rights were carefully guarded. The smiting out of a servant's eye, or tooth even, brought freedom to the servant. A master who killed his servant, man or maid, was to be "punished" (Ex. xxi. 20)—the law does not say how, but probably, as in Egypt, with death. With the Greeks and Romans slavery formed the very basis of the political constitution, and Plato, although he recognized it as being opposed to the true idea of human nature, declared it, nevertheless, necessary for the maintenance of the state. In all the Greek states the slaves outnumbered the freemen, and in some—as, for instance, in Sparta—they were treated very harshly (see HELOTA), while in others—as, for instance, in Athens—the institution assumed a much milder character, and attempts were made to give the slave some rights and a certain dignity. In Rome the slave had originally no rights at all. For the smallest misdemeanor he could be legally punished with death—crucifixion—and he was never admitted as a witness without being put to the torture. Subsequently, the rich Romans fed the murænas for their tables by throwing their old slaves into the ponds, and hosts of young slaves were annually educated to fight and kill each other in the arena. The institution was not only cruel, however; it also by degrees assumed almost incredible dimensions. Many a rich Roman possessed from 10,000 to 20,000 slaves—a large number in his luxurious house in the city, the rest on the immense sheep-walks, vineyards, olive-plantations, etc., from which he derived his income. Slave revolts occurred in 140 and 104 B. C. in Sicily, and in 73 B. C. under SPARTACUS (which see), and led to the introduction of some milder measures. But it was not until the time of the emperors that any great change took place in the condition of the slaves. Augustus granted every ill-treated slave a hearing before the magistrates when he sought refuge at his statue. Antoninus deprived the master of his right over the lives of his slaves. Manumissions became very frequent for political reasons; and finally, the institution vanished before the spirit of Christianity, or assumed another character. (See SERF.)

The Koran forbids the Moslems to keep their co-religionists as slaves, and neither Mohammed nor his next successors subjected their conquered enemies to slavery. They kept negro slaves, however, imported from Africa, but they treated them very mildly. It was the contact between the Mohammedans and the Christians during the Crusades which gave a new impulse to slavery. The Christian knights made slaves of their Mohammedan captives; the Mohammedan warriors took redress, and from the tenth to the fourteenth century there grew up a considerable slave-trade, of which Rome was the centre. Here the Spaniards brought their Moorish prisoners into the market, and here, under the very eyes of the popes, the Venetian merchants sold Christian men and women into Mohammedan slavery. Slavery still exists in most Mohammedan countries, but in a very mild form, and as a political rather than as a social institution, it being possible for the slave not only to acquire liberty, but even to attain the highest social position. Among the Berbers, however, along the northern coast of Africa, slavery and the slave-trade developed, as early as the fifteenth century, into a terrible calamity. Merchants, sailors, casual passengers, and others, crossing the Mediterranean, were kidnapped by the Berbers, and if not ransomed sold into slavery. Charles V. fought against this evil with some momentary success, but it was not fully suppressed until 1830 by the French conquest of Algeria. Another and still more powerful impulse the institution and the trade received after the discovery of America. The invention of hunting negroes in the interior of Africa to use them as slaves in the colonies is due to the Portuguese, but for its application to the New World and its establishment as a regular and legal business the world is indebted to the Spanish priest, Las Casas. In 1517, Charles V. gave the marquis de la Bresa a monopoly for eight years of importing negro slaves to the American colonies; but soon a very extensive and profitable trade sprang up, in which the English procured their share by the Peace of Utrecht (1713), where Spain was compelled to allow them to import 144,000 slaves to her American colonies. But the history of this part of the subject is fully treated under the heads ABOLITION OF SLAVERY, ANTI-SLAVERY, AMENDMENT, CONSTITUTION, REPUBLICAN PARTY, and UNITED STATES (*History*), in CYCLOPÆDIA.

**Sloane** (JAMES RENWICK WILSON), D. D., b. at Topsham, Orange co., Vt., May 29, 1823; graduated at Jefferson College in 1847; studied theology at the Reformed Presbyterian seminary of North-western Ohio, where he graduated in 1853, and in 1854 became pastor of the Reformed Presbyterian church in Rushsylvania, O., and in 1855–56 of the Third Reformed Presbyterian church in New York City. In 1868 he was elected professor of theology in the Reformed Presbyterian theological seminary at Allegheny City, Pa.—a position which he still holds. He has published a number of sermons and some literary addresses.

**Smalley** (DAVID A.), b. at Middleton, Addison co., Vt., Apr. 6, 1809; studied law, and entered the Franklin county bar in 1831; was made a State senator in 1842; admitted to the bar of the U. S. Supreme Court in 1844; appointed collector of customs for Vermont in 1853, and U. S. district judge of Vermont in 1857, from which position he retired on full pay, by act of Congress, in 1875. D. Mar. 10, 1877.

**Smith** (BENJAMIN BOSWORTH), b. at Bristol, R. I., June 13, 1794; studied theology at Brown University; was ordained deacon in 1817, and priest in 1818, and was consecrated bishop of the Protestant Episcopal diocese of Kentucky Oct. 31, 1832, at New York. He edited the *Episcopal Register of Vermont* in 1827, and the *Episcopal Recorder*, Philadelphia, from 1829.

**Smith** (E. P.), b. at South Britain, Conn., in June, 1827; was educated at Dartmouth and Yale colleges, and graduated from the theological seminary of New Haven; was settled for several years as a minister of the Congregational church at Pepperell, Mass.; became one of the most active members of the U. S. Christian Commission during the war, and published in 1869 a large volume, *Incidents of the Christian Commission*; was appointed, after the war, general field-agent for the American Missionary Association in the Southern States, and in 1873 U. S. commissioner of Indian affairs, but retired from this position in 1875, and went next spring to visit the African mission-field for the American Missionary Association; arrived at the mouth of the Gambia Apr. 27, but died at Aura in July, 1876.

**Smith** (HAMILTON LANPHERE), A. M., LL.D., b. at New London, Conn., Nov. 5, 1819; graduated at Yale College in 1839; was appointed professor of natural philosophy and astronomy at Kenyon College in 1854, and at Hobart University in 1869, and has published *Natural Philosophy* (1847–50), *World* (1848), *Sundry Papers on Microscopy, Diatomaceæ, etc.*, in *Silliman's Journal*, etc.

**Smith** (JOHN COTTON), D. D., b. at Andover, Mass., Aug. 4, 1820; graduated at Bowdoin College in 1847, and studied theology in the divinity school of the diocese of Ohio; was ordained in 1849, and immediately became rector of St. John's church, Bangor, Me.; in 1852 became assistant minister on the Greene foundation of Trinity church, Boston, whence in 1860 he was called as rector of Ascension church, New York City. He has written essays on evolution and a personal Creator, and on the modern schools of thought, collected in his *Miscellanies, Old and New* (New York, 1875). JAMES APPLETON MORGAN.

**Spencer** (SARAH ANDREWS), b. at Lavoola, N. Y., in 1837; graduated from high and normal schools in St. Louis, Mo.; was a teacher from the age of sixteen to her marriage in 1864 with Henry C. Spencer, when she removed to Washington, D. C., where she conducts a school for the business training of women. In 1871–72 she defeated attempts to license the "social evil" in Washington; in 1873 she secured a bill from the District of Columbia legislature for the reform of outcast girls, and has a girls' reform school bill now (1876) pending in Congress. Apr. 14, 1871, Mrs. Spencer and 72 other ladies of Washington were refused their right to register and vote. Mrs. Spencer brought suit in the supreme court of the District, and Judge Cartter's decision that "women are citizens, but have not the right to vote without local legislation," was reaffirmed by the U. S. Supreme Court in 1874. Mrs. Spencer represented the National Woman Suffrage Association at the Republican Presidential convention at Cincinnati in 1876, and addressed both the convention and the committee on resolutions and platform. Mrs. Spencer engrossed and signed the Woman's Declaration of Rights, and was one of the committee of five who presented it to Vice-President Ferry at the Centennial celebration in Independence Square, Philadelphia, July 4, 1876. SUSAN B. ANTHONY.

**Sponges** [Gr. σφογγιά]. Until quite recently these animals have held a doubtful position, but the observations of Grant and Lieberkuhn, Carter, Clark, Haeckel, have placed them unquestionably in the animal kingdom. They are structurally remarkably uniform, though differing greatly in external aspect. They (Fig. 1) consist internally of a mass or layer of sarcode or mesoderm containing a greater or less number of true cells, and have an ectoderm and endoderm of cellular tissue. The majority of the forms are supported by a skeleton of interwoven threads or spicules, or both, of various forms. The exterior is perforated by innumerable pores leading into channels in the interior, which enlarge and join with groups of neighboring channels, forming large branches. These in turn form junctions with other branches, and finally all of them unite into one or several

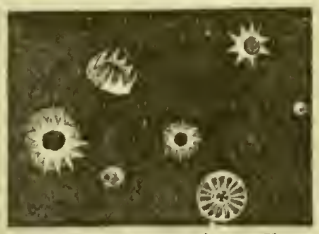
largo trunks, which open outwards like minute craters on the external surface. These are lined with another membrane, differing from anything else of its kind in the ani-

Fig. 1.

*Tethya gravata*, Hyatt (N. S.).

mal kingdom. It is composed of minute cells furnished on the free side with a long whip or flagellum surrounded by a collar. Their interiors contain a nucleus and digestive vacuoles, and they in all respects resemble the independent animals known as Flagellate Infusoria. They take in and digest food in the same manner, and eject excrements in great profusion from the area enclosed by the membranous collar, as shown by Carter and Clark. In the silicious sponges these flagellate cells are surrounded by a distinct bag-like membrane, and the whole is called an ampullaceous sac. The eggs and spermatozoa, as shown by Schultze, are derived from modified cells of the mesoderm, whereas the skeleton is either built up partly from the external membrane and partly from the sarcode by exogenous growth, or by the transformation of the loose cells of the sarcode into spiculæ, as shown first by Lieberkuhn. The function of the smaller external pores is to admit the water, which is thus strained and deprived of its coarser floating material. It is then carried along the canals by the motion of the cilia, and conveys its load of minute food to the ampullaceous sacs and zoöidal cells. The hydraulic pressure occasioned by the inward flow of the innumerable minute streams forces it through the larger trunks and out at the craters or ostioles with great rapidity. The excrements of the zoöidal cells and other fæcal matters are thus cast out of the ostioles at such a distance from the body that they are not affected by the inward currents through the pores, and are carried away by the water. This peculiar structure induced Carter and Clark to consider them compound animals, and the latter associated them directly with the Flagellate Infusoria. The observations of Haeckel, however, substantiated and corrected by those of Metschnikoff, Carter, and especially Schultze and Barrois, show that this view is not consistent with the history of their development. They have true eggs, derived from the mesodermic layer. These undergo segmentation, and a single layer of cells is formed around the exterior. Those on one hemisphere of the larva of the Calci-spongiæ speedily acquire the collars and flagelli and elongated forms of the mature zoöidal cells, but those of the other hemisphere remain simple. The next stage is a gastrula made by the invagination of the simple-celled membrane (Fig. 4). Subsequently, the opening of the bag-like stomach becomes filled again by an extension or evolution of the same cells, according to Barrois, and the larva penetrates through the endoderm into the channels, and from thence into the water. The larvæ of Silicioidea and Carneo-spongiæ differ from these in not having a gastrula stage. The endoderm either occupies one pole at first, as in the Calci-spongiæ, or fills the interior with a granular mass. This last or solid form is the more common one, and is also distinguished by the fact that the endoderm is visible at one end of the larva in what might be called the basal area, a circular space, which is usually surrounded

Fig. 2.



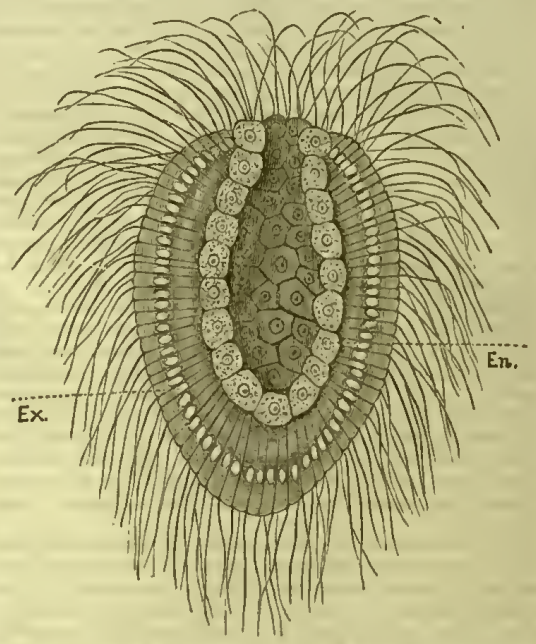
Ostioles of *Cliona sulphurea*, Verr., projected through the epidermis of the shell of a mussel.

Fig. 3.

Aspect of a section through Fig. 2.

by a thickened rim or tumid collar, the basal collar. The area is in the Silicioidea marked with bright spots, the bases of a primitive bunch of spicules, and in the Carneo-spongiæ these spicules are absent. This space is the homologue of the mouth of the gastrula of the Calci-spongiæ, and like that, also, is the true base of the larva and the end by which it usually attaches itself. The ampullaceous sacs are developed from the endoderm, and the canals are subsequently hollowed out of the mesoderm. Holes or perforations, the pores, are formed, connecting the interior with the surrounding waters, a large ostiole or cloacal aperture breaks through at the top, and the simplest sponge form is complete. Huxley and Lieberkuhn ascertained that the

Fig. 4.




Gastrula of *Luculmis echinus*, Haeckel: *En*, endoderm; *Ex*, ectoderm. (From *American Naturalist.*)

sponges are hermaphroditic, developing both eggs and spermatozoa in the same individual. Besides this means of propagation, they also possess another class of reproductive bodies known as gemmules, which are usually protected by a leathery or horny case, in most cases strengthened by spines or spicules of various shapes. These contain a cellular mass, whose development has been followed by Lieberkuhn in Spongilla. The earlier stages of the development of the gemmule are not well understood, but the result is the same as in the development of an egg, the first form of the sponge being a body with a ramifying cavity and ostiole, permeated on the sides by pores leading into a system of canals and ampullaceous sacs.

The structural evidence, therefore, leads to the following anomalous conclusion: that the sponge, though developed like other individual animals from a single egg or bud, eventually acquires a membrane, either partially or wholly lining the interior, which is partly composed of cells functionally and structurally homologous with Flagellate Infusoria. It is therefore in its simplest adult form homologically a single animal with the internal structure and functions of a colonial organization. This transformation is so complete that the distinguishing characteristic of the group, the water-system with its innumerable pores and oscules, and all the modifications of the form and skeleton, are directly subordinate to the function of supplying the zoöidal cells with floating food of suitable size and the efficient exportation of the excrements. Haeckel and some other authorities consider the water-system of the sponges as homologous with the gastro-vascular system of the Cœlenterata. The true stomach of the Cœlenterata, however, is formed either by a division of the contents of the planula, or by the invagination of the external membrane. The gastrula stage, therefore, arises in a different way in the two groups, but even if similarly formed, I cannot see that this agreement would necessarily associate the sponges with the Hydrozoa and corals, when the young differ so essentially in all the succeeding stages. Huxley was the first to recognize the importance of the characteristics of the sponges, but was completely misled by the too hasty adoption of Haeckel's gastrea theory and his low estimate of the value of taxonomy, which makes his own attempts in that direction, though very original and often very valuable, more remarkable for the strong light they throw on some single

structural character than for their comprehensiveness. The Poriferata or Poriferæ were called by him, in his classification of the animal kingdom founded on embryological data, the Metazoa Polystomata, and considered the equivalent in this respect of the remaining sub-kingdoms or branches, the radiates, articulates, and vertebrates, which were united under the name of Metazoa Monostomata. Though the sponges, like all animals except the Protozoa, as shown by Haeckel, have eggs which undergo segmentation, and they may therefore be called Metazoa, they cannot be said to be monostomatous, since, as above described, the homologue of the mouth is the basal area, and this does not persist in the adult colony, but serves as the base of attachment. MacAllister, in his *Animal Morphology*, subsequently corrected this mistake, and gave the true value of the characteristics of the Poriferata, considering them a distinct sub-kingdom of animals. The conclusion recorded in this article was reached independently of either of these authors, MacAllister's book not having been seen until after the manuscript was sent to the publisher, and it may therefore be considered more reliable than if it stood alone. From the Protozoa the sponges are still more remote, since their nearest allies, the Flagellate Infusoria, propagate either by direct fission or by the encystment of one individual alone, or by the fusion of two individuals into one, and the subsequent encystment and division of this one into many others, as shown by Dallinger and Dryadale. Viewed in every light, therefore, the sponges appear distinct from all other animals, and we must consider them as a branch or sub-kingdom. The older classifications were founded upon the peculiarities of the external form, and are now useless. The modern classifications, though based on an extended knowledge of the skeletons, are also necessarily very imperfect, owing to the slight and fragmentary nature of our existing information with regard to the fossil forms. The following is a modification of various other classifications, especially those of Schmidt, Carter, and Haeckel, but is based on original observations and adopted by the author in his *Memoirs on the Poriferæ (Poriferata) of North America*, now in course of publication by the Boston Society of Natural History:

## BRANCH OR SUB-KINGDOM—PORIFERATA.

### CLASS CALCI-SPONGLÆ.

Animal supported by a skeleton of calcareous material, disposed in lines or columns at right angles to the walls.

#### ORDER OLYNTHOIDEA.

Skeleton spicular. Spicules calcareous and of three kinds; single axis or needle-shaped, and three or four rayed. These last are arranged usually in one or two rows, so that the rays of the bases interlace and are the principal supports of the walls.

##### Sub-order Ascones.

Described by Haeckel as having thin walls, with pores which are not permanent, but may close, and open again anywhere through the wall. The skeleton spicules are in one row, except in Ascyssa.

##### Sub-order Leucones.

Described by Haeckel as having irregular, branching, permanent canals and thick walls. The skeleton spicules are in two rows in most species.

##### Sub-order Sycones.

Described by Haeckel as having regular, tubular, permanent, radiatory canals and thick walls. The skeleton spicules are in two rows in most of the species.

#### ORDER COLUMNOIDEA.

This is instituted for the reception of those fossil forms which like Receptaculites and Stromatopora have columnar instead of spicular supports between the walls of the body, the walls themselves being in the fossils largely calcareous, and partly composed of the expanded bases of the columns. Receptaculites, though its affinity with sponges has been very clearly shown by Billings, may be still considered doubtful, but there can be no question of the affinities of Stromatopora since the figures published by James Hall in the *Reports of the State Museum of New York* and the analysis of the structure of the genus by Nicholson in the *Annals and Magazine of Natural History*.

### CLASS CARNEO-SPONGIÆ.

The central layer or mesoderm is exceedingly thick. The skeleton may be either of keratode or silicious, and may consist of fibres or spicules, or a combination of both. These are distributed with reference to the greater or less irregularity of the form in a more or less radiatory manner, but this plan is subordinate to the necessity of producing a strong supporting framework for the canals and form by the interlacement of fibres and skeletal spicules. Some species have no skeleton, but they lead by slight gradations into true keratose and silicious sponges.

#### ORDER HALISARCOIDEA.

No skeleton. Animal gelatinous. Only one genus, *Halisarca*, has as yet been described, which can be properly referred to this group.

#### ORDER KERATOIDEA.

Skeleton consisting of horny fibre, either wholly or partly formed by the external layer, and therefore frequently containing foreign materials.

##### Sub-order Gummineæ.

Skeleton consists of very fine keratose threads, according to Schmidt. Animal very tough and leathery. The external layer thick and cortical. Only one genus, *Gummina*, can be referred to this order.

##### Sub-order Darwinellinæ.

Has the primary fibres similar to those of the Aplysinæ, but with a solid core and horny flesh spicules.

##### Sub-order Spongiæ.

Fibre solid, rounded, not generally thickened by exogenous growth.

##### Sub-order Aplysinæ.

Fibres hollow, thickened by exogenous growth, generally flattened.

#### ORDER KERATO-SILICIOIDEA.

Skeleton composed of solid keratose fibre and silicious spiculæ.

##### Sub-order Chondrillinæ.

This is established in order to include the singular genus *Chondrilla*, Schmidt excluding the genus *Columnitis* and *Chondrilla phyllodes*, Schm., which are true Silicleæ. The skeleton consists of very fine keratose fibre and scattered star-like silicious spiculæ.

##### Sub-order Rhaphidonemata.

Fibres with a core of silicious, simple spiculæ. Equivalent to the order thus described by Carter.

##### Sub-order Echinonemata.

Fibres with a core of silicious spicules, and a secondary system of spicules projecting from the fibres. Equivalent to Carter's order of the same name.

#### ORDER SILICIOIDEA.

Skeleton composed of silicious spicules, either separate or arranged in bundles.

##### Sub-order Chondrosinæ.

This division includes the *Chondrosia* of Nardo, which has been described by Schmidt as permeated by hard granules and distinct silicious spicules. It is likely, also, that the two species, *Chondrilla phyllodes* and *Columnitis squamata*, Schmidt, both belong to this sub-order, since they have the silicious star-like spicules and also a system of true skeletal spicules.

##### Sub-order Holoraphidota.

The fibres are composed of silicious spicules of the single-axis system in great abundance, intertwined and bound together by sarcode (*Carter*).

##### Sub-order Ancorinæ.

This group, according to Schmidt, contains the Lithistidæ, Leodinidæ, and Ancorinidæ. They have anchor-shaped spicules or spiculæ, belonging to the pyramidal type.

##### Sub-order Hexactinellæ.

Skeleton spicules with six rays.

The Poriferata are probably universal in distribution, but none have been described from the extreme arctic or antarctic zones, and but few species of one genus, *Spongilla*, inhabit the fresh waters. They are almost invariably attached or anchored to the bottom and to stationary or floating objects, and are only found in pure waters. None seem to be truly parasitic—that is, capable of living upon the juices or in the interior of other animals—though several are externally parasitic, and several are borers in shells or limestone. None are used as food either by animals or by man, though frequently serving as the abode of larval and adult forms, especially of the worms and Zoanthidæ.

The Calci-spongiæ are generally small in size, and attracted but little attention until Haeckel published his great work on the *Kalkschwämme*. They are inconspicuous in color, and generally fusiform, or if branching the branches are of the usual fusiform shape, with the single opening at the apex (Fig. 6). There are many exceptions to this rule in the shape of solid branching and irregular forms, but these do not come under general observation. They are all

marine, and, so far as known, generally distributed, but are only found in the shallower waters.

The order Keratoidea is the best known of the Carnospongiæ through their common representatives, the commercial sponges. The marketable kinds are all of one genus, that from which all the sponges derive their common name, *Spongia*. There are six species only, with numerous varieties, which are offered for sale. Three of the species are from the Mediterranean and the Red Sea, and three from the Bahamas and Florida. Other species of this genus have a very general distribution, but they are all confined to the equatorial and south temperate zones, within an area on either side of the equator which is limited by the isotherm or average temperature for January of 50° F. The *Spongia graminea*, Hyatt, and *Spongia cerebriformis*, Duch. et Mich., are occasionally used in Florida and Bermuda, but not exported. The marketable sponges owe their excellence to the closeness, fineness, and resiliency of the interwoven fibre of the skeleton. The Mediterranean appears to be particularly favorable to the production of specimens with skeletons possessing these desirable qualities in the greatest perfection. Those from the Red Sea are next in rank, while those of our own shores, though corresponding species to species with these and the Mediterranean forms, are coarser and less durable. Thus, *Spongia equina*, Schm., the horse or bath sponge of the Mediterranean, is finer than the *Spongia gossypina*, Duch. et Mich., the Wool-sponge of Florida and Nassau, though it otherwise resembles it closely. The *Spongia zimoeca*, Schm.—Zimocca sponge—represents in the Mediterranean waters the much coarser *Spongia corlosia* and *Spongia dura*, Hyatt, the Yellow-sponge and Hard-head, on the American side. The *Spongia adriatica*, Schm., the Turkey-cup sponge and Levant toilette sponge of the Mediterranean, answers to the finest of our own sponges, the *Spongia tubulifera*, Duch. et Mich., the Glove-sponge. It is probable that the Mediterranean and Red Sea were both colonized from the Caribbean Sea, and, strictly speaking, the six marketable species ought to be classed as three species, with six principal varieties, differing from each other according to their habitat. This conclusion is borne out by the facts that the Caribbean Sea contains more species of this genus than any other locality, that no marketable sponges are found in the Indian or Pacific Ocean, and that the differences in quality cited above are occasioned in these and other sponges with fibrous skeletons by any change from shallower to deeper water, or from waters loaded with sediment to clearer waters. In each and all of these cases a finer texture is the result, and this correlates directly with the fact that even in the Mediterranean the marketable kinds are found in waters which are probably very rarely reduced even during the month of January to 55°, and perhaps for the best qualities not below 60°. They are confined to the coast between Trieste and Ceuta on the African side of the Straits of Gibraltar, none being found in the Black Sea, on the coasts of Italy, France, or Spain, or the islands of Corsica, Sardinia, the Balearic Islands, or even Sicily.

When living, the commercial sponges have the general aspect and consistency of a piece of beef's liver, but the color is darker. They are gathered by means of hooks on long poles, or directly by the hands of divers, or, as in case of some of the coarser kinds, dragged up roughly by dredges. When secured they are exposed to the air for a limited time, either in the boats or on shore, and then thrown in heaps into the water again in pens or tanks built for the purpose. Decay takes place with great rapidity, and they are soon fished up again and the animal matter squeezed and washed out, leaving the cleaned skeleton ready for the market. In this condition, after being sorted, they are sold to the dealers, who have them trimmed, re-sorted, and put up in bales or on strings ready for exportation. There are many modifications of these processes in different places, but in a general way these are the essential steps through which the sponge passes before it is considered suitable for domestic purposes. Bleaching-powders or acids are sometimes used to lighten the color, but these, unless very delicately handled, injure the durability of the fibres. The genus *Spongia* does not usually appear in water deeper than 30 fathoms, but other members of the order may occur at a depth of even 75 fathoms. The Keratoidea are all marine, and are found on stony ground or coral-reefs; muddy and sandy bottoms are not favorable to their growth.

Fig. 5.

Aspect of a specimen of *Spongia corlosia* (yellow sponge) when dried, before the animal matter is washed out. Near the top of the figure the outer membrane, ectoderm, is unbroken except by the pores and the large ostioles, but below it is much torn.

The Kerate-Silicioidea resemble the Keratoidea closely in appearance, but possess less consistency and are the most difficult to preserve, the mesoderm being, even in the strongest alcohol, liable to wash out of the skeleton. The fibres are harsh and stiff, and the forms generally bush-like. The distribution is general, so far as known, and they are found on clean hard bottoms or in situations exposed to the full sweep of the strongest currents. They are all marine, and vary from the most brilliant colors to the dullest whitish-brown. They are found principally in the shallow water near the shore, but probably occur at all moderate depths on the proper kind of bottom.

The order Silicioidea has the greatest range in all respects. The forms differ, from those like *Vioa* and *Cliona*, which may be of any shape, to those like the *Euplectella* or Venus's flower-basket, which excel all others in the beauty and regularity of their spun-glass skeletons. They are found on all kinds of bottom, in all climates, and at all depths, in both salt and fresh water, and contain the only species known to occur in situations periodically exposed to the air, such as the *Spongillæ* in the tanks of India and one marine species, not yet described, from the coast of California. They are best known by the mud-dwelling forms belonging to the sub-order Hexactinellæ, or spun-glass sponges, so called on account of the aspect of the long fibres, which spring out in all directions from the base of the mass, and serve to anchor them in the mud. These are almost exclusively found in the deeper waters and on muddy bottoms. Some of the forms of the sub-order Heloraphidota are also remarkable for their habit of growing in the bottom itself, between and around the particles of sand, but no ampullaceous sacs have yet been described in these forms, so that their true nature is still doubtful. Perhaps the most remarkable are the boring sponges, which dissolve the interior of shells, destroying vast numbers of oysters, mussels, and scallops. One of these, *Cliona sulphurea*, Verrill, does not confine itself alone to the shell in which it generally starts, but spreads out on all sides, killing the animal, surrounding and dissolving the entire shell, and continuing to grow, taking in sand and stones in great quantities, until some of the masses reach the diameter of a foot or more. No other species of the Periferata is known to have such varied habits, since it is sometimes also found attached to rocks, with a perfectly clean interior. One species also, *Suberites compacta*, Verrill, inhabits shifting sands on exposed coasts, where it must lie loose upon or partly buried in the surface. This, however, is no exception to the rule that all sponges are normally attached, since one specimen found on stony bottom was fastened at one end to a stone, and the skeleton was modified, as usual, to form the base.

A. Hyatt.

Fig. 6.

*Sycandra ciliata*, Haeckel. (From *American Naturalist.*)

**Squier** (Miles Powell), D. D., b. in Cornwall, Vt., May 4, 1792; graduated at Middlebury College 1811, and at Andover Theological Seminary 1814; ordained first pastor of the First Presbyterian church of Buffalo, N. Y., May 3, 1816, where he continued eight years; in 1824, for one year, financial agent of Auburn Theological Seminary; from 1825 to 1833 Western agent of the American Home Missionary Society; founded Geneva Lyceum in 1831; elected professor of intellectual and moral philosophy in Beloit College in 1849; retained that connection till he d. at Geneva, N. Y., June 22, 1866. Dr. Squier was a frequent contributor to religious papers and reviews, and was author of the following works—viz. *The Problem Solved* (1855), *Reason and the Bible* (1860), *The Being of God and Moral Government* (1867).

A. L. Chapin.

**Staff and Staff Schools** [Fr. *état major;* Ger. *Stab;* It. *stato maggiore;* Span. *estado mayor*], the body of officers and their assistants whose special function is the direction of the mass which constitutes the force of an army. Its constitution varies in different armies. In the French army the *état major général* (the general staff) comprises the marshals of France, the generals of division, the gen-