Life Sciences: *Life cycles, Inheritance and Variation of Traits*

Washington University in St. Louis
Institute for School Partnership

unit 14

Change Over Time

mySci™ hands on science for elementary students

MONSANTO *Fund*®

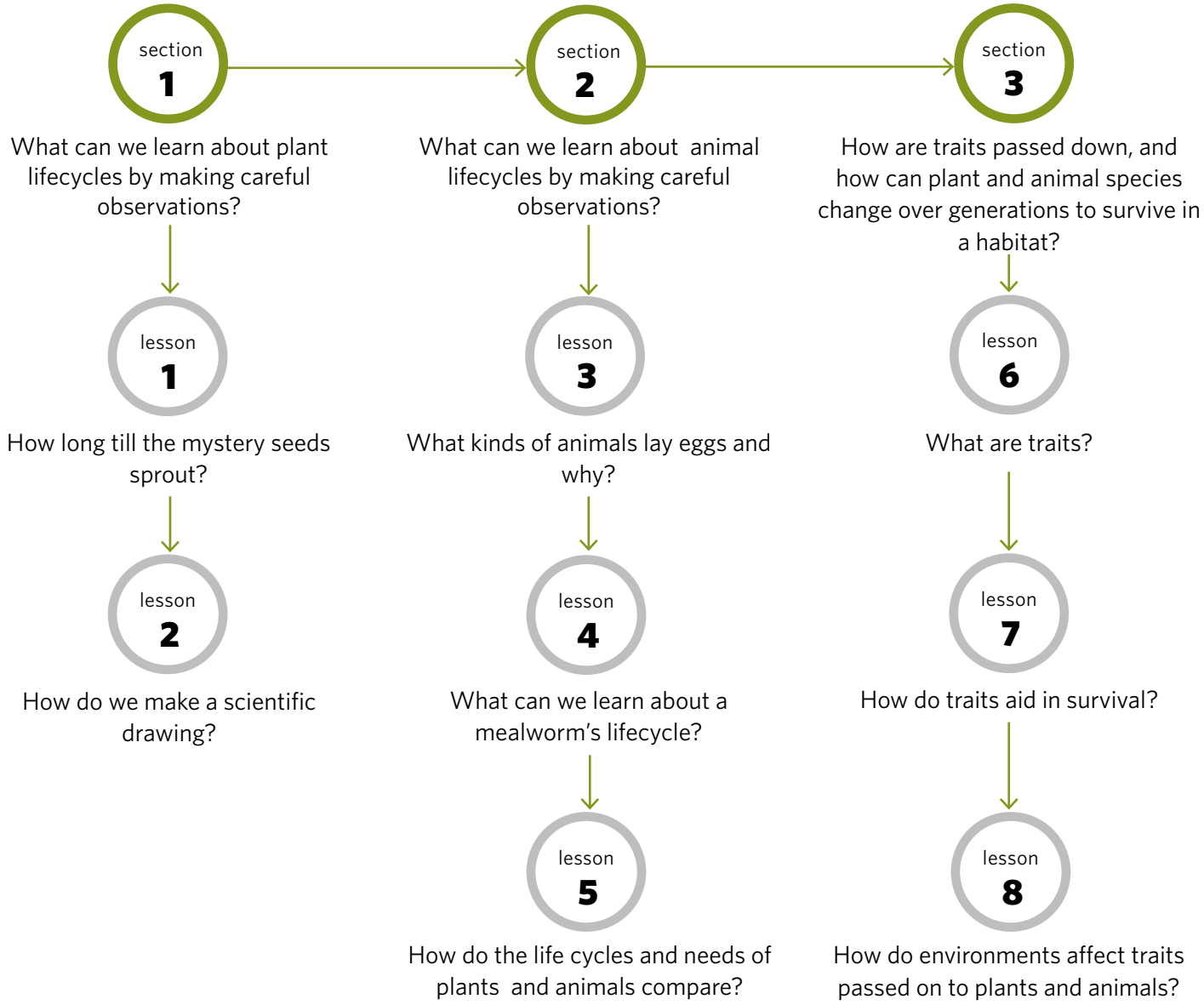
MySci Project-Based Curriculum Unit Structure

Unit 14

Change Over Time

Visit the Unit 14 Curriculum Page for more resources: http://schoolpartnership.wustl.edu/instructional-materials/mysci-unit-14-change-time/

DESIGN CHALLENGE:
How can we show that inherited traits can be influenced by the environment?



Unit 14 Teacher Preparation List

Lesson	Inside MySci kit, you'll find:	Items you must supply:	Extra prep time needed:
Lesson 1	30 Peat pots, plastic cups to put the peat pots in Soil 1 pack each: parsley, chives, mint and basil seeds Spray bottle 15 hand lenses	Science notebooks & internet access Chart paper	Review MySci Safety Guidelines Copy and administer the pre-assessment Copies of the plant measurement and observation sheet (Appendix i)
Lesson 2		Science notebooks Plant or other object for drawing demonstration	Copies of the Scientific Drawing rubric (Appendix ii) Copies of Fish handout (Appendix iii)
Lesson 3	*The Egg*, by Pascale de Bourgoing and Gallimard Jeunesse	Science notebooks & internet access	Copies of the Egg Development Chart (Appendix iv)
Lesson 4	*Mealworms*, by Martha Rustard Mealworms in habitat Petri dishes	Science notebooks & internet access	Copies of the Mealworm Observation sheet (Appendix v) Prepare mealworms
Lesson 5	Life Cycle Video Life Cycle Cards *Animal Life Cycles*, by Angela Royston	Science notebooks & internet access Plants from Lesson 1	Copies of the Living Organism Needs chart (Appendix vi) Copies of the Leaf Comparison Chart (Appendix vii)
Lesson 6	30 pipe cleaners *Inheritance of Traits: Why is My Dog Bigger Than Your Dog?*, by Jen Green (Optional extension lesson)	Science notebooks & internet access Scissors	Copies of Inheritable Traits strips (Appendix viii) Copies of Inheritable Traits Chart (Appendix ix) Copies of What Are Inheritable Traits? (Appendix x)
Lesson 7	Colored toothpicks	Science notebooks & internet access	Copies of Camouflage Evaluation Sheet (Appendix xi)
Lesson 8		Science notebooks & internet access Tape Crayons Scissors	Copies of the Peppered moth activity sheets (Appendix xii-xiv) Copy and administer post-assessment

section 1

What can we learn about plant lifecycles by making careful observations?

Lesson 1: How long until the mystery seeds sprout?

LEARNING TARGET

Identify ways to care for a seed so that it sprouts.

Describe the conditions a plant needs to survive.

SUMMARY

Students receive their mystery seed and discuss care and observation sheet duties.

ENGAGE

Ask the class: *What do you notice about these seeds?*

Activity: Put the students into groups. Give each group just one or two of each type of seed, along with hand lenses. **Do not let the students see the names of the seeds on the seed packages!** Number each package 1 through 4.

EXPLORE

Ask the class: *How are the seeds the same or different?*

Activity: Have each group of students examine the seeds and come up with ways they are the same and different. Record their ideas on the board. **(After the students examine the seeds, discard those seeds because they will probably get mixed up!)**

EXPLAIN

Ask the class: *How do we set up our observation sheets to record plant growth?*

Activity: Hand out the Plant Observation and Recording sheet (Appendix i). Give each group 2 peat pots and 2 cups, with soil in each peat pot (easier to prepare this ahead of time). Give each group 5 or 6 seeds of one type. They should plant seeds in each peat pot. Have the students discuss the care their seeds will need. (Water, sunlight, etc.)

ELABORATE

Ask: *What have we tried to grow before?* Have students share stories of gardening, etc. with their group.

EVALUATE

✓ Have students write a set of directions for taking care of their plants in their science notebooks. Ask students to predict what would happen to their seeds or plants if these directions were not followed.

MYSCI MATERIALS:

30 peat pots, plastic cups to put the peat pots in

Soil

1 pack each: parsley, chives, mint and basil seeds

15 hand lenses

Spray bottle

TEACHER PROVIDES:

Chart paper

Science notebooks

Internet access

Copies of the Plant Observation and Recording sheet (Appendix i)

Teaching Tip:

✓ This icon highlights an opportunity to check for understanding through a formal or informal assessment.

Teaching Tip:

Start seeds IMMEDIATELY! After the seeds are started, daily monitoring will need to occur. The seeds should sprout in seven days. Plant extra for insurance.

Before handing out the mystery seeds, number each package. You can then know that 1 = parsley, etc.

Teaching Tip:

Store these recording sheets in the classroom near the plants and record observations, measurements, and plant care (such as watering) daily.

Teaching Tip:

Watch Tips for Starting Seeds Indoors https://www.youtube.com/watch?v=RW-ClaydwM_w. The first 2 minutes of the Plant Care video have the most important tips for the students.

Lesson 2: How do we make a scientific drawing?

LEARNING TARGET
Develop a model by using a scientific drawing.

SUMMARY
Students will learn how to make drawings that include scientific measurements and observations.

ENGAGE
Tell the students: *I am going to draw a picture of something.* (Teacher draws a circle on the board.) *What is it?* Take guesses from the class. *Is it the moon? Is it a hula hoop? What kinds of information could we add to our drawing so that you can tell exactly what it is?*

EXPLORE
Ask the class: *What would a scientist have to include in his/her notes to make them useful?*

Activity: The teacher takes a plant or other object and shows the students how to make observations about it. Together the class writes observations and draws the object.

EXPLAIN
Ask the class: *What made our drawing more useful?*

Activity: The students pair up with a partner to discuss what parts of their observations were most useful. The teacher leads a class discussion about important components of a good observation. Display or pass out the Scientific Drawing Rubric (Appendix ii) to the students. Ask them if their drawing would pass this rubric. *Is your drawing useful? Did you:*

- *Show labels*
- *Make it big enough to see*
- *Explain it in words*
- *Give the date and time*
- *Use colors*
- *Use of science vocabulary*
- *Show the size*

ELABORATE
Once the plants begin to grow, have students carefully examine all of the plants. If they haven't sprouted yet, have 2 different plants for the students to compare. *How are they the same? How are they different?*

EVALUATE
✓ Pass out the Fish Drawing Comparison (Appendix iii). Have the students list 4 reasons why one drawing is more scientific than the other in their science notebooks.

TEACHER PROVIDES:
Copies of Scientific Drawing Rubric (Appendix ii)

Copies of Fish Drawing Comparison handout (Appendix iii)

Plant or other object for drawing demonstration

Science notebooks

Teaching Tip:
Objects that would be good for drawing are: classroom plants, light fixtures, projector, a chair, etc.

section 2

What can we learn about animal lifecycles by making careful observations?

Lesson 3: What kinds of animals lay eggs and why?

LEARNING TARGETS
Compare and contrast the life cycles of two different animals that lay eggs.

SUMMARY
The students explore the structure and function of the parts of an egg.

ENGAGE
Ask the class: *What kinds of animals lay eggs? Turn to a partner and make a list of all the animals you know that lay eggs.* Have students share out their answers, making a list of the animals, making categories such as reptiles, insects, birds, fish on chart paper.

EXPLORE
Say: *Some animals lay eggs and others give birth to live young. How are eggs helpful for survival?*

Watch Science — Animal Reproduction, Egg Laying Animal and Mammals — English https://www.youtube.com/watch?v=Mkvof36Kp_Q

Have students discuss the video and write how eggs help animals survive. Take ideas from students. Ideas might include: the parents can lay eggs and leave them to hatch on their own; egg-laying creatures can sometimes lay a lot of eggs at once; etc.

EXPLAIN
Tell the students: *We are going to read a book and then watch a movie about the development of a chicken egg. Then we will compare what we learned with our drawings.* Read *The Egg* by Pascale de Bourgoing and Gallimard Jeunesse.

Watch Flight: The Genius of Birds — Embryonic Development https://www.youtube.com/watch?v=-Ah-gT0hTto

ELABORATE
Ask: *Do all animal eggs develop in the same way?* Pass out Egg Development chart (Appendix iv). Have students look for comparisons of egg development on chart: *Isn't it amazing how similar animals are in early stages of development?*

EVALUATE
✓ *How is a turtle egg different from a chicken egg? How are they the same?* Write 2 ways they are the same and 2 ways they are different in your science notebook.

MYSCI MATERIALS:
The Egg, by Pascale de Bourgoing and Gallimard Jeunesse

TEACHER PROVIDES:
Copies of the Egg Development chart (Appendix iv)

Science notebooks

Internet access

Lesson 4: What can we learn about a mealworm's life cycle?

LEARNING TARGET
Observe and describe an animal's life cycle that experiences metamorphosis.

SUMMARY
Students examine the different stages of an organism that goes through a complete metamorphosis.

ENGAGE
Tell the class: *In the last lesson, we talked about how some animals lay eggs and how there are similarities and differences in their life cycles. There are other ways that animal life cycles can differ. Some amphibians and insects go through something called metamorphosis. Does any one know what that means or can someone give an example?*

Write the word "metamorphosis" on the board, and take student ideas about this word.

EXPLORE
Tell the class: *We have some animals in our classroom today that go through a metamorphosis. We are going to carefully observe these animals.*

Activity: Pass out the Mealworm Observation Sheets (Appendix v) and give a group of students a mealworm or beetle in a petri dish. They may handle them very carefully, then they should wash their hands. Remind the students that these are living creatures and to be very gentle with them.

EXPLAIN
Read *Mealworms*, by Martha Rustard. Discuss the vocabulary words in the back of the book: hatch, insect, larva, metamorphosis, molt, pupa.

Watch Mealworm to Darkling Beetle in Under Two Minutes http://www.youtube.com/watch?v=mXIuSXFGX-k

ELABORATE
Ask: *What is the difference between a complete and incomplete metamorphosis?*

Watch Complete Vs. Incomplete Metamorphosis https://www.youtube.com/watch?v=nuPCu8lHC8I

EVALUATE
Ask the class: *What can you learn about the life cycle of a frog from this fun song?*

Watch Pollywog in a Bog https://www.youtube.com/watch?v=MIkqEF2Mvc8

✓ Have students draw and label the life cycle of a frog in their science notebooks.

MYSCI MATERIALS:
Mealworms, by Martha Rustard

Mealworms in habitat (oatmeal)

Petri dishes

TEACHER PROVIDES:
Copies of the Mealworm Observation sheet (Appendix v)

Science notebooks

Internet access

Prepare mealworms

Lesson 5: How do the life cycles and needs of plants and animals compare?

LEARNING TARGET

Describe the basic needs of all organisms.

Compare the life cycles of some plants and some animals.

SUMMARY

Students will compare the needs and life cycles of plants and animals by using a card activity, reading a book, and watching a video. They will also revisit their mystery plants and observe the leaves of the plant.

ENGAGE

Tell the class: *So far we have talked about plants and animals, including some who lay eggs and some who go through metamorphosis. What does* ***every*** *living thing need to survive?*

Have students record their ideas in their notebooks before taking ideas from the class. The ideas you are looking for are: air/oxygen, water, food, protection, warmth.

EXPLORE

Ask: *Do all baby organisms have the same needs? What about plants? What are their lifecycles?*

Activity: Put the class into groups. Give each group a set of lifecycle cards. Have them put the cards in order.

Then use the Life Cycle Cards with the students to look for similarities and differences in stages of development.

EXPLAIN

Read the book Animal Life Cycles by Royston. Next, watch the Life Cycle video. Ask: *What part of the life cycle ensures that the species survives even after an individual dies?* Discuss with the class. They should discuss reproduction/egg laying/giving birth.

ELABORATE

After all of the plants have leaves, hand out copies of the Leaf Comparison Chart (Appendix vii) and have students use their observation skills to complete the chart. Discuss their observations as a class. Bring the discussion back to life cycles and needs. Tell students that leaves are a feature of the plant's life cycle and help plants get one of their basic life requirements.

EVALUATE

Hand out copies of the Living Organism Needs chart (Appendix vi) and have students complete it. Go over their ideas with the whole class. Ask students to pick two animals and/or plants and compare their life cycle. Have them record their ideas in their science notebooks.

MYSCI MATERIALS:

Life Cycle Video

Life Cycle Cards

Animal Life Cycles, Angela Royston

TEACHER PROVIDES:

Copies of the Living Organism Needs (Appendix vi)

Copies of the Leaf Comparison Chart *(Optional)* (Appendix vii)

Plants from Lesson 1

Science notebooks

Teaching Tip:

The lifecycle cards are numbered on the back, if there is confusion about the order.

Teaching Tip:

There are many ways you could use these cards. Compare different stages with other animals.

Teaching Tip:

This portion of the lesson will have to be conducted once all plants have visible leaves.

section 3

How are traits passed down, and how can plant and animal species change over generations to survive in a habitat?

Lesson 6: What are traits?

LEARNING TARGET

Identify that offspring share traits from their parents.

Compare and contrast inherited and learned traits.

SUMMARY

Students survey their classmates for similar inherited traits.

ENGAGE

Ask the class: *What tells us something is the offspring (child) of a parent? Write your thoughts in your science notebook.* Discuss their ideas after they have a chance
to write.

EXPLORE

Ask the class: *What do we inherit from our parents? There are certain things that we have or can do that are inherited, such as the color of our eyes. Here are 6 common traits.* Hand out a trait strip (Appendix viii) to each student and assist them in filling out their own traits.

1. Thumb dominance (*Interlock your hands. Which thumb lies on top, left or right?*)
2. Earlobes (*Are they attached or unattached?*)
3. Tongue curl (*Can you curl up your tongue?*)
4. Hand dominance (*Do you use your left or right hand most?*)
5. Dimples (*in cheeks, when you smile?*)
6. Long second toe (*Is your second toe longer than your big toe?*)

Activity: Pass out one pipe cleaner to each student. They should cut apart the traits and thread them one at a time on the pipe cleaner (using the circles to show where to push the pipe cleaner through). This is a model of DNA.

EXPLAIN

Watch What is DNA and How Does it Work? https://www.youtube.com/watch?v=zwibgNGe4aY

MYSCI MATERIALS:

30 pipe cleaners

Inheritance of Traits: Why is My Dog Bigger Than Your Dog? by Jen Green *(Optional extension lesson)*

TEACHER PROVIDES:

Copies of Inheritable Traits Strips (Appendix viii)

Copies of Inheritable Traits Chart (Appendix ix)

What Are Inheritable Traits? (Appendix x)

Scissors

Science notebooks

Internet access

ELABORATE

Activity: Ask students to take their pipe cleaner with them as they move around the classroom. Instruct students with right over left thumb dominance to move to one area of the room; left over right dominance move to another area. Count the students and make the chart (Appendix ix) on the board to show how many students have that trait, then repeat for each trait.

EVALUATE

✓ Pass out the What are Inheritable Traits? worksheet (Appendix x). Have the students complete and then discuss their answers as a class.

EXTEND (OPTIONAL)

More information about how genes work are found in the book *Inheritance of Traits: Why is My Dog Bigger Than Your Dog?* by Jen Green.

Lesson 7: How do traits aid in survival?

LEARNING TARGET
Describe how inherited traits can help a living thing survive.

SUMMARY
Students explore how camouflage helps organisms survive.

ENGAGE
Tell the students: *In the last lesson, we discovered which traits are inherited and which ones are learned. Who can give an example of an inherited trait?* (Take a few examples.) *Who can give an example of a learned behavior?* (Take a few examples.) *Of the ones that we inherited, are there any that help animals survive? Write your thoughts in your notebook and share with a partner.*

EXPLORE
Tell the students: *Look at this box of color toothpicks. Which of these toothpicks do you think will be hard to find in the grass? Why? Discuss your prediction with a partner.*

Activity: Take the box of toothpicks and spill them out on a white piece of paper. Lead a class discussion about what colors the kids see. Ask if they are easy to see and why. Have students count the number of each color of toothpick. Make a graph on the board to show the amount of each color in the box.

Explain that these toothpicks are like insects. The students will pretend they are birds that prey on these insects.

Take the students outside and toss the toothpicks out into the grass. Spread them out so that the children can spread out when they "hunt" them. Give the students 30 seconds to locate as many toothpicks as possible. When the 30 seconds are up, the students go back inside. If the weather is inclement, use the floor or rug in the classroom.

The students should combine their toothpicks and create a bar graph to show the amount of toothpicks found for each color. Discuss with their group the difference between the two graphs. (Ideally, the colors that are camouflaged, will not be found so there will be less of them.) The students should write about the data they collected. They should use the science vocabulary in their description (camouflage, prey, predator, survive). They should think about these questions when they write in their notebook:

- *What colors were easy to find? Why?*
- *What colors were not easy to find? Why?*
- *If these were insects, which colors would survive?*
- *Which colors would disappear over time? Why?*
- *Next year, what colors would be found in the forest?*
- *What would eventually happen to the colors that you found?*

MYSCI MATERIALS:
Colored toothpicks

TEACHER PROVIDES:
Copies of Camouflage Evaluation Sheet (Appendix xi)

Science notebooks

Computer with Internet access

(The students should understand that the colors that were found "captured" were the colors that were eaten and did not survive. The colors that were not found, therefore survived and were around to reproduce. Therefore there will be more of them.)

EXPLAIN

Ask the class: *What is camouflage? Write your definition in your science notebook, then share with a partner.*

Watch 25 Incredible Camouflaged Animals https://www.youtube.com/watch?v=XpdoDBYuHIA

ELABORATE

Ask: *Is camouflage more important to the predator or the prey? Write your answer in your science notebook, then discuss with a partner.*

EVALUATE

Pass out the Camouflage Evaluation sheet (Appendix xi) and have the students fill it out. Discuss their answers as a class.

Lesson 8: How do environments affect traits passed on to plants and animals?

LEARNING TARGET

Describe how some inherited traits in a species can change over time in response to a changing environment.

SUMMARY

Students experience the peppered moth activity to see how the environment changed a trait of the peppered moth.

ENGAGE

Tell the students: *I'm going to play a game on the computer and I want you to watch what happens to the moth populations as I play.*

Play the Peppered Moth online game. Discuss what happened as the generations went on. http://askabiologist.asu.edu/activities/peppered-moth

EXPLORE

Activity: Hide-a-Moth (adapted from Animal Survival #37 by TOPS Learning Systems). Ask students: *Think about some of the organisms we've studied in this Unit. How could we design an experiment to show that inherited traits can be influenced by the environment? What variables would you need to keep the same in order for your experiment to be a fair test?* Students can brainstorm in small groups or as a class.

1. Form groups of 4 students. Each group should get 3 sheets of moths (Appendix xii).
2. Find an area in your classroom that will be your moths landing place. Color half of your moths to look like the surface that you chose, and the other half a very different color. This will be the moth's camouflage.
3. Cut out the moths. Put 5 "camouflaged" and 5 other moths in the "habitat". Tape the moths to the surface that you chose.
4. Invite your Principal (Hungry Bird) to come and hunt in the whole classroom for moths for 1 minute.
5. Each group should count how many of their "camouflaged" moths survived and how many many of their other moths survived. Create a graph of the results.
6. Discuss each group's result (record on the board) and reasons why some moths survived and others did not.
7. For every camouflaged moth that survived, add 3 more camouflaged moths (babies of the survivor). Do the same for each of the different moths that survived.
8. Tape up the new moths and repeat directions 4–6.
9. Discuss the difference in graphs. What would happen over time?

TEACHER PROVIDES:

Copies of the Peppered Moth Activity Sheets (Appendix xii – xiv)

Tape

Crayons

Scissors

Science Notebooks

Internet access

Teaching Tip:

More reading activities and background information are available at classzone http://www.classzone.com/science_book/mls_grade7_FL/497_505.pdf

EXPLAIN

After discussing #9, watch the video Natural Selection — Peppered Moth https://www.youtube.com/watch?v=Uf-mOCN7rUU

ELABORATE

Hand out the worksheets (Appendix xiii - xiv) and have students read and answer the questions. Discuss their answers as a class.

EVALUATE

Tell students that after the Industrial Revolution, laws were put in place to help limit the amount of pollution. After some time, the trees returned to their normal color. Ask students to predict the change over time they would expect to see in the peppered moths once the trees returned to their normal color. What evidence did you use to make your prediction? The students should record their answers in their science notebooks.

NEXT GENERATION SCIENCE STANDARDS

Key to Understanding the NGSS Codes

NGSS codes begin with the grade level, then the "Disciplinary Core Idea code", then a standard number. The Disciplinary Core Ideas are:

Physical Sciences

PS1: Matter and its interactions

PS2: Motion and stability: Forces and interactions

PS3: Energy

PS4: Waves and their applications in technologies for information transfer

Life Sciences

LS1: From molecules to organisms: Structures and processes

LS2: Ecosystems: Interactions, energy, and dynamics

LS3: Heredity: Inheritance and variation of traits

LS4: Biological evolution: Unity and diversity

Earth and Space Sciences

ESS1: Earth's place in the universe

ESS2: Earth's systems

ESS3: Earth and human activity

Engineering, Technology, and Applications of Science

ETS1: Engineering design

ETS2: Links among engineering, technology, science, and society

For more information, visit http://www.nextgenscience.org/next-generation-science-standards

NGSS PERFORMANCE EXPECTATIONS

Content

3-LS1-1

Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

3-LS3-1

Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.

3-LS3-2

Use evidence to support the explanation that traits can be influenced by the environment.

3-LS4-2

Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

3-5-ETS1-1

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2

Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3

Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

SCIENCE AND ENGINEERING PRACTICES

Concepts

Asking Questions and Defining Problems

- Ask questions about what would happen if a variable is changed.
- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.

Developing and Using Models

- Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.
- Develop and/or use models to describe and/or predict phenomena.
- Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system.

Planning and Carrying Out Investigations

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
- Evaluate appropriate methods and/or tools for collecting data.
- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
- Make predictions about what would happen if a variable changes.

Analyzing and Interpreting Data

- Represent data in tables and/or various graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.
- Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.
- Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.

Using Mathematics and Computational Thinking

- Organize simple data sets to reveal patterns that suggest relationships.
- Describe, measure, estimate, and/or graph quantities (e.g., area, volume, weight, time) to address scientific and engineering questions and problems.

Constructing Explanations and Designing Solutions

- Construct an explanation of observed relationships (e.g., the distribution of plants in the back yard).
- Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.
- Identify the evidence that supports particular points in an explanation.

Engaging in Argument from Evidence

- Compare and refine arguments based on an evaluation of the evidence presented.
- Construct and/or support an argument with evidence, data, and/or a model.
- Use data to evaluate claims about cause and effect.

Obtaining, Evaluating and Communication Information

- Read and comprehend grade-appropriate complex texts and/or other reliable media to summarize and obtain scientific and technical ideas and describe how they are supported by evidence.
- Compare and/or combine across complex texts and/or other reliable media to support the engagement in other scientific and/or engineering practices.
- Combine information in written text with that contained in corresponding tables, diagrams, and/or charts to support the engagement in other scientific and/or engineering practices.
- Communicate scientific and/or technical information orally and/or in written formats, including various forms of media as well as tables, diagrams, and charts.

DISCIPLINARY CORE IDEAS

Concepts

Inheritance and Variation of Traits: Life Cycles and Traits

LS1.B: Growth and Development of Organisms

Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3-LS1-1)

LS3.A: Inheritance of Traits

Many characteristics of organisms are inherited from their parents. (3-LS3-1)

Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3-LS3-2)

LS3.B: Variation of Traits

Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1)

The environment also affects the traits that an organism develops. (3-LS3-2)

LS4.B: Natural Selection

Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (3-LS4-2)

CROSSCUTTING CONCEPTS

Patterns

- Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products.
- Patterns of change can be used to make predictions.
- Patterns can be used as evidence to support an explanation.

Cause and Effect: Mechanism and Prediction

- Cause and effect relationships are routinely identified, tested, and used to explain change.

Systems and System Models

- A system can be described in terms of its components and their interactions.

Structure and Function

- Different materials have different substructures, which can sometimes be observed.
- Substructures have shapes and parts that serve functions.

Stability and Change

- Change is measured in terms of differences over time and may occur at different rates.
- Some systems appear stable, but over long periods of time will eventually change.

MISSOURI GLE STANDARDS

Key to Understanding the GLE Codes

GLE codes are a mixture of numbers and letters, in this order: Strand, Big Idea, Concept, Grade Level and GLE Code.

The most important is the strand. The strands are:

1. **ME**: Properties and Principles of Matter and Energy
2. **FM**: Properties and Principles of Force and Motion
3. **LO**: Characteristics and Interactions of Living Organisms
4. **EC**: Changes in Ecosystems and Interactions of Organisms with their Environments
5. **ES**: Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydroshpere)
6. **UN**: Composition and Structure of the Universe and the Motion of the Objects Within It
7. **IN**: Scientific Inquiry
8. **ST**: Impact of Science, Technology and Human Activity

For more information, visit http://dese.mo.gov/college-career-readiness/curriculum/science

GLE Standards

Concepts

Second Grade

LO 1 B 2 a
Identify and sequence life cycles (birth, growth, and development, reproduction, and death) of animals (i.e., butterfly, frog, chicken, snake, dog)

LO 1 B 2 b
Record observations on the life cycle of different animals (e.g., butterfly, dog, frog, chicken, snake)

LO 3 D 2 a
Identify and relate the similarities and differences among animal parents and their offspring or multiple offspring

Third Grade

LO 1 B 3 a
Describe and sequence the stages in the life cycle (for a plant) of seed germination, growth and development, reproduction and death (i.e., a flowering plant)

LO 3 D 3 a
Identify and relate the similarities and differences between plants and their offspring (i.e., seedlings)

IN 1 A 3 b
Plan and conduct a fair test to answer a question

IN 1 B 3 a
Make qualitative observations using the five senses

IN 1 B 3 d
Compare amounts/measurements

IN 1 C 3 a
Use quantitative and qualitative data as support for reasonable explanations

IN 1 C 3 b
Use data as support for observed patterns and relationships, and to make predictions to be tested

IN 1 C 3 c
Evaluate the reasonableness of an explanation

IN 1 C 3 d
Analyze whether evidence supports proposed explanations

IN 1 D 3 a
Communicate simple procedures and results of investigations and explanations through: oral presentations, drawings and maps, data tables, graphs (bar, single line, pictograph), writings

ST 2 A 3 a
Research biographical information about various scientists and inventors from different gender and ethnic backgrounds, and describe how their work contributed to science and technology

ST 3 A 3 b
Work with a group to solve a problem, giving due credit to the ideas and contributions of each group member

ST 3 A 3 a
Identify a question that was asked, or could be asked, or a problem that needed to be solved when given a brief scenario (fiction or nonfiction of people working alone or in groups solving everyday problems or learning through discovery)

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Plant Observation and Recording Sheet

Section 1, Lesson 1

Name: _____ **Date:** _____

DESCRIBE AND SKETCH THE SEEDS YOU PLANTED:

_____

_____

PREDICT WHAT YOUR PLANT WILL LOOK LIKE (DESCRIBE AND SKETCH):

_____

_____

DATE YOU PLANTED THE SEEDS:

_____

PREDICT THE DATE THAT THE SEEDS WILL SPROUT:

_____

DATE	MEASUREMENTS	OBSERVATIONS	PLANT CARE

Scientific Drawing Rubric

Section 1, Lesson 2

Name: _____ **Date:** _____

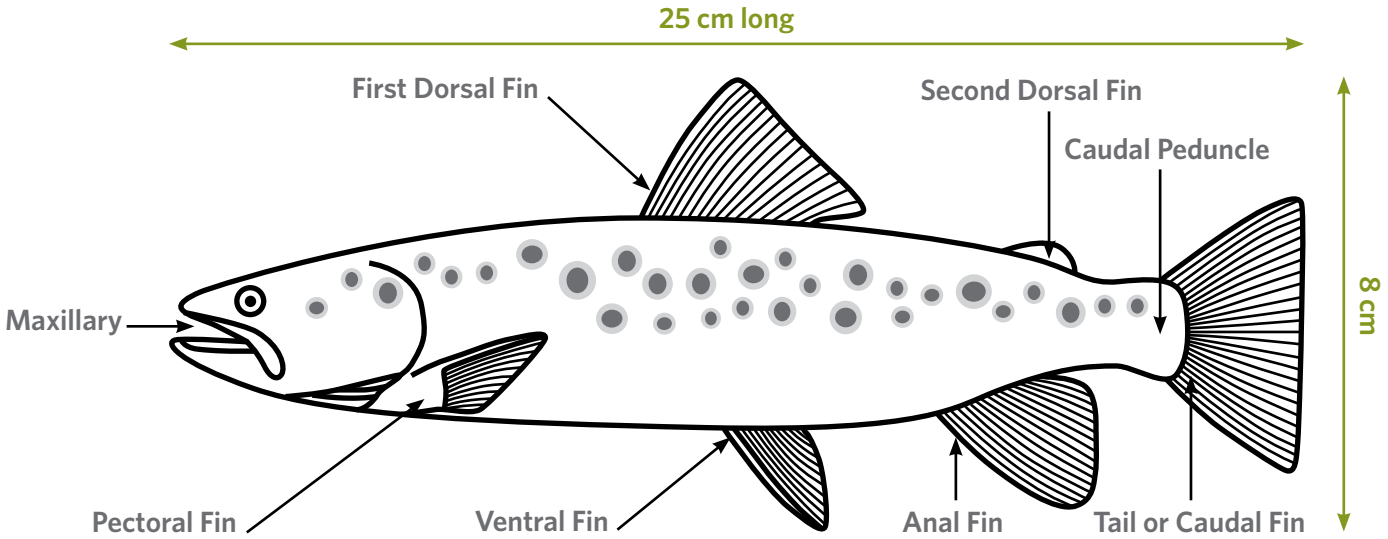
	NO 	SOMEWHAT 	YES 
Did I draw everything I saw?			
Did I label the parts of my drawing?			
Did I give my drawing a title?			
Is my drawing big enough and clear enough to see everything?			
Is my drawing realistic?			

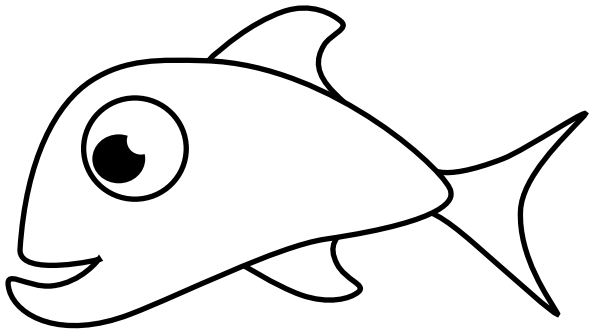
Fish Drawing Comparison

Section 1, Lesson 2

Name: _____ **Date:** _____

BROWN TROUT DRAWING





List four reasons why one drawing is more scientific than the other drawing.

1. _____

2. _____

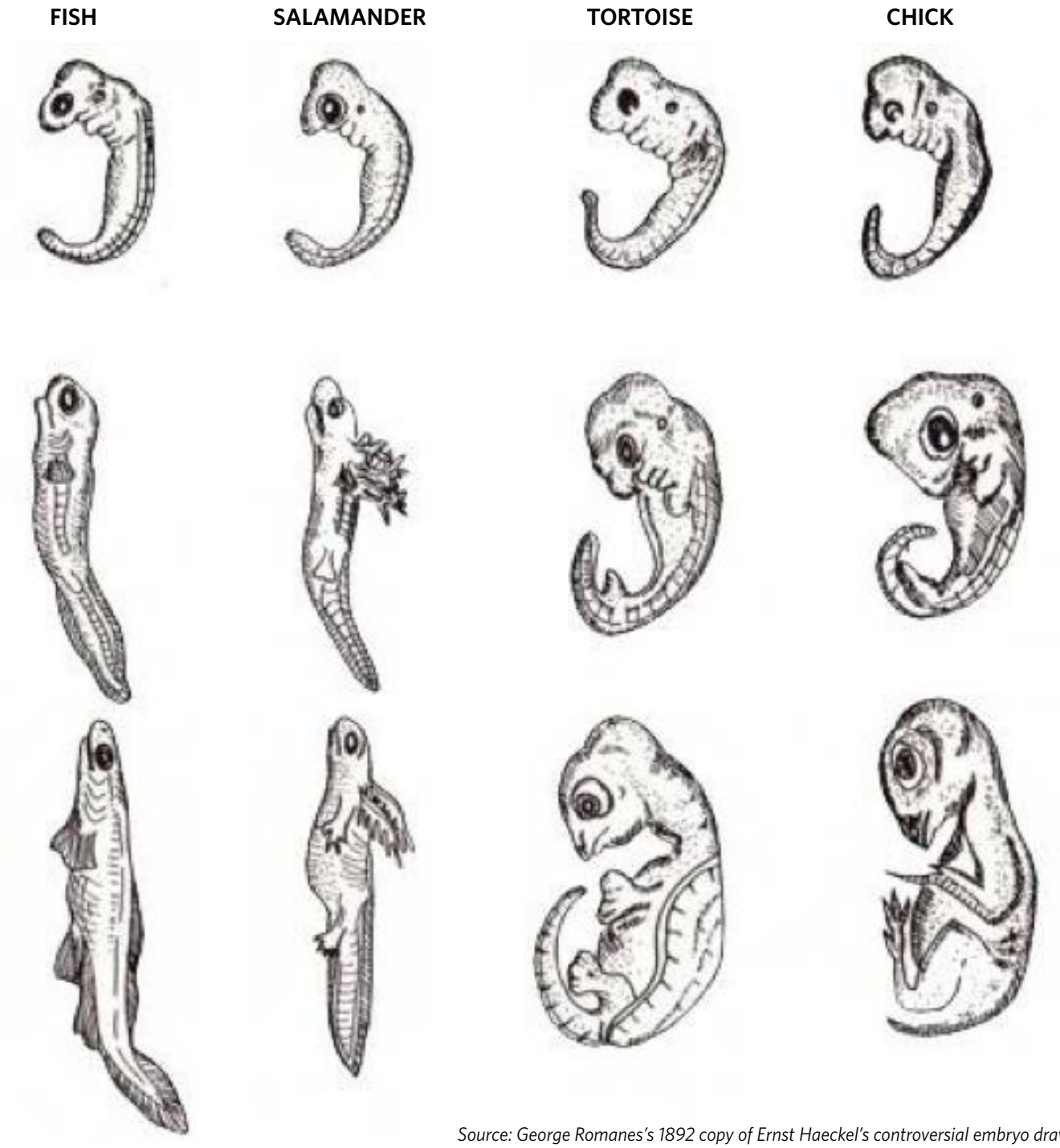
3. _____

4. _____

Egg Development

Section 2, Lesson 3

Name: _____ **Date:** _____



Source: George Romanes's 1892 copy of Ernst Haeckel's controversial embryo drawings

Mealworm Observation Sheet

Section 1, Lesson 4

Name: _____ **Date:** _____

PROPERTIES	LARVA	PUPA	BEETLE
Color			
Shape			
Size			
Texture			
Other Observations			
Scientific Drawing			

Living Organism Needs

Section 1, Lesson 5

Name: _____ **Date:** _____

This chart shows what all living things need to survive. How does each one get what it needs? A few have been done for you as a guide.

NEEDS	HUMAN BABY	CHICK	PLANT
Food			A plant makes food using the sun (photosynthesis).
Water		A chick gets water from eating juicy food or drinking water from their environment.	
Protection	A human baby is protected by adults.		
Warmth			
Air			

Leaf Comparison Chart

Section 1, Lesson 5

Name: _____ **Date:** _____

LEAF	SHAPE	EDGES	SMELL	TEXTURE	TASTE
					
					
					
					

Source: ©Veggieful

Inheritable Traits Strips

Section 2, Lesson 6

THUMB DOMINANCE	
EAR LOBES	
TONGUE CURL	
HAND DOMINANCE	
DIMPLES	
SECOND TOE LENGTH	

THUMB DOMINANCE	
EAR LOBES	
TONGUE CURL	
HAND DOMINANCE	
DIMPLES	
SECOND TOE LENGTH	

Inheritable Traits Chart

Section 2, Lesson 6

thumb dominance	right over left	left over right
ear lobes	attached	not attached
tongue curl	yes	no
hand dominance	right	left
Dimples	yes	no
second toe	longer	shorter
eye color	brown	not brown

What are Inheritable Traits?

Section 1, Lesson 6

Name: _____ **Date:** _____

Put a check in the column describing the nature of the trait.

TRAIT	INHERITED	LEARNED
Height		
Skin Color		
Dimples		
Earlobes		
Knowing the alphabet		
Liking a subject in school		
Birds singing		
Favorite food		
Riding a skateboard		
Speaking Spanish		
Hair color		
Eye color		
A flower's color		
Liking classical music		
Color of a dogs eyes		
Liking to read		
A zebra's stripes		
Being left handed		
A dog sitting on command		
Shape of your nose		
Being able to hit a baseball		
Having a camouflaged skin pattern to avoid predators		

Camouflage Evaluation

Section 2, Lesson 7

Name: _____ **Date:** _____

Animals use camouflage to hide. Why would each of these animals want to hide? What are they hiding from?

1. **Rabbit** _____

_____

2. **Tiger** _____

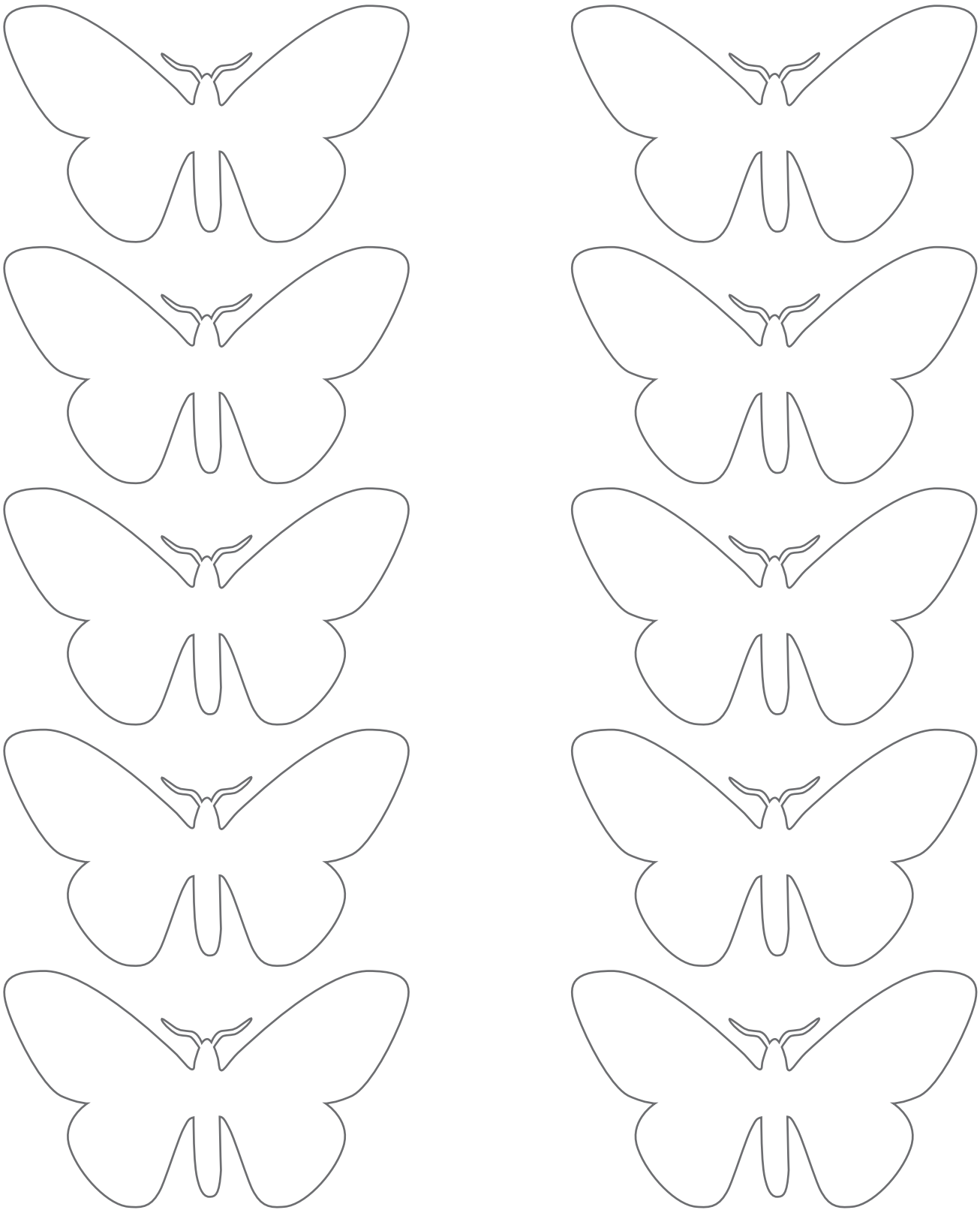
_____

3. **Snake** _____

_____

Moth Template

Section 2, Lesson 8



How Animals Adapt to Their Environment: The Peppered Moth and the Industrial Revolution

Section 2, Lesson 8

Name: _____ **Date:** _____

There is a substance in your skin that gives it color. This substance is called melanin. The more melanin you have, the darker your skin will be. For example, African American people have lots of melanin in their skin so they are darker, while White Americans have less melanin so their skin is lighter. People aren't the only ones that produce melanin. Other animals and organisms such as bugs produce melanin also. A black cat is black because of melanin. The more melanin organisms have, the darker they will appear.

1. What is melanin?

_____

_____

_____

In the 1800s, many countries went through an industrial boom. Many factories were built to produce a variety of different products. While these factories were busy producing goods, they were also releasing soot into the atmosphere. Soot is a black powder that is formed when something is burned. As the factories burned coal to produce energy, they also produced lots of soot into the atmosphere. This soot landed on the trees. Before the industries came, the tree trunks were light-grayish green. After the industries came, the barks of the trees started turning black.

2. What is an industrial boom?

_____

_____

_____

3. Why were the trees turning dark?

_____

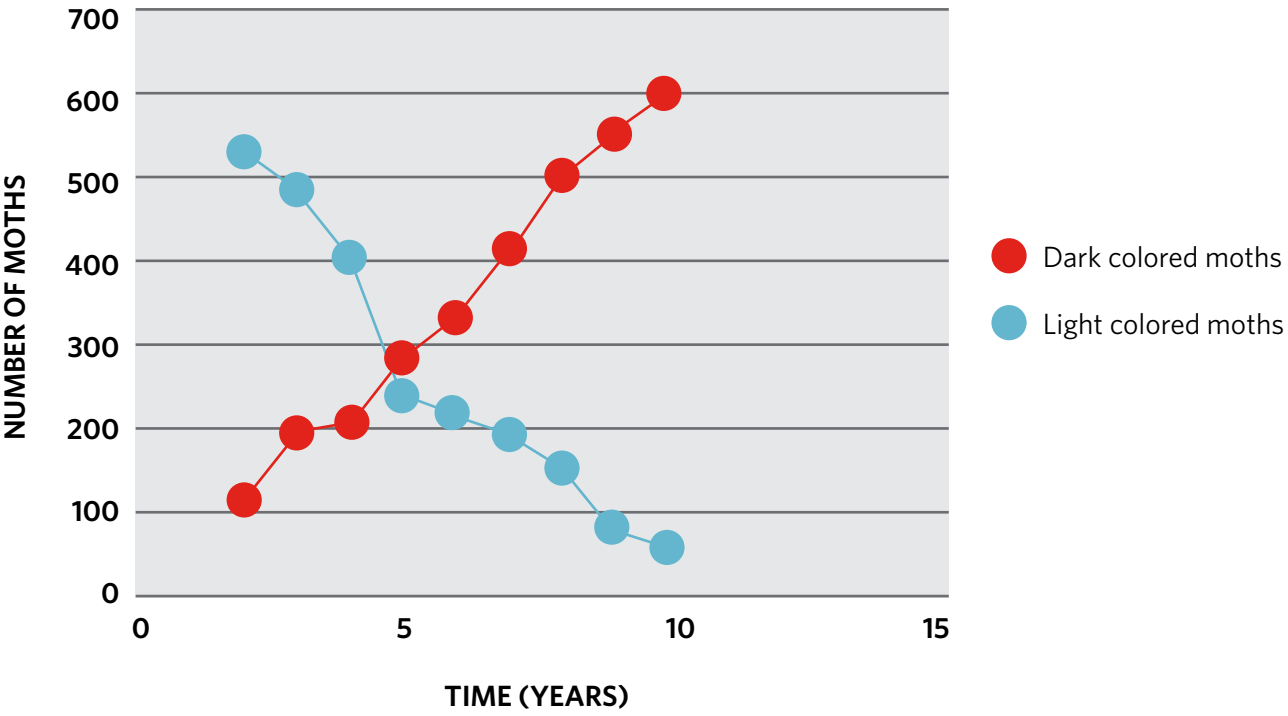
_____

_____

Change of Pepper Moths Over Time

Section 2, Lesson 8

Name: _____ **Date:** _____



1. According to the graph, what happened to the number of lighter colored-moths over time?

_____

2. Why do you think the number of lighter-colored moths changed over time?

_____

3. According to the graph, what happened to the number of darker colored moths over time?

_____

4. Why do you think the number of darker-colored moths changed over time?

_____

Vocabulary & Glossary

All Sections and Lessons

RECOMMENDATION

We recommend that students participate in investigations as they learn vocabulary, that it is introduced as they come across the concept. MySci students work collaboratively and interact with others about science content also increasing vocabulary. The hands-on activities offer students written, oral, graphic, and kinesthetic opportunities to use scientific vocabulary and should not be taught in isolation.

organism
offspring
generation
DNA
seedling
sprout
metamorphosis
population
environment
survive
reproduce
germinate
predict
prediction
observe
observation
data
embryo
yolk
shell
development
hatch
protection
life cycle
larva
pupa
habitat
characteristic
inherit
traits
camouflage
survive
adapt
adaptation