

Gene Manipulations in Fungi

Edited by

J. W. Bennett

Linda L. Lasure

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Elkhart, Indiana*

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Preface

The fungi constitute a morphologically and physiologically diverse group of eukaryotes, now usually classified in a separate kingdom. Among the attributes that distinguish the fungi are a hyphal or yeastlike form; a rigid, frequently chitinous cell wall; apical growth; absorptive, heterotrophic metabolism; reproduction by spores; and small genome size.

The economic importance of the fungi is a reflection of their diverse, and often unique, metabolic capabilities. In nature, they are major agents of disease and decay. The ability to secrete enzymes into the environment makes filamentous fungi attractive to exploiters of modern biotechnology. In industry, they are the source of many important natural products such as citric acid and penicillin. In the laboratory, they are model systems for basic research.

Scientists who are otherwise separated by discipline, organism, geography, and objectives nevertheless share common goals in applying modern genetic techniques to fungi. With the important exception of *Saccharomyces cerevisiae*, the molecular biology of fungi is just beginning. Chapter after chapter in this volume emphasizes the need for improved transformation systems, appropriate vectors, and broadly applicable selectable markers.

"Gene Manipulations in Fungi" combines a review of classical fungal genetics, contemporary research, and responsible speculation about the future. Yeast is, without question, the primary model system for eukaryotes. It is rapidly replacing *Escherichia coli* as the organism of choice for advanced studies in molecular genetics. Elegant research is also being conducted with the molds *Aspergillus nidulans* and *Neurospora crassa*.

We have included a number of topics of economic importance. Although the ability to manipulate genomes from plant and animal pathogens, or from most industrial fungi, is currently very limited, intense research is under way. It is useful for applied scientists to understand the state of the art. All of these economically important fungi offer special challenges to the virtuosity of the molecular biologist. Novel adaptations of recombinant DNA techniques are required, and we hope this book will stimulate innovative approaches. Where

appropriate, useful methodologies are described in the text; elsewhere, literature citations are provided.

Molecular biology generates optimism, even euphoria. Many of our authors project their enthusiasm. We share their optimism and are pleased to have brought together such a diverse group of mycophiles. We predict that "Gene Manipulations in Fungi" will be only the first of many books celebrating the marriage between molecular biology and mycology.

J. W. Bennett
Linda L. Lasure

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Our thanks to the American Society for Microbiology and Miles Laboratories for having sponsored a conference on Gene Manipulations in the Exploitation and Study of Fungi, held in South Bend, Indiana, during May, 1983. It was this conference and the enthusiasm of the participants that were the inspiration for this book. Special acknowledgments go to Arny Demain, then Chairman of the ASM Conference Committee, who first urged us to organize the Conference on Gene Manipulations in Fungi, and to Jim Lovett, who first put us in touch with Academic Press.

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I

Historical Perspective: Mutants to Models

1

From Auxotrophic Mutants to DNA Sequences

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I. THE ESTABLISHMENT OF THE PARADIGM: ONE GENE–ONE POLYPEPTIDE

A. The Identification of Metabolic Lesions in Auxotrophs

The idea of congenital defects in metabolism is due to Garrod (1909), who was concerned with human disease. In the 1930s it resurfaced in the work at the John

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