www.Cryp2Day.com
موقع مذكرات جاهزة للطباعة

Biology

For 1st secondary

Dr. Ahmed Mostafa
Msc. Of Sciences
01013883112
Dr Ahmed Mostafa biology

Biology

IST sec.

Prepared by:

Dr. Ahmed Mostafa

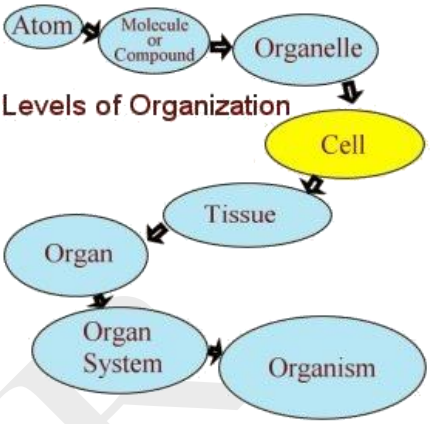
Master degree in Sciences

Tel: 01093339977

Whatsapp: 01013883112

CH: 1
Lesson: 1

Chemical structure of living organism



- The human body

consists of a group of **systems**,

each system consists of a group of **organs** (The organ level)

each organ consists of group of **tissues** (The tissue level)

each tissue consists of a group of **cells** (The cell level)

each cell consists of a group of **organelles** (The organelle level)

each organelle consists of a group of **molecules** (The chemical level)

each tissue consists of a group of **atoms**.

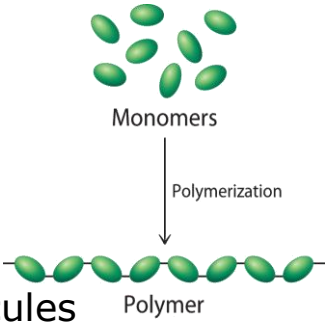
The living cell consists of two types of mplecules

- **Organic compounds (such as biological macromolecules)**
- **Inorganic compounds (Such as water and minerals s NaCl)**

Compare between the organic and inorganic molecules in the cell.

Organic compounds	Inorganic compounds
- They are large molecules. - Mainly contain carbon (C) and hydrogen (H) atoms. - May contain other elements, such as oxygen (O) and nitrogen (N). - They are called biological macro-molecules. Examples: Carbohydrates, lipids, proteins and nucleic acids.	They are molecules that don´t contain carbon (atoms) Examples: Water (H2O) and mineral salts (e.g. NaCl)

Biological macro-molecules (Polymers)



Definition:

They are large-sized compounds formed by smaller molecules (monomers) combined together through **polymerization process.**

Polymerization:

It is the process by which the monomers are combined together to form the polymers.

Monomers —(polymerization)→ Polymers

Importance:

They are extremely necessary for the life of the living organisms.

Classification inside the living cell:

- **They are classified into 4 groups according to their:**
  - molecular structure.
  - functions
- **These 4 groups are**:
  - Carbohydrates, Lipids, Proteins, Nucleic Acids.

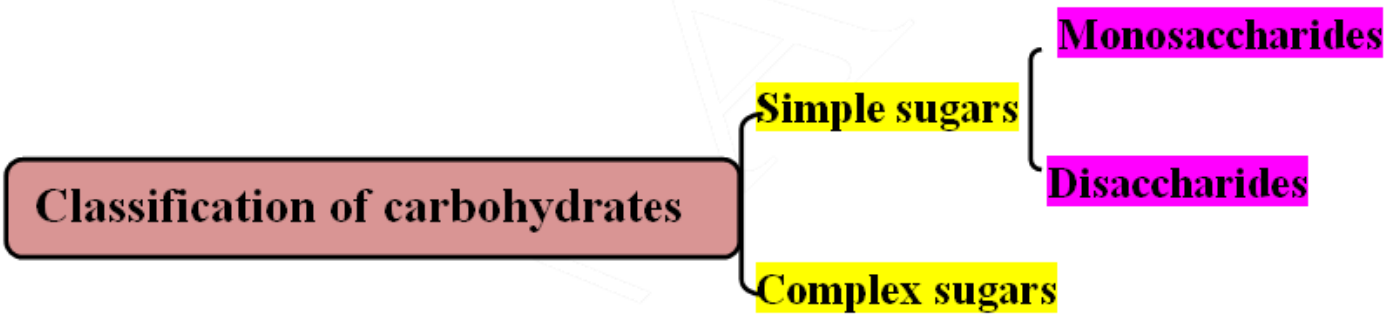
First **CARBOHYDRATES**

- **Definition:**

They are biological macromolecules (polymers) that are made up of many smaller molecules (monomers) called **monosaccharides.**

Monomers	Monosaccharides (such as Glucose, Fructose, Ribose and Galactose)
They include	Sugars, starches and fibers.
General formula	$(CH_2O)_n$ e.g. Glucose ($C_6H_{12}O_6$)
Atoms	Carbon (C), Hydrogen (H) and Oxygen (O) atoms in ratio **1:2:1**
Classification	They are classified according to their molecular structure into: Simple Sugars and Complex Sugars

- **Classification of carbohydrates:**

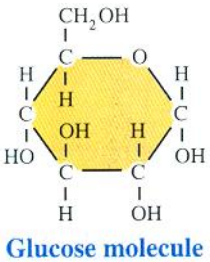


<table>
<tr><th>Simple Sugars</th><th>Complex Sugars</th></tr>
<tr><td>1- Water soluble</td><td>1- Insoluble in water.</td></tr>
<tr><td>2- Having a law molecular weight</td><td>2- Have a high molecular weight.</td></tr>
<tr><td>3- Having a sweet taste</td><td>3- Do not have a sweet taste.</td></tr>
<tr><td colspan="2">4- They are two types:
Monosaccharides and Disaccharides</td><td rowspan="2">- They are made up of many monosaccharides linked together.

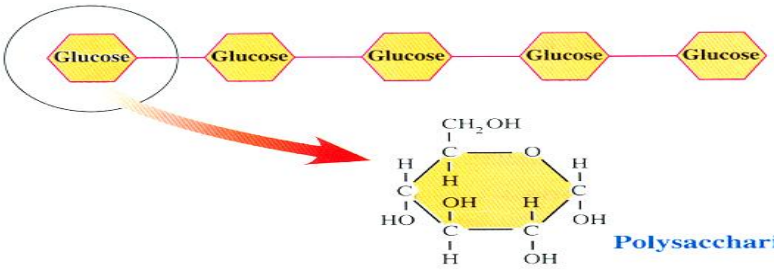
Examples
- Starch
- Cellulose
- Glycogen
-Each of these molecules conists of glucose molecules linked together.
$(C_6H_{12}O_6)_n$</td></tr>
<tr><td>Monosaccharides</td><td>Disaccharides</td></tr>
<tr><td>- No. of carbon atoms 3 to 6, each atom is connected to oxygen and hydrogen atoms in a certain way.
- The simplest type of sugars (G.R).
- Formed of one molecule.
Examples :
- Glucose (grape sugar)
- Fructose (fruit sugar)
- Ribose (pentose sugar)(5 C atoms)
- Galactose. (made in the glands that produce milk)</td><td>-Each molecule is made up of two molecules of monosaccharides linked together.
Examples :
- Maltose (malt sugar) :- Formed of glucose + glucose.
- Lactose (milk sugar) :- Formed of glucose + galactose
- Sucrose (cane sugar) :- Formed by glucose + fructose</td></tr>
</table>

SUMMARY

- Monosaccharides, the simplest sugars, number of C atoms = 3:6
- Monosaccharide + Monosaccharide ⟶ Disaccharide.
- Glucose + Glucose ⟶ Maltose
- 3 Monosaccharides or more ⟶ Complex Sugars.
- Glucose + Glucose + Glucose ⟶ Complex Sugar (Starch, Cellulose, Glycogen)



Glucose molecule



Starch molecule (Polysaccharide) is made up of several molecules of monosaccharides (glucose)

Role of monosaccharides in energy transferring processes inside the cells:

- Oxidation of glucose occurs inside mitochondria.
- The energy that is stored in chemical bonds of glucose is released to be stored in a ATP molecule (compound called adenosine triphosphate).
- ATP is then transferred to other places in the cell to use the stored energy in it for performing all vital processes inside the cell.

Importance of carbohydrates:

Obtaining energy	They are one of the basic and fast resources for obtaining energy
Storing energy	They are used for storing energy in organisms until be needed, as: 1- **Plants** store carbohydrates in the form of **starch**. 2- **Human and animals** store carbohydrates in the form of **glycogen** in cells of liver and muscles.
Building cells	They are basic component of some parts of the cell, as: - **Cellulose, enters** in the structure of **cell walls of plant cells**. - **Carbohydrates enters** in the structure of in **cell membranes and protoplasm**.

• Practical activity:

Detection of simple sugars

- By using **Benedict' reagent** where: its color turns from **blue** into **orange**.
- Benedict' reagent is used to detect mono- and di-saccharides.
- Benedict' reagent is used to detect simple sugars in urine and blood.
- Benedict' reagent is used to detect simple sugars in foods.

Detection of starch:

- By using **iodine solution** where: its colour turns from **orange** into **dark blue**.
- Iodine solution is used to detect starch in food samples.
- The degree of the colour of iodine solution depends on the amount of starch in the food samples.

N.B) Diabetic (مرضى السكر) and obese patients (مرضى السِمنة) must keep themselves away from taking sugary and starchy substances.

CH: 1
Lesson: 2

Second

LIPIDS

Definition:

They are biological macromolecules (polymers) that are made up of many smaller molecules (monomers) called **fatty acids.**

Lipids consist of large group of heterogeneous compounds.

Monomers	Fatty acids
They include	Oils, Fats, Waxes, Steroids and cholesterol.
Atoms	Carbon (C), Hydrogen (H) and Oxygen (O) atoms.
Molecular structure	**Lipids are formed by the union of:** Fatty acids + Glycerol Glycerol: an alcohol containing 3 hydroxyl groups.
Solubility	- Insoluble in **polar solvents** (as water). - Soluble in **non-polar solvents** such as benzene and carbon tetrachloride.
Classification	• Lipids are classified into 3 types: - Simple lipids. - Complex lipids. - Derived lipids

• Classification of lipids:

Lipids are classified according to **their chemical structure** into:

Classification of lipids
- **Simple lipids** (divided into oils, fats and waxes)
- **Complex lipids** (such as phospholipids)
- **Derived lipids** (as Cholesterol and some hormones (steroids))

Simple lipids

- Formed by the reaction of fatty acids with alcohol.
- They are divided into oils, fats and waxes, **according to**:

The saturation degree of the fatty acids. and The type of alcohols.

Fatty acids + **alcohol** → **simple lipids** → **oils**, **fats**, **waxes**

Lipid	Nature	Reaction of formation	Example
Oils	Liquid (at ordinary temperature)	Unsaturated fatty acids + glycerol	Oils that cover the feathers of water birds (G.R) to prevent water penetration to their bodies which hinders their movement.
Fats	Solid (at ordinary temperature)	Saturated fatty acids + glycerol	The stored fats under the skin in some animals (polar beer) (G.R) to act as thermal insulator (عازل حرارى) for keeping their body temperature in the severe cold (polar) region.
Waxes	Solid (at ordinary temperature)	**Fatty acids** (high molecular weight) + **Alcohol** (monohydric, contains only one **OH^-** group)	The waxes covering the desert plant leaves (G.R) to keep water inside their tissues and reduce its loss during transpiration.

Complex lipids

Structure	- Their structure involves carbon, hydrogen, oxygen, phosphorous and sulphur.
Example	- Phospholipids
Importance	- Present in cell membranes of animal and plant cells.
Molecular structure	- It is similar to the structure of **fat** molecules with a phosphate group $(PO_4)^{-3}$ and choline group replacing the 3rd fatty acid in fats. i.e. It consists of two fatty acids, glycerol molecule, $(PO_4)^{-3}$ and choline group.

Lipids derivatives

Synthesis	- They are derived from both simple and complex lipids by hydrolysis (adding water).
Example	- Cholesterol. - Some hormones, e.g. Steroids
Importance	- Steroids are involved in composition of some hormones such as sex hormones

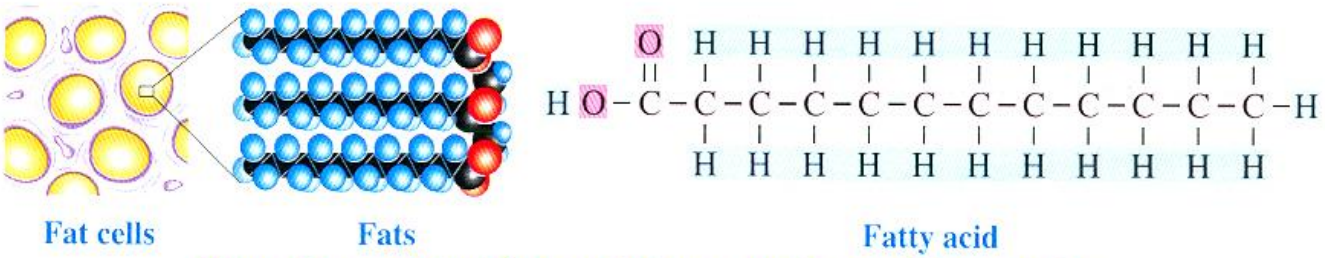
- **Practical activity:**

Detection of lipids

- **Sudan-4 reagent** is used for detecting fats in different foods (G.R).
- Lipids change the colour of Sudan-4 stain into **red**.
- Sudan-4 is used to detect the fats in various foods, such as oils. Milk and peanut butter (G.R) because Sudan-4 is soluble in fats, where it turns into red colour in the presence of fats (lipids)

Importance of carbohydrates:

Obtaining energy	- Lipids (fats) are an important source for obtaining energy. - The body does not begin to get energy from the stored fats unless in case of absence of carbohydrates. - The energy obtained from lipids is **more** than that obtained from the same amount of carbohydrates.
Building cells	- They represent about **5%** of organic materials of the cell. - Lipids (Phospholipids) are involved in the structure of cell membranes.
Work as thermal insulator	- Lipids (fats) form insulator layer under the skin of human and some animals (as polar bear) **(G.R)** to keep their body temperature in the severe cold regions.
Work as a protective cover	- Lipids (waxes) cover the surface of several plants, especially the desert plants **(G.R)** for reducing the water loss in transpiration process.
Works as hormones	- Lipids (Steroids) work as hormones, such as steroids.



Fat cells consist of fats which are made up of fatty acids

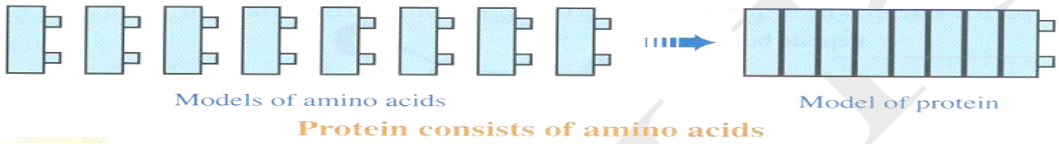
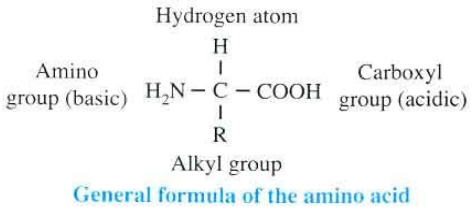
CH: 2
Lesson: 1

Third

PROTEINS

Definition:

They are biological macromolecules (polymers) that are made up of many smaller molecules (monomers) called **amino acids.**

Structure	**They have high molecular weight and made up of structural units called** amino acids**.**  Models of amino acids Model of protein Protein consists of amino acids
Atoms	Carbon (C), Hydrogen (H) Oxygen (O) and Nitrogen (N) atoms.
Amino acids	**Definition**: They are organic compounds that are made up of C, H, O and N atoms and they are represent the protein building units. **Number:** About 20 types of amino acids participate in building of proteins. **Examples:** glycine, alanine, valine, …etc. **Chemical structure:** Each amino acid composed of **a carbon atom** attached to: 1: **Hydrogen atom** (H). 2: **2 functional groups**: - A basic amino group (NH_2) - An acidic carboxyl group (COOH).  Hydrogen atom; Amino group (basic); $H_2N-C(H)(R)-COOH$; Carboxyl group (acidic); Alkyl group General formula of the amino acid 3: **A terminal alkyl group (R),** which differs from an amino acid to another, so that it determines the type of amino acid.

Notes

- **Number of amino acids 20.**
- **Number of amino acids containing alkyl group = 19** (G.R) because the simplest amino acid (glycine) does not contain alkyl group but contains another hydrogen atom.
- **The alkyl group determines the type of amino acid because it differs from an amino acid to another.**

Amino acids and building proteins

- Proteins are made up of repeated units of **amino acids**.
- Amino acids are linked together by **peptide bonds**.
- The peptide bond originates between:

The carboxyl group of an amino acid and the amino group of another amino acid, through the removal of **water** molecule (**OH^-** group from the carboxyl group and **H^+** ion from the amino group)

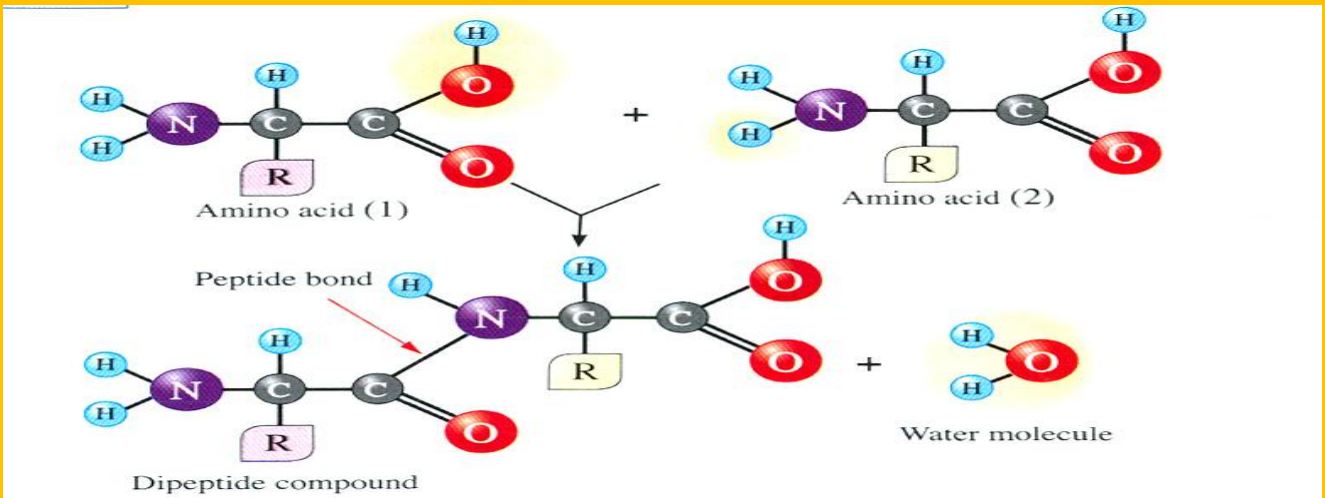
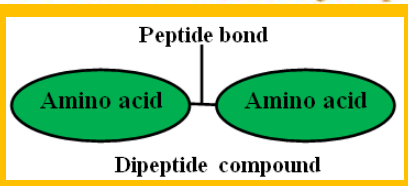


Figure illustrates the link between two amino acids by a peptide bond

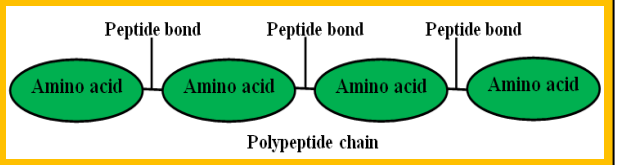
- When two amino acids combine together:

A **dipeptide molecule** is produced.



- When several amino acids combine together:

A **polypeptide chain** is produced.

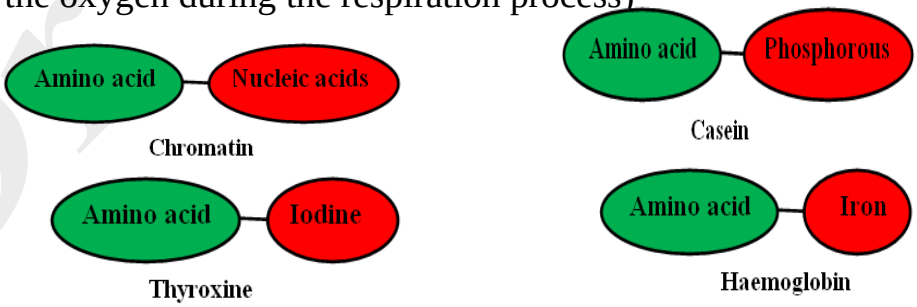


- It is not condition for protein formation, the combination among similar amino acids occurs, so there are extensively wide and various possibilities to form proteins, depending on:
- There are extensively wide and various possibilities to form proteins, because, the similarity of amino acids forming the protein is not conditional, forming proteins depending on **the types**, **the order** and **the number** of amino acids in the chain.

The stages of protein complexity

Amino acid → 2 linked amino acids → 2 linked amino acids

Monomer **Dipeptide molecule** **Protein**

Classification Of proteins	
Simple proteins	They are formed of **amino acids only** e.g.) **Albumin:** It a simple protein found in roots and leaves of the plants and in the human blood plasma.
Conjugated proteins	They are formed of amino acids and other elements. - Examples : • Amino acids + nucleic acids. e.g) **Chromatin:** (**Nucleic proteins**: inside the nucleus) • Amino acids + phosphorous. e.g.) **Casein:** (**Phosphoproteins**: milk protein) • Amino acids + Iodine. **e.g.) Thyroxin hormone** (Secreted from **thyroid gland**) • Amino acids + Iron. e.g) **Hemoglobin** (Inside red blood cells, it is necessary for transporting the oxygen during the respiration process) 

What happens in the following cases:

1- Two amino acids linked together by a peptide bond:

A dipeptide molecule is formed.

2- Several amino acids combine together.

A polypeptide chain is formed.

3- Analysis of Albumin protein.

Amino acids only are produced because it is a simple protein.

Practical activity

Detection of Proteins

1- **Biuret's reagent** is used in detecting the presence of proteins in various foods.

2- The colour of **Biuret's reagent** is changed from blue into violet.

3- Egg albumen is an example of foods containing proteins.

Importance of proteins

1- They are contributed in the biochemical processes that keep the life and its continuity(تحافظ على الحياة و استمرارها), as they are involved in the structure of **enzymes** and **several hormones** that stimulate and organize all vital processes in the body.

2- They are the the structural building units for all the living organismas, where they are involved in the structur and function of all living cell, where:

1- They are one of the basic components of the **cell membranes** and **chromosomes**.

2- They form the **muscles**, **ligaments**, **tendons**, **organs**, **glands**, **nails**, **hairs** and **skin**.

3- They are involved in the structure of many **body fluids**, **such as blood and lymph**.

4- They are necessary for **body growth**.

Note:

Proteins enter in the structure of: spider´s net(شبكة العنكبوت), Hooves(الحوافر) and Horns(القرون).

Fourth]

Nucleic Acids

Definition

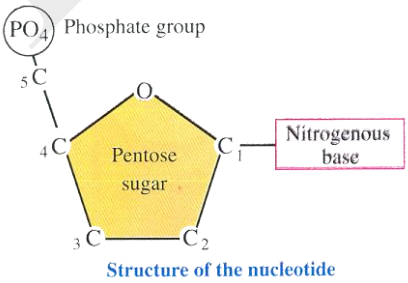
They are biological macro-molecules (polymers) that are made up of many smaller molecules (monomers) called **Nucleotides**.

Molecular structure of Nucleic acids

- They are macromolecules which are formed of building units (monomers) called **Nucleotides.**
- Nucleotides bind together by covalent bonds to form polynucleotide (nucleic acid).

Structure of the nucleotide:

Each nucleotide consists of 3 units:



Structure of the nucleotide

a-A pentose sugar:

(consists of 5 carbon atoms may be:

- deoxyribose sugar (in DNA) or - ribose (in RNA)

b- A phosphate group:

(attached to the carbon atom no. 5 of the pentose sugar by a covalent bond)

c-**A nitrogenous base:**

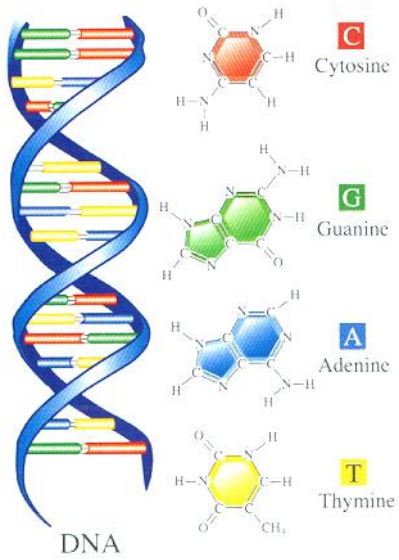
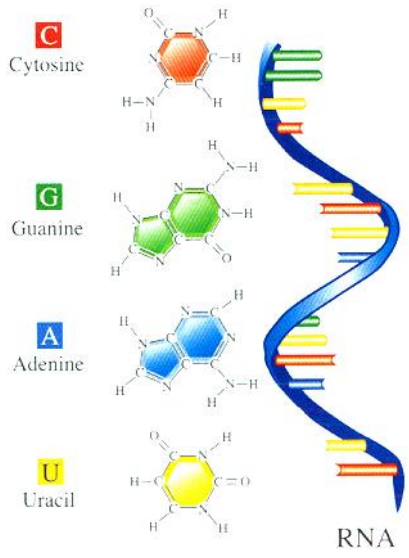
- Attached to the carbon atom no. 1 of the pentose sugar by a covalent bond.
- There are 5 types of nitrogenous bases:
- **Adenine** (A), **Guanine** (G), **Cytosine** (C), and **Thymine** (T) and **Uracil** (U).

Classification of Nucleic acids

There are 2 types of nucleic acids:

1- Deoxyribonucleic acid (DNA).

2- Ribonucleic acid (RNA).

	Deoxyribonucleic acid (DNA)	Ribonucleic acid (RNA)
Type of pentose sugar	Deoxyribose sugar (lack an oxygen atom than ribose sugar)	Ribose sugar
nitrogenous bases	Adenine (A), Guanine (G), Cytosine (C), and **Thymine (T).**	Adenine (A), Guanine (G), Cytosine (C), and **Uracil (U).**
No. of strands	2 strands of nucleotides.	Single strand of nucleotides.
Location	Inside the nucleus of the cell where it is involved in the structure of the chromosomes.	It is transcribed (formed) from DNA inside the nucleus and then transferred into the cytoplasm.
Importance	It carries the genetic information that passes from a generation to another, when the cells divide and these information are responsible for: - Appearing the distinctive characters of the living organism. - Organizing all vital activities of cells.	- It is used in building the proteins which the cell needs. - These proteins are responsible for: • Appearing the genetic traits. • Organizing the vital activities.
Molecular structure		

CH: 3

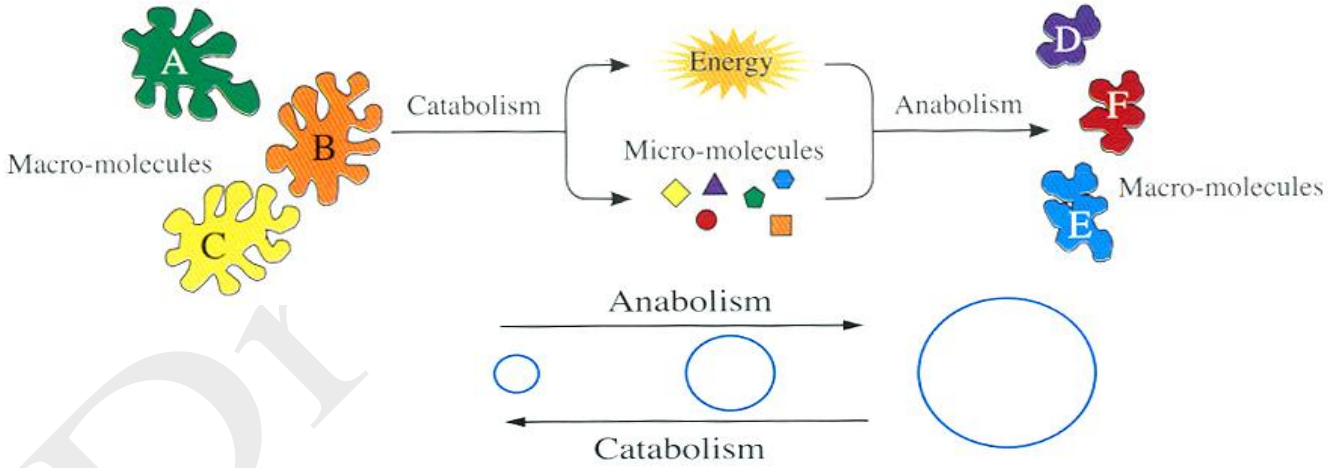
Chemical reactions in organisms' bodies

Metabolism

It is a group of continuous biochemical reactions taking place inside living cells.

- **Metabolic reactions are divided into two processes: Catabolism and Anabolism.**

Catabolism	Anabolism
- It is the process of breaking down chemical bonds between atoms of molecules (macromolecules) to extract the chemical energy stored in them. **Example**: - Releasing the energy from glucose oxidation during cellular respiration.	- It is the process of using simple molecules for building more complex substances. - It consumes energy **Example:** - Synthesis of proteins from amino acids. - Photosynthesis in green plants.



Importance of metabolism:

1- It is necessary for growth of the body (anabolism).

2- It is necessary for repairing damaged tissues (anabolism).

3- It is necessary for obtaining energy required for the vital activity (catabolism).

- These reactions continue in all living organisms, stopping of these reactions leads to death.

ENZYMES

They are protein molecules acting as biological catalysts to increase the speed of chemical reactions inside the cell.

Why does the cell need energy?

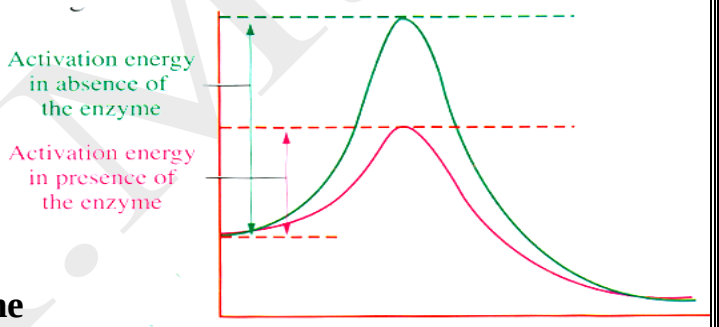
- Metabolism needs high activation energy to get started, therefore, these reactions need a catalyst (enzyme).

Activation energy

It is the minimum energy needed in order for a chemical reaction to occure.

Effect of enzymes on the activation energy:

The opposite graph illustrates the consumption of a biochemical reaction to the energy.



Effect of enzymes on the activation energy needed for starting the chemical reaction

Observation:

Activation energy **in the presence of the enzyme is less than** Activation energy **in the absence of the enzyme**

Importance of the enzymes

a) They reduce the activation energy.

b) They reduce consumption of more energy.

c) They ensure the occurrence of chemical reactions more rapidly.

Structure of the enzyme

The enzyme is made up of large number of amino acids that form one polypeptide chain or more which forms the specific spatial structure (البناء أو الشكل الفراغى)of the enzyme.

Origin of the word enzymes

Enzyme (Latin word) = In the yeast

As the enzymes had been discovered for the first time from the process of glucose fermentation into alcohol by the yeast.

Properties of the enzymes

1- They are Similar to chemical catalysts (GR), because they participate in the chemical reactions to speed them without being affected or consumed.

2- They are highly specific than other chemical catalysts (GR), because each enzyme is specific for:

- One reactant substance (called the substrate)
- One or few types of chemical reactions.

3- They reduce the activation energy needed to start start the rection.

4- They are affected in their action by temperature and pH (hydrogen ion concentration).

Factors that affect the speed of enzyme action

1- Temperature.
2- pH (hydrogen ion concentration).
3- Enzyme concentration.
4- Substrate concentration.
5- Presence of inhibitors.

1- Effect of Temperature On the enzyme action

- Enzymes are sensitive to thermal changes (GR.) because they are made up of protein substances.
- Their activity is determined in a narrow range of temperature (GR.), because each enzyme has an **optimal temperature** at which the enzyme activity is more, it ranges between 37° and 40°C.

Enzyme optimal temperature

It is the temperature at which the enzyme is more active (it ranges between 37° and 40°C).

c

1- If the temperature rises above the optimal temperature of the enzyme:

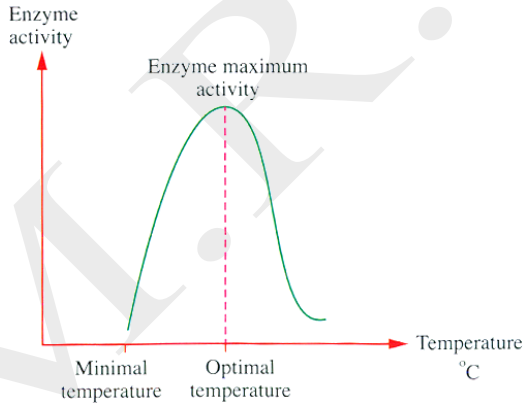
The enzyme activity gradually decreases until it reaches a certain temperature at which the enzyme activity stops and it will not restore its activity even after decreasing the temperature (GR.) due to the change of its normal composition.

2- <u>If the temperature decreases below the optimal temperature of the enzyme:</u>

The enzyme activity **gradually decreases** until it reaches a minimum temperature at which the enzyme activity **stops completely at 0ºC**, <u>but the enzyme restores its activity</u> (reactivated) once more by rising the temperature.

Enzyme minimal temperature

It is the temperature at which the enzyme is less active.



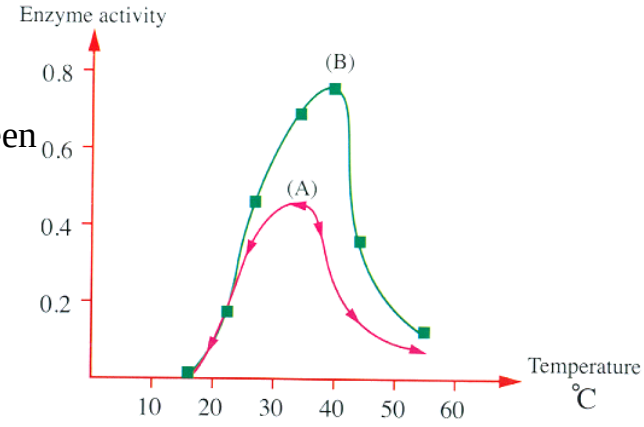
Life application

Temperatures are recorded on some detergents to use them properly (GR.), due to providing the optimal temperature at which the enzymes present in these detergents work with their maximum activity.

Example

The following graph shows the relationship between

- The activity of two enzymes
- And temperature.



Observation:

From the graph you may notice that:

	Enzyme A	Enzyme A
Temperature at which the enzyme starts its activity (minimal temperature)	**16ºC**	**16ºC**
Temperature at which the maximum enzyme activity (optimal temperature)	**35ºC**	**40ºC**
Temperature at which the enzyme activity stops.	**c**	**55ºC**
The thermal range of enzyme activity	**16ºC : 55ºC**	

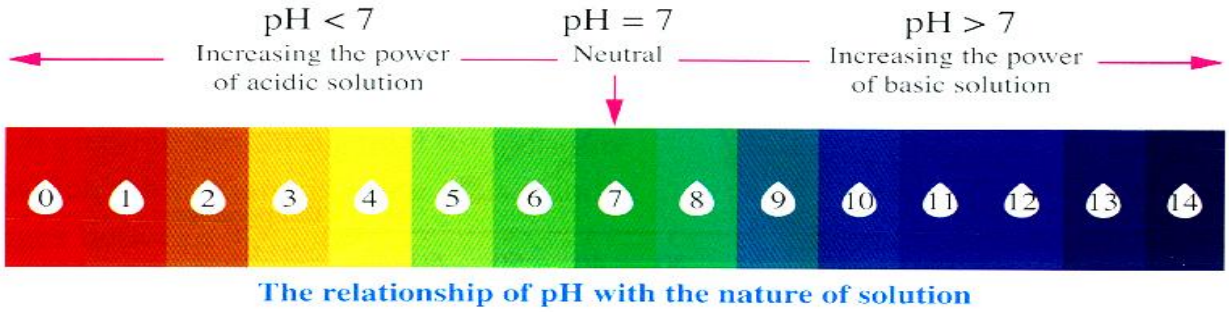
2- Effect of pH on the enzyme action

Power of hydrogen (Potential of hydrogen) pH:

It is a measurement that determines the concentration of hydrogen ion (H^+) in the solution, whether the solution is acidic, basic or neutral, where:

- If pH < 7 the solution is acidic.
- If pH > 7 the solution is basic.
- If pH = 7 the solution is neutral (This is the pH of pure water at **25°C)**

- The values of pH are ranged between (0 : 14) depending on the positive hydrogen ion concentration (H^+).



The relationship of pH with the nature of solution

Note: You can determine the pH of any solution by using the pH indicators.

Relationship between pH and enzyme activity:

- The enzyme activity is affected by changing pH values (GR.) because they are protein substances that contain:

- **Acidic** carboxyl groups (COOH).
- **Basic** amino groups (NH_2).

- Each enzyme has its optimal pH value at which it works with a maximum efficiency.

optimal pH of the Enzyme

It is the pH value at which it works with a maximum efficiency.

What happens in the following cases:

- **If the pH is lower or higher than the optimal pH of the enzyme**, the enzyme activity decreases until it stops.

Examples:

Pepsin enzymes

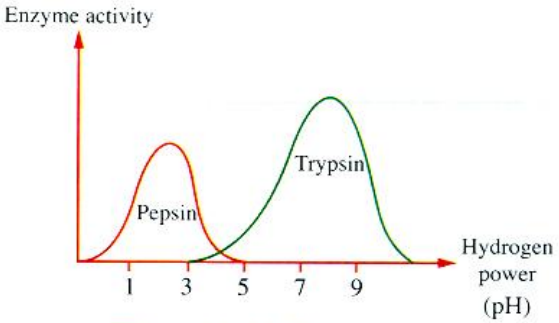
Works in the stomach at an **acidic** medium

pH (1.5 : 2.5)

Trypsin enzymes

Works in the small intestine at at an **alkaline** medium

pH (7.5 : 8.0)



The optimal pH values for pepsin and trypsin enzymes

Note:

- **Most enzymes work at pH value equals 7.4** (neutral medium) (GR.), as the amino acid molecules that form the enzyme contain acidic carboxyl groups and basic amino groups.
- **Amylase enzyme:**

- Is an enzyme that catalyses the hydrolysis of starch into maltose.
- It acts in a solution of pH = 7.5
- If the pH value is more or less than 7.5 amylase enzyme doesnot affect starch.

- **Buffer solution:**

  It is the solution that keeps the value of pH of a solution constant.

Biology

IST sec.

Unit 2

Prepared by:

Dr. Ahmed Mostafa

Master degree in Sciences

Tel: 01093339977

Whatsapp: 01013883112

CH: 1
Lesson: 1

CELL THEORY

The living organisms:

- They are divided into **two types** according to the structure of their bodies:

Unicellular organisms	Their body consists of one cell only, which perform all the vital activities needed for the continuity of life. e.g. Amoeba, bacteria and Paramecium.
Multicellular organisms	Their body consists of many cells, which differentiate and specialize in their functions. e.g. Man, whale and trees.

The common characteristics (الخصائص العامة) of living organisms are:

Feeding, transporting, respiration, excretion, motion, ….. etc.

The cell

- It is the smallest (tiniest) (أبسط) functional and building unit in all living organisms.
- It is capable of carrying out all the functions of life.

Properties of the cells:

1- They are varied in shape, structure and size, where:

- The tiniest cell in size is the bacterial cell.
- The biggest cell in size is the cell of the unfertilized egg of the Ostrich (بويضة النعامة غير المخصبة).

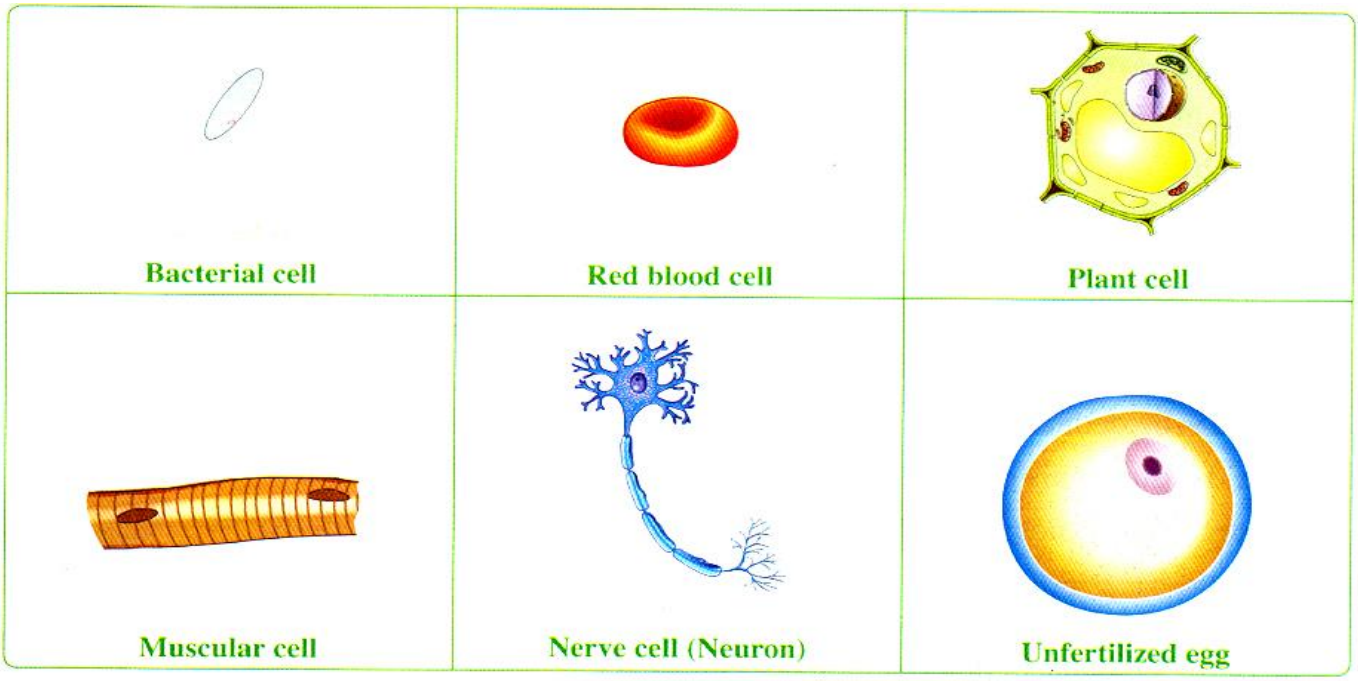
2- There is a relationship between the shape of cells and functions they perform, (explain):

Nerve cells (neurons):

Are the longest cells (may reach 1 meter or little more) (GR.) to be able to transfere the messages from the spinal cord that present inside the vertebral column to the farthest parts of the body, such as toes.

Muscular cells:

Are cylindrical, long and gather with each other to form the muscle fiber which can contract and relax, helping the animal to move freely.



Discovery of the cell

The role of scientists in discovering the cell and its structure:

Robert Hook	The favour in cell discovery is referred to Robert Hook (GR.), because: - He invented a simple microscope in 1665 and used it to examine a piece of cork tissue, it was composed of small boxes arranged in rows, he named each box by the word **the cell**.(it is derived from the latin word (cellula = the cell or the small room)
Van Leeuwenhoek	He was the first to observe microscopic organisms and living cells (GR.), as: - He made a simple microscope (1674) by using lenses with the ability to - magnify objects up to 200 times of their original size. - He examined different substances (water ponds, blood and others)
Shleiden	He deduced that plants are composed of cells (In 1838). He stated this depending on his own researches and those of other previous scientists.
Schwann	He deduced that all living organisms are composed of cells.(In 1893)
Virchow	In 1855, he stated that: - The cell is the functional and building unit of all living organism. - The new cells are produced only by pre-existing other living cells.

The cell theory:

- It is considered as one of the most important basic theories in the modern biology.
- It is based upon 3 principles.

Principles of the cell theory:

1- All the living organisms are made up of cells which may single or grouped in clusters.

2- Cells are the basic functional units of all living organisms.

3- All cells come only from other pre-existing living cells.

Van Leeuwenhoek microscope

CH: 1
Lesson: 2

Development of microscopes

- It is difficult to visualize the cell or its components (GR.), because it is has a very minute size.
- The cell discovery was related to the invention of microscopes (GR.) because it has a very minute size and it was difficult to see it or its components.
- The vision of the cell components was related to the invention of the electron microscope (GR.) because it has a high magnifying power.

Types of microscopes

Light microscope	electrone microscope
It was the only available device to examine the living structures and non-living things till 1950.	It was used by the scientists since 1950.
Idea of work	
It depends on the sunlight or an artificial light.	It depends on using a beam of high speed electrons instead of light.
Types of used lenses	
Glass lenses (ocular and objective lenses)	Electromagnetic lenses (control the electron beam)
Functions	
- Magnifying many micro-organisms and non-living things. - Examining large-sized objects after cutting them into very thin slices (GR.) to allow the light to transmit through them.	- Clarifying the cellular components that had not been known before. - Knowing more accurate details about the cellular structures that had been known before.

Properties of its image

Less magnified and Less contrasted.

Magnifying power

- Up to 1500 times of their real size (low).
- It can´t magnify objects more than 1500 times because the image becomes unclear.

Calculation of the magnifying power:

(Magnigying power of the ocular lense) X **(Magnigying power of the objective lense)**

How to obtain the most clear image of specimens:

1- **Changing the level of light**.

2- Using dyes:

- Dayes are used to stain or colour certain parts of the specimen to be more clear.

Example: A day is added on examining the white blood cells.

- **Disadvantage of using dyes**: they kill the living specimens. so, it is not preffered to add dyes on examining the specimens of unicellular organisms (prokaryotes) such as:

Amoeba, *Paramecium* and *Yeast*.

- Highly magnified and highly contrasted than that of the light microscope (GR.) due to the shortness of wavelength of the electronic ray comparatively to that of the light ray.
- They are received on a fluorescent screen or on a highly sensitive photographinging board.

Magnifying power

It magnifies objects one million time or more (very high).

Types of electron microscopes

Scanning electron microscope:

It is used to study the cell surface.

Transmission electron microscope:

It is used to study the cell internal structures.

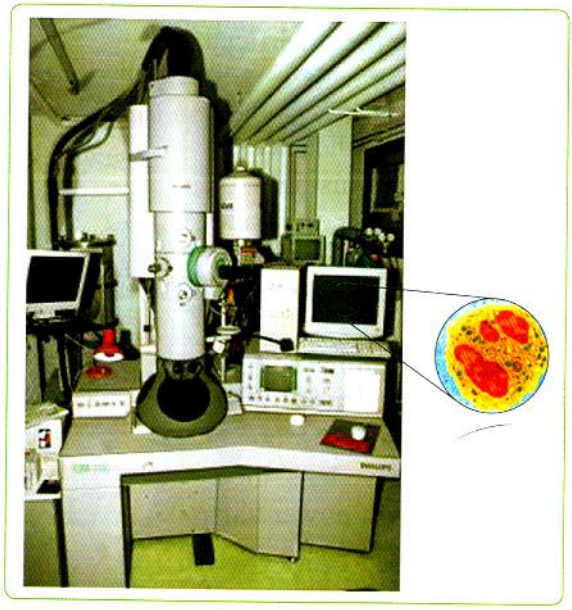
❶ Scanning electron microscope :

It is used to study the cell surface.

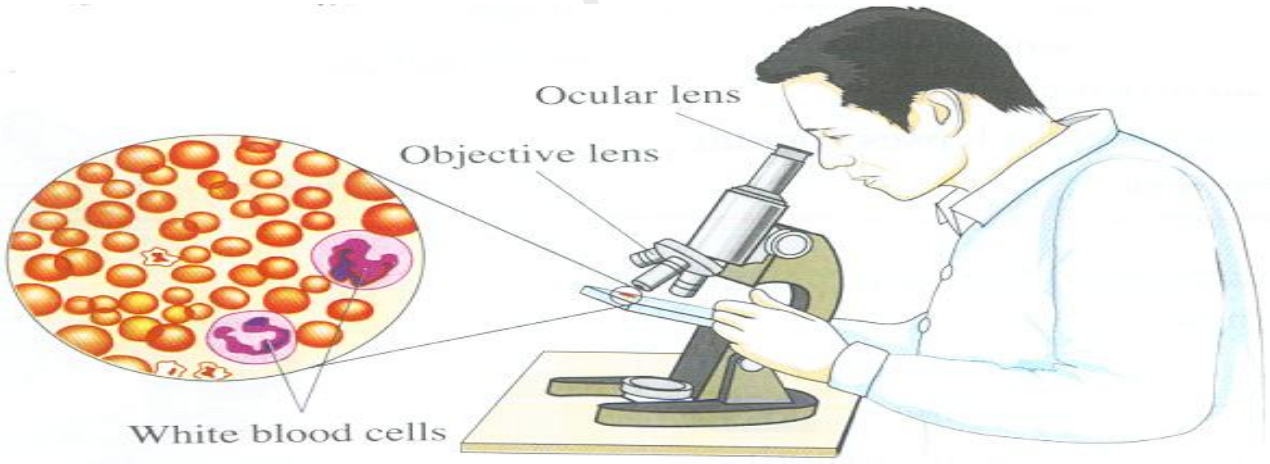
A micrograph of a white blood cell by using the scanning electron microscope. (Magnifying power is 3500x)

❷ Transmission electron microscope :

It is used to study the cell internal structures.



A micrograph of a white blood cell by using the transmission electron microscope. (Magnifying power is 8900x)

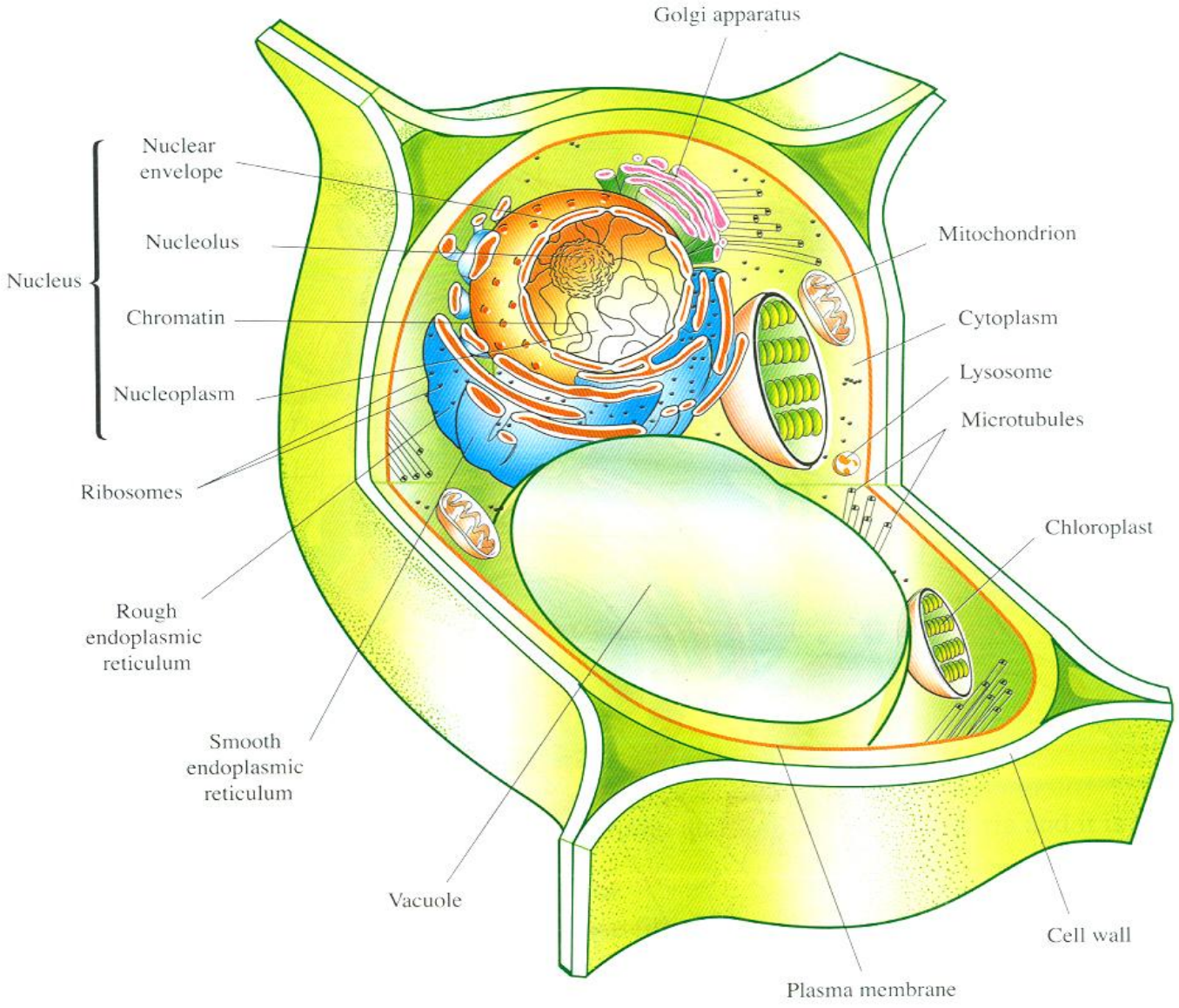


White blood cells are seen by a compound light microscope and the image is magnified 1000 times of its real size

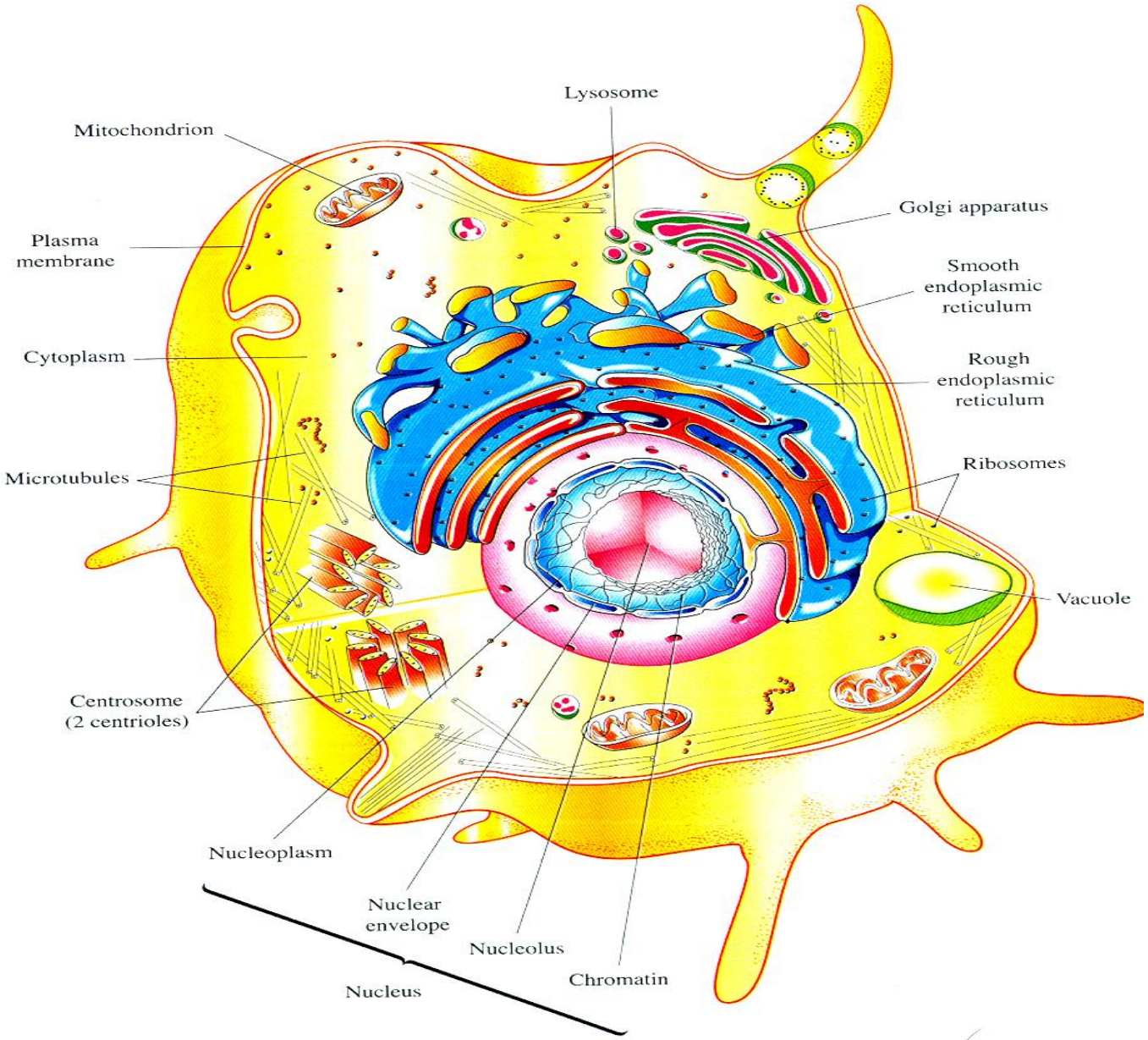
CH: 2
Lesson: 1

Cell struture

- Cell can perform different metabolic activities.
- It can do these functions by its main parts.
- It is formed of a protoplasmic mass which is surrounded by cell membrane and cell wall or by a cell membrane only.
- The protoplasm is differentiated into nucleus and cytoplasm.
- The cytoplasm contains a group of cellular structures called cell organelles.



Plant cell

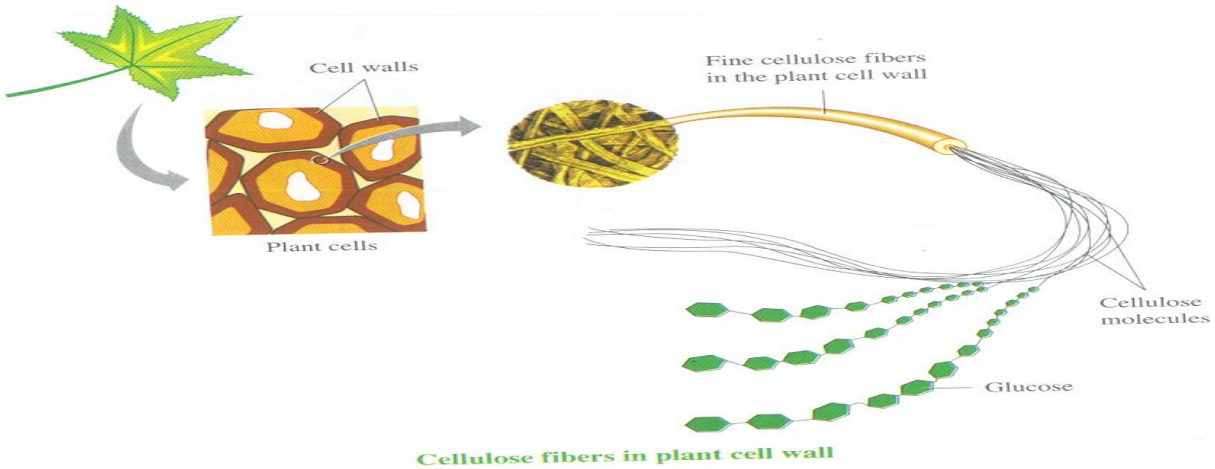


Animal cell

First

Cell wall and cell membrane

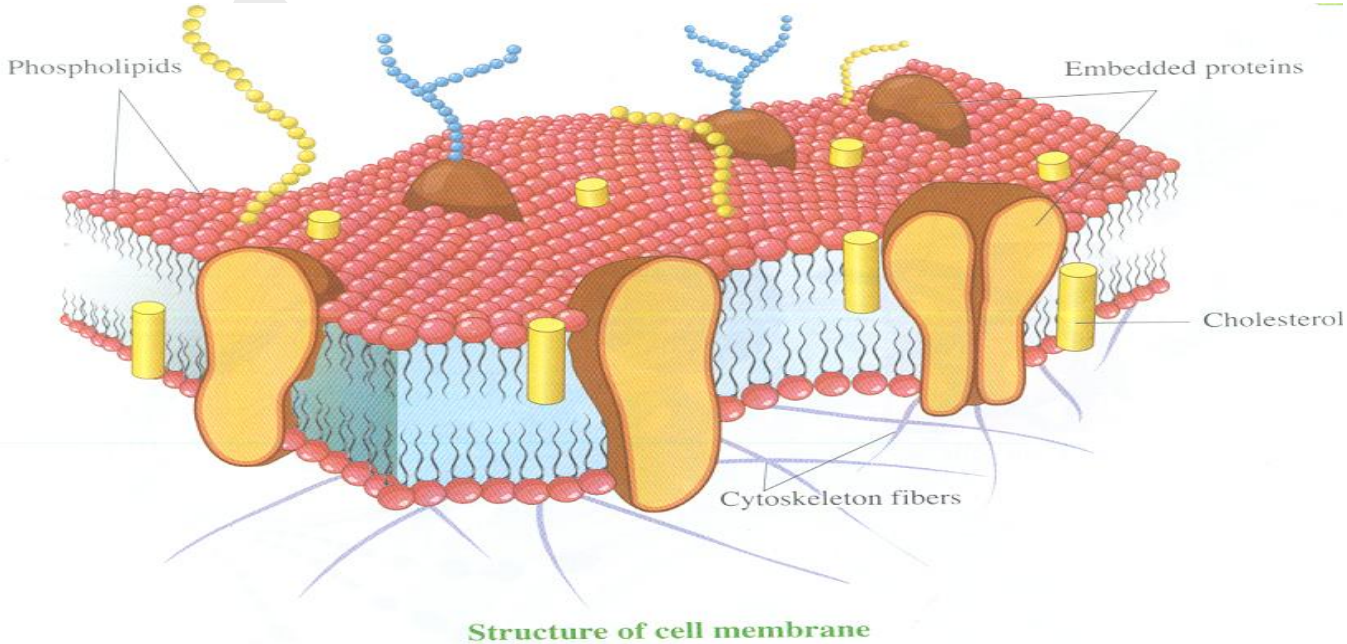
1 Cell wall



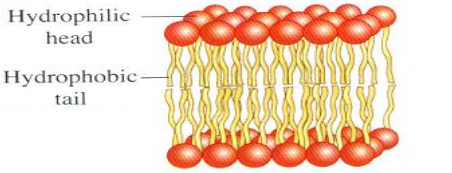
Cellulose fibers in plant cell wall

Location	- It surrounds: the plant cell, algae, fungi and some types of bacteria. - It is not present in the animal cell.
Structure	It is mainly composed of cellulose fibers.
Functions	It supports and protects the plant cell and gives its characteristic shape. It allows the passage of water and dissolved substances through it easily (GR.) because it is pitted (مثقب).

2 Cell membrane:

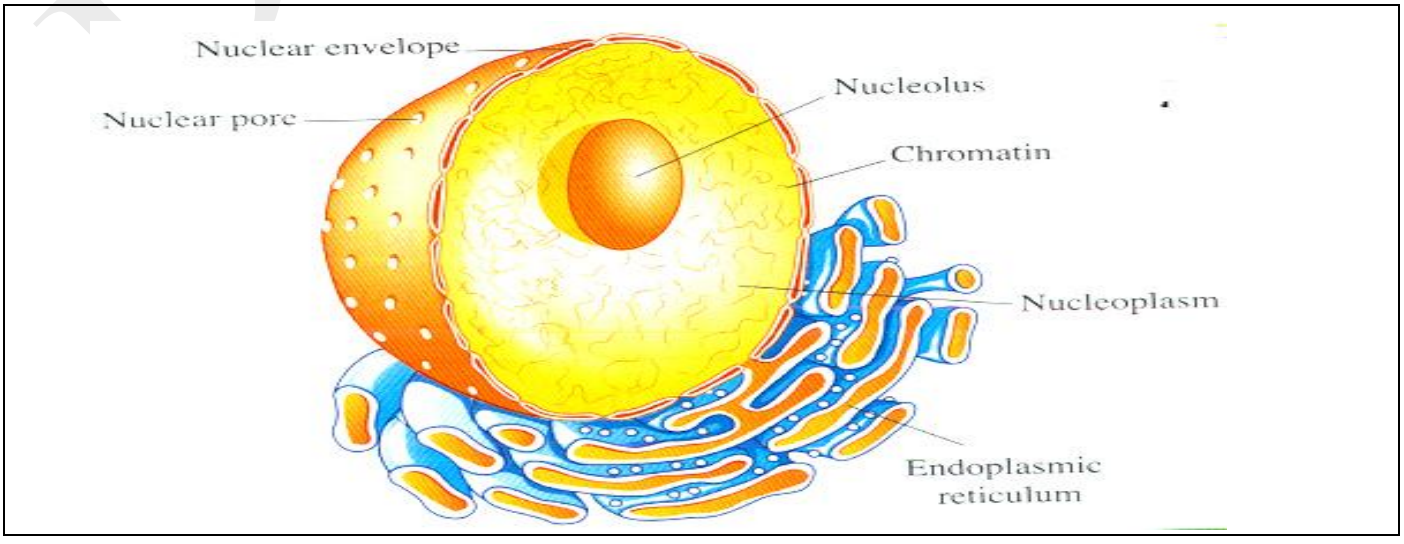


Structure of cell membrane

Location	It surrounds: the cytoplasm of plant and animal cell.
Structure	It is a thin membrane consists of: 1- **Two layers of fluid phospholipid molecules**, each of them consists of: - **Hydrophilic heads**: soluble in water, facing the water medium inside and outside the cell. - **Hydrophobic tails**, insoluble in water, present inside the membrane.  Structure of phospholipids molecule 2- **Molecules of protein** embedded between the molecules of these two phospholipids layers, where: - **Some of them work as cell identification sites** for different substances such as nutrients, hormones and others. - **Others, work as gates** for the passage of substances to and from the cell. 3- Cholesterol molecules, linked with phospholipid molecules (GR.) to maintain the membrane cohesive (متماسك) and intact (سليم).
Functions	- **It covers the cell and separates its content** from the surrounding medium, so that it prevents the spreading out of protoplasm outside the cell. - **It performs a basic role in organizing the passage of substances** to and from the cell.

Second Nucleus

- It is the most obvious organelle in the cell that can be seen under the microscope.
- It has a spherical or oval shape.

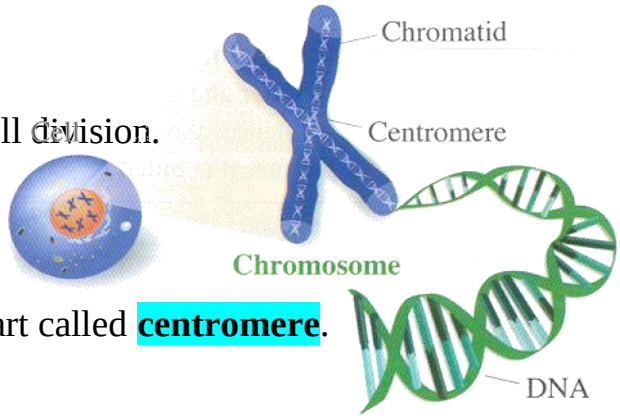


Location	- It is often located in the center of the cell. - It is present in the plant and animal cell.
Structure	It is mainly composed of cellulose fibers.
Functions	It is composed of: 1 **Nuclear envelope**: double membrane, surrounds the nucleus. - Separates the nucleus from the cytoplasm. - It has several tiny pores, through which substances pass between the nucleus and cytoplasm. 2 **Nucleoplasm**: transparent gelatinous fluid inside the nucleus. - It contains the nucleolus and chromosomes. 3 **Nucleolus**: It is responsible for the synthesis of ribosomes which play an important role in protein synthesis. - **Many cells**, especially the cells that secrete enzymes and hormones, **have more than one nucleolus** as it play an important role in protein synthesis such as enzymes and hormones. 4 **Chromatin**:it is minute tangled (متشابكة) filaments that are coiled around each other. During cell division, it changes into rod-like structures called **chromosomes**.

chromosomes

Appearance:

They appear more obvious during the metaphase of cell division.



Structure:

Each one consists of two filaments, two **chromatids**.

The two chromatids are joined together by a central part called **centromere**.

Structure of the chromatid:

It consists of **DNA** that is coiled around protein molecules called **histones**.

Functions of DNA: It carries the genetic information (genes) that:

- Control the shape and structure of the cell and organize its vital activities.
- Transfere the genetic traits (characters) from a generation to another through reproduction process.

Cell structure

Third: Cytoplasm

Location: It fills the space between cell membrane and nucleus.

Structure: It is a fluid-like substance found, composed mainly of water and some organic and inorganic substances.

Contents: it contains:-

1- **Cytoskeleton:**

This is a network of filaments and microtubules which:

- Acquires the cell with a support to help it to maintain its shape and form.
- It helps to transport different substances from a place to another inside the cell.

2- **Cell organelles**:

- They are various structures in the cytoplasm.
- They are divided into two types: membranous and Non-membranous organelles.

Non-membranous organelles (surrounded by a membrane).

Membranous organelles.

Non-membranous organelles	Membranous organelles
They are not surrounded by a membrane.	They are surrounded by a membrane.
Such as:	**Such as:**
- Ribosomes	- Endoplasmic reticulum. - Golgi body
- Centrosome	- Lysosomes. - Mitochondria.
	- Vacuoles. - Plastids.

Non-membranous organelles

They are two organelles:

- Ribosomes
- Centrosome

Ribosomes

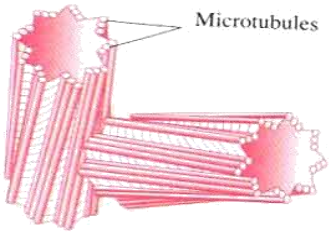
Description	- Rounded – shaped non-membranous organelles.
Function	- Synthesizing protein in the cell.
Location	- **Some** present freely in the cytoplasm and **most** of them present on the surface of the endoplasmic reticulum. **<u>Free ribosomes in the cytoplasm</u> :** - They are single or in clusters (تجمعات). - **They produce proteins directly into the cytoplasm** where the cell uses it in its vital processes as growth, regeneration and others. **<u>Ribosomes found on the outer surface of endoplasmic reticulum:</u>** - **They produce proteins as enzymes that transported by endoplasmic reticulum to outside of the cell** after making changing to them.

Centrosome

Structure

It consists of 2 tiny particles called **centrioles**.

Each centriole consists of **(9) groups** of microtubules arranged in **triples** (ثلاثيات) in cylindrical shape.



The 2 centrioles

Function

It plays an importanat role in:

1- **Cell division**:

where the spindle filaments extend between the 2 centrioles present at each pole of the cell.

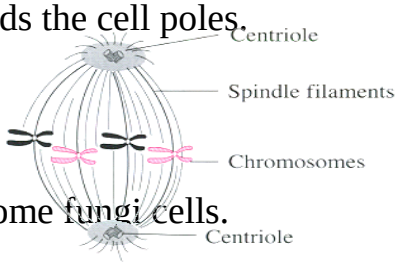
The centrioles withdraw the chromosomes towards the cell poles.

2- **Formation of flagella and cilia**.

Location

- It is located near the nucleus in:

The animal cells (except the verve cells) and in some fungi cells.



The role of centrosome during the cell devision

- It is not present in:

The cells of plant, algae and most fungi where these cells contain **a region of cytoplasm** performing the same function instead of centrosome.

Membranous organelles

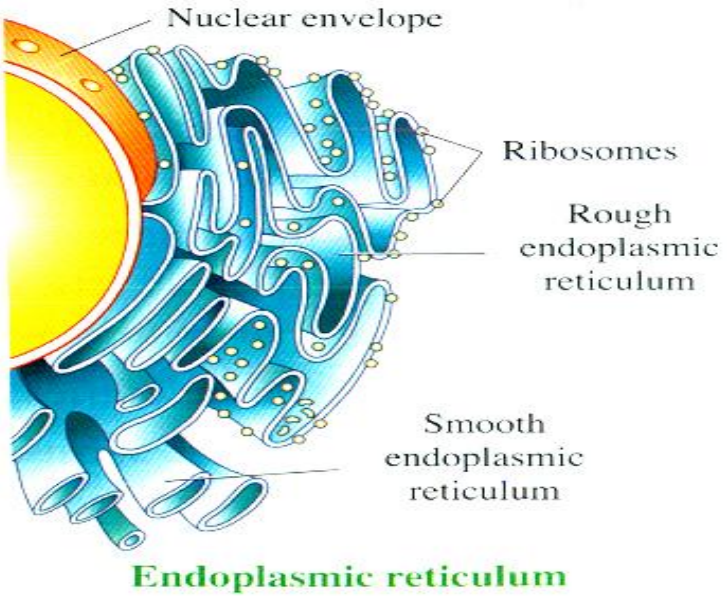
They are six organelles:

- Endoplasmic reticulum. - Golgi body - Lysosomes.
- Mitochondria. - Vacuoles. - Plastids

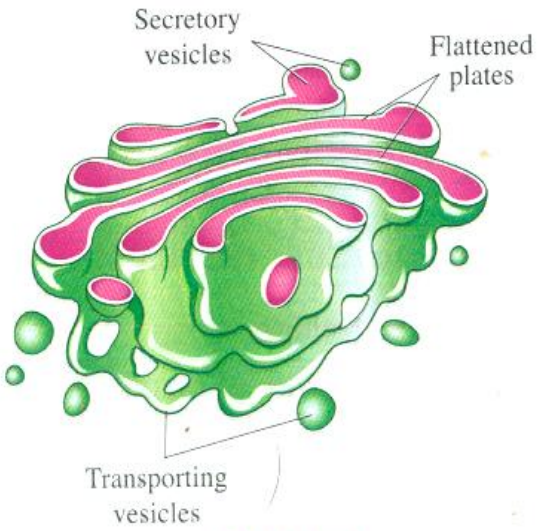
1- Endoplasmic reticulum

Description	It is a network of membranous canaliculi (انفاق صغيرة); it extends through all parts of cytoplasm.
Location	It extends through all the parts of the cytoplasm and attaches to the nuclear envelope and the cell membrane.
Function	1- It forms an internal transferring system that transfers substances from a part to another inside the cell. 2- It transfers substances between the cytoplasm and the nucleus.
Types	There are 2 types: 1- Rough endoplasmic reticulum 2- Smooth endoplasmic reticulum

	Rough endoplasmic reticulum	**Smooth endoplasmic reticulum**
Ribosomes	Large number of ribosomes present on its outer surface.	Absent from its outer surface
Function	1- Synthesis of proteins. 2- Making changes in proteins produced by ribosomes. 3- Making new membranes in the cell.	1- Synthesis of lipids. 2- Transform glucose into glycogen. 3- Modifying the nature of some toxic chemicals to reduce their toxicity.
Presence	It increases in the cells lining the stomach (المعدة) and endocrine glands (الغدد الصماء) **(GR.)** as these cells are responsible for secretion of enzymes and hormones.	It increases in hepatic (liver) cells **(GR.)**, **because** the liver cells converte glucose into glycogen that stored in liver and also some toxic compounds are converted into less toxic ones in liver.



Endoplasmic reticulum

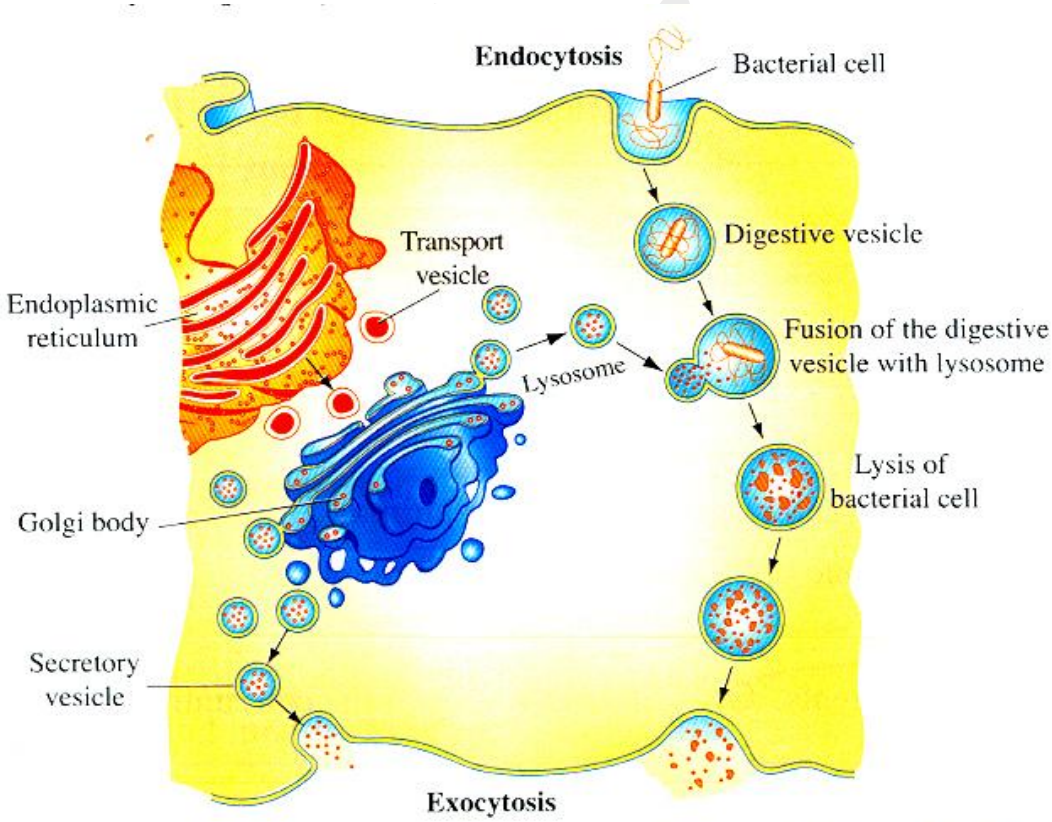


Golgi body

2- Golgi body (Golgi apparatus)	
Description	- It is a number of flat membranous round-ended sacs.
Discovery	- They are described for the first time by the Italian scientist Camilo Golgi in 1898. - It is known as **Golgi complex.** - In plants and algae as **dictyosomes**.
Number	- Its number in the cell differs acccording to the cell`s secretion activity where **it increases in the glandular cells**.
Function	- It receives the molecules secreted by endoplasmic reticulum through a group of **transporting vesicles.** - It classifies and modifies these molecules. - It distributes these molecules to the places where they are used inside the cell, or it may pack them inside **secreting vesicles** (**lysosomes**) which move toward the cell membrane where the cell expels them to outside as **secretory products.**
Location	They are found in all types of cells (animals and plants).

3- Lysosomes

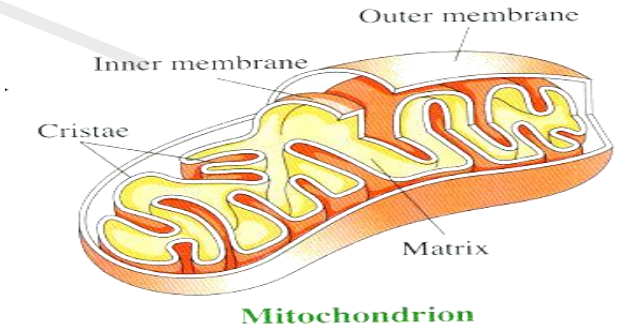
Description	- They are small, rounded and membranous vesicles. - Formed by Golgi bodies and contain a group of digestive enzymes, called lysosomal enzymes. **Note**: The cell is not affected by the lysosomal enzymes **(GR.)** because they are surrounded by a membrane that isolates them from the cell components.
Function	1-**Getting ride** of worn out (التالفة) and senile (المُسِنة) cells and organelles which have no longer benefits to the cells. 2-**Digestion** of large molecules of nutrients engulfed (تم ابتلاعها) by the cell and changing them into simplest substances that the cell can make benefit (تستفيد) from them. **Example**: White blood cells (corpuscles) use the enzymes of lysosomes to digest and destroy the pathogens (microbes) which invade the cell.



Role of lysosomes in digesting and lysing the pathogens inside a white blood cell

4- Mitochondria

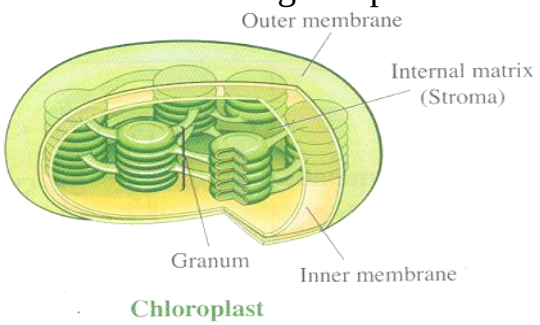
Description	They are sac-like membranous organelles.
Structure	Its matrix is surrounded by a double membrane (outer and inner).
	Cristae: They are a group of folds that extend from the inner membrane into the matrix.
	The function of the matrix:
	They increase the inner surface area on which the chemical reactions that produce energy take place.
Number	Their number increases in muscular cells **(GR.)** to increase the production of energy needed by the muscles.
Function	They represent the centres of energy production in the cell (the energy storehouse in the cell) **(GR.)**, because:
	- They are considered the main storehouse for the respiratory enzymes in the cell.
	- They are the storehouse for ATP compounds necessary to store energy resulting from oxidation of nutrients (المغذيات), especially glucose, and the cell can extract this energy from ATP molecules once more.



Mitochondrion

5- Vacuoles

Description	- They are Membranous sacs (similar to bubbles filled with a fluid).
Location	- **In animal cells**: They are small in size and large in number.
	- **In plant cells**: There is only one big vacuole or more.
Function	- Storing of water and nutrients, OR storing wastes of the cell until it gets rid of such wastse.

6- Plastids		
Description **Location** **Types**	They are various shaped membranous organelles. They are present in plant cells only and There are three types of plastids, differ from each others depending on **the type of pigment that presents in each of them.**	
Leucoplasts (white or colourless plastids)	**Chromoplasts (colored plastids)**	**Chloroplasts (green plastids)**
- Do not contain any pigment.	- Carotenoid pigments (their colour varies between red, yellow and orange)	- Green chlorophyll pigment.
- They work as centers for storing starch.	- They give the plant or its parts contain them its characteristic own colour.	- Photosynthesis, where the chlorophyll transforms light energy into chemical energy and stores them in chemical bonds of glucose sugar.
- Roots of sweet potatoes. - Stems of potatoes. - Internal leaves of cabbage.	- Petals of flowers. - Fruits. - Roots of some plants such as repeseed (اللفت).	- Leaves and stems of green plants.  Chloroplast

Structure(of the chloroplast):-

It is composed of:

a- A **double envelope** (membrane) consists of outer and inner.

b- A matrix called **stroma**.

c- Compact layers of shaped-like structures called **thylakoids**; each group of them is called **granum**, grana are found inside the stroma.

CH: 3
Lesson: 1

Organization of living organisms

The body

- The body of the living organism is composed of a group of **systems** which ntegrate and organize together.

Example: Circulatory, skeletal, muscular, nervous, digestive, excretory, respiratory and reproductive systems.

The system

- It is composed of a group of **organs** work together.

Example: - The circulatory system which consists of the heart, the blood and the blood vessels.

The organ

- It is composed of a group of tissues work together to perform certain functions.

Example: - The heart which consists of 3 different tissues:

1- The cardiac muscular tissue.
2- The nervous tissue.
3- The connective tissue.

All of them collaborate (تتعاون) together to pump the blood from the heart to all the body parts.

The tissue

- It is composed of a group of **cells** specialized in their work.

Example: The cardiac muscular tissue of the heart is composed of cardiac muscular cells.

- There are two types of tissues :

1- Simple tissue:

It consists of **one type** of cells, which are symmetrical in their structure, shape and function.

2- Compound tissue:

It consists of **more than one type** of cells.

Tissues are varied depending on:

- The difference on the living organism.
- Their vital activities.
- The functions they perform.

The plant tissues

I- Simple tissues: Such as:

1- Parenchyma tissue. **2- Collenchyma tissue.** 3- **Sclerenchyma tissue**

II- Compound (complex) tissues: Such as conductive (vascular) tissues:

1- **Xylem tissue.** 2- **Phloem tissue.**

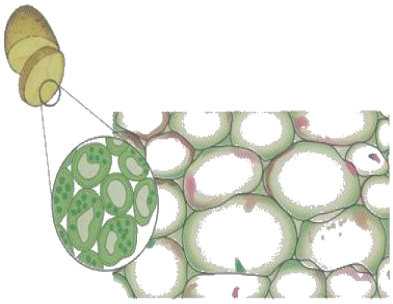
First: The simple tissues

Parenchyma tissue

- Living tissue.
- Its cells are, oval or rounded cells with thin and elastic walls.
- There are intercellular spaces for aeration.
- The cells contain chloroplasts, chromoplasts or leucoplasts.
- Contain one big vacuole or more, filled with water and salts.

Function:

- Do **photosynthesis**
- **Aeration**
- **Storing nutrients** e.g) starch



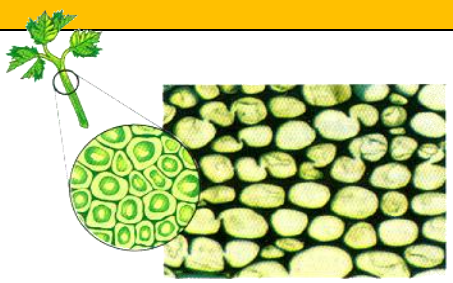
Parenchyma tissue
(As in potato tuber)

Chollenchyma tissue

- Living tissue.
- Its cells are somewhat rectangular shaped.
- Their walls are irregularly thickened with **cellulose**.

Function:

- Supporting the plant by acquiring it a **suitable elasticity**.



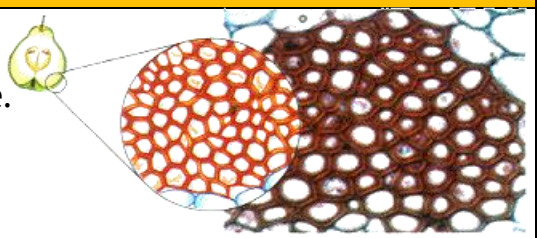
Collenchyma tissue
(As in parsley stem)

Sclerenchyma tissue

- **Non-living tissue**.
- The walls of its cells are thickened by **lignin** substance.

Function:

- Strengthening and supporting the plant.
- Acquiring it the **hardness** and **elasticity**.



Sclerenchyma tissue
(As in pear fruit)

Second: The complex tissues

Such as conductive or vascular tissues:

- **They are two types**: Xylem tissue and Phloem tissue.
- **Their function is**: transportation.

Xylem tissue

It is composed of xylem vessels, trachieds and parenchyma cells.

The vessels:

- They are hollow tubes, each of them is made up of a vertical raw of cells, where:

- Protoplasm and transverse walls were disappeared.
- Lignin substance was deposited on their walls from the inside and the cells are converted into long wide vessels.
- The length of the vessels ranges from few centimeters to several meters as in high trees.

The trachieds:

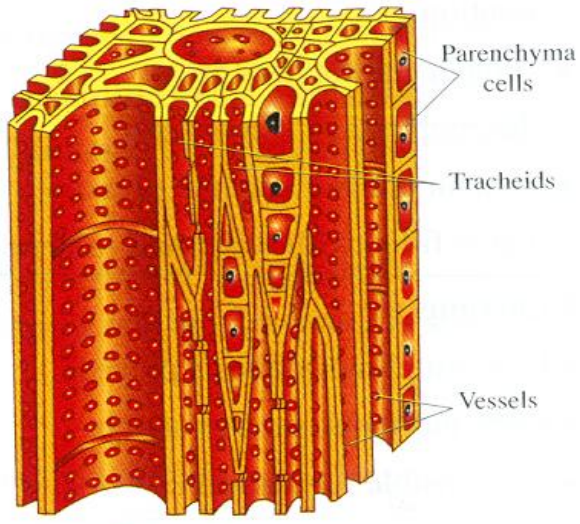
- Each one of them is composed of one cell where:

The protoplasm disappeared from it and its walls get lignified.

Function of xylem:

1- Transporting water and salts from the root to the stem and leaves.

2- Supporting the plant.



Xylem tissue

Phloem tissue

It is composed of sieve tubes and companion cells.

The sieve tubes:

They originate from vertically compacted cells above each other.

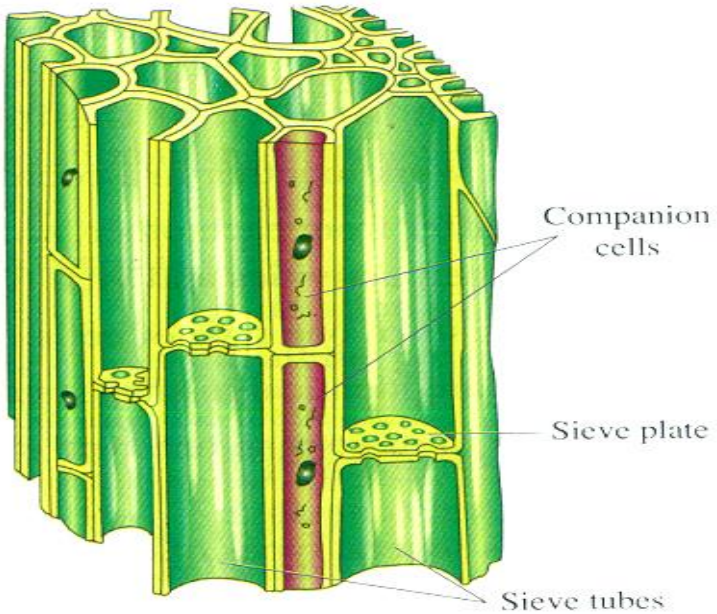
- their nuclei disappeared and their separating walls became perforated, so they are called sieve plates, **(GR.)** to allow the passage of of cytoplasm through them in the form of cytoplasmic strands.
- Cytoplasmic strands passe through the pores between sieve tubes.

The companion cells:

- They are living cells located adjacent to the sieve tubes **(GR.)** to provide them with energy they require to perform their function.

Function of the phloem:

Transporting the nutrients produced in photosynthesis, from the leaves to the other plant parts.

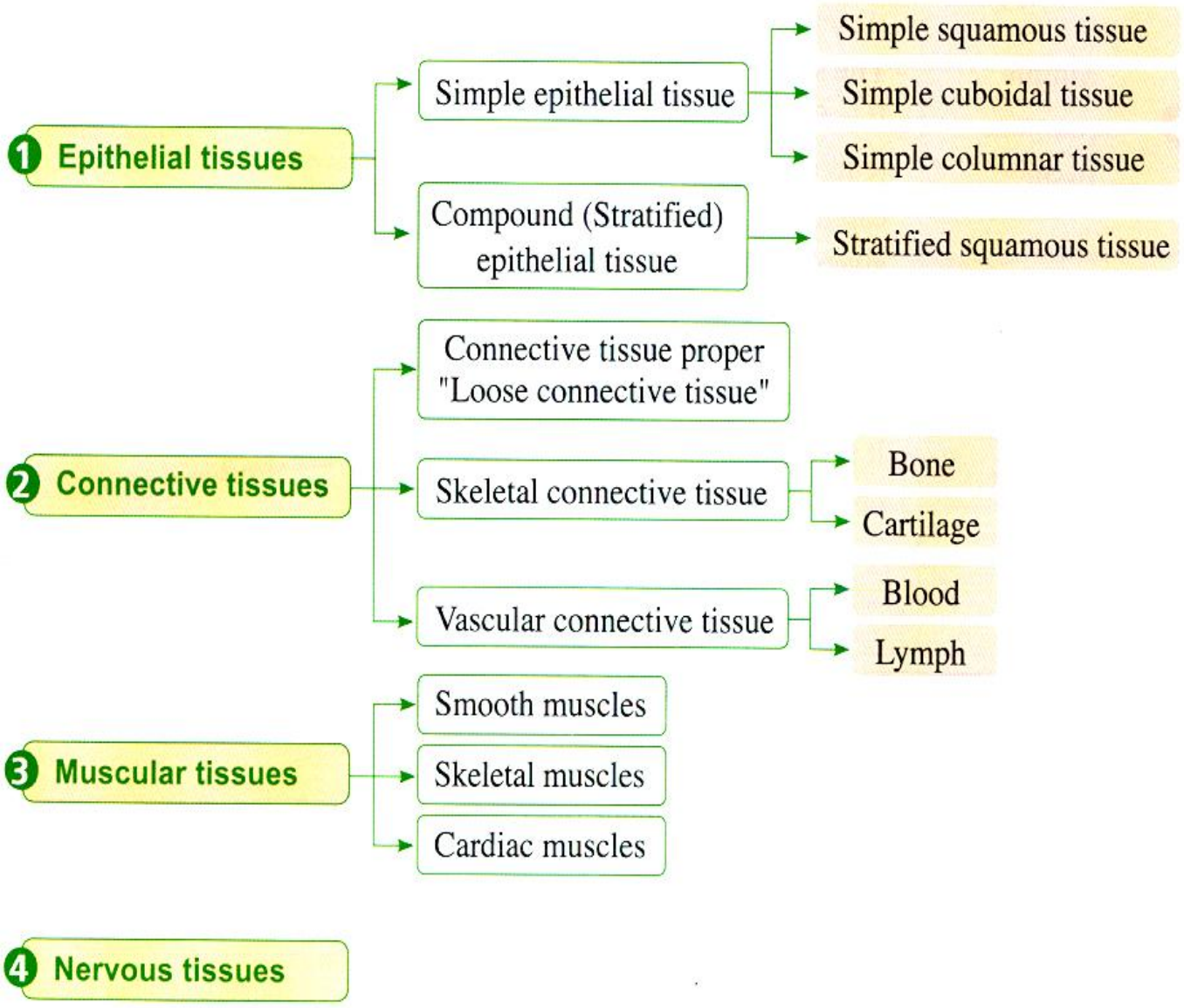


Phloem tissue

CH: 3
Lesson: 2

Differantiation of cells and diversity of animal tissues

Animals tissues can be differentiated into 4 basic types, each of them matches with the function it perform, as the following:



1- Epithelial tissues

Location: They cover the outer surface of the body and line the body internal cavities.

Structure: They are composed of a great number of closely adjacent cells connected by little interstitial (intercellular) substance.

Functions: They perform different functions, depending on their site in the body, such as:

1- **Absorbing water and digested food**, as the lining of digestive canal.

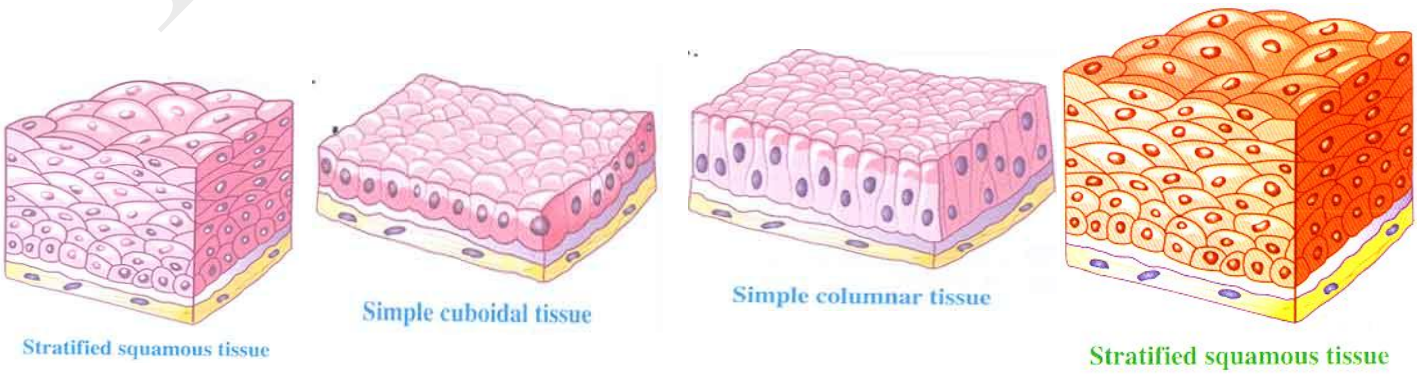
2- **Protecting the cells which they cover** from drought and pathogens (as microbes), as in the skin epidermis.

3- **Secreting the mucus** that makes the cavities they line smooth and moist, as in the digestive canal and trachea.

Types: There are two main types according to their shape and structure:

1- Simple epithelial tissues. 2- Compound epithelial tissues.

Simple epithelial tissues	Compound epithelial tissues.
Its cells are organized in one layer, such as: Simple squamous tissue - Its cells are flattened. **Examples**: the lining wall of the blood capillaries and the wall of alveoli in lungs. **Simple cuboid tissue** - Its cells are cuboid. **Example**: the lining of the kidney tubules. **Simple columnar tissue** - Its cells are columnar. **Example**: the lining of the stomach and intestine.	Its cells are organized in several layers. Its cells are organized in several layers. **Example**: **The stratified squamous tissue** which consists of several layers of compact cells above each others, its surface layer is squamous, as the tissue of skin epidermis.\



2- Connective tissues

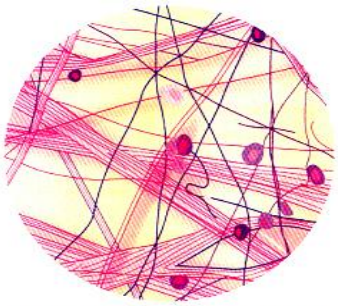
Description:

- They are made up of somewhat distant cells that immersed in an intercellular substance, that may be fluid, semi-solid or solid.

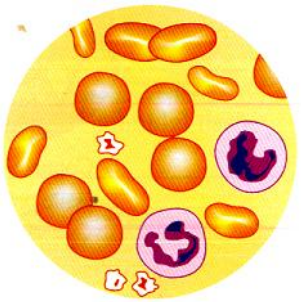
Types:

There are 3 types according to the kind of the intercellular substances.

Connective tissue proper	Skeletal connective tissue	Vascular connective tissue
- It gathers between being fairly solid and quite elastic. Function:-Connecting the different body tissues and systems with each other, so it is widely spread. Examples: The dermis of skin and the mesentries.	- Its intercellular substance is solid in which calcium deposits in case of bones. Function: Supporting the body. Examples: Bones and cartilage.	Its intercellular substance is fluid. Function: Transporting the digested food and the excretory substances. Examples: Blood and lymph.

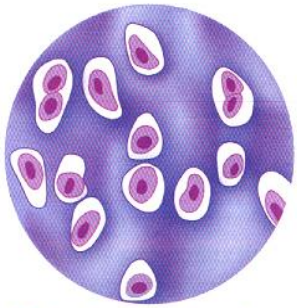


Connective tissue proper



Vascular connective tissue
(Blood)

Skeletal connective tissue
(Bone)



Skeletal connective tissue
(Cartilage)

3- **Muscular tissues**

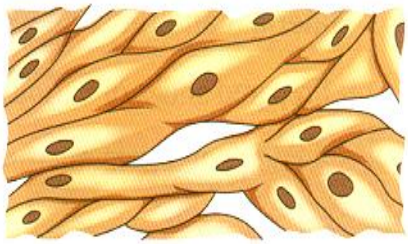
Description:

- They are made up of cells known as muscular cells or muscle fibers.
- The cells are characterized by their ability of contraction and relaxation, so this helps the organism to move.

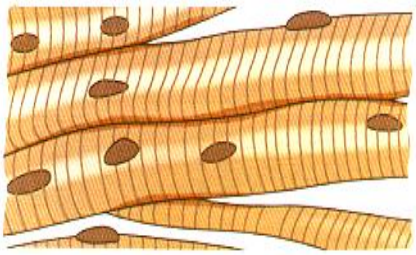
Types:

There are 3 types

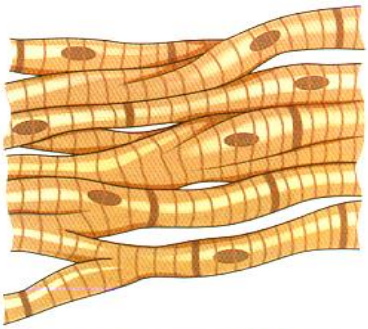
Smooth muscles	Skeletal muscles	Cardiac muscles
- Muscle fibers are unstriated and involuntary. Its presence: - Present in the wall of the digestive canal, urinary bladder and blood vessels.	- Muscle fibers are striated and voluntary. Its presence: - Usually connected with the skeleton, such as muscles of the arm, legs and trunk.	Muscle fibers are striated and involuntary, they contain intercalated discs that bind the muscle fibers together and make the heart beats in a rhythmic way as one functional unit. Its presence: - Present in the heart wall only.



Smooth muscle fibers



Skeletal muscle fibers



Cardiac muscle fibers

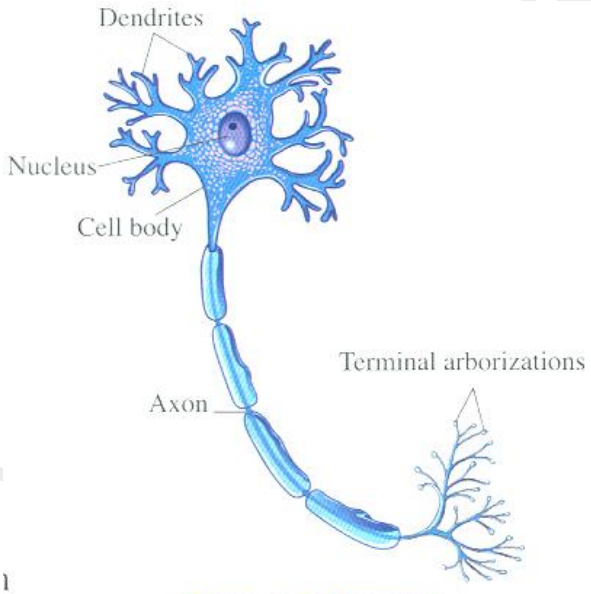
4- Muscular tissues

Description:

- They are made up of cells known as nerve cells or neurons.
- Neurons: are the building and functional units of the nervous system.

Function:

- Receiving the internal and external sensory stimuli and conduct them to the brain and the spinal cord, then transmitting the motor impulses to the effector organs (muscles or glands). Therefore nervous tissues are responsible for organizing different activities of the body.



Nerve cell (Neuron)