Chapter 05 Test Bank

Student: _____

1. What are the most common receptors for hydrophilic intercellular messenger molecules?
A. peripheral membrane proteins
B. integral membrane proteins
C. specialized phospholipids within the membrane
D. nucleic acids
E. intracellular proteins

2. Specificity is an important characteristic of intercellular communication; which of these best explains why it occurs?
A. because all cells have very similar compositions of their phospholipid membranes
B. because protein receptors are only located on the surface of target cells
C. because all cells have the same DNA, so any cell can express protein receptors for a specific chemical
D. because chemical messengers are all proteins
E. because protein receptors for chemical messengers are only expressed in specific target cells

3. Which of the following are ways in which binding of an intercellular chemical messenger with a cell's receptor can bring about a cellular response?
A. opening or closing of specific ionic channels in the plasma membrane
B. activation of an intracellular second-messenger system
C. promoting or inhibiting the transcription of genes that code for the synthesis of cellular proteins
D. activating or inhibiting intracellular enzymes
E.

All of the choices are correct.

4. Which of these is a lipid soluble messenger?
A. thyroid hormone
B. protein kinase
C. glucose
D. sodium
E. cyclic AMP

5. The process whereby repeated exposure to a hormone can cause a decrease in the number of receptors for that hormone is called
A. competition.
B. inhibition.
C. down regulation.
D. antagonism.

E. saturation.

6. Cocaine lowers the levels of a chemical messenger in the brain called enkephalin. Researchers have found the number of enkephalin receptors to be higher in cocaine addicts than nonaddicted people. This is an example of
A. saturation.
B. up regulation.
C. antagonism.
D. affinity.
E. down regulation.

7. Methadone is a drug given to treat heroin addicts. It works by binding to the same receptors as heroin but with greater affinity, thereby preventing heroin from binding. This is an example of
A. competition.
B. down regulation.
C. signal transduction.
D. agonistic behavior.
E. up regulation.

8. Epinephrine activates the cyclic AMP pathway in liver cells. In this example, epinephrine is a _____ and cAMP is a _____.
A. ligand, receptor
B. first messenger, hydrophobic hormone
C. second messenger, ion channel
D. first messenger, second messenger
E. enzyme, second messenger

9. At very low concentrations, epinephrine causes an artery to dilate. At higher concentrations epinephrine causes the same artery to constrict. How can these different effects be explained?
A. There is one type of epinephrine receptor that uses two second messenger systems.
B. There are two types of epinephrine receptors with different affinities for epinephrine that use two different second messenger systems.
C. There are two types of receptors for epinephrine that use the same second messenger system.
D. At higher concentrations epinephrine can pass through the plasma membrane and directly stimulate contraction within the cell.

10. With regard to the action of hormones and neurotransmitters on cellular receptors, which of these describes "amplification?"
A. When the extracellular concentration of a chemical messenger reaches a very high level, it overwhelms transporter molecules and the chemical floods into the cell.
B. Only hydrophilic first-messenger molecules can activate second messenger molecules within the cell cytosol.
C. A single first messenger molecule activates multiple second messenger molecules, each of which activate thousands of enzymes.
D. Some cellular receptors have such low affinity for chemical ligands that it can require a million or more

molecules to activate them.

11. Cells can increase their responsiveness to an external chemical regulator by
A. increasing the number of their transmembrane receptors by exocytosis.
B. decreasing the number of their transmembrane receptors by endocytosis.
C. uncoupling their receptors from the second message generator.
D. increasing the number of their transmembrane receptors by endocytosis.
E. mutating their extracellular receptors so that the affinity for the chemical regulator is reduced.

12. In which of these would an injected drug be the most effective agonist for an endogenous chemical messenger?
A. The drug has a lower affinity for the messenger's receptors than the messenger does.
B. The drug achieves 50 percent saturation of the messenger's receptors at a lower concentration than that required by the messenger.
C. The drug does not couple to the binding site of the messenger's receptor.
D. The drug binds to an alternate binding site on the protein receptor and reduces its affinity for the endogenous chemical messenger.

13. A fat cell responds to the presence of the hormone epinephrine by increasing cytosolic cyclic AMP production, which leads to the catabolism of both glycogen and fat. What is the most likely explanation for this phenomenon?
A. Epinephrine is binding to two types of receptors in the plasma membrane.
B. The activated receptor complex stimulates production of two different second messengers.
C. Cyclic AMP directly activates two kinds of enzymes.
D. Cyclic-AMP-dependent protein kinase activates two kinds of enzymes.

14. Which of the following is NOT typically true about G proteins?
A. They act as second messengers.
B. They can be stimulatory for second-messenger production.
C. They can be inhibitory for second-messenger production.
D. They can act as transducers for activated receptors by opening or closing ion channels.

15. Which is NOT typically a step in the cAMP second-messenger system?
A. A first-messenger binds to a transmembrane receptor.
B. There is dissociation of G-protein subunits.
C. An activated G-protein subunit phosphorylates cAMP-dependent protein kinase.
D. Adenyl cyclase converts ATP into cAMP.
E. Active cAMP-dependent protein kinase phosphorylates cell proteins.

16. Second messengers:
A. are necessary for all receptor signal transduction mechanisms.
B. act in the cell cytoplasm.
C. only function as intercellular messengers.

D. always function to activate enzymes.
E. are always proteins.

17. Which of the following statements is true?
A. Phosphorylation by protein kinases can stimulate or inhibit the activity of effector proteins.
B. Ca2+ is not a second messenger.
C. Phosphodiesterase converts GMP into cGMP
D. Conversion of ATP to cAMP is a phosphorylation reaction.
E. Phospholipase C converts ATP to cAMP.

18. Which of the following are known to be second messengers?
A. diacylglycerol
B. phospholipase C
C. ATP
D. adenylyl cyclase
E. epinephrine

19. Amplification during a second messenger cascade is beneficial because amplification:
A. takes small molecules and makes polymers out of them.
B. results in the production of more of the first messenger.
C. allows a cell to respond to more different hormones.
D. allows small amounts of hormones to produce large responses in target cells.

20. Amplification of a second messenger cascade can take place at which level of a signal cascade?
A. One activated receptor can activate numerous G-proteins.
B. One activated G-protein can activate numerous effector enzymes.
C. One active effector enzyme can catalyze numerous reactions.
D. One activated protein kinase can allosterically modulate numerous proteins.
E. All of the choices are correct.

21.

What is a role of calcium ions in the second messenger cascade involving phospholipase C, diacylglycerol, and inositol trisphosphate?

A. It splits and activates G-protein subunits.
B. It binds to the endoplasmic reticulum and causes the release of inositol trisphosphate.
C. It phosphorylates cell proteins.
D. It is the first messenger that binds to the integral membrane protein receptor.
E. Along with diacylglycerol, it activates protein kinase C.

22. What second messenger most directly causes calcium ions to be released from intracellular stores?
A. diacylglycerol
B. adenylyl cyclase

C. inositol triphosphate
D. phospholipase A
E. phospholipase C

23. First messengers may bind to a membrane receptor that is an ion channel, which promotes a change in membrane polarity.
True False

24. Eicosanoids are a family of ubiquitous, fatty-acid-derived, local chemical messengers.
True False

25. Aspirin and other nonsteroidal anti-inflammatory drugs are more specific in their effects on eicosanoid synthesis than are steroidal anti-inflammatory drugs.
True False

26. Two cell types having the same type of receptor for a chemical messenger will always respond to that messenger in the same way.
True False

27. Competition for receptors is strictly a pharmacological phenomenon, since naturally occurring chemical messengers do not compete with each other for the same receptor site.
True False

28. An antagonist blocks the action of a chemical messenger by binding to its receptor.
True False

29. Phosphorylation is a necessary component of any enzyme activation.
True False

30. The enzyme that catalyzes the production of cAMP from ATP is phosphodiesterase.
True False

31. Cyclic AMP activates allosteric proteins.
True False

32. Activated calmodulin functions to activate or inactivate cytosolic enzymes.
True False

Chapter 05 Test Bank Key

1. What are the most common receptors for hydrophilic intercellular messenger molecules?
A. peripheral membrane proteins
B. integral membrane proteins
C. specialized phospholipids within the membrane
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Bloom's: Level 1. Remember
Learning Outcome: 05.01
Section: 05.01
Topic: Cells
Topic: General principles of physiology

2. Specificity is an important characteristic of intercellular communication; which of these best explains why it occurs?
A. because all cells have very similar compositions of their phospholipid membranes
B. because protein receptors are only located on the surface of target cells
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D. because chemical messengers are all proteins
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Bloom's: Level 1. Remember
Learning Outcome: 05.01
Section: 05.01
Topic: Cells
Topic: General principles of physiology

3. Which of the following are ways in which binding of an intercellular chemical messenger with a cell's receptor can bring about a cellular response?
A. opening or closing of specific ionic channels in the plasma membrane
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All of the choices are correct.

Bloom's: Level 1. Remember
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

4. Which of these is a lipid soluble messenger?
A. thyroid hormone
B. protein kinase
C. glucose
D. sodium
E. cyclic AMP

Bloom's: Level 1. Remember
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

5. The process whereby repeated exposure to a hormone can cause a decrease in the number of receptors for that hormone is called
A. competition.
B. inhibition.
C. down regulation.
D. antagonism.
E. saturation.

Bloom's: Level 1. Remember
Learning Outcome: 05.01
Section: 05.01
Topic: Cells
Topic: General principles of physiology

6. Cocaine lowers the levels of a chemical messenger in the brain called enkephalin. Researchers have found the number of enkephalin receptors to be higher in cocaine addicts than nonaddicted people. This is an example of
A. saturation.
B. up regulation.
C. antagonism.
D. affinity.
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Bloom's: Level 2. Understand
Learning Outcome: 05.01
Section: 05.01
Topic: Cells
Topic: General principles of physiology

7. Methadone is a drug given to treat heroin addicts. It works by binding to the same receptors as heroin but with greater affinity, thereby preventing heroin from binding. This is an example of
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Bloom's: Level 2. Understand
Learning Outcome: 05.01
Section: 05.01
Topic: Cells
Topic: General principles of physiology

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Bloom's: Level 1. Remember
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

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Bloom's: Level 2. Understand
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

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Bloom's: Level 1. Remember

Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

11. Cells can increase their responsiveness to an external chemical regulator by
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B. decreasing the number of their transmembrane receptors by endocytosis.
C. uncoupling their receptors from the second message generator.
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Bloom's: Level 2. Understand
Learning Outcome: 05.01
Section: 05.01
Topic: Cells
Topic: General principles of physiology

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Bloom's: Level 3. Apply
Learning Outcome: 05.01
Section: 05.01
Topic: Cells
Topic: General principles of physiology

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Bloom's: Level 2. Understand
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

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Bloom's: Level 2. Understand
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

15. Which is NOT typically a step in the cAMP second-messenger system?
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Bloom's: Level 1. Remember
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

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Bloom's: Level 1. Remember
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

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Bloom's: Level 1. Remember
Learning Outcome: 05.02
Section: 05.02
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Topic: General principles of physiology

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Bloom's: Level 1. Remember
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

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Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

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Bloom's: Level 1. Remember
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
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B. It binds to the endoplasmic reticulum and causes the release of inositol trisphosphate.
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D. It is the first messenger that binds to the integral membrane protein receptor.
E. Along with diacylglycerol, it activates protein kinase C.

Bloom's: Level 1. Remember
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

22. What second messenger most directly causes calcium ions to be released from intracellular stores?
A. diacylglycerol
B. adenylyl cyclase
C. inositol triphosphate
D. phospholipase A
E. phospholipase C

Bloom's: Level 1. Remember
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

23. First messengers may bind to a membrane receptor that is an ion channel, which promotes a change in membrane polarity.
TRUE

Bloom's: Level 1. Remember
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

24. Eicosanoids are a family of ubiquitous, fatty-acid-derived, local chemical messengers.
TRUE

Bloom's: Level 1. Remember
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

25. Aspirin and other nonsteroidal anti-inflammatory drugs are more specific in their effects on eicosanoid synthesis than are steroidal anti-inflammatory drugs.
TRUE

Bloom's: Level 1. Remember
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

26. Two cell types having the same type of receptor for a chemical messenger will always respond to that messenger in the same way.
FALSE

Bloom's: Level 1. Remember
Learning Outcome: 05.01
Section: 05.01

Topic: Cells
Topic: General principles of physiology

27. Competition for receptors is strictly a pharmacological phenomenon, since naturally occurring chemical messengers do not compete with each other for the same receptor site.
FALSE

Bloom's: Level 1. Remember
Learning Outcome: 05.01
Section: 05.01
Topic: Cells
Topic: General principles of physiology

28. An antagonist blocks the action of a chemical messenger by binding to its receptor.
TRUE

Bloom's: Level 1. Remember
Learning Outcome: 05.01
Section: 05.01
Topic: Cells
Topic: General principles of physiology

29. Phosphorylation is a necessary component of any enzyme activation.
FALSE

Bloom's: Level 2. Understand
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

30. The enzyme that catalyzes the production of cAMP from ATP is phosphodiesterase.
FALSE

Bloom's: Level 1. Remember
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

31. Cyclic AMP activates allosteric proteins.
TRUE

Bloom's: Level 2. Understand
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

32. Activated calmodulin functions to activate or inactivate cytosolic enzymes.

TRUE

Bloom's: Level 1. Remember
Learning Outcome: 05.02
Section: 05.02
Topic: Cells
Topic: General principles of physiology

Chapter 05 Test Bank Summary

Category	*# of Questions*
Bloom's: Level 1. Remember	23
Bloom's: Level 2. Understand	8
Bloom's: Level 3. Apply	1
Learning Outcome: 05.01	10
Learning Outcome: 05.02	22
Section: 05.01	10
Section: 05.02	22
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