THE LIFE HISTORY OF A CORAL.

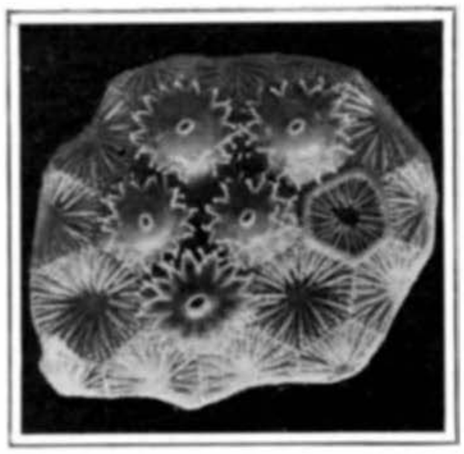
Although many of us may know a coral when we see it, it takes a zoologist to tell us what it is. To him a coral is a hard, chalky skeleton secreted by certain polyps for their support and protection. Coral polyps are closely allied to sea-anemones or actinians, only in these no skeleton is formed. Sometimes the coral structure branches like a shrub, or spreads out like a fan; sometimes it assumes the appearance of a human brain, or of a flower or mushroom. The skeletons often form reefs varying in length from a few yards to hundreds of miles, as in the Great Barrier Reef of Australia. They may also produce coral islands, frequently occupied in the middle by water, when they are called atolls. In a general way, the books tell us that the coral-producing polyps form colonies which increase by gemmation (budding). In this process young polyps spring from the original polyp, sometimes indifferently from any part of its surface, sometimes only from its upper circumference or from its base. These buds do not separate from the parent polyp, but remain and give rise to buds in turn, the whole producing what is known as a colony. Reproduction by division or fission is also a very general process in the growth of coral masses.

In order to show how a coral develops, the American Museum of Natural History has placed on exhibition a series of splendid wax models made under the direction of Dr. D. E. Dahlgren, head of the Museum's Department of Preparation, on the basis of researches carried out by Dr. J. E. Duerden in Jamaica. The accompanying illustrations are photographic reproductions of the models in the museum. The coral selected is a West Indian form known as *Siderastrea radians*. The Carnegie Institution, of Washington, has recently published a monograph by Dr. Duerden, in which the complete process of development of a coral is described. Its life-history may be considered as fairly typical of the life-history of most corals, though certain details with regard to the development of the tentacles are perhaps characteristic of the species.

A coral colony has its beginning in a simple larva set free from the parent polyp and is usually just large enough to be visible to the naked eye. Such a free swimming larva of an elongated, pear-shaped form, is shown in Fig. 1, of course much magnified. As it swims or drifts about, one end of the larva swells or thickens, and four pairs of striations begin to appear, clearly shown in Fig. 2. The external striations give evidence of an internal division of the hollow cavity of the larva and are the first signs of the mesenteries (partitions). Soon the rudimentary mesenteries increase in number to six pairs (Fig. 3) and about this time the larva settles to the bottom of the sea, attaching itself to some rock or stone, perhaps to some old piece of coral. A change of shape now takes place, more pronounced than any of the preceding structural modifications. Now permanently secured, the base of the larva flattens until the organism resembles an open umbrella in form. The larva may now be called a polyp. Fig. 4 depicts the individual at this stage and also reveals the developing mesenteries radiating from the mouth. It is through this mouth that the animal receives nourishment and also gets rid of its waste matters. Around and under the base of the polyp a very thin layer of lime is now secreted by the activity of the cells. This is the beginning of a skeleton.

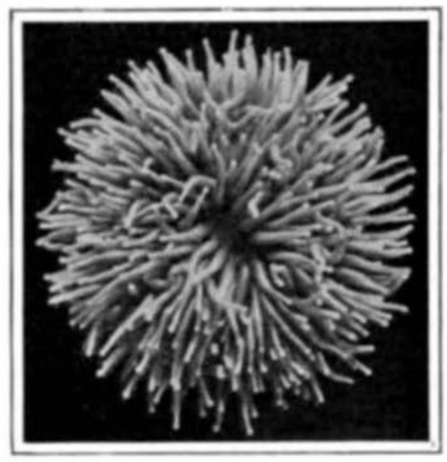
West Indian Sea Anemone (*Condylactis passiflora*).

The resemblance to a coral polyp is apparent.



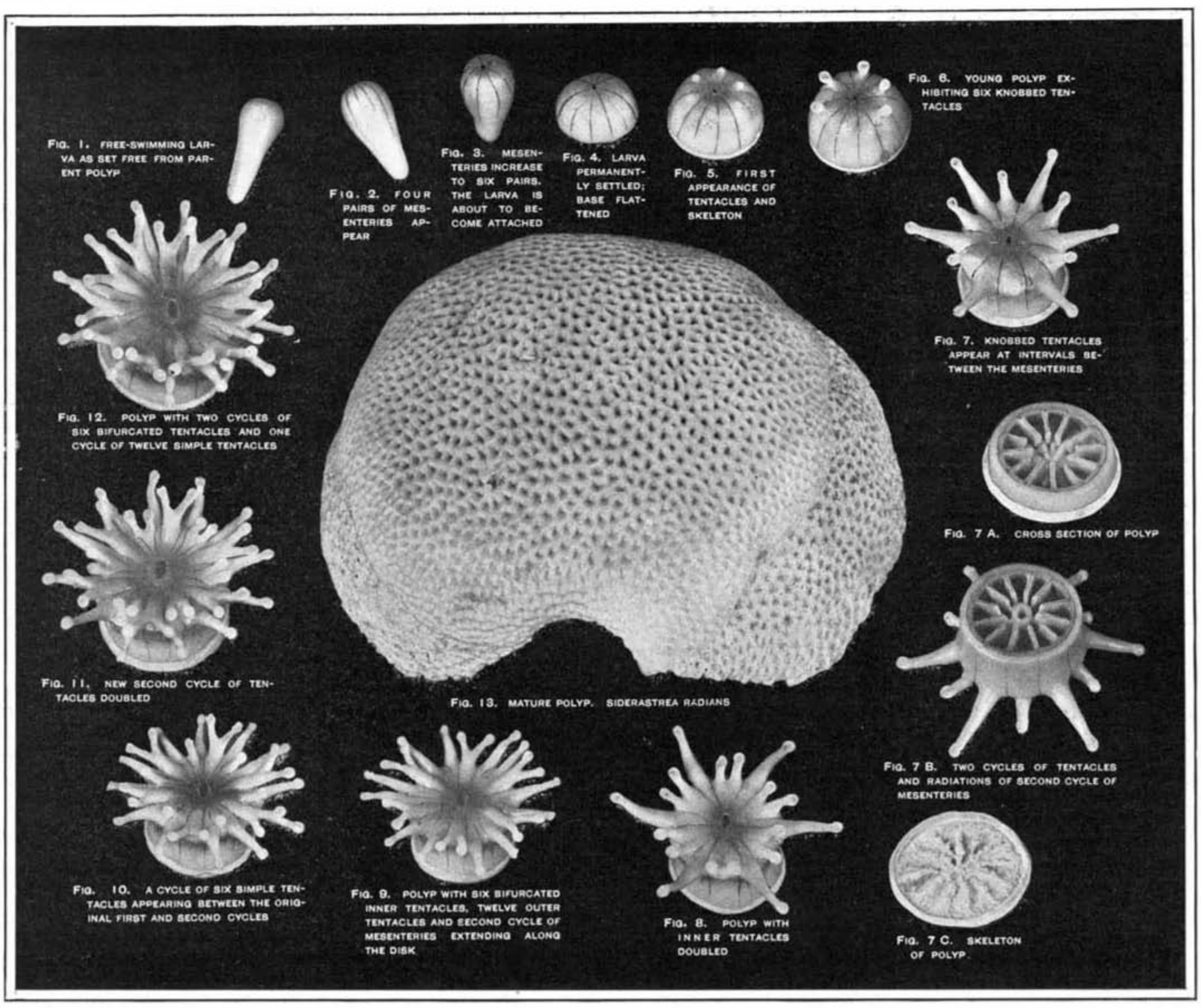
A Portion of the Mature Coral (*Siderastrea radians*) Enlarged.

Four expanded polyps (one partly contracted) are shown; also a polyp in cross-section and the skeleton (secreted by the polyp). The cross-section shows the mesenteries of the polyp alternating with the septa of the skeleton.



A Mushroom Coral of the Pacific Showing Resemblance of a Coral Polyp to a Sea Anemone.

This coral consists of a single polyp and its secreted skeleton. In the center is the mouth, surrounded by tentacles.



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Six knobs also appear around the mouth and represent the first stages in the formation of the tentacles or feelers (Fig. 5). They push their way upwardly like so many seedlings (Fig. 6). As they continue to grow and increase in size, they develop into true knobbed tentacles characteristic of coral polyps (Fig. 7). They appear at regular intervals between or alternating with the mesenteries. Another set of six tentacles appears in the spaces between the first six, making the number thus far attained twelve. Then at the base of the second set, a third series of six sprouts out, as illustrated in Fig. 8. In Fig. 9 the inner tentacles are now shown doubled. Next (Fig. 10) we find the polyp equipped with six bifurcated inner tentacles and twelve outer tentacles; moreover, a second cycle of six pairs of mesenteries faintly traces its course along the disk. In the following stage a cycle of six simple tentacles appears between the original first and second cycles (Fig. 11), and soon the polyp doubles its second cycle of tentacles (Fig. 12). Finally, we find two cycles of six bifurcated tentacles and one cycle of twelve simple tentacles, all situated over the internal chambers produced by the presence of the mesenteries or partitions.

Thus the polyp develops by gemmation, tentacle crowding on tentacle. The young animals form skeletons from the parent polyps, the new skeletons literally growing out of the older ones. It is evident enough how, by a process with such immense possibilities of multiplication, a large area can be rapidly built up.

Under the special conditions necessary for the growth of a coral, it is a matter of interest to discover by what means the reefs and atolls have been formed, that often rise from depths of several hundred and even thousands of feet. According to Darwin—the first man who clearly recognized how essential is shallow water to the development of a coral—polyps colonized along the shores of an island to form eventually a fringing reef. Assuming a slow subsidence of the ocean floor, sufficiently slow in fact to permit a continuation of growth on the outer edge of the reef, the water channel would gradually widen and deepen to form a barrier reef, which upon the submergence of the entire island would yield place to an atoll. Elaborated by Dana, this theory was promulgated in almost every text book on geology. Unfortunately for Darwin's view, however, it was discovered that some islands instead of subsiding were actually elevated. Then Murray proved that corals may grow on a perfectly stable floor, such as the slopes of a volcanic island, or submarine banks of fossil organisms. Simultaneously with this outward growth, the coral reef is washed by the sea. The debris carried down to the bottom forms a table for their future growth. It may happen that the original foundation projected above the sea-level, and might thus have been cut down by breakers. How is the characteristic ring-shaped formation produced? Simply by the solvent action of the water acting on the dead coral (which is nothing but carbonate of lime), thus forming a lagoon.

Probably both Darwin's and Murray's theories are correct; and what is more, other theories, equally plausible, may be advanced to account for the coral atoll. The truth is that each atoll has probably been produced under peculiar local conditions, and that these conditions are sufficiently alike in many cases to permit a Darwin or a Murray to formulate interesting if not generally acceptable theories.