

their appearance in the ocean when the gradual elimination of the magnesium, and particularly of the potassium and calcium, began. The forms were in all probability unicellular, and as the period must have been of great duration, the organisms and their protoplasm acquired a fixed relation to the four elements.

5. With the appearance of vegetable land forms and the formation of soils the removal of potassium from the land to the sea by river water diminished, and this, in conjunction with the elimination of the element from sea water by organisms, made the amount in the sea stationary. Through the action of living forms the calcium also in sea water has been kept stationary since that remote period.

6. In the transition from the ocean of the more ancient composition to that of the present, the unicellular forms became multicellular, and developed circulatory systems, the vascular fluids of which were at first simply modified sea water. In the blood plasma of Vertebrates, the three elements, sodium, potassium, and calcium are in relative proportions strikingly like those which now obtain in sea water. The magnesium only is considerably less than it is in sea water. The whole is due to heredity, the proportions of the saline constituents of the plasma being a reproduction of the proportions which obtained in sea water when circulatory plasmata were developed.

7. The proportions of the four elements which obtain in living protoplasm are as yet unknown, for the latter has the power of precipitating the potassium, calcium and probably the sodium and magnesium as inert compounds in itself or in its adventitious structures, and thus analyses would comprehend the inert material as well as the quantities of these elements which are actively participating in the processes of the living substance. If we could determine the latter quantities alone we could regard them as a representation of the proportions obtaining in primeval sea water to which the protoplasm of unicellular organisms had established a fixed relation.

8. That such a relation could be inherited may be inferred from the fact that the karyokinetic process, being practically the same in the animal and vegetable cell, has continued unchanged in both from the primeval period when the karyokinetic process first developed in a parent unicellular organism neither distinctly animal nor distinctly vegetable. This indicates how marked an influence heredity wields.

9. Briefly, animal as well as vegetable protoplasm owes its relations