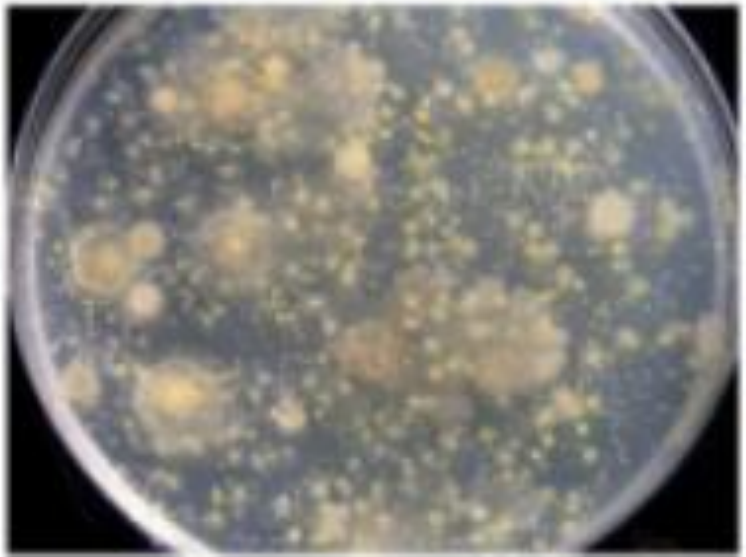
Go to the "Slide Show" shade above

Click on "Play from Beginning"

Bacteria, Protists, Fungi
Chapters 21-23



Chapter 23: Kingdom Fungi

https://somup.com/c3j6qEu7Xf Bacteria Protists Fungi Lab (14:44)

CHARACTERISTICS OF FUNGI

Fungi are NOT plants (No Chlorophyll)

Eukaryotes

Heterotrophic

Non-motile

Grow best in warm, moist environments

Most are saprophytes (decomposers)

THE CHARACTERISTICS OF FUNGI

Absorptive heterotrophs: digest food first and then absorb it into their bodies (**Extracellular Digestion**).

Release **digestive enzymes** to break down organic material or their host.

BREAD MOLD

THE CHARACTERISTICS OF FUNGI

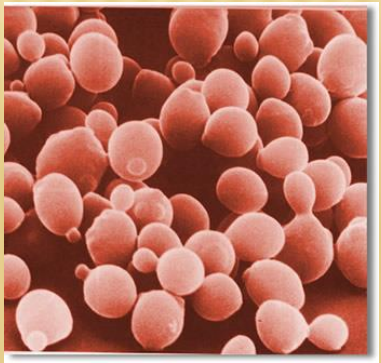
Important decomposers and recyclers of nutrients in the environment.

Most are multicellular, except unicellular yeast.

Lack true roots, stems or leaves (no tissues).

MYCOLOGY is the study of fungi.

MULTICELLULAR MUSHROOM



UNICELLULAR YEAST

CHARACTERISTICS OF FUNGI

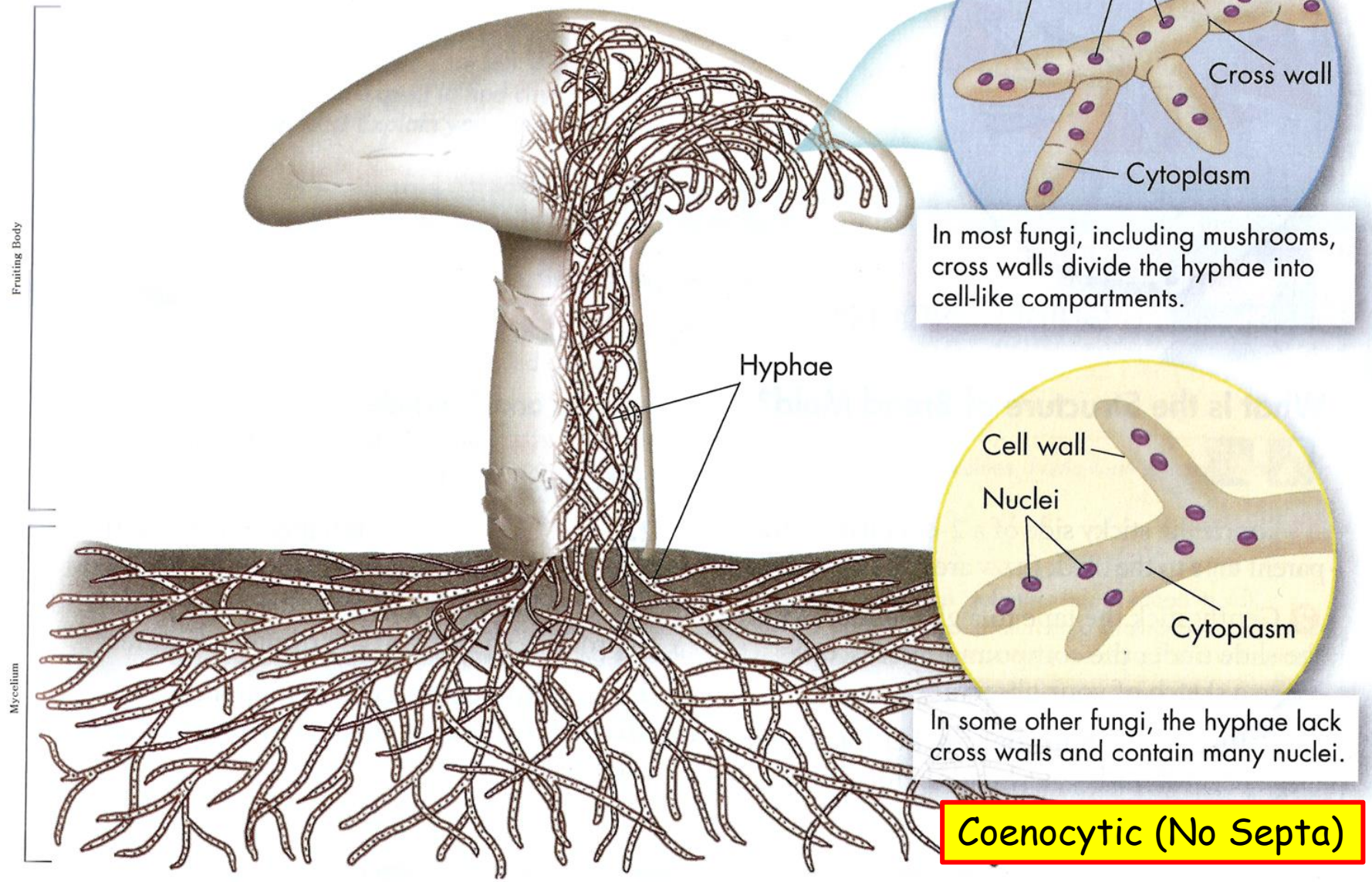
The visible body and underground structure of a multicellular fungus are made up of long chains of cells called **HYPHAE,** that are entwined to form a mass, the **MYCELIUM.**

Mycelia digest, absorb, and transport nutrients for the rest of the fungus.

A multicellular fungus consists of an above-ground **FRUITING BODY** and a below-ground **MYCELIUM.**

Cell walls are made of **CHITIN** (complex carbohydrate).

HYPHAE: Thin filaments that compose a fungus.

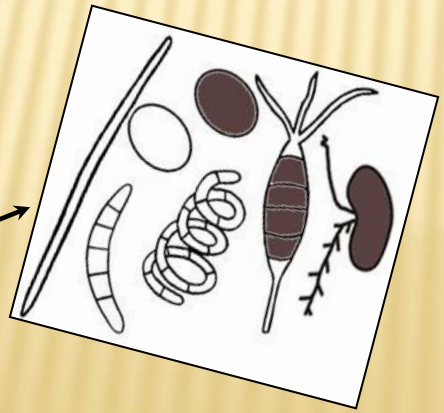


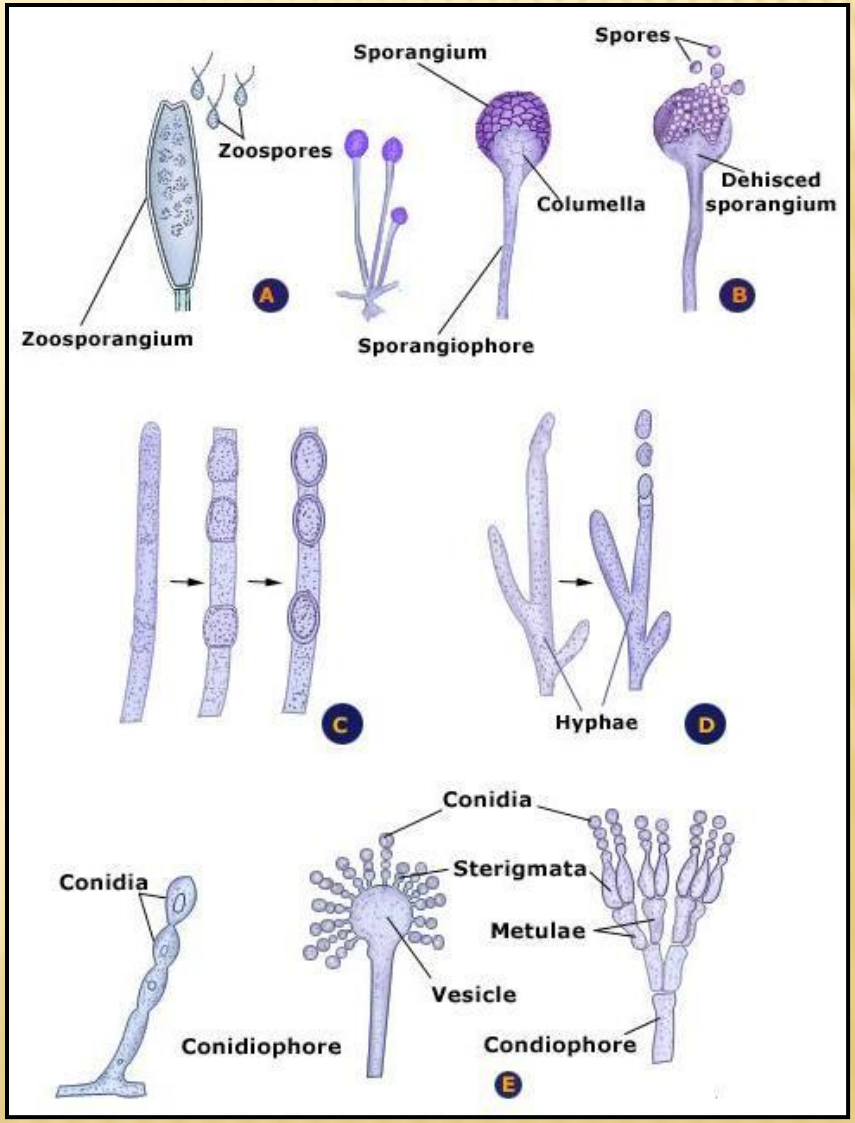
THE CHARACTERISTICS OF FUNGI

Reproduce **sexually** and **asexually** through **SPORES.**

Fungi are classified by the **form of sexual reproduction** it carries out.

Spores come in various shapes





REPRODUCTION

Most fungi exist in the haploid state and reproduce by SPORES, that are produced asexually or sexually.

Either way, spores that land on a suitable habitat can germinate and give rise to haploid hyphae, starting a new organism.

ASEXUAL reproduction is the most common method and produces genetically identical organisms (mitosis).

Fungi reproduce SEXUALLY when conditions are poor and nutrients scarce.

ASEXUAL REPRODUCTION: THREE TYPES

1) FRAGMENTATION – part of the mycelium becomes separated and begins a life of its own.
2) BUDDING – a small cell forms and gets pinched off as it grows to full size.
   - Used by Yeasts
3) ASEXUAL SPORE PRODUCTION –
   - Most common method
   - Sporangiophore: Specialized hyphae where spores are formed within an enclosure, called Sporangium.
   - Conidiophore: Specialized hyphae where spores are formed at the tips of the hyphae.
     - Spores are called = Conidia

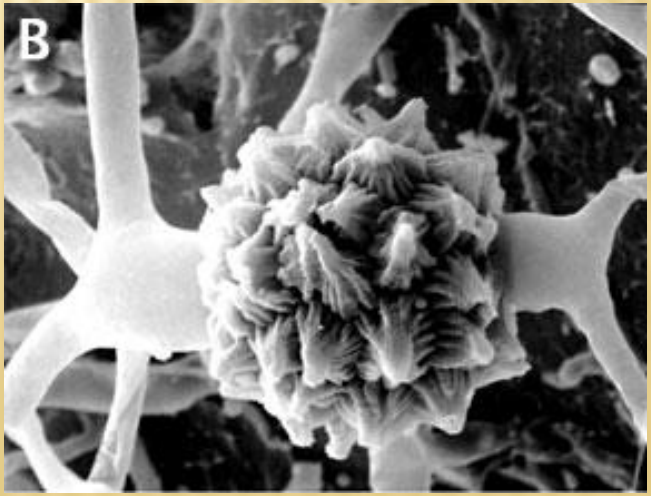
SEXUAL REPRODUCTION

Haploid hyphae from 2 mating types (+ and -) FUSE (Fertilization).

Form a FRUITING BODY (DIPLOID) that will produce diploid Zygotes.

Zygotes go through meiosis to produce haploid SPORES.

Haploid Spores germinate and give rise to haploid hyphae, starting a new organism.

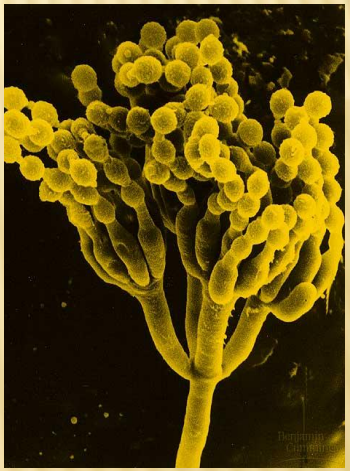


SPORES Forms

REPRODUCTION BY SPORES

Spores may be Formed:

- Directly on tips of **Hyphae** (asexual)
- Inside **Sporangia** (asexual)
- On **Fruiting Bodies** (sexual)



Penicillium Hyphae

Amanita Fruiting Body

Pilobolus Sporangia

The Kingdom Fungi has over 100,000 species.

Fungi are classified according to.... ....the **form of sexual reproduction** they carry out.

The four main groups of fungi are:

Phylum **Zygomycota:**

The common Molds

Bread mold; *Penicillium*

Phylum **Ascomycota:**

The Sac fungi

Yeasts

Phylum **Basidiomycota:**

The Club fungi

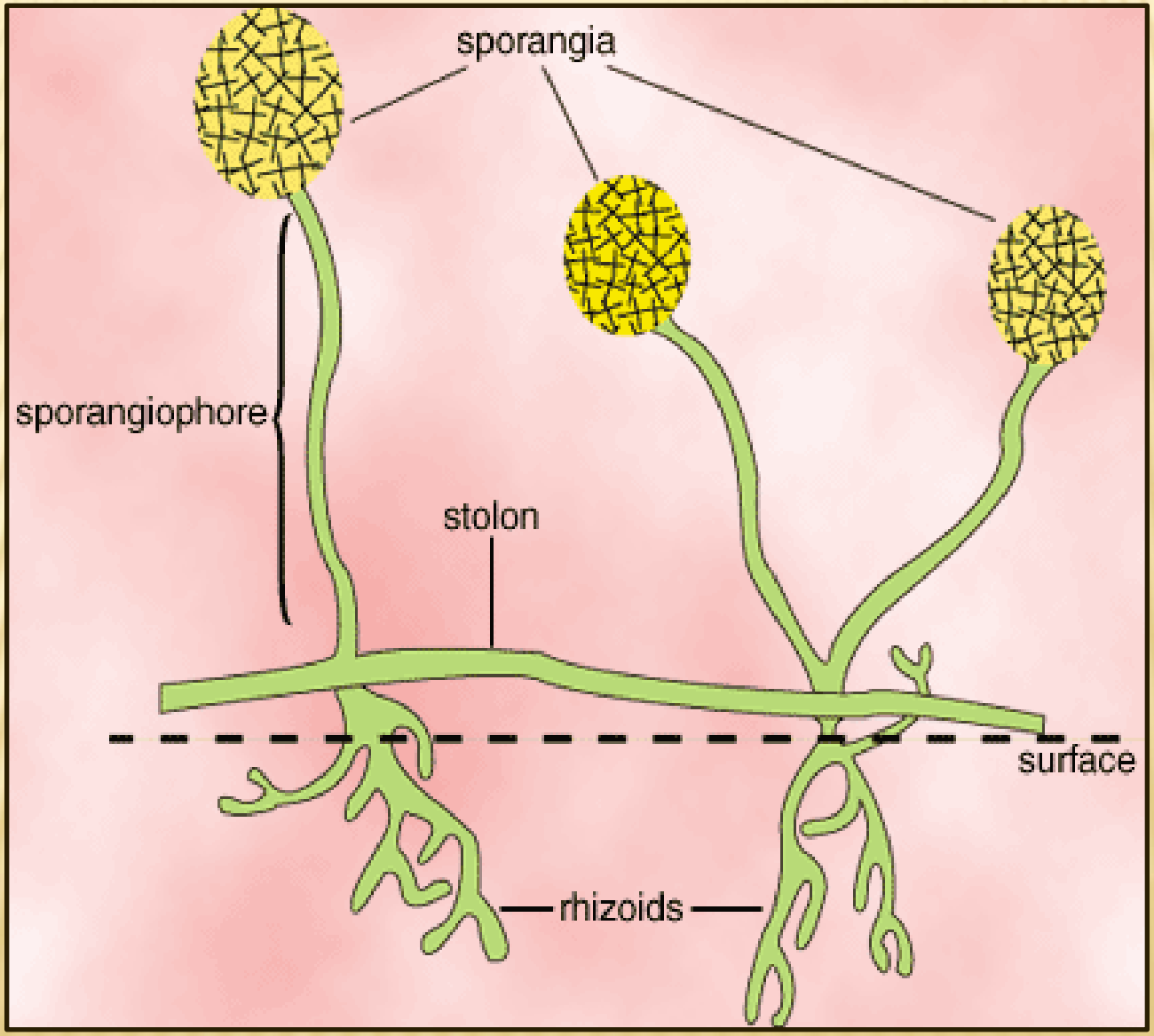
(Mushrooms)

Phylum **Deuteromycota**

The Imperfect fungi

(athlete's foot)

ZYGOMYCOTA (Molds)



ZYGOMYCOTA

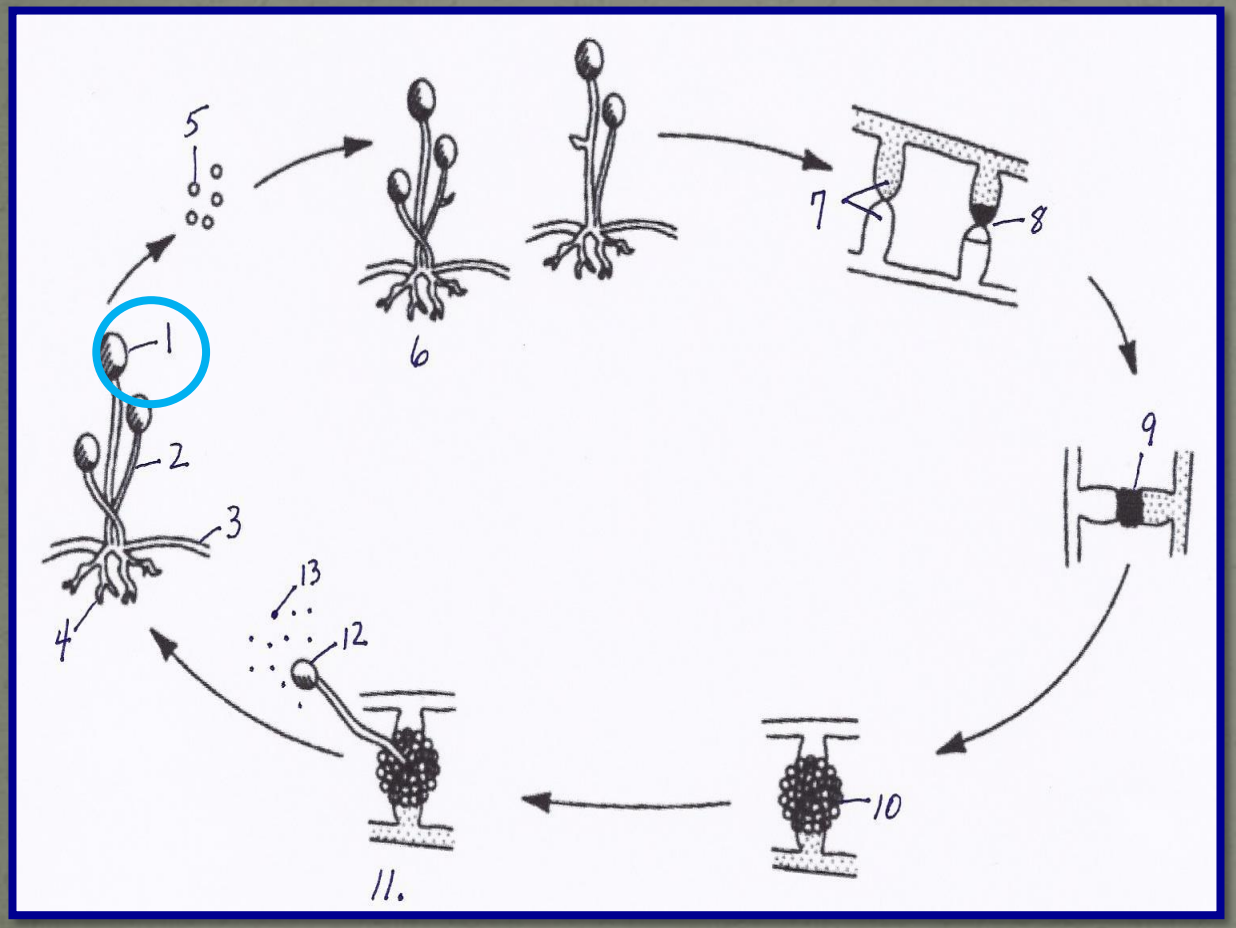
Commonly called **Molds**

Includes bread mold ***Rhizopus stolonifer***

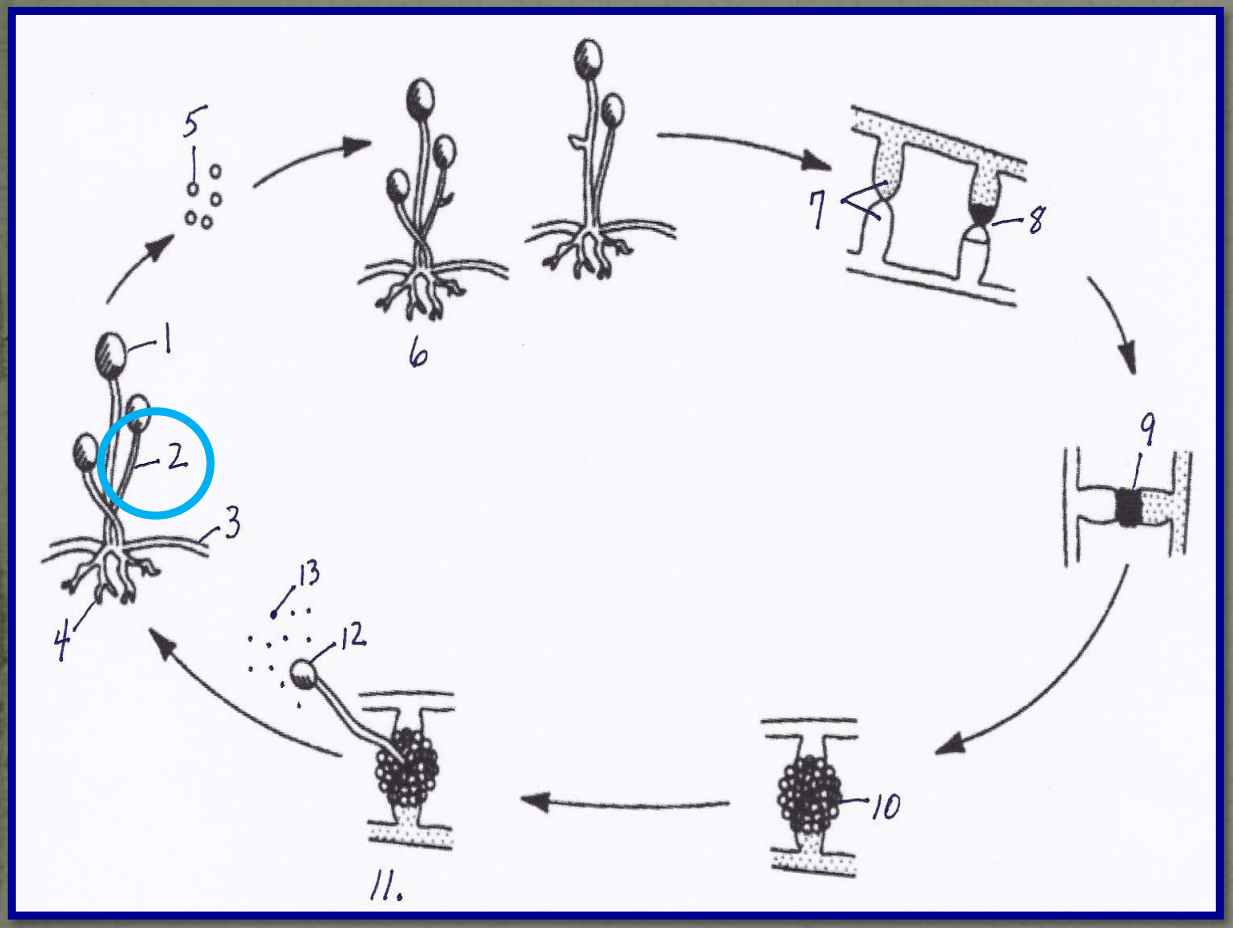
***Rhizopus* on strawberries**

***Rhizopus* on bread**

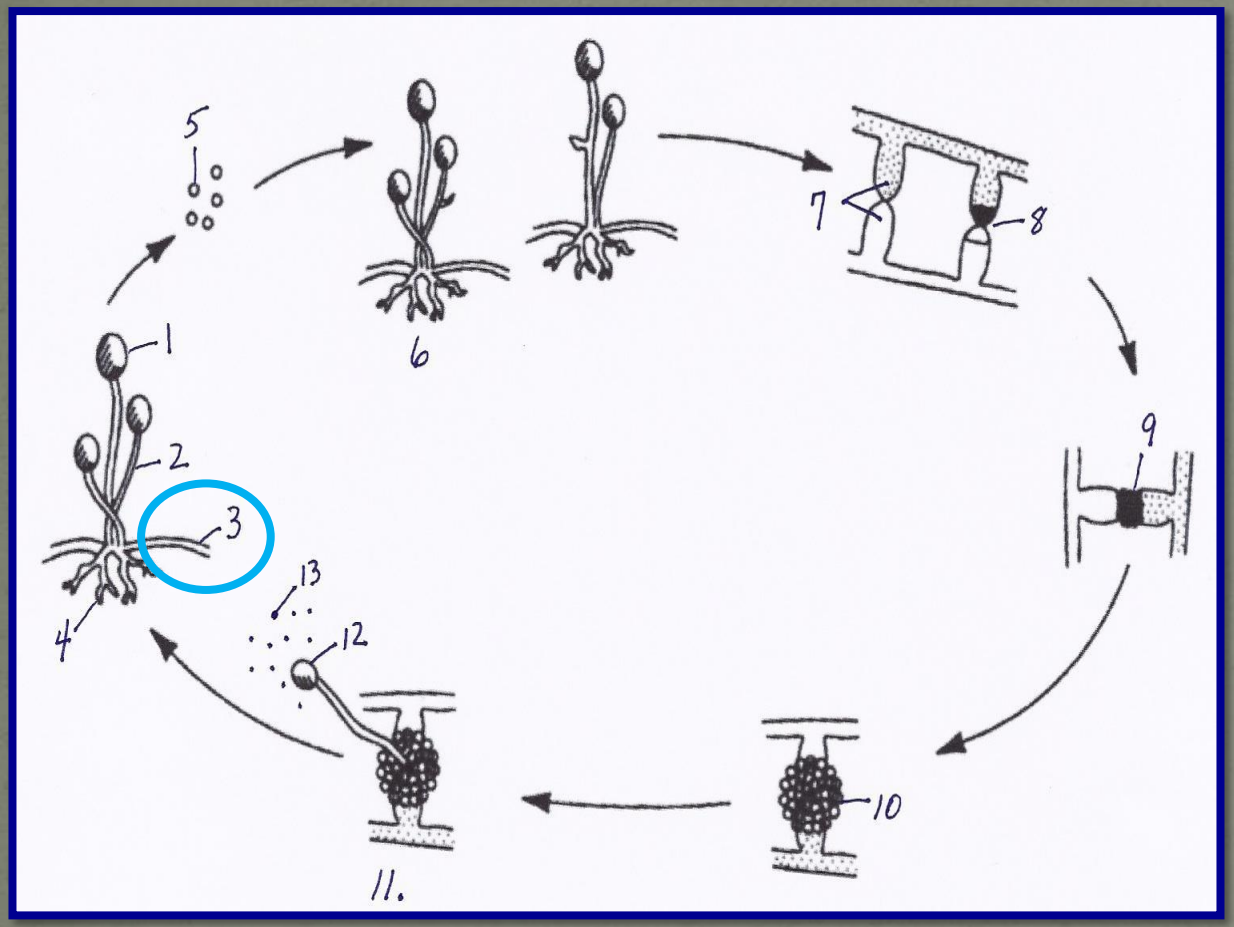
The life cycle of the common bread mold has both asexual and sexual components.

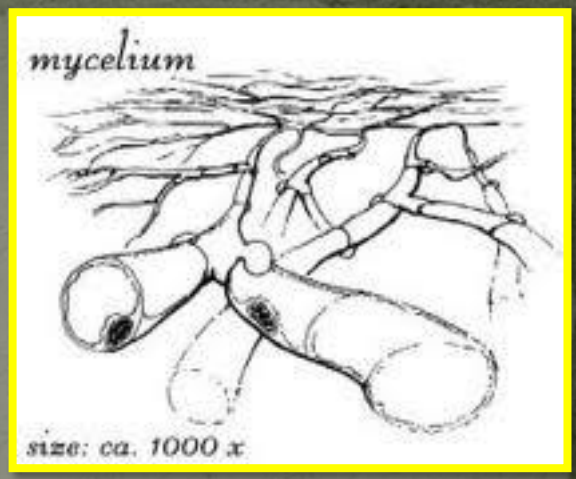


1. The sporangium produces **asexual** spores.

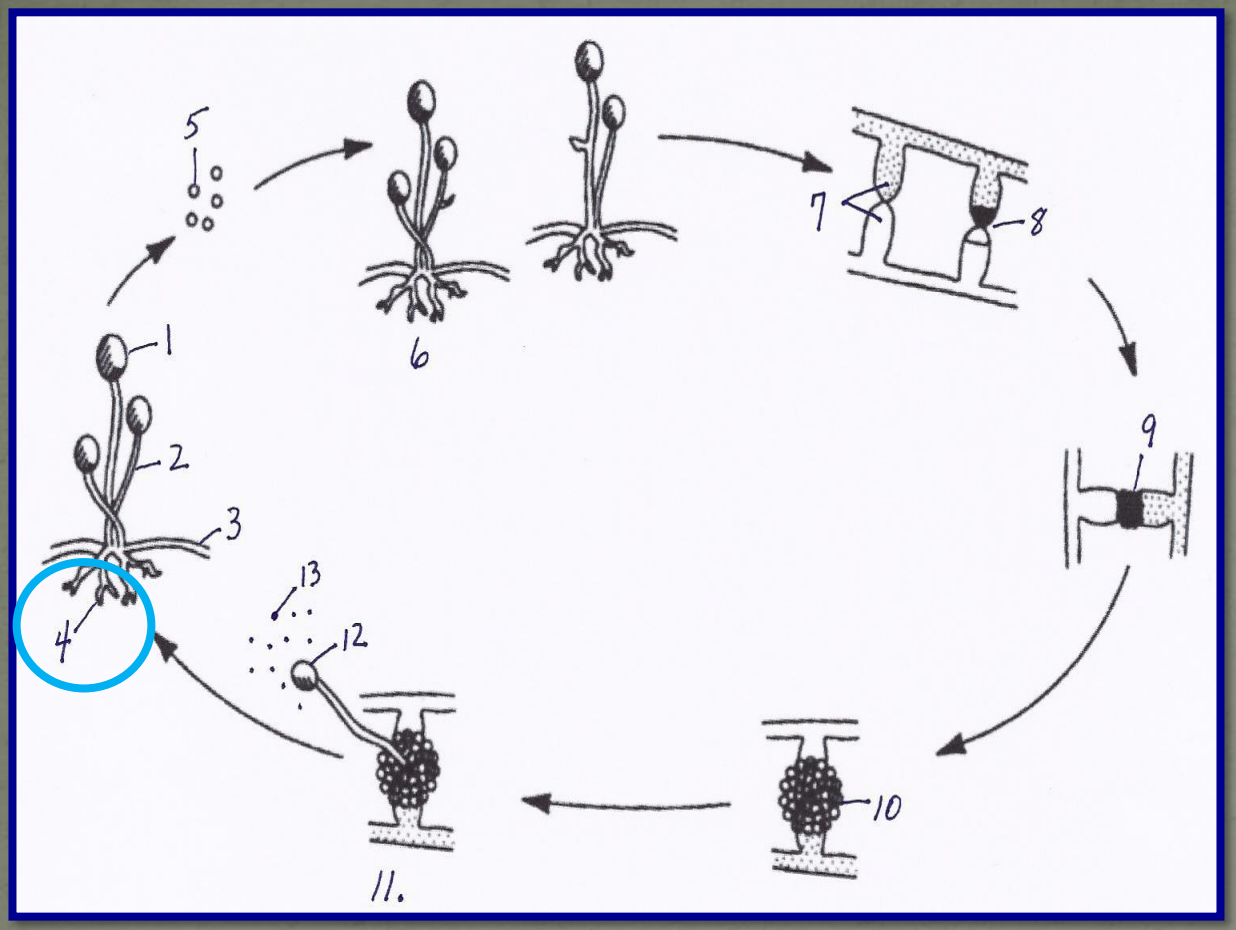


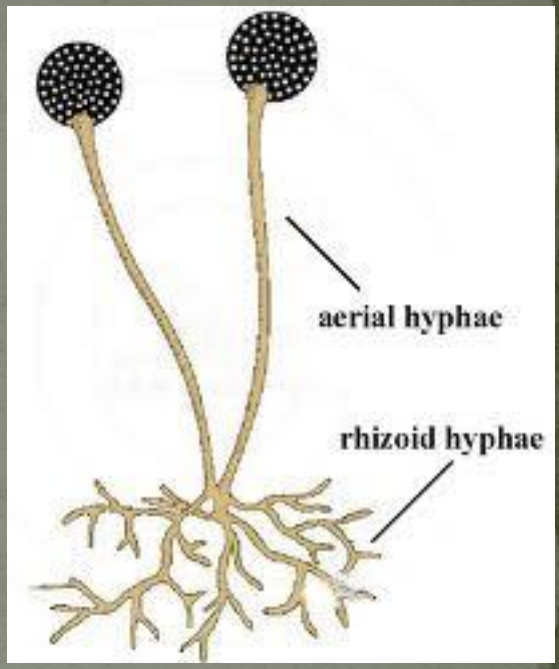
2. The sporangium is held up in the air by a Sporangiophore (special kind of hyphae).





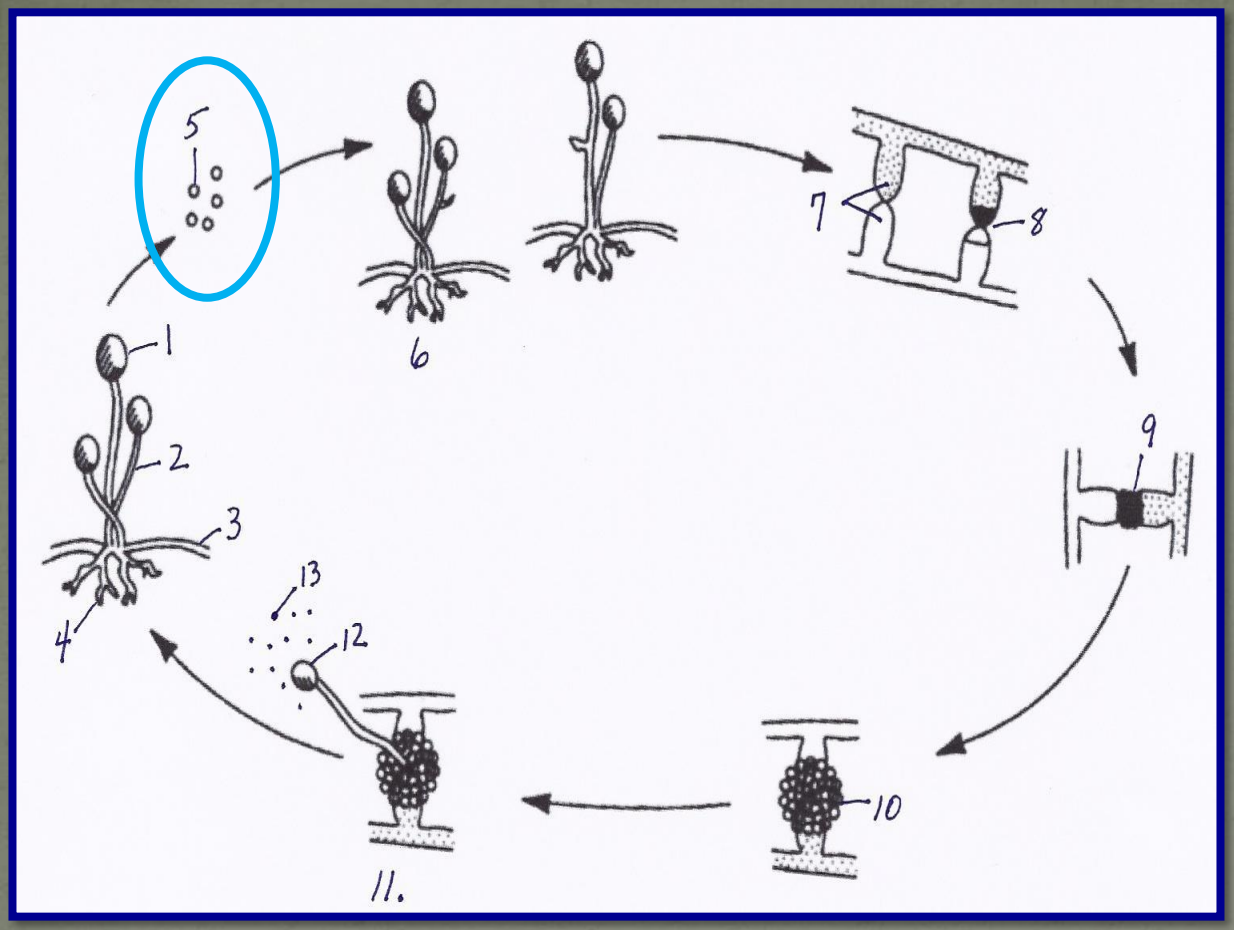
3. **Stolons** spread the fungus across the surface of the substrate.



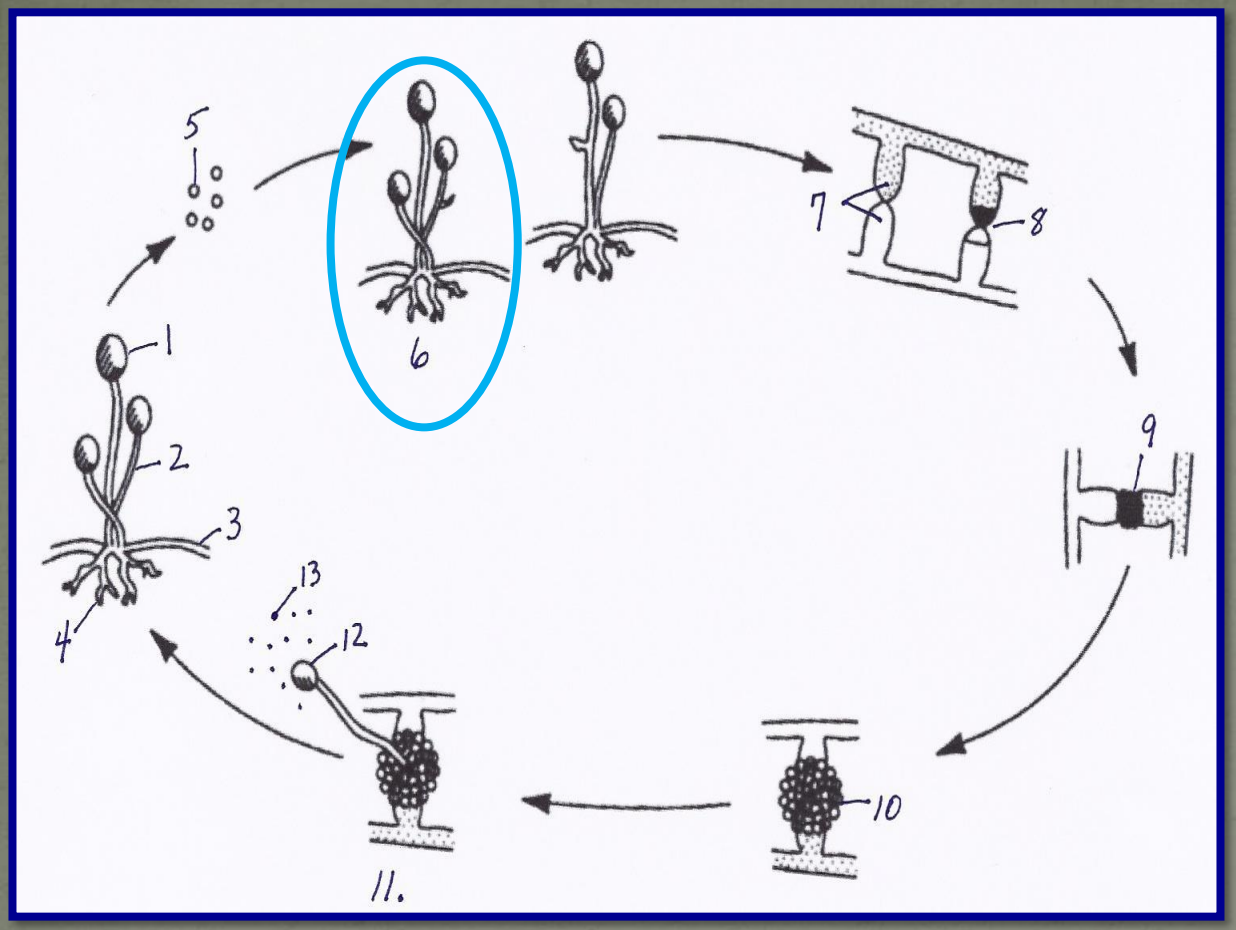


4. Rhizoids anchor the fungus in the bread.

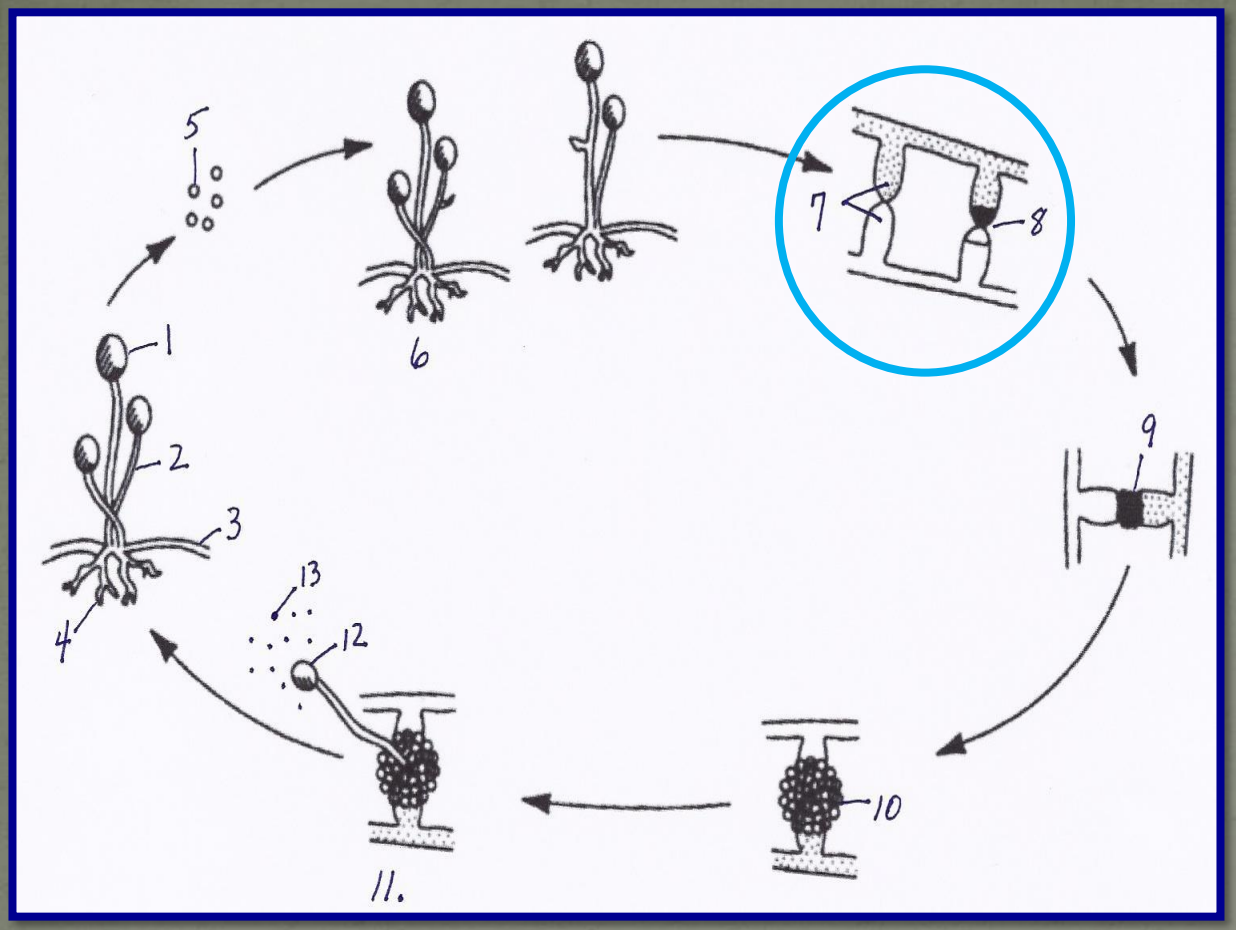
   They absorb water and nutrients.



5. The spores produced by the sporangium are released.

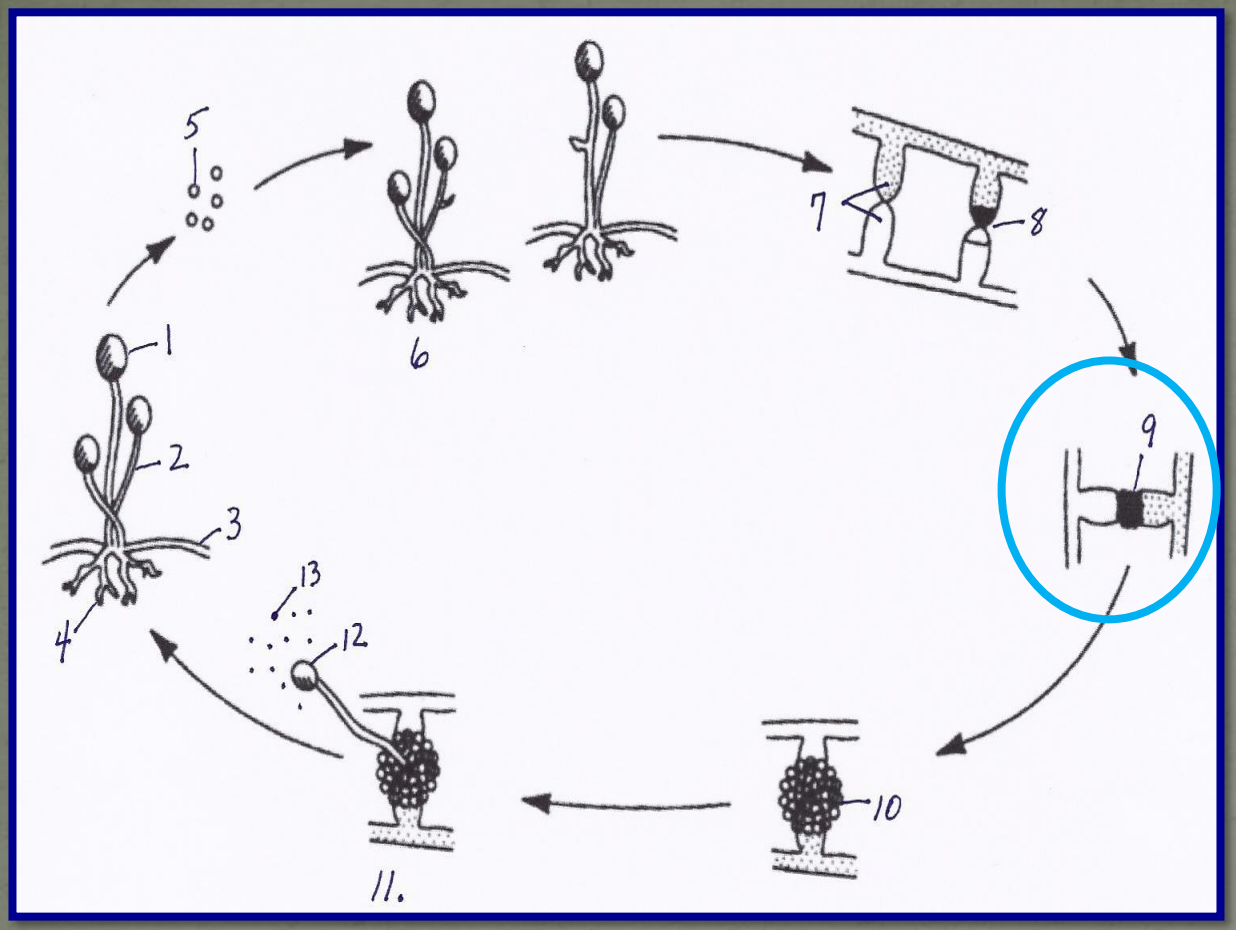


6. Spores germinate into new hyphae.

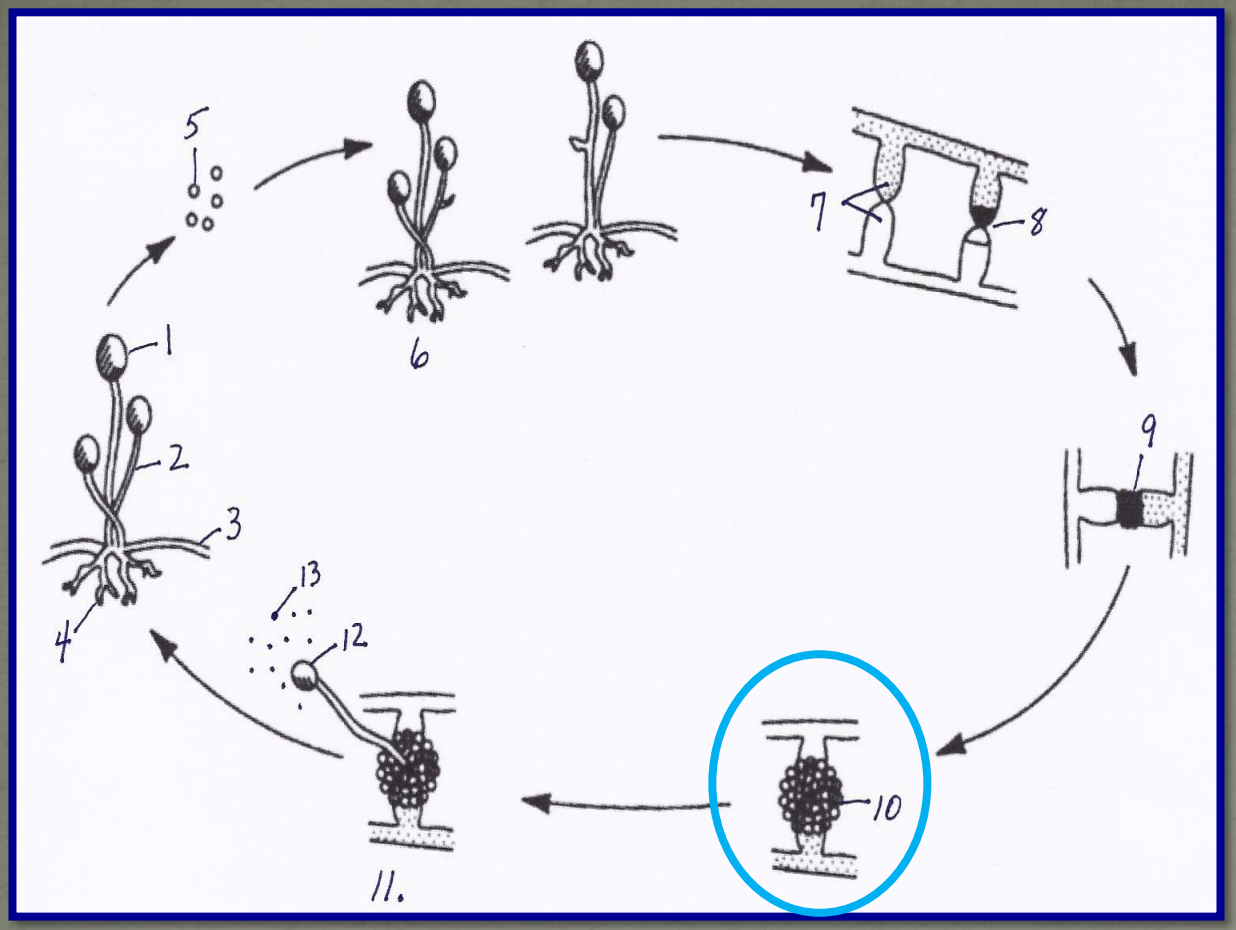


8. Hyphae containing haploid gametes (+ and -) fuse.

7. The tips of the hyphae contain gametes that are neither male nor female, but rather, are referred to as "plus" and "minus".

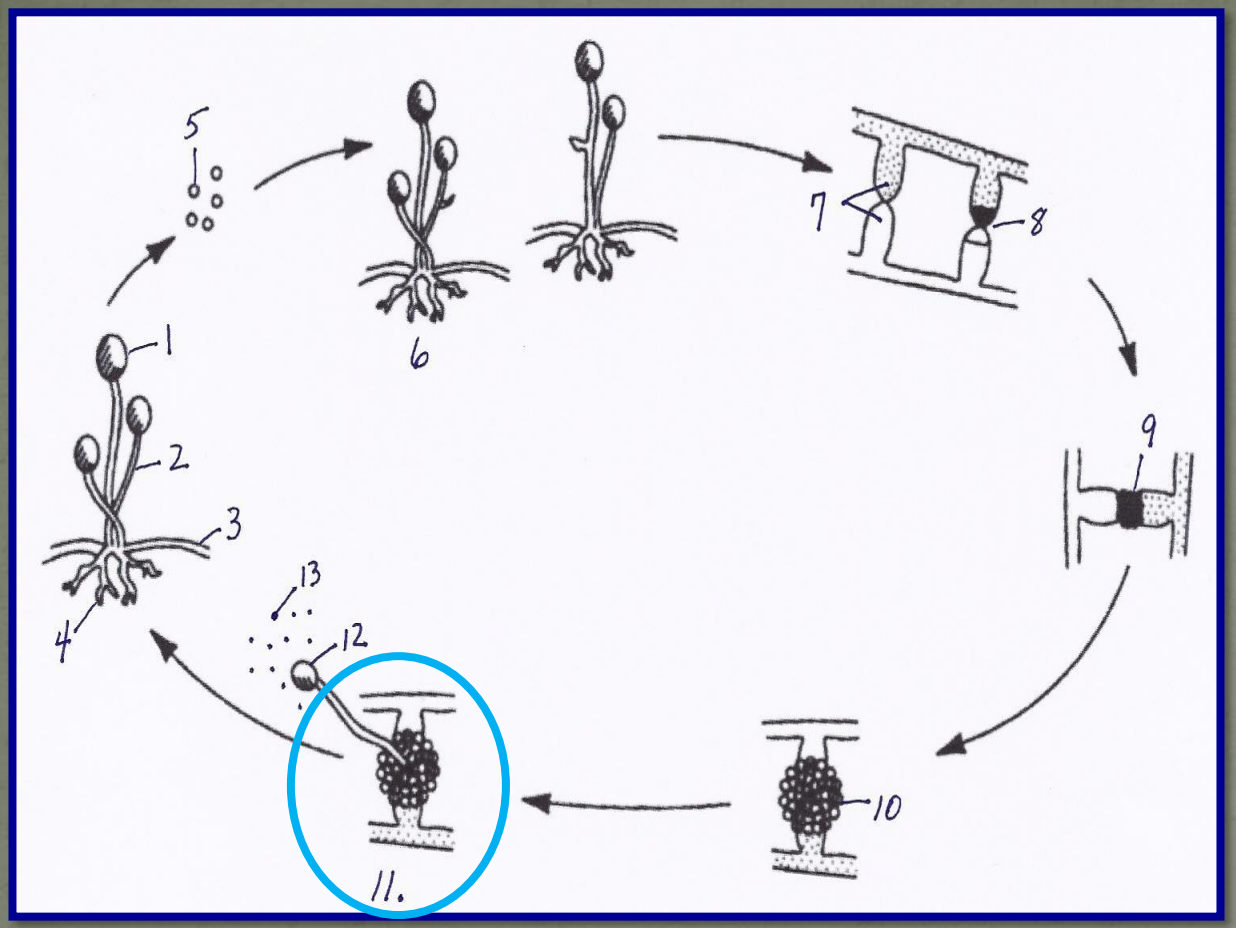


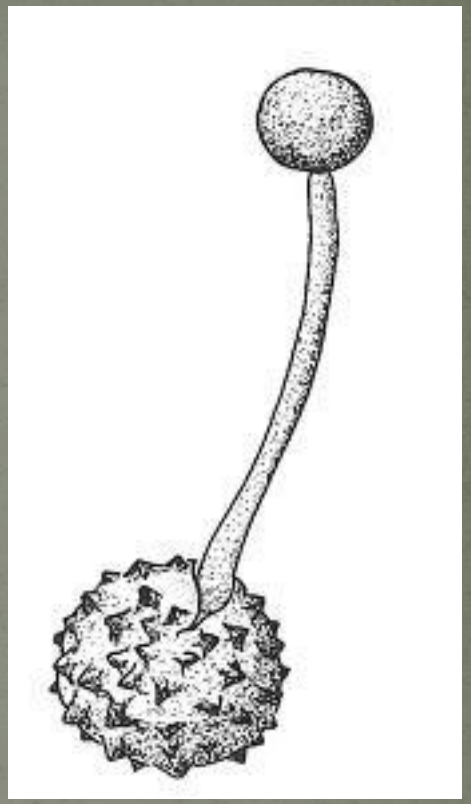
9. Fusion of gametes produces a diploid zygote.



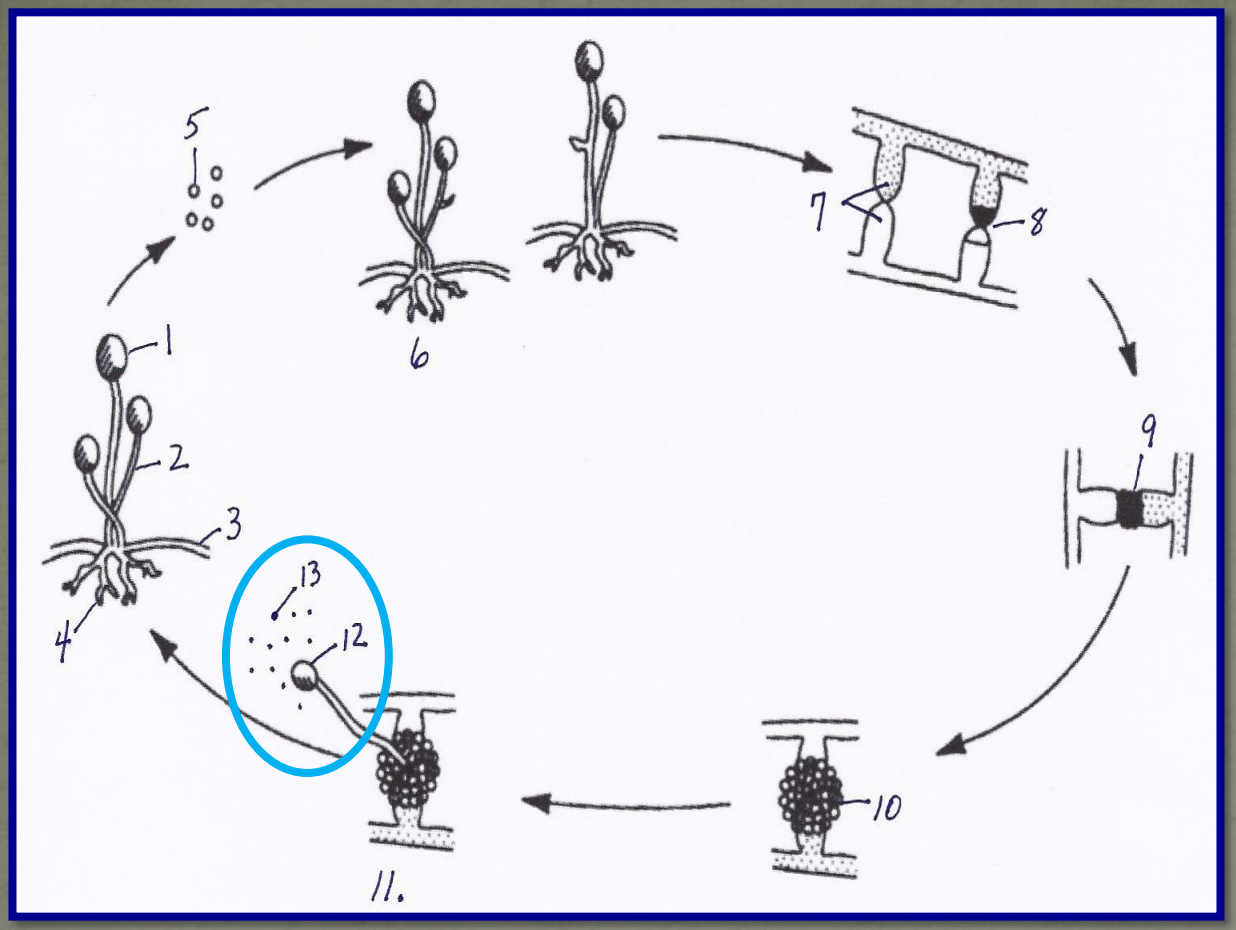
10. Zygotes develop into thick walled zygospores.

    The zygospore may remain dormant for months, and can withstand unfavorable conditions.



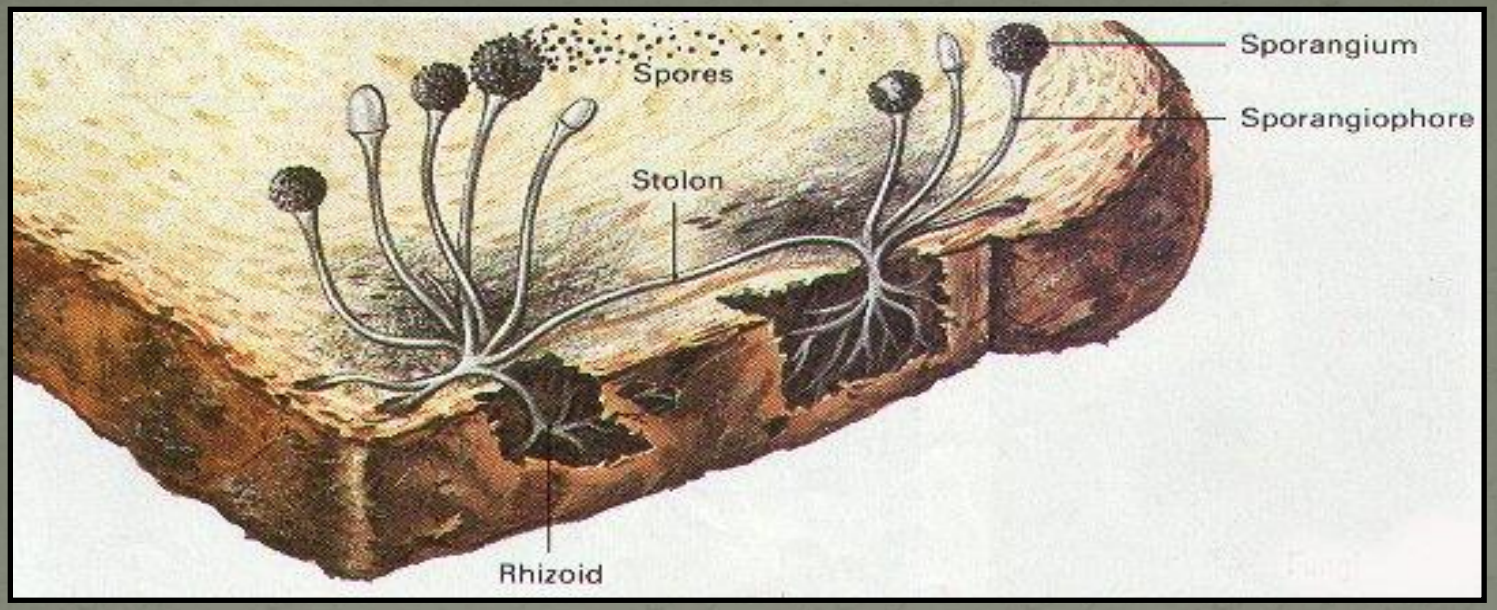


11. When conditions become favorable, the zygospore germinates, and undergoes meiosis.



12. The sporangium releases new, haploid spores.

13. The spores germinate and grow into new hyphae.



14. This process insures genetic variation.

    It produces new combinations of genetic information that may help the organism meet changing environmental conditions.

ASCOMYCOTA

Phylum Ascomycota – The Sac Fungi

All of the fungi in this phylum are so named because they have an "ascus" or sac.

An ascus is a reproductive structure that contains sexual ascospores.

This is the largest phylum of fungi, containing over 30,000 different species.

CHARACTERISTICS

Includes Cup fungi, morels, truffles, yeasts, and mildew.

May be plant parasites (Dutch Elm disease and Chestnut Blight).

Penicillium

Asexual spores called Conidia form on the tips of special hyphae called Conidiophores.

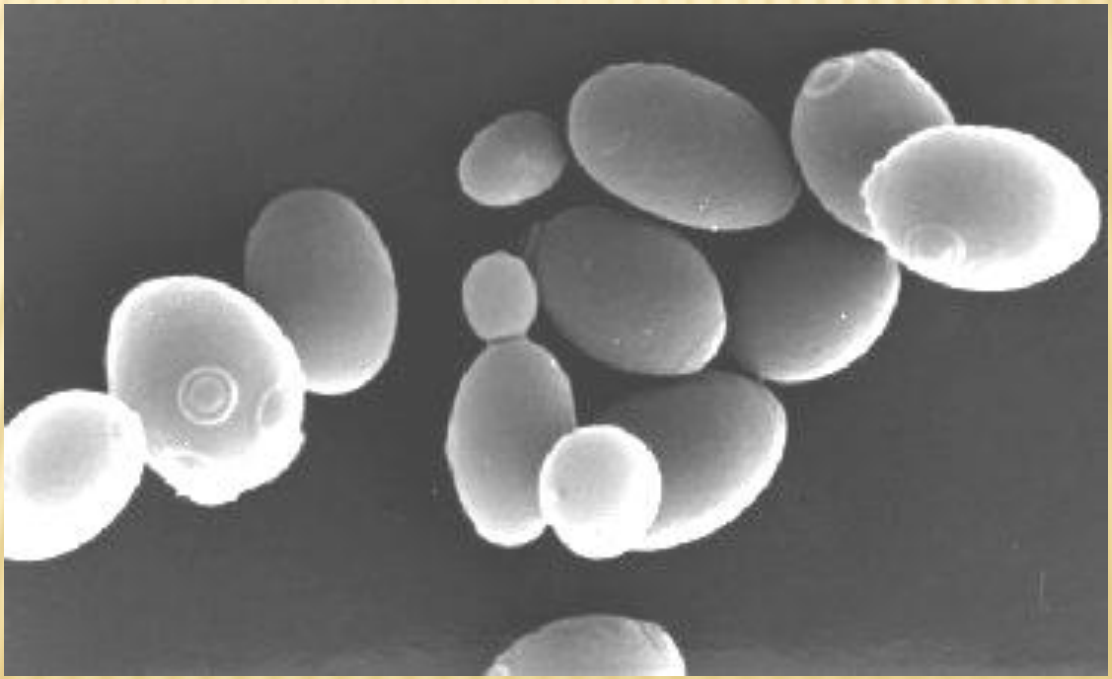
Ascus (fruiting body): visual Sexual reproductive structure that produces sexual spores (Ascospores).

ASCOMYCOTA

Penicillium

ASCOMYCOTA

Yeasts reproduce **asexually** by **budding** (buds break off to make more yeast cells).



Saccharomyces

USES OF ASCOMYCOTA

Truffles and morels are good examples of edible *ascomycota*.

Penicillium mold makes the antibiotic penicillin.

Some ascomycota also give flavor to certain cheeses.

Saccharomyces cerevesiae (yeast) is used to make bread rise & to ferment beer & wine.

A package of yeast contains dry granules containing ascospores. These ascospores become active when placed in a moist environment.

Prior to baking, yeasts are mixed with a thick, rich dough. This is an environment containing very little oxygen.

Yeasts survive using the process of alcoholic fermentation. In fermentation, the sugar of the bread dough is converted to energy.

Two waste products are produced: carbon dioxide and alcohol. The carbon dioxide gas makes beverages bubble and breads rise.

The alcohol evaporates during baking.

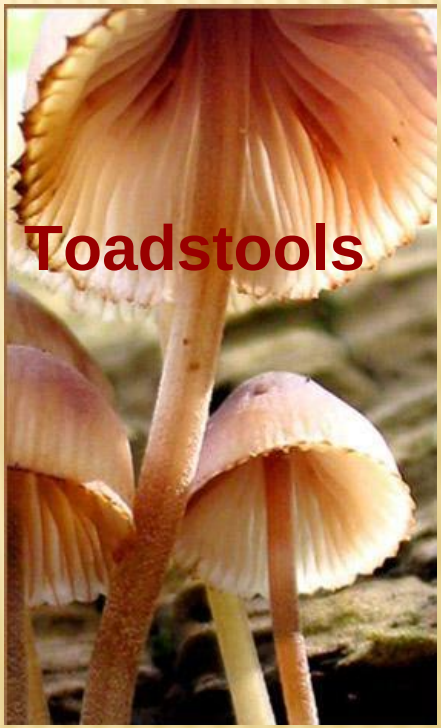
BASIDIOMYCOTA (Club Fungi)

BASIDIOMYCOTA

Called Club fungi

Mushrooms

Bracket & Shelf fungi



Toadstools

Puffballs

Stinkhorns

Rusts & Smuts

USES FOR BASIDIOMYCOTA

Some are used as food (mushrooms)

Portobello Mushrooms

Others damage crops (rusts and smuts)

Corn Smut

Soybean Rust

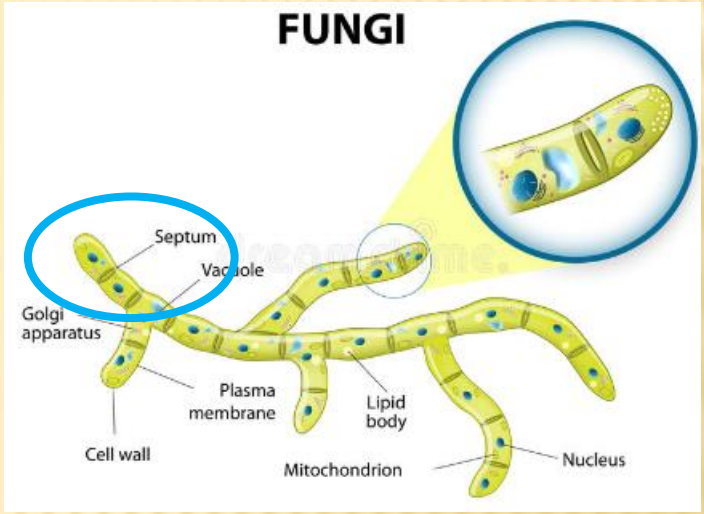
CHARACTERISTICS OF CLUB FUNGI

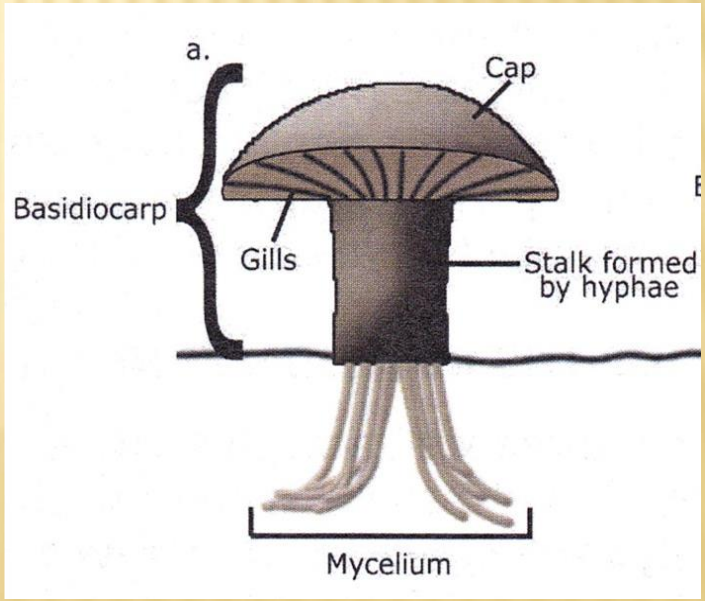
- **Seldom** reproduce asexually

Septated Hyphae

The visible mushroom is a **Fruiting Body** (sexual reproductive structure)

Fruiting Body (**Basidiocarp**) is made of a stalk called the **Stipe** and a flattened **Cap** with **Gills.**



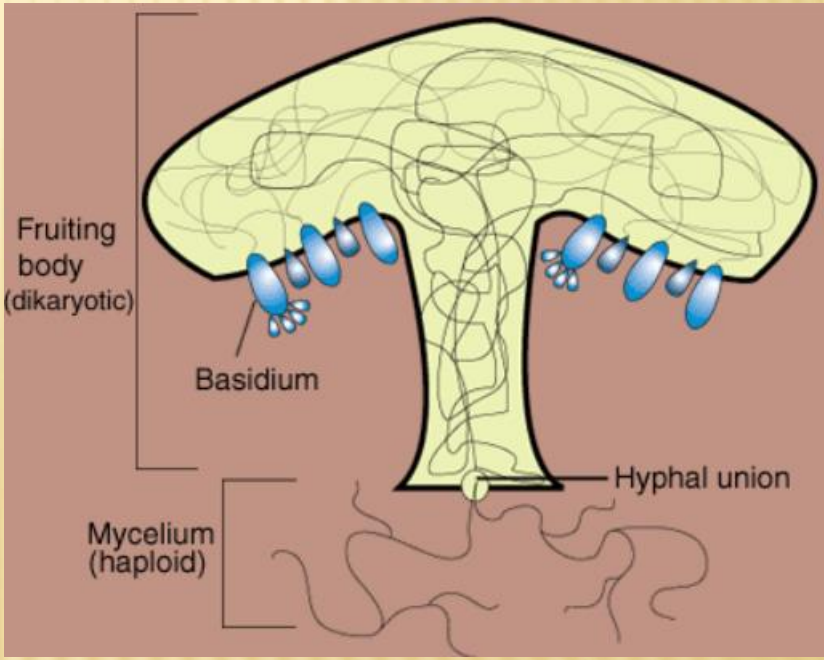


CHARACTERISTICS OF CLUB FUNGI

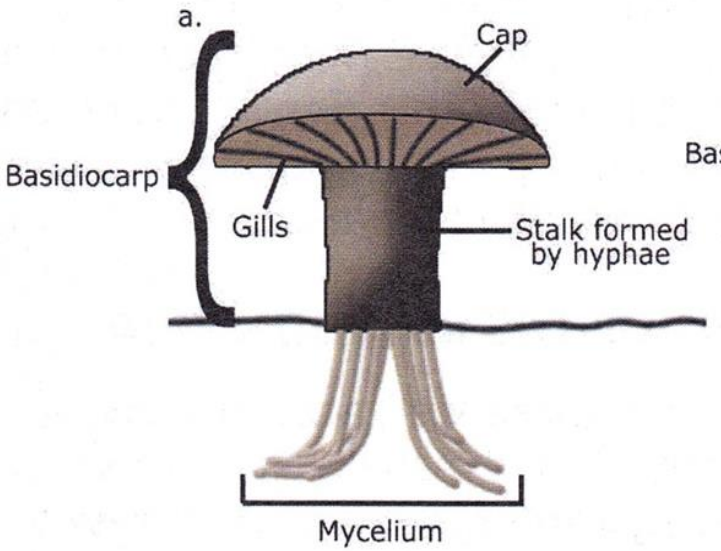
Inside walls of gills: **Basidia** (club-shaped hyphae that produce spores sexually).

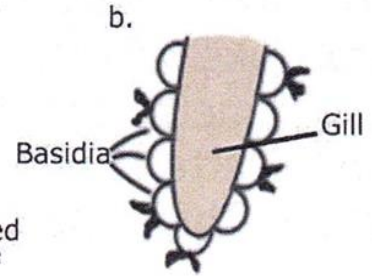
Basidiospores (sexually produced gametes found in **Basidia**) are released during reproduction and are dispersed by wind, water, or animals.

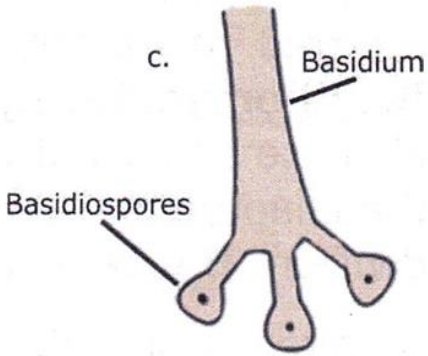
Mycelium network found below ground.



Basidiomycota Structure







Life Cycle of Club Fungi

1. The mycelium lives underground and may grow for years, reaching an enormous size.
2. When the favorable conditions of moisture and nutrients are present, fruiting bodies will appear above ground.
3. These fruiting bodies are mushrooms.
4. Mushrooms appear and grow at a very rapid rate. Their growth is caused by c enlargement, not cell division. The cel enlarge by rapidly taking in water.

5. The mushroom opens, exposing hundreds of tiny gills. Each gill is lined with basidia.
7. A diploid zygote in the basidium undergoes meiosis forming clusters of haploid basidiospores.
8. A single mushroom can produce billions of spores and a giant puffball can produce trillions!

DEUTEROMYCOTA

"Imperfect Fungi"

- Not known to have any sexual reproductive cycle.
- **Ringworm, Athlete's foot, and some other human parasitic fungi.**

The term "imperfect fungi" does not mean that there's anything wrong with the organism. It simply means that our understanding of the life cycle is "imperfect".

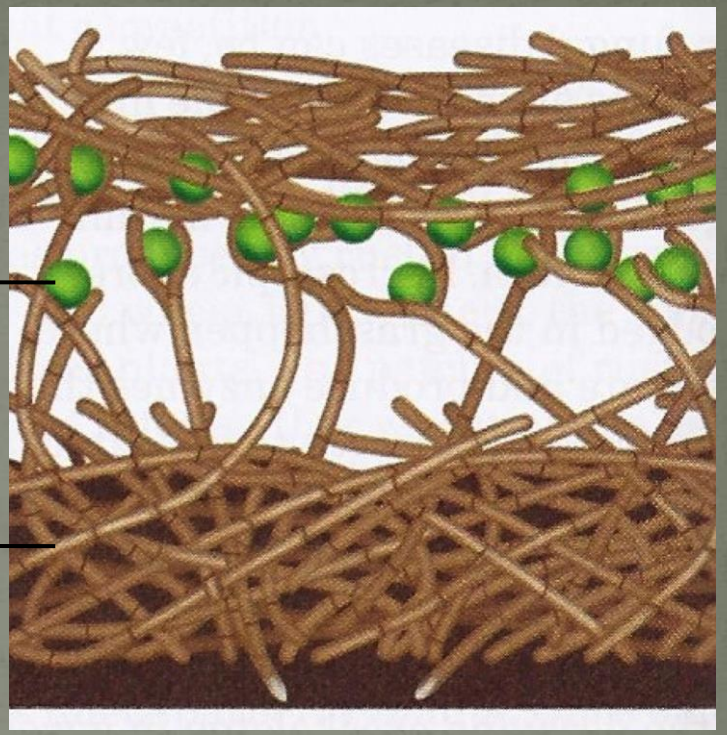
Ringworm hyphae

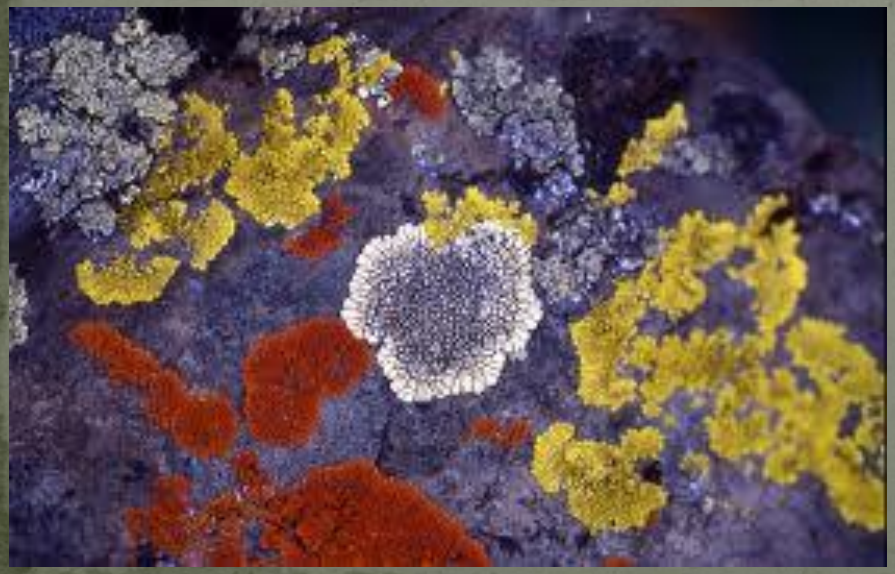
Athlete's Foot hyphae

Whenever a mycologist discovers a sexual stage in one of these fungi, the species is moved from the imperfect category to a particular phylum, depending on the type of sexual structures.

Lichens

A lichen is a combination of a specific fungus and a green algae.





A lichen shows the biological relationship of **mutualism**.

The algae provides food for the fungi. The fungus provides water and shelter in which to live for the algae. Both benefit.

Since they are very resistant to drought and cold, they are often the first organisms to begin the colonization of barren environments.

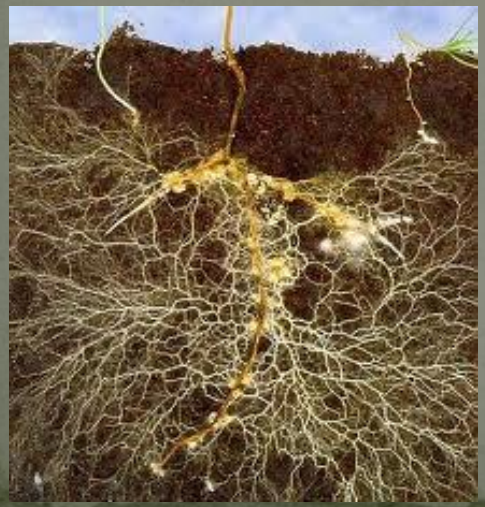
They break down the rocks upon which they grow, the first step in the formation of soil.

They are very sensitive to air pollution and are often used as an indicator of poor air quality.

Mycorrhizae

This is a symbiotic (mutualistic) relationship between a fungus and the roots of plants.

The mass of fungal hyphae is found wrapped around the true roots of plants.



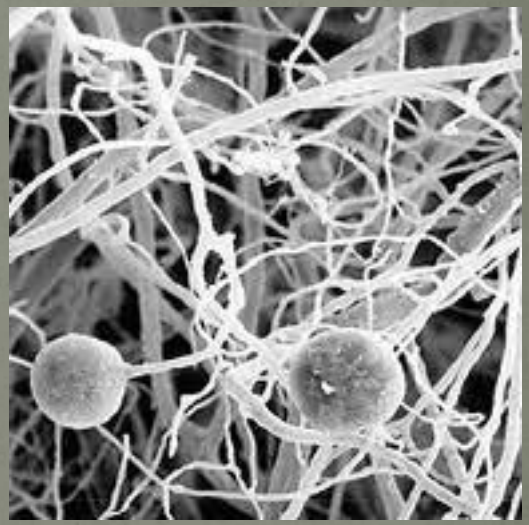
The fungal hyphae helps to increase the surface area for the absorption of water.

The hyphae also improve the delivery of phosphate ions and other minerals to plants.

Mycorrhizae

The plant provides food for the fungus.

Almost all vascular plants have mycorrhizae and rely on their fungal partners for essential nutrients.



FUNGI: PRACTICAL ASPECTS

Primary **decomposers** in the world

They break down organic substances into simple, soluble forms that plants can use.

Ergot of Rye: fungus that causes a purplish black swelling in rye grain.

"St. Anthony's Fire": Vomiting, Gangrene, Hallucinations, etc.

Believed to have been the cause behind accusations of witchcraft in Massachusetts in 1600s.

Chestnut Blight and **Dutch Elm disease**

Have destroyed many trees in the USA

The Importance of Decomposition

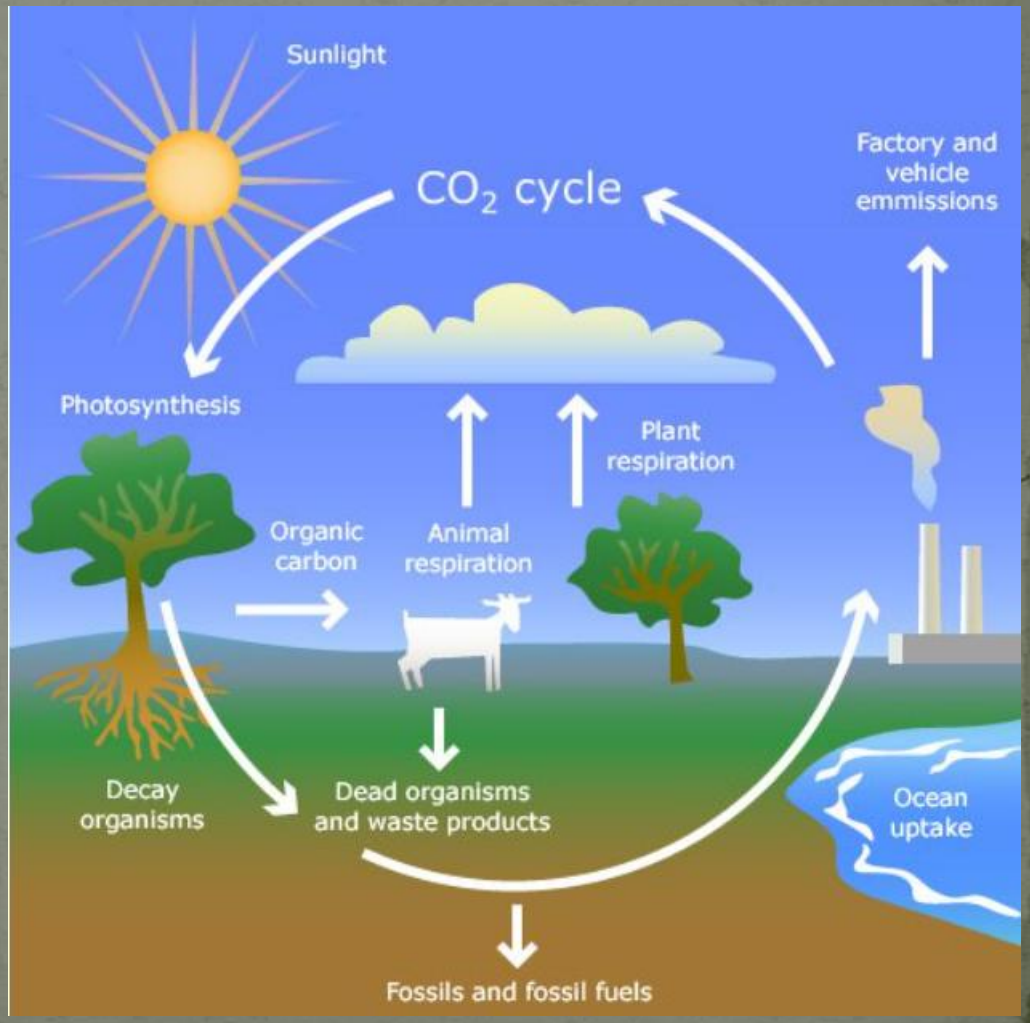
Fungi play an essential role in nearly every ecosystem by breaking down the bodies and wastes of other organisms.

This promotes the recycling of nutrients and essential chemicals.

Without decomposition, these elements and compounds would be forever locked in the bodies of dead organisms.

The Importance of Decomposition

Life on Earth depends upon the chemical elements being returned to the ecosystem so that they may be used in the bodies of new organisms.



If these materials were not returned, the soil would quickly be depleted, and Earth would become lifeless.

PRACTICAL ASPECTS

Dutch Elm disease

PRACTICAL ASPECTS

Edible Mushrooms

Making of Cheese

Yeast in Baking

PRACTICAL ASPECTS

Yeast to ferment beer and wine

Yeast to make ethanol added to gasoline

Antibiotics - Penicillin