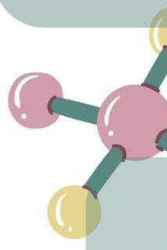
تَنوير

BIOLOGY

Lec no : 8

File Title : The beginning of Chapter 8

Done By : AlMiqdad Nwihi



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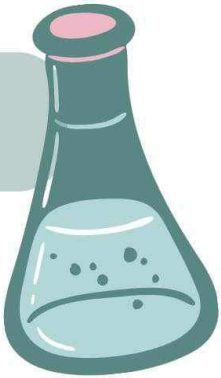

Overview: Life at the Edge

- The plasma membrane is the boundary that separates the living cell from its surroundings
- The plasma membrane exhibits **selective permeability**, allowing some substances to cross it more easily than others

نفاذية اختيارية

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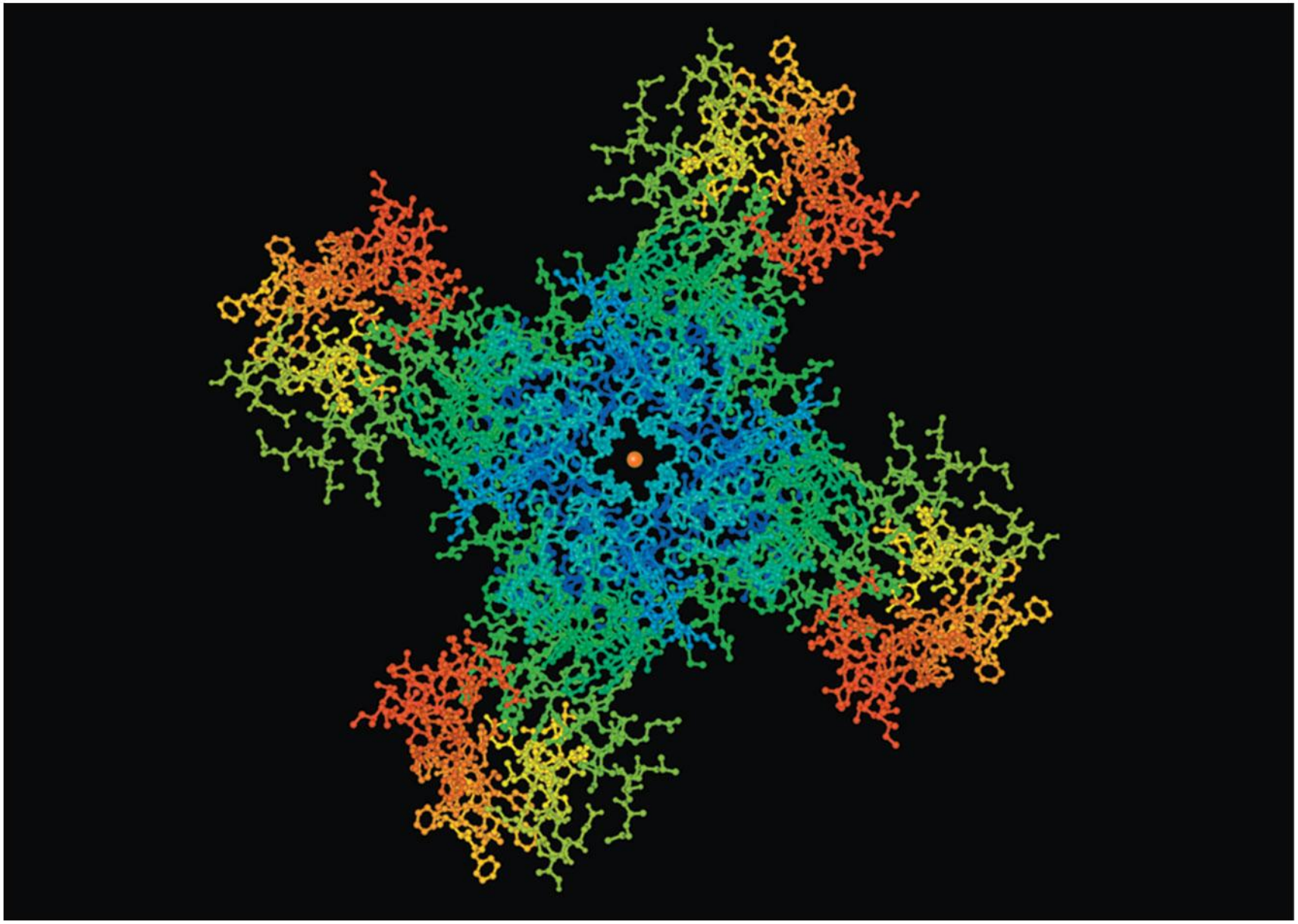
Figure 7.1



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Concept 7.1: Cellular membranes are fluid mosaics of lipids and proteins

- Phospholipids are the most abundant lipid in the plasma membrane there are other kinds of lipids like cholesterol
- Phospholipids are **amphipathic molecules**, containing hydrophobic (tails) and hydrophilic (head) regions
- The **fluid mosaic model** states that a membrane is a fluid structure with a "mosaic" of various proteins embedded in it (ما تبع)

البروتينات عائمة زي الفشار في العشاء

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Membrane Models: *Scientific Inquiry*

- Membranes have been chemically analyzed and found to be made of proteins and lipids
- Scientists studying the plasma membrane reasoned that it must be a phospholipid bilayer

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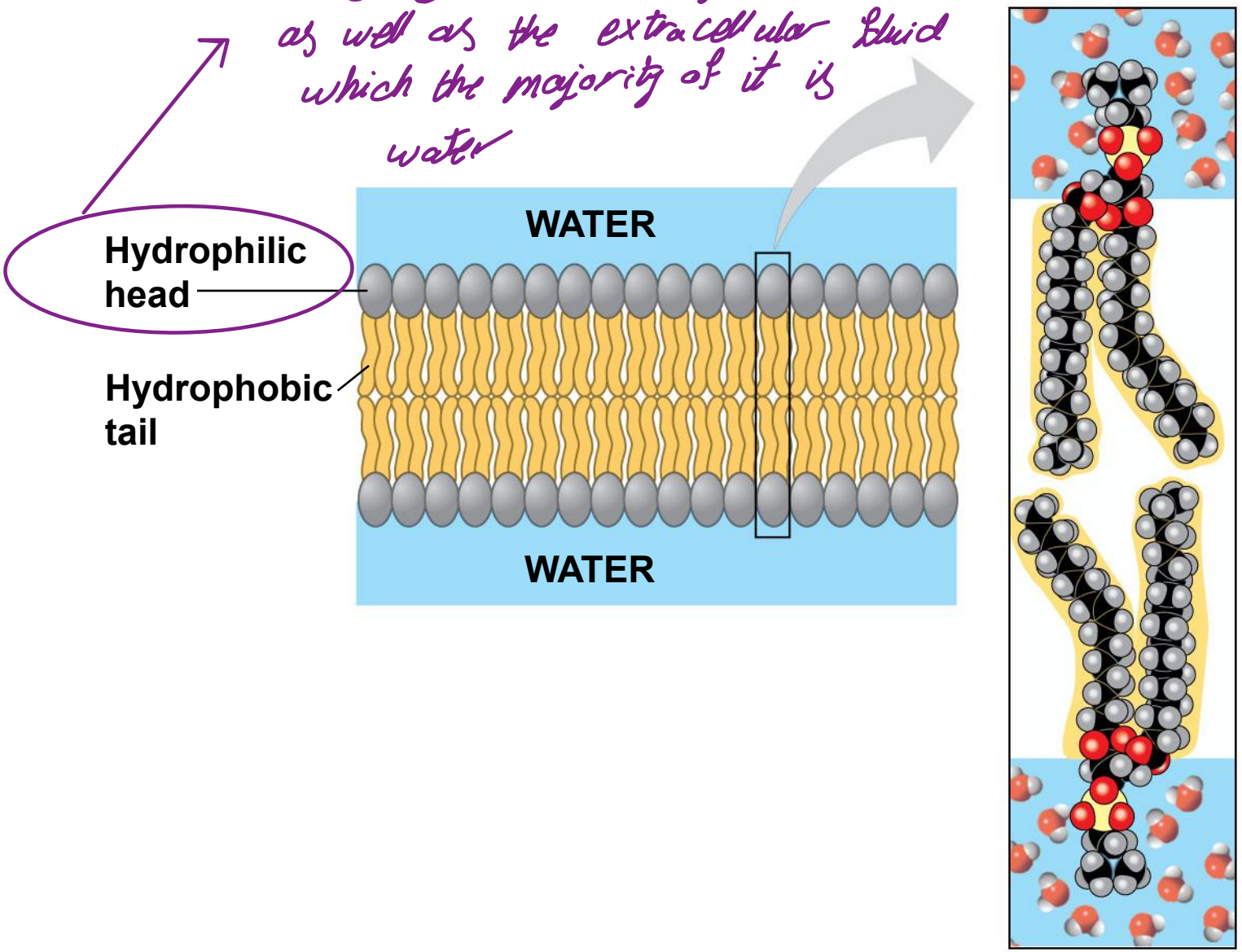
Figure 7.2

because inside the cell there is the cytoplasm which contains alot of water as well as the extracellular fluid which the majority of it is water



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- In 1935, Hugh Davson and James Danielli proposed a sandwich model in which the phospholipid bilayer lies between two layers of globular proteins
- Later studies found problems with this model, particularly the placement of membrane proteins, which have hydrophilic and hydrophobic regions
- In 1972, S. J. Singer and G. Nicolson proposed that the membrane is a mosaic of proteins dispersed within the bilayer, with only the hydrophilic regions exposed to water

named it "fluid mosaic model"

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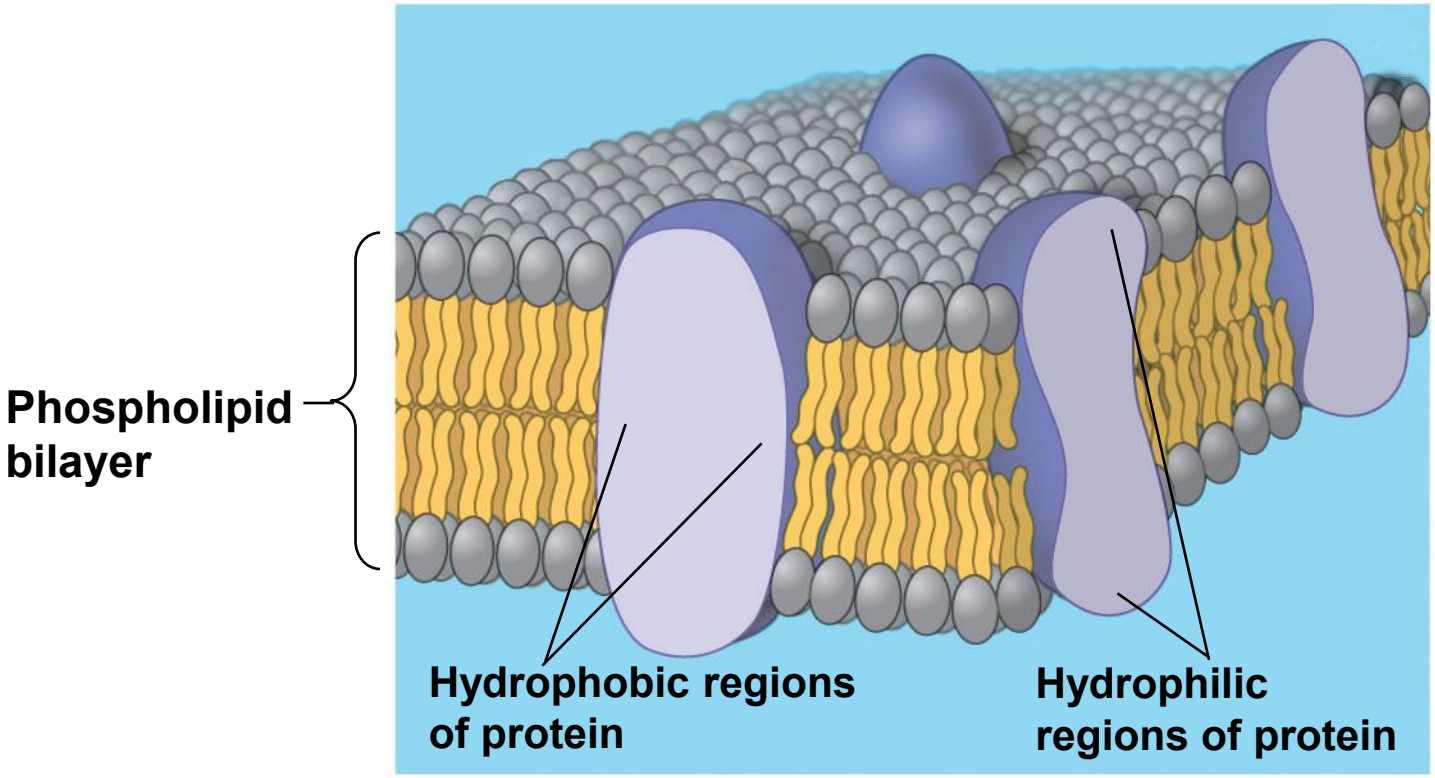
Figure 7.3

the integral proteins are the reason why the plasma membrane is mosaic



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- Freeze-fracture studies of the plasma membrane supported the fluid mosaic model
- Freeze-fracture is a specialized preparation technique that splits a membrane along the middle of the phospholipid bilayer

They freeze the cell and they take the cell membrane then they fracture it in the middle to know the structure and found out that there is a diffrrence between each half of the membrane

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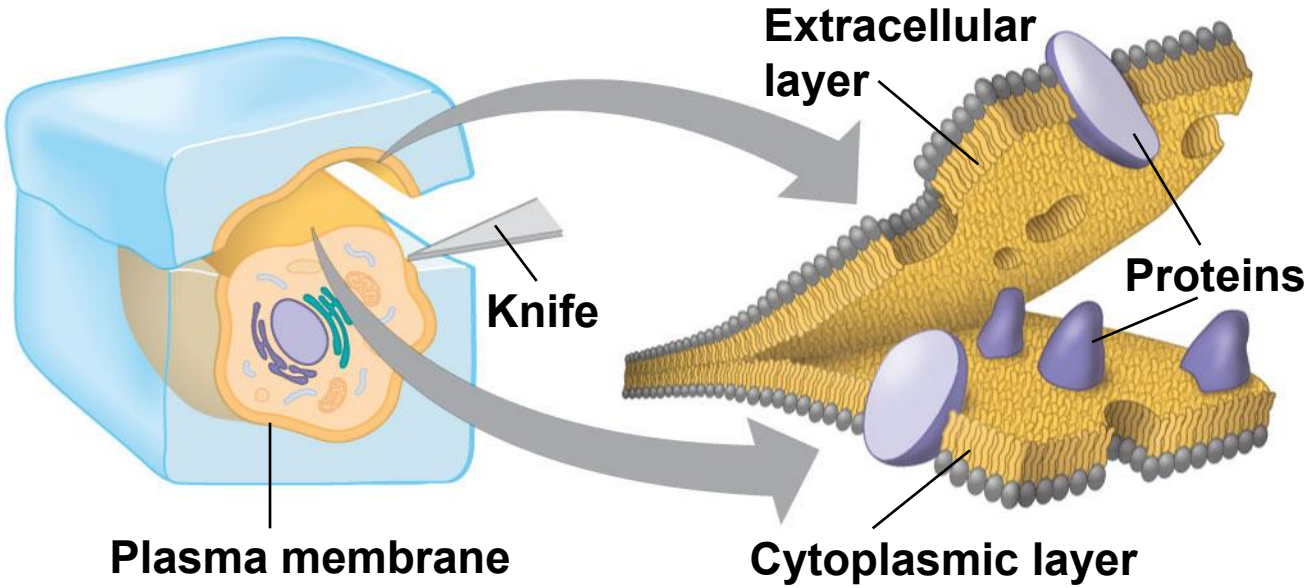
Figure 7.4

Freeze - fracture

TECHNIQUE



RESULTS

Inside of extracellular layer

Inside of cytoplasmic layer

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Figure 7.4a

Inside of extracellular layer

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Figure 7.4b

Inside of cytoplasmic layer

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The Fluidity of Membranes

- Phospholipids in the plasma membrane can move within the bilayer
- Most of the lipids, and some proteins, drift laterally
- Rarely does a molecule flip-flop transversely across the membrane

The factors that affect the plasma membrane fluidity:

1) movement of phospholipids (حركة جزيئية)
2) movement of proteins (حركة جزيئية)
3) Type of fatty acids in phospholipids
   - saturated (decrease fluidity)
   - unsaturated (increase fluidity)
4) cholesterol (Temp. buffer منظم): when

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The factors that affect the plasma membran fluidity

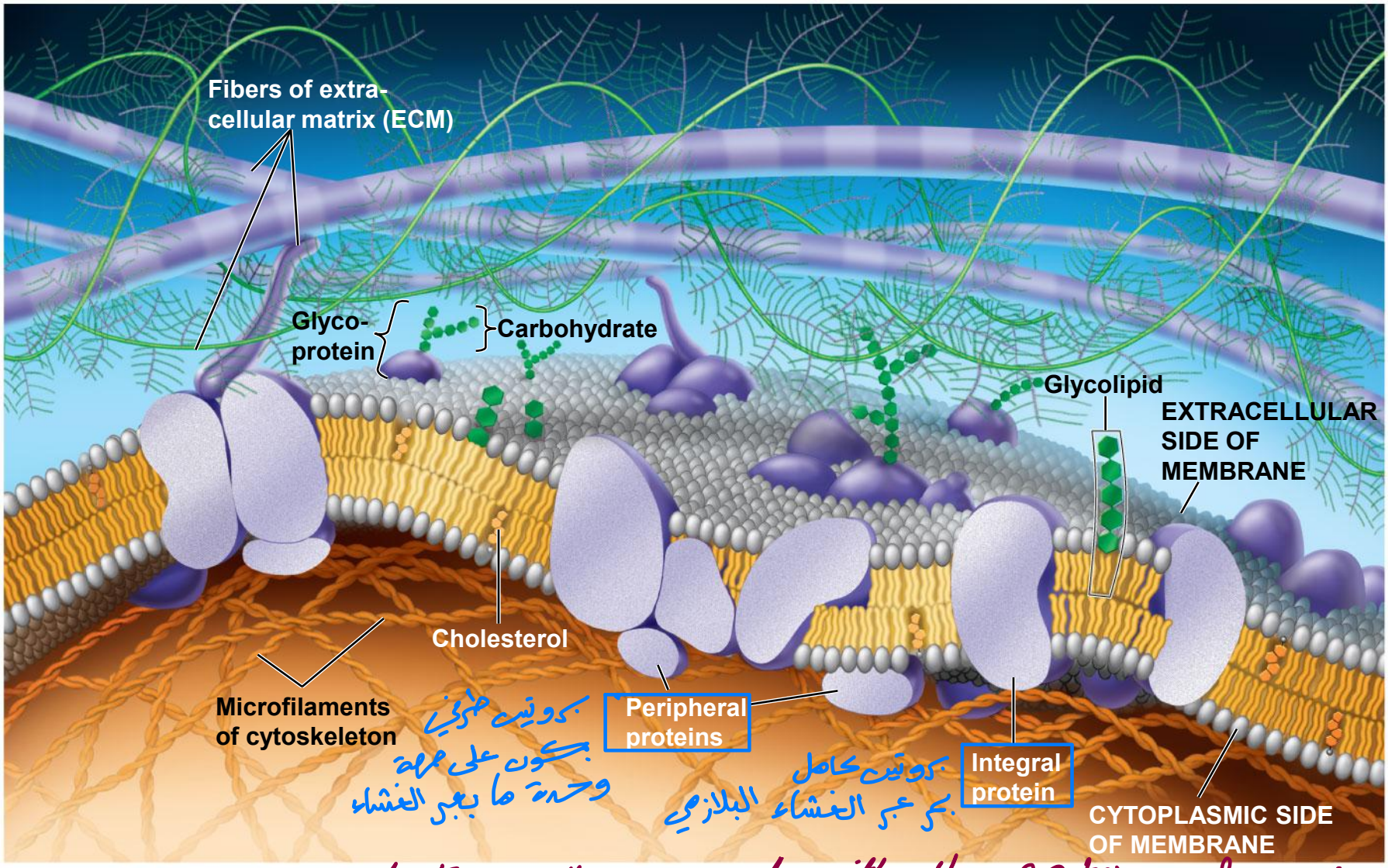
1) The movement of phospholipids: ...

2) The movement of proteins: ...

3) Kind of fatty acids in phospholipids:
   - saturated → decreases fluidity
   - unsaturated → increases fluidity

4) Cholesterol (Temp. buffer): when the temperature is high the movement of phospholipids increases so does the fluidity and this might make the membrane liquid, so the cholesterol lowers the fluidity, the opposite happens when the temperature is low, the fluidity rises and might make the membrane solids so the cholesterol makes space between the phospholipids to regulate the fluidity

Figure 7.5



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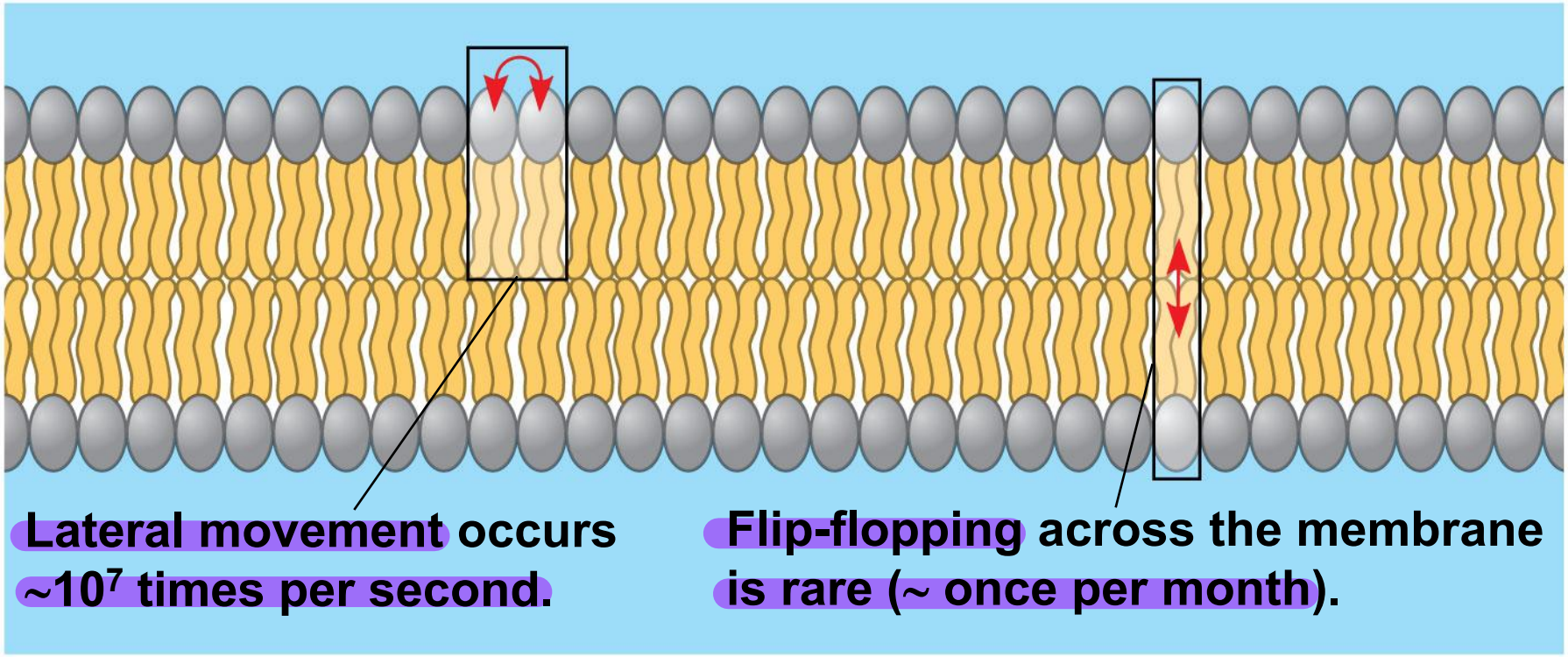
carbohydrates rather bond with the proteins forming glycoproteins of bond with lipids forming glycolipids

Figure 7.6

movement of phospholipids



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تبديل موقع بينه و بين اللي جنبه

بيحي بتصير

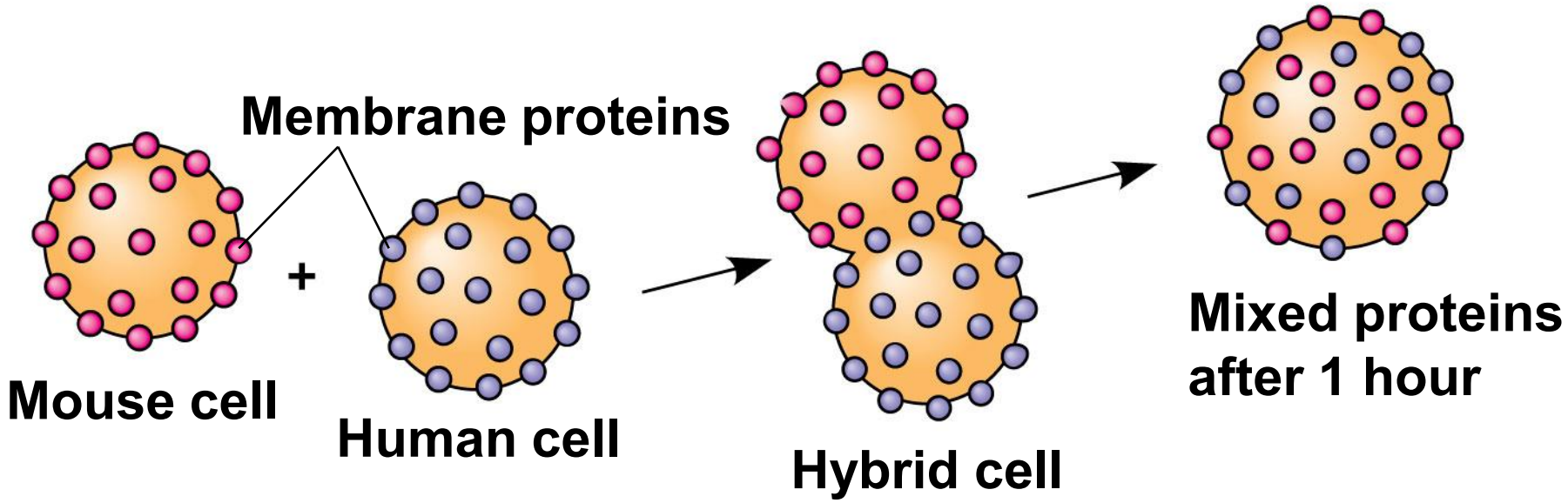
تبديل موقع بينه و بين اللي تحته

نادر ما تصير

Figure 7.7

movement of proteins

RESULTS



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قاموا بصباغة البروتينات على كلا الخليتين بالوان متناقضة بعديها حطوا الخليتين بأنبوب اختبار فتكون عندي (Hybrid cell) كان كل بروتين في طرف بعديها بشوية وقت كله دخل ببعض و صار اندماج بالبروتينات (صارت خبصة يعني)

- As temperatures cool, membranes switch from a fluid state to a solid state
- The temperature at which a membrane solidifies depends on the types of lipids
- Membranes rich in unsaturated fatty acids are more fluid than those rich in saturated fatty acids
- Membranes must be fluid to work properly; they are usually about as fluid as salad oil

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- The steroid cholesterol has different effects on membrane fluidity at different temperatures
- At warm temperatures (such as 37°C), cholesterol restrains movement of phospholipids
- At cool temperatures, it maintains fluidity by preventing tight packing

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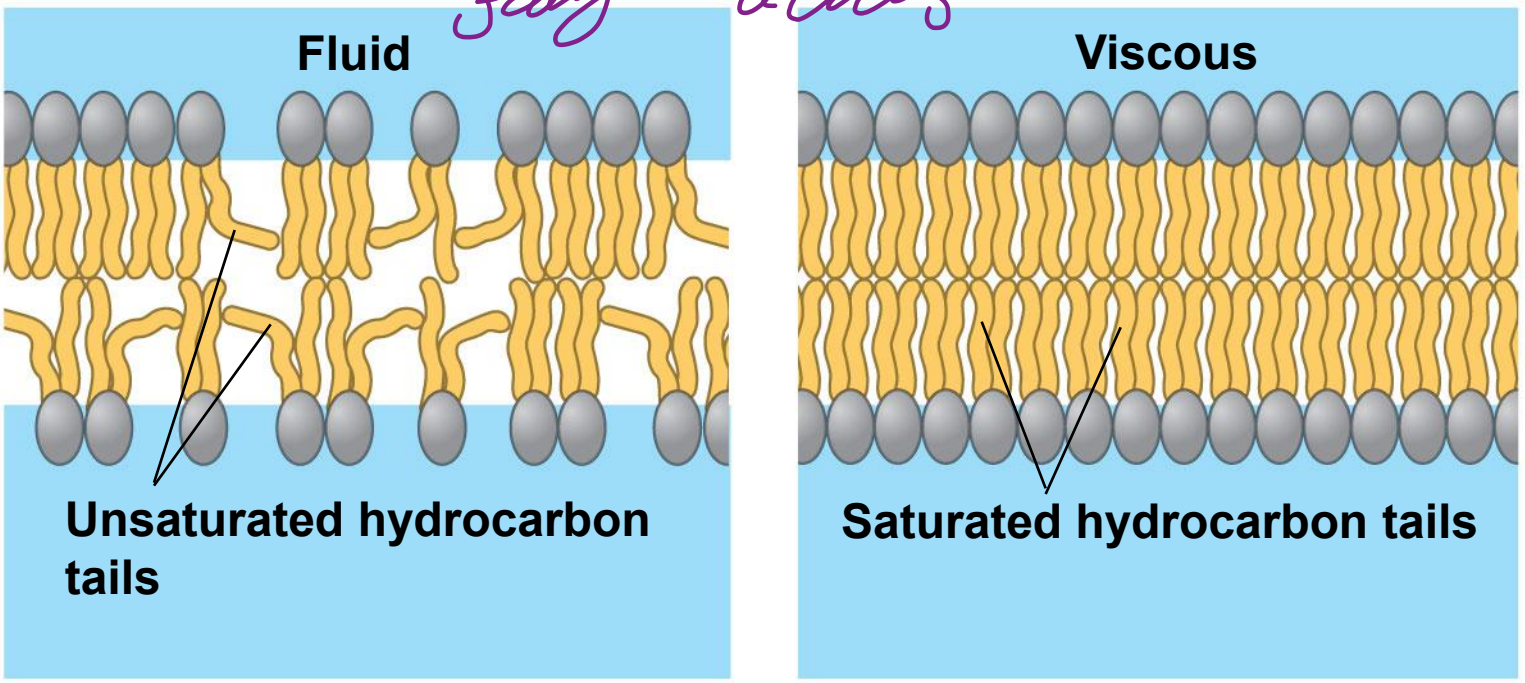
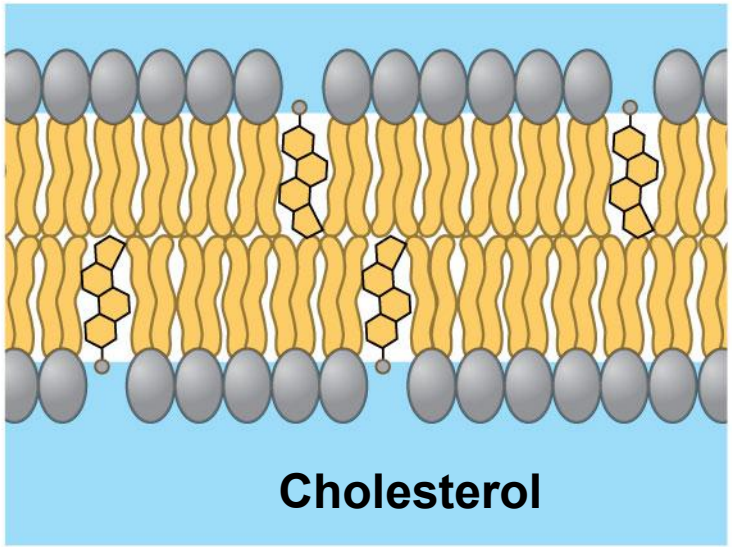
Figure 7.8



(a) Unsaturated versus saturated hydrocarbon tails

(b) Cholesterol within the animal cell membrane



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Membrane Proteins and Their Functions

- A membrane is a collage of different proteins, often grouped together, embedded in the fluid matrix of the lipid bilayer
- Proteins determine most of the membrane's specific functions

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- **Peripheral proteins** are bound to the surface of the membrane
- **Integral proteins** penetrate the hydrophobic core
- Integral proteins that span the membrane are called transmembrane proteins
- The hydrophobic regions of an integral protein consist of one or more stretches of nonpolar amino acids, often coiled into alpha helices

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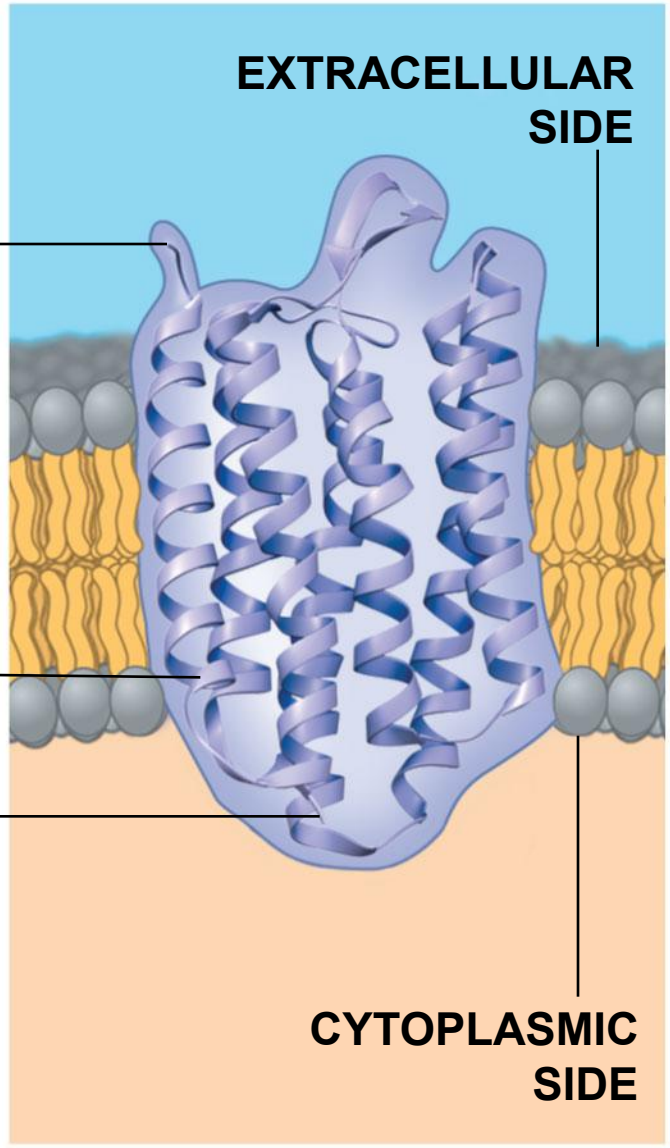
Figure 7.9



The protein must contain amino acids that are polar on the end parts and nonpolar in the middle

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integral

- Six major functions of membrane proteins
  - Transport
  - Enzymatic activity
  - Signal transduction
  - Cell-cell recognition
  - Intercellular joining
  - Attachment to the cytoskeleton and extracellular matrix (ECM)

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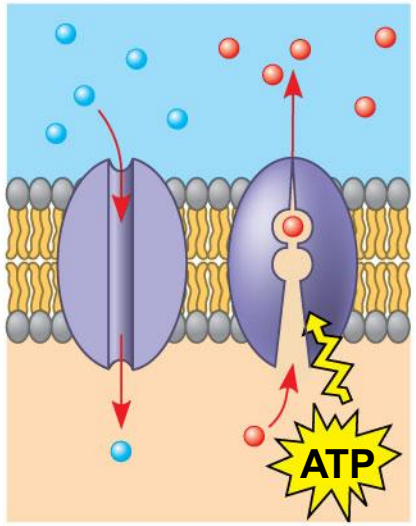
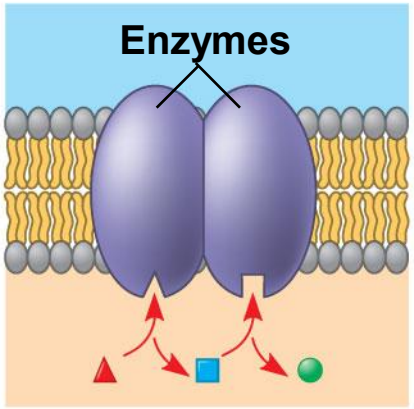
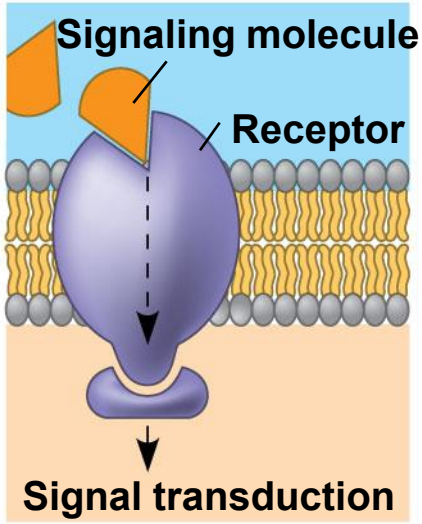
Figure 7.10



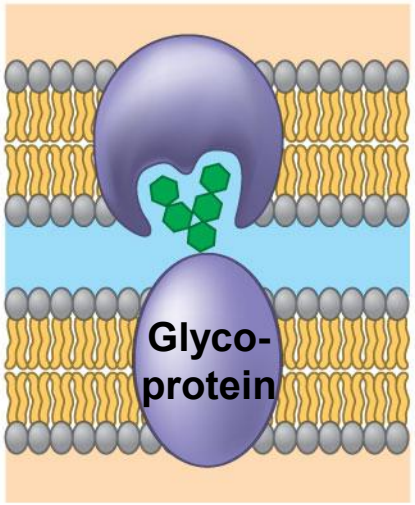
(a) Transport



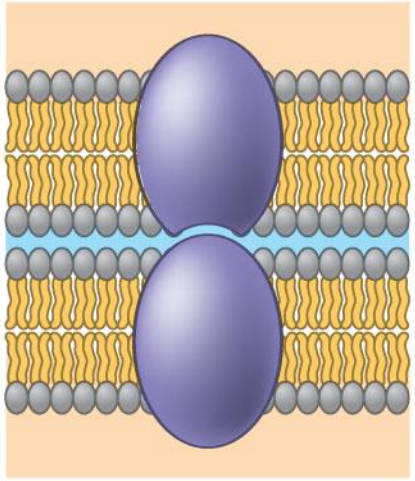
(b) Enzymatic activity



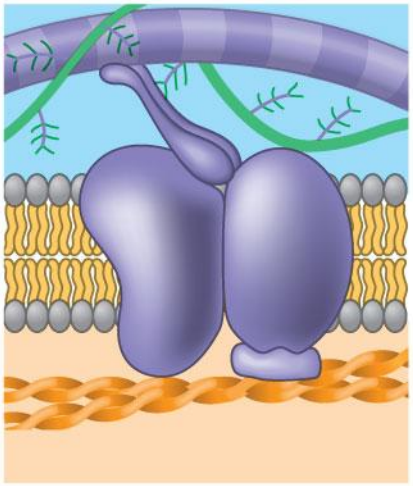
(c) Signal transduction



(d) Cell-cell recognition



(e) Intercellular joining



(f) Attachment to the cytoskeleton and extracellular matrix (ECM)

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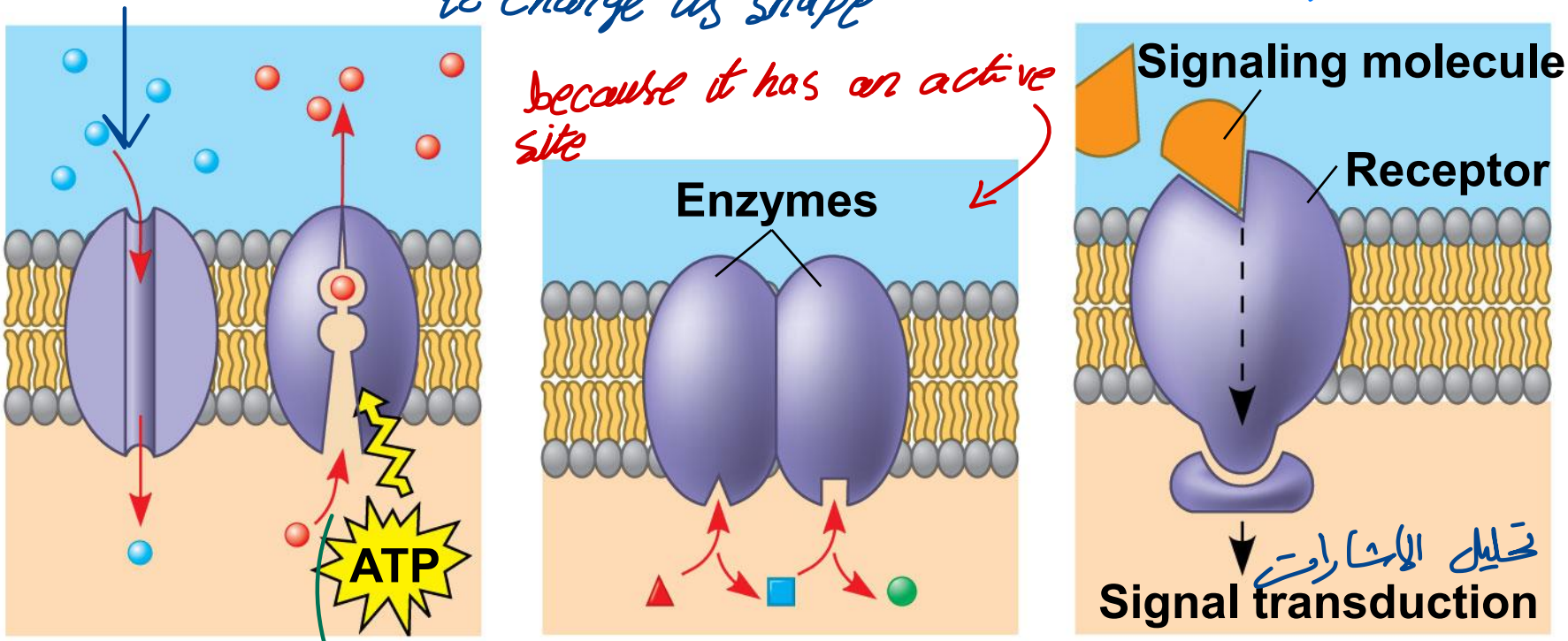
Figure 7.10a

channel protein
the substances pass through without the need of energy or the protein to change its shape

الإشارة قادمة من المستقبل (receptor) الذي ارتبط به ال (signaling molecule)



because it has an active site

تحليل الإشارات

(a) Transport

(b) Enzymatic activity

(c) Signal transduction

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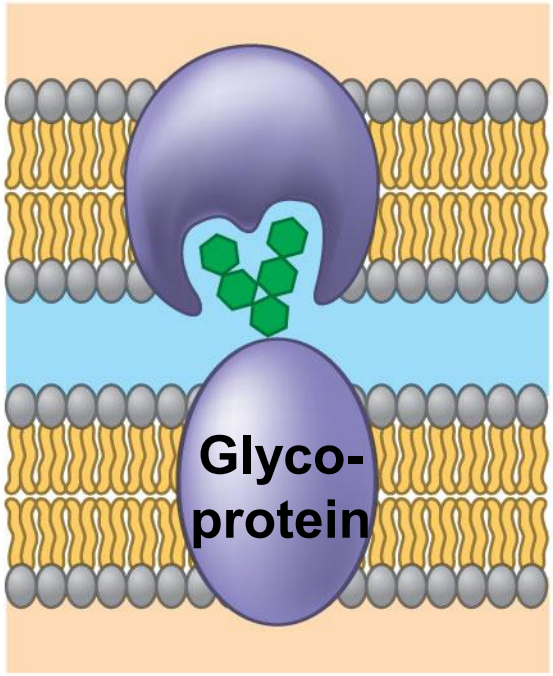
carrier protein changes shape and uses ATP (need energy) to transport substances

Figure 7.10b



(d) Cell-cell recognition

تعرّف

زي في صفات التطابق في عمليات الزراعة و المسؤول عنه هو الكربوهيدرات المرتبطة بالبروتين

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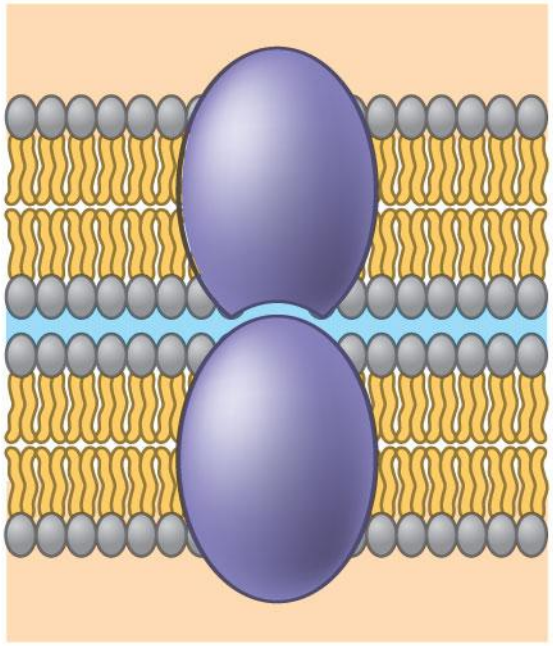
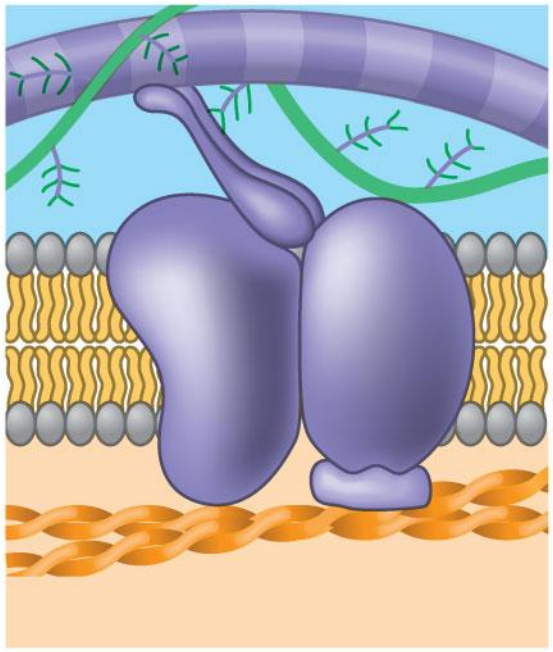


(e) Intercellular joining



(f) Attachment to the cytoskeleton and extracellular matrix (ECM)