Guided Reading Questions

Chapter 10
Molecular Biology of the Gene

(intro) How are viruses similar to living things? Why are they generally not considered alive? Define molecular biology.

(10.1) Chromosomes are made of what two substances? What is the bacteriophage T2 made of? Where in T2 are radioactive sulfur and radioactive phosphorus incorporated? After separating the bacteria from the phages, where was most of the radioactive sulfur and where was most of the radioactive phosphorus? Was radioactive sulfur or radioactive phosphorus found with the bacteria? How did this demonstrate that DNA was the hereditary material?

(10.2) What is the monomer of DNA and RNA? What are the components of a nucleotide? What makes up the backbone of a polynucleotide? What is DNA an acronym for? How do the four nucleotides differ from each other? Define pyrimidine and purine. What are the pyrimidine bases and the purine bases in DNA? What does the acronym RNA stand for? How does RNA differ from DNA?

(10.3) Why is DNA called a double helix? Why did the A–A pair model of DNA not work? What nucleotides pair with each other? What are Chargaff's rules? How is the sequence of nucleotides, i.e., the sequential order of nucleotides, restricted in the Watson-Crick model of DNA? In Figure 10.3D, note that the sugar–phosphate backbones are oriented in opposite directions.

(10.4) How many identical molecules of daughter DNA are produced from one parental DNA molecule? Where do the strands of the daughter DNA molecules come from? Define semiconservative model.

(10.5) Where does DNA replication begin? What are replication bubbles? What do 3' and 5' refer to? What is DNA polymerase? In what direction is a DNA strand manufactured? What is the function of DNA ligase? What is the mistake rate in DNA replication?

(10.6) Redefine genotype and phenotype. What is the chain of command in the cell? Define transcription and translation. How did Garrod hypothesize that genes control phenotype? What is the one gene-one enzyme (now one gene-one polypeptide) hypothesis?

(10.7) What is produced by transcription? What are the complementary strands in transcription? Which polynucleotide is the template? In translation, the RNA code is converted into what? How many nucleotides code for a single amino acid? Define codon.

(10.8) Define start codon, stop codon, and redundancy. Contrast redundancy versus ambiguity.

(10.9) Where does transcription occur? How many DNA strands are transcribed. What enzyme makes RNA? Define promoter. What are the three phases of transcription? Define terminator.

(10.10) What is mRNA? Where do transcription and translation occur in prokaryotes? In eukaryotes? What are caps and tails in mRNA and what are their functions? Define intron and exon. What is RNA splicing? In addition to mRNA, what else is needed for translation?

(10.11) What is tRNA? What does the anticodon in tRNA complement? What attaches the amino acid to tRNA? How many versions of these enzymes are there?

(10.12) What RNA is found in ribosomes? What are the three binding sites on the ribosome?

(10.13) What are the three stages of translation? What are the two steps of initiation? What codon initiates translation? What is the location where the first tRNA binds called? What is the second tRNA binding site called?

(10.14) What are the three steps in elongation? Which tRNA holds the growing polypeptide after the peptide bond is formed? What stops translation?

(10.15) How long does it take to translate a single polypeptide? How many ribosomes can translate an mRNA at the same time? When does a polypeptide develop its tertiary structure? What level of protein structure does DNA (through mRNA) dictate? In Figure 10.15, is a tRNA associated with the stop codon?

(10.16) Define mutation. What are the two types of mutations that occur within a gene? Are mutations usually beneficial or detrimental? Which type is more disastrous? Define reading frame. Contrast spontaneous mutations and mutagens? How do mutations benefit living organisms? genetic research?