

Cells...they ain't just your home away from home in prison...

Introduction to Cells

What are cells?

- **Cells** are the basic units of life.
- They can only be seen under the **microscope**.

- Basic types of cells:



History of Cells

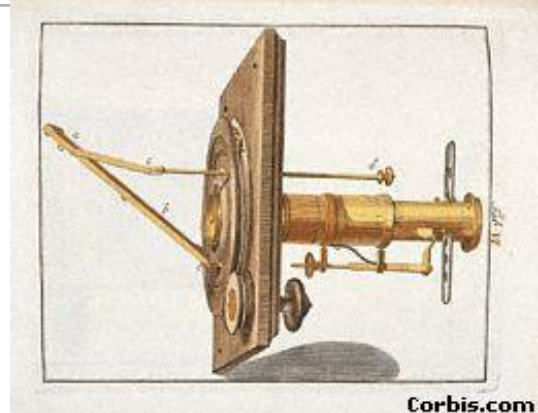
- No one knows precisely when the first cells lived on Earth.
- 1st cells lived when Earth's atmosphere **lacked oxygen**.
- **Photosynthetic bacteria** were the **first** organisms to perform photosynthesis (they released oxygen into the atmosphere).
- Photosynthesis may have **increased oxygen** levels so much that oxygen became more prominent in Earth's atmosphere, making it possible for organisms who rely on oxygen for cellular respiration to exist on land (eukaryotes came after).
- The first cells were photosynthetic and did not require oxygen (**anaerobic**).
 - Aerobic= with oxygen
 - Anaerobic= without oxygen

History of Cells

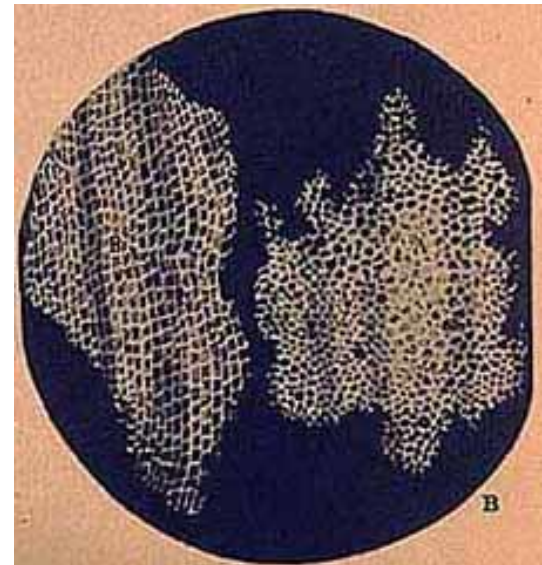
- Before microscopes, people couldn't see cells and therefore, didn't know they existed.
- Diseases, human reproduction, and many other biological concepts were blamed on "magic" before the discovery of cells...

Robert Hooke (1635-1703)

- Hooke invented the **first** microscope and observed a piece of **cork** in 1665.
- The hollow spaces he observed reminded him of the chambers monks slept in, so he called them **cells**.
- They weren't living cells, but they were the first "cells" to be seen under the microscope.

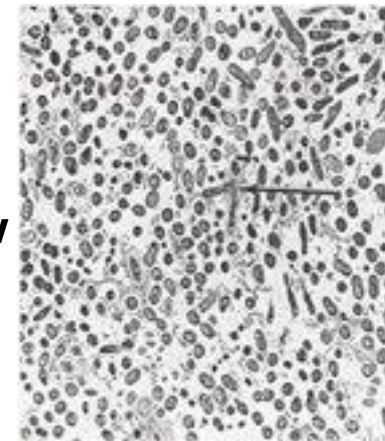


Corbis.com



Anton van Leeuwenhoek (1632-1723)

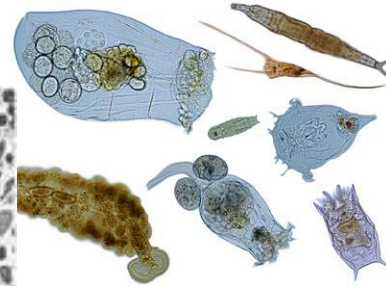
- In 1675, the Dutch microscope maker, van Leeuwenhoek, was the first person to observe **living** cells.
- van Leeuwenhoek used a microscope to view pond water.
- He discovered many living creatures that he called **animalcules** (tiny animals).
- Many of them were not animals, but single celled organisms (protists, bacteria).



Dental plaque

Microscope view of dental plaque. The plaque consists of over 500 different species of bacteria, each with a form and metabolism of its own.

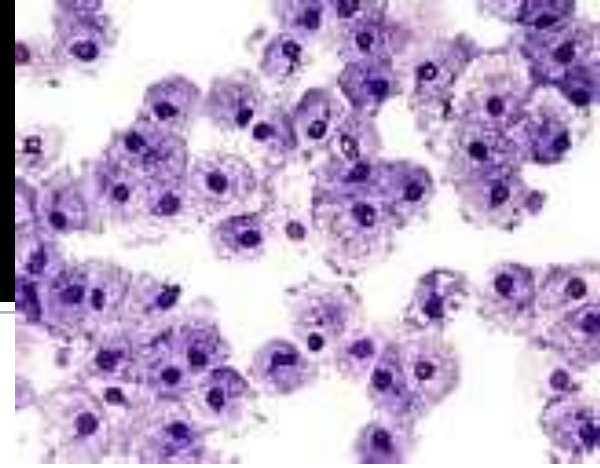
Rotifers



Ciliates



The Cell Theory



The observations of these scientists form
The Cell Theory:

- 1. All **living** things are made of one or more cells.
- 2. Cells are the basic units of life
- 3. All cells come from **existing** cells.

Levels of Organization

- Cells are grouped together and work together to perform special functions

- Cells
- Tissues
- Organs
- Organ systems
- Organisms

Smallest



Largest



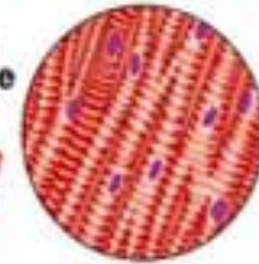
Organism level
Zebra (Includes several organ systems)

Organ system level
Circulatory system

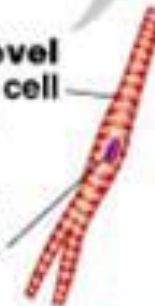


Organ level
Heart

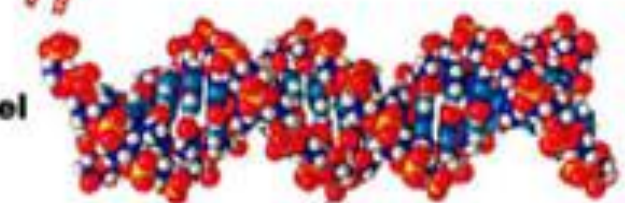
Tissue level
Cardiac muscle tissue



Cellular level
Cardiac muscle cell

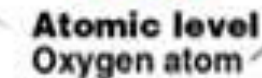
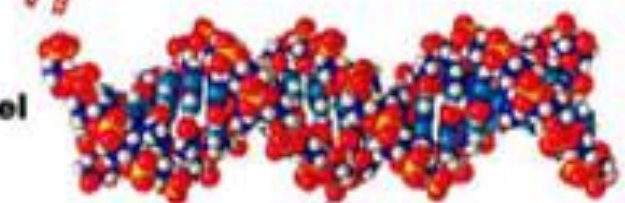


Organelle level
Cell nucleus

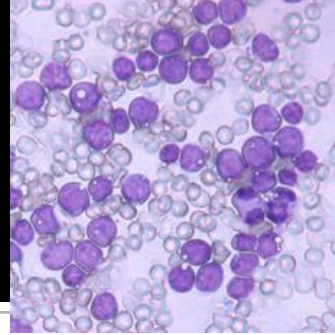


Molecular level
DNA

Atomic level
Oxygen atom



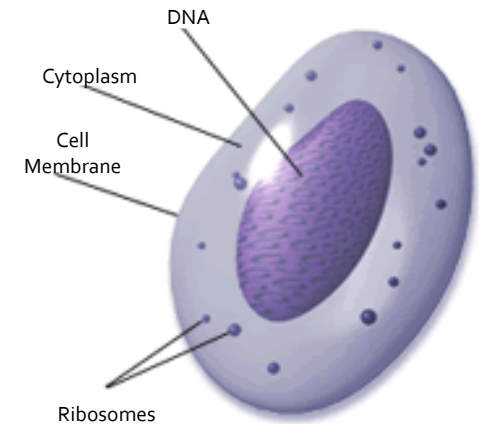
Cell Size



- There are about 100 trillion cells in the human body, most ranging in size from $5\ \mu\text{m}$ to $20\ \mu\text{m}$ in diameter.
- Small cells function **more** efficiently than large cells.
- Why? Surface Area-to-volume ratio.
- Smaller cells move materials in and out of the cell **faster** than a large cell can

4 common features of all cells...

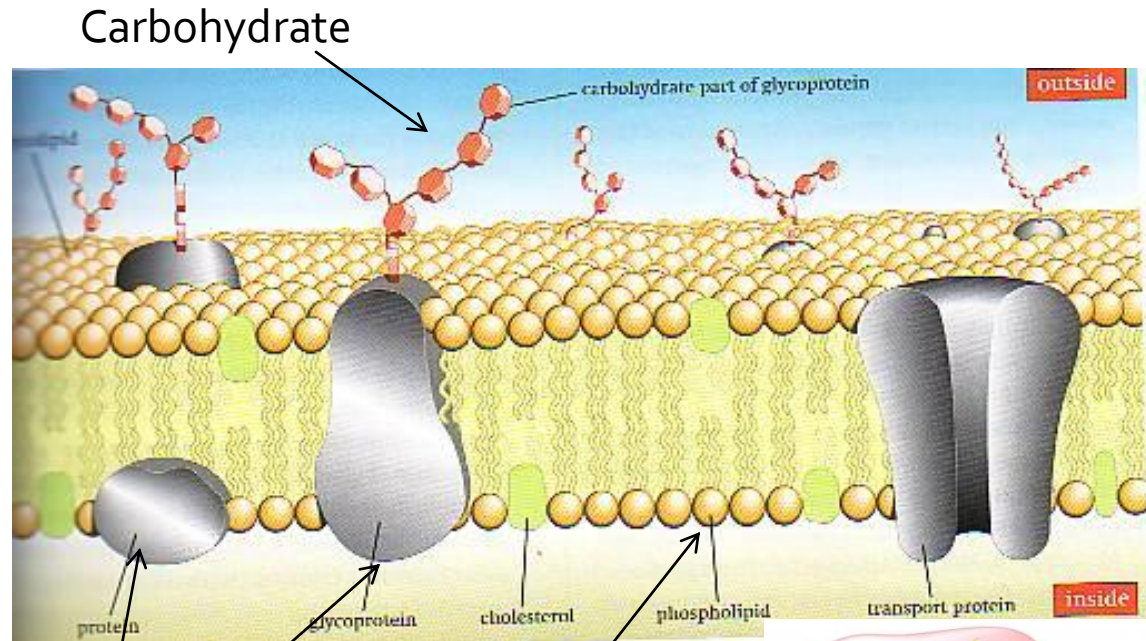
- **1. Cell membrane**-encloses the cell
- **2. Cytoplasm**-“gooey-stuff” in the interior of the cell
- **3. Ribosomes**-structures within cells where **proteins** are made
- **4. DNA** (even if the cell does not have a nucleus, it still contains **DNA**)



Basic materials that make up cell parts

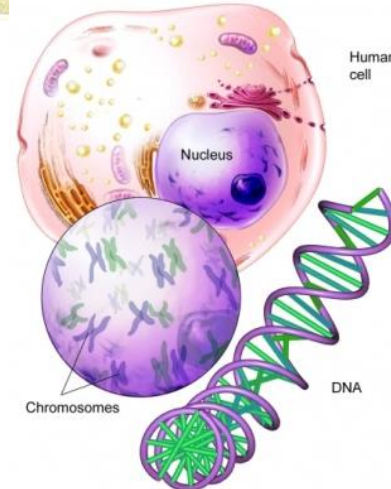
The 4 Major Organic Molecules

- 1) Carbohydrates
- 2) Lipids
- 3) Proteins
- 4) Nucleic Acids



Protein

Phospholipid



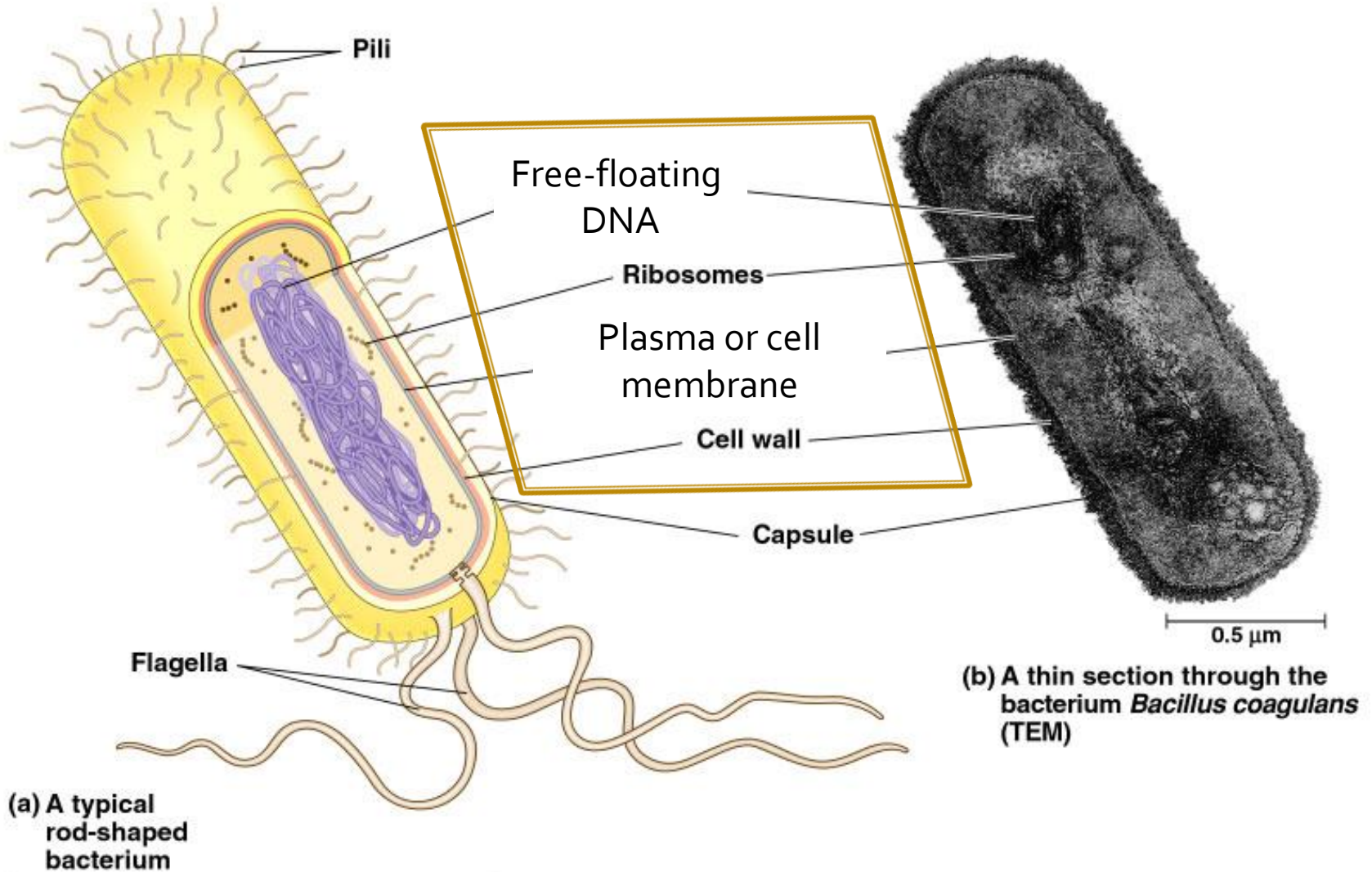
Two Basic Cell Types

Prokaryote “Pro-No” (No Nucleus!)

- **Lacks** internal compartments
- Limited organelles
- **No** true nucleus
- Organelles: Have DNA, ribosomes & a cell membrane
- Most are single-celled (unicellular) organisms
- Examples: bacteria



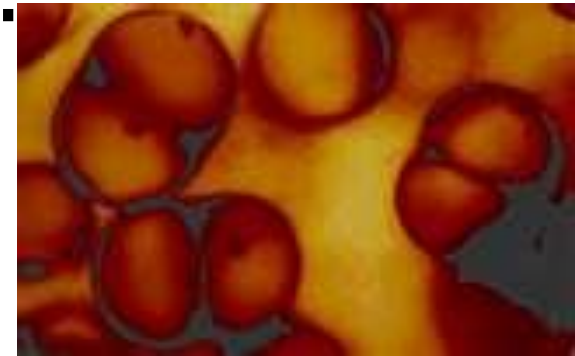
Prokaryotic Cell



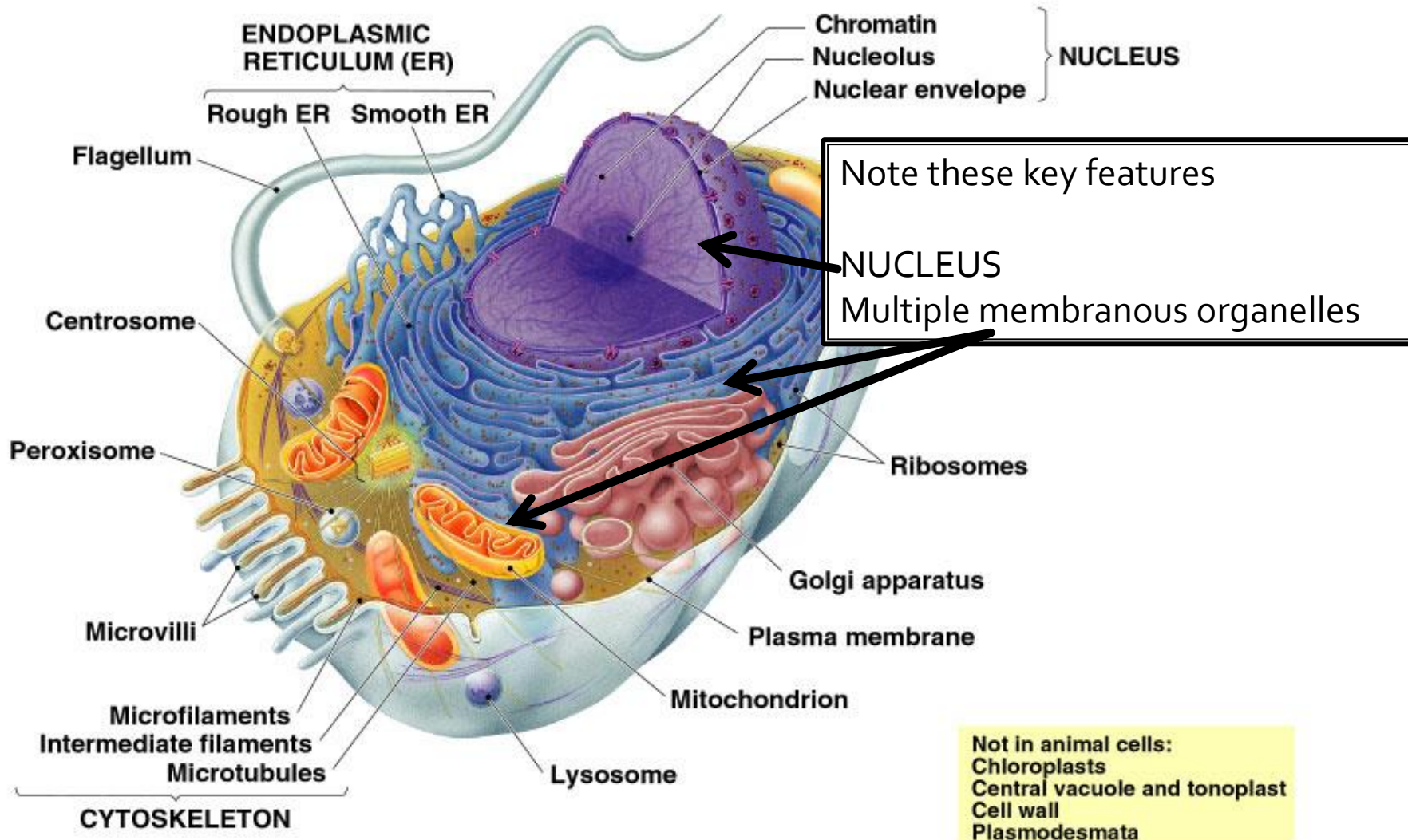
Two Basic Cell Types

Eukaryote

- Has several internal structures (organelles).
- True **nucleus**.
- Either unicellular or multicellular.
unicellular example: yeast
multicellular examples:
plants and animals



Eukaryotic Cell



Characteristics of Prokaryotes vs. Eukaryotes

Characteristic	Prokaryotes	Eukaryotes
Nucleus	Absent	Present
Organelles	Limited	Many different organelles present
DNA structure	Single looping strand	Many chromosomes
Chlorophyll	Dissolved in cytoplasm (when present)	Found in chloroplasts (when present)
Ribosomes	Free floating in cytoplasm Smaller than eukaryotes	Free or attached to membranes Larger than prokaryotes
Cell Walls	Present and chemically complex	May or may not be present and chemically simple
Reproduction	Binary fission	Mitosis



Summary



- All living things are made of one or more cells.
 - Cells are the basic units of structure and function in organisms.
 - All cells arise from existing cells.
- Cells make up tissues->which make up organs->etc.
 - There are many kinds of cells but there are two major groups that all of those cells belong in:
 - **Prokaryotic** → **NO NUCLEUS** & few organelles...bacteria
 - **Eukaryotes** → **NUCLEUS**, lots of organelles...**everything** except bacteria

Summary Continued

- ALL cells are made up of the 4 organic macromolecules- carbohydrates, lipids, proteins and nucleic acids
- ALL cells contain:
 - cell membrane
 - Cytoplasm
 - Ribosomes
 - DNA