

tune of 33° Fahr. (0°·3 C.) charged with Radiolarians, *Polythalamæ*, *Globigerinæ*, *Biloculinæ*, *Dentalia*, and *Nonioninæ*, together with some Annelids (*Spiochaetopterus* and *Cirratulus*), two Crustaceans (*Cuma rubicunda* and *Apsodes*), one Mollusc, two *Holothurina*, one *Gephyrea*, and one Sponge. Even at a depth of 15,900 feet animal life was found in unexpected profusion, the mud consisting almost entirely of brown and white *Foraminiferæ*, among them one Crustacean (a species of *Cuma*). But marine life is much poorer on the east coast, resembling that of Greenland.

Man does not live on Spitzbergen, and the attempts of the Swedes to winter there have for the most part proved failures, except in the case of the "Sofia" expedition, which succeeded in wintering without great loss, though not without suffering from scurvy. None but the Russian "Pomor" (inhabitants of the Murman coast) have succeeded in enduring the arctic winters. The patriarch of Spitzbergen, the Pomor Staraschin (Starostine), spent no less than thirty-two winters (fifteen being consecutive) on the islands, dying of old age in 1826. There was a time in the 17th and 18th centuries when thousands of Dutch, Danes, and others were attracted to Spitzbergen by the whale-fishing. Whole villages sprang up on the shores, the best being that of the Dutch—Smeerenberg—which is said to have been visited by 18,000 men in a single summer. The "right whale" having disappeared, the whalers ceased to visit Spitzbergen, and only quite recently an attempt has been made to renew the pursuit of the *Balanoptera boops*. The chief object of pursuit is the walrus, carried on by Norwegians; sea-birds and siders are also occasionally sought.

*History.*—Spitzbergen was discovered in 1596 by William Barents, and his companion, Cornelius Rijp, is believed to have circumnavigated the archipelago. Nevertheless it was long considered as a part of Greenland, and described under the names of East Greenland, Newland, King James's Land, until the old name of Spitzbergen gained the ascendancy. But long before Barents discovered it the Russians had known it under the name of Grumant (a word of unknown origin), and when Chancellor arrived at Archangel in 1553 he learned that the Russians visited Grumant for hunting purposes. After the 17th and 18th century whalers, the Russians began to visit the group, chiefly for walruses, seals, foxes, reindeer, bears, and birds; their huts and crosses are met with at very many places on the coast. Many wintered for several consecutive winters. Since 1830 their visits have almost ceased. The Norwegians began to visit the archipelago about 1795, and their small vessels now visit the Spitzbergen waters in considerable numbers. In 1822 a party wintered successfully, but later attempts have for the most part proved fatal on account of scurvy. To these experienced arctic navigators—assisted by Norwegian savants—we are indebted for so many important discoveries in the Barents, Kara, and Siberian Seas.

Several expeditions have made Spitzbergen their base in attempts to reach the north pole. The Russian admiral Tchitchagoff visited it twice, in 1765 and 1766, and reached 80° 28' N. lat. John Phipps mapped the north of Spitzbergen in 1773, and reached 80° 37' N. lat. In 1813 Buchan and Franklin reached 80° 34' to the north of the archipelago. Clavering and Sabine in 1823 explored the islands, and Sabine made his remarkable magnetic observations, while Clavering reached 80° 20' N. lat. Parry, shortly after his return from his third voyage, went to Spitzbergen and reached 82° 44' N. lat. on sledges. In the same year the Norwegian geologist Keilhau visited the group and has related his experiences in a remarkable book, *Resu i Ost og West Finmarken*. The Swedish professor Lovén was the first to undertake, in 1837, dredging and geological explorations in Spitzbergen and its vicinity. Next year a body of French, Swedish, Danish, and Norwegian naturalists, among whom was Charles Martins, visited the western coast. From 1853 onwards the archipelago has been the object of a series of scientific expeditions. At the suggestion of Lovén, Otto Torell, accompanied by Nordenskjöld and Quennerstedt, opened the series, making many important observations and bringing home rich geological collections. In 1861 a larger expedition led by Torell, Nordenskjöld, Malmgren, Chydenius, and Petersen set out with the object of finding how far it was possible to obtain a measurement of an arc of meridian of sufficient extent. This aim was only partly accomplished, but the expedition returned with an invaluable stock of various observations. The work of the measurement of the arc was completed in 1864 by another expedition conducted by Nordenskjöld, assisted by Malmgren and Duner, who returned again with a vast number of new and important observations. This expedition was followed in 1868 by that of the "Sofia," under Nordenskjöld, having on its scientific staff Holmgren, Malmgren, and F. Smitt, zoologists; Berggren and Fries, botanists; Lemström, physicist; and Nauckhoff, geologist. They were prevented by ice from getting higher than 81° 42' N. lat.; but, to use Oswald Heer's words, the expedition "achieved more and gave a wider extension to the horizon of our knowledge than if it had returned merely with the information that the 'Sofia' had hoisted her flag on the north pole." In 1870 two young Swedish savants, Nauckhorst and Wilander, visited Spitzbergen in order to examine the phosphoric

deposits, and two years later a colony was formed in Ice Fjord, and a small railway constructed to work the beds. The attempt, however, did not prove successful. Mr Leigh Smith and the Norwegian Captain Ulve visited and mapped parts of East Spitzbergen in 1871, returning with valuable information. They reached 81° 24' N. lat. In the same year Mr Lamont visited the archipelago. In 1872 a great polar expedition set out to winter on Spitzbergen with the intention of attempting in the spring to advance towards the pole on sledges drawn by reindeer. But the expedition encountered a series of misfortunes. The ships were beset in the ice very early in Mussel Bay, and six Norwegian fishing vessels having been likewise overtaken and shut in, the expedition had to feed the crews on its provisions and thus to reduce the rations of its own men. The reindeer all made their escape during a snow-storm; and, when the sledge party reached the Seven Islands, they found the ice so packed that all idea of going north had to be abandoned. Instead of this, Nordenskjöld explored North-East Land and crossed the vast ice-sheet which covers it. The expedition returned in 1873 with a fresh store of important scientific observations, especially in physics and submarine zoology. In 1873 Drasche, the geologist, paid a short visit to Spitzbergen, and the Dutch polar expedition approached it in 1882. In 1882 the Swedish geologists Naathorst and De Geer made a journey to which we are indebted for most interesting data about the flora of the islands. In the same year a polar meteorological station was established at Cape Hordsen for carrying on the observations desired by the international polar committee. The year 1883 being very favourable, the Norwegian walrus-hunters Andreassen and Johannessen pushed to the north-east of Spitzbergen and discovered new land to the north-east of the archipelago apparently extending as far as 39° E. long.

*Bibliography.*—The literature of the subject is very voluminous, and for full bibliographical details reference must be made to such works as Chydenius's *Svenska Expeditionen til Spetsbergen*, translated into German by Passarge (Gena, 1869); A. Leslie's *Arctic Voyages of A. E. Nordenskjöld* (London, 1879); and Chavanne's *Bibliographie der Polar-Regionen*, 1878. The earliest maps of Spitzbergen up to 1864 have been reprinted in a Dutch publication (*Tijdschrift van het Aardrijkskundig Genootschap te Amsterdam*, pt. II.); it contains the maps of 1596, 1612, 1625, 1634, 1642, 1648, and so on. Petermann's *Mittheilungen, with Ergänzungshefte, the Geographische Jahrbücher, the Iner* (Journal of the Swedish Geographical Society), and the *Journal of the Roy. Geog. Society* contain more or less detailed accounts of all the Swedish expeditions up to date. The scientific results of the Swedish expeditions are embodied in very many papers, amounting to from 6000 to 7000 printed pages, reference to which will be found in the above-mentioned works and periodicals. Oswald Heer's *Flora Fossilis Arctica* deserves special mention. Every volume of the memoirs and proceedings (*Handlingar and Förhandlingar*) of the Swedish Academy of Sciences contains some remarkable contributions to our scientific knowledge of the far north, and the same can be said of many volumes of the Christiania Academy of Sciences and the Swedish Geological, Botanical, and Zoological Societies. (P. A. K.)

**SPLEEN.** See VASCULAR SYSTEM. For diseases of the spleen, see PATHOLOGY, vol. xviii. p. 376 sq.; also MALARIA and WOOL-SORTER'S DISEASE.

**SPOHR, LUDWIG (1784-1859)**, violinist and composer, was born at Brunswick on 25th April 1784, but spent his childhood at Seesen, where in 1789 he began to study the violin, and worked so industriously that at six years old he was able to take the leading part in Kalkbrenner's trios. He received his general education at the Brunswick grammar-school,—taking lessons on the violin from Kunisch and studying composition under Hartung. The little he learned from the last-named professor was the only theoretical instruction he ever received, for, as he himself tells us, he taught himself to compose by studying the scores of Mozart. After playing a concerto of his own at a school concert with marked success, he was placed for a time under Maucourt, the leader of the duke's band; and so rapid was his progress that in 1798 he was able to start on his first artistic tour. This proved a failure; but on his return to Brunswick the duke gave him an appointment in his band, and defrayed the expense of his future education under Franz Eck, in company with whom he visited St Petersburg and other European capitals. His first violin concerto was printed in 1803. In that year Spohr returned to Brunswick and resumed his place in the duke's band. A visit to Paris was prevented by the loss of his favourite violin,—a magnificent Guarnerius, presented to him in Russia. Having played in Berlin, Leipsic, Dresden, and other German towns, his increasing reputation gained for him in 1805 the appointment of leading violinist at the court of the duke of Gotha. Soon after this he married his first wife, Dorette Scheidler, a celebrated harpist. At Gotha he composed his first opera, *Die Prüfung*, but did

not succeed in placing it on the stage. *Alruna* was equally unfortunate, though it was rehearsed with approval at Weimar in 1808. During this year Spohr accomplished one of the most extraordinary musical exploits on record. Hearing that Talma was performing at Erfurt before the reigning princes assembled for the famous congress, and failing in his attempt to obtain admission to the theatre, he bribed a horn-player to send him as his deputy; and, though he had never touched a horn in his life, he learned in a single day to play it so well that in the evening he was able to fulfil his self-imposed duty without exciting suspicion or remark. Spohr's third opera, *Der Zweikampf mit der Geliebten*, written in 1809, was successfully performed at Hamburg in the following year. In 1811 he produced his (first) *Symphony in E♭*, and in 1812 composed his first oratorio, *Das jüngste Gericht*.<sup>1</sup> It was while employed in the preparation of this work that he first felt the inconvenience inseparable from an imperfect theoretical education; and, with characteristic energy, he set about the diligent study of Marpur's *Abhandlung von der Fy.e*.

In 1812 Spohr visited Vienna, where his splendid violin-playing created a profound sensation, and he was induced to accept the appointment of leader of the orchestra at the Theater na der Wien. He then began the preparation of his greatest dramatic composition, *Faust*, which he completed in 1813, though it was not performed until five years later. His strength as a composer was now fully developed; and the fertility of his imagination enabled him to produce one great work after another with astonishing rapidity. He resigned his appointment at Vienna in 1815, and soon afterwards made a tour in Italy, where he performed his eighth violin concerto, the *Scena Cantante nello Stilo Drammatico*,—the finest of his compositions for his favourite instrument. The performer was described by the leading critics of the country as "the finest singer on the violin that had ever been heard." On Spohr's return to Germany in 1817 he was appointed conductor of the opera at Frankfurt; and in that city in 1818 he first produced his dramatic masterpiece, *Faust*. The favour with which this was received led to the composition of *Zemire und Azor*, a romantic piece founded on the story of *Beauty and the Beast*, which, though by no means equal to its predecessor in merit, soon attained a much higher degree of popularity. There can, indeed, be no doubt that *Faust* suffered from the very first from the weakness of its miserable libretto. Had the words been worthy of the music *Faust* would have taken rank among the finest German operas in existence.

Spohr first visited England in 1820, and on 6th March played his *Scena Cantante* with great success at the first Philharmonic concert. At the third he produced a new *Symphony (No. 2) in D minor*, written expressly for this occasion, which is remarkable as the first on which the conductor's *bâton* was used at a concert of the Philharmonic Society. Spohr's new symphony met with an enthusiastic reception, as did the earlier one (No. 1, in E♭), which was played, together with his *Nonetto*, at the last concert of the series. Indeed he had a triumphant success both as composer and as *virtuoso*; and he on his side was delighted with the performances of the Philharmonic orchestra. Before leaving London he gave a farewell concert, at which Madame Dorette Spohr played on the harp for the last time. Her health at this period was so delicate that she was recommended to exchange her favourite instrument for the less fatiguing pianoforte; and Spohr, with his accustomed facility, wrote a number of pieces for pianoforte and violin, which the husband and wife played

<sup>1</sup> Literally *The Last Judgment*, but not to be confounded with the oratorio now so well known by that name in England.

together with perfect artistic sympathy. After supplementing his visit to England by a short sojourn in Paris, Spohr returned to Germany and settled for a time in Dresden, where German and Italian opera were flourishing side by side under the direction of Weber and Morlacchi. His artistic relations with the composer of *Der Freischütz* were not altogether satisfactory; nevertheless Weber did not hesitate to recommend him strongly to the elector of Hesse Cassel as "kapellmeister." Spohr entered upon his duties at Cassel on 1st January 1822, and soon afterwards began the composition of his sixth opera, *Jessonda*, which he produced in 1823. This work—which he himself always regarded as one of his best productions—marks an important epoch in his career as a dramatic composer. It was the first opera he ever wrote with accompanied recitative throughout in place of the usual spoken dialogue; and by a remarkable coincidence it was produced in the same year as Weber's *Euryanthe*, a work characterized by the same departure from established custom. Unhappily Weber's early death prevented him from making a second essay in the same direction; but Spohr consistently carried out the idea in his later operas, and always with marked success.

Spohr's appointment at Cassel gave him the opportunity of bringing out his new works on a grander scale and with more careful attention to detail than he could have hoped to attain in the service of a less generous patron than the elector. And he never failed to use these privileges for the purpose of doing justice to the works of other composers. Soon after his instalment in his new office Mendelssohn, then a boy of thirteen, visited Cassel with his father; notwithstanding the disparity of their years, a firm and lasting friendship sprang up between the rising genius and the already famous composer, which ceased only with Mendelssohn's death in 1847; and in other similar cases Spohr always proved himself ready to appreciate and foster the talent displayed by others, though it must be admitted that as a critic he was very difficult to please. The success of *Jessonda* led him to produce in 1825 a seventh opera—*Der Berggeist*—founded upon the old German legend of Rubezahl, the ruling spirit of the Riesengebirge. Though less popular than its predecessor, this fine work attained a very fair success. But a far greater triumph awaited the composer at the Rhenish musical festival held at Düsseldorf in 1826. On this occasion his oratorio *Die letzten Dinge* met with so enthusiastic a reception that it had to be repeated a few days later for the benefit of a charity. This work, known in England as *The Last Judgment*, is undoubtedly the greatest of Spohr's sacred compositions, and is remarkable as the first oratorio in which the romantic element is freely introduced, with marked success throughout, and without detriment either to the solemnity of the subject or the sobriety of style which has always been regarded as an indispensable characteristic of sacred music of the highest order. In 1827 Spohr produced his eighth opera, *Pietro von Abano*, the plot of which depends for its chief interest upon the resuscitation by the famous necromancer of a lady long since dead and committed to the tomb. The work met with a fair, though not a lasting, success; and the same may be said of a much finer opera, *Der Alchymist*, produced in 1830. Spohr's next publication was of a very different character. His *Violin School*, produced in 1831, is so useful as a code of instruction for advanced students that there is probably no great violinist now living who has not been more or less indebted to it for the perfection of his technique. It holds with regard to the violin a position no less important than that which Cramer's *Studies* has so long held in connexion with the pianoforte.

The year 1833 Spohr spent in the preparation of a new



oratorio—*Des Heiland's letzte Stunden*, known in England as *Calvary* or *The Crucifixion*—which was performed at Cassel on Good Friday 1835, and sung in English at the Norwich festival of 1839, under Spohr's own direction, with such unexampled success that he was accustomed to speak of this event as the greatest triumph of his life. For the Norwich festival of 1842 he composed *The Fall of Babylon*, which also was a perfect success. His last opera, *Die Kreuzfahrer*, was produced at Cassel in 1845. Of his nine symphonies the finest, *Die Weihe der Töne*, was produced in 1832. His compositions for the violin include concertos, quartets, duets, and other concerted pieces and solos, adapted for the chamber and the concert room, and among these a high place is taken by four double quartets,—a form of composition of which he was both the inventor and the perfecter. He was, indeed, very much inclined to explore new paths, notwithstanding his attachment to classical form, and his freedom from prejudice was proved by the care with which he produced Wagner's *Flying Dutchman* and *Tannhäuser* at Cassel in 1842 and 1853, in spite of the elector's opposition. Spohr retained his appointment until 1857, when, very much against his wish, he was pensioned off. In the same year he broke his arm, but he was able to conduct *Jessonda* at Prague in 1858. This, however, was his last effort. He died at Cassel on 16th October 1859. (w. s. r.)

SPOLETO (Lat. *Spolegium*), a city of Italy, in Umbria, placed in a commanding position near the Via Flaminia, between Rome and Perugia, is said to have been colonized in 240 B.C. (Liv., *Epit.*, xx.; Vell. Pat., i. 14), and is called by Cicero (*Pro Balb.*, 21) "colonia Latina in primis firma et illustris." After the battle of Trasimenus (217 B.C.) Spolegium was attacked by Hannibal, who was repulsed by the inhabitants (Liv., xxii. 9). During the Second Punic War the city was a useful ally to Rome. It suffered greatly during the civil wars of Marius and Sulla. The latter, after his victory over Crassus, confiscated the territory of Spolegium and reduced it to the rank of a military colony. Under the empire it again became a flourishing town (Strabo, v. p. 227; Plin., *H.N.*, iii. 14; Ptol., iii.

1, 54). Owing to its elevated position it was an important stronghold during the Vandal and Gothic wars; its walls were dismantled by Totila (Procop., *Bell. Get.*, iii. 12). Under the Lombards Spoleto became the capital of an independent duchy (from c. 570), and its dukes ruled a considerable part of central Italy. Together with other fiefs, it was bequeathed to Pope Gregory VII. by the empress Matilda, but for some time struggled to maintain its independence. In 1881 it had a population of 7969 (commune, 21,507), many of whom are occupied in the weaving of woollen stuffs. It is the seat of an archbishopric for the three dioceses of Spoleto, Bevagna, and Trevi.

The city contains many interesting ancient remains,—traces of an early polygonal wall, a Roman theatre, and parts of three temples, built into the churches of S. Agostino, S. Andrea, and S. Giuliano. Remains of a fine Roman bridge were found a few years ago buried in the former bed of a torrent, which now runs along a different line. These remains have recently been buried again under a newly made road. On the citadel, which commands the town, still stands an ancient castle, originally built by Theodorici. This castle was mostly destroyed by the Goths, but was afterwards rebuilt and enlarged at many different times, especially by Pope Nicholas V. The existing building contains work of many different dates. The cathedral of S. Maria Assunta dates partly from the time of the Lombard duchy, but was much modernized in 1644. Over the main entrance is a very interesting and large mosaic of Christ in Majesty signed "Salsernus," 1207; at the sides are figures of the Virgin and St. John. In the choir and on the half cupola of the apse are some of the finest frescoes of Lippo Lippi, representing scenes from the life of the Virgin. Lippo died in 1469, leaving part of the work to be completed by his assistant Fra Diamante. The fine stalls and panelling in the choir are attributed to Bramante. The church of S. Pietro is a fine early example of Lombard architecture, though much modernized. The façade is remarkable for its rich sculptured decorations of grotesque figures, dragons, and foliage. S. Domenico is a fine example of later Italian Gothic with bands of different coloured stones. The three-apsed crypt of the church of S. Gregorio is of great interest; it probably dates from the founding of the church in the 9th century. S. Niccolò is a beautiful example of Pointed Gothic.

The city is still supplied with water by a grand aqueduct (see vol. ii. pl. IV.) across the adjacent gorge; it has stone piers and brick arches, and is about 268 feet high and 676 feet long. It is said to have been built in 604 by Theodelapius, the third Lombard duke, and the stone piers belong probably to that time. The brick arches are later restorations.

## SPONGES

THE great advance which has been made during the past fifteen years in our knowledge of the sponges is due partly to the vivifying influence of the evolutionary hypothesis, but still more to the opportunities afforded by novel methods of technique. To the strength and weakness of the deductive method Haeckel's work on the *Kalkschwämme* (6)<sup>1</sup> is a standing testimony, while the slow but sure progress which accompanies the scientific method is equally illustrated by the works of Schulze (20), who by a masterly application of the new processes has more than any one else reconstructed on a sure basis the general morphology of the sponges. In the general progress the fossil sponges have been involved, and the application of Nicol's method of studying fossil organisms in thin slices has led, in the hands of Zittel and others (24, 35), to a complete overthrow of those older classifications which relegated every obscure petrification to the fossil sponges and consigned them all to orders no longer existing. But, whilst many problems have been solved, still more have been suggested. An almost endless diversity in details differentiates the sponges into a vast number of specific forms; the exclusive possession in common of a few simple characters closely unites them into a compact group, sharply marked off from the rest of the animal kingdom.

<sup>1</sup> These numbers refer to the bibliography at the end of the article.

### Structure and Form.

*Description of a Simple Sponge.*—As an example of one Simple sponge of the simplest known sponges we select *Ascetta primordialis* (fig. 1), Haeckel. This is a hollow vase-like sac closed at the lower end, by which it is attached, opening above by a comparatively large aperture, the *osculum* or vent, and at the sides by numerous smaller apertures or *pores*, which perforate the walls. Except for the absence of tentacles and the presence of pores it offers a general resemblance to some simple form of *Hydrozoan*. Histologically, however, it presents considerable differences, since, in addition to an endoderm and an ectoderm, a third or mesodermic layer contributes to the structure of the walls; and the endoderm consists of cells (see fig. 21g) each of which resembles in all essential features those complicated unicellular organisms known as choanoflagellate *Infusoria* (see PROTOZOA, vol. xix. p. 858). With this positive character is associated a negative one: nematocysts are entirely absent. The activity

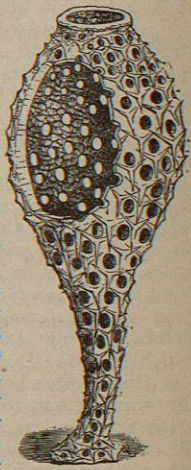


FIG. 1.—*Ascetta primordialis*, Hk. After Haeckel.

of the *Ascetta*, as of all sponges, is most obviously manifested, as Grant (5) first observed, by a rapid outflow of water from the oscule and a gentle instreaming through the pores,—a movement brought about by the energetic action of the flagella of the endodermic cells. The instreaming currents bear with them into the cavity of the sac (paragastric cavity) both protoplasmic particles (such as *Infusoria*, diatoms, and other small organisms) and dissolved oxygen, which are ingested by the flagellated cells of the endoderm. The presence of one or more contractile vacuoles in these cells suggests that they extricate water, urea, and carbonic acid. The insoluble residue of the introduced food, together with the fluid excreta, is carried out through the oscule by the excurrent water. New individuals are produced from the union of ova and spermatozoa, which develop from wandering amoeboid cells in the mesoderm. The walls of *Ascetta* are strengthened by calcareous scleres, more especially designated as spicules, which have the form of tri-radiate needles. If we make abstraction of these we obtain an ideal sponge, which Haeckel has called *Olynthus* (6), and which may be re-

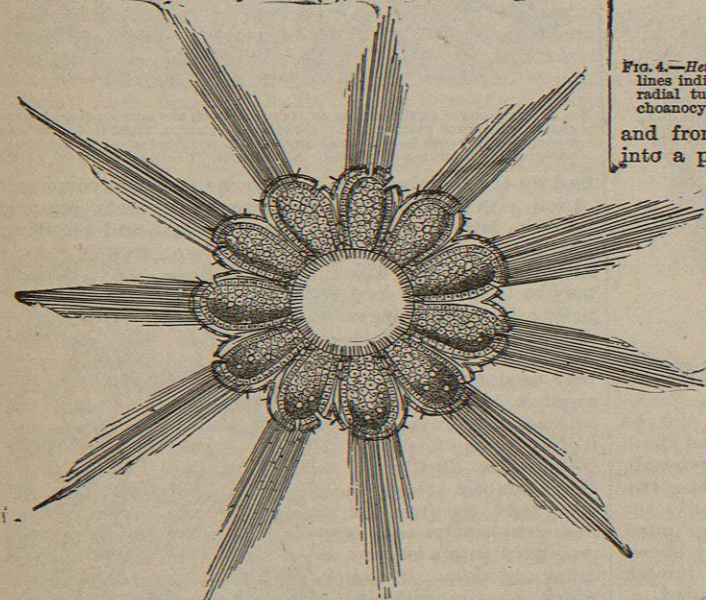


FIG. 3.—*Homoderma sycandra*, Lfd. Transverse section, showing radial tubes opening into central paragastric cavity. After V. Lendenfeld (x about 12).

garded as the ancestral form from which all other sponges have been derived. To give greater exactness to our abstraction we should perhaps stipulate for the *Olynthus* a somewhat thicker mesoderm and more spherical form than a decalcified *Ascon* presents.

*Canal System.*—We shall now trace the several modifications which the *Olynthus* has undergone as expressed in the different types of canal system.

The simple paragastric of *Ascetta* may become complicated in a variety of ways, such as by the budding off type from a parent form of stolon-like extensions, which then give rise to fresh individuals, or by the branching of the *Ascon* sac and the subsequent anastomosis of the branches; but in no case, so long as the sponge remains within the *Ascon* type, does the endoderm become differentiated into different histological elements. The most interesting modification of the *Ascon* form occurs in *Homoderma sycandra* (12), in which from the walls of a simple *Ascon* caecal processes grow out radiately in close regular whorls, each process reproducing the structure of the parent sponge (figs. 2, 3). From this it is but a short step to the important departure which gives rise to the *Sycons*.

In the simplest examples of this type the characters of *Sycon* *Homoderma sycandra* are reproduced, with the important type<sup>1</sup> exception that the endoderm lining the paragastric cavity of the original *Ascon* form loses its primitive character.

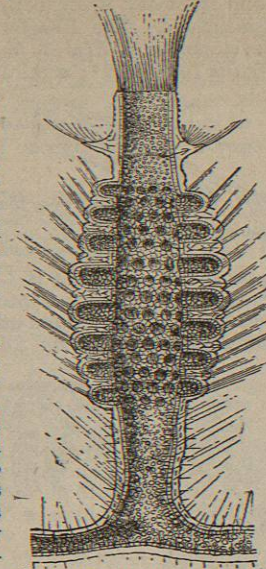


FIG. 2.—*Homoderma sycandra*, Lfd. One half cut away by a vertical median section. After V. Lendenfeld (x about 6).

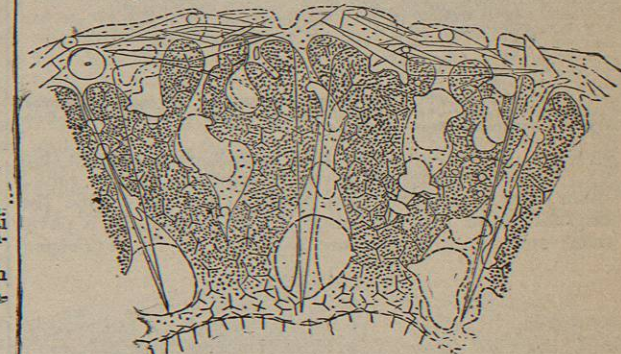


FIG. 4.—*Heteropogma nodus-gordis*, Pol. Part of a transverse section. The straight lines indicate spicules; the perforous surface is uppermost; the branching radial tubes are rendered dark by numerous small circles representing choanocytes. After Polejaeff, "Challenger" Report (x50).

and from a layer of flagellated cells becomes converted into a pavement epithelium, not in any distinguishable feature different from that of the ectoderm. The flagellated cells are thus restricted to the caecal outgrowths or radial tubes. Concurrently with this differentiation of the endoderm a more abundant development of mesoderm occurs. In some *Sycons* (*Sycaltis*, Hk.) the radial tubes remain separate and free; in others they lie close together and are united by trabeculae, or by a trabecular network, consisting of mesodermic strands surrounded by ectoderm (fig. 4). The spaces between the contiguous radial tubes thus become converted into narrow canals, through which water passes from the exterior to enter the pores in the walls of the radial tubes. These canals are the "intercanals" of Haeckel, now generally known by their older name of *incurrent canals*. The openings of the incurrent canals to the exterior are called pores, a term which we have also applied to the openings which lead directly into the radial tubes or paragastric cavity; to avoid ambiguity we shall for the future distinguish the latter kind of opening as a *prosopyle*. The term "pore" will then be restricted to the sense in which it was originally used by Grant. The mouth by which a radial tube opens into the paragastric is known as a *gastric ostium*. In the higher forms of *Sycons* the radial tubes no longer arise as simple outgrowths of the whole sponge-wall, but rather as outgrowths