the germ in multicellular organisms is less readily influenced by environmental influences than the soma; profound somatic modifications may leave the germ-plasm apparently unaffected. There is, however, nothing surprising in this when it is considered that the undeveloped germ forms in most cases only a small and inaccessible part of the total organism; it is usually not subjected to external influences until it separates from the parent and begins its own independent development. But after this has happened environmental conditions may affect the egg and developing embryo just as they affect the adult, and the normal course of development may then be experimentally modified; *e. g.*, cyclopia may be produced in fish embryos, etc. No one can say at what time the protoplasm of the developing germ, whether in the one-celled or many-celled stage, ceases to be germ-plasm and becomes somatoplasm. Just as the rigid distinction between germ and soma can not be maintained, so it is doubtful if the "hereditary material" can be identified with any special single structures or cell-constituents, such as the chromatin. A universal peculiarity of the cellular type of organization appears to be that the nucleus, which always contains chromatin among other constituents, is indispensable to the continued normal physiological activities of the cell, including those specific synthetic processes of which growth and heredity are the most evident expressions. But to regard protoplasm (somatoplasm) as the *expression* and chromatin as the *seat* of heredity (p. 93) does not seem justifiable on physiological grounds. In the specific constructive processes which determine the course of development the physiological activity of the *entire* cell is concerned. To say this, however, is not to deny that there may be a functional differentiation, corresponding to the chemical and structural differentiation, among the various cell-constituents; and that a special significance in relation to the specific syntheses involved in development may attach to the nucleoproteins of the cell-nuclei, *i. e.*, to the chromatin. It is more consistent with modern physiology to conceive of chromatin as an especially active or constant participant in cell-metabolism, with some such special rôle as this, rather than as primarily a reservoir of hereditary determinants.

The consideration of organic evolution leads inevitably to a consideration of the physico-chemical nature of living matter and to speculations regarding its possible mode of origin from non-living matter. In Part I. the author discusses briefly some of the supposed steps in this evolution. He points out that the process must have been prolonged and complex. A prerequisite for the appearance of life was the production of the vital energy-yielding compounds, probably by photosynthesis, as well as of other compounds of colloidal character forming the structural substratum required for the metabolic reactions of protoplasm. To produce a regulated self-maintaining system of this kind, capable of indefinite growth, probably required ages of evolution. The rôle of electrolytes in living matter, and the necessity for special chemical compounds (catalysers, hormones) to control and coordinate the chemical processes of the primitive protoplasm, are among the matters especially discussed in this section. Interesting geological evidence is presented indicating the existence of an abundant unicellular flora and fauna (*e. g.*, calcareous bacteria) at extremely remote periods. This part of the book is highly suggestive, but less complete and authoritative than Part II.

Many striking observations and generalizations are scattered throughout the whole book and a masterly survey is given of the paleontological succession of animal forms. The illustrations are especially interesting, particularly the reproductions of Knight's landscapes, at once imaginative and scientifically exact, showing the prehistoric monsters in their native surroundings.

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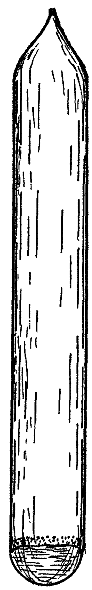
SPECIAL ARTICLES

NOTE ON A SIMPLE DEVICE FOR ILLUSTRATING MOLECULAR MOTION

In experimenting with mercury heated in an evacuated glass vessel, I observed that fine particles of solid matter on the surface of the mercury were carried away by the evaporating mercury and moved about in the vessel in a very chaotic manner similar to the movement of molecules as postulated in the kinetic theory of gases and vapors. The stream of vapor which carried with it the particles was condensed upon the walls of the vessel and dropped back into the pool in the bottom of the tube.

A simple tube for illustrating the phenomenon is shown in the figure. The tube is about ten inches long and one inch in diameter and contains a small pool of mercury. A small quantity of finely crushed material, such as colored glass or carbon is placed upon the surface of the mercury to form a layer two or



three millimeters deep. Blue glass crushed in a mortar to give pieces about one half to one millimeter in size is found to be very satisfactory since particles of this size are easily visible. Particles of granular carbon or any other light material will do equally well provided that it does not amalgamate with the mercury. The tube is then evacuated and sealed from the pump in the usual manner. The degree of vacuum is not essential provided that it suffices to prevent oxidation of the mercury when the latter is heated, and thus to prevent the mercury from becoming sticky and adhering to the particles. The tubes experimented with were evacuated to a pressure of a few thousandths of a millimeter.

A gradual increase in the temperature of the mercury brought about by holding it over a Bunsen flame shows the following interesting phenomena: At a low temperature the particles begin to move about on the mercury surface. This movement of the particles gives the surface formed by them the appearance of a liquid agitated by convection currents. In this condition the particles have left the mercury surface and are moving about among each other close to the mercury in a layer having a rather well defined surface. A further slight increase in the temperature of the mercury causes some of the particles to leave the layer and to move about chaotically in the space above the surface similar to molecules which have left an evaporating liquid. At the same time the surface formed by the particles becomes indistinct and there is a gradual gradation of density of particles upward from the region just above the mercury. As the temperature continues to rise more of the particles leave the surface and also those which are moving in the space move to a greater height. Finally all of the particles leave the surface of the mercury and move about in the space colliding with each other and with the sides of the tube like the molecules of a gas.

The phenomena just described are more easily produced by first heating the mercury to the temperature at which all of the particles have left the surface and then observing them while the tube gradually cools; the above-described processes then occurring in the reverse order and simulating a condensing vapor. Because of the vacuum in the tube the temperature which is necessary to cause all of the particles to leave the surface is not sufficient to make the top of the tube too warm to hold in the hand. In order to make the particles more easily visible it is desirable to provide a white background by painting or frosting one side of the tube.

The device affords a simple means of illustrating the chaotic movement of a large number of small particles similar to the motion of molecules in gases and vapors. The similarity is especially instructive when compared with the evaporation of a liquid since the effect of the evaporating mercury upon the particles leaving its surface is similar to the actual motion of vapor molecules which leave a liquid.

The phenomenon can be projected upon a screen and the particles and their movement greatly magnified, so that the device may be used for lecture demonstration of the kinetic theory.

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ABNORMALITIES IN THE CHICK EMBRYO[1]

For the past five years the writer has had under her supervision the preparation of the vast amount of material used for large embryology classes. On account of the possibly controlled conditions under which it could be obtained, the chick was extensively used. Hundreds of these embryos have been examined. Seldom were the eggs incubated for a longer period than three days. For the first two years the pressure to secure material was so great than only the normal embryos of the right degree of development were saved. It was noticed that a large per cent. of the fertile eggs did not give embryos which were satisfactory for class use. The obtaining of an extremely abnormal embryo and two embryos on one blastoderm in a single incubation lead to the saving of all of the specimens. Since that time, over two hundred abnormal ones have been collected.

The abnormalities seemed to occur more in the central nervous system than elsewhere. Two regions were particularly affected, the brain and the neural tube in the region of the last two or three mesoblastic somites and the beginning of the segmental plate. However, the abnormalities did not occur in both of these regions in the same embryo. In embryos obtained from eggs incubated forty-eight hours the abnormality of the neural tube extended over a length of between one eighth and one fourth of a millimeter. The neural tube here was either solid without a central canal or the central canal was extremely small, or there were from two to five canals. This could be recognized in the whole mount as apparent loops of one side of the neural plate, or as a thickened part of the entire tube. The most extreme case of the abnormality of the brain was a seventy-two-hour chick, in which the brain was only about one-fourth the normal size and the fore-, mid- and hind-brains appeared as a series of loops. Another example was a forty-eight-hour chick which had an optic vesicle less than one third the normal size. This optic vesicle was connected with the brain by a stalk more than twice the normal length.

During the past summer Miss Alsop, a graduate student, undertook some experiments upon the cause of these abnormalities. At the same time we were running some controls under normal conditions. She found that she could obtain a large per cent. of abnormalities, and, at will, could produce them either in the brain region or in the region of the tube. She hopes to have a detailed account of her experiments, along with drawings and a more extended description of these abnormalities, ready for publication in a short time.

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