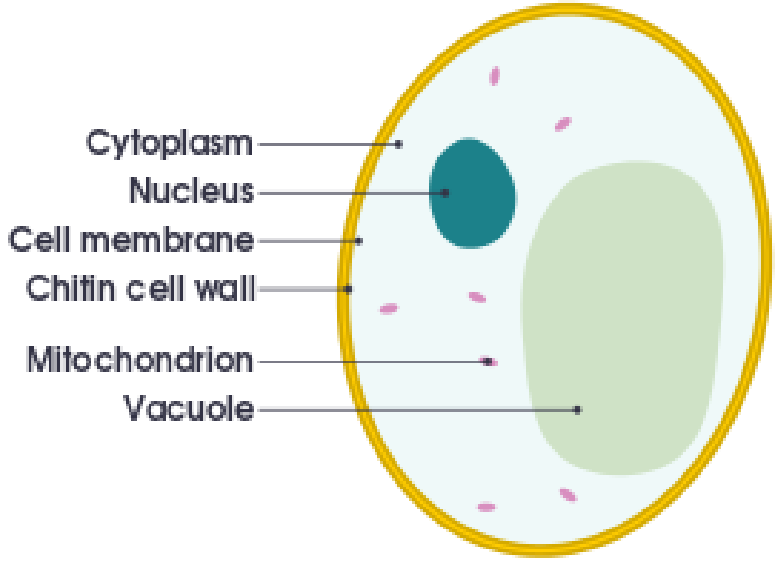
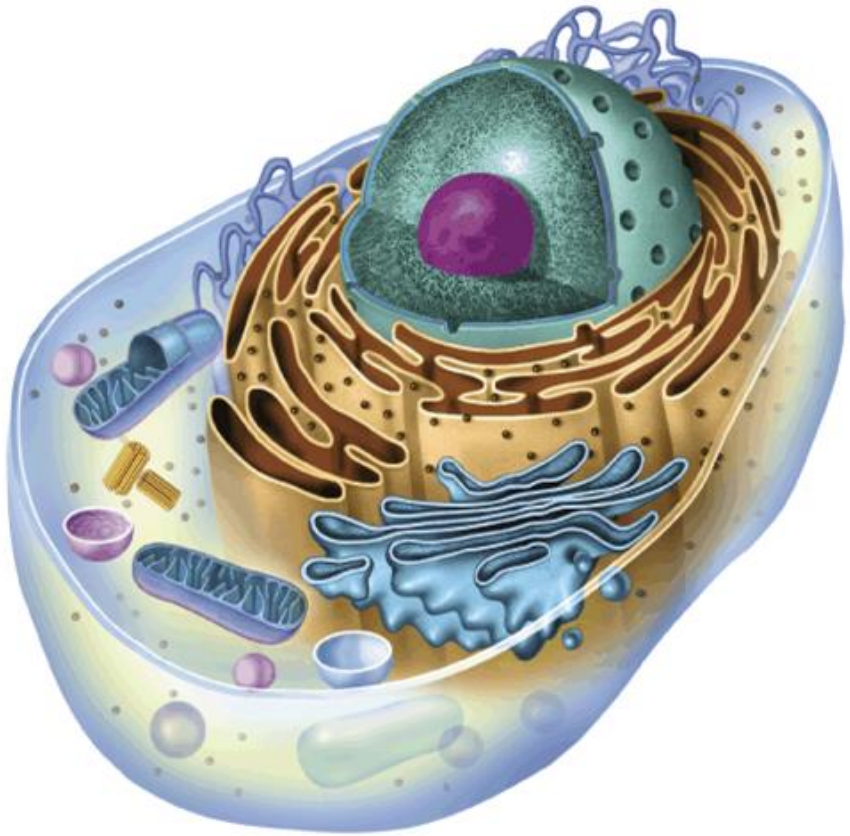
Introduction to Cell Biology





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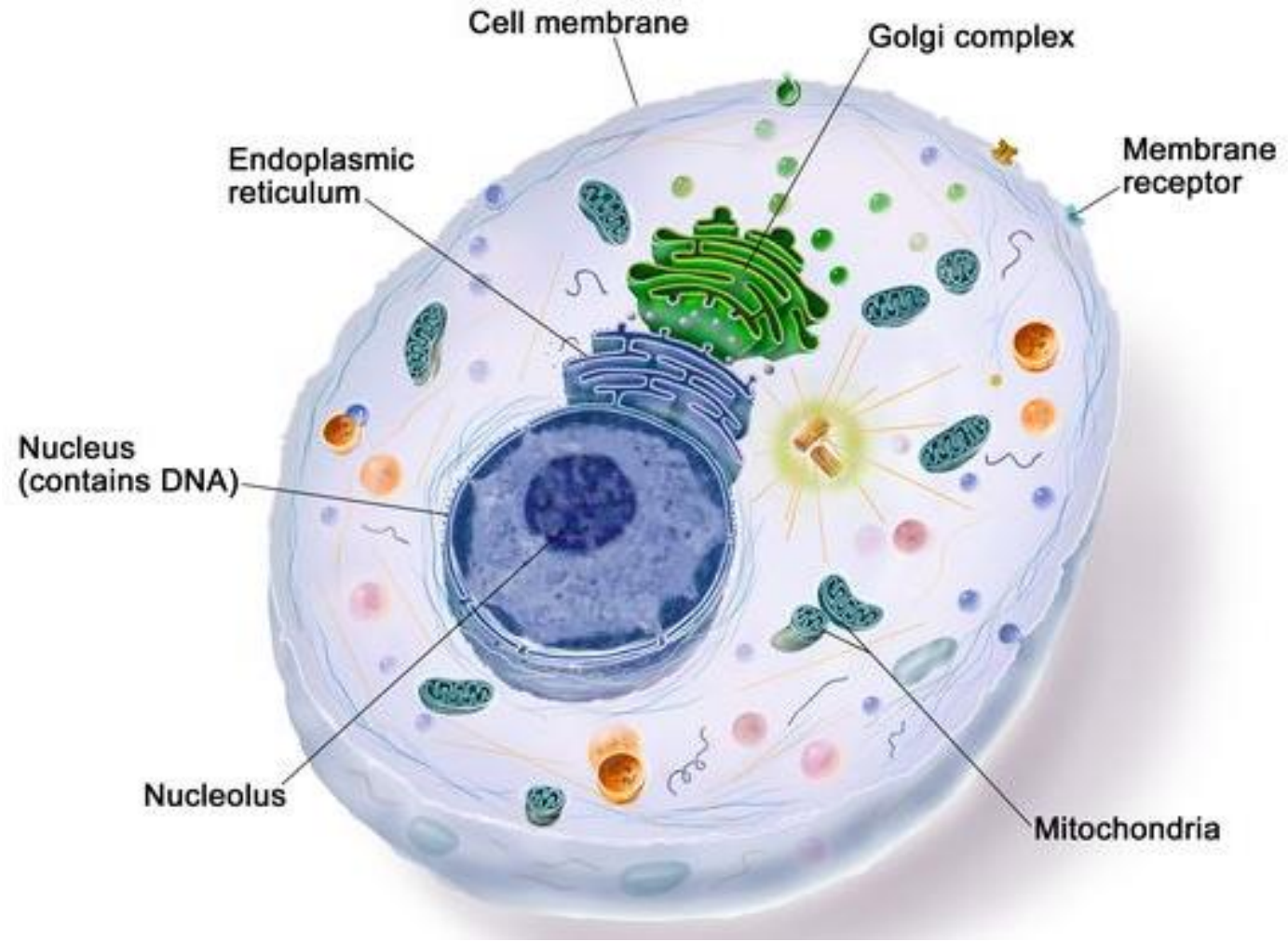
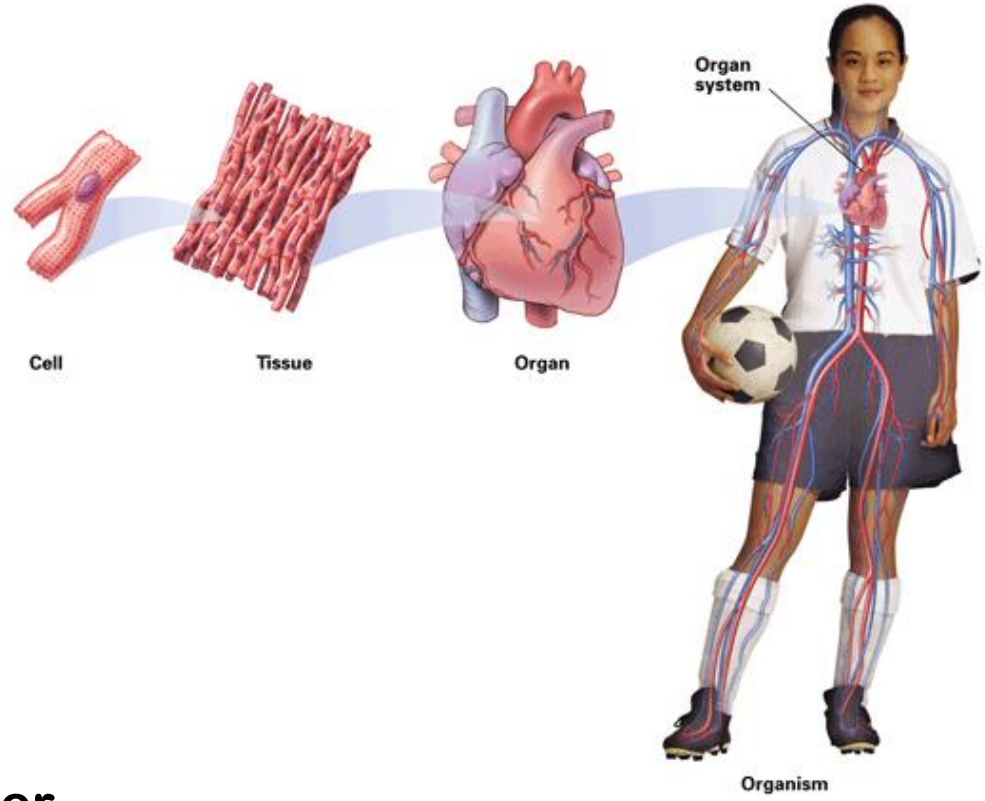
Definition

- Cell biology is a branch of biology that studies the structure, function, and behavior of cells.



What is Cell



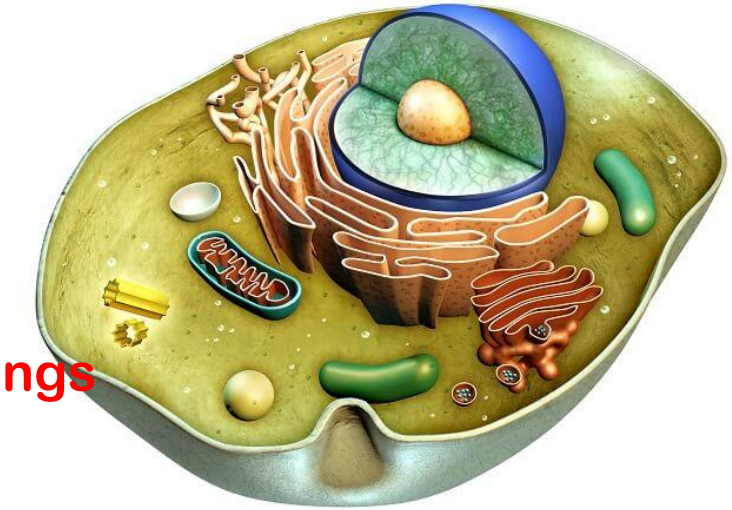
- **Structural & functional unit** of living organism
- Cells are the **fundamental building blocks** of life
- Two types of organism
  - ✓ **Multicellular organism** – Human & many other
  - ✓ **Unicellular organism** - Bacteria, Algae & fungi

  (first form of life on earth about 3-4 billion years ago)

Discovery

- **Robert Hooke** was the first to use the word cell in **1665**
  He observed the cell in plant **cork slide** (Dead cell)
- **A. Van Leeuwenhoek** was the first person to ever observe a cell under a microscope in **1674** (Living cell)
- **Schleiden & Schwann-** Proposed the **cell theory (1830)**
- **Robert Brown-** Discovered the **nucleus (1831)**
- Schleiden, Schwann & **Rudolf Virchow- Modern cell theory(1855)**

The basic cell theory



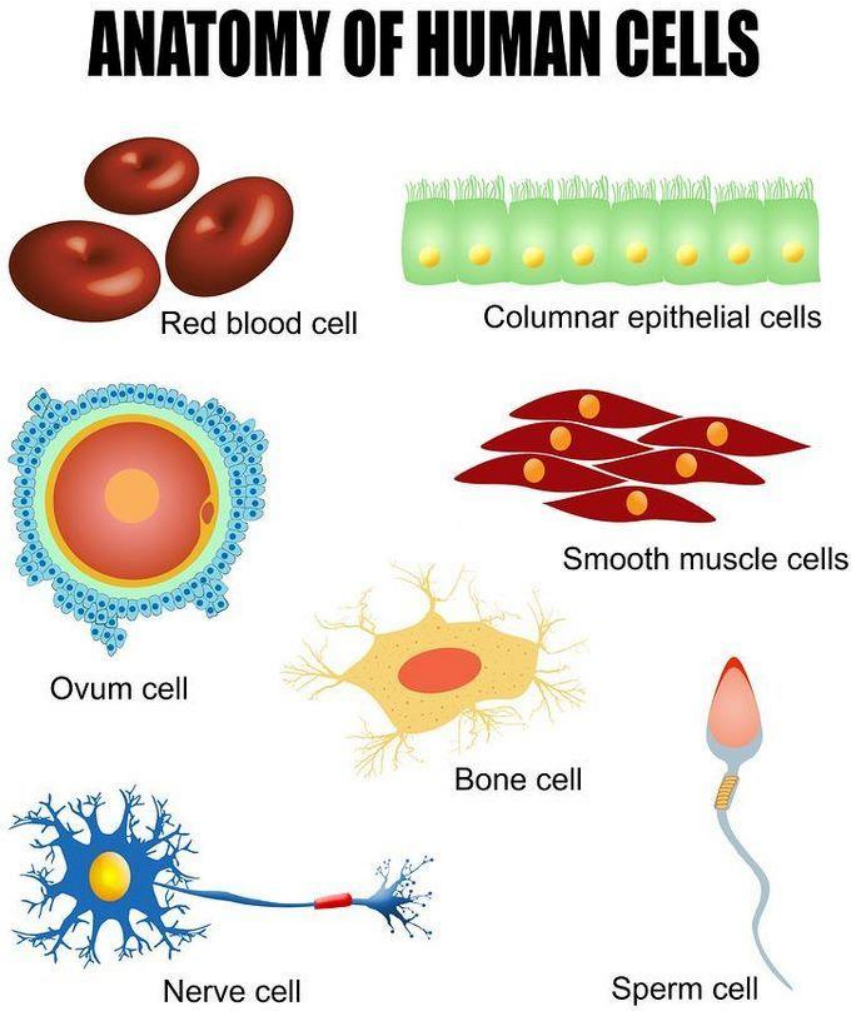
- All living things are composed of cells
- Cells are the basic structure and function unit in living things
- All Cells are raised from pre- existing cell

A modern version of the cell theory

- Energy flows within the cells.
- Genetic information is passed on from one cell to the other.
- The chemical composition of all the cells is the same.

About cell

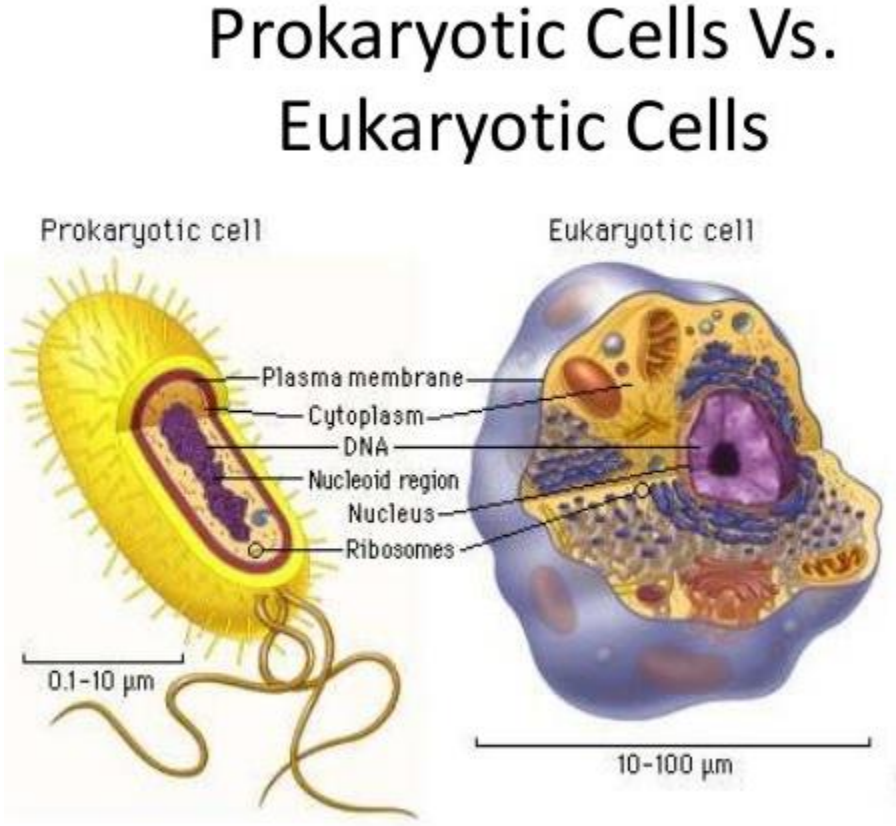
- In humans, there are more than 200 different types of cell.
- Humans consists of approximately 100 trillion cells.
- A typical cell size is 10µm
- Smallest cells are < 1µm in diameter,
  While nerve cells can be up to a 1m long
- A typical cell mass is 1 ng.
- Reproduce by cell division.
- Metabolize raw materials into energy.
- Respond to external and internal stimuli



Two types of cells

Prokaryotic cell

- ✓ **Cells without a nucleus such as bacteria**



Eukaryotic cell

- ✓ **Cells with a distinct nucleus which possess organized chromosomes that store genetic material**

Prokaryotic cell

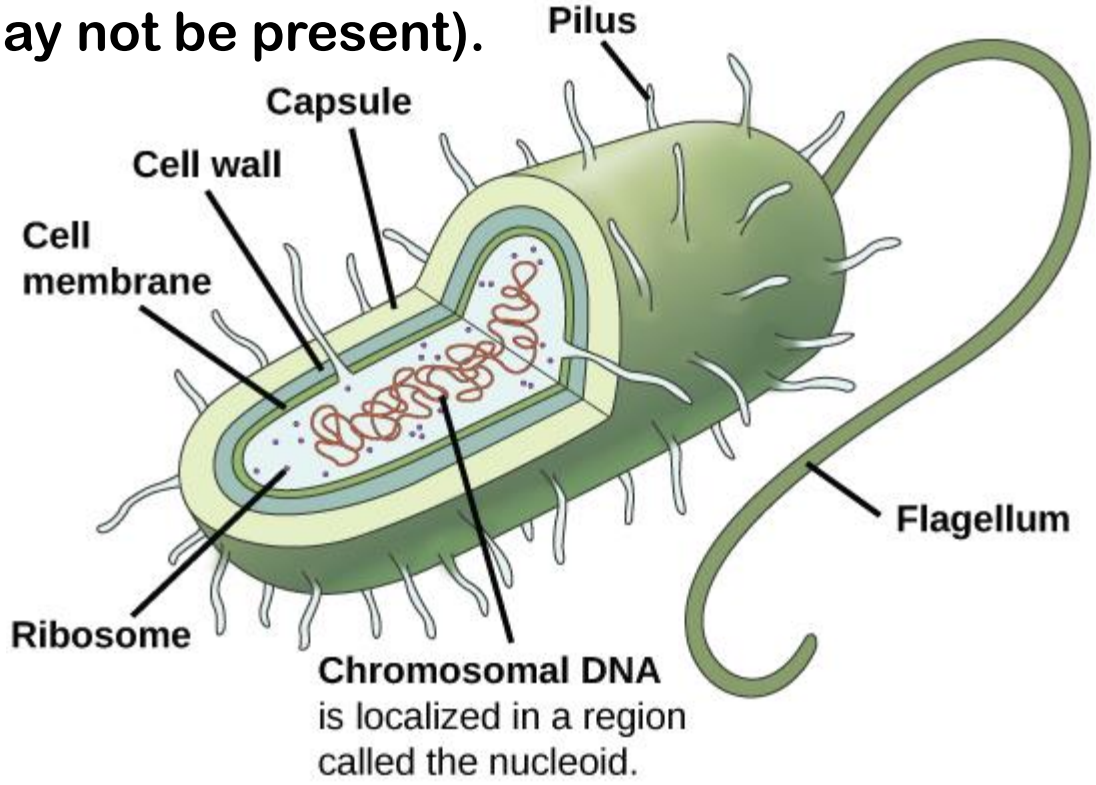
(Pro- Primitive. Karyon- Nucleus)

- Prokaryotic cells have no nucleus. Instead, some prokaryotes such as bacteria have a region within the cell where the genetic material is freely suspended.
- This region is called the nucleoid.
- They all are single-celled microorganisms.
- Examples include archaea, bacteria, and cyanobacteria.
- The cell size ranges from 0.1 to 0.5 µm in diameter.
- The hereditary material can either be DNA or RNA.
- Prokaryotes generally reproduce by binary fission, a form of asexual reproduction.
- They are also known to use conjugation – which is often seen as the prokaryotic equivalent to sexual reproduction (however, it is NOT sexual reproduction).

Prokaryotic cell

(Pro- Primitive. Karyon- Nucleus)

- Oval or rod shape body
- Outer covering is Cell wall (peptido glycan) & beloved plasma membrane
- Outer side of cell wall consist of gelatinous capsule (glycocalyx) which protect the cell from drying or desiccation (the capsule may or may not be present).
- Inside the cell there is cytoplasm, in cytoplasm there are enzymes which require for cellular activities.
- Genetic material are present in the form of circular DNA.



Prokaryotic cell

- **In Prokaryotic cell, Plasmid contains 3 types of genes**
  1. F- Gene: Fertility gene
  2. R- Gene: Antibiotic resistance gene
  3. Col Gene: Provide resistance against colicines secret by E. coli

- **Two types of strains observed in Bacteria**
  1. +Ve strain – Plasmid is present
  2. - Ve strain- Plasmid is absent

Prokaryotic cell

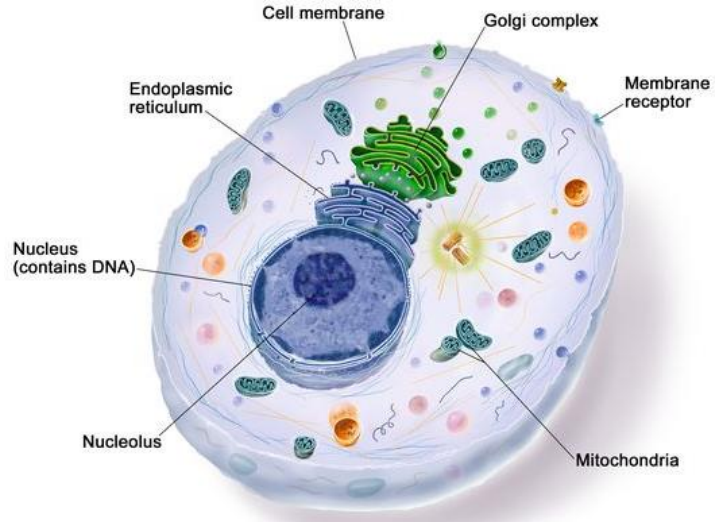
- **Gram +Ve & Gram –Ve**

1. **Gram +Ve – The outer covering of bacterial cell wall is made up of Peptidoglycan. Gram stain can easily stains Peptidoglycan (Purple staining).**

2. **Gram -Ve – Some of the bacterial cell wall externally covered by Lipo-Protein and due to which it can't stain with gram stain**

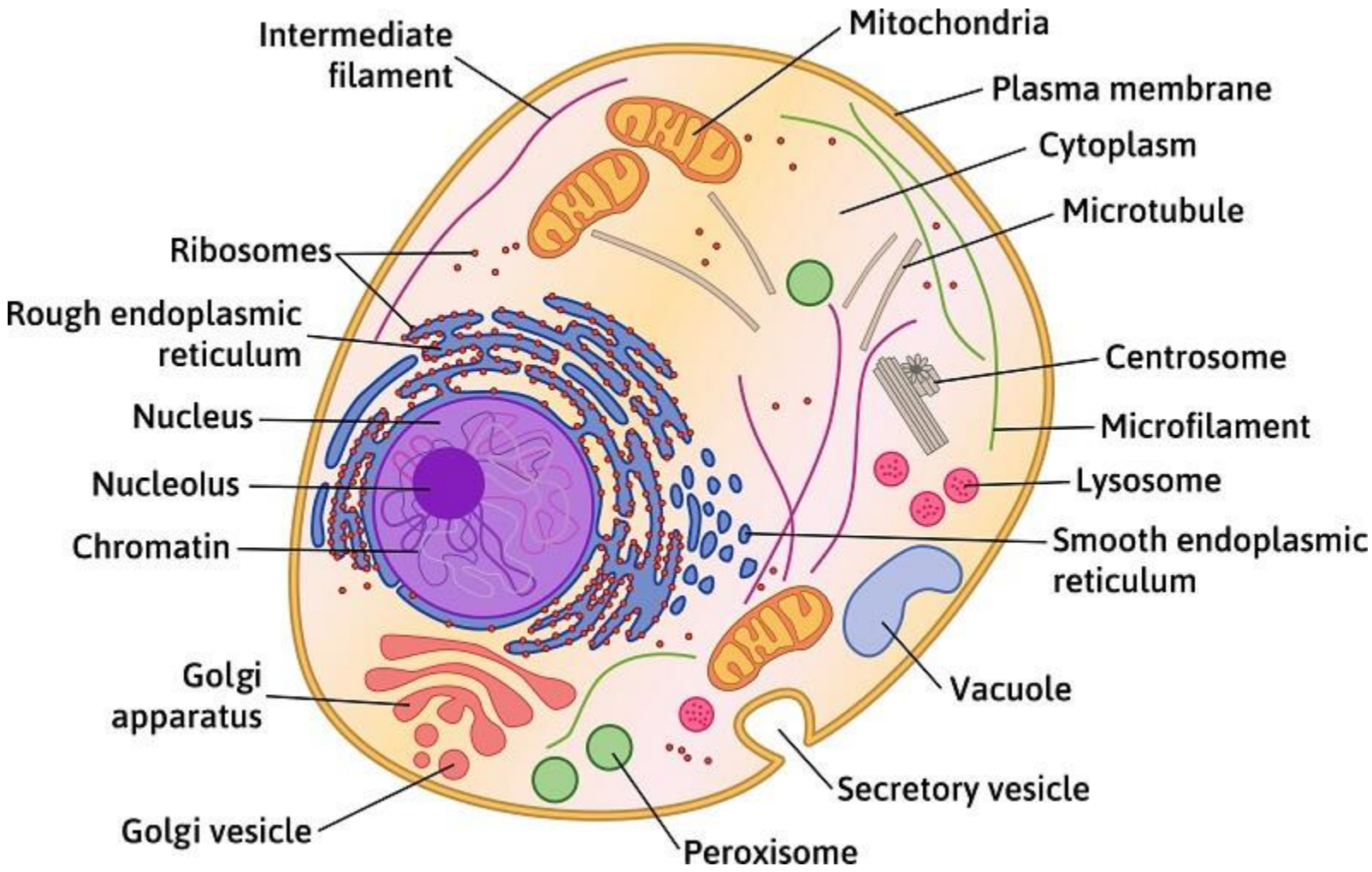
Eukaryotic cell

- Eukaryotic cells are characterized by a true nucleus.
- The size of the cells ranges between 10–100 µm in diameter.
- This broad category involves plants, fungi, protozoans, and animals.
- The plasma membrane is responsible for monitoring the transport of nutrients and electrolytes in and out of the cells.
- It is also responsible for cell to cell communication.
- They reproduce sexually as well as asexually.
- There are some contrasting features between plant and animal cells. For eg., the plant cell contains chloroplast, central vacuoles, and other plastids, whereas the animal cells do not.



Structure of Eukaryotic cell

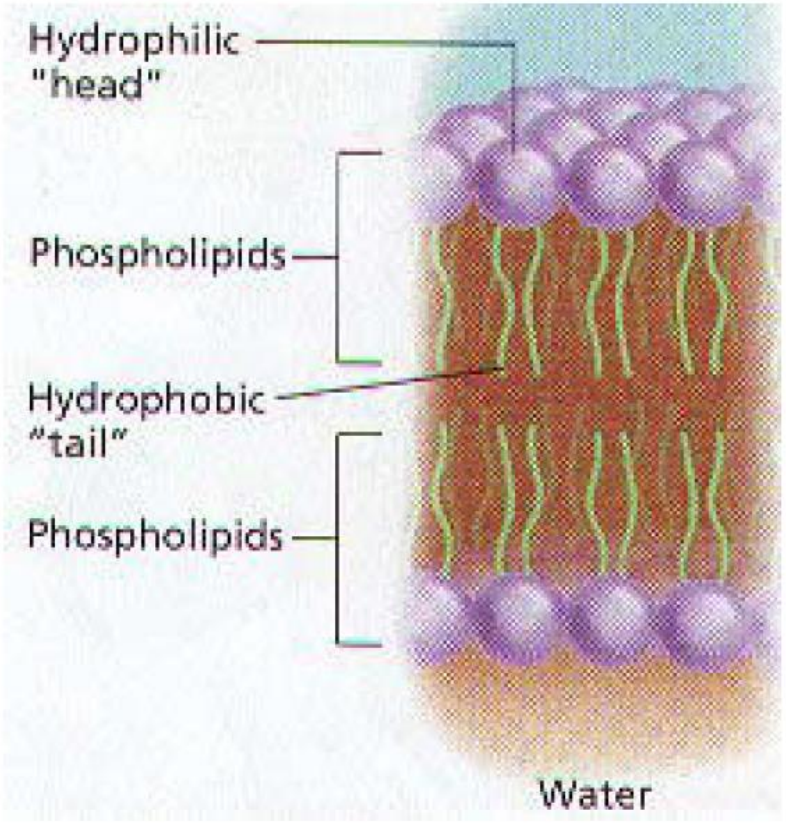
A cell consists of three parts: the cell membrane, the nucleus, and in between of these two, the cytoplasm.



1. Plasma membrane

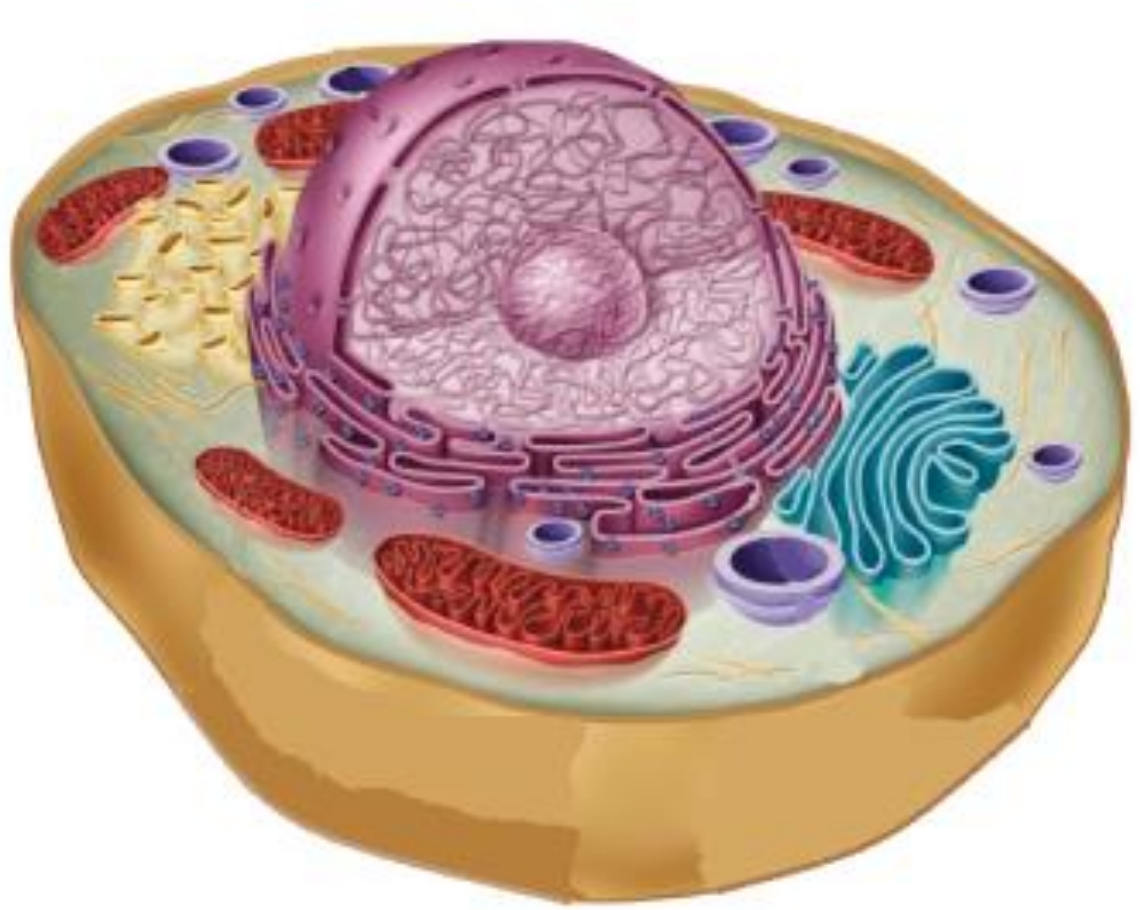
- The cell membrane (plasma membrane) is a biological membrane that separates the interior of all cells from the outside environment which protects the cell from its environment

- The cell membrane functions like a gate, controlling which molecules can enter and leave the cell.



2. Cell organelles

1. Endoplasmic reticulum
2. Ribosome
3. Golgi Complex
4. Lysosomes
5. Mitochondria
6. Plastid
7. Centrosome
8. Cytoplasmic vacuoles
9. Microtubules



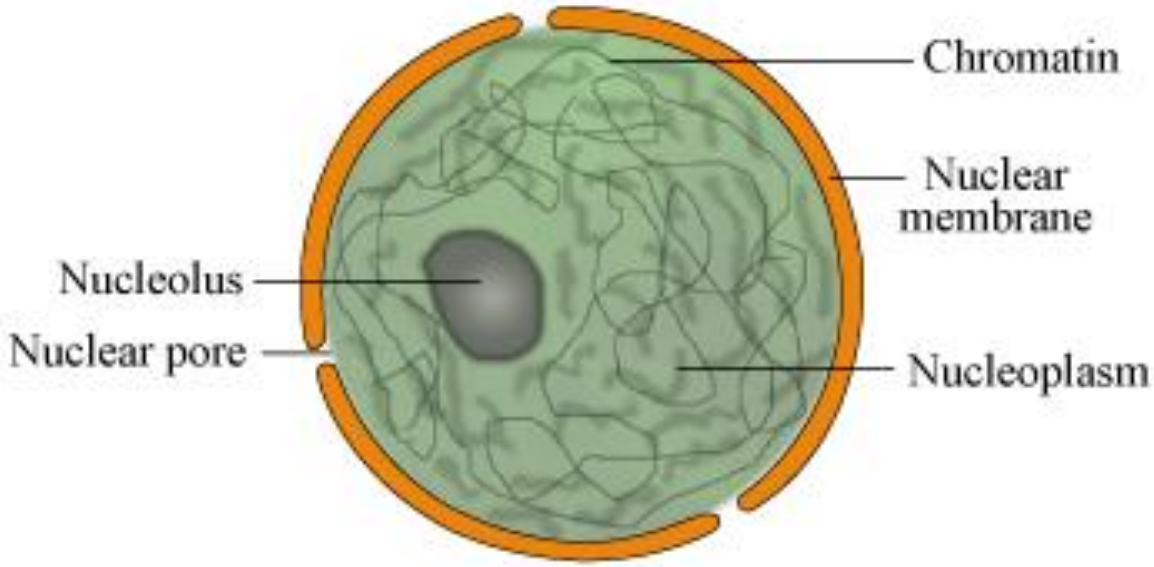
10. Basal Granules
11. Cilia & flagella

3. Nucleus

1. Nuclear membrane or envelope

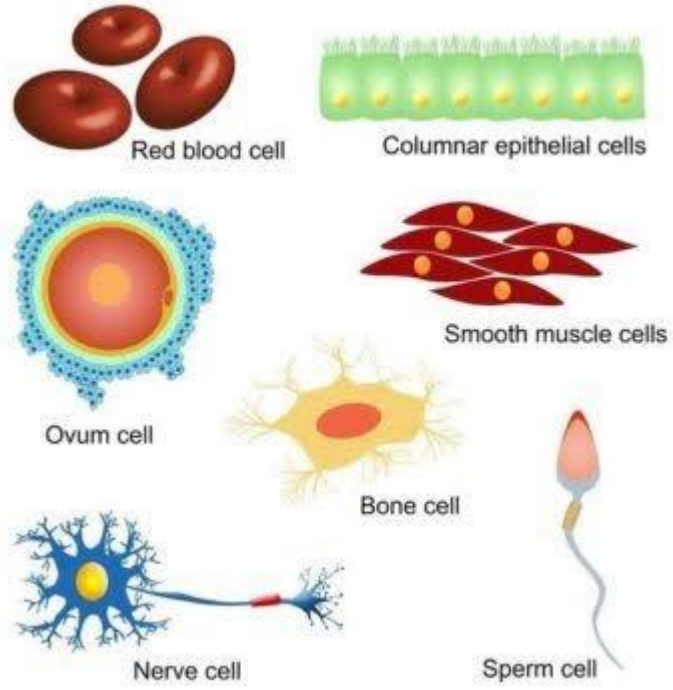
2. Nucleoplasm & chromatin fibre

3. Nucleolus



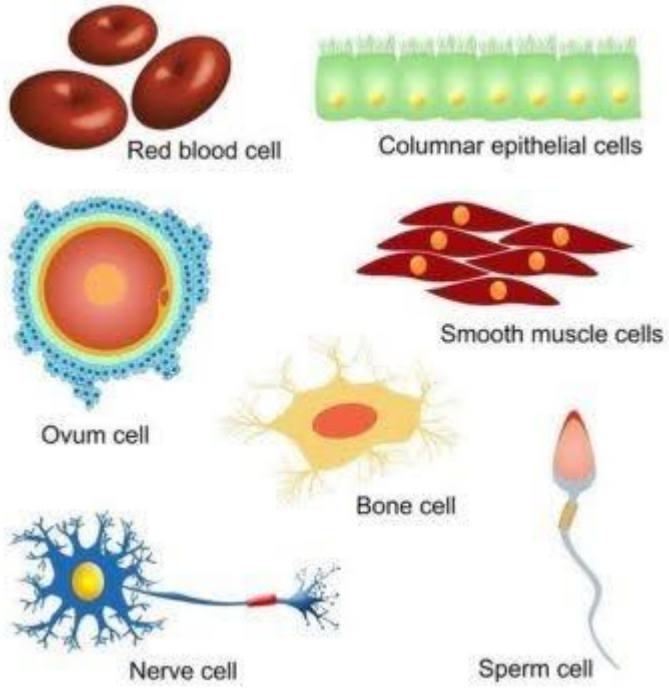
Size, shape and structure

- Every cell is microscopic.
- Within our body, we can observe a variety of cells of different shapes and sizes.
- Cells are the lowest level of organization in every life form.
- From organism to organism, the count of the cell may vary. Humans have more cells than bacteria.
- Among multicellular organisms, the count of the cell varies.
- Some might have billions of cells while others have trillions (like the human).
- But every organism starts its life from a single cell which further divides into thousands and millions.

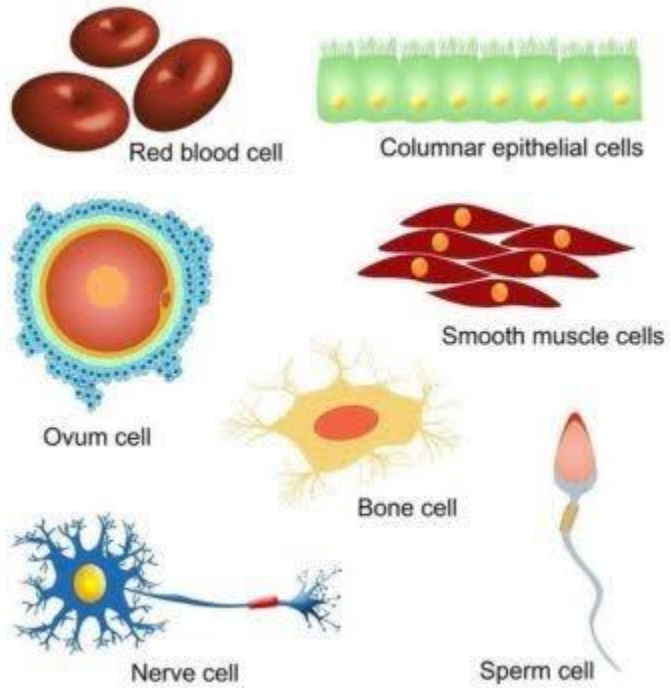


Size, shape and structure

- Living organisms are made up of different types of cells, of different sizes and shapes.
- A unicellular organism differs in shape from another unicellular organism.
- Within a multicellular organism, there are a variety of cells.
- Some are long while others are short; some are circular while some are oval.
- Shape and size vary from cell to cell according to their functions and composition.
- For example, a nerve cell is long and branched, meant for the transmission of signals throughout our body while a muscle cell is small and spindle-shaped which helps in movement.



Shape of the cell



1. Variable changing shape : Protozoan animals like Amoeba

2. Fixed shape:

1. **Cuboidal- eg. Squamous epithelium, Thyroid follicle**
2. **Columnar- Inner lining of Intestine**
3. **Discoidal – Erythrocytes or RBCs**
4. **Spherical : The eggs of animals are rounded or spherical in shape**
5. **Spindle : Smooth muscle**
6. **Elongated : Nerve cell**
7. **Branched: Chromatophore cells of the skin**

Thank You