

Large central vacuole

● Essential Questions:

- *What is a cell?*
- *What are cells made of?*
- *How are animal cells and plant cells different?*
- *How are they the same?*
- *What are the functions of organelles?*

Cytoskeleton

Centrioles

Mitochondrion

Cell wall

Rough endoplasmic reticulum

Nucleus

Smooth endoplasmic reticulum

Cellulose

Golgi apparatus

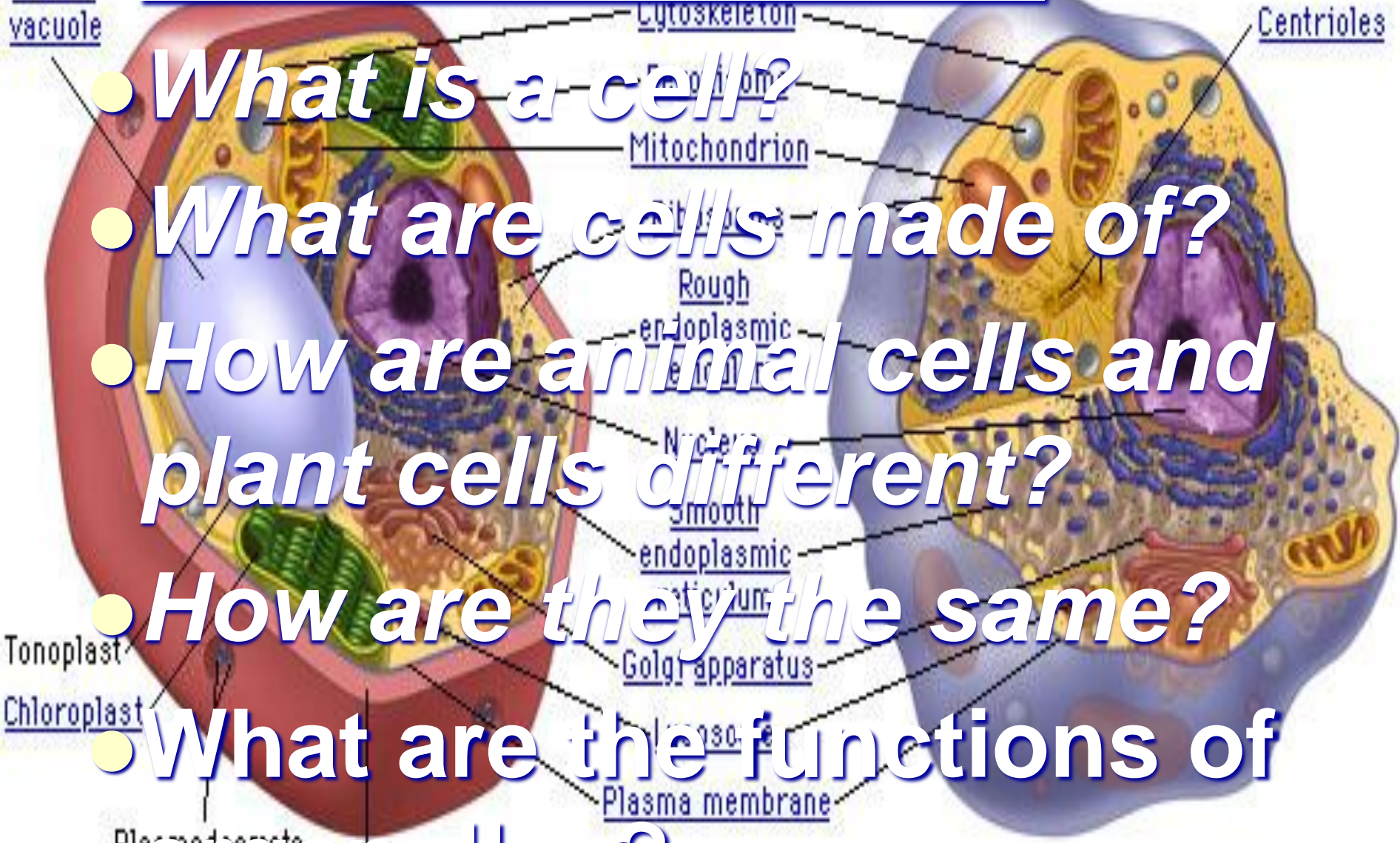
Plasmodesma

Plasma membrane

Tonoplast

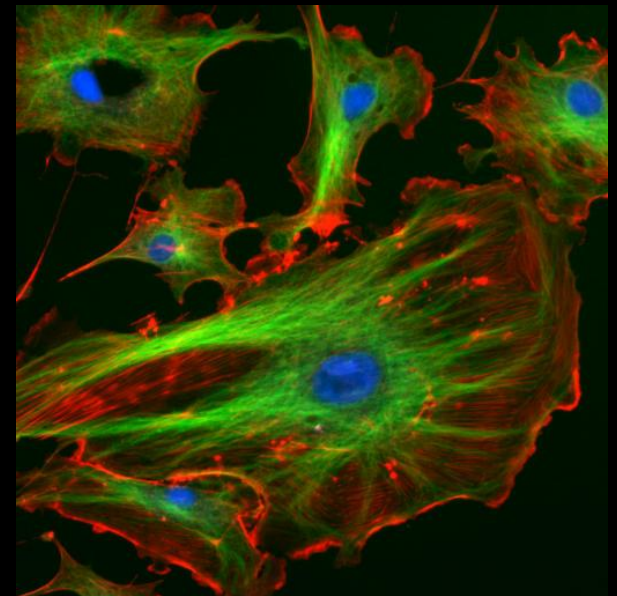
Chloroplast

Plasmodesma



Section 1: Discovering cells

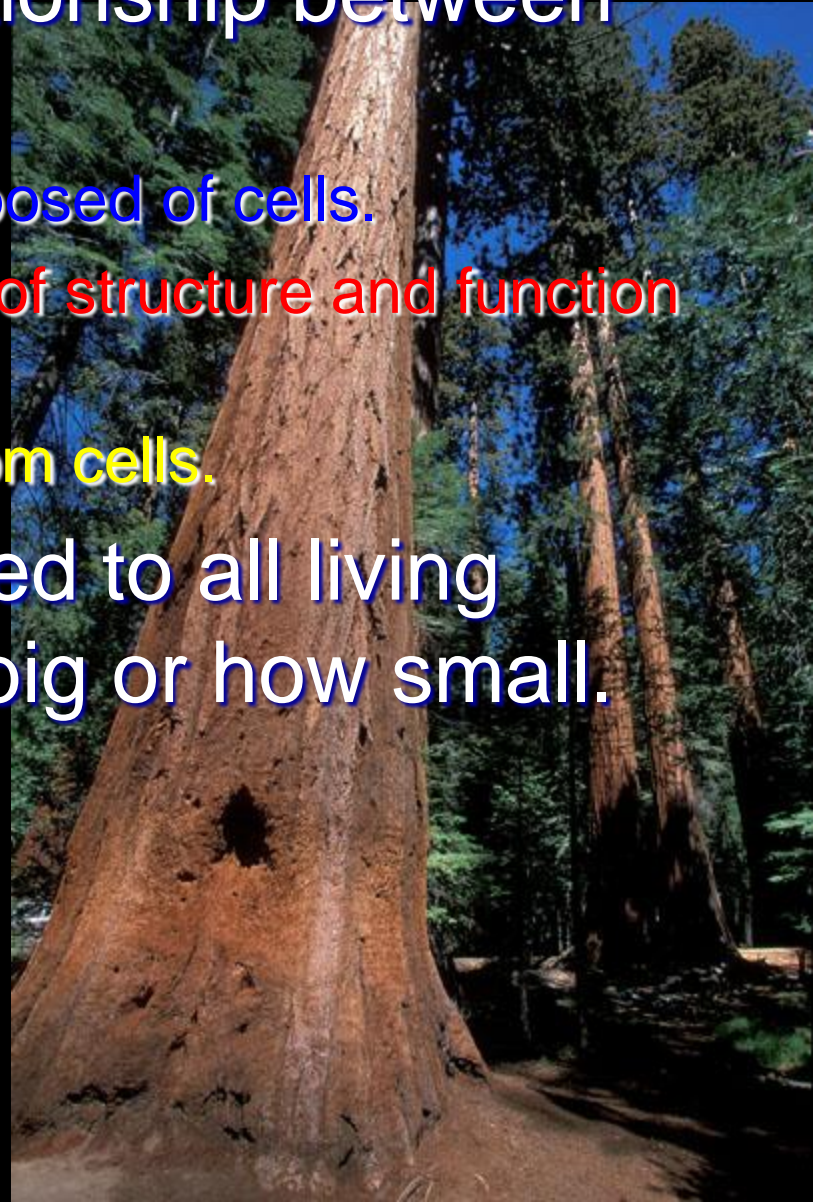
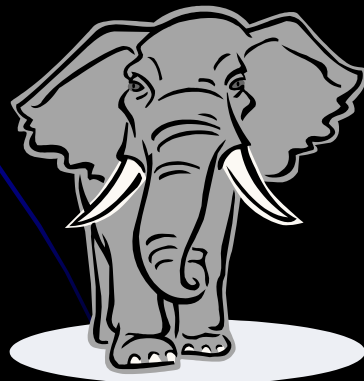
- Cells are the basic units of structure and function in living things.
- The structure of all living things are determined by the way in which cells are put together.
- Some functions of cells include
 - Obtaining oxygen
 - Obtaining food
 - Ridding the body of waste
 - Growth and development



- The Cell Theory is a widely accepted explanation of the relationship between cells and living things.

1. All living things are composed of cells.
2. Cells are the basic units of structure and function in living things.
3. All cells are produced from cells.

- The cell theory is applied to all living things, no matter how big or how small.

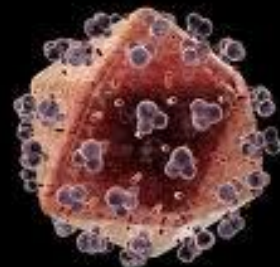
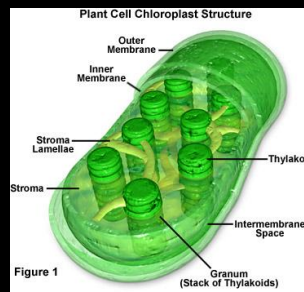
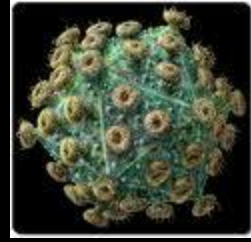


● “Modern” cell Theory

- The generally accepted parts of modern cell theory include:
- The cell is the fundamental unit of structure and function in living organisms.
- All cells arise from pre-existing cells by division.
- Energy flow (metabolism and biochemistry) occurs within cells.
- Cells contain hereditary information (DNA) which is passed from cell to cell during cell division.
- All cells are basically the same in chemical composition in organisms of similar species.
- All known living things are made up of one or more cells.
- Some organisms are made up of only one cell and are known as unicellular organisms others are multi-cellular and composed of a number of cells.
- The activity of an organism depends on the total activity of independent cells.

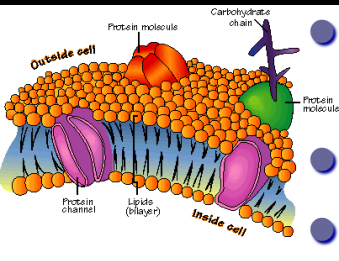
● Cell Theory exceptions

- Viruses are considered alive by some, yet they are not made up of cells. Viruses have many features of life, but by definition of the cell theory, they are not alive.
- The first cell did not originate from a pre-existing cell. There was no exact first cell since the definition of cell is imprecise.
- **Mitochondria and chloroplasts have their own genetic material**, and reproduce independently from the rest of the cell.



● Organelles of the cell

● Cell membrane



- Forms the outside boundary that separates the cell from the environment.
- Found in both plant (inside cell wall) and animal cells.
- Controls what substances come into and out of a cell.
- Cell membranes are composed primarily of lipids (fats), proteins, and carbohydrates.

● Cell wall

- Rigid layer of nonliving material that surrounds the cells of only plants & some other non-animal celled organisms.
- Composed of cellulose.
- Allows specific material to enter cell.
- Plasmodesmata is an open channel in the cell wall of plants through which strands of cytosol (cytoplasm) connect from adjacent cells.

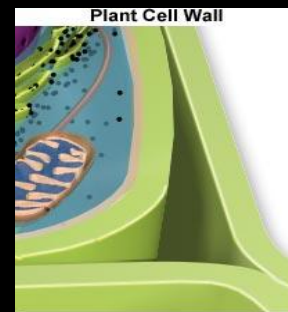


Figure 1

● Nucleus

- Location of most of the genes that directs the majority of the cell's activities.
- Location of most of the organelles of the cell in a eukaryotic cell.
- Because prokaryotic cells contain no nucleus they have a nucleoid.
 - A **nucleoid** is a localized region within the cell where the genetic material can be found not separated by a membrane.

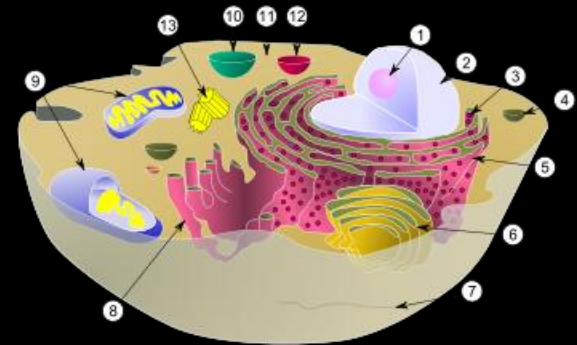
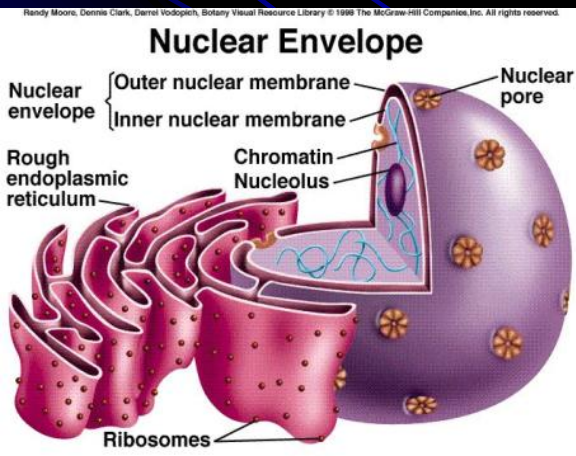
● Parts of the Nucleus

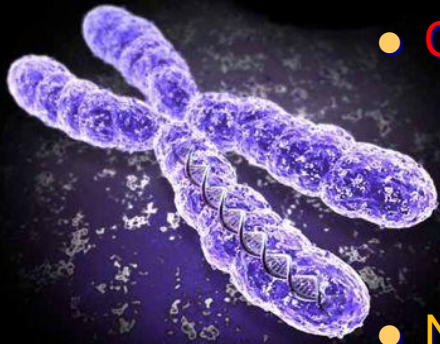
- **Nuclear envelope (membrane)**

- Controls what enters and leaves the nucleus

- **Nuclear lamina**

- A netlike array of protein filaments that maintains the shape of the nucleus & forms the boundary of the nucleus.





- **Chromatin**

- Genetic material that provides the instructions for how the cell coils DNA into chromosomes.
- Chromosomes are the condensed coils of chromatin that form as a cell begins the Cell Cycle.

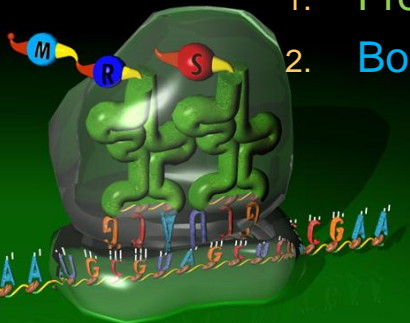
- **Nucleolus**

- Structure within the nucleus that synthesizes and assembles ribosomes.

- **Ribosomes**

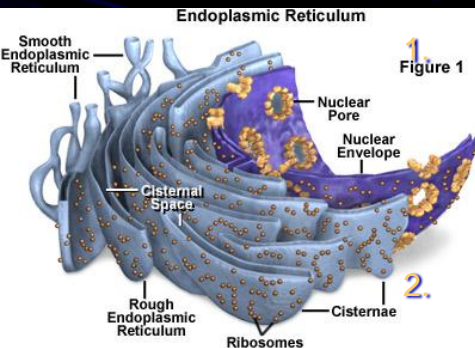
- Small grain-like structures that are found throughout the cytoplasm.
- Ribosomes take the genetic code from the DNA via RNA and turns the code into specific proteins that can then be utilized throughout the body.
- There are 2 types of ribosomes

1. **Free ribosomes** are suspended in the cytoplasm.
2. **Bound ribosomes** are attached to the Endoplasmic Reticulum.



● Endoplasmic Reticulum

- Passageways that carry proteins and other materials from one part of the cell to another.
- It is connected directly to the nuclear membrane.
- The endoplasmic reticulum accounts for 1/2 the total membranes found within a cell.
- The word “*endoplasmic*” means “*within the cytoplasm.*”
- The word “*reticulum*” is derived from the Latin word for “*network.*”
- “Highway” of the cell.
- There are 2 types of endoplasmic reticulum



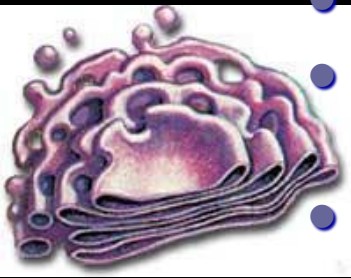
Smooth endoplasmic reticulum

- Called smooth because its surface lacks ribosomes.
- Used in the synthesis (making) of lipids (fats), metabolism of carbohydrates, and detoxification of drugs & poisons.

Rough endoplasmic reticulum

- Called rough because of the presence of ribosomes on its surface.
- Proteins made in the rough ER are used by various cells within the body; pancreas, liver, etc.

- **Golgi apparatus**



- Also known as the Golgi body.
- It is the center of manufacturing, warehousing, sorting, and shipping....in essence the “mail room” of the cell.
- Receives proteins & other materials from the endoplasmic reticulum. Then packages and distributes to other parts of the cell as well as stores them for later secretion.

- **Lysosomes**

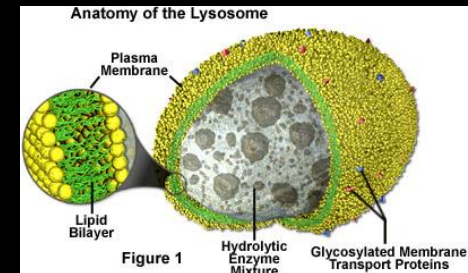
- “Recycling center” of the cell.
- Small, round structures containing chemicals that break down certain materials in cells.

- Large food particles
- Old cell parts

- Does these by a process called phagocytosis

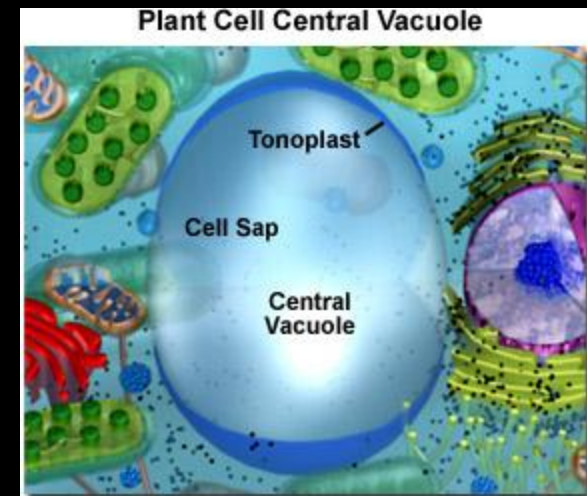
- Phagocytosis is the process by which a cellular membrane surrounds and engulfs large molecules creating a vacuole around them.

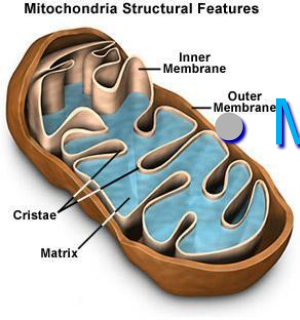
- Lysosomal diseases include Pompe’s disease as well as Tay Sach’s disease.



● Vacuoles

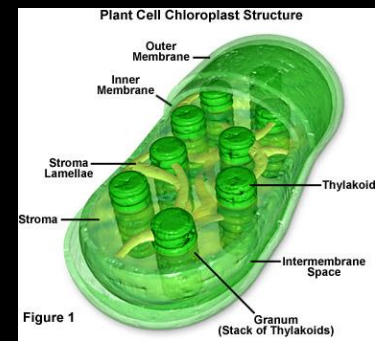
- Membrane bound sacs within a cell that perform various functions.
- Some sacs act as a storage area for the cell.
 - Store excess nutrients, water, waste products, etc.
- Some sacs created via phagocytosis are used to break down macromolecules.
- Food vacuoles are created via phagocytosis to store food.
- Contractile vacuoles in protists are used to pump excess water from the cell.
- The central vacuole in plants in addition to storage also allows the plant cell to grow as it absorbs water without having to produce new cytoplasm.





Mitochondrion (*mitochondria, pl.*)

- “Powerhouses” of the cell.
- Organelle in which cellular respiration takes place.
- Cellular respiration is the process by which energy from food molecules are converted into energy that the cell can use to carry out its functions.
- Mitochondria contains its own DNA that regulates the production of proteins by its own free ribosomes.
- **Chloroplasts**
 - Green structures inside plant cells that capture energy from sunlight in the process called photosynthesis & uses it to produce food for the cell.
 - In addition they also, produce chlorophyll the green pigment responsible for the green color found in plant leaves.



- **Cytoplasm**

- Thick gel-like substance located within the cell membrane & houses all organelles of the cell.
- Located within the cytoplasm is the cytoskeleton.

- **Cytoskeleton**

- The cytoskeleton is a network of fibers extending throughout the cytoplasm that plays a major role in organizing the structures & activities of a cell.

- Divided into 3 main components

- **Microtubules**
- **Microrfilaments**
- **Intermediate filaments**

- Its most obvious function is to give mechanical support to the cell and help maintain its shape.

- It also anchors some organelles and directs the movement of others.

- It also is involved in changing a cell's shape & the movement or motility of a cell.

