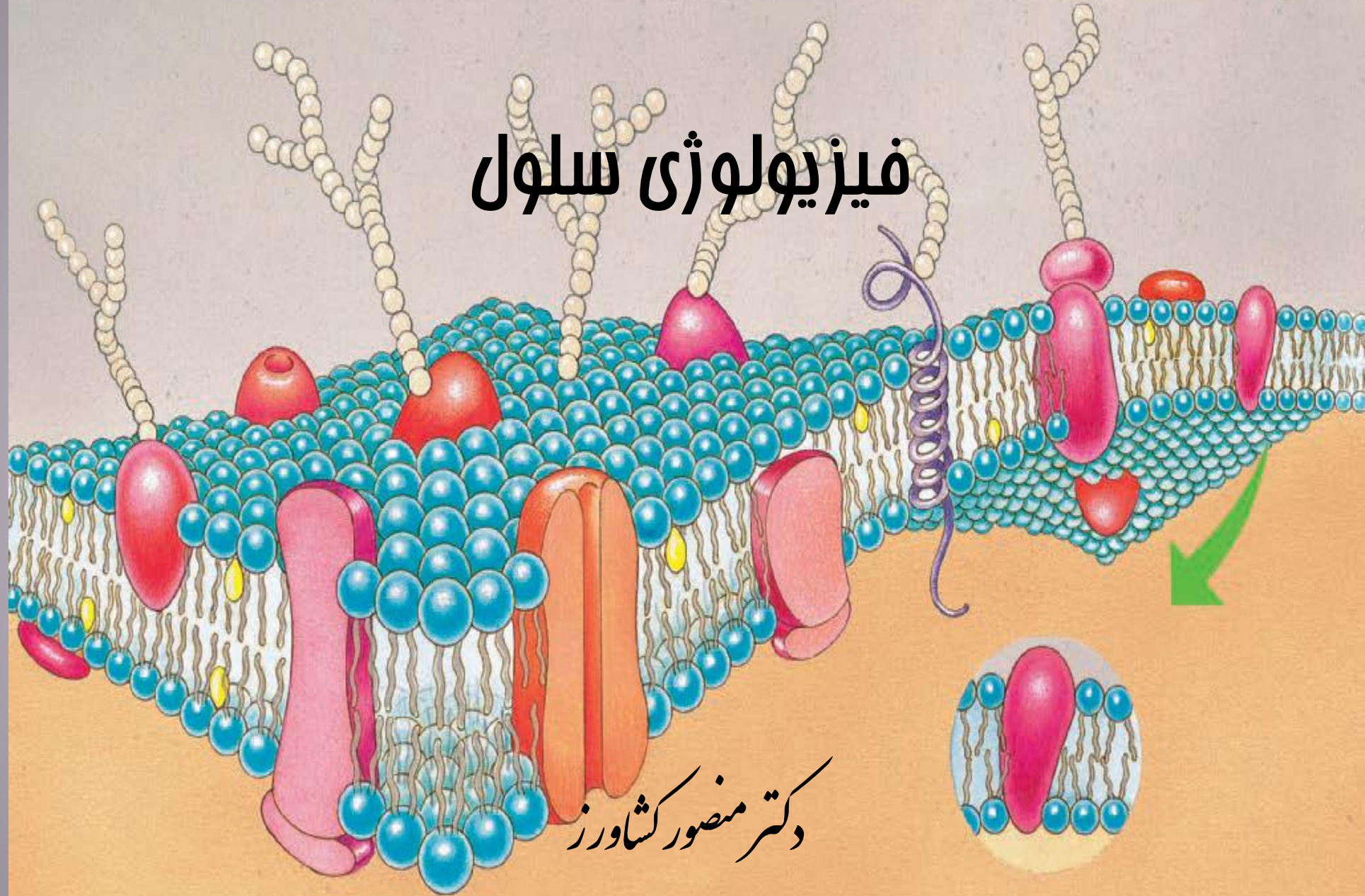


فیزیولوژی سلول



دکتر منصور کشاورز

فیزیولوژی Physiology

- تعریف

— شناخت عملکرد طبیعی بدن

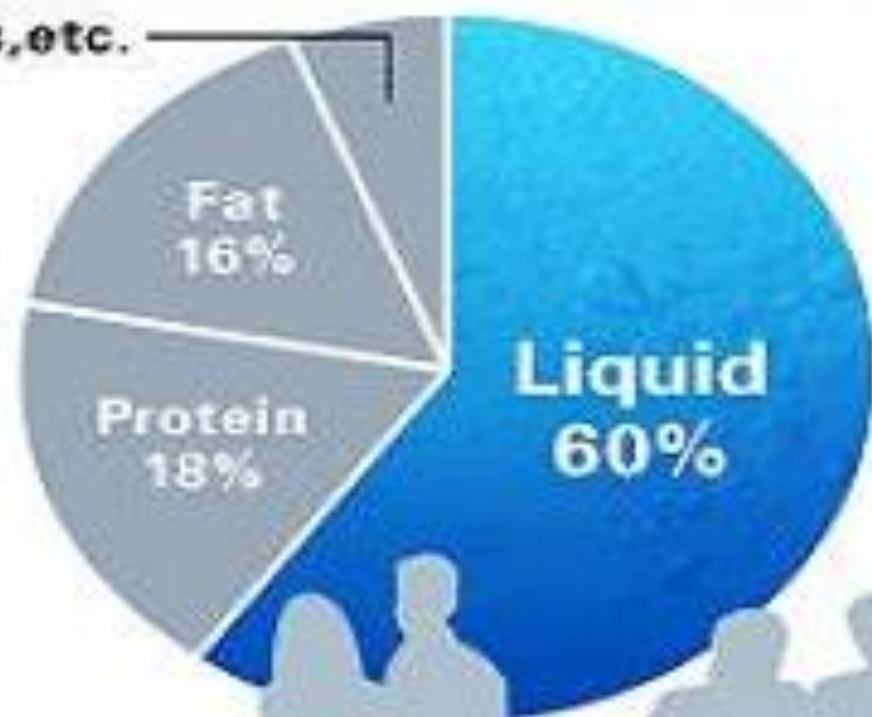
— Physio طبیعت

— طبیعت؛ قوانین حاکم بر جسم، نرم افزار راه انداز (Driver) جسم

— علوم مختلف؛ بیوشیمی، بیوفیزیک، بیولوژی و... نتیجه تلاش بشر برای شناخت طبیعت است.

Body Composition

Minerals, etc.
6%



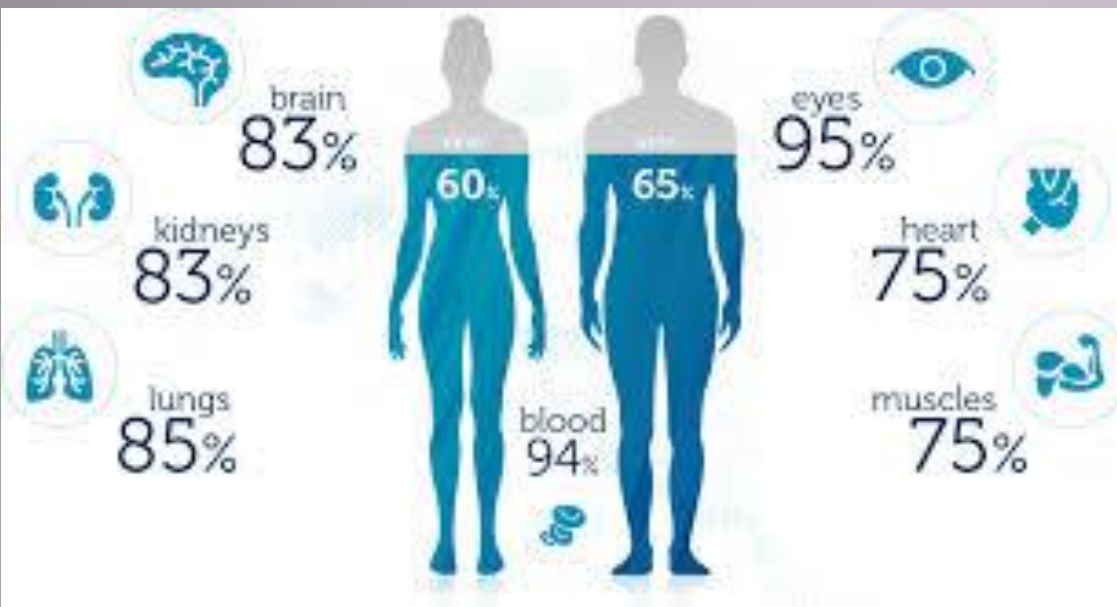
Infant **70%**



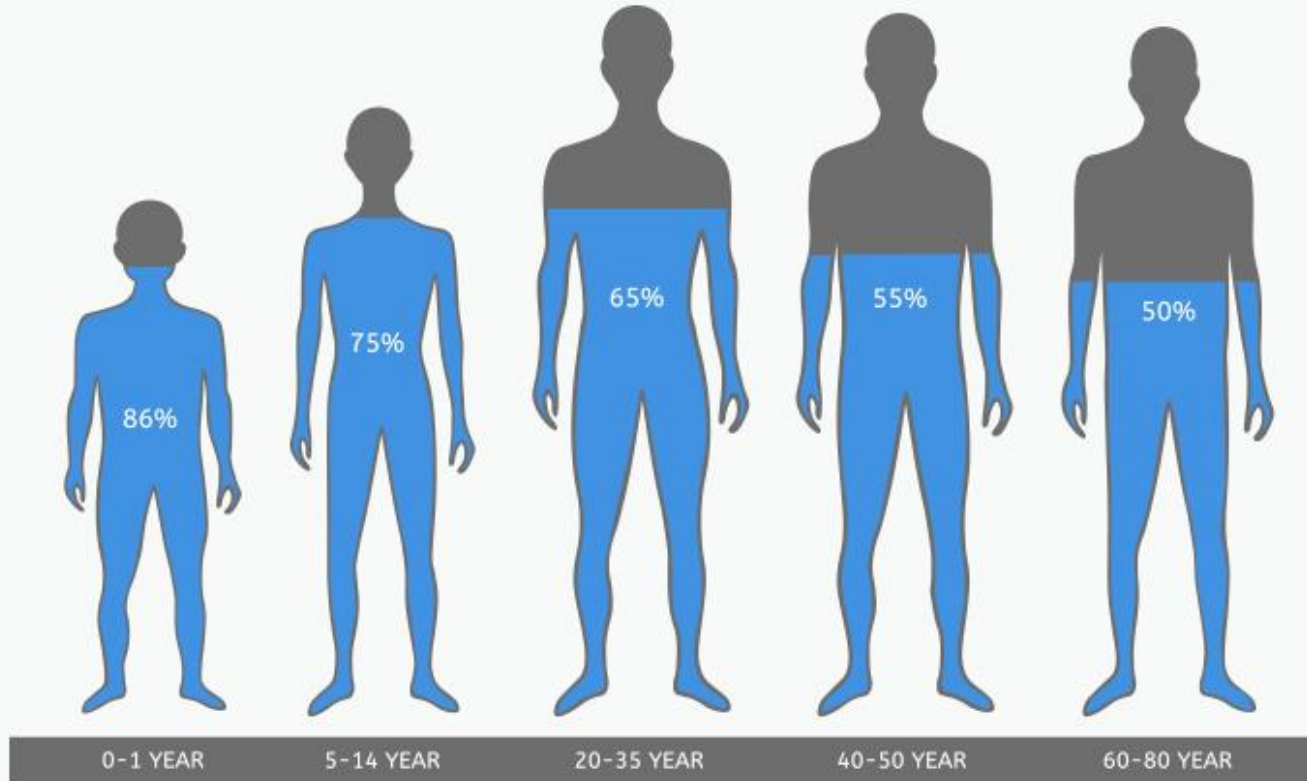
Adult **60%**



Elderly Person **50~55%**



آب بدن



آب
و
حیات

مجموعه مایعات بدن

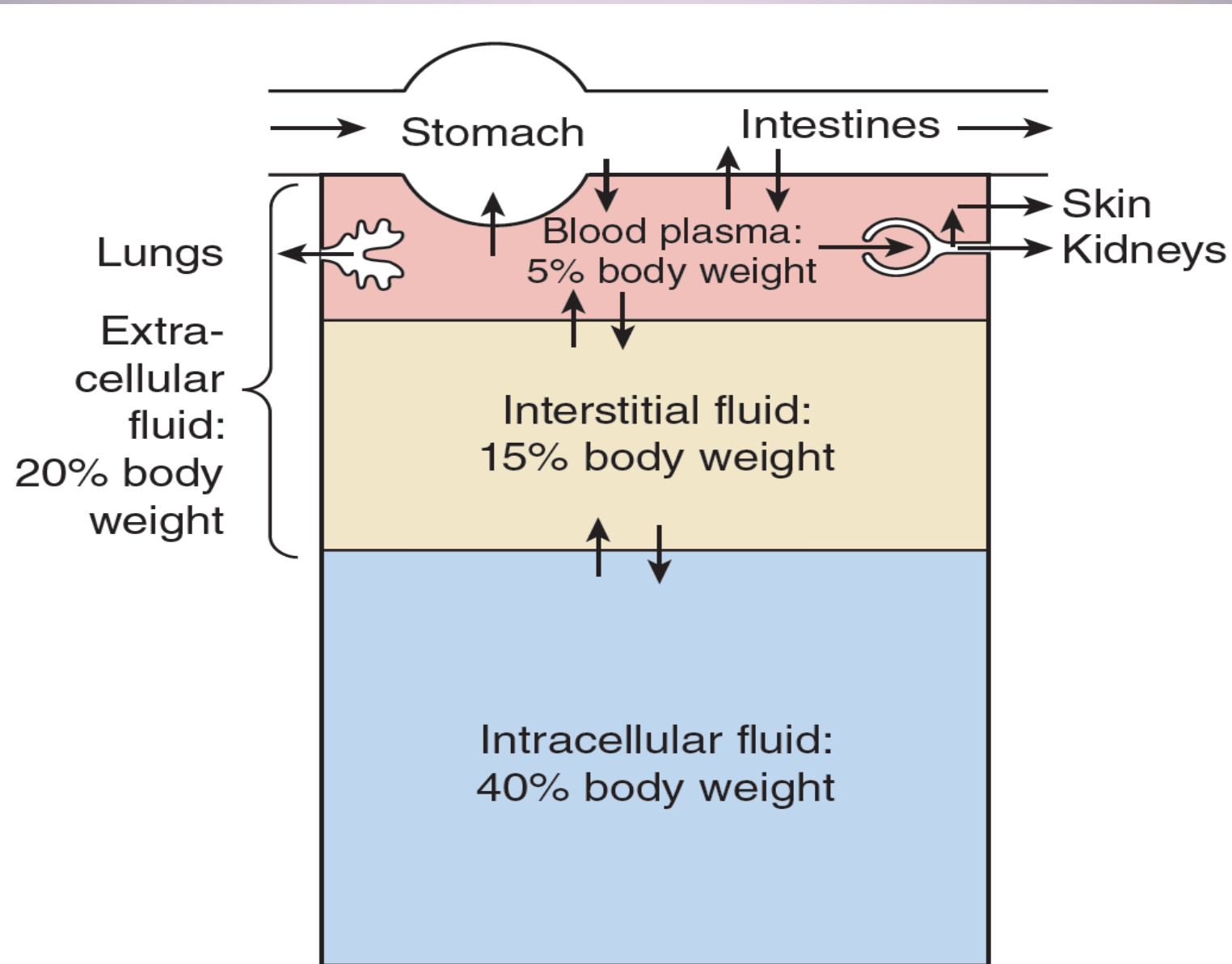
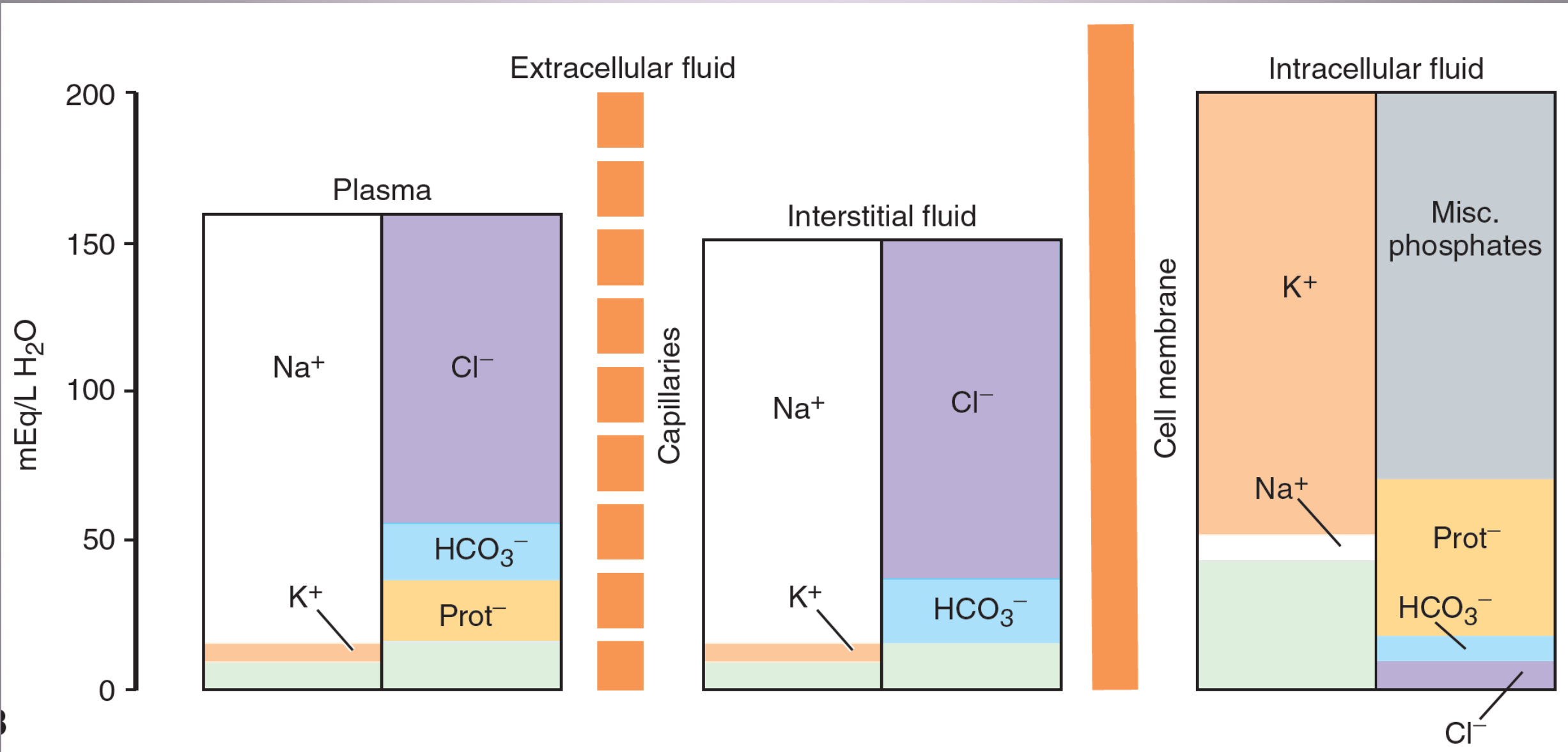


Table 5-1 Approximate Water Distribution in Adult Humans*

	Men	Typical Volume (liters)	Women	Typical Volume (liters)
Total body water (TBW)	60% of body weight	42	50% of body weight	35
Intracellular fluid (ICF)	60% of TBW	25	60% of TBW	21
Extracellular fluid (ECF)	40% of TBW	17	40% of TBW	14
Interstitial fluid	75% of ECF	13	75% of ECF	10
Plasma volume (PV)	20% of ECF	3	20% of ECF	3
Blood volume (BV)	$PV/(1 - Hct)$	5.5	$PV/(1 - Hct)$	5
Transcellular fluid	5% of ECF	1	5% of ECF	1

*Assuming a body weight of 70 kg for both sexes and a hematocrit (Hct) of 45% for men and 40% for women.

ترکیب مایعات بدن



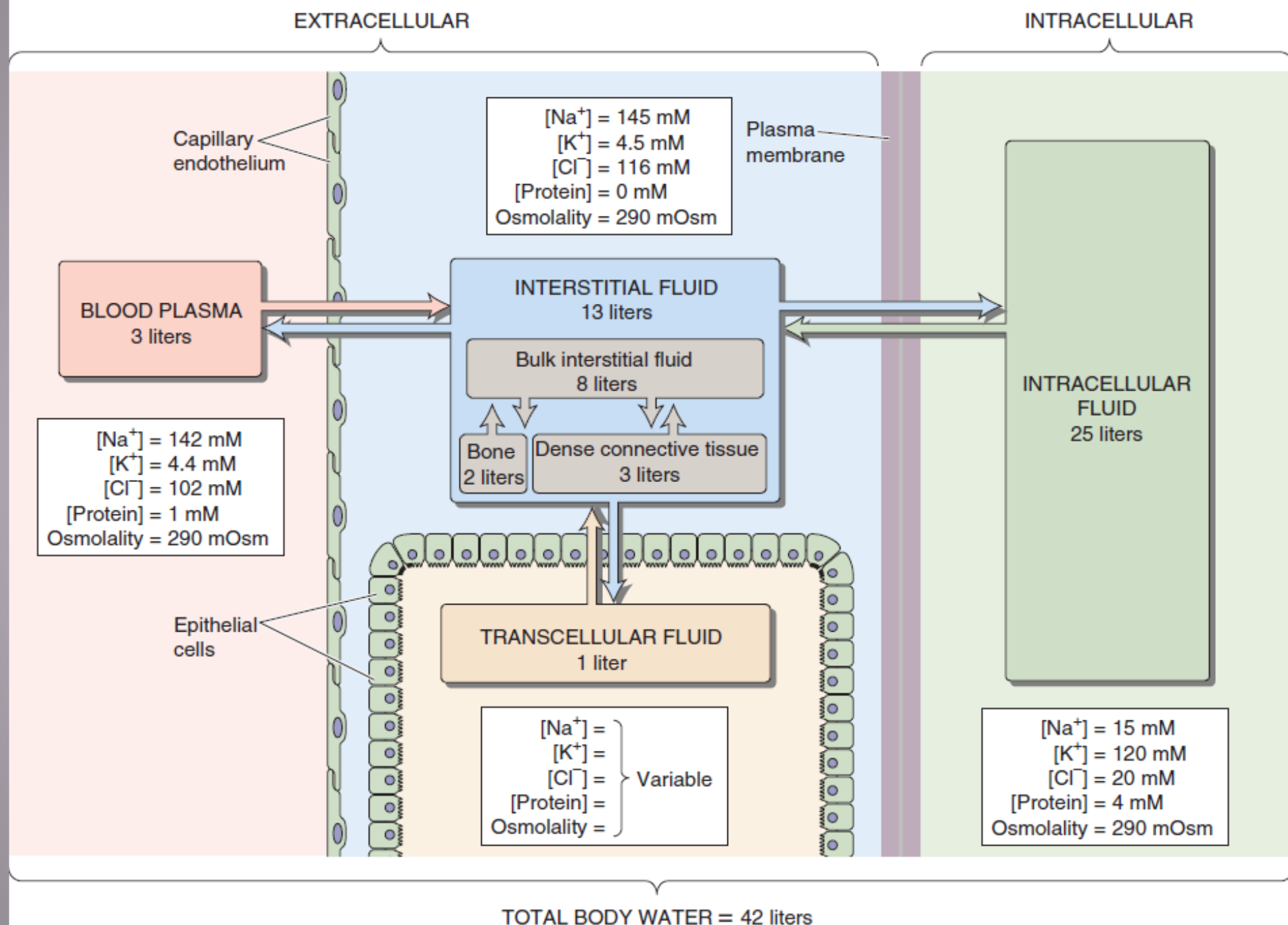


Table 5-2 Approximate Solute Composition of Key Fluid Compartments

Solute	Plasma	Protein-Free Plasma	Interstitial	Cell
Na ⁺ (mM)	142	153	145	15
K ⁺ (mM)	4.4	4.7	4.5	120
Ca ²⁺ (mM)	1.2 (ionized) 2.4 (total)*	1.3 (ionized)	1.2 (ionized)	0.0001 (ionized)
Mg ²⁺ (mM)	0.6 (ionized) 0.9 (total)*	0.6 (ionized)	0.55 (ionized)	1 (ionized) 18 (total)
Cl ⁻ (mM)	102	110	116	20
HCO ₃ ⁻ (mM)	22 [†]	24	25	16
H ₂ PO ₄ ⁻ and HPO ₄ ²⁻ (mM)	0.7 (ionized) 1.4 (total) [‡]	0.75 (ionized)	0.8 (ionized)	0.7 (free)
Proteins	7 g/dL 1 mmol/L 14 mEq/L	—	1 g/dL	30 g/dL
Glucose (mM)	5.5	5.9	5.9	Very low
pH	7.4	7.4	7.4	~7.2
Osmolality (mosmole/kg H ₂ O)	291	290	290	290

*Total includes amounts ionized, complexed to small solutes, and protein bound.

[†]Arterial value. The value in mixed-venous blood would be ~24 mM.

[‡]As discussed in Chapter 52, levels of total plasma inorganic phosphate are not tightly regulated and vary between 0.8 and 1.5 mM.

TABLE 1.1 Approximate Compositions of Extracellular and Intracellular Fluids

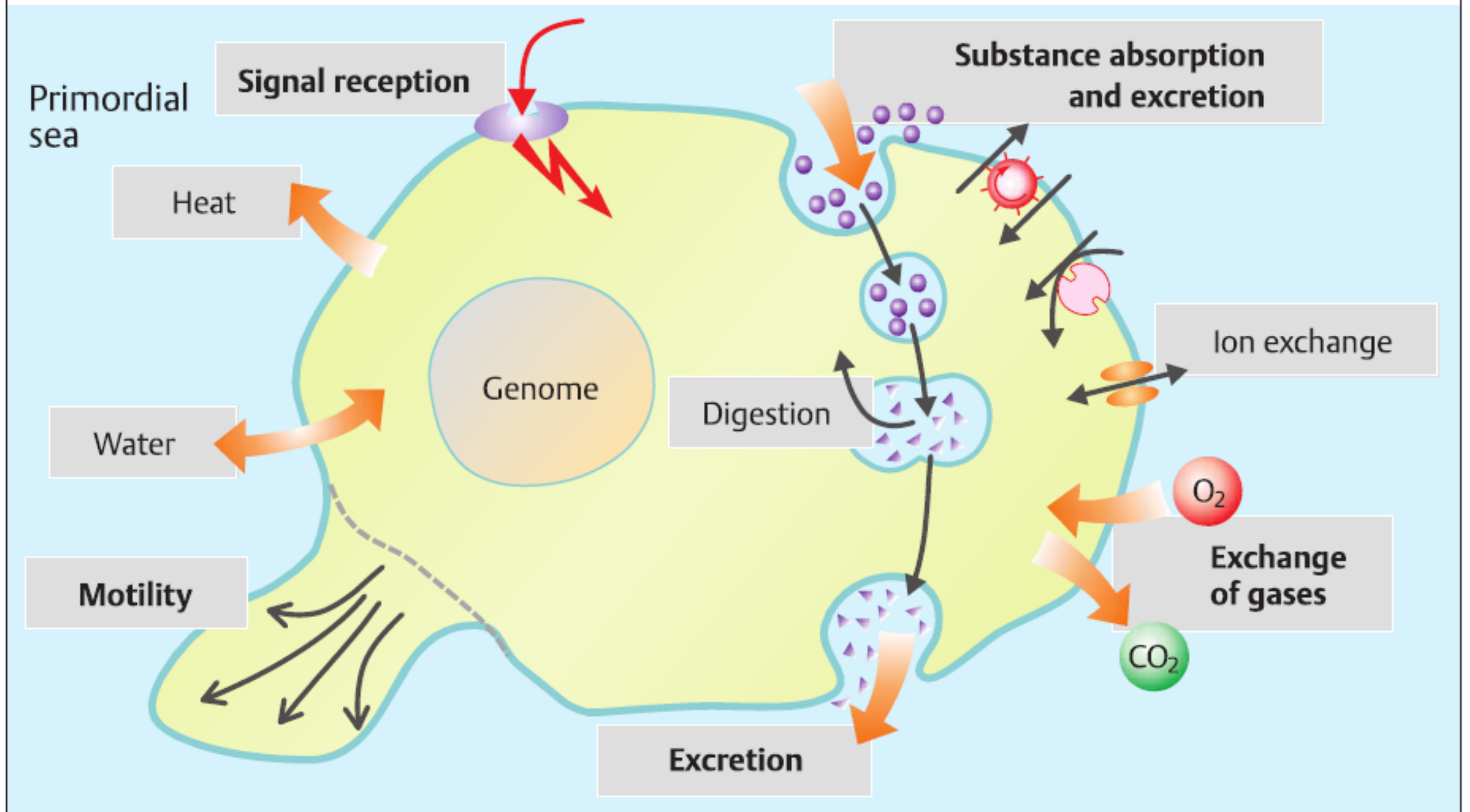
Substance and Units	Extracellular Fluid	Intracellular Fluid ^a
Na ⁺ (mEq/L)	140	14
K ⁺ (mEq/L)	4	120
Ca ²⁺ , ionized (mEq/L)	2.5 ^b	1×10^{-4}
Cl ⁻ (mEq/L)	105	10
HCO ₃ ⁻ (mEq/L)	24	10
pH ^c	7.4	7.1
Osmolarity (mOsm/L)	290	290

^aThe major anions of intracellular fluid are proteins and organic phosphates.

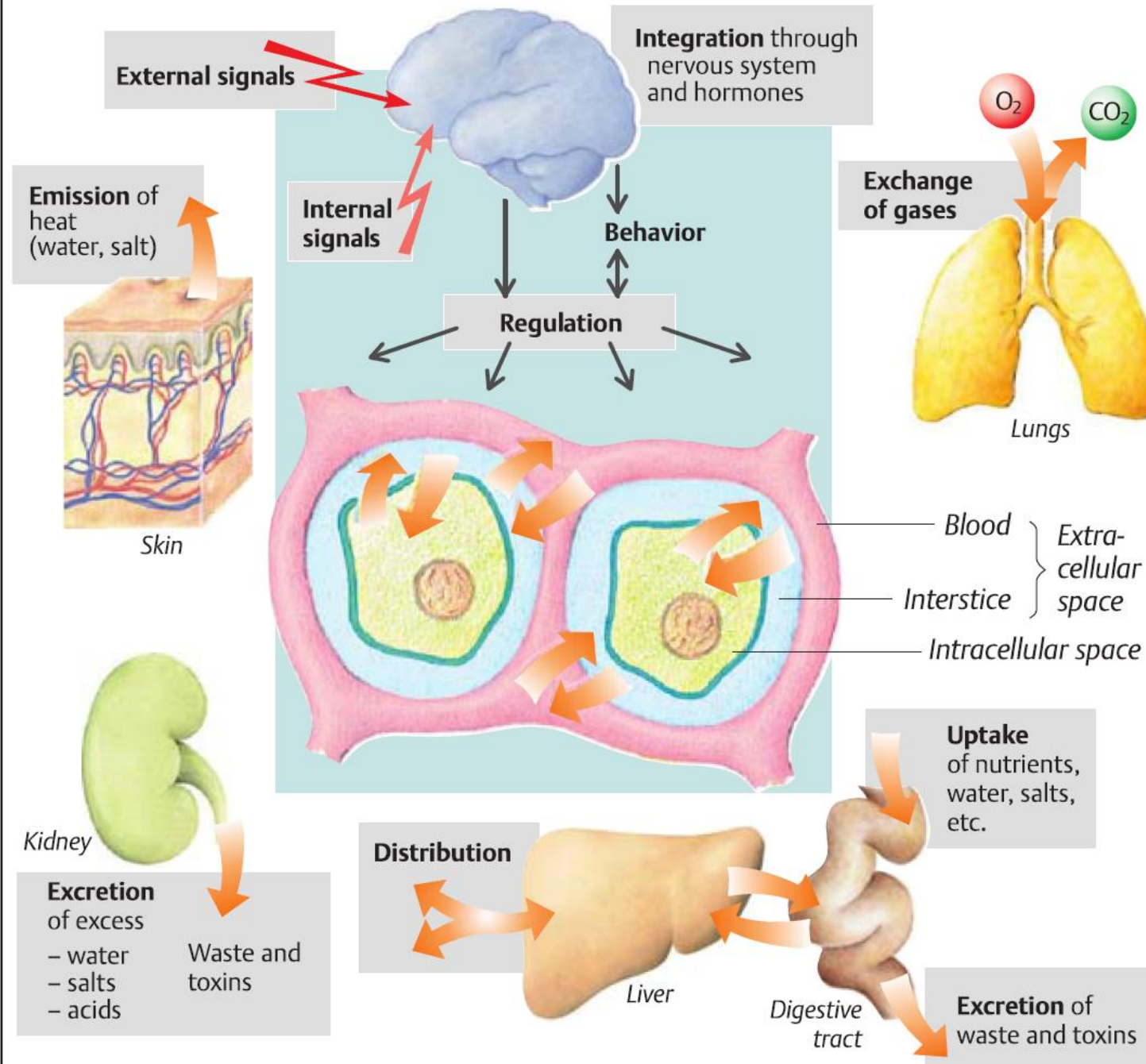
^bThe corresponding total [Ca²⁺] in extracellular fluid is 5 mEq/L or 10 mg/dL.

^cpH is $-\log_{10}$ of the [H⁺]; pH 7.4 corresponds to [H⁺] of 40×10^{-9} Eq/L.

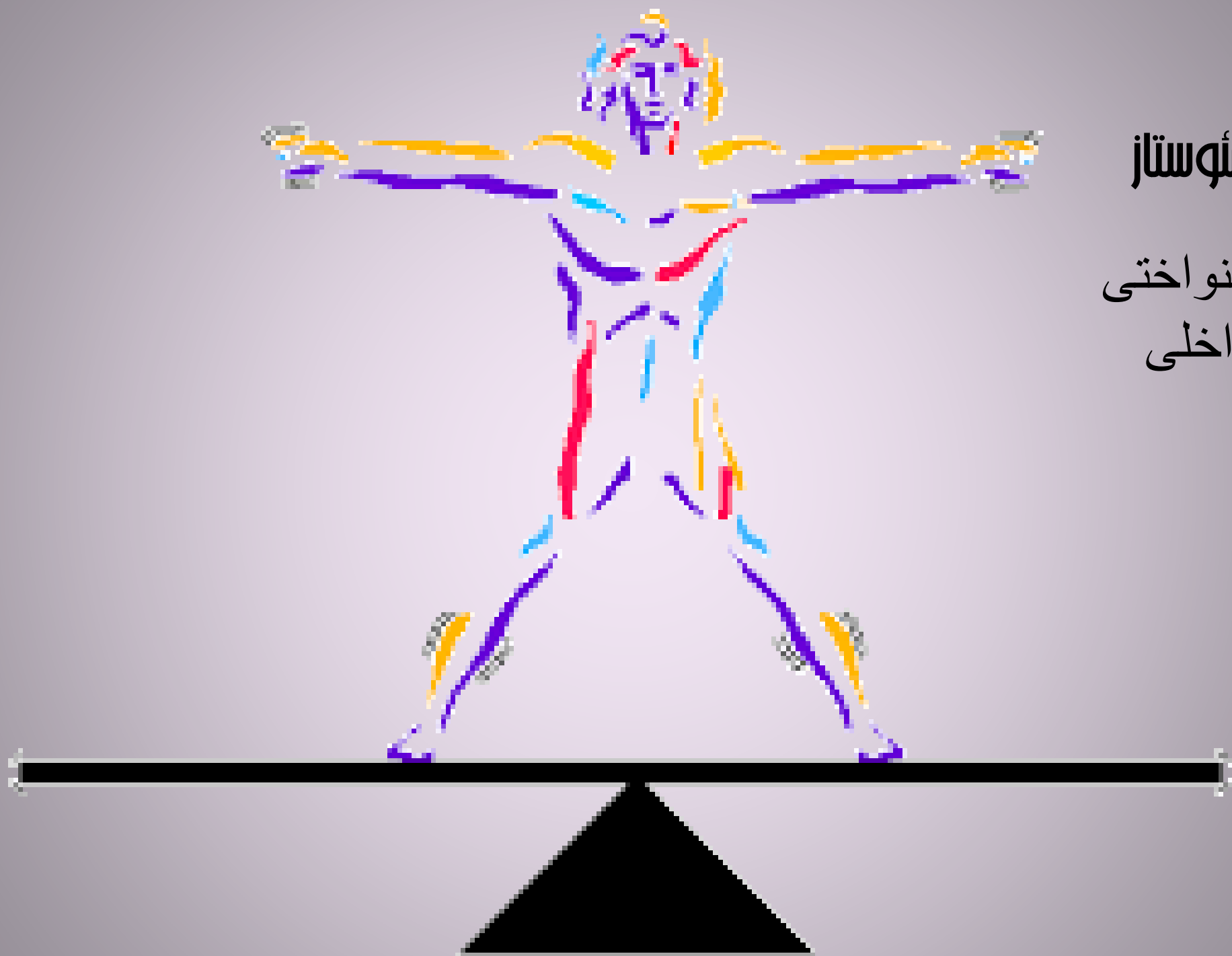
A. Unicellular organism in the constant external environment of the primordial sea



B. Maintenance of a stable internal environment in humans

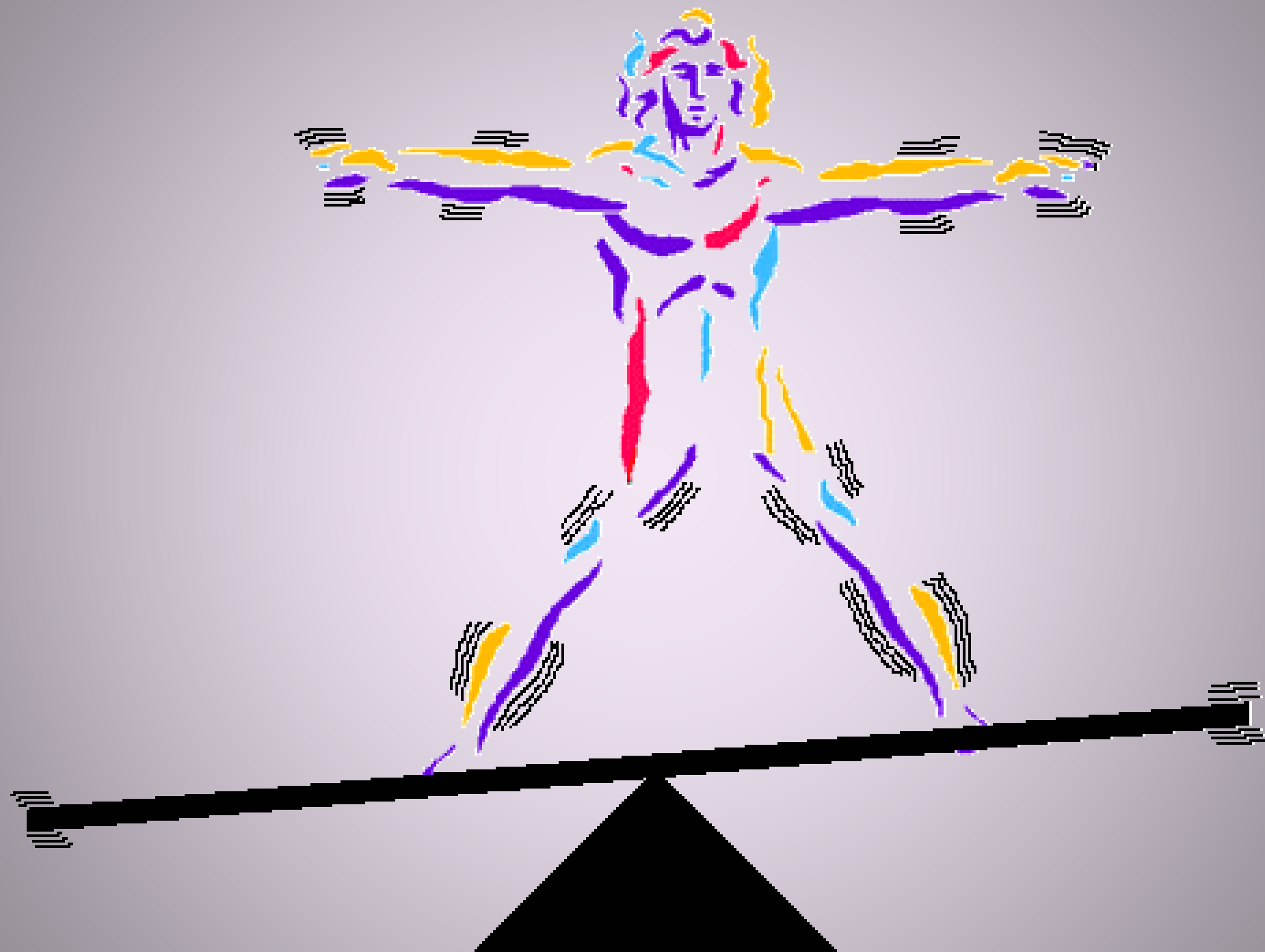


محيط داخلي

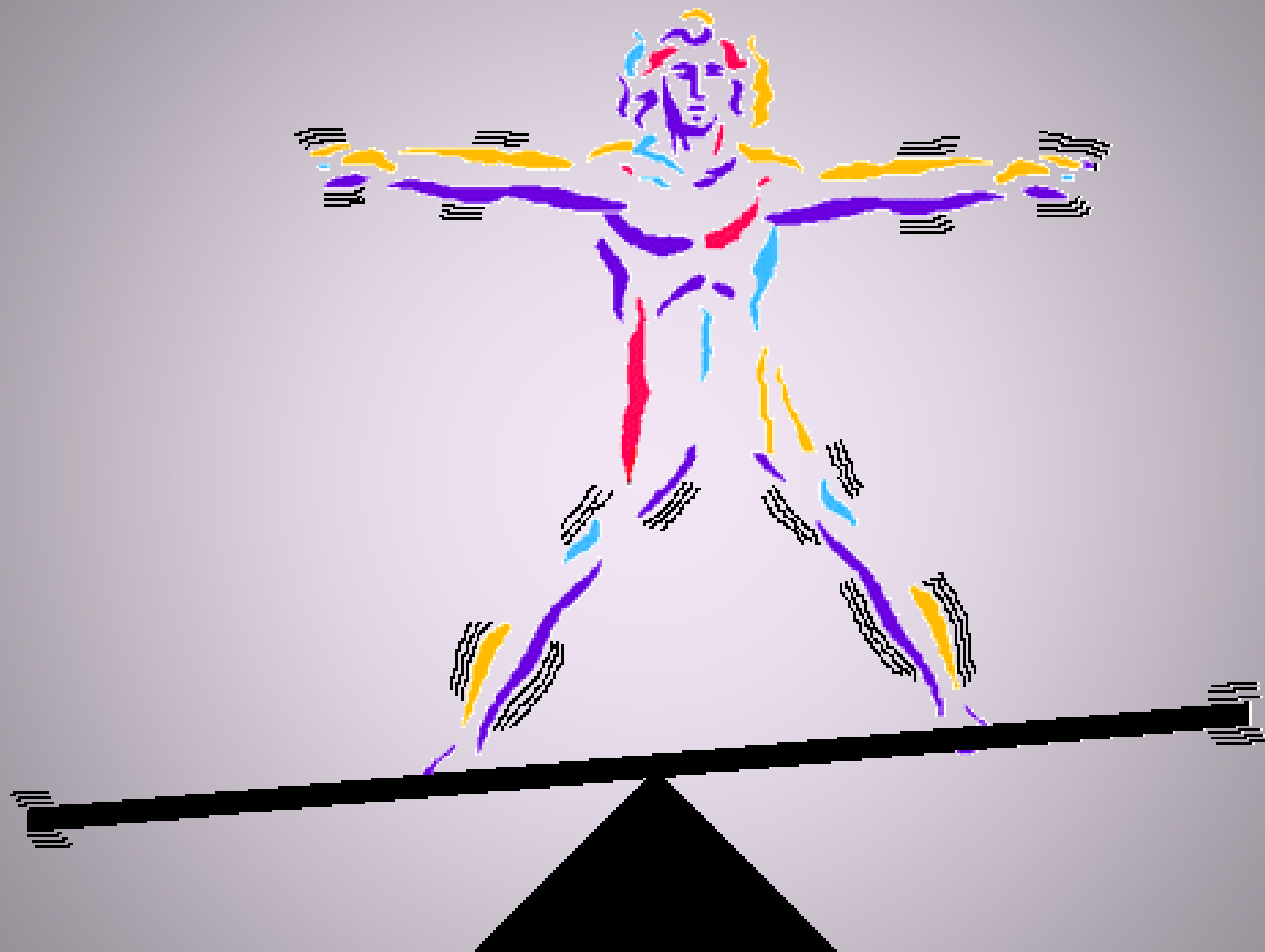


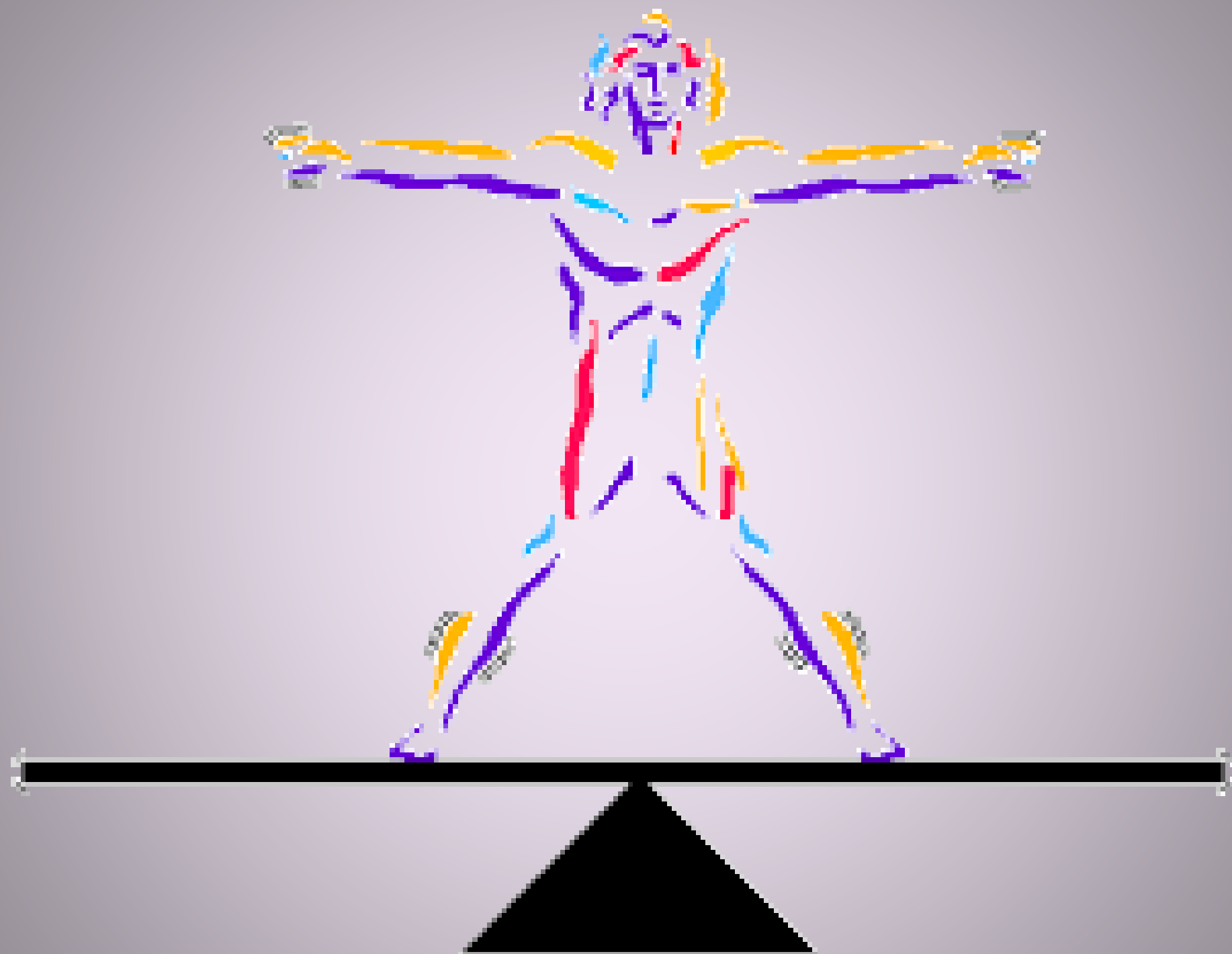
هه مئو ستاز

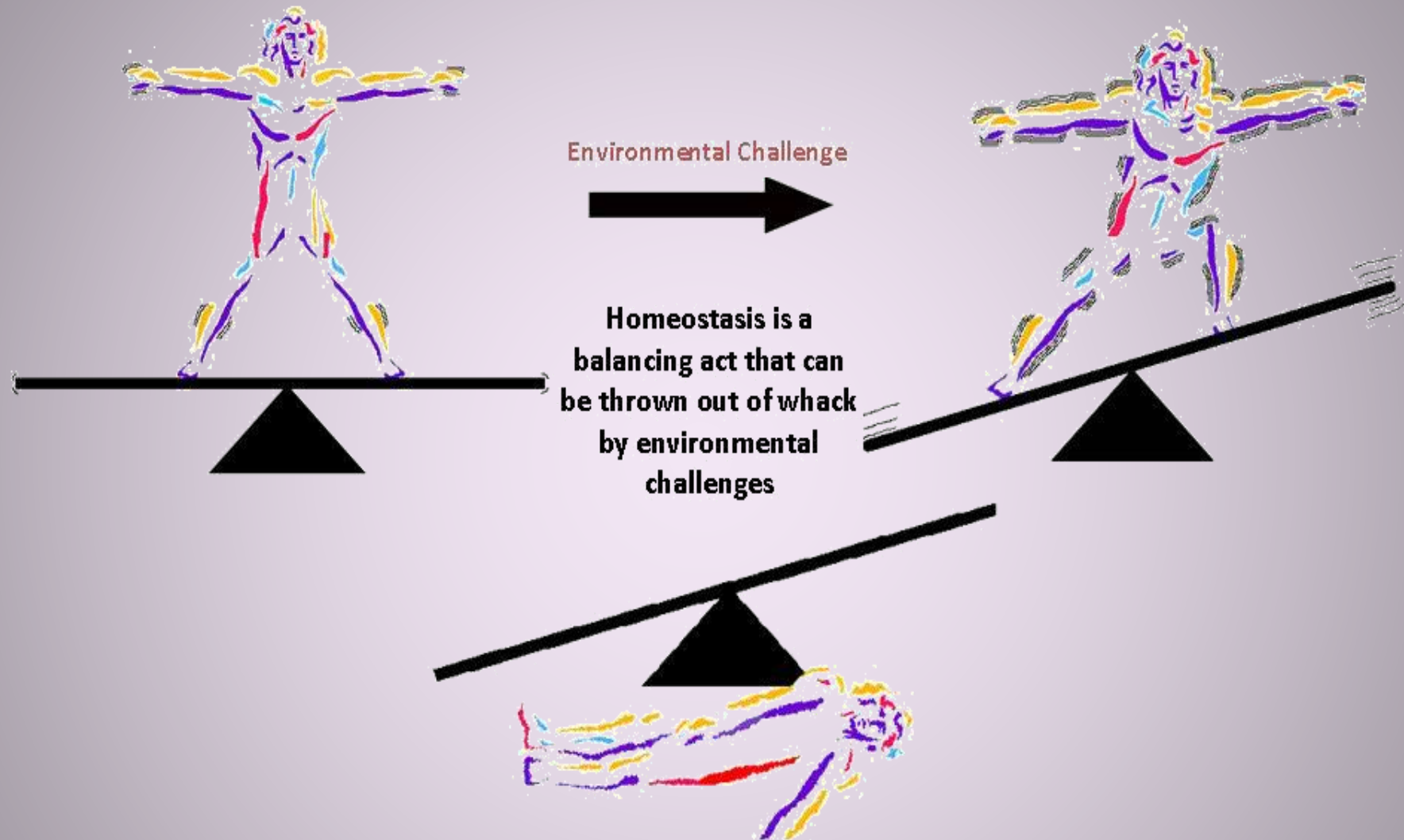
- حفظ یکنواختی
محیط داخلی







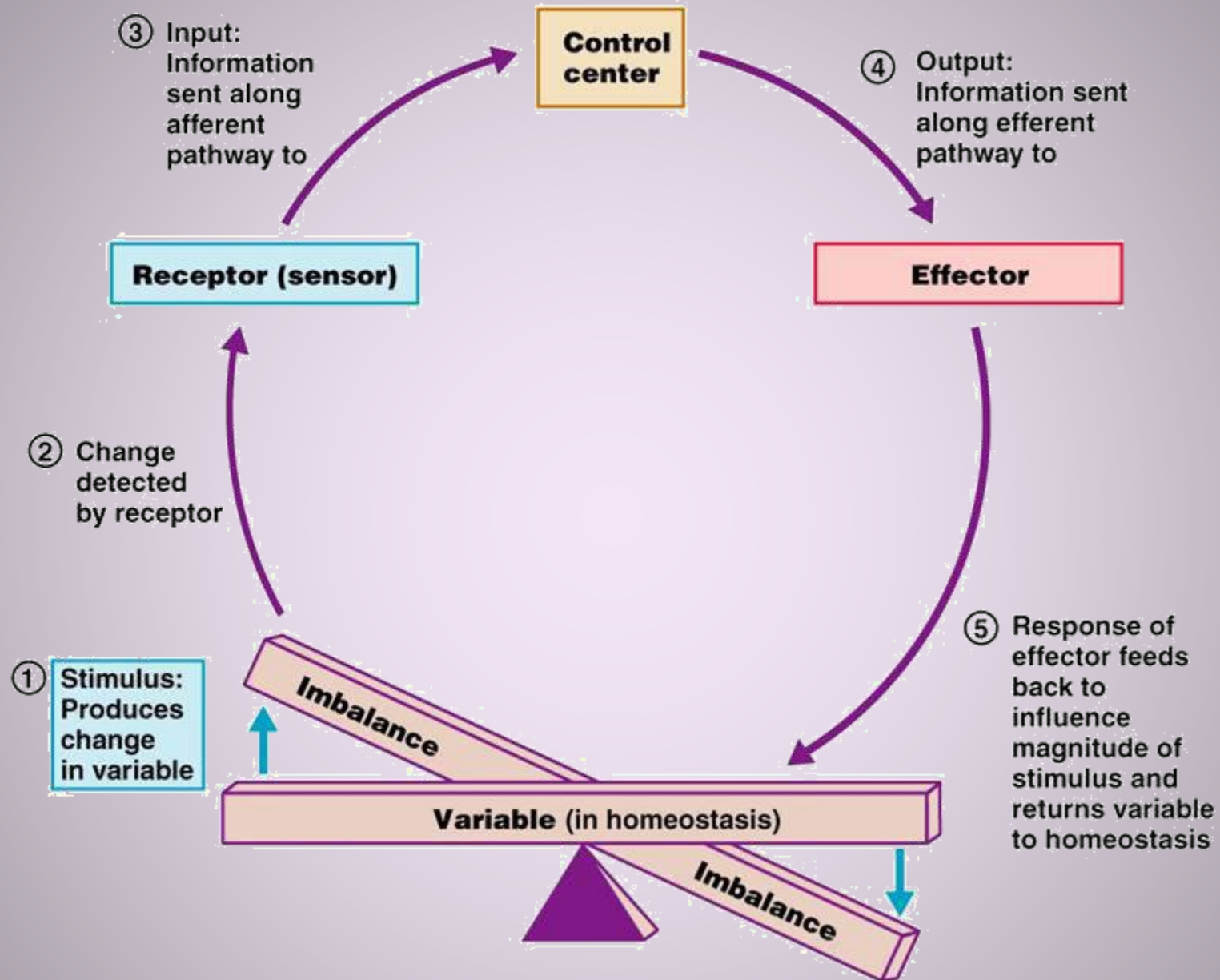


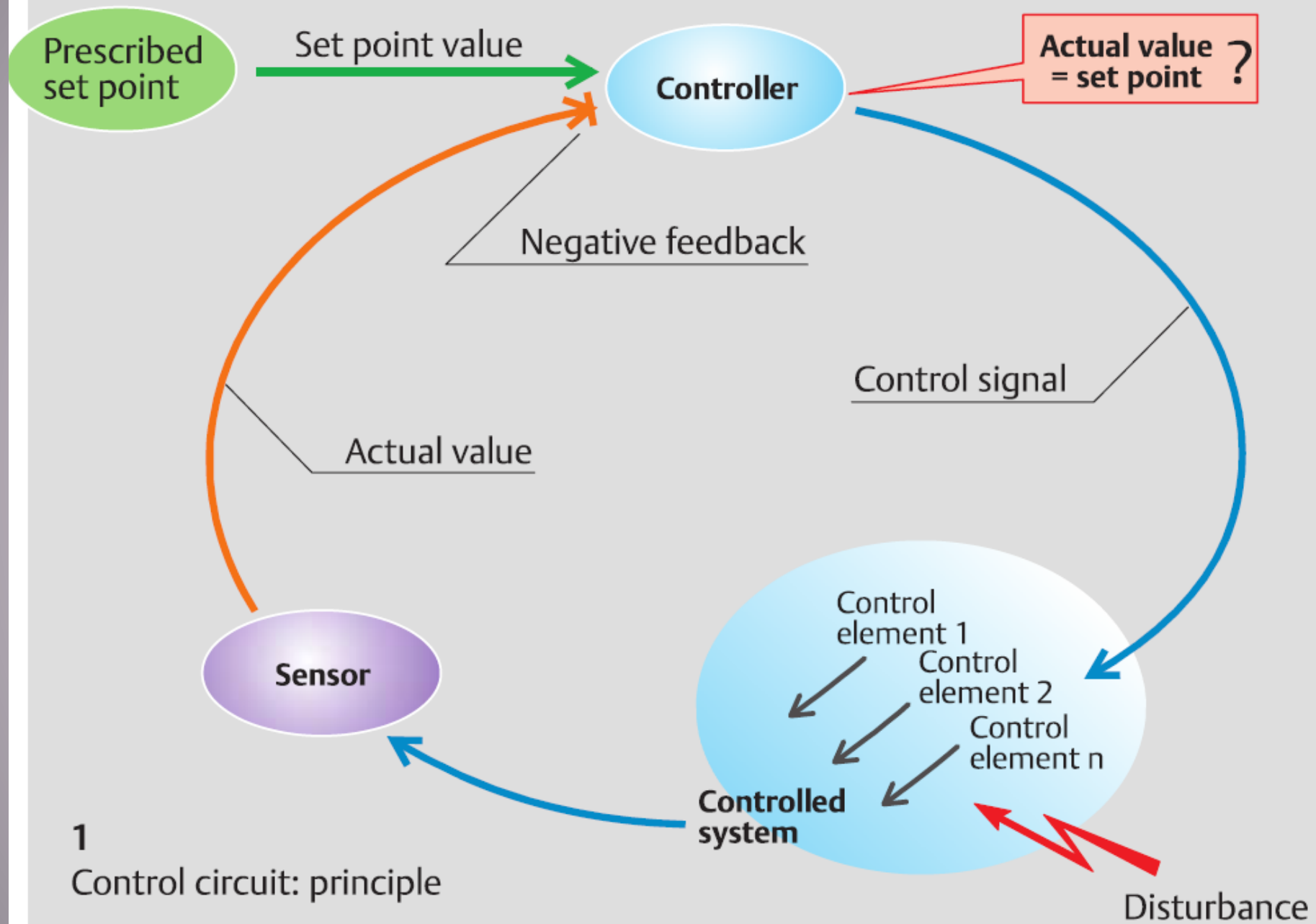


Environmental Challenge

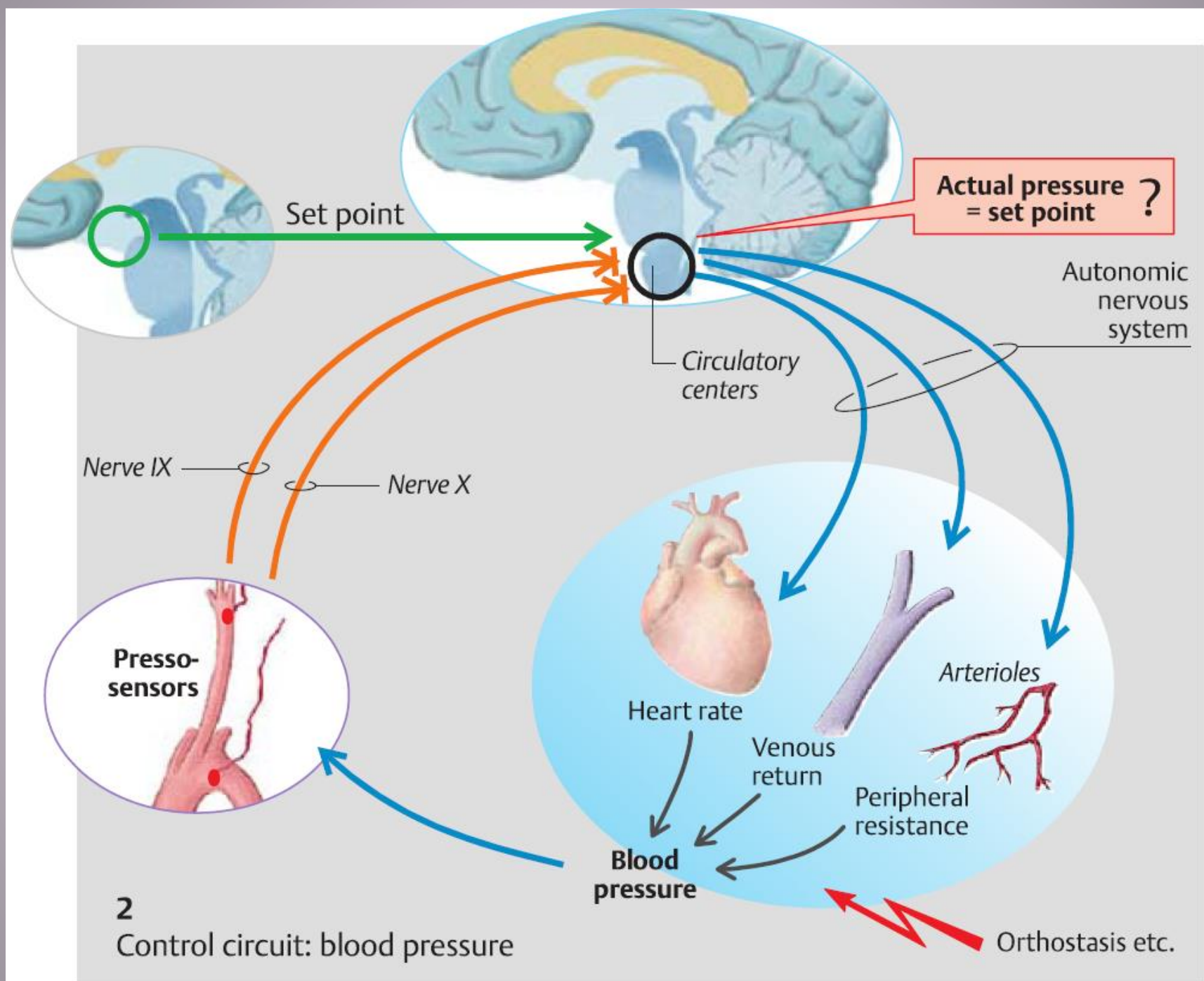
Homeostasis is a
balancing act that can
be thrown out of whack
by environmental
challenges

If the system cannot restore balance, it can
lead to death! (Credit: tollecausam.com)

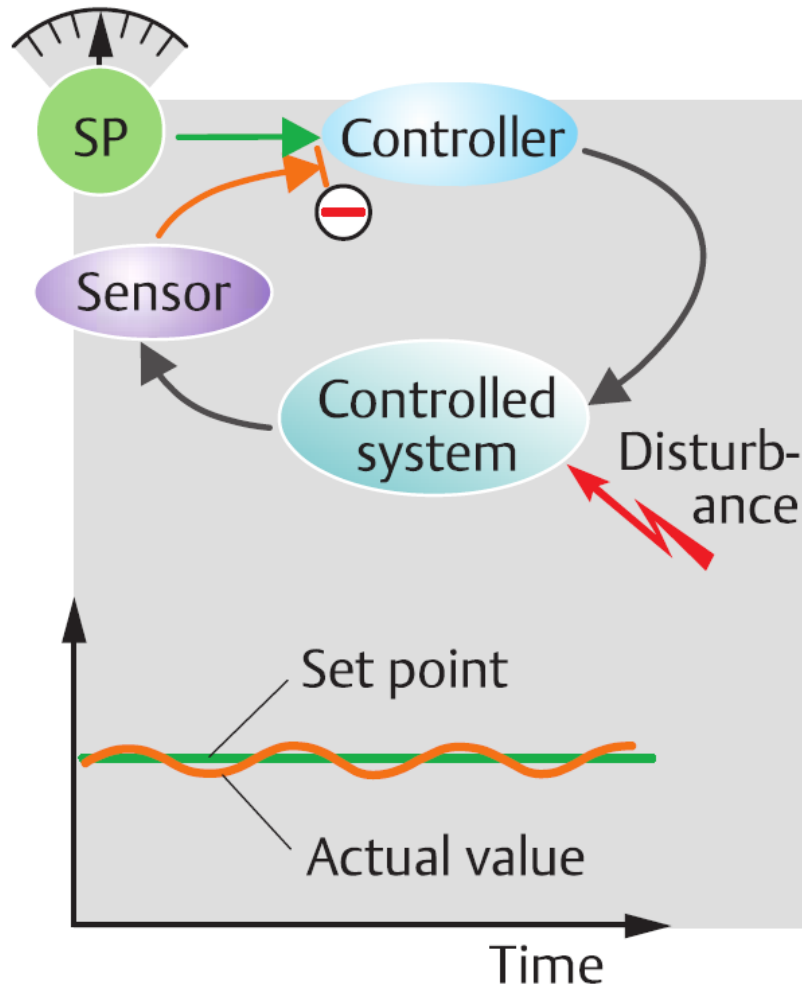




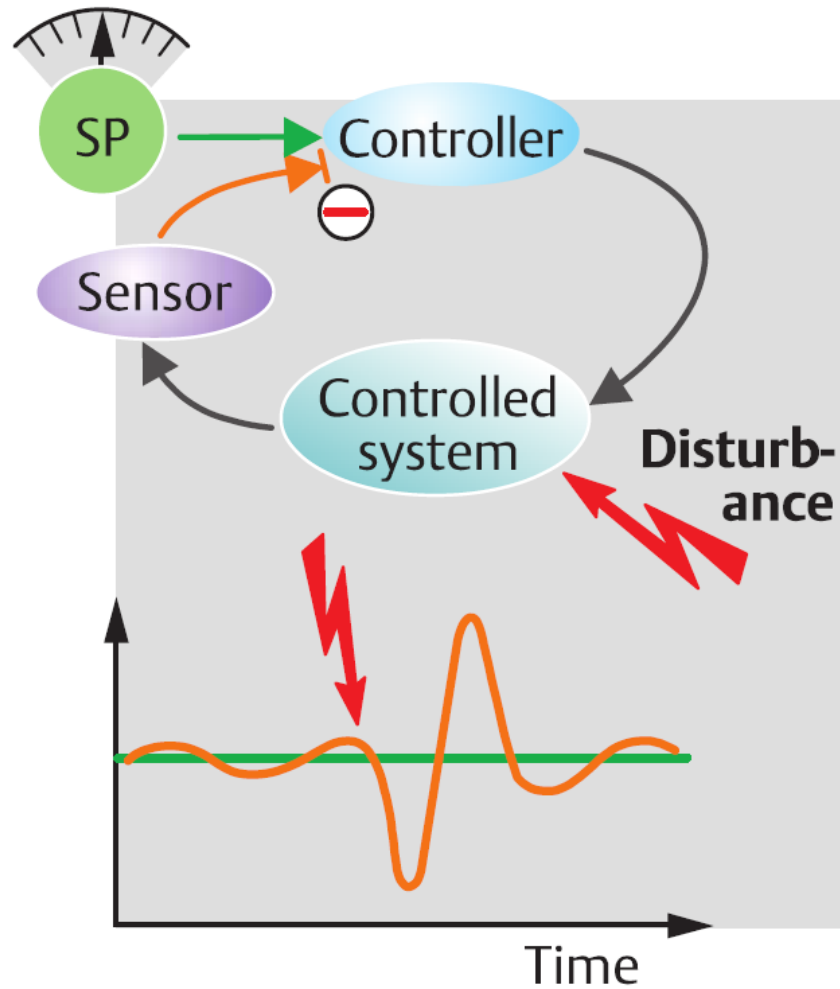
1
Control circuit: principle



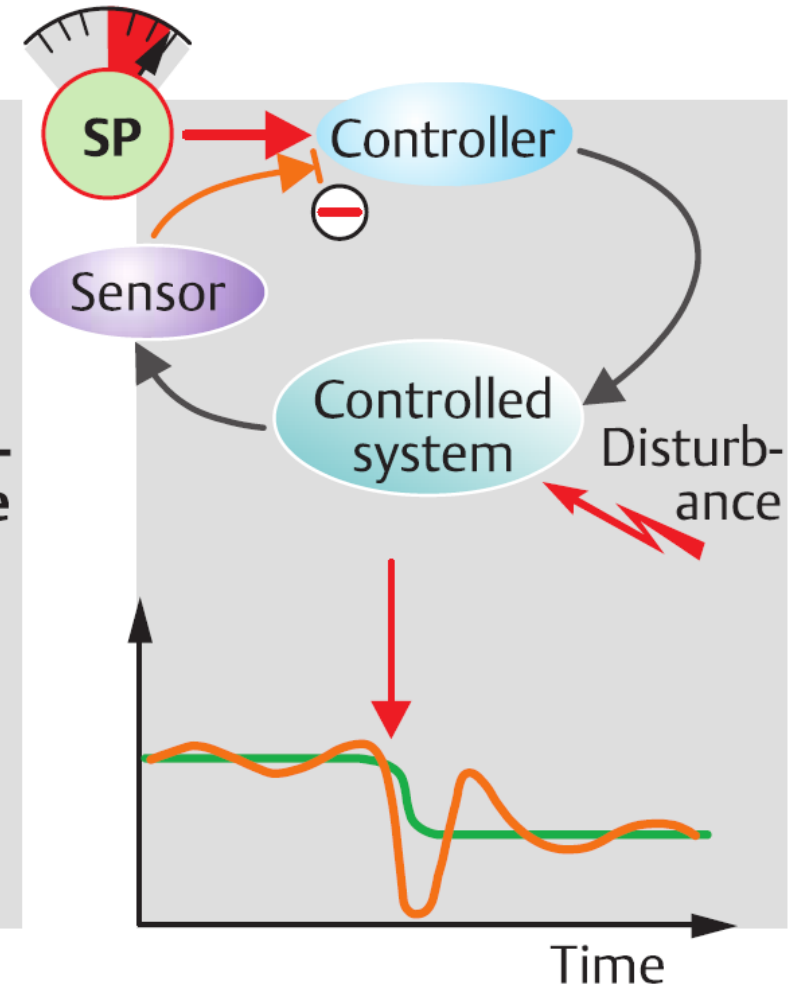
D. Control circuit response to disturbance or set point (SP) deviation



1 Stable control

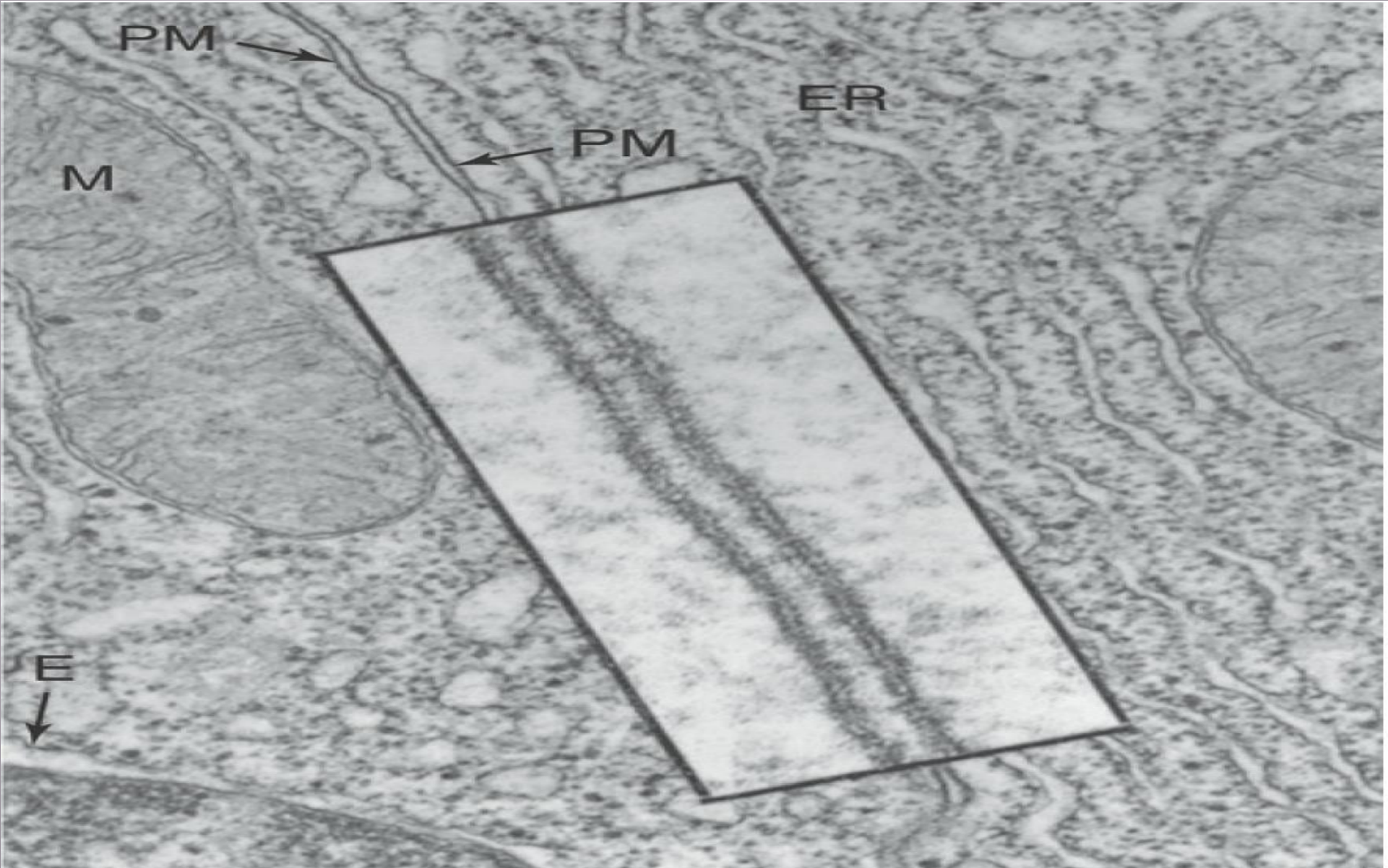


2 Strong disturbance



3 Large set point shift

غشای سلول



سلول ۱

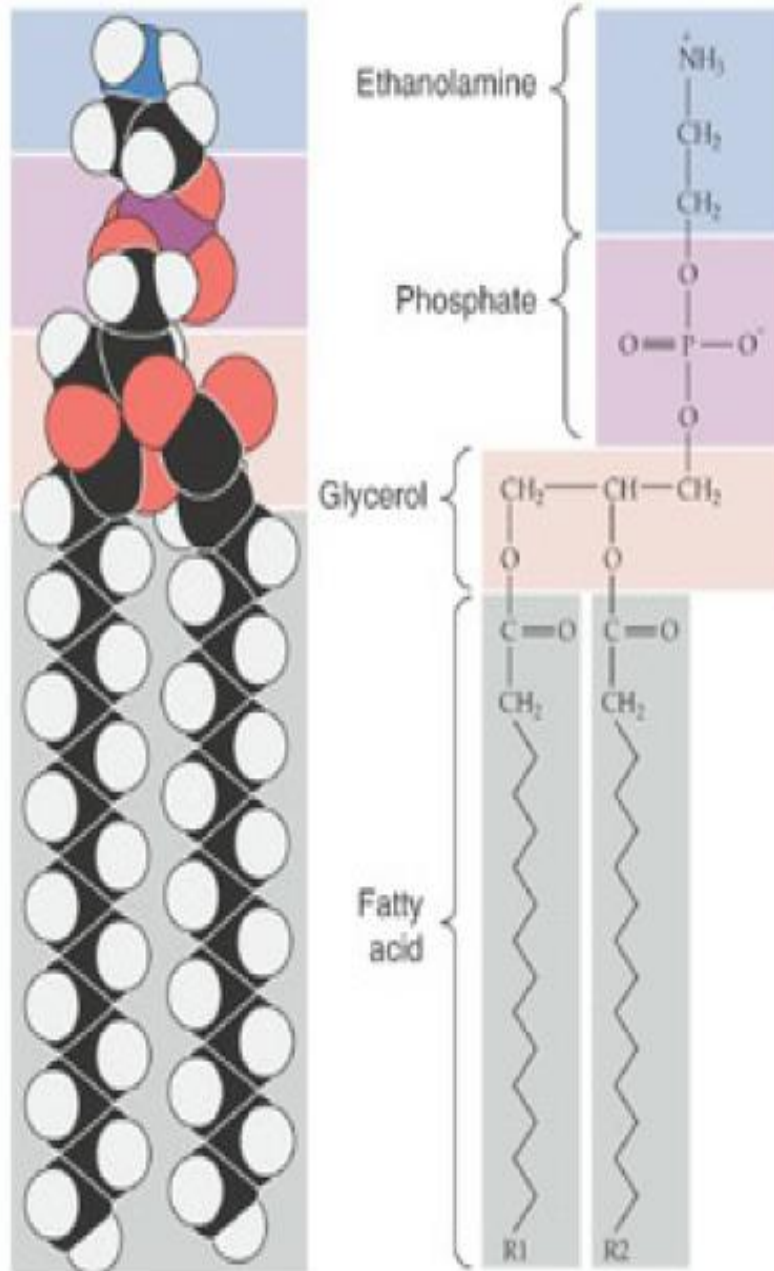
غشای پلاسمایی

فضای بین سلولی

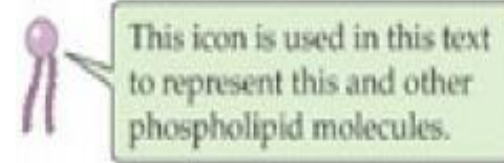
غشای پلاسمایی

2 سلول

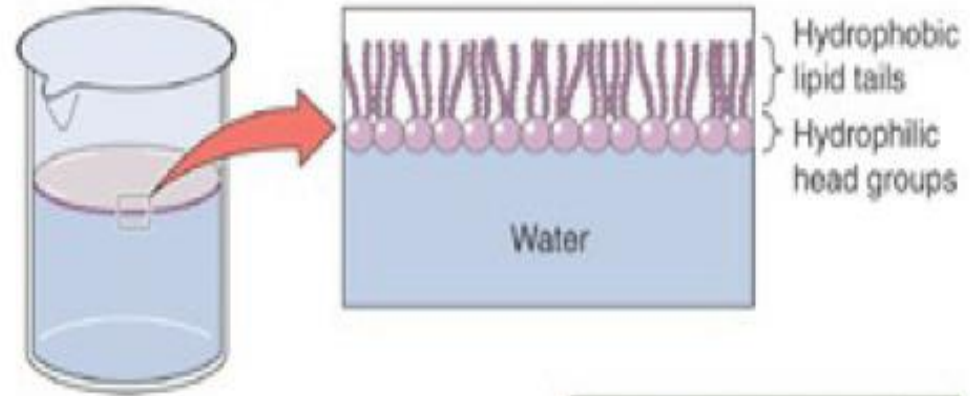
A PHOSPHATIDYLETHANOLAMINE



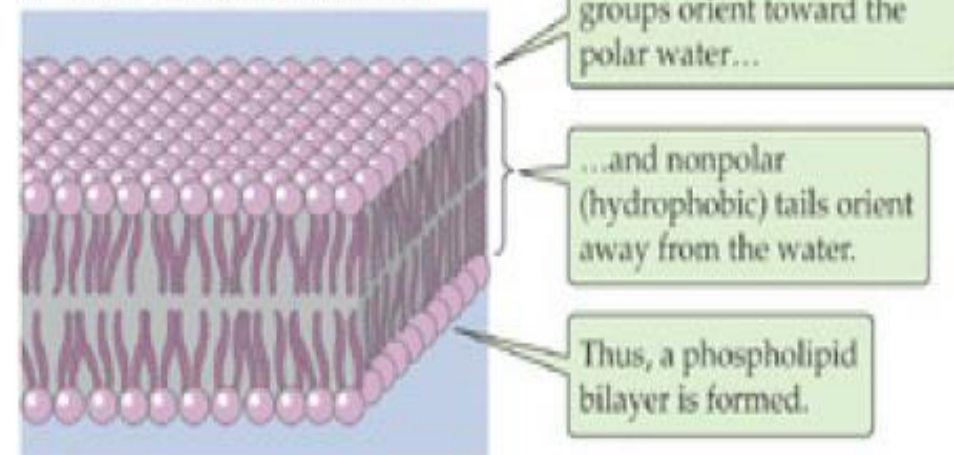
B PHOSPHOLIPID ICON



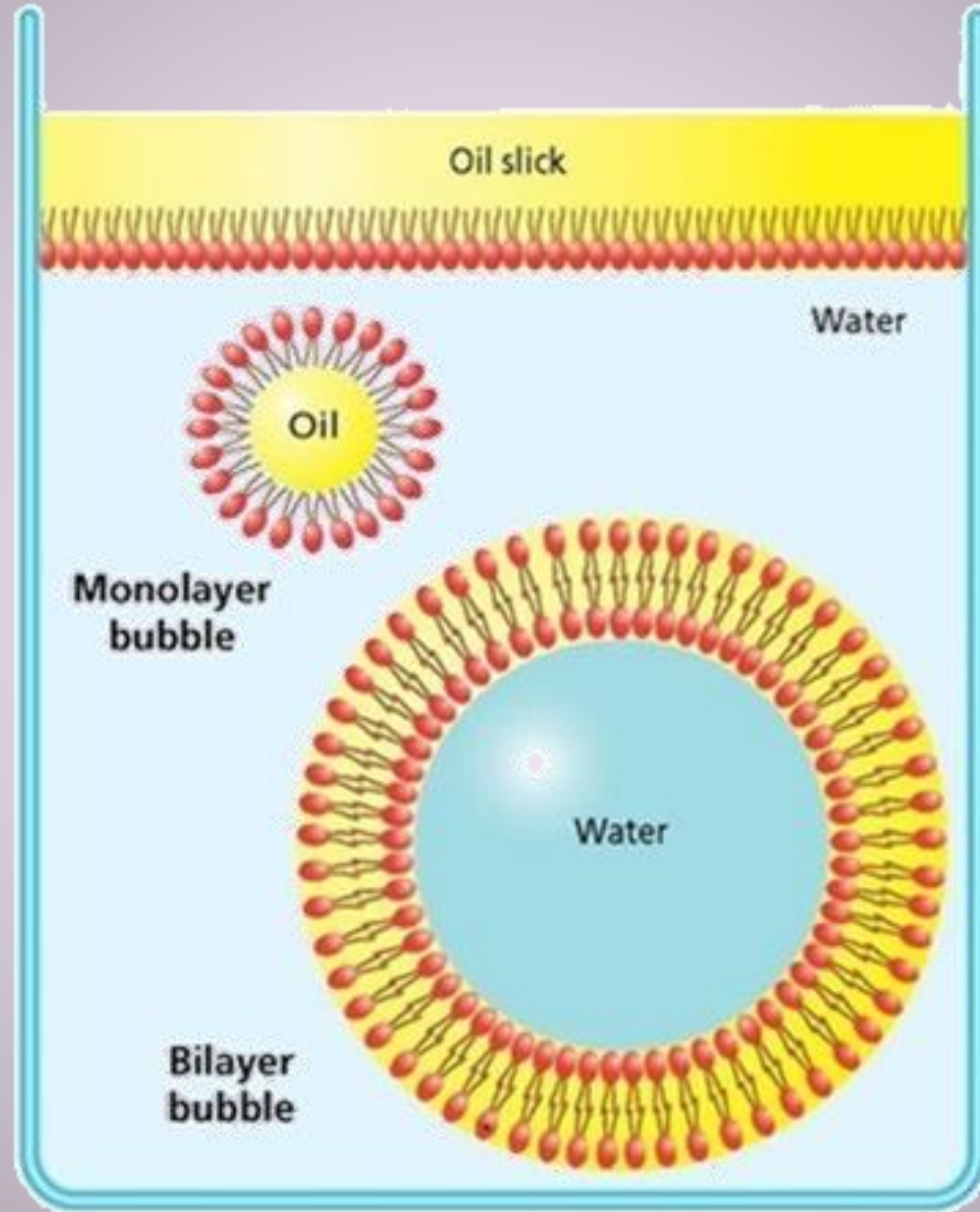
C MONOLAYER



D PHOSPHOLIPID BILAYER

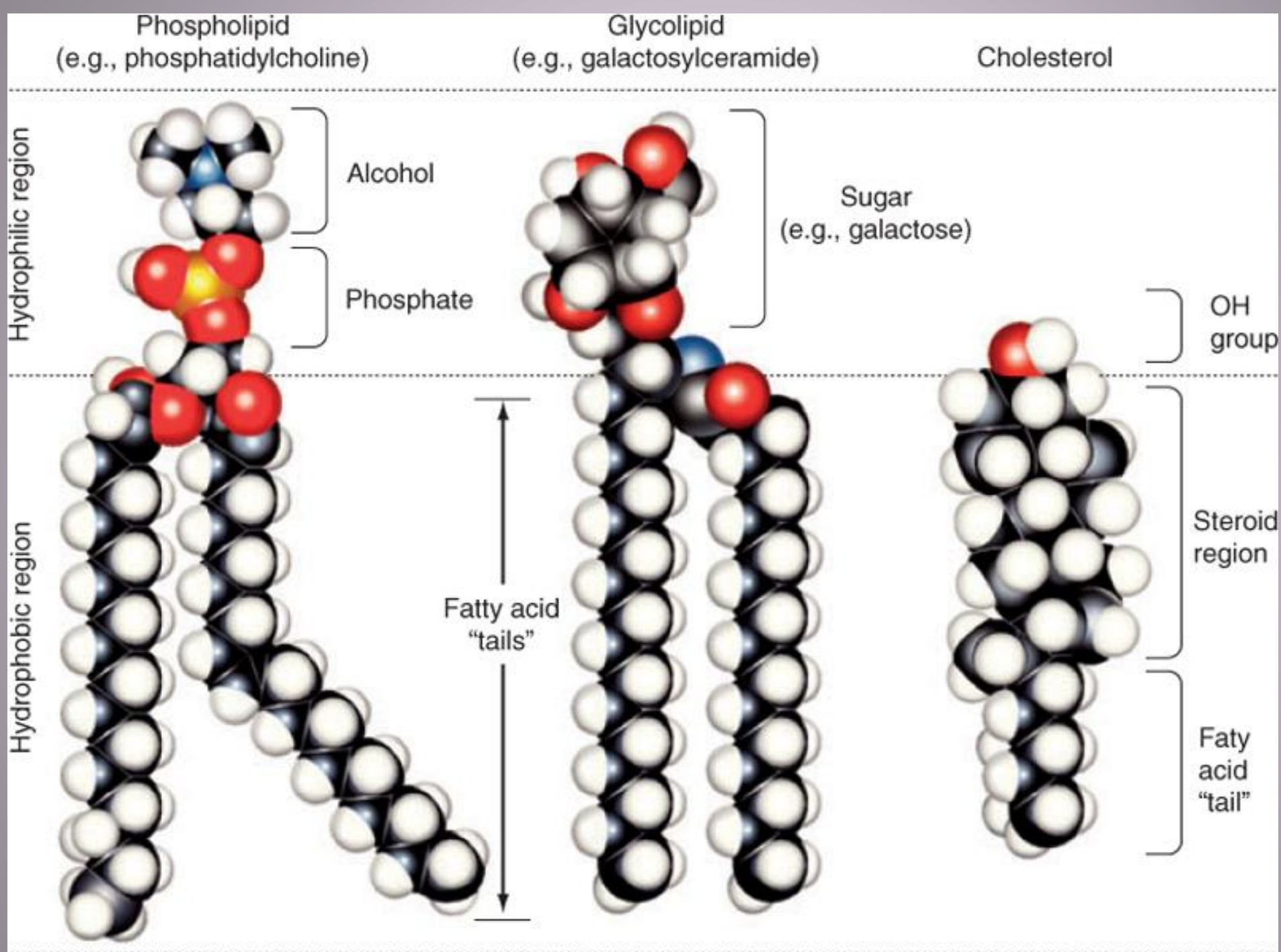


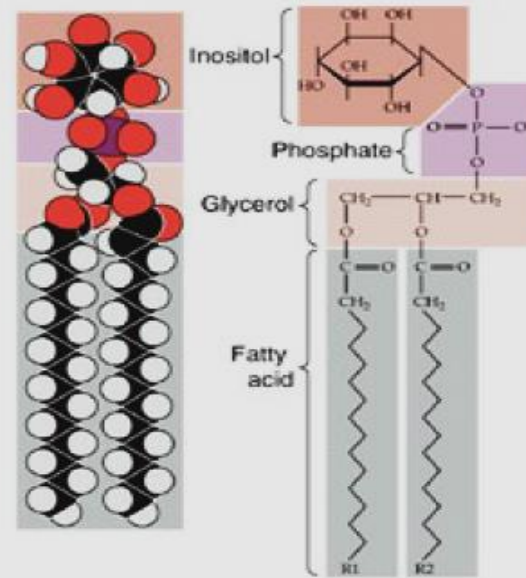
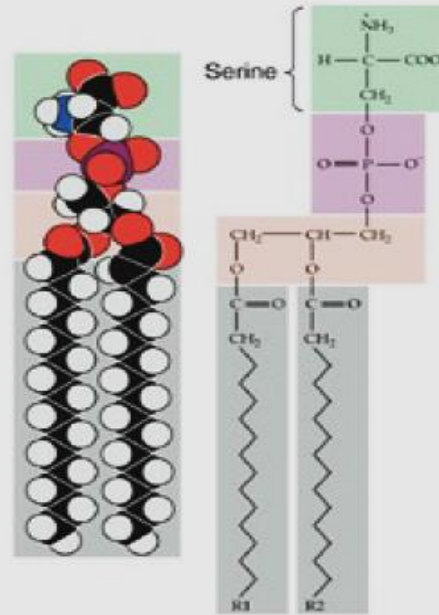
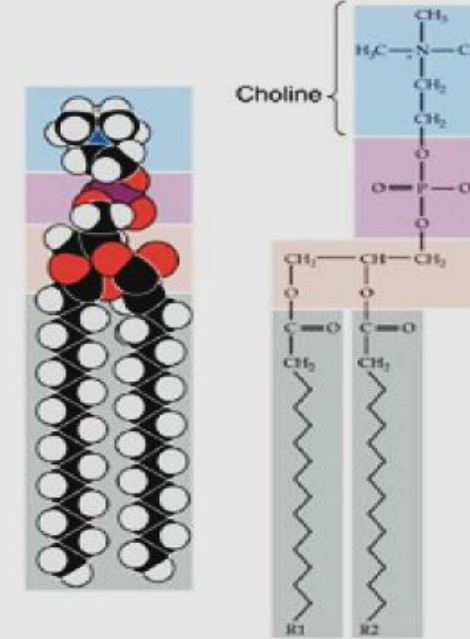
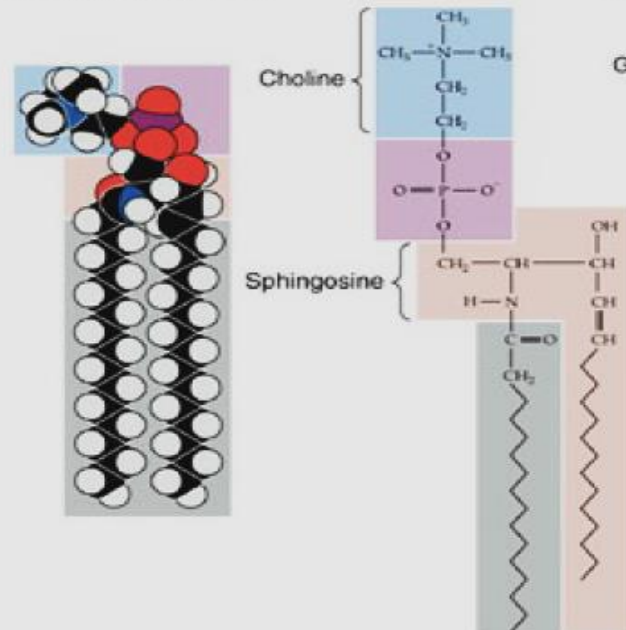
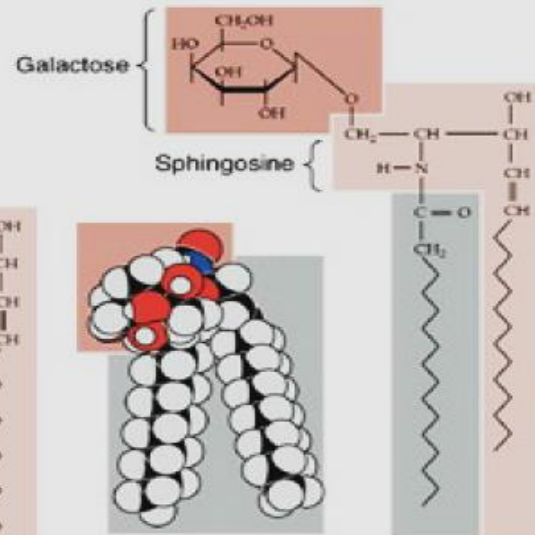
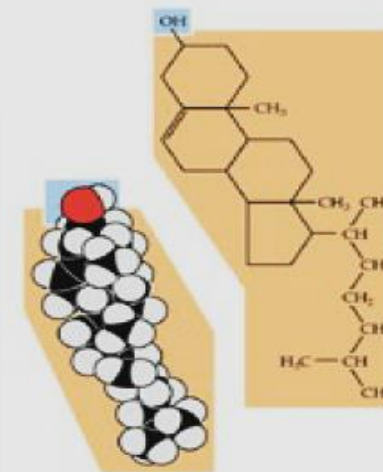
غشاء دوائی چربی



غشاء دوتایی چربی

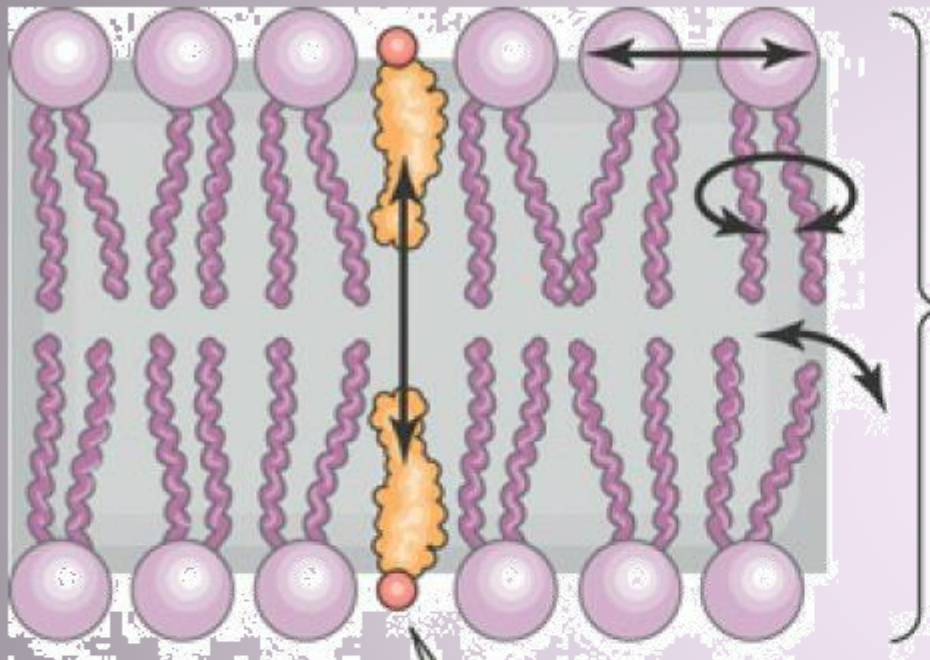
انواع چربی‌های غشای



A PHOSPHATIDYLINOSITOL**B PHOSPHATIDYLSERINE****C PHOSPHATIDYLCHOLINE****D SPHINGOMYELIN****E GALACTOCEREBROSIDE****F CHOLESTEROL**

انواع چربیهای غشای

حرکت مولکولهای چربی در غشاء

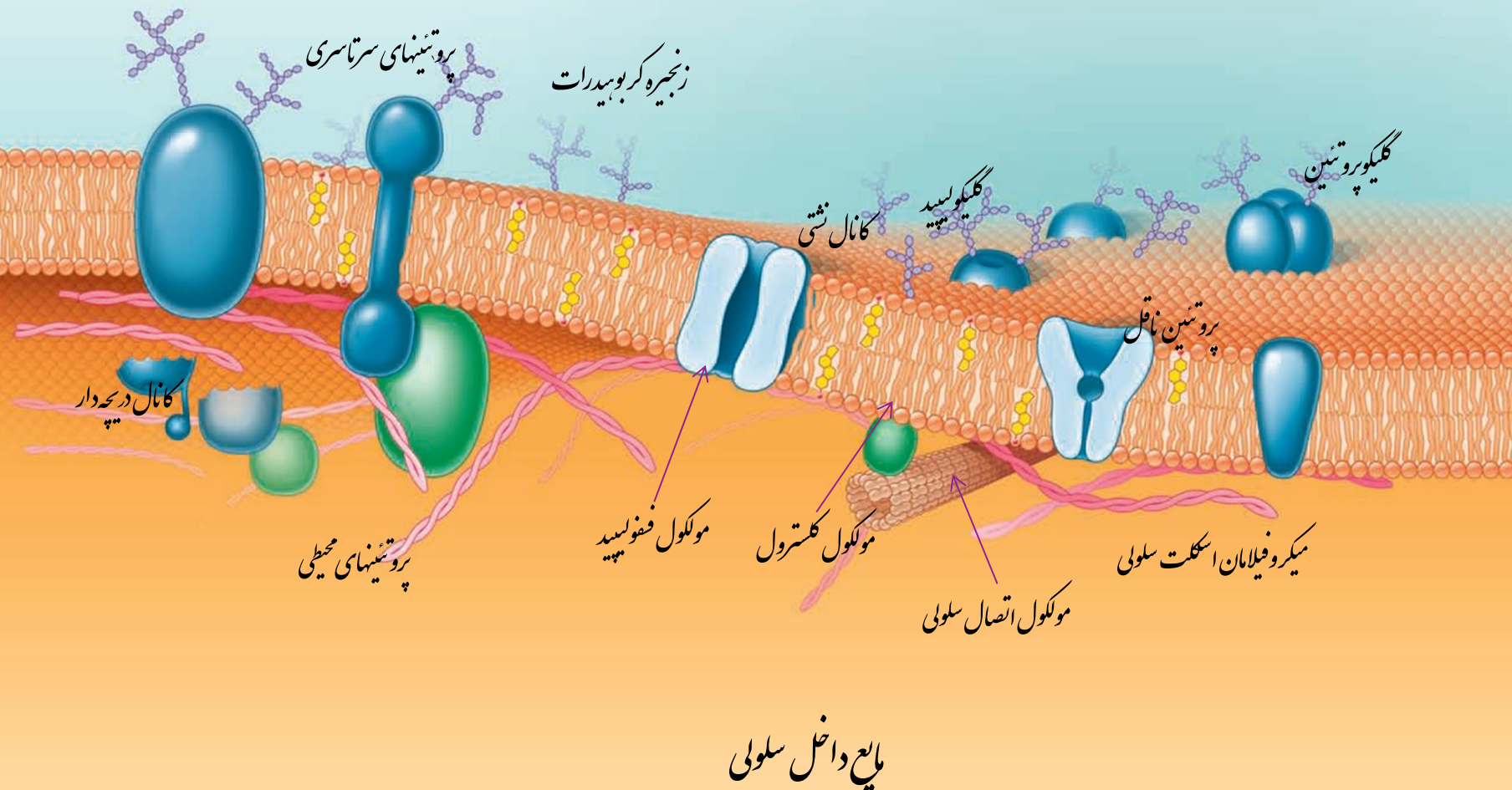


Phospholipids can move laterally, rotate, or flex. Rarely do they flip to the other leaflet.

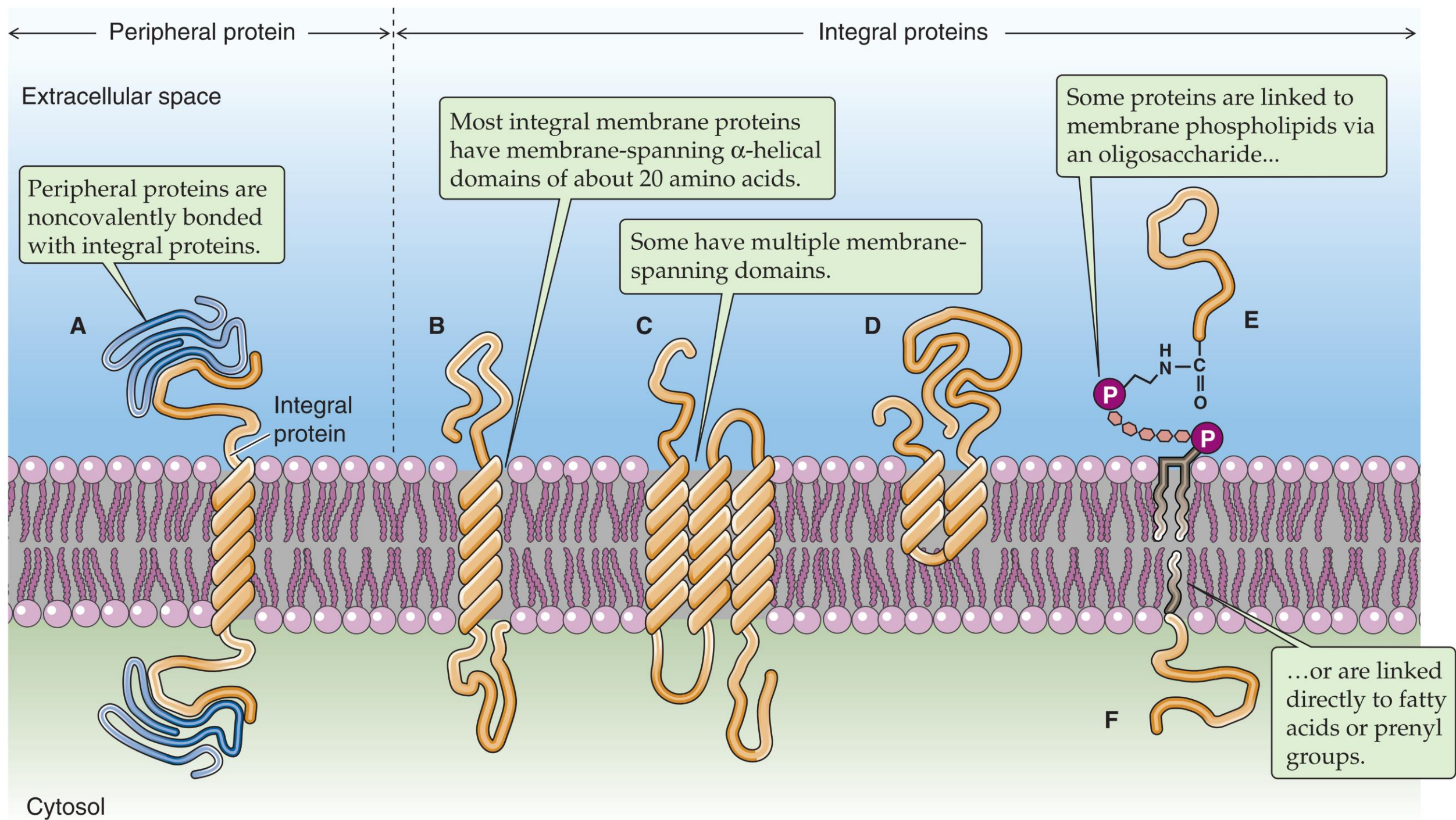
Cholesterol aids in stiffening the membrane and can flip easily.

ساختار غشاء

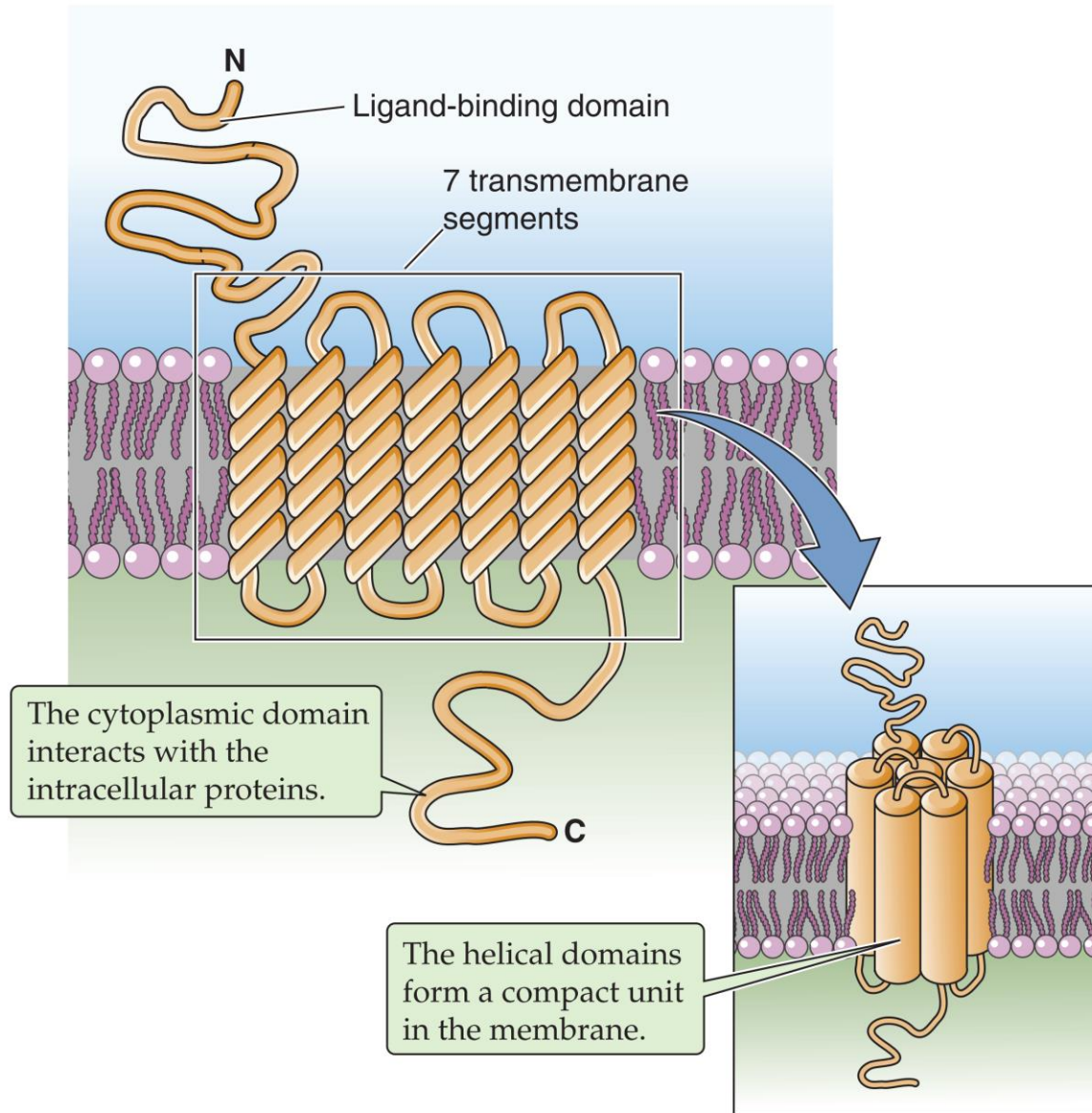
بایع خارج سلولی



- چربی
 - فسفولیپید
 - کلسترول
- پروتئین
 - ساختاری
 - محیطی
- کربوهیدرات
 - گلیکوپروتئین
 - گلیکولیپید



A LIGAND-BINDING RECEPTOR



B CELL-MATRIX ADHESION MOLECULE (INTEGRIN)

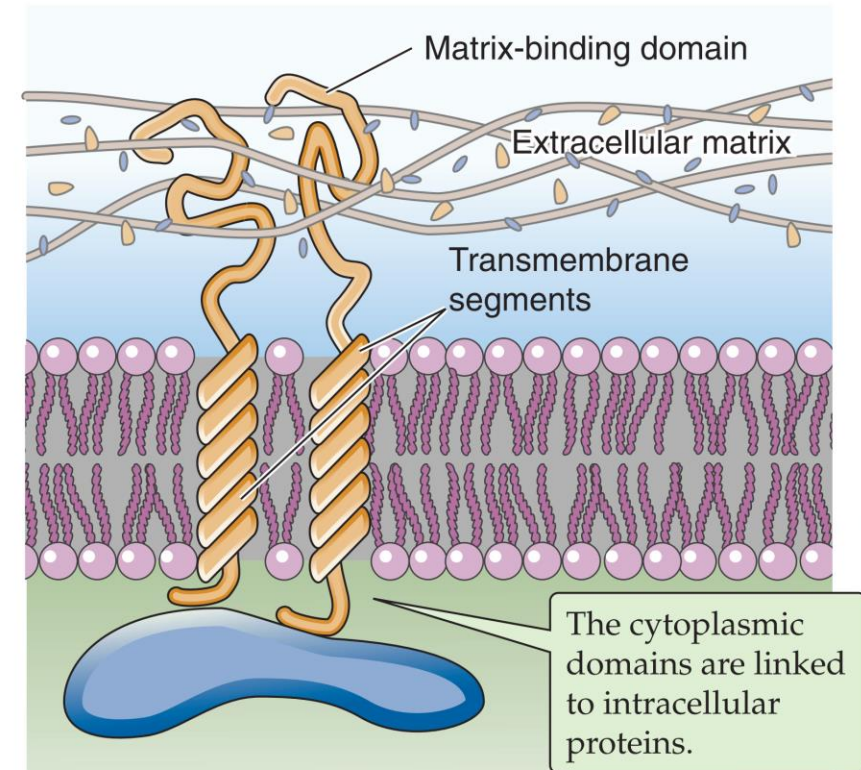
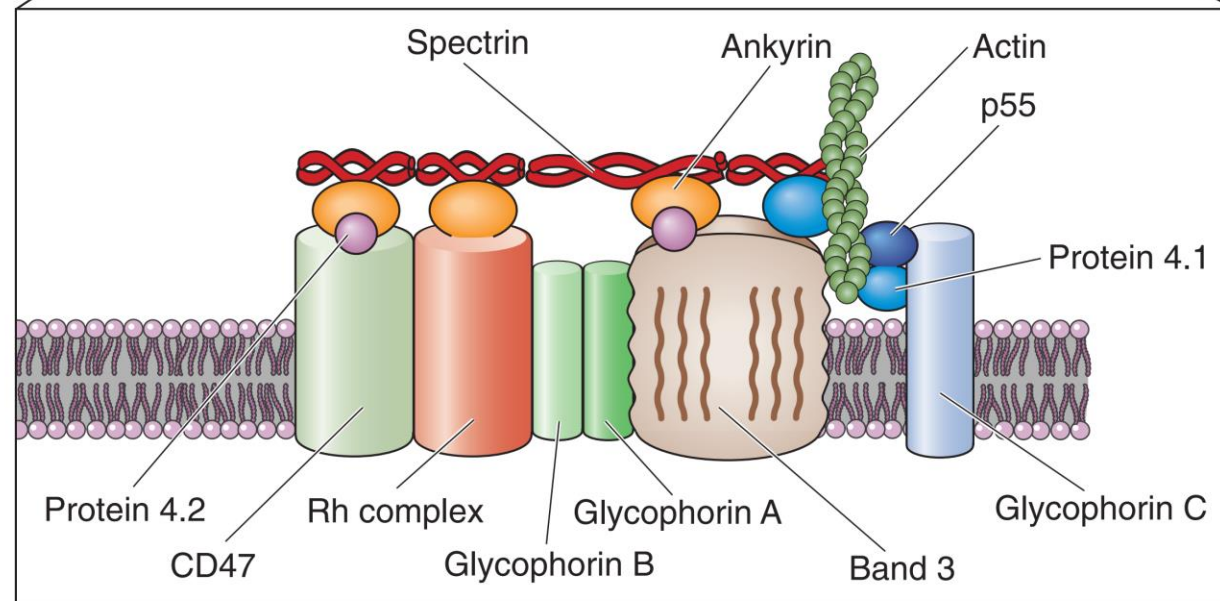
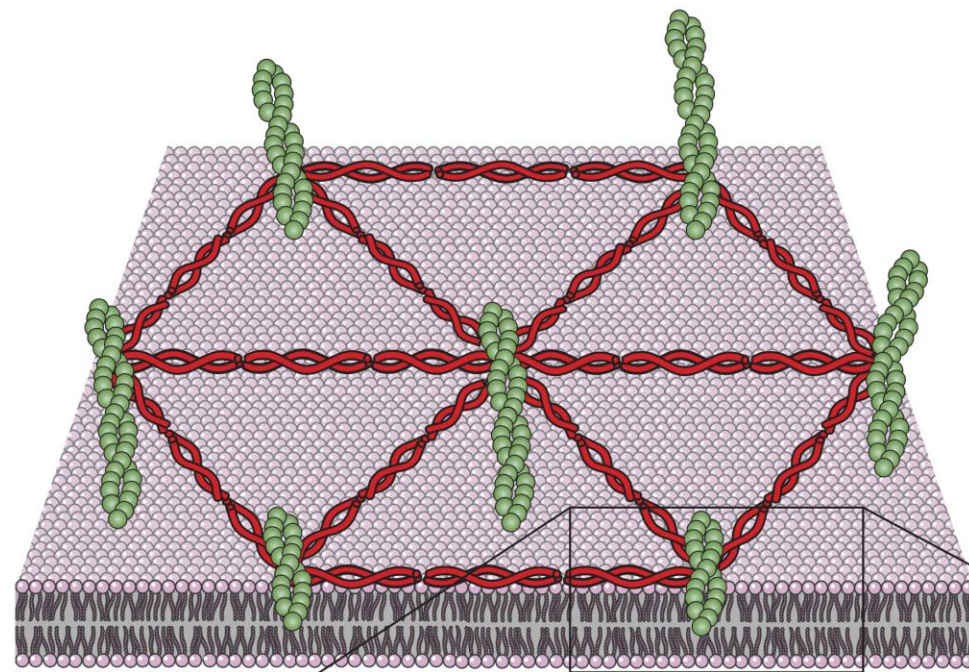
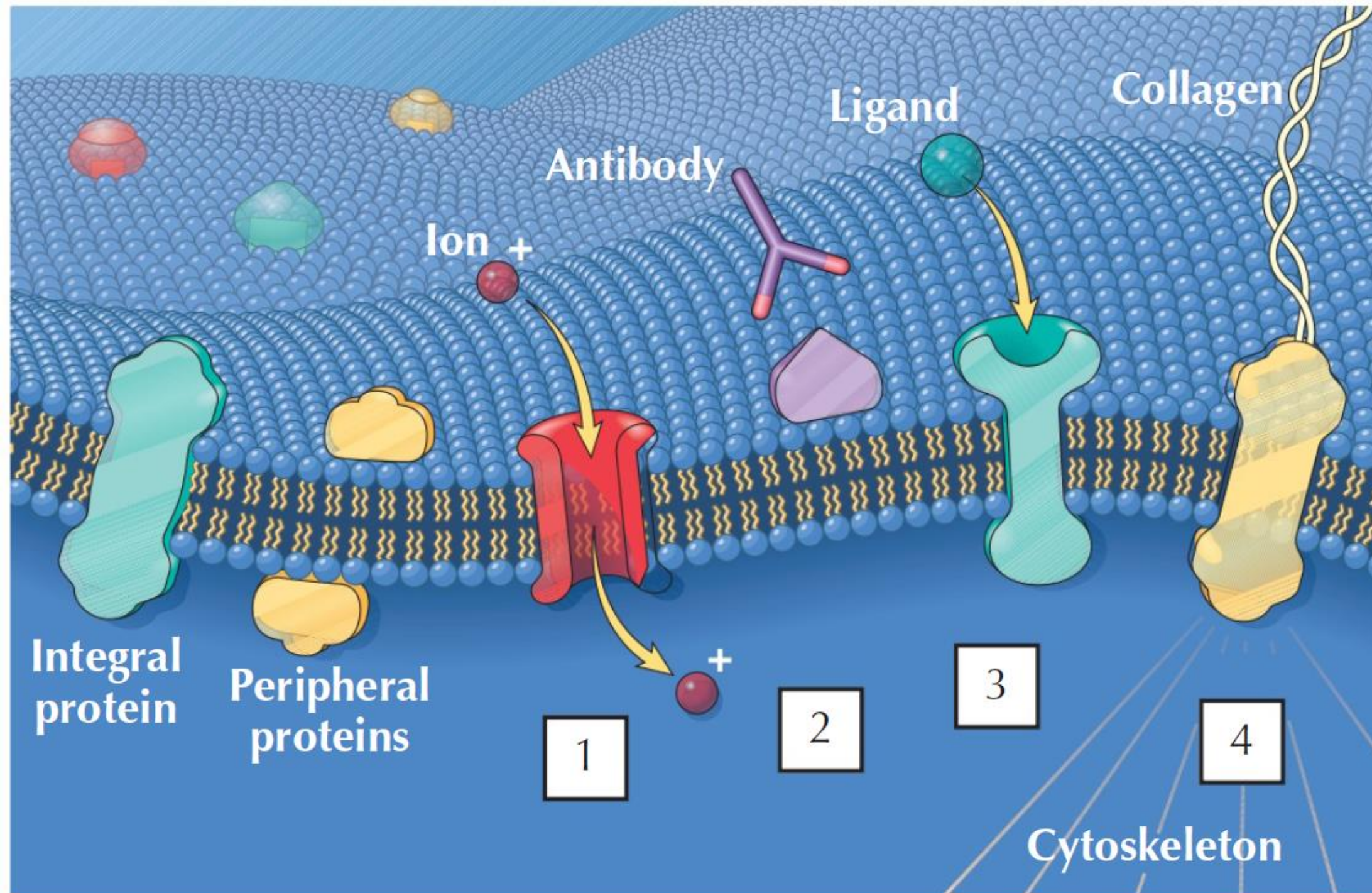


Figure 2-7 Integral membrane proteins that transmit signals from the outside to the inside of a cell.
A, The ligand may be a hormone, a growth factor, a neurotransmitter, an odorant, or another local mediator.
B, An integrin is an adhesion molecule that attaches the cell to the extracellular matrix.

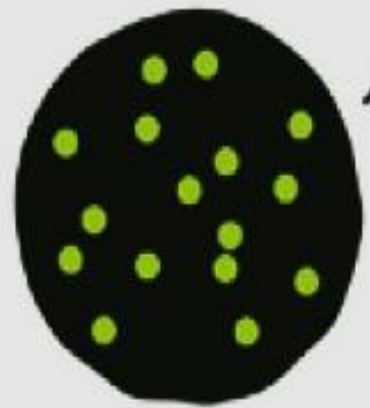
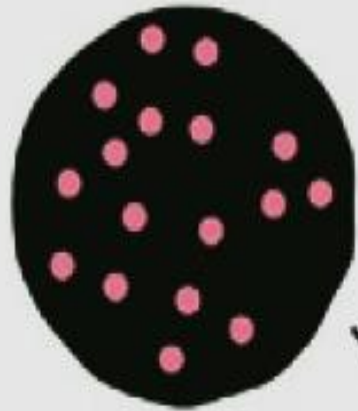


اعمال پروتئینهای غشای



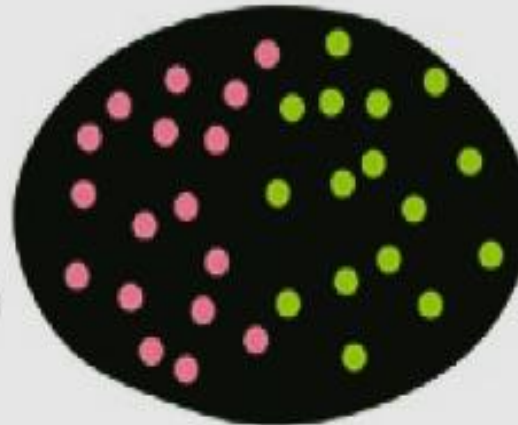
حرکت مولکولهای پروتئین در غشاء

Rhodamine-tagged
membrane proteins

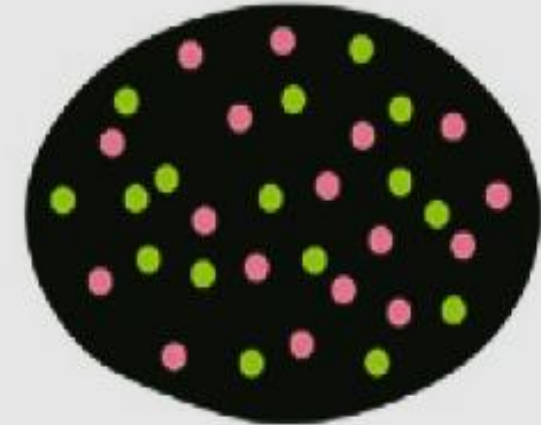


Fluorescein-tagged
membrane proteins

Cell fusion



Immediately
after cell fusion



After about $\frac{1}{2}$ hour,
tagged proteins spread
throughout the membrane.