expressible as an adsorption-isotherm equation and the fraction attached to the bacteria is irreversibly bound.

The attachment of phage to either living or dead susceptible staphylococci increases the negative electrokinetic potential as measured directly by the rate of cataphoretic migration and indirectly by the increased stability of suspensions to the action of quadrivalent cations. This is not proof that phage action is limited to the cell surface but it does furnish evidence that certain of the bacterium's surface-properties are altered either directly as a result of phage-attachment or indirectly as a reflection of intracellular reactions in which cellular constituents and phage participate.

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## Liver Proteins. II. Liver Albumin.

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In the course of investigations on the chemistry of the liver proteins we have had occasion to determine the liver-albumin content under a variety of conditions. The fundamental problem which we desired to elucidate was whether liver albumin exists as a preformed protein or whether it arises as an artefact during fractionation. It occurred to us that a partial answer would be obtained by studying the ratio, albumin/total salt-soluble protein, at different hydrogen ion concentrations maintained during the preliminary sodium chloride extractions. It is known[1] that the total salt-soluble protein extractable from liver increases greatly with increase of pH over the range pH 4 to 8. If the liver albumin were largely an artefact, arising as a dissociation product from the salt-soluble protein fraction, one might reasonably expect that increases in the latter would be reflected by equi-proportional increases in the former; the ratio, albumin/total salt-soluble protein, would remain constant. Although the present work does not give a decisive answer to the question it yields certain information about the liver-albumin content which is pertinent and significant.

For the purposes of this investigation we used dog liver, rapidly perfused *in situ* to remove blood, then excised, frozen with liquid air, powdered, and preserved at −10°C.

[1] Luck, J. M., and Nimmo, C. C., *Proc. Am. Soc. Biol. Chem.*, in press.

In the first group of experiments the procedure followed was essentially that reported previously,[2] except that 3 successive extractions with sodium chloride were employed instead of 2, and the period of dialysis was shortened to 2 days. Extractions were made at pH 4.3, 4.7, 5.0, 6.4, and 7.0. Between pH 4.7 and 7.0 the albumin content remained virtually constant at about 2.2% (extremes 2.07, 2.33); the total salt-soluble protein content increased progressively from 6.44 to 9.18%; the ratio, albumin/total salt-soluble protein, decreased from 0.36 to 0.23.

In the second group of experiments 3 successive extractions were made with 0.5 *M* $(NH_4)_2SO_4$ instead of sodium chloride. The combined extracts were not dialyzed but were immediately salted out by addition of solid ammonium sulphate to the point of half saturation. Albumin was determined in the filtrate gravimetrically after heat coagulation. The extractions were made at pH 4.0, 5.1, 6.3, 7.3, 7.7, and 8.3 and the salting out at pH 6.4. The corresponding values for liver albumin were 0.86, 2.79, 3.47, 3.39, 2.93, and 3.26% respectively; for the total salt-soluble protein, 0.96, 6.93, 10.1, 10.4, 10.3, and 10.2% respectively; and for the ratio of the two, 0.89, 0.42, 0.35, 0.33, 0.29, and 0.32 respectively.

The experiments in the second group reveal that the values for albumin and total salt-soluble protein increase up to pH 6.3 but further increases in pH do not yield higher values. Below pH 6.3 the proportion of the total salt-soluble protein represented by albumin tends to increase but the number of experiments conducted in these more acid regions is insufficient to permit a final interpretation.

We would like to draw attention, also, to the low level at which albumin is maintained in the liver. The highest value we have ever observed is 3.47%. Due to proteolysis which proceeds during dialysis, the albumin values in the first group of experiments are lower than those where dialysis was omitted. Still lower were the albumin values previously reported,[2] where prolonged dialysis was employed.

In the light of these determinations, and on the assumption that serum albumin has its origin in the liver, the slow regeneration of serum albumin during hypoproteinemia may be associated with the low reserves of liver albumin.

[2] Luck, J. M., *J. Biol. Chem.*, 1936, **115**, 491.