

*The Primary Factors of Organic Evolution.* By E. D. Cope, Ph. D., Member of the U. S. National Academy of Sciences, Professor of Zoölogy and Comparative Anatomy in the University of Penn. Chicago, The Open Court Publishing Co.; (London, 17 Johnson's Court, Fleet Street, E. C.). 1896.

The facts and theories contained in this book will interest the zoölogists, and, to a certain extent, the geologists. But the portion which will most interest the anthropologist is contained in the second chapter. The topic treated is, according to the title, General Phylogeny, which means in reality, the genealogy of plants, animals and man. The general topic of the book is Organic Evolution. It begins with the chapter on Variation, and ends with chapters on Heredity and the Function of Consciousness; but the book is so full of technical terms and is so minute in its illustrations that the ordinary reader finds it difficult to follow the author. In this chapter, however, the reasoning is clear and the language simple enough to be understood.

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The following is a summary of the argument: "The study of philogeny shows that the evolution of life forms has been from the simple to the complex, and from the generalized to the specialized in an ascending scale, which has not been prevented by the occasional degeneracy of parts." "Both animals and plants have a common origin, and are not distinguishable at first by any sharp line of demarcation." "The capacity for motion so general in animals is present in the earlier stages of certain plants, especially the Algæ." "The distinction between the lower animals and plants is, however, that the former introduce their food at a definite point of the body, while plants absorb theirs at all points." "The progress in plants is seen chiefly in the modification of the methods of reproduction." "In the simplest plants there is no sexuality." "In the next stage sexual conjugation is necessary, but the sexes do not differ." "In the third stage the sex is distinct, for there are male and female germ cells."

"In the animal kingdom, as with plants, we commence with non-sexual forms (Protozoa)." "In the second grade a distinct digestive chamber appears, but no organs of nutrition and reproduction are visible. "There are five succeeding classes—the Echinodermata, Vermes, Mollusca, Arthropoda and Vertebrata. In the first, the form seems inclined to be radiated; in the second, the form is composed of rings; in the third it is sac-like; in the fourth, the body is segmented and limbs are present, but no internal skeleton; in the fifth, the body is longitudinally segmented, has a nervous axis and an internal skeleton." "The two series present a history which is very different, as the animals have an increased mobility and control over environment. Sensibility through the nervous system increases, and the highest development is that of emotion and intelligence." "The plant in no case reaches these higher stages, there having been an arrested development of these qualities."

The geological history of plants and animals is better known than the embryonic history."

The following may be regarded as the geologic history of the plants: "The Algæ appear in the Siluric, the (Coniferæ) Phaenogamia, the (Lycopodia and Ferns) Gymnosperma in the Carboniferous, the Angiosperma and Polypetalous forms in the Cretaceous." The genealogical history of animals is about as follows: "The Protozoa appear in the Archæan rocks in the Huronian beds, the Echinoderms, Mollusca and Arthropoda (Trilobites) in the Cambrian, and the Vertebrate in the Silurian."

As to the evolution of the Vertebrates, the author follows Haeckel "Many of them present rudimentary organs—digits, feet, fins, teeth and wings—and there is scarcely an organ which is not somewhere rudimentary." The reptiles are supposed by Haeckel to be derived from the Batrachia, but the Batrachia may have been derived from a certain kind of fish. Prof. Cope says: "I have traced the Mammalia to the reptiles of the Permian epoch. The crocodiles display superiority over other reptiles, but the brain of the living mammalia over all other vertebrates." The air-breathing types display a wide diversity from the gill-bearing types, though fishes and birds are both egg-producers.

As to the Batrachians, we find them first in the Coal Measures. They reach a large development in the Permian epoch. The reptilian line is traced back to the Triassic period. The paleontology of birds is not so

well known. The first bird known is the Archeopteryx of the Jurassic period. "The paleontology of the Mammalia is better known, for the placental animals appear in the Jurassic." The phylogeny of man is remarkable, for it is in the structure of the brain and in the reproductive system that he excels. But the period in which he begins his history is uncertain. Prof. Virchow maintains that scientific anthropology begins with living races, but Prof. Cope carries it back to the time when there was an approximation to the Simian type, and considers the Neanderthal man as the missing link. He classifies all of the recently discovered skeletons which have been ascribed to the palaeolithic times together under one head; includes the man of Spy, the man of Java, and of Naulette, and Shipka. He says, they belong to the species "*Homo Neanderthalensis*" and not to "*Homo sapiens*." In the first we have a greater number of Simian characteristics than in any of the known races. No trace of the species has been found in America. It is interesting to observe that the flints found with the human remains in France, known as Mousterien, are of the same form as the Obsidian implements collected at Fossil Lake, in Oregon, with the bones of extinct animals — such as llamas, horses and elephants. Prof. Cope believes that there was a wide gap separating the Paleolithic man from the Neolithic. That the first was associated with extinct animals, and the last with living species only.