

- 1.The cell , definition of the cell**
- 2.The cell structure and function .**
- 3.Cell wall, plasma membrane , cytoplasmic matrix. endoplasmic reticulum, Golgi apparatus , cilia and flagella .**

Cell is the basic unit of life .

The idea that cells are the basic unit of life began to take shape in the early 1800s, as many biologists contributed data and ideas that led to the “ cell theory ”, which can be stated in three parts :

- 1- All organisms are composed of one or more cells .
- 2- Cells, products or made by cells , are the units of structure and function in organisms .
- 3- All cells come from preexisting cells .

In 1831 Robert Brown saw a dense object in many cells named it the nucleus.

Schleiden , a botanist , advanced the idea that plants are made of cells that contain nuclei and cell fluid .

In 1839, Schwann used a microscope to examine parts of animals . animals also seemed to be made up of small units . Schwann suggested that animals are also made of cells .

The cell theory is made up of three main ideas :

1. All organisms are composed of one or more cells .
2. The cell is the basic unit of structure and organization of organisms . although organisms such as human , dogs, and trees can become very large and complex , the cell remains the simplest most basic component of any organism.

3. All cells come from preexisting cells before the cell theory , not one knew how cells were formed , where they came from , or what determined the type of cell they become .

The biologists who have land-mark discoveries for the cells :

- 1- Robert Hook : discovered the cell (cellula).
- 2- Schleiden and Schwann : discovered the cell theory .
- 3- Robert Brown : discovered the nucleus .
- 4- Antony van Leeuwenhook : discovered the Micros-cope and bacterial cell.

1- Definition of the cell :

The cell is the basic structural and functional unit of all living organisms .

2- The characteristics functions of cells include :

- 1- DNA replication .
- 2- Manufacture of macromolecules such as proteins , fats , lipids, starch, Glycogen and Carbohydrates.
- 3- Energy use .
- 4- Reproduction .

3- The structures of cells :

Each cell can be divided (distinguished) into three parts :

- 1- Cell (plasma) membrane :
 - A- Selectively permeable .
 - B- Cell membrane gives form to the cell .
 - C- It controls the passage of molecules into and out of the cell .

D- It separates the cell's internal structures from the extracellular environment .

2- Cytoplasm and organelles :

A- The cytoplasm is the cellular material between nucleus and the cell membrane .

B- Organelles are the specialized structures suspended within the cytoplasm of the cell that perform specific functions .

3- Nucleus :

The nucleus is the large spheroid or oval body usually located near the center of the cell . it contains the DNA or genetic material , that directs the activities of the cell . with the nucleus , one or more dense bodies called “ Nucleoli ” (singular = Nucleolus) maybe seen . the nucleolus contains subunits for ribosomes , the structures that serve as sites for protein synthesis .

The cell organelles :

Cytoplasm refers to the material located within the cell membrane but outside the nucleus . the material with nucleus is frequently called the **nucleoplasm** .

The term protoplasm is sometimes used to refer to the cytoplasm and nucleoplasm collectively . when observed through an electron microscope , distinct cellular components called organelles can be seen in the highly structured cytoplasm .

The matrix of the cytoplasm (the cytosol) is a jelly like substance that is 80% to 90% water .

The organelles and inorganic colloid substances (suspended particles) are dispersed throughout the cytoplasm. Metabolic activity occurs with the organelles of the cytoplasm. Specific roles such as **heat production**, **cellular maintenance**, **repair**, **storage** and **protein synthesis** are carried out within the organelles.

1- **Ribosomes** : they are the most organelles in many cells, they are not surrounded by membrane, a ribosome is a combination of two organic compounds-protein and RNA.

Some ribosomes remain free within the cytoplasm, while others are attached to the endoplasmic reticulum. They play important roles in the synthesis of proteins. Proteins that are used within the cytoplasm are produced on free ribosomes, while proteins exported from the cell are produced on ribosomes attached to E.R.

2- **Endoplasmic Reticulum** : is a system of membranes, tubules and sacs, and it's an intracellular highway, where the molecules move from one part of the cell to another.

There are two types of E.R. :

- Rough E.R. (RER) : covered with ribosomes and is involved in protein synthesis that is exported from the cell or inserted into the cell membrane.
- Smooth E.R. (SER) : is not covered with ribosomes and it's involved in the synthesis of steroids in gland cells, the regulation of calcium levels in muscle cells, and the breakdown of toxic substances by liver cells (detoxification).

- 3- Golgi complex :** it called Golgi apparatus , Golgi bodies . the Golgi apparatus is composed of flattened membranous sacs, containing cisternae , that are stacked on each other located near the nucleus .
- the Golgi apparatus modifies packages and distributes proteins and lipids manufactured by the rough and smooth endoplasmic reticula.
- 1- Modifies protein by attaching with carbohydrates molecules to the proteins from glycoproteins or attaching lipids to proteins to form lipoproteins .
 - 2- Secreted large amount of protein or glycol-proteins , such as cells in salivary glands and the pancreas .

4-Mitochondria : (Mitochondrion = singular) : Mitochondria are double-membraned saclike organelles . they are found in all cells in the body with the exception of mature red blood cells . the outer mitochondrial membrane is smooth, whereas the inner membrane is arranged in complex folds called cristae . the cristae create an enormous surface area for chemical reactions . Mitochondria vary in size and shape .

They can migrate through the cytoplasm and can reproduce themselves by budding or cleavage . they are often called the (power houses) of cells because of their role in producing metabolic energy . enzymes connected to the cristae control the chemical reactions that form ATP metabolically active cells , such as muscle cells . liver cells , and kidney cells , have a large number of mitochondria because of their high energy requirements .

5-lysosomes : they are small organelles that enclosed by hydrolytic enzymes with single membrane , these enzymes can digest proteins, carbohydrate ,

lipids, DNA, and RNA, they also digest old organelles as well as viruses and bacterial that have been digested by the cell .

White blood cells contain large numbers of lysosomes and are said to be “phagocytic” meaning that they will ingest , kill and digest bacteria through the enzyme activity of their lysosomes .

6-Peroxisomes : are membrane-bounded vesicles that are smaller than lysosomes .

Peroxisomes contain enzymes that break down fatty acids and amino acids. Hydrogen peroxides (H_2O_2) which can be toxic to the cell is by – product of that break down .

Peroxisomes also contain the enzyme catalase , which break down hydrogen peroxide , to water and oxygen . cells that are active in detoxification such as liver and kidney cells , have many peroxisomes .

7- Cytoskeleton : a network of long protein strands are not surrounded by membranes . cytoskeleton involved in the movement of organelles within the cytoplasm . the cytoskeleton composed of :

1- **Microfilaments** :

Are the smallest strands of cytoskeleton , they are theards of protein called “ actin ”

- Actin filaments provide structure to cytoplasm .
- Actin filament support the plasma membrane and define the shape of the cell . muscle cells contain a large number of actin .
- Filaments . actin filament responsible for the muscle’s contractile .

2- Intermediate filaments :

Are protein fibers provide mechanical strength to cells , which . for example, intermediate filaments support the extensions of nerve cells , which have a very small diameter but can be a meter .

3- Microtubules :

Are the largest strands of cytoskeleton , they are hollow tubules composed primarily of protein units called “ tubulin ” .

They help provide support and structure to the cytoplasm of the cell , much .

They are involved in the process of cell division , transport of intracellular material , and form essential components of certain cell organelles , such as centrioles , spindle , fibers , cilia and flagella .

8- Centrosomes and centrioles : each centrosome contains a pair of small, cylindrical bodies called “ centrioles ” (the centriole composed of a triplets bundles) of microtubules . the centrosomes “ central body ” is a non-membranous spherical mass positioned near the nucleus . within the centrosomes , a pair rod like structures called “ centrioles ” are positioned at right angles to each other .

The wall of each centriole is composed of nine evenly spaced bundles , and each bundle contains three microtubules . centrosomes are found only in these cells that can divide . during thee mitotic (replication) process , the centrioles move away from each other and take positions on either side of the nucleus . they are then involved in the distribution of the chromosomes during cellular reproduction .

Mature muscle and nerve cells lack centrosomes , and thus cannot divide .

9- Cilia and Flagella :

Are hairs like organelles that extend from surface of a cell, when these organelles are short and present in large numbers on a cell called “ cilia” .

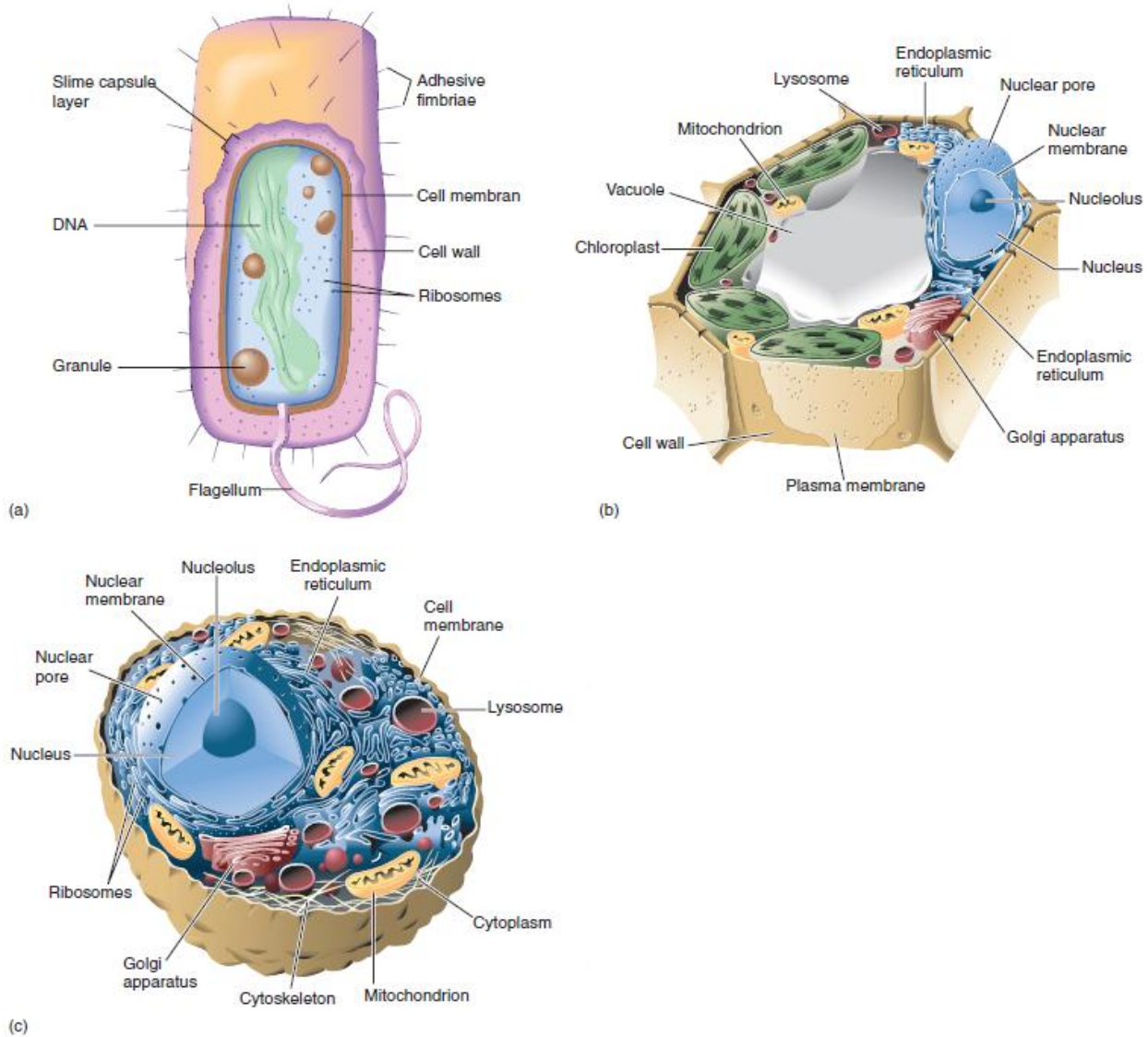
In unicellular organisms e.g. paramecium , the cilia help the movement through the water as they search for food or escape from predators . also cilia found in multicellular organisms such the cells of respiratory tract .

When the hair like organelles are long and less numerous on a cell , they are called “ flagella ” , which facilitate the movement of unicellular organisms like Trypanosomes , or specialized cells in multicellular organisms such as sperm cells.

Both cilia and flagella composed of a pairs microtubules arranged around a central pair the function of cilia is to move the mucus and any adheren material toward the exterior of the body .

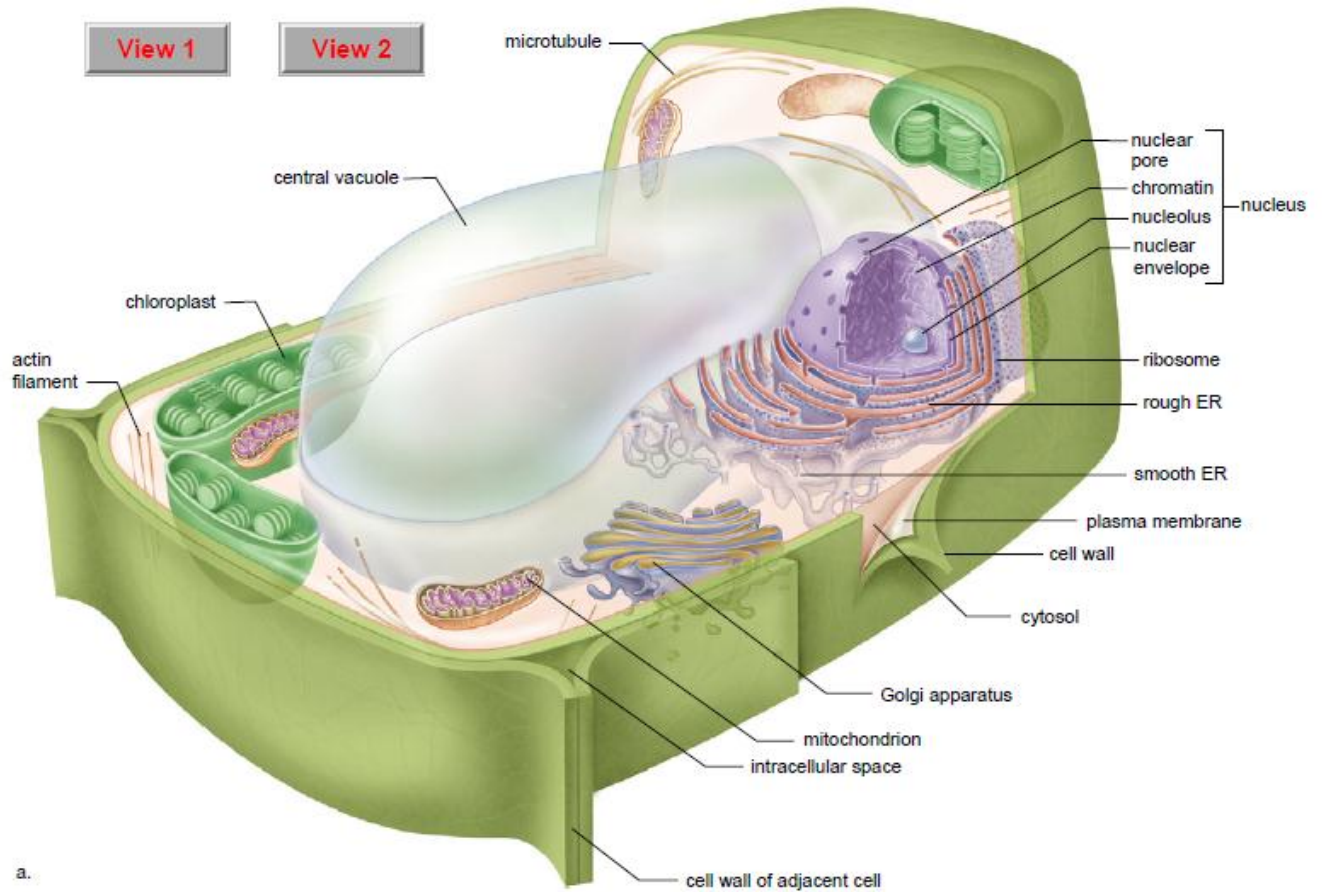
Flagella are similar to cilia in basic micro-tubular structure , but they are longer than cilia .

The only example of flagellated cell in humans is the sperm cell . which uses the single structure for locomotion .

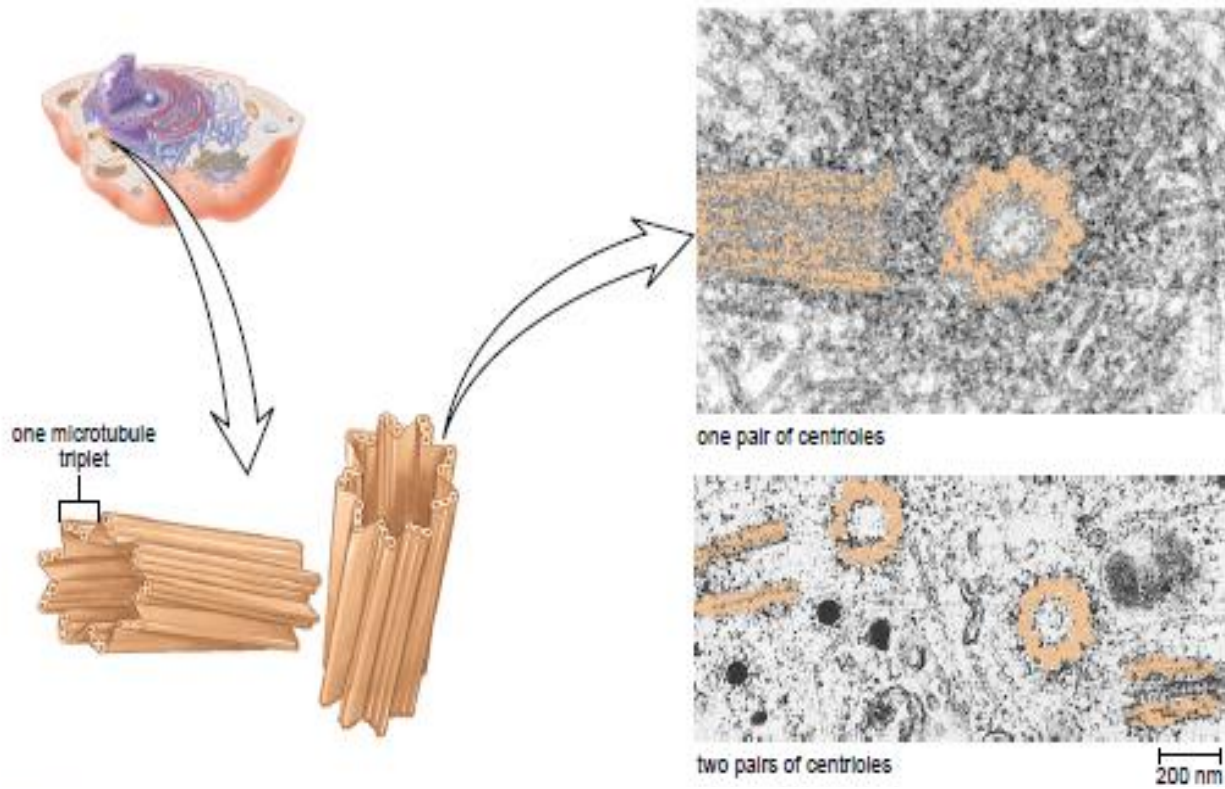


Major Cell Types

There are two major types of cells, the prokaryotes and the eukaryotes. Prokaryotic cells are represented by the (a) bacteria, and eukaryotic cells by (b) plant and (c) animal cells.

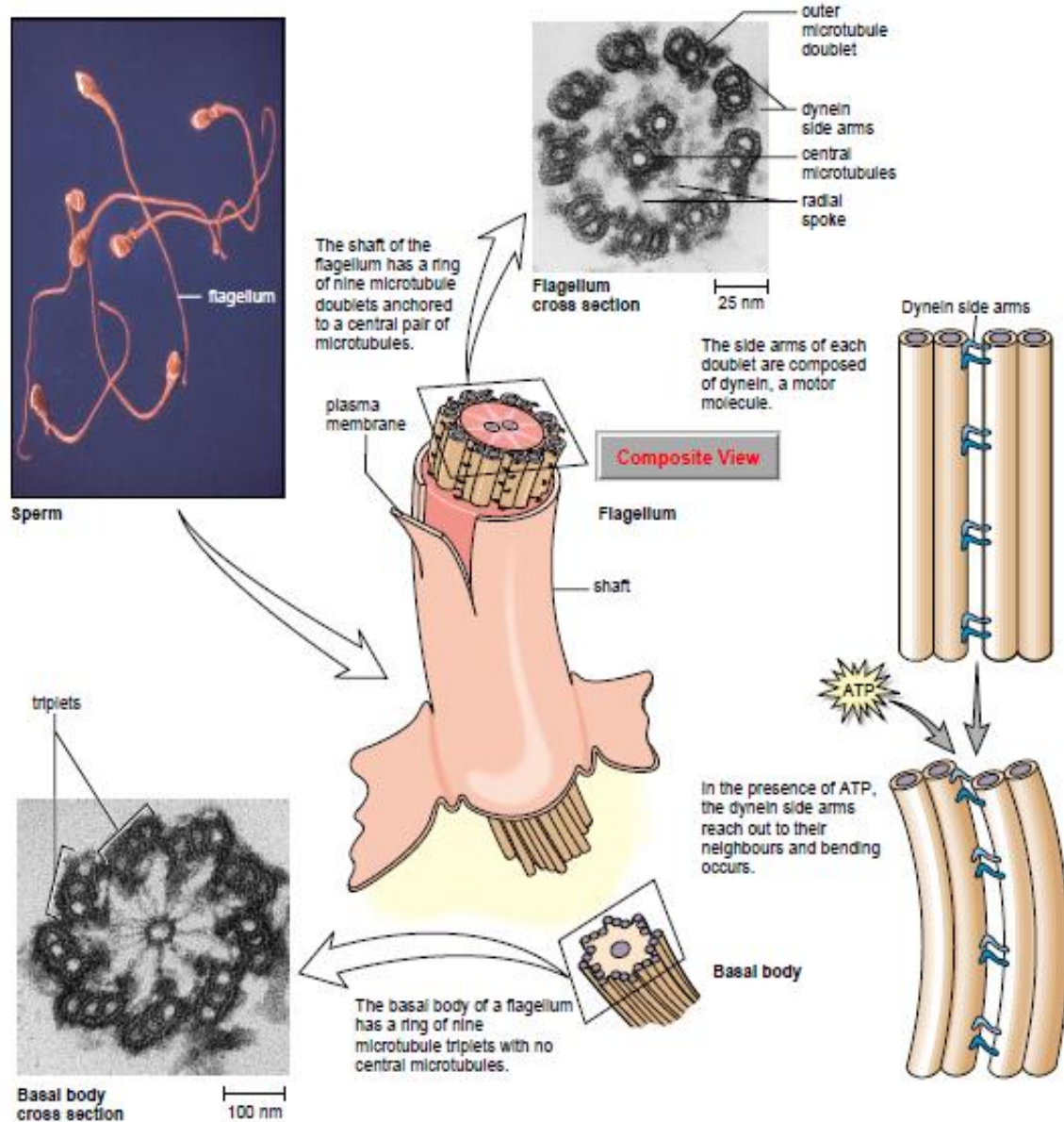


Plant cell anatomy.
a. Generalized drawing. b. Transmission electron micrograph of young leaf cell. See Table 3.1 for a description of these structures, along with a listing of their functions.



Centrioles.

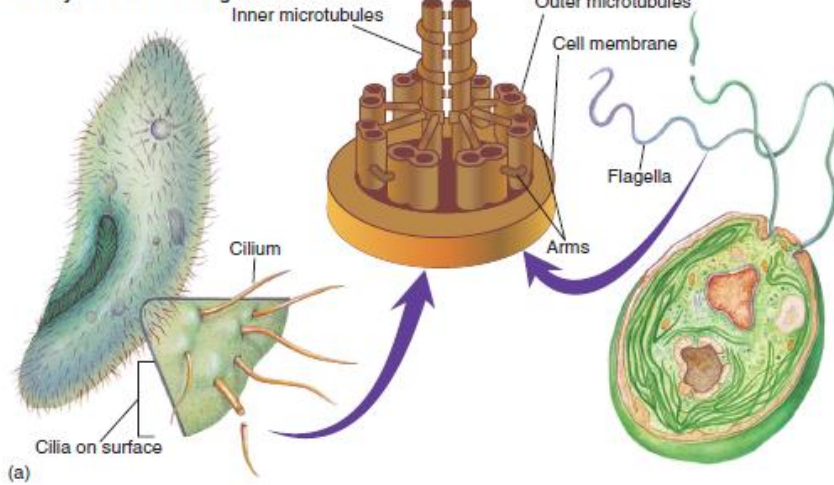
In a nondividing cell there is a pair of centrioles in a centrosome outside the nucleus. Just before a cell divides, the centrosome divides so that there are two pairs of centrioles. During cell division, the centrosomes separate so that each new cell has one pair of centrioles.



Structure of a flagellum or cilium.

A basal body derived from a centriole is at the base of a flagellum or cilium. The shaft of a flagellum (or cilium) contains microtubule doublets whose side arms are motor molecules that cause the flagellum (such as those of sperm) to move. Without the ability of sperm to move to the egg, human reproduction would not be possible.

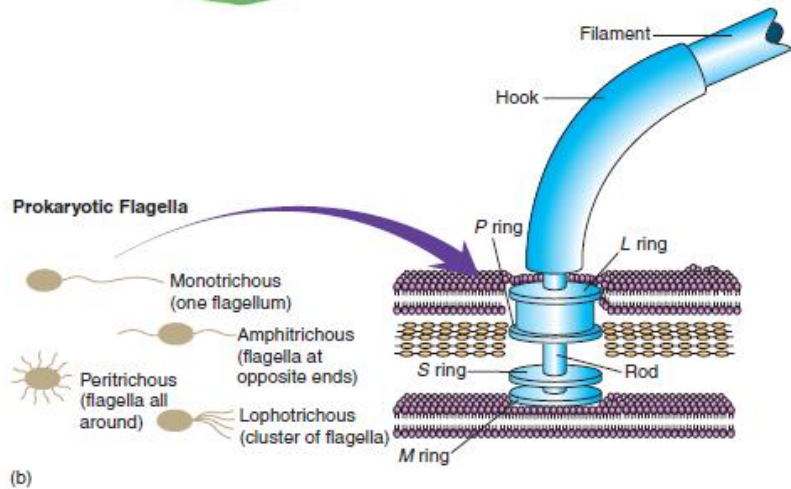
Eukaryotic Cilia and Flagella



Eukaryotic and Prokaryotic Cilia and Flagella

(a) These two structures function like oars or propellers that move the cell through its environment or move the environment past the cell. Cilia and flagella are constructed of groups of microtubules as in the ciliated protozoan shown on the left and the flagellated alga on the right. Flagella are usually less numerous and longer than cilia. (b) The flagella of prokaryotes are composed of a single type of protein arranged in a fiber that is anchored into the cell wall and membrane. Bacterial flagella move the cell by rotating.

Prokaryotic Flagella



The End