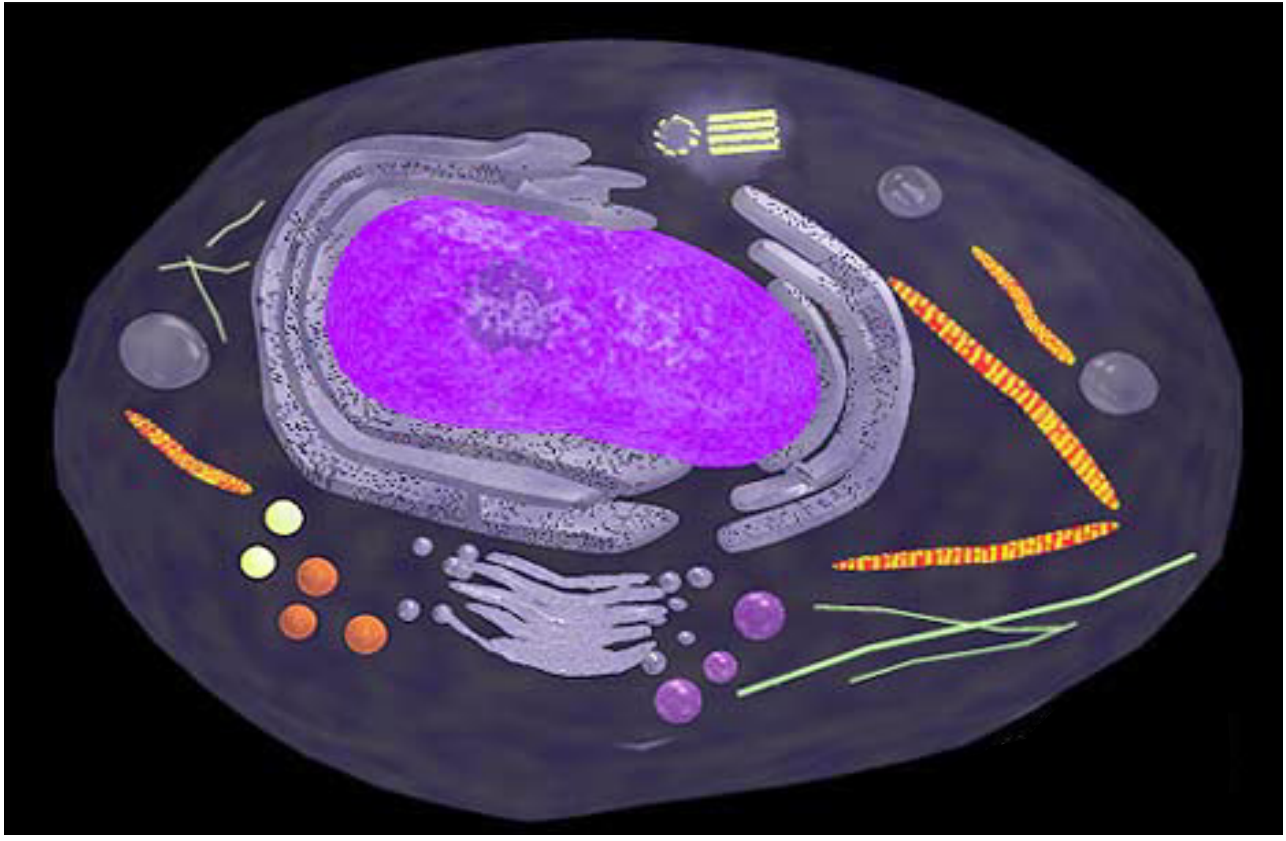
Cells and Cell Theory



3 Types of Cells

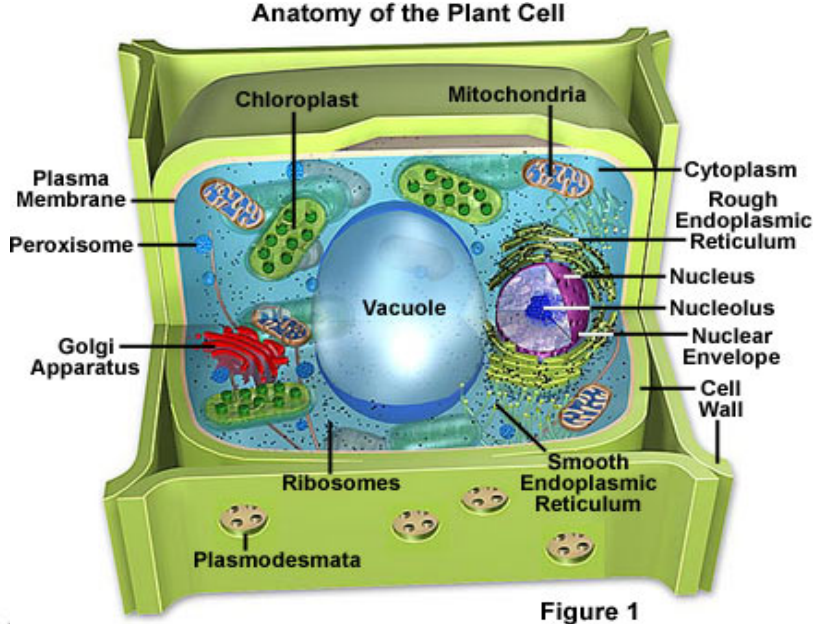
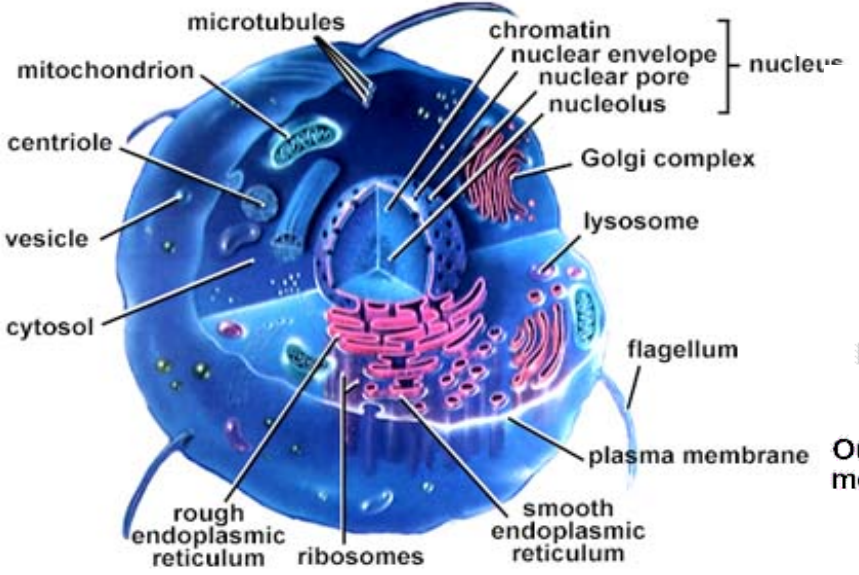
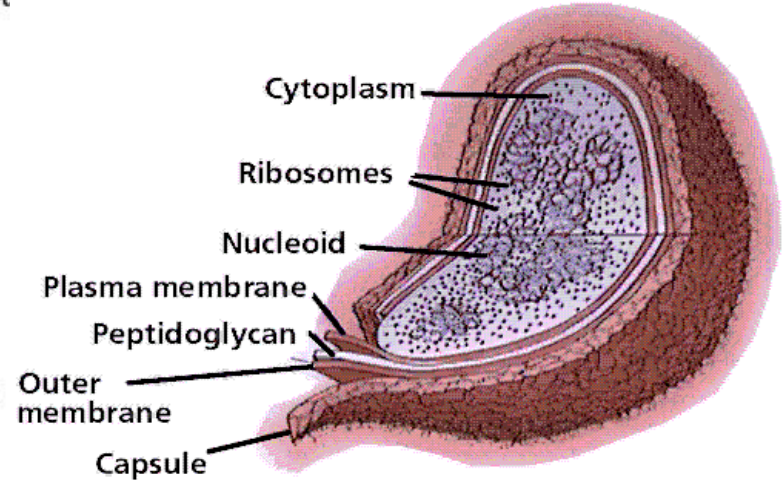


Figure 1



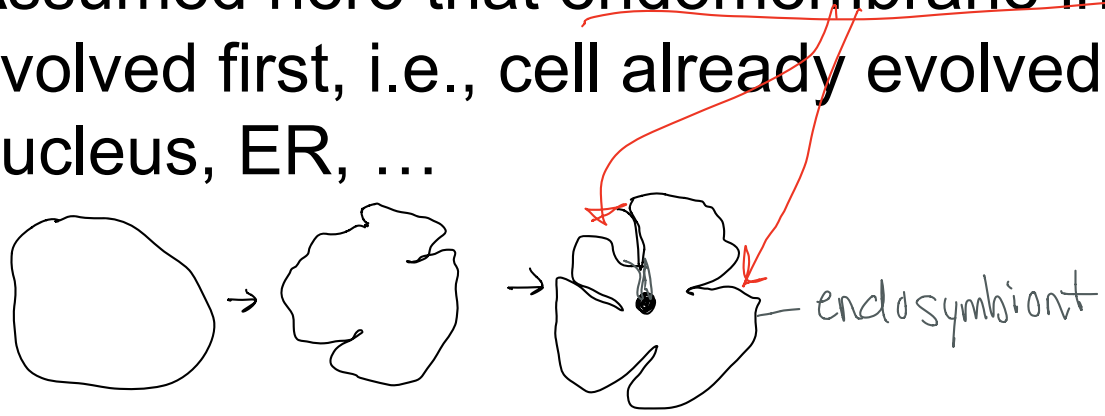


Eukaryotic versus Prokaryotic Cells

- Prokaryotic - Cells lacking a nucleus and other membrane-bound organelles.
- Eukaryotic - Cells containing a nucleus.
  - Organelles - Membrane-bound bodies found within eukaryotic cells.

Origin of Eukaryotes

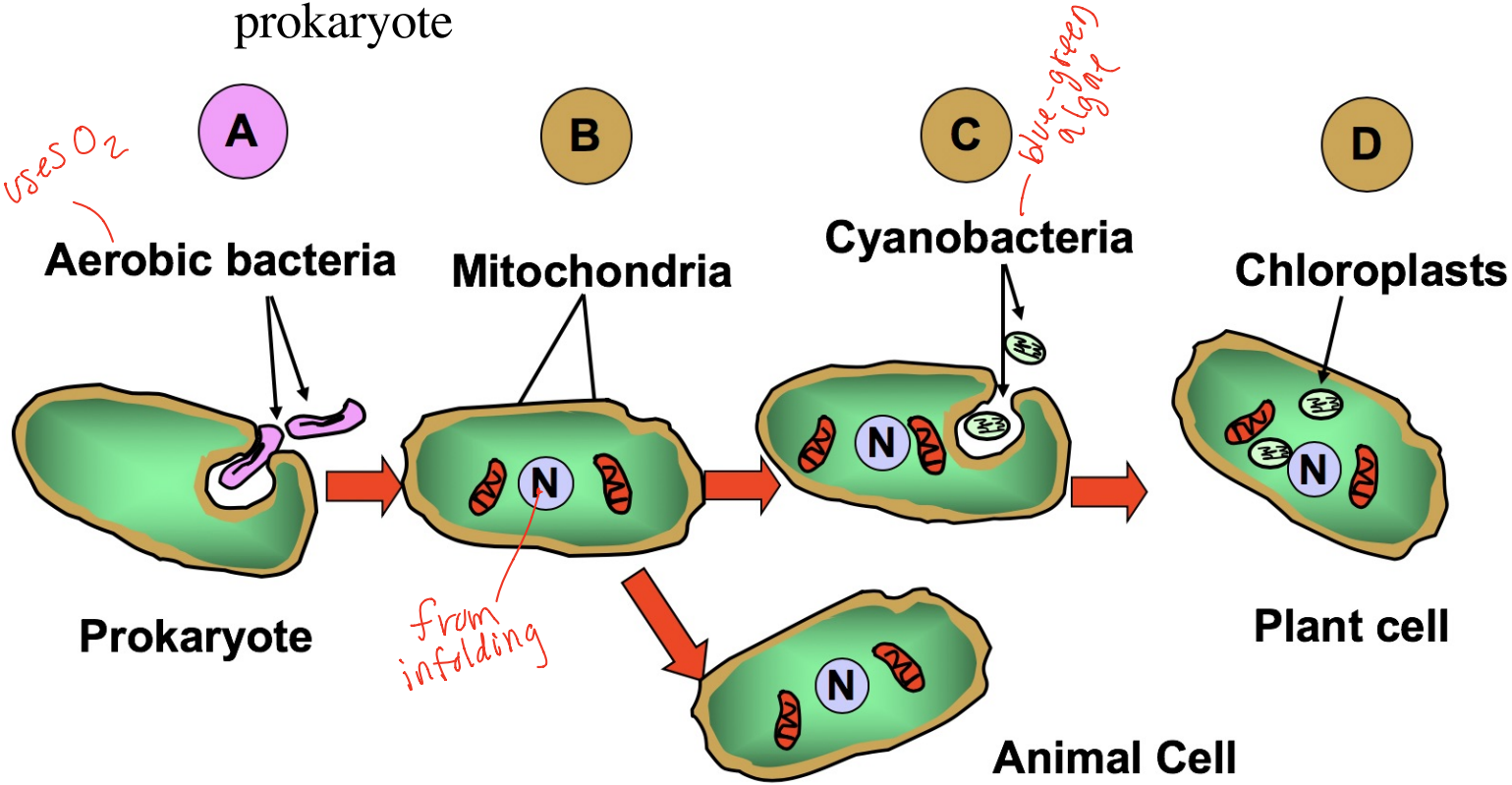
- Ancestral chloroplasts were photosynthetic, prokaryotes that became endosymbionts
- Relationship began as parasitic or undigested prey
- Assumed here that endomembrane infolding evolved first, i.e., cell already evolved nucleus, ER, …



Endosymbiosis ~~Hypothesis~~ theory

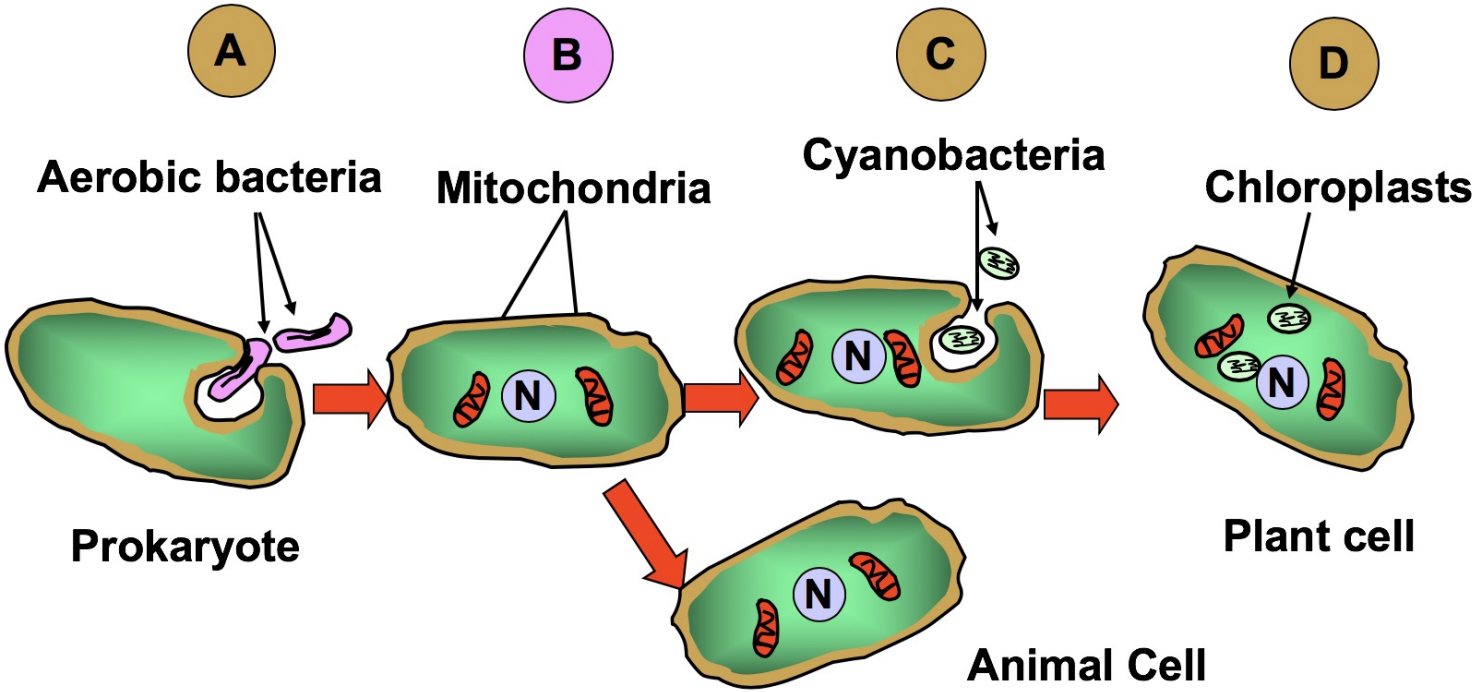
A

A prokaryote ingested some aerobic bacteria. The aerobes were protected and produced energy for the prokaryote



Endosymbiosis Hypothesis

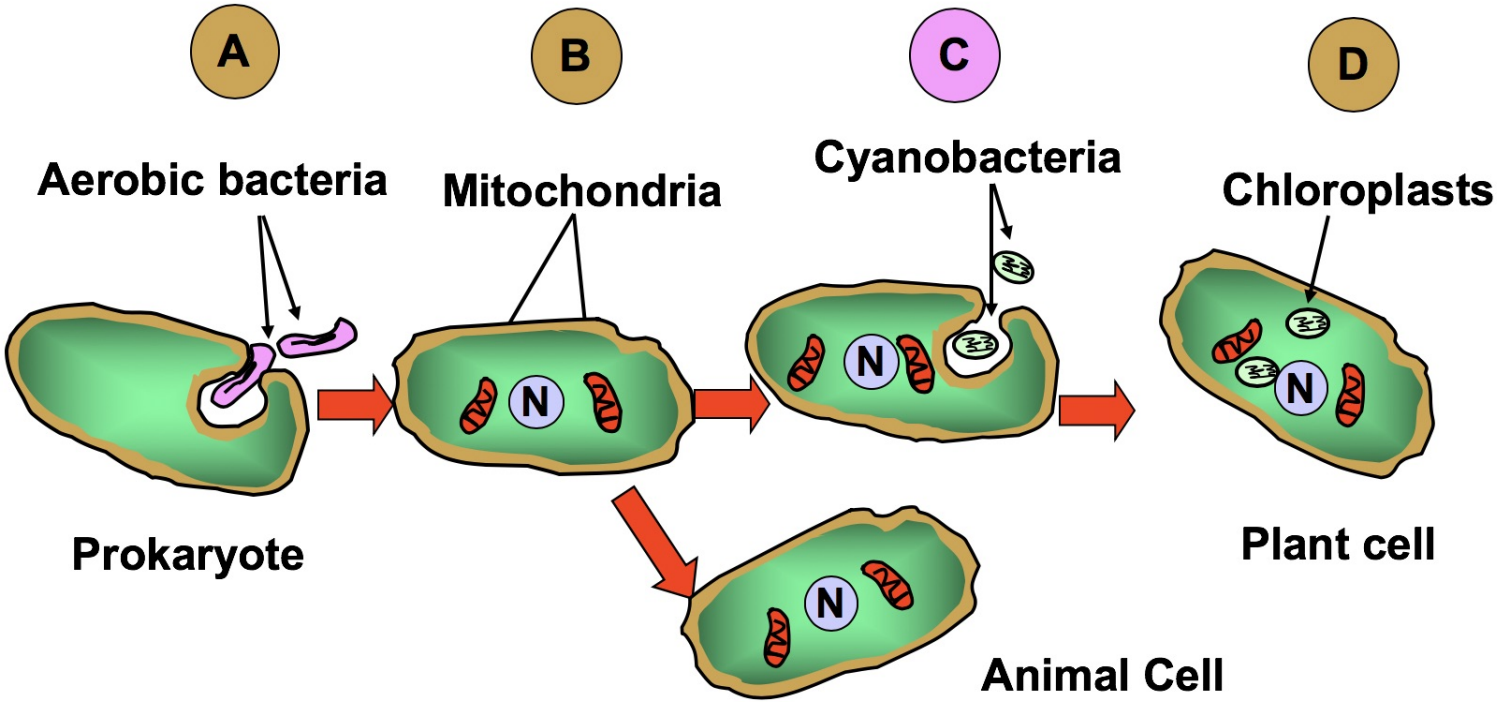
B Over a long period of time the aerobes became mitochondria, no longer able to live on their own



Endosymbiosis Hypothesis

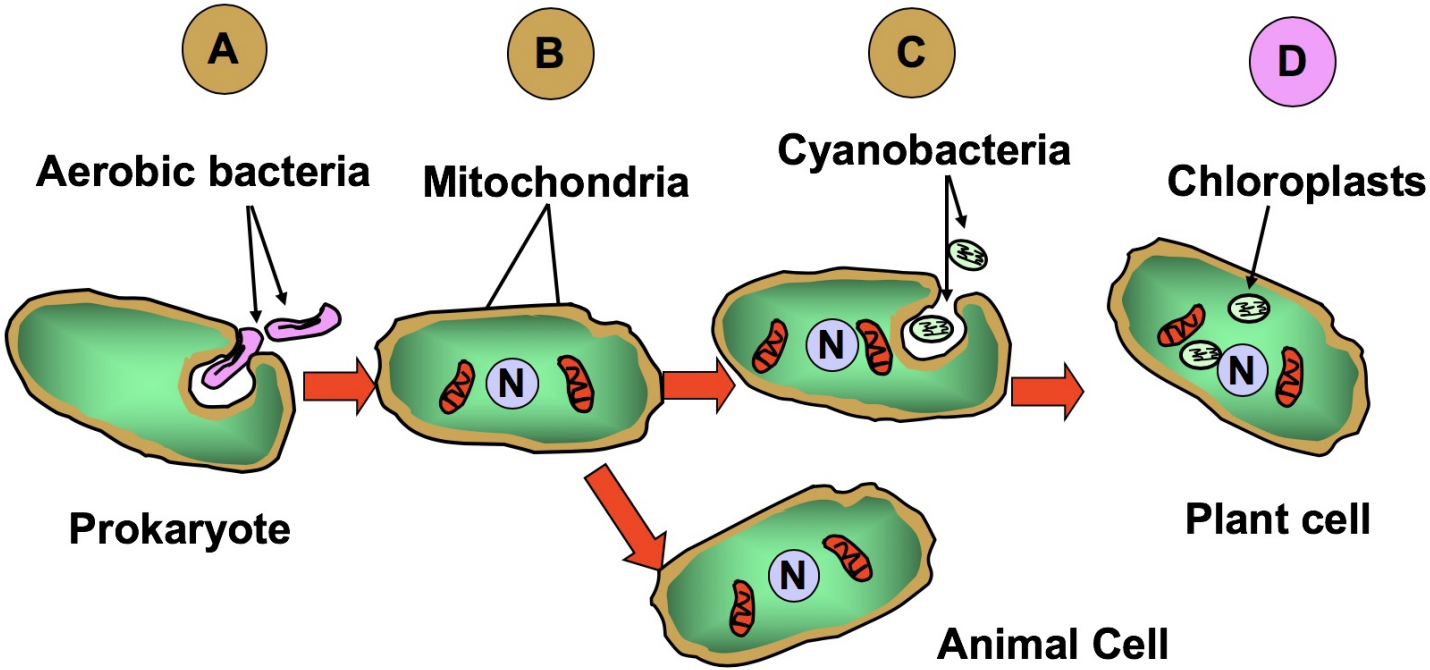
C

Some primitive prokaryotes also ingested cyanobacteria, which contain photosynthetic pigments



Endosymbiosis Hypothesis

D Cyanobacteria became chloroplasts, unable to live on their own



Aerobic bacteria and Cyanobacteria
↓ ↓
mitochondria chloroplasts
both have cell membrane and DNA

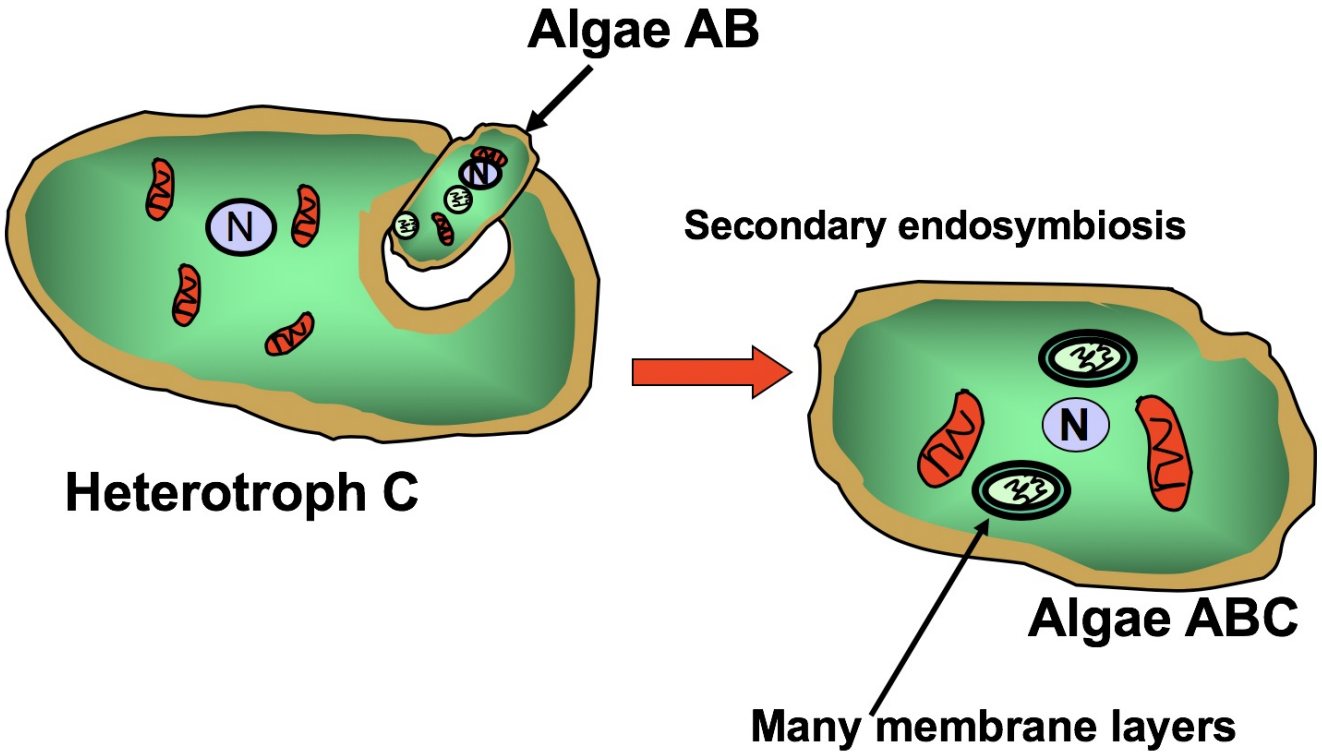
Current mitochondria, chloroplasts, and cell nuclei have:
- double membranes
- DNA (different from in nucleus and one another)

(3) hypothesis - testable statement of what you expect to find
Y/N

(1) Law - observed repeatedly, many times. Happens the same way, often, an equation ex. $F = ma$ or $D = \frac{m}{V}$

(2) Theory - explains an observation or set of observations

Secondary Endosymbiosis and Origin of Agal Diversity

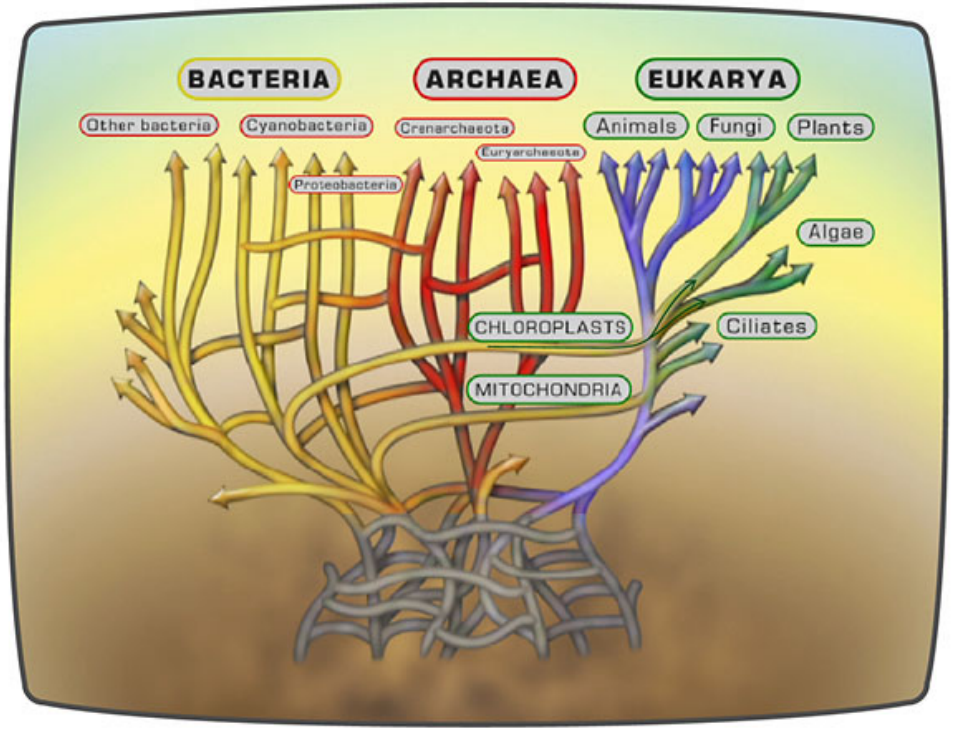


Endosymbiosis

Fusion evolution - major process for forming the diversity of life

“mitochondria” transfer - 2000 mya

“chloroplast” transfer - 1600 mya



A. Prokaryotes

Small, simple cells (relative to eukaryotes)

Size: about 1 μm (1 micron)

No internal membrane-bounded organelles

No nucleus

Simple cell division

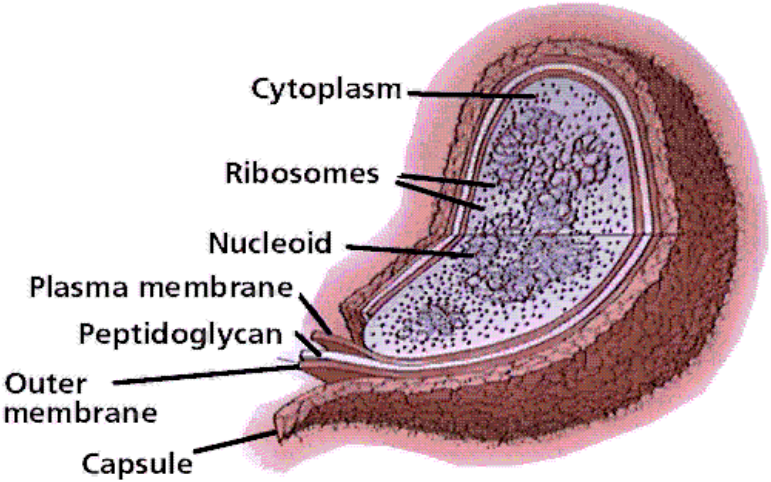
Contain the;

1. *true bacteria* (Eubacteria) Eukarya
2. *archaebacteria* Archea

1. True Bacteria = Eubacteria

- Majority of bacteria

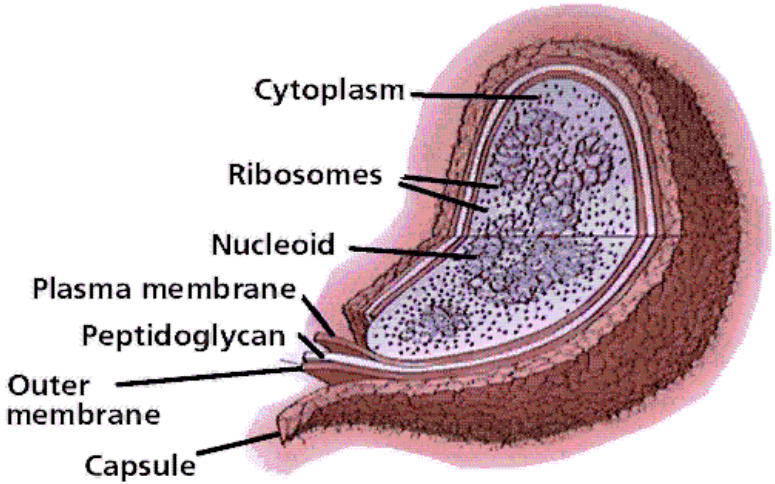
- Examples include: *E. coli*, *Lactobacillus* (yogurt), Lyme disease



Eubacteria

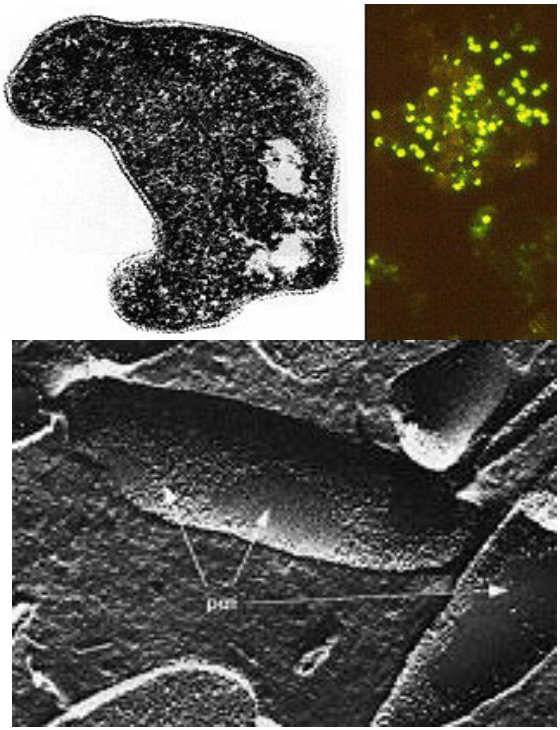
- Peptidoglycan cell walls (carbs & AA)

- Separated into Gram + and - forms



2. *Archaebacteria*

- Live in extreme environments: high salt, high temps
- Different cell wall
- Very different membrane lipids
- Unusual nucleic acid sequence



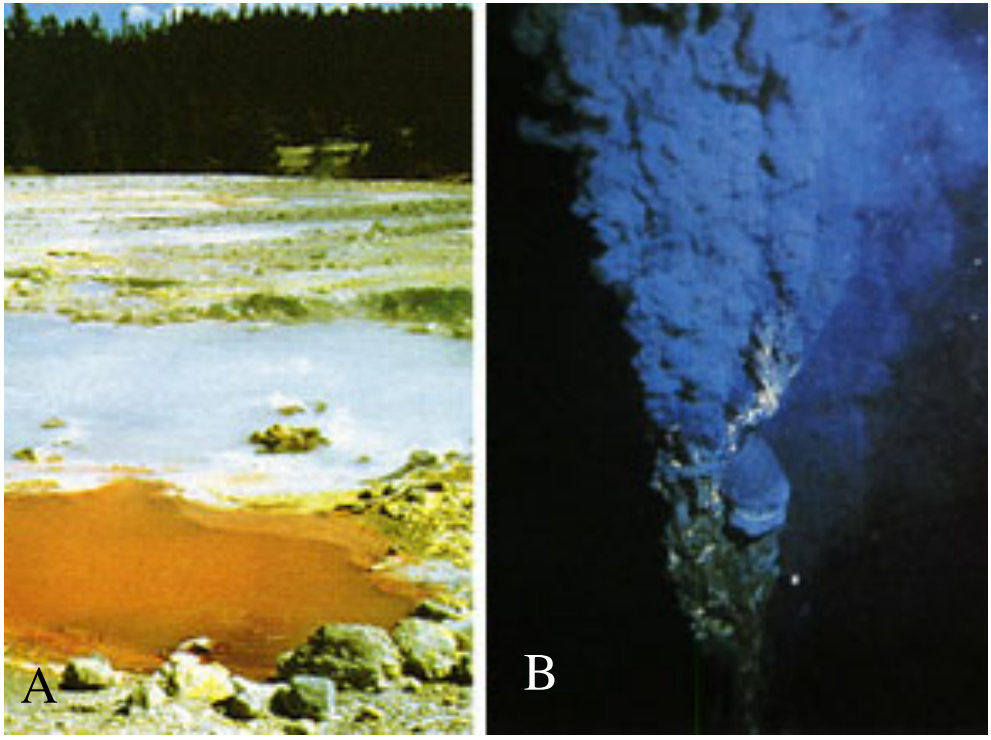
Archaeabacteria

The prokaryotes Archaebacteria are organized into 3 types based on physiology,

- **Methanogens** produce methane
- **Extreme halophiles** live at very high concentrations of salt (NaCl);
- **Extreme (hyper) thermophiles** live at very high temperatures.

Bacteria in the Environment

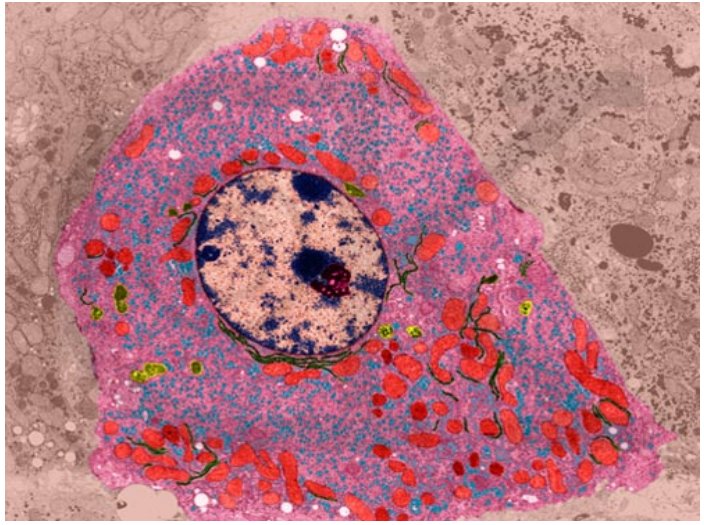
example:
Iron
utilizing
Baceria



A) An acid hot spring in Yellowstone is rich in iron and sulfur.
B) A black smoker chimney in the deep sea emits iron sulfides at very high temperatures (270 to 380 degrees C).

B. Eukaryotes

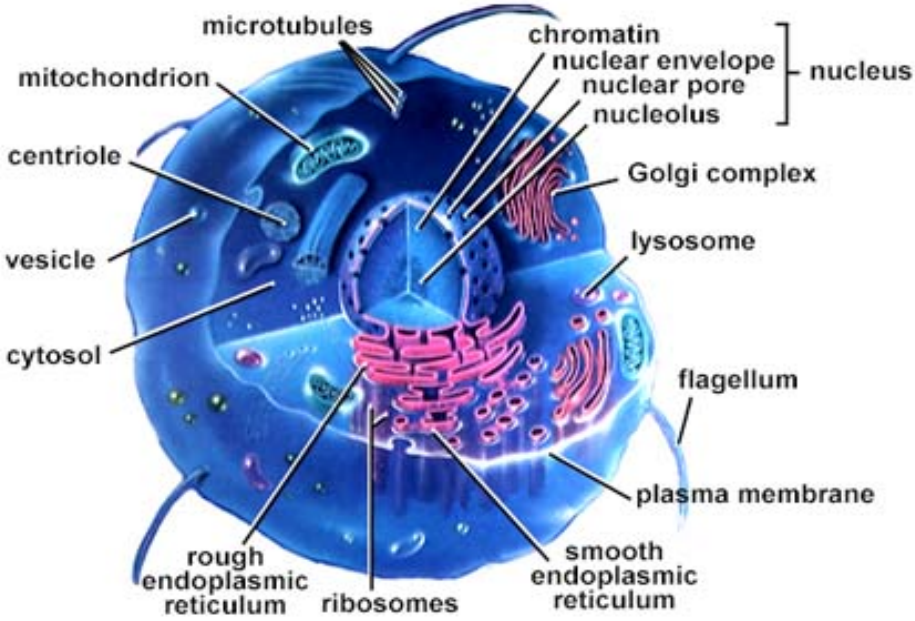
- Bigger cells: 10-100 μm
- True nucleus
- Membrane-bounded structures inside. Called organelles
- Divide by a complex, well-organized mitotic process



Liver Cell 9,400x

Eukaryotes

- Larger more complex cells that make up most familiar life forms: plants, animals, fungi, algae
- Surrounded by a cell membrane made of lipids
- **Have membrane-bound organelles**, including a nucleus



Cells

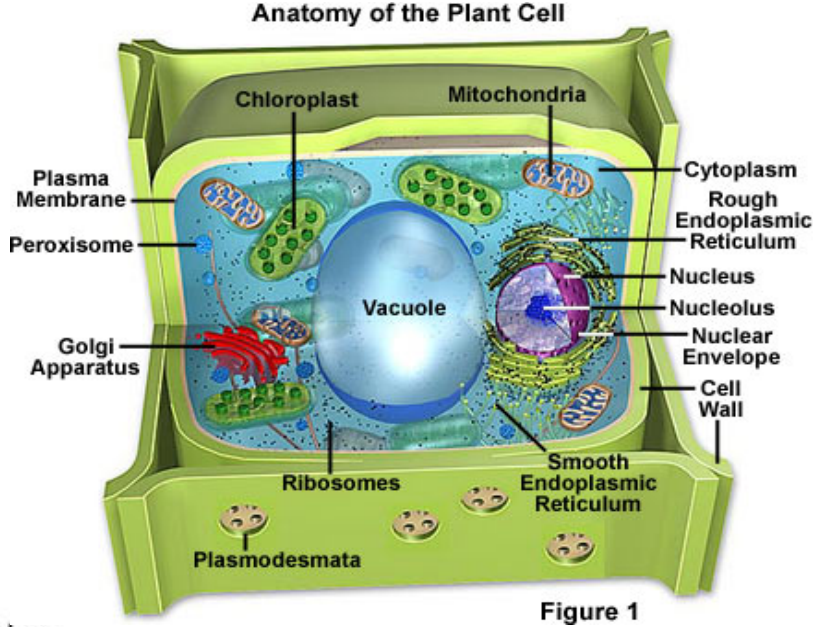


Figure 1