

Distinctive characteristics of major groups of fungi

Fungal classification is based largely on morphology and, particularly on the morphology of reproductive structures. The first major distinction between fungi is made on the basis of presence or absence of cell wall: wall-less fungi are grouped as the **Myxomycota**, though in some cases they are more akin to Protozoa than fungi; all walled fungi are grouped as the **Eumycota** (literally, 'true fungi').

The **Eumycota** are then divided into five main categories, termed as **Mastigomycotina**, **Zygomycotina**, **Ascomycotina**, **Basidiomycotina** and **Deuteromycotina**. Of these, Zygo, Asco and Basidiomycotina seem to be 'natural', well-defined groupings but the Mastigomycotina is a composite grouping, covering all fungi that form motile, flagellated spores (**zoospores**). It contains among others, two important classes, the **Chytridiomycetes** and **Oomycetes**.

Mastigomycotina (zoospore-forming fungi)

Class: Chytridiomycetes

Example: *Allomyces macrogynus*

Main distinguishing features:

1. Vegetative state: typically unicellular or short chains of cells attached to the food-source by rhizoids. A few have primitive hyphae.
2. Cell wall composed of chitin and glucans.
3. Normally haploid.
4. Asexual reproduction: by motile spores (zoospores) with one flagellum formed by cleavage of the cytoplasm in a sporangium.
5. Sexual reproduction: often by release of motile gametes (sex cells), which fuse to form a diploid cell, the **zygote**. This functions as a resting stage and then undergoes meiosis to form a new haploid generation.

Mastigomycotina (zoospore-forming fungi)

Class: Oomycetes

Example: *Phytophthora infestans*

Main distinguishing features:

1. Vegetative state: a hypha lacking cross-walls (**Septa**).
2. Cell wall composed of chitin and other glucans.
3. Normally diploid.
4. Asexual reproduction: by motile spores (zoospores) with two flagella formed in a sporangium which may be borne on a special hypha, the **sporangiophore**.
5. Sexual reproduction: by fusion of sex organs, an **antheridium** (male) and an **oogonium** (female). The resulting sexual spore (**oospore**) acts as a resting stage and germinates by a germ tube or by producing zoospores to produce a new diploid generation.

Zygomycotina

Example: *Mucor hiemalis*

Main distinguishing features:

1. Vegetative state: usually a hypha, lacking septa.
2. Cell wall composed of chitosan and chitin.
3. Normally haploid.
4. Asexual reproduction: by non-motile spores, formed in a sporangium, itself borne on a sporangiophore.
5. Sexual reproduction: by fusion of **gametangia** (sex organs). The resulting diploid cell develops into a spiny-walled **zygospore**, which acts as a resting stage and then undergoes meiosis to form a new vegetative generation.

Two classes: **Zygomycetes** and **Trichomycetes**.

Ascomycotina

Examples: *Schizosaccharomyces octosporus*, *Neurospora crassa*.

Main distinguishing features:

1. Vegetative state: either septate hyphae or yeasts.
2. Cell wall composed of chitin and glucans.
3. Normally haploid.
4. Asexual reproduction: by non-motile spores (**Conidia**), formed on hyphae or on modified hyphal branches (**conidiophores**) but not within a sporangium.
5. Sexual reproduction: by fusion of a conidium (acting as male) with fertile hyphae of a female sex organ (**ascogonium**), or by fusion of hyphae, or by fusion of yeast cells. Diploid **ascus** is formed and a fruiting body, or **ascocarp** may develop to enclose several such asci. Meiosis occurs in the ascus, followed by mitosis to release 8 haploid **ascospores**; these serve as resting cells and eventually germinate to produce a new generation.

Five classes: **Hemiascomycetes**, **Loculoascomycetes**, **Plectomycetes**, **Pyrenomycetes** and **Discomycetes**, depending on features of ascus and ascocarp.

Basidiomycotina

Examples: *Agaricus campestris*, *Lycoperdon pyriforme*, *Puccinia graminis*

Main distinguishing features:

1. Vegetative state: usually hyphae with simple septa or complex dolipore septa, sometimes yeasts. Hyphae may bear **clamp connections**.
2. Cell wall composed of chitin and glucans.
3. Normally haploid.
4. Asexual reproduction: absent from some of the higher members, otherwise by conidia; some lower members (Teliomycetes) have several spore-types.
5. Sexual reproduction: usually by fusion of vegetative hyphae of two **compatibility groups**. Nuclear fusion is delayed, however, and the fungus

exists for most of its life with two types of nucleus in its hyphae (termed a **dikaryon**). Eventually a complex fruiting body or **Basidiocarp** may be formed; this contains many **basidia** in which nuclear fusion and meiosis take place. Then four haploid **basidiospores** form from each basidium to complete the life cycle.

Three classes: **Teliomycetes**, **Hymenomycetes** and **Gasteromycetes**.

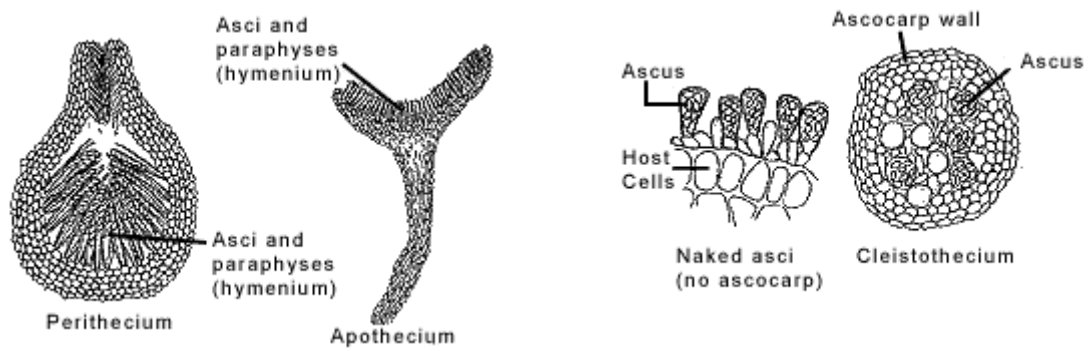
Deuteromycotina (imperfect fungi)

Examples: *Penicillium*, *Aspergillus*, *Graphium*, *Doratomyces*, *Phomopsis*, *Gloeosporium*

Main distinguishing features:

1. Vegetative state: usually hyphae with simple septa, sometimes yeasts.
2. Cell wall composed of chitin and glucans.
3. Normally haploid.
4. Asexual reproduction: conidia, as in the Ascomycotina. These may be formed by fragmentation of hyphae, or on simple conidiophores, or on/in more complex structures such as **coremia**, **pycnidia** and **acervuli**.
5. Sexual reproduction: absent, rare or unknown; where present it is usually typical of Ascomycotina.

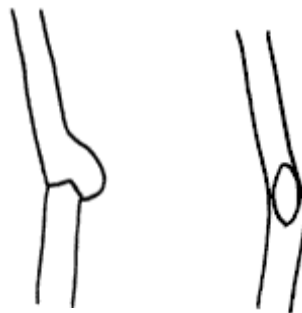
Three classes: **Blastomycetes** (yeast-like species), **Hyphomycetes** (have relatively simple conidiophores) and **Coelomycetes** (form pycnidia and acervuli).



1: Ascocarps



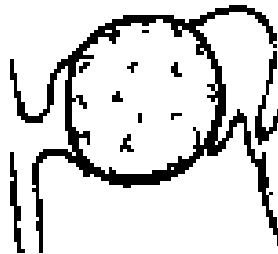
2: Basidiospore



3: Clamp connections



4: Pycnidium



5: Zygospore