

Unit Activities:

Setting the Stage,
Objectives, Bacteria Lab

Inquiry**Learning:**

1. Engage 2. Explore

Materials:

Supplies: Petri plates,
parafilm, hand sanitizer,
hand soap, sharpie
markers

Student**Handouts:**

-Bacterial Growth
Experiment: Set Up (pg.
12)

Activities:

*Setting the
Stage
(10 minutes)*

Purpose: To help students make connections between past and present learning experiences, lay the organizational ground work for the activities ahead and stimulate their involvement in the anticipation of these activities.

Displayed on board as students enter the room: **On a scale of 1-10, how clean do you think your hands are right now? (1= dirtiest, 10=cleanest). Make a list of 10 things you have touched since you last washed your hands.**

- Ask students to write down their response to the question. Allow 3-5 minutes for students to do so.
- Allow students to share their responses with the class.
- Pose questions for discussion
 - After considering the things you've touched, do any of you think you gave yourself too high a score?

*Inform
Learners of
the Objectives
(3 minutes)*

Tell students: **Today we are going to conduct a lab to learn about bacteria, where it grows, and how you can avoid getting sick from bacteria.**

**Learning
Objectives:**

Students will be able to:

1. Apply Scientific Method to conduct an investigation
2. Identify the variable and control in a scientific investigation
3. Follow appropriate lab rules and safety procedures

PA**Standards:**

3.2.7.B
3.2.7.C
3.2.7.D

Activities:*Bacteria
Growth Lab:
Set-up
(40 minutes)*

Purpose: To provide students with an opportunity to get directly involved with the scientific materials and develop a base of experience with new concepts.

- Follow the procedures of **Bacterial Growth Experiment: Set-Up** (pg. 12) sheet
- Provide each student with a lab sheet handout.
- Students should record their procedures as they set up the experiment.
- Remind students that there are 3 variables in their treatments:
 - Temperature of water
 - Length of time
 - Presence/absence of soap
- Ask each student (or lab group) to brainstorm a hypothesis for this experiment.
- Students will observe their Petri plates for two days and record their observations on their lab sheet.
- Refer to **Bacterial Colony Growth Descriptors** (pg.15) to help students describe their observations.
- Be sure to review **SAFETY Procedures** for Science Laboratories and Materials on **page 9**.

Unit Activities:

Review, Collect Data,
Bacteria Brainstorm,
Bacteria Lecture

Inquiry Learning:

3. Explain

Materials:

Supplies: Gloves,
Introduction to Bacteria
PP, computer

Student Handouts:

-Bacterial Growth
Experiment: Set Up (pg.12)
-Bacteria Concept Map
(pg.22)

Activities:**Review
(5 minutes)**

Daily Review Question: **Yesterday we set up a bacterial growth experiment. What do you think the bacteria will look like when you look at your Petri plates today? Today we are going to observe and collect data from your experiments and we are going to learn about bacteria.**

**Collect Data
(10 minutes)**

- Have students put on gloves and observe Petri plates. Students should write down observations of plates on Bacterial Growth Experiment worksheet.

**Brainstorming
About Bacteria
(10 minutes)**

- On a large piece of drawing paper (or the board) write the word: **Bacteria** large enough that all students can see it.
- Ask students to volunteer any information they know about bacteria.
- Record student responses in the format of a concept map on the drawing paper.
- At this stage, the focus is not on correct answers, merely on brainstorming to assess prior knowledge of the concept.
- Student knowledge will vary depending on how much prior learning they've had on bacteria.

Learning Objectives:

Students will be able to:

1. Accurately collect data in a scientific investigation
2. Connect prior knowledge to new concepts about bacteria
3. Understand basic differences between bacteria cells and plant and animal cells

PA Standards:

3.3.7.B

Activities:**Introduction
to Bacteria
Presentation
(20 minutes)**

Purpose: To help students begin to understand, in greater depth, the materials and concepts they explored in the previous activities.

Learner Level: Average-High

- Use the PowerPoint presentation *Introduction to Bacteria*
- Students should complete the graphic organizer **Bacteria Concept Map** during the presentation.
- Be sure to allow time for students to fill in their concept map throughout the presentation.

Learner Level: Low-Average

- Use the PowerPoint presentation *Introduction to Bacteria*
- Divide students into small groups of 2-3
- Assign each group one main heading from the **Bacteria Concept Map** graphic organizer
- Each group should listen carefully for all information related to their heading and fill in only their section during the presentation.
- After the presentation, have each group share what they recorded with the rest of the class so that each group has a complete concept map.

Unit Activities:

Review, Collect Data,
Complete Lecture, RAFT

Inquiry**Learning:**

4. Elaborate

Materials:

Gloves, Markers,
Construction Paper

Student**Handouts:**

Bacterial Growth
Experiment: Set-Up
(pg.12)

Activities:**Review**

(5 minutes)

Daily Review Question: **Yesterday we learned about bacteria. What did you learn yesterday that you did not know before? Today you are going to use your imaginations to share what you've learned about bacteria with others.**

Collect Data

(10 minutes)

Have students put on gloves and observe Petri plates. Students should write down observations of plates on Bacterial Growth Experiment worksheet.

Complete**Lecture**

(10 minutes)

- Finish discussing information from day before
- Make sure students have concept maps filled out
- Add to brainstorming chart about Bacteria from previous day

RAFT**Activity**

(20 minutes)

Purpose: To provide opportunities for students to expand on the concepts they have learned, make connections to other related concepts, and apply their understandings to the world around them.

- Display the RAFT chart on the overhead or board (page 24).
- Assign each student (or pairs) one of the roles. You may allow students to choose groups and assignments or make assignments based on ability levels and learning styles.
- Students will then assume the role of their assignment and create the prescribed product.
- Once the products have been completed, students should present their work to the class.

Example: Students will write as though they are a helpful bacteria writing to a group of teenagers. The writing will take the form of a rap song on the topic of "Can I help U?"

Learning**Objectives:**

Students will be able to:

1. Accurately collect data
2. Synthesize information about pathogens and helpful bacteria into a product that clearly communicates an understanding of bacterial growth

PA**Standards:**

3.3.7.B

Unit Activities:

Review, RAFT,
Aggregating Data

Inquiry**Learning:**

4. Elaborate

Materials:

Gloves, sharpie markers,
student Petri plates

Student**Handouts:**

-Bacterial Growth
Experiment: Aggregating
Data (pg. 28).

**Learning
Objectives:**

Students will be able to:

1. Interpret data collected from scientific investigation
2. Recognize sources of error and bias
3. Draw conclusions from data from a scientific investigation

PA**Standards:**

3.2.7.A
3.2.7.B
3.2.7.C

Activities:

Review
(5 minutes)

Daily Review Question: **Yesterday you started creating your RAFT assignments to share with your new knowledge of bacteria. Was it hard pretending to be bacteria? What was the hardest part of this assignment? Today you are going to present your RAFT products to the class and we are going to complete the lab experiment that you started on Monday.**

*Complete
RAFT activity*
(20 minutes)

- Have students finish and present RAFT activity from previous day

*Aggregating
Data*
(30 minutes)

- Aggregate the class data by recording student plate counts by treatment.
 - To save class time, consider passing around a form for students to record their plate counts on one day and presenting them with a completed data set when you begin this activity.
- Total and average the amount of growth in each treatment.
- Ask students to consider explanations for the trends and discrepancies they notice in the data.
- Pose questions for discussion:
 - Why are plate counts so different even in the same treatments? (washed for different amounts of time, touched doors after washing hands, pressed harder on Petri plates, etc.)
 - What surprises you about the results?
 - Do you think our data is accurate?
 - What could we do to make our results more reliable?
 - Were your hypotheses correct?
- Students should then draw conclusions based on the experiment results and answer **Questions for Consideration**.
- Be sure to review **SAFETY Procedures** for Science Laboratories and Materials (pg. 9).

Unit**Activities:****Inquiry****Learning:****Materials:****Student****Handouts:****Activities:****Review**
(5 minutes)**Generating a Researchable Question**
(30 minutes)**Microscope Introduction**
(20 minutes)

Review, Researchable Question, Microscope Introduction

4. Elaborate

Microscopes, slides, dropper bottles with water, toothpicks, iodine solution

-Generating a Researchable Question (pg.31)
-Microscope Lab Handout (pg. 33).

Learning**Objectives:****PA****Standards:**

Students will be able to:

1. Design a scientific investigation
2. Demonstrate understanding of controls and variables in a scientific investigation
3. Select appropriate tools and methods for a scientific investigation
4. Recognize basic parts of a compound microscope
5. Demonstrate appropriate care and use of compound light microscopes

3.2.7.A

3.2.7.B

3.2.7.C

3.2.7.D

3.7.7.D

- Daily Review Question: **Yesterday we gathered class data from your bacterial growth experiment. Were you surprised by the number of bacteria on your hands? Did any of you find yourselves washing your hands more often after class yesterday? Today you are going to work in groups to design a new experiment, and we are going to learn how to use a microscope.**
- Allow students to work in small groups to complete **Generating a Researchable Question (pg.31)**. Examples and possible answers for all lab follow-up activities are included on the Teacher's Copy of the **Bacterial Growth Lab: Generating a Researchable Question sheet (pg. 30)**.
- Encourage students to share their researchable questions and experiment design with the class.
- Students should complete the **Bacterial Growth Lab Self-Assessment (pg.32.)** once these activities are completed.
- The purpose of this activity is to familiarize students with the microscope before they view bacterial cells in a later lesson.
- Students should follow the procedures outlined on the Microscope Lab handout.
- Encourage students to pay close attention to detail when drawing their observations in the data sections.

Unit Activities:

Review, Complete
Microscope Introduction,
Edible Cells

Inquiry**Learning:**

4. Elaborate

Materials:

Edible Cell materials (see
pgs. 36-37)

Student**Handouts:**

Microscope Lab
Handout (pg.33),Edible
Cells Handout (pgs.36-
37).

Activities:**Learning
Objectives:**

Students will be able to:

1. Recognize basic parts of a compound microscope
2. Demonstrate appropriate care and use of compound microscopes
3. Recognize and understand major organelles in bacterial cells
4. Compare and contrast bacteria cells with plant and animal cells.
5. Apply safe food handling behaviors

PA

Standards:

3.3.7.B

3.7.7.B

**Review
(5 minutes)**

Daily Review Question: **Last week we learned a lot about bacteria, how it can help us, and how it can make us sick. Today we are going to build a model of a bacterial cell using food. What are some important safe food handling rules that we need to follow?**

**Complete
Microscope
Introduction
(10 minutes)**

Purpose: To familiarize students with the microscope before they view bacterial cells in a later lesson.

- Students should follow the procedures outlined on the **Microscope Lab** handout.
- Encourage students to pay close attention to detail when drawing their observations in the data sections.

**Edible Cells
(40 minutes)**

Purpose: To familiarize students with the structure of a bacterial cell while allowing them an opportunity to practice safe food handling.

- Decide which version of the **Bacteria Cell Model** activity you will use. Give each student a copy of the **Bacterial Cell Model** handout.
- Remind students to wash their hands thoroughly before beginning this activity and before eating.
- Use sanitizing wipes to clean and disinfect students' desks and other surfaces used in this activity before you begin.
- Lead students through the construction of their cell models.
- Explain each cell "component" as students are constructing their models.

Unit Activities:

Review, Staining Slides,
Reflection Writing

Inquiry**Learning:**

4. Elaborate 5.Evaluate

Materials:

Slides, clothes pins, loops, gloves,
sharpie markers, student Petri
plates, dropper bottles with stain,
dropper bottles with water,
sanitizing wipes, paper towels,
bleach disinfectant

Student**Handouts:**

-Preparing and
Staining Slides (pg.
39).

**Learning
Objectives:**

Students will be able to:

1. Evaluate size and shape of a bacteria cell as seen under a compound light microscope
2. Demonstrate an ability to accurately follow lab protocol
3. Clearly communicate a scientific understanding of cell shape and size through descriptions and sketches
4. Apply lab safety rules and procedures

PA

Standards:

3.7.7.D

Activities:

Review
(5 minutes)

Daily Review Question: **Yesterday we built edible models of bacterial cells. What were some of the cellular structures that were in your “cells”? Today we are going to prepare and stain slides of the bacteria you grew in Petri plates earlier last week. What do you expect to see on the slides?**

*Preparing and
Staining
Slides*
(40 minutes)

- Before beginning this activity, give some thought to the arrangement and traffic patterns of your classroom.
 - Consider setting up 4-7 work stations for students where they will complete all steps. This reduces traffic flow around the room and allows you to guide all students through the activity at once.
- Give each student a copy of **Preparing and Staining Slides**.
- Provide a complete demonstration of slide staining to familiarize students with the procedure.
- Remind students that they should not touch the colonies growing on their Petri plates with their fingers...only the loops. Petri plates should be closed immediately after use.
- Once students have observed their slides, they should answer the questions found on the bottom of the procedure handout.
- Be sure to review **SAFETY Procedures** for Science Laboratories and Materials on **page 9**.

*Reflection
Writing*
(10 minutes)

Purpose: To determine if students are successfully meeting the learning objectives for this lesson.

- Ask students to consider all they’ve learned about bacteria
- Have students write a paragraph response to the following:
 - **Imagine you have a sister in 1st grade. In language she can understand, explain to her what bacteria are, how it can make you sick, and how you can avoid getting sick from bacteria.**
- Encourage students to share their responses with the class