



لجان الرفعات

PHYSIOLOGY

MORPHINE ACADEMY

MORPHINE
ACADEMY



PHYSIOLOGY

FACULTY OF PHARMACEUTICAL SCIENCES

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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.

Cytoplasm السيتوبلازم يتكون من جميع المحتويات الخلوية الواقعة بين النواة والعشاء البلازمي

- 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.

السيتوسول : هو الجزء المائع/السائل من السيتوبلازم يحيط بالعضيات

العضيات: هي تراكيب صغيرة تقوم بوظائف متعددة في الخلية

THE CYTOPLASM

- Cytosol:

السيتوسول يحتوي كمية كبيرة من الماء بنسبة 75-90% ويحتوي العديد من المواد المذابة والمعرفة مثل: سكر الغلوكوز و الأحماض الامينية والدهنية والبروتين والليبيدات و ATP والفضلات

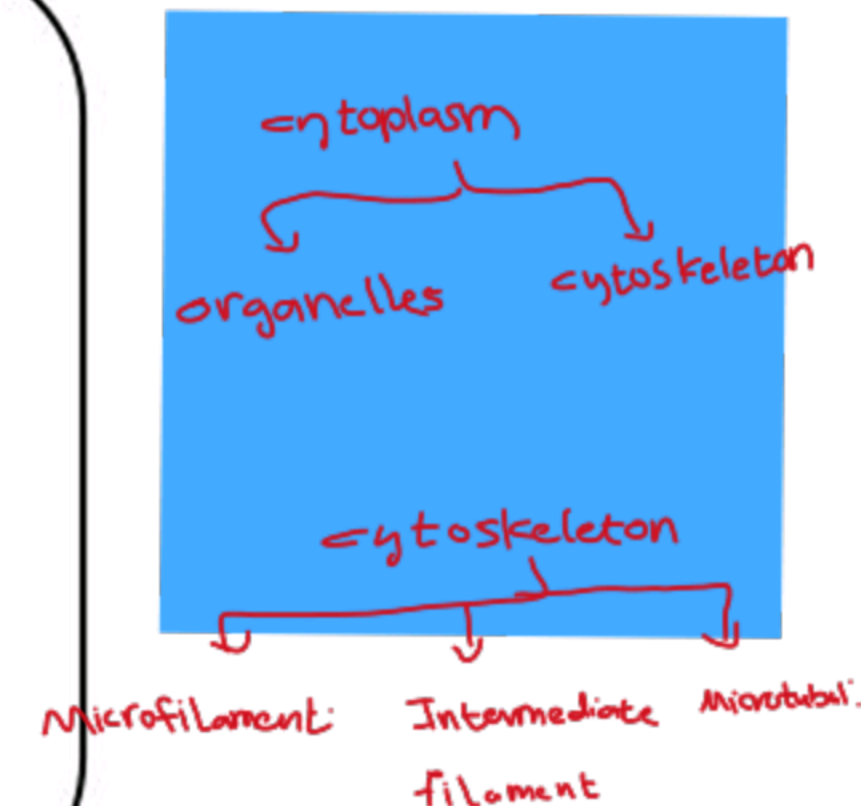
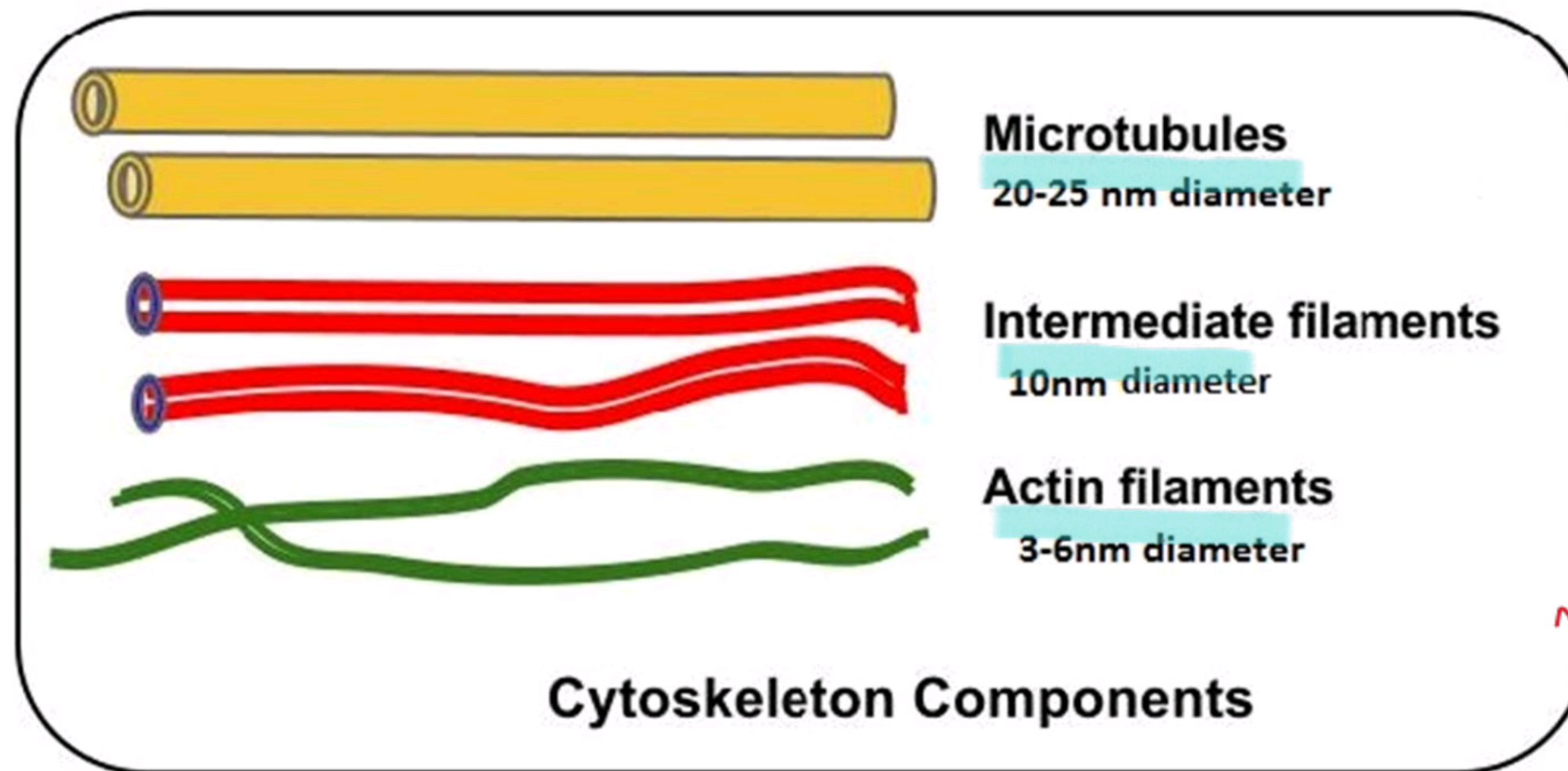
1. Contains **75–90% water** plus **various dissolved and suspended components** (i.e. glucose, amino acids, fatty acids, proteins, lipids, ATP, and waste products).
2. It is **the site of many chemical reactions** required for a cell's existence (i.e. glycolysis, maintenance of cell structures and for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

السيتوسول هو موقع للكثير من التفاعلات الكيميائية من هدم وتكسير مكونات وصناعة المواد التي تحتاجها الخلية ك: تحليل سكر الغلوكوز والحفاظ على وجود الخلية ونموها وتركيبها

THE CYTOPLASM

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

هيكل خلوي: هو شبكة من خيوط البروتين الممتدة عبر السيتوسول.



THE CYTOPLASM

- Microfilaments: 3 to 6 nm diameter

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).

الرفع عنصر في الهيكل الخلوي

يتكون من بروتين الأكتين والمايوسين

له وظيفتان:

① الحركة / Muscle contraction, cell division, cell locomotion
القبض العضلات والبروتين
انقسام الخلية
حركة الخلية (البسطة)

② يعطي دعم ميكانيكي لتشكل وقوة الخلية.

- 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**.

اهم خصائص الintermediat filament: أنه يأتي متوسط السمك / يكون في الأجزاء الأكثر عرضة للضغط مثل الغضاريف ويحافظ على موقع العضيات مثل النواة ويساعد في ربط الخلايا ببعضها

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.

اهم الخصائص لل actin filament: هو أنه أكبر مكونات الهيكل الخلوي ويتكون بشكل رئيس من بروتين ال tubulin وتعمل على (تحديد شكل الخلية) وحركة العضيات في السيتوبلازم

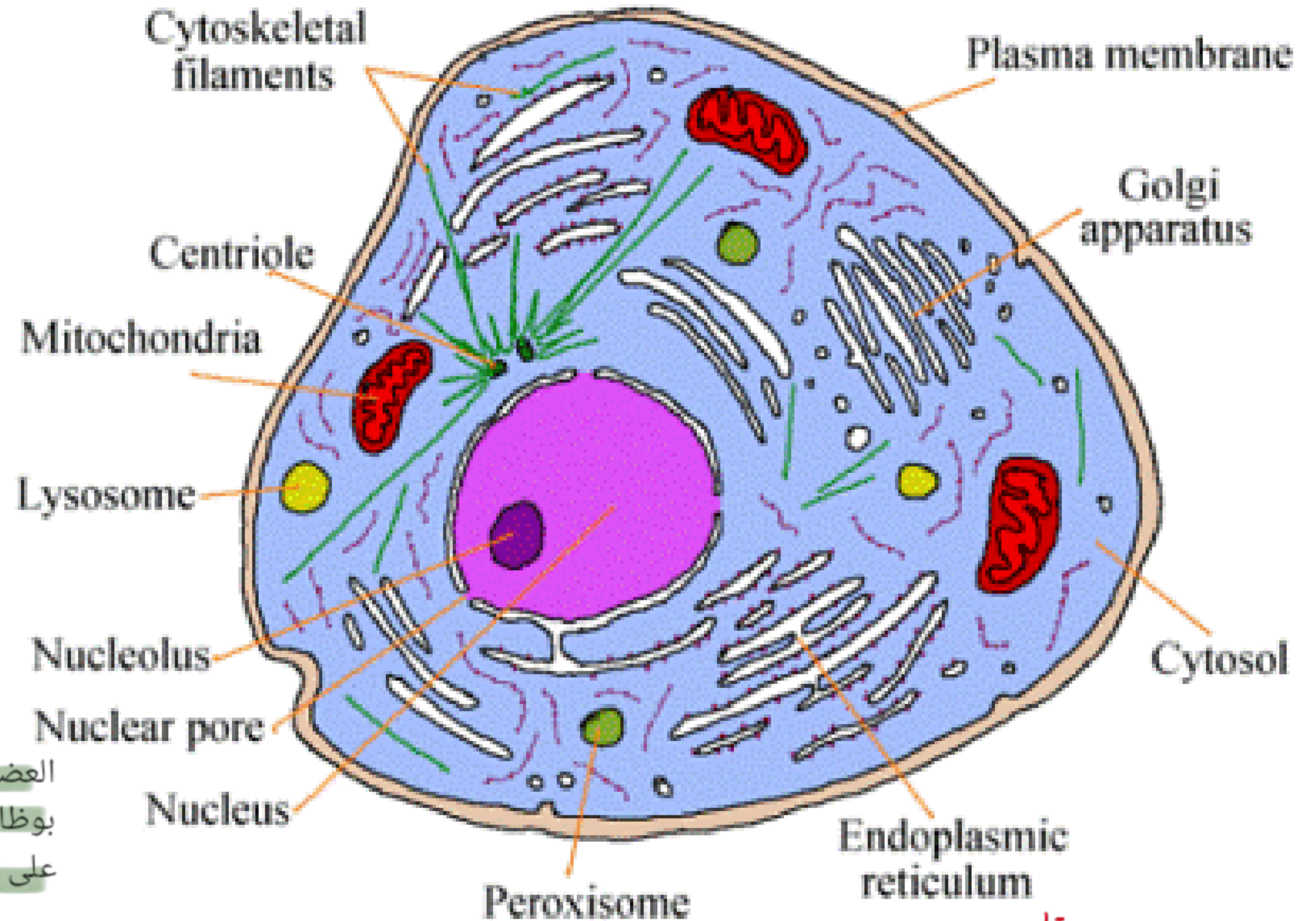
THE ORGANELLES

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.

التوازن
equilibrium

العضيات هي تراكيب مميزة في الخلية وهي أحد مكونات السيتوبلازم / تقوم بوظائف محددة كالنمو الخلوي والإصلاح والتكاثر وهي تشارك في الحفاظ على توازن الخلية

Organelles of the Cell



* تذكر
the many reaction occur in cytosol

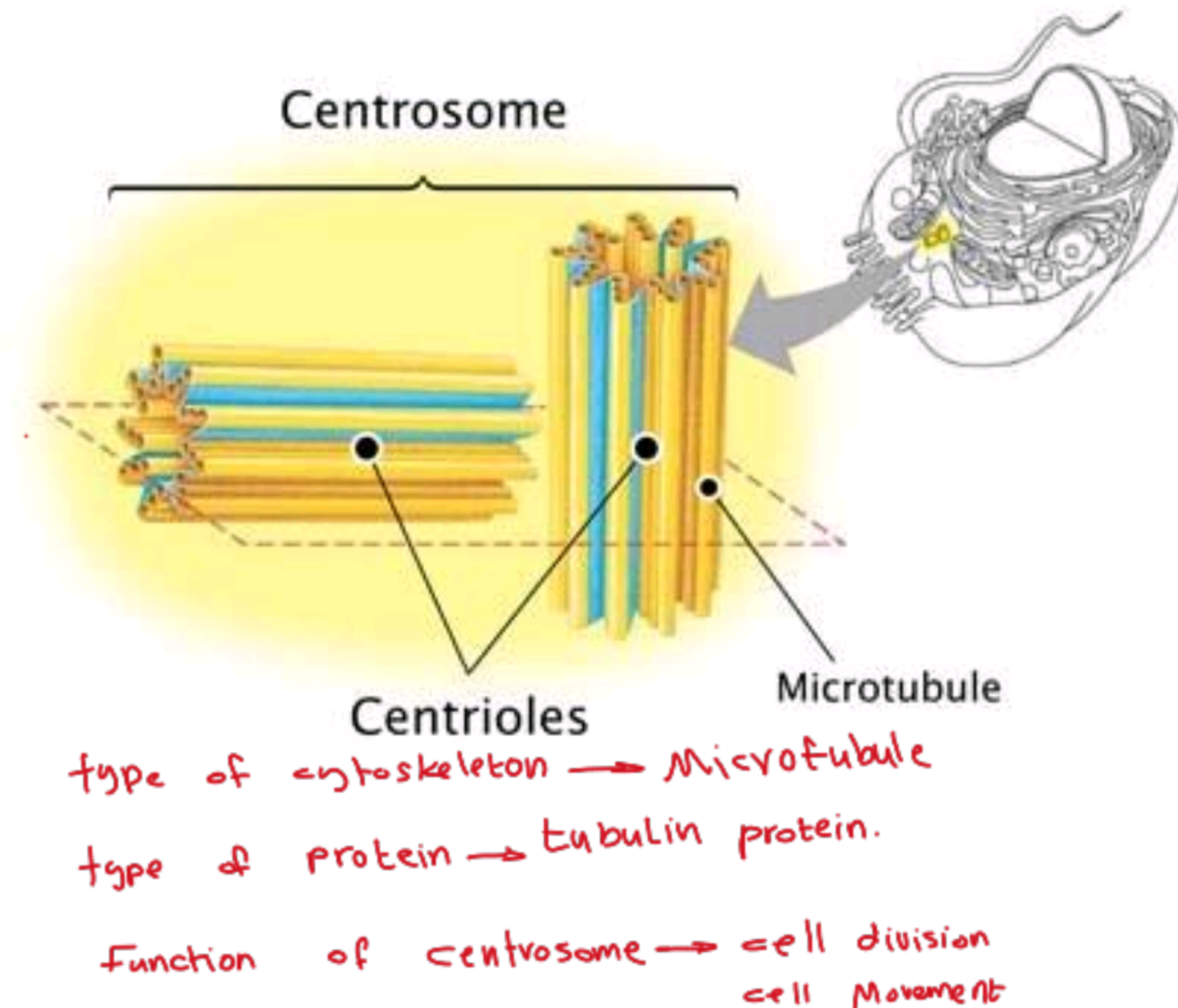
THE ORGANELLES

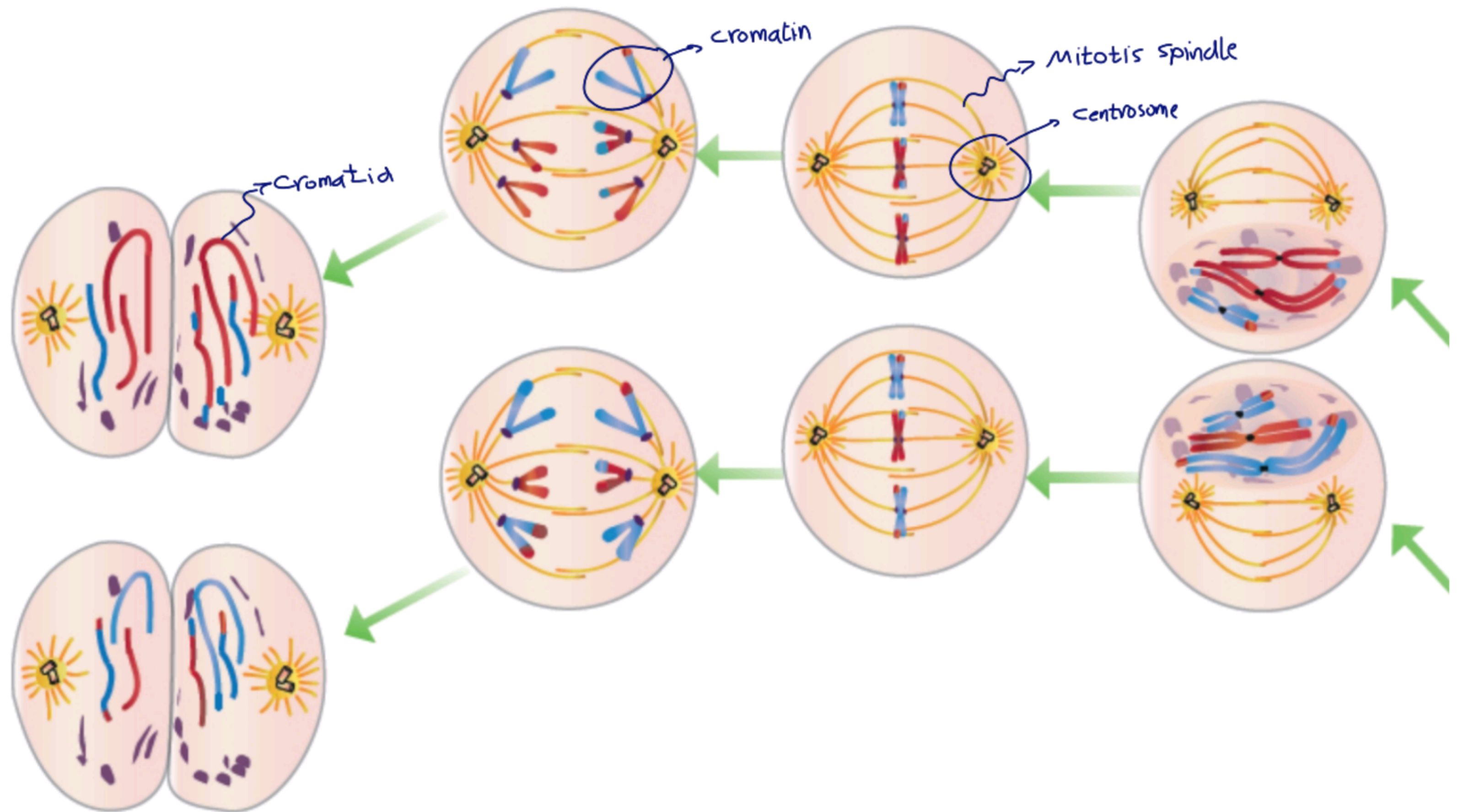
1. Centrosome.
2. Cilia and Flagella.
3. Ribosomes.
4. Endoplasmic Reticulum.
5. Golgi Complex.
6. Lysosomes.
7. Peroxisomes.
8. Proteasomes.
9. Mitochondria.
10. Nucleus.

المطلوب: حفاضة الوظيفة الموقع

Centrosome

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

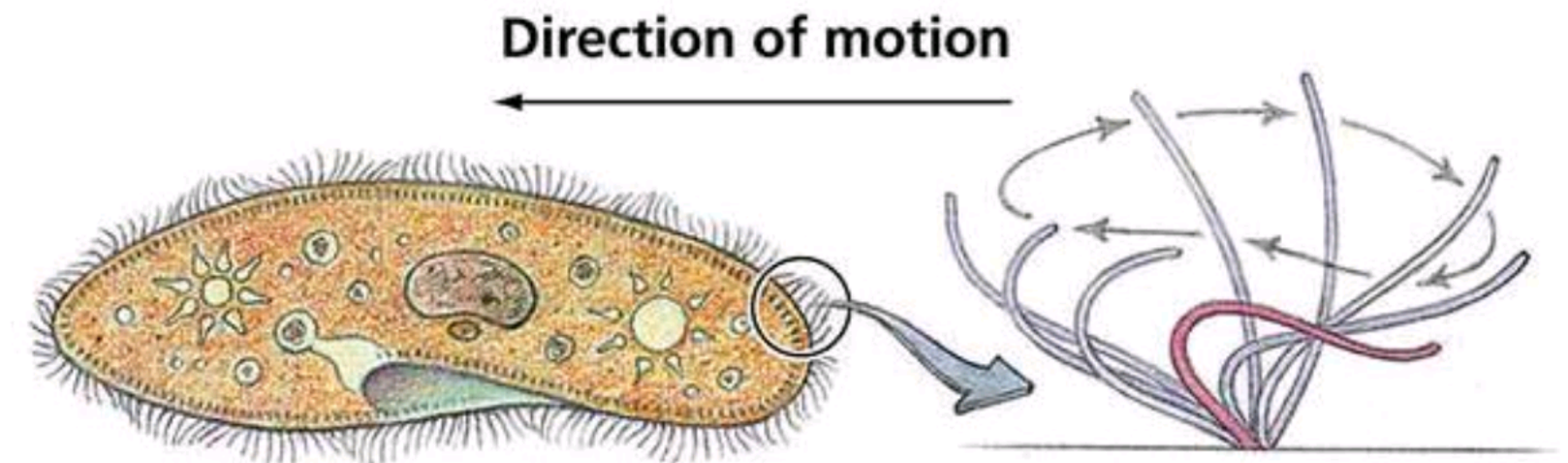




Cilia

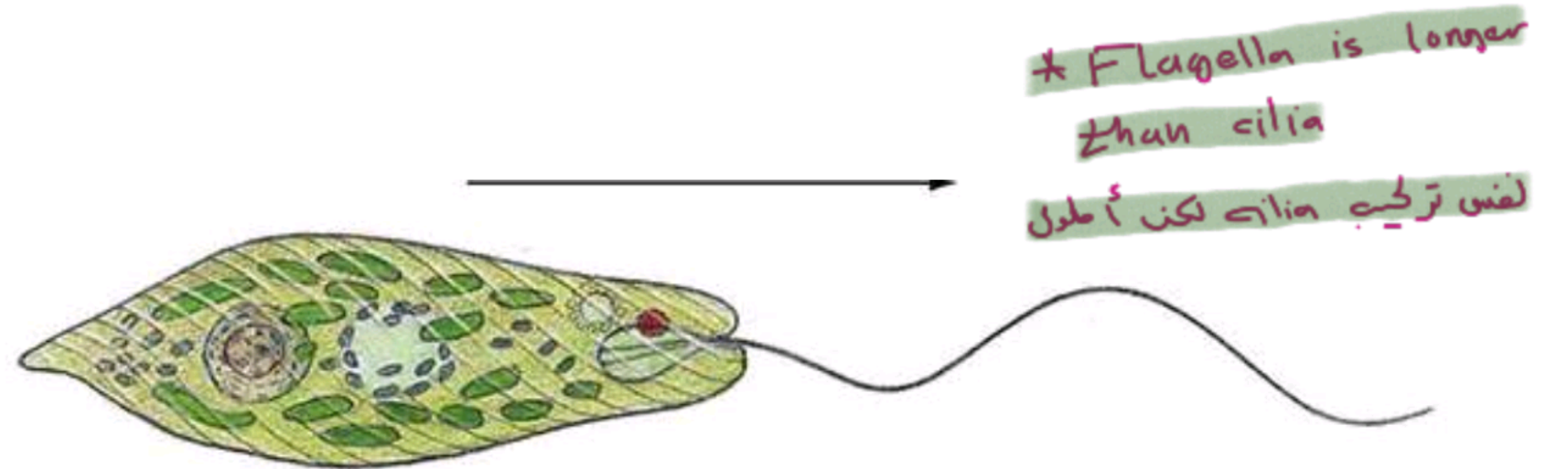
- **Microtubules are the dominant components of cilia and flagella.** Both are motile projections. However, cilia is present throughout the surface of a cell, but flagella is present at both the ends or all over the surface.
- Hair-like structure.
- **The main function of motile cilia is to keep the airways clear of mucus and dust.**

cilia: هي شعيرات متحركة توجد بشكل رئيس في الجهاز التنفسي لإزالة المخاط والغبار وإخراجه خارج الجسم



(b) Cilia

Flagella



(a) Flagella حركة ال cilia متناسقة أو وحدة وراء وحدة أي باتجاه واحد/أما ال flagella فهي حركتها مستقلة تكون في حقيقيات النوى حركة كموجة waving وفي بدائيات النوى حركته دورانية

Direction of motion

type of organelle	شعيرات cilia	أعصاب Flagella
Location الموقع	on a surface of a cell	ends or all over the cell
type of motion الحركة	rotation	bending movement rotation

* type of Cytoskeleton
In cilia and flagella is: Microtubules

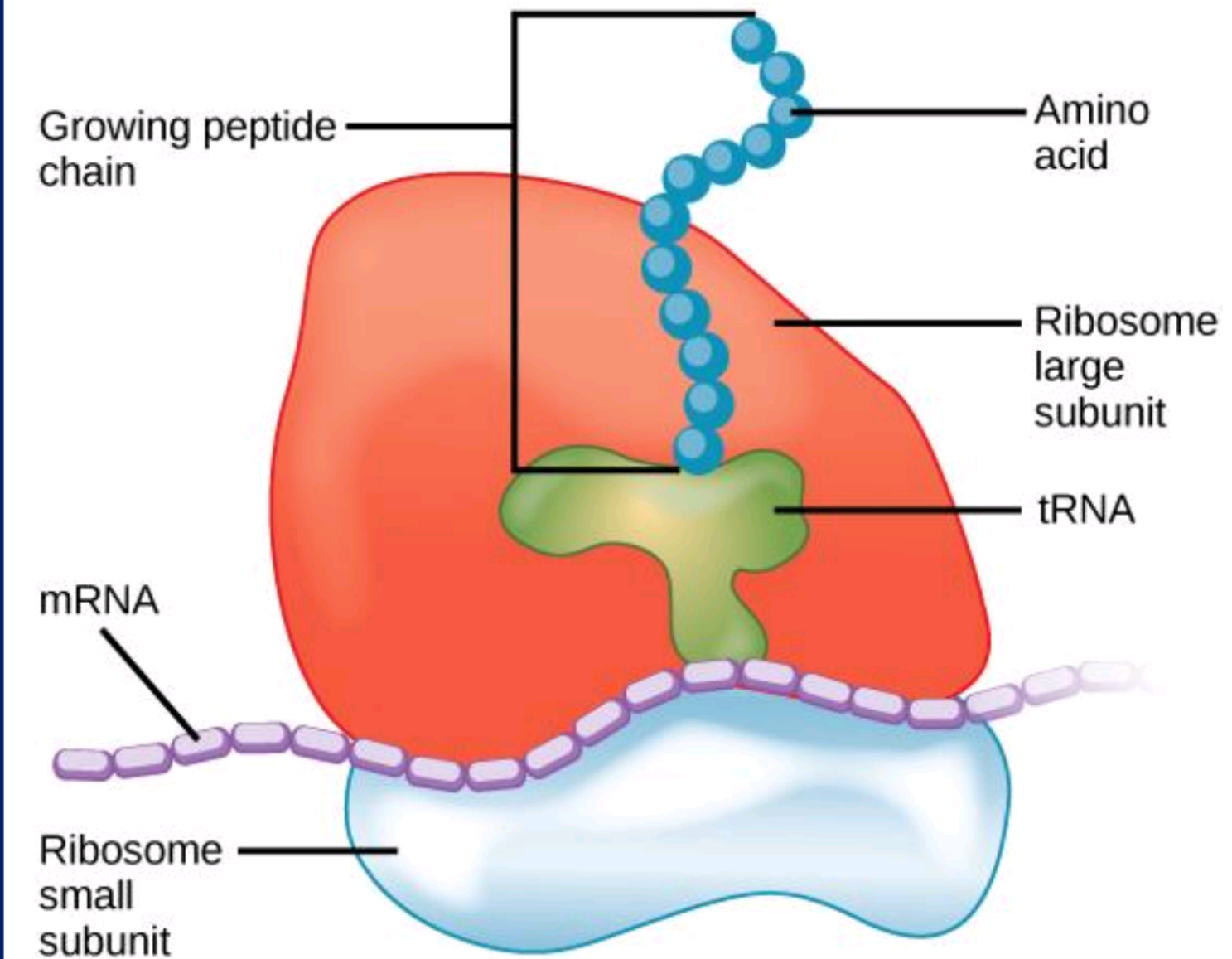
- Flagella are similar in structure to cilia but are typically much longer.
- Flagella usually move an entire cell (i.e. sperm).
- The motion of cilia is rotational, very fast moving. The motion of flagella is rotary movement in prokaryotes whereas it is bending movement in eukaryotes. Cilia beat in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

Ribosomes

- Are the sites of protein synthesis.
- The name of these tiny structures reflects their high content of one type of ribonucleic acid (ribosomal RNA, or rRNA).

Location of ribosome:-

- “Scattered throughout cytoplasm”⁽¹⁾: Some ribosomes are attached to the outer surface of the nuclear membrane⁽²⁾ and to an endoplasmic reticulum⁽³⁾. Ribosomes are also located within mitochondria⁽⁴⁾. Other ribosomes are “free” or unattached to other cytoplasmic structures.



المختصر: الريبوسوم هو مصنع البروتين وسبب تسميته بأنه يحتوي على نسبة كبيرة من الحمض النووي الرايبوسومي rRNA / يوجد الريبوسوم على سطح الغشاء النووي / وعلى الشبكة الاندوبلازمية / الميتوكوندريا / وحرة غير مرتبطة في السيتوبلازم

Endoplasmic Reticulum

- **The endoplasmic reticulum (ER)** is a network of membranes in the form of flattened sacs or tubules.

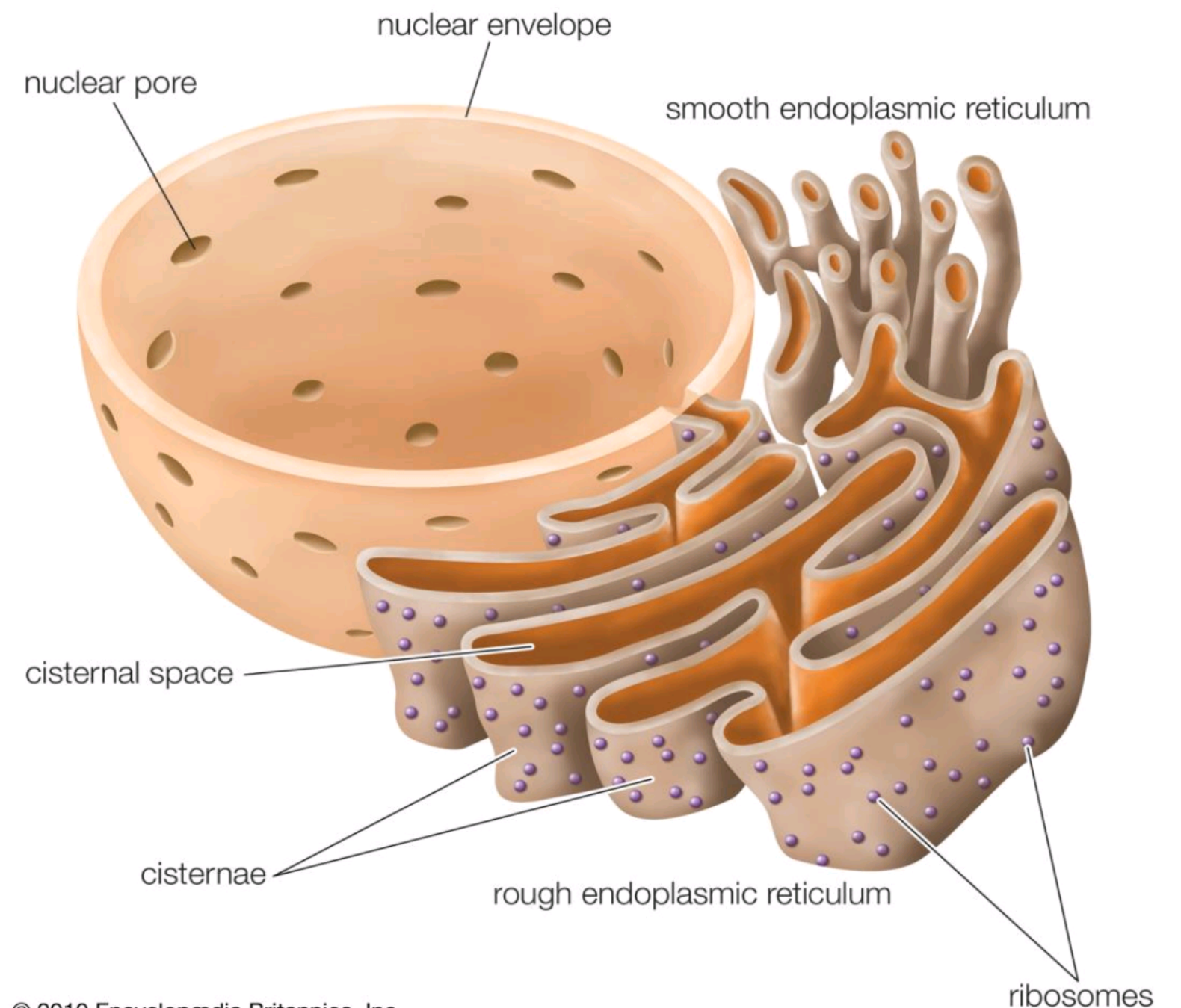
الشبكة الاندوبلازمية هي شبكة من الأغشية على شكل اكياس وأنابيب مستوية

- The ER extends from the nuclear envelope (membrane around the nucleus), to which it is connected and projects throughout the cytoplasm.

تمتد الشبكة الاندوبلازمية من الغشاء النووي المتصلة به وتنطلق خلال السيتوبلازم

- Cells contain two distinct forms of ER (**rough ER** and **smooth ER**), which differ in structure and function.

Endoplasmic reticulum



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الخلايا تحتوي على نوعين من الشبكة الاندوبلازمية وهما الخشنة والنعمة وكلاهما يختلف بالترتيب والوظيفة

Endoplasmic Reticulum

اهم شي نفد المواد

- 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.

الشبكة الخشنة تكون الرايبوسومات منغمسة في غشائها وتعمل على إنتاج البروتين الذي يدخل المساعدة داخل الشبكة الاندوبلازمية ويحدث للبروتين معالجة وفرز / الشبكة تعمل على معالجة البروتين ليكون عضيات بروتيني كالبروتينات الافرازية والغشائية...

- 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.

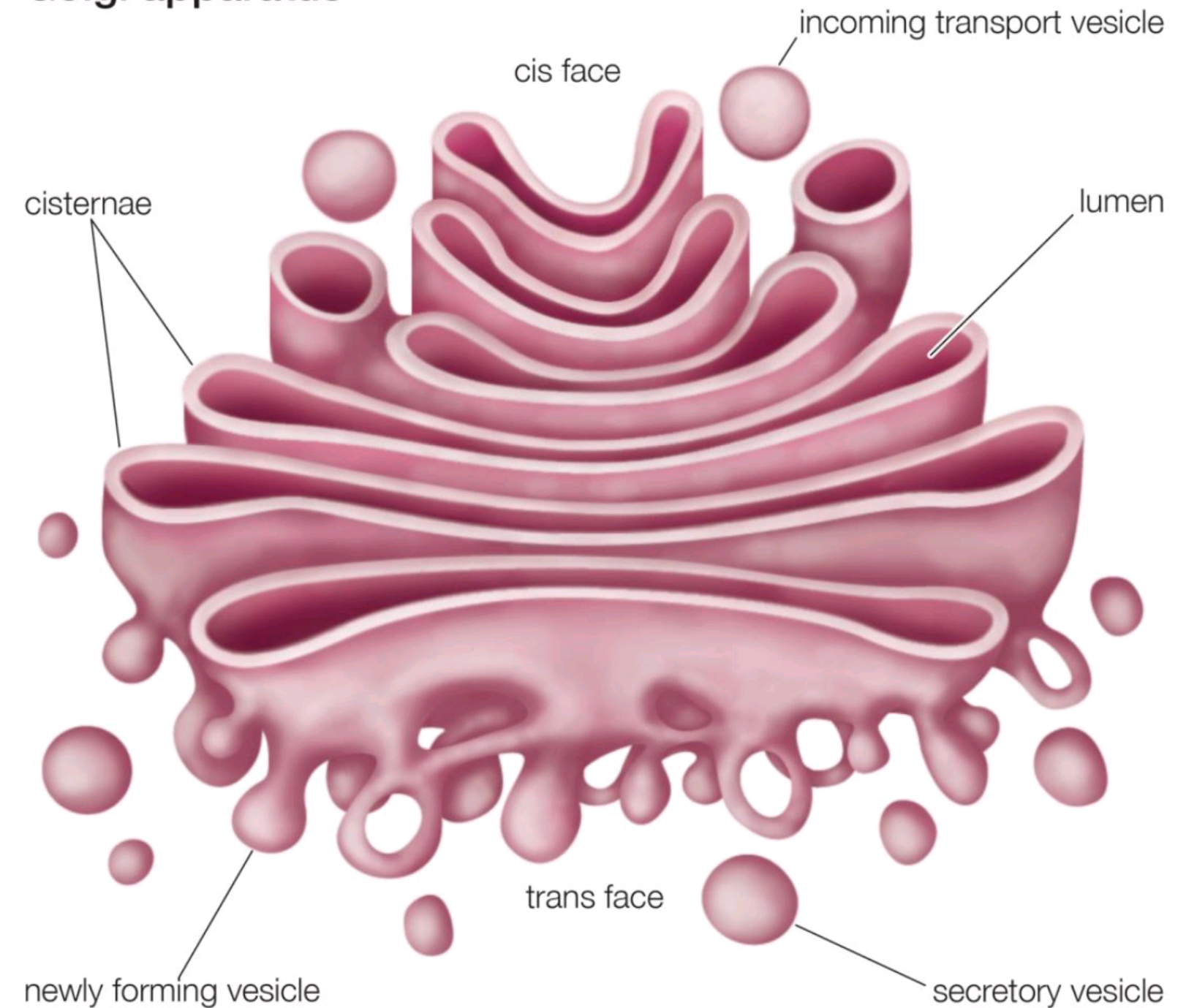
الشبكة الناعمة لا تحتوي على رايبوسومات في إنشائها / ووظيفتها إنتاج الليبيدات والكربوهيدرات / وإفراز الكالسيوم وتخزينه (مهم لعملية انقباض العضلات للمساعدة على الحركة)

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**).

البروتين الذي أنتج في الشبكة الاندوبلازمية ينتقل لجهاز جولجي في النهاية

Golgi apparatus



Golgi Complex

■ Functions of Golgi Complex:

بالمختصر يعمل جهاز جولجي على التعديل وفرز وتغليف البروتين وإضافة تعديلات عليه لإنتاج مواد مثل glycoprotein/ glycolipid/lipolipid.. ثم يعمل حويصلة إفرازية تنقله إلى السائل الخلوي ومن ثم تنشأ حويصلة ناقلة لنقل البروتين المعالج إلى أحد العضيات كالإيزوم

1. **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. Forms **secretory** ^①vesicles that discharge processed proteins via exocytosis (**through exist or trans face**) into extracellular fluid and forms transport ^②vesicles that carry molecules to other organelles, such as lysosomes.

exocytosis عملية

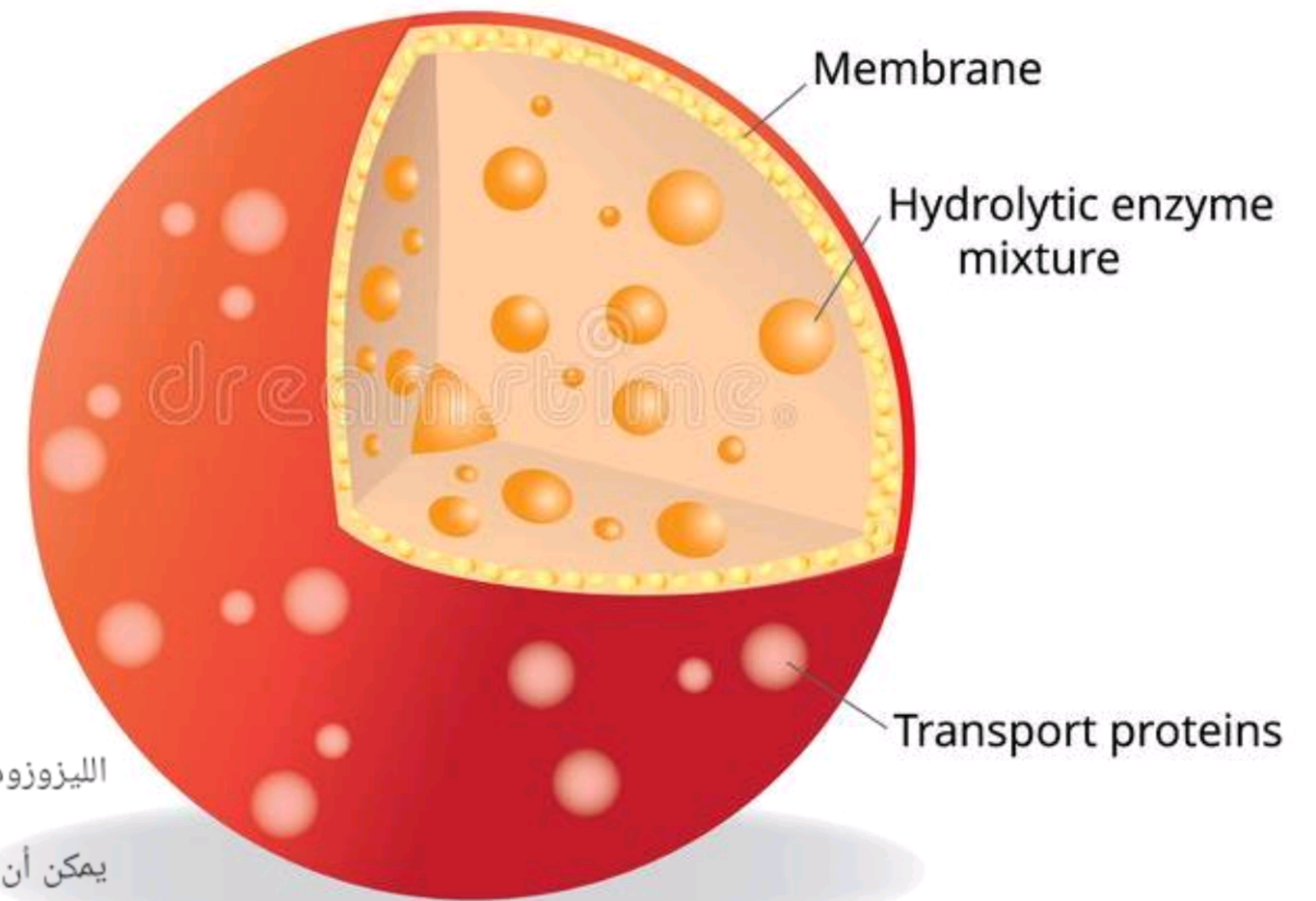
Lysosomes

- **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.

الليزوسومات هي حويصلات محاطة بغشاء، تتكون من جهاز جولجي.

يمكن أن تحتوي على ما يصل إلى 60 نوعاً من الإنزيمات الهاضمة والتحليلية القوية، القادرة على تفكيك مجموعة واسعة من الجزيئات.

LYSOSOME



Lysosomes

■ Functions of lysosomes:

1. **Digest substances (within the cell)** that enter a cell via endocytosis and transport final products of digestion into cytosol.

عمل هضم عبر الانزيمات للمواد التي تدخل الخلية عبر endocytosis ثم تنقل نواتج الهضم الى cytosol

2. Carry out **autophagy**, the digestion of worn-out organelles.

عملية البلعمة و هضم العضيات التالفة

3. Implement **autolysis**, the digestion of an entire cell.

تعمل تحلل ذاتي اي لخلية كاملة



bacteria
and
verouse

4. Accomplish **extracellular digestion**.

إكمال عملية الهضم خارج الخلية

Peroxisomes

- **Peroxisomes** contain several oxidases^①, enzymes that can oxidize (remove hydrogen atoms from) various organic substances.
- They protect the cells from oxidative damage.
- They protect other parts of the cell from the toxic effects of potentially toxic compounds.
- Peroxisomes are very abundant in the liver, where **detoxification of alcohol** and other damaging substances occurs.
- Peroxisomes also contain the enzyme catalase^②, which decomposes by-product of the oxidation reactions which is hydrogen peroxide (H₂O₂); thus, it decomposes hydrogen peroxide to water and oxygen.

مقطع use

يد على انزيم

عضي البيروكسيوسوم يحتوي على انزيمات الأكسدة التي تعمل على إزالة الهيدروجين من المواد فبذلك تعمل على حماية الخلية من الضرر التأكسدي وتحمي الأجزاء الأخرى من المركبات المحتمل أن تكون سامة

بنسبة كبيرة يوجد في الكبد لعمل إزالة سموم الكحول واضرار المواد الأخرى



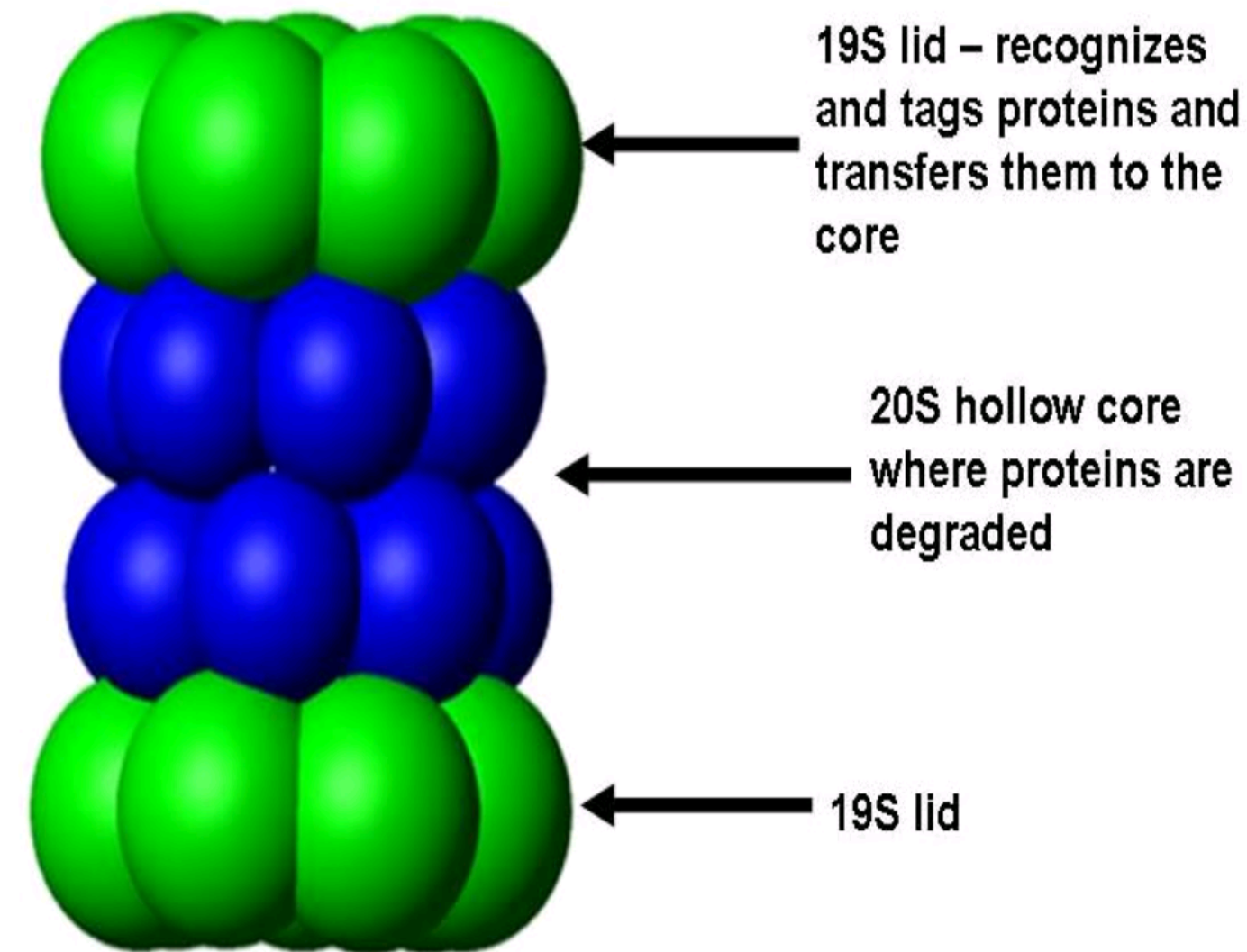
يحتوي على انزيم (catalase) الذي يحلل الناتج الثانوي من تفاعلات الأكسدة فيحلل H₂O₂ الى ماء و الأكسجين

Proteasomes

- لَدَ حَيَر البرد، تِيْنَات الدَالِيَّة
- Cytosolic proteins require disposal at certain times in the life of a cell. **Function:-** Continuous destruction of **unneeded, damaged, or faulty proteins** is the function of tiny barrel-shaped structures consisting of four stacked rings of proteins around a central core called **proteasomes**.

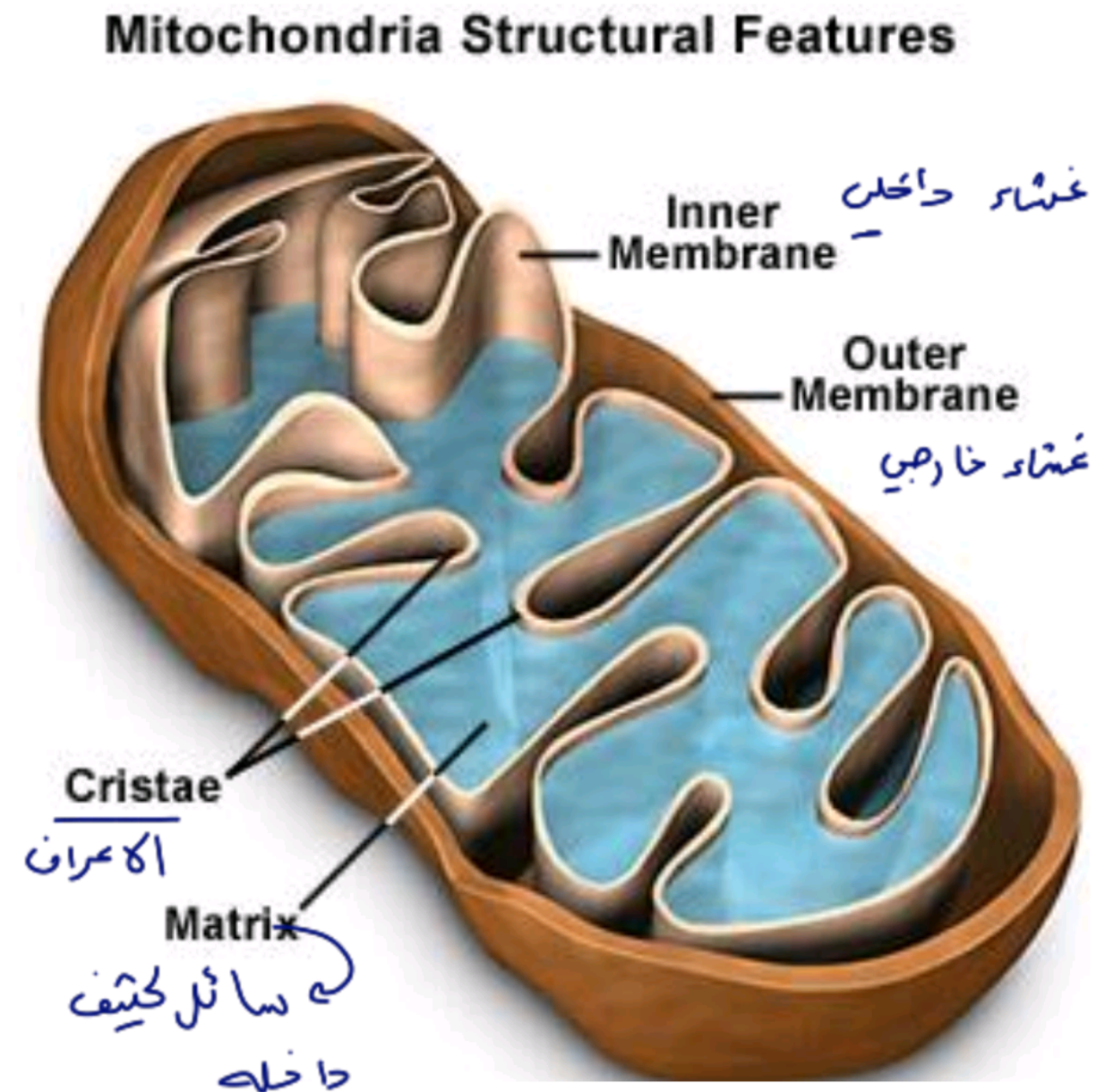
- يَحْتَوِي عَلَى التَّزْيِجَات لِتَحْطِيمِ البرد تِيْن
أَسْطُوَانَة مَكُونَة مِنْ (٤) حَلَقَات مُتَوَاصِلَة
- Proteasomes **were so named** because they contain **proteases, enzymes that cut proteins into small peptides**. Once the enzymes of a proteasome have chopped up a protein into smaller chunks, **other enzymes then break down the peptides into amino acids, which can be recycled into new proteins.**

26S proteasome



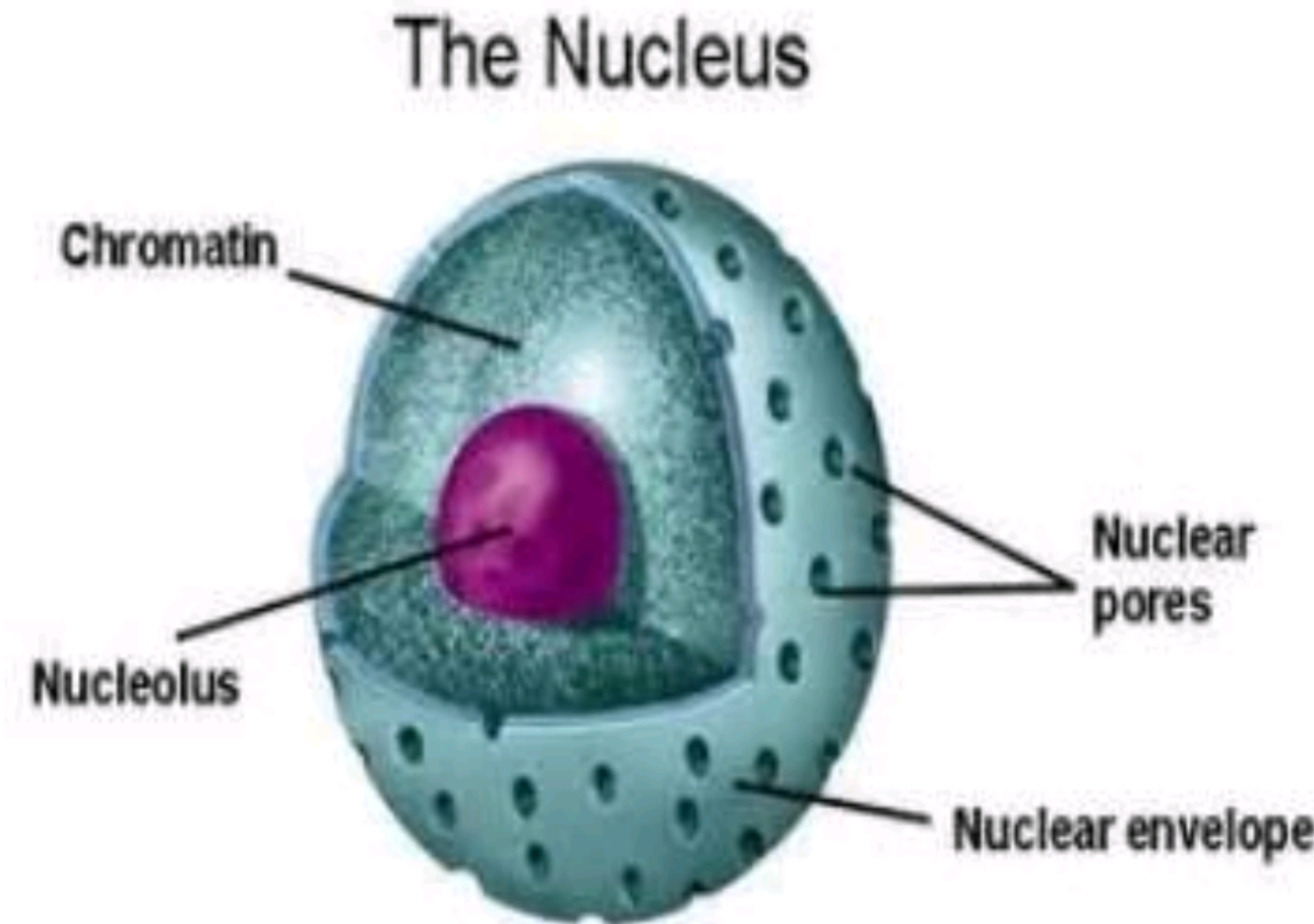
Mitochondria

- **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. هو العضو الذي يدرج الطاقة عند التنفس الهوائي وله به الانزيمات الخاصة بهذه العملية
- 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. بالترتيب الأعضاء فيها الميتوكوندريا بنسبة الجيد
- A mitochondrion consists of an outer mitochondrial membrane and an inner mitochondrial membrane with a small fluid-filled space between them (mitochondrial matrix).



Nucleus

- **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 تركيب الخلية

2. Directs cellular activities.

٢. تباشر عمل أنشطة الخلية

3. Produces ribosomes in nucleoli.

٣. تنتج الرايبوسوم في النوية

4. Nuclear pores control the movement of substances between the nucleus and cytoplasm.

٤. لديها فجوات في غشائها تتحكم في مرور المواد

بين النواة والسيتوبلازم.



PHYSIOLOGY

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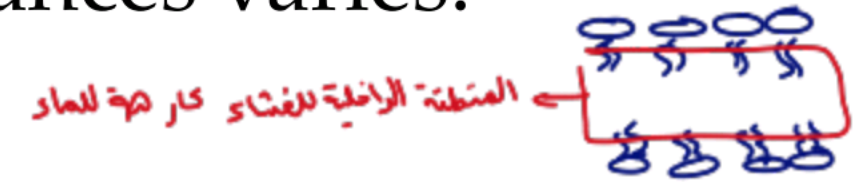
DR. AMJAAD ZUHIER ALROSAN

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

Membrane permeability:

- 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 ^①ions and ^②large, ^③uncharged polar molecules.
- Because **water and urea** are small polar molecules that have no overall ^{uncharge}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.
- 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).

نفاذية الغشاء للمواد



يمنع الغشاء الكاره للماء من مرور

الأيونات

المجزيئات الغير مشحونة و الكبيرة

منعوق تمرير من الغشاء باستثناء ال urea and water ^{uncharged polar material}

لأنهم حجمهم صغير نسبي غير ال ديموس (الفجوات) موجودة في وسط غشاء الخلية.

البروتينات الناقلة تزيد من نفاذية الغشاء وهي شديدة الانتقائية عبارة عن قنوات ومواقف
channel and carrier

Gradients across the Plasma Membrane:

- 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.

تدرج التركيز: هو اختلاف تراكيب المواد الكيميائية كالايونات على جانبي الغشاء

- The plasma membrane also creates a difference in the distribution of positively and negatively charged ions between the two sides of the plasma membrane.

downhill: with concentration gradient... from
Large concentration to less concentration

← الغشاء يعمل منفعة في التوزيع على جانبيه ✓

يمكن ان يكون سؤالا false and true

الحركة من المنطقة الأعلى تركيز الى الأقل تركيز الحركه قد تكون التركيز

Gradients across the Plasma Membrane:

- The difference in electrical charges between two regions constitutes an electrical gradient. This 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.

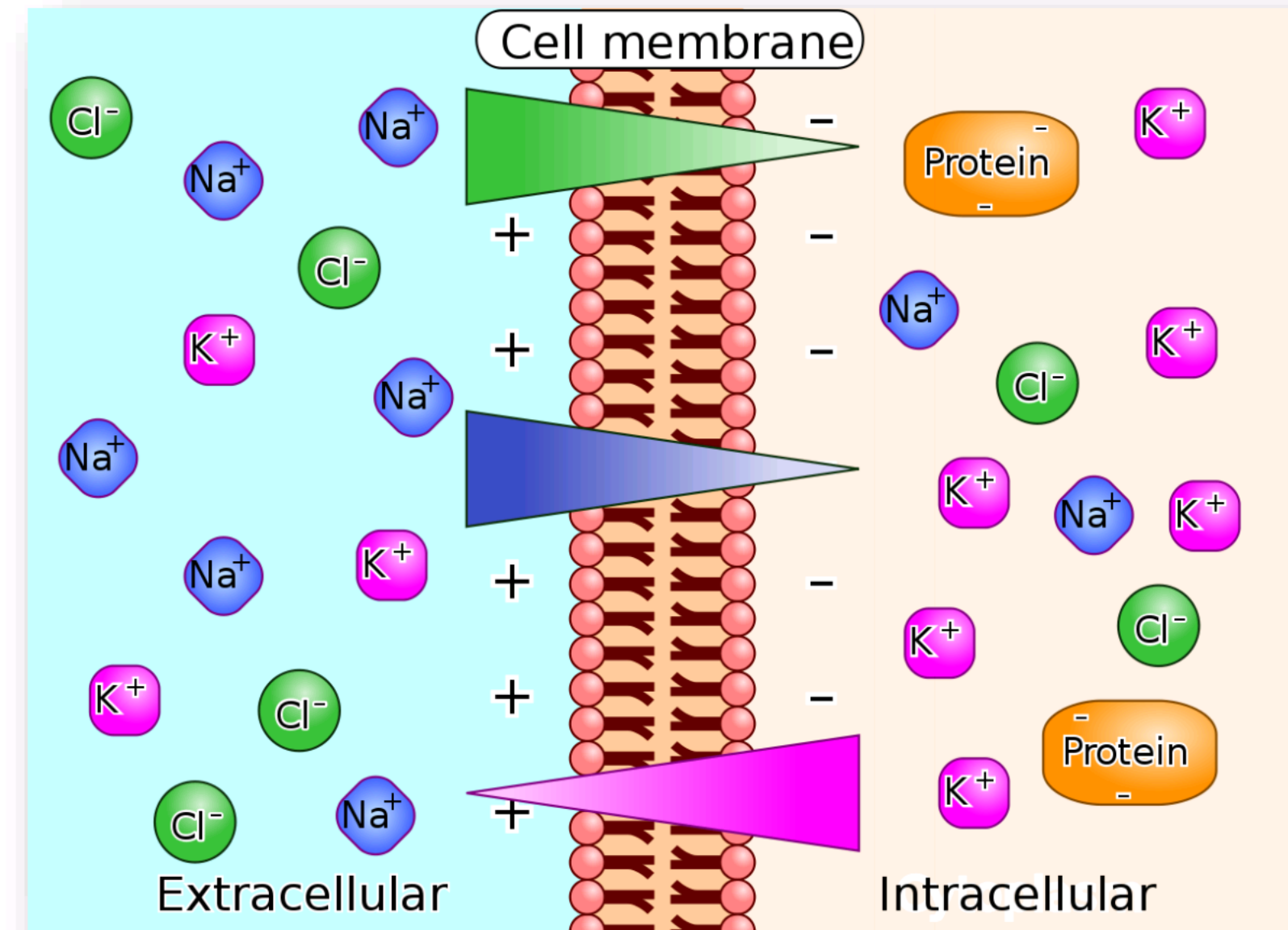
اختلاف تركيز الأيونات يعمل تدرج كهربائي

ويعمل جهد للخلية كما وبه ذللك الأيون + يعمل للحركة نحو الأيون + والعكس كذلك .

تأثير الخلية

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

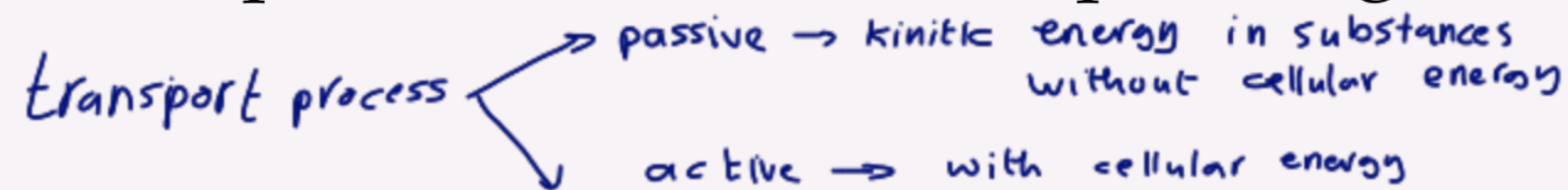
معدل ميل شغل التدرج الكيميائي
والكهربائي



TRANSPORT ACROSS THE PLASMA MEMBRANE

المواد تمر الغشاء الفوق بعملية الانتقال

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



- 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).

- 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.

الذي يتم إنتاجه في Mitochondria

أي من منطقة الأمل تركيز إلى الأعلى تركيز
لذلك تحتاج إلى طاقة من الخلية

TRANSPORT ACROSS THE PLASMA MEMBRANE

active
transport

أهم معلومة انه endocytosis و exocytosis نوع من أنواع ال

تعريف الرصة

لنستخدم الحويصلات (Vesicles) لننقل المواد

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

without cellular energy

Diffusion الانتشار

facilitated diffusion (with assistance) الانتشار المُيسَّر

- **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.

المحلول يحتوي خليطاً من المواد المذابة

والمذيب لها طاقة حركية خاصة تجعلها تفر من الفشار بدون قناة أو ناقل

- 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).

PASSIVE PROCESSES

جميع العوامل تؤثر هيرديا
ما ية diffusion
distance

- 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:**

عوامل مؤثرة على معدل عملية 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).
الانحدار
كلما زاد الفرق في التركيز بين الجانبين، زاد معدل الانتشار.
2. Temperature (the higher the temperature, the faster the rate of diffusion).
علاقة طردية
كلما زادت الحرارة، زاد معدل الانتشار.
3. Mass of the diffusing substance (the larger the mass of the diffusing particle, the slower its diffusion rate).
علاقة عكسية
كلما زاد حجم وكتلة الجزيء المنتقل، قل معدل الانتشار.
4. Surface area (the larger the membrane surface area available for diffusion, the faster is the diffusion rate).
دائماً كلما زادت المساحة المتاحة للانتشار، زاد معدل الانتشار للمواد.
5. Diffusion distance (The greater the distance over which diffusion must occur, the longer it takes).
كلما كانت المسافة المقطوعة للمواد قل، قل معدل الانتشار.

DIFFUSION

1- Simple diffusion

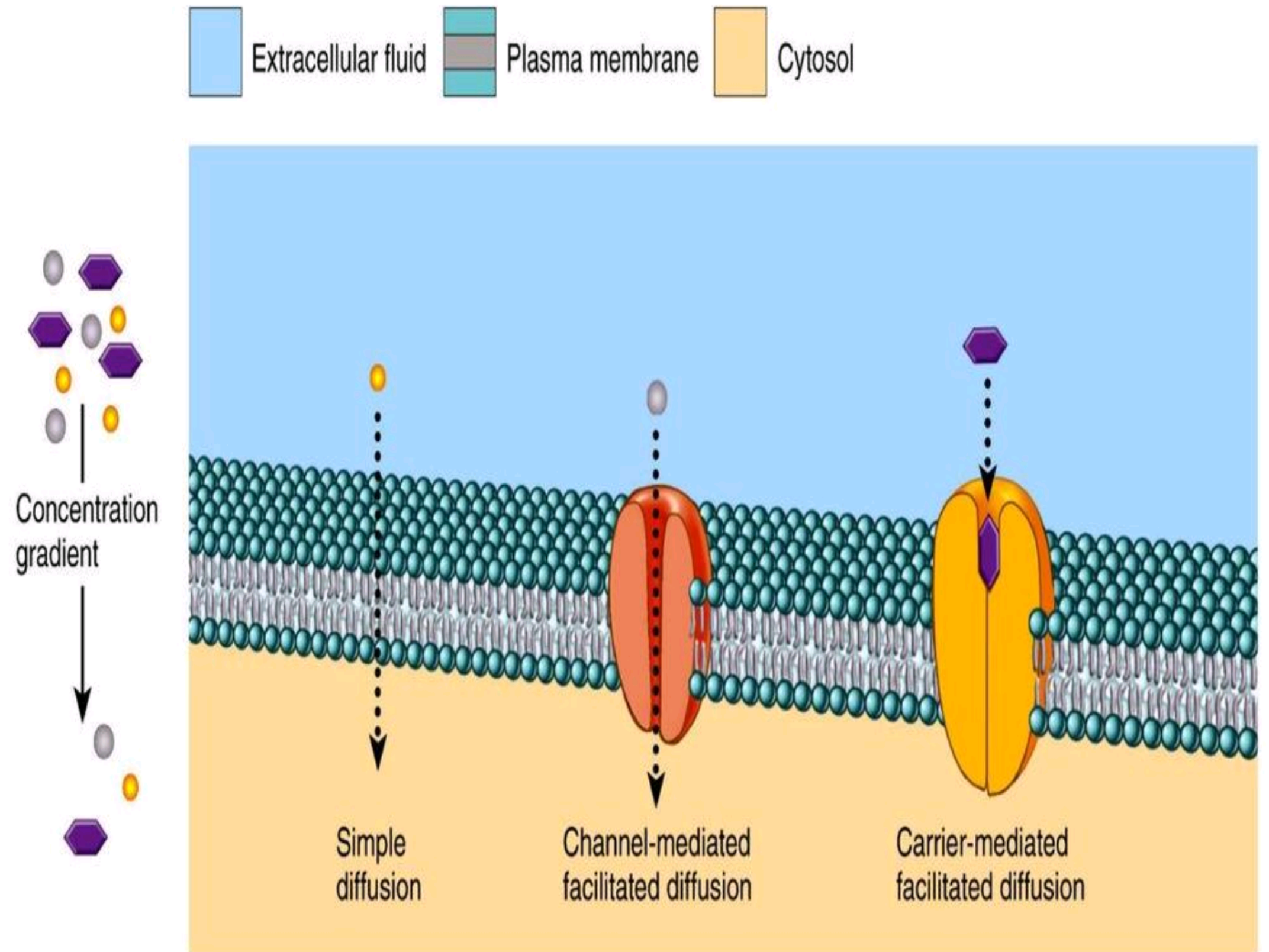
a substance moves across the lipid bilayer of the plasma membrane without the help of membrane transport proteins

الصبر بدون مساعدة البروتين كما هي المواد غير القطبية.

2- Facilitated diffusion

^① channel-mediated facilitated diffusion, and ^② carrier-mediated facilitated diffusion

A substance moves across the lipid bilayer aided by a ^① channel protein or a ^② 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.

مواد ذات قطبية عالية
ومواد مشحونة (ions)

مواد غير قطبية

كارهة للماء

N_2

دهون

O_2

CO_2

فيتامينات ذائبة في الدهون

المواد التي تعبر احدى هاتين الوصلتين
بسهولة جداً

FACILITATED DIFFUSION

1. Channel- mediated facilitated diffusion

- Most membrane channels are ion channels ^{مخترة الغشاء بالكاس} integral transmembrane proteins ^{اختراق} that allow passage of small, inorganic ions that are too hydrophilic to penetrate the nonpolar interior of the lipid bilayer.
- Some gated channels ^{نوع آخر من channel} randomly 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. Carrier- mediated facilitated diffusion

- 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.
- 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.
- Substances that move across the plasma membrane by carrier mediated facilitated diffusion include **glucose**, **fructose**, **galactose**, and **some vitamins**.

السكريات الأحادية وبعض الفيتامينات



OSMOSIS

- **Osmosis** is a type of diffusion that occurs only when a membrane is permeable to water but is not permeable to certain solutes.

أي أنها تقتصر على انتقال الماء من المنطقة الأعلى تركيز فيه إلى الأقل تركيز فيه

- 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**.

تعريف لعملية الـ osmosis

OSMOSIS

- 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.

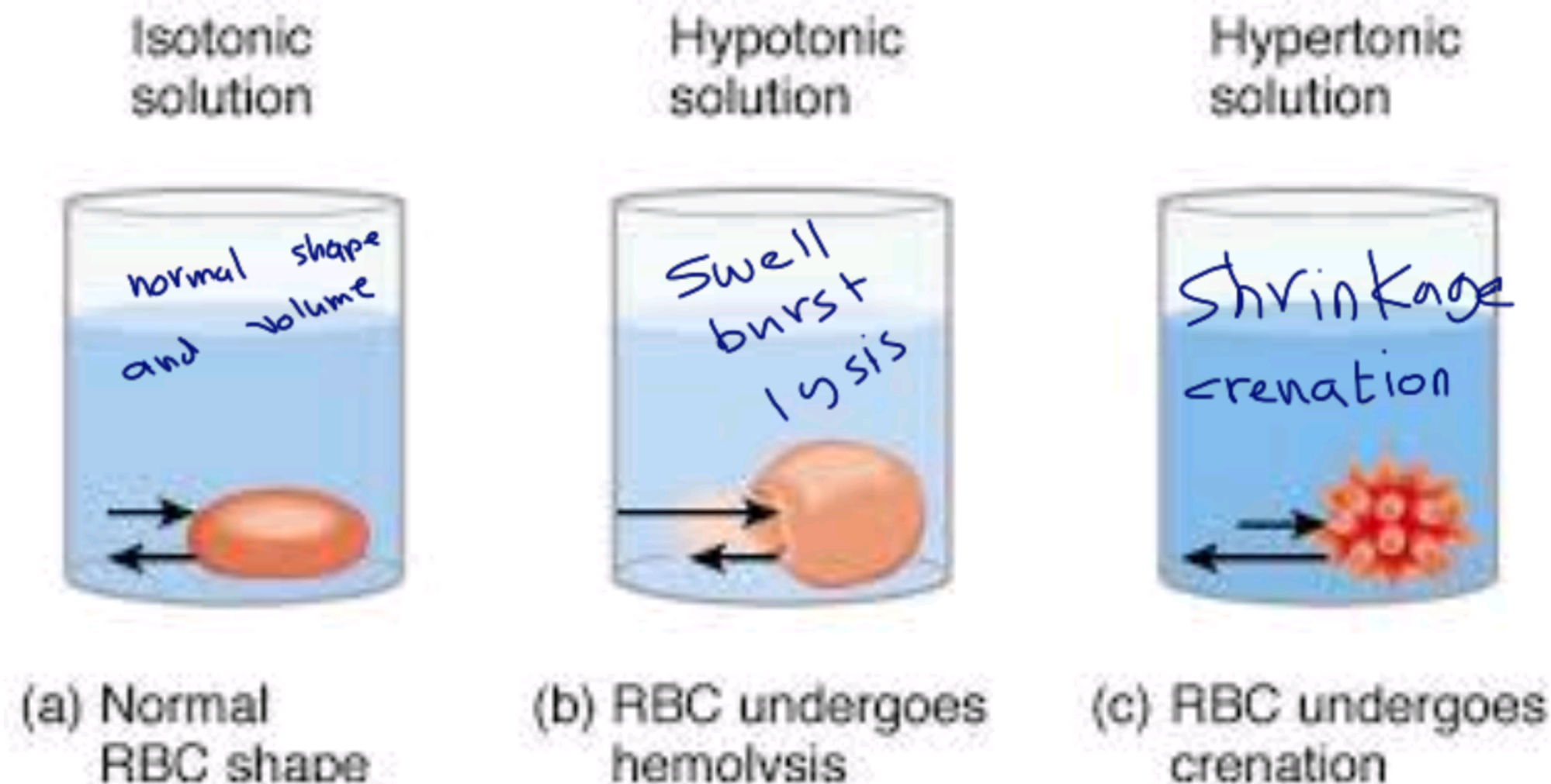
توكيز هتساوي على جانبي الخلية

- 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).

ان الماء يدخل الخلية
و يستفجر
خارج الخلية فالبصني
اي الماء اقل

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.



الماء قليلة خارج
لذلك سيخرج الماء من
الخلية الى الخارج وستكمن
الخلية .

ACTIVE PROCESSES

مصدر الطاقة
عن طريق تحليل ATP
عن طريق تدفق تدرج الأيونات
(عن طريق التناقل الأيون مع تدفق تركيزه
ينقل المكون عكس تركيزه)

- **Two sources of cellular energy can be used to drive active transport:**
 1. Energy obtained from 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.
- carrier
المستخدمة لهذا
النوع من النقل

ACTIVE PROCESSES

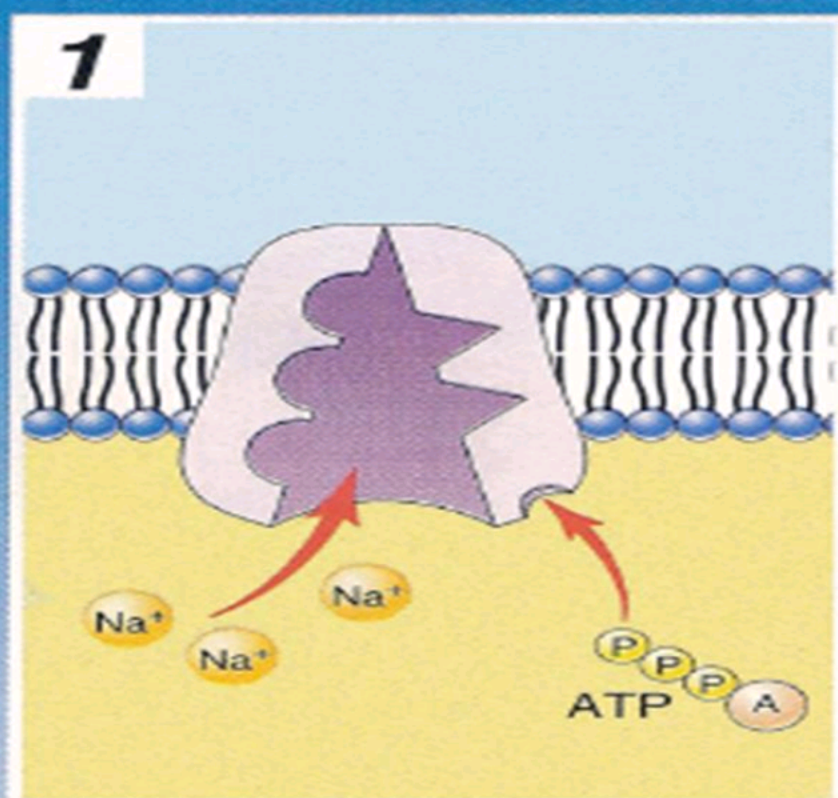
The most prevalent primary active transport mechanism expels sodium ions from cells and brings potassium ions in (**sodium-potassium pump**). All cells have thousands of sodium-potassium pumps in their plasma membranes.

الأداة السائدة لنقل
 Na^+ و K^+

تستخدم المصدر
الادوية الطاقة ATP

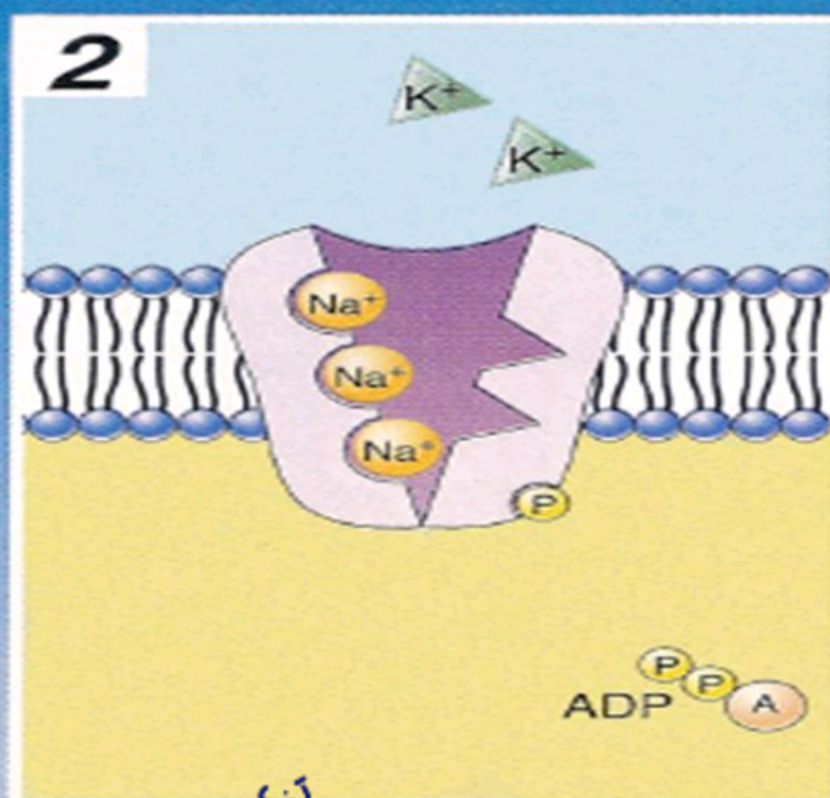
100%

SODIUM-POTASSIUM PUMP



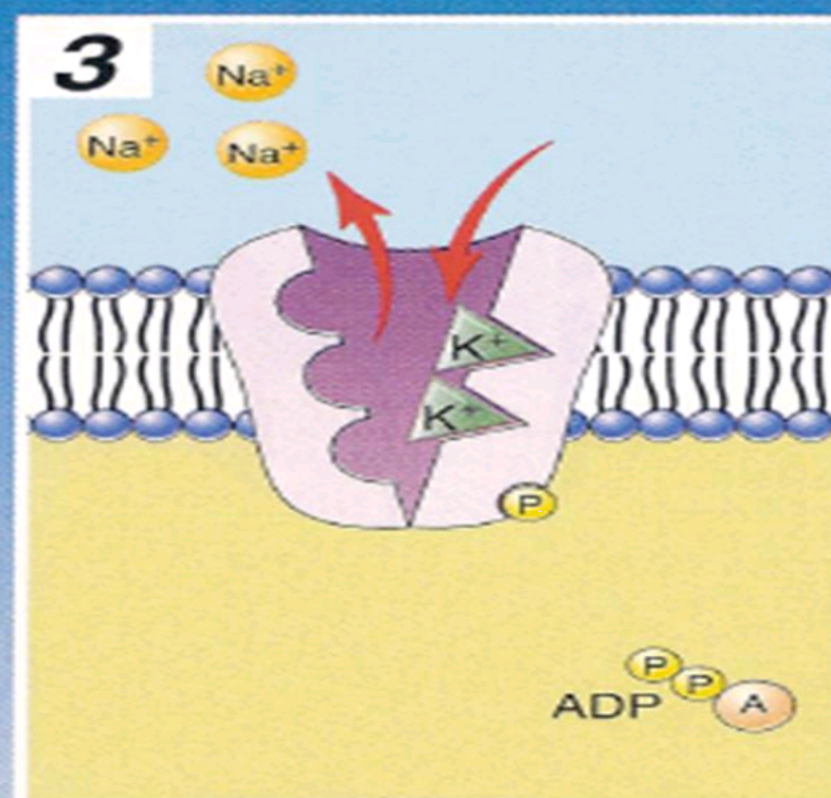
The sodium-potassium pump binds three sodium ions and a molecule of ATP.

ATP
مادة مخزنة
السرعة

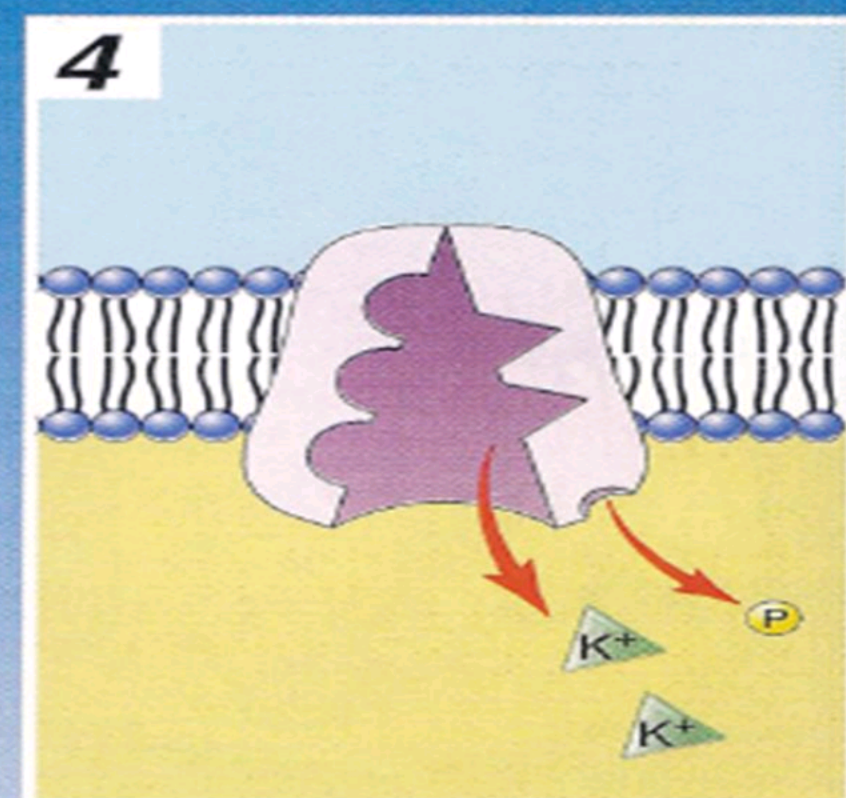


The splitting of ATP provides energy to change the shape of the channel. The sodium ions are driven through the channel.

تفكيك



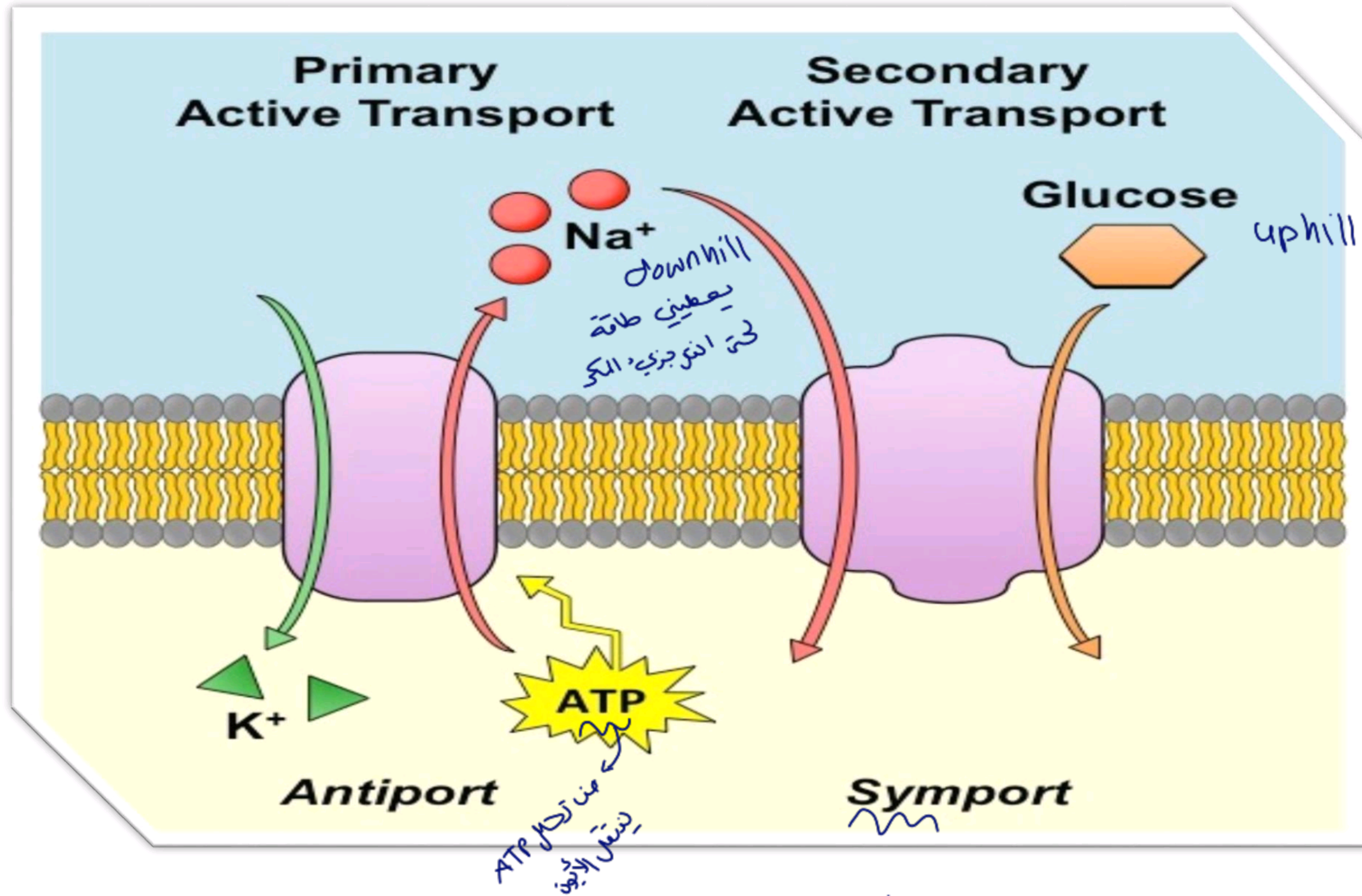
The sodium ions are released to the outside of the membrane, and the new shape of the channel allows two potassium ions to bind.



Release of the phosphate allows the channel to revert to its original form, releasing the potassium ions on the inside of the membrane.

الشكل
الاصلي

ACTIVE PROCESSES



TRANSPORT IN VESICLES

النقل الذي يتم من خلال الحويصلات يسمى

Transcytosis
= endocytosis + exocytosis

- 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.

التي يعمل الحويصلة
(أو هي أنها جزء من الغشاء)

القنوات المواد التي تخرج من الخلية بالغشاء وتخرج على شكل حويصلة

- The three types of endocytosis:

1. Receptor-mediated endocytosis.

2. Phagocytosis.

3. Bulk-phase endocytosis. →

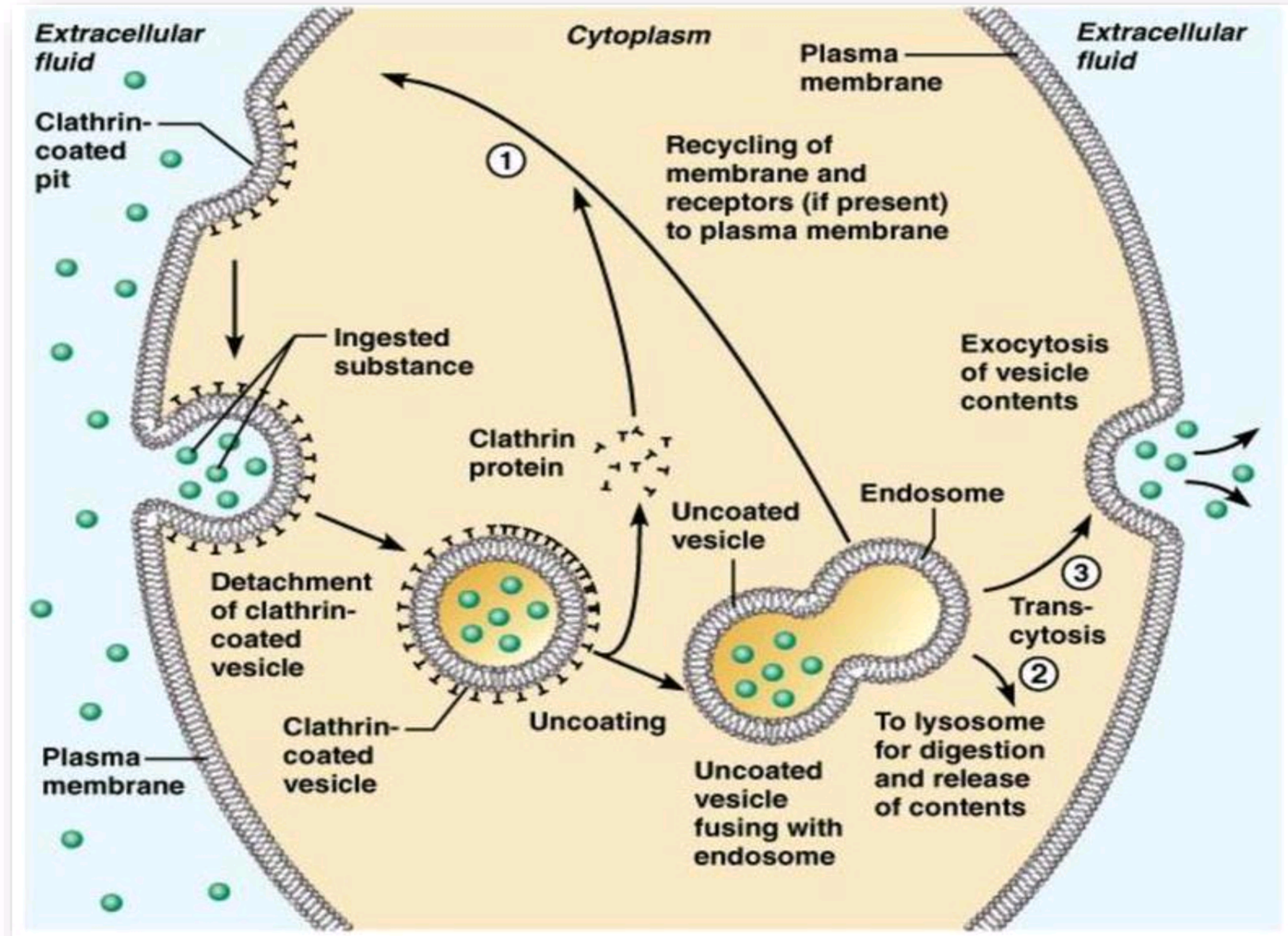
بلعمة

receptor لا يحتاج مستقبل

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.

لا تم لغرف المواد التي تدخل
الخلية عبر
receptor-mediated
endocytosis



PHAGOCYTOSIS

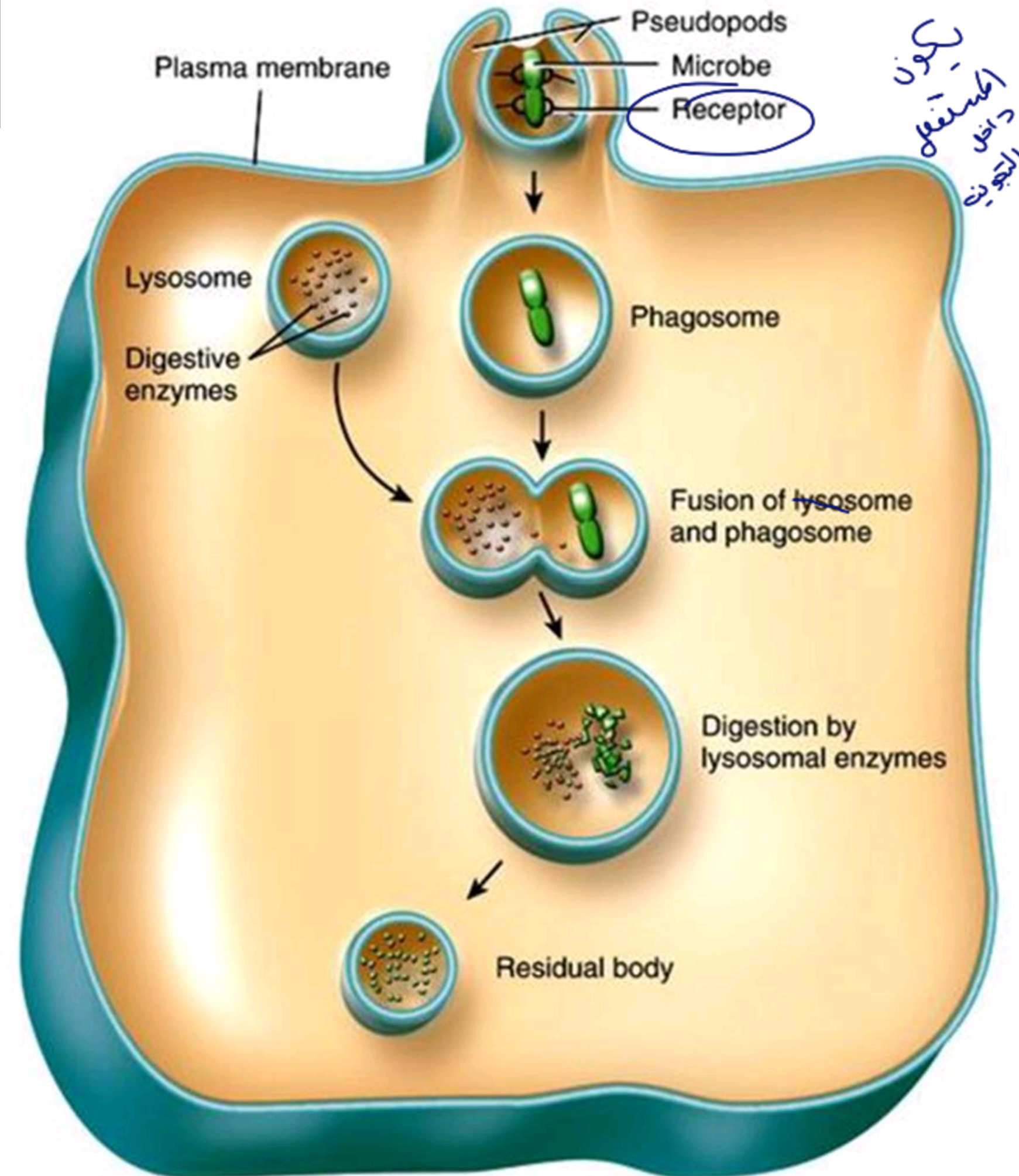
- **Phagocytosis** is a form of endocytosis in which the cell engulfs large solid particles, such as worn-out cells, whole bacteria, or viruses.
انتكاع مواد كبيرة الحجم / خلايا تالفة / بكتيريا / فيروسات
- Two main types of phagocytes are macrophages, located in many body tissues, and neutrophils, a type 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.

في اجزاء غير مهضومة تسمى residual body

ولها في الاحياء تبقى في الجبع البعسي او يمكن للخلية طردها



BULK-PHASE ENDOCYTOSIS (PINOCYTOSIS)

Bulk-phase Endocytosis

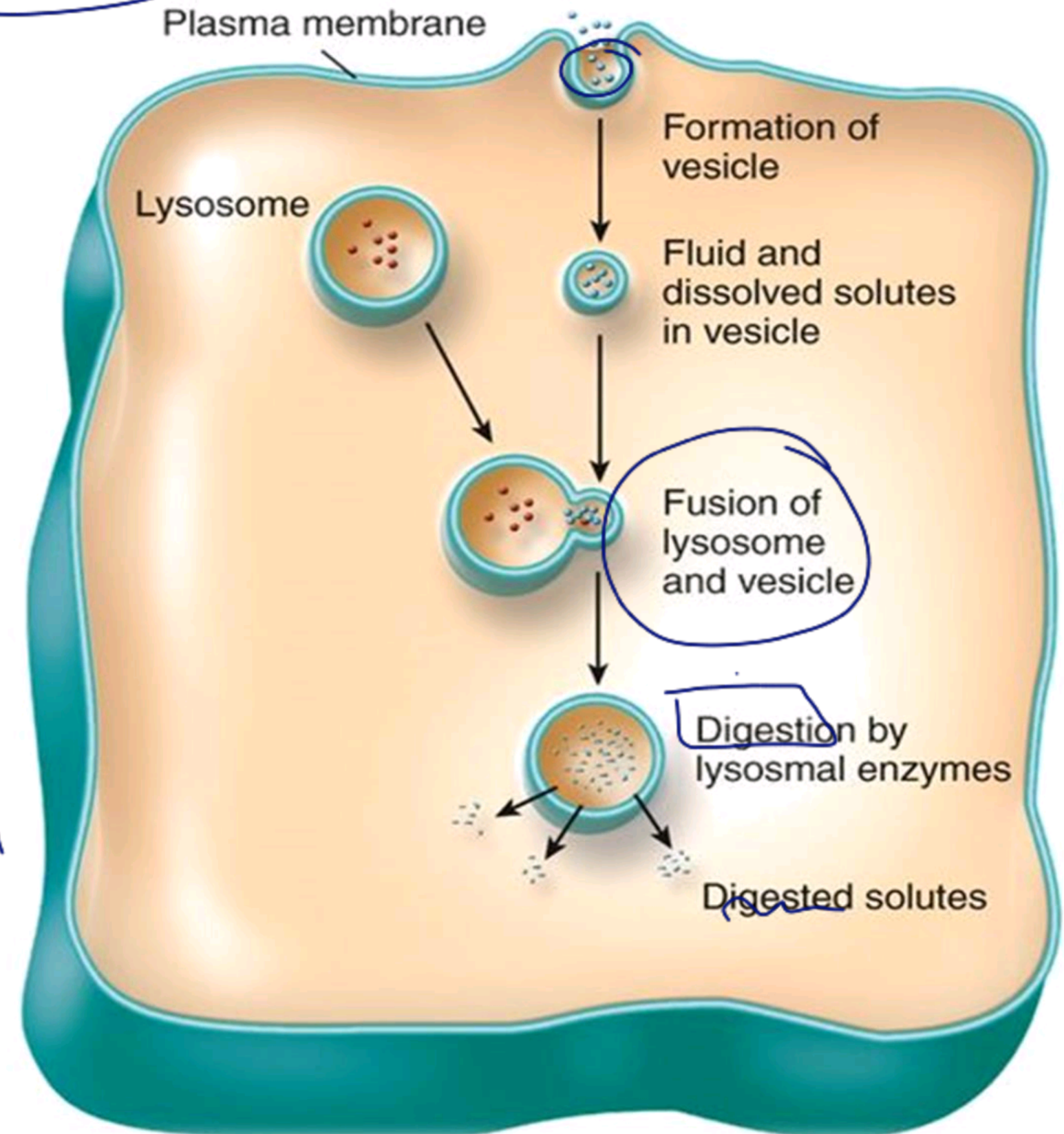
- بلعمة لكن لسائل فيه مواد ذائبة في الخلية
- Bulk-phase endocytosis is a form of endocytosis in which tiny droplets of extracellular fluid are taken up (all solutes dissolved in the extracellular fluid are brought into the cell.).

- 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.

تفاد المواد التي تم هضمها في Lysosomes لتستخدم في الخلية



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.

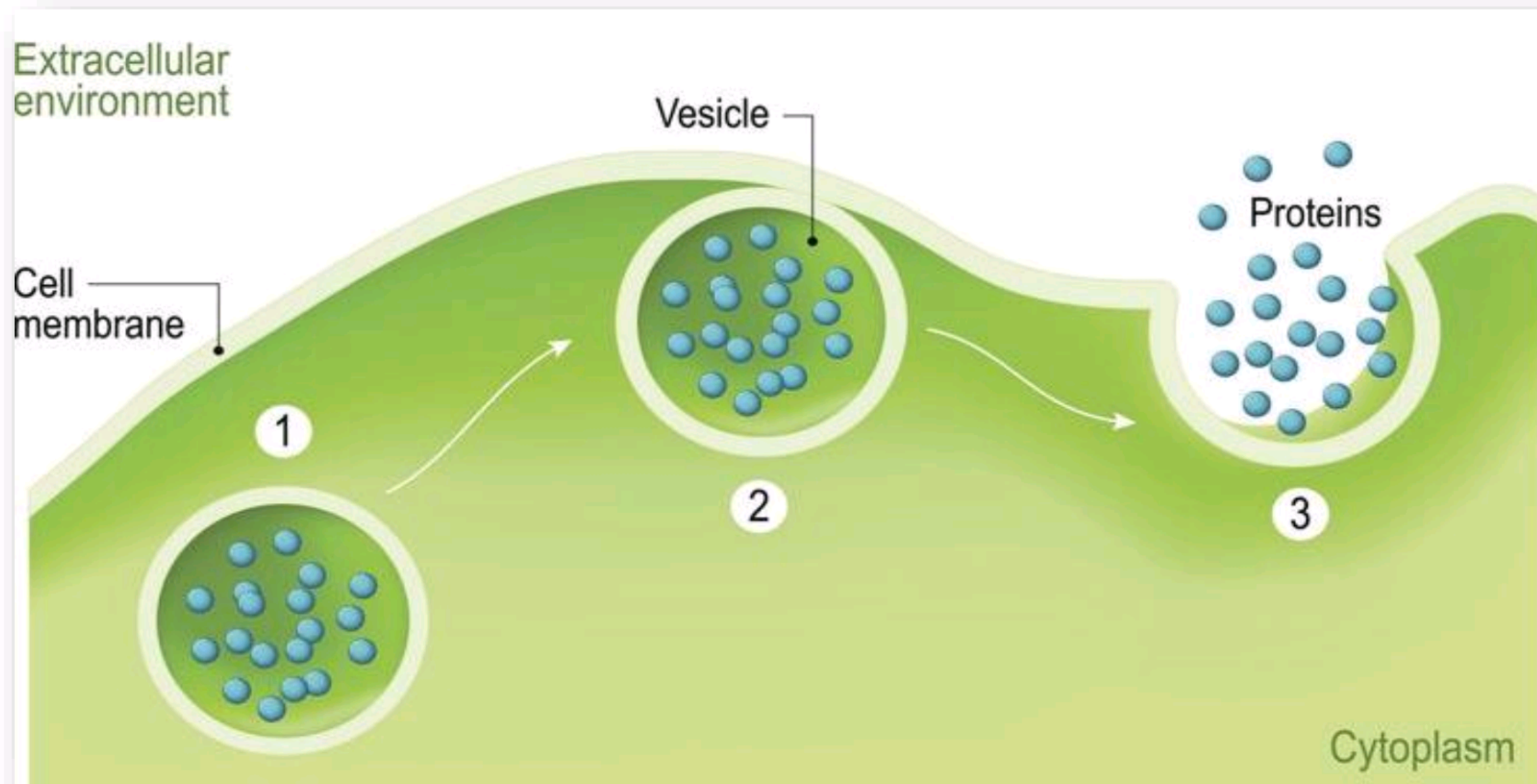
نواقل عصبية

أهم نوعين خلايا تقوم عليه exocytosis

EXOCYTOSIS

- 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.

يُحرر المحتويات



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.

لذلك لازم كل endocytosis يغير exocytosis
لتعويض الفقدان في الغشاء الخلوي بعمليات endocytosis

TRANSCYTOSIS

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

- 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.

عمليات الإدخال والإخراج الخلوي

دخول جزيئات كبيرة في blood vessel في طبقة endothelial

المأخذ خارج الخلية

مرأة حامل

تقويع البروتينات إلى الجنين عبر دورة الدموية



THANK YOU

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