for acetone bodies of the blood of 60, 50, 66, 28 and 8 mg. per 100 cc. were found associated with pH values of 7.58, 7.54, 7.50, 7.52 and 7.50 respectively. The bicarbonate contents of these bloods were 84, 83, 88, 87, and 70, respectively. The amount of acetone bodies excreted in the urine was determined in two instances and was found to be abnormally large.

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A reaction given by insulin solutions in-vitro.

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It has been found that solutions of insulin (Iletin, Lilly) markedly accelerate the digestion of starch by various diastases. The studies thus far seem to show that this action is not due to the hydrogen ion or to the protein content of the insulin solutions. Further work is, however, necessary to show definitely whether the insulin is the effective factor. The work is being continued and is including a study of the effect of diastase injections upon blood sugar concentration.

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Electric charges and stability in suspensions of red blood cells.

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A quantitative study by means of the Michaelis cataphoresis cell of the electric charge of red cells suspended in isotonic sucrose solution has given the following results:

The negative charge of the cells in pure sucrose solution is not permanent, but falls in the course of a few minutes to a point so near zero that it can not be accurately determined. With this fall in potential agglutination of the suspension occurs.

Electrolytes affect the charge of the cells in the same manner as has been observed for their action on the charge of other suspended particles. All electrolytes depress the original negative charge to an isoelectric point and some reverse this negative charge to positive one. With negative cells the degree of change varies with the valency of the cations present. The observation of the effect of valency is, however, complicated by the fact that the cells act as amphoteric electrolytes with the result that hydrolysis may cause the salt of a bivalent metal ($CuCl_2$) to produce more marked changes than are caused by the salt of a trivalent metal which hydrolyzes less ($CeCl_3$). Reversal of the negative charge to a positive one is produced by all trivalent ions and occurs with bivalent ions of strongly hydrolyzed salts. These positive charges are permanent and so differ from the negative charge which exists in weak concentrations of all electrolytes.

Stability of the suspension occurs whenever the charge, either positive or negative, is above a certain critical potential. But stability may also occur in the complete absence of any potential in high concentrations of all electrolytes. "Irregular series," in which a zone of stability is found between two zones of instability, are produced by a reversed strongly positive charge which surpasses the critical potential. Such an effect is produced by trivalent salts and is also observed with salts of bivalent metals which are strongly hydrolyzed. In the latter case the reversal is probably due to the effect of the H ions acting on the amphoteric red cells. "Prozones," in which a zone of stability in the highest concentrations of the electrolyte is followed by a zone of instability, are not the result of charges of the cells.

A suspension of red cells in sucrose resembles, therefore, a lyophobe colloid in its sensitivity to flocculation by electrolyte, and the mechanism of this flocculation is the same as is observed with such solutions. The stability, except in the very highest concentrations of electrolyte, depends on the potential of the electric double layer at the surface of its suspended particles. On the other hand, both in the chemical nature of its particles and in the amphoteric reaction of these to H and OH ions, it resembles more closely the lyophile colloids, such as proteins and gelatin.

Such solutions do not depend on the charge of their particles for stability, but more likely on "chemical forces acting in true solubility" (Loeb).

This resemblance of a suspension of red cells to a lyophobe colloid casts a certain light on the nature of the suspended cells. The protoplasm of red cells consists of a semi-fluid jelly-like substance of the nature of a lyophile colloid, but the stability of a suspension of suspended particles of such nature would not react to electrolyte flocculation as does a suspension of red cells, whose stability has been shown to depend on electric charges. If, however, it is assumed that the surface of the cells is covered with an insoluble film of amphoteric character, the conditions which obtain in a red cell suspension are met.

Protein, when denatured, loses its lyophile properties so that the stability of a suspension of it depends on the electric properties of its particles, which are also amphoteric in reaction with H and OH ions. Ramsden has shown that many proteins are denatured in film formation, and Loeb has shown that genuine crystaline egg albumin loses its hydrophile properties and acts as a lyophobe colloid when it is deposited in a thin layer on collodion particles. Such protein coated particles resemble very closely a suspension of red cells in their flocculation by electrolytes and in their reaction with H and OH ions.

It is suggested that a denaturing of the proteins on the surface of the cell and the formation of a membrane would account for the properties of the cell suspension. The insolubility of this surface film would cause the stability of the suspension to depend on electric charges; the chemical nature of the film would account for its amphoteric properties.

265 (2497)

A study of the bi-refringence of agar agar.

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Many gels when subjected to strain become anisotropic. A film of gelatin or colloid dried on glass is anisotropic with one optical axis normal to the surface of the film.[1] With the removal

[1] F. Weigert and H. Pohle, *Kolloid Z.*, 1921, xxviii, 153.