COORDINATION OF PROTEINS WITH FERROMESOPORPHYRIN

Sirs:

Lacking space in which to credit all who have studied those so called “hemochromogens” which involve proteins, we may cite arbitrarily the observations by Bertin-Sans and Moitessier in 1893 as exploratory antecedents to the following quantitative relations. Those authors reported the remarkable similarity of absorption spectra given by alkaline solutions containing reduced heme and some ill defined proteins, and they emphasized the low concentration at which they detected a protein by means of such a spectrum.

The similarity of spectra is shown in the figure. Included in the black area A are the optical densities per 1 cm. for the following cases. Each solution contained (or data were reduced to) 0.02 mM ferromesoporphyrin IX, 0.1 M NaOH, and 0.16 per cent protein. The proteins included were egg albumin (five times recrystallized by Dr. R. M. Herriott), chymotrypsinogen (three times recrystallized by Dr. Herriott), squash globulin (purified by Dr. Vickery), casein (Difco Laboratories), and the human plasma protein fractions, albumin, γ-globulin fraction II, α1-globulin fraction V-1 (from the Department of Physical Chemistry, Harvard

Medical School). At a concentration of 1 per cent crystalline zinc insulin (Eli Lilly and Company) gave a curve falling within area A.

Curves similar to those in area A are given by pyridine and several other bases but with slight shifts in the positions of the peaks. The less stable "protoheme" gives similar spectra with proteins but with peaks shifted to longer wave-lengths.

Included between the dashed lines B are curves for 0.02 mm ferromesoporphyrin in 0.1 M NaOH. Turbidity develops so quickly that optical measurements must be made rapidly. Also included is the curve for the same concentration of ferromesoporphyrin with $5 \times 10^{-4}$ per cent albumin, which enhances dispersion of the solute. The upper curve is that for a solution to which was added 0.16 per cent pepsin (crystallized by Dr. Herriott).

Bands represented in areas A were not revealed by a direct vision spectroscope when relatively high concentrations of gelatin (Difco), Bactopeptone (Difco), a casein hydrolysate, salmine (Lilly), or any one of several simple substances other than those giving the curves of area A were used.

The inset of the figure (C) shows curves of two types relating the logarithms of protein concentrations to degree of transformation calculated from optical densities on assumptions similar to those used in the series of papers entitled "Metalloporphins."2

We shall not draw conclusions until several series of quantitative measurements shall have been completed. In the meanwhile we shall appreciate an opportunity to study such proteins, or simpler substances, as readers of this Letter may conceive would aid in the elucidation of the phenomena. In view of the low concentration of protein (about 0.01 per cent in the case of egg albumin; see inset of figure) at which 50 per cent change of optical density occurs, none but reasonably pure proteins of known composition will serve if the phenomena are to be referred to protein composition.

We are grateful to those mentioned above who have contributed proteins of very high quality.

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