

salts of copper, cocoa, cryolite, unwrought metals, vegetable tanning materials, corundum, copperas, fertilisers, gums, resins, glue stock, raw hides, crude iodine, the platinum metals, rubber, gutta percha, iron ore, kieserite, asphalt, bitumen, wood pulp, crude minerals, thorium ores, certain oils, crude phosphates, certain potash salts, radium, selenium, certain soda salts, strontium ores, sulphur, wood tar and pitch, tin ore, turpentine, rosin, uranium oxide and salts, wax, and witherite.

REVIEWS.

- I. THE FORMATION OF COLLOIDS. By THE SVEDBERG. *Monographs on the Physics and Chemistry of Colloids*. Pp. viii.+127. (London: J. and A. Churchill. 1921.) Price 7s. 6d. net.
- II. KOLLOIDCHEMIE DER EIWEISSKÖRPER. Part I. By PROF. W. PAULI. Pp. viii.+117. (Dresden and Leipzig: Th. Steinkopff. 1920.) Price, paper, 10 mk.

1. It is not often that a reviewer has an opportunity of expressing such unreserved approval as is possible in bringing Prof. T. Svedberg's little monograph on the "Formation of Colloids" to the attention of all interested in colloids. That Prof. Svedberg is the outstanding authority on the preparation of colloidal solutions was shown by his larger work of reference in 1909. He has now written a most readable and suggestive account of the various ways in which matter may be brought into colloidal form. Within the compass of a little more than 100 pages, he has managed to include the most varied and stimulating information. This is supplemented by the inclusion, without detriment to the text, of nearly 200 references to the most important original papers and books.

The subject matter is very clearly arranged, and passes from a brief mention of general principles and a similarly brief treatment of phenomena observed *in vacuo*, to the formation of disperse systems in gases. The remaining half of the book is chiefly devoted to observations in liquids. This brief outline, however, does not do justice to the scope and variety of the examples to be found on almost every page, varying from laboratory experiments to naturally occurring phenomena and important industrial operations. Indeed, this last appears particularly valuable in placing in a new light so many industrial observations whose explanation has been obscure. Another very pleasing and unusual feature is to be found in the numerous references to the historical literature, including facts recorded as early as the 18th century.

It is with mixed feelings that one notes that a whole series of these monographs is in preparation, for if the quality of the present one is maintained, every student of the subject will find himself compelled to purchase a copy, although the total amount of text may be considerably less than in one or two of the bigger treatises at a similar price. However, the paper and printing are excellent, and the illustrations numerous and clearly arranged. This little book is certain to enjoy an extensive sale and to attract the attention of wide circles to a consideration of this fascinating subject.

II. Prof. Pauli's monograph on "The Colloid Chemistry of Proteins" is of a different character, and it constitutes a very great achievement. It brings together in masterly summary the results of the extensive investigations carried out by Pauli and his numerous collaborators, who have partly

built upon the earlier work of W. B. Hardy and others. Through this work there is now possible a comprehensive survey of the physico-chemical behaviour of these substances, so fundamental in their importance to biology and medicine.

With extraordinary ingenuity and sureness of treatment, the most important quantitative methods of physical chemistry have been applied to these exceptionally difficult and elusive materials. Measurement of hydrogen and chlorine ions by electromotive force, of conductivity, migration, osmotic pressure and viscosity are combined to deduce the last shred of significance from the behaviour of the proteins alone and in the presence of acids, alkalis and salts, and, where necessary, bold and simple hypotheses are made use of to bridge gaps, only to receive remarkable confirmation from later work.

Pauli first briefly summarises the concepts of colloid chemistry, emphasising the stabilising effect of hydration even at the isoelectric point. There remains, however, a strong impression that the foundations of this branch of science have still to be laid, and that it is just in regard to the more obvious questions that secure and accurate knowledge is most lacking. Pauli tends strongly towards a more chemical conception of colloidal solution in all cases, in reaction against the almost purely physical conception of suspension colloids now current.

Seven more chapters follow, each dealing with one aspect of the behaviour of proteins and their derivatives: dissociation, isoelectric point, acid solutions, hydrolysis, alkaline solutions, effects of time, migration, and electrochemical equivalent of proteins.

It is hardly possible to summarise here in useful form the great variety of reactions and characters shown under different circumstances by this class of substances whose chemical formulae, constitution, and even molecular weight are still subjects of investigation. They are notorious for their responsiveness to the slightest change in environment, and indeed, it is partly upon this that the mechanism of life processes depends. Even the purely chemical reactions are susceptible of almost infinite gradation. Herein lies the difficulty of securing exact explanations and trustworthy hypotheses; there is always the danger that the number of assumptions is comparable with the number of facts to be explained. All the greater, therefore, is the achievement in having now attained such substantial progress, so that several types of behaviour appear to be finally explained, whilst for the remainder a comprehensive system of hypotheses is available for grouping what is already known and as a guide to further experiment.

Pauli's work has been to establish the nature of alkali and acid albumins as electrolytic colloids or colloidal electrolytes. The alkali caseins are analogous to the neutral salt of a moderately strong acid: one molecule dissociates into three ordinary sodium ions and a trivalent colloidal anion to which in some cases an extra molecule of neutral casein is added. These results revise the earlier and well-known conception of T. Brailsford Robertson, to whom, however, the credit is due of having gone ahead with the attempt to systematise and greatly extend our knowledge of this most complicated subject. Unfortunately, Robertson was led to adopt the hypothesis that both ions were colloidal, each containing the protein molecule, so that simple ions were assumed not to occur.

This monograph, indispensable to serious students, should also appear in an English edition. This would greatly extend its influence and accessibility. A second part is promised, dealing with the numerous groups of substances of organic and inorganic origin whose behaviour bears resemblance to that of the proteins.

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