



Enzyme Activity Guided Inquiry Lab Turnip Peroxidase

Introduction

Peroxidase enzymes are widely distributed in plants and animals, including bacteria, to protect cells against the effects of oxidative stress and cell damage due to hydrogen peroxide. Peroxidases are easily extracted from turnips and other root vegetables and provide a model enzyme for studying enzyme activity—how the rate of an enzyme-catalyzed reaction depends on biotic and abiotic factors. Enzyme activity studies reflect enzyme structure and function and provide the foundation for understanding the mechanism or theory of enzyme action.

Background

The term *peroxidase* refers to both a class of oxidoreductase enzymes and to specific enzymes within that class. As a general class of enzymes, peroxidases catalyze the oxidation–reduction decomposition reaction of hydrogen peroxide. There are two general types of peroxidases—catalase and peroxidase. Catalase catalyzes the disproportionation reaction of hydrogen peroxide to water and oxygen gas (Equation 1). In reactions mediated by catalase, hydrogen peroxide substrate molecules act as both oxidizing agent (electron acceptor) and reducing agent (electron donor). In contrast, peroxidase acts in the presence of other naturally occurring organic reducing agents, such as ascorbic acid and glutathione, to catalyze the decomposition of hydrogen peroxide. Organic reducing agents, abbreviated AH_2 , transfer hydrogen atoms and electrons to hydrogen peroxide, resulting in the formation of water and oxidized organic substrates such as A_2 in Equation 2.

Catalase-catalyzed reaction



Equation 1

Peroxidase-catalyzed reaction



Equation 2

The differences in the two equations shown above provide a basis for studying the enzyme activity of turnip peroxidase in this guided-inquiry laboratory investigation. Many endogenous organic compounds may be used as reducing agents in Equation 2. One of the most common and convenient reducing agents for this purpose is guaiacol, a colorless compound having the formula $C_7H_8O_2$. Oxidation of guaiacol according to Equation 2 converts it to a dark orange compound called tetraguaiacol. The rate of the reaction may be followed by measuring the absorbance or color intensity of the orange product as a function of time.

Materials

Buffer capsules, pH 3–8, 100 mL, each

Distilled or deionized water

Guaiacol, $C_7H_8O_2$, 1 mL

Hydrogen peroxide, H_2O_2 , 3%, 3 mL

Isopropyl alcohol, $(CH_3)_2CHOH$ 70%, 100 mL

Phosphate buffer, pH 7, 300 mL, NaH_2PO_4 and Na_2HPO_4 , 0.05 M

Turnip (root/tuber)

Ice and water baths

Blender

Erlenmeyer flask, 500-mL

Filter paper and funnel

Hot plate

Knife, paring

pH paper, narrow range

Pipets, serological, 2- and 5-mL

Spectrophotometer

Test tubes, 13 × 100 mm, 6, and rack

Thermometer

Timer

Enzyme Activity Guided Inquiry Lab Turnip Peroxidase

Julianne Zedalis, John Eggebrecht



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The Peroxidase Multigene Family of Enzymes Petro E. Petrides, William M. Nauseef, 2012-12-06 In September 1998 experts from 19 countries came together for an interdisciplinary discussion of the function of animal peroxidases a family of enzymes embracing myeloperoxidase eosinophil peroxidase thyroid peroxidase and lactoperoxidase Their papers have been updated for publication yielding a wide ranging overview of the state of the art The chapters cover a wide range of topics including three dimensional structure of representative family members their biosynthesis and intracellular transport mechanism of action as well as applications to clinical medicine They are of clinical relevance in for example arteriosclerosis multiple sclerosis infections tumorigenesis rheumatic diseases and hypothyroidism This book forms an excellent introduction for anyone interested in the peroxidase family of enzymes *Heme Peroxidases* Emma Raven, Brian Dunford, 2015-10-27

This book will provide an up to date handbook that is unique in its combination of both the general aspects of heme protein structure and the function in a single volume **Ionic and Solvent Effects on the Activity of Horseradish Peroxidase**

Javier Perez-Villasenor, 1964 **Biology for AP ® Courses** Julianne Zedalis, John Eggebrecht, 2017-10-16 Biology for AP courses covers the scope and sequence requirements of a typical two semester Advanced Placement biology course The text provides comprehensive coverage of foundational research and core biology concepts through an evolutionary lens Biology for AP Courses was designed to meet and exceed the requirements of the College Board s AP Biology framework while allowing significant flexibility for instructors Each section of the book includes an introduction based on the AP curriculum and includes rich features that engage students in scientific practice and AP test preparation it also highlights careers and research opportunities in biological sciences [Encyclopedia of Biology](#) Don Rittner, Timothy Lee McCabe, 2004-08 Contains approximately 800 alphabetical entries prose essays on important topics line illustrations and black and white photographs

A Consumer's Guide to Archaeological Science Mary E. Malainey, 2010-09-28 Many archaeologists as primarily social scientists do not have a background in the natural sciences This can pose a problem because they need to obtain chemical and physical analyses on samples to perform their research This manual is an essential source of information for those students without a background in science but also a comprehensive overview that those with some understanding of archaeological science will find useful The manual provides readers with the knowledge to use archaeological science methods to the best advantage It describes and explains the analytical techniques in a manner that the average archaeologist can understand and outlines clearly the requirements benefits and limitations of each possible method of analysis so that the researcher can make informed choices The work includes specific information about a variety of dating techniques provenance studies isotope analysis as well as the analysis of organic lipid and protein residues and ancient DNA Case studies illustrating applications of these approaches to most types of archaeological materials are presented and the

instruments used to perform the analyses are described Available destructive and non destructive approaches are presented to help archaeologists select the most effective technique for gaining the target information from the sample Readers will reach for this manual whenever they need to decide how to best analyze a sample and how the analysis is performed

Postharvest Handling Nigel H. Banks,Wojciech J. Florkowski,Stanley E. Prussia,Robert L. Shewfelt,Bernhard Brueckner,2009-02-21 Consideration of the interactions between decisions made at one point in the supply chain and its effects on the subsequent stages is the core concept of a systems approach Postharvest Handling is unique in its application of this systems approach to the handling of fruits and vegetables exploring multiple aspects of this important process through chapters written by experts from a variety of backgrounds Newly updated and revised this second edition includes coverage of the logistics of fresh produce from multiple perspectives postharvest handling under varying weather conditions quality control changes in consumer eating habits and other factors key to successful postharvest handling The ideal book for understanding the economic as well as physical impacts of postharvest handling decisions Key Features Features contributions from leading experts providing a variety of perspectives Updated with 12 new chapters Focuses on application based information for practical implementation System approach is unique in the handling of fruits and vegetables

NSCA's Guide to Sport and Exercise Nutrition NSCA -National Strength & Conditioning Association,Bill Campbell,Marie Spano,2011-01-18 NSCA s Guide to Sport and Exercise Nutrition provides valuable information and guidelines that address the nutrition needs for the broad range of clientele serviced by strength and conditioning professionals personal trainers and sport dietitians Whether you work with fitness enthusiasts or competitive athletes this resource will lead you through the key concepts of sport and exercise nutrition so that you can assess an individual s nutrition status and if it falls within your scope of practice develop customized nutrition plans Developed by the National Strength and Conditioning Association NSCA and subjected to an intensive peer review process this authoritative resource offers the latest research and literature review from respected scientists and practitioners with expertise in nutrition exercise and sport performance NSCA s Guide to Sport and Exercise Nutrition covers all aspects of food selection digestion metabolism and hydration relevant to sport and exercise performance This comprehensive resource will help you understand safe and effective ways to improve training and performance through natural nutrition based ergogenic aids like supplementation and macronutrient intake manipulation You will also learn guidelines about proper fluid intake to enhance performance and the most important criteria for effectively evaluating the quality of sport drinks and replacement beverages Finally cutting edge findings on nutrient timing based on the type intensity and duration of activity will help you understand how to recommend the correct nutrients at the ideal time to achieve optimal performance results In addition to presenting research relating to sport and exercise nutrition each chapter includes a professional application section that will help you make the connection between the literature and its practical implementation Sidebars emphasize important topics and

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Text Book of Microbiology, 2010 Preface INTRODUCTION HISTORY OF MICROBIOLOGY EVOLUTION OF MICROORGANISM CLASSIFICATION OF MICROORGANISM NOMENCLATURE AND BERGEY S MANUAL BACTERIA VIRUSES BACTERIAL VIRUSES PLANT VIRUSES THE ANIMAL VIRUSES ARCHAEA MYCOPLASMA PHYTOPLASMA GENERAL ACCOUNT OF CYANOBACTERIA GRAM ve BACTERIA GRAM ve BACTERIA EUKARYOTA APPENDIX 1 Prokaryotes Notable for their Environmental Significance APPENDIX 2 Medically Important Chemoorganotrophs APPENDIX 3 Terms Used to Describe Microorganisms According to Their Metabolic Capabilities QUESTIONS Short Multiple Choice Questions INDEX

Natural Products as Source of Molecules with Therapeutic Potential Valdir Cechinel Filho, 2018-12-07 This book addresses the highly relevant and complex subject of research on drugs from natural products discussing the current hot topics in the field It also provides a detailed overview of the strategies used to research and develop these drugs Respected experts explore issues involved in the production chain and when looking for new medicinal agents including aspects such as therapeutic potential functional foods ethnopharmacology metabolomics virtual screening and regulatory scenarios Further the book describes strategic methods of isolation and characterization of active principles biological assays biotechnology of plants synthesis clinical trials and the use of tools to identify active principles

5 Steps to a 5 AP Biology, 2014-2015 Edition Mark Anestis, Kellie Cox, 2013-07-24 A PERFECT PLAN for the PERFECT SCORE STEP 1 Set up your study plan with three customized study schedules STEP 2 Determine your readiness with an AP style diagnostic exam STEP 3 Develop the strategies that will give you the edge on test day STEP 4 Review the terms and concepts you need to score high STEP 5 Build your confidence with full length practice exams

Antibiotic Discovery and Development Thomas J. Dougherty, Michael J. Pucci, 2011-12-18 This volume covers all aspects of the antibiotic discovery and development process through Phase II III The contributors a group of highly experienced individuals in both academics and industry include chapters on the need for new antibiotic compounds strategies for screening for new antibiotics sources of novel synthetic and natural antibiotics discovery phases of lead

development and optimization and candidate compound nominations into development Beyond discovery the handbook will cover all of the studies to prepare for IND submission Phase I safety and dose ranging progression to Phase II efficacy and Phase III capturing desired initial indications This book walks the reader through all aspects of the process which has never been done before in a single reference With the rise of antibiotic resistance and the increasing view that a crisis may be looming in infectious diseases there are strong signs of renewed emphasis in antibiotic research The purpose of the handbook is to offer a detailed overview of all aspects of the problem posed by antibiotic discovery and development

DNA Science David A. Micklos, Greg A. Freyer, 2003 This is the second edition of a highly successful textbook over 50 000 copies sold in which a highly illustrated narrative text is combined with easy to use thoroughly reliable laboratory protocols It contains a fully up to date collection of 12 rigorously tested and reliable lab experiments in molecular biology developed at the internationally renowned Dolan DNA Learning Center of Cold Spring Harbor Laboratory which culminate in the construction and cloning of a recombinant DNA molecule Proven through more than 10 years of teaching at research and nonresearch colleges and universities junior colleges community colleges and advanced biology programs in high school this book has been successfully integrated into introductory biology general biology genetics microbiology cell biology molecular genetics and molecular biology courses The first eight chapters have been completely revised extensively rewritten and updated The new coverage extends to the completion of the draft sequence of the human genome and the enormous impact these and other sequence data are having on medicine research and our view of human evolution All sections on the concepts and techniques of molecular biology have been updated to reflect the current state of laboratory research The laboratory experiments cover basic techniques of gene isolation and analysis honed by over 10 years of classroom use to be thoroughly reliable even in the hands of teachers and students with no prior experience Extensive prelab notes at the beginning of each experiment explain how to schedule and prepare while flow charts and icons make the protocols easy to follow As in the first edition of this book the laboratory course is completely supported by quality assured products from the Carolina Biological Supply Company from bulk reagents to useable reagent systems to single use kits thus satisfying a broad range of teaching applications

Vegetables and Fruits Thomas S. C. Li, 2008-01-24 The modern synthetic diet formulated to appeal to our inherent attraction to sugar salt fats and calories at the expense of nutrition leaves us over fed and under nourished A considerable portion of chronic human diseases including diabetes and heart disease appear to be related largely to a diet that is inadequate in the essential vitamins

Practical Applications in Sports Nutrition Heather Hedrick Fink, Alan E. Mikesky, 2013-11-25 Revised and updated to keep pace with the growing changes in the field the Fourth Edition of Practical Applications in Sports Nutrition provides students and practitioners with the latest sports nutrition information and dietary practices and prepares them to assist athletes and fitness enthusiasts in achieving their personal performance goals Early chapters provide an introduction to sports nutrition and give a thorough explanation of macronutrients micronutrients and

water and their relation to athletic performance Later chapters focus on the practical and applied aspects of sports nutrition including behavior change through consultations and weight management Chapter 15 targets the unique nutrition requirements of special populations such as athletes who are pregnant vegetarian or have chronic diseases The text concludes with a chapter dedicated to helping readers discover the pathway to becoming a sports dietitian through education and experience New to the Fourth Edition New discussion of sports nutritionists as evidence based practitioners Current MyPlate food group recommendations Revised discussion of the relationship between current body weight and carbohydrate intake as well as the types and the amounts of carbohydrates that should be consumed during exercise New Food For Thought callouts identify related material in Sports Nutrition Workbook and Assessments Updated statistics guidelines and regulations found throughout the text including obesity statistics carbohydrate intake and vitamin needs

Principles of Biology Lisa Barteo, Walter Shiner, Catherine Creech, 2017 The Principles of Biology sequence BI 211 212 and 213 introduces biology as a scientific discipline for students planning to major in biology and other science disciplines Laboratories and classroom activities introduce techniques used to study biological processes and provide opportunities for students to develop their ability to conduct research

[America's Lab Report](#) National Research Council, Division of Behavioral and Social Sciences and Education, Center for Education, Board on Science Education, Committee on High School Laboratories: Role and Vision, 2006-01-20 Laboratory experiences as a part of most U S high school science curricula have been taken for granted for decades but they have rarely been carefully examined What do they contribute to science learning What can they contribute to science learning What is the current status of labs in our nation s high schools as a context for learning science This book looks at a range of questions about how laboratory experiences fit into U S high schools What is effective laboratory teaching What does research tell us about learning in high school science labs How should student learning in laboratory experiences be assessed Do all student have access to laboratory experiences What changes need to be made to improve laboratory experiences for high school students How can school organization contribute to effective laboratory teaching With increased attention to the U S education system and student outcomes no part of the high school curriculum should escape scrutiny This timely book investigates factors that influence a high school laboratory experience looking closely at what currently takes place and what the goals of those experiences are and should be Science educators school administrators policy makers and parents will all benefit from a better understanding of the need for laboratory experiences to be an integral part of the science curriculum and how that can be accomplished

Resources and Applications of Biotechnology Rod Greenshields, 1989 This volume consists of major articles from the journal Industrial Biotechnology which reflect both the educational nature of much of the journal s output and the very wide range of its subject matter They consider major applications in pharmaceuticals and other areas

New Perspectives and Approaches in Plant Growth-Promoting Rhizobacteria Research P.A.H.M. Bakker, J.M. Raaijmakers, G. Bloemberg, M. Höfte, P.

Lemanceau,B.M. Cooke,2010-04-02 In the context of increasing concern for food and environmental quality use of Plant Growth Promoting Rhizobacteria PGPR for reducing chemical inputs in agriculture is a potentially important issue This book provides an update by renowned international experts on the most recent advances in the ecology of these important bacteria the application of innovative methodologies for their study their interaction with the host plant and their potential application in agriculture POGIL Activities for High School Chemistry High School POGIL Initiative,2012

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