The Best of the Best

Darwinian Fitness

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Grade Level	8th – 12th Grade	**Time Frame**	2-3 class period(s)
Subject	Science	**Duration**	95 minutes
Course	Biology		

Essential Question

Why is biological fitness such a difficult concept to describe?

Summary

This lesson is intended to be either an introduction or a refresher of Darwinian fitness. Students think about what it means to be 'fit' and the impact humans have had on this natural mechanism.

Snapshot

Engage

Students examine and discuss their prior knowledge about fitness.

Explore

Students complete the Mice Living in a Desert activity to gain a more in-depth working definition of fitness.

Explain

After a class discussion about Darwin's five factors that influence survival, students identify evidence of the factors from the Mice Living in a Desert activity.

Extend

Students read a story about Frog Evolution in Chernobyl and discuss how the story shows evidence of each factor that influences survival.

Evaluate

Students create a cartoon to illustrate their understanding of the Frog Evolution story or another example in nature that shows how the five factors influence survival in an organism. Students provide a final definition of fitness based on evidence from the reading or research from the real-world example and share out with the class.

Standards

ACT College and Career Readiness Standards - Science (6-12)

IOD201: Select one piece of data from a simple data presentation (e.g., a simple food web diagram)
SIN303: Find basic information in text that describes a complex experiment
EMI603: Use new information to make a prediction based on a model

Next Generation Science Standards (Grades 6, 7, 8)

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.

Next Generation Science Standards (Grades 6, 7, 8)

HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

Oklahoma Academic Standards (8th Grade)

8.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.
8.LS4.4.1: Natural selection leads to the predominance of certain traits in a population, and the suppression of others.

Oklahoma Academic Standards (8th Grade)

B.LS4.2 : Construct an explanation based on evidence that biological diversity is influenced by (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
B.LS4.2.1: Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2)variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals.

Attachments

- Four Corners Signs–The Best of the Best - Spanish.docx
- Four Corners Signs–The Best of the Best - Spanish.pdf
- Four Corners Signs–The Best of the Best.docx
- Four Corners Signs–The Best of the Best.pdf
- Frog Evolution Article—The Best of the Best - Spanish.pdf
- Frog Evolution Article—The Best of the Best.pdf
- Lesson Slides—The Best of the Best.pptx
- Mice Living in a Desert Explore—The Best of the Best - Spanish.docx
- Mice Living in a Desert Explore—The Best of the Best - Spanish.pdf
- Mice Living in a Desert Explore—The Best of the Best.docx
- Mice Living in a Desert Explore—The Best of the Best.pdf
- The Peppered Moth Story—The Best of the Best - Spanish.docx
- The Peppered Moth Story—The Best of the Best - Spanish.pdf
- The Peppered Moth Story—The Best of the Best.docx
- The Peppered Moth Story—The Best of the Best.pdf

Materials

- Lesson Slides (attached)
- Four Corners Signs (attached; one per teacher)

- Mice Living in a Desert handout (attached; one half page per student)
- Frog Evolution Article (attached; one per student)
- The Peppered-Moth (attached; optional)

Engage

Teacher's Note: Lesson Preparation

Print the **Four Corner Signs.** Post the four signs around the room for the Four Corners strategy.

Use the attached **Lesson Slides** to introduce the lesson. Use **slides 2-4** to go over the topic, learning objectives, and the essential question. Show **slide 5,** which contains different student statements about fitness. Tell students to read the statements, and then move around the room to the "corner" with the name of the student whose definition of 'survival of the fittest' they agree with the most.

Once the students have chosen a corner, have them talk with others at that corner to build an 'argument' of why the statement they chose is the best. Have each group share its argument.

20 minutes

Explore

Show **slide 6**, which includes pictures of a variety of animals. Have the students answer the questions on the slide. What makes the animals special? What is 'useful' about what makes them special? Ask students to share their thoughts with a partner before sharing with the whole class.

Show **slide 7**, this shows the same pictures as the previous slide but now the question is about which animals fit with their original definition of “fitness.” Ask students to write down which animals fit their definition, which ones don’t, and why.

Teacher Notes

You can discuss adaptations like the following:

- Wolf Spider - camouflage to hide in leaf litter, venom to paralyze prey, keen sense of sight and vibrations.
- Owl - camouflage to hide in tree, fringed feathers for silent flight, large eyes to hunt at night, turn head all the way around to track prey, talons to grab prey while flying.
- Moth - Camouflage to hide on trees, thin body and wings allow them to fly quickly or hover over flowers.
- Pufferfish - Artificial bigness to scare off predators, sharp spines that can excrete poison for protection.
- Crocodile - Camouflage in the water, high acidic stomach contents to allow wide range of foods, cold blooded so they can regulate their own metabolic rate.
- Flounder - Camouflage to the ocean floor, eyes on the same side to see as they travel along the ocean floor.

Once they're done thinking of answers, move to **slide 8**. Have them think back on how they defined the term "survival of the fittest" in the Engage section. Have students create an Example Non-Example chart in their notes. Have them list each animal that supports that definition as an example and each animal that doesn't support that definition as a non-example. Just like the Engage activity, try not to get hung up on every detail being exactly right. Let students go on the full journey instead of expecting them to reach the end immediately.

25 minutes

Explain

Move to **slide 9.** Pass out the **Mice Living in a Desert** activity to each student. Allow them to work in groups of two or three and allow them about 20 minutes to answer the questions.

Start with talking about the last question of the handout (which references the four definitions of fitness again). Have students share their answers in a way that is comfortable to you and your class.

The Big Reveal

If students haven't figured out that survival and reproduction are the key components of Darwinian fitness, this is your chance to guide them a little more in that direction. My main suggestion here is to provide counterexamples of each incorrect definition.

30 minutes

Extend

Pass out the **Frog Evolution Article** from Science Journal for Kids and Teens.

Show **slide 10** have students read the article and use the Why-Lighting strategy as they read.

- Prompting question: "What is the human influence on Darwinian fitness?"
- Highlight phrases within the article that contribute to answer the question.
- Write in the margins why you highlighted that phrase.

Why-lighting may not come naturally to students, so modeling how to do why-lighting with the whole class for the first 1-2 paragraphs may be beneficial. As you model, ask students to consider what makes a “good” note? Did we highlight something that helps us answer the question? Give them time to continue why-lighting on their own or with a partner. After students are done, have them jot all of their margin justifications on a sheet of paper.

Differentiation

If you need an 'easier' example, you can use the **The Peppered Moth** article for the Why-Lighting and comic activities. However, I personally find the peppered moth example to be a bit overused, and there's evidence that this entire scenario is incorrect. If you're trying to shy away from climate change, then the peppered moth example still isn't great, but it would be better than the reef example because the peppered moth changes are technically a result of pollution and not climate change. However, in both examples it is the human impact on the environment that has caused the shift in animal fitness and genotype. Either way, don't be shy about introducing a topic and allowing students to think for themselves.

Show **slide 11.** From their margin writings, ask students to put together a PSA (Public Service Announcement) Cognitive Comic about how animals or organisms are influenced by humans, for good and for bad.

Tell students:

- There needs to be a message, but this is also a comic so see if you can add in some laughs
- This is a great time to reflect on how good your margin notes were. What was helpful and what was hurtful toward making your comic?
- How will your illustrations help with the message? They need to be more than just a person standing there talking.

Teacher's Note: Technology Opportunties

If you have the option, consider using the tech-integrated strategy of Cognitive Comics with Canva. Using Canva, students can create Cognitive Comics without the pressure some of them might feel when asked to draw them by hand. Comics can then be downloaded from Canva and uploaded to a LMS.

When students have completed their comics, post their work around the room (or in the hall) for everyone to see.

10 minutes

Evaluate

Show **slide 12**, which asks students to reflect on their learning using a modified Metacognitive Cards strategy. For a template of metacognitive cards, go to the instructional strategy card. Stress to the students that they are reflecting on how they learned, not what they learned. Have them put this reflection in their notebook so that they can revisit it the next time you do a similar activity or the next time you ask them to reflect on their metacognition.

Resources

- Burraco, P., & Orizaola, G. (2024, May 27). *Tree Frogs in Chernobyl and radiation - science journal for kids*. Science Journal for Kids and Teens. https://www.sciencejournalforkids.org/articles/what-can-tree-frogs-in-chernobyl-tell-us-about-radiation/
- K20 Center. (n.d.). Cognitive comics. Strategies. https://learn.k20center.ou.edu/strategy/198
- K20 Center. (n.d.). Examples and non-examples. Strategies. https://learn.k20center.ou.edu/strategy/163
- K20 Center. (n.d.). Four corners. Strategies. https://learn.k20center.ou.edu/strategy/138
- K20 Center. (n.d.). Metacognitive cards. Strategies. https://learn.k20center.ou.edu/strategy/175
- K20 Center. (n.d.). Why-lighting. Strategies. https://learn.k20center.ou.edu/strategy/128
- K20 Center. (n.d.). Cognitive comics with canva. Tech-integrated strategies. https://learn.k20center.ou.edu/tech-strategy/3025
- Rutowski, R. & Hannam, S. (2015). The peppered moth: A seasoned survivor. ASU - Ask A Biologist. Retrieved from https://askabiologist.asu.edu/peppered-moth
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