

Preface

There are a Million Stories in the Microbe Jungle

One measure of a subject's impact on the everyday lives of people is how often it is mentioned in the popular press. By this measure, it seems that microbiology has really come of age. Consider some of the "buzz words" creeping into the tabloids of late: MRSA, *C. diff*, killer cold viruses, bacterial cultures in yogurt, the bird flu, biofilms, cancer vaccines, designer bacteria, and personal gene chips, just to name a few. If a quick glance at some of the latest headlines has inspired you to enhance your understanding of these topics and hundreds of others, this book is a good place to start. Inquiring minds want to know!

It is true that a substantial portion of discoveries in science right now are emerging from the realm of microbiology. In fact, microbiology has entered a new "golden age" that is generating information at a rapid rate. Much of it relates to genetics and infectious disease, but a lot of it comes from discoveries about the activities of microbes in the natural environment. Because microbes are so small, widespread, and largely nonvisible, there will always be some places that have not yet been thoroughly explored where microbes are living and doing their thing. As greater attention is focused on the rainforest, oceans, bedrock, or even the human body, and advanced tools are used in probing these environments, our perspectives on the microbial world are expanded to new and greater dimensions.

What Sets This Book Apart?

Engaging, Straightforward Presentation

The primary aims of this book have been 1) to present guiding principles in a straightforward and readable style that is neither too wordy nor too simplistic, and 2) to explain complex topics clearly and vividly. I have continued to organize the content in a logical order that builds foundations from early chapters to later ones. The text is backed up with numerous tables, flow charts, and other support features. Having many different levels and cognitive styles for students increases retention, understanding, and success in learning.

A Vivid, Self-Explanatory Art Program

My experiences as a teacher, microbiologist, and illustrator have helped me to visualize abstract concepts and transform them into scientifically accurate and attractive illustrations. Vivid,

multidimensional art pieces complement self-contained, concept-specific narrative; it is not necessary to read page content surrounding the artwork to grasp concepts being illustrated. Development of the art in this manner further enhances learning and helps to build a solid foundation of understanding.

This seventh edition has given us the opportunity to hone and improve the art even more. In addition to many new and revised figures, the Process Figures are now clearly defined as such and include colored steps that correlate the art to step-by-step explanations. Art has also been pulled into special Visual Understanding study tools to help students make connections between concepts presented in different chapters.

Early Survey of Microbial Groups and Taxonomy

A unique feature of this text's format is the early survey of microbial groups and their taxonomy (chapters 4, 5, and 6). By using general and specific names for microbes from the very beginning students develop a working background that eases them into the later chapters. I have always felt that microbes are the "stars of the show," and that students have a far greater appreciation for later topics of nutrition, metabolism, genetics, and microbial control if they recognize the main characters—bacteria, viruses, and eukaryotic microorganisms—and already know significant facts about them.

Relevant, Up-to-Date Disease Chapters

Unique among microbiology textbooks, chapter 17, "Diagnosing Infections" brings together in one place the current methods used to diagnose infectious diseases. The chapter starts with collecting samples from the patient and details the biochemical, serological, and molecular methods used to identify causative microbes.

The pathogen chapters (18–27) are organized by microbial group (taxonomy) because many users feel this orientation has greater coherence and concentrates more on infectious agents than anatomy and physiology. All characteristics of the microorganism and its diseases may be presented simultaneously. This system will not only be familiar to students from their laboratory work, but it helps them maintain a more distinct separation between microbial groups and their diseases.

Pedagogy Designed for the Way Students Learn

Foundations in Microbiology makes learning easier through its carefully crafted pedagogical system. Following is a closer look

at some of the key features that our students have taught us are useful.

- All chapters open with **Case File** mysteries to solve. These real-world case studies help students appreciate and understand how microbiology impacts our lives on a daily basis. The solutions appear later in the chapter, after the necessary elements have been presented.
- A **Chapter Overview** at the beginning of each chapter provides students with a framework from which to begin their study of a chapter.
- In chapters 1–16 and 26–27, major sections of the chapter are followed by **Checkpoints** that repeat and summarize the concepts of that section. In the disease chapters (18–25) the Checkpoints are in the form of the **disease tables** described earlier.
- **Insight** readings allow students to delve into material that goes beyond the chapter concepts and consider the application of those concepts. The Insight readings are divided into four categories: Discovery, Historical, Medical, and Microbiology.
- All chapters end with a **summary**, and a comprehensive array of **end-of-chapter questions** that are not just multiple-choice, but also questions that require writing and critical thinking about topics in the chapter. Considering and answering these questions, and even better, discussing them with fellow students, can make the difference between temporary (or limited) learning and true knowledge of the concepts.
- **Visual Understanding** questions incorporate art to help students connect important concepts from chapter to chapter.
- **Concept Mapping** assists in retention as well as contextual organization.

What's New with This Edition?

Since the science of microbiology is constantly changing and advancing, the textbook must also change and advance to stay current and continue to be useful and relevant. With each edition we will continue to create a current, well-organized, and scientifically accurate book, and provide an active learning opportunity for students.

I have been fortunate to have my colleague Barry Chess, of Pasadena City College and Kelly Cowan of Miami University of Ohio continue in their capacity as significant contributors. They have helped write new sections and Insight boxes, suggested ideas for new and improved figures, edited and updated text, and improved chapter overviews, summaries, and questions. Kelly is instrumental in developing case files and both she and Barry have constructed some of the active learning features in the end-of-chapter sections. Many additions and innovations were done at the request of reviewers and users, whose input continues to be invaluable.

Active Learning Experience

- New **Visual Understanding** Questions supply a photo or a graphic that students have already seen, along with a thought-provoking question. Many of these questions use images from

previous chapters and pose queries that require students to combine knowledge from the current chapter with the material they already have learned from previous chapters.

- **Concept Mapping** Exercises ask students to organize information in more meaningful forms than just simple lists. Three different types of concepts maps are used throughout the text. A new Appendix introduces students to concept mapping.
- **Process figures** now have matching numbered steps for easy to see explanations of complex processes.
- **Special icons** correlate over 100 total animations to figures in the text. When students see the icon next to a figure legend, they'll know to check out the accompanying website for a helpful animation to actively illustrate the concept. Additional animations with quizzes are also on the website.
- **Study on the Fly Content**—now students have access to downloadable chapter summaries and animations so they can study anywhere, anytime.

Up-To-Date Content

- The single chapter (26) that covered both environmental and applied microbiology has been split into two separate chapters (26 and 27). Chapter 26 now focuses on ecological principles and the interactions of microbes with the environment, and chapter 27 examines the use of microbes in industry and biotechnology.
- Chapter 9 introduces some of the newer concepts in genetics that have emerged from genome analysis studies. The most significant discovery involves the role of special types of RNA in regulating genes and their expression.
- Applications of regulatory RNA in biotechnology and engineering of transgenic animals have been added to chapter 10.
- To consolidate and streamline the section on chemical control of microorganisms in chapter 11, we have compiled several new tables that summarize and illustrate common applications.
- Now that probiotics have become more widely used and understood, their coverage has been updated and enlarged in chapters 12 and 13.
- Throughout the book there is much more emphasis on polymicrobial infections and biofilms.
- In chapter 17 we have included a more detailed table of specimen collection and increased coverage of PCR technology in diagnosis of infections.
- After much consideration and a number of requests, the spelling of prokaryote and eukaryote and related terms has been revised to the form with a "k" instead of a "c" throughout all chapters.
- The section on photosynthesis that was originally covered in chapter 26 in the section on environmental microbiology has been moved into chapter 8 along with other metabolic and bioenergy concepts.
- Overall, we have added a number of new case studies (called case files), photographs, figures, notes, and boxes.

For a complete listing of chapter-by-chapter changes, please visit the text's ARIS website.

Acknowledgments

My involvement in this textbook goes back over twenty-five years. Throughout this active and fulfilling time, I have had the good fortune to be supported by the best publishing staff in the business. I have collaborated with dozens of top-notch editors, researchers, production staff, illustrators, and designers. It has been clear to me that, from the very beginning, the textbook teams have shared my love for the project, and have brought their own expertise and commitment to maintaining a high quality product. This seventh edition has carried on this tradition.

Several key people made significant contributions to this edition. First, I wish to commend my senior developmental editor, Kathleen Loewenberg, for her enthusiastic support and suggestions. Her experience and thoughtful comments have been a real asset, and she is an awesome “figure wrangler,” bringing a fresh perspective and keen eye to the art program. I greatly appreciate the contributions of the editorial coordinator Ashley Zellmer, who cheerfully takes on the sometimes tedious work of preparing and processing manuscript and keeping track of the numerous revisions in text and figures. I am indebted to senior sponsoring editor Jim Connely, who keeps us laughing when we need it, and whose advice “If you put something in, you’ll need to take something out” has been a useful guide for many a decision about content, length, and new features. I have received much helpful input from publisher Michelle Watnick, another experienced and well-informed member of the book team. I admire her ability to grasp “the big picture” of book creation. Senior project manager, Jayne Klein, has done a first-rate job of overseeing the minutiae of production. I especially appreciate her flexibility in considering changes I feel strongly about and the detailed efforts from her team. They can actually find an italicized period in a footnote—just to give you an idea of the level of scrutiny this book receives! Other gifted and dedicated personnel that I would like to thank include the photo research coordinator, Carrie Burger; photo researcher, Danny Meldung at Photo Affairs; Jeanne Patterson, the copy editor; and the book designer, Michelle Whitaker. No list of acknowledgments would be complete without mentioning senior marketing manager Tami Petsche, who has to wear several hats, including having to take a crash course in microbiology with each new edition.

Just like the living world, this textbook is evolving. A major force behind this trend relates to the constant discoveries happening in microbiology that must be addressed and updated. But another undeniable force for change is the feedback that we get from users and reviewers. I want to make special mention of Dr. Wan H. Ooi and his colleagues Pramilla Sen, Marsha Turell, and Donna Wiersema of *Houston Community College*, and Dr. Reza Marvdashti of *San Jacinto College* for their insights in several chapters. Other reviewers who have provided substantive comments on content and accuracy are Melissa Rubin, Kelly Gridley, Dana Nayduch, and Davis Pritchett. Our team of reviewers for the seventh edition has contributed valuable ideas for new figures, boxes, and coverage. They have helped to fine tune language, terminology, headings, Checkpoints, and pedagogy. These reviewers teach the subject and are interpreters of it to beginning students. It is obvious that

they share a passion for knowledge and wish to impart the excitement of microbiology to their classes. We commend you for your dedication.

For the users of this book, we hope that you enjoy our journey into the world of microbiology and nurture a long-term interest in this fascinating science. Though many elaborate steps are taken to weed out errors, the very nature of an evolving book means that “mutations” may slip in without notice. If you detect any missing or misspelled words, missing labels, mistakes in content, or other errata, do not hesitate to contact the publisher, representative, or the author (ktalaro@aol.com).

Reviewers

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