1.ULTRA STRUCTURE OF CELL:

A cell is the structural and functional unit of the living body. Each cell is formed by a cell body which has the nucleus and the cytoplasm as the parts and Cell membrane which covers the cell body. The cell contains various structural components to allow it to maintain life which are known as **organelles**. All the organelles are suspended within a gelatinous matrix, the **cytoplasm,** which is contained within the cell membrane.

CYTOPLASM

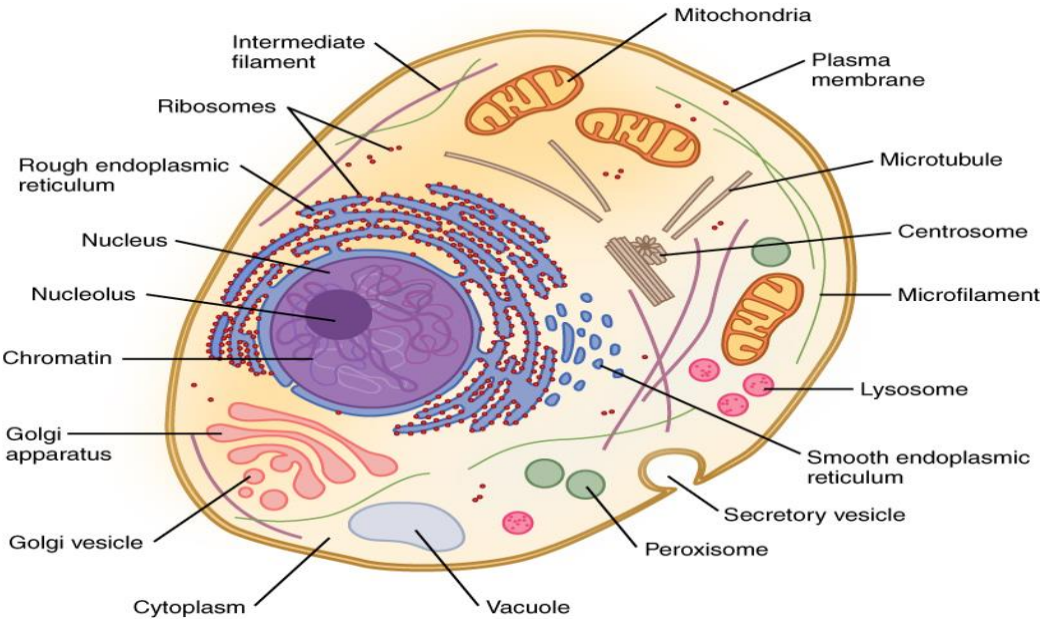
It is the simplest structure of the cell. Organelle free sap is called cytosol. Cytoplasm contains two zones:

1. Endoplasm: fluid like and interposed between the nucleus and ectoplasm.
2. Ectoplasm: lies just beneath the cell membrane and consists of a network of microfilaments. Organelles of different structure and function are present in the cytoplasm.

CELL ORGANELLES

The main organelles are as follows:

- nucleus
- endoplasmic reticulum
- Golgi apparatus
- lysosomes
- mitochondria
- peroxisomes
- Centrosome and centrioles
- microfilaments and microtubules



2.ANATOMY OF THE HEART

STRUCTURE OF THE HEART WALL

The heart wall is made of 3 layers: epicardium, myocardium and endocardium.

1.Pericardium

The heart sits within a fluid-filled cavity called the pericardial cavity. The walls and lining of the pericardial cavity are a special membrane known as the pericardium. Pericardium is a type of serous membrane that produces serous fluid to lubricate the heart and prevent friction between the ever-beating heart and its surrounding organs. Besides lubrication, the pericardium serves to hold the heart in position and maintain a hollow space for the heart to expand into when it is full. The pericardium has 2 layers fibrous pericardium and serous pericardium.

Fibrous pericardium

The **fibrous pericardium** is the most superficial layer of the pericardium. It is made up of dense and loose connective tissue, which acts to protect the heart, anchoring it to the surrounding walls, and preventing it from overfilling with blood. It is continuous with the outer adventitial layer of the neighboring great blood vessels. It is inside the great blood vessels.

Serous pericardium

The **serous pericardium**, in turn, is divided into two layers, the *parietal pericardium*, which is fused to and inseparable from the fibrous pericardium, and the *visceral pericardium*, which is part of the epicardium. Both of these layers function in lubricating the heart to prevent friction during heart activity.

2. Myocardium. The myocardium is the muscular middle layer of the heart wall that contains the **cardiac muscle tissue**. Myocardium makes up most the thickness and mass of the heart wall and is the part of the heart responsible for pumping blood. Below the myocardium is the thin endocardium layer.

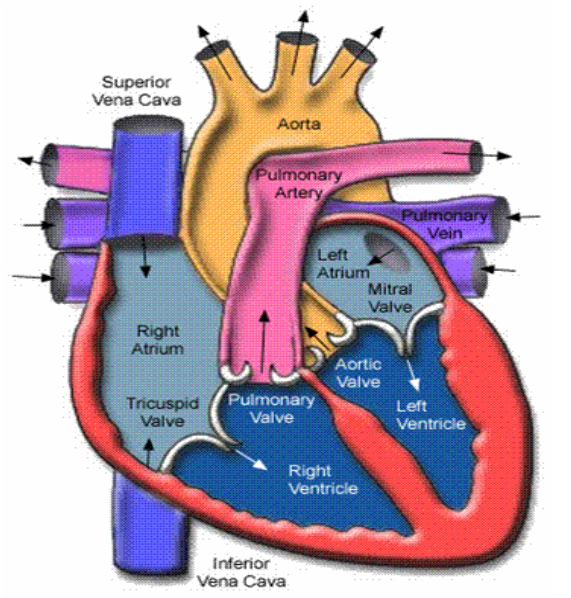
3.Endocardium. Endocardium is the simple squamous endothelium layer that lines the inside of the heart. The endocardium is very smooth and is responsible for keeping blood from sticking to the inside of the heart and forming potentially deadly blood clots.

The thickness of the heart wall varies in different parts of the heart. The atria of the heart have a very thin myocardium because they do not need to pump blood very far—only to the nearby ventricles. The ventricles, on the other hand, have a very thick myocardium to pump blood to the **lungs** or throughout the entire body. The right side of the heart has less myocardium in its walls than the left side because the left side must pump blood through the entire body while the right side only must pump to the lungs.

CHAMBERS OF THE HEART

The heart contains 4 chambers: the **right atrium**, **left atrium**, **right ventricle**, and **left ventricle**. The atria are smaller than the ventricles and have thinner, less muscular walls than the ventricles. The atria act as receiving chambers for blood, so they are connected to the veins that carry blood to the heart. The ventricles are the larger, stronger pumping chambers that send blood out of the heart. The ventricles are connected to the arteries that carry blood away from the heart.

The chambers on the right side of the heart are smaller and have less myocardium in their heart wall when compared to the left side of the heart. This difference in size between the sides of the heart is related to their functions and the size of the 2 circulatory loops. The right side of the heart maintains pulmonary circulation to the nearby lungs while the left side of the heart pumps blood all the way to the extremities of the body in the systemic circulatory loop.



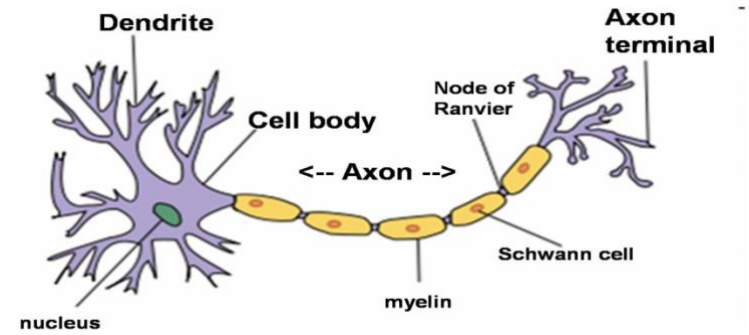
VALVES OF THE HEART

The heart functions by pumping blood both to the lungs and to the systems of the body. To prevent blood from flowing backwards or "regurgitating" back into the heart, a system of one-way valves is present in the heart. The heart valves can be broken down into two types: atrioventricular and semilunar valves.

- ***Atrioventricular valves***- The atrioventricular (AV) valves are in the middle of the heart between the atria and ventricles and only allow blood to flow from the atria into the ventricles. The AV valve on the right side of the heart is called the **tricuspid valve** because it is made of three cusps (flaps) that separate to allow blood to pass through and connect to block regurgitation of blood. The AV valve on the left side of the heart is called the **mitral valve** or the bicuspid valve because it has two cusps.

- ***Semilunar valves***- The semilunar valves, so named for the crescent moon shape of their cusps, are located between the ventricles and the arteries that carry blood away from the heart. The semilunar valve on the right side of the heart is the **pulmonary valve**, so named because it prevents the backflow of blood from the pulmonary trunk into the right ventricle. The semilunar valve on the left side of the heart is the **aortic valve**, named for the fact that it prevents the **aorta** from regurgitating blood back into the left ventricle. The semilunar valves are smaller than the AV valves and do not have chordae tendineae to hold them in place. Instead, the cusps of the semilunar valves are cup shaped to catch regurgitating blood and use the blood's pressure to snap shut.

3.STRUCTURE OF NERVE CELLS: The human body is made up of trillions of cells. Cells of the nervous system, called nerve cells or neurons. There are three distinct parts in all kinds of neurons. The human brain has approximately 100 billion neurons. Nerves act like wires in a telephone .Neurons come in many different shapes and sizes. Some of the smallest neurons have cell bodies that are only 4 microns wide.



Some of the biggest neurons have cell bodies that are 100 microns wide. .Neurons is responsible for sending, receiving, and interpreting information from all parts of the body.

Neuron and Glial cells: Nervous system is made up of two kinds of cells- **Neurons (Nerve cells)** and **Glial cells**. **Neurons** are the functional units, which receive and process information and generate responses.

Glial cells are supportive cells-they help the neuron in carrying out its function by providing nutrients. They also protect the neurons. Insulate neurons, nourish neurons, and remove waste products. Neurons receive information, integrate it, and pass it along. They communicate with one another, with cells in the sensory organs, and with muscles and glands.

Both the cells are equally important for the nervous system to function. No two neurons in the nervous system have the same appearance. In general, we can identify three distinct Parts in all kinds of neurons. They are **cell body, dendrites and axon.** The cytoplasm of the neuron has all the organelles like mitochondria, Golgi, lysosomes etc., Nerves does not have centrosome so it cannot undergo division. Neurons may be Unipolar, Bipolar and Multipolar.

Cell Body: Each neuron has a soma, or cell body, which is the central area of the neuron. Cell body is the centre for all the synthetic activity of the neuron. The cell body has a large nucleus with one or two large nucleoli. The most characteristic feature of the cell body in the presence of large granules in the cytoplasm called Nissl Granules. These are groups of ribosomes and are made up of RNA and proteins and other structures common to all cells in the body.

Dendrites: These are projections or processes arising from the cell body. The number of dendrites ranges one to several thousands. Dendrites are short and branched structures. They arranged in the form of a tree with branches. Dendrites receive information from other neurons and carry this information to the cell body. They do not have Nissl substance.

Axon: Axon is also a projection from the cell body. Each neuron has only one axon. Unlike dendrites, axons are very long and are usually branched structures. The axon is generally called as nerve fiber. The cytoplasm of the axon is covered with a plasma membrane. Nissl granules are absent in axon. At the end, the axon gives out several branches that end in Nerve Terminals. Each of these nerve terminals makes contact with the dendrites or cell body or even axons of another neuron. Some of the axons also make contact with the cells in the effectors organs such as muscles or glands. This site is called a SYNAPSE. At the synapse, the membranes of nerve terminal and the cells of the effectors organ are separated from each other by a space. In neurons, axons are covered by a whitish, fatty substance sheath called MYELIN SHEATH. At regular intervals, the myelin sheath leaves small gaps called nodes of ranvier. Neurons having myelin sheath are called myelinated neurons and those that do not have myelin sheath are called unmyelinated neurons. Myelin sheath prevents the leakage of electrical currents from the axon. Myelinated axons conduct impulses much faster than unmyelinated axons.