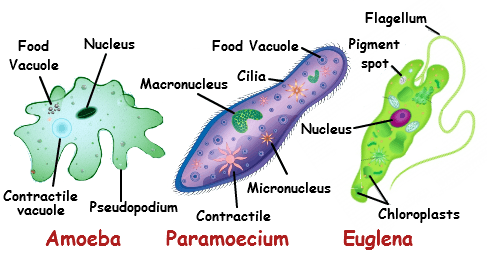
Lecture – 1- Animal physiology

**Physiology**:is a branch of medical science that studies of the integrated functions of the body and the functions of all its parts (systems, organs, tissues, cells, and cell components), including biophysical and biochemical processes.

**Cell physiology**: The cell (is from Latin *cella*, meaning "small room") is the basic structural and functional units of all living organisms. Cells are the building blocks of life. All living organisms are made up of cells.

The cells were discovered by Robert Hooke in 1665. In the human body there are about 100 trillion to 1014 cells. The size of the cells is about 10 micrometers. The cell contains cellular organelles that control the activity of the cell. Organisms can be classified as unicellular and multicellular organisms.



**Prokaryotic and Eukaryotic cells**

**Prokaryotes**

1- Prokaryotes are made up of cells with no nucleus.

2. They all are single-celled microorganisms

including archaea, bacteria and photosynthetic

blue-green algae known as cyan bacteria.

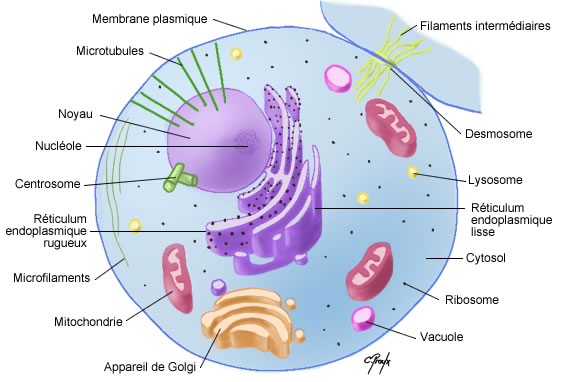
3. The cell size ranges from 0.1 to 0.5μm in diameter.

4. The hereditary material DNA is found in the

nucleoid present in the central part of the cell.

5. They reproduce by binary fission.

**Eukaryotes**



1- Eukaryotes are made up of cells consisting of

a true nucleus.

2. This large category involves all plants, fungi

(such as molds, yeast, and mushrooms), protozoa

(Plasmodium falciparum and parasite that cause

malaria) and animals.

3. The plasma membrane is responsible for

Monitoring the transport of nutrients and

electrolytes in and out of the cell and also

responsible for cell-to-cell communication.

4. Cellular life is entirely dependent on the various

chemical process for survival. These chemical reactions mainly occur in a watery solution within the cell known as cytoplasm.

5. They reproduce sexually as well as asexually.

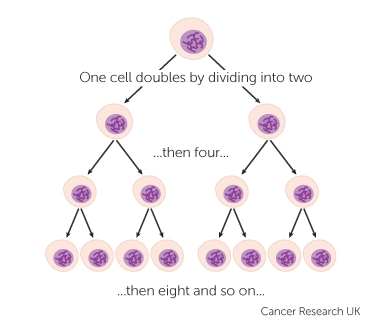
6. There are some contrasting features between plant and animal cell. For eg., the plant cell contains chloroplast, central vacuoles, and other plastids, whereas the animal cell does not.



A variety of animal cells

**Cell properties:**

**1- Growth:** Refers to **increase in size**, usually by **increase in amount of protoplasm**, the increases in size of cell or organ beyond normal is called **hypertrophy.**



**How body tissues grow**

Body tissues grow by **increasing the number of cells**

that make them up. Cells in many tissues in the body

**divide and grow very quickly** between **conception** and

**adulthood**. This process is called **cell division**.

One cell double by dividing into two. Two

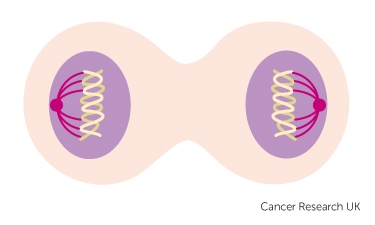
cells become four and so on. It seems that human

cells are programmed to reproduce up to 50 or 60

times at most and then they usually die.

**2- Cell division or replication**

Bacteria divide by binary fission, while eukaryotes divide



by mitosis or meiosis. Cell division involves a single cell

(Called a **mother cell**) dividing in into two daughter

cells. This leads to growth in **multicellular organisms**

(the growth of tissue).

Cell devision

**DNA replication**

The process of duplicating a cell’s genome always happens when a cell divides through mitosis or binary fission. This occurs during the phase of cell cycle. In meiosis, the DNA is replicated only once, while the cell divides twice. DNA replication only occurs before **meiosis I.** DNA replication does not occur when the cells divide the second time, in **meiosis** **II**. Replication, like all cellular activities, requires specialized proteins.

**3- Absorption :** Absorption refers to the process of taking dissolved materials into the substance of the cell. This may be a passive process dependent on such force as diffusion (from **higher** concentration to **lower**) and **osmosis** (from **lower** concentration to **higher**).

**4- Excretion**

The process by which animals **rid themselves of waste products** and of the **nitrogenous by-products of** [**metabolism**](http://www.britannica.com/science/metabolism). Through excretion organisms control osmotic pressure, the balance between inorganic ions and water and maintain acid-base balance. The process thus promotes [**homeostasis**](http://www.britannica.com/science/homeostasis), the **constancy of the organism’s internal environment**.

**5- Secretion:**

Secretion in biology means **production** **and release of a useful substance** by a [**gland**](http://www.britannica.com/science/gland)or[**cell**](http://www.britannica.com/science/cell-biology); also, the **substance produced**. In addition to the **enzymes** and **hormones** that facilitate and regulate complex biochemical processes, **body tissues also secrete a variety of substances that provide lubrication and moisture**. Within an individual cell the **[Golgi apparatus](http://www.britannica.com/science/Golgi-apparatus) and its associated secretory granules** are thought to be the structures responsible for the production and release of secretory substances.

**6- Irritability:**

The **ability to be excited** to a characteristic **action** or **function** by the **application of some stimulus**: Protoplasm displays irritability by **responding to heat**, and **eye to light**.

**7- Conductivity:**

Is the property of **transmitting impulse of some nature** from **one point in the cell to another**.

**8- Contractility:**

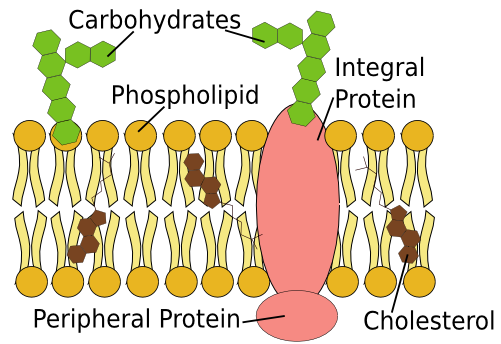
Refers to the ability for **self-**[**contraction**](https://en.wiktionary.org/wiki/contraction), especially of the muscles, or similar active biological tissue.

**Lecture 2: The Cell Membrane is a Fluid Mosaic**

A **cell** is the basic unit of life, and all organisms are made up of one or many cells. One of the things that all cells have in common is a **cell membrane**. It is a barrier that separates a cell from its surrounding environment. This outer boundary of the cell is also called the plasma membrane. It is composed of four different types of molecules: **Phospholipids, cholesterol, proteins** and **carbohydrates**.

The **fluid mosaic model** describes the structure of a cell membrane. It indicates that the cell membrane is **not solid**. It is flexible and has a similar consistency to vegetable oil, so all the individual molecules are just floating in a fluid medium, and they are all capable of moving sideways within the cell membrane. Mosaic refers to something that contains many different parts. **1-** The **lipid** composed of (**phospholipids, cholesterol** and **glycolipid**) molecules they have a **hydrophilic polar** region at one end of the molecule and a **hydrophobic hydrocarbon tail** the other end.

**2-** **Proteins** are embedded in the lipid bilayer, some proteins (called **integral** **or intrinsic proteins**) bind to the hydrophobic center of the lipid bilayer.



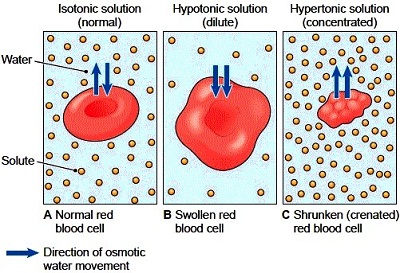
**Figure:** Fluid mosaic model of the cell membrane and proteins associated with the membrane.

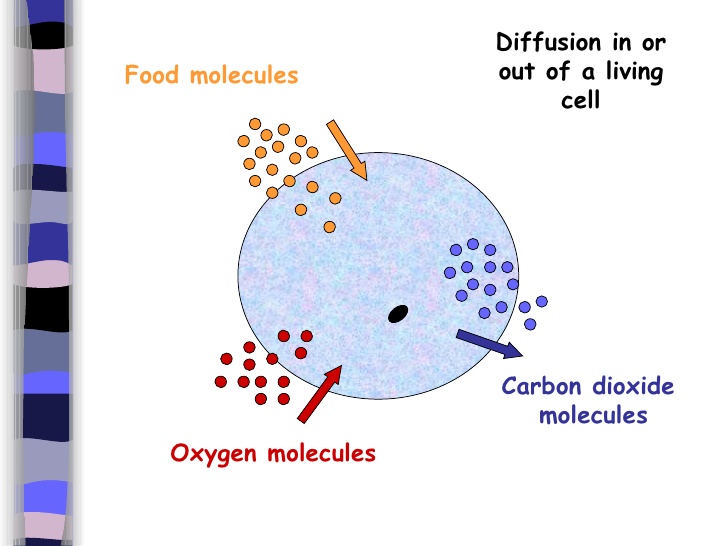
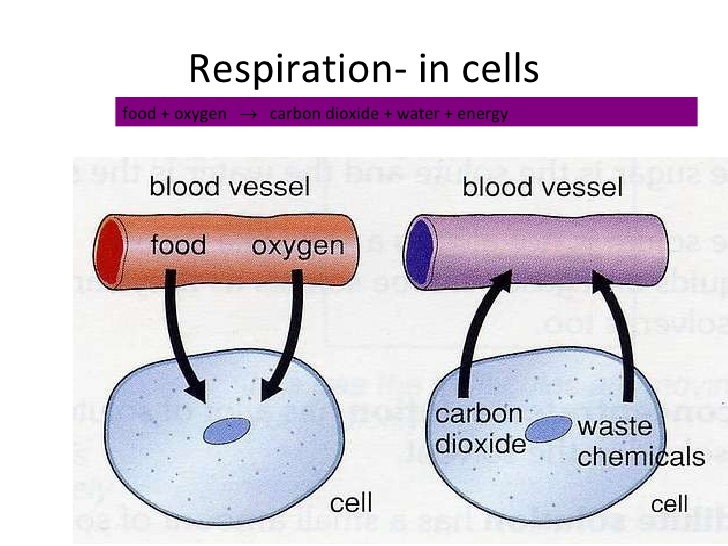
**How substances move across the Plasma Membrane**

Substances need to pass through the membrane to enter or leave the cell and they do so in a number of ways. Some of these processes require no energy i.e. they are passive, while others require energy i.e. they are **active** process and **vesicular transport**.

1-The **passive process** include:

|  |  |
| --- | --- |
| **Osmosis** | **Diffusion** |
| 1- It involves movement of solvent molecules | 1- It involves movement of solute molecules |
| 2- Molecules move from lower concentration of solvent (water) to higher concentration of solute. | 2- Molecules move from higher concentration of solute to lower concentration of solvent (water). |
| 3- It occurs only across a semipermeable membrane | 3- It does not require semipermeable membrane |
| 4- Example: red blood cells in different tonic solution | 4-Example: O2 from the blood into the body cells - CO2 from the body cells into the blood. |



[](http://www.google.iq/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwjMkefdsO3LAhXCzRQKHZwlDEQQjRwIBw&url=http://www.slideshare.net/rossbiology/b-diffusion-and-osmosis&psig=AFQjCNGoAHTPSXDba9WzcgNDpgvGBoik-Q&ust=1459598064670066) [](http://www.slideshare.net/clairebloom/diffusion-and-osmosis-homework-powerpoint)**Diffusion in a liquid**

2- **Active processes** include:

**a-Active transport**

Directly use the energy obtained from the hydrolysis of adenosine triphosphate (ATP) to transport material against an energy (e.g. concentration, electrical) gradient. The most common of these active transport systems is the **sodium-potassium** (Na – K- ATPase) pump which uses the membrane- bound ATPase as carrier molecule.

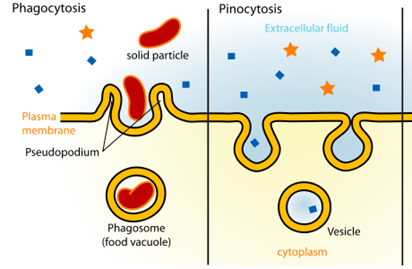
**b- Phagocytosis and pinocytosis:**

**Phagocytosis**

Is the process being **large** and **solid molecules**. Phagocytosis, also called "**cell eating**" the **cell membrane folds around the object by engulfing them to be eaten**. For example, a **white blood cell** in immune system can **eat a foreign bacterium** whole in one bite.

**Pinocytosis**

Is the process where **small**, **dissolved substances** and **liquids** are taken up by a cell, also called "**cell drinking**". Pinocytosis is similar to phagocytosis, **smaller vesicles** are **taking up liquid** and **dissolved solutes** in that liquid, for example, the **cells surrounding blood capillaries** perform pinocytosis to **'drink' the blood** while at the same time taking up any solutes that are dissolved inside of the blood.



**3- Vesicular Transport**

Many substances are transported across the cell membrane **endocytosis** and **exocytosis.**

1. **Endocytosis**: **Taking** substances **into the cell**, such as: **pinocytosis** for water, **phagocytosis** for solids).
2. **Exocytosis:** **Pushing** substances **out of the cell**, such as the **removal of waste**.

