



# The Best of the Best

## Darwinian Fitness



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<b>Grade Level</b>	6th – 12th Grade	<b>Time Frame</b>	1-2 class period(s)
<b>Subject</b>	Science	<b>Duration</b>	90 minutes
<b>Course</b>	Biology I		

### 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 coral reefs and discuss how the story shows evidence of each factor that influences survival.

#### Evaluate

Students create a cartoon to illustrate their understanding of the coral reef 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

*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.LS3.2.2:** Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited.

*Oklahoma Academic Standards (8th Grade)*

**B.LS3.2 :** Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

## Attachments

- [Four Corners Signs - Spanish.docx](#)
- [Four Corners Signs - Spanish.pdf](#)
- [Four Corners Signs.docx](#)
- [Four Corners Signs.pdf](#)
- [Mice Living in a Desert Explore - Spanish.docx](#)
- [Mice Living in a Desert Explore - Spanish.pdf](#)
- [Mice Living in a Desert Explore.docx](#)
- [Mice Living in a Desert Explore.pdf](#)
- [Teacher Slides - Evolution and Fitness.pptx](#)
- [The Peppered Moth Story - Spanish.docx](#)
- [The Peppered Moth Story - Spanish.pdf](#)
- [The Peppered Moth Story.docx](#)
- [The Peppered Moth Story.pdf](#)
- [There's still time for us to save the Great Barrier Reef.pdf](#)

## Materials

- Prompt Slide - "Is It Fitter?"
- Activity Handout - Mice Living in a Desert
- Activity Handout - The Peppered-Moth Story
- Colored Pencils, pencils, markers, and highlighters
- Activity Handout - Blank Cartoon Template
- Chromebooks
- Evolution and Fitness Teacher Slides

# Engage

Post four signs around the room for the [Four Corners](#) strategy.

1. Dora- "I think 'fit' means being bigger and stronger."
2. Lance- "I think 'fit' means being more likely to reproduce."
3. Felix- "I think 'fit' means being able to run faster."
4. Keisha- "I think 'fit' means being more intelligent."

Open the Evolution and Fitness Teacher Slides and display slide 2, 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.

## Make It Quick

This is only the Engage activity, there are still many activities left to complete. Do not use this activity for a full discussion or to dig too deep. Just let the students share their arguments and move on. Reflection and revision will happen later in the lesson.

# Explore

Show slide 3, 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?

## 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 4. Have students create an [Example Non-Example](#) chart in their notes. Have them think back on how they defined the term "survival of the fittest" in the Engage section. 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.

## Let It Roll

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.

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.

# Explain

Start with talking about the last question of the handout (which references the four definitions of fitness again). Have students share out 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.

# Extend

Pass out the article titled 'Coral Reef and Fitness' to students.

## Tech Upgrade

If you are concerned about printing costs, we understand that, but note that printing a class copy or one copy per group will not work in this situation. Putting a copy in your Google Classroom, or equivalent, is a better option. If you do this, have students add comments and use other tech review tools to replace the traditional Why-Lighting and you will still get the same effect without ever visiting the copier.

Have students read the article and use the [Why-Lighting](#) strategy as they read. Directions for students are on slide 5.

- 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.

After students are done, have them jot all of their margin justifications on a sheet of paper.

## Teaching How To Learn

Learning about Darwinian fitness is great for students, but as educators we also have to teach students how to learn. Why-Lighting does not come naturally to students. They need to learn that the margin notes are vital and understand what makes a good note or a useless note. If you hold them accountable, then the next time they Why-Light the results will be much better.

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.

## Where To Find Comic Strips

Here's a nice resource with a variety of [comic strip layouts](#) that you can download. You can use one of these, or have students make their own. At minimum, show some examples so that students know there are more options than equally sized rectangles in a row.

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.

## Differentiation

If you need an 'easier' example, you can use [this article about the peppered moth](#) 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.

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

# Evaluate

Post slide 6, which asks students to reflect on their learning using a modified [Metacognitive Cards](#) strategy. 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.

## Using Student Reflection For Good

This is a great opportunity for you to see how students accepted the activities and the content. If they expressed that a particular activity was useful, you know to try it again. Think about the potential of maximizing not only learning but feelings about learning.



## Resources

- K20 Center. (n.d.) Cognitive Comics. Strategies. Retrieved from <https://learn.k20center.ou.edu/strategy/fe96d3de46cfdc1f385aab7e7500a422>
- K20 Center. (n.d.). Examples and Non-Examples. Strategies. Retrieved from <https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f5073fd8>
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- Rutowski, R. & Hannam, S. (2015). The peppered moth: A seasoned survivor. ASU - Ask A Biologist. Retrieved from <https://askabiologist.asu.edu/peppered-moth>
- Urry, A. (2018, April 19). There's still time for us to save the Great Barrier Reef. Popular Science. Retrieved from <https://www.popsci.com/great-barrier-reef-adaptation-survival>