Name: Answer Key

Quiz #3:

Chapters 8, 11 &12: Control of gene expression; Structure and Transport across Membranes (12pts)

1. Transcriptional regulation allows different genes in the same cell to be expressed at different levels. Imagine a situation where two genes both require the same transcriptional activator in order to be transcribed. Describe another type of transitional regulator, in addition to this activator and the RNA polymerase, that would allow the expression of ONE of these genes and NOT the other? (1 pt)

   A transcriptional REPRESSOR could be bound to one of the genes. This would allow activator-promoted transcription at one gene while the repressor-bound gene would not be transcribed

2. Indicate if the followings statements about transcriptional regulators and their interactions with DNA are TRUE or FALSE. (0.5pts each)

   T A) Transcriptional regulators bind DNA in a sequence-specific manner

   T B) Transcriptional regulators often dimerize to increase the strength and specificity of their interactions

   F C) The ability of transcriptional regulators to access DNA is not influenced by histone modifications

   T D)The transcription of a eukaryotic gene can be influenced by proteins that bind far from the promoter

3. The expression state of a gene can be remembered over generations: being passed on to daughter cells during cell division, or even from a mother to her offspring. Describe ONE example of how a gene can be highly expressed in subsequent generations. (1 pt)

   1) A feedback loop where the protein product of a transcript is a transcriptional regulator that promotes its own transcription

   2) self-propagating histone modifications (the histone marks recruit enzymes that place the same mark on neighboring histone)

4. Would the example that you have provided in question #3 also enable inheritance of a transcription state where transcription is being repressed/silenced? Why or why not? (1 pt)

   1) this would NOT work with a repressor since there would be no protein product (its repressed) to sustain repression.

   2) this would work provided the methyl mark/histone modification promotes compaction/limits transcription.

5. Each of the following molecules has a limitation or challenge to getting through a cell membrane. ***Identify*** the limitation and ***describe*** how the cell overcomes this obstacle to move the molecule from one side of the membrane to the other. (0.5pt each)

   A. Water - polar & diffuses slowly = limitation
   - aquaporin channels to facilitate movement quickly

   B. Glucose uncharged but large = limitation
   - transporter to facilitate specific movement across membrane

   C. Na+ charged = limitation
   - ion channel OR transporter to move across membrane.

   (a channel large enough would not be specific)

6. Describe one way in which ***lipids*** regulate membrane ***fluidity***. (1 pt)

Saturation of hydrocarbon tails: more saturated pack more closely = less fluid membrane.

7. Describe one way in which ***proteins*** regulate membrane ***fluidity*** (1 pt)

Through protein - protein binding.
Transmembrane proteins bind proteins outside the membrane, restricting their movement = less fluid membrane.

8. Consider a situation where K+ concentration is much higher in the cytosol than in the extracellular environment.
   A. What else must you take into account before deciding whether K+ transport from the cytosol to the extracellular space will be favorable? (0.5 pt)

isoelectric / electrochemical gradient

   B. Assume that K+ transport into the extracellular space is ***unfavorable***. Describe one way that K+ transport out of the cell could be achieved anyway. Be specific and be sure to specify if your suggestion would require energy (1 pt)

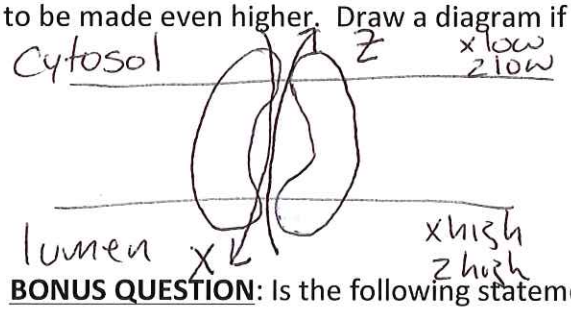
Active transport: powered by ATP or GTP hydrolysis
powered by light
powered by coupling to favorable transport (symport or antiport)

9. Fill in the blanks with the best word selected from the following list (1 pt, no partial credit):

active	Amino acid	Amphipathic	hydrophilic	hydrophobic
noncovalent	ion channels	passive	transporters	

A molecule moves down its concentration gradient by <u>passive</u> transport, but requires <u>active</u> transport to move up its concentration gradient. Transporter proteins and ion channels function in membrane transport by providing a <u>hydrophilic</u> pathway through the membrane for specific polar solutes or ions. <u>Transporters</u> are highly selective in the solutes that they transport, binding the solute at a specific site and changing conformation so as to transport the solute across the membrane. However, <u>channels</u> discriminate between solutes mainly on the basis of size and electrical charge.

10. Two molecules, X and Z, are both at a higher concentration in the lumen of an organelle then in the cytosol. Identify and describe the type of transport that would allow concentrations of X in the lumen to be made even higher. Draw a diagram if useful. (1 pt)



Antiporter
Active transport that couples the favorable movement of Z down its concentration gradient of X into the lumen.

11. **<u>BONUS QUESTION</u>**: Is the following statement TRUE or FALSE: A ***channel*** can never be used to move an ion ***against*** its concentration gradient. Explain your answer (1pt):

FALSE. Movement of an <u>ion</u> through a channel depends on <u>both</u> concentration and membrane potential = electrochemical gradient