

# **Bacteria and Viruses Unit**

## 7<sup>th</sup> Grade Life Science

By: Ms. Ann Balster

### **General Overview:**

**Lesson 1:** The unit will begin with an introduction to Bacteria through a Eukaryotic vs. Prokaryotic discussion. There will be a light introduction to organismal complexity: unicellular, multicellular, and colonial.

**Lesson 2:** This lesson will define major bacterial structures, functions, movement and ecology.

**Lesson 3:** This lesson will cover bacterial binary fission and the three modes of DNA transfer, namely conjugation, transformation, and transduction.

**Lesson 4:** This lesson will begin the discussion of bacteria in our everyday lives, including beneficial and harmful bacteria. Pathogenesis and Antibiotics are also covered in this lesson.

**Lesson 5:** The Black Plague Case study will continue dialogue about epidemics and pathogenesis.

**Lesson 6:** Viruses are introduced in this lesson through a conversation about the components of life and the defining of structures of a virus, bacteriophage, host cell, and latent and active viruses. Replication within a host cell will be thoroughly discussed.

**Lesson 7:** General issues of viral disease including an understanding North Dakota Flu that will be introduced. Vaccines will be a primary issue as well as how they work, and what controversies surround them.

**Lesson 8:** Frontline's "The Vaccine War" movie is shown describing vaccines, their usages, and the controversies surround them in more detail.

**Lesson 9:** A Disinfection lab and several review activities are preformed to insure understanding on the processes discussed in the unit.

**Lesson 10:** This lesson is primarily a review day that includes options such as Quizlet, Concept map diagramming, and Vocab relay. Initially question and answer segment

about the student's points of confusion will be addressed and given the proper amount of time.

**Lesson 11 (probably the Monday of the 3<sup>rd</sup> week):** The final day dedicated to this unit has the Bacteria and Viruses Exam. Data collection from Disinfection Lab will also happen, if there is time.

### **Unit Standards:**

MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2- 4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

### **KNOW:**

Demonstrate understanding that living things are made up of cells, and can be single celled or multi-cellular

### **UNDERSTAND:**

Patterns can be used to identify cause and effect relationships.

Predatory interactions may reduce the number of organisms or eliminate whole populations. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.

Growth of organisms and population increases are limited by access to resources

### **DO:**

MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS1-1. \*\*Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

MS-LS2- 4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

# Bacteria and Viruses Lesson 1

Grade level: 7<sup>th</sup> Grade

Subject area: Life Science

Materials Needed: Life science Textbook (Chapter on Bacteria and Viruses), Internet for the websites

Additional Notes: Students will have previous knowledge on Eukaryotic cells. Students should also know the four macromolecules of life: proteins, carbohydrates, lipids, and nucleic acids.

## Standards:

MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

## Objectives:

Students will be able to:

1. Compare and contrast the structures of a Eukaryotic and Prokaryotic cell.
2. Compare and contrast unicellular, multicellular, and colonial organisms

## Learning Activities:

- I. Week I, Day 1: Bacteria
  - a. **Class handouts- Bacteria worksheet (Due Next Monday)→ Answers to this document will be discussed throughout the week.**
  - b. Day 1: Introduction to Bacteria
    - i. Recall a Eukaryotic cell. (15 min)
      1. Students will find the etymology of *Eukaryotic* using the Internet.
    - ii. I will have the students use the “How Do I Find an Credible Online Source” document (10 min)
      1. Go through document with the student so that they are familiar with the information and what you are looking for.

- a. Tell the students that they have to follow this guideline when searching for this information.
  - b. Also even if they know the answer already, they must find sources to prove what they know.
  - c. Ask the students to answer the following questions about the site that they received the information from (write questions on board):
    - i. What is the web address?
    - ii. Is this site credible?
    - iii. How do you know?
    - iv. What important information did you take from this site?
  - d. The students will hand in the answers to these questions on a piece of loose-leaf paper at the end of class. Rather than a grade, I will most likely just give feedback about the site that they used for finding the meaning and etymology of “Eukaryotic” and “Prokaryotic.”
2. *Eukaryotic* means “with nut/kernel” from Greek
    - a. Has a Nucleus... it has a membrane
    - b. Notice all organelles have a membrane.
  3. Teacher will draw a Eukaryotic cell on the board by having the students describe the cell to her.
    - a. Include a nucleus, vacuole, Rough ER, Smooth ER, ribosomes, lysosomes, Golgi Apparatus, mitochondria... or chloroplasts
- iii. Teacher will introduce Prokaryotic cells (10-15 min)
    1. Student will find the etymology of *Prokaryotic* using the Internet, and answer the same credible source questions written above.
      - a. *Prokaryotic* means “before nut/ kernel” from Greek
      - b. No nucleus... or membrane bound organelles
    2. Teacher will draw a Prokaryotic cell on the board
      - a. What are the similarities between Eukaryotic and Prokaryotic cells?
        - i. What are the differences?
  - iv. “What organisms are Prokaryotes and what are Eukaryotes”
  - v. Description and definition of Bacteria (5 min)
    1. Including definitions of:
      - a. Unicellular- single celled organism bacteria
      - b. Multicellular- human (have more than one type of cell to make up the organism)
      - c. Colony- a group of organisms (can also call them cells) working together
      - d. If information isn’t finished move it to the next day

- c. Homework: Bacteria Worksheet
- d. Dismissal: Wish everyone a good rest of the day.

**A**ssessment: Today I am assessing the students' ability to lookup a credible source on the internet. This will improve their literacy skills. I am also using formative assessment throughout the class period to check for understand. The Bacteria Worksheet will be an assessment throughout the week.

# Bacteria and Viruses Lesson 2

Grade level: 7<sup>th</sup> Grade

Subject area: Life Science

Materials Needed: Life science Textbook (Chapter on Bacteria and Viruses), Notebooks

## S standards:

MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2- 4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

## O bjectives:

Students will be able to:

1. Label the correct parts of a bacterial cell
2. Understand the effect of the environment/ ecosystem on the bacterium

## L earning Activities:

- II. Week I, Day 2- Bacterial structures, functions, movement, and ecology
  - a. What do bacteria look like? (20-30min)
    - i. Continue where the class left off yesterday→ Can anyone tell me what we learned about bacteria yesterday? (5 minute recall)
    - ii. Open PowerPoint: “Bacteria: A Visual Guide”
    - iii. The inside of a Bacterial cell:
      1. The brain of the bacterium:
        - a. Bacterial chromosome- the Typical DNA of a cell→ codes for shape, function, movement, protein synthesis, etc.
          - i. It is in a circle, and should not be confused with plasmids or Eukaryotic DNA
        - b. Plasmids- a small DNA molecule that replicates independently of DNA
          - i. Offers genetic advantages to the offspring of the bacteria
            1. What would be genetic advantages?
              - a. Being able to resist drugs
              - b. Being able to resist the immune system

- c. Having a vast range of living conditions
    - 2. Ribosomes in cytoplasm- make proteins
      - a. How are Bacterial ribosomes different from a Eukaryotic cell?
        - i. They are not found on an endoplasmic reticulum
        - ii. They are smaller
  - iv. The outside of the bacterium:
    - 1. Glycocalyx- very strong outer player of a bacterium (not all have them)
      - a. 2 types- slime and a capsule
      - b. Genetic advantage discussion again
      - c. It is not a cell membrane or a cell wall because it helps with attachment.
    - 2. Cell envelope- includes the cell membrane and the cell wall → can be used to identify the type of bacteria
    - 3. Appendages (not all species have these characteristics)
      - a. Flagella- “tail-like” appendages that helps with movement
      - b. Fimbriae- little hair-like appendages on the surface of bacteria that are used for adhesion
      - c. Pilus- Appendage used for DNA transfer (we will talk about this later on in the week)
  - v. 3 structures of bacteria: cocci (spherical), bacillus (rod-like), and spiral
    - 1. Bacteria are really small, a lot smaller than our human Eukaryotic cells. We have to use an electron microscope and a light microscope to see it.
    - 2. Arrangements: the arrangement of bacteria tells us how many bacteria live together in a colony and how the colony is organized.
- b. What and how do they eat? → They absorb foods from where they live.
  - i. Phagocytosis- engulfing
- c. Ecology of bacteria: where do they live? Turn and Talk portion of the PowerPoint. (10 min)
  - i. Natural flora → parts of the body where bacteria reside and are not harmful. This can be really anywhere (except the heart, brain, lungs, and organs not associated to the digestive tract, muscles, bones, and skin)
  - ii. Things that are infected in the body- skin, mucosal membranes (nose, mouth, genitals), and any part of the digestive tract.
  - iii. Some have very specific needs → They can only survive in a very small range of environmental stimulus (aka temperature, moisture level, oxygen level)

1. Define: aerobic and anaerobic using a analogy of yoga (anaerobic) and basketball (aerobic)
  - a. Humans are obligate aerobic organisms (We need air!)
  - b. Bacteria can be aerobic and/or anaerobic.
  - c. What would happen if an anaerobic bacterium was exposed to oxygen?
  - d. Can you think of any places in your body where bacteria are anaerobic? Aerobic?
- iv. What happens when environmental conditions are unfavorable?
  1. Some die.
  2. Some produces endospores.
    - a. A resistant spore produced by some bacteria that allows the bacteria to lay dormant until favorable conditions occur
- d. Homework: Bacteria worksheet
- e. Dismissal: Wish everyone a good rest of the day.

**A**ssessment- Today I am assessing the students by constant group discussing of difficult term. I will be using the Socratic method to determine if the students understand the concepts. They will also be working ont eh Bacteria worksheet.



# Bacteria and Viruses Lesson 3

Grade level: 7<sup>th</sup> Grade

Subject area: Life Science

Materials Needed: Life science Textbook (Chapter on Bacteria and Viruses), String

## **S**tandards:

MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2- 4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

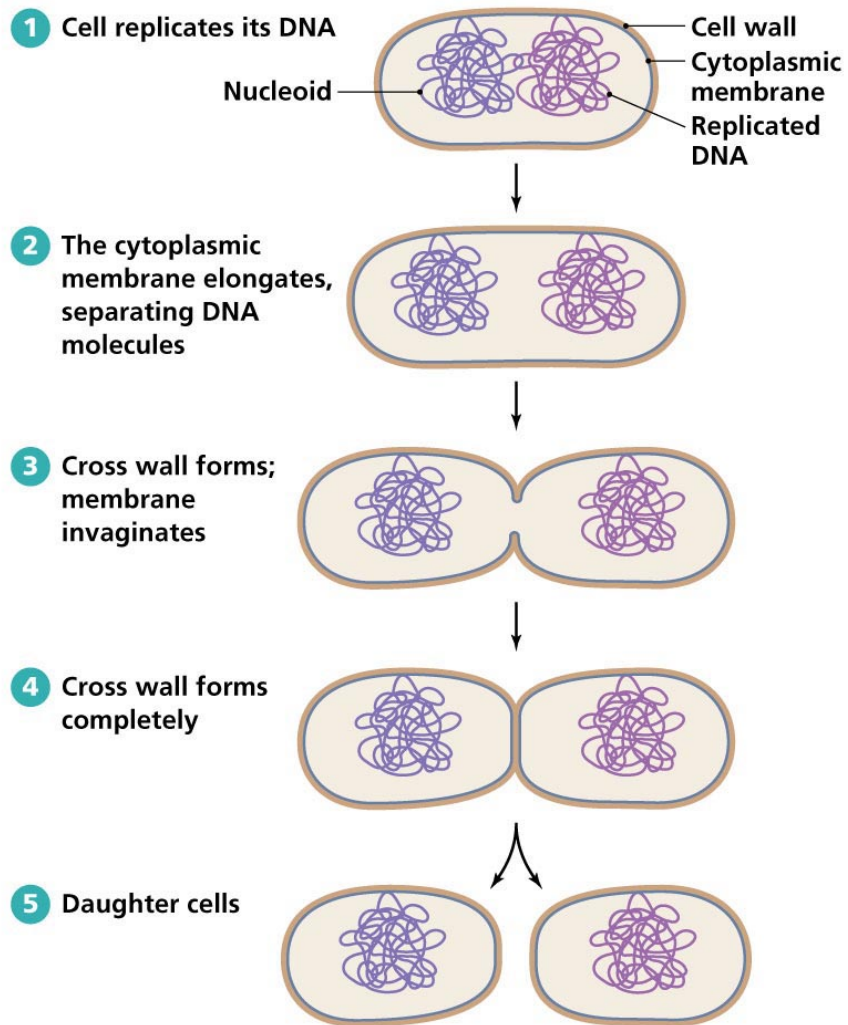
## **O**bjectives:

Students will be able to:

3. Diagram the process of Bacteria reproduction
4. Compare and contrast modes of Genetic Recombination

## **L**earning Activities:

- III. Week I, Day 3- Bacterial Reproduction and DNA transfer
  - a. Binary fission- Bacterial Reproduction (10-5 min)
    - i. Recall the Eukaryotic forms of reproduction
      1. Meiosis- the creation of gametes
      2. Mitosis- the creation of identically similar daughter cells
        - a. Binary fission is very similar to this.
    - ii. Process- when a cell swells in size, replicates it's DNA, and then splits in half to form two daughter bacterial cells.
    - iii. Draw the following diagram on the board and go through each one of the steps. Have the student on a blank sheet of paper draw out the process as you explain it.
      1. Pass out different colors if students want to use 2 different colors for the different sets of Bacterial Chromosomes



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- iv.
- b. So, bacteria can create new bacteria through binary fission. It can also change itself through DNA transfer. (20 min)
- i. Big word: Genetic Recombination (say out loud together, write word on board)- occurs when an organism acquires genes that originated in another organism
1. Genetic- means having to do with genes
  2. Recombination- has the word “combine” in it right?
    - a. Combine genes
  3. This means that the bacterium gains new DNA from something else.
  4. Recall the 2 types of DNA molecules in a bacterial cell= Plasmids (in charge of drug resistance, toxin production, etc.) or Chromosomal fragments (normal DNA)
    - a. Both types of DNA can be taken up by bacteria in 3 ways:

- c. 3 means for Genetic Recombination in bacteria:
  - i. Conjugation (have the students say it out loud)- transfer of a plasmid or chromosomal fragment from a donor bacteria to another
    - 1. Pilus- appendage involved with DNA transfer→ not all bacteria have the ability to create a pilus.
    - 2. Direct contact
      - a. Have 2 students stand up next to you
        - i. 1<sup>st</sup> have them try and figure out a method of showing this process without help
        - ii. Then guide them
        - iii. Student A can hold some string
          - 1. Student A cuts string in half
        - iv. Both students link arms (aka the Pilus) then Student A transfers one of the strings into the Student's B hands
      - b. However this can only happen if both bacteria are related
        - i. They have to have the same receptors
        - ii. So in our analogy, Student B receives DNA from Student A via the use of their hands.
          - 1. Student A could not transfer DNA to a squirrel, because they have different receptors.
        - iii. Genes cross between species
    - 3. This can be a good thing for the bacteria and bad for us
      - a. What if the bacteria passes along drug or antibiotic resistance?
  - ii. Transformation (say out loud)- Who do you think that means?
    - 1. To transform- After this process it becomes something else.
      - a. Note: It doesn't become a different bacteria, but it will have changed.
    - 2. Definition- Loose Chromosome fragments from a lysed (destroyed) bacterial cell are accepted by a recipient bacteria cell and are added into chromosome
    - 3. What does lysed mean? Think of it as Lysed=sliced
      - a. All lysed DNA have been destroyed by something, lets say the human immune system (white blood cells)
    - 4. Bacterial cells can take up random DNA floating around
      - a. Donor bacterium and recipient bacterium DO NOT have to be related, however recipient has to have DNA receptors

5. How did we figure this out? Draw the following experiment on the board to help those who understand visually.
    - a. A man named Griffith was thinking that something like this happened.
    - b. He took two completely different strains of bacteria (not of the same species).
      - i. One had a capsule, and one didn't. (Capsule- a type of glycocalyx, or outer covering)
      - ii. A capsule makes it hard for the infected organism's immune system to kill the invader
    - c. The one with the capsule was toxic to the mouse, while the other without the capsule was not toxic,
    - d. Griffith took DNA from the encapsulated bacteria and put it in a solution with the non-encapsulated bacteria
    - e. Later he infected the mouse with the previously non-encapsulated bacteria and the mouse died.
      - i. What happened?
        1. The DNA that coded for the capsule was among the DNA fragments that was added to the solution with the non-encapsulated bacteria.
        2. THE bacteria took up the new DNA and produced a capsule.
        3. The capsule could not be beaten by the mouse's immune system and killed it
        4. The previous, non-lethal bacteria became lethal through the process of transformation
      - iii. Transduction (say out loud)- A Virus serves as a carrier of DNA from a donor cell to a recipient bacterial cell
        1. Virus infects a bacteria cell, and releases some DNA from another bacteria cell that the virus has infected prior to this infection.
          - a. AKA- a virus can uptake DNA in a cell and then pass it along to another cell
        2. The virus has to match the junction sites of the bacteria, therefore not all viruses can infect all bacteria
- d. Homework: Bacteria Worksheet
- e. Dismissal: Wish everyone a good rest of the day.

**A**ssessment: Today I am assessing the students' ability to understand complex ideas and break them into easy steps. For example, I asked a couple students to reenact in their own way the process of conjugation using their bodies. This shows that they can synthesize with the information given to them in an analogous way. Other Formative assessments will be used. The students also still have the Bacteria Worksheet to complete.

# Bacteria and Viruses Lesson 4

Grade level: 7<sup>th</sup> Grade

Subject area: Life Science

Materials Needed: Life science Textbook (Chapter on Bacteria and Viruses), Individual parts for Case Study

## Standards:

MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2- 4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

## Objectives:

Students will be able to:

5. Organize bacteria's place in the world
6. Describe methods of avoiding and treating disease

## Learning Activities:

- IV. Week I, Day 4: Bacteria in our everyday lives
  - a. Bacteria like every living thing has its place in nature (10-15 minutes)
    - i. Beneficial bacteria:
      1. Recall: Natural flora- The bacteria found on our bodies
        - a. Areas with natural flora= skin, hair, digestive system, genitals, mouth.
        - b. They do not harm us, but in fact help us. How?
          - i. Bacteria in our stomachs help us digest food.
            1. Probiotics in yogurt
          - ii. Competing bacteria on our skin and other surfaces
            1. Natural Flora kill bad bacteria because they fight for space
      2. Decomposing decaying matter
      3. Plants need help too!
        - a. Plants need nitrogen (an element that is crucial to life!)

- b. Sometimes a plant works with certain types of bacteria so that they can get the nitrogen necessary for survival
- b. Teacher will bring out disinfectants (maybe even an antiseptic like hand sanitizer) and ask the students what these supplies are used for. (20 minutes)
  - i. To kill germs!- A better term is pathogens, which can include bacteria.
  - ii. Harmful bacteria cause sickness and disease.
    - 1. Ex: Strep throat, E. coli, Tetanus
    - 2. Do students know of other bacterial infections?
    - 3. How do we “catch” them?
      - a. Many ways (and easily)→ We ingest bacteria; we breathe in bacteria; we drink bacteria, and bacteria can enter our bodies through a wound.
  - iii. Treating Disease
    - 1. Antibiotics and Bacterial Resistance discussion
      - a. Antibiotics are drugs that people take to get rid of an infection.
        - i. They do not prevent infections.
        - ii. Anti- against, biotic- life
          - 1. Anti-life, these drugs kill bacteria
      - b. Yesterday, we talked about how DNA is transferred between bacteria.
        - i. Bacteria can gain antibiotic resistance through DNA transfer, or it can originate in it.
        - ii. Why would antibiotic resistance be a problem?
  - iv. Avoiding Disease
    - 1. Pasteurization or other food sanitation methods kill possible bacteria that can live in food.
      - a. Milk and cheese are pasteurized so that bacteria doesn't infect people who eat them.
    - 2. Other disinfection and antiseptic methods
      - a. Hand sanitizers get rid of bad bacteria on our skin
      - b. Cleaning the bathrooms can kill lots of bacteria depending on the type of cleaning product.
      - c. Why do you boil water when you go camping?
        - i. To kill all of the bad bacteria found in stagnant water.
- c. Speaking of Disease: Teacher will introduce tomorrow's activity (5 min).
  - i. Teacher will pass out character parts for the case study lab for the following day. The students will only receive the case study that they are in, so they can read over the information.
  - ii. Teacher will briefly describe the procedures of the activity.

1. What is a common disease that a lot of people died from in 1300?
  - a. The BLACK PLAGUE!
  - b. Well at the time, people didn't know that what was causing the Black Plague.
    - i. Some people thought it meant an un-holy life.
    - ii. Some people thought that it was karma.
  - c. No one really knew what caused it at the time and so there was constant terror about contracting this epidemic.
    - i. Epidemic- a disease that spread quickly between countries.
  - d. This case study will put you in those people's shoes
2. Together we will solve the mystery of what caused the Black Plague.
  - iii. Students do not have to memorize their parts, but are encouraged to look over their lines and create a character.
    1. Students can volunteer for the part of they want if there aren't enough parts for everyone.
    2. Costumes are optional, but encouraged! (Of course)
  - d. Homework: Bacteria Worksheet, go over case study lines so they feel confident about tomorrow's presentation
  - e. Dismissal: Wish everyone a good rest of their day.

**A**ssessment: Today the students are assessed through their ability to relate information given to them to their natural world. If the students can come up with their own disinfectants and antiseptics or ways to avoid "catching a disease," they will show proficiency in this lesson. There will be continued Formative assessment through out the lesson. They will also have their Bacterial Worksheet.



# Bacteria and Viruses Lesson 5

Grade level: 7<sup>th</sup> Grade

Subject area: Life Science

Materials Needed: Life science Textbook (Chapter on Bacteria and Viruses), Individual parts for Case Study, Notes handed out prior to class

## S standards:

MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2- 4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

## O bjectives:

Students will be able to:

7. Create a hypothesis
8. Support a hypothesis with data
9. Understand methods of contracting disease
10. Perform and create a character in front of the class

## L earning Activities:

- V. Week I, Day 5: The Black Plague Case Study lab, see <http://teacherlink.ed.usu.edu/tlresources/units/Byrnes-S2000/Symons/bubonic.htm> for instructions.
  - a. Ask students to get out their notes and then start class with a little Q and A about the previously discussed topics of the week.
    - i. Remind students of what they already know about Bacterial Disease!
      1. Who knows what Reservoirs are?
      2. Who knows how we can acquire pathogens such as bacteria?
    - ii. Now it is time to put this knowledge to the test.
  - b. Teacher will reiterate the format of the case study lab.
    - i. What is a case study? A form of research where you look at actual quotes and testimonials from eyewitnesses (like a court case).
  - c. Case studies will start, and students are instructed to take notes on clues that are presented along the way. (20-30 minutes)

- i. Remind the students that they do not have to feel afraid about getting up “on stage” to perform.
  - 1. My biology classroom is a safe environment, and if at any point a student is feeling nervous, they can always come and talk to me. I just want everyone to give it a try.
  - 2. An actor ceases to be “Jim” and become the character chosen for you once you leave your seat.
    - a. Give yourself the opportunity to be creative with your character
- ii. Then teacher will start the Introduction as the Narrator about the Black Plague, and the case studies will proceed.
- d. After all case students are finished, students will talk with neighbors (3-4 students in groups) about their findings and hypothesize the cause of the Black plague. Groups will present a clear hypothesis and reasoning to the class after about a couple minuets of table-talk. (5-10 minutes)
- e. Teacher will finish with the paragraph provided on the website, solving the case. (2 minutes)
- f. Students will write down the questions, and then return next Monday with them answered: (2+ minutes)
  - i. Monday Entrance slip:
    - 1. What did you enjoy about this case study?
    - 2. What do you think it would feel like, living through a massive epidemic like the Black Plague?
    - 3. What are ways to prevent the spread of horrible diseases like the Black Plague?
- g. **Weekend Homework: Bacteria worksheet (due Monday), Entrance Slip, and prepare for Bacteria Quiz which will be on Monday right at the start of class.**
- h. Dismissal: Wish everyone a good rest of their day and a fantastic weekend.

**A**ssessment: Today, I will assess the student on their understanding through the small group discussions and large group discussions. I will also take into account the Entrance slip on Monday. The Bacteria Worksheet is due on Monday, so I will check understanding about that, then.

**R**eflection: I thought that this lesson was really fun, not only for the students but for me. I felt that everyone was really enjoying all parts of the lesson. Perhaps this was due to the fact that it dabbled in different interests that the student(s) might have. Biology wasn't the only subject presented in the Case Studies. Drama and history skills were also included. Perhaps for the first time ever, a students that I was working with *liked* biology/life science because it wasn't entered on cells and population distribution. A student could have been super interested in theater, and as a biology teacher I would have

ever know unless I gave that student the opportunity to shine in my classroom. Integration of seemingly opposing subjects is extremely important. It allows for differentiated instruction and different learning theories to be used in the same class and lesson, which is a very rare thing.

If I could change anything it would be to give the students a copy of the case studies so that they could follow along. Granted, it is more fun to watch the acting than to read a script, but it is also good for the students to receive the information in more than one way (e.g. auditory and visual). However, I would need to find a way to hand out the packets of case studies while not allowing the students look ahead and receive clues about the Black Plague before they were mentioned in class. Also I did decide during my lesson that I would change the exit slip into an entrance slip for convenience of time. I want the students to think about my questions, rather than quickly finish the problem set and head to the next class without true reflection on the topic and learning opportunity given to them.

All in all, I really hope to put this lesson into my actual practice. I feel like this lesson could be modified to a high school level too. Future modification could include an application of technology into the lesson such as giving the students the opportunity to make a movie of the case study. This could increase the Project-based learning aspect, and it could teach the students a lot about project responsibility as well as videography and of interesting technological skills.

# Bacteria and Viruses Lesson 6

Grade level: 7<sup>th</sup> Grade

Subject area: Life Science

Materials Needed: Life science Textbook (Chapter on Bacteria and Viruses), Virus: A Visual Guide Power point, Virus Worksheet

## Standards:

MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2- 4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

## Objectives:

Students will be able to:

1. Relate the characteristics of life to living and nonliving things.
2. Describe the process of viral infection.
3. Create a diagram of a virus.

## Learning Activities:

- VI. Week II, Day 1: Introduction to Viruses
  - a. Hand in Bacteria worksheet and Entrance Slip.
  - b. Bacteria Quiz! (5 minutes)
  - c. Class handouts: Virus worksheet
  - d. Use the PowerPoint, Viruses: A Visual Guide, to guide learning and to offer a visual representation of the components of a virus to those who learn visually.
  - e. “Are viruses alive?” discussion (15- 20 minutes)
    - i. What constitutes as alive?
      1. The 7 characteristics of Life
        - a. Genetic material- DNA and/or RNA
        - b. Organization- Includes both molecular and cellular organization
        - c. Metabolism-Use Energy
          - i. Individual takes in energy and uses it for growth and development
        - d. Respond to environment/stimulus
          - i. Behavior is a complex set of responses.

- e. Reproduce- Necessary for the continuation of a species
- f. Grows and develops
- g. Adapt to their environment
  - i. Creates homeostasis in the body in the environment
    - 1. Homeostasis= balanced
    - 2. Organisms have to change in order to survive and reproduce in their environment.
  - ii. Creates variation in a species, and eventually creates new species through evolution.
- ii. Of all the characteristics of life, which do viruses have?
  - 1. Genetic material, Organization (at a very small level), Adapt to their host environment
  - 2. They do not, however, take in energy or respond to the environment.
  - 3. They technically can't live without a host...
    - a. They need a host to multiply (which could be a form of reproduction, but not as have learned it as of yet.
- iii. They straddle the line of living and non-living, but in this class we will say that they are non-living
  - 1. We will call them "infectious particles," meaning that they are either infecting someone or not infecting someone (rather than alive or non-living).
- iv. Ask if there are questions.
- f. Tell the students that the next information may seem a little quick, but as long as they get the general idea they will be good.
- g. If they aren't alive, then how do they work? (15-20 minutes)
  - i. General Structures→ Viruses only have what is necessary for invading a host cell.
    - 1. Capsid- the shell
    - 2. Genetic material- DNA or RNA at core
    - 3. Envelope- Not all viruses have one
      - a. The envelope comes from the previous host cell (as the virus escapes from the host cell it takes some of the membrane of the host cell with it).
      - b. Sometimes have spikes
      - c. Aids in protection, adhesion, and penetration of new host cell
  - ii. Remember last week we talked about Transduction (when a virus goes into a bacteria cell and transfers DNA)?
    - 1. Phage- Viruses that infect bacteria.
      - a. It looks a little different then the general virus.

- b. Recognize the capsid shape (the head of the virus)
  - iii. What is a host cell?
    - 1. This is the cell that a virus infects.
      - a. It has to have receptors for the virus to attach too in order for it to be infected.
        - i. Like the key of a door
  - iv. Replication in a host cell
    - 1. Once attached to a host, the Viral DNA/RNA or the whole virus enters the host cell (penetration).
    - 2. Virus takes over host cell's metabolism and causes the Host cell to start creating the building blocks of new viral particles.
    - 3. Then the new virus particles form new viruses.
    - 4. Then they are released.
      - a. Some gain an envelope on the way out.
      - b. Others just lyse/destroy the cell (rip it apart) as it exits.
  - v. Latent Virus- A virus that does not become active immediately after entering the host cell.
  - vi. Active Virus- A virus that becomes active immediately after entering the host cell.
- h. Homework: Virus Worksheet**
- i. Dismissal: Wish everyone a good rest of the day.

**A**ssessment: Today was another very formative assessment-based lesson, with many instances of Socratic method teaching. The virus worksheet will assess understanding about basic viral topics.

# Bacteria and Viruses Lesson 7

Grade level: 7<sup>th</sup> Grade

Subject area: Life Science

Materials Needed: Life science Textbook (Chapter on Bacteria and Viruses)

## **S**andard:

MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

## **O**bjectives:

Students will be able to:

1. Understand the effects of a virus spreading through a population by looking at actual evidence
2. Compare and contrast innate and acquired immunity.
3. Explain the effects that antibodies have on the immune system.
4. Cognize the importance of vaccines and the medical advancements accompanied with it.

## **L**earning Activities:

- VII. Week II, Day 2: Viral Diseases and vaccines
- a. Are there any questions about yesterday's work?
    - i. Does everyone understand the terms: Latent Virus, Active Virus, Host cell, and/or Phage?
    - ii. Does everyone understand the process of Virus replication?
  - b. Examples of viral diseases (10-15 minutes)
    - i. AIDS/HIV, Flu
    - ii. Visit North Dakota Flu Data: <http://www.ndflu.com>
    - iii. Note: the Virus can only replicate in cells where it infects.
      1. Flu virus replicates in the lungs, HIV in the blood
      2. However, some viral strains are very versatile.
  - c. Does everyone get sick? (15-20 minutes) No all the time!
    - i. Define:
      1. Immunity- resistance to disease
      2. Innate immunity- Immunity that is present before exposure to the virus and effective from birth
      3. Acquired immunity- Immunity that is present only after exposure and is highly specific.

- a. You never get the same virus again, because your body builds up antibodies that learn how to kill the virus right away.
  - 4. Antibody- a protein that acts against a specific antigen (virus)
    - a. This is not the same thing as Antibiotics!!!
- ii. 5 signs of inflammation
  - 1. Redness
  - 2. Swelling
  - 3. Pain
  - 4. Heat
  - 5. Loss of function
    - a. When you get a paper cut, what signs do you see?
      - i. Redness
      - ii. Maybe a little swelling
      - iii. Pain
    - b. When you break your leg, what signs do you see?
      - i. Pain
      - ii. Loss of function
      - iii. Swelling
    - c. When you are infected with the flu virus, what signs do you see?
      - i. Pain
      - ii. Heat (fever)
- d. Disease prevention
  - i. Disinfection and Sanitary methods as discussed in the bacteria portion of this unit are reiterated here in less detail.
- e. To prevent the spread of the viruses- Vaccines (10-15 minutes)
  - i. Usually a vaccine is administered through injection (a shot), but it can also be a drug or a nasal spray.
    - 1. Common viruses that are prevented with a vaccine:
      - a. Flu, chicken pox, measles, mumps, rubella, diphtheria
  - ii. How do they work?
    - 1. Vaccines act as a boot camp for your immunity.
    - 2. They prepare your body to fight off the virus if you happen to contact it.
    - 3. How?
      - a. You are actually injected (or you inhale or swallow) with the virus in question that is either inactivated or not-whole (neither are harmful to the body).
      - b. Then your body builds antibodies to destroy these non-harmful viruses.
      - c. These antibodies give you acquired immunity, meaning that the next time you contract the virus,



your antibodies will be able to fight off the virus without an issue.

4. Vaccine controversy
  - a. Some people think that vaccinations should not be mandatory, because they go against a religious stance, or the freedom of speech.
  - b. Others think that it is important to vaccinate your students so that harmful diseases don't spread through the nation.
  - c. Why is it important to discuss this controversy?
    - i. It is important to be aware that your parents faced this controversy when they had you!
      1. Were they going to vaccinate you, or weren't they?
      2. Were they going to opt out of several types of vaccines?
    - ii. It is also important that you, as a student, become aware of controversial topics.
      1. You become a better citizen, since you are actively participating in the discussion.
    - iii. If there is no more class time left, tell the students that tomorrow we will be watching a video on the Vaccine controversy. If there is time, start The Vaccine War, Frontline video that address the debate of whether or not parents can decide to opt out of vaccines, or whether it should be mandatory:  
<https://www.youtube.com/watch?v=VPOrnU3ImxI>
  - f. Homework: Virus Worksheet
  - g. Dismissal: Wish everyone a good rest of the day.

**A**ssessment: I will test graph reading with analyzing North Dakota Flu Data, by asking questions about scale, key, and other notable facts that can be taken from the chart and diagram. Formative assessments are throughout, and the virus worksheet is due later on in the week.

# Bacteria and Viruses Lesson 8

Grade level: 7<sup>th</sup> Grade

Subject area: Life Science

Materials Needed: Life science Textbook (Chapter on Bacteria and Viruses)

## **S**andard:

MS-LS2- 4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

## **O**bjectives:

Students will be able to:

1. Understand how Vaccines work
2. Support and defend a viewpoint from a controversial topic

## **L**earning Activities:

- VIII. Week II, Day 3: The Vaccine War: Frontline video (whole class period)
- a. <https://www.youtube.com/watch?v=VPOrnU3ImxI>
  - b. If there is time, there can be a class discussion about what students thought about the video. Agrees and Disagrees?
    - i. Exit slip:
      1. Suppose you were pro-vaccination, how would you defend your viewpoint?
      2. Suppose you were anti-vaccination, how would you defend your viewpoint?
    - ii. If there is still time left, have the students work on their worksheet due tomorrow if it isn't finished.
  - c. **Class Handouts- Study guide (due the day of Exam)**
  - d. **Homework: Virus worksheet (due next class period)**
  - e. Dismissal: Wish everyone a good rest of the day.

**A**ssessment: I will assess my students today on their understanding of complex controversial ideas. If they can pick apart both sides of the vaccination argument, they will show proficiency in understanding this debate. This will be assessed through their answers to the exit slip. Virus worksheet is due next class period

# Bacteria and Viruses Lesson 9

Grade level: 7<sup>th</sup> Grade

Subject area: Life Science

Materials Needed: Life science Textbook (Chapter on Bacteria and Viruses), 4 agar plates per student, goggles, gloves, cotton swabs/ inoculation needles, incinerator if using an inoculation needle, distilled water, permanent marker, hand sanitizer, and 409 disinfectant, Concept Map instructions, Vocab Relay queue cards

## Standard:

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

## Objectives:

Students will be able to:

3. Perform basic aseptic techniques and follow lab safety protocol
4. Understand the difference in antiseptics and disinfectants

## Learning Activities:

- IX. Week 2, Day 4: Disinfection lab p. 254 in textbook
  - a. **Collect the Virus worksheet.**
  - b. Disinfection lab (remaining class time)
    - i. Introduction: What are some common disinfectants and antiseptics?
      1. Today, we are determining if a common disinfectant and antiseptic actually work.
    - ii. Materials needed- goggles, gloves, agar plates, cotton swabs/ inoculation needles, incinerator, permanent marker, hand sanitizer, and 409 disinfectant
    - iii. The Methods for this lab looks like it will take the whole class period, but realistically it will take probably about 10-15 minutes
    - iv. Use proper aseptic techniques
      1. If you are using a cotton swab, wet the cotton swab with some distilled water and then rub on the surface of the tested spot.
        - a. You have to use a different cotton swap every time you are swabbing a location.

- b. Dispose of all cotton swabs in the hazard waste basket as soon as you are finished with the inoculation
        - c. This process will be demonstrated.
  - 2. If you are using an inoculation needle, apply a drop of distilled water on the surface that you are testing. Rub the needle tip onto the surface with the water on it.
    - a. You have to incinerate it before and after you use it
    - b. The incinerator is very hot (hotter than an oven). Do not touch it! Slowly place the needle portion of the inoculation needle in the incinerator hole (I repeat, **only** the needle portion of the inoculation needle).
    - c. This process will be demonstrated.
  - 3. Wear gloves
    - a. When the lab call you to swab a hand, swab your neighbor's hand rather than your own. Keep your gloves on your hands! You neighbor can take off his/her glove.
  - 4. Wear goggles
  - 5. Tie back hair
  - 6. Avoid breathing or touching the agar plates or inoculation device (cotton swab or inoculation needle) during a bacteria transfer.
  - 7. Close the agar plate as soon as possible.
- v. Label all lids on the agar plates prior to inoculation
- 1. Students should write:
    - a. Their names,
    - b. Location of where they took their sample from,
    - c. And what is on the plate:
      - i. Control- received no disinfectant or antiseptic
        - 1. There will be 2 controls (one from the inanimate surface, one from the living surface, aka. the tested hand)
      - ii. 409- the disinfectant
      - iii. HS (hand sanitizer)- the antiseptic
- vi. Using proper aseptic techniques, swab an area of the room (non-living) where you believe there will be bacterial growth with the inoculation device.
- 1. Inoculate (transfer the bacteria from inoculation device to) an agar plate
    - a. Cover this plate as soon as possible with the lid.
  - 2. Using proper aseptic techniques, inoculate another agar plate with bacteria from the same area.
    - a. Then Spray 409 on this inoculated plate.
    - b. Cover with the lid as soon as possible.

3. Incinerate the inoculation needle or throw the cotton swab in the hazard wastebasket.
  - vii. Using proper aseptic techniques, do the same method as above, but instead of swabbing a non-living object, swap your neighbor's hands (a living object).
    1. First inoculate a agar plate with inoculation device
      - a. Close agar plate
      - b. Dispose of cotton swap or incinerate inoculation needle
    2. Second inoculate another agar plate with inoculation device.
      - a. Then put a little bit of hand sanitizer on it
      - b. Close the agar plate
  - viii. Place all plates in the incubator to let the bacteria grow
  - ix. Have the students write a hypothesis about what type of growth they expect to see.
  - x. Incubate the plates, and have the students make conclusions in the next week.
    1. Conclusion Questions:
      - a. Compare growth of plates: which has more growth, which has less?
        - i. Did the hand sanitizer or the 409 kill all of the bacteria?
        - ii. Does the bacteria on each plate look the same to you?
      - b. Was your hypothesis incorrect or correct?
      - c. What can you do to decrease the spread of disease in schools or at home?
  - xi. Make sure all of the materials are properly stored away and the lab stations are cleaned up.
- c. Options for the rest of class
- i. Play this game: (5-10 minutes)  
[http://www.glencoe.com/sites/common\\_assets/science/virtual\\_labs/LS08/LS08.html](http://www.glencoe.com/sites/common_assets/science/virtual_labs/LS08/LS08.html)
  - ii. Vocab relay or the Concept map.
    1. The students will be doing both activities eventually (either today or tomorrow), but depending on how prepared they are determines which one chosen for today's activity.
      - a. The Vocab relay will be used if it seems like the student has a solid grasp on the information for the test.
      - b. The Concept Map activity will be used if it seems like the students are not at the point of a timed vocab activity (aka they aren't fluent with the terms or concepts yet).

- d. At the end of class, write on the board the Quizlet web address for extra help and test prep.
  - i. <https://quizlet.com/127231342/bacteria-and-virus-unit-7th-grade-flash-cards/original>
  - ii. Again it is up to them to go to this site and study.
  - iii. Make sure that the students have their Study Guide that was passed out yesterday. It is always good to make extra copies, because students could easily lose something like this.
- e. Test is Next week Monday. Tomorrow (Friday) we will be doing a study day. Come prepared with questions.
- f. Homework- Study for Bacteria and Virus Unit Exam, prepare for study session tomorrow. Come with points of confusion and/or questions.
- g. Dismissal: Wish everyone a good rest of the day.

**A**ssessment: Student comprehension will be assessed on the understanding of disinfectants through their ability to hypothesize the results of the disinfection lab. It should be fairly easy at this point to understand that disinfectants kill bacteria and viruses. If they do not understand this, then I will have to make arrangements for them to come in and work with me individually on the processes of disinfection and antisepsis. I will also assess their readiness for the exam through the vocabulary review game/exercise.

# Bacteria and Viruses Lesson 10

Grade level: 7<sup>th</sup> Grade

Subject area: Life Science

Materials Needed: Life science Textbook (Chapter on Bacteria and Viruses), netbooks/laptops/iPads, extra study guides, Concept Map instructions, Vocab Relay queue cards

## Standard:

MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

MS-LS2- 4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

## Objectives:

Students will be able to:

1. Memorize and understand concepts provided to them in this unit about bacteria and viruses

## Learning Activities:

- X. Week 2, Day 5: Review/ Study day
  - a. This review day is a “self study.”
    - i. I will give the students several options, and then they have to choose what activity they want to do.
    - ii. Tell the students that they are actively deciding on the BEST method of studying for them, and so they shouldn’t pick what their neighbor picked unless it is equally effective for them.
      1. They should pick what mode of studying will help them the most.
  - b. Start class off with an open discussion about questions and confusing area of bacteria and viruses.
    - i. Instruction on the problem areas will take up the necessary time.
  - c. Options

- i. Depending on the activity that the students used for review yesterday (either the Concept Map or Vocab relay), the other activity will be used today.
- ii. They students also have the opportunity to get out the netbooks/laptops/iPads and work on the Quizlet
  1. <https://quizlet.com/127231342/bacteria-and-virus-unit-7th-grade-flash-cards/original>
- iii. Make it known that both are very good options for studying, but that the students have to take it into their own hands in order to make their studying proactive.
  1. It is their choice to be productive and learn!
    - a. Remind the students that there is a Test on Monday, and that this is the last time I (as the teacher) can help answer questions or offer explanations.
    - b. Also remind them that having a study day is a privilege. If they work quietly and efficiently, they will continue to have study days for future tests.
      - i. If they do not work quietly and efficiently, this privilege will go away.
  - d. The rest of class is devoted to their studying.
  - e. **Test on Monday, study!**
  - f. Dismissal: Wish everyone a good rest of the day and a fantastic weekend.

**A**ssessment: I asked the students to come prepared with points of confusion about the bacteria and viruses, and so I will assess their ability to self-reflect on the knowledge that they have. I will also test their fluency through the vocab review game/excessive and independent study. Formative Assessment is used throughout the class period.



# Bacteria and Viruses Lesson 11

Grade level: 7<sup>th</sup> Grade

Subject area: Life Science

Materials Needed: Bacteria and Viruses Unit Exam, agar plates with bacteria cultures, goggles, and gloves

## Standard:

MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS1-1. \*\*Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

MS-LS2- 4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

## Objectives:

Students will be able to:

1. Prove their knowledge or growth in the area tested.

## Learning Activities:

- I. Week 3, Day 1: Bacteria and Virus Unit Exam
  - a. Spend the first 3-5 minutes going over the exam. Make sure to specify each section as well as the corresponding instructions.
    - i. Be sure to remind the students that there is a Bonus questions on the last page!
  - b. Pass out the exam, and for the 1<sup>st</sup> 5-10 minutes walk around the room making sure that the students are working independently.
  - c. Students can take as long as they need for the exam, and once the students are finished, they can work independently on other homework.
  - d. Depending on the amount of time left, once all the students are finished with their exam either continue to let them do their homework, or move to the results portion of the disinfection lab.
    - i. It is important that all the students have completely the test before the lab results are completed for two reasons:
      1. If half the class is still working on the test, they will not be as alert as a student should be during lab.

- a. This could increase the chance of accidents, since everyone isn't focused on being safe with the bacteria cultures.
    - b. Also they are not wearing goggles or gloves.
  - 2. Some students may not have enough time to complete both the exam and the lab, and so they would be behind for a bit. However, they should not be penalized for working hard on an exam.
  - 3. Therefore the completion of the lab is depending on 100% class participation
    - ii. Have the student don goggles and gloves as they handle the agar plates with the live bacteria cultures on them.
    - iii. Students should take out a piece of paper and write the questions and their corresponding answers legibly and with complete sentences.
      - 1. Conclusion Questions:
        - a. Compare growth of plates: which has more growth, which has less?
          - i. Did the hand sanitizer or the 409 kill all of the bacteria?
          - ii. Does the bacteria on each plate look the same to you?
        - b. Was your hypothesis incorrect or correct?
        - c. What can you do to decrease the spread of disease in schools or at home?
      - iv. All agar plates should be discarded in the hazard waste basket once results are recorded.
    - e. At the end of class give the students a heads up on the next unit. Also give them a tentative date as to which you will have the exams graded and handed back.
    - f. Dismissal: Wish everyone a good rest of the day.

**A**ssessment: Today's usage of the Exam provides my assessment for the Bacteria and Viruses' Unit. At this point they should have completed the following standards:

MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

MS-LS2- 4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.