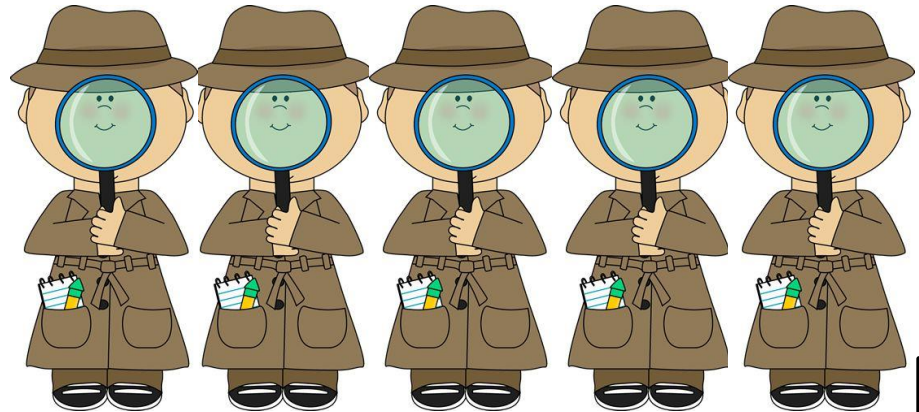


Plants Week 5 Booklet

- Living vs. Non-Living
 - Foss Investigation #4 Domains
 - Part 3: Fungi
- Not in Foss-
- Fungi-Categorization & Obtaining Energy
 - Fungi-Tropisms



Fungi Vocabulary

2

Word	Definition
1. heterotroph	Need to eat other organisms to get energy.
2. autotroph	Plants who make their own food (sugar/glucose) through photosynthesis using sunlight.
3. eukaryotic	Cells that have a nucleus.
4. prokaryotic	Cells that do not have a nucleus.
5. unicellular	Single-celled organism.
6. multicellular	More than one celled organism.
7. fungi	Live in moist environments include microorganisms such as yeasts, molds as well as multicellular organisms such as mushrooms. Heterotrophs that obtain energy in three ways: saprophytic, parasitic, symbiotic.
8. saprophytic	Fungi that get their energy from decaying organic matter.
9. parasitic	Fungi that feed on other living organisms (host) and harm the host.
10. symbiotic	Fungi that feed on other living organisms (host) but do not harm the host. In many cases the host benefits from the fungi.
11. hyphae	Fungi lack a root system so they use long fibrous strands that allow the fungus to obtain water and nutrients. Hyphae growth is influenced by stimuli and will grow toward a food source, water or even toward reproductive units of other fungi. A mass of hyphae is called <u>mycelium</u> .
11. fruiting structures	Fungi are categorized based on their fruiting structure (structures for reproduction and spore dispersal).

Quick Write Date: _____

What do you know about fungi?



3

Draw your LINE OF LEARNING here. Date when your ideas have changed. Date: _____

Protists & Fungi Rap

This ones for them protists, In Kingdom Protista
I'm talking bout, euglena, paramecium, amoeba
In loco-motion, trying to explore
Gotta obtain that energy, I mean we all need that for
sure

Who knew that? Yes ma'am
That protists are single celled
Who knew that? Yes ma'am
Protists live in moist environments
Who knew that? Yes ma'am
How I move can tell you who I am
Who knew that? Yes ma'am
Just trying to find that energy

Break it down,

Euglena whipping that flagella Whoa
Paramecium hairy cilia Whoa
Pseudopods are false feet on amoeba Whoa
Are you getting what I'm saying to you
Are you getting what I'm saying to you
Are you getting what I'm saying to you
Raise your hand and tell if you're not and if you
Don't believe me just watch...come on

Stop! Wait a minute!
Bout to put another Kingdom in it
Fungi, like yeast and mold, mushrooms, don't forget
Saprophytic, Parasitic, Symbiotic as well
Are three ways they get energy, they gotta live on
something else

Who knew that? Yes ma'am That fungi are
heterotrophs
Who knew that? Yes ma'am They reproduce using
spores
Who knew that? Yes ma'am My Fruiting body tells
you who I am
Who knew that? Yes ma'am Just trying to find that
energy

Break it down,

Decaying matter saprophytic Whoa
If you harm the host its parasitic Whoa
If you help the host its symbiotic Whoa
Are you getting what I'm saying to you
Are you getting what I'm saying to you
Are you getting what I'm saying to you
Are you getting what I'm saying to you
Raise your hand and tell if you're not and if you
Don't believe me just watch...come on

4



Thank you to Danielle Watson for the great rap! ☺

Quick Write Date: _____

**Focus Question: What evidence is there
that fungi are living organisms?**



5

Draw your LINE OF LEARNING here. Date when your ideas have changed. Date: _____

LAB: #4 Domains-Part 3 Fungi

- 1. Where do you find fungi?**
- 2. What do fungi look like?**
- 3. What are examples of different kind of fungi?**
- 4. What role do fungi play in the environment?**
- 5. Are fungi living or nonliving?**

On Friday of Week 3: Set Up Bread Mold Cultures

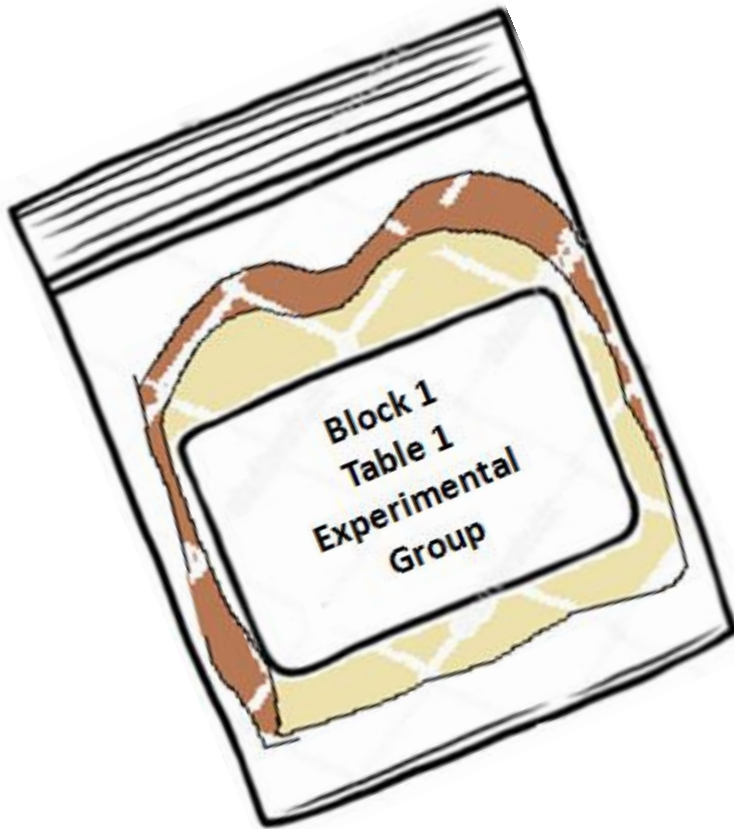
The Case of the Moldy Bread



Teacher:

1. Get fresh bakery bread without preservatives and slice in at least 32 slices (enough for 8 groups/8 tables).
2. Teacher will label with a permanent marker on a single Ziplock bag as CONTROL GROUP and she will place one slice of bread into the bag. She will seal the bag allowing for some air to be in it. The bag should be puffy. The top of the bag should not rest on the bread.

The Case of the Moldy Bread



Students:

1. Take a permanent marker and label a Ziplock bag (Block 1, Table 1, Block 2, Table 2 and etc.). On your bag write: EXPERIMENTAL GROUP.
2. Wipe one side of your bread over a surface in the room to be tested (this will expose it to the elements). We call this inoculated. Make sure that you place it in the bag with the inoculated side up.
3. If the bread is very dry, mist the surface lightly. The bread should not be soggy. Place a moist cotton ball inside the bag.
4. Zip the bag shut with some air inside. The bag should be puffy. The top of the bag should not rest on the bread.
5. Tape the bag shut.
6. Fill out your form entitled, "Observing Fungi" and record where the sample was taken. Write a description in words and draw a 2-D Model of the bread and any mold that appears.
7. Store the bags on a tray in a dark cabinet.
8. These will be observed for three days.

Observing Fungi

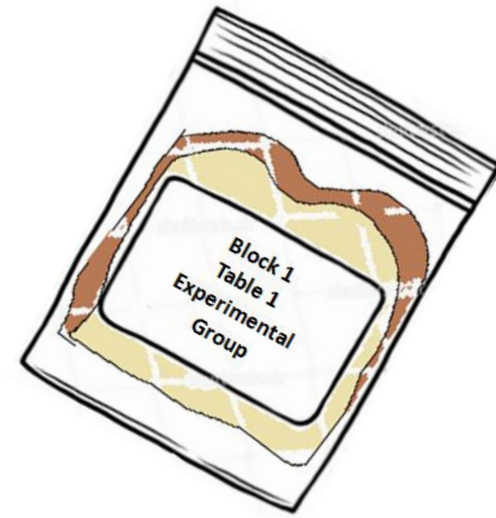
LAB: #4 Domains-Part 3 Fungi

Date	Description of bread (include number of colonies)	Drawing of bread
	Sample taken from	
	Observations	
	Observations	
	Observations	



LAB: #4 Domains-Part 3 Fungi

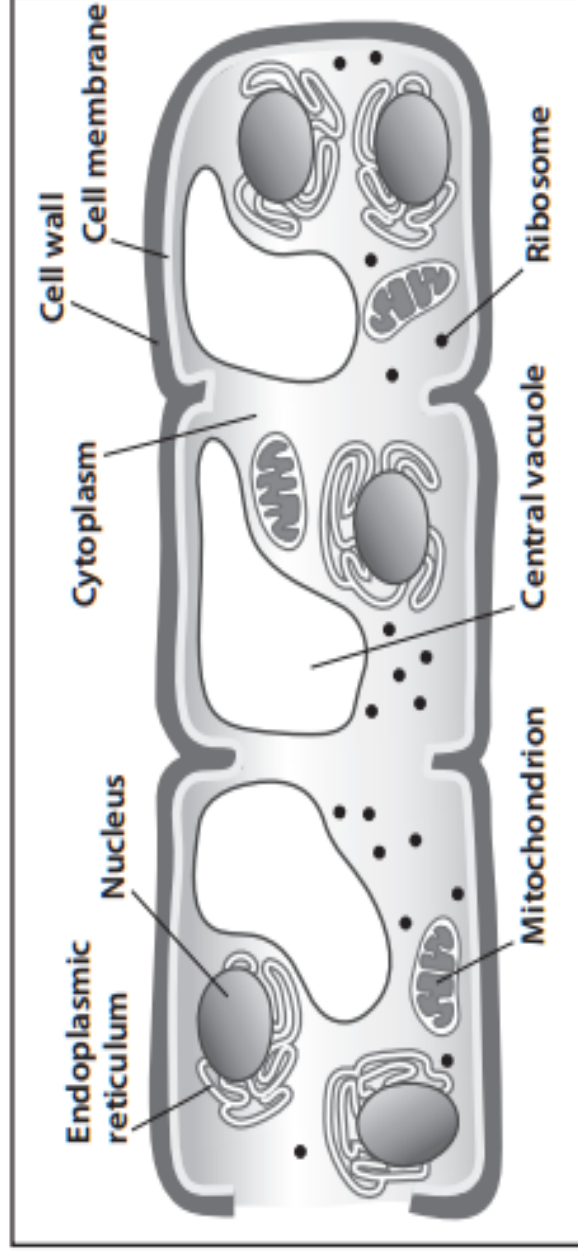
FINAL DAY OF BREAD MOLD INSPECTION



10

1. Inspect your bread mold. What changes do you notice?
2. What causes the colonies to appear?
3. What colors were the first colonies?
4. What colors appeared later?
5. Using your hand lens, look at the bread mold again. What do you see?
6. Look at the teacher's bread in the CONTROL GROUP bag. What differences do you see from your EXPERIMENTAL GROUP bag?
7. What similarities do you see?
8. What possible reasons can you give for these differences or similarities?
9. Was there mold already on the bread?

Fungal Cell Structures and Functions



Cell structure	Function
	Cell boundary that controls what enters and leaves the cell.
	A rigid layer that supports the cell and provides shape.
	Internal fluid that contains the cell structures.
	A membranous structure that assembles proteins and parts of the cell membrane.
	Converts the energy in food into usable energy for the cell.
	Contains the cell's genetic material (DNA), which determines the nature of cell structures and substances.
	Makes proteins. (Found either free or bound to the surface of the endoplasmic reticulum.)
	Stores water and other substances, and provides structure and support for the cell.



and

12

Step 3: Place your card on a tray and leave it overnight in a closed cabinet.

[illegible]

Block 1, Table 1

LAB: #4 Domains-Part 3 Fungi



Teacher: Have the students get their mushroom print cards and hand lenses.

*Cover each index card with clear packing tape to secure the print.

**Tape your piece
of the
Mushroom
Spore Print
here.**



13

1. Carefully look at your mushroom print. What do you notice?
2. Where did they come from?
3. Fungal spores travel in three ways. Write them down.

W _____ W _____ A _____

*Cut the index card into four even sections. Tape your piece of the card on the top right hand corner where there is a blank box on this page.

Sample Food of Fungi

LAB: #4 Domains-Part 3 Fungi
Teacher: Give every group one small sample
plate of Food of Fungi. 😊

14

Mushrooms

Bread

Cheese

Is the mushroom a
single-celled or
multicellular organism?

How do you know?

Yeast is a single-celled fungus. Which lab did we
first discover yeast?

When did we encounter it again?

What is the texture of the bread?

What did you notice about it?

Where did the holes come from?

How does the yeast cause the holes to form as the
bread rises?

Gorgonzola
cheese is made
of cow's milk.
Spores of a
mold are added
and during an
aging process
metal rods are
inserted and
moved to create
air channels.
The mold spores
grow into long
strands that we
call hyphae,
which cause
veining.

Characteristics of Fungi

Fungi are classified into the K____ F____. This includes microorganisms such as yeast and molds as well as multicellular organisms such as mushrooms.

Three Main Ways Fungi Obtain Energy

Saprophytic

Fungi that get their energy from decaying organic matter.



"Dude, you won't feel a thing, you are already dead!"

PARASITIC

Fungi that feed on other living organisms (host) and harm the host.



"Dude, get away from me, you make me sick."

Symbiotic

Fungi that feed on other living organisms (host) but do not harm the host. In many cases the host benefits from the fungi.



"I help you, you help me, we are friends!"

In most cases, fungi are NOT mobile organisms.

Remember the Rap? Are three ways they get energy, they gotta live on something else . . . Who knew that? Yes ma'am Just trying to find that energy .

Characteristics of Fungi

Three Ways Fungi Can Be Categorized
#1 Their F_____ structures
#2 Their structures for R_____
#3 Their method of S_____ dispersal

Remember the Rap?
Who knew that? Yes ma'am . . .
My Fruiting body tells you who I am . . .

Fungi are able to respond to information from their environment to ensure survival of the organism. Fungi, like plants, respond to stimuli from the environment.

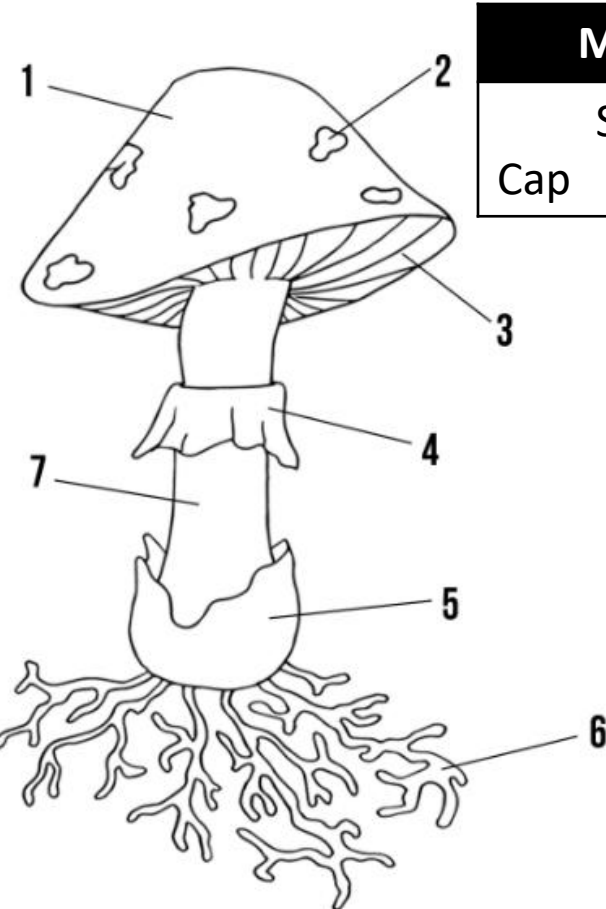
Fungi and Plant Tropisms

T_____-the turning of all or part of an organism in a particular direction in response to an external stimulus.

Fungi/Plant Tropism	Fungi, Plant or both	Draw 2-D Model	Stimulus	Response
Phototropism				
Thigmotropism				
Hydrotropism				
Gravitropism or Geotropism (including negative gravitropism or negative geotropism)				*As the fungal species mature, they tend to display negative gravitropism.
Temperature				

Characteristics of Fungi

Fungi are able to respond to information from their environment to ensure survival of the organism. Fungi, like plants, respond to stimuli from the environment.



Mushroom Parts Word Box					
Stem	Hyphae/Mycelium				
Cap	Cup	Ring	Scales	Gills	

Label the mushroom using the word box above.

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____
- 6. _____
- 7. _____



"YOU ARE RIGHT; IT DOES APPEAR TO BE SOME SORT OF FUNGUS."

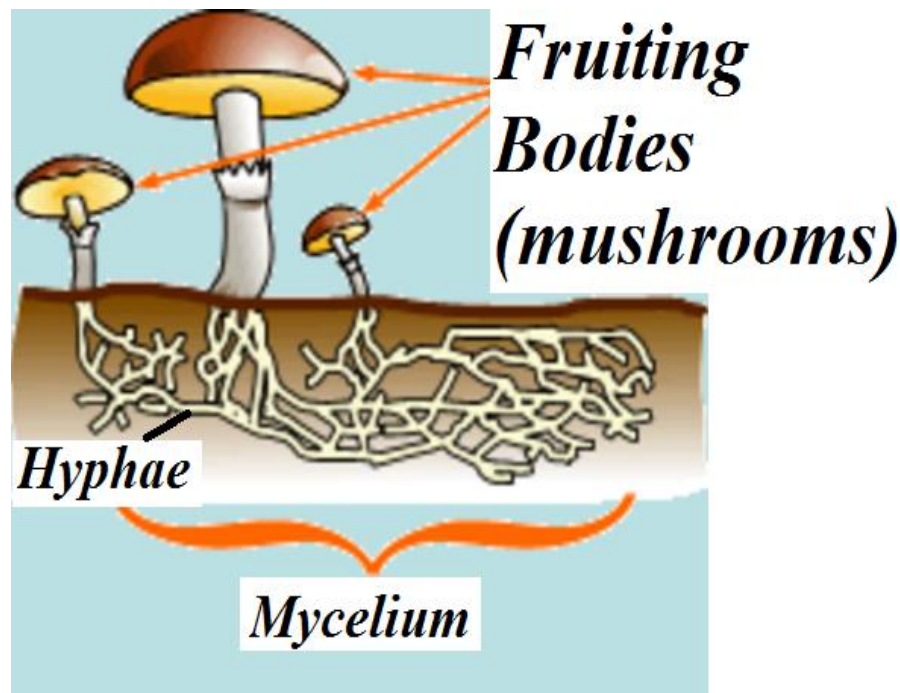
Remember the Rap?
Who knew that? Yes ma'am . . . My Fruiting body tells you who I am . . .

Characteristics of Fungi

- In early development, many species will grow in response to light (P_____) or away from gravity (G_____ or Geotropism). However, as the fungal species mature, they tend to display N_____ Gravitropism.

Because fungi L_____ a R_____ S_____, they use hyphae.

- H_____ -are long fibrous strands that allow the fungus to obtain water and nutrients.
- Hyphal growth is greatly influenced by stimuli and will grow toward a food source, water, or even toward reproductive units of other fungi.
- Collectively, a mass of hyphae are referred to as a M_____.



What did Mr. Fungus say to Ms. Algae, when he proposed? I lichen you!

Why did the mushroom go to the party? Because he was a fun guy. Why did he leave the party? Because there wasn't mushroom! ☺



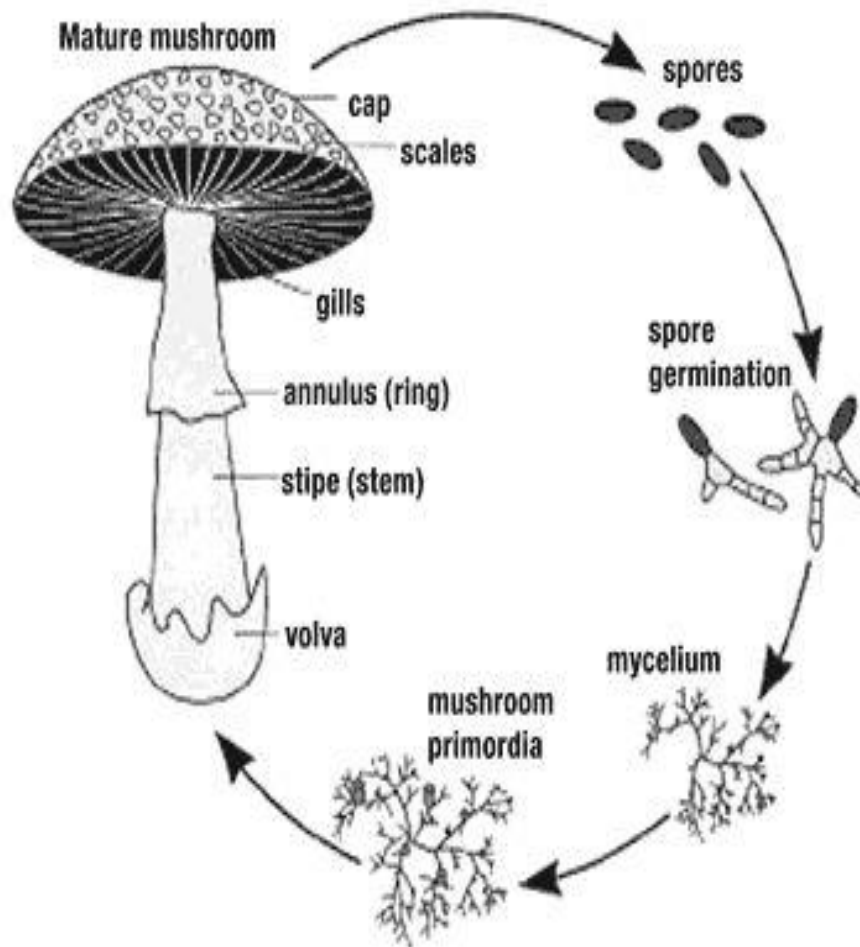
Characteristics of Fungi

Reproduction-Spores



Fungi can reproduce both Asexually and Sexually.

Sexually=ex. mushroom spores



Asexually=ex. bread mold spores

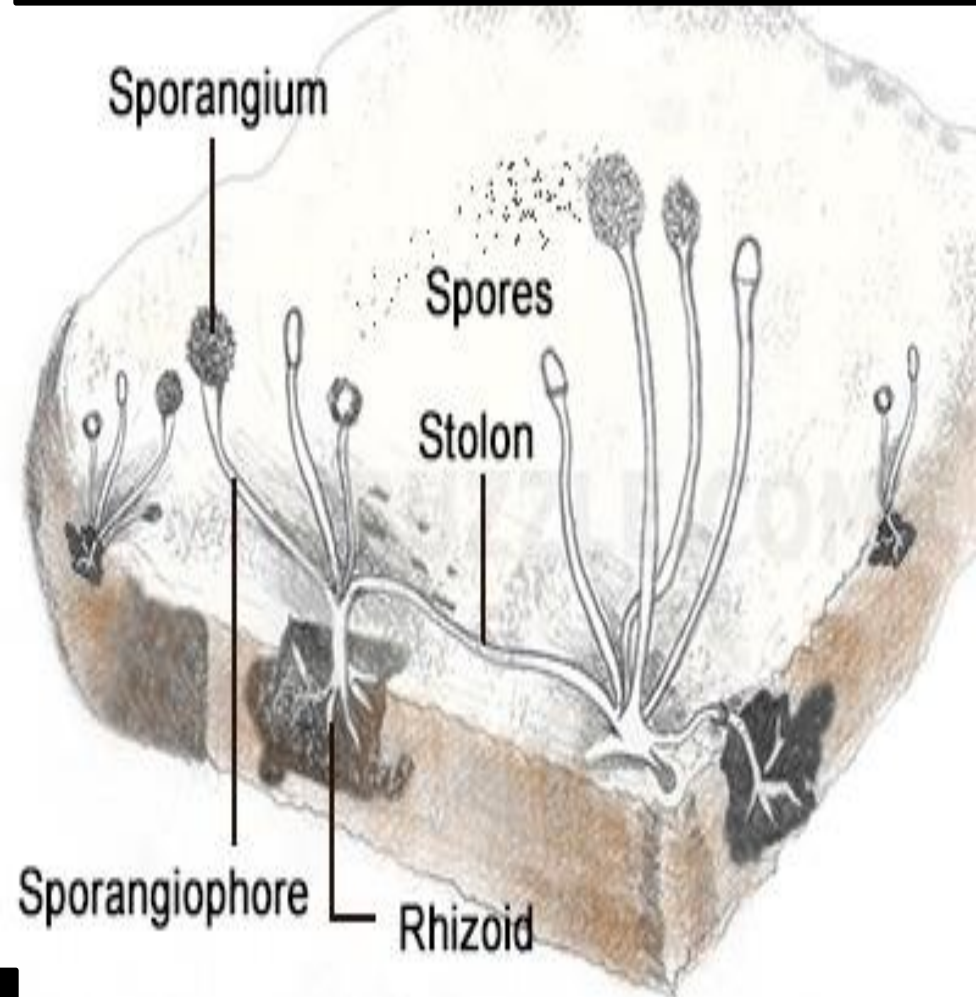


Illustration by Snehal Motkar

What did one mushroom say to the other mushroom? Your one fungi to be with! ☺

Based on my way to obtain energy, what kind of fungi am I?

Fungal Type:

**Example:
Mushrooms**



Characteristics:

Fungal Type:

**Example: Mildew
on Cucumber leaf**



Characteristics:

Fungal Type:

**Example:
Lichen**



Characteristics:

Fungi are Alive!

Cross-Curricular Focus: Life Science



You might think that all living things are classified as either plants or animals, but there are some mysterious little organisms which are neither, yet are still alive. Many are invisible, hiding deep in the ground or floating silently on the air. Unlike plants, they do not rely on the heat or light of the sun for survival. They have no chlorophyll and do not create food through photosynthesis. They must find a source of nutrients outside themselves. They are very adaptable to any weather conditions. If temperatures fall too low to support life, they go into a deep sleep. This sleep is like the hibernation state that some animals use during the coldest part of the winter. In this inactive state, they wait for living conditions to get better.

These mysterious little creatures are all around us. We call them **fungi**, and we even use their extraordinary abilities to help us produce some of our favorite foods. If you enjoy biting into a nice, fluffy piece of bread, you can thank the yeast that helped the bread rise. Yes, yeast is a **fungus**. If you like mushrooms on your pizza or in your salad, you are eating fungi, too.

Because of fungi, we are able to control nasty infections with antibiotics. You may have heard of the most common antibiotic: penicillin. Dr. Alexander Fleming discovered penicillin in 1928 completely by accident. He left his science experiment out on the counter instead of cleaning up after himself. When he came back from his vacation, a strange bluish fungus was growing on it. Penicillin had been discovered.

As people become more aware of better ways to meet our survival needs without harming our planet, we are finding more and more uses for fungi. We can create pesticides to control insects and make detergents that are more Earth-friendly. It makes sense that fungi can do things without harming Earth. They have been turning dead plant materials into rich soil for thousands of years. They eat the nutrients that would otherwise be wasted. Without them, we'd be walking around on thick layers of dead leaves and other discarded plant materials.

Although there are many good things about fungi, we must not forget that some fungi are harmful. There are certain varieties that will make us sick or give us skin reactions, like athlete's foot. It is important to be aware of the various types of fungi. We can benefit from the good fungi and protect ourselves from the harmful ones.

Name: _____

Answer the following questions based on the reading passage. Don't forget to go back to the passage whenever necessary to find or confirm your answers.

1) Why can't fungi make their own food using photosynthesis?

2) Name at least two ways that fungi can be beneficial for us.









3) Give an example of one way that fungi can be harmful for us.

4) What do fungi do when it gets too cold for them?

5) Imagine a world with no fungi. How would their absence impact your life?

SPORE DISPERSAL

Fungi utilize some incredibly complex methods of getting their spores into the environment. Some of the more interesting methods are explained below.

FUNGI	TECHNIQUE	ILLUSTRATION
Shaggy mane, Inky caps	Most spores are shot away from basidia at the very edge of the gill. The cap then dissolves via autodigestion; enzymes that destroy fungus melting everything, including remaining spores down to the ground.	
Truffles	Truffles produce an odor that attracts mice, squirrels and bears; the spores move undigested through animal's bodies. Truffle hunters in France use dogs and female pigs to sniff out truffles.	
Stinkhorns	Stinkhorns rely on insects; they produce a slimy odorous substance that smells like rotting flesh or excreta. Carnion flies are attracted to the smell and as they walk on the fungus, the spores stick to their feet and are carried off.	
Bird's nest fungi	A drop of water hits an "egg" and it pops out of the nest scattering the spores.	
Puffballs	Some of these fungi have a blowhole, and when it rains, drops fall and hit the sides and cause the spores to jump out. Others are like tumbleweed and blow around spilling their spores as they go.	
Earthstars	The rays of these fungi are closed up and protective when it is sunny. When it rains, the rays open up, and the rain drops splash the spores around.	
Bracket fungi	These fungi reorient if tree falls; in some species, beetles gnaw holes through the fruiting body and the spores fall through the hole into the air.	
Pilobolus	Pilobolus is phototropic which means it reacts to light. This fungus grows on horse dung; the clear bulbs at the terminal end explode and shoot spores onto vegetation at speeds up to 50km/hr and as far as 2m! There the spores are eaten by a herbivore whose digestive system dissolves the outer casing, readying it for germination in droppings.	



mycelium gills ring stem
cup scales cap

[illegible]

mycelium spores hypha
spore case bread

[illegible]

Scientific Argument: Claim, Evidence, Reasoning

6.E.2A.2

Fungi	Plants
Eukaryotes	Eukaryotes
Heterotrophs Saprophytes Parasites	Autotrophs
*Cell wall made of chitin	Cell wall made of cellulose
Multinucleated cells	Single-celled nuclei
Lacking chloroplasts	Containing chloroplasts
<i>*Most fungi have cell walls made of chitin.</i>	

Find a fact: What is one thing that fungi lack that plants have according to this graph?

Answer: _____

Using the graph, use your scientific argument skills to make a claim, find evidence and reasoning about the differences and or similarities of Fungi and Plants.

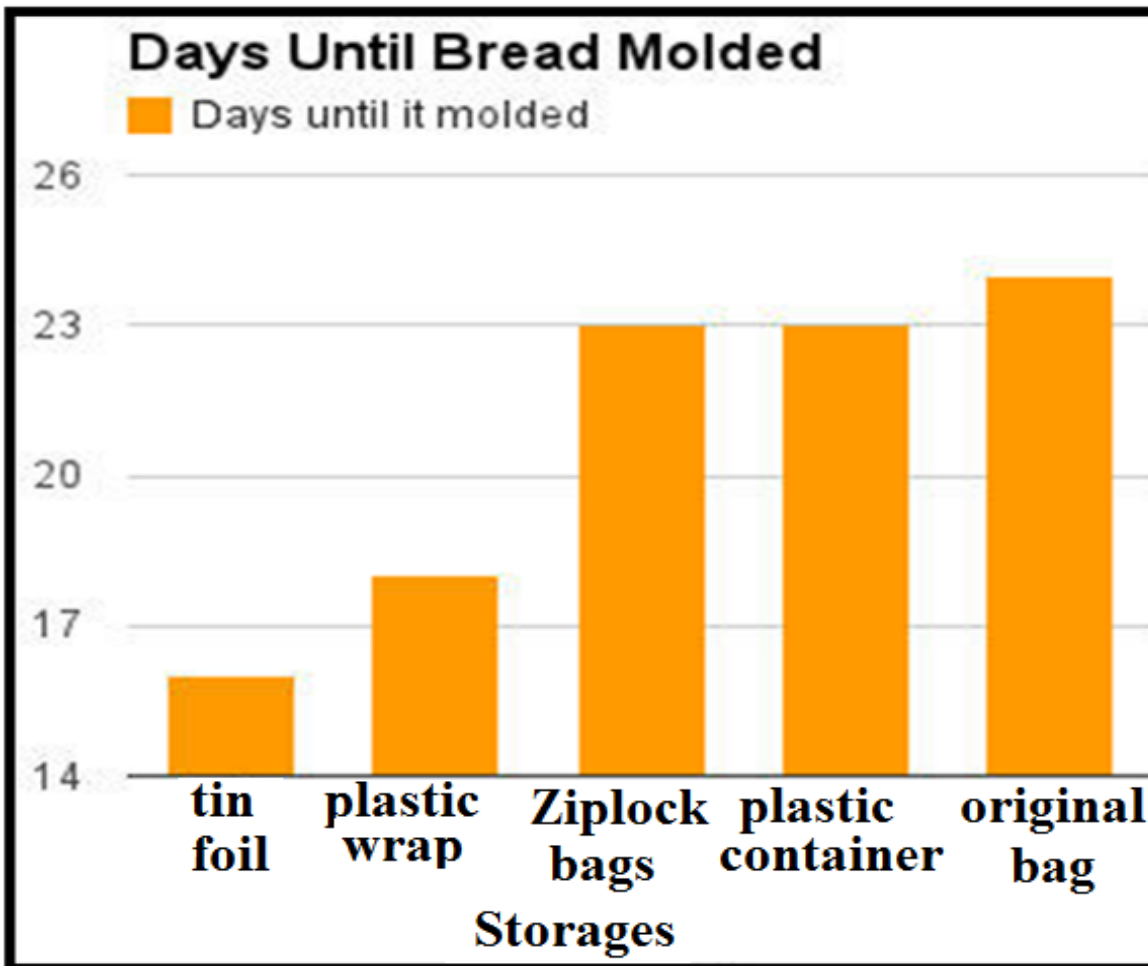
Claim: _____

Evidence:

Reasoning:

Scientific Argument: Claim, Evidence, Reasoning

6.E.2A.2



Find a fact: Which two storage types recorded the same amount of days before the bread molded according to this graph?

Answer: _____

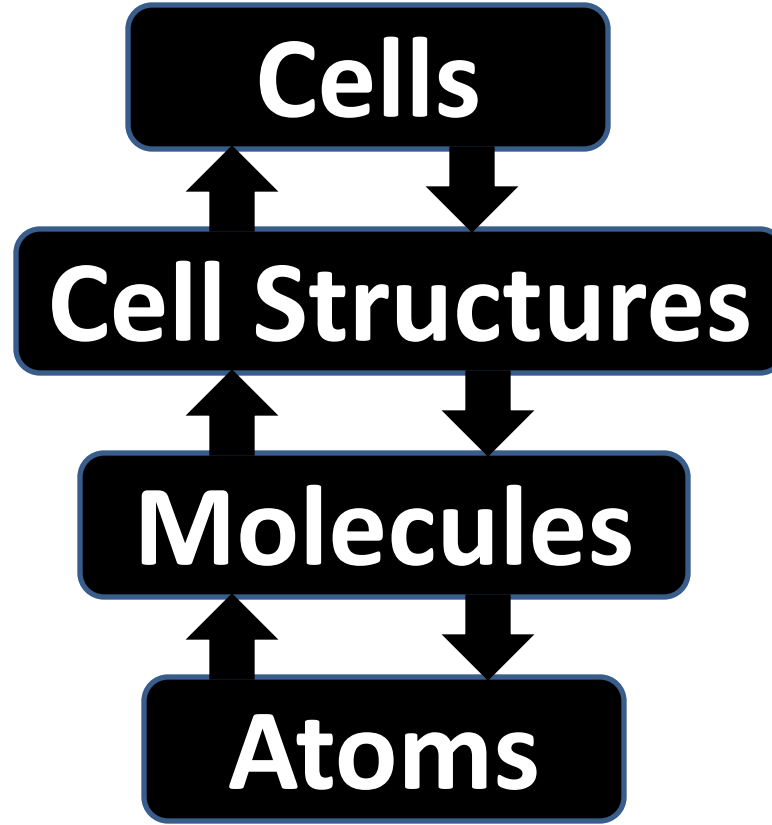
Using the graph, use your scientific argument skills to make a claim, find evidence and reasoning about the concept of what type of storage container is best to reduce the molding of bread.

Claim: _____

Evidence: _____

Reasoning: _____

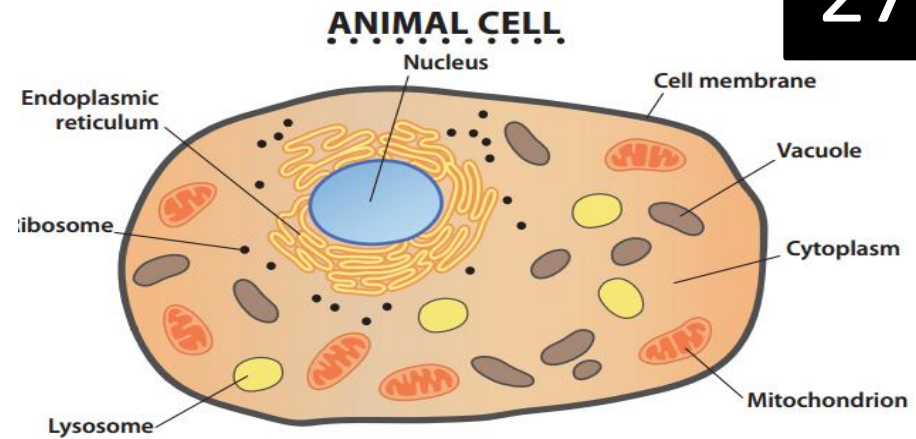
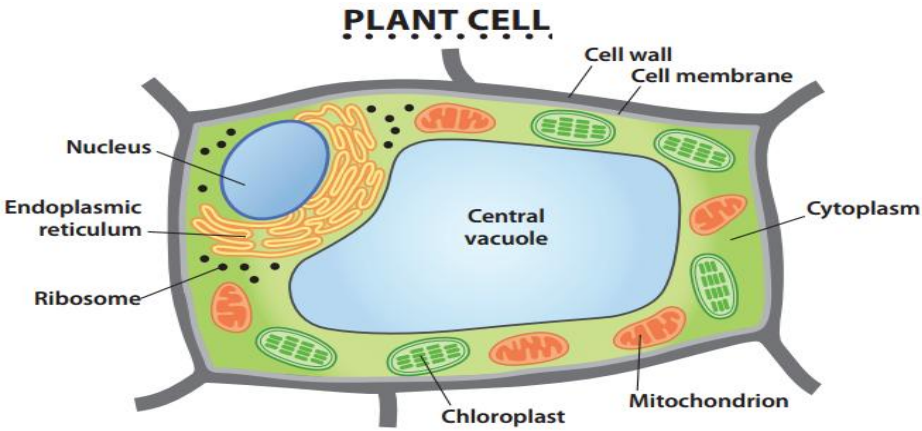
Are the building blocks of



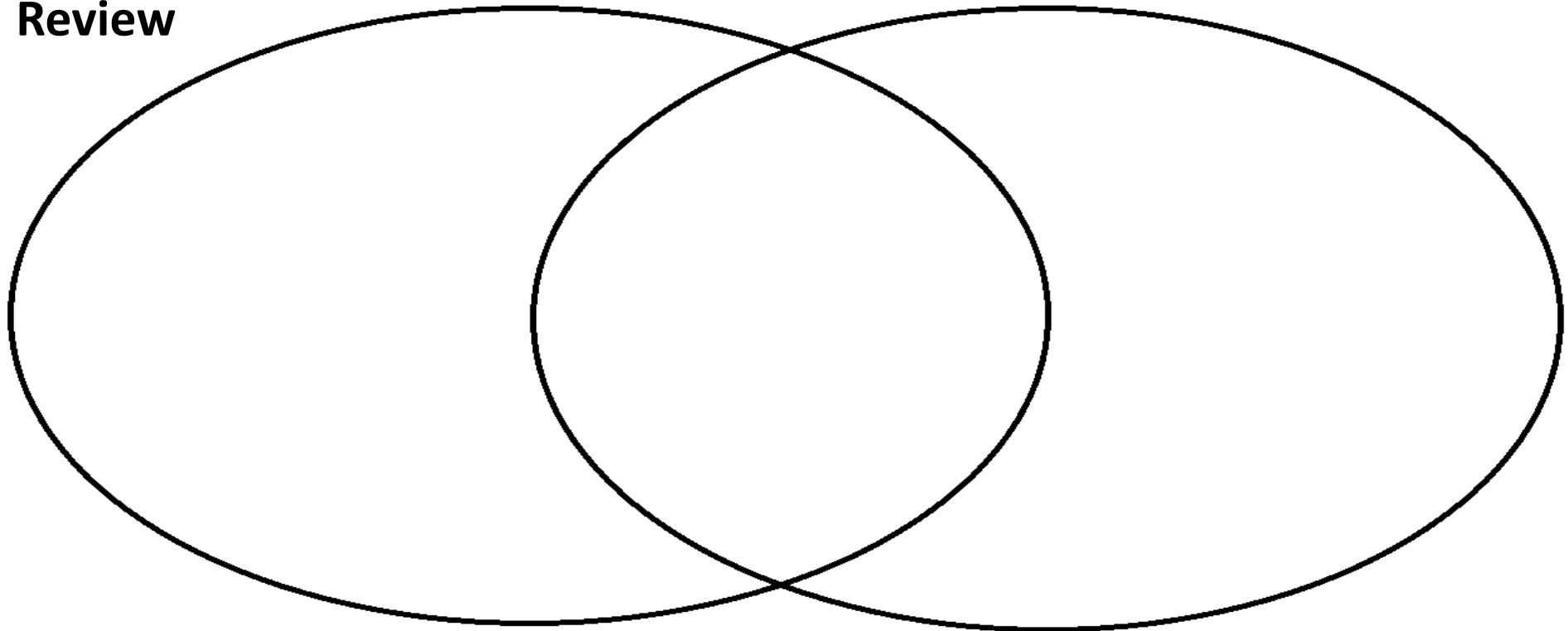
Are made up of

HOW ARE THE PLANT AND ANIMAL CELL ALIKE AND DIFFERENT?

27



Review



Find a Fact: What is the most obvious difference about a plant cell? _____

Why do you think this is? _____

1. _____ autotrophs
2. _____ hyphae
3. _____ fruiting structure
4. _____ parasitic
5. _____ unicellular
6. _____ fungi
7. _____ eukaryotic
8. _____ symbiotic
9. _____ multicellular
10. _____ saprophytic
11. _____ prokaryotic
12. _____ heterotrophs

- A. Plants who make their own food (sugar/glucose) through photosynthesis using sunlight.
- B. Cells that have a nucleus.
- C. Fungi that feed on other living organisms (host) but do not harm the host. In many cases the host benefits from the fungi.
- D. Fungi lack a root system so they use long fibrous strands that allow the fungus to obtain water and nutrients. Hyphae growth is influenced by stimuli and will grow toward a food source, water or even toward reproductive units of other fungi. A mass of hyphae is called mycelium.
- E. Cells that do not have a nucleus.
- F. Fungi that get their energy from decaying organic matter.
- G. Fungi are categorized based on their fruiting structure (structures for reproduction and spore dispersal).
- H. Single-celled organism.
- I. Need to eat other organisms to get energy.
- J. Live in moist environments include microorganisms such as yeasts, molds as well as multicellular organisms such as mushrooms. Heterotrophs that obtain energy in three ways: saprophytic, parasitic, symbiotic.
- K. Fungi that feed on other living organisms (host) and harm the host.
- L. More than one celled organism.

- **6.L.5A.1** Analyze and interpret data from observations to compare how the structures of protists (including euglena, paramecium, and amoeba) and fungi allow them to obtain energy and explore their environment.

- **Essential Knowledge**

Fungi

Fungi are classified into the Kingdom Fungi. This includes microorganisms such as yeast and molds as well as multicellular organisms such as mushrooms.

There are three main ways Fungi obtain energy:

- **Saprophytic** - Fungi that get their energy from decaying organic matter.
- **Parasitic** - Fungi that feed on other living organisms (host) and harm the host.
- **Symbiotic** - Fungi that feed on other living organisms (host) but do not harm the host. In many cases the host benefits from the fungi.

In most cases, fungi are not mobile organisms.

Fungi can be categorized based on their fruiting structures (structures for reproduction and spore dispersal).

Extended Knowledge

- There are many other examples of protists that use the various methods mentioned above to move or obtain energy. Euglena, paramecium, and amoeba are only a small sample.
- In order to observe the movement and structure of protists, students could be introduced to basic microscopy and observe the organisms first-hand.
- Other cells outside of Protista that have flagellum (many bacteria or sperm cells), cilia (cells in the trachea), and pseudopods (white blood cells).
- Fungi are a very diverse group of organisms. Students may develop and use models that show the methods of fungal reproduction and spore dispersal.

Assessment Guidance

The objective of this indicator is to analyze and interpret data from observations to compare how the structures of protists (including euglena, paramecium, and amoeba) and fungi allow them to obtain energy and explore their environment. Therefore, the primary focus of assessment should be for students to analyze and interpret data from informational texts, observations, measurements, or investigations that supports the claim that protists and fungi have specialized structures that allow them to obtain energy and explore their environment. This could include, but is not limited to, students observing videos of protists and constructing 2-D models to explain how the specialized structures of protists that allow for movement and obtaining energy. Students can also analyze informational text and use that as evidence to argue whether a sample fungus is saprophytic, parasitic, or symbiotic. These fungal examples can be diagrams, images, or live specimens.

In addition to analyze and interpret data, students should ask questions; plan and carry out investigations; use mathematics and computational thinking; engage in argument from evidence; construct explanations; develop and use models; obtain, evaluate, and communicate information; and construct devices or define solutions.

- **6.L.5A.2 Analyze and interpret data to describe how fungi respond to external stimuli (including temperature, light, touch, water, and gravity).**

- Essential Knowledge

It is essential that students understand that fungi are able to respond to information from their environment to ensure survival of the organism. Fungi, like plants, respond to stimuli from the environment.

- In early development, many species will grow in response to light (phototropism) or away from gravity (gravitropism/geotropism).

However, as the fungal species mature, they tend to display negative gravitropism.

Because fungi lack a root system, they use hyphae.

- Hyphae are long fibrous strands that allow the fungus to obtain water and nutrients.
- Hyphal growth is greatly influenced by stimuli and will grow toward a food source, water, or even toward reproductive units of other fungi.
- Collectively, a mass of hyphae are referred to as a mycelium.

Extended Knowledge

- Students can explore how tropisms in fungi and plants are similar and obtain, evaluate, and communicate information regarding how these two different kingdoms have similarities in early development and growth.
- Students may also develop and use models to explain how various types of fungi reproduce.

Assessment Guidance

The objective of this indicator is to analyze and interpret data to describe how fungi respond to external stimuli.

Therefore, the primary focus of assessment should be for students to analyze and interpret data from informational texts, observations, measurements, or investigations that supports claims that fungi are able to respond to stimuli from their environment. This could include but is not limited to students analyzing informational text and using that as evidence to argue whether a sample fungus has grown in response to light (phototropism) or away from gravity (gravitropism/geotropism). These fungal examples can be diagrams, images, or live examples. Students can also use a variety of resources to explain how the hyphae, although not easily observed, are present and how the mycelium is helping the fungus to survive.

In addition to analyze and interpret data, students should ask questions; plan and carry out investigations; use mathematics and computational thinking; engage in argument from evidence; construct explanations; develop and use models; obtain, evaluate, and communicate information; and construct devices or define solutions.