PRINCIPLES OF INSECT PATHOLOGY

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by

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TABLE OF CONTENTS

CHAPTER 1.
INSECT-PATHOGEN RELATIONSHIPS

1. Introduction 1

2. Sites of Pathogen Entry 6

3. Insect Integument 7

4. Insect Alimentary Tract 13

5. Spread of Pathogens in the Host Insect 23

6. Survival and Replication of Pathogens in the Insect 24

7. Mechanisms of Cell and Tissue Damage 26

8. Pathogen Egress and Transmission 26

CHAPTER 2.
GENERAL FEATURES OF VIRAL DISEASE AGENTS

1. Introduction 31

2. Morphology of Insect Viruses 34

3. Composition of Insect Viruses 40

4. Insect Viruses as Etiological Agents of Disease..... 47

5. Viral Pathogenesis 50

CHAPTER 3.
MAJOR GROUPS OF INSECT VIRUSES

1. Introduction	65
2. Group I (dsDNA viruses)	68
3. Group II (ssDNA Viruses)	89
4. Group III (dsRNA Viruses)	91
5. Group IV (+ ssRNA Viruses)	95
6. Group V (- ssRNA Viruses)	102
7. Group VI: Retrovirus-like Particles (Insect Transposable Elements)	104

CHAPTER 4.
BACULOVIRUSES

1. Introduction	111
2. Structural Components of Baculoviruses	114
3. Gene Organization	122
4. Baculovirus Cell Cycle	125
5. Baculovirus-Insect Associations	133

CHAPTER 5.
CHARACTERISTICS OF THE PATHOGENIC PROKARYOTES

1. Introduction	147
2. Bacterial Characteristics	149
3. Bacterial Growth and Metabolism	157
4. Bacterial Genetics	161
5. Detection of Bacterial Pathogens	167
6. Bacterial Pathogenicity	170

CHAPTER 6.
INSECT PATHOGENIC BACTERIA

1. Introduction	177
2. Entomopathogenic Gracilicutes	177
3. Entomopathogenic Firmicutes: Gram Positive, Walled Eubacteria	194
4. Tenericutes: The Cell Wall-less Eubacteria	209

CHAPTER 7.
***BACILLUS THURINGIENSIS*: PRODUCER OF POTENT
INSECTICIDAL TOXINS**

1. Introduction	217
2. Isolation and Detection of <i>Bacillus thuringiensis</i>	219
3. Exoenzymes and Exotoxins of <i>Bacillus thuringiensis</i>	221
4. Structure and Diversity of the Delta (δ) Endotoxins	222
5. Genetics of Delta Endotoxin Synthesis	228
6. Biosynthesis of Delta Endotoxins	231
7. Mode of Action of the Delta Endotoxins	233
8. Genetic Engineering of <i>Bacillus thuringiensis</i>	244

CHAPTER 8.
GENERAL PROPERTIES OF FUNGAL PATHOGENS

1. Introduction to the Fungal Kingdom	259
2. Fungal Characteristics	261
3. Structure and Formation of the Fungal Cell Wall	267
4. The Entomogenous Fungi	275
5. History	275
6. Fungal Disease Symptoms	277

7. The Non-Pathogenic Entomogenous Fungi	278
8. Fungal Pathogenicity	281
9. Pathogenicity and the Infection Pathway	283

CHAPTER 9.

ENTOMOPATHOGENIC FUNGI: “PERFECT” PHYLA

1. The Entomopathogenic Water Molds and Chytrids	287
2. The True Fungi	297

CHAPTER 10.

ENTOMOPATHOGENIC FUNGI: FUNGI IMPERFECTI

1. Hyphomycetes	321
2. <i>Nomuraea rileyi</i> : A Dimorphic Hyphomycete	321
3. <i>Beauveria bassiana</i> : A Toxin-Producing Biocontrol Agent	329
4. <i>Metarhizium anisopliae</i> : Cuticle-Degrading Enzymes	338
5. Genus <i>Paecilomyces</i>	348
6. <i>Verticillium lecanii</i> : A Mycopathogen of Homopterans	350
7. <i>Culicinomyces clavisporus</i> : A Hyphomycete of Vector Mosquitos	351
8. <i>Sorospora-Syngliocladium</i> : Alternate States of a Hyphomycete	353
9. <i>Hirsutella thompsonii</i> , <i>Tolypocladium</i> , and <i>Aspergillus</i> : Production of Secondary Metabolites	354
10. <i>Coelomycetes</i>	358
11. The Entomopathogenic Fungi: Conclusions	359

CHAPTER 11.

INSECT PATHOGENIC PROTOZOA

1. Introduction	365

2. Phylum Apicomplexa	369
3. Phylum Ciliophora	380
4. Phylum Rhizopoda	383
5. Phylum Zoomastigina	387

CHAPTER 12.

PHYLUM MICROSPORIDIA

1. Introduction	399
2. General Structure and Biology	402
3. The Identification and Systematics of Microsporidia	412
4. Representative Genera of Insect Microsporidia	414

CHAPTER 13.

INSECT IMMUNE DEFENSE SYSTEM, PART I: INNATE DEFENSE REACTIONS

1. Introduction	439
2. Invertebrate Members of the Ig Supergene Family	441
3. Innate Immunity	444

CHAPTER 14.

INSECT IMMUNE DEFENSE SYSTEM, PART II: THE RECOGNITION OF NONSELF

1. Introduction	469
2. Phagocytic Cells	469
3. The Phagocytic Process	472

CHAPTER 15.

INSECT IMMUNE DEFENSE SYSTEM, PART III: PROPHENOLOXIDASE CASCADE AND POST-ATTACHMENT PROCESSES OF PHAGOCYTOSIS

1. Insect Phenoloxidase	499

2. Phenoloxidase-Related Specific Immune Defense Activities	504
3. Post-Attachment Processes of Phagocytosis	517
4. Microbial Evasion of Cellular Immune Response	528
5. Summary	532

PREFACE

This book is designed to be a textbook that encompasses the general principles of insect pathology. It is divided into 15 chapters that are grouped into five sections covering the viruses, bacteria, fungi, protozoa, and host defenses. The introductory chapter for each section provides the student with a general perspective of the major taxa that contain insect pathogens. The material in these chapters highlights important biological properties of the microbes and outlines certain aspects of the pathological process. The text, ranging from general to detailed, discusses insect pathology at the cellular and molecular levels, and it emphasizes structure-function relationships. This text takes a different approach from most insect pathology books, and whenever possible, it includes discussions of homologous pathogens infecting vertebrate and plant hosts. The fact is that most determinants that regulate the pathogenicity or virulence of insect pathogens are similar, if not identical, to those found in other systems. The homology or conservation of traits among the various pathogens has allowed the insect pathologist to borrow many data from the fields of plant and animal, including human, pathology. In this book many of the concepts, subdisciplines, and terms are presented in an abbreviated format and will require further elucidation by the instructor as well as supplementary reading by the graduate student. The use of this book as a framework rather than as a definitive text is especially important in the rapidly changing areas of molecular biology, biochemistry, and evolution. We have attempted to present the student with a core of knowledge that can be used to delineate the major areas of insect pathology. We hope that this text will provide graduate students with an appreciation of the diverse biologies of the insect pathogenic microbes and that students will seek supplemental information on disease epidemiology. In addition, we believe that this text will serve as a general introductory reference

book for both the entomologist and microbiologist interested in, as Edward Steinhaus has called it, “disease in a minor chord.”

Past books on insect pathology have concentrated on the unique features of insect diseases and their potential manipulation as microbial control agents against pest insects. A separate presentation of insect pathogens as microbial control agents was omitted from this text for several reasons. Firstly, much of the critical work dealing with the development of microbial control agents was conducted in the 1970's and early 1980's, and it has been amply reviewed in numerous texts. In our experience, most entomology graduate students are well-versed in ecological concepts and have little difficulty with the concepts of biological control by insect pathogens. Secondly, many of the significant advances made in the production and formulation of insect pathogens and microbial toxins have been developed in the private sector and are proprietary. Thirdly, except for *Bacillus thuringiensis*, the subject of Chapter 7, very few insect pathogens have been successfully manipulated as insect control agents. In the 1980's, research papers, reviews, books, and grants optimistically presented insect pathogens as the environmentally sound alternative to chemical pesticides. But after more than two decades of private and public research, the “tremendous potential” of insect pathogens has yet to become a reality. Without question, insect diseases act as natural mortality agents and represent the third leg of the triad of biological control. As such, much of the information describing the impact of disease on insect populations is included in the biological control of insects.

The senior author acknowledges the friendship of Dr. Jean-Paul Latgé (Institut Pasteur), who over the past 15 years has served as a mentor for comparative research on mycopathogens. I would like to thank Dr. Trevor Jackson and Dr. Travis Glare for providing me the opportunity to spend most of 1997 at AgResearch in Lincoln, New Zealand. During this sabbatical I was able to work on the text of this volume and to conduct research on the amber disease in scarabs. In New Zealand I met and worked with Dr. Olivier Thaler, who kindly reviewed Chapters 5 and 6. The authors extend their sincere appreciation to their chairman, Dr. John Capinera, who provided encouragement and allowed them to take on this project. We also acknowledge Dr. James Becnel and Elizabeth Johnson (USDA-ARS, Gainesville, Florida) for providing a short course to the senior author on the terminology and biology of the microsporidia. In addition, they and Dr. Wayne Brooks (University of North Carolina) provided critical reviews of Chapters 11 and 12 and numerous photographs and illustrations for the protozoan chapters. Complementing these figures were the contributions of Dr. T. Fukuda (USDA-ARS, Gainesville, Florida), Dr. L. Solter (University of Illinois) and Dr. D. Hall (University of Florida), who provided illustrations and micrographs of various protozoa. We acknowledge Dr. J.

Principles of Insect Pathology

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Principles of Insect Pathology

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