ANSWERS TO EXERCISES

1. genetic code
2. RNA polymerase
3. "one-gene, one-protein" hypothesis
4. anticodon
5. translation
6. stop codons
7. messenger RNA (mRNA)
8. Transcription
9. mutation
10. transfer RNA (tRNA)
11. point mutation
    insertion mutations
    deletion mutation
12. codon
13. ribosome
14. false, DNA
15. true
16. true
17. false, single
18. false, nucleus
19. false, codons
20. false, translation
21. false, amino acid
22. true
23. false, inactive
24. tRNA
25. tRNA
26. mRNA
27. tRNA
28. rRNA
29. mRNA
30. tRNA
31. tRNA
32. transcription
33. translation
34. transcription
35. translation
36. transcription
37. translation
38. translation
39. translation
40. transcription
41. translation
42. b
43. c
44. a
45. c
46. a
47. transcription
48. translation
49. modification
50. catalysis

51.

Type of molecule	Sequences of bases or amino acids See text Table 10-3 for genetic code.					
DNA template strand	CTT	TAG	AAT	AGC	GGC	TCA
DNA non-template strand	GAA	ATC	TTA	TCG	CCG	AGT
messenger RNA codons	GAA	AUC	UUA	UCG	CCG	AGU
transfer RNA anticodons	CUU	UAG	AAU	AGC	GGC	UCA
protein amino acid sequence	glutamic acid	isoleucine	leucine	serine	proline	serine

52. AUG-AAA-UGC-AGC-ACU-UUU- GCC-AUA
53. Methionine-lysine-cysteine-serine-threonine-phenylalanine-alanine-isoleucine
54. AUG-GAA-AUG-CAG-CAC-UUU-UGC-CAU-A
55. Methionine-glutamic acid-methionine-glutamine-histidine-phenylalanine-cysteine-histidine-
56. The reason so many amino acids are changed is that the addition of one base causes all the codons to become different because they are read by ribosomes as three consecutive mRNA bases and the addition of one base results in a shift in the "reading frame" the ribosome uses to determine the codons.
57. If a mouse embryo with two X chromosomes is given a copy of the SRY gene normally found only in males, the embryo develops completely male characteristics, including a penis and testes, and the juvenile and adult mouse behaves as a male. However, it is sterile because other genes on the Y chromosome apparently are needed for production of functional sperm. Thus, an XX mouse has all the genes necessary to develop into a male if the SRY gene is present.

58. A mouse embryo, either XX or XY in sex chromosome content, will develop into a female if the SRY gene is lacking or not functional. Such XY females are sterile, however, since two X chromosomes are needed for completely normal ovary development. Thus, an XY mouse has all the genes necessary to develop into a female but usually doesn't because the SRY gene is present.
59. Normally, all calico cats are females, because the genes for black and orange fur color are on the X chromosome in cats. In mammalian females, only one X is active in body cells, determined randomly early in development. So, in the hair cell population of a female cat who has an orange color gene in one X and a black color gene in the other X, half the hair cells would make black hair and the other half would make orange hair. Male cats, on the other hand, with only one X chromosome per cell, would have either all black or all orange hair. However, once in a while, a calico male cat is born. This type of cat has an XXY sex chromosome constitution, with the orange color gene on one X and the black color gene on the other X. Thus, the X chromosomes behave as they do in females, while the cat is a male because of the action of the Y chromosome.
60. According to McKusick et. al. at the National Center for Biotechnology Information, three lines of evidence indicate that the SRY gene is necessary and sufficient for male sex determination and is the testis-determining factor. First, the SRY gene maps to the smallest region of the Y chromosome known to be male determining in humans and in the mouse; namely, the 35-kb interval just proximal to the pseudoautosomal boundary of the Y chromosome. Second, XY females with gonadal dysgenesis and with the Y chromosome intact have mutations in the SRY gene. Third, a 14-kb genomic fragment carrying the mouse SRY gene and no other coding sequence was sufficient to induce testis differentiation and subsequent male development when introduced into chromosomally female mouse embryos.
61. According to R. Bock at National Institute of Health, XXY individuals are male and sterile. According to the Turner's Syndrome Society, XO individuals are female and sterile. And According to J. Nielsen at the Turner Center, XYY individuals are male and fertile, and XXX individuals are female and fertile. Any human with a Y chromosome containing a functional SRY gene is male, and all other humans are female.
62. According to researchers at the John Hopkins University School of Medicine, Division of Pediatric Endocrinology, an XY human could be physiologically female if the SRY gene on the Y chromosome is abnormal and non-functional due to mutation. Another possibility is that during meiosis in the father of the XY "female," a rare crossover occurred between the X and the Y, moving the SRY gene from the Y chromosome over to the X chromosome. If that occurs, the father's Y chromosome without the SRY could produce an XY "female" offspring, and the father's X chromosome containing the SRY gene could produce an XX "male" offspring.