

Ministry of Higher Education and Scientific Research

Al-Mustaqbal University

Intelligent of Medical Systems Department

Subject : Biology- Class 1<sup>st</sup> Lecture

1,2 and3

Lecture 1

The word biology is derived from the Greek word /bios/means /life/and /logos/ means /study/and is defined as the sciences of life and living organisms. An organism is a living entity consisting of one cell e.g.bacrteria,or several cells e.g. animal. Plant and fungi.

Diversity and living things

Diversity means being different from each other's in term of a number of factors like physical ,culture, language,etc.

Diversity in the living world means that diverse forms of living organisms are found in different habitats ( habitat is a place where an organism makes its home ) like oceans , forest ,deserts , hot water springs , etc.

There is a large diversity in the living world because the living organism found in different habitats have different structural organizations or functions developed as per the conditions of their habitat. Warm and humid region have diverse organism known as megabiodiversity .

The term Biodiversity ( from biological diversity ) refers to the variety of life on Earth at all its levels. From genes to ecosystems , and can encompass the evolutionary,ecological ,and cultural processes that sustain life.

## Structural Organization of Animals

The structural organization in animals starts from the smallest fundamental unit—the cell. Animal cells are typical of the Eukaryotic cells, (Eukaryotic cells have a well – defined nucleus surrounded by a nuclear membrane.). Animal cell enclosed by plasma membrane and contain a membrane bound nucleus and organelles.

Functions of the Human Cell :

The functions of the human cell varies based on the type of cell and its location in the human body. All the organelles work together to keep the cell alive and allow it to carry out its specific function.

Sometimes these organelles are highly specialized and can vary in ( size, shape , and number ). The organelles are the most basic functional units but it cannot exist and operate without the cell as a whole. Its functions include intake of nutrients and other substances , processing of these compounds, producing of new substances, cell replication and energy production. In specialized cells that need to

be motile, like sperm cells, tail-like projections allow for cellular locomotion.

## Lecture 2

### Cell Theory:

#All living things are composed of one or more cells.

#Cells are the basic units of structure and function in an organism.

#Cells come only from the replication of existing cells.

### Cells Growth and Metabolism:

Growth means an increase in the size of the cell as a result of increasing the amount of protoplasm.

**METABOLISM** : is a chemical process of a living cell by which nutrient material is effected , and its two types:

**Catabolism** : this process involves the breakdown of the food material ( protoplasm of other cell),brought into the cell. Energy will be released by this process to be used by the cell in different activities .

Anabolism : in this process energy released by catabolism is utilized by the cell to produce materials that are retained or released from cell.

There are many different types , sizes, and shapes of cells in the body.

A cell consist of three parts:

The cell membrane

The nucleus

The cytoplasm ( between them )

Within the cytoplasm lie intricate arrangement of fine fibers and hundreds or even thousands of miniscule but distinct structures called organelles.

All the organelles are suspended within a gelatinous matrix, the cytoplasm, which is contained within the cell membrane. One of the few cells in the human body that lacks almost all organelles are the red blood cells.

The main organelles are as the follows:

## Nucleus:

Is the master control of the cell. It contains genes, collection of DNA, which determine every aspects if human anatomy and physiology. Within the nucleus is an area known as the **nucleolus**. It is not enclosed by a membrane but is just an accumulation of RNA and protein within the nucleus.

## Cell membrane

Is the outer coating of the cell and contains the cytoplasm, substances within it and the organelle . It is a double- layered membrane composed of proteins and lipids. The lipid molecules on the outer and inner part ( lipid bilayer ) allow it to selectively transport substances in and out of the cell.

## The cytoplasm

\*consists of all the cellular contents between the plasma membrane and the nucleus.

The cytoplasm compartment has Two components : # cytosol: means the fluid portion of

cytoplasm ( contains : WATER , DISSOLVED SOLUTES, and SUSPENDED PARTICLES ) ,surrounded by cytosol are several different types of organelles (little organs)

Each type of organelle has a characteristic shape and specific function:

The Endoplasmic reticulum : ( ER ):

Is a membranous structure that contains a network of tubules and vesicles . Its structure is such that substances can move through it and kept in isolation from the rest of the cell until the manufacturing processes conducted within are completed. There are two types of endoplasmic reticulum:

Rough ( granular) ,and Smooth (a granular )

Golgi Apparatus :

Is a stacked collection of flat vesicles. It is closely associated with the ER in that substances produced in the ER are transported as vesicles and fuses with Golgi Apparatus . In this way , the products from the ER are stored in the Golgi

apparatus and converted into different substances that are necessary for the cell's various functions.

## Lysosomes

Are vesicles that break off from the Golgi apparatus . It varies in size and function depending on the type of cell. Lysosomes contain enzymes that help with the digestion of nutrients in the cell and break down any cellular debris or invading microorganisms like bacteria. A structure that is similar to a lysosomes is the secretory vesicle, it contains enzymes that are not used within the cell but emptied outside of the cell, for example the secretory vesicles of the pancreatic lacunar cell release digestive enzymes which help with the digestion of nutrient in the gut.

Peroxisomes :



These organelles are very similar to the lysosomes and contain enzymes that act together in the form of hydrogen peroxide neutralize substances that may be toxic to the cell. Peroxisomes are formed directly from the endoplasmic reticulum rather than from the Golgi apparatus like lysosomes.

### Mitochondria

These are the powerhouses of the cell and break down nutrients to yield energy. Apart from producing its own energy, it also produces a high-energy compound called ATP (adenosine triphosphate) which can be used as a simple energy source elsewhere. Mitochondria are composed of two membranous layers- an outer membrane that surrounds the structure and inner membrane that provides the physical sites of energy production. The mitochondria also contain DNA which allows it to replicate where and when necessary.

### Mitochondria Structural Features

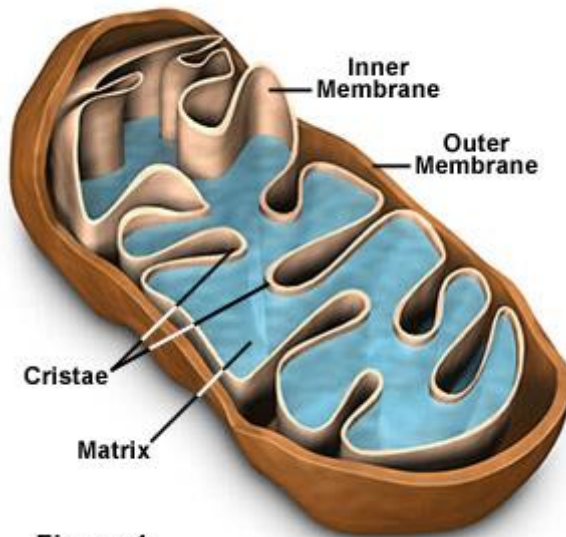


Figure 1

### Microfilaments and Microtubules :

Are rigid protein substances that form the internal skeleton of the cell known as the cytoskeleton . Some of these microtubules also make up the centrioles and mitotic spindles within the cell which are responsible for the division of the cytoplasm when the cell divides. The microtubules are the central components of cilia , small hair –like projections that protrude from the surface of certain cells. It is also the central component of specialized cilia like the tail of the sperm cells which beats in a manner to allow the cell to move in a fluid medium.

## **chemistry and Cells**

**About 99% of the mass of living cells is composed of the elements carbon, hydrogen, nitrogen, oxygen, phosphorus and sulphur. The remaining 1% includes small amounts of the elements calcium iron, zinc, sodium, potassium, chlorine, selenium and iodine, and very small amounts of molybdenum, manganese fluorine and chromium. Hydrogen and oxygen as water accounts for approximately 70% of the mass of a cell.**

**In addition to water the elements present are mainly built into four main chemical groups: carbohydrates, proteins, fats and nucleotides (nucleotides are important molecules used in the construction of RNA, DNA and energy transfer molecules such as ATP). These four main groups can form other biologically important chemical groups.**

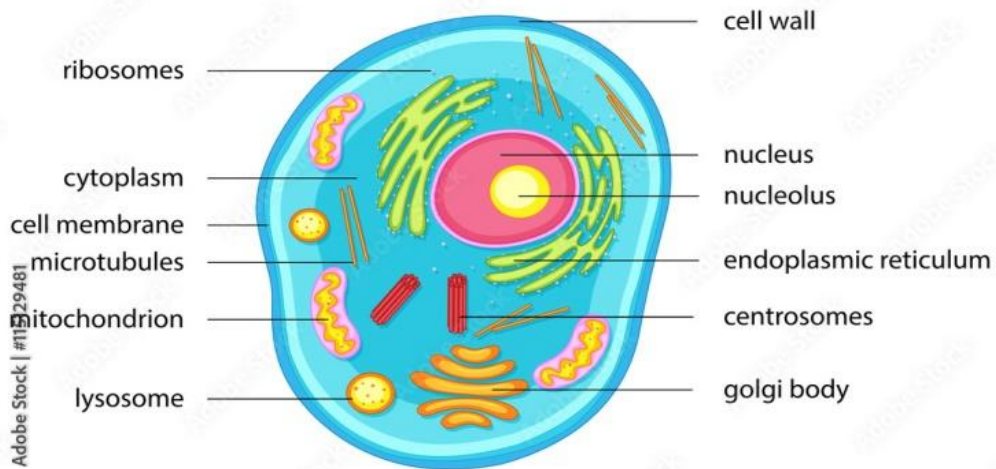
**Carbohydrates can link with proteins to form glycoproteins (*glyco* from Greek, *glykis*, meaning sweet). – Glycoproteins are found extensively in animals and plants where they help cells adhere to one another through a material called extra cellular matrix. In animals glycoproteins are closely associated with the very important collagen fibres.**

**Carbohydrates can link with fats or lipids to form glycolipids – glycolipids are closely associated with membranes of the brain and nerve cells**

**Fats or lipids can link with protein to form lipoprotein– these molecules are used in the construction of many biological membranes and in the transport of dietary fat.**

**Nucleotides can link with proteins to form nucleoproteins. – Viruses, a ribosome (a cell organelle) and chromatin are largely nucleoprotein. Chromatin is DNA linked to a protein called histone.**

# Anatomy of an Animal Cell



## Lecture 3

A group of cells that perform a similar function forms tissue. When tissues group together to perform specific functions, they form organs.

The cell is the smallest , structural and functional unit of an organism. The cell components are mainly involved in carrying out various life functions. To carry out these functions. Cell required specialized structures called cell organelles.

## TISSUES

Tissues are an integrated group of cells which perform similar functions and possess similar cellular structure .

These tissues provide a basic framework in multicellular animals.

There are four different types of tissues:

\_ Epithelial tissue

\_ Connective tissue

\_ Muscular tissue

\_ Nervous tissue

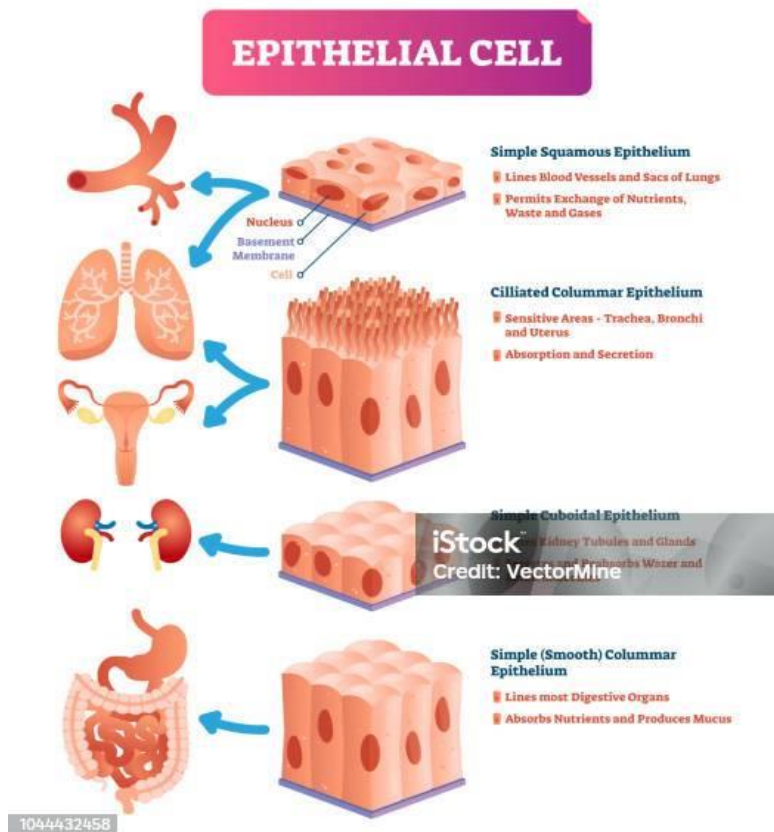
### **Epithelial Tissue :**

Characterized by the absence of blood vessels .  
Instead , it receives the required nutrition through diffusion. They form the outer covering as well as the inner lining of many organs . In epithelial tissues all cells are densely packed with little intercellular matrix between them. Epithelial tissue is classified into tow types :

Simple epithelium and Compound epithelium

Moreover , epithelial tissue can be classified based on its shape as well

Cuboidal Squamous columnar



## **Connective Tissue:**

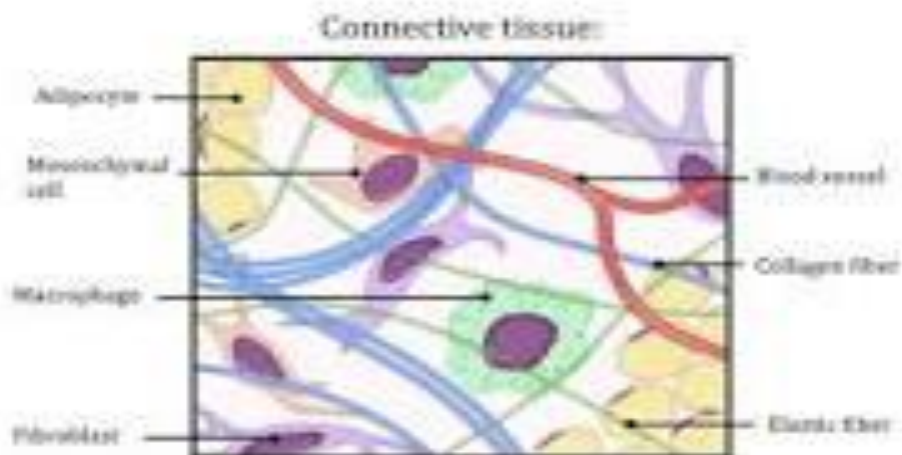
They are the most abundant and widely distributed tissues in animal. All connective tissues, apart from blood cells, secrete collagen or elastin ( fibrous proteins that provide structural support , flexibility ,and elasticity.) Connective tissues are called so because of their special function of killing and supporting other tissues in the body.

There are three different types of connective tissues:

Loose connective tissue

Dense connective tissue

Special connective tissue



## **Muscular Tissue**

These tissues are composed of long , tube-shaped fibers, which are structured in parallel arrays and are mainly composed of numerous fine fibrils, called Myofibrils.



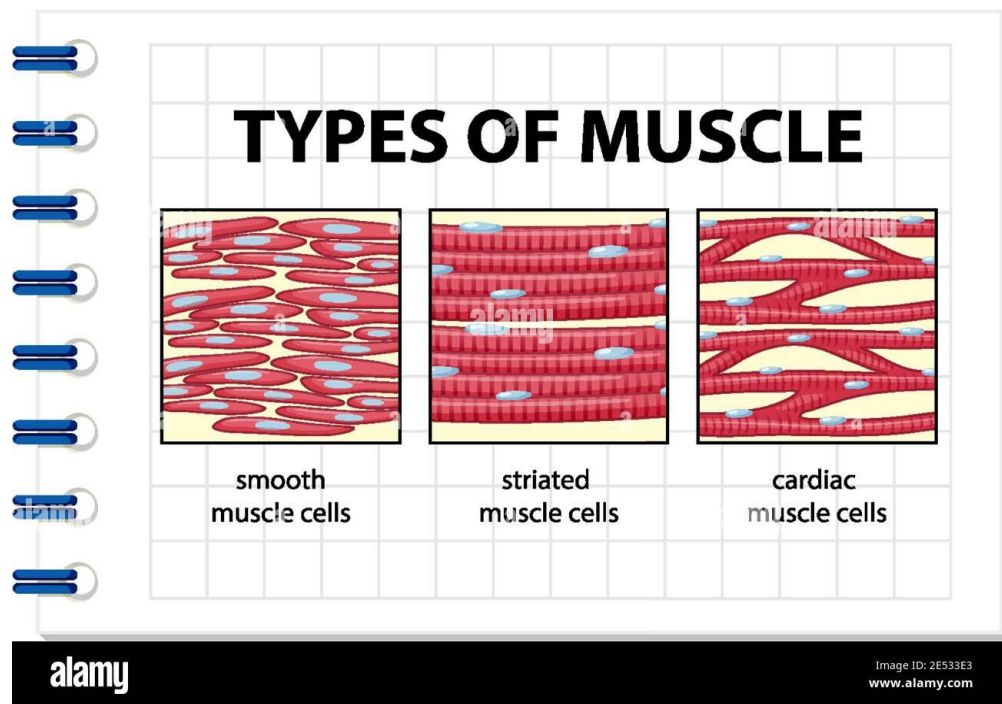
Muscular tissues play a vital role in contraction, relaxation and other body movement.

There are three different types of muscular tissues:

Skeletal muscles

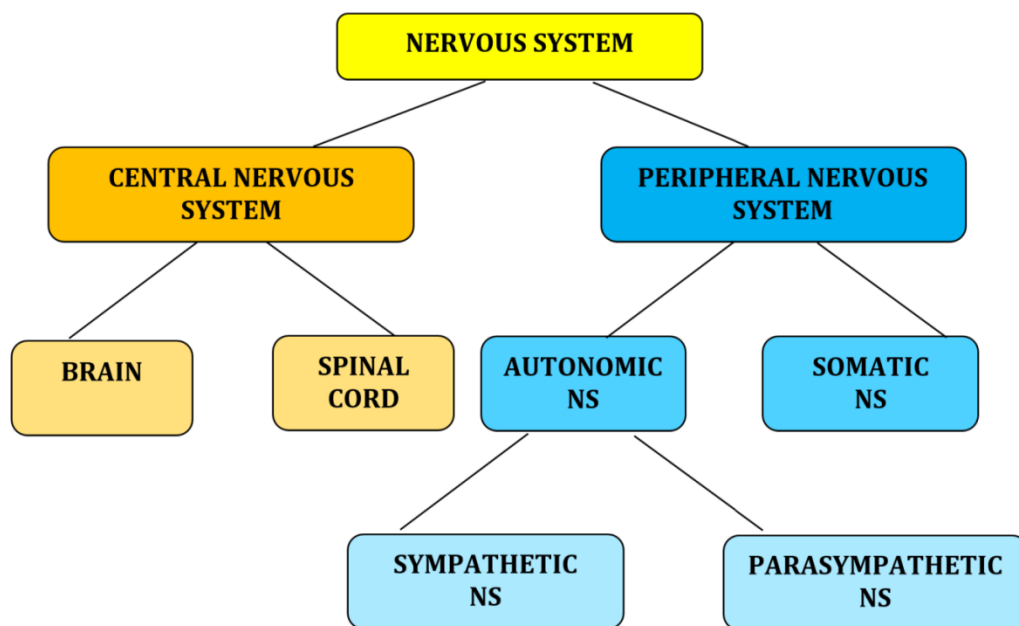
Smooth muscles

Cardiac muscles



**Nervous Tissue**

Nervous tissues consist of neurons and neuroglia cells, These neuron is an excitable cell and a main component of the neural system . The neuroglia forms the rest if the neural system, which makes up double the volume of neural tissue in the human body. Nervous tissues have the general control over the body’s responsiveness to changing conditions.



<b>Tissue</b>	<b>Origin</b>	<b>Function</b>
Epithelial	Ecto, Meso& Endoderm	Protection, absorption & secretion
Connective	Mesodermal	Connect, support& transport
Muscular	Mesodermal	Locomotion& movement
Nervous	Ectodermal	Control & coordination

## **Organ and Organ Systems**

A collection of tissues form an Organ; a group of organs that work together to perform one or more functions is called an Organ system.

Every organ is composed of one or more type of tissues. A group of organs working together to perform a common function is called an organ system. Excretory system, Reproductive system, Endocrine system, Circulatory system, Respiratory system are examples of organ system.

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