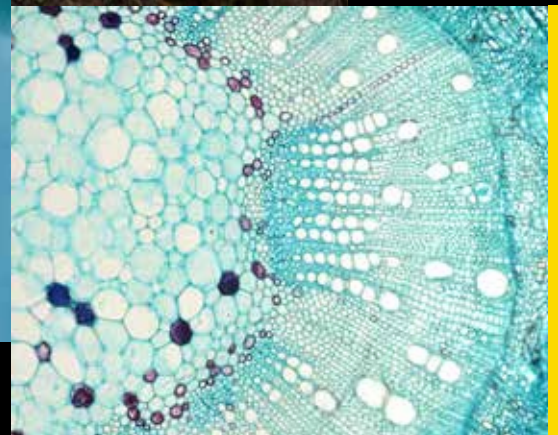


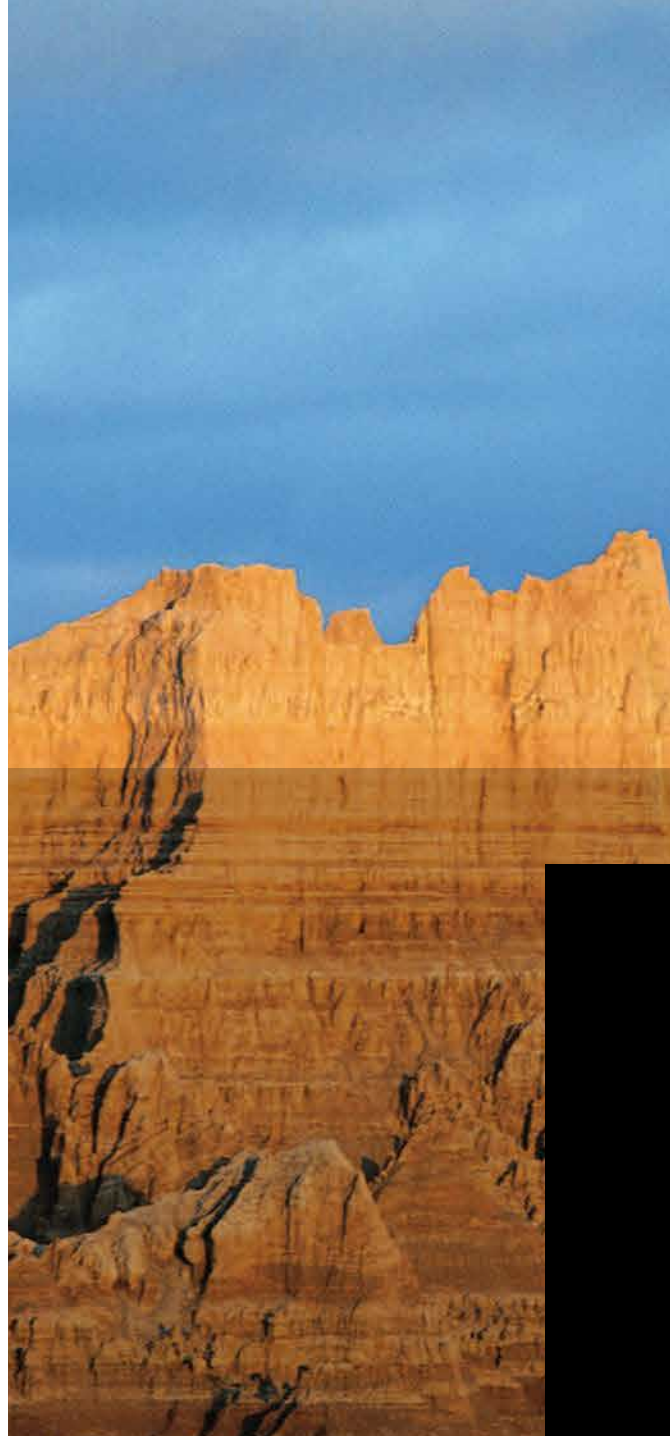


BIOLOGY



PHENOMENA-BASED INSTRUCTION WITH NATIONAL GEOGRAPHIC RESOURCES

As teaching shifts towards multidisciplinary approaches to learning, *National Geographic Biology* is designed specifically to meet the needs of Phenomena-Based instruction. Deepen concept knowledge and inquiry skills by combining phenomena-based instruction with National Geographic resources. *Biology* empowers all students to investigate real-world scenarios and build skills towards academic and career success.



BUILT FOR 3-DIMENSIONAL INSTRUCTION

The 3-Dimensional approach to teaching is changing the way science and biology are taught. *National Geographic Biology* was created to guide teachers through 3D instruction by incorporating Disciplinary Core Ideas (DCI), Science and Engineering Practices (SEP), and Crosscutting Concepts (CCC) into each lesson to prepare students to master the Performance Expectations.

AUTHENTIC NATIONAL GEOGRAPHIC EXPERIENCE

National Geographic Biology connects students to the field of biology through content and features that showcase the experiences of diverse National Geographic Explorers and photographers. This engaging content consists of lessons with featured articles, videos, and Virtual Investigations in the digital platform hosted by the National Geographic explorers themselves.

Cengage MindTap

With the help of the MindTap digital platform, students are transported into the world of biology with:



- realistic simulations allowing them to interact with data and graphs
- guided Virtual Investigations where they are immersed in field-relevant environments
- engaging videos embedded in the interactive eBook

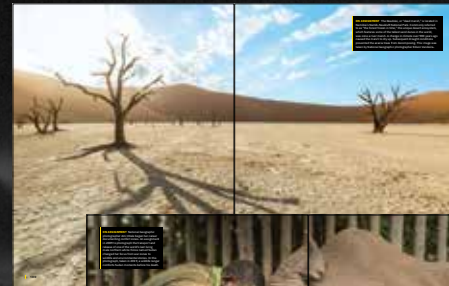


ENGAGE STUDENTS WITH AUTHENTIC BIOLOGY STORIES

Diverse National Geographic Explorers share their personal backgrounds and exciting biology stories that engage students with relevant content that resonates!



National Geographic "On Assignment" photo features illuminate stories and transport students into the biological world around them.



Digital Biology Explorations

Transport students into the field with simulations, engaging videos, and Virtual Investigations where a National Geographic Explorer guides students through a virtual biology research project.



A video series featuring National Geographic Explorers highlighting their unique biology stories and research supports the phenomena in the print text. Students see themselves reflected in these diverse biologists.



ENSURING BIOLOGY STANDARDS ARE MET

National Geographic Biology was created specifically to teach 3-Dimensional standards and the NGSS to support high school life science standards core ideas, practices, and concepts.



PREPARE STUDENTS FOR COLLEGE AND CAREER

Skills introduced in *National Geographic Biology* build a foundation for other high school science courses and for other disciplines. Projects, assessments, and personal stories cultivate the problem solving and critical thinking skills needed for college and/or careers.

Connections to other disciplines in the student book and Teacher's Edition reinforce skills used throughout high school in all courses.

Figure 4.1 Exponential population growth curve. The population of a species grows exponentially when resources are unlimited. The population of a species grows exponentially when resources are unlimited. The population of a species grows exponentially when resources are unlimited.

Figure 4.2 Exponential population growth curve. The population of a species grows exponentially when resources are unlimited. The population of a species grows exponentially when resources are unlimited.

Figure 4.3 Exponential population growth curve. The population of a species grows exponentially when resources are unlimited. The population of a species grows exponentially when resources are unlimited.

Questions and prompts throughout each chapter serve as 3D checkpoints, prompting students to engage with Disciplinary Core Ideas, Crosscutting Concepts, and Science and Engineering Practices.

SEP Construct an Explanation Describe the difference between the biotic potential of a population of organisms and the population's growth rate.

Authentic Phenomena-Based Learning

Each unit opens with an Anchoring Phenomenon. A Driving Question frames the phenomenon as something students will investigate and revisit multiple times throughout the unit.

UNIT 5 GENETICS

HOW CAN WE SLOW THE SPREAD OF A VIRUS?

In this unit, you will learn how scientific and technological advancements can help us better understand and respond to a viral pandemic.



MATH AND ENGLISH LANGUAGE ARTS CONNECTIONS

Standard	Grade
Mathematics: Data Analysis and Statistics	HS-MS-1
Mathematics: Algebra	HS-MS-2
Mathematics: Geometry	HS-MS-3
Mathematics: Probability	HS-MS-4
Mathematics: Number and Quantity	HS-MS-5
Mathematics: Operations and Algebraic Thinking	HS-MS-6
Mathematics: Functions	HS-MS-7
Mathematics: Modeling	HS-MS-8
Mathematics: Problem Solving	HS-MS-9
Mathematics: Communication	HS-MS-10
Mathematics: Reasoning	HS-MS-11
Mathematics: Connections	HS-MS-12
Mathematics: Applications	HS-MS-13
Mathematics: Problem Solving	HS-MS-14
Mathematics: Communication	HS-MS-15
Mathematics: Reasoning	HS-MS-16
Mathematics: Connections	HS-MS-17
Mathematics: Applications	HS-MS-18
Mathematics: Problem Solving	HS-MS-19
Mathematics: Communication	HS-MS-20
Mathematics: Reasoning	HS-MS-21
Mathematics: Connections	HS-MS-22
Mathematics: Applications	HS-MS-23
Mathematics: Problem Solving	HS-MS-24
Mathematics: Communication	HS-MS-25
Mathematics: Reasoning	HS-MS-26
Mathematics: Connections	HS-MS-27
Mathematics: Applications	HS-MS-28
Mathematics: Problem Solving	HS-MS-29
Mathematics: Communication	HS-MS-30
Mathematics: Reasoning	HS-MS-31
Mathematics: Connections	HS-MS-32
Mathematics: Applications	HS-MS-33
Mathematics: Problem Solving	HS-MS-34
Mathematics: Communication	HS-MS-35
Mathematics: Reasoning	HS-MS-36
Mathematics: Connections	HS-MS-37
Mathematics: Applications	HS-MS-38
Mathematics: Problem Solving	HS-MS-39
Mathematics: Communication	HS-MS-40
Mathematics: Reasoning	HS-MS-41
Mathematics: Connections	HS-MS-42
Mathematics: Applications	HS-MS-43
Mathematics: Problem Solving	HS-MS-44
Mathematics: Communication	HS-MS-45
Mathematics: Reasoning	HS-MS-46
Mathematics: Connections	HS-MS-47
Mathematics: Applications	HS-MS-48
Mathematics: Problem Solving	HS-MS-49
Mathematics: Communication	HS-MS-50
Mathematics: Reasoning	HS-MS-51
Mathematics: Connections	HS-MS-52
Mathematics: Applications	HS-MS-53
Mathematics: Problem Solving	HS-MS-54
Mathematics: Communication	HS-MS-55
Mathematics: Reasoning	HS-MS-56
Mathematics: Connections	HS-MS-57
Mathematics: Applications	HS-MS-58
Mathematics: Problem Solving	HS-MS-59
Mathematics: Communication	HS-MS-60
Mathematics: Reasoning	HS-MS-61
Mathematics: Connections	HS-MS-62
Mathematics: Applications	HS-MS-63
Mathematics: Problem Solving	HS-MS-64
Mathematics: Communication	HS-MS-65
Mathematics: Reasoning	HS-MS-66
Mathematics: Connections	HS-MS-67
Mathematics: Applications	HS-MS-68
Mathematics: Problem Solving	HS-MS-69
Mathematics: Communication	HS-MS-70
Mathematics: Reasoning	HS-MS-71
Mathematics: Connections	HS-MS-72
Mathematics: Applications	HS-MS-73
Mathematics: Problem Solving	HS-MS-74
Mathematics: Communication	HS-MS-75
Mathematics: Reasoning	HS-MS-76
Mathematics: Connections	HS-MS-77
Mathematics: Applications	HS-MS-78
Mathematics: Problem Solving	HS-MS-79
Mathematics: Communication	HS-MS-80
Mathematics: Reasoning	HS-MS-81
Mathematics: Connections	HS-MS-82
Mathematics: Applications	HS-MS-83
Mathematics: Problem Solving	HS-MS-84
Mathematics: Communication	HS-MS-85
Mathematics: Reasoning	HS-MS-86
Mathematics: Connections	HS-MS-87
Mathematics: Applications	HS-MS-88
Mathematics: Problem Solving	HS-MS-89
Mathematics: Communication	HS-MS-90
Mathematics: Reasoning	HS-MS-91
Mathematics: Connections	HS-MS-92
Mathematics: Applications	HS-MS-93
Mathematics: Problem Solving	HS-MS-94
Mathematics: Communication	HS-MS-95
Mathematics: Reasoning	HS-MS-96
Mathematics: Connections	HS-MS-97
Mathematics: Applications	HS-MS-98
Mathematics: Problem Solving	HS-MS-99
Mathematics: Communication	HS-MS-100

LOOKING AT THE DATA

THE BIODIVERSITY CONSERVATION PARADOX

Crosscurricular Connections

Chemistry Transpiration is the evaporation of water inside the plant through the stomata. Evaporation is the change in water from liquid to gas that occurs at a lower temperature than water's boiling point. Water molecules in the liquid state have a wide range of kinetic energy, and those that have kinetic energy above a threshold amount can overcome intermolecular bonds and escape into the atmosphere in the gas state. The result of transpiration is a force that pulls water and its dissolved nutrients upward from the soil to all parts of the plant.

Connect to Careers

Evolutionary Ornithologist Ornithology is the study of birds. Evolutionary ornithologists study how avian species have changed over time, using phylogenetics, evolutionary evidence of feathers from fossils, and a variety of other methods. They may use traditional field biology techniques, genetic testing and technology such as drones and field cameras to collect data. Evolutionary ornithologists typically need a bachelor or master's degree in biology. Evolutionary ornithologists who lead research projects or work in specialized positions typically have a master's degree or higher degree. Universities, museums, and wildlife and conservation organizations hire evolutionary ornithologists to study birds in the field and in laboratory settings.

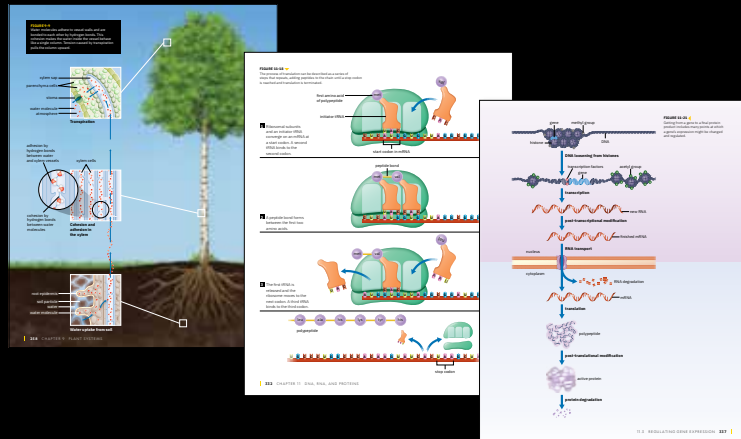
Wildlife Rehabilitator As environments continue to change, animals are more affected by human activities. Wildlife rehabilitators care for injured and ill animals and assist residents with animal conflicts. They work for nonprofit or governmental agencies to promote conservation of species and educate the public about wildlife. Wildlife rehabilitators are required to have knowledge about ecology, biology, and medical care, but a college degree is not always required.



Explorer stories and case studies inspire views into science careers

CONNECT ALL STUDENTS IN QUALITY LEARNING

Student and teacher resources provide tools and strategies allowing all students to access the text, experience biology concepts through various media, remediate where needed, and be challenged when ready.



Full page illustrations and photographs make the details of biology visible and tell visual stories

The Teacher's Edition includes support throughout each lesson to address the needs of all students including ELL, struggling, advanced, students with disabilities, and economically disadvantaged students.

DIFFERENTIATED INSTRUCTION | English Language Learners

Using Academic Language Have pairs discuss the visual on this page using the following terms: stem cell, DNA, segments, expressed, tissues, and organs.

Beginning Provide sentence frames: In the middle is a _____. It can become a cell in different _____ and _____. It depends on what _____ segments are _____. Have students read the labels and point to where each of these cell types might be in their own bodies.

Intermediate Have pairs describe how a stem cell becomes a fat cell and what structures it develops bank with the academic students to use.

Advanced Have pairs cell can become any e pictured. Provide a list of words. Encourage the structures of some of types.

DIFFERENTIATED INSTRUCTION | Leveled Support

Struggling Students For students struggling with the concept of habitat destruction and recovery efforts for the El Rincon stream frog, have them look for local examples of habitat loss, such as clearing land for building, and what organisms were affected. They may then work in pairs to write their own species recovery plan.

Advanced Learners For students who easily grasp the concepts discussed here, assign them the role of an investigative reporter. Have them work in groups to develop a list of questions that they would like to pose to Dr. Kacelnik about his work, his career, or other topics related to what they are learning in this chapter about interactions and relationships in ecosystems.

Modified Digital Text

The online eBook can instantly lower the reading level two grades for struggling readers.



HANDS-ON BIOLOGY AND DATA ACTIVITIES



Applying Biology with Hands-on Science and Data Activities

Each chapter provides multiple opportunities for hands-on learning. Quick minilabs and full laboratory investigations give students practice with lab equipment and lab safety procedures. Data analysis activities give students practice reading data and identifying patterns in data sets.

Labs, Engineering Activities, and Research Projects

Chapter Investigations provide more in-depth laboratory experiences with Guided Inquiry, Open Inquiry, and Design-Your-Own approaches. Also included are Engineering Design activities, research and writing activities in the "Tying It All Together" lesson for each chapter, and Claims, Evidence, Reasoning (CER) activities for each unit. Lab guides, worksheets, and rubrics are available in the MindTap digital platform.

TYING IT ALL TOGETHER
TRACKING TUSKLESS ELEPHANTS

WHY DO NEW SPECIES EMERGE WHILE OTHER SPECIES DISAPPEAR?

In this chapter, you learned how human activity can lead to changes in the biodiversity of an ecosystem. The Case Study described how ivory poaching has resulted in an increased proportion of tuskless elephants in Mozambique's Gorongosa National Park. Savanna elephants that reproduce at about 12 years old and give birth every three to four years. The offspring of tuskless elephants are born as tuskless elephants. These elephants are thought to have evolved from tusked elephants through a process called genetic drift.

Develop a Model

2. Suppose all the males in an elephant population have tusks and half of the females are tuskless. If the population is stable, what is the probability that you would see the first tuskless male in the population after three generations?

Construct an Explanation

3. Under what conditions could the presence of the gene for tusklessness in an elephant population lead to extinction?

4. All tuskless elephants, such as the one shown in Figure 16-26, have almost the same long-tooth reproductive age, with few to six years between offspring. The graph shows projected tuskless elephant population growth modeled using the natural birth and death rates of tusked elephants in Gorongosa National Park. How would the effects of poaching on tusked elephant populations compare to tuskless elephant populations? Explain your reasoning.

FIGURE 16-26

Elephant population growth projections. The graph compares the projected growth rates of tusked and tuskless populations.

UNIT 1 ACTIVITY

HOW DO SEA PIGS SURVIVE IN THE DEEP OCEAN?

Apply From Evidence In this unit, you learned that the ability for one organism to graze from the sea floor, the deep-sea hydrothermal vents, and the deep-sea hydrothermal vents, in generally hot regions called hydrothermal vents. These vents make up approximately 10 percent of the global seafloor.

The Monterey Bay Aquarium Research Institute (MBARI) has monitored an abyssal seamount off the central coast of California for 30 years. Their ROV (Remotely Operated Vehicle) has captured images of the seamount and its inhabitants and has measured carbon and oxygen levels to determine what the animals and bacteria there eat and produce. Sea pigs are abundant in this ecosystem. They have long, thin bodies and "marine snow," the dead organic matter and waste that sinks from shallow waters to the ocean floor.

Although they share their habitat with many other species of sea cucumbers, brittlestars, marine worms, mollusks, crabs, fish, and coral, sea pigs are not usually a food source for other organisms.

Claim Make a claim about the role of sea pigs in an abyssal plain ecosystem.

Evidence Use the evidence that you gathered throughout the unit to support your claim.

Reasoning To help evaluate your reasoning, you can develop a model that explains how abyssal plain organisms obtain the energy and matter they need to survive.

COURSE SUPPORT AND TEACHER TOOLS

National Geographic Biology supports teachers in the classroom with a thoughtfully designed Teacher's Edition and a wealth of teacher resources and assessments built in to the MindTap digital platform.



Teacher's Edition

The print and digital resources guide teachers through each unit and chapter to prepare students for 3-Dimensional skills, practices, and Performance Expectations including lessons built on the 5E lesson model, background information, and connections to math and English language arts.

CROSSCUTTING CONCEPTS | Energy and Matter

Modeling at Varied Scales This chapter focuses on modeling energy and matter transfer at ecological scales: between organisms in a community, between organisms and their environment, and among the biosphere, atmosphere, hydrosphere, and geosphere. Some fields of biology, such as physiology, cell biology, molecular biology, and biochemistry, essentially study how energy and matter enable life processes at various scales. Chapters 5 and 6 in Unit 2 addresses transformations of energy and matter at the molecular and cellular levels. Further reinforce this crosscutting concept throughout Unit 3 by having students organize information about living systems in terms of how they enable an organism to obtain energy and matter from its surroundings, transfer energy and matter within its body, and use energy and matter to survive.

SCIENCE AND ENGINEERING PRACTICES
Developing and Using Models

Limits of Models Students should recognize that food chains generally do not represent all members of a community and that they are subsets of food webs that can be constructed to represent the whole community (with more than one species at each trophic level). Students may notice that detritivores and decomposers are not represented in Figure 2-8. Ask students how they would refine the food web model shown here to include these types of organisms. You may wish to draw students' attention back to the Anchoring Phenomenon by encouraging them to build a food web based on the sea pig's deep-sea ecosystem. Students can do a similar analysis of the limitations of the pyramid models presented in the next section.

Connect to English Language Arts

Integration of Knowledge and Ideas Systems models presented in Chapter 2, such as the food web, ecological pyramids, and matter cycles, typically detail specific components or illustrative examples. When reading to understand how energy flows and matter cycles through ecosystems, students should be able to apply information from the model. Students can apply the same concepts to different ecosystems.

Make students translate between specific visual information and general text by writing a label for each arrow in Figures 2-3, 2-4, 2-7, or 2-8. Their labels should describe each transfer or transformation in terms of energy and matter.

CHAPTER INVESTIGATION A

Student Inquiry Students use three 10-day lessons.

Time: 130 minutes over 3 days

Students will follow a step-by-step procedure to investigate how different variables affect the building of a live shrimp.

Use online or access detailed teacher notes, answers, videos, and lab worksheets.

Crosscurricular Connections

Physical Science Students should be familiar with the electromagnetic spectrum. Ask them to identify colors that they have seen in plants. Students may identify a variety of colors as some plant leaves may be green, yellow, pink, and purple, but the most common color called out will likely be green. Refer students to the chloroplast model in Figure 6-24. They should understand that chloroplasts are certain colors they are because they only absorb certain wavelengths of light that provide the energy for photosynthesis. These pigments can change with the seasons. If time permits, share with students different graphs of the absorption spectra of chlorophyll. Ask students to use the graphs to determine the most likely colors of plant leaves.

12-2 Construct an Explanation Photosynthetic organisms produce the sugar molecules (glucose) that are needed for all organisms to run processes requiring energy in their cells.

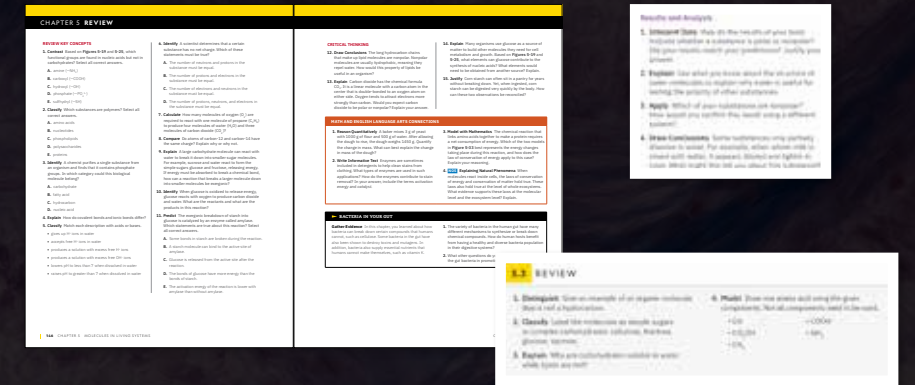
Teachers are provided with targeted support for 3D instruction and cross-curricular connections to Math, English Language Arts, and other science disciplines.

Connect to Mathematics

Define Quantities for Modeling Have students return to Figure 2-8 and apply estimated quantities to a pyramid of biomass and a pyramid of numbers for an Antarctic food web. For example, students can research the average mass of an elephant seal and the number of elephant seals in an average Antarctic colony. They can then work backwards to estimate the average mass and numbers of squid, krill, and phytoplankton to support that food chain.

ASSESSMENTS IN A VARIETY OF FORMATS

Biology prepares students for end of course exams through frequent formative assessment and through activity-based summative assessments getting students to master higher level depths of knowledge on biology content and science practice skills.



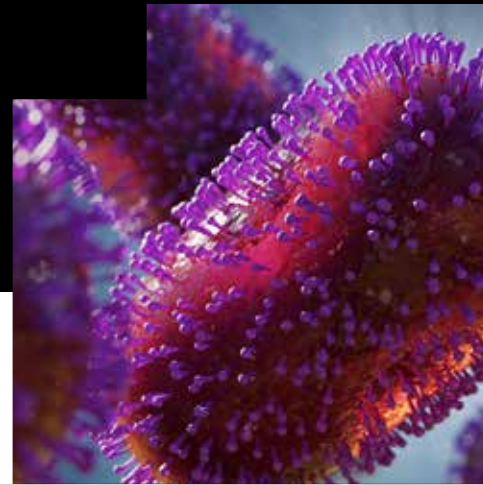
Summative Assessment

Chapter Assessments offer a combination of open-response and machine-scored items carefully designed to measure students' understanding and retention of the content. Unit Performance Tasks assess bundled Performance Expectations.



NATIONAL GEOGRAPHIC

BIOLOGY



NATIONAL GEOGRAPHIC
LEARNING

Cengage



For more information, visit
NGL.Cengage.com/NGBiology

@NatGeoLearning

@ExploreInside

@NatGeoLearning

"National Geographic", "National Geographic Society" and the Yellow Border Design are registered trademarks of the National Geographic Society® Marcas Registradas

ISBN-13: 979-8-214-07679-9



9 798214 076799