GENERATIONGENIUS
ALWAYS QUESTION. ALWAYS WONDER.

LESSON PLAN

NATURAL SELECTION
GRADES 6-8

SUMMARY

Students engage in an activity to figure how different factors affect natural selection.

NEXT GENERATION SCIENCE STANDARDS CORRELATION

MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

MS-LS4-5. Gather and synthesize information about the technologies that have charged the way humans influence the inheritance of desired traits in organisms.

MS-LS4-6. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

Science & Engineering Practices	Connections to Classroom Activity
Constructing Explanations and Designing Solutions	• Students engage in an investigation to analyze data about populations. Students use the data to create an explanation for natural selection.
Obtaining, Evaluating, and Communicating Information	• Students watch a video on the peppered moth and the Generation Genius video, and they use the information from the videos as evidence of natural and artificial selection.
Using Mathematics and Computational Thinking	• Students collect quantitative data during the moth investigation and use this data as evidence to support an explanation for the shift in the moth population.

Disciplinary Core Ideas	Connections to Classroom Activity
LS4.B: Natural Selection Natural selection leads to the predominance of certain traits in a population and the suppression of others.	• Students see this during the moth investigation and in the Generation Genius video.
LS4.B: Natural Selection In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring.	• This is demonstrated during the Generation Genius video. This idea can also come up during class discussion about how populations can change.
LS4.C: Adaptation Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.	• Students figure out adaptation during the moth investigation, and it is also demonstrated during the Generation Genius video.

Cross Cutting Concepts	Connections to Classroom Activity
Cause and Effect	• Students use and discuss cause- and effect-relationships throughout the lesson. They create an explanation for how the moth population changes, they discuss how camouflage helps the octopus survive, and this is also demonstrated within the Generation Genius video.

DURATION

60 min.

MATERIALS

Per group:

- 1 sheet of newspaper
- 1 piece of black construction paper (larger sheet)
- 20 newspaper circles (quarter size)
- 20 black paper circles (quarter size)
- Tweezers
- Timer

ENGAGE

Tell students you have a short video called "Octopus Camouflage" you would like them to view. Start the video and then pause it at 6 seconds. Ask students what they see.

When students are finished sharing, resume the video and play the first 22 seconds of it. Prompt students to think about how what they saw helps the octopus survive and have a short discussion. Next, have students brainstorm ideas about what characteristics help different organisms live in their environment. Differentiate this activity by assigning students different animals or different environments.

Have students share their ideas with a shoulder partner for 3 minutes. Students may add to their list as they discuss.

Ask groups to share their collective ideas. Common ideas include the following: faster animals don't get eaten, or faster animals catch prey easier. Animals that can hide or blend in survive better, whereas venomous or poisonous animals live because nothing can eat them.

Have students make a simple chart with 3 columns labeled *rock*, *paper*, and *scissors*. In groups of two, have students play 10 rounds of the game rock, paper, scissors. Use tally marks to keep track of which object wins each game. Remember, scissors cuts paper, paper covers rock, and rock smashes scissors. Create a class data chart and have groups add their data when they are finished. Have students look for patterns in the data and share what they notice. Ask students if they think any one object had an advantage?

Tell students that the paper has become stronger over time and can no longer be cut by scissors. In fact, the scissors break when they try to cut the paper. Ask them to discuss ideas about how the game might change if paper could win against both rock and scissors and scissors could never win. Students should conclude that the paper would have an advantage, and no one would ever want to be scissors because they could never win.

Ask students, "Do you think this happens to living things? Do organisms naturally change over time?" Have students discuss this idea in small groups.

Next, have groups share their ideas. Groups will often have conflicting ideas, and some will bring up the idea of artificial selection because of background knowledge. Possible student ideas include the following:

- Yes, living things change because only fast ones survive if slow ones always get eaten.
- Yes, because we can mix things together to change them, like Labradoodles.
- No, because there are always differences in living things.

At this point, it is not important to correct misconceptions, incomplete science ideas, or the difference between natural and artificial selection. As students' progress through the rest of the lessons, they come to discover and develop these science concepts on their own.

Tell students that it seems that they have a lot of different ideas about how populations of organisms may or may not change over time. Let them know that they will now explore a population to see what they can figure out.

EXPLORE

Tell students they are going to investigate a population of moths to figure out if (and/or why) some populations shift.

Conducting the Investigation

This investigation will allow students to collect data to identify how an animal population might shift.

Ask students to create a data table in their notebooks or on their devices or a piece of paper.

Number of Light and Dark Moths Caught on Light Trees and Dark Trees

Light Trees (newspaper)

	Number of Light Moths (newspaper circles) Caught	Number of Dark Moths (black paper circles) Caught
1		
2		
3		
4		
5		

Dark Trees (black contruction paper)

	Number of Light Moths (newspaper circles) Caught	Number of Dark Moths (black paper circles) Caught
1		
2		
3		
4		
5		

Hand out the materials to student groups. Give students these directions: You play the role of a predator that eats moths. The goal is to eat as many moths as you can in 10 seconds, and the color does not matter. The newspaper represents light-colored trees, and the black paper represents dark-colored trees. The circle represents the moths. You will collect five sets of data for each colored tree. Place the 40 "moths" on the newspaper, and use the tweezers to pick the moths up one at a time and place them in a pile on the table. Record how many of each colored moth was eaten after each trial. Do not add moths back to the "tree" after each trial.

Repeat the investigation, this time placing the 40 moths on the black construction paper. Students should also switch roles at this time.

When the investigation is finished, have students share their data in a class chart. This data could also be replicated in a graph.

EXPLAIN

Have students analyze their data. Ask them what patterns they notice in the data. What conclusions can they make from their data? Patterns in the data should show that the moths that blended in (camouflaged) survived better than the ones that didn't.

Next, share that this activity is based on a real moth population, and share this data table.

Light and Dark Moths Captured Over 10 Years

Year	Number of Light Moths Captured	Number of Dark Moths Captured
1	551	85
2	537	112
3	484	198
4	392	210
5	246	281
6	225	357
7	193	412
8	147	503
9	84	594
10	56	638

Ask students what patterns they notice.

Have a short discussion about the patterns they see (i.e., the moth population seemed to shift). Ask students why they think the population changed. Students will most likely respond with ideas such as the birds ate dark moths and then they started eating light-colored moths. This is true, but then prompt students to think about why this might have happened and have them brainstorm in small groups.

ELABORATE

Have students write a prediction about why they think the birds started eating the light-colored peppered moth. Next, show the video "Famous Peppered Moths Dark Secret Revealed," which elaborates on the environmental changes that

caused the peppered moth population to shift.

After the video, ask students if what they found out supported or refuted their prediction and have them share. Inform students that many different factors can cause plant and animal populations to change, including environmental factors like pollution. Tell them they will see more examples of how populations change in the following video.

WATCH THE GENERATION GENIUS NATURAL SELECTION VIDEO AS A GROUP

After the video say, "You investigated one example of natural selection, but what other examples did you learn about in the video?" Have students share the things they have learned.

Lastly, circle back to the octopus from the video, and ask students to discuss the similarities and differences they notice between the moths, octopus, and ideas from the video. This discussion should surface important science ideas such as the following:

- Natural selection occurs for many different reasons.
- Genetic factors can affect an organism's traits.
- Environmental factors can affect an organism's traits.
- Humans can interfere with genetics; this is artificial selection.

EVALUATE

There are multiple ways to assess your students' understanding of this topic. The exit ticket is an opportunity for students to use the science ideas they built in the lesson in a new context. Alternatively, you can use the Kahoot! quiz (which provides downloadable scores at the end of the game) and/or the paper quiz. All these resources are located right below the video in the assessment section.

EXTENSION

Have students engage in the moth activity, but include a reproduction piece. After each round, add two moth "babies" for each moth that is left. Make sure the total population (remaining moths and the added babies) of moths are recorded before each trial. Have students analyze the populations after all the trials. Students should figure out that only the moths that survive can reproduce and although some of both moths reproduce, one population grows faster while the other continues to decline.