



Preface to Biology

Bởi:

OpenStaxCollege

Welcome to *Biology*, an OpenStax College resource. This textbook has been created with several goals in mind: accessibility, customization, and student engagement—all while encouraging science students toward high levels of academic scholarship. Instructors and students alike will find that this textbook offers a strong foundation in biology in an accessible format.

About OpenStax College

OpenStax College is a non-profit organization committed to improving student access to quality learning materials. Our free textbooks are developed and peer-reviewed by educators to ensure they are readable, accurate, and meet the scope and sequence requirements of today’s college courses. Unlike traditional textbooks, OpenStax College resources live online and are owned by the community of educators using them. Through our partnerships with companies and foundations committed to reducing costs for students, OpenStax College is working to improve access to higher education for all. OpenStax College is an initiative of Rice University and is made possible through the generous support of several philanthropic foundations.

About OpenStax College’s Resources

OpenStax College resources provide quality academic instruction. Three key features set our materials apart from others: they can be customized by instructors for each class, they are a “living” resource that grows online through contributions from science educators, and they are available free or for minimal cost.

Customization

OpenStax College learning resources are designed to be customized for each course. Our textbooks provide a solid foundation on which instructors can build, and our resources are conceived and written with flexibility in mind. Instructors can select the sections most relevant to their curricula and create a textbook that speaks directly to the needs of their classes and student body. Teachers are encouraged to expand on existing

examples by adding unique context via geographically localized applications and topical connections.

Biology can be easily customized using our online platform. Simply select the content most relevant to your current semester and create a textbook that speaks directly to the needs of your class. *Biology* is organized as a collection of sections that can be rearranged, modified, and enhanced through localized examples or to incorporate a specific theme of your course. This customization feature will help bring biology to life for your students and will ensure that your textbook truly reflects the goals of your course.

Curation

To broaden access and encourage community curation, *Biology* is “open source” licensed under a Creative Commons Attribution (CC-BY) license. The scientific community is invited to submit examples, emerging research, and other feedback to enhance and strengthen the material and keep it current and relevant for today’s students. Submit your suggestions to info@openstaxcollege.org, and check in on edition status, alternate versions, errata, and news on the StaxDash at <http://openstaxcollege.org>.

Cost

Our textbooks are available for free online, and in low-cost print and e-book editions.

About Biology

Biology is designed for multi-semester biology courses for science majors. It is grounded on an evolutionary basis and includes exciting features that highlight careers in the biological sciences and everyday applications of the concepts at hand. To meet the needs of today’s instructors and students, some content has been strategically condensed while maintaining the overall scope and coverage of traditional texts for this course. Instructors can customize the book, adapting it to the approach that works best in their classroom. *Biology* also includes an innovative art program that incorporates critical thinking and clicker questions to help students understand—and apply—key concepts.

Coverage and Scope

Biology meets the scope and sequence of a typical two semester biology course for biology majors, pre-med majors, and science majors. In developing *Biology*, we listened to hundreds of General Biology instructors who readily provided feedback about their courses, students, challenges, and hopes for innovation. The expense of textbooks and related items did prove to be a barrier to learning. But more importantly, these

teachers suggested improvements for the textbook, which would ultimately lead to more meaningful and memorable learning experiences for students.

The result is a book that addresses a core organizational reality of the course and its materials – the sheer breadth of the topical coverage. We provide a thorough treatment of biology’s foundational concepts while condensing selected topics in response to the market’s request for a textbook with a scope that is manageable for instructors and students alike. We also strive to make biology, as a discipline, interesting and accessible to students. In addition to a comprehensive coverage of core concepts and foundational research, we have incorporated features that draw learners into the discipline in meaningful ways.

The pedagogical choices, chapter arrangements, and learning objective fulfillment were developed and vetted with the feedback of another one hundred reviewers, who thoroughly read the material and offered detailed critical commentary.

- **Unit 1: The Chemistry of Life.** Our opening unit introduces students to the sciences, including the scientific method and the fundamental concepts of chemistry and physics that provide a framework within which learners comprehend biological processes.
- **Unit 2: The Cell.** Students will gain solid understanding of the structures, functions, and processes of the most basic unit of life: the cell.
- **Unit 3: Genetics.** Our comprehensive genetics unit takes learners from the earliest experiments that revealed the basis of genetics through the intricacies of DNA to current applications in the emerging studies of biotechnology and genomics.
- **Unit 4: Evolutionary Processes.** The core concepts of evolution are discussed in this unit with examples illustrating evolutionary processes. Additionally, the evolutionary basis of biology reappears throughout the textbook in general discussion and is reinforced through special call-out features highlighting specific evolution-based topics.
- **Unit 5: Biological Diversity.** The diversity of life is explored with detailed study of various organisms and discussion of emerging phylogenetic relationships. This unit moves from viruses to living organisms like bacteria, discusses the organisms formerly grouped as protists, and devotes multiple chapters to plant and animal life.
- **Unit 6: Plant Structure and Function.** Our plant unit thoroughly covers the fundamental knowledge of plant life essential to an introductory biology course.
- **Unit 7: Animal Structure and Function.** An introduction to the form and function of the animal body is followed by chapters on specific body systems and processes. This unit touches on the biology of all organisms while

maintaining an engaging focus on human anatomy and physiology that helps students connect to the topics.

- Unit 8: **Ecology**. Ecological concepts are broadly covered in this unit, with features highlighting localized, real-world issues of conservation and biodiversity.

Pedagogical Foundation and Features

Biology is grounded on a solid scientific base and designed to help students understand the concepts at hand. Throughout the text, one can explore features that engage the students in scientific inquiry by taking selected topics a step further. Our features include:

- **Evolution Connection** features uphold the importance of evolution to all biological study through discussions like “The Evolution of Metabolic Pathways” and “Algae and Evolutionary Paths to Photosynthesis.”
- **Scientific Method Connection** call-outs walk students through actual or thought experiments that elucidate the steps of the scientific process as applied to the topic. Features include “Determining the Time Spent in Cell Cycle Stages” and “Testing the Hypothesis of Independent Assortment.”
- **Career Connection** features present information on a variety of careers in the biological sciences, introducing students to the educational requirements and day-to-day work life of a variety of professions, such as microbiologist, ecologist, neurologist, and forensic scientist.
- **Everyday Connection** features tie biological concepts to emerging issues and discuss science in terms of everyday life. Topics include “Chesapeake Bay” and “Can Snail Venom Be Used as a Pharmacological Pain Killer?”

Art and Animations That Engage

Our art program takes a straightforward approach designed to help students learn the concepts of biology through simple, effective illustrations, photos, and micrographs. *Biology* also incorporates links to relevant animations and interactive exercises that help bring biology to life for students.

- **Art Connection** features call out core figures in each chapter for student study. Questions about key figures, including clicker questions that can be used in the classroom, engage students’ critical thinking and analytical abilities to ensure their genuine understanding.
- **Link to Learning** features direct students to online interactive exercises and animations to add a fuller context and examples to core content.

About Our Team

Biology would not be possible if not for the tremendous contributions of the authors and community reviewing team.

Senior Contributors

Yael Avissar	Rhode Island College	Cell Biology
Jung Choi	Georgia Institute of Technology	Genetics
Jean DeSaix	University of North Carolina at Chapel Hill	Evolution
Vladimir Jurukovski	Suffolk County Community College	Animal Physiology
Robert Wise	University of Wisconsin, Oshkosh	Plant Biology
Connie Rye	east Mississippi Community College	General Content Lead

Faculty Contributors and Reviewers

Julie Adams	Aurora University
Summer Allen	Brown University
James Bader	Case Western Reserve University
David Bailey	St. Norbert College
Mark Belk	Brigham Young University
Nancy Boury	Iowa State University
Lisa Bonneau	Metropolitan Community College - Blue River
Graciela Brelles-Marino	California State University Pomona
Mark Browning	Purdue University
Sue Chaplin	University of St. Thomas
George Cline	Jacksonville State University
Deb Cook	Georgia Gwinnett College
Diane Day	Clayton State University

Frank Dirrigl	The University of Texas - Pan American
Waneene Dorsey	Grambling State University
Nick Downey	University of Wisconsin La Crosse
Rick Duhrkopf	Baylor University
Kristy Duran	Adams State University
Stan Eisen	Christian Brothers University
Brent Ewers	University of Wyoming
Myriam Feldman	Lake Washington Institute of Technology
Michael Fine	Virginia Commonwealth University
Linda Flora	Delaware County Community College
Thomas Freeland	Walsh University
David Gris�	Texas A & M University - Corpus Christi
Andrea Hazard	SUNY Cortland
Michael Hedrick	University of North Texas
Linda Hensel	Mercer University
Mark Kopeny	University of Virginia
Norman Johnson	University of Massachusetts - Amherst
Grace Lasker	Lake Washington Institute of Technology; Walden University
Sandy Latourelle	SUNY Plattsburgh
Theo Light	Shippensburg University
Clark Lindgren	Grinnell College
James Malcolm	University of Redlands
Mark Meade	Jacksonville State University
Richard Merritt	Houston Community College
James Mickle	North Carolina State University
Jasleen Mishra	Houston Community College
Dudley Moon	Albany College of Pharmacy and Health Sciences

Jonas Okeagu	Fayetteville State University
Diana Oliveras	University of Colorado Boulder
John Peters	College of Charleston
Joel Piperberg	Millersville University
Johanna Porter-Kelley	Winston-Salem State university
Robyn Puffenbarger	Bridgewater College
Dennis Revie	California Lutheran University
Ann Rushing	Baylor University
Sangha Saha	City College of Chicago
Edward Saiff	Ramapo College of New Jersey
Brian Shmaefsky	Lone Star College System
Robert Sizemore	Alcorn State University
Marc Smith	Sinclair Community College
Frederick Spiegel	University of Arkansas
Frederick Sproull	La Roche College
Bob Sullivan	Marist College
Mark Sutherland	Hendrix College
Toure Thompson	Alabama A&M University
Scott Thomson	University of Wisconsin - Parkside
Allison van de Meene	University of Melbourne
Mary White	Southeastern Louisiana University
Steven Wilt	Bellarmino University
James Wise	Hampton University
Virginia Young	Mercer University
Leslie Zeman	University of Washington
Daniel Zurek	Pittsburg State University

Learning Resources

- **Wiley Plus for Biology-Fall 2013 Pilot**

[WileyPLUS](#) provides an engaging online environment for effective teaching and learning. WileyPLUS builds students' confidence because it takes the guesswork out of studying by providing a clear roadmap; what to do, how to do it, and if they did it right. With WileyPLUS, students take more initiative. Therefore, the course has a greater impact on their learning experience. Adaptive tools provide students with a personal, adaptive learning experience so they can build their proficiency on topics and use their study time most effectively. Please let us know if you would like to participate in a Fall 2013 Pilot.

- **Biology Powerpoint Slides (faculty only)**

The [PowerPoint slides](#) are based on the extensive illustrations from Biology. They can be edited, incorporated into lecture notes, and you are free to share with anyone in the community. This is a restricted item requiring faculty registration. NOTE: This file is very large and may take some time to download.

- **SimBio (Laboratory)**

[SimBio's interactive modules](#) (virtual labs and interactive tutorials and chapters) provide engaging, discovery-based learning tools that complement many of the chapters of Biology. SimBio is best known for their EcoBeaker® and EvoBeaker® suites of simulated ecology and evolution laboratories that guide students through the "discovery" of important concepts via a mix of structured and open-ended experimentation on simulated systems. In response to popular demand, SimBio has begun applying the same powerful approaches to topics in cell biology, genetics, and neurobiology. All of SimBio's modules include instant-feedback questions that enhance student comprehension and auto-graded questions that facilitate implementation.

Preface to Biology

