

Unit 1: Mushroom Farm

OVERVIEW

Back to the Roots is on a mission to Undo Food™ and reconnect kids to where food comes from. We're bringing this mission into your classroom with the Garden Toolkit—including the Mushroom Farm, Water Garden, and Garden-in-a-Can—designed to inspire you to take a closer look at how food grows.

Unit 1 is based on the Mushroom Farm that you will use to grow organic oyster mushrooms over the course of 10 days! By the end of this unit, you will be able to answer the questions below and be well on your way to becoming a **mycologist** (someone who studies mushrooms and other members of the Kingdom Fungi).



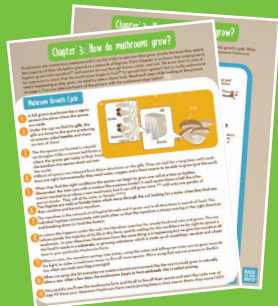
Chapter 1: What are mushrooms?

Introduction to the tree of life, how fungi and other organisms are classified, and the important resources that mushrooms and people need to live!



Chapter 2: What do they do?

Exploration of the circle of life and how mushrooms break down trees and plant material to make nutrients and minerals.



Chapter 3: How do they grow?

A closer look at the anatomy and life cycle of the oyster mushroom and the differences between your Mushroom Farm and mushrooms growing in nature.

WORD BANK

Keep an eye out for vocabulary words in **blue** throughout each chapter, and visit the Mushroom Glossary at the end to find each definition.

- | | |
|--------------|---------------|
| mycologist | ecosystem |
| tree of life | resources |
| organisms | decompose |
| species | enzymes |
| mushrooms | soil food web |
| hyphae | substrate |
| mycelium | gills |
| nucleus | basidia |

Thinking Cap

When you see the brain icon put on your thinking cap and write down your answers to our challenge questions!



ACTIVITIES

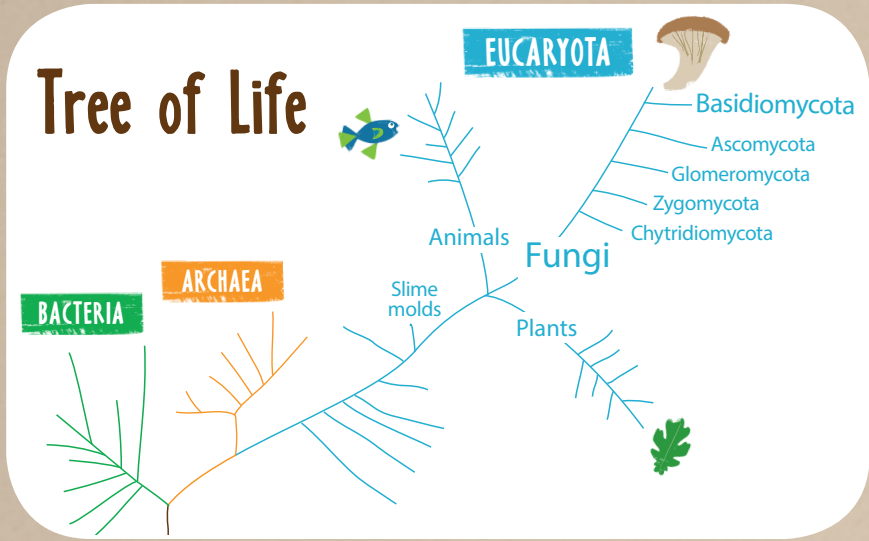


Mushroom Farm Growth Log



Thinking Cap: Unit Review

Chapter 1: What are mushrooms?



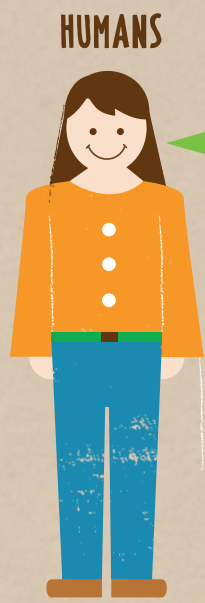
The **tree of life** (or technically-the **phylogenetic tree of life**) represents how life has evolved on planet Earth! Some brilliant scientists not too long ago decided they needed a way to talk about the living things they saw.

They set out to organize and classify life as we know it using a science called **taxonomy** (or **Taxonomic Classification**). The scientists made groups based off of similar traits, then divided groups within those groups, and more groups within those groups! It is these groups that we see in our tree. The closer two branches are to each other, the more similar the **organisms**, or living things, within them are. Based on this tree, which **organisms do you think are most similar?**

Taxonomic Classification

In taxonomy, life is divided into 8 groups. They start off broad and get more specific, until we arrive at a unique living thing, called a **species**. New species are discovered all the time and so the list is always being added to and improved upon. Some day you could be one of the scientists who finds new species or decides where they belong in the tree!

- CLASSIFICATION GROUPS**
1. Domain
 2. Kingdom
 3. Phylum
 4. Class
 5. Order
 6. Family
 7. Genus
 8. Species

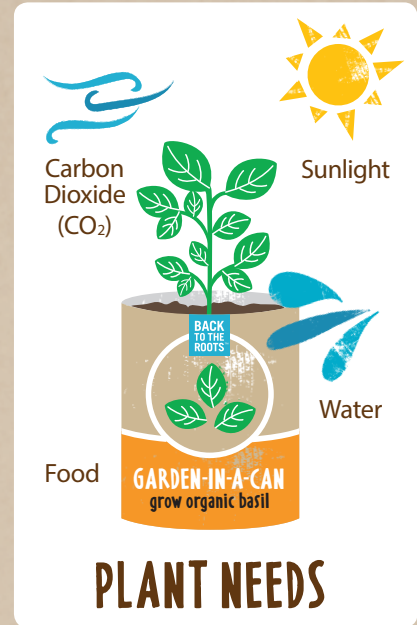


HUMANS

MEMORY TIP!
A great way to remember the names of the groups is using the phrase "Dominating King Phillip Came Over From Great Spain". Dominating = Domain, King = Kingdom, Phillip = Phylum, Came = Class, Over = Order, From = Family, Great = Genus, and Spain = Species!

Chapter 1: What are mushrooms?

Mushrooms are more like animals than plants, even though they might not look like it. When we look at what they need, it becomes a little more clear. 🧠 What do you see that all mushrooms and people need that plants do not?



Inside the Mushroom

Mushrooms are like fungal towers with cannons under their caps that shoot **spores** (similar to seeds) into the world. The tower is made up of millions of single celled units called **hyphae** that grow to form tiny threads (imagine them like the cars that make up a train!).

The hyphae weave together underground to form a thick network called **mycelium**. Each hypha has a **nucleus**, or cell brain, that can travel freely throughout the entire network. It communicates almost instantaneously with all the others (imagine the nuclei like passengers moving around in a long train). Mycelium is always growing new hyphae and learning from each new cell brain as it interacts with its environment and others in the network. When the mycelium gets enough water, it sends a signal telling the hyphae to begin to form the tower in the shape of the mushroom you see in the diagram above.

🧠 What do you think the tower will help the mushroom do?




Chapter 2: What do mushrooms do?

The Ecosystem

An **ecosystem** is an ecological system, or all the living things in an area interacting with one another and the resources available there. Every living thing, or **organism**, has a special role to play as they interact with the same **resources** (the things that aren't alive like nutrients, minerals, air, water, and sunlight). Everything feeds something else, and eventually everything dies. Some organisms have evolved to be able to break down the dead things to recycle the nutrients and continue the circle of life. 🧠 Which resources do you need to live? (Hint: See Chapter 1!)



Chapter 3: How do mushrooms grow?

Mushrooms are mysterious creatures and it can be tricky to see how they grow, mostly because they spend the majority of their life below ground as a network of hyphae (see Chapter 2 if you need a refresher). To really understand what's happening as mushrooms grow, we need to take a closer look. Read each step of the growth cycle below while looking at the diagram on Page 7.  Can you label each part of the picture with the numbered steps below?

Understanding Mushroom Growth

- 1 A full grown mushroom has a **cap** to protect the place where the spores are made. **Spores** are the reproductive units of mushrooms (similar to seeds in plants).
- 2 Under the cap we find the **gills**, which are the home to the spore producing structures called **basidia**, and there are lots of them!
- 3 The spores are formed in a **basidium** (imagine it like a cannon-ball factory where the spores get ready to fire). From the basidium the spores shoot out into the world. Millions of spores are released from the basidiums on the gills. They can wait for a long time until conditions are right, but eventually they need water, oxygen, and a food source to be able to grow (just like you!).
- 4 When they find the right conditions the spores can begin to grow one cell at a time as hypha. (Remember the train cars with a nucleus like a passenger inside from Chapter 1?) In each spore there is only half of the information needed to produce a new mushroom, but it can still grow more hyphae with only one gender of nucleus inside. The hyphae are male or female threads which move through the soil looking for a mate. When they find one, they combine and become mycelium!
- 5 The mycelium branches out in search of food. The nuclei move throughout the network and communicate to keep the mycelium moving in the right direction and using the right enzymes to break down food in the most efficient way.



Chapter 3: How do mushrooms grow?

Understanding Mushroom Growth cont'd.

- 6 In nature this happens under the soil where the mycelium searches for woody food to eat. In your classroom Mushroom Farm the same thing is happening, but we went ahead and gave the mycelium all the food it needs in a **substrate**, or growing substance. The bag inside your Mushroom Farm includes woodchips, sawdust, and wheat bran for your mycelium to eat.
- 7 When it rains, the mycelium springs into action! Using the water, hyphal threads to grow towards the light to make a mushroom tower to fire off spores so it can reproduce. To mimic the rain in nature, the Mushroom Farms needs to be soaked overnight to trigger the mycelium.
- 8 In nature, mushrooms grow in the humid environment after a rain. By spraying the Mushroom Farm every day, you will create a similar environment in your classroom for the mushrooms to grow. After a few days, tiny mushroom caps called pinheads begin to form, this stage is called **pinning**.
- 9 Once mushrooms start pinning, they grow very quickly. When you see this happening in your Mushroom Farm, start to record what you see in your **Daily Growth Log**. In a matter of days, you will have fully formed mushrooms that are releasing their spores. In nature, these spores re-enter the soil and the cycle begins again. With your Mushroom Farm, this means it's time to harvest!

IMPORTANT NOTE: Our oyster mushrooms are safe to cook and eat, but never do this in nature as not all mushrooms are safe to eat.

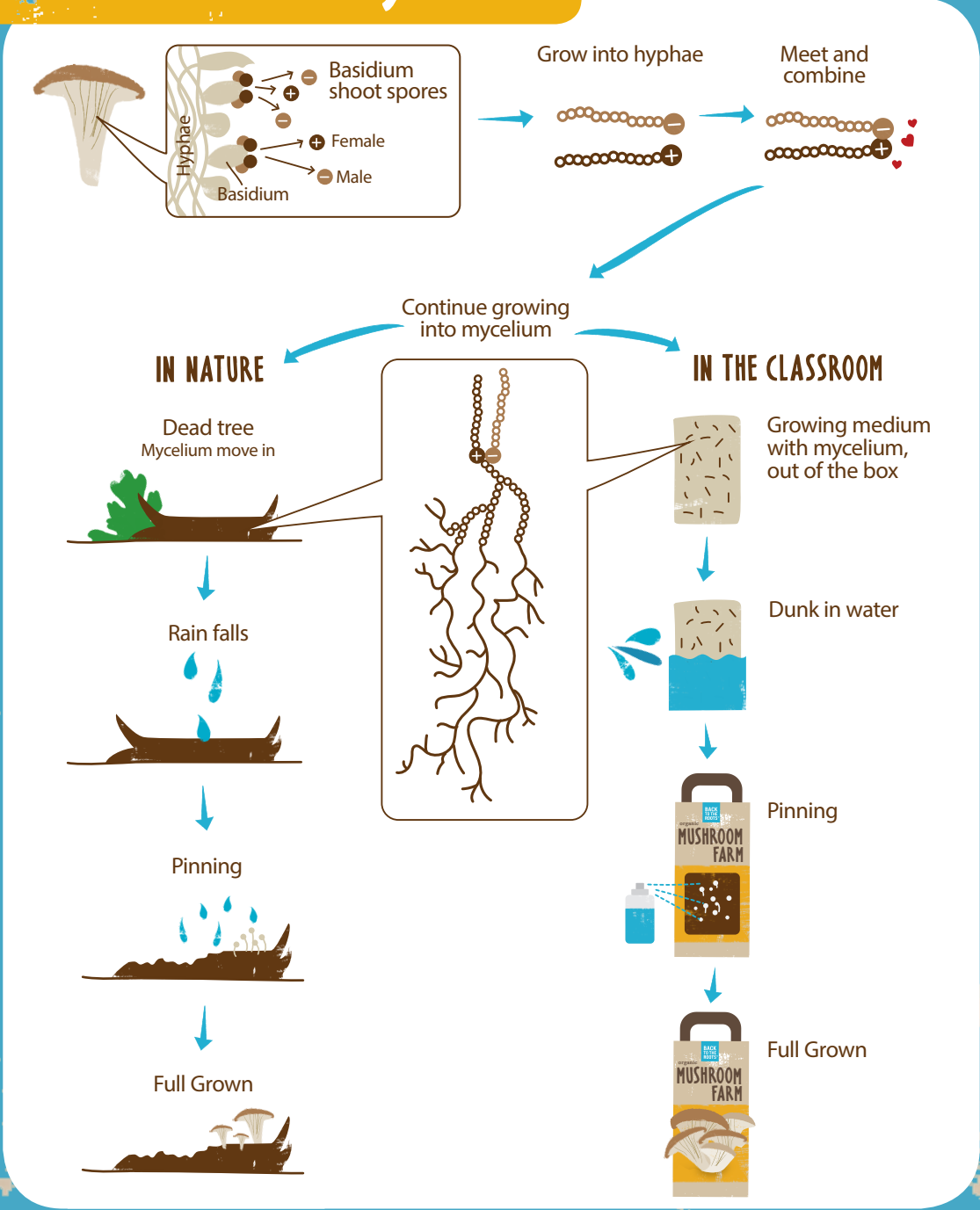
NEVER EAT WILD MUSHROOMS



Chapter 3: How do mushrooms grow?

Label each step in the diagram below with the numbers from “Understanding Mushroom Growth” on Page 5-6.
 🧠 What are the major differences between how mushrooms grow in nature versus in your classroom Mushroom Farm?

The Mushroom Growth Cycle



Vocabulary

Basidium (ba-sid-i-um) Spore Cannons! Microscopic structures on the gills of the mushroom which form spores and shoot them out like cannons!

Decompose (de-com·pose) To break down or decay over time.

Eukaryota (eu-kary-ot-a) Domain of living things with multiple cells and a nucleus. Includes Kingdom Plantae, Animalia, and Fungi.

Ecosystem (eco-sys-tem) An ecological system of all living things interacting with one another and the resources in a given area.

Enzymes (en-zyme) Compounds that help break down potential food sources in the environment.

Fungi (fun-gi) The Kingdom where we find mushrooms, mycorrhizae, molds, and lichen.

Gills The part of the mushroom under the cap where we find the basidium, from here the spores form and release.

Hyphae (hy-phae) The single celled unit that grows and extends to make up the mycelium.

Mushroom (mush-room) The reproducing body of the fungus, it's purpose is to release the spores (it just happens to be delicious and nutritious!)

Mycelium (my-ce-li-um) The web-like network made up of many combined hyphae. The mycelium lives under the soil until it rains then it forms the mushroom fruiting body.

Mycologist (my-col-o-gist) A person who studies the Kingdom Fungi.

Nucleus (nu-cle-us) The cell brain that holds the DNA.

Vocabulary

Organism (or-gan-ism) Any living thing.

Phylogenetic Tree of Life (phy-lo-ge-net-ic) A visual representation of the evolution of life on Earth showing relationships between species.

Pinning (pin-ning) The early stage of mushroom growth when the mushroom caps begin to appear.

Resources (re-source) The non-living parts of an environment like nutrients, minerals, air, water, and sunlight.

Soil Food Web An ecosystem living below the soil.

Species (spe-cies) The most specific group in Taxonomic Classification that indicates organisms that can reproduce with each other.

Spores Mushroom Seeds! The reproductive units of fungi which find their mate and combine to form hyphae.

Substrate (sub-strate) Substance mushroom is growing in, generally plant based or woody. In our kit its corn cob, wheat bran and sawdust!

Taxonomy/Taxonomic Classification (tax-on-o-my) The naming and organization of living things.

Mushroom Daily Growth Log

Use this growth log to carefully observe your Mushroom Farm over the next 10 days, and draw what you see below (feel free to use a separate piece of paper if you want to make your drawings bigger!).

Day 1	Day 6	Day 7	Day 8	Day 9
				

What do you think is happening inside your Mushroom Farm on each of these days?

Day 1: _____

Day 6: _____

Day 7: _____

Day 8: _____

Day 9: _____

What day do you think your mushrooms will start pinning? _____

What day did they actually start pinning? How close was your estimation? _____

Day 10!



Draw your full grown Mushroom Farm and label the parts below.

- cap
- gills
- mycelium
- stalk
- hyphae

DID YOU KNOW?
The largest living organism in the world is the mycelium network growing in an Oregon forest—it's bigger than 1,600 football fields!





Thinking Cap: Garden Toolkit Unit 1 Review

Now that you've completed **Unit 1: Mushroom Farm** of the Garden Toolkit, fill out the answers to the questions we set out to learn.

Chapter 1: What are mushrooms?

Chapter 2: What do mushrooms do?

Chapter 3: How do mushrooms grow?

Congratulations! You're officially a mycologist!



Teacher Resources

GROWING YOUR MUSHROOM FARM

Step 1: Open the package and cut a cross in the plastic bag

- Students should open the kit, remove the sprayer and cut open the packaging. Have them scratch up the white block as indicated on the package, and remove a small bit of the substrate* and put it on a plate.
- Place removed substrate on a white plate (best to use microscope if possible).
- Pass the plate around. Have them touch the substrate, and ask them what they feel?
 - Earthy, Soil, leafy, straw
 - Explain that the substrate is vegetative, meaning it came from vegetation, from plants.
 - What are some examples of plants?
 - Trees, vegetables, bushes, straw
- What do they smell?
 - The substrate smells earthy like soil, because it is!

Step 2: Soak the bag in water overnight (Day 1)

Soaking the Mushroom Farm simulates a heavy rain in nature, it gives the mycelium the water it needs to grow into a mushroom to spread spores!

Step 3: Dry off the bag and place it back in the box (Day 2)

Now we wait! Over the next few days the mycelium will wake up and begin to grow towards the light, the fresh air, and water. Have students continue to spray it twice a day and watch it turn into a mushroom (mushrooms are likely to start pinning around day 6-7).

Step 4: Monitor Daily (Days 3-9)

Every day be sure to take a picture and/or have students draw the box as they see it on the Mushroom Growth Log provided.

Step 5: Harvest and enjoy! (Day 10)

Pinch the mushroom at the base of the stalk and tear away, or you can use scissors to cut the mushrooms from the box. The mushrooms are edible but should be cooked. *Optional: Cook mushrooms and have students try them. NOTE: Be mindful of students*

Need more help with growing your Mushroom Farm? Visit backtotheroots.com/FAQ.
More questions? Visit our FAQ page at backtotheroots.com/FAQ.

Download all Unit 1 materials at: backtotheroots.com/curriculum