Actinobacteria Diversity And Biotechnological Applications New And Future Developments In Microbial Biotechnology And Bioengineering

#actinobacteria #biotechnological applications #microbial biotechnology #bioengineering developments #actinobacteria diversity

Explore the vast diversity of Actinobacteria and their significant biotechnological applications. This resource delves into new and future developments, highlighting their pivotal role in microbial biotechnology and bioengineering advancements.

Actinobacteria: Diversity and Biotechnological Applications

Actinobacteria: Diversity and Biotechnological Applications: New and Future Developments in Microbial Biotechnology and Bioengineering, a volume in the series New and Future Developments in Microbial Biotechnology and Bioengineering series, offers the latest on the biotechnology of Kingdom actinobacteria, covering unique niches like their endosphere, rhizospheric soil and contaminated sites, etc. The book also covers the bioactive secondary metabolites obtained from actinobacteria and describes the application of microorganism (Actinobacteria) in plant growth promotion and in environmental cleanup. Finally, the book describes the biocontrol aspects of actinobacteria and how they can control fungal phytopathogens and the production of secondary metabolites. Includes an overview of all types of actinobacteria, source and enzymatic activity Lists various bioengineering methods for the production of these enzymes Reviews numerous industrial applications of actinobacteria, i.e., crop improvement, removal of heavy metals, etc. Offers unique coverage of the application of actinobacteria in bioremediation processes Explores the plant growth promoting potential of endophytic actinobacteria Describes biosynthetic potential genes associated with actinobacterial genome

New and Future Developments in Microbial Biotechnology and Bioengineering

New and Future Developments in Microbial Biotechnology and Bioengineering: Microbial Secondary Metabolites Biochemistry and Applications examines the areas of biotechnology and chemical engineering, covering aspects of plants, bacteria and machines, and using microbes as factories. The book is aimed at undergraduates, post-graduates and researchers studying microbial secondary metabolites, and is an invaluable reference source for biochemical engineers working in biotechnology, manipulating microbes, and developing new uses for bacteria and fungi. The applications of secondary metabolites in biotechnology, pharmaceuticals, diagnostics and medical device development are also extensively covered. The book integrates the aforementioned frontline branches into an interdisci-

plinary research work to satisfy those working in biotechnology, chemical engineering, alternative fuel development, diagnostics and pharmaceuticals. Chapters related to important research work on applications of microbial secondary metabolites are written by specialists in the various disciplines from the international community. Compiles the latest developments in the area of microbial secondary metabolites Authored by the top international researchers in this area Includes information related to nearly all areas of a microbial secondary metabolites system

Advances in Plant Microbiome and Sustainable Agriculture

Microbes are ubiquitous in nature, and plant-microbe interactions are a key strategy for colonizing diverse habitats. The plant microbiome (epiphytic, endophytic and rhizospheric) plays an important role in plant growth and development and soil health. Further, rhizospheric soil is a valuable natural resource, hosting hotspots of microbes, and is vital in the maintenance of global nutrient balance and ecosystem function. The term endophytic microbes refers to those microorganisms that colonize the interior the plants. The phyllosphere is a common niche for synergism between microbes and plants and includes the leaf surface. The diverse group of microbes are key components of soil-plant systems, and where they are engaged in an extensive network of interactions in the rhizosphere/endophytic/phyllospheric they have emerged as an important and promising tool for sustainable agriculture. Plant microbiomes help to directly or indirectly promote plant growth using plant growth promoting attributes, and could potentially be used as biofertilizers/bioinoculants in place of chemical fertilizers. This book allows readers to gain an understanding of microbial diversity associated with plant systems and their role in plant growth, and soil health. Offering an overview of the state of the art in plant microbiomes and their potential biotechnological applications in agriculture and allied sectors, it is a valuable resource for scientists, researchers and students in the field of microbiology, biotechnology, agriculture, molecular biology, environmental biology and related subjects.

Plant Microbiomes for Sustainable Agriculture

This book encompasses the current knowledge of plant microbiomes and their potential biotechnological application for plant growth, crop yield and soil health for sustainable agriculture. The plant microbiomes (rhizospheric, endophytic and epiphytic) play an important role in plant growth, development, and soil health. Plant and rhizospheric soil are a valuable natural resource harbouring hotspots of microbes, and it plays critical roles in the maintenance of global nutrient balance and ecosystem function. The diverse group of microbes is key components of soil–plant systems, where they are engaged in an intense network of interactions in the rhizosphere/endophytic/phyllospheric. The rhizospheric microbial diversity present in rhizospheric zones has a sufficient amount of nutrients release by plant root systems in form of root exudates for growth, development and activities of microbes. The endophytic microbes are referred to those microorganisms, which colonize in the interior of the plant parts, viz root, stem or seeds without causing any harmful effect on host plant. Endophytic microbes enter in host plants mainly through wounds, naturally occurring as a result of plant growth, or through root hairs and at epidermal conjunctions. Endophytes may be transmitted either vertically (directly from parent to offspring) or horizontally (among individuals). The phyllosphere is a common niche for synergism between microbes and plant. The leaf surface has been termed as phyllosphere and zone of leaves inhabited by microorganisms as phyllosphere. The plant part, especially leaves, is exposed to dust and air currents resulting in the establishments of typical flora on their surface aided by the cuticles, waxes and appendages, which help in the anchorage of microorganisms. The phyllospheric microbes may survive or proliferate on leaves depending on extent of influences of material in leaf diffuseness or exudates. The leaf diffuseness contains the principal nutrients factors (amino acids, glucose, fructose and sucrose), and such specialized habitats may provide niche for nitrogen fixation and secretions of substances capable of promoting the growth of plants. The microbes associated with plant as rhizospheric, endophytic and epiphytic with plant growth promoting (PGP) attributes have emerged as an important and promising tool for sustainable agriculture. PGP microbes promote plant growth directly or indirectly, either by releasing plant growth regulators; solubilization of phosphorus, potassium and zinc; biological nitrogen fixation or by producing siderophore, ammonia, HCN and other secondary metabolites which are antagonistic against pathogenic microbes. The PGP microbes belong to different phylum of archaea (Euryarchaeota); bacteria (Acidobacteria, Actinobacteria, Bacteroidetes, Deinococcus-Thermus, Firmicutes and Proteobacteria) and fungi (Ascomycota and Basidiomycota), which include different genera namely Achromobacter, Arthrobacter, Aspergillus, Azospirillum, Azotobacter, Bacillus, Beijerinckia, Burkholderia, Enterobacter, Erwinia, Flavobacterium, Gluconoacetobacter, Haloarcula, Herbaspirillum, Methylobacterium, Paenibacillus, Pantoea, Penicillium, Piriformospora,

Planomonospora, Pseudomonas, Rhizobium, Serratia and Streptomyces. These PGP microbes could be used as biofertilizers/bioinoculants at place of chemical fertilizers for sustainable agriculture. The aim of “Plant Microbiomes for Sustainable Agriculture” is to provide the current developments in the understanding of microbial diversity associated with plant systems in the form of rhizospheric, endophytic and epiphytic. The book is useful to scientist, research and students related to microbiology, biotechnology, agriculture, molecular biology, environmental biology and related subjects.

Actinobacteria

This book provides in-depth insights into the diversity of actinobacteria, their various medical aspects, and their biotechnological applications. It is aimed at graduate students and researchers working with actinobacteria who need to know about recent advances in their research fields. The book, which is divided into four sections, contains 13 chapters that review the most recent methods, discuss various applications of actinobacteria, introduce some interesting results, and explore future prospects for the topics covered.

Actinobacteria

This book presents an introductory overview of Actinobacteria with three main divisions: taxonomic principles, bioprospecting, and agriculture and industrial utility, which covers isolation, cultivation methods, and identification of Actinobacteria and production and biotechnological potential of antibacterial compounds and enzymes from Actinobacteria. Moreover, this book also provides a comprehensive account on plant growth-promoting (PGP) and pollutant degrading ability of Actinobacteria and the exploitation of Actinobacteria as ecofriendly nanofactories for biosynthesis of nanoparticles, such as gold and silver. This book will be beneficial for the graduate students, teachers, researchers, biotechnologists, and other professionals, who are interested to fortify and expand their knowledge about Actinobacteria in the field of Microbiology, Biotechnology, Biomedical Science, Plant Science, Agriculture, Plant pathology, Environmental Science, etc.

Current Trends in Microbial Biotechnology for Sustainable Agriculture

Microbial biotechnology is an emerging field with applications in a broad range of sectors involving food security, human nutrition, plant protection and overall basic research in the agricultural sciences. The environment has been sustaining the burden of mankind from time immemorial, and our indiscriminate use of its resources has led to the degradation of the climate, loss of soil fertility, and the need for sustainable strategies. The major focus in the coming decades will be on achieving a green and clean environment by utilizing soil and plant-associated beneficial microbial communities. Plant-microbe interactions include the association of microbes with plant systems: epiphytic, endophytic and rhizospheric. The microbes associated with plant ecosystems play an important role in plant growth, development, and soil health. Moreover, soil and plant microbiomes help to promote plant growth, either directly or indirectly by means of plant growth-promoting mechanisms, e.g. the release of plant growth regulators; solubilization of phosphorus, potassium and zinc; biological nitrogen fixation; or by producing siderophores, ammonia, HCN and other secondary metabolites. These beneficial microbial communities represent a novel and promising solution for agro-environmental sustainability by providing biofertilizers, bioprotectants, and biostimulants, in addition to mitigating various types of abiotic stress in plants. This book focuses on plant-microbe interactions; the biodiversity of soil and plant microbiomes; and their role in plant growth and soil health. Accordingly, it will be immensely useful to readers working in the biological sciences, especially microbiologists, biochemists and microbial biotechnologists.

Plant Growth-Promoting Microbes for Sustainable Biotic and Abiotic Stress Management

Abiotic and biotic stress factors, including drought, salinity, waterlog, temperature extremes, mineral nutrients, heavy metals, plant diseases, nematodes, viruses, and diseases, adversely affect growth as well as yield of crop plants worldwide. Plant growth-promoting microorganisms (PGPM) are receiving increasing attention from agronomists and environmentalists as candidates to develop an effective, eco-friendly, and sustainable alternative to conventional agricultural (e.g., chemical fertilizers and pesticide) and remediation (e.g., chelators-enhanced phytoremediation) methods employed to deal with climate change-induced stresses. Recent studies have shown that plant growth-promoting bacteria (PGPB), rhizobia, arbuscular mycorrhizal fungi (AMF), cyanobacteria have great potentials in the management of various agricultural and environmental problems. This book provides current research

of biofertilizers and the role of microorganisms in plant health, with specific emphasis on the mitigating strategies to combat plant stresses.

Nanotechnology and the Environment

Nanotechnology is a vibrant area of research and a growing industry. The core scientific principles and applications of this interdisciplinary field bring together chemists, physicists, materials scientists, and engineers to meet the potential future challenges for sustainable development through new technologies and preparation of advanced materials with sustainable environmental protection. This book on Nanotechnology and the Environment includes the design and the sophisticated fabrication of nanomaterials along with their potential energy and environmental applications. This book is a significant contribution towards the development of the knowledge for all advanced undergraduate, graduate level students, researchers, and professional engineers leading in the fields of nanotechnology, nanochemistry, macromolecular science and those who have interest in energy and environmental science.

Agriculturally Important Fungi for Sustainable Agriculture

Microbes are ubiquitous in nature. Among microbes, fungal communities play an important role in agriculture, the environment, and medicine. Vast fungal diversity has been associated with plant systems, namely epiphytic fungi, endophytic fungi, and rhizospheric fungi. These fungi associated with plant systems play an important role in plant growth, crop yield, and soil health. Rhizospheric fungi, present in rhizospheric zones, get their nutrients from root exudates released by plant root systems, which help with their growth, development, and microbe activity. Endophytic fungi typically enter plant hosts through naturally occurring wounds that are the result of plant growth, through root hairs, or at epidermal conjunctions. Phyllospheric fungi may survive or proliferate on leaves depending on material influences in leaf diffuseness or exudates. The diverse nature of these fungal communities is a key component of soil-plant systems, where they are engaged in a network of interactions endophytically, phyllospherically, as well as in the rhizosphere, and thus have emerged as a promising tool for sustainable agriculture. These fungal communities promote plant growth directly and indirectly by using plant growth promoting (PGP) attributes. These PGP fungi can be used as biofertilizers and biocontrol agents in place of chemical fertilizers and pesticides for a more eco-friendly method of promoting sustainable agriculture and environments. This first volume of a two-volume set covers the biodiversity of plant-associated fungal communities and their role in plant growth promotion, the mitigation of abiotic stress, and soil fertility for sustainable agriculture. This book should be useful to those working in the biological sciences, especially for microbiologists, microbial biotechnologists, biochemists, and researchers and scientists of fungal biotechnology.

Recent Advancement in White Biotechnology Through Fungi

White biotechnology, or industrial biotechnology as it is also known, refers to the use of living cells and/or their enzymes to create industrial products that are more easily degradable, require less energy, create less waste during production and sometimes perform better than products created using traditional chemical processes. Over the last decade considerable progress has been made in white biotechnology research, and further major scientific and technological breakthroughs are expected in the future. Fungi are ubiquitous in nature and have been sorted out from different habitats, including extreme environments (high temperature, low temperature, salinity and pH), and may be associated with plants (epiphytic, endophytic and rhizospheric). The fungal strains are beneficial as well as harmful for human beings. The beneficial fungal strains may play important roles in the agricultural, industrial, and medical sectors. The fungal strains and their products (enzymes, bioactive compounds, and secondary metabolites) are very useful for industry (e.g., the discovery of penicillin from Penicillium chrysogenum). This discovery was a milestone in the development of white biotechnology as the industrial production of penicillin and antibiotics using fungi moved industrial biotechnology into the modern era, transforming it into a global industrial technology. Since then, white biotechnology has steadily developed and now plays a key role in several industrial sectors, providing both high value nutraceutical and pharmaceutical products. The fungal strains and bioactive compounds also play an important role in environmental cleaning. This volume covers the latest developments and research in white biotechnology with a focus on diversity and enzymes.

Bioprocessing for Biomolecules Production

Presents the many recent innovations and advancements in the field of biotechnological processes This book tackles the challenges and potential of biotechnological processes for the production of new industrial ingredients, bioactive compounds, biopolymers, energy sources, and compounds with commercial/industrial and economic interest by performing an interface between the developments achieved in the recent worldwide research and its many challenges to the upscale process until the adoption of commercial as well as industrial scale. Bioprocessing for Biomolecules Production examines the current status of the use and limitation of biotechnology in different industrial sectors, prospects for development combined with advances in technology and investment, and intellectual and technical production around worldwide research. It also covers new regulatory bodies, laws and regulations, and more. Chapters look at biological and biotechnological processes in the food, pharmaceutical, and biofuel industries; research and production of microbial PUFAs; organic acids and their potential for industry; second and third generation biofuels; the fermentative production of beta-glucan; and extremophiles for hydrolytic enzymes productions. The book also looks at bioethanol production from fruit and vegetable wastes; bioprocessing of cassava stem to bioethanol using soaking in aqueous ammonia pretreatment; bioprospecting of microbes for bio-hydrogen production; and more. Provides up to date information about the advancements made on the production of important biotechnological ingredients Complete visualization of the general developments of world research around diverse products and ingredients of technological, economic, commercial and social importance Investigates the use and recovery of agro-industrial wastes in biotechnological processes Includes the latest updates from regulatory bodies for commercialization feasibility Offering new products and techniques for the industrial development and diversification of commercial products, Bioprocessing for Biomolecules Production is an important book for graduate students, professionals, and researchers involved in food technology, biotechnology; microbiology, bioengineering, biochemistry, and enzymology.

Microorganisms for Green Revolution

This book explores basic and applied aspects of microorganisms, which have a unique ability to cope with abiotic stresses such as drought, salinity and changing climate, as well as biodegrader microorganisms and their functional roles. Further, readers will find detailed information on all aspects that are required to make a microbe “agriculturally beneficial.” The book’s primary focus is on microbes that are essentially “hidden miniature packages of nature” that influence agro-ecosystems. Inviting papers by prominent national and international scientists working in the field of agricultural microbiology, it addresses the biogdegrader group of microbial inoculants. Each chapter covers the respective mechanism of action and recent advances in agricultural microbiology. In addition, the book especially highlights innovations involving agriculturally beneficial microorganisms, including strategies for coping with a changing climate, and methods for developing microbial inoculants and promoting climate-smart agriculture. The information presented here is based on the authors’ extensive experience in the subject area, gathered in the course of their careers in the field of agricultural microbiology. The book offers a valuable resource for all readers who are actively involved in research on agriculturally beneficial microorganisms. In addition, it will help prepare readers for the future challenges that climate change will pose for agriculture and will help to bridge the current gaps between different scientific communities.

Microbial Interventions in Agriculture and Environment

Microbial communities and their functions play a crucial role in the management of ecological, environmental and agricultural health on the Earth. Microorganisms are the key identified players for plant growth promotion, plant immunization, disease suppression, induced resistance and tolerance against stresses as the indicative parameters of improved crop productivity and sustainable soil health. Beneficial belowground microbial interactions with the rhizosphere help plants mitigate drought and salinity stresses and alleviate water stresses under the unfavorable environmental conditions in the native soils. Microorganisms that are inhabitants of such environmental conditions have potential solutions for them. There are potential microbial communities that can degrade xenobiotic compounds, pesticides and toxic industrial chemicals and help remediate even heavy metals, and thus they find enormous applications in environmental remediation. Microbes have developed intrinsic metabolic capabilities with specific metabolic networks while inhabiting under specific conditions for many generations and, so play a crucial role. The book Microbial Interventions in Agriculture and Environment is an effort to compile and present a great volume of authentic, high-quality, socially-viable, practical and implementable research and technological work on microbial implications. The whole content of the volume covers protocols, methodologies, applications, interactions, role and impact of research and development aspects on microbial interventions and technological outcomes in prospects of

agricultural and environmental domain including crop production, plan-soil health management, food & nutrition, nutrient recycling, land reclamation, clean water systems and agro-waste management, biodegradation & bioremediation, biomass to bioenergy, sanitation and rural livelihood security. The covered topics and sub-topics of the microbial domain have high implications for the targeted and wide readership of researchers, students, faculty and scientists working on these areas along with the agri-activists, policymakers, environmentalists, advisors etc. in the Government, industries and non-government level for reference and knowledge generation.

Plant Growth Promoting Rhizobacteria for Sustainable Stress Management

Increasing agro productivity to feed a growing global population under the present climate scenario requires optimizing the use of resources and adopting sustainable agricultural production. This can be achieved by using plant beneficial bacteria, i.e., those bacteria that enhance plant growth under abiotic stress conditions, and more specifically, microorganisms such as plant growth promoting rhizobacteria (PGPR), which are the most promising candidates in this regard. Attaining sustainable agricultural production while preserving environmental quality, agro-ecosystem functions and biodiversity represents a major challenge for current agricultural practices; further, the traditional use of chemical inputs (fertilizers, pesticides, nutrients etc.) poses serious threats to crop productivity, soil fertility and the nutritional value of farm produce. Given these risks, managing pests and diseases, maintaining agro-ecosystem health, and avoiding health issues for humans and animals have now become key priorities. The use of PGPR as biofertilizers, plant growth promoters, biopesticides, and soil and plant health managers has attracted considerable attention among researchers, agriculturists, farmers, policymakers and consumers alike. Using PGPR can help meet the expected demand for global agricultural productivity to feed the world’s booming population, which is predicted to reach roughly 9 billion by 2050. However, to do so, PGPR strains must be safe for the environment, offer considerable plant growth promotion and biocontrol potential, be compatible with useful soil rhizobacteria, and be able to withstand various biotic and abiotic stresses. Accordingly, the book also highlights the need for better strains of PGPR to complement increasing agro-productivity.

New and Future Developments in Microbial Biotechnology and Bioengineering

New and Future Developments in Microbial Biotechnology and Bioengineering: Trends of Microbial Biotechnology for Sustainable Agriculture and Biomedicine Systems: Diversity and Functional Perspectives describes how specific techniques can be used to generalize the metabolism of bacteria that optimize biologic improvement strategies and bio-transport processes. Microbial biotechnology focuses on microbes of agricultural, environmental, industrial, and clinical significance. This volume discusses several methods based on molecular genetics, systems, and biology of synthetic, genomic, proteomic, and metagenomics. Recent developments in our understanding of the role of microbes in sustainable agriculture and biotechnology have created a highly potential research area. The soil and plant microbiomes have a significant role in plant growth promotion, crop yield, soil health and fertility for sustainable developments. The microbes provide nutrients and stimulate plant growth through different mechanisms, including solubilization of phosphorus, potassium, and zinc; biological nitrogen fixation; production of siderophore, ammonia, HCN and other secondary metabolites which are antagonistic against pathogenic microbes. This new book provides an indispensable reference source for engineers/bioengineers, biochemists, biotechnologists, microbiologists, agrochemists, and researchers who want to know about the unique properties of this microbe and explore its sustainable agriculture future applications. Introduces the principles of microbial biotechnology and its application in plant growth and soil health for sustainable agriculture Explores various plant microbiomes and their beneficial impact on plant growth for crop improvement Explains the mechanisms of plant-microbe interaction and plant growth promotion Includes current applications of microbial consortium for enhance production of crop in eco-friendly manners

Microbial Mediation of Crop Abiotic Stress Tolerance

Across the Philippine archipelago are countless stories of innovation, brilliance, and curiosity. From highly respected National Scientists to unsung science heroes working silently and tirelessly, there is no shortage of individuals in the Philippines who find ways to use their expertise to solve longstanding mysteries, protect the environment, improve their community’s way of life, educate the public, and inspire budding scientists to follow in their footsteps. Here’s a sampling of the best Pinoy scientist features and profiles published on FlipScience.ph, in an easily accessible format that everyone,

anywhere can enjoy and draw inspiration from. Read the tragic tale of the Ilonggo doctor who discovered a life-saving drug, the amazing achievements of a heroic Filipina chemist, the awe-inspiring accounts of two remarkable young physicists, the shocking story of a man whose research changed four industries, and more. Now more than ever, it's time to shine the spotlight on Pinoy scientists of the past, present, and future.

Istoryang Siyentipiko

Extremophiles are organisms that are able to live in extreme conditions due to their unique physiological and genetic adaptations. Extremophiles are harnessed for their extremozymes that have wide applications in biotechnology, pharmaceutics, and industry. Recent developments in genomics and proteomics have helped unravel the mechanism of survival, physiological adaptation, and genomics structure of extremophiles. Physiology, Genomics, and Biotechnological Applications of Extremophiles covers innovative developments in understanding the physiology and biochemistry of extremophiles using the -omics perspective, focuses on the advancement in mechanisms of the extremophiles that makes them able to survive under extreme conditions, and discusses the applications of extremophiles in astrobiology. Covering topics such as genomics and the history and identification of extremophiles, it is ideal for students, professors, researchers, academicians, microbiologists, agricultural scientists, and biotechnologists.

Physiology, Genomics, and Biotechnological Applications of Extremophiles

To meet the food security needs of the 21st century, this book focuses on ecofriendly and sustainable production technologies based on plant growth promoting rhizobacteria (PGPR). It is estimated that the global population could increase to 9 billion by 2050. Further, the amount of land devoted to farming has decreased. Soil is a living entity, and is not only a valuable natural resource for agricultural and food security, but also for the preservation of all life processes. Agricultural productivity rests on the foundation of microbial diversity in the soil, and in recent years, PGPR have emerged as an important and promising tool for sustainable agriculture. The injudicious use of agrochemicals by farmers has created a range of negative impacts, not only threatening the environment, but also destroying useful microorganisms in the soil. The efficient use of PGPR reduces the need for these chemicals while simultaneously lowering production costs. In turn, increased yields could provide a more favourable environment and encourage sustainability. This book assesses the impacts of PGPR on crops, environmental and socio-economic sustainability, and demonstrates these ecofriendly technologies' three critical advantages, namely (a) enhanced crop productivity, (b) reduced application of agrochemicals, and (c) increased incomes for farmers. Besides offering an economically attractive and ecologically sound means of augmenting the nutrient supply and combatting soil-borne pathogens, PGPR play an important part in boosting soil fertility, bioremediation and stress management for the development of ecofriendly and sustainable agriculture.

Plant Growth Promoting Rhizobacteria for Agricultural Sustainability

Crop Improvement through Microbial Biotechnology explains how certain techniques can be used to manipulate plant growth and development, focusing on the cross-kingdom transfer of genes to incorporate novel phenotypes in plants, including the utilization of microbes at every step, from cloning and characterization, to the production of a genetically engineered plant. This book covers microbial biotechnology in sustainable agriculture, aiming to improve crop productivity under stress conditions. It includes sections on genes encoding avirulence factors of bacteria and fungi, viral coat proteins of plant viruses, chitinase from fungi, virulence factors from nematodes and mycoplasma, insecticidal toxins from Bacillus thuringiensis, and herbicide tolerance enzymes from bacteria. Introduces the principles of microbial biotechnology and its application in crop improvement Lists various new developments in enhancing plant productivity and efficiency Explains the mechanisms of plant/microbial interactions and the beneficial use of these interactions in crop improvement Explores various bacteria classes and their beneficial effects in plant growth and efficiency

New and Future Developments in Microbial Biotechnology and Bioengineering

Fungi are an understudied, biotechnologically valuable group of organisms. Due to their immense range of habitats, and the consequent need to compete against a diverse array of other fungi, bacteria, and animals, fungi have developed numerous survival mechanisms. However, besides their major basic positive role in the cycling of minerals, organic matter and mobilizing insoluble nutrients, fungi have

other beneficial impacts: they are considered good sources of food and active agents for a number of industrial processes involving fermentation mechanisms as in the bread, wine and beer industry. A number of fungi also produce biologically important metabolites such as enzymes, vitamins, antibiotics and several products of important pharmaceutical use; still others are involved in the production of single cell proteins. The economic value of these marked positive activities has been estimated as approximating to trillions of US dollars. The unique attributes of fungi thus herald great promise for their application in biotechnology and industry. Since ancient Egyptians mentioned in their medical prescriptions how they can use green molds in curing wounds as the obvious historical uses of penicillin, fungi can be grown with relative ease, making production at scale viable. The search for fungal biodiversity, and the construction of a living fungi collection, both have incredible economic potential in locating organisms with novel industrial uses that will lead to novel products. Fungi have provided the world with penicillin, lovastatin, and other globally significant medicines, and they remain an untapped resource with enormous industrial potential. Volume 1 of Industrially Important Fungi for Sustainable Development provides an overview to understanding fungal diversity from diverse habitats and their industrial application for future sustainability. It encompasses current advanced knowledge of fungal communities and their potential biotechnological applications in industry and allied sectors. The book will be useful to scientists, researchers, and students of microbiology, biotechnology, agriculture, molecular biology, and environmental biology.

Industrially Important Fungi for Sustainable Development

A holistic approach covering a wide range of environmental microbial applications along with current and future trends In Microbial Biotechnology: Role in Ecological Sustainability and Research, a team of distinguished researchers delivers an authoritative overview of the role of microbial biotechnology in the pursuit of environmental and ecological sustainability. The book provides readers with compelling presentations of microbial technology, including its applications in the removal of environmental pollutants, and sustainable agriculture using microbial biocontrol agents or bio-fertilizers. Readers will also be able to explore the microbial reduction of greenhouse gases and a wide range of other cutting-edge applications, including the removal of various toxic environmental contaminants, such as antibiotics, pesticides, dyes, and heavy metals. Microbial Biotechnology provides: A thorough introduction to microorganisms, their metabolic engineering, the human microbiome, and other foundational topics An in-depth exploration of environmental management, including bioremediation through a nexus approach A fulsome treatment of current trends in microbial biotechnology and its role in sustainable production Perfect for professionals in applied microbiology, biotechnology, environmental engineering, green chemistry, and soil science, Microbial Biotechnology: Role in Ecological Sustainability and Research will also earn a place in the libraries of research scholars, scientists, and academicians with an interest in environmental microbiology and ecology.

Microbial Biotechnology

This book explores microbial symbiosis, with a particular focus on soil microorganisms, highlighting their application in enhancing plant growth and yield. It addresses various types of bacterial and fungal microbes associated with symbiotic phenomena, including rhizobium symbiosis, arbuscular mycorrhizal symbiosis, ectomycorrhizal symbiosis, algal/lichen symbiosis, and Archeal symbiosis. Presenting strategies for employing a diverse range of bacterial and fungal symbioses in nutrient fortification, adaptation of plants in contaminated soils, and mitigating pathogenesis, it investigates ways of integrating diverse approaches to increase crop production under the current conventional agroecosystem. Providing insights into microbial symbioses and the challenges of adopting a plant-microbe synergistic approach towards plant health, this book is a valuable resource for researchers, graduate students and anyone in industry working on bio-fertilizers and their agricultural applications.

Symbiotic Soil Microorganisms

New and Future Developments in Microbial Biotechnology and Bioengineering: Microbial Biofilms is divided into three sections: microbial adhesion/biofilms in medical settings, microbial adhesion/biofilms in agriculture, and microbial adhesion/biofilm in the environment and industry. Chapters cover adhesion and biofilm formation by pathogenic microbes on tissue and on indwelling medical devices, including sections on human infections, microbial communication during biofilm mode of growth, host defense and antimicrobial resistance, and more. Other sections cover the biofilms of agriculturally important and environmental friendly microbes, including biofilm formation on plants, in soil, and in aquatic

environments. Finally, the latest scientific research on microbial adhesion and biofilm formation in the environment and in industry is covered. Provides an overview on the growth, structure, cell-to-cell interactions, and control/dispersal of bacterial and fungal of in vitro and in vivo biofilms Presents an overview on the microbial adhesion, biofilm formation and structures of single-species and multi-species biofilms on human tissues/medical devices, agriculture, environment and chemical industries Includes chapters on microbial biofilms of pathogenic microbes on human tissues and in medical indwelling devices Covers factors affecting microbial biofilm, adhesion and formation

New and Future Developments in Microbial Biotechnology and Bioengineering: Microbial Biofilms

This book provides in-depth information about the ecology, diversity and applications of Actinomycetes. The book is divided into two major parts. The first part discusses the diversity, chemical biology and ecology of Actinomycetes. It also covers the discovery of natural products from soil, endophytic and marine-derived Actinomycetes. It includes natural product discovery, chemical biology, new methods for discovering secondary metabolites, structure elucidation and biosynthetic research of natural products. The chapters in this part focus on the effects of biological and chemical elicitation at molecular level on secondary metabolism in Actinomycetes. The second part of the book discusses genomic and synthetic biology approaches in Actinomycetes drug discovery. This part includes chapters focused on the application of metabolic engineering to optimize natural product synthesis and the use of omics data in engineering of regulatory genes. It covers the advanced tools of synthetic biology and metabolic engineering including cluster assembly, CRISPR/Cas9 technologies, and chassis strain development for natural product overproduction in Actinomycetes. It describes the use of bioinformatics tools for reprogramming of biosynthetic pathways through polyketide synthase and non-ribosomal peptide synthetase engineering. These advanced genomic and molecular tools are expected to accelerate the discovery and development of new natural products from Actinomycetes with medicinal and other industrial applications. The book is useful to researchers and students in the field of microbiology, pharmaceutical sciences and drug discovery.

Natural Products from Actinomycetes

New and Future Developments in Microbial Biotechnology and Bioengineering: Microbial Genes Biochemistry and Applications consolidates the most widely used genetic methods available, bringing together the fields of biochemistry, biotechnology, and microbiology. The chapters outlined give clear and concise direction on both standard and applied microbial genetic improvements, presenting undergraduates, postgraduates, and researchers with the latest developments in microbial gene technology. In addition, the book describes the background and usefulness of each experiment in question. All chapters covered in the book are derived from current peer-reviewed literature as accepted by the international scientific community. Compiles the latest developments made in the area of microbial gene systems Includes exhaustive information on almost all areas of microbial gene technology Relates microbial engineering and its direct application to the production of many useful compounds Written by an international team of authors and compiled by award winning editors

New and Future Developments in Microbial Biotechnology and Bioengineering

This book provides in-depth insights into the biology, taxonomy, genetics, physiology and biotechnological applications of Actinobacteria. It especially focuses on the latter, reviewing the wide variety of actinobacterial bioactive molecules and their benefits for diverse industrial applications such as agriculture, aquaculture, biofuel production and food technology. Actinobacteria are one of the most promising sources of small bioactive molecules and it is estimated that only a small percentage of actinobacterial bioactive chemicals have been discovered to date. Identifying new diverse gene clusters of biotechnological relevance in the genome of Actinobacteria will be crucial to developing advanced applications for pharmaceutical, industrial and agricultural purposes. The book offers a unique resource for all graduate students, researchers and practitioners in the fields of microbiology, microbial biotechnology, and the genetic engineering of Actinobacteria.

Biology and Biotechnology of Actinobacteria

New and Future Developments in Microbial Biotechnology and Bioengineering: From Cellulose to Cellulase: Strategies to Improve Biofuel Production outlines new methods for the industrial production of the cellulose enzyme. The book compares the various processes for the production of biofuels, including the cost of cellulose production and availability. Biofuels are considered to be the main

alternatives to fossil fuels in reducing environmental pollution and climate change. Currently, all existing biofuel production is suffering because of the high costs of production processes. As a result, cost effective practical implementation is needed to make this a viable energy alternative. Introduces new and innovative strategies for cellulase enzyme production at industrial scale Provides sustainable approaches to produce cellulase at low cost Covers all aspect and possible factors for economical, low cost, cellulase mediated biofuels production

New and Future Developments in Microbial Biotechnology and Bioengineering

This eBook is a collection of articles from a Frontiers Research Topic. Frontiers Research Topics are very popular trademarks of the Frontiers Journals Series: they are collections of at least ten articles, all centered on a particular subject. With their unique mix of varied contributions from Original Research to Review Articles, Frontiers Research Topics unify the most influential researchers, the latest key findings and historical advances in a hot research area! Find out more on how to host your own Frontiers Research Topic or contribute to one as an author by contacting the Frontiers Editorial Office: frontiersin.org/about/contact.

Actinobacteria: Prolific Producers of Bioactive Metabolites

Plant endophytes are a potential source for the production of bioactive compounds that can fight against devastating diseases in both plants and humans. Among these endophytic microorganisms, endophytic fungi are one of the dominant group of microorganisms with a potential role in plant growth promotion and the discovery of noble bioactive natural products. Endophytic fungi possess several bioactivities like anticancer, antimicrobial, insecticidal, plant growth stimulants, crop protection, phytoremediation, etc. Presence of modular biosynthetic genes clusters like PKS and NRPS in several endophytic fungi underscores the need to understand and explore such organisms. This volume presents and demonstrates the applied aspects of endophytic fungi. Practical applications of such endophytes are discussed in detail, including studies in pharmaceutical development and agricultural management of important microbial diseases. The beneficial effects that endophytic fungi provide to host plants—enhancing growth, increasing fitness, strengthening tolerance to abiotic and biotic stresses through secondary metabolites—are also discussed. The reader is provided with a comprehensive and detailed understanding of such relationships between endophytic fungi and their host.

Advances in Endophytic Fungal Research

The challenges to meet the food requirement of the burgeoning population and stabilized productivity of agriculture lands can only be met by a second green revolution. After steadily declining for over a decade hunger is on the rise again, affecting million people of the global population. Therefore, crop yields must be increased substantially over the coming decades to keep pace with global food demand. The plant rhizosphere is a multidimensional and dynamic ecological environment of complicated microbe–plant interactions for harnessing essential macro and micronutrients from a limited nutrient pool. This book will showcase naturally-occurring endophyte which can be explored for nutrient mineralization and mobilization for sustainable agriculture. This will cover recent trends, prospects, critical commentaries and advancement in the research area focusing on naturally-occurring beneficial endophytic microbes. Thus, it is proposed to bring out new scientific insights and frontiers of research that have exploration of endophyte for mineral nutrient management in soil and crops. The chapters are contributed by leading scientists across the globe. The book will be useful to agronomists, microbiologists, ecologists, plant pathologists, molecular biologists, environmentalists, policy makers, conservationists, and NGOs working for the crop production and productivity development and consequently over all agricultural significance.

Endophytes: Mineral Nutrient Management, Volume 3

Freshwater Microbiology: Perspectives of Bacterial Dynamics in Lake Ecosystems provides a comprehensive and systematic analysis of microbial ecology in lakes. It offers basic information on how well the bacterial community composition varies along the spatio-temporal and trophic gradients along with the evaluation of the bioindicator species of bacteria so as to act as a key to predict the trophic status of lake ecosystems. The book helps to identify the factors of potential importance in structuring the bacterial communities in lakes as it delves into the dynamics and diversity of bacterial community composition in relation to various water quality parameters. It helps to identify the possibility of bioremediation plans

and devising future policy decisions, with better conservation and management practices. Provides a comprehensive and systematic analysis of microbial ecology Helps to identify the factors of potential importance in structuring the bacterial community composition Gives insight into the bacterial diversity of freshwater lake ecosystems along with their industrial potential Caters to the needs and aspirations of students and professional researchers

Freshwater Microbiology

The rapid increase in microbial resources along with the development of biotechnological methods has revolutionized the field of microbial biotechnology. Genome characterization methods and metagenomic approaches further illustrate the role of microorganisms in various fields of research. Recent Advancement in Microbial Biotechnology: Agricultural and Industrial Approach provides an overview on the recent application of the microorganisms in agricultural and industrial improvements. The purpose of this book is to integrate all these diverse areas of research in a common platform. Recent advancement in Microbial Biotechnology targets researchers from both academia and industry, professors and graduate students working in molecular biology, microbiology and biotechnology. Gives insight in the exploration of microbial functional diversity in different systems Highlights important microbes and their role in enhancing agricultural productivity Provides understanding to the basics with advance information of microbial biotechnology Explores the importance of microbial genomes studies in agricultural and industrial applications

Recent Advancement in Microbial Biotechnology

Microbial Extremozymes: Novel Sources and Industrial Applications is a unique resource of practical research information on the latest novel sources and technologies regarding extremozymes in bioremediation, waste management, valorization of industrial by-products, biotransformation of natural polymers, nutrition, food safety and diagnosis of disease. The book's broad knowledge and varying applications are useful to the food industry, dairy industry, fruit and vegetable processing, and baking and beverages industries, as well as the pharmaceutical and biomedical industries. This is a concise, all-encompassing resource for a range of scientists needing knowledge of extremozymes to enhance and research. Furthermore, it provides an updated knowledge of microbial enzymes isolated from extreme environments (temperatures, etc.) and their biotechnological applications. It will be useful to researchers, scientists and students in enzyme research. In addition, users from the dairy and baking industries will benefit from the presented content. Explores recent scientific research on extremophiles and extremozymes technologies that help innovate novel ideas Provides innovative technologies for enzyme production from extremophilic microbes Includes cutting-edge research for applications in various industries where extreme temperature conditions exist Presents novel microorganisms and their enzymes from extreme environments (Thermophilic, Psychrophilic, Acidophilic, Alkaliphilic, Anaerobic, Halophilic, Barophilic, Metallotolerant, Radioresistant, etc.)

Management of agroecosystems for enhancement of soil microbial communities and soil natural fertility

Bioremediation for Environmental Sustainability: Approaches to Tackle Pollution for Cleaner and Greener Society discusses many recently developed and successfully applied bio/phytoremediation technologies for pollution control and minimization, which are lacking more comprehensive coverage in previous books. This book describes the scope and applications of bio/phytoremediation technologies and especially focuses on the associated eco-environmental concerns, field studies, sustainability issues, and future prospects. The book also examines the feasibility of environmentally friendly and sustainable bio/phytoremediation technologies to remediate contaminated sites, as well as future directions in the field of bioremediation for environmental sustainability. Illustrates the importance of microbes and plants in bio/phytoremediation and wastewater treatment Includes chapters on original research outcomes pertaining to pollution, pollution abatement, and associated bioremediation technologies Covers emerging bioremediation technologies, including electro-bioremediation, microbial fuel cell, nano-bioremediation, constructed wetlands, and more Highlights key developments and challenges in bioremediation and phytoremediation technologies Describes the roles of relatively new approaches in bio/phytoremediation, including molecular engineering and omics technologies, microbial enzymes, biosurfactants, plant-microbe interactions, genetically engineered organisms, and more

Microbial Extremozymes

Summarize the recent insight in the Microbiome and host interactions in distinct habitat including antarctic, hydrothermal vents water, speleothems, oral, skin, gut, feces, reproductive tract, soil, root, root nodules, forest and mangroves. Illustrates the high-throughput amplicon sequencing, computational techniques involved in the microbiota analysis, downstream analysis and visualization, multivariate analysis commonly used for microbiome analysis. Describe the probiotics and prebiotics in the composition of the gut microbiota, skin microbiome impact in dermatologic disease prevention, microbial communities in the reproductive tract of human and animals. Information presented in a reachable way for valuable to students, teachers, researchers, microbiologists, computational biologist and other professionals who interested to strengthen and enlarge their knowledge about microbiome analysis by with Next-Generation DNA Sequencing in different branches of sciences.

Bioremediation for Environmental Sustainability

Actinobacteria are highly diverse prokaryotes that are ubiquitous in soil, freshwater and marine ecosystems. Although various studies have focused on the ecology of this phylum, data are still scant on the diversity, abundance and ecology of actinobacteria endemic to special and extreme environments, such as gut, plant, alkaline saline soil, deep sea sediments, hot springs and other habitats. Actinobacteria are well-known producers of a vast array of secondary metabolites, many of which have useful applications in medicine and agriculture. Furthermore, actinobacteria also have diverse functions in different environments apart from antibiotic production. For example, actinobacteria are reported to contribute to the break-down and recycling of organic compounds. They play a significant role in fixation of nitrogen, improvement plant growth, biodegradation, bioremediation and environmental protection. Therefore, understanding the actinobacterial diversity and distribution in such special environments is important in deciphering the ecological roles of these microorganisms and for biotechnological bioprospecting. Recent advances in cultivation, DNA sequencing technologies and -omics (metagenomics, metaproteomics etc) methods have greatly contributed to the rapid advancement of our understanding of microbial diversity, function and they interactions with environment. Furthermore, comparative genomic studies can provide overall information about actinobacterial speciation, evolution, metabolism and environment adaptation mechanisms. This research topic comprising reviews and original articles highlights the recent advances regarding the unexpectedly diverse/rare group of actinobacteria with special selective isolation methods or culture-independent methods, as well as their biological activities, ecophysiologica function and mechanisms from diverse special and extreme environments.

Microbiome-Host Interactions

Microbial Diversity in the Genomic Era presents insights on the techniques used for microbial taxonomy and phylogeny, along with their applications and respective pros and cons. Though many advanced techniques for the identification of any unknown bacterium are available in the genomics era, a far fewer number of the total microbial species have been discovered and identified to date. The assessment of microbial taxonomy and biosystematics techniques discovered and practiced in the current genomics era with suitable recommendations is the prime focus of this book. Discusses the techniques used for microbial taxonomy and phylogeny with their applications and respective pros and cons Reviews the evolving field of bacterial typing and the genomic technologies that enable comparative analysis of multiple genomes and the metagenomes of complex microbial environments Provides a uniform, standard methodology for species designation

Actinobacteria in Special and Extreme Habitats: Diversity, Function Roles and Environmental Adaptations

Microbial Diversity in the Genomic Era