

### Theory of Endosymbiosis

1. *Endoplasmic reticulum and nuclear origins*

#### Ancestral Prokaryote

- How nuclear envelope evolved with the ER that eventually lead to the endomembrane system.
- The folding of the membrane reached nucleus and surrounded it to create the ER

2. *Presence of Mitochondria and Chloroplasts*

#### Ancestral Heterotrophic Eukaryote

- Small cell gets eaten by big cell
- All eukaryotic cells have mitochondria but not all have chloroplasts

#### Ancestral Photosynthetic Eukaryote

Evidence:

- Inner membranes are similar to plasma membranes of prokaryotes
- Division is similar in these organelles and some prokaryotes
- DNA structure is similar to that of prokaryotes
- These organelles transcribe and translate their own DNA

Placid --> Cells like chloroplasts

### Multicellular Organization

*Bodies consists of hyphae:* maximize surface area, aid in absorption

Not all fungi have the above ground structure

Fungi made up of whitish thin strands to maximize surface area

#### Absorption

Feed in a way no other organism does

Grow through the food they are going to eat and break down the organic molecules and then gets absorbed

--When that happens water follows by osmosis

#### Advantages of Cells

### Multicellular Organization (cont)

Water builds pressure which takes the nutrients to the tips of the cells which leads to fast growth

*Made of nutrition.* Don't use CO<sub>2</sub>. Have to use organic molecules for carbon and energy

**Incomplete septum between cells allows for rapid growth**

Fungal cell walls include chitin - allows for structural stability

#### Hyphae organize into mycelium

Mycelium can be formed for the hyphae from a single organism or from multiple organism

**Largest organism is a fungi**

### Special Points

Protists kingdom no longer exists because they don't have all descendants in common.  
*not all protists are related to each other*  
Protists are not monophyletic

### Prokaryote Fossil Record Changes

1st record dates back 1.8bya (fossils)  
- Before fossils there was chemical evidence found (*lipids*)

### Mitochondrial Charts: How To

- Looks at the percent similarity of bacterial evolution
- Mitochondria from wheat was closest to the ribosomal RNA
- the # is the % of the SAME genetic variation

### Fungi

Supergroups of fungi, protists, animals

*Choanoflagellates and Nucleariids are both protists*

|                                             |                                                     |
|---------------------------------------------|-----------------------------------------------------|
| - Nucleariids most closely related to fungi | - Choanoflagellates most closely related to animals |
|---------------------------------------------|-----------------------------------------------------|

Complex multicellularity evolved

### Multisimilarity Origins

Some single-celled eukaryotes gave rise to multicellular forms, whose descendants include algae, plants, fungi, and animals

- Sexual reproduction evolved

#### Simple Multicellular Organisms Contain

- Adhesion molecules that cause adjacent cells to stick together but there is little communication or transfer of resources between cells and little differentiation of specialized cell types

- Most or all of the cells retain a full range of functions including reproduction

- Every cell is in contact with the external environment

- Complex multicellular organisms contain as many as a trillion or more cells that work in close coordination

- Complex multicellularity has evolved at least six times

*Simple:* colonies of bacteria. Each cell is almost exactly the same with no specialized function. Little common transfer of resources. Need to exchange with the external environment

*Complexity:* Independent functions working as one system developed specialization



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### Vocabulary

**Monophyletic:** a group that includes all of the descendants of a group that includes all of the descendants of a given common ancestor

**Protists:** still used as an informal name of the diverse group of mostly unicellular eukaryotes

### Early Eukaryote Qualities vs. Prokaryotes

*Early Eukaryotes were single celled for a long time*

**Membrane Bound Nucleus** - Separates the location where DNA replication and transcription occurs  
--More elaborate but less efficient  
- Mitochondria, chloroplasts and vesicles  
- All processes occur simultaneously

**Cytoskeleton** - Shapes can be varied and changed  
- allows cells to "move"  
- Helped catch prey...survival

**Genome** - Segmented chromosome  
got more complex

Larger Cell

### Endosymbiosis in Modern Cells

Two cells together are better than one alone  
- amoebas and x-bacteria (protists)

After testing in the lab, the ameba couldn't survive without the bacteria

**Simbiot:** one organism living inside the other where they each depend on each other

### Generalized Lifecycle of Fungi

*Propagate by using spores*

| Asexual Reproduction          | Sexual reproduction                                    |
|-------------------------------|--------------------------------------------------------|
| 1. Spores                     | 1. Plasmogamy<br><i>fusion of cytoplasm</i>            |
| 2. Germination                | 2. Heterokaryotic stage                                |
| 3. Mycelium                   | 3. Karyogamy<br><i>fusion of nuclei</i><br>3.a. Zygote |
| 4. Spore-producing structures | 4. Meiosis                                             |
| 5. Spores                     | 5. Spores                                              |
|                               | 6. Germination                                         |
|                               | 7. Mycelium                                            |
|                               | 8. Plasmogamy                                          |



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