SCIENCE AND GLOBAL ISSUES BIOLOGY



NGSS Biology: Looking for Patterns in Species Diversity

Science & Global Issues: Biology – Ecology Unit Maia Binding, SEPUP Developer Friday, April 1 – NSTA 2022 - Houston The Lawrence Hall of Science





Science Education for Public Understanding Program (SEPUP)

- Based at the Lawrence Hall of Science, University of California at Berkeley
- Designing science curriculum, working with teachers, and supporting quality science instruction since 1983
- Specializing in issue-based science
- Published by Lab-Aids (<u>www.lab-aids.com</u>)



Why Issues?

In order for students to develop a sustained attraction to science and for them to appreciate the many ways in which it is pertinent to their daily lives, classroom learning experiences in science need to connect with their own interests and experiences.

> Next Generation Framework National Research Council, 2011



Science and Global Issues: Biology

- Redesigned for the NGSS
- Covers all high school NGSS PEs for Life Science
- Sustainability framework

Unit Theme	Content Focus	Sustainability Focus
Changing Human Impact	Sustainability	4-activity Introduction
Living on Earth	Ecology	Human influence on ecosystems
Improving Global Health	Cell Biology	Global health issues
Feeding the World	Genetics	Genetic modification
Managing Change	Evolution	Changes and threats to biodiversity



SGI Units

Ecology: Living on Earth

- **Unit Issue**: People rely on natural resources, including fish, for many reasons, including food, yet many of these fisheries are no longer sustainable.
- Overarching Question: How can we use our knowledge about ecology to make informed decisions about managing fisheries to be more sustainable?

Cells: Improving Global Health

- Unit Issue: Human health is increasingly subject to emerging global patterns, including extreme heat events, changes in the frequency of diseases, and climate effects on the food supply.
- **Overarching Question**: What are the challenges to human health in a changing world?



SGI Units

Genetics: Feeding the World

- Unit Issue: People rely on genetically engineered crop plants to maintain a global food supply, but the use of this technology can impact sustainability.
- Overarching Question: How do genetically engineered crops affect the sustainability of food production?

Evolution: Managing Change

- Unit Issue: Human activity can have evolutionary consequences for both biodiversity and ourselves.
- **Overarching Question**: How do human activities affect the evolution of other species, and what are the consequences for both biodiversity and for ourselves?



Why Sustainability?

- More avenues to relevance for students, both local and global.
- Issues clearly relate to science.
- Sustainability decision-making and scientific literacy are closely related—one has the potential to develop and inform the other.



3 Pillars of Sustainability

- Economic Pillar
 - How does the action affect the economy? Does it create or take a way jobs? What is the financial cost or benefit?
- Social Pillar
 - How does the action affect social aspects of the community? Does it protect or improve human health? How does it affect food availability, human interactions, etc.?
- Environmental Pillar
 - How does the action affect the environment? Does it protect or endanger critical ecosystems? Does it create or reduce pollution?





Ecology: Living on Earth

• Unit Issue: People rely on natural resources, including fish, for many reasons including food, yet many fisheries are no longer sustainable.

FIGURE B: Sustainability of fisheries over time



Ecology: Living on Earth

Learning Sequence	Activities	Investigative Phenomenon	Performance Expectations Addressed
1	1-3	Different populations of organisms can have a wide range of growth patterns over time.	HS-LS2-1
2	4-5	Coral reefs do not all look the same and can be quite different from one another in several ways.	HS-LS2-2
3	6-10	The population of Southern Resident orcas in the Pacific Northwest has not recovered, despite protection from hunting and capture.	HS-LS2-3, HS-LS2-4
4	11-12	Earth's atmospheric carbon dioxide levels have cycled between 300 ppm and 180 ppm for the past 800,000 years ago, until recently.	HS-LS2-5
5	13-17	Ecosystem health can vary.	HS-LS2-6, HS-LS2-7



PE HS-LS2-2

 PE: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems on different scales.

• SEP:

- Using mathematics and computational thinking
- DCI:
 - Interdependent relationships in ecosystems
 - Ecosystem dynamics, functioning, and resilience
- CCC:
 - Scale, proportion, and quantity



Investigative Phenomenon:

What similarities and differences do you notice? In the previous learning sequence, you explored individual populations of organisms and factors affecting them. Populations are part of ecosystems that include many kinds of organisms. The song sparrows are part of the Mandarte Island ecosystem, which also includes cowbirds and many other organisms. Coral reefs are another type of ecosystem. Imagine a coral reef in your mind. Which of the photos in Figure 4.1, all of coral reefs, most closely resembles what you imagined? What similarities and differences do you notice among the different reefs? What factors do you think could contribute to these differences? In this learning sequence, you will explore

factors that explain some of the differences among ecosystems.









FIGURE 4.1: Coral reefs can be many different shapes, sizes, and colors.

- Driving Questions Board
 - What are the factors that determine the biological diversity of an ecosystem?
- Introduction & Guiding Question:
 - What defines an ecosystem?
- Crosscutting Concept: Systems and system models
- Crosscutting Concept: Scale, proportion and quantity
- Procedure Step 3
 - Student Sheet 4.1



	Ocean Sunlight Zone	Coral Reefs	Intertidal Zone	Humpback Whale Respiratory System
Components	organisms, light, temperature, salinity, depth	organisms, light temperature, depth	organisms, light temperature, air exposure	organisms, oxygen, carbon dioxide
Interactions	abiotic/biotic, predator-prey	abiotic/biotic, predator-prey	abiotic/biotic, predator-prey	abiotic/biotic, predator-prey mutualism
Boundaries	above 200 m	Tropics of Cancer/ Capricorn	near shore, water levels	whale's respiratory system
Scale	most extensive on Earth	about 285,000 km²	some 100s of meters, some less than 1 meter	size of respiratory system

Ocean Sunlight Zone



Small group and then class consensus on definition of ecosystem:

An ecosystem is a set of biotic and abiotic components that interact on a regular basis within a particular boundary.



- Build Understanding Items:
 - Issue Connection (BU 3)
 - Revisit scale, proportion, and quantity (BU 4)
 - Revisit guiding question (BU 5)
- Extension: Engineering Connection



- Do all places have the same number of species?
- Introduction & Guiding Question:
 - What patterns of biological diversity occur for different groups of organisms, and what might cause these patterns?
- Crosscutting Concept: Patterns
- Part A: Procedure Steps 1-4
 - Step 1: Explain based on Figure 5.1
 - Steps 2 & 3: Add data, build your explanation
 - Step 4: Revise your explanation



Global Coral Diversity



FIGURE 5.1: Global coral diversity



Ocean Surface Temperature





Ocean Depth





- Part B: Procedure Steps 5-10
 - Step 5: Vertebrate Diversity Map–reptiles, amphibians, birds, or mammals
- **Reptiles**, such as snakes, lizards, turtles, and crocodiles, are *ectothermic* (coldblooded) vertebrates. They are characterized by having dry scaly skin, and typically lay soft leathery eggs on land. Reptiles have four limbs or, like snakes, are descended from four-limbed ancestors.
- Amphibians, such as frogs, salamanders, toads, and newts, are *ectothermic* (coldblooded) vertebrates. They typically start their lives as larva living in water and using gills to breathe. As they grow, amphibians develop lungs and spend more time on land.
- **Birds** are *endothermic* (warm-blooded) vertebrates that are characterized by having feathers, laying hard-shelled eggs, and (typically) being able to fly. Birds inhabit every continent and are the most diverse group of vertebrates on Earth.
- Mammals, such as humans, koalas, bats, dolphins, and whales, are *endothermic* (warm-blooded) vertebrates. Mammals are characterized by having hair or fur, producing milk to feed their young, and (typically) having live births, rather than from eggs. There are over 4,000 different species of mammals worldwide that live in a variety of habitats.



- Part B: Procedure Steps 5-10
 - Step 6: Examine with your group, discuss ideas
 - Step 7: Abiotic Factor Maps, start with Elevation & Topography as a group
 - Step 8: Examine remaining maps individually
 - Step 9: Share observations
 - Step 10: Discuss data and how it might account for patterns



- Build Understanding Items:
 - PE Assessment (BU 1)
 - Writing Frame
 - Writing Review
 - Revisit Investigative Phenomenon (BU 3)
 - Issue Connection (BU 4)



Teacher's Guide Highlights

- Storyline by learning sequence and by activity
- Sensemaking Progression for each activity
- Connections to Crosscutting Concepts and Science and Engineering Practices
- Diverse Learner supports
- Writing Frames & Writing Review
- NGSS correlations for formative assessments (dots)
- Assessments & Scoring Guides
 - Item-Specific PE Scoring Guides
 - Sample leveled responses



Item-Specific Scoring Guides

Item Specific Scoring Guide - PE-HS-LS2-2

Constructing Explanations (EXP)

Level	Description	Specific Response
Level 4 Complete and correct	 The student's explanation is supported by sufficient use of appropriate evidence and concepts* AND links the evidence and concepts to provide a clear and complete causal mechanism for the phenomenon. 	 The student's response considers all abiotic factors and identifies which factors are most important in explaining the pattern of distribution for their vertebrate group AND which factors do not seem important, using data from the maps provides a possible causal mechanism for why the factors are important, based on characteristics of the vertebrate group in Part b, provides an explanation for how their answer changed as they examined additional factors in Part c, provides a plausible explanation for whether they would see the same pattern at a larger scale
Level 3	The student's explanation	The student's response



Units

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Student Book

Scaling Up: Ecosystems

Investigative Phenomenon

In the previous learning sequence, you explored individual populations of organisms and factors affecting them. Populations are part of ecosystems that include many kinds of organisms. The song sparrows are part of the Mandarte Island ecosystem, which also includes cowbirds and many other organisms. Coral reefs are another type of ecosystem. Imagine a coral reef in your mind. Which of the photos in Figure 4.1, all of coral reefs, most closely resembles what you imagined? What similarities and differences do you notice among the different reefs? What factors do you think could contribute to these differences? In this learning sequence, you will explore factors that explain some of the differences among



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In the previous activity, you investigated data collected from a bird population on an isolated island. Scientists can define that ecosystem easily: it's the island. But what happens when an ecosystem is not isolated? How can researchers define what that ecosystem is? How can an understanding of an isolated ecosystem be applied to other, less isolated ecosystems? In this activity, you will explore how four different types of occan ecosystems can be defined.

Guiding Question What defines an ecosystem?

what defines an ecosyste

Materials

Student Sheet 4.1, "Ecosystem Comparisons"

Procedure -

 Read the text box below about the crosscutting concept of systems and system models, and discuss with your partner how you think this concept relates to ecosystems.

A system is an organized group of related components that form a whole.

A system model specifies the components within the system and how the components interact with one another. It must also specify the boundary of the system being modeled, defining what is included in the model and what is considered external.

- Follow your teacher's instructions for determining which of the four ecosystems your group will explore.
- With your group, read the information about the ecosystem you are investigating. Use Student Sheet 4.1, "Ecosystem Comparisons," to take notes on the following factors for your ecosystem:
- Components: Abiotic and biotic factors that are important in your ecosystem

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SCALING UP: ECOSYSTEMS

- Interactions: Relationships between different components of your ecosystem
- Boundaries: Limits to your ecosystem; how it is divided from other ecosystems

Scale: The relative size of your ecosystem

Ocean Sunlight Zone

Oceans cover more than 70% of the earth and contain more than 97% of the earth's water. Scientists divide the ocean into different layers, or zones. The zone above 200 meters in depth is considered the sunlight zone. Below this depth, the amount of light drops significantly. The ecosystem occupying the sunlight zone is the most extensive ecosystem on Earth. It begins where the shallow coastal waters surrounding all the continents end, and it extends outward FIGURE 4.2: through the rest of the oceans' surfaces. Abiotic ns, such as light, temperature, salinity, cond and circulation, in the ocean sunlight zone are whales and si fairly consistent at any given locatio Approximately 10-15% of the known species species, inch on Earth are found in the sunlight zone, but this The majority live in the su accounts for 90% of all marine (ocean) life. Many Invertebra unique types of organisms in the ocean are not animal speci found on land. In fact, the ocean is more diverse than land with regard to major groups of crustaceans | clams, octopa organisms. Several groups of animals are found only in the ocean, including sea stars (starfish), sunlight zon sea urchins and their relatives, comb jellies, acorn called plankte currents. On worms, and trumpet worms. Other animals in the ocean include extremely large species, such as too small to s hundreds of th



ridoke 4.3: The ocean sunlight zone refers to the top 200 m of the op

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- 3. Repeat Step 2 for the map of ocean depth in Figure 5.3.
- Based on your discussions in Steps 2 and 3, revise your explanation in your science notebook from Step 1. Be prepared to share your revised explanation with the class.

Part B: Vertebrate Groups in the United States

- Follow your teacher's instructions for determining which groups of vertebrate organisms you will investigate (reptiles, amphabians, birds, or mammals), and obtain the Vertebrate Diversity Map for that group.
- 6. With your group, read about your vertebrate group and study the map. Where is your vertebrate group most diverse? Where is it least diverse? Based on what you read about your vertebrate group, what ideas do you have about this pattern? In your science notebook, record your initial ideas about what factors might explain the patterns you see in the map.
- Obtain a set of five Abiotic Factor Maps. With your class, review the Elevation and Topography Map and compare it to the Vertebrate Diversity Map for your organism.

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PATTERNS OF BIOLOGICAL DIVERSITY

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Scaling Up: Ecosystems

MODELING

ACTIVITY OVERVIEW

STORYLINE

Investigative Phenomenon for the Second

In the previous learning sequence, students di factors (biotic, abiotic, intrinsic) affect the pop population of song sparrows on an isolated isi investigative phenomenon for this learning see the same and can be quite different from one i begin with the phenomena of one eccosystem ty different. Students examine several photograph they share the similarities and differences they might cause these differences. Students build the similarities and differences by revisiting their id this learning sequence.

This Activity

Students investigate ecosystem boundaries and and abiotic components that interact in specific Scientists draw boundaries around these interac system from another. Ecosystems also exist at di four examples of ecosystems of varying scales, fi to the tiny blowhole ecosystem of a humpback w one system (e.g., the whale respiratory system) e system (e.g., the ocean).



- Students know from the previous learning sestand what is happening to a population of or understand what is happening in the ecosyste
- Students may not have a firm understanding of
- Students might not yet understand explicitly different spatial scales.

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ACTIVITY 4 SCALING UP: ECOSYSTEMS

MATERIALS AND ADVANCE PREPARATION

- For the teacher Student Sheet 4.1, "Ecosystem Comparisons"
- For each student Student Sheet 4.1, "Ecosystem Comparisons"

TEACHING STEPS

GET STARTED Students are introduced to the investigative phenomenon for d sequence (Activities 4–5): Coral reefs do not all look the same and from one another in several ways.

 Set the stage for the second learning sequence by introdu investigative phenomenon, using the photo montage of co Student Book.

Instruct students to examine and discuss these photogra four. They should describe what they see, noting both si ences, and suggest what might be causing the difference

Eliciting what they notice from the photographs gives a starting point and lessens the significance of prior know which encourages students from non-dominant backgr they notice.

Pacilitate a class discussion about what students noticmight cause the differences they noticed. Accept all rethis point. Ask students if they have any new question Questions Board. Explain to them that in this activity explore concepts and ideas that will help them make between the coral recis in the photos. The suggested learning sequence is: What are the factors that determin an ecosystem?

 Have students read the introduction and guiding qu clicit their initial ideas for what defines an ecosystem

Accept all reasonable responses at this point. Recorboard or chart paper to revisit later in this activity. read about and compare four marine (ocean) ccos, them more clearly define what an ecosystem is.

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ACTIVITY 4 SCALING UP: ECOSYSTEMS

 Suppose you were a scientist developing a model for the Mandarte Island ecosystem and the song sparrows. Would it be easier to identify the components, interactions, and boundaries of this ecosystem than others? Why or why not? What challenges might you have?

I think it would be pretty easy to identify the comp aries of the Mandarte Island ecosystem because it pretty chear, and a'r on land, so you can see and a interaction. I think it would be much casier to do many other consystems with beamdaries that are h that down't have a distinct dg() or where it's han and interactions (like an understart ecosystem).

 Issue connection: How could understanding and boundaries of a fishery's ecosystem help so ability of that fishery?

Understanding the components, interactions, and be can help scientists know what might be adjecting the of they know that the fish east oversitin species of m monitor the smaller fish to make sure that there's a Knowing the boundaries of the ecosystem can help part of the ecosystem, so they know what's most imp

 4. Below are three images taken of the same coral what types of factors researchers might investig carrying capacity of the reef ecosystem at the se left (a), in the middle (b), and on the right (c).

Hint: Consider what types of components and in these three scales.



If researchers want to study the carrying capacity of 1 components and interactions that affect the population the left, researchers might investigate if the whole resp time. In the middle, researchers might study the fish ti

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ACTIVITY 5 PATTERNS OF BIOLOGICAL DIVERSITY

distribution of another group of vertebrates. You might also consider asking students if they can predict global patterns of these different groups.

Build Understanding item 3 asks students to return to the coral reef photographs at the start of the learning sequence. It is the second sensemaking opportunity in this activity for the investigative phenomenon for this learning sequence: Coral reefs do not all look the same and can be quite different from our another in second ways. Have students record their ideas in their science notebooks; they will return to these ideas in the next activity.

Build Understanding item 4 relates the idea of species diversity to the unit issue of sustainable fisheries. Students can discuss their ideas with their group members or respond individually, or you may wish to facilitate a class discussion.

9. Return to the guiding question and Driving Questions Board to complete this learning sequence.



Have students revisit the guiding question for this activity: What patterns of biological diversity occur for different groups of organisms, and subat might cause three patterns? Students should be able to offer several ideas from this activity but, more importantly, they should have noticed that a combination of factors cause many of these patterns, rather than a single factor.

This provides a good opportunity to revisit the Driving Questions Board, note the questions that students answered in this learning sequence, and add any new questions students have, particularly about additional factors that might affect biological diversity. Tell students that in the next learning sequence, they will deepen their understanding of ecosystem interactions, many of which are important factors in patterns of biological diversity on different scales.

SAMPLE RESPONSES TO BUILD UNDERSTANDING

- 1. (EXP ASSESSMENT, HS-LS2-2) For the group of vertebrate organisms that you examined:
 - a. Write an explanation that can account for the pattern of species distribution. Be sure to discuss all the factors and to use data from the maps to support your explanation.
 - b. How did your explanation change as you examined more factors?
 - c. Imagine that you were looking at the map for your vertebrate group but on a global scale—like the coral maps you examined. Would you expect to see the same patterns of species distribution in other locations in the world? Why or why not?

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																NGSS AND	COMMON CORE	
			NGSS AND	COMMON CORE						Activity 4	N Body Sys	GSS Integration tems in Balance	Dis Co LS	ciplinary re Ideas I.A	Science and Engineering Practices Developing and	Crosscutting Concepts Structure and	Common Core State Standards ELA/Literacy	
as	'H ed on evidenc	te for how the stru	acture of DNA de	termines the							As student senting lev the humar develop m systems respiratory varving lev	ts sort cards repre- vels of organization a body system, the odels of four diffe cardiovascular, dia y, and endocrine- y, and organization	- a in y rent gestive, -at a and		Using Models Constructing Explanations and Designing Solutions	Function Stability and Change Systems and System Models Scale,	RST.9-10.7	
o il elli iga	llustrate the h ular organism ation to provid	ierarchical organi s. de evidence that fo	zation of interacti eedback mechanis	ng systems that							scale. They to constru- various dis mal function	y apply what they ct explanations fo seases disrupt the ons of body system	learn r how nor- ns and			Proportion, and Quantity		
pla	photosynthes	is transforms ligh on evidence for h	t energy into stor	ed chemical gen, and	N	GSS AND								L	Constructing Explanations and Designing Solutions	Connections to Nature of Science Stability and	ELA/Literacy RST.9-10.7	
at	e with other e cellular respir	ration is a chemic be bonds in new c	amino acids and/o al process whereby compounds are for	y the bonds of	4	Activity	NGSS Integration	Disciplinary Core Ideas	Science and Engineering Practices	Cross	cutting cepts	Common Core State Standards			Connections to Nature of Science	Change Structure and Function		
ola on te he:	nation based s. the role of ph re, hydrosphe solution for r	on evidence for the otosynthesis and geosphere educing the impa	he cycling of matt cellular respiration cts of human activ	er and flow of n in the cycling vities on the		2	Everyday Hydration Students consider the effects of dehydration on the structure and function of the human body, using plant cells as a model. Students conduct an investigation of plant cells to explore the effects of changing conditions on homeo- vasis at the level of the cell. They	LSLA	Constructing Explanations and Designing Solutions Planning and Carrying Out Investigations	Stability Change Scale, Proport Quantit	ion, and	ELA/Literacy RST.11-12.3			Destroises of	Frank and d	PT A.F. Income	
it o	Disciplinary Core Ideas LS1.A ETS1.B	Science and Engineering Practices Asking Questions and Defining Problems	Crosscutting Concepts Stability and Change Patterns	Common Core State Standards Mathematics MP.2			apply what they observe at the col- lular level to create an explanation of how these changing conditions affect other levels of structure and function. A question about tourist water consumption raises the issue of sustainability and prompts students to weight evidence and consider the trade-offs of limiting the number of tourists at popular travel destinations. Note: "Review and Refreche". Cell Structure and Function," an optional reading provided in the Student Hook, can serve as either a review of NOLSS middle school cell concepts or a reference for students.								Developing and Using Models Constructing Explanations and Designing Solutions	System and System Models Structure and Function Scale, Proportion, and Quantity	ELALitersy SL11-125 ELALiteracy WHST-9- 12.9	
n						3	Homeostasis Disrupted Students explore three case studies on infectious and non- infectious diseases that explain how disruptions to homeostasis can result in illness or be caused by illness. They examine models of how the body's systems and	LS1.A	Developing and Using Models Constructing Explanations and Designing Solutions	Systems System Stability Change Cause a	and Models and nd Effect	ELA/Literacy RST.9-10.1						
on.	02022 The Reg	ents of the University	of California	CILLS T-1			subsystems work together to main- tain homeostasis when challenged with changing external or internal conditions. The role of negative feedback loops in maintaining homeostasis is introduced. Stu- dents apply what they learn about specific feedback loops to create another model.							he Reg	ents of the University	of California	CELLS T-3	
									-	-						6		

CELLS: IMPROVING GLOBAL HEAD

Performance Expectations

NGSS OVERVIEW

HS-LS1-1: Construct an explanation be structure of proteins, which carry out th HS-LS1-2: Develop and use a model to provide specific functions within multice

HS-LS1-3: Plan and conduct an investi home

HS-LS1-5: Use a model to illustrate ho energy.

HS-LS1-6: Construct and revise an exp oxygen from sugar molecules may comb carbon-based molecules.

HS-LS1-7: Use a model to illustrate the food molecules and oxygen molecules ar in a net transfer of energy.

HS-LS2-3: Construct and revise an exp energy in aerobic and anaerobic condition

HS-LS2-5: Develop a model to illustrat of carbon among the biosphere, atmosph

HS-LS2-7: Design, evaluate, and refine environment and biodiversity.

Activity	NGSS Integration	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
1	Survival Needs A scenario involving an environ- ment of extreme heat motivates students' exploration of the phenomenon and conditions that can challenge the body's ability to maintain homeostanis. Students investigate the effects of extreme heat by imagining a survival scenario in a desert and ranking the importance of 13 items (such as food, water, and clothing) for survival. Through this exploration of challenges to homeostasis, stu- dents develop concepts related to stability and change in the human body. Students begin to generate questions about how the body maintains homeostasis.	LSLA ETSLB	Asking Questions and Defining Problems	Stability and Change Patterns	Mathematics MP.2

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NGSS AND COMMON CORE

TEACHER PREPARATION OVERVIEW

GENETICS: FEEDING THE WORLD

Listed below is a summary of the activities in this unit. Note that the total teaching time as listed is 23-34 periods (approximately 41/2-7 weeks) if you teach the activities as recommended every day).

Activity	What Students Do	Key Scientific Terms	Advance Preparation	Class Sessions
1	Investigation: Superweeds! Where Did They Come From? Students brainstorm, generate, and consider different ways that superweeds could have gotten into Farmer Green's fields.	herbicide superweed	Prepare Student Sheets.	1-2
2	Laboratory: Creating Genetically Modified Bacteria Students genetically modify a population of E . $coli$ and read a case study about genetic engineering.	biofuel DNA gene gene expression genetic engineering genetically modified organism (GMO)	Order live materials in time for class use. Prepare Student Sheets. Prepare LB-only and LB-ampicillin plates. Prepare E. coli source plates. Prepare tubes of plasmid and CaCl2. Decide how students will share the ultraviolet light source. Gather materials for student groups and prepare water bath.	2-3
3	Modeling: Mitosis and Asexual Reproduction Students work with an online simulation and physical models to explain the process of mitosis.	asexual repro- duction centromere chromatid chromosomes daughter cells mitosis parent cell	Preview the mitosis simulation. Locate additional mitosis simula- tions. (optional) Prepare Student Sheets.	1-2
4	Investigation: Breeding Corn Using the traditional model of the Punnett square, students analyze and predict the results of genetic crosses for one trait and are introduced to the concept of <i>indexive breading</i> as one way to improve crops.	alleles dominant Punnett square recessive selective breeding sexual reproduction region	Prepare Student Sheets.	1-2

Activity	What Students Do	Key Scientific Terms	Advance Preparation	Class Sessions
5	Investigation: Breeding Corn For Two Traits Students continue their investigation of patterns of heredity, expanding their model from the last activity to explore two inherited traits, and they read about the history of selective breeding in corn.	llele dihybrid cross gamete genome genotype phenotype Punnett square selective breed- ing trait	Laminate the corn ears and gather dry-erase markers. (optional) Prepare Student Sheets.	2
6	Talking It Over: How Did This Happen? Class Consensus Students draw on their understanding of genetic inheritance to generate a class consensus explanation of how superweeds most likely arrived in the farmer's corn fields and were able to spread.	genetic engineer- ing genome phenotype Punnett square selective breed- ing trait	None	1
7	Modeling: Protein Synthesis: Transcription and Translation Students use cards, physical models, and online simulations to explore the molecular process of protein synthesis and what happens inside a plant's cell when a genetic modification is introduced.	amino acid DNA mRNA mutation protein protein synthesis RNA transcription translation tRNA	Prepare Student Sheets. Preview the protein synthesis simulation. Photocopy the Transcription and Translation cards. (optional)	2-3
8	Modeling: Cell Differentiation and Gene Expression Students use a physical model to investigate gene expression as it relates to cell differentiation in different cell types.	chromosome differentiation DNA expressed (gene) gene expression repressed (gene) stem cells transcription factor	Prepare Student Sheets.	1-2

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GENETICS T-21

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T-20 GENETICS

SUPPORTS FOR DIVERSE LEARNERS OVERVIEW

ECOLOGY: LIVING ON EARTH

This table summarizes activity-specific supports that are embedded in the Student Book and Teacher Edition (TE). Additional strategies can be found in the Teacher Resources.

Activity	Strategy location	Designed to address
1	TE Step 2, Class Discussion	Students' varied life experiences
2	TE Step 4, Class Discussion	English language development
3	Extension	Opportunities for advanced learning
4	TE Step 2, Small-Group Work	Equitable participation
4	Extension	Opportunities for advanced learning
6	TE Step 11, Class Discussion	Equitable participation
6	Extension	Opportunities for advanced learning
8	TE Step 4, Do the Activity	Learning disabilities and/or neurodiverse learners
8	Extension	Opportunities for advanced learning
9	TE Step 11, Build Understanding Items	Learning disabilities and/or neurodiverse learners
9	Extension	Opportunities for advanced learning
10	TE Step 6, Class Discussion	Equitable participation
11	Extensions 1 and 2	Opportunities for advanced learning
14	TE Step 5, Class Discussion	Students' varied life experiences
14	Extensions 1 and 2	Opportunities for advanced learning
15	Extension	Opportunities for advanced learning
16	TE Step 2, Do the Activity	Learning disabilities and/or neurodiverse learners
16	TE Step 5, Class Discussion	Students' varied life experiences
16	Extension	Opportunities for advanced learning

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Materials Packages

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Online Platform

- Syncs with LMS such as Google Classroom, Schoology, Clever, etc
- Fully digital student book and TE
 - Can be read aloud to students using ReadSpeaker
 - Highlight/take notes right on the page
 - o Spanish
- Editable PowerPoint files for each Activity
- Student worksheets
- Videos of all hands-on activities
- Remote learning supports
- Digital assessment tools
 - o item banks by unit
 - ability to create assessment items in a variety of formats
 - o automatically scored items

SCIENCE AND GLOBAL ISSUES BIOLOGY

Professional Learning

The Teriodic Table

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Contact Information

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 - For slides go to the News section and look for SEPUP Workshop Materials
 - <u>https://sepuplhs.org</u>
 - Twitter: @SEPUP_UCB
- Lab-Aids
 - Our fabulous publisher! Handles all sales, kits, etc.
 - https://www.lab-aids.com
 - Or go to the great staff at the back of the room. igodot

