

## THE RIDDLE OF THE UNIVERSE

general conclusions. They had not that great lever which the "natural history of creation" needed for its firm foundation on a criticism of the dogma of fixed species; this lever was first supplied by Lamarck.

The first thorough attempt at a scientific establishment of transformism was made at the beginning of the nineteenth century by the great French scientist Jean Lamarck, the chief opponent of his colleague, Cuvier, at Paris. He had already, in 1802, in his *Observations on Living Organisms*, expressed the new ideas as to the mutability and formation of species, which he thoroughly established in 1809 in the two volumes of his profound work, *Philosophie Zoologique*. In this work he first gave expression to the correct idea, in opposition to the prevalent dogma of fixed species, that the organic "species" is an *artificial abstraction*, a concept of only relative value, like the wider-ranging concepts of genus, family, order, and class. He went on to affirm that all species are changeable, and have arisen from older species in the course of very long periods of time. The common parent forms from which they have descended were originally very simple and lowly organisms. The first and oldest of them arose by abiogenesis. While the type is preserved by *heredity* in the succession of generations, *adaptation*, on the other hand, effects a constant modification of the species by change of habits and the exercise of the various organs. Even our human organism has arisen in the same natural manner, by gradual transformation, from a group of pithecoïd mammals. For all these phenomena—indeed, for all phenomena both in nature and in the mind—Lamarck takes exclusively mechanical, physical, and chemical activities to be the true efficient causes. His magnificent *Philosophie Zoologique* con-