

## 1. Complete the table

1. An enzyme that catalyzes the conversion of adenosine triphosphate (ATP) to cyclic AMP (cAMP)	
2. An enzyme, which removes a phosphate group from the phosphorylated amino acid residue of the protein	
3. The signaling molecule, produced by endocrine cells, that is transported by the circulatory system to target cells to regulate their physiology	
4. Female sex hormone that binds to the intracellular receptor	
5. The molecule that binds the ligand	
6. An enzyme which is responsible for the phosphorylation of proteins	
7. The ligand capable of binding to a specific receptor but not activating it	

A. Estrogen

B. Receptor

C. Adenylyl cyclase

D. Kinase

E. Hormone

F. Phosphatase

G. Antagonist

## 2. Complete the table

1. The process when the signal is converted from one form to another	
2. The calcium-binding protein, activates CaM-kinases	
3. Cytoplasmic tyrosine kinase, activated by cytokine receptors	
4. The process induced by death receptors	
5. Enzyme responsible for the formation of inositol trisphosphate (IP3) and diacylglycerol (DAG)	
6. First messenger that acts in synaptic communication	
7. Amino acid that is phosphorylated by protein kinase A	
8. Monomeric GTP-binding protein, activated by receptors tyrosine kinase	

A. Ras

B. Phospholipase

C. Apoptosis

D. Jak

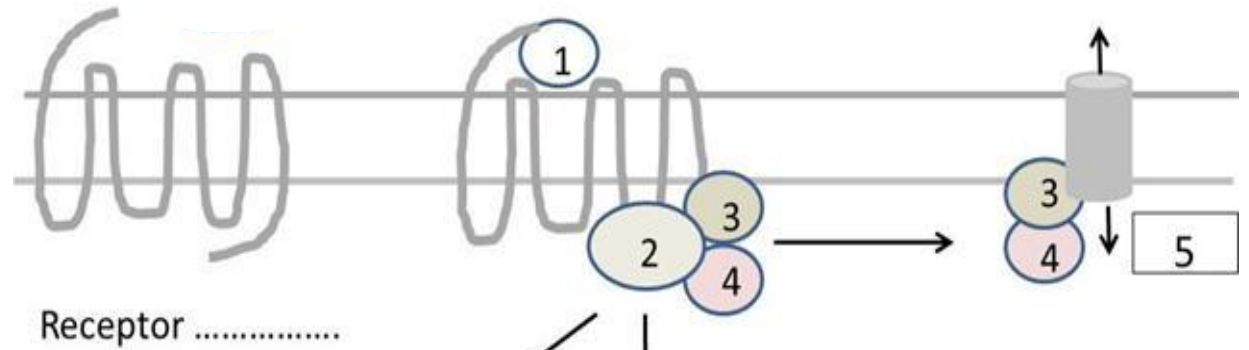
E. Calmodulin

F. Transduction

G. Neurotransmitter

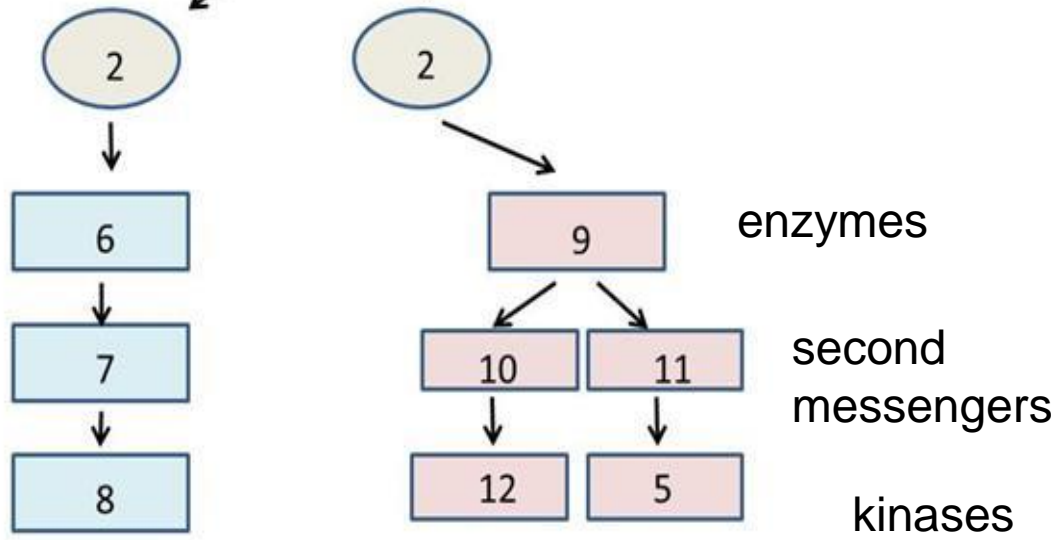
H. Serine

### 3. Complete the scheme.



Receptor -

- 1 -
- 2 -
- 3 -
- 4 -
- 5 -
- 6 -
- 7 -
- 8 -
- 9 -
- 10 -
- 11 -
- 12 -



G $\gamma$	ligand	adenylate cyclase	G $\beta$	diacyl glycerol (DAG)	G $\alpha$
cAMP	PKA - Protein kinase A	inositol trisphosphate (IP3)	calcium ions	Protein kinase C	G-protein-linked receptor

#### 4. Connect pairs:

1. endocrine communication
2. paracrine communication
3. metabolic connections
4. autocrine communication
5. juxtacrine communication

- A. contact- dependent signaling
- B. hormones
- C. information acts locally (cytokines)
- D. gap junctions
- E. receptor for the ligand is located on the surface of signaling cell

1 - .....

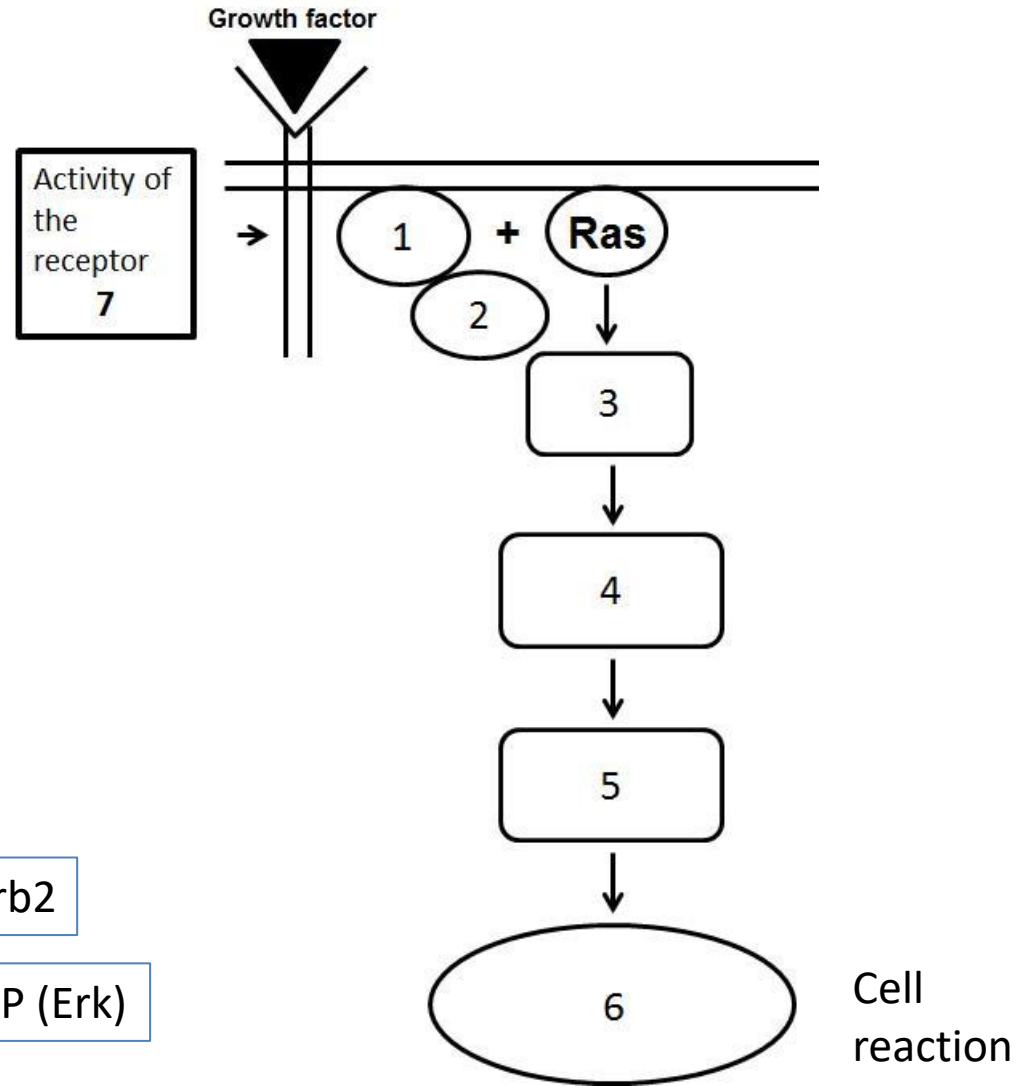
2 - .....

3 - .....

4 - .....

5 - .....

## 5. Complete the scheme



- 1 -
- 2 -
- 3 -
- 4 -
- 5 -
- 6 -
- 7 -

Kinase kinase kinase MAP (Raf)

Grb2

SOS

Tyrosine kinase

Kinase MAP (Erk)

Kinase kinase MAP (Mek)

Cell proliferation (phosphorylation)

## 6. Connect pairs:

1. adenylyl cyclase
2. phospholipase C
3. phosphodiesterase (PDE)

- A. converts cAMP to the AMP
- B. cAMP
- C. inositol trisphosphate (IP3) and diacylglycerol (DAG)

- 1 - .....
- 2 - .....
- 3 - .....

## 7. Complete the sentences.

The receptor which, after activation, causes the depolarization of the cell membrane is called .....

The monomeric GTP-binding protein that resembles  $\alpha$  subunit of G protein is called .....

TGF- $\beta$  receptor has an activity of ..... kinase.

## 8. Connect pairs:

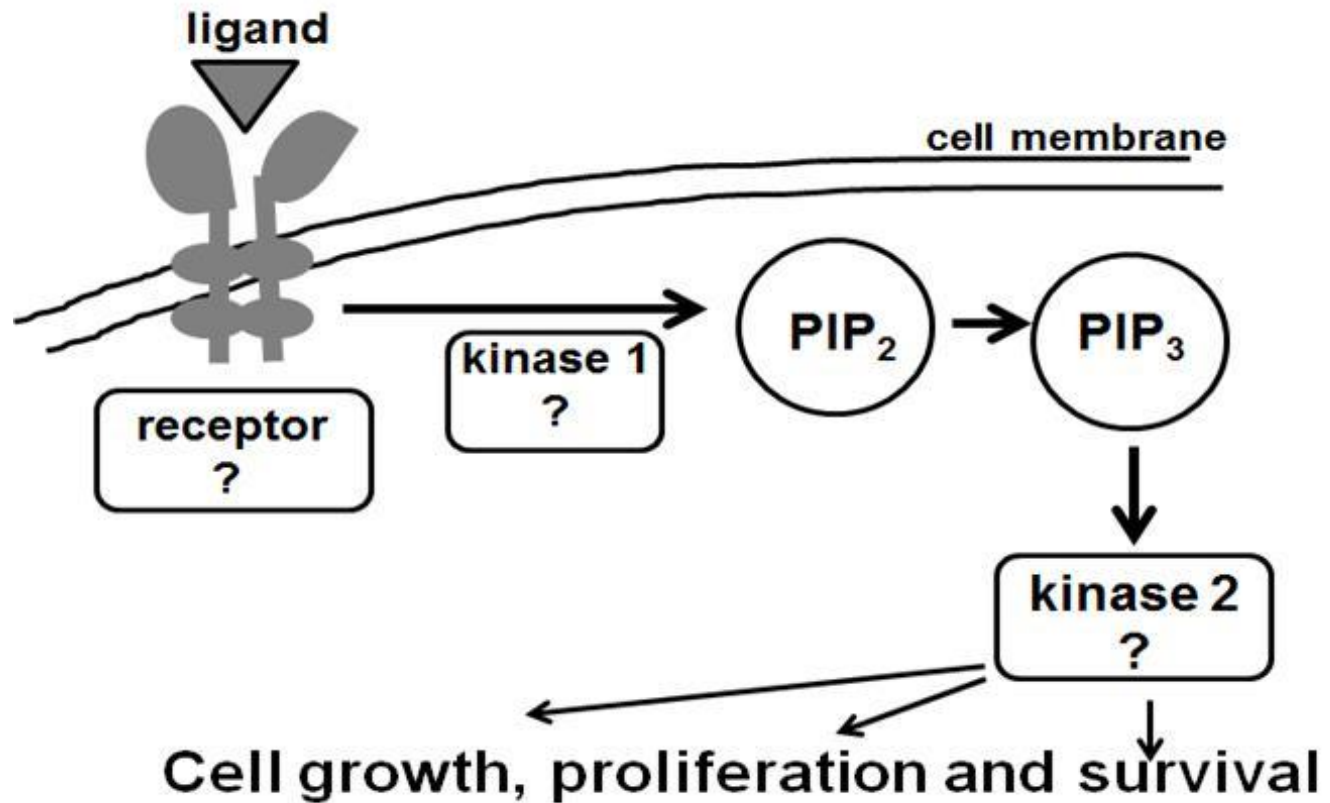
1. Protein kinase A (PKA)
2. Protein kinase C (PKC)
3. CaM-kinase

- A. cAMP
- B. calcium ions ( $\text{Ca}^{2+}$ ) and calmodulin
- C. calcium ions ( $\text{Ca}^{2+}$ ) and diacylglycerol (DAG)

- 1 - .....
- 2 - .....
- 3 - .....



## 9. Complete the scheme.



Receptor -  
Kinase 1 -  
kinase 2 -

Phosphatidylinositol 3-kinase (PI 3-kinase)

protein kinase B (PKB) - Akt kinase

tyrosine kinase receptor

10. Connect pairs:

- 1. CREB
- 2. NF- $\kappa$ B
- 3. Vitamin A
- 4. Notch receptor

- A. juxtacrine signaling
- B. cAMP
- C. protein kinase C
- D. nuclear receptor

- 1 - .....
- 2 - .....
- 3 - .....
- 4 - .....