

**Principles of Genetics (BIOL-362)**  
**Spring 2009**  
**Review Questions #1**

**(2-1) What is the historical basis for concluding that the heritable material is composed of DNA or RNA and not protein?**

**(2-1) Illustrate the phosphodiester bond, and explain why we speak about DNA 5' to 3'.**

**(2-2) How does the strength of base pairing differ between A, C, G, and T, and why?**

**(2-3) Illustrate a DNA double helix. Label the bases and sugar-phosphate backbone.**

**(2-4) How does RNA differ from DNA?**

**(2-1) What is the relationship between cellular DNA content and the structural or organizational complexity of the organism?**

**(2-2) Arrange the following in increasing order of eukaryotic chromosome condensation, beginning with the simplest level of organization (1) and ending with the most complex level of organization (6).**

- \_\_\_\_\_ Chromatin fiber
- \_\_\_\_\_ Metaphase chromosome
- \_\_\_\_\_ DNA double helix
- \_\_\_\_\_ Extended section of looped domains on chromosome
- \_\_\_\_\_ “Beads-on-a-string” form of chromatin
- \_\_\_\_\_ Condensed section of chromosome

**(2-3) How does the DNA of prokaryotes and eukaryotes differ?**

**(3-1) Draw a DNA replication fork and identify and label the locations of the following major components: (1) 5' and 3' ends of each strand, (2) leading strand, (3) lagging strand, (4) single-stranded binding proteins, (5) DNA polymerase, (6) Okazaki fragments, (7) RNA primer, (8) DNA helicase, (9) DNA ligase, (10) primase.**

**(3-2) How did the Meselson-Stahl experiment demonstrate that DNA replication is semiconservative and not conservative?**

**(4-2) Discuss problems and limitations of the “One gene – one enzyme hypothesis” and how it can be better formulated.**

**(4-3) Explain one example of how mutations in either the  $\alpha$ - or  $\beta$ -hemoglobins can produce an altered phenotype that may be adaptive to a particular geographic region.**

**(5-1) Distinguish between leader sequence, trailer sequence, coding sequence, intron, spacer sequence, nontranscribed spacer sequence, external transcribed spacer sequence, and internal transcribed sequence.**

**(5-2) Briefly summarize the post-transcriptional modifications and processing events that take place on the primary transcripts of eukaryotic rRNA and protein-coding genes.**

**(5-3) What major difference concerning the timing of transcription and translation exists between prokaryotes and eukaryotes?**

**(6-1) Why is degeneracy of the genetic code important for maintaining protein structure and function?**

**(6-2) What are the 4 main types of amino acids? How many amino acids are there total? How many stop codons exist?**

**(6-3) Illustrate a peptide bond? Label the N- and C- termini.**

**(6-4) What distinguishes primary, secondary, tertiary, and quaternary protein structure?**

**(6-5) What is a frameshift mutation? Why may they be deleterious?**

**(6-6) What is the wobble in the genetic code?**

**(6-7) How does tRNA become aminoacylated?**

**(6-8) Illustrate the site of protein synthesis on the ribosome? Label the P, A, and E sites and indicate the position of the growing peptide before and after elongation.**

**(7-1) How did Lamarck’s and Darwin’s concepts of adaptation and inheritance differ?**

**(7-2) How was Salvador Luria’s and Max Delbrück’s 1943 experiment with *E. coli* used to test alternative hypotheses about environmental induction of adaptive mutations?**

**(7-3) Identify and distinguish: transition, transversion, insertion, deletion, indel, missense mutation, nonsense mutation, neutral mutation, silent mutation, and frameshift mutation:**

**(7-4) How might a tRNA gene act as an intergenic suppressor mutation? What other factors involving protein translation might need to be compensated for?**

**(7-5) What are the differences between base analogs, base modifying agents, and intercalating agents?**

**(7-6) What are the important DNA repair mechanisms that exist?**