EVOLUTION

BEYOND The Origin of life through six kingdoms ending with Animalia

FUNGI

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POPULATION GENETICS & EVOLUTION

LECTURE XI

Making sense of evolution by classification

Robert Whittaker's 5 kingdom classification

1. **Monera**

- Single-celled prokaryotes (bacteria).
- Display great biochemical diversity but little internal complexity.
- Includes producers and decomposers.

2. **Protista**

- Mostly single-celled eukaryotes.
- Photoautotrophs (algae) and heterotrophs (protozoa).
- More internal complexity than bacteria.

3. **Fungi**

- Multicelled eukaryotes that feed by extracellular digestion and absorption.
- Heterotrophs; includes major decomposers; many are pathogens and parasites.

4. **Plantae**

- Multicelled photosynthetic autotrophs.
- Producers; form embryos.

5. **Animalia**

- Diverse multicelled heterotrophs.
- Range from sponges to vertebrates.
- The latest scheme **uses six-kingdoms** in which the **Monera** are divided into the **Eubacteria** and the **Archaebacteria.**

❖ FUNGI

- Fungi make up their own monophyletic kingdom within the eukarya domain.
- Most fungi are multicellular, sessile decomposers
- they were originally thought to be plants lacking chlorophyll, it turns out that they have little in common with plants.
- In fact, DNA sequence comparisons reveal that fungi are more closely related to animals than they are to plants

WHAT IS A FUNGUS?

FUNGI ARE DECOMPOSERS OR SYMBIONTS

Fungi acquire energy by breaking down the tissues of dead organisms or by absorbing nutrients from living organisms

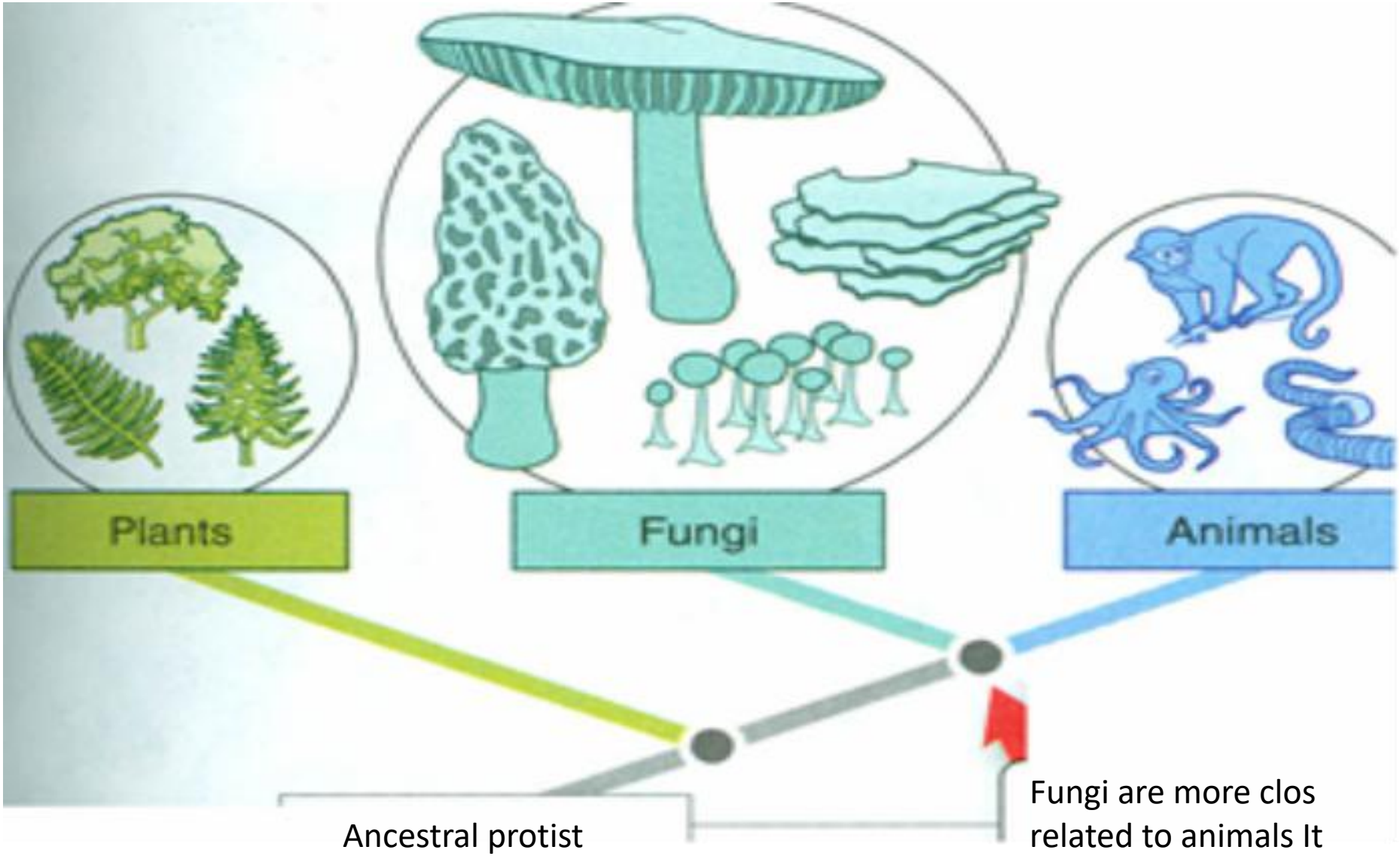
FUNGI ARE SESSILE

Fungi are anchored to the organic material on which they feed.

FUNGI HAVE CELL WALLS MADE OF CHITIN

Fungi have cell walls made of chitin, a chemical that is also important in producing the exoskeleton of insects.

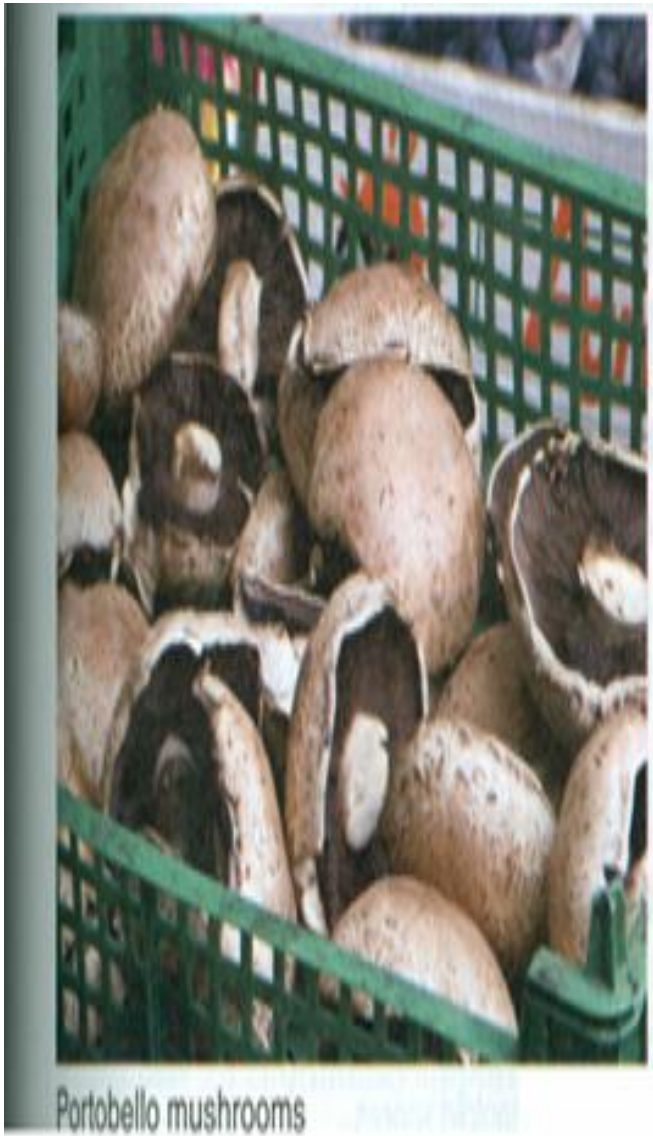
THE FUNGI



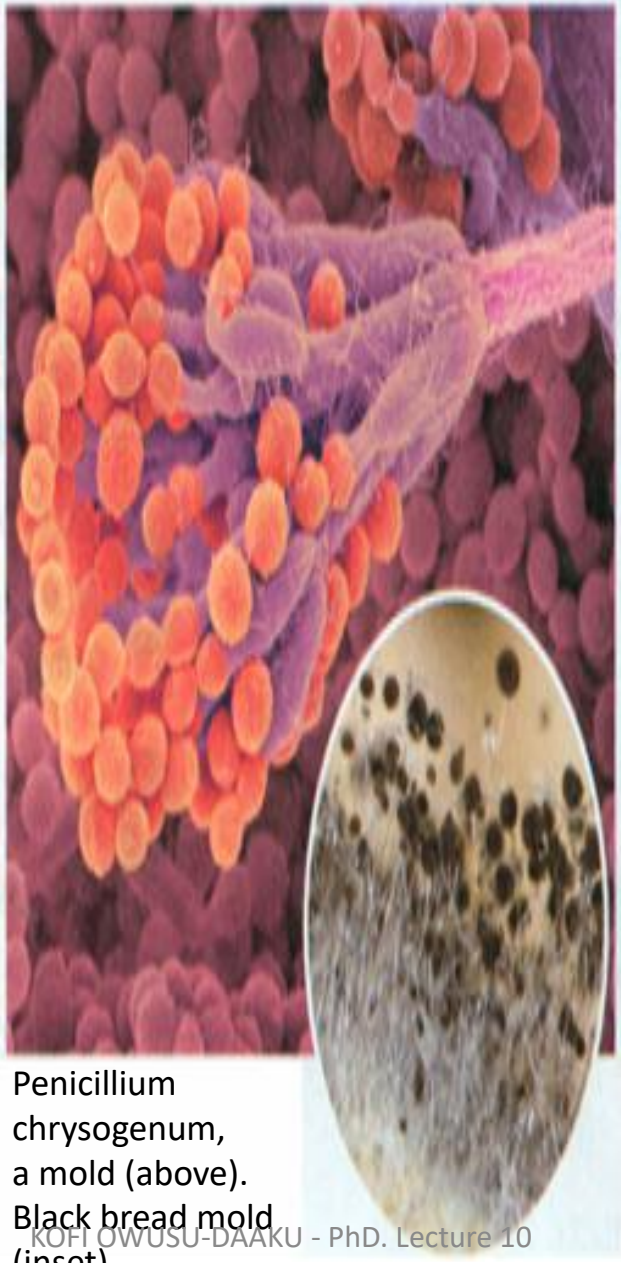
Fungi are more clos related to animals It they are to plants

- These species are divided into about seven phyla
- About 98% of the described species belong to two monophyletic phyla, Ascomycota (about 64,000 species) and Basidiornycota (about 31,000species).
- the two phyla with the largest number of described species are Microsporidia, with about 1,300 species, and Chytridiornycota, with about 700 species.
- The most commonly encountered types of fungi are
- (1) yeasts (the only single-celled fungi), truffles, and morels of the phylum Ascomycota;
- (2) mushrooms, of the phylum Basidiomycota; and
- (3) molds

FAMILIAR FUNGI



Portobello mushrooms

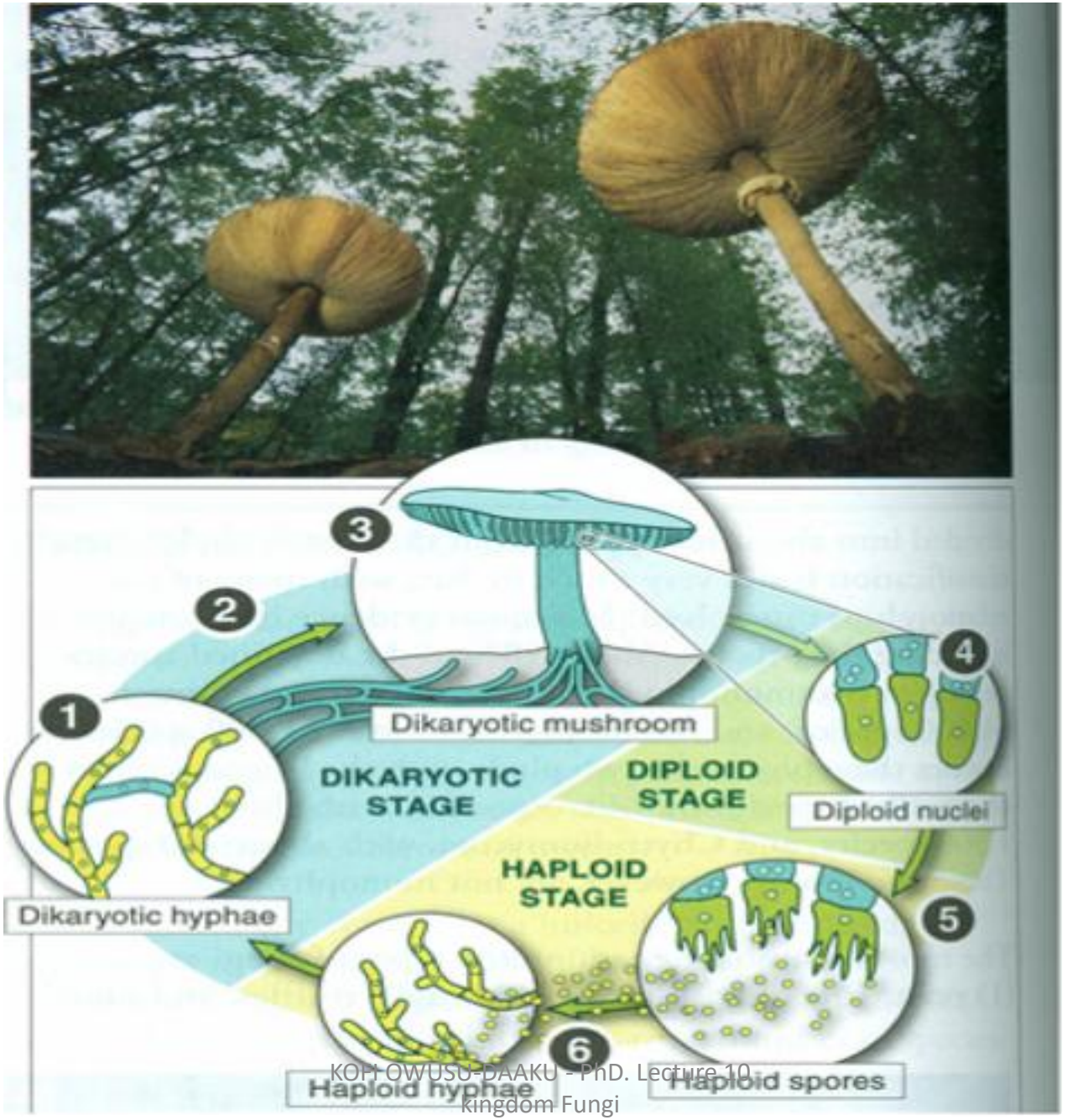


Penicillium chrysogenum, a mold (above). Black bread mold (inset).

Candida albicans, a yeast (above). Baker's yeast (inset).

- examining the roots of a plant with a microscope, reveals round structures and fibers closely associated with fine rootlets and root hairs.
- These are root fungi, or mycorrhizae, some mycorrhizae have hyphae that press closely against the walls of root hair cells.
- Others send hyphae through the root cell walls and into the space between the cell wall and the plasma membrane
- The association between mycorrhizal fungi and plants is beneficial to both partners.

FUNGUS LIFE CYCLE



A yellow honey mushroom fungus in eastern Oregon is the largest organism by area on earth,

- Fungi can grow in many different habitats because, as decomposers, all they need for their nutrient supply is some sort of organic material that they can break down.
- Fungi play an enormously important ecological role in speeding the decay of organic material in forests.
- they can grow underground or inside dead trees and logs.
- Fungi can also thrive in poorly ventilated spaces in building

- Molds are multicellular fungi that are responsible for many unpleasant effects.
- People living or working in a "sick building" can experience burning or watering eyes, a runny nose, and itchy skin-allergic reactions to the proteins in fungal spores.
- More severe effects, such as cancers and miscarriages, are produced by toxins released when the fruiting bodies of the fungi disintegrate
- Fungi can cause a variety of health problems, but also are responsible for antibacterial medicines such as penicillin.


Molds can contaminate poorly ventilated buildings, causing a variety of irritating and potentially dangerous health problems.

- The mycorrhizal fungus benefits by drawing sugar from the plant, which it uses to support its own cellular respiration.
- The fungus extracts phosphorus and nitrogen from the soil and releases them inside the roots of the plant, allowing it to grow faster and larger.
- the impact of root fungi on their plant hosts even demonstrated that the offspring of parental plants with mycorrhizae had significantly better survival than the offspring of parental plants without mycorrhizae.

- Some plants take nutrients from the fungus and give nothing in return.
- One of the best known of these mycorrhizal parasites is the ghost pipe, which grows in forests in the northern hemisphere
- The plant's name comes from its ghostly white appearance.
- The roots of the ghost pipe are associated with mycorrhizal fungi that are also connected to the roots of trees
- The ghost pipe obtains all its nutrients from or through the mycorrhizae: nitrogen and phosphorus are provided by the mycorrhizal fungus, and sugar travels through the fungus from tree roots to the ghost pipe.

Ghost pipe is a plant that parasitizes mycorrhizae for nutrients.

- Some plants manipulate mycorrhizae to gain a competitive advantage over other plants.
- Garlic mustard, for example
- Garlic mustard excretes compounds from its roots that interfere with the partnership between mycorrhizal fungi and local native plants.
- Because the native plants need mycorrhizal fungi to prosper, the destruction of these fungi by garlic mustard weakens the plants.
- This chemical warfare is so successful that garlic mustard has wiped out entire populations of native woodland plants and is threatening many forests in the central United States.

- Fungi also form mutually beneficial relationships with chlorophyll-containing bacteria and/or algae.
- These two-way or three-way partnerships are called lichens, and they grow on surfaces such as tree trunks and rocks.
- The fungus is fed by its photosynthetic partner and helps it absorb water and nutrients.
- On the other hand, the fungus provides nutrients for its partners by excreting enzymes that dissolve organic material and acid that dissolves rock.