ENZYMES, SIX LECTURES, DELIVERED UNDER THE HERTER LECTURESHIP FOUNDATION AT THE UNIVERSITY AND BELLEVUE HOSPITAL MEDICAL COLLEGE

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649130573

Enzymes, six lectures, delivered under the Herter lectureship foundation at the University and Bellevue hospital medical college by Otto Cohnheim

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

www.triestepublishing.com

OTTO COHNHEIM

ENZYMES, SIX LECTURES, DELIVERED UNDER THE HERTER LECTURESHIP FOUNDATION AT THE UNIVERSITY AND BELLEVUE HOSPITAL MEDICAL COLLEGE

Trieste

ENZYMES

BY

OTTO COHNHEIM

A. O. PROFESSOR OF PHYSIOLOGY, HEIDELBERG

SIX LECTURES

DELIVERED UNDER THE HERTER LECTURESHIP FOUNDATION

AT THE

UNIVERSITY AND BELLEVUE HOSPITAL MEDICAL COLLEGE

FIRST EDITION

FIRST THOUSAND

NEW YORK:

JOHN WILEY & SONS

LONDON: CHAPMAN & HALL, LIMITED

1912

PREFACE

THE following lectures were given under the Herter Foundation at the University and Bellevue Hospital Medical College in the City of New York in 1910.

They were delivered before an audience of physicians and medical students and the subject was treated from the biological point of view. Here let me take occasion to express my indebtedness to the members of the faculty of the College, as well as to many other colleagues in New York, for their kindness during a visit which I shall ever remember with pleasure.

I am also indebted to Dr. W. B. Cannon for assistance which has enabled me to deliver these lectures in a language foreign to me.

OTTO COHNHEIM.

HEIDELBERG, *September*, 1910.

CONTENTS

pound which is acted upon by the enzyme is taken, and is connected with the ending "*ase*." Thus sucrase is an enzyme which acts upon sucrose or cane sugar; protease acts upon proteins; and maltase upon maltose. I think it will be impossible to employ these designations very closely, because proteins can be dissociated by different enzymes, *e.g.*, peptones by two enzymes with different qualities. Glucose is converted by zymase into carbon dioxide and alcohol, and by the enzyme of the Bacillus acidi lactici into lactic acid. Different qualities necessitate different names. I shall use the historical names, and employ the name that was given to the enzyme by its first discoverer, or that which has been generally adopted. Similarly the so-called rational nomenclature, as adopted by all chemists, employs really the old names. I shall therefore employ the terms pepsin, trypsin, erepsin, ptyalin, invertin, maltase, lactase, zymase, and steapsin. In the case of the enzyme that converts starch into dextrin and maltose, both names, diastase and maltase, are authorized because the existence of two enzymes in malt and in saliva has been suggested. The methods which enable us to obtain and to work with enzymes, have first to be dealt with, and later comes the discussion of the general properties of enzymes, after which the individual enzymes will be considered.

ENZYMES

CHAPTER I

Methods of Obtaining Enzymes

Chemistry cannot produce enzymes. They are found only as products of the living protoplasm of cells, and in all investigations on enzymes they must be separated from the cells and the organs. So far as ease of separation is concerned, a great difference exists between enzymes—the extracellular enzymes, that act outside of the cell, and the intracellular enzymes, or endo-enzymes, which in living organisms never leave the cell.

The enzymes of the first class are secreted by the glands, and in many cases these secretions can be obtained, and with them the enzymes. Human saliva is easily obtained; and following the methods of Pawlow[1] and of Bayliss and Starling[2] we can get pure saliva, pure gastric and pancreatic juice of the dog, cat, horse, goat, and other higher animals. The pure secretions of

[1] J. P. Pawlow: "Arbeit der Verdauungsdrüsen," 1898.—Nagel's "Handbuch," Bd. ii., 1906.

[2] W. M. Bayliss and E. H. Starling: Journal of Physiology, 28 and 29 (1903).

the digestive glands of some invertebrates can also be obtained. One advantage of these methods is that the product is free from many undesired substances; the chief advantage is the certainty of having the correct solubility and the proper reaction. Where the actual secretions are obtainable, investigations should never be made with extracts.

In many cases, however, the secretions cannot be obtained. For instance, the small intestine secretes a litre, or more, of fluid, but the greatest part of this enteric juice is reabsorbed before running out of a fistula, and we can get but a few cubic centimetres from a large dog, or even from the large ruminants. From small animals, most invertebrates, and micro-organisms, it is naturally impossible to get secretions in quantities sufficient for any precise investigation. We are forced to make extracts from the organs or from the whole organism, and to examine the enzymes present in such extracts. The only fluid that dissolves enzymes is water; no enzyme is extractable by strong alcohol, ether, benzene, chloroform, strong glycerin, etc. Diluted glycerin was often used by the earlier investigators (Wittich). It has the advantage that the growth of bacteria is checked by a glycerin of seventy or eighty per cent, and that the changes which enzymes undergo in watery solutions are prevented or much retarded by glycerin. Thus a solution of pepsin or of trypsin in diluted glycerin can be preserved for many months or even years, and the quantity of the dissolved enzyme can be measured better than if the ferment were