

Enzymes and Cellular Regulation

What are the factors that regulate the rate at which enzymes catalyze reactions?

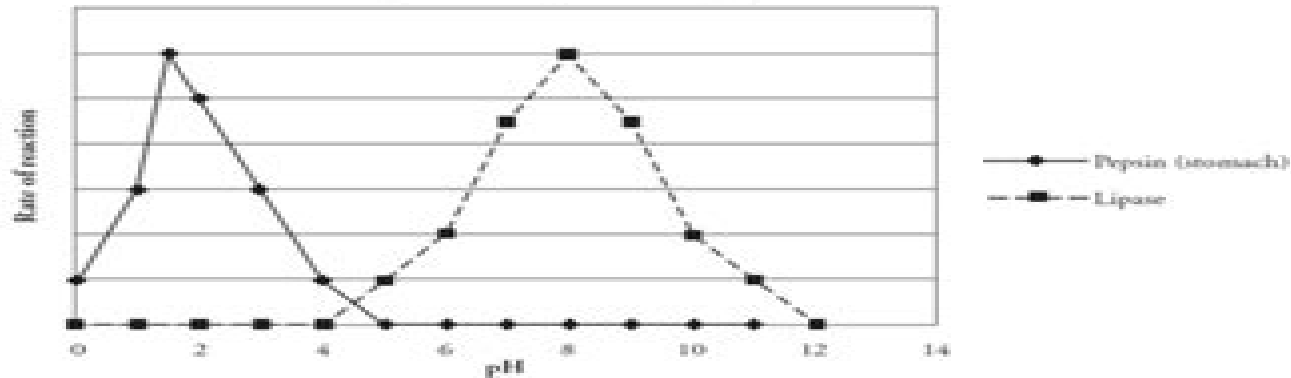
Why?

Digestive enzymes are protein-based biological catalysts that play important roles in our lives. They help remove stains from our shirts, turn milk into cheese, and are responsible for turning our dinner into useable fuel for our bodies. Enzymes however do not work well universally. Some are meant to work at high temperatures, others at low temperatures. They may work best in acidic conditions or neutral conditions. In this activity we will look at the optimal conditions for two different enzymes. The digestive enzyme lipase is made in the pancreas and breaks down lipids in the small intestine, while pepsin breaks down proteins in the stomach.

Model 1 – Two Digestive Enzymes



Effect of pH on Enzyme Activity



- Name the two enzymes illustrated in Model 1.
- Consider the information provided in the *Why?* box and in Model 1 about these proteins.
 - In which body organ is pepsin active?
 - In which body organ is pancreatic lipase active?
- For each enzyme in Model 1, circle the pH that best represents the environment in which the enzyme is most active.

Pepsin	1.5 8	10.4
Lipase	1.5 8	10.4
- Compare the rate of the pepsin-catalyzed reaction at pH 1.5 with the rate of the lipase-catalyzed reaction at pH 1.5.
- Compare the rate of the pepsin-catalyzed reaction at pH 8 with the rate of the lipase-catalyzed reaction at pH 8.
- Using your knowledge of protein structure, explain in detail the effect of exposing an enzyme to a pH outside of its optimal range. Include the effect on both enzyme structure and function.
- At what pH values is lipase likely to be denatured? Justify your answer.
- At what pH values is pepsin likely to be denatured? Justify your answer.
- In addition to being produced in the pancreas, lipase is also produced in the stomach. Is the structure of pancreatic lipase the same as gastric (produced in the stomach) lipase? Justify your reasoning.

Enzymes And Cellular Regulation

RD Boyd



Enzymes And Cellular Regulation:

Molecular and Cellular Regulation of Enzyme Activity ,1984

Current Topics in Cellular Regulation Bernard L.

Horecker, Earl R. Stadtman, 2014-06-28 Current Topics in Cellular Regulation Volume 12 focuses on the binding of polypeptide hormones to the specific receptor sites on the cellular membrane This book consists of six chapters Chapter 1 describes how several polypeptide regulators hormones and growth factors act through very similar mechanisms The second messenger roles of cAMP and cGMP in the regulation of various protein kinases are dealt with in Chapter 2 Chapter 3 discusses the experimental conditions employed in studying the characteristics of regulatory enzymes in vitro and in vivo while Chapter 4 elaborates the intracellular compartmentation of enzymes cofactors and metabolic intermediates of glycolysis in various tissues from different organisms The biochemical mechanisms that underlie the induction of enzymes in catabolic pathways are considered in Chapter 5 The last chapter is devoted to the role of T4 phage induced covalent modification reactions in the transcriptional control of DNA dependent RNA polymerase in E coli This volume is suitable for biologists and researchers concerned with the basic mechanisms involved in the regulation of diverse cellular activities

Cellular Regulation of Secretion and Release P. Michael Conn, 2013-09-24 Cellular Regulation of Secretion and

Release is a compilation of papers that deals with the processes in cellular perception of stimuli and the response to them Part I describes the receptor occupancy and regulation of stimulus through the use of video image intensification techniques This part also explains a model for the transmembrane regulation of adenylate cyclase that shows the mechanisms that cells use in sensing and responding to extracellular conditions Part II discusses the early responses of secretory cells including changes in phospholipid metabolism in electrophysiological events and in macromolecular carboxymethylation One paper suggests that protein carboxyl methylase has a role in neurotransmission and secretion whether as a part of the exocytotic process or just a help to regulate the process Part III addresses the role in secretion of the subcellular architecture particularly as regards the role of the cytoskeleton in endocrine function or insulin secretion and cytoskeletal proteins Part IV discusses the synthesis processing and storage of secretory products including the role of signal peptides their properties and interactions Part V addresses the mechanisms and modulation of secretion and release in a study of Leydig cells One paper concludes that the regulation of release through dopamine and TRH factors can have more than one mechanism of action This book can be useful for cellular microbiologists bacteriologists endocrinologists researchers and academicians in the biochemistry and in reproductive medicine *Study on the Cellular Regulation and Function of Lysine Malonylation, Glutarylation and Crotonylation* Xiucong Bao, 2020-03-20 This book presents pioneering findings on the characterization of cellular regulation and function for three recently identified protein posttranslational modifications PTMs lysine malonylation Kmal glutarylation Kglu and crotonylation Kcr It addresses three main topics i Detecting Kmal substrates using a chemical reporter which provides important information regarding the complex cellular networks modulated by Kmal ii Identifying

Kglu as a new histone PTM and assessing the direct impact of histone Kglu on chromatin structure and dynamics and iii Revealing Sirt3 s value as a regulating enzyme for histone Kcr dynamics and gene transcription which opens new avenues for examining the physiological significance of histone Kcr Taken together these studies provide information critical to understanding how these protein PTMs are associated with various human diseases and to identifying therapeutic targets for the dysregulation of these novel protein markers in various human diseases

Biochemistry of Cellular Regulation: The cell surface Michael J. Clemens,1980 **Regulation of Organelle and Cell Compartment Signaling** Ralph A. Bradshaw,Edward A. Dennis,2011-04-12 Cell signaling which is also often referred to as signal transduction or in more specialized cases transmembrane signaling is the process by which cells communicate with their environment and respond temporally to external cues that they sense there All cells have the capacity to achieve this to some degree albeit with a wide variation in purpose mechanism and response At the same time there is a remarkable degree of similarity over quite a range of species particularly in the eukaryotic kingdom and comparative physiology has been a useful tool in the development of this field The central importance of this general phenomenon sensing of external stimuli by cells has been appreciated for a long time but it has truly become a dominant part of cell and molecular biology research in the past three decades in part because a description of the dynamic responses of cells to external stimuli is in essence a description of the life process itself This approach lies at the core of the developing fields of proteomics and metabolomics and its importance to human and animal health is already plainly evident Provided by publisher Cellular Regulation and Malignant Growth Setsurō Ebashi,1985 ADP-Ribosylation: Metabolic Effects and Regulatory Functions Joel Moss,Peter Zahradka,2012-12-06

Considering the current interest in cellular regulation and intracellular signalling systems it is surprising that the contribution of ADP ribosylation reactions to the modulation of a variety of specific cell processes in parallel with other post translational modifications such as phosphorylation has not been generally recognized While it is not feasible to cover all aspects of ADP ribosylation the thirty one articles contained in this volume provide a valuable overview of recent progress in the field within the context of cell control mechanisms For the convenience of the reader the various topics have been grouped into several sections a poly ADP ribosyl ation b mono ADP ribosylation c toxin mono ADP ribosylation d inhibitors and activators e protein modification with ADP ribose and its analogues and f non modification forms of ADP ribose The contents of the individual chapters reflect the ideas of the contributors many of whom have spent their careers attempting to resolve the biological functions of ADP ribosylation We hope that this publication will serve as a useful reference for those investigators that are new to the area as well as those who are actively studying ADP ribosylation

Current Topics in Cellular Regulation ,1984 *Enzymes Biotechnology Handbook* NIIR Board of Consultants & Engineers,2004-01-01

Industrial biotechnology is the practice of using cells to generate industrially useful products An enzyme is a protein that catalyzes or speeds up a chemical reaction Enzymes are the focal point of biotechnological processes without them

biotechnology as a subject would not exist The main advantage of enzymes compared to most other catalysts is their stereo region and chemo selectivity and specificity Enzymes are responsible for many essential biochemical reactions in micro organisms plants animals and human beings Biotechnology processes may have potential in energy production specifically in the substitution of renewable plant biomass for fossil feedstock This will depend on the development of enzymes able to degrade cellulose in plant biomass and designing methods to recycle or dispose of spent biomass With time research and improved protein engineering methods many enzymes have been genetically modified to be more effective at the desired temperatures pH or under other manufacturing conditions typically inhibitory to enzyme activity e g harsh chemicals making them more suitable and efficient for industrial or home applications Enzymes are used in the extraction of natural products as catalysts in organic chemistry in clinical analysis in industrial processes and so on The application of enzymes is found in many different fields and it is one of the good sectors to venture In coming few years it is estimated that world enzyme demand will average annual increases of 6.3 percent This book basically deals with principles of industrial enzymology basis of utilization of soluble and immobilized enzymes in industrial processes principles of immobilization of enzymes enzymes in clinical analysis principles practical aspects of large scale protein purification the applications of enzymes in industry use of enzymes in the extraction of natural products data on techniques of enzyme immobilization and bio affinity procedures etc In this book you can find all the basic information required on the fundamental aspects of the enzymes their chemistry bio chemistry as well as detailed information of their applications a wide variety of industrial processes etc The book is very useful for research scholars technocrats institutional libraries and entrepreneurs who want to enter into the field of manufacturing of enzymes

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Hormones and Cell Regulation Jacques Nunez, Jacques E. Dumont, Roger John Benjamin King, 1986

Principles of Metabolic Control in Mammalian Systems Herman, 2013-11-11 In this work we present the basic principles of metabolic control which we hope will serve as a foundation for the vast array of factual matter which the biochemist and the physician engaged in metabolic research must accumulate Accordingly we attempt to set forth these principles along with sufficient explanation so that the reader may apply them to the ever expanding literature of biochemistry If we are successful this will provide a theoretical

approach which can be applied to any given set of metabolic reactions It is impossible to enumerate each and every biochemical reaction and pathway since such a work would be too unwieldy for efficient use Rather we hope our presentation of the principles of metabolic control will be sufficiently basic to be of lasting usefulness no matter how detailed biochemistry may become We would like to be able to condense biochemistry into a theoretical biology that will not only allow for the general treatment of any given reaction but will enable predictions to be made as to the existence of necessary pathways and the consequences of altered control Such is not possible today but this may be accomplished in the future We believe it is now possible to institute the beginnings of such a theoretical biology

Ryanodine Receptors Vincenzo Sorrentino,1995-12-05 This is the first single source to present this important topic from the points of view of many international experts Chapters written by morphologists biochemists pharmacologists and molecular biologists from around the world are brought together to provide an introductory overview to this key component of intracellular signalling This ideal text reference will be useful to students of the basic sciences and medicine as well as professional scientists who want to update their knowledge in this field

Research Awards Index ,1978 *PHOSPHOLIPIDS & CELLULAR REGULATION* Jyh-Fa Kuo,1985-12-06 **Concepts in Biochemistry** Rodney F. Boyer,1998 Rodney Boyer's text gives students a modern view of biochemistry He utilizes a contemporary approach organized around the theme of nucleic acids as central molecules of biochemistry with other biomolecules and biological processes treated as direct or indirect products of the nucleic acids The topical coverage usually provided in current biochemistry courses is all present only the sense of focus and balance of coverage has been modified The result is a text of exceptional relevance for students in allied health fields agricultural studies and related disciplines

Molecular and Cellular Regulation of Enzyme Activity ,1981 *Cell Chemistry and Physiology: Part I* Edward Bittar,1996-01-04 This is the first of a 4 volume module that is an introduction to the study of cell chemistry and physiology It is not intended to be encyclopedic in nature but rather a general survey of the subject with an emphasis on those topics that are central to an understanding of cell biology and those that are certain to become of increasing importance in the teaching of modern medicine We have followed what appeared to as to be the logical divisions of the subject beginning with proteins Allewell and her colleagues stress the point that proteins fold spontaneously to form complex three dimensional structures and that some of them unfold with the help of proteins called chaperones Michaelis Menten kinetics are shown by Nelsestuen to describe the behaviour of enzymes in the test tube The formalism is particularly useful in the search for agents of therapeutic value as exemplified by methotrexate Uptake by mammalian cells of substrates and their metabolic conversions are discussed by van der Vusse and Reneman However both Welch and Savageau expound the view that the cell is not simply a bagful of enzymes The biologist is urged by Savageau to abandon Michaelis Menten formalism and apply the Power Law The biologist is also told that the approach to arriving at a theory of metabolic control would have to be one of successive approximations requiring the use of the computer Information gained

from comparative biochemistry is shown by Storey and Brooks to have shed new light on mechanisms of metabolic rate depression and freeze tolerance and to be applicable to organ transplantation technology We are reminded that enzyme adaptation is partly the result of the presence of a hydrating shell of vicinal water that stabilises conformation of the enzyme Vicinal water according to Drost Hausen and Singleton lies adjacent to most solids and protein interfaces The kinks or breaks observed in the slope of the Arrhenius plot are attributed to structural changes in vicinal water Regulation of cell volume is shown by Hempling to involve regulation of cell water It could be that the osmo receptor or volume detection system is a protein that links the cytoskeleton to specific K and C1 channels Additionally it is interesting that aquaporins which are water channel forming membrane proteins are now known to exist in both renal and extra renal tissues One of the renal porins is affected by vasopressin We then pass on to protein synthesis Rattan and other important topics including protein glycosylation Hounsell methylation Clarke ADP ribosylation Pearson and prenylation Gelb Among the four types of lipids attached to membrane proteins are the prenyl groups Ford and Gross in their chapter on lipobiology drive home the point that there is an accumulation of acyl carnitine and lysophospholipids during myocardial infarction

Current Topics in Cellular Regulation Bernard L. Horecher, Earl R. Stadtman, 1970 Handbook of Proteolytic Enzymes Alan J. Barrett, Neil D. Rawlings, J. Fred Woessner, 2012-10-30 Extensively revised and updated the new edition of the highly regarded Handbook of Proteolytic Enzymes is an essential reference for biochemists biotechnologists and molecular biologists Edited by world renowned experts in the field this comprehensive work provides detailed information on all known proteolytic enzymes to date This two volume set unveils new developments on proteolytic enzymes which are being investigated in pharmaceutical research for such diseases as HIV Hepatitis C and the common cold Volume I covers aspartic and metallo peptidases while Volume II examines peptidases of cysteine serine threonine and unknown catalytic type A CD ROM accompanies the book containing fully searchable text specialised scissile bond searches 3 D color structures and much more The only comprehensive book on proteolytic enzymes Includes 671 chapters each written by experts in their field on proteolytic enzymes from all groups of living organisms and the viruses including those that are currently major targets of pharmaceutical research Accompanying CD ROM provides fully searchable text 2D structures of peptidases in color and links directly to PubMed and MEROPS databases Each chapter describes in detail the enzyme name its history activity and specificity structural chemistry preparation biological aspects and distinguishing features Over 1000 peptidases included

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