

set in, and a typical response of the reticulocytes occurred, accompanied by a considerable rise in the cholesterol and lecithin values. As the red blood cells and the hemoglobin rose the cholesterol and lecithin increased still further and approximately normal values were reached when the red blood cells had increased about 1.0 million per cu. mm.

A second case during a 9 day control period was fed with an inert preparation, and the red blood cells remained about 700,000 per cu. mm.; the plasma cholesterol varied from 48 to 91 mg. per 100 cc., and the lecithin phosphorus from 3.9 to 5.0 mg. A transfusion of 500 cc. of blood was given on the ninth day and the patient placed upon a daily dose of a liver extract preparation. Directly after the transfusion, the red blood cells rose from 600,000 to 1,500,000 per cu. mm. without any appreciable rise of the cholesterol and the lecithin. On the seventh day after commencing the liver extract, the reticulocytes reached the peak of their rise which indicated the onset of remission. This was accompanied by an increase of both cholesterol and lecithin which reached 101 and 6.2 mg. per 100 cc. respectively, when the red blood cells numbered only 1.3 million per cu. mm.

The observations in these 2 cases of pernicious anemia, which are comparable to those upon others, indicate that cholesterol and lecithin increase in the plasma coincident with the onset of remission. The increase is evidently not dependent upon the actual number of red blood cells in the circulation. Whatever fundamental changes occur with the onset of the remission in pernicious anemia, the increase of cholesterol and lecithin seems to be one phase of this change.

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Permeability of the Fundulus Egg to Ions: Chorion versus Skin.

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In previous studies on the permeability of the Fundulus egg, little attention has been paid to the fact that the embryo is enclosed by 2 membranes. One of these is the skin of the embryo itself; or, at very early stages before the blastodisc has completely enclosed the yolk, the delicate vitelline membrane which covers the yolk. The

other is the chorion, the noncellular, flexible, inelastic outer shell, which has no organic connection with the embryo, but retains a cushioning fluid layer about it. Some of the criteria of permeability used in the previous work on *Fundulus* eggs, such as cessation of the heartbeat, and coagulation of the embryo, by acid penetration, may have required that both membranes be traversed by the substance studied. Others, of which Loeb's specific gravity test is a type, probably involved only the chorion. But in none of the earlier papers have data been presented for a satisfactory comparison of the permeabilities of the 2 membranes.

It was thought that evidence bearing on this question might be obtained by a method which Michaelis has recently applied to the study of the permeability of certain non-living membranes, such as dried collodion. Michaelis has described the permeability to ions of these membranes in terms of concentration potentials measured across the membranes between solutions of N/10 and N/100 KCl. This general method with certain modifications has been applied to the *Fundulus* egg material by measuring E.M.F. across the membranes of a single egg from inside to outside. The egg was impaled on a capillary pipette which, in connection with a calomel half cell made up in sea water, constituted the inside electrode; and was immersed in a solution into which dipped the outside electrode, of similar construction. The electrodes were made up with sea water rather than KCl in order that the solution introduced into the egg with the capillary electrode might be a physiologically balanced mixture. Experiments with sea water half cells in a non-living system in which saturated KCl half cells could also be used, indicate that the diffusion potentials introduced into the E.M.F. measurements by the former largely balance out, and that the small residual error is insignificant when it is the difference between the two kinds of concentration potentials which is being considered. Since the egg contents had to be maintained constant, the concentration effect was secured by exposing the outside of the egg successively to 2 concentrations of the same solution. In the present paper, the algebraic difference between the potentials observed when the egg was in undiluted sea water and in sea water diluted 100 times, is termed the concentration potential. The movements of the inside electrode were governed by a Chambers micromanipulator and observed through the low power of a microscope. For a measurement across the chorion alone, the electrode tip penetrated the chorion and lay in the subchorionic fluid; for a measurement across chorion and embryonic skin together, it was thrust into the yolk sac of the embryo.

The results of these measurements showed that the compound membrane of skin plus chorion was capable of producing concentration potentials much greater than those produced by the chorion alone. The average of the chorion values was 19.4 mv. with a maximum of 40.5 mv., as compared with the figures across chorion plus skin, which averaged 55.2 mv. and reached an extreme of 114.6 mv. For both sets of values, with change to the dilute solution, the inside of the egg became more negative to the outside. If it is permissible to interpret these results in the same manner as those of Michaelis on simpler membranes, the negative sign of the concentration potential indicates a relatively greater impermeability of the membranes to anions than to cations. And its greater magnitude in the case of the 2 membranes together, than in that of the chorion alone, furnishes evidence that the differential permeability is less pronounced in the chorion than in the system as a whole.

That the relative impermeability to anions of the system as a whole is largely due to the skin is indicated by measurements of electrical resistance. When allowance was made for the resistance of the remainder of the system, the net resistance of the chorion to direct current was found in 23 experiments to range from 7,000 to 92,000 ohms. On the other hand, the resistance of the chorion plus the skin was 300,000 ohms, or more, in all cases. Since resistances in series are summed, it would appear that the resistance of the skin alone was, in these cases, at least 208,000 ohms.

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Preservation of Luminous Bacteria in Absence of Oxygen.

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In the course of experiments on the respiration of the luminous bacterium, *Bacillus fischeri*,¹ it became necessary to determine whether or not this organism was a facultative anaerobe, a characteristic assigned by Beijerinck² to one species of luminous bacteria.

The luminescence of luminous bacteria is absolutely dependent on the presence of a partial pressure of oxygen in the medium or

¹ Migula, W., *System der Bakterien*. Jena, 1900.

² Beijerinck, M. W., *Arch. Neerlandaises*, 1889, T. 23, 416.