

**MCB II**  
**MCDB 3451**  
**Exam 1**  
**Spring, 2016**

**50 minutes, close everything and be concise!**

Name \_\_\_\_\_

ID \_\_\_\_\_

NOTE: QUESTIONS ARE NOT ALL WORTH THE SAME POINTS

Total (100) \_\_\_\_\_

Grade \_\_\_\_\_

## MCBII

1. Which is UNIQUE to eukaryotes (4 pts)?
  - A. Plasma membrane
  - B. Endoplasmic reticulum (ER)
  - C. Phospholipids
  - D. mRNAs.
  - E. Enzymes
  
2. Which statement is INCORRECT regarding pluripotent stem cells? (4 pts)
  - A. Pluripotent stem cells can undergo unlimited rounds of division.
  - B. Pluripotent stem cells can differentiate into most all cell types.
  - C. Pluripotent stem cells can be either isolated from blastocysts or reprogrammed from adult cells.
  - D. Cells differentiated from induced pluripotent stem (iPS) cells, but not from embryonic stem (ES) cells, can trigger strong immune responses (immune rejection).
  
3. Formation of SNARE protein complexes is mediated by amino acid residues buried inside the protein complex. These amino acids are likely \_\_\_\_\_. (4 pts)
  - A. positively charged.
  - B. negatively charged.
  - C. hydrophobic.
  - D. cysteines
  - E. Prolines and glycines.
  
4. Which is the major component of the lipid droplets found in adipocytes (fat cells)? (4 pts)
  - A. Glucose.
  - B. Glycogen.
  - C. GPI-anchored proteins.
  - D. Triglyceride.
  
5. The Sec9p protein is found on the plasma membrane of yeast cells. Sequence analysis reveals that Sec9p does not possess a hydrophobic transmembrane domain. List all possible ways a non-transmembrane protein can associate with the plasma membrane? (8 pts)

They can associate in the following ways: (3 pts for 1<sup>st</sup> two correct, 2 pts for third)

  - 1) Covalently bound to a lipid (example GPI, 2) electrostatic interaction with the lipid head groups 3) via protein-protein interactions with an integral membrane protein.

6. Cells exposed to heat shock (heat stress) increase expression of chaperones. How, exactly, are these events linked? (8pts)

Increased concentration of unfolded proteins (2 pts) causes Hsp 70 to dissociate from Hsf1 (2 pts). Whereupon Hsf1 associates into a trimer and is transported to the nucleus. (2pts) HSF1 then activates transcription of heat shock genes (2pts).

7. Which is mediated by a noncovalent bond? (4 pts)
- A. Stabilization of protein secondary structures.
  - B. Formation of disulfide bonds.
  - C. Polymerization of glucose into glycogen.
  - D. Linkage between fatty acids and glycerol in phospholipids.
8. Which is CORRECT regarding protein folding in the cell? (4 pts)
- A. The native conformation of a protein represents the highest energy state.
  - B. Hsp70 chaperones are often found in complexes with properly folded proteins.
  - C. Both Hsp70 chaperones and chaperonins require GTP as a cofactor.
  - D. A protein may require the assistance of both Hsp70 chaperones and chaperonins to reach its native conformation.
9. Which process is the slowest? (4 pts)
- A. Phospholipid flex (rotating).
  - B. Lateral diffusion of phospholipids.
  - C. Transverse diffusion of phospholipids.
  - D. B and C are similar in speed.
10. Which serves as an “eat-me” signal for the engulfment of dead cells by phagocytes? (4 pts)
- A. Externalization of phosphatidylcholine.
  - B. Externalization of glycoposphatidylinositol (GPI)-anchored proteins.
  - C. Externalization of phosphatidylserine.
  - D. Externalization of phosphatidylinositol.

## MCBII

11. Which is a form of active transport? (4 pts)
- A. Transport of water molecules through aquaporins.
  - B. Transport of glucose by Na<sup>+</sup>/glucose cotransporters.
  - C. Transport of Na<sup>+</sup> ions by ligand-gated Na<sup>+</sup> channels.
  - D. Transport of K<sup>+</sup> ions by voltage-gated K<sup>+</sup> channels.
12. Which ions are responsible for the depolarization and repolarization phases, respectively, in an action potential? (4 pts)
- A. Na<sup>+</sup>; K<sup>+</sup>.
  - B. K<sup>+</sup>; Na<sup>+</sup>.
  - C. Na<sup>+</sup>; Cl<sup>-</sup>.
  - D. Na<sup>+</sup>; Ca<sup>2+</sup>.

13. Briefly explain the molecular steps of neurotransmitter release from a presynaptic terminal and subsequent activation of a postsynaptic action potential (8 pts).

Increased Calcium in presynaptic neuron allows vesicles to fuse with PM and release neurotransmitters. The released neurotransmitters cross the synaptic cleft where they bind ligand-gated ion channels which causes them to open and allow Na<sup>+</sup> ions to flow down their potential gradient which depolarizes the membrane and activates voltage-gated sodium channels. Must mention both Na<sup>+</sup> ligand and voltage-gated channels for full credit.

14. Detergents are commonly used to solubilize integral membrane proteins. Explain why (4 pts).

The detergents have a high CMC and disrupt the lipid-detergent interaction forming micelles containing individual membrane proteins.

Some strong detergents can also denature proteins (induce protein unfolding/misfolding). Explain why (4 pts).

Such detergents disrupt the van der Waals and hydrophobic interactions that maintain the hydrophobic core of the protein.

15. Which is NOT a feature of ion channels? (4 pts)

- A. Selectivity.
- B. Integral membrane proteins.
- C. Gating.
- D. Requiring ATP.

16. Glucocorticoids (hydrophobic molecules) and glutamates (amino acids) are two types of hormones. Explain how each of these individual molecules can elicit responses in their target cells. (8 pts)

Glucocorticoids diffuse across the plasma membrane (2pts) to interact with an intracellular receptor (2pts). Glutamates bind to a receptor on the plasma membrane (2pts) and elicit a signaling cascade or open an ion channel (2pts).

17. Which phospholipids are the least charged (4 pts)?

- A. Phosphatidylethanolamine and phosphatidylinositol.
- B. Phosphatidylserine and phosphatidylinositol.
- C. Phosphatidylcholine and phosphatidylserine.
- D. Phosphatidylcholine and phosphatidylethanolamine.

18. What is the primary energy source that drives the  $\text{Na}^+/\text{K}^+$  pump? (4 pts)

- A.  $\text{K}^+$  ion gradient.
- B.  $\text{Na}^+$  ion gradient.
- C. ATP hydrolysis.
- D.  $\text{Ca}^{2+}$  gradient.

19. Neurotransmitter receptors are usually found on \_\_\_\_\_. (4 pts)

- A. presynaptic membranes.
- B. postsynaptic membranes.
- C. synaptic vesicles.
- D. synaptic intracellular organelles.

20. Blood glucose concentration is higher than the glucose concentration in muscle cells. The transport of glucose from blood into muscles is likely mediated by \_\_\_\_\_. (4 pts)

- A. facilitated diffusion.
- B. simple diffusion (no transporters are needed).
- C. sodium-coupled cotransporters.
- D. potassium-coupled cotransporters.