

Evolution

Learning Objectives:

- Understand the process of evolution.
- Learn how natural selection shapes the development of animals.
- Identify factors that can affect the livelihood of populations.

Key Vocabulary:

- Fitness
- Adaptation
- Selection
- Gene Flow
- Genetic Drift
- Speciation
- Homologous
- Analogous

INTRODUCTION (15 MIN. OPEN DISCUSSION)

What is fitness?

Sample answers

- To be in shape
- Working out
- Being able to lift
- Running a marathon
- The Rock

Why does your mom like your dad?

Sample answers

- really good at video games
 - In the animal world, that would translate to being skilled and therefore likely to survive.
- smart
 - can solve problems that arise
- attractive
 - offspring will be attractive as well, and they will then have a good chance of mating and having offspring of their own, when the time comes!
- funny
 - a good personality increases the chances of the offspring being equally charming, and being able to create as many offspring as necessary to carry the genes on.
- loaded
 - can provide

You pick friends that have biological fitness, whether it is in the form of being nice, or pretty, or really good at a sport. Biological fitness is the ability to survive your environment long enough to grow up and have babies.

That means that everyone in this room is super fit because you are successful enough to not have been eaten by a lion at the zoo, or run over by your school bus, so you get to pass down those rocking good genes eventually. Congratulations!

What do you guys think adaptations are?

Traits passed down from your parents that help you survive your environment better, and therefore increases your fitness.

↳ Let's say you're a cute little rabbit, living in the Arctic. Snow is 2 feet deep, and there's a wolf roaming around, looking for its next meal. Ideally, you'd be white and able to hide in the snow, but it turns out that the genes you've inherited have made you green, and so unable to hide, you're immediately eaten.

Is this an adaptation? No! You've been eaten and murdered!

What adaptations have you seen in animals or even in yourself?

↳ We have opposable thumbs that allow us to use tools, and male peacocks have huge tails because the ladies love it.

Those who are best adapted are the most fit, and therefore, the ones whose genes get passed down.

Who's heard of survival of the fittest? Why do animals compete to survive?

Resources are scarce, there's just not enough to go around. This is Darwin's Theory of Evolution and Natural Selection.

↳ Two elephants would produce 19 million descendants in 750 years if all offspring survived! Because food, water, and sunlight are limited, only the very best adapted to their specific environments are able to get the food and water to live, or the mechanisms to evade predators (they're hungry too!)

Those whose adaptations are the ones who pass on their genes, so future populations will have similar adaptations, that is natural selection.

What happens when the adaptations that enabled you to survive are no longer useful?

You die, but others who by chance had adaptations suited for the new environment get to live.

↳ This is called genetic drift, which is the random increase or decrease of alleles in a population.

What would happen if half of this room's population became permanently submerged in water and you couldn't escape?

Most of you would die, but maybe there's two among you who secretly have gills and would survive, and their offspring would then have gills, and because most of you are dead, the entire population now has gills.

This is both bottleneck and founder effect. Bottleneck is when a big portion of the population is wiped out, mostly by natural disasters, and founder effect is when a small subset of the population moves away and changes as they adapt to their new environment.

Eventually, what happens after a population just keeps changing and changing as they adapt to their new environment?

They become a new species altogether, called speciation.

What is a species?

A group of individuals capable of breeding with one another

As species adapt to their changing environments, they evolve.

[Mini-Activity] Discuss the following:

1. *How could you turn a pack of wolves into Chihuahuas? Explain why your strategy would work*
2. *Are humans evolving? If so, which trait is changing? Explain*
3. *How would you test whether peacocks with large spots on their tails have "good genes"?*

BACTERIAL RESISTANCE

GROW BACTERIAL CULTURES WITH ANTIBIOTICS AND WATCH THEIR FUTURE GENERATIONS BECOME RESISTANT AND SUBSEQUENTLY SURVIVE

| Materials: | Procedure: |
|---------------------------|--|
| e. Coli sample (cultured) | 1. Break the students up into groups of 4 and give each table 2 pre-prepared petri dish with e. coli strains, normal and resistant cultures. |
| Ampicillin | 2. Explain bacterias to the students and the difference between the two plates. Talk about resistance. |
| Eye droppers | 3. Administer ampicillin to both plates and observe the changes. |
| | |

Reinforcement. Talk about how the bacteria is becoming resistant. Ask them to identify what is occurring to the population by being subject to antibiotics (is it bottleneck or founder effect?)

Wrap-Up! After the students have written down their observations and completed a concluding discussion about the results, review the learning objective by asking the students what new information they have learned and reviewing the key vocabulary words. Discuss how now that they have antibiotic resistance bacteria, they can win the arms race against germs?