CHAPTER 17
FROM GENE TO PROTEIN

Learning Objectives

The Connection between Genes and Proteins

1. Distinguish between the "one gene-one enzyme" hypothesis, the "one gene-one protein" hypothesis and the "one gene-one polypeptide" hypothesis and explain why each is incorrect.
2. Explain how RNA differs from DNA.
3. Briefly explain how information flows from gene to protein. Is the central dogma ever violated?
4. Define between transcription and translation.
5. Compare the cellular locations of transcription and translation in bacterial and eukaryotic cells.
6. Define "codon" and explain the relationship between codons on mRNA and the amino acids in a polypeptide.
7. Describe the properties of the genetic code – how many codons code for amino acids, stop codons, redundancy, universality, etc.
8. Explain the significance of the "reading frame" during translation.
9. Explain the evolutionary significance of a nearly universal genetic code.

The Synthesis and Processing of RNA

10. Explain how RNA polymerase recognizes where transcription should begin. Describe the role of the promoter, the terminator (in bacterial cells), and define the transcription unit.
11. Explain the general process of transcription, including the three major steps of initiation, elongation, and termination.
12. Describe all of the ways in which RNA is modified after transcription in eukaryotic cells.
13. Define and explain the role of ribozymes. What three properties allow some RNA molecules to function as ribozymes?
14. Explain why, due to alternative RNA splicing, the number of different protein products an organism can produce is much greater than its number of genes.

The Synthesis of Protein

15. Describe the structure and function of tRNA.
16. Explain the significance of the wobble base.
17. Describe the process by which tRNA is joined to the appropriate amino acid.
18. Describe the structure and functions of ribosomes.
19. Describe the process of translation (including initiation, elongation, and termination) and explain which enzymes, protein factors, and energy sources are needed for each stage.
20. Define and describe the significance of polyribosomes.

21. Describe the primary post-translational modifications that occur before a protein becomes fully functional.
22. Describe the function of a signal peptide and a signal-recognition particle.
23. Define "point mutations." Distinguish between base-pair substitutions and base-pair insertions. Give an example of each and note the significance of such changes.
24. Distinguish between a missense and a nonsense mutation.
25. Why is an insertion or deletion more likely to be deleterious than a substitution?
26. Briefly compare gene expression in bacteria and eukaryotes.
27. Describe the historical evolution of the concept of a gene (these are the definitions that have been assigned over time).