BASIDIOMYCOTA

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General Overview of Basidiomycota

- Basidiomycota is a major division of the kingdom Fungi whose members are typically characterized by the presence of a basidium
- Basidia "**Little pedestral**"
- Basidiomycota commonly are known as "**club fungi**"
- Contain about 30,000 described species
- Fruiting bodies are popularly know as mushrooms and toadstools
- Numerous of the species are edible but also include many species which are toxic or hallucinogenic

Overview Cont'd...

- Well-known cup-fungi include;
- Rust, smuts, various yeast, true mushrooms, jelly fungi, false truffles, puffballs, stinkhorns, bracket fungi, boletes, chanterelles, earth stars, bunts, mirror yeasts, human pathogenic yeast; Cryptococcus...

Puccinia graminis (Stem rust of wheat

Jelly fungi

Corn smut

Puffballs

Boletes

True mushrooms

Overview Cont'd...

- The most conspicuous and familiar Basidiomycota are those that produce mushroom, which are sexual reproductive structures
- Basidiomycota have huge impact on human affairs and ecosystem functioning
  - Many species obtain nutrition by decaying dead organic matter such as wood and leaf litter
- On the contrary, some species do have a negative impact

General Characteristic of Basidiomycota

- Badisiomycota is very varied although they are considered monophyletic
  - They contain unicellular and multicellular species
  - Undergo sexual and asexual reproduction
  - Terrestrial and aquatic form

- Production of "**basidia**" is the most diagnostic feature
- They contain a long-lived dikaryon, in which all the cells in the thallus contain two haploid nuclei as a result of a mating event
- When compatible nuclei remain in pairs they form **Dikaryon**, resulting into ***dikaryotic hyphae***.
  - Conversely, the ***haploid mycelia*** are called **Monokaryons**

General Characteristic Cont'd...

- The **dikaryotic mycelium** is more vigorous than the individual **monokaryotic mycelia**
  - It proceeds to take over the substrate in which they are growing.
  - The **Dikaryons** can be long-lived, lasting years, decades, or centuries
  - The **Monokaryons** are neither male nor female
    - ✓ They have either a bipolar (**unifactorial**)
    - ✓ or a tetrapolar (**bifactorial**) mating system
- Basidiomycota are filamentous fungi
- Composed of hyphae and reproduce sexually via the formation of specialized cup-shaped end cells

General Characteristic Cont'd...

- Another fascinating characteristics of basidiomycota is production of forcibly discharged **Ballistospores**:
  - Which are propelled into the air from the **Sterigma**
  - They may be Sexual or Asexual
  - And may be produced by Basidia, **Hyphae**, **Yeast cells**, or even other **Ballistospores**.
  - It aids in the production of a liquid filled "**hilar droplet**" that forms at the base of the spore, just above its attachment to the sterigma

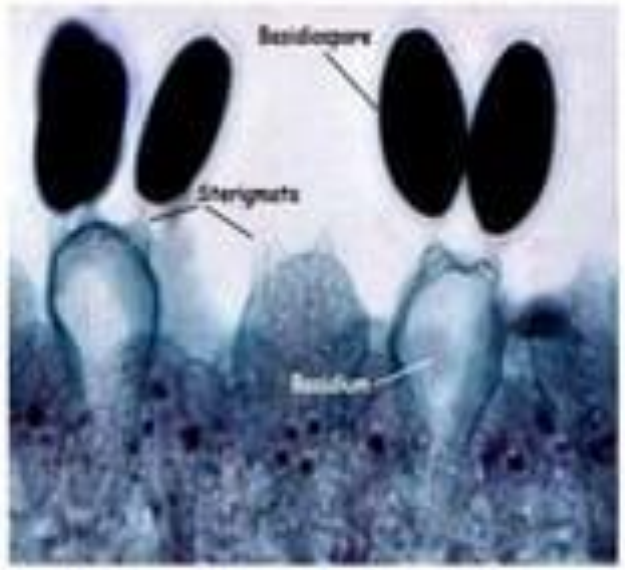


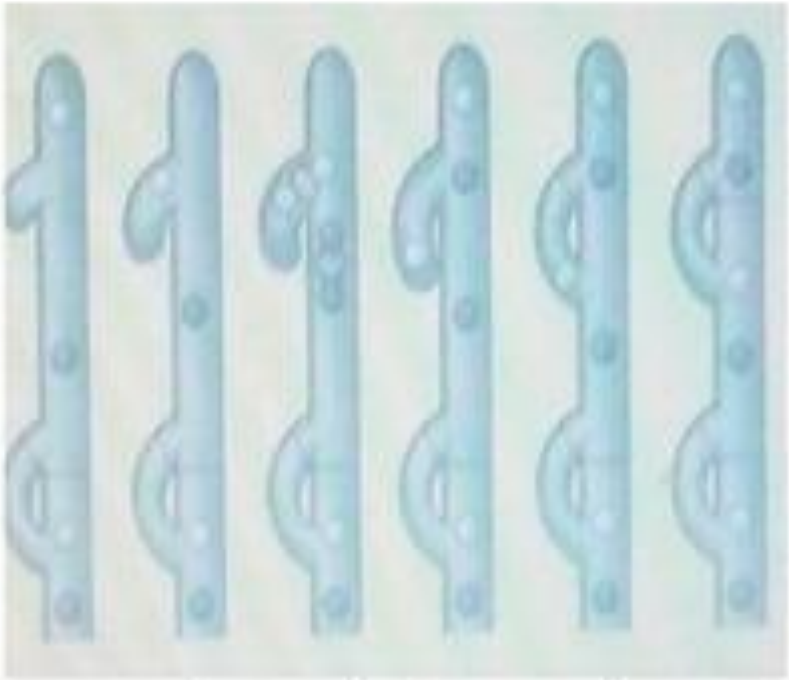
Fig 1.3 Basidiospre, basidium and Sterigmata

General Characteristics Cont'd…

- Finally, **clamp connections** are a kind of **hyphal** outgrowth that is unique to Basidiomycota

- Clamp connections are hyphal outgrowths that form when cells in **dikaryotic hyphae** divide

  - They are not present in all basidiomycota



Development of a clamp connection

Basidiomycetes:

A) Germinating **Basidiospore of Coprius**

B) Primary Mycelium with one of the Hyphae breaking into Oidia

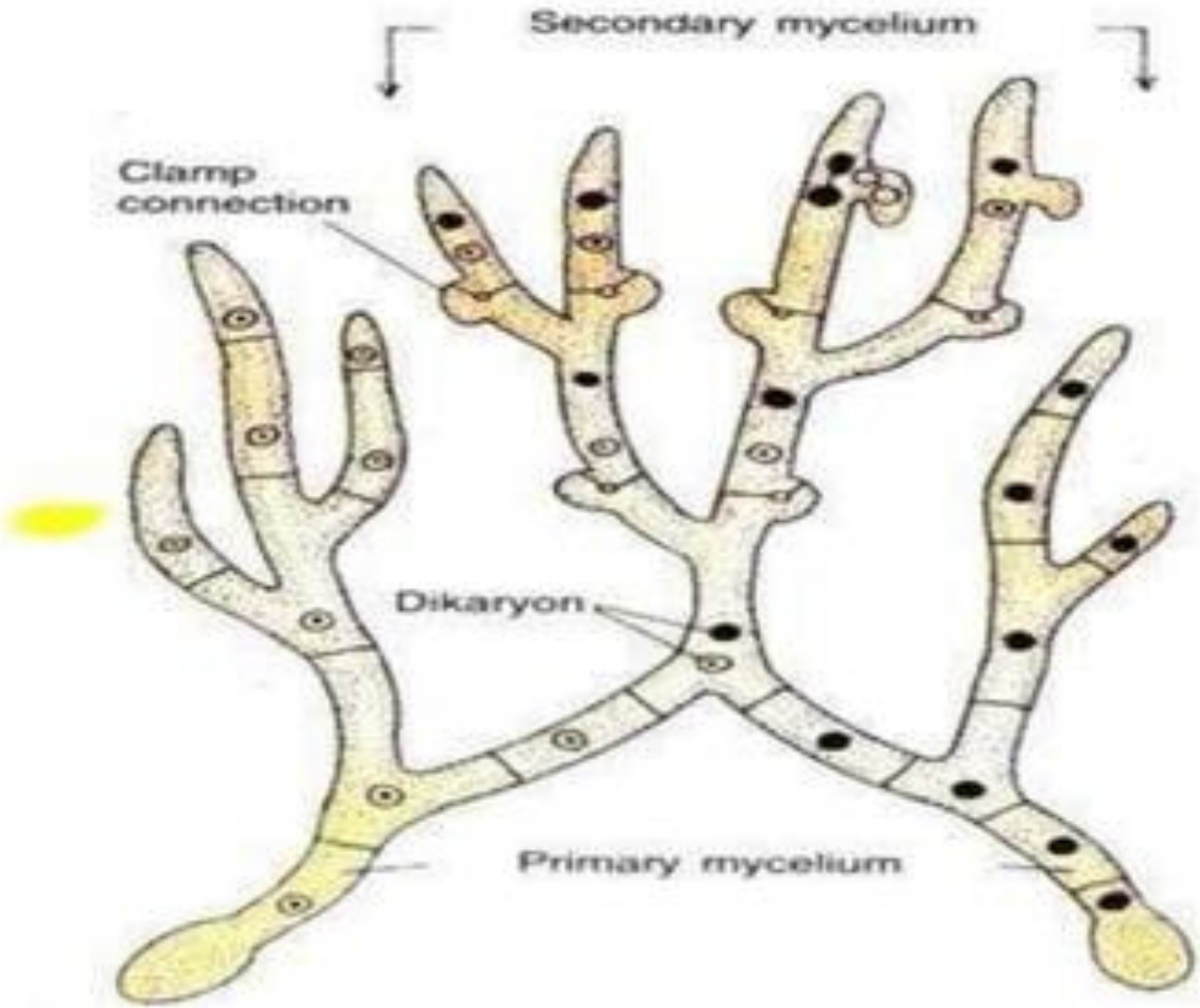


Fig. 13.2. *Basidiomycetes*. Sketch showing the formation of a secondary mycelium from a dikaryotised cell produced by somatogamous copulation between two uninucleate cells of primary mycelia of opposite strains.

General Characteristics Cont'd...

- Sexually reproducing Ascomycota also form dikaryons, although they are not as long lived as those of Basidiomycota

- Ascomycota produced ***clamp-like "croziers"*** at the bases of **Asci**: (***cells in which meiosis occurs, homologous to basidia***
  - Croziers may be homologous to clamp connection

Classification of Basidiomycota

- The most recent classification adopted by a coalition of 67 mycologists recognizes three subphyla;
  - Pucciniomycotina, Ustilaginomycotina and Agaricomycotian

- Basidiomycota comprise 3 subphyla, 52 orders, 177 families, 1,589 genera
- Approximately 30,000 species
- Basidiomycota are divided into three (3) classes depending on the form of their basidium
- The classes include;
  - **Class Hymenomycetes**
  - **Class Teliomycetes**
  - **Class Urediniomycetes**

Classification Cont'd...

Class Hymenomycetes:

- One of the three major classes of badisiomycota with roughly 20,000 described species
- Constitute 70% of the know Basidiomycota species
- They include; mushrooms, bracket fungi, puffballs, boletes, canterelles, coral fungi, pore fungi...

Bracket fungi

Coral fungi

Canterelles

Pore fungi

Classification Cont'd...

- Hymenomycetes species are characterized by an exposed spore-bearing layer "**hymenium**"basidiospores that are forcibly discharges
- One of the most important characters in the higher-level taxonomy of Basidiomycota has been **the form and septation of the basidia**
- Basidia of Hymenomycetes have various shapes and may be undivided or divided by transverse or longitudinal septa.
- Most hymenomycetes produce four spores on each basidium, but some species produce as few as one or as many as eight spores per basidium
- Another important characteristic is the presence of absence of "spore repetition"

Classification Cont'd...

Class Teliomycetes:

- This class inclused many plant pathogens commonly known as rusts and smuts
- They contain a mycelia hyphae septate
- Asexual reproduction is uncommon
- Basidiocarp absent
- The class is characterized by thick walled, dikaryotic resting spores called **Teliospores** and **Chlamydospores**

- The class is divided into two (2) orders:
  - **Order Uredinales** (Rust)
  - **Order Ustilaginales** (Smuts)

Order Uredinale: Rust

Groundnut rust *(P. arachidis*

- Members of this order are commonly called "Rust funig"
- Species are obligate parasites and cause great losses to many cultivated crops
- Mycelium is septate without clamp connections
- It grows intercellularly, frequently producing haustoria
- The order uredinales are pathogenic to plant species and can result into diseases such as;
  - **Groundnut rust** (P. arachidis) **Sugarcane rust** (P. kuehnii and P. erianthi), **Sunflower rust** (P. helianthi), **Corn rust** (P. sorghi), **Guava rust** (P. psidii)…

Sunflower rust *(P. helianthi)*

Sugarcane rust *(P. kuehnii)*

Order Ustilaginales: Smuts

- Members of this order are commonly called **"Smut fungi"**
- They form dry, dusty, smutty masses of spores - chlamydospores
- Like the rust fungi, the smut fungi are all parasites of vascular plants
- They produce basidiospores on transversely septate basidia arising from overwintering teliospores
- Both rust and smut differ in many respects
- Many smut funig are heterothallic, so fusion must be between cells of different and compatible parents

Classification Cont'd...

Class Urediniomycetes:

- The class contains appx. 7,400 species
- Distributed among appx. 215 genera
- Urediniomycetes develop no basidiocarp
- Karyogamy occurs in a thick-walled spore called teliospore and meiosis occurs upon germination of teliospore

Reproduction in Basidiomycetes

- Sexual reproduction in Basidiomycota takes place in the **fruiting body**, in specialized structures called **Basidia**:
  - Basidia itself is formed by **plasmogamy** between mycelia from two different spores.
  - Plasmogamy results in **binucleate hyphae**:
    - that is, hyphae with two types of nuclei, one from each parent.

- The life cycle of basidiomycetes includes **Alternation Of Generations**:
  - Spores are generally produced through **asexual reproduction**, rather than a sexual reproduction

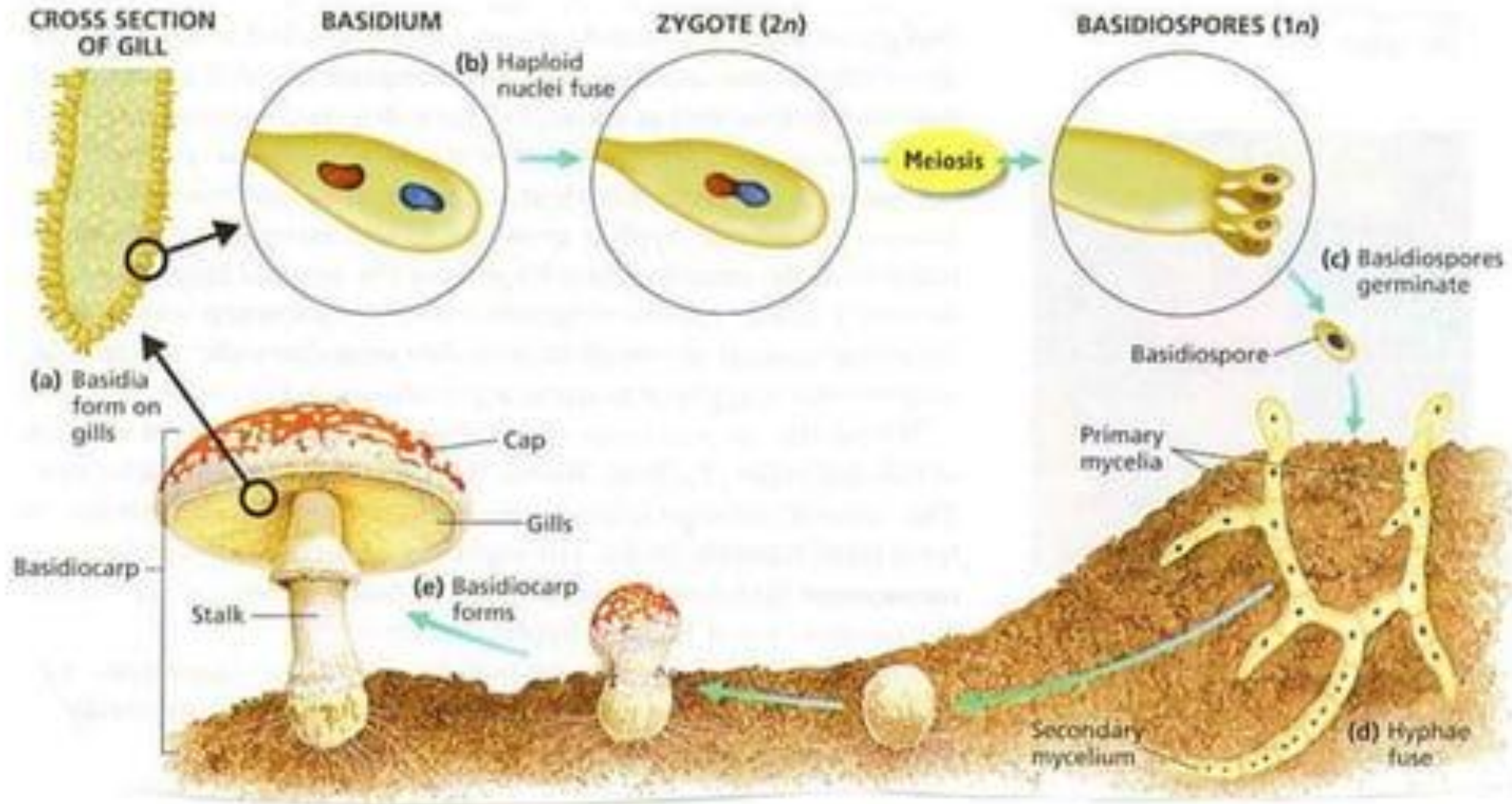
- Basidium between mycelia form two different spores. Plasmogamy results in binucleate hyphae, that is, hyphae with two types of nuclei, one from each parent.

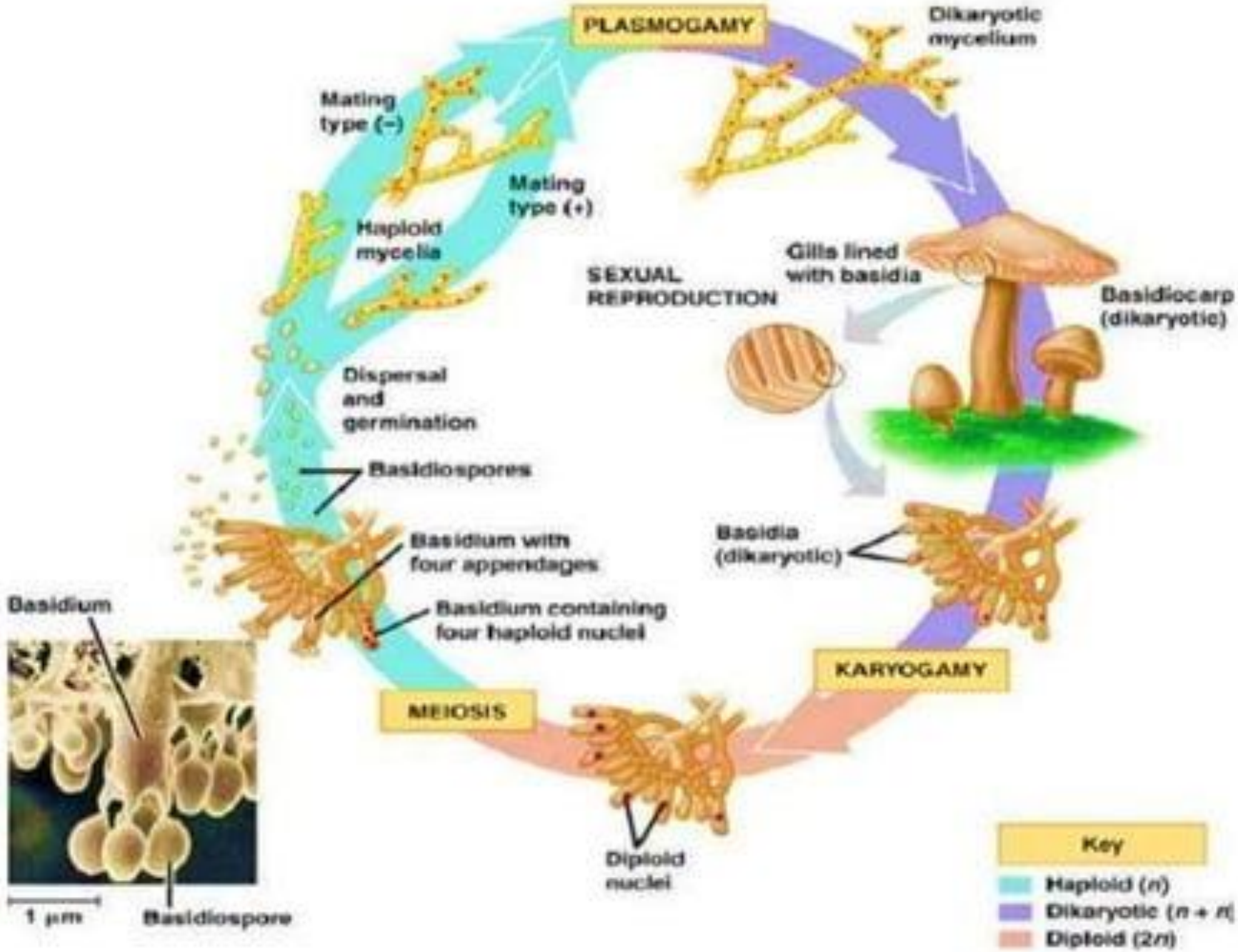
Reproduction Cont'd...

- Basidiomycota reproduce asexually by either **budding** or **asexual spore formation**.

- Asexual spore formation takes place at the ends of specialised structures called **Conidiophores.**

Life Cycle Of The Basidiomycota




PLASMOGAMY
Dikaryotic mycelium
Mating type (–)
Mating type (+)
Haploid mycelia
SEXUAL REPRODUCTION
Gills lined with basidia
Basidiocarp (dikaryotic)
Dispersal and germination
Basidiospores
Basidium with four appendages
Basidia (dikaryotic)
Basidium containing four haploid nuclei
KARYOGAMY
MEIOSIS
Diploid nuclei
Basidium
1 µm
Basidiospore
Key
Haploid (n)
Dikaryotic (n + n)
Diploid (2n)

Economic Importance of Basidiomycota

- The ***fungal like*** the mushrooms and puffballs are **edible** forms which is having **high food value**
- The mushrooms are idea food which contains **20-35% proteins**. These proteins are rich in two essential **amino acids**, **Lysine** and **Tryptophan** which can supplement the cereals.
- The ***fungus clavatia*** contain the ***anti-cancer*** substance known as **Clavicin.**
- Some of the basidiomycetes are wood rotters and decomposers of **Cellulose** and **Lignin**
- Some members are deadly poisonous like the **Amanita phalloides**, **Amanita virosa,** and **Amanita Verna** are the deadliest forms.
- Whereas some other members produce the **Hallucinoeni chemicals**.
  - **Yeast**, are single cell organisms that are important in **fermentation**.

Ecological Importance

- Beneficial to forest ecosystems because **they decompose rotten tissues** or form some other symbiotic relationship with trees

- Some of them, like chanterelles, are **ectomycorrhizal fungi supplying their partner tree with nitrogen**. However, most, like the gill fungi, are decomposers.

- Some Basidiomycetes form **mutualistic associations**; their hyphae grow around tree roots without penetrating.

Fungi Association with Other Organisms

Fungi Association with Other Organisms

- Symbiosis from Greek "συμβιωσις" meaning "**living together**"
- It s any type of a close and long-term biological interaction between two different biological organisms
- Be it; **mutualism, commensalism**, or **parasitism**
- Organisms that undergoes symbiosis are called **Symbiont**

- Symbiosis is also classified by physical attachment; symbiosis in which the organisms have bodily union is called **conjunctive symbiosis**, and symbiosis in which they are not in union is called **disjunctive symbiosis**.

Fungi Association with Other Organisms

- Two (2) types of symbiosis;
  - **Endosymbiosis**
  - **Ectosymbiosis**

- Endosymbiosis is any relationship in which the symbiont lives within the tissues of the host.

- Ectosymbiosis is any relationship in which the symbiont lives on the body surface of the host.
- Fungi undergo two major form of mutualist association with other organisms
- These are;
  - **Mycorrhiza**
  - **Lichen**

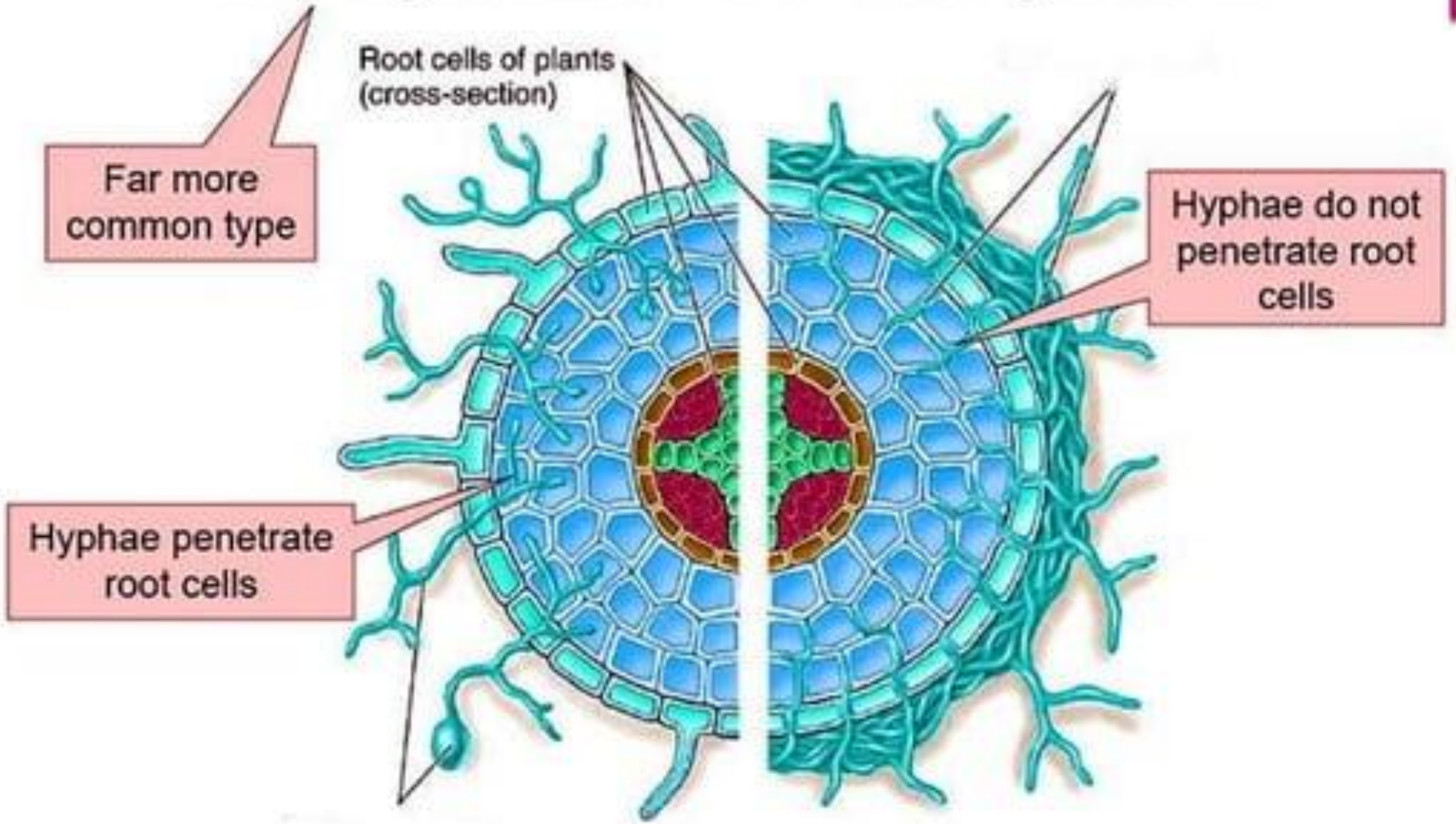
Mycorrhiza

- Mycorrhizae is defined as a symbiotic relationship between the roots of a plants and fungi

- There are three (3) types of mycorrhizae:
  - **Ectomycorrihizae**
  - **Endomycorrhizae**
  - **Ectendomycorrhizae**

- Ectomycorrhizae is characterised by forming an external sheath of mycelium around the root tips.

Endomycorrhizae VS. Ectomycorrhizae



Mycorrhiza Cont'd...

- **Endomycorrhizae** is characterised by the lack of an external sheath around the root tip.

- **Ectendomycorrhizae**
- The type that seems to be intermediate between ectomycorrhizae and endomycorrhizae
- Mycelium sheath around root is reduced or may even be absent

Importance of Mycorrhizae

- Plants that are involved in ectomycorrhizae are always trees and are found only in a few families. They include the Betulaceae, Beeches and Alders, Casuarinaceae, Ironwood, Fagaceae Oaks,
  - Most serve as a source of lumber
  - They serves as means of resisting fungal, root pathogens.

Lichen

Fungi and colonizing a rock

- In looking at the anatomy of the lichen, it is obvious that there is interaction between the phycobiont and mycobiont, but what kind of interaction is occurring.
- Mutualistic association between a fungus and an algae
- **HOW IS THE RELATIONSHIP MUTUALISTIC?**

Importance of Lichen

- They are commonly use as indicators of pollutants
- They play very significant role in nature. . They are the pioneers in rocky substrates, where there is no soil. Lichens break down the rocky substrate into soil
- They are use in comistic industries
- Some are use for food
- They are use in extraction of blue red, brown or yellow eyes in gametes industries
- They are use as indicators pigment in litmus paper

In Conclusion

- Basidiomycota is a major division of the kingdom Fungi whose members are typically characterized by the presence of a basidium
- Basidiomycota is divided into three classes; Class Hymenomycetes, Class Teliomycetes, Class Urediniomycetes
- They reproduced sexually (spores formation) qnd asexually (budding)
- Their main characteristic feature is the production of their basidum
- Fungi form a mutualitic relationship with plants (mycerrhizae) and with algae (lichens)

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