

Reproduction in Fungi

Week 6

Fungi, have the ability of asexual (sporulation) and sexual reproduction.

If myceliums get mature and stored enough food or environmental conditions become suitable for sporulation, the hyphae (generally aerial hyphae) will develop spores in different shapes.

When spores get matured they leave the hyphae and become independent. After that they develop new fungi by germination in optimal environment and conditions

Fungal spores have different shapes and structures

This feature is used for the fungal classification

The fungal spores are very resistant to environmental conditions. Because of this they can live for many years and reside infective

There can be found one or more nucleus placed in a spore, at the end of sexual or asexual reproduction.

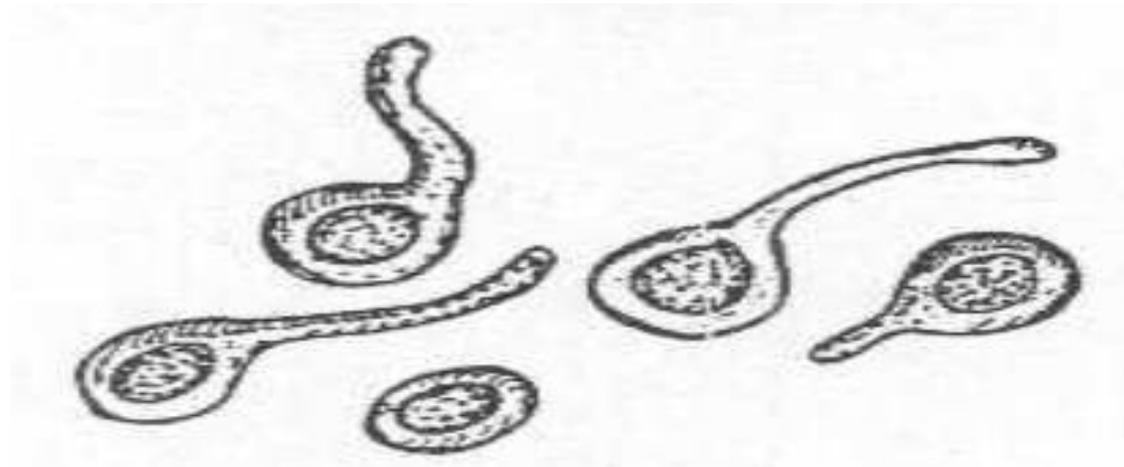
Around the spore a thick spore protection coat (episore) and under this coat an endospore that surrounds the protoplasm is found

In some fungal spores there is an extra coat (perispore) can be found that surrounds the spore exterior

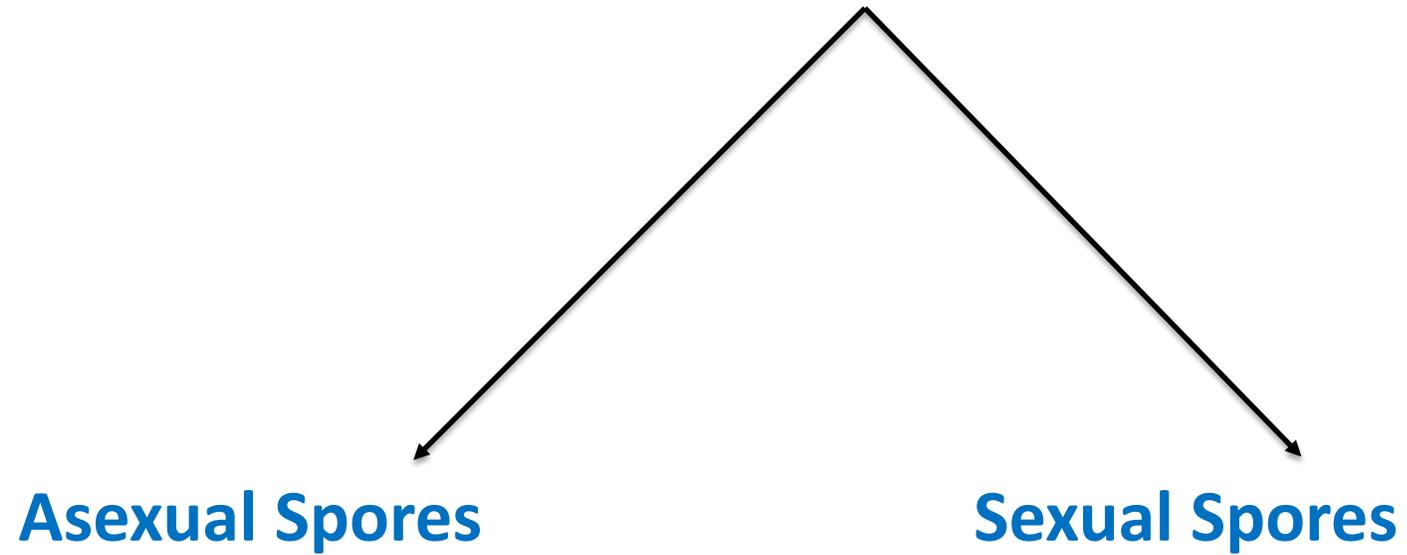
In a spore cytoplasm nucleus, vacuoles, lipid granules and enough organic and inorganic compounds are found to build new fungi

During the development of thallus from spore (germination), spores get water inside and become swelling. After getting enough water and other necessary substances, a germ tube grows longer from inside to outside

This tube develops rapidly and gets bigger in volume to differentiate into hyphae that are special to the species. These hyphae also develop other reproductive hyphae



Spores



Asexual Spores

Asexual spores, occurs from single parenteral fungus and thus they will become identic to parenteral fungus genetically

Arthrospore

Blastospore

Clamidospore

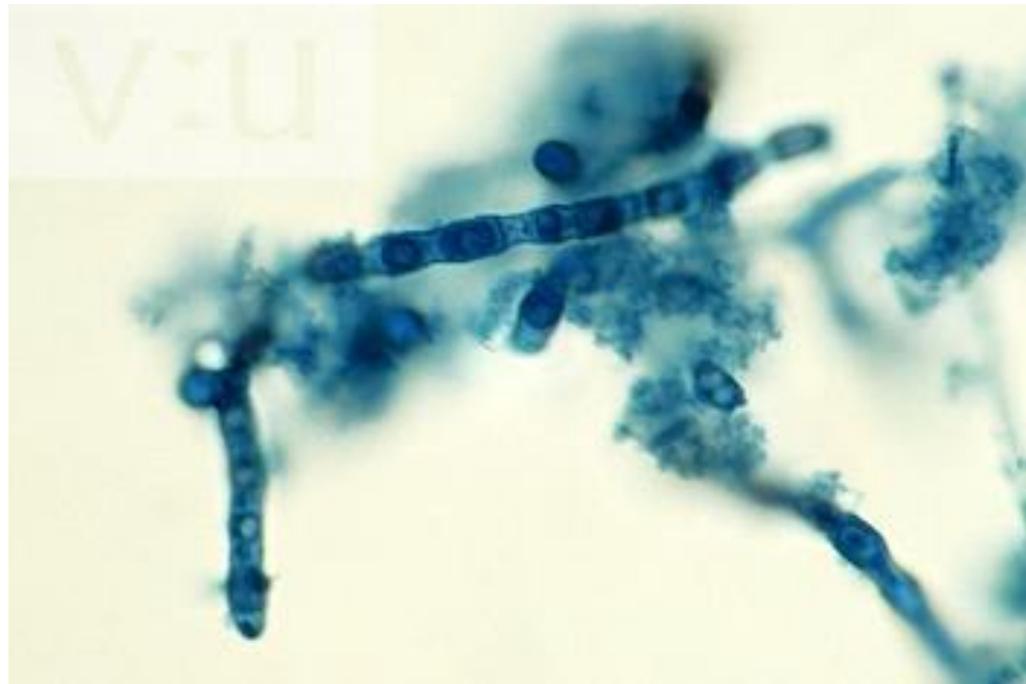
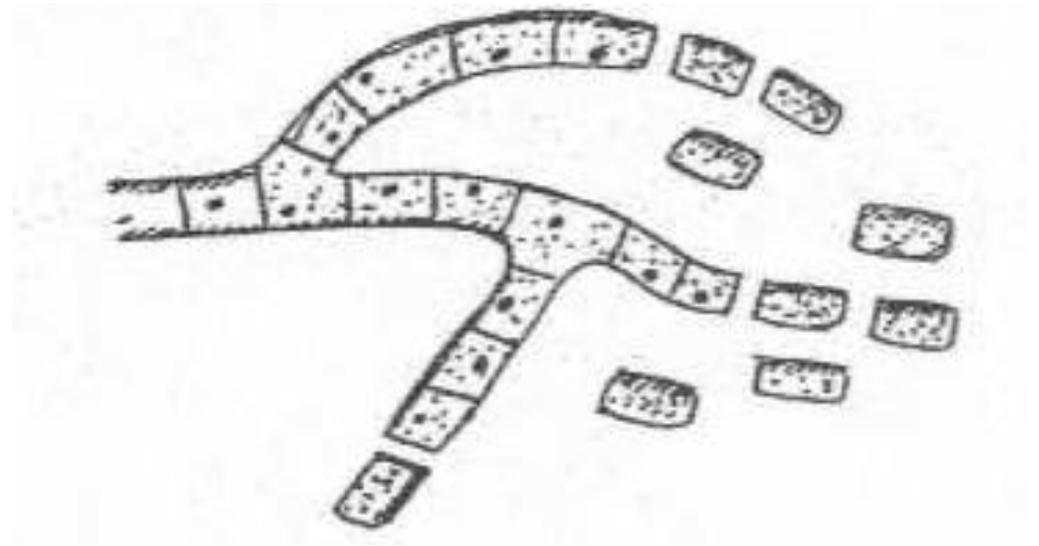
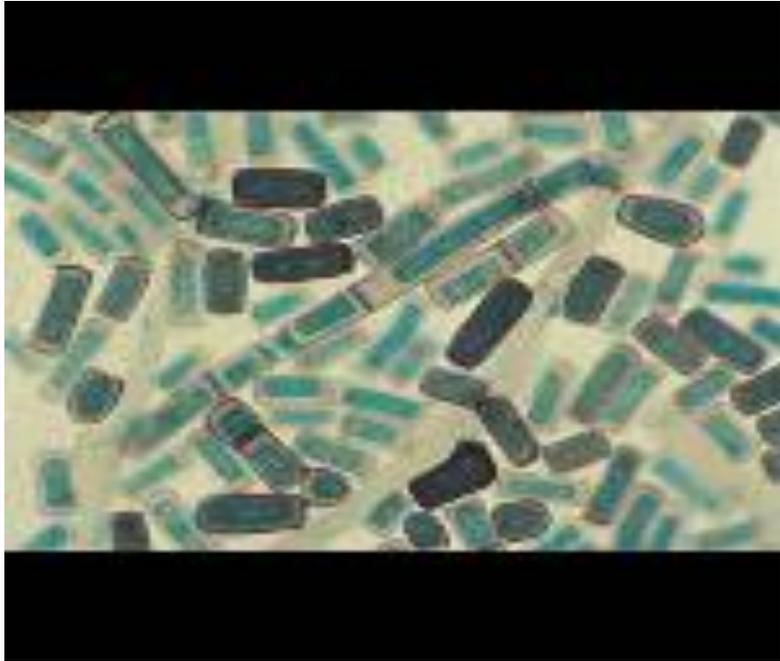
Conidiospore

Sporangiospore

Arthrospore

- No major change is observed in shape of hypha while developing Arthrospore
- Only reproductive hyphae are separated by septumes (fragmentation)
- Arthrospores which are oval or cylindrical shaped leave the hyphae and become independent. In optimal environmental conditions they germinate and each of them turn into new fungus
- In dermatophytes arthrospores can be observed mostly on skin and hairs, they are not observed on fungal cultures

Arthrospore



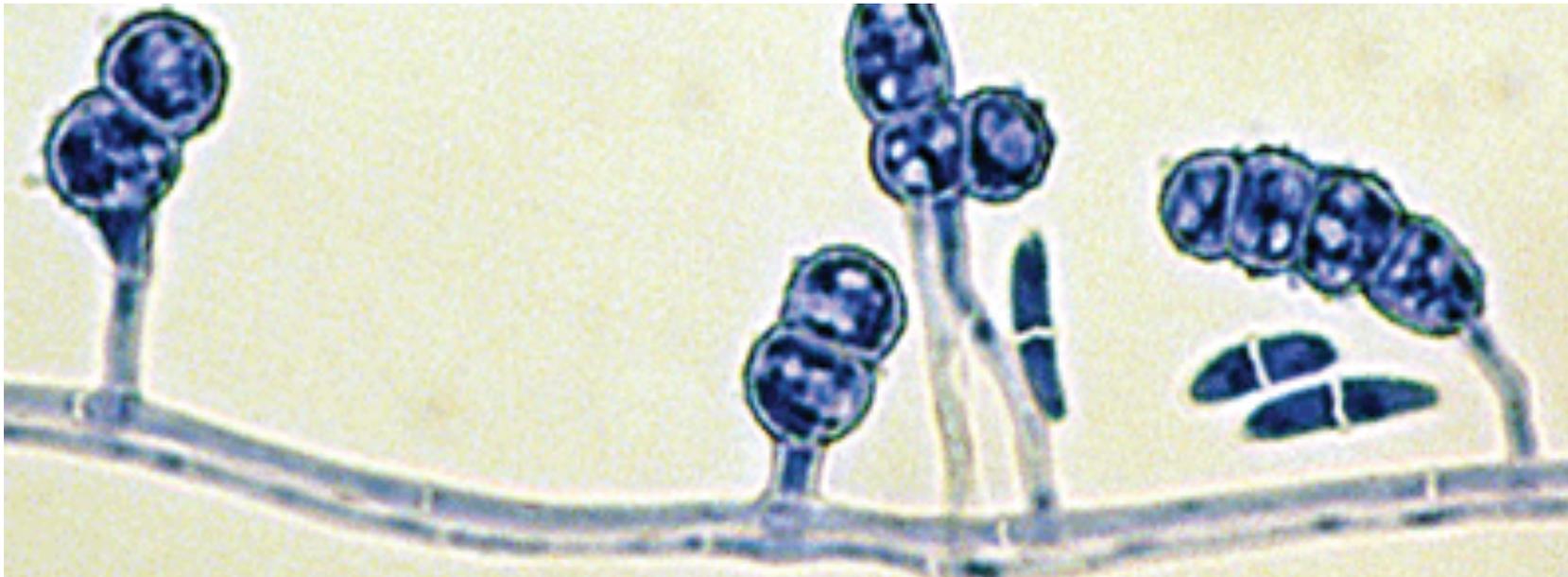
Blastospore

- In filamentous Ascomycetes fungi, yeasts and fungi that form yeast-like colony, tiny buds (tomurcuk) occur on different places of hyphae. Generally, more than one small buds (blastospores) are developed and grow
- Blastospores become independent after getting matured
- Blastospores, may remain attached to the hyphae or main cell (*Saccharomyces cerevisiae*)

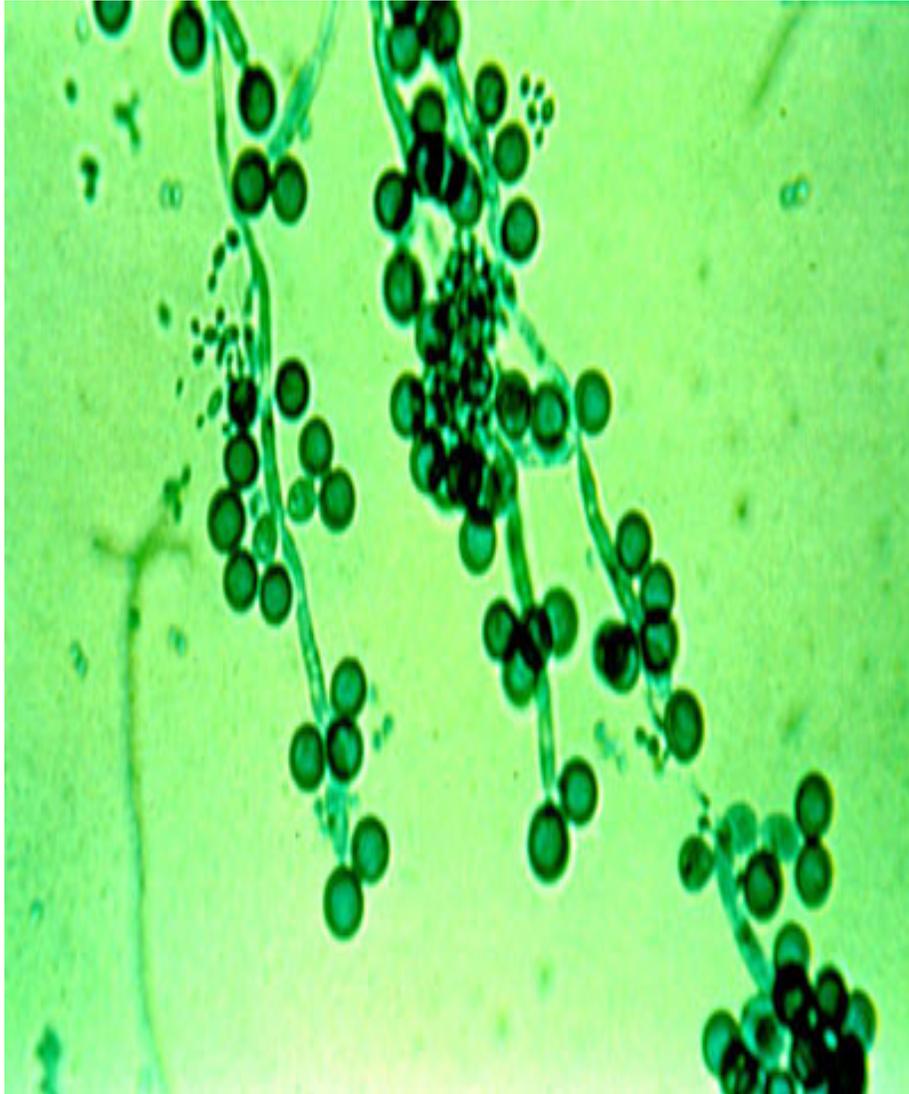


Clamidospore

- Some cells in hyphae gets bigger, develops, edge (cell wall) gets thicker and protoplasm gets concentrated to form clamidospores
- The spores surrounded with thick cell Wall resists to the environmental conditions (mechanical, physical and chemical factors)
- Clamidospores may occur in the middle, side and at the end of the hyphae



Clamidospore



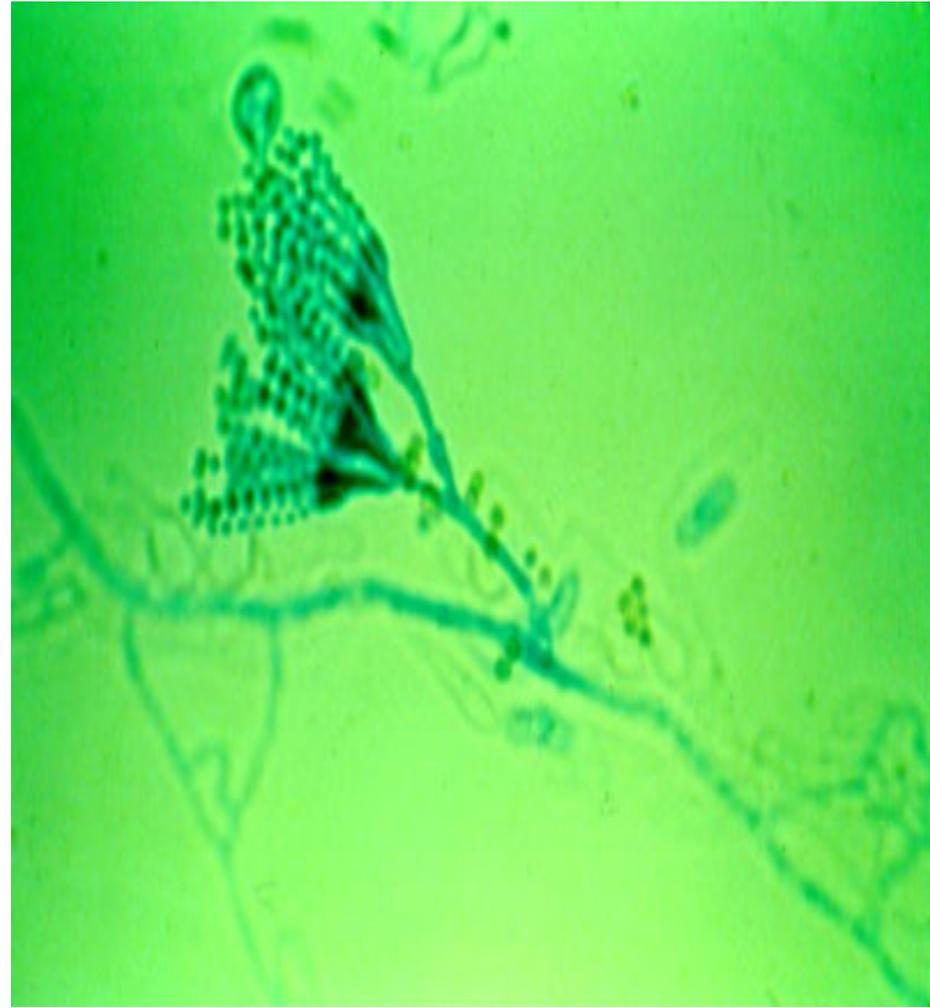
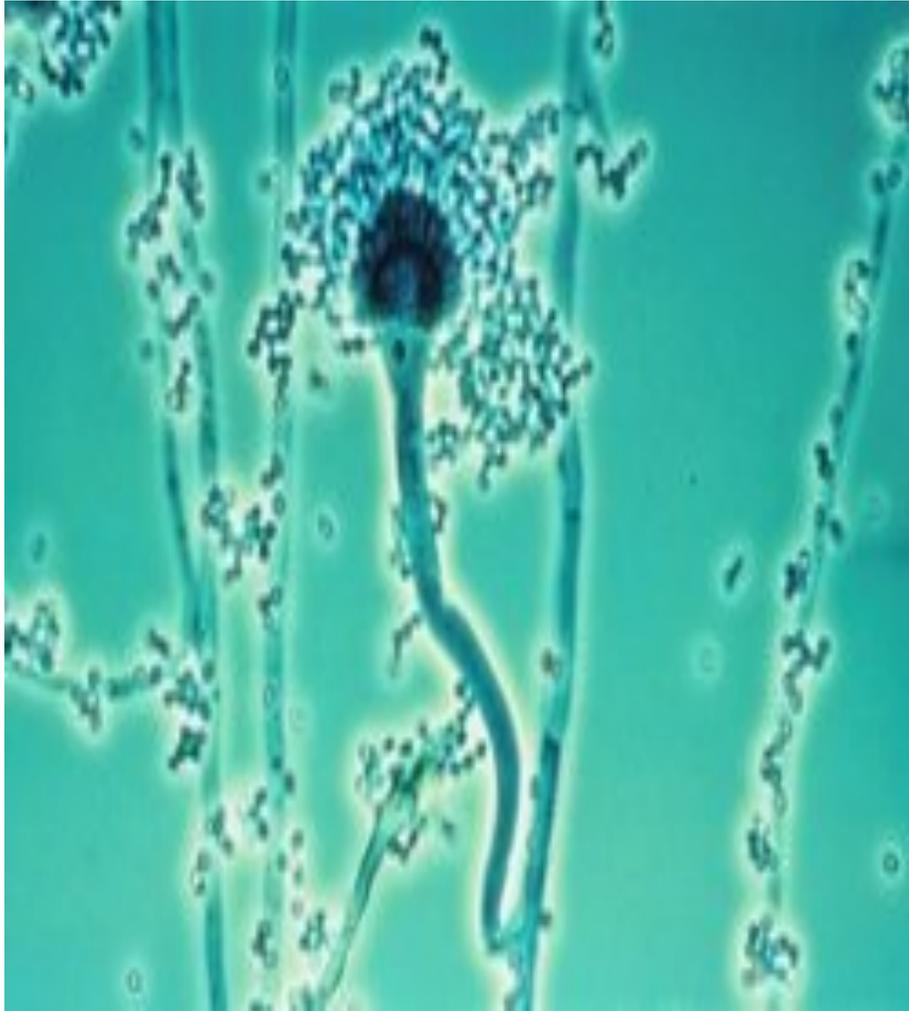
Conidiospore

- Filamentous Ascomycetes and several Deuteromycetes (*Fungi imperfecti*) fungi exhibit
- Spores (conidia), arise beside and at the end of the special reproductive hyphae (conidiophore)
- These hyphae, occur by the modification and differentiation of aerial hyphae
- Some spores occur directly on fertile hyphae
- Some other spores may occur on a short sterigmata (Sporotrichum)

Conidiospore

- In Dermatophytes (*Microsporum*, *Trichopyton*) 2 different conidium found on the same hyphae
- Single cell types are localised on different places of hyphae and small, oval, spherical shaped (microconidium)
- Multicellular cell types are big spores which are also lemon or puro shaped (makrokonidium) and these spores are seperated into more than one cell by septums (*Microsporum canis*)
- Conidia are spherical, round, shuttle or bottle like shaped, big or small sized spores
- The morphological characteristics like the size, shape, arrangement and other features of conidiospores are used to discriminate fungal species (*Aspergillus*, *Penicillium* ve *Hormodendrum*)

Conidiospore

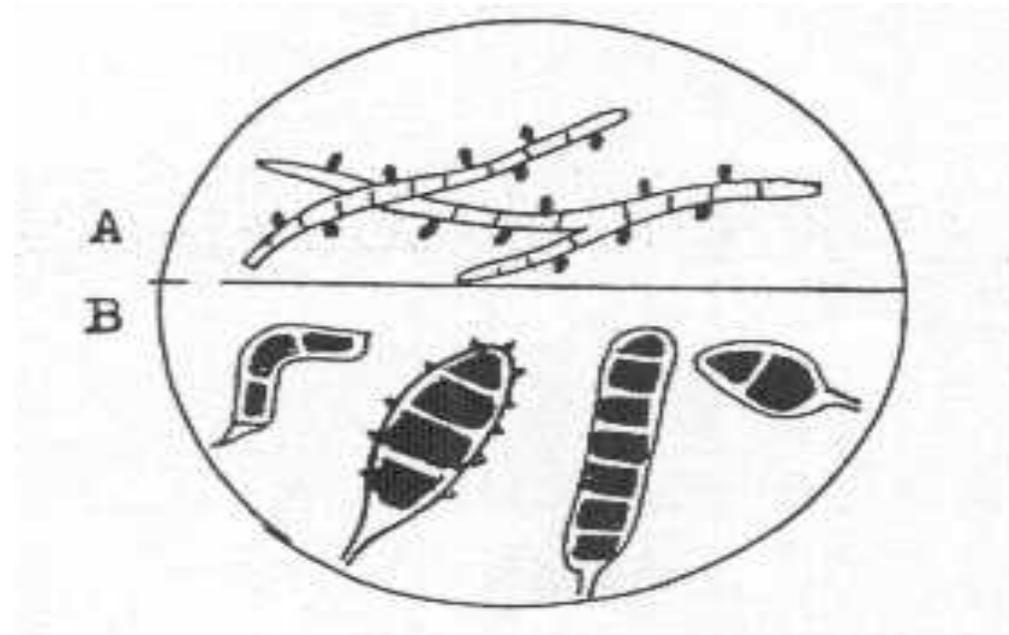




Conidiospore

A= Microconidium

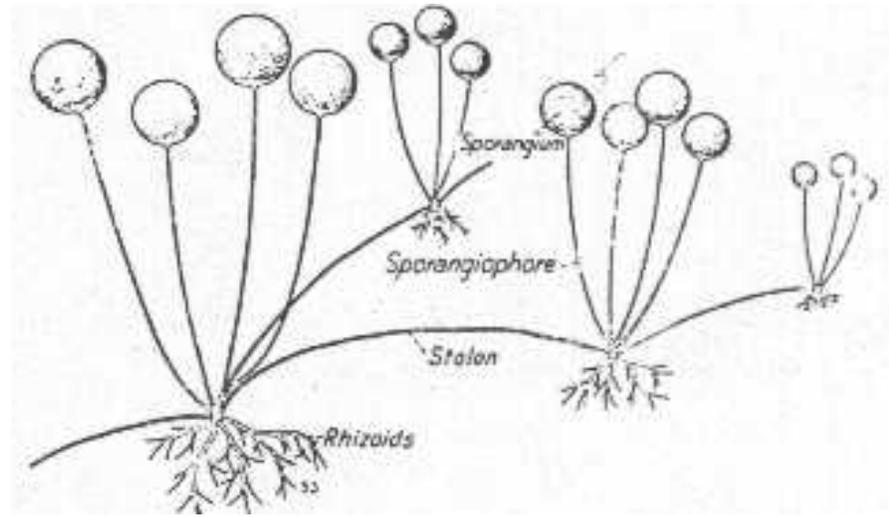
B= Macroconidium



Sporangiospore

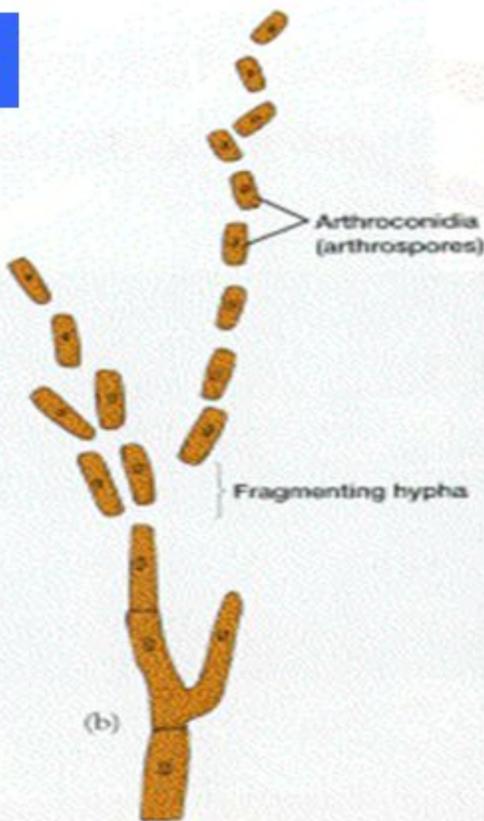
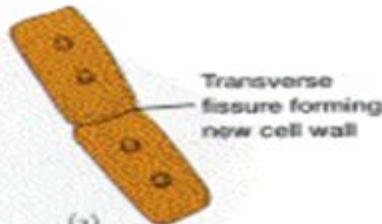
- Observed in *Phycomycetes* fungi
- These spores (*sporangiospore*) are localised at the end of the special hyphae (*sporangiophore*) which are big and spherical shaped sacs (kese) (*sporangium*). These small, dehydrated and thick edged spores are located in these sporangiums
- *Columella* is found at the bottom of sporangiums in order to support
- When these sporangiums are burst spores come out. Optimal environmental conditions lead to the germination of these spores in order to form their own fungal species
- *Rhizopus nigricans*

Sporangiospore



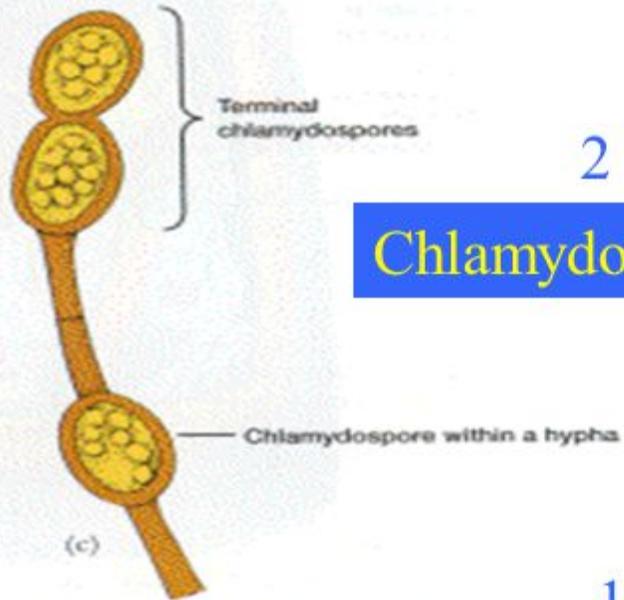
Arthrospores

1A



2

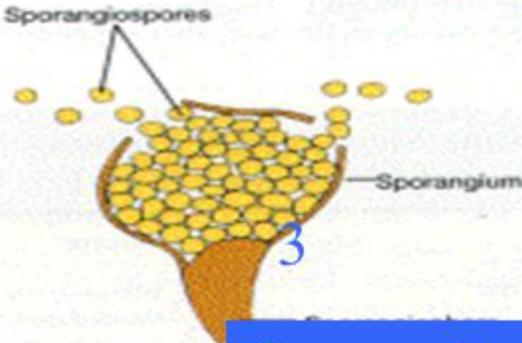
Chlamydo spores



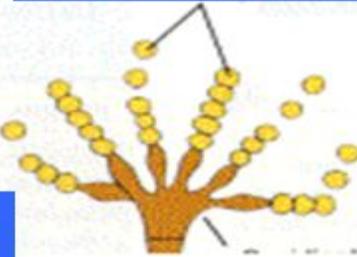
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Conidiospores

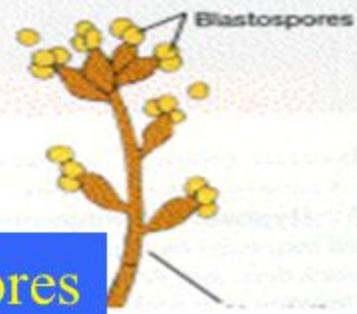
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Sporangiospores



Blastospores



Sexual Spores

In sexual reproduction, sexual spores arise from the fusion of two distinct sex's germ cells

There are 4 stages in sexual reproduction

- 1) Developing of gamet or sexual organs of cells
- 2) The fusion of these organs (plasmogami), rapidly or soon nuclear fusion (karyogami)
- 3) Meiosis in haploid fungi
- 4) Occurrence and developing of spores

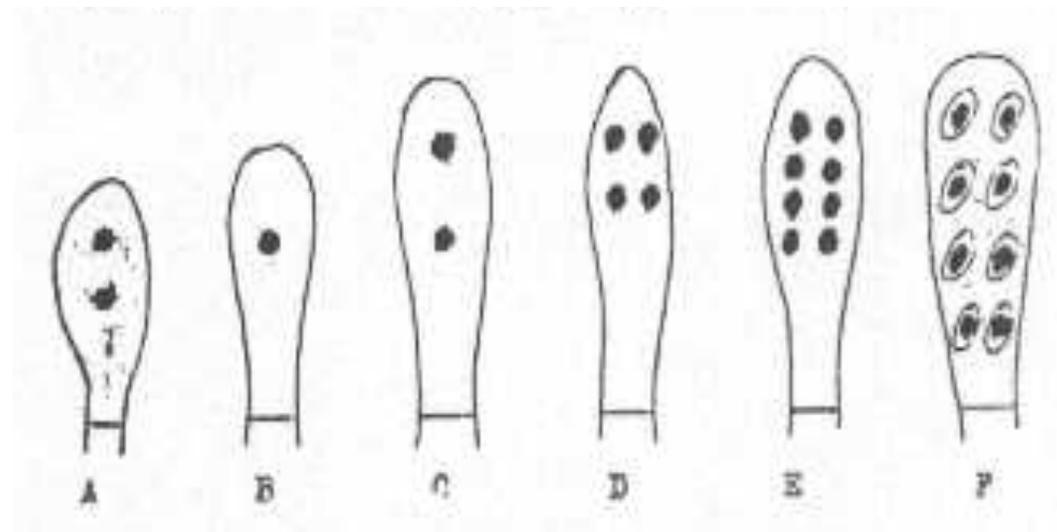
Sexual Spores

- **Ascospores**
- **Basidiospores**
- **Oospores**
- **Zygosporos**

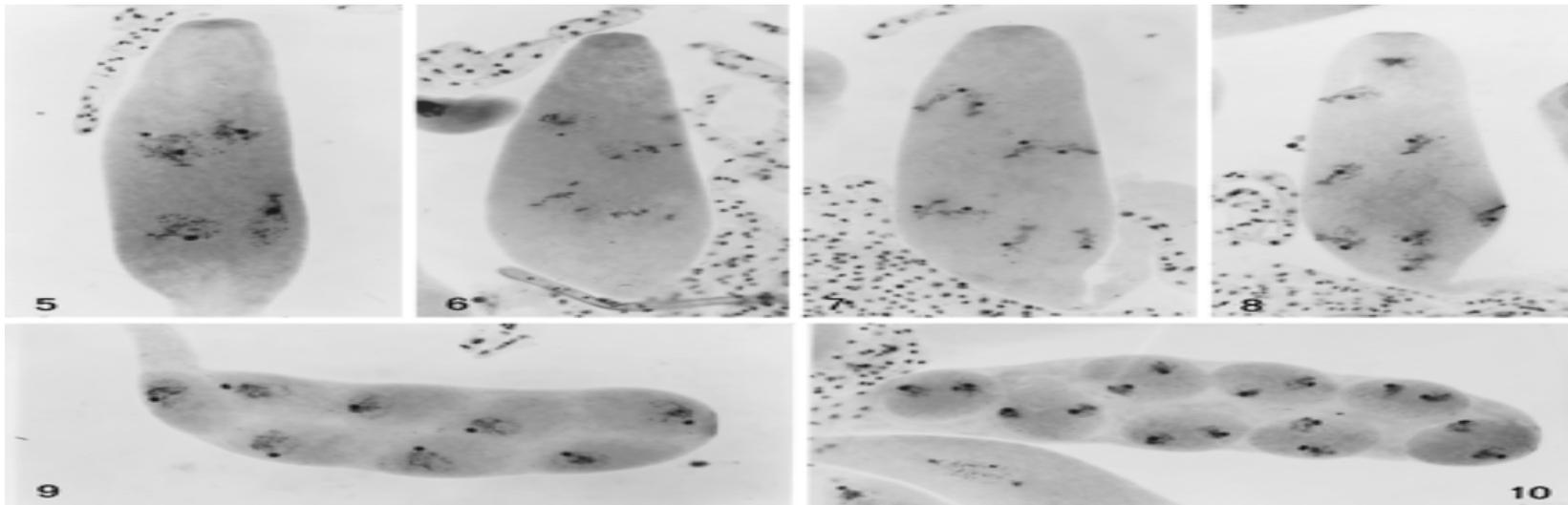
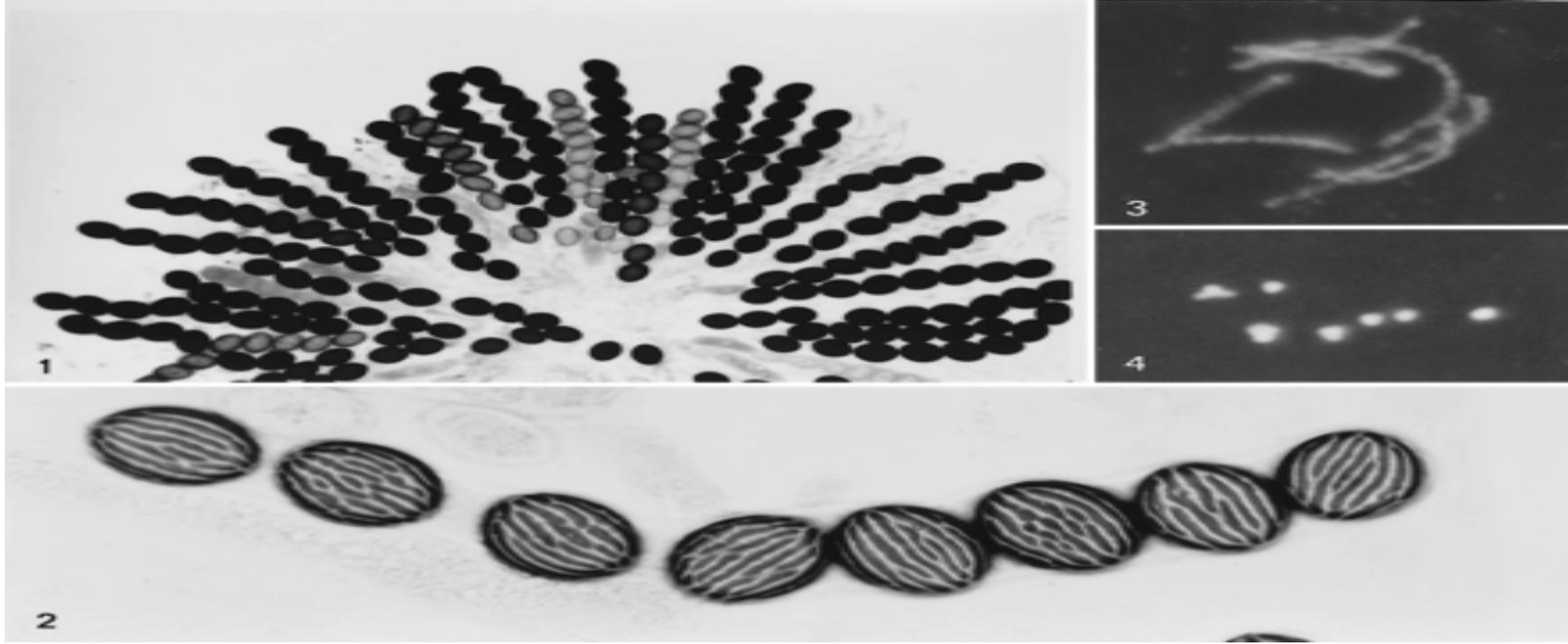
Ascospores

- In Ascomycetes fungi sexual spores are produced in enlarged and elongated cell sacs called ascus
- On the same or distinct hyphae, 2 neighbour cells (ascogonium and anteridium) elongated each other and fused to form ascospores
- First 2 cell membranes melt and get lost
- Then anteridial nucleus goes into ascogonium and new cell become 2 nucleated
- After nucleuses combined, the division of meiosis starts
- After 2 or more divisions nucleuses surrounded by thick protection coat
- Thus 4 or 8 haploid ascospores will occur
- When spores get matured the sac will be teared and spores get out

Ascospores

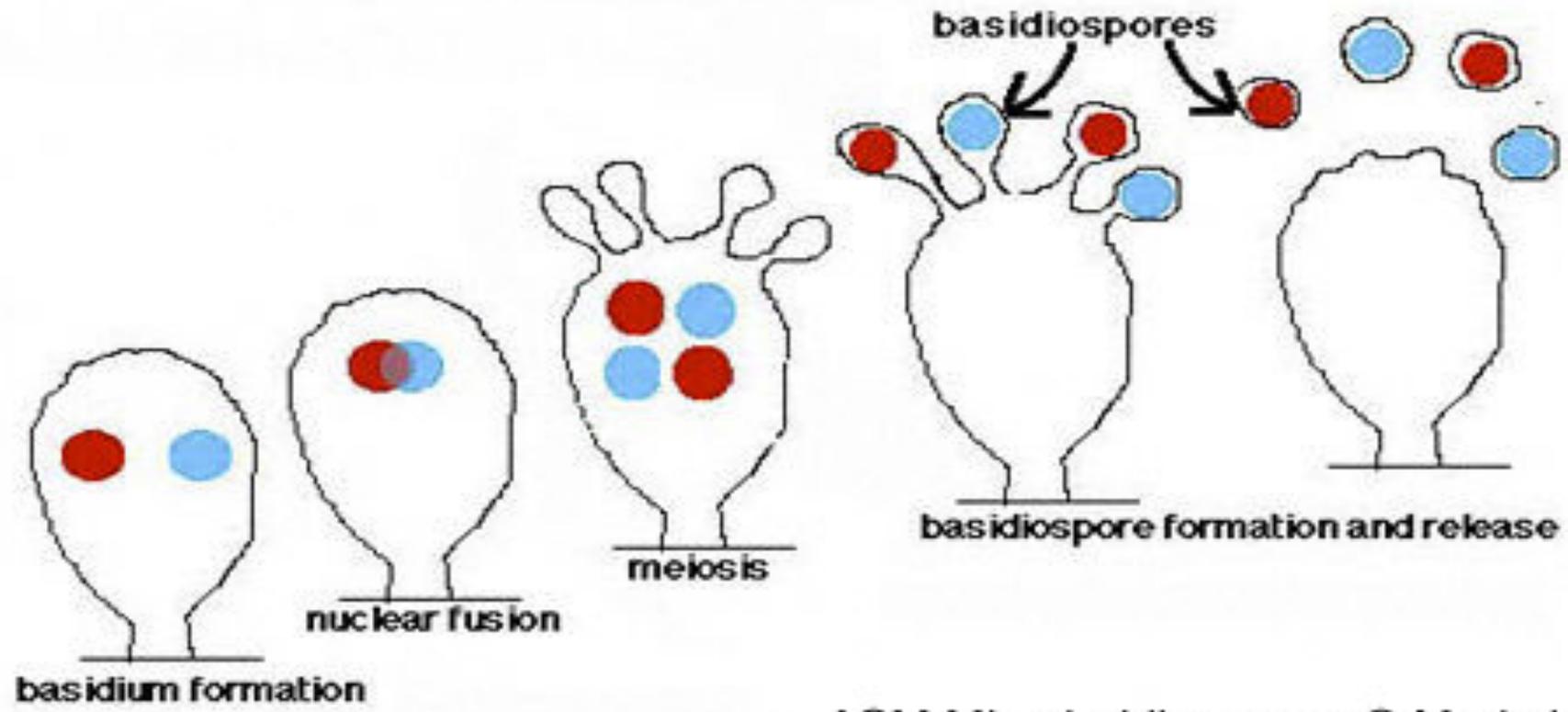


Ascospores

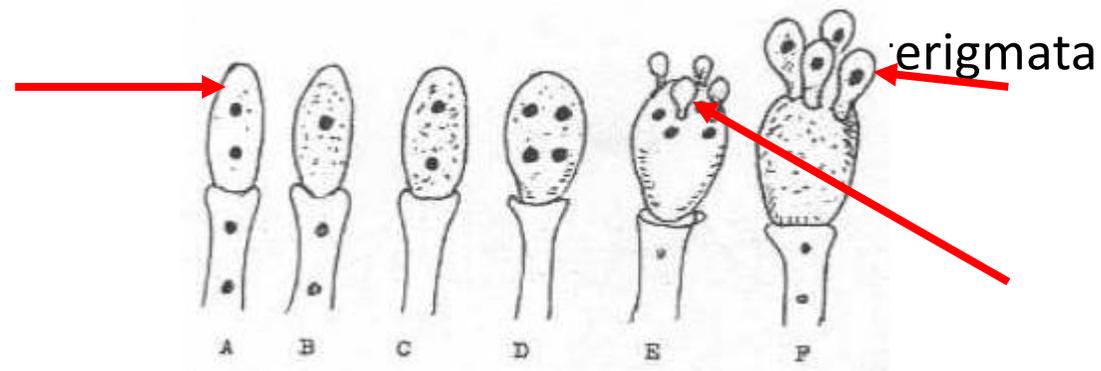


Basidiosporlar

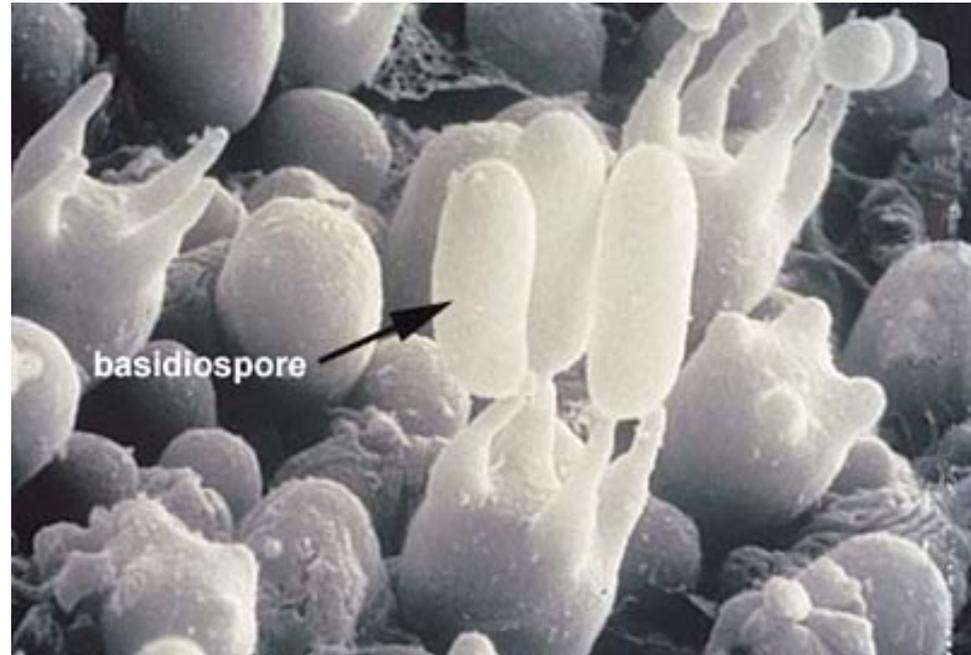
- These sexual spores are found in Basidiomycetes
- With the enlargement of Basidiums and occurrence of basidiospores they will look like ascospores
- First the neighbour cells elongated to each other and the membrane get lost
- Then, the nucleus of one cell goes into other's and become single nucleated
- The single nucleus continues meiosis division and seperated into 4 haploid nucleus
- At the end of Basidiums, for each cell a sterigmata (basidium) will occur and each nucleuses goes into its own sterigmata to form basidiospores
- Spores leave and spread to the environment
- They form new fungi by germination at the optimum conditions



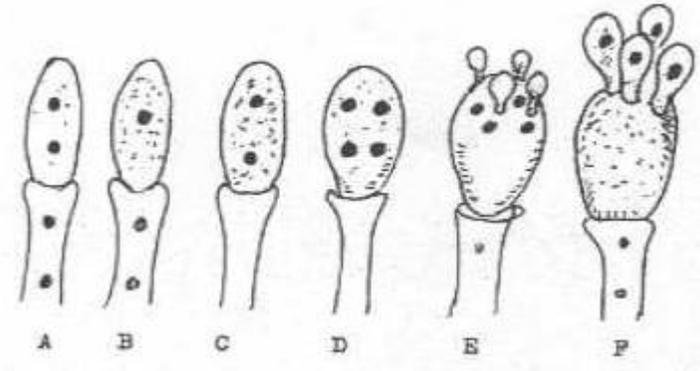
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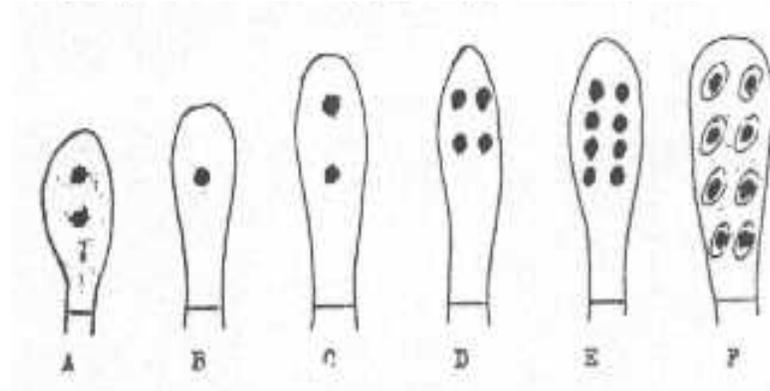
Basidiospores



- Basidiospores, are developed externally (just the opposite of ascospores)



Basidiospore

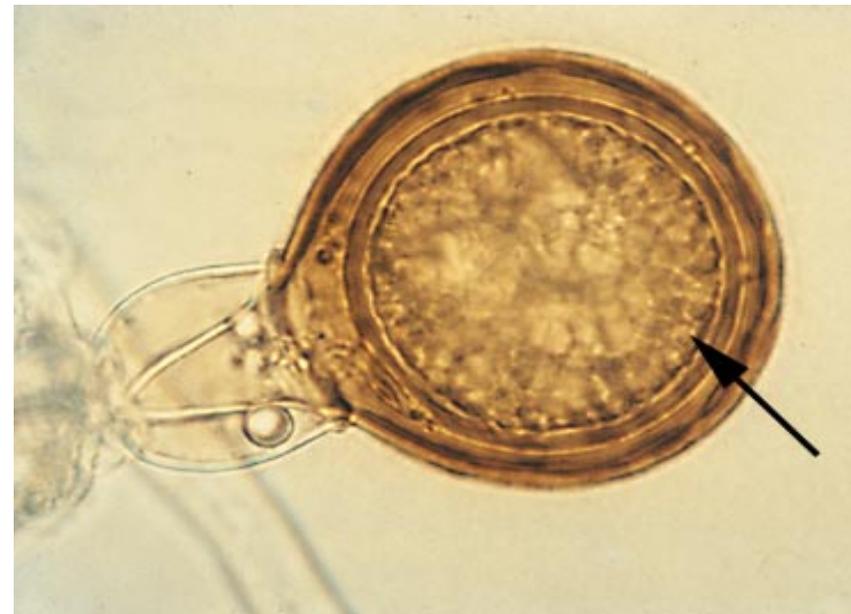


Ascospore

Oospores

- In Oomycetes class fungi sexual reproduction occurs by oospores
- Male gamet (antheridium) is smaller than the female gamet (oogonium) and differs in shape
- Oospores are formed by the joining of these gametes
- Oospores are thick walled, round shaped, resistant to the environmental conditions and full of food
- In *Saprolegnia* fungi, among the gametes found on the same fungi are filamentous and originated from another hyphae
- Round and spherical shaped gamet elongated to the oogonium and joins by fertilisation tube to form oospores
- The occurrence of gametes from the same fungi's hyphae is called **homotallic**, from different fungal hyphae is called heterotallic

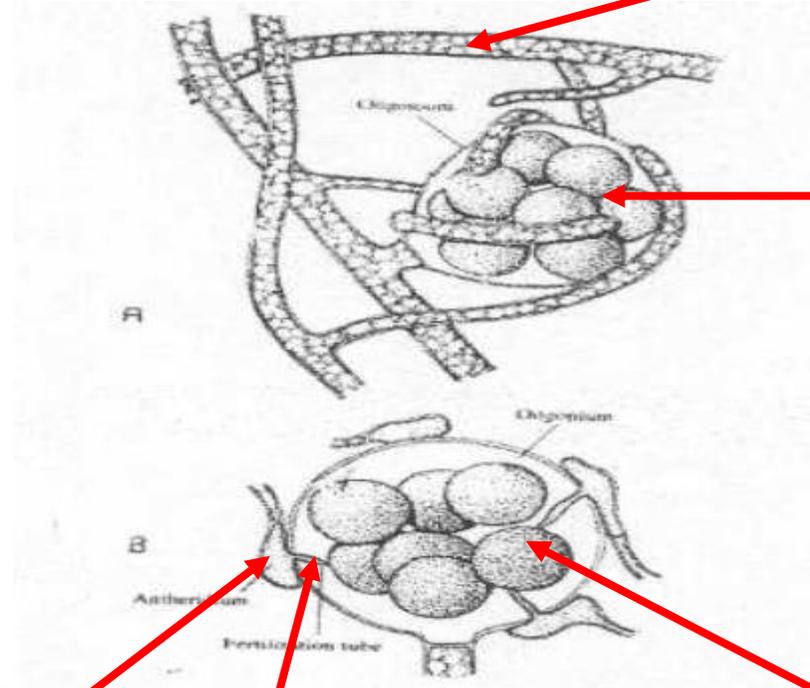
Oospores



Oospores

Anteridium

Oogonium



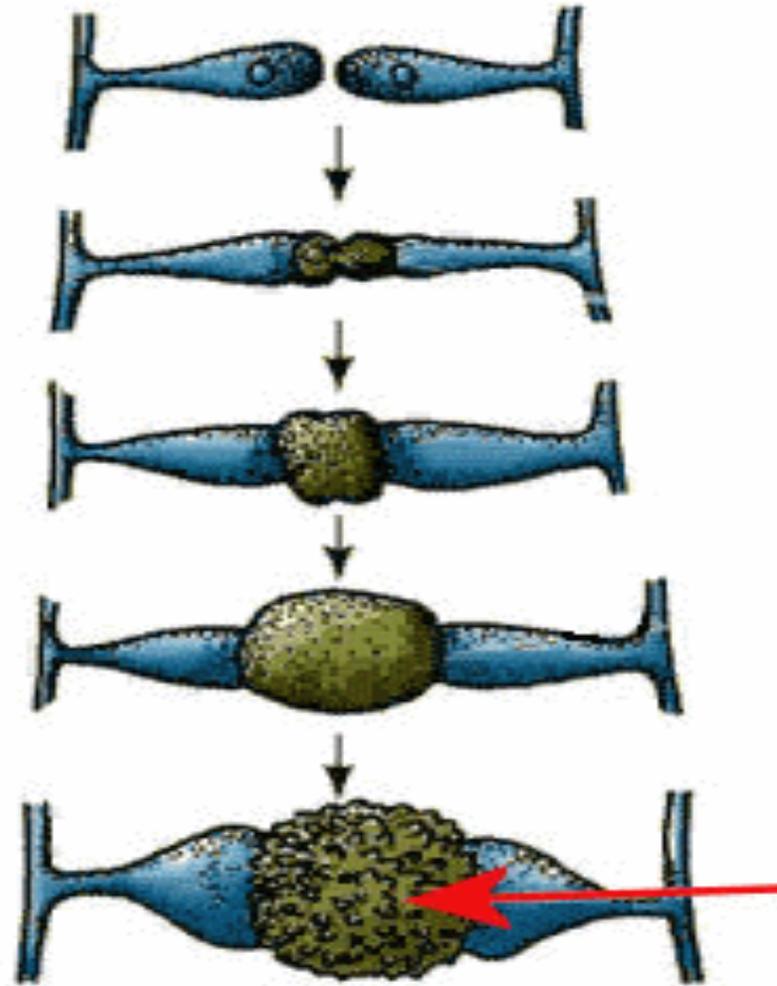
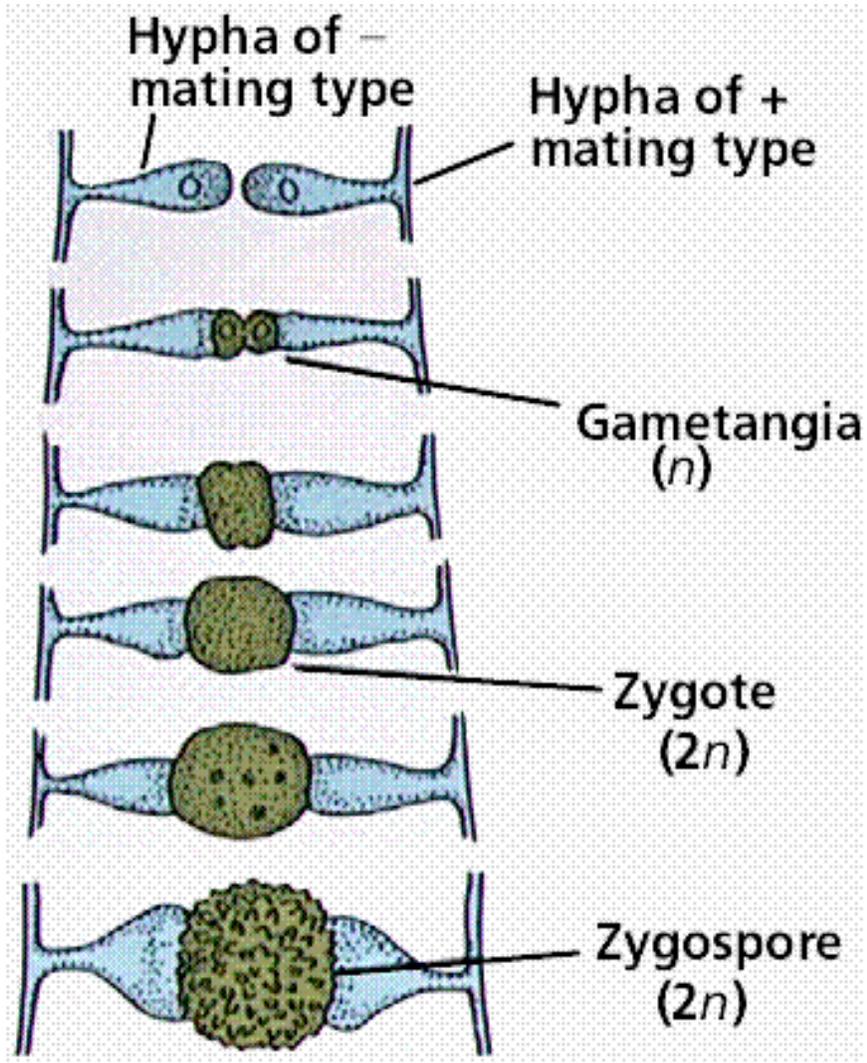
Anteridium
Fertilisation tube

Oogonium

Zygosporeres

- In *Zygomycetes* class fungi gametangiums (+ and - cells) originated from branches of somatic hyphae and they are found on the same fungi (homotallic)
- There will be no definitive shaped male or female cells occurred
- 2 gametes which looks like each other elongated to each other and joins to form sexual spore (zygospore)
- During joining the intrasellular compartments get lost and both nucleuses fused
- Then the around of the spore surrounded by a thick protection coat
- At the optimum conditions Zygospore germinated and produce new hyphae and fungi

Zygospores



Zygospores

10 um



Zygospores

