Biological Ninjas

Learning Objectives:
- Understand the differences between viruses and bacteria.
- Learn the characteristics of the two groups.
- Identify ways bacteria can adapt?

Key Vocabulary:
- Virus
- Bacteria
- Fission
- Conjugation
- Transduction
- Transformation
- Plasmids
- Retrovirus

INTRODUCTION (15 MIN. OPEN DISCUSSION)

How do you actually get sick? If a fellow student comes to class coughing and sneezing, why do you get sick?
Sample Answers:
- People sneeze without covering their mouths and noses
- They touch us afterwards
- They touch other things we might touch
- By touching dirty things

So we need to wash our hands because surfaces can be dirty and can give you a cold. But what is a cold?
Colds are caused by a virus and the virus goes into your mucus membranes and then you get sick because its inside you.

Who knows what a bacteria is?
Really diverse single-celled organisms that come in a variety of shapes and live in almost every corner of the earth, even inside active volcanoes.

Who can guess how many bacteria there are in your body?
100 trillion bacterial cells

What part of the body do you think has the most bacteria?
The most bacteria can be found in the mouth, tongue and throat. However, the most diverse population of bacteria can be found on your arm! Meaning, that at any given moment, there are 44 different species of bacteria living in the forest that is your arm hair!

Does anyone know how many human are alive on Earth? 7 billion people. **Okay, now how about bacteria?**
5 million trillion trillion! That number has 30 zeros!

15-20 min Background Info.

Only 1% of all bacterial species have been identified, cultured and studied, yet bacteria make up over 50% of the earth's biomass!

With so many bacteria species, there's bound to be diversity! To sort them all out, we classify them into three shapes:

(Show pictures on slideshow)

- *cocci:* spherical
- *bacilli:* rod shaped
- *spirilla:* spiral shaped

Who's had strep throat? Congratulations, your throat has been the home of a spherical bacteria!

Who here likes eating beef or any kind of meat? The reason why we cook meat is to kill bacteria, like E.coli (show picture). **Can anyone tell what kind of shape this bacteria is?**

You may be wondering, how do these little guys get such big population numbers? *They reproduce by binary fission.*

↳ Fission allows bacteria to proliferate very quickly. Since bacteria chromosomes are so simple, they can easily replicate it and multiply. *(Show time lapse video of bacteria multiplying on a petri dish.)*

The study of diseases and how they spread, can be controlled and other factors relating to health is called epidemiology.

Our body luckily has an immune system to defend us and white blood cells are made in our bones to defend us from diseases.

Here are some responses our bodies have to diseases:

↳ **Coughing and sneezing** *Our body hopes to shake out the pathogen by cough and sneezing to expel it.*

↳ **Fever** *A fever to respond to the pathogen sometimes to kill it. If your body gets to a higher temperature it can kill the pathogen but, too high and it hurts you.*

↳ **White blood cells and antibodies** *When we are sick our body has an immune system that learns from its mistakes.*

In the future you wont feel as bad because the body learns to make antibodies quicker to train our white blood cells to attack evil invaders.

Materials:	Procedure:
30% HCl	1. Each student should get a cup of water. Introduce clear diluted HCL into a few cups of water from a volunteers cup to about 3 – 5 different cups depending on class size (aim for 30% of students HCL added)
Cups	2. The students should randomly share some water into other students cups. Pour about half of their water into other students cups.
Eye droppers	Once the students have shared water around the room some students will have received HCL and others would have not.
Phenolphthalein indicator	3. To test you can use an indicator in each students waters to show them how the spread occurred.
pH strips	

Reinforcement. Ask the students what viruses they know (flu, HIV, hepatitis) and discuss their transmission? Discuss the differences between a virus and a bacteria, and talk about why both are so successful. Have the students hypothesize if the bacteria will be able to survive the virus. Ask them to explain their reasoning.

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.