Molecular Cell Biology 5068 Exam 1
October 2, 2018

Exam Number: __________

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 6 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.

______________________________________________________________
Comments:
1. List 3 major functions of the plasma membrane in cells. (3 points)

2. What is the enzyme catalyzing the rate-limiting step in cholesterol biosynthesis and what is the step it catalyzes (precursor and product)? (3 points)

3. Explain the “inside out” structure of the membrane proteins and why this is how they fold. (4 points)
4. Name 3 properties of the Secretory Signal Sequence. (3 points)

5. Describe how the Ran-GDP/GTP concentration gradient is established in order to confer directionality on nuclear transport by the keryopherins. Make sure to mention all the components necessary for this cycle to occur, including the locations of Ran-GAP and Ran-GEF. (6 points)

6. Draw a route of a single pass protein into inner-mitochondrial membrane. Name the proteins involved and what they do for this process. (6 points)
7. Explain the charge difference rule and what might occur if there is a problem with this. (3 points)

8. What enzyme is responsible for the formation of disulfide bonds? Where does this occur? (2 points)

Dr. Hanson’s Lectures (30 Points)

1. Draw out COPII vesicle biogenesis and name the proteins involved and what they do. (5 points)
2. What major biochemical change is associated with the maturation of an endosome? (1 point)

3. Explain what COPII, COPI, and clathrin do, and which specific process each are involved in. (4 points)

4. Answer either A or B. (5 points)

A. Name and briefly describe four different pathways of internalization at the cell surface mentioned in class.

B. Describe how t-SNARES and v-SNARES form the mechanism of membrane fusion. What protein is responsible for the disassembly of SNARE complexes after fusion is complete?
5. Pick one receptor transport pathway (Transferrin, LDL, EGF) and briefly describe it in detail. Please be sure to comment on the fate of the receptor and cargo. (5 points)

6. Patients with I-cell disease have lysosomal enzymes that lack a M6PR tag. What is the critical role of M6P for lysosomal function? (2 points)
7. Why is glycosylation necessary? How does it guide proteins through the secretory pathway? (4 points)

8. T / F (Correct if false) The KDEL peptide binds the KDEL receptor at low pH in the cis-Golgi and releases at high pH in the rough ER. (2 points)

9. What initiates synaptic exocytosis and what protein senses this? (2 points)
1. The ubiquitination of proteins occurs in a step wise process. Briefly describe the roles of the E1, E2, and E3 enzymes in this process. (3 points)

2. Name the 4 structures that actin forms in a migrating cell. (4 points)

3. Rapamycin induces autophagy by inhibiting what important pathway? (2 points)
4. What is the difference between G-actin and F-actin? Explain the barbed and pointed ends and which end grows faster. (4 points)

5. Name two actin-binding proteins and what general function they serve. (4 points)

6. True or false: Instability is healthy for a cell because it allows for a dynamic cytoskeleton. (1 point)
7. Match the three upstream regulators of actin-binding proteins mentioned in class to which motility functions they govern. (3 points)

<table>
<thead>
<tr>
<th>Regulator</th>
<th>Function</th>
</tr>
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<tbody>
<tr>
<td>Rac</td>
<td>stress fibers</td>
</tr>
<tr>
<td>Rho</td>
<td>lamellipodia</td>
</tr>
<tr>
<td>Cdc42</td>
<td>filopodia</td>
</tr>
</tbody>
</table>

8. Fill in the following table. (9 points)

<table>
<thead>
<tr>
<th>Subunit</th>
<th>Polar? (y/n)</th>
<th>Relative size (large, medium, small)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microtubules</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actin</td>
<td></td>
<td></td>
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<tr>
<td>Intermediate filaments</td>
<td></td>
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</tr>
</tbody>
</table>

9. Name two ways that force can be generated by the cytoskeleton. (2 points)

10. Name 2 in vivo functions of intermediate filaments. (2 points)
11. What is the master nucleator and how does it work? (3 points)

12. List 3 functions of microtubules. (3 points)