



1

Part I: Fungi form and function

Learning goals

- Identify characteristics that distinguish fungi from other eukaryotes.
- Compare mitosis in fungi and animals.
- Describe the reproductive processes of fungi
- Explain what differentiates fungi nutrition from animals
- Explain why stressful conditions lead to sexual reproduction vs. asexual reproduction

2

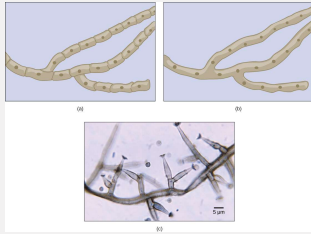
What are fungi?

- 1.5 million species
- Single-celled or multicellular
- Sexual or asexual
- Extract and absorb nutrients from surroundings
- Animals and fungi share a common ancestor 460 mya

3

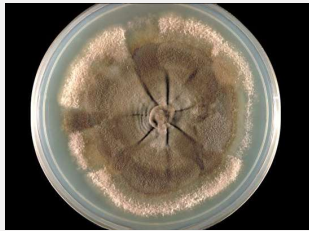
Fungal hyphae

- Multicellular fungi consist of long, slender filaments called hyphae
- Some are continuous
- Some are divided by septa
- Cytoplasm flows through hyphae
- Allows for rapid growth under good conditions



4

Mycelium: a mass of connected hyphae that grows through and digests its substrate



5

Hyphae cells

Hyphae may have more than one nucleus

- **Monokaryotic** (1)
- **Dikaryotic** (2)
- both genomes transcribed

Nuclei may intermingle in the common cytoplasm of the fungal mycelium

- **Heterokaryotic:** nuclei from genetically distinct individuals
- **Homokaryotic:** nuclei from genetically similar individuals

Fungi go through unusual mitosis

- Cell is not the unit of reproduction
- The nucleus is the focus, and the nuclear envelope does not break down

6

Reproduction via spores

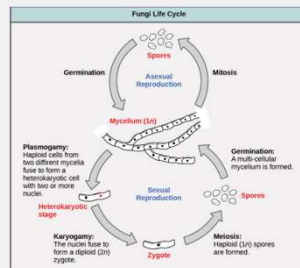
Spores are the most common means of reproduction. Used for sexual and asexual processes and most are dispersed by wind



7

Sexual reproduction

- Fusion of two haploid hyphae of compatible mating types
- **Two outcomes:**
Fuse immediately: diploid ($2n$) cell
Dikaryon stage ($n + n$) before diploid nucleus



8

Fungi are heterotrophs

- Secrete digestive enzymes into surroundings
- Absorb the organic molecules produced by external digestion
- Some can break down cellulose and lignin
- Some can decompose wood
- Some are carnivorous



9

Fungi ecology



10

Lichens

- Fungus and photosynthetic partner
- Cyanobacteria or green algae
- Mutualistic
- Adaptation for life on nutrient poor substrates
- Predominantly Ascomycetes



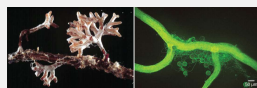
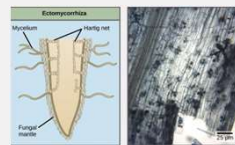
11

Mycorrhizae

Mutualistic fungi and plants

On roots of 90% of vascular plants as extensions of the root system

- Two types:
- Arbuscular mycorrhizae
 - Ectomycorrhizae



12

Animal mutual symbioses

- Ruminant animals host neocallimastigamycete fungi in their gut
- Leaf-cutter ants have domesticated fungi which they keep in underground gardens



13

Understanding check

What are mycelium?

What ecological functions do fungi serve?

What does it mean for a fungal cell to be dikaryotic and heterokaryotic?

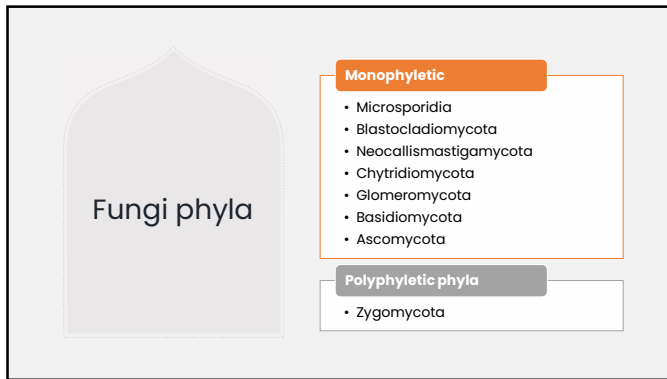
14

Part II: Groups of fungi

Learning goals

- Compare and contrast major phyla of fungi
- Discuss symbiotic relationships exhibited by fungi

15



16

Microsporidia

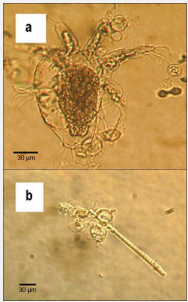
- Unicellular
- Obligate, intracellular, animal parasites
- Long thought to be protists
- Lack mitochondria



17

Chytridiomycota

- Chytrids
- Aquatic, flagellated fungi
- Motile zoospores
- Invasive chytrid fungus responsible for extinction of many frog species in the North and South America



18

Blastocladiomycota

Important parasites of

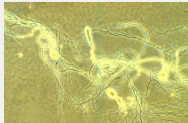
- Insects
- Plants
- Humans



19

Neocallimastigomycota

- Anaerobic
- Digest plant biomass in mammalian herbivore rumens



20

Glomeromycota

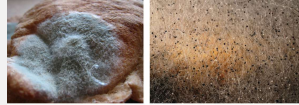
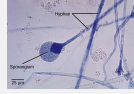
- Arbuscular mycorrhizae of trees
- Reproduce asexually



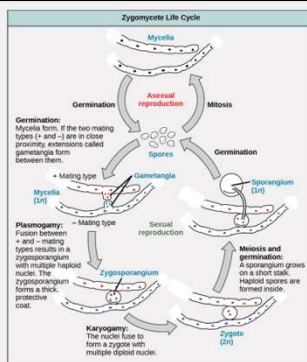
21

Zygomycota

- Incredibly diverse
- Lack septa except when reproducing
- Asexual reproduction most common: hyphae produce clumps of erect stalks, called **sporangiophores**
- Sexual reproduction forms zygospores
- Example: common bread molds



22



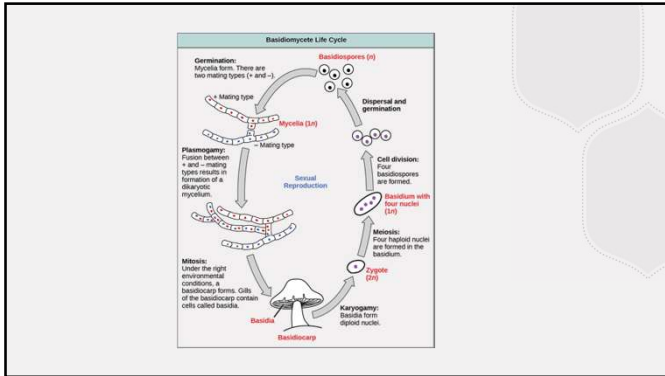
23



Basidiomycota

- Most familiar fungi (club fungi)
- Reproductive structure called **basidium**
- Karyogamy occurs within basidia
- Examples: Mushrooms, Toadstools, Puffballs, Shelf fungi, Plant pathogens (rusts and smuts)

24



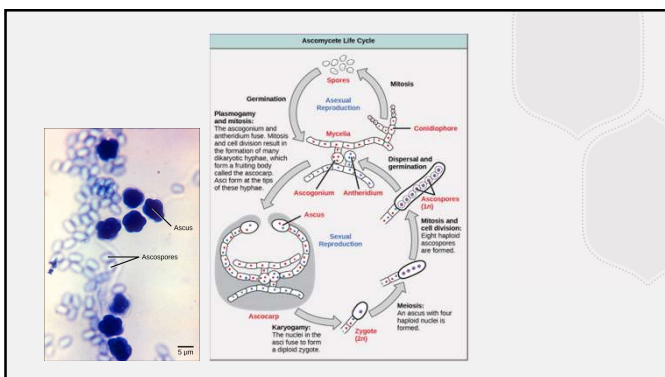
25

Ascomycota

- 75% of the known fungi
- Examples:
 - Bread yeasts
 - Common molds
 - Cup fungi
 - Truffles and morels
 - Plant pathogens (chestnut blight)
- Penicillium* (penicillin-producing fungi are in the genus)
- Sexual reproductive structure, **ascus**, where karyogamy occurs (functionally identical to basidium)
- Asexual reproduction via **conidia**



26



27

Understanding check

**What are the reproductive structures that distinguish
Basidiomycota from Ascomycota?**

What is karyogamy?

How does karyogamy differ from fertilization?
