

THE RIDDLE OF THE UNIVERSE

is transformed into kinetic energy. We may distinguish four stages in the upward development of memory, corresponding to the four stages of presentation.

I. *Cellular memory*.—Thirty years ago Ewald Hering showed "memory to be a general property of organized matter" in a thoughtful work, and indicated the great significance of this function, "to which we owe almost all that we are and have." Six years later, in my work on *The Perigenesis of the Plastidule, or the Undulatory Origin of the Parts of Life : an Experiment in the Mechanical Explanation of Elementary Evolutionary Processes*, I developed these ideas, and endeavored to base them on the principles of evolution. I have attempted to show in that work that unconscious memory is a universal and very important function of all *plastidules*; that is, of those hypothetical molecules, or groups of molecules, which Naegeli has called *micellae*, others *bioplasts*, and so forth. Only *living* plastidules, as individual molecules of the active protoplasm, are reproductive, and so gifted with memory; that is the chief difference between the organic and inorganic worlds. It might be stated thus: "Heredity is the memory of the plastidule, while variability is its comprehension." The elementary memory of the unicellular protist is made up of the molecular memory of the plastidules or *micellae*, of which its living cell-body is constructed. As regards the extraordinary performances of unconscious memory in these unicellular protists, nothing could be more instructive than the infinitely varied and regular formation of their defensive apparatus, their shells and skeletons; in particular, the diatomes and cosmaria among the protophytes, and the radiolaria and thalamophora among the protozoa, afford an abundance of most interesting illustrations.