2024 Release

Microbiology FUNDAMENTALS

A Clinical Approach

SDI Productions/Getty Images

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Mc Graw Hill

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Brief Contents

About the Authors

Greg Zoeller

Marjorie Kelly Cowan, PhD, started teaching microbiology at Miami University in 1993. Her specialty is teaching microbiology for pre-nursing/allied health students at the university's Middletown campus, a regional open-admissions campus. She started life as a dental hygienist. She then went on to attain her PhD at the University of Louisville, and later worked at the University of Maryland's Center of Marine Biotechnology and the University of Groningen in The Netherlands. Kelly has published (with her students) 24 research articles stemming from her work on bacterial adhesion mechanisms and plant-derived antimicrobial compounds. But her first love is teaching—both doing it and studying how to do it better. She is past chair of the Undergraduate Education Committee of the American Society for Microbiology (ASM). Her current research focuses on the student achievement gap associated with economic disparities, as well as improving communication in the health care setting. In her spare time, Kelly hikes, reads, and chases around three grown kids and one son-in-law, a granddaughter, and two dogs, Doug and Daisy.

Heidi Smith

Heidi Smith, MS, leads the microbiology department at Front Range Community College in Fort Collins, Colorado. Collaboration with other faculty across the nation, the development and implementation of new digital learning tools, and her focus on student learning outcomes have revolutionized Heidi's face-to-face and online teaching approaches and student performance in her classes. The use of digital technology has given Heidi the ability to teach courses driven by real-time student data and with a focus on active learning and critical thinking activities.

Besides teaching at FRCC, Heidi directs a federal grant program designed to increase student success in transfer and completion of STEM degrees at the local university as well as facilitate undergraduate research opportunities for underrepresented students.

Off campus, Heidi spends as much time as she can enjoying the beautiful Colorado outdoors with her husband and four teenagers.

Tia Brayman

Jennifer Lusk, MSN, RN, CCRN, is a registered nurse at a large academic children's hospital in Denver, Colorado. She has practiced in pediatric intensive care for over 15 years in urban pediatric hospitals. Jennifer has spent her nursing career caring for critically ill children as a bedside nurse, charge nurse, and Continuous Renal Replacement Therapy (CRRT) specialist. She is the CRRT Clinical Program Manager, providing oversight and program development for the critical care dialysis therapies. She enjoys her diverse clinical role, which involves educating nurses and physicians, mentoring, researching, program development, and quality improvement work. In her time away from work, Jennifer enjoys spending time outdoors with her husband and sons, especially hiking and exploring national parks.

Preface

Students:

Welcome! I am so glad you are here. I am very excited for you to try this book. I wrote it after years of frustration, teaching from books that didn't focus on the right things that my students needed. My students (and, I think, you) need a solid but not overwhelming introduction to microbiology and infectious diseases. I asked myself: What are the major concepts I want my students to remember five years from now? And then I worked backward from there, making sure everything pointed to the big picture. And of course, the COVID-19 pandemic has made it clear how important this subject matter is to all of us.

While this book has enough detail to give you context, there is not so much detail that you will lose sight of the major principles. Biological processes are described right next to the illustrations that illustrate them. A working nurse, Jennifer Lusk, brings her experience to life on the pages and shows you how this information will matter to you when you are working as a health care provider. My coauthor, Heidi Smith, writes all of the online content specifically for this book. I don't think you'll find a better online set of learning tools anywhere.

I really wanted this to be a different kind of book. I use it in my own classes and my students love it! Well, maybe they have to say that, but I hope you truly do enjoy it and find it to be a refreshing kind of science book.

—Kelly Cowan

C Squared Studios/Photodisc/Getty Images

I dedicate this book to every front-line health care worker. During the COVID-19 pandemic your heroism has become obvious to all.–Kelly

I dedicate this book to my daughter, Ryleigh, who is just starting her journey to becoming an RN, as well as all of the other diligent students who are working hard to learn to help others prevent and heal from disease.–Heidi

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A complete course platform

Connect enables you to build deeper connections with your students through cohesive digital content and tools, creating engaging learning experiences. We are committed to providing you with the right resources and tools to support all your students along their personal learning journeys.

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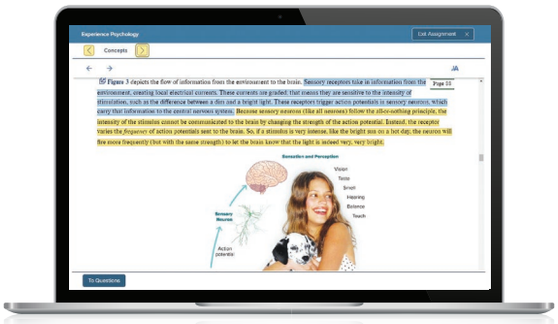

Laptop: Getty Images; Woman/dog: George Doyle/Getty Images

Every learner is unique

In Connect, instructors can assign an adaptive reading experience with SmartBook®. Rooted in advanced learning science principles, SmartBook delivers each student a personalized experience, focusing students on their learning gaps, ensuring that the time they spend studying is time well spent.
mheducation.com/highered/connect/smartbook

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Encourage your students to download the free ReadAnywhere® app so they can access their online eBook, SmartBook, or Adaptive Learning Assignments when it's convenient, even when they're offline. And since the app automatically syncs with their Connect account, all of their work is available every time they open it. Find out more at
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"I really liked this app—it made it easy to study when you don't have your textbook in front of you."

Jordan Cunningham, a student at *Eastern Washington University*

Effective tools for efficient studying

Connect is designed to help students be more productive with simple, flexible, intuitive tools that maximize study time and meet students' individual learning needs. Get learning that works for everyone with Connect.

SUPPORT AT every step

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McGraw Hill works directly with Accessibility Services departments and faculty to meet the learning needs of all students. Please contact your Accessibility Services Office, and ask them to email **accessibility@mheducation.com**, or visit **mheducation.com/about/accessibility** for more information.

Affordable solutions, added value

Make technology work for you with LMS integration for single sign-on access, mobile access to the digital textbook, and reports to quickly show you how each of your students is doing. And with our Inclusive Access program, you can provide all these tools at the lowest available market price to your students. Ask your McGraw Hill representative for more information.

Solutions for your challenges

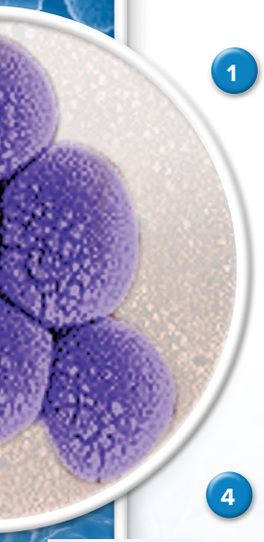
A product isn't a solution. Real solutions are affordable, reliable, and come with training and ongoing support when you need it and how you want it. Visit **supportateverystep.com** for videos and resources both you and your students can use throughout the term.

Updated and relevant content

Our new Evergreen delivery model provides the most current and relevant content for your course, hassle-free. Content, tools, and technology updates are delivered directly to your existing McGraw Hill Connect® course. Engage students and freshen up assignments with up-to-date coverage of select topics and assessments, all without having to switch editions or build a new course.

UNIQUE INTERACTIVE QUESTION TYPES

Unique Interactive Question Types in Connect, Tagged to ASM's Curriculum Guidelines for Undergraduate Microbiology



Janice Carr/CDC

1. **Case Study:** Case studies come to life in a learning activity that is interactive, self-grading, and assessable. The integration of the cases with videos and animations adds depth to the content, and the use of integrated questions forces students to stop, think, and evaluate their understanding. Some of these case studies involve a critical reading of popular media articles on relevant microbiology topics.
2. **Concept Maps:** Concept maps allow students to manipulate terms in a hands-on manner in order to assess their understanding of chapter-wide topics. Students become actively engaged and are given immediate feedback, enhancing their understanding of important concepts within each chapter.
3. **What's the Diagnosis:** Specifically designed for the disease chapters of the text, this is an integrated learning experience designed to assess the student's ability to utilize information learned in the preceding chapters to successfully culture, identify, and treat a disease-causing microbe in a simulated patient scenario. This question type is true experiential learning and allows the students to think critically through a real-life clinical situation.
4. **SmartGrid Questions:** SmartGrid questions replace the traditional end-of-chapter questions, and all of these questions are available for assignment in Connect. This question grid takes the topics from the chapter and arranges them with respect to the American Society for Microbiology's Nursing and Allied Health Curriculum Guidelines that are addressed in this chapter. Three questions are supplied about each relevant guideline, in increasing levels of Bloom's taxonomy for learning.
5. **Animation Learning Modules:** Making use of McGraw Hill's collection of updated videos and animations, this question type presents an interactive, self-grading, and scaffolded activity. These modules take a stand-alone, static animation and turn it into an interactive learning experience for your students with real-time remediation.
6. **Labeling:** Using the high-quality art from the textbook and other reliable sources, check your students' visual understanding as they practice interpreting figures and learning structures and relationships. Easily edit or remove any label you wish!
7. **Classification:** Ask students to organize concepts or structures into categories by placing them in the correct "bucket."
8. **Sequencing:** Challenge students to place the steps of a complex process in the correct order.
9. **Composition:** Fill in the blanks to practice vocabulary and show a critical understanding of the connections between several different concepts. These exercises may qualify as "writing across the curriculum" activities.
10. **Animations:** Animation quizzes pair our high-quality animations with questions designed to probe student understanding of the illustrated concepts.

All McGraw Hill Connect content is tagged to Learning Outcomes for each chapter as well as topic, textbook section, Bloom's Level, and ASM Nursing and Allied Health Curriculum Guidelines to assist you in customizing assignments and in reporting on your students' performance against these points. This will enhance your ability to assess student learning in your courses by allowing you to align your learning activities to peer-reviewed standards from an international organization.

NCLEX®

NCLEX® Prep Questions: Sample questions are available in Connect to assign to students, and there are questions throughout the book as well.

Source: CDC/Janice Haney Carr (*S. aureus* and *Legionella*); Source: CDC/Dr. Erskine Palmer & Byron Skinner (Rotavirus); Source: CDC/Dr. Stan Erlandsen (*Giardia* cyst); ©Science Photo Library/ Getty Images (white blood cells); ©Steve Gschmeissner/ Science Source (fallopian tube surface); NIAID, NIH/Rocky Mountain Laboratories (*Salmonella typhimurium*)

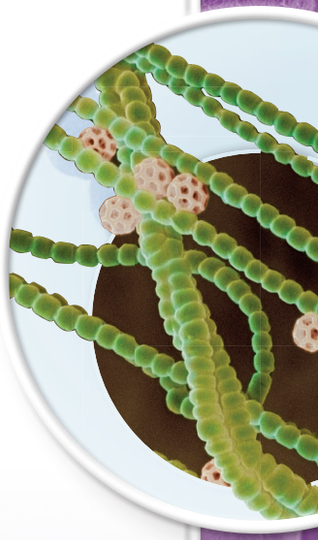
ADDITIONAL RESOURCES

Virtual Labs Virtual Labs and Lab Simulations

While the biological sciences are hands-on disciplines, instructors are often asked to deliver some of their lab components online: as full online replacements, supplements to prepare for in-person labs, or make-up labs.

These simulations help each student learn the practical and conceptual skills needed, then check for understanding and provide feedback. With adaptive pre-lab and post-lab assessment available, instructors can customize each assignment.

From the instructor's perspective, these simulations may be used in the lecture environment to help students visualize complex scientific processes, such as DNA technology or Gram staining, while at the same time providing a valuable connection between the lecture and lab environments.



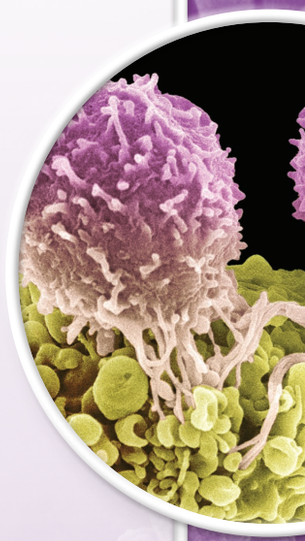
Steve Gschmeissner/
Science Photo Library/
Getty Images

Relevancy Modules for Microbiology

With the help of our Relevancy Modules within McGraw Hill Connect, students can see how microbiology actually relates to their everyday lives. For this book, students and instructors can access the Relevancy Modules eBook at no additional cost. Auto-graded assessment questions that correlate to the modules are also available within Connect. Each module consists of videos, an overview of basic scientific concepts, and then a closer look at the application of these concepts to the relevant topic. Some topics include microbiome, immunology, microbes and cancer, fermentation, vaccines, biotechnology, global health, SARS-CoV-2, antibiotic resistance, and several others.

Prep for Microbiology

is designed to get students ready for a forthcoming course by quickly and effectively addressing prerequisite knowledge gaps that may cause problems down the road. This question bank highlights a series of questions, including Fundamentals of Science, Fundamentals of Math and Statistics, Fundamental Skills for the Scientific Laboratory, and Student Success, to give students a refresher on the skills needed to enter and be successful in their course! Prep maintains a continuously adapting learning path individualized for each student, and tailors content to focus on what the student needs to master in order to have a successful start in the new class.



Steve Gschmeissner/
Science Source

Writing Assignment

Available within Connect and Connect Master, the Writing Assignment tool delivers a learning experience to help students improve their written communication skills and conceptual understanding. As an instructor you can assign, monitor, grade, and provide feedback on writing more efficiently and effectively.

Explore our microbiology articles and podcasts dedicated to sharing ideas, best practices, teaching tips, and more! **www.mheducation.com/highered/microbiology.html**

NewsFlash brings the real world into your classroom! These activities in Connect tie current news stories to key concepts. After interacting with a contemporary news story, students are assessed on their ability to make the connections between real-life events and course content.

Remote Proctoring & Browser-Locking Capabilities

Remote proctoring and browser-locking capabilities, hosted by Proctorio within Connect, provide control of the assessment environment by enabling security options and verifying the identity of the student.

Seamlessly integrated within Connect, these services allow instructors to control the assessment experience by verifying identification, restricting browser activity, and monitoring student actions.

Instant and detailed reporting gives instructors an at-a-glance view of potential academic integrity concerns, thereby avoiding personal bias and supporting evidence-based claims.

ReadAnywhere®

Read or study when it's convenient for you with McGraw Hill's free ReadAnywhere app. Available for iOS or Android smartphones or tablets, ReadAnywhere gives users access to McGraw Hill tools including the eBook and SmartBook or Adaptive Learning Assignments in Connect. Take notes, highlight, and complete assignments offline—all of your work will sync when you open the app with WiFi access. Log in with your McGraw Hill Connect username and password to start learning—anytime, anywhere!

OLC-Aligned Courses

Implementing High-Quality Online Instruction and Assessment through Preconfigured Courseware

In consultation with the Online Learning Consortium (OLC) and our certified Faculty Consultants, McGraw Hill has created preconfigured courseware using OLC's quality scorecard to align with best practices in online course delivery. This turnkey courseware contains a combination of formative assessments, summative assessments, homework, and application activities, and can easily be customized to meet an individual's needs and course outcomes. For more information, visit www .mheducation.com/highered/olc.

Create

Your Book, Your Way

McGraw Hill's Content Collections Powered by Create® is a self-service website that enables instructors to create custom course materials—print and eBooks—by drawing upon McGraw Hill's comprehensive, cross-disciplinary content. Choose what you want from our high-quality textbooks, articles, and cases. Combine it with your own content quickly and easily, and tap into other rights-secured, third-party content such as readings, cases, and articles. Content can be arranged in a way that makes the most sense for your course, and you can include the course name and information as well. Choose the best format for your course: color print, black-and-white print, or eBook. The eBook can be included in your Connect course and is available on the free ReadAnywhere app for smartphone or tablet access as well. When you are finished customizing, you will receive a free digital copy to review in just minutes! Visit McGraw Hill Create—www .mcgrawhillcreate.com—today and begin building!

Test Builder in Connect

Available within Connect, Test Builder is a cloud-based tool that enables instructors to format tests that can be printed, administered within a Learning Management System, or exported as a Word document of the test bank. Test Builder offers a modern, streamlined interface for easy content configuration that matches course needs, without requiring a download.

Test Builder allows you to:

- access all test bank content from a particular title.
- easily pinpoint the most relevant content through robust filtering options.
- manipulate the order of questions or scramble questions and/or answers.
- pin questions to a specific location within a test.
- determine your preferred treatment of algorithmic questions.
- choose the layout and spacing.
- add instructions and configure default settings.

Test Builder provides a secure interface for better protection of content and allows for just-in-time updates to flow directly into assessments.

Polling

Every learner has unique needs. Uncover where and when you're needed with the new Polling tool in McGraw Hill Connect! Polling allows you to discover where students are in real time. Engage students and help them create connections with your course content while gaining valuable insight during lectures. Leverage polling data to deliver personalized instruction when and where it is needed most.

Tegrity: Lectures 24/7

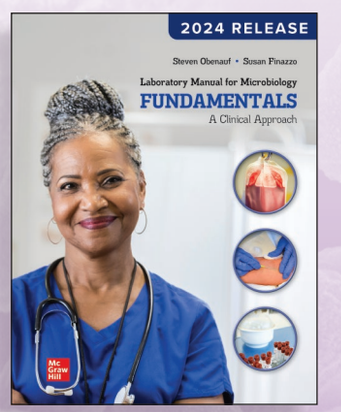
Tegrity in Connect is a tool that makes class time available 24/7 by automatically capturing every lecture. With a simple one-click start-and-stop process, you capture all computer screens and corresponding audio in a format that is easy to search, frame by frame. Students can replay any part of any class with easy-to-use, browser-based viewing on a PC, Mac, or other mobile device.

Educators know that the more students can see, hear, and experience class resources, the better they learn. In fact, studies prove it. Tegrity's unique search feature helps students efficiently find what they need, when they need it, across an entire semester of class recordings. Help turn your students' study time into learning moments immediately supported by your lecture. With Tegrity, you also increase intent listening and class participation by easing students' concerns about note-taking.

Microbiology Fundamentals Laboratory Manual, 2024 Release

Steven Obenauf, Broward College
Susan Finazzo, Perimeter College, Georgia State University

Written specifically for pre-nursing and allied health microbiology students, this manual features brief, visual exercises with a clinical emphasis.

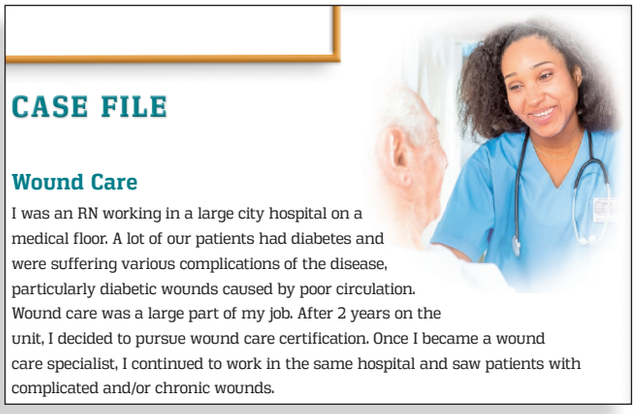


CLINICAL

Clinical applications help students see the relevance of microbiology.

Case File Each chapter begins with a case written from the perspective of a student who is working in health care now.

These relatable introductions provide a specific example of how the chapter content is relevant to real life and future health care careers.



CASE FILE

Wound Care

I was an RN working in a large city hospital on a medical floor. A lot of our patients had diabetes and were suffering various complications of the disease, particularly diabetic wounds caused by poor circulation. Wound care was a large part of my job. After 2 years on the unit, I decided to pursue wound care certification. Once I became a wound care specialist, I continued to work in the same hospital and saw patients with complicated and/or chronic wounds.

Shutterstock/GagliardiImages

Medical Moment

Plastic Bottles for Clean Water

Every week around the world, 30,000 people die from lack of clean water. Ninety percent of these are children under 5 years old. Clean water—taken for granted in the developed world—is a resource more precious than gold on the rest of the planet. Even though we take it for granted, the processes and infrastructure used to deliver it to us are complex and expensive. How can we export those to other settings? Maybe we don't have to. Solar water disinfection is a method of safely disinfecting drinking water by simply placing contaminated water in a transparent plastic bottle and leaving it in the sun for 6 hours. Ultraviolet light kills bacteria and parasites and inactivates viruses, making the water safe. This technique has been used all over the world in impoverished nations where citizens have no access to clean drinking water, and it has proven to be an effective way of preventing diarrheal disease.

Q. Would you suspect that the water treated this way becomes sterile?

Khalil Senosi/AP Images

Medical Moment These boxes give students a more detailed application of a nearby concept in the chapter. Each Medical Moment ends with a question. Answers appear in Appendix B.

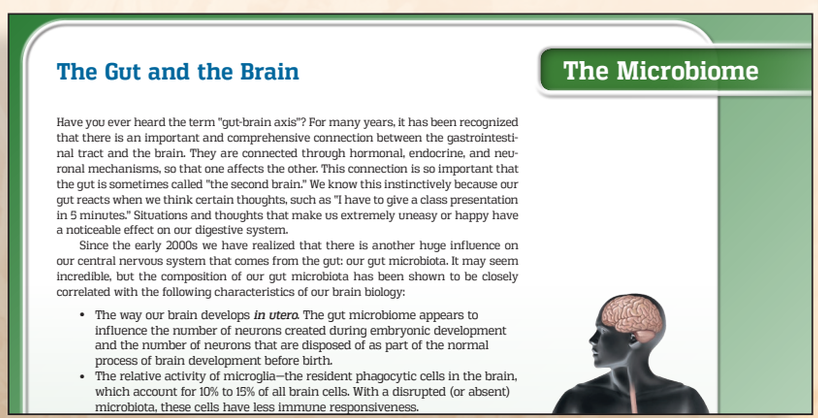
NCLEX® Prep Questions Found throughout the chapter, these multiple-choice questions are application-oriented and designed to help students learn the microbiology information they will eventually need to pass the NCLEX® examination. Students will begin learning to think critically, apply information, and, over time, prep themselves for the examination.

Additional questions are available in Connect for homework and assessment.

NCLEX® PREP

1. Which of the following factors would promote progression of an infection? Select all that apply.

- **a.** *Low microbial virulence*
- **b.** *Proper portal of entry*
- **c.** *Genetic profile of host resistance to microbe*
- **d.** *No previous exposure to this infection*
- **e.** *Host immunosuppression*



The Microbiome

The Gut and the Brain

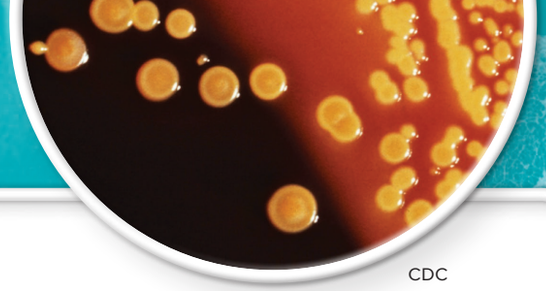
Have you ever heard the term "gut-brain axis"? For many years, it has been recognized that there is an important and comprehensive connection between the gastrointestinal tract and the brain. They are connected through hormonal, endocrine, and neuronal mechanisms, so that one affects the other. This connection is so important that the gut is sometimes called "the second brain." We know this instinctively because our gut reacts when we think certain thoughts, such as "I have to give a class presentation in 5 minutes." Situations and thoughts that make us extremely uneasy or happy have a noticeable effect on our digestive system.

Since the early 2000s we have realized that there is another huge influence on our central nervous system that comes from the gut: our gut microbiota. It may seem incredible, but the composition of our gut microbiota has been shown to be closely correlated with the following characteristics of our brain biology:

- The way our brain develops *in utero*. The gut microbiome appears to influence the number of neurons created during embryonic development and the number of neurons that are disposed of as part of the normal process of brain development before birth.
- The relative activity of microglia—the resident phagocytic cells in the brain, which account for 10% to 15% of all brain cells. With a disrupted (or absent) microbiota, these cells have less immune responsiveness.

The Microbiome Each chapter ends with a reading about a microbiome discovery or story that is relevant to that chapter.

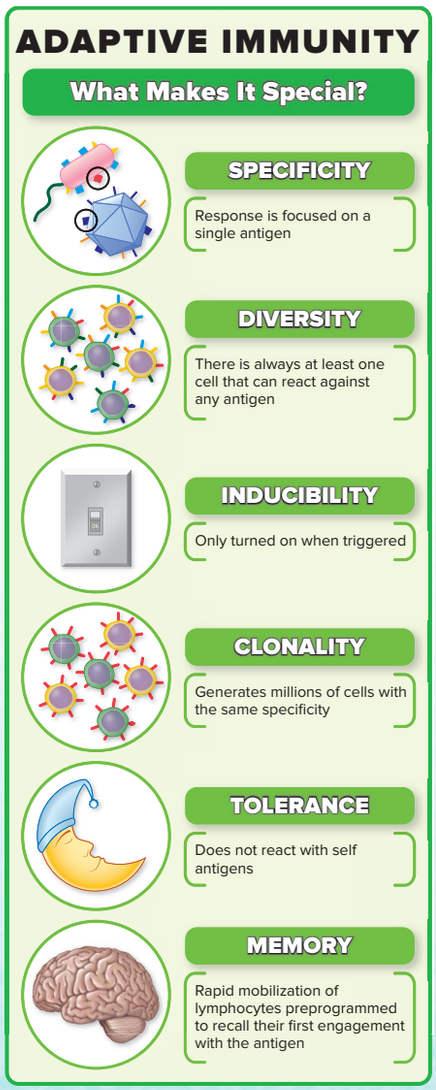
VISUAL



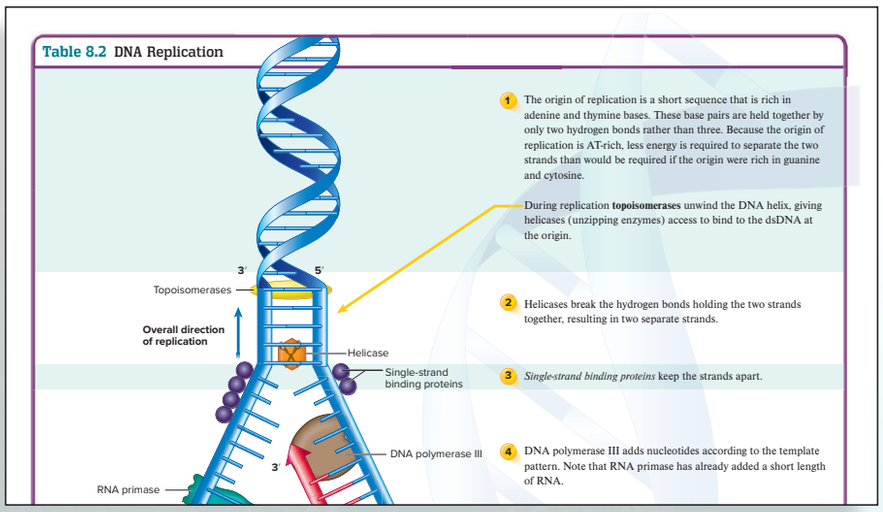
CDC

Visually appealing layouts and vivid art closely linked to narrative for easier comprehension.

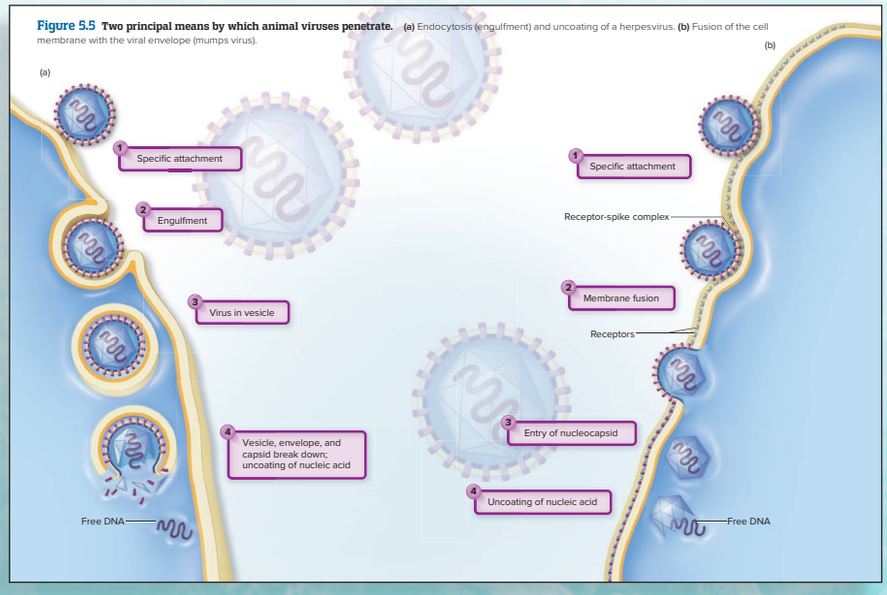
Infographics Infographic-style visual summaries that students can relate to.



Visual Tables The most important points explaining a concept are distilled into table format and paired with the relevant art.



Process Figures Complex processes are broken into easy-to-follow steps. Numbered steps help students walk through the figure.



BRIEF

Streamlined coverage of core concepts helps students retain information that matters.

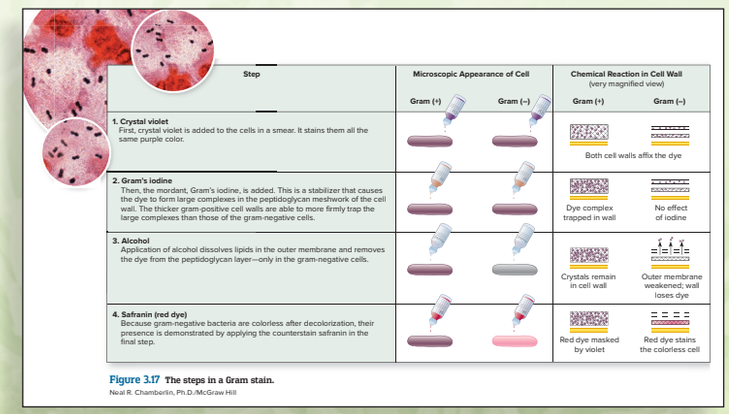
Martin Oeggerli/
Science Source

Chemistry topics required for understanding microbiology are combined with the foundational content found in chapter 1.

Basic genetics and genetic engineering are synthesized into one chapter covering the concepts that are key to microbiology students.

A chapter in microbiology textbooks that is often not used in health-related classes becomes relevant because it presents the 21st-century idea of "One Health"—that the environment and animals influence human health and infections. This is extremely relevant to the COVID-19 pandemic, and the climate change crisis.

Brief Contents



Step	Microscopic Appearance of Cell		Chemical Reaction in Cell Wall (very magnified view)	
	Gram (+)	Gram (–)	Gram (+)	Gram (–)
1. Crystal violet First, crystal violet is added to the cells in a smear. It stains them all the same purple color.			Both cell walls affix the dye	
2. Gram's iodine Then, the mordant, Gram's iodine, is added. This is a stabilizer that causes the dye to form large complexes in the peptidoglycan meshwork of the cell wall. The thicker gram-positive cell walls are able to more firmly trap the large complexes than those of the gram-negative cells.			Dye complex trapped in wall	No effect of iodine
3. Alcohol Application of alcohol dissolves lipids in the outer membrane and removes the dye from the peptidoglycan layer—only in the gram-negative cells.			Crystals remain in cell wall	Outer membrane weakened; wall loses dye
4. Safranin (red dye) Because gram-negative bacteria are colorless after decolorization, their presence is demonstrated by applying the counterstain safranin in the final step.			Red dye masked by violet	Red dye stains the colorless cell

Figure 3.17 The steps in a Gram stain.
Neal R. Chamberlin, Ph.D./McGraw Hill

Duplication Eliminated Detail is incorporated into figures so students can learn in context with the art. This allows a more concise narrative flow while still retaining core information.

Changes to 2024 Release

Global Changes

COVID-19 content In all chapters—used as an illustration of the sometimes esoteric concepts in a way that has immediacy for students.

New epidemiological information in each disease chapter Case fatality rates, reproduction numbers, and herd immunity thresholds are included for each infection for which they are known.

Chapter summaries The chapter summaries have been converted into succinct, visual infographics, a format students are accustomed to and that provides the high points in a format that is reproduced chapter after chapter.

ASM MINAH Curriculum Guidelines Questions in each chapter are tagged for the *Microbiology in Nursing and Allied Health* standards, compiled by the American Society for Microbiology.

Renewed emphasis on diversity, equity, and inclusion (DEI) Although Cowan texts have always aimed for equity in our visual representations and language, in this edition, we have redoubled our efforts. We worked hard to be inclusive of cultural diversity and gender representations. More diversity is represented, and nonbinary and religiously diverse people are included. Information about non-Western scientists has been included. This work will never stop, and we welcome comments about how we can do even better.

Color contrast and accessibility In every chapter we have improved the colors and contrasts of labels, colors, and other details to assist readers who have variations in visual acuity and color vision, and to make details more visible in classroom projection.

Chapter Highlights

Chapter 1 Used an early figure (Figure 1.5) to walk students through how to read a graph. Added information about neglected tropical diseases (WHO) and neglected parasitic diseases in U.S. (CDC). Updated evolutionary history graph. Discussed watching science unfold in public during COVID, and mistakes made.

Chapter 2 Added a photo and text of Fanny Hesse, who invented agar growth medium. Updated maximum size of bacterium to reflect discovery of *Thiomargarita magnifica*.

Chapter 3 Specifically addressed exceptions to the norm in biology, in the context of our continuing discoveries of polyploidy bacteria.

Chapter 4 Added information about the mucormycosis fungal outbreak in India during COVID-19.

Chapter 5 Added information about the number of viruses in the sky and falling from it, as well as SARS-CoV-2 as an example of a positive-strand RNA virus. Introduced Baltimore classification system of viruses. Updated classification of human prion diseases. Added information about Indian female biologist Kamal Ranadive, who connected viruses to cancer in the 1960s. Added information on oncolytic viruses. Added information on the possible role of Epstein-Barr virus in long COVID.

Chapter 6 Expanded discussion of the role of microbial antagonism in the human gut microbiome. Added information about artificial joints and biofilms.

Chapter 7 Added information about nitrate production from the microbiome and its possible damage to blood vessels.

Chapter 8 Added information that even silent mutations can have an effect on translation. Introduced CRISPR and photo of Jennifer Doudna and Emmanelle Charpentier, Nobel Prize winners.

Chapter 9 Added information about disinfecting and filtering for SARS-CoV-2, and why hand washing is important for protection against COVID, due to the number of times we touch our faces.

Chapter 10 Addition of MBC to MIC discussion, highlighting its importance in immunocompromised patients. Added *therapeutic window* as a term. New Medical Moment about the importance of taking antibiotics at the correct times. Information about how most people who report being allergic to penicillin are not allergic, but have experienced some mild toxicity in the past.

Chapter 11 Expanded section on herd immunity, adding a figure. New text about R_0, case fatality rate (with tables), and herd immunity thresholds. Clarified difference between microbiome and microbiota. Used COVID to illustrate how and why some people get infected and others do not, and why some people get frank disease and others do not. Used COVID to illustrate the difference between direct respiratory transfer and indirect air transfer, noting that both are seen with this virus. New infographic illustrating healthcare-associated infections.

Chapter 12 Revamped the discussion of blood cell lineages to include the paradigm-shifting discovery of innate lymphoid cells (ILCs). This led to a new nomenclature of cells as being from a common lymphoid precursor or from a common myeloid precursor. Added the concept of the interstitium. Added new information that normal body temperature might be lower than 98.6°F.

Chapter 13 Incorporated the innate lymphoid cell (ILC) system into discussion of T cell activity. Discussed discovery that live attenuated vaccines for other diseases can boost immunity to third-party diseases. This plays into an increased emphasis on vaccine inequities in this chapter. COVAX, its intentions and failures, is discussed. Used discussion of the speedy approval of COVID-19 vaccines to put emphasis on understanding the vaccine development and approval process, including Emergency Use Authorization. New sections on herd immunity and booster shots.

Chapter 15 Added information about COVID testing in all its forms. Added special icons and text in several sections highlighting

bloodstream infections. Updated language of indirect and direct fluorescence tests to “DFA” and “IFA”. Added complement fixation and took out pulsed-field gel electrophoresis and explained that the CDC now uses whole genome sequencing in their food outbreak investigations. Updated language for DNA techniques to the terminology used in clinical labs: nucleic acid tests (NAATs).

Chapter 16 New smallpox/Mpox vaccine.

Chapter 17 Note added that SARS-CoV-2 infection also causes neurological symptoms. Added information about wildfire smoke carrying fungi long distances. Information about baby formula shortage caused by *Cronobacter* contamination added.

Chapter 18 COVID-19 is in this chapter, with an explanation of why. In discussion of normal biota, the role of gut microbiota in hypertension is addressed. Made COVID-19 and septicemia Highlight Diseases, and moved HIV and malaria to “ordinary” status. New malaria vaccine for children. Discussed impact of pandemic on reducing new HIV infections.

Chapter 19 More information about why some flu is called bird flu, and why bird flu outbreaks are closely monitored. Big new graph illustrating and comparing the influenza and pneumonia deaths every year with COVID-19 deaths.

Chapter 20 More emphasis on the effects of dysbiosis. Role of backyard chickens in *Salmonella* outbreaks. First fecal transplantation treatment approved by FDA. Added photo of Rita Colwell and her inventive approach to cholera mitigation—the use of women’s saris to filter out the copepods harboring the bacterium. Added discussion and photograph of Ruth Bishop, who discovered rotavirus, leading to vaccines that saved millions. Added illustration of depths of periodontal pockets. Added photo of LGBTQ couple with child. Revisited neglected tropical diseases (NTDs—international) and neglected parasitic infections (NPI—U.S.).

Chapter 21 Added the gut-kidney axis. Problems with urinary catheters. Information about how to increase detection of STIs by making patients and health care professionals more comfortable talking about them. More instructions on how to interpret graphs. Information that *Mycoplasma genitalium* and *Neisseria meningitidis* are causing increasing numbers of STIs. Link between HSV-1 and neurodegenerative diseases such as Alzheimer’s and ALS. HSV vaccine in trials.

Chapter 22 Added entire section devoted to spillover events. Added the idea of wastewater surveillance for SARS-CoV-2 (and history of tracking polio that way). Added Mpox to emerging disease table. Emphasis on new, as yet undiscovered, viruses. The central role of bats. Wildfire seasons lengthening.

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—Kelly Cowan

I, too, am thankful for the many students that enter my classroom every year. My work is greatly inspired by their questions, their ideas, and their unique way of looking at complex things. I am filled with gratitude to Kelly Cowan for her willingness to partner with me; I constantly learn from her about better ways to reach all students. I appreciate the entire microbiology team at McGraw Hill who truly believes in producing materials that lead to student success.

—Heidi Smith

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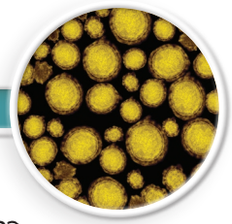

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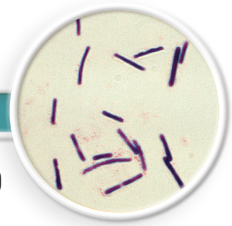

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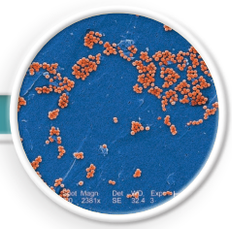

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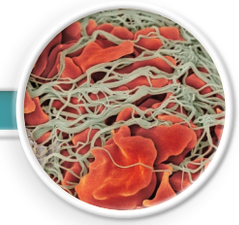

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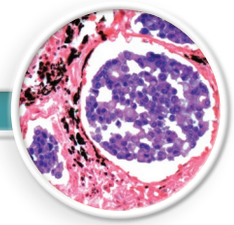

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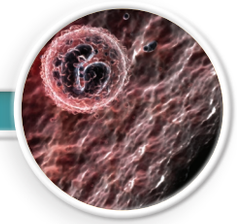

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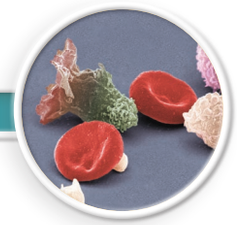

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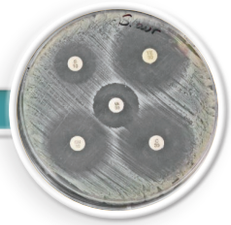

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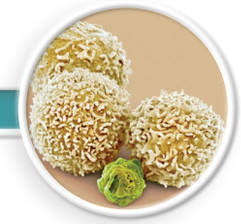

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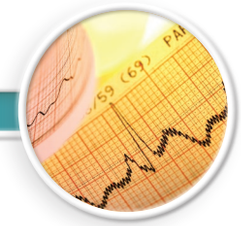

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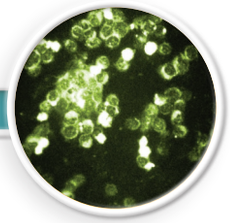

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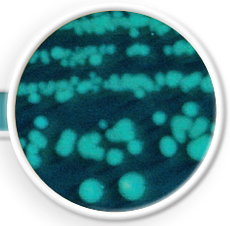

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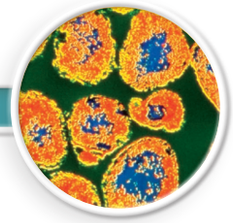

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