



تَوِير

# BIOLOGY

Lec no : 7

File Title : Summary from lec 7 to the end of chapter 7

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وَقُلْ رَبِّ زِدْنِي عِلْمًا



# Mitochondria

In all eukaryotic cells

Mitochondria are the sites of cellular respiration, a metabolic process that uses oxygen to generate ATP

## The structure of the mitochondria

• **Double membrane:** (inner membrane and outer membrane)

The inner membrane separates the mitochondria into two spaces:

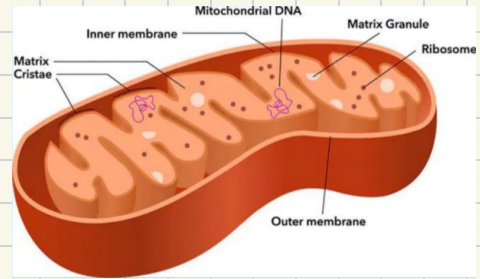
- 1-**Matrix** (the inside of the inner membrane)
- 2-**Intermembrane space** (between the two membranes)

Some metabolic steps of cellular respiration are catalyzed in the **mitochondrial matrix**

Cristae present a **large surface area** for enzymes that synthesize ATP

note: -

The inner membrane is folded into cristae, the outer membrane is smooth



# Chloroplasts

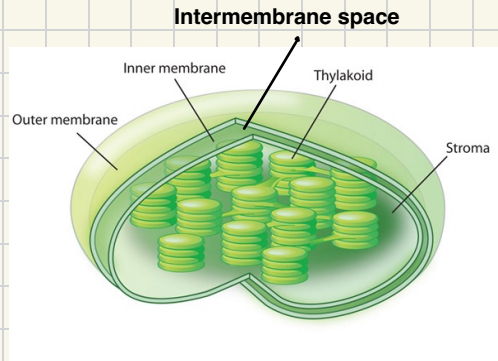
In the green parts

**Chloroplasts**, found in plants and algae, are the sites of **photosynthesis**

Chloroplasts contain the green pigment chlorophyll, as well as enzymes and other molecules that function in photosynthesis

## The structure of plastids

- **double membrane** (outer and inner)
- The fluid inside is called **stroma**
- **Thylakoids** membranous sacs piled into grana

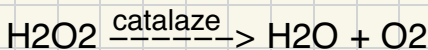


Chloroplasts are one type of plastids, and there are other types of plastids like

# Peroxisomes

**Oxidative organelles**

- They have a **single membrane**
- They can produce **hydrogen peroxide**  $H_2O_2$  and convert it to **water** and oxygen

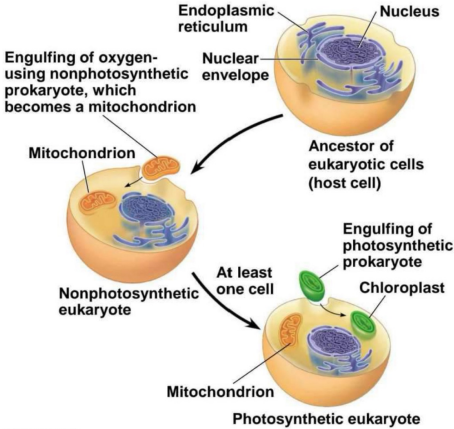


A type of peroxisomes is **glyoxisomes** → they are found in plant seeds, and they convert lipids to carbohydrates to have a quicker energy source for developing embryos

Chromoplasts (colorful)  
They attract insects for pollination  
تلقيح

Leukoplasts (amyloplast)  
Amylose Storage

# The endosymbiont theory



An early ancestor of eukaryotic cells engulfed a nonphotosynthetic prokaryotic cell, which formed an endosymbiont relationship with its host

The host cell and endosymbiont merged into a single organism, a eukaryotic cell with a mitochondrion

At least one of these cells may have taken up a photosynthetic prokaryote, becoming the ancestor of cells that contain chloroplasts

## Similarities between bacterial cells, mitochondria, and chloroplasts

- Enveloped by a double membrane
  - Contain free ribosomes and circular DNA molecules
  - Grow and reproduce somewhat independently in cells
- التضاعف داخل الخلية فقط

كل القصة انه لقو العلماء تشابه بين الميتوكوندريا والبلاستيدات الخضراء والبكتيريا فحكو انه اصلهم خلية بكتيرية ابتلعتها خلية أخرى

## Cytoskeleton

**A network of fiber that organizes the cells, structure and activities**

### Functions of the cytoskeleton

- The cytoskeleton helps to support the cell and maintain its shape
- It interacts with **motor proteins** to produce motility
- Inside the cell, vesicles can travel along "monorails" provided by the cytoskeleton
- Recent evidence suggests that the cytoskeleton may help regulate biochemical activities

### Components of the cytoskeleton

- Microtubules
- Microfilaments
- Intermediate filaments

# Microtubules

- hollow tubes
- 13 columns of tubulin
- 25 nm in diameter (thickest)
- 200 nm long

A dimer (alpha and beta tubulin)

## Microtubules functions :-

- Shaping the cell (compression resisting)

يمنع تأثرها بالضغط  
(ما بتتكمش ولا بتتفجر)

- Cell motility (flagella and cilia)

cilia and flagella are locomotor appendages

Loco موقعي

Motor حركي

يتحرك لتغيير الموقع

(سواء موقع الخلية نفسها زي الحيوان المنوي مثلا)

او موقع اشي ملامس للخلية زي الغبار في القصبة الهوائية)

## They have the same structure :

- Microtubules surrounded by cell membrane
- basal body that connects it to the cell
- Dynein (motor protein) regulate the movement

## The type of movement:

Flagella → undulations حركة موجية

Cilia → stroke ذهاباً وإياباً

Dynein arms alternately grab, move, and release the outer microtubules

Protein cross-links limit sliding

Forces exerted by dynein arms cause doublets to curve, bending the cilium or flagellum

## The pattern of microtubules (in cilia and flagella)

is (9+2) doublets

كيف يعني pattern :

الأرقام زي (0+9) او (2+9)

The pattern of the basal body is

معنى 9 هو وجود تسع وحدات من microtubules

(9+0) triplets

كل وحدة ممكن تكون ثلاثية يعني بتتكون من ثلاث انابيب microtubules

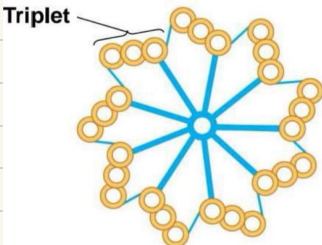
او ثنائية من أنبوبين

رقم 2 او 0 معناه وجود انابيب microtubules مركزية او لا

(مركزية يعني في وسط التركيب)

Triplets ثلاثيات

Doublets ثنائيات



Notes :

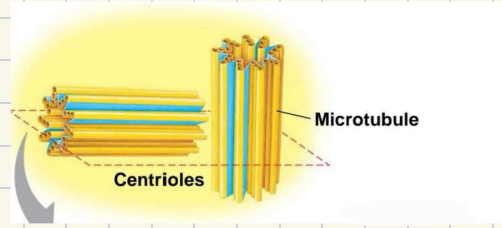
- Flagella are usually longer than cilia
- one cell can have only one to a few flagella, but cells can have thousands of cilia

## • chromosome movement in cell division

In many cells, microtubules grow out from a **centrosome** near the nucleus

The centrosome is a "microtubule-organizing center"

In animal cells, the centrosome has a pair of **centrioles**, each with nine triplets of microtubules arranged in a ring



pattern is (9+0) triplets

## • organelle movement

By getting attached to a motor protein, and walking along the microtubule (vesicle movement)

## Microfilaments

- two intertwined strands of actin
- 7nm in diameter

## Microfilaments functions :-

- maintaining the cell shape (tension resisting)

By creating a 3-D network called cortex on the inner side of the cell membrane

مثال :

بتحافظ على شكل الخملات المعوية (microvilli) في الأمعاء

بتمنع تمدد الخلية  
(بتعطي مرونة)

- changes in cell shape (motility in pseudopodia )

Localized contraction brought about by actin and myosin also drives amoeboid movement

**Pseudopodia** (cellular extensions) extend and contract through the reversible assembly and contraction of actin subunits into microfilaments

المنطقة الغنية بالألياف (أطراف الخلية)  
اسمها gel

بعض الخلايا بتتحرك عن طريق تركيب اسمه الأقدام الكاذبة

آلية تحركها بتعتمد على وجود microfilaments في أطراف الخلية

بتمتد الخلية وتتشكل أقدم كاذبة وانقباض الactin الموجود في

microfilaments بسحب جسم الخلية باتجاه الأقدام الكاذبة



## •Cytoplasmic streaming

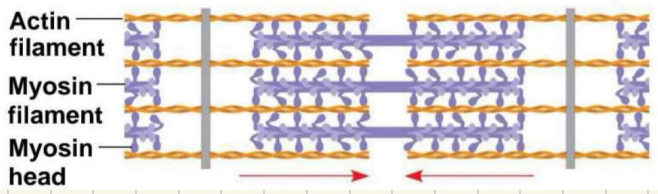
**Cytoplasmic streaming** is a circular flow of cytoplasm within cells

This streaming speeds distribution of materials within the cell

In plant cells, actin-myosin interactions and sol-gel transformations drive cytoplasmic streaming

## • muscle contraction

Actin and myosin filaments are responsible of muscle contraction (by sliding along each other)



In muscle cells, thousands of actin filaments are arranged parallel to one another

Thicker filaments composed of myosin interdigitate with the thinner actin fibers

اللي بصير فعليا هو انه حركة  
رؤوس الميوسين (بالرسمه) بتخلي  
الياف الاكتين تقترب من بعضها  
وهذا هو انقباض العضلة

## Intermediate filaments

- 8-12nm in diameter (it changes because the proteins change)
- made of several proteins, for example keratin
- super coiled

### Intermediate filaments functions :-

- maintaining cell shape (most stable filaments)
- keeping the nucleus in place (a cage around the nucleus)
- components of the nuclear lamina

# Extracellular components and connections between cells

Most cells synthesize and secrete materials that are external to the plasma membrane  
These extracellular structures include

- Cell walls of plants
- The extracellular matrix (ECM) of animal cells
- Intercellular junctions

**Note**  
Cell walls have holes in them (plasmodesmata) to exchange substances between cells like water, RNA, proteins and solutes

## Cell walls

- distinguishes animal cells from plant cells
- is considered extracellular because it's on the outside of the plasma membrane
- it's found in plants, prokaryotes, fungi, and some protists

### Cell wall functions in plants:-

It's made of cellulose and other polysaccharides and proteins

- maintains the shape of the cell
- protect the cell
- prevent excessive water uptake

### layers of the cell wall

Plant cell walls may have multiple layers

- **Primary cell wall:** relatively thin and flexible
- **Middle lamella:** thin layer between primary walls of adjacent cells
- **Secondary cell wall** (in some cells): added between the plasma membrane and the primary cell wall

النباتات العشبية تحتوي على primary cell wall فقط  
النباتات الخشبية تحتوي على الطبقتين

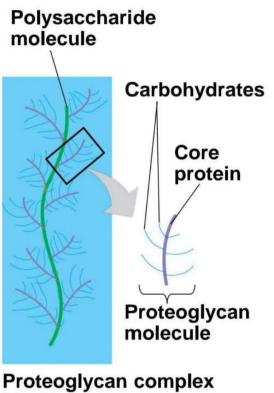
## Extracellular matrix

Only in animal cells (a substitution for the cell wall)

### Components :

- collagen
- fibronectin
- proteoglycan

يربط بين الكولاجين والبروتينات التي يتخترق الغشاء البلازمي اسمها (integrins)



## Extracellular matrix functions :-

- Support
- adhesion
- movement
- regulation (sign translation)

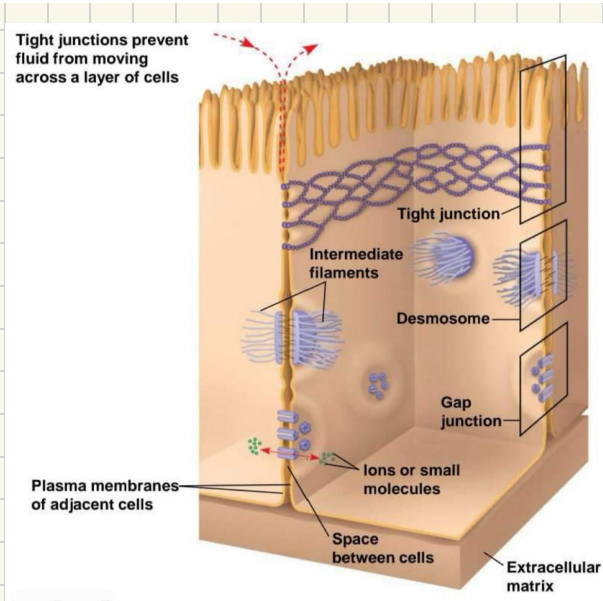
# Cell junctions

Neighboring cells in tissues, organs, or organ systems often adhere, interact, and communicate through direct physical contact

Intercellular junctions facilitate this contact

There are several types of intercellular junctions

- Plasmodesmata
- Tight junctions
- Desmosomes
- Gap junctions



## Tight

Membranes are pressed together to prevent leakage of fluids

## Desmosomes

Made of intermediate filaments, and they hold the cells together strongly (Anchoring)

## Gap

Channels between cells, the two cells cytoplasm is connected (communicating)