

*change

Fungi Worksheet

Complete the blanks using the list of vocabulary words below and complete the instructions given in each section.

- | | | | |
|---------------------------|--------------------------|--------------------------|------------------------|
| Absorptive | Chlorophyll | Lobsters | Nematodes |
| Asexual | Enzymes | Molds | Parasitic |
| Basidia spores | Fruiting body | Multicellular | Predatory |
| Budding | Heterotrophic | Mushrooms | Saprophytes |
| Cellulose | Hyphae | Mutualistic | Successful |
| Chitin | Insects | Mycelium | |

A- Structure

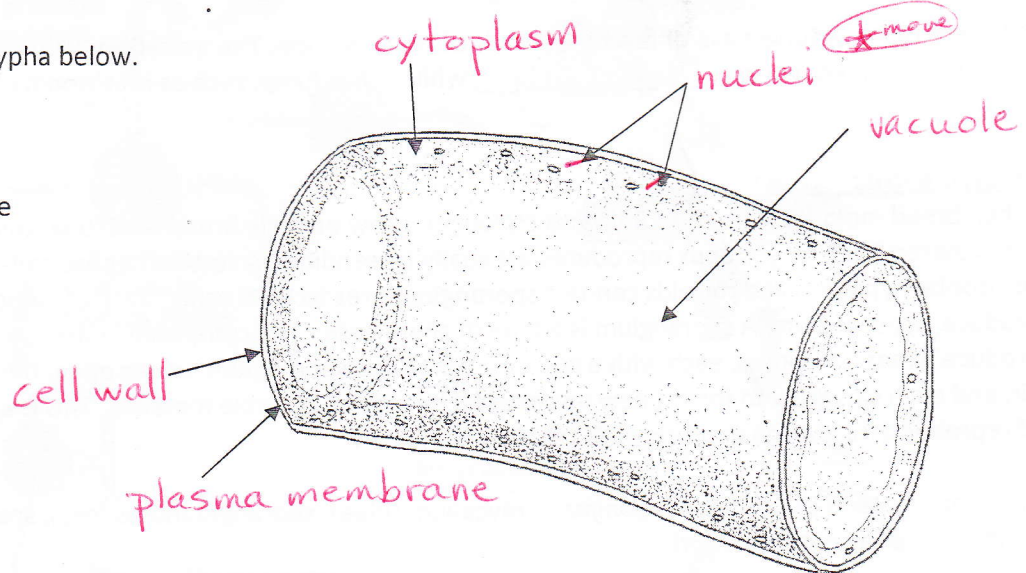
Some fungi, molds for example are unicellular while others are multicellular

A fungal organism consists of a mass of threadlike filaments called hyphae, which combine to make up the fungal mycelium. Each hypha can be composed of a chain of fungal cells as is the case with septate ~~coenocytic~~ fungi. In this case, the hyphae are separated into sections by cross walls called septa. In some organisms, the hypha is a continuous cytoplasm with many nuclei. These hyphae are known as septate ~~coenocytic~~ fungi.

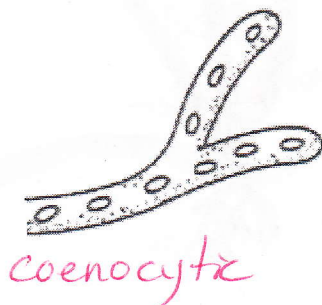
Hyphae contain large vacuoles. The hypha is surrounded by a plasma membrane and a cell wall, which is made of chitin, in contrast to plant cell walls made of cellulose. Chitin also makes up the exoskeletons of arthropods such as insects and lobsters.

1) Label the parts of a hypha below.

- Cell wall
- Cytoplasm
- Nuclei
- Plasma membrane
- Vacuole



2) Identify the following as coenocytic or septate fungi.



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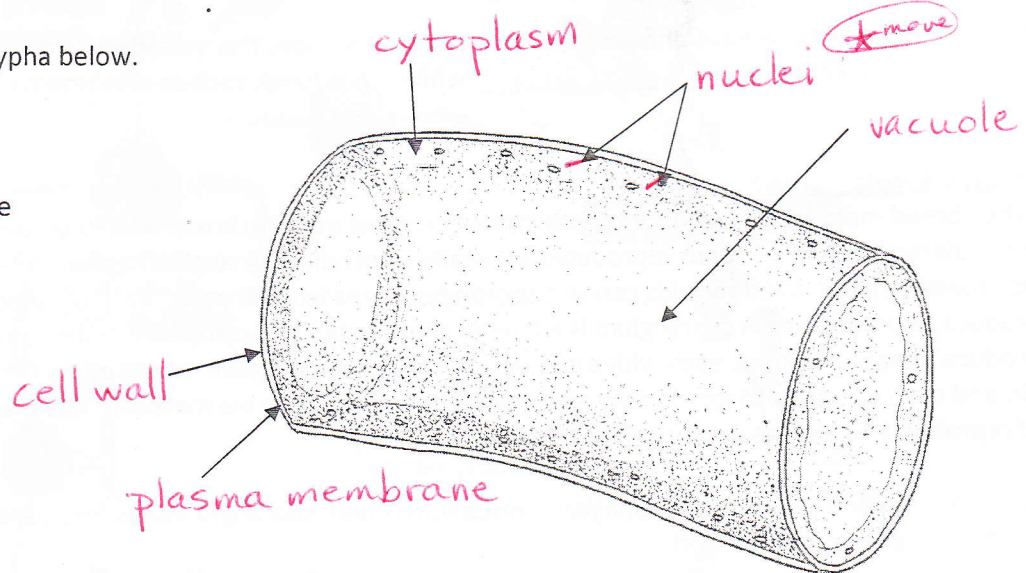
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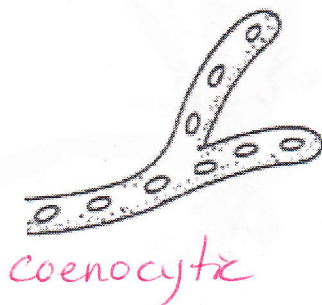
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B- Nutrition

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 not ingestive heterotrophs that digest food after they eat it like animals. They feed on and are classified as saprophytes. Their hyphae penetrate the dead material and form a branching network. 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.

Some fungi are predatory. They will capture food. For example, mycelium trap nematodes to absorb nitrogen.

Other fungi are mutualistic. Mycorrhizae absorb and concentrate phosphate which they deliver to plant roots. In turn, the fungi receive sugars from the plant. Ascomycetes in lichen provide moisture, shelter and anchorage for its partner, the green algae. The green algae provides it with nutrients.

Some fungi are parasitic. They absorb nutrients from their host. They may cause devastating plant infections such as rust and smuts and ruin entire crops such as wheat and corn. Only about 50 species are known to harm animals.

A fourth group of fungi are known as saprophytes. They feed on dead or decaying organic matter. Mushrooms are part of this group.

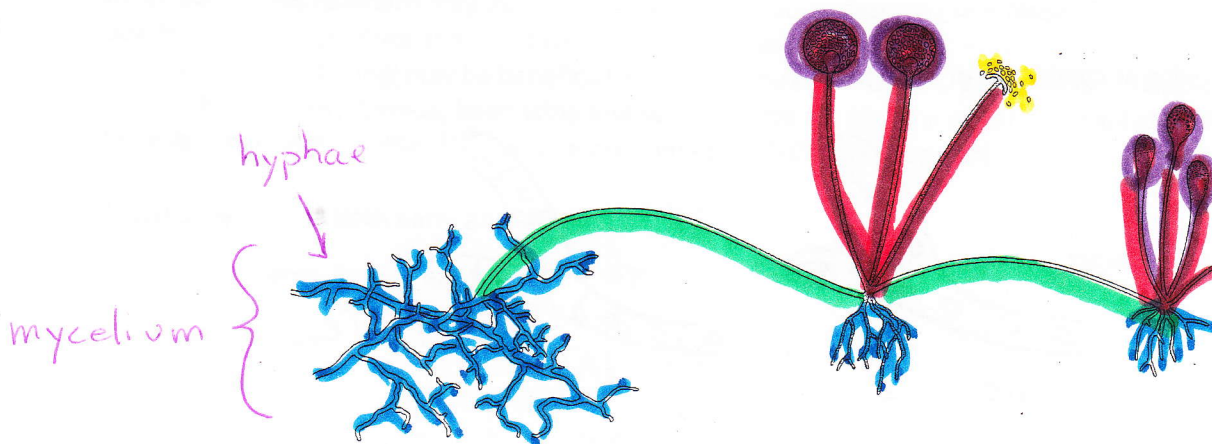
C- Reproduction

Different types of fungi have different methods of reproduction. The unicellular yeasts reproduce asexually through mitotic division known as budding, while other fungi, such as mushrooms, have much more complex life cycles.

Ex. 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.

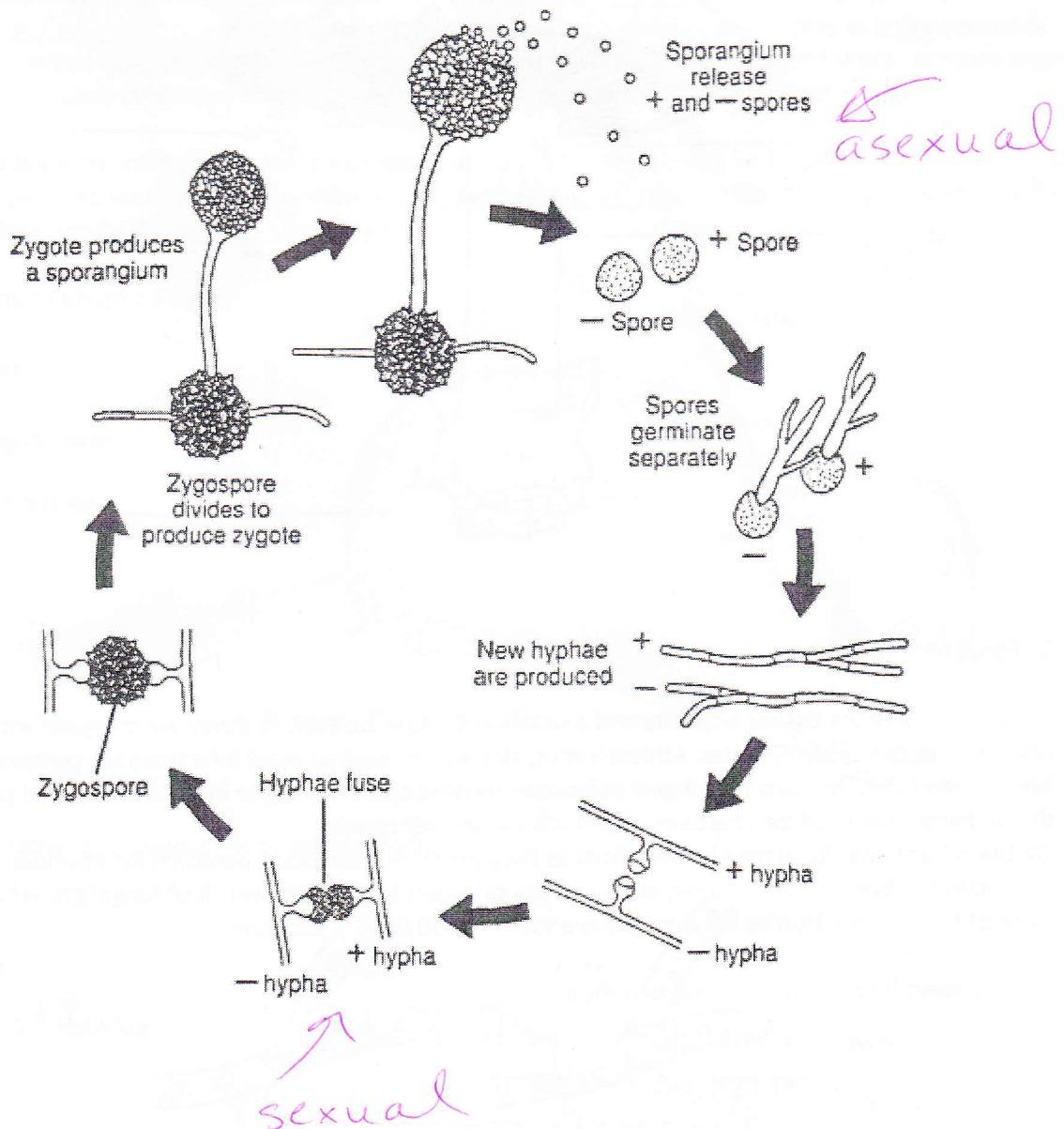
- 1) Color the parts of *Rhizopus stolonifer* --- mycelium (blue), sporangiophores (red), sporangium (purple), rhizoid (green), and spores (yellow).



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.

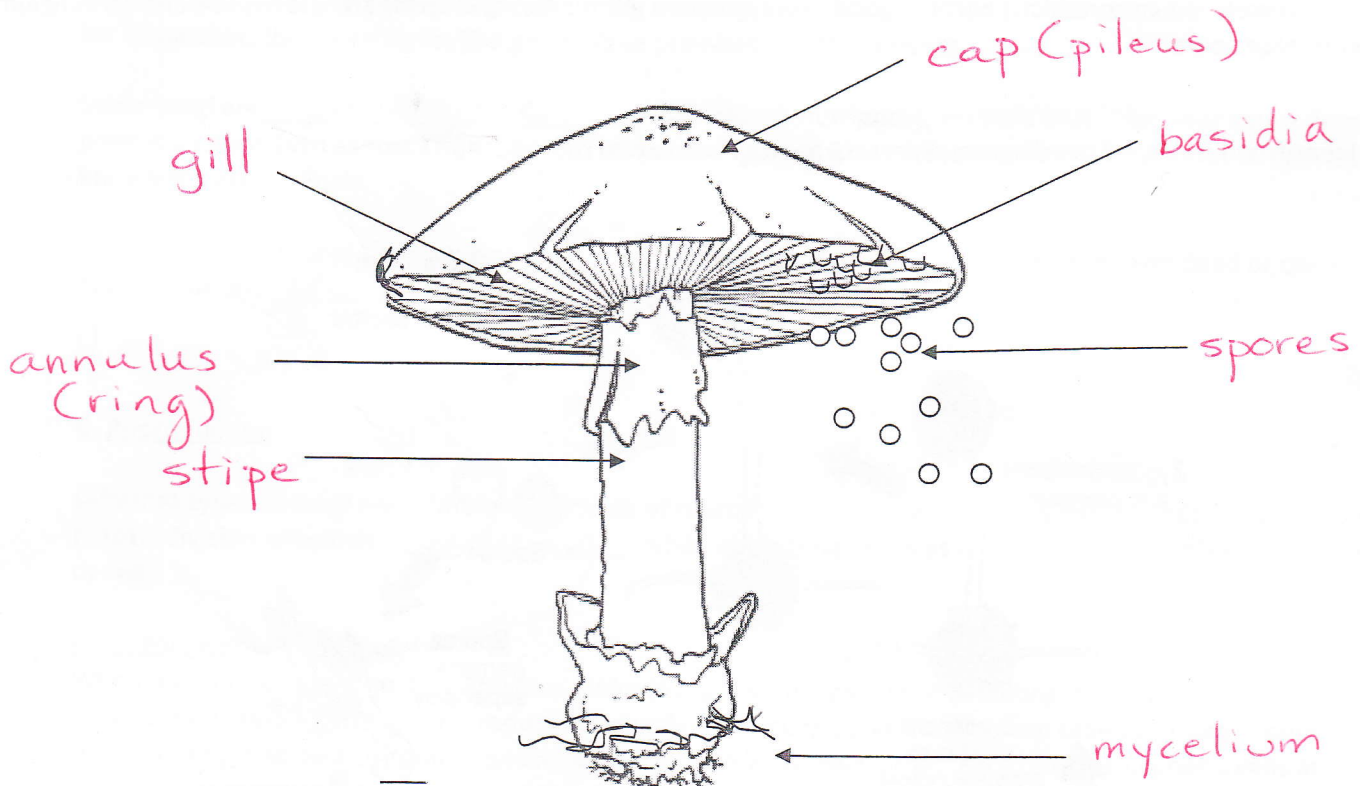
1) Identify which step in the diagram represent asexual and sexual reproduction.



In mushrooms, the part of the organism seen above ground is known as the fruiting body. As is the case with *Psalliota campestris* (field mushroom) and *Psalliota arvensis* (horse mushroom), they are edible. Those 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. As this body grows, it develops three distinct regions: a stalk called the stipe, a cap or pileus, and gills under the cap. Basidia 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.

1) Label the parts of the mushroom below.



D- Fungi and Humans

Fungi can attack the tissues of plants and animals and cause disease. In a way we compete with fungi for our food. Mold spores can cause allergies. Athlete's foot, ring worm, vaginal yeast infections are common diseases caused by fungi. Sometimes, humans may ingest poisonous mushrooms resulting in intense abdominal pain, vomiting and death. Fungi may produce aflatoxins which will cause liver cancer.

On the other hand, fungi may be beneficial as they produce antibiotics, penicillin for example. Yeast is used in the production of bread. Cheese, beer, wine and soy products are also the result of fungal growth. Many also enjoy the taste of fungi. Some truffles for example are valued at 10 000\$ a kilogram!

1) List 3 ways fungi both harm and benefit us.

- harm:
- mold → spoils food
 - liver cancer
 - spoils crops
 - diseases (athlete's foot, yeast)
 - allergies
 - sick (vomit) (death)

- benefit:
- antibiotics
 - food (mushrooms, cheese, soy)
 - beer/wine
 - r