of importance not only to scientists but also to statesmen and financiers. There is probably a basis of truth and, if so, in the future such developments are likely to be more or less controllable by proper use of air-conditioning and to depend less and less on the external climate.

Tropical areas now provide an interesting field for study, for the efficiency of control of cold conditions is already highly developed. On the other hand, little has been done to obtain practical methods for the application of air-conditioning under the heavy heat loads and on the enormous scale that would be needed to modify life in the tropics. Yet these areas contain enormous undeveloped sources of wealth, and we would be foolish to assume that control can not possibly be attained. There is little doubt that highly populated areas such as India will not be able to compete in the industrial field with areas in which the climate is more favorable, without the use of sweated labor, unless the factories are air-conditioned. It is also very probable that the output of a factory in such a climate would be still more affected beneficially, if the living quarters of the workers could be cooled. If choice had to be made between cooling a factory or living quarters, the latter is probably the more important. Such projects are at present not even under consideration and might involve changes in the housing and living conditions of whole nations in the tropics, since cooling could be more efficiently attained in large buildings.

Not only should air-conditioning be considered for industrialized areas, it may also prove of value to agriculture. Thus in Brisbane recently 25,000 chickens died in a single unusually hot day from heat stroke. This accident led to experimental work in the University of Queensland under Professor D. H. K. Lee, with the result that limits of tolerance and methods of control (by spraying) are now available. The difficulties of obtaining a good yield of milk from cattle in the tropics is well known, but, surprisingly enough, it is claimed that air-conditioning of a milking barn will more than pay for itself by increasing this yield. Also much work in cross-breeding is required to determine the best strains of cattle and other animals for life in the tropics.

It would appear that innumerable fields for study exist, and that the effects of changes in temperature even for part of the day are not readily predictable. We know little about the agricultural problems, we know almost nothing about the human side. We have no information as to the effect on man of living continuously in cooled houses for generations in areas with a hot external climate.

It is not improbable that cooled houses in a tropical climate, if used consistently for one generation, might modify the whole character of a population. It would certainly not be wise to rely for such information on chance observations, when large-scale experiments could be carried out much more accurately, more cheaply in the long run and probably with the approval of those used as subjects. Such experiments involve mental activity and should be made on man. Data of this type might be expensive to obtain but should pay dividends, possibly very large dividends. All the world would be served, the tropical countries through the more rapid development that would be possible when the facts were known, and countries in more temperate zones by demands on their supplies of mechanical equipment. International cooperation, whether on a limited scale as through the Pan American Union, or preferably on a broader basis, should expedite progress.

These future possibilities are only hinted at by Markham. Prophecies as to the future are left to the reader. However, if people with imagination read Markham's speculations as regards the past and make efforts to speculate as regards the future, it is to be expected that some extremely valuable experiments may materialize.

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AMINO ACIDS AND PROTEINS

Outline of the Amino Acids and Proteins. Melville Sahyun, editor. 251 pages. New York, N. Y.: Reinhold Publishing Corp. 1944. $4.00.

AMONG the major problems in the organic chemistry of natural products, that attracting the keenest interest of investigators is the constitution of proteins. As a consequence, much is currently being printed in the technical journals concerning the chemistry of the amino acids and several publishers of scientific books have recently issued text-books on the subject.

The stated purpose of the volume under review is "to outline in a simple and readable manner the essentials of the chemistry and biochemistry of amino acids and proteins." This it attempts to do in a group of essays by more than a dozen experts; as is unfortunately too frequent in such collections, insufficient effort appears to have been made to coordinate the subject-matter and to maintain a logical balance between the individual chapters. Moreover, several of these essays labor under deficiencies of structural equilibrium within themselves. In the opening chapter, discursive accounts of investigations which led to the characterization of individual amino acids are interspersed with passages intelligible only to the expert. How much information could be extracted from the bare remark that the first synthesis

of glutamic acid was accomplished with levulinic acid as starting material? In the account of Hedin's procedure for the isolation of histidine, no reference is made to the fact that the silver salt is precipitated in one of the steps, nor are the conditions of this precipitation indicated. And an uninformed reader could gain little from the statement that Harington, in his work on thyroxine, "subjected his crystalline product to dismutation and identified each fraction."

The story of the discovery of tryptophane is misleading in one respect, apparently owing to the misinterpretation of a passage, paraphrased from a review article by Vickery and Schmitt, to the effect that as a result of Kühne's researches "indole and tryptophane very early became associated with each other." The identification of indole as a product of the putrefaction of proteins was accomplished by Nencki, and not by Kühne.

In the second chapter, on proteins, accuracy and lucidity are too often sacrificed to impressiveness of utterance. For example, it is here stated that "Those substances that are contained in or produced by bacteria and that engender the production of specific immune bodies are likewise proteins"; the reader has to traverse more than 100 pages before encountering the more correct statement that "many antigens are proteins and most proteins are antigens." In the discussion of amino acids as dipolar ions an unsuspecting student would have difficulty in interpreting the dissociation curves (p. 70) in which zero percentage dissociation is attributed to amino acids in the intermediate zones of pH.

On the other hand, the third chapter, on protein structure, is an admirable exposition of a difficult subject; clearly expressed, logical and well balanced.

Chapter IV, on the hydrolysis of proteins, abounds in detailed, but poorly integrated, information. It also contains obscure passages such as "Some hydrochloric acid is lost during boiling. Alkalies . . . absorb carbon dioxide . . . . Therefore, if one wishes to perform accurate hydrolysis and be in a position to duplicate his own results, it is necessary to express the concentration of acids and alkalies in terms of normality," and is not free of errors like ". . . the ratio $\frac{\alpha\text{-amino N}}{\text{total N}}$ is 100."

The fifth chapter, on the synthesis and isolation of certain amino acids, is more elaborate in treatment than the third, but equally meritorious. It is obviously addressed to advanced students, and shows care in the accentuation of principles and the avoidance of unessential detail.

In the next chapter, on methods of analysis for amino acids and proteins, the treatment in some, but not all, sections approaches that of a manual of analysis; the information here supplied could be of practical value only in conjunction with that obtainable from a standard work like that of Hawk and Bergeim. This chapter concludes with a very brief statement, without theoretical explanation, of the electrophoretic procedure of Tiselius for the separation of plasma proteins, a section on "protein levels in health and disease" and some semi-detailed accounts of analytical methods for the determination of serum proteins.

An excellent, though brief, review of the role of amino acids in immunochemistry, addressed to the trained biochemist, is followed by an equally authoritative essay on amino acids in detoxication, the subject-matter for which is carefully selected, informative and thoughtfully discussed. The organic chemist will accept with some reserve the inferences drawn from the results of physiological balance experiments, which are often open to more than one interpretation. The biochemist sometimes yields, for the sake of simplicity, to the temptation to ascribe only one of several possible courses to a series of metabolic conversions. For example, it is here unequivocally stated that in the formation of a mercapturic acid the acetylation takes place subsequently to the combination of the aromatic group with the sulfur atom. This is no doubt probable, but has not been proved.

The chapters on the metabolism of proteins and amino acids and on the intermediary metabolism of individual amino acids are among the best in the book, and will well repay study by biochemist and organic chemist alike. The very short account of nitrogen equilibrium and the biological value of proteins serves as a stimulating introduction to the subject of the final chapter, amino acids and proteins in nutrition, the presentation of which is conscientious but rather lacking in chemical imagination. This failing is perhaps attributable to the magnitude of the load of published matter which the review has to bear.

An appendix contains a list of titles of U. S. patents issued on amino acids and related organic compounds.

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