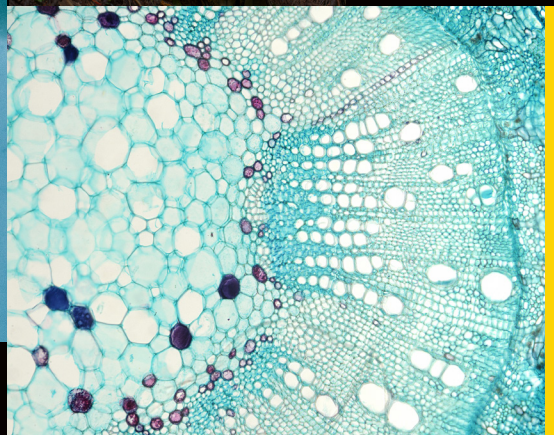
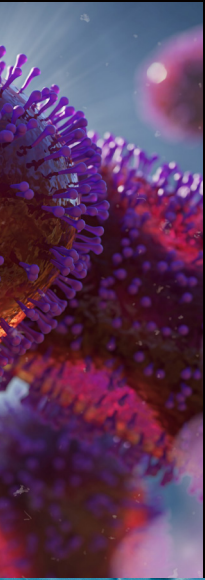




BIOLOGY

Florida Edition



PHENOMENA-BASED INSTRUCTION WITH NATIONAL GEOGRAPHIC RESOURCES



As teaching shifts towards multidisciplinary approaches to learning, *National Geographic Biology, Florida Edition* 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. Empower all students to investigate real-world scenarios and build skills towards academic and career success.



IN ENGLISH
AND SPANISH

BUILT FOR 3-DIMENSIONAL INSTRUCTION

The 3-Dimensional approach to teaching is changing the way science and biology are taught. *National Geographic Biology, Florida Edition* was created to guide teachers through 3D instruction by incorporating support for teaching the core ideas of science, the practices of science and engineering, and concepts that cut across all of science. Each lesson is built to prepare students to master the Big Ideas and Benchmarks of all your Florida Next Generation Sunshine State Standards (NGSSS) for Science.



FLORIDA Standards Correlations

Component Codes

BF: Biotechnology Focus
CA: Chapter Assessment
CI: Chapter Investigation
Conn: Connections
CR: Chapter Review
CS: Case Study
Explorer: Explorer feature
LAD: Looking At the Data
ML: Minilab
Math/ELA: Math and English Language Arts Connections
PT: Performance Task
RP: Revisit the Phenomenon
SR: Section Review
TIAT: Tying It All Together
U: Unit
UO: Unit Opener
*Bold numbers indicate chapters or sections.
Standards unique to Honors Biology 1 are indicated with an asterisk (*).*

Next Generation Sunshine State Standards (NGSSS) Correlations for Biology 1FL2
Additional Standards for Biology 1FL12

Next Generation Sunshine State Standards

BIOLOGY 1		
STANDARD	STUDENT/TEACHER EDITION	ONLINE RESOURCES
SC.912.E.7.1 Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon.	2.1 p. 42, pp. 44–45; 2.1 SR p. 45 #4; 2.3 pp. 54–55; 2.4 pp. 59–60; 2.5 pp. 65–68, p. 70; 2.5 SR p. 71 #1, #3, #4; 2 TIAT p. 73 #1–3; 2 CR pp. 74–75 #6, #10–13, Math/ELA #4, RP #1; U1 Activity p. 123; 6 CR p. 195 #17	2 CA #4, #5, #7, #12; U1 PT1 #1–4; U1 PT2 #1–4
SC.912.L.14.1 Describe the scientific theory of cells (cell theory) and relate the history of its discovery to the process of science.	1.1 p. 4; 6.1 p. 166; 6.1 Conn p. 167; 6 CR p. 195 #15, Math/ELA #4	
SC.912.L.14.2 Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).	6.1 p. 169, pp. 171–173; 6.1 SR p. 174 #1–3; 6.2 pp. 178–183; 6.2 SR p. 183 #1–3; 6 ML p. 184; 6.3 pp. 186–188, pp. 190–191; 6 CR pp. 194–195 #2, #4, #7, #9, #10, #16, Math/ELA #3; 7.3 pp. 211–212; 9.1 pp. 266–267; 9 ML p. 272 #1; 9.4 SR p. 291 #1; 9 CR pp. 294–295 #10, #14	6 CA #1, #3–6, #13–15, #17; CI 7B
SC.912.L.14.3 Compare and contrast the general structures of plant and animal cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.	6.1 pp. 166–169, pp. 171–174; 6.1 SR p. 174 #1, #2; 6 CR pp. 194–195 #1, #3, #12, #13, #16; U2 Activity p. 219; 8.1 p. 227; 8.2 SR p. 241 #1; 8 ML p. 242 #2; 8 CR pp. 262–263 #1, Math/ELA #3; 11 CR p. 364 #1	6 CA #2, #3, #13; 8 CA #4; 11 CA #3
SC.912.L.14.4 Compare and contrast structure and function of various types of microscopes.	6.1 Conn p. 167; 6 CR p. 195 #14, Math/ELA #3, #4; 8.4 p. 252; Appendix A pp. 546–547	

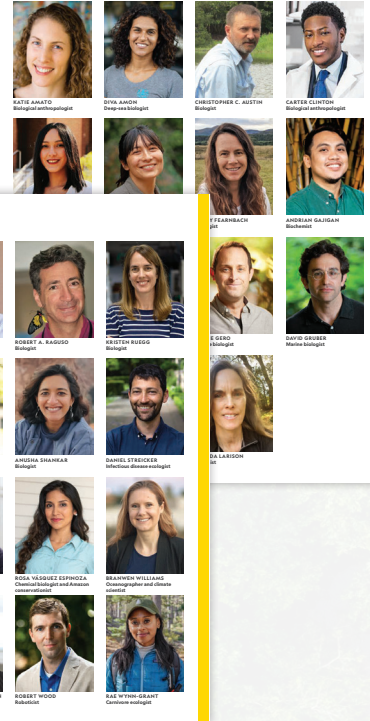
AUTHENTIC NATIONAL GEOGRAPHIC EXPERIENCE

National Geographic Biology, Florida Edition connects students to the field of biology through content and features that showcase the experiences and diverse perspectives of 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.

Real People Make the Difference

Explorers help to set the stage of the Unit Anchoring Phenomena, they share their personal experiences in the field of Biology, and lead students through the virtual labs and simulations in order to make the learning relevant, purposeful and accessible.

NATIONAL GEOGRAPHIC EXPLORERS



In our programs, students hear real-world stories and diverse perspectives from scientists and National Geographic Explorers



Analyze Describe how a human activity such as seabed mining might affect organisms that live in a deep-ocean ecosystem.

UNIT VIDEO 2 Go online to watch our interview with Amich and learn more about her career and research.

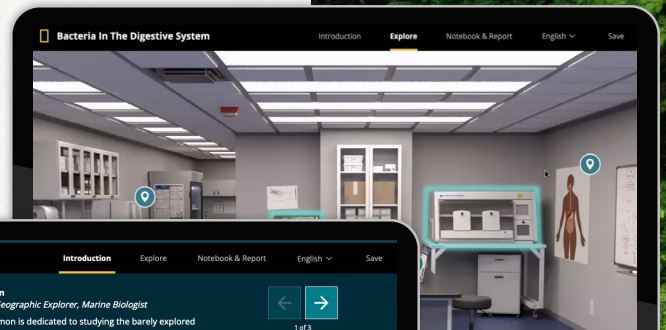
WORK SIDE BY SIDE WITH NATIONAL GEOGRAPHIC EXPLORERS

National Geographic Biology Virtual Investigations

National Geographic Explorers embark on amazing adventures and students will follow in their footsteps to conduct Virtual Investigations in the deep ocean, rainforest canopy, and other locations around the world bringing the content to life in the real world. These labs have been designed exclusively for *National Geographic Biology, Florida Edition* and cannot be found anywhere else.

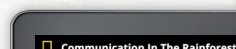
Digital Biology Explorations

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.



Virtual Investigations written exclusively for *National Geographic Biology*

Hosted by a National Geographic Explorer



PHENOMENA-BASED LEARNING

Biology 5E Lesson Model

ENGAGE

- 3D Lesson Design
- Anchoring Phenomena
- Driving Question
- Case Study
- Explore Video

EXPLORE/EXPLAIN

- MindTap Simulation
- Explore Lesson/Video
- Minilab
- Virtual Investigation
- Connection Lesson
- Biotechnology Lesson
- Explorer Connect To Careers

ELABORATE

- Tying it All Together
- Lesson Video
- Investigation Lab
- Phenomena Result

EVALUATE

- Unit Activity (CER)
- Formative Assessment
- Summative Assessment
- EOC Exam Prep

Every Unit begins with a Unit Explorer helping to launch the **Real World Anchoring Phenomena**. The **Driving Question** focuses students' observations into an investigable question they can answer at the end of the unit by using **evidence and reasoning** to apply biology concepts. These topics are current and relatable to students.



UNIT 1
RELATIONSHIPS IN ECOSYSTEMS

From a human point of view, life on the ocean floor seems tough. Thousands of meters beneath the surface, organisms contend with some of the most extreme conditions that exist on Earth. Sunlight does not travel to these depths, so it is very dark and cold. Pressures in the deep ocean are hundreds of times greater than on land. Most of the ocean floor is a vast plain of mud and rock. Despite these apparent challenges, a variety of animals, bacteria, and other organisms thrive in this environment.

The sea pig is one of the most common residents on the ocean floor. However, because their habitat is so difficult for humans to reach, much about sea pigs remains unknown.

HOW DO SEA PIGS SURVIVE IN THE DEEP OCEAN?

In this unit you will explore systems and interactions that enable organisms to survive within their ecosystems.

CHAPTER 2
ENERGY AND MATTER IN ECOSYSTEMS

CHAPTER 3
BIODIVERSITY AND ECOSYSTEM STABILITY

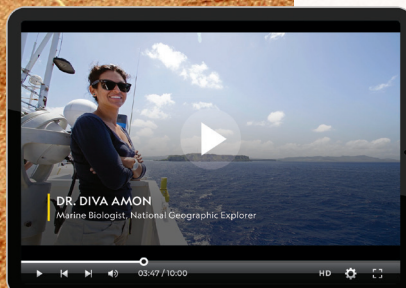
CHAPTER 4
POPULATION MEASUREMENT

A soft-bodied sea pig shuffles across the seafloor on unfeathered legs. It finds food by sifting through mud with its tentacles around its mouth.

28

HOW DO SEA PIGS SURVIVE IN THE DEEP OCEAN?

In this unit you will explore systems and interactions that enable organisms to survive within their ecosystems.



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.

2.1

ECOLOGICAL SYSTEMS

SC.912.E.7.1, SC.912.L.17.5, SC.912.L.17.8, SC.912.L.18.7, SC.912.L.18.9, SC.912.N.1.1, SC.912.P.10.1*

EXPLORE/EXPLAIN

This section provides a review of Earth's interconnected systems, introduces the hierarchical organization of the biosphere, and describes the main processes through which energy and matter support organism survival.

Objectives

- Distinguish between the levels of ecological organization.
- Describe how matter and energy support the survival of organisms.

Pretest Use **Question 6** to identify gaps in background knowledge or misconceptions.

Vocabulary Strategy

Word Families The Greek root *bio-* (life) should be familiar to students from *biology* and other common words, such as *biography*. It is also the root of five Key Terms in this chapter: *biome*, *biosphere*, *biomass*, *biomass pyramid*, and *biogeochemical cycle*. Suggest that students add each of these terms to a word tree or other graphic organizer. Students can also add other terms, such as *biomagnification*, which they will see in the Looking at the Data feature, and *symbiosis*, which they will encounter in Chapter 3.

Video

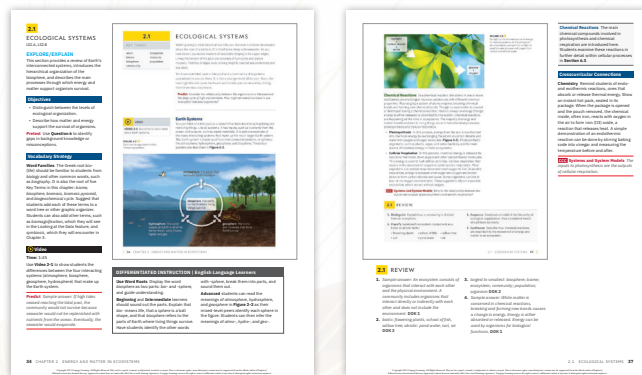
Time: 1:45

Use **Video 2-1** to show students the differences between the four interacting systems (atmosphere, biosphere, geosphere, hydrosphere) that make up the Earth system.

Predict *Sample answer: If high tides ceased reaching the tidal pool, the community would not survive because seawater would not be replenished with nutrients from the ocean. Eventually, the seawater would evaporate.*

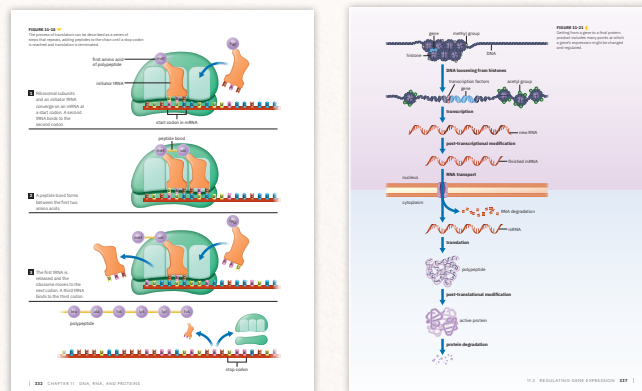
Student Centered Learning

A highly visual 2-4 page spread supports the students' ability to absorb the content. The teacher notes follow the 5E model, clearly stating the objective of the lesson, vocabulary strategies and the exact video created specifically for this lesson.



Visual Literacy

Careful thought is given to the layout of every page utilizing the expertise of National Geographic, ensuring every image and graphic set with the purpose of further deepening the students understanding, sparking interest, and increasing their retention of content details.



SUPPORT FOR ALL LEARNERS

Differentiated Instruction and Support

Teachers are provided with helpful notes and support suggestions for **Differentiated Instruction**. These embedded supports help to unlock the content for all learners, giving equal access to rigorous content.

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. Provide a word bank with the academic words for students to use.

Advanced Have pairs explain why a stem cell can become any of the types of cells pictured. Provide a list of academic words. Encourage them to describe the structures of some of the different cell 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. Kacolis about his work, his career, or other topics related to what they are learning in this chapter about interactions and relationships in ecosystems.

National Geographic Explorer Katie Amato

Grade-Level Text

Grade-Level Text

Modified Text

SOMETHING ABOUT YOUR GUT

CONNECTING GUT MICROBIOMES

THE 30-40 SQUARE METERS environment every time you take that make up your body. The colic microbes thrive in your gut's environment. Biological anthropologists and paleoanthropologists look at this relationship in how it to the gut microbiome's impact on

ON-LEVEL TEXT

3.3 BIODIVERSITY

A biological system's richness and complexity are measured by the number of species and the genetic diversity within those species. The richness of a system is the number of different species it contains. The complexity of a system is the number of different genetic forms within those species. The more complex a system is, the more genetic diversity it has. The more genetic diversity a system has, the more complex it is. The more complex a system is, the more genetic diversity it has. The more genetic diversity a system has, the more complex it is.

KEY TERMS

Biodiversity The richness and complexity of a biological system, measured by the number of species and the genetic diversity within those species.

Richness The number of different species in a biological system.

Complexity The number of different genetic forms within a species in a biological system.

Genetic diversity The number of different genetic forms within a species in a biological system.

Modified Text

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Modified Text

The eBook can instantly lower the reading level by two grade levels for Striving Readers.

Virtual Simulations

Virtual Simulations are an essential component integrating technology into the learning model. These interactive features bring figures and concepts from the print book to life.

Antarctic Food Web

The arrows indicate the flow of energy between organisms.

Select one of the 4 interactive organisms to explore the food web.

Figure 2.6

How does the flow of energy between organisms in an ecosystem?

EVIDENCE-BASED SOLUTIONS



CASE STUDY SOMETHING FISHY IN THE FOREST

HOW DO ENERGY AND MATTER MOVE THROUGH AN ECOSYSTEM?

Biologists have identified several large populations of brown bears living in the temperate rainforest along the Pacific Ocean in Southeast Alaska. About 4300 brown bears inhabit Admiralty, Chichagof, and Baranof Islands in the Tongue National Forest. The bear population density on Admiralty Island is among the highest in the world at one bear per square mile. Bears are famous for their enormous appetites. They eat a variety of vegetation including berries, roots, and grasses. Bears also hunt large animals such as moose, deer, and caribou as well as smaller mammals. To obtain their primary source of protein, Alaskan coastal brown bears fish for salmon in the rivers that extend from the forest to the ocean (Figure 2-5). These species of salmon are born in freshwater streams and migrate to the ocean where they spend much of their lives. When it's time to reproduce, the salmon return to the same freshwater streams where they were born.



Typically, a bear eats only the most energy-rich parts of the fish, such as the brain and the eggs of female salmon that have not yet spawned. Brown bears gain just over one kilogram of fat per day to store energy to survive through the winter months, during which they lose 20 to 40 percent of their body mass. In particular, pregnant bears must build up energy fat reserves to give birth and feed cubs. Bears carry their meals away from the watershed, where they leave fish carcasses to decay or be scavenged by other animals.

Temperate rainforest soils naturally contain the levels of nitrogen, an element that is abundant in salmon and essential for plant growth. In a new ecosystem, plants and trees enhance conditions for the reproduction and growth of new fish. Thriving vegetation provides shade, stabilizes riverbank soil, filters sediment, and serves as a nutritious food source for other animals and microbes. The relationship between bears and salmon affects many other organisms and is key to maintaining healthy coastal forest ecosystems. In turn, the forests provide suitable habitats for sustainable populations of bears and salmon. These relationships are characterized by the movement of both energy and matter throughout the ecosystem.

Ask Questions As you read this chapter, generate questions about the ways in which matter cycles and energy flows between organisms and their environment.



FIGURE 2-5 When salmon are plentiful in the late summer months, Alaskan brown bears can catch more than 30 fish per day!

CASE STUDY 35 |

The Chapter Opener and Case Study

All learning opportunities work together to support the unit phenomenon carefully tied to the **Driving Question** and revisited again at the end of the chapter in the **Tying It All Together** activity. Callouts within the chapters prompt students to connect concepts back to the **Case Study** as they read and grow in their knowledge toward an evidence-based solution.

HANDS-ON BIOLOGY AND DATA ACTIVITIES

Applying Biology with Hands-on Science and Data Activities

Each Unit of *National Geographic Biology*, *Florida Edition* provides multiple opportunities for hands-on learning all supporting a deeper understanding of the **Anchoring Phenomena**. Minilabs have been carefully designed for your classroom along with full chapter investigations that give students opportunities to expand their understanding. Data analysis activities give students practice reading data and identifying patterns in data sets.

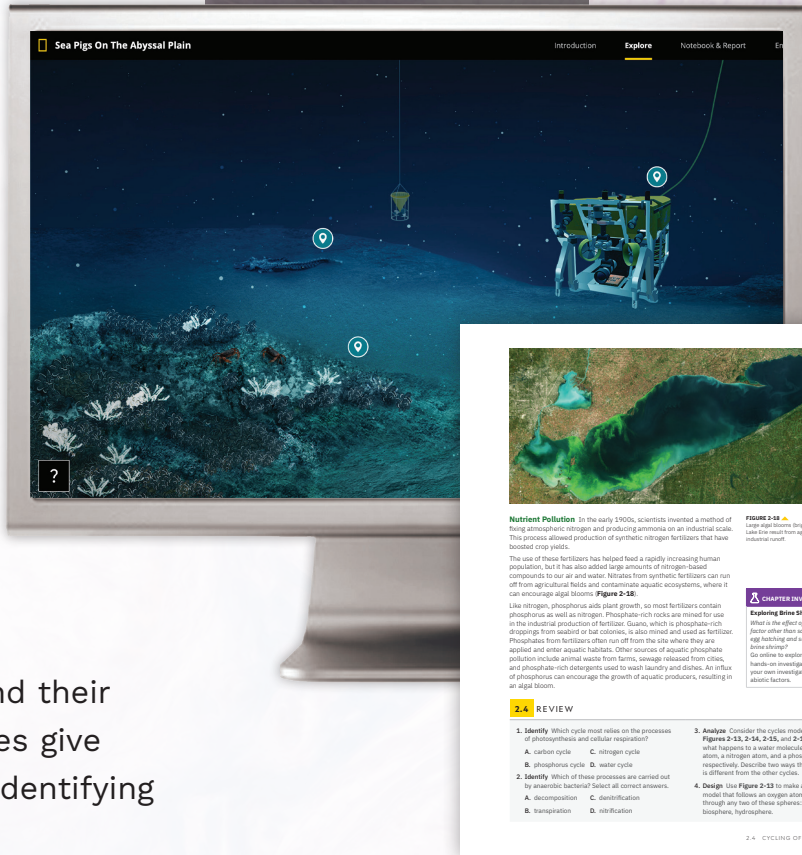


Figure 2-18 A large aquaculture facility grows on land the much more sustainable and nutrient-rich tilapia.

Nutrient Pollution In the early 1900s, scientists invented a method of fixing atmospheric nitrogen and producing ammonia as an industrial scale. This process allowed production of synthetic nitrogen fertilizers that have boosted crop yields. The use of these fertilizers has helped feed a rapidly increasing human population, but it has also added large amounts of nitrogen-based compounds to air and water. Nitrogen from synthetic fertilizers can run off from agricultural fields and contaminate aquatic ecosystems, where it can encourage algal blooms. **Figure 2-18**

Like nitrogen, phosphorus aids plant growth, so most fertilizers contain phosphorus as well as nitrogen. Phosphate-rich rocks are mined for use in the industrial production of fertilizer. Guano, which is phosphate-rich droppings from seabird or bat colonies, is also mined and used as fertilizer. Phosphates from fertilizers often run off from the site where they are applied and enter aquatic habitats. Other sources of aquatic phosphate pollution include animal waste from farms, sewage released from cities, and phosphate-rich detergents used to wash laundry and dishes. An influx of phosphorus can encourage the growth of aquatic producers, resulting in algal blooms.

Figure 2-18 A large aquaculture facility grows on land the much more sustainable and nutrient-rich tilapia.

CHAPTER INVESTIGATION

Exploring Brine Shrimp Survival

What is the effect of an abiotic factor other than salinity on egg hatching and survival of brine shrimp? Go online to explore this chapter's hands-on investigation and design your own investigation about abiotic factors.

2-4 REVIEW

1. Identify Which cycle most relies on the processes of photosynthesis and cellular respiration?
 - A. carbon cycle
 - B. nitrogen cycle
 - C. phosphorus cycle
 - D. water cycle
2. Identify Which of these processes are carried out by autotrophic bacterial species at correct answers.
 - A. decomposition
 - B. transpiration
 - C. denitrification
 - D. nitrification
3. Analyze Consider the cycles modeled in Figures 2-12, 2-14, 2-15, and 2-16 that show what happens to a water molecule, a carbon atom, a nitrogen atom, and a phosphorus atom, respectively. Describe two ways the water cycle is different from the other cycles.
4. Design Use Figure 2-13 to make a simple model that follows an oxygen atom as it cycles through any two of these spheres: atmosphere, biosphere, hydrosphere.

2-4 CYCLING OF MATTER 55

CHAPTER INVESTIGATION

Exploring Brine Shrimp Survival

What is the effect of an abiotic factor other than salinity on egg hatching and survival of brine shrimp?

Go online to explore this chapter's hands-on investigation and design your own investigation about abiotic factors.

LOOKING AT THE DATA

BIOMAGNIFICATION OF MERCURY

Read and Interpret Data Shown of the most popular fish found on seafood menus are now considered unsafe to eat. The Environmental Protection Agency (EPA) monitors mercury contamination in commercially fished species and their prey along the west coast of the United States. The data is used to provide seafood consumption warnings for the public.

Table 1 gives the average mercury concentration (in micrograms/liter) for four marine species monitored by the EPA. Herring and shrimp are two common food sources for halibut, while swordfish prey on halibut.

Species	Average mercury concentration (µg/L)	Species average mass (kg)	Average length (cm)
halibut	0.25	200	200
herring	0.078	0.2	25
shrimp	0.029	0.8	18
swordfish	0.99	350	300

1. Represent Data Construct a partial marine food web that includes halibut, herring, shrimp, and swordfish.

2. Infer Based on the partial food web, which population do you expect to be the largest in any given community?

- A. halibut and herring
- B. herring and shrimp
- C. shrimp
- D. swordfish

3. Infer Based on the partial food web, which population do you expect to be the smallest in any given community?

- A. halibut and herring
- B. herring and shrimp
- C. shrimp
- D. swordfish

4. Analyze Data Rank the fish species by mercury concentration. List the species from highest to lowest.

5. Identify Patterns How does the ranking of species by mercury concentration compare to the ranking of species by population size? Support your claim with evidence and propose an explanation.

6. Formulate State a claim about what happens to the concentration of mercury as it moves through trophic levels. Support your claim with evidence and propose an explanation.

7. Apply Halibut is popular on seafood menus. The Food and Drug Administration (FDA) reports that the maximum safe mercury consumption is 0.4 µg/kg per week. Based on this recommendation, how many servings per week of wild halibut would be safe?

8. Design Using only the data provided, propose one way that farming halibut could make it safer for human consumption.

MINILAB

MODEL A BIOMASS PYRAMID

Develop and Use a Model How can you model the distribution of biomass in an ecosystem? The freshwater springs of Florida are among the most studied aquatic ecosystems on Earth. In this activity, you will build a model of organisms found in one of these springs to see how biomass is distributed among trophic levels in the ecosystem.

Materials

- poster board or large sheet of paper
- marker
- pipe beans, 200 g
- calculator

Procedure

1. Draw a large triangle on the paper. This will be your biomass pyramid. Divide the pyramid into four rows and label the trophic levels.
2. For your model, assume that one pipe bean represents 270 g of biomass per 100 m³. Calculate how many beans would represent the biomass of each species shown in Table 1. Round fractions to the nearest whole number.
3. As a group, count out the appropriate number of beans for each species that you calculated in Step 2. Arrange the beans representing each species on the pyramid. Divide rows into multiple parts if there is more than one species at that level. Record the names of the species near the bean piles that represent them.
4. Return all of your beans to the container.

Results and Analysis

1. **Organize Data** Draw a bar graph that shows the biomass at each level.
2. **Calculate** Determine how much biomass is transferred from
 - producers to primary consumers
 - primary consumers to secondary consumers
 - secondary consumers to tertiary consumers
 Use the formula:

$$\text{percent biomass transferred} = 100 \times \frac{\text{total biomass of the lower level}}{\text{total biomass of the higher level}}$$
3. **Interpret Data** Can this ecosystem support a higher-level consumer than the base? Use your graph and pyramid to support your answer.
4. **Evaluate** What happens to the biomass that does not move on to the next trophic level?

Labs, Engineering Activities, and Research Projects

Minilabs are an essential part of each chapter enabling a quick investigation supporting conceptual development.

Each lab is tied to a Science and Engineering Practice. Students will discuss how they have come to grow their knowledge using evidence from the text and labs advancing their critical thinking skills.


Rigorous Practice

In the Teacher's Edition, the **Depth of Knowledge** Question level is called out. *National Geographic Biology, Florida Edition* has carefully constructed learning opportunities to allow continued practice in Levels 1–3 higher order thinking questions, so students are not stumped when it comes time for the End of Course Exam.

MINILAB
MODEL A BIOMASS PYRAMID

189 Develop and Use a Model How can you model the distribution of biomass in an ecosystem?

Freshwater springs in Florida are among the most studied aquatic ecosystems on Earth. In this activity, you will build a model of organisms found in one of these springs to see how biomass is distributed among trophic levels in the ecosystem.



Freshwater springs in Florida have support a large amount of biomass.

2. For your model, assume that one Pinto bean represents 270 g of biomass per 100 m². Calculate how many beans would represent the biomass of each species shown in **Table 1**. Round fractions to the nearest whole number.

3. As a group, count out the appropriate number of beans for each species that you calculated in Step 2. Arrange the beans representing each species on the overhead. Divide rows into multiple parts if large sheet of paper.

4. As a group, count out the appropriate number of beans for each species that you calculated in Step 2. Arrange the beans representing each species on the overhead. Divide rows into multiple parts if large sheet of paper.

Scientists sampled various regions of a freshwater spring in Florida to estimate the populations and biomasses of some species found in the spring. The table shows their results.

TABLE 1. Organism Biomass in a Florida Ecosystem

Organism	Trophic level	Population (per 100 m ²)	Biomass (g/100 m ²)
narrow-leaved arrowhead	producer	16,800	60,480
algae	producer	N/A*	20,160
turtles	primary consumer	80	2000
shrimp	primary consumer	380	2470
insects	primary consumer	450	2025
anemones	secondary consumer	23	322
small fish	secondary consumer	30	330
bass (larger fish)	tertiary consumer	1	74

4. Evaluate What has not moved on to the next level?

Results and Analysis

- Organize Data** Draw a bar graph that shows the biomass at each level.
- Calculate** Determine how much biomass is transferred from:
 - producers to primary consumers
 - primary consumers to secondary consumers
 - secondary consumers to tertiary consumers
 Use this formula:

$$\text{percent biomass transferred} = 100 \times \frac{\text{total biomass of higher level}}{\text{total biomass of the lower level}}$$
- Interpret Data** Can this ecosystem support a higher pyramid to support?
- Evaluate** What has not moved on to the next level?

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 pyramidal models presented in the next section.

MINILAB
MODEL A BIOMASS PYRAMID

Students use mathematical models to represent how energy stored in biomass moves through an ecosystem.

Time: 30 minutes

Advance Preparation

- One 18-cm-dia bag of dry pinto beans should be enough for each group. The beans may be replaced by another small object, such as beads. Provide a container for each group to store the beans in when not in use.

189 Develop and Use a Model How can you model the distribution of biomass in an ecosystem?

The freshwater springs of Florida are among the most studied aquatic ecosystems on Earth. In this activity, you will build a model of organisms found in one of these springs to see how biomass is distributed among trophic levels in the ecosystem.

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algae	producer	N/A*	20,160
turtles	primary consumer	80	2000
shrimp	primary consumer	380	2470
insects	primary consumer	450	2025
anemones	secondary consumer	23	322
small fish	secondary consumer	30	330
bass (larger fish)	tertiary consumer	1	74

4. Evaluate Answers will vary. At each level, some of the mass is converted to energy, which is used to fuel metabolic processes. Some of the energy is lost to the environment as heat. Some of the mass becomes waste products. Some of the mass cannot be transferred at all—shrimp have shells that cannot be easily digested, for example. The waste products and indigestible remains are consumed by decomposers over time. **DOK 2**

Results and Analysis

- Organize Data** Student bar graphs should show a large number of producers and decreasing amounts of primary, secondary, and tertiary consumers. **DOK 3**
- Calculate** The total mass of producers is 80,640 g. The total biomass of primary consumers is 2000 g + 2470 g + 2025 g = 6495 g. The percent biomass transferred from producers to primary consumers is (6495 / 80,640) × 100 = 8.1%. The total biomass of secondary consumers is 322 g + 330 g = 652 g. The percent biomass transferred from primary consumers to secondary consumers is (652 / 6495) × 100 = 10.0%. The total biomass of secondary consumers is 652 g. The biomass of tertiary consumers is 74 g. The percent biomass transferred from secondary consumers to tertiary consumers is (74 / 652) × 100 = 11.3%. **DOK 2**

Interpret Data The most likely reason a secondary consumer would need to reliably find and hunt the tertiary consumer, the bass, is that bass are relatively large and scarce. This ecosystem would not be able to support a tertiary consumer.

48 CHAPTER 2 ENERGY AND MATTER IN ECOSYSTEMS

ASSESSMENT IN A VARIETY OF FORMATS

Tying It All Together

Students will wrap up the learning with **Tying it all together Lessons**. Students will obtain information, propose solutions and evaluate the solutions. No longer will you have to supplement your current curriculum to reach this level of authentic assessment opportunities. Everything you need is here!

TYING IT ALL TOGETHER
SOMETHING FISHY IN THE FRESH


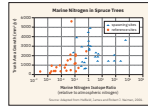
HOW DO ENERGY AND MATTER MOVE THROUGH AN ECOSYSTEM?

In this activity, you learned about the transfer of energy and matter in an ecosystem. The Case Study described the flow of energy and matter through a freshwater ecosystem. You learned about the flow of energy and matter through a freshwater ecosystem. You learned about the flow of energy and matter through a freshwater ecosystem.

Claim an Evidence
Analyze the data and provide evidence to support your claim. Use the data to support your claim. Use the data to support your claim.

Develop and Use a Model
Develop a model to represent the system. Use the model to represent the system. Use the model to represent the system.

Control an Experiment
Control an experiment to test your claim. Use the experiment to test your claim. Use the experiment to test your claim.

Unit Activity

Every unit also offers an opportunity for students to share their claim based on the **Unit Anchoring Phenomenon**.

NATIONAL GEOGRAPHIC FLORIDA

BIOLOGY

FLORIDA TEST PREP WORKBOOK

UNIT 1 ACTIVITY

HOW DO SEA PIGS SURVIVE IN THE DEEP OCEAN?

Anchor Phenomenon In this unit, you learned that the deep ocean is a dark, cold, and high-pressure environment. Sea pigs are a group of deep-sea fish that live in this environment. They have adapted to survive in this environment. They have adapted to survive in this environment.

Claim Make a claim about the role of sea pigs in the deep ocean ecosystem.

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

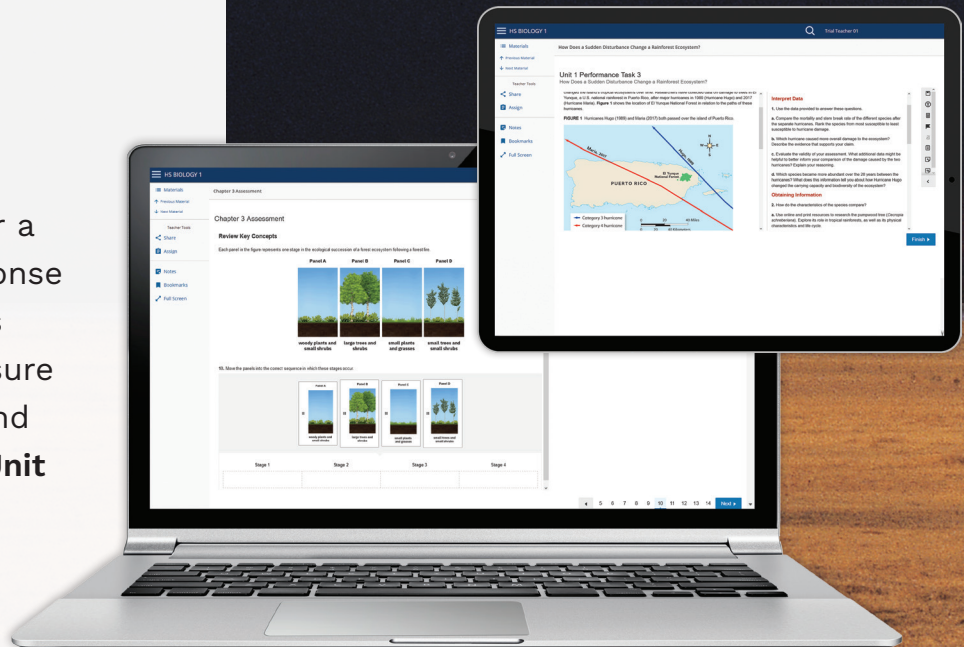
Reasoning Explain how your evidence supports your claim.



Florida End of Course Exam Test Prep Workbook

Summative Assessments

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 Big Ideas expectations.



COURSE SUPPORT AND TEACHER TOOLS

National Geographic Biology, Florida Edition 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 assessments including lessons built on the 5E lesson model, background information, and connections to Math and English Language Arts.

Connect to English Language Arts

Integration of Knowledge and Ideas System models introduced in Chapter 2, such as the food web, ecological pyramids, and matter cycles, typically depict specific ecosystems as illustrative examples. When reading to understand how energy flows and matter transfers through ecosystems, students should be able to apply information from the model illustrations to apply the same concepts to different ecosystems.

Have students translate between specific visual information and general text by writing a label for each arrow in Figures 2-2, 2-5, 2-7, or 2-8. Their labels should describe each transfer or transformation in terms of energy and matter.

CHAPTER INVESTIGATION A

Guided Inquiry *Salinity and Brine Shrimp Survival*

Time: 130 minutes over 3 days

Students will follow a step-by-step procedure to investigate how different salinities affect the hatching of brine shrimp.

Go online to access detailed teacher notes, answers, rubrics, 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.

SEP Construct an Explanation

Photosynthetic organisms produce the sugar molecules (glucose) that are needed for all organisms to run processes requiring energy in their cells.

PRACTICES OF SCIENCE

Connect Practices to Content Use this section to reinforce the importance of applying the Practices of Science to the content being addressed. For students to see the connection between the practices and investigations and laboratory experiences, conduct an activity where students match a practice to the section in the guide. For example, discusses the importance of investigations, which corresponds with the "plan and conduct investigations." Encourage students to identify how a lab or critical thinking question connects to a practice. When students know and understand the "why" of what they are doing, they are more likely to find and make connections between content and

SCIENTIFIC THEMES | Patterns

Butterfly Migration Students explore the concept of identifying patterns as they learn how generations of butterflies complete an annual migration route and analyze the routes on a map. Emphasize to students that identifying trends and patterns in data is an important skill in science, as it can lead to evidence that either supports or does not support a proposed hypothesis. Focus student attention as they read about the migratory observations of the painted lady butterfly. Have students create a T-chart that lists evidence for or against the hypothesis.

Connect to Math

Define Quantities for students return to Figure 6-24 to estimate quantities to biomass and a pyramid of an Antarctic food web. students can research the number of 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.

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

A LOOK INSIDE NATIONAL GEOGRAPHIC BIOLOGY



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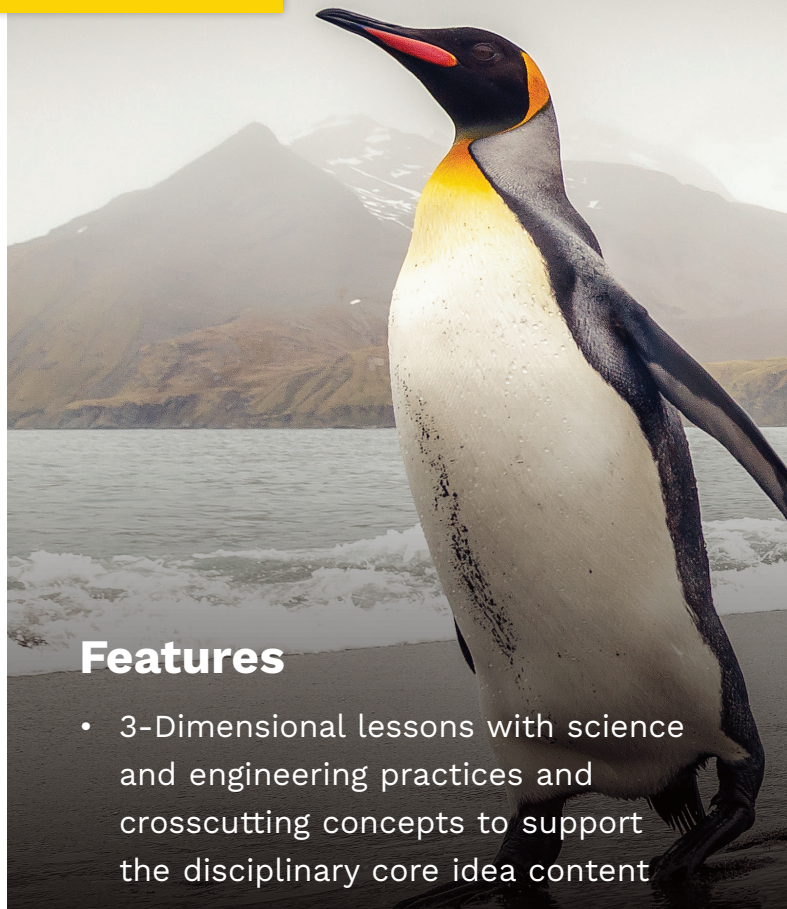
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- Taxonomies and Classification



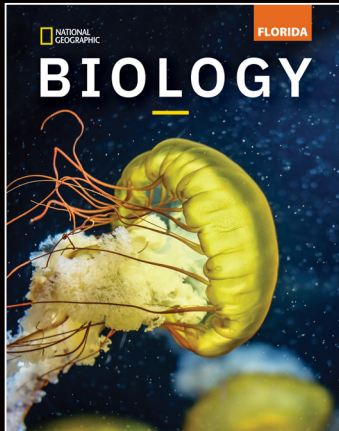
Features

- 3-Dimensional lessons with science and engineering practices and crosscutting concepts to support the disciplinary core idea content
- Phenomena-based instruction geared towards students figuring out how the phenomenon works in through investigation and discovery
- National Geographic Explorers, photography, and graphics show real-world phenomena and inspire students to think like real scientists
- Data analysis and data literacy activities promote critical thinking and analysis skills
- Literacy and language support including modified text English and Spanish text and assessments available



Technology

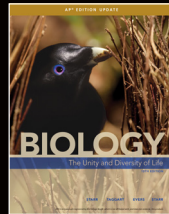
- MindTap is a cloud-based, highly personalized learning environment that combines student learning tools—readings, multimedia, activities, and assessments—into a single learning path
- Teachers can customize content for their students to introduce their own content, and teachers have access to powerful class reports to measure progress and improve outcomes
- MindTap for Biology offers unique videos featuring National Geographic Explorers, interactive simulations, and immersive virtual labs to simulate real-world research



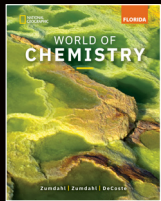
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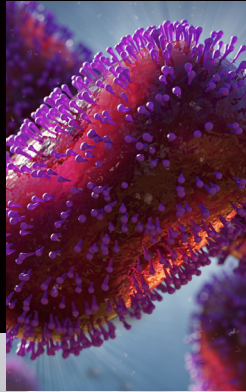
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