Faculty of Science
Zoology Department

Cell Signaling / Final Exam

Prof. Mahmoud M. Zakaria

4th level (Molecular Biology Program), 2024/2025

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1st question: MCQs on Cell Signaling

(15 Mark)

1. **SH2 domains specifically bind to**
   a phosphorylated serine residues.
   b. phosphorylated tyrosine residues.
   c. GDP
   d. Ca2+

2. **Synaptic signaling between adjacent neurons is like hormone signaling in which of the following ways?**
   a. It sends its signal molecules through the blood.
   b. It sends its signal molecules quite a distance.
   c. It requires calcium ions.
   d. It requires binding of a signaling molecule to a receptor.

3. **Which of the following statements about G proteins is false?**
   a. They are involved in signal cascades.
   b. They bind to and are regulated by guanine nucleotides.
   c. They become activated when bound to GDP.
   d. They must be active before the cell can make needed cAMP.

4. **The sensitivity of the cellular response to the frequency of Ca2+ oscillations requires a special kind of protein**
   a. cyclic AMP (cAMP)
   b. Cyclic GMP (cGMP)
   c. Calmodulin
   d. Tyrosine kinases

5. **Mark the signal molecule which does not interact with cell surface receptor.**
   a. Insulin
   b. Testosterone
   c. Glucagon
   d. Gastrin

6. **The function of Cyclic guanosine monophosphate (cGMP) is**
   a. Hormone transduction
   b. Lipid metabolism
   c. Increased gene expression of bacteria
   d. Apoptosis regulation

7. **What is paracrine signaling?**
   a. Signal released by the cell to bind to the receptor of nearby cell
   b. Signal released by the cell to bind to the receptor of distant cell
   c. Signal released by the cell to bind to the receptor of the same cell
   d. Non of them

8. **As with all signaling components, receptors need to be switched off as well as on. Receptor inactivation can operate by**
   a. Degradation
   b. Desensitization
   c. Sequestration
   d. All of them

9. **To which of the following residues of the protein, the protein kinases do not add phosphate groups?**
   a. Cytosine
   b. Serine
   c. Threonine
   d. Tyrosine

10. **From the perspective of the cell receiving the message, the three stages of cell signaling are**
    a. the paracrine, local, and synaptic stages.
    b. signal reception, signal transduction, and cellular response.
    c. signal reception, nucleus disintegration, and new cell generation.
    d. the alpha, beta, and gamma stages.

11. **Protein kinases and phosphatases act by altering _____ of the signaling proteins.**
a. basicity b. conformation
c. acidity d. size

12. **What are scaffolding proteins?**
a. ladder-like proteins that allow receptor-ligand complexes to climb through cells from one position to another
b. microtubular protein arrays that allow lipid-soluble hormones to get from the cell membrane to the nuclear pores
c. relay proteins that orient receptors and their ligands in appropriate directions to facilitate their complexing
d. large molecules to which several relay proteins attach to facilitate cascade effects

13. **Arrange the following sequence of extracellular signaling in the correct order?**
1) Signaling cell synthesize and release signaling molecules
2) Start of signal transduction pathways and response
3) Transport of signal to a target cell
4) Binding of the signal to the specific receptor
a. 2, 3, 4, 1 b. 3, 1, 4, 2
c. 1, 3, 4, 2 d. 1, 2, 3, 4

14. **The toxin of Vibrio cholerae causes profuse diarrhea because it**
a. modifies a G protein involved in regulating salt and water secretion.
b. decreases the cytosolic concentration of calcium ions, making the cells hypotonic to the intestinal cells.
c. binds with adenylyl cyclase and triggers the formation of cAMP.
d. signals inositol trisphosphate to become a second messenger for the release of calcium.e. modifies calmodulin and activates a cascade of protein kinases.

15. **Name the signaling which requires physical contacts between the cells involved.**
a. Paracrine signaling b. Intracellular signaling
c. Autocrine signaling d. Juxtacrine signaling

2nd question: Which of the following statements about cell signaling is true and which is false

(15 Mark)

1. **The JAK–STAT pathway is an important protein kinase pathway** ( )
2. **Nitric oxide (NO) has earned repute as a potent vasoconstrictor also known as EDRF.** ( )
3. **Yeast cells respond to mating factor by extending cellular protrusions towards the cell** ( )
4. **cAMP is not synthesized by adenylyl cyclase, which synthesizes from ATP** ( )
5. **The macrophages secreting IL-1 also possess the IL-1 receptors, and bound receptors induce the intracellular cascade for more IL-1.** ( )
6. **The primary receptors for hydrophobic steroid hormones, such as the sex hormones estradiol.** ( )
7. **Bifurcation proteins branch the signal to different signalling pathways.** ( )
8. **Second messengers such as diacylglycerol (DAG) are water-soluble, and can't diffuse along the inside of the plasma membrane.** ( )
9. **Responses : cell signaling leads to regulation of cytoplasmic activities or transcription.** ( )
10. **Antagonists bind to the receptor, but do not promote the switch to the active conformation.** ( )
11. **Muscarinic receptors can bind two naturally occurring powerful toxins, the polypeptide α -bungarotoxin and the alkaloid tubocurarine.** ( )
12. **The ligands of intracellular receptors are small, hydrophilic (water-soluble).** ( )
13. **Nicotinic receptors are composed of sex subunits (three α subunits together with one each of the β, γ and δ subunits), which assemble to form a pore in the membrane.** ( )
14. **Cardiac muscle contains the other type of ACh receptor, which is a G protein-coupled 7TM receptor (GPCR).** ( )
15. **The interaction of the receptor and the signal causes the receptor to change shape** ( )

3rd question: Draw TWO ONLY of the following with short comment: (30 Mark)

a) Types of cell to cell signal via secreted molecules

b) Calcium ions help to synchronize the rapid contraction of skeletal muscle cells as a second messenger.

c) Signaling through G protein-coupled receptors (GPCRs), all components of the signaling pathway are inactive form and the change in conformation of the 7TM receptor.

4th question: write THREE ONLY about of the following: (30 Mark)

1) Discus the principles of second messengers the roles and mechanisms of action of the other chief mediators, which are Ca2+ ions.

2) The transmission of a signal must occur in a time-frame appropriate for the cellular response, write short notes only about signal transduction mechanism.

3) Acetylcholine (ACh) is a neurotransmitter that is released from neuron presynaptic terminals, write about ACh receptors.

4) Cell to cell signal via secreted molecules referring to the types of signaling.

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With my all best wishes .....
Mahmoud M. Zakaria