Exam 3 **Name** _____

MCBII

1. What makes intermediate filaments (IFs) an inefficient track for motor proteins (4 pts)?

   A. The outer surface of IFs is hydrophobic.

   B. **IFs are nonpolar structures.**

   C. IFs contain coiled coil domains.

   D. IFs are too diverse to support motor movement.

2. What does MCAK do to microtubules (MTs)? (4pts)

   A. **It stimulates GTP hydrolysis at the plus end.**

   B. It stabilizes lateral bonds between protofilaments.

   C. It recruits free tubulin to the plus end of MTs.

   D. It is a minus-end directed motor protein.

3. Which region of conventional kinesin 1 binds to microtubules? (4 pts)

   A. The light chains.

   B. The coiled coil.

   C. The neck domain.

   D. **The motor domain.**

4. Explain why the plus end of a Microtubule depolymerizes faster than the plus end of actin? (8 pts)

   The structure of the microtubule protofilament is altered when GTP is hydrolyzed to GDP at the "+" end, leading to rapid depolymerization. Actin filaments do not rapidly depolymerize when they hydrolyze ATP, they are equilibrium polymers and addition or loss of subunits is based on the concentration of free actin.

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5. What is the function of XMAP215? (4 pts)

   A. It is a motor protein.

   B. It nucleates formation of MTs from their minus end.

   C. **It recruits free tubulin for addition to the plus end of MTs.**

   D. It forms a 1:1 complex with free tubulin to block its polymerization.

6. Circle ALL of the following that are shared by MTs and actin filaments? (4 pts)

   A. **They have a minus and plus end.**

   B. They are nucleated at the centrosome.

   C. **They can be bound by motor proteins.**

   D. They hydrolyze GTP as they grow.

7. COPII vesicles traffic to the MTOC using which motor protein? (4 pts)

   A. Kinesin 1.

   B. **Dynein.**

   C. Myosin.

   D. Clathrin.

8. Describe how you would use FRAP to determine whether tubulin is exchanged more rapidly from the minus end, plus end, or middle of a microtubule. Carefully describe your experimental setup as well as the result that you expect to see. (8pts)

   Start with fluorescence microscope and cells expressing GFP-tubulin.

   Separately photobleach the minus, middle and plus ends.

   Monitor for fluorescence returning to photobleached area.

   Should only observe fluorescence returning at plus end, showing new addition of tubulin subunits.

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9. Circle ALL that are true about "tubulin" subunits? (4 pts)?

   A. **Tubulin is a heterodimer of alpha plus beta tubulin.**

   B. alpha tubulin can hydrolyze GTP but beta tubulin cannot.

   C. alpha and beta tubulin form a dimer only when they are incorporated into the MT.

   D. **They can self polymerize in solution into the shape of a microtubule.**

10. If the critical concentration of the actin minus end is 0.5 uM and the critical concentration of the plus end is 0.2 uM, what would happen at 0.1 uM free actin? (4 pts)

   A. The plus end would lengthen and the minus end would shorten.

   B. **Both ends would shorten.**

   C. Both ends would lengthen.

   D. The minus end would lengthen and the plus end would shorten.

11. Which of the following is the best description of the center of a centrosome? (4 pts)

   A. 2 parallel centrioles, each made up of 9 paired MTs.

   B. **2 perpendicular centrioles, each made up of 9 triplet MTs.**

   C. a pair of centrioles –one made of 9 MTs the other with a triplet of MT.

   D. a single centriole surrounded bound by gamma-tubulin ring complex.

12. During mitosis, microtubules are more abundant and more dynamic. Describe a change in a protein or complex that occurs at 1) the minus and at the 2) plus end that could cause this outcome. (8 pts)

   Minus End: Increased #'s of gamma tubulin ring complexes to nucleate growth of more MTs.

   Plus End: decreased XMAP215 to reduce stabilization at the "+" end.

13. What would happen if you lengthened the regulatory domain (lever arm) of myosin V? (4pts)

A. It could potentially bind to multiple cargoes at the same time.

B. It would spend more time attached to actin filaments.

C. It would form a tighter coiled-coil interaction with other tail domains.

D. **This would increase the distance per step size as it moves.**

14. What phenotype would you expect in a cell that expresses a lamin mutant that cannot be phosphorylated? (4 pts)

A. The nuclear envelope would lack nuclear pores.

B. The nuclear envelope would be smaller.

C. **The nuclear envelope would not disassemble during mitosis.**

D. No phenotype because lamin is not regulated by phosphorylation.

15. ORDER the following events during muscle contraction? (4pts) ***4, 2, 3, 1***

A. ATP hydrolysis by myosin II.

B. Tropomyosin exposes the myosin II binding site on actin.

C. Myosin II binds actin filament.

D. Calcium binds to troponin.

16. Diagram the 1 or more roles of Arp2/3, Profilin, and Cofillin during cell migration. (8pts)

What needed to be clearly indicated:

Arp2/3 nucleates actin assembly at the "-" end and nucleates branched actin filament growth.

Profilin stimulates "+" end addition by capping the "+" end of the actin monomer and catalyzing exchange of ADP for ATP on the monomer (NEF).

Cofilin breaks old ADP-bound actin filaments to recycle monomers.

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17. Actin is <u>not</u> involved in which of the following processes? (4pts)

    A. Cell division.

    B. Cell shape.

    C. **Trafficking of mitochondria from the cell body to the axon.**

    D. Trafficking of vesicles under the plasma membrane.

18. What would happen if you delete the tail domain of Myosin V? (4 pts)

    A. It would traffic towards the minus end of actin filaments.

    B. It would no longer bind to ATP.

    C. It would no be able to form a homo-dimer.

    D. **It would no longer bind to cargo.**

19. Nocodazole depolymerizes microtubules because….? (4pts)

    A. **It binds and blocks free tubulin from addition.**

    B. It binds and blocks the plus end of the microtubule.

    C. It disrupts lateral bonds between protofilaments in the middle of MTs.

    D. It locks tubulin in a GTP bound state.

20. Describe a strategy for how you would successfully purify the kinesin protein. (8pts)

    Begin with a cell type with lots of MTs and kinesin.

    Use taxol to stabilize the MTs.

    Add non-hydrolyzable ATP to lock Kinesin on MTs.

    Pellet to purify by centrifugation.

    Add ATP and centrifuge again.