Medical Biology

COLLEGE OF DENTISTRY

UNIVERSITY OF BASRAH

Principles of Cell Biology

Cell biology:

Biology is a scientific study of the living organisms, which grow, reproduce and respond to stimuli of the environmental factors.
The science of medical biology mainly concerns with studying of human body, its structure, functions and the organization of the body parts.

The Cell

Cells are the structural and functional unit of all living organisms, from the unicellular organisms, like amoeba, which are the body made up of one cell to the multicellular organisms, such as human beings, whom their body made up of 50-100 trillion cells.

The cell was discovered by Robert Hooke in 1665, with discovery of the light microscope.

Cell Theory consists of three principles:

a. All living things are composed of **one or more cells.**

b. Cells are the **basic units of structure and function in an organism.**

c. Cells come only from the **replication of existing cells.**

Types of the cells:

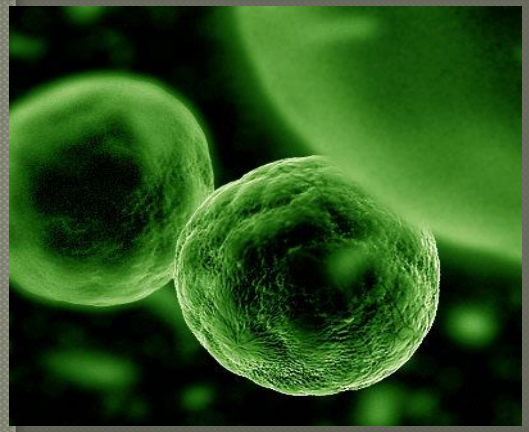
Cells, based on their internal organization, are divided into two types:

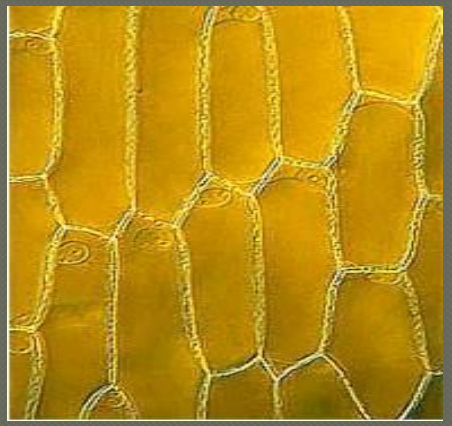
1- Prokaryotic – single cell with nuclear material but no nuclear membrane or membrane bound organelles

2- Eukaryotic – most cells – with organized nucleus and membrane bound Organelles

Cells come in a variety of shapes – depending on their location and function:-

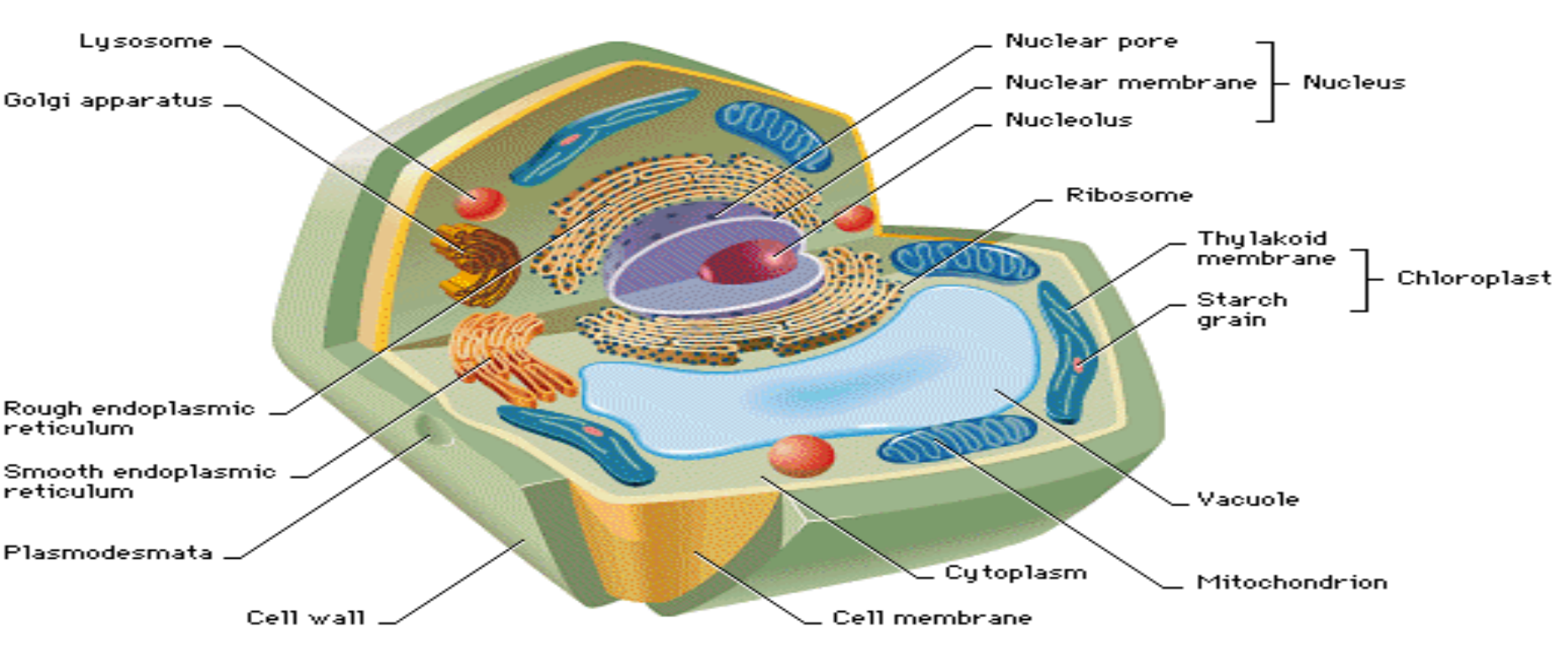
The shapes can be spherical, flattened ,columnar, cuboidal





General structure of cell:

Cell membrane--made of two layers of phospholipid and surrounds the cytoplasm.
Nucleus--control center of the cell surrounded by a nuclear membrane.
Cytoplasmic structures--perform various cellular functions: mitochondria, chloroplasts, and others.
The nucleuse and cytoplasm called protoplasm



Cell Chemistry

Chemical analysis of different types of animal and plant cells show that the protoplasm is a coiled material made up of inorganic and organic molecules .

Inorganic materials•

The inorganic material are represented by water and inorganic ions (sodium, potassium, magnesium, calcium, chloride, etc.)

The inorganic ions are important in maintaining the osmotic pressure and acid- base equilibrium of the cell

Organic materials:

Organic compounds contain carbon and are found in all living things.

1- **Carbohydrates** -

major source of energy and include sugars and starches, contain C,H,O in a ratio - of 1: 2:1. plant and animal cells use carbohydrates for maintaining structure within the cells

2- Proteins

Represent 15-20 % of the chemical component of a dray cell and composed of chains of different types of amino acids.

3- Lipids (15%)–

Are insoluble in water, made up of C,H,O; composed of glycerol and fatty acid . Provide insulation, store energy, cushion internal organs.

4- Nucleic Acids -

are biopolymers, or large biomolecules, essential for all known forms of life . - Nucleic acids, which include DNA and RNA , are made from monomers known as nucleotides. Each nucleotide has three components: a sugar, a phosphate group, and a nitrogen base.

The living properties of the protoplasm

1- Conductivity:

It is the transmission of waves of excitation throughout the cell from the point of stimulus, as that of the nerve and muscle cells.

2- Contraction:

Contraction is a property of change in size to achieve locomotion of an organism as that of contraction of skeletal muscle tissue.

3- Respiration:

Respiration is a process whereby oxygen and food substances within the cell interact chemically to produce energy, carbon dioxide and water.

4- Absorption:

Is the capacity of the living cell to get in a substance from its environment (columnar epithelium of small intestine.

5- Secretion:

It is a process by which a cell extrudes materials. These materials may be a useful (secretion) or useless product (excretion) e.g. digestive enzymes and hormones or urea.

6- Growth and reproduction:

Growth means an increase in the size of the cell as a result of increasing the amount of protoplasm.

Reproduction of a living cells is achieved by division of a mature cell either by mitosis or meiosis.

Movement of the cells :

Movement of unicellular organisms is necessary for defense or for obtaining a food .

Cellular locomotory mechanisms may be achieved by :

1- Activity cellular appendages: cilia and flagella as in some bacteria and protozoa.

2- Streaming movement of the cellular cytoplasm as in amoeboid movement.

3- Movement of human being, is achieved by contraction of a muscle fiber as of the striated and smooth muscle.

Energy requirement and supply

Cells can:

- use DNA as hereditary material,
- use proteins as catalysts
- reproduce
- transform matter and energy
- respond to their environment