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Food Biotechnology **Career Development in Bioengineering and Biotechnology The Biotechnology Series Biotechnology** *Functional Foods and Biotechnology* **Studies in Biotechnology Series** *Native Crops in Latin America* **An Introduction to Biotechnology Vistas in biotechnology series** *Food Science and Food Biotechnology* **Functional Foods and Biotechnology Biotechnology Annual Review** *Experimental Design in Biotechnology Biotechnology Series Vaccine Development and Manufacturing* **Plants, Biotechnology and Agriculture** *Bioanalytical Aspects in Biological Therapeutics* **Environmental Biotechnology** *Advances in applied biotechnology series* **Advances in Textile Biotechnology Food Biotechnology** Techniques and Perspectives in Food Biotechnology Series *Bioluminescence: Fundamentals and Applications in Biotechnology - Volume 2* **Functional Foods and Biotechnology, Two Volume Set The Biotechnology of Malting and Brewing Advanced Methods in Plant Breeding and Biotechnology Proceedings of Biotechnology** *Wiley Biotechnology Series* **IUL Biotechnology Series** Preparative Chromatography for Separation of Proteins **Forest Genomics and Biotechnology Biosurfactants and Biotechnology** *Molecular Biology and Biotechnology* IUL Biotechnology Series **Molecular Analyses** Applied Mycology **Fermented Foods, Part I** *Advances in Applied Biotechnology Series Industrial Biotechnology Series* **Bioreactor Engineering Research and Industrial Applications II**

The second book of the Food Biotechnology series,

Functional Foods and Biotechnology: Biotransformation and Analysis of Functional Foods and Ingredients highlights two important and interrelated themes: biotransformation innovations and novel bio-based analytical tools for understanding and advancing functional foods and food ingredients for health-focused food and nutritional security solutions. The first section of this book provides novel examples of innovative biotransformation strategies based on ecological, biochemical, and metabolic rationale to target the improvement of human health relevant benefits of functional foods and food ingredients. The second section of the book focuses on novel host response based analytical tools and screening strategies to investigate and validate the human health and food safety relevant benefits of functional foods and food ingredients. Food biotechnology experts from around the world have contributed to this book to advance knowledge on bio-based innovations to improve wider health-focused applications of functional food and food ingredients, especially targeting non-communicable chronic disease (NCD) and food safety relevant solution strategies. Key Features: Provides system science-based food biotechnology innovations to design and advance functional foods and food ingredients for solutions to emerging global food and nutritional insecurity coupled public health challenges. Discusses biotransformation innovations to improve human health relevant nutritional qualities of functional foods and food ingredients. Includes novel host response-based food analytical models to optimize and improve wider health-focused application of functional foods and food ingredients. The overarching theme of this second book is to advance the knowledge on metabolically-driven food system innovations that can be targeted to enhance human health and food safety relevant nutritional qualities and antimicrobial properties of functional food and food

ingredients. The examples of biotransformation innovations and food analytical models provide critical insights on current advances in food biotechnology to target, design and improve functional food and food ingredients with specific human health benefits. Such improved understanding will help to design more ecologically and metabolically relevant functional food and food ingredients across diverse global communities. The thematic structure of this second book is built from the related initial book, which is also available in the Food Biotechnology Series Functional Foods and Biotechnology: Sources of Functional Food and Ingredients, edited by Kalidas Shetty and Dipayan Sarkar (ISBN: 9780367435226) For a complete list of books in this series, please visit our website at: https://www.crcpress.com/Food-Biotechnology-Series/book-series/CRCFOOBIOTECH Revised and updated to reflect the latest research and advances available, Food Biotechnology, Second Edition demonstrates the effect that biotechnology has on food production and processing. It is an authoritative and exhaustive compilation that discusses the bioconversion of raw food materials to processed products, the improvement of food This book review series presents current trends in modern biotechnology. The aim is to cover all aspects of this interdisciplinary technology where knowledge, methods and expertise are required from chemistry, biochemistry, microbiology, genetics, chemical engineering and computer science. Volumes are organized topically and provide a comprehensive discussion of developments in the respective field over the past 3-5 years. The series also discusses new discoveries and applications. Special volumes are dedicated to selected topics which focus on new biotechnological products and new processes for their synthesis and purification. In general, special volumes are edited by well-known guest editors. The series editor and publisher will however

always be pleased to receive suggestions and supplementary information. Manuscripts are accepted in English. The techniques of high quality beer production are described in a concise account of malting and brewing processes and the science upon which they are based. This indispensable guide provides a roadmap to the broad and varied career development opportunities in bioengineering, biotechnology, and related fields. Eminent practitioners lay out career paths related to academia, industry, government and regulatory affairs, healthcare, law, marketing, entrepreneurship, and more. Lifetimes of experience and wisdom are shared, including "war stories," strategies for success, and discussions of the authors' personal views and motivations. This book is one of a series of brief fundamental texts for junior under graduates and diploma students in biological science. The series, Molecular and Cell Biochemistry, covers the whole of modern biochemistry, integrating animal, plant and microbial topics. The intention is to give the series special appeal to the many students who read biochemistry for only part of their course and who are looking for an all-encompassing and stimulating approach. Although all books in the series bear a distinct family likeness, each stands on its own as an independent text. Many students, particularly those with less numerate backgrounds, find elements of their biochemistry courses daunting, and one of our principal concerns is to offer books which present the facts in a palatable style. Each chapter is prefaced by a list of learning objectives, with short summaries and revision aids at the ends of chapters. The text itself is informal, and the incorporation of marginal notes and information boxes to accompany the main text give a tutorial flavour, complementing and supporting the main narrative. The marginal notes and boxes relate facts in the text to applicable examples in everyday life, in industry, in other life sciences and

in medicine, and provide a variety of other educational devices to assist, support, and reinforce learning. References are annotated to guide students towards effective and relevant additional reading. DNA and RNA extraction methods from a variety of tissues and samples are now routine, including extraction from single cells. Many methods are now automated. Sequencing efficiency has reached the point where it is now possible to obtain gigabases of data, both quickly and inexpensively. Such methods permit the identification of gene versions, including those associated with disease (e.g. small nucleotide polymorphism analyses, or SNPs). The general public as well as clinicians can now access a wide variety of literature on the molecular bases of diseases, allowing them to better assess disease risks and treatments. This volume concentrates on medically-focused methods, and therefore the major audience will be medical professionals, students, and those involved in medically-related research endeavors. There are also papers in this volume dealing specifically with methods developed to analyze large sequence data sets. Many methods reviewed herein are more broadly applicable to other fields in biology, chemistry, bioinformatics, and bioengineering, and are intended for a broad readership. Key Features Summarizes nucleic acid extractions from a wide variety of tissues and cells Describes processes of nucleic acid preservation Reviews forensic sampling, detection of nucleic acids, and delivery of nucleic acids to multicellular organisms Provides essential guidance for sequencing, sequence analysis, database searches, and phylogenetic analyses Includes additional methods useful for analysis of nucleic acids and proteins Related Titles DeSalle, et al. Phylogenomics: A Primer (ISBN 978-0-3670-2849-7). Jennings, W. B. Phylogenomic Data Acquisition: Principles and Practice (ISBN 978-0-3678-6980-9). Wang, X. Next-Generation Sequencing Data Analysis (ISBN 978-1-4822-1788-9) Sung,

W.-K. Algorithms for Next-Generation Sequencing (ISBN 978-0-3676-5797-0) Developments in genomics and biotechnology are opening up new avenues for accelerating the domestication of forest trees in a climate change-driven world. This book presents an authoritative update of forest tree biotechnology and genomics methodologies, procedures and accomplishments, from basic biological science to applications in forestry and related sciences. It gives expert evaluation of achievements and discussion about the impact that novel forest biotechnological and genomics approaches are having on traditional breeding for improvement of forest tree species and production of forest-based products. It also describes the legal and regulatory aspects of forest biotechnology, with an emphasis on biosafety. It is a reference for forest biologists, including basic and applied scientists involved in forest tree breeding and biotechnology, bioenergy research, biomaterial product development. It is a comprehensive text for graduate-level students in the areas of Plant Biology and Forest Genetics, Silviculture and Agroforestry, and Bioenergy Science and Technology. A two volume set that kick off the Food Biotechnology series, Functional Foods and Biotechnology combines the work of experts around that world to advance knowledge on bio-based innovations to improve wider health-focused applications of functional food and food ingredients. Volume I focuses on the recent advances in the understanding of the role of cellular, metabolic, and biochemical concepts and processing that are important and relevant to improve functional foods and food ingredients targeting human health benefits. Volume II highlights two important and interrelated themes: biotransformation innovations and novel bio-based analytical tools for understanding and advancing functional foods and food ingredients for health-focused food and nutritional security solutions Key Features:

Provides ecological and metabolic rational to integrate novel functional food and functional ingredient sources in wider health-focused food system innovations. Examines the value-added role of select functional foods and food ingredients to improve NCD-linked health benefits such as type-2 diabetes, cardiovascular disease, and human gut improvement Provides system science-based food biotechnology innovations to design and advance functional foods and food ingredients for solutions to emerging global food and nutritional insecurity coupled public health challenges. Discusses biotransformation innovations to improve human health relevant nutritional qualities of functional foods and food ingredients. The overall goal of Volume I is to provide insights on role of these functional food and ingredient sources for their integration in wider health-focused food systems, which will help food scientists, food industry personnel, nutritionists, crop science researchers, public health professionals, and policy makers to make appropriate decisions and to formulate strategies for improving health and well-being. Volume II aims to advance the knowledge on metabolically-driven food system innovations that can be targeted to enhance human health and food safety relevant nutritional qualities and antimicrobial properties of functional food and food ingredients. Traditional fermented foods are not only the staple food for most of developing countries but also the key healthy food for developed countries. As the healthy functions of these foods are gradually discovered, more high throughput biotechnologies are being used to promote the fermented food industries. As a result, the microorganisms, process biochemistry, manufacturing, and down-streaming processing, as well as the bioactive metabolites released by the fermenting organisms and, above all, the healthy functions of these foods were extensively researched. The application and progress of

biotechnology and biochemistry of traditional fermented food systems are different from each other, as the microorganisms and the food matrices vary widely. Part I (Biochemistry and Biotechnology) of this book (Fermented Foods) discusses the general aspects of biochemistry and biotechnological application of fermented foods involving acetic acid bacteria, lactic acid bacteria, ethanolic yeasts, and fungi in accelerating the many and variable functional factors in the fermented foods as well as metagenomics of fermented foods. The detailed technological interventions involved in different categories of fermented foods such as fermented cereals (bread and sourdough), fermented milk products (yogurt, cheese), fermented sausages, fermented vegetables (kimchi, sauerkraut), fermented legumes (tempeh, natto) and coffee and cocoa fermentations, and fermented beverages (animal- and plant-based) with their potential and actual health benefits, are discussed in Part II (Fermented Foods: Technological Interventions). The Biotechnology Annual Review covers the various developments in biotechnology in the form of comprehensive, illustrated and well referenced reviews. With the expansion of the field of biotechnology, coupled with the vast increase in the number of new journals reporting recent results in this field, the need for a publication that is continuously providing reviews is urgent. Hence, each volume of the Biotechnology Annual Review will have a number of reviews covering different aspects of biotechnology. Reviewed topics will include biotechnology applications in medicine, agriculture, marine biology, industry, bioremedation and the environment. Fundamental problems dealing with enhancing the technical knowledge encountering biotechnology utilization regardless of the field of application will be particularly emphasized. This series will help both students and teachers, researchers as well as administrators to remain

knowledgeable on all relevant issues in biotechnology. Proposals for contributions and/or suggestions for topics for future volumes in this series should be sent to the Editor: professor M.R. El-Gewely Department of Biotechnology University of Tromslø IMB, MH-Bygget N-9037 Tromsø Norway Tel: (+47) 77 644000 Fax: (+47) 77 645350 Biotechnology has impacted the textiles industry through the development of more efficient and environmentally friendly manufacturing processes, as well as enabling the design of improved textile materials. This book will provide a thorough overview of current and future focuses of biotechnology in the fibre and textile industry. Part one of the book opens with a review of technologies involved in textile biotechnology. Chapters explore the design and engineering of novel enzymes for textile applications and developments in processes and equipment for enzymatic textile treatments. Part two investigates the modification of particular fibres through the use of biotechnology. Key topics include the treatment of wool and silk fibres and the enzymatic treatment versus conventional processing of cotton. With expert contributions from leaders in their fields, Advances in textile biotechnology is a comprehensive guide for those in the textile and fibre industry, as well as experts in the biology, chemical and environmental engineering industries. Provides a thorough overview of current and future focuses of biotechnology in the fibre and textile industry Explores production of enzymes, searching for efficient production systems and also documents the advantages and limitations associated with the process Reviews the debate surrounding enzymatic treatment versus conventional processing of cotton along with engineering of plants for improved fibre qualities The fungal kingdom consists of a wide variety of organisms with a diverse range of forms and functions. Fungi have been utilized for thousands of years and their

importance in agriculture, medicine, food production and the environmental sciences is well known. New advances in genomic and metabolomic technologies have allowed further developments in the use of fungi in industry and medicine, increasing the need for a compilation of new applications, developments and technologies across the mycological field. Applied Mycology brings together a range of contributions, highlighting the diverse nature of current research. Chapters include discussions of fungal associations in the environment, agriculture and forestry, long established and novel applications of fungi in fermentation, the use of fungi in the pharmaceutical industry, the growing recognition of fungal infections, current interests in the use fungal enzymes in biotechnology and the new and emerging field of myconanotechnology. Demonstrating the broad coverage and importance of mycological research, this book will be of interest to researchers and students in all biological sciences. This groundbreaking book provides a balanced and organized discussion of the interactions of food science and biotechnology at the molecular and industrial levels. Carefully selected and reviewed contributions stress the aspects of modern bioprocessing, analysis, and quality control that are common to both food science and biotechnology. The detail This highly useful book deals with the prospects for the successful application of modern techniques in molecular biology to the food processing industry. A wide ranging account of the commercial, industrial, and governmental constraints is provided, with a particularly detailed treatment of the development and production of two food products arising from the successful application of biotechnology--high-fructose corn syrup and mycoprotein. The book stresses the integration of the scientific and commercial aspects of food biotechnology, and includes a section on investment appraisal. Indeed, the combined experience of the

authors, each of whom works in the food processing industry, gives it the blend of scientific expertise and commercial realism that will make it attractive to all those professionally involved in the application of biotechnology to the processing of food products. Reviews a number of novel techniques recently developed in plant breeding and plant biotechnology. The emphasis is on newer methods for the genetic modification of plants rather than on the more traditional areas but the aim is to integrate advances with established knowledge in plant breeding. Functional foods improve health and can reduce the risk of different diseases. In this sense, a variety of bioactive compounds present in functional foods are able to modulate inflammatory responses or exhibit interesting bioactivities such as antihypertensive, antioxidants, anticancer, antimicrobials, anticariogenics, among others. There is a revalorization and mounting characterization on ancient grain crops of Latin America such as chia, amaranth, quinoa, Andean lupin, sacha inchi. This area also posseses a huge variety of native fruits such as camu camu, goldenberry, lucuma, which have health-promoting compounds. Native Crops in Latin America: Biochemical, Processing, and Nutraceutical Aspects explores recent investigations related to the potential use of the native crops as sources of bioactive compounds (proteins, hydrolysates, peptides, antioxidants, essential lipids, dietary fiber, pre- and probiotics) and as ingredients in functional foods. Key Features: Contributes to increasing knowledge of Latin American crops Contains information of various native crops and nutraceutical potentiality Discusses characterization of their by-products Explores revaluation and food application for enrichment food matrices This book contains recent findings impacting research in subjects such as cardiovascular and gastrointestinal systems, gut microbiota, delivery

systems, product development, and gastronomy. Such information on Latin American crops may significantly influence the well-being, health, and nutrition of consumers. This will be a useful resource for food scientists, food technologists, nutritionists, ingredient manufacturers, and health care professionals, and relevent knowledge for any University's Food Science department. Also available in the Food Biotechnology and Engineering series: Volatile Compounds Formation in Specialty Beverages, edited by Felipe Richter Reis and Caroline Mongruel Eleutério dos Santos (ISBN: 9780367631901) For a complete list of books in this series, please visit our website at: https://www.routledge.com/Food-Biotechnology-and-Engineering/book-series/CRCFOOBIOENG Here is the first comprehensive reference to examine microbial surface active agents (biosurfactants)and biological emulsifiers as applied in biotechnology and other industries.Biosurfactants and Biotechnology highlights state-of-the-art uses of these agents, and incorporatesa wealth of ideas for future research and development related to feedstocks, production,and processing. The book delineates the chemistry, biochemistry, mechanisms, and propertiesof biosurfactants and biological emulsifiers .. . critically assesses their role in enhanced oil recoveryand other industrial applications . .. and includes numerous references to the literature.Biosurfactants and Biotechnology is an invaluable guide for physical, surface, and colloidchemists working on or with surfactants, interfacial phenomena, and cell-surface physiology ;petrochemical, chemical, biochemical, petroleum, and pollution control engineers; pharmacologists,cosmetic scientists, food scientists, and microbiologists. It is also an important resourcefor graduate students in these fields. This book review series presents current trends in modern biotechnology. The aim is to cover all aspects

of this interdisciplinary technology where knowledge, methods and expertise are required from chemistry, biochemistry, microbiology, genetics, chemical engineering and computer science. Volumes are organized topically and provide a comprehensive discussion of developments in the respective field over the past 3-5 years. The series also discusses new discoveries and applications. Special volumes are dedicated to selected topics which focus on new biotechnological products and new processes for their synthesis and purification. In general, special volumes are edited by well-known guest editors. The series editor and publisher will however always be pleased to receive suggestions and supplementary information. Manuscripts are accepted in English. This book provides the first time user of statistics with an understanding of how and why statistical experimental design and analysis can be an effective problem solving tool. It presents experimental designs which are useful for small screening and response surface experiments. Preparative Chromatography for Separation of Proteins addresses a wide range of modeling, techniques, strategies, and case studies of industrial separation of proteins and peptides. • Covers broad aspects of preparative chromatography with a unique combination of academic and industrial perspectives • Presents Combines modeling with compliantce useing of Quality-by-Design (QbD) approaches including modeling • Features a variety of chromatographic case studies not readily accessible to the general public • Represents an essential reference resource for academic, industrial, and pharmaceutical researchers Bioanalytical Aspects in Biological Therapeutics Deepen your understanding of how critical data are generated from bioanalysis In Bioanalytical Aspects in Biological Therapeutics, a team of renowned chemists, immunologists, and biologists delivers a timely and practical exploration of the diverse

scientific and technical literature on the bioanalytical investigation of current biotherapeutics under development. The book discusses the challenges and considerations for bioanalytical support, covering a wide range of central topics in the field, including overview and basic immunology for testing of biological therapeutics, pharmacokinetic aspects, clinical immunogenicity prediction and testing, biomarker testing, biotransformation assessment for biologics, statistical aspects of bioanalytical testing, regulatory expectations, and more. Drug development and analysis professionals will learn how critical data are generated from bioanalysis and how proven tools and methods are applied to the development of biologics. Alongside coverage of topics like PK, immunogenicity, neutralizing antibody assays, and the importance of quality control for reagents, readers will benefit from: A thorough overview of the development of biotherapeutics and the role played by bioanalytical tests, as well as basic immunology for bioanalytical testing of biological therapeutics Comprehensive explorations of platform and instrument considerations in bioanalytical testing, pharmacokinetics assays, and biomarker analysis using LC-MS, LBA, and other technologies Practical discussions of immunogenicity prediction, preclinical and clinical anti-drug antibody assays, and bioanalytical schemes for anti-drug neutralizing antibody assays In-depth examinations of critical reagents in bioanalysis Regulatory expectations for bioanalytical method development, validation, and sample testing Perfect for pharmaceutical scientists in industry, Bioanalytical Aspects in Biological Therapeutics will also earn a place in the libraries of pharmaceutical regulators and other professionals working in pharmaceutical companies, as well as graduate students studying bioanalytical assays for biological therapeutics. The second book of the Food Biotechnology series, Functional Foods and

Biotechnology: Biotransformation and Analysis of Functional Foods and Ingredients highlights two important and interrelated themes: biotransformation innovations and novel bio-based analytical tools for understanding and advancing functional foods and food ingredients for health-focused food and nutritional security solutions. The first section of this book provides novel examples of innovative biotransformation strategies based on ecological, biochemical, and metabolic rationale to target the improvement of human health relevant benefits of functional foods and food ingredients. The second section of the book focuses on novel host response based analytical tools and screening strategies to investigate and validate the human health and food safety relevant benefits of functional foods and food ingredients. Food biotechnology experts from around the world have contributed to this book to advance knowledge on bio-based innovations to improve wider health-focused applications of functional food and food ingredients, especially targeting non-communicable chronic disease (NCD) and food safety relevant solution strategies. Key Features: Provides system science-based food biotechnology innovations to design and advance functional foods and food ingredients for solutions to emerging global food and nutritional insecurity coupled public health challenges. Discusses biotransformation innovations to improve human health relevant nutritional qualities of functional foods and food ingredients. Includes novel host response-based food analytical models to optimize and improve wider health-focused application of functional foods and food ingredients. The overarching theme of this second book is to advance the knowledge on metabolically-driven food system innovations that can be targeted to enhance human health and food safety relevant nutritional qualities and antimicrobial properties of functional food and food ingredients. The examples of biotransformation

innovations and food analytical models provide critical insights on current advances in food biotechnology to target, design and improve functional food and food ingredients with specific human health benefits. Such improved understanding will help to design more ecologically and metabolically relevant functional food and food ingredients across diverse global communities. The thematic structure of this second book is built from the related initial book, which is also available in the Food Biotechnology Series Functional Foods and Biotechnology: Sources of Functional Food and Ingredients, edited by Kalidas Shetty and Dipayan Sarkar (ISBN: 9780367435226) For a complete list of books in this series, please visit our website at: https://www.crcpress.com/Food-Biotechnology-Series/book-series/CRCFOOBIOTECH Vaccine Manufacturing and Production is an invaluable reference on how to produce a vaccine - from beginning to end - addressing all classes of vaccines from a processing, production, and regulatory viewpoint. It will provide comprehensive information on the various fields involved in the production of vaccines, from fermentation, purification, formulation, to regulatory filing and facility designs. In recent years, there have been tremendous advances in all aspects of vaccine manufacturing. Improved technology and growth media have been developed for the production of cell culture with high cell density or fermentation. Vaccine Manufacturing and Production will serve as a reference on all aspects of vaccine production by providing an in-depth description of the available technologies for making different types of vaccines and the current thinking in facility designs and supply issues. This book will provide insight to the issues scientists face when producing a vaccine, the steps that are involved, and will serve as a reference tool regarding state-of-the-art vaccine manufacturing technologies and facility set-up. Highlights include:

Comprehensive coverage of vaccine production : from a process point of view- fermentation to purification to formulation developments; from a production point of view - from facility design to manufacturing; and from a regulatory point of view - requirements from government agencies Authors from different major pharmaceutical and biotechnology companies Describes the challenges and issues involved in vaccine production and manufacturing of the different classes of vaccines, an area not covered by other books currently on the market An Introduction to Biotechnology is a biotechnology textbook aimed at undergraduates. It covers the basics of cell biology, biochemistry and molecular biology, and introduces laboratory techniques specific to the technologies addressed in the book; it addresses specific biotechnologies at both the theoretical and application levels. Biotechnology is a field that encompasses both basic science and engineering. There are currently few, if any, biotechnology textbooks that adequately address both areas. Engineering books are equation-heavy and are written in a manner that is very difficult for the non-engineer to understand. Numerous other attempts to present biotechnology are written in a flowery manner with little substance. The author holds one of the first PhDs granted in both biosciences and bioengineering. He is more than an author enamoured with the wow-factor associated with biotechnology; he is a practicing researcher in gene therapy, cell/tissue engineering, and other areas and has been involved with emerging technologies for over a decade. Having made the assertion that there is no acceptable text for teaching a course to introduce biotechnology to both scientists and engineers, the author committed himself to resolving the issue by writing his own. The book is of interest to a wide audience because it includes the necessary background for understanding how a technology works. Engineering principles are addressed, but in such a way

that an instructor can skip the sections without hurting course content The author has been involved with many biotechnologies through his own direct research experiences. The text is more than a compendium of information - it is an integrated work written by an author who has experienced first-hand the nuances associated with many of the major biotechnologies of general interest today. At a time when the world's food supplies are increasingly unable to meet the needs of a burgeoning population, there is significant diversity of opinion concerning the benefits and perceived dangers of the application of biotechnology to food production. Plants, Biotechnology and Agriculture provides the reader with a guide to plants as both organisms and resources. The first half of the book gives an overview of plant biology, suitable for students of plant biology and agriculture as well as those without a biology background. This is followed by an outline of the human exploitation of plants, from domestication to scientific manipulation. Further chapters describe the technologies that are now being used to improve crops, society's responses to these technologies, and how they are being modified as a result. The book concludes with a discussion of future challenges for biotechnology in the face of rapid population growth, depletion of non-renewable resources and climate change. Considers the ethics and challenges of biotechnology.