

## Lecture (8)

### Characteristic of higher fungi .

- 1- It includes only .Two phyla – Ascomycota and Basidiomycota
- 2- Thallus in both consists of sepatate hyphae that form extensive mycelia, Septa have pores that allow migration of cytoplasm, organelles and nuclei .
- 3-Asexual reproduction by conidia bearing on conidiophores
- 4-In sexual cycle, plasmogamy is separated from karyogamy – produces dikaryotic phase.
- 5-Sexual reproduction produces spores after meiosis – ascospores or basidiospores (1n)
- 6- Evidence from DNA sequences suggests that Ascomycota and Basidiomycota are sister groups but to date no indication of ancestors.

### Phylum : Acomycota

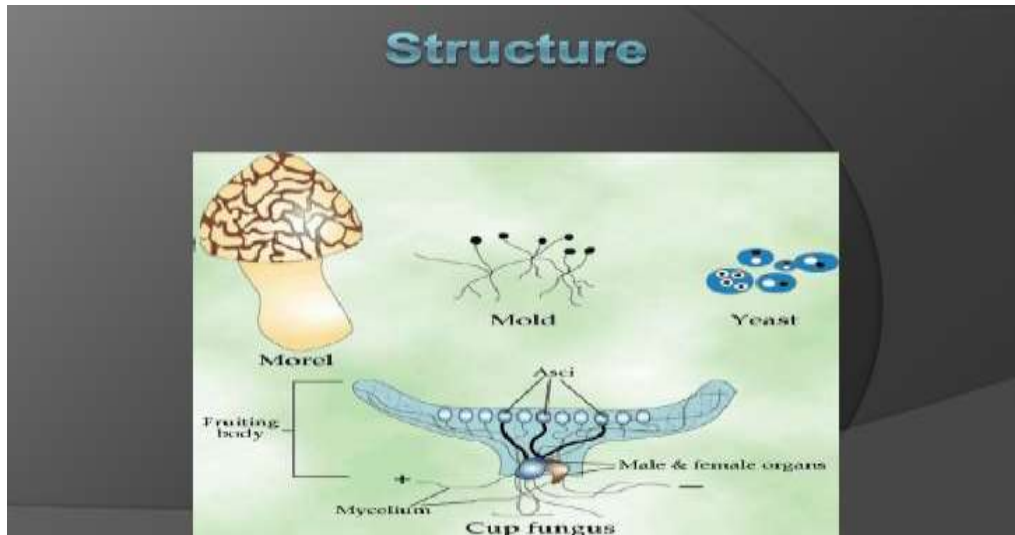
Its members are commonly known as the **sac fungi this name comes from forming sexual spore (ascospore)**. They are the largest phylum of Fungi, with over 64,000 species. Among the Ascomycota are some famous fungi: *Saccharomyces cerevisiae*,(baker yeast) the yeast of commerce and foundation of the baking and brewing industries, *Penicillium chrysogenum*, producer of penicillin, *Morchella esculentum*, the edible morel, and *Neurospora crassa*, **using as a model in genetic studies**. There are also some in famous Ascomycota, a few of the worst being: *Aspergillus flavus*, producer of aflatoxin, the fungal contaminant of nuts and stored grain that is both a toxin and known natural carcinogen, *Candida albicans*, cause of thrush, diaper rash and vaginitis and some species cause powdery mildew on plants like - *Erysiphae* sp. is caused powdery mildew on grasses and cucumberaceae plants

### Characteristics of Ascomycota

- 1-Somatic phase :Most have either unicellular like yeast or filamentous growth forms Hyphae have perforated septa.

2-Almost all ascomycetes are terrestrial or parasitic. However, a few have adapted to marine or freshwater environments.

3-The cell walls of the hyphae are variably composed of *chitin* and  $\beta$ -glucans, just as in Basidiomycota.



5-Includes yeast, cup fungi, truffles, powdery mildew, & morels(true mushrooms).

6- Sexual reproduction by forming ascospores produce inside sacs are called asci(singular :ascus) ,Most asci are cylindrical, or globose each ascus has 8 ascospores .

7- Most produce multicellular fruiting body – the ascocarp in which the asci and ascospores are formed . Asci usually develop on an inner surface of the ascocarp , a layer called the hymenium or hymenial layer .

**Ascocarp** – specialized hyphae formed by parent fungi during **sexual reproduction**

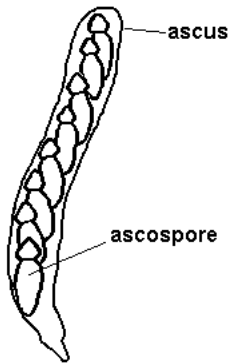
8-Characteristics of asci and ascocarp important in classification

9-Asexual reproduction – production of conidia bearing on conidiophores or budding .

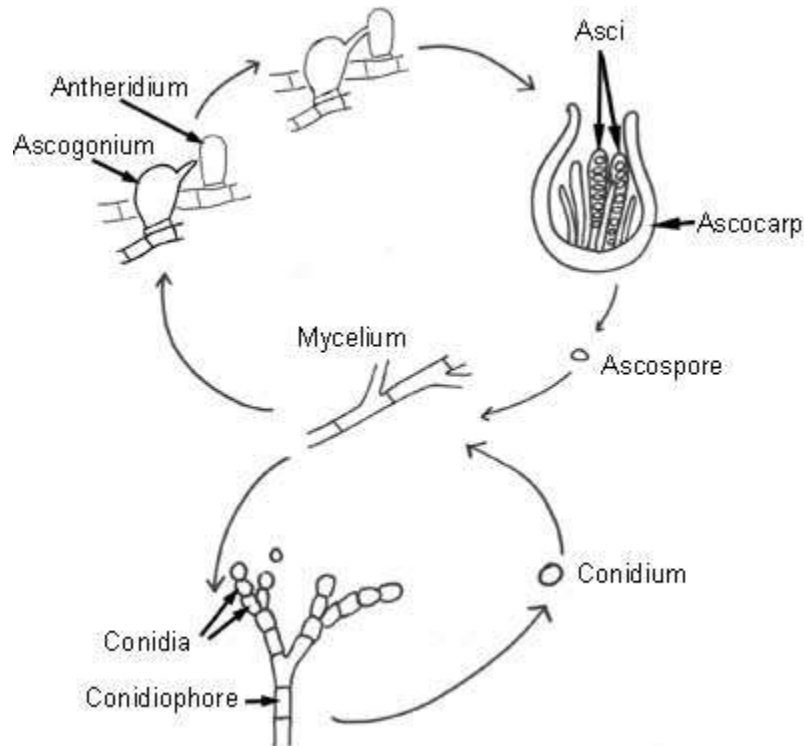
10-Many of the Deuteromycota thought to be asexual or anamorphs of Ascomycota.

11-Previous hypotheses that the Ascomycota evolved from red algae (similarities in

morphology of sexual structures) and Mucorales



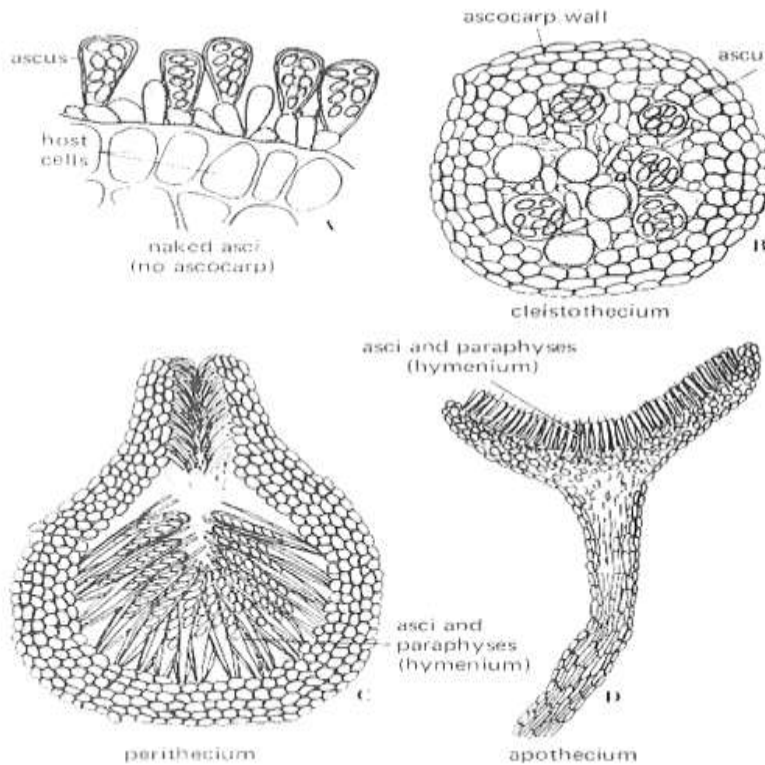
### Life cycle of Ascomycota



In asexual reproduction, spores are formed as the result of **mitosis** (nuclear division in which the number of chromosomes in the daughter nuclei is the same as it was in the parent nucleus). The resulting **mitospores** (also called **conidia**) are released in large numbers, and allow the ascomycete to disperse over a wide area.

Sexual reproduction involves the formation of an **ascus** (plural; asci) by the fusion of two hyphae of different mating types. The ascus is shaped like a bag, and acts like a bag in that it contains the spores. These spores are called **ascospores** and are formed by the fusion of two nuclei (karyogamy) to form a diploid nucleus. This diploid nucleus divides by **meiosis** (nuclear division with reduction in the number of chromosomes) to give four spores, which then divide by **mitosis** to give eight haploid **ascospores**.

These ascospores have thick cell walls, and have the ability to persist in the environment for a long time. The structure of the ascus varies within the group except yeasts tend to have single asci (naked asci) not forming ascocarp, others have their asci formed within a fruiting body called an **ascocarp**. These occur in several different forms:



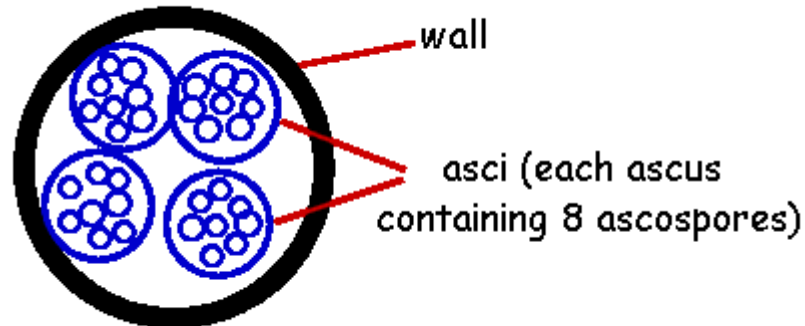
**FIGURE 33-5**  
Four ways in which  
Ascomycetes bear their asci.  
(From Alexopoulos, [1962]. By  
Wiley & Sons, Inc.)

**Use of ascocarps in the classification of fungi belonging to the Ascomycota:**

**1. Hemiascomycetes (includes yeasts)**

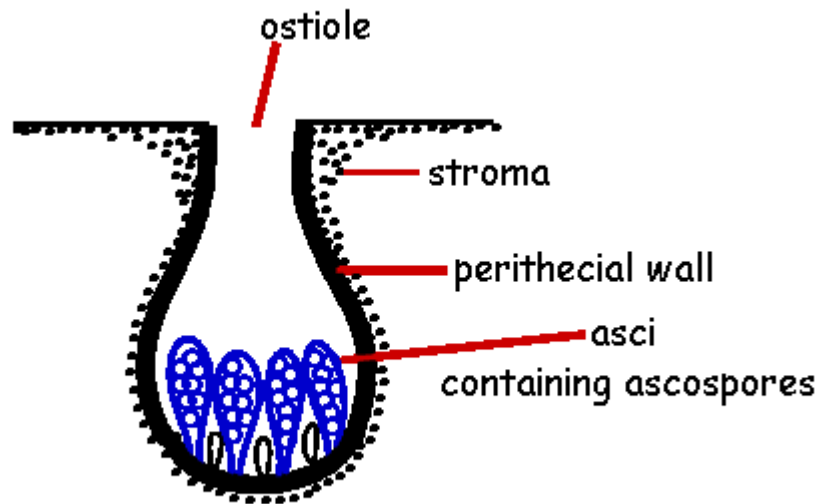
- In this case the asci are NOT ENCLOSED in an asocarp.
- Asci are naked

## 2. Plectomycetes



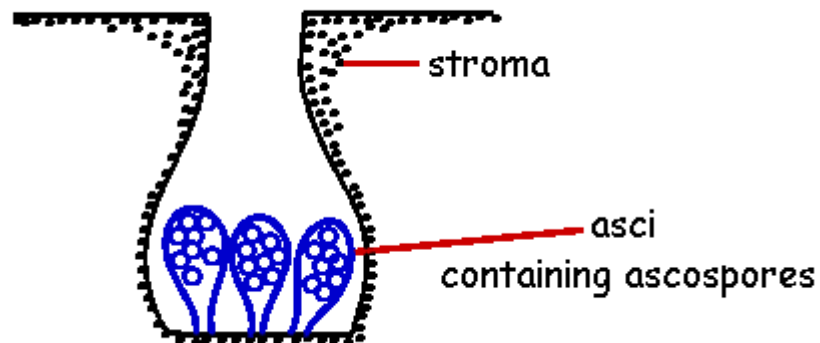
- Fungi belonging to this group form CLEISTOTHECIA.
- These are round, completely closed ascocarps, possessing no natural opening.
- The asci are arranged irregularly within them.
- When mature the cleistothecia burst open to release their asci and ascospores.
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3.  
Pyrenomycetes



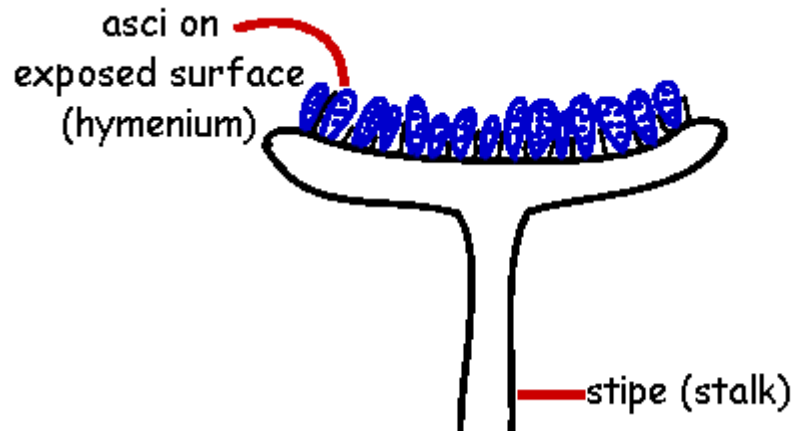
- Fungi belonging to this group form PERITHECIA.
- Perithecia are spherical or flask-shaped ascocarps.
- They open via a neck-like OSTIOLE with a terminal pore through which the ascospores are liberated.
- The asci are arranged in an orderly layer at the base of the cavity.

4. Loculoascomycetes



- Fungi belonging to this group form ASCOSTROMATA (or PSEUDOTHECIA).
- Ascostromata resemble perithecia but in the former there is no wall surrounding the central region of the ascocarp - only a cavity within the mass of hyphal tissue (STROMA) in which the asci are located. Ascocarp with asci formed in cavity (locule) within stromatic tissue

## 5. Discomycetes

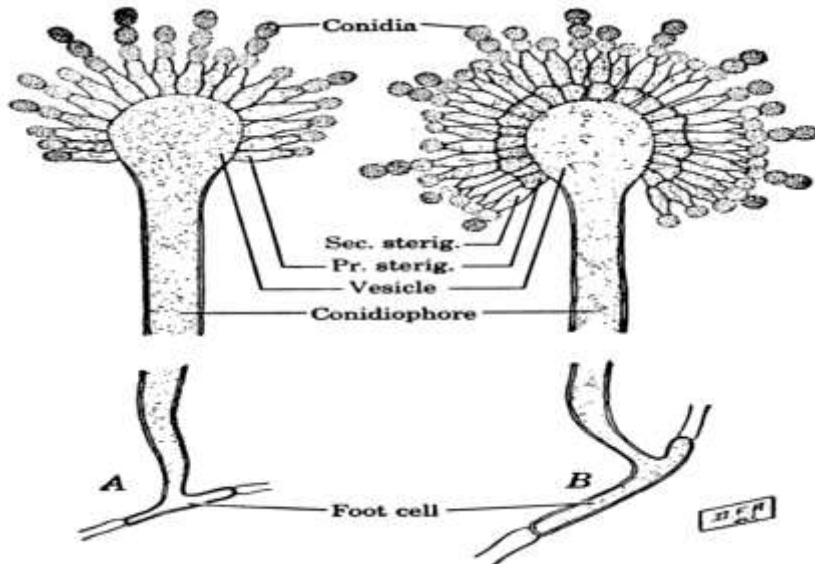


- Fungi belonging to this group form APOTHECIA.
- An apothecium is an OPEN- or CUP-SHAPED ascocarp.
- The asci are arranged on the exposed surface (HYMENIUM).

### Examples of Ascomycota

#### *Aspergillus*

- Anamorphic genus – close to 100 species
- 11 different teleomorphic genera produce *Aspergillus* conidia on conidiophores, including *Eurotium*, *Emericella*
- Common fungi found in air, soil, water
- Grow on a variety of substrates, in humid climates found growing on clothing, shoes, etc.
- Important as contaminants of stored grain, species produce aflatoxin
- Produce characteristic conidiophore
- Conidia produced by phialides – flask shaped conidiogenous cells
- Have a characteristic foot cell



*Penicillium* spp.

- Over 95 species connected to 3 teleomorphic (sexual reproduction) genera – *Talaromyces*, *Eupenicillium*, *Carpentales*
- Very common in soil, conidia found in air, water, soil
- Food spoilage – on citrus fruits, jelly, cheeses
- Produce penicillin and other chemicals industrially
- *P. roqfertii*, *P. camembertii* used to make cheeses
- Asexual conidiophore – not swollen at tip, no foot cell
- Phialides arranged in a brushlike manner

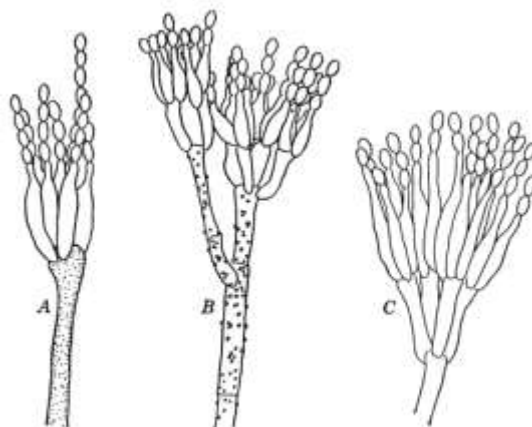
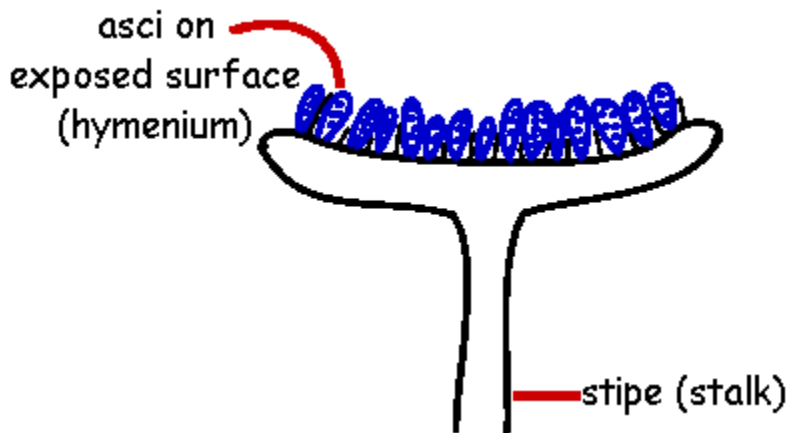
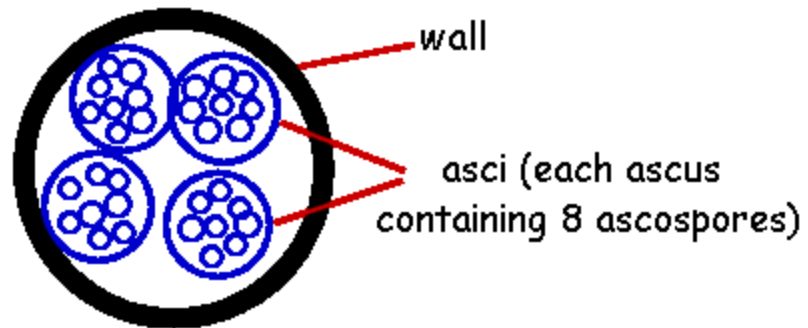


Figure 13-10. Three types of conidiophores of *Penicillium*. A. *Penicillium thomii*. B. *Penicillium lanosco-coeruleum*. C. *Penicillium wortmanni*.

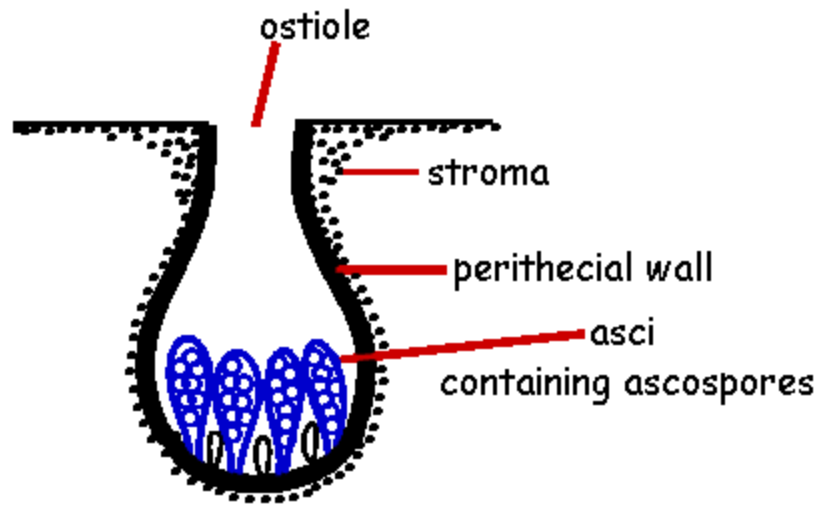


Cleistothecium



Apothecium

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Peritheicim