

“The man who asks a question is a fool for a minute,
the man who does not ask is a fool for life.”
— Confucius

Fungi

Chapter 31

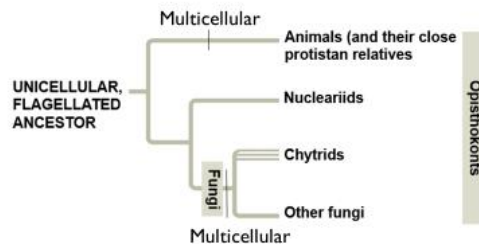
General Characteristics

- ▶ _____ eukaryotes that _____ nutrients from environment
 - ▶ _____ enzymes
- ▶ Mostly multicellular
 - ▶ Yeast = unicellular
- ▶ Decomposers (_____), parasites or mutualists
 - ▶ Excess sugar stored as _____
- ▶ Primarily terrestrial



History of Fungi

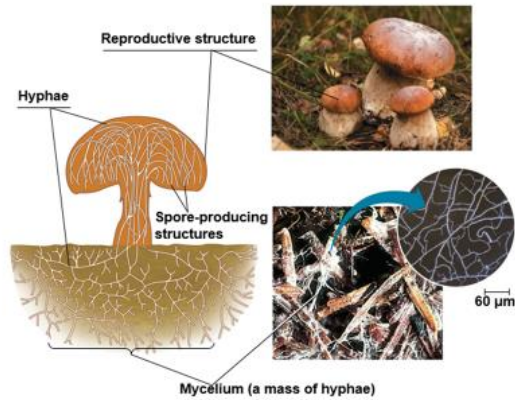
- ▶ First fungi were likely _____, single celled flagellated protist
- ▶ First fossils – _____ million years ago
 - ▶ Ordovician Period



Era	Period	Epoch	Age (Millions of Years Ago)
Cenozoic	Quaternary	Holocene	0.01
		Pleistocene	2.6
		Pliocene	5.3
	Neogene	Miocene	23
		Oligocene	33.9
	Paleogene	Eocene	55.8
		Paleocene	65.3
Mesozoic	Cretaceous		145.5
			199.6
			251
Paleozoic	Permian		299
			359
	Carboniferous		416
			444
			488
Precambrian	Ediacaran	542	
		635	
		1,800	
		2,500	
		2,700	
		3,500	
		3,800	
		Approx. 4,600	

Fungi Anatomy

- ▶ Multicellular or single celled (_____)
- ▶ _____: long, thread-like filamentous structure that forms the main vegetative growth of fungi
 - ▶ Tubular cell walls strengthened by _____
 - ▶ Fast growing
- ▶ _____: the interwoven mass of hyphae
- ▶ Above ground parts produce _____



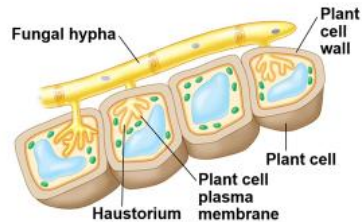
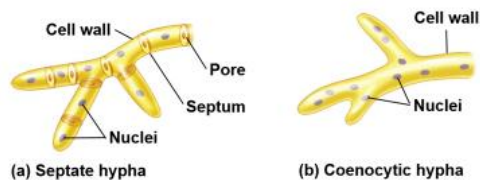
Types of Fungi Hyphae

Septate hyphae: _____ (septa) divide the hyphae into cells

_____ **hyphae:** no cross walls divide hyphae resulting in a continuous _____

_____: specialized hyphae that extract or exchange nutrients with plant host

- ▶ _____: beneficial relationship between fungi and plant roots
- ▶ May have facilitated plants movement on to land



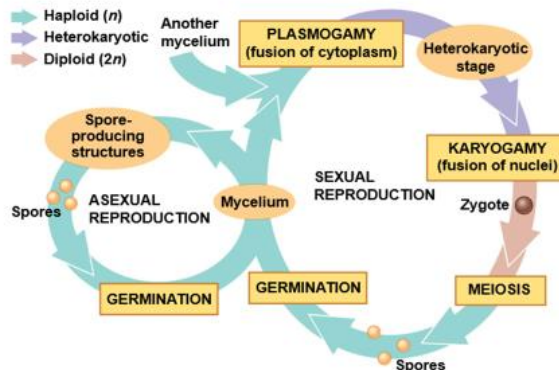
Reproduction in Fungi

Sexual Reproduction

- ▶ **Plasogamy:** union of _____ between two mycelia
- ▶ **Heterokaryon:** presence of two separate haploid nuclei
- ▶ _____: nuclei fuse to form single diploid nuclei

Asexual Reproduction

- ▶ Haploid spores
 - ▶ Conidia
 - ▶ Sporangia



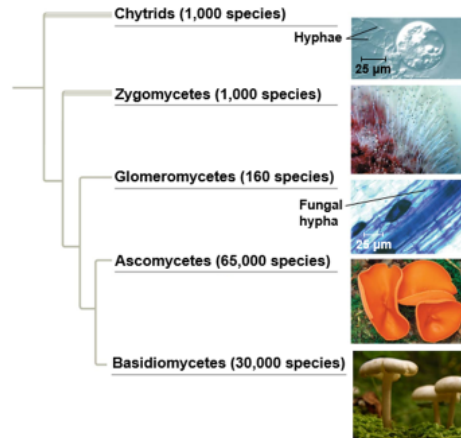
Fungal Diversity

Five major fungi classes

- ▶ Chytridomycetes
- ▶ Zygomycetes
- ▶ Glomeromycetes
- ▶ Ascomycetes
- ▶ Basidiomycetes

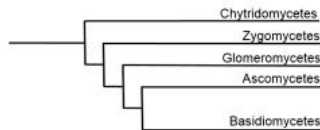
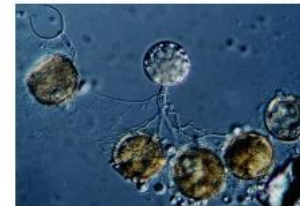
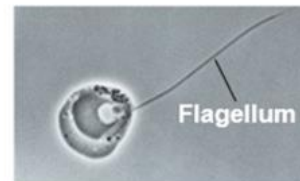
Approx. 100,000 fungi species described

- ▶ Estimates around 1.5 million species



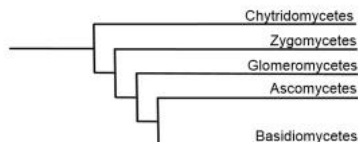
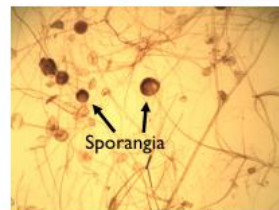
Class Chytridiomycetes (Chytrids)

- ▶ _____ hyphae
- ▶ _____ (zoospores)
- ▶ Chitin cell walls
- ▶ Lakes and soil
- ▶ Decomposers (Saprobies) or parasites
- ▶ Chytridiomycosis



Class Zygomycetes

- ▶ About 1,000 known species
- ▶ _____ hyphae
- ▶ Includes _____ (bread molds)
- ▶ Sexual reproduction
- ▶ _____
- ▶ Asexual reproduction
- ▶ Sporangia



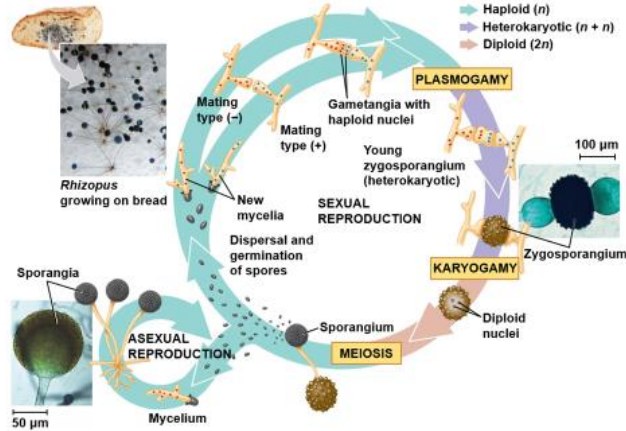
Life Cycle of Zygomycete (*Rhizopus*)

Sexual Reproduction

- ▶ **Zygosporangium:** sturdy, _____ structure where karyogamy then meiosis occur
- ▶ Resistant to harsh conditions

Asexual Reproduction

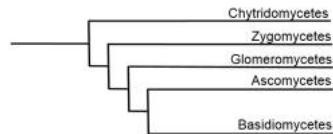
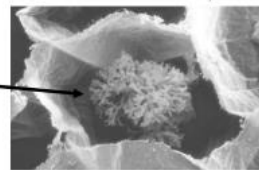
- ▶ _____: haploid spore producing structures on the tips of upright hyphae



Class Glomeromycetes

- ▶ About 160 species
- ▶ Used to be grouped with Zygomycetes
- ▶ Coenocytic hyphae
- ▶ Nearly all are _____
- ▶ Mutualistic relationships with 90% of all plant species

Arbuscule (branched hyphae) pushing into root cell

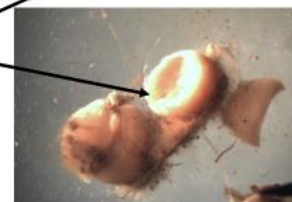


Class Ascomycetes (Sac Fungi)

- ▶ Approximately 65,000 species
- ▶ Multicellular and unicellular (yeasts)
- ▶ _____ hyphae
- ▶ Marine, freshwater and terrestrial
- ▶ Saprobes and mutualistic
 - ▶ Endophytes
 - ▶ Lichens
- ▶ _____: reproductive fruiting bodies



Ascocarps



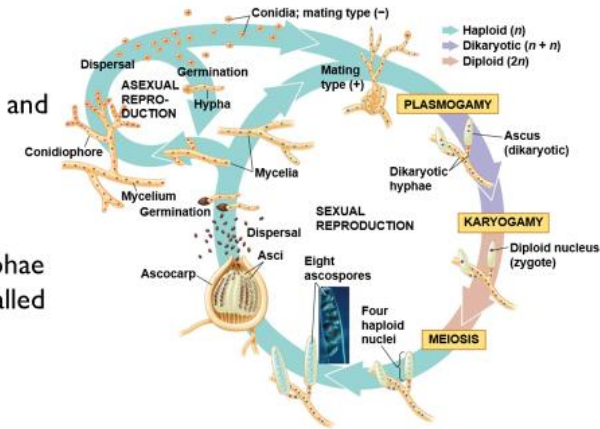
Life Cycle of Ascomycete

Sexual Reproduction

- ▶ Sac-like _____ produce eight ascospores through meiosis and mitosis

Asexual Reproduction

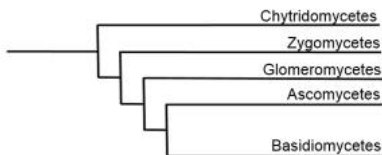
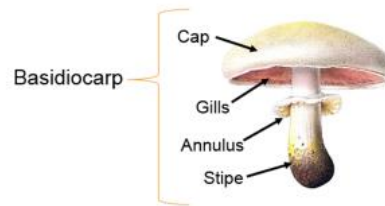
- ▶ **Conidiophore**: specialized hyphae that produce asexual spores called _____
- ▶ Conidia also involved in sexual reproduction



Class Basidiomycete (Club Fungi)



- ▶ Approximately 30,000 species
- ▶ _____ hyphae
- ▶ Saprobes, parasites, and mutualistic
 - ▶ Decomposers of lignin
- ▶ _____: reproductive fruiting bodies



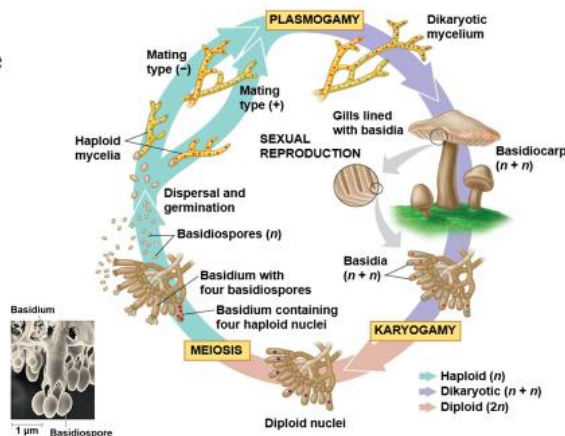
Life Cycle of Basidiomycete

Sexual Reproduction

- ▶ _____: specialized cells that line the gills of the basidiocarp where basidiospores are produced
- ▶ Dikaryotic and diploid stages

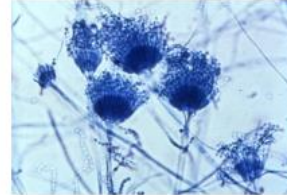
Asexual Reproduction

- ▶ _____



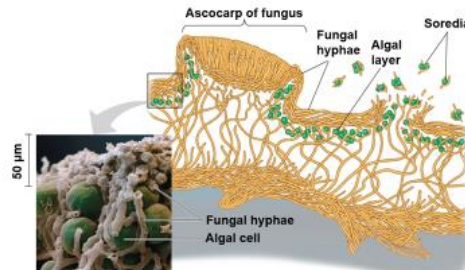
Deuteromycota (Fungi imperfecti)

- ▶ No longer a formal Division
- ▶ Asexually reproducing members of Ascomycota and Basidiomycota
- ▶ Imperfect (_____)
- ▶ Includes *Penicillium* and *Aspergillus*



Lichen

- ▶ Symbiotic association between a _____ microorganisms and a fungus
- ▶ Photosynthetic organism (cyanobacteria or green algae) provides carbon compounds
- ▶ Fungi (primarily Ascocarps) provided environment suitable for growth
- ▶ _____: small clusters of hyphae with embedded algae
- ▶ Asexual reproduction



Ecological Impacts and Uses of Fungi

- ▶ Important decomposers
 - ▶ Nutrient recycling
- ▶ Mutualistic relationships
 - ▶ Lichen
 - ▶ Mycorrhizae
- ▶ Parasitic pests (30% of all fungi)
 - ▶ Chestnut blight
 - ▶ _____: fungal infection in animals
 - ▶ *B. dendrobatidis*
 - ▶ Athletes foot and ring worm
- ▶ Yeasts = booze and bread. Yay!
- ▶ Penicillin



Check Your Understanding

True or False: The first fungi are likely photosynthetic aquatic organisms with a flagella

True or False: Lichens are a symbiotic relationship between plants and fungi



Check Your Understanding

Which of the following are involved in asexual reproduction in zygomycetes?

- a. Conidia
- b. Sporangia
- c. Yeasts
- d. Mycorrhizae
- e. Zygosporangium



Check Your Understanding

The fusion of nuclei during the fungi life cycle is known as _____.

- a. heterokaryon
- b. plasmogamy
- c. karyogamy
- d. nucleogamy
- e. sporogamy



Check Your Understanding

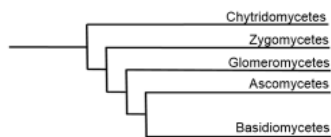
Which of the following classes of fungi have coenocytic hyphae?





- Zygomycetes
- Ascomycetes
- Basidiomycetes
- Glomeromycetes
- More than one of the above

Check Your Understanding

Draw and describe the life cycle of an ascomycete fungi with your neighbor

Fungi Review



Fungal Phylum	Distinguishing Features
Chytridiomycota (chytrids)	Flagellated spores 
Zygomycota (zygomycetes)	Resistant zygosporangium as sexual stage 
Glomeromycota (arbuscular mycorrhizal fungi)	Arbuscular mycorrhizae formed with plants 
Ascomycota (ascomycetes)	Sexual spores (ascospores) borne internally in sacs called asci; vast numbers of asexual spores (conidia) produced 
Basidiomycota (basidiomycetes)	Elaborate fruiting body (basidiocarp) containing many basidia that produce sexual spores (basidiospores) 