



PHYSIOLOGY

FACULTY OF PHARMACEUTICAL SCIENCES

DR. AMJAAD ZUHIER ALROSAN

LECTURE 2, PART (1): CELLULAR LEVEL OF ORGANIZATION

Objectives

1. Discuss **cellular level of organization. (Continue the previous lecture)---Part (1)**
2. Describe **transport processes of solutes and water .----- Part (2)**

(Pages 60-84 of the reference)

THE CYTOPLASM

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

من سلايد 3 لحتى سلايد 7 مكررات بالانثرو نفسهم

- It has two components:
- **(1) the cytosol**, is the fluid portion of the cytoplasm that surrounds organelles.
- **(2) organelles**, are tiny structures that perform different functions in the cell.

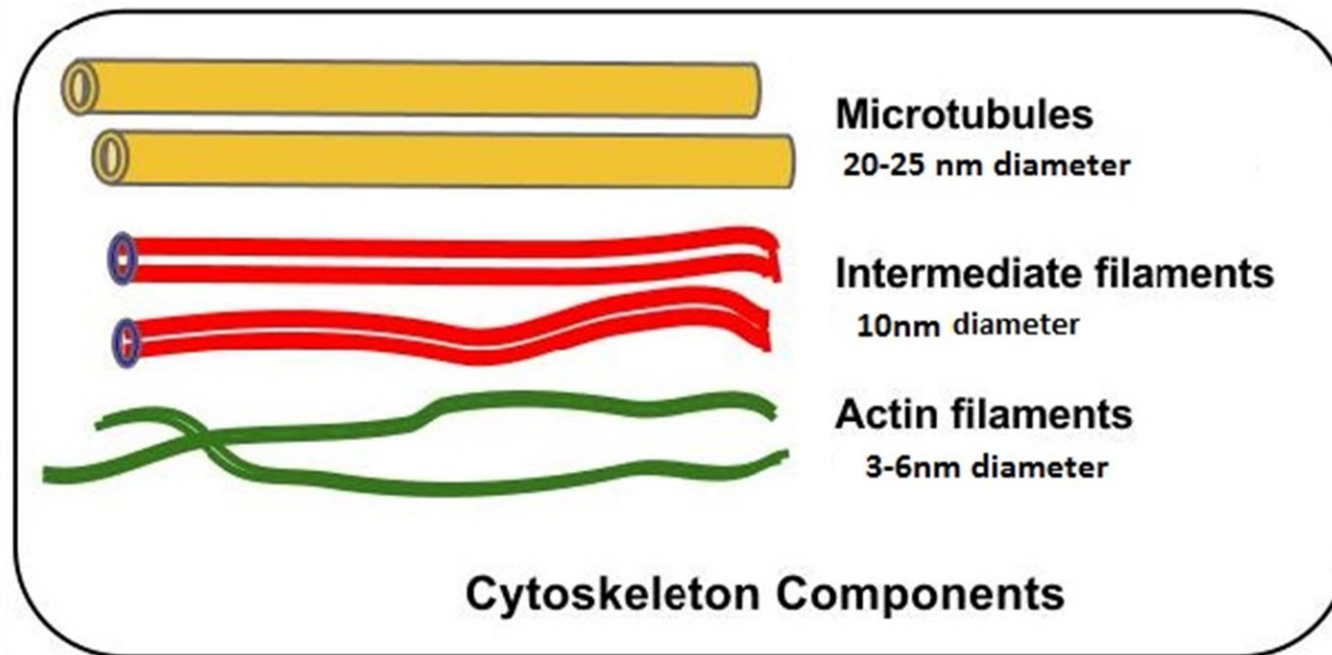
THE CYTOPLASM

- Cytosol:

1. Contains **75–90% water** plus various dissolved and suspended components (i.e. glucose, amino acids, fatty acids, proteins, lipids, ATP, and waste products).
2. It is **the site of many chemical reactions** required for a cell's existence (i.e. glycolysis, maintenance of cell structures and for cell growth).

THE CYTOPLASM

- The **cytoskeleton** is a network of protein filaments that extends throughout the cytosol (**microfilaments, intermediate filaments, and microtubules**).



THE CYTOPLASM

- **Microfilaments:**

1. Are the thinnest elements of the cytoskeleton.
2. They are composed of the proteins actin and myosin.
3. They have two general functions: help generate movement (muscle contraction, cell division, and cell locomotion) and provide mechanical support (basic strength and shapes of cells).

- **Intermediate filaments:**

1. Are thicker than microfilaments but thinner than microtubules.
2. They are found in parts of cells subject to mechanical stress.
3. They help stabilize the position of organelles such as the nucleus and help attach cells to one another.

THE CYTOPLASM

- **Microtubules:**

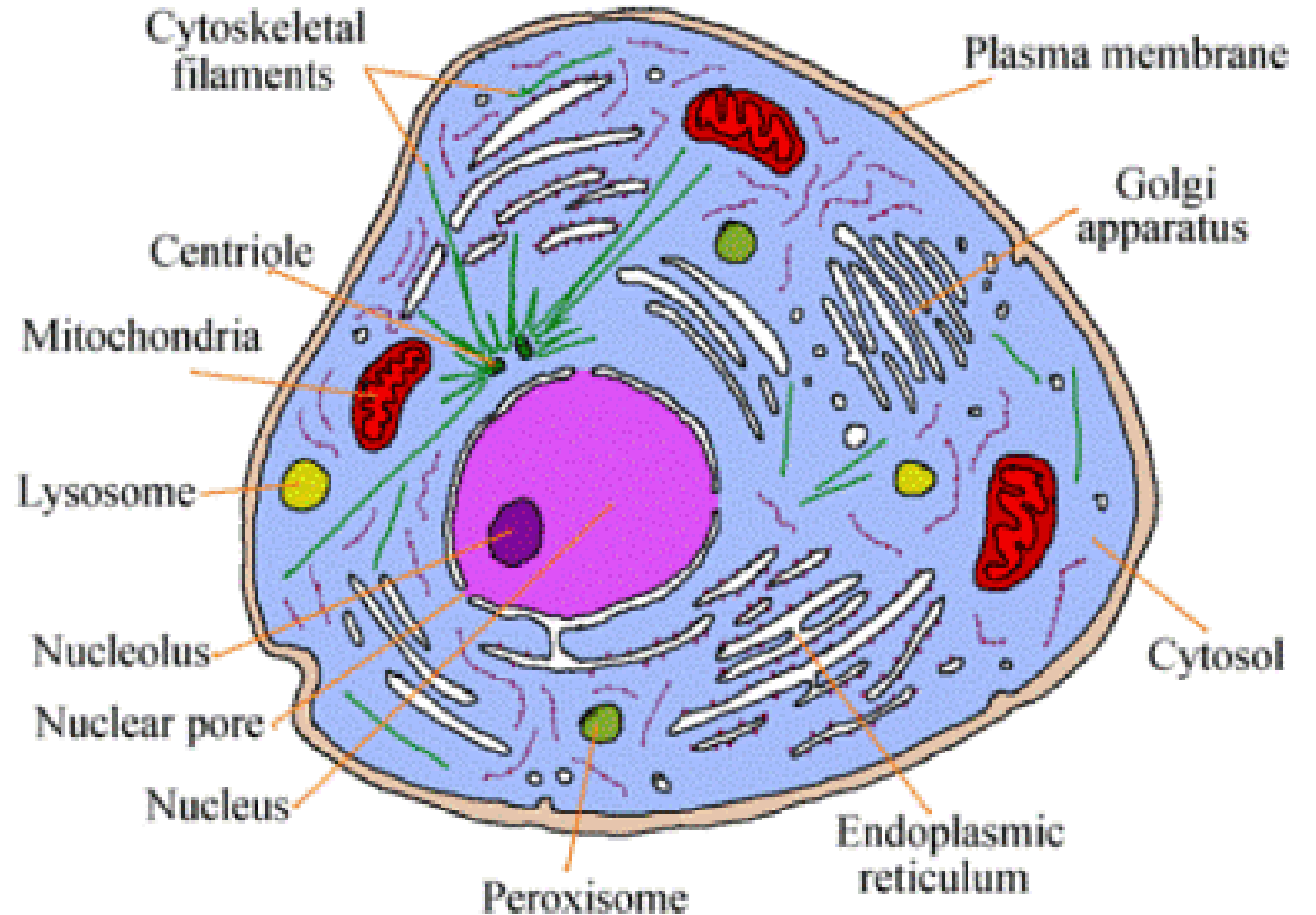
1. Are the largest of the cytoskeletal components.
2. They are composed mainly of the protein tubulin.
3. They help determine cell shape.
4. They also function in the movement of organelles.

THE ORGANELLES

Organelles are specialized structures within the cell that have characteristic shapes, and they perform specific functions in cellular growth, maintenance, and reproduction. They often cooperate to maintain homeostasis.

العضيات هي هياكل متخصصة داخل الخلية لها أشكال مميزة، وتؤدي وظائف محددة في نمو الخلايا وصيانتها وتكاثرها. وغالبًا ما تتعاون للحفاظ على التوازن الداخلي.

Organelles of the Cell



THE ORGANELLES

1. Centrosome. الجسيم المركزي
2. Cilia and Flagella. الاهداب والاسواط
3. Ribosomes. الرايبوسومات
4. Endoplasmic Reticulum. الشبكة الاندوبلازميه
5. Golgi Complex. جهاز غولجي
6. Lysosomes. الليزوزومات
7. Peroxisomes. البيروكسيسومات.
8. Proteasomes. البروتيازومات.
9. Mitochondria. الميتوكوندريا
10. Nucleus. النواة

Centrosome

- Is located near the nucleus and it consists of two components: **a pair of centrioles and pericentriolar material.**

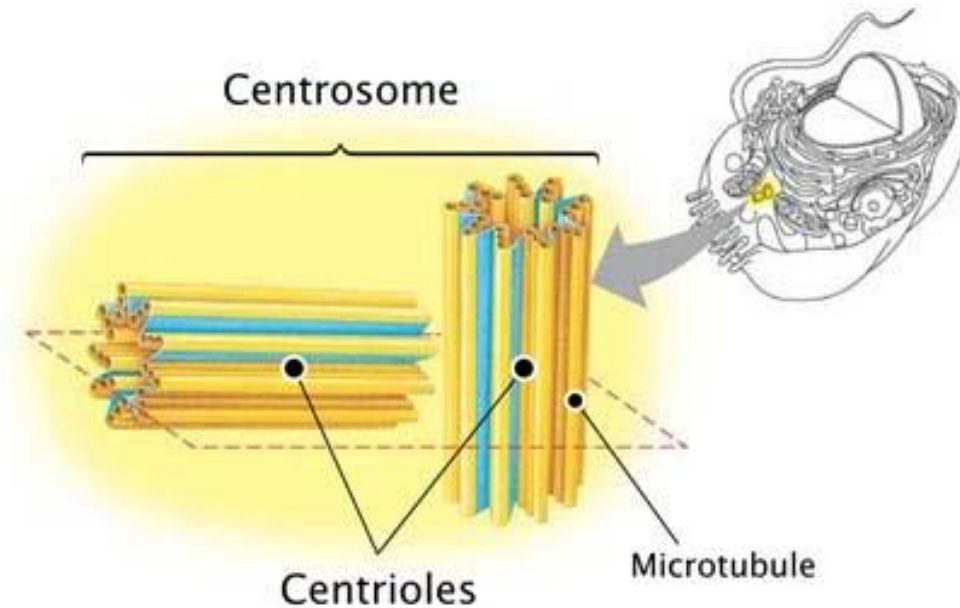
الجسيمات المركزيه

هياكل اسطوانيه

- The **centrioles** are cylindrical structures (microtubules). Surrounding the centrioles is pericentriolar material which contains the tubulin complexes.

- These complexes organize centers for growth of the mitotic spindle (cell division).

تنظم هذه المعقدات مراكز نمو المغزل الانقسامى (انقسام الخلية).



Cilia

الأهداب

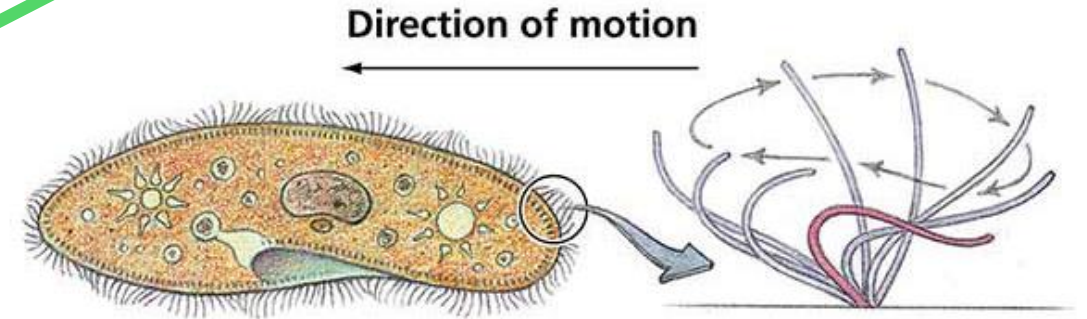
- **Microtubules are the dominant components of cilia and flagella.** Both are motile projections. However, cilia is present throughout the surface of a cell, but flagella is present at both the ends or all over the surface.

- Hair-like structure. بنية تشبه الشعر.

- The main function of motile cilia is to keep the airways clear of mucus and dust.

الوظيفة الرئيسية للأهداب المتحركة هي الحفاظ على مجرى الهواء خاليًا من المخاط والغبار.

فإن الأهداب موجودة في جميع أنحاء سطح الخلية، ولكن الأسواط موجودة في كلا الطرفين أو في جميع أنحاء السطح.



(b) Cilia

Flagella

الأسواط



(a) Flagella

Direction of motion

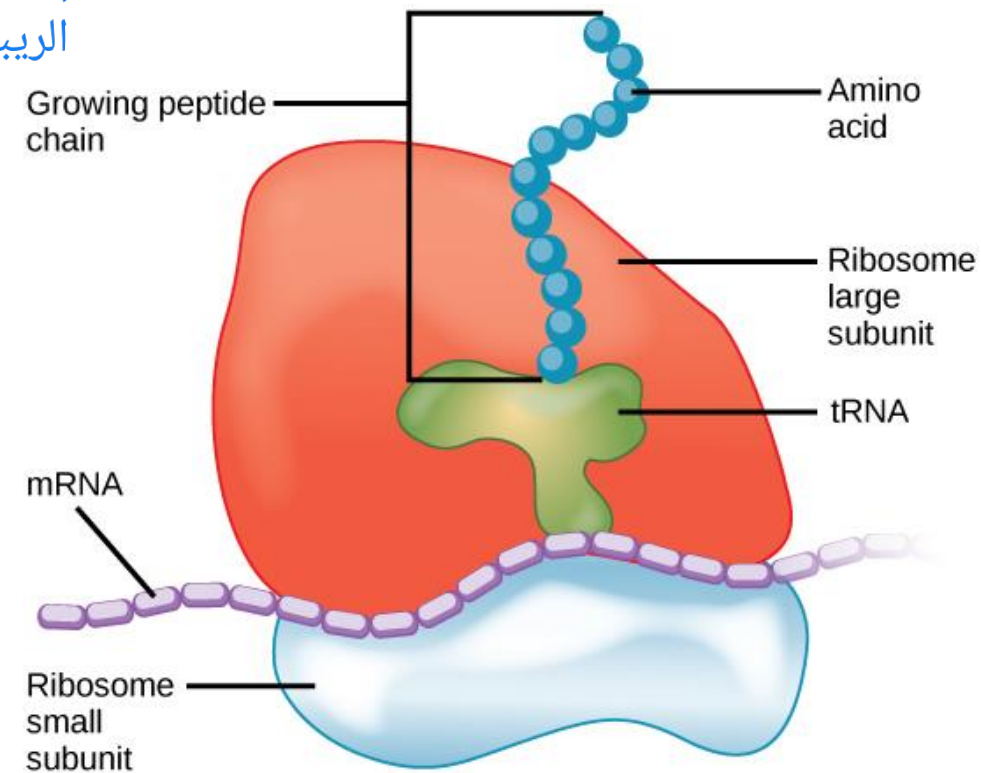


حركة الأهداب دورانية وسريعة جدًا. حركة الأسواط حركة دورانية في بدائيات النوى بينما هي حركة انحناء في حقيقيات النوى. تنبض الأهداب بالتنسيق أو واحدًا تلو الآخر. تنبض الأسواط بشكل مستقل عن بعضها البعض.

- Flagella are similar in structure to cilia but are typically much longer.
- Flagella usually move an entire cell (i.e. sperm).
- The motion of cilia is rotational, very fast moving. The motion of flagella is rotary movement in prokaryotes whereas it is bending movement in eukaryotes. Cilia beat in coordination or one after the other. Flagella beat independent of each other.

Ribosomes

- **Are the sites of protein synthesis.** مناطق تصنيع البروتين يعكس اسم هذه الهياكل الصغيرة محتواها العالي من نوع واحد من الأحماض النووية (الحمض النووي الريبوزي الريبوسومي، أو rRNA).
- The name of these tiny structures reflects their high content of one type of ribonucleic acid (ribosomal RNA, or rRNA).
- جميع أنحاء "Scattered منتشرة throughout cytoplasm": Some ribosomes are attached to the outer surface of the nuclear membrane and to an endoplasmic reticulum. Ribosomes are also located within mitochondria. Other ribosomes are "free" or unattached to other cytoplasmic structures.



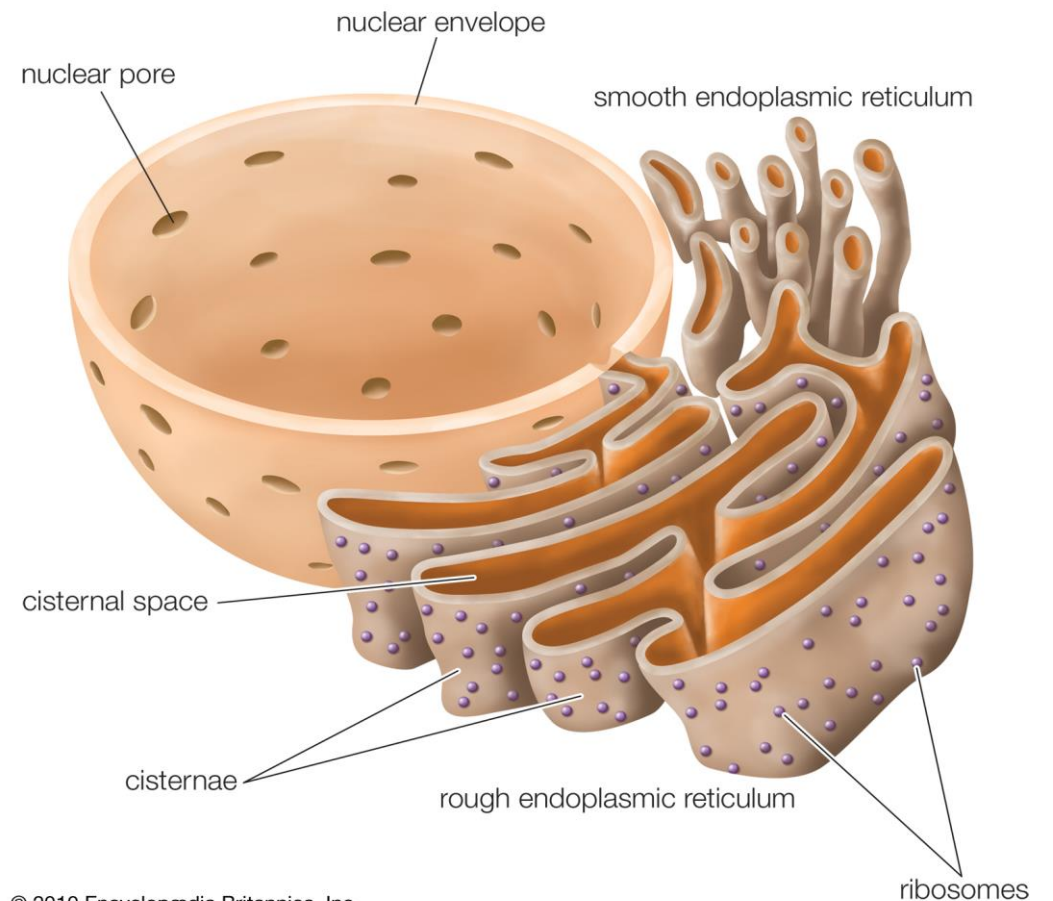
Endoplasmic Reticulum

الشبكة الإندوبلازمية

الشبكة الإندوبلازمية (ER) هي شبكة من الأغشية على شكل أكياس أو أنابيب مسطحة

- **The endoplasmic reticulum (ER)** is a network of membranes in the form of flattened sacs or tubules.
- The ER extends from the nuclear envelope (membrane around the nucleus), to which it is connected and projects throughout the cytoplasm.
- Cells contain two distinct forms of ER (**rough ER** and **smooth ER**), which differ in structure and function.

Endoplasmic reticulum



Endoplasmic Reticulum

مرصع او مغطى

المعالجة والفرز

- The outer surface of **rough ER** is studded with ribosomes (membrane-bound ribosomes). Proteins synthesized by ribosomes enter spaces within the ER for processing and sorting. Thus, rough ER produces secretory proteins, membrane proteins, and many organellar proteins. بروتينات افرازيه

- Unlike rough ER, **smooth ER** does not have ribosomes on its membrane. However, smooth ER contributes to lipids and carbohydrates synthesis, making phospholipids bilayer for cell membranes as well as it stores and releases calcium ions that trigger contraction in muscle cells. تخزن

تطلق

يحفز

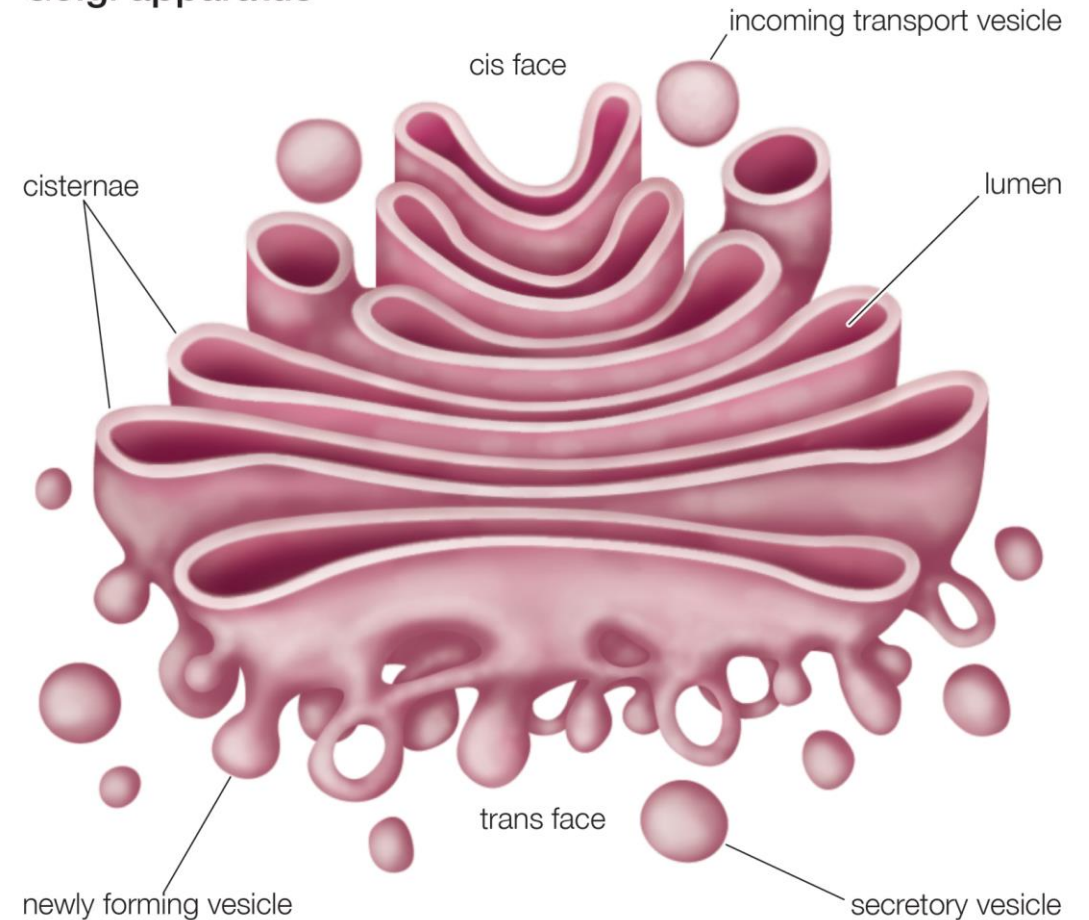
انقباض الخلية العضلية

Golgi Complex

- Most of the proteins synthesized by ribosomes attached to rough ER are ultimately transported to other regions of the cell (i.e. **Golgi complex**).

ينقل في النهاية

Golgi apparatus



Golgi Complex

■ Functions of Golgi Complex:

1. ^{يعدل} Modifies, sorts, packages, and transports proteins received from the rough ER (through face or cis entry). Enzymes in the middle site of the Golgi complex modify the proteins to form glycoproteins, glycolipids, and lipoproteins.
2. ^{تفرز او تطلق} ^{الحويصلات الافرازية} Forms secretory vesicles that discharge processed proteins via ^{الايخراج الخلوي} exocytosis (through exist or trans face) into extracellular fluid and forms transport vesicles that carry molecules to other organelles, such as lysosomes.

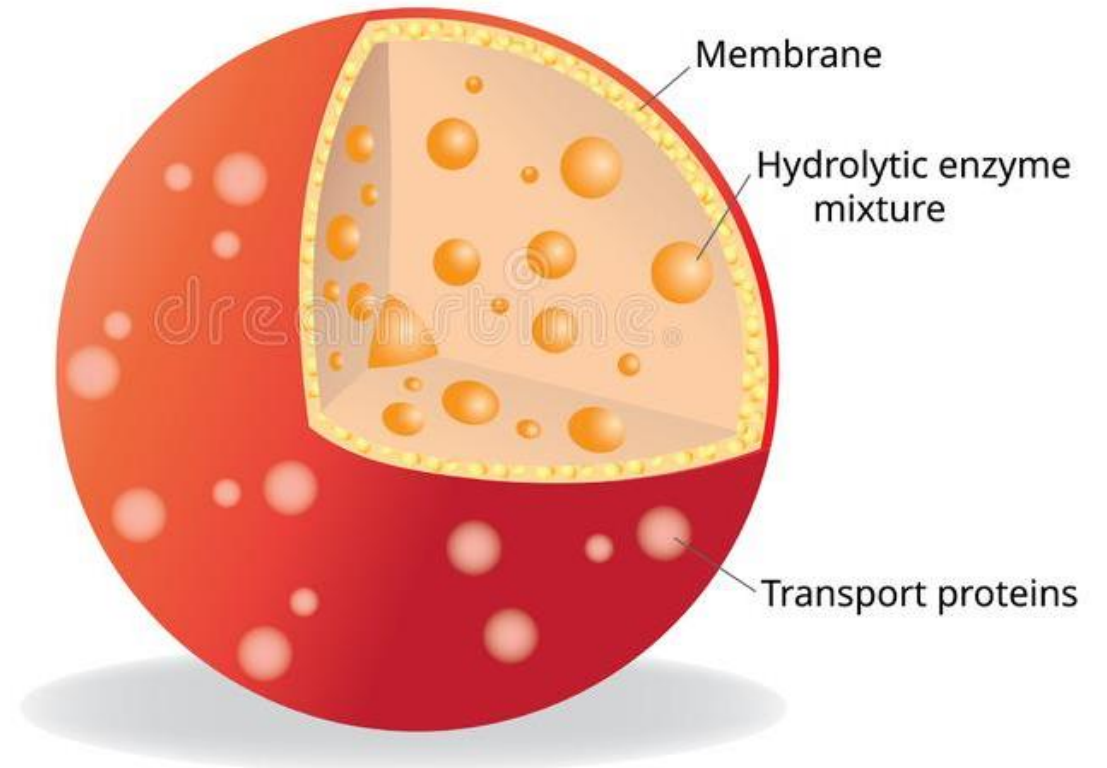
Lysosomes

حويصلات محاطة بغشاء تتكون من جهاز جولجي.

- **Lysosomes** are membrane-enclosed vesicles that form from the Golgi complex.
- They can contain as many as 60 kinds of **powerful digestive and hydrolytic enzymes** that can break down a wide variety of molecules.

يمكن أن تحتوي على ما يصل إلى 60 نوعًا من الإنزيمات الهاضمة والتحليلية القوية التي يمكنها تحليل مجموعة واسعة من الجزيئات.

LYSOSOME



Lysosomes

■ Functions of lysosomes:

1. ^{هضم} Digest substances (within the cell) that enter a cell via ^{البلعنة الخلوية} endocytosis and transport final products of digestion into cytosol.
2. Carry out ^{التغذية الذاتية} autophagy, the ^{هضم العضيات البالية} digestion of worn-out organelles.
3. Implement ^{تنفيذ} autolysis, the ^{التحلل الذاتي} digestion of an entire cell. ^{هضم خلية كامله}
4. ^{إنجاز الهضم خارج الخلية.} Accomplish extracellular digestion.

Peroxisomes

انزيمات مؤكسده

- **Peroxisomes** contain several **oxidases**, enzymes that can oxidize (remove hydrogen atoms from) various organic substances.
- They protect the cells from oxidative damage. تحمي الخلايا من التلف التأكسدي.
- They protect other parts of the cell from the toxic effects of potentially toxic compounds. إنها تحمي أجزاء أخرى من الخلية من التأثيرات السامة للمركبات السامة المحتملة.
- Peroxisomes are very abundant in the liver, where detoxification of alcohol and other damaging substances occurs. وفيره الكبد ازاله السموم من الكحول
- Peroxisomes also contain the enzyme **catalase**, which decomposes by-product of the oxidation reactions which is hydrogen peroxide (H_2O_2); thus, it decomposes hydrogen peroxide to water and oxygen. يحلل

تحتوي بيروكسيسومات أيضًا على إنزيم الكاتاليز، الذي يحلل المنتج الثانوي لتفاعلات الأكسدة وهو بيروكسيد الهيدروجين (H_2O_2)، وبالتالي، فإنه يحلل بيروكسيد الهيدروجين إلى الماء والأكسجين.

Proteasomes

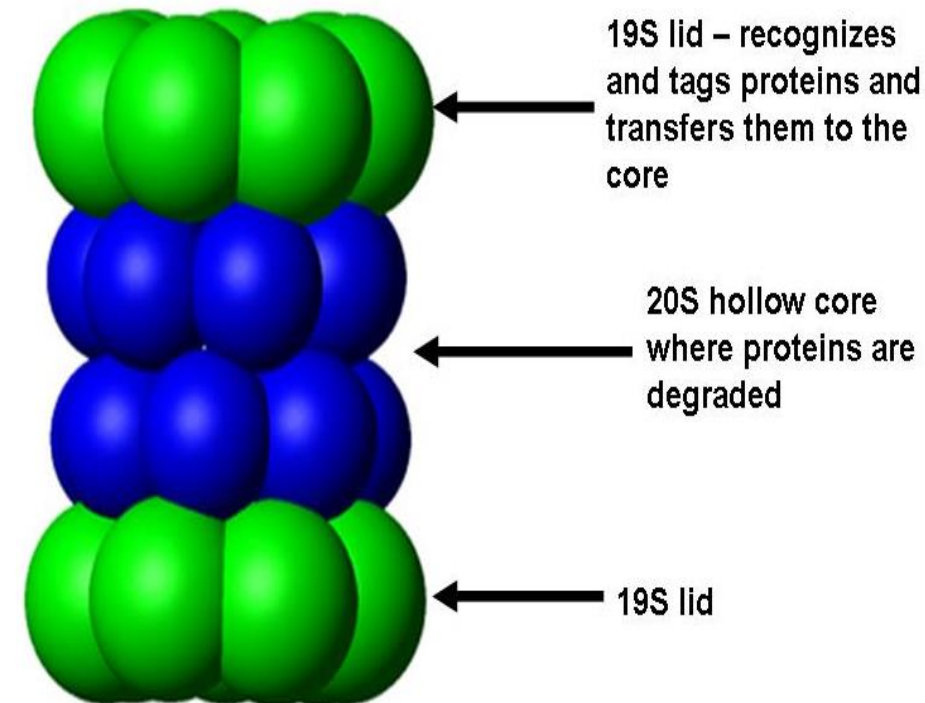
تتطلب البروتينات السيتوبلازمية التخلص منها في أوقات معينة من حياة الخلية. إن التدمير المستمر للبروتينات غير الضرورية والتالفة والمعيبة هو وظيفة هياكل صغيرة على شكل برميل تتكون من أربع حلقات مكدسة من البروتينات حول نواة مركزية تسمى البروتيازومات.

التخلص

بروتينات سيتوبلازمية

- Cytosolic proteins require disposal at certain times in the life of a cell. Continuous ^{تحتيم} destruction of unnneeded, damaged, or ^{المعيبة} faulty proteins is the function of tiny barrel-shaped structures consisting of four stacked rings of proteins around a central core called **proteasomes**.
- Proteasomes were so named because they contain proteases, enzymes that cut proteins into small peptides. Once the enzymes of a proteasome have ^{تقطع} chopped up a protein into smaller chunks, other enzymes then break down the peptides into amino acids, which can be recycled into new proteins.

26S proteasome

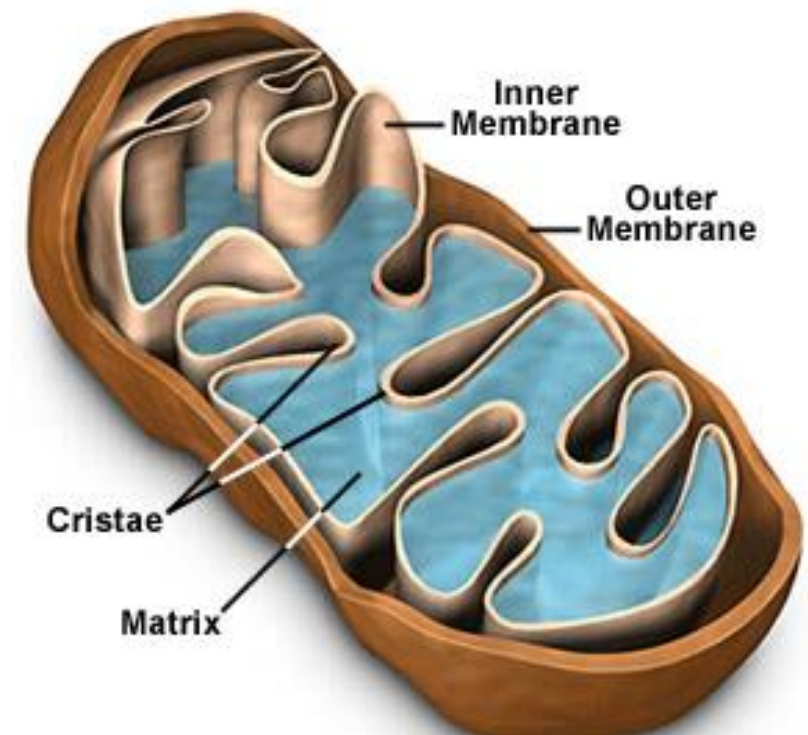


Mitochondria

تنتج الميتوكوندريا معظم ATP من خلال التنفس الهوائي (الذي يتطلب الأكسجين)، ("محطات توليد الطاقة" للخلية). توجد الإنزيمات التي تحفز التفاعلات الكيميائية التي تعد جزءًا من المرحلة الهوائية من التنفس الخلوي في الميتوكوندريا.

- **Mitochondria** generate most of the ATP through aerobic (oxygen requiring) respiration, ("powerhouses" of the cell). The enzymes that catalyze the chemical reactions which are part of the aerobic phase of cellular respiration are located in the mitochondria.
- Active cells that use ATP at a high rate—such as those found in the muscles, liver, and kidneys—have a large number of mitochondria.
- A mitochondrion consists of an outer mitochondrial membrane and an inner mitochondrial membrane with a small fluid-filled space between them (mitochondrial matrix).

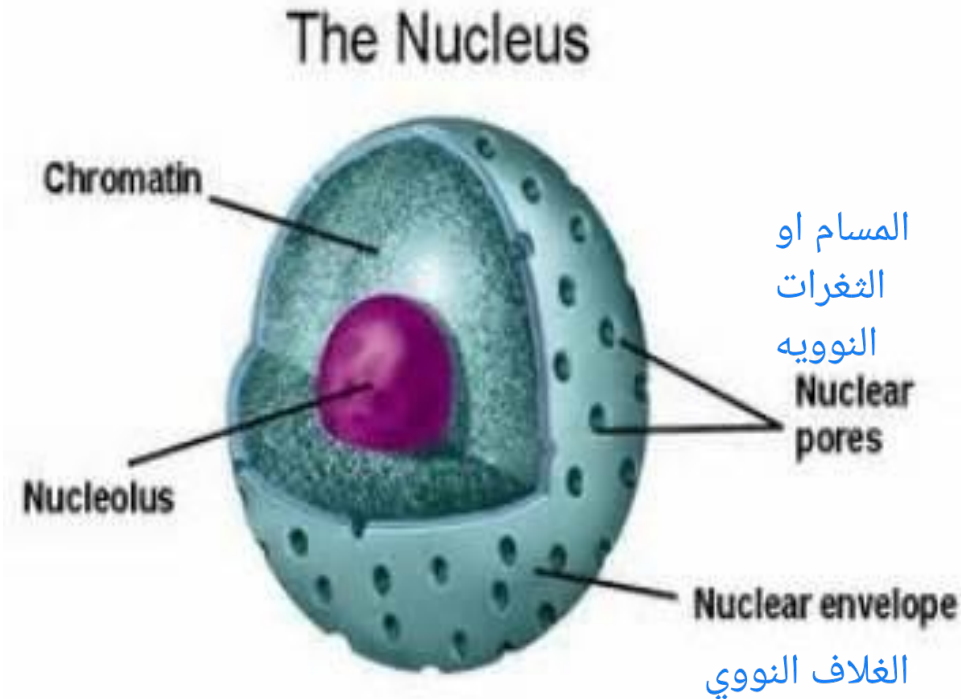
Mitochondria Structural Features



Nucleus

النواة هي بنية كروية أو بيضاوية الشكل وهي عادةً السمة الأبرز للخلية.

- **The nucleus** is a spherical or oval-shaped structure that usually is the most prominent feature of a cell.
- Most cells have a single nucleus, although some, such as mature red blood cells, have none. Other types of cells have multiple nuclei.
- A double membrane called the nuclear envelope separates the nucleus from the cytoplasm. Many openings called nuclear pores extend through the nuclear envelope.
- The complex of DNA, proteins, and some RNA is called chromatin. The total genetic information carried in a cell, or an organism is its genome.



Nucleus

■ Functions of nucleus:

1. Controls cellular structure.
١. تتحكم في بنية الخلية.
2. Directs cellular activities.
2. توجيه الأنشطة الخلوية.
3. Produces ribosomes in nucleoli.
3. إنتاج الريبوسومات في النوية.
4. Nuclear pores control the movement of substances between the nucleus and cytoplasm.
4. تتحكم المسام النووية في حركة المواد بين النواة والسيتوبلازم.



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LECTURE 2, PART (2): TRANSPORT PROCESSES OF SOLUTES AND WATER

نفاذية الغشاء: **Membrane permeability:**

تختلف نفاذية الغشاء البلازمي للمواد المختلفة.

- The permeability of the plasma membrane to different substances varies.
 - The hydrophobic interior of the plasma membrane allows nonpolar molecules to rapidly pass through, but prevents passage of ions and large, uncharged polar molecules.
 - Because water and urea are small polar molecules that have no overall charge, they can move from one gap (small gaps appear in the hydrophobic environment of the membrane's interior) to another until they have crossed the membrane without any assistance.
- تعمل البروتينات عبر الغشائية التي تعمل كقنوات وناقلات (انتقائية للغاية) على زيادة نفاذية الغشاء البلازمي لمجموعة متنوعة من الأيونات والجزيئات القطبية غير المشحونة (بحاجة إلى المساعدة).
- **Transmembrane proteins that act as channels and carriers** (very selective) increase the plasma membrane's permeability to a variety of **ions and uncharged polar molecules** (need assistance).

التدرجات عبر الغشاء البلازمي:

Gradients across the Plasma Membrane:

تدرج التركيز

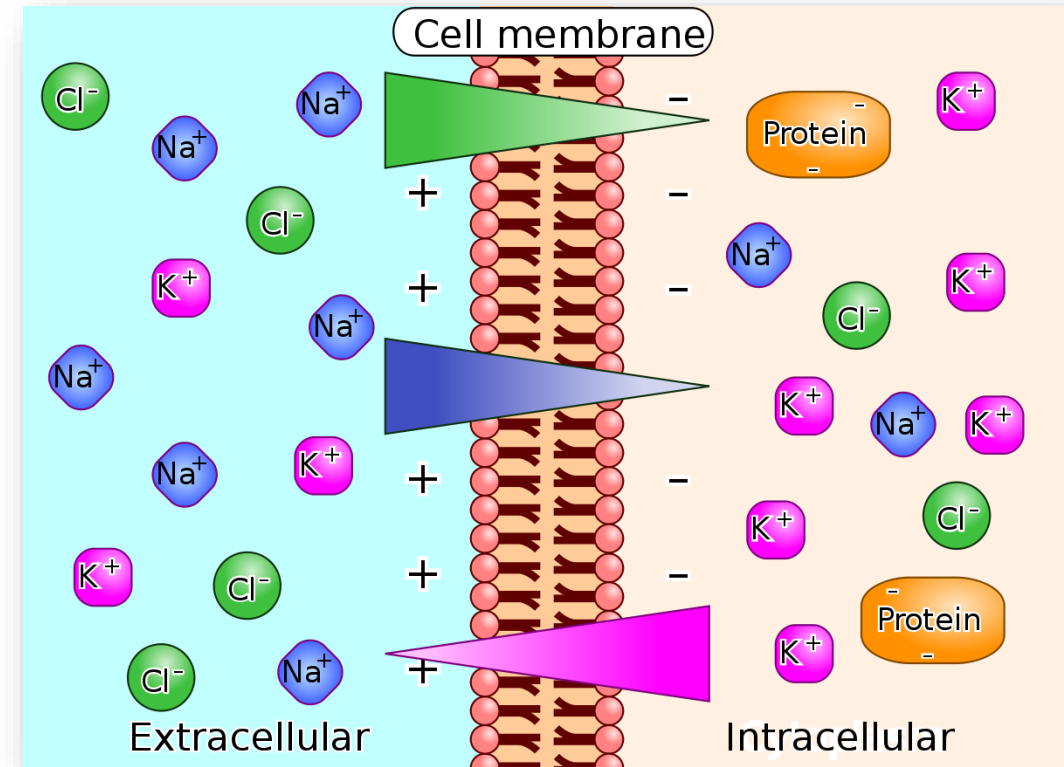
- A concentration gradient is a difference in the concentration of a chemical from one place to another, such as from the inside to the outside of the plasma membrane. A substance will move “downhill,” from where it is more concentrated to where it is less concentrated, to reach equilibrium. downhill= إلى الأسفل
- The plasma membrane also creates a difference in the distribution of positively and negatively charged ions between the two sides of the plasma membrane.

يخلق الغشاء البلازمي أيضًا اختلافًا في توزيع الأيونات الموجبة والسالبة بين جانبي الغشاء البلازمي.

Gradients across the Plasma Membrane:

- The difference in electrical charges between two regions constitutes an electrical gradient. This is termed the membrane potential. A positively charged substance will tend to move toward a negatively charged area, and a negatively charged substance will tend to move toward a positively charged area.

- The combined influence of the concentration gradient and the electrical gradient on movement of a particular ion is referred to as its electrochemical gradient.



TRANSPORT ACROSS THE PLASMA MEMBRANE

- Substances generally move across cellular membranes via **transport processes** that can be classified as passive or active, depending on whether they require cellular energy.

يعني لا يحتاج طاقه اضافيه هو فقط يعتمد على طاقته الحركيه

- In **passive processes**, a substance moves down its concentration or electrical gradient to cross the membrane using only its own kinetic energy (energy of motion).

اما هنا فيجب ان نزوده بطاقه تدفعه والتي تكون على شكل ادينوسين ثلاثي الفوسفات ATP

- In **active processes**, cellular energy (in the form of adenosine triphosphate (ATP)) is used to drive the substance “uphill” against its concentration or electrical gradient.
الى اعلى

TRANSPORT ACROSS THE PLASMA MEMBRANE

Another way that some substances may enter and leave cells is an **active process** in which tiny, spherical membrane sacs referred to as **vesicles** are used. Examples include **endocytosis**, in which vesicles detach from the plasma membrane while bringing materials into a cell, and **exocytosis**, the merging of vesicles with the plasma membrane to release materials from the cell.

PASSIVE PROCESSES

- **Diffusion** is a passive process in which the random mixing of particles (solutes, the dissolved substances, and the solvent) in a solution occurs because of the particles' kinetic energy.
- If a particular solute is present in high concentration in one area of a solution and in low concentration in another area, solute molecules will diffuse toward the area of lower concentration—they move down their concentration gradient (the solution after diffusion is said to be at equilibrium).

إذا كان المذاب معين موجودًا بتركيز عالٍ في منطقة واحدة من المحلول وبتركيز منخفض في منطقة أخرى، فإن جزيئات المذاب ستنتشر نحو منطقة التركيز المنخفض - تتحرك لأسفل تدرج تركيزها (يقال إن المحلول بعد الانتشار يكون في حالة توازن).

PASSIVE PROCESSES

يعني كلها علاقتها طرديه ما عدا كتله
الجزئيات بتكون عكسيه لتسهيل الحفظ

- Substances may also diffuse through a membrane, if the membrane is permeable to them.
Several factors influence the diffusion rate of substances across plasma membranes:

شدة تدرج التركيز

(كلما زاد الفرق في التركيز بين جانبي الغشاء، زاد معدل الانتشار).

1. Steepness of the concentration gradient (the greater the difference in concentration between the two sides of the membrane, the higher is the rate of diffusion).
2. Temperature (the higher the temperature, the faster the rate of diffusion).
3. Mass of the diffusing substance (the larger the mass of the diffusing particle, the slower its diffusion rate).
4. Surface area (the larger the membrane surface area available for diffusion, the faster is the diffusion rate).
5. Diffusion distance (The greater the distance over which diffusion must occur, the longer it takes).

DIFFUSION

تتحرك المادة عبر الطبقة الدهنية

1- Simple diffusion

الثنائية للغشاء البلازمي دون

مساعدة بروتينات النقل الغشائي



Extracellular fluid



Plasma membrane



Cytosol

a substance moves across the lipid bilayer of the plasma membrane without the help of membrane transport proteins

الميسر أو السهل

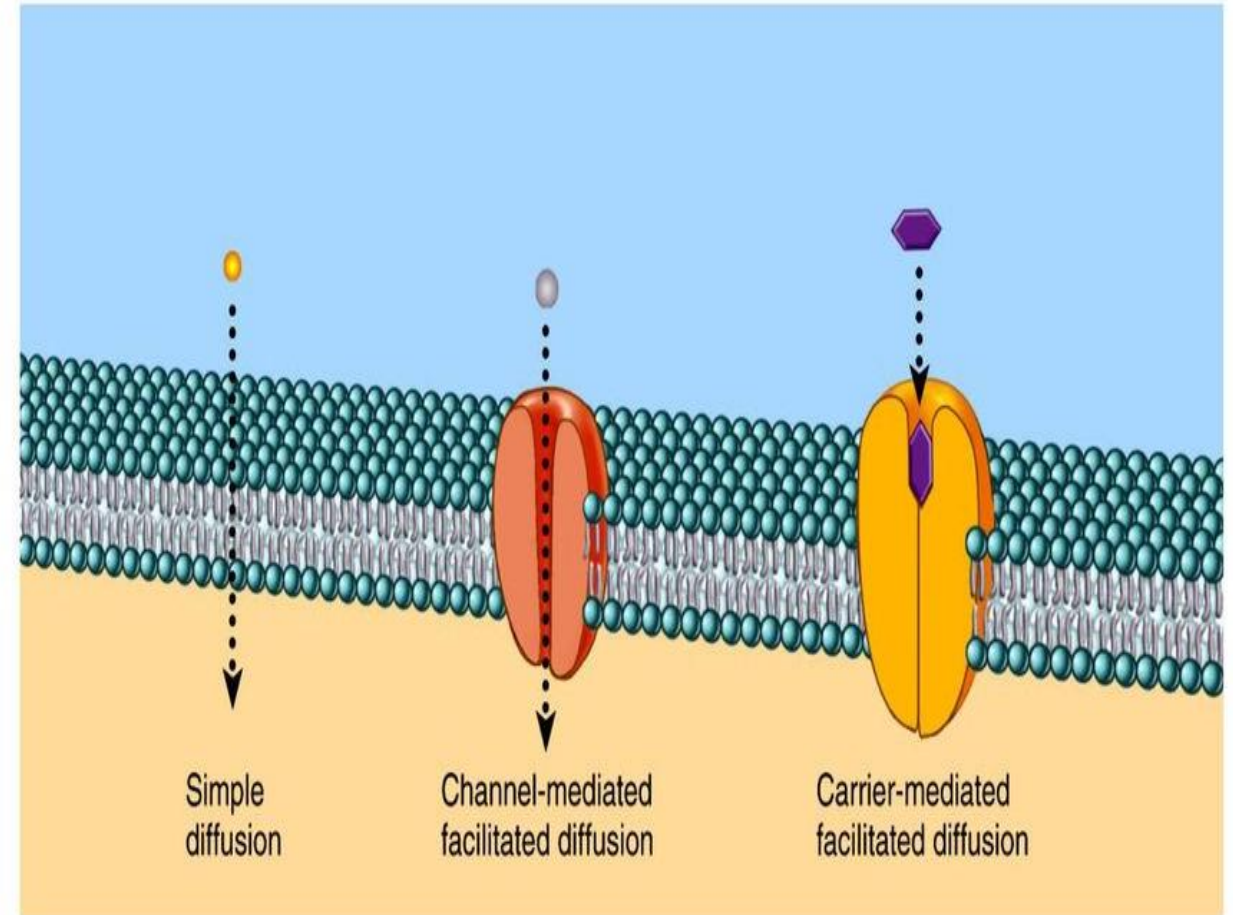
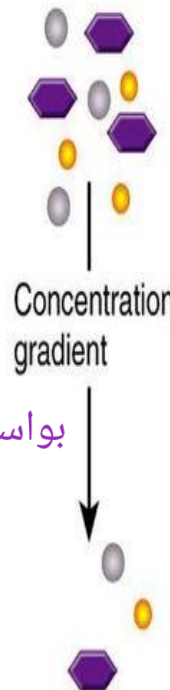
2- Facilitated diffusion

بواسطه قناه

channel-mediated facilitated diffusion, and carrier-mediated facilitated diffusion

بواسطه ناقل

A substance moves across the lipid bilayer aided by a channel protein or a carrier protein



DIFFUSION

Examples of simple diffusion

Nonpolar, hydrophobic molecules include oxygen, carbon dioxide, and nitrogen gases; fatty acids; steroids; and fat-soluble vitamins (A, D, E, and K) as well as small, uncharged polar molecules such as water, urea, and small alcohols.

Examples of facilitated diffusion

Too polar or highly charged solutes.

FACILITATED DIFFUSION

الانتشار المسهل بواسطة القناة

1. Channel-mediated facilitated diffusion

- Most membrane channels are ion channels ^{متكامل} integral transmembrane proteins that allow passage of small, inorganic ions that are too hydrophilic to penetrate the nonpolar interior of the lipid bilayer.
- Some ^{القنوات المحصورة} gated channels randomly ^{يبدل او يتناوب} alternate between the open and closed positions; others are regulated by chemical or electrical changes inside and outside the cell. When the gates of a channel are open, ions diffuse into or out of cells, down their electrochemical gradients.

FACILITATED DIFFUSION

2. الانتشار الميسر بواسطة الناقل

2. Carrier- mediated facilitated diffusion

- يرتبط The solute binds more often to the carrier on the side of the membrane with a higher concentration of solute and is released on the other side after the carrier undergoes a change in shape.
يرتبط المذاب بشكل أكثر تكرارًا بالناقل على جانب الغشاء ذي التركيز الأعلى من المذاب ويتم إطلاقه على الجانب الآخر بعد أن يخضع الناقل لتغيير في الشكل.
- Once the concentration is the same on both sides of the membrane, solute molecules bind to the carrier on the cytosolic side and move out to the extracellular fluid.
بمجرد أن يكون التركيز هو نفسه على جانبي الغشاء، ترتبط جزيئات المذاب بالناقل على الجانب السيتوبلازمي وتتحرك إلى السائل خارج الخلية.
- Substances that move across the plasma membrane by carrier mediated facilitated diffusion include glucose, fructose, galactose, and some vitamins.

OSMOSIS

- **Osmosis** is a type of diffusion that occurs only when a membrane is permeable to water but is not permeable to certain solutes.
- In living systems, the solvent is water, which moves by osmosis across plasma membranes from an area of **higher water concentration to an area of lower water concentration**. In other words, water moves through a **selectively permeable membrane from an area of lower solute concentration to an area of higher solute concentration**.

في الأنظمة الحية، المذيب هو الماء، الذي يتحرك بالخاصية الاسموزية عبر الأغشية البلازمية من منطقة ذات تركيز ماء أعلى إلى منطقة ذات تركيز ماء أقل. بمعنى آخر، يتحرك الماء عبر غشاء نافذ بشكل انتقائي من منطقة ذات تركيز مذاب أقل إلى منطقة ذات تركيز مذاب أعلى.

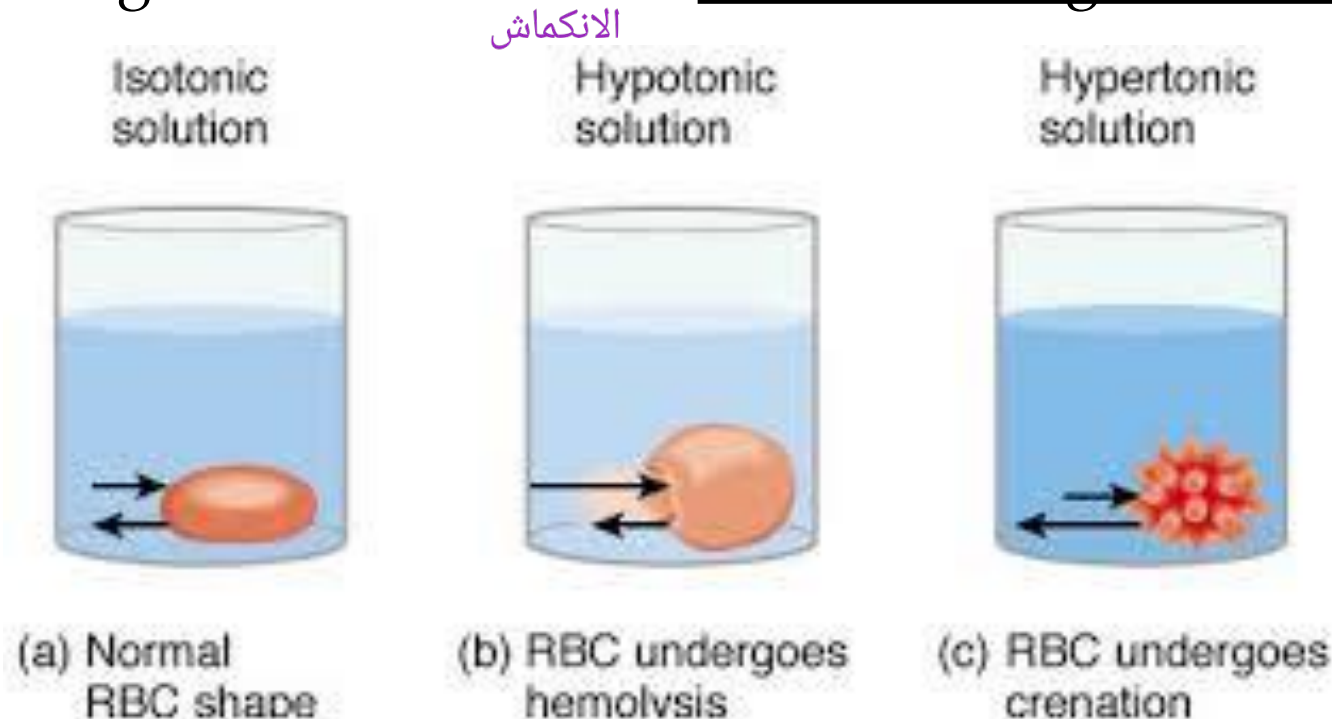
OSMOSIS

أي محلول تحافظ فيه الخلية على شكلها وحجمها الطبيعيين هو محلول متساوي التوتر. تكون تركيزات المواد المذابة التي لا يمكنها عبور الغشاء البلازمي متساوية على جانبي الغشاء في هذا المحلول.

- Any solution in which a cell maintains its normal shape and volume is an **isotonic solution**. The concentrations of solutes that cannot cross the plasma membrane are the same on both sides of the membrane in this solution.
- A different situation results if the cells are placed in a **hypotonic solution**, a solution that has lower concentration of solutes than the cytosol inside the cells. In this case, water molecules enter the cells faster than they leave, causing the cells to swell and eventually to burst (lysis).
تضخم أو انتفاخ
التحلل الانفجار

OSMOSIS

- A hypertonic solution has a higher concentration of solutes than does the cytosol inside cells. In such a solution, water molecules move out of the cells faster than they enter, causing the cells to shrink. Such shrinkage of cells is called crenation.



ACTIVE PROCESSES

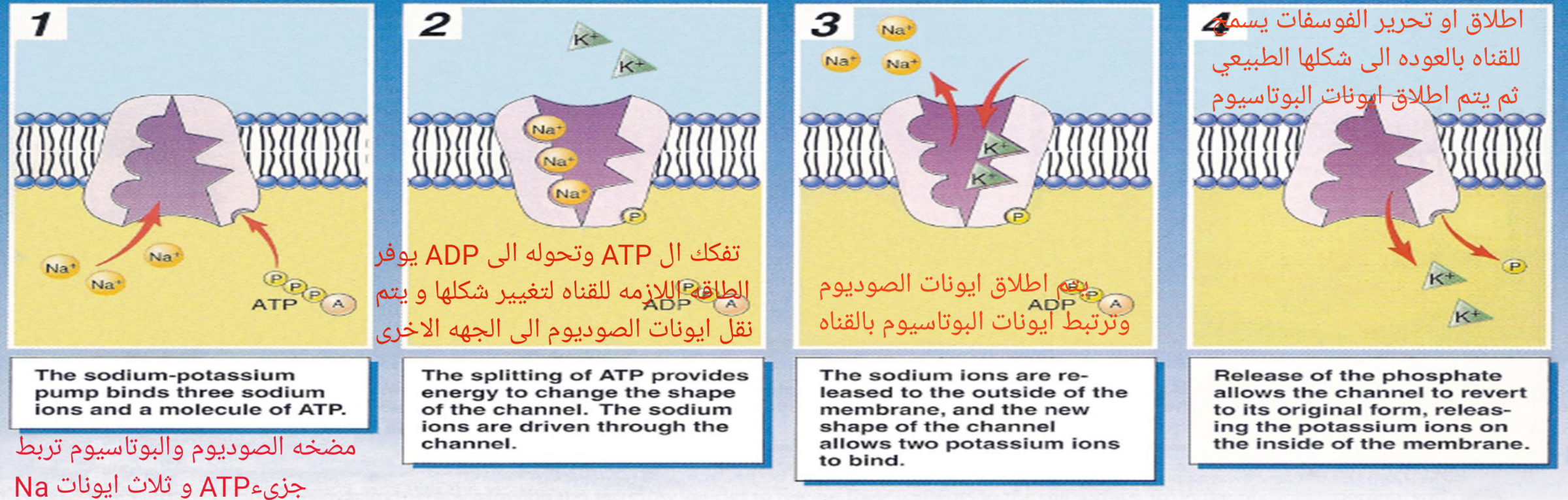
يمكن استخدام مصدرين للطاقة الخلوية لدفع النقل النشط:

- **Two sources of cellular energy can be used to drive active transport:**
 1. Energy obtained from ^{التحلل المائي} hydrolysis of adenosine triphosphate (ATP) is the source in primary active transport.
 2. Energy stored in an ionic concentration gradient is the source in secondary active transport.
- Carrier proteins that mediate primary active transport are often called pumps.

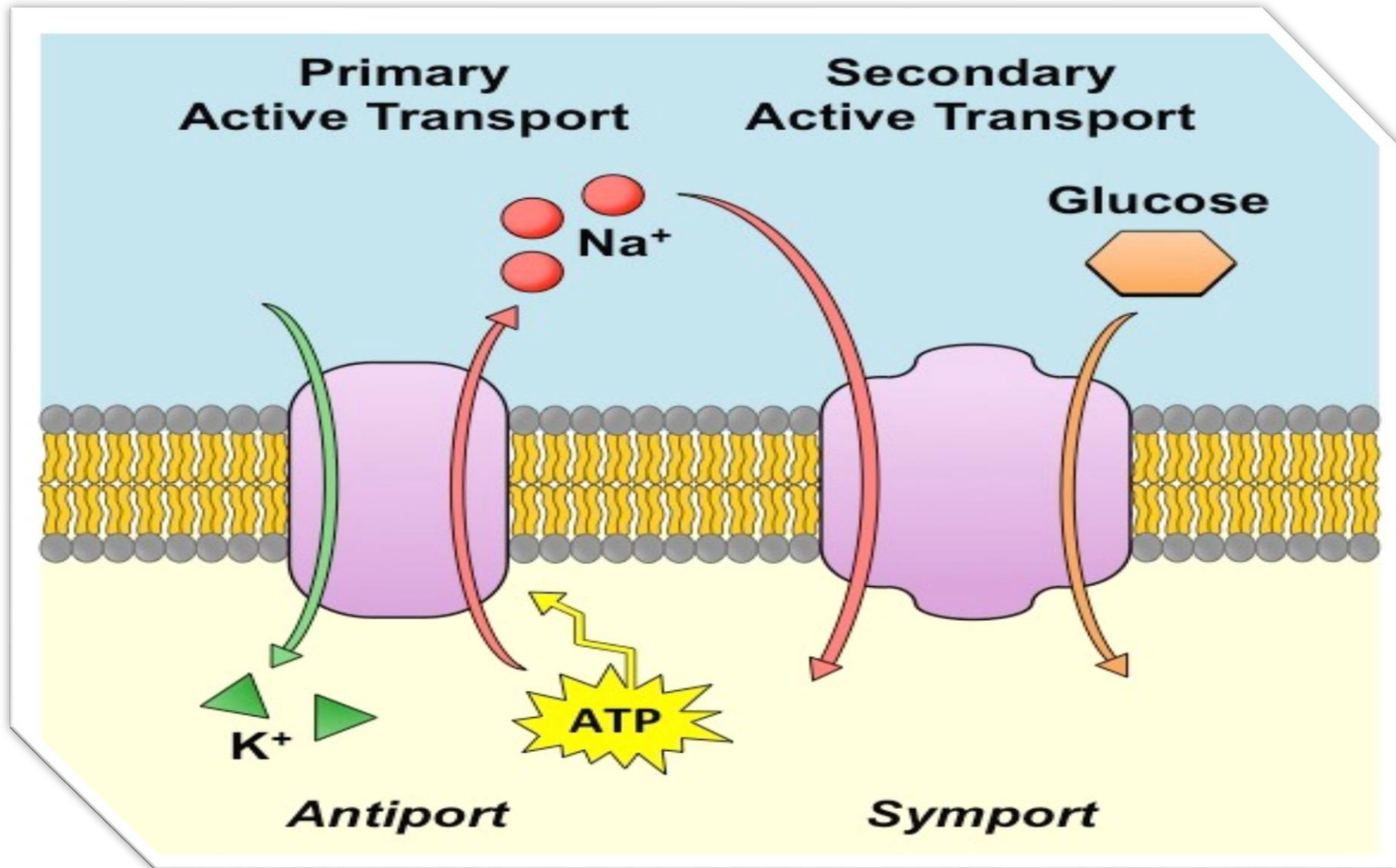
ACTIVE PROCESSES

The most prevalent primary active transport mechanism expels sodium ions from cells and brings potassium ions in (sodium-potassium pump). All cells have thousands of sodium-potassium pumps in their plasma membranes.

SODIUM-POTASSIUM PUMP



ACTIVE PROCESSES



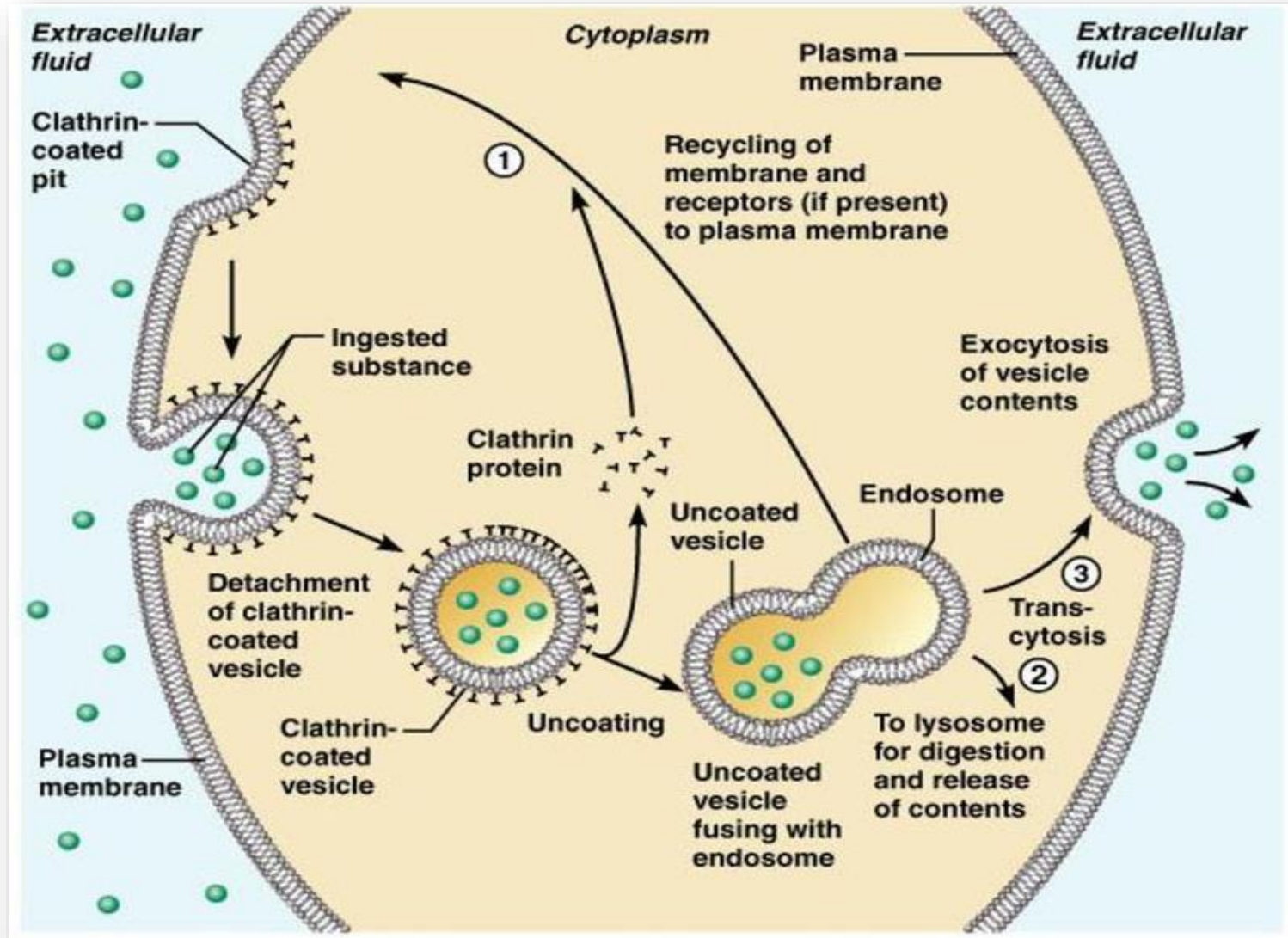
TRANSPORT IN VESICLES

أثناء البلعمة الخلوية، تنتقل المواد إلى الخلية في حويصلة مكونة من الغشاء البلازمي.

- During endocytosis, materials move into a cell in a vesicle formed from the plasma membrane.
- In exocytosis, materials move out of a cell by the fusion with the plasma membrane of vesicles formed inside the cell.
- Both endocytosis and exocytosis require energy supplied by ATP. Thus, transport in vesicles is an active process.
- The three types of endocytosis:
 1. Receptor-mediated endocytosis. الابتلاع الوسيط المستقبلات
 2. Phagocytosis. البلعمة
 3. Bulk-phase endocytosis. الابتلاع الخلوي بكميات كبيره

RECEPTOR-MEDIATED ENDOCYTOSIS

- Cells take up cholesterol-containing low-density lipoproteins (LDLs), transferrin (an iron-transporting protein in the blood), some vitamins, antibodies, and certain hormones by receptor-mediated endocytosis.



تمتص الخلايا البروتينات الدهنية منخفضة الكثافة (LDL) المحتوية على الكوليسترول، والبروتينات (بروتين ناقل للحديد في الدم)، وبعض الفيتامينات، والأجسام المضادة، وبعض الهرمونات عن طريق البلعمة بواسطة المستقبلات.

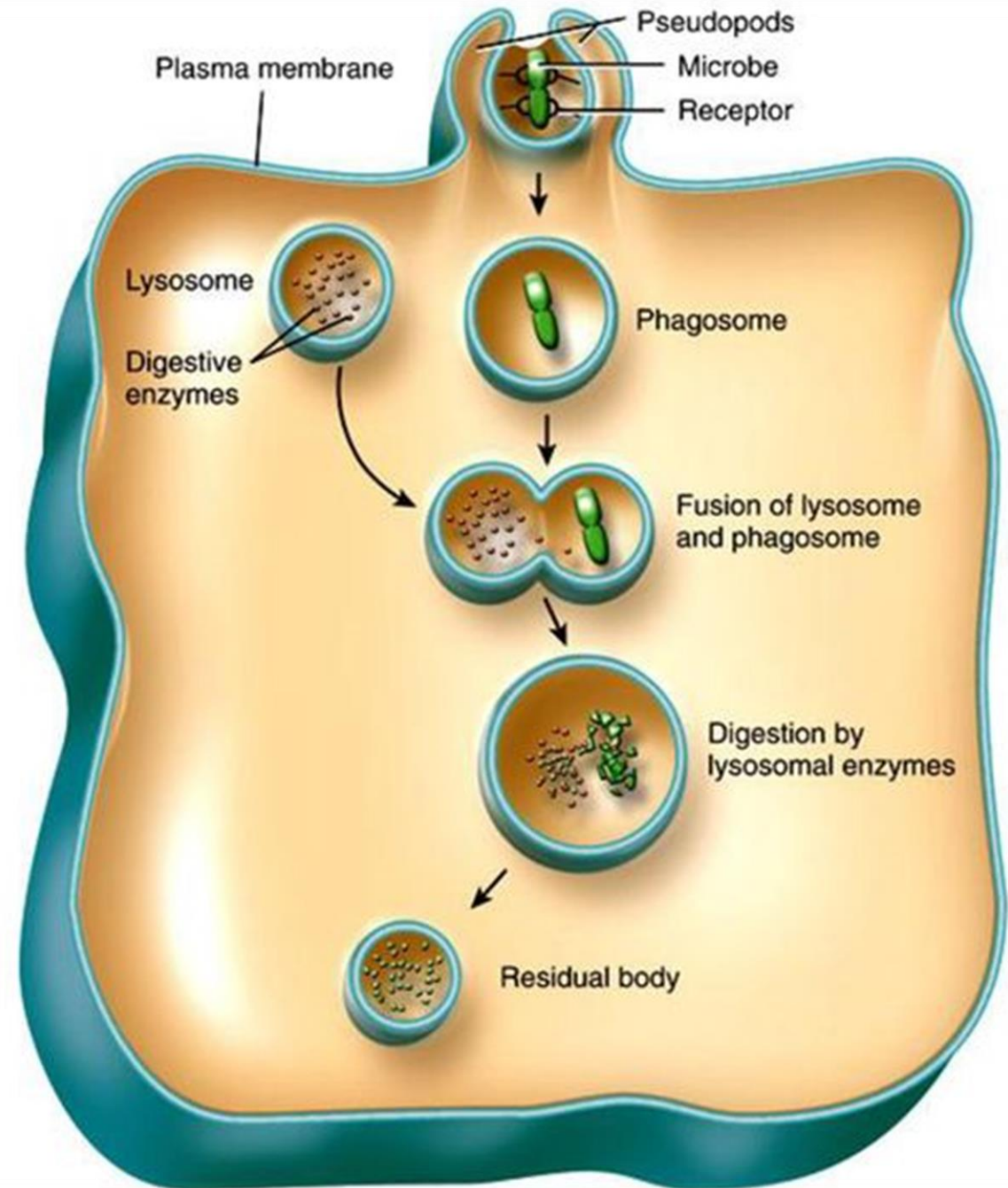
PHAGOCYTOSIS

- Phagocytosis is a form of endocytosis in which the cell ^{تلتهم} engulfs large solid particles, such as worn-out cells, whole bacteria, or viruses.
الخلايا الباليه
- Two main types of phagocytes are macrophages, located in many body tissues, and neutrophils, a type of white blood cell.

PHAGOCYTOSIS

- Any undigested materials in the phagosome remain indefinitely in a vesicle called a **residual body**. The residual bodies are then either secreted by the cell via exocytosis or they remain stored in the cell.

المختصر في مواد بتظل غير مهضومه موجوده في الحويصله وسميها
المواد الباقيه او المتبقيه هاي المواد يا بتفرزها الخليه عن طريق الاخراج
الخلوي او تبقى مخزنه في الخليه



BULK-PHASE ENDOCYTOSIS (PINOCYTOSIS)

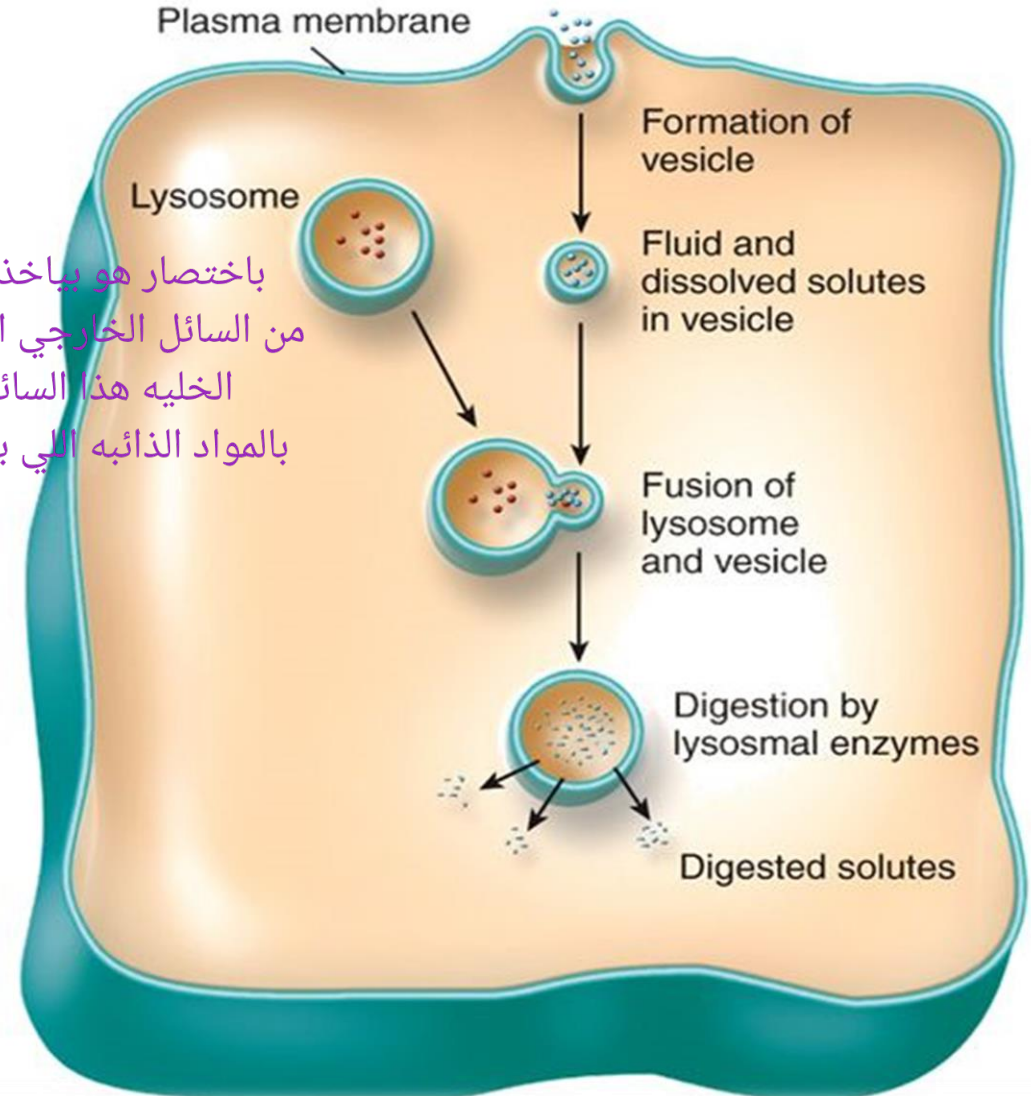
- Bulk-phase endocytosis is a form of endocytosis in which tiny droplets of extracellular fluid are taken up (all solutes dissolved in the extracellular fluid are brought into the cell.).
- No receptor proteins are involved.
- Bulk-phase endocytosis occurs in most cells, especially absorptive cells in the intestines and kidneys.
- The resulting smaller molecules leave the lysosome to be used elsewhere in the cell.

الامعاء

تنتج جزيئات صغيرة تخرج من الللايزوزومات
لكي تستخدم في اماكن اخرى

باختصار هو يياخذ قطرات صغيره
من السائل الخارجي او السائل خارج
الخلية هذا السائل سيكون محمل
بالمواد الذائبه اللي بتحتاجها الخليه

Bulk-phase Endocytosis



الإخراج الخلوي

EXOCYTOSIS

- In contrast with endocytosis, which brings materials into a cell, exocytosis releases materials from a cell.
- All cells carry out exocytosis, but it is especially important in two types of cells: **(1) secretory cells that liberate digestive enzymes, hormones, mucus, or other secretions and (2) nerve cells that release substances called neurotransmitters.**

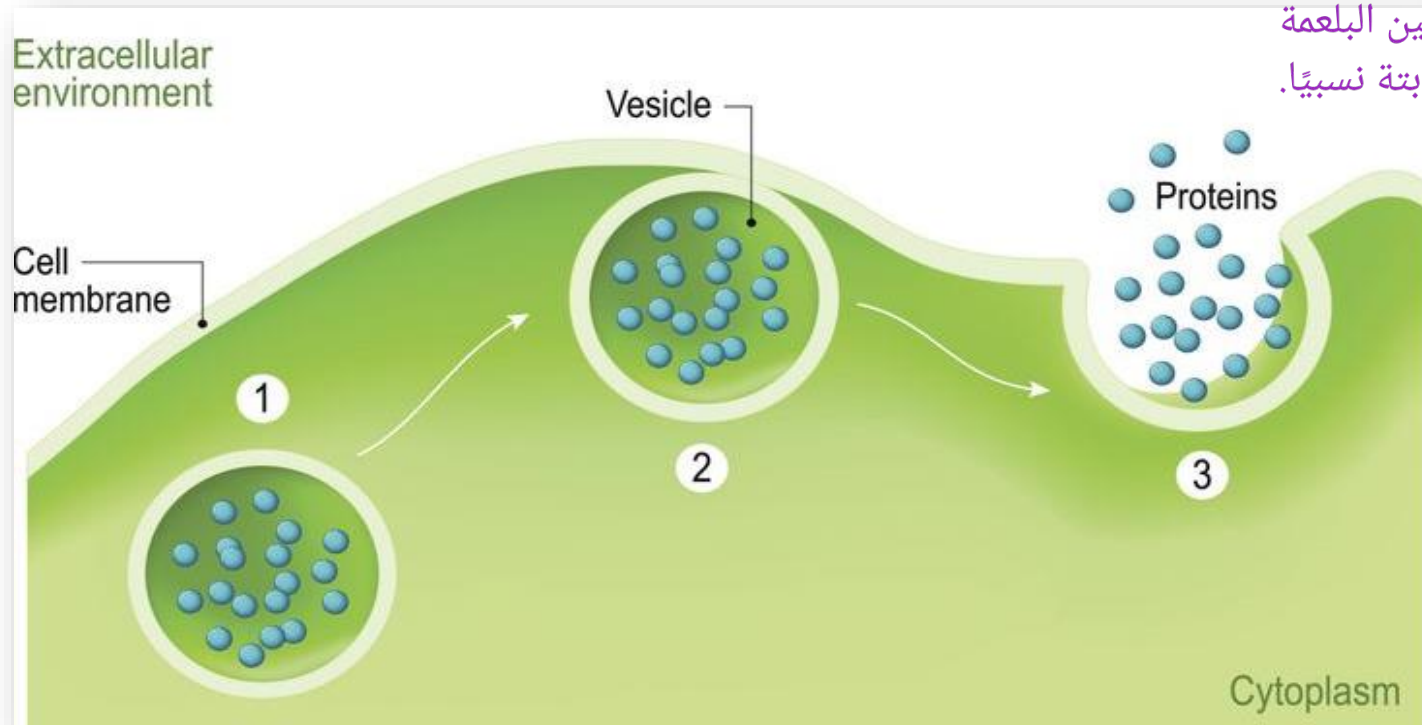
جميع الخلايا تقوم بالإخراج الخلوي، ولكنه مهم بشكل خاص في نوعين من الخلايا: (1) الخلايا الإفرازية التي تطلق الإنزيمات الهضمية والهرمونات والمخاط أو إفرازات أخرى و(2) الخلايا العصبية التي تطلق مواد تسمى النواقل العصبية.

EXOCYTOSIS

- في بعض الحالات، يتم إطلاق الفضلات أيضًا عن طريق الإخراج الخلوي. أثناء الإخراج الخلوي، تتشكل حويصلات محاطة بغشاء تسمى الحويصلات الإفرازية داخل الخلية، وتندمج مع الغشاء البلازمي، وتطلق محتوياتها في السائل خارج الخلية.

- In some cases, wastes are also released by exocytosis. During exocytosis, membrane-enclosed vesicles called secretory vesicles form inside the cell, fuse with the plasma membrane, and release their contents into the extracellular fluid.

يتم استعادة أو إعادة تدوير أجزاء الغشاء البلازمي المفقودة من خلال عملية البلعمة الخلوية عن طريق الإخراج الخلوي. يحافظ التوازن بين البلعمة والإخراج الخلوي على مساحة سطح الغشاء البلازمي للخلية ثابتة نسبيًا.



Segments of the plasma membrane lost through endocytosis are recovered or recycled by exocytosis. The balance between endocytosis and exocytosis keeps the surface area of a cell's plasma membrane relatively constant.

النقل الخلوي

TRANSCYTOSIS

تخضع الحويصلات للبلعمة على جانب واحد من الخلية، وتتحرك عبر الخلية، ثم تخضع للإخراج الخلوي على الجانب الآخر.

- Vesicles **undergo endocytosis on one side of a cell, move across the cell, and then undergo exocytosis on the opposite side.**

يحدث النقل الخلوي غالباً عبر الخلايا البطانية التي تبطن الأوعية الدموية وهو وسيلة لنقل المواد بين بلازما الدم والسائل الخلالي.

- **Transcytosis occurs most often across the endothelial cells that line blood vessels** and is a means for **materials to move between blood plasma and interstitial fluid.**
- For instance, when a **woman is pregnant**, some of her **antibodies cross the placenta** into the **fetal circulation via transcytosis.**

على سبيل المثال، عندما تكون المرأة حاملاً، تعبر بعض أجسامها المضادة المشيمة إلى الدورة الدموية للجنين عبر النقل الخلوي.



THANK YOU

AMJADZ@HU.EDU.JO