SBI4U UNIT #1: BIOCHEMISTRY LECTURE #4 (CELL STRUCTURE AND FUNCTION)



CELL STRUCTURE AND ORGANELLES

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CELLULAR BIOLOGY

Definition: Cellular biology is a branch of biology that studies the different structures and functions of the cell and focuses mainly on the idea of the cell as the basic unit of life

A cell: In biology, the basic membrane-bound unit that contains the fundamental molecules of life and of which all living things are composed.



Nerve cell **Examples of Cells**





Fat cell

Red blood cell

Egg and sperm



CELL THEORY

Definition: Living organisms are made up of cells, that they are the basic structural/organizational unit of all organisms, and that all cells come from pre-existing cells (Matthias Schleiden & Theodor Schwann, 1839)



The cell theory are as described as:

➢ All living organisms are composed of one or more cells.

The cell is the basic unit of structure and organization in organisms.

Cells arise from preexisting cells.

Source: Wikipedia

TYPES OF ORGANISMS

□ Unicellular Organisms: Organisms that are made of only one single cell. e.g. Bacterium cell

➤The single cell completes all characteristics of life and maintains homeostasis on its own.

□ Multicellular Organisms: Organisms made of many different types of specialized cells.

Each different body part / organ is made of different types of cells.

- > Each type of cell has a unique structure and function.
- \succ All of the different cells must work together to complete the characteristics of life, and homeostasis.

MULTICELLULAR ORGANISMS

□ Multicellular Organization Levels:

Atoms & Molecules

➤Cells (The basic units of life.)

➤Tissues (Similar cells working together on a common function.)

➢Organs (Different types of tissues working together on a common function.)

Organ Systems (Different types of organs working together on a common function.)

➢Organism (All organ systems working together to maintain homeostasis.)



Multicellular Organization



TYPES OF CELLS

□ Based on structure:

Prokaryotic Cells: cells lack a true nucleus and its DNA consists of a single chromosome found in a region called the nucleoid. They Are smaller (range between 1 µm to 10 µm in diameter) than eukaryotic cells. E.g Bacterium cell.

Eukaryotic Cells: cells have a membrane bound nucleus that holds DNA within thread-like structures called chromosomes. They are generally quite a bit bigger (range between 10 µm and 100 µm) than prokaryotic cells. E.g. algae, protozoa, fungi, plants and animals



TYPES OF CELL

Eukaryotic vs. Prokaryotic

	Eukaryotic Cell	Prokaryotic Cell
Nucleus	Present	None
Cell Wall	Only plant and fungi	Present
Cell Types	uni- and multicellular	Unicellular
Organelles	Present	Absent
Chromosomes	More than one; Linear	One; Circular
Cytoskeleton	present	absent
Examples	Animals, Plants, Fungi	Bacteria, Archea

ANATOMY OF PROKARYOTIC AND EUKARYOTIC CELLS



COMMON COMPONENTS OF ALL CELLS

All cells share four common components:

- 1) a plasma membrane, an outer covering that separates the cell's interior from its surrounding environment;
- 2) cytoplasm, consisting of a jelly-like region within the cell in which other cellular components are found;
- 3) DNA, the genetic material of the cell; and
- 4) ribosomes, particles that synthesize proteins. However, prokaryotes differ from eukaryotic cells in several ways.

Source: http://www.opentextbooks.org.hk/ditatopic/34604

ORGANELLES OF EUKARYOTIC CELLS

Organelles: A membrane-bound compartment or structure in a **cell** that performs a special function.

Organelles are found only in eukaryotic cells and are absent from the cells of prokaryotes such as bacteria.





INSIDE AN ANIMAL CELL



EUKARYOTIC CELL STRUCTURES AND FUNCTIONS:

Look at your handout

Biology: Cell Structure

https://www.youtube.com/watch?v=URUJD5NEXC8

2 MIN. BREAK!!!

OTHER ORGANELLES

□ **Mitochondrion** (plural: Mitochondria): an organelle with two membranes; the site of most ATP synthesis during aerobic cellular respiration. Typically between 1 to 4 µm in length



OTHER ORGANELLES

Plastids: a membrane-bound organelle that in involved in photosynthesis and storage in plants and algae

Types of plastids:

Chloroplasts: contain Chlorophyll, and perform photosynthesis

Chromoplasts: lack of Chlorophyll but contain carotenoids (different pigments: yellow, red, orange) and responsible for different colour of fruits.

Amyloplasts: non-pigmented and store starch in nonphotosynthetic tissue of plants.





OTHER ORGANELLES

□ Cytoskeleton: a dynamic system of filaments that provides cell structure, helps with cell division, and enables the cell and inner organelles to move around. E.g Microtubules and Microfilaments.



3 TYPES OF CYTOSKELETON FIBRES

Microtubules

Microfilaments

Intermediate Filaments

- Protein = tubulin
- Largest fibers
- Shape/support cell
- Track for organelle movement
- Forms spindle for mitosis/meiosis
- Component of cilia/flagella

- Protein = actin
- Smallest fibers
- Support cell on smaller scale
- Cell movement
- Eg. ameboid movement, cytoplasmic streaming, muscle cell contraction

- Intermediate size
- Permanent fixtures
- Maintain shape of cell
- Fix position of organelles

3 TYPES OF CYTOSKELETON FIBRES



CILIA, FLAGELLA, AND PSEUDOPODS

□ **Flagellum:** a whiplike tail that is used in propulsion of both prokaryotic and eukaryotic cells. (Fig. a)

□ Cilia: tiny hairlike structures that move water and mucus in eukaryotes; used for movement of prokaryotic cells. (Fig. b)

Pseudopods: temporary cytoplasmic projections of the cell membrane in certain unicellular protists such as amoeba. Pseudopods, also called pseudopodia (singular: pseudopodium), literally means false foot. (Fig. c)





THE CELL SURFACE

□ Cell wall: A cell wall is an outer layer surrounding certain cells that is outside of the cell membrane. All cells have cell membranes, but generally only plants, fungi, algae, most bacteria, and archaea have cells with cell walls.

Primary wall: a cellulose coating that surrounds a plant cell; thin and pliable layer.

> Secondary wall: a coating that is added to a plant cell wall; it is more rigid and often thicker than the primary cell wall. E.g. wood.



EXTRACELLULAR MATRIX (ECM)

Definition: Extracellular matrix (ECM) is a non-cellular three-dimensional macromolecular network composed of collagens, proteoglycans/ glycosaminoglycans, elastin, fibronectin, laminins, and several other glycoproteins that provides structural and biochemical support to the surrounding cells.



ACTIVITY# Label the diagram (Handout)

