LECTURE :

ONE

New words in this lecture :

Catabolism – تفاعلات الهدم
Anabolism – تفاعلات البناء
Meiosis – الانقسام غير المباشر
Mitoses – الانقسام المباشر
Uni – أحادي
Multi – عديد
Block – وحدة
Homeostasis – الاتزان الداخلي
Ecosystem – النظام البيئي
Offspring – النسل
Sperm – الحيوان المنوي
Stimuli – مؤثرات خارجية

Biology: the study of life

Life study

★ Biology:

- Zoology : the study of animals (it contains HUMAN BIOLOGY)
- Botony : the study of plants
- Microbiology : the study of small organisms like : Bacteria And viruses

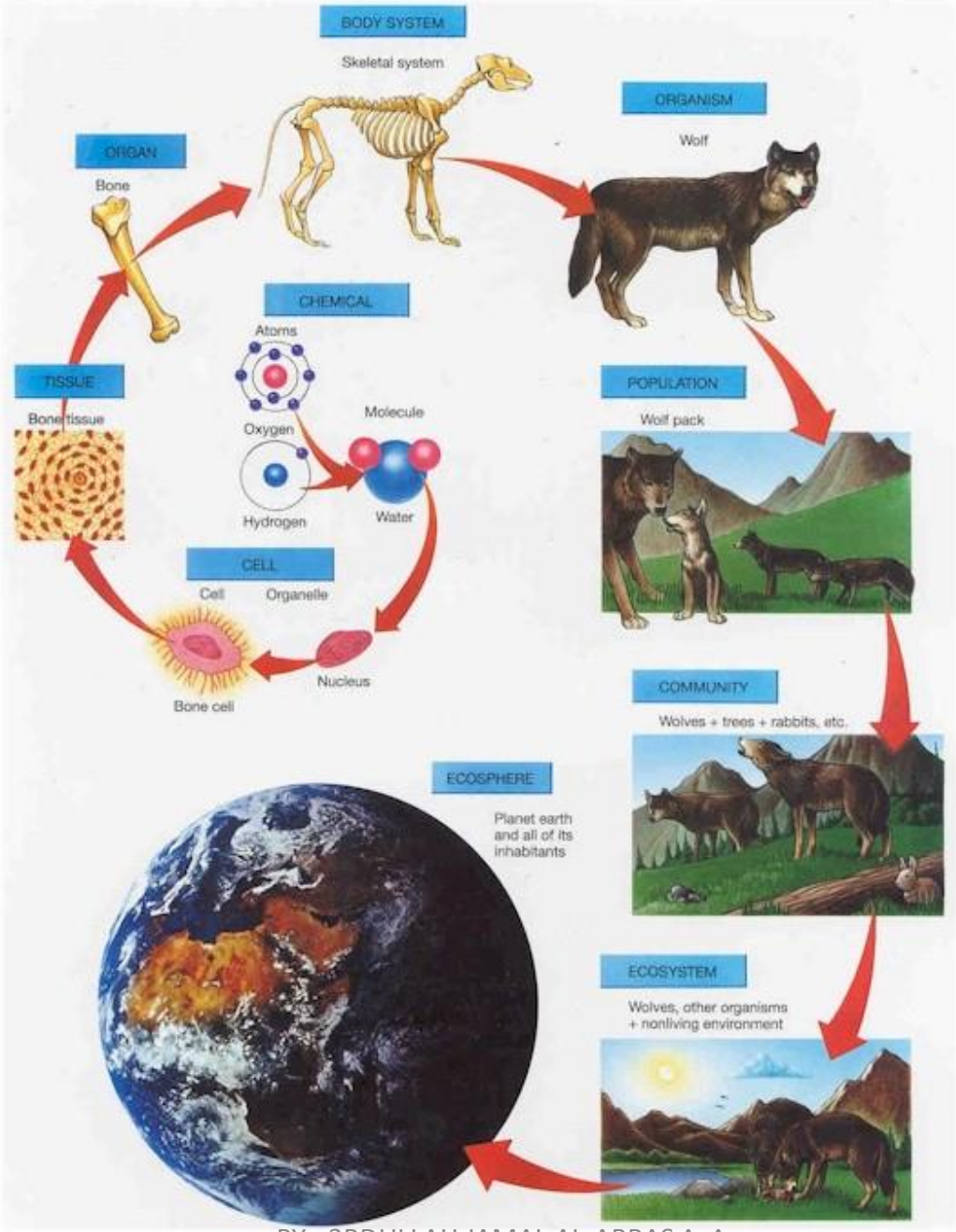
Characteristics of life

- **All organisms are made of cells , cells are tiny structures that are the fundamental building blocks , cells consist of Molecules .**
  - **non-living particles composed of small units called : atoms**
- **All organisms grow and maintain their complex organization by taking in molecules (row materials in food) and Energy from their surrounding .**
- **Homeostasis :is a state of relative constancy that helps ensure human health . Or it is a state of internal constancy , it's not a static state . It's a dynamic (ever-changing) state .**
- **Metabolism : chemical reactions in the cell and tissues of organisms . It could be : Anabolic or Catabolic**
- **Living things sense and respond : ability to perceive stimuli and respond to them .**
- **Reproduction and growth : human produce offspring by combining sex cells(sperm and egg)from male+female**
- **All organisms are parts of the ecosystem**

Organization of life : *nature is organized in 11 basic levels :-*

atom → molecule → cell → tissue → organ → organ system → organism

Population → community → ecosystem → Biosphere


BODY SYSTEM
Skeletal system
ORGANISM
Wolf
ORGAN
Bone
CHEMICAL
Atoms
Molecule
Oxygen
Hydrogen
Water
TISSUE
Bone tissue
POPULATION
Wolf pack
CELL
Cell
Organelle
Nucleus
Bone cell
COMMUNITY
Wolves + trees + rabbits, etc.
ECOSPHERE
Planet earth and all of its inhabitants
ECOSYSTEM
Wolves, other organisms + nonliving environment

Human biology studies :

- What your body is made of
- How your body works
- How the body can be fixed if something goes wrong

- Atom : smallest unit of an element that retains the properties .
- Molecule : unit of two or more bounded-together atoms of the same element of different elements .
- Cell : smallest unit with the ability to live and reproduce independently or as a part of multicelled organism
- Tissue : organize aggregation of cells and substances functioning together in a specialized activity .
- Organ : structural unit in which tissues combined in specific amount and pattern to perform a common task .
- Organ system : two or more organs interacting chemically , physically or both in ways that contribute to organisms survival .
- Multicelled organism : individual consisting of cells , typically organize in : tissues , organs and organ systems
- Population : group of individuals of the same kind occupying the same area .
- Community : population of all species occupying the same area .
- Ecosystem : community and it's physical environment .
- Biosphere : all regions of the earth's crust , water and atmosphere that sustain life .

Lecture : two

Words from the margin :

Organelles -- عضيات

Pro- بدائي Eu – حقيقي

Karyon – النواة

Karyotic – نووي

Prokaryotic – بدائي النواة

Nuclear membrane (envelope) – الغشاء النووي

Cilium – هدب cilia - أهداب

Flagellum – سوط flagella – أسواط

Pores – ثقوب

Filament -خيط

Skeleton – الهيكل العظمي

- All cells are alike in three ways (aspects)
  - Plasma membrane
  - DNA
  - Cytoplasm

- ***Surrounded by a plasma membrane , outer covering encloses the cell's internal parts it doesn't completely isolate the cell's interior , substances can move through the plasma membrane***
- ***Contain an inner region of DNA which contains the genetic information .***
- ***Cell's components are suspended in a semiliquid matrix of water , proteins , vitamins , ions , nutrients , dissolved gases and waste products . It forms a nutrient pool from Which the cell draws chemical it need for metabolism . it's also a dumping ground***

- Cytoplasm : ***the contents of a cell between the plasma membrane and the nucleus***
  - **Cytosol : the jelly-like fluid portion of the cell's cytoplasm in which the cell's Organelles are suspended .**

prokaryotic	Eukaryotic
- No true nucleus because there is no nuclear envelope . - DNA is concentrated in a region of cytoplasm called : nucleoid - Most are surrounded by an outer cell wall around their plasma membrane - Ex : bacteria	- Has a new nucleus . - Nucleus is surrounded with a double walled nuclear membrane holds the cell's DNA - Only plant cells surrounded with a cell wall - Ex : all the other living cells .

TABLE 3-1 Overview of Cell Organelles

Organelle	Structure	Function
Nucleus	Round or oval body; surrounded by nuclear envelope	Contains the genetic information necessary for control of cell structure and function; DNA contains hereditary information.
Nucleolus	Round or oval body in the nucleus consisting of DNA and RNA	Produces ribosomal RNA
Endoplasmic reticulum	Network of membranous tubules in the cytoplasm of the cell. Smooth endoplasmic reticulum contains no ribosomes. Rough endoplasmic reticulum is studded with ribosomes	Smooth endoplasmic reticulum (SER) is involved in the production of phospholipids and has many different functions in different cells; round endoplasmic reticulum (RER) is the site of the synthesis of lysosomal enzymes and proteins for extracellular use.
Ribosomes	Small particles found in the cytoplasm; made of RNA and protein	Aid in the production of proteins on the RER and polysomes
Polysome	Molecule of mRNA bound to ribosomes	Site of protein synthesis
Golgi complex	Series of flattened sacs usually located near the nucleus	Sorts, chemically modifies, and packages proteins produced on the RER
Secretory vesicles	Membrane-bound vesicles containing proteins produced by the RER and repackaged by the Golgi complex; contain protein hormones or enzymes	Store protein hormones or enzymes in the cytoplasm awaiting a signal for release
Food vacuole	Membrane-bound veside containing material engulfed by the cell	Stores ingested material and combines with lysosome
Lysosome	Round, membrane-bound structure containing digestive enzymes	Combines with food vacuoles and digests materials engulfed by cells
Mitochondria	Round, oval, or elongated structures with a double membrane. The inner membrane is thrown into folds.	Complete the breakdown of glucose, producing NADH and ATP
Cytoskeleton	Network of microtubules and microfilaments in the cell	Gives the cell internal support, helps transport molecules and some organelles inside the cell, and binds to enzymes of metabolic pathways
Cilia	Small projections of the cell membrane containing microtubules; found on a limited number of cells.	Propel materials along the surface of certain cells
Flagella	Large projections of the cell membrane containing microtubules; found in humans only on sperm cells.	Provide motive force for sperm cells
Centrioles	Small cylindrical bodies composed of microtubules arranged in nine sets of triplets; found in animal cells, not plants.	Help organize spindle apparatus necessary for cell division

Lecture :

Three

- **A cell is like a factory with different departments**

❑ Cell theory :

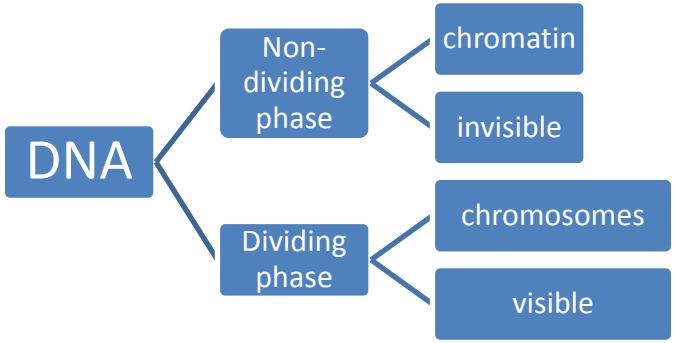
All organisms are alike , they all consist of one or more cells made of the same kind of substances

The cell is the smallest unit having the properties of life

All cells come from pre-existing cells .

❑ DNA :

- *Is a nucleic acid*
- *Is the signature molecule of life*
- *Is the basis of growth , survival and reproduction*
- *Protein synthesis*
- *Inheritance*



- ***Organelles with double membrane in the eukaryotic cells :***

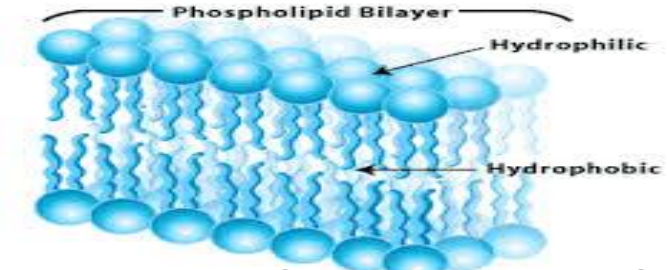
- Nucleus - mitochondria

- **The rest of the organelles are only Single-bound membrane**

- **Organelles without membranes :**
- **Cytoskeleton – cilia – flagella – centrioles**

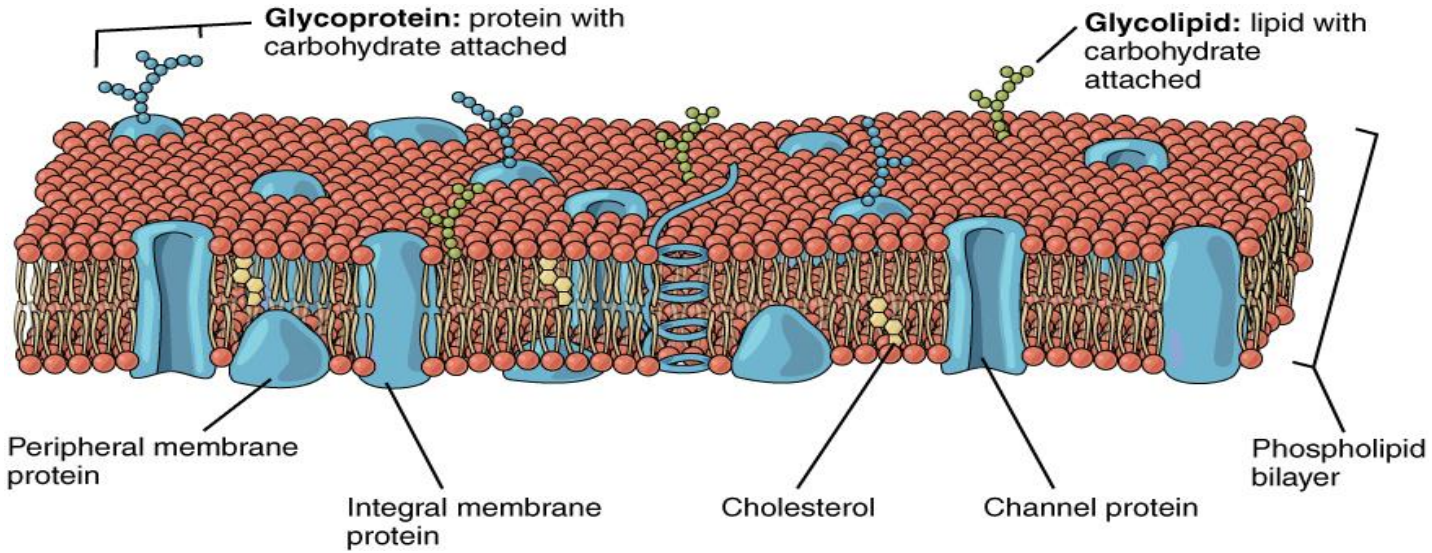
Lipid bilayer : composed of phospholipid unit each consist of

- ***Hydrophilic head (like water) (polar) (faced outward)***
- ***hydrophobic tail (non polar) (hate water) (faced inward)***



❑ Mosaic model :the surface view of the plasma membrane

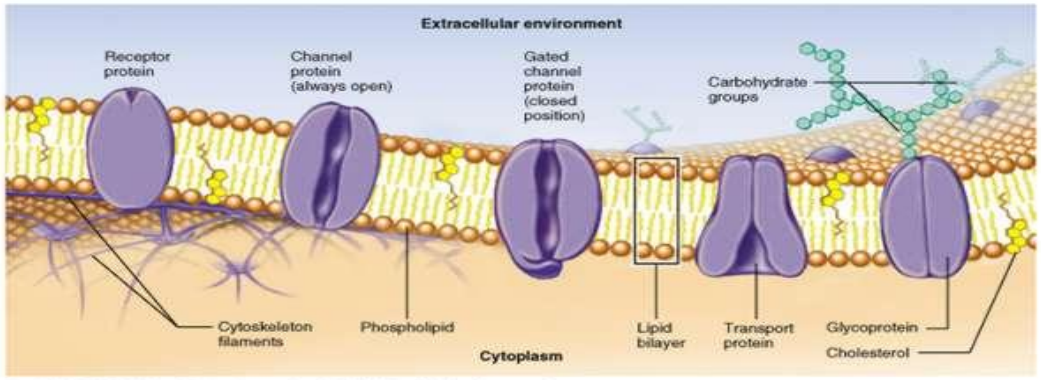
The plasma membrane isn't solid , rigid wall because if it were , needed substances couldn't Enter the cell . And wastes couldn't leave it . Instead the plasma membrane has a fluid quality And it's not smooth .. Because it made of protein and lipids (projections)

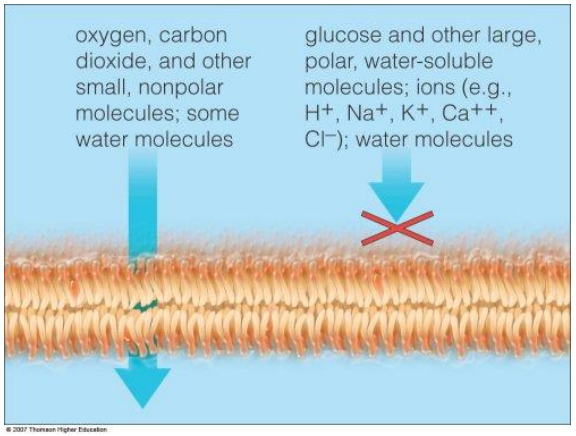


- ***The structural unit of the plasma membrane is phospholipids 75 %***
- ***The plasma membrane consist of lipids + proteins + small amount of carbohydrates***
- ***Proteins perform most of the functions of the plasma membrane .***

- There are 2 types of proteins according to the way they associate 2 the membrane
  - Integral proteins: attach to the lipid bilayer and passes through the hydrophobic region , sometimes it forms channels for transport .
  - peripheral protein : attach to only the head of the lipid bilayer . Usually used for cellular signaling path ways .

- 4 types of proteins according to their functions :
  - Receptor : bind to extracellular substances that deliver certain signals as division , metabolites and hormones (integral + peripheral)
  - Recognition protein : Identifier of cell type (self and non-self) (integral)
  - Adhesion protein : attachment of cells one another to form tissues (integral)
  - Transport protein : transport of molecules and ions across cell membrane





- The Permeability of the Plasma Membrane :

The plasma membrane is a bilayer composed of lipids and proteins and these molecules give the membrane *SELECTIVE PERMEABILITY* : It allows only certain substances to cross it .

❑ Molecules move through the plasma membrane with 5 ways :

❖ Diffusion : the movement of molecules from high to low concentration .

- It doesn't utilize proteins . – passive transport (without ATP) – lipid-soluble substances Such as alcohols + small molecules (gases like : oxygen + carbon dioxide) + water > move Through the plasma membrane with relative ease (down concentration gradient)

❖ Facilitated diffusion(carrier protein and diffusion) : water-soluble molecules such as GLUCOSE + AMINO ACEDS pass(diffuse) Through membrane through pores formed by Integral proteins . (passive transport ; it does not need any energy . (down concentration Gradient)

❖ Active transport : movement of molecules across membranes with the aid of protein Carrier molecules with energy supplied by ATP (Adenosine triphosphate) from low to high Concentration .

❖ Endocytosis : Large molecules and entire cells can be engulfed (incorporated) by cells be this process . (into the cell) it requires ATP and consist of two activities :

- phagocytosis (cell eating) : engulf large particles like BACTERIA . (limited to few cells)
- pinocytosis : (cell drinking) : engulf extracellular fluids and dissolved materials . All cells are capable of pinocytosis .

❖ Exocytosis : (out of the cell) this process allows cells to release large molecules held in their Cytoplasm .

❖ Osmosis : the diffusion of water between two solution across a selective permeable membrane

- Endo/Exocytosis : engulfment or/and releasing of materials inside or/and outside the cell

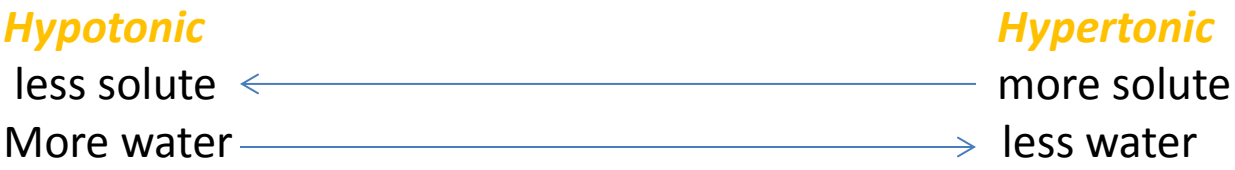
TABLE 3-2 Summary of Plasma Membrane Transport

Process	Description
Simple diffusion	Flow of ions and molecules from high concentrations to low. Water-soluble ions and molecules probably pass through pores; water-insoluble molecules pass directly through the lipid layer.
Facilitated diffusion	Flow of ions and molecules from high concentrations to low concentrations with the aid of protein carrier molecules in the membrane.
Active transport	Transport of molecules from regions of low concentration to regions of high concentration with the aid of transport proteins in the cell membrane and ATP.
Endocytosis	Active incorporation of liquid and solid materials outside the cell by the plasma membrane. Materials are engulfed by the cell and become surrounded in a membrane.
Exocytosis	Release of materials packaged in secretory vesicles.
Osmosis	Diffusion of water molecules from regions of high water (low solute) concentration to regions of low water (high solute) concentrations.

- ✓ **Solute :** dissolved substance in a solution (ex : sugar)
- ✓ **Solvent** : dissolving medium
- ✓ **Concentration :** the number of molecules of a solute in a specific region
- ✓ **Concentration gradient :** different in the solute concentration between two adjacent regions
- ✓ **Tonicity** : concentration of solutes in a solution or is the measure of osmotic pressure

❑ Types of solutions :

1- Isotonic : same concentration in all regions .
2- hypotonic : it has fewer solute .
3- hypertonic : it has more solute .



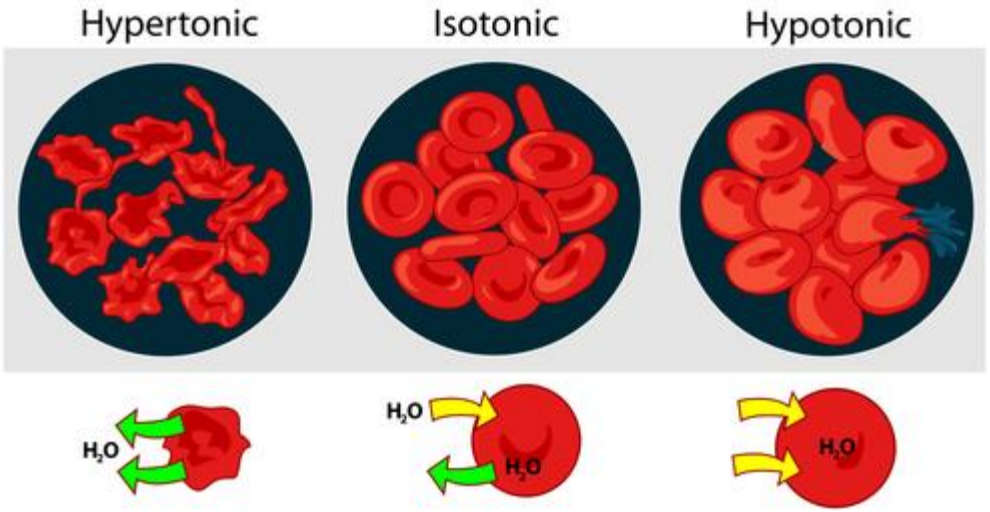
Behavior of red blood cells (RBCs)

If we put RBCs in a :

1- hypotonic : water will rushing causing the cells to swell And burst .

2- hypertonic : the water will exist the cell and the cells will Shrink .

3- Isotonic : no change in the blood .



Lecture

four

THE NUCLEUS : the control center of the cell because it contains the DNA and it has :

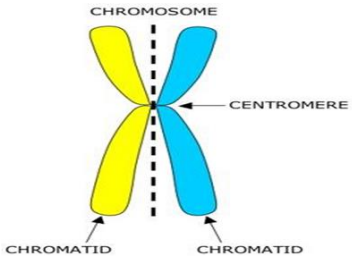
- 1 or 2 nucleoli

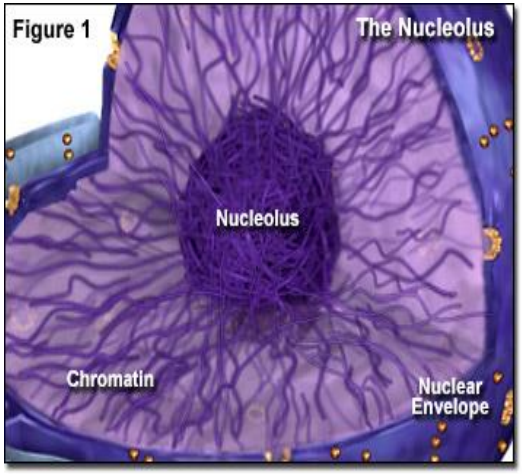
– semiliquid called : nucleoplasm : the nuclear equivalent of cytoplasm .

– it's perforated (contains pores)

- double membrane (nuclear envelop) which separates the nucleus material .

- the bulk of nucleus containing long , threadlike fibers of DNA and protein called : chromatin .





- chromosome :A strand of chromatin with it's protein

DNA : is a double helix , controls the structure And functions of the cell .

RNA : A single strand .

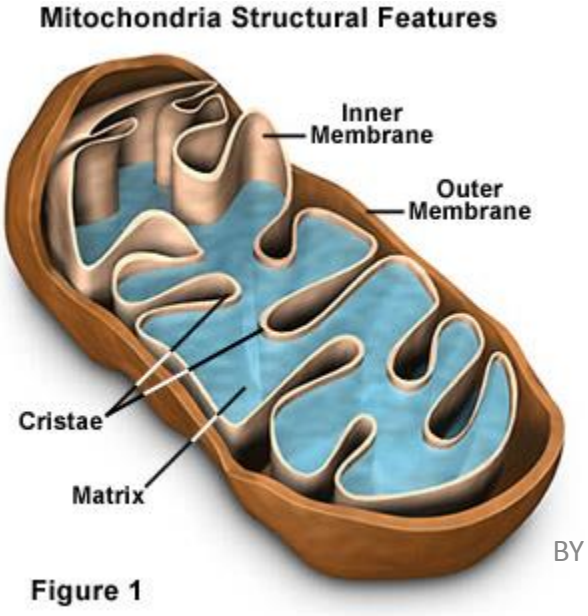
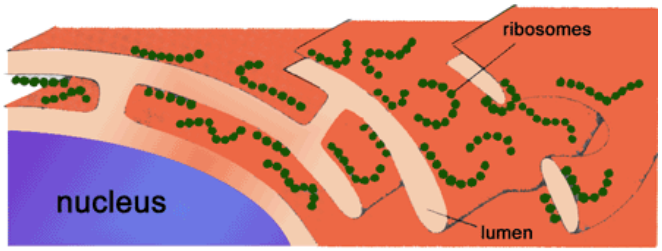


Figure 1

- Mitochondria : it's a double-bound membrane
  - The inner membrane is thrown into folds .
  - There is two compartments(chamber) in the mitochondria
  - Crista : in their surface there are " respiratory Enzymes to produce ATP when the Oxygen enter The cell .

Rough Endoplasmic Reticulum



Smooth Endoplamic Reticulum

THE Endoplasmic reticulum : is an extension to the Nucleus .

- It's a single-bound membrane .
- it's a network of tubules
- Functions : transfer substances + support the cell
- There are two types from it : smooth + rough

ERE : Studded with ribosomes. SER : NO ribosomes

The flagellum (whip) : long , whiplike extension of the plasma membrane of the sperm Cell .

The cilium : small extensions of the cell membrane

TYPES OF RESPITATION

- Aerobic – in the mitochondria
- Anaerobic – in the cytoplasm

***Cytoskeleton** : interconnected system of many protein filaments .(doesn't have A membrane)*

- *for : support , movement and division .*
- *there are three types of them according to their size : microfilament + microtubules + intermediate tubules .*
- *cilia and flagella : 9+2 (outer 9 pairs . Inner 1 pair)*
- *centriole : 9 + 0 (outer 9 pairs)*