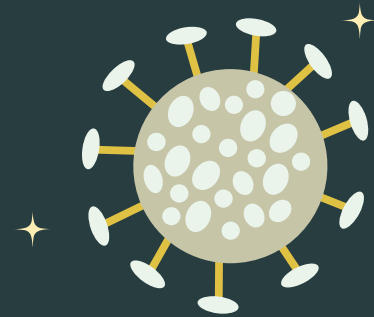
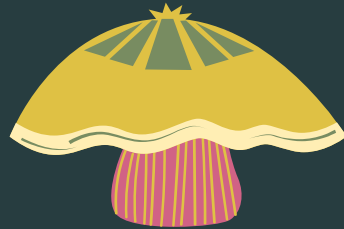
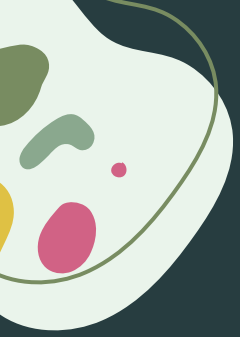


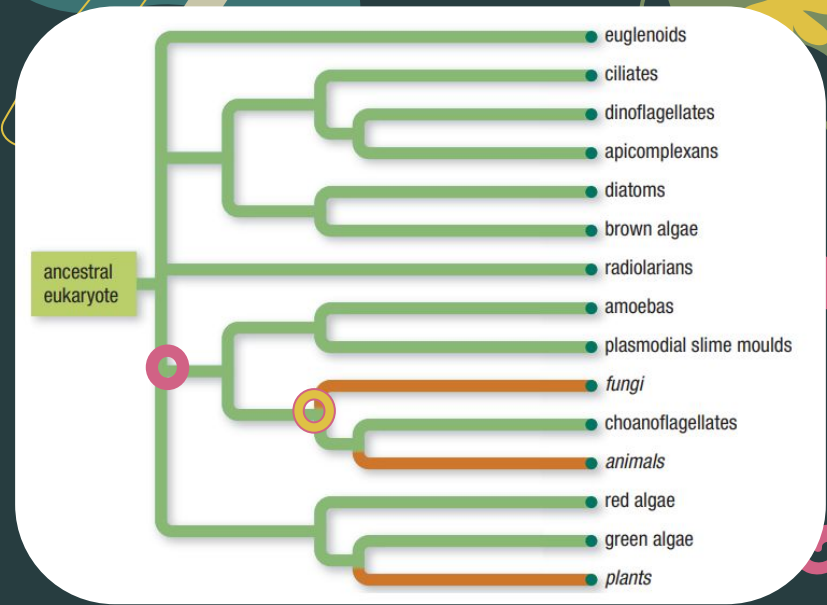
# 3.1 - Fungi



P. 80 - 84

# Fungi Introduction

- All fungi are eukaryotic
- Like animals, fungi are **heterotrophs**.
- All have cell walls composed of chitin
- Fungi are more closely related to **animals** than they are to plants although many people confuse them with plants.



Fungi and animals share a more recent common ancestor than fungi and plants

# Classification and Phylogeny

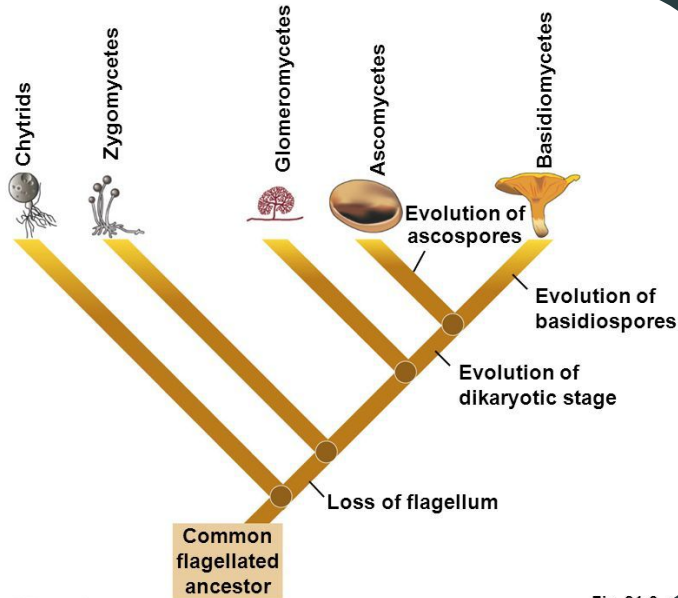
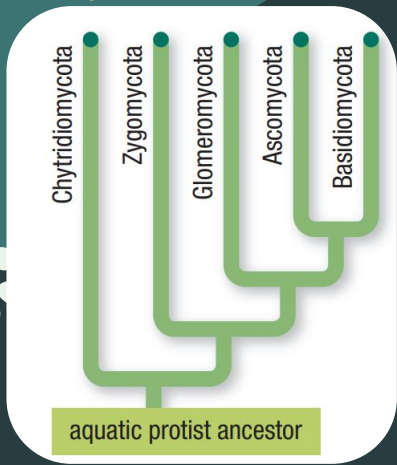


Fig. 21-3

- More than 100 000 species have been described.
- They are classified into **5 major phyla**
  - Phyla range in diversity of **size, shape and life cycles**.
- Two **most recognizable** phyla include:
  - Basidiomycota (most mushrooms)
  - Zygomycota (moulds)

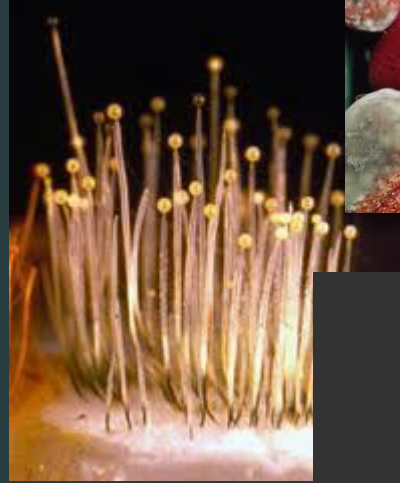
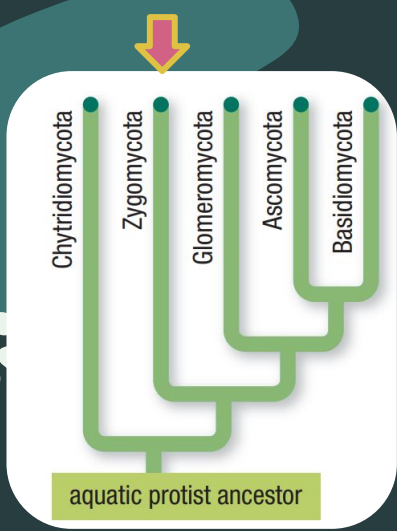


01

# Chytridiomycota (chytrids)

- Only fungi with swimming spores
- Most are saprophytes
- Single or multi-celled

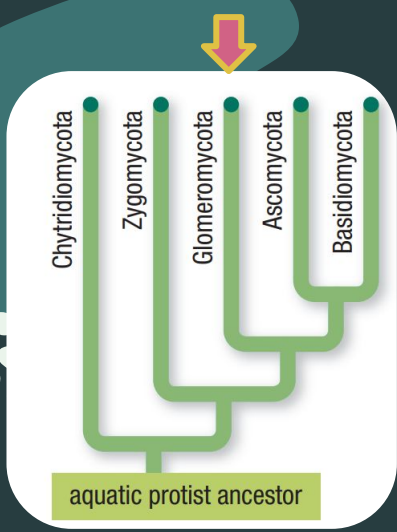
**Saprophytes:** Live and feed on dead or decaying plant material.



02

# Zygomycota (zygomycetes)

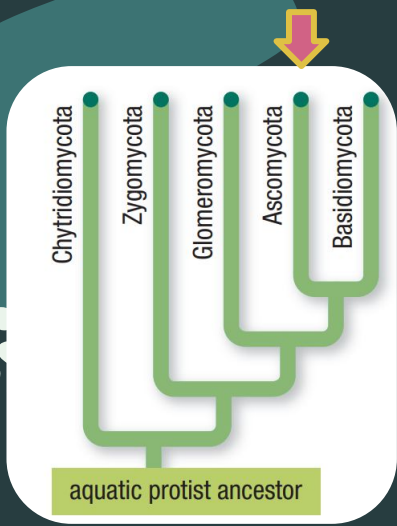
- Include some familiar bread and fruit moulds
- Most are soil fungi
- Many are insect parasites
- Many used commercially



03

# Glomeromycota (glomeromycetes)

- All form symbiotic relationships with plant roots

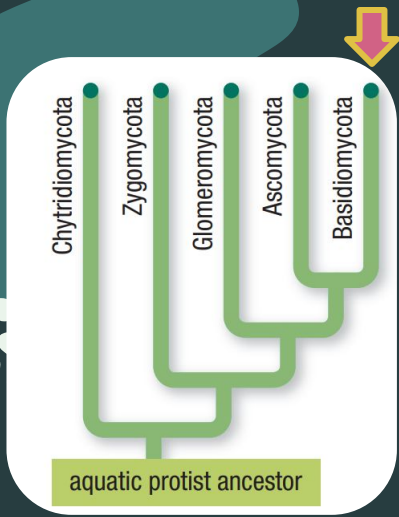


04

# Ascomycota (ascomycetes)

- Many useful to humans (yeast)
- Some cause plant diseases





05

# Basidiomycota (basidiomycetes)

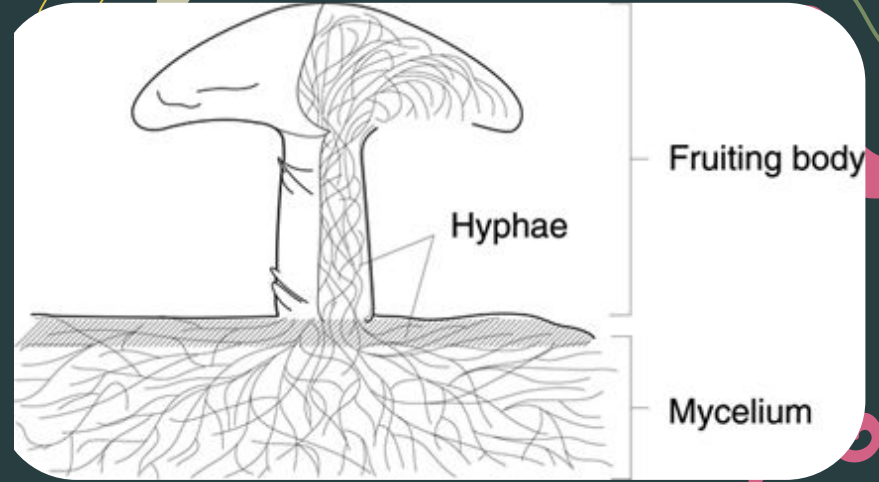
- Include mushrooms puffballs, and bracket fungi
- Most are decomposers
- Some form symbiotic relationships with plants



# Fungi

## Characteristics

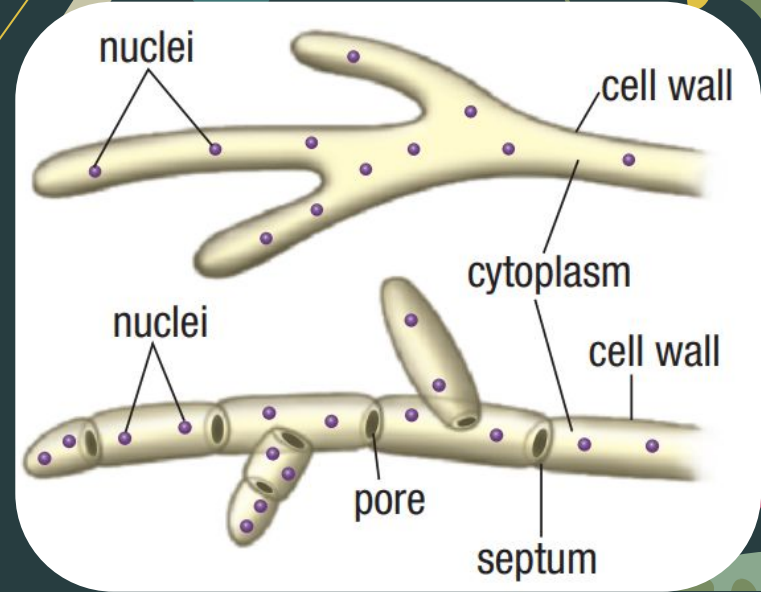
- What we think of as a fungus is usually only one small part of the organism – its reproductive structure growing out.
- Most of its body often remains hidden below the ground.
- Hyphae (sing. Hypha) are thin filaments that make up the body of a fungus. They branch together into a mass that we call mycelium.





# Fungi Characteristics Hyphae

- Hyphae are often microscopically thin
- They consist of long tubes of cytoplasm containing many nuclei
  - Cytoplasm is contained by a cell wall made of chitin (complex chemical)
  - Tubes may be separated into cell-like compartments by cell walls called **septa**
  - Pores between cells allow movement of nutrients across hyphae



Cytoplasm is continuous from end to end allowing materials to move quickly.

# Fungi

## Characteristics

### Hyphae Cont'd

- Hyphae also form the fuzz often associated with mould (a)
- Hyphae also form reproductive structures
  - e.g. mature puffballs release millions of microscopic spores (b)



# Fungi

## Characteristics

- Fungi can be multicellular or unicellular
- Yeast is a unicellular form of fungus
  - valuable economically (e.g. production of food and beverages)



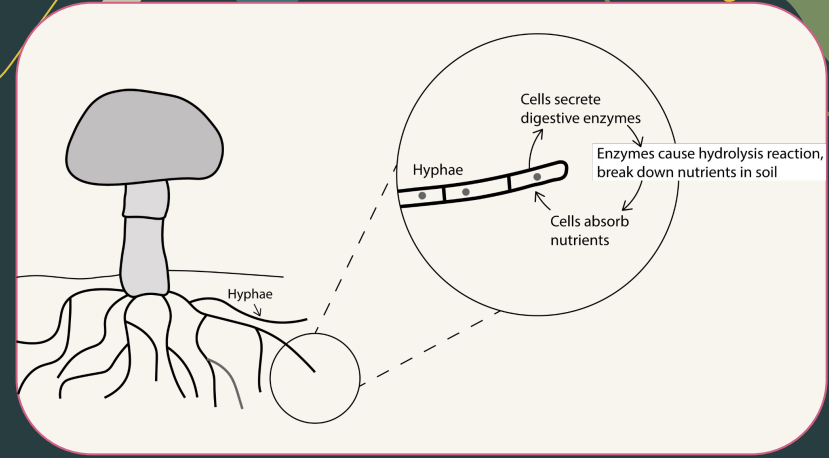
Unicellular yeast cells

# Fungi

## Characteristics

### Nutrition

- Fungi are **heterotrophs** that differ from most
- They digest **externally**
  - they grow within, or next to, their food source
  - they release enzymes to digest the food
  - Then absorb the nutrients through the cell membrane of the hyphae.



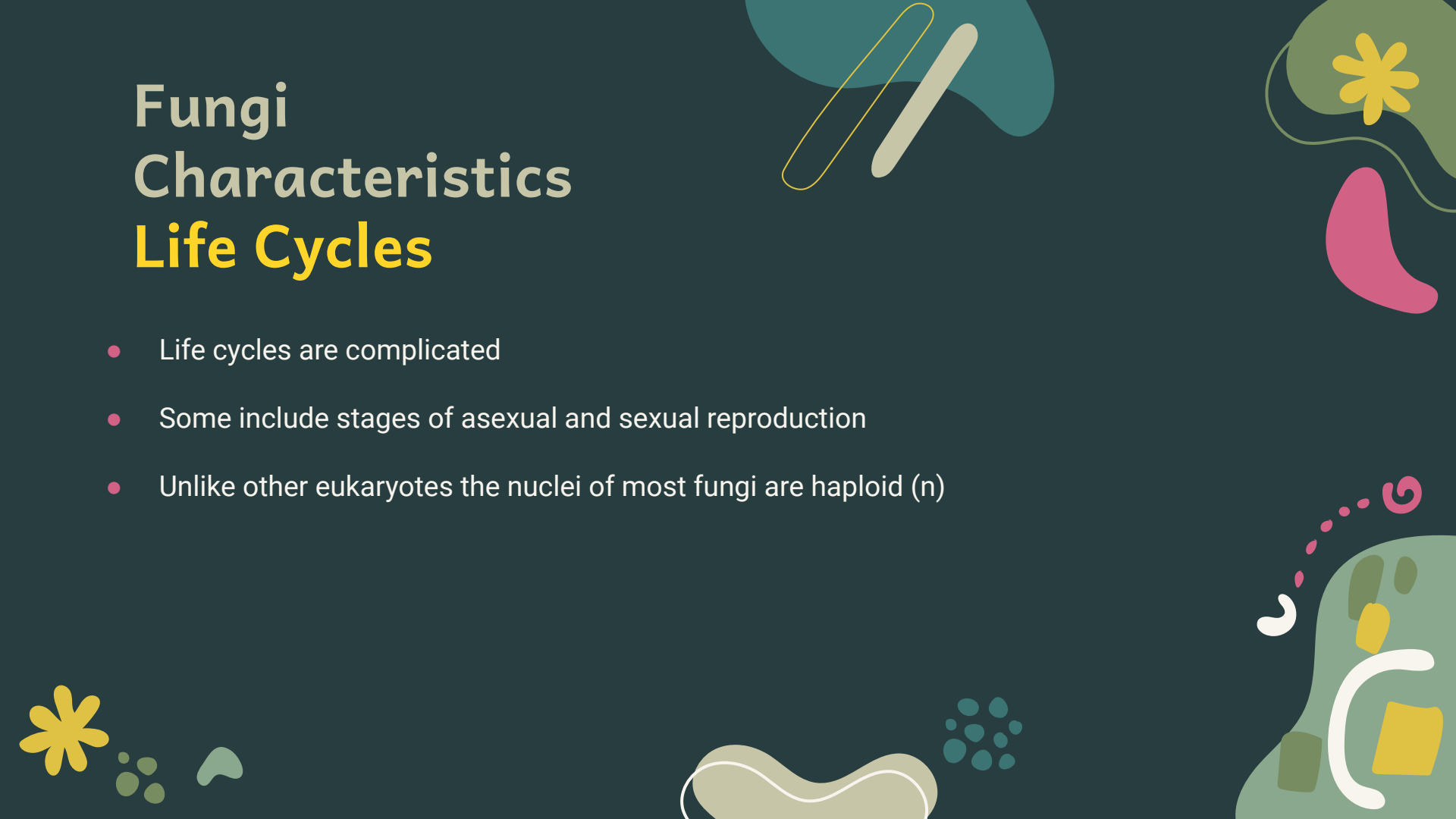
External digestion

# Fungi

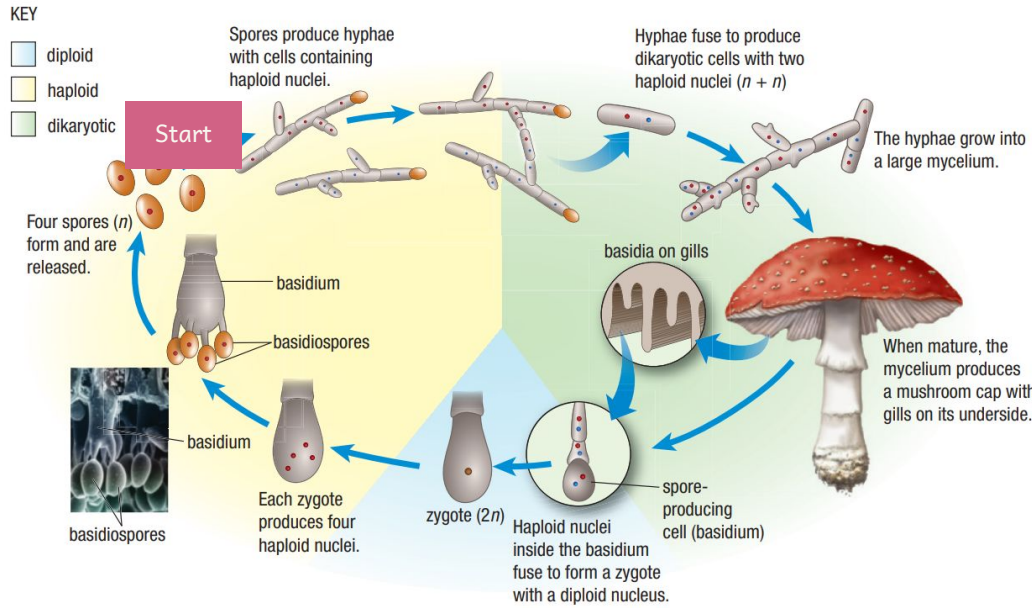
## Characteristics

## Life Cycles

- Life cycles are complicated
- Some include stages of asexual and sexual reproduction
- Unlike other eukaryotes the nuclei of most fungi are haploid (n)



# A life cycle of a basidiomycete



Start

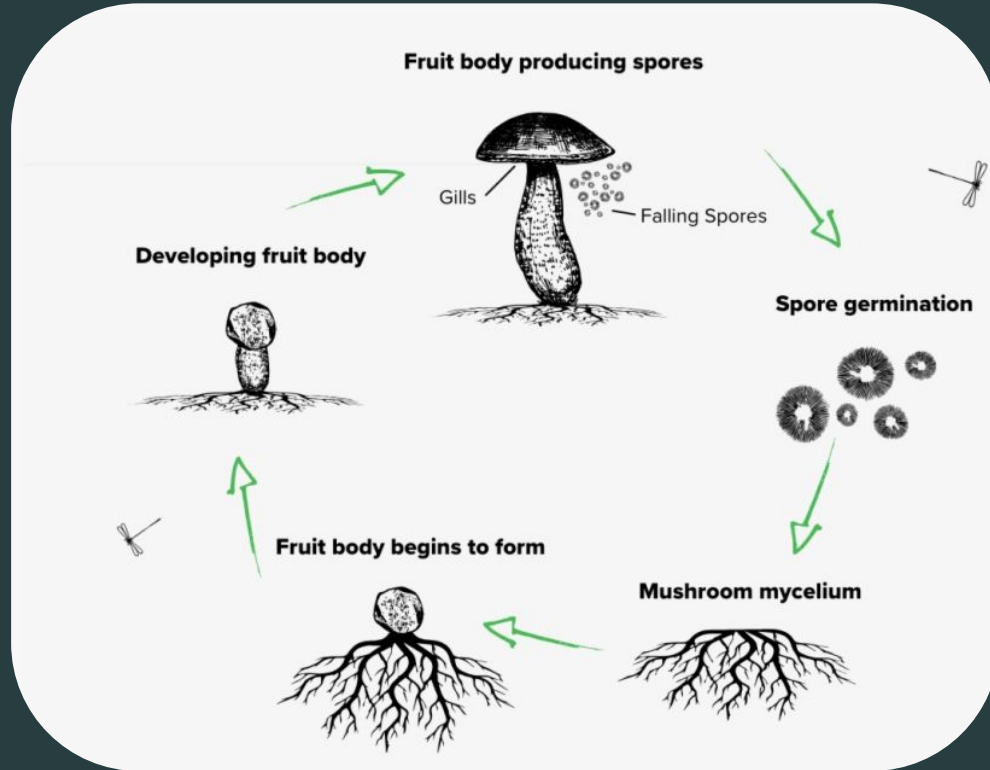
- Spores each contain haploid nuclei
- Spores germinate producing hyphae

- 2 hyphae fuse forming dikaryotic cell (2 nuclei)
- The hyphae grow forming mycelium
- Mycelium forms mushroom cap

- Haploid nuclei fuse in basidia forming diploid zygote

- Zygote produces 4 haploid nuclei through meiosis
- Nuclei become basidiospores  
Spores are released

# More General

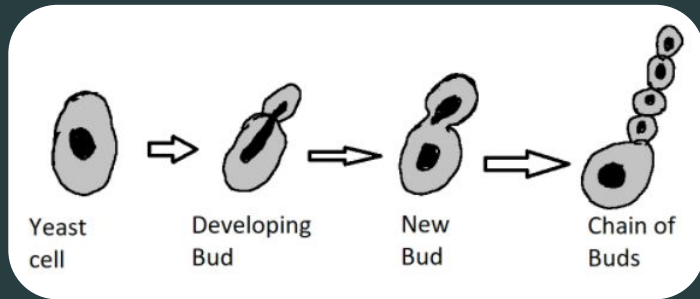




# How do Yeast Cells Reproduce



## Asexual (by budding)

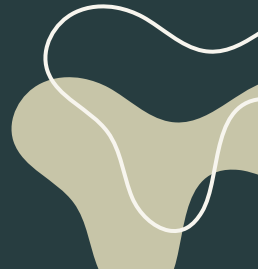


- The nucleus divides
- A septum forms between the two nuclei
- A small daughter cell is formed on the side of the original yeast

Yeast cells are unicellular and capable of reproducing **asexually (by budding)** or **sexually**.

## Sexual

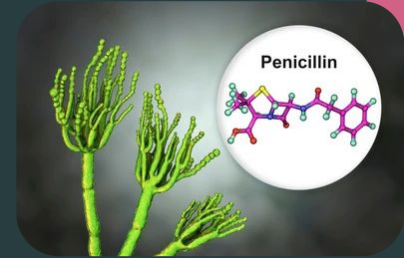
- Yeast cells fuse forming a diploid cell that produces four haploid spores



# Importance to Humans

Humans have many uses for fungi:

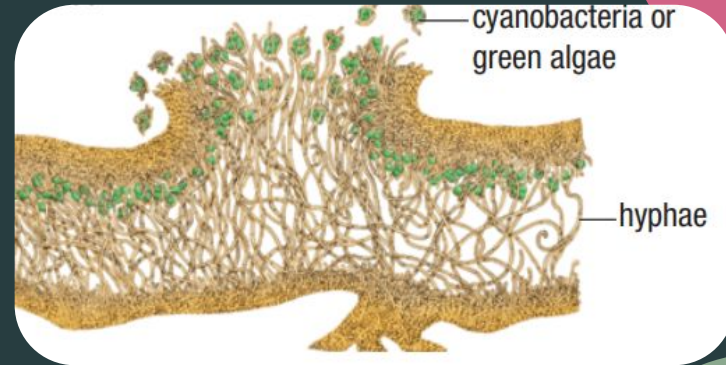
- Food:
  - mushrooms, truffles, blue cheese
  - yeast in production of bread, beer
- Non-food products:
  - penicillin – one of our most important antibiotics
  - cyclosporine – anti-rejection drug



# Lichens

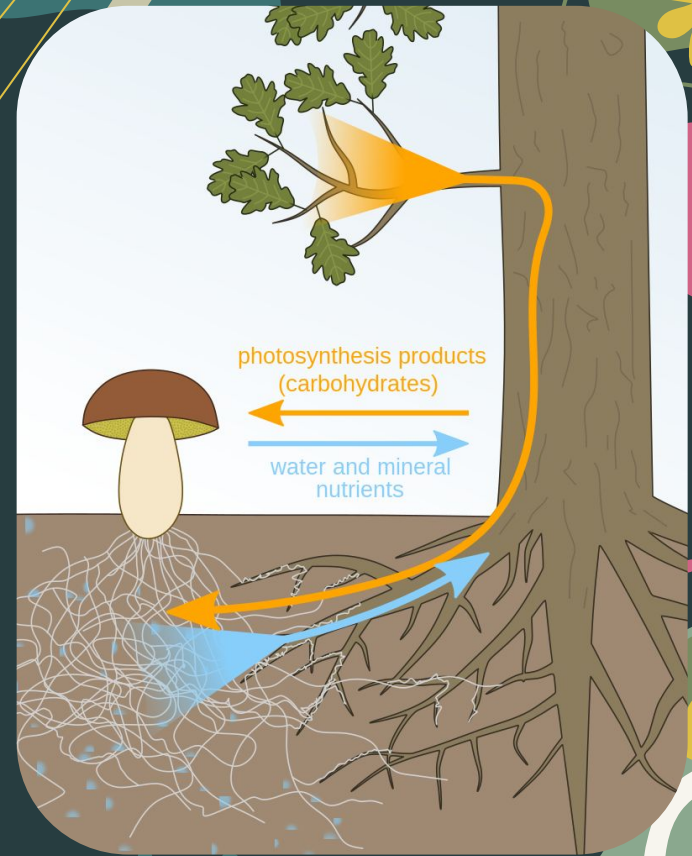
## A symbiosis

- Lichens are symbiotic combinations of fungi and photosynthetic cyanobacteria or green algae.
  - The fungi's mycelium envelopes and **protects** the cyanobacteria or algae and **supplies them with water and minerals**.
  - In return the photosynthetic organism provides the fungi with food.



# Mycorrhiza: Fungi and Plants Symbiosis

- Mycorrhiza is a symbiotic relationship between a fungus and a plant root
- Hyphae grow around or within the root cells of the plant.
  - The fungi help supply the plant with needed nutrients such as phosphorus and copper.
  - In return, the plant provides the fungus with energy-rich food molecules



# Fungi and Human Disease

## Athlete's Foot

- Athlete's foot is a fungal infection of the skin that causes scaling, flaking, and itch of affected areas.
- It is caused by fungi in the genus *Tricophyton*
  - typically transmitted in moist areas where people walk barefoot, such as showers.



# Fungal Diseases:

## Ringworm

- Dermatophytosis or ringworm is a clinical condition caused by a fungal infection of the skin.
- The fungi that cause parasitic infections feed on keratin, the material found in the outer layer of skin, hair, and nails.



# Fungal Diseases: Aspergillosis

- Aspergillosis is the name given to a wide variety of diseases caused by fungi of the genus *Aspergillus*.
- Most humans inhale *Aspergillus* spores every day.
- Aspergillosis develops mainly in individuals who are immunocompromised.
- It is a leading cause of death in people with acute leukemia

