



6.3 – Microorganisms

Grade 6 Activity Plan

Reviews and Updates

6.3 Microorganisms

Objectives:

1. To introduce microorganisms and their subcategories.
2. To describe how microorganisms meet their basic needs.
3. To learn about ways to protect against unwanted microorganism growth.
4. To learn about disease prevention and spread.

Keywords/concepts: Microorganism, bacteria, viruses, fungus, germs, carbon dioxide, fermentation, disinfectant, agar

Curriculum Outcomes: 108-8, 204-1, 204-6, 204-8, 205-8, 206-9, 300-15, 300-19, 302-12.

Segment	Details
African Proverb and Cultural Relevance (5 min.)	"The frog wanted to be as big as the elephant, and burst." Ethiopia
Demo 1 Part 1 (2 min.)	Demo 1 is set up by passing around the item with powder on it and shaking student's hands.
Background (15 min.)	What are microorganisms? Where do they come from? How do they live? There are six types of microorganisms (bacteria, archaea, protozoa, algae, fungi, and viruses) but we will focus on the main three: bacteria, fungi and viruses. Explain the differences between the three types. Helpful and harmful microorganisms. Explain germs. The debate about viruses.
Demo 1 Part 2 (10 min.)	Use <i>Glitter Bug</i> powder to demonstrate the spread of bacteria and viruses. Discuss cross contamination in food, the spread of diseases and ways to control the growth of unwanted microorganisms.
Activity 2 (15 min.)	Demonstrate how microorganisms meet their basic needs by growing yeast in various conditions. Explain that the yeast gives off a gas called carbon dioxide when it eats the sugar, which is what blows up the balloon. This is called fermentation.
Activity 3 (30 min.) + (10 min. the following week)	Demonstrate the growth of bacteria using samples from various surfaces. Explain that individual bacteria can only be seen with a microscope but they reproduce so rapidly that they can form colonies that we can see.
Post-test (10 min.)	Microorganism crossword

Suggested interpretation of the proverb:

You should be happy with the way you are because changing yourself might not always be the best option. Today we will be learning about microorganisms. Although they are small and we don't think about them on a daily basis life on earth would be vastly different or even non-existent without them.

Background Information

Microorganisms

Microorganisms, also called microbes, are extremely tiny organisms that can only be seen under a microscope. Microorganisms are one of the most diverse organisms and they include bacteria, fungi, archaea, protozoa, algae, fungi and viruses.

Debate about viruses

Some scientists do not classify viruses as microorganisms as:

- a) They can't reproduce on their own. They need to infect or invade a host cell. That host cell will do all the work to duplicate the virus.
- b) They don't respond to anything. You can poke them or set up barriers, it doesn't matter. They either function or they are destroyed.
- c) They don't really have any working parts. While there some advanced viruses that seem fancy, viruses don't have any of the parts you would normally think of when you think of a cell.

Bacteria

Bacteria are the simplest of creatures that are considered alive. Bacteria are everywhere. They are in the bread you eat, the soil that plants grow in, and even inside of you. They are very simple cells that fall under the heading prokaryotic. That word means they do not have an organized nucleus. Bacteria are small single cells whose whole purpose in life is to replicate. There are three basic types of bacteria:

- a) Spherical bacteria are in the shape of little spheres or balls. They usually form chains of cells like a row of circles.
- b) Rod shaped bacteria look like the *E. coli* living in your intestine. You can imagine a bunch of bacteria that look like hot dogs. They can make chains like a set of linked sausages.
- c) Spiral shaped bacteria twist a little. Think about balloon animals for these shapes. It's like a balloon animal in the shape of a corkscrew.

Bacteria do just about everything. Some help plants absorb nitrogen (N) from the soil. Some cause diseases like botulism. Some bacteria even live inside the stomachs of cows to help them break down cellulose. Cows on their own can digest grass and plants about as well as we do. They don't get many nutrients out of the plants and can't break down the cellulose. With those super bacteria, the cellulose can be broken down into sugars and then release all of the energy they need.

Fungus

Fungi are classified within their own kingdom - The Kingdom Fungi, while some are in The Kingdom Protista. A fungus is neither a plant nor an animal. It is similar to a plant, but it has no chlorophyll and cannot make its own food like a plant can through photosynthesis. They get their food by absorbing nutrients from their surroundings. Many fungi play a crucial role in decomposition (breaking things down) and returning nutrients to the soil. They are also used in medicine, an example is the antibiotic penicillin, as well as in industry and food preparation.

Types of fungus:

- a) Club fungi: Let's look at Club Fungi first. Mushrooms! Everyone knows about these fungi. So what is a mushroom or a puffball? Bunches of strands living underground are called hyphae (pronounced hi-fah). Those strands are the basic fungus in action, decomposing leaves, or rotting bark on the ground. When it's time to reproduce, they develop a stalk and cap. The mushroom that you see popping out of the ground. It's only one part of the fungus. On the bottom of that cap are a set of gills that have little clubs with fungus spores.
- b) Zygote fungi (ex moulds): These have hyphae-like mushrooms but they reproduce in a different way. When it's time to make more fungi, they create a stalk and release something called zygospores (thus the name zygote). When your bread gets old and green or black, you are seeing a type of zygote fungus in action. If you wait long enough, you will see the stalks develop and the zygotes released.
- c) Sac fungi: Let's finish up by looking at Sac Fungi, simple, single celled fungi. Yeast is used to make several types of food for humans. We need yeast to make breads. We also use them to make alcohol. It's a whole process called fermentation. Sugars are broken down in an environment without oxygen. It's called anaerobic fermentation. And voila, alcohol. Even though they are single celled, you may find them in colonies. They reproduce very quickly and hang out together. It takes a lot of them (because they are so small) to get a lot of work done.

Germs

Microorganisms that cause disease.

Agar

A gelatinous material obtained from marine algae, especially seaweed, used as a medium for growing bacterial cultures in the laboratory and as a thickener and stabilizer in food products.

References:

<http://www.neok12.com/Microorganisms.htm>

http://www.biology4kids.com/files/micro_virus.html

http://www.biology4kids.com/files/micro_bacteria.html

http://www.biology4kids.com/files/micro_fungi.html

Demo 1: How germs spread

Purpose: To show how easily germs spread and the importance of hand washing in disease prevention.

Suggested format: Start this activity before the background information and conclude it after.

Item	Quantity (10 students)
Glitter Bug powder	1 bottle https://www.brevis.com/search?q=powder
Backlight	1
Items to put Glitter Bug powder on (ex. Tennis ball)	1

Procedure:

- 1) **TO BE DONE BY MENTOR PRIOR TO ACTIVITY:** Cover the items with *Glitter Bug* powder and rub it in so that it is invisible. Put extra powder on your hands.
- 2) Pass the items around the classroom so that all of the students can touch them. Shake student's hands and touch various items (ex. Light switches, door handles, and desks). Do not tell the students about the powder.
- 3) After all of the students have touched the items tell them that the items had fake germs on them that will glow under blacklight.
- 4) Turn out lights and take ultraviolet light around room and have participants come forward to observe their hands under the blacklight.
- 5) Use the blacklight stick to trace the "germs" from the objects to their hands face, tables etc.
- 6) How did the germs spread? How can we prevent them from spreading?

The science:

Microorganisms are a lot like this powder. Microorganisms can be everywhere, even though we can't see them without the use of a microscope.

Reference:

<http://www.health.state.mn.us/handhygiene/curricula/curriculumadult.pdf>

(Rubber Chicken and Blacklight)

Activity 1: Growing Yeast

Purpose: To show how microorganisms meet their basic needs.

Suggested format: Students work in pairs. This activity can be set aside and the next activity can be started while waiting for the yeast to react.

Item	Quantity (10 students)
Plastic soda bottle	5
Packet of yeast	5
Small balloons	5
Spoons	5
Funnel	5
Warm water	~2 litres
Cold water	~2 litres
Honey	2 tablespoons
Sugar	2 Tablespoons

Procedure:

- 1) Fill up the bottle with about 1 inch of water (refer to the combination table below for the temperature).
- 2) Add the entire yeast packet and gently swirl the bottle for a few seconds.
- 3) Add one tablespoon of sugar (depending on the combination this step can also be honey or nothing) and gently swirl again.
- 4) Blow up the balloon a few times to stretch it out then place the neck of the balloon over the neck of the bottle.
- 5) Have the students hypothesize about which balloon will blow up the most and why.
- 6) Let the bottle sit in a warm place for about 20 minutes.

Combination table:

Combination #	Water temperature	Sweetener
1	Cold	Sugar
2	Warm	Sugar
3	Warm	None
4	Cold	None
5	Warm	Honey
6	Cold	Honey

Reference:

<http://sciencebob.com/blow-up-a-balloon-with-yeast/>

The science:

Yeast is a type of fungus. If you open up a package of baker's yeast bought from the supermarket and sprinkle some out, you'll see tiny brownish grains. These are clumps of dehydrated yeast cells. The yeast filled up the balloon with CO₂ using a process called fermentation. All living things respire but yeast can do it

without oxygen. The sugar in the water fed the yeast, and the yeast filled the balloon with CO₂. The smell the yeast made was alcohol, which is another by-product of fermentation. All alcoholic beverages are made by the fermentation induced by various types of yeast. Most breads are made using yeast. When bread is made, the yeast becomes spread out in flour. Each bit of yeast makes tiny gas bubbles and that puts millions of bubbles (holes) in our bread before it gets baked.

Activity 2: Growing bacteria

Purpose: To show and understand the growth and spread of bacteria in different locations. To understand the importance of disinfectants and cleaning. To describe products and techniques that can be used at home to prevent against unwanted microorganism growth.

Suggested format: This activity will take one week to set so it will be concluded the following week. Students using the same surface should pair up for simplicity.

Item	Quantity (10 students)
10 cm (3.5") diameter petri dishes	10 (Optional: plus an extra to use as control)
Cotton swabs	10
Nutrient agar	125ml bottle
Rubber gloves	20 pairs (Plus mentors)
Clear tape	1 roll
Sharpie	5
Lysol disinfectant wipes	1 package
Hand sanitizer (available at most schools)	1 small bottle
Sandwich sized Ziploc bags	10 (Optional: plus an extra for the control)
Plastic goggles	1
Apron	1
Garbage bag	1
Bleach	1 Litre

Procedure:

Part 1 (Preparing the petri dishes) TO BE DONE BY MENTOR PRIOR TO ACTIVITY:

- 1) Petri dishes must be completely sterilized before they are used for growing bacteria, otherwise the results of the experiment could be affected. Newly purchased petri dishes should come pre-sterilized and sealed in plastic packaging.
- 2) Place the bottle of nutrient agar in a hot water bath at about 80-90°C until all of the agar is liquid.
- 3) Let the agar cool to about 40-50°C or until the bottle is warm but not too hot to touch.
- 4) Put on rubber gloves.
- 5) Slide open the cover of the petri dish just enough to pour agar into the dish. Don't let the bottle mouth touch the dish. Cover the dish

immediately to avoid contamination.



- 6) Tilt the dish back and forth gently until the agar coats the entire bottom of the dish.
- 7) Let the petri dishes stand one hour for the agar to solidify before using them.
- 8) Wash hands.

Part 2 (Starting the experiment):

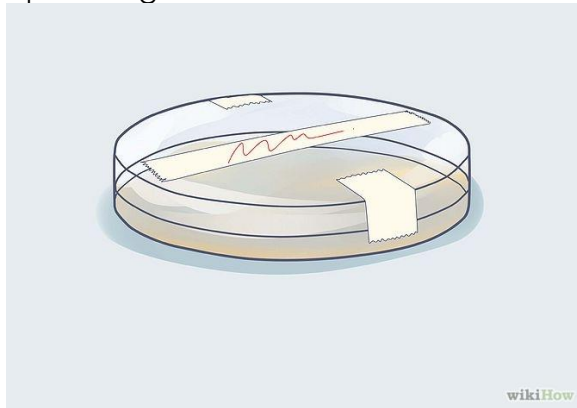
- 1) **TO BE DONE BY MENTOR (Optional):** Label one uncontaminated petri dish of agar "control" with a sharpie (you can place a piece of tape over the writing) and tape it shut. Seal it in a Ziploc bag.
- 2) **Students:** Put on a pair of rubber gloves.
- 3) Brainstorm surfaces to swab that the students think have the most bacteria. Suggested areas to swab:
 - a. Hands
 - b. Cell phone
 - c. Keyboard
 - d. Light switch
 - e. Soap dispenser

Note: While trying to find the grossest surfaces and areas to swab is fun, it can also be dangerous. Sample areas that don't pose extreme risks.

- 4) Have one partner roll their cotton swab on their chosen surface then have the second partner disinfect the same surface with a Lysol wipe and then swab (if they are swabbing a hand use hand sanitizer instead of Lysol wipes).
- 5) Gently remove the cover of the petri dish.
- 6) Lightly draw a zigzag pattern in the agar with the end of the cotton swab.



- 7) Cover the petri dish with the top half. Label the dish with the sharpie (you can place a piece of tape over the writing) and tape it shut. Seal it in a Ziploc bag.



- 8) Place the dishes in a warm dark place to grow.
- 9) Wash hands.
- 10) Discuss which surface they think will breed the most bacteria and why. Take a vote and save the results for the following week.

Part 3 (Viewing and discussing the bacteria) Following week:

- 1) **TO BE DONE BY MENTOR:** Display the petri dishes at the front of the classroom; order them with the pairs together.
- 2) If students want to examine the dishes have them wear gloves and make sure that they don't open the dishes or Ziploc bags as the bacteria can be harmful.
- 3) Wash hands.
- 4) Discuss which surface breed the most bacteria and compare it to the vote last week. Are the results surprising?
- 5) Discuss ways to reduce harmful bacteria.

Part 4 (Disposing of Bacteria) TO BE DONE BY MENTOR:

- 1) Before you attempt to dispose of your petri dishes, you first need to take the proper safety precautions: Protect your hands from the bleach by

- wearing rubber gloves, protect your eyes with plastic goggles and protect your clothes by wearing an apron.
- 2) Open the petri dish and carefully pour a small amount of bleach on top of the bacteria colonies, holding the dish over a sink. This will destroy the bacteria.



- Note: Be very careful not to let any of the bleach touch your skin, as it will burn.
- 3) Place the disinfected petri dish into a Ziploc bag and dispose of the bag in the trash.

References:

<http://www.wikihow.com/Grow-Bacteria-in-a-Petri-Dish>

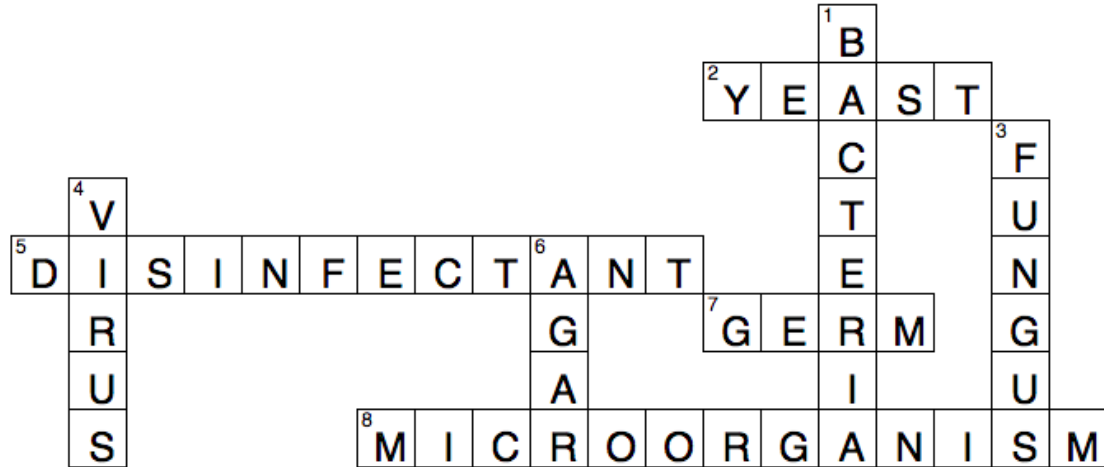
<http://www.hometrainingtools.com/a/bacteria-experiment-guide>

<http://www.stevespanglerscience.com/lab/experiments/growing-bacteria>

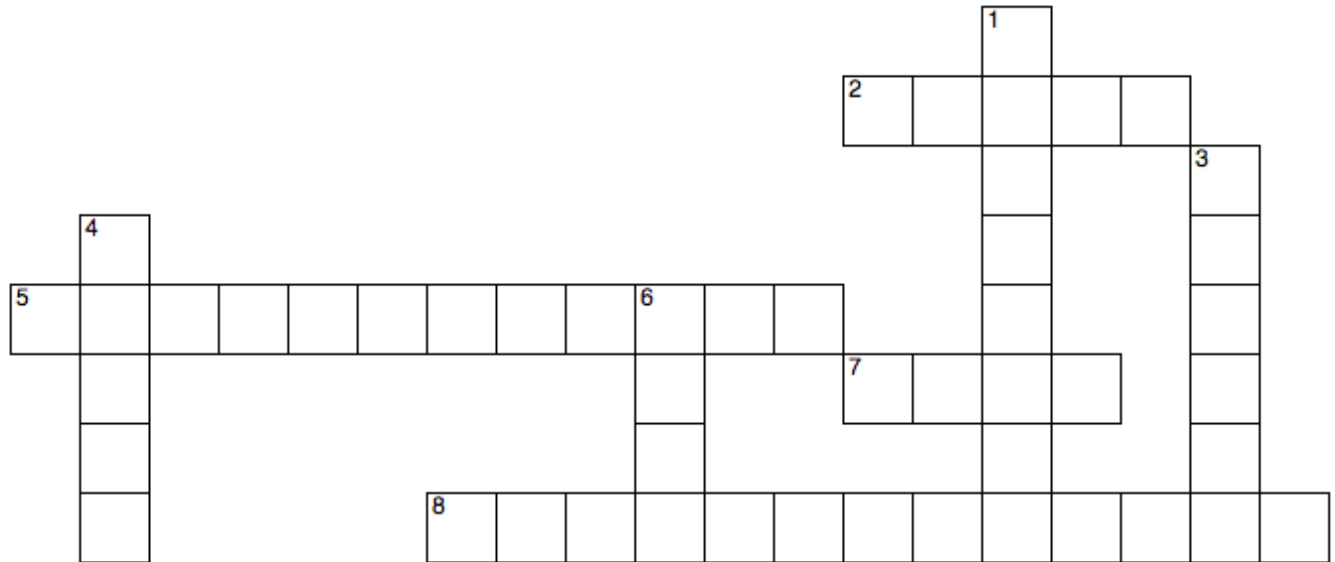
Post Test

Print off the "Microorganism Crossword" worksheet.

Answers:



Microorganism Crossword



Across

- 2 A type of fungus used to make bread.
- 5 A chemical liquid that destroys bacteria.
- 7 A microorganism that causes disease.
- 8 Extremely tiny organism that can only be seen under a microscope.

Down

- 1 Single celled microorganisms that can be found almost everywhere.
- 3 A type of microorganism that gets food by absorbing nutrients from its surroundings.
- 4 A type of microorganism that can't reproduce without a host cell.
- 6 A Jelly-like substance, obtained from marine algae, used as a medium for growing bacterial cultures in the laboratory.

Materials list

Materials	Source	Cost
Glitter Bug powder	Brevis https://www.brevis.com/search?q=powder	\$18.00 (1 bottle, 8oz)
Backlight	Home Depot http://www.homedepot.com/p/Unbranded-28-LED-UV-Flashlight-900221/203772119	\$19.97 (1 UV Flashlight, 28 LED)
Items to put Glitter Bug powder on (ex. Tennis ball)	Walmart http://www.walmart.ca/en/ip/3-tennis-ball-pack/6000157340045	\$1.88 (3 tennis balls)
Plastic soda bottle	Walmart http://www.walmart.ca/en/ip/pepsi/6000016941356	\$1.97 (1 bottle of Pepsi)
Packet of yeast	Walmart http://www.walmart.ca/en/ip/fleischmanns-quick-rise-instant-yeast-strips/6000132108868	\$1.88 (3 packs of instant yeast)
Small balloons	Walmart http://www.walmart.com/ip/9-Standard-Color-Balloons-Pack-of-100/33455896 Activity bins: 7.3, 7.7, 8.1, 8.4 and 9.5	\$7.10 (100 balloons, 9")
Spoons	Walmart http://www.walmart.ca/en/ip/great-value-clear-plastic-spoons/6000191349719 Activity bin: 8.8	\$1.00 (48 spoons)
Funnel	Walmart https://www.walmart.ca/en/ip/quickfill-funnel/6000162308402	\$2.00 (1 funnel)
Warm water	On site	-
Cold water	On site	-
Honey	Activity bin: 7.9	-
Sugar	Walmart	\$1.97 (1 bag, 2kg)

	http://www.walmart.ca/en/ip/redpath-granulated-white-sugar/6000023803963	
*Nutrient agar kit (easier than buying everything separate)	We Enable Science https://ca.vwr.com/store/catalog/product.jsp?product_id=8882266	\$32.85 (Pour Pack) -3 Bottles of Agar (125 ml) -20: 100mm x 15mm Sterile Petri Dishes with Lids
Cotton swabs	Activity bin: 9.2	-
Rubber gloves	Activity bins: 7.1, 7.8, 8.1, 8.2, 8.4 and 9.2	-
Clear tape	Activity bins: 8.1, 8.6, 8.9, 9.5 and 9.8	-
Sharpie	Walmart http://www.walmart.ca/en/ip/sharpie-fine-point-permanent-markers-black-5-pack/6000016952933	\$3.00 (5 markers)
Lysol disinfectant wipes	Walmart: http://www.walmart.com/ip/Lysol-Disinfecting-Wipes-Lemon-Lime-Blossom-Scent-80-ct/14711712	\$4.66 (80 wipes)
Hand sanitizer (available at most schools)	Walmart: http://www.walmart.com/ip/Purell-Advanced-Refreshing-Gel-Hand-Sanitizer-8-fl-oz/24447243	\$2.87 (1 bottle, 8 floz)
Sandwich sized Ziploc bags	Activity bins: 7.4 and 8.6	-
Plastic goggles	Activity bin: 7.7	-
Apron	Walmart: http://www.walmart.com/ip/Canvas-Corp-Twill-Adult-2-Pocket-Apron/23081066	\$4.98 (1 apron)
Garbage bag	Activity bin: 9.2	-
Bleach	Activity bin: 8.2	-