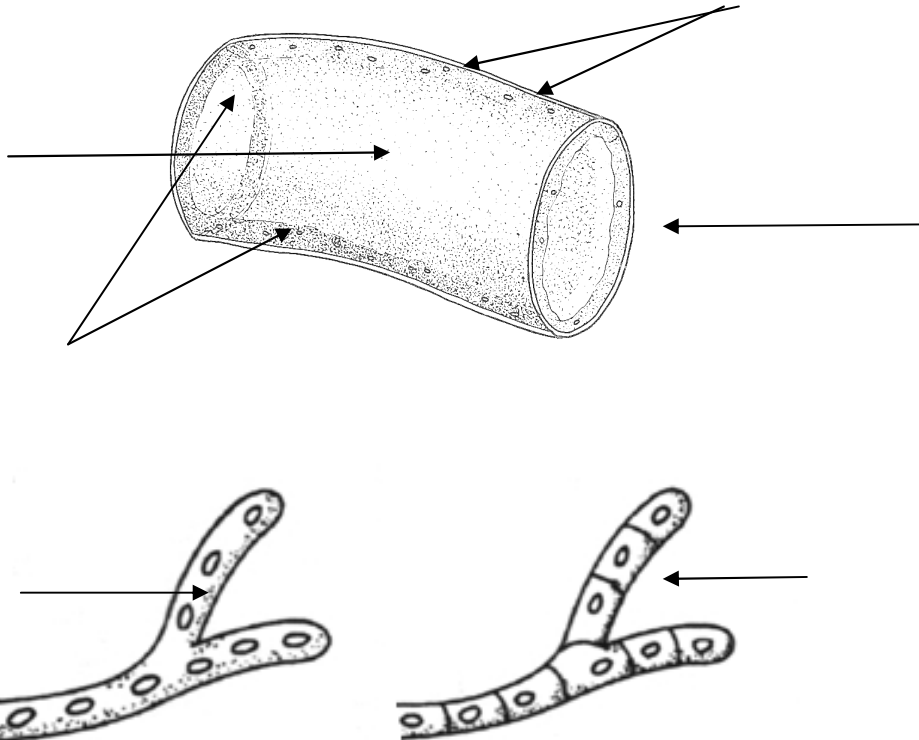




The basic structural features of fungi are not cells but **hyphae**. Hyphae are microscopic branching filaments filled with **cytoplasm** and **nuclei**. Each thread consists of a tube formed from a wall enclosing cytoplasm and a **vacuole**. The hyphal walls are not made of cellulose but of a substance called **chitin**, also found in the exoskeletons of arthropods, an organic nitrogenous compound. The hyphae contain **many nuclei distributed throughout the cytoplasm**. Sometimes the hyphae are divided into compartments by cross walls called **septa**. Fungi with cross walls are called septate fungi, while fungi without cross walls are called coenocytic fungi.

Label and color the parts of the hyphae --- cytoplasm (orange), vacuole (yellow), nuclei (black), and cell wall (brown).
Label and color the two types of hyphae --- coenocytic fungi green and septate fungi blue.



1. What are hyphae?
2. Describe the inside of hyphae.
3. What surrounds the hyphae and what compound is it made of?
4. What are hyphal cross walls called? Are they always present?
5. Compare and contrast coenocytic and septate fungi.

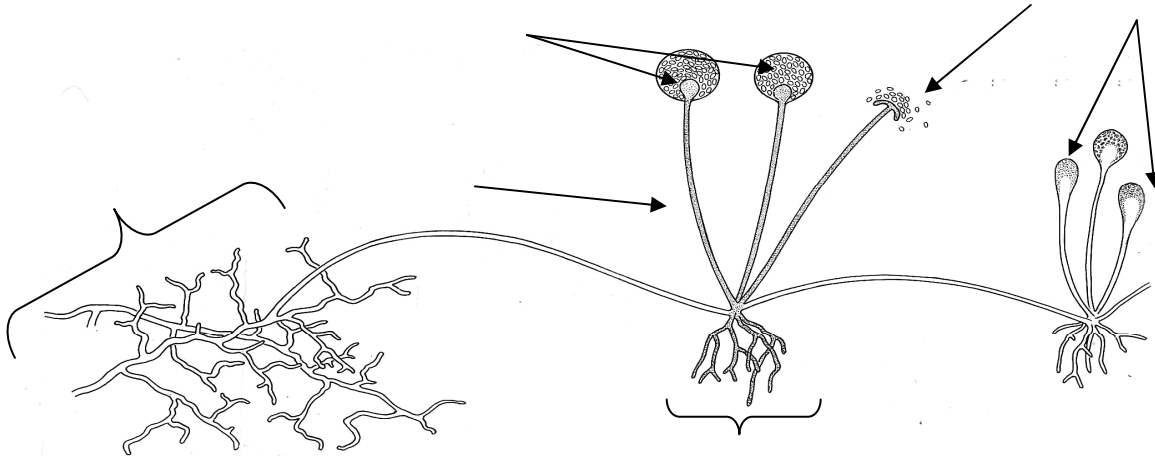


The fungi do not have chlorophyll so they **cannot make their food** in the way that plants do. Fungi, like animals are **heterotrophs**. However, fungi are **absorptive**, not ingestive heterotrophs (digest food after they eat it) like animals. They feed on dead or **decaying organic matter** and are classified as **saprophytes**. Their hyphae penetrate the dead material and form a branching network called a **mycelium**. The **tips of the growing hyphae** produce enzymes which digest the organic material. The **soluble products are absorbed** into the hyphae. Because **fungi digest food first and then absorb it**, they are **absorptive** heterotrophs.

ZYGOMYCOTA (bread Mold)

When bread mold fungi, such as *Rhizopus stolonifer*, grow on stale bread or rotting fruit, the mycelium can be seen as gray colored “fuzz”. *Rhizopus* reproduces **asexually** by sending up **vertical hyphae** called **sporangiophores**. Horizontal hyphae called **rhizoids** connect sporangiophores to each other. Each of these hyphae **swells at the tip** to produce a **sporangium**. A sporangium is a type of **spore case**. The cytoplasm in the sporangium divides repeatedly to produce a mass of **spores**, each with a nucleus. When the sporangium breaks open, the spores are dispersed in the air, and each can grow to form a **new mycelium** if it lands on suitable material. This is an asexual type of reproduction, but the mold can also reproduce sexually.

Label and color the parts of *Rhizopus stolonifer* --- mycelium (dark brown), hyphae (light brown), mature sporangium (orange), sporangium releasing spores (yellow), sporangiophores (purple), rhizoid (blue), and an immature sporangium (red).



6. Fungi aren't classified with plants. Explain why?
7. Why are fungi classified as heterotrophs like animals?
8. Why are fungi considered as saprobes
9. Explain how an absorptive heterotroph feeds?
10. What is the scientific name for a common mold that grows on bread?
11. A mass of hyphae that grows into bread to digest it is called what?
12. Vertical hyphae produce what structures?
13. What is the function of these structures?
14. When spores spread and land in a suitable place, what forms?
15. Is this a sexual or asexual method of reproduction?

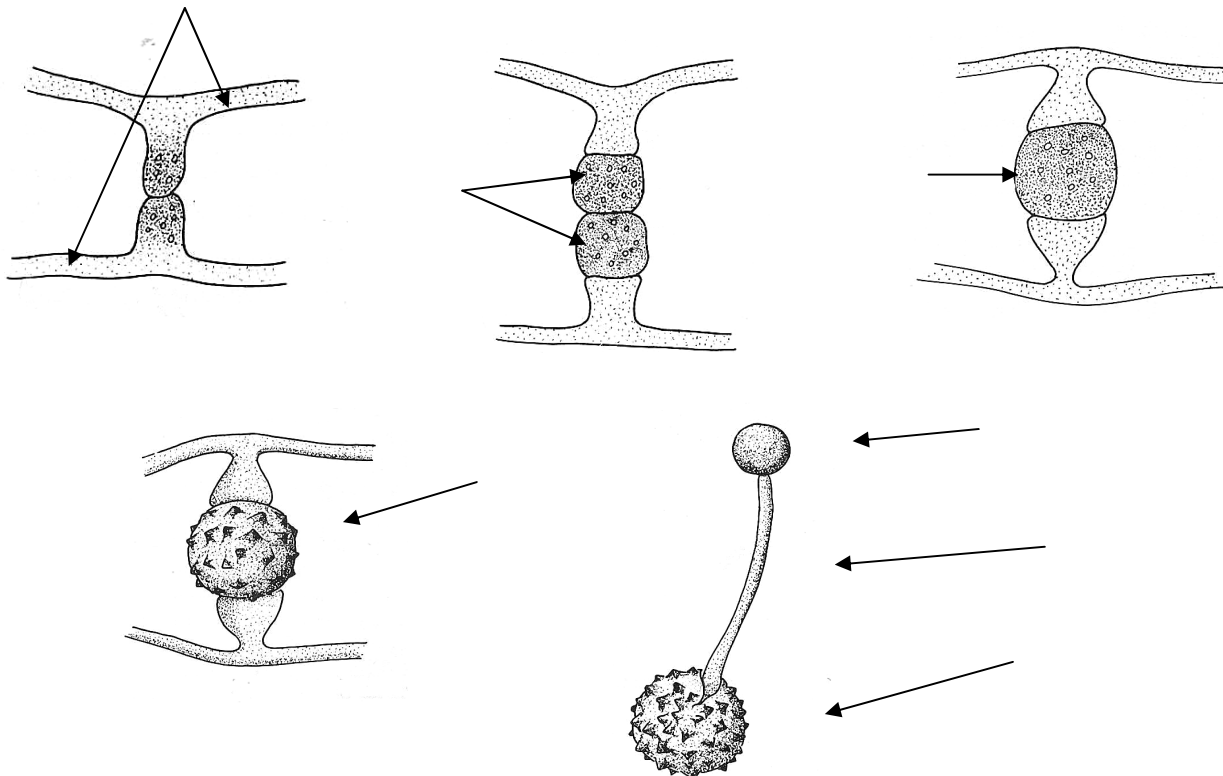
**SEXUAL REPRODUCTION IN ZYGOMYCOTA**

Sexual reproduction takes place only between **two different strains** of *Rhizopus*. The strains are visually indistinguishable but may have differences in their physiology, e.g. one may be able to digest organic matter better than the other. In sexual reproduction, **beneficial characteristics like this may be combined, leading to a more successful strain of the fungus.**

Sexual reproduction in molds like the Zygomycetes occurs when **hyphae** called “+” and “-” start growing toward each other. When they meet, their **tips swell** and are **cut off by cross walls** or septa. The **nuclei divide rapidly** in the tips and then **fuse** when the cross walls break down. These fused nuclei form a **zygospore**. The **cell wall of the zygospore thickens** as the hyphae break down. The zygospore can remain **dormant for a long time surviving drought or extreme temperatures**. When conditions become good, the **zygospore germinates** and **forms a single hyphae and sporangium** that **release spore**.

16. Sexual reproduction is only possible in *Rhizopus* if what is true?
17. Can you physically tell the two strains apart?
18. What type of benefit can there be for the new strain?
19. What are the two hyphae called that are involved in sexual reproduction?
20. Describe what happens when the tips grow together.
21. What happens to the nuclei in the tips of the hyphae?
22. What is an advantage of the zygospores if it is extremely dry or hot?
23. What happens when a zygospore germinates?

Label and color the sexual reproduction structures in *Rhizopus*--- hyphae (yellow), fused nuclei (red), rapidly dividing nuclei (purple), zygospore with thick cell wall (brown), germinating spore (blue), growing sporangiophore (pink), and sporangium (green).

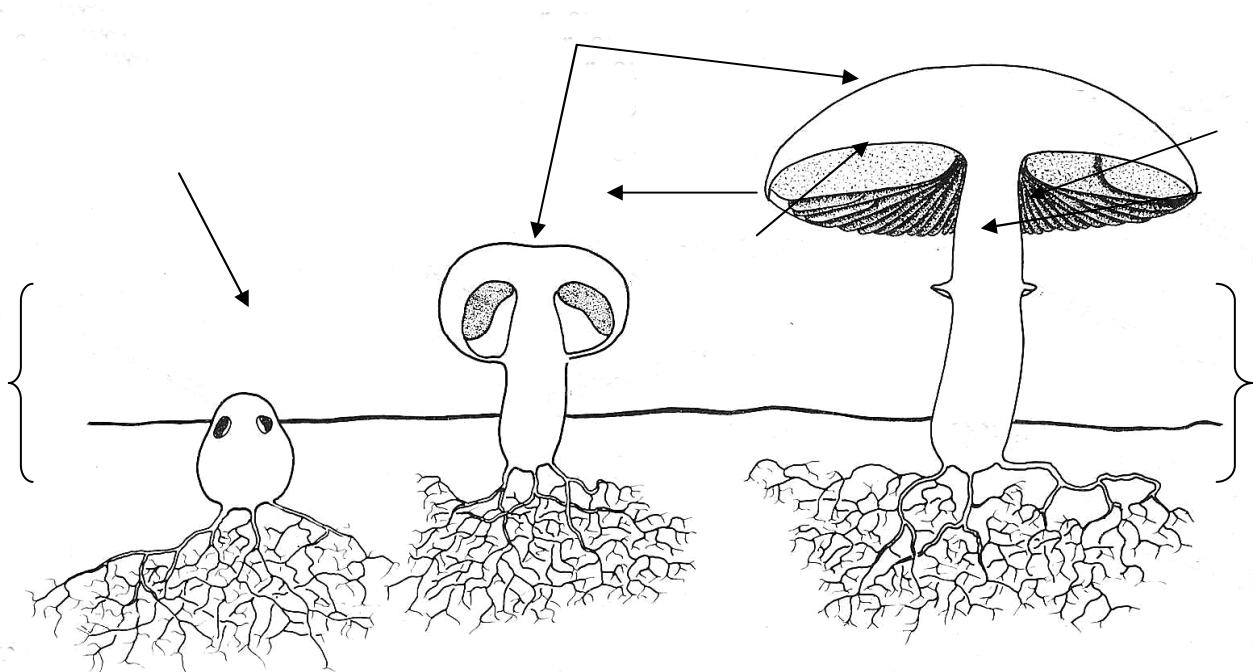


**BASIDIOMYCOTA (Mushrooms and Toadstools)**

Mushrooms and toadstools form a large group of fungi which **live in the soil or in rotting wood**. Their **mycelia** (plural of mycelium) spread through the soil or the dead wood, dissolving and absorbing the organic substances. The **fruiting bodies** (part of the organism seen above ground) of *Psalliota campestris* (field mushroom) and *Psalliota arvensis* (horse mushroom) are **edible**. The fruiting bodies of **toadstools are mostly inedible or even poisonous**.

Under favorable conditions some of the **hyphae just below the soil**, mass together into **mycelia** and **form a spherical body that grows rapidly and pushes above the surface**. This is what is called the **fruiting body**. As this body grows, it develops three distinct regions: **a stalk called the stipe, a cap or pileus, and gills under the cap**. **Spores** develop on these gills on structures called **basidia** under the cap. At first, the cap is joined all round its edge to the stalk but later, as a result of the rapid growth of stalk and cap, the cap breaks free leaving a ring of tissue, the **annulus or ring**, round the stalk. Some fungi also have a sack like structure at their base called the **volva**.

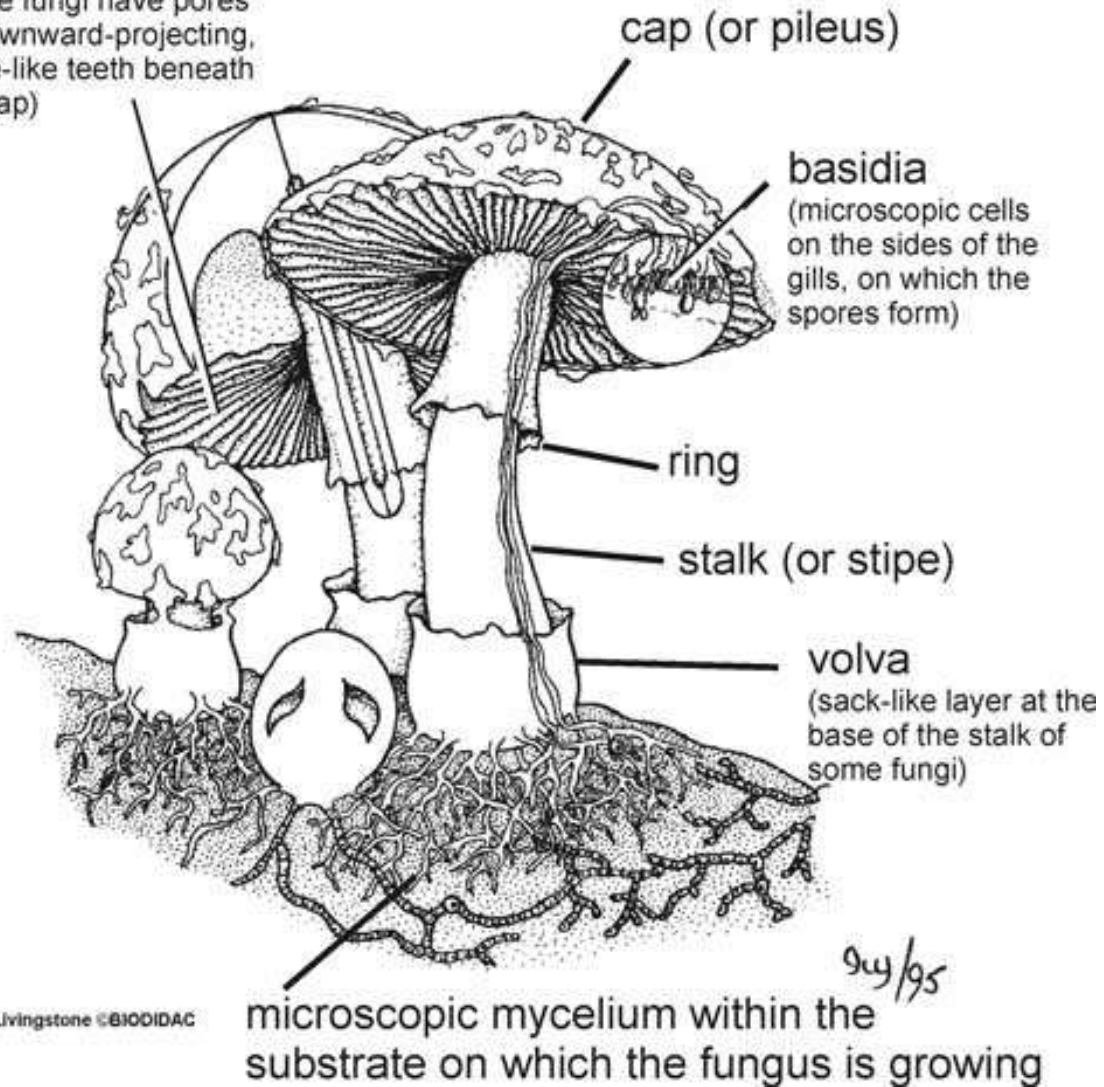
Label and color BOTH drawings as follows --- forming fruiting body (light brown), mycelia (dark brown), cap (orange), gills (yellow), annulus (violet), and stipe gray.





gills underneath cap

(some fungi have pores or downward-projecting, spine-like teeth beneath the cap)



24. What does the fruiting body form from underground?
25. What is another name for the stalk?
26. What is another name for the cap?
27. What is the ring around the stalk called and what causes it to form?
28. Where do spores form & what are the spore-forming structures called?