

**EXAM 1**  
**BIO 309 Summer 2005**

**True False** – Circle the correct answer (1 point each)

1. Lipids are polymers made of *many* nearly identical low molecular weight subunits
2. Phospholipids usually have a glycerol backbone with the exception of sphingomyelin
3. Bacteriophage (phage) can be used when constructing cDNA or genomic libraries
4. Electron microscopy is useful for looking at cellular structures that can't be seen by light microscopy
5. Lipid rafts are microdomains of the membrane containing specialized proteins
6. Cellulose is assembled with  $\beta$ 1-4 glycosidic linkages
7. Sines are found only in the telomeric regions of the chromosomes
8. Genomic libraries are made from mRNA
9. cDNA libraries contain sequences often contain introns
10. Euchromatin refers to "naked" DNA found in an interphase cell
11. The repetitive sequences called LINES are transposons
12. Currently it is possible to map and even sequence entire genomes
13. Enzymes do not affect the activation energy of a reaction
14. The eukaryotic genome has changed/evolved over evolutionary time
15. The folding of chromosomes is different each time a cell divides

**Multiple Choice** – Circle the **most correct** answer (1 point each)

16. The feature that most clearly separates eukaryotes from prokaryotes is the presence of \_\_\_\_\_ in eukaryotic cells.
 

A. ribosomes	C. DNA molecules.
B. oxidative phosphorylation.	D. a nucleus
  
17. *S. cerevisiae* is a good model system for molecular biology studies because
 

A. it has a small genome.	C. mutants can be easily isolated from culture dishes.
B. it reproduces rapidly.	D. All of the above are true.
  
18. Histidine and lysine are all
 

A. basic amino acids.	C. polar amino acids.
B. acidic amino acids.	D. non-polar amino acids
  
19. Integral membrane proteins can be attached to membranes by
 

A. spanning the membrane as a transmembrane protein.	B. electrostatic (charged) links to membrane lipids.
C. non-covalent bonds with transmembrane proteins.	D. B and C
E. All of the above are true.	
  
20. In the base pairing within a DNA double helix,
 

A. pyrimadines always pair with pyrimadines.	B. A always pairs with U and G always pairs with C.
C. A always pairs with G and C always pairs with T.	D. A always pairs with T and G always pairs with C.

+18



Name: \_\_\_\_\_

30. If you wanted to amplify a particular stretch of DNA and you already knew its sequence, you would use the technique of

- A. PCR
- B. restriction digestion
- C. RNA interference
- D. FISH

**Fill in the blank - 1 point each**

31-33. DNA is copied by the process of \_\_\_\_\_ to form more DNA, RNA is \_\_\_\_\_ from DNA, and \_\_\_\_\_ is made from mRNA.

34-36. Proteins are always made in the \_\_\_\_\_ to \_\_\_\_\_ direction, assembled with \_\_\_\_\_ bonds.

37. A psuedogene is a gene that has been duplicated but does not make \_\_\_\_\_, most probably because it's promoter is missing or mutated.

38-42. The actual sequence of amino acids that form a protein is called the \_\_\_\_\_ structure, the way the amino acid chain fold locally into alpha-helices and/or beta-strands is called the \_\_\_\_\_ structure of a protein. The why the alpha helices or beta strands are folded onto each other is called long distance folding or \_\_\_\_\_. When multiple subunits of a protein fold together this called \_\_\_\_\_ structure, \_\_\_\_\_ is a multisubunit protein that has this kind of structure.

**Short Essay questions, read carefully and answer completely. When appropriate use diagrams.**

1. What are gene families and how do they come about? Please give an example of a gene family. (4 points)

Name: \_\_\_\_\_

2. *E.coli* and the mouse are two very different model systems. (9 points)

- A. Please compare and contrast the advantages/disadvantages of each.
- B. You have isolated a gene encoding a protein called "X" that seems to be in the same gene family as *wnt*. Because *wnt* is a secreted molecule involved in regulating cell-to-cell interactions during embryogenesis you hypothesize that X. has a similar role. Which model system would you use to determine this and why?

Name: \_\_\_\_\_

3. You are interested in studying the molecular basis of a rare human genetic disease called Lissencephaly (LIS) - literally meaning smooth brain. One form of LIS has been mapped to the human chromosome 17p13.3. Although you can use imaging techniques to look at the brain, to determine the actual defect that results in LIS, you will need to isolate the proteins and mRNA from brain tissues. Because it is ethically impossible to carry out your research on humans, you have decided to use a model organism to try and study the disease. What model system would you use? WHY? Provide at least 2 reasons (5 points)

**ANSWER ONLY 4 OF THE NEXT 6 QUESTIONS (10 points each)**

ONLY 4 will be graded. If you answer more than 4 please indicate which of them you want graded. If there is no indication as to which 4 you want graded, I will grade only the first 4.

**For Extra Credit (5 points) answer one additional question – YOU MUST indicate which is the extra credit question**

1. **Briefly** define the following terms

cDNA library, Northern Blot, Microarray, Western Blot, Plasmid, PCR, Reverse Transcriptase, FISH, RNAi, homologous recombination

Name: \_\_\_\_\_

2. There are 4 main kinds of organic molecules in cells.

a. What are they?

b. 3 of the 4 groups of organic molecules form polymeric structures - what are these polymers called?

c. The 4th organic molecule does not form polymers, what kind of structure does it form? Please give an example of this type of molecule.

Name: \_\_\_\_\_

3. You have sequenced the gene for an uncharacterized protein from a mouse cDNA library. After analyzing the sequence of the gene, deducing the amino acid sequence (using the genetic code), and comparing the sequence to all other known sequences in the database, you discover that the sequence is similar to the human gene for the FGF receptor, a transmembrane protein that binds FGF (fibroblast growth factor – induces the growth of fibroblasts). Because you are an expert in Cell and Molecular Biology, you have no problem cloning the gene into an expression vector or in creating a transgenic animal. How would you determine if the gene does indeed code for the FGF receptor? Describe at least 2 experiments.

Name: \_\_\_\_\_

4. In a cell, DNA is always associated with proteins. Describe the structure of the DNA in an **interphase** cell, name the most abundant proteins associated with the DNA? Compare and contrast this with the structure of DNA in a **metaphase** cell. Identify **regions** of importance on the structure of DNA in a **metaphase cell** (HINT there are 3, a drawing may be useful).

5. What are the differences between a frameshift mutation, a missense mutation, and a nonsense mutation? Which is the most likely to be harmful to the cell? Why? (NOTE a drawing/sketch may be helpful)

Name: \_\_\_\_\_

6. You are interested in constructing (making) a new extrachromosomal vector for a yeast cell. What region(s) of chromosomal DNA would you want to include in your vector to ensure that the vector will be replicated when the host cell's DNA is copied and that each daughter cell will inherit the vector? Describe briefly the function of each of the regions.

What sequences would you include if you wanted to make the vector into a yeast artificial chromosome? Why?