

STRUCTURAL AND FUNCTIONAL UNIT OF LIFE

STRUCTURAL AND FUNCTIONAL UNIT OF LIFE: CELL

- ▶ A cell is the smallest and most basic form of life.
- ▶ In all life forms, including bacteria, plants, animals, and humans, the cell was defined as the most basic structural and functional unit.
- ▶ A single cell is often a complete organism in itself, such as a bacterium and yeast.
- ▶ **DISCOVERY:**
Robert Hooke, one of the first scientists to use a light microscope, discovered the cell in 1665.

Conti...

- ▶ All types of cells have 3 major components:
 1. Cell membrane
 2. Cytoplasm
 3. DNA

CELL THEORY

- ▶ Based on scientific observations over the next 150 years, scientists formulated the cell theory, which is used for all living organisms no matter how simple or complex. The cell theory incorporates three principles:
- ▶ All living things are composed of one or more cells[Schleiden & Schwann(1838-39)].
- ▶ The cell is basic unit of structure and function in all living things[Schleiden & Schwann(1838-39)].
- ▶ All cells are produced by the division of preexisting cells[Virchow(1858)].

CELL AS STRUCTURAL AND FUNCTIONAL UNIT

- ▶ Although we defined the cell as the “most basic” unit of life, it is structurally and functionally complex. A cell can be thought of as a mini-organism consisting of tiny organs called organelles. The organelles are structural and functional units constructed from several macromolecules bonded together. Cells provide specific conditions, for the occurrence of the metabolic reactions. These have specialized enzymes, which catalyze the biochemical reaction and regulates the functions of the body.
- ▶ All of the organelles are anchored in the cell’s cytoplasm via a cytoskeleton. The cell’s organelles are isolated from the surrounding environment by a plasma membrane.

- ▶ Cell is considered as functional unit of life because living organism/ beings consist of cells and all the physiological, biochemical, genetic and metabolic functions are performed inside of the cell. It is believed as the smallest functional unit that can exist independently.
- ▶ Unicellular organisms can exist as independent which tells a cell's capacity to exist independently. Eg: Euglena, Paramecium, Yeast. Because of this, a cell is termed as the fundamental/basic and structural unit of life.
- ▶ Four macromolecules—carbohydrates, lipids, proteins, and nucleic acids—make up all of the structural and functional units of cells.

CELL ORGANISATION

- ▶ **Cells**
- ▶ **Tissues.**

There are four types of human tissues: connective, which connects tissues; epithelial, which lines and protects organs; muscle, which contracts for movement and support; and nerve, which responds and reacts to signals in the environment.

The background features abstract green geometric shapes, including triangles and overlapping polygons, in various shades of green, ranging from light to dark. These shapes are positioned primarily on the right side of the slide, with some extending towards the left.

▶ **Organs**

▶ **Organ systems**

There are eleven organ systems in the human body.

▶ **Organism**

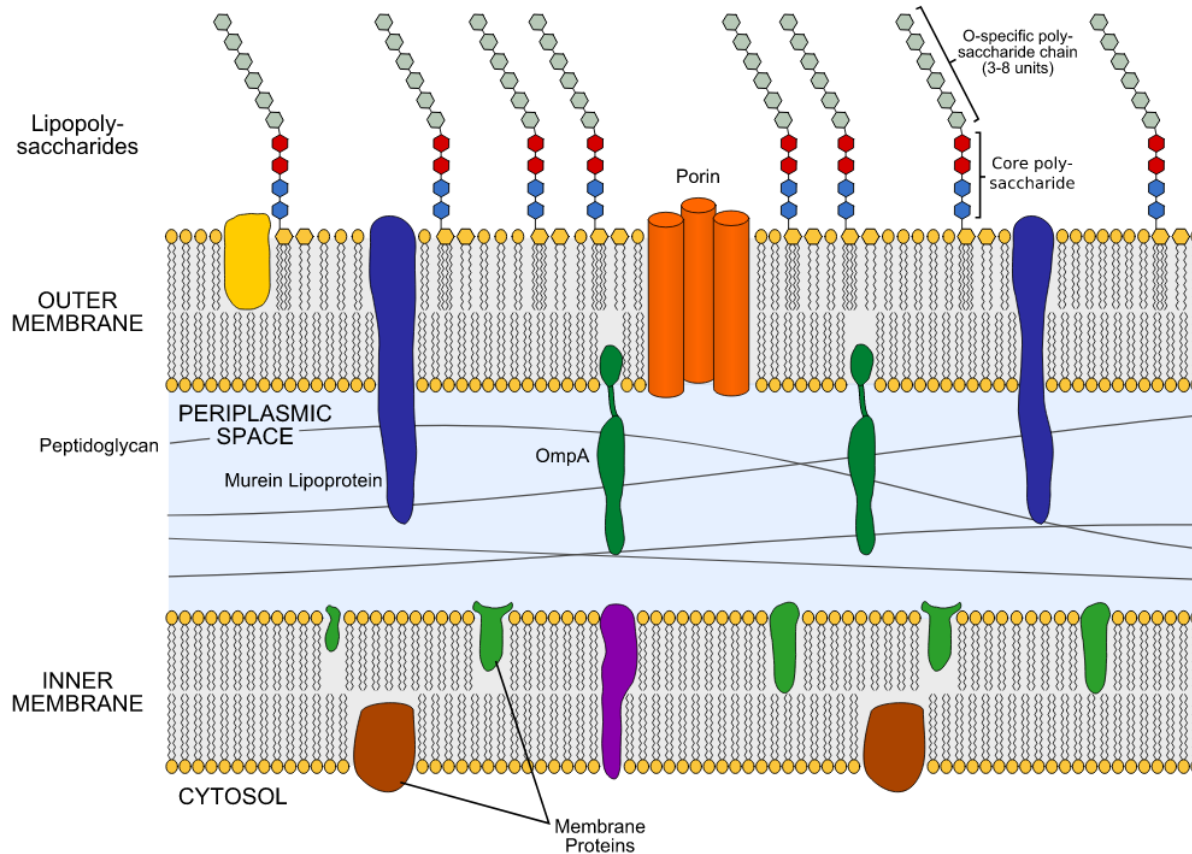
CELL SIZE

- ▶ Smallest cell: Mycoplasma (size:0.1micrometer)
- ▶ Largest cell: Ostrich egg (size: 18cm)
- ▶ Plant cell> animal cell> bacterial cell.
- ▶ WHY CELL IS SMALL?
- ▶ The reason cells can grow only to a certain size has to do with their surface area to volume ratio. If it is small, the cell is very big.

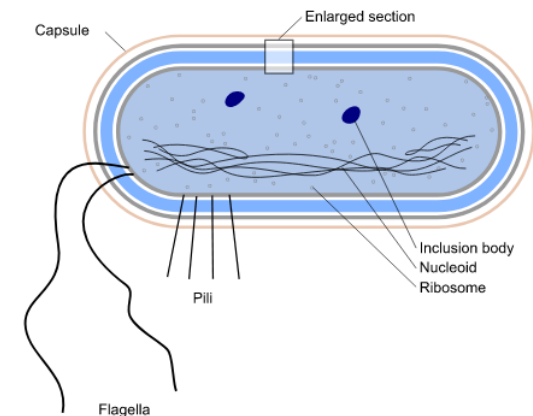
SHAPE OF CELLS

- ▶ Vary in shape.
- ▶ Generally spherical , in multicellular forms due to pressure become polyhedral.
- ▶ Some cells can change their shape, but mostly having fixed shape.
- ▶ Animal cell: irregular
- ▶ Plant cell: rectangular or cube shaped.
- ▶ Human RBCs are circular biconcave.
- ▶ Nerve cells are branched.
- ▶ Human WBCs can change their shape.

TYPES OF CELL: PROKARYOTIC CELLS

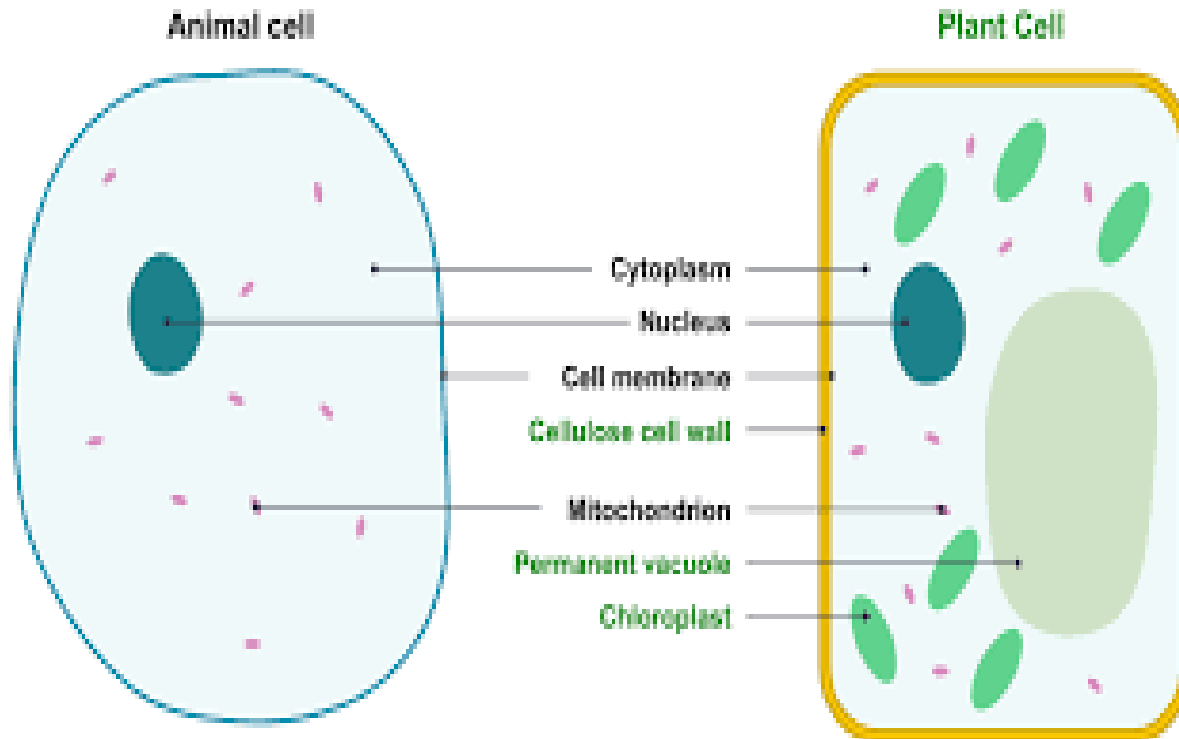


Gram Negative Bacterial Cell Wall



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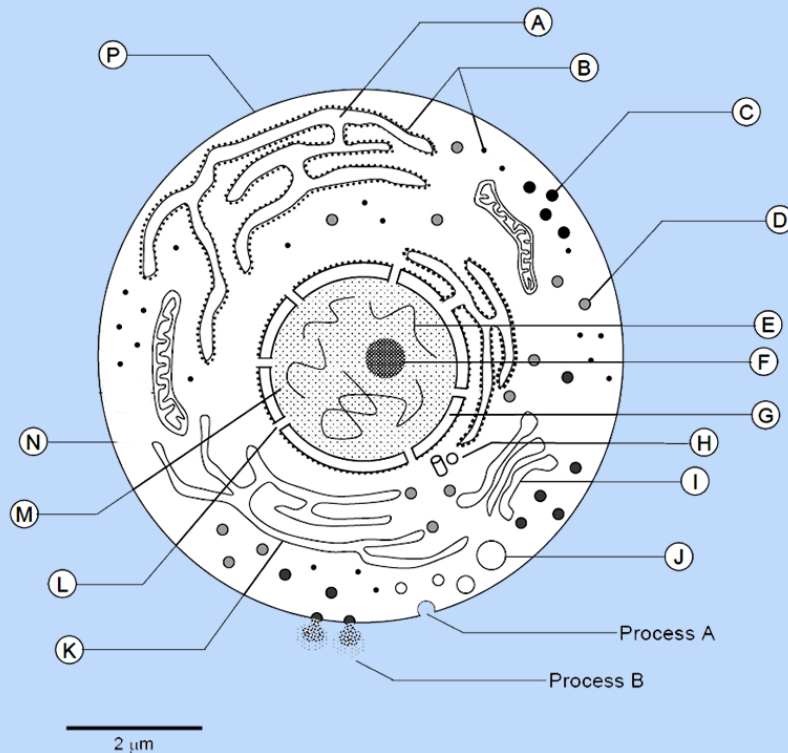
EUKARYOTIC CELLS



MESOKARYOTIC CELLS

- ▶ Intermediate between prokaryotic and eukaryotic cells.
- ▶ Nucleus is larger in size: Mesokaryon (by Dodge)
- ▶ Dinoflagellets
- ▶ Mitotic spindle is not formed.
- ▶ Eg: certain algae

Cell Structure



- A-Rough endoplasmic reticulum
 - B-Ribosomes
 - C-Glycogen granules
 - D-Vesicle
 - E-Chromatin
 - F-Nucleolus
 - G-Nuclear envelope
 - H-Centrosome
 - I-Golgi apparatus
 - J-Vacuole(e.g. lysosome,food vacuole)
 - K-Smooth endoplasmic reticulum(SER)
 - L-Nuclear pore
 - M-Nucleoplasm / Nucleus
 - N-Cytosol ('cytoplasm')
 - P-Cell surface membrane
- Process A is endocytosis
Process B is exocytosis

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STRUCTURE OF CELL

- ▶ Cell membrane or Plasma membrane: A very thin, delicate and flexible membrane surrounding each cell. Selectively permeable.
- ▶ Cell wall: Found only in plants and is made up of cellulose. It gives shape and rigidity to the plant cell. Freely permeable.
- ▶ PROTOPLASM: CYTOPLASM+NUCLEUS
- ▶ Cytoplasm: Semi- liquid, colorless and translucent fluid which forms the entire portion of a cell inside the cell membrane except for the nucleus .In it cytosol and cell organelles are present.
- ▶ Nucleus: Regulates and coordinates various life processes including cell division. Contains genes which determine the heredity.

CYTOPLASM

- ▶ Protoplasm outside the nucleus.
- ▶ Has two parts:
 1. Cytosol
 2. Cell organelles

CYTOSKELETON

- ▶ MICROFILAMENTS
- ▶ MICROTUBULES

STEM CELL

- ▶ Body's raw material.
- ▶ Can self renew or differentiate.
- ▶ Enable body to grow, repair and renew.
- ▶ Divide-daughter cells-new stem cells or specialized cells.
- ▶ No other cell in body has the natural ability to generate new cell type.

THANK YOU

The background features abstract, overlapping geometric shapes in various shades of green, ranging from light lime to dark forest green. These shapes are primarily located on the right side of the frame, creating a modern, layered effect against the white background.