



ADAPTATIONS

Students will learn what adaptations are, identify some potential adaptations, and create a novel organism that has creative adaptations suited to its environment.

LESSON LENGTH:

- 1-1.5 hours

GOALS:

- Understand what adaptations are in the context of evolution

OBJECTIVES:

- Define adaptations and differentiate evolutionary adaptations from plasticity or habituation
- Identify adaptations of organisms and how they may increase the fitness of an organism given its environment

STUDENT TAKEAWAYS FROM LESSON:

- Essential Question/Theme:
 - What is an adaptation, in evolution-speak?
- Key Concepts and Vocabulary
 - **Adaptation:** “A trait or characteristic of an organism, like a redder beak, that increases its fitness relative to individuals without the trait.”
 - **Note:** An adaptation in the context of evolution does *not* describe change in a trait within an organism’s lifetime. That would either be habituation or plasticity (e.g., bears can ‘adapt’ or habituate to living near humans; if you wake up really early every day, eventually your body will ‘adapt’ to that and it won’t feel so terrible).
 - **Also note:** Not every trait of an organism is an adaptation! This is a dangerous thing to assume. For example, the fact that our elbows are kind of pointy is probably a byproduct of the way our joints are connected. It’s almost definitely *not* an adaptation.

ASSESSMENTS:

- Formative: Quick-write definition of an adaptation
- Summative: Create an organism that has adaptations well-suited to its environment. Share these adaptations with peers.

DIVERSITY (REACHING STUDENTS OF ALL LEVELS/ABILITIES):

- Read the instructions of the activity aloud.
- Have a small slip of paper with the instructions for students to read.

MATERIALS & EQUIPMENT:

- Colored pencils/markers
- Pencils/pens
- Notebooks

LOCATION:

- This lesson can be taught anywhere, but it involves a little time poking around outside. This is a good rainy day activity.

RISK MANAGEMENT & SAFETY CONCERNS:

- Check that the outside area is safe for exploring.

BAD WEATHER ALTERNATIVE:

- The outdoor exploration can be skipped, and this entire activity can be done under a tarp or in tents.

LESSON:

Note: Instructor prompts are in italics.

ENGAGE

- Diagnostic: What's an adaptation?
 - Think-pair-share: *What is an adaptation? Jot down your definition.*
 - Share definitions. Students can make a word cloud for each on whiteboards.
 - If understanding is fuzzy (which it probably is), point out a few examples.
 1. One fun way to think of adaptations is to think of them as (evolved) 'superpowers'!
 2. Rhododendron's waxy leaves are an adaptation to prevent it from losing lots of water in the heat.
 3. Foxes and coyotes have "shearing" teeth that help them tear up and eat their prey.
 4. Sifakas, a lemur species that eats leaves (folivores), have really long guts to help them get as much nutrients out of that food sources as possible. Other lemur species that eat fruit (frugivores), like black and white ruffed lemurs, have really short guts! (see figure at end of lesson)
 5. Some human adaptations (some of which are specific to certain populations or locations) include nimble fingers and thumbs, big brains, more melatonin in sunnier climates.
 - See if the group can come up with a definition and some examples of adaptations. Main take-away: Adaptations are traits evolved through natural selection. Adaptations increase the fitness of an organism.
 - Explain: *Adaptations are NOT: habituation or plasticity. We use the word 'adapt' colloquially to mean that a person or organism is changing something about itself to adjust to a different environment. Adaptations are evolved traits; they don't arise within the lifespan of one organism.*
 1. If you move to a city, you habituate to your new life there.
 2. A bear may learn to open 'bear-proof' trash cans. That's not an adaptation!
 - Explain: Not every trait of an organism is an adaptation! This is a dangerous thing to assume. For example, the fact that our elbows are kind of pointy is probably a byproduct of the way our joints are connected. It probably doesn't increase our fitness, so it's almost definitely not an adaptation.
 - *Take 2 minutes to chat with someone next to you - tell each other the definition of adaption in your own words and discuss any questions you have about this.* Field questions, or see if the students can answer each other's questions.

EXPLORE

- Summative: Identifying adaptations
 - Tell students to take 5-10 minutes, either on their own or in partners, to try to identify some potential adaptations of organisms around them. Tell them to jot these observations down and make some sketches. Let them wander within eyesight of you.



- Regroup and have students share some of the adaptations. For each, evaluate whether it's an adaptation. For most instances, we may not know - and that can be fun to bring up! To show that a trait is an adaptation, you have to show that it increases the fitness of the organism.
- Summative: "Creating" adaptations
 - Now, it's time to create-a-beast! Tell students to think about their environment where they live (back home). Now, they're going to think up a new organism that has adaptations that make it well-suited to live in that environment. There are no trade-offs here - they can go wild! Make sure to emphasize that the adaptations should increase the organisms' fitness in their home environment.
 - Take 15-20 minutes for them to think of, draw, and name their organism.
 - Then, either have an "art show" where half the group displays their organism and the other half walks around and asks questions, or have each student talk about their organism in front of the group. In either scenario, the students should explain some of the coolest adaptations it has and how those adaptations increase the organism's fitness.

EXTEND

- Debrief: (include/exclude questions based on time and student interest)
 - Have students jot down their new and improved definition of an adaptation and give a few examples. Be sure to confirm that they know the difference between an (evolutionary) adaptation and habituation/plasticity.
 - How can we tell if a trait is an adaptation or an evolutionary byproduct?
 - Need to measure fitness - does the trait increase fitness?
 - What kinds of adaptations would plants and animals need to evolve to withstand climate change? Do you think natural selection can act fast enough for species to survive and adapt to an increase in global temperature?

REFERENCEMATERIALS/RESOURCES:

- Adaptation definition from: Herron, Jon, and Scott Freeman. *Evolutionary Analysis*. 5th ed., Pearson, 2013.
- Lemur gut figure and information from: McKenney, E. A., O'Connell, T. M., Rodrigo, A., & Yoder, A. D. (2017). Feeding strategy shapes gut metagenomic enrichment and functional specialization in captive lemurs. *Gut microbes*, (just-accepted), 00-00.



