Competitive Exams: Evolution Time Scale: Corals & Molluscs

Evolution of the Corals

Again we must refrain from following in detail the development of this new world of life which branches off in the Archaean ocean. The evolution of the Corals alone would be a lengthy and interesting story. But a word must be said about the jelly-fish, partly because the inexpert will be puzzled at the inclusion of so active an animal, and partly because its story admirably illustrates the principle we are studying. The Medusa really descends from one of the plant-like animals of the early Archaean period, but it has abandoned the ancestral stalk, turned upside down, and developed muscular swimming organs. Its past is betrayed in its embryonic development. As a rule the germ develops into a stalked polyp, out of which the free-swimming Medusa is formed. This return to active and free life must have occurred early, as we find casts of large Medusae in the Cambrian beds. In complete harmony with the principle we laid down, the jelly-fish has gained in nerve and sensitiveness in proportion to its return to an active career.

But this principle is best illustrated in the other branch of the early many-celled animals, which continued to move about in search of food. Here, as will be expected, we have the main stem of the animal world, and, although the successive stages of development are obscure, certain broad lines that it followed are clear and interesting.

It is evident that in a swarming population of such animals the most valuable qualities will be speed and perception. The sluggish Coral needs only sensitiveness enough, and mobility enough, to shrink behind its protecting scales at the approach of danger. In the open water the most speedy and most sensitive will be apt to escape destruction, and have the larger share in breeding the next generation. Imagine a selection on this principle going on for millions of years, and the general result can be conjectured. A very interesting analogy is found in the evolution of the boat. From the clumsy hollowed tree of Neolithic man natural selection, or the need of increasing speed, has developed the elongated, evenly balanced modern boat, with its distinct stem and stern. So in the Archaean ocean the struggle to overtake food, or escape feeders, evolved an elongated two-sided body, with head and tail, and with the oars (cilia) of the one-celled ancestor spread thickly along its flanks. In other words, a body akin to that of the lower water-worms would be the natural result; and this is, in point of fact, the next stage we find in the hierarchy of living nature.

Worm-Like Organization

Probably myriads of different types of this worm-like organisation were developed, but such animals leave no trace in the rocks, and we can only follow the development by broad analogies. The lowest flat-worms of to-day may represent some of these early types, and as we ascend the scale of what is loosely called "worm" organisation, we get some instructive suggestions of the way in which the various organs develop. Division of labour continues among the colony of cells which make up the body, and we get distinct nerve-cells, muscle-cells, and digestive cells. The nerve-cells are most useful at the head of an organism which moves through the water, just as the look-out peers from the head of the ship, and there they develop most thickly. By a fresh division of labour some of these cells become especially sensitive to light, some to the chemical qualities of matter, some to movements of the water; we have the beginning of the eyes, the nose, and the ears, as simple little depressions in the skin of the head, lined with these sensitive cells. A muscular gullet arises to protect the digestive tube; a simple drainage channel for waste matter forms under the skin; other channels permit the passage of the fluid food, become (in the higher worms) muscular blood-vessels, and begin to contract--somewhat erratically at first--and drive the blood through the system.

Here, perhaps, are millions of years of development compressed into a paragraph. But the purpose of this work is chiefly to describe the material record of the advance of life in the earth's strata, and show how it is related to great geological changes. We must therefore abstain from endeavouring to trace the genealogy of the innumerable types of animals which were, until recently, collected in zoology under the heading “Worms.” It is more pertinent to inquire how the higher classes of animals, which we found in the Cambrian seas, can have arisen from this primitive worm-like population.

The struggle for life in the Archaean ocean would become keener and more exacting with the appearance of each new and more effective type. That is a familiar principle in our industrial world to-day, and we shall find it illustrated throughout our story. We therefore find the various processes of evolution, which we have already seen, now actively at work among the swarming Archaean population, and producing several very distinct types. In some of these struggling organisms speed is developed, together with offensive and defensive weapons, and a line slowly ascends toward the fish, which we will consider later. In others defensive armour is chiefly developed, and we get the lines of the heavy sluggish shell-fish, the Molluscs and Brachiopods, and, by a later compromise between speed and armour, the more active tough-coated Arthropods. In others the plant-principle reappears; the worm-like creature retires from the free-moving life, attaches itself to a fixed base, and becomes the Bryozoan or the Echinoderm. To trace the development of these types in any detail is impossible. The early remains are not preserved. But some clues are found in nature or in embryonic development, and, when the types do begin to be preserved in the rocks, we find the process of evolution plainly at work in them. We will therefore say a few words about the general evolution of each type, and then return to the geological record in the Cambrian rocks.

The Starfish

The starfish, the most familiar representative of the Echinoderms, seems very far removed from the kind of worm-like ancestor we have been imagining, but, fortunately, the very interesting story of the starfish is easily learned from the geological chronicle. Reflect on the flower-like expansion of its arms, and then imagine it mounted on a stalk, mouth side upward, with those arms--more tapering than they now are--waving round the mouth. That, apparently, was the past of the starfish and its cousins. We shall see that the earliest Echinoderms we know are cup-shaped structures on stalks, with a stiff, limy frame and (as in all sessile animals) a number of waving arms round the mouth. In the next geological age the stalk will become a long and flexible arrangement of muscles and plates of chalk, the cup will be more perfectly compacted of chalky plates, and the five arms will taper and branch until they have an almost feathery appearance; and the animal will be considered a "sea-lily" by the early geologist.

The evidence suggests that both the free-moving and the stalked Echinoderms descend from a common stalked Archaean ancestor. Some primitive animal abandoned the worm-like habit, and attached itself, like a polyp, to the floor. Like all such sessile animals, it developed a wreath of arms round the open mouth. The "sea-cucumber" (Holothurian) seems to be a type that left the stalk, retaining the little wreath of arms, before the body was heavily protected and deformed. In the others a strong limy skeleton was developed, and the nerves and other organs were modified in adaptation to the bud-like or flower-like structure. Another branch of the family then abandoned the stalk, and, spreading its arms flat, and gradually developing in them numbers of little "feet" (water-tubes), became the starfish. In the living Comatula we find a star passing through the stalked stage in its early development, when it looks like a tiny sea-lily. The sea-urchin has evolved from the star by folding the arms into a ball.

The Bryozoa (sea-mats, etc.) are another and lower branch of the primitive active organisms which have adopted a sessile life. In the shell-fish, on the other hand, the principle of armour-plating has its greatest development. It is assuredly a long and obscure way that leads from the ancestral type of animal we have been describing to the headless and shapeless mussel or oyster. Such a degeneration is, however, precisely what we should expect to find in the circumstances. Indeed, the larva, of many of the headless Molluscs have a mouth and eyes, and there is a very common type of larva--the trochosphere--in the Mollusc world which approaches the earlier form of some of the higher worms. The Molluscs, as we shall see, provide some admirable illustrations of the process of evolution. In some of the later fossilised specimens (Planorbis, Paludina, etc.) we can trace the animal as it gradually passes from one species to another. The freshening of the Caspian Sea, which was an outlying part of the Mediterranean quite late in the geological record, seems to have evolved several new genera of Molluscs.

Primitive Molluscs

The remains are not preserved of those primitive Molluscs in which we might see the protecting shell gradually thickening, and deforming the worm-like body, we are not without indications of the process. Two unequal branches of the early wormlike organisms shrank into strong protective shells. The lower branch became the Brachiopods; the more advanced branch the Molluscs. In the Mollusc world, in turn, there are several early types developed. In the Pelecypods (or Lamellibranchs--the mussel, oyster, etc.) the animal retires wholly within its fortress, and degenerates. The Gastropods (snails, etc.) compromise, and retain a certain amount of freedom, so that they degenerate less. The highest group, the Cephalopods, "keep their heads," in the literal sense, and we shall find them advancing from form to form until, in the octopus of a later age, they discard the ancestral shell, and become the aristocrats of the Mollusc kingdom.

The last and most important line that led upward from the chaos of Archaean worms is that of the Arthropods. Its early characteristic was the acquisition of a chitinous coat over the body. Embryonic indications show that this was at first a continuous shield, but a type arose in which the coat broke into sections covering each segment of the body, giving greater freedom of movement. The shield, in fact, became a fine coat of mail. The Trilobite is an early and imperfect experiment of the class, and the larva of the modern king-crab bears witness that it has not perished without leaving descendants. How later Crustacea increase the toughness of the coat by deposits of lime, and lead on to the crab and lobster, and how one early branch invades the land, develops air-breathing apparatus, and culminates in the spiders and insects, will be considered later. We shall see that there is most remarkable evidence connecting the highest of the Arthropods, the insect, with a remote Annelid ancestor.

We are thus not entirely without clues to the origin of the more advanced animals we find when the fuller geological record begins. Further embryological study, and possibly the discovery of surviving primitive forms, of which Central Africa may yet yield a number, may enlarge our knowledge, but it is likely to remain very imperfect. The fossil records of the long ages during which the Mollusc, the Crustacean, and the Echinoderm slowly assumed their characteristic forms are hopelessly lost. But we are now prepared to return to the record which survives, and we shall find the remaining story of the earth a very ample and interesting chronicle of evolution.