The most successful new microbiology text in a generation

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“This text stands out from among traditional texts in that it incorporates recent advances, hot research issues as well as thought-provoking questions.”
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“The artwork is stunning in places. [It] is the best I have ever seen in a micro textbook, and I have seen dozens.”
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“The book is very clear and the authors should be thrilled with their work.”
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Microbiology: An Evolving Science, Second Edition, provides students with the tools they need to understand the rapidly advancing field of microbiology by enriching foundational topics with current research examples. The readable and authoritative text is paired with a stunning and unified art program that helps students visualize key microbial processes and structures.

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JOAN L. SLONCZEWSKI, Kenyon College
JOHN W. FOSTER, University of South Alabama
An emphasis on current research gives students a contemporary portrait of the dynamic and exciting science of microbiology.

Microbiology: An Evolving Science seamlessly integrates current research within the up-to-date framework of molecular biology, facilitating the incorporation of the latest research into the foundational topics of genetics, physiology, ecology, evolution and immunology.
A visually stunning art program teaches students to visualize key concepts.

Successful microbiology students must learn to visualize microbial processes and structures that by nature occur at an unseen level. *Microbiology: An Evolving Science*’s extensive and consistently executed art program helps students visualize key microbial processes and showcases the latest structural discoveries.

Large, engaging figures are accompanied by distinctive bubble captions and numbered labels that help students interpret and analyze microbial processes and structures.

To convey microbiology as a diverse and dynamic field, photos of iconic and contemporary microbiologists are paired with figures of their most important contributions. Many figures are also accompanied by photos of researchers, graduate students and even undergraduates doing research, putting a human face to the science.

Figure 10.26 Chemotaxis. A. Chemotaxis signaling pathway in *E. coli*, Ann Stock, Robert Wood Johnson Medical School (B), and Howard C. Berg, Harvard University (C), are major contributors to the fields of signal transduction, motility, and chemotaxis.
Engaging process animations make complex concepts clear.

Each animation topic was chosen by instructors and developed specifically for *Microbiology: An Evolving Science*, in close coordination with the authors. Concepts are presented accurately and with just the right level of detail. Animations are available to students on the free and open StudySpace and are included on the Instructor’s Resource Disc for instructors to use in lecture.

### Process Animation Topics

- Microscopy
- Replisome Movement in a Dividing Cell
- Chemotaxis
- Phosphotransferase System (PTS) Transport
- Endospore Formation
- Dilution Streaking Technique
- Biofilm Formation
- Twitching Mobility
- Lysis and Lysogeny
- DNA Replication
- PCR
- Supercoiling and Topoisomerases
- Rolling Circle Mechanism of Plasmid Replication
- DNA Sequencing
- Protein Synthesis
- Protein Export
- SecA-Dependent General Secretion Pathway
- ABC Transporters
- Recombination
- Transposition
- DNA Repair Mechanisms: Methyl Mismatch Repair
- DNA Repair Mechanisms: Nucleotide Excision Repair
- DNA Repair Mechanisms: Base Excision Repair
- Bacterial Conjugation
- The lac Operon
- Transcriptional Attenuation
- Quorum Sensing
- Influenza Virus Entry into a Cell
- Influenza Virus Replication
- HIV Replication
- Herpes Virus Replication
- Tagging Proteins for Easy Purification
- Real-Time PCR
- DNA Shuffling
- Construction of a Gene Therapy Vector
- A Bacterial Electron Transport System
- ATP Synthase Mechanism
- Oxygenic Photosynthesis
- Agrobacterium: A Plant Gene Transfer Vector
- Phyllogenetic Trees
- Listeria Infection
- Light-Driven Ion Pumps and Sensors
- Malaria: A Cycle of Transmission between Mosquito and Human
- The Basic Inflammatory Response
- Phagocytosis
- The Activation of the Humoral and Cell-Mediated Pathways
- Cholera Toxin Mode of Action
- Process of Type III Secretion
- Retrograde Movement of Tetanus Toxin to an Inhibitory Neuron
- The bacteria glow only under certain conditions. The genes needed to make light are off when bacterial cell densities are low (such as in sea water), but turn on under crowded conditions (such as in the light organ of the squid), when enough cells are together to make a visual impact. How do cells know they have achieved an adequate number of nearby individuals—that is, a quorum—before turning on their luminescence genes?

The bacteria glow only under certain conditions. The genes needed to make light are off when bacterial cell densities are low (such as in sea water), but turn on under crowded conditions (such as in the light organ of the squid), when enough cells are together to make a visual impact. How do cells know they have achieved an adequate number of nearby individuals—that is, a quorum—before turning on their luminescence genes?

It turns out that this phenomenon, called quorum sensing, is only loosely associated with cell numbers. Induction of a quorum-sensing gene system requires the accumulation of a molecule called an autoinducer. After a cell produces an autoinducer, the molecule rapidly diffuses out of the cell. The more cells in a given space, the faster the autoinducer builds up and the more likely it will reenter cells and trigger the luminescence response.

Luciferase catalyzes a redox reaction that produces oxidized and reduced chemical products as well as blue-green light. Because the Lux proteins, like other proteins, require energy to produce, the cells turn this system on only when appropriate—such as when they are crowded together in the light organ of the squid.
Contents

A contemporary organization integrates genomics and molecular genetics and balances medical and ecological microbiology.

PART I
THE MICROBIAL CELL
CHAPTER 1 Microbial Life: Origin and Discovery
CHAPTER 2 Observing the Microbial Cell
CHAPTER 3 Cell Structure and Function
CHAPTER 4 Bacterial Culture, Growth, and Development
CHAPTER 5 Environmental Influences and Control of Microbial Growth
CHAPTER 6 Virus Structure and Function

PART II
GENES AND GENOMES
CHAPTER 7 Genomes and Chromosomes
CHAPTER 8 Transcription, Translation, and Bioinformatics
CHAPTER 9 Gene Transfer, Mutations, and Genome Evolution
CHAPTER 10 Molecular Regulation
CHAPTER 11 Viral Molecular Biology
CHAPTER 12 Molecular Techniques and Biotechnology

PART III
METABOLISM AND BIOCHEMISTRY
CHAPTER 13 Energetics and Catabolism
CHAPTER 14 Respiration, Lithotrophy, and Photolysis
CHAPTER 15 Biosynthesis
CHAPTER 16 Food and Industrial Microbiology

PART IV
MICROBIAL DIVERSITY AND ECOLOGY
CHAPTER 17 Origins and Evolution
CHAPTER 18 Bacterial Diversity
CHAPTER 19 Archaeal Diversity
CHAPTER 20 Eukaryotic Diversity
CHAPTER 21 Microbial Ecology
CHAPTER 22 Microbes and the Global Environment

PART V
MEDICINE AND IMMUNOLOGY
CHAPTER 23 Human Microbiota and Nonspecific Host Defenses
CHAPTER 24 The Adaptive Immune Response
CHAPTER 25 Microbial Pathogenesis
CHAPTER 26 Microbial Diseases
CHAPTER 27 Antimicrobial Chemotherapy and Resistance
CHAPTER 28 Clinical Microbiology and Public Health

APPENDICES
APPENDIX 1 Biological Molecules
APPENDIX 2 Introductory Cell Biology: Eukaryotic Cells
In-text tools aid student understanding and stimulate inquiry.

A readable narrative and helpful pedagogical features in every chapter challenge students to review what they’ve learned, to identify key themes, and to think critically about important questions.

Ample Thought Questions throughout each chapter integrate core concepts and get students thinking critically.

Possible answers are located at the back of the book.

End-of-chapter Thought Questions further challenge students to think critically by asking them to consider the big-picture concepts introduced in each chapter. The answers to the questions are included in the instructor’s manual only, making them great discussion, quiz, and homework questions.
The HSV-1 virion binds to receptors on the host cell membrane and releases its capsid into the cytoplasm. The envelope fuses with the host membrane, releasing the capsid into the cytoplasm. The circular DNA chromosomes are transferred into the host nucleus to conduct the replicative cycle. Replicative cycle of HSV-1: The viral DNA is replicated by viral DNA polymerase by the rolling-circle method, generating a concatemer.

1. The HSV-1 virion binds to extracellular matrix.
2. The envelope fuses with the host membrane, releasing the capsid into the cytoplasm.
3. The capsid then travels down a scaffold of microtubules to the nuclear pore.
4. The capsid injects the DNA through a nuclear pore complex into the nucleus.
5. The DNA then circularizes and is transcribed to mRNA.
6. The cell cycle now takes one of two alternative directions: mRNA encoding LAT proteins to maintain latency, or mRNA for proteins of the infectious cycle.
7. Immediate and early mRNAs leave the nucleus to be translated. The translated proteins return to the nucleus for packaging within capsids.
8. The circular DNA is replicated by viral DNA polymerase by the rolling-circle method, generating a concatemer.
9. The DNA concatemer expresses late-stage mRNA, which exits the nucleus for translation including envelope proteins.
10. Envelope proteins migrate through the ER back to the nuclear membrane.
11. The late proteins return to the nucleus, where they are packaged into capsids with DNA cleaved into linear chromosomes.
12. The capsid receives envelope membrane and proteins from either the nuclear membrane or the ER.
13. The virions are released through the ER to the Golgi and ultimately through exocytosis.
14. . . . the cell membrane releases mature virions through exocytosis.
Resources for Students

**StudySpace: Your Place for a Better Grade**

StudySpace tells students what they know, shows them what they still need to review, and then gives them an organized study plan to master the material. Students rely on effective and well-designed online resources to help them succeed in their courses—StudySpace is unmatched in providing a one-stop solution that’s closely aligned with their textbook. This free and easy-to-navigate website offers students a range of exercises, interactive learning tools, assessment, and review materials, including:

- **50 Process Animations, 22 new.** All animations are based on textbook art, developed with direct input from the text authors, and include narration. The new animations focus on concepts students struggle to visualize and understand.

- **Quiz+ Diagnostic Quizzes** take online assessment to the next level. Quiz+ doesn’t just tell students how they did; it shows them how they can do better, by giving them a targeted study plan that offers specific page references and links to the ebook and other online learning tools.

- **Visual Quizzes.** Five questions per chapter are based on textbook art. Students are asked to identify regions of a figure to demonstrate their understanding of key processes.

- **Detailed Study Plans** guide students through mastering the core concepts for each chapter and help them utilize all the online resources for the chapter.

- **Summaries from the textbook**

- **Flashcards for vocabulary terms**

- **New eTopics.** These are supplemental topics that are ideal for instructors who want to go beyond the text.

- **Weblinks.** Author-curated links are available from StudySpace and at MICROBIOLOGY2.COM/LINKS. The ebook allows students to navigate to the StudySpace links page when appropriate.

- **Links to Joan Slonczewski’s MicrobeWiki**

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The ebook edition of *Microbiology, Second Edition*, features integrated links to the 50 process animations as well as to the central repository of weblinks found on StudySpace.

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**Culturing the “unculturable.”** MSC33 is a typical marine “unculturable” microorganism that refuses to grow on standard laboratory media (SEM). It was recently discovered that adding a short peptide will stimulate growth of this organism in the laboratory. The peptide, which is produced by a companion microbe found in the natural environment, does not fulfill a nutritional need of MSC33 but has an apparent signaling function that somehow induces cell division. **William Fowle, Northeastern University**
Gray is from 0 to 180 nanometers (nm); red, from 180 to 210 nm; and rainbow coloring from red to blue, between 210 and 250 nm.

Mimivirus, a cause of pneumonia, the largest known virus, larger even than some bacteria. Its genome poses intriguing questions for evolution. This cryo-EM model was developed by Michael Rossmann and colleagues.

**CONTACT INFORMATION**

