

Preface



A TRADITION CONTINUES

In December 2002, Ed Alcamo passed away after a battle with cancer. Since the publication of the first edition of *Fundamentals of Microbiology* in 1983, Ed had devoted much of his time and effort to microbiology teaching and producing a textbook that students would find challenging yet enjoyable to read. He was both a colleague and friend, and I miss seeing Ed at conferences and meetings, having a beer or two while discussing microbiology education or more mundane topics, and, yes, listening to him play the harmonica. All of us in microbiology miss his passion, enthusiasm, and humor.

Ed's philosophy with *Fundamentals of Microbiology* was to share with students in a friendly and accessible way what he knew about the subject and what he considered important for them to know. He believed students must be informed and knowledgeable citizens in their community. As the new author of *Fundamentals*, I can say that his philosophy and tradition remain the backbone of the new seventh edition; in fact, notice that the new edition is titled *Alcamo's Fundamentals of Microbiology*. His influence and spirit remain—the tradition continues.

The times in which we live are progressing so rapidly that it is hard to keep up with the world around us. In microbiology, newly emerging infectious diseases, such as West Nile fever and severe acute respiratory syndrome (SARS), the spread of antibiotic resistance, and the threat of bioterrorism are just some of the issues we face today. *Alcamo's Fundamentals of Microbiology* continues to provide you, the student, with up-to-date content so you can read newspaper or magazine articles about microorganisms with understanding, or talk to your doctor with confidence about infectious diseases. In addition, if you are a nursing student or allied health major, the text will give you the information and understanding of microbiology that you need to perform well in your chosen health field.

The new seventh edition contains new pieces of artwork and many new photographs to improve learning and understanding. Jones and Bartlett Publishers remains committed to producing the best microbiology textbook available today, and I believe Ed would be proud of the new edition. He may not be with us physically, but his ideas and thoughts remain integral to the new edition of *Alcamo's Fundamentals of Microbiology*.

AUDIENCE

Alcamo's Fundamentals of Microbiology, Seventh Edition, is written for introductory microbiology courses having an emphasis on the biology of human disease. It is geared toward students in health and allied health science curricula such as nursing, dental

hygiene, medical assistance, sanitary science, and medical laboratory technology. It also will be an asset to students studying food science, agriculture, environmental science, and health administration. In addition, the text should provide a firm foundation for advanced programs in biological sciences, as well as medicine, dentistry, and other health professions.

OBJECTIVES

Alcamo's Fundamentals of Microbiology presents a broad coverage of microorganisms. Looking at the thickness of this text, you might believe that learning and understanding the fundamentals of microbiology are going to be an enormous task. Honestly, there is a substantial body of material to learn and it will require significant effort on your part. As such, one of my objectives as author has been to make sure the fundamentals are presented in an organized and logical way. Also, realize that a substantial portion of the textbook contains figures, tables, diagrams, photographs, and other study aids that are designed to help you more easily envision the concepts being described and discussed. In this regard, make sure you read the section **To the Student** (p. xxiii) because I give you many tips on how best to use and read this textbook to master the fundamentals. One of my most important objectives, as was Ed's, is to ensure the material presented is accessible. I have tried to build on Ed's framework of storytelling (that was how people learned in past centuries) mentioning the men and women who succeeded in advancing our knowledge; and telling you why something is important, not just that it is important. I hope you find the microbial world you are about to enter interesting if not downright fascinating. Enjoy!

ORGANIZATION

Alcamo's Fundamentals of Microbiology, Seventh Edition, is divided into seven major areas of concentration. These areas use basic principles as frameworks to provide the unity and diversity of microbiology. Among the principles explored are the variations in structure and growth of microorganisms, the basis for infectious disease and resistance, and the beneficial effects microorganisms have on our lives.

Part 1 deals with the foundations of microbiology. It includes chapters on the origins of microbiology and the universal concepts that underpin the science. Part 2 then concentrates on the bacteria, the microorganisms most of us think of when we say "germs." The discussions carry over to Part 3, where the spectrum of bacterial diseases is surveyed. Part 4 looks at the significance of other microorganisms, including viruses, fungi, protozoa, and the multicellular parasites.

In Part 5 of the text, the emphasis turns to infectious disease and the body's resistance through the immune system. Here, we study the reasons for disease and the means for surviving it. A logical segue is in Part 6, which presents various mechanisms for controlling microorganisms using such things as heat, radiation, disinfectants, and antibiotics. Part 7 closes the text with brief discussions of how public health measures interrupt epidemics. Some key insights also are given on the positive effects microorganisms exert through biotechnology.

WHAT'S NEW

Today, microbiology is in a third Golden Age. It is one of the most dynamic disciplines of science and information is changing almost exponentially. This has necessitated a comprehensive updating of several chapters.

New Infectious Disease Coverage. Since the last edition, several newly emerging diseases have made themselves known (either naturally or through bioterrorism) while others have spread in geographic location. New material, therefore, has been added to Chapter 12 on **mad cow disease**. **Severe acute respiratory syndrome (SARS)** as well as material on **smallpox** and **monkeypox** has been added to Chapter 13. Chapter 14 has been updated with new information on **AIDS** and new material on **West Nile fever**.

Protein Synthesis Has Moved. The material on protein synthesis that was in Chapter 5 of the previous edition is now in Chapter 6, Bacterial Genetics. Chapter 6 represents a more traditional chapter, covering DNA replication, transcription and translation, mutations, and gene regulation.

New Coverage of Bacterial Genomics. Rapid advances in genetic engineering and bacterial genomics has necessitated adding a new chapter entitled **Genetic Engineering and Bacterial Genomics** (Chapter 7) to cover the exciting discoveries being made.

New MicroInquiry Exercises. One of the major movements in science education today involves bringing a more inquiry approach to learning and engaging students in critical reasoning. To this end, embedded in each chapter is a **MicroInquiry** box (exercise), which require critical reasoning on your part and an understanding of material presented in that chapter. These “real life” exercises include such activities as analyzing experiments and experimental data, diagnosing the signs and symptoms of an infectious disease in a case study, understanding the steps and decisions required to test and bring an antibiotic to market, and determining how to decontaminate a building after a bioterrorism incident. Answers to each MicroInquiry are provided in Appendix E.

SPECIAL FEATURES

To help you achieve your learning goals and to reduce the anxiety that comes with approaching a new subject, the publisher and I have incorporated several features into this book. We hope that these features will enhance the accessibility of the key concepts and generate real enthusiasm for microbiology.

Career Essays, titled “Microbiology Pathways,” open each part of the text and discuss various career options available.

Chapter Introductions provide a stimulating thought or historical perspective to set the tone for the chapter.

Marginal Definitions present succinct definitions of notable terms as they enter the discussion.

Boldface Terms highlight important terms and ideas in the text.

Mid-Chapter Summaries, titled “To This Point,” allow you to pause and summarize the previous few pages and preview the next section.

MicroFocus Boxes explore interesting topics concerning microbiology or microorganisms.

Serotypes:
variants of organisms that differ according to the antibodies they elicit from the immune system.

MicroFocus 13-5

The march of new human viruses seems to keep on coming—or perhaps keep on being discovered. In June 2003, researchers at Yale University reported they had discovered an RSV-like virus that might explain several mysterious respiratory illnesses in children and colds in adults.

The Yale researchers reported the presence of the human metapneu-

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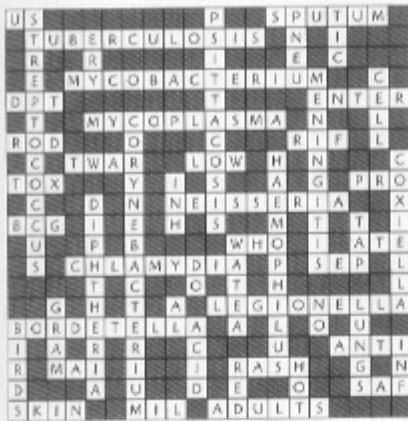
WHY PATHOGENS?

Microorganisms perform many useful services for humans when they produce food products, manufacture organic materials in industrial plants, and recycle such elements as carbon and nitrogen. The emphasis of this book, however, is on the tiny, but important percentage of microorganisms that cause human disease, the so-called pathogens. Why do we emphasize pathogens? Here are several reasons:

- Pathogens have regularly altered the course of human history.
- Pathogens are familiar to audiences of microbiology.
- Pathogens add drama to an invisible world of microorganisms.
- Pathogens illustrate ecological relationships between humans and microorganisms.
- Pathogens point up the diversity of microorganisms.

Moreover, the study of pathogens makes basic science relevant and shows how microbiology interfaces with other disciplines such as sociology, economics, history, politics, and geography. Finally, the study of pathogens helps us to understand contemporary newspaper articles, magazine headlines, and stories on the late news. And in the end, that makes us better citizens. Indeed, the famous essayist Thomas Mann has written, "All interest in disease is only another expression of interest in life."

Note to the Student



MicroInquiry Boxes allow you to investigate (usually interactively) some important aspect of the chapter being studied.

Textbook Cases help you understand pathogens and present contemporary disease outbreaks in pictorial format.

Summary Tables pull together the similarities and differences of topics discussed in the chapter.

Notes to the Student at the end of each chapter present an editorial comment within the framework of the chapter.

Summaries of Key Concepts pull together the major ideas discussed in the chapter.

Questions for Thought and Discussion encourage you to use the text to resolve thought-provoking problems with contemporary relevance.

Chapter Reviews contain questions of a somewhat unconventional type to assist review of the chapter contents.

The Glossary contains concise definitions for the major microbiological terms and concepts.

Pronouncing Microorganism Names (inside back cover) helps you correctly pronounce difficult microorganism names.



A List of the Textbook Cases

A Case of <i>Salmonella</i> Food Poisoning	63
A Case of Corneal Infection Caused by a Pathogenic Bacterium	64
An Outbreak of Intestinal Disease at a Summer Day Camp	86
A Case of Rabies Occurring in Warren County, New Jersey, in October 1997	88
An Outbreak of <i>Enterobacter cloacae</i> Infection Associated with Biofilms in the Waste Drainpipe of a Hemodialysis Machine	30
An Outbreak of Campylobacteriosis Caused by <i>Campylobacter jejuni</i> Occurring in Oklahoma	147
Legionnaires' Disease on a Cruise Ship	295
Two Outbreaks of Psittacosis	299
An Outbreak of Botulism	312
Outbreak of <i>E. coli</i> O157:H7 Infection	325
An Episode of Plague	355
An Outbreak of Tickborne Relapsing Fever	362
A Case of Chlamydia	385
A Hospital Outbreak of <i>Burkholderia</i> Infection	410
An Outbreak of SARS	480
The First Case of Monkeypox	499

SUPPLEMENTS TO THE TEXT

We have developed a number of ancillaries that further amplify the concepts of this text:

For the Student

The web site we have developed exclusively for the seventh edition of this text, <http://microbiology.jbpub.com>, offers a variety of resources to enhance understanding of microbiology. The site contains eLearning, a free on-line study guide with chapter outlines, chapter essay questions, key term reviews, and short study quizzes.

The *Study Guide* that accompanies this textbook contains over 3000 practice exercises and study questions of various types to help you learn and retain the information in the text.

Laboratory Fundamentals of Microbiology, Seventh Edition, is a series of 30 multi-part laboratory exercises that provide basic training in the handling of microorganisms and reinforce ideas and concepts described in the textbook.

An anthology called *Encounters with Microbiology* brings together "Vital Signs" articles from *Discover Magazine* in which health professionals use their knowledge of microbiology in their medical cases.

For the Instructor

Compatible with Windows and Macintosh platforms, the **Instructor's Tool Kit—CD-ROM** provides instructors with the following traditional ancillaries:

- The *Instructor's Manual*, provided as a text file, includes chapter summaries, complete chapter lecture outlines, and answers to all the Questions for

Outbreaks of Norovirus on Cruise Ships	524
An Unusual Case of Rabies	540
An Outbreak of Eastern Equine Encephalitis	540
A Fatal Case of <i>Amanita</i> Food Poisoning	571
An Outbreak of Ringworm	582
An Outbreak of Sporotrichosis	587
An Outbreak of Leishmaniasis	614
An Outbreak of Schistosomiasis in Delaware	635
An Outbreak of Q Fever Associated with a Cat	672
An Outbreak of Blastomycosis	680
An Outbreak of <i>Pseudomonas</i> Infection Traced to a Contaminated Solution	832
A Case of <i>Plesiomonas</i> and <i>Salmonella</i> Infection	870
A Case of <i>Vibrio parahaemolyticus</i> Food Poisoning	7918
A Case of <i>Staphylococcus aureus</i> Food Poisoning	922
A Case of Botulism Due to Leftover Food	935

Thought and Discussion.

- The *Test Bank* is available as straight text files and as part of the Diploma™ Test Generator software included on the CD. The Test Generator software helps choose an appropriate variety of questions, create multiple versions of tests, even administer and grade tests on-line.
- The *PowerPoint™ Lecture Outline Slides* presentation package provides lecture notes, and images for each chapter of *Alcamo's Fundamentals of Microbiology*. Instructors with the Microsoft PowerPoint™ software can customize the outlines, art, and order of presentation.

The *Kaleidoscope Media Viewer* provides a library of all the art and tables in the text to which Jones and Bartlett Publishers holds the copyright or has digital reprint rights. The *Kaleidoscope Media Viewer* uses your browser—Internet Explorer or Netscape Navigator—to enable you to project images from the text in the classroom, insert images into PowerPoint presentations, or print your own acetates.

A set of *Acetate Overhead Transparencies* includes 100 color figures and 75 electron micrographs from the textbook.