Of all the five major kingdoms of living organisms on earth, the fungi certainly contain some of the most bizarre and fascinating species. Mycology is the study of fungi, and much of the current research in this field is at the molecular level. For example, molecular Mycologists are trying to piece together the very complex interrelationships between fungal taxa using comparative DNA sequencing. You have probably heard about some of these modern techniques (PCR and RFLP) if you followed the infamous O. J. Simpson Trial. There are about 100,000 known species of mushrooms, rusts, molds, mildews, stinkhorns, puffballs. Truffles and other organisms assigned to the Kingdom Fungi, and hundreds of new species are described each year. They come in an astonishing variety of shapes, colors and sizes. From brilliant red cups and orange jellylike masses to strange fungi resembling golfballs, bird nests with eggs, starfish, parasols and even male genitalia.

**Kingdom – Fungi**

**Division – Eumycophtya (True Fungi)**

**Division – Myxomycophtya (Slime Molds)**

**Division – Eumycophtya**

**Class – Phycomyetae**

“algal”

Fungi

**Class – Ascomycetae**

“sac”

Fungi

**Class – Basidiomycetae**

“club”

Fungi

**Class – Deuteromycetae**

“imperfect”

Fungi
Kingdom Fungi
Multicellular eukaryotes; heterotrophic by absorption; lack flagella; nonmotile spores form during both asexual and sexual reproduction

- Phycomycetes: "algal" fungi
- Ascomycetes: "sac" fungi
- Basidiomycetes: "club" fungi
- Deuteromycetes: imperfect "fungi (i.e., means of sexual reproduction not known)
TWO TYPES OF FUNGAL MYCELIUM

**a.** nonseptate hypha
- **cell wall**
- **nuclei**
- **coenocytic**
- **septum**

**b.** septate hypha

---

**383 Mycelium of fungi**

Figure 23.1b

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Class Phycomycetaceae

a. thallus
b. spores
c. sporangium
d. sporangiophore
e. stolon
f. rhizoid (haustorium)

Phizopus

Label black bread mold diagram

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WATER MOLD AS Saprolegnia

Sexual reproduction

- Oospore (zygote)
- Antheridium (♂)
- Sperm nucleus
- Oogonium (♀)
- Egg nuclei
- Enlarged hyphae

Fertilization

♂ and ♀ nuclei fuse

Germination of the oospore

Asexual reproduction

- Zoosporangium with primary zoospores (pear shape)
- Enlarged hyphae
- Encysted secondary zoospore
- Secondary zoospores (Kidney bean shape)

Growth into new mycelium

Germination of the zoospore

Encysted primary zoospore
**Rhizopus Life Cycle**

- **Zygote**
- **Nuclear fusion**
- **Cytoplasmic fusion**
- **Gametangia**
- **Meiosis**
- **Sporangium**
- **Zygospore germination**
- **Sporangiophore**
- **Mycelium**
- **Stolon**
- **Rhizoid**

**Sexual Reproduction**
- **Diploid (2n)**
- **Haploid (n)**
- **Mating type**
- **Spores (n)**

**Asexual Reproduction**
- **Mating type**

Black bread mold, *Rhizopus stolonifer*

Figure 23.3

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Class Ascomycetae

zygote (2n)  |  ascospores

nuclear fusion  |  mature ascus

meiosis

hymenium

(ascogenous hyphae)
dikaryotic hyphae
- mating type (n)

spore

male organ

female organ

- mating type (n)

spore

a. Cup fungus, Sarcoscypha

Sac fungi

Figure 23.4a
Ascomycetae

Yeast

Two cells fuse forming zygote which undergoes meiosis

Asexual (Budding)

Tetrad of N yeast cells

Peziza

Portion of hymenium of ascocarp showing ascites and ascospores.
Life cycle of Ascomycetes

Conidium (spore)
Conidia break off

Asexual reproduction
Mycelium
Germinating conidium (n)

Mitosis

Sexual reproduction
Sterile hyphae form the ascocarp
Dikaryotic hyphae form the ascus

Meiosis
First division
Second division

Ascospores released

2 nuclei fuse
Ascus

Mitosis

n + n

Germinating ascospore (n)
Ascomycetes

ascus

ascospore
c. Peach leaf curl, *Taphrina*
Label life cycle of a mushroom

Class: Basidiomycetes

Fermentation

Haploid (n)

Cytoplasmic fusion

Dikaryotic (n+n)

Nuclear fusion

Meiosis
Class: Basidiomycetes

**Fertilization**

- Nuclear fusion
  - Diploid (2n)
  - Zygote
- Meiosis
  - Monokaryotic (n)
  - Spores are released
  - Germination of spores

**Basidium**
- Portion of gill
- Cap (pileus)
- Annulus
  - Monokaryotic mycelium (n)
- Dikaryotic mycelium (n+n)

**Fruiting body (basidiocarp)**
- Gills
- Stalk

**Cytoplasmic fusion**
Basidium with basidiospores
$N$ haploid hyphae $\rightarrow$ \(N+N\) dikaryotic stage $\rightarrow$ \(2N\) diploid zygote

meiosis
LICHEN MORPHOLOGY

- Reproductive unit
- Algal cells
- Algal layer
- Fungal hyphae

**Exists in a Symbiotic Relationship**

a. (Each member benefits from the relationship)
Placopsis gelida: A striking North American crustose lichen. The pinkish bodies in center (called cephalodia) contain nitrogen-fixing cyanobacteria.
Two species of fruticose ground lichens (Cladina evensii and C. subtenuis)

"Reindeer moss"
A close up of crustose lichen

British soldier Lichen (fruticose)

Pixie Cup Lichen (fruticose)