

group has indicated an area of uncertainty in this region, there is an obvious difference in the two structures involving, in its simplest terms, an interposition of a glycine and an alanine residue.

Our evidence for the sequence in this region is primarily from the stepwise hydantoin reaction. Application of a modification of the Edman procedure⁵ to the long chain C-terminal tryptic peptide (T_E , Table I) gave the sequence as shown from position 22 to 28. Further confirmation of part of the sequence was obtained by the isolation of the dipeptide Ala.Glu (PAH_1 , Tables I and II) from the products of partial acid hydrolysis of peptide P_5 .⁶

In attempting to close the gap between the two ends of corticotropin-A, we have concentrated on a study of the products of tryptic digestion. In addition to the N-terminal octapeptide (T_C , Table I) and the long-chain C-terminal fragment (T_E), our chromatograms of the tryptic digests show only two other prominent fragments. These, with their chemical and enzymatic characteristics, are shown in Table II. Since tryptophan had

(5) W. A. Landmann, M. P. Drake and J. Dillaha, *THIS JOURNAL*, **75**, 3638 (1953). The authors also wish to acknowledge help from unpublished manuscripts made available by Dr. J. I. Harris, The Carlsberg Labs., Copenhagen, Denmark.

(6) This fragment is formed by 24-hour peptic digestion of corticotropin-A. By this treatment five amino acid residues are split off the amino end and eleven off the carboxyl end. The remaining portion of the molecule (P_5) is separated from the smaller fragments by means of its immobility in the two chromatographic solvent systems used throughout our work (*cf.* ref. 2).

previously⁷ been shown to occur in an Arg.Try sequence, fragment T_D obviously fitted next to T_C , leaving T_B to fill the final gap between T_D and T_E . Because of the possibility of transpeptidation during the tryptic digestion, we sought confirmation of the multiple basic amino acid sequence. Three peptides which were isolated from the products of partial acid hydrolysis, as shown in Table I (PAH_2 , PAH_3 , PAH_4), provided the desired overlap.

Thus it appears that the backbones of corticotropin-A and β -ACTH are very similar, with only the seven uncertain residues in our structure and the three uncertain ones in β -ACTH as possible differences. A further point of difference rests in the amide linkages. β -ACTH has been shown to possess only one such linkage, on the Glu residue located ten positions from the carboxyl end. We have not yet made a systematic investigation of the amide linkages in corticotropin-A, but with the procedures used to date, no evidence has been obtained that any of the acidic residues is in the amide form.

The central line of Table I shows the sequence of corticotropin-A as we know it at the present time. The fragments referred to for the first time in this paper are indicated by the dotted lines and arrows.

Acknowledgment.—The authors wish to acknowledge the technical assistance of Mr. A. M. Gross.

(7) W. F. White and W. A. Landmann, *THIS JOURNAL*, **76**, 4193 (1954).

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BOOK REVIEWS

The Elementary Chemical Composition of Marine Organisms. By A. P. VINOGRADOV, Vernadsky Laboratory for Geochemical Problems, Moscow, U.S.S.R. Translated from Vinogradov's original Russian by Julia Efron and Jane K. Setlow, with bibliography edited and newly enlarged by Virginia W. Odum, for the Survey of Existing Knowledge of Biogeochemistry, American Museum of Natural History, Sears Foundation for Marine Research, Yale University, New Haven, Connecticut. 1953. xiv + 647 pp., 370 tables. 24.5 × 31.5 cm. Price, \$17.00.

It is quite natural that sooner or later someone would bring together and evaluate the vast number of elemental analyses of living things that, for more than a century and a half, have preoccupied chemists and biologists working at the simplest contact of their two sciences. To the biogeochemist such a compilation has now become a necessity, and it is the great merit of Professor Vinogradov's compendium that it summarizes and tabulates most of what has been written on the elemental composition of living matter, threading the whole together with a discerning discussion.

The aim of Vinogradov's enquiry is ultimately to provide insight to the geochemical roles of living matter, and the primary data sought are precise determinations of the elementary compositions of organisms living in the sea. It is regrettable, from Vinogradov's point of view, that relatively few analyses have been made of whole organisms. Even where this has been done, relatively few elements have been investigated in any single research. Indeed an analysis of

a plant, for example, is quite generally viewed as "complete" if it includes some 9 or 10 elements; comparable analyses of animals are ordinarily still less inclusive. However there seems no lack of limited elemental analyses of the parts of organisms, and it is chiefly from these that Vinogradov has drawn this first comprehensive account of the elemental composition of marine life. This account is necessarily very approximate, for many of the data are old (perhaps a third having been collected before 1900), there is scant attention to measures of the reliability of chemical determinations, and for the most part potentially significant biological variables, such as age, sex, symbiont associations, season of capture, and so on, remain unassessed. Vinogradov is of course acutely conscious of all this, and his book may be expected to prove a marked influence in bringing about an over-all improvement in research of this sort.

Following a brief introduction that comments on the history of the subject, on the nature of the analytical data, and on the elemental composition of sea water and of living matter, there are 18 chapters that survey the elementary composition of particular marine organisms. Each chapter is devoted to a more or less coherent taxonomic assemblage of organisms; collectively they deal with flowering plants, algae, bacteria, protozoa, most kinds of invertebrate animals and fish. These chapters are topically subdivided to the degree that analytical information or knowledge of special biological aspects warrants, and for this reason they are of very unequal length. Thus, of the 586 pages of text and tables, nearly 60% is devoted to algae (139 pp.), molluscs (104 pp.) and fish (105 pp.). Four other chapters dis-

cuss general topics: metal-bearing respiratory pigments of invertebrates (14 pp.), mineral composition of skeletons (10 pp.), the regulating influence of oceanic salt on the composition of marine organisms (10 pp.), and fundamental changes in the elementary composition of marine organisms during geological time (12 pp.). Concluding the monograph, there is a most impressive bibliography of more than 2000 titles that is largely the work of Mrs. Virginia Odum. Regrettably the topical subdivision of chapters, which is listed in the table of contents, provides the only means of entrance to the welter of information that is interwoven through the text as a whole, for there is no index—an omission that greatly impairs the usability of this enormously factual book.

For all who wish information as to the more than 60 elements recorded from living things, this will prove a useful and informative volume. It will help orient the reader, and perhaps enliven his interest in the ways in which organisms accumulate, limit, or reduce constituents in terms of the relative abundance of the elements in their immediate environment. Unfortunately little is known of the ways in which organisms effect this control, and Vinogradov's orientation to the subject permits scant consideration of mechanisms. But the problems are pointed out, and there is great advantage to having the background information available in one source. Although there are many biologists who will place quite different interpretations or emphasis upon the phylogenetic significance that Vinogradov attributes to certain correspondences among organisms in elemental accumulations, few will feel the discussions of these problems unrewarding. Perhaps the chief complaint concerning the text, if any need be made, lies with the general diffuseness of Vinogradov's treatment, and his willingness to discuss or record much that seems trivial. This criticism is dispelled, however, when it is recalled that we are dealing with a reference work that encompasses a literature of more than 2000 titles. To Vinogradov, and to his translators and collaborators, much gratitude is owing for this useful, expensively manufactured, and beautiful book.

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Physical Properties of Solid Materials. By C. ZWIKKER, Director, National Aeronautical Research Institute, Amsterdam. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1954. viii + 300 pp. 16.5 × 25 cm. Price, \$8.75

In the preface of this book the author states it is his purpose to give a summary of the physics of solids, to consider the theoretical concepts involved with a minimum of mathematical detail, and to consider as examples a few practical applications of the theories. He has adhered to this purpose with remarkable consistency. Consequently the book covers a wide range of subject matter and is a useful reference. The broad coverage makes it particularly useful to those whose main interests lie in other branches of science or as an introductory book for those primarily interested in solid state physics. On the other hand, the work is too condensed and the mathematics too abbreviated to satisfy the specialist interested in completeness and scientific unity; such a reader will probably feel that interrelations between the various phenomena have not been sufficiently emphasized.

The author has directed his discussions primarily at the beginner in solid state and has included several unusual explanations to clear up points which are frequently bothersome. For example, on page 102 (Chapter VI) after a good discussion of the concepts of elasticity and elastic waves, he has given an unusual drawing to illustrate the identity of long and short waves in an atomic chain. This is one particular item that is invariably confusing to the beginner and is seldom cleared up by the textbooks.

The text is clearly written and for a technical book is very readable. The author's apology for his language difficulties is entirely unnecessary as few English speaking scientists have written more clearly.

In particular the chapter on thermal properties is better than that found in most comparable books and provides the reader with some feeling for the problems and the various

simplifying assumptions which have been employed in solving the problems. In comparison with earlier books less attention has been given to the electronic properties of solids and the band theory. This may well represent a current trend in emphasis rather than the author's personal viewpoint.

As a minor matter of convenience the publishers could have put the chapter and paragraph numbers on each page.

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Structure Reports for 1950. Volume 13. General Editor: A. J. C. WILSON, University of Wales, Cardiff, Great Britain. Section Editors: N. C. BAENZIGER (Metals), University of Iowa, U. S. A.; J. M. BIJVOET (Inorganic Compounds), University of Utrecht, Holland; J. MONTEATH ROBERTSON (Organic Compounds), University of Glasgow, Great Britain. N. V. A. Oosthoek's Uitgevers MIJ., Domstraat 1-3, Utrecht, Holland. 1954. viii + 643 pp. 17.5 × 25 cm. Price, 80.—Dutch florins.

This newest volume of "Structure Reports" maintains the general excellence of its predecessors in the series. The reporting of essential structural results is critical and adequately detailed, with many excellent diagrams contributing to clarity. As "Structure Reports" is sponsored by the International Union of Crystallography, diffraction studies of crystalline structure naturally preponderate, and the coverage of such matters apparently is complete. Many data related to and even somewhat peripheral to this main theme are included, however. For example, there are reported numerous electron diffraction studies of gaseous molecules, several microwave studies of simple organic molecules, phase diagrams for many systems (metals particularly), studies of texture and epitaxy, etc. The convenience and utility to the student of crystalline structure of having "Structure Reports" at hand scarcely can be overestimated. As a reliable and easy to use guide to what has been done in the field, "Structure Reports" is warmly commended to the attention of the non-specialist.

It may be useful to note that with the appearance (also during 1954) of "Structure Reports" for 1945-46, volume 10, the gap in coverage between the last volume of "Strukturbericht," volume 7 (1939) and the "Structure Reports" has been narrowed to the period, 1940-44. "Structure Reports" for 1942-44, volume 9, now is being prepared for publication.

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Monomeric Acrylic Esters. By E. H. RIDDLE, Rohm and Haas Company, Philadelphia, Pennsylvania. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1954. vii + 221 pp. 16 × 23.5 cm. Price, \$5.00.

This book is a practical guide to those who wish to use monomeric acrylic esters in polymerization on almost any scale, or in synthesis. Emphasis is on the four acrylic and seven methacrylic esters which are commercially available. By concentrating on operations and observations, and by reducing theoretical considerations to simple generalizations, much practical information has been included in moderate space. In general, journals and patents have been covered adequately through 1952, but there are many references to more recent or unpublished work.

The first three chapters tell how the monomers are made commercially, handled, stored and freed from inhibitor, and list their physical properties. The last chapter describes in detail analytical methods for the monomers and inhibitors. More than three-quarters of the book is devoted to the remaining three chapters on polymerization, copolymerization and other reactions. The reviewer's impressions are that the author writes well, that he knows his subject, that he has summarized the many patents briefly and rather optimistically, but that he has made little effort to evaluate the relative importance or usefulness of the numerous patents. Perhaps one should not expect the author to state the ad-