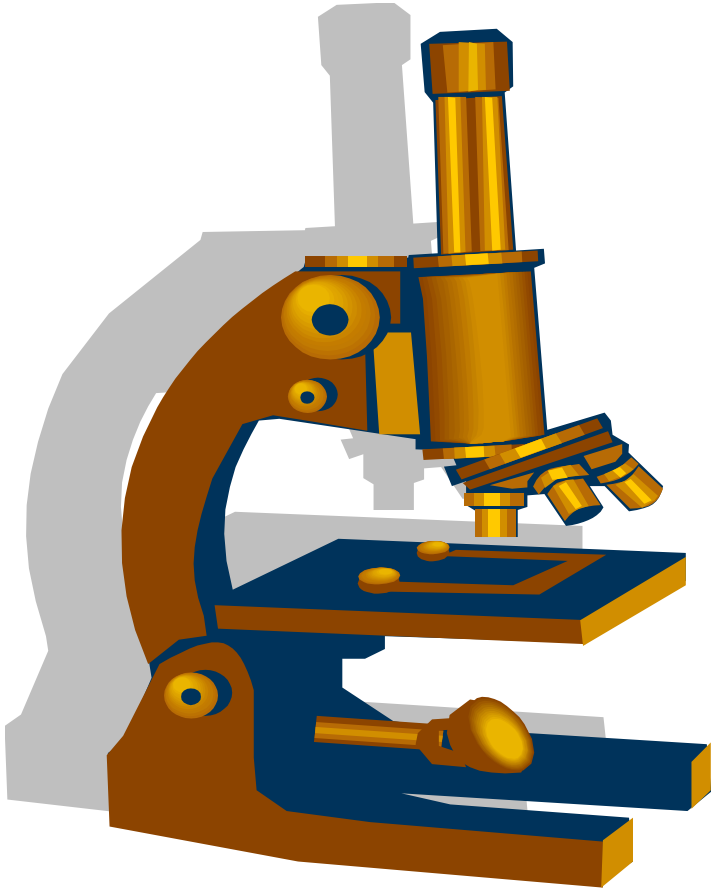
Light Microscope



Human Biology Lab. First Stage

College of Pharmacy Al Nahrain University

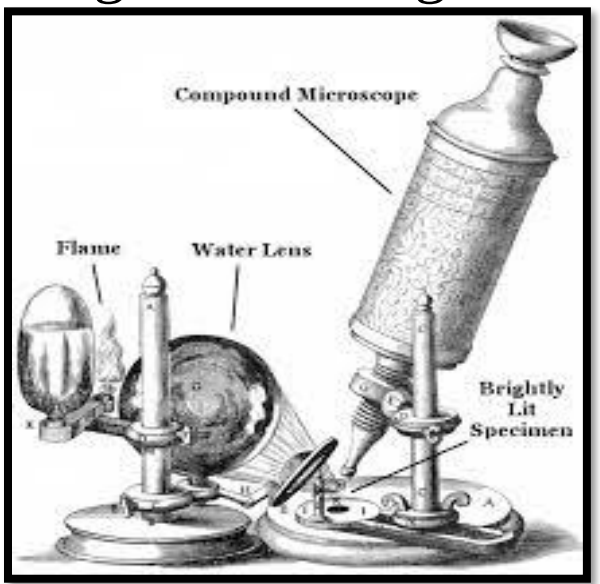
Biology
Bio= life, logy= the study of
is the science that studies life

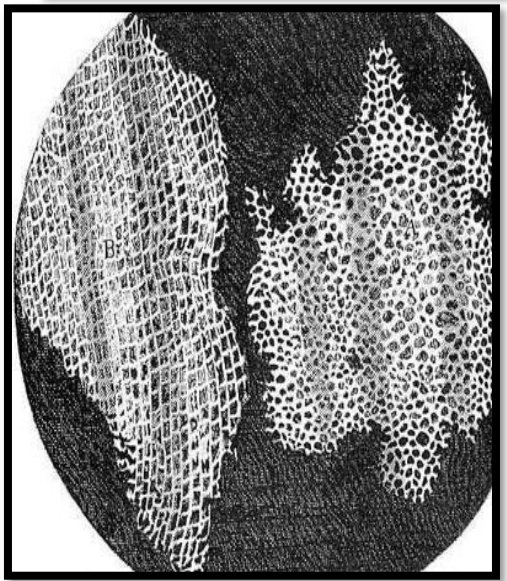
Microscope History

- 1595 –several lenses in a tube making the first compound microscope
- 1600 – Antoine van Leeuwenhoek one lens installed on the plate of brass, with a mechanism to install the sample for testing – 1st to see single-called organisms in pond water
- 1655 – Robert Hooke

used a compound microscope to observe pores in cork

– He called them "cells"





Monocular Microscopes

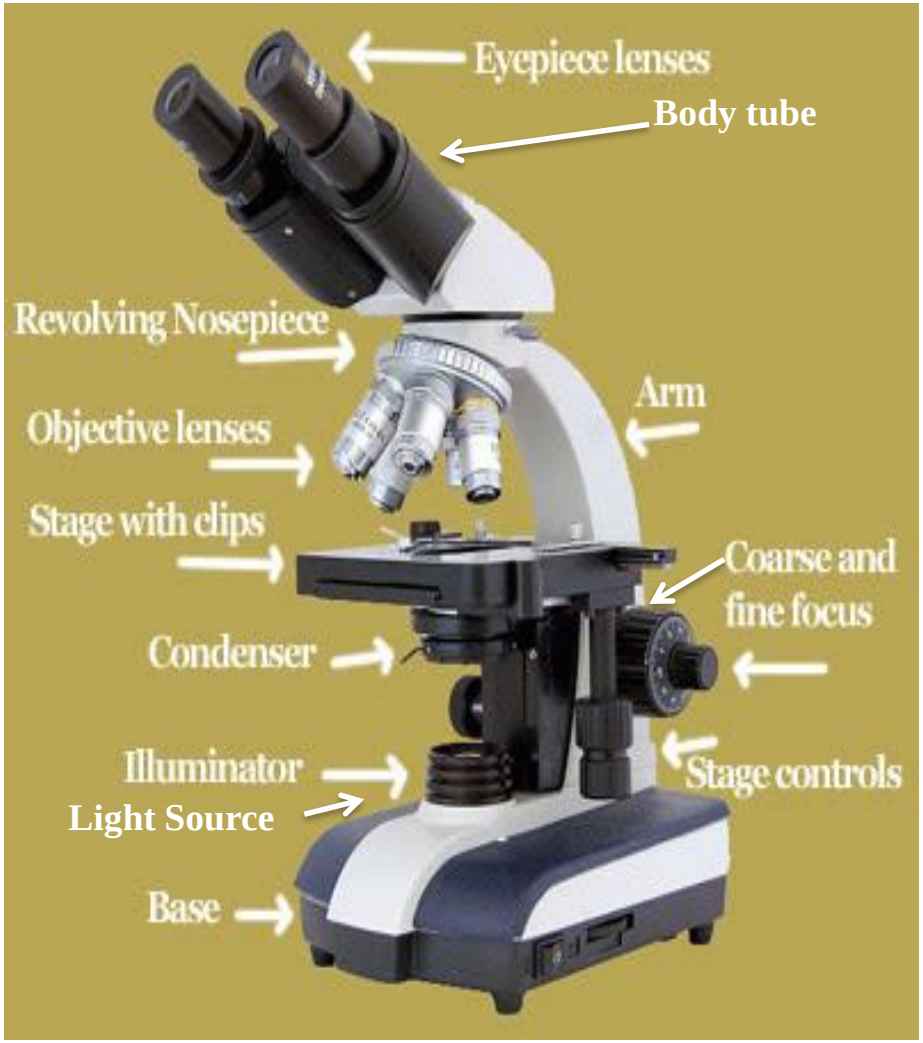
Binocular Microscopes

Compound Light Microscope

- 1st type of microscope, most widely used
- light passes through 2 lenses
- Unit of measurement of magnification power in a microscope (x)
- Carrying a Microscope

Microscope Parts

- Ocular Eyepiece Lenses 10x
- Body tube
- Revolving nose piece
- Objectives (4,10, 40, 100) x
- Arm
- Stage with clips
- Condenser or Diaphragm
- Coarse adjustment
- Fine adjustment
- Stage controls
- Light source illuminator
- Base



Compound Light Microscope Parts and Functions

Microscope Part	Function
Arm	Supports the body tube and lenses. Use the arm to carry your microscope.
Base	Supports the entire microscope. Broad and heavy, the base gives the instrument stability.
Ocular	The lens in the upper part of the microscope. **Monocular** microscopes have one ocular, while **binocular** microscopes have two oculars.
Body Tube	Holds the ocular at one end and the nosepiece at the other. A prism housed in the body tube helps to reflect light towards the eye.
Revolving Nose Piece	Located at the lower end of the body tube. A revolving device that holds the objectives.
Objective Lenses	Located on the revolving nosepiece. There are typically four objective lenses – referred to as SCANNING, LOW, HIGH and OIL. The selected lens is rotated into position by turning the nosepiece.
Stage	The horizontal platform upon which the slide rests.
Stage Clips	Used to hold slides in place on the stage
Condenser	Helps to adjust the amount of light that reaches the specimen
Coarse Adjustment Knob	Moves the stage up and down to help you get the specimen into view
Fine Adjustment Knob	Moves the stage slightly to help you sharpen or "fine tune" the specimen
Light Source	Projects light upwards through the diaphragm to allow you to see the specimen

High Dry Objective Lens 40X

Low Power Objective Lens 10X

Scanning Power Objective Lens 4X

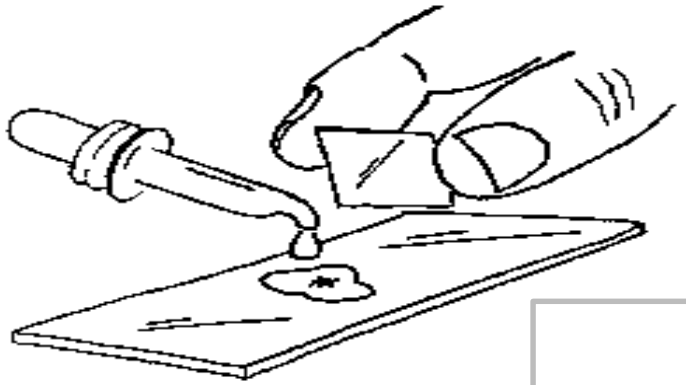
Oil immersion Lens 100X

Cleaning the Microscope

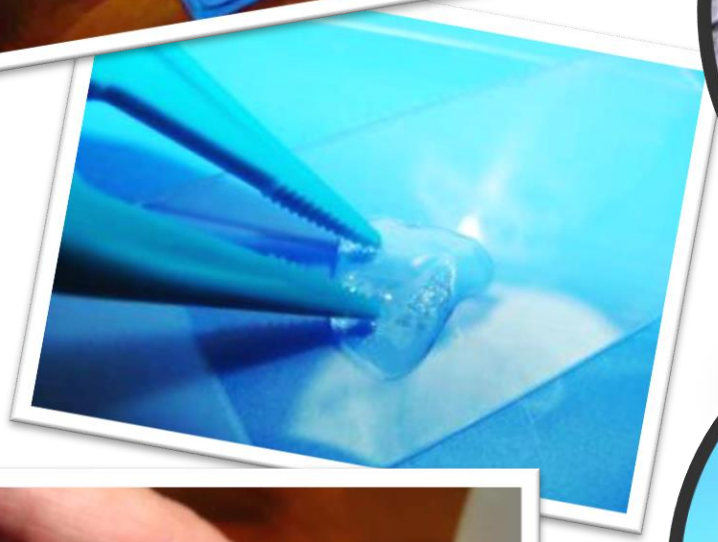
- Use lens paper on all glass parts of the microscope.
- Clean oil immersion lens with chemicals provided by your instructor

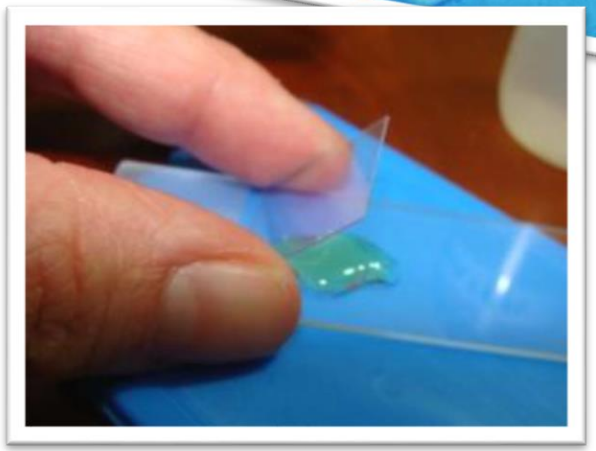
Preparing of slide

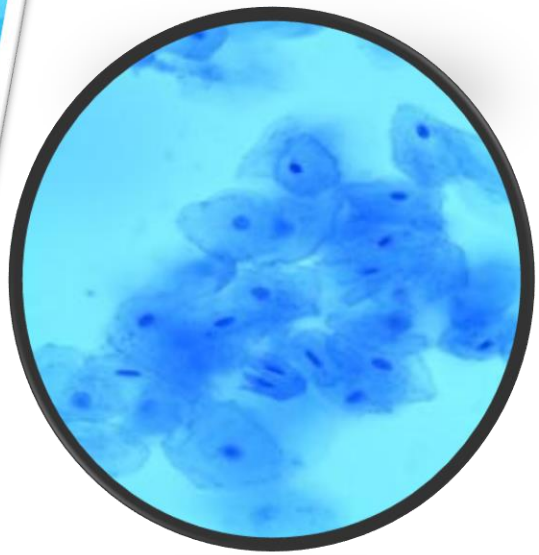
- Using a pipette or dropper, add a drop of water or another solvent That contain specimen to a clean microscope slide.
- Place the edge of a cover slip on the slide so that it touches the edge of the specimen.
- Slowly lower the cover slip to prevent the formation of air bubbles.

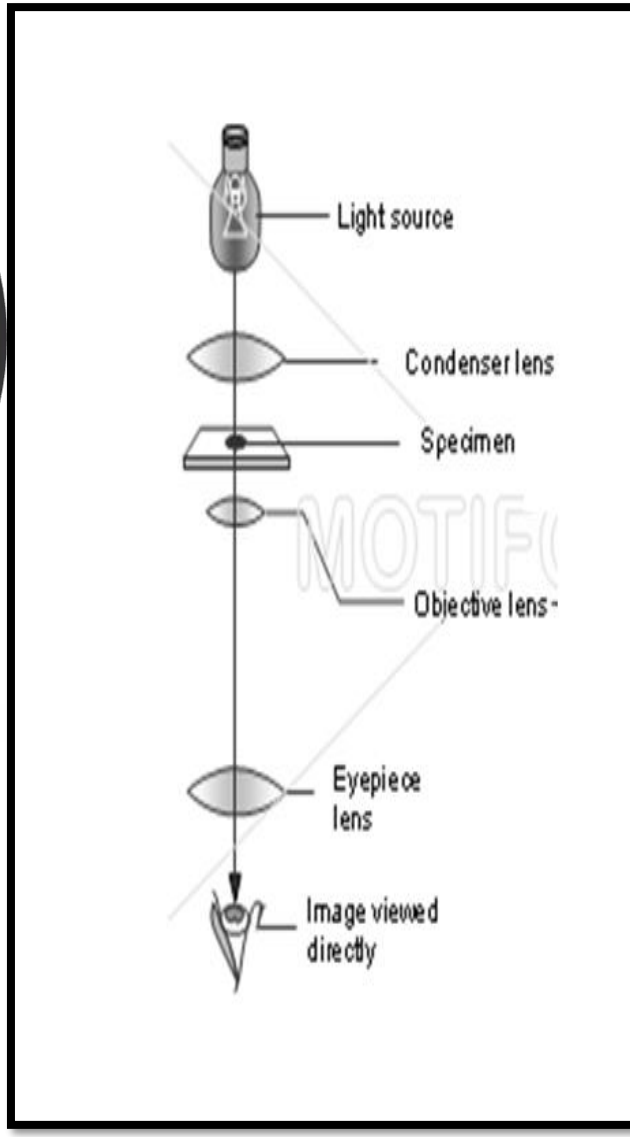


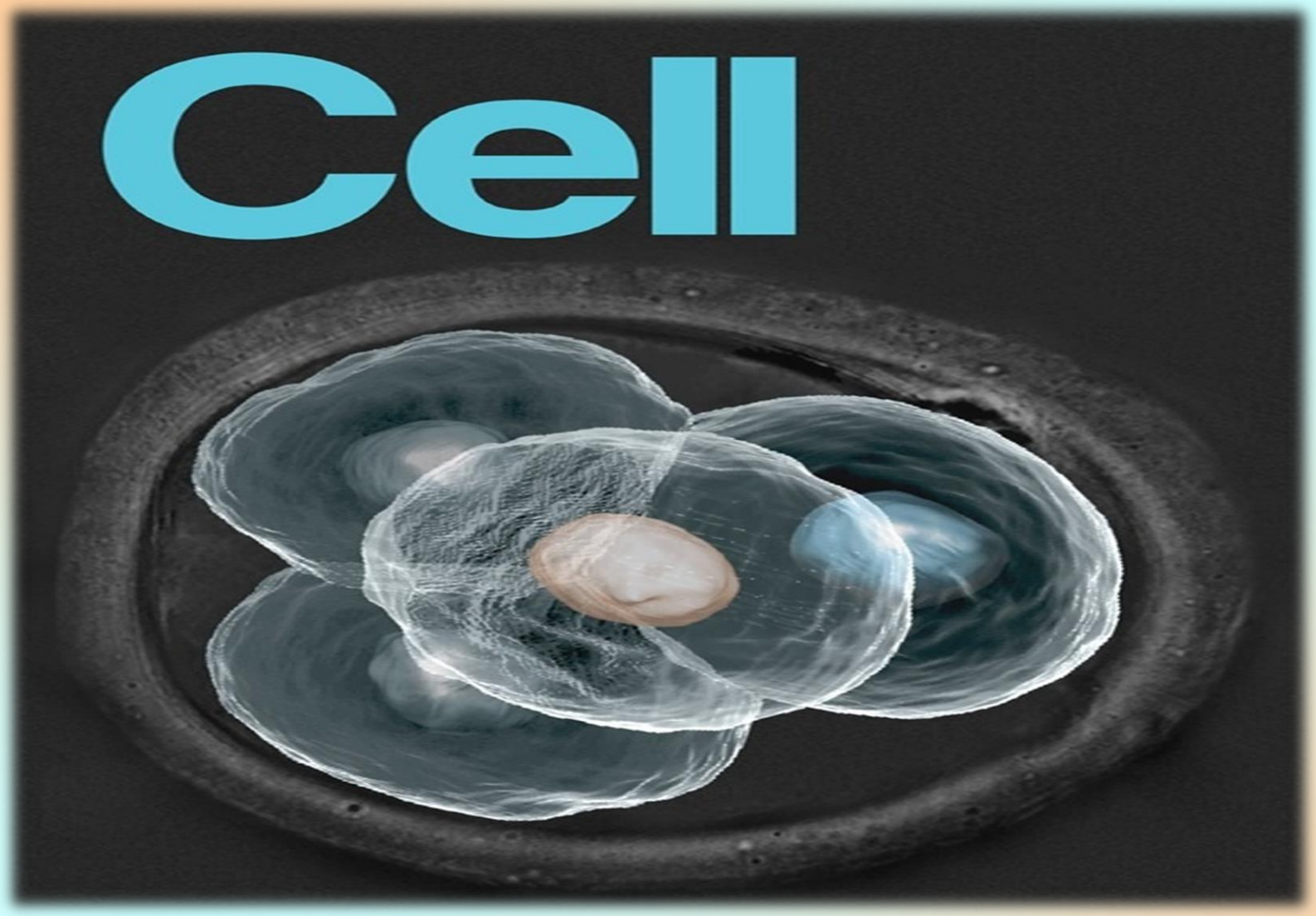

WATER








Light source
Condenser lens
Specimen
Objective lens
Eyepiece lens
Image viewed directly



Human Biology Lab. First Stage

College of Pharmacy Al Nahrain University

Principles of Cell Theory

- **Cell** is the structural and functional smallest unit of all living organisms, sometimes called the building block of life.
- Some organisms such as bacteria are unicellular (consist of a single cell) while other organisms such as human are multicellular.
- Humans have an estimated 100 trillion cells, atypical cell size is 10μm, atypical cell mass is 1 nanogram.

Principles of Cell Theory

- All cells arise from preexisting cells.
- All cells contain the hereditary information necessary for regulating cell functions and for transmitting information to the next generation of cells.

- 3 types of Human Cell Shape:

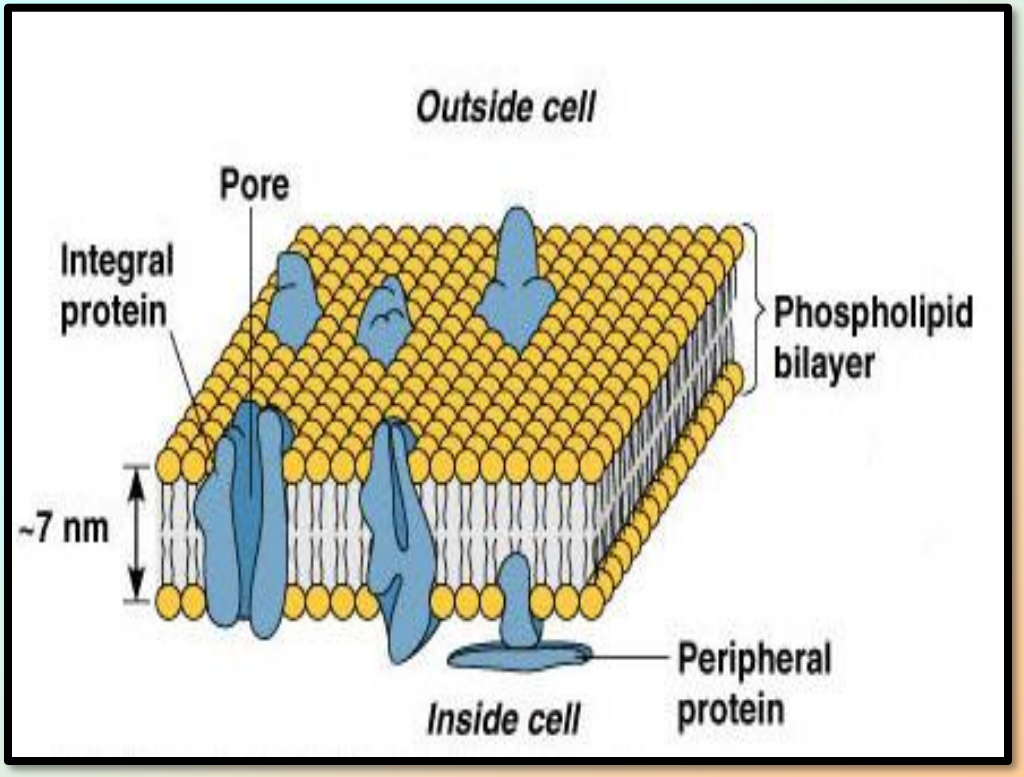
1. Star Shape: Nerve cell
2. Spindle Shape: Smooth muscle cell
3. Amoeboid Shape: Macrophage

Structure of Human Cells Organelles

Cell Membrane

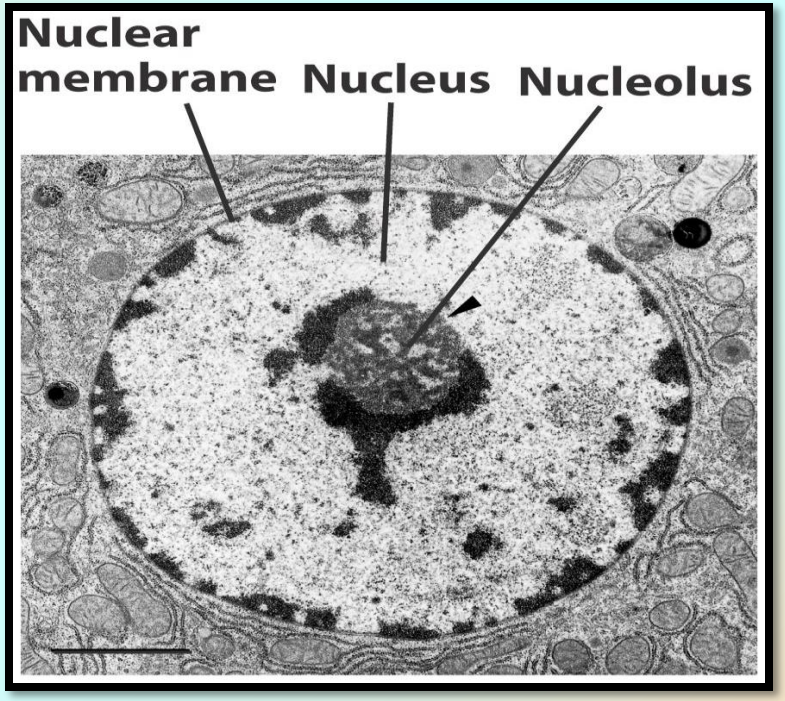
- Boundary of the cell
- Made of a phospholipids bilayer & proteins

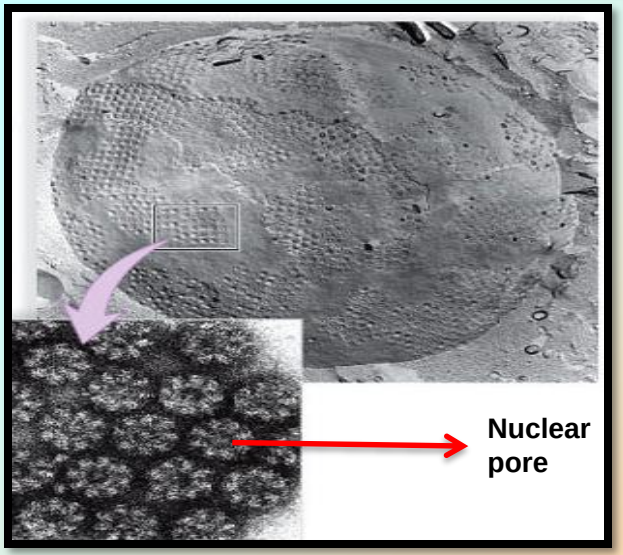
- Polar Interacts with water
  - Hydrophylic head
  - Hydrophobic tail



Nucleus

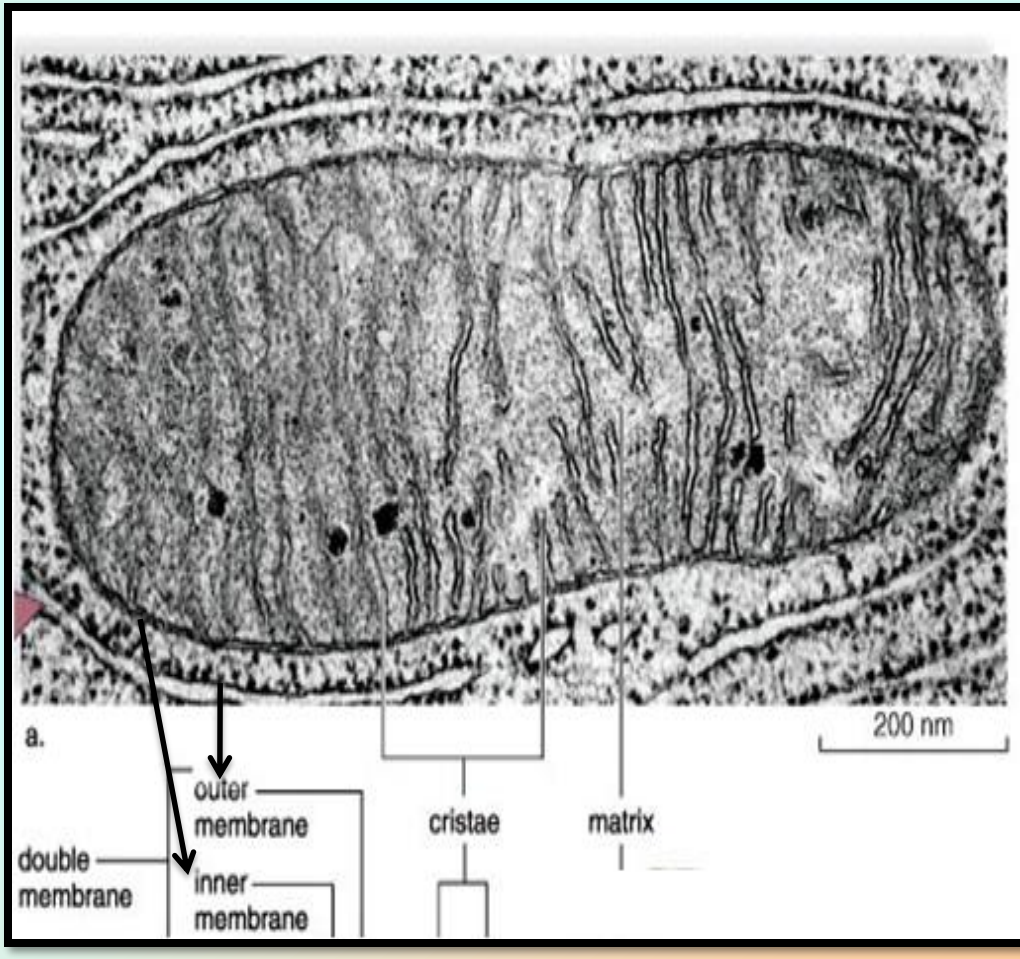
- Control center of the cell
- Contains **DNA, Chromatin**
- Surrounded by a double membrane called **Nuclear envelope**
- Contains **Nucleolus**
- Usually the easiest organelle to see under light microscope
- Usually one per cell





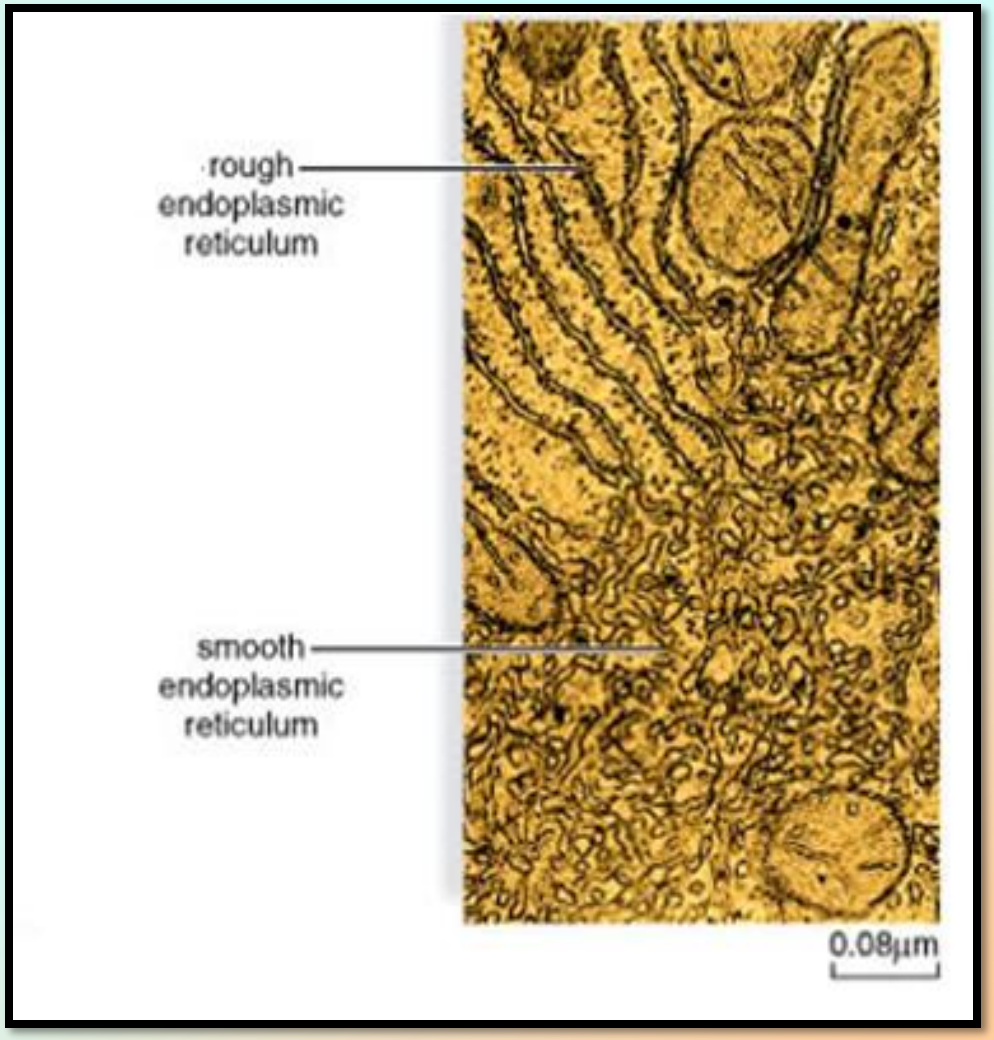
Mitochondria

- Bound by a double membrane
- Mitochondrial (maternal) DNA
- “Powerhouse of the cell”
- **Cellular respiration** occurs by the Food converted into energy to release this energy for the cell to use
- Adenosine triphosphate (ATP)
- Consumes Oxygen, produces CO_2



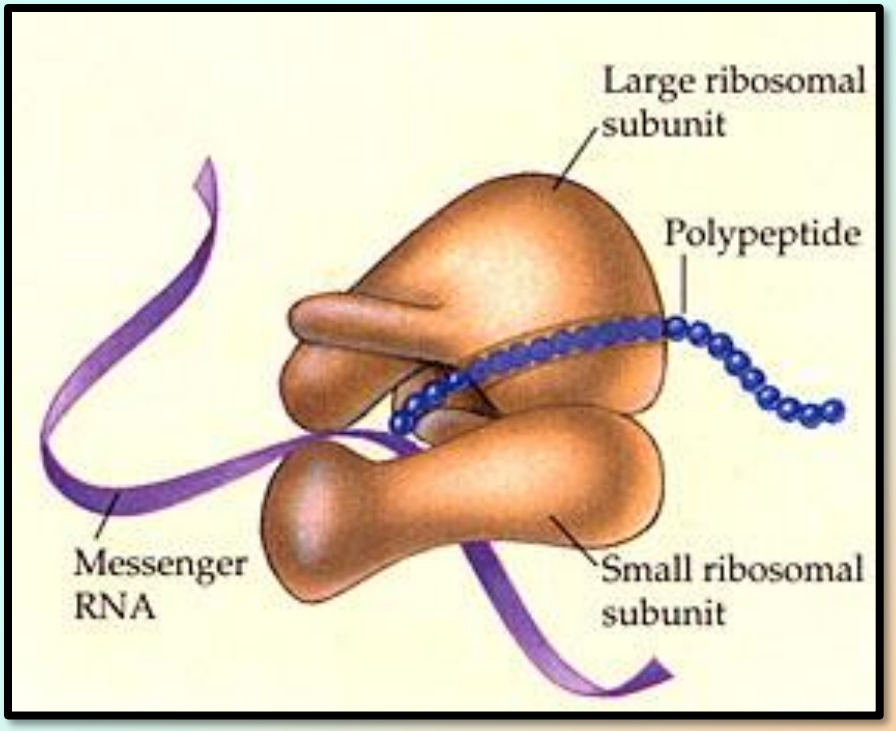
Endoplasmic Reticulum

- "ER"
- Connected to nuclear membrane
- Highway of the cell
- **Rough ER:** with ribosomes; it makes proteins
- **Smooth ER**: no ribosomes; it makes lipids



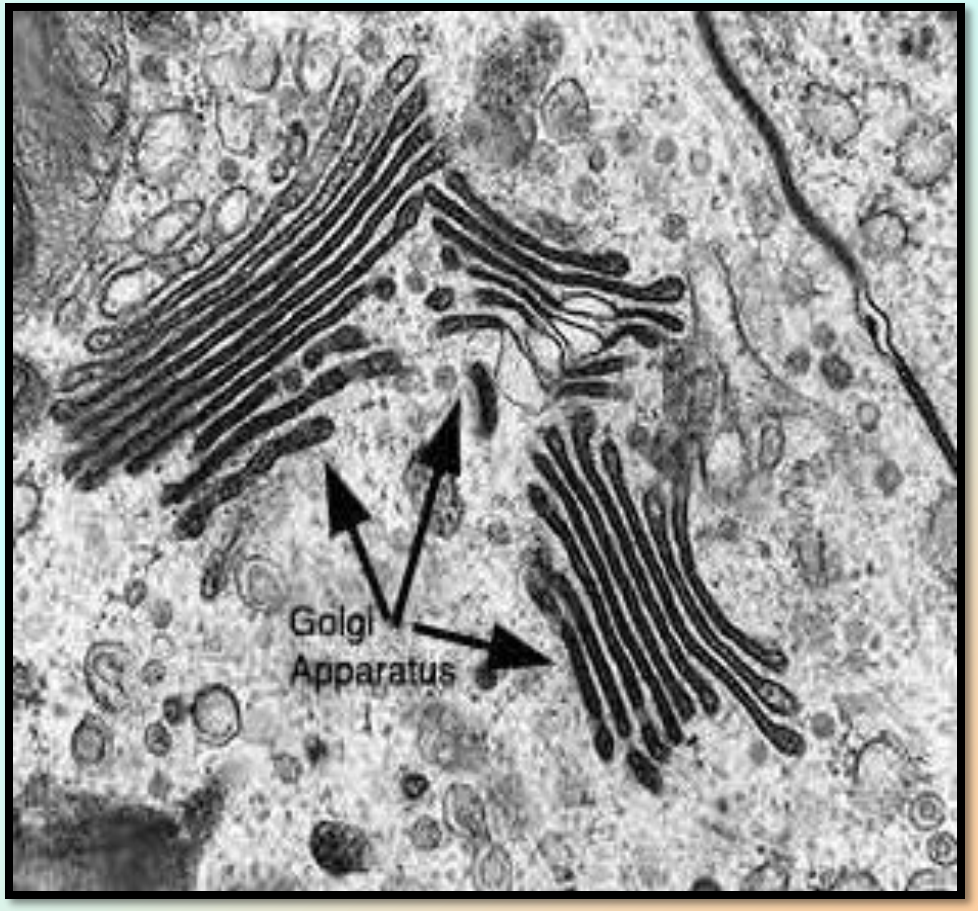
Ribosome

- Site of protein **synthesis**
- Found attached to rough ER or floating free in cytosol
- Produced in a part of the nucleus called the **nucleolus**



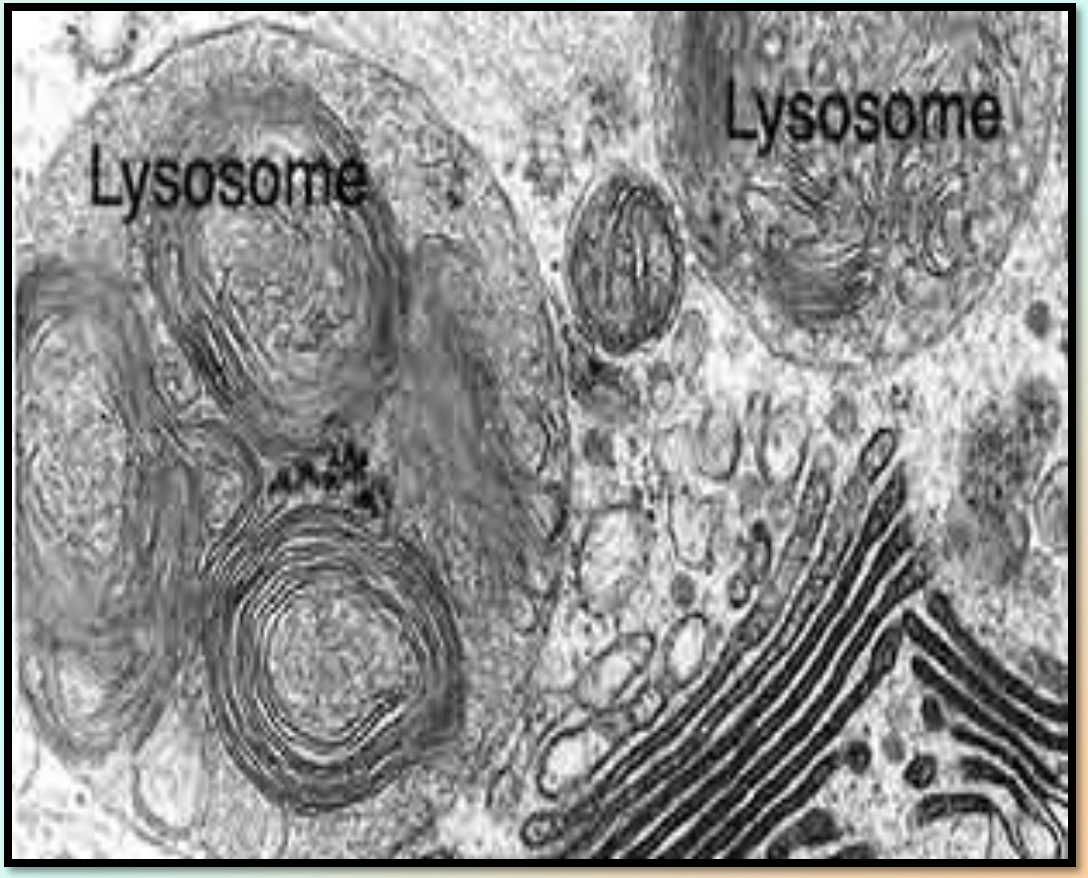
Golgi Apparatus

- Looks like a stack of plates
- Stores, modifies and packages proteins
- Molecules transported to and from the Golgi by means of **vesicles**



Lysosomes

- Garbage disposal of the cell
- Intracellular digestion
- Releases nutrients
- Contain digestive enzymes that break down old cell parts and waste

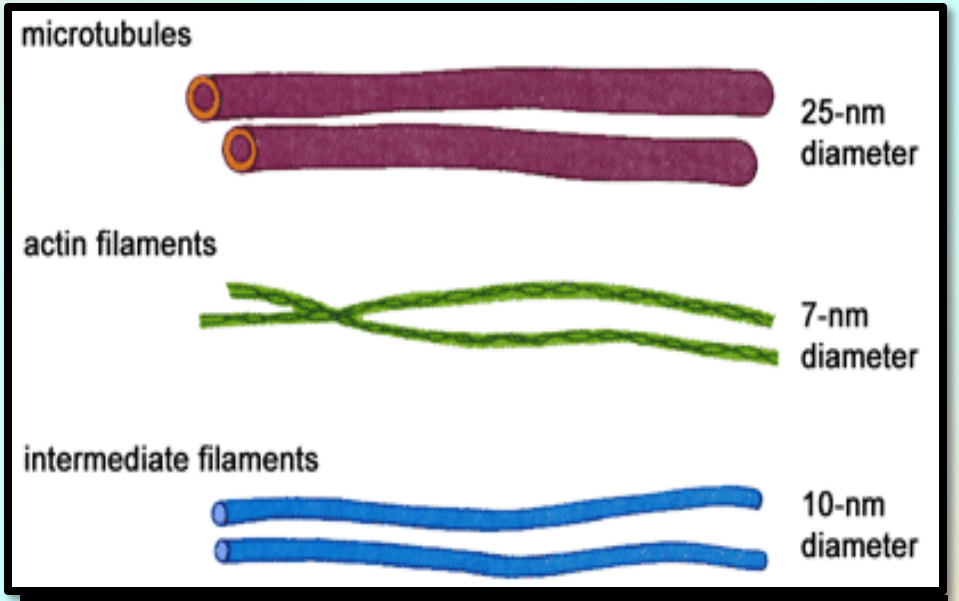


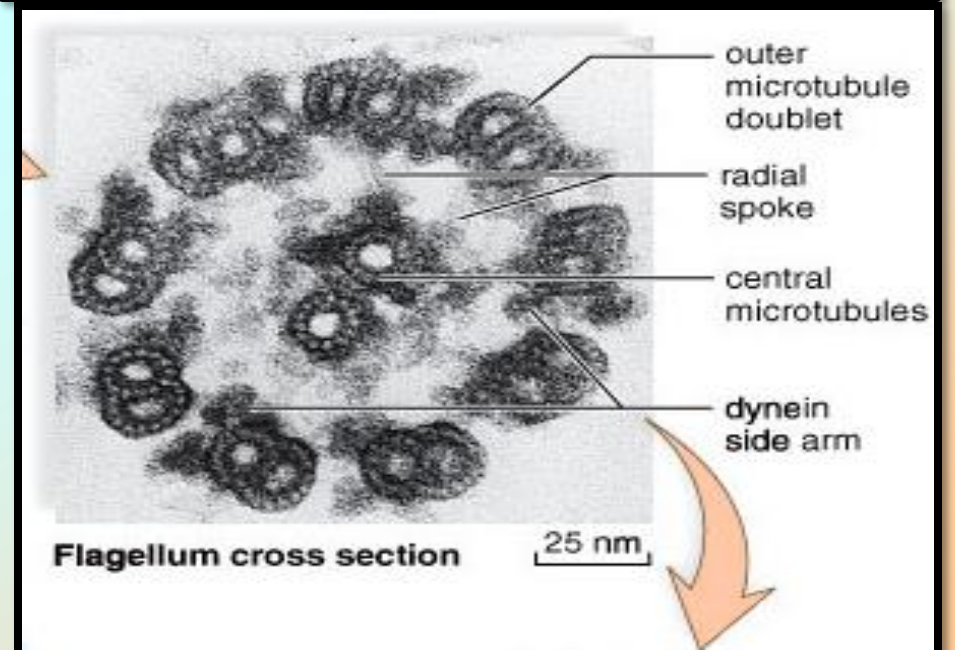
Cytoskeleton

- Acts as **skeleton** and **muscle**
- Provides shape and structure
- 3 types of filaments:
  - Microtubules
  - Actin filaments
  - Intermediate filaments
- functions:

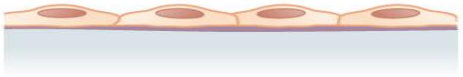
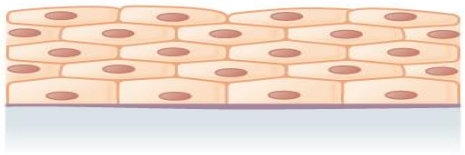
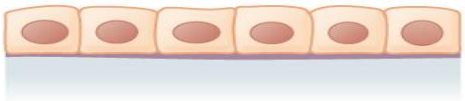
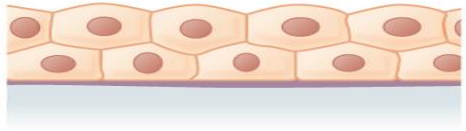
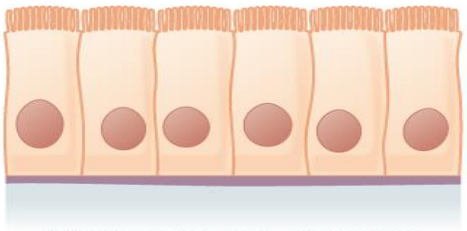
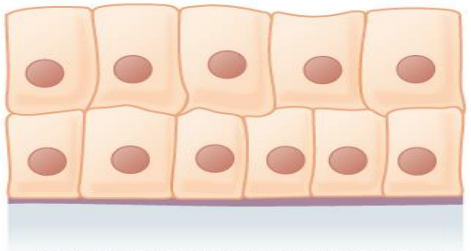
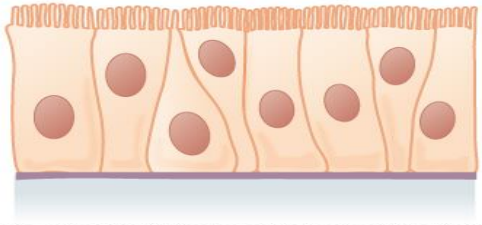
Helps move organelles around the cell and mechanical support

- such as Cilia ,Flagella ,villi and centrioles





Epithelial Tissue

	Simple	Stratified	
Squamous	 Simple squamous epithelium	 Stratified squamous epithelium	
Cuboidal	 Simple cuboidal epithelium	 Stratified cuboidal epithelium	
Columnar	 Simple columnar epithelium	 Stratified columnar epithelium	Pseudostratified  Pseudostratified columnar epithelium

Human Biology Lab. First Stage

College of Pharmacy Al Nahrain University

- **Epithelial Tissue**: group of similar cells specialized to carry on a particular function

tissue = cells + extracellular matrix

Locations

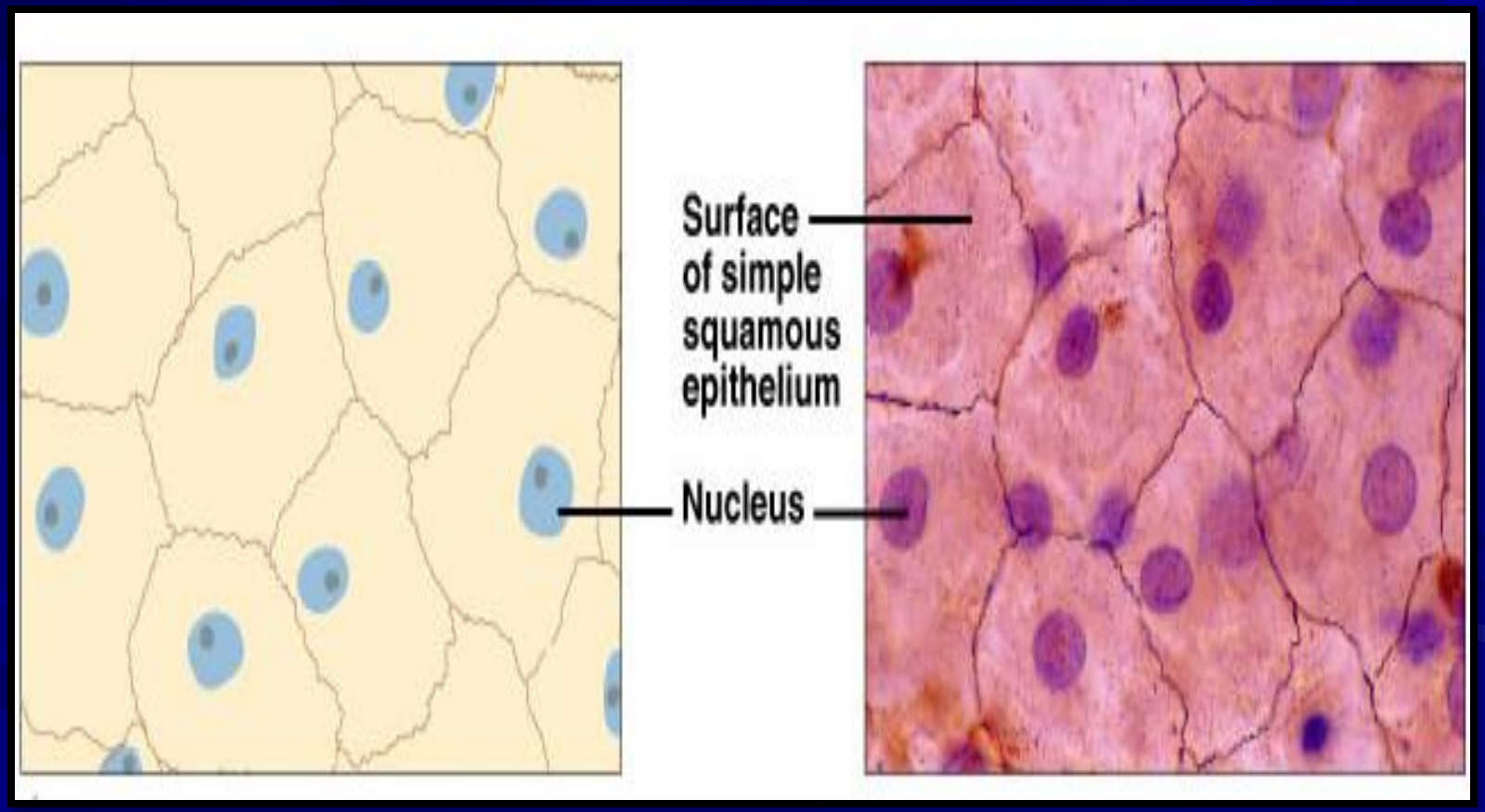
- Covering of body surfaces skin
- Lining of body cavities
- Lining of digestive tract
- Lining of heart and blood vessels
- Lining of gland ducts

Functions

- Absorption: intestine
- Secretions: glands hormones, mucus, enzymes
- Contraction: myeo epithelial cell
- Protection

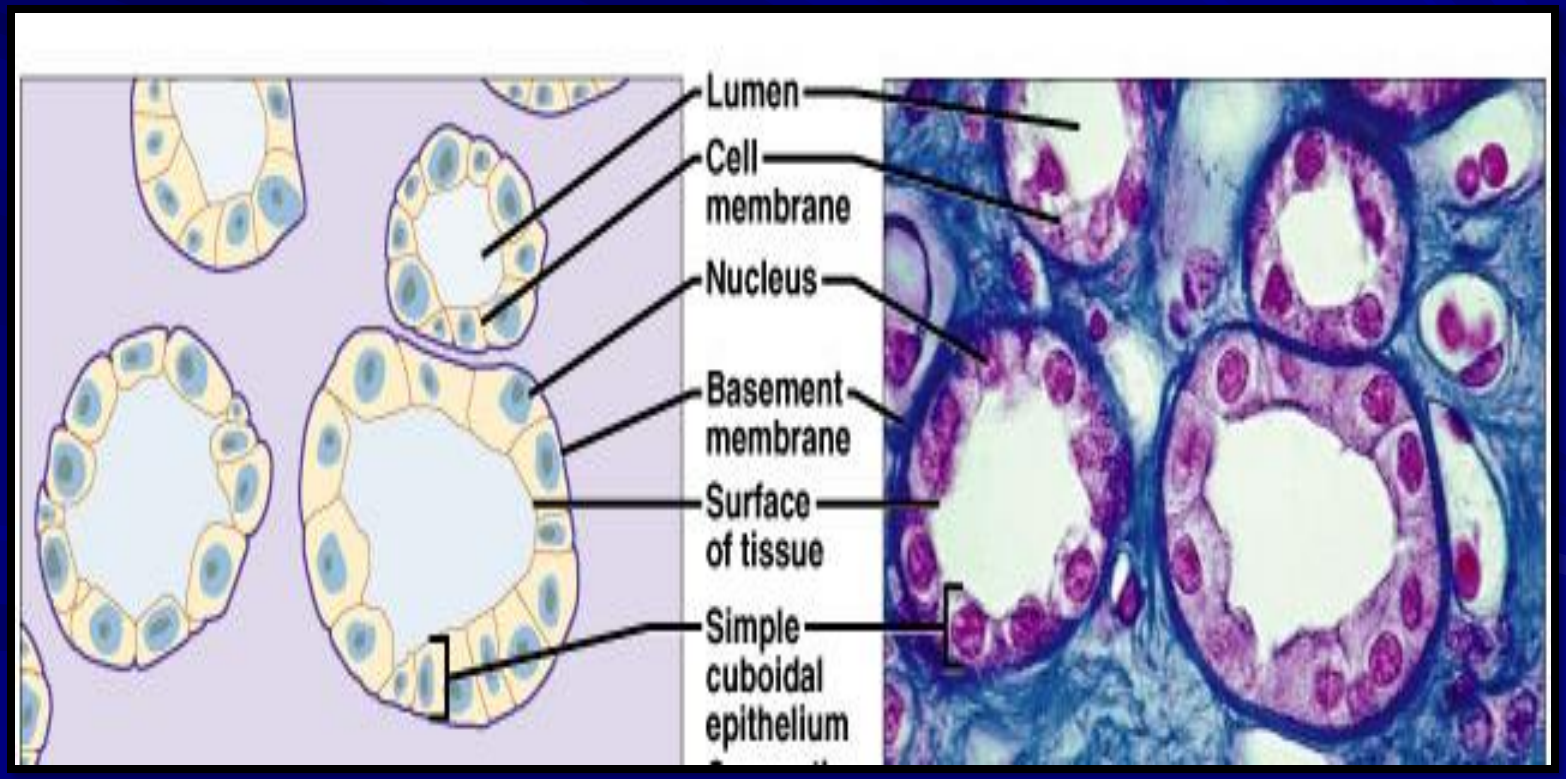
Simple Squamous Epithelium T.

- Single layer of thin, flattened cells.
- Location, in lungs and body cavities.



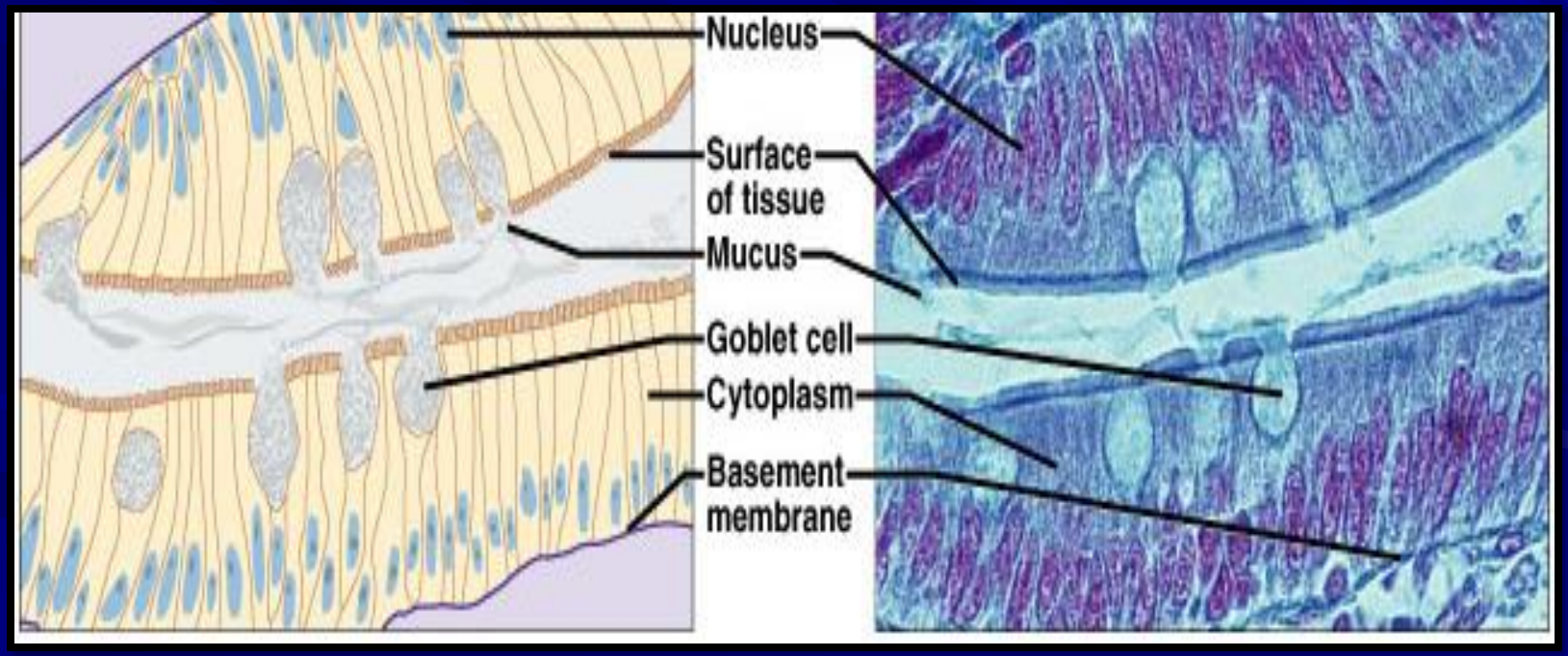
Simple Cuboidal Epithelium T.

- Single layer of cube-shaped cells with centrally located nuclei.
- Function, secretion and absorption in the kidneys, and in secretion in glands.



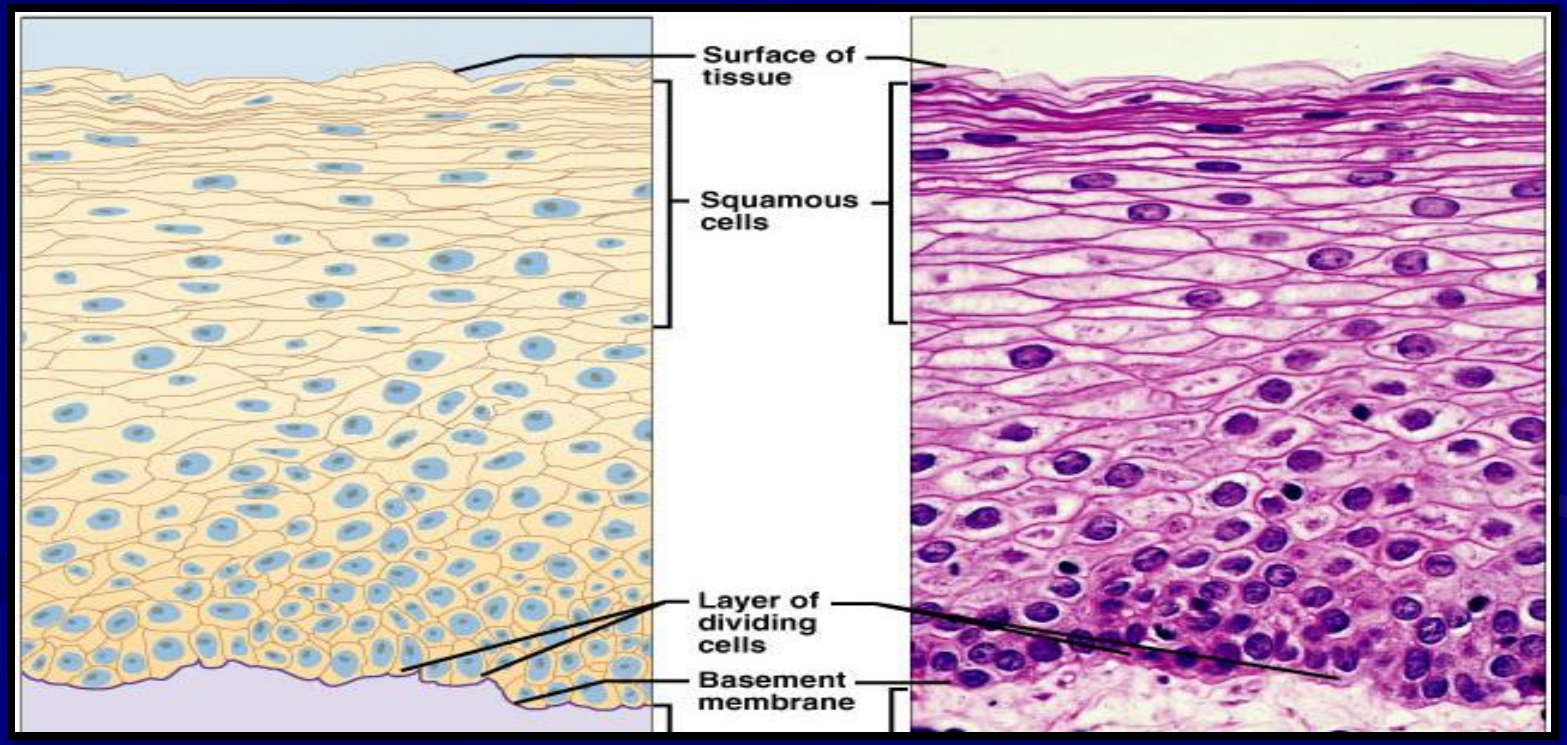
Simple Columnar Epithelium T.

- Single layer of longer cells ciliated or no ciliated
- Some have microvilli
- Goblet cells = secrete mucus
- Functions, absorption, secretion, protection
- Linings of the uterus, stomach, and intestine



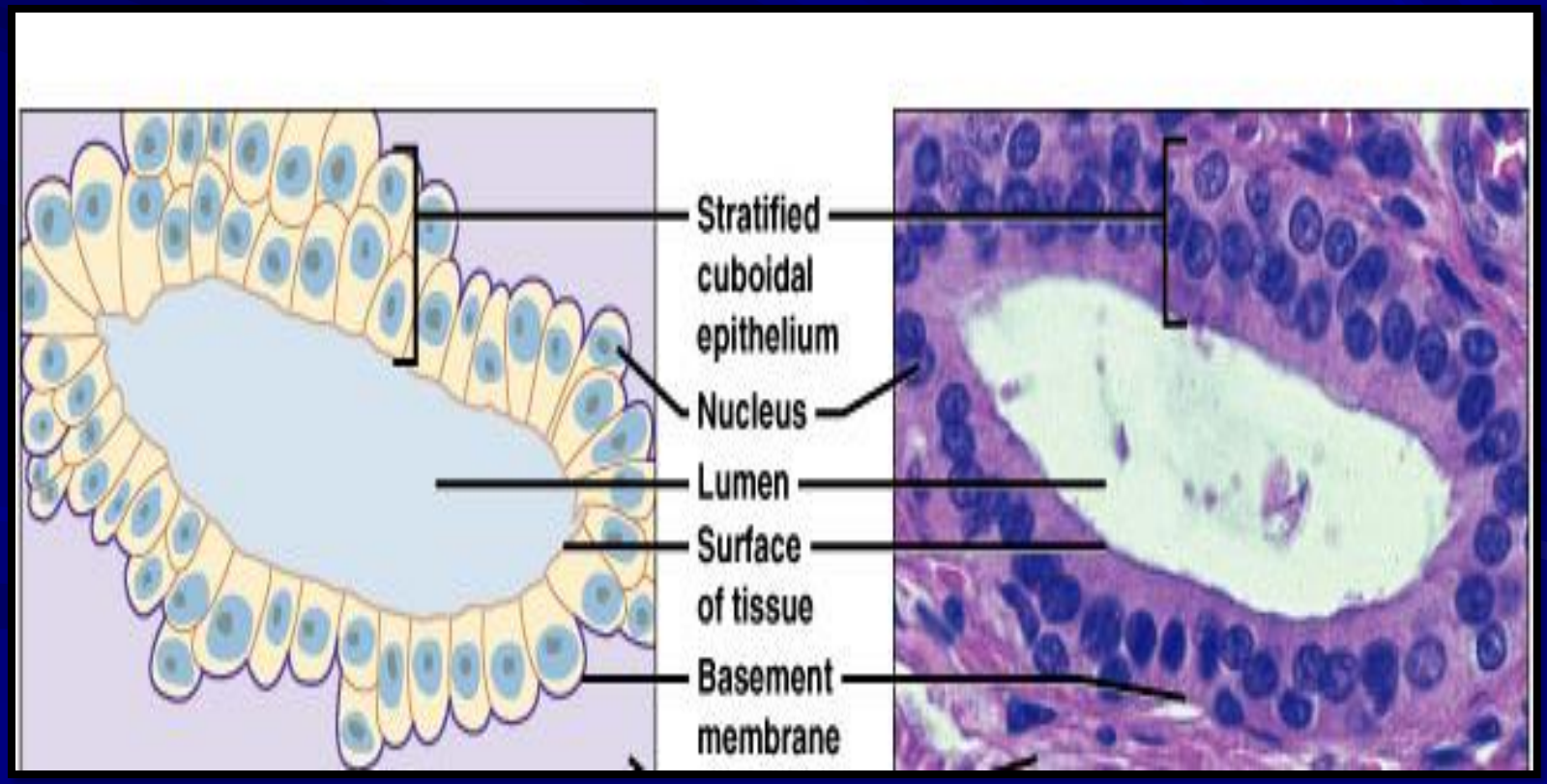
Stratified Squamous Epithelium T.

- Many layers of flattened cells
- Function, protection
- Outer layers of skin, linings of oral cavity, throat, vagina, and anal canal



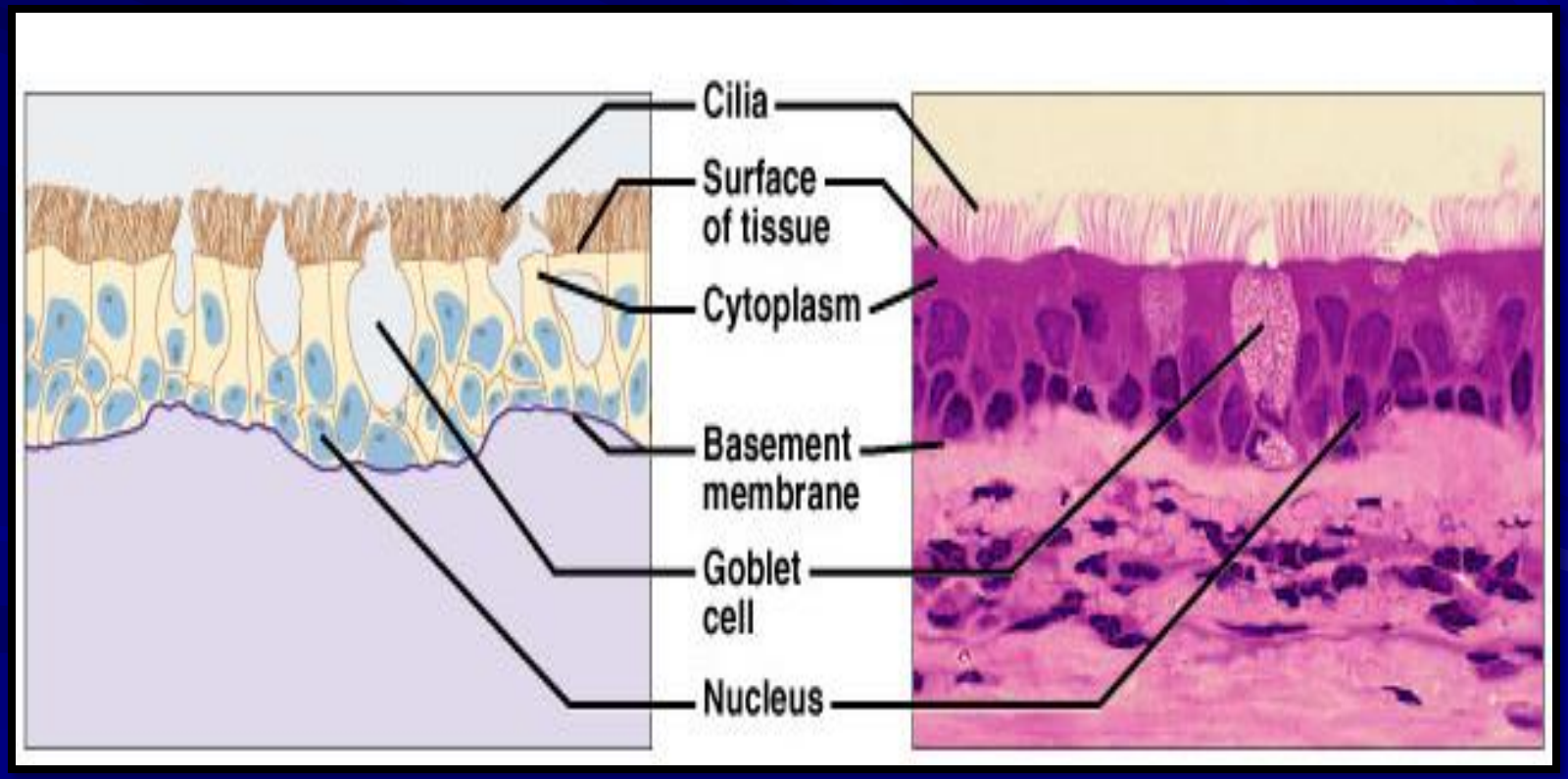
Stratified Cuboidal Epithelium T.

- 2 to 3 layers of cuboidal cells lining a lumen of the mammary glands, sweat glands, salivary glands, and pancreas.
- Function, Provide greater protection



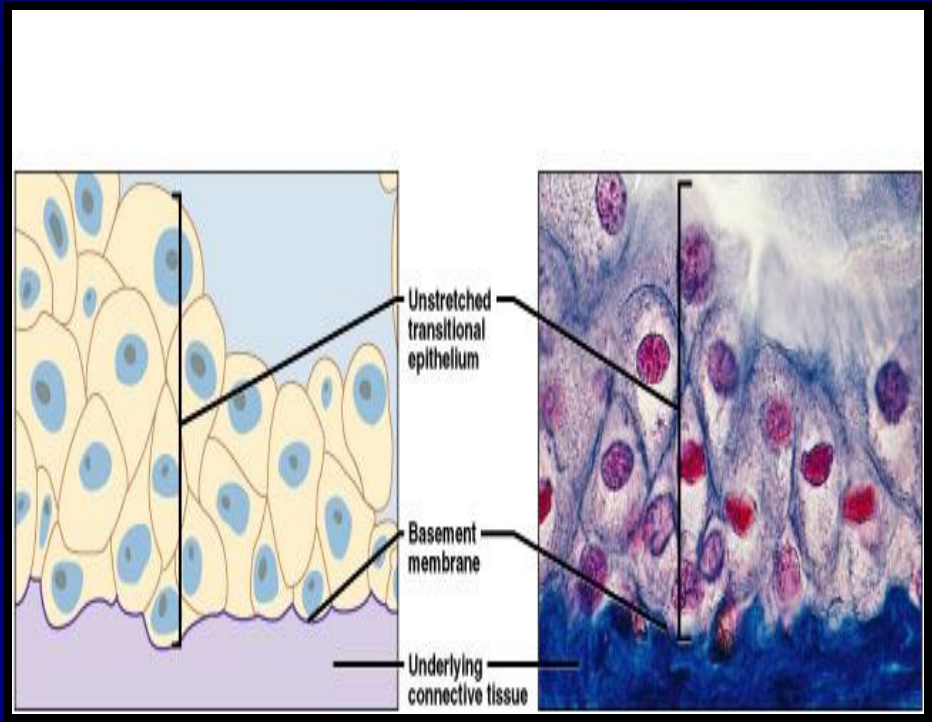
Pseudo stratified (ciliated)Columnar Epithelium T.

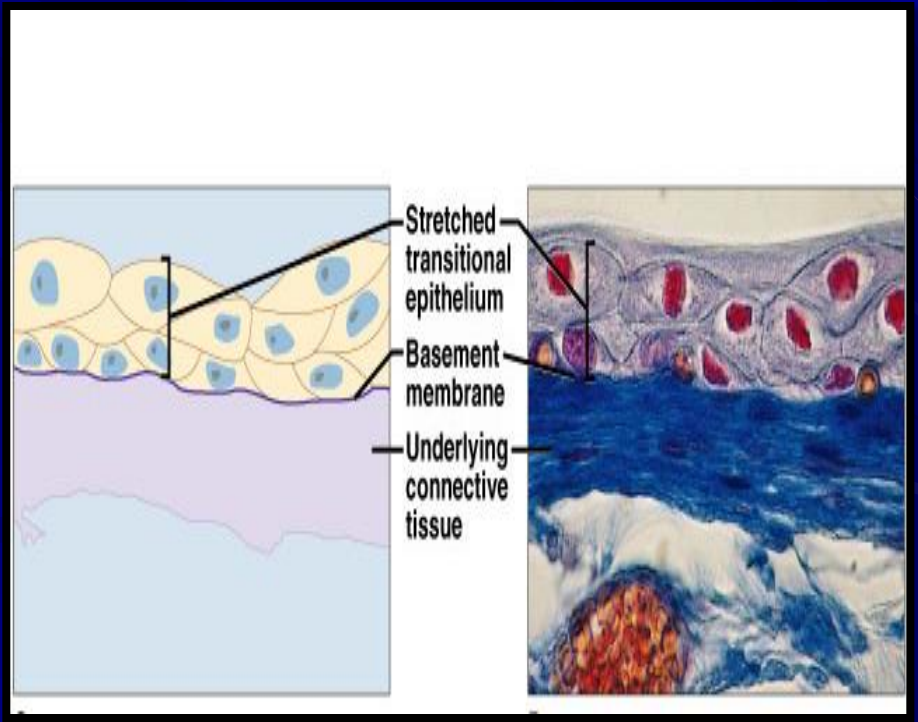
- "false layers", looks like there is more than one layer but are not truly layered. these cells appear layered due to the varying positions of their nuclei within the row of cells.
- Cilia may be present, along with mucus-secreting goblet cells.



Transitional Epithelium T.

- Tissues adjusts to various tensions because can be stretch
- Location, bladder, inner lining of urinary bladder and linings of the ureters
- Function, protection



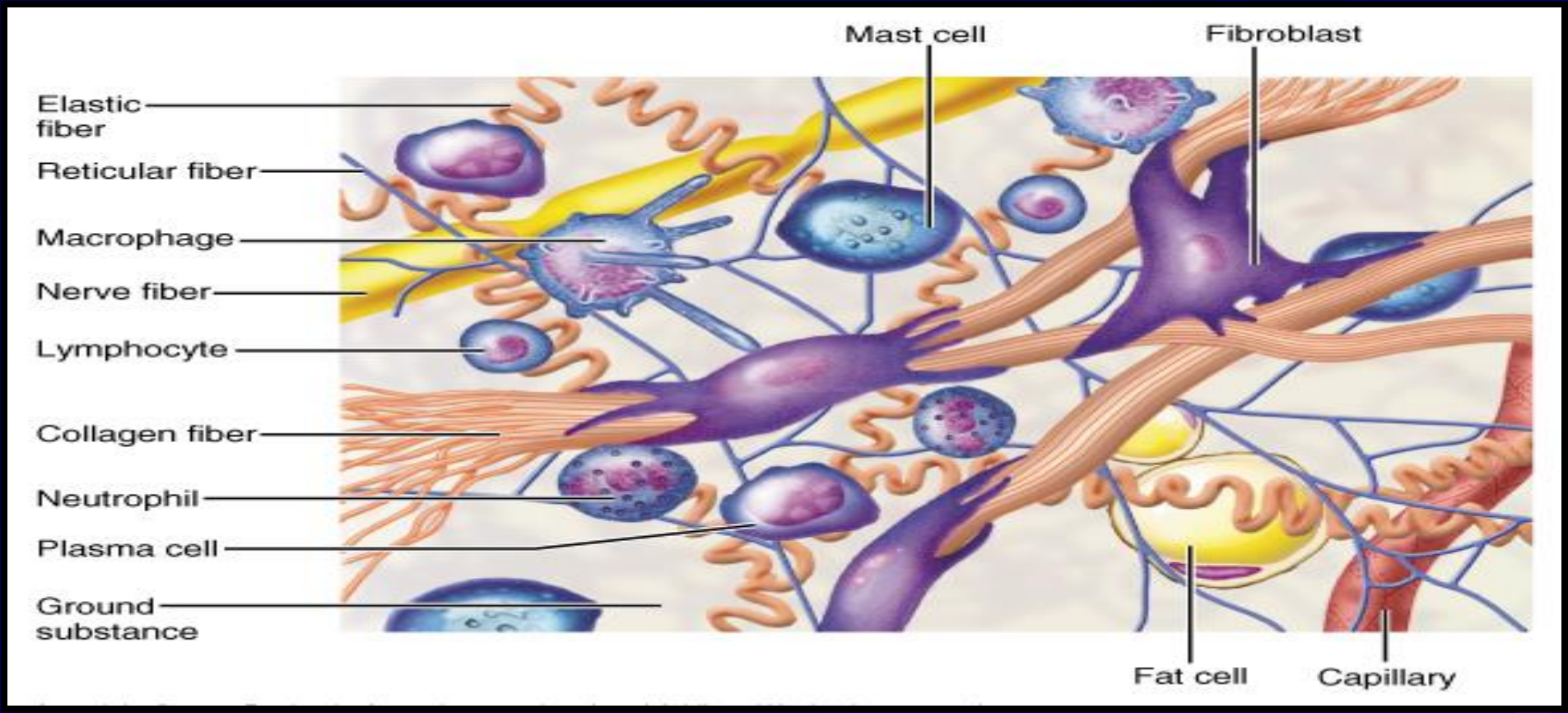


Glandular Epithelium Tissue

- One or more cells that make and secrete a product.
- Secretion = protein in aqueous solution: hormones, acids, oils.
- Glands Classified according to mechanism of secretions:

1. Endocrine glands
   - No duct, release secretion into blood vessels
   - Often hormones, Thyroid, adrenal and pituitary glands
2. Exocrine glands
   - Contain ducts, empty onto epithelial surface
   - Sweat, Oil glands, Salivary glands, Mammary glands.

Connective Tissue



Human Biology Lab. First Stage

College of Pharmacy Al Nahrain University

Connective Tissue

• Formed by three components: cells , fibers and ground substance Ex. of where found = tendons, ligaments surrounding organs, surrounds respiratory passageway

Functions of C.T.

1. Binding and Support
2. Protection
3. Movement
4. Immune Defense
5. Energy Storage
6. Mineral Storage
7. Heat Production

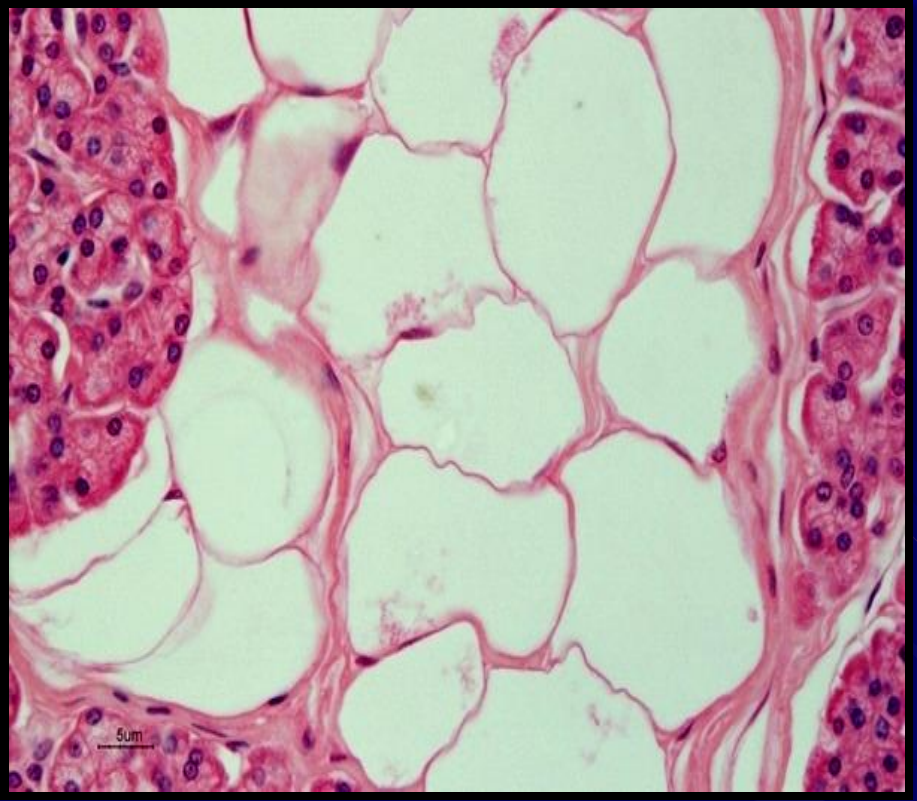
Connective tissue CELLS

- Fibroblasts

Fibroblasts are large, long, flat, branching cells with large light colored nuclei. Fibroblasts are the most abundant cells in connective tissue proper. They are responsible for production and maintenance of fibers and ground substance.

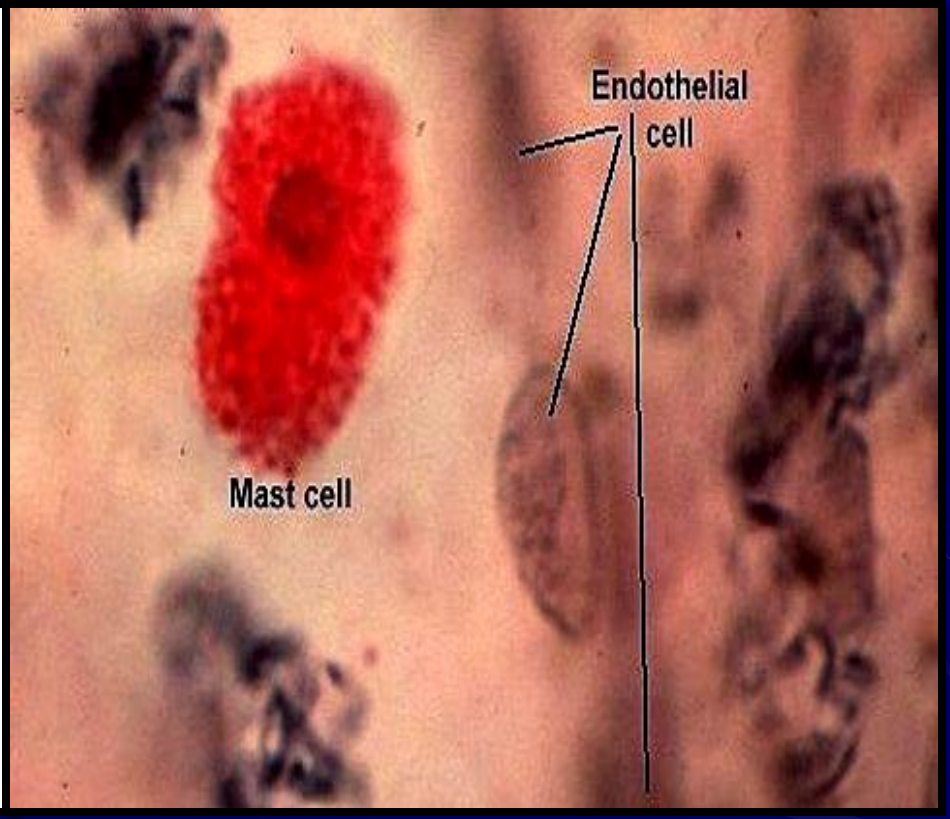
- Fat cells (Adipocyt)

Fat cells, also called **adipose cells**, synthesize and store fats. A mature adipose cell accumulates so much fat that the nucleus and cytoplasm are pushed to the sides of the cell.



Mast Cells

Mast cells are relatively large cells with irregular shapes and small pale nuclei. They are often found near blood vessels. Their cytoplasm is crowded with dark staining secretory granules. These granules contain heparin (a compound that prevents blood from clotting as it circulates throughout the body) and histamine (a compound that initiates the inflammatory response and allergic reactions.



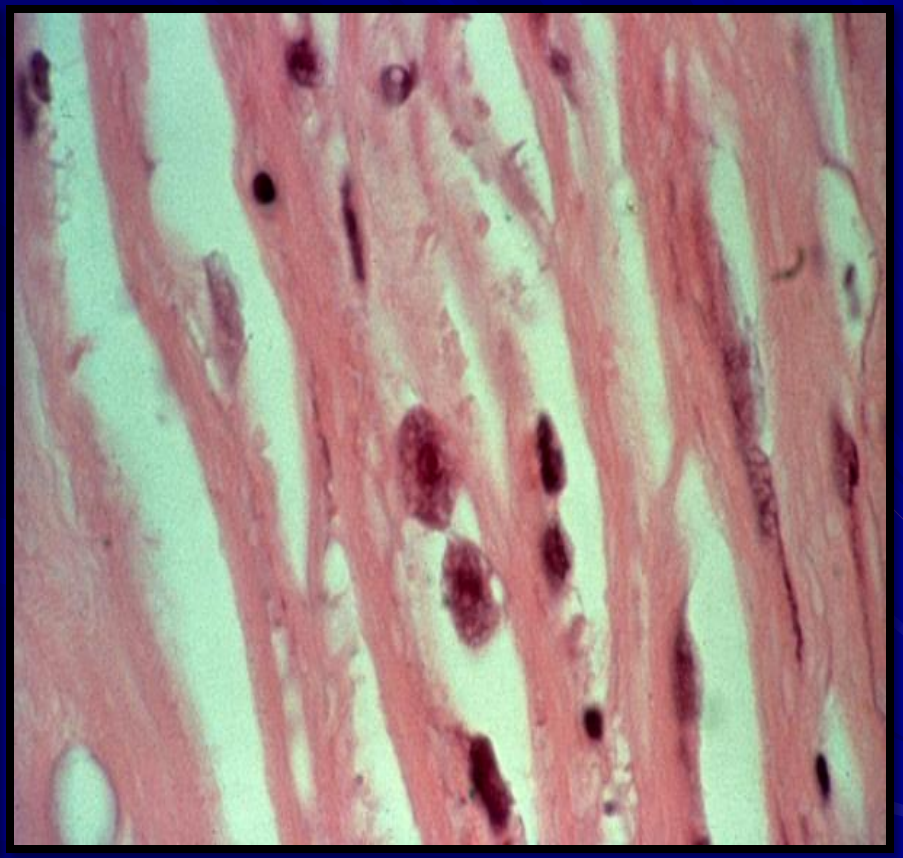
❖ Plasma Cells

Plasma cells are a specific type of white blood cell. Plasma cells are oval-shaped and have a large, dark nucleus located off center. They are the main producers of antibodies that help defend the body against infection and cancer.

Connective tissue FIBERS

- Collagen (white) Fibers Found in tendons and ligaments

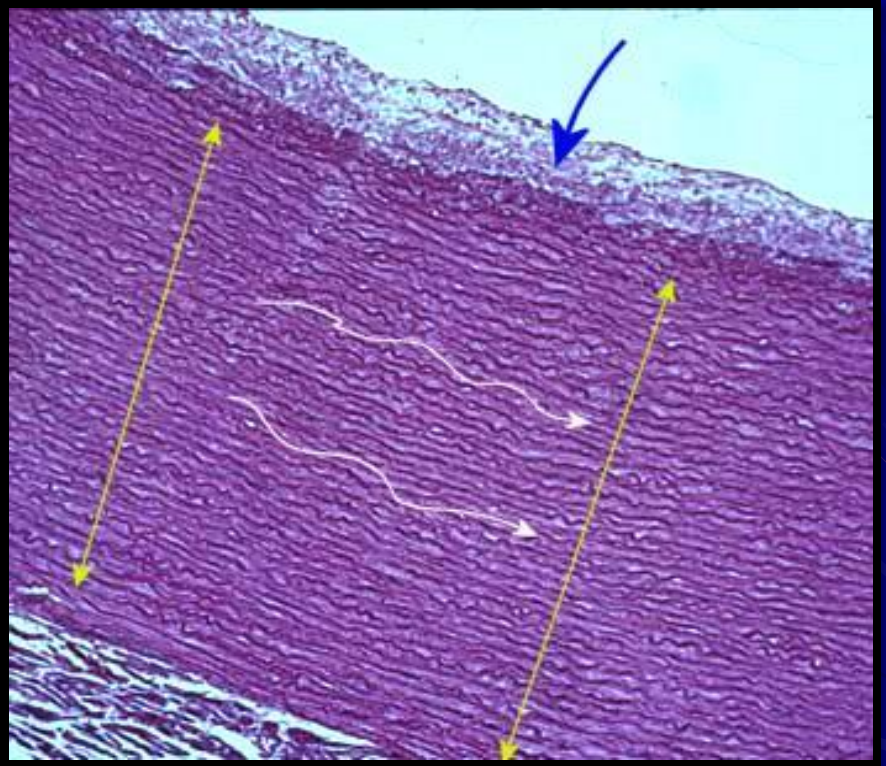
Collagen (collagenous) fibers are composed of the protein collagen. These fibers are thick, sturdy, strong, flexible, and unstretchable. They are the most common type of fiber found in connective tissue. They appear blue or pink when stained.



Connective tissue FIBERS

- Elastic (yellow) Fibers
  - Rare but important, Found between vertebrae and aorta

Elastic fibers are composed of the protein elastin. These fibers stretch easily and appear wavy, curly, and black.



Connective tissue
GROUND SUBSTANCE

- **Loose Connective Tissue**
  - (Areolar) Loose Connective Tissue
  - (Reticular) Loose Connective Tissue
- **Dense Connective Tissue**
  - Regular Connective Tissue
  - Irregular Connective Tissue

Specialized Connective Tissue CARTILAGE

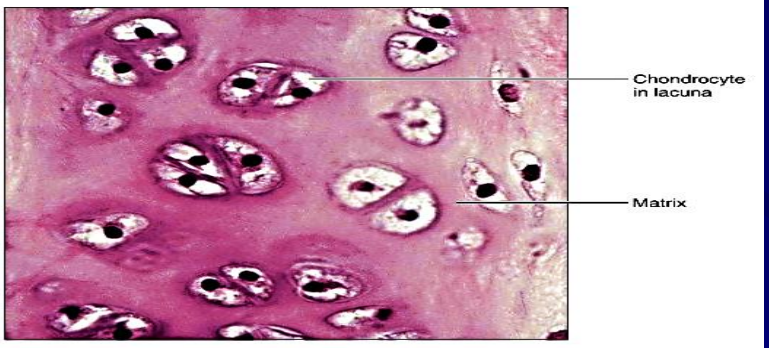
A ground substance surrounding chondrocytes (cartilage cells) called matrix, matrix is like gel, 3 types:

- **Hyaline:** flexible material – between ribs and the sternum
- **Elastic:** more flexible material – outer ear, epiglottis and tip of nose
- **Fibro cartilage:** tough flexible material –between intervertebral disc

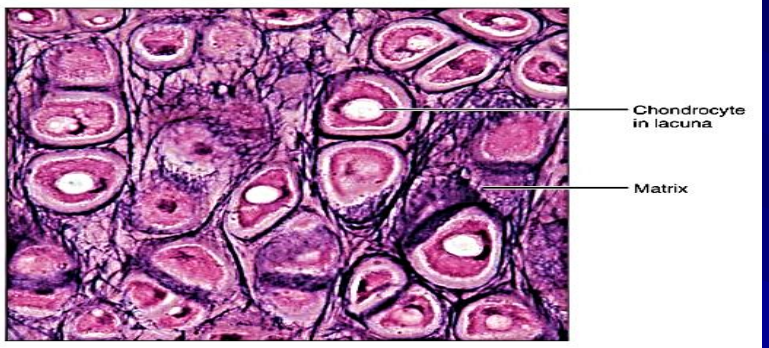
Specialized Connective Tissue BONE

A matrix is rigid because of calcification and contains osteocytes, 2 types:

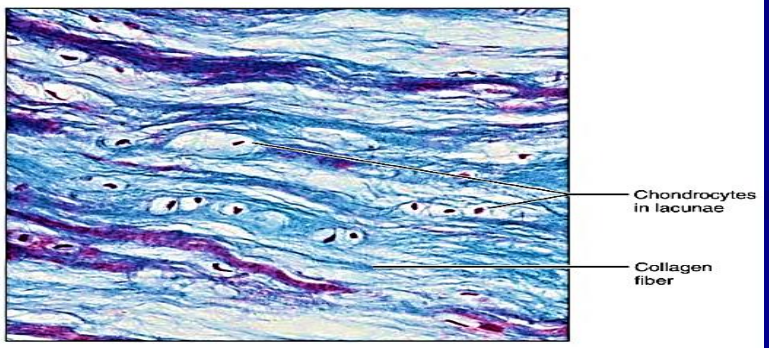
- **Compact Bone:** is formed of haversian system - outer surface of the bone.
- **Sponge Bone:** it has no haversian system - inner region of flat bones.



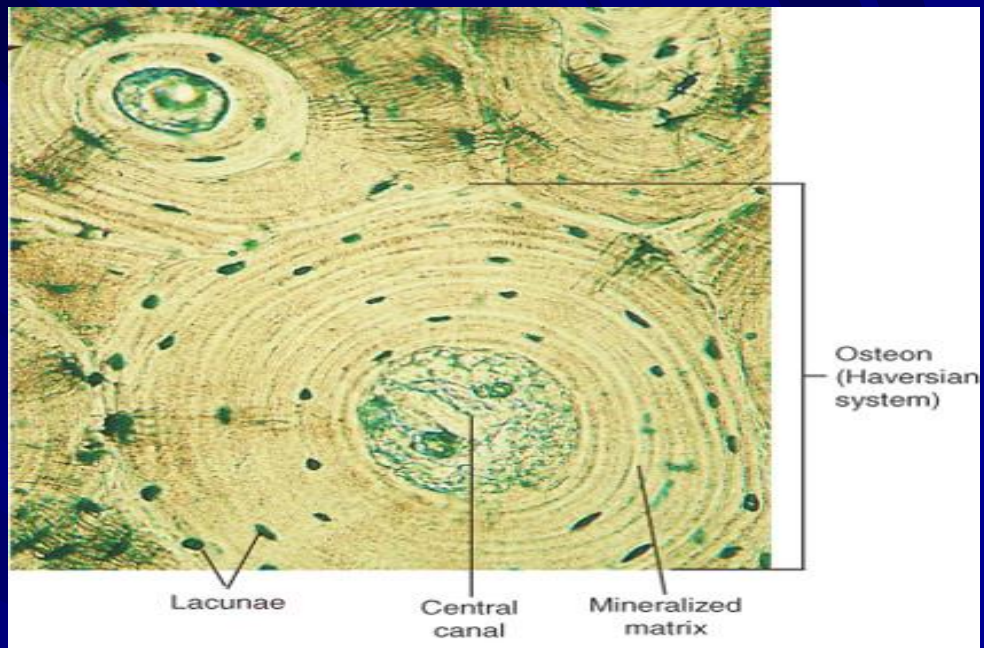
Photomicrograph: Hyaline cartilage from a costal cartilage of a rib (470×).

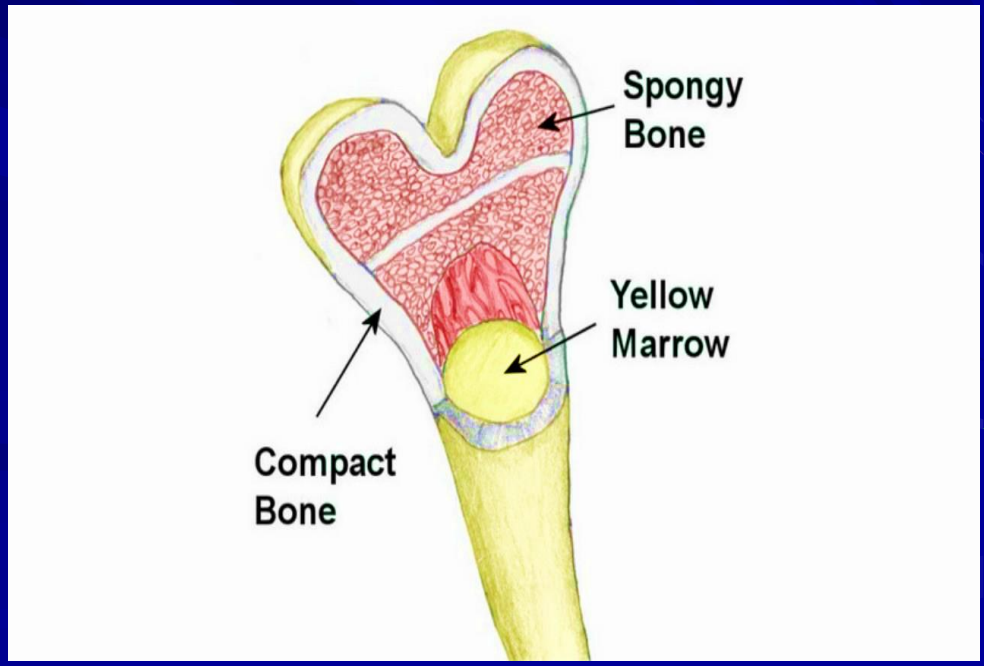


Photomicrograph: Elastic cartilage from the human ear pinna; forms the flexible skeleton of the ear (800×).

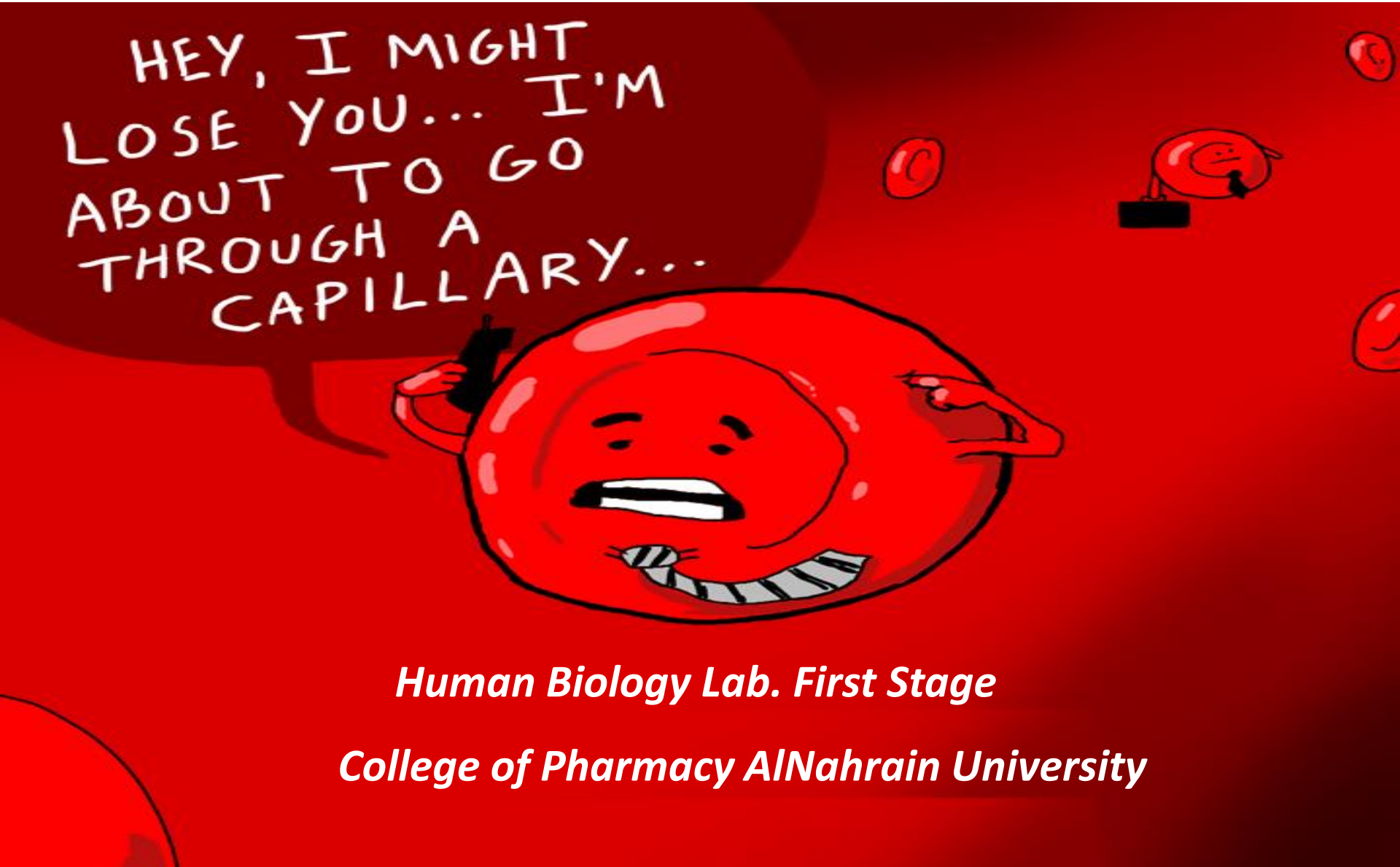


Photomicrograph: Fibrocartilage of an intervertebral disc (125×). Special staining produced the blue color seen.





BLOOD



Human Biology Lab. First Stage

College of Pharmacy AlNahrain University

Blood

The Blood is a specialized form of connective tissue consisting of formed elements (blood cells) and a fluid intercellular substance (plasma).

Blood Elements

1- Erythrocytes (RBCs):

- Biconcave disc shape and when observed on a flat have a circular outline.
- RBCs is composed of a lipid and protein colloidal complex basically hemoglobin which is responsible for the color of the RBCs.

2- Leukocytes (WBCs):

They are nucleated with an average of 5000-9000 cells per cu mm in normal human blood.

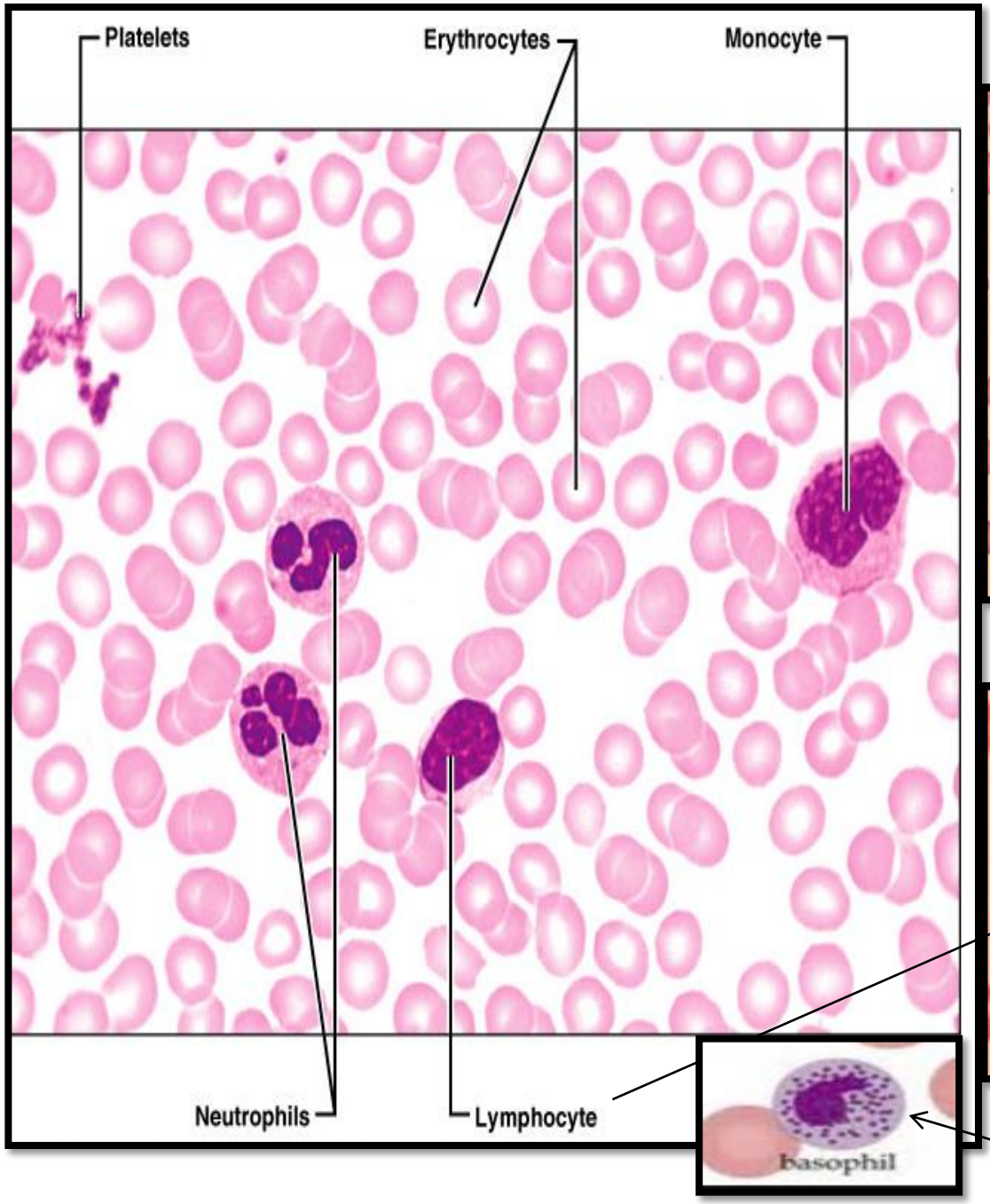
A/ A granular WBCs: contain homogenous cytoplasm and spherical nuclei, they include lymphocytes and monocytes.

B/ Granular WBCs: contain abundant specific granules cytoplasm and possess nuclei variation in shape, they include neutrophils, eosinophils and basophils.

3- Blood Platelets (Thrombocytes):

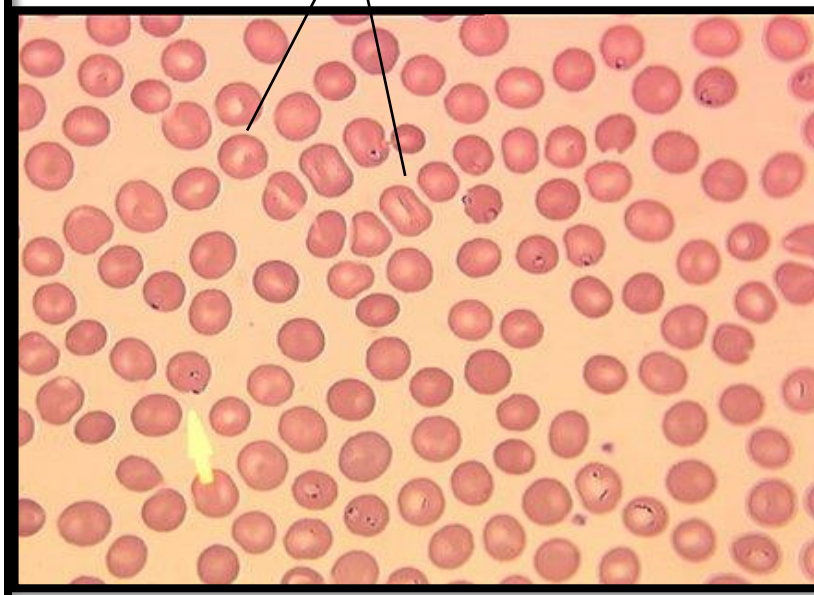
- Small protoplasmic discs (2-4 µ diameter).
- Their number varies from 200,000 to 300,000 per cu mm blood.
- The life time of each platelets about 10 dayes.
- Play an important role with blood clotting.

1

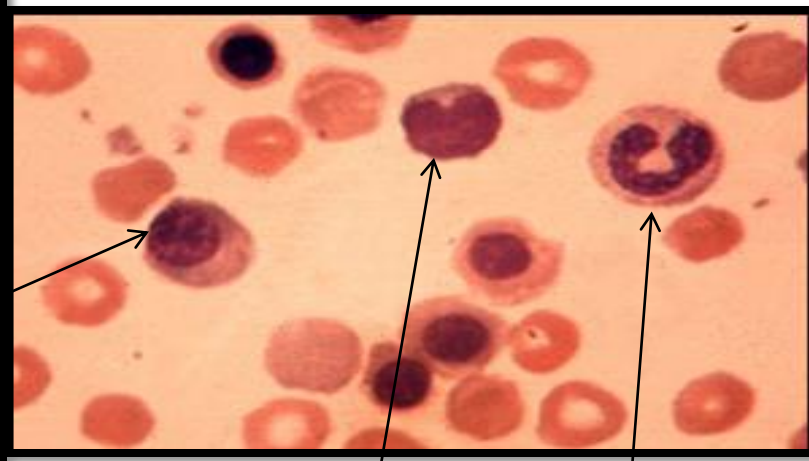


2

Erythrocytes



3



Plasma:

It is 55% of blood constitutes, a homogenous alkaline fluid contain nutritive substances derived from digestive system, the waste substances produced in tissues, hormones, dissolved gasses, inorganic salts, protein, carbohydrates, lipids and other certain organic substances.

Lymph:

Fluid that is collected from the tissues and returned to the blood stream. No cellular elements within the lymph of the lymph vessels.

Blood functions

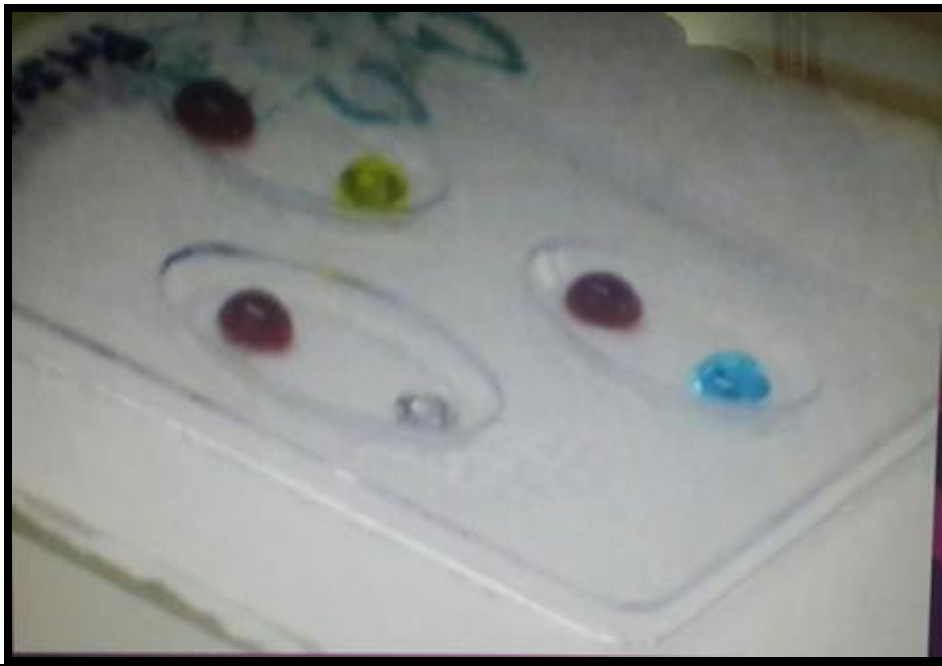
1- Respiration of body.
2- Waste elimination.
3- Immune defense.
4- Water balance.
5- Nutrition.
6-Thermoregulation.
7- Acid-base balance.
8- Internal communication.

ABO Blood Groups

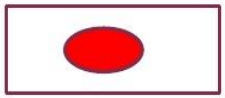
Blood Type	Cell Antigen	Serum Antibodies	Donor
A	A	B	A or O
B	B	A	B or O
AB	AB	None	All
O	None	A and B	O

Rh group


BIOTEC LABORATORIES LTD
Anti-A, B, D
(IgG+IgM) CErytec KIT
2°C
8°C
0843
REF: 1/060CE
VOL: 3 x 10ml
LOT:

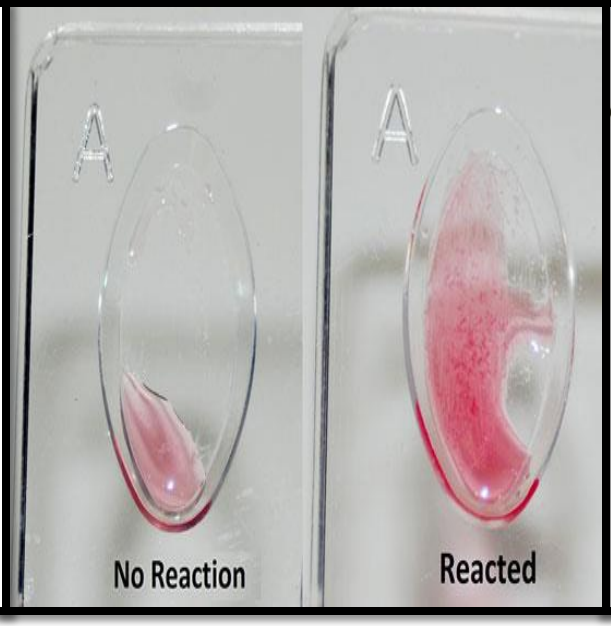


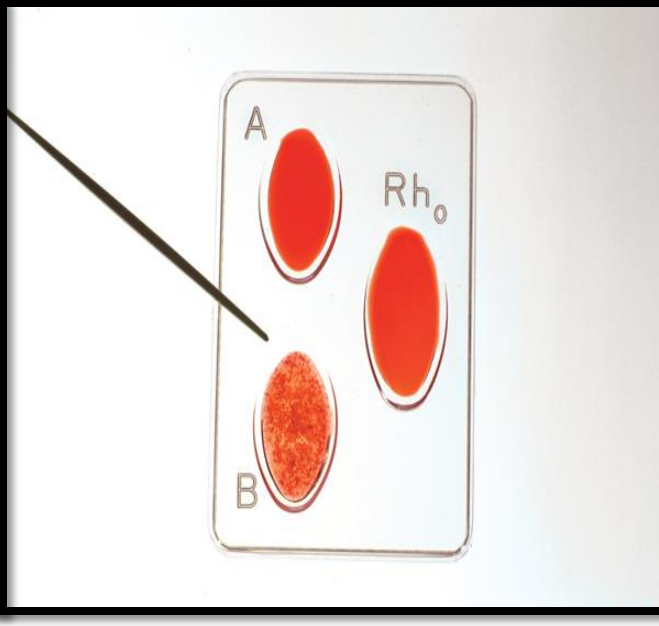
Rh typing



Rh Negative
(No agglutination)

Rh Positive
(agglutination)

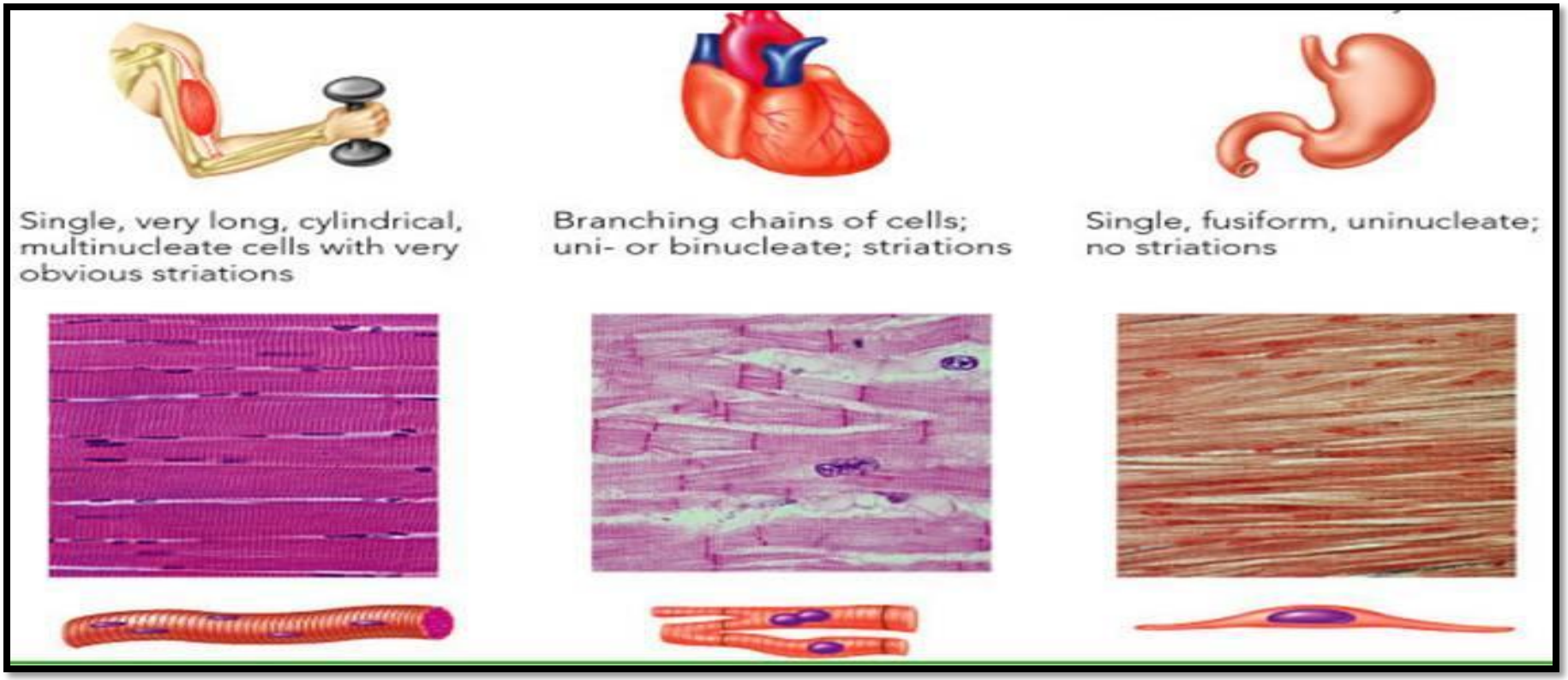




How to Read your Results

Anti-A	Anti-B	Anti-D	Blood type
			A^+
			B^+
			AB^+
			O^-

Muscular Tissue



Human Biology Lab. First Stage

College of Pharmacy Al Nahrain University

Origin and Function of the Muscular Tissue

- The origin of muscular tissue from mesodermal germ layer.
- The muscular tissue involves contractility and elongation because of this the cell are often referred to as muscle fibers.
- The muscles are responsible for the movement of the body either partial movement or whole movement.

Basic Element of the Muscular Tissue

1- Muscle fibers.

2- Rich network of capillaries and blood vessels.

3- Connective tissue participating in transmission of contraction.

Muscular Tissue Morphology

Muscular tissue has very long cells, their length range from (1-40 mm) for this reason these cells are called muscle fibers.

Types of Muscular Tissue

1- Skeletal Muscle

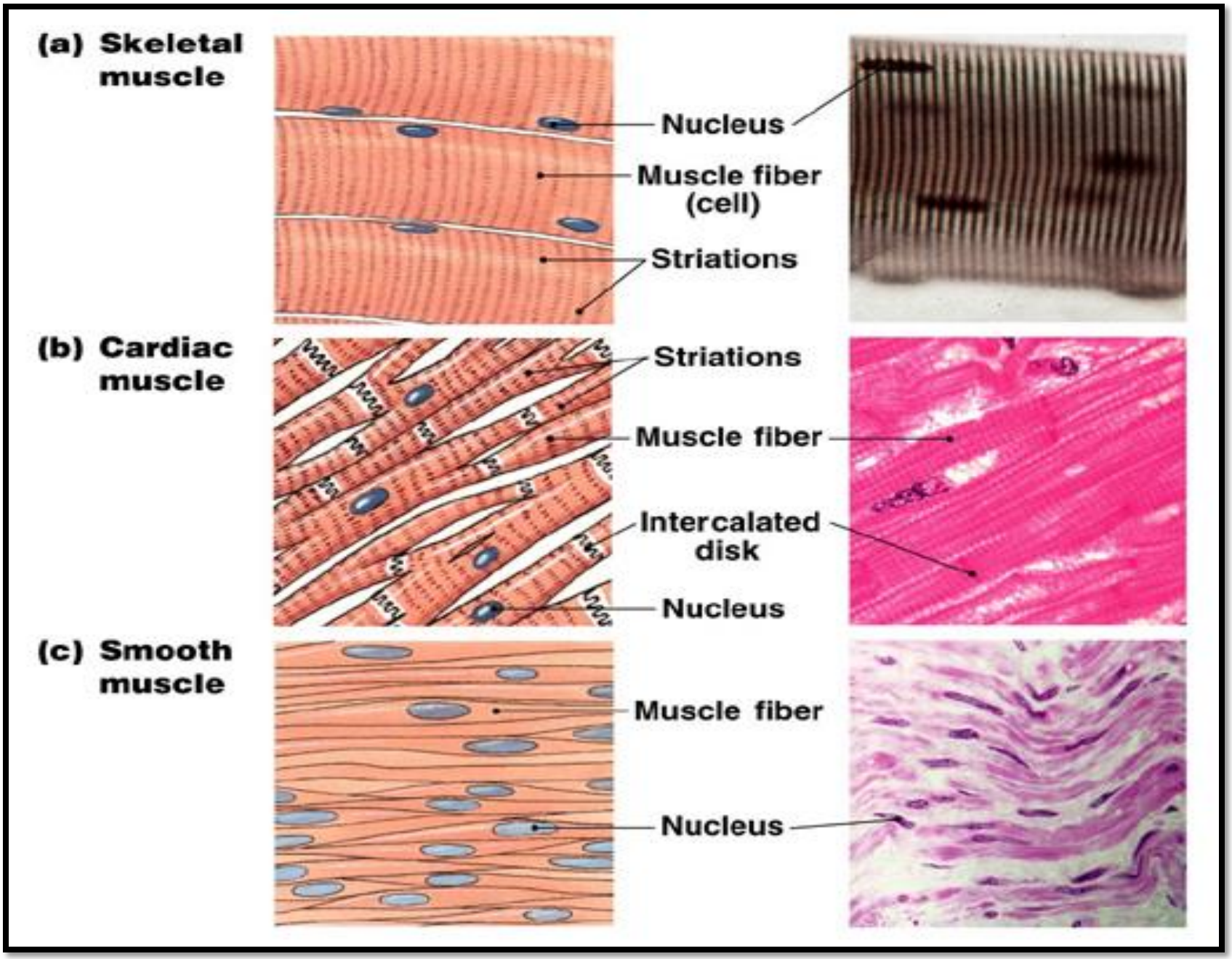
- long cylindrical multinucleated stratified cell.
- The location of this muscle is attached to bones.
- This muscle enables us to move our arms & legs.

2- Cardiac Muscle

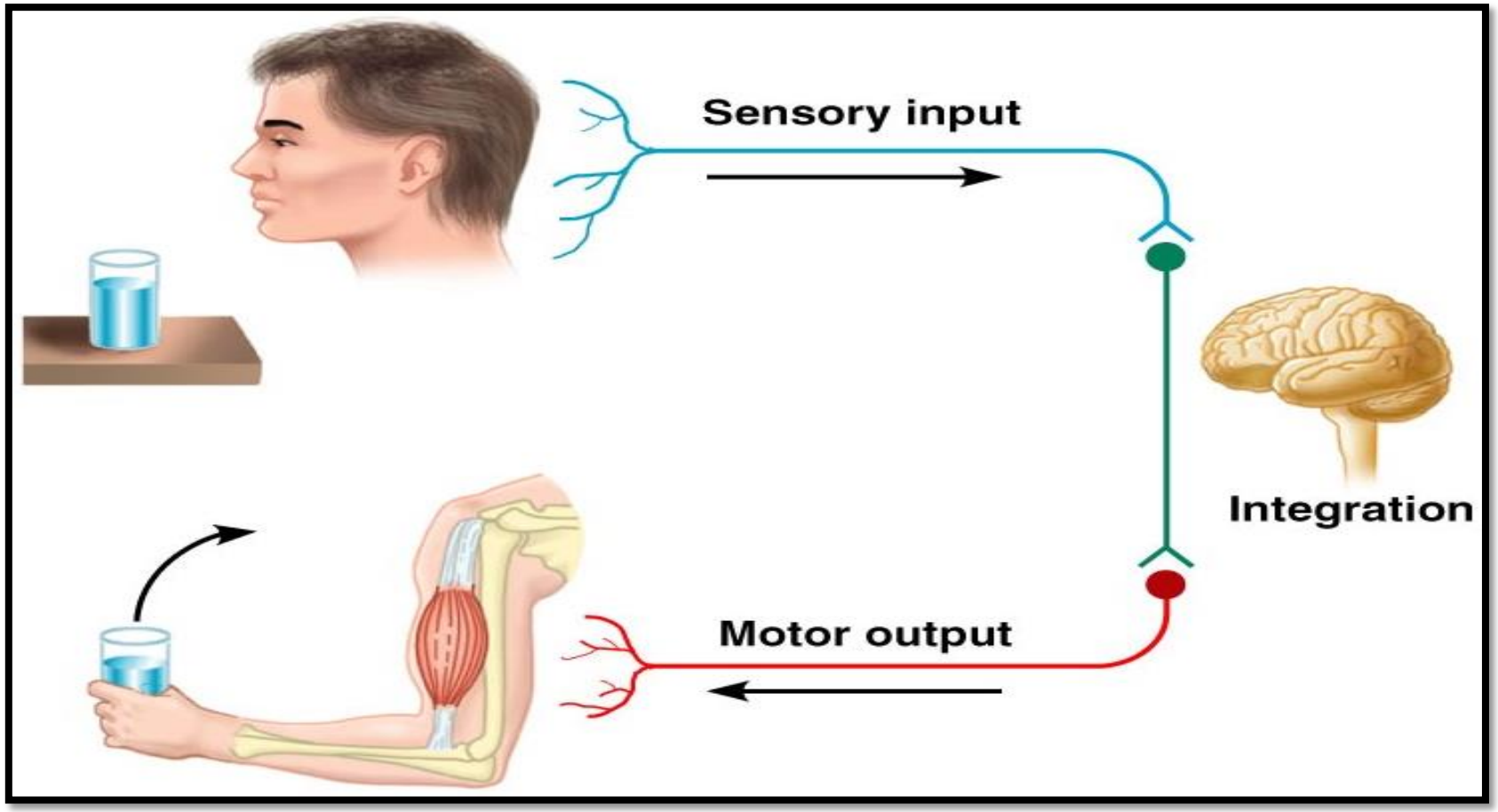
- Branch involuntary uninucleated stratified cell.
- The location of this muscle is the heart walls.
- This muscle contain specialized junctions called (intercalated discs).

3- Smooth Muscle

- Spindale shaped involuntary cell with central nuclei.
- The location of this muscle in stomach organ.
- Cells are arranged to form sheets no stratified.


(a) Skeletal muscle
Nucleus
Muscle fiber (cell)
Striations
(b) Cardiac muscle
Striations
Muscle fiber
Intercalated disk
Nucleus
(c) Smooth muscle
Muscle fiber
Nucleus

Nervous Tissue



Human Biology Lab. First Stage

College of Pharmacy Al Nahrain University

Nervous System

- This system is composed of 2 kinds of cells:

1. Neurons or nerve cells: are the functional unit of the nervous system.
2. Neuroglia or glia or neurological cells: are supportive and nutritive cells.

Locations

1. Central nervous system (CNS)
   - Brain and spinal cord
   - Integration and command center
2. Peripheral nervous system (PNS)
   - Nerve fibers and ganglia
   - Carries messages to and from the spinal cord and brain

Functions

General Functions of Neurons:

- The nervous system receives stimuli from outside or inside and transfers them towards highly specified central parts (brain and spinal cord).

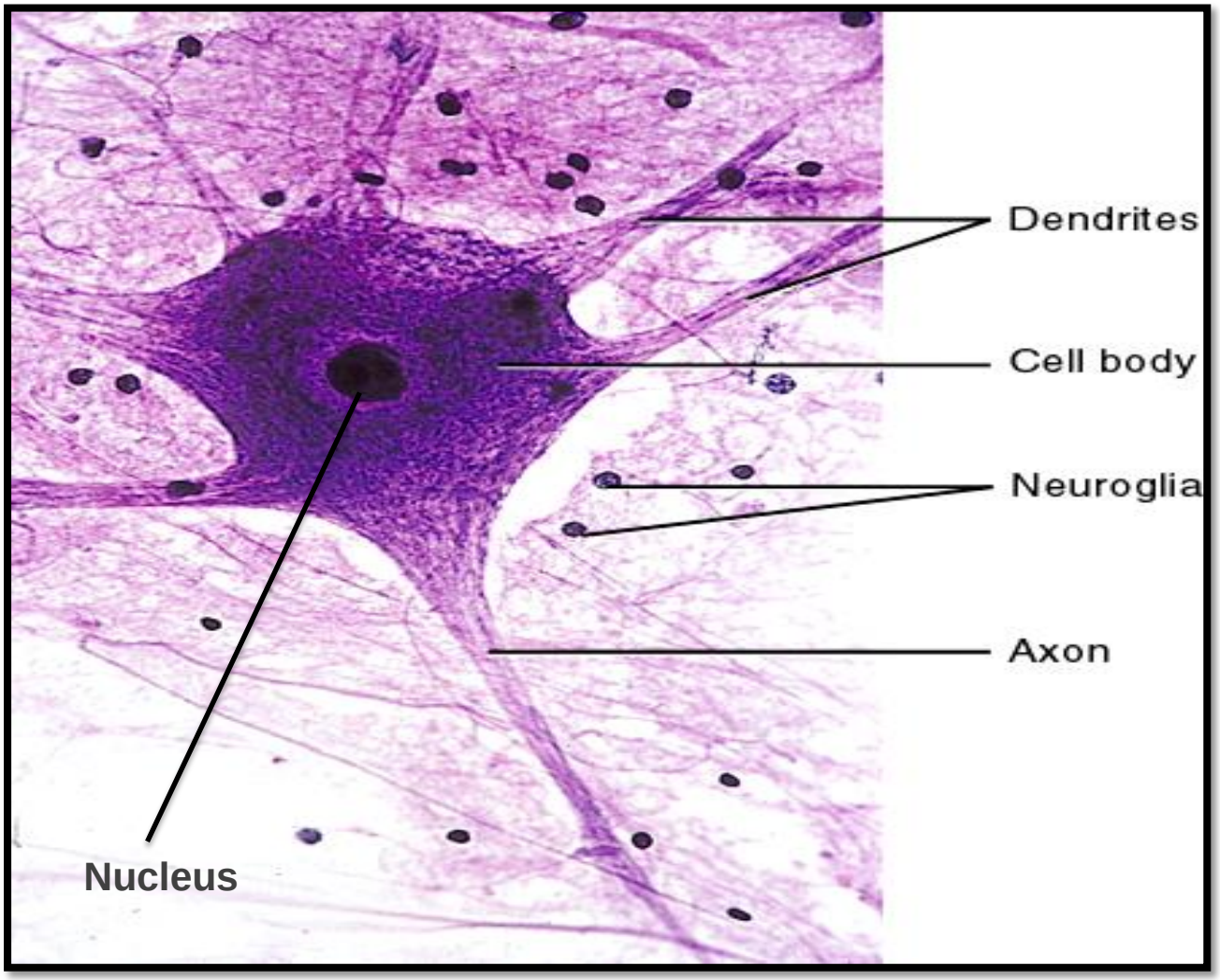
Specific Functions of Neurons:

- Sensory (afferent) — transmit impulses toward the CNS
- Motor (efferent) — carry impulses toward the body surface
- Interneuron's (association neurons) — any neurons between a sensory and a motor neuron

Neurons (Nerve Cells)

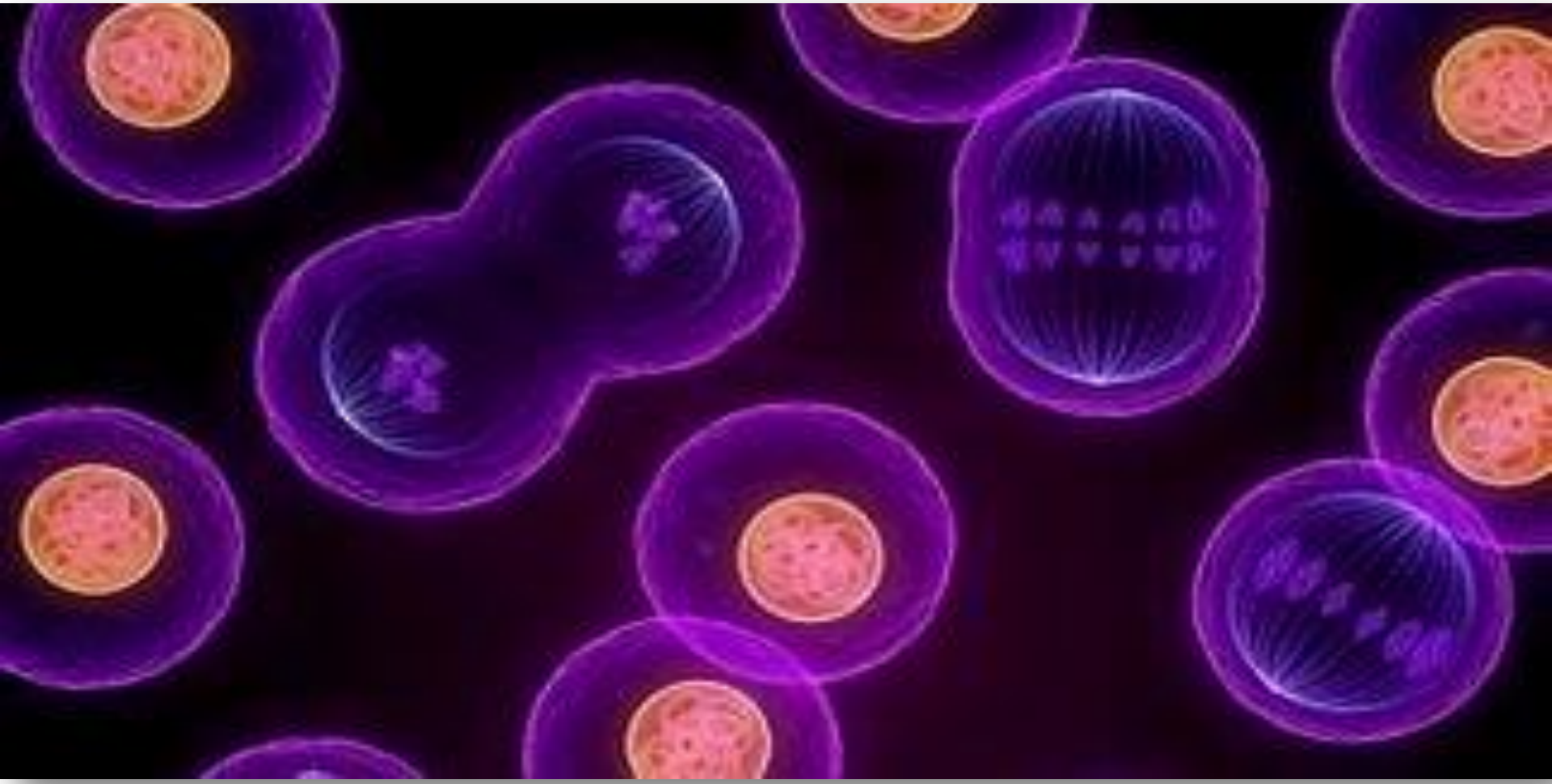
- Composed of 3 components:

1) **Cell body** is called perikaryon; it usually contain large nucleus surrounded by nissl bodies and neuro fibrils in the cytoplasm.
2) **Axon** is a single elongated extension of the cytoplasm, function transmits impulses away from the dendritic zone.
3) **Dendrites** function receiving signals from receptors and play an important part in integration of the formation.



Nerve Cell

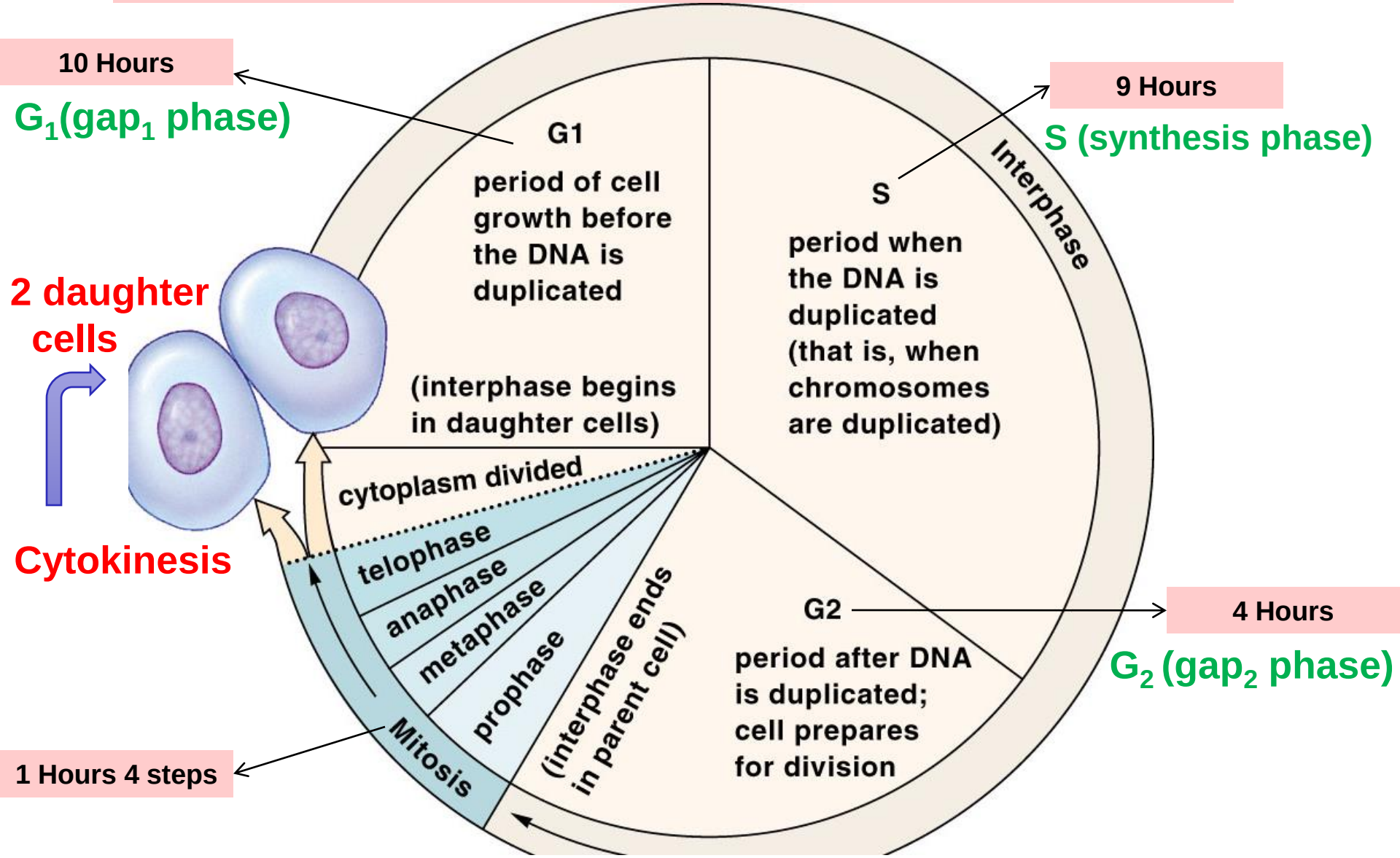
Cell Divisions



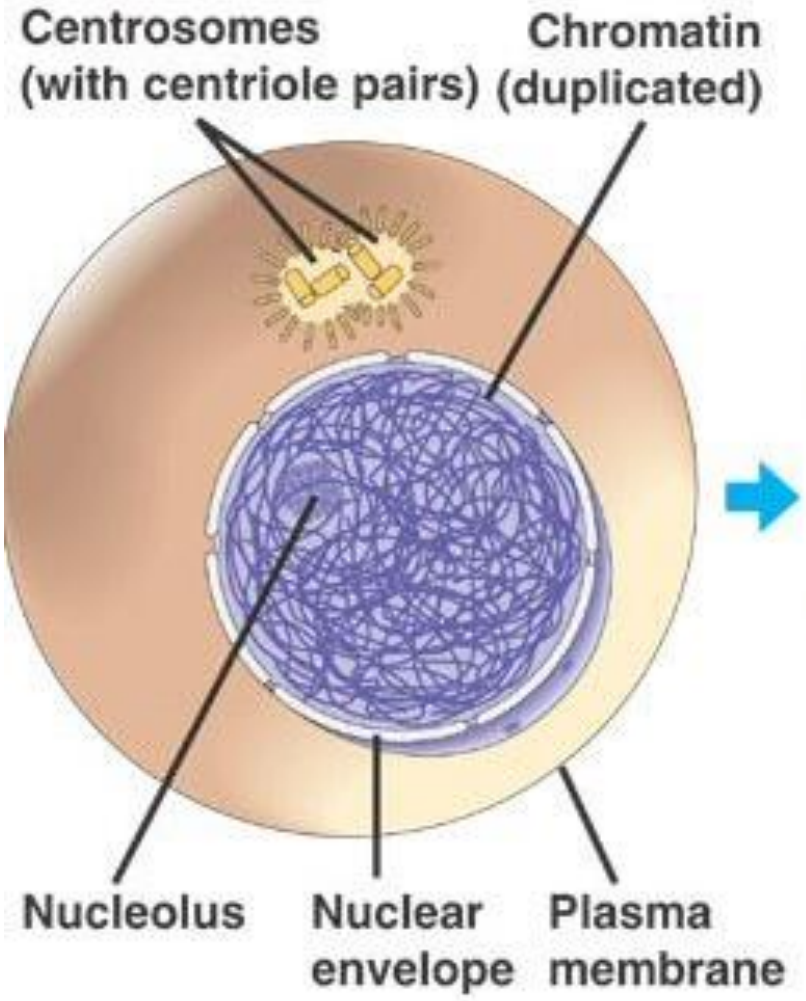
Human Biology Lab. First Stage

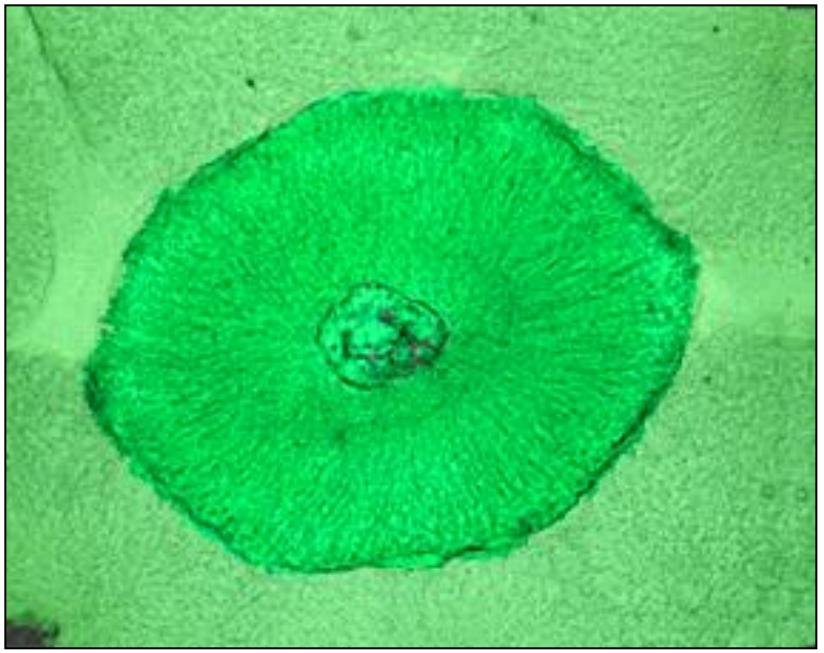
College of Pharmacy Al Nahrain University

Scheme illustrate Cell Cycle



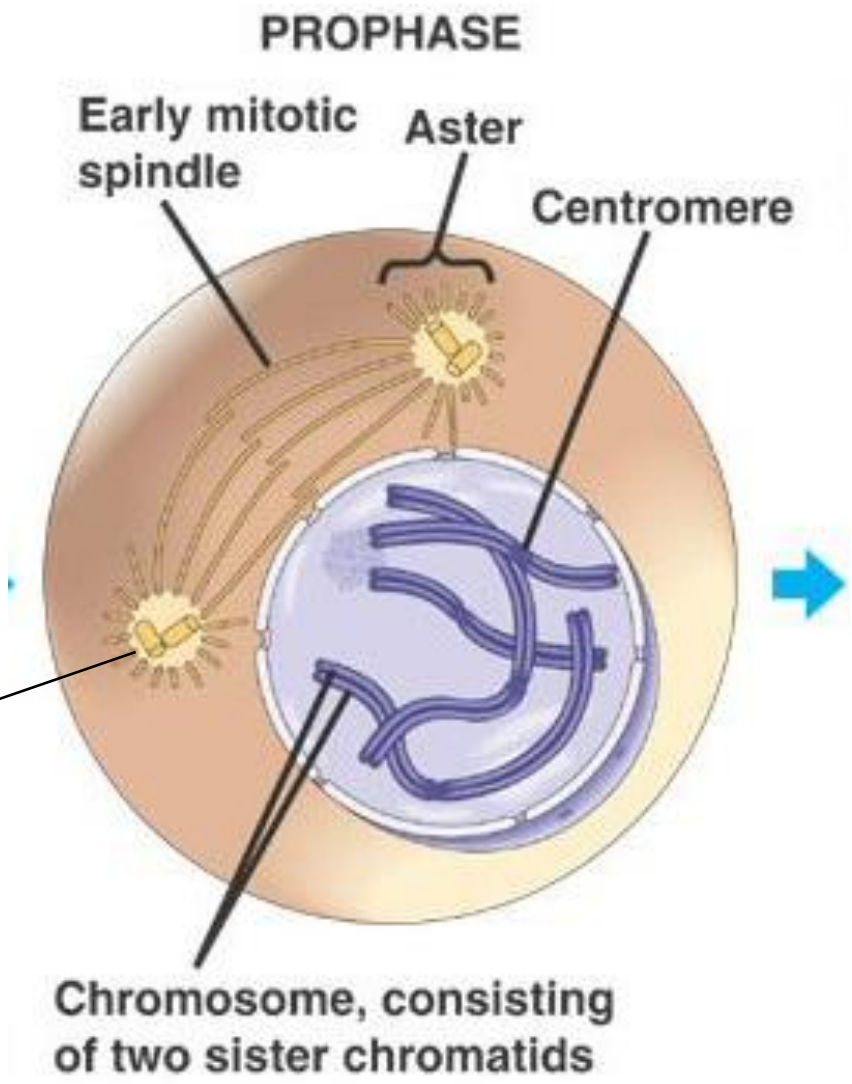
Interphase


Centrosomes
(with centriole pairs)
Chromatin
(duplicated)
Nucleolus
Nuclear
envelope
Plasma
membrane



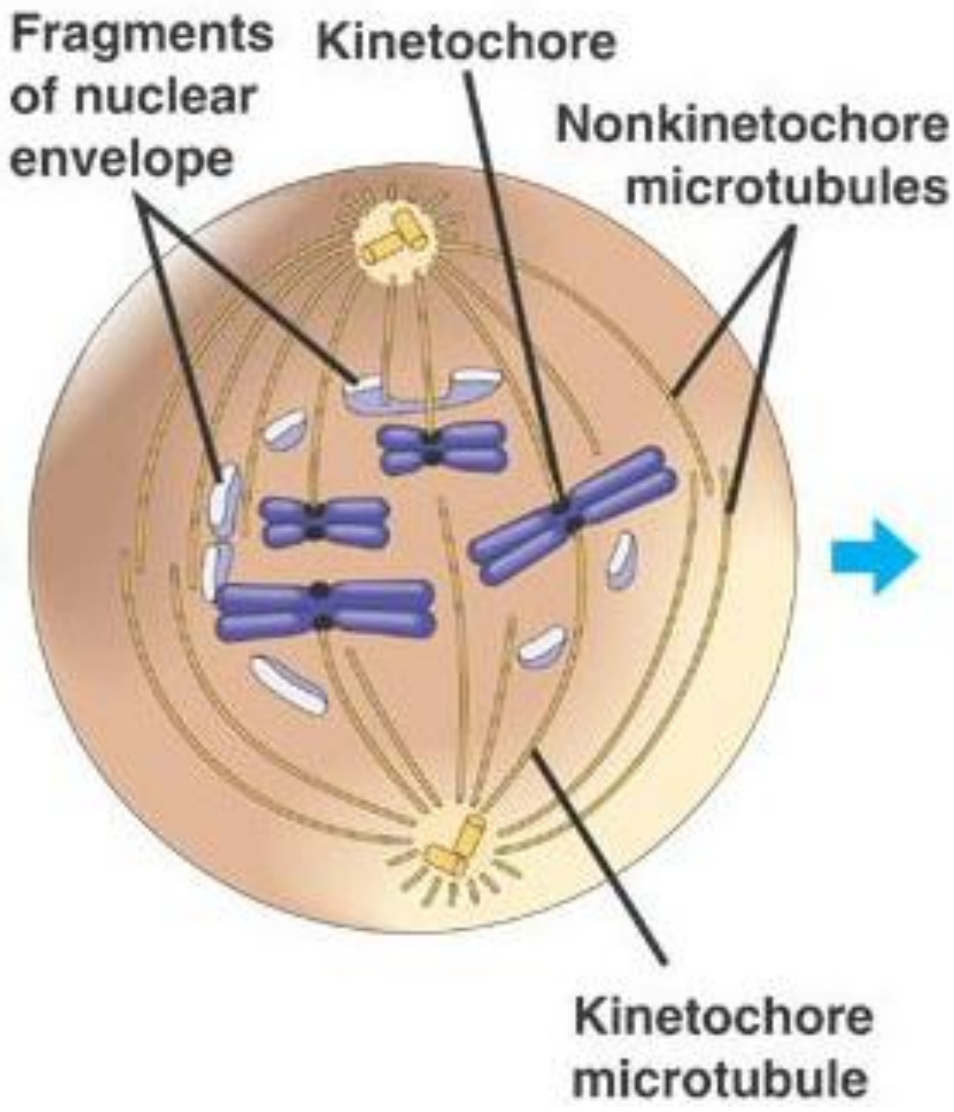
Mitosis → Prophase

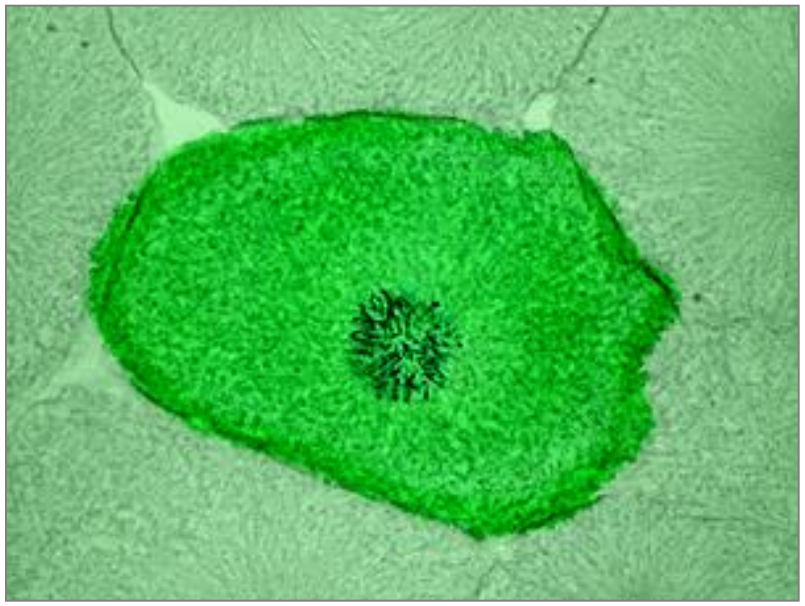
Early



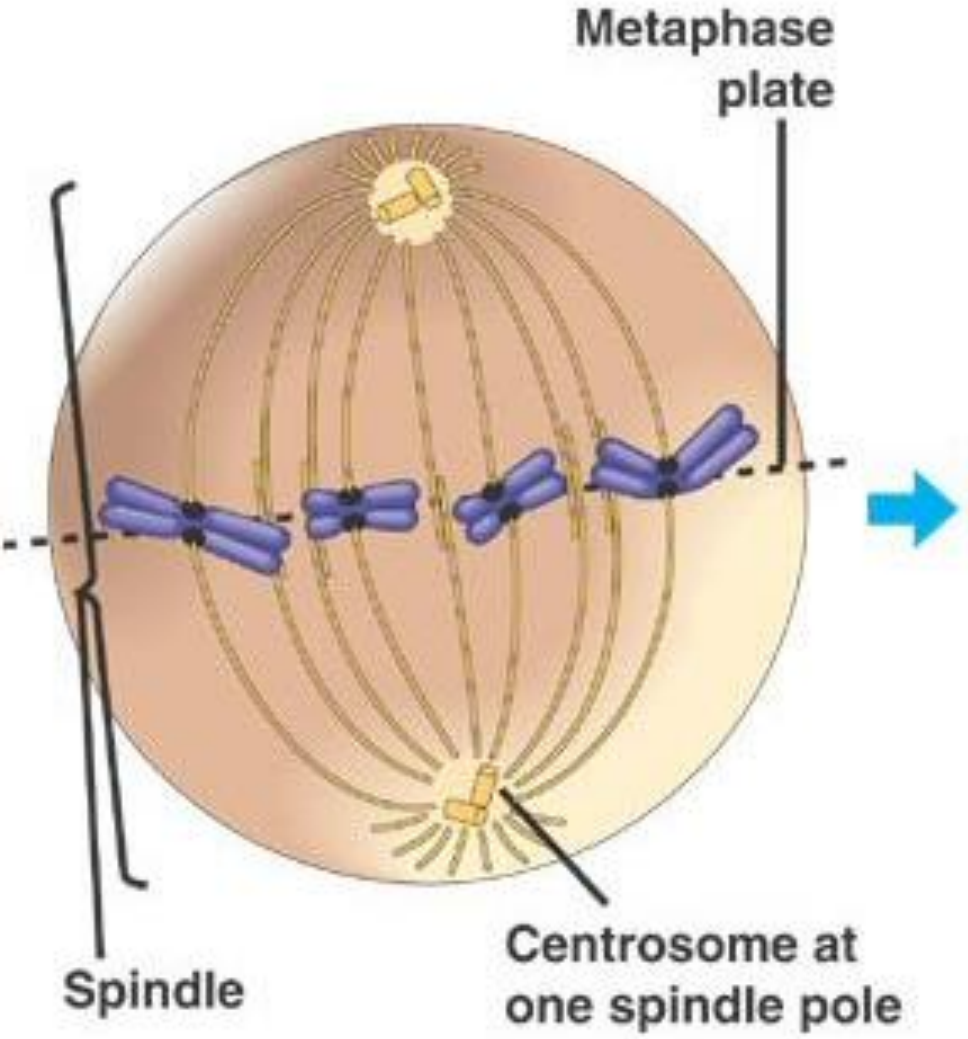
Prophase

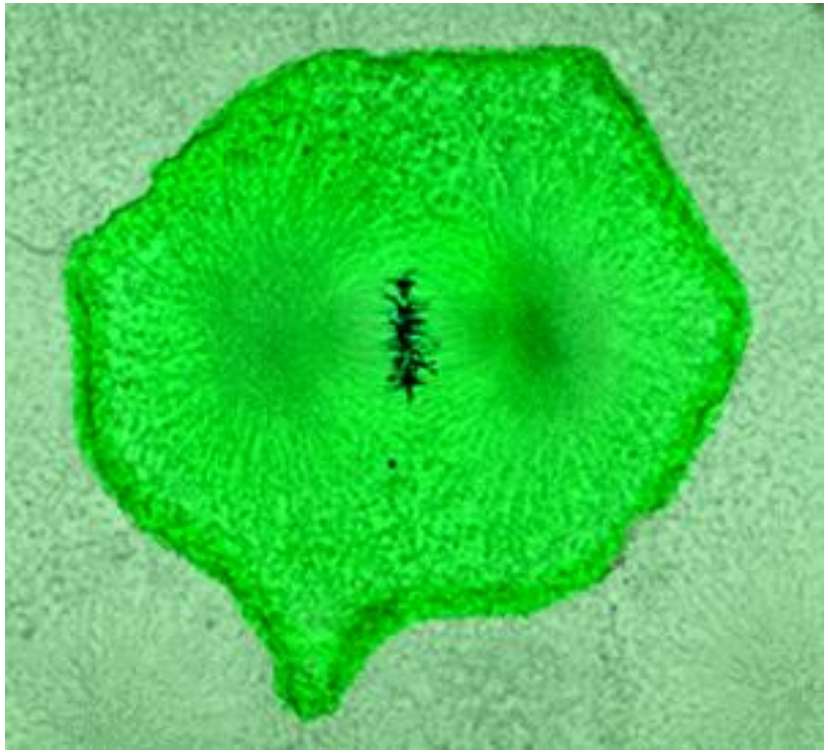
Late



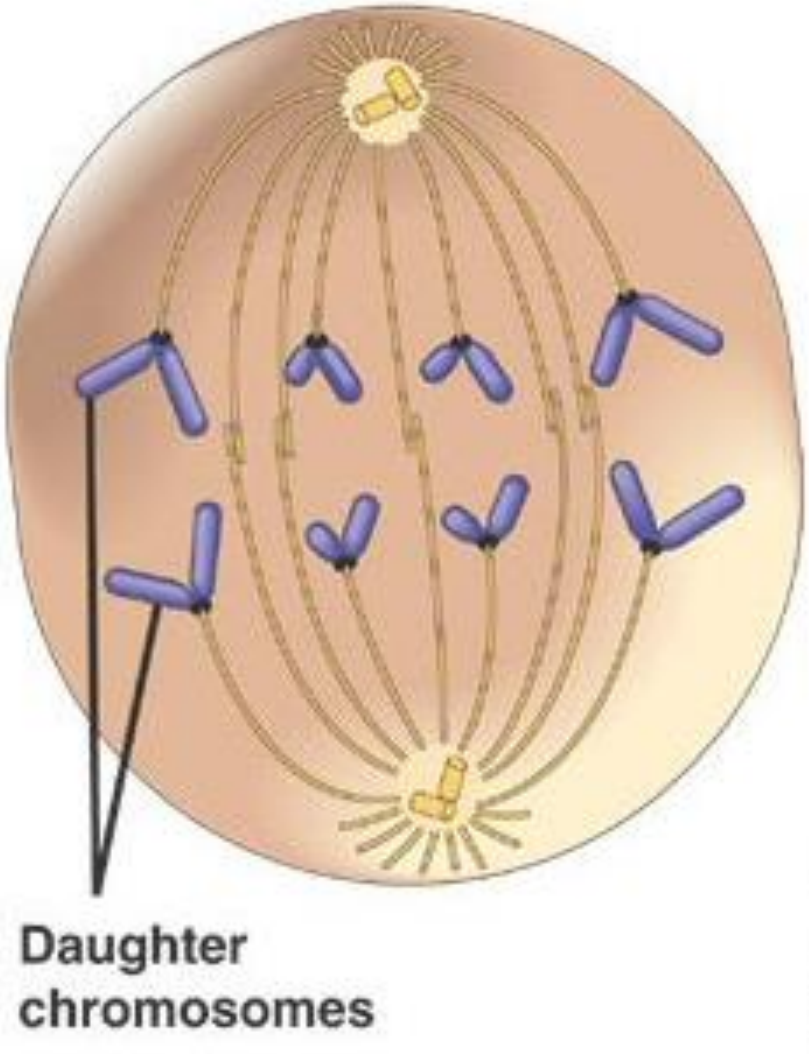


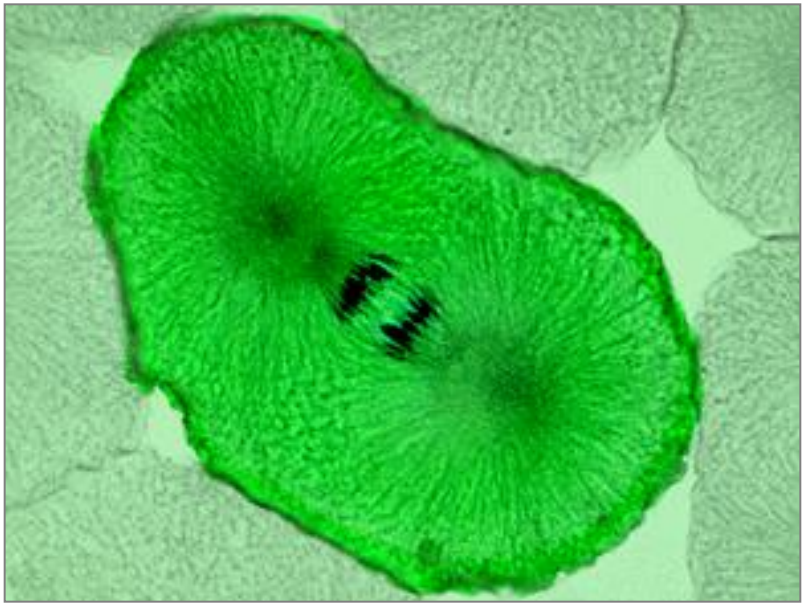
Metaphase



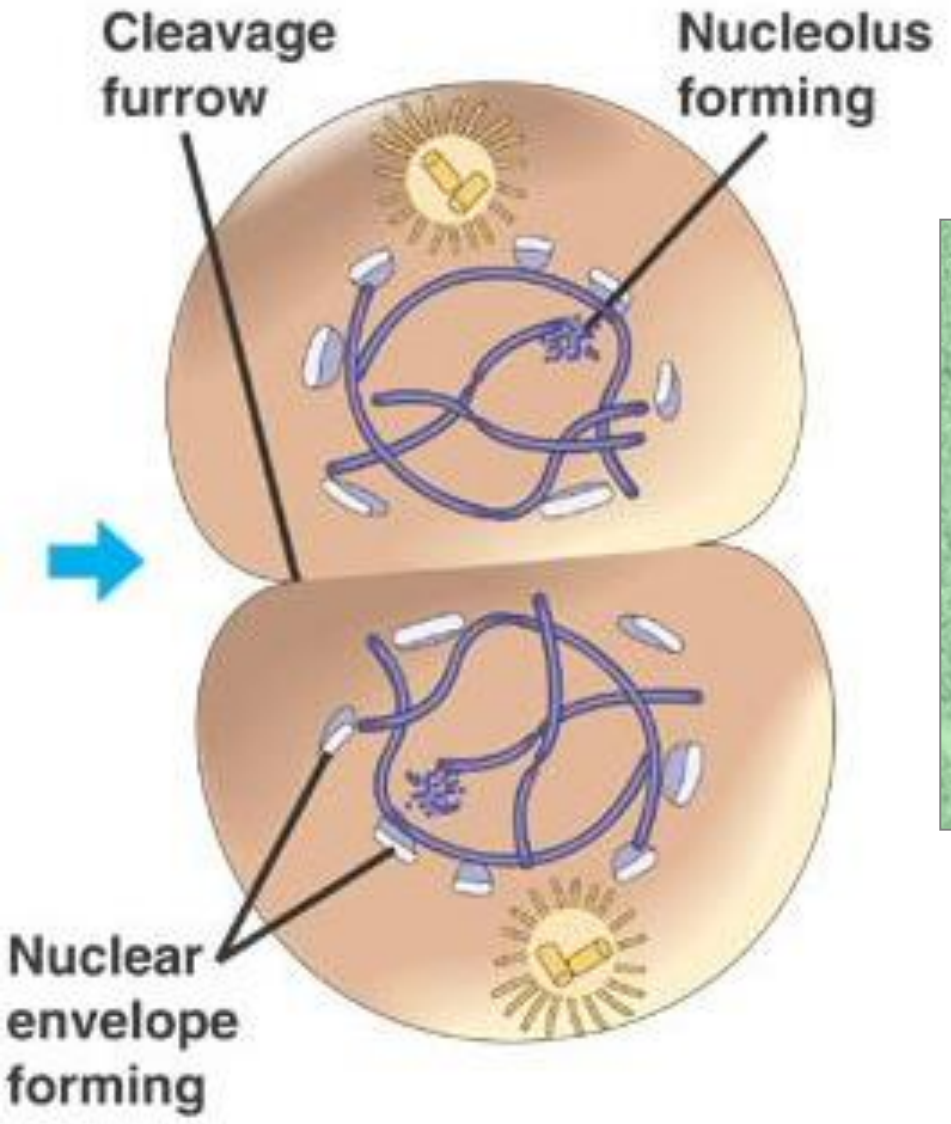


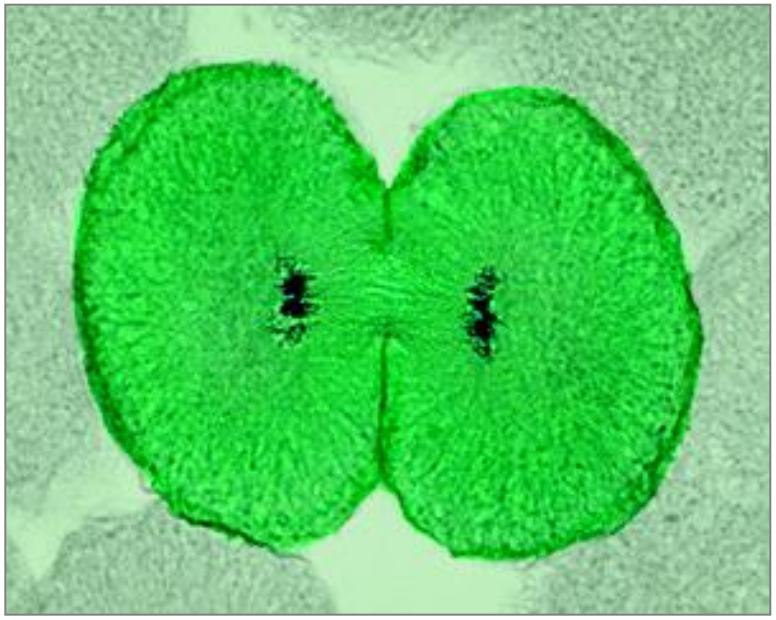
Anaphase





Telophase

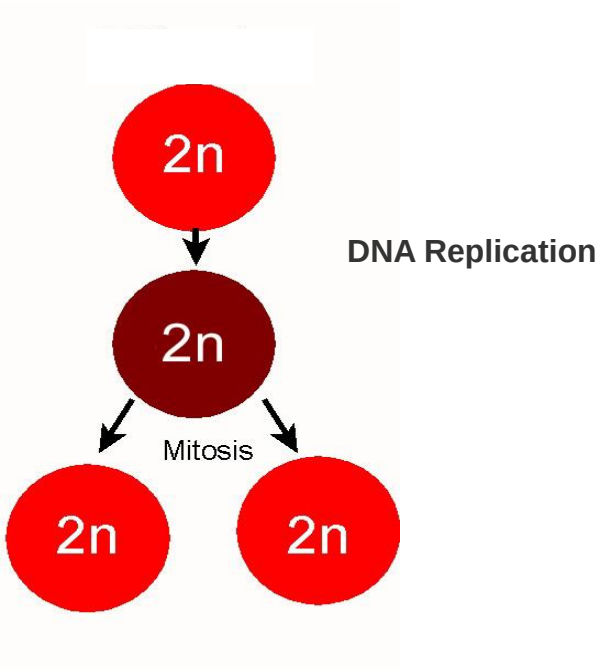

Cleavage furrow
Nucleolus forming
Nuclear envelope forming



Mitosis Division of somatic cells (non-reproductive cells)

- A single cell divides into two identical daughter cells

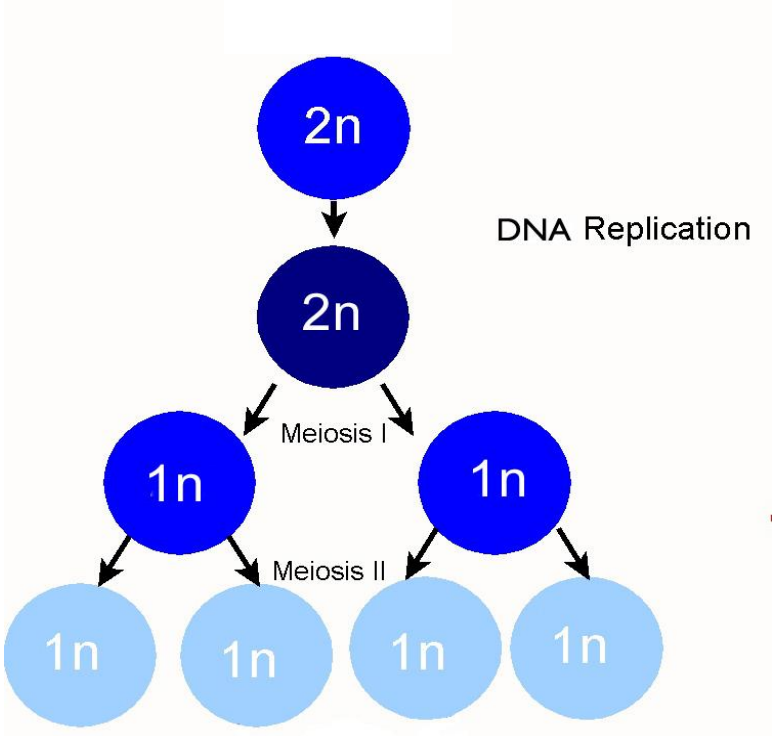
- Daughter cells have same of chromosomes as does parent cell, so they are considered diploid.



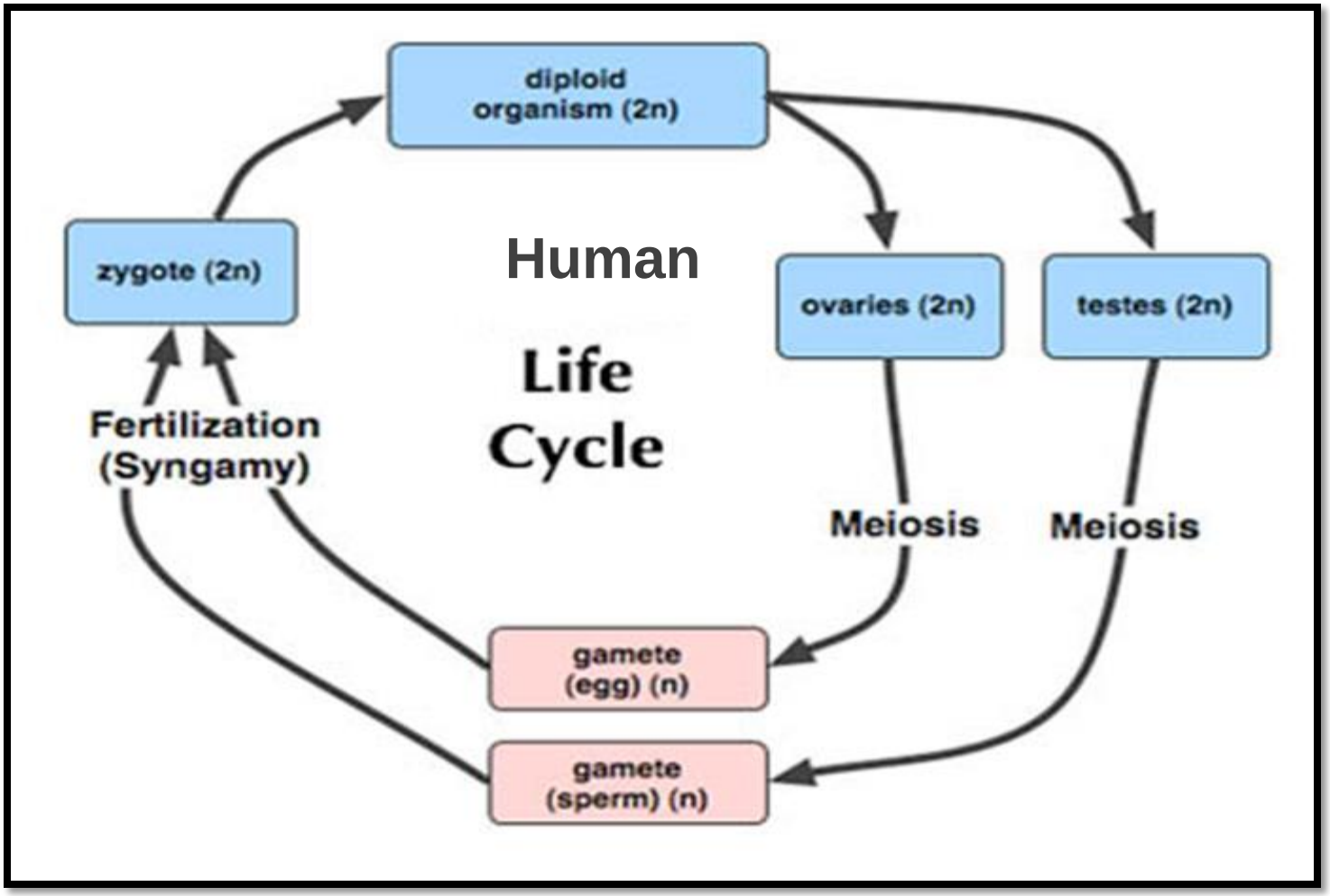
Meiosis Division of gametes cell

-A single germ cell divides into four unique daughter cells.

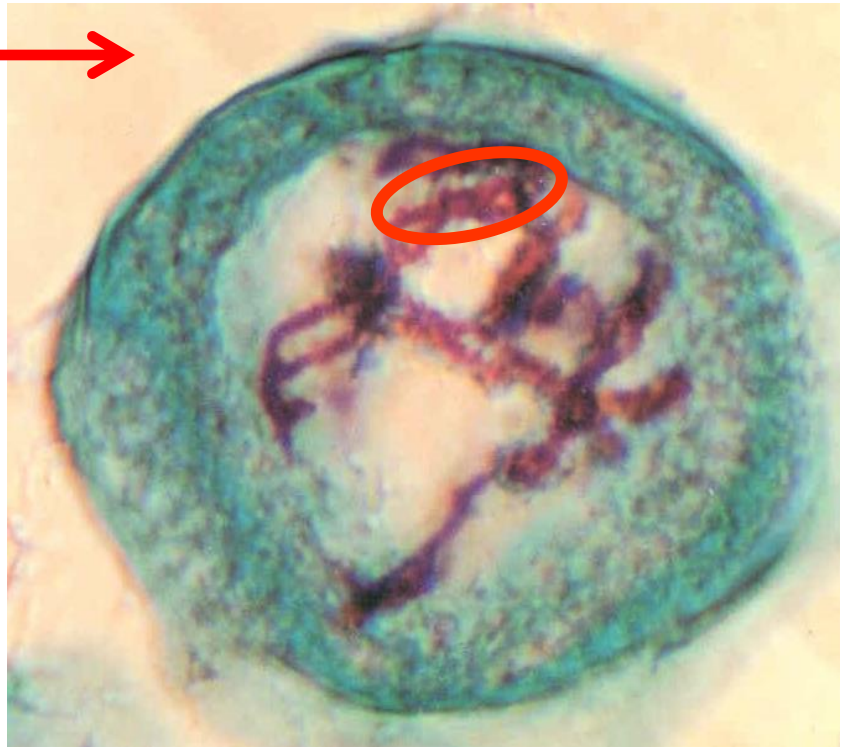
- Daughter cells have half the of chromosomes as parent cell, so they considered haploid.



Scheme illustrate Meiosis & Sexual Reproduction

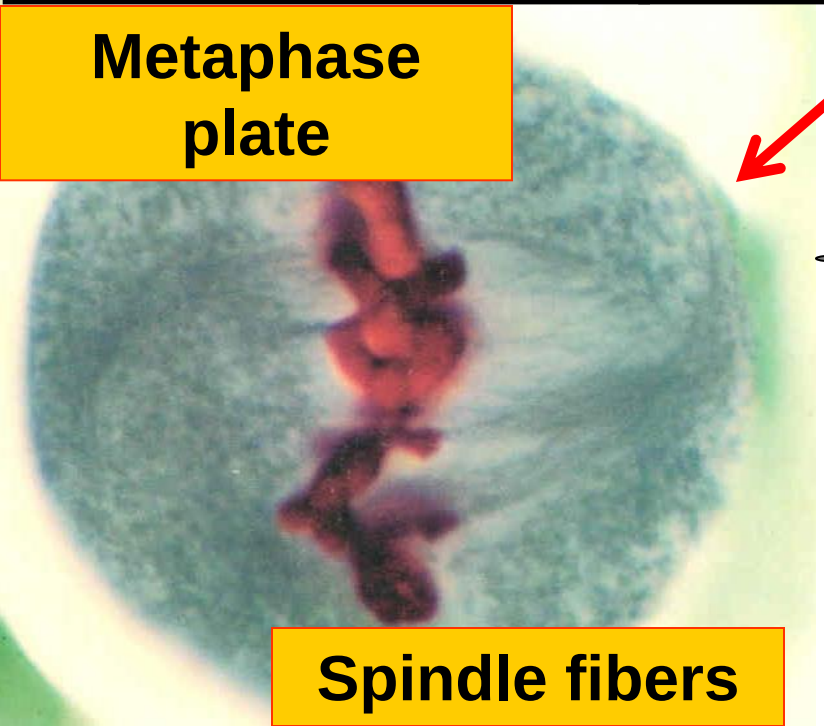


Meiosis I: Prophase I



- Chromatin condenses into discrete chromosomes
- Homologous chromosomes pair up—crossing over can occur: genetic diversity

Meiosis I: Metaphase I

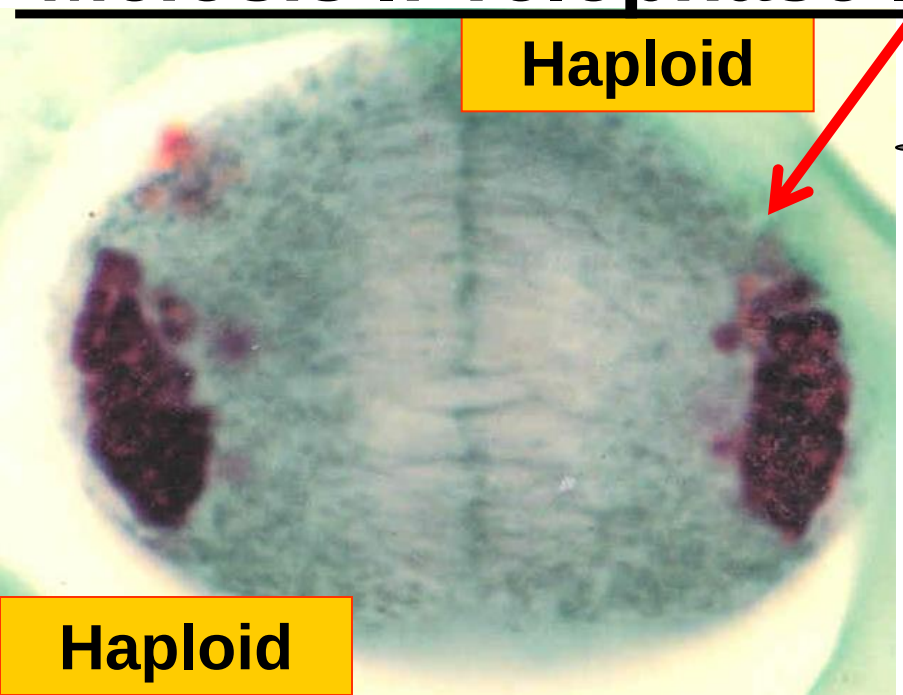


- Spindle fibers from each pole attach to one chromosome of each homologue
- Chromosomes align on the metaphase plate as homologous pairs

Meiosis I: Anaphase I

- The 2 chromosomes of each homologous pair separate
- Move toward opposite poles

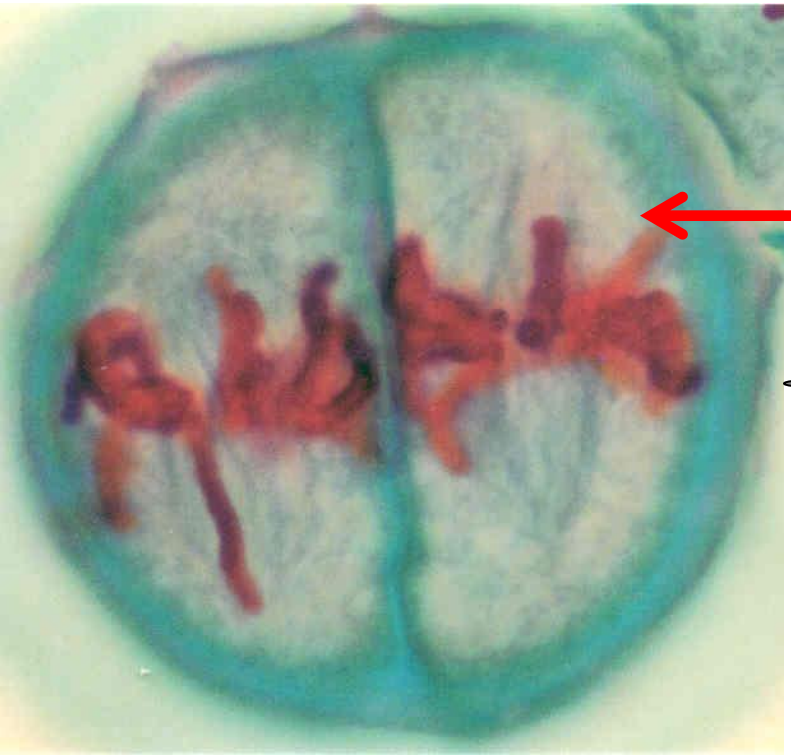
Meiosis I: Telophase I



- The chromosomes moved to opposite poles
- Cytokinesis separates the cytoplasm into 2 daughter cells
- Each cell is haploid

Meiosis II: Prophase II

- The chromatin again condenses into chromosomes

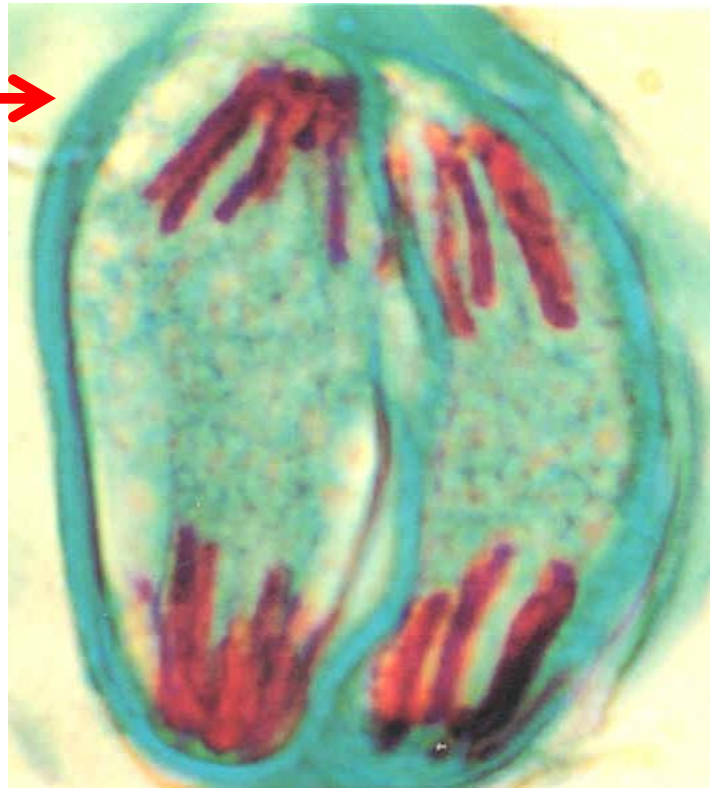


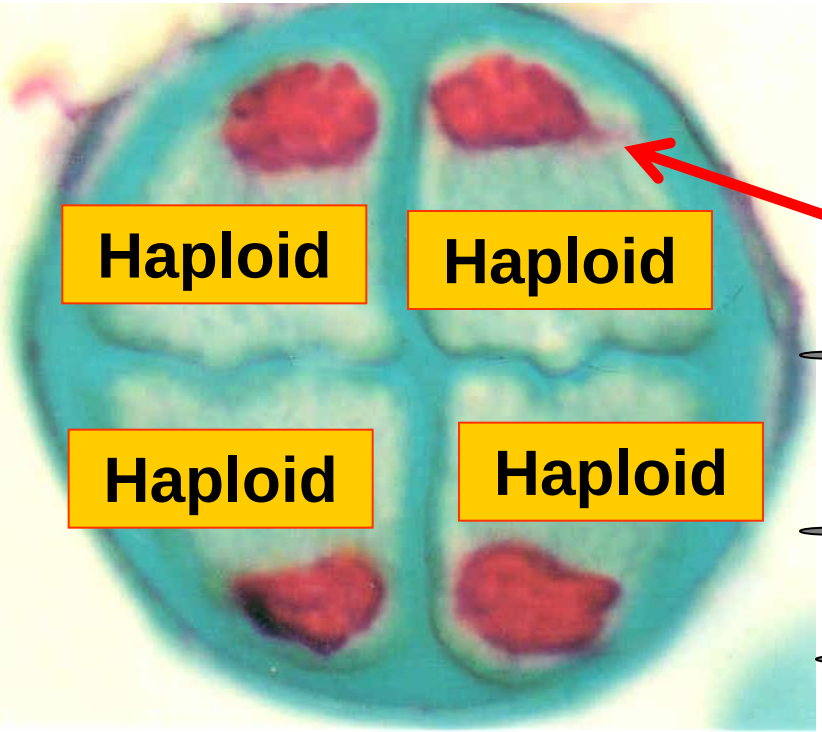
Meiosis II: Metaphase II

- The chromosomes align on the metaphase plate

Meiosis II: Anaphase II

- Sister chromatids separate
- Move toward opposite poles
- Sister chromatids are now individual chromosomes





Meiosis II: Telophase II

- Nuclei begin to form at opposite poles
- Cytokinesis occurs
- 4 Haploid daughter cells