

driven through want to water, to find the prey on which it feeds, will separate its toes whenever it strikes the water or wishes to displace itself on its surface. The skin uniting the base of the toes acquires, through the repeated separating of the toes, the habit of stretching; and in this way the broad membrane between the toes of ducks and geese has acquired the appearance we observe today."

Darwin fell back occasionally upon Lamarck's doctrine in explanation of adaptation and of the origin of new species, but included it only as a minor factor. The theory of the action of *use* and *disuse* explains better than any other (1) the origin of many indifferent characters such as change of color-patterns of butterflies' wings due to changes of temperature; (2) many simple adaptations of active organs, such as the development of muscles and bone crests; and (3) some simple adaptations of passive organs, such as the loss of hair and the layer of fat in the skin of whales.

On the other hand Lamarckism does not explain satisfactorily (1) many characters of active adaptation, such as the penetration of the lung-sacs of birds into the bones; (2) many complicated adaptations of active organs, such as eyes, smelling organs, auditory organs, light-making organs; and (3) all complicated passive adaptations such as mimicry (Plate).

According to Lamarck "the structure of organisms is in harmony with the conditions under which they live; in other words it is adapted to these conditions. The organism is shaped by the environment; usage develops the organs; without usage they atrophy. The modifications thus acquired are transmitted to posterity."

Lamarckism as a scientific theory of evolution is in one sense more complete than Darwinism in that it looks to the very cause of the change of organisms by its method of explaining adaptation.

(d)—Darwin and Darwinism

Charles Darwin (1809-1882)¹ published his "*Origin of Species by Natural Selection*" in 1859 after twenty years of most patient and painstaking labor. This work at once compelled the attention of scientists by its wonderful com-

(1)—Darwin was the grandson of Dr. Erasmus Darwin. He studied at Edinburgh and Cambridge, then served as Naturalist on the exploring ship *Beagle* (1831-1836). He settled at Down in England on his return and began that wonderful series of researches on plants and animals which he has described in a large number of well written volumes.