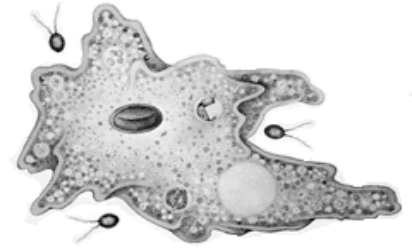**MCDB 1150-3:Biofundamentals 2014 Midterm 3 Name:_____**

There are 10 questions, each worth a maximum of 6 points. For the
multiple choice, drawing, graphing questions, your choice (if correct)
is worth 3 points, your explanation of the logic of your answer is worth
3 points. You always have a choice to pick "no idea" and get +1
point. No written answer is required if you pick "no idea".

1. There is a short insertion of 4 base pairs into the coding region of
a gene; the insertion is just downstream of the start codon. It will ….
    ☐ A. have no effect on the sequence of the encoded polypeptide
    ☐ B. change one amino acid in the polypeptide sequence
    ✔ C. change the overall sequence of the polypeptide
       no idea
Explain (below) why the incorrect answers are wrong or irrelevant.
C
Shift the frame from the beginning, so change overall sequence.

2. If a protein has a short half-life, that means it is ….
    ✔ A. is rapidly degraded
    ☐ B. rarely synthesized
       C. is produced by an unstable mRNA
        no idea
Explain (below) why the incorrect answers are wrong or irrelevant.

A

b/c half life is determined by how rapidly (probability of protein degradation as a function of time)
a protein is degraded.

B is wrong b/c if a protein rarely synthesized, but never degraded or slowly degraded, it has a
long half-life.

C is wrong b/c not related to mRNA

3. In the text and in class we discussed a type of mutation that allow a stop codon to be read as
       an amino acid. Such mutations occur in genes that encode
       A. ribosomal RNAs
       B. messenger RNAs
    ✔ C. transfer RNAs
       D. the mutated gene's regulatory region   no idea
Explain (below) why the incorrect answers are wrong or irrelevant.
C

**rRNA and mRNA do not have the ability to recognize codon. tRNA contains the anti-codon
       and bring amino acid to the polypeptide.**

4. The basis for Chargaff's rules (remember A equals T and C equals G) is….
   ☐ A. the fact that DNA directs the synthesis of RNA
   ☐ B. the fact that DNA encodes information in its base sequence
   ✔ C. the fact that A binds to T, G binds to C
       D. the fact that A and T are similar in size and shape, as are C and G   no idea
Explain (below) why the incorrect answers are wrong or irrelevant.

C
Chargaff's rule only tells that A pairs with T, G pairs with C. that's why A=T C=G. The other aspects are irrelevant.

5. A gene encodes a negatively acting transcription factor. A mutation occurs that leads to the protein's localization to the cell's (plasma) membrane. What is the effect on gene expression?
   A. no effect, since it normally acts negatively
   ✔ B. the expression of certain genes could increase
   C. the expression of all genes would increase   no idea
 Explain (below) why the incorrect answers are wrong or irrelevant.

B

Since it is a negatively acting transcription factor, the mutation will change its ability A wrong. Basically transcription factors work on certain genes, not all the genes. So it will increase certain genes expression C wrong.

6. A polypeptide passes through a membrane once, and only once. What type of structure would you expect to find in the membrane region?
   A. an unstructured polypeptide with both hydrophobic and hydrophilic R-groups
   B. a β-sheet like structure with hydrophilic R-groups
   ✔ C. an α-helix with hydrophobic R groups
       no idea
Now draw (and label) how a membrane channel protein made up of a single polypeptide chain might be organized?
C
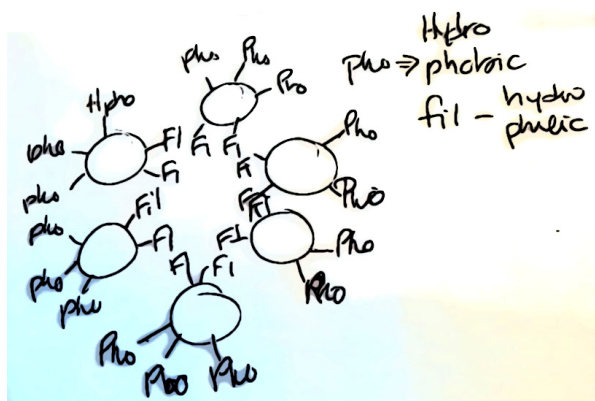
7. DNA repair systems can recognize a mismatched base pair, the absence of a base, or a single-stranded break in a DNA molecule because it …

      A. alters the polypeptide that the gene encodes

      B. it alters the binding of transcription factors.

    ✔ C. alters the structure of the DNA molecule

      no idea

Explain (below) why the incorrect answers are wrong or irrelevant.

C

DNA repair system only repairs DNA.

8. In his studies, Griffith found that S-strain (smooth, virulent) bacteria grown in culture very occasionally gave rise to R-strain (rough, avirulent) bacteria. Given what you know, predict the relative frequency of a S to R mutation.

      A. The same as the R to S rate

    ✔ B. Much higher than the R to S rate

    ☐ C. Much lower than the R to S rate

    ☐ D. impossible to say

    ☐ no idea

Explain (below) why the <u>correct</u> answer is correct

B

Bacteria have more chance to have a mutation that makes them from virulent to avirulent than backward. (why? Because it is easier (many more ways) to break a protein, that to do fix a broken protein (generally very few ways). Since mutations occur at random, probabilities matter.

9. A protein kinase phosphorylates a normally cytoplasmic protein, which changes the protein's structure. The phosphorylated protein is found in the nucleus. Which is the most likely to explain the observation? (more than one answer could be correct)

      A. phosphorylation inactivates a nuclear localization sequence

      B. phosphorylation activates a signal sequence

    ✔ C. phosphorylation activates a nuclear localization sequence

    ✔ D. phosphorylation inactivates a nuclear export sequence

    ☐ no idea

Explain (below) why the incorrect answers are wrong.

CD

C and D make the protein stay in the nucleus.

Proteins stay in the nucleus should have an activated nuclear localization sequence and inactived nuclear export sequence.

Inactivated nuclear localization sequence cannot make the protein stay in the nucleus.

10. In a bacterium, the gene "Chilly" is not expressed unless a specific sigma factor is active. Assume that this sigma factor is activated at time 0. The Chilly gene encodes a 100 amino acid long polypeptide that is secreted form the cell. Assume that you are looking at a large population of bacteria; indicate on the graph the time of the appearance of the full length Chilly protein in the population.
   (Y-axis = numbers of full length, secreted Chilly polypeptides)   NO IDEA

Q: Note on your graph when the various processes involved are occurring.

Q: How would your graph change in you were looking at a single bacterium?

translation

Secretion

time to make
Chilly mRNA

time