MCB110
FINAL

May 17, 2008

_____.
Your name and student ID

QUESTION	POINTS
1 (15 points)	
2 (20 points)	
3 (15 points)	
4 (10 points)	
5 (20 points)	
6 (15 points)	
7 (25 points)	
8 (25 points)	
9 (15 points)	
10 (40 points)	
11 (50 points)	
12 (50 points)	

TOTAL (300 points)

WARNING: Your exam will be taken apart and each question graded separately. Therefore, if you do not put your name and ID# on every page or if you write an answer for one question on the backside of a page for a different question, you are in danger of irreversibly LOSING POINTS!

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Q1 – There are two main structural motives for integral membrane proteins, one exemplified by bacterial porins and another by GPCRs. Briefly describe each one (5 points). Which one can be predicted using hydropathy analysis and why? (10 points)

Q2 – The diffusion of integral membrane proteins in the plasma membrane can be demonstrated using cell fusion experiments and fluorescently label antibodies for the extra cellular regions of an integral membrane protein. Can you please describe such an experiment and the results for either a freely diffusing protein versus one that is anchored to the cytoskeleton and thus unable to diffuse? (10 points) In the first case, can you predict what the effect of lowering the temperature in the experiment would do to the quantitative outcome? (10 points).

Q3 – Voltage-gated ion channels typically become inactivated after about 1 msec following opening of the gate. What structural element is responsible for this inactivation, how does it work, and how was the element and its overall mechanism tested by an experiment described in class (15).

Q4 – Explain the physical bases for potassium selectivity based on the crystal structure of the open potassium channel. In particular, why does the channel not allow Na+ through, even thought sodium ions are smaller? (10)

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Q5 – Describe the structural steps in the ATP cycle of the Na/K ATPase that lead to the pumping of three Na+ ions out of the cell and two K+ ions into of the cell. Pay particular attention to describing the changes in affinity for the two ions that allow for the formation of high concentration gradients (20).

Q6 – The epithelial cells of the intestine need to concentrate glucose and then release it into the blood steam. The process requires three distinct transporters: a pump, a facilitative transporter and a co-transporter. Name and describe the activity of these transporters and indicate where they are located in the cell to ensure proper physiology (apical versus basal surfaces) (15).

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Q7 – An a neuronal synapse the action potential is converted into a chemical signal that diffuses through the synaptic cleft and potentially initiates a new action potential in the postsynaptic cell.

(a) How does the arrival of the action potential at the axon terminal result in the fusion of neuro-transmitter containing vesicles to the presynaptic membrane? (5)

(b) How does a neuro-transmitter like acetocholine activate an action potential in a postsynaptic cell? (10)

(c) How is the signaling by a neuro transmitter terminated at the synapse (two possibilities need to be mentioned) (5)

It has to be removes, either by reuptake thought endocytosys into the presynaptic cell, or by enzymatic degradation.

(d) How it is possible for a neuro-transmitter to bind to its ligand-gated channel in the postsynaptic membrane and result in hyperpolyrization rather than depolarization of the postsynaptic membrane? (5)

Q8 – Predict the phenotypic effect in the biosynthetic pathways of temperature-sensitive mutations in the following proteins as yeast is switched into a non-permissive temperature (5 each):

Name_____ SID _____

(a) SRP receptor

(b) Sec 23

(c) T-snare in the cis golgi

(d) ARF1

(e) V-snare between trans-golgi and lisosome

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Q9 –- During the process of LDL endocytosys,

a) What is the role of dynamin? (5)

b) How are clathrin and LDL-receptor recycled? (10)

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Q10 – In the response of a liver cell to glucagon,

(a) How is the signal amplified? (15)

(b) How is the signal terminated (15)

(c) Muscle cells do not contain glucagons receptors but contain epinephrine receptors that give rise to a very similar response in glycogen metabolism. Which signaling pathway in muscle cells antagonize the epinephrine pathway and results in glycogen synthesis? (10)