

TABLE I

pH	Temp., °C.	Speed	Prot. concn., g./l.	Concn. at meniscus, g./l.		Mol. wt.
				$\frac{1}{cx}$	$\frac{dc}{dx}$ extrapd.	
1.64	24.8	42,040	10.7	0.25	3.30 ± 0.20	16,900 ± 1000
				0.1	3.49 ± .20	17,900 ± 1000
				2.8	3.75 ± .30	20,300 ± 1600
2.01	23.7	39,460	13.2	0.36	3.23 ± .20	17,500 ± 1100
				0.1	3.22 ± .10	17,400 ± 500
				5.4	1.047 ± .02	22,700 ± 500
2.08	25.0	20,410	12.1	4.7	1.054 ± .03	22,900 ± 700

Solutions of β -lactoglobulin were prepared under the desired conditions of pH and ionic strength, and centrifuged in a Spinco Model E analytical ultracentrifuge. In each case, the protein solution was centrifuged in one Kel-F cell, while pure solvent was centrifuged in an identical cell used in place of the counterbalance. The menisci of the two were made to coincide by weighing in the proper amount of liquid into each cell, as suggested by Singer.¹⁷ In this manner, the correct base line was obtained directly on each ultracentrifugal pattern. The weight average molecular weight at the meniscus was calculated at various times late in the run, so that the equilibrium be close to total

(17) S. J. Singer, private communication.

dissociation. Some of the results obtained in a 0.1 M/2 NaCl-HCl medium are presented in the table.

These data show that the molecular weight of the dissociated species of β -lactoglobulin is in the vicinity of 17,500, or half of the normally accepted value. It is interesting to note that Bull has obtained a molecular weight of 17,000 from surface pressure measurements under a different set of conditions.¹⁸ These results, together with the reports that β -lactoglobulin contains two identical amino¹⁹ and carboxyl^{19,20} end groups, strongly suggest that the molecular unit observed at isoelectric conditions is an aggregate of two identical protein units. It would appear, therefore, that the molecule of β -lactoglobulin consists of a single polypeptide chain with a molecular weight of *ca.* 17,500.

(18) H. B. Bull, *THIS JOURNAL*, **68**, 745 (1946).

(19) H. Fraenkel-Conrat, "Symposium on Structure of Enzymes and Proteins," Gatlinburg, Tenn., 1955, p. 133.

(20) L. Weil, E. B. Kalan, T. S. Seibles and M. Telka, private communication.

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BOOK REVIEWS

Biochemical Problems of Lipids. Proceedings of the Second International Conference held at the University of Ghent 27-30 July, 1955, organized with the collaboration of the "Vlaamse Chemische Vereniging" of Belgium, under the presidency of Professor R. Ruysen. Editors, G. POPJÁK and E. LE BRETON. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1956. xvi + 509 pp. 16 × 25.5 cm. Price, \$10.75.

This volume contains about 80 papers including a discussion of the nomenclature of the enzymes concerned in fatty acid metabolism. The languages used were English, French and German. There were present about 250 scientists representing 20 nationalities.

The papers are arranged in four sections as they were presented at the meetings: (1) physical and chemical properties of the lipids—methods of separation, structure; (2) metabolism and biosynthesis, enzyme systems; (3) phospholipids and transport; (4) miscellaneous problems.

An excellent outline of the work covered is given in the introduction by President R. Ruysen. Among his comments are remarks about the complex chemical constitution of the lipids and their behavior as amphophilic substances. The knowledge of structure and composition of the natural phospholipids has much increased due almost entirely to new methods of separation and identification, such as countercurrent distribution, chromatography and spectrophotometry. Knowledge of the enzyme systems and their isolation as discussed in the conference puts us now in position to describe precisely most of the reactions in the fatty acid cycle. The part taken by the phospholipids in the transport of the fatty acids is now due for a reconsideration. Also thereby, new light has been thrown on fat absorption.

It would be impossible in a brief outline to mention the topics presented and their discussion by the attending members. It is sufficient to say that practically every phase of lipid structure, behavior and metabolism has been brought out and examined so that a reader gets a comprehensive picture of the present state of the problems connected with the lipids. A fact which detracts a little from the book as a publication is the repetition of the last three papers of section (1) together with an occasional extra page. Of course, this does not affect the value of the material from a scientific point of view.

The book will be of interest, not only to the purely lipid chemists, but since the lipids in nature combine with most known biochemical substances, forming aggregates of great size and complexity, it should interest all biochemists as well as those whose main interest is in the huge molecules which constitute living matter.

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Microcalorimétrie. Applications Physico-Chimiques et Biologiques. By E. CALVET, Professeur à la Faculté des Sciences de Marseille, and H. PRAT, Professeur à l'Université de Montréal. Masson et Cie., Editeurs, 120, Boulevard Saint-Germain, Paris-6e, France. 1956. viii + 395 pp. 17 × 25 cm. Price, Broché, 4,500 fr. Cartonné toile, 5,200 fr.

Microcalorimetry comprises the measurement of small quantities of thermal power either exothermic or endother-

mic as produced in chemical reactions. In the apparatus developed by Calvet, Prat and co-workers the sensitivity has been increased to the point where the incredibly small power of 0.2 microwatt (1.5 cal./yr.) can be recognized. The fundamental idea which makes this possible was originally proposed by A. Tian in Marseille in 1923 (whose apparatus was used by Calvet for his doctoral research). Tian suggested that the heat generated or adsorbed in the reaction under study be compensated by electrical cooling (Peltier Effect) or heating (Joule Effect). The present authors over a period of twenty years have developed the apparatus to the sensitivity mentioned above and by means of ingenious innovations as well as of sound theoretical analyses of error brought the science of microcalorimetry to a high state of perfection.

The book has been written in three sections, the first two by Calvet and the third by Prat. The first on apparatus and methods gives detailed mathematical analyses of errors, heat leaks, thermal unbalance in the calorimeter, etc., as well as a description of the calorimeter, methods of forming the thermocouple junctions, electrical circuits (which are relatively simple), etc. In order to avoid unknown heat losses due to temperature gradients along the exterior surface of calorimeter and interior surface of jacket (a difficulty commonly overlooked by many calorimetrists), Calvet covers nearly the whole surface of the calorimeter with thin silver plates each connected to a thermocouple. Thus in his calorimeter heat leaks are magnified, but controlled and measured. This is perhaps the outstanding feature of his technique. It would be interesting to know how such a scheme works at high temperatures where heat exchange by radiation becomes dominant.

The second part describes the special methods and results of calorimetric studies of heats of solution, dilution, mixing, gelatinization, esterification, hydrolysis, saponification, immersion, decomposition and hydration (especially of cements). A large and important part of this section is devoted to the description not only of total heats but also of kinetic heat effects. The apparatus can also be used for specific heat and thermal conductance measurements although in these two fields the special advantages of the Tian-Calvet calorimeter are not so marked.

The final part describes chiefly Prat's work on biological systems such as heat effects of germination and respiration of seeds, bacteria, tissues, invertebrates and vertebrates. Of especial interest here are the kinetic heat effects which make it possible to recognize and measure quantitatively different stages in growth cycles as well as the effects produced on the organisms by herbicides, hormones, variations of temperature and humidity, etc.

The authors make no attempt to review the whole subject of microcalorimetry, their purpose in writing this book being to expound their own techniques. A general bibliography is given as well as indices and a table of contents. F. D. Rossini in his capacity of President of the Commission of Chemical Thermodynamics of the I. U. P. A. C. generously contributed an appreciative preface.

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MALCOLM DOLE

Treatise on Inorganic Chemistry. Volume II. Sub-Groups of the Periodic Table and General Topics. By H. REMY, Professor of Inorganic Chemistry, University of Hamburg, (Germany). Translated by J. S. Anderson, F.R.S., Professor of Inorganic Chemistry, University of Melbourne (Australia), Formerly Deputy Chief Officer, Atomic Energy Research Establishment, Harwell (England). Edited by J. KLEINBERG, Professor of Inorganic Chemistry, University of Kansas, Lawrence, Kansas (U.S.A.). D. Van Nostrand Co., Inc., 126 Alexander Street, Princeton, New Jersey. 1956. xxviii + 800 pp. 18 × 25.5 cm. Price, \$17.75.

The English translation of this famous German textbook by Professor Remy is a welcome addition to the number of treatises in inorganic chemistry which have appeared in the last few years. Professor Anderson who has translated this book has been successful in keeping basic objectives of Professor Remy intact.

As the title indicates, a large part of this book pertains to the treatment of the various groups in relation to their position in the periodic table. However, several chapters have been added which treat subjects of great present interest.

The first chapter is a discussion of the metals and the intermetallic phases emphasizing the theoretical and practical aspects of this subject. Chapters 2, 3, 4, 5 and 6 discuss the first five periods of the transition elements. Chapter 7 discusses the 8th sub-group divided into the metals of the iron series and the metals of the platinum series. This division, unfortunately, produces a loss of some of the significance of the electronic structure in the sub-groups of group VIII. Chapters 8 and 9 discuss the 1st and 2nd sub-group of the periodic system and chapter 10 discusses the Lanthanum group.

Chapters 2 through 10 start with a general discussion of the groups such as their valence, basicity of the hydroxides, oxides and salts, properties of the metals, alloys, etc. Much of this discussion is of the type which still adheres to the memory type discussion which was so typical of German treatises. The other parts of the chapter consist of the discussion of the physical and chemical properties of the metals and their compounds including their analytical chemistry. Energy relationships which are so important in discussion of trends in the groups are unfortunately not included for most groups. In many cases certain aspects of a group are discussed in great detail whereas other parts are just barely mentioned. Some compounds are discussed as Werner type complexes although this has not been fully established.

The rest of the chapters consider general phenomena important in inorganic chemistry. Chapter 11, for example, considers radioactivity and isotopes, and chapter 12, isotopes of the stable elements; chapter 13, artificial radioactivity in nuclear chemistry and chapter 14, the Transuranic elements in general. This discussion covers about 150 pages and is quite well organized and presented. Chapter 15 considers geochemistry in general and could possibly be included in this group.

Chapter 16 discusses colloids and surface; chapter 17, catalysis and reaction kinetics; chapter 18, reactions in non-aqueous solutions and chapter 19, reactions of solid substances. These chapters are well organized but consider phenomena which can, because of space limitation, be only discussed superficially. In such a case, naturally, the specific interest of the author determines the treatment of the subject matter.

In general, this second volume of Remy's Treatise on Inorganic Chemistry is a very welcome addition to the shelf of general reference books in inorganic chemistry. The author, the translator and the American editor are to be congratulated for having undertaken to make this reference book available to those research chemists in inorganic chemistry who are not too familiar with the German language.

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Organic Analysis. Volume III. Editorial Board: JOHN MITCHELL, JR., I. M. KOLTHOFF, E. S. PROSKAUER and A. WEISSBERGER. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1956. viii + 546 pp. 16 × 23.5 cm. Price, \$11.50.

This latest publication in the series "Organic Analysis" marks another forward step in the projection originally set forth by its editors of consolidating and critically evaluating the extensive and widely scattered literature of the field. It is gratifying to note in this connection that the contributors to Volume III have completed their assignments with distinction.

The book contains six chapters, the first four of which deal with functional group analyses (1. Organic Acids, 2. Organic Anhydrides, 3. Amines and Amides, and 4. Olefinic Unsaturation), the fifth with a relatively new instrumental technique, analytical mass spectrometry, and the sixth with synthetic organic resin coatings. The chapters are all of uniformly high quality, their treatment showing ample evidence of both painstaking scholarly care and of broad