

colourless. The following figures are for 5 gm. of (1) Merck's alumina for adsorption, activated according to Brockmann, (2) B.D.H. aluminium oxide for adsorption purposes, (3) B.D.H. aluminium oxide, calcined, and (4) B.D.H. aluminium oxide (calcined) 'AnalaR', shaken in 50 c.c. of distilled water.

	c.c. of 0.1 N H ₂ SO ₄ consumed				% Alkalinity calc. as NaOH
	At once	After 6 hr.	After 18 hr.	Total	
1	2.0	1.2	0.8	4.1	0.33
2	3.5	1.1	0.6	5.2	0.41
3	0.3	0.1	0.1	0.5	0.04
4	0.2	0.1	0.1	0.4	0.03

The amounts of adsorbed alkali, as shown in the last column, for the 'activated' aluminas are surprisingly high. The low figures for the ordinary aluminas are a satisfactory 'control'.

Hydrolysis of diacetyltoxicarol is prevented by previously washing the alumina with acetic acid or a solution of phenol in a neutral solvent (we are indebted to Prof. Heilbron for suggesting the use of phenol), but the activity of the adsorbent is largely destroyed by acetic acid and to a less, but still considerable, extent by phenol.

Other reactions of rotenone and its derivatives normally associated with the use of alkali in a hydroxylic solvent can also be effected by passage through activated alumina in chloroform or benzene, and we hope to report these experiments in detail elsewhere. Great caution is advisable when adsorbing alkali-labile compounds. It seems probable that the alkalinity of activated alumina may be responsible for some of the abnormal results recorded by other workers, for example, the isomerization of carotene¹, and the partial inactivation of vitamins A² and K³.

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but relates to all megamolecules. In connexion with Dr. Huggins's letter, I would direct attention to the diagram given by Jordan Lloyd on p. 267 of her 1932 paper of the structure involving hydrogen bonds associated with . . . HNCOHNCO . . . strings which is now proposed by Dr. Huggins. Further, I may perhaps be permitted to point out that "pictures of this sort" which Dr. Huggins finds "preferable to those proposed by Wrinch", have in fact already been given by Wrinch and Jordan Lloyd³, and that in any event (as there explained) they are not inconsistent with the cyclol structures which (presumably) Dr. Huggins had in mind. It may well be the case that all three types of link are relevant to the question of the structure of proteins in its various aspects, and possibly others so far unformulated. Thus the prudent course is to seek for support for each and every type of link which is geometrically feasible.

If, however, at this early stage in the history of the protein molecule, it is important to decide between alternatives which are not mutually exclusive, I suggest that it would be of interest to consider how far hydrogen bonds alone can (1) yield structures for protein films and (2) yield structures for the globular proteins which explain the non-random distribution of the molecular weights of proteins established by Svedberg⁴ and (3) explain the relation between α - and β -keratin. It appears from a recent series of experiments by Langmuir, Schaefer and Wrinch⁵ that the mechanical characteristics of protein films are in good accord with the cyclol hypothesis and its predictions: it is now clear that this hypothesis implies the existence of globular proteins and explains why they fall into discretely arranged molecular weight classes¹⁰: further, the cyclol link appears to fit elegantly⁶ into Astbury's keratin structures. Alternative structures depending upon hydrogen bonds alone would, however, be of great interest.

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¹ Gillam, A. E., and El Ridi, M. S., *Biochem. J.*, **30**, 1735 (1936).

² Castle, D. C., Gillam, E. E., Heilbron, I. M., and Thompson, H. W., *Biochem. J.*, **23**, 1702 (1934).

³ Dam, H., and Lewis, L., *Biochem. J.*, **31**, 17 (1937); cf. Dam, H., and Schenheyder, F., *Biochem. J.*, **30**, 897 (1936).

⁴ Astbury and Woods, *NATURE*, **127**, 663 (1931). Astbury, *NATURE*, **132**, 593 (1933); *Koll. Z.*, **69**, 350 (1934).

⁵ Jordan Lloyd, *Biol. Rev.*, **7**, 254 (1932) and later papers. Mirsky and Pauling, *Proc. Nat. Acad. Sci.*, **22**, 439 (1936).

⁶ Wrinch and Jordan Lloyd, *NATURE*, **133**, 753 (1936).

⁷ Wrinch, *Proc. Roy. Soc. A*, in the press.

⁸ Wrinch, *NATURE*, **137**, 411 (1936). **133**, 741 (1936).

⁹ Astbury, *J. Text. Inst.*, **27**, P 282 (1936). *Chem. Weekbl.*, **33**, 778 (1936).

¹⁰ Huggins, *NATURE*, **139**, 550 (1937).

¹¹ Svedberg *et al.*, a series of papers in *J. Amer. Chem. Soc.* since 1929.

¹² *Science*, **85**, 76 (1937). See also, *NATURE*, **139**, 516 (1937).

¹³ As explained in a communication to the Editor of *NATURE* dated March 10, 1937.

Nature of the Linkages in Proteins

THERE is now a considerable amount of agreement that the polypeptides in the protein molecule are held together by cross-linkages¹, but so far crucial experiments, from which the exact nature of these linkages may be deduced, are lacking. The only logical procedure is therefore to consider in turn all possible types of link and to investigate experimentally the deductions to be made from those which pass the qualifying test of being geometrically feasible. Among the links so far proposed are: (a) hydrogen bonds^{2,3,4}, (b) cyclol links^{4,5,6} and (c), as a deduction from (b), hydroxyl bonds^{4,5}.

The hypothesis of hydrogen bonds has recently gained further support from the suggestion, contained in the interesting communication from Dr. Huggins in *NATURE* of March 25, of synchronized oscillations in hydrogen bridges⁷. The importance of these synchronized oscillations is not confined to proteins

Isomerism of Derivatives of Cyclohexane

BOTH 4-methylcyclohexane-1-carboxy-1-succinic acid and 3-methylcyclohexane-1-carboxy-1-succinic acid, synthesized by condensation of ethyl bromoacetate with the sodio derivatives of the dicyano esters prepared by Higson and Thorpe's method¹, have been isolated in two forms; there being no indication of isomerism connected with multiplanar forms². This method provides a satisfactory synthesis of the tricarballic acids derived from cyclic ketones, and the low yield of $\alpha\alpha$ -dimethyltricarballic acid