

GLOBAL
EDITION



Human Biology

Concepts and Current Issues

EIGHTH EDITION

Michael D. Johnson

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ABOUT THE AUTHOR



Dr. Michael D. Johnson spent most of his youth in the fields and forests of rural Washington, observing nature. He earned his B.S. degree in zoology from Washington State University and then moved east to earn a Ph.D. in physiology from the University of Michigan. After completing a Postdoctoral Research Fellowship at Harvard Medical School, he joined the faculty of West Virginia University, where he remained for most of his career.

In 2001, Dr. Johnson moved to the Middle East, where he served first as the founding dean of Oman Medical College in the Sultanate of Oman and then as associate dean for premedical education at Weill Cornell Medical College in Qatar. In both positions, he directed the premedical education of students from more than 25 countries. He returned to the United States in 2011 to focus on his writing.

Dr. Johnson received several teaching awards during his career, including the West Virginia University Foundation Outstanding Teacher award and the Distinguished Teacher Award of the School of Medicine. He is a member of the American Physiological Society, the Human Anatomy and Physiology Society, the National Association of Biology Teachers, and the American Association for the Advancement of Science.

Whether teaching undergraduates or medical students, Dr. Johnson has always had a keen interest in instilling in students an appreciation of science. He seeks to show students how the advancement of scientific knowledge sometimes raises unforeseen ethical, political, economic, and social issues for all of us to discuss and solve. Through this book, he encourages students to become scientifically literate so that they will feel comfortable making responsible choices as consumers of science.

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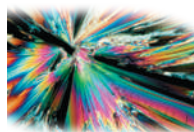
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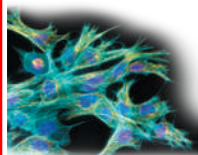
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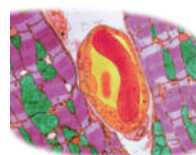
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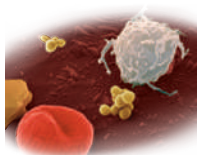
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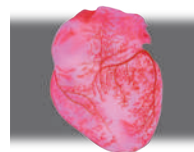
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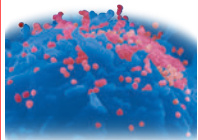
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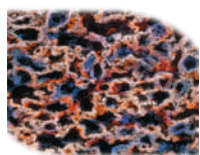
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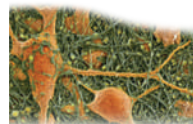
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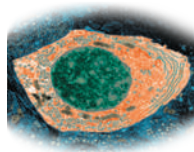
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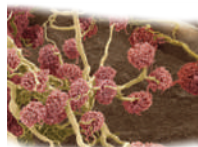
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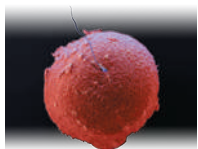


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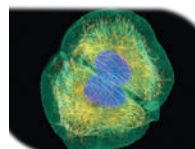
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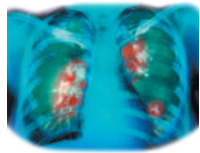
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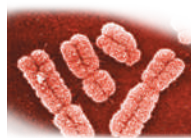
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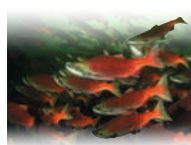


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PREFACE

Should childhood vaccinations be mandatory for school attendance? Are genetically modified organisms (GMOs) a good or a bad thing? How will our future be affected by global warming and global climate change, and what, if anything, should we be doing about these phenomena? Are organic foods better for you than conventional foods?

Questions such as these seem to come up almost daily. Those of us who find these questions and the news stories about them fascinating—and yes, even exciting!—have an obligation to help others understand science and the impact it has on their lives. Science is too much fun and far too important to be left to scientists.

New to This Edition

Changes to this edition are designed to encourage students who do not have a strong background in science to become actively engaged in the course. Improved pedagogy helps students focus their learning, directs their attention to key concepts and current issues in biology, and encourages thoughtful analysis and critical thinking.

- **New organization to the chapter opening material.** To help the student develop an organized approach to a chapter's content, each chapter opener now includes an outline of the main headings and a list of the key concepts to be covered.
- **Addition of a “connections” passage.** The initial section of text in each chapter includes a “connections” passage, delineated by a chain-link icon  that provides the student with a sense of how a chapter's specific topic interrelates to the overall subject of human biology, biology in general, and the larger world.
- **New ways to access MJ's BlogInFocus entries.** To rouse students' interest in the science they encounter in their everyday lives, once again incorporated into each chapter are references to the author's blog. With this edition, the MJ's BlogInFocus is more accessible, as students can now view the blog entries via three different ways: directly with their smartphones by scanning a QR code, online by typing a URL into a search engine, or by visiting the MasteringBiology Web site. Each chapter includes two to four MJ's BlogInFocus references. It is hoped that these references to the author's Web site will encourage students to further explore science related topics that are of particular interest to them.
- **Refreshed Visual Content.** To revitalize the visual content, 120 new photos replace images from the previous edition, and 16 figures are new. More than 30 other figures have been improved from the previous edition.
- **The use of numbered steps.** Where complex processes are described, numbered step icons, , , ,

and so forth, are included both in the text and in the accompanying figure. These correlating step icons will help students follow the logical sequence of events as those events unfold within a complex process.

- **Updated Features, Graphs, Tables, and Text.** Key features of this text are currency and accuracy. Time-dependent data has been updated with the latest information available. The updated text includes eleven new or extensively updated *Current Issue* features, three new Health & Wellness features, and more than 60 new MJ's BlogInFocus entries.

The Focus Is On the Student

This book is written for students who do not yet have a strong background in science so that they, too, might share in the joy and wonder of science. Every effort is made to make the book accurate and up to date while keeping it inviting, accessible, and easy to read. The look and feel of the text is intentionally like that of a news magazine, peppered with short features likely to be of interest to the student and designed with a strong visual appeal.

Each chapter begins with an outline of the main topic headings and a list of key concepts to be covered. Next, a *Current Issue* feature highlights a recent controversy or ethical/social/political issue related to topics to be covered in the chapter. In the introductory section of each chapter, a new “connections” passage helps the student understand just how the topic of the chapter fits into the bigger picture of human biology and the larger world.

Students are naturally curious about how their own bodies work and human diseases and disorders. We capitalize on this curiosity with Health & Wellness features that highlight timely health topics. In addition, organ system chapters generally conclude with a section covering the more common human diseases and disorders.

Once again, a key feature of the book is MJ's BlogInFocus, brief references to a blog Web site written by Dr. Johnson in support of this text. The URL is www.humanbiologyblog.blogspot.com. Two to four MJ's BlogInFocus entries per chapter highlight recent discoveries or news items relevant to the subject of each chapter. Most of the blog entries have an additional embedded URL that takes the student directly to a news source or research paper. We hope that MJ's BlogInFocus entries and the author's blog will encourage curious students to dig a little deeper into topics that interest them. New to this edition are the means by which students can access the blog entries. Students can now get to the blog in any one of three ways: They can scan a QR code, type a URL into a search engine, or visit Pearson's MasteringBiology Web site.

To help students assess whether or not they understand the material, check questions throughout the text allow the students to test their understanding as they go along. Finally, at the end of each chapter is a range of question types, from concept review to recall to application, each designed to test the student's knowledge of facts as well as stimulate their critical thinking skills.

Unifying Themes Tie the Subjects Together

Several unifying themes in biology hold the chapters together. Homeostasis, the state of dynamic equilibrium in which the internal environment of an organism is maintained fairly constant, is one of those recurrent themes. The concept of homeostasis ties in with another recurrent theme: Structure and function are related. Structure/function relationships are the very core of the study of anatomy and physiology, and both of these fields in turn rely on the most unifying concept in all of biology: evolution. Only in the context of evolution can anatomy and physiology be fully understood; without the concept of evolution, very little in biology makes sense.

A predominant theme of this book is that each of us has choices to make—choices that will affect ourselves, other humans, and the entire planet. Should all children be vaccinated against childhood diseases? Should we spend time and money preparing for a pandemic that may never occur? Will we be willing and able to slow the rate of global warming? Is it important that we save other species from extinction, and if so, how should we go about it? Students are encouraged to formulate their own views on these and other topics so that they will feel comfortable with related choices they make.

The Organization Fits the Course

This book was designed to accommodate the fairly standard format for college courses in human biology. There are chapters that introduce science and chemistry, chapters that cover basic human biology from cells through the human organ systems, and finally, chapters on evolution, ecosystems and populations, and human impacts on the environment.

With such broad coverage, however, there is never enough time to teach all that is interesting, exciting, and relevant about human biology in one semester. Fortunately, because each chapter was written to stand on its own, this book allows for a certain degree of flexibility. Instructors wishing to emphasize the basics of human anatomy and physiology or focus on the medical aspects of human biology could omit or de-emphasize the last two chapters. Instructors should also feel free to present the organ system chapters in a different order if they feel more comfortable doing so. Within chapters, sections on diseases and disorders could be omitted or considered optional. Those interested in a more molecular or cellular approach might want to give greater emphasis to Chapters 2–4 and 17–21 and move more quickly through the organ systems chapters. Those more interested in the broader picture of where humans came from and how humans fit into the world order may want to allow sufficient time for the last three chapters, even if it means that they must move quickly or selectively through the organ system chapters. All of these approaches are equally valid.

However much you cover, dig in and enjoy your course!

Michael D. Johnson

KEEP CURRENT IN BIOLOGY

Through his teaching, his textbook, and in his online blog, award-winning teacher Michael D. Johnson sparks your interest by connecting basic biology to real-world issues relevant to your life.



"I hope the blog will stimulate students to go beyond the required reading, leading them to discover and explore subjects of personal interest. When this happens, students will ultimately be learning because they want to, not because they have to, and they'll be more comfortable with science and with biology."

—**Michael Johnson**, Author of *Human Biology: Concepts and Current Issues*

BlogInFocus in-text references appear at applicable points within the chapter and direct you to the blog that provides up-to-date insights on important issues in the news. The blog is updated 3–4 times per month.

NEW! Three options for accessing **Michael Johnson's BlogInFocus entries:** You may scan a QR code using a smartphone, type the URL (www.humanbiologyblog.blogspot.com) into a search engine, or log into your MasteringBiology subscription.

MJ's BlogInFocus Does radiation therapy for cancer treatment ever cause additional cancers? Visit MJ's blog in the Study Area in MasteringBiology and look under "Radiation and Cancer."
<http://goo.gl/nAnLuL>



◀ **BlogInFocus** MasteringBiology™ activities encourage students to read the blog and allow instructors to assess their understanding of the applied material.

ENGAGE WITH HIGH INTEREST ESSAYS

Each chapter opens with Michael Johnson's popular "Current Issue" essays, and BlogInFocus references within the chapter direct you to his frequently updated online blog for breaking human biology-related news.

Located at the start of each chapter, **Current Issue essays** draw you into the subject with interesting science and health news items, connecting human biology to real-world issues. Each essay provides contrasting views on the featured hot topic.

Many **NEW** Current Issue essays replace those from the previous edition, including:

- The 2013 Ebola outbreak (Chapter 9)
- Regulation of e-cigarettes (Chapter 10)
- Choosing between organic or conventional foods (Chapter 14)

CHAPTER 9

The Immune System and Mechanisms of Defense

CURRENT ISSUE
An Outbreak of Ebola

One-year-old Emile Ouamouno of the West African nation of Guinea developed a cough and mild fever. Emile's parents thought nothing of the sickness at first, but then he developed widespread uncontrollable bleeding. Within days, he was dead. Shortly thereafter, his mother, sister, and grandmother all came down with the same symptoms, and all three died. A village nurse and the local midwife also died of the mysterious and apparently contagious disease, but not before the midwife had passed it on to people in the surrounding area.

Young Emile, whose death occurred on December 6, 2013, was posthumously diagnosed with a disease called Ebola hemorrhagic fever (EHF), or simply Ebola. Emile is thought to be patient zero in an ongoing outbreak of Ebola that has spread in Guinea and two neighboring countries, Liberia and Sierra Leone. As of 2013, the death toll from Ebola in those countries is over 8,000.

What is Ebola?
Ebola is an infectious disease caused by a virus called Zaire ebolavirus. The virus's normal hosts are certain animals such as monkeys and bats, but it can also infect humans if there is direct contact with an infected animal's bodily fluids. Young

Emile Ouamouno was probably bitten by an infected fruit fly living in the trees nearby. Once the first person is infected, the Ebola virus is transmitted from human to human by direct contact with bodily fluids such as saliva, nasal mucus, or feces. It's no surprise, then, that the next victims in the most recent outbreak were Emile's relatives and caretakers. An infection begins with symptoms that may include fever, weakness, muscle pain, sore throat, and headache. These early symptoms are followed by vomiting, damage to liver and kidneys, and, in some patients, internal and external bleeding. In the most severe cases, blood begins to leak from every opening and every organ, leading to rapid death.

Questions to Consider

- 1 What should the United States do when an infectious disease breaks out elsewhere in the world? In such a scenario, what is our responsibility and/or what is in our best interests?
- 2 How afraid are you of Ebola? Would you be willing to travel to Guinea if your boss asked you to? Why or why not?

Key Concepts

- The health risk of a pathogen (disease-causing organism) is determined by its transmissibility (how easily it can be passed from person to person), mode of transmission (how it is transmitted; through air, food, blood, etc.), and virulence (how damaging the disease is when one catches it).
- The immune system has nonspecific (against many pathogens) and specific (against one pathogen) defense mechanisms.
- Nonspecific defense mechanisms include immune system cells that engulf and digest foreign cells, chemicals that are toxic to foreign cells, proteins that interfere with viral reproduction, and the development of a fever.
- Specific defense mechanisms involve the production of antibodies and T cells that recognize and inactivate one particular pathogen. Specific defense mechanisms have a memory component that is the basis of immunity.
- Inappropriate immune system activity can lead to allergies and autoimmune diseases.
- AIDS (acquired immune deficiency syndrome) is caused by a virus that targets certain cells of the immune system.

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Key Concepts

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- Inappropriate immune system activity can lead to allergies and autoimmune diseases.
- AIDS (acquired immune deficiency syndrome) is caused by a virus that targets certain cells of the immune system.

NEW! Key Concepts are now listed at the beginning of each chapter for a handy "big picture" overview of topics that will be discussed in greater detail in the pages that follow.

Questions to Consider at the end of each essay ask you to form your own opinions on the featured issue.

Questions to Consider

- 1 What should the United States do when an infectious disease breaks out elsewhere in the world? In such a scenario, what is our responsibility and/or what is in our best interests?
- 2 How afraid are you of Ebola? Would you be willing to travel to Guinea if your boss asked you to? Why or why not?

CONNECT CONCEPTS AND APPLICATIONS TO EVERYDAY LIFE

HEALTH & WELLNESS

Treating a Sprained Ankle

For a severe sprain, many physicians advise the frequent application of cold to the sprained area during the first 24 hours, followed by a switch to heat. Why the switch, and what is the logic behind the timing of cold versus heat? The biggest immediate problem associated with a sprain is damage to small blood vessels and subsequent bleeding into the tissues. Most of the pain associated with a sprain is due to the bleeding and swelling, not damage to ligaments themselves. The immediate application of cold constricts blood vessels in the area and prevents most of the bleeding. The prescription is generally to cool the sprain for 30 minutes

every hour or 45 minutes every hour and a half. In other words, keep the sprain cold for about half the time, for as long as you can stand it. The in-between periods ensure adequate blood flow for tissue metabolism. It's also a good idea to keep the ankle wrapped in an elastic bandage and elevated between cooling treatments, to prevent swelling. If you're having trouble remembering all this, remember the acronym "RICE"—Rest, Ice, Compression, Elevation.

The key to a quick recovery from a sprain is rapid application of the RICE method. Athletes who try to "work through the pain" by continuing to compete while



Treat sprains first with cold, then later with heat.

injured generally pay the price in a longer recovery time.

After 24 hours there shouldn't be any more bleeding from small vessels. The damage has been minimized, so now the goal is to speed the healing process. Heat dilates the blood vessels, improves the supply of nutrients to the area, and attracts blood cells that begin the process of tissue repair.

UPDATED! Health & Wellness boxes provide insights and practical advice on health topics, such as the causes and risks of carbon monoxide poisoning and the prevalence and consequences of Viagra abuse.

NEW! Health & Wellness boxes include:

- Donating Blood (Chapter 7)
- Water Intoxication (Chapter 15)
- What If You Could Save Someone's Life? (Chapter 18)

MJ's Human Biology Blog

"MJ's Human Biology blog" highlights recent items in the news or in scientific journals that cover new findings and hot topics relevant to the teaching of human biology. The host is Dr. Michael Johnson, author of Johnson's Human Biology: Concepts and Control Issues. Postings are open to comments so that Human Biology instructors and students can share their own views on the topics.

SUNDAY, SEPTEMBER 9, 2012

First Drug Approved for HIV Prevention

For the first time, the U.S. Food and Drug Administration (FDA) has [approved a drug](#) specifically for the prevention of sexually-acquired HIV infection. The drug, called Truvada, is currently being used in combination with other drugs in the treatment of existing HIV infections.

Not everyone is happy about the FDA's decision. The main concern is that using the drug in a large number of uninfected individuals could increase the risk of the HIV virus becoming resistant to the drug. To

Contributors

- Deborah Taylor
- Michael Johnson

Topics

- [Blood](#) (14)
- [Cancer](#) (27)
- [Cells and Tissues](#) (15)

◀ **Michael Johnson's blog** also features posts on recent health and wellness related news items.

Way back when life began, a single cell floating freely in the primordial sea received all its nutrients from the surrounding fluid and dumped all its wastes into it. Today, a single cell in the human body still does essentially the same thing; it receives its nutrients from (and dumps its waste into) the surrounding fluid, called the *interstitial* (between cells) *fluid*. In the human body, though, the cells are packed closely together, with very little fluid between them. A human cell would soon starve to death in a sea of waste if not for blood circulating through nearby blood vessels. Blood picks up nutrients from the digestive tract. It transports waste carbon dioxide gas to the lungs and picks up much-needed oxygen. It transports the waste products of metabolism to the liver for destruction or to the kidneys for removal from the body. It even transports waste heat to the skin, as part of the control mechanism for regulating body temperature. Last but not least, blood contains specialized cells of the immune system that are essential to our defense against invading microorganisms. Always and everywhere throughout the body, blood is seeing to it that each living cell is bathed in a fluid conducive to life. Blood is our internal primordial ocean. ■

NEW! “Connections” passage at the start of each chapter provides the student with a sense of how a chapter’s specific topic interrelates with the overall subject of human biology, biology in general, and to the larger world.

Steroid hormones enter target cells

Figure 13.2 depicts the mechanism of action for steroid hormones. Recall that the cell membrane is primarily composed of a bilayer of phospholipids. 1 Because they are lipid soluble, steroid hormones can easily diffuse right across both the cell membrane and the nuclear membrane. Once inside the cell, steroid hormones bind to specific hormone receptors, forming a hormone-receptor complex either within the nucleus or within the cytoplasm (not shown). If the hormone-receptor complex was formed in the cytoplasm, it too can diffuse into the nucleus.

2 Once inside the nucleus, the hormone-receptor complex attaches to DNA, activating specific genes. 3 Gene activation causes the formation of messenger RNA, which then leaves the nucleus and directs the synthesis of certain

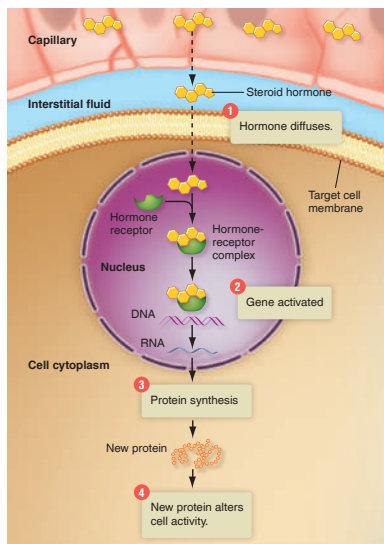


Figure 13.2 Mechanism of steroid hormone action on a target cell. Lipid-soluble steroid hormones diffuse across the cell and nuclear membranes into the nucleus, where they bind to hormone receptors that activate genes. Gene activation results in the production of a specific protein.

proteins. 4 The proteins then carry out the cellular response to the hormone, whatever it might be.

Steroid hormones tend to be slower acting than nonsteroid hormones because the entire protein production process (starting with gene activation) begins only after arrival of the steroid hormone within the cell. Starting from the time the steroid hormone first enters the cell, it can take minutes or even hours to produce a new protein.

Nonsteroid hormones bind to receptors on target cell membranes

Nonsteroid hormones have an entirely different mechanism of action from steroid hormones (Figure 13.3). Nonsteroid hormones cannot enter the target cell because they are not lipid soluble. Instead, they bind to receptors located on the outer surface of the cell membrane. The receptors are generally associated with, or are part of, protein molecules floating in the phospholipid bilayer of the cell membrane (Chapter 3). 1 The binding of hormone to receptor causes a change in the shape of the membrane protein, which in turn initiates a change within the cell. It’s like turning the lights

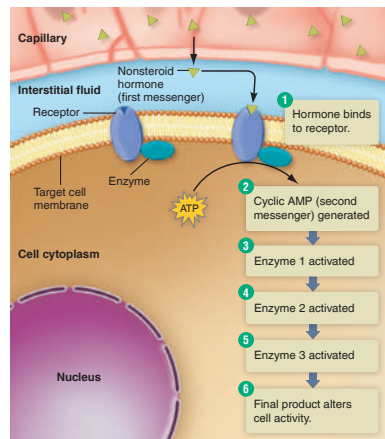


Figure 13.3 Mechanism of nonsteroid hormone action on a target cell. Nonsteroid hormones bind to receptors in the cell membrane, leading to the conversion of ATP to cyclic AMP (the second messenger) within the cell. Cyclic AMP initiates a cascade of enzyme activations, amplifying the original hormonal signal and generating a cellular response.

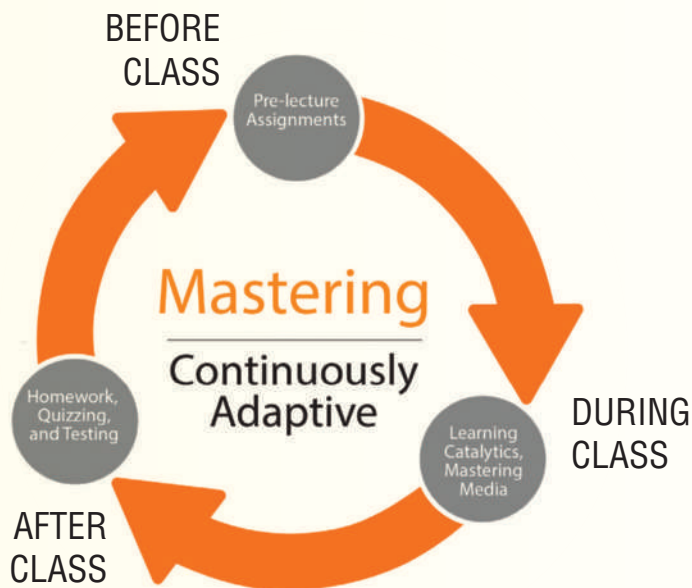
NEW! The use of numbered steps.

Where complex processes are described, numbered step icons are included both in the text and in the accompanying figure. These correlating step icons help students follow the logical sequence of events as those events unfold within a complex process.

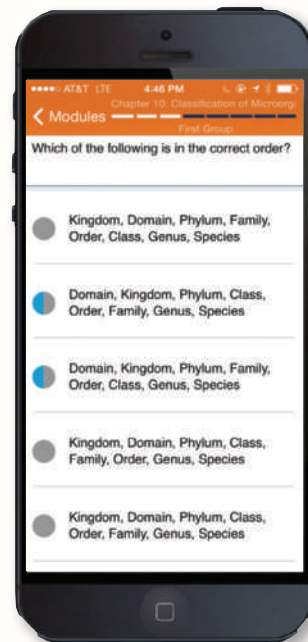
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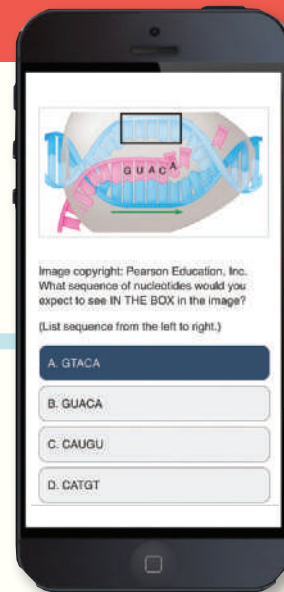
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DURING CLASS

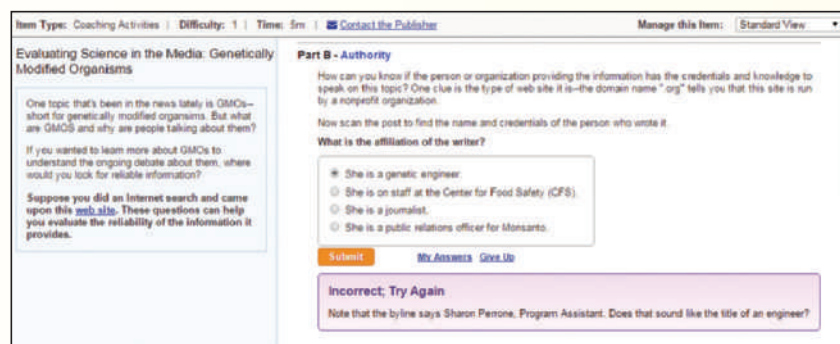
NEW! Learning Catalytics is an assessment and classroom activity system that works with any web-enabled device and facilitates collaboration with your classmates. Your MasteringBiology subscription with eText includes access to Learning Catalytics.



AFTER CLASS

A wide range of question types and activities are available for homework assignments, including the following assignment options for the Eighth Edition:

- **NEW!** Interactive Physiology 2.0 tutorials help students advance beyond memorization to a genuine understanding of complex physiological processes. Full-color animations and videos demonstrate difficult concepts to reinforce the material. IP 2.0 features brand new graphics, quicker navigation, and more robust mobile-ready interactivities where students can explore, experiment, and predict.
- **Blog In Focus activities** ask students to read Michael Johnson's blog and answer questions.
- **NEW!** Evaluating Science in the Media activities challenge you to evaluate various types of information from web sites, articles, and videos.



CHAPTER-SPECIFIC CHANGES

Chapter 1 Human Biology, Science, and Society

- Updated *Current Issue*, “Mandated Childhood Vaccinations”
- New **MJ’s BlogInFocus** topics:
 - The human hand makes a good fist
 - Science and the popular press
- New **MJ’s BlogInFocus** question:
 - Who should pay for very expensive drugs?

Chapter 2 The Chemistry of Living Things

- Updated Figure 2.1, the Periodic Table of the Elements
- New material added on free radicals
- New Figure 2.7, a polar molecule
- Redrawn Figure 2.13, dehydration synthesis and hydrolysis
- New **MJ’s BlogInFocus** topic:
 - The purity of herbal supplements
- New **MJ’s BlogInFocus** question:
 - Should the government approve a powdered alcohol product?

Chapter 3 Structure and Function of Cells

- New **MJ’s BlogInFocus** topic:
 - An inexpensive microscope

Chapter 4 From Cells to Organ Systems

- Updated *Current Issue*, “Reshaping Your Body”
- New **MJ’s BlogInFocus** topics:
 - Wearable skin patches
 - Severe sunburns and risk of melanoma

Chapter 5 The Skeletal System

- New Figure 5.14, the fontanels in a baby’s head
- New **MJ’s BlogInFocus** topics:
 - Bone density scans to measure bone mass
 - Why are knee and hip surgeries on the rise?
 - Smoking and bone deposition in young women

Chapter 6 The Muscular System

- Updated *Current Issue*, “Drug Abuse Among Athletes”
- New **MJ’s BlogInFocus** topics:
 - Growth hormone to athletic performance
 - Xenon gas and athletic performance

Chapter 7 Blood

- New text discussion, “New Tests Make Transfused Blood Safer”
- Updated text discussion of “Human Blood Types”
- New **MJ’s BlogInFocus** topic:
 - Blood clotting factor VII and mortality after surgery

Chapter 8 Heart and Blood Vessels

- New Figure 8.17 on negative feedback control of blood pressure

- New **MJ’s BlogInFocus** topics:
 - A new class of cholesterol-lowering drugs
 - A next-generation artificial heart

Chapter 9 The Immune System and Mechanisms of Defense

- New *Current Issue*, “An Outbreak of Ebola”
- New Figure 9.24, persons living with HIV by sex and exposure categories
- New **MJ’s BlogInFocus** topics:
 - Purchasing human breast milk
 - A home test for HIV
- New **MJ’s BlogInFocus** question:
 - Why is a pill to prevent HIV infection not popular?

Chapter 10 The Respiratory System: Exchange of Gases

- New *Current Issue*, “The Fight over Regulation of E-Cigarettes”
- New **MJ’s BlogInFocus** topics:
 - Smoking and shortened life expectancy
 - Who should be screened for lung cancer?
- New **MJ’s BlogInFocus** question:
 - Why are rates of smoking continuing to decline?

Chapter 11 The Nervous System: Integration and Control

- Replaced Figures 11.15, parts of the brain, and 11.17, the limbic system, with new art
- Streamlined the discussions of sleep and wakefulness
- Revised the section on the limbic system
- Added a passage on changing societal views on marijuana
- New **MJ’s BlogInFocus** topics:
 - New ways to diagnose a concussion
 - An outbreak of meningitis

Chapter 12 Sensory Mechanisms

- Added a new figure to the Health & Wellness on Lasik eye surgery
- Updated **MJ’s BlogInFocus** topic:
 - State laws on texting while driving

Chapter 13 The Endocrine System

- Added text discussion on hypogonadism to endocrine disorders section
- New **MJ’s BlogInFocus** topics:
 - Endocrine disruptor Bisphenol A (BPA) in food cans
 - Low testosterone; how common is it?
- Updated **MJ’s BlogInFocus** question:
 - Why hasn’t inhalable insulin been a blockbuster drug?

Chapter 14 The Digestive System and Nutrition

- New *Current Issue*, “Choosing Organic Versus Conventional Foods”
- New Health & Wellness, “Should You Drink Raw Milk?”
- Added new Figure 14.8, peptic ulcers
- Added new Figure 14.17 on saturated and unsaturated fats
- New **MJ’s BlogInFocus** topics:
 - Antioxidants in organic foods
 - A human feces bank
 - Drinking bone broth for good health?
- New **MJ’s BlogInFocus** question:
 - What do food “sell by” and “best if used by” dates mean?

Chapter 15 The Urinary System

- Revised *Current Issue*, “A Shortage of Kidneys” to include recent changes in the allocation procedure
- New Health & Wellness, “Water Intoxication”
- Revised Figure 15.10, urinary dilution and concentration
- Revised several pieces of nephron art for consistency and clarity
- Expanded the discussion of acute and chronic renal failure
- New **MJ’s BlogInFocus** topics:
 - Economic theory and kidney donations
 - The connection between a kidney disease and African sleeping sickness

Chapter 16 Reproductive Systems

- Combined old Figures 16.7 and 16.8, both on the menstrual cycle, into new Figure 16.7
- Re-rendered Figure 16.11, pelvic inflammatory disease
- New **MJ’s BlogInFocus** topics:
 - A state restricts the use of Mifeprex
 - What is an embryoscope?
 - Does vaccination against HPV change sexual behavior?

Chapter 17 Cell Reproduction and Differentiation

- New *Current Issue*, “Therapeutic Cloning”
- New **MJ’s BlogInFocus** topics:
 - An anti-aging protein in blood
 - Cloning goes commercial
- New **MJ’s BlogInFocus** question:
 - Could stem cells be used to produce edible meat?

Chapter 18 Cancer: Uncontrolled Cell Division and Differentiation

- Updated *Current Issue*, “Preventive Double Mastectomy to Reduce Breast Cancer Risk”
- Added a discussion of cancer stages
- New Health & Wellness, “What If You Could Save Someone’s Life”
- New Figure 18.4 on proto-oncogenes and tumor suppressor genes

- Added the current recommendations regarding mammograms and self-examination for detecting breast cancer
- New discussion of pancreatic cancer
- New discussion and Figure 18.12, esophageal cancer
- New **MJ’s BlogInFocus** topics:
 - Radiation therapy for cancer can sometimes cause cancer
 - Double mastectomies to prevent breast cancer
 - An alternative to the Pap test for cervical cancer

Chapter 19 Genetics and Inheritance

- Revised the *Current Issue* for greater emphasis on the risks and benefits of genetic testing.
- New **MJ’s BlogInFocus** topics:
 - Marketing genetic tests and predicting risk of genetic disease
 - State laws on screening newborns for genetic diseases.
 - Accuracy of commercially available genome tests

Chapter 20 DNA Technology and Genetic Engineering

- Revised *Current Issue*, “Genetically Modified Plants” to include concerns about labeling GM foods
- Expanded the Health & Wellness feature on DNA-based vaccines
- Updated the text discussion of DNA fingerprinting
- New **MJ’s BlogInFocus** topics:
 - Patenting human genes
 - The long-term effects of herbicide resistance in weeds
 - A genetically modified potato
- New **MJ’s BlogInFocus** question:
 - Are alcoholic beverages made from non-GMO grains any safer to drink?

Chapter 21 Development, Maturation, Aging, and Death

- New chapter title includes “Maturation” and “Death”
- New *Current Issue*, “Death with Dignity (Brittany Maynard’s Journey)”
- New **MJ’s BlogInFocus** topics:
 - Taking acetaminophen during pregnancy
 - When should the umbilical cord be cut?
- New **MJ’s BlogInFocus** question:
 - Why do older fathers pass on more genetic mutations to their offspring than mothers?

Chapter 22 Evolution and the Origins of Life

- New Figure 22.8 to illustrate genetic drift and gene flow
- New **MJ’s BlogInFocus** topics:
 - Pinpointing the time of Earth’s largest mass extinction
 - How many species of extinct humans are there?

Chapter 23 Ecosystems and Populations

- New *Current Issue*, “Overharvesting is Depleting the Oceans’ Wildlife Populations”
- Updated Figure 23.15 and the text discussion, human population dynamics
- New **MJ’s BlogInFocus** topics:
 - Why societies collapse

Chapter 24 Human Impacts, Biodiversity, and Environmental Issues

- Updated *Current Issue*, “Global Warming and Global Climate Change”

- Revised Figure 24.2 on solar radiation and the greenhouse effect
- New **MJ’s BlogInFocus** topics:
 - Regional climate changes due to global warming
 - Depletion of a freshwater aquifer
 - Advanced biofuels
- New **MJ’s BlogInFocus** question:
 - What is a carbon tax?

ACKNOWLEDGMENTS

The Eighth Edition of *Human Biology: Concepts and Current Issues* is once again the product of the continued hard work and dedication of the people at Pearson Education, led by VP, Editor-in-Chief Beth Wilbur, Executive Editorial Manager Ginnie Simone Jutson, and Senior Acquisitions Editor Star Mackenzie Burruto. Star directs a team that functions as smoothly and professionally as any in the business.

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Changes to the art and photos in the Eighth Edition are the result of the hard work of artists at Imagineering and Rights and Permissions Project Managers Donna Kalal, at Pearson Education, and Candice Velez, at QBS Learning. Photo Researcher Pat Holl found the new photos you see in this edition.

Accuracy and clarity have been checked and rechecked by the hundreds of insightful faculty members around the country over the past 10 years. Reviewers specific to this edition are listed below.

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Last but not least, I'd like to thank my wife, Pamela, for her wholehearted support and understanding over the years.

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