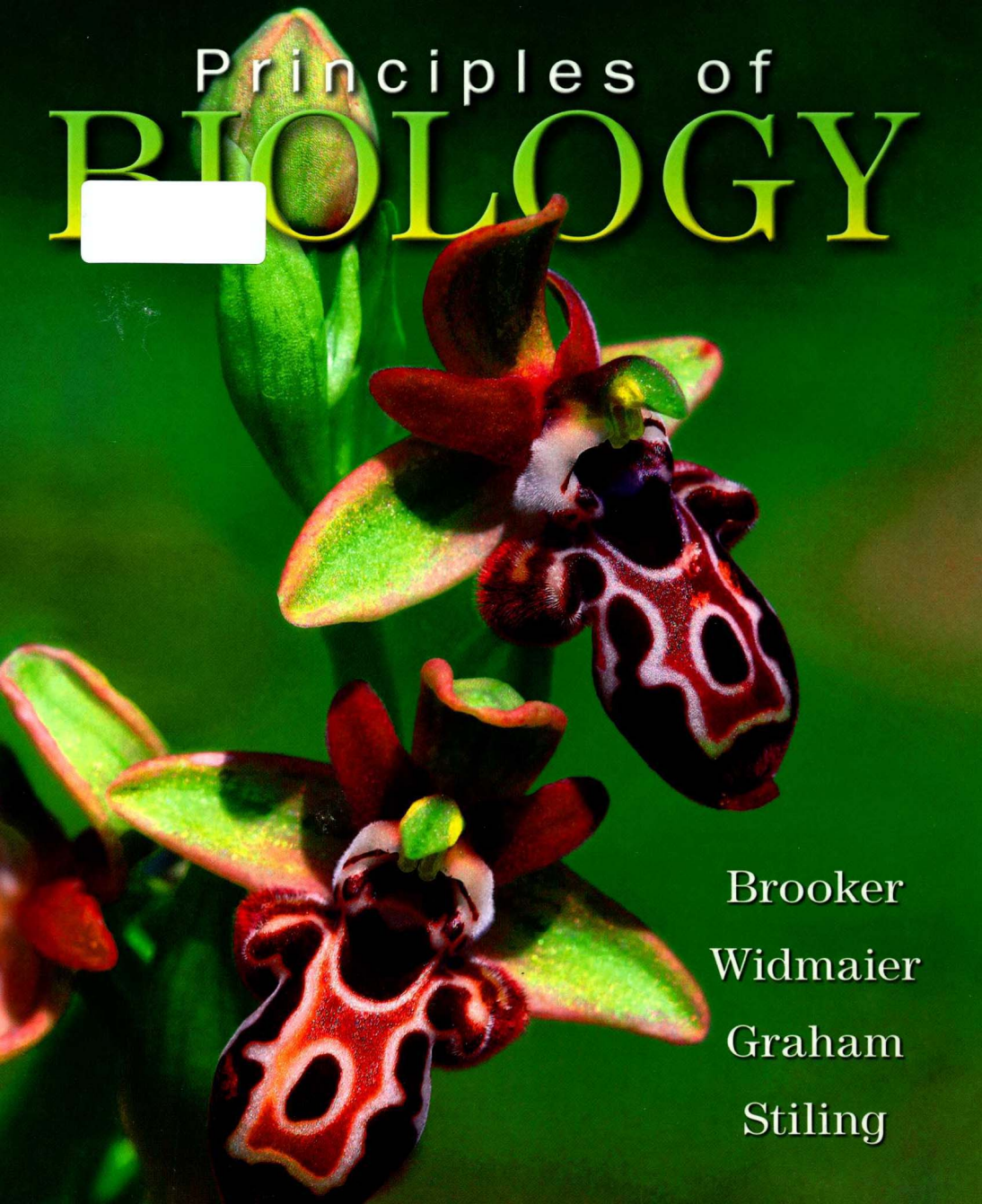
Principles of BIOLOGY



Brooker
Widmaier
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Principles of BIOLOGY

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PRINCIPLES OF BIOLOGY

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Rob Brooker received his Ph.D. in genetics from Yale University in 1983. At Harvard, he studied lactose permease, the product of the *lacY* gene of the *lac* operon. He continues working on transporters at the University of Minnesota, where he is a Professor in the Department of Genetics, Cell Biology, and Development and has an active research laboratory. At the University of Minnesota, Dr. Brooker teaches undergraduate courses in biology, genetics, and cell biology. In addition to many other publications, he has written two undergraduate genetics texts: *Genetics: Analysis & Principles*, 5th edition, copyright 2015, and *Concepts of Genetics*, copyright 2012; and he is the lead author of *Biology*, 3rd edition, copyright 2014, all published by McGraw-Hill Education.

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Eric Widmaier received his Ph.D. in 1984 in endocrinology from the University of California at San Francisco. His research focuses on the control of body mass and metabolism in mammals, the hormonal correlates of obesity, and the effects of high-fat diets on intestinal cell function. Dr. Widmaier is currently Professor of Biology at Boston University, where he teaches undergraduate human physiology and recently received the university's highest honor for excellence in teaching. Among other publications, he is a coauthor of *Vander's Human Physiology: The Mechanisms of Body Function*, 13th edition, copyright 2014; and *Biology*, 3rd edition, copyright 2014, both published by McGraw-Hill Education.

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Linda Graham received her Ph.D. in botany from the University of Michigan, Ann Arbor. Her research explores the evolutionary origin of land-adapted plants, focusing on their cell and molecular biology as well as ecological interactions. Dr. Graham is now Professor of Botany at the University of Wisconsin–Madison. She teaches undergraduate courses in biology and plant biology. She is the coauthor of, among other publications, *Algae*, 2nd edition, copyright 2008, a major's textbook on algal biology; and *Plant Biology*, 2nd edition, copyright 2006, both published by Prentice Hall/Pearson. She is also a coauthor of *Biology*, 3rd edition, copyright 2014, published by McGraw-Hill Education.

Left to right: Eric Widmaier, Linda Graham, Peter Stiling, and Rob Brooker

Peter D. Stiling

Peter Stiling obtained his Ph.D. from University College, Cardiff, Wales, in 1979. Subsequently, he became a postdoctoral fellow at Florida State University and later spent two years as a lecturer at the University of the West Indies, Trinidad. During this time, he began photographing and writing about butterflies and other insects, which led to publication of several books on local insects. Dr. Stiling is currently a Professor of Biology at the University of South Florida at Tampa. His research interests include plant-insect relationships, parasite-host relationships, biological control, restoration ecology, and the effects of elevated carbon dioxide levels on plant–herbivore interactions. He teaches graduate and undergraduate courses in ecology and environmental science as well as introductory biology. He has published many scientific papers and is the author of *Ecology: Global Insights and Investigations*, 2nd edition, copyright 2015, and is coauthor of *Biology*, 3rd edition, copyright 2014, both published by McGraw-Hill Education.

Ian Quitadamo

Ian Quitadamo served as lead digital author for *Principles of Biology*, overseeing the development of the digital content by a team of subject matter experts. He is an Associate Professor with a dual appointment in Biological Sciences and Science Education at Central Washington University in Ellensburg, WA. He teaches introductory and majors biology courses and cell biology, genetics, and biotechnology as well as science teaching methods courses for future science teachers and interdisciplinary content courses in alternative energy and sustainability. Dr. Quitadamo was educated at Washington State University and holds a Bachelor's degree in biology, Master's degree in genetics and cell biology, and an interdisciplinary Ph.D. in science, education, and technology. Previously a researcher of tumor angiogenesis, he now investigates critical thinking and has published numerous studies of factors that affect student critical thinking performance. He has received the Crystal Apple award for teaching excellence, led various initiatives in critical thinking and assessment, and is active in training future and currently practicing science teachers. He served as a co-author on *Biology*, 11th edition, by Mader and Windelspecht, copyright 2013, and is the lead digital author for *Biology*, 3rd edition by Brooker and *Biology*, 10th edition by Raven, both copyright 2014, and *Understanding Biology* by Mason, all published by McGraw-Hill Education.

A Note about *Principles of Biology . . .*

A recent trend in science education is the phenomenon that is sometimes called "*flipping the classroom*." This phrase refers to the idea that some of the activities that used to be done in class are now done out of class, and vice versa. For example, instead of spending the entire class time lecturing about textbook and other materials, some of the class time is spent engaging students in various activities, such as problem solving, working through case studies, and designing experiments. This approach is called *active learning*. For many instructors, the classroom has become more learner-centered rather than teacher-centered. A learner-centered classroom provides a rich environment in which students can interact with each other and with their instructors. Instructors and fellow students often provide formative assessment—immediate feedback that helps each student understand if his or her learning is on the right track.

What are some advantages of active learning? Educational studies reveal that active learning usually promotes greater learning gains. In addition, active learning often focuses on skill development rather than the memorization of facts that are easily forgotten. Students become trained to "think like scientists" and to develop a skill set that enables them to apply scientific reasoning.

A common concern among instructors who are beginning to try out active learning is that they think they will have to teach their students less material. However, this may not be the case. Although students may be provided with online lectures, "flipping the classroom" typically gives students more responsibility for understanding the textbook material on their own. Along these lines, *Principles of Biology* is intended to provide students with a resource that can be effectively used out of the classroom. Several key pedagogical features include the following:

- **Focus on Core Concepts:** Although it is intended for majors in the biological sciences, *Principles of Biology* is a shorter textbook that emphasizes core concepts. Twelve principles of biology are enunciated in Chapter 1 and those principles are emphasized throughout the textbook with specially labeled figures. An effort has also been made to emphasize some material in bulleted lists and numbered lists, so students can more easily see the main points.
- **Learning Outcomes:** Each section of every chapter begins with a set of learning outcomes. These outcomes help students understand what they should be able to do if they have mastered the material in that section.
- **Formative Assessment:** When students are expected to learn textbook material on their own, it is imperative that they be given regular formative assessments so they can gauge whether or not they are mastering the material. Formative assessment is a major feature of this textbook and is bolstered by McGraw-Hill Connect®—a state-of-the-art digital assignment and assessment platform. In *Principles of Biology*, formative assessment is provided in multiple ways.

  1. Each section of every chapter ends with multiple-choice questions.
  2. Most figures have concept check questions so students can determine if they understand the key points in the figure.
  3. End-of-chapter questions continue to provide students with feedback regarding their mastery of the material.
  4. Further assessment tools are available in Connect. Question banks, Test banks, and Quantitative Question banks can be assigned by the professor. McGraw-Hill LearnSmart® allows for individual study as well as assignments from the professor.

- **Quantitative Analysis:** Many chapters have a subsection that emphasizes quantitative reasoning, an important skill for careers in science and medicine. In these subsections, the quantitative nature of a given topic is described, and then students are asked to solve a problem related to that topic.
- **BioConnections and Evolutionary Connections:** To help students broaden their understanding of biology, two recurring features are BioConnections and Evolutionary Connections. BioConnections are placed in key figure legends in each chapter and help students relate a topic they are currently learning to another topic elsewhere in the textbook, often in a different unit. Evolutionary Connections provide a framework for understanding how a topic in a given chapter relates to evolution, the core unifying theme in Biology.

Overall, the pedagogy of *Principles of Biology* has been designed to foster student learning. Instead of being a collection of "facts and figures," *Principles of Biology* is intended to be an engaging and motivating textbook in which formative assessment allows students to move ahead and learn the material in a productive way. We welcome your feedback so we can make future editions even better!

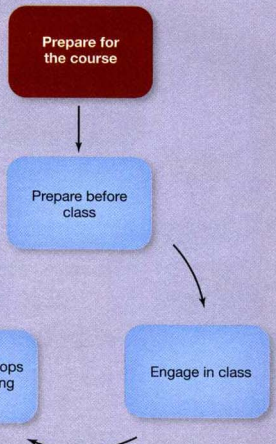
Rob Brooker
Eric Widmaier
Linda Graham
Peter Stiling

GUIDING YOU THROUGH *PRINCIPLES OF BIOLOGY*

Principles of Biology and its online assets have been carefully crafted to help you, the student, work efficiently and effectively through the material in the course, making the most of your study time. This *Guiding You Through Principles of Biology* section explains how you can use the text and online resources to help you succeed in Majors Biology.

Prepare for the Course

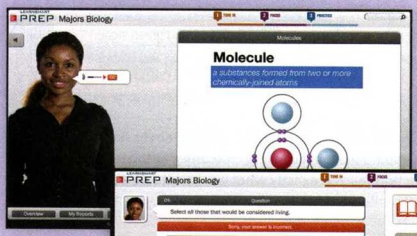
Many biology students struggle the first few weeks of class. Many institutions expect students to start majors biology having a working knowledge of basic chemistry and cellular biology. If you need a primer to help you get up to speed, consider McGraw-Hill's new program, *LearnSmart Prep*.

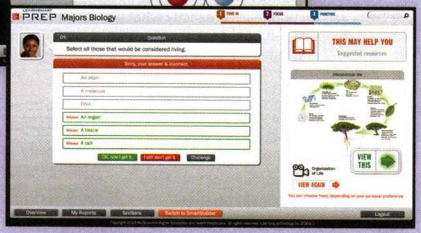


LEARNSMART PREP™

LearnSmart Prep is an adaptive learning tool designed to increase student success and aid retention through the first few weeks of class. Using this digital tool, Majors Biology students can master some of the most fundamental and challenging principles of biology before they begin to struggle in the first few weeks of class.

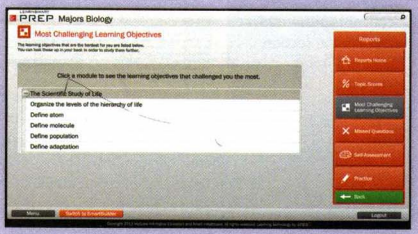
1 A diagnostic establishes your baseline comprehension and knowledge; then the program generates a learning plan tailored to your academic needs and schedule.



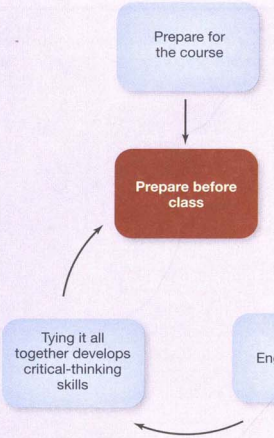


2 As you work through the learning plan, the program asks you questions and tracks your mastery of concepts. If you answer questions about a particular concept incorrectly, the program will provide a learning resource (ex. animation or tutorial) on that concept, then ensure that you understand the concept by asking you more questions. Didn't get it the first time? Don't worry—*LearnSmart Prep* will keep working with you!

3 Using *LearnSmart Prep*, you can identify the content you don't understand, focus your time on content you need to know but don't, and therefore improve your chances of success in your majors biology course.

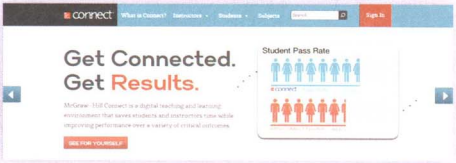


Prepare Before Class



Students who are most successful in college are those who have developed effective study skills and who use those skills, before, during, and after class.

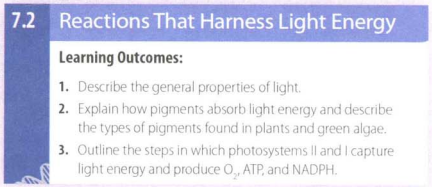
You can maximize your time in class by previewing the material before stepping into the lecture hall. *Principles of Biology* is available in several formats that allow you to fit studying into your busy schedule: the printed text as well as online offerings that include the interactive eBook in ConnectPlus+ and SmartBook. All three formats deliver the chapter material and valuable learning aids presented in the text, but the online options offer additional resources. Use any or all of these options to preview the material before lecture. Familiarizing yourself with terminology and basic concepts will allow you to follow along in class and engage in the content in a way that allows for better retention.



1 The traditional printed text offers many embedded study aids.

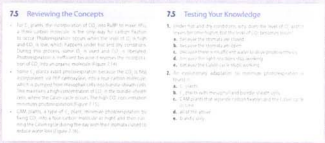
Guiding You Through *Principles of Biology*

Every chapter opens with a Chapter Outline that walks through the main concepts and organizes the material in the chapter and provides a story that puts the topic of the chapter into context.



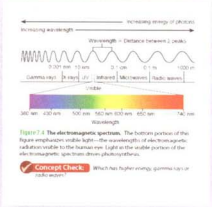
Chapters are broken down into sections that cover skills or ideas you should master. Learning Outcomes at the beginning of each section tell you exactly what you should be able to do by the end of the section.

Reviewing the Concepts provides a summary of the key concepts presented in the section.



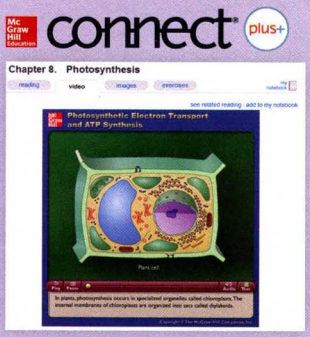
Testing Your Knowledge allows you to check your understanding of key concepts in the section before moving on. Additional questions are available at the end of the chapter.

Many figures throughout the text are supported with *Concept Check* questions that test your understanding of the concept illustrated in the figure.

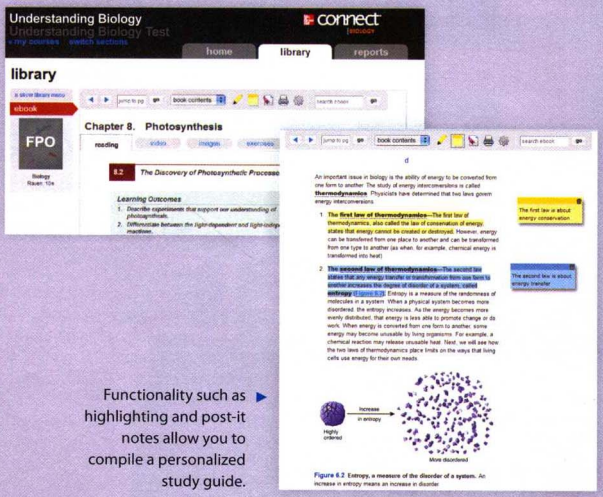


2 Online interactive eBook in ConnectPlus+ offers additional animations and study aids.

Enhancements found in the interactive eBook



The interactive eBook takes the reading experience to a new level with links to animations and videos that supplement the text.



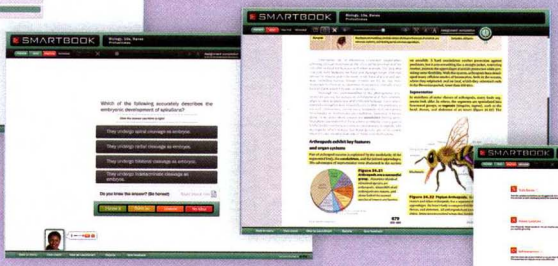
Functionality such as highlighting and post-it notes allow you to compile a personalized study guide.

3 SmartBook provides a personalized, adaptive reading experience.

SMARTBOOK™

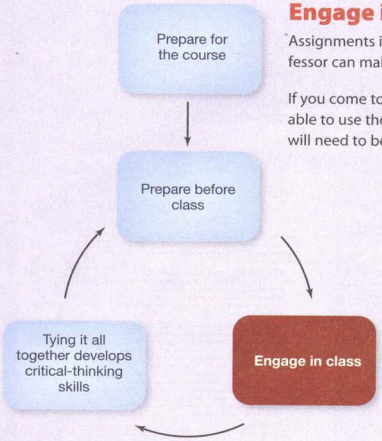
Powered by an intelligent diagnostic and adaptive engine, **SmartBook** facilitates the reading process by identifying what content a student knows and doesn't know through adaptive assessments.

The SmartBook experience starts by previewing key concepts from the chapter and ensuring that you understand the big ideas.



SmartBook asks you questions that identify gaps in your knowledge. The reading experience then continuously adapts in response to the assessments—highlighting the material you need to review based on what you don't know.

The reports in SmartBook help identify topics where you need more work.



Engage in Class

Assignments in Connect and LearnSmart will help you understand concepts so that you and your professor can make the most of in-class time.

If you come to class having a working knowledge of concepts and terminology, the professor will be able to use the class period to help you develop critical thinking and analytical skills—skills that you will need to be successful in upper level courses and in your career.

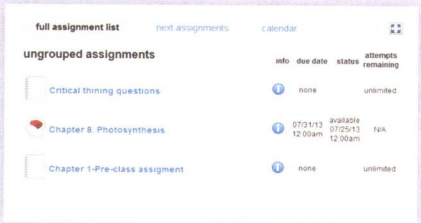
LEARNSMART®

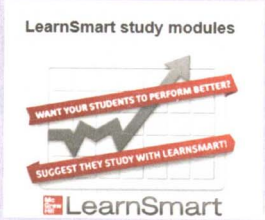
McGraw-Hill LearnSmart™ is available as an integrated feature of McGraw-Hill Connect Biology. It is an adaptive learning system designed to help students learn faster, study more efficiently, and retain more knowledge for greater success. LearnSmart assesses a student's knowledge of course content through a series of adaptive questions. It pinpoints concepts the student does not understand and maps out a personalized study plan for success. This innovative study tool also has features that allow students access to rich reporting and provides instructors with a built-in assessment tool for grading assignments. Visit www.mhlearnsmart.com for a demonstration.

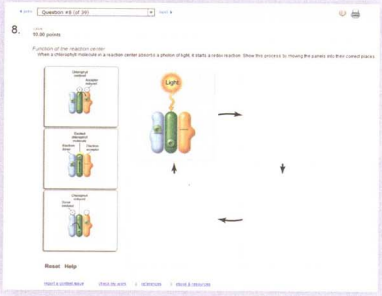
1 Your professor may make pre-class assignments to help you engage in the content during class.

connect® plus+ BIOLOGY

Assignments are accessed through Connect and could include homework assignments, quizzes, reading assignments, LearnSmart assignments, and other resources.





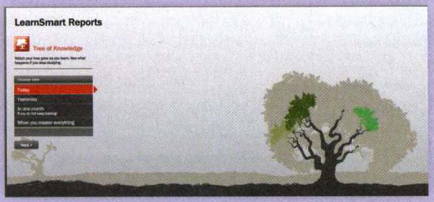


Interactive and traditional questions help assess your knowledge of the material.

2 Your professor can assign modules in LearnSmart, which are also available in Connect or on your mobile device for self-study.

LEARNSMART®

◀ Study with LearnSmart by working through modules and using LearnSmart's reporting to better understand your strengths and weaknesses.



▲ The Tree of Knowledge tracks your progress, reporting on short term successes and long term retention.

◀ Download the LearnSmart app from iTunes or Google Play and work on LearnSmart from anywhere!

3 Your professor may record his or her lectures. If your professor is using Tegrity, you can review the lecture after class along with the corresponding PowerPoint® presentations. A Search function allows quick access to the content you want to review.

Tegrity

▲ More than just a recorded lecture, Tegrity lets you search and bookmark content, take notes, and work with fellow classmates in order to make learning incredibly efficient.

To save time, search through the Tegrity lecture using key terms—all PowerPoint slides that contain the term are identified for a quick review.

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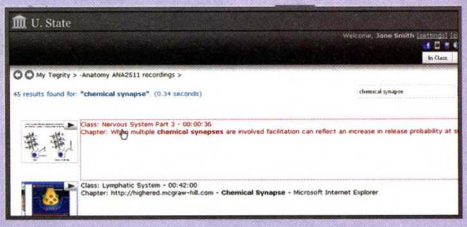
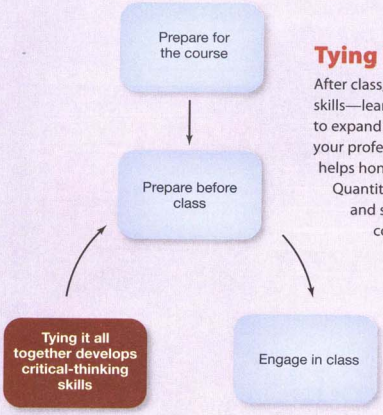




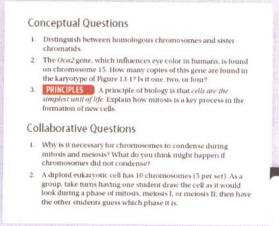
Tying It All Together Develops Critical-Thinking Skills

After class, put your new-found knowledge to work by developing your critical thinking skills—learning to apply, analyze, and synthesize information. There are many opportunities to expand your skills. End-of-chapter questions in the book and online assignments from your professor challenge your understanding, revisiting LearnSmart/SmartBook modules helps hone your understanding, and Feature Investigations, Evolutionary Connections, and Quantitative Analysis are features in the book that encourage you to think past the facts and start putting your understanding to work. The Quantitative Analysis features are complemented by an online component to help you develop data analysis skills. BioConnection questions and *Principles of Biology* figures help you see how topics in biology are interconnected. All of these help develop critical-thinking and analytical skills.

1 Working through problems and questions that develop critical-thinking skills is key to understanding the concepts at a higher level.

Questions that challenge your comprehension

Following lecture, you should be able to answer Conceptual and Collaborative questions at the end of the chapter. A "Principles" question tests your understanding of how chapter concepts relate to the principles of biology that provide a framework for organizing concepts in biology.



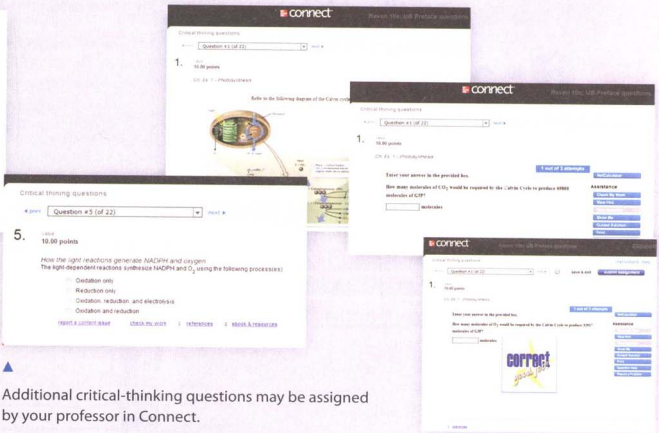
Conceptual Questions

1. Distinguish between homologous chromosomes and sister chromatids.
2. The *Oca2* gene, which influences eye color in humans, is found on chromosome 15. How many copies of this gene are found in the karyotype of Figure 13.1? Is it one, two, or four?
3. PRINCIPLES **A principle of biology is that** *cells are the simplest unit of life.* Explain how mitosis is a key process in the formation of new cells.

Collaborative Questions

1. Why is it necessary for chromosomes to condense during mitosis and meiosis? What do you think might happen if chromosomes did not condense?
2. A diploid eukaryotic cell has 10 chromosomes (5 per set). As a group, take turns having one student draw the cell as it would look during a phase of mitosis, meiosis I, or meiosis II, then have the other students guess which phase it is.

Quantitative questions assigned in Connect allow you to practice answering mathematically-based biological problems—with hints and guided solutions to help you along the way. Numerical values in these questions change so that you can keep practicing until you understand the concept.

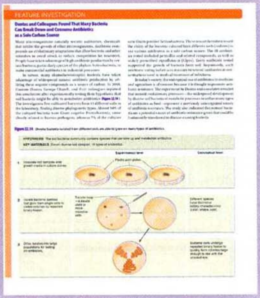


Additional critical-thinking questions may be assigned by your professor in Connect.

2 The development of critical thinking and analytical tools is also achieved by analyzing scientific research.

Think like a scientist

Feature Investigations walk you through a scientific investigation looking at the experimental and conceptual aspects. The Investigation lays out the hypothesis, test procedures, data, and conclusion. Experimental questions test your understanding of the experiment, data, and conclusions. ▼



EVOLUTIONARY CONNECTIONS

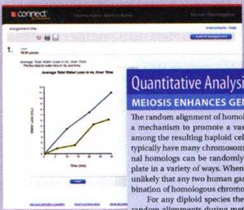
Cell Division in Bacteria Involves FtsZ, a Protein Related to Eukaryotic Tubulin

As discussed in Chapter 15 (see Figure 15.11), bacteria divide by a process called binary fission. Because bacteria usually have only one type of chromosome, the process of sorting different types of chromosomes is not necessary. Even so, events during bacterial cell division may provide insights as to the manner in which mitosis evolved in eukaryotes.

Prior to cell division, bacterial cells copy, or replicate, their chromosomal DNA. This produces two identical copies of the genetic material, as shown at the top of Figure 13.6. During binary fission, the two daughter cells become separated from each other by the formation of a septum. Recent evidence has shown that bacterial species produce a protein called FtsZ, which is important in cell division. This protein assembles into a ring at the future site of the septum. FtsZ is thought to be the first protein to move to this division site, and it recruits other proteins that produce a new cell wall between the daughter cells.

FtsZ is evolutionarily related to the eukaryotic protein called tubulin, which is the main component of microtubules, which compose the mitotic spindle. In all eukaryotes, the midpoint of the mitotic spindle, which is called the metaphase plate, identifies the site for cytokinesis (look ahead to Figure 13.7d and f). This observation indicates that tubulin is also critical for cytokinesis in eukaryotic cells.

◀ The Evolutionary Connections feature examines the evolutionary implications of scientific research.



The Quantitative Analysis feature explores the quantitative aspect of the study of biology. The features walk you through biological concepts that have a quantitative component. The Crunching the Numbers provides a sample problem that tests your understanding. Associated online activities can help you practice your data analysis skills. ▶

Quantitative Analysis

MEIOSIS ENHANCES GENETIC DIVERSITY

The random alignment of homologous chromosomes provides a mechanism to promote a vast amount of genetic diversity among the resulting haploid cells. Because eukaryotic species typically have many chromosomes per set, maternal and paternal homologs can be randomly aligned along the metaphase plate in a variety of ways. When meiosis is complete, it is very unlikely that any two human gametes will have the same combination of homologous chromosomes.

For any diploid species the possible number of different, random alignments during metaphase I of meiosis equals 2^n, where n equals the number of chromosomes per set. The random alignments equal 2^n because each chromosome is found in a homologous pair and each member of the pair can align on either side of the metaphase plate. It is a matter of chance which daughter cell of meiosis I will get the maternal chromosome of a homologous pair, and which will get the paternal chromosome. Because the homologs are genetically similar but not identical, the random alignment of homologous chromosomes provides a mechanism to promote a vast amount of genetic diversity among the resulting haploid cells.

Crunching the Numbers: Humans have 23 chromosomes per set. How many possible random alignments could occur during metaphase I? How does crossing over further contribute to the genetic diversity of the resulting haploid cells?

3 A key component to learning is understanding the underlying principles of biology and making connections between different topics.

Biology principles and making connections

Biology Principle

New Properties Emerge from Complex Interactions

This principle of biology is apparent at the protein level. The primary sequence of proteins determines their final three-dimensional structures. Compare this with the chapter-opening depiction of two real proteins, and the several intermediate levels of protein structure shown in Figure 3.13. It is the three-dimensional shape of different proteins that determines their ability to interact with other molecules, including other proteins.

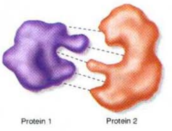
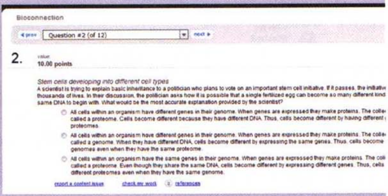


Figure 3.14 Protein-protein interaction. Two different proteins may interact with each other due to hydrogen bonding, ionic bonding, the hydrophobic effect, and van der Waals forces. Interaction is also facilitated by their respective three-dimensional shapes.

▲ Figures that are highlighted as Biology Principles discuss not only how the figure relates to the topic under consideration, but also how that figure illustrates a biological principle. Biology Principles provide a framework for organizing concepts in biology.


Bioconnection
◀ prev
Question #2 (of 12)
next ▶
2.
value:
10.00 points
Stem cells developing into different cell types
A scientist is trying to explain basic inheritance to a politician who plans to vote on an important stem cell initiative. If it passes, the initiative
thousands of lives. In their discussion, the politician asks how it is possible that a single fertilized egg can become so many different kind
same DNA to begin with. What would be the most accurate explanation provided by the scientist?
All cells within an organism have different genes in their genome. When genes are expressed they make proteins. The colle called a proteome. Cells become different because they have different DNA. Thus, cells become different by having different proteomes.
All cells within an organism have different genes in their genome. When genes are expressed they make proteins. The colle called a genome. When they have different DNA, cells become different by expressing the same genes. Thus, cells become genomes even when they have the same proteome.
All cells within an organism have the same genes in their genome. When genes are expressed they make proteins. The col called a proteome. Even though they share the same DNA, cells become different by expressing different genes. Thus, cells different proteomes even when they have the same genome.
report a content issue
check my work
references

▲ Additionally, your professor may assign questions in Connect that require you to pull together and synthesize information from various chapters to address a more complex issue.

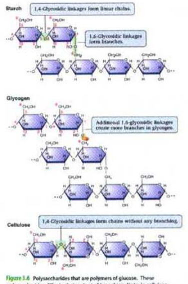
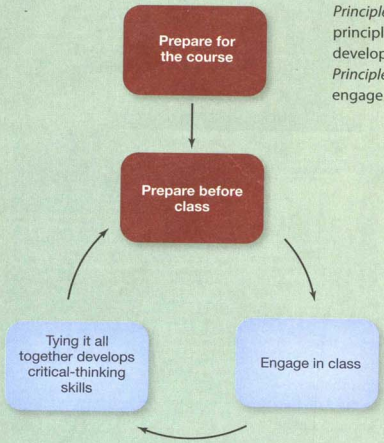


Figure 3.6 Polysaccharides that are polymers of glucose. These polysaccharides differ in their extent of branching. Note: In cellulose, the bonding arrangements cause every other glucose to be inverted with respect to its neighbors.

BioConnections: Look ahead to Figures 4.30 and 4.31 for the role of cellulose in plant structure and to Figures 27.10 and 27.11 for its role in plant growth. Considering the amount of plant life on Earth, what might you conclude about the abundance of cellulose on the planet?

▲ BioConnections in figure legends direct you to figures in other chapters that are related to the topic or concept being illustrated. Although material is presented in separate chapters, many concepts in biology are related. BioConnections help you examine connections between seemingly unrelated concepts.

GUIDE YOUR STUDENTS THROUGH *PRINCIPLES OF BIOLOGY*

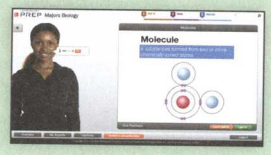


Principles of Biology offers professors a text focused on developing an understanding of the core principles that provide a foundation for students intending to pursue a degree in biology and developing critical thinking skills that will serve them well into the future. This *Guide Through Principles of Biology* explains how professors can use the text and online resources to help engage their students and maximize their instructional time.

Prepare for the Course and for the Class

The Majors Biology class is changing in new and exciting ways, with more emphasis on active learning. Digital resources can help you achieve your instructional goals—making your students more responsible for learning outside of class by meeting your students where they live: on the go and online. Use the text and digital tools to empower students to come to class more prepared and ready to engage!

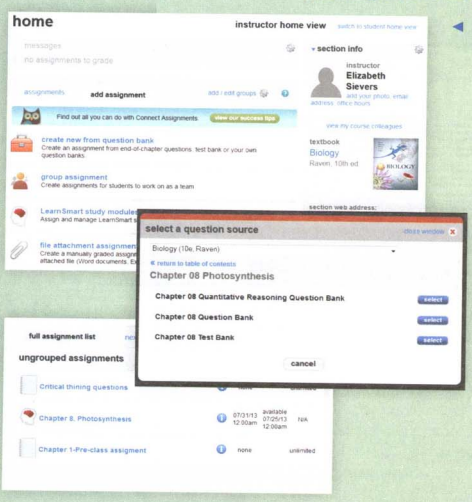
To help your students get up to speed, assign *LearnSmart Prep* at the beginning of the course. ***LearnSmart***™ *Prep* is an adaptive learning tool designed to increase student success and aid retention through the first few weeks of class. Using this digital tool, Majors Biology students can master some of the most fundamental and challenging principles of biology before they begin to struggle in the first few weeks of class.



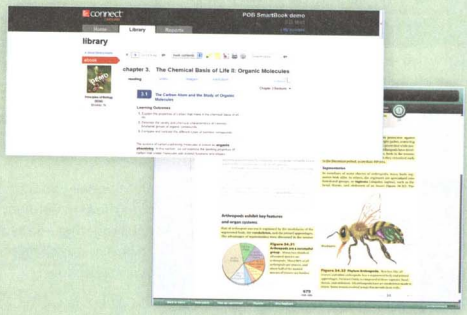
Assessment with timely learning resources helps students with foundational material that you want them to know coming into the course.

1 Create assignments and use adaptive resources to introduce terminology and basic concepts to students before class.

Help your students prepare for class by making assignments—reading, homework, and LearnSmart



◀ Assignments can include Reading assignments from the ConnectPlus eBook, homework or quizzes, LearnSmart, your own Web or short answer activities, and more.



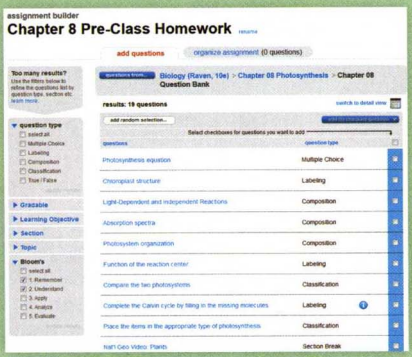
▲ Reading assignments can be made using the ConnectPlus eBook, but students also have access to SmartBook or the standard printed text.

McGraw-Hill Connect Biology provides online presentation, assignment, and assessment solutions. It connects your students with the tools and resources they'll need to achieve success. With Connect Biology you can deliver assignments, quizzes, and tests online. A robust set of questions and activities are presented in the Question Bank and a separate set of questions to use for exams are presented in the Test Bank. As an instructor, you can edit existing questions and author entirely new problems. Track individual student performance—by question, assignment, or in relation to the class overall—with detailed grade reports. Integrate grade reports easily with Learning Management Systems such as Blackboard and Canvas—and much more. ConnectPlus Biology provides students with all the advantages of Connect Biology plus 24/7 online access to an eBook. This media-rich version of the book is available through the McGraw-Hill Connect platform and allows seamless integration of text, media, and assessments.

To learn more, visit www.mcgrawhillconnect.com

2 Customize Connect and LearnSmart assignments to address knowledge gaps so students can get the most out of class.

Customize your assignments using Connect filters

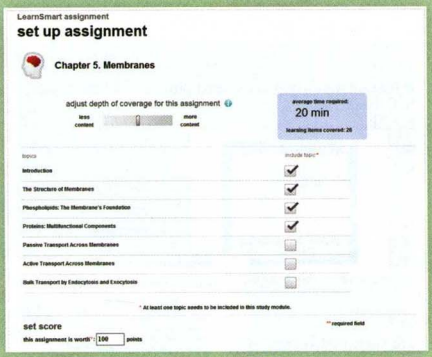


▲

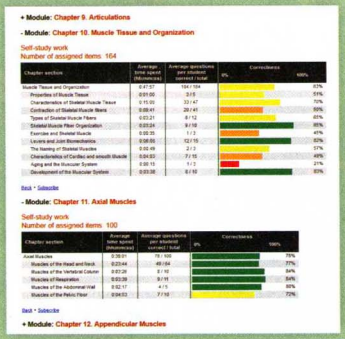
Use the filters in Connect to select questions that match your desired level of assessment—filter questions for lower-level Blooms to assess basic concepts and understanding prior to lecture. Filter using upper-level Blooms after class to develop critical-thinking and analytical skills.

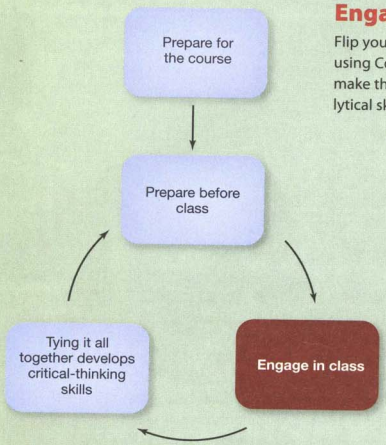
You can customize your LearnSmart assignments by topic (selecting the sections in the chapter you will cover in class) and by the amount of time investment you expect from your students. Reducing the length of time focuses the LearnSmart questions on core concepts in the chapter.

▼



Reports in Connect and LearnSmart help you monitor student assignments and performance, allowing for "just-in-time" teaching to clarify concepts that are more difficult for your students to understand. ▶





Engage Your Students in Class

Flip your classroom and make time for active learning in class by creating preclass assignments using Connect and LearnSmart. Your students will come to class better prepared and you can make the most of your valuable class time to work on developing their critical thinking and analytical skills.

McGraw-Hill Tegrity® records and distributes your class activities or lectures with just a click of a button. Students can view the recorded videos anytime/anywhere via computer, iPod, or mobile device. Tegrity indexes your PowerPoint® presentations and anything shown on your computer so that students can use keywords to find exactly what they want to study. Tegrity is available as an integrated feature of McGraw-Hill Connect Biology and as a standalone resource.

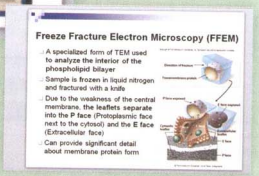
1 Within Connect, you will find presentation materials to enhance your class.

Presentation Tools in Connect

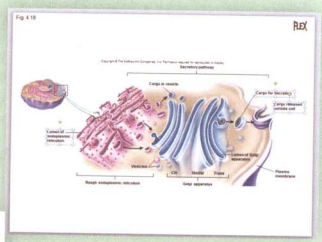
The Presentation Tools in Connect provide everything you need for outstanding presentations all in one place.

◀ Animation PowerPoints contain full-color animations illustrating important processes, which are fully embedded in PowerPoint slides for easy use in your presentations.

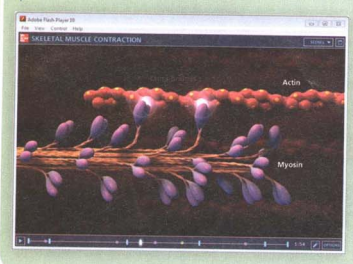
FlexArt PowerPoints contain editable art from the text. For all figures, labels and leader lines are editable allowing you to customize your PowerPoint presentations.

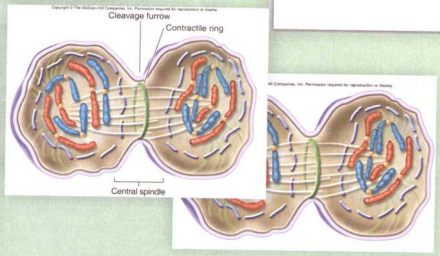


◀ Enhance your presentations with lecture PowerPoints with animations fully embedded.



3-D Animations bring biology to life with dynamic imagery and interesting presentation tools, such as the highlighting pen.





◀ Labeled and unlabeled JPEG files of all art and photos in the text can be readily incorporated into presentations, exams, or custom-made classroom materials.

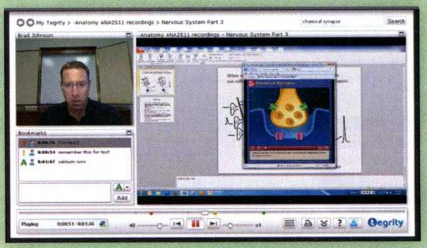
2 Engage your students during class with Active Learning resources. Use Tegrity, the lecture-capture program in Connect, to reach your students outside of class.

Active Learning in Connect

Chapter	Guided Collaborative Activities	Minute Papers	Clicker Questions	Concept Mapping
All Chapters	Guided Collaborative Learning Activities (11186.0K)	Available soon	Available soon	Available soon
Ch01 An Introduction to Biology	Experimental Design - Metabo-Herb (91.0K) Hypothesis Testing (172.0K)	Ch01 Minute Papers PPT (324.0K)	Ch01 Clicker Questions PPT (350.0K)	Ch1 Concept Map Scientific Theory (296.0K)
Ch02 The Chemical Basis of Life I: Atoms, Molecules, and Water		Ch02 Minute Papers PPT (177.0K)	Ch02 Clicker Questions PPT (215.0K)	Ch2 Concept Map Chemistry (226.0K)
Ch03 The Chemical Basis of Life II: Organic Molecules	Fatty Acids, Nutrition, Health (432.0K) How Expensive Are You? (125.0K)	Ch03 Minute Papers PPT (175.0K)	Ch03 Clicker Questions PPT (221.0K)	Ch3 Concept Map Biomolecules (130.0K)
Ch04 General Features of Cells	Organelles and Illness (91.0K)	Ch04 Minute Papers PPT (168.0K)	Ch04 Clicker Questions PPT (227.0K)	Ch4 Concept Map Eukaryotic Cell Components (143.0K)

Active-learning resources in Connect are sorted by chapter and designed to help you offer activities with varying degrees of participation: from Collaborative In-class Activities that are supported with instructor resources and prebuilt student assignments to Clicker Questions, Minute Papers, and Concept Maps.

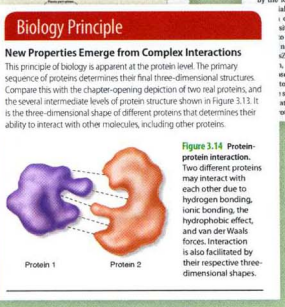
Use Tegrity to record your class activities. Your students can revisit your presentations and discussions after class with access to all the materials you covered.

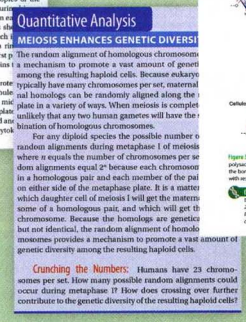


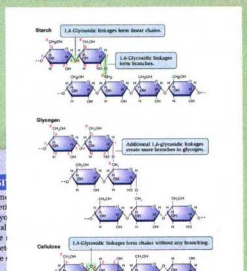
3 If your students are better prepared when they walk into class, you can expand your coverage beyond the scope of basic concepts, incorporating discussion sessions and working on critical thinking skills.

Challenge your students

The authors of *Principles of Biology* understand that today's biology majors need to move beyond memorization and content acquisition. Features in the text such as Feature Investigations, Quantitative Analysis, Biology Principles figures, Evolutionary Connections, and Bio-Connections questions challenge students to apply their knowledge. Assignable online assessments and activities support the development of critical-thinking skills.

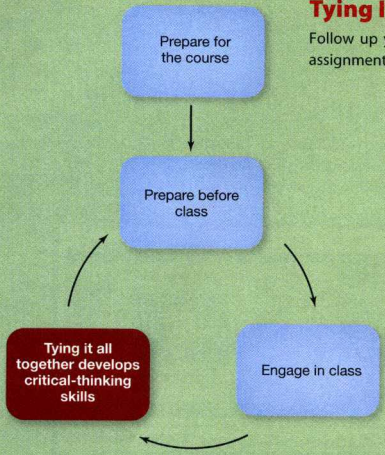




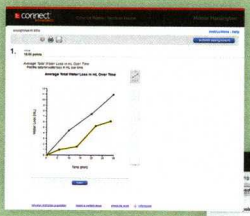


Tying It All Together for Your Students

Follow up your class with assessment that helps students develop critical-thinking skills. Set up assignments from the various assessment banks in Connect.



The Question and Test Banks contain higher order critical thinking questions that require students to demonstrate a more in-depth understanding of the concepts—as described on page xiii, you can quickly and easily filter the banks for these questions using higher level Blooms. BioConnections question banks provide questions that require students make connections among topics across chapters, developing critical-thinking skills.



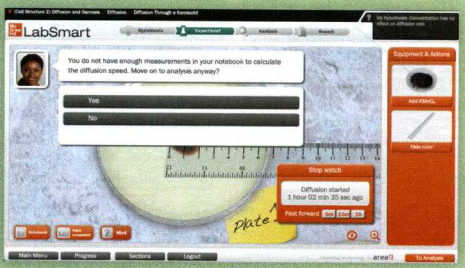
◀ **Quantitative Analysis** features in the text have assignable online activities that encourage students to practice and strengthen their quantitative reasoning skills.

Many chapters also contain a **Quantitative Question Bank.** These are more challenging algorithmic questions, intended to help your students practice their quantitative reasoning skills. Hints and guided solution options step students through a problem. ▶

LEARNSMART LABS™

Based on the same world-class superadaptive technology as LearnSmart, McGraw-Hill LearnSmart-Labs is a must-see, outcomes-based lab simulation. It assesses a student's knowledge and adaptively corrects deficiencies, allowing the student to learn faster and retain more knowledge with greater success. Whether your need is to overcome the logistical challenges of a traditional lab, provide better lab prep, improve student performance, or create an online experience that rivals the real world, LabSmart accomplishes it all.

Learn more at www.mhlabsmart.com



LearnSmart Labs can be used to help students apply the scientific process, thinking and doing like scientists via rich simulations.