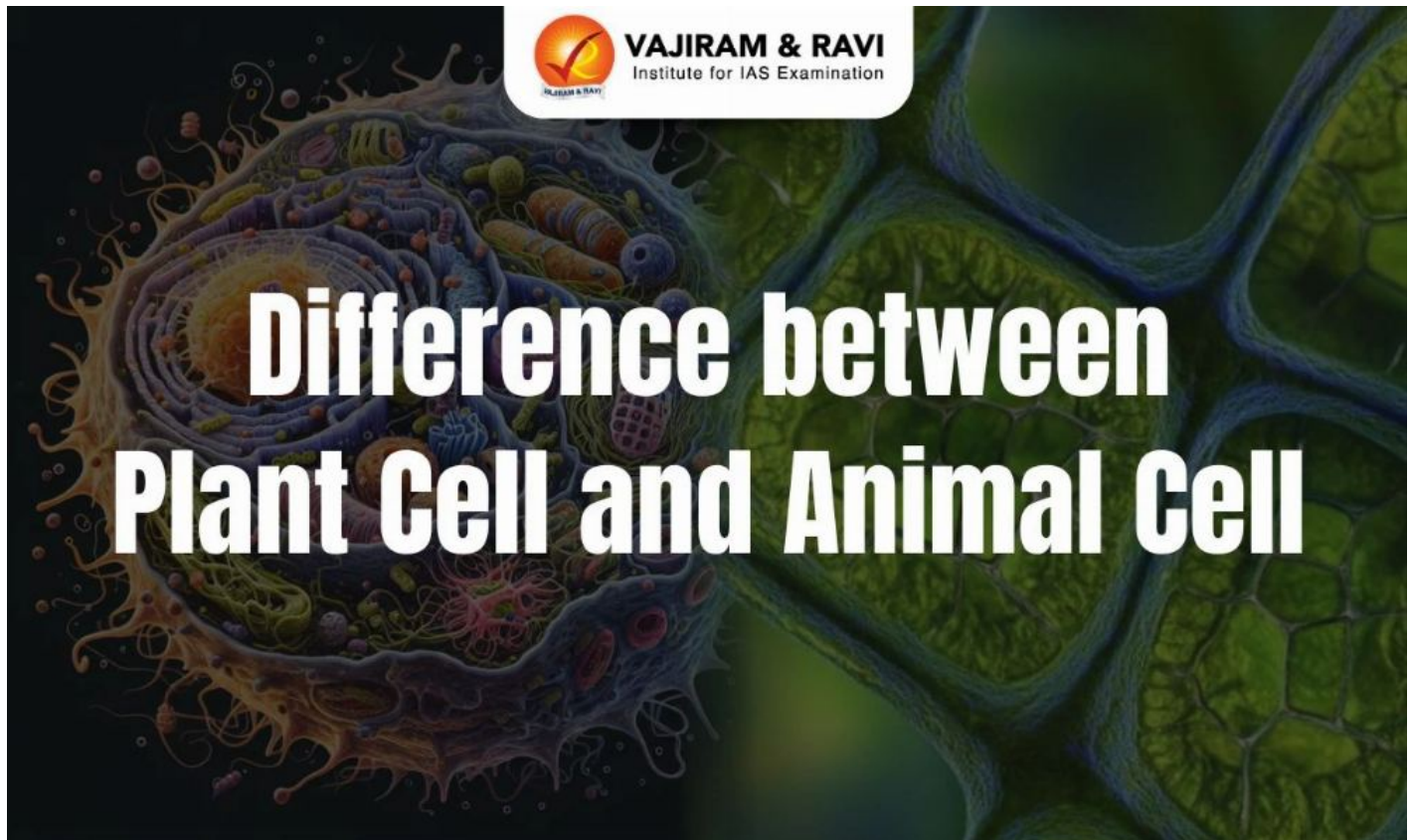


Difference between Plant Cell and Animal Cell

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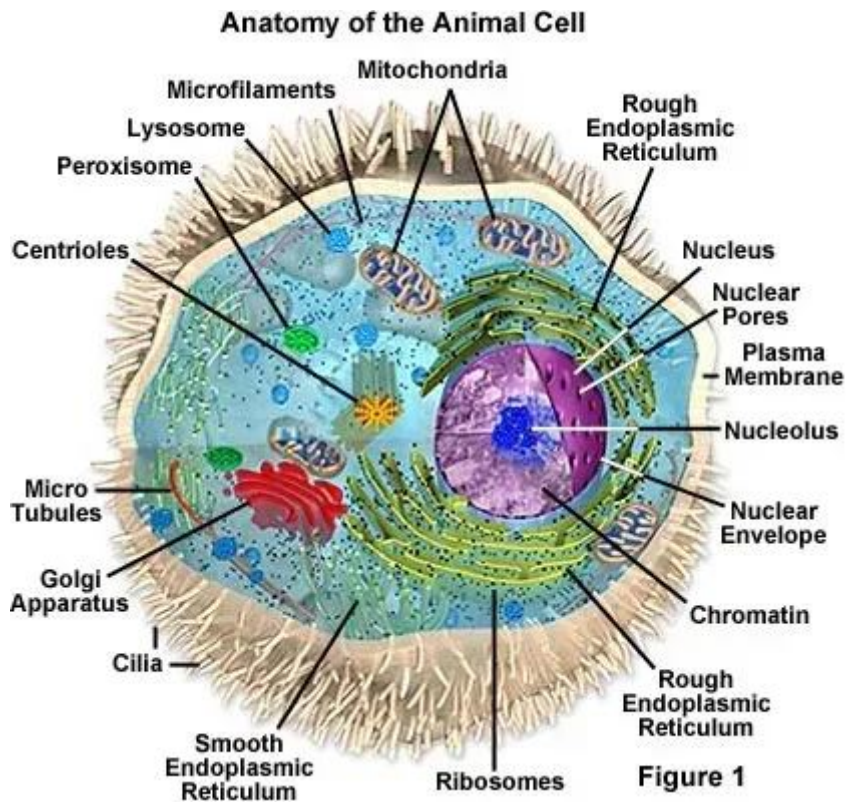
Cells are the basic units of life, carrying out various metabolic functions. They can be either plant or animal cells, both of which are **eukaryotic** and composed of a **cell membrane, nucleus, and cytoplasm**. The key distinction between Plant cells and Animal cells lies in the **presence of cell walls** made of cellulose in plant cells, providing structural support.

Plant cells also possess a large **central vacuole** for storage and shape maintenance, while animal cells have **multiple smaller vacuoles**. Additionally, both types of cells contain mitochondria, but only plant cells have **chloroplasts** for photosynthesis.

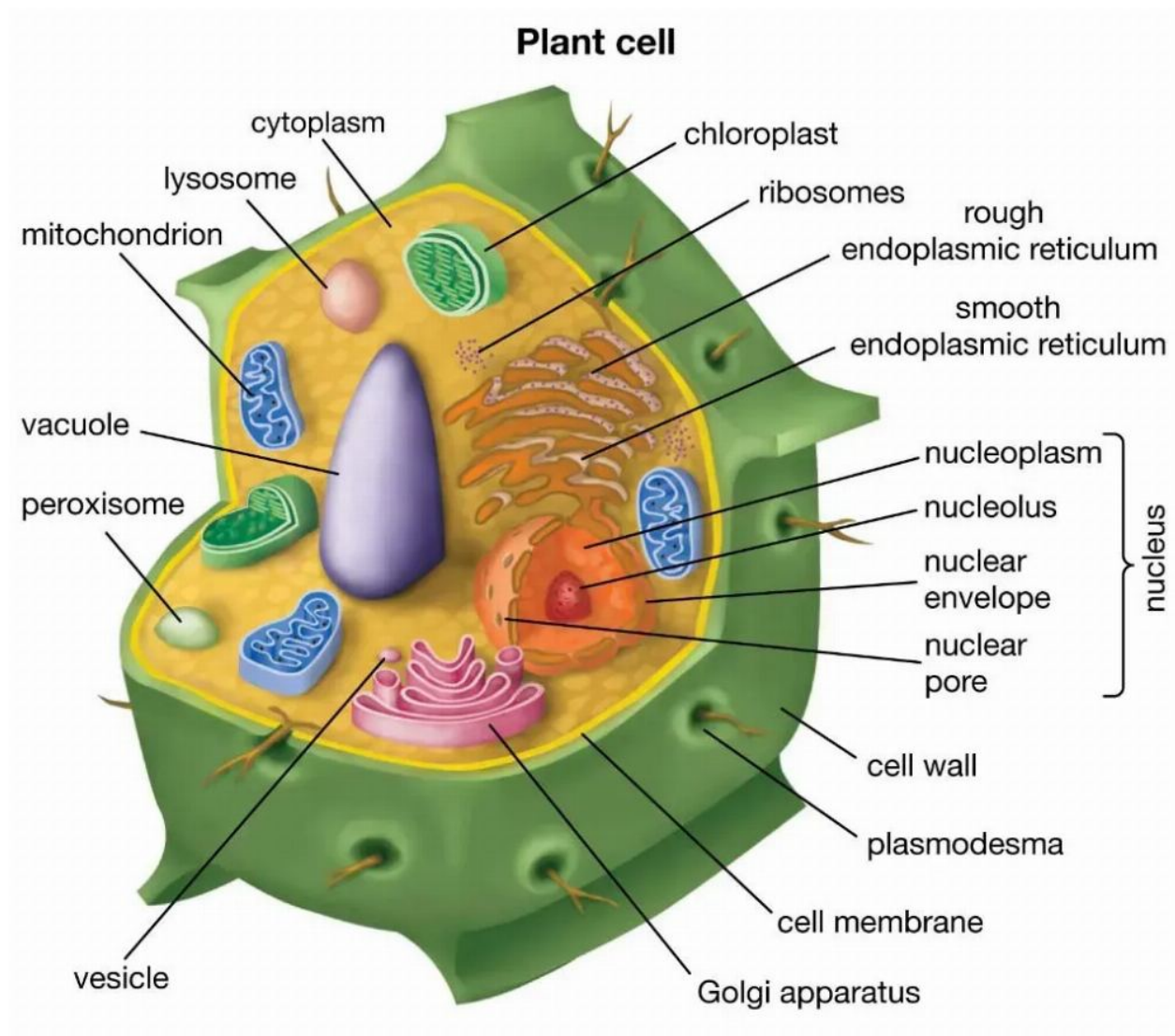
Plant Cell vs Animal Cell

Cells were discovered in **1665** by British scientist **Robert Hooke**, who observed them for the first time in his primitive (by modern standards) seventeenth-century optical microscope. The **cell** is the fundamental unit of life, serving as the building block for all plants and animals on the planet.

- **Animal Cell:** Animal cells are **eukaryotic cells** that are surrounded by a plasma membrane and contain a **membrane-bound nucleus** and organelles.



- Plant Cell:** Plant cells are eukaryotic, which means that they contain a distinct nucleus. Plant cells have three unique structures that set them apart from other eukaryotes, i.e. animal cells: the cell wall, plastids, and vacuoles.



Part	Animal Cell	Plant Cell
Cell membrane	Present	Present
Cell wall	Absent	Present
Nucleus	Present	Present
Nuclear membrane	Present	Present
Cytoplasm	Present	Present
Plastids	Absent	Present

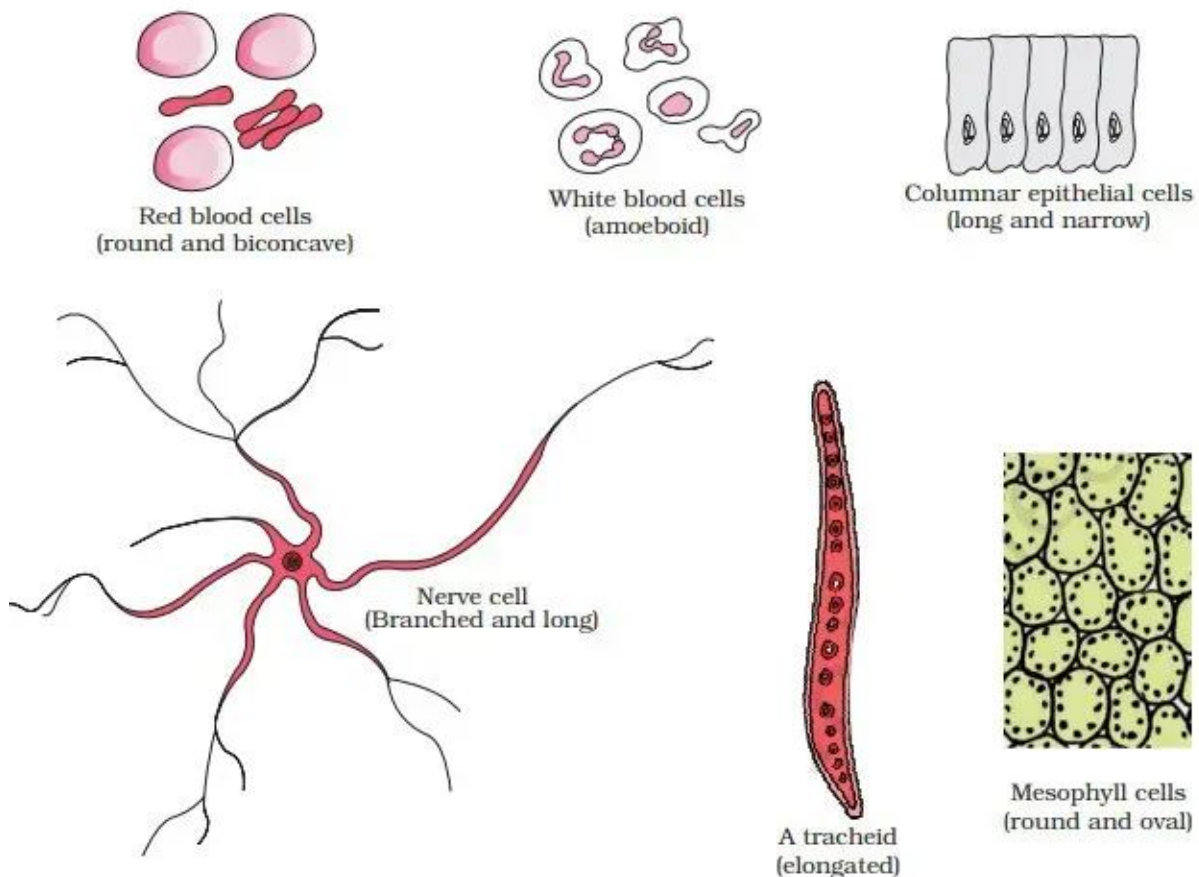
Comparison of Plant Cell and Animal Cell

Size

Cells differ greatly in size. For example, **Mycoplasmas**, the smallest cells, are only **0.3 μm** long while bacteria could be **3 to 5 μm** . The largest isolated single cell is the egg of an **ostrich**. Among multicellular organisms, human red blood cells are about **7.0 μm** in diameter. Nerve cells are some of the longest cells.

- **Animal Cell:** A typical animal cell is **10-20 μm** in diameter, which is roughly one-fifth the size of the smallest particle visible to the naked eye.
 - Animal cells are not only tiny, but they are also colourless and translucent.
- **Plant Cell:** On average, plant cells are between **10 and 100 micrometres** long, around the same size as the diameter of a human hair.

Shape



Cells also vary greatly in their shape. They may be disc-like, polygonal, columnar, cuboid, thread-like, or irregular. The shape of the cell may vary with the function it performs. The shape of a **plant cell** typically appears **square or rectangular**, whereas **animal cells** tend to be **irregular or round** in shape.

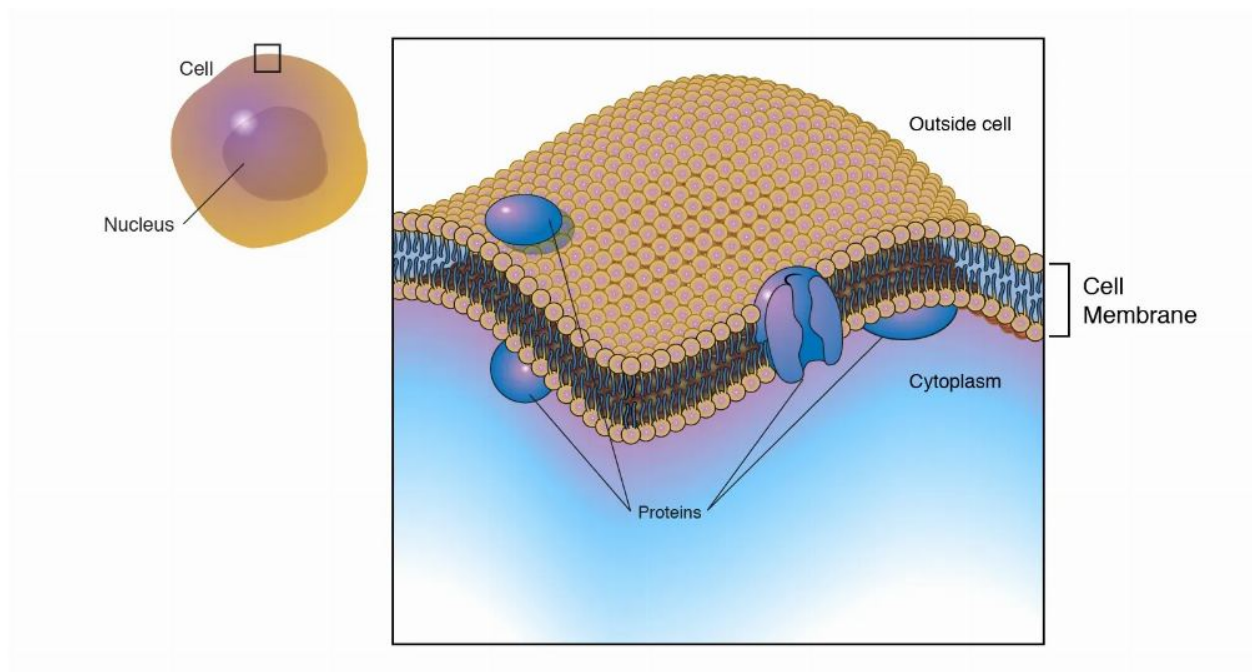
Cell Wall of Plant and Animal Cells

The cell wall is a thick layer around the **cell membrane** and protects the cell from mechanical damage and infection. It facilitates cell-to-cell interaction and provides a **barrier to undesirable** substances.

- **Plant Cell:** A typical plant cell has a distinct cell wall as its outer boundary. Cell walls in algae are composed of cellulose, galactans, mannans, and minerals such as calcium carbonate, whereas cell walls in other plants are composed of cellulose, hemicellulose, pectins, and proteins.
 - The primary wall of a young plant cell is capable of growth, which gradually diminishes as the cell matures, and the secondary wall is formed on the cell's inner (towards the membrane) side.
- **Animal Cell:** It is **absent** in animals.

Plasma Membrane

The plasma membrane, also known as the **cell membrane**, is the membrane that **separates** the interior of a cell from its surroundings. The plasma membrane **controls the flow** of materials into and out of the cell.



- **Plant Cell:** In plants, the plasma membrane serves two main roles i.e., transport of solutes into and out of each cell, and sensory transduction, which is the sensing and initiation of the cellular response to changing environmental conditions.
 - Plant cells **lack cholesterol** as well, but they do contain related compounds (sterols) that serve a similar function.
- **Animals Cell:** The plasma membrane **consists of cholesterol** in animal cells. The amount of cholesterol in animal plasma membranes **regulates membrane fluidity** and varies according to the temperature of the cell's environment.

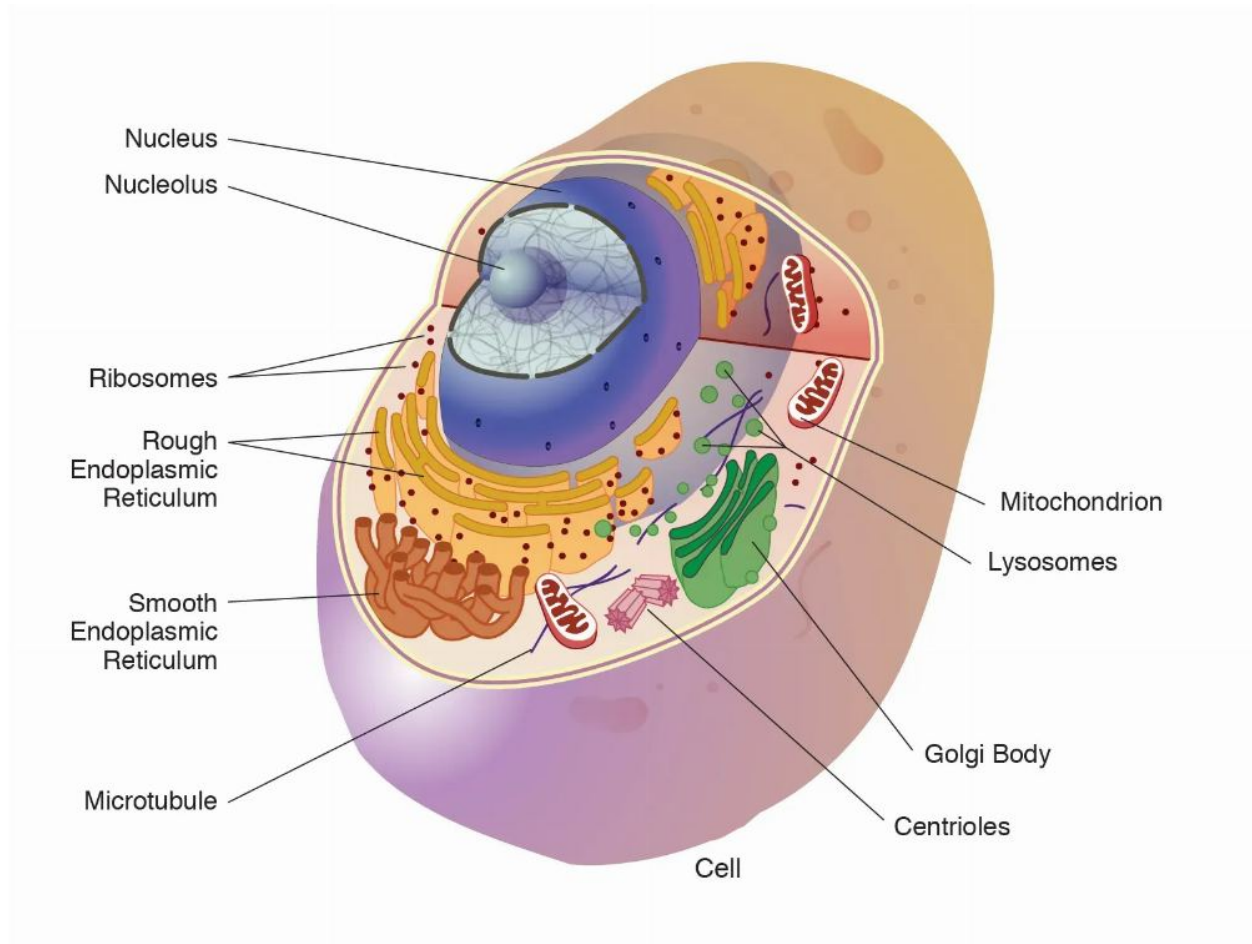
Cytoplasm

Cytoplasm, a **semi-fluid matrix**, occupies the volume of both prokaryotic and eukaryotic cells. The cytoplasm is the **main arena of cellular activities** in both plant and animal cells.

- **Plant Cell:** Plant cell cytoplasm maintains cell **shape**, provides **critical support** to internal structures, and serves as a **suspension** medium for organelles. Plant cells' cytoplasm contains **chloroplasts**, which contain **chlorophyll**.
- **Animal Cell:** The cytoplasm surrounds the nucleus in animal cells and is mostly composed of water, as well as sugars, salts, carbohydrates, amino acids, and nucleotides.
- **Functions:** Maintaining the cell structure, and providing an appropriate medium for cellular organelles such as the endoplasmic reticulum, golgi bodies, mitochondria, and ribosomes to remain suspended, allows the cellular contents and organelles to remain suspended while allowing them to move around in the cell.

Cell Organelles

An organelle is a subcellular structure that, like an organ, performs one or more specific functions in the cell. Among the more important cell organelles are **nuclei**, which store genetic information, mitochondria, which produce chemical energy, and ribosomes which assemble proteins.



- **Mitochondria:** The Mitochondria is a double membrane-bound structure also known as the powerhouse of the cell as they produce cellular energy in the form of ATP' (adenosine triphosphate) through the process of aerobic respiration.

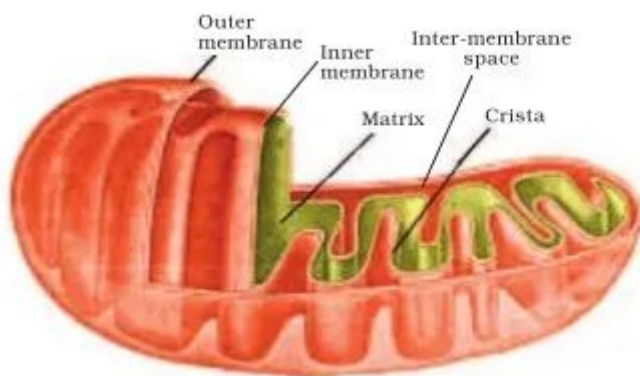
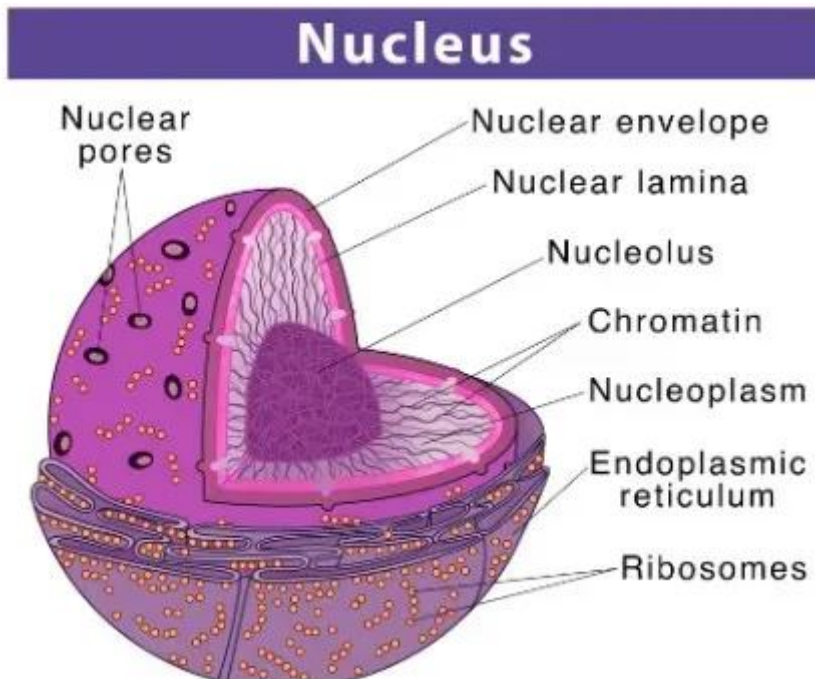


Diagram of Mitochondria

- **Plant Cell:** Plant cells do contain mitochondria. Plant cells need mitochondria to produce energy for the cell, which is usually done during the day through photosynthesis.
- **Animal Cell:** Higher animals would most likely not exist without mitochondria because their cells could only obtain energy through anaerobic respiration (in the absence of oxygen), a much less efficient process than

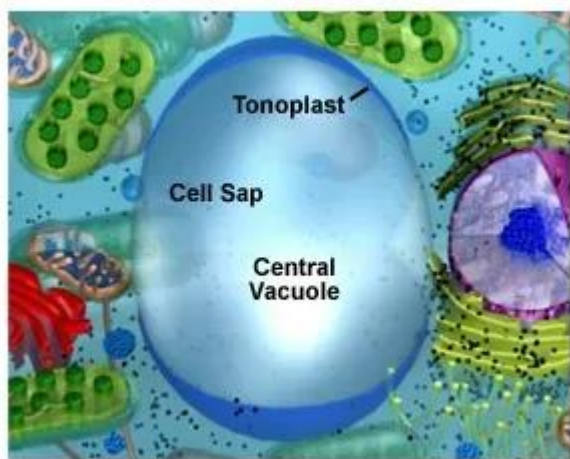
aerobic respiration.

- **Nucleus:** The nucleus is a double membrane-bound organelle found in the center of only eukaryotic cells. It serves primarily as the cell's information centre.
 - Both plant and animal cells have a nucleus.



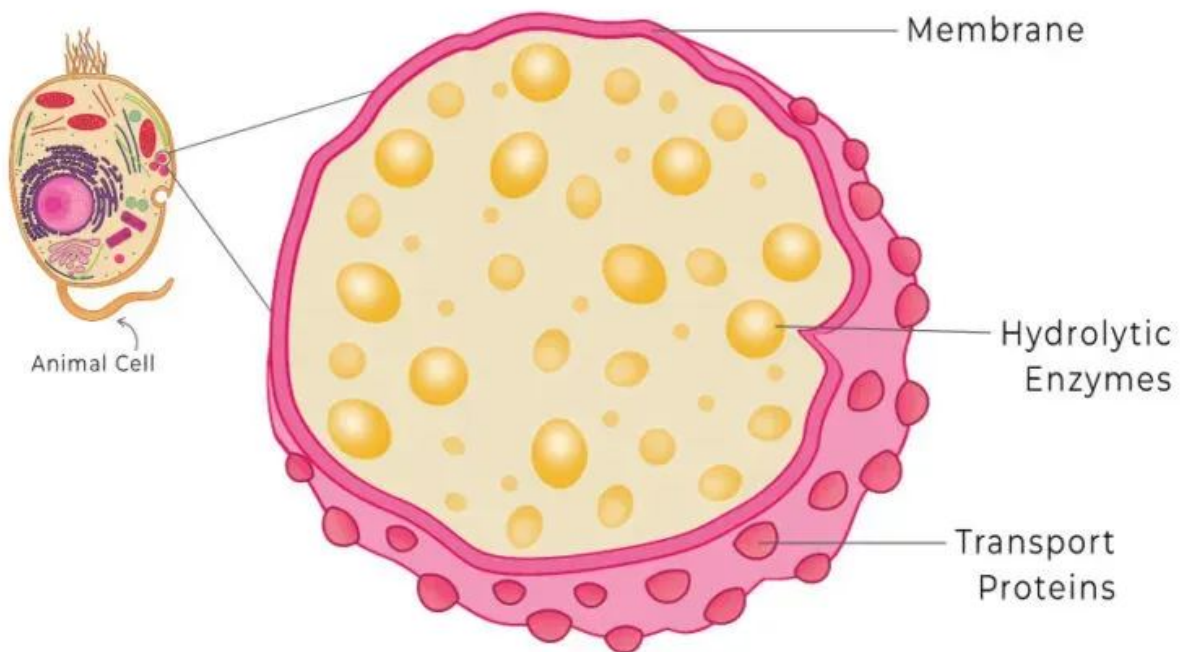
- **Chloroplast:**
 - **Plant Cell:** A chloroplast is an organelle within the cells of plants that contain chlorophyll and carotenoid pigments which are responsible for trapping light energy essential for photosynthesis.
 - **Animal Cell:** Animal cells **do not have** chloroplasts.
- **Vacuoles:** The vacuole is a membrane-bound space within the cytoplasm. It is surrounded by a single membrane known as a **tonoplast**. Vacuoles can be found in **both animals and plants**.
 - **Plant Cell:** In plants, the vacuole is **crucial for growth and development** and has a variety of functions, including storage and transport of water and food, intracellular environmental stability, and response to injury. Most mature plant cells usually have one large (central) vacuole.

Plant Cell Central Vacuole



- **Lysosomes:** These are membrane-bound **vesicular structures** formed during the packaging process in the **Golgi apparatus**. These enzymes are capable of digesting carbohydrates, proteins, lipids, and nucleic acids.
 - **Plant Cell:** Plant cell does not have lysosomes. In plant cells, vacuoles can carry out lysosomal functions.
 - **Animal Cell:** Lysosomes are found in all animal cells, but are most numerous in disease-fighting cells, such as white blood cells.

Lysosome



- **Centrosome:** A centrosome is a cellular structure that participates in **cell division**. It usually has two cylindrical structures known as centrioles.
 - **Plant Cell:** Most plant cells lack centrosomes but use other structures such as a nuclear envelope, smooth endoplasmic reticulum, and plasmalemma, to organise their microtubules.
 - **Animal Cell:** The **centrosome** is the primary microtubule-organizing centre (MTOC) in animal cells, and so it regulates cell motility, adhesion, and polarity in interphase, and facilitates the organization of the spindle poles during mitosis.

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