag., Dec. vi, vol. iv. p. 170), who shows that Linnæus deliberately altered his own genus *Eschara* (1758, p. 804) to *Flustra*, and that *Flustra foliacea*, Linn. (*Eschara foliacea*, 1758, p. 804) is the genotype of both genera. Although this course is not admissible under the Rules, I fully agree with Dr. Lang that it is in the highest degree desirable to suppress *Eschara* and to use *Flustra* in its accepted sense. It may be noted that Lamarck (1801, Syst. An. s. Vert. p. 383) accepted *Flustra*, with the genotype *Flustra foliacea*, L.

Gemellaria, Van Beneden, 1845, Nouv. Mém. Acad. Roy. Brux. xviii. p. 9.—Based on Savigny's name "Gémellaires," appearing at the foot of pl. xiii (referring to figs. 4¹–4⁵) of the "Description de l'Égypte." Savigny's species was described by Audouin (1826, p. 243) as *Loricaria ægyptiaca*, without reference to the fact that *Loricaria* was used for a Fish by Linnæus (1758, p. 307), as pointed out by Fleming (1828, p. 541). Lamouroux (1827, p. 434) mentions *Gemellaria*, without any associated trivial name, but only to state that it is referable to *Loricaria*. Gregory (1893, Trans. Zool. Soc. xiii. p. 227) discusses the generic name, but de Blainville (1830, p. 425; see also 1834, p. 461), whom he quotes as the first author to mention the genus in a correct form, merely places *Gemellaria loriculata* in his synonymy of *Gemicellaria loriculata*, ascribing the combination wrongly to Savigny. The first use of the generic name which is completely in order appears to be that of Van Beneden, 1845, who describes *Gemellaria loriculata* (*Cellularia loriculata*, Pallas, 1766, p. 64 = *Sertularia loricata*, L., 1758, p. 815); and in this sense the genus has been used by the majority of recent writers. *Gemellaria* thus becomes a synonym of *Eucratea* (*q. v.*). It is in any case desirable that it should drop out of use, since it is based on Savigny's "Gémellaires," and the species figured by this author is not congeneric with *S. loricata*, L. (See *Synnotum*.)

Gemicellaria, de Blainville, 1830, p. 425; see also 1834, p. 460.—Genosyntypes, *Gemicellaria loriculata* (see *Gemellaria*), among the synonyms of which

appears "*Gemellaria loriculata*, Savigny," a combination which was used neither by Savigny nor by Audouin; and *G. bursaria* (*Sertularia bursaria*, L., 1758, p. 814). These two species are respectively the genotypes of *Eucratea*, Lamx. 1812, and *Epistomia*, Fleming, 1828. *Gemicellaria*, which was an alteration of the genus proposed by Savigny, "sous le nom de *Gemellaria*" (really "Gémellaires"), thus becomes synonymous with two genera of earlier introduction.

Halophila, Gray, 1843, p. 292.—Genotype (the only species), *Halophila johnstonæ*, Gray, n. sp. (thus written, although frequently modified later, even by Gray himself, to *johnstonia*). If this species is referred to *Bugula*, as I think is proper, *Halophila* becomes a synonym of that genus.

Heterocella, Canu, 1907, Ann. Paléont. ii. p. 70 (sep. p. 14).—Genotype, selected by the author, *Heterocella fragilis* (*Vincularia fragilis*, DeFrance, 1829, Dict. Sci. Nat. lviii. p. 214). See also de Blainville, 1834, p. 454.

Heteroflustra, Levinsen, 1909, pp. 124, 125.—A very unsatisfactory genus, proposed for those species of *Flustra*, auctt., which have not been placed in other genera, and "must provisionally be characterized mainly in a negative way." This appears to mean that all species not belonging to *Flustra* (*s. str.*), *Sarsiflustra*, *Kenella*, *Retiflustra*, and *Spiralaria* (genera recognized by Levinsen, p. 88), together with other genera such as *Carbasea*, *Chartella*, etc. (not considered by him), are to be placed in this provisional genus, which has no validity until it is more definitely characterized.

Hiantopora, MacGillivray, 1887, Tr. Proc. R. Soc. Vict. xxiii. p. 208.—Genotype (the only species), *Hiantopora ferox* (*Lepralia ferox*, MacGillivray, 1869, *Ibid.* ix. p. 132).

*Himantozoum**, n. gen.—Genotype, *Himantozoum mirabile* (*Bugula mirabilis*, Busk, 1881, Q. J. M. S. xxi. p. 12; 1884, p. 39).

I propose this genus for Sect. *a* of *Bugula*, as given by Busk, 1884, p. 37, with the following diagnosis:—

Zoarium stalked, the stalk composed of rootlets and prolonged into an attaching tuft of rootlets. Zoœcia biserial to multiserial, the biserial branches composed of asymmetrical zoœcia, between which are intercalated, in the pluriserial branches, one or more rows of median zoœcia, which are symmetrical and some of which produce eggs. The ovicells are vestigial, and the egg, which is of large size, develops in the body-cavity of the fertile zoœcium. Opesia occupying all or most of the front, an operculum being distinguishable. Zoœcia overlapping their predecessors on the basal surface, their proximal ends strongly forked. Avicularia unstalked, attached to the proximal ends of the zoœcia, those of the lateral and median rows more or less unlike.

The differentiation of median, symmetrical, fertile zoœcia, as well as the characters of the avicularia, are striking features of this genus. In addition to the genotype, the following species may be included:—*Bugula leontodon*, Busk (1884, p. 39), *B. sinuosa*, Busk (1884, p. 39), *B. margaritifera*, Busk

* *ipás*, a strap, in allusion to the strap-shaped branches.

(1884, p. 41) and *B. sinuosa*, Busk, var. *variabilis*, Kluge (1914, p. 632). Most of the species are from abyssal depths, the shallowest record being that of Busk, 80–150 fathoms, for *B. sinuosa*.

The statements in the diagnosis referring to the eggs are based on the examination of Siboga material. *B. versicolor*, a member of Busk's Sect. a (1884, pp. 37, 38), differs from the other three species in certain points which appear to be important, and I do not feel justified in placing it in *Himantozoum*, although I am unable to make any other suggestion. The most important of its characters are the large endozoöcial ovicells, the unforked proximal ends of the zoöcia, which barely overlap their predecessors, and the absence of avicularia.

Hoplitella, Levinsen, 1909, pp. 135, 136.—Genotype (the only species), *Hoplitella armata* (*Carbasea armata*, Busk, 1852², p. 50).

Huxleya, Dyster, 1858, Q. J. M. S. vi. p. 260.—Genotype (the only species), *Huxleya fragilis*, Dyst., n. sp.

Jubella, Jullien, 1882, Bull. Soc. Zool. France, vii. p. 519.—Genotype (the only species), *Jubella enucleata*, Jull., n. sp., described as being near *Caberea*, but differing from it by the absence of vibracula.

Kenella, Levinsen, 1909, p. 124.—Genotype (the only species), *Kenella biseriata* (*Flustra biseriata*, Busk, 1884, p. 54).

Kinetoskias, Danielssen, 1868, Forh. Vid.-Selsk. Christiania, Aar 1867, p. 23.—Genosyntypes, *K. arborescens* and *K. smithi*, Dan., n. spp. In their detailed account, Koren and Danielssen (1877, Faun. Litt. Norv. Pt. 3, pp. 104, 109) describe the same two species, the latter as *K. smittii*, but without comment on the altered spelling. There can be no doubt that this species was named after Prof. Smitt, and the form *smithi* should be considered a printer's error. *K. arborescens* is not a completely typical member of the genus, as the stalk is very short and the avicularia are more *Bugula*-like than usual. I propose accordingly to regard *Kinetoskias smittii* as the genotype.

Loricaria, Lamouroux, 1821, p. 7.—Genosyntypes, *L. europæa* and *L. americana*, Lamx., n. spp., both synonymous with *Eucratea loricata*, L. (*q. v.*). Pre-occupied by *Loricaria*, L. (Pisces), as pointed out by Fleming, 1828, p. 541. See *Gemellaria* and *Eucratea*.

Loricula, Templeton, 1836, Loudon's Mag. Nat. Hist. ix. p. 469.—This genus is usually attributed to Cuvier, who used it (1830, Règne An. Nouv. Éd. iii. p. 303) merely as "Les Loricules," proposing it for *Sertularia loricata*, L. (1758, p. 815), on the ground that "Loricaires" Lamx. (see *Loricaria*) was pre-occupied for Fishes. The genus was used in a correct form by Templeton, for *Loricula loricata*; and, later, by Voigt, 1843, Das Thierreich, vi. p. 248, in the same combination. It is synonymous with *Eucratea*, Lamx. 1812, with the same genotype, but it is pre-occupied by *Loricula*, Curtis, 1833, Ent. Mag. i. p. 197, for Hemiptera.

Maplestonia, MacGillivray, 1885, Tr. Proc. R. Soc. Vict. xxi. p. 92.—Genotype (the only species), *Maplestonia cirrata*, MacG., n. sp.

Melicerita.—The introduction of this genus by Milne Edwards (1836, A. S. N. Zool. (2) vi. p. 347), with only one species given merely as “Mélécérîte de Charlesworth,” was not strictly in order. Searles Wood (1844; see *Ulidium*) quotes this as *Melicerita charlesworthii*, which was thus regularized, and became the genotype. His simultaneous introduction of *Ulidium*, with the same genotype, was unnecessary. In the A. S. N. (3) xvii., dated 1852, but probably published later, D’Orbigny refers to the species as *M. charlesvorthii*.

Melicertina, Ehrenberg, 1839, Phys. Abh. Akad. Wiss. Berlin, J. 1838, Tab. ii.—Proposed to replace *Melicerita*, which “ist nicht sprachgemäss.” This emendation need not be accepted.

Membranicellaria, Levinsen, 1902, Vid. Medd. naturh. Foren. Copenhagen, 1902, p. 22 n.—Introduced for *Melicerita dubia*, Busk (1884, p. 97) and a number of Cretaceous species, which are indicated. Genotype, now selected, *Membranicellaria dubia* (*Melicerita dubia*, Busk). Levinsen subsequently (1909, p. 207) described *M. dubia*, from part of Busk’s original material, but he gives *M. dubia*, Busk, as a doubtful synonym. His reason for inserting a query is not apparent, but if it should prove that two species were included in Busk’s material the form described by Busk would be the genotype, as no other was indicated in Levinsen’s original account.

Menipea, Lamouroux, 1812, p. 183.—Genosyntypes, *Cellaria cirrata*, Ellis and Solander (1786, p. 29), quoted by Lamouroux as *cirrhata*, and *C. flabellum*, Ell. and Sol. (1786, p. 28). Genoelectotype, *Menipea cirrata*; see Schweigger, 1819, Tab. 8; 1820, p. 428. The reasons given by Marcus (1922, p. 11) for regarding *M. cirrata* as a synonym of *Cellularia crispa*, Pallas (1766, p. 71) seem to me sufficient. Pallas gave the locality as “Oceanus Orientalis,” but on p. 72 he states that it was found with a *Fucus* qualified by the adjective “capensis,” which presumably meant the Cape of Good Hope, as explicitly stated in the German Edition (1787, i. p. 107) of Pallas’ work. Seba’s figure (Thesaurus, iii. Pl. 101, No. 8) is hardly demonstrative, as it is stated to be by Marcus, but it may have referred to the species which was later described by Pallas, who gives this reference. The correct name of the genotype appears to be *Menipea crispa* (Pall.). Waters’ selection (1897, J. L. S. xxvi. p. 2) of *M. buskii*, Wyv. Thoms. (see under *Emma*, in Sect. V.) is obviously invalidated by the fact that this species was not included by Lamouroux.

Mononota, Pieper, 1881.—See *Synnotum*.

Monsella, Canu, 1900, Bull. Soc. Géol. France (3) xxviii. p. 437.—Genotype, selected by the author, *Monsella eocena* (*Planicellaria eocena*, Meunier and Pergens, 1886, “Les Bryozoaires du Système Montien (Éocène Inférieur),” Louvain, privately printed, p. 7). Canu gives figures of this species, copied from Meunier and Pergens.

Naresia, Wyville Thomson, 1873, Nature, vii. p. 388; see also Humbert, 1874, J. de Zool. iii. p. 134 and Wyville Thomson, 1877, “The Voyage of the

Challenger," "The Atlantic," i. pp. 144, 142, 193, fig. on p. 143.—Genotype (the only species), *Naresia cyathus*, Wyv. Thoms., n. sp. Synonym of *Kinetoskias*, Danielssen, 1868.

Nellia, Busk, 1852², p. 18.—Genosyntypes, *Nellia oculata*, Busk, nom. nov. (*Salicornaria dichotoma*, Busk, 1852¹, p. 367, nec *S. dichotoma*, Schweigger, 1819, Tab. 8; 1820, p. 428) and *N. simplex*, Busk, nom. nov. 1852², p. 19 (*S. marginata*, Busk, 1852¹, p. 367). Genoelectotype, *Nellia oculata*; see Canu, 1900, Bull. Soc. Géol. France (3) xxviii. p. 382. It seems moderately certain that *N. oculata* is a synonym of *Cellaria tenella*, Lamarck, 1816, p. 135; and the correct name of the genotype would thus be *Nellia tenella* (Lamk.).

Notamia, Fleming, 1828, p. 541.—Proposed, to replace *Loricaria* (*q. v.*), pre-occupied, for *Cellularia loriculata*, Pallas (1766, p. 64) (*Sertularia loricata*, L., 1758, p. 815) and *S. bursaria*, L. (1758, p. 814), but immediately qualified by the statement that *N. bursaria* is the type of a new genus, *Epistomia* (*q. v.*). The genotype is thus *Notamia loricata*, and the genus becomes a synonym of *Eucratea*, Lamx. 1812 (*q. v.*). The loss of *Notamia*, in Polyzoa, would in any case have been inevitable, as the name was pre-occupied by *Notamia*, Rafinesque (1819, J. de Physique, etc., lxxxix. p. 153), introduced for a species described as a "Polype" and also as belonging to the Fam. Sipunculidæ, but with a terminal anus. See also *Gemellaria*.

Notoplites, n. gen.—See p. 348.

Onchoporella, Busk, 1884, p. 103.—Genotype, *Carbacea bombycina*, Busk, 1852², p. 52. Busk's species was not identical with *Flustra bombycina*, Ell. and Sol. (see *Euthyris*), and it thus appears necessary to propose a new name for *C. bombycina*, Busk. I suggest, therefore, that the genotype should be known as *Onchoporella buskii*, n. sp. I consider that Busk indicated his own *C. bombycina* as the genotype, by placing it alone under the generic heading, although he stated in a footnote (p. 104) that *Scruparia diaphana*, Busk, is a second species of *Onchoporella*. He here made a curious mistake, as it appears, on consulting the reference he gives (1860, Q. J. M. S. viii. p. 281, pl. 31. fig. 1), that he was deceived by the fact that fig. 1 does not occur as the first species on the Plate. It is clear, from the description and figures, that Busk meant to refer to fig. 2, which comes first on the Plate, and that the second species he intended to place in *Onchoporella* was *Carbacea ligulata*, described by him on p. 282 of his 1860 paper.

Ornithopora, D'Orbigny, 1852, A. S. N. (3) xvi. p. 312; 1852, P. F. T. C. p. 321.—Genotype (the only species), *Ornithopora avicularia* (*Sertularia avicularia* (*pars*), L., 1758, p. 809; *Cellularia avicularia*, Pallas, 1766, p. 68). This species is also the genotype of *Bugulina*, Gray, 1848; and the genus is a synonym of *Bugula*, Oken, 1815.

Ornithoporina, D'Orbigny, 1852, A. S. N. (3) xvi. pp. 312, 313 (*Ornithoorina*, errorim, on p. 312); 1852, P. F. T. C. p. 322.—In the A. S. N. D'Orbigny mentions only one species, *O. avicularia*, which should accordingly be regarded as the genotype. His citation of Ellis (1756, French Ed., p. 119, pl. 38. fig. 7) shows, however, that the species intended was probably *Avicularia*

flabellata, Gray, 1848, p. 106 (see *Avicularia*); and the correct name of the genotype is thus *Ornithoporina flabellata* (Thomps., MSS.) (Gray). In the second work cited D'Orbigny includes two other species as well. Synonym of *Avicularia*, Gray, 1848 (with the same genotype) and of *Bugula*, Oken, 1815.

Petalostegus, Levinsen, 1909, pp. 97, 114.—Genotype (the only species), *Petalostegus bicornis* (*Catenaria bicornis*, Busk, 1884, p. 14).

Planicellaria, D'Orbigny, 1852, A. S. N. (3) xvi. pp. 333, 338; P. F. T. C. pp. 26, 36, 181.—Genosyntypes, *P. oculata* and *P. fenestrata*, two fossil species, apparently belonging to different genera.

Poricellaria, D'Orbigny, 1852, A. S. N. (3) xvi. p. 338; 1854, P. F. T. C. p. 1106.—Genotype, selected by the author, *Poricellaria alata*, D'Orb., n. sp. Canu, 1907, Ann. Paléont. ii. p. 142 (sep. p. 38) regards *Diplodidymia*, Reuss, 1869, as a synonym of this genus; and he describes and figures a specimen which he refers to *D. alata* (D'Orb.).

Retiflustra, Levinson, 1909, pp. 124, 125, 414.—Genosyntypes, *R. schönau*, Lev., n. sp., *Carbasea cribriformis*, Busk, 1852², p. 51 (*Retepora cornea*, Busk, 1852¹, p. 380) and *Flustra reticulum*, Hincks, 1882, A. M. N. H. (5) x. p. 163. Genotype, now selected, *Retiflustra cornea* (Busk).

Rhabdozoum, Hincks, 1882, A. M. N. H. (5) x. p. 160.—Genotype (the only species), *Rhabdozoum wilsoni*, Hincks, n. sp.

Sacchohydra, Billard, 1914, 2^e Exp. Antarct. Franç., Hydroïdes, p. 5.—Genotype (the only species), *Sacchohydra problematica*, Billard, n. sp. Prof. Billard recently wrote to me informing me that he had ascertained this genus, described as a Hydroid, to be a synonym of *Barentsia*. There is no doubt, from his figures, that this conclusion is correct, and that *Sacchohydra* is to be regarded as one of the Entoprocta, and as a synonym of *Barentsia*, Hincks, 1880, A. M. N. H. (5) vi. p. 285. I publish this note at Prof. Billard's request.

Salicornaria, Schweigger, 1819, Tab. 8; 1820, p. 428.—This genus is usually attributed to Cuvier, 1817 (Règne An. iv. p. 75), who introduced it, in the form "Salicorniaires," for *Cellularia salicornia* (Pallas, 1866, p. 61), and three other species referable to *Tubucellaria* and *Menipea*. Schweigger seems to have been the first to use the form *Salicornaria*, while he may be considered to have selected the genotype by including only one species, *S. dichotoma* (*Cellularia salicornia*, Pall.). If *Cellaria* (*q. v.*) is accepted, *Salicornaria* becomes a synonym of that genus.

Salicornia, de Blainville, 1830, p. 419; see also 1834, p. 455.—De Blainville gives this as *Salicornia*, Cuv., although Cuvier did not use it in this form, and he includes two species, *Cellularia salicornia*, Pall. (see *Salicornaria*) and *Cellaria salicornioides*, Lamouroux (1816, p. 127, but not in Cuvier's list). *Salicornia* is merely another form of *Salicornaria*.

Salicorniaria, Schinz, 1825, Das Thierreich, iv. p. 155.—Another variant of the same name, the species included being those of Cuvier's original list (see *Salicornaria*), with some additional synonyms. The genus is used in the same form by Templeton (1836, Loudon's Mag. Nat. Hist. ix. p. 469).

- Salpingia*, Coppin, 1848, A. M. N. H. (2) ii. p. 273; see also Gray, 1848, p. 149.—Genotype (the only species), *Salpingia hassallii*, Copp., n. sp. Synonym of *Aetea*, Lamouroux, 1812.
- Sarsiflustra*, Jullien and Calvet, 1903, Rés. Camp. Sci. Prince de Monaco, xxiii. pp. 43, 126.—Genotype (the only species), *Sarsiflustra abyssicola* (*Flustra abyssicola* (M. Sars, MSS.), G. O. Sars, 1872, Christiania Univ. Progr. 1st half-year, 1869, p. 19).
- Scruparia*, Oken, 1815, p. 90.—Based on 9 species, one of which (*Cellularia repens*, presumably = *Sertularia repens*, Ellis and Solander, 1786, p. 52) is a Hydroid. The others are Polyzoa, corresponding with four modern genera. The first species mentioned, and the only one in which a trivial name is definitely associated with *Scruparia*, is *Scruparia chelata* (*Sertularia chelata*, L., 1758, p. 816). This was the only species included in *Scruparia* (*errore*), Gray, 1848, p. 132, and in *Scruparia*, Busk, 1852², p. 28; in the latter case with a new diagnosis. *Scruparia chelata* should thus be regarded as the genotype. Hincks' later proposal (1880, p. 21) to make his own *S. clavata* the genotype is inadmissible, as this species is not included in Oken's original list. Verrill, 1880 (Proc. U. S. Nat. Mus. ii. 1879, p. 190) chose *S. reptans* [*Scrupocellaria*] as the genotype, but although in Oken's list, this species has no claims if those of *S. chelata* are established.
- Scrupocellaria*, Van Beneden, 1845, Nouv. Mém. Acad. Roy. Brux. xviii. p. 26.—Genotype (the only species), *Scrupocellaria scruposa* (*Sertularia scruposa*, L., 1758, p. 815).
- Scuparia*, Gray, 1848, p. 132.—This seems to have been a misquotation of *Scruparia* (*q. v.*).
- Scupocellaria*, Gray, 1848, p. 111.—A similar mistake for *Scrupocellaria* (*q. v.*).
- Selbia*, Gray, 1843, p. 292.—Genotype (the only species), *Selbia zelandica*, Gray, n. sp. Busk (1852², pp. 37, 38) cites Gray's species as a synonym of *Caberea* (*Crisia*) *borji*, Audouin (1826, p. 242); and even if not identical with Audouin's species, *Selbia*, of which no generic diagnosis was given, must be regarded as a synonym of *Caberea* (*q. v.*).
- Semiflustra*, D'Orbigny, 1852, A. S. N. (3) xvi. p. 317; 1852, P. F. T. C. p. 326.—Genotype, *Semiflustra bombycina* (*Flustra bombycina*, Ellis and Solander, 1786, p. 14), which is the only species mentioned in the "Annales des Sciences Naturelles." In the second work cited two other species are also included. *Carbasea bombycina*, Busk, 1852², p. 52, is a distinct species (see *Onchoporella*). *Euthyris*, Hincks, 1882, A. M. N. H. (5) x. p. 164, may perhaps be regarded as a synonym of *Semiflustra* (see *Euthyris*).
- Spiralaria*, Busk, 1861, Q. J. M. S. (N. S.) i. p. 153.—Genotype, *Spiralaria florea*, Busk, n. sp.
- Spiralis*, Levinsen, 1909, p. 408 (Explanation of Pl. 19. fig. 10 a).—A mistake for *Spiralaria*, as shown by p. 125.

Stirparia, Goldstein, 1880, Q. J. Micr. Soc. Vict. Proc. i. p. 75.—Genotype (the only species), *Stirparia annulata* (*Bicellaria annulata*, Maplestone, 1879, *t. cit.*, p. 19). The generic name is pre-occupied, for Pennatulacea, by Leuckart, 1841, Zool. Bruchstücke, ii. p. 122; and I propose that it be replaced by *Stirpariella* (nom. nov.), with the genotype *Stirpariella annulata* (Mapl.).

Stirpariella, nom. nov.—See *Stirparia*.

Stolonella, Hincks, 1883, A. M. N. H. (5) xi. p. 197.—Genotype (the only species), *Stolonella clausa*, Hincks, n. sp.

Synnota, Pieper, 1881.—See *Synnnotum*.

Synnnotum, Pieper, 1881, Neunte Jahresb. Westfäl. Provinzial-Ver. pro 1880, p. 47.—Pieper suggested the alternative names *Mononota* and *Synnota* for a single new species, *Gemellaria* (?) *avicularis*. *Synnota* was adopted, but amended to *Synnnotum*, presumably on etymological grounds, by Hincks, 1886 (A. M. N. H. (5) xvii. p. 255); and I think this change in spelling may be accepted. Waters (1897, J. L. S. xxvi. p. 15) pointed out that *S. aviculare* is probably a synonym of *Loricaria ægyptiaca*, Audouin, 1826, p. 243; and I have satisfied myself that this conclusion is correct. The name of the genotype should thus be *Synnnotum ægyptiacum* (Aud.). It does not seem to have occurred to other authors that this species cannot be placed in the same genus as *Eucratea loricata* (Linn.). See *Eucratea* and *Gemellaria*.

Ternicellaria, D'Orbigny, 1851, P. F. T. C. pp. 40, 47; see also 1852, A. S. N. (3) xvi. p. 330.—Genotype (the only species), *Ternicellaria aculeata* (*Bicellaria* (*Tricellaria* on pl. 2) *aculeata*, D'Orb., 1839–1846, Voy. Amér. Mérid. v. 4, p. 8). Synonym of *Tricellaria*.

Tricellaria, Fleming, 1828, p. 540.—Genotype (the only species), *Tricellaria ternata* (*Cellaria ternata*, Ellis and Solander, 1786, p. 30).

Ulidium, Searles Wood, 1844, A. M. N. H. xiii. p. 17.—Genotype (the only species), *Ulidium charlesworthii* (*Melicerita charlesworthii*, Milne Edwards). The principal reasons given for its introduction are that *Melicerita* is etymologically incorrect, *Melicertina* is objectionable, and names similar to *Melicerita* have been used in other groups. Synonym of *Melicerita*; see also *Melicertina*.

Unicellaria, de Blainville, 1830, p. 425; see also 1834, p. 461.—Genosyntypes, *Sertularia chelata*, L. (as described by Ellis, 1756, Hist. Nat. Cor. French Ed. p. 57), *S. cornuta*, L., 1758 (p. 810), *Eucratea appendiculata*, Lamouroux, 1821 (p. 8), and *Lafoea lafoyi*, de Blainville, nom. nov. for *Lafoea cornuta*, Lamouroux, 1821 (p. 8). The first of these species is referable to *Scruparia*, Oken, 1815; the second and third to *Crisia*, Lamouroux, 1812; and the fourth appears to be a Hydroid.

Watersia, Levensen, 1909, pp. 94, 99.—Genotype (the only species), *Watersia militaris* (*Flustra militaris*, Waters, 1887, A. M. N. H. (5) xx. p. 93).

III. INTERNAL AVICULARIA.

Levinsen (1909, p. 139, pl. 2. figs. 7*b*, *d*, *e*, *g*, *j*, *k*) has described the occasional replacement of an ordinary frontal avicularium, in *Menipea roborata*, by an avicularium which grows into the body-cavity; and in one of his letters quoted in Sect. V. (p. 336) he refers to the presence of internal avicularia in *M. marionensis*. He makes no comment on this extraordinary occurrence; but however improbable it may seem, both on morphological and on physiological grounds, there is no doubt of the accuracy of the description. I have found these internal avicularia, not only in the two species indicated by Levinsen, but also in certain other species of the same genus.

The internal avicularia of *M. marionensis* are represented in three of my figures. Pl. 19. fig. 44, a basal view, shows one of these structures (*i. av.*) in each of the zoëcia D and E. The avicularium is a more or less cylindrical structure situated on the inner side of the frontal wall, and projecting basally into the body-cavity. The palatal surface is on the basal side, there is a normal beaked rostrum, with which is connected an acute, triangular mandible. The material is not in the best condition, and it has the appearance of having been allowed to dry. The polypides are, however, perfectly recognisable, and there seems to be clear evidence that the mandible opens and closes in the body-cavity, and in actual contact with the tissues of the polypide. The arrangement seems an inconvenient one, and I can suggest no explanation of its purpose. There is no evidence whatever that the avicularium lies in a cavity invaginated from the frontal side, and I cannot escape from the conclusion that the mandible actually moves in the body-cavity. Four of these internal avicularia are shown, in basal view, in Pl. 17. fig. 22, in the zoëcia C, D, E, and K. The base of the cylindrical avicularium, *i. av.* (Pl. 19. fig. 43), is not raised above the general level of the frontal wall, and from it originate the occlusor muscles, which are seen in frontal view, of the mandible. The avicularium has in fact an inverted position, and has been developed on the inner side of the wall of the zoëcium, instead of on its outer side.

The account given by Levinsen of the internal avicularia of *Menipea roborata* is not easy to understand; and a renewed study of these remarkable structures was required. There is no doubt that, as stated by Levinsen, the internal avicularium replaces an ordinary frontal avicularium. I do not find them always present, as he states, when an external avicularium is absent, and I have not found them in the marginal rows. They may usually be found without difficulty in some of the zoëcia of the submarginal rows, and occasionally in other zoëcia further removed from the margin. They seem to be always wanting on the distal side of an ovicell, where two external avicularia are constantly present, directed obliquely distally, and thus reversed

in their direction as compared with the avicularia not related to an ovicell ;— again in accordance with Levinsen's description.

The internal avicularium is longer than would be inferred from Levinsen's account. Its proximal end is in the same position as that of an external avicularium. The side view (Pl. 18. fig. 29) shows, in each of two zoëcia, a pair of avicularia lying side by side. While one of them (*f.av.*) rises normally on the frontal side of the zoëcium, the other (*i.av.*) runs distally and basally below the cryptocyst, the avicularium being long and sub-cylindrical, and terminating in a beaked rostrum, with an opesia subdivided by the projection into it of two calcareous teeth (see Levinsen, pl. 2. fig. 7*k*). In a frontal view (Pl. 18. fig. 30) the distal end of the internal avicularium (*i.av.*) is seen through the opesia, and its proximal end (*p.*) forms a slightly convex calcareous film, which is partly crossed by the triangular proximal end of the cryptocyst (*cr.*). This overgrowth by the cryptocyst does not occur in the external avicularia, which grow frontally from their base.

Levinsen did not discover internal avicularia in *M. ligulata* and *M. spicata*, two species which were associated by MacGillivray with *M. roborata* in his genus *Craspedozoum* (see Sect. II.). I have found them in both these species, as well as in *M. vectifera*, n. sp. (see Sect. V.) and in *M. triseriata*, Busk. Their occurrence in undoubted species of *Menipea* is of special interest, as indicating that *Craspedozoum* should probably be merged in that genus.

The internal avicularia do not seem to be common in *M. ligulata*, but I have found them, as shown in Pl. 18. fig. 33, in one or two zoëcia. They resemble those of *M. roborata*, but they appear to be less asymmetrical in position.

In *M. spicata* (figs. 32, 35) the internal avicularia are considerably smaller than in the other two species. They lie closely attached to one of the lateral walls of the zoëcium, and do not reach its opesia (fig. 35). In side view (fig. 32) they are seen to pass nearly vertically downwards into the body-cavity. The internal avicularia of *M. vectifera* (fig. 36) resemble those of *M. spicata*.

In *M. triseriata* (Pl. 19. figs. 41, 42) the internal avicularium is broad and short, its distal end being just visible, through the opesia, in frontal view (fig. 42). It will be seen from these figures, as well as from one or two of those illustrating other species, that a considerable proportion of the internal avicularia found occur in the more proximal of the two zoëcia formed when a longitudinal row is doubled.

The species in which I have found internal avicularia may all be placed in *Menipea*, *s. str.*, as understood in Sect. V.; and they constitute a definite evidence of affinity in a group of species which can be placed together for other reasons. It seems probable that these remarkable structures will be found in other species of the same genus, though I have failed to find them at present in any but the ones which have been mentioned above.

IV. METHODS OF BIFURCATION OF THE COLONY.

The "Cellularine" series of Cheilostomatous Polyzoa, which takes its name from the genus *Cellularia* (see Sect. II.), consists of numerous genera and species in which the zoëcium has a membranous frontal wall and the colony has an erect, branching habit. The character of the frontal wall places them in Levinsen's Sub-order *Anasca* (1909, p. 91). The Cellularine habit of growth is closely paralleled, however, in members of the Sub-order *Ascophora*, in which the frontal wall is calcareous and a compensation-sac is present (*cf.* Harmer, 1902, ref. on p. 295). The genus *Catenicella* and its allies may be mentioned in this connection; but none of the Ascophorous genera are here considered.

The Anascous branching forms are usually placed, in systematic treatises, near the commencement of the Cheilostomatous series; and it has often been at least tacitly assumed that they represent a low stage in the evolution of the Cheilostomata. This view seems to me erroneous; and the highly evolved nature of this assemblage is indicated by the characters of their heterozoëcia, a term introduced by Levinsen (*Vid. Medd. Naturh. Foren. Copenhagen, 1902, p. 3*) to include the avicularia and vibracula. The avicularium reaches the summit of its development in such Cellularine genera as *Bugula* and *Cornucopina*, while the vibraculum is highly specialized in *Caberea*, belonging to the same assemblage. The assumption that the branching habit is in any sense primitive appears to me fundamentally wrong. It is no doubt true that the Cellularine species are less adapted for preservation as fossils than the encrusting forms; but, making every allowance for this consideration, the Palæontological evidence points to the encrusting habit as the more primitive; and already in the Cretaceous Period, large numbers of encrusting Cheilostomes, of a primitive type in other respects, are known.

Not only are there these reasons for viewing with suspicion the claims of the Cellularine genera to be regarded as representing an early stage in evolution, but the study of their mode of branching leads readily to the conclusion that the erect colony is a lamina which has been more or less subdivided. It may be noticed that the majority of Cellularine species consist entirely of branches having two surfaces sharply differentiated. The basal surface of the branch shows merely the "backs" of the individual zoëcia, all of which have their orifices on the opposite or frontal surface. There is thus no difficulty in regarding the typical Cellularine colony as a unilaminar sheet of zoëcia, divided by more or less radial slits into narrow branches, which in the majority of species are built up of two longitudinal series of zoëcia, alternating on the two sides of the branch. It might appear logical to regard the biserial condition as representing the last stage in this process, and thus to suppose that when biserial and multiserial branches occur in closely related species, the multiserial condition should in all cases

be regarded as the more primitive. I am not sure that this is always the case, and I think it is at least possible that a multiserial branch may in some cases have been derived secondarily from a preceding biserial condition. I do not consider it necessary to discuss this question in the present paper, in which I desire to point out, however, that the extent to which the splitting of the original lamina has taken place differs in various genera and species; and that the study of the actual facts of the bifurcation of the branches may be of great assistance in systematic work. So far as I am aware, there has been no previous comparative account of this subject, although the importance of the mode of branching has not been overlooked by other writers. I may refer especially to the account given by Davenport (1891, Bull. Mus. Comp. Zool. Harvard, xxii. p. 41) of the branching of *Bugula*, and to two papers by Waters (1897, J. Linn. Soc. xxvi. p. 2; 1913, Proc. Zool. Soc. p. 473), dealing with the mode of bifurcation in *Scrupocellaria* and *Menipea*. These papers record important facts, but they do not exhaust the subject. Davenport is concerned with the general laws of branching, and he does not attempt to show how his results can be applied to classification. In his 1913 paper Waters divides *Menipea* into several groups, based on differences in the mode of branching; but I think he has not been altogether successful in his conclusions. Waters (1913) defines a group "C," for instance, which he supposes to include species having a common type of bifurcation; but he places in it *Menipea patagonica* and *Bugulopsis peachii*, two species which, according to my own results, differ essentially in their mode of bifurcation.

In studying the bifurcation, particularly in the Family Scrupocellariidæ, it is necessary to devote special attention to the formation of the chitinous joints with which many species are provided. In the majority of cases, each of the branches is jointed at its base, in such a way that the actual bifurcating point is immediately succeeded by a joint at the origin of each branch. In some cases, only one of the branches is thus jointed; an arrangement which may give rise to a sympodial form of stem, unilateral when the joints all occur on the same side, or bilateral when they are formed alternately on the two sides. The joint is developed in a manner which is remarkably constant in the most diverse members of the calcareous Polyzoa; occurring in fundamentally the same way in Cyclostomata (*Crisia*) and in a variety of Cheilostomata, which seem to have no close connection with one another. The process has been described by various authors, among whom I may mention Waters (1881, Q. J. Geol. Soc. xxxvii. p. 320; 1887, Ann. Mag. Nat. Hist. (5) xx. pp. 89, 92; 1897, J. Linn. Soc. xxvi. p. 2; 1913, Proc. Zool. Soc. p. 472); Pergens (1890, Bull. Soc. Belge Géol. iii. p. 313); and Lomas (1889, Proc. Liverpool Biol. Soc. iii. p. 219). The joint is formed across one or more zoœcia, the calcareous walls of which are at first complete and continuous. A chitinous lining is developed on the inner side of the calcareous wall and in close contact with it (*cf.* Pergens, text-fig. 8, on

p. 314), in the form of a cylindrical tube, rather longer than the future joint, and open at both ends. An annular zone of the calcareous wall is then absorbed, at the middle of the chitinous tube, which is left as the sole connection between the distal part of the zoëcium and the parent-internode. It thus follows that the jointed zoëcium partakes in the formation of two internodes; the greater part of it usually lying in the proximal end of the daughter-internode, while the part on the proximal side of the chitinous joint is immersed in the parent-internode. The polypide commonly passes through the jointed region of the zoëcium, not only in the early stage, before the absorption of the calcareous annulus, but through the chitinous tube even after the completion of the joint, and in fact throughout the whole period of its own life. The proximal segment of the jointed zoëcium has often been described as a "special chamber" of the parent-internode, by authors who have not fully appreciated its morphological significance.

In certain cases, as in species of *Scrupocellaria* and in *Poricellaria* (*Diplo-didymia*), further strength is afforded to the joint by the development of additional tubes of chitin, each formed on the inner side of its predecessor and somewhat longer than it. A considerable number of these tubes may be formed, and the whole chitinous complex thus acquires a considerable thickness, showing at each end a series of rings of diminishing diameter in passing from the outer to the inner surface of the tube. This arrangement, which may be described as a system of tubes "en échelon," is indicated by Claparède (1870, *Zeitschr. wiss. Zool.* xxi. pl. 9. fig. 1 C), and his figure also shows the circular, transverse furrows of the annular thickenings of the calcareous wall with which the edges of the successive chitinous tubes are firmly united. This arrangement, which is most noticeable in the more robust species of *Scrupocellaria*, appears to be a mechanical arrangement admirably adapted to give the greatest strength at the middle of the joint, and to allow the entire stem the flexibility which is required in order to obviate fracture of the delicate branches.

The bifurcation of a biserial branch takes place by the doubling of the number of zoëcia, and generally in such a way that two successive, alternating zoëcia of opposite side of the parent-internode are each followed by two distal successors, instead of by a single successor as in parts where the internode is merely elongating without dividing. For the purpose of comparison I have adopted a uniform notation for the zoëcia concerned in the bifurcation, as may be seen by reference to figs. 1-18. The more proximal of the two zoëcia which prepare the way for the bifurcation is distinguished as A, and the more distal zoëcium, on the other side of the branch, as B. C and D, on the outer sides of the arms of the Y-shaped bifurcation, may be regarded as the direct successors of A and B respectively; and it will be seen that they agree closely with their predecessors in form, differing from them only by diverging from one another to an extent sufficient to allow

two other zoëcia to be intercalated between them. These two zoëcia are denoted E and F; E being derived from A and lying on the inner side of C; and F being derived from B and lying on the inner side of D. E is usually in close relation with the axil of the bifurcation, and for this reason I term it the axillary zoëcium. It may be the proximal inner zoëcium of one of the branches and it is succeeded by G, the second inner zoëcium. F and H are the corresponding members of the other branch.

A careful study of various Cellularine genera, with particular reference to the relations of the zoëcia above enumerated (and in some cases of one or two additional zoëcia) has led me to the conclusion that the mode of bifurcation may be used as an important generic or specific character. I do not overlook the danger of relying exclusively on a single character, but the use I make of the bifurcation seems to be justified by finding that species thus assorted appear, on the evidence of other characters as well, to form natural groups. It appears to me probable that during the evolution of these genera particular methods of bifurcation were adopted at an early stage, and can be recognized, with modifications, in most if not in all of the species which constitute the genera. It must be added that in most of the species here considered the proximal end of the distal zoëcium of a longitudinal row overlaps its predecessor on its basal side. The diagrammatic figures are all representations of basal views, and the distal ends of the zoëcia are thus hidden by the proximal ends of their successors. The zoëcium A always lies to the right of the figure; and, in species in which A and B alternate, A typically lies on that side of the parent-internode which is external in relation to the preceding bifurcation. It thus follows that if the branches E C G and F D H were followed further to the points where new bifurcations occurred, the "A" zoëcium of each of these would be found on the outer side. The right hand bifurcation would be a repetition of the bifurcation actually figured, and the left hand bifurcation would be its looking-glass image, A lying on the left or outer side. *Didymozoum* forms an exception to this rule, as the intercalation of a median ovicell-bearing zoëcium takes place by a division of the inner row of a biserial branch into two rows.

Before bifurcation occurs, the zoëcia of opposite sides of the branch are in lateral contact with one another, and are connected by rosette-plates or communication-pores. In *Bugula* and some of its allies a peculiar modification of this relation is found at the bifurcations (Pl. 16. figs. 3-5). Before becoming completely disjoined, the two branches remain as a rule united with one another by a special communication, formed in the axil by two of the lower members of the branches. The connecting process (*c. p.*) is formed in several different ways, which are remarkably constant within the limits of a species, which may thus be distinguished from others with which it might be confused. In only one or two species I have found, however, that the more proximal bifurcations of a colony may belong to one type, and the more

distal ones to another. This is the case, for instance, in a colony of *Bicellarina alderi*, in which two successive types are represented; but, so far as my observations go, this is exceptional. It is well known, however, that the proximal end of a colony may show characters regarded as juvenile, as compared with the more differentiated distal parts; and even if it should be found that differences in the mode of bifurcation occur at opposite ends of the colony, in other species, it will not, I think, affect the correctness of the statement that each species of *Bugula* has a practically constant method of bifurcation, in its fully developed condition. It may be added, finally, that the arrangement assumed is dependent, in the main, on the extent to which the inner zoëcia remain in lateral contact with one another, or, in other words, on the distance to which the split forming the bifurcation extends towards the zoëcia A and B.

The position of the rootlets, with regard to the bifurcations, has previously been recognized as a character of importance, particularly by Waters (1897, 1913, cited on p. 321). In the series including *Menipea* and its allies, these structures are given off from a pore-chamber which projects into the body-cavity, sometimes on the distal side of the jointed region (fig. 15), and sometimes on its proximal side (figs. 9-11). The difference may appear a slight one, but the general flexibility of the colony must be affected by the position of the rootlets. It seems probable that, when a joint has been evolved, the relation of the rootlets to it would not be easily altered during subsequent modifications of the species. Thus one series of species, represented by *Menipea* and *Notoplites*, may be supposed to have started with their rootlets on the distal sides of the joints, and at the proximal ends of the internodes; and to have retained these relations during their later evolution. *Tricellaria* may be similarly supposed to have originated from a condition in which the rootlets were on the proximal sides of the joints and at the distal ends of the internodes.

Levinsen (1909, p. 132 n.) has stated that vestigial vibracula may be recognized in the pore-chambers of the rootlets of *Tricellaria ternata*. I think this view is correct, and in fig. 11 I have shown structures which admit of this interpretation in *T. peachii*, on the proximal segments of the zoëcia C and D. In *Scrupocellaria* each zoëcium is typically provided with a vibraculum, which lies on the basal surface of the branch, usually near its external border. The vibraculum belongs to the proximal end of the zoëcium, although it is in close relation with the external or marginal avicularium of the preceding zoëcium of the same longitudinal row. The vibraculum is constantly provided, in this genus, with a chamber, cut off by calcareous walls from the cavity which contains its muscles, and this chamber gives origin to a rootlet, in the more proximal members of the colony at least; although in many of the other vibracula the rootlet is merely represented by an oval fenestra in the outer wall of the rootlet-chamber, corresponding exactly with

the fenestra occurring in a vibraculum which actually develops a rootlet. I cannot agree with Levinsen's statement (1909, p. 134) that the rootlet-chamber is not thus cut off in *Scrupocellaria*. In *Tricellaria peachii* (fig. 11) the structure from which the rootlet originates is a chamber cut off by a wall from a more distally placed portion which shows a slight longitudinal groove, apparently representing the rostral groove which receives the seta of a normal vibraculum. I regard the structure in question as a vestigial vibraculum, situated in its proper place at the proximal end of a zoëcium and on its basal surface. The rootlet-chambers thus situated are doubtless the rootlets produced by "a definite dorso-lateral chamber situated just above the lateral avicularium," mentioned by Miss Robertson (1905, Univ. California Publ., Zool. ii. p. 250) in "*Menipea*" (*Tricellaria*). As pointed out by the same author, the rootlets given off by these chambers may pass distally and form the tendril-like structures known to occur in *Tricellaria*. The tendrils are not always formed in this way, however; as I find that in *Emma tricellata*, Busk, one of these structures may replace a branch at a bifurcation. I believe this to occur by the suppression of the proximal segment of F or G at a bifurcation, as in fig. 13, and by the hypertrophy of the chitinous tube which would otherwise have formed a joint, unaccompanied by the production of the calcareous parts constituting a zoëcium. In other cases, as in fig. 12, a rootlet is developed from the outer side of a zoëcium which is not concerned in a bifurcation. The pore-chamber of the rootlet is still in the proper place for a vibraculum, at the proximal end of a zoëcium; and although greatly reduced may still represent that structure.

The rootlets which do not become tendrils pass proximally, sometimes along the basal surface, but in many cases along the lateral margins of the branches. The formation of lateral bundles of parallel rootlets is specially characteristic of *Amastigia*, *Notoplites*, and *Menipea*.

Type 1 (Pl. 16. fig. 1).—The zoëcia occur in pairs, and not alternately on the two sides of the branch. A and B are thus at the same level, and the split separating the two branches reaches their distal ends. E, C and F, D thus form symmetrical pairs, E and F remaining in contact with one another, at their proximal ends, on the basal side of A and B.—*Didymozoum*. (The arrangement is slightly modified in an internode which has become triserial distally by the development of an ovicell.)

Type 2 (fig. 2).—Bifurcation occurs before a doubling of the number of zoëcia takes place, the proximal end of each branch being thus uniserial. C remains in contact with the inner lobe of the proximal fork of D; and the doubling of the number of zoëcia takes place at the distal ends of C and D, or of one of their successors if more than a single uniserial zoëcium occurs at the proximal end of the branch.—*Stirpariella*, sp. ('Siboga' Collection).

Type 3 (fig. 3).—The split extends nearly to the proximal end of the axillary zoëcium, E, which is accordingly free, on its inner side, for the greater part of its length. E gives off a connecting process (*c.p.*) to meet the proximal end of F. In the species figured, each of the pairs E, C and F, D has a single fork, at the proximal end, divided by the common septal wall in such a way that each of the four zoëcia has only a half fork, instead of a complete fork as in the other zoëcia.—*Bugula johnstonæ* (Gray), 1843, and other species of this genus.

Type 4 (fig. 4).—The split does not extend proximally so far as in type 3, not more than half the axillary zoëcium (E) being free on its inner side. The connecting process (*c.p.*) is given off by F, and joins the inner lobe of the fork of G, which crosses the basal side of E.—Species of *Bugula*, e. g., *B. scaphoides*, Kirkp., 1890, A. M. N. H. (6) v. p. 18, and *Bicellariella*, and most of the species of *Stirpariella*, e. g., *S. zanzibariensis*, Waters, 1913, P. Z. S. p. 469.

Type 5 (fig. 5).—The axillary zoëcium is almost completely immersed in the parent-internode, the split only reaching its distal end. The connecting process (*c.p.*) is given off by G and joins the inner lobe of the fork of H.—Species of *Bugula*, e. g., *B. dentata* (Lamx.), 1816, p. 135, and of *Stirpariella*, e. g., *S. caraibica*, Levinsen, 1909, p. 104.

Type 6 (fig. 6).—Although F is in contact with B, it appears to be derived from E, which it meets near the middle of the length of the latter. The connection between the proximal ends of the inner zoëcia of the branches is formed by the independent junction of F and G with E. The proximal ends of the zoëcia are not bifurcate. Oblique joints, indicated by dotted lines and of a type common in *Bugula*, traverse the zoëcia.—*Euoplozoum cirratum* (Busk), 1884, p. 17.

Type 7 (fig. 7).—Resembles type 6 in the relation of G and F to E, but is peculiar in other respects. The axillary zoëcium (E), which gives rise to F and G, passes into the proximal end of the branch on the side opposite to A, a relation which has not been found in any other type. B takes no part in the doubling of the number of zoëcia, the proximal ends of which are not bifurcate.—*Kinetoskias cyathus* and all the other species (4) examined.

In the following types* (8–18) the position of the chitinous joints is of importance.

Type 8 (fig. 8).—The proximal segments of F and G are in contact on the basal side of E, and are shorter than the corresponding parts of C and D; the joints traversing F and G near their proximal ends, and passing much more distally through C and D. In the species figured (*Scrupocellaria ferox*, Busk, 1852), the joint traverses the middle of the opesia, which is represented by dotted lines, of each of the outer zoëcia C and D. In certain other

species of the genus each joint passes across the proximal end of the opesia of the outer zoëcium ; and in others, particularly in those with elongated zoëcia, it passes entirely on the proximal side of the opesia of C and D.—*Scrupocellaria*, all species. *Himantozoum* may be considered to belong to this type, with which it agrees except that it is unjointed.

Type 9 (fig. 9).—The proximal segments of F and G are not in contact, and are shorter than the corresponding parts of C and D ; the joints traversing CG and DF respectively. A rootlet-chamber occurs on the proximal segment of C or D, or of both, and the rootlet is thus given off on the proximal side of the joint.—*Tricellaria*, spp.

Type 10 (fig. 10).—The proximal segments of F and G are separated by the whole width of E, and the two branches come off at different levels, that on the side of A being the more proximally situated. Internodes commonly composed of three zoëcia, C and D then taking on the character of A and B zoëcia in the next internode.—*Tricellaria*, spp. (Figured specimen, *T. occidentalis* var. *dilatata*, Ortmann, 1889, p. 21.)

Type 11 (fig. 11).—Except in the fact that the proximal segments of F and G are in contact, this agrees with type 9.—*Tricellaria peachii* (Busk).

Type 12 (fig. 12).—Readily derivable from type 10 by the suppression of the proximal segments of F and G, the internode thus consisting of a single zoëcium at its proximal end, connected with its predecessor by a single chitinous joint.—*Tricellaria aculeata*, D'Orb.

Type 13 (fig. 13).—A modification agreeing with type 12, occurring in *Emma cyathus*. The zoëcia C and D take on the character of A and B zoëcia at their distal ends.

Type 14 (fig. 14).—Internodes composed of three zoëcia and, like the zoëcia, very short. A slight modification of type 9.—*Emma*, spp.

Type 15 (fig. 15).—Proximal segments of F and G in contact, much longer than the corresponding parts of J and K. The joints are on the distal sides of C and D, and traverse the zoëcia FJ and GK. The joints are situated at some distance from the axil, instead of being on the same level with it, and do not traverse the opesia of any zoëcium. Rootlets given off on the distal sides of the joints.—*Notoplites*. A modification represented, in the same genus, in the 'Siboga' Collection results from the suppression of one of the joints of the bifurcation.

Type 16 (Pl. 17. fig. 16).—The axillary zoëcium is free on both sides distally. The zoëcia F and G are not in contact with one another, but each is connected with one side of E at a point marked by the presence of a conspicuous rosette-plate (*r.p.*).—*Cornucopina*, all species examined. The zoëcia are very long, and a constriction partially separates a small proximal section from the main part of the zoëcium.

Type 17 (fig. 17).—Proximal segments of F and G in contact (rarely separated), longer than the corresponding parts of J and K. The joints are on the distal sides of C and D, lying hardly in advance of the axil, and they traverse the zoœcia FJ and GK, passing through the opesia of F and G, the two *inner* zoœcia. Rootlets given off on the distal sides of the joints.—*Menipea*.

Type 18 (fig. 18).—The internode becomes triserial by the development of a median row of two or more zoœcia. The distal member of the median row (E^2 in the figured specimen) behaves as an axillary zoœcium. Bifurcation in other respects as in type 17.—*Menipea* (triserial species).

Type 19 (fig. 19).—Part of a sympodial colony of *Menipea spicata*, only one of the branches being jointed at each bifurcation.

Type 20 (fig. 20).—Agreeing with type 8 except for the intercalation of a median series of zoœcia in the internode.—*Amastigia kirkpatricki* (Lev., MSS.), n. sp.

V. CHARACTERS OF CERTAIN GENERA AND SPECIES OF SCRUPOCELLARIIDÆ.

Family SCRUPOCELLARIIDÆ.

Cellulariidæ, Hincks, 1880, p. cxxxvii; Busk, 1884, p. xxii; MacGillivray, 1887, Trans. Proc. R. Soc. Vict. xxiii. p. 199; *et auctt.*

Scrupocellariidæ, Levinsen, 1909, pp. 89, 130; Canu & Bassler, 1920, U.S. Nat. Mus., Bull. 106, p. 180.

A diagnosis, based on Levinsen's study of the Family, has been given by Canu and Bassler, and this may be accepted with but few modifications. The Family consists of Anascous Cheilostomata, of erect habit, usually much branched, and attached by rootlets. With rare exceptions the zoarium is unilaminar, and the branches are biserial in the majority of species. The branches are nearly always flexible, well-developed chitinous joints occurring in most cases. The opesia is large, and spines usually occur distally or at the sides of the orifice. A specially modified spine, the scutum or fornix, jointed at its base, projects horizontally over the opesia, being branched or broadened except in the region of its narrow stalk; but it may be completely wanting. The full equipment of heterozoœcia consists of (1) an avicularium, or a pair of avicularia, on the frontal surface, typically on the proximal side of the opesia, and with the rostra directed proximally. The frontal avicularia on the distal side of an ovicell are commonly paired and directed distally; (2) a lateral or marginal avicularium at the outer distal corner of the zoœcium; (3) a basal heterozoœcium, which may be either an avicularium or a vibraculum, on the basal surface, at the proximal end of the zoœcium, usually in contact with the lateral avicularium of the preceding zoœcium. The heterozoœcia are not jointed at their base, and any or all of them may

be wanting. The mandibles of the avicularia are invariably of the pointed type. The terminal wall of the zoëcium is at first vertical, its origin from the basal wall straight or slightly curved, but then bends distally, in approaching the frontal surface; the proximal portion of each zoëcium thus overlapping its predecessor on its basal side. The ovicells are hyperstomial, frequently completely contained in a depression on the frontal wall of the zoëcium which succeeds the fertile zoëcium, and not projecting beyond the general frontal level of the zoëcia.

The scutum and the heterozoëcia appear to be very capricious in their occurrence. In several of the genera one or more of these structures are present, on most of the zoëcia, in certain species; while they are absent in other species which appear to be closely allied to those of the first series. I think the only interpretation which can be given of these facts is that all these structures are to be regarded as original possessions of the Family, and that their absence is to be attributed to loss.

Dr. W. D. Lang has come to a similar conclusion with regard to Cretaceous Cribrimorphs (1922, Cat. Foss. Bry. (Pol.) Brit. Mus. iv. pp. 3, 156, and elsewhere).

The extreme amount of loss is found in *Tricellaria peachii*, in which scutum and heterozoëcia are completely wanting, if exception be made of the possibly vestigial vibraculum which has been described on p. 324. On the assumption that the heterozoëcia are structures which give their possessors some advantage in the struggle for existence, it is very difficult to understand the frequency with which they disappear entirely; the species in which this takes place continuing to exist, apparently with undiminished efficiency.

Genera here considered:—

1. *Amastigia*, Busk.
2. *Menipea*, Lamouroux.
3. *Notoplites*, n. gen.
4. *Tricellaria*, Fleming.
5. *Emma*, Gray.
6. *Scrupocellaria*, Van Beneden.

[The genera *Canda* and *Caberea* are omitted.]

1. AMASTIGIA, *Busk*.

Amastigia, Busk, 1852², p. 40.

Caberiella, Levensen, 1909, pp. 134, 135.

Anderssonia, Kluge, 1914, p. 617.

Scrupocellaria (*pars*) and *Menipea* (*pars*), *auctt.*

Zoarium usually unjointed, the branches in nearly all cases pluriserial. Frontal surface typically convex, so that the marginal zoëcia face outwardly, the basal surface more or less flat, the zoëcia of the median rows as a rule partially or completely excluded from it. Spines, scutum, frontal and marginal avicularia present or wanting. Basal heterozoëcia typically

present, in the form of avicularia, occasionally vibraculoid, or of vibracula. Rootlets given off by the basal heterozoëcia or from the sides of the marginal zoëcia, passing proximally as marginal bundles down the colony and frequently extending round the axils of the bifurcations. Ovicells typically small, often with a frontal fenestra.

Distribution, circumpolar (Southern), reaching as far north as Victoria in shallow water and Valparaiso in deep water.

The characteristic features of this genus appear to be the pluriserial branches, which are usually more or less semi-cylindrical, with the zoëcia opening on the curved surface; the tendency for the basal walls of some of the inner zoëcia to be reduced; the occurrence of basal heterozoëcia (sometimes wanting); and the arrangement of the rootlets in marginal bundles. The last character also occurs in *Menipea* and *Notoplites*. The genus is of special interest as demonstrating, better than any other, the intimate relation between avicularia and vibracula. Joints definitely associated with a bifurcation seldom occur, but there is reason to believe that even in "unjointed" species they may be formed secondarily, as fractures occurring at some point of an internode, the fracture being mended by the formation of chitinous connecting tubes formed externally to the zoëcia and not as a modification of their own body-walls. It is not unlikely that I have included too many species in this genus, which may have to be further subdivided.

1. *AMASTIGIA NUDA*, Busk. (Pl. 17. figs. 21, 24, 25; Pl. 19. figs. 50, 51.)

Amastigia nuda, Busk, 1852², p. 40, pl. 36. figs. 1-5. Tierra del Fuego.

" " (*pars*), MacGillivray, 1887, Trans. Proc. R. Soc. Vict. xxiii. p. 200. Victoria.

The interest of this remarkable species seems to have completely escaped recognition since the publication of Busk's original account. MacGillivray records it, on the authority of J. Bracebridge Wilson, from Victoria, and the record is confirmed by slides in the British Museum. Kluge (1914, p. 613) mentions the genus only to dismiss it.

The type-slide (Brit. Mus. 54.11.15.87), from material collected by Charles Darwin, shows some interesting peculiarities which were not noticed by Busk. The branches are at first biserial, and the zoëcia of the two rows here meet one another, in a normal manner, in the middle line of the basal surface. They later become 3-serial, and then 5-serial, by the intercalation of three additional rows. A basal view of a 5-serial region shows the appearance indicated in Pl. 17. fig. 24. The greater part of the basal surface is formed by the marginal zoëcia (1, 5), while the median (3) and submedian (2, 4) zoëcia have only a restricted origin from this wall. The frontal surface is very convex, the middle region being much thicker than the sides, and the marginal zoëcia face obliquely outwards. As shown in Busk's figs. 2, 3, there is a large, undivided scutum, rounded distally. A frontal avicularium may occur on the submedian zoëcia, but there is usually a pair on those of

the median row, the rostrum directed obliquely proximally except on the distal side of an ovicell, where the direction is reversed, as in allied species. A characteristic feature of Busk's specimen is the occurrence of well-developed lateral avicularia on the marginal zoëcia. The most interesting point is the presence of basal avicularia, which give off rootlets running on the inner side of the lateral avicularia, as shown in Busk's figs. 4, 5. These have an acute rostrum, directed proximally, and they are rather longer than wide, but not vibraculoid. The spines are well developed, though thin; four occurring on the outer side of the marginal zoëcia and two, in addition to the scutum, on the inner side. Scutum (Pl. 19. fig. 50) with a cavity which is very narrow at its commencement but dilates towards the free edge. The other zoëcia have three spines on each side, one of them being a scutum on one side. In several of the marginal zoëcia the distal external spine, which is jointed at its base, is enormously elongated, being much longer than a zoëcium, and running straight distally, just on the outer side of the margin of the branch, and parallel with it. The thick walls of these enlarged spines appear to be entirely chitinous. The ovicells have a frontal fenestra.

In addition to the type-slide the British Museum possesses the following specimens which I refer to *A. nuda*:—

97.5.1.246. Port Phillip Heads, Victoria, J. Bracebridge Wilson.

97.5.1.266 and 267. Same locality and donor (labelled *Menipea funiculata*).

97.5.1.250. Port Phillip, Victoria, Miss E. C. Jelly (labelled *A. nuda*).

99.7.1.823. Australia, Busk Collection (labelled *A. nuda*).

87.12.9.68. Kerguelen, 'Challenger' Collection, Stat. 149 I., 45–127 fathoms.

Recorded by Busk (1884, p. 19) as *Menipea benemunita*.

97.5.1.266 and 267 agree with the type, and differ from the other Victorian specimens, by possessing conspicuous marginal avicularia. Some of their spines are considerably enlarged, notably the second and third marginal ones, and the spine on the distal side of the scutum. I have hesitated whether to consider them distinct from the other Victorian specimens, but I think it is safer to regard them as one species. Basal avicularia are plentiful in all, sometimes completely alternate on the two sides of the branch and sometimes, in the same colony, meeting one another in pairs (Pl. 17. fig. 25). The branches are at most 5-serial, and the number of spines and the frontal avicularia (fig. 21) agree with the corresponding parts of the type. It is noteworthy that ovicells occur in all five rows.

The 'Challenger' specimen from Kerguelen is of more slender habit than typical *A. benemunita*, and is 5-serial. Its scutum is smaller than in that species, and its spines are 4, 2+scutum, on the marginal zoëcia, and 3, 3 (one being a scutum) on the others. In all these respects, as in the characters of the marginal and frontal avicularia, it agrees with *A. nuda*, to which I refer it. If my determinations are correct, this species has a circumpolar distribution, from Tierra del Fuego to Kerguelen and Victoria.

On isolating the rows of zoëcia, after boiling in Eau de Javelle, the method by which the zoëcia of the median rows become partially separated from the basal surface becomes apparent. As shown by Pl. 19. fig. 51, the basal wall is very sinuous, the vertical diameter of the body-cavity being greatest on the distal side of the length of the zoëcium, and smallest at the proximal end. The prominent part of the wall reaches the basal surface of the branch, while the indented proximal part is excluded from it, the lateral walls of the adjacent zoëcia sending lobes across this part, nearly or quite meeting one another. The lozenges formed by the median zoëcia on the basal wall are thus produced; and the arrangement will be more easily understood by referring to Pl. 17. fig. 27 (*A. rudis*), in which the complete lateral outline of the distal median zoëcium is represented. It will be seen that the greatest prominence of the basal wall corresponds with the widest part of the zoëcium, while the proximal region of the zoëcium is narrower, and is either completely excluded from the basal wall or only meets it in a linear median region. I believe this to be the method universally adopted in this group of species, when the zoëcia meet the basal wall partially.

2. *AMASTIGIA RUDIS* (*Busk*). (Pl. 17. figs. 26, 27; Pl. 19. figs. 49, 52.)

Caberea rudis, Busk, 1852¹ p. 377; 1852², p. 38, pl. 46. figs. 1-3.

„ „ MacGillivray, 1887, Prodr. Vict., Dec. xiv. p. 137, pl. 136. figs. 1-1 b.

Menipea marginata, Hincks, 1884, A. M. N. H. (5) xiv. p. 276, pl. 9. figs. 1-1 d;
1893, *Ibid.* (6) xii. p. 143.

Branches 2-8-serial, coarser than in the preceding species, the zoëcia larger in all their measurements. Frontal surface strongly convex, the marginal zoëcia facing outwards. Basal surface flat or concave, the marginal zoëcia often projecting strongly as a broad, convex, longitudinal band on each side, the region of the median rows depressed and concave. Marginal zoëcium forming a disproportionate part of the basal surface, the others reaching the wall in regularly alternating lozenge-like areas, the proximal end of each of these zoëcia being overlapped by the broad parts of those of contiguous rows, and excluded from the basal wall or meeting it in a linear region. Opesia longer than in *A. nuda*, the cryptocyst not quite so much developed. Spines more uniform in size than in *A. nuda*, those of the marginal zoëcia 4, 1, the fourth external more nearly vertical than the others. Spines in the other zoëcia 2, 2; the second of one side in the form of a scutum, which does not fill the opesia, its distal lobe pointed (Pl. 19. fig. 49), its cavity as in *A. nuda*. Frontal avicularia paired on some of the median rows, meeting in a median suture, their rostra directed as in the preceding species; those in relation with an ovicell distant from one another. Outer frontal avicularium suppressed on the marginal and often on the submarginal rows, where the inner avicularium is often enlarged. On the marginal zoëcia the single frontal avicularium is commonly

gigantic (Pl. 17. fig. 26), with a strongly hooked rostrum, its articular condyles strong and spike-like, and the mandible triangular and pointed (as in the other avicularia), and with an incurved acuminate tip. Marginal avicularia wanting. Basal heterozoëcia in the form of curved vibracula (fig. 27), placed in alternating pairs, the tip of the rostrum of each vibraculum meeting the middle of its predecessor on the opposite side of the branch. Rootlets as in other species. Ovicells resembling those of *A. nuda*.

Described from specimens in the British Museum, including Busk's type (54.11.15.82).

The basal heterozoëcia of *A. rudis* (Pl. 17. fig. 27) are of the kind described by Levinsen (1909, p. 135) as "curved or angularly bent vibracula" in *A. benemunita*, as noticed under that species. Levinsen founded the genus *Caberiella* on this character, not recognizing the fact that *Menipea benemunita*, Busk, is referable to *Amastigia*. Vibracula of this type occur in profusion in *A. rudis*, varying in size but not in form. The rostral groove, in which the long seta is received, is very long. The occurrence of different types of basal heterozoëcia in *Amastigia nuda* and *A. rudis* indicates that these structures are in a plastic condition in the genus, assuming the form indifferently of avicularia and vibracula, or being completely absent.

In side view (Pl. 19. fig. 52) the zoëcia are very different from those of *A. nuda*, being larger in all their dimensions. The terminal wall is more vertical, and the proximal end of the zoëcium much deeper, the median zoëcia being more completely represented on the basal wall than in that species, a fact with which the smaller amount of sinuosity of the basal wall (Pl. 19. fig. 52) is associated. The lateral communication-plates, as in other species of *Amastigia* (as well as in *Menipea*), are two in number.

The basal view (Pl. 17. fig. 27) of a branch of *A. rudis* is very characteristic. The marginal zoëcia occupy a disproportionate amount of this wall, but the others, though here reduced, are not nearly as much so as in *A. nuda*. Each zoëcium is wide distally, where it meets the basal wall along its whole width. It becomes narrower proximally, as shown in the distal zoëcium of the median row; but the greater part of this region is excluded from the basal surface by the union or close approximation of the widened parts of the preceding zoëcia of the rows on either side of it. The basal walls of all the zoëcia except those of the marginal rows thus appear as a series of regularly alternating spindle-shaped figures. The basal vibracula, which are not drawn on the younger zoëcia, are another very characteristic feature of the species.

A. rudis differs from *A. nuda* in the larger number of series of zoëcia in its branches, in the smaller number of spines, in the distal lobe of the scutum which is usually pointed, in the character of the basal heterozoëcia, in the gigantic frontal avicularia of the marginal rows, and in the larger measurements of all of its parts.

3. *AMASTIGIA CRASSIMARGINATA* (Busk).

Caberea crassimarginata, Busk, 1884, p. 28, pl. 11. figs. 1-1 b. S.E. of Buenos Aires, 600 fathoms.

Rootlets running down the margins of the branches. Vibracula covering only a small part of the basal surface, and resembling those of *A. rudis*. Although this species is biserial the characters of its rootlets, vibracula and scutum are in agreement with those of other species which I refer to *Amastigia*. Waters (1913, Proc. Zool. Soc. p. 480) has suggested that it should be placed in *Canda*.

4. *AMASTIGIA BENEMUNITA* (Busk).

Menipea benemunita, Busk, 1884, p. 19, pl. 4. figs. 4, 4 a (specimens from Stations 303 (probably 308), 313, 314, 315 only). Straits of Magellan, W. of S. end of S. America, Falkland Is., 5-175 fathoms.

Scrupocellaria benemunita, Jullien, 1888, Miss. Sci. Cap Horn, vi. p. 69, pl. 8. figs. 1-3. S. of Cape Horn, 99 metres.

Caberiella benemunita, Levinsen, 1909, p. 135, pl. 22. figs. 8 a, 8 b. 'Challenger' Exp., Stat. 313.

British Museum, 'Challenger' Collection, 87.12.9.69-73. The type-slide is 87.12.9.70, Stat. 313, E. end of the Straits of Magellan, 55 fathoms. Sir John Murray thought that a mistake was made in one of the records, and that Stat. 303 (slide 87.12.9.69) should have been Stat. 308, the depth of which was 175 fathoms, and the locality near the W. coast of the S. end of S. America.

This species has a close resemblance to *A. nuda*, and it is curious that Busk did not refer it to his own genus *Amastigia*. It can be distinguished from *A. nuda* by its much larger scutum, with a large, upturned, truncate, distal lobe, and by its flatter branches, which may be at least 7-serial, in which all the zoëcia appear to meet the basal wall normally, although the width of the median zoëcia, basally, is less than that of the marginal zoëcia. The spines of the marginal zoëcia are 3, 1+scutum. Marginal avicularia are minute and commonly wanting. Under *A. rudis* I have alluded to Levinsen's account of the basal heterozoëcia, which he found in a 'Challenger' specimen from Stat. 313. I have not found heterozoëcia of this type in the British Museum slide (87.12.9.70) from this Station, and the specimen seems to have only a single basal heterozoëcium closely resembling those of *A. nuda*. In 87.12.9.72, from Stat. 315, basal vibracula as described by Levinsen occur; and they resemble those figured by me (Pl. 17. fig. 27) in *A. rudis*. The occurrence of two different types of basal heterozoëcia in different specimens of what I think must certainly be referred to the same species is an interesting fact.

The 'Challenger' slide from Stat. 149, Kerguelen, referred to this species by Busk, appears to belong to *A. nuda*.

5. *AMASTIGIA FUNICULATA* (*MacGillivray*).

Menipea funiculata, MacGillivray, 1886, Trans. Proc. R. Soc. Vict. xxii. p. 128, pl. 1. figs. 8, 8 a; 1889, Prodr. Zool. Vict., Dec. xviii. p. 285, pl. 177. figs. 6-6 b. Victoria.

The British Museum possesses several Victorian specimens (87.12.10.38; 88.11.14.221, 241; 97.5.1, 247, 269) of this species. It resembles *A. nuda* in general appearance, but the frontal surfaces of the peripheral branches are flat, and all the zoëcia meet the basal wall normally. Some of the spines are long and thick, particularly the second of the outer group of three in the marginal zoëcia. The single inner spine and the third or proximal outer spine are short and thick, often crossing one another over the orifice of the zoëcium. The scutum is oval, with a simple cavity, and it fills most of the opesia. The branches are in the main triserial, sometimes 4-serial, and marginal avicularia occur, though not commonly; both these and the frontal avicularia being small. I have not found basal heterozoëcia. The branches do not form joints at the bifurcations, but although typically unjointed there seem to be indications of the occasional occurrence of secondarily formed joints. The more proximally placed branches may be narrow, with a very convex frontal surface.

6. *AMASTIGIA ABYSSICOLA* (*Kluge*).

Scrupocellaria funiculata, Waters, 1904, 'Belgica' Bryozoa, p. 23, pl. 8. figs. 1 a, b. Antarctic, 2800 metres.

Scrupocellaria abyssicola, Kluge, 1914, p. 611. Antarctic, 2450 metres.

Kluge doubts Waters' determination, and has suggested a new name for the deep water Antarctic form observed by Waters and himself. Basal heterozoëcia not described.

7. *AMASTIGIA CABERIOIDES* (*Kluge*).

Scrupocellaria caberioides, Kluge, 1914, p. 612, pl. xxvii. figs. 9, 10. Antarctic, 350-385 metres.

Unjointed, 2-4-serial. Scutum originating distally, not filling the opesia, oval or long and narrow, the stalk inserted into the distal end of its lamina. Marginal and frontal avicularia, the latter sometimes gigantic. Basal avicularia paired, directed obliquely proximally, the tip of the rostrum slightly vibraculoid. Median zoëcia much reduced basally. Kluge rejects his own suggestion that this species might be placed in *Amastigia*.

8. *AMASTIGIA KIRKPATRICKI* (*Levinsen, MSS.*), n. sp. (Pl. 17. fig. 20; Pl. 19. figs. 46-48.)

Menipea marionensis (*pars*), Busk, 1884, p. 21, pl. 14. fig. 9 (specimens from Stat. 144 a, Marion Island, 50-75 fathoms, only).

Branches biserial, becoming triserial at a varying distance from the proximal end. Internodes usually of 3-6 pairs of zoëcia, with at least one

median zoëcium preceding the bifurcation, often with a row of 2-4 median zoëcia. Rootlets arising from the proximal members, mainly attached to the edges of the branches, some of them passing down the basal surface. Opesia oval, rather more than half the frontal length, with a moderate cryptocyst, extending completely round the opesia, and of practically equal width all round. Spines one external (rarely two) and one internal, at the distal end, the external spine placed rather more distally than the internal; occasionally more numerous (fig. 46), the figure probably representing a zoëcium in an early state of growth of a colony. Scutum wanting. Frontal avicularia single on most of the zoëcia, those of some of the median zoëcia enlarged or even gigantic (fig. 48); much raised, directed obliquely proximally, and situated on the inner side of the zoëcium, on the proximal side of the opesia, which they do not reach. Two frontal avicularia may be found on the axillary zoëcium. Marginal avicularia small, often absent. Vibracula large, on the inner side of the lateral zoëcia, placed nearly longitudinally, the rostrum or groove for the seta greatly prolonged beyond the main part of the vibraculum, and reaching the middle line of the branch; a single vibraculum in the axil of the bifurcation. Ovicells large, longer than wide, the frontal surface rather flat, becoming concave just distally to the rim of the orifice of the ovicell. The surface is imperforate, and the ectoëcium covers only a narrow part of the frontal surface. Bifurcation (fig. 20) as described below; both branches jointed at their base, the joint involving the proximal end of the opesia of the outer zoëcium.

Type-slide (Brit. Mus.), 87.12.9.97, 'Challenger' Coll., Stat. 144 a.

In his 'Challenger' Report, Busk described as *Menipea marionensis* specimens from the two following localities:—

Stat. 142, off Cape of Good Hope, 150 fathoms; Stat. 144 a, off Marion Island, 50-75 fathoms.

On Oct. 4, 1910, the late Mr. G. M. R. Levinsen wrote to Mr. R. Kirkpatrick, at the British Museum, stating that a fragment of a 'Challenger' specimen of "*Menipea marionensis*," from Stat. 144 a, had come into his hands, through the Dundee Museum, and that it proved to be a *Caberea*. On Jan. 26, 1911, he wrote further, to the effect that he had described and figured the species from Stat. 144 a, as *Caberea kirkpatricki*; and, having examined material, from Stat. 142, which had been sent to him by Mr. Kirkpatrick, he had found that "the great plurality of the frontal avicularia are internal" in *M. marionensis*. In returning the material which had been lent to him, he added a label to the specimens from Stat. 144 a, as follows:—"Busk had wrongly named the specimen *M. marionensis*, the type of which is from Stat. 142, Cape of Good Hope."

Levinsen died in 1914, and, although I have made every effort to satisfy myself on the subject, I have failed to find evidence that his results were published. It must be assumed that the description referred to in his letter

of Jan. 26, 1911, remained in MS. at the time of his death. Having examined the whole of the material from the two Stations, I can confirm all Levinsen's statements of fact quoted above, although I do not agree with him in placing the new species in *Caberea*. There is no doubt that Busk confused two species, and it is unfortunate that *marionensis* must be applied, as shown by his description, to a species from the Cape of Good Hope, not at present known to occur off Marion Island.

I have adopted Levinsen's MS. name *kirkpatricki* for the new species ; and I give below a new diagnosis of *Menipea marionensis*. The two species can readily be distinguished under a low magnification. In *Menipea marionensis* the joints are placed at some distance from the axil of the bifurcation, the ovicells are small and short, there are no vibracula, and none of the frontal avicularia are enlarged. In *Amastigia kirkpatricki* the joints are at the level of the axil, the ovicells are large and long, conspicuous basal vibracula are present, and the frontal avicularium of the axillary zoëcium (or of the proximal median zoëcium if more than one is present) is usually much larger than the others. This last feature is indicated in Busk's fig. 9 (Pl. 14.), which I suppose to have been drawn from a specimen obtained at Stat. 144a, and therefore to belong to *Amastigia kirkpatricki*. In describing a species obtained from more than one locality, it is always expedient to indicate the locality of the specimens figured ; and this omission, by Busk and others, gives rise to many difficulties.

With reference to Levinsen's proposal to place this species in *Caberea*, I think it desirable to exclude from this genus those species in which the rootlets pass down the margins of the branches instead of down the middle of the basal surface. I think that *C. rudis*, Busk, should be placed in *Amastigia*, and that *C. crassimarginata*, Busk, may be referred to the same genus. It must be admitted that *A. kirkpatricki* has a considerable claim to be included in *Scrupocellaria*, which it resembles in its mode of bifurcation (Pl. 17. fig. 20). The branches are well jointed at their commencement, but a median series of zoëcia, usually commencing near the proximal end of the internode, is present, in opposition to what is found in typical *Scrupocellaria*. The first median zoëcium (E^1) originates from a zoëcium ("A") situated on the outer side of a branch with reference to the preceding bifurcation. It gives to a second (E^2), which may be followed by others in a median row. The distal member of this series (E^3 in fig. 20) behaves as an axillary zoëcium.

A. kirkpatricki thus seems to unite the characters of more than one genus, which may be explained by the assumption that *Amastigia* represents, better than any other genus, the ancestral character of the Scrupocellariidæ, and that its species show approaches in various directions to those of other genera. I have suggested above that the pluriserial condition was probably antecedent to the biserial condition ; and on this view *A. kirkpatricki* is a species which

has almost become biserial, while its basal heterozœcia have acquired the full vibracular form, so as closely to resemble those of *Scrupocellaria*. *A. kirkpatricki* from Marion Id., *A. gaussi* from the Antarctic, and *A. crassimarginata* from off Buenos Aires all come from localities within the range of *Amastigia* and apparently outside that of *Scrupocellaria*; and their distribution supports the conclusion I have come to on other grounds as to their generic position.

The vibraculum (fig. 47) possesses a rootlet-foramen of the usual kind, situated opposite the proximal end of the muscular mass and given off from a small chamber separated by a calcareous wall from the rest of the vibraculum. The figure shows what appears to be another rounded chamber on the distal side of the rootlet-chamber. In side view this is seen to be continuous with the main vibracular chamber, and it is really the foot by which the vibraculum is connected with the proximal end of its zoœcium, a communication-pore occurring in the wall which separates it from the zoœcium.

9. AMASTIGIA GAUSSI (*Kluge*).

Scrupocellaria gaussi, Kluge, 1914, p. 609, pl. 27. figs. 3, 4. Antarctic.

Closely allied to *A. kirkpatricki*, and differing from it mainly in possessing a scutum, and in being 2-5-serial.

10. AMASTIGIA SOLIDA (*Kluge*).

Scrupocellaria solida, Kluge, 1914, p. 611, pl. 27. figs. 7, 8. Antarctic, 350-385 metres.

Unjointed, 3-serial. Stalk of scutum connected with the middle of its lamina, which is lobed externally. Frontal avicularia occur, but marginal avicularia are not described. Basal avicularia paired, directed transversely inwards, the rostrum rather more vibraculoid than in the last species. Median zoœcia reduced on the basal surface.

11. AMASTIGIA ANTARCTICA (*Kluge*).

Anderssonia antarctica, Kluge, 1914, p. 618, pl. 33. figs. 3, 4. Antarctic, 76-170 metres.

Unjointed, 6-8-serial. Scutum and spines wanting, the opesia with straight lateral margins. The marginal zoœcia face outwards, and they form the whole of the basal surface. Frontal avicularia present. The lateral avicularia described appear to be morphologically basal avicularia, since they are placed on the proximal and not on the distal ends of the zoœcia. They are large and are arranged alternately on the basal surface, the rostrum directed obliquely proximally and being linear distally. A rootlet-foramen is present, a structure which seems to decide the question that these are basal heterozœcia.

This species differs from the others described by Kluge in the absence of spines and scuta; and in these respects it has a considerable resemblance to

the *Craspedozoum* group of *Menipea*. Its reference to *Amastigia* seems to be indicated by its well developed basal heterozoëcia and by the complete exclusion of all the zoëcia except those of the marginal rows from the basal wall.

12. *AMASTIGIA PATERIFORMIS* (*Busk*).

Menipea pateriformis, Busk, 1884, p. 22, pl. 5. figs. 4, 4 a. Off Valparaiso, 2160 fathoms.

The type-specimen (Brit. Mus. 87.12.9.101) has not been satisfactorily described by Busk. It appears to be allied to *A. antarctica*, which it resembles in the absence of scutum and spines. It agrees with *Amastigia* in possessing basal heterozoëcia, which may be regarded as avicularia, although the mandible is distally linear and rather long. The rostrum is directed obliquely proximally. The colony is apparently unjointed, the branch thick and semicylindrical, the marginal zoëcia facing obliquely outwards; a median row of zoëcia, or two submedian rows, occurring in parts of the colony. Rootlets in two lateral groups. Frontal avicularia stout and prominent, the mandibles broadly triangular proximally, becoming narrow distally. Ovicells large, and distinctly long and narrow.

2. *MENIPEA*, *Lamouroux*.

Menipea, Lamouroux, 1812, p. 183.

Craspedozoum, MacGillivray, 1886, Trans. Proc. R. Soc. Vict. xxii. p. 131.

Flabellaris (pars), Waters, 1898, J. Linn. Soc. xxvi. p. 672.

Flabellina, Levinsen, Vid. Medd. Naturh. Foren. Copenhagen, 1902, p. 21.

Cellularia (pars), Busk, *et auctt.*

Zoarium jointed (rarely unjointed); the joints, if present, traversing the opesia of each of the *inner* zoëcia at a bifurcation (Types 17, 18, Pl. 17. figs. 17, 18). Branches biserial to pluriserial. Scutum wanting. Frontal and marginal avicularia present or wanting; basal heterozoëcia found only in *M. vectifera*. In several species a frontal avicularium may grow inwards into the body-cavity, instead of occupying the position normal to these avicularia. Rootlets associated with a bifurcation originating on the distal side of the joint. The rootlets are nearly always in lateral bundles, as in *Amastigia* and *Notoplites*.

The genus *Menipea*, as usually understood, embraces a number of species which are apparently not nearly allied. I lay special stress, in re-defining the genus, on the fact that (in all the jointed species) the joint traverses the opesia of the *inner* zoëcium, in each branch. This may happen in such a way that a portion of the opesia lies on each side of the joint (Pl. 17. fig. 17); or the proximal end of the opesia may lie in the region of the joint (fig. 18). The relation of the joint to the opesia is implied by Busk (1852², p. 21) when he states that in *M. cirrata* one of the lower zoëcia in the internode is more or less aborted.

The species here included in *Menipea* form a group with a considerable resemblance to one another in general *facies*. It will be observed that (No. 2 excepted) they are all Southern forms, and that none of the Northern species are included:—a result which has already been anticipated by Norman (1903, A. M. N. H. (7) xi. p. 578).

1. *MENIPEA CRISPA* (*Pall.*). (Pl. 17. fig. 17.)

Cellularia crispa, Pallas, 1766, p. 71.

Cellaria cirrata, Ellis and Solander, 1786, p. 29, pl. 4. figs. *d*, *D*. "East Indies."

Menipea cirrata, Busk, 1852², p. 21, pl. 20. figs. 1, 2. S. Africa.

Menipea crispa, Marcus, 1922, p. 11.

Easily recognizable by the characteristic inflexion of the branches, described by Pallas and well represented in Ellis and Solander's fig. *d*, and by the very long, cylindrical frontal avicularia (Busk, fig. 1), situated on the proximal border of the opesia, which they overarch. There are typically six zoëcia in the internode, which commonly has a single, large lateral avicularium. Three strong, curved spines, jointed at the base, are commonly present on the outer side of the distal end of the zoëcium.

2. *MENIPEA FLABELLUM* (*Ell. and Sol.*).

Cellaria flabellum (*pars*), Ellis and Solander, 1786, p. 28, pl. 4. figs. *c*, *C*.

Ellis and Solander state that two distinct species are included in their account of *C. flabellum*, one from the Bahama Is. and the other from the E. Indies. From the description it would appear that the figured specimens are from the Bahamas, although they might quite well be taken to represent the South African form to which this name has usually been applied. Perhaps a mistake in the locality of the specimens was made in the original account; but in view of the uncertainty of the question I think it best to use the name given by Busk, as indicated in the next species, for the common S. African species. *M. flabellum*, Ell. and Sol. may be regarded as at present unrecognizable.

3. *MENIPEA ORNATA* (*Busk*).

?*Cellularia floccosa*, Pallas, 1766, p. 70.

Cellularia ornata, Busk, 1852², p. 20, pl. 26. figs. 3, 4. Algoa Bay.

Menipea flabellum, Busk, 1884, p. 21. Simon's Bay, Cape of Good Hope.

" " Marcus, 1922, p. 13, figs. 7 *a-c*.

Flabellaris flabellum, Waters, 1898, J. L. S. xxvi, p. 672.

Internodes often increasing regularly in width from the proximal to the distal end, their lateral margins nearly straight; the number of constituent zoëcia reaching at least 13. Marginal avicularia and spines wanting. Frontal avicularia inconspicuous, not prominent, often confined to the zoëcia E, F, and G; when on F and G occurring on the part of the zoëcium on the proximal side of the joint, as shown in Busk's fig. 3.

4. *MENIPEA PATAGONICA*, Busk.

Menipea patagonica, Busk, 1852², p. 22, pl. 23. fig. 1; pl. 25. figs. 1-3; pl. 26. figs. 1, 2. Falkland Is., Patagonia.

Menipea patagonica, Jullien, 1888, Miss. Sci. Cap Horn, vi. p. 71. Tierra del Fuego.
? *Scrupocellaria patagonica*, Kluge, 1914, p. 615, text-fig. 4. Kerguelen.

Internodes commonly consisting of six zoecia. A single spine typically present on each side, or two on the outer side, distally. Marginal avicularia well developed, frontal avicularia small.

5. *MENIPEA MARIONENSIS*, Busk. (Pl. 17. fig. 22; Pl. 19. figs. 43-45.)

Menipea marionensis (*pars*), Busk, 1884, p. 21, pl. 4. figs. 3, 3a (specimens from Stat. 142, Cape of Good Hope, 150 fathoms, only).

Branches mainly biserial, the axillary zoecium sometimes preceded by a more proximal median zoecium. Internodes usually of 3-5 pairs of zoecia, in addition to the median zoecium or zoecia, but sometimes with a larger number, particularly in those with ovicells. Zoecia facing obliquely outwards, from a raised keel passing down the middle of the branch. Opesia nearly oval, but distinctly wider distally, the cryptocyst more developed proximally than elsewhere. Strong calcareous spines given off basally from the edge of the cryptocyst, in young zoecia, becoming more numerous with increased age, and some of them directed frontally. Spines usually two external and one internal, often one on each side, the external spine the more distal. Scutum wanting. Frontal avicularia single on most of the zoecia, the rostrum directed obliquely proximally; not quite reaching the opesia. Two symmetrically placed frontal avicularia may occur on the axillary zoecium, where two median zoecia are present. Frontal avicularia of the usual type may be replaced by internal avicularia (Pl. 17. fig. 22; Pl. 19. figs. 43, 44), situated in the body-cavity. Marginal avicularia moderate, constantly present. Vibracula and basal avicularia wanting. Ovicells very short, wider than long. At the bifurcation (fig. 22) both branches are jointed, the distal end of the parent-internode being prolonged beyond the axil like the base of a tuning-fork. The joints are thus at some distance from the axil and traverse the proximal end of the opesia of each inner zoecium. Zoecia F and G meeting in a long median suture on the basal side of E.

The material which was described by Busk as *M. marionensis* included two very distinct species, as has been explained above (p. 336), under *Amastigia kirkpatricki*. The 'Challenger' specimens (Brit. Mus.) referable to *M. marionensis* are four slides, 87.12.9.94, 95 and 99.7.1. 698, 699, all from Stat. 142; 87.12.9.94 being marked as the type.

In examining the spirit material of *Menipea triseriata* obtained by the 'Challenger' from Simon's Bay, Cape of Good Hope, I found a fragment of another species, the original of my figs. 22, 43, and 45 of this

species. Its determination was confirmed when I remounted in Canada balsam one of Busk's dry slides (99.7.1.698) of *M. marionensis* from Stat. 142. Fig. 44 has been drawn from Busk's slide thus treated.

The calcareous spines developed from the cryptocyst are one of the most striking features of a Canada balsam preparation of *Menipea marionensis*. They are relatively few in young zoëcia, in which they are directed towards the basal surface (figs. 22, 43, 44). In the older zoëcia (fig. 45) they are much more numerous, some of them being branched, and some of them being directed towards the frontal membrane. These spines appear to be of the same nature as the similar structures which have been described by Levinsen (1909, p. 138, pl. ii. fig. 7, *c-e*) in *Menipea roborata*. As in other members of its family, each distal zoëcium of *Menipea marionensis* overlaps its predecessor to a considerable extent on its basal surface, as indicated in fig. 22. In the older zoëcium represented (fig. 45) *p* is the proximal wall of the distal zoëcium, and the opesia has been restricted by the formation of a horizontal calcareous lamina, the free edge of which is in the form of a Gothic arch (*e*); while the opesia is further reduced by the enlargement of the proximal cryptocyst.

The remarkable internal avicularia of this species are described above, in Sect. III.

6. *MENIPEA TRISERIATA*, Busk. (Pl. 17. fig. 18; Pl. 19. figs. 40-42.)

? *Crisia elegans*, Lamouroux, 1821, p. 6, pl. 65. figs. 4-7. Cape of Good Hope.

Menipea triseriata, Busk, 1852², p. 22, pl. 23. figs. 2-4. S. Africa.

" " Busk, 1884, p. 21. Cape of Good Hope.

" " Waters, 1898, J. L. S. xxvi. p. 672, pl. 48. fig. 12.

Internodes more or less triserial, composed of numerous zoëcia. External spines 2, internal 2, on outer zoëcia; 1, 1 on median zoëcia. Cryptocyst strongly developed on the proximal side of the opesia, covered with minute tubercles, its free margin here strongly thickened, and usually produced into a strong median tooth which may be directed basally. Marginal avicularia on most of the zoëcia. Frontal avicularia often two on the median zoëcia, one of which may be replaced by an internal avicularium; reversed (the rostrum directed distally) on the distal side of an ovicell, an arrangement commonly found in this genus. The outer frontal avicularium is wanting on the marginal zoëcia. Ovicells short, usually broader than long.

The British Museum possesses a number of slides, all from South Africa.

A specially interesting feature of this genus is the possession of internal avicularia (figs. 41, 42), which have been described above, under Sect. III.

7. *MENIPEA QUADRATA* (Busk).

Cellularia quadrata, Busk, 1884, p. 18, pl. 5. figs. 5-5*b*. Kerguelen, Heard Island.

Internodes long and narrow, consisting of numerous zoëcia. Spines and frontal avicularia wanting. Marginal avicularia small.

8. *MENIPEA FLAGELLIFERA*, Busk.

Menipea flagellifera, Busk, 1884, p. 21, pl. 4. figs. 1-1*b*. Kerguelen, Marion Id., Straits of Magellan, W. of Falkland Is.

Scrupocellaria flagellifera, Kluge, 1914, p. 615, text-fig. 5. Kerguelen.

Internodes of moderate length. Usually a single external spine. Marginal avicularia large. Frontal heterozoëcia vibraculoid.

The frontal heterozoëcia of this species are so peculiar as to suggest the possibility that it should be placed in a new genus. I refer it to *Menipea* because it has the mode of bifurcation characteristic of the genus, the joints traversing the opesia of each inner zoëcium. The frontal heterozoëcia, which are constantly present, have the seta of a vibraculum, but they do not possess the rootlet-foramen which is always found in a basal heterozoëcium, whether it is an avicularium or a vibraculum. In view of the fact that in *Amastigia* avicularia and vibracula are interchangeable on the basal surface, a corresponding plasticity may perhaps be conceded to *Menipea*. The structures in question replace the frontal avicularia of other species; and, in spite of the presence of a greatly elongated mandible, I think they may be regarded as avicularia.

9. *MENIPEA SPICATA* (*MacGillivray*). (Pl. 17. fig. 19; Pl. 18. figs. 32, 34, 35.)

Craspedozoum spicatum, MacGillivray, 1886, p. 132, pl. i. figs. 2, 2*a*; 1889, Prodr. Zool. Vict., Dec. xviii. p. 283, pl. 177. figs. 3-3*b*. Victoria.

Unilaminar. Internodes curved frontally, composed of numerous zoëcia, biserial at their origin, becoming 4-serial distally. Bifurcation cymose, owing to the fact that only one of the branches is jointed; the ultimate branches being unilateral cymes and the larger stems being bilateral (fig. 19). While the lateral internodes give off a single branch, those of the larger stems give off two branches, one on each side. The proximal branch comes off near the commencement of the internode, and forms the commencement of a lateral branch. The distal branch is placed in the line of the main stem, of which it forms a segment, and the distal, unjointed termination of the parent-internode diverges from the stem, on the same side of it as the proximal branch. The mode of branching of *M. spicata* does not seem to have been previously noticed, but a similar suppression of one of the joints occurs also in the allied genera *Notoplites* and *Tricellaria*. The affinity of *M. spicata* to the other species which I place in *Menipea* is shown by the fact that the joint traverses the opesia of an inner zoëcium.

M. spicata has two well-developed spines on the outer side of the marginal zoëcia and one on the inner side; and one spine on each side of the median zoëcia. The cryptocyst is strongly developed on the proximal side of the opesia, and calcareous spines project into the body-cavity from the lateral walls, as in *M. roborata*. The ordinary frontal avicularia do not occur on all

the zoëcia, but when present they are large and prominent. They are very asymmetrical, the rostrum much elevated, and situated at the outer side of the zoëcium, indicating that the avicularium is one of the pair found in other species, its direction being as required by this hypothesis. Internal avicularia (figs. 32, 35) occur, always in zoëcia which do not succeed an ovicell, and, as noticed on p. 319, they are concealed by the proximal cryptocyst, in frontal view. They are considerably smaller than in *M. roborata*, and they lie close to one side of the zoëcium, being directed almost vertically towards the basal surface. Ovicells occur only on the two median rows, and two strong calcareous thickenings of the frontal wall converge distally, uniting with one another to form a strong recurved spike projecting in the middle line beyond the ovicell (fig. 34). The basal walls of the median zoëcia are considerably constricted near the middle (fig. 35).

This and the next two species were placed in *Craspedozoum* by MacGillivray (1886, Trans. Proc. R. Soc. Vict. xxii. p. 131), who instituted this genus for their reception. They are all provided with the lateral bundles of rootlets which usually occur in *Menipea*. The pore-chamber for the rootlet (fig. 35) is situated in the usual place, at the proximal end of a marginal zoëcium, and it probably represents a vestigial basal heterozoëcium. It is inconspicuous in *M. spicata*, in which there are no blister-like pore-chambers on the terminal walls, at their insertion into the basal wall.

The British Museum possesses several slides of Victorian specimens (88.11.14.97, 298; 97.5.1.459, 460; 83.10.15.46).

10. *MENIPEA LIGULATA* (*MacGillivray*). (Pl. 18. figs. 31, 33.)

Craspedozoum ligulatum, MacGillivray, 1886, p. 132, pl. 1. figs. 3-3a; 1889, Prodr. Zool. Vict., Dec. xviii. p. 283, pl. 177. figs. 1, 1b, 2. Victoria.

Flabellaris roborata, var. *ligulata*, Waters, 1898, J. Linn. Soc. xxvi. p. 672.

Menipea ligulata, Levinsen, 1909, p. 140, pl. 2. figs. 8a-e.

Unilaminar, the frontal surface convex, with the marginal zoëcia facing partly outwards, the basal surface flat or concave. Branches composed of as many as nine rows of zoëcia, unjointed. Proximal cryptocyst less extensive than in *M. spicata*, usually prolonged into a thick calcareous spike or column (fig. 31), descending basally into the body-cavity, on one or both sides. When paired these spikes are not on the same level, one being usually just visible in frontal view, at the proximal end of the opesia, the other completely concealed by the cryptocyst and best seen in a basal view of a Canada balsam preparation. Spines 1, 1, well developed. Frontal avicularium single, symmetrical, its rostrum broadly triangular and directed proximally, shorter and wider than in *M. spicata*; not developed on the distal side of an ovicell. Internal avicularia (fig. 33) rather short, nearly horizontal, the base wide, the rostrum just appearing in the proximal end of the opesia. Ovicells longer than wide, the two calcareous bars uniting in a wide Gothic arch near the distal end, with a short median mucro. Basal walls of zoëcia strongly

constricted laterally, the arrangement being as in *Amastigia rudis* (Pl. 17. fig. 27), the basal wall correspondingly sinuate. Branches bordered by lateral groups of rootlets, as in the allied species, given off from pore-chambers at the proximal ends of the marginal zoëcia. The terminal walls may or may not be provided with blister-like pore-chambers at their insertion into the basal wall.

Victorian specimens, Bracebridge Wilson Coll., in British Museum, 97.5.1.453,454.

Waters regards this as a unilaminar variety of *M. roborata*, but I think its characters entitle it to specific rank.

11. *MENIPEA ROBORATA* (*Hincks*). (Pl. 18. figs. 28-30.)

Membranipora roborata, Hincks, 1881, A. M. N. H. (5) viii. p. 128, pl. 2. figs. 3, 3 a. Curtis Id., Bass Straits; 1892, *Ibid.* (6) ix. p. 331.

Flustra membraniporides, Busk, 1884, p. 54, pl. 32. figs. 7 a, b. Port Jackson, Bass Straits.

Craspedozoum roboratum, MacGillivray, 1886, p. 131, pl. 1. fig. 4; 1889, Prodr. Zool. Vict., Dec. xviii. p. 284, pl. 177. figs. 4, 5, 5 a. Victoria.

Flabellaris roborata (pars), Waters, 1898, J. L. S. xxvi. pp. 660, 662, 672.

Flabellina (Flabellaris) roborata, Levinsen, Vid. Medd. Naturh. Foren. Copenhagen, 1902, p. 21.

Menipea roborata (pars), Waters, 1887, A. M. N. H. (5) xx. p. 183.

Menipea roborata, Levinsen, 1909, pp. 3, 9, 131, 132, 138, pl. 2. figs. 7 a-k (*Flabellina* on plate).

Bilaminar, unjointed, pluriserial, with at least 17 rows of zoëcia, the branches bordered by marginal bundles of rootlets, widening terminally and assuming an almost Flustrine appearance. Basal walls of the median zoëcia only slightly constricted, laterally, near the middle. Spines 1, 1. Cryptocyst less developed than in *M. ligulata*. Thickening bars of ovicells uniting in the form of a Gothic arch and more or less acuminate; or in a rounded curve, without a mucro. Frontal avicularia paired (except on the lateral zoëcia, where the avicularium is single) close together, the rostrum directed obliquely proximally; two constantly present on the distal side of an ovicell, widely separated, their direction reversed. Internal frontal avicularia large, directed nearly horizontally, on the basal side of the cryptocyst; their distal end visible at the proximal end of the opesia. Rootlet pore-chambers of the marginal zoëcia inconspicuous. Blister-like pore-chambers on the proximal side of the insertion of the terminal walls into the basal wall present or absent.

The synonymy shows that there has been much difference of opinion with regard to the generic position of the present species; but I agree with Waters and others that it must be placed in *Menipea*. Hincks (1892) and Waters have both expressed the opinion that *M. ligulata* and *M. spicata* are varieties of this species. That it actually belongs to *Menipea* is indicated by *M. spicata*, which has the typical unilaminar character of the genus, while

retaining the characteristic position of the joint at the bifurcation. This species has a close resemblance to *M. spicata* in all essential details of structure; and its internal avicularia (figs. 29, 30) found also in other species (see Sect. III.) are a striking point of agreement. Another resemblance is the occurrence in both species of calcareous spines projecting into the body-cavity, as originally described by Levinsen. On separating the two laminæ of a branch of *M. roborata*, after boiling in Eau de Javelle, it is found that while rosette-plates are wanting in all the zoëcia of the median rows, typical lateral rosette-plates occur on all those of the two marginal rows. *M. ligulata* shows a distinct tendency to curve the margins of its branches towards the basal surface. If this process were continued until the edges united to form a hollow unilaminar cylinder, with the basal surface internal and the frontal surface external, and if this cylinder were then compressed so that the cavity disappeared and the basal walls of opposite sides came into contact, a bilaminar branch would result. At each lateral margin the external zoëcia would be united by rosette-plates, while none of the others would be thus united. This is the arrangement actually found in *M. roborata*.

Specimens (slides) in the British Museum: 97.5.1.455, 457, Victoria, Bracebridge Wilson Collection; 81.10.21.352-354, Port Jackson; 50.5.2.2.

12. *MENIPEA VECTIFERA* *, n. sp. (Pl. 17. fig. 23; Pl. 18. figs. 36-39.)

Unilaminar, the frontal surface flat, the basal surface also flat or slightly convex; the branches composed of as many as seven series of zoëcia, and bordered by lateral bundles of rootlets. Apparently not normally jointed, although secondary breaks are formed across the branches, becoming converted into joints by the development of irregular chitinous tubes. Habit as in *M. spicata*, but less calcified. Cryptocyst (fig. 23) finely tubercular, the proximal part extensive, especially in the marginal zoëcia, the free edge narrow on the distal side of an ovicell. A pair of long bars, expanding at their free ends in a palmate manner (figs 37, 39), descend from the thickened edge of the proximal cryptocyst into the body-cavity, their direction being nearly vertical, but with a slight slope proximally. Spines small, 2, 2, the inner or distal pair commonly vestigial and recognizable by their tubular cavities trasversing the oral frame, as seen in a Canada balsam preparation. Frontal avicularium single, asymmetrical, commencing at one edge of the proximal cryptocyst, the rostrum directed transversely or slightly proximally, the mandible rather elongated and linear distally. On the distal side of an ovicell two frontal avicularia occur, widely separated, their rostra reversed so as to point distally and outwards. Internal avicularia (fig. 36) found in several cases in the more proximal zoëcium of the two formed when a row is doubled, close to the concave side of the

* *Vectis*, a bar; referring to the two bars borne by the proximal cryptocyst.

zoëcium and directed more or less basally ; concealed beneath the proximal cryptocyst in frontal view. Marginal avicularia (fig. 23), on the marginal zoëcia, small, with a deep cavity excavated in the distal part of the outer calcareous wall. Basal surface of zoëcia moderately constricted laterally, the terminal wall showing one, two, or even three blister-like pore-chambers projecting into the proximal zoëcium, close to the basal wall. A conspicuous pore-chamber giving off a rootlet at the proximal end of each marginal zoëcium, situated just distally to the marginal avicularium. A single basal heterozoëcium (fig. 38) sometimes present at the angle of the bifurcation, its rostrum narrow and elongated distally. Ovicells without distinct thickening bars, the free edge of the ectoëcium forming a rounded curve, passing near the sides and distal margin, and not giving rise to a mucro. Operculum distinct and Membraniporiform, without basal sclerite, but with well-marked lateral, triangular, occlusor flanges.

Described from three specimens in the British Museum Collection, all from New Zealand :—Hincks Collection, 99.5.1.630 (Type) and 458 (labelled *Menibranipora roborata*) ; Busk Collection, 99.7.1.703 (labelled *Menipea multiseriata*).

This interesting species would be referable to *Craspedozoum* if that genus were recognized as distinct. In the presence of internal avicularia it agrees with the other three species which were placed in that genus by MacGillivray. But this feature allies the *Craspedozoum* group with typical species of *Menipea* such as *M. triseriata* and *M. marionensis*, while *C. spicatum* shows a further agreement with *Menipea* in the character of its jointing. The present species, in retaining a single basal heterozoëcium at the bifurcation, indicates that these structures form a part of the original inheritance of the genus, as in other genera of Scrupocellariidæ, and notably *Amastigia* and *Notoplites*. The presence of marginal avicularia, which I have not found in other species of *Craspedozoum*, is a further feature of interest.

13. MENIPEA MULTISERIATA, Busk.

Menipea multiseriata, Busk, 1852², p. 22, pl. 60. figs. 1, 2. New Zealand.

Unilaminar, multiserial, jointed, bordered by marginal groups of rootlets, the number of series of zoëcia at least 8. Basal walls of the zoëcia hardly contracted laterally. Spines 1, 1. Ovicells closely resembling those of *M. roborata*. Frontal avicularia 2 on the median zoëcia, the rostrum directed obliquely proximally ; two constantly present on the distal side of an ovicell, the rostrum directed nearly transversely outwards ; one on the marginal zoëcia. A small lateral avicularium on the marginal zoëcia.

Busk considered this species nearly allied to *M. triseriata*, and possibly a variety of it. The locality was said to be unknown by him. The type-slide (99.7.1.112.D) was not returned to the Museum on the completion of the Catalogue, but it came later, with the remainder of the Busk Collection

received in 1899. It was then unnamed, but it had been marked by Busk "New Zealand." The specimen was determined by Mr Kirkpatrick, in 1904, as the missing type-slide. The evidence in favour of this view seems to me conclusive. A portion of the specimen exactly resembles Busk's fig. 1; and there are certain agreements between the specimen and the figure, particularly the occurrence of a minute emargination in the outer outline of the uppermost marginal zoëcium, on the left side, which show that the figure had been drawn with great accuracy. It must therefore be assumed that Busk had obtained evidence, after the publication of his description, that the figured specimen came from New Zealand. It may here be noted that Waters (1887, A. M. N. H. (5) xx. pp. 84, 183), who does not admit the specific distinctness of *M. roborata* and the allied forms, and has stated that a New Zealand unilaminar form is jointed, may have had *M. multiseriata* under observation. It is possible, on the other hand, that he was referring to *M. vectifera*.

It is remarkable that the resemblance of *M. multiseriata* to *M. roborata* has not previously been noticed. I have felt some hesitation in separating them, but I think this procedure may be justified on the following grounds:—*M. multiseriata* is unilaminar. I do not think it is a specimen of *M. roborata* in which the laminæ had become separated, because the marginal zoëcia show no rosette-plates and because occasional rootlets pass across the basal surface. The species under consideration has marginal avicularia, which do not occur in *M. roborata*; and it is jointed, another definite difference. In a normal bifurcation of the type-specimen it appears to me that only one of the branches of the fork is jointed, and that in this one the joint traverses the opesia of the innermost zoëcium. The jointed branch consists of only 2 or 3 zoëcia at its base. In other parts, secondary joints occur as in certain other species of *Menipea*. The joint in these cases traverses the whole width of a branch, without having any relation to a bifurcation. It has clearly been formed by absorption of the calcareous matter, but the separate edges are joined by irregular chitinous tubes, which have the appearance of being new formations, and not simply the chitinous lining of the zone of the zoëcium which lies in the region of the joint.

I have been unwilling to interfere with the type-specimen to the extent that would be necessary in order to obtain evidence with regard to the occurrence of internal avicularia; and I must leave this point undecided.

3. NOTOPLITES*, n. gen. Genotype, *N. rostratus*, n. sp.

Cellularia (pars), *Menipea* (pars), and *Scrupocellaria* (pars), auctt.

Bifurcation of type 15 (fig. 15), one or both branches jointed, the proximal segments of F and G in contact and much longer than the corresponding

* *νωτον*, back; *ὀπλίτης*, an armed man; in allusion to the basal avicularia.

parts of J and K. The joints are on the distal side of C and D, and traverse the proximal ends of GK and FJ without passing through an opesia. Rootlets given off on the distal side of the joint. Zoœcia elongated, the opesia relatively short. Basal avicularia, approaching a vibraculoid form, typically present, and then usually confined to the neighbourhood of the axils; the rootlets given off by them or from other parts closely applied to the margins of the branches and strengthening the axils. Scutum, frontal and marginal avicularia present or absent. Ovicells typically large, and with a frontal fenestra. Zoarium biserial.

I propose this genus primarily for several deep-water species represented in the 'Siboga' Collection, all of them supported by an elongated stalk composed of parallel rootlets, which diverge at the base to form an anchoring tuft—a type of growth frequently found in Cheilostomes from deep water. I select as the genotype *N. rostratus*, of which I give a preliminary diagnosis; this species representing the genus in what I consider the full expression of its characters, some of which are lost in other species. The features which I regard as specially characteristic are: (1) the mode of bifurcation, the joints being at a considerable distance from the axil (a convenient way of recognizing members of the genus), and the position of the joints, which are completely on the distal side of C and D; (2) the occurrence of basal heterozoœcia, commonly confined to the bifurcations. Certain species do not possess these structures, but their affinity is indicated by the mode of branching.

Notoplites appears to be allied to *Amastigia*, as shown by the occurrence of basal avicularia; but it differs from that genus in being biserial and jointed, in the longer zoœcia, and in having the basal avicularia confined, as a rule, to the bifurcations. It differs from *Menipea* in the fact that the joint does not traverse the opesia of the inner zoœcium at a bifurcation. It will be observed that the genus, as here understood, occurs from the Arctic to the Antarctic Oceans, but that a connecting-link is afforded by the 'Siboga' species, from the neighbourhood of the equator.

1. NOTOPLITES ROSTRATUS, n. sp.

Zoarium reaching a length of 55 mm., attached by a proximal tuft of rootlets which separate from a main stem, about 20 mm. long, composed of parallel rootlets. Zoœcia long and narrow, their outer outline concave; the opesia, which occupies less than half the frontal length, oval, much reduced proximally by a broad, crescentic cryptocyst. Distal spines 2 external, 1 median, 1 internal, with another arising from the basal surface. Scutum jointed at the base, the lamina lobed, its distal portion the smaller and generally acutely pointed and narrow. Frontal avicularium, in ordinary zoœcia, variable in size, elevated, at some distance from the opesia, on the inner side of the cryptocyst, reclining against the opesia of the preceding

alternate zoëcium, the rostrum linear and directed obliquely inwards and distally. Frontal avicularium succeeding an ovicell gigantic, directed transversely outwards, the upcurved rostrum resting on the distal border of the ovicell, the much elongated linear mandible on the distal side. Marginal avicularia varying in size, usually small, the rostrum directed obliquely outwards, basally and proximally; occasionally gigantic; on the fertile zoëcia gigantic, originating slightly on the basal side, the rostrum directed distally, nearly parallel to the edge of the branch, the distal half free, the mandible on the outer side. Basal avicularia (one pair) occur on the inner zoëcia succeeding the joints, inflated proximally, the long linear rostrum directed distally; each giving off a rootlet at its proximal end, in line with itself, the rootlet running closely attached to the margin of the axil. Ovicells large and very long, imperforate except for a transversely elongated fenestra, on the frontal surface, near the orifice.

'Siboga' Expedition, Stat. 211, $5^{\circ} 40' 7''$ S., $120^{\circ} 45' 5''$ E., 1158 metres.

Various species which have been referred to other genera appear to belong to *Notoplites*; and, in some of these, basal avicularia have already been described or have been found by me in specimens in the British Museum Collection. In other species basal avicularia seem to be wanting; but here, as in other genera of *Scrupocellariidæ*, it may be assumed that an important generic character may fail to develop, the affinities of the species being indicated mainly by the mode of bifurcation.

(a) *Species in which basal avicularia occur.*

2. *NOTOPLITES BILOBA* (Busk).

Cellularia biloba, Busk, 1884, p. 18, pl. 3. figs. 2-2*b*. Azores, 900 fathoms.

Resembling *N. rostratus* in habit, in the form of its zoëcia, scutum, marginal avicularia, and ovicells. Frontal avicularia wanting. The 'Challenger' slides (87.12.9.63, 64) show a pair of small transverse basal avicularia, which were not noticed by Busk, at the bifurcation.

3. *NOTOPLITES CRATERIFORMIS* (Busk).

Cellularia crateriformis Busk, 1884, p. 16, pl. 3. figs. 1-1*b*. E. of Buenos Aires, 1900-2650 fathoms.

Resembling the preceding species in habit and in the marginal avicularia. Scutum and frontal avicularia wanting. Of the 'Challenger' slides (87.12.9.51, 52) 51 shows a pair of small basal avicularia, directed nearly transversely, at a bifurcation. These seem to be referred to by Busk, who says: "Occasionally a radical tube may be seen supporting, instead of an ordinary zoëcium, a small curiously formed avicularium."

4. NOTOPLITES AVICULARIÆ (*Yanagi & Okada*).

Scrupocellaria aviculariæ, Yanagi & Okada, 1918, Ann. Zool. Japon. ix. p. 413, pl. vi. fig. 4, text-fig. 4. Japan, 78 fathoms.

Scutum large, with a complicated cavity. Frontal and marginal avicularia small. Basal avicularia small, the rostrum directed obliquely proximally and inwards, not confined to the bifurcations, but occurring alternately, on the proximal ends of the zoëcia. The text-figure shows clearly the origin of a rootlet from a basal avicularium.

5. NOTOPLITES MARSUPIATUS (*Jullien*).

Scrupocellaria marsupiata, Jullien, 1882, Bull. Soc. Zool. France, vii. p. 506, pl. 13. figs. 17-20. N.W. of Spain, 2018 metres; 1888, Miss. Sci. Cap Horn, vi. Zool. p. 69.

„ „ Calvet, 1907, Exp. Sci. 'Travailleur' et 'Talisman,' viii. p. 377.

„ „ Waters, 1888, 'Challenger' Rep. pt. lxxix. p. 9.

Menipea clausa, Busk, 1884, p. 20, pl. iv. figs. 5, 5a. W. of Azores, 1675 fathoms.

Jullien and Waters both pointed out in the same year (1888) that Busk's species is a synonym of *S. marsupiata*. A special peculiarity of the species is that the convex scutum so completely fills the opesia that it appears at first sight to be the frontal wall. It is attached to its stalk at the distal inner corner, and its free border is marked by characteristic radial slits, in the 'Challenger' specimen (87.12.9.83) at least. Frontal and marginal avicularia small. Jullien states that he found a single basal vibraculum in this species, and Waters points out that Kirkpatrick has found vibracula on the basal side, on two zoëcia.

(b) *Species in which basal avicularia are not recorded.*6. NOTOPLITES ELONGATUS (*Busk*).

Cellularia elongata, Busk, 1884, p. 19, pl. 3. figs. 3-3b. Kerguelen, 28 fathoms.

Scutum elongated, the distal lobe the smaller. The 'Challenger' slides (87.12.9.65, 66) show that this species agrees in its bifurcation with *Notoplites*. Marginal avicularia small, frontal avicularia wanting. I cannot find any case in which two median zoëcia occur, as shown in Busk's fig. 3a.

7. NOTOPLITES JEFFREYSII (*Norman*).

Menipea jeffreysii, Norman, 1868, Q. J. M. S. (n. s.) viii. p. 213, pl. 5. figs. 4-8*. Shetland; 1893, A. M. N. H. (6) xii. p. 446, pl. 19. fig. 1. Hardanger and Trondhjem Fjords, Finmark; 1903, *Ibid.* (7) xi. p. 579.

„ „ Hincks, 1880, p. 42, pl. 9. figs. 1, 2. Shetland.

„ „ Nordgaard, 1918, Tromsø Mus. Aarsheft. xl. (1917), p. 35.

In his 1893 paper Norman pointed out that the scutum is not correctly described in his original account and in Hincks' fig. 1, also referring to the

* The figures are wrongly given in the text as 3-5, as pointed out by Norman (1903, p. 446).

original specimen, but that it fills the entire opesia (in the same way as in *N. marsupiatum*, Jull.). He refers to a figure by Alder, reproduced in his own original account (fig. 6), supposing that certain avicularia which appear to be on the basal surface are really frontal avicularia seen through the zoecia by transparency. It appears possible that these are really basal avicularia, and in a specimen from Norway in the Cambridge Collection I have observed structures on the basal surface which may perhaps be of this nature.

8. NOTOPLITES SMITTHI (*Norman*).

Cellularia ternata, forma *duplex*, Smitt, 1868, Öfv. K. Vet.-Akad. Förh. xxiv. (1867), pp. 283, 312, pl. 16. figs. 25, 26. Spitsbergen.

Menipea smittii, Norman, 1868, Q. J. M. S. (n. s.) viii. p. 214.

„ „ Hincks, 1880, p. 43.

Menipea duplex, Levinsen, 1887, Dijnphna-Togtets zool.-bot. Udbytte (Copenhagen), p. 309, pl. 26. figs. 1, 2. Kara Sea.

Scrupocellaria smittii, Waters, 1900, J. L. S. xxviii. p. 57, pl. 7. figs. 8-11. Franz Josef Land.

Hincks remarks of this species, which has frontal and lateral avicularia but no scutum, that it is nearly allied to *M. jeffreysii*. The mode of branching characteristic of the genus may be seen in Smitt's fig. 25; but it is better shown by Waters (fig. 8), who emphasizes its difference from certain other species.

9. NOTOPLITES ANTARCTICUS (*Waters*).

Scrupocellaria antarctica, Waters, 1904, 'Belgica' Bryozoa, p. 25, pl. 1. figs. 5 a-e; pl. viii. figs. 2 a, b. Antarctic, 435-480 metres.

„ „ Kluge, 1914, p. 606, pl. 28. fig. 1. Antarctic, 350-385 metres.

Frontal and marginal avicularia and scutum present. Waters' fig. 5 a shows the mode of bifurcation well.

The three species next following, described by Kluge from Antarctic waters, may be referred to *Notoplites*, on the evidence of the bifurcation, as shown in the figures. *S. watersi* appears to bifurcate in the same manner; while *S. perdita*, in which there is no evidence with regard to this point, has an ovicell resembling that of other species of *Notoplites*.

10. NOTOPLITES TENUIS (*Kluge*).

Scrupocellaria tenuis, Kluge, 1914, p. 608, pl. 27. fig. 2. Antarctic, 46-385 metres.

Frontal avicularia and scutum present. Marginal avicularia wanting. Bifurcation clearly represented.

11. NOTOPLITES DRYGALSKII (*Kluge*).

Scrupocellaria drygalskii, Kluge, 1914, p. 609, pl. 27. fig. 5. Antarctic, 70-385 metres.

Frontal and marginal avicularia present. The scutum fills the opesia, as in *N. jeffreysii*. Bifurcation figured.

12. NOTOPLITES VANHÖFFENI (*Kluge*).

Scrupocellaria vanhoeffeni, Kluge, 1914, p. 610, pl. 27. fig. 6. Antarctic, 350-385 metres.

Frontal and marginal avicularia and scutum present; differing from the preceding species in the scutum, which has a complicated or "cervicorn" cavity. Bifurcation figured.

13. NOTOPLITES WATERSI (*Kluge*).

Scrupocellaria watersi, Kluge, 1914, p. 607, pl. 27. fig. 2. Antarctic, 350-385 metres.

Frontal and marginal avicularia and scutum present. The bifurcation represented in the figure is typical except for the zoecium B. I suspect that a mistake was made with regard to this point.

14. ? NOTOPLITES PERDITUS (*Kluge*).

Scrupocellaria perdita, Kluge, p. 613, text-fig. 2. Antarctic, 2450 metres.

Bifurcation not described. The scutum and ovicell resemble the corresponding parts in *N. rostratus*.

Incertæ sedis (possibly belonging to *Notoplites*).

15. MENIPEA NORMANI, *Nordgaard*, 1900, *Norske Nordhavs-Exp.*, p. 4, pl. i. figs. 2-8. Off Norway, 408-1134 metres.16. ? NOTOPLITES SIMPLEX (*Kluge*).

Scrupocellaria simplex, Kluge, 1914, p. 607, pl. 27. fig. 1. Antarctic, 385 metres.

Branches biserial, the opesia elongated, oval, with much raised margin. Scutum and spines wanting. A single frontal avicularium, and occasionally a minute marginal avicularium. Ovicells unknown, basal heterozoecia not described. Rootlets at first passing down the margins of the branches, given off from a chamber at the proximal end of the zoecium. Kluge states that this species is ordinarily unjointed, but that the branches may be jointed "oberhalb der Gabelung." The zoecium and the opesia resemble the corresponding parts of *Notoplites elongatus* (Busk); and it seems possible that the species should be referred to the same genus.

4. TRICELLARIA, *Fleming*.

Tricellaria, Fleming, 1828, p. 540.

Cellarina, Van Beneden (*pars*), 1848, p. 70 (nec *Cellarina*, D'Orbigny, 1851, p. 181).

Ternicellaria, D'Orbigny, 1851, pp. 40, 47.

Bugulopsis, Verrill, 1880, p. 190.

Cellularia (*pars*) and *Menipea* (*pars*), auctt.

Zoarium jointed, the branches biserial. Internodes commonly constituted by three zoecia, at least in the main stems. Zoecia more elongated than in *Emma*, the opesia occupying a small proportion of the front and without a

large development of cryptozost proximally. Bifurcation of types 9-12 (figs. 9-12), the joints traversing the proximal ends of the zoecia CG and DF; one or other of the joints occasionally suppressed. F and G usually separated on the basal side of E, sometimes by its whole width, their proximal segments shorter than the corresponding parts of C and D. The proximal ends of F and G may be suppressed, in which case the internode consists of a single zoecium at its proximal end, and the joint consists of a single chitinous tube. Rootlet given off on the proximal side of the joint. Scutum, marginal and frontal avicularia present or wanting. Basal avicularia and vibracula wanting, but probably represented by the rootlet pore-chamber.

Among the species which I include in *Tricellaria* are the following:—

A. Internodes biserial at the proximal end. Joints composed of two chitinous tubes (figs. 9-11).

1. TRICELLARIA TERNATA (*Ell. & Sol.*). (Fig. 9.)

Cellaria ternata, Ellis & Solander, 1786, p. 30. Aberdeen.

Menipea ternata, Hincks, 1880, p. 38, pl. 6. figs. 1-4. British coasts.

This common species has often been described. I may draw attention to the possibility, mentioned on p. 324, that the structure from which a rootlet may arise in this species may represent a basal heterozoecium—a structure otherwise absent in the genus.

1 a. TRICELLARIA TERNATA (*Ell. & Sol.*), var. GRACILIS, *Smitt.*

Cellularia ternata, forma *gracilis*, Smitt, 1868, Öfv. K. Vet.-Akad. Förh. xxiv. (1867), pp. 282, 305, pl. 16. figs. 10-16. Spitsbergen to Britain and Belgium.

Menipea gracilis, Busk, 1878, in Nares, Narr. Voy. Polar Sea 'Alert' and 'Discovery,' ed. by H. W. Feilden, ii. p. 284.

It may be observed that *gracilis* as the trivial name of this form is antedated by *Cellarina gracilis*, Van Beneden, 1848 (see Sect. II.).

2. TRICELLARIA OCCIDENTALIS (*Trask*), 1873*. (Fig. 10.)

Menipea occidentalis, Trask, 1873, Proc. Calif. Acad. Nat. Sci. i. (1854-1857), 2 ed. p. 113, pl. 4. fig. 4.

„ „ Robertson, 1905, Univ. Calif. Publ., Zool. ii. p. 254, pl. 6. figs. 22-25. California.

„ *compacta*, Hincks, 1882, A. M. N. H. (5) x. p. 461. Queen Charlotte Is.

3. TRICELLARIA PRIBILOFI (*Robertson*).

Menipea pribilofi, Robertson, 1905, *t. cit.* p. 257, pl. 7. figs. 32, 33; pl. 8. fig. 34. Alaska, islands of Bering Sea.

* The Proceedings of the California Academy for 1854-1857 were originally printed in a newspaper, "The Pacific," but were republished, *verbatim*, in 1873. Dr. Trask's paper was read at the meeting, Mar. 30, 1857.

4. TRICELLARIA SYMPODIA (*Yanagi & Okada*).

Menipea sympodia, Yanagi & Okada, 1918, Ann. Zool. Japon. ix. p. 410, pl. 6. fig. 1, text-fig. 2. Japan, 250 fathoms.

As indicated by its name, this species is an instance of the sympodial mode of growth, due to the suppression of one of the joints at the bifurcation. The remarkably elongated, cylindrical frontal avicularia resemble those of *Menipea crispa* and of ? *Notoplites normani*.

5. TRICELLARIA PEACHII (*Busk*). (Fig. 11.)

Cellularia peachii, Busk, 1851, A. M. N. H. (2) vii. p. 82, pl. 8. figs. 1-4. British coasts; Busk, 1852², p. 20, pl. 27. figs. 3-5.

This common species has been frequently described. It appears to represent the extreme amount of loss of structures which typically occur in the genus, as shown by the disappearance of the frontal and marginal avicularia and of the scutum. It was made the genotype of *Bugulopsis* by Verrill; but its mode of bifurcation is that of *Tricellaria*, with which I think it should be placed.

6. TRICELLARIA MONOTRYPA (*Busk*).

Cellularia monotrypa, Busk, 1852¹, p. 368. Bass Straits.

„ *cuspidata*, Busk, 1852², p. 19, pl. 27. figs. 1, 2; 1884, p. 17.

In 1884 Busk remarked that it might be proper, conditionally, to revert to his original name, *monotrypa*. There seems no question that this should be done, as Busk was not justified by the Rules of Nomenclature in substituting a new name without adequate reason, which was not given in his second work published in 1852.

B. Internodes uniserial at the proximal end. Joints composed of a single chitinous tube (fig. 12).

I regard this condition as secondary, and as due to the suppression of the proximal segments of the zoëcia F and G. A similar suppression is found in *Emma*.

7. TRICELLARIA ACULEATA (*D'Orb.*). (Fig. 12.)

Bicellaria aculeata, D'Orbigny, 1839-1846, Voy. Amér. Mérid. v. 4, p. 8, pl. 2. figs. 1-4 (*Tricellaria aculeata* on the plate). Falkland Is.

Menipea aculeata, Busk, 1884, p. 20, pl. 4. figs. 2, 2a. Falkland Is., Patagonia, 5-175 fathoms*.

„ „ Marcus, 1921, Vid. Medd. Dansk naturh. Foren. lxxiii. p. 93. Campbell Id.

* Busk's record of Stat. 303, 1325 fathoms, should probably have been Stat. 308, 175 fathoms (see under *Amastigia benemunita*, p. 334).

- Menipea fuegensis*, Busk, 1852², p. 21, pl. 19. figs. 1-3. Tierra del Fuego, Falkland Is.; 1879, Phil. Trans. vol. 168, p. 194. Kerguelen.
 „ „ Jullien, 1888, Miss. Sci. Cap Horn, vi. p. 70, pl. 12. figs. 1, 2; pl. vii. figs. 8-10. Tierra del Fuego.
Scrupocellaria fuegensis, Waters, 1904, 'Belgica' Bryozoa, p. 24. Straits of Magellan.
 „ *bifurcata*, Kluge, 1914, p. 614, text-fig. 3. Kerguelen.

There is some uncertainty with regard to *T. aculeata* and its synonyms. In 1879 Busk expressed the opinion that *Menipea fuegensis* (Busk, 1852) is a synonym of *M. aculeata*; and I think this opinion is correct. The type-specimen (54.11.15.262) of *M. fuegensis* is from the Falkland Islands, and it is of rather coarser habit than those described and figured in the 'Challenger' Report; while its scutum is linear instead of being branched. The scutum is known to be variable, within the limits of a single species, or even of the same colony, in other Scrupocellariidæ; and the differences in question do not seem to be sufficient for the establishment of two species from material from substantially the same locality. The fertile internodes figured by Jullien as *M. fuegensis* and by Kluge as *Scrupocellaria bifurcata* are very long, and Waters has expressed the opinion that Jullien's species should be considered distinct. I am inclined to regard them as different forms of a single species, as indicated in my synonymy. D'Orbigny's figures are probably not correct in all details, but some latitude must be allowed to observations made so long ago. All the specimens I have examined in the British Museum Collection, whether from the Falkland Islands, Patagonia, or Kerguelen, agree in the important character of having the internode composed of a single zoecium at its proximal end, associated with the existence of a single chitinous tube, instead of two tubes, in each joint.

8. TRICELLARIA LONGISPINOSA (*Yanagi & Okada*).

Menipea longispinosa, Yanagi & Okada, 1918, Ann. Zool. Jap. ix. p. 408, pl. 6. fig. 3, text-fig. 1. Japan, 312 fathoms and depth not stated.

5. EMMA, *Gray*.

Emma, Gray, 1843, p. 293.

„ Busk, 1852², p. 27.

Menipea (pars), auctt.

Internodes very short, typically composed of two or three zoecia. Bifurcation of types 13, 14 (figs. 13, 14), the two branches given off symmetrically or asymmetrically. Opesia reduced by an extensive development of cryptocyst, sloping considerably in a basal direction. Marginal avicularia on the proximal side of the opesia, or opposite its proximal end. Scutum usually present, sometimes wanting. Joints conspicuous, the internodes very narrow proximally.

Gray gave no generic characters, which were later described by Busk. Although the genus has been considered unnecessary by MacGillivray (1881,

Prodr. Zool. Vict., Dec. vi. p. 32) and others, I think it may conveniently be retained for the following group of southern species. As pointed out by Busk, *Emma* is nearly related to *Tricellaria*.

A. Internodes biserial at the proximal end. Joints composed of two chitinous tubes (fig. 14).

1. EMMA CRYSTALLINA, *Gray*.

Emma crystallina, Gray, 1843, p. 293. New Zealand.

" " Busk, 1852², pp. 28, 33, pl. 40. figs. 1-3. New Zealand, Bass Straits.

Menipea crystallina, MacGillivray, 1881, Prodr. Zool. Vict., Dec. vi. p. 31, pl. 58. figs. 2-2 b.

" " Waters, 1887, A. M. N. H. (5) xx. pp. 88, 265. New South Wales, etc.

" " Levinsen, 1909, pp. 132, 133, pl. 2. figs. 1 a, 1 b.

2. EMMA TRICELLATA, *Busk*.

Emma tricellata, Busk, 1852², pp. 28, 33, pl. 41. figs. 1, 2. Bass Straits, New Zealand.

Menipea tricellata, MacGillivray, 1881, *t. cit.* p. 34, pl. 58. figs. 5-5 b.

3. EMMA BUSKII (*Wyv. Thoms.*) (fig. 14).

Menipea buskii, Wyville Thomson, 1858, Nat. Hist. Rev. v. Proc. of Societies, p. 144, pl. 12. fig. 1. Tasmania, New Zealand.

" " MacGillivray, 1881, *t. cit.* pp. 35, 32, pl. 58. figs. 6-6 b.

" *buski*, Levinsen, 1909, pp. 59, 131-133, pl. 2. figs. 3 a-3 c.

4. EMMA CERVICORNIS, *MacGill*.

Emma cervicornis, MacGillivray, 1869, Trans. Proc. R. Soc. Vict. ix. p. 127. Victoria.

Menipea cervicornis, MacGillivray, 1881, *t. cit.* pp. 34, 32, pl. 58. figs. 4-4 b.

" " var., Waters, 1887, A. M. N. H. (5) xx. p. 88, pl. 4. fig. 1. New South Wales.

" " Levinsen, 1909, pp. 59, 132, 133, pl. 2. figs. 4 a, 4 b.

B. Internodes uniserial at the proximal end. Joints composed of a single chitinous tube (fig. 13).

5. EMMA CYATHUS (*Wyv. Thoms.*) (fig. 13).

Menipea cyathus, Wyville Thomson, 1858, *t. cit.* p. 143, pl. 15. figs. 10, 10 a. Bass Straits; Port Fairy (Victoria).

" " MacGillivray, 1881, *t. cit.* pp. 33, 32, pl. 58. figs. 3-3 b.

" " Levinsen, 1909, pp. 132, 133, pl. 2. figs. 2 a, 2 b.

6. SCRUPOCELLARIA, *Van Beneden*.

Zoarium jointed, biserial, bifurcation of type 8 (fig. 8), the joints crossing the zoecia CG and DF; frequently traversing the opesia of the outer zoecia, C and D, but never those of F and G. Proximal segments of F and G in contact on the basal side of E, shorter than the corresponding parts of

C and D. Rootlets not forming marginal bundles, some of them given off by basal heterozoëcia. Each zoëcium is typically provided with frontal and marginal avicularia and with a basal vibraculum, the last at its proximal end, the marginal avicularium at its distal end. Cavity of the vibraculum divided by a calcareous septum into a larger chamber containing the muscles, and a smaller chamber, from which a rootlet originates in the proximal members of the colony at least. Seta of the vibraculum without lateral branches.

This genus is readily recognizable, and as but little confusion exists with regard to its limits, I do not think it necessary to discuss the species in detail. The relations of the joints to the outer zoëcia at the bifurcations give useful assistance in characterizing species; a point which will be brought out more fully in my forthcoming Siboga Report. In some cases, as in fig. 8, the joint traverses the opesia at its middle. In other cases it merely involves the proximal end of the opesia; and in others it passes entirely on the proximal side of that opening.

Kluge (1914) has described 17 species which he refers to *Scrupocellaria*. One of these, *S. bertholletii*, Aud. (p. 616) is from Cape Verde, and is rightly placed. The remainder are from Kerguelen (1 species) and Antarctic localities (15 species). All of these may more properly, in my opinion, be distributed among the genera *Amastigia*, *Notoplites*, *Menipea*, and *Tricellaria*, and I think it has still to be proved that the genus occurs within the limits of the Antarctic Circle. *Scrupocellaria* is a characteristic genus of Northern latitudes, it is well represented in the Siboga Collection from near the Equator, and it is well known to occur in localities much further south, as for instance off the south coast of Australia. Its possible relation to *Amastigia* is indicated on p. 337, under *A. kirkpatricki*.

Although *Scrupocellaria* exhibits the tendency, shown in other members of its Family, to suppress important structures like the scutum and the frontal and marginal avicularia, all these structures are more commonly retained than in certain other genera. The basal vibracula are very rarely wanting; and in most cases they occur regularly on every zoëcium. The occurrence of either one or two vibracula in the axil of the bifurcation is a useful systematic character, as has been pointed out by Waters (1897, J. L. S. xxvi, p. 7). Levinsen (1909, p. 134) has stated that the vibraculum of *Scrupocellaria* is not divided into two chambers. I do not understand this assertion, which is at variance with my own results.

EXPLANATION OF THE PLATES.

The drawings made with an A objective were reduced to $\frac{1}{2}$, and those with a C objective to $\frac{1}{3}$ their original size.

PLATE 16.

Diagrams of bifurcation in Cellularine genera (Text, Sect. IV.). The branches are all seen from the basal surface, and a uniform notation has been adopted for the zoëcia, of which A is the more proximally situated zoëcium which gives rise to two distal successors. The preparations from which the drawings were made were, in nearly all cases, Canada balsam mounts.

- Fig. 1.—Type 1. *Didymozoum triseriale* ('Siboga').
 Fig. 2.—Type 2. *Stirpariella* (undescribed species in the 'Siboga' Collection).
 Fig. 3.—Type 3. *Bugula johnstonæ* ('Siboga'); *c.p.*, connecting process.
 Fig. 4.—Type 4. *Bugula scaphoides* ('Siboga'); „ „ „
 Fig. 5.—Type 5. *Bugula dentata* ('Siboga'); „ „ „
 Fig. 6.—Type 6. *Euoplozoum cirratum* ('Siboga'). The dotted lines indicate the joints.
 Fig. 7.—Type 7. *Kinetoskias* (undescribed, 'Siboga' Collection).
 Fig. 8.—Type 8. *Scrupocellaria ferox* ('Siboga'). The joint traverses the opesia (dotted lines) of the outer zoëcia.
 Fig. 9.—Type 9. *Tricellaria ternata* (Norway). A rootlet occurs on the proximal segment of D.
 Fig. 10.—Type 10. *Tricellaria occidentalis* var. *dilatata* (Japan); *r.*, rootlet.
 Fig. 11.—Type 11. *Tricellaria peachii* (Durham coast).
 Fig. 12.—Type 12. *Tricellaria aculeata* ('Challenger,' Stat. "303," but probably Stat. 308; see text, p. 355).
 Fig. 13.—Type 13. *Emma cyathus* (Bass Straits).
 Fig. 14.—Type 14. *Emma buskii* (Victoria).
 Fig. 15.—Type 15. *Notoplites rostratus*, n. sp. ('Siboga'). A rootlet occurs on the distal segment of K.

PLATE 17.

Figs. 16-20. Diagrams of bifurcation, continued. The specimens from which figs. 21 and 23-27 were drawn had been cleaned with Eau de Javelle, involving the loss of the spines and chitinous parts.

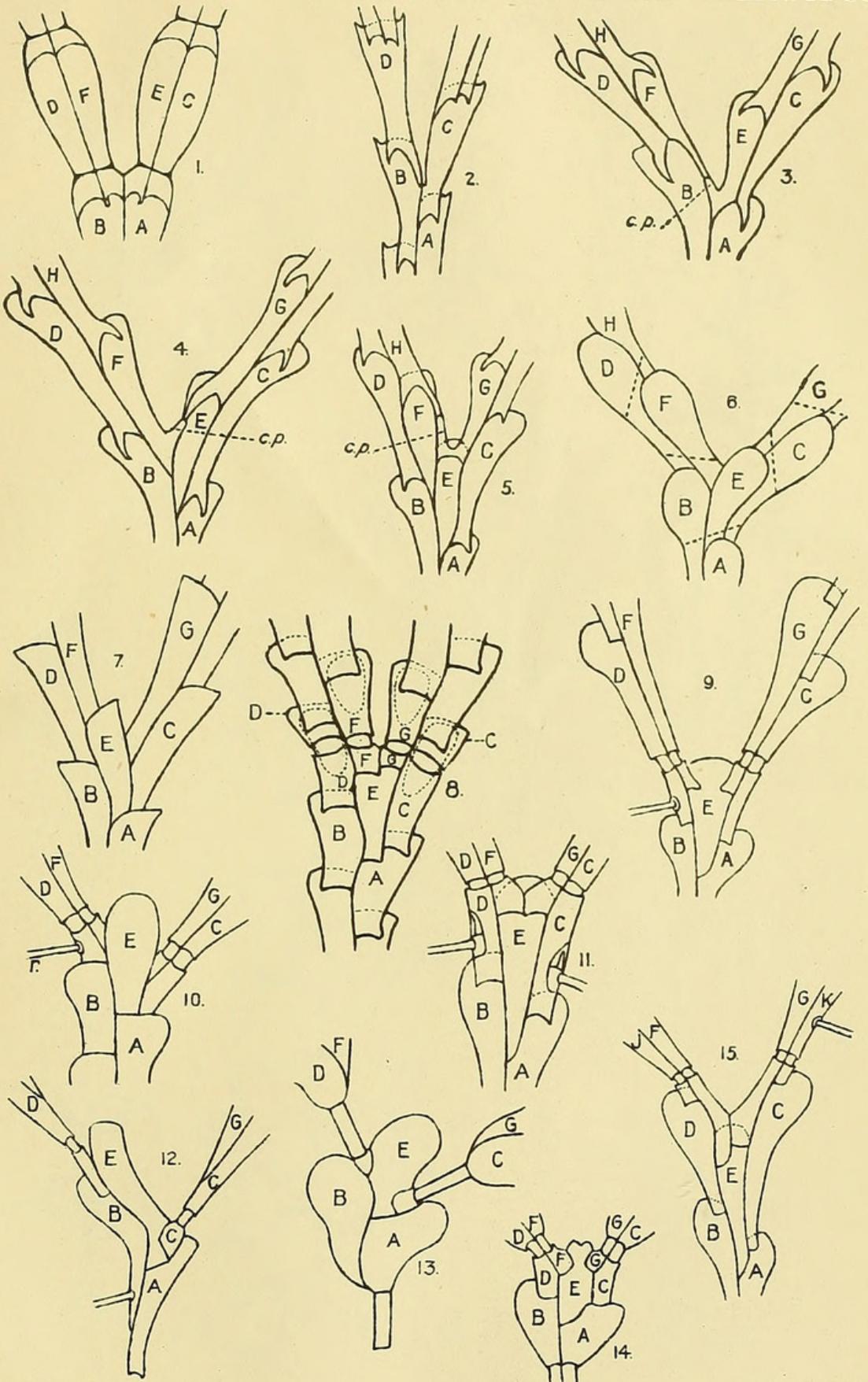
- Fig. 16.—Type 16. *Cornucopina* (from a specimen in the 'Siboga' Collection); *r.p.*, rosette-plates.
 Fig. 17.—Type 17. *Menipea crispa* (Algoa Bay, S. Africa). The joint traverses the opesia (dotted lines) of the inner zoëcia.
 Fig. 18.—Type 18. *Menipea triseriata* (Simon's Bay, S. Africa, B.M. 87.12.9.99).
 Fig. 19.—Type 19. *Menipea spicata* (Victoria). A system of branches, showing a sympodial form of colony, associated with the suppression of one of the joints at each bifurcation (B.M. 97.5.1.460).
 Fig. 20.—Type 20. *Amastigia kirkpatricki* (Lev. MSS.), n. sp. (Marion Id., B.M. 87.12.9.97).
 Fig. 21.—*Amastigia nuda* (Victoria, B.M. 97.5.1.246). Frontal view. Obj. A.

- Fig. 22.—*Menipea marionensis* (Simon's Bay, S. Africa, 'Challenger,' B.M. 87.12.9.99; found with *M. triseriata*). Basal view, showing 4 internal avicularia (*i.av.*); *l.av.*, lateral avicularium. Obj. A.
- Fig. 23.—*Menipea vectifera*, n. sp. (New Zealand, B.M. 99.5.1.630). Frontal view. Obj. A.
- Fig. 24.—*Amastigia nuda* (Tierra del Fuego, B.M. 54.11.15.87, type-specimen). Diagram of basal surface; *l.av.*, lateral avicularium; 1, 5, marginal zoëcia; 3, median zoëcium; 2, 4, submedian zoëcia.
- Fig. 25.—*Amastigia nuda* (Victoria, B.M. 97.5.1.246). Basal view of a 5-serial branch, showing 4 basal avicularia and 2 ovicells on marginal zoëcia. Obj. A.
- Fig. 26.—*Amastigia rudis* (Victoria, B.M. 97.5.1.462). Frontal view, showing gigantic frontal avicularia on the marginal zoëcia. Obj. A.
- Fig. 27.—*Amastigia rudis*. Basal view of the same branch, a seta having been inserted from another specimen which was not cleaned with Eau de Javelle. Obj. A.

PLATE 18.

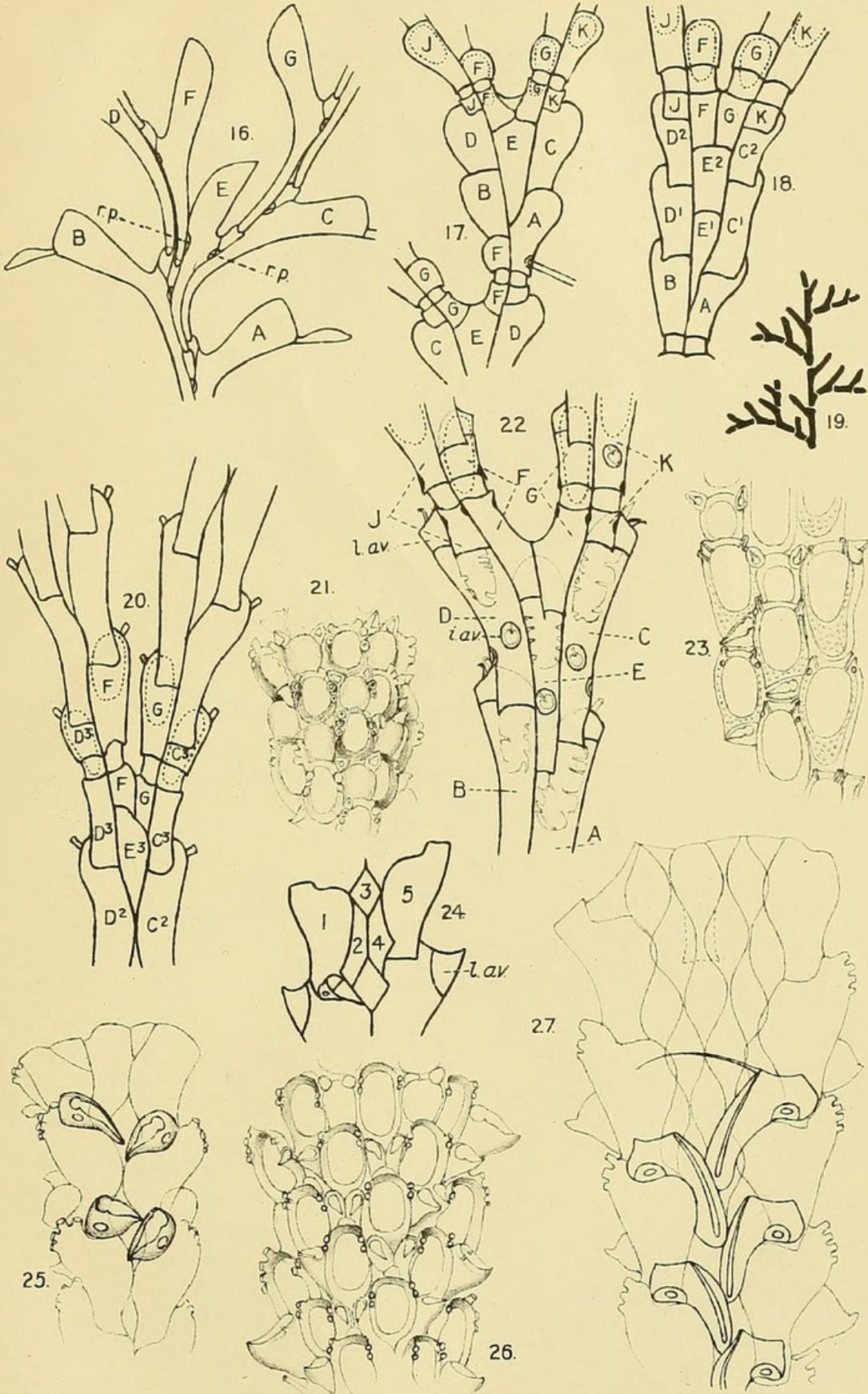
All the drawings are from specimens which had been boiled with Eau de Javelle, after which treatment the longitudinal rows can be separated by gentle pressure of a needle on the basal surface. The drawings were made with a C objective and reduced to one-third their original size.

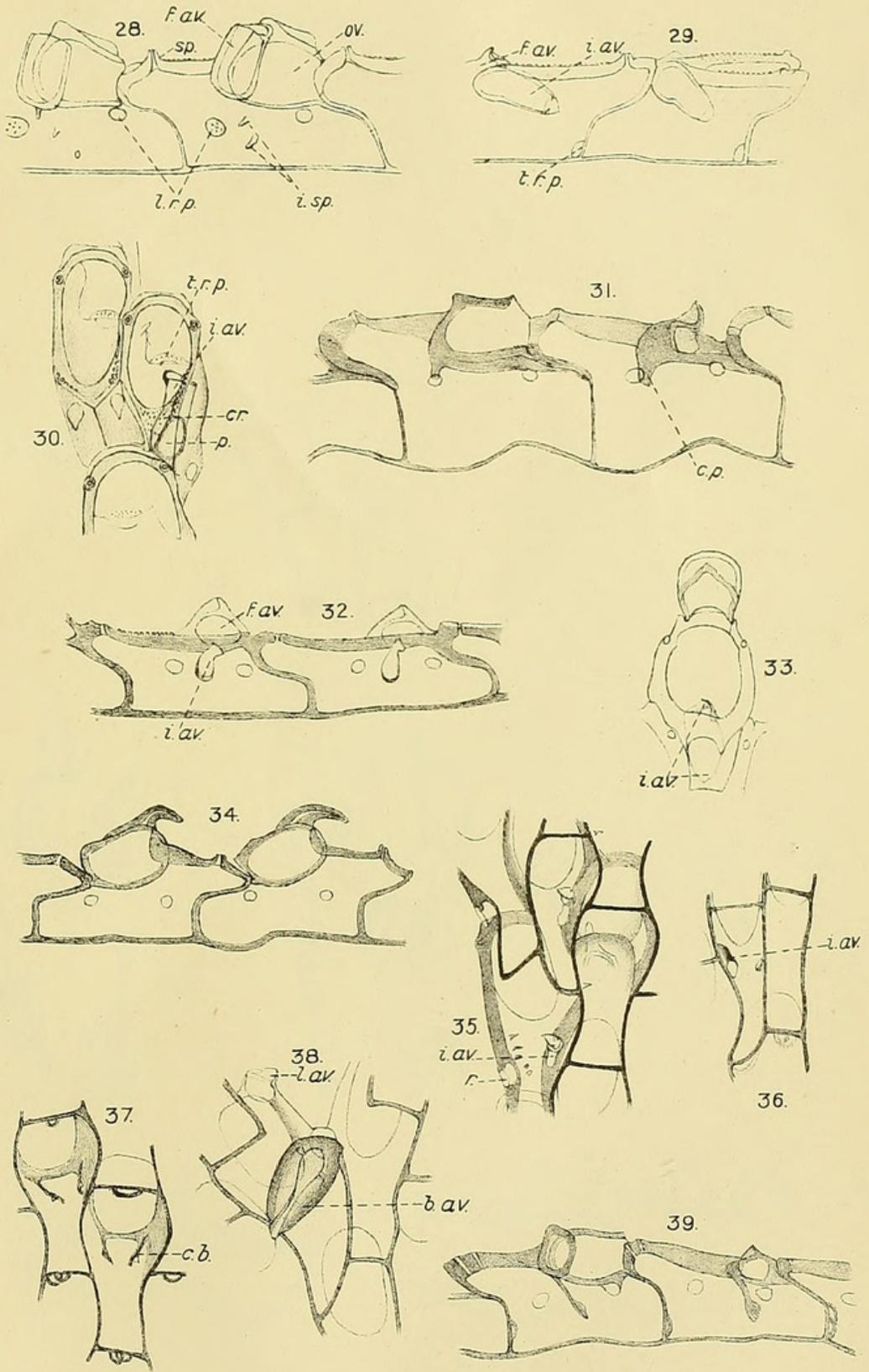
- Fig. 28.—*Menipea roborata* (Australia, B.M. 50.5.2.2). Lateral view of two zoëcia, with ovicells (*ov.*) and frontal avicularia (*f.av.*); *l.r.p.*, lateral rosette-plates; *sp.*, base of spine; *i.sp.*, internal calcareous spines.
- Fig. 29.—*Menipea roborata* (same slide). Lateral view of two zoëcia without ovicells; *f.av.*, frontal avicularium; *i.av.*, internal avicularium; *t.r.p.*, terminal rosette-plate.
- Fig. 30.—*Menipea roborata* (same slide). Frontal view; *cr.*, the part of the cryptocyst which overlies the internal avicularium (*i.av.*), of which the proximal end (*p.*) is seen partly through the frontal wall and partly through the lateral wall of the zoëcium; *t.r.p.*, terminal rosette-plate.
- Fig. 31.—*Menipea ligulata* (Victoria, B.M. 97.5.1.454). Lateral view, showing two ovicells, a frontal avicularium, and a strong calcareous process (*c.p.*) projecting vertically into the body-cavity at the proximal end of the opesia.
- Fig. 32.—*Menipea spicata* (Victoria, B.M. 83.10.15.46). Lateral view of two zoëcia without ovicells; *f.av.*, frontal avicularium; *i.av.*, internal avicularium.
- Fig. 33.—*Menipea ligulata* (Victoria, B.M. 97.5.1.454). Frontal view of a zoëcium with an ovicell and an internal avicularium (*i.av.*).
- Fig. 34.—*Menipea spicata* (same slide as fig. 32).—Lateral view of two zoëcia, each with an ovicell produced into a conspicuous spike.
- Fig. 35.—*Menipea spicata* (same slide). Basal view; two of the zoëcia with internal avicularia (*i.av.*); *r.*, origin of marginal rootlet.
- Fig. 36.—*Menipea vectifera*, n. sp. (New Zealand, B.M. 99.5.1.630). Basal view of two zoëcia, one with an internal avicularium (*i.av.*).
- Fig. 37.—*Menipea vectifera*, n. sp. (same slide). Basal view of two zoëcia, showing the characteristic calcareous bars (*c.b.*) projecting into the body-cavity from the proximal cryptocyst.
- Fig. 38.—*Menipea vectifera*, n. sp. (same slide). Basal view, showing the large basal avicularium (*b.av.*) at the bifurcation; *l.av.*, lateral avicularium.
- Fig. 39.—*Menipea vectifera*, n. sp. (same slide). Lateral view of two zoëcia, showing an ovicell, two frontal avicularia, and the characteristic internal calcareous bars.



S. F. Harmer, del.

J. T. Renne Reid Lith. Edin.





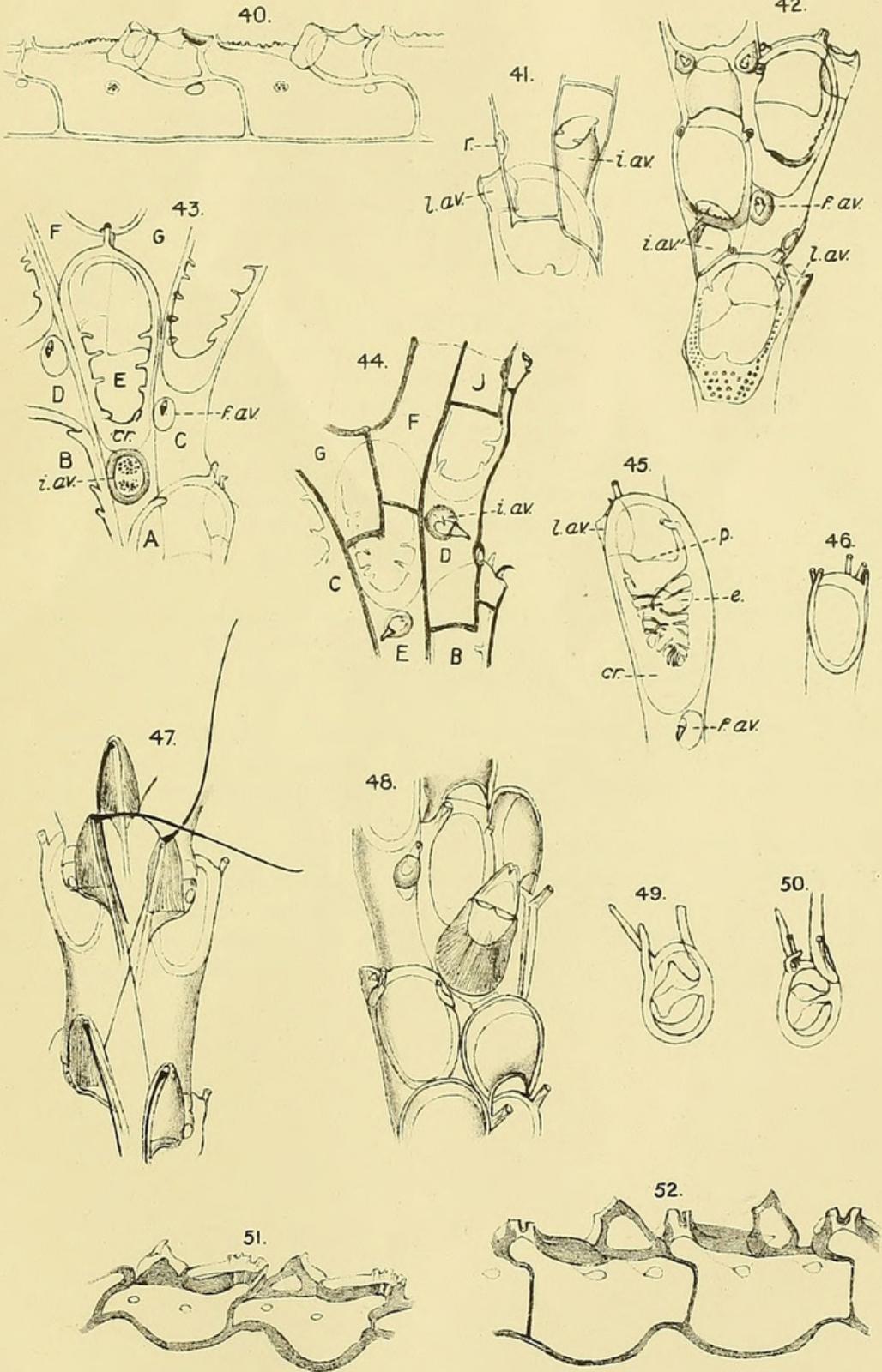


PLATE 19.

The originals of Figs. 40-42, 51 and 52 were treated with Eau de Javelle.

Scale of figures as in Pl. 18.

- Fig. 40.—*Menipea triseriata* (Simon's Bay, S. Africa, 'Challenger,' B.M. 87.12.9.99). Lateral view of two zoecia with ovicells and frontal avicularia.
- Fig. 41.—*Menipea triseriata* (same slide). Basal view, showing an internal avicularium (*i.av.*), a lateral avicularium (*l.av.*), and the origin of a marginal rootlet (*r.*).
- Fig. 42.—*Menipea triseriata*. Frontal view of the same zoecia; *f.av.* frontal avicularium; *i.av.*, internal avicularium; *l.av.*, lateral avicularium, above which is seen the origin of a rootlet.
- Fig. 43.—*Menipea marionensis* (Simon's Bay, 'Challenger,' B.M. 87.12.9.99). Frontal view; *cr.*, cryptocyst; *f.av.*, normal frontal avicularium; *i.av.*, base of an internal avicularium, showing the origin of its muscles from the frontal surface.
- Fig. 44.—*Menipea marionensis* (Cape of Good Hope, 'Challenger,' Stat. 142, B.M. 99.7.1.698). Basal view, showing two internal avicularia (*i.av.*), with their mandibles.
- Fig. 45.—*Menipea marionensis* (same slide as fig. 43). An old zoecium, showing an excessive development of the internal calcareous spines; *cr.*, cryptocyst; *p.*, proximal end of the next distal zoecium, connected with the edge of the opesia (*e.*) by a calcareous film; *f.av.*, frontal avicularium; *l.av.*, lateral avicularium.
- Fig. 46.—*Amastigia kirkpatricki* (Lev., MSS.), n. sp. (Marion Id., 'Challenger,' B.M. 87.12.9.97). Young zoecium, with 5 oral spines.
- Fig. 47.—*Amastigia kirkpatricki* (same slide). Basal view, showing vibracula, the uppermost axillary.
- Fig. 48.—*Amastigia kirkpatricki* (same slide). Frontal view, showing a gigantic frontal avicularium and two ovicells.
- Fig. 49.—*Amastigia rudis* (Victoria, B.M. 97.5.1.462). Part of a zoecium, with scutum, in frontal view.
- Fig. 50.—*Amastigia nuda* (Victoria, B.M. 97.5.1.246). A similar preparation, frontal view.
- Fig. 51.—*Amastigia nuda* (same slide as fig. 50). Lateral view of two zoecia, with frontal avicularia (paired).
- Fig. 52.—*Amastigia rudis* (same slide as fig. 49). A similar view of two zoecia with frontal avicularia.



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