

CHEMISTRY and PHYSIOLOGY

of the *Vitamins*

CHEMISTRY and PHYSIOLOGY **of the Vitamins**

By

H. R. ROSENBERG, Sc.D.

Revised Reprint

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PREFACE TO THE REVISED REPRINT

The present volume is essentially a reprint of the "Chemistry and Physiology of the Vitamins" which was published in 1942. Although many new discoveries have been made since the manuscript for the first edition was written, practically none of these has been incorporated into the reprint. Only actual errors which have crept into the first edition and which have come to the attention of the author have been corrected. However, the "Recommended Daily Allowances" as published in January 1943 by the Food and Nutrition Board of the National Research Council have been added.

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Spring 1945

H. R. ROSENBERG

PREFACE TO THE 1942 EDITION

This monograph, "Chemistry and Physiology of the Vitamins," has a long historical background. Exactly a decade ago it was the privilege of the author to be present at the meeting held by the Zürich section of the Swiss Chemical Society when Paul Karrer announced a few days prior to its publication the successful isolation of essentially pure vitamin A from fish liver oils and the establishment of the structure of this vitamin. It was then that the author felt the urge to compile the available data on the chemistry and physiology of all vitamins. The science of vitamins had by that time advanced to a state at which the existence of vitamins, brought into the limelight between 1906 and 1914, was no longer questioned. In 1926 B. C. P. Jansen and W. F. Donath had announced the isolation of pure, crystalline vitamin B₁ but the constitution of this vitamin remained unknown for many years to come. At the same time (1926), Pohl, Windaus, Hess, Rosenheim and Webster had recognized that the long known ergosterol could be converted into a vitamin D by activation with ultraviolet light; but the pure vitamin D was not obtained until 1931-1932, and the correct chemical constitution was not known. Thus, Karrer was the first to establish the true chemical constitution of a vitamin.

In the years following Karrer's announcement, the author, while working in the laboratories of L. Ruzicka and T. Reichstein, had the good fortune of being able to see and observe the progress made on the establishment of the structure and the synthesis of several vitamins and hormones. During that time Reichstein synthesized vitamin C, the first vitamin ever obtained by total synthesis. And, Karrer, in a laboratory only a few blocks removed, worked in a dramatic race against Kuhn in Germany on vitamin B₂, and was the first to announce the successful synthesis of this vitamin. From Ruzicka's laboratory the synthesis of the male sex hormones, androsterone and testosterone, by degradation of cholesterol was announced, and Reichstein started to investigate the hormones of the adrenal cortex.

The author was then tempted to plan the publication of a comprehensive volume on the chemistry and physiology of the vitamins and hormones. These two classes of compounds have so much in common that a review of one of them seemed to necessitate a review of the other. The extraordinary activity of research workers in all parts of the world, however, has resulted in the accumulation of such an enormous amount of scientific and practical material, that it became infeasible to combine a discussion of

both the vitamins and the hormones in one volume. Thus, this monograph is confined to a treatment of the vitamins exclusively.

Since the author left the hospitable Swiss Laboratories, he has been connected, at some time or other, with the development of many of the vitamins known today. Simultaneously, the need for an up-to-date presentation of the chemistry and physiology of the vitamins became more and more recognized, and this need is felt today by everyone who desires to inform himself or others on this subject. Short tabulations of the vitamins and scattered review articles do not answer the need. Books written for the general public are obviously of a different category than books of a purely technical character. Fortunately, there have been available in the English language a number of excellent books on the medical aspects of vitamin therapy, such as "The Vitamins," a symposium published under the auspices of the American Medical Association and "The Avitaminoses" by W. H. Eddy and G. Dalldorf. There is also a very satisfactory book on "The Biological Standardization of the Vitamins," written by K. H. Coward. In addition, there are monographs on special vitamins such as the book on "Vitamin B₁" by R. R. Williams and T. D. Spies; "Vitamin D" by C. I. Reed, H. C. Struck and I. E. Steck; "Vitamin K" by H. R. Butt and A. M. Snell and "Vitamin E," a symposium held under the auspices of The Food Group of the Society of Chemical Industry. The author, however, knows of no comprehensive treatment of the chemistry and physiology of all the vitamins.

The present monograph on the "Chemistry and Physiology of the Vitamins" begins with the presentation of a definition of the vitamins which distinguishes this group of compounds sharply from the hormones and from other essential and non-essential food constituents. A new classification for compounds which have the dual character of vitamins and structural building units or suppliers of energy is introduced. Each vitamin is then discussed separately, emphasis being laid upon the chemistry and the physiological action of these compounds. The chapters on each vitamin start with a review of the nomenclature and a tabulation of the historical development followed by a paragraph on the occurrence of the vitamin. The main discussions on the chemistry and physiology follow. Under the chemistry of each vitamin the procedures used for the isolation of the vitamin, the proof of the chemical constitution and the synthesis of the vitamin are reviewed separately. There are special paragraphs on industrial methods of preparing the vitamins and on their biogenesis. The specificity of the vitamin action is treated separately. The determination of the vitamins is subdivided into physical, chemical,

biochemical and biological methods, and is followed by a paragraph on the vitamin standards. The physiology of plants and microorganisms is separated from the animal physiology which is subdivided into the metabolism of the vitamin, the physiological action and the mechanism of the vitamin action. The relation of each vitamin to other vitamins, to hormones, and to inorganics is presented in special paragraphs. This is followed by a short review of the present-day knowledge of the pathological aspects, the hypovitaminoses, avitaminoses, hypervitaminoses and paravitaminoses, with a special section on clinical test methods. Finally the vitamin requirements are briefly stated. The book ends with a list and abstracts of vitamin patents which have issued in the United States of America, Great Britain, Germany and France, arranged in a manner similar to that of the main text.

The vitamins are presented according to the alphabetical order of nomenclature. This arrangement follows in general the incidental discovery of the vitamins. Eventually, a classification according to the function of the vitamins will probably prove to be more satisfactory, but cannot successfully be undertaken at this time due to the rather incomplete knowledge of the primary function of many members.

This volume has been prepared with the idea of covering all topics of vitamin research and especially the chemistry and physiology of the vitamins. In presenting this monograph to the public the hope is expressed that it may guide the student and the scholar through our present-day knowledge of the field and inspire further development. This is especially desirable and should be expedited as much as possible since the health and successful propagation of man are, to a considerable extent, dependent upon proper nutrition, and any advance in the knowledge of the vitamins can be utilized immediately for the benefit of mankind.

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