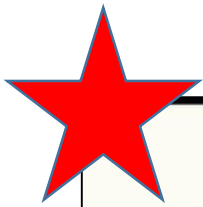




WELCOME NEW CLASS



Congratulations Match 2024 Mutah University



Mina Al-Sammarraie-2022
(Internal Medicine)
University of South
Dakota /SD



Malek Amro-2021
(Internal Medicine)
wellington regional Med
Ctr /FL



Mays Khweileh-2016
(Neurology)
Duke University
Hospital/NC



Mustafa Subhi-2020
(Neurology)
Houston Methodist/TX



Husam Shakour-2022
(Internal Medicine)
U Kansas SOM-
Wichita/KS



Mai Al Khatalin-2021
(Internal Medicine)
Saint Peter's University
Hospital/NJ



Basel Masarweh-2019
(Internal Medicine)
Portsmouth Regional
Hospita/NH



Mohammad Salameh-2022
(Internal Medicine)
Meharry Med College/TN



Dana Ahmad-2019
(Internal Medicine)
White County Med
Ctr/AR



Anas Al Mardini-2020
(Internal Medicine)
Marys and St Clares/NJ





CONGRATULATIONS MATCH 2023 MU'TAH UNIVERSITY



OMAR DARWISH
2020
UNIVERSITY OF ARKANSAS
MEDICAL SCHOOL (UAMS)/ IM



ZAID ALWARAWRAH
2019
GRIFFIN HOSPITAL/ IM



NMAIR ALZIADIN
2019
HCA /TUFTS UNIVERSITY/
PORTSMOUTH/ IM



MOHAMMAD KLOUB
2017
SAINT MICHAEL/ IM



BAKER ABU SA'ALEK
2021
KANSAS UNIVERSITY/
NEUROLOGY



ALI ALZEGHOUL
2020
MAGNOLIA REGIONAL
HEALTH CENTER/ IM



DAOUD ELDAWUD
2020
SUNY DOWNSTATE
UNIVERSITY/ IM



YAZAN ALAMRO
2020
COREWELL HEALTH
HOSPITAL/ IM



SARA ALZAGLOOL
2021
HACKENSACK
MERIDIAN/JERSEY
SHORE UNIVERSITY
MED CTR/ IM



FAIQ ALDARAB'AH
2019
NYC HEALTH +
HOSPITALS/ LINCOLN
MEDICAL CENTER/ IM



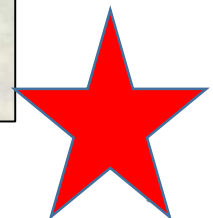
KHALED EL-QAWAQZEH
2021
WESTCHESTER MEDICAL
CENTER/ GENERAL
SURGERY



AMMAR ADAILEH
2020
HENNEPIN COUNTY
MEDICAL CENTER/ IM



TARIQ ALMANASEER
2019
HELEN DEVOS CHILDREN'S
HOSPITAL/ PEDI





Think positive

- **It is going to be hard, but hard does not mean impossible**
- **Don't stop when you're tired stop when you're done**



Introduction To Cell Biology



Cell Biology

- The study of normal cells structures & functions
(Cellular & Molecular levels)
- The cell is the smallest & the basic unit of a living body
(The cell can carry on all the process of life)
- The living body is made of different types of cells
- Cells varies in size from 4 to 200 microns.
- The living organisms are either unicellular or multicellular
- The cell can't be seen by naked eye but only by microscope

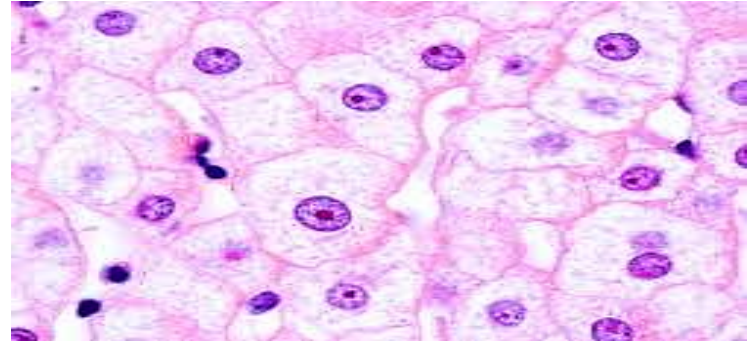


Histology (histo: tissue, ology : science):

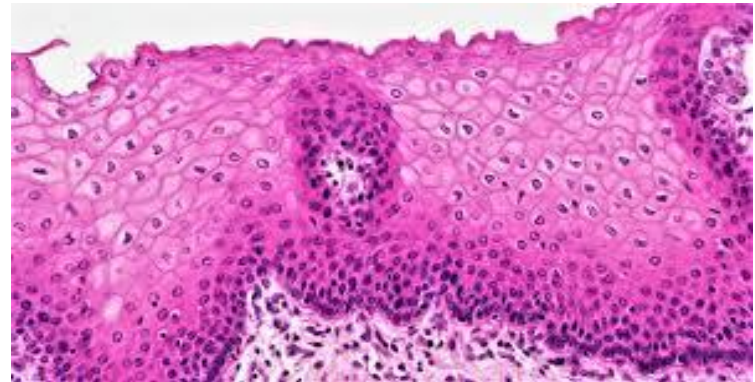
Microscopic study of tissues of the body and how these tissues form the organs



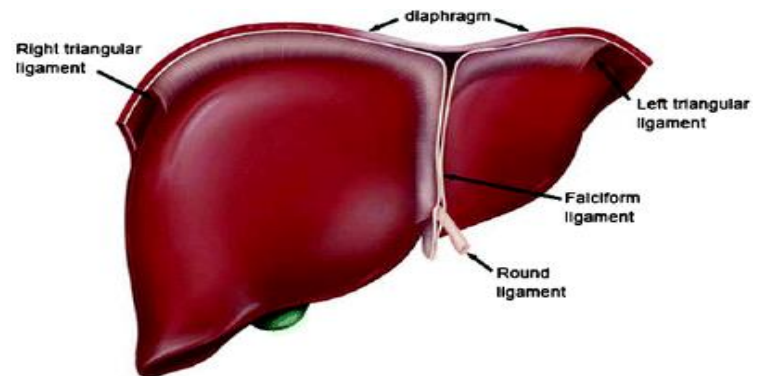
Cells

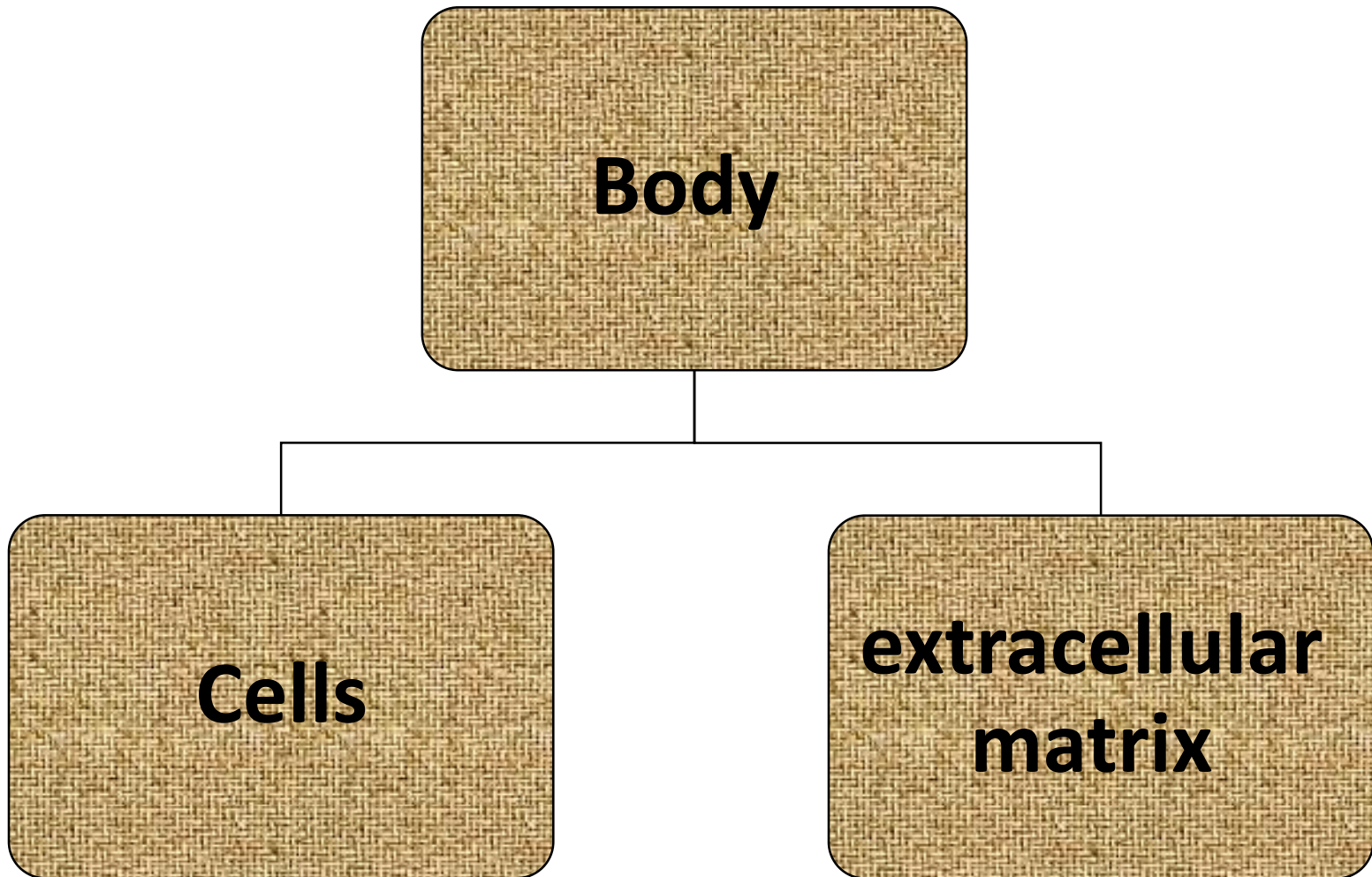


Tissue



Organ



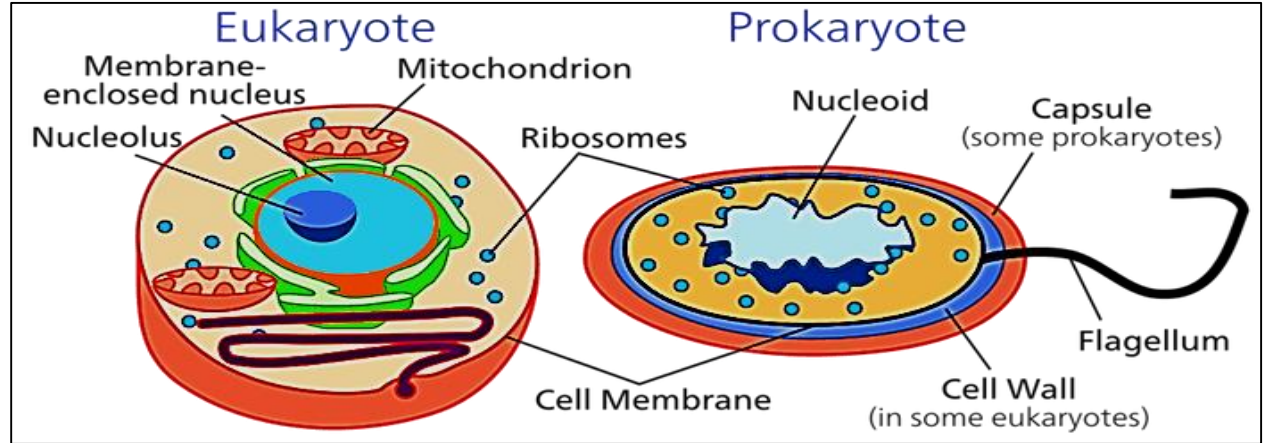


1- The cell

The cells are classified into :

1. Prokaryote

2. Eukaryote



Prokaryotic cell:

lacks the nucleus, the genetic material (Genophore) is located in the cytoplasm in area called Nucleoid & has No membrane bounded cell organelles

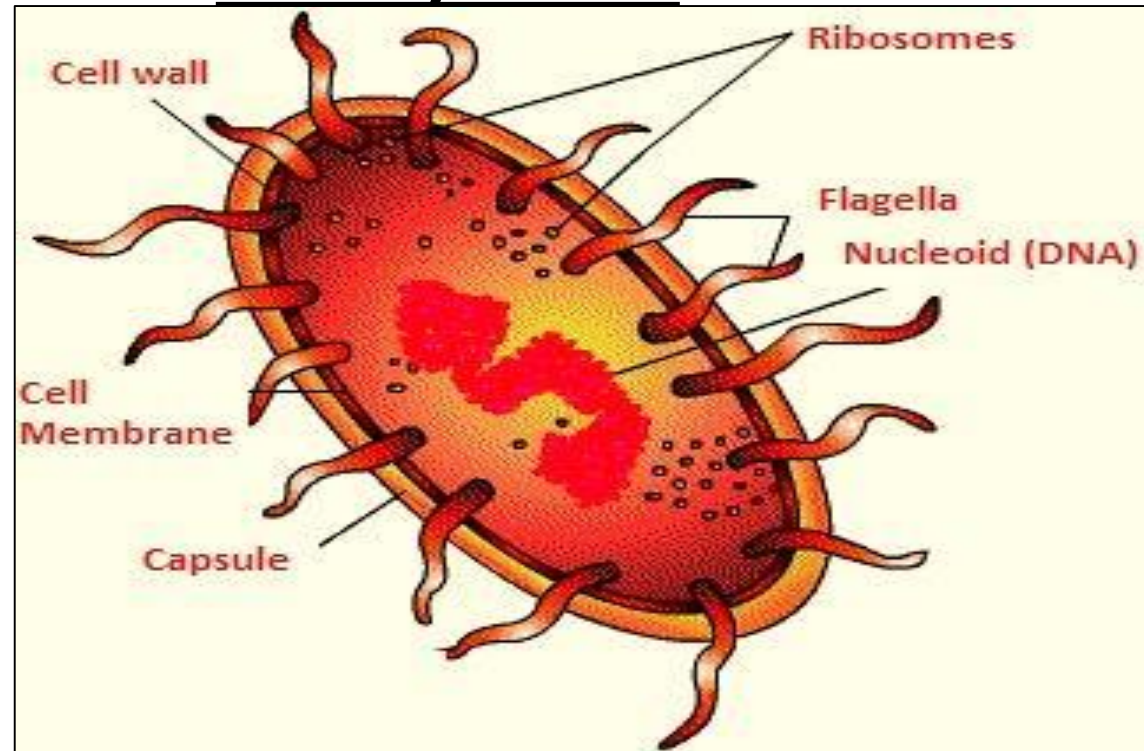
Eukaryotic cell

contains nucleus & membrane bounded organelles.

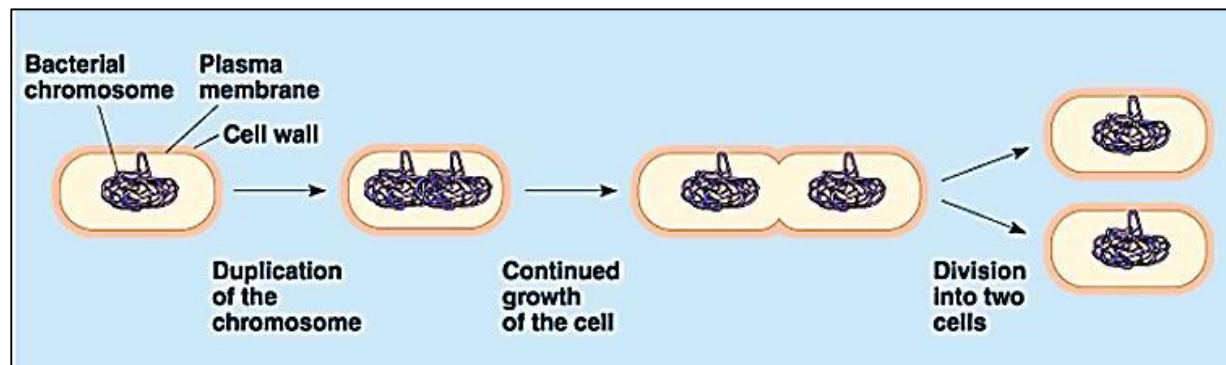
Both (Pro & Eu) share 4 key elements (cell membrane, cytoplasm, genetic material, ribosomes)

Prokaryote cell

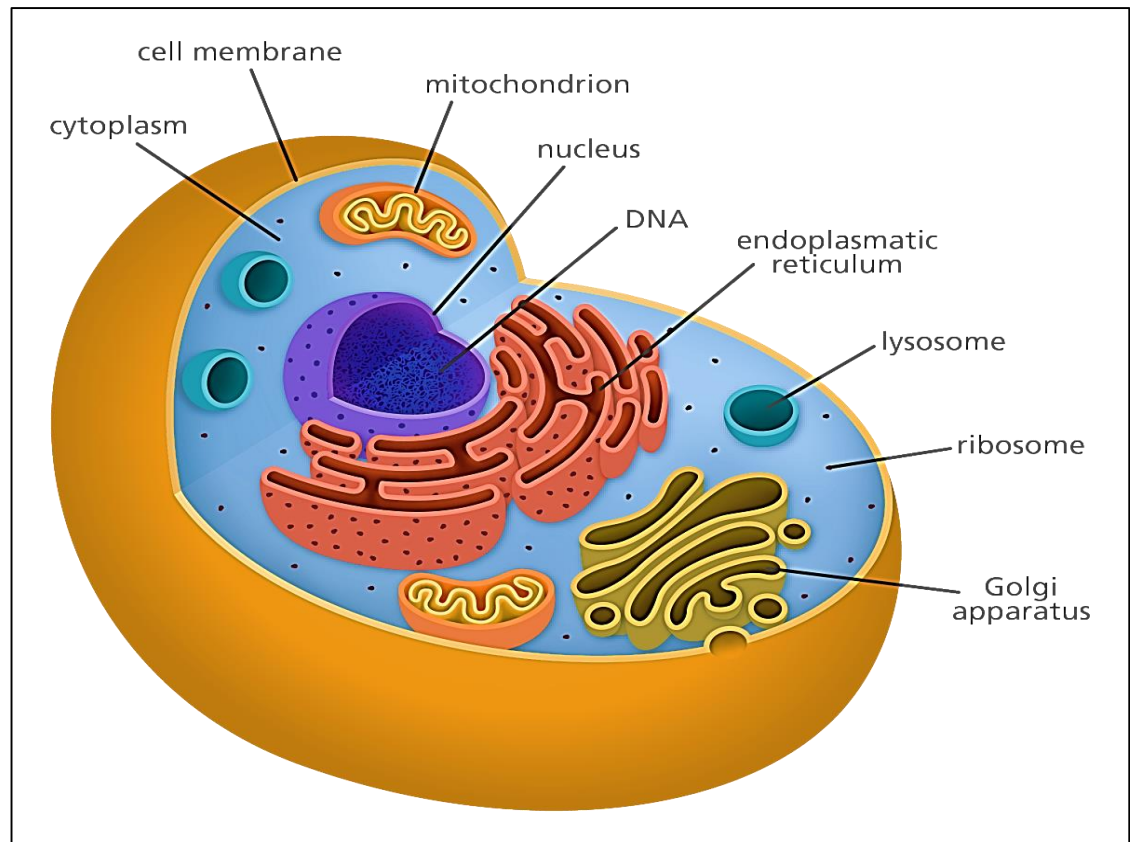
The DNA strand is circular and is called **gonophore** and found in area called nucleoid



Prokaryotes divide by process called **Binary fission**



Eukaryote cell



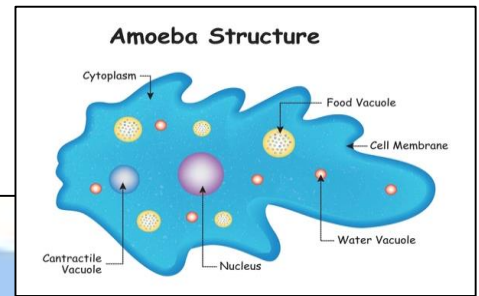
Equivalent lengths:

1 millimeter (mm) = 1000 micrometer (micron)

1 micrometer (um)= 1000 nanometer

1 nanometer(nm)= 10 angstrom

Prokaryote vs. Eukaryote



Prokaryotic

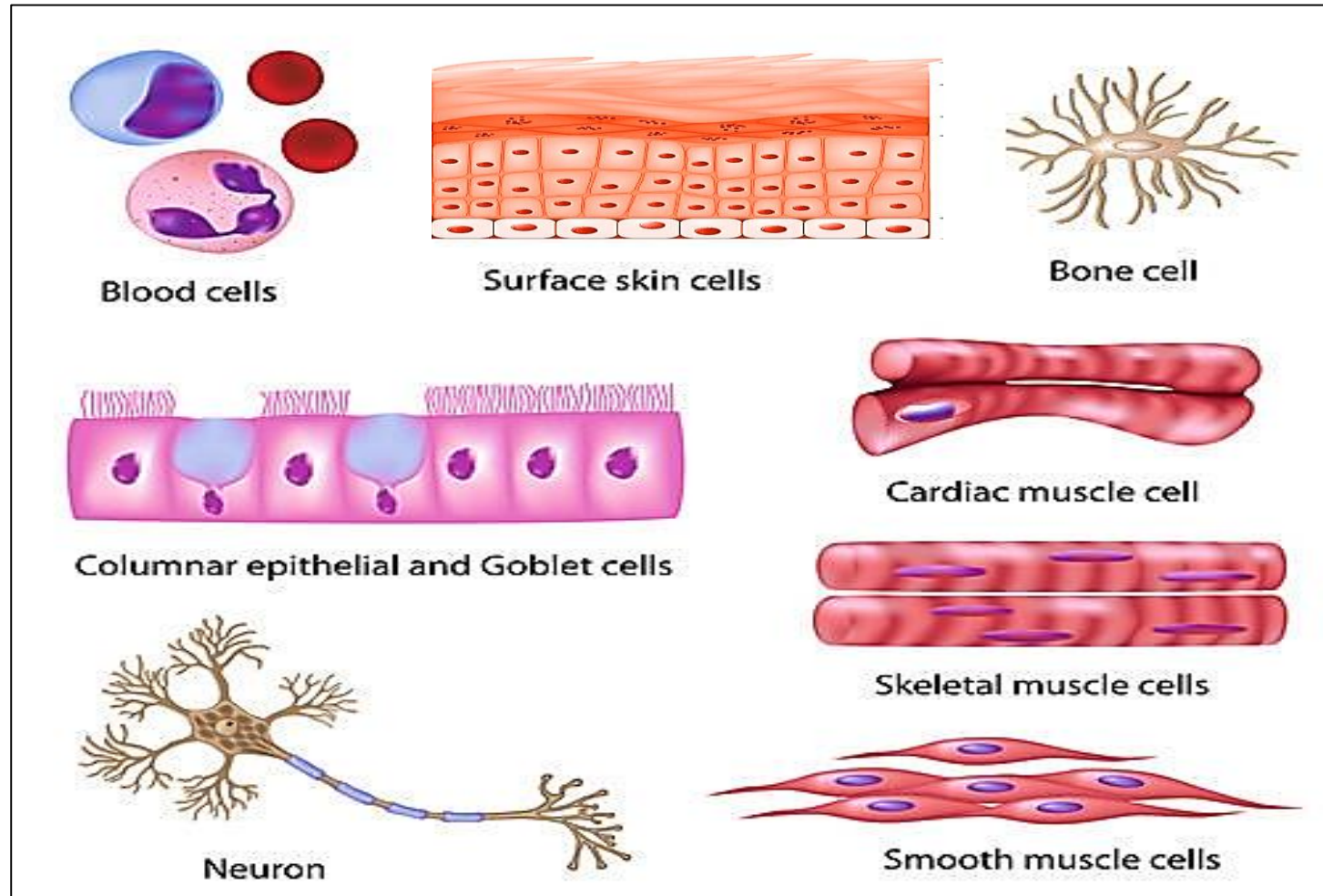
- no membrane bound organelles
- no true nucleus
- unicellular
- 0.1-5 micrometers
- has cell wall
- asexual reproduction

- Ribosomes
- Cell membrane
- Has DNA
- Cytoplasm

Eukaryotic

- contains membrane bound organelles
- contains true nucleus
- uni-, multicellular
- 10-100 micrometers
- asexual and sexual reproduction

There are around 200 cell types in the human body.
Cell types look different and carry out different functions



Different types of cells of the body

The 4 basic types of tissues that make the human body

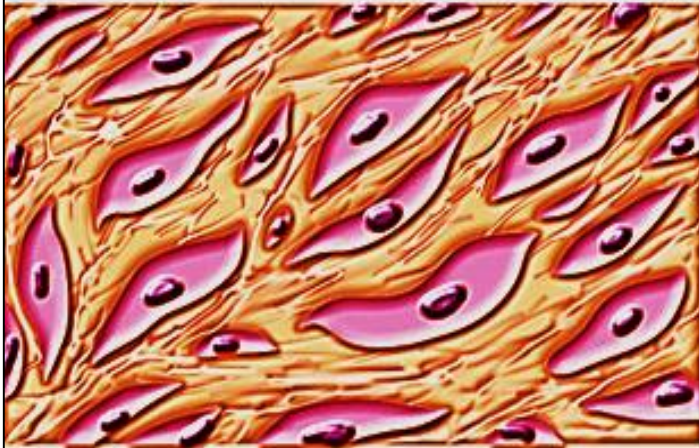
1- Epithelial tissue : refers to groups of cells that cover the exterior surfaces of the body, line internal cavities and passageways, and form certain glands

2- Connective tissue : binds the cells and organs of the body together

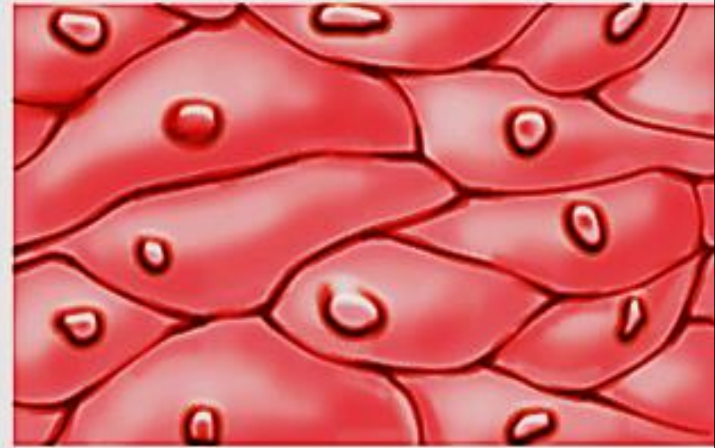
3- Muscular tissue: contracts forcefully when excited, providing movement

4- Nervous tissue: is also excitable, allowing for the generation and propagation of electrochemical signals in the form of **nerve impulses** that communicate between different regions of the body

Four types of tissue



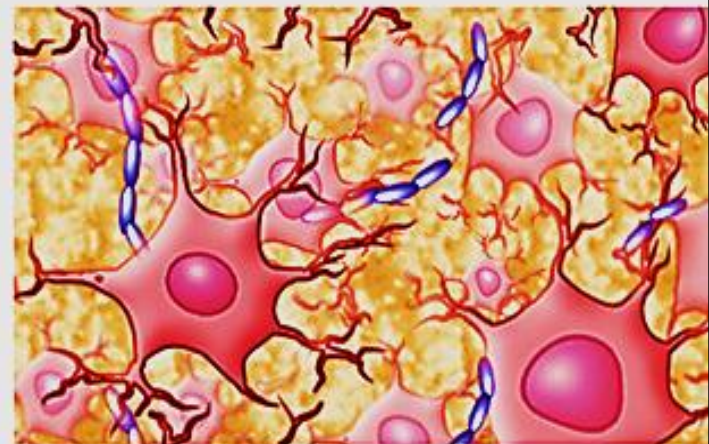
2- Connective tissue



1- Epithelial tissue



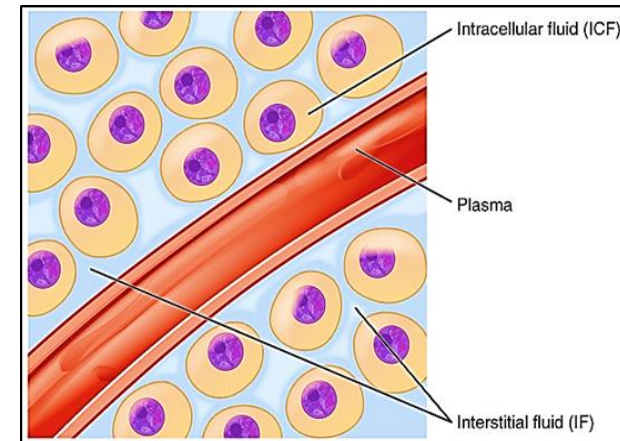
3- Muscle tissue



4 - Nervous tissue

2- Extracellular matrix (ECM)

- is the substance (non cellular) that fills the spaces between cells & it is secreted by the cells
- Composed of proteins and other molecules that surround, support, and give structure to cells and tissues in the body.
- The extracellular matrix helps cells attach to, and communicate with, nearby cells, and plays an important role in cell growth, cell movement, and other cell functions



Types of Extracellular matrix (ECM)

The ECM has two basic forms

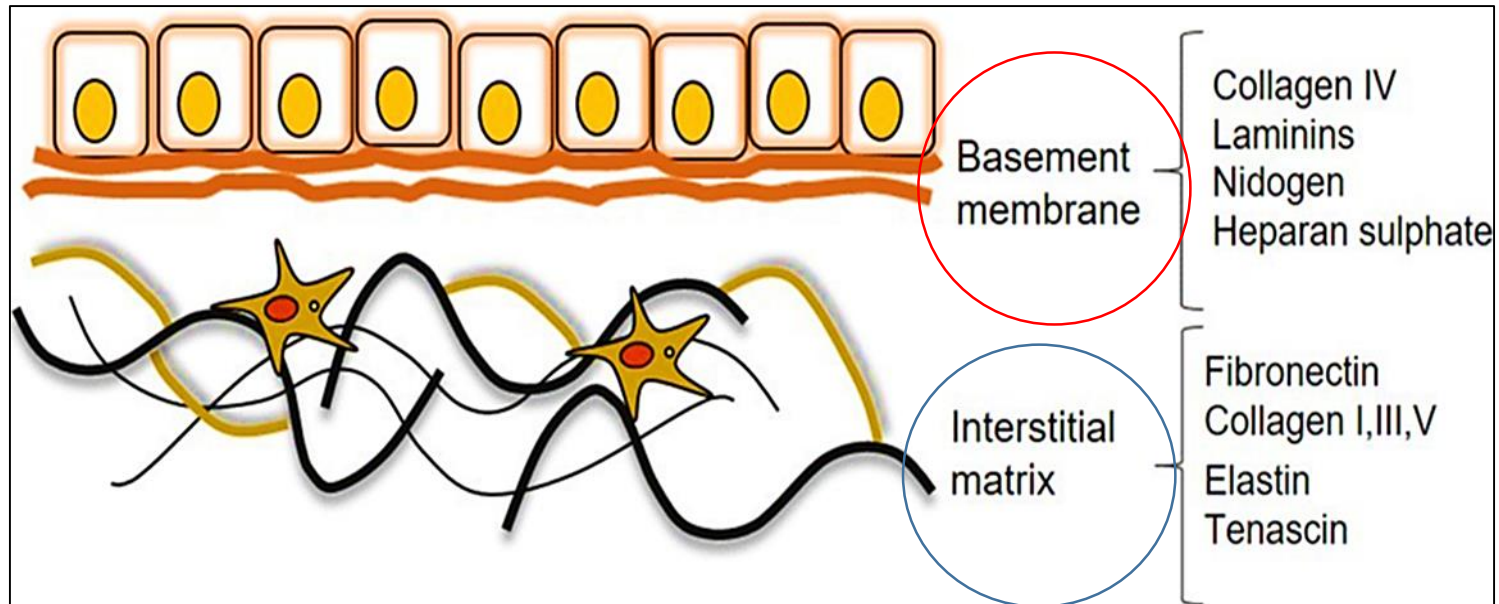
1-Basement Membrane

is sheet-like depositions of ECM
at the base of epithelial cells
surround muscle cells

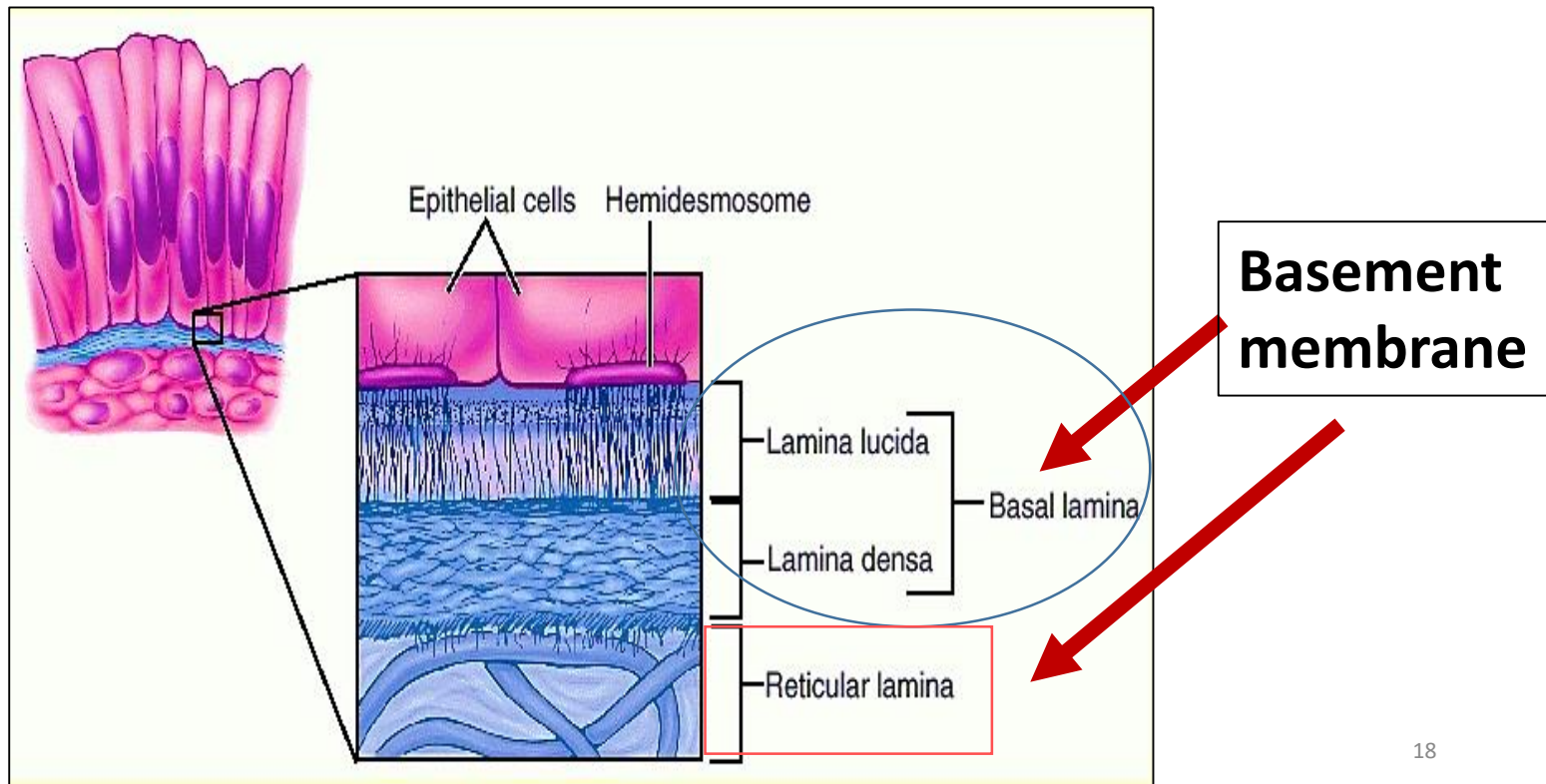
(only found under epithelial cells)

2-Interstitial fluid

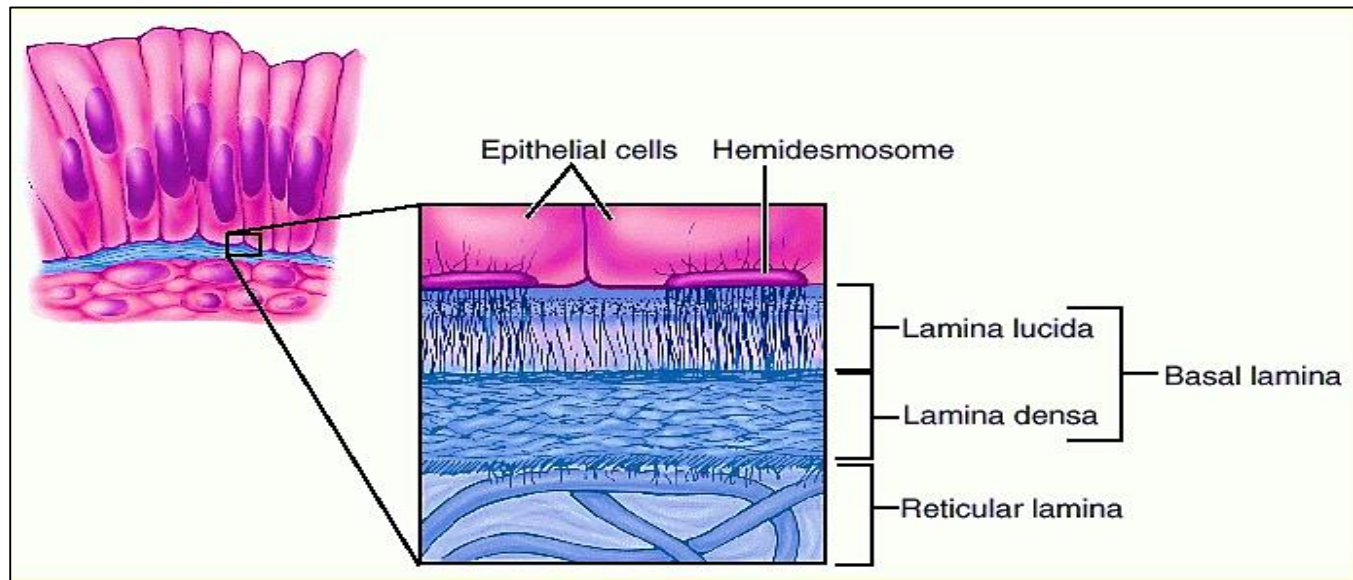
thin layer of fluid surrounds the cells : H₂O, proteins, electrolytes, acids, hormones , waste materials



- Most epithelial cells are separated from the connective tissue beneath it by a sheet of extracellular material called basement membrane
- The basement membrane is usually visible with light microscope
- Is formed by 2 layers basal lamina & reticular lamina

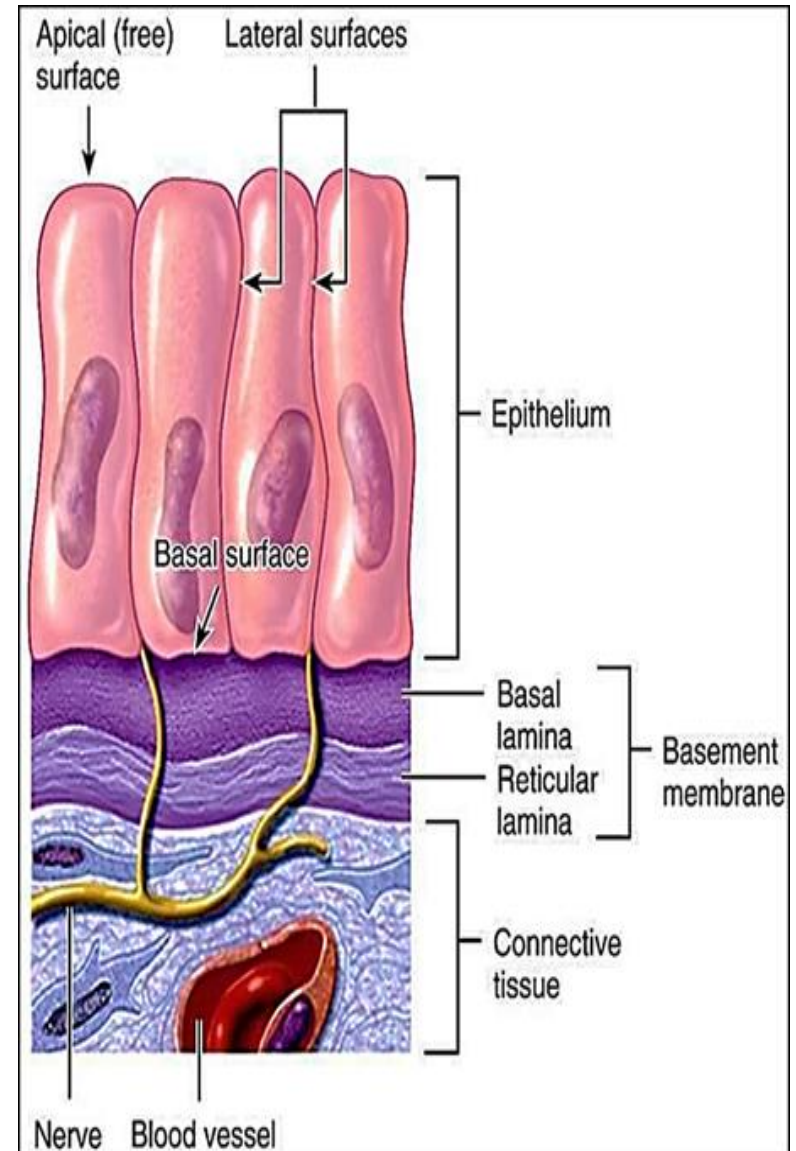


- The basal lamina itself is visible with EM about 20 -100 nm in thickness. secreted by epithelial cells
- Basal lamina consists of 2 layers lamina lucida & lamina densa



- **NB: in diabetes mellitus , the basement membrane of small blood vessels especially in retina & kidney became thick**

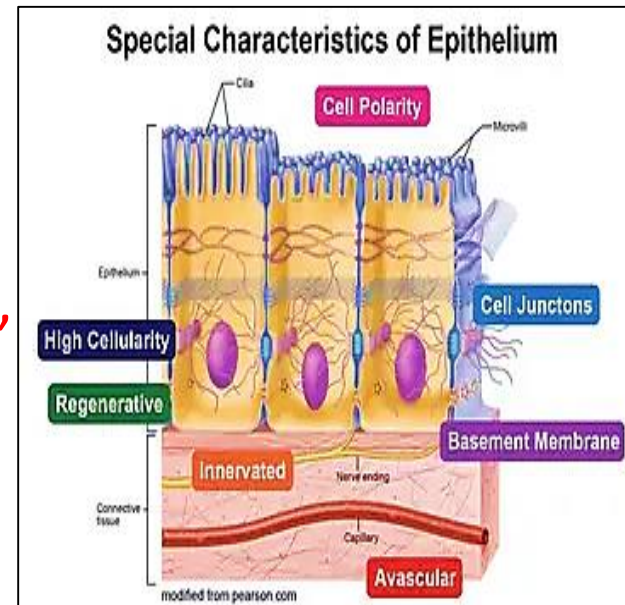
- The main components of basal lamina are: **type IV (4) collagen**
- **The reticular lamina** is formed by reticular fibers, usually thicker than basal lamina, secreted by connective tissue cells (fibroblasts)



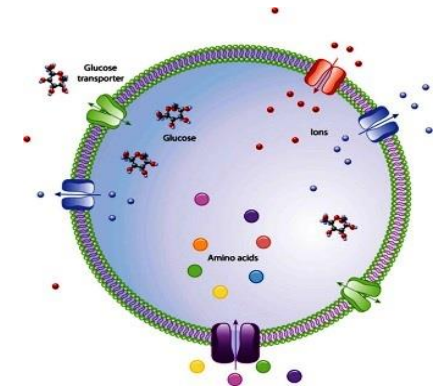
- Epithelia tissue compose of cells laid together in sheet & tightly connected to one another. Epithelial cells are avascular but innervated so it gets its nourishment from the underlying connective tissue

- Function of basement membrane :

- 1- Anchoring epithelial cells to underlying tissue,
- 2- pathway for cell migration,
- 3- wound healing,
- 4- barrier between epithelial cells & CT,
- 5- participate in filtration of blood in kidney,
- 6- early stages in cancer called carcinoma in situ (limited to epithelial layer)



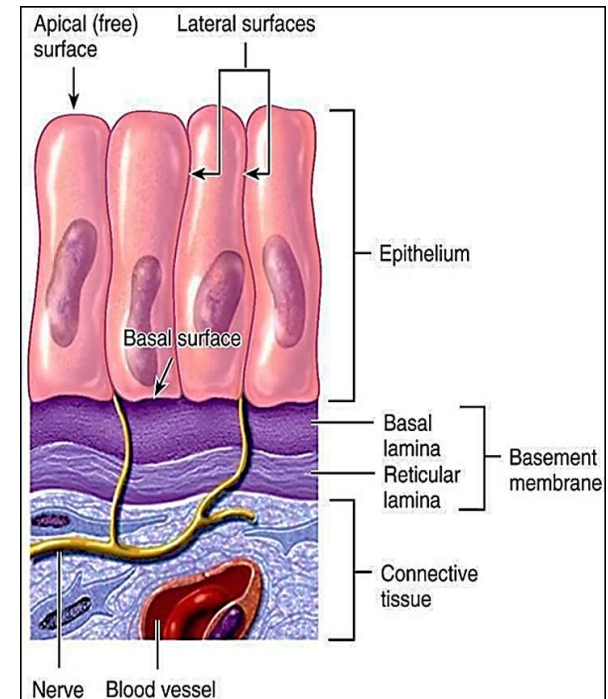
- **Plasma Membrane**: also called **cell membrane** surrounds the cell & separates the interior of the cell from the outside & provides protection for the cell



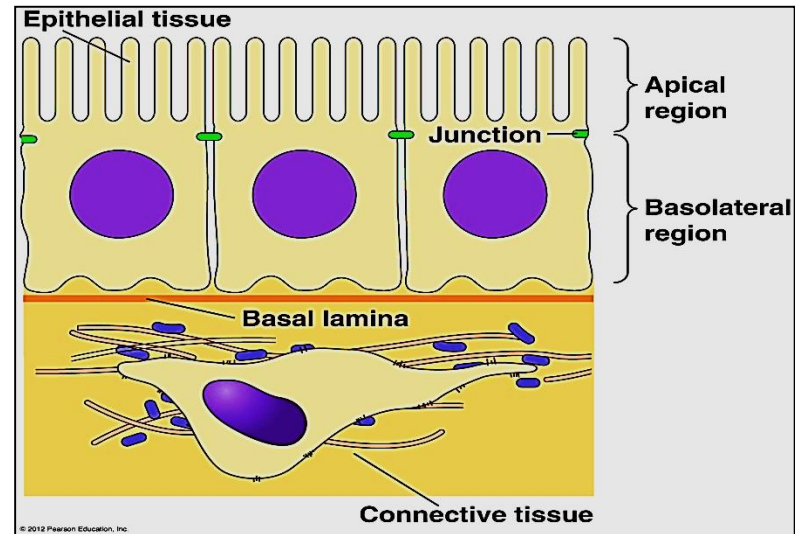
- **Basal Lamina**: thin sheet of ECM which are made by and located underneath the epithelial cells

- **Basement Membrane**: sheet-like form of extra cellular matrix underlie epithelial cells & surround muscle cells

- **Intracellular Matrix**: the substance that fill the inside of the cell = cytoplasm



- ECM amount varies according to tissue type (**minimal** in **epithelium** and **plenty** in **connective tissue**)



ECM consistency varies:

It may be **jelly like** e.g. connective tissue proper

It may be **rubbery** e.g. cartilage

It may be **hard** e.g. bone

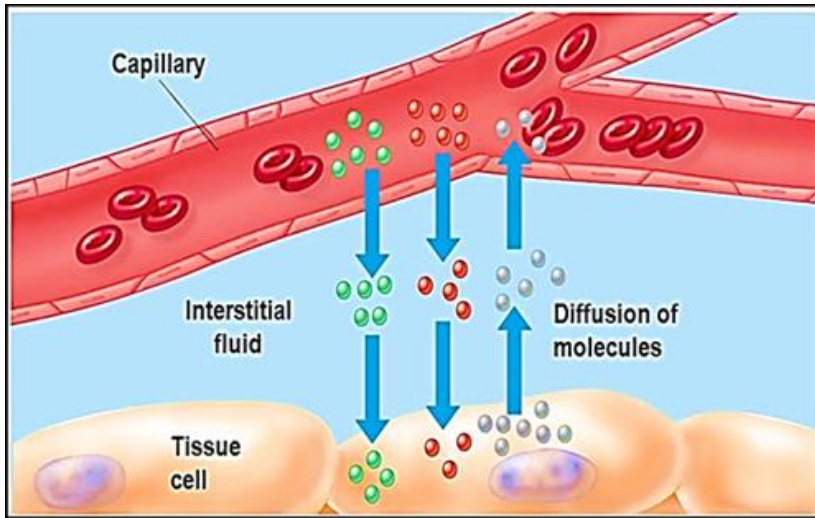
It may be **fluid** e.g. blood

Functions:

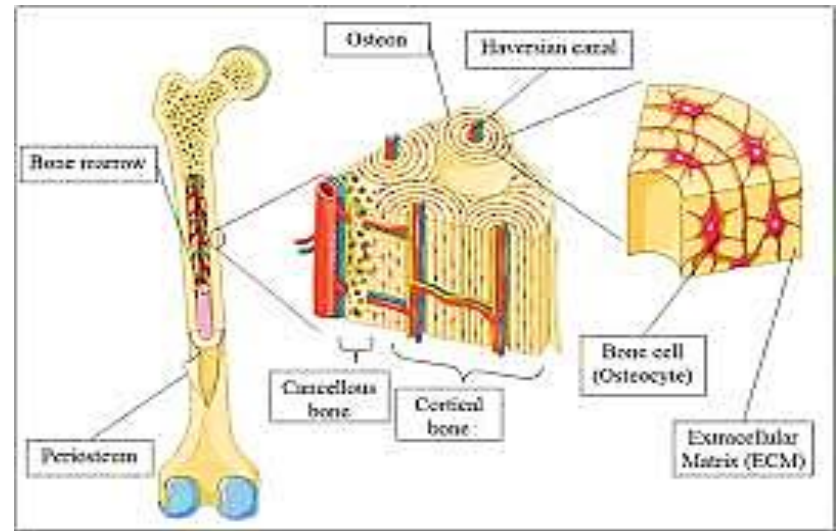
1-Support of cells

2-Supply of nutrition and oxygen, communication

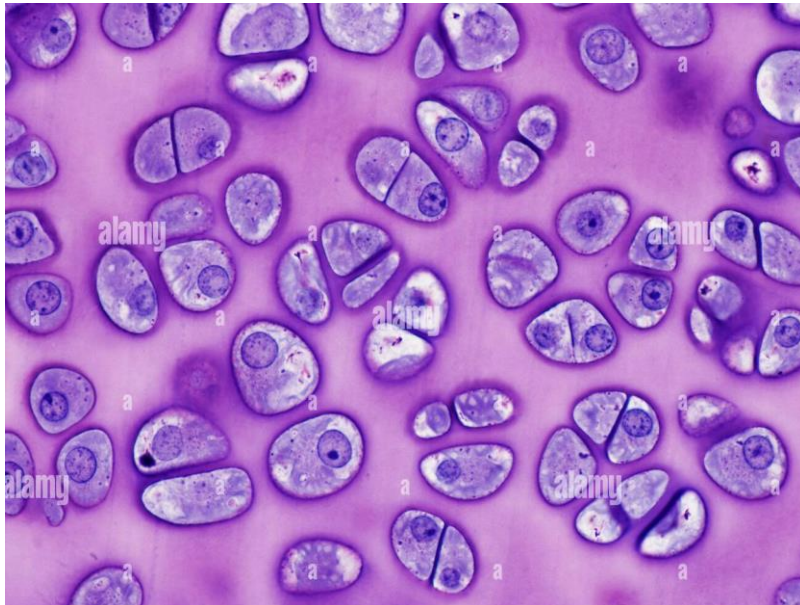
3-Removal of waste products



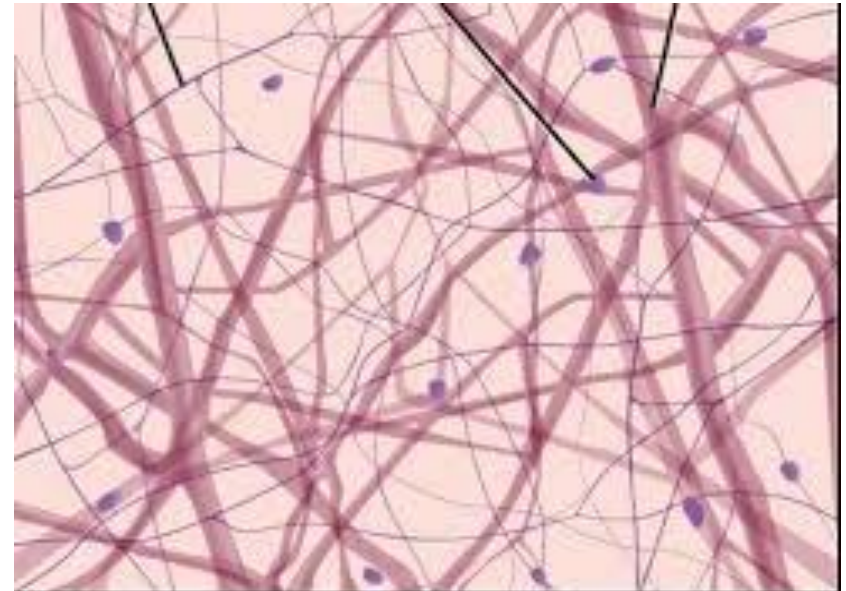
ECM in blood



ECM in bone



ECM in cartilage

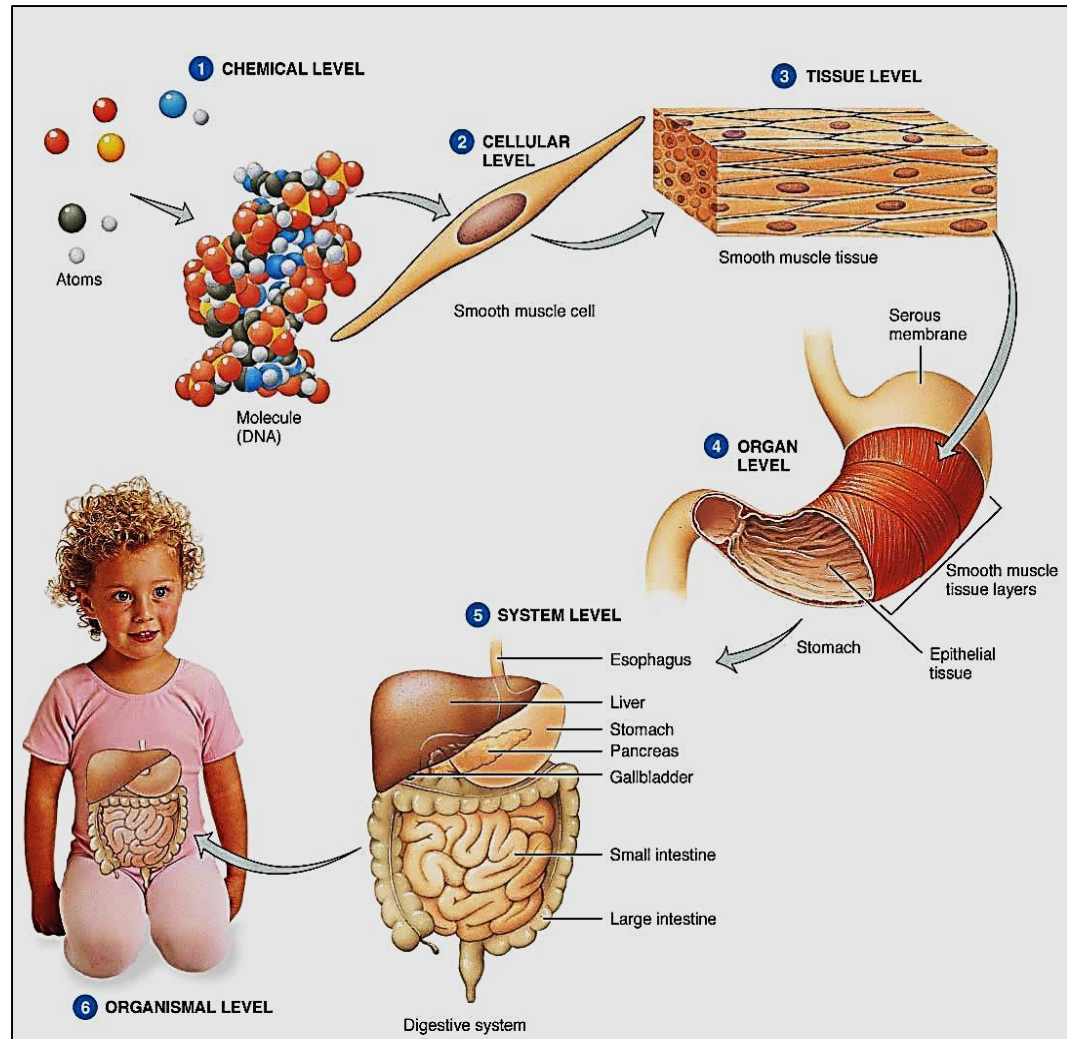


ECM in CT proper

Organization of the human body

Human body is organized as follow:

1. Cells
- ↓
2. Tissues
- ↓
3. Organs
- ↓
4. Systems

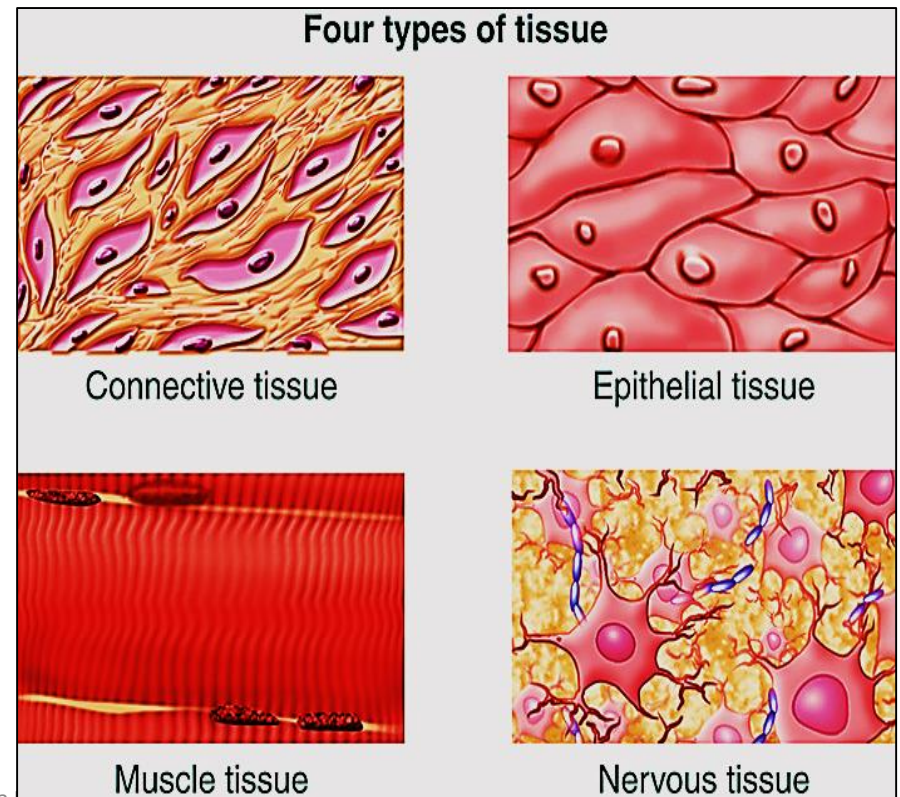


Tissues

- Each **basic tissue** is formed of special types of cells have the same general features and perform specific functions.

The four basic tissues are:

1. Epithelial tissue
2. Connective tissue
3. Muscular tissue
4. Nervous tissue



Organs

Each organ is formed of different kinds of tissues that perform together a special function.

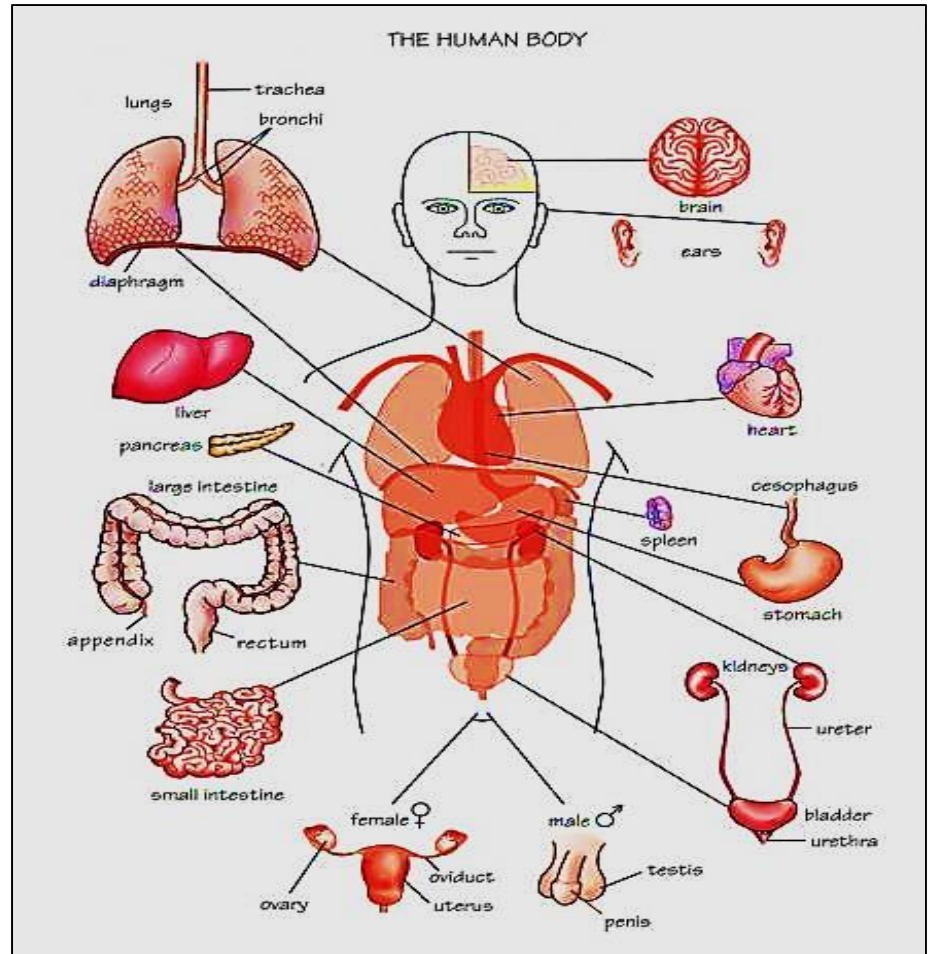
Examples of organs :

The kidney

The liver

The lung

The stomach



Systems

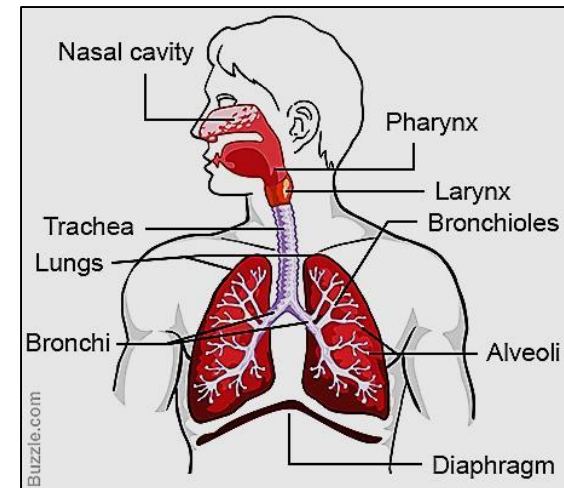
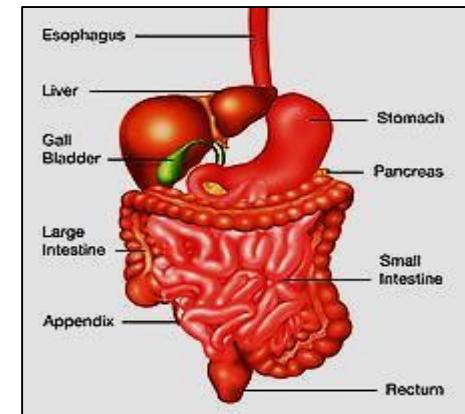
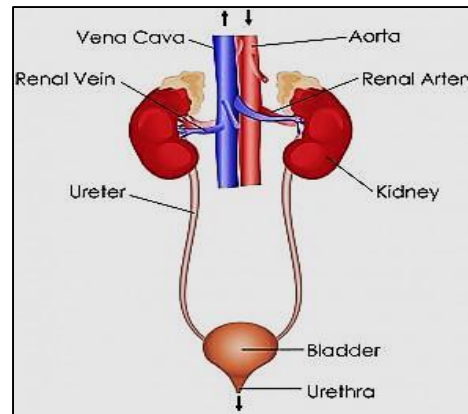
A system is an organization of different organs that together perform integrated complex functions of the body.

Examples of systems :

The urinary system

The digestive system

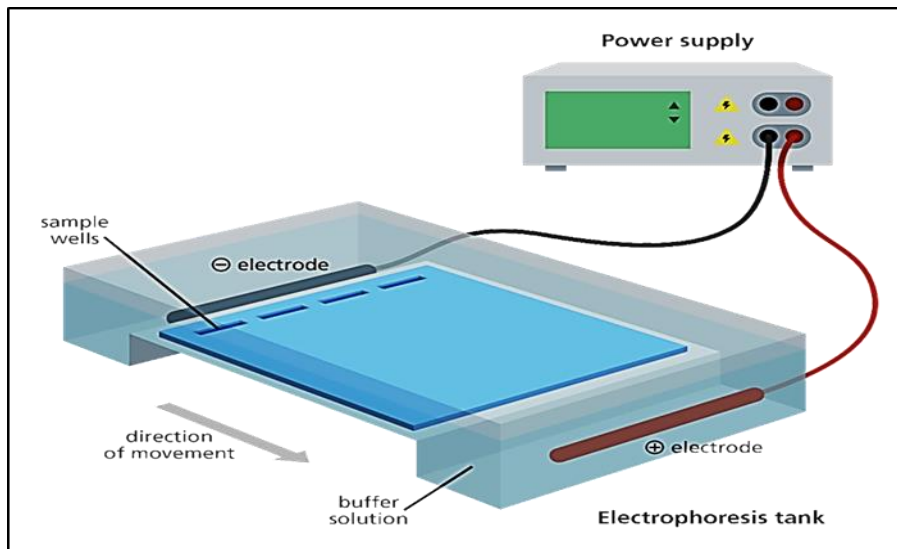
The respiratory system



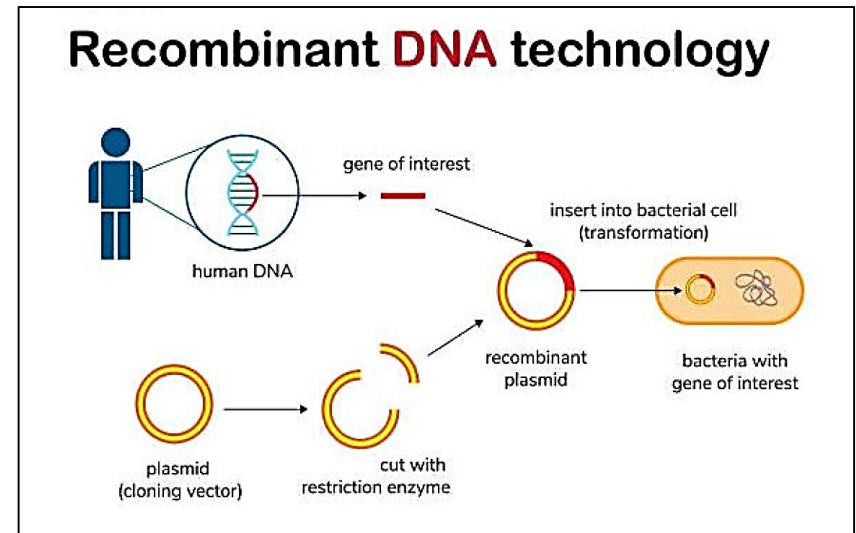
Methods Of Studying Cell Biology

- **Cell culture**: isolating the cells and make them grow under controlled conditions
- **Cell fractionation**: Separate cellular components while persevering the individual functions of each component by breaking the cells by process called centrifugation
- **Chromatography**: chemical analysis done in the lab for separation of a mixture into its component composed of 2 phases mobile & stationary phase

- **Electrophoresis:** separating of charged molecules using an electrical field (size & charge)
- **Genetic technology:** study the structure and function of genes (Isolating gene, copy genes = cloning, determine unknown DNA sequence



Gel electrophoresis



recombinant DNA technology

Microscopy

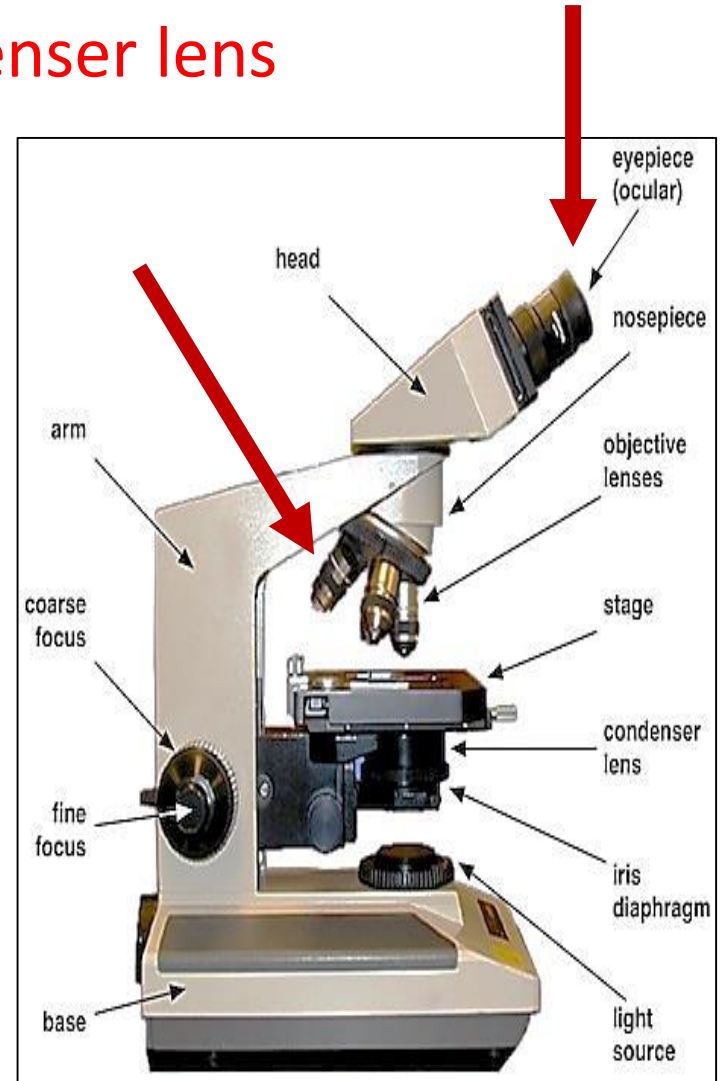
Is the standard optical instrument for generating magnified image & to examination of histological

Types:

1. Light microscope (LM)
2. Electron microscope (Transmission and scanning)
3. Phase contrast microscope
4. Differential interference microscope
5. Fluorescence microscope
6. Confocal microscope

1- Light microscopy (LM)

- The widely used microscope
- LM uses visible **light source** + **condenser lens** (to send light through the object).
- The image of this object is magnified by two sets of lenses:
 1. **Ocular lens** (10)
 2. **Objective lenses** (5 ,10 , 40)
- Total magnification power = 1×2
e.g. $10 \times 40 = 400X$ times



• The capacity of microscopes depends on:

1. **Magnification power**: the power to enlarge objects .

2. **The resolution power** : is the smallest distance between two particles that can still be seen by eye or camera as two separate objects & not a as single object (done by : lenses)

The magnification valuable only when accompanied by high resolution.

• The resolution power of:

1. Healthy naked eye = 0.2 millimeter

2. L M = 0.2 micrometer (um)

3. EM = 0.2 nanometer (nm)

Equivalent lengths:

1 millimeter (mm) = 1000 micrometer (micron)

1 micrometer (um)= 1000 nanometer

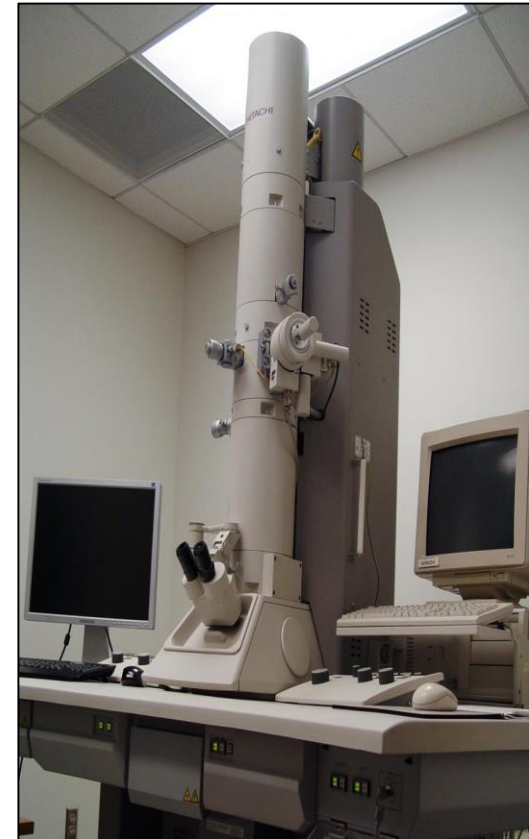
1 nanometer(nm)= 10 angstrom

Binocular light microscopy



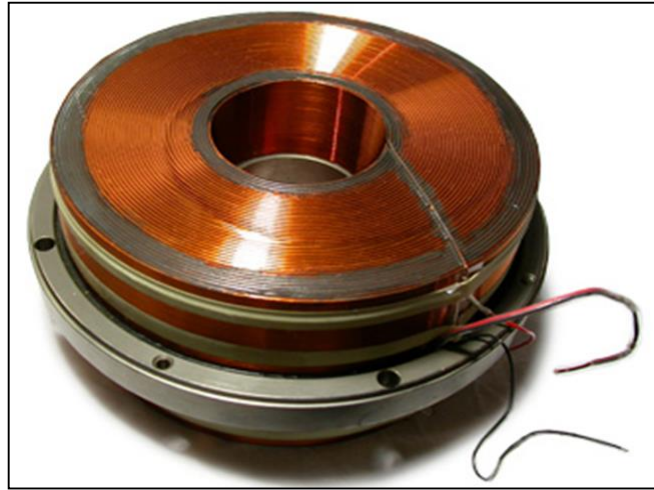
6- The Electron Microscope (EM)

- Technique is used to obtain high resolution images
- **Beam of electrons** is used as source of light
- The image is formed from the interaction of the electrons with the specimen as the beam travelling through it
- Beam passes through a vacuum tube
- The lenses are electromagnetic coils instead of glass lenses



- The lenses are electromagnetic coils instead of glass lenses

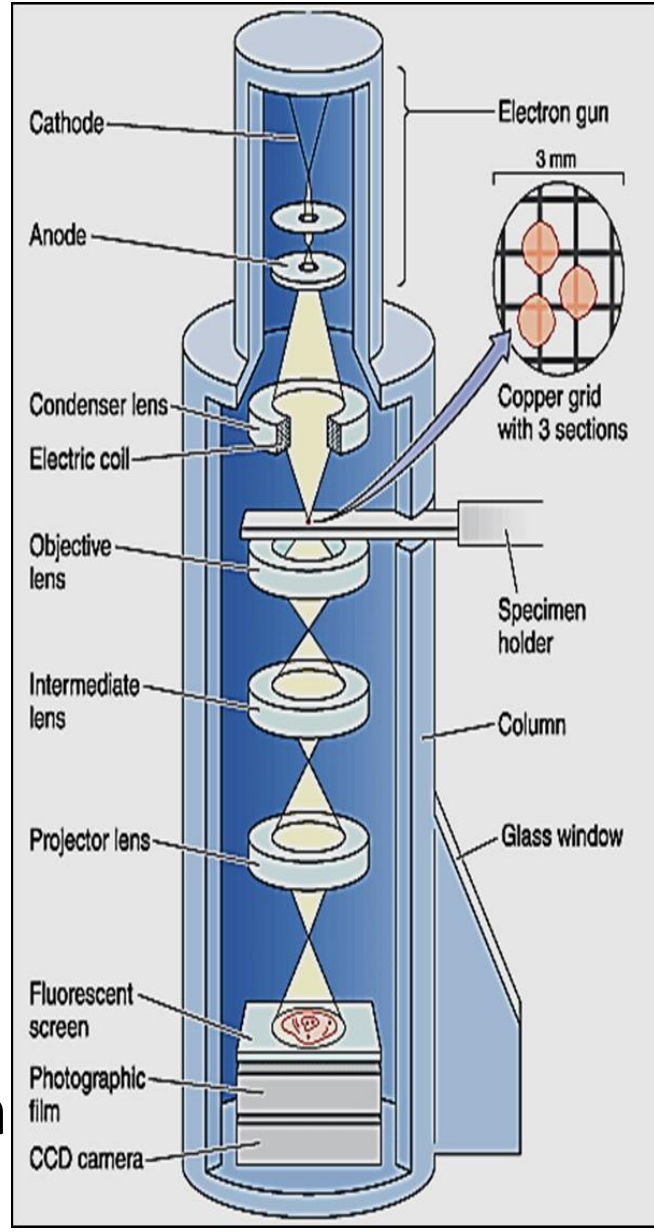
Electromagnetic lens



Illuminating system consists of:

Consists of: electron gun & condenser lens

- Condenser lens is capable of generating circular magnetic field that act to focus electrons on the specimen

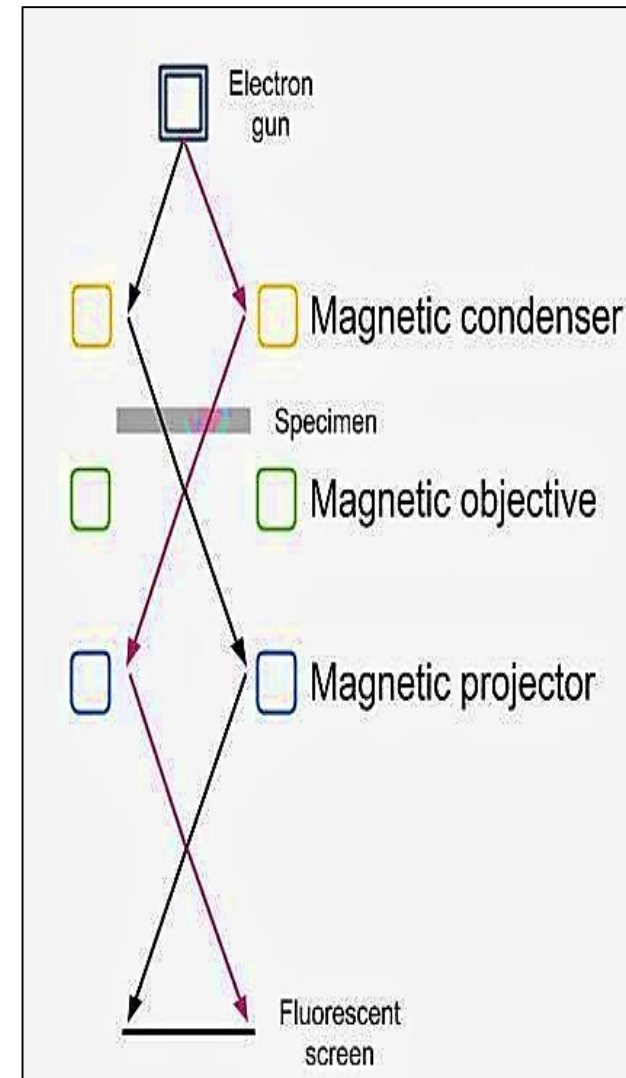


Imaging system consists of :

A- Another electromagnetic lenses (2-3)

B- Screen

- The objective lens is used to refocusing the electrons after they pass through the specimen & form image
- The projector lens is to enlarge the image of the object and projecting it into the fluorescent screen



- The image appears on screen plate which glows when being hit by electrons

- Images can be detected as:
Light areas (**electron lucent**) &
dark areas (**electron dense**)
Corresponding to areas through
which electrons readily passed



The tissues and cells need special preparation & then cut into very thin sections

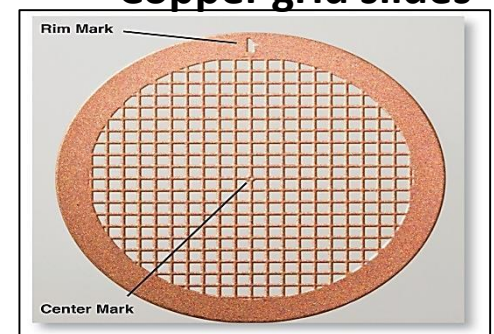
(**ultra thin sections** = 0.01 of the micron)

Then collected on a copper metal grid



Embedding in resin

Copper grid slides

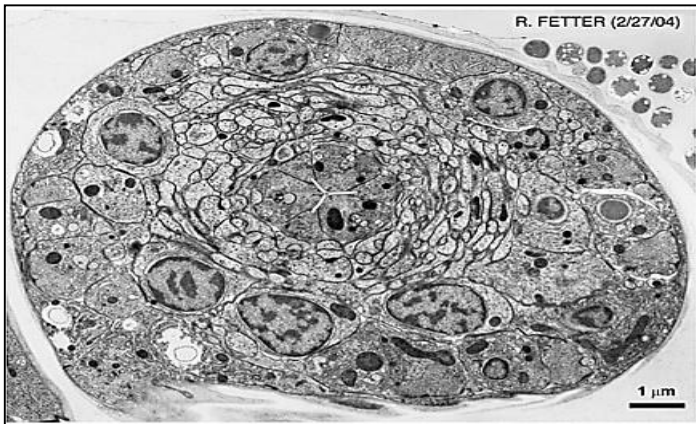


- During preparation sections are stained with salts of heavy metals like **lead nitrate** and **uranyl acetate** that precipitate in tissues.
- EM can magnify the image thousands of times (up to 200.000 times).
- The resolution power = 0.2 nanometer (nm)
- For permanent records, **photos are made**

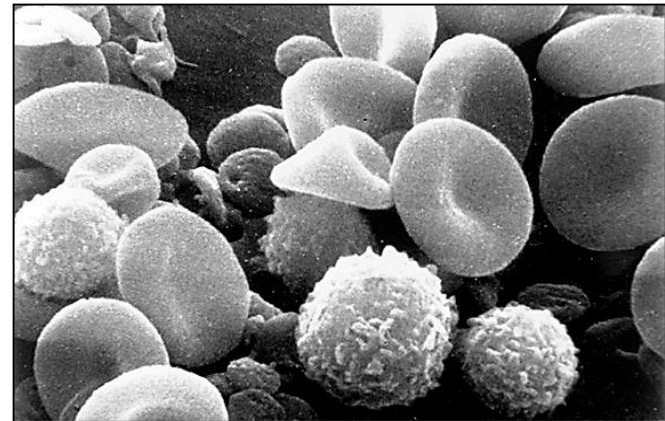
Types of EM

• **Transmission EM (TEM)** : where electron beams pass through the specimen. It shows the details of internal structures of cells. **Resolution power: 0.2 nanometer**

TEM



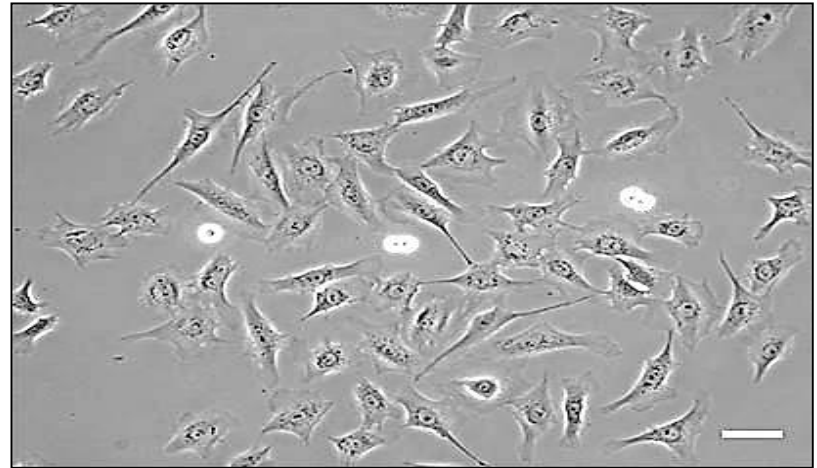
SEM



• **Scanning EM (SEM)** : a special type of EM where electron beams are reflected from the surface of coated specimen. This gives a three dimensional image of a specimen. **Resolution power: 10 nanometer**

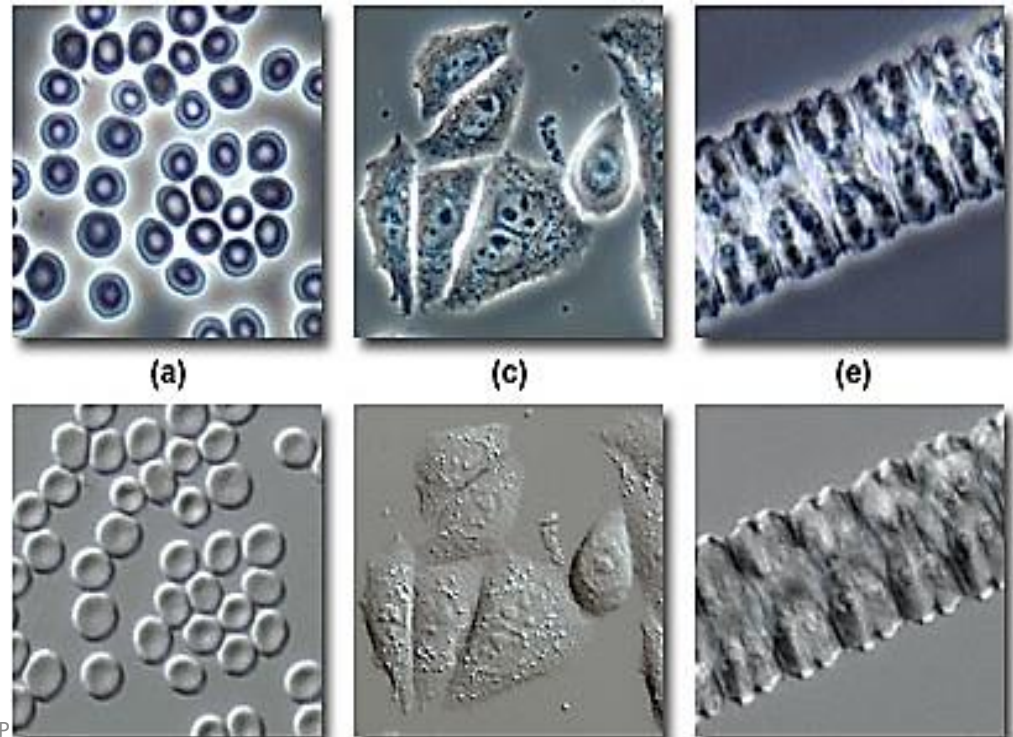
3-Phase contrast microscope

- It depends on the idea that some lens systems can produce visible images from **transparent objects (unstained)**.
- The principal is that light changes speed when passes through cellular and extracellular structures & with different refractive indices.
- Objects appear lighter or darker to each others.
- It is useful in examining **living cells & tissue cultures e.g. blood cells and sperms**



4- Differential interference contrast microscope

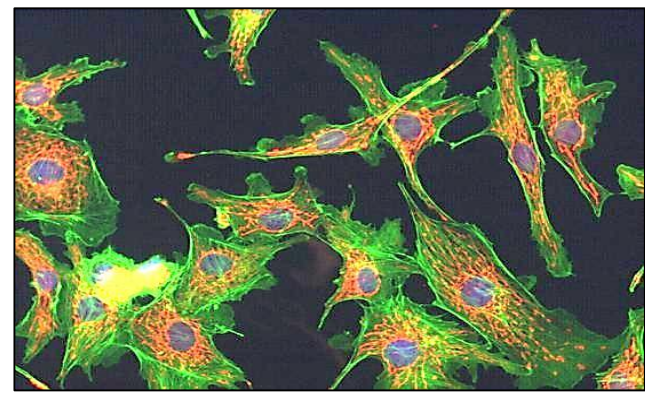
- is advanced version of phase contrast microscope (**used for transparent or unstained samples**).
- The obtained image appears **three dimensional characters**.
- It utilizes **two separate beams of light**.



DIC microscopy

5- Fluorescence Microscopy

- Certain substances absorb invisible ultraviolet light of short wavelength



- and emit (reflect) it as visible light of long wavelength and are known to exhibit **fluorescence** (physical property).

- This microscope is provided with **special lamp** that can **emit ultraviolet rays** which pass through the tissue.

- It can be used to **visualize DNA, RNA, proteins and antigen antibody complex (antibodies labeled with fluorescence)**



6- Confocal Laser Microscope (3D)

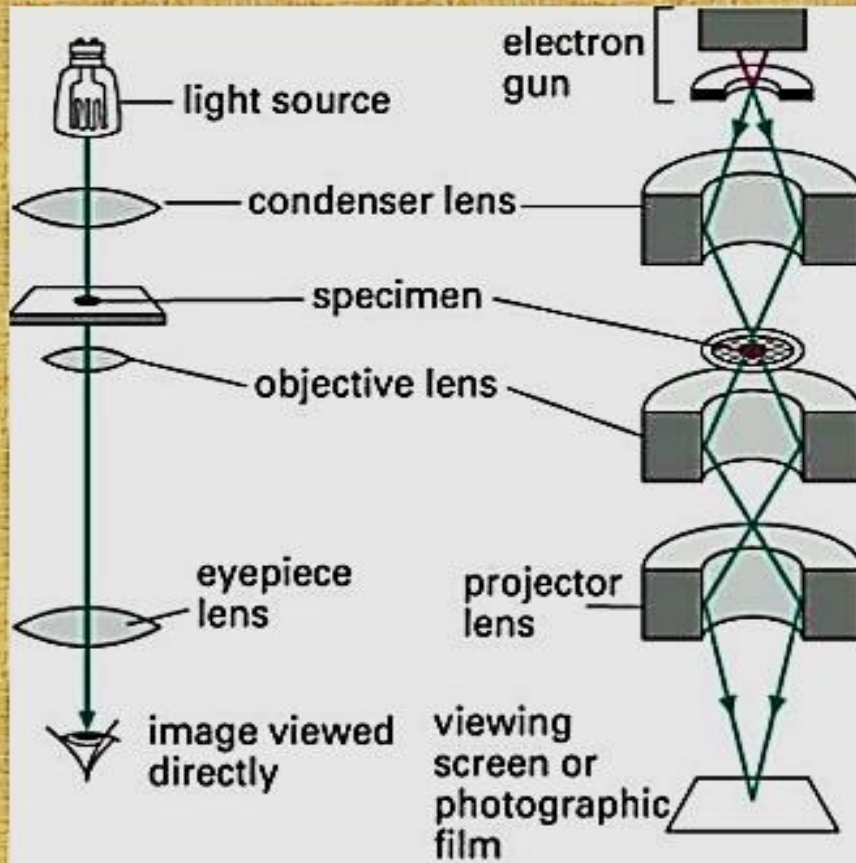
- * The illumination is provided by a **laser source**.
- The specimen should be **labeled by fluorescent** molecules
- Uses: increase optical resolution and contrast (better image)
- The **LASER** light passes **through a small hole (to avoid photo bleaching) to examine fine details**
- It is connected to a computer system to reconstruct full image of the specimen



LM & EM



LM



EM



Thank you

