Viruses & Bacteria

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)

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 greatest number of bacteria is found in the mouth, tongue and throat. The greater number of different species though, is in the forearm, with at least 44 types of bacteria living on your arm at any time!

How many can be found in the world?
5 million trillion trillion

Who can tell me how many zeroes that has? 30!

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:

cocci: spherical
bacilli: rod shaped
spirilla: spiral shaped

15-20 min Background Info.

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

You guys see that E.coli you grew last week? *That one is rod shaped!*

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

Binary fission happens very quickly, because bacterial cells lack all of the organelles that we have. Their single chromosome replicates and the cell splits into two. In your cultures from last week, we were able to see, in a matter of days, dozens of generations be created, enough for the bacteria to evolve antibiotic resistance before your eyes, and that is thanks to binary fission!

Now, if they're all just exact replicas of one another, how do you think can they survive their changing environments, or even live in different environments?

They have their own mechanisms to get variation into their genomes, the coolest of which, is **transformation**, where bacteria can just absorb DNA from their surroundings and put it in their genomes. More commonly though, they do **conjugation**, where one bacteria creates a little tube that connects to its neighbor and it passes on plasmids.

What are plasmids you ask? *Short little pieces of DNA not found in their chromosome, they're just floating around, and are very easily spread around.*

Plasmids are actually the reason the bacterial cultures in front of you are alive today! We forced antibiotics on these little guys, and they should all be dead, but they aren't, and that is because at least one little bacteria had **R plasmids,** which give bacteria resistance, and they passed these plasmids around to all of their friends.

The last way bacteria get variation, is through viruses.

Who remembers what a virus is?

Nonliving DNA containing "things" that go around taking control of other's cells so that they could carry out their functions since they have no way of doing so themselves.

Viruses inject DNA into bacteria in the very same way they do to us. Whenever we're cloning, or genetically modifying things, we usually use viruses as vectors

to transfer DNA! This is called **Transduction**. Sometimes, as the virus is replicating inside a bacterial cell, it picks up some bacterial DNA, and when it goes to another cell, it can drop it off. These bacteria infecting viruses are called bacteriophages, and they are what we will be using today to terrorize our *E. coli.*

A virus is like an invading soldier: **What do all soldiers have?**

Commands

Like any good soldier, a virus has strict orders and instructions within its nucleic acid, which can be DNA or RNA

Armor

All soldiers have to protect themselves, and likewise, viruses have armor. The first layer is the **capsid**, a protein structure surrounding the nucleic acids. Next we've got the **protein coat**, a shell of proteins surrounding the capsid. And lastly, our more paranoid soldiers have an **envelope**, protecting the already strong protein coat.

Just like evil little soldiers, viruses are on two types of mission: the **lytic** and **lysogenic** mission

In the lytic cycle, the viral soldier storms into the cell and takes control over it, using its machinery to strengthen and multiply itself. On its way out, it takes no prisoners and destroys its host, moving on to its next target.

In the lysogenic mission, the viral soldier is undercover and inserts itself into the hosts DNA and stays in its covert position until it is found out, and then it resorts to its lytic mission and attacks, multiplies, and destroys.

Bacteriophages: Infecting antibiotic resistant E.Coli w/ Virus

Materials:	Procedure:
prepared e. coli dishes	1. Break the students up into groups of 4 and distribute the e. coli dishes.
coliphage	2. Recap the content covered and explain the purpose to coliphage.
Droppers	3. Infect the plate with the coliphage sample and observe. Ask the students what they think is occurring.

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.