

# Antibiotic Resistance

*Recommended Age: 9-11 years old*

*Time: 30 minutes*



## In this activity we will:

- learn how antibiotic resistance can occur.
- learn the importance of taking prescribed antibiotics for recommended amount of time.

## Materials

- A bag of mixed beans
- Pencil
- A Paper or Styrofoam bowl
- Several Pieces of Paper



## Safety

- Be careful not to poke yourself while poking holes into the bottom of your bowl.

## Before we get started:

1. Choose three different types of beans of three different sizes, one large, one medium and one small. Gather 15 of each type.
2. Obtain a new paper/Styrofoam bowl and using a pencil, poke 6 holes the size of your smallest bean into the bottom of your bowl. Only the smallest bean type should be able to fall through the holes, the other two bean sizes should be able to stay in the bowl.
3. Place **ONLY** the smallest and the largest beans into the bowl. Set the middle sized beans aside. You will have 30 beans in your bowl to begin.

## Pre-Activity Notes

1. We are going to pretend that the bowl of beans is a sick patient. The large beans in the bowl represent the cells that are normally found in the patient's body when he is healthy. The small beans represent bacteria that have made our patient sick. The holes will represent antibiotics that you have prescribed to your sick patient.
2. As a good doctor you have told your patient that he needs to take his antibiotics for 15 days. In this model, we will pretend that a one day dose of our antibiotic is given to the patient by shaking the bowl of beans side to side. So, for example, if we want the patient to take his antibiotics for 15 days, we will have to shake the bowl side to side 15 times.

## Activity

1. Begin by shaking the bowl of 30 beans from side to side 15 times. Examine the contents of the bowl. Did all of the small beans fall through the holes? Did any of the large beans fall through the holes? The small beans that fell through the holes represent the bacteria that were killed off by the antibiotics. The antibiotics were only able to target the bacteria and not the normal body cells. This demonstrates how antibiotics are very specific to certain types of bacteria.
2. Replace all of the small beans back into the bowl. Now let's imagine that the patient ignored your recommendation for how long he should take his antibiotic. This time, the patient only takes the antibiotics for 6 days. So we are going to shake the bowl from side to side six times. Did you get rid of all of the small beans?
3. If you have some small beans that are left over they can reproduce and can also figure out a way to become stronger. Bacteria in this situation can *mutate*, which means they can be physically altered so that the antibiotic we have will no longer recognize them. So we are going to replace the left over small beans with the middle sized beans. Now try to shake the bowl a few times. Do any of your beans fall out? What if the new bacteria begin to multiply and the patient gets sick again? Do you think the doctor will be able to give them the same antibiotic?

## Extension Activities

After doing the above activity, how do you think doctors know how much antibiotic to give to a sick patient? Do you think that we really needed to shake the bowl 15 times in order to completely get rid of all of the small beans (bacteria)? Was it too many shakes or just enough? Try the following experiment to investigate these questions.

1. First we will see how many shakes it actually takes to get rid of 15 small beans. Using the same set-up as above (15 small beans and 15 large beans) test the number of shakes it takes to completely get rid of all 15 of the small beans. Do this four times to make sure your observations are good. Record your numbers in the table below.
2. Now instead of using 15 small beans, add 20 small beans to your bowl (do not change the number of large beans). Repeat step one. Do you need to shake the bowl more times or is it the same? Remember to do four trials to make sure your results are precise.
3. Try adding 30 small beans and see how many times it takes to get rid of them all. Do this four times again. What is happening to the number of shakes?
4. Do doctors know how much bacteria is in your body when you get sick? Do you think they might give you more than you need just to make sure they can get rid of all of the bacteria?

### Data table to show how many shakes needed to get rid of the small beans

Contents of the Bowl		Number of shakes needed to get rid of small beans			
# of Small Beans	# of Large Beans	Trial 1	Trial 2	Trial 3	Trial 4
15	15				
20	15				
30	15				
?	15				

### Resources

<http://www.microbeworld.org/mlc/gifs/activities/pgs14-16.pdf>

[http://images.google.com/imgres?imgurl=http://www.clipartguide.com/\\_small/0008-0709-2522-3732.jpg&imgrefurl=http://www.clipartguide.com/\\_pages/0008-0709-2522-3732.html&usg=\\_\\_9rtGQU6oPMFRW4GX0BU6PfCR2as=&h=300&w=291&sz=18&hl=en&start=18&sig2=IDizvIPyK104VR220iIMZw&tbnid=616GjrY4fsSkLM:&tbnh=116&tbnw=113&prev=/images%3Fq%3Dpill%2Bbottle%26gbv%3D2%26hl%3Den&ei=1b2WStqyEsrgIAeRh\\_nADA](http://images.google.com/imgres?imgurl=http://www.clipartguide.com/_small/0008-0709-2522-3732.jpg&imgrefurl=http://www.clipartguide.com/_pages/0008-0709-2522-3732.html&usg=__9rtGQU6oPMFRW4GX0BU6PfCR2as=&h=300&w=291&sz=18&hl=en&start=18&sig2=IDizvIPyK104VR220iIMZw&tbnid=616GjrY4fsSkLM:&tbnh=116&tbnw=113&prev=/images%3Fq%3Dpill%2Bbottle%26gbv%3D2%26hl%3Den&ei=1b2WStqyEsrgIAeRh_nADA)