KINGDOM FUNGI

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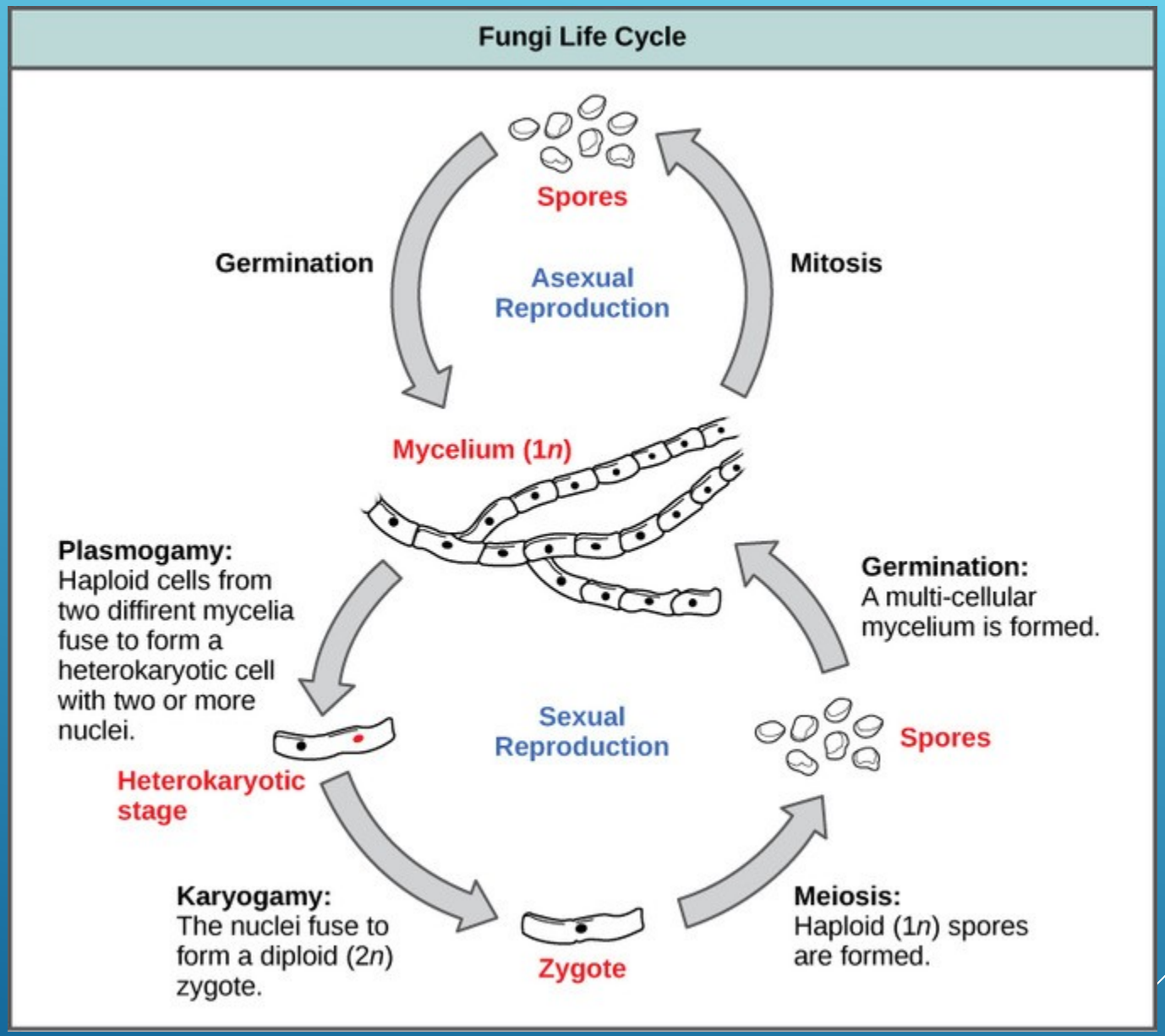
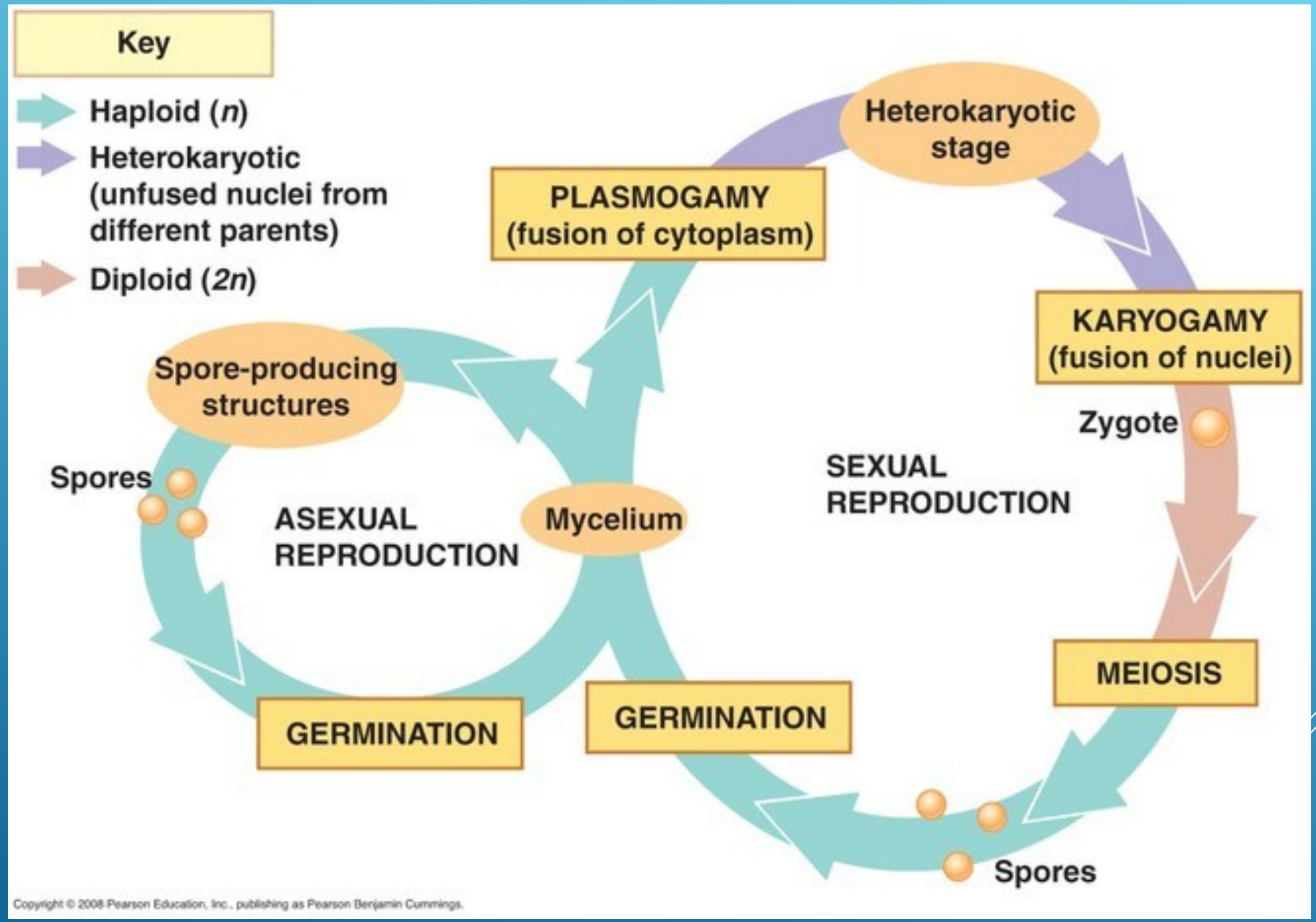
KINGDOM FUNGI – INTRODUCTION

- Grow as filaments called hyphae
- Mass of hyphae is called mycelium
- Some have septa or cross walls
- Some are coenocytic
- Cell walls are made of chitin (nitrogen containing polysaccharide)

KINGDOM FUNGI – INTRODUCTION

- Either parasites or saprobes
- Parasites have haustoria
- Dominantly fungi are haploid with temporary diploid structures for sexual reproduction


Fungi Life Cycle
Spores
Germination
Asexual Reproduction
Mitosis
Mycelium (1n)
Plasmogamy:
Haploid cells from two diffirent mycelia fuse to form a heterokaryotic cell with two or more nuclei.
Germination:
A multi-cellular mycelium is formed.
Sexual Reproduction
Spores
Heterokaryotic stage
Karyogamy:
The nuclei fuse to form a diploid (2n) zygote.
Meiosis:
Haploid (1n) spores are formed.
Zygote


Key
Haploid (n)
Heterokaryotic (unfused nuclei from different parents)
Diploid (2n)
Heterokaryotic stage
PLASMOGAMY (fusion of cytoplasm)
KARYOGAMY (fusion of nuclei)
Zygote
SEXUAL REPRODUCTION
MEIOSIS
Spores
GERMINATION
Mycelium
ASEXUAL REPRODUCTION
Spore-producing structures
Spores
GERMINATION
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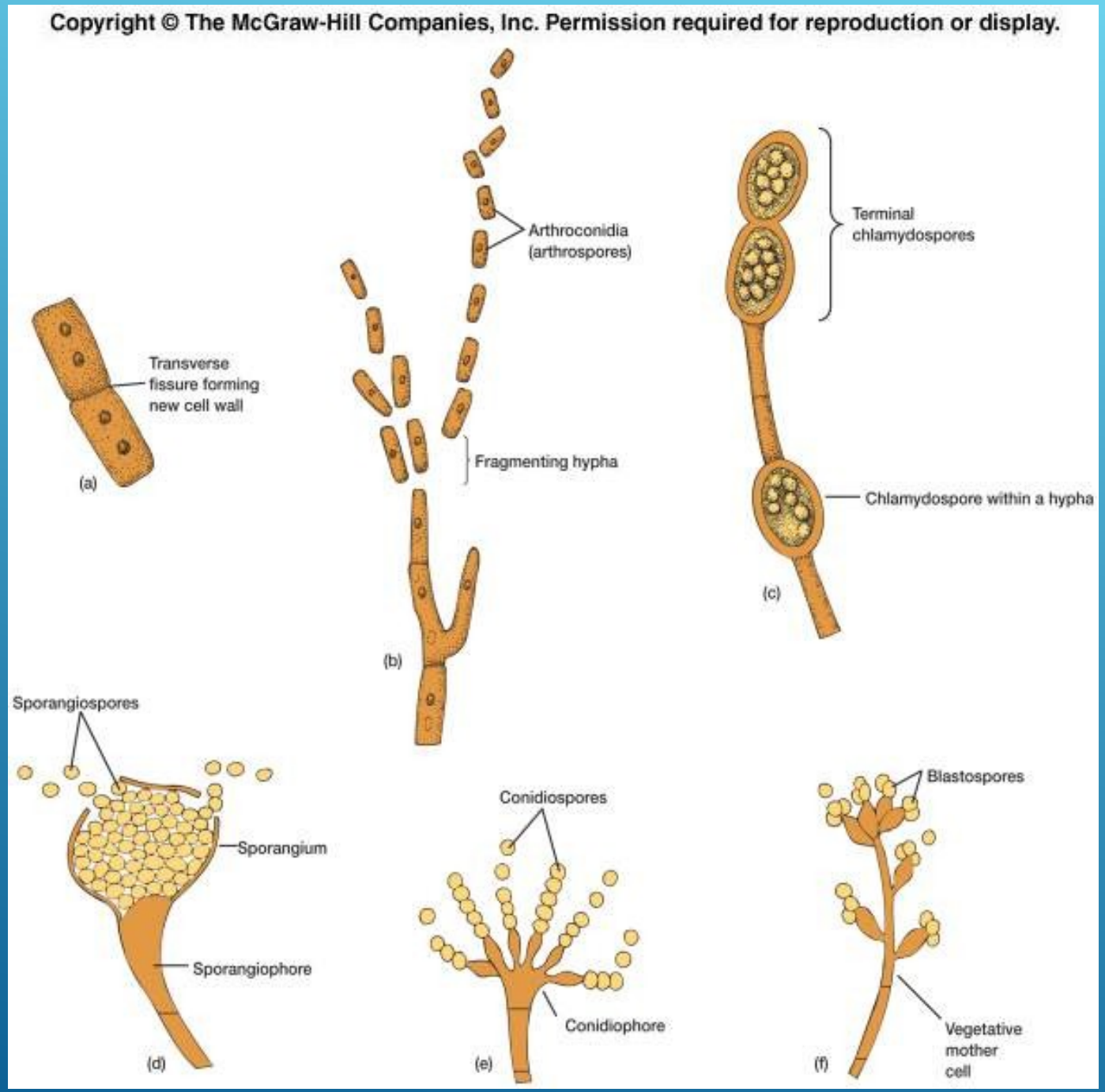
STAGES IN SEXUAL REPRODUCTION

1. **Plasmogamy** – fusion of cells from 2 different fungal strains to produce a single cell with nuclei from both strains
   - **Dikaryon** – refers to the pair of haploid nuclei
   - **Dikaryotic** hypha – hypha containing a dikaryon
2. **Karyogamy** – fusion of the two haploid nuclei of a dikaryon to form a single diploid nucleus
3. **Meiosis** – diploid nucleus restores the haploid condition
   - Daughter cells develop into haploid spores, germinates and form haploid hyphae

ASEXUAL REPRODUCTION

- **Fragmentation** – breaking up of hyphae
- **Budding** – pinching off of a small hyphal outgrowth
- **Asexual spores**
  - **Sporangiospores** – produced in saclike capsules called sporangia borne in stalk called sporangiophore
  - **Conidia** – formed at the tips of specialized hyphae, not enclosed inside sacs ; hyphae bearing conidia (conidiophores)

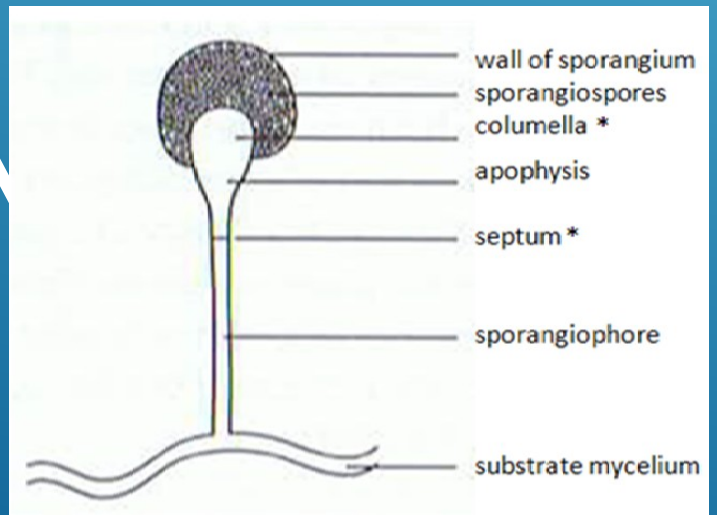


GROUPINGS OF FUNGI

- Form 3 natural groups based on sexual reproduction; three additional groups are artificial
- May be considered division (-mycota) or classes (-mycete)

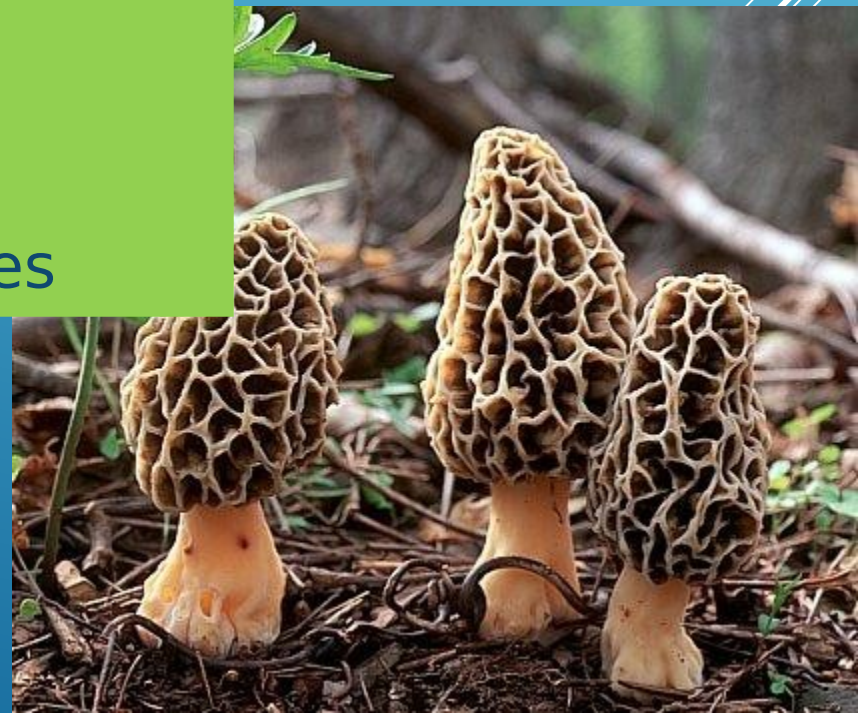
GROUPINGS OF FUN

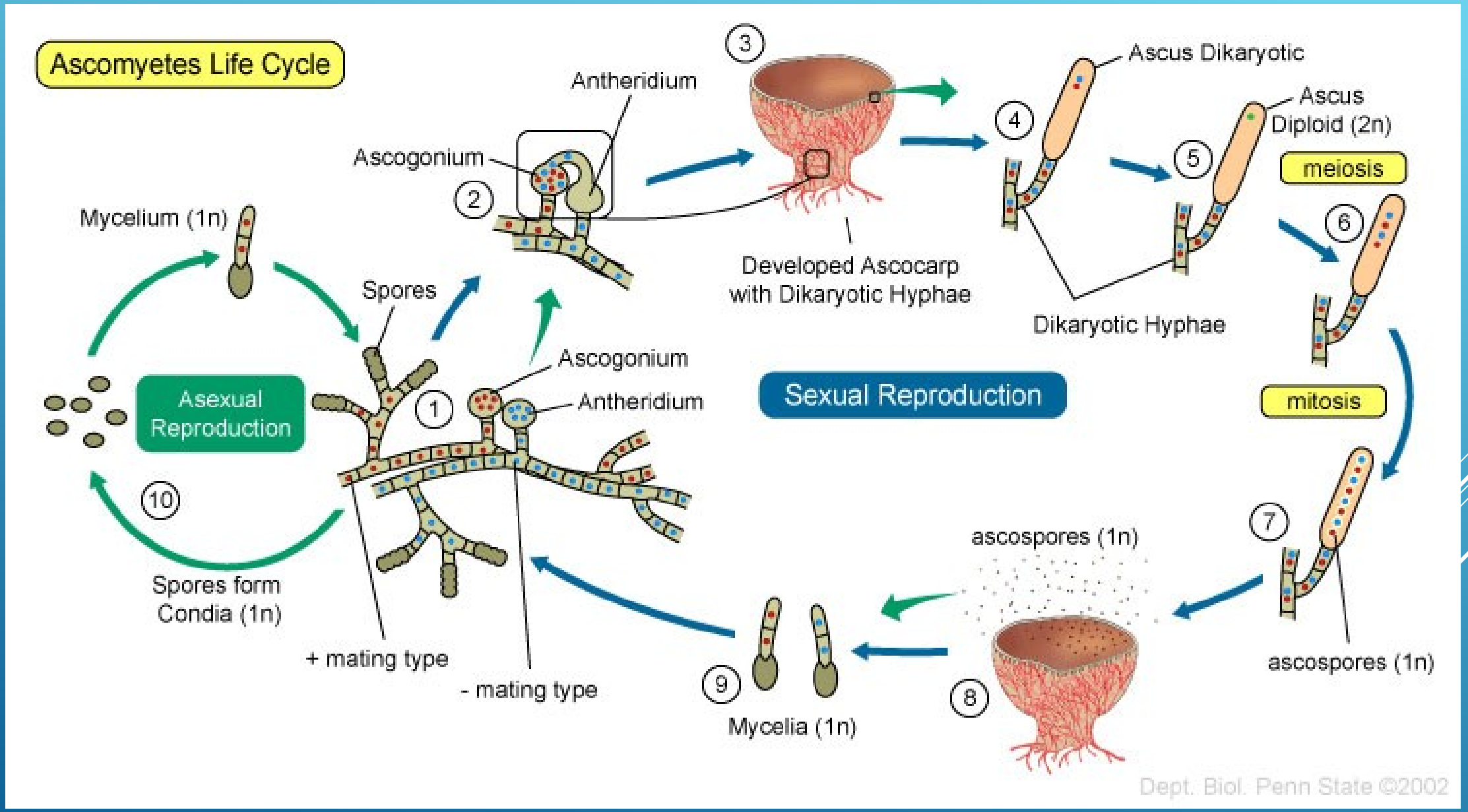
- **Zygomycota**
  - Lack septa (except when filaments border reproductive filaments)
  - Reproduce sexually by fusion of hyphae from different strains plasmogamy karyogamy and meiosis = zygospores (haploid
  - Example: bread mold



GROUPING OF FUNGI

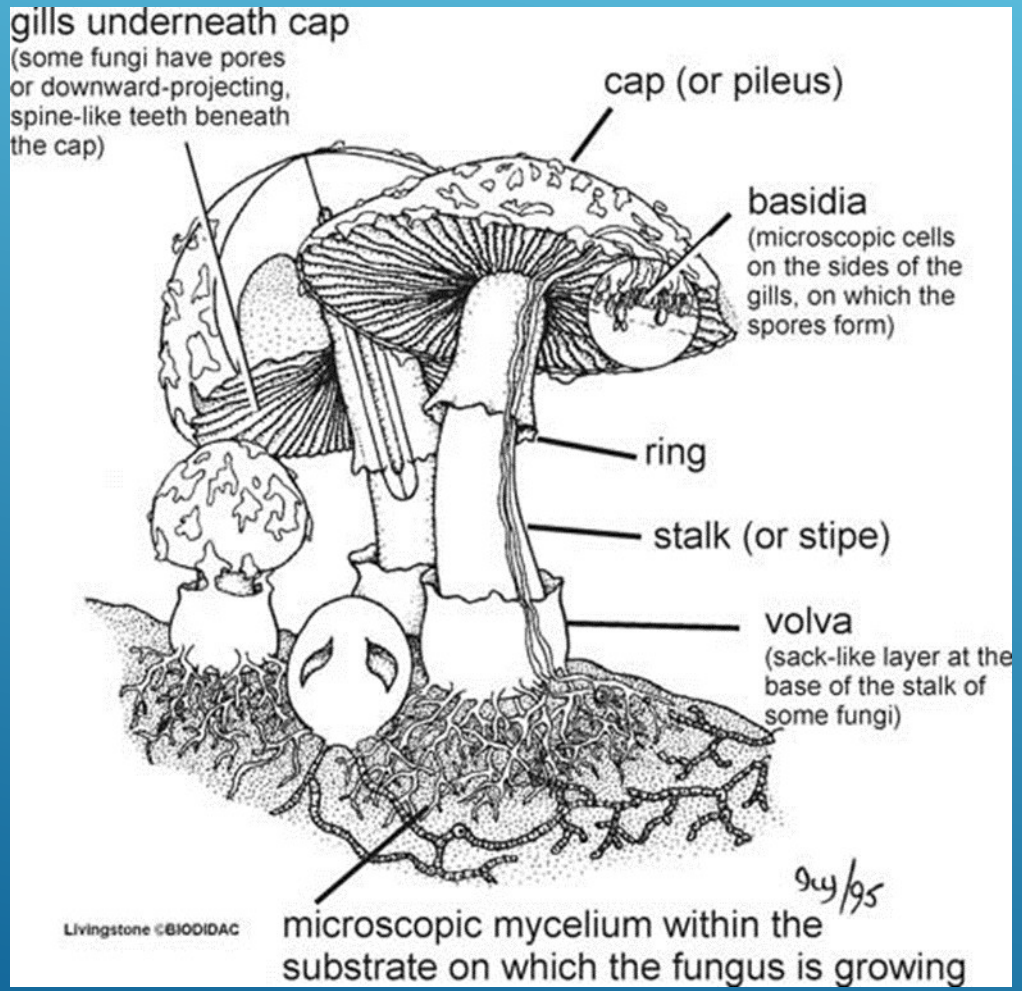
- **Ascomycota**
  - Have septa and reproduce sexually by producing haploid ascospores
    - Plasmogamy of hyphae dikaryotic hypha (mitosis)
    - Karyogamy and meiosis subsequently occur in terminal hyphal cells producing four haploid cells divide by mitosis to produce 8 haploid ascospores in the **ascus**
  - Asci are grouped together into a specialized fruiting body, ascocarp
  - Includes yeasts, powdery mildews, and truffles

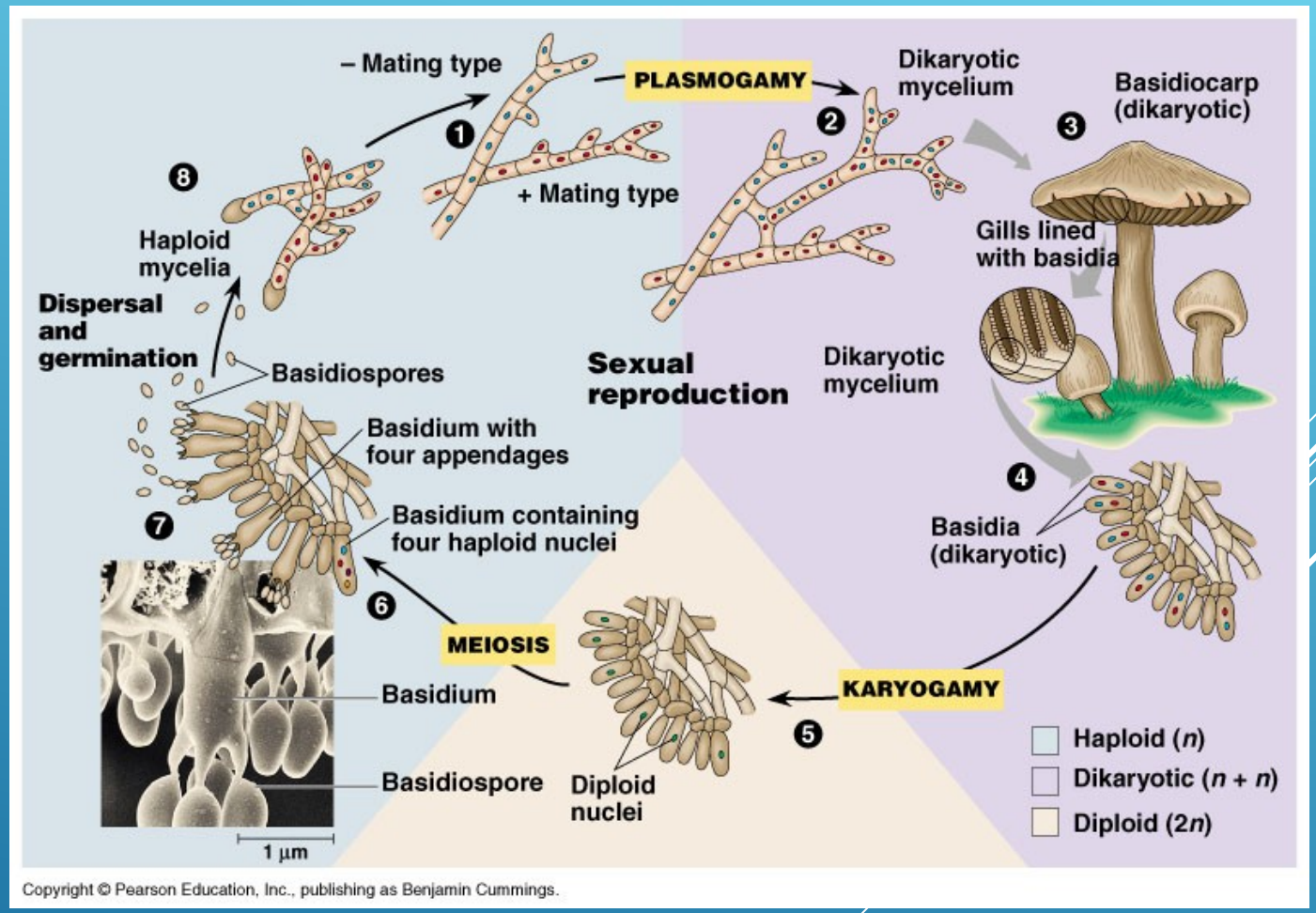



Ascomyetes Life Cycle
Antheridium
Ascogonium
2
3
Ascus Dikaryotic
4
Ascus
Diploid (2n)
5
meiosis
6
Mycelium (1n)
Developed Ascocarp
with Dikaryotic Hyphae
Dikaryotic Hyphae
Spores
Ascogonium
Antheridium
1
Asexual
Reproduction
Sexual Reproduction
mitosis
10
7
ascospores (1n)
Spores form
Condia (1n)
+ mating type
- mating type
9
Mycelia (1n)
8
ascospores (1n)
Dept. Biol. Penn State ©2002

GROUPING OF FUNGI

- **Basidiomycota**
  - Have septa and reproduce sexually by producing haploid basidiospores
  - Plasmogamy → mitosis → growth of dikaryotic hyphae → FORMS A FRUITING BODY CALLED **BASIDIOCARP**
  - Karyogamy occurs in terminal hyphal cells called **basidia**, followed by meiosis producing 4 haploid **basidiospores**


gills underneath cap
(some fungi have pores or downward-projecting, spine-like teeth beneath the cap)
cap (or pileus)
basidia
(microscopic cells on the sides of the gills, on which the spores form)
ring
stalk (or stipe)
volva
(sack-like layer at the base of the stalk of some fungi)
microscopic mycelium within the substrate on which the fungus is growing
Livingstone ©BIODIDAC


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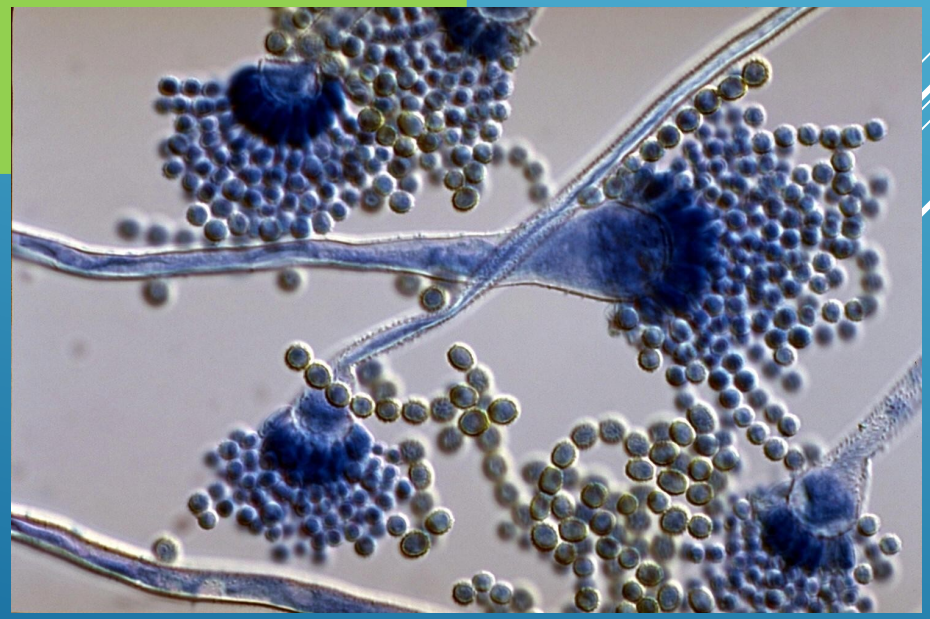
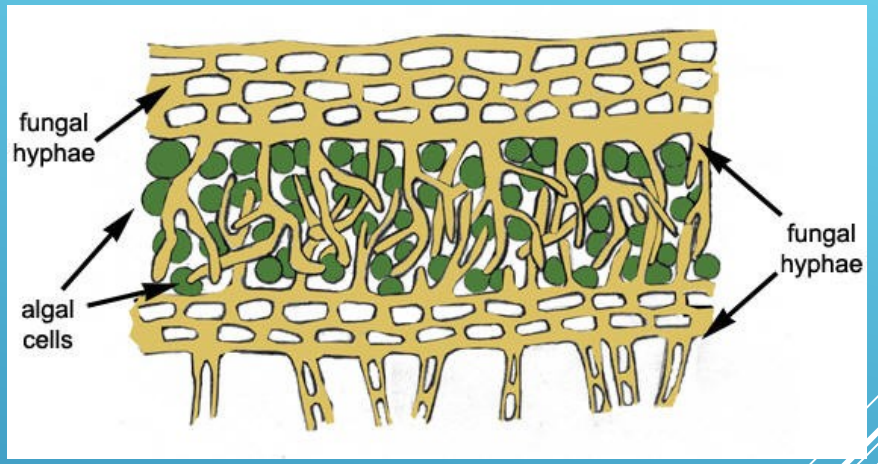
GROUPINGS OF FUNGI

- **Deuteromycota**
  - Imperfect fungi
  - Artificial group comprising fungi for which no sexual reproductive cycle has been observed
  - Example: *Penicillium*



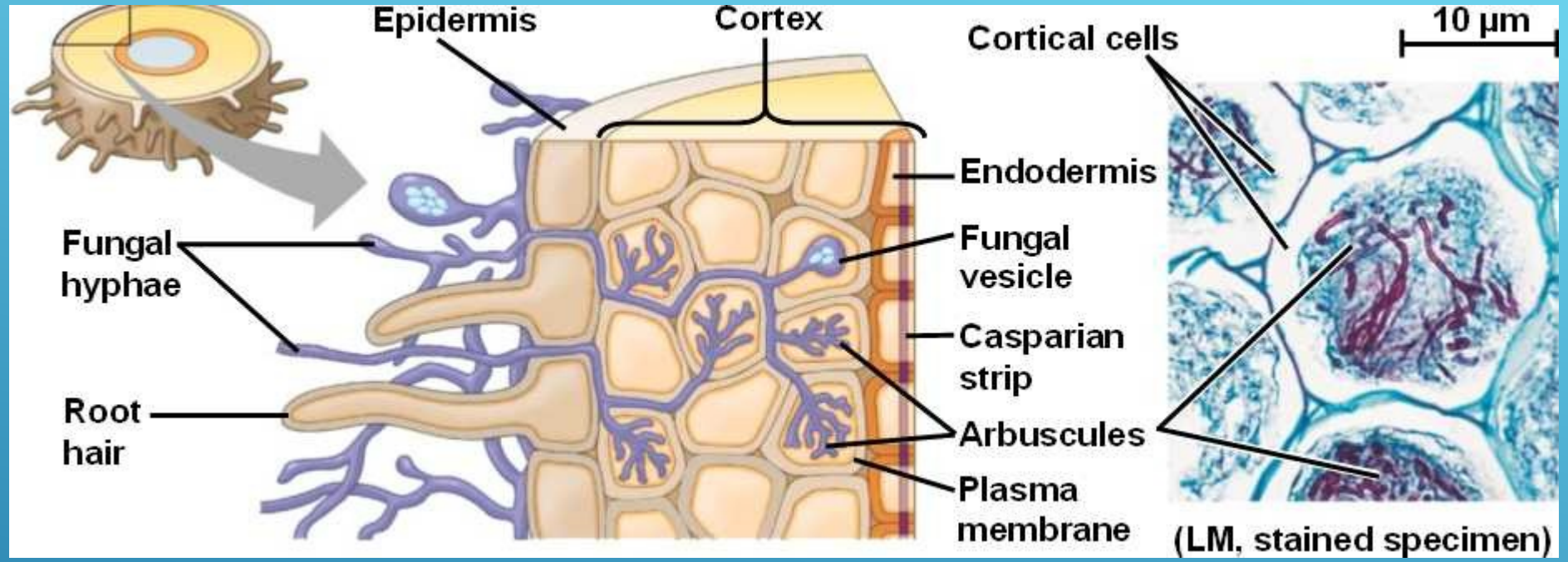
GROUPINGS OF FUNGI

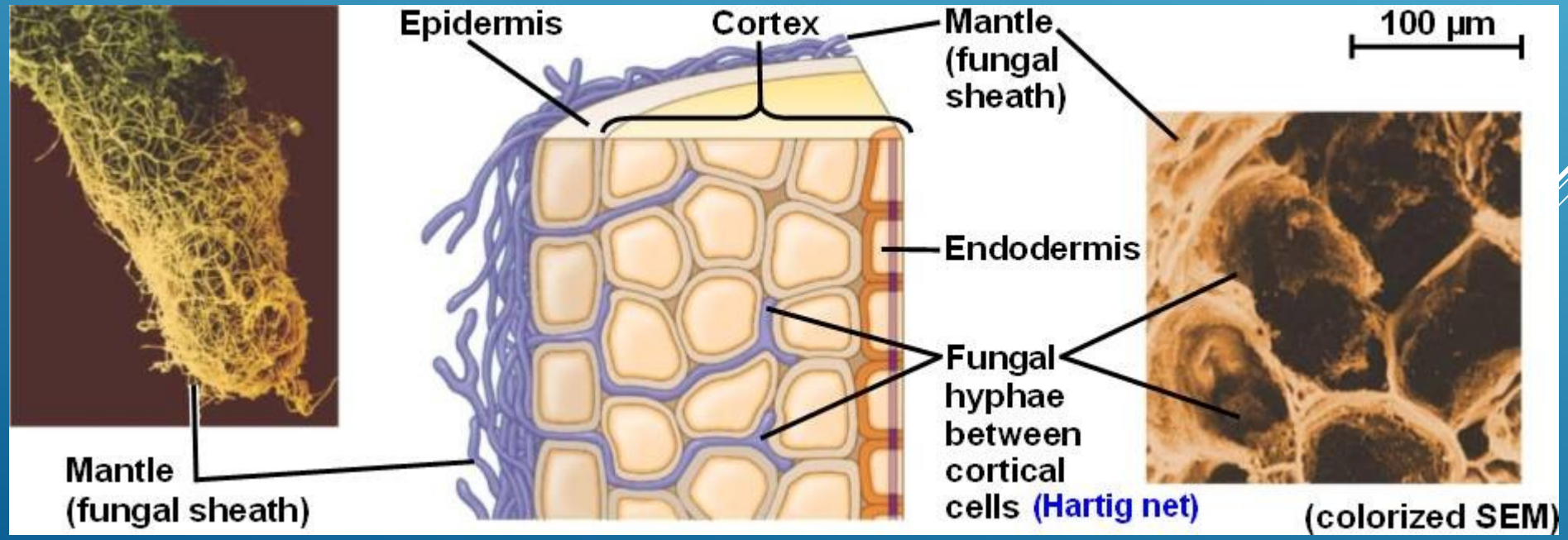
- **Lichens**
  - Mutualistic associations between fungi and algae
  - Fungus is most often an **ascomycetes**, provides water and protection from the environment
  - Algae, chlorophyta or cyanobacteria, provides sugar and nitrogen



GROUPING OF FUNGI

- **Mycorrhizae**
  - Mutualistic associations between fungi and roots of plants
  - Plant provides sugars to the fungus, while the fungus increases the ability of the roots to absorb water and minerals, especially phosphorous


Epidermis
Cortex
Cortical cells
10 µm
Endodermis
Fungal hyphae
Fungal vesicle
Casparian strip
Root hair
Arbuscules
Plasma membrane
(LM, stained specimen)


Epidermis
Cortex
Mantle (fungal sheath)
100 µm
Endodermis
Fungal hyphae between cortical cells (Hartig net)
Mantle (fungal sheath)
(colorized SEM)

Kindom Protist and Fungi