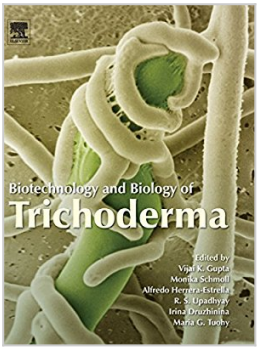

Biotechnology and Biology of Trichoderma

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Biotechnology and Biology of Trichoderma serves as a comprehensive reference on the chemistry and biochemistry of one of the most important microbial agents, Trichoderma, and its use in an increased number of industrial bioprocesses for the synthesis of many biochemicals such as pharmaceuticals and biofuels. This book provides individuals working in the field of Trichoderma, especially biochemical engineers, biochemists and biotechnologists, important information on how these valuable fungi can contribute to the production of a wide range of products of commercial and ecological interest.

- Provides a detailed and comprehensive coverage of the chemistry, biochemistry and biotechnology of Trichoderma, fungi present in soil and plants
- Includes most important current and potential applications of Trichoderma in bioengineering, bioprocess technology including bioenergy & biofuels, biopharmaceuticals, secondary metabolites and protein engineering
- Includes the most recent research advancements made on Trichoderma applications in plant biotechnology and ecology and environment

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Editorial Review

From the Back Cover

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KEY FEATURES

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- Includes most important current and potential applications of Trichoderma in bioengineering, bioprocess technology including bioenergy & biofuels, biopharmaceuticals, secondary metabolites and protein engineering
- Highlights the most recent research advancements made on Trichoderma applications in plant biotechnology and ecology and environment

About the Author

Dr. Vijai Kumar Gupta is the Co-lead Inventor of EI project, Molecular Glycobiotechnology, Department of Biochemistry, National University of Ireland Galway, Galway city, Ireland. He is on research leave from MITS University, India. Before joining NUIG, he worked as Assistant Professor of Biotechnology, FASC, MITS University, Lakshmangarh (Sikar), India. His area of expertise includes mycological research and plant-microbial interactions, bio-fuels and bioenergy research, and microbial biotechnology.

He completed his Ph.D. in Microbiology from Dr. R.M.L. Avadh University, Faizabad, UP, India in 2009.

He is one of the experts in the area of fungal biology and biotechnology. He is the active member of International Sub-commission on Trichoderma and Hypocrea, Austria and a working group member of the International Society for Fungal Conservation, UK. His work with Fusarium spp., Colletotrichum gloeosporioides, Aspergillus spp. Penicillium spp., and Trichoderma spp. has been complemented by contributions to biotechnological development, molecular diversity, disease diagnostic, plant pathology, fungal-plant interaction, secondary metabolites, and industrial applications.

Dr. Gupta is the Fellow of Prestigious- The Linnaean Society, London, UK; Fellow of Hind Agri Society, India; Fellow of Society of Applied Biotechnologist India; and Fellow of International Society of Contemporary Biologist, India. He has been honored with several awards in his career including the prestigious Indian ICAR Senior Research Fellowship and Indian Young Scientist Award 2009, 2011 & Gold Medal Award-2009 for his advanced research achievements in the field of fungal genetics and biology. He is the Editor-in-Chief of the International Journal of Plant Pathology, USA; Senior Editor of Fungal Biology & Biotechnology, BioMed Central; Series Editor of a book series on fungal biology, Springer; and regional editor (Asia)/editorial board member of several International and national journals with many

research/review publication/book chapter publications. He has edited about 16 books for publishers of international renown such as CRC Press, Taylor and Francis, USA; Springer, USA; Elsevier Press, The Netherlands; Nova Science Publisher, USA; LAP Lambert Academic Publishing, Germany; and CABI, UK.

Dr. Monika Schmoll received her degree (1999) and Ph. D. (2003) on regulation of cellulase expression and signal transduction in the filamentous fungus Hypocrea jecorina (Trichoderma reesei) at the Vienna University of Technology. Besides gaining postdoctoral experience and building her own group at the Vienna University of Technology, she has been a visiting scientist in the laboratory of Professor N. Louise Glass (Department of Plant and Microbial Biology, University of California, Berkeley, USA), the University of Rome La Sapienza and the University of Szeged, Hungary. She is author of 33 publications and 2 book chapters. Currently, Dr. Schmoll is group leader in the Research Area Molecular Biotechnology at the Vienna University of Technology. The primary research field of Dr. Schmoll is the interconnection between light response, sexual development and cellulase gene expression in Trichoderma reesei. She showed for the first time that cellulase gene expression is modulated by light in T. reesei and could since then elucidate important mechanistic details on the underlying mechanism. Her group discovered the sexual cycle in the biotechnological workhorse Trichoderma, which had previously considered asexual. This work was published in PNAS in 2009 and since then investigation of this phenomenon and its peculiarities in Trichoderma has become an additional focus. Her work with Trichoderma is complemented by contributions to genome annotation of several fungi (Trichoderma spp., Aspergillus nidulans, Postia placenta, Ceriporiopsis subvermispora), especially in the field of signal transduction.

Prof. Alfredo Herrera-Estrella grew up in Mexico City and graduated from the National School of Biological Sciences in 1985. He did his graduate research (1986-1990) with Prof. Marc Van Montagu at the State University of Ghent, Belgium, studying the T-DNA transfer process from Agrobacterium tumefaciens to plants. He described for the first time Agrobacterium virulence proteins capable of carrying the T-DNA into the plant cell nucleus, and began to study the mycoparasitic process of the biocontrol agent Trichoderma atroviride. Dr. Herrera-Estrella pioneered the development of molecular tools for the study of a biocontrol agent with the establishment of transformation systems, and cloning of the first mycoparasitism related genes. Such developments opened possibilities for strain improvement. He continued those studies while at the Genetic Engineering Department of the Irapuato Unit of Cinvestav (1991-2004), and began studies towards the elucidation of the mechanisms involved in light perception in Trichoderma. In 2000, he was awarded the prize of the Mexican Academy of Sciences. By 2004, he got involved in the establishment of the National Laboratory of Genomics for Biodiversity. Since then he and his group have been involved in Functional Genomics Projects, including the elucidation of the complete maize genome, and the development of advanced techniques to study gene expression by deep sequencing. Dr. Herrera-Estrella has continuing efforts in the elucidation of signaling cascades triggering asexual development in fungi. In particular his group has been using functional genomics approaches for this purpose, and recently has been involved in the study of the role of reactive oxygen species as signal molecules in injury responses in fungi.

Professor R. S. Upadhyay (b. November 15, 1955) received his M. Sc. (1976) and Ph. D. (1980) degrees from Banaras Hindu University (BHU), Varanasi, India. Since then he has been actively engaged in research. His main focus on research has been on biological control of plant pathogens, programmed plant cell death in response to pathogens, bioremediation of toxic effluents, induced resistance in plants and their immunization, plant growth promoting microbes, chitinase production from actinomycetes, mycorrhizal technology for reclamation of wastelands, role rhizobacteria in detoxifying phytotoxic effects, development of molecular markers in tracking microbes in environment, effect of biotic and abiotic factors on plants, and molecular basis of plant-microbe interaction specially for Trichoderma spp. & Fusarium spp. His work has

been well cited internationally. He has been working at Banaras Hindu University in various positions such as Lecturer, (1984-88), Senior Lecturer, (1988-1991), UGC Research Scientist-B, BHU (1988-1991 on lien from BHU), Reader, Banaras Hindu University (1991-1999, appointed in absentia), Professor, (1999 till date), Student Advisor, Faculty of Science, BHU (2010-11), Coordinator, Environmental Science, BHU (2011 till date) and Dy. Coordinator, Centre of Advanced Study in Botany, BHU (2011, for five years). He has been recipient of six prestigious national fellowships of the Government of India. He is recipient of five national awards in the area of science, two conferred by the Prime Minister of India. In addition he worked in prestigious foreign laboratories as visiting Scientist of The Royal Society, London (1988-89), Research Associate of NIH, U.S.A. (1990-91), and INSA- JSPS Fellowship, Japan (1994-95). He has also visited many other courtiers to participate in International conferences or for delivering invited lectures.

Dr. Irina Druzhinina studied biology at the Lomonosov's State University in Moscow, Russia, and at the University of Vienna, where she graduated (PhD) in 2001. Thereafter she became a University Assistant in the research area of C.P. Kubicek at Vienna University of Technology, and habilitated in 2011 in "Microbiology". She is now leader of the working group "Microbiology" at the same institute.

The scientific work of Irina Druzhinina started with a focus on mycology and molecular evolution, working on species diversity and population differentiation in Trichoderma, where she established an online tool for species identification based on DNA barcodes that is today one of the main resources for this purpose for researchers worldwide. In addition, she worked on such diverse topics as phenotype profiling of industrial fungi, peptaibol biosynthesis in Trichoderma, biodiesel production by marine algae, Trichoderma endophytes, biofungicide development and molecular ecology of Trichoderma. In the last years, her interest expanded to ecological genomics, i.e. the use of genome wide information to study the evolutionary adaptation of Trichoderma in its habitats. She acts as a member of the editorial board for Applied and Environmental Microbiology, and is the chair of the International Subcommission on Taxonomy of Trichoderma and Hypocrea, a member of ICTF/IUMS. She published > 60 papers in peer reviewed international journals and edited a book

Dr. Maria G. Tuohy is the Head of the Molecular Glycobiotechnology Research Group, Department of Biochemistry, School of Natural Sciences, NUI Galway which has developed a strong track record in Glycobiotechnology and Enzyme Biotechnology. She has more than 20 years experience in the molecular biochemistry, genetics and biotechnology of fungi, with a special interest in thermophilic ascomycetes and the characterization of these fungi as cell factories for protein production, including novel thermostable enzymes/enzyme systems. Dr. Tuohy and her group have developed patented enzyme-based technologies for key bioenergy and biorefinery applications from terrestrial and marine biomass and wastes, including 3rd generation feedstocks. The group also investigates the use of enzymes for the recovery and selective modification of high-value biochemicals and plant carbohydrate-derived bioactives ('Glycobioengineering'). Dr. Tuohy is a PI in the Energy Research Centre, NUI, Galway and the recently funded national Bioenergy and Biorefinery Competence Centre, is a member of the EU FP7 Biofuels Platform and a national research PhytoNetwork. Dr. Tuohy has been a visiting researcher in RUGhent, Belgium and BSH Institut fur Holzchemie, Hamburg. Dr. Tuohy is author of ~132 research publications, including refereed publications, book chapters, conference papers poster/short communications. She is also a reviewer for international journals and funding agencies and several books as co-editor- Springer Science Publisher, USA; CRC Press, Taylor and Francis, USA; Germany; Nova Science Publisher, USA and Elsevier Press, USA (under Progress) with Dr. V. K. Gupta

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