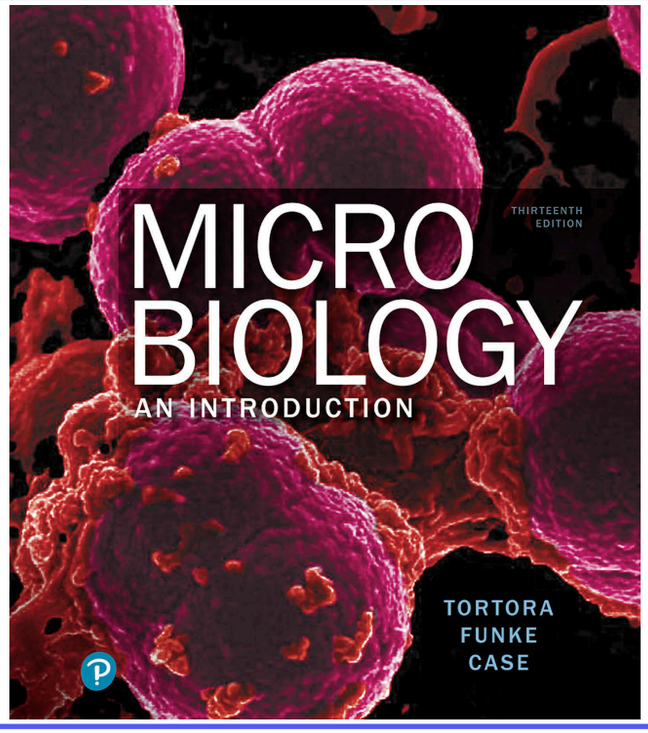
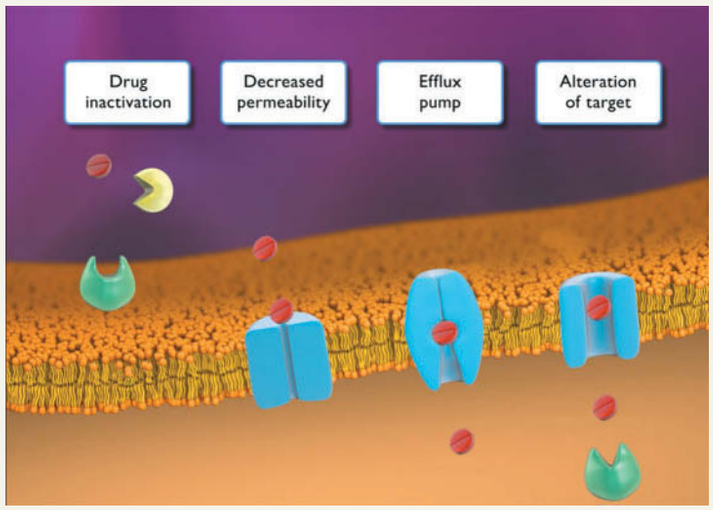


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or scan the QR code to access the digital study portal.

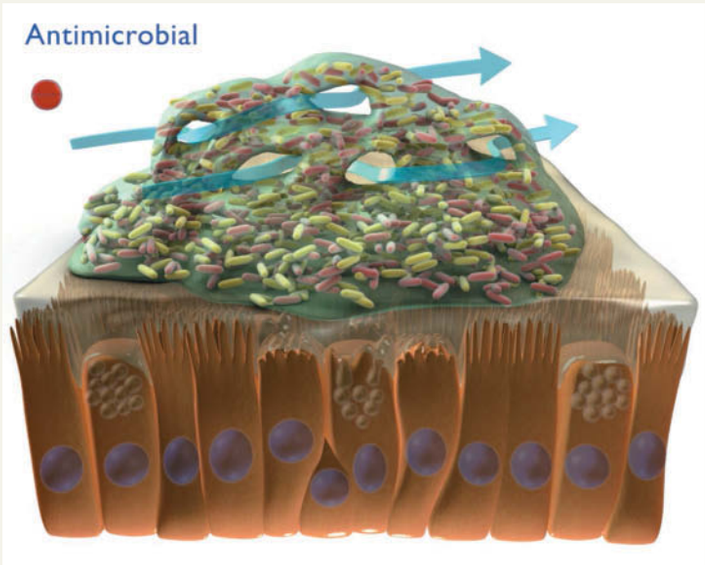
understanding the toughest

Interactive Microbiology is a dynamic suite of interactive tutorials and animations that teach key microbiology concepts. Students actively engage with each topic and learn from manipulating variables, predicting outcomes, and answering assessment questions that test their understanding of basic concepts and their ability to integrate and build on these concepts. These are available in Mastering Microbiology.



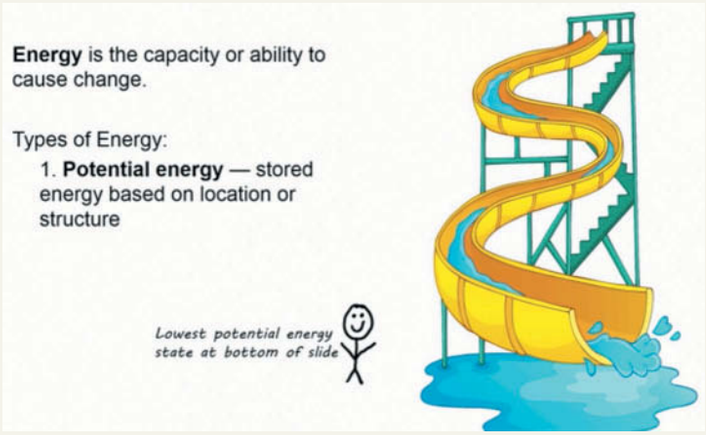
NEW! Even more Interactive Microbiology modules are available for Fall 2018. Additional titles include:

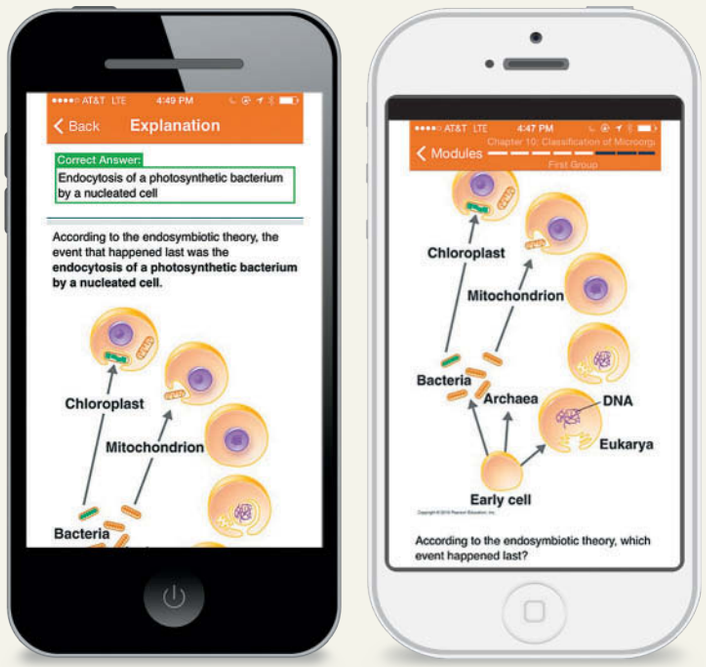
- Antimicrobial Resistance: Mechanisms
- Antimicrobial Resistance: Selection
- Aerobic Respiration in Prokaryotes
- The Human Microbiome



concepts in microbiology?

MicroBoosters are a suite of brief video tutorials that cover key concepts some students may need to review or relearn. Titles include Study Skills, Math, Scientific Terminology, Basic Chemistry, Cell Biology, and Basic Biology.





Dynamic Study Modules help students acquire, retain, and recall information faster and more efficiently than ever before. The flashcard-style modules are available as a self-study tool or can be assigned by the instructor.

NEW! Instructors can now remove questions from **Dynamic Study Modules** to better fit their course.

organizing and synthesizing

Big Picture spreads integrate text and illustrations to help students gain a broad, "big picture" understanding of important course topics.

Each Big Picture spread includes an overview that **breaks down important concepts** into manageable steps and gives students a clear learning framework for related chapters. Each spread includes Key Concepts that **help students make the connection** between the presented topic and previously learned microbiology principles. Each spread is paired with a coaching activity and assessment questions in Mastering Microbiology.

BIG PICTURE

Bioterrorism

Biological agents were first tapped by armies, and now by terrorists. Today, technology and ease of travel increase the potential damage.

History of Bioweapons

Biological weapons (bioweapons)—pathogens intentionally used for hostile purposes—are not new. The "ideal" bioweapon is one that disseminates by aerosol, spreads efficiently from human to human, causes debilitating disease, and has no readily available treatment.

The earliest recorded use of a bioweapon occurred in 1346 during the Siege of Kaffa, in what is now known as Feodosia, Ukraine. There the Tartar army catapulted their own dead soldiers' plague-ridden bodies over city walls to infect opposing troops. Survivors from that attack went on to introduce the "Black Death" to the rest of Europe, sparking the plague pandemic of 1348–1350.

In the eighteenth century, blankets contaminated with smallpox were intentionally introduced into Native American populations by the British during the French and Indian War. And during the Sino-Japanese War (1937–1945), Japanese planes dropped canisters of fleas carrying *Yersinia pestis* bacteria, the causative agent of plague, on China. In 1975, *Bacillus anthracis* endospores were accidentally released from a bioweapon production facility in Sverdlovsk.



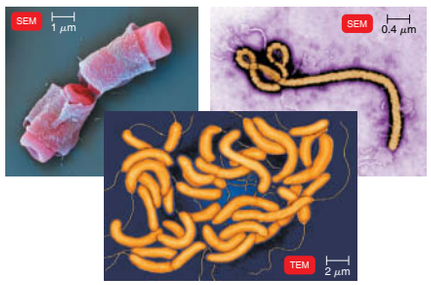
A citadel in Ukraine, location of the first known biowarfare attack in history.

Selected Diseases Identified as Potential Bioweapons

Bacterial	Viral
Anthrax (*Bacillus anthracis*)	Nonbacterial meningitis (Arenaviruses)
Psittacosis (*Chlamydophila psittaci*)	*Hantavirus* disease
Botulism (*Clostridium botulinum* toxin)	Hemorrhagic fevers (Ebola, Marburg, Lassa)
Tularemia (*Francisella tularensis*)	Monkeypox
Cholera (*Vibrio cholerae*)	Nipah virus infection
Plague (*Yersinia pestis*)	Smallpox

Biological Weapons Banned in the Twentieth Century

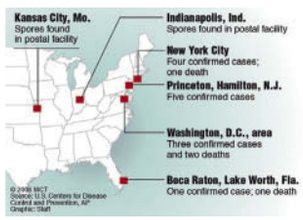
The Geneva Conventions are internationally agreed upon standards for conducting war. Written in the 1920s, they prohibited deploying bioweapons—but did not specify that possessing or creating them was illegal. As such, most powerful nations in the twentieth century continued to create bioweapons, and the growing stockpiles posed an ever-growing threat. In 1975, the Biological Weapons Convention banned both possession and development of biological weapons. The majority of the world's nations ratified the treaty, which stipulated that any existing bioweapons be destroyed and related research halted.



***(Clockwise from top left): Bacillus anthracis, Ebolavirus,* and *Vibrio cholerae* are just a few microbes identified as potential bioterrorism agents.**

Emergence of Bioterrorism

Unfortunately, the history of biowarfare doesn't end with the ratification of the Biological Weapons Convention. Since then, the main actors engaging in biowarfare have not been nations but rather radical groups and individuals. One of the most publicized bioterrorism incidents occurred in 2001, when five people died from, and many more were infected with, anthrax that an army researcher sent through the mail in letters.



Map showing location of 2001 bioterrorism anthrax attacks.

visual information?

Play MicroFlix 3D Animation
@MasteringMicrobiology

Public Health Authorities Try to Meet the Threat of Bioterrorism

One of the problems with bioweapons is that they contain living organisms, so their impact is difficult to control or even predict. However, public health authorities have created some protocols to deal with potential bioterrorism incidents.



Biological hazard symbol.

New Technologies and Techniques to Identify Bioweapons

Monitoring public health, and reporting incidence of diseases of note, is the first step in any bioterrorism defense plan. The faster a potential incident is uncovered, the greater the chance for containment. Rapid tests are being investigated to detect genetic changes in hosts due to bioweapons even before symptoms develop. Early-warning systems, such as DNA chips or recombinant cells that fluoresce in the presence of a bioweapon, are also being developed.



Pro Strips Rapid Screening System, developed by ADVNT Biotechnologies LLC, is the first advanced multi-agent biowarfare detection kit that tests for anthrax, ricin toxin, botulinum toxin, plague, and SEB (staphylococcal enterotoxin B).

Vaccination: A Key Defense

When the use of biological agents is considered a possibility, military personnel and first -responders (health care personnel and others) are vaccinated—if a vaccine for the suspected agent exists. New vaccines are being developed, and existing vaccines are being stockpiled for use where needed.

The current plan to protect civilians in the event of an attack with a microbe is illustrated by the smallpox preparedness plan. This killer disease has been eradicated from the population, but unfortunately, a cache of the virus remains preserved in research facilities, meaning that it might one day be weaponized. It's not practical to vaccinate all people against the disease. Instead, the U.S. government's strategy following a confirmed smallpox outbreak includes "ring containment and voluntary vaccination." A "ring" of vaccinated/protected individuals is built around the bioterrorism infection case and their contacts to prevent further transmission.



Examining mail for *B. anthracis*.

KEY CONCEPTS

- Vaccination is critical to preventing spread of infectious diseases, especially those that can be weaponized. **(See Chapter 18, "Principles and Effects of Vaccinations," pages 500–501.)**
- Many organisms that could be used for weapons require BSL-3 facilities. **(See Chapter 6, "Special Culture Techniques," pages 161–162.)**
- Tracking pathogen genomics provides information on its source. **(See Chapter 9, "Forensic Microbiology," pages 258–260.)**

Three Big Picture spreads focus on **important fundamental topics in microbiology:**

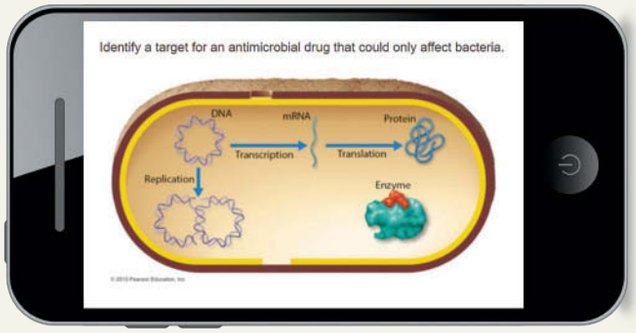
- Metabolism
- Genetics
- Immunity

Eight Big Picture spreads focus on **diseases and related public health issues that present complex real-world challenges:**

- Vaccine-Preventable Diseases
- The Hygiene Hypothesis
- Neglected Tropical Diseases
- Vertical Transmission: Mother to Child
- Climate Change and Disease
- Bioterrorism
- Cholera After Natural Disasters
- STI Home Test Kits

Student Resources

Learning Catalytics is a "bring your own device" (laptop, smartphone, or tablet) student engagement, assessment, and classroom intelligence system. With **Learning Catalytics**, instructors can assess students in real time using open-ended tasks to probe student understanding. Mastering Microbiology users may select from Pearson's library of questions designed especially for use with **Learning Catalytics**.



Instructor Resource Materials for *Microbiology: An Introduction*

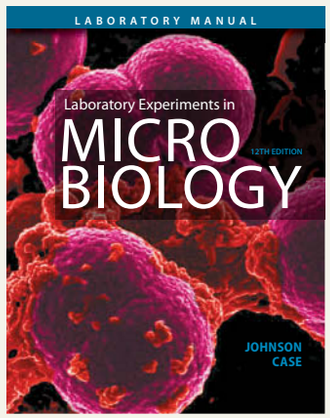
The Instructor Resource Materials organize all instructor media resources by chapter into one convenient and easy-to-use package containing:

- All figures, photos, and tables from the textbook in both labeled and unlabeled formats
- TestGen Test Bank
- MicroFlix animations
- Instructor's Guide

A wealth of additional classroom resources can be downloaded from the Instructor Resources area of Mastering Microbiology.

Laboratory Experiments in Microbiology, 12th Edition by Johnson/Case

0-134-60520-9 / 978-0-134-60520-3



Engaging, comprehensive and customizable, ***Laboratory Experiments in Microbiology*** is the perfect companion lab manual for ***Microbiology: An Introduction***, 13th Edition.

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MICRO BIOLOGY

AN INTRODUCTION

THIRTEENTH EDITION

Gerard J. Tortora
BERGEN COMMUNITY COLLEGE

Berdell R. Funke
NORTH DAKOTA STATE UNIVERSITY

Christine L. Case
SKYLINE COLLEGE



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Library of Congress Cataloging-in-Publication Data

Names: Tortora, Gerard J., author. | Funke, Berdell R., author. | Case, Christine L., 1948- , author.
Title: Microbiology : an introduction / Gerard J. Tortora, Bergen Community College, Berdell R. Funke, North Dakota State University, Christine L. Case, Skyline College.
Description: Thirteenth edition. | Boston : Pearson, [2019] | Includes bibliographical references and index.
Identifiers: LCCN 2017044147| ISBN 9780134605180 (student edition) | ISBN 0134605187 (student edition) | ISBN 9780134709260 (instructor's review copy) | ISBN 0134709268 (instructor's review copy)
Subjects: LCSH: Microbiology.
Classification: LCC QR41.2 .T67 2019 | DDC 579--dc23 LC record available at https://lccn.loc.gov/2017044147

1 17

ISBN 10: 0-13-460518-7; ISBN 13: 978-0-13-460518-0 (Student edition)
ISBN 10: 0-13-470926-8; ISBN 13: 978-0-13-470926-0 (Instructor's Review Copy)

www.pearson.com

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Above all, Jerry is devoted to his students and their aspirations. In recognition of this commitment, MACUB presented Jerry with the organization's 1992 President's Memorial Award. In 1995, he was selected as one of the finest faculty scholars of Bergen Community College and was named Distinguished Faculty Scholar. In 1996, he received a National Institute for Staff and Organizational Development (NISOD) excellence award from the University of Texas and was selected to represent Bergen Community College in a campaign to increase awareness of the contributions of community colleges to higher education.

Jerry is the author of several best-selling science textbooks and laboratory manuals, a calling that often requires an additional 40 hours per week beyond his full-time teaching responsibilities. Nevertheless, he still makes time for four or five weekly aerobic workouts. He also enjoys attending opera performances at the Metropolitan Opera House, Broadway plays, and concerts. He spends his quiet time at his beach home on the New Jersey Shore.

To all my children, the most important gift I have: Lynne, Gerard Jr., Kenneth, Anthony, and Drew, whose love and support have been such an important part of my personal life and professional career.



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Christine L. Case Chris Case is a professor of microbiology at Skyline College in San Bruno, California, where she has taught for the past 46 years. She received her Ed.D. in curriculum and instruction from Nova Southeastern University and her M.A. in microbiology from San Francisco State University. She was Director for the Society for Industrial Microbiology and is an active member of the ASM. She received the ASM and California Hayward outstanding educator awards. Chris received the SACNAS Distinguished Community College Mentor Award for her commitment to her students, several of whom have presented at undergraduate research conferences and won awards. In addition to teaching, Chris contributes regularly to the professional literature, develops innovative educational methodologies, and maintains a personal and professional commitment to conservation and the importance of science in society. Chris is also an avid photographer, and many of her photographs appear in this book.

I owe my deepest gratitude to Don Biederman and our three children, Daniel, Jonathan, and Andrea, for their unconditional love and unwavering support.