Please print your name: ____________________________________________

Instructions:

Please write only on these pages, in the spaces allotted and not on the back. Write your number on each page (not your name), so that we can split them up and grade them anonymously. There are a total of 7 pages including this cover page. You may not use any books or notes, and no electronic aids, including calculators.

Answer only in the space provided; short, concise answers are preferred and will be rewarded. Please be as neat as possible.

When you are finished, turn this in to the TA and pick up the take-home portion.
In Class Questions for Dr. Cooper’s lectures.

1. What is the meaning of the term “quasi-equivalence” in the context of subunits within a polymer (2 pts).

2. True or False (correct if false) (2 pts):

   _______ Tubulin binds ATP or ADP.

   _______ ADP tubulin strongly favors polymerization, while ATP tubulin favors polymerization less strongly.

3. Expression of active forms of small G-proteins in cells can induce different subcellular structures that are based on assemblies of actin filaments. Fill in the blank with the name of a small G-protein (3 pts).

   ________ can cause the formation of stress fibers.

   ________ can cause the formation of lamellipodia.

   ________ can cause the formation of filopodia.

4. You use fluorescence microscopy to observe the leading edge of a cell that contains fluorescently labeled microtubules. Growth occurs at a constant rate, and then suddenly the microtubule stops growing and shortens at much faster rate.

   Name the protein(s) necessary to form a microtubule. ___________________________ (1 pt)

   Name the polypeptide(s) that compose this protein. ___________________________ (1 pt)

   Explain one likely cause of the rapid shortening. (1 pt)

   Name a protein whose addition would help stabilize the microtubule against depolymerization (1 pt).
5. Describe two functions of class-V myosin in cells. Include a statement of the type of cell. Be as specific as possible (4 pts).

a.

b.

6. Wiskott–Aldrich syndrome is an X-linked recessive disease resulting from mutations in the gene encoding the protein WASp. In cells, WASp influences actin polymerization by activation of ______________________________ (1 pt).

Familial hypertrophic cardiomyopathy can result from mutations in genes encoding what protein(s)? (1 pt)

7. You discover a mutant cell with less mannose 6-P receptor on its surface than its wild-type counterparts.

Inhibition of the function of what protein would likely explain this phenotype? (2 pts)

This inhibited protein might be expected to bind to what other protein (excluding M6PR). (2 pts)

8. True or False (correct if false):

_______ Animal cells have a centriole triplet in an amorphous cloud (1 pt).

_______ Flowering plants lack centrioles (1 pt).
9. Draw how one chromosome is attached to the two poles of the mitotic spindle at the metaphase stage of mitosis. Label the chromosome, microtubules, and kinetochores. Label the polarity of the ends of the microtubules (3 pts).

Do the same for the anaphase B stage of mitosis (3 pts).

9. Draw the three-dimensional structure of an intermediate filament with the component monomers. State the directionality of the strands at each level of organization (3 pts).

State one way in which cells induce intermediate filaments to disassemble during mitosis (1 pt).

Why is this disassembly important? What might result if the disassembly failed? (2 pts)
In Class Questions for Dr. Mueckler’s lectures.

1. At the level of atoms, draw an example of an unsaturated phosphoglyceride that lacks a head group (2 pts).

Name one phosphoglyceride head group that has a net negative charge at neutral pH (write its charge next to it) (2 pts).

Phospholipids with this head group typically appear on which leaflet (cytosolic or extracellular) of the plasma membrane (1 pt)?

2. Ceramides contain ___________________________ moieties in an ether linkage to ___________________________ (2 pts).

3. What is coordinated phase transition of a lipid bilayer? (2 pts)

State one reason why biological membranes almost never undergo coordinated phrase transition (1 pt).
4. True or False (correct if false) (1 pt):

_________ Phosphoglyceride biosynthesis occurs on the cytoplasmic face of the ER.

5. Describe a detergent protocol for isolating integral membrane proteins from the plasma membrane into smaller vesicles. Includes step(s) in the protocol to insure that the resulting vesicles’ membranes are made up predominantly of phospholipids (3 pts).

Why are detergents effective in isolating both hydrophobic and hydrophilic proteins? (1 pt)

Name two detergents commonly used in studying integral membrane proteins (2 pts).

6. You want to restrict the mobility of an integral protein in the cell membrane. Name three different ways you could do this (3 pts).
7. Draw the process of protein translocation into the ER (4 pts).

Label the ribosome, mRNA, SRP, SRP receptor, translocon (open and closed conformations), signal peptidase, protein (folded and/or unfolded), GTP, GDP, and signal sequence. Clearly show which factors are cytosolic, luminal, and membrane embedded.

State the function of each component.

8. Draw 4 membrane protein topologies, depicting both the protein and the membrane (4 pts).

State whether each is single-pass or multipass, label the carboxy- and amino- terminus of each protein.

9. State the charge difference rule for multspanning membrane proteins.

Explain how it applies to at least one of the membrane topologies from question 8 (this can be shown via a diagram) (4 pts).
10. Oligosaccharides used in ER quality control are attached to this residue: ________, that resides in this 3-amino-acid motif: ________  ________  ________ (2 pts).

11. Describe the general structure of a mitochondrial matrix targeting sequence. What specific protein in the outer mitochondrial membrane does it interact with? If you experimentally collapse the proton gradient across the inner mitochondrial membrane with an ionophore, what would be the fate of newly synthesized nuclear-encoded mitochondrial matrix proteins? (4 pts)

12. True or False (correct if false) (1 pt):

_________ Reduced Ero1 converts oxidized PDI to reduced PDI. This reduced PDI then catalyzes the formation of a disulfide bond in the target protein.

13. Draw the Ran-GTP/Ran-GDP cycle near the nucleus. Label the nuclear membrane(s), cytosol, lumen of the nucleus, nuclear pores, Ran-GAP, Ran-GEF, GTP, GDP, and chromatin (4 pts).
Describe what Ran-GEF and Ran-GAP do (1 pt).

14. True or False (correct if false) (1 pt):

________ Ran-GEF contains a nuclear localization signal.
In Class Questions for Dr. Hanson’s lectures.

1. Name a unique feature of the pathway in which (3 pts):
   
   A. proteins successfully fold
   
   B. proteins that need more time to fold
   
   C. terminally misfolded proteins.

   What purpose does re-glucosylation, de-glucosylation, and de-mannosylation serve? (3 pts)

2. True or false (correct if false) (1 pt):
   
   ______ XBP1 (HAC1 in yeast) mRNA is spliced by BiP.

3. What is one function of the Sec23/Sec24 complex in the context of the COPII vesicle? (2 pts)

   What is one function of Sec13/Sec31 in the context of the COPII vesicle? (2 pts)
4. Describe how Schekman et. al. generated and isolated yeast secretory mutants. List the central steps of the protocol (4 pts).

5. True or False (correct if false) (1 pt):
   COPI vesicles are used for anterograde transport, and COPII vesicles are used for retrograde transport.


7. Diagram the steps by which vesicles dock and fuse with their target membrane. Label and state the function of syntaxin, SNAP-25, VAMP/synaptobrevin, NSF, and α-SNAP in fusion of synaptic vesicles with the plasma membrane. Show which membrane or compartment each factor is located in (4 pts).
8. The two models of transport through the Golgi are the _____________________________

model and the ____________________________ model (2 pts).

Describe the two models, and list key differences between them (2 pts).

9. What is the cause of I-cell disease? (2 pts)

10. List four routes by which extracellular components can be internalized into cells. Describe one feature that is unique to each one (4 pts).

What is the function of Rab proteins? (2 pts)