# CELLS

Cellular Structure and Function

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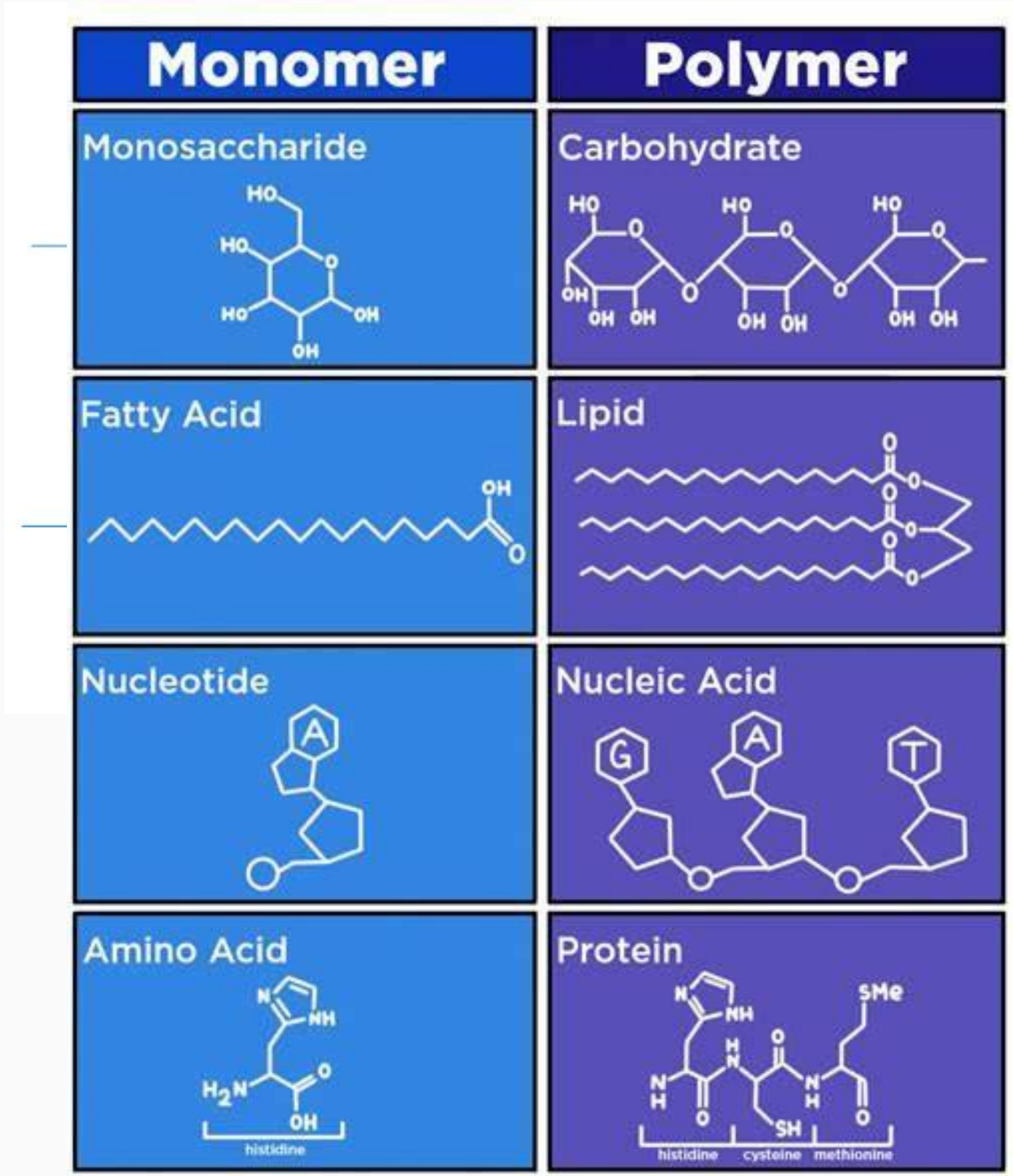


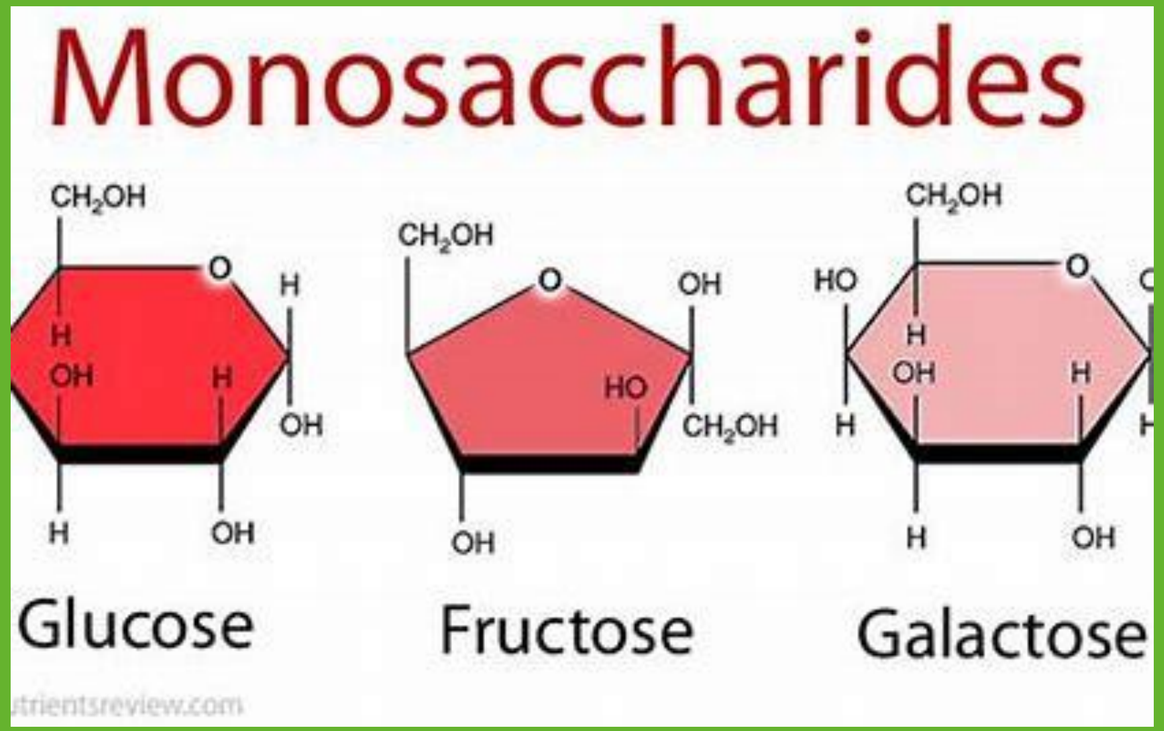

# MACROMOLECULES

Macromolecules are large organic molecules that are found in living things

- Macro= Big / Micro= Little
- Macromolecules are made by a process called polymerization.
- Monomers are small chemical units, when put together, they make a polymer
- Polymers make up Macromolecules.
- The four Macromolecules are: Carbohydrates, Lipids, Nucleic Acids and Proteins

# Carbohydrates:

- Sugar, Starch, cellulose
- are made up of Carbon, Hydrogen and Oxygen atoms
- Carbohydrates store and release energy, give structural support and protection.
- The monomers that make up Carbs are Monosaccharides ( Mono= One/ Saccharide= sugar)
- When monosaccharides come together through polymerization, it creates a polysaccharides

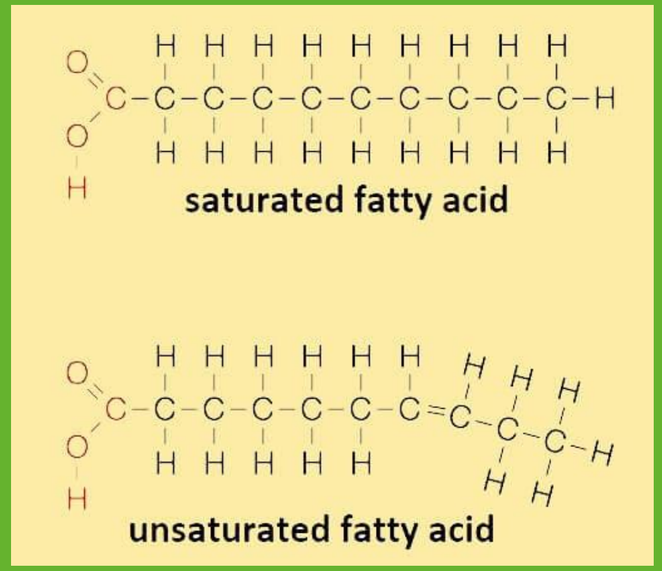


# How are Carbohydrates important to an organism and the structure and function of its cells?

1. Plants have cell walls of carbohydrates (cellullose)
2. Fungi have cell walls of carbohydrates (chitin) for structural support
3. Insects have an exoskeleton made of carbohydrates (chitin) for protection
4. Carbohydrates is used to create a quick energy source in cells
    a. The energy from carbohydrates can be stored in a polysaccharide form ( Starch is an energy source for plants and Glycogen is an energy source for animals)

# Lipids:

- fats, oils, waxes, and certain components of cellular membranes (Phospholipid)
- Lipids are made of long hydrocarbon chains( hydrogen, oxygen and carbon)
- not generally soluble in water. (can’t mix in water)
- lipids are crucial for storing ( long-term ) energy, building cellular membranes, and signaling within cells
- Fatty acids are  of lipids the monomers of lipids



# How are Lipids important to an organism and the structure and function of cells?

1. Lipids are a long-term source of energy with carbohydrates are not present.
2. Lipids help create the cellular membrane for all cells
3. Lipids help with signaling between cells (stimulus)
4. Many lipids act as hormones ( chemical messengers; example steroids)

1. What are the monomers of carbohydrates?
2. Why are lipids important for the cellular membrane?

# Nucleic acids:

- nucleic acids are polymers made of nucleotide monomers
- store and transmit hereditary information (Genetic codes)
- made of carbon, hydrogren, oxygen, nitrogen and phosphorus

## How are nucleic acids important to an organism and the structure and function of a cell?

1. Nucleic acids store genetic information, which is needed for the coding of our genes and traits

# Proteins

- Examples: beans, meat, antibodies
- Proteins are polymers made of amino acids (monomer of proteins)
- made of carbon, hydrogen, oxygen, and nitrogen
- help with controlling the rate of reactions(enzymes) , regulating cell processes (embedded in cellular membrane) , transporting substances, and fighting disease (antibodies).
- Antibodies are proteins that help fight off viruses
    - Antibodies are protective proteins produced by your immune system. They attach to antigens (foreign substances) — such as bacteria, fungi, viruses and toxins — and remove them from your body.

# How are Proteins important in an organism and in the structure and functions on cells?

1. Proteins help speed up reactions in cells (enzymes)
2. Proteins help transport materials into cells by being in the cellular membrane.
3. Proteins help to fight diseases

# Check for understanding

1.What is a macromolecule ?

2.what are the 4 macromolecules?

3.What are the monomers for each macromolecule?

4.What do they have in common?

# Video: Guided notes

Follow along the video and fill in the blanks

# How are Polymers built vs Broken down

Review: What is the process called when Monomers combine to make a Polymer?

- Polymers are broken down into monomers by a process called Hydrolysis.
  - Hydro= water, -lysis=break
  - think of when a cell lyses or breaks in lytic replication in viruses
- In hydrolysis, water is ADDED to the polymer to make monomers.

# CELL

Basic and fundamental unit of life, it possesses a highly organized structure that enables it to carry out its vital functions.

# Hydrolysis

- The process to breakdown macromolecules by adding water
  - Hydro- water
  - Lyse- breaking
  - Supplemental video: https://youtu.be/zYi64bYbGnU?si=927l8f29VmaD2mlo
  - https://youtu.be/ZMTeqZLXBSo?si=_-dXnPdRjuT2HLkx

# TYPES OF CELLS

## Prokaryotic

Lack a defined nucleus

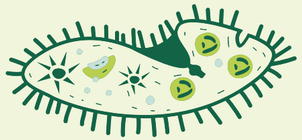
**Prokaryotic**
Dispersed genetic material in the cytoplasm.

## Eukaryotic

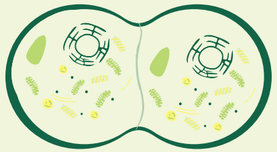
Have a defined nucleus

**Plant**
Cellulose cell wall; chloroplasts and vacuoles.

**Animal**
Rigid cell wall; may have flagella.

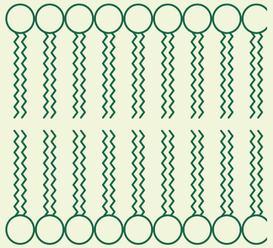


**Protist**
They can have a cell wall, without differentiated tissues.



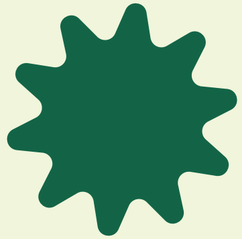
**Fungal**
Chitin Cell Wall;

# Composed of several fundamental components



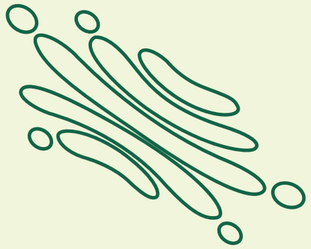
Cell membrane

Nucleus



Ribosome

Rough endoplasmic reticulum.

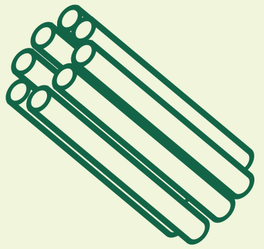


Golgi Apparatus

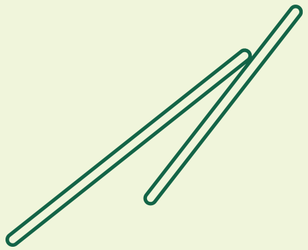
Mitochondria

Chloroplasts

Lysosome and peroxisome



Centriole



Microtubules

# STRUCTURE AND BASIC FUNCTIONS

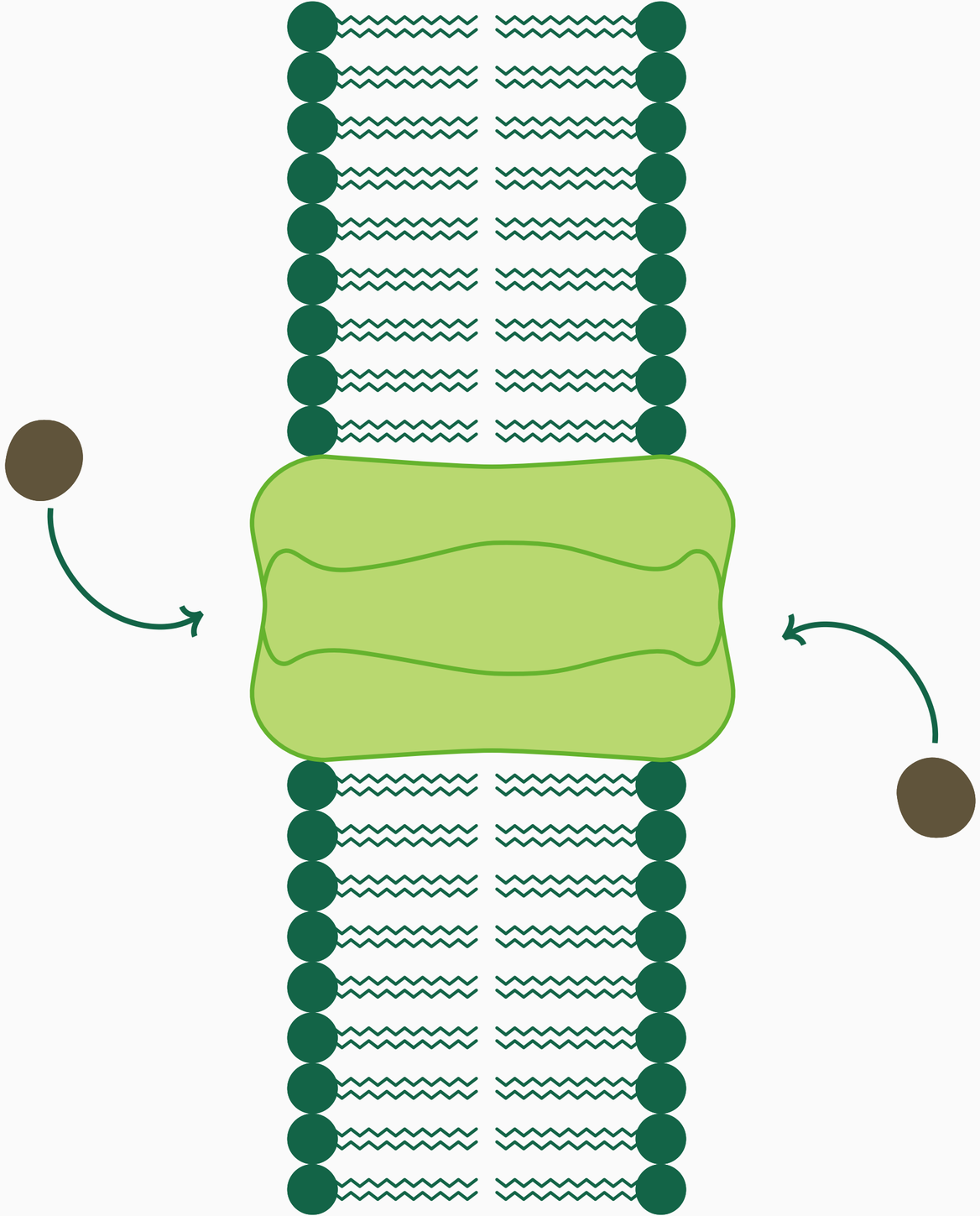
These components work together to maintain cellular homeostasis and perform essential life activities.

# Cell membrane

- selective barrier between the interior and the exterior.

- regulating the passage of substances, including nutrients and waste materials.

Within it, specialized proteins play a crucial role in facilitating molecular transport and cellular communication.



# Cell nucleus

An organelle that houses DNA, located in the center of eukaryotic cells.

Its primary function is to store and safeguard genetic information, controlling gene expression and DNA replication.

It also contains the nucleolus, which is involved in ribosome synthesis.
Synthesis: make up

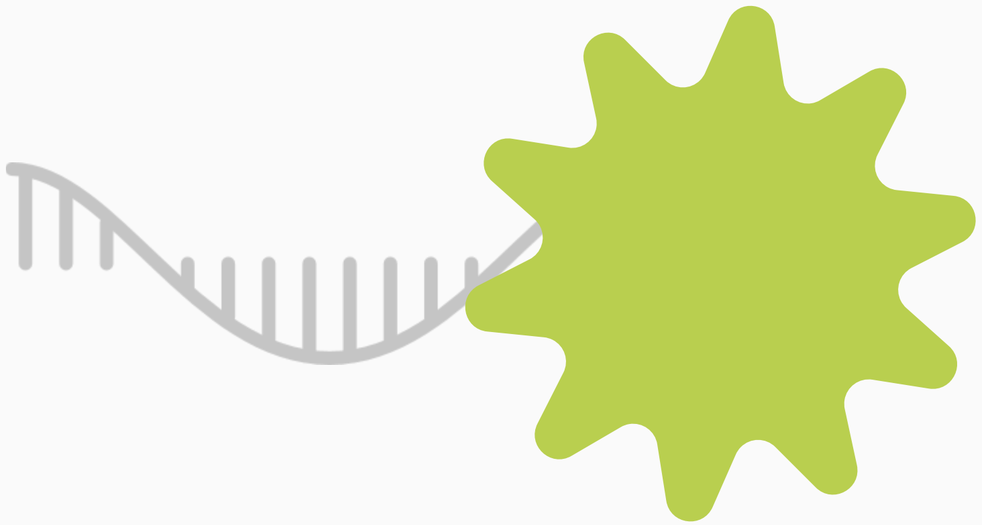
# Cytoplasm

The cytoplasm is a gel-like matrix containing water, salts, proteins, and other molecules. It occupies the intracellular space between the cell membrane and the nucleus.

It plays a crucial role in biochemical reactions, energy production, and substance transport. Essential for cellular metabolism, it provides structural support to the cell.

# PROTEIN SYNTHESIS

Building and repairing cellular structures, regulating biological processes, and expressing specific characteristics of each organism.



# Ribosome

Ribosomes are essential organelles for cellular functioning and survival.

They synthesize proteins using the genetic information from messenger RNA (mRNA), which is crucial for cellular structure, function, and regulation.

Ribosomes are located in the cytoplasm and the rough endoplasmic reticulum.

# Endoplasmic reticulum

A network of interconnected membranes that extends from the nuclear membrane to the cell membrane. It plays a fundamental role in the transport, processing, and distribution of proteins and lipids within the cell.

There are two main types of ER:

- The Rough Endoplasmic Reticulum (RER) is studded with ribosomes and is involved in the synthesis and modification of proteins.
- The Smooth Endoplasmic Reticulum (SER) specializes in lipid synthesis, carbohydrate metabolism, and detoxification.

# Golgi apparatus

Key in the processing and packaging of proteins and lipids produced in the endoplasmic reticulum.

It synthesizes carbohydrates and lipoproteins and is essential for maintaining the cell's internal balance and facilitating communication with the outside.

Composed of a series of flattened sacs called cisternae, it acts as the 'shipping center' of the cell, sorting and packaging proteins into vesicles for transport and distribution.

# ENERGY SUPPLY

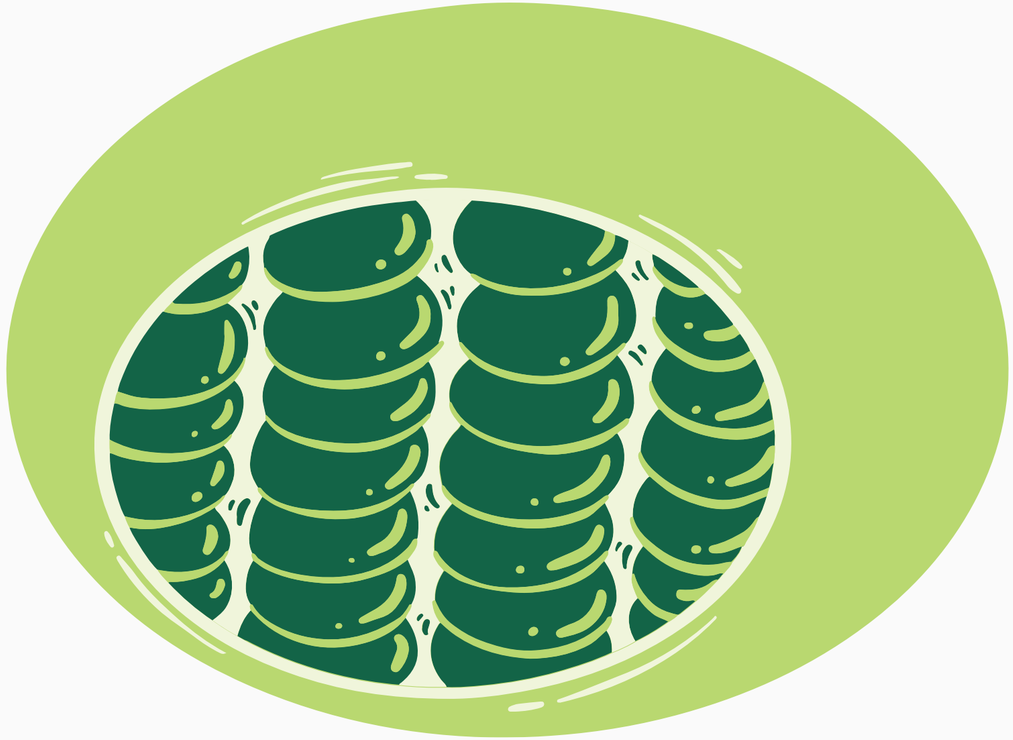
To carry out vital functions and necessary metabolic processes essential for the proper functioning of the cell and/or organism.

# Mitochondria

Present in eukaryotic animal and plant cells. Their primary function is energy generation through cellular respiration (ATP production).

The double membrane of mitochondria allows for the organization of various stages of the respiratory chain, making it crucial for cellular function and survival.

# Chloroplasts



Exclusive to plant cells and photosynthetic organisms, chloroplasts carry out photosynthesis, converting solar energy into chemical energy.

During photosynthesis, they synthesize glucose and other organic compounds using carbon dioxide and water, releasing oxygen as a byproduct.

They are responsible for the crucial production of oxygen that sustains the planet.

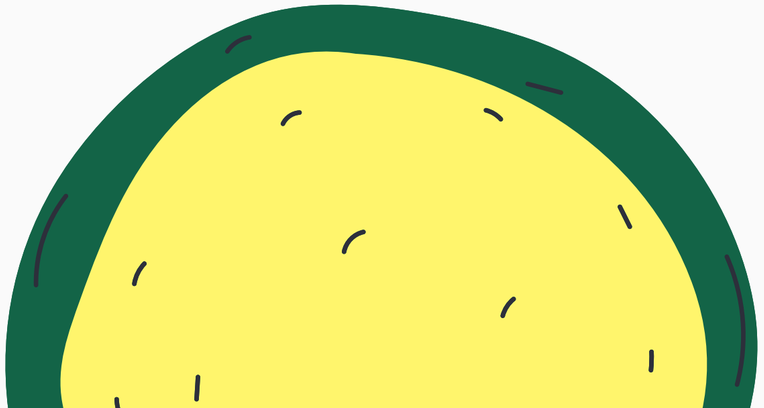
# CELLULAR DIGESTION

It involves breaking down molecules and unwanted materials, enabling the recycling of nutrients and cellular maintenance.

# Lysosomes

They contain digestive enzymes that break down molecules and unwanted cellular materials.

They facilitate cellular digestion, by disposing of waste, recycling nutrients, and defending against pathogenic invasions.



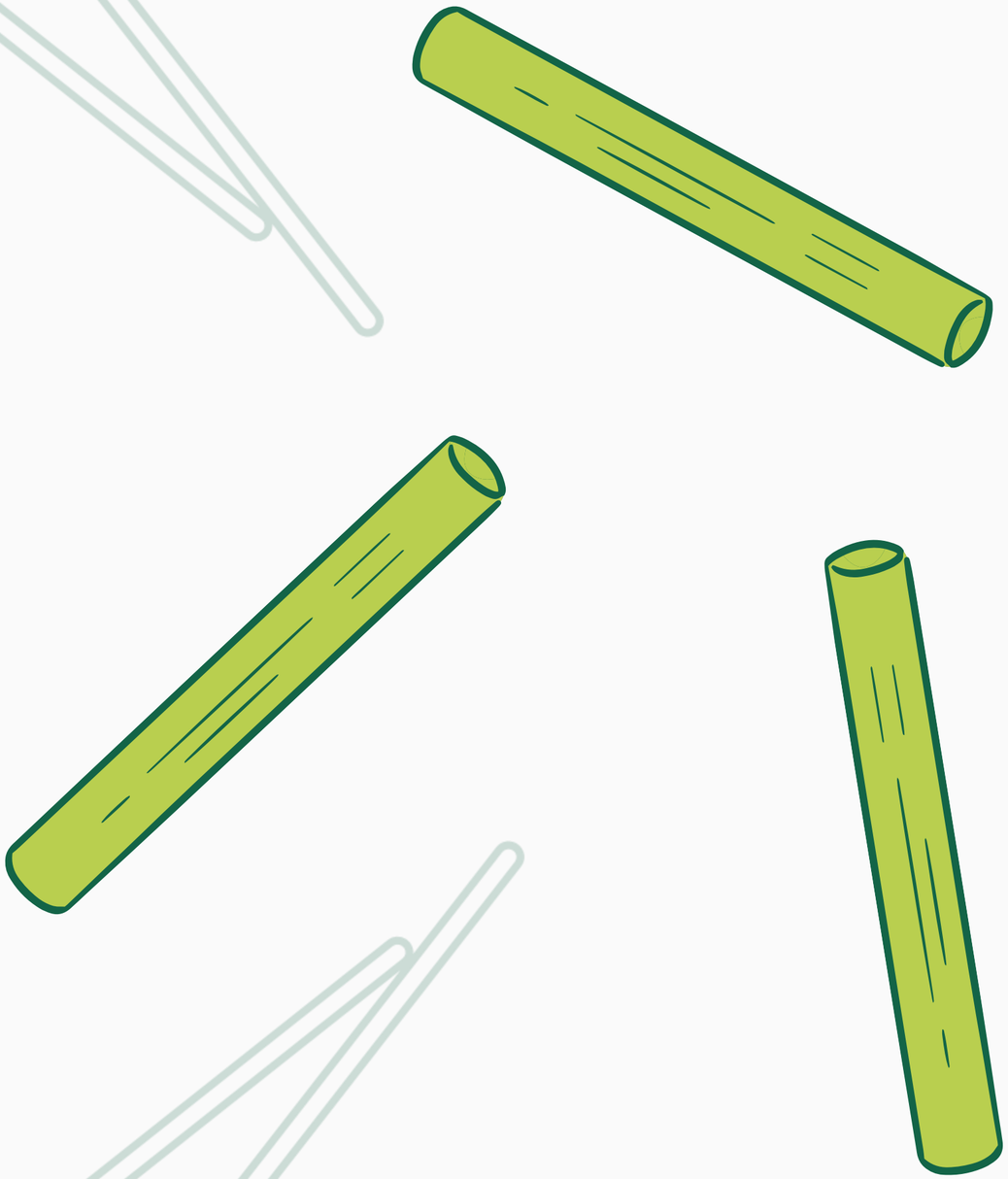
# Peroxisomes

They contain enzymes that degrade hydrogen peroxide and toxic compounds, thereby protecting the cell from oxidative damage.

Additionally, they play a role in the synthesis and degradation of lipids and bile acids, regulating lipid metabolism and overall homeostasis.

# SUPPORT AND MOVEMENT

Maintaining cellular shape, enabling cellular movement and division, are essential for its functioning and survival.



# Cytoskeleton

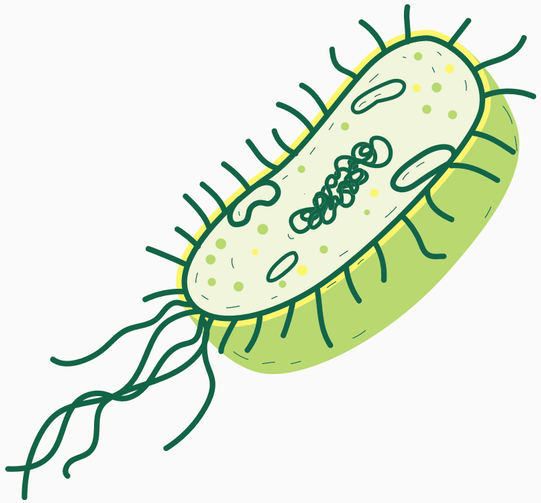
It is composed of protein filaments (microtubules, microfilaments, and intermediate filaments) and provides support and enables movement in eukaryotic cells.

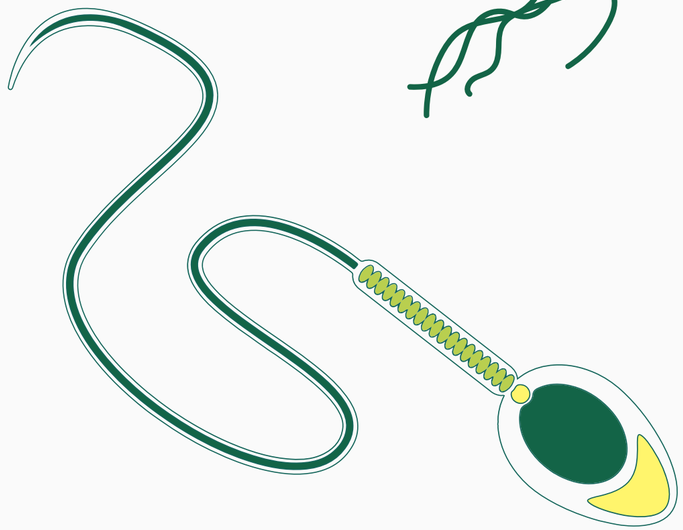
Its specific functions encompass stability, intracellular transport, and contraction. Furthermore, it regulates cellular shape and plays a role in division, migration, and communication.

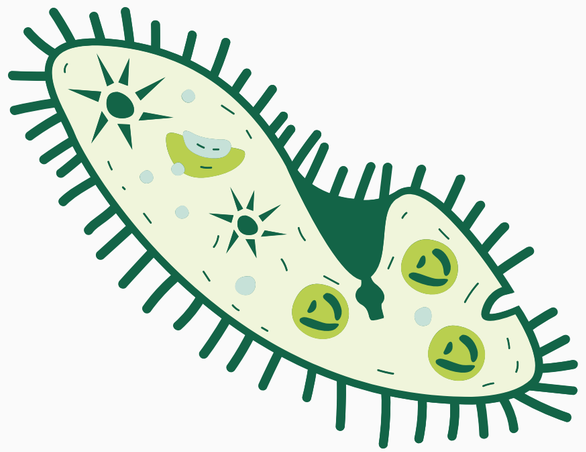
# Flagella and cilia

Specialized structures for movement. They are elongated and enable locomotion in liquid environments, whereas cilia are shorter and create coordinated flow on the cell surface.

Composed of microtubules in a '9+2' pattern, they are essential for sperm motility.

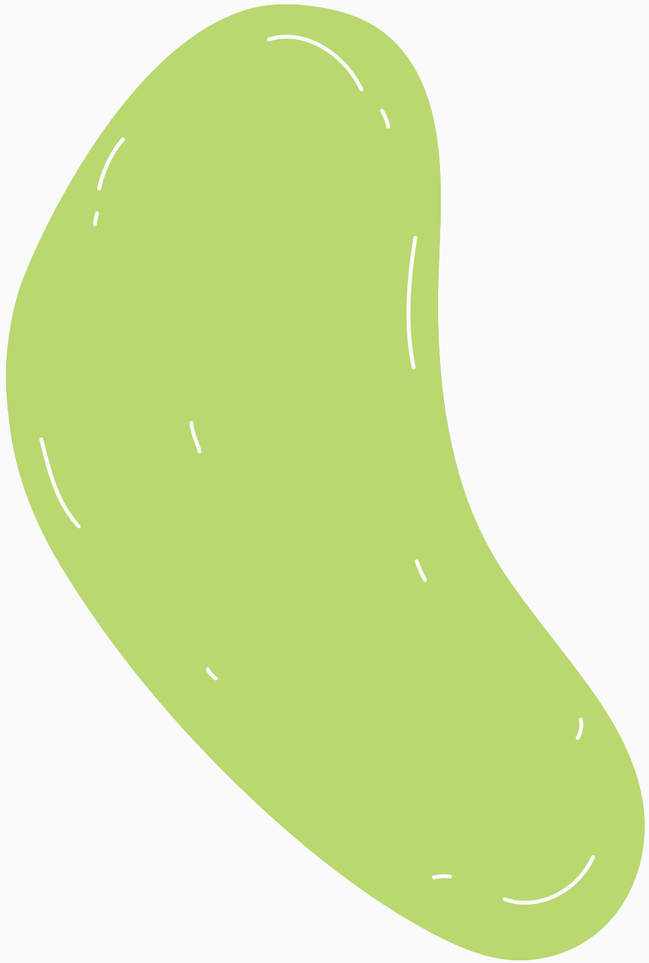






# STORAGE AND TRANSPORTATION

They manage nutrients, eliminate waste,
and regulate metabolic processes.



# Vacuoles

Membrane-bound organelles found in plant cells and some animal cells. They store nutrients, water, ions, and waste materials, regulating turgor pressure and osmotic balance.

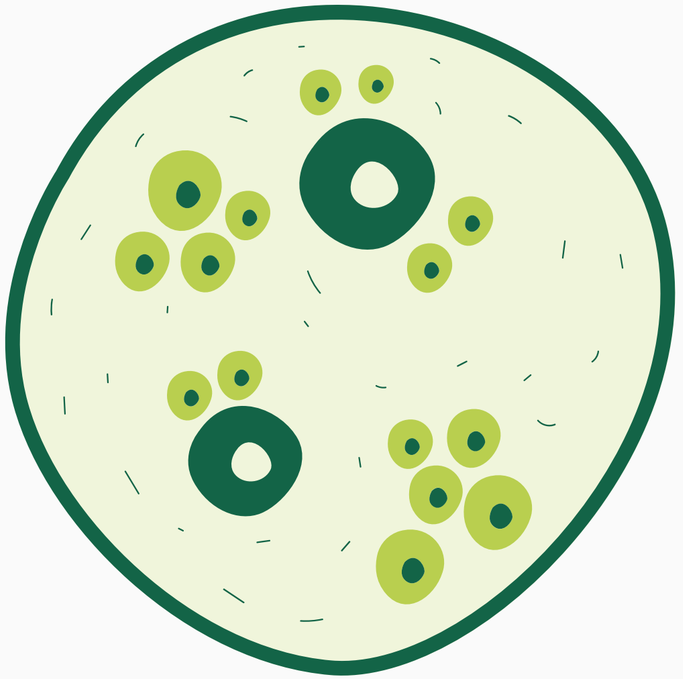
Vacuoles can also be involved in the digestion of substances and serve as a defense mechanism against predators by containing toxins.

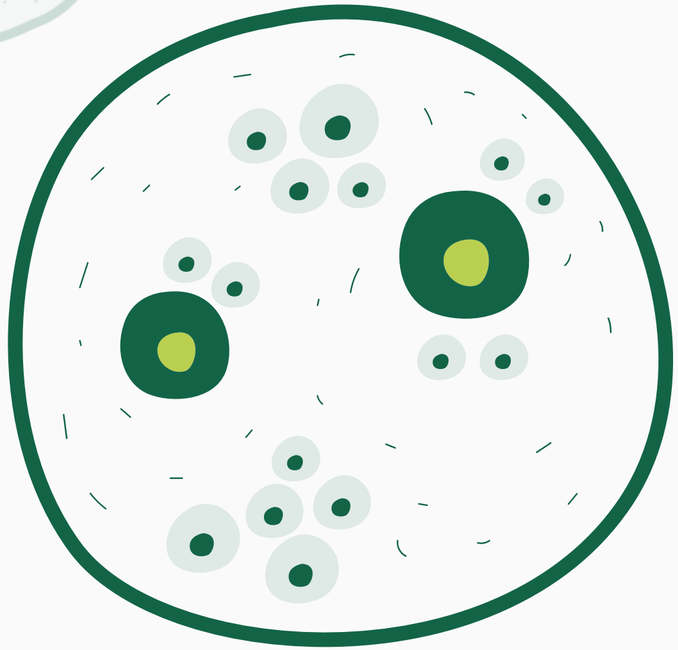
# Vesicles and endosomes

Membranous vesicles that transport specific materials between organelles and the cell membrane.

Vesicles: They transport materials from the endoplasmic reticulum and the Golgi apparatus to other destinations.

Endosomes: They capture and distribute materials for degradation, recycling, or their incorporation into metabolic pathways.





Any questions?