

by the researches of Hofmeister and Fischer, explain how this must be. These amino-acid radicles which compose the protein molecule are all built up along the same lines. They have multiple affinities. Possibly I here delve too deeply for some to follow me, but an elementary knowledge of chemistry and of chemical nomenclature is a part of modern culture, and therefore I presume to venture, and the accompanying diagrams may help to explain my meaning. From our knowledge of the constitution of the protein molecule we may regard the biophoric or living molecule as made up of a series of amino-acid radicles joined together in ring form. Fischer's studies have taught us the mode of junction of these radicles; it is by the acid carboxyl (C O) group of the one radicle to the alkaline amine (N H) group of the other. To this extent the radicles or nuclei are relatively firmly united. The other components of the different amino-acids must then form free swinging or *side chains*, and it is according to how these side chains are built up, that we obtain the different nuclei, or amino-acid components. These are capable of replacement and modification according to the ions or compounds attracted from the surrounding medium. They may be regarded as less stable, able to be detached and replaced.

In discussing what life is, we may therefore, lay down in the first place that *all vital manifestations are manifestations of chemical change in proteidogenous matter, are, in short, the outcome of arrangement of that matter with the necessary LIBERATION or STORING UP of energy.* To this extent all vital phenomena resemble phenomena of surrounding inanimate nature; they differ from those only in degree, not in kind. There is not one vital activity which can be mentioned that demands for its explanation something over and above chemical change;¹ and to this extent, inanimate and animate nature are one. There is, however, an apparent, most important difference between the results of vital and non-vital phenomena. This has been well put by Earl. "Every living organism may be regarded as a centre at which energy is being constantly transformed. It is by the nature of this transformation that we recognize it as a living organism. But," he continues, "the continuous operation of these transformations in the region of the organism is distinctive. In all exchanges of energy between inanimate bodies there is a speedy attainment of equilibrium, whereas the organism, so long as it lives, is incessantly disturbing the equilibrium which would otherwise arise between itself and its environment. In other words, living

¹ Even memory has been explained by Hering and others as a reproduction under particular stimuli of particular relationships between particular molecules, so that now they set in order an identical series of reactions in the cerebral cells.