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Can Protein Act as a Carrier in Penetration?

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1. Experiments[1] were carried out at 10°C.

2. Gelatin was placed in cresyl blue solution at pH 9 and at pH 5.5. Dye solutions were changed before alteration in the dye occurred. After 24 hours gelatin was removed, washed in distilled water, and melted in a test-tube. The concentration of the dye in the gelatin was determined colorimetrically. More dye was taken up by gelatin at pH 9 than at pH 5.5 due to greater concentration of negatively charged protein ions at pH 9 capable of combining with the dye cations.

3. The gelatin stained at pH 9 was placed in buffer solutions at pH 9 and at pH 5.5. After 12 hours the concentrations of the dye in the buffer solutions were determined colorimetrically. More dye passed out of the gelatin into the buffer solution at pH 5.5 than at pH 9. This is due to the decrease in the negatively charged protein ions at pH 5.5.

4. Experiments were repeated 10 times and without exception the above results were obtained.

5. These results are significant as indicating the following possibility. If the dye penetrates a living cell in a dissociated form from cresyl blue solution we may picture the mechanism as above described when the external protoplasmic surface and the vacuolar surface consist of protein or a substance behaving like it. No matter how readily the dye is taken up by the surface, it cannot penetrate into the interior of the cell unless it is capable of being given up at the inner side in such a manner as described above. If both the acid and basic dyes penetrate we may assume that these surfaces consist of a mixture of proteins with various isoelectric points.

[1] Loeb, J., Proteins and the theory of colloidal behavior, McGraw-Hill Book Co., Inc., New York, 2nd ed., 1924.