

*PROKARYOTIC &
EUKARYOTIC CELLS*

Modern Classification

- Five Kingdom System: Older system, lumps all prokaryotic species into one kingdom: **Monera**

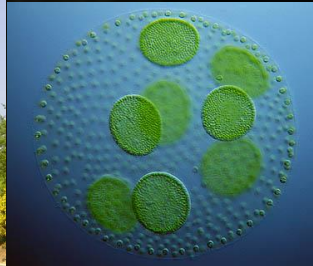
Animal



Plant



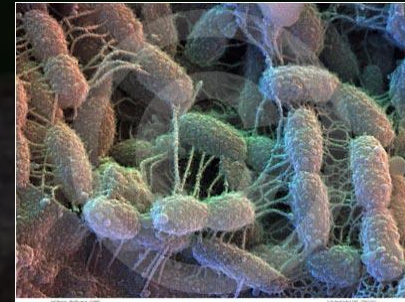
Protist



Fungi



Monera



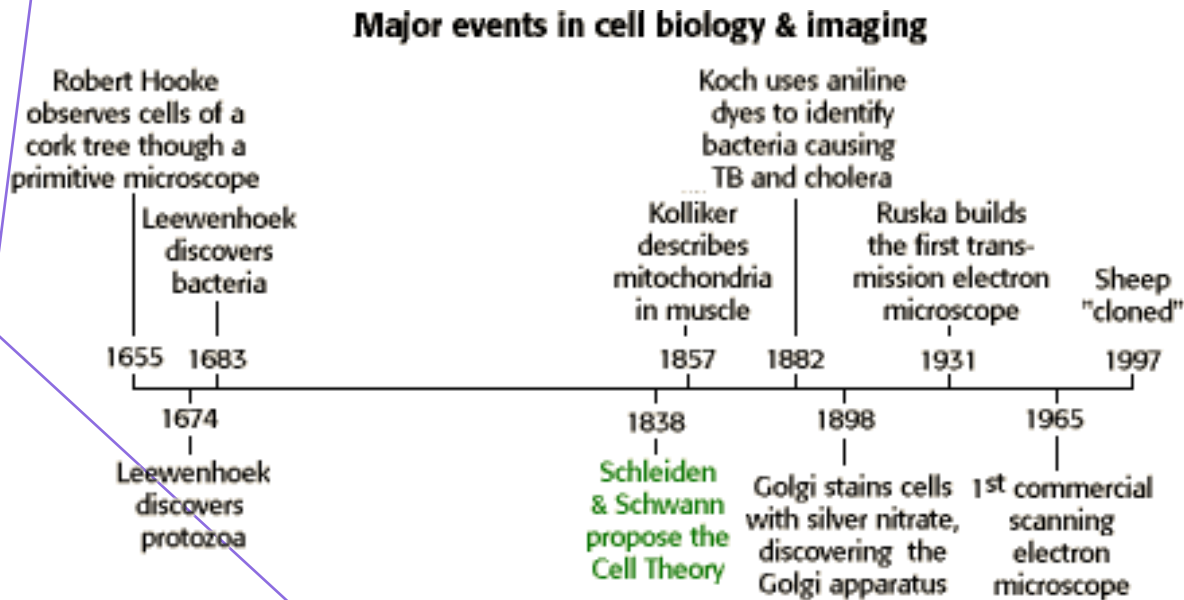
*STRUCTURE
AND
FUNCTION*



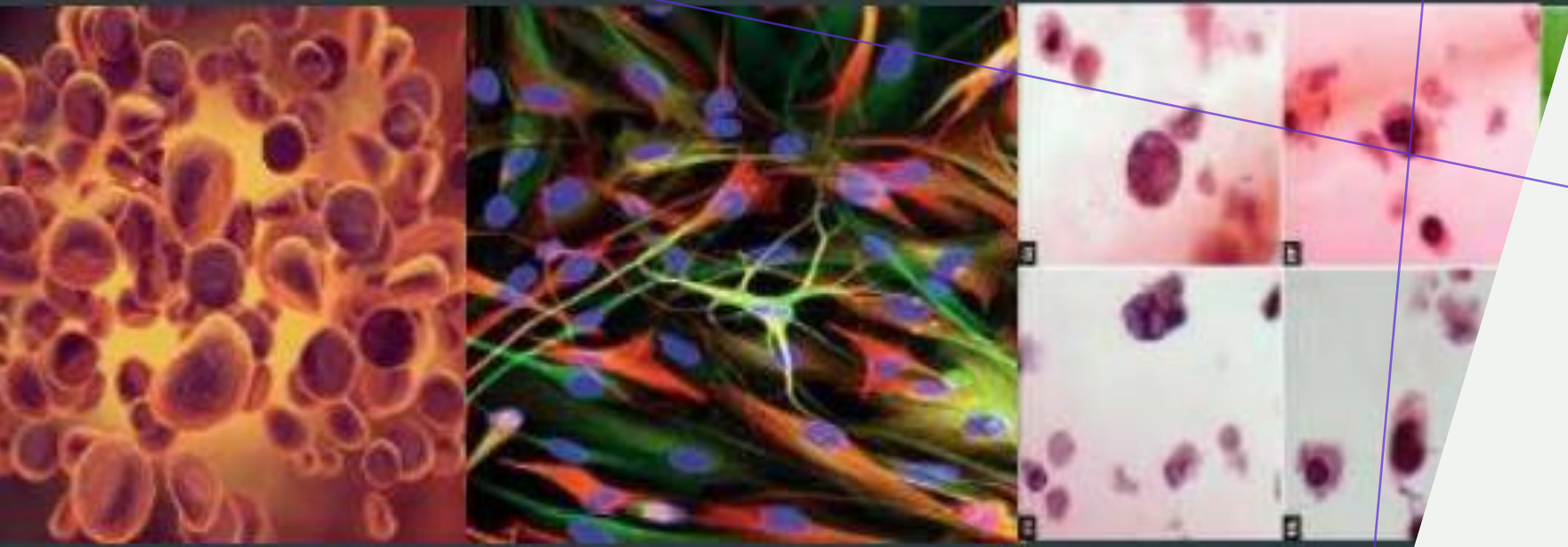
INTRODUCTION

- ✓ The smallest unit of life is cell. All living beings except the viruses are composed of one or many cells.
- ✓ On the cytological basis, the cellular organisms fundamentally may have either prokaryotic cells or eukaryotic cells.
- ✓ All unicellular organisms (single cell) including bacteria and archae, which are composed of a single cell, are examples of prokaryotic cells.
- ✓ All multicellular organisms (many or more than one cell) including humans, which are composed of complex or many cells, are examples of eukaryotic cells. Both prokaryotic cells and eukaryotic cells have cytoplasm, cell membrane and genetic material in common.

CELL THEORY SAYS THAT



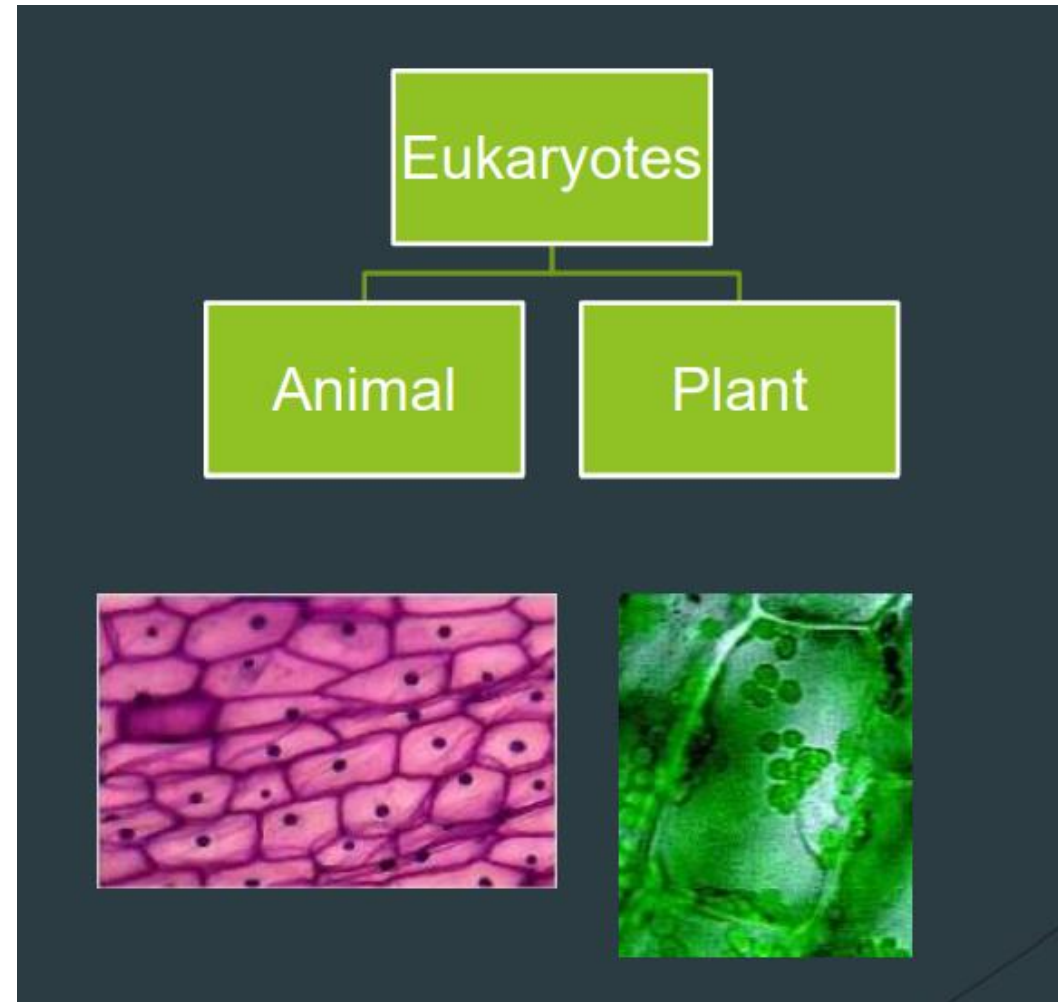
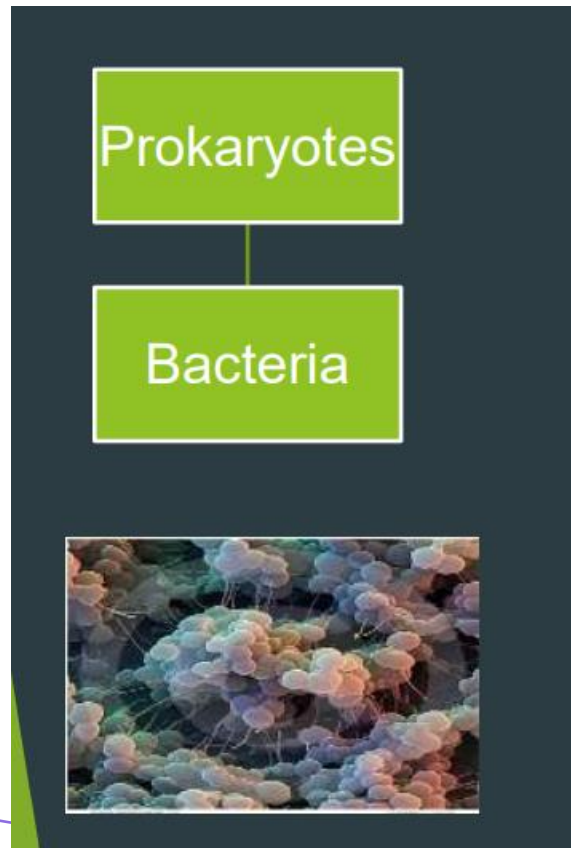
1. All living things are made of Cells.
2. Cells are the basic units of structure and function in all living things.
3. New cells are only made from existing cells.



*CELLS
HAVE
DIVERSE
VARIETIES*

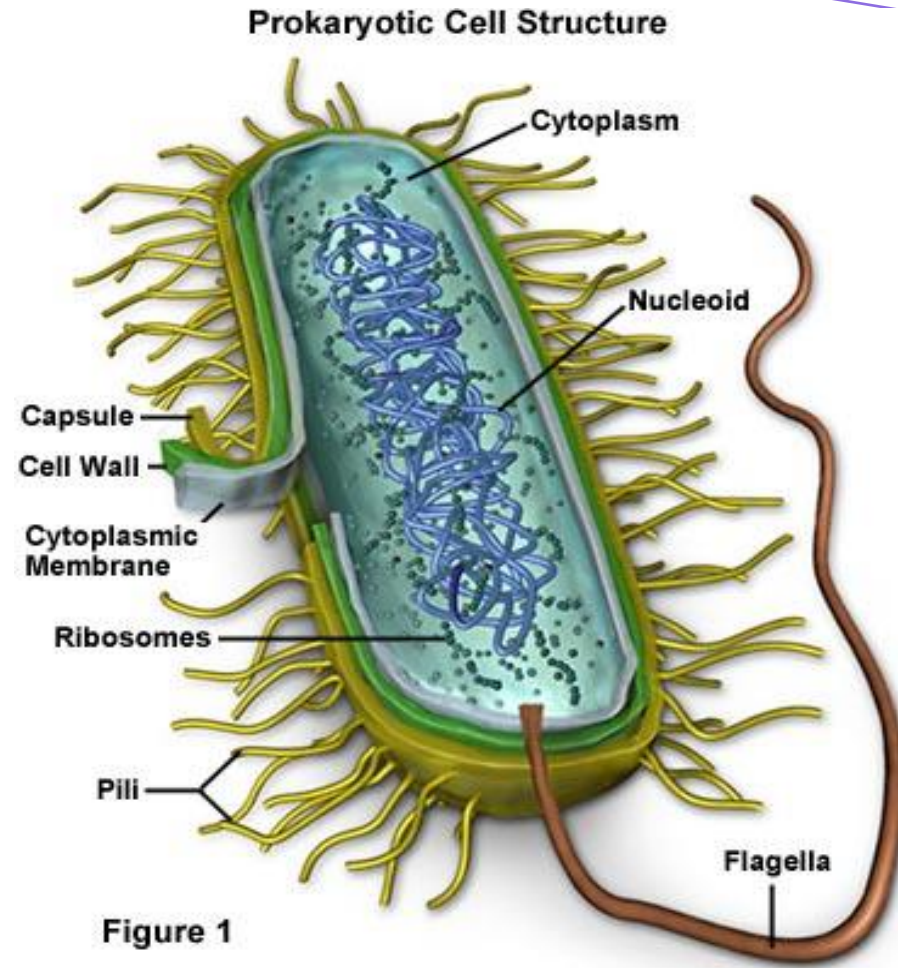


THESE ARE TWO DISTINCT TYPES OF CELLS WITH STRUCTURAL DIFFERENCES.



CELL TYPES

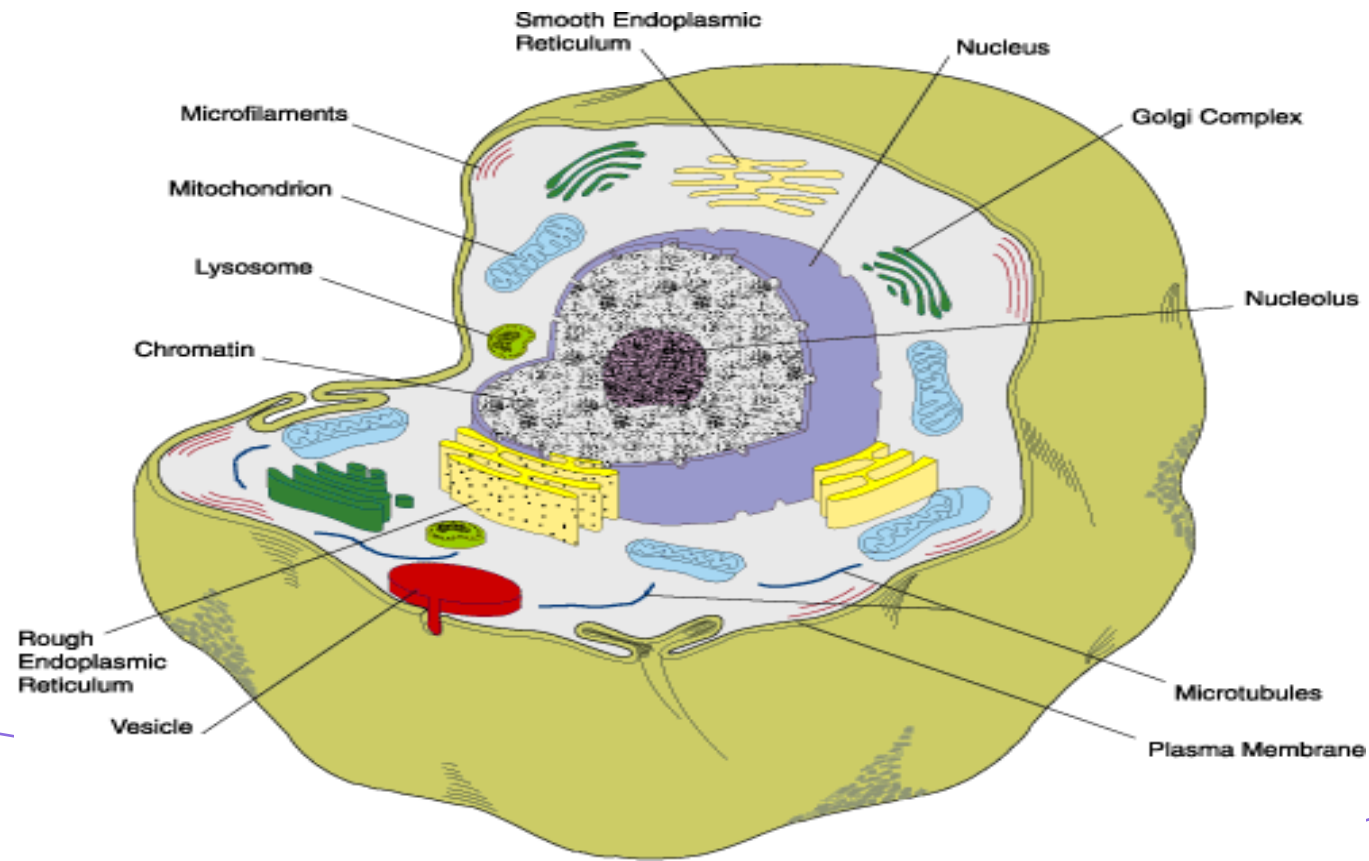
- Two categories:
 1. Cell that have membrane-bound organelles
 - Called **Eukaryotic Cells**
 2. Cells that **do not** have membrane-bound organelles
 - called **prokaryotic cells**
 - **Unicellular** organisms such as **bacteria** are examples of prokaryotes.



CELL TYPES

- **Eukaryotic cells-**

- Cells that contain organelles which are held together by membranes
- Examples include plant and animal cells.



PROKARYOTES

Prokaryotes are organisms without a cell nucleus, or any other membrane bound organelles. Most prokaryotes are unicellular, but some prokaryotes are multicellular.

Examples: Blue-green algae (cyanobacteria), bacteria, archaea etc.

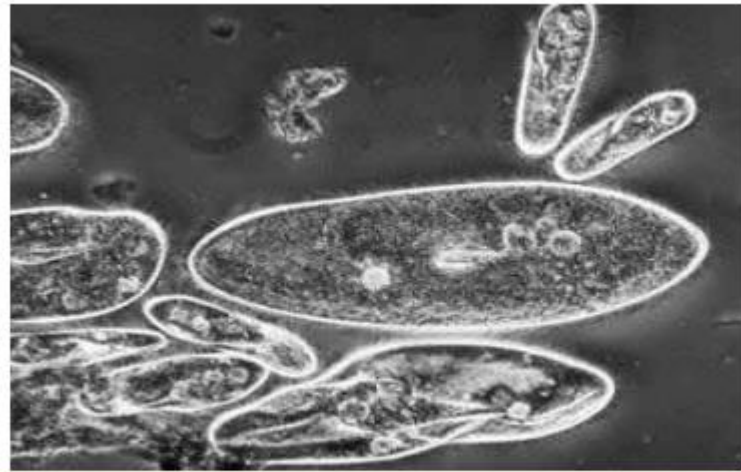
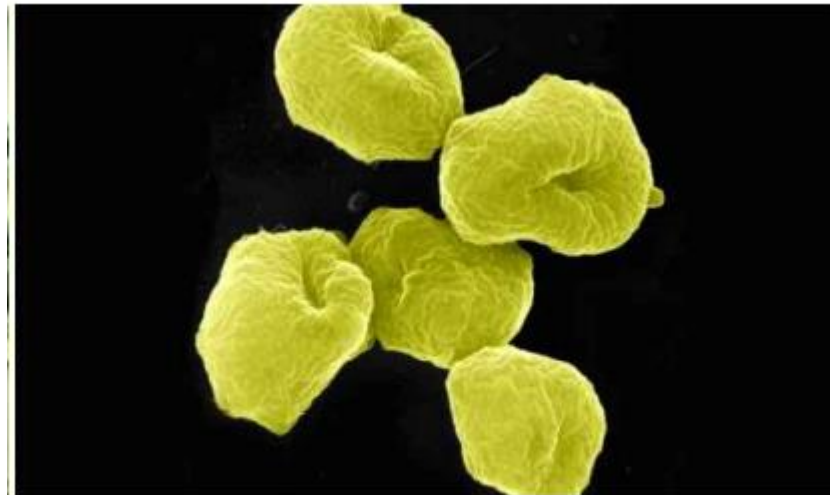


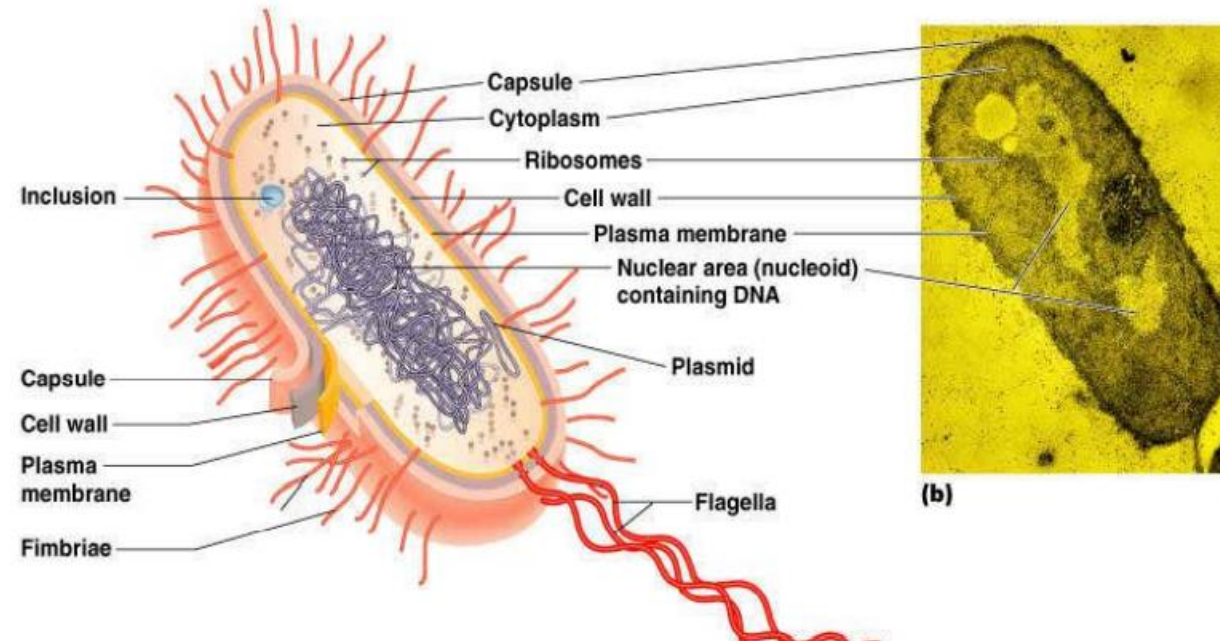
Figure: Microscopic view of Prokaryote (Bacteria)



Archaea

PROKARYOTES

The cell which are composed of primitively organized cytoplasm and nucleus; the nuclear substances (i.e. DNA and RNA) do not remain isolated or separated from the cytoplasm which lacks in mitochondria, endoplasmic reticulum, Golgi complex, lysosomes, centrioles etc., by any nuclear membrane, are called prokaryotic cells.



CHARACTERISTICS OF PROKARYOTES

1. They do not have a nucleus, and their genetic material is not stored in the nucleus.
2. They have some organelles(structures), but not many.
3. They are less complicated that eukaryotes.
4. All bacteria are prokaryotes.
5. Most are unicellular, but some prokaryotes are multicellular.

CHARACTERISTICS OF PROKARYOTES

Prokaryotes are the simplest type of cell

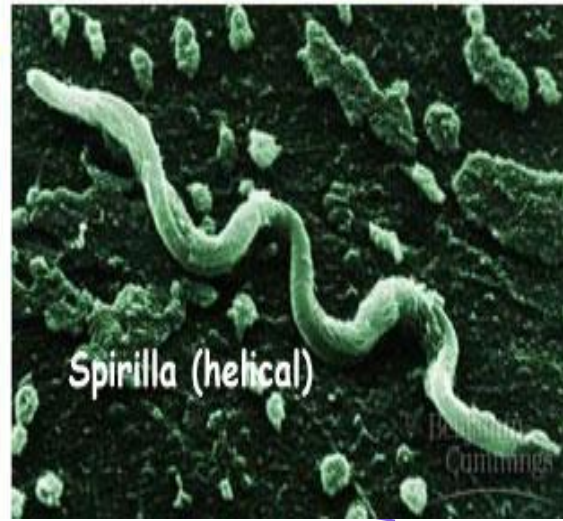
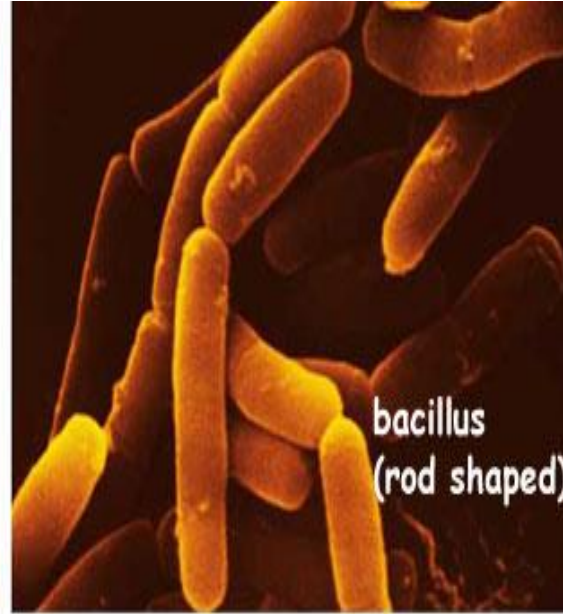
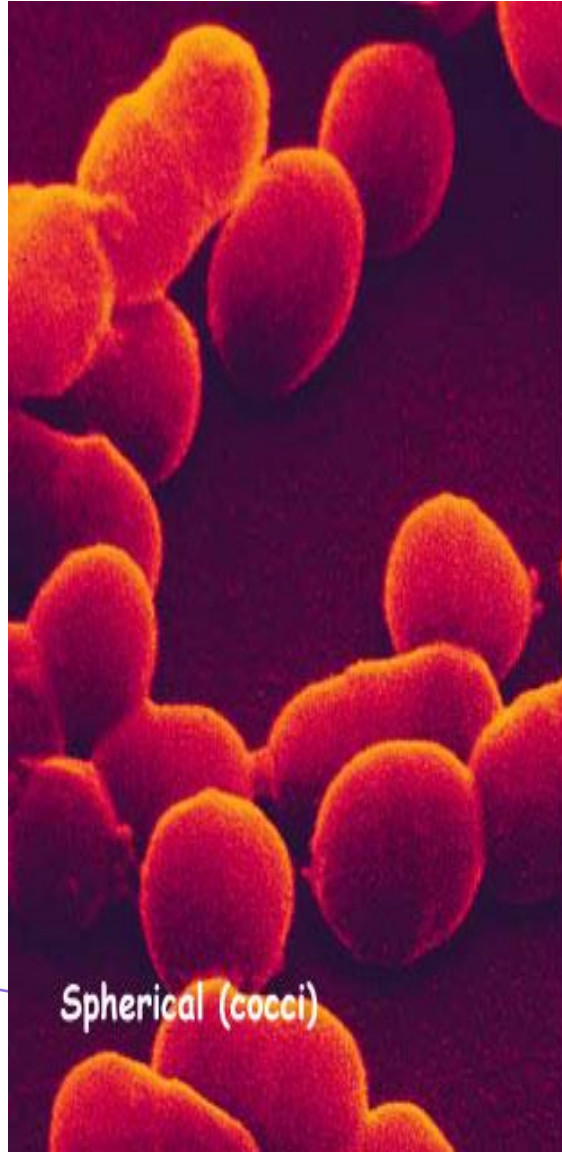
Oldest type of cell appeared about four billion years ago.

Prokaryotes are the largest group of organisms

Prokaryotes organisms are found in all environments.

Prokaryotes do not have a nuclear membrane . Their circular shaped genetic material dispersed throughout cytoplasm.

SHAPES OF PROKARYOTES



- Cocci = spherical (round)
- Bacillus = (rod shaped)
- Spirilla = helical (spiral)

EUKARYOTES

Eukaryotes are organisms whose cells are organized into complex structures by internal membranes and cytoskeleton. The most characteristic membrane bound structure is the nucleus. This feature gives them the name.

Examples: Animals, plants, fungi and protists etc



Figure: Microscopic View of Eukaryote (Animal cell)



Tenuatosa ilisha



Oryza sativa

EUKARYOTES

Eukaryote, any cell or organism that possesses a clearly defined nucleus. The eukaryotic cell has a nuclear membrane that surrounds the nucleus, in which the well-defined chromosomes (bodies containing the hereditary material) are located.

CHARACTERISTICS OF EUKARYOTIC

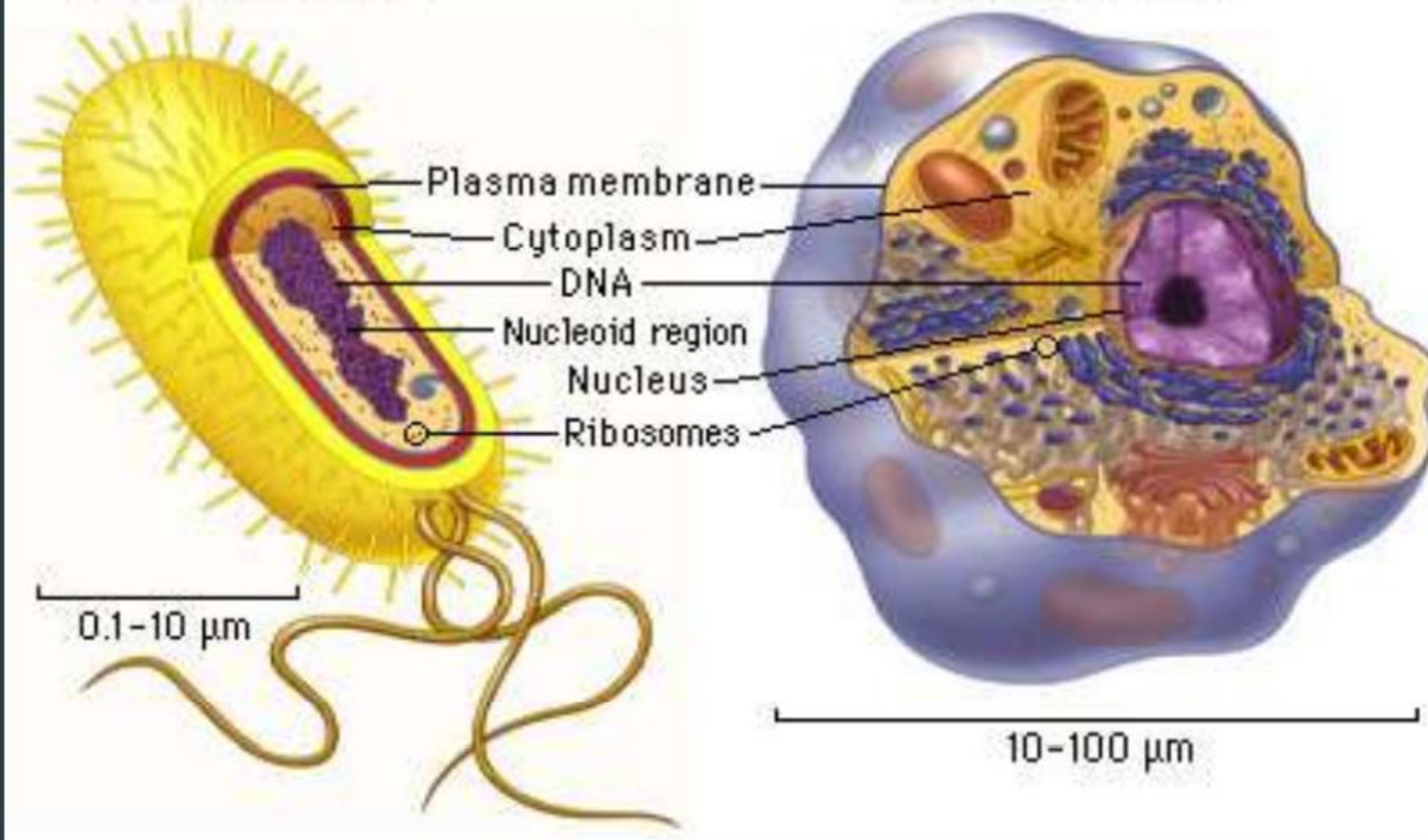
Eukaryotic cells are much more complex than prokaryotic cells. 4. They can be just one cell or can make up more complex multicellular organisms. 5. All plants, animals, fungi, and protists are eukaryotic cells.

They can be just one cell or can make up more complex multicellular organisms.

All plants, animals, fungi, and protists are eukaryotic cells.

Prokaryotic cell

Eukaryotic cell



Prokaryotic and Eukaryotic Cells

Prokaryotes differ from eukaryotes in several ways including but not limited to:

Characteristics	Prokaryotic	Eukaryotic
Types	bacteria (monerans)	protists, fungi, plants, and animals
Organization	unicellular	usually multicellular (exception some protists)
Cell size	small (0.1-10um)	larger (10-100um)
Membrane-bound organelles	absent	present
Reproduction	asexual	asexual and sexual
DNA	circular	linear
Proteins assoc. with DNA	Basic	Histone
Plasma membrane	No sterols	Sterols
Ribosomes	70S	80S
Cytoskeleton	Absent	Present

How do the differences line up?

Prokaryotes

- Organelles lack a membrane
- Ribosomes are the only organelles
- Genetic material floats in the cytoplasm (DNA and RNA)

Eukaryotes

- Organelles covered by a membrane
- Multiple organelles including ribosomes
- Membrane covered Genetic material

How do the differences line up?

Prokaryotes

- Circular DNA
- Unicellular
- Cells are smaller in size
- Has larger number of organisms

Eukaryotes

- Linear DNA
- May be multicellular or unicellular
- Cells are larger in size
- Has smaller number of organisms

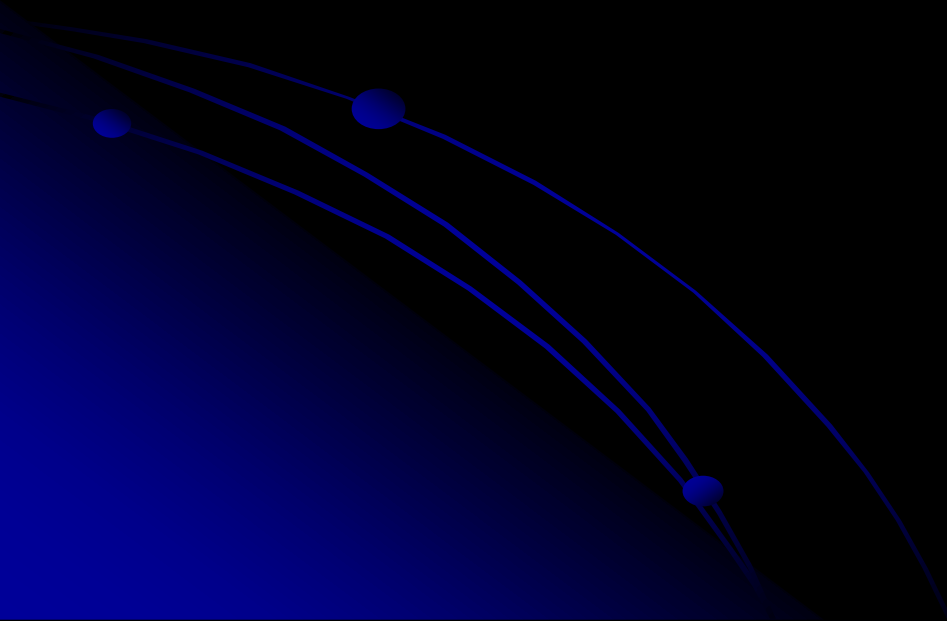
How do the differences line up?

Prokaryotes

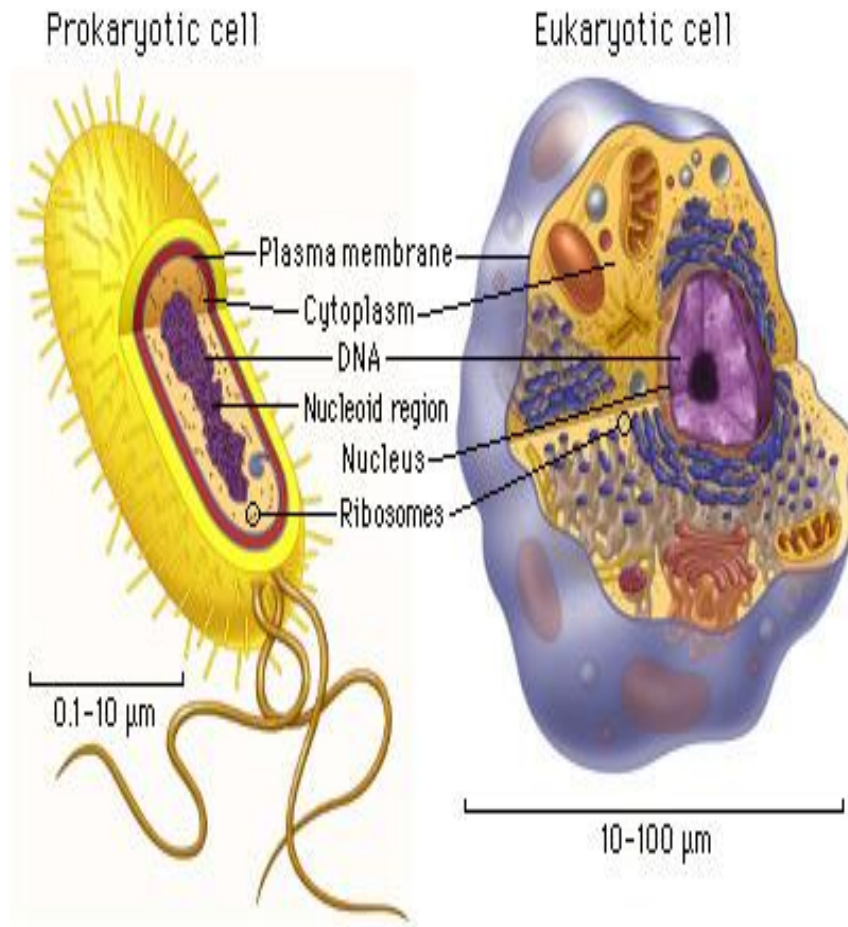
- Appeared 4 billion years ago

Eukaryotes

- Appeared 1 billion years ago



HOW DO THE SIMILARITIES LINE UP?



LETS SEE!!!

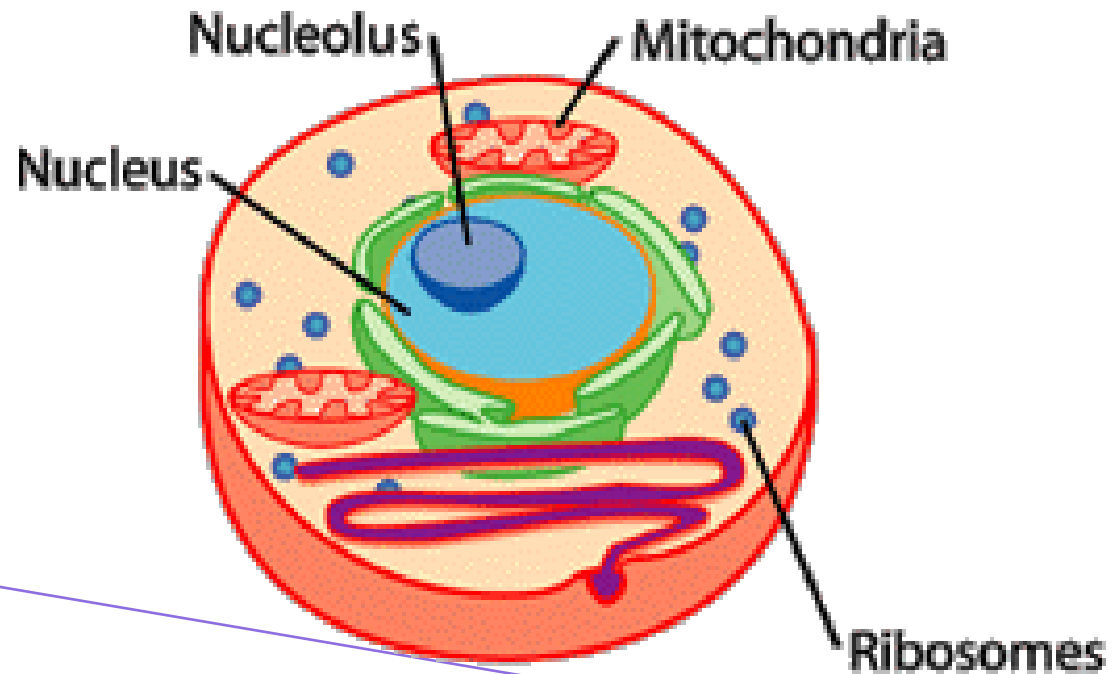
- Both types of cells have cell membranes (outer covering of the cell)
- Both types of cells have ribosomes
- Both types of cells have DNA
- Both types of cells have a liquid environment known as the cytoplasm

CELL MEMBRANE

- Barrier
- Transport (know diffusion, osmosis, facilitated diffusion and active transport) Recognition (e.g., self vs. non-self)
- Reception (for protein hormones)
- Adhesion

RIBOSOMES

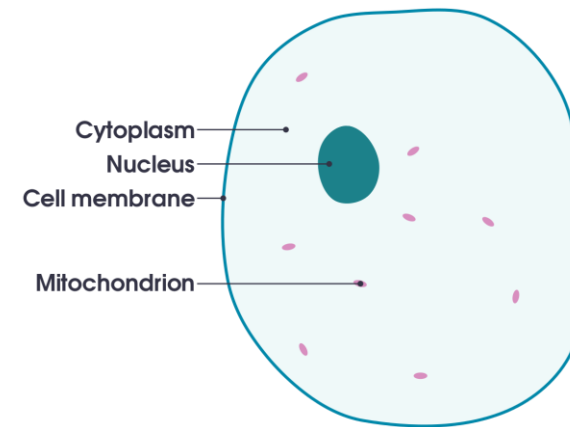
- Site of protein formation (translation)
- Found in both prokaryotes and eukaryotes (different structurally)



CYTOPLASM

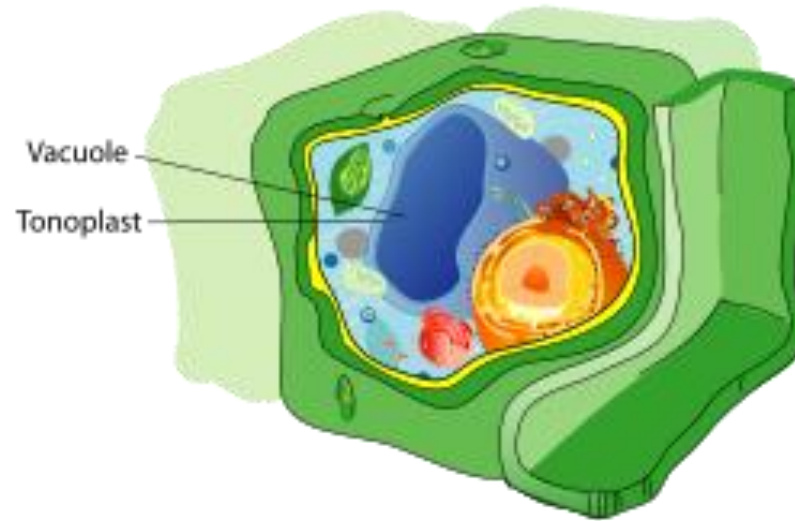
Cytoplasm:

The cytoplasm in the cell is jelly-like liquid that fills all the empty space in a cell. Is the dense gelatinous solution within the cell membrane that is the primary site for the cell's biochemical and synthetic processes



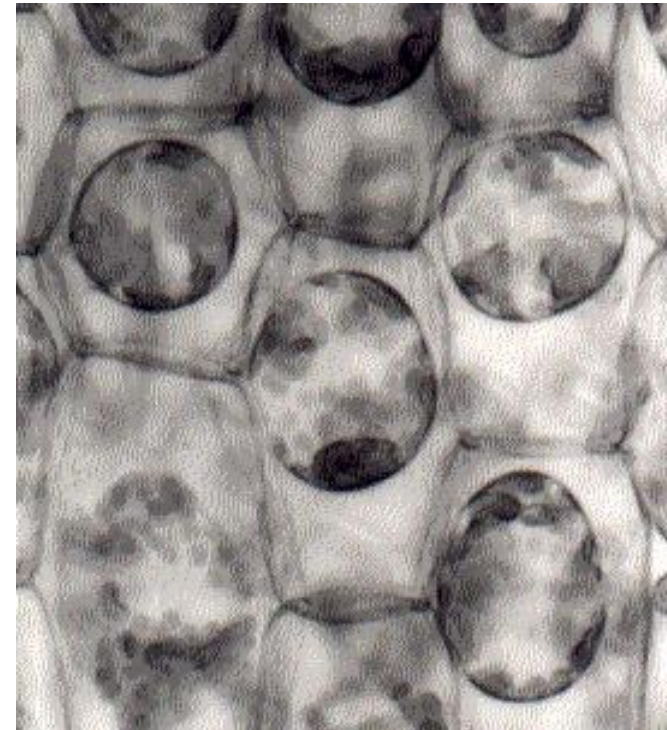
VACUOLES

The vacuoles are the cell's storage place where it keeps water, food and waste.



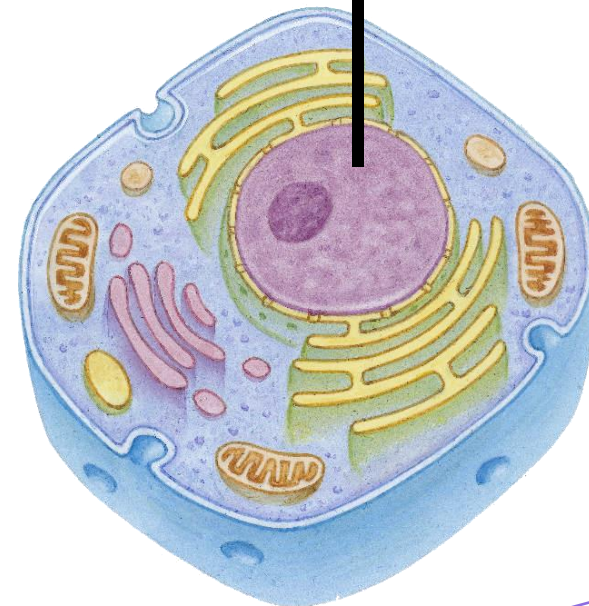
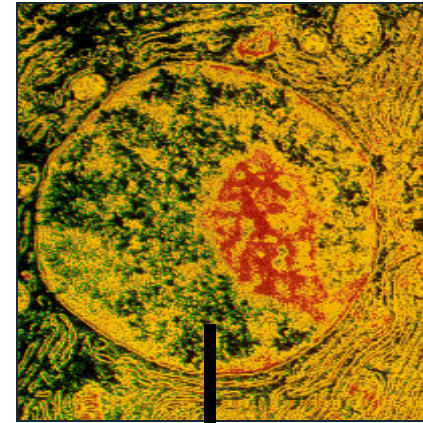
VACUOLES

- In plants, they store **Cell Sap**
- Includes storage of sugars, proteins, minerals, lipids, wastes, salts, water, and enzymes



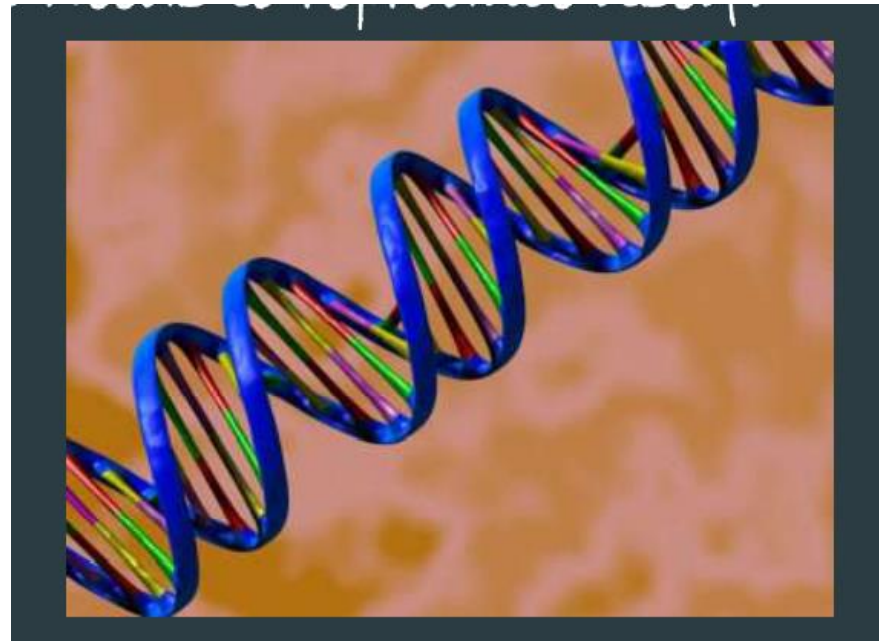
THE CONTROL ORGANELLE - NUCLEUS

- Controls the normal activities of the cell
- Contains the DNA in chromosomes
- Bounded by a **nuclear envelope** (membrane) with pores
- Usually the largest organelle



GENETIC MATERIAL (DNA)

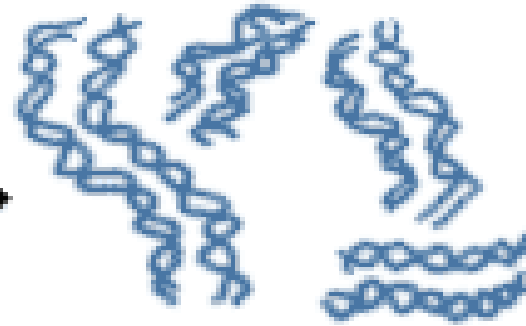
- The genetic material (DNA) is stored in the nucleus and holds information a cell needs to reproduce itself.



INSIDE THE NUCLEUS -

The genetic material (DNA) is found

CHROMATIN

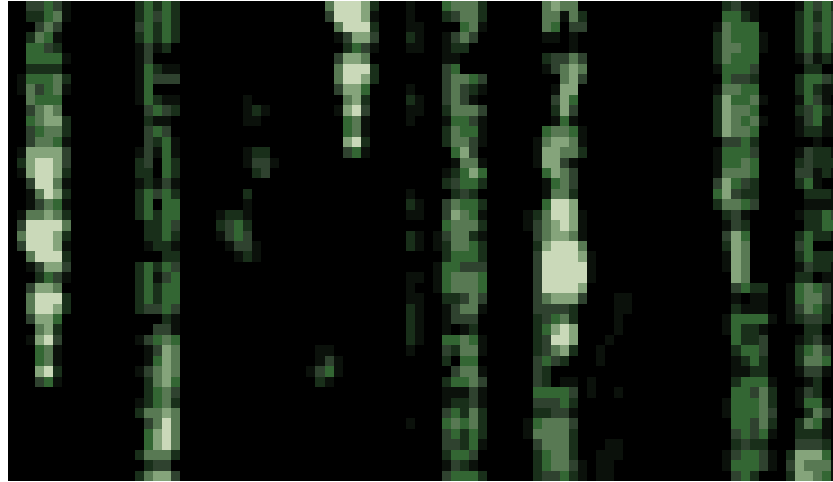


CHROMOSOMES

DNA is spread out
And appears as
CHROMATIN
in non-dividing cells

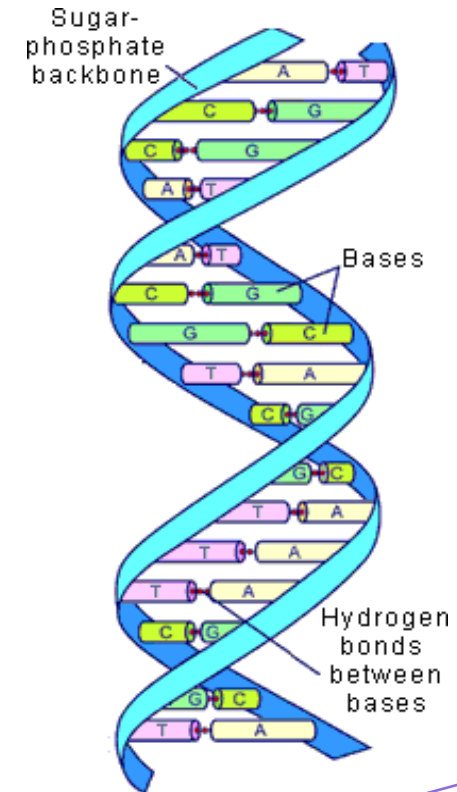
DNA is condensed &
wrapped around proteins
forming
as **CHROMOSOMES**
in dividing cells

WHAT DOES DNA DO?



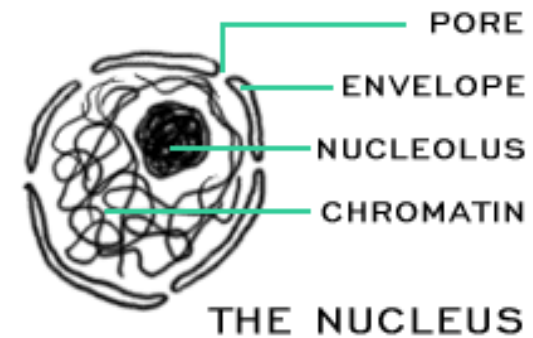
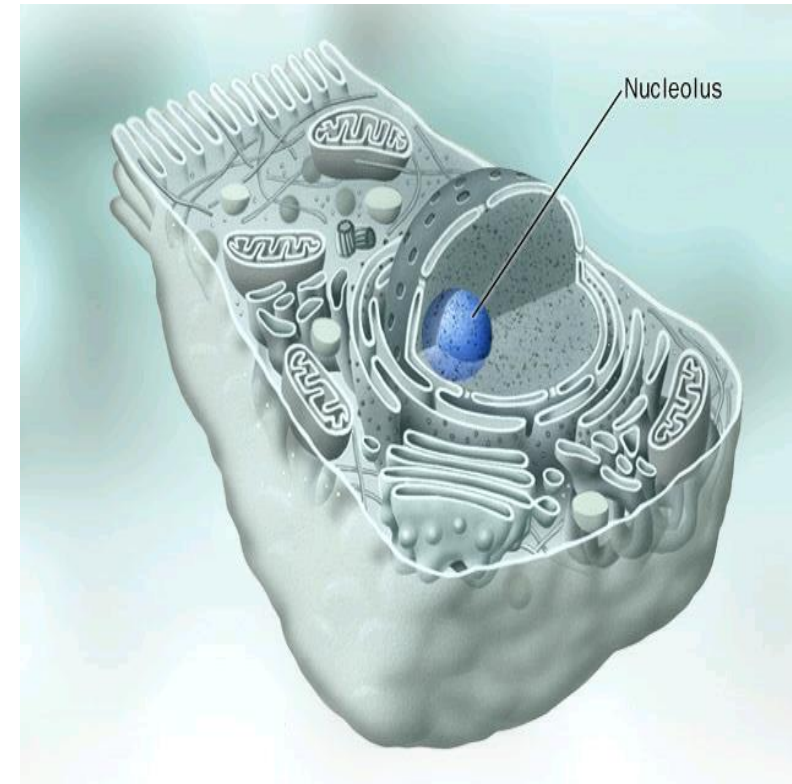
DNA is the **hereditary material** of the cell

Genes that make up the DNA molecule code for different **proteins**

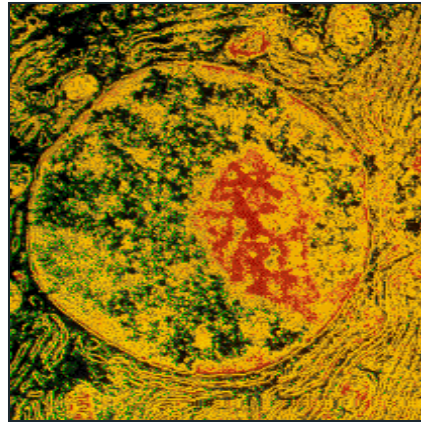


NUCLEOLUS

- Inside nucleus
- Disappears when cell divides
- Makes ribosomes that make proteins

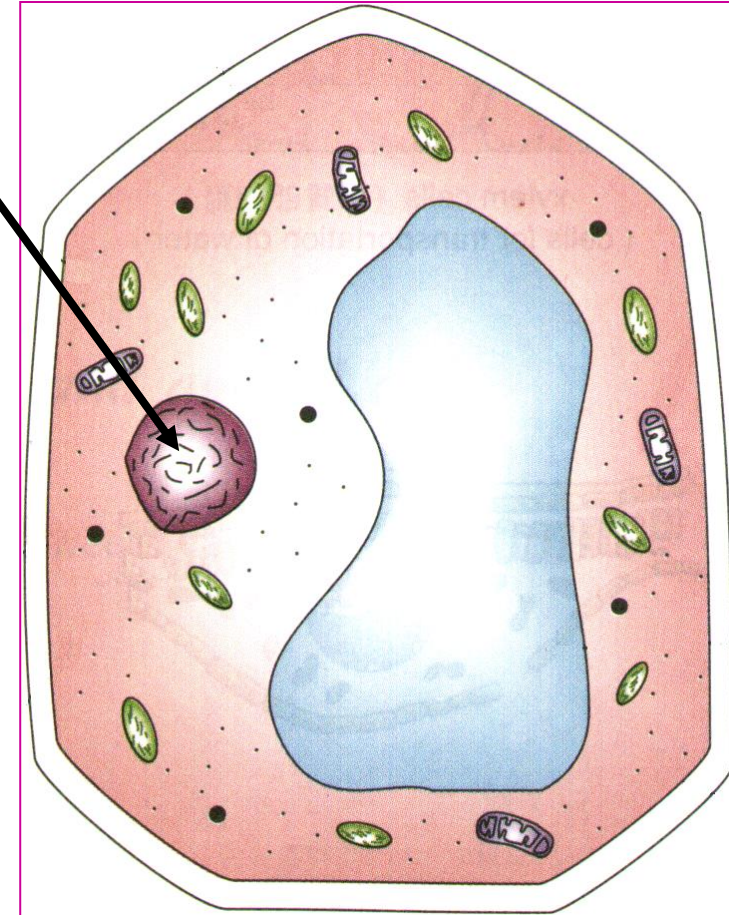


MORE ON THE NUCLEUS



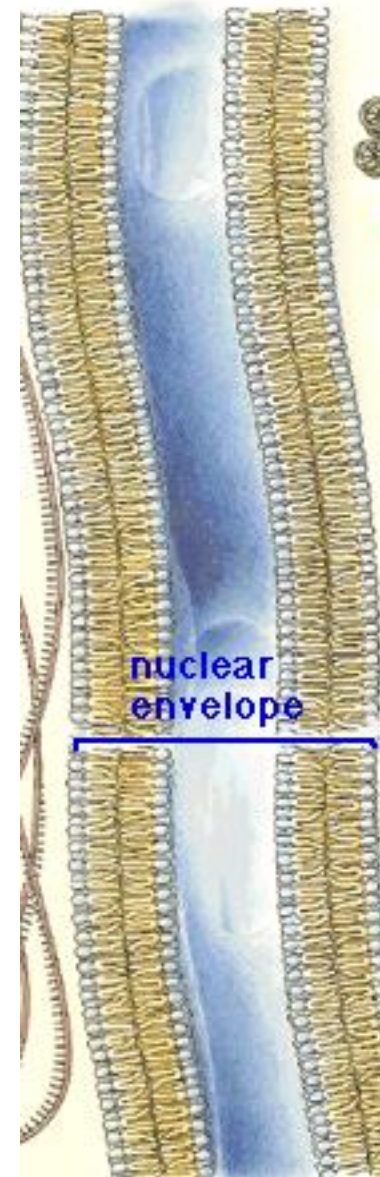
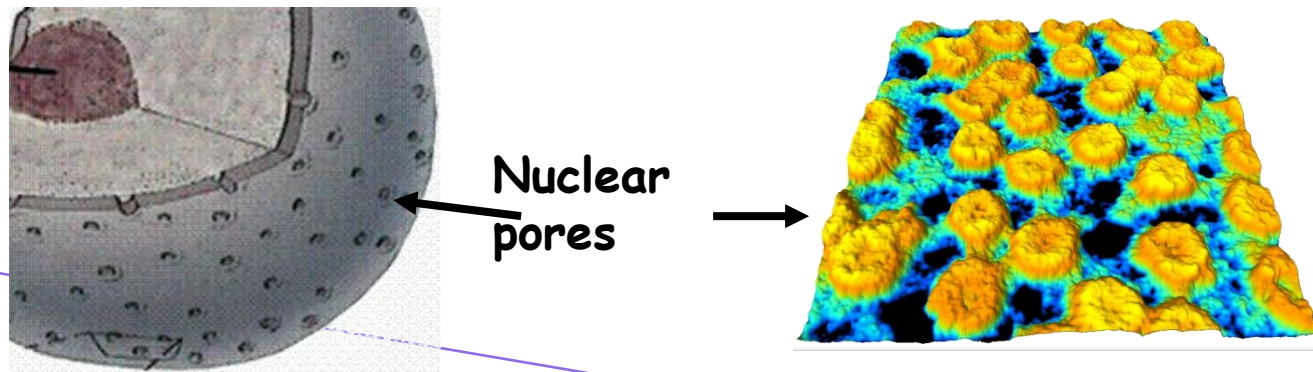
- Each cell has fixed number of chromosomes that carry **genes**
- **Genes** control cell characteristics

Nucleus



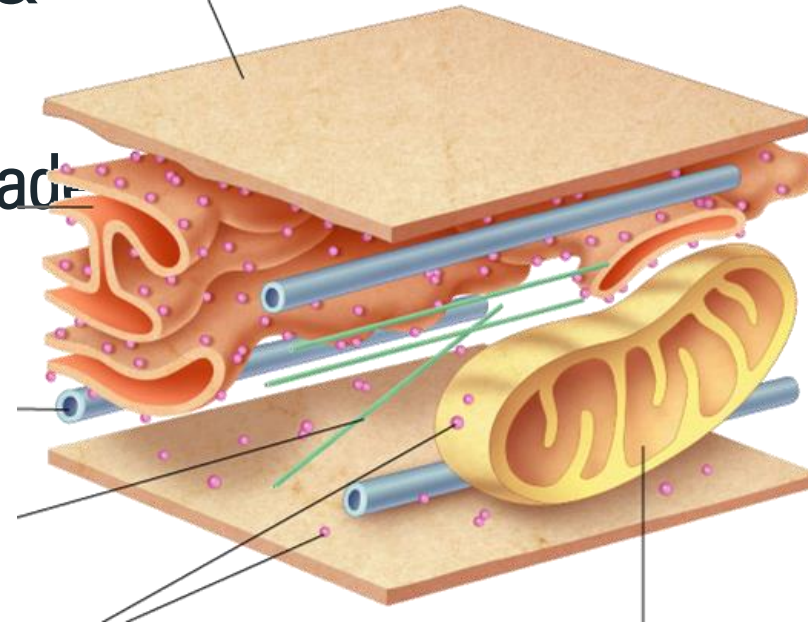
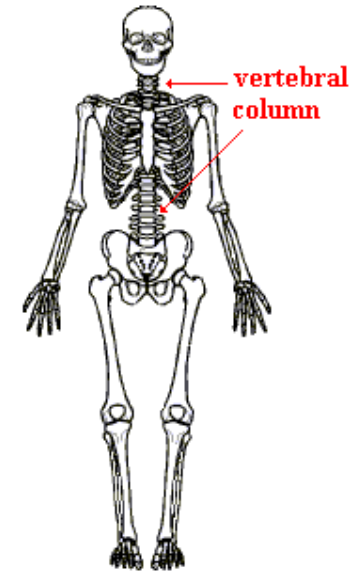
NUCLEAR ENVELOPE

- **Double membrane** surrounding nucleus
- Also called **nuclear membrane**
- Contains **nuclear pores** for materials to enter & leave nucleus

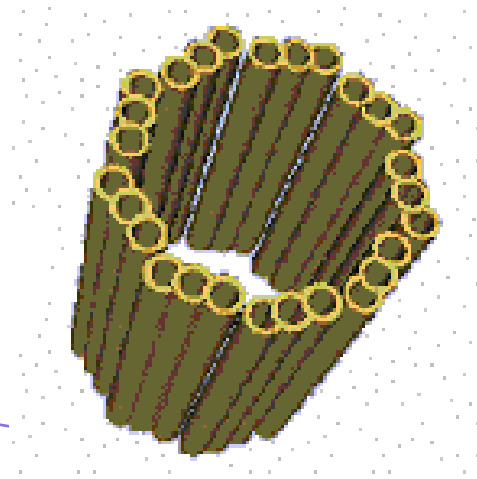


CYTOSKELETON

- Helps cell maintain **cell shape**
- Also help **move organelles** around
- Made of **proteins**
- **Microfilaments** are threadlike & made of ACTIN
- **Microtubules** are tubelike & made of TUBULIN



CENTRIOLES



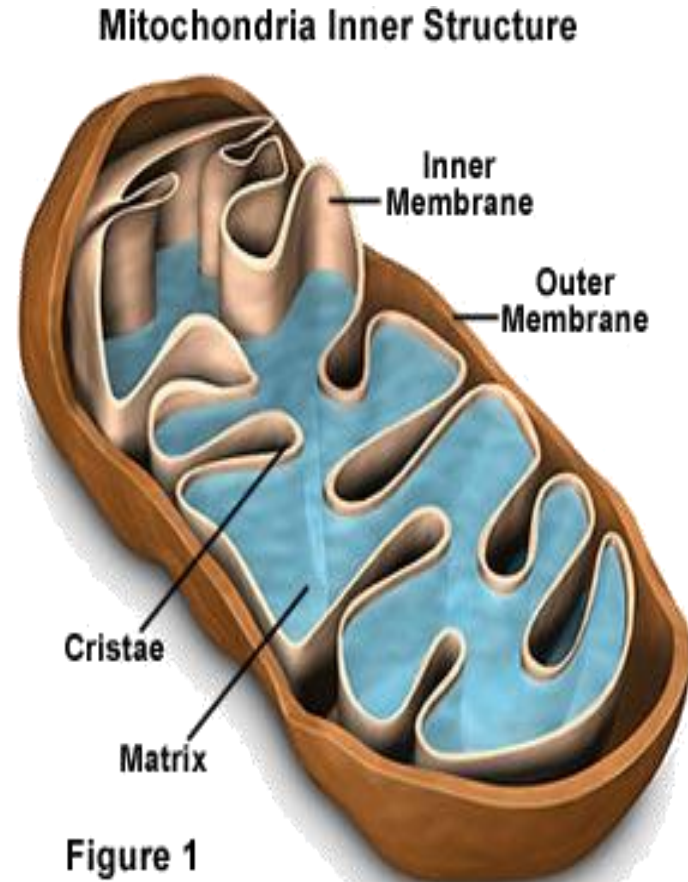
- Found only in **animal** cells
- **Paired** structures near nucleus
- Made of bundle of **microtubules**
- Appear during **cell division** forming **mitotic spindle**
- Help to **pull chromosome pairs apart** to opposite ends of the cell

MITOCHONDRION (PLURAL = MITOCHONDRIA)

- “Powerhouse” of the cell
- Generate cellular **energy (ATP)**
- More **active cells** like **muscle** cells have **MORE mitochondria**
- Both plants & animal cells have mitochondria
- Site of **CELLULAR RESPIRATION** (burning glucose)



MITOCHONDRIA



Surrounded by a **DOUBLE** membrane

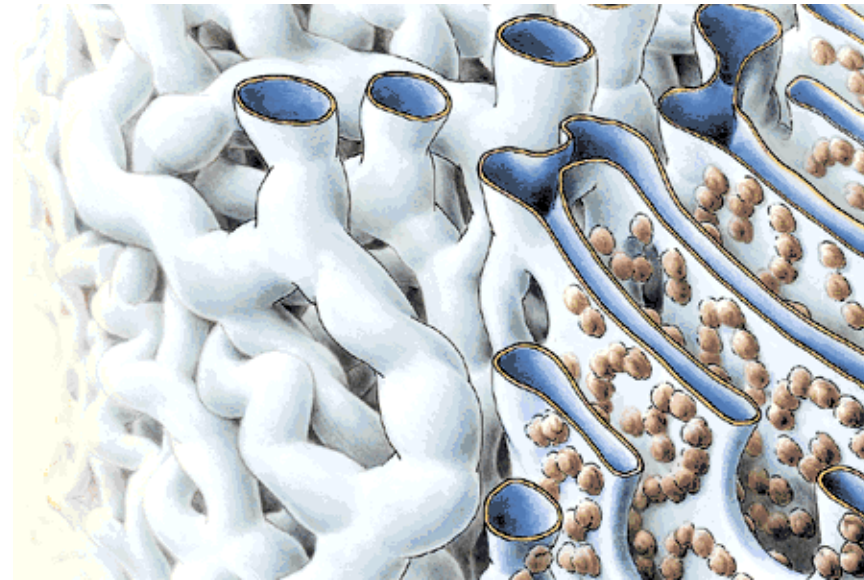
Has its own **DNA**

Folded inner membrane called **CRISTAE** (increases surface area for more chemical Reactions)

Interior called **MATRIX**

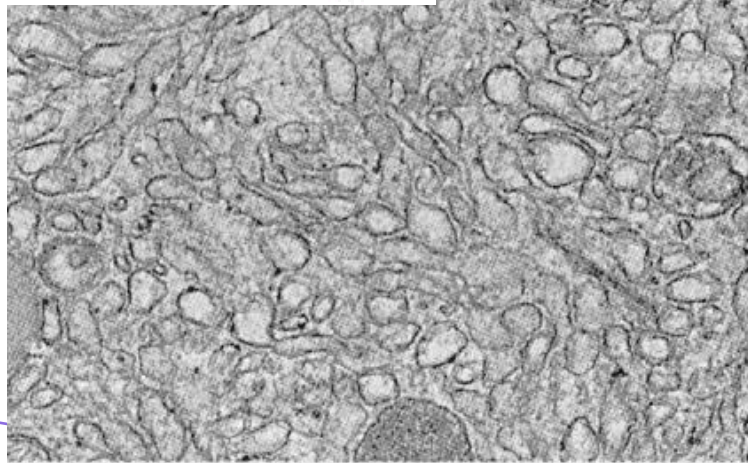
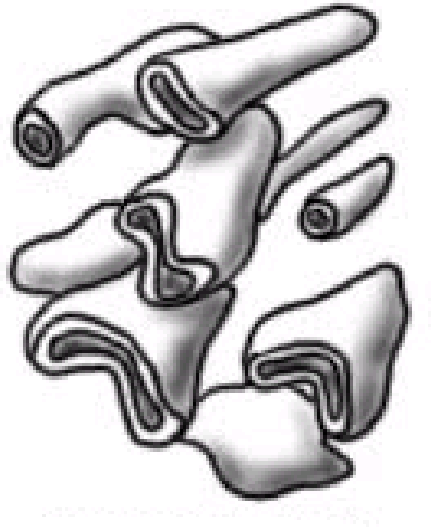
ENDOPLASMIC RETICULUM - ER

- Network of **hollow membrane tubules**
- Connects to **nuclear envelope & cell membrane**
- Functions in **Synthesis** of cell products & **Transport**



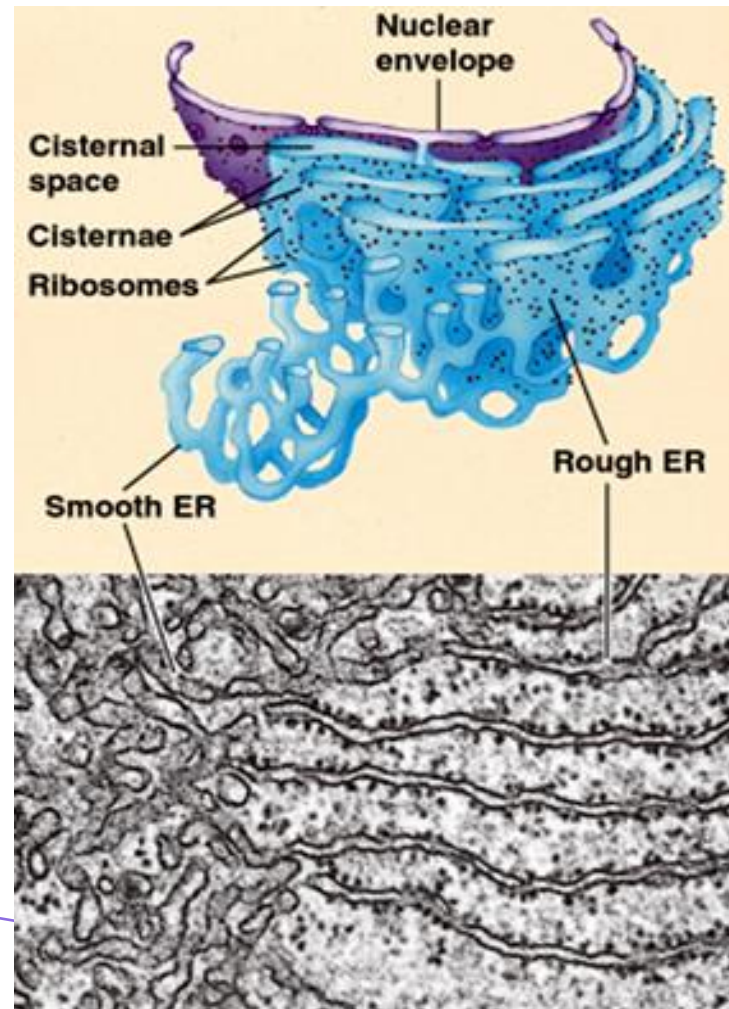
Two kinds of ER ---ROUGH & SMOOTH

FUNCTIONS OF THE SMOOTH ER



- Makes membrane lipids (steroids)
- Regulates calcium (muscle cells)
- Destroys toxic substances (Liver)

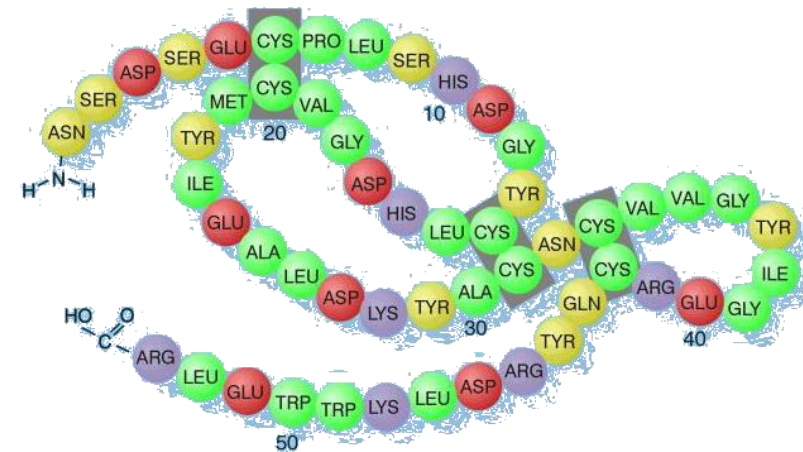
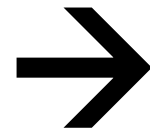
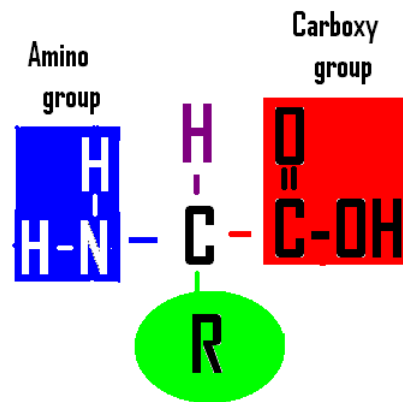
ROUGH ENDOPLASMIC RETICULUM (ROUGH ER)



- Proteins are made by **ribosomes on ER surface**
- They are then **threaded into the interior** of the **Rough ER** to be modified and transported

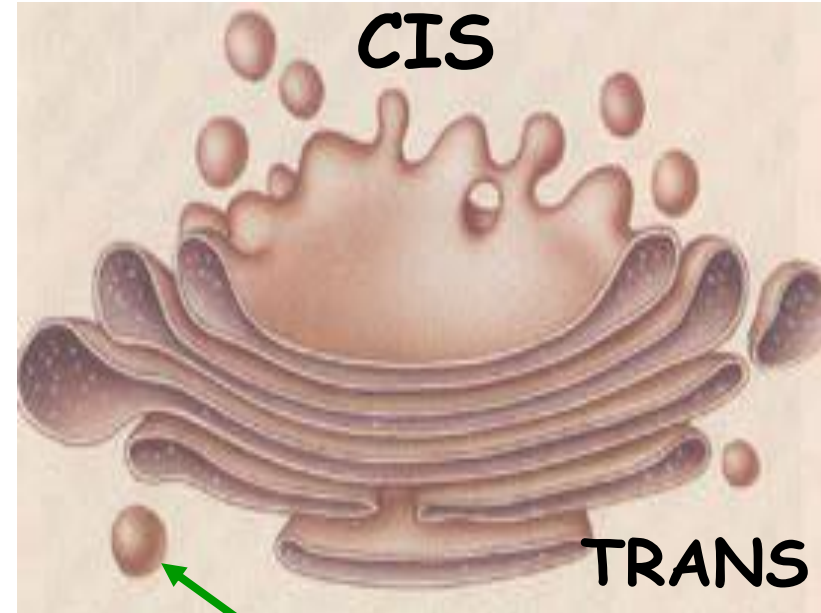
RIBOSOMES

- Made of **PROTEINS** and **rRNA**
- “Protein factories” for cell
- Join amino acids to make proteins through protein synthesis



GOLGI BODIES

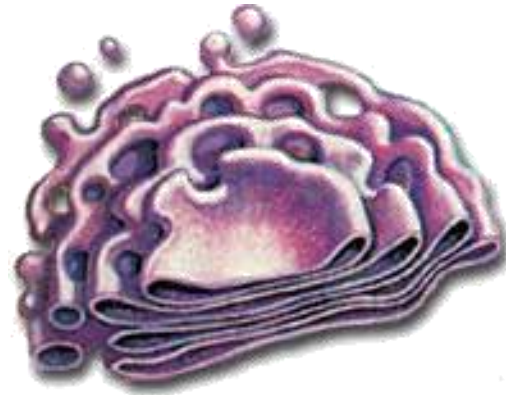
- Stacks of **flattened sacs**
- Have a shipping side (**cis face**) & a receiving side (**trans face**)
- Receive **proteins** made by ER
- **Transport vesicles** with modified proteins pinch off the ends



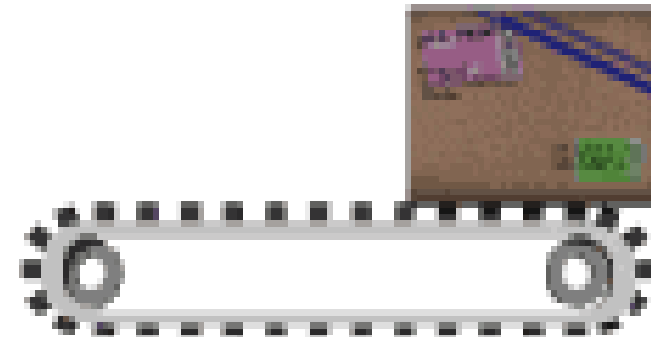
Transport vesicle

GOLGI BODIES

Look like a stack of pancakes

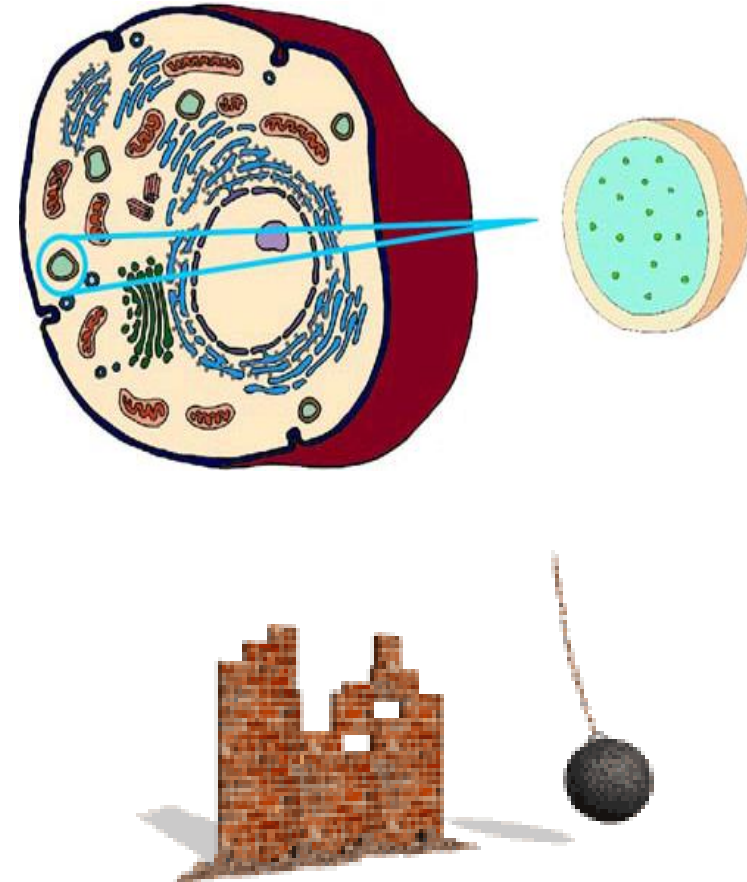


Modify, sort, & package
molecules from ER
for **storage** OR
transport out of cell



LYSOSOMES

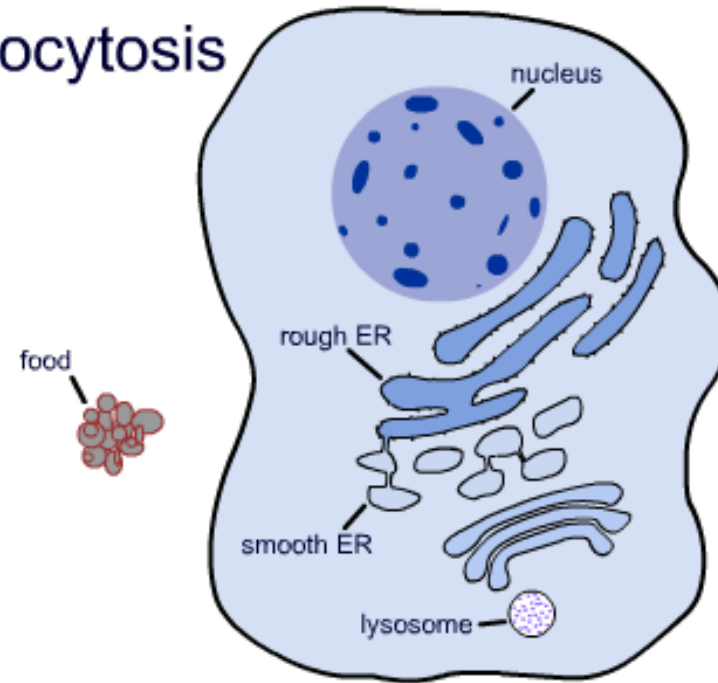
- Contain **digestive enzymes**
- Break down **food, bacteria, and worn out cell parts** for cells
- Programmed for **cell death (APOPTOSIS)**
- Lyse & **release enzymes** to break down & recycle cell parts)



Lysosome Digestion

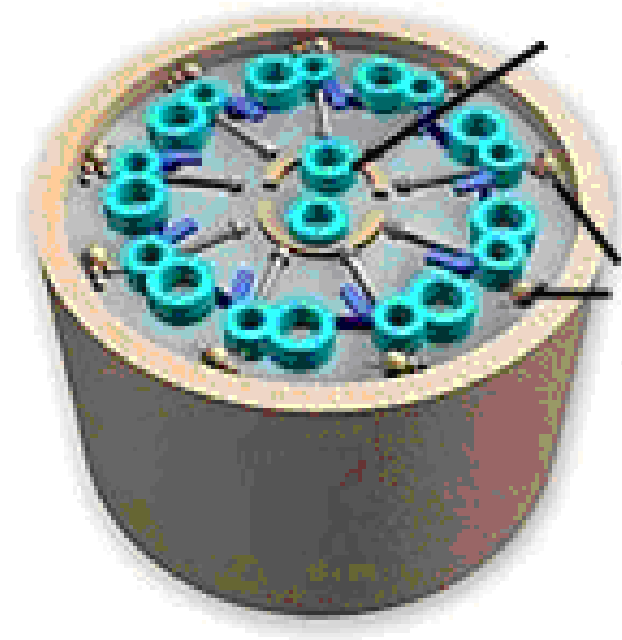
- Cells take in food by **phagocytosis**
- Lysosomes **digest** the food & **get rid of wastes**

Phagocytosis



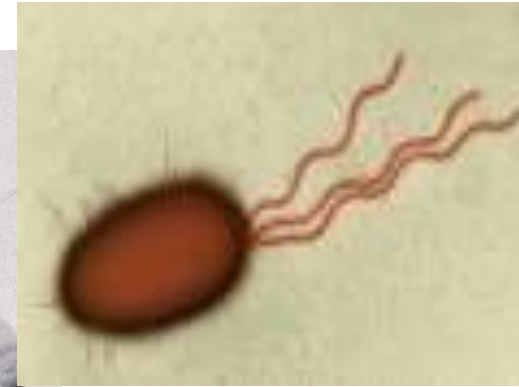
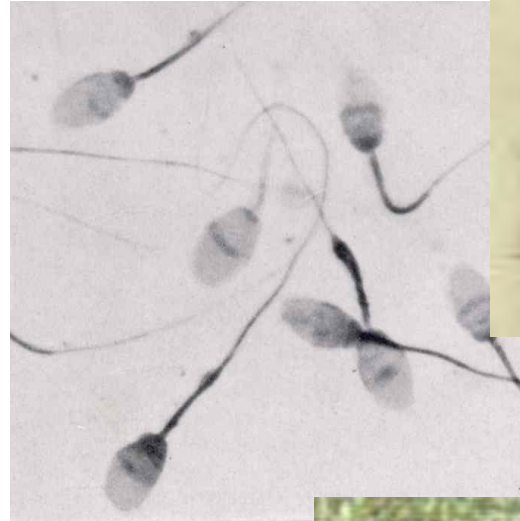
CILIA & FLAGELLA

- Function in **moving cells**, in **moving fluids**, or in **small particles across the cell surface**



CILIA & FLAGELLA

- **Cilia** are shorter and more numerous on cells
- **Flagella** are longer and fewer (usually 1-3) on cells



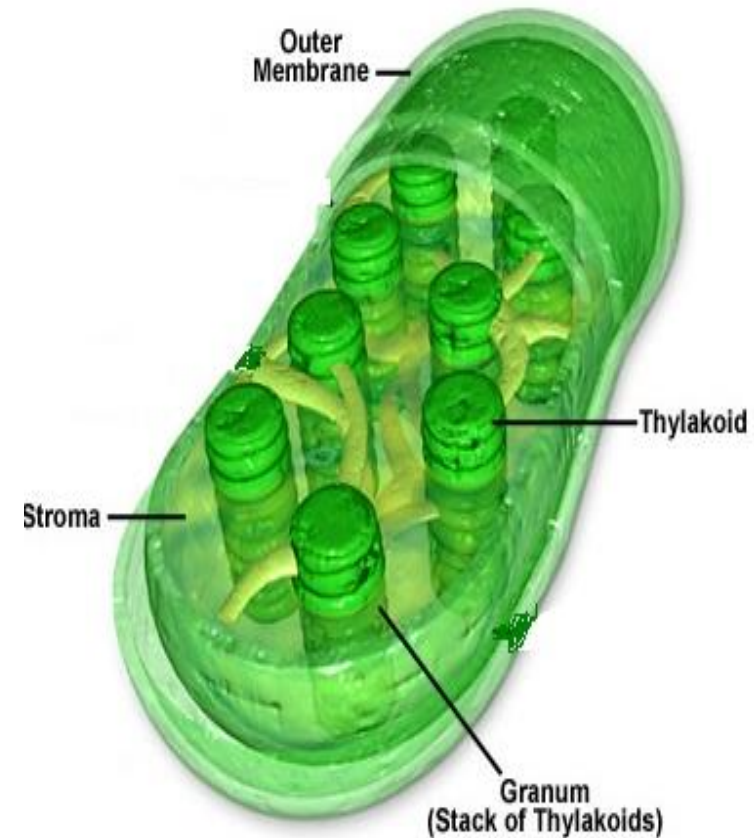
CHLOROPLASTS

- Found only in **producers** (organisms containing **chlorophyll**)
- Use **energy from sunlight** to make own **food (glucose)**
- Energy from sun stored in the **Chemical Bonds of Sugars**



CHLOROPLASTS

- Surrounded by **DOUBLE** membrane
- **Outer** membrane **smooth**
- **Inner** membrane modified into sacs called **Thylakoids**
- Thylakoids in **stacks called Grana** & interconnected
- **Stroma** – gel like material surrounding thylakoids



CONCLUSION

- For cellular study in genetics the knowledge about prokaryotic and eukaryotic cell must be studied clearly.

Microorganisms and all other living organisms are classified as prokaryotes or eukaryotes.

Prokaryotes and eukaryotes are distinguished on the basis of their cellular characteristics.

For example, prokaryotic cells lack a nucleus and other membrane-bound structures known as organelles, while eukaryotic cells have both a nucleus and organelles.

CONCLUSION

- Prokaryotic and eukaryotic cells are similar in several ways. Both types of cells are enclosed by cell membranes (plasma membranes), and both use DNA for their genetic information.

Prokaryotes include several kinds of microorganisms, such as bacteria and cyanobacteria.

Eukaryotes include such microorganisms as fungi, protozoa, and simple algae.

Viruses are considered neither prokaryotes nor eukaryotes because they lack the characteristics of living things, except the ability to replicate (which they accomplish only in living cells).