Science Learning Packet
Grade 8:
Natural Selection, Lesson 5A

science learning activities for SPS students during the COVID-19 school closure.

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Due to the COVID-19 closure, teachers were asked to provide packets of home activities. This is not intended to take the place of regular classroom instruction but will help supplement student learning and provide opportunities for student learning while they are absent from school. Assignments are not required or graded. Because of the unprecedented nature of this health crisis and the District’s swift closure, some home activities may not be accessible.

If you have difficulty accessing the material or have any questions, please contact your student’s teacher.
Grade 8 Science Learning Activity
Natural Selection Unit
Lesson 5 Instructional Materials

Name ___________________________________
School___________________________________
Class Period ______________________________
Teacher __________________________________
Hello Families,

We hope you and your family are well and safe during this time. During this unprecedented out-of-school time, the SPS middle school science team will be offering instructional opportunities for students that align with the district’s adopted middle school science instructional materials.

This investigation packet is part of a series of district-aligned lessons for middle school science developed by AmplifyScience and adopted by SPS in 2019. While Amplify Science lessons are designed to be done in the classroom with peers, there are some activities that students can complete at home.

In this packet you will find activities to accompany the lesson videos being aired this week through Seattle’s Public television programming on SPS TV (local channel 26). The videos and packets are also posted to the, SPS Science webpage under their corresponding grade level. These lesson videos, developed in collaboration between SPS teachers, Denver Public Schools teachers, and Amplify Science, feature teachers going through the information in the lessons. The work in this packet is intended to be completed alongside the viewing of the video of the corresponding videos.

Closed captioning for the videos is available many home languages if this helpful to your family.

| ○ Click CC (bottom right of video) | ○ Click Setting (the gear next to CC) |
| ○ Click Subtitles/CC | ○ Click Auto-translate |
| ○ Choose your language |

For students who have access to the internet and the following devices and browsers may wish to log-in to their AmplifyScience account from home are welcome to do so. Chrome and Safari are the recommended browsers to use for full functionality of the Amplify digital tools and features.

Sincerely,
Seattle Public Schools Science Department
Lesson 5 Survival and Reproduction

In the previous lesson, you explored how traits are passed down from one generation to the next when organisms reproduce. How is it possible that, over many generations, some traits can become more common, while others become less common? Shouldn’t each generation match the generation before it? Today, you will observe one more example of how individuals in a population get their traits through reproduction.

Unit Question

- Why do populations change over time?

Chapter 2 Question

- How did the trait for increased poison level become more common in the newt population?

Learning Objectives

- Genes are instructions for making protein molecules and protein molecules determine an organism’s traits.

- Individuals inherit their genes from their parents. Genes, and therefore traits, in a population are passed down from generation to generation.

Vocabulary

<table>
<thead>
<tr>
<th>Adaptive trait</th>
<th>Environment</th>
<th>Non-Adaptive Trait</th>
<th>Trait</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause</td>
<td>Evidence</td>
<td>Population</td>
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<tr>
<td>Claim</td>
<td>Gene</td>
<td>Prediction</td>
<td>Variation</td>
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<tr>
<td>Distribution</td>
<td>Generation</td>
<td>Protein Molecule</td>
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<tr>
<td>Effect</td>
<td>Natural Selection</td>
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</tr>
</tbody>
</table>

Materials you will need

- Pencil or Pen

- Different colored writing utensils (colored pencils, crayons, highlighters, markers, etc.)

- Someone near you to talk through your ideas with
Let’s Warm-Up!

Observe the spider family tree in the image and answer the questions below.

1. What do you notice about the traits of the offspring compared to the traits of the parents?

__________________________________________________________________________________________
__________________________________________________________________________________________
__________________________________________________________________________________________
__________________________________________________________________________________________

2. Where do organisms get their traits?

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__________________________________________________________________________________________
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Natural Selection—Lesson 2.2—Activity 1
Observing Genes, Protein Molecules and Traits

In our previous lesson, we read about glowing jellies and the protein molecule that leads to that trait. In this lesson, we are going to look at another kind of organism and explore a model of how individuals in a population get their traits. We will be focusing on the feature of stripe color in a population of spiders.

Observe the diagram above and make the additions to the diagram according to the list below with different color writing utensils:

1. Write the name of this spider here ________________________
2. Color this spider’s body brown, if another color name that here: ________________________
3. Color the stripes on the back of the spider blue, if another color- name that here: ________________________
4. What trait does this spider have for stripe color? ________________________
5. Color all the proteins in the cell pink, if another color- name that here: ________________________
6. Color the dark gray circles floating inside the cell blue or same color as the stripe color in #3
7. Look at the shape of the proteins in the cell and then look at the protein key at the bottom. Which protein(s) does this spider have? (circle) Protein 1 Protein 2 Protein 3
8. Write the two gene versions this spider has on its chromosomes here ________________________

Notice the star in the diagram. It shows how the proteins sometimes have a shape that allows them to fit in other larger molecules like a lock and key. When they fit together, this produces the blue pigment.
Observe the diagram above and make the additions to the diagram according to the list below with different color writing utensils:

1. Write the name of this spider here ________________________
2. Color this spider’s body yellow (note: this must be different than Otis), if another color name that here:
3. Color the stripes on the back of the spider black, if another color- name that here:
4. What trait does this spider have for stripe color? ____________________
5. Color all the proteins in the cell pink, if another color- name that here:
6. Color the dark gray circles floating inside the cell blue
7. Look at the shape of the proteins in the cell and then look at the protein key at the bottom. Which protein(s) does this spider have? (Hint: one is more round, while the other is pointy- circle all that apply)

   Protein 1   Protein 2   Protein 3

8. Write the two gene versions this spider has on its chromosomes here __________________________

Notice the stars in the diagram. It shows how the proteins sometimes have a shape that allows them to fit in other larger molecules like a lock and key. When they fit together, this produces the blue pigment.

Genes are instructions for making proteins. We now know that Otis has two of the same gene version (T2T2) while Ruby has two different gene versions (T2T3). What do you think might happen if you changed one of the gene versions Otis has from T2 to T3?

___________________________________________________________________________________________
___________________________________________________________________________________________

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How Genes Affect Proteins and Traits

As we saw with Otis and Ruby, the structure—or shape—of the protein molecule determines its function, or what that protein molecule does. The rounded protein molecule only fit together with a certain molecule, which led to the production of blue pigment. The pointy protein molecule only fit together with a different molecule, which led to the production of black pigment. **Genes are instructions for making proteins and thus they determine the shape of the protein. So if the genes (instructions) are changed, the protein’s shape will change, and then the function of the protein will change with the trait that is expressed being changed as well.**

<table>
<thead>
<tr>
<th>Genes</th>
<th>Proteins</th>
<th>Traits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide instructions for</td>
<td>Expressed as</td>
<td></td>
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</tbody>
</table>

**Key Concept**

- Genes are instructions for making protein molecules and protein molecules determine an organism’s traits.
- Individuals inherit their genes from their parents. Genes, and therefore traits, in a population are passed down from generation to generation.
Reproduction in the Simulation

In Chapter 1, we ended by agreeing that the newt population became more poisonous because the snakes in this environment caused poison to be an adaptive trait, but now some park visitors are offering additions to the claim. But why exactly is poison level 10 most common now amongst the newts? Visitors are offering two possible claims:

- Poison level 10 is the most common because the newts with this trait were able to live longer than other newts.
- Poison level 10 is the most common because the newts with this trait reproduce more than other newts.

To be able to support one of these claims we need to understand why traits become more common in a population. In previous activities, we looked at how offspring get genes from their parents when organisms reproduce. Genes are instructions for making protein molecules that determine an individual’s traits. How is it possible then that some traits can become more common over many generations while others become less common over many generations? If offspring are inheriting their traits from their parents, shouldn’t each generation match the generation before it?

Turn and talk to someone near you about the investigation question and the two claims.

Investigation question: How do some traits become more common over many generations while others become less common?

Let’s Gather Evidence from the simulation to see help us answer this investigation question.

Collecting Reproduction Evidence in the Natural Selection Simulation

In the simulation, I chose an Ostrilope of the designated color and counted how many times that Ostrilope reproduced before dying. If the Ostrilope did not reproduce before dying, their data is listed as a 0. The data I collected is in the table below:

<table>
<thead>
<tr>
<th></th>
<th>Blue 1</th>
<th>Blue 4</th>
<th>Yellow 7</th>
<th>Yellow 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Trial 2</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Trial 3</td>
<td>3</td>
<td>3</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Trial 4</td>
<td>0</td>
<td>6</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Trial 5</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Average</td>
<td>2.2</td>
<td>3.2</td>
<td>4.6</td>
<td>2.4</td>
</tr>
</tbody>
</table>

Natural Selection—Lesson 2.2—Activity 2
Analyzing the Data

With the activity we just did, we counted how many types each Ostrilope with a designated color reproduced. We calculated the average by adding up each of the numbers for a particular Ostrilope and dividing it by 5 for the number of trials we did. The bar graph below represents the average number of times an Ostrilope reproduced, and therefore an average number of offspring.

![Ostrilope Reproduction by color](image)

Making Sense of the Data

1. What pattern describes the relationship between how long an Ostrilope lived and how many offspring it had? Hint: Try to complete this sentence: Ostrilopes that lived longer had (more / fewer / the same number of) offspring than . . .

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

2. Which Ostrilopes became more common over time, and why?

__________________________________________________________________________________________
Making sense of the Data (Continued)

3. Which Ostrilopes became less common over time, and why?


4. If the color of the environment became blue, which ostrilopes do you think would become more or less common, and why?


Revisiting the Claim

Based on the evidence that we just collected is the following claim SUPPORTED or REFUTED?

**Claim:** Ostrilopes with adaptive traits are more likely to reproduce than Ostrilopes with non-adaptive traits.

- [ ] Supported
- [ ] Refuted

5. Explain how you know. Sentence starter: Since the evidence from the Sim showed....., The evidence we collected from the Sim showed us.....


6. **How would you respond to the Investigation Question:** How do some traits become more common over many generations while others become less common?
Natural Selection- Lesson 6

In the previous lesson, you explored how traits are passed down from one generation to the next when organisms reproduce. How is it possible that, over many generations, some traits can become more common, while others become less common? Shouldn’t each generation match the generation before it? Today, you will observe one more example of how individuals in a population get their traits through reproduction.

Unit Question

• Why do populations change over time?

Chapter 2 Question

• How did the trait for increased poison level become more common in the newt population?

Learning Objectives

• Poison can serve as an adaptive trait if predators detect the poison before killing their prey.

• Organisms with adaptive traits are less likely to die than organisms with non-adaptive traits, which means they have more opportunities to reproduce.

Vocabulary

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Materials you will need

• Pencil or Pen

• Different colored writing utensils (colored pencils, crayons, highlighters, markers, etc.)

• Someone near you to talk through your ideas with
Let’s Warm Up!

Read Sherman’s Story #3 below and answer the questions that follow.

Sherman’s Stories #3: Green Dragonflies

1. What is Sherman right about?

__________________________________________________________________________________________________
__________________________________________________________________________________________________
__________________________________________________________________________________________________
__________________________________________________________________________________________________

2. What is Sherman wrong about?

__________________________________________________________________________________________________
__________________________________________________________________________________________________
__________________________________________________________________________________________________
__________________________________________________________________________________________________

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Reading: The Deadly Dare

Active Reading Guidelines

- Think carefully about what you read. Pay attention to your own understanding.
- As you read, annotate the text to make a record of your thinking.
- Use a highlighter to highlight unknown words and in context definitions.
- Write in the margins to identify questions, impactful ideas, and paragraph summaries.
- Examine all visual representations carefully. Consider how they go together with the text.
- After you read, discuss what you have read with others to help you better understand the text.

Rough-Skinned Newt Defenses

In 1979, friends dared a 29-year-old man in Oregon to swallow a living rough-skinned newt. The man didn’t realize how poisonous rough-skinned newts are. A lethal, fast-acting poison called tetrodotoxin (TTX) oozes from their skin. The man swallowed the newt whole and started feeling weak a few minutes later. He described a numb feeling all over his body. His friends tried to take him to a hospital, but he refused. Just 20 minutes later, the man was dead.

Of course, the newt the man swallowed died, too. In that particular case, being poisonous didn’t help that individual newt survive. If newts have to be eaten in order to defend themselves, being poisonous doesn’t sound like a very good defense! How is being poisonous—having a high level of TTX poison—an adaptive trait for a rough-skinned newt?

Why Poison Is Adaptive

One reason TTX is adaptive is that it acts quickly. A predator that tries to eat a poisonous newt may become sick before it’s able to kill the newt, allowing the newt to escape. In fact, TTX acts so quickly that sometimes predators die before finishing their meals. Scientists have observed rough-skinned newts crawling out of dead or paralyzed predators.

Even more important, predators can smell and taste TTX poison. The main predator of rough-skinned newts is the garter snake. Scientists have found evidence that garter snakes use their senses of smell and taste to tell whether a rough-skinned newt is too poisonous to eat. They have even observed garter snakes doing quick “taste tests”—licking rough-skinned newts before deciding whether to eat them.

Scientists have studied whether garter snakes are able to detect TTX poison in newts. Biologists have placed one newt and one garter snake together in a cage to see whether the snake would eat the newt. They have tried this test over and over again, using different snakes and different newts. Even though the newts are...
Biologists are able to consider the cause-and-effect relationship between high poison levels and survival in newts by examining a population of newts with high variation. The newts in the test range from having no poison to having very high levels of TTX in their bodies. In these tests, the snakes consistently eat the newts with the lowest levels of TTX, and do not eat the newts with high levels of TTX. These results are evidence that garter snakes can detect TTX and that they prefer to eat rough-skinned newts with lower levels of TTX. The more poisonous a rough-skinned newt is, the less likely it is to be eaten by a garter snake. That means high levels of TTX are an adaptive trait in rough-skinned newts that live near garter snakes.

How Adaptive Traits Spread

If snakes are in its environment, a poisonous newt is less likely to die from being eaten than a newt that isn’t poisonous. The newts that don’t get eaten have a better chance of living longer, and that’s important because it means more chances to reproduce. Organisms have to reproduce in order to pass on their genes, which are the instructions for making the protein molecules that determine traits: if they don’t reproduce, their traits die with them. In the newt population, more poisonous newts are more likely to survive long enough to reproduce and pass down their genes, and therefore the trait of being poisonous, to the next generation. As a result, there will be more and more highly poisonous rough-skinned newts in each generation. This will cause the distribution of traits in the population to change over many generations. Scientists call this process natural selection. This process does not only happen in rough-skinned newts. It has been observed in populations of different species all over the world.
How Natural Selection Works

1. There are different inherited traits in the population.

2. Adaptive traits help organisms survive in their environment. Organisms with adaptive traits are more likely to survive long enough to reproduce.

3. The organisms that reproduce pass on their traits to the next generation.

KEY

- = amount of TTX poison
- = death
- = reproduction
Other Poisonous Organisms

Being poisonous is an adaptive trait for many different organisms, not just rough-skinned newts. There are many poisonous plants, such as deadly nightshade, hemlock, and mint. You might be surprised to see mint on this list, since you’ve probably eaten mint yourself! The poisons in mint are harmless to humans, but deadly to some plant-eating insects. These poisons are what give mint its minty taste and smell—they are warning signals telling insects to stay away.

Like rough-skinned newts, poisonous plants are poisonous as a defense against being eaten. Plants can’t run away from animals that want to eat them, so they have to defend themselves in other ways—with adaptive traits like tough bark, sharp thorns, and being poisonous.

Deadly nightshade (left) is an extremely poisonous plant; eating just a few berries can kill a human. Mint (right) is harmless to

Comprehending the Reading

1. What is the definition of Natural Selection?

_______________________________________________________________________________________________
_______________________________________________________________________________________________

2. In the study that scientists conducted where garter snakes were paired with newts in a cage, why did the garter snake sometimes eat the newt but other times did not?

_______________________________________________________________________________________________
_______________________________________________________________________________________________
_______________________________________________________________________________________________
_______________________________________________________________________________________________

3. How did more highly poisonous newts end up in the population generation after generation? Why is every generation more poisonous than the generation before?

_______________________________________________________________________________________________

Making sense of the information

Observe the diagram above and answer the questions below.

1. What is the diagram showing? __________________________
2. What do the dots in the newts represent? ___________________________
3. What does the X represent?________________________
4. What does the little line of dots represent? ____________________
5. How would you describe the newt population in Diagram 1? (circle)
   a. There are fifteen poison levels shown, and each individual has a different amount of poison.
   b. There is one poison level shown, and all newts have the same amount of poison.
   c. There are three poison levels shown, and no poison-level trait is more common than the others.
   d. There are three poison levels shown, and one poison-level trait is the most common.
6. In diagrams 2 and 3 did all newts reproduce? (circle) YES NO
7. In diagram 2, did newts from all poison levels die? (circle) YES NO
8. How would you describe the newt population in Diagram 3? (circle)
   a. There are fifteen poison levels shown, and each individual has a different amount of poison.
   b. There is one poison level shown, and all newts have the same amount of poison.
c. There are three poison levels shown, and no poison-level trait is more common than the others.
d. There are three poison levels shown, and one poison-level trait is the most common.

Making sense of the information (continued)

Use the diagram from the previous page and the “Deadly Dare” article to answer the following questions.

1. Which individuals are more likely to die before reproduction, those with adaptive traits or non-adaptive traits? Explain why.

____________________________________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________

2. When many individuals with the same trait die before reproducing, what happens to the distribution of that trait in the population? Why?

____________________________________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________

3. Why are there more newts with high-poison level in the population in Diagram 3 than the population in Diagram 1?

____________________________________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________

4. Are the newts with high poison in Diagram 3 simply the oldest newts? How do you know?

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____________________________________________________________________________________________________________
____________________________________________________________________________________________________________
____________________________________________________________________________________________________________
Putting the Pieces together

Now that we understand more about the process of natural selection, we are ready to answer the Chapter 2 Question: How did the trait for increased poison level become more common in the newt population? Make sure your explanation includes detail and evidence that we have gathered so far from the article and SIM.

Sentence Starter: “The less poisonous newts.... And the more poisonous ones....”
Scientific Argument: Writing about the Rough-Skinned Newts

Remember in this unit we started with the question: How does a population over time? Using the example of the rough skinned newt population, we now have sufficient evidence to provide an explanation to this question. Based on ALL of the evidence we have collected in this unit, use evidence and reasoning to support the following claim: **CLAIM: The newt population became more poisonous because the snakes in this environment caused poison to be an adaptive trait, and Poison Level 10 is the most common because the newts with this trait were able to live longer and reproduce more than other newts.**

**Sentence starters**

**Describing evidence:**
- The evidence that supports my claim is . . .
- My first piece of evidence is . . .
- Another piece of evidence is . . .
- This evidence shows that . . .

**Describing how the evidence supports the claim:**
- If ____________, then . . .
- This is important because . . .
- Since ____________, . . .
- Based on the evidence, I conclude that . . .
- This claim is stronger because . . .

**ORGANIZE YOUR WRITING FIRST**

<table>
<thead>
<tr>
<th>Paragraph 1</th>
<th><strong>Question:</strong> How did the Rough-Skinned Newt population become more poisonous over time?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Claim:</strong></td>
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<tr>
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<th><strong>Evidence 1:</strong></th>
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<td><strong>Key Concept from Class related to Evidence 1:</strong></td>
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<tr>
<td>Evidence 1</td>
<td>Key Concept from Class related to Evidence 1:</td>
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<tr>
<td></td>
<td>Explanation of how Evidence 1 and Key Concept explain your claim:</td>
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<table>
<thead>
<tr>
<th>Evidence 2</th>
<th>Key Concept from Class related to Evidence 2:</th>
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<tbody>
<tr>
<td></td>
<td>Explanation of how Evidence 2 and Key Concept explain your claim:</td>
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</table>

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<thead>
<tr>
<th>Conclusion: (quick summary of everything you’ve said; start with question and end with conclusion.)</th>
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<tbody>
<tr>
<td>Paragraph 4</td>
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Writing an Explanation for the Park Visitors

**Question:** How did the Rough-Skinned Newt population become more poisonous over time?

**Vocabulary**

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