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CELL THEORY



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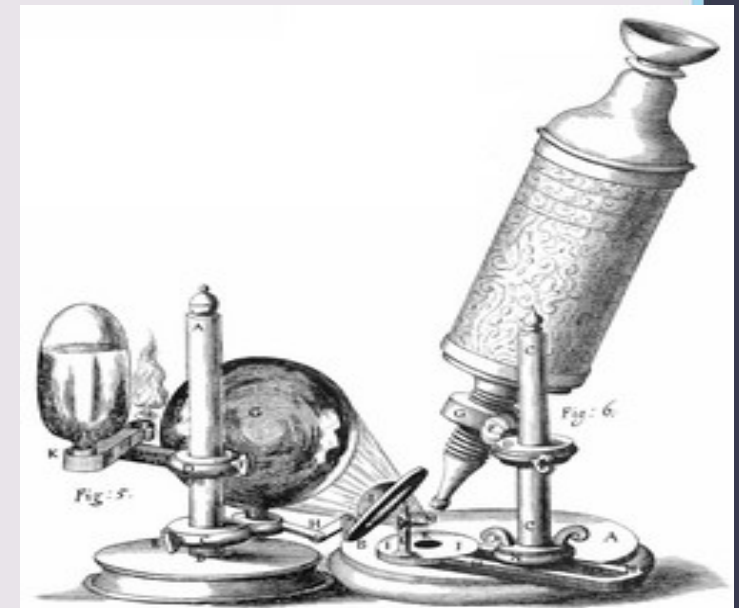
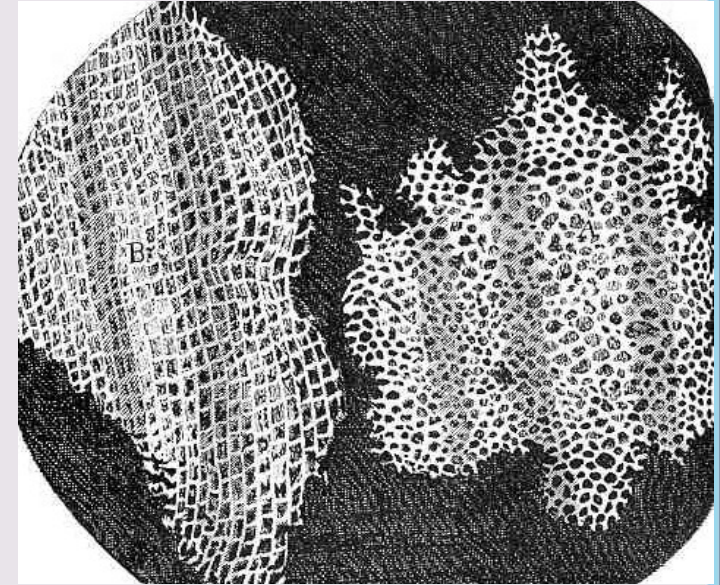


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History of Cells & the Cell Theory

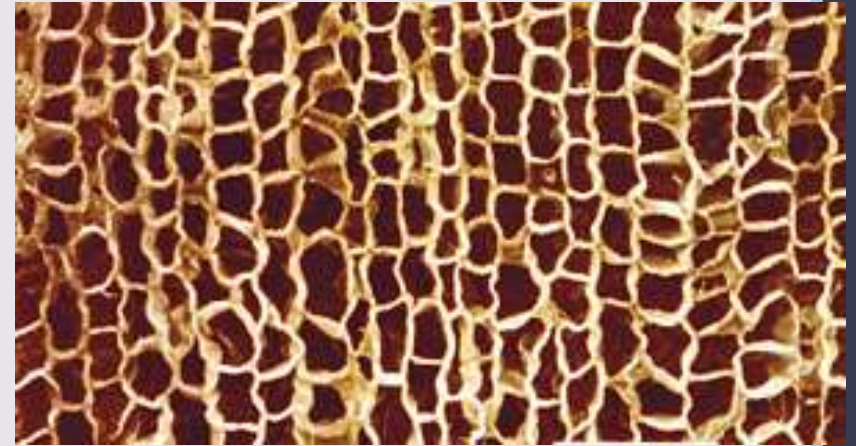
- In 1665, **Robert Hooke** used a microscope to examine a thin slice of **cork** (dead plant cells)
- What he saw looked like small boxes





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- **Hooke is responsible for naming cells**
- **Hooke called them “CELLS” because they looked like the small rooms that monks lived in called Cells**





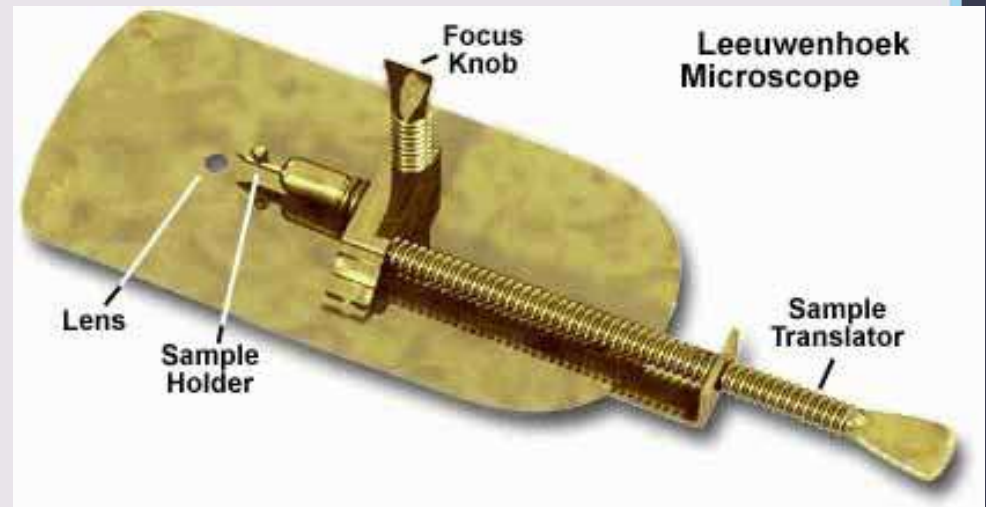
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- In 1673, **Leeuwenhoek** (a Dutch microscope maker), was **first to view organism** (living things)



- Leeuwenhoek used a simple, handheld microscope to **view pond water & scrapings from his teeth**





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Beginning of the Cell Theory

- In 1838, a German botanist named **Matthias Schleiden** concluded that all **plants** were made of cells
- Schleiden is a **cofounder** of the cell theory





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Beginning of the Cell Theory

- In 1855, a German medical doctor named **Rudolph Virchow** observed, under the microscope, **cells dividing**
- He reasoned that **all cells come from other pre-existing cells** by cell division





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CELL THEORY

- All living things are made of **cells**
- Cells are the basic unit of **structure and function** in an organism (basic unit of life)
- Cells come from the **reproduction of existing cells** (cell division)





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Two types of cells

- **Prokaryotes**
- **Eukaryotes**

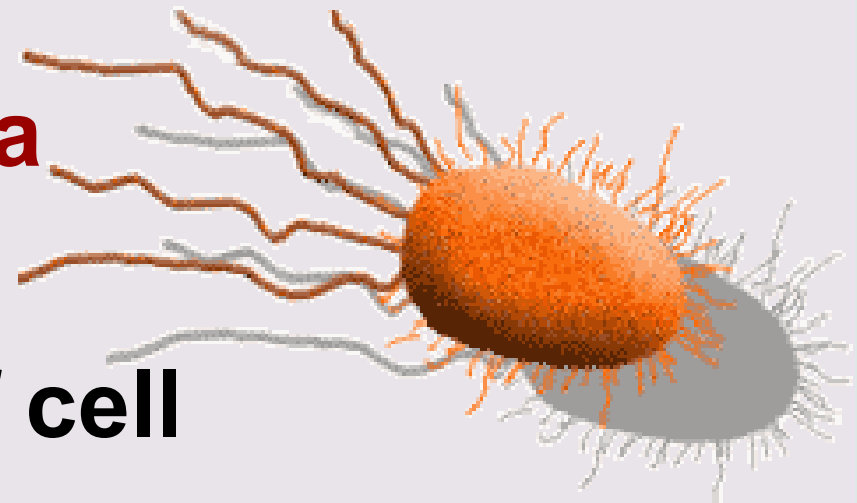


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Prokaryotes – The first Cells

- Cells that **lack a nucleus or membrane-bound organelles**
- Includes **bacteria**
- Simplest type of cell
- Single, **circular chromosome**



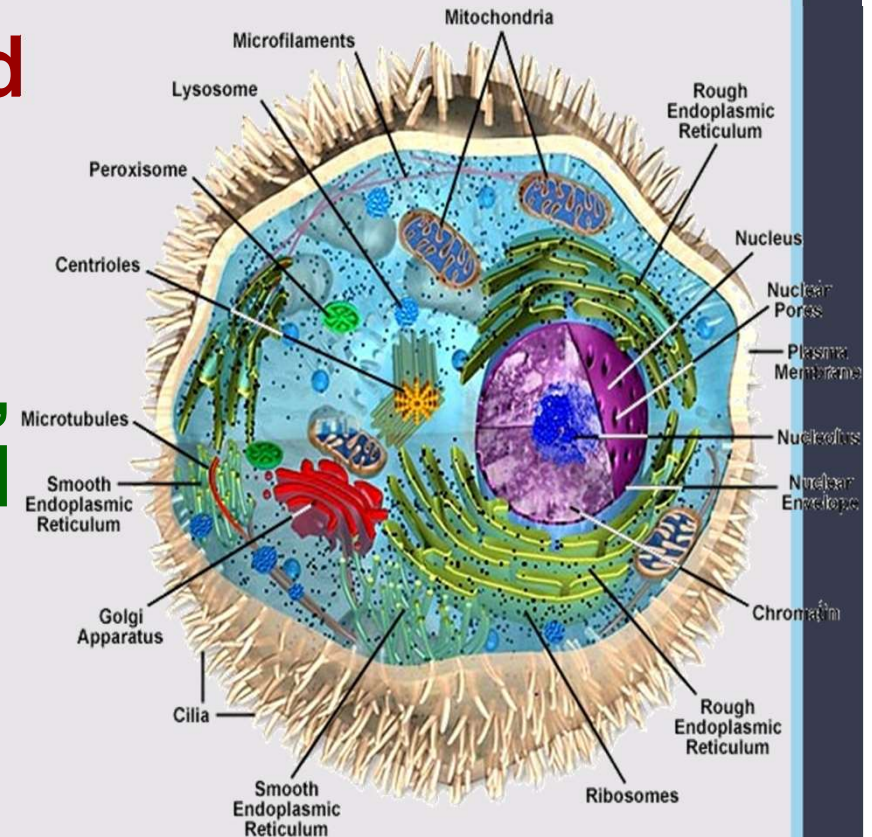


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Eukaryotes

- Cells that **HAVE a nucleus and membrane-bound organelles**
- Includes **protista, fungi, plants, and animals**
- More **complex** type of cells

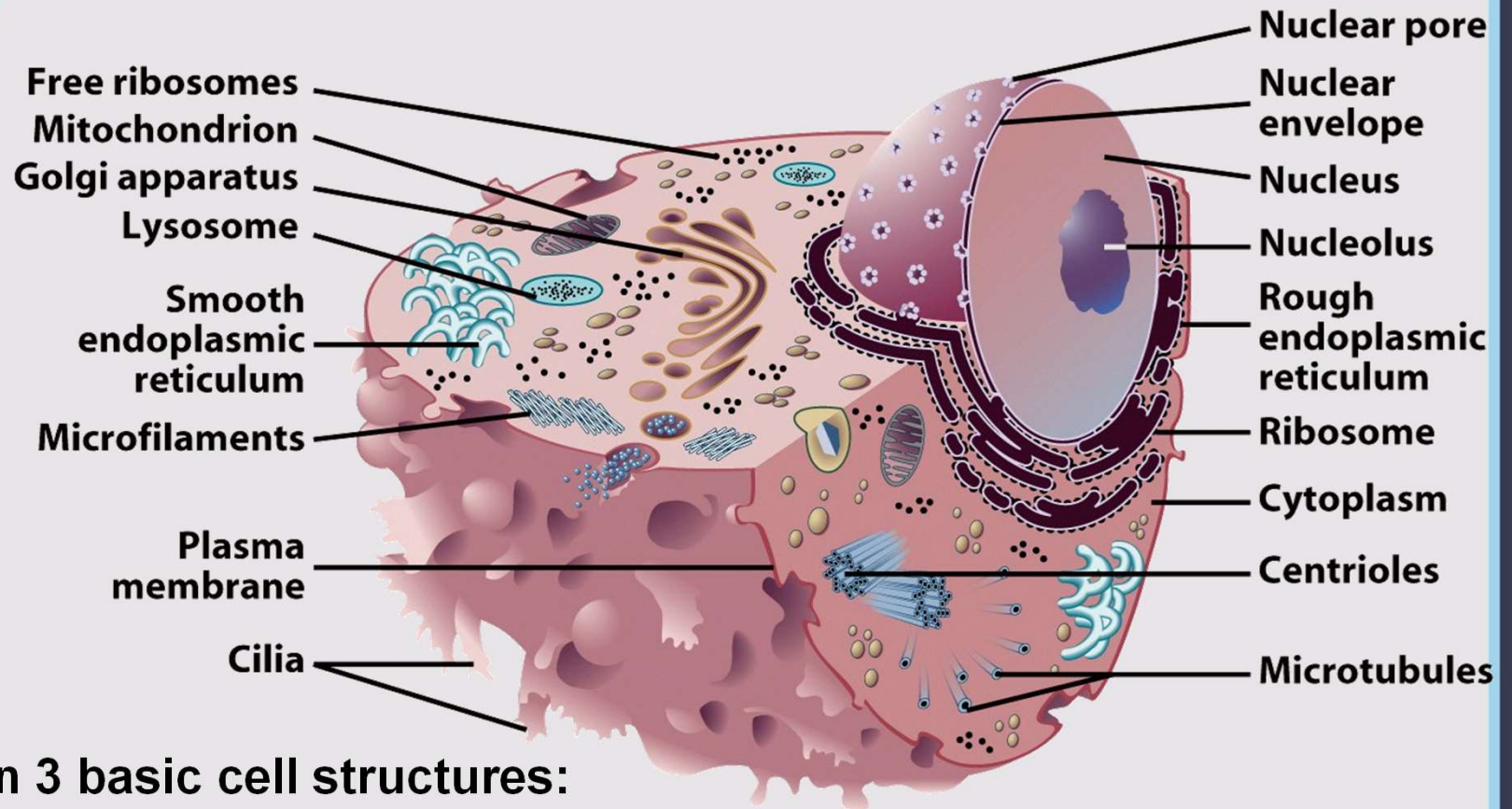




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Eukaryotic Cell



Contain 3 basic cell structures:

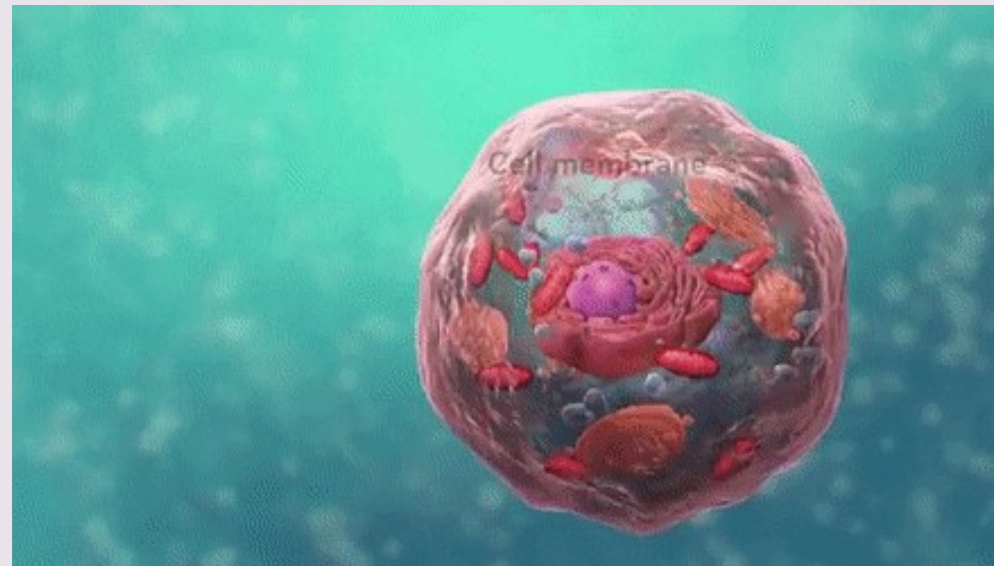
- **Nucleus**
- **Cell Membrane**
- **Cytoplasm with organelles**



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Organelles

- **Very small (Microscopic)**
- **Perform various functions for a cell**
- **Found in the cytoplasm**
- **May or may not be membrane-bound**



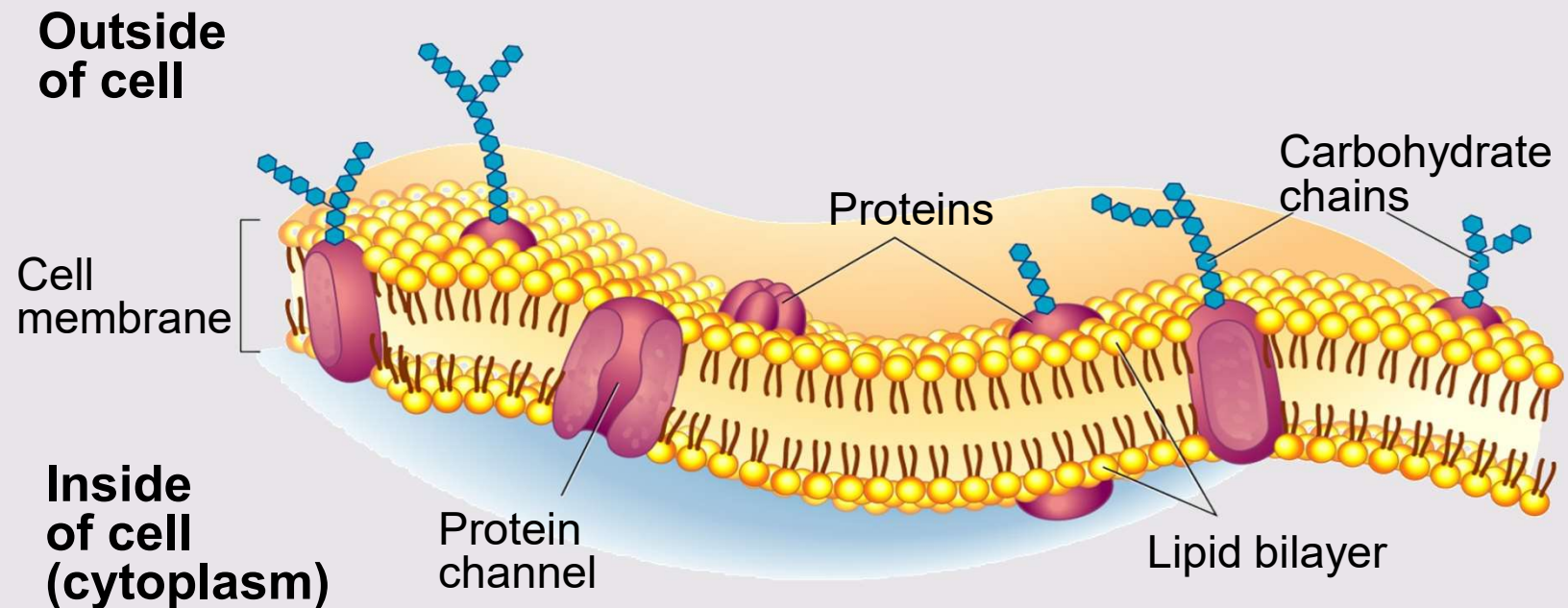


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Cell or Plasma Membrane

- Composed of **double layer of phospholipids and proteins**
- **Surrounds outside of ALL cells**
- Controls what **enters or leaves the cell**
- **Living layer**





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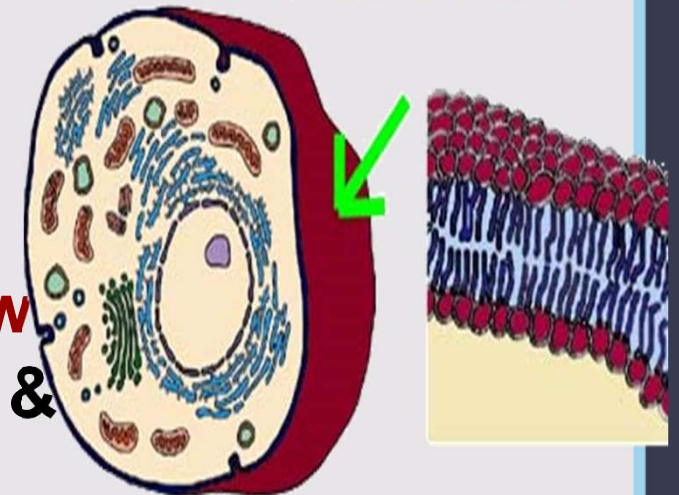
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Phospholipids

- **Heads** contain glycerol & phosphate and are **hydrophilic** (attract water)
- **Tails** are made of **fatty acids** and are **hydrophobic** (repel water)
- Make up a **bilayer** where tails point inward toward each other
- Can **move laterally** to allow **small molecules** (O_2 , CO_2 , & H_2O to enter)



Cell Membrane

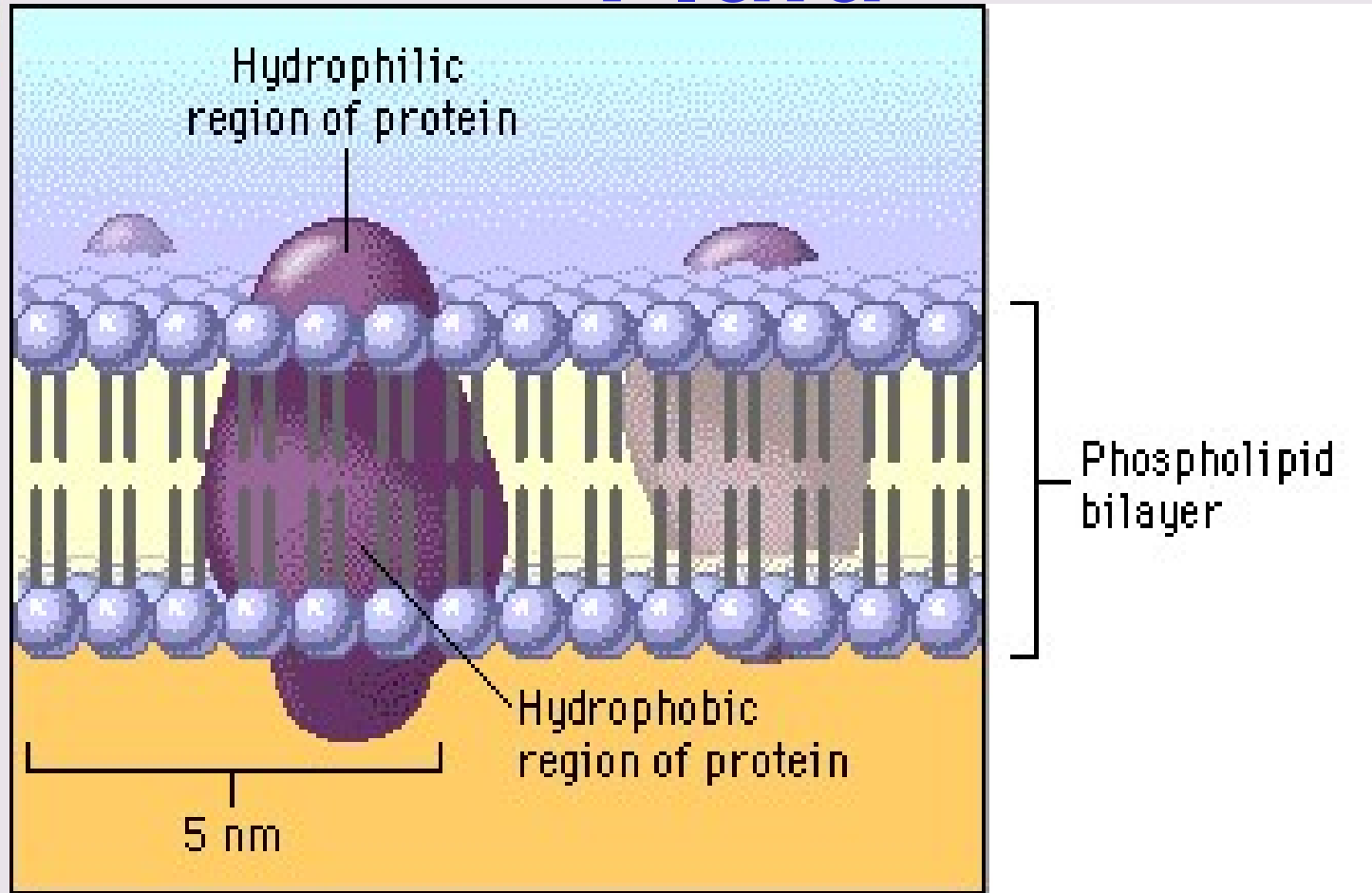




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The Cell Membrane is Fluid



Molecules in cell membranes are constantly moving and changing

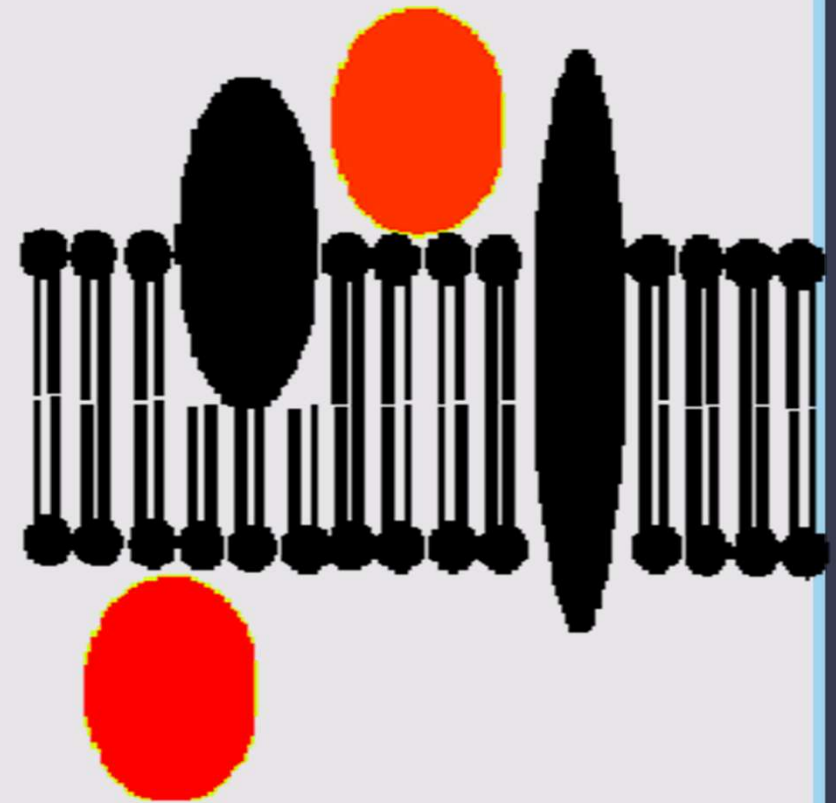


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Cell Membrane Proteins

- Proteins help **move large molecules** or aid in **cell recognition**
- **Peripheral proteins** are attached on the surface (inner or outer)
- **Integral proteins** are embedded completely through the membrane

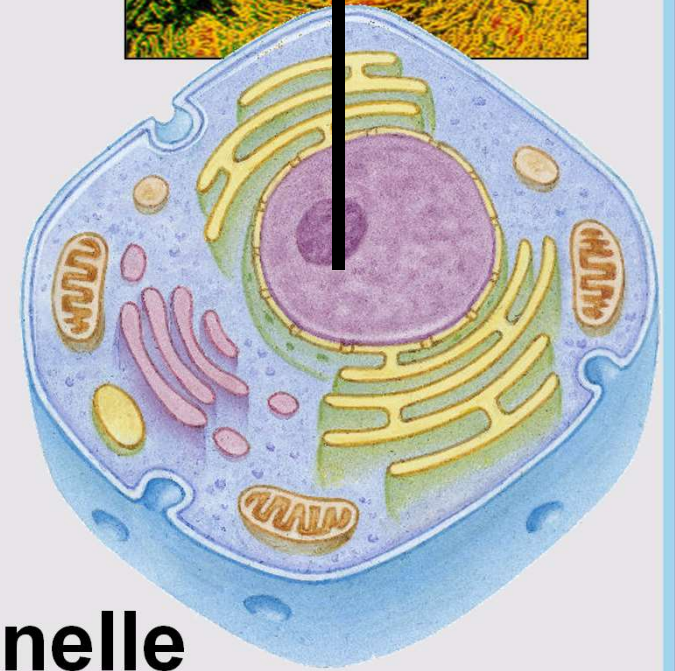
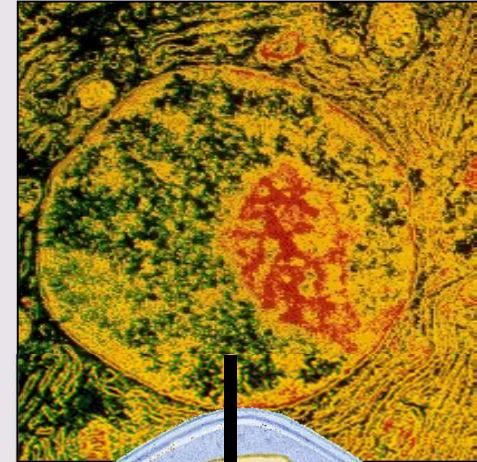




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The Control Organelle - Nucleus

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

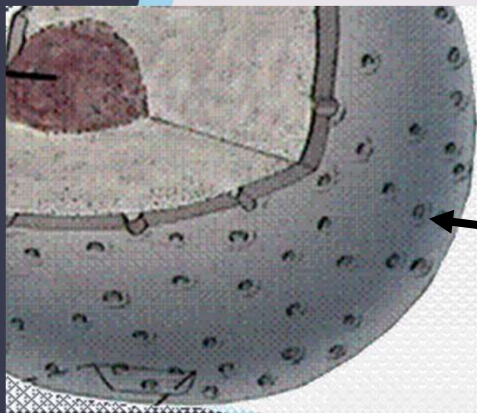
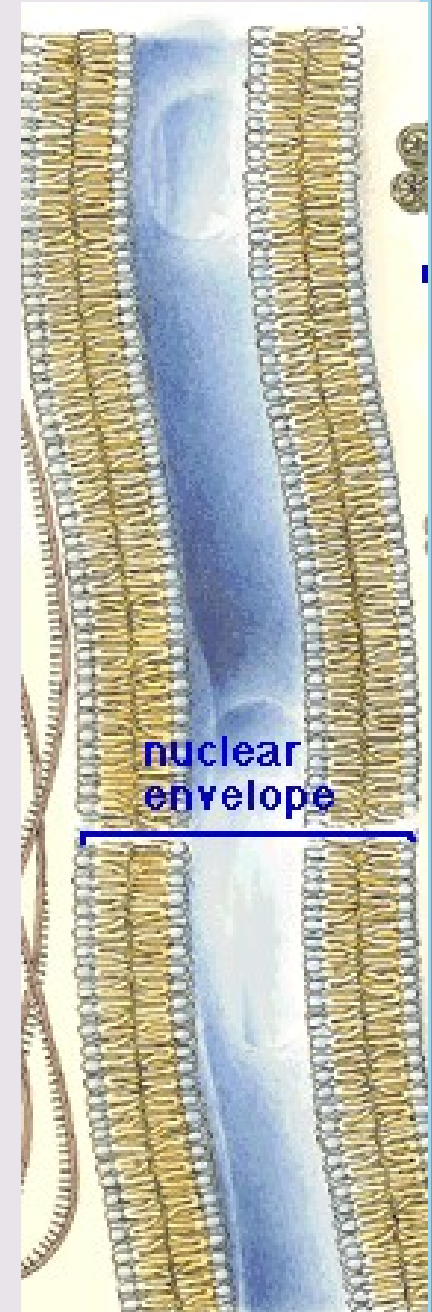




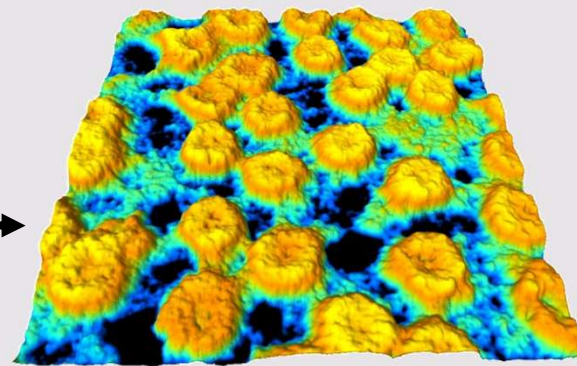
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Nuclear Envelope

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



Nuclear pores





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Inside the Nucleus -

The genetic material (DNA) is found



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

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



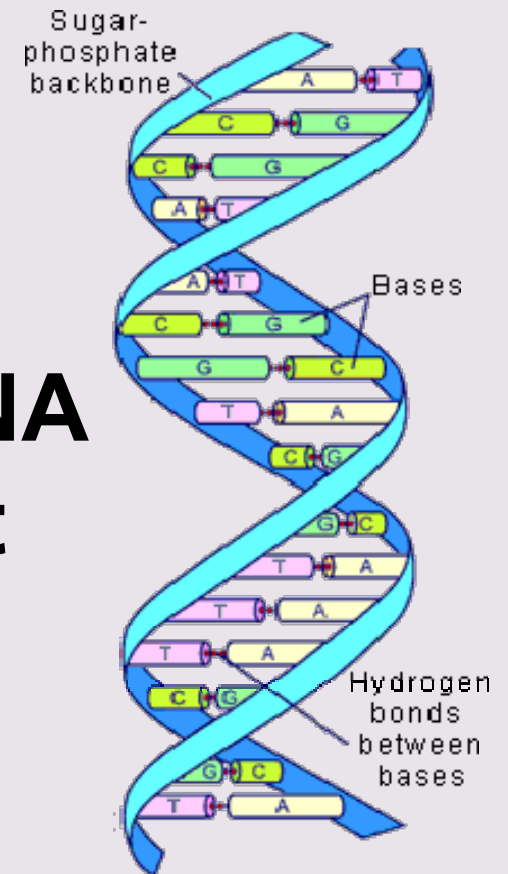
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What Does DNA do?

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

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

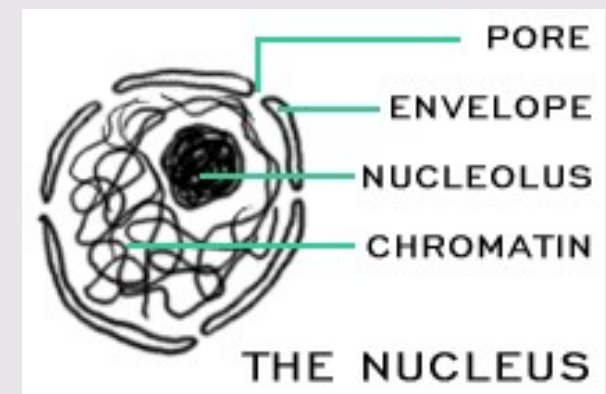
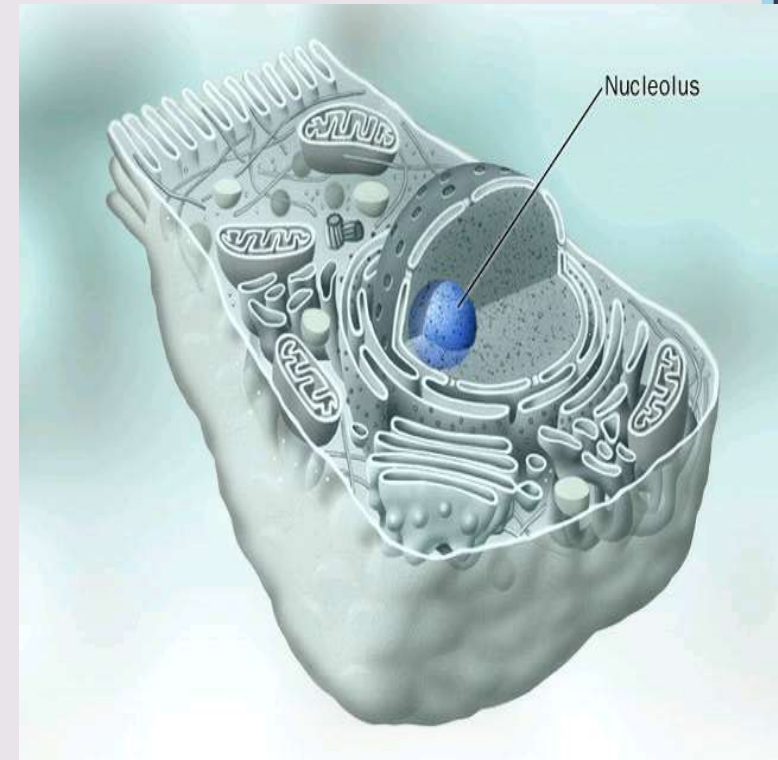




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Nucleolus

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



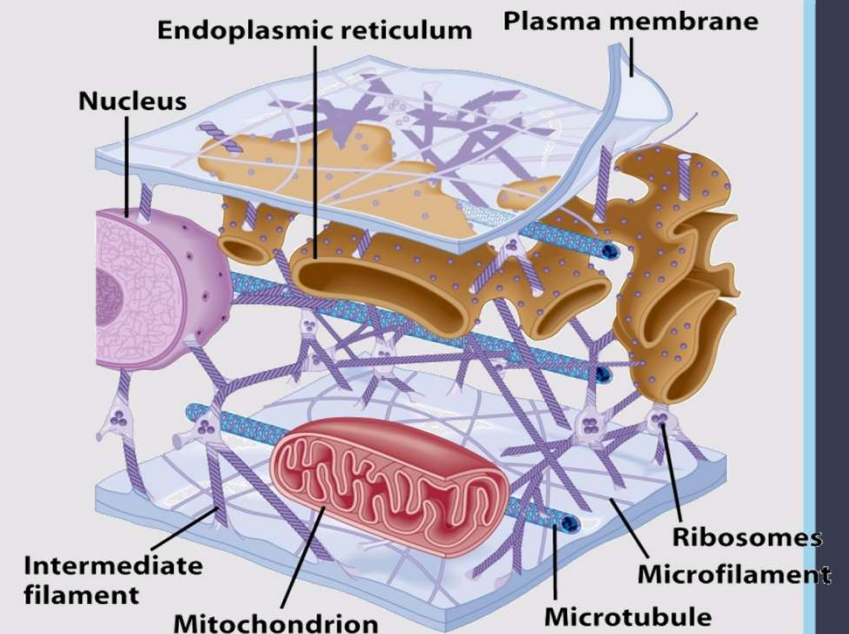
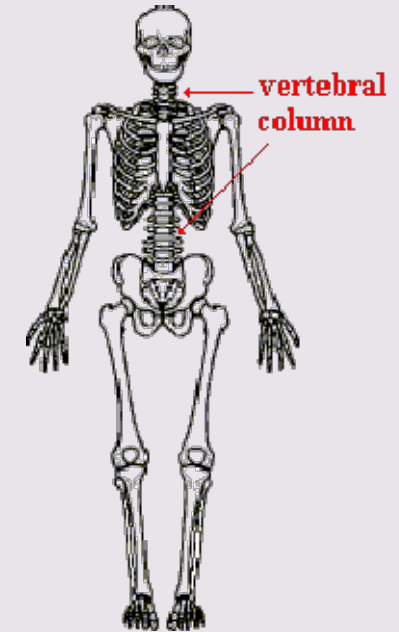


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Cytoskeleton

- 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**



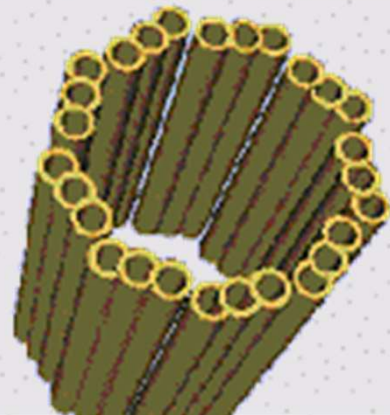


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Centrioles

- 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





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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)





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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**

Mitochondria Inner Structure

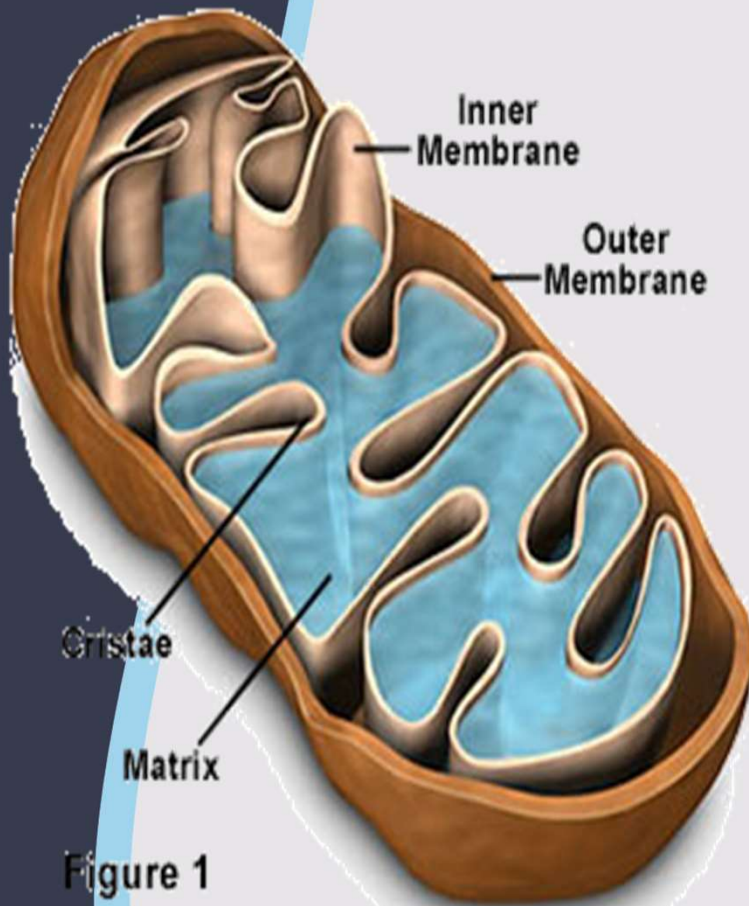


Figure 1



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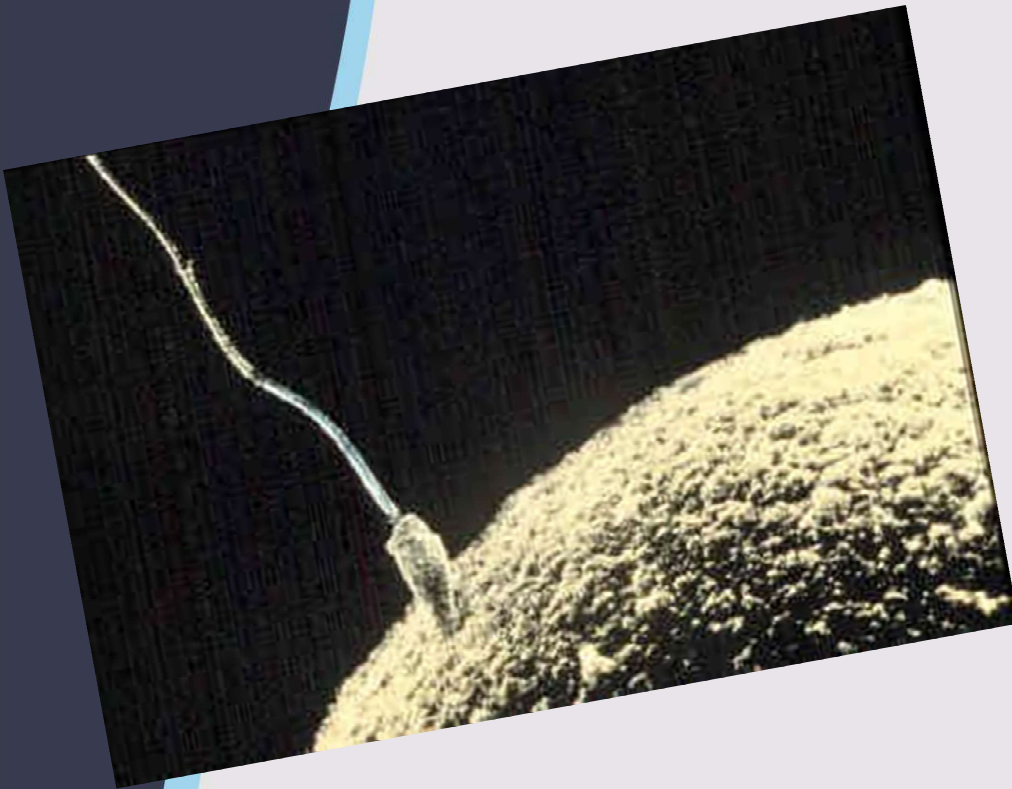
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Interesting Fact ---

- **Mitochondria Come from cytoplasm in the EGG cell during fertilization**

Therefore ...

- **You inherit your mitochondria from your mother!**

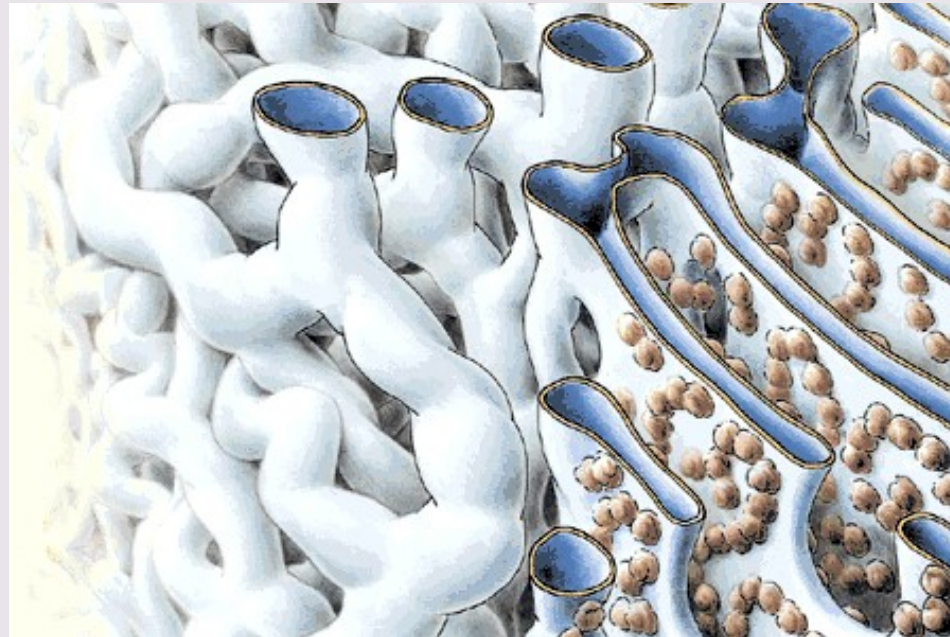




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Endoplasmic Reticulum - ER

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



Two kinds of ER ---ROUGH & SMOOTH

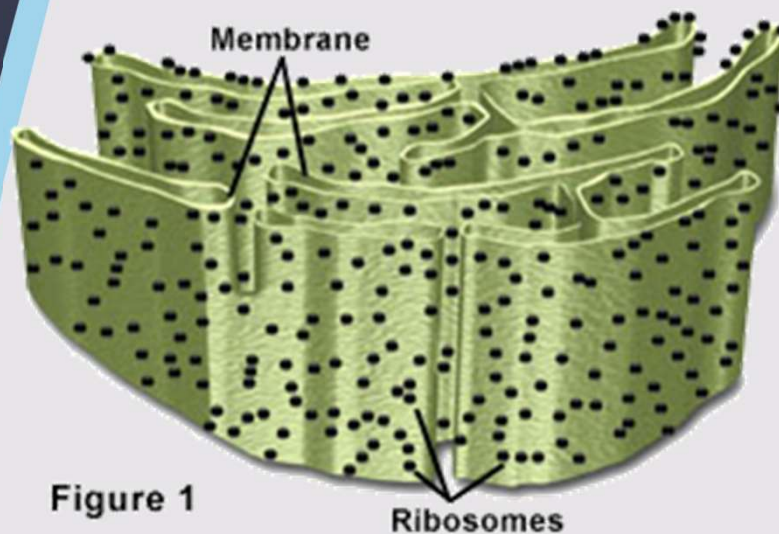


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Rough Endoplasmic Reticulum (Rough ER)

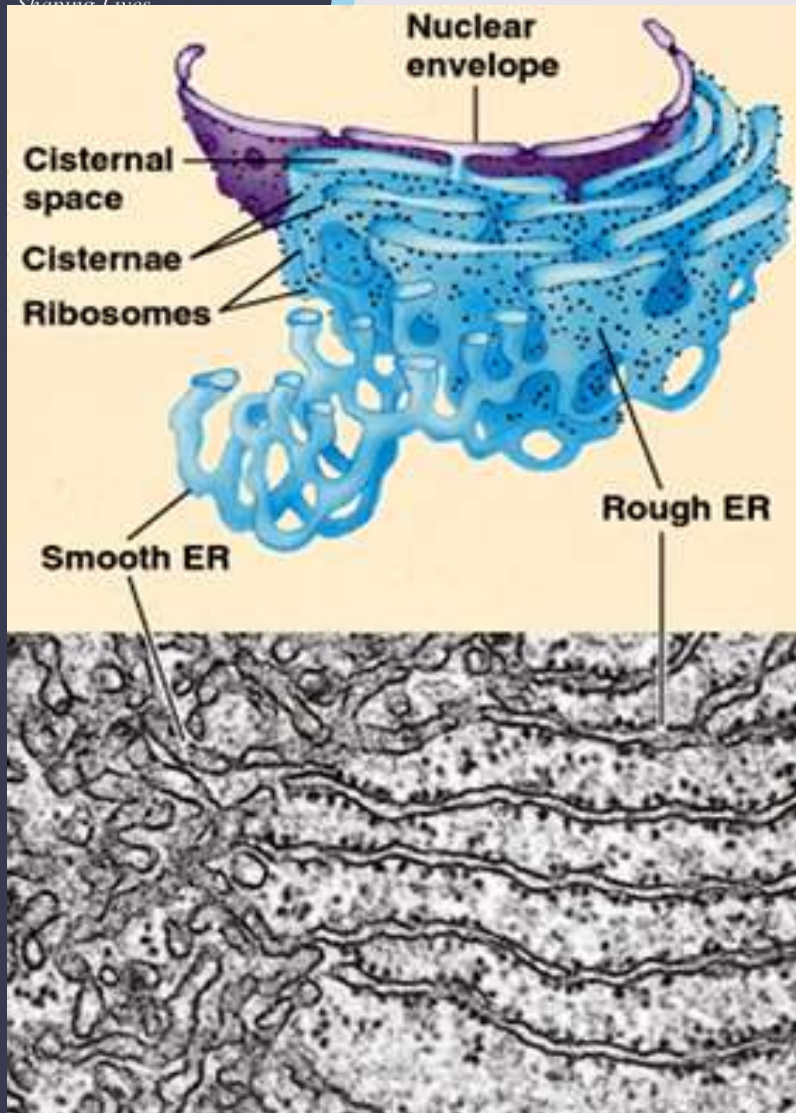
- Has **ribosomes** on its surface
- Makes membrane proteins and **proteins for export out of cell**





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Rough Endoplasmic Reticulum (Rough ER)

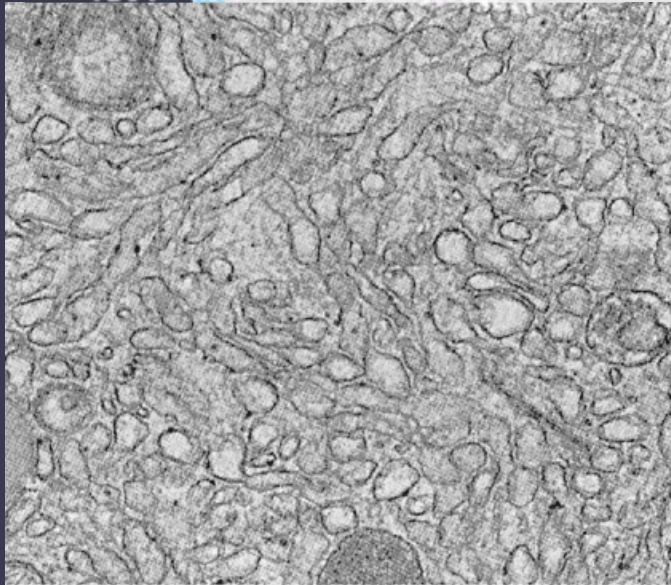


- Proteins are made by **ribosomes on ER surface**
- They are then **threaded into the interior of the Rough ER** to be modified and transported



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Functions of the Smooth ER



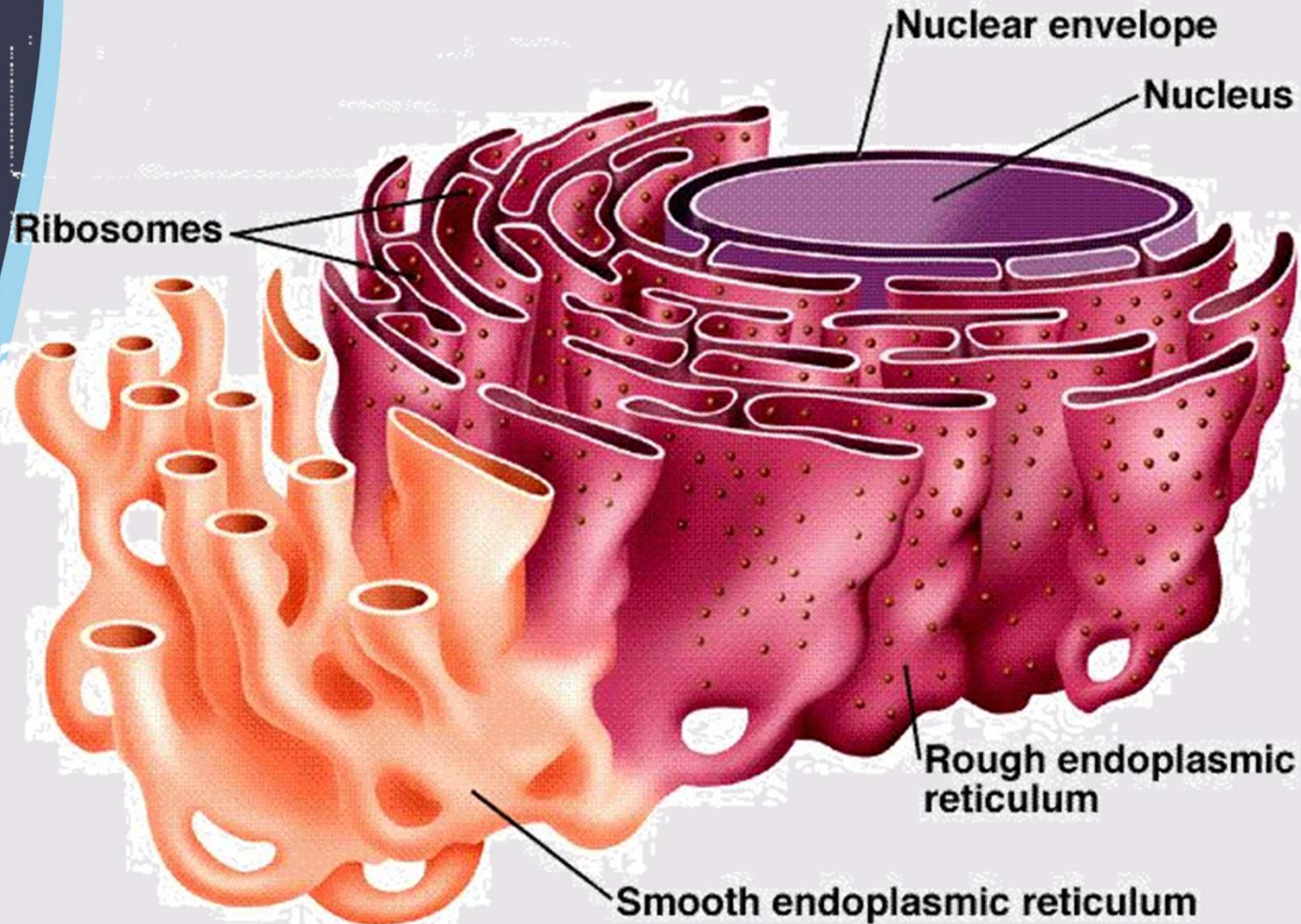
- **Makes membrane lipids (steroids)**
- **Regulates calcium (muscle cells)**
- **Destroys toxic substances**



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Endomembrane System



**Includes nuclear membrane connected to ER
connected to cell membrane (transport)**

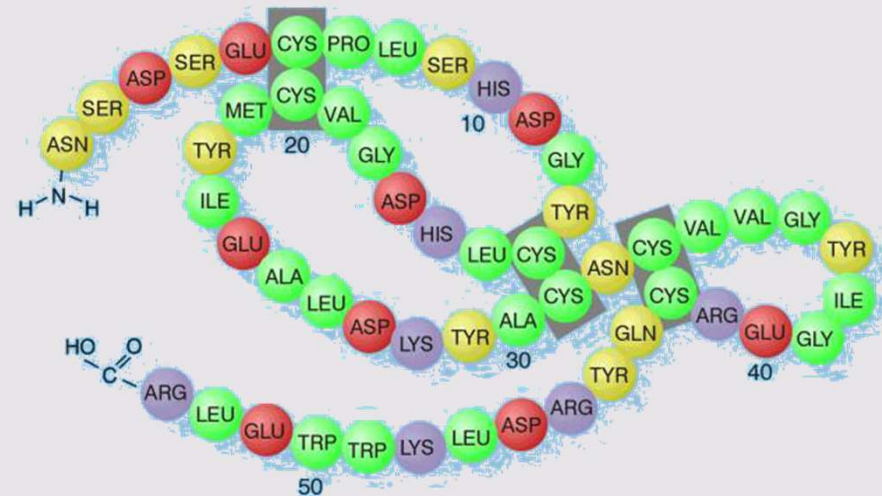
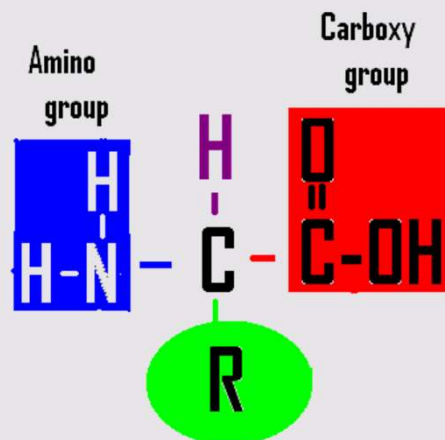


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Ribosomes

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

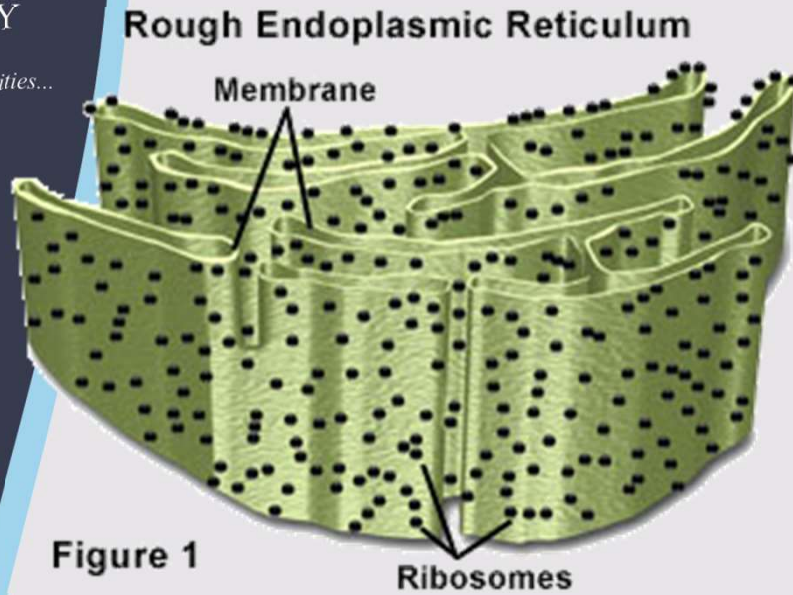




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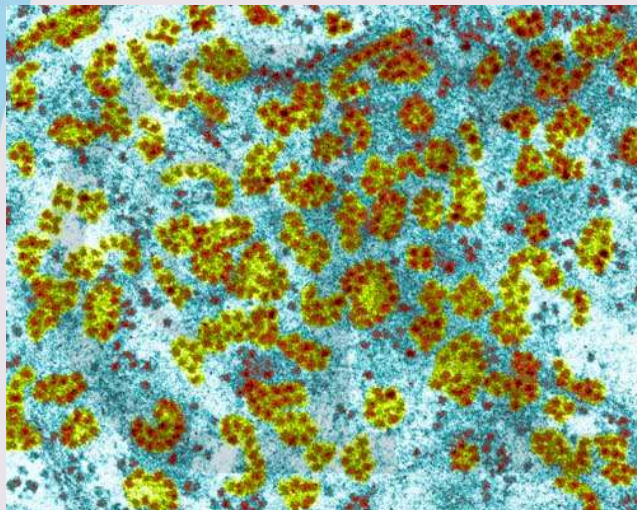
Ribosomes



**Can be attached to
Rough ER**

OR

**Be free
(unattached)
in the
cytoplasm**



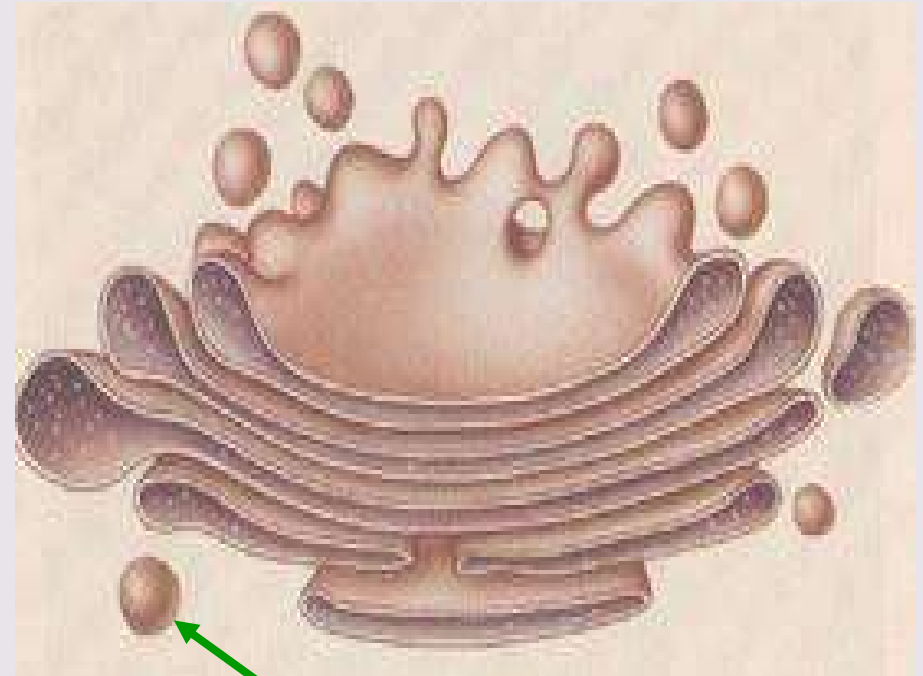


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Golgi Bodies

- 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



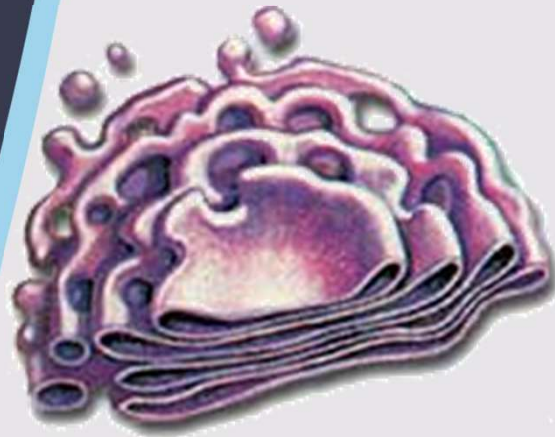
Transport
vesicle



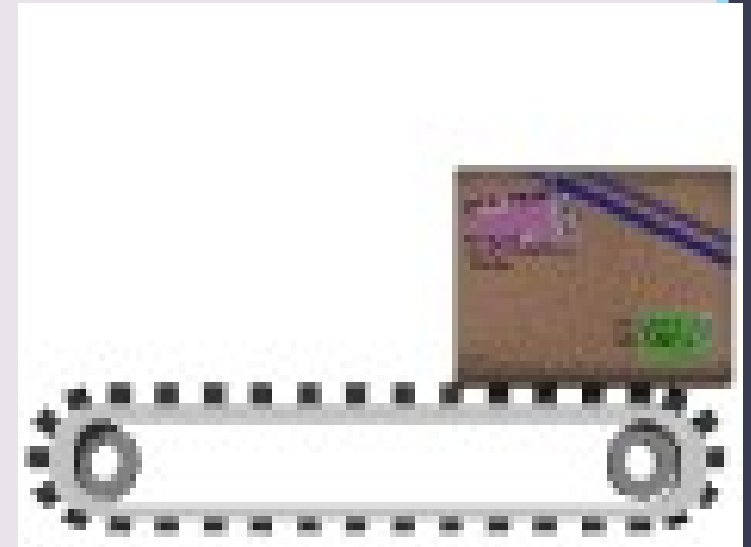
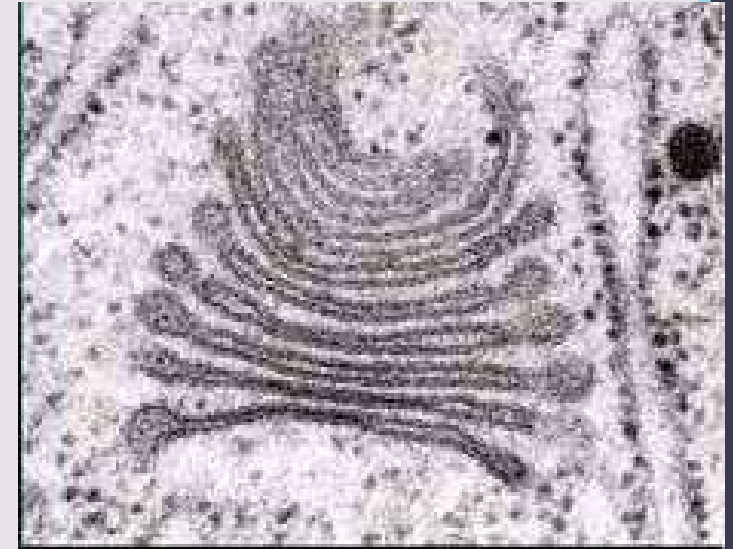
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Golgi Bodies

**Look like a stack of
pancakes**



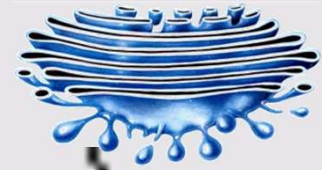
**Modify, sort, &
package**
molecules from ER
for **storage** OR
transport out of cell





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Golgi Animation



Materials are transported from Rough ER to Golgi to the cell membrane by VESICLES

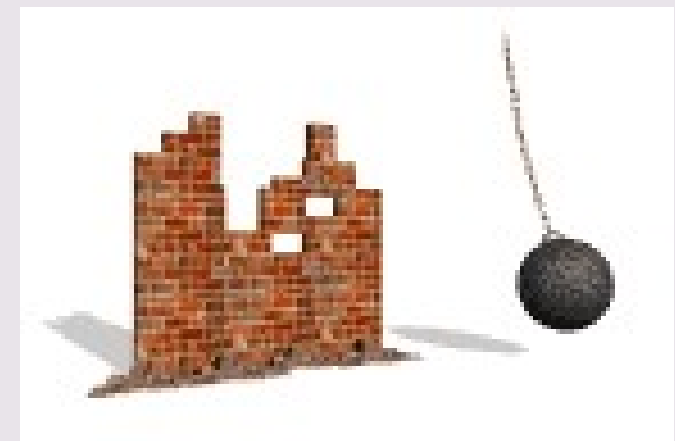
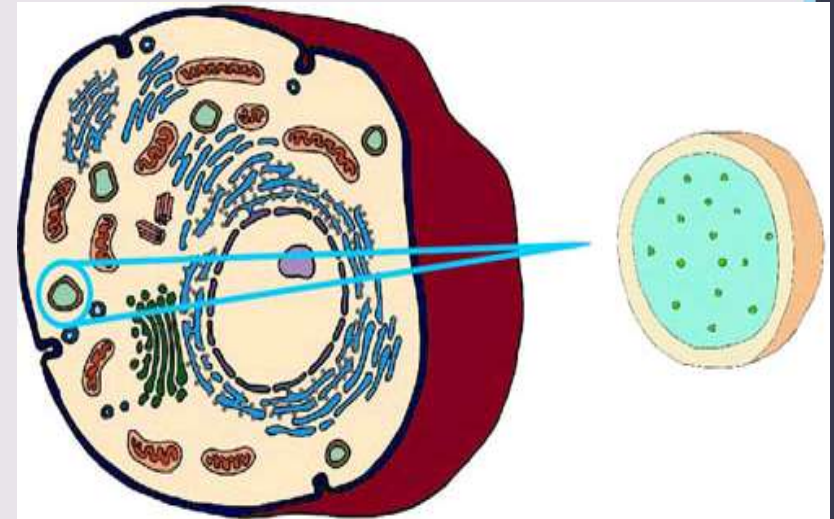


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Lysosomes

- 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)





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Lysosome Digestion

- Cells take in food by **phagocytosis**

- Lysosomes **digest** the food & get **rid of wastes**

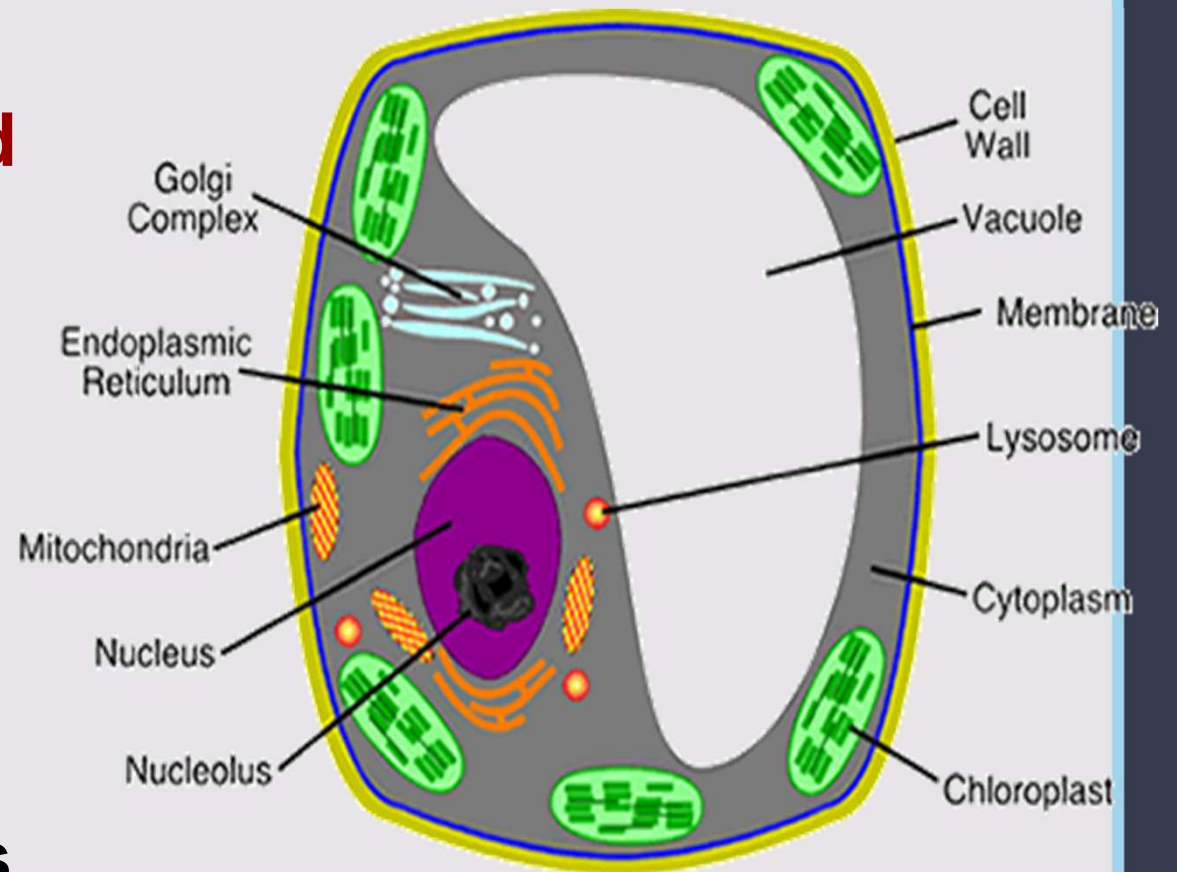


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Vacuoles

- **Fluid filled sacks for storage**
- **Small or absent in animal cells**
- **Plant cells have a large Central Vacuole**





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Vacuoles

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

