النادي الطبي

تَنوير

BIOLOGY

Lec no : 8

File Title : End of Chapter 7

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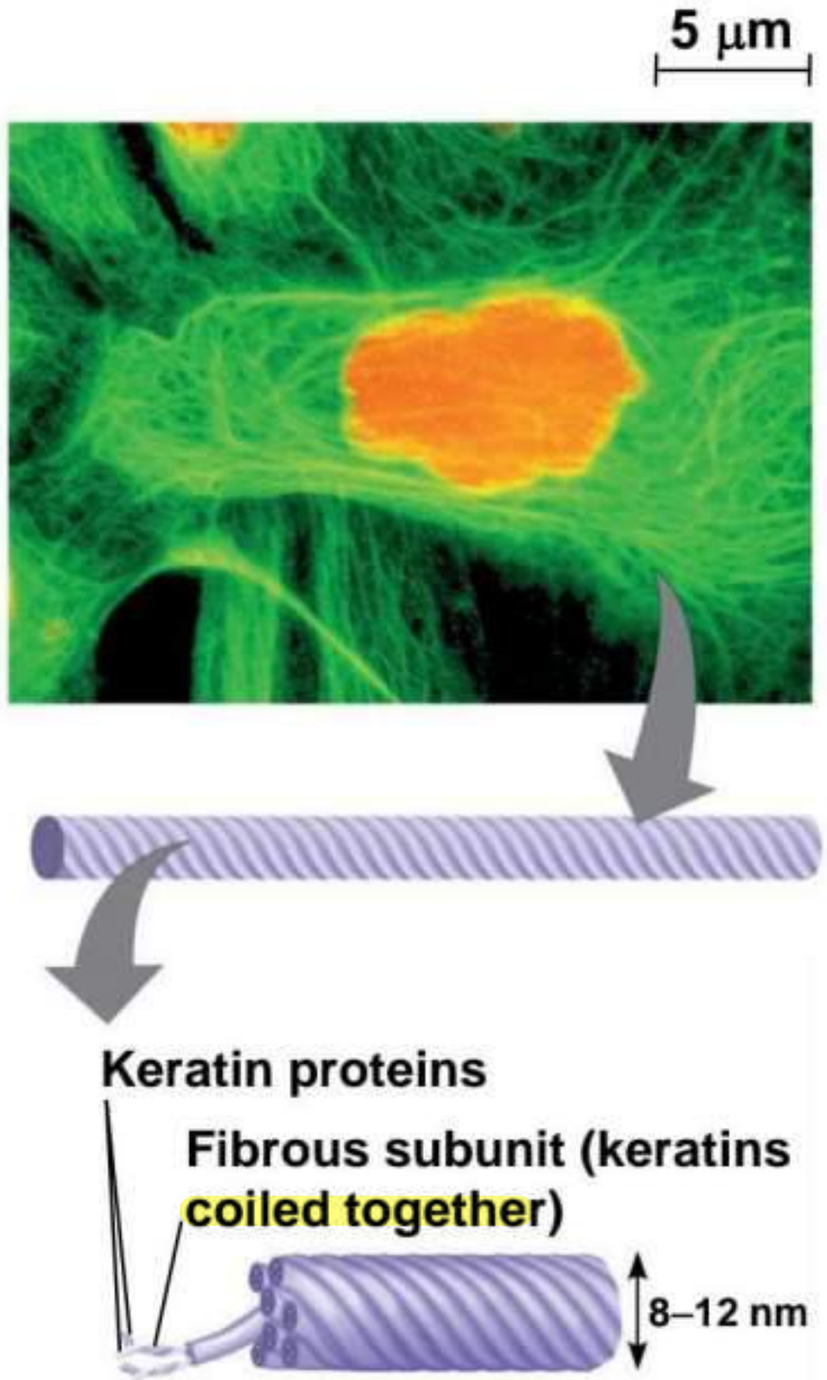
Table 6.1c

Property	Intermediate Filaments
Structure	Fibrous proteins supercoiled into thicker cables
Diameter	8–12 nm
Protein subunits	One of several different proteins (such as keratins), depending on cell type
Main functions	Maintenance of cell shape (tension-bearing elements) تثبيت Anchorage of nucleus and certain other organelles Formation of nuclear lamina



They used to call it Keratin filaments because they thought that it only contains keratin protein, Later they found out that it has different protein but mainly consists of keratin

Intermediate Filaments

- **Intermediate filaments** range in diameter from 8–12 nanometers, larger than microfilaments but smaller than microtubules
- They support cell shape and fix organelles in place
- Intermediate filaments are more permanent cytoskeleton fixtures than the other two classes

intermediate filaments are found in the cells of some animals including Vertebrates

Concept 6.7: Extracellular components and connections between cells help coordinate cellular activities

- 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

Cell Walls of Plants

- The **cell wall** is an extracellular structure that distinguishes plant cells from animal cells
- Prokaryotes, fungi, and some protists also have cell walls
- The cell wall protects the plant cell, maintains its shape, and prevents excessive uptake of water
- Plant cell walls are made of cellulose fibers embedded in other polysaccharides and protein

- 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
- Plasmodesmata are channels between adjacent plant cells

Plants

- herbaceous: primary cell wall only — نباتات عشبية (طرية خضراء) ورقية وساقها طري
- woody: primary + secondary cell wall

Figure 6.28

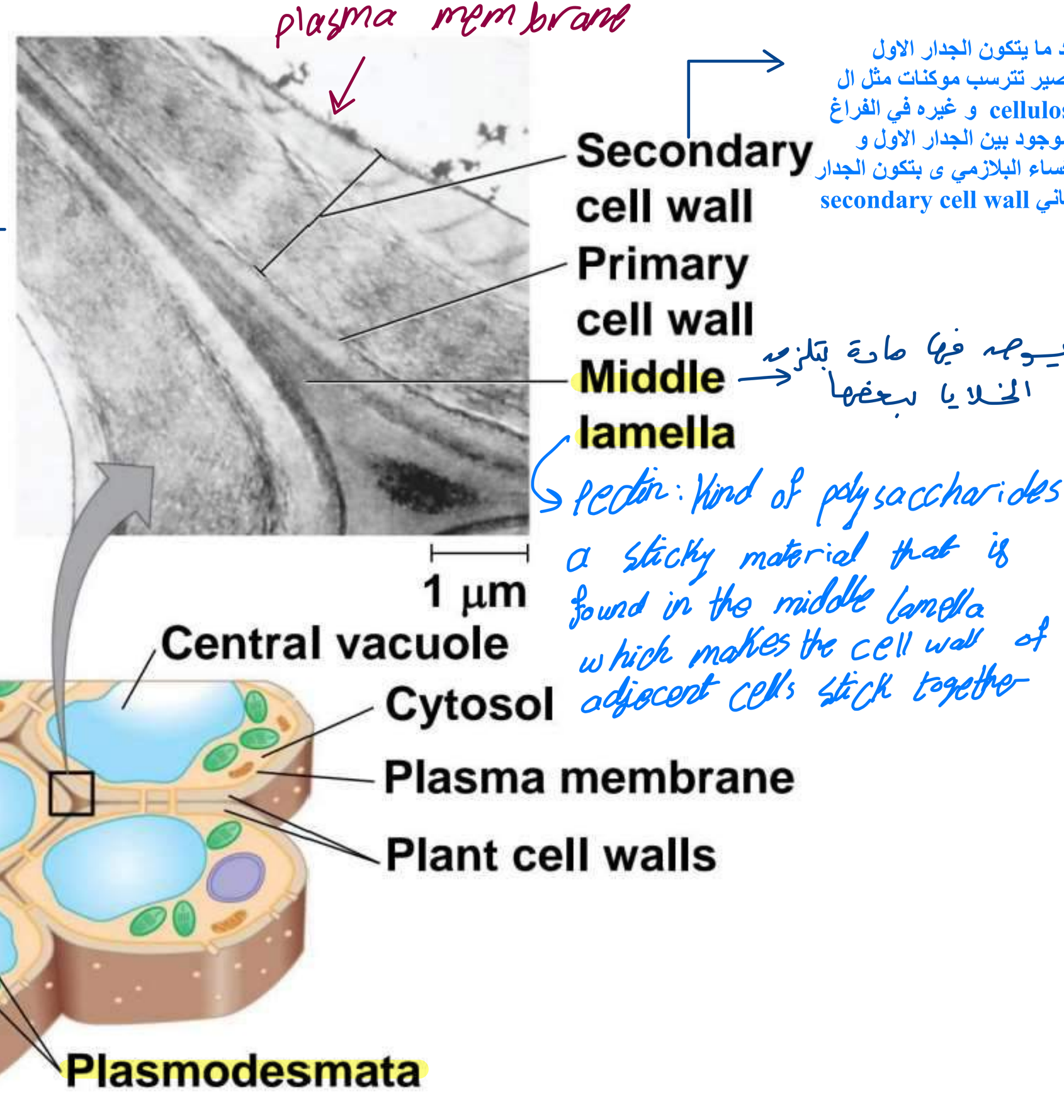
woody plant cells →

Primary cell wall:

يتكون بشكل رئيسي من ترسب ال (**cellulose**) و يتكون قبل ال (**secondary cell wall**)

order of formation:

1) Plasma membrane
2) primary cell wall
3) secondary cell wall



بعد ما يتكون الجدار الاول بتصير تترسب موكنات مثل ال cellulose و غيره في الفراغ الموجود بين الجدار الاول و الغساء البلازمي ى بتكون الجدار الثاني secondary cell wall

يوجد فيها مادة بتلزم الخلايا ببعضها

Pectin: kind of polysaccharides a sticky material that is found in the middle lamella which makes the cell wall of adjacent cells stick together

Figure 6.28a

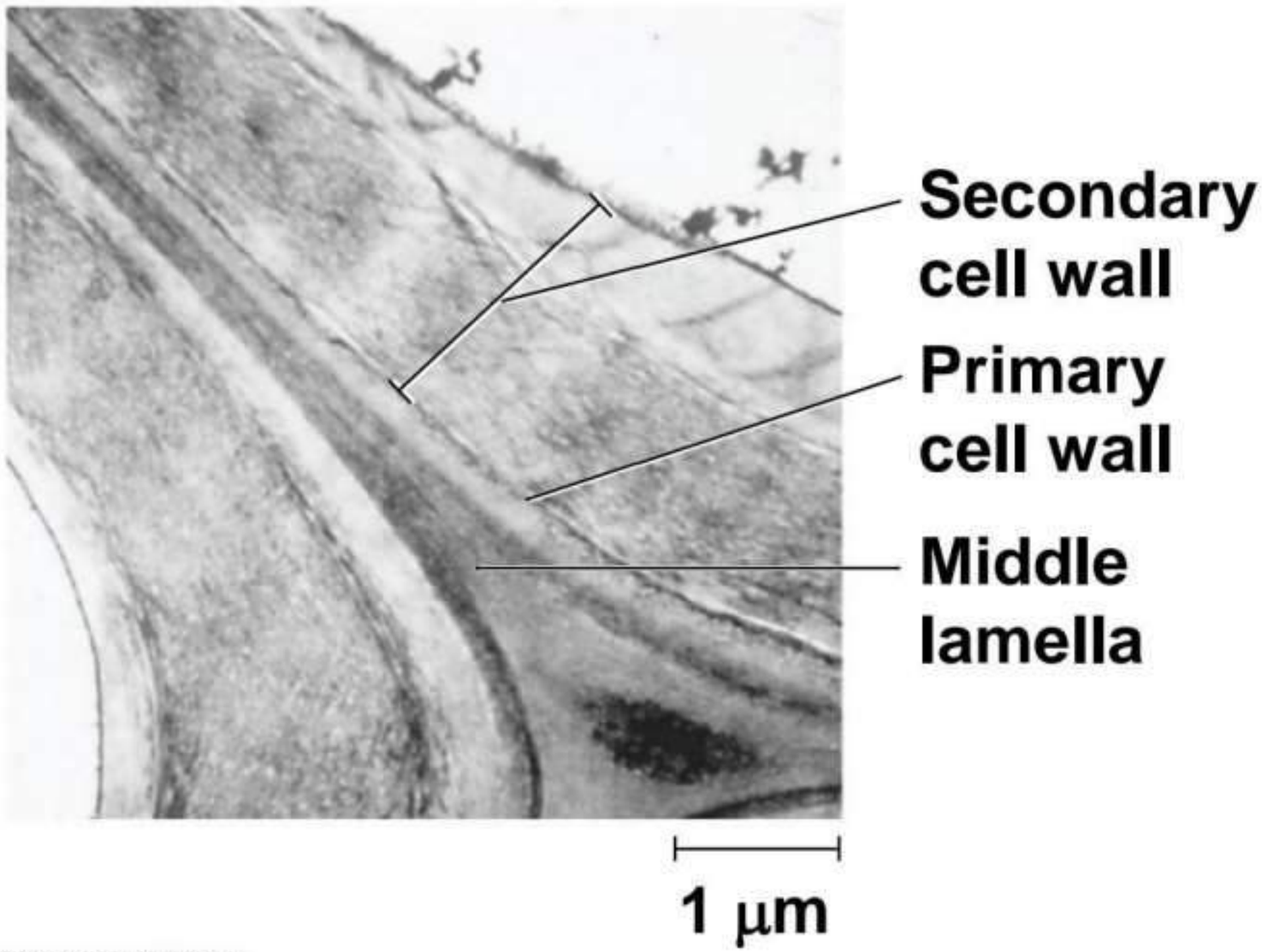


Figure 6.29

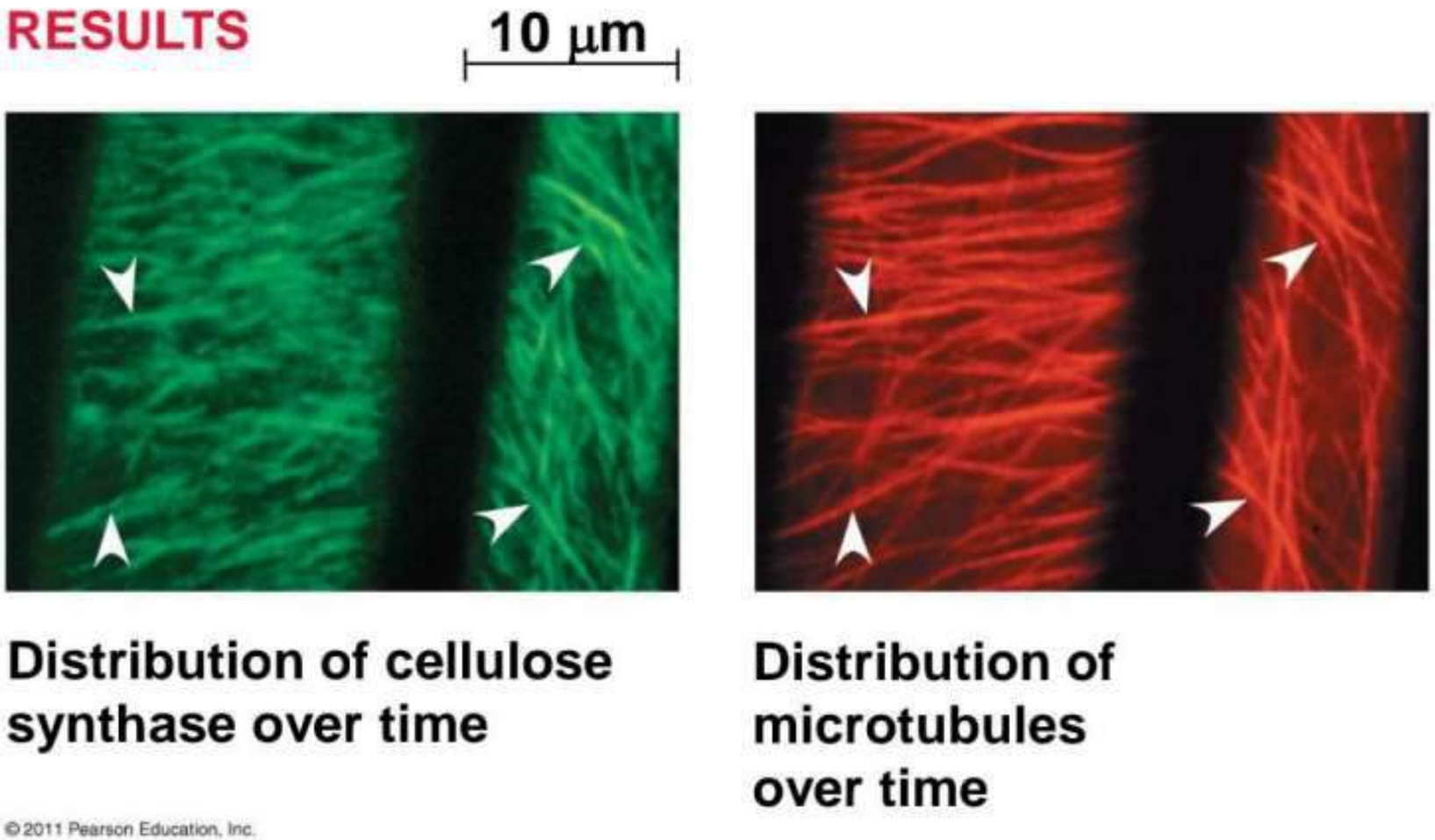
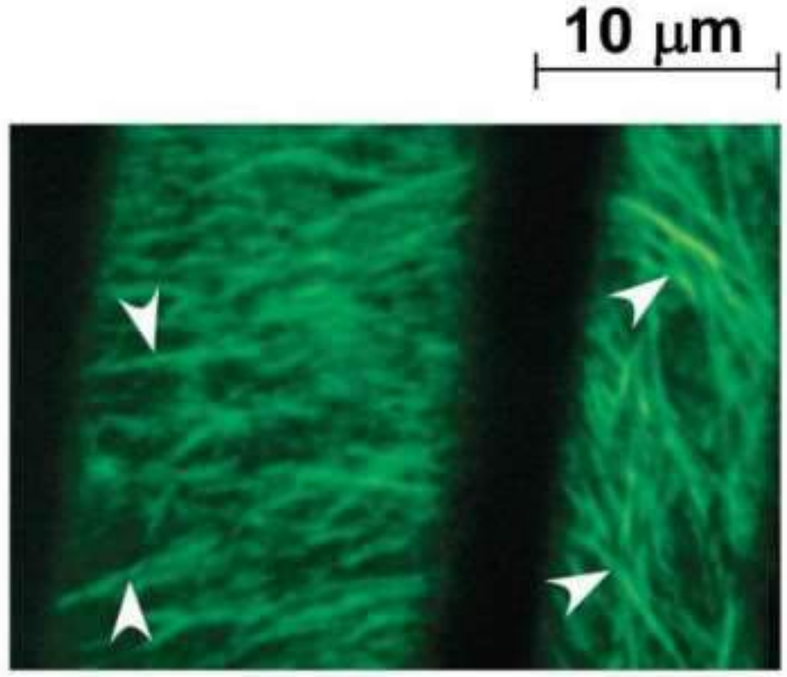
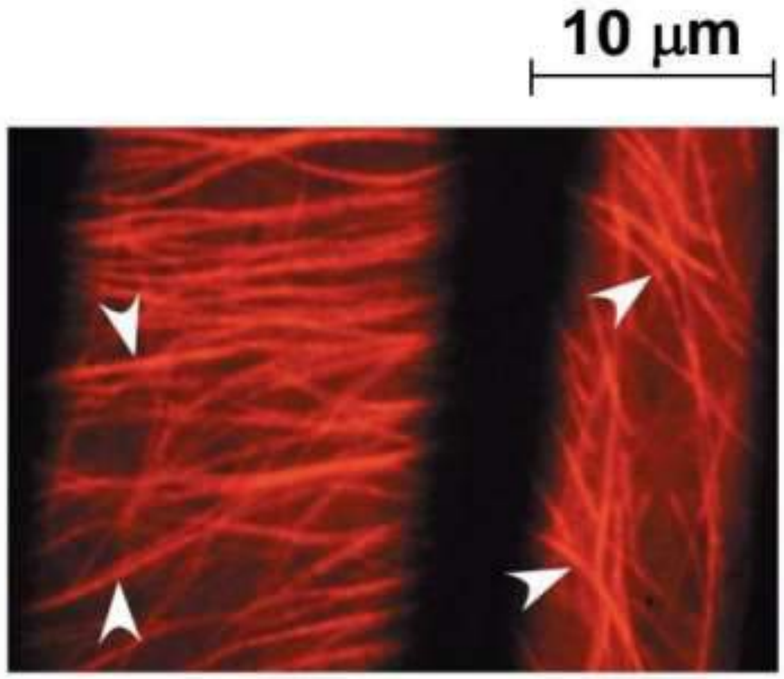


Figure 6.29a



Distribution of cellulose synthase over time

Figure 6.29b

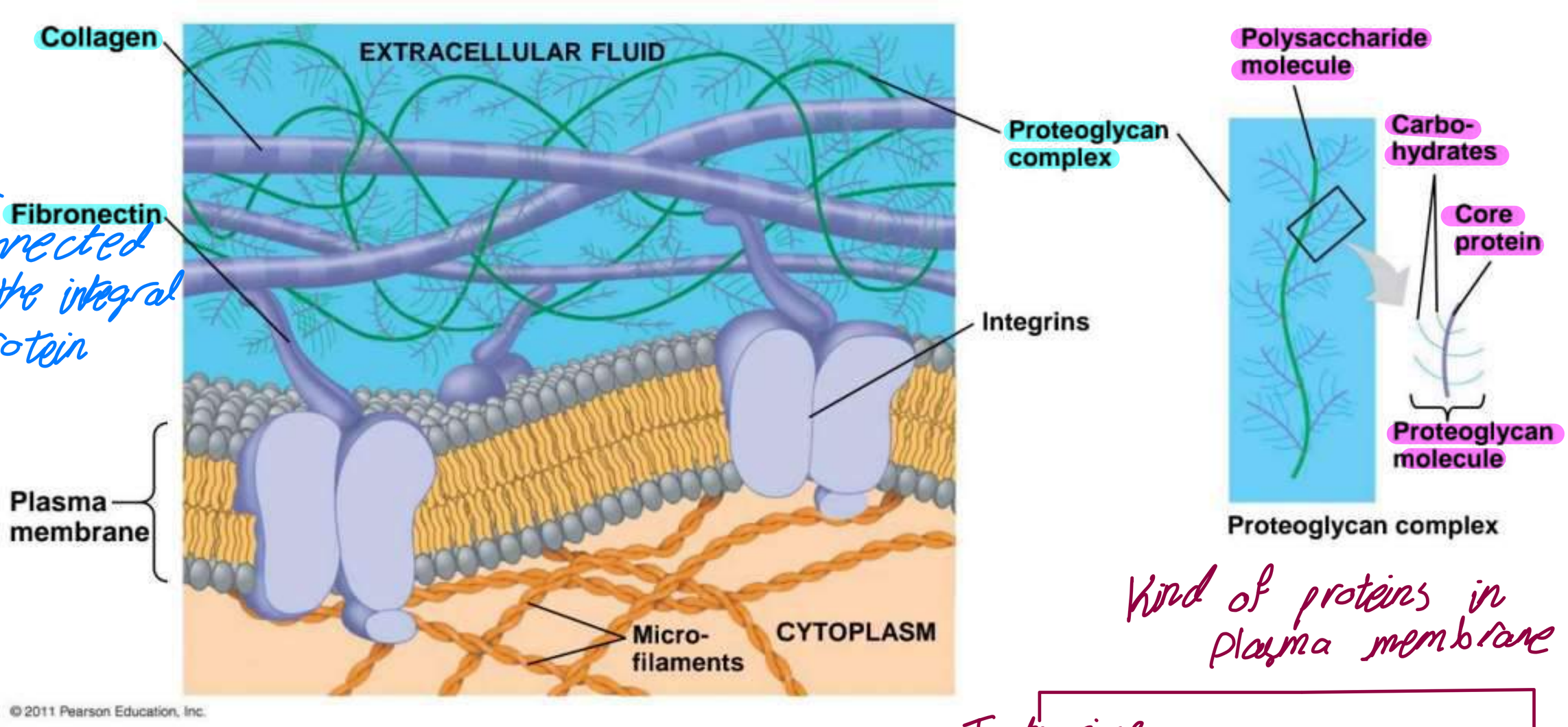


Distribution of microtubules over time

The Extracellular Matrix (ECM) of Animal Cells

- Animal cells lack cell walls but are covered by an elaborate **extracellular matrix (ECM)**
- The ECM is made up of glycoproteins such as **collagen**, **proteoglycans**, and **fibronectin**
- ECM proteins bind to receptor proteins in the plasma membrane called **integrins**

Figure 6.30



connected to the integral protein

Kind of proteins in plasma membrane

Integrins

اللي بخترقه الغشاء البلازمي

اللي بكون على الطرف

Figure 6.30a

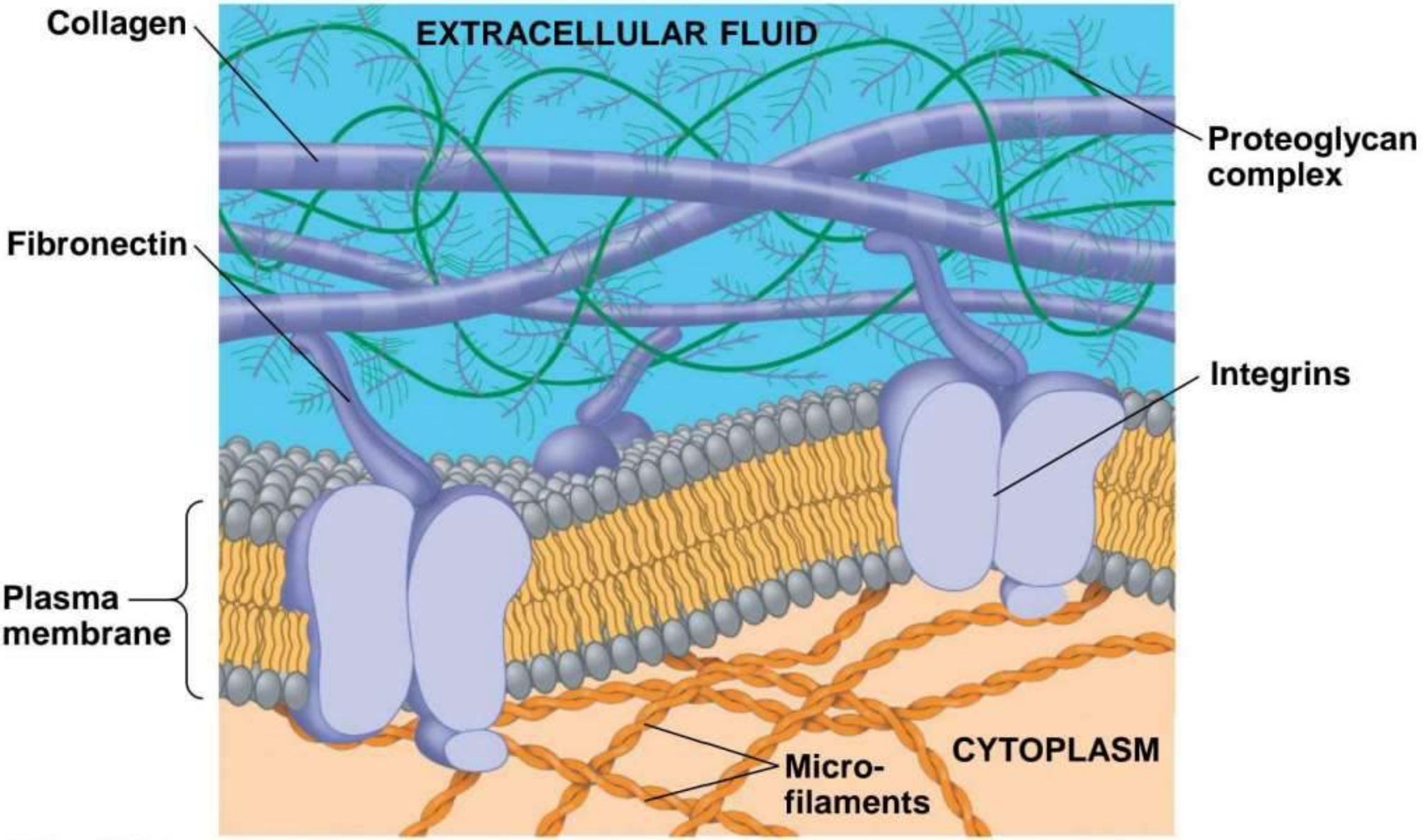
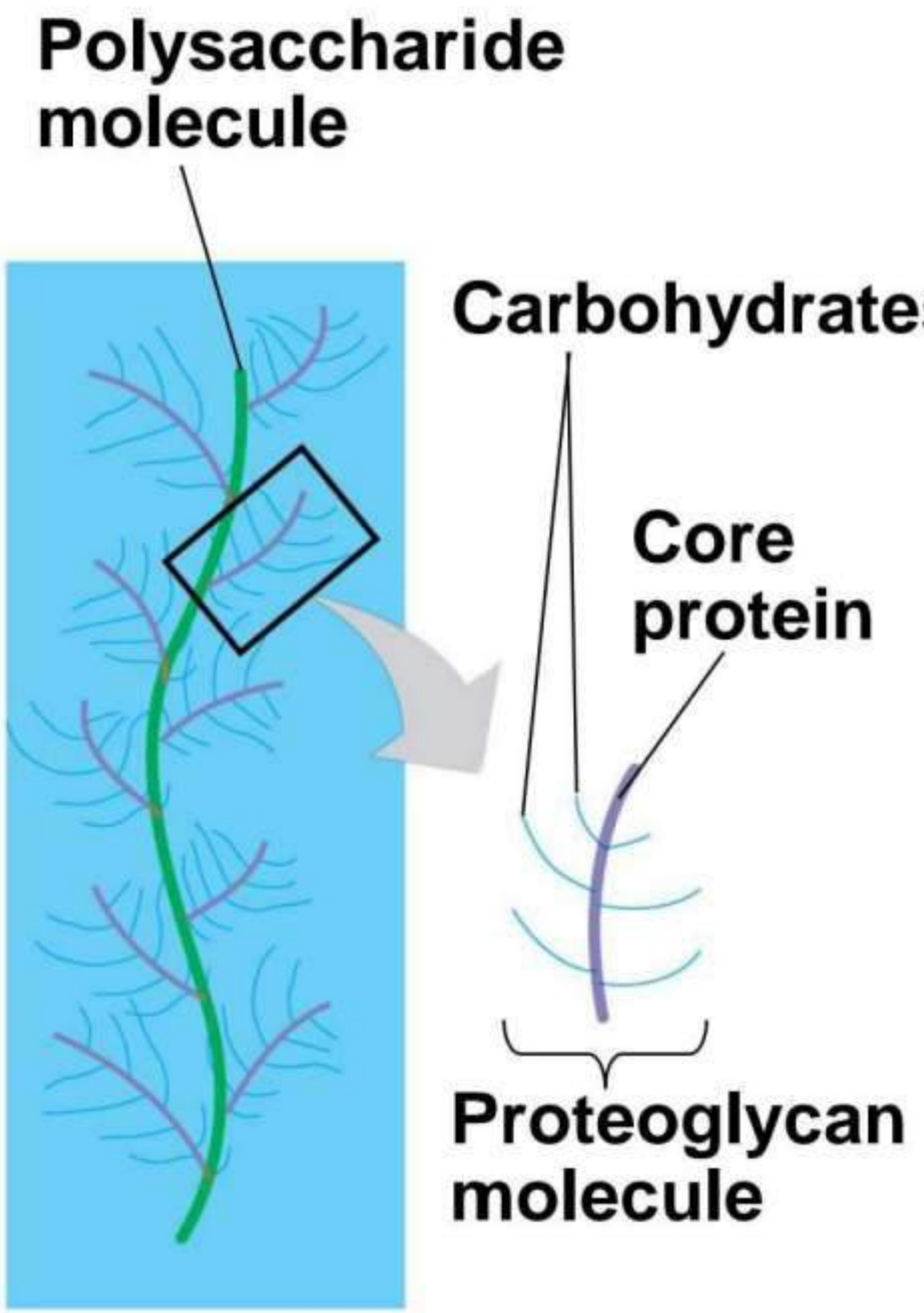


Figure 6.30b



- Functions of the ECM
  - Support
  - Adhesion
  - Movement
  - Regulation

Cell Junctions

روابط

- 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 → in plant cells
  - Tight junctions
  - Desmosomes
  - Gap junctions

} in animal cells

Plasmodesmata in Plant Cells

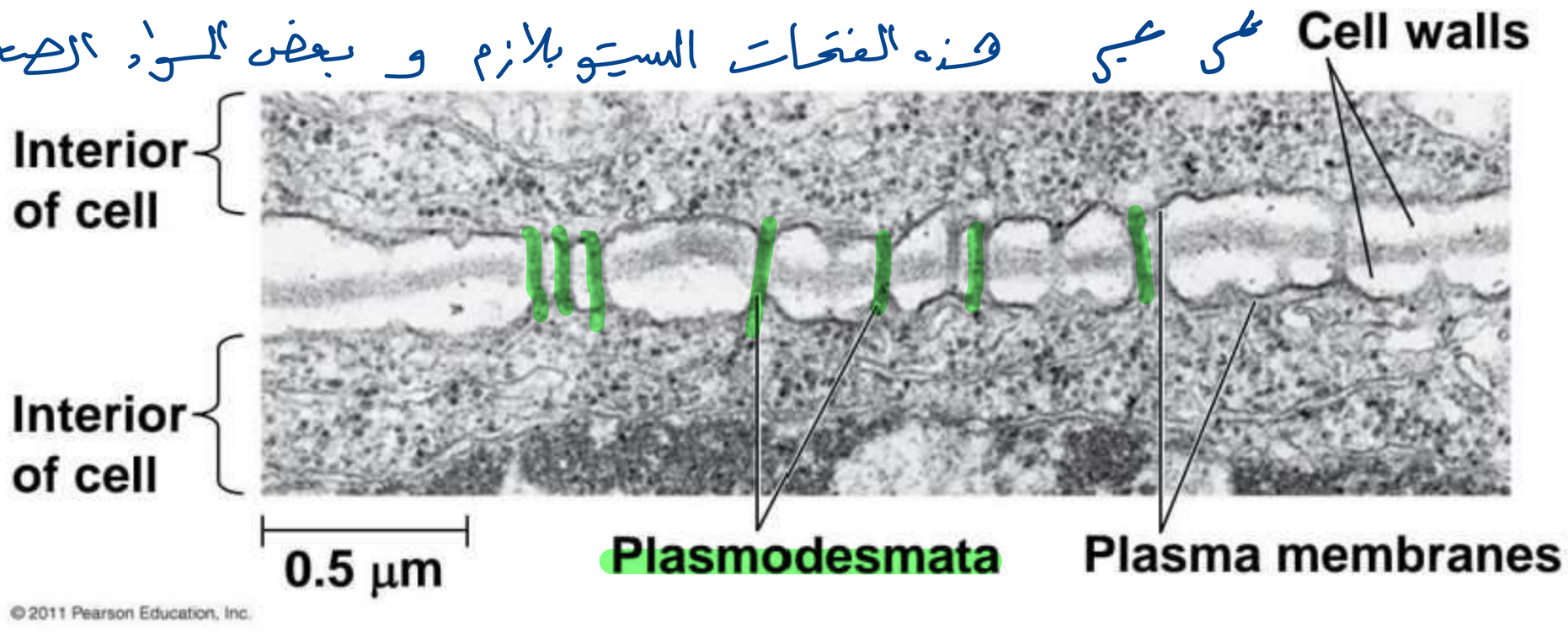
also called communication junctions

- **Plasmodesmata** are channels that perforate (مثقوب) plant cell walls
- Through plasmodesmata, water and small solutes (and sometimes proteins and RNA) can pass from cell to cell

The main function is communication

Figure 6.31

هذه الفتحات السيتوبلازم و بعض المواد الصغيرة تمر عبر



Tight Junctions, Desmosomes, and Gap Junctions in Animal Cells

المادة الرابطة فيهم
بحسبهم هي بروتين

- At **tight junctions**, membranes of neighboring cells are pressed together, preventing leakage of extracellular fluid
- **Desmosomes** (anchoring junctions) fasten cells together into strong sheets

into mediat filament
بكون في مرونة وعادي في تمزيب

- **Gap junctions** (communicating junctions) provide cytoplasmic channels between adjacent cells

Ions and small molecules like heart muscles
filled with gab junctions

Cell junctions in animal cells

all of them are proteins

Tight Junctions

connect cells tightly so there won't be any leakage

Example:
Urinal bladder
مثانة

Desmosomes (Anchoring junctions)

connect cells together but there is some flexibility and there is space for substances to leak through it made of intermediate filaments

Gap Junctions

the protein is shaped like a channel so ions, solutes and small molecules can pass through from one cell to the adjacent cell also called communicating junctions

found in places that need high communication like heart muscles which is filled with gap junctions intercalated disks

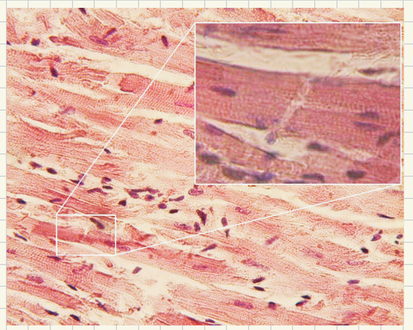


Figure 6.32

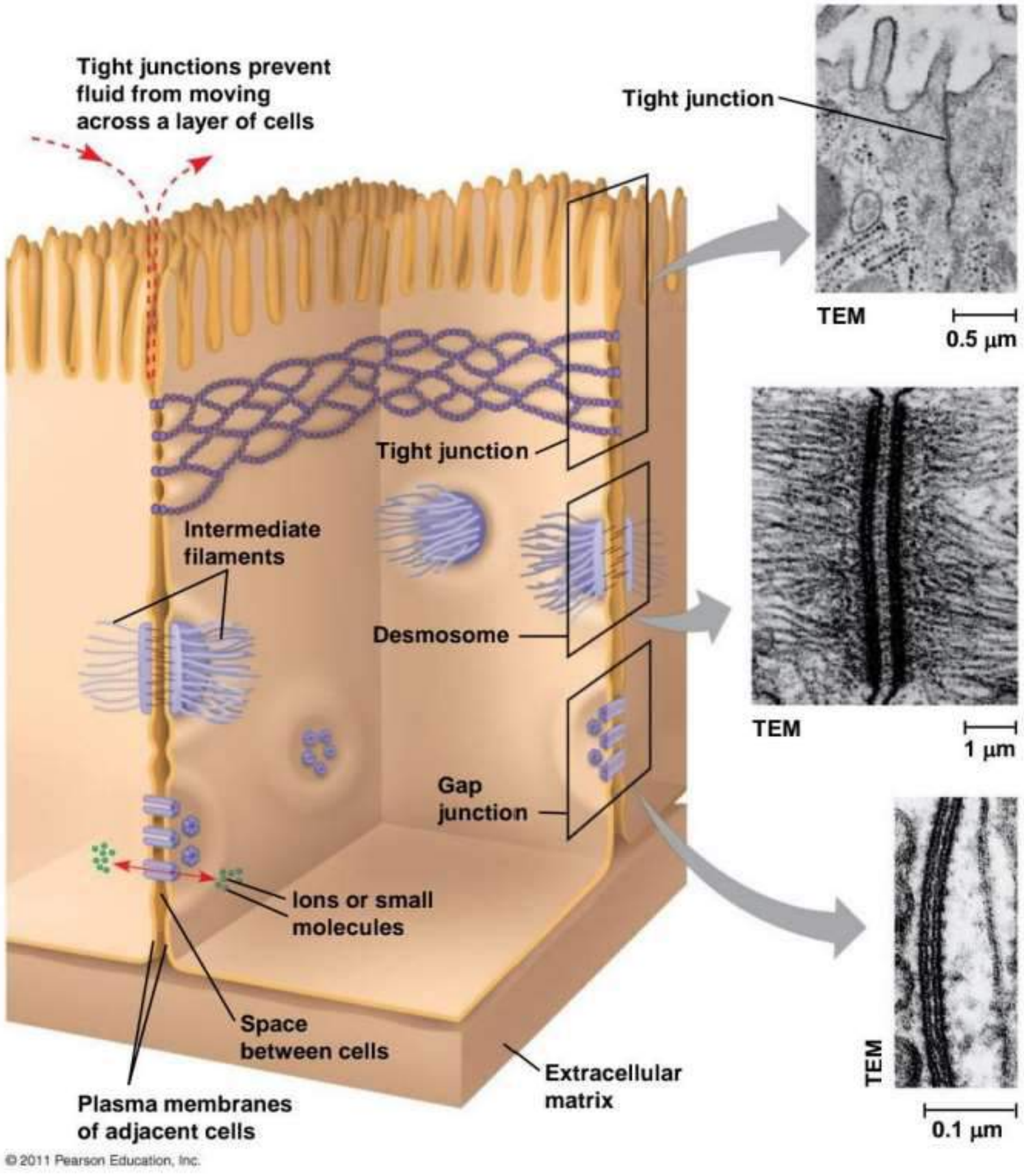
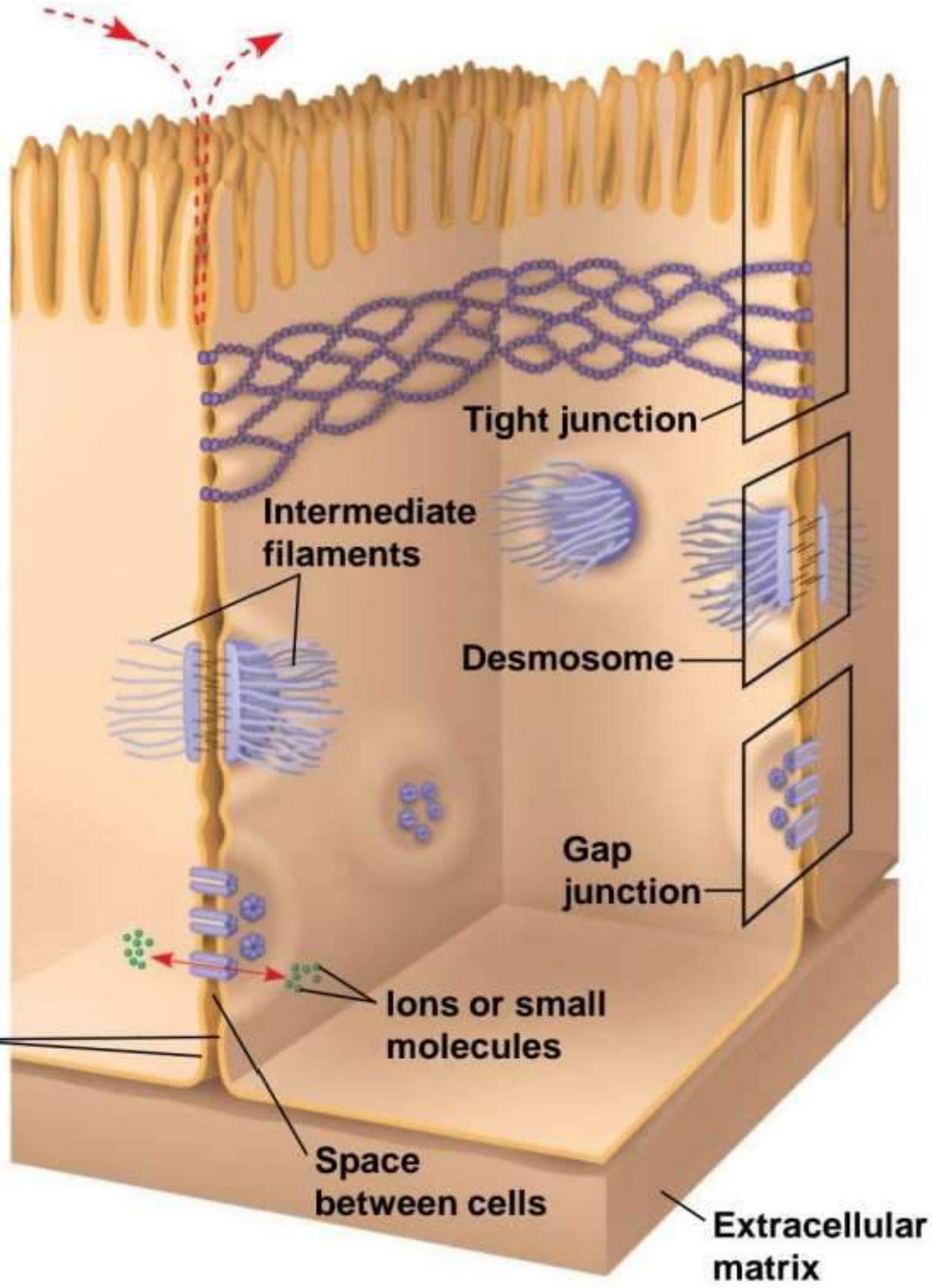


Figure 6.32a

Tight junctions prevent fluid from moving across a layer of cells



The Cell: A Living Unit Greater Than the Sum of Its Parts

- Cells rely on the integration of structures and organelles in order to function
- For example, a macrophage's ability to destroy bacteria involves the whole cell, coordinating components such as the cytoskeleton, lysosomes, and plasma membrane

Figure 6.UN01

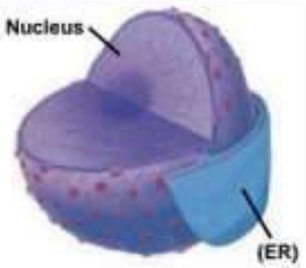
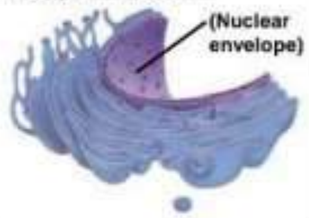
	Cell Component	Structure	Function
CONCEPT 6.3 The eukaryotic cell's genetic instructions are housed in the nucleus and carried out by the ribosomes		Surrounded by nuclear envelope (double membrane) perforated by nuclear pores; nuclear envelope continuous with endoplasmic reticulum (ER)	Houses chromosomes, which are made of chromatin (DNA and proteins); contains nucleoli, where ribosomal subunits are made; pores regulate entry and exit of materials
	Ribosome 	Two subunits made of ribosomal RNA and proteins; can be free in cytosol or bound to ER	Protein synthesis
CONCEPT 6.4 The endomembrane system regulates protein traffic and performs metabolic functions in the cell	Endoplasmic reticulum 	Extensive network of membrane-bounded tubules and sacs; membrane separates lumen from cytosol; continuous with nuclear envelope	Smooth ER: synthesis of lipids, metabolism of carbohydrates, Ca^{2+} storage, detoxification of drugs and poisons Rough ER: aids in synthesis of secretory and other proteins from bound ribosomes; adds carbohydrates to proteins to make glycoproteins; produces new membrane
	Golgi apparatus 	Stacks of flattened membranous sacs; has polarity (*cis* and *trans* faces)	Modification of proteins, carbohydrates on proteins, and phospholipids; synthesis of many polysaccharides; sorting of Golgi products, which are then released in vesicles
	Lysosome 	Membranous sac of hydrolytic enzymes (in animal cells)	Breakdown of ingested substances, cell macromolecules, and damaged organelles for recycling
	Vacuole 	Large membrane-bounded vesicle	Digestion, storage, waste disposal, water balance, cell growth, and protection
CONCEPT 6.5 Mitochondria and chloroplasts change energy from one form to another	Mitochondrion 	Bounded by double membrane; inner membrane has infoldings (cristae)	Cellular respiration
	Chloroplast 	Typically two membranes around fluid stroma, which contains thylakoids stacked into grana (in cells of photosynthetic eukaryotes, including plants)	Photosynthesis
	Peroxisome 	Specialized metabolic compartment bounded by a single membrane	Contains enzymes that transfer hydrogen atoms from substrates to oxygen, producing hydrogen peroxide (H_2O_2) as a by-product; H_2O_2 is converted to water by another enzyme

Figure 6.UN01a

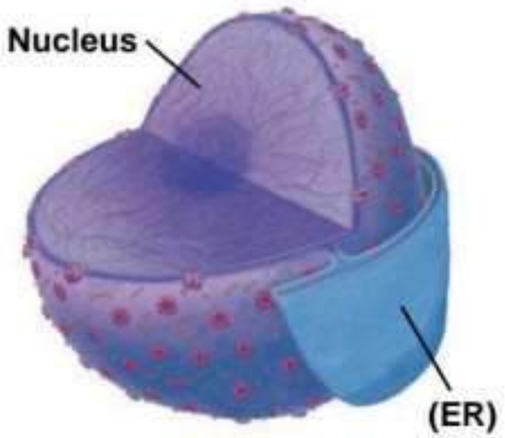
	Cell Component	Structure	Function
CONCEPT 6.3 **The eukaryotic cell's genetic instructions are housed in the nucleus and carried out by the ribosomes**		Surrounded by nuclear envelope (double membrane) perforated by nuclear pores; nuclear envelope continuous with endoplasmic reticulum (ER)	Houses chromosomes, which are made of chromatin (DNA and proteins); contains nucleoli, where ribosomal subunits are made; pores regulate entry and exit of materials
	Ribosome 	Two subunits made of ribosomal RNA and proteins; can be free in cytosol or bound to ER	Protein synthesis

Figure 6.UN01b

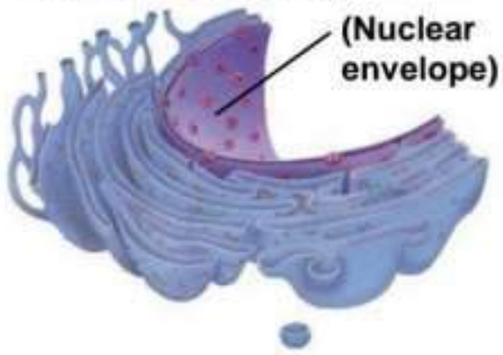
	Cell Component	Structure	Function
CONCEPT 6.4 **The endomembrane system regulates protein traffic and performs metabolic functions in the cell**	Endoplasmic reticulum 	Extensive network of membrane-bounded tubules and sacs; membrane separates lumen from cytosol; continuous with nuclear envelope	Smooth ER: synthesis of lipids, metabolism of carbohydrates, Ca^{2+} storage, detoxification of drugs and poisons Rough ER: aids in synthesis of secretory and other proteins from bound ribosomes; adds carbohydrates to proteins to make glycoproteins; produces new membrane
	Golgi apparatus 	Stacks of flattened membranous sacs; has polarity (*cis* and *trans* faces)	Modification of proteins, carbohydrates on proteins, and phospholipids; synthesis of many polysaccharides; sorting of Golgi products, which are then released in vesicles
	Lysosome 	Membranous sac of hydrolytic enzymes (in animal cells)	Breakdown of ingested substances, cell macromolecules, and damaged organelles for recycling
	Vacuole 	Large membrane-bounded vesicle	Digestion, storage, waste disposal, water balance, cell growth, and protection

Figure 6.UN01c

	Cell Component	Structure	Function
CONCEPT 6.5 **Mitochondria and chloroplasts change energy from one form to another**	Mitochondrion 	Bounded by double membrane; inner membrane has infoldings (cristae)	Cellular respiration
	Chloroplast 	Typically two membranes around fluid stroma, which contains thylakoids stacked into grana (in cells of photosynthetic eukaryotes, including plants)	Photosynthesis
	Peroxisome 	Specialized metabolic compartment bounded by a single membrane	Contains enzymes that transfer hydrogen atoms from substrates to oxygen, producing hydrogen peroxide (H_2O_2) as a by-product; H_2O_2 is converted to water by another enzyme