تَنوير

BIOLOGY

Lec no : 6

File Title : Chapter 7

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وَقُل رَّبِّ زِدْنِي عِلْمًا

- In the nucleus, DNA is organized into discrete units called **chromosomes**
- Each chromosome is composed of a single DNA molecule associated with proteins
- The DNA and proteins of chromosomes are together called **chromatin** ⟵ in non-dividing cell
- Chromatin condenses to form discrete **chromosomes** as a cell prepares to divide
- The **nucleolus** is located within the nucleus and is the site of ribosomal RNA (rRNA) synthesis

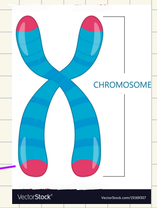
نَوَوِيّة

يدخل في بناء الريبوسوم

(non dividing) Chromatin: a thin net found in the nucleus it holds 2 things the DNA and protein

↓ preparing to divide after DNA replication

Chromosomes: when the chromatin net condenses as the cell prepare to divide



chromatid ←

each chromosome consist of 2 sister chromatids

each chromatid carry one copy of the DNA

Nucleolus: found inside the nucleus and it builds the ribosomal RNA (rRNA) → importan in the synthesis of ribosomes → protein factories

Ribosomes: Protein Factories

of 2 subunits large and small

- **Ribosomes** are particles made of ribosomal RNA and protein
- Ribosomes carry out protein synthesis in two locations
  - In the cytosol (free ribosomes)
  - On the outside of the endoplasmic reticulum or the nuclear envelope (bound ribosomes)

synthesis the proteins that will stay and function in the cytosol

depending on the protein function

synthesis the proteins that will be secreted out of the cell or integrated into other organelles

Figure 6.10 Process of building the ribsomes: the ribosomes existing in the cytosol build a protein that enters the nucleus from the nuclear pores and unite with the rRNA that the nucleolus produced to creat ribosome subunits, then the subunits exit the nucleus as single subunits (to fit through the nuclear pores) and pair with each other in the cytosol

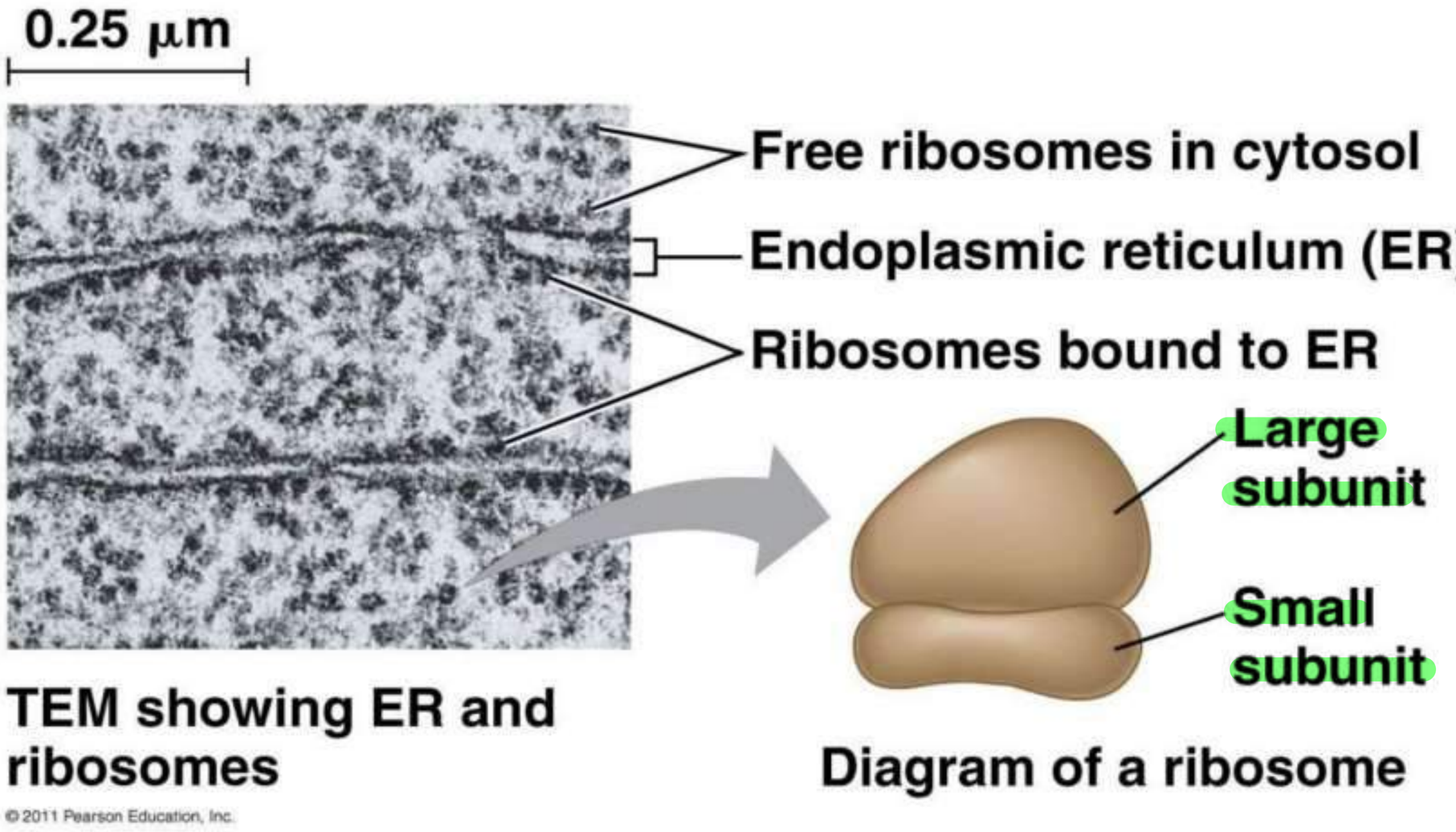
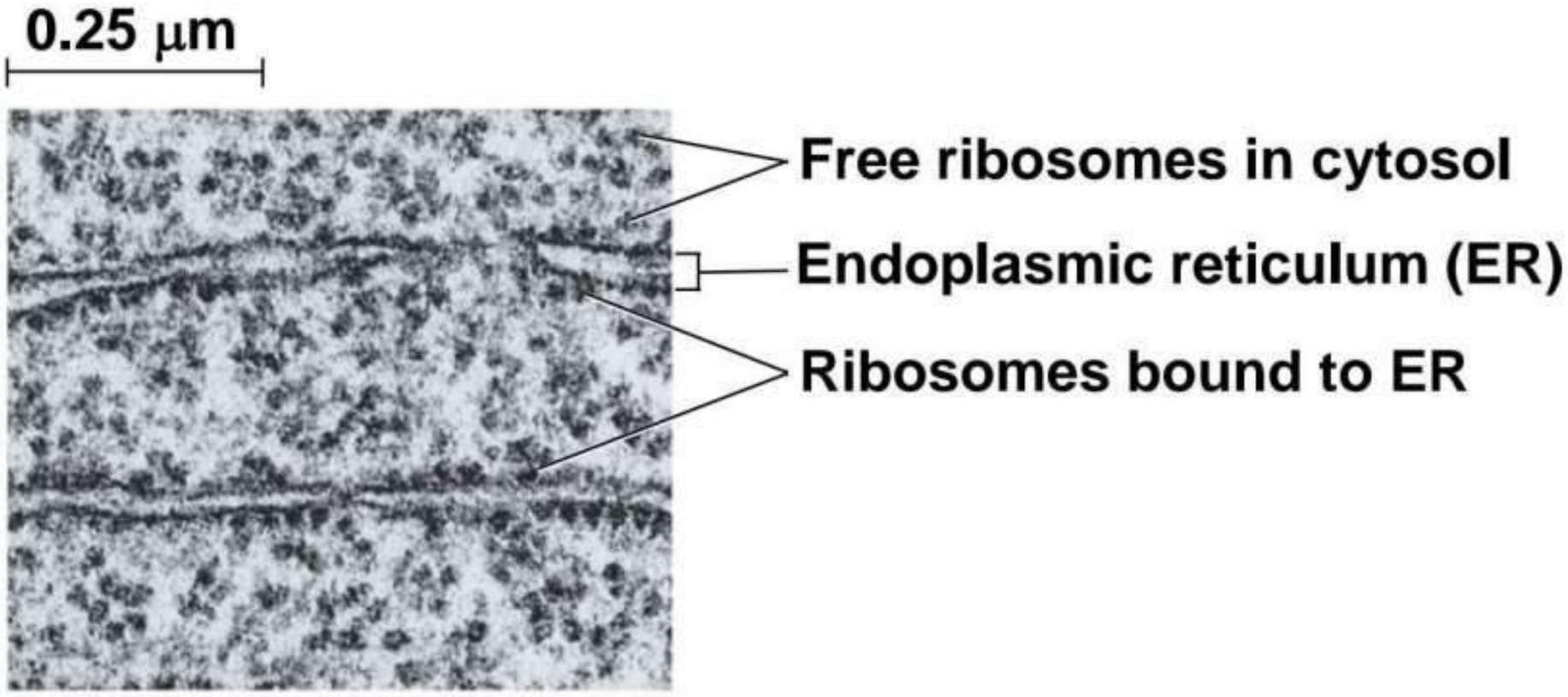


Figure 6.10a



TEM showing ER and ribosomes

داخل الغشاء

Concept 6.4: The endomembrane system regulates protein traffic and performs metabolic functions in the cell

they have the same structure of the membrane

- Components of the **endomembrane system**
  - Nuclear envelope
  - Endoplasmic reticulum
  - Golgi apparatus
  - Lysosomes → الأجسام الحالة
  - Vacuoles
  - Plasma membrane

مما يعني انه ممكن ان يكونوا على امتداد بعضهم او ان كل واحد بعطي الثاني او الاحتمالين مع بعض

بعض العلماء قاموا باستثناءه من هذه المجموعة لانه يحيط بالخلية و ليس داخلها (اعتمدوا على الموقع) و البعض الآخر اعتبروه من ضمن المجموعة بسبب تشابه التركيب (اعتمدوا على التركيب) و يذكروا انه خارج الخلية (محيطها)

- These components are either continuous or connected via transfer by **vesicles** حويصلات

The Endoplasmic Reticulum: Biosynthetic Factory

- The **endoplasmic reticulum (ER)** accounts for more than half of the total membrane in many eukaryotic cells
- The ER membrane is continuous with the nuclear envelope
- There are two distinct regions of ER
  - **Smooth ER**, which lacks ribosomes
  - **Rough ER**, surface is studded with ribosomes

Figure 6.11

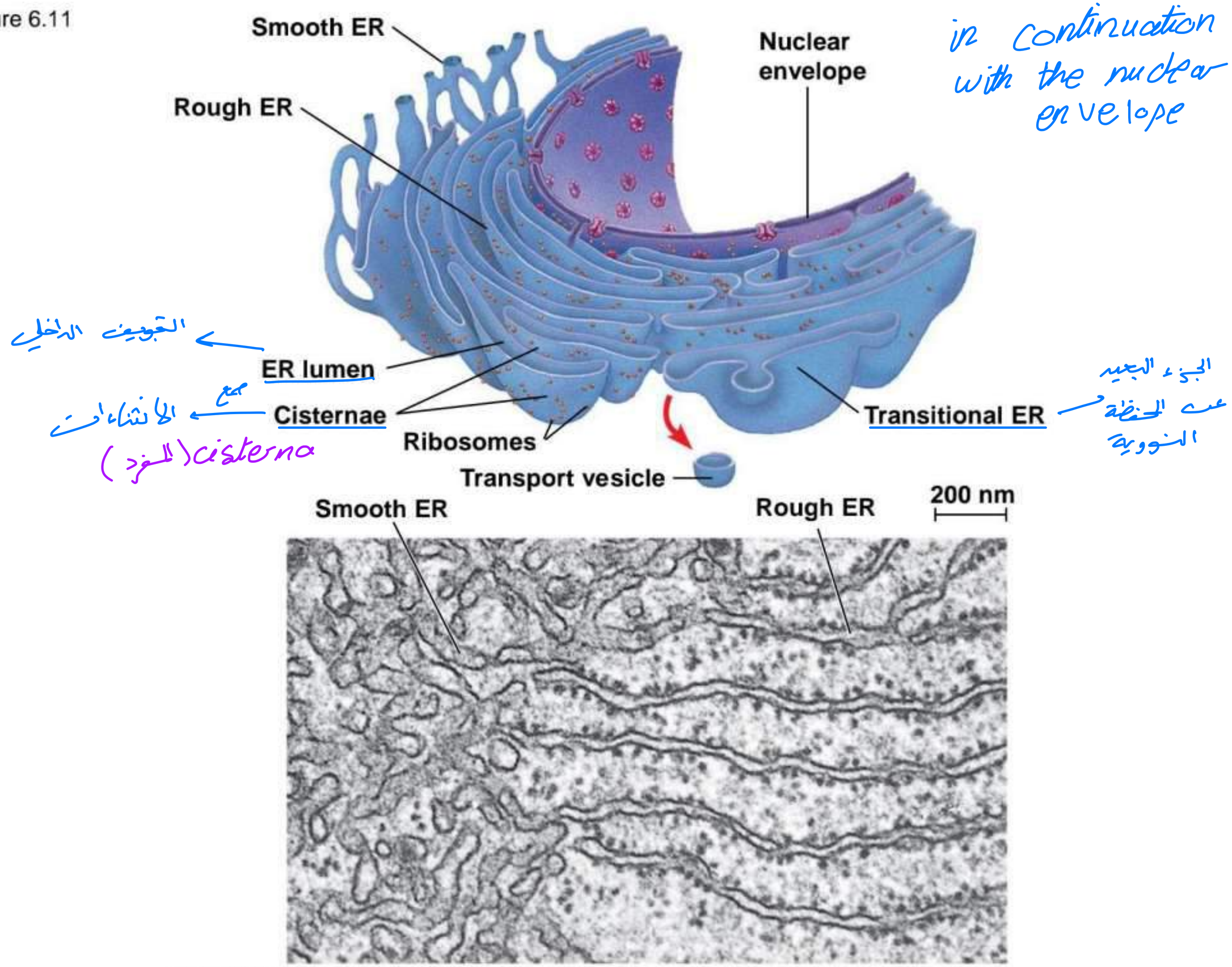
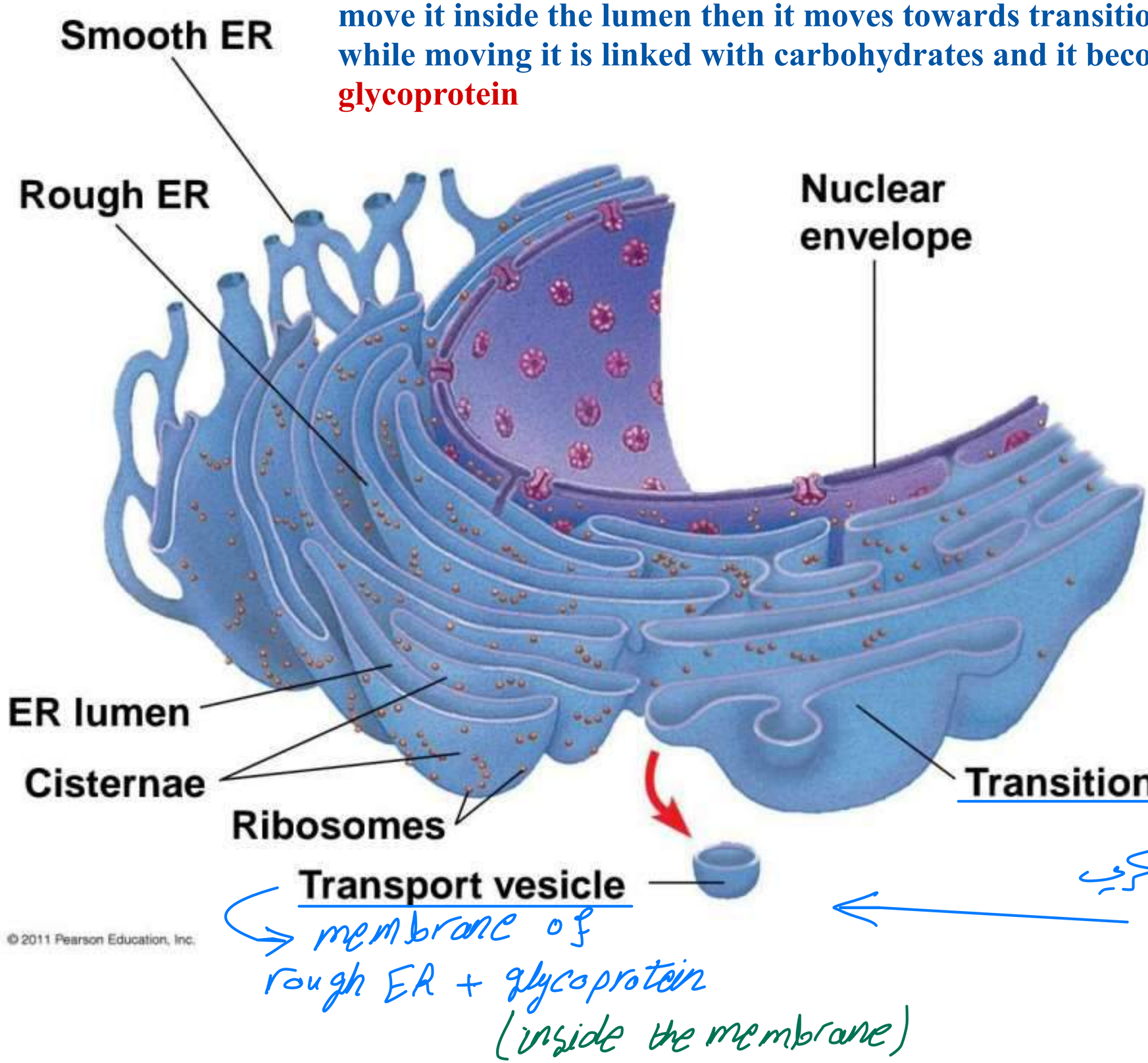


Figure 6.11a

When building proteins secreted to the outside or integrated into other organelles the bound ribosomes build the protein and move it inside the lumen then it moves towards transitional ER, while moving it is linked with carbohydrates and it becomes a glycoprotein



membrane of rough ER + glycoprotein (inside the membrane)

تحيط بالبروتين السكري وتنفصل فتصبح

Functions of Smooth ER

- The smooth ER
  - Synthesizes lipids → mainly steroids (more in the book)
  - Metabolizes carbohydrates — بناء وهدم
  - Detoxifies drugs and poisons — ازالة سمية
  - Stores calcium ions
    muscles need Calcium to function

Functions of Rough ER

- The rough ER
  - Has bound ribosomes, which secrete **glycoproteins** (proteins covalently bonded to carbohydrates)
  - Distributes **transport vesicles**, proteins surrounded by membranes
  - Is a membrane factory for the cell

glycoproteins

The Golgi Apparatus: Shipping and Receiving Center

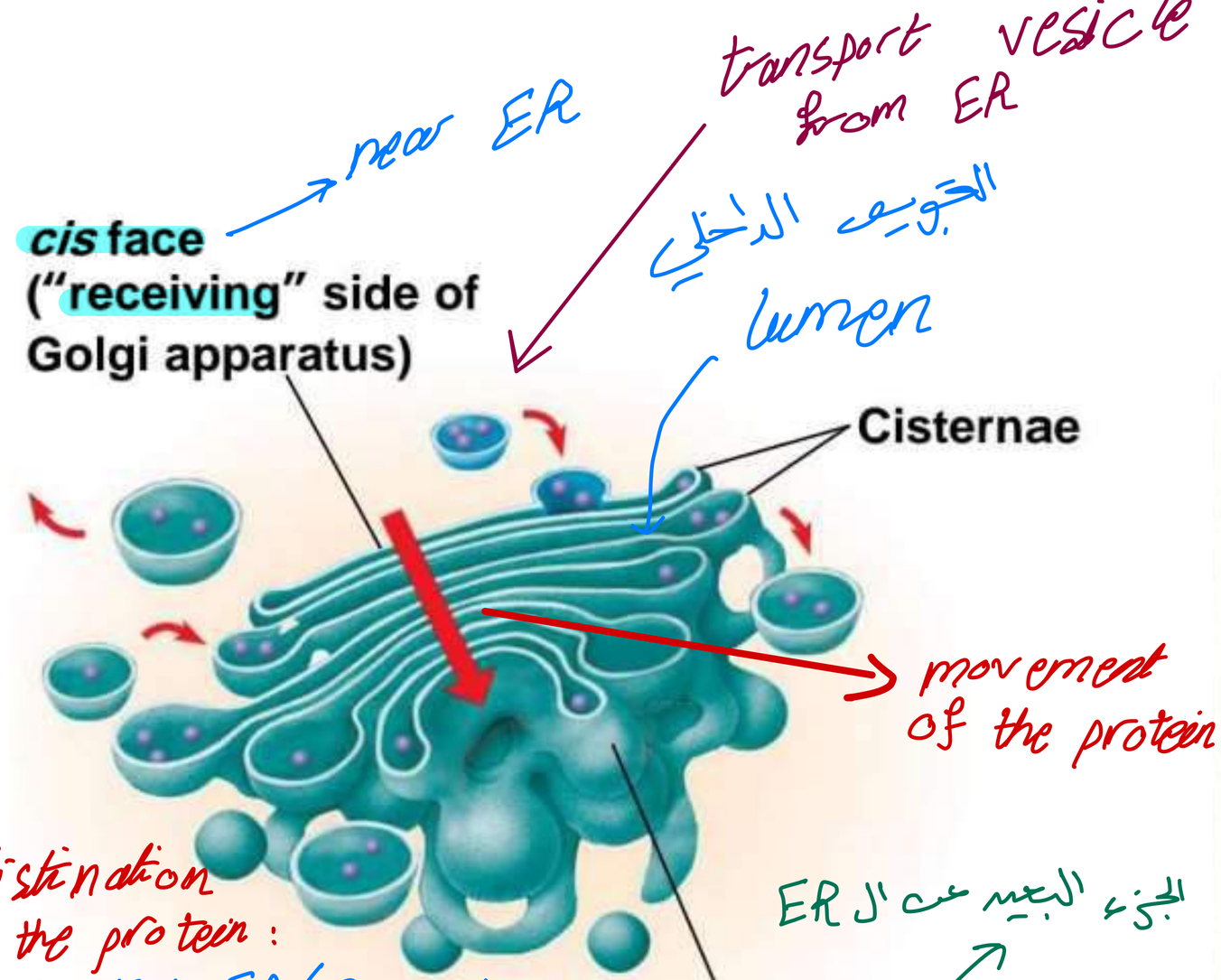
sort the glycoprotein

- The **Golgi apparatus** consists of flattened membranous sacs called cisternae
- Functions of the Golgi apparatus
  - Modifies products of the ER
  - Manufactures certain macromolecules
  - Sorts and packages materials into transport vesicles

in the plant cell Golgi apparatus secrete vesicles that contain carbohydrates instead of proteins which help with the building the cell wall

Figure 6.12

* the membrane of the transport vesicle unite with Golgi membrane



TEM of Golgi apparatus

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while the protein moves from cis face to trans face it is modified for example: addition of phosphate group, or the addition of carbohydrates

الأجسام الحالة

Lysosomes: Digestive Compartments

الشروط:
1) animal cell
2) the vesicle contains hydrolytic enzymes
3) Acidic pH

- A **lysosome** is a membranous sac of hydrolytic enzymes that can digest macromolecules

انزيمات حالة

- Lysosomal enzymes can hydrolyze proteins, fats, polysaccharides, and nucleic acids
- Lysosomal enzymes work best in the acidic environment inside the lysosome

PLAY Animation: Lysosome Formation

Intracellular digestion

- Some types of cell can engulf another cell by **phagocytosis**; this forms a food vacuole
- A lysosome fuses with the food vacuole and digests the molecules
- Lysosomes also use enzymes to recycle the cell's own organelles and macromolecules, a process called autophagy

بلعة

بلع ذاتي

phagy: بلع

3) Apoptosis: programmed cell death

when there is an abnormal cell like cancer cell, if the body can't defend itself doctors use medication that break down the lysosome membrane so the lysosomal enzymes leak in the cell and it digest it self

4) Development:

تساهم في تطوير الكائنات على سبيل المثال :
في المراحل الجنينية يوجد اغشية بين الاصابع (مش مفصولات عن بعض) مع الوقت تتكون الانزيمات الحالّة و تحلل هذا الغشاء، و مثلا الضفدع فيتم تحليل الذيل الذي يملكه عندما يكون في مرحلة أبو ذنيبة (يرقة الاسم العلمي ابو ذنيبة من عنا هاي)

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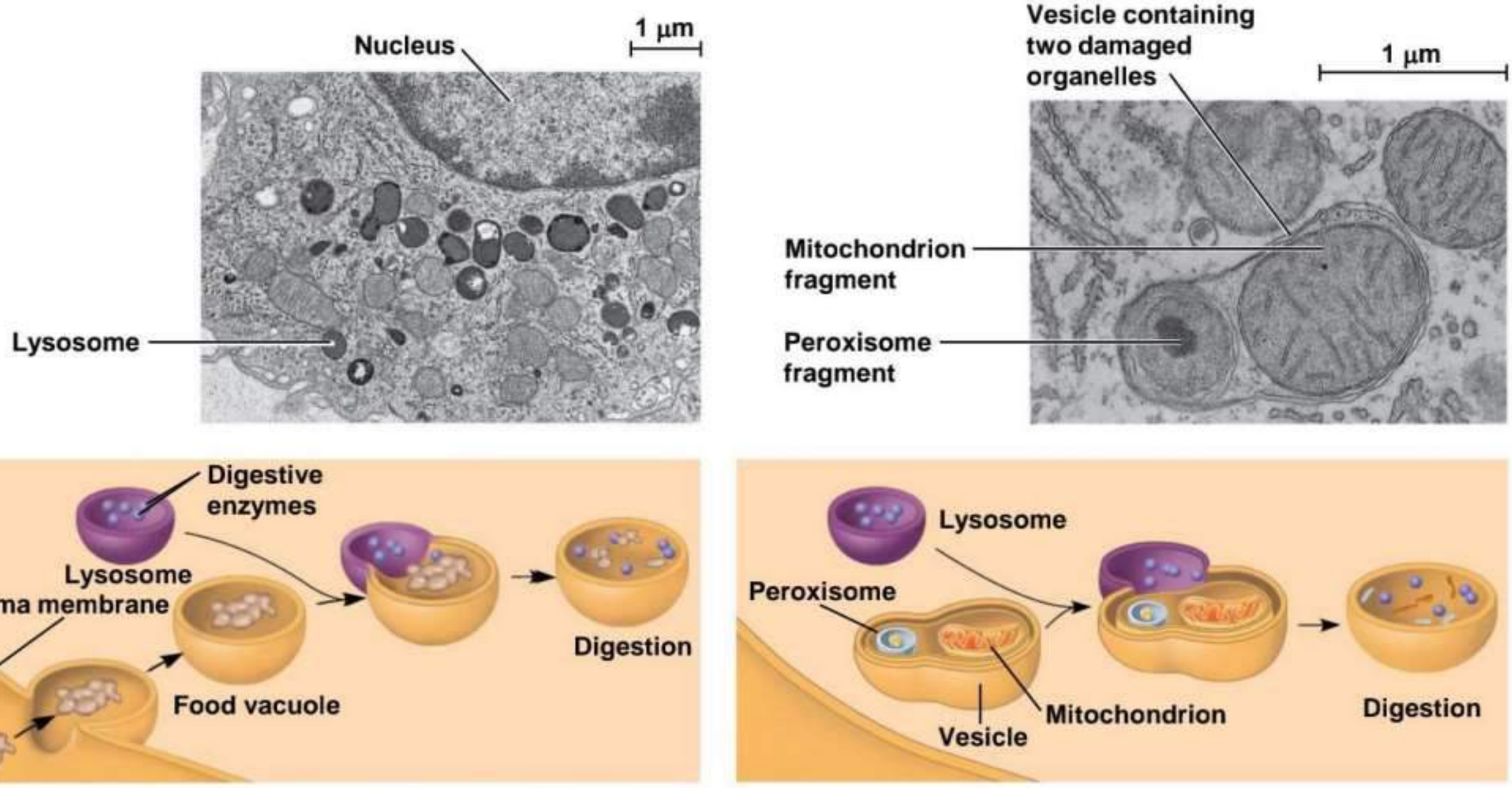
lysosomal storage disease

Caused by a disfunction in the lysosome or the lysosomal enzymes

Like: Taysacches disease

سببه هو تراكم الدهون على الخلايا العصبية بسبب خلل في الأنزيمات الحالّة المسؤولة عن تفكيك الدهون

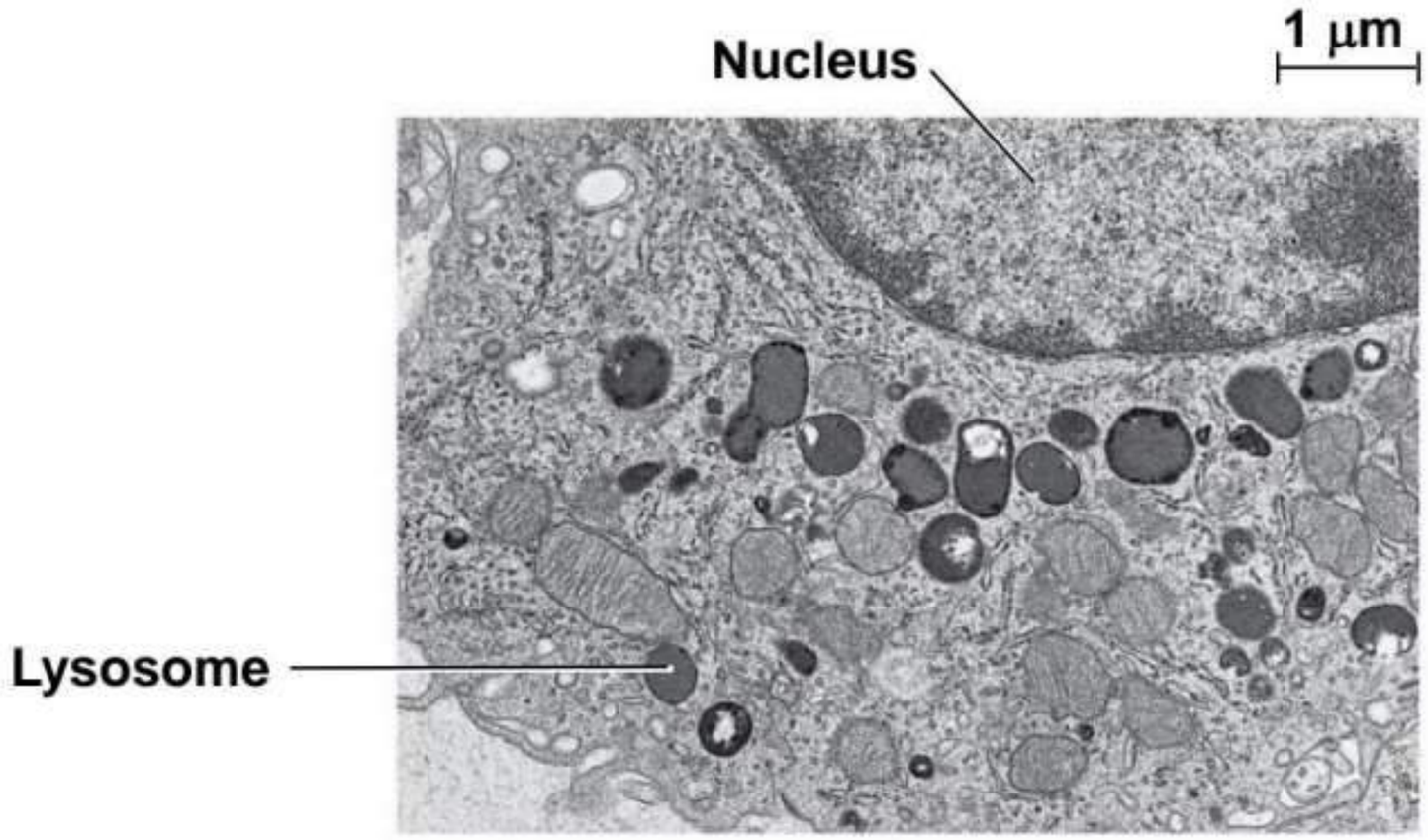
Figure 6.13

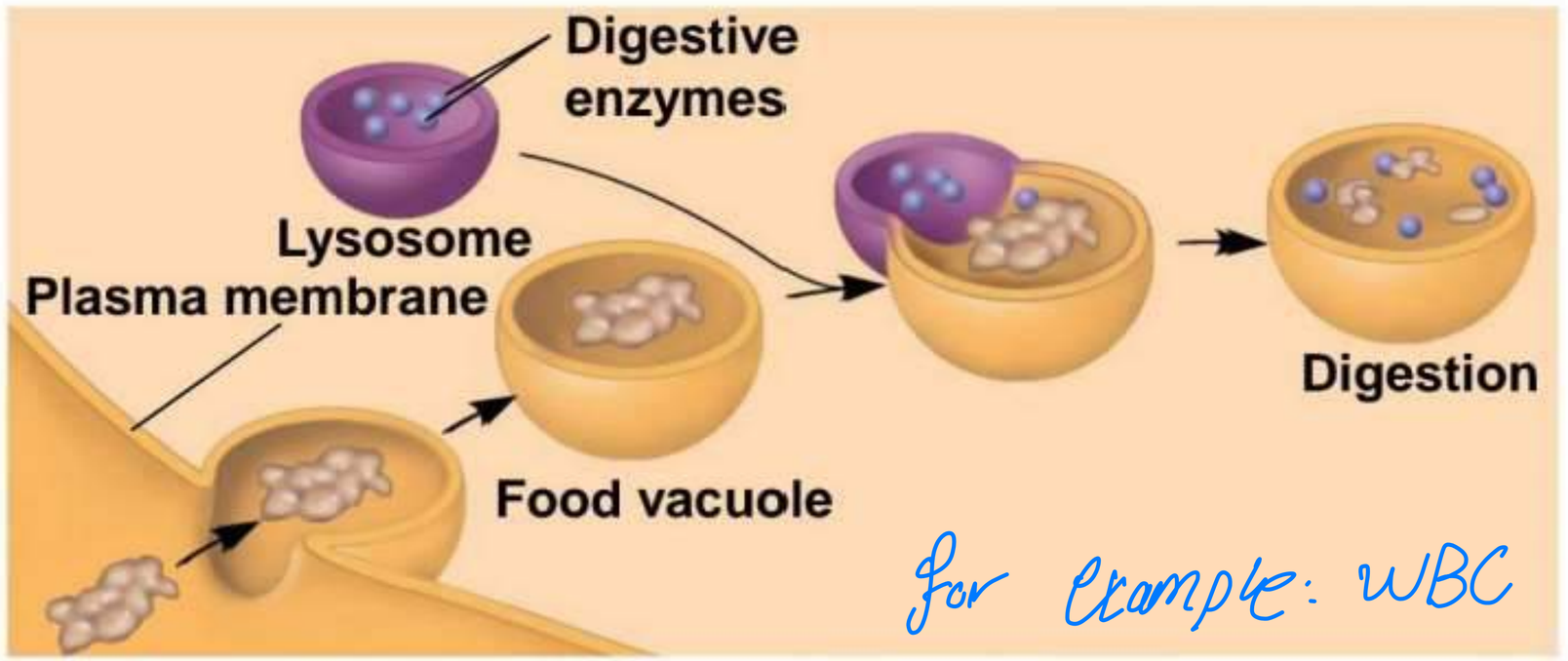


(a) Phagocytosis

(b) Autophagy

Figure 6.13a

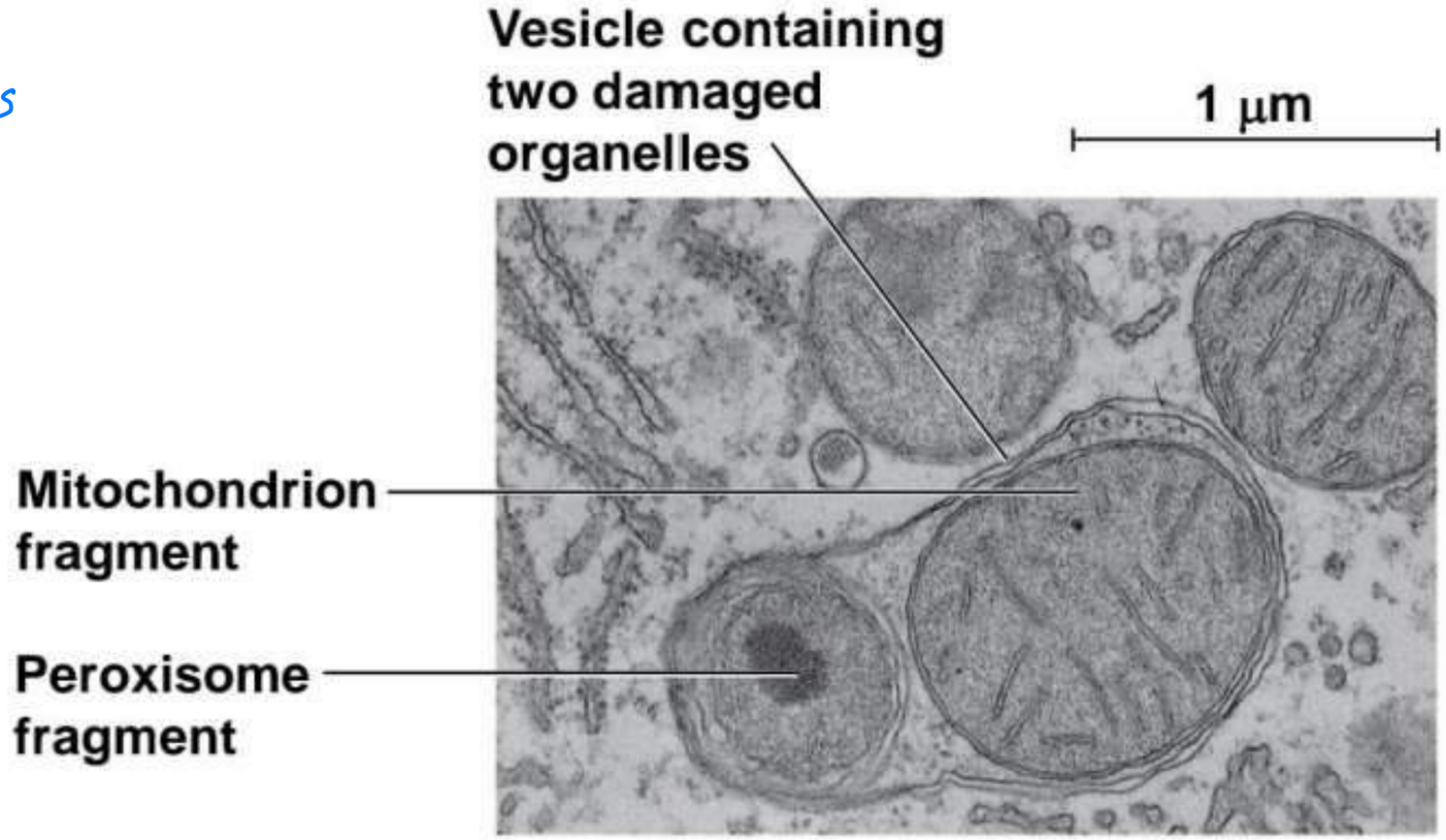


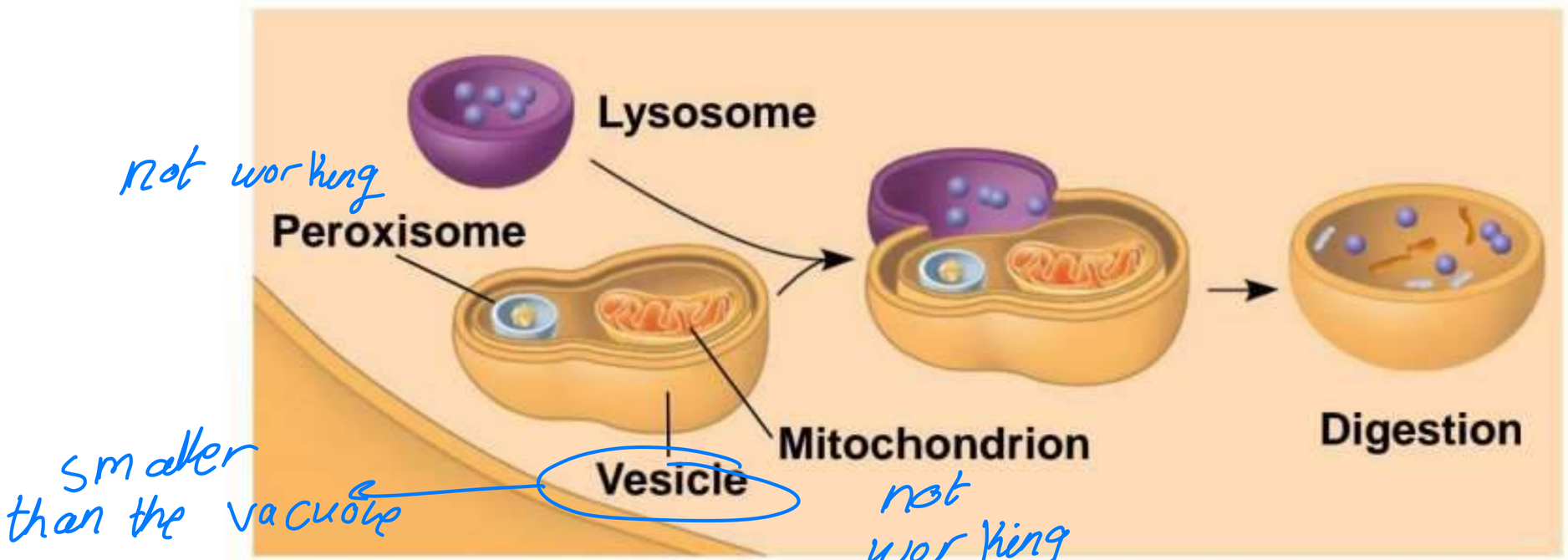


(a) Phagocytosis

Figure 6.13b

Taysaccharides





(b) Autophagy

Vacuoles: Diverse Maintenance Compartments

- A plant cell or fungal cell may have one or several **vacuoles**, derived from endoplasmic reticulum and Golgi apparatus

Kinds of vacuoles

- **Food vacuoles** are formed by phagocytosis
- **Contractile vacuoles**, found in many freshwater protists, pump excess water out of cells
- **Central vacuoles**, found in many mature plant cells, hold organic compounds and water

osmo-regulation
تنظيم الضغط الاسموزي

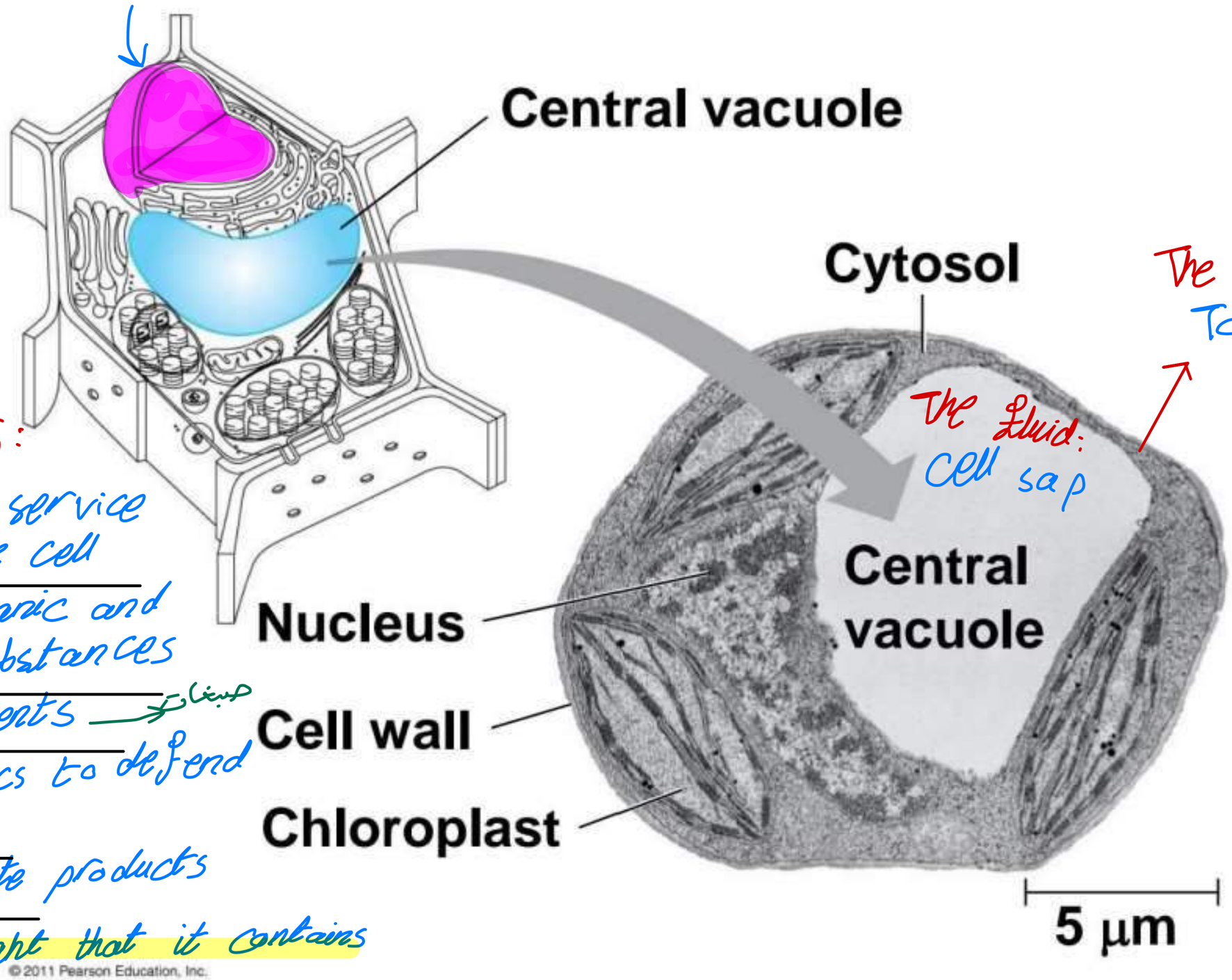
Small vacuoles gather together and unite to create a central vacuole

عند دخول ماء زائد على جسم الكائن تخزن هذه الماء الزائدة في الفجوات المنقبضة (contractile vacuolea) و تتخلص من الماء الزائد عن طريق الانقباض

PLAY Video: Paramecium Vacuole

Figure 6.14

nucleus in a peripheral location



The membrane: Tonoplast

The fluid: cell sap

Functions:

1) increase the service area of the cell
2) stores organic and inorganic substances
3) stores pigments → صبغات
4) stores toxics to defend it self
5) stores waste products
6) it is thought that it contains enzymes similar to hydrolict enzymes

The Endomembrane System: *A Review*

- The endomembrane system is a complex and dynamic player in the cell's compartmental organization

Figure 6.15-3