Prof. Dr. Hanaa Kamil

The cell

Animals, plants, fungi, and protists are all made up of at least one eukaryotic cell. In contrast, bacteria and archaea are made up of a single prokaryotic ce ll.

All cells are surrounded by a cell membrane (also called a plasma membrane). The cell membrane is the boundary that separates the inside of the cell from the outside. The plasma membrane encloses all the cell components, which are suspended in a gel-like fluid called the cytoplasm. The cytoplasm is the location of the organelles.

There are two basic types of cells

1- Prokaryotes (all bacteria are prokaryotes.)

2- Eukaryotes

The differences between prokaryotic and eukaryotic cells are as below.

Prokaryotic cell	**Eukaryotic cell**
1- Single-celled.	1- Can either be single-celled or multi-celled.
2- Size of the cell is generally small (1-10µm)	2- Size of cell is generally large (5-100µm).
3- Nucleus is absent (Nuclear region or nucleoid is not surrounded by a nuclear membrane) and DNA travels openly around the cell.	3- Nucleus is present (Nuclear material is surrounded by a nuclear membrane within containing its DNA).
4- Nucleolus is absent.	4- Nucleolus is present.
5- It contains single chromosome.	5- It contains more than one chromosome.
6- Cell division takes place by fission or budding (no mitosis) another copy by dividing.	6- Can reproduce in one of several ways (Ex. meiosis, mitosis).

Animal cell shapes.

Animal cells can adopt a variety of shapes and each type of cell performs a specific function. The size, shape and number of the cell vary greatly among unicellular and multicellular organisms.

The basic shape of eukaryotic cell is spherical but the shape of cell is ultimately determined by the specified function of the cell. Thus, the shape of the cell may be variable (frequently changing its shape) or fixed. Variable or irregular shape occurs in amoeba and white blood cells or leucocytes. In fact, leucocytes are spherical in the circulating blood, but in other conditions they may produce pseudopodia and become irregular in shape.

Cell size.

Some plant and animal cells are visible to the naked eye. Most cells, however, are visible only with a microscope, since they are only a few micrometers in diameter. A micrometer (μm) is one thousand of a millimeter. The size of cells varies from the very small cells of bacteria (0.2 to 5.0 μm) to the very large eggs of the ostrich (18 cm).

Cell number.

The number of cells in multi-cellular organisms usually is correlated with size of the organism. Thus, small sized organism has less number of cells in comparison to large sized organisms.

Though their shape, size and varied activities, all cells have three major functional regions:

1- The plasma membrane or cell membrane.

2- The nucleus.

3- The cytoplasm.

Some Cell Types

Nerve cells:

Electrochemically send information's between sensory receptors and the central nervous system. The **nerve cells** or **neurons** come in many different shapes and sizes and have specialized extensions called **dendrites** and **axons**.

Blood cells:

Carry oxygen to the body's tissues and collect carbon dioxide. They also carry hormones, enzymes and vitamins to different parts of the body.

Red blood cells called **erythrocytes:** carrying oxygen from the lungs or gills to body tissues via the blood. White blood cells, called **leukocytes**: are parts of the immune system and defend the body against infectious disease and foreign materials.

Muscle cells

Comprise the three different types of muscles: **skeletal, cardiac**, and **smooth** types. Muscle works to produce force and cause movement within internal organs.

Animal cell structure.

Animal cells have a variety of different organelles that work together to allow the cell to perform its functions. There are lots of different animal cells that each carry out specialized functions. Therefore**,** not every animal cell has all types of organelles, but in general, animal cells contain most (if not all) of the following organelles. Additionally, some organelles will be highly abundant in certain cells and not others.

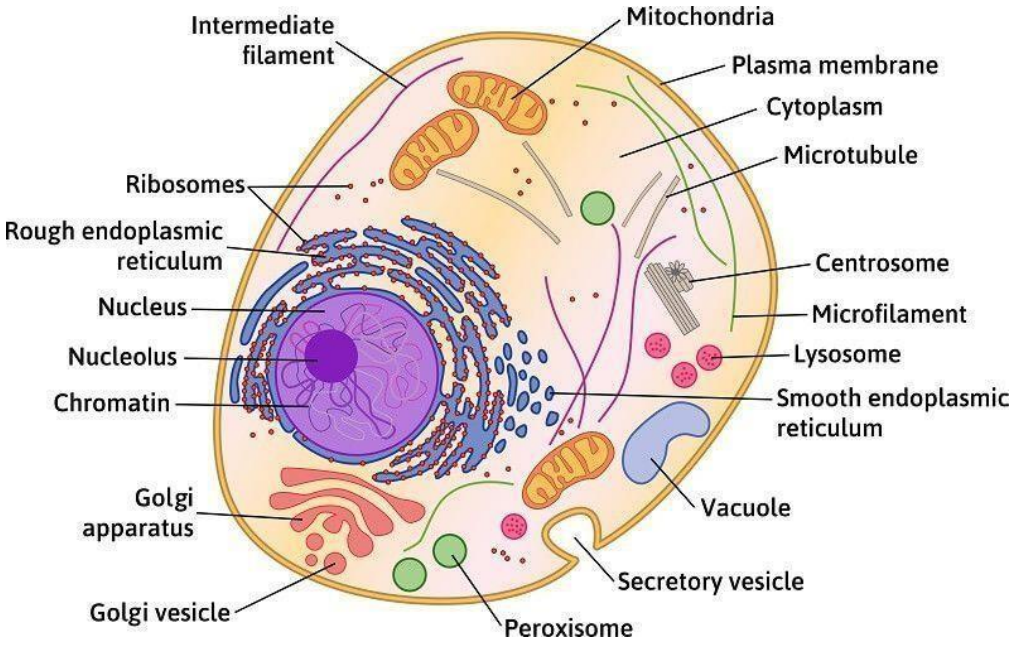

Diagram of a typical animal cell

The animal cell involves:

1- Nucleus.

The nucleus contains all the genetic material in a cell. This genetic information is called deoxyribonucleic acid (DNA). DNA contains all the instructions for making proteins, which control all of the body's activities. The nucleus is surrounded by a nuclear envelope (also called the nuclear membrane), which separates it from the rest of the cell. The nuclear envelope also contains pores to allow certain materials to pass in and out. The nucleus regulates the growth and division of the cell.

As well as all the genetic material, there is also a sub-section of the nucleus called the nucleolus. The nucleolus is the site of ribosome synthesis.

2- Ribosome's

Ribosomes are organelles found in both prokaryotic and eukaryotic cells that synthesize all the proteins in the cell. In animal cells, ribosome's can be found freely in a cell's cytoplasm or attached to the endoplasmic reticulum.

3- Endoplasmic Reticulum

The endoplasmic reticulum (ER) is a network of flattened membrane-bound sacs that are involved in the production, processing and transport of proteins that have been synthesized by ribosomes.

There are two kinds of endoplasmic reticulum: **smooth** and **rough**. The rough ER has ribosomes attached to the surface of the sacs. Smooth ER does not have ribosome's attached and has functions in storage, synthesizing lipids and removing toxic substances.

4- Golgi Apparatus

The Golgi apparatus also called the Golgi complex or Golgi body, receives proteins from the ER and folds, sorts and packages these proteins into vesicles.

5- Lysosomes

Lysosomes are a type of vesicle. Vesicles are spheres surrounded by a membrane that excludes their contents from the rest of the cytoplasm. Vesicles are used extensively within the cell for metabolism and transport of large molecules that cannot cross membrane unaided. Lysosomes contain digestive enzymes; these enzymes can break down large molecules like organelles, carbohydrates, lipids and proteins into smaller units so that the cell can reuse them.

6- Mitochondria

Mitochondria are the energy-producing organelles." The process of cellular respiration occurs in the mitochondria. During this process, sugars and fats are broken down through a series of chemical reactions, releasing energy in the form of adenosine triphosphate (ATP).

7- Cytoplasm

The cytosol is the gel-like liquid contained within cells. The cytosol and all the organelles within it – except for the nucleus – are collectively referred to as the cell's cytoplasm. This cytosol consists primarily of water, but also contains ions, proteins, and small molecules. The pH is generally neutral, around 7.

8- Cytoskeleton

The cytoskeleton is a network of filaments and tubules found throughout the cytoplasm of the cell. It has many functions:

- Gives the cell shape.
- Provides strength.
- Stabilizes tissues.
- Anchors organelles within the cell.
- Has a role in cell signaling**.**
- Provides mechanical support to allow cells to move and divide.

There are three types of cytoskeletal filaments: microfilaments, microtubules and intermediate filaments.

9- Cell Membrane

The cell membrane surrounds the entire cell and separates its components from the outer environment. The cell membrane is a double layer made up of phospholipids (called the phospholipids bilayer). The cell membrane is selectively permeable, meaning it only allows certain molecules to enter and exit. Oxygen and carbon dioxide pass through easily, while larger or charged molecules must go through special channels, bind to receptors or be engulfed.