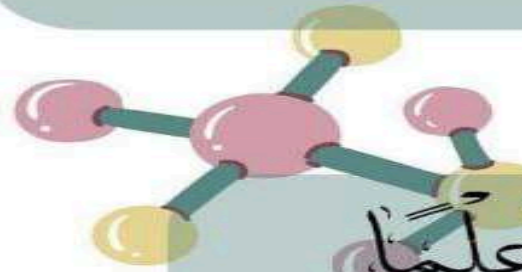
تَنوير

BIOLOGY

Lec no : 8

File Title :

Done By : Haneen Frehat



وَقُل رَّبِّ زِدْنِي عِلْمًا

Chapter 8

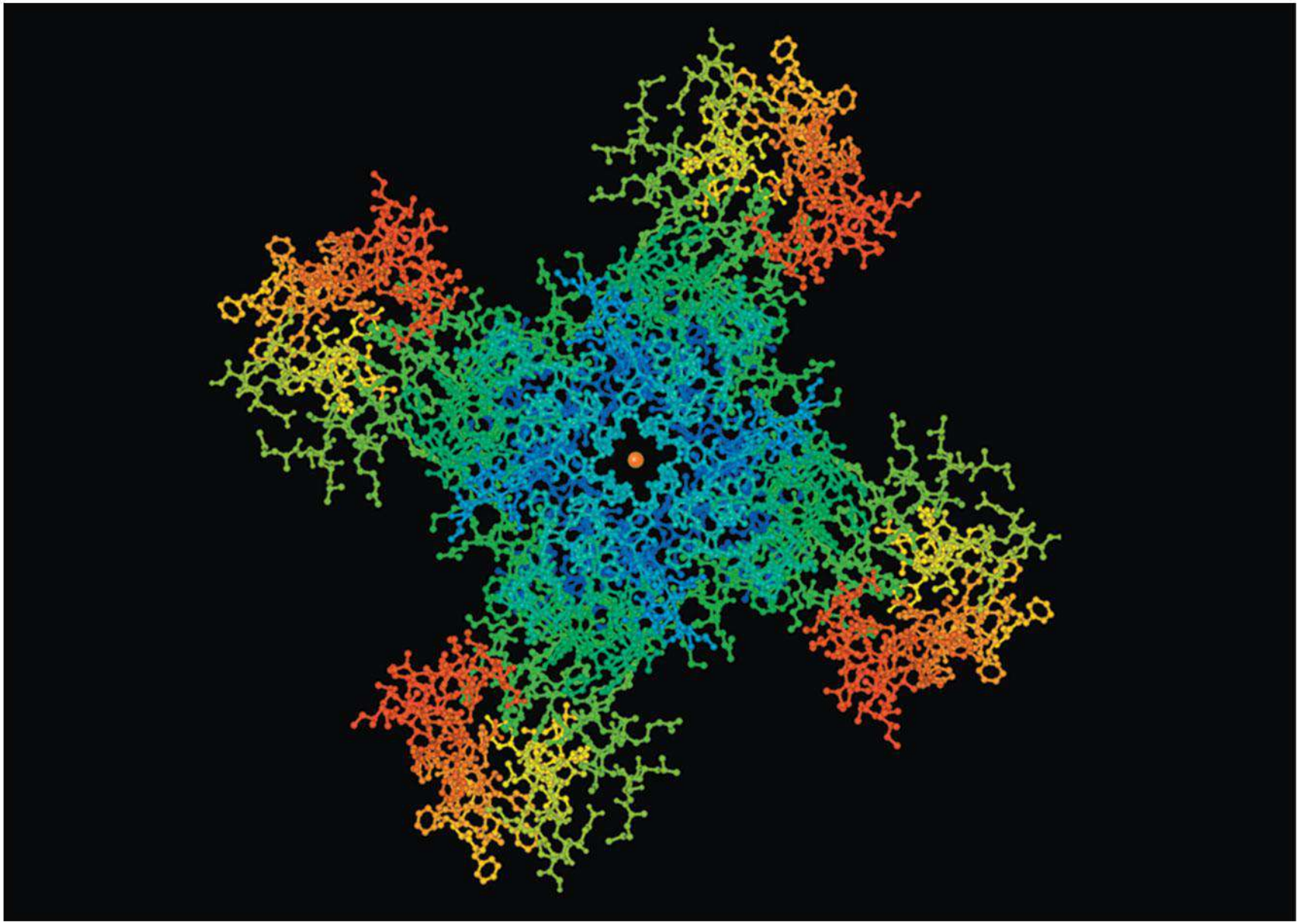
Overview: Life at the Edge

- 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

حاجز للخلية يسمح بادخال
واخراج المواد من والى الخلية

بناء على ال selective permeability العلماء
عرفوا ال function of plasma membrane
لكن ماعرفوا ال stracture فبلشوا يفكروا ،،،،،،

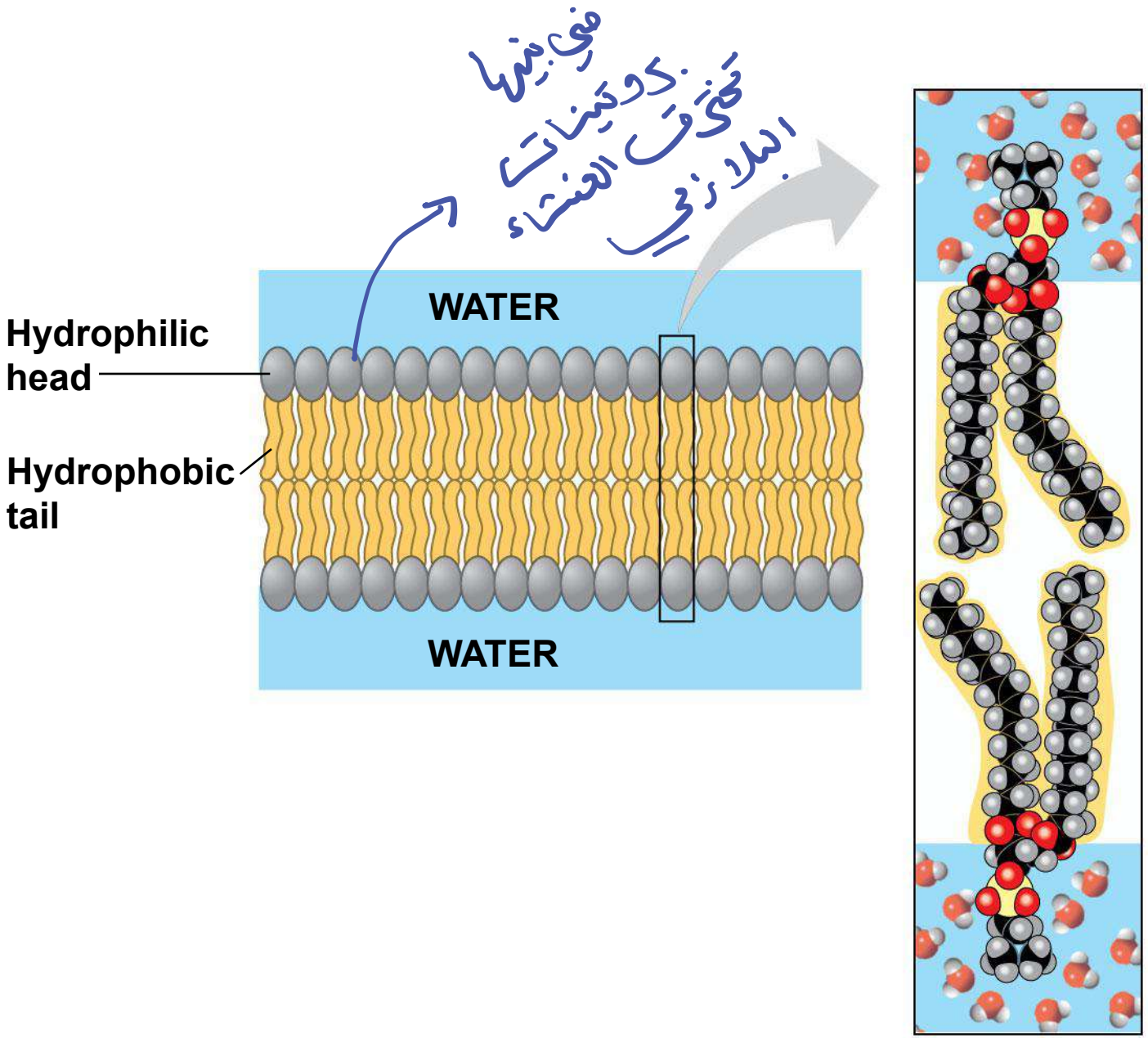
Figure 7.1



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

- Phospholipids are the most abundant lipid in the plasma membrane
- Phospholipids are **amphipathic molecules**, containing hydrophobic and hydrophilic regions
- The **fluid mosaic model** states that a membrane is a fluid structure with a "mosaic" of various proteins embedded in it

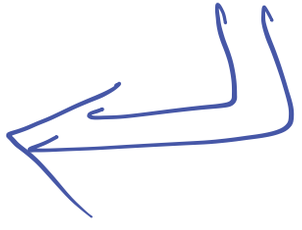
Figure 7.2

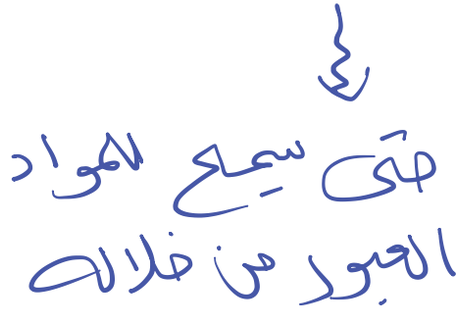


- In 1935, Hugh Davson and James Danielli proposed a sandwich model in which the phospholipid bilayer lies between two layers of globular proteins
  - Later studies found problems with this model, particularly the placement of membrane proteins, which have hydrophilic and hydrophobic regions
- In 1972, 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

استمر العلماء في المحاولة في معرفة ال stracture of
plasma membrane حتى توصلوا الى عام 1972...
فرسموا model of plasma membrane فوجدوا انه the
most acceptable model الاكثر قبول وصحة

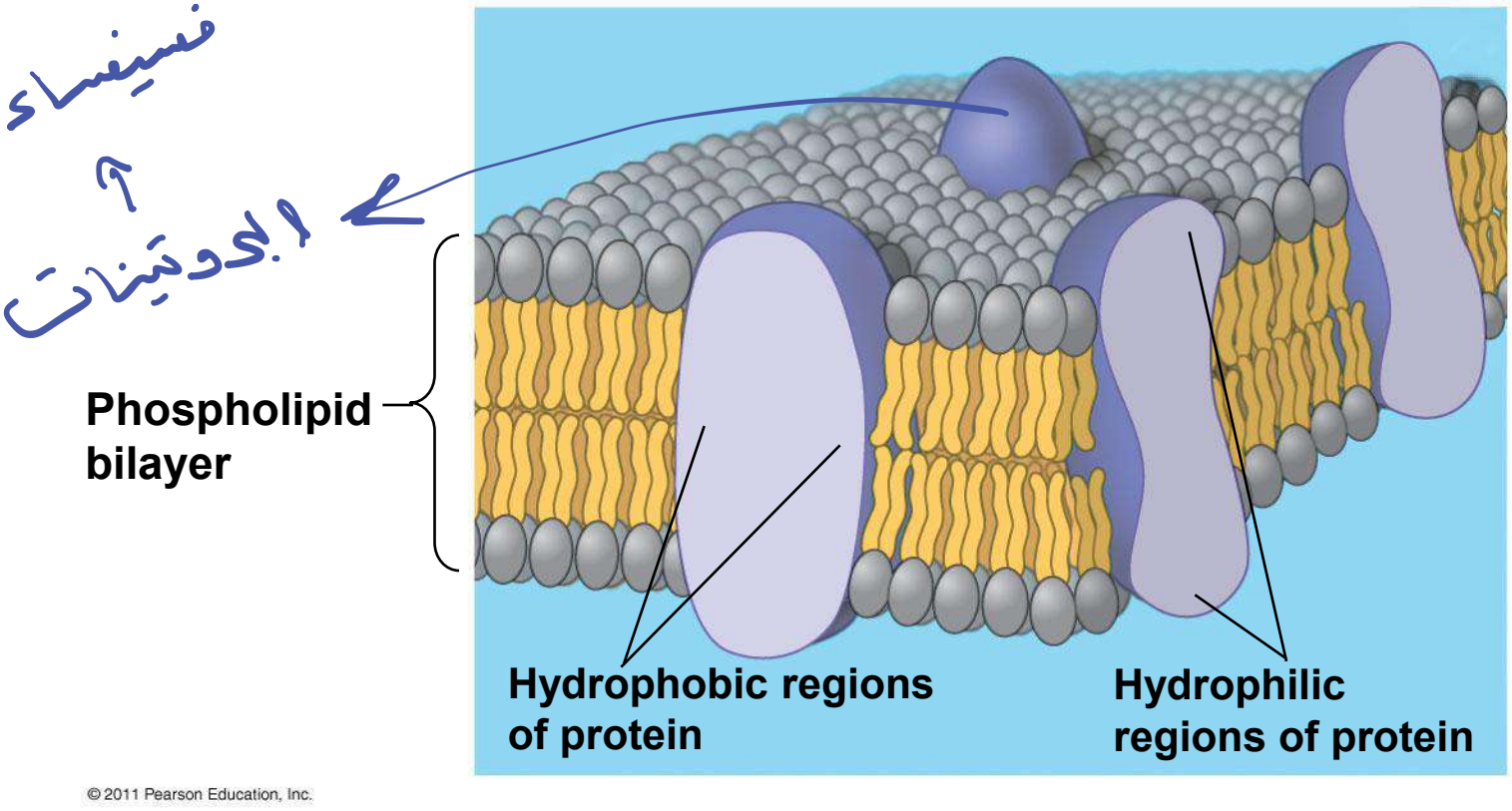
The name of this model
is the fluid mosaic mode
نموذج فسيفسائي لزج او مائع





The majr component is phospholibids
المكون الرئيسي للـ plasma membrane
وبنعرف انه ال phospholibids تمتلك جانبين
amphipathic لازم يكون ترتيبهم على شكل طبقتين

Figure 7.3



فهم بكون فيي مطلوب

دراسات كس التجميد

- Freeze-fracture studies of the plasma membrane supported the fluid mosaic model

نحوز على الفرضيات السائل

- Freeze-fracture is a specialized preparation technique that splits a membrane along the middle of the phospholipid bilayer

تقنية تحضير مخصصة

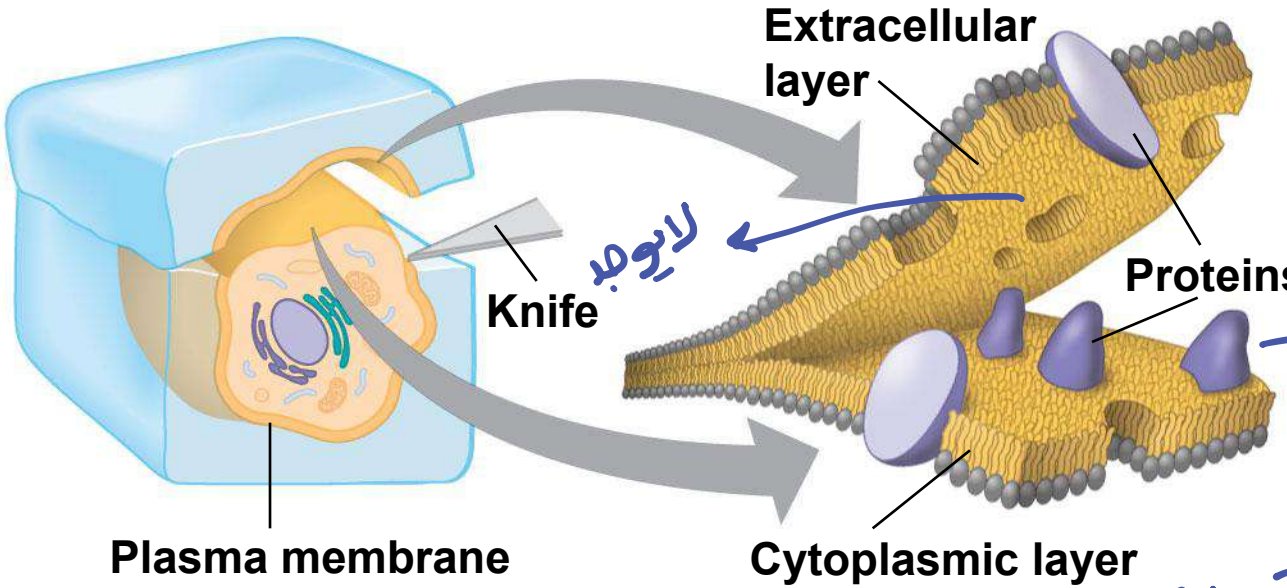
يقسم

منتصف

جابوا خليه جمدوها حتى يكشفوا صحة الاكتشافات واخذوا ال plasma membrane وفتحوه من النص صوروا كل طبقة من الداخل فوجدوا اختلاف

Figure 7.4

TECHNIQUE



RESULTS

Inside of extracellular layer

Inside of cytoplasmic layer

Figure 7.4a

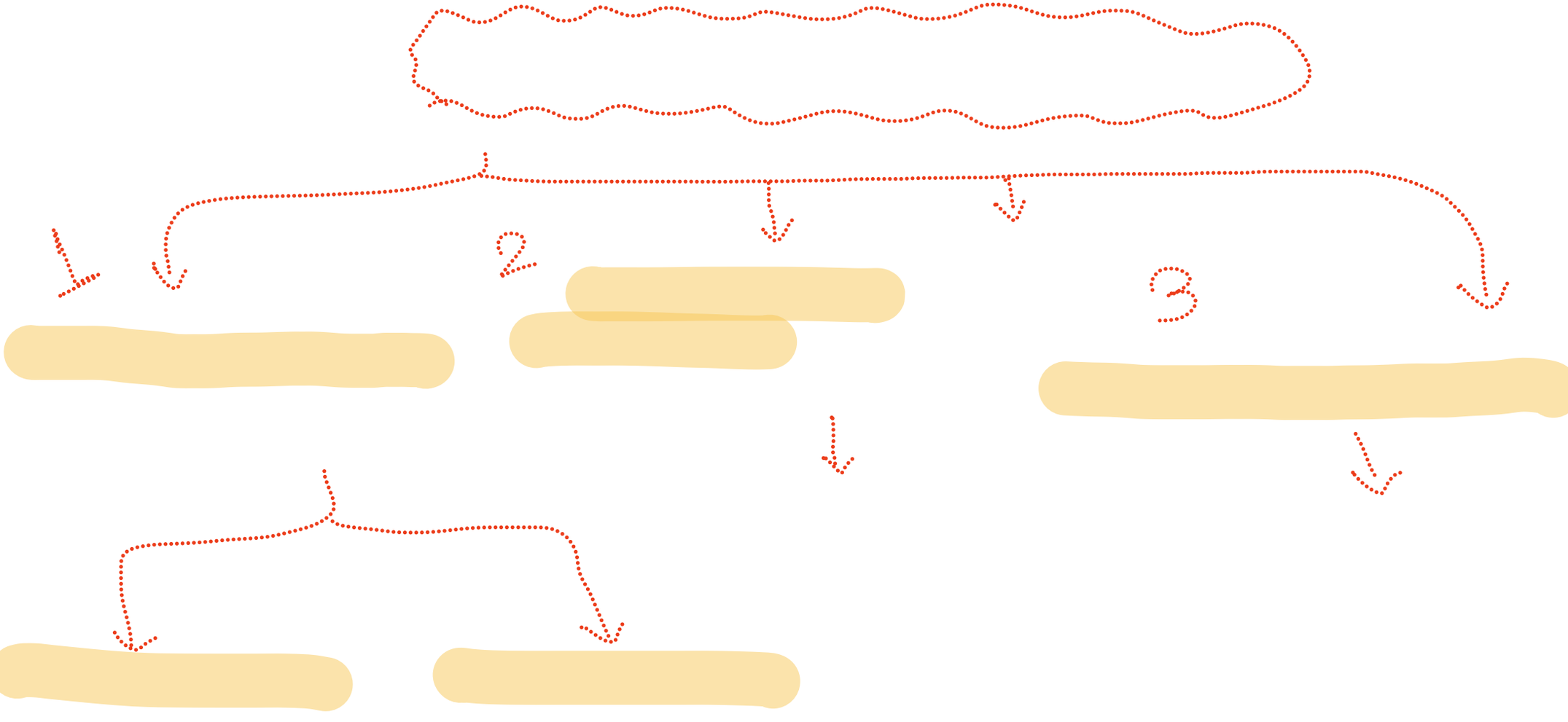
Inside of extracellular layer

Figure 7.4b

Inside of cytoplasmic layer

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


1
2
3

The Factores Can Affect in the Fluidity of Membranes

1

The phospholipids movement تزيد ال fluidity

Lateral movement
الحركة الجانبية
تبديل الاماكن وتحدث عشر ملايين مرة في الثانية

Flip flopping movement القلب
تحدث نادرا مرة واحدة في الشهر

2

Type of fatty acid in phospholipids نوع الحمض الدهني

عندما تكون unsaturated تكون فيها فراغات وجود الفراغات يزيد ال fluidity اما اذا كانت saturated تكون مرصوصة فتقل ال fluidity

3

The protein movement

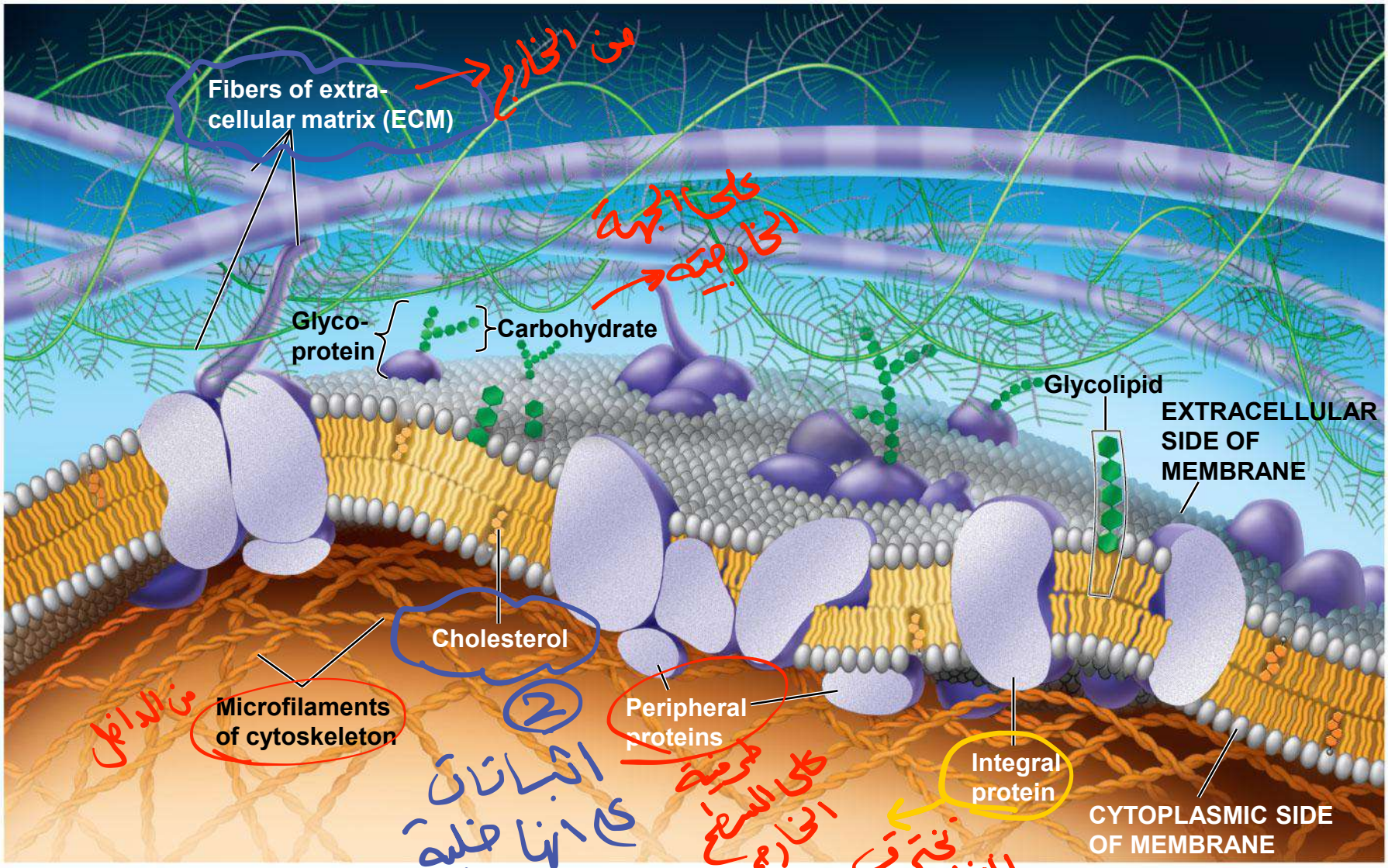
بما ان ال plasma membrane يتكون من phospholipids and protein فبما ان ال phospholipids تتحرك فان البروتينات تتحرك (حدث عليها جدال بين العلماء لانه من المنطق حركة الدهون بسبب تركيبتها اما البروتينات تكون مثبته داخل الغشاء البلازمي)
حتى جاء علماء واجروا تجربه على خلية الفأر والانسان

4

The Cholesterol in animal cells

عامل منظم للحرارة وجود الكوليسترول في الخلايا الحيوانية بيعمل covering on temperature

Figure 7.5



For animal

Figure 7.6

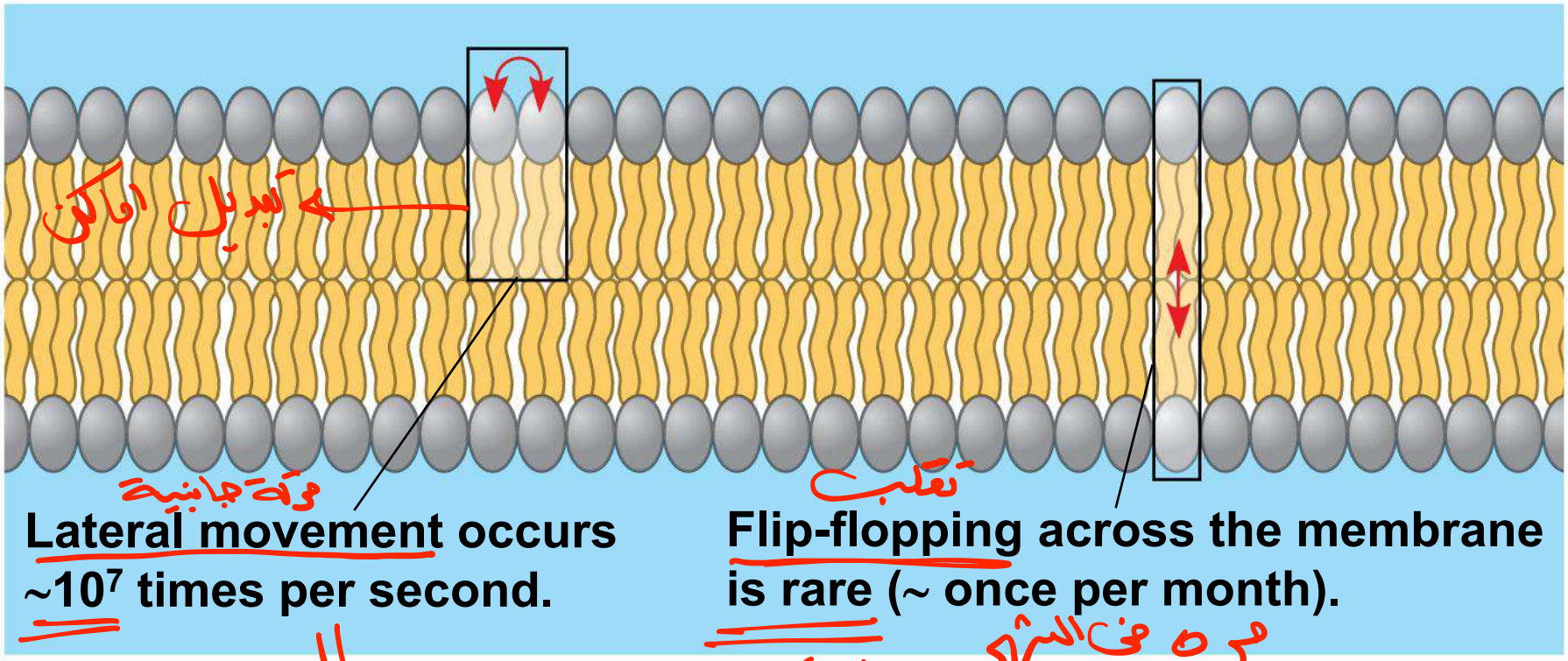
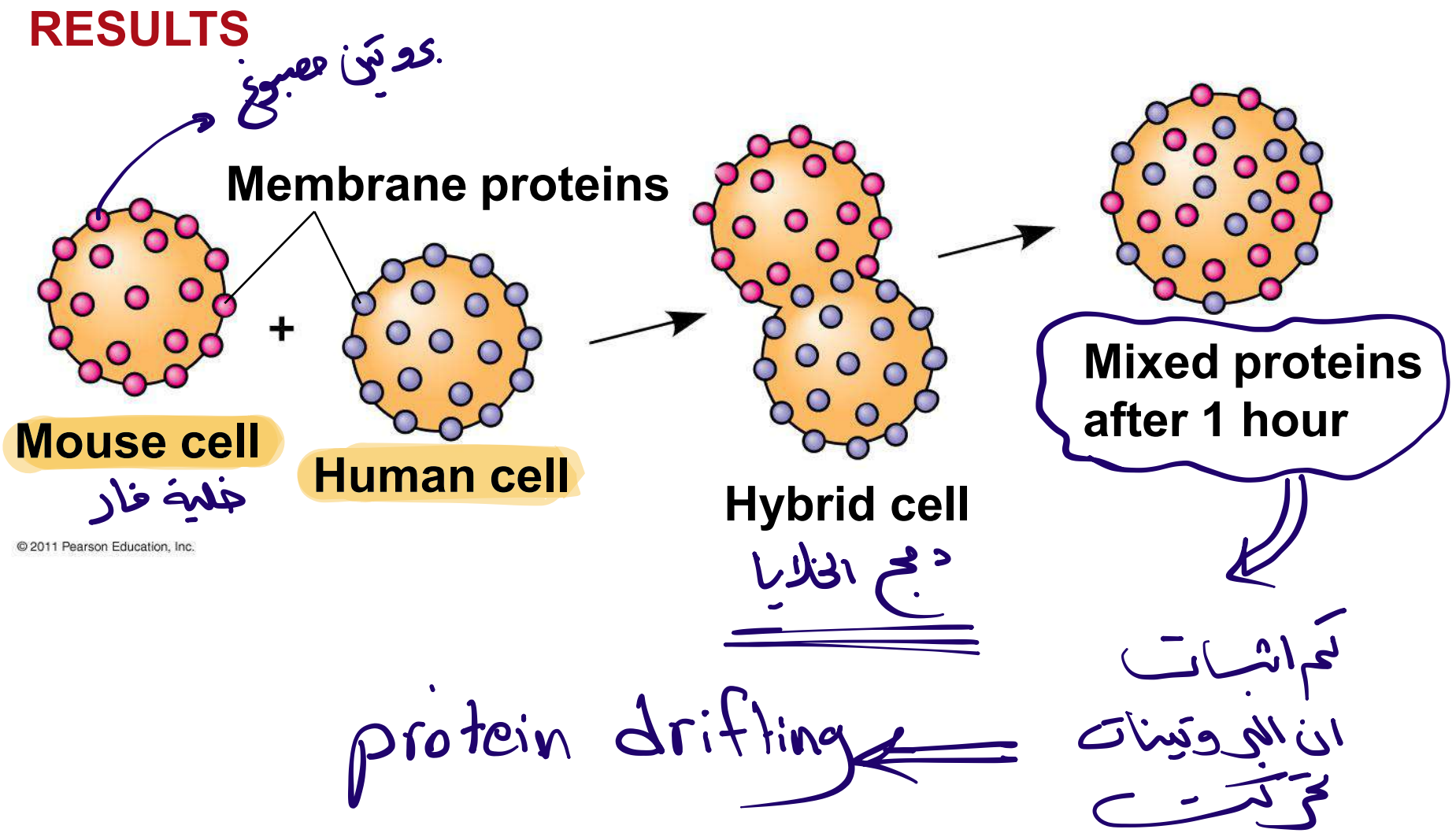


Figure 7.7


RESULTS
بروتين مصبوغ
Membrane proteins
+
Mouse cell
خلية فار
Human cell
Hybrid cell
دمج الخلايا
Mixed proteins after 1 hour
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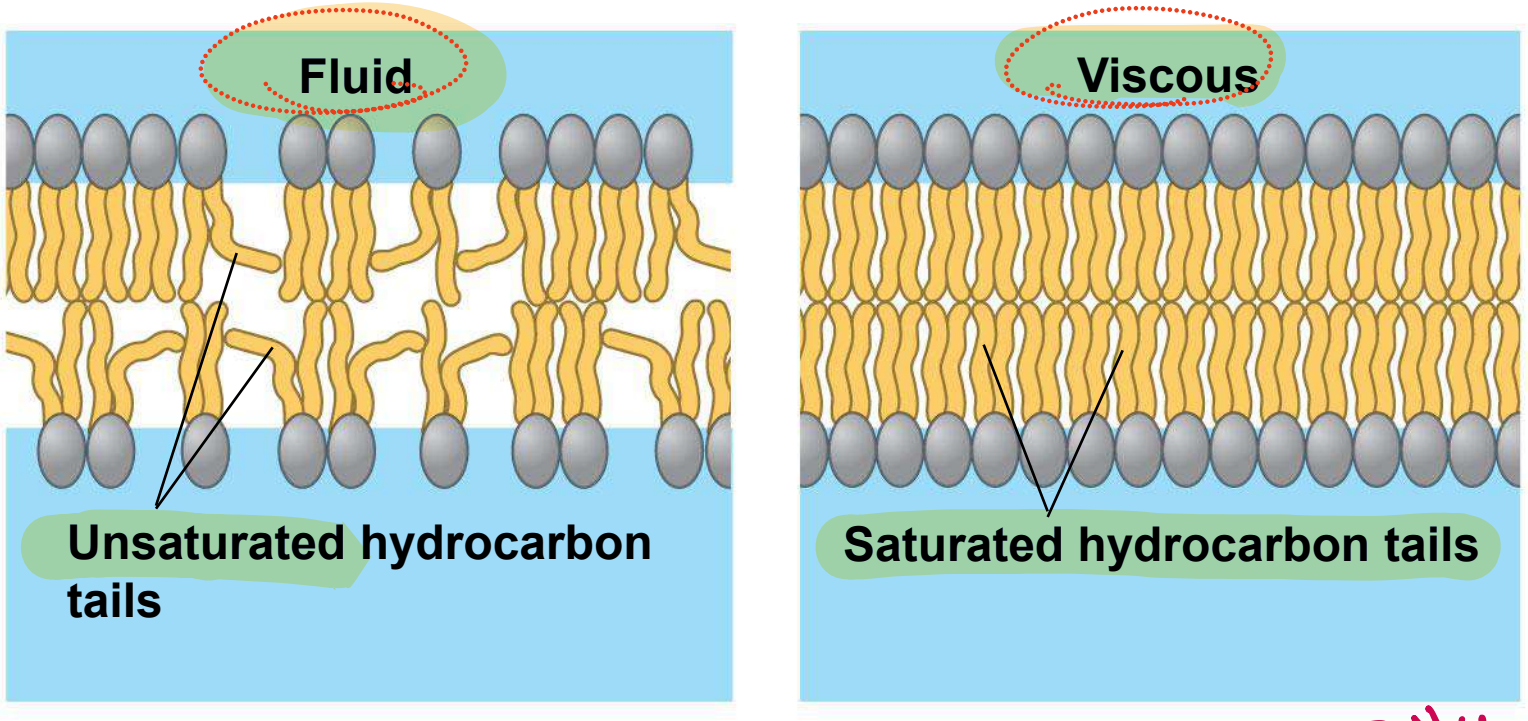
protein drifting
تم اثبات ان البروتينات متحركة

- 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

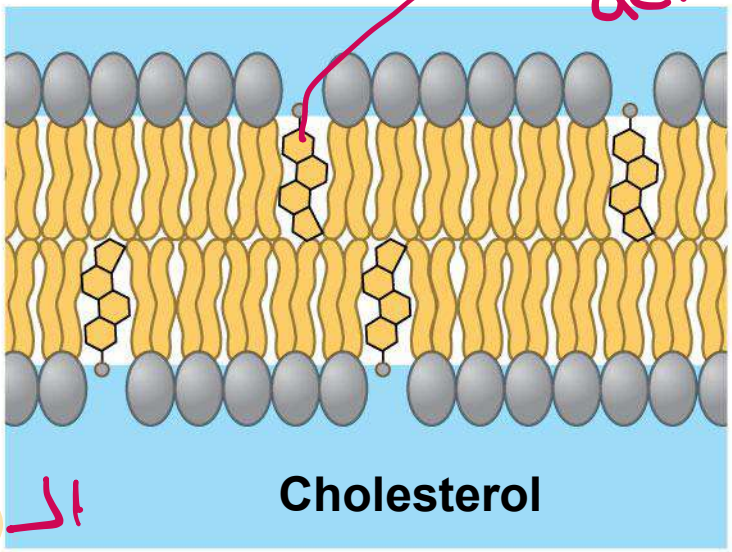
- The steroid cholesterol has different effects on membrane fluidity at different temperatures
- At warm temperatures (such as 37°C), cholesterol restrains movement of phospholipids ⟹ انخفاض في Fluidity
- At cool temperatures, it maintains fluidity by preventing tight packing ⟹ زيادة Fluidity
  منع التعبئة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

Figure 7.8



(a) Unsaturated versus saturated hydrocarbon tails

(b) Cholesterol within the animal cell membrane



بين ال

عندما يتنخ الحرارة يزيد حركة ال phospholipids

بالتالي يزيد ال Fluidity

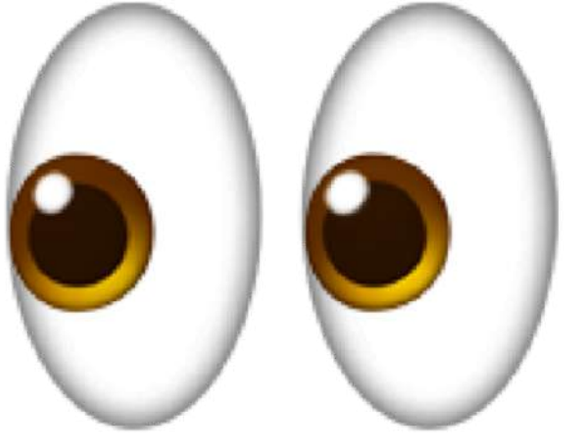
وجود الكلسترول يمنع حركة

phospholipids ⇐ تقل ال Fluidity

عندما تنخفض الحرارة ⟸ الفراغ الذي بين ال phospholipids

يقل فقل ال Fluidity ⟸ وجود الكلسترول

يحتوي أغلب بنهم فزيد ال Fluidity



* ارتفاع حرارة ⟸ تقل Fluidity

* انخفاض حرارة ⟸ تزيد Fluidity

Evolution of Differences in Membrane Lipid Composition

محذوف χ

- Variations in lipid composition of cell membranes of many species appear to be adaptations to specific environmental conditions
- Ability to change the lipid compositions in response to temperature changes has evolved in organisms that live where temperatures vary

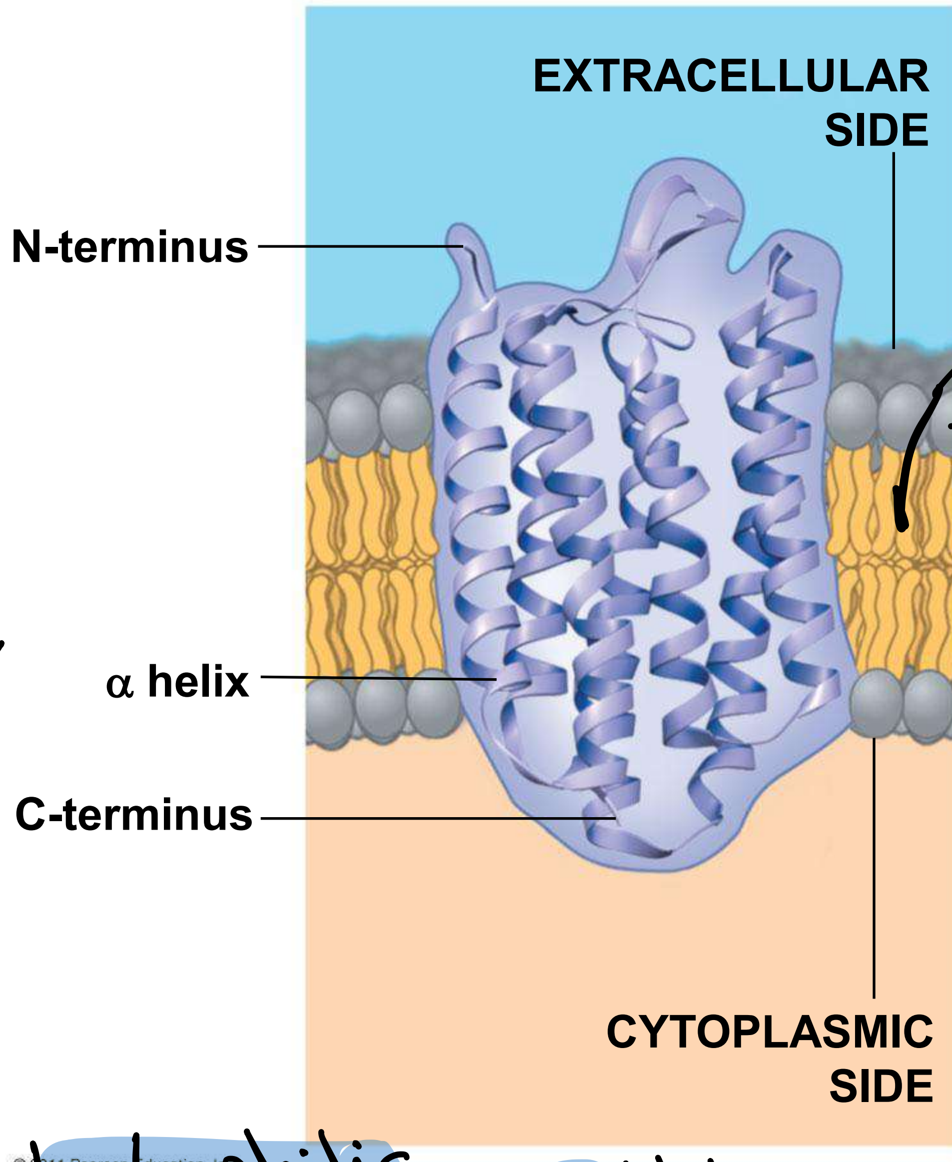
Membrane Proteins and Their Functions

- 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

البروتينات المحيطيه (الجانبية)

- **Peripheral proteins** are bound to the surface of the membrane (سطح)
- **Integral proteins** penetrate the hydrophobic core (البروتينات المخترقة) (تخترق الكاره للماء (phospholipids))
- Integral proteins that span the membrane are called transmembrane proteins (تمتد) (بروتينات الغشاء)
- The hydrophobic regions of an integral protein consist of one or more stretches of nonpolar amino acids, often coiled into alpha helices

Figure 7.9



هي يثبت حاله بال
plasma membrane

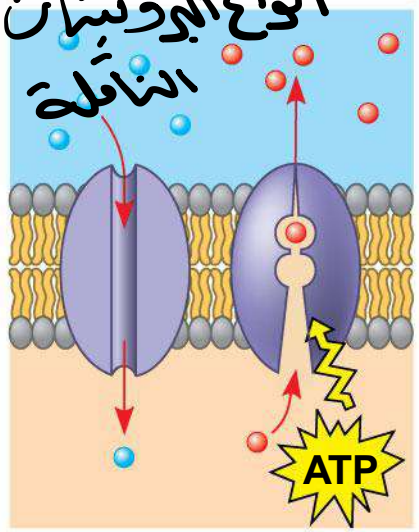
hydrophobic
hydrophilic

بالتالي لما يجي
كرتين يخترق
الغشاء البلازمي
لازم يتكون
من Amino acid ⇐ من الاطراف ← hydrophilic
من الداخل hydrophobic ← non polar

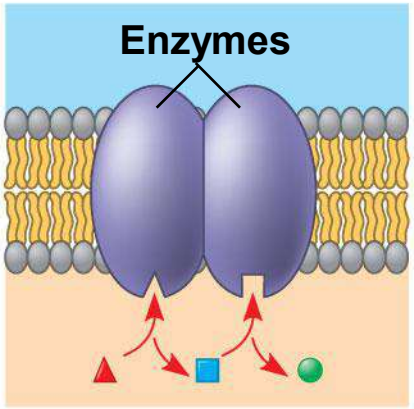
integral

- Six major functions of membrane proteins
  - Transport ⇒ نقل ⇒ ينقل المواد من والى الخلية
  - Enzymatic activity ⇒ Catalyst
  - Signal transduction ⇒ تقليل الاشارات ⇒ يكون البروتين عبارة عن بروتين مستقبل للاشارة
  - Cell-cell recognition ⇒ تعارف الخلايا ⇒ تحفز التفاعلات بين الانسجة والخلايا في عمليات دفاعية عضو مثلا
  - Intercellular joining ⇒ بروتينات تربط الخلايا
  - Attachment to the cytoskeleton and extracellular matrix (ECM)

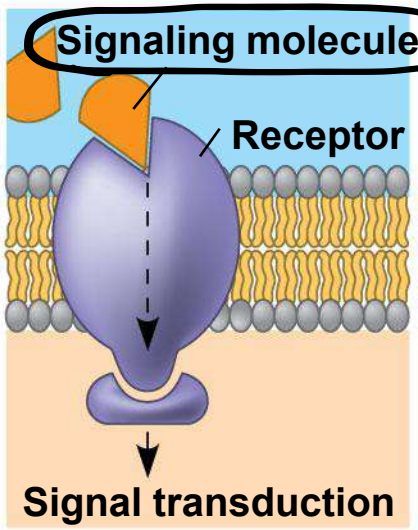
Figure 7.10



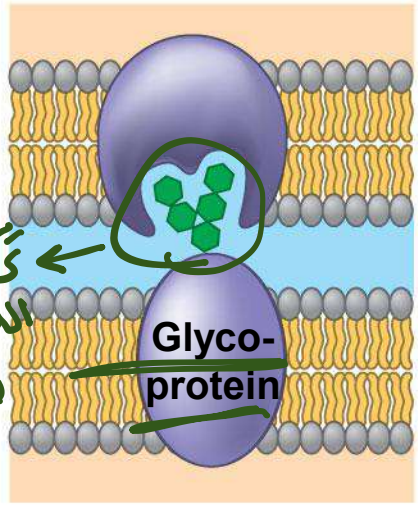
(a) Transport



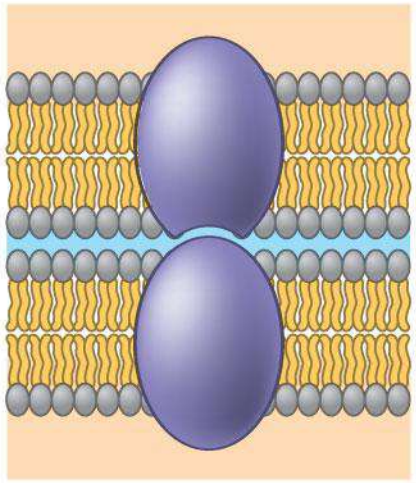
(b) Enzymatic activity



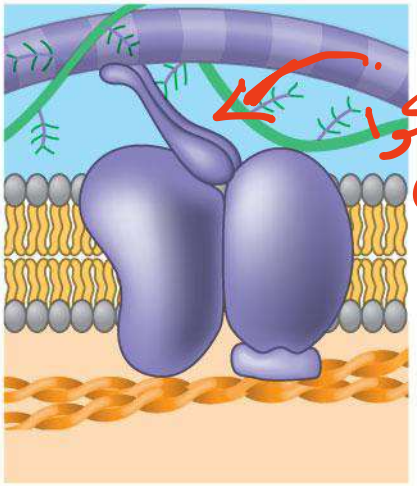
(c) Signal transduction



(d) Cell-cell recognition

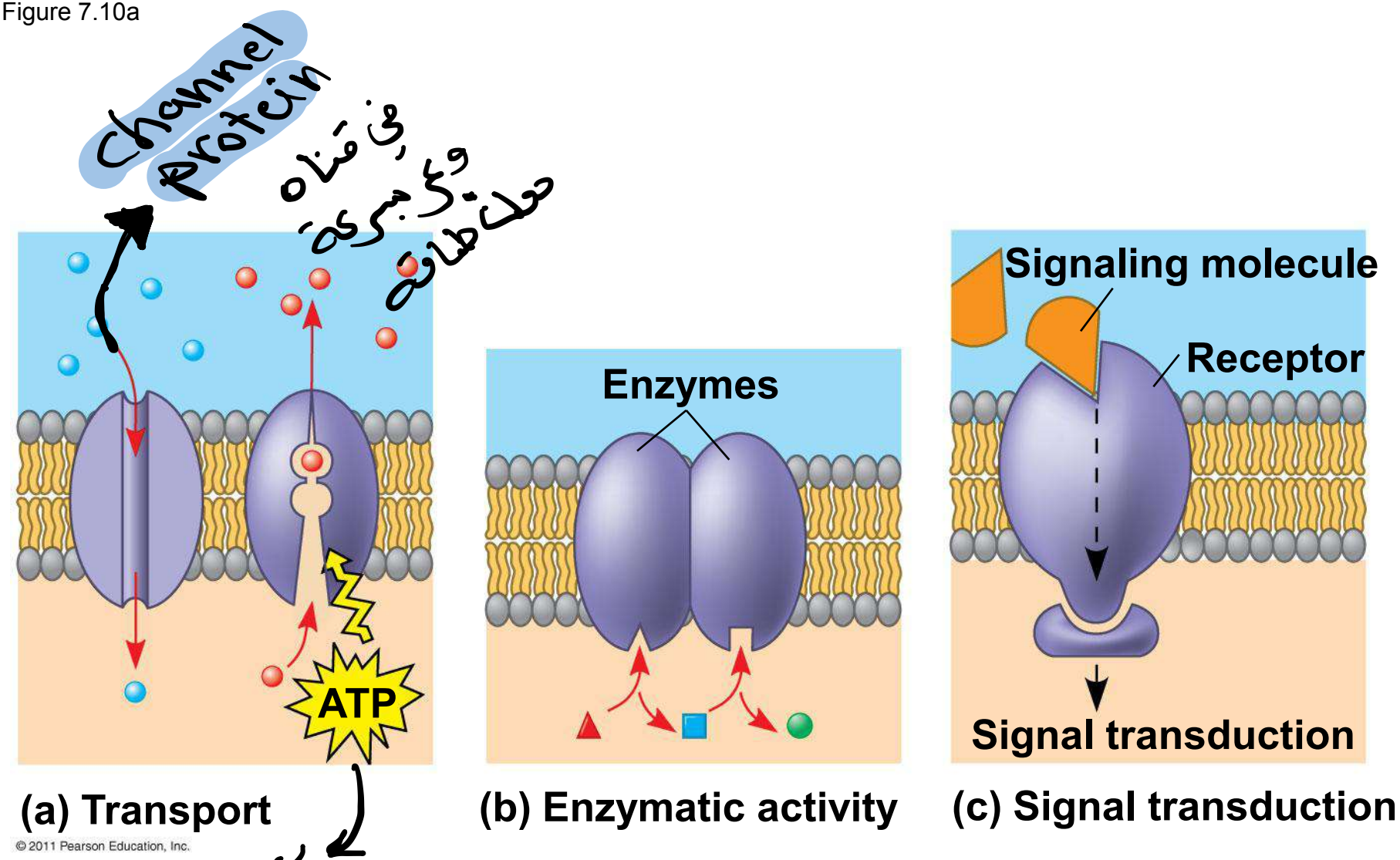


(e) Intercellular joining



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

Figure 7.10a


Channel Protein
في قناه
وبسرعه
طاقه
ATP
Enzymes
Signaling molecule
Receptor
Signal transduction
(a) Transport
(b) Enzymatic activity
(c) Signal transduction
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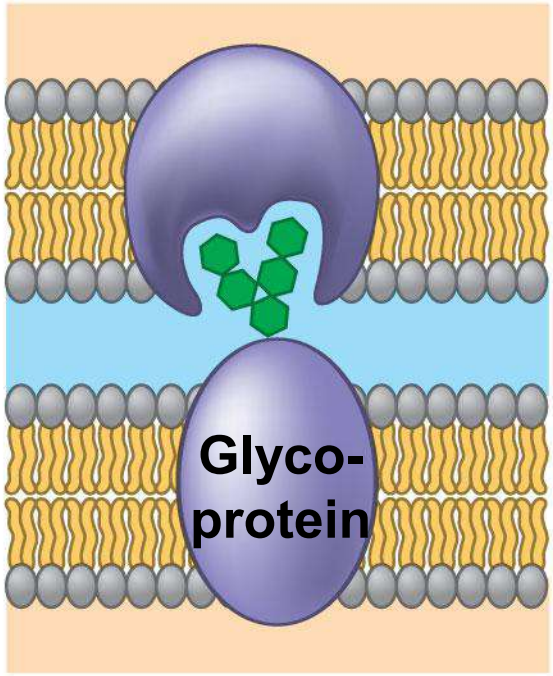
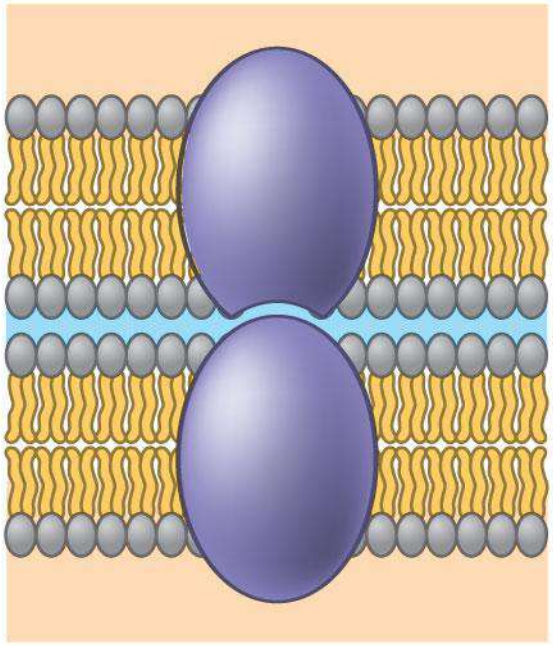
كناقل للطاقه
في يغير شكل
Carrier Protein

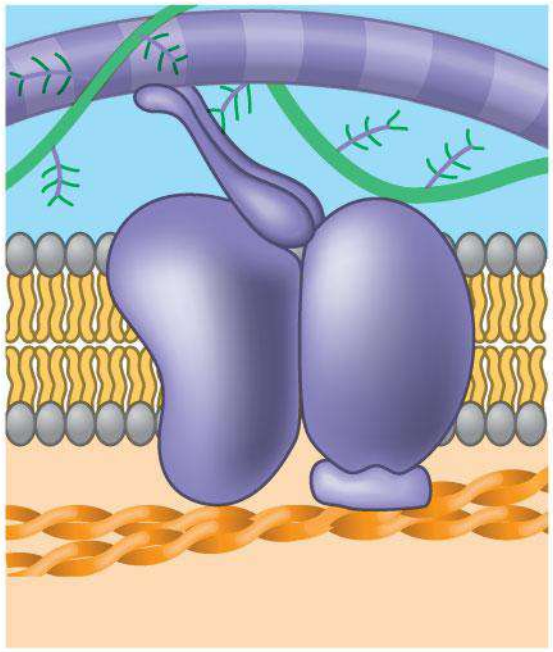
Figure 7.10b



(d) Cell-cell recognition



(e) Intercellular joining



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

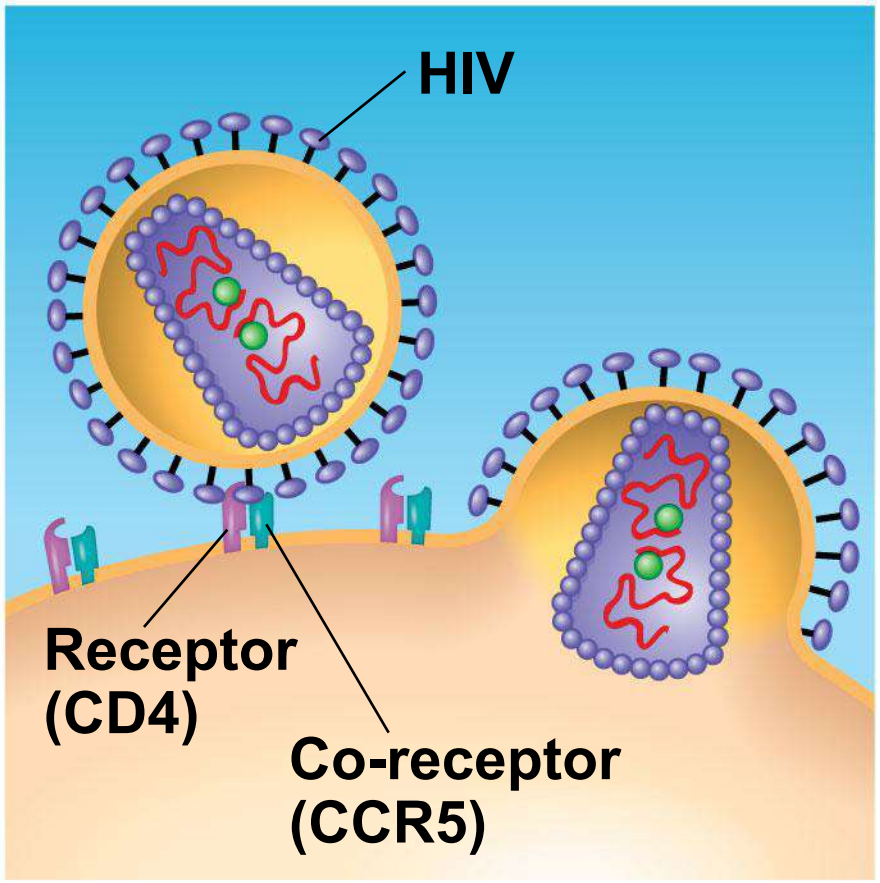
The Role of Membrane Carbohydrates in Cell-Cell Recognition

محذوف

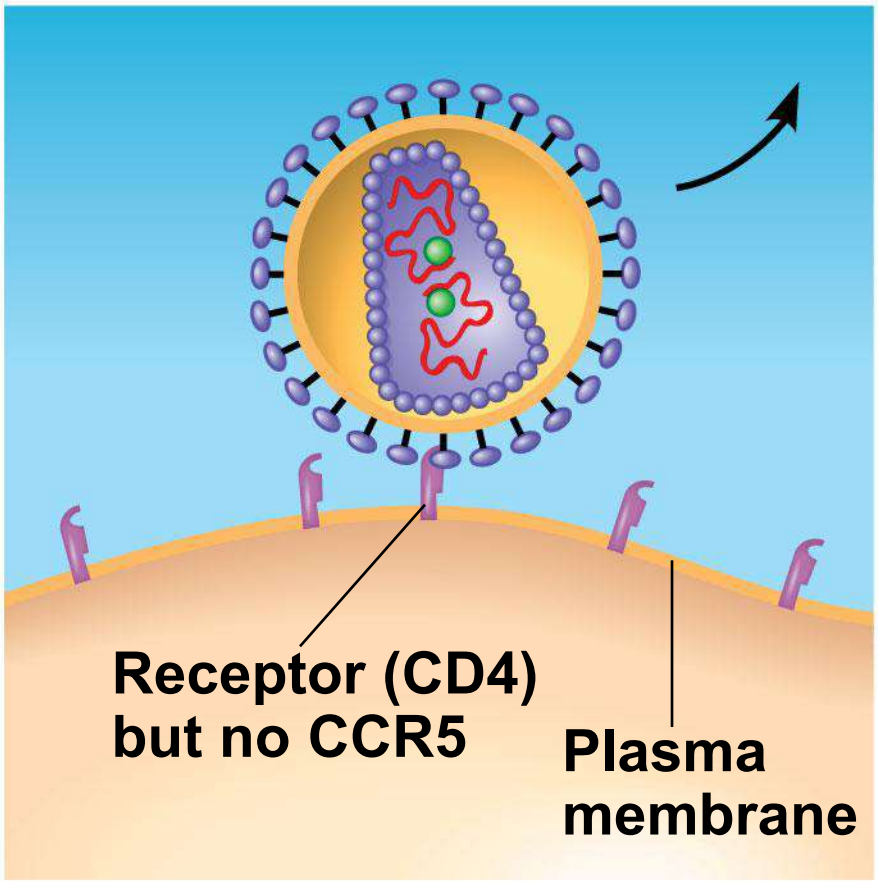
- Cells recognize each other by binding to surface molecules, often containing carbohydrates, on the extracellular surface of the plasma membrane
- Membrane carbohydrates may be covalently bonded to lipids (forming **glycolipids**) or more commonly to proteins (forming **glycoproteins**)
- Carbohydrates on the external side of the plasma membrane vary among species, individuals, and even cell types in an individual

Figure 7.11

محذوف



HIV can infect a cell that has CCR5 on its surface, as in most people.



HIV cannot infect a cell lacking CCR5 on its surface, as in resistant individuals.