

PREFACE TO THE PAPERBACK EDITION

A REPRINT such as this serves five purposes. In the first place, it enables those who are interested in a topic to find out what was known about it at some date in the past. An enzymologist should be aware of what was and what was not known in 1930. Secondly, it may describe lines of work which have not been followed up systematically since it was written and might be fruitfully pursued once more. Tables II, V, and XII suggest generalisations which may turn out to be false or to throw a good deal of light on enzyme action in general. Had I retired from active research, which I have not, and were I living in a country with good library facilities, I should have tried to expand these tables into a book. Thirdly, it may give references to researches which have been wholly forgotten but which may now prove to be relevant to modern problems. Fourthly, it can serve as an Awful Warning. How, readers may ask, could Haldane, whose account of enzyme kinetics in Chapters III and V requires many additions, but few corrections, back so many wrong horses as he did in some of the later chapters? Perhaps some modern molecular biologists may seem equally shortsighted thirty-four years hence. And lastly, such a reprint may convince the author that he has not wasted his life.

I think the main advances in enzymology since I wrote this book have been three. First, in the purification of numerous enzymes, starting with Sumner's pioneer work. All turn out to be proteins, and many lack a prosthetic group. Secondly, in a few cases we know, and in the rest we guess with high probability, that the structure of an enzyme is exactly specified by that of one or more genes. Finally, we know that metabolic processes, such as oxidations and syntheses, are usually series of enzyme-catalysed reactions, each reversible because it causes a small free energy change, and involving small molecules, often nucleotides such as the adenosine phosphates and the phosphopyridine nucleotides, which were unknown in 1930. In that year I confidently hoped that thirty years hence we should know the exact structure of the active centres of a number of enzymes and be able to calculate their properties from this structure. This hope has not yet been fulfilled, partly because the active centres seems to include amino-acid residues in several adjacent and loosely bonded peptide chains. It is one of

my ambitions to live long enough to read a paper whose author explains, from the amino-acid sequences of two enzymes, why one must be an esterase and the other a peptidase.

Finally, I want to remedy an omission. As Sir Frederick Hopkins was not only a very modest man, but editor of the series in which this book first appeared, I could not state how much I owed him. Until I came to work in his laboratory I had only used enzymes as analytical tools and had not thought about them for five consecutive minutes. Hopkins convinced me that they were a central topic in biochemistry. My father, J. S. Haldane, had shown about 1910 that though haemoglobin is a large molecule, its reactions can be predicted from the laws known to hold for small molecules. I had only to bring the ideas of these two great men together to produce an account of enzyme action which, though sketchy, seems to have been largely correct.

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PREFACE

THIS book differs in two respects from the other members of the series to which it belongs. It lays no claim to completeness. For an exhaustive account of the subject the student is referred to Oppenheimer and Kuhn's monumental *Die Fermente*, while a very full treatment of many aspects may be found in Euler's *Chemie der Enzyme*. I do not propose to treat of the biology of enzymes, either from the point of view of their function or formation; still less of their applications in the laboratory or factory. Even so the account of their purely chemical side will be inadequate.

Secondly, the subject has already been treated in this series by the late Sir Wm. Bayliss. In view of the great additions to our knowledge in the last few years a demand has arisen for a new work on the subject. *The Nature of Enzyme Action*, like all Bayliss' work, was strongly individual, and could not have been brought up to date without at least a partial loss of that individuality. Moreover, Bayliss' book was to some extent a polemic for the view now universally accepted, that enzymes are catalysts, and for the thermodynamical implications of such a view, which are not always so fully recognized. As such it is in no sense superseded by the present book, which, to a large extent, attempts to build on the ground cleared by Bayliss. In order to keep the book within reasonable dimensions, I have been forced to assume a considerable knowledge of organic and physical chemistry in its readers, but I have added an appendix to Chapter VI on some recent work on carbohydrate chemistry which is not yet wholly incorporated into the textbooks. I have dealt in a very summary manner with the enzymes concerned in the complicated processes of alcoholic fermentation, and respiration. It will only be possible to study them in a really quantitative way when they have been separated from the other catalysts with which they cooperate. Moreover, the subject of alcoholic fermentation has already been dealt with in this series by Prof. Harden, while Dr. Dixon is preparing a volume on the catalysis of oxidations.

This book is based on a course of lectures which I have delivered here since 1923. It owes much to conversations with Drs. Dixon, Quastel, and Wurmser, and with Mr. Woolf.

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