



Lesson Plan 4: From bugs to superbugs: How bacteria become resistant to antibiotics

This session is to understand how bugs (bacteria) become superbugs and in the process also understand the process of evolution.

Time: 30 minutes

Overview:

In this activity, student volunteers (simulating the trait of different heights) will try to catch food hanging at a height (which simulates an environment with elevated food source) to understand the concept of selective pressure and natural selection.

Time: 30 minutes

Preparation:

1. Tie a large net over the front of the classroom, should be accessible only when students stretch.
2. Hang different large candies from the net (or different candies can be stuck at a height, or hung using thread or rope)
3. Reward stickers
4. Stop-watch
5. [Activity Sheet](#)



Activity:

Antibiotics only work on bacteria, they do not work on viruses and sometimes bugs change into superbugs that stop antibiotics from working on them. Superbugs are created due to changes in genes. Let us now understand this through an activity.

1. Identify 6 volunteers from the students
2. Ask all the children to kneel down on all fours like an animal. Tell the children that they all belong to a family of animals on an island
3. Now, a random mutation happened in this population and some of them gained a gene that enables them to stand upright. Stick a smiley face sticker on three children. Ask them to stand upright.
4. Explain to the students that they are now stuck on this island and the hanging candies are the only food source. They have to catch the food to survive.



5. Within the given minute, the children are asked to reach out and catch food only using their mouths.
6. See who manages to catch most food.
7. Obviously the tall ones on both feet who are able to stretch and reach out. The kids on knees will be the poor performers.
8. Explain to them that the ones on knees will eventually not survive due to lack of food and the ones on both feet will thrive as they can access all the food. This is called survival of the fittest.
9. Standing on two feet is an advantageous trait in this environment. Eventually, only they will survive, reproduce and pass on the gene for the standing up trait to their offspring. Give these children smiley face stickers and ask them to pass on this sticker to 3 others from the audience. They are the offspring that also have the gene for standing up right, who will also have the advantage of reaching out to the food better compared to the others and will survive better.
10. This continues over generations. This is an example of evolution. These animals have evolved to stand up right.
11. Draw analogy and explain the concept of natural selection and adaptation over generations.



An organism is able to better survive in its environment when it develops favorable characteristics or traits that gives it an advantage in finding food, shelter, and mates or escape an enemy in the food chain. This process is called natural selection (point to the standing upright children). These favorable traits and characteristics are known as adaptations making them better able to survive than other animals of the same species that do not have favorable adaptations (point to the children on all fours). These favorable traits and characteristics are then passed on to their babies (point to the new children with stickers) through a process called inheritance. This means these babies will be able to better survive in the environment and eventually pass on the favorable trait or characteristic to their own offspring!

12. Explain how the same thing happens in bacteria and how over generations, the ones that develop a resistant gene to antibiotic have survival advantage.



Image: Downtoearth.org

In antibiotic rich environment, antibiotic becomes the selective pressure (like the food source in our activity). In our activity the favorable adaptation is standing up right, whereas for bacteria, favorable adaptation would be gaining a mutation that enables them to survive the antibiotic. The rise of antibiotic resistance over the past half-century is one of the most dramatic examples of evolution in action. Bacteria have adapted to nearly every antibiotic we've developed.

Play [video](#) till 5 minutes

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