COMPREHENSIVE BIOCHEMISTRY

EDITED BY

MARCEL FLORKIN

AND

ELMER H. STOTZ

VOLUME 11

WATER-SOLUBLE VITAMINS
HORMONES
ANTIBIOTICS

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WATER-SOLUBLE VITAMINS, HORMONES, ANTIBIOTICS

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GENERAL PREFACE

The Editors are keenly aware that the literature of Biochemistry is already very large, in fact so widespread that it is increasingly difficult to assemble the most pertinent material in a given area. Beyond the ordinary textbook the subject matter of the rapidly expanding knowledge of biochemistry is spread among innumerable journals, monographs, and series of reviews. The Editors believe that there is a real place for an advanced treatise in biochemistry which assembles the principal areas of the subject in a single set of books.

It would be ideal if an individual or small group of biochemists could produce such an advanced treatise, and within the time to keep reasonably abreast of rapid advances, but this is at least difficult if not impossible. Instead, the Editors with the advice of the Advisory Board, have assembled what they consider the best possible sequence of chapters written by competent authors; they must take the responsibility for inevitable gaps of subject matter and duplication which may result from this procedure.

Most evident to the modern biochemist, apart from the body of knowledge of the chemistry and metabolism of biological substances, is the extent to which he must draw from recent concepts of physical and organic chemistry, and in turn project into the vast field of biology. Thus in the organization of Comprehensive Biochemistry, the middle three sections, Chemistry of Biological Compounds, Biochemical Reaction Mechanisms, and Metabolism may be considered classical biochemistry, while the first and last sections provide selected material on the origins and projections of the subject.

It is hoped that sub-division of the sections into bound volumes will not only be convenient, but will find favour among students concerned with specialized areas, and will permit easier future revisions of the individual volumes. Toward the latter end particularly, the Editors will welcome all comments in their effort to produce a useful and efficient source of biochemical knowledge.

Liège/Rochester
July 1962

M. FLORKIN
E. H. STOTZ

PREFACE TO SECTION II

(VOLUMES 5–11)

Section II on the Chemistry of Biological Compounds deals with the organic and physical chemistry of the major organic constituents of living material. A general understanding of organic and physical chemistry is presumed, but the reader will find the special topics in Section I of value in the fuller understanding of several parts of Section II. The Editors have made special effort to include a sound treatment of the important biological high polymers, including sections on their shape and physical properties. A number of substances peculiar to plants, certain isoprenoids, flavonoids, tannins, lignins, and plant hormones, often omitted from textbooks of biochemistry, are included. Nevertheless, it is inevitable that some omissions, hopefully minor ones, have occurred. The only intentional omission is the chemistry of the coenzymes and certain components of biological oxidation, which will be covered in connection with their function in Section III.

The previous policy of dividing the section into smaller volumes has been continued, resulting in seven volumes for Section II. Two of the volumes each contain a complete area, namely Carbohydrates (Volume 5) and Sterols, Bile Acids and Steroids (Volume 10). Comments from readers will be appreciated by the Editors and be most helpful for possible future revisions.

Liège/Rochester
December 1962

M. FLORKIN
E. H. STOTZ

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Chapter II. Electronic theory of organic molecules by H. H. JAFFÉ (Cincinnati, Ohio)
Chapter III. The structure of molecules by J. D. BERNAL (London)
Chapter IV. Stereoisomerism by KURT MISLOW (New York, N.Y.)

Volume 2. *Organic and Physical Chemistry*
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Volume II

Part A

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Chapter 1

Thiamine

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1. Discovery and isolation

In 1890 the Dutch physician Eijkman, working in Java, observed that fowls, mainly fed upon polished rice, developed a disease characterized by a weakness of the legs, a loss of balance, paralyses and a drastic drop of body temperature just before death. Microscopic examination revealed a degeneration of the peripheral nervous system. Sometimes the spinal marrow was also affected. He gave this disease the name of *polyneuritis gallinarum*. It did not develop on a diet of unpolished rice. Once developed, it could be cured by administering rice polishings or by feeding unpolished rice[1].

As the disease also occurred upon feeding rice starch or other kinds of starch, but not upon feeding meat, Eijkman suggested that a toxic principle, formed from starch in the intestine, would cause the observed degeneration of the nervous system. Rice polishings would contain an antidote.

In 1901 Grijns, also working in Java, arrived at the conclusion that *polyneuritis gallinarum* should be regarded as a partial starvation and that "there occur in various natural foods substances, which cannot be absent without serious injury to the nervous system"[2]. He was therefore the first to advance an explanation which later proved to be correct.

Another ten years were to elapse before Funk gave the name of "vitamine" to the substance whose absence from foodstuffs was responsible for the development of polyneuritis[3]. Later the term vitamin(e) was applied to the whole group of organic compounds, small amounts of which are essential to the health of man and beast. The various vitamins were distinguished by prefixes or subscripts, and later still by giving them names from which the word "vitamin" had disappeared completely. As years went by, the substance connected with polyneuritis has been called: vitamine, vitamine B, vitamin B_1, oryzanin, toruline, antineuritic vitamin, anti-beriberi vitamin