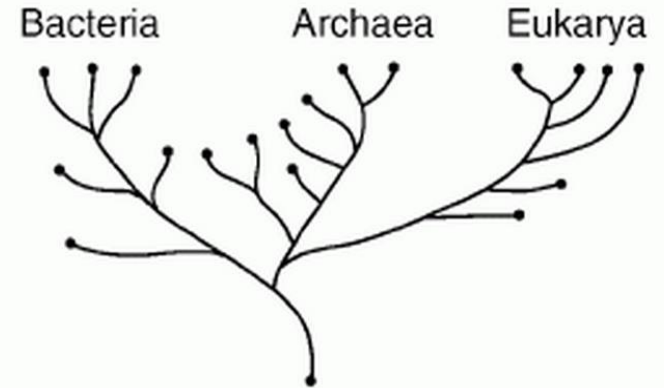
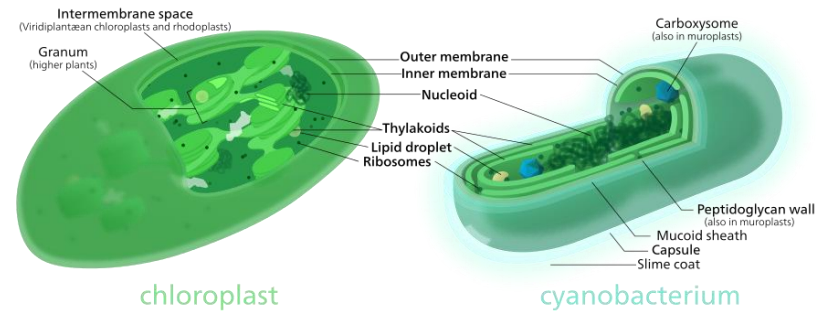
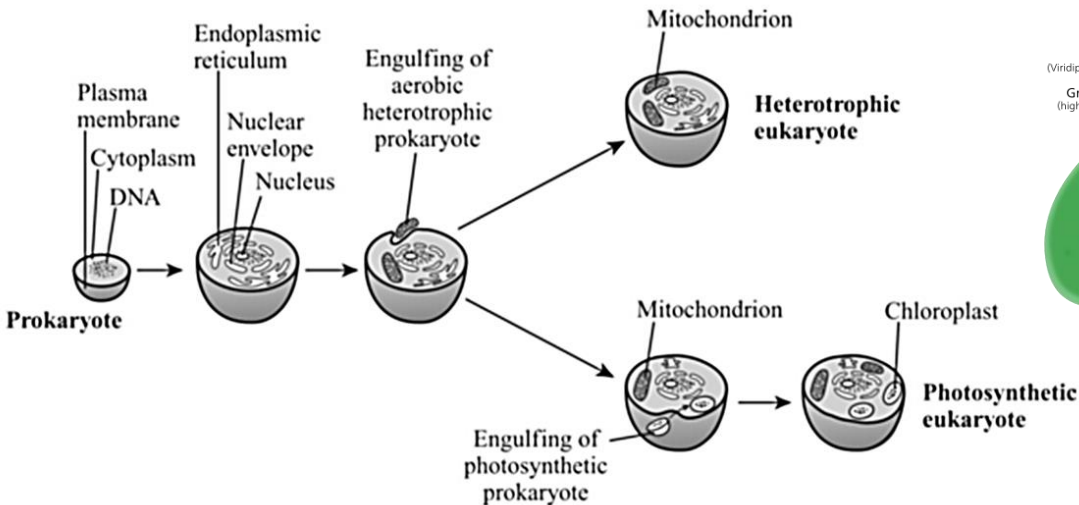


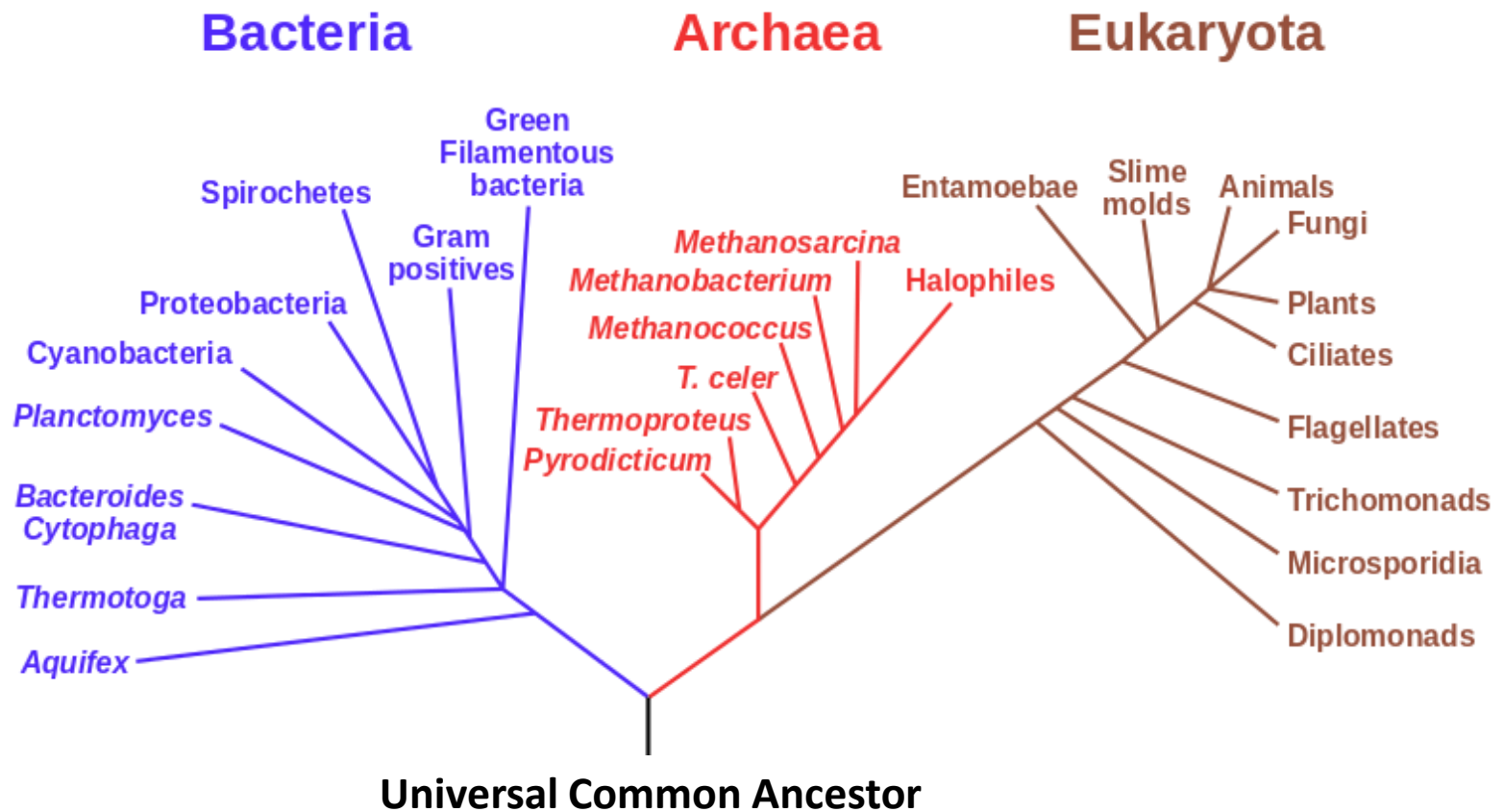
Present
↑
Past



Universal Common Ancestor

The Development of Cell Complexity

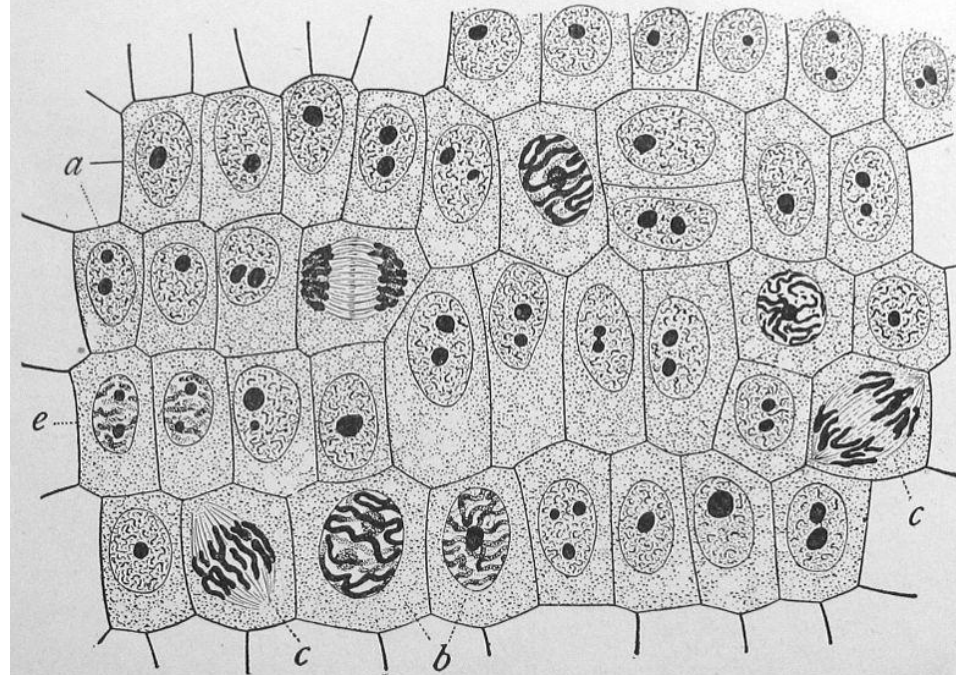
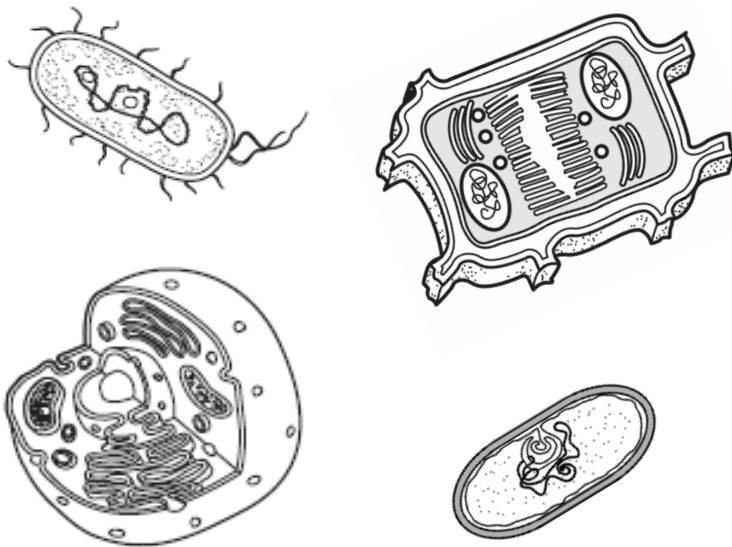




Most scientists believe that all forms of life can trace their origins back to a universal common ancestor. This is mainly because there are homologies between *ALL LIVING THINGS*.

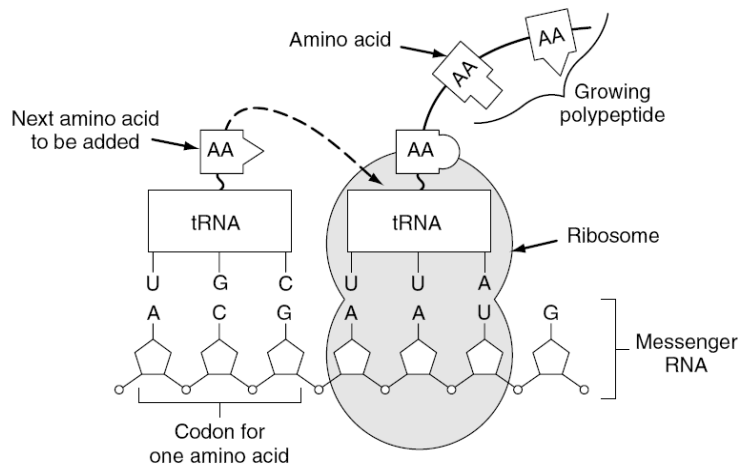
1. All living things are made of cells

The cell is the *building block* of all organisms.
Because of this, scientists believe the first life form for was a *single cell*.

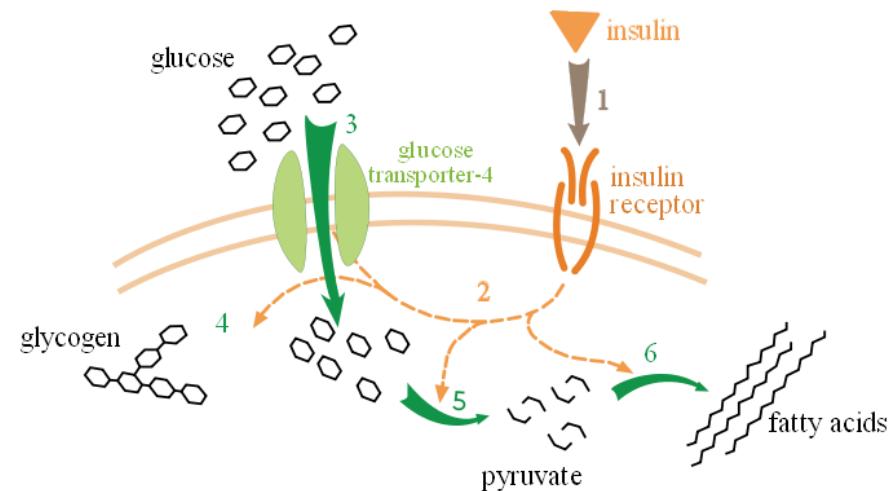


2. All living things metabolize nutrients using similar molecules and processes

Metabolism is the set of *chemical reactions* that occur inside of living cells. All cells use ribosomes to create proteins.



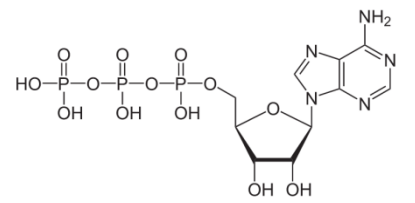
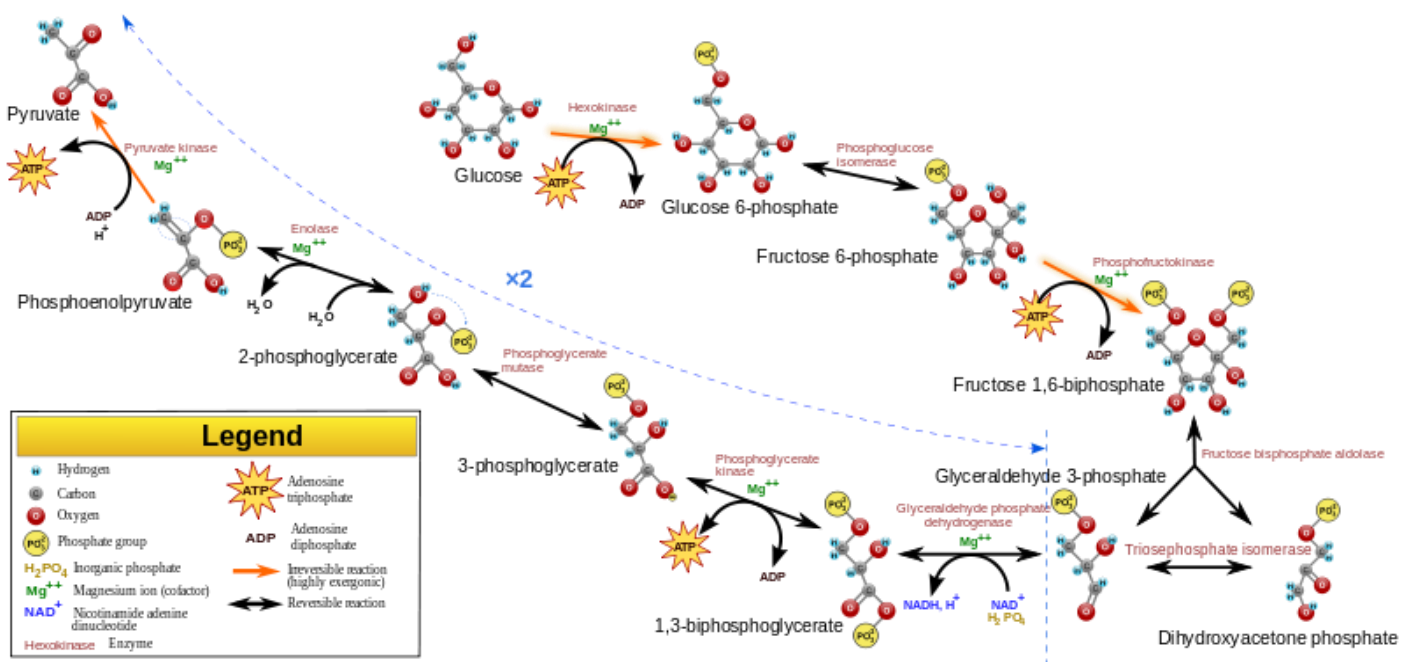
Protein Synthesis



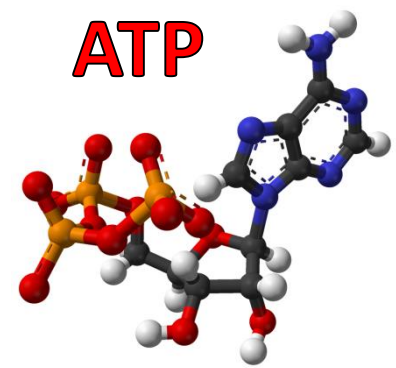
Glucose metabolism

2. All living things metabolize nutrients using similar molecules and processes

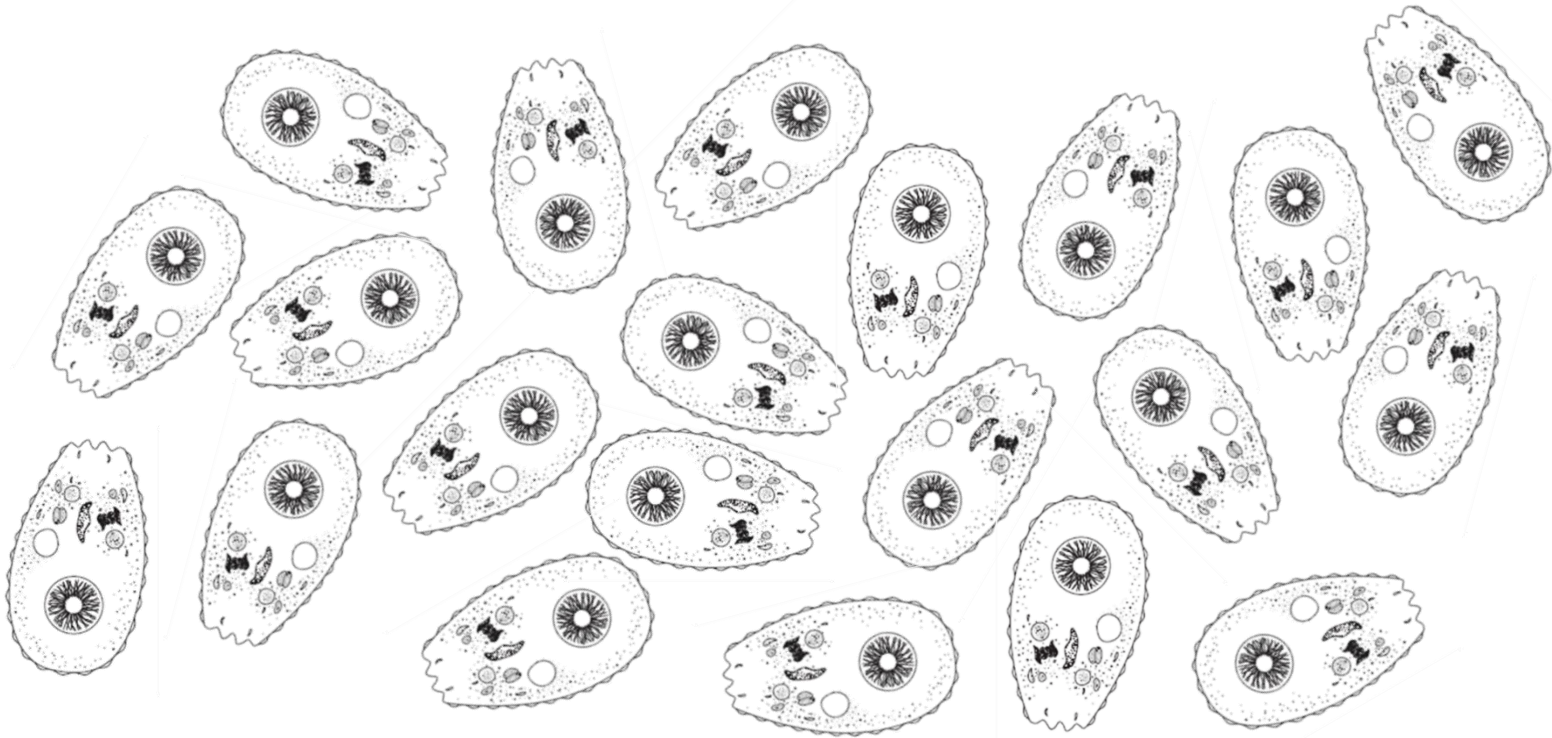
All living things also rely on enzymes, a special type of protein, to *speed up* and *direct* chemical reactions and ATP as a source of cellular energy.



ATP

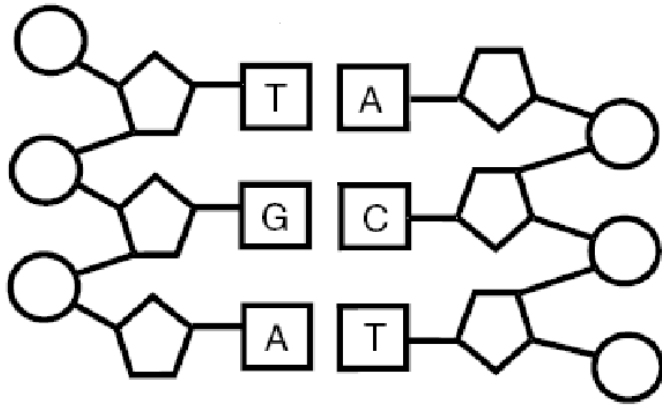


3. All living things reproduce themselves



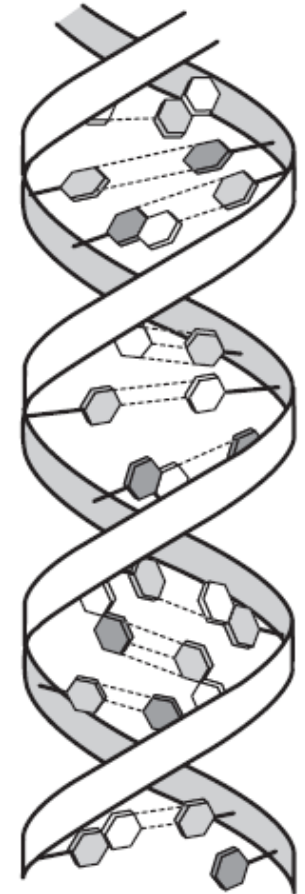
4. All living things contain a set of instructions in the form of DNA.

The information in DNA is used to make proteins in all living cells.

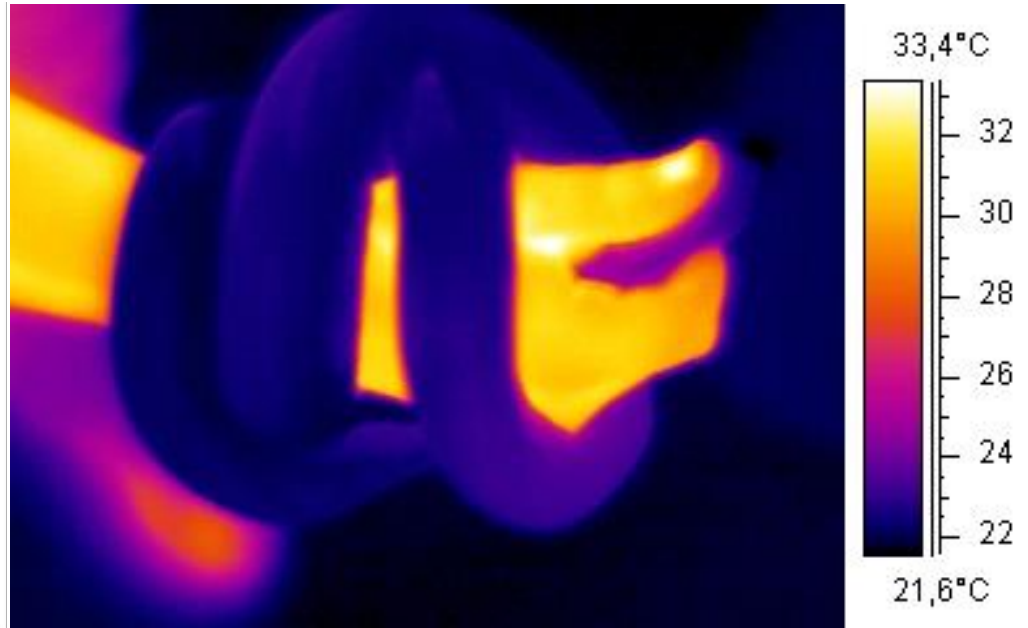
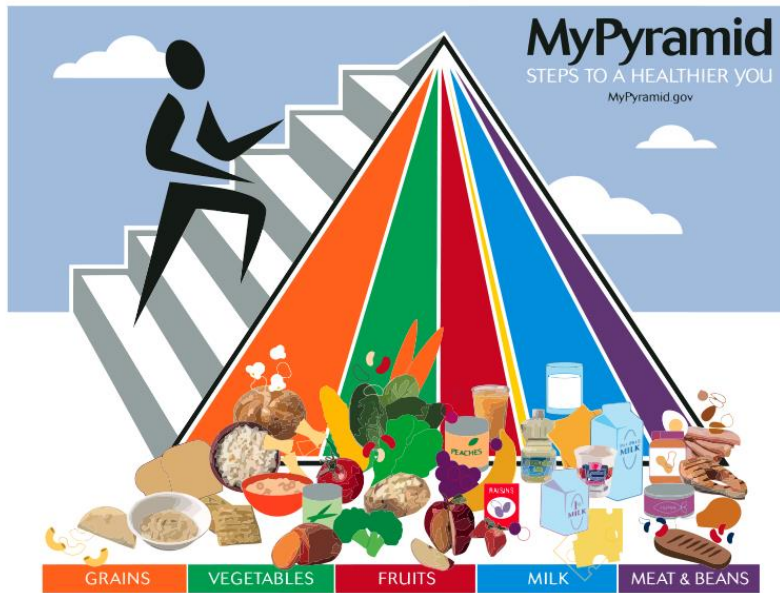


A DNA molecule is a polymer of nucleotides.

Segment of a DNA Molecule

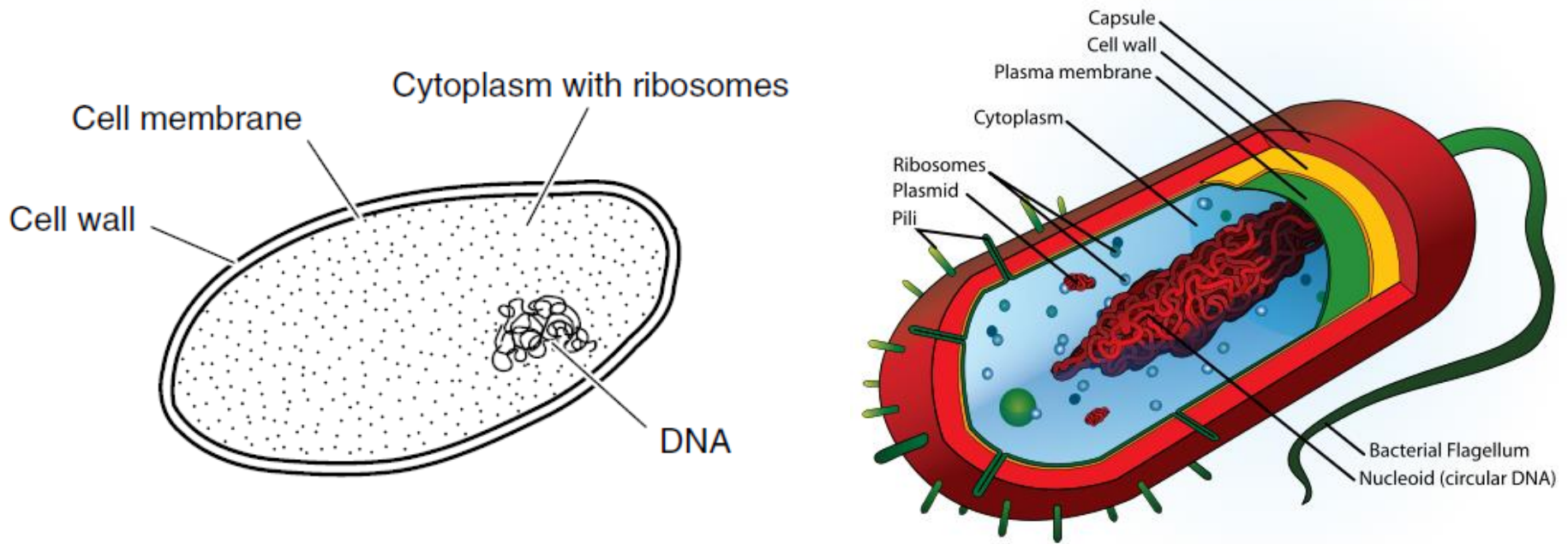


5. All living things maintain a steady balance of water, nutrients and energy known as homeostasis.



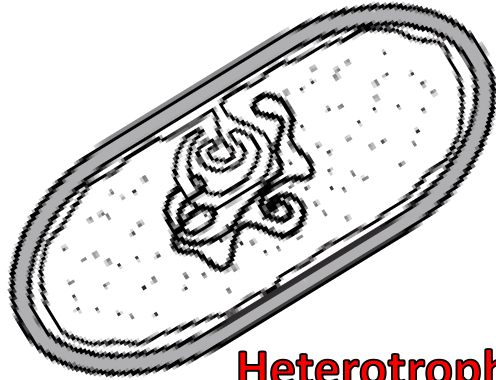
Energy is gained from food by consumers and lost in the form of heat.

Understanding Cell Complexity



Most scientists believe that the first living thing was a prokaryotic cell. These cells do not contain any membrane bound organelles, and they contain a single, circular chromosome of DNA.

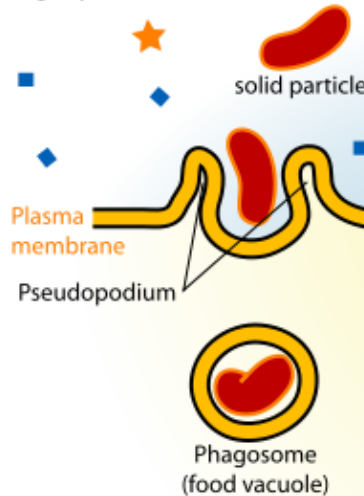
Understanding Cell Complexity



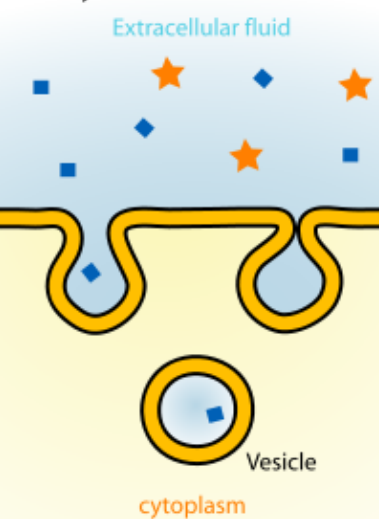
**Heterotrophic
Prokaryote**

Endocytosis

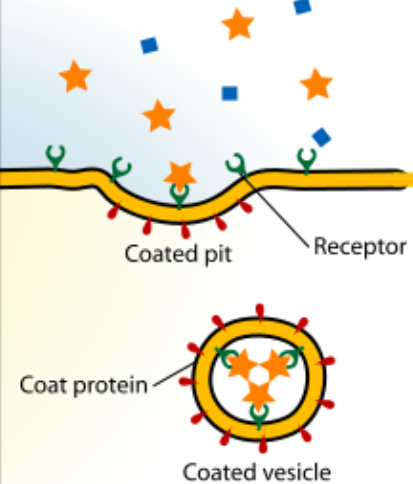
Phagocytosis



Pinocytosis

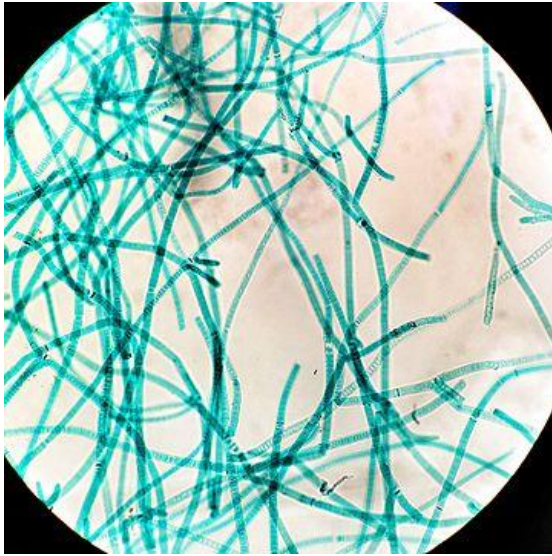


Receptor-mediated endocytosis

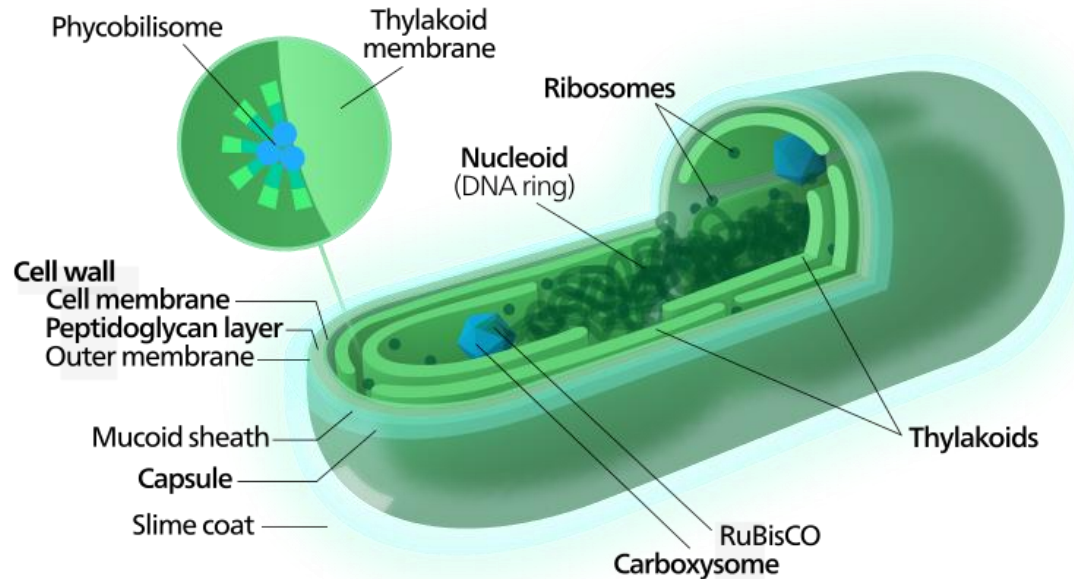


According to the Heterotroph Hypothesis, the first cells were heterotrophic consumers that got energy from nutrients in their environment that they engulfed and digested.

Understanding Cell Complexity



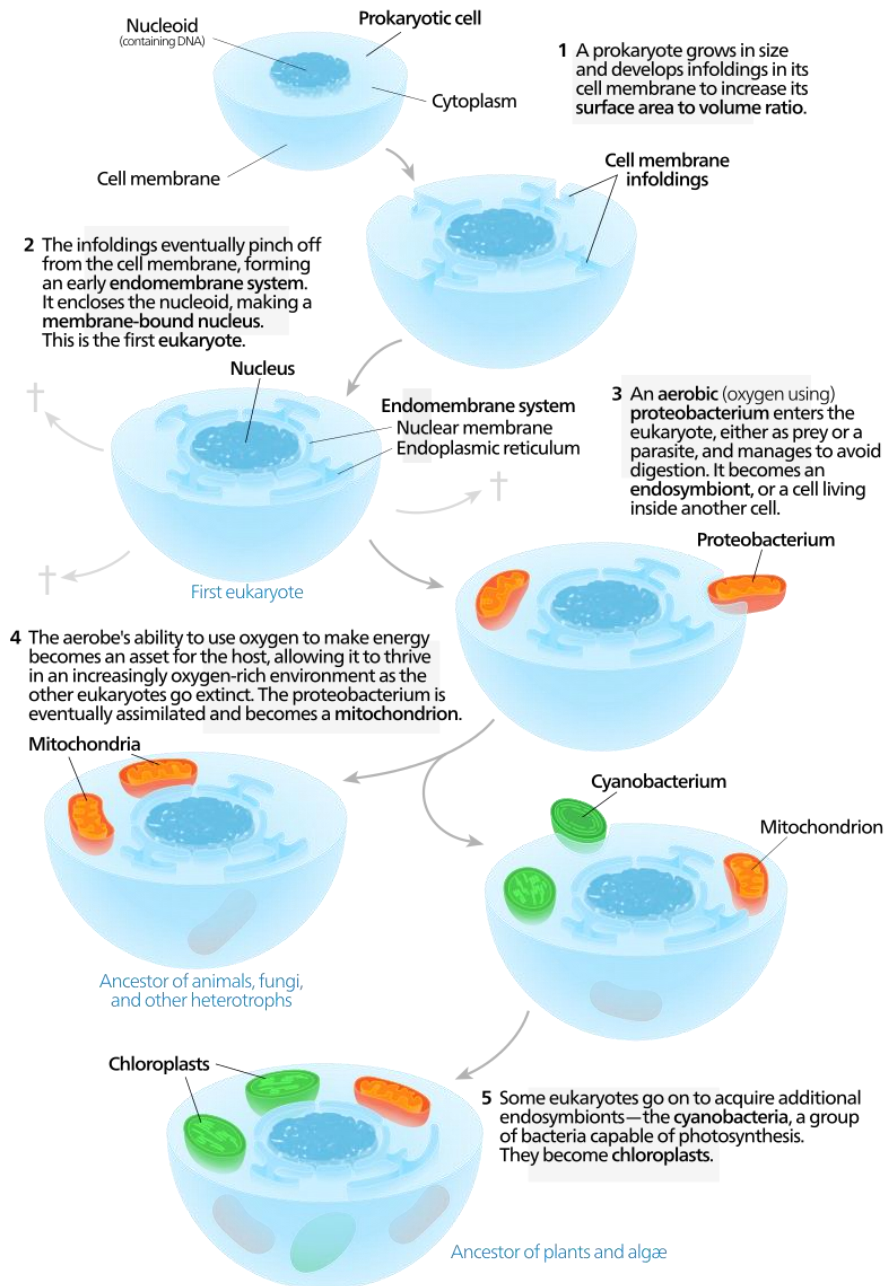
Cyanobacteria



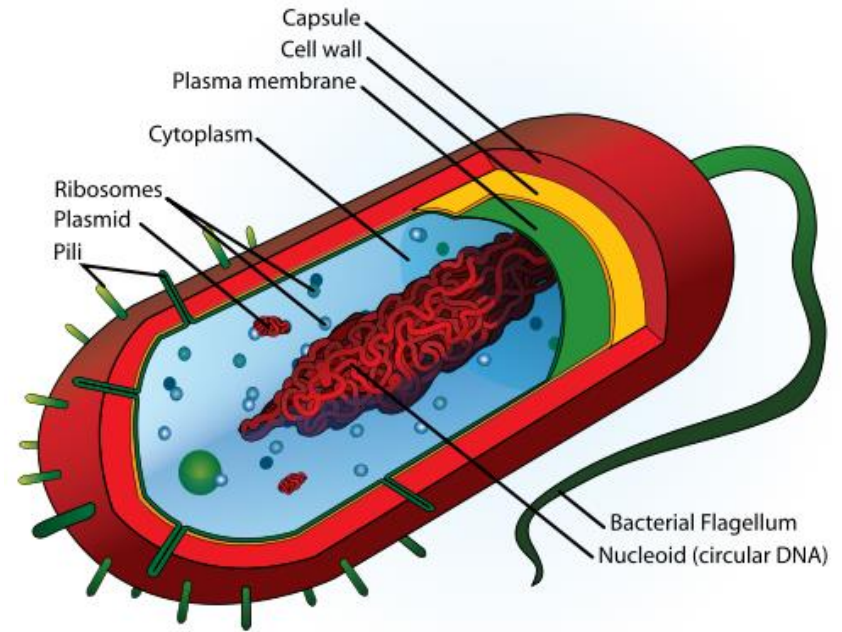
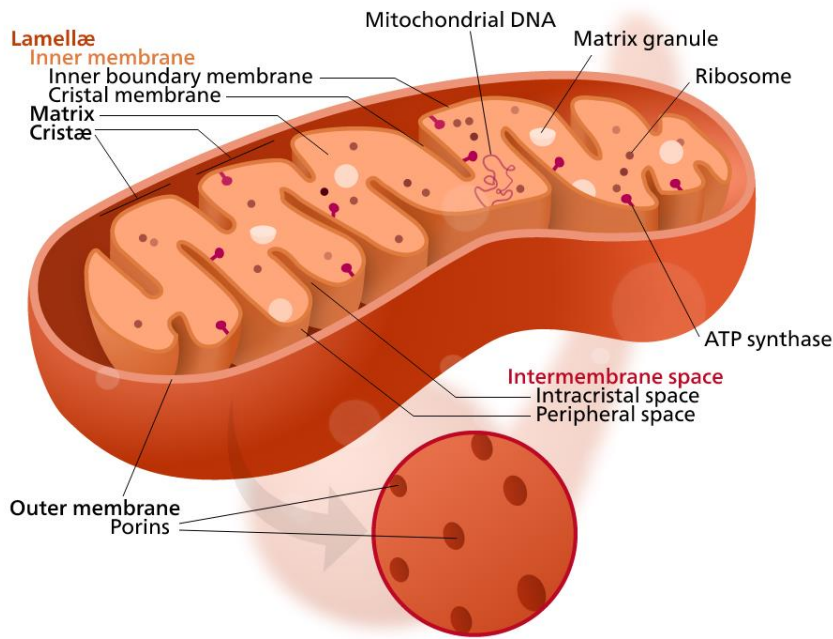
Later, **autotrophic** prokaryotes similar to cyanobacteria developed. These could perform photosynthesis and make their own food using energy from the sun.

Endosymbiosis

The first eukaryotic cells developed in part from the fusion of larger cells with other prokaryotes. This is known as the endosymbiotic theory.

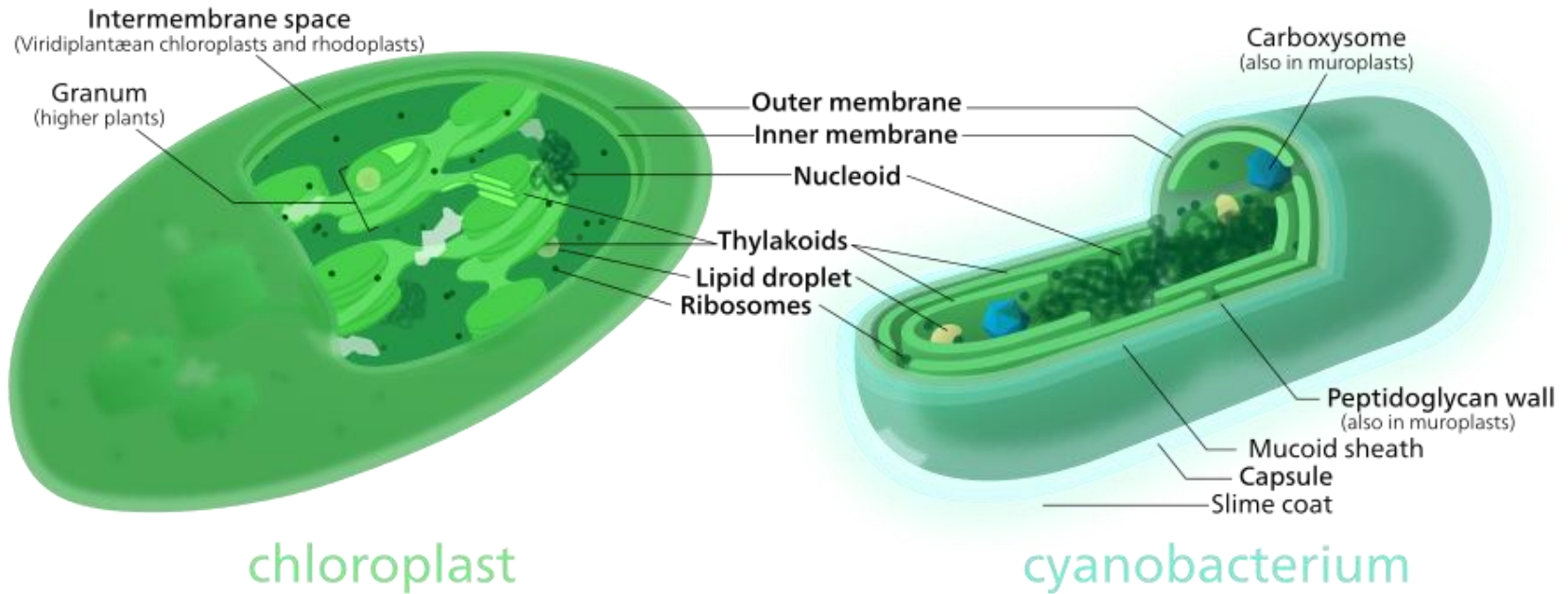


Endosymbiotic Theory



Mitochondria are very similar to prokaryotic **bacteria**. They are about the same size, they both contain a circular chromosome of DNA, and the structure of the ribosomes in mitochondria are similar to those in bacteria.

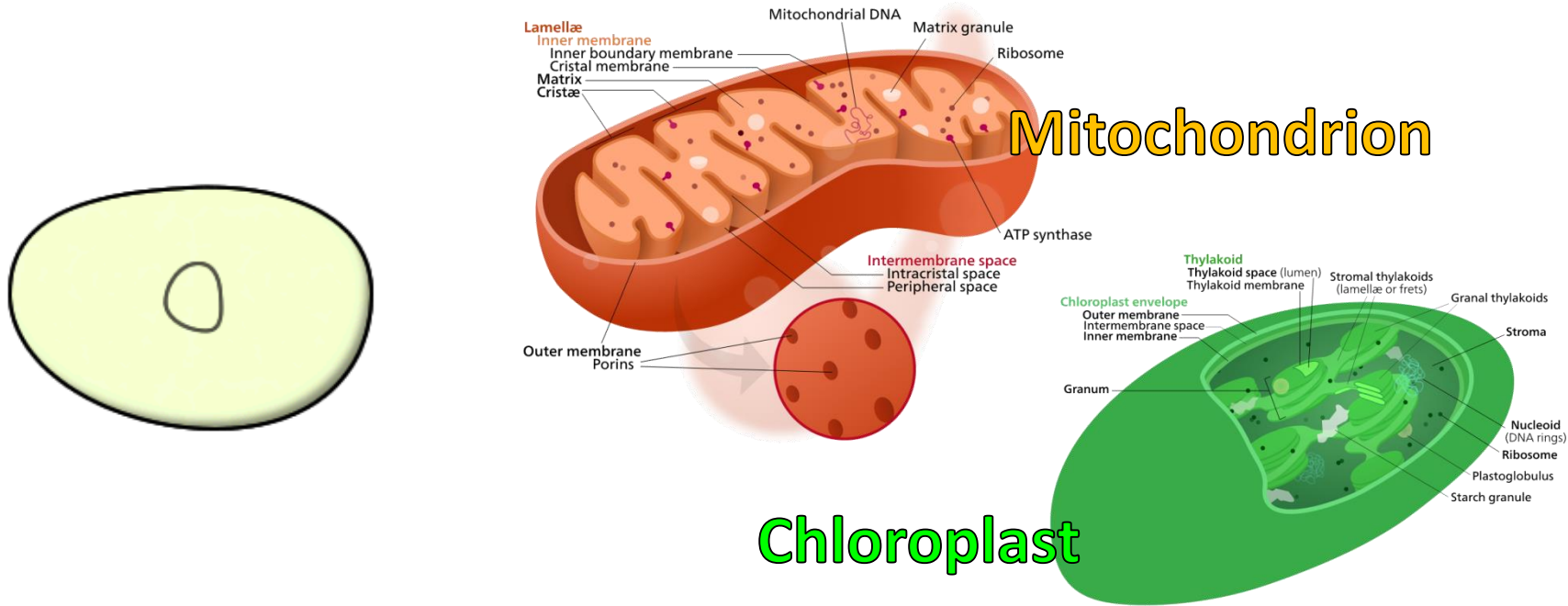
Endosymbiotic Theory



Chloroplasts are very similar to **cyanobacteria**.

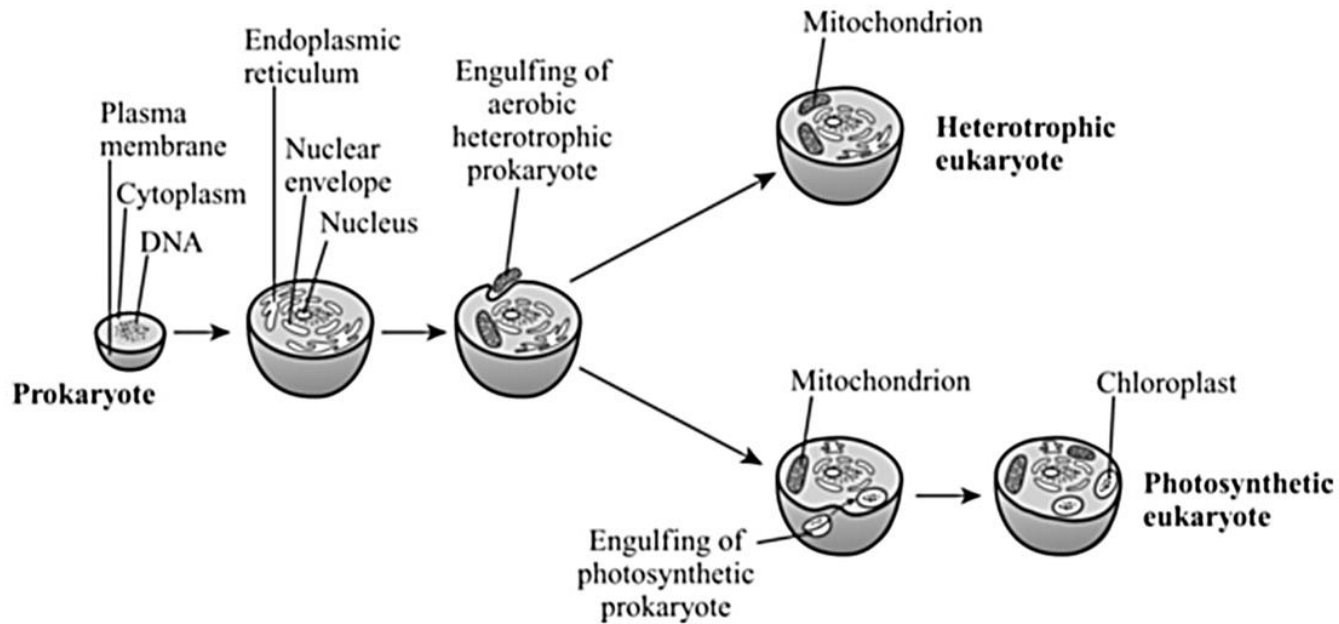
They are about the same size, and they also both contain a circular chromosome of DNA, and the structure of the ribosomes in chloroplasts are similar to those in cyanobacteria.

Endosymbiotic Theory



Also, **mitochondria** and **chloroplasts** both reproduce through binary fission. This is the same method used by prokaryotes.

Endosymbiotic Theory

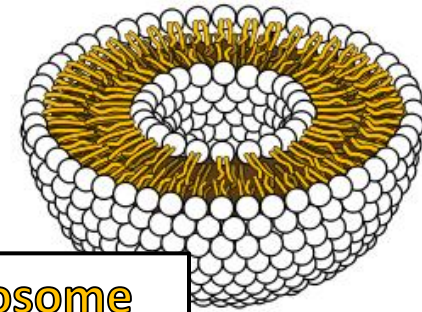


Because of these many homologies between mitochondria, chloroplasts and bacteria, scientists believe that prokaryotes were the ancestors of these organelles.

The First Cell



Stromatolites about one billion years old in the Siyeh rock formation of Glacier National Park, Montana, USA.



A naturally occurring liposome formed from phospholipids.

The creation of the very *first cell* is still a mystery that scientists are trying to solve. They have developed many theories to try and explain how this might have happened.

The First Cell

There are 3 main questions that these theories try to answer:

1. How were the organic compounds needed for life originally formed?

2. How was information first stored inside molecules like DNA and RNA?

3. How were the first cells able to replicate themselves and their genetic material?