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978-0-521-85935-6 - Exploitation of Fungi

Edited by G. D. Robson, P. van West and G. M. Gadd

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Exploitation of Fungi

The fungi are a highly diverse kingdom of eukaryotic microbes. Recent advances in molecular genetics, together with the release of whole genome sequences of an increasing number of fungi, are facilitating their exploitation and commercialization. Fungi have the ability to secrete large quantities of proteins of commercial value, and their complex secondary metabolic pathways produce a diverse range of bioactive compounds that have had a major impact in the pharmaceuticals market. In addition, the fungi themselves are increasingly being developed as alternatives to conventional chemically based pest control strategies, and as bio-remediation agents capable of transforming pollutants in the soil environment. With chapters written by international experts, this volume highlights current and future biological, biochemical and molecular exploitation of the fungi in biotechnology. It will have broad appeal, not only to mycologists and microbiologists, but also to biomedical scientists, biotechnologists, environmental and molecular scientists, plant pathologists and geneticists.

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Exploitation of Fungi

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EDITED BY

G. D. ROBSON, P. VAN WEST
AND G. M. GADD

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Preface

The fungi are a highly diverse kingdom of eukaryotic microbes that have been exploited commercially for decades due to their ability to secrete large quantities of proteins of commercial value, and because they possess complex secondary metabolic pathways producing a diverse range of bioactive compounds that have had a major impact in the pharmaceutical market. For example, penicillin and cephalosporin (antibiotics), cyclosporin (immunosuppressant) and more recently the statins (cholesterol reducing agents) are estimated to be worth over \$5 billion per annum, while enzymes and proteins produced commercially in fungal hosts are used in a diverse number of commercial markets including baking, brewing, detergent, textile and animal feed industries. In addition to the exploitation of fungal products, the fungi themselves are increasingly being developed as alternatives to conventional chemically based pest control strategies, as biocontrol agents active against commercially damaging insect pathogens and weeds, and as bioremediation agents capable of transforming organic and inorganic pollutants in the soil environment. Recent advances in the molecular genetics of the fungi together with the recent release of whole genome sequences of an increasing number of fungi will facilitate further the exploitation and commercialization of these important and ubiquitous eukaryotic microorganisms. The objective of this symposium volume is to highlight current and future biological, biochemical and molecular exploitation of the fungi in biotechnology, and act as an interface between current research and future commercialization.

The book is divided into five general parts, each dealing with an important area relevant to the overall topic, but with a considerable degree of complementarity between all the sections. The topics chosen provide a wide-ranging source of examples relating to the exploitation of fungi in a wide range of biomedical, industrial and environmental contexts. The first

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part, *Comparative and functional fungal genomics*, comprises chapters relating to genomic and proteomic analysis of industrial and plant pathogenic fungi, and how such information can be related to function. The second part on *Bioactive molecules* contains chapters that discuss the synthesis of some specific metabolites in fungi, e.g. pyridones and tetramic acids, as well as certain metabolites with important applications in agriculture. Molecular analysis of secondary metabolite production from endophytic fungi is also described together with a synthesis of modern genomic approaches that can elucidate secondary metabolism in *Aspergillus* species. The next part on *Protein folding and secretion* includes accounts of the roles of microtubules and motors in polarized fungal growth, cellular responses to protein-unfolding stress, as well as a genomic perspective on protein excretion and associated stresses in *Aspergillus*. The next part on *Fungal bioremediation* includes the Berkeley Award lecture on stress and the single cell, a topic relevant to many other research areas as well as fungal responses to toxicants. Other chapters provide accounts of novel bioluminescent fungal sensors for pollutants in the environment as well as the theory and practice of fungal bioremediation of xenobiotics and toxic metal pollutants. The final part on *Fungal biocontrol of pests* has accounts of the fungal control of subterranean pests, the development of mycoherbicides, interactions between *Trichoderma* spp. with plant hosts and fungal pathogens, and fungal parasites of invertebrates.

This book arises from the British Mycological Society Symposium on *Exploitation of Fungi* held at the University of Manchester in September 2005 and the editors would like to thank those authors who contributed enthusiastically to this book. Special thanks also go to Diane Purves in Dundee, who greatly assisted communication, collation, editing and formatting of chapters. The prime objective was to produce a wide-ranging volume that would highlight the importance of fungi in modern biotechnology as well as highlighting the modern approaches and tools that are now used to understand and manipulate fungal biology. We think that this has been achieved and hope the volume has broad appeal not only to mycologists of all persuasions but also to other microbiologists, biotechnologists and molecular biologists, who routinely rely on fungal model systems. It will be interesting to see how genomic revelations influence developments over the next few years.

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