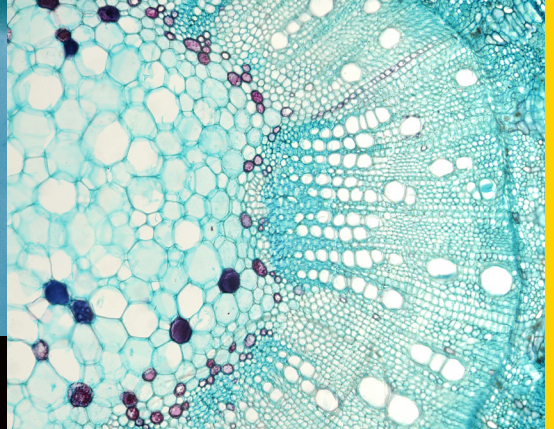
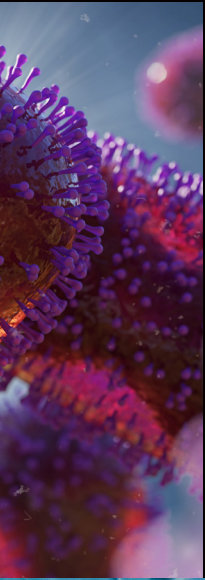




BIOLOGY

Texas Edition



PHENOMENA-BASED INSTRUCTION WITH NATIONAL GEOGRAPHIC RESOURCES



As teaching shifts towards multidisciplinary approaches to learning, *National Geographic Biology, Texas 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, Texas Edition* was created to guide teachers through 3D instruction by incorporating support for teaching the core ideas of science, the scientific and engineering practices, and recurring themes and concepts. Each lesson is built to prepare students to master the Big Ideas and Benchmarks of all your Texas Essential Knowledge and Skills (TEKS) for Science.



TEXAS Standards Correlations

Component Codes

CA: Chapter Assessment
CI: Chapter Investigation
CR: Chapter Review
CS: Case Study
Explorer: Explorer feature
LAD: Looking At the Data
Math/LA: Math and Language Arts Connections
ML: Minilab
PT: Performance Task
RP: Revisit the Phenomenon
SR: Section Review
TIAT: Tying It All Together
U: Unit
UO: Unit Opener

Bold blue numbers indicate chapters or sections.

Texas Essential Knowledge and Skills (TEKS)TX2

English Language Proficiency Standards (ELPS).....TX21

Texas Essential Knowledge and Skills

BIOLOGY		
STANDARD	STUDENT/TEACHER EDITION	ONLINE RESOURCES
(b) Introduction.		
(1) Biology. Students in Biology focus on patterns, processes, and relationships of living organisms through four main concepts: biological structures, functions, and processes; mechanisms of genetics; biological evolution; and interdependence within environmental systems. By the end of Grade 12, students are expected to gain sufficient knowledge of the scientific and engineering practices across the disciplines of science to make informed decisions using critical thinking and scientific problem solving.		
	1.1 p. 4, pp. 6–7; 1.1 SR p. 7 #1, #2; 1.2 pp. 11–12; 1.3 pp. 18–21; 14 ML p. 444	CI 11A; CI 14B; CI 16B
(2) Nature of science. Science, as defined by the National Academy of Sciences, is the “use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process.” This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.		
	1.2 pp. 9–15; 1 CR p. 35 #9, #10; 2 CR p. 67 #13; 6 CR p. 187 #14	CI 8A; CI 14B
(3) Scientific hypotheses and theories. Students are expected to know that:		
(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and	1.1 SR p. 7 #4; 1.2 p. 14; 1 CR p. 35 #10; 11.1 p. 333; 11.1 SR p. 333 #4	CI 2A; CI 2B; CI 3B; CI 7A; CI 8B

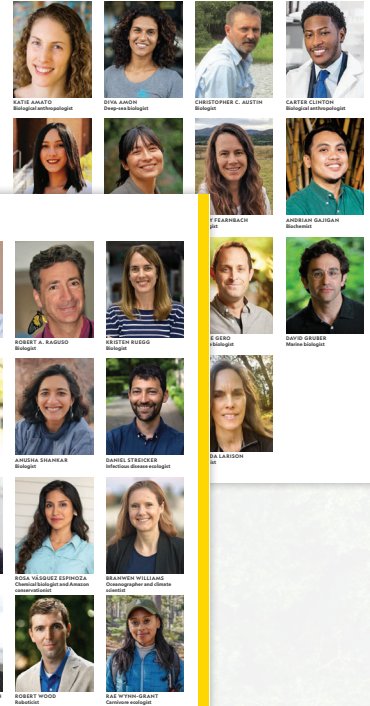
AUTHENTIC NATIONAL GEOGRAPHIC EXPERIENCE

National Geographic Biology, Texas 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



NATIONAL GEOGRAPHIC EXPLORER CARTER CLINTON

DISCOVERING GENETIC HISTORY

Dr. Carter Clinton works to identify and analyze DNA from ancient remains to better understand the lives and migration patterns of ancient humans. He uses genetic data to learn more about human evolution and migration.

Fast forward to a sunny day in New York City. Dr. Carter Clinton is standing in front of a building that he would like to stop here for the night. Back in the day, Clinton is responding to determine if he can tell where all the ancient humans that lived in other details. Computer algorithms also tell him about how the people lived, and possibly how they died.

Clinton is continuing similar work in what he describes as the most out-of-the-ordinary project he's ever worked on: sampling DNA from the New York African Burial Ground in Lower Manhattan. Burial discovered in 1991, the New York City World Journal reported.

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 Amon and learn more about her career and research.

Ask Questions Pose a question or problem that might be answerable using techniques similar to Clinton's research on detecting and analyzing DNA in soil.

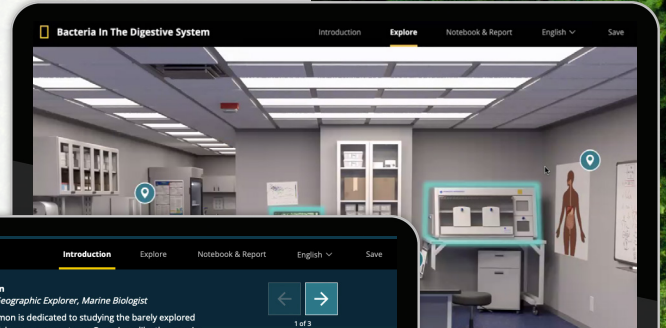
WORK SIDE BY SIDE WITH NATIONAL GEOGRAPHIC EXPLORERS

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, Texas 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

Communication In The Rainforest



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

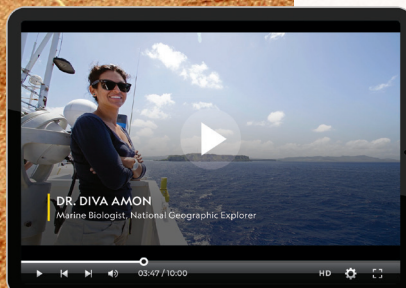
CHAPTER 4
POPULATION MEASUREMENT

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 TEKS 13.B

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

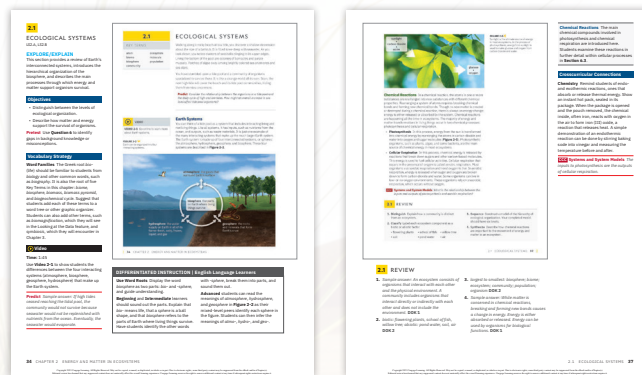
Time: 1:45

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.*

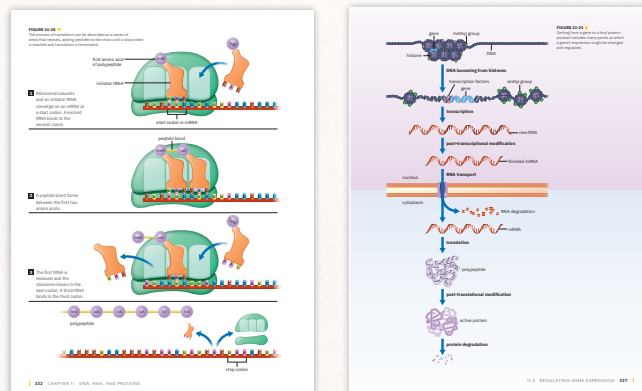
Student Centered Learning

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. The teacher will also find the exact TEK this lesson is covering called out at the top.



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.

Modified Text

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

POPULATION DENSITY
A variety of statistical characteristics can be used to describe a population. In addition to measuring population size, ecologists make detailed observations of organisms' locations in order to determine a population's density and distribution.

Population density is the number of individuals of a species that inhabit a given area. This density is population density (individuals per square meter). The number of individuals in a 4000-sq-m area is 4000 times the number of individuals per square meter.

Population Distribution is the relative number of individuals that inhabit a given area. Individuals are separated by equal distances in a population.

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.

National Geographic Explorer Katie Amato

NATIONAL GEOGRAPHIC EXPLORER KATIE AMATO

SOMETHING GOOD YOUR GUT
CONNECTING GUT MICROBIOMES TO HUMAN

THE 30-40 SQUARE METERS of surface area in your gut interact environment every time you take a bite of food. Your gut is home to as many as 100 trillion microbes that make up your body. The collection of gut microbes forms a symbiotic community that thrives in your gut's environment while your body benefits from their presence. Biological anthropologist and National Geographic Explorer Dr. Katie Amato looks at this relationship in howler monkeys in 2010, and she is now trying to see how the gut microbiome's impact on human nutrition and brain growth.

ON-LEVEL TEXT
Each section opens with a brief, reliable introduction to the topic to get students thinking and primed for learning.

MODIFIED TEXT
With **Modified Text** in the MindTap digital platform, students can simplify the text to a middle school reading level, reducing cognitive load and improving learning outcomes for struggling readers.

A definition of each **Key Term** gives students access to definitions at point of use. Other important terms are defined at point of use and with the Key Terms in the Glossary.

ELPS Standard Support

Teachers will find supports for meeting the ELPS standards. These embedded supports help to unlock the content for all learners, giving equal access to rigorous content.

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.

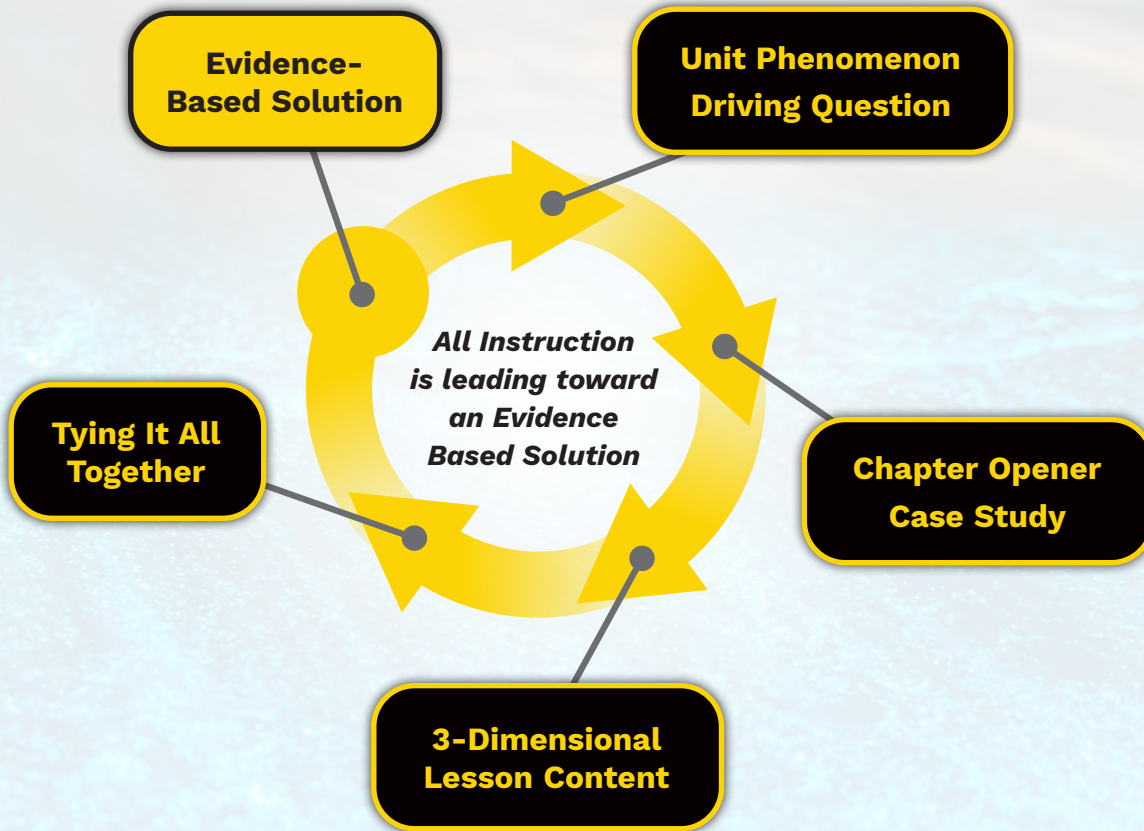
Select one of the 4 interactive organisms to explore the food web.

FIGURE 2.3 A diagram of the complex feeding relationships in an ecosystem.

FIGURE 2.4 A diagram of the complex feeding relationships in an ecosystem.

CHAPTER 2 | ENERGY AND MATTER IN ECOSYSTEMS

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 gestate 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 and fall, 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, Texas 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 case apt beams bright green to take the much from agricultural and industrial runoff.

Figure 2-19 A case apt beams bright green to take the much from agricultural and industrial runoff.

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. denitrification C. nitrification D. transpiration
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

52A Analyze 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	0.2	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. Infer Patterns How does the ranking of species by mercury concentration compare to the ranking of species by population size?

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.

58 CHAPTER 2 ENERGY AND MATTER IN ECOSYSTEMS

MINILAB

MODEL A BIOMASS PYRAMID

52B 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

1. Organize Biomass in a Florida Ecosystem

Organism	Depth level	Population (per 200 mL)	Biomass (µg/200 mL)
green-bean daphnia	epilimnion	15,000	40,000
green-bean daphnia	metolimnion	100	200
shrimp	primary	300	2400
shrimp	secondary	30	300
shrimp	tertiary	2	74

2. For your model, assume that one pipe bean represents 270 µg of biomass per 100 mL. 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 beach? 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?

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.

48 CHAPTER 2 ENERGY AND MATTER IN ECOSYSTEMS

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 Practices. 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, Texas 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 Texas Biology 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.

2. 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

3. Interpret Data Can this ecosystem support a higher-level consumer than the bass? Use your graph and pyramid to support your answer.

4. Evaluate What factors would limit the number of tertiary consumers that could move 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 pyramid 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 x 24-cm 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.

1. Organize Data Student bar graphs should show a large number of producers and decreasing amounts of primary, secondary, and tertiary consumers. **DOK 3**

2. 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**

COURSE SUPPORT AND TEACHER TOOLS

National Geographic Biology, Texas 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.

RECURRING THEMES | Scale, Proportion, and Quantity

Levels of Organization Have students analyze Figure 2-3 and consider the scale of each level of organization. Ask them to brainstorm phenomena that are significant at the different levels of hierarchical structure. Then discuss how a phenomenon or event that occurs at one scale may or may not have an impact at another scale. For example, an individual diseased organism might spread disease to the population with which it comes in contact, but this would not necessarily disrupt the local community if other organisms or species fill a similar role. In contrast, climate change at the biome or biosphere levels may have a large impact on all the levels.

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 2-3. Have students estimate quantities to biomass and a pyramid of an Antarctic food web. Have students 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.

Teachers are provided with targeted support for 3D instruction and cross-curricular connections to Math, English Language Arts, and other science disciplines with the Recurring Themes and Concepts clearly called out.

A LOOK INSIDE NATIONAL GEOGRAPHIC BIOLOGY



Table of Contents

1. Introduction To Biology

UNIT 1 Relationships In Ecosystems

2. Energy and Matter In Ecosystems
3. Biodiversity and Ecosystem Stability
4. Population Measurement and Growth

UNIT 2 Cell Systems

5. Molecules In Living Systems
6. Cell Structure and Function
7. Cell Growth

UNIT 3 Interactions In Living Systems

8. Diversity Of Living Systems
9. Plant Systems
10. Animal Systems

UNIT 4 Genetics

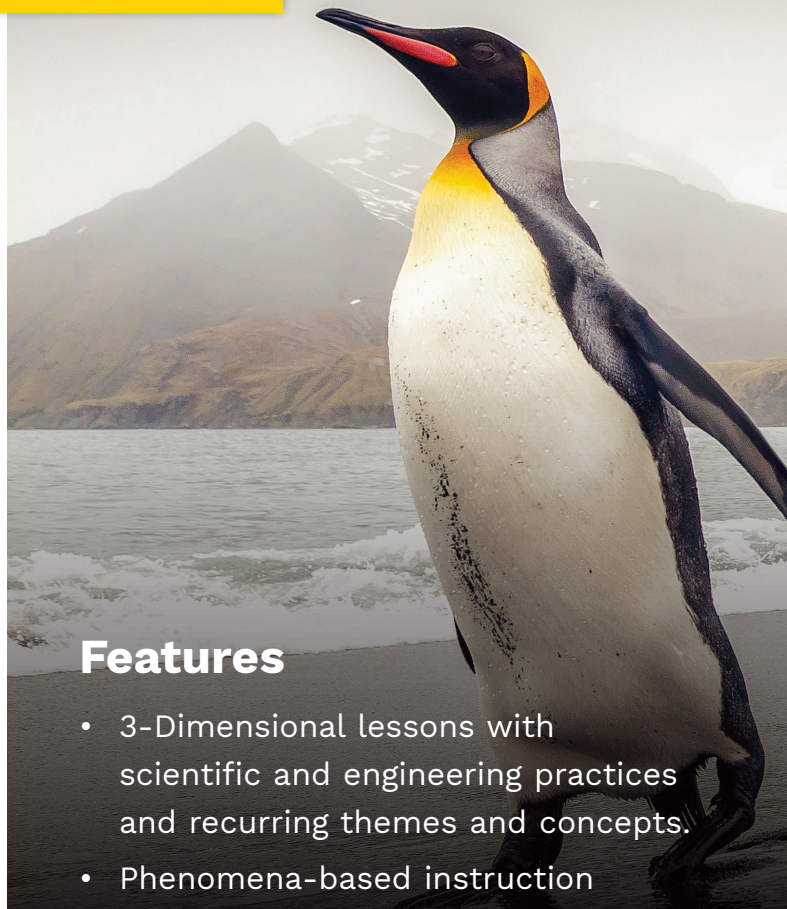
11. DNA, RNA, and Proteins
12. Genetic Variation and Heredity
13. Genetic Technologies

UNIT 5 Evolution and Changing Environments

14. Evidence For Evolution
15. The Theory Of Evolution
16. Survival In Changing Environments

Appendices

- Lab Safety and Procedures
- Data Analysis Guide
- Cell Processes: Respiration and Photosynthesis
- The Periodic Table
- Taxonomies and Classification



Features

- 3-Dimensional lessons with scientific and engineering practices and recurring themes and concepts.
- 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



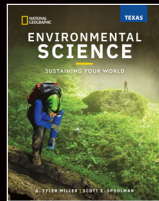
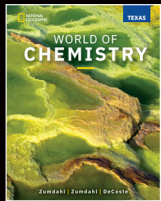
National Geographic Biology, Texas Edition is part of our biology series to meet the needs of on-level, honors, and AP® Biology. Help students become expert problem-solvers and think like biologists with our high school biology solutions.



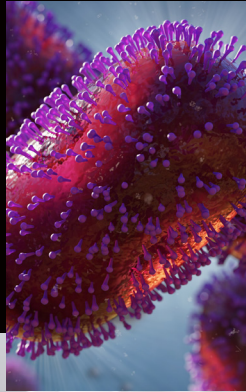
Honors



AP®



Let National Geographic engage all of your learners. Explore our other high school solutions, and bring the world to your classroom.



For more information, visit NGL.Cengage.com/TX-Science

@NatGeoLearning



@ExploreInside



@NatGeoLearning



"National Geographic," "National Geographic Society," and the Yellow Border Design are registered trademarks of the National Geographic Society. ®Marcas Registradas. AP® is a trademark registered and/or owned by the College Board, which was not involved in the production of, and does not endorse, this product.

MAY / 2023

ISBN-13: 979-8-214-08323-0



9 798214 083230