

**BMB/MICRB 252 – February 4, 2004 - Exam 1**

Use #2 pencil. Answer all questions on the enclosed optical read form.

There is only one answer for each question.

Read the question carefully and choose the best answer.

Write your name and student I.D. number and fill in the corresponding oval.

Be sure that your TEST FORM letter matches you EXAM FORM letter.

This is EXAM FORM A

There are 33 questions. This exam ends at 11:00 am

- 1 A protein kinase primarily uses which as a substrate?
  - A. GTP
  - B. ATP
  - C. CTP
  - D. UTP
  - E. TTP
  
- 2 If you were dieing of cholera, which protein in your body is being directly affected by the toxin?
  - A. Cell surface receptor
  - B. Trimeric G protein
  - C. Protein Kinase A
  - D. Phospholipase C- $\gamma$
  - E. CREB
  
- 3 Bears have a great sense of smell because
  - A. They have a high density of ofactory receptors
  - B. They have a high density of opsin receptors
  - C. They have a high density of acetylcholine receptors
  - D. They have poor eyesight
  - E. They use trimeric G proteins.
  
- 4 What does SOS stand for in the RAS signaling pathway?
  - A. Sensor-of-Signal
  - B. Son-of-Sam
  - C. Save-our-Souls
  - D. Son-of-Sevenless
  - E. Smoothened-or-Smads
  
- 5 An important aspect of activation by enzyme-linked receptors is:
  - A. Interactions with trimeric G-proteins
  - B. cAMP production
  - C. Receptor dimerization induced by ligand binding
  - D. A conformational change propogated through the single-pass transmembrane domain.
  - E. Receptor internalization

- 6 Which is most likely to travel through a gap junction?
- A. Protein kinase A
  - B. Calcium
  - C. Estrogen
  - D. Vitamin D
  - E. Ribosomes
- 7 When one cell communicates with another cell through direct cell-cell contact of the signal and the receptor, what type signaling molecule is likely to be directly involved?
- A. Peptide
  - B. Hormone
  - C. Protein
  - D. Calcium
  - E. Nitric oxide
- 8 A cell that is not receiving any signals from other cells is most likely to do what?
- A. Differentiate into another cell type
  - B. Initiate apoptosis
  - C. Divide
  - D. Produce more receptors
  - E. Maintain itself in a resting state
- 9 A receptor that traverses the membrane seven times is likely to interact with which protein?
- A. Monomeric G-protein
  - B. Trimeric G-protein
  - C. Opsin receptor
  - D. cAMP
  - E. Src tyrosine kinase
- 10 Choose the best answer that fills the blank in this pathway:  
Trimeric G-protein alpha subunit  $\rightarrow$  Adenylyl cyclase  $\rightarrow$  cAMP  $\rightarrow$  \_\_\_\_\_
- A. Protein kinase A
  - B. Protein kinase B
  - C. Protein kinase C
  - D. Phospholipase C
  - E. MAP kinase
- 11 Phospholipase C cleaves PI(4,5)P<sub>2</sub> into what?
- A. Calcium and trisphosphate
  - B. cAMP and diacylglycerol
  - C. Fatty acids and sterol
  - D. Diacylglycerol and inositol trisphosphate
  - E. PIP and phosphate

- 12 How does  $IP_3$  function as an intracellular second messenger?
- A. It binds to protein kinase C
  - B. It activates adenylyl cyclase
  - C. It opens calcium ion channels in the endoplasmic reticulum
  - D. It activates receptor tyrosine kinases
  - E. It induces proteolysis of the Notch receptor
- 13 Which is not a typical substrate for phosphorylation?
- A. Alanine
  - B. Serine
  - C. Phosphatidyl inositol bisphosphate
  - D. Threonine
  - E. Tyrosine
- 14 Mad cow disease is caused by which of the following
- A. Virus
  - B. Bacteria
  - C. DNA
  - D. Protein
  - E. Parasite
- 15 The major driving force for the interaction of androgen (a steroid) with the nuclear androgen receptor is
- A. Ionic interactions
  - B. Hydrogen bonding
  - C. Hydrophobic interactions
  - D. Covalent bonds
  - E. Van der waals interactions
- 16 Which of the following is NOT part of the general communication process among cells?
- A. Signaling molecules
  - B. Receptor protein
  - C. Intracellular mediator
  - D. Target protein
  - E. Alternative messenger molecules
- 17 Which is NOT one way that cells become desensitized to a signal molecule?
- A. Receptor sequestration via internalization
  - B. Receptor inactivation
  - C. Inactivation of signaling protein
  - D. Production of inhibitor protein
  - E. Production of more signaling molecules
- 18 The Hedgehog signaling molecule binds to what
- A. Smoothed
  - B. Patch
  - C. Nuclear receptors
  - D. Receptor tyrosine kinase
  - E. Frizzled

- 19 A protein having an SH2 domain can do what?
- A. Bind to cAMP
  - B. Bind calcium
  - C. Specifically phosphorylate another protein
  - D. Specifically acetylate another protein
  - E. Bind to a certain phosphoprotein
- 20 Consequences of protein phosphorylation include all of the following except
- A. Activation of the enzymatic activity of the protein
  - B. Causes the protein to be degradation
  - C. Induces translocation of steroids across membranes
  - D. Provides a binding site for another protein
  - E. Allows the protein to move into the nucleus
- 21 Which of the following does NOT spend much of its time in a two dimensional diffusion plane?
- B. Cell surface receptors
  - C. Trimeric G-proteins
  - D. Diacylglycerol
  - E. MAP kinase
  - F. Testosterone
- 22 What protein keeps NF $\kappa$ B in an inactive form in the cytoplasm?
- A. Microtubules
  - B. Actin
  - C. I $\kappa$ B
  - D. p65 and p50
  - E. TNF $\alpha$  receptor
- 23 What protein phosphorylates MAP kinase?
- A. MAP kinase kinase kinase
  - B. MAP kinase kinase
  - C. MAP kinase
  - D. MAP
  - E. MAP kinase phosphatase
- 24 Which is NOT a cytokine?
- A. Interleukines
  - B. Interferon
  - C. Erythropoetin
  - D. Ephrins
  - E. Growth hormone

- 25 Phosphatidylinositol-3' kinase (PI3-kinase) does what?
- A. Generates an allosteric activator of phospholipase C- $\gamma$  (PLC-  $\gamma$ )
  - B. Cleaves PI(4,5)P<sub>2</sub>
  - C. Phosphorylates MAP kinase
  - D. Phosphorylates receptor tyrosine kinase
  - E. Phosphorylates CREB
- 26 How is RAS activated?
- A. By a GAP (guanine activating protein)
  - B. By a GEF (guanine nucleotide exchange factor) called SOS
  - C. By direct interactions with a receptor tyrosine kinase
  - D. By a the APC/axin/GSK complex
  - E. By IP<sub>3</sub>
- 27 Humans have three main photoreceptors. What colors do each absorb?
- A. Red, green, blue
  - B. Black, white, gray
  - C. Blue, Green, yellow
  - D. Orange, green, purple
  - E. Cyan, yellow, green
- 28 What is the function of Toll-like receptors?
- A. Direct axon migration
  - B. Binds to Serotonin
  - C. Sense the presence of pathogens
  - D. To activate trimeric G proteins
  - E. Collect cellular currency like ATP
- 29 Which best describes the location of the activator of Notch-responsive genes, when Delta is not present?
- A. Plasma membrane
  - B. Cytosol (away from membranes)
  - C. Endoplasmic Reticulum
  - D. Nuclear envelope
  - E. Nucleus
- 30 Which is NOT an event in Wnt signaling
- A. Blockage of APC/GSK3/axin by Dishevelled
  - B. Inhibition of Smoothed by Patch
  - C.  $\beta$ -catenin translocation into the nucleus
  - D. Elimination transcription inhibition by Groucho
  - E. Binding of Wnt to Frizzled

- 31 What do the Janus kinases activate?
- A. Smads
  - B. STATs
  - C.  $\beta$ -catenin
  - D. MAP kinase
  - E. PI3 kinase
- 32 Stem cells need to maintain themselves in an undifferentiated state, while daughter cells generated from these stem cells need to be free to differentiate. Which type of receptor is likely to be found in these stem cells?
- A. FGF receptor
  - B. Notch
  - C. Patch
  - D. Estrogen receptor
  - E. Stem receptor
- 33 How is Alzheimer Disease and Notch signaling related?
- A. Both are triggered by Delta
  - B. Both are triggered by Wnt signaling
  - C. Both require the proteolysis activity of presenilin-1
  - D. Both involve extracellular aggregation and precipitation of  $\beta$ -amyloid.
  - E. Both cause severe loss of long term memory