AP Biology REVIEW--Chapters 09-12

MULTIPLE CHOICE QUESTIONS

1. Which of the following is true of mitosis?
   A) The chromosome number in the resulting cells is halved.
   B) DNA replication is completed prior to the beginning of this phase.
   C) The chromosome number of the resulting cells is the same as that of the parent cell.
   D) Both b and c

2. Which of the following is true of meiosis?
   A) The chromosome number in the resulting cells is halved.
   B) DNA replication occurs before meiosis I and meiosis II.
   C) The homologs do not pair during prophase I.
   D) The chromosome number of the resulting cells is the same as that of the parent cell.

3. Which of the following is true of kinetochores on mitotic chromosomes?
   A) They are located at the centromere of each chromosome.
   B) They are the sites where microtubules attach to separate the chromosomes.
   C) They are organized so that there is one per sister chromatid.
   D) All of the above

4. Which of the following is true of the mitotic spindle?
   A) It is composed of actin and myosin microfilaments.
   B) It is composed of kinetochores at the metaphase plate.
   C) It is composed of microtubules, which help separate the chromosomes to opposite poles of the cell.
   D) It originates only at the centrioles in the centrosomes.

5. Imagine that there is a mutation in the Cdk2 gene such that its gene product is nonfunctional. What kind of effect would this mutation have on a mature red blood cell?
   A) The cell would be unable to replicate its DNA.
   B) The cell would not be able to enter G1.
   C) The cell would be unable to reproduce itself.
   D) There would be no effect, because mature red blood cells do not enter the cell cycle.

6. Imagine that there is a mutation in the Cdk2 gene such that its gene product is nonfunctional. What kind of effect would this mutation have on a mammalian white blood cell?
   A) The cell would be unable to replicate its DNA.
   B) The cell would be unable to enter G1.
   C) The cell would be unable to reproduce itself.
   D) Both a and c

7. Which is true of DNA replication and cytokinesis in Escherichia coli?
   A) DNA replication occurs in the nucleus.
   B) Cytokinesis is facilitated by microfilaments of actin and myosin.
   C) Cell reproduction is initiated by reproductive signals, which result in DNA replication, DNA segregation, and cytokinesis.
   D) The *E. coli* chromosome is linear.

8. Which of the following is true of chromatids?
   A) They are replicated chromosomes still joined together at the centromere.
   B) They are identical in mitotic chromosomes.
   C) They are identical in meiotic chromosomes.
   D) Both a and b

9. Histones are positively charged because
   A) the majority of the ions in the nucleus of the cell are negatively charged.
   B) histones interact with acidic residues of proteins found in the nucleus.
   C) the basic side chains of histone proteins interact with the negatively charged DNA.
   D) histones have a majority of acidic residues in their protein sequence.

10. Chromosome movement during anaphase is the result of
   A) the molecular motors at the kinetochores that move the chromosomes toward the poles.
   B) molecular motors at the centrosome that pull the microtubules toward the poles.
   C) shortening of the microtubules at the centrosome that pull the chromosomes toward the poles.
   D) Both a and c

11. Programmed cell death (apoptosis)
   A) occurs in cells that have been deprived of essential nutrients.
   B) occurs only in cells that have damaged DNA.
   C) is a natural process during development.
   D) is signaled by the initiation of mitosis.

12. What would happen to an E. coli cell if the ori site on its chromosome was deleted?
   A) Nothing.
   B) Replication would start but could not continue.
   C) Replication could not start.
   D) The chromosome would be replicated but the cell could not divide.

13. Chiasmata
   A) are sites where nonsister chromatids can exchange genetic material during meiosis.
   B) are sites where sister chromatids can exchange genetic material during meiosis.
   C) increase genetic variation among the products of meiosis.
   D) increase genetic variation among the products of mitosis.
   E) Both a and c

14. The difference between asexual and sexual reproduction is
   A) asexual reproduction only occurs in bacteria, and sexual reproduction occurs in plants and animals.
   B) asexual reproduction results in an organism that is identical to the parent, whereas sexual reproduction results in an organism that is not identical to either parent.
   C) asexual reproduction results from the fusion of two gametes; sexual reproduction produces clones of the parent organism.
   D) asexual reproduction only occurs in haplontic organisms, and sexual reproduction occurs only in diplontic organisms.

15. In the beginning of Chapter 10, hemophilia is mentioned as a trait carried by the mother and passed to her sons. What is the pattern of inheritance for this trait?
    A) Hemophilia is an allele carried on one of the mother's autosomal chromosomes.
    B) Hemophilia is an allele carried on the Y chromosome because more males have this genetic disorder than females.
    C) Hemophilia is an allele carried on the X chromosome and can be directly inherited by the son from the father or the mother.
    D) Hemophilia is carried on the X chromosome and can only be inherited by the son if the mother is a carrier.

16. Originally, genetic inheritance was thought to be a function of the blending of traits from the two parents. Which exception to Mendel's rules is an example of blending?
    A) Polygenic inheritance
    B) Incomplete dominance
    C) Codominance
    D) Pleiotropism

17. True-breeding plants
    A) produce the same offspring when crossed for many generations.
    B) result from a monohybrid cross.
    C) result from a dihybrid cross.
    D) result from crossing over during prophase I of meiosis.

18. What is the probability that a cross between a true-breeding pea plant with spherical seeds and a true-breeding pea plant with wrinkled seeds will produce F_1 progeny with spherical seeds?
    A) 1/2
    B) 1/4
    C) 0
    D) 1

19. What is the pattern of inheritance for a rare recessive allele?
    A) Every affected person has an affected parent.
    B) Unaffected parents can produce children who are affected.
    C) Unaffected mothers have affected sons and daughters who are carriers.
    D) None of the above

20. What is the pattern of inheritance for a rare dominant allele?
    A) Every affected person has an affected parent.
    B) Unaffected parents can produce children who are affected.
    C) Unaffected mothers have affected sons and daughters who are carriers.
    D) None of the above

21. What is the pattern of inheritance for a sex-linked allele?
    A) Every affected person has an affected parent.
    B) Unaffected parents can produce children who are affected.
    C) Unaffected mothers have affected sons and daughters who are carriers.
    D) None of the above

22. Penetrance and expressivity are related to
   A) the increased expression of a particular trait when a hybrid species is formed.
   B) quantitative traits that diminish or intensify a particular phenotype.
   C) the influence of environment on the expression of a particular genotype.
   D) the expression of one gene masking the effects of another gene.

23. Sex determination in humans and Drosophila is similar because
   A) females are hemizygous.
   B) males have one X chromosome and females have two X chromosomes.
   C) all males from both species always have one Y chromosome
   D) the ratio of X chromosomes to sets of autosomes determines maleness or femaleness.

24. Linked genes are genes that
   A) assort independently.
   B) segregate equally in the gametes during meiosis.
   C) always contribute the same trait to the zygote.
   D) are found on the same chromosome.
   E) recombine during mitosis.

25. Cytoplasmic inheritance
   A) results from polygenic nuclear traits.
   B) is the result of gametes contributing equal amounts of cytoplasm to the zygote.
   C) is determined by genes on DNA molecules in mitochondria and chloroplasts.
   D) follows Mendel's law of segregation.

26. Epistasis is
   A) the degree a particular genotype is expressed in an individual.
   B) the proportion of individuals within a group with a particular genotype that show the expected phenotype.
   C) when a heterozygotic individual expresses an intermediate phenotype of the parents.
   D) when one gene masks the expression of another gene.

27. Quantitative traits are
   A) affected by the environment.
   B) traits that affect the same phenotype.
   C) traits where each allele intensifies or diminishes the phenotype.
   D) All of the above

28. A test cross
   A) is used to determine if an organism that is displaying a dominant trait is heterozygous or homozygous for that trait.
   B) is used to determine if an organism that is displaying a recessive trait is heterozygous or homozygous for that trait.
   C) results in the F_2 generation having a phenotypic ratio of 3/4 dominant to 1/4 recessive.
   D) results in the same alleles being transferred from generation to generation.

29. An individual has a karyotype that is XX but is phenotypically male. What could explain this result?
    A) The Y chromosome was not visible in the karyotype.
    B) Sex determination is determined by the autosomes and not the X chromosomes.
    C) A translocation has occurred placing the *SRY* gene on one of the X chromosomes.
    D) The DAX I protein is overproduced.

30. Griffith's experiments showing the transformation of R strain pneumococcus bacteria to S strain pneumococcus bacteria in the presence of heat-killed S strain bacteria gave evidence that
    A) an external factor was affecting the R strain bacteria.
    B) DNA was definitely the transforming factor.
    C) S strain bacteria could be reactivated after heat killing.
    D) All of the above

31. Experiments by Avery, MacLeod, and McCarty supported DNA as the genetic material by showing that
    A) both protein and DNA samples provided the transforming factor.
    B) DNA was not complex enough to be the genetic material.
    C) only samples with DNA provided transforming activity.
    D) even though DNA was molecularly simple, it provided adequate variation to act as the genetic material.

32. Hershey and Chase used radioactive ^{35}S and ^{32}P in experiments to provide evidence that DNA was the genetic material. These experiments pointed to DNA because
    A) progeny viruses retained ^{32}P but not ^{35}S.
    B) presence of ^{32}P in progeny viruses indicated that DNA was passed on.
    C) absence of ^{35}S in progeny viruses indicated that proteins were not passed on.
    D) All of the above

33. X-ray crystallography provides information about the _______ of DNA but is limited because of the _______ of DNA. The technique is based on the pattern of _______ off the atoms in the molecule.
    A) structure; difficulty of purification; light absorption
    B) dimensions; molecular weight; diffraction
    C) molecular weight; shape; diffraction
    D) dimensions; linearity; light absorption

34. Chargaff observed that the amount of
    A) purines is roughly equal to the amount of pyrimidines in all tested organisms.
    B) A is roughly equal to the amount of T in all tested organisms.
    C) A + T is roughly equal to the amount of G + C in all tested organisms.
    D) Both a and b

35. Watson and Crick's model allowed them to visualize
    A) the molecular bonds of DNA.
    B) how the purines and pyrimidines fit together in a double helix.
    C) that the two strands of the DNA double helix were antiparallel.
    D) All of the above

36. A fundamental requirement for the function of genetic material is that it must be
   A) conserved among all organisms with very little variation.
   B) passed intact from one species to the next species.
   C) accurately replicated.
   D) found outside the nucleus.

37. Evidence indicating that DNA replication was semiconservative came from
   A) DNA staining techniques.
   B) DNA sequencing.
   C) density gradient studies using "heavy" nucleotides.
   D) None of the above

38. Current evidence indicates that replication complexes are attached to stationary nuclear components and that DNA is threaded through these complexes. Which of the following best describes the role of the replication complex?
   A) The complex acts as an enzymatic center for DNA replication.
   B) The complex binds specifically to replication origins, then controls the rate at which replication occurs.
   C) The complex is the initiating site of replication forks.
   D) All of the above

39. The primary function of DNA polymerase is to
   A) add nucleotides to the growing daughter strand.
   B) seal nicks along the sugar–phosphate backbone of the daughter strand.
   C) unwind the parent DNA double helix.
   D) prevent reassociation of the denatured parent DNA strands.

40. The lagging daughter strand of DNA is synthesized in what appears to be the "wrong" direction. This synthesis is accomplished by
   A) synthesizing short Okazaki fragments in a 5′-to-3′ direction.
   B) synthesizing multiple short RNA primers to initiate DNA replication.
   C) using DNA polymerase I to remove RNA primers from Okazaki fragments.
   D) All of the above

41. RNA primers are necessary in DNA synthesis because
   A) DNA polymerase is unable to initiate replication without an origin.
   B) the DNA polymerase enzyme can only catalyze the addition of deoxyribonucleotides onto the 3′ (—OH) end of an existing strand.
   C) RNA primase is the first enzyme in the replication complex.
   D) All of the above

42. Proofreading and repair occur
   A) at any time during or after synthesis of DNA.
   B) only before DNA methylation occurs.
   C) only in the presence of DNA polymerase.
   D) only in the presence of an excision repair mechanism.

43. DNA replication is an _______ process and _______ energy.
   A) exergonic; does not require
   B) endothermic; does require
   C) endergonic; does require
   D) endodontic; does not require

44. *T. aquaticus* DNA polymerase is not denatured during the heat cycling required to denature DNA. This property led to advances in what technique?
   A) RFLP analysis
   B) PCR
   C) Sequencing
   D) EPA

45. Thirty percent of the bases in a sample of DNA extracted from eukaryotic cells is adenine. What percentage of cytosine is present in this DNA?
   A) 10 percent
   B) 20 percent
   C) 30 percent
   D) 40 percent

46. Which of the following represents a bond between a purine and a pyrimidine (in that order)?
   A) C–T
   B) G–A
   C) G–C
   D) T–A

47. Which of the following statements about DNA replication is false?
   A) Okazaki fragments are synthesized as part of the leading strand.
   B) Replication forks represent areas of active DNA synthesis on the chromosomes.
   C) Error rates for DNA replication are often less than one in every billion base pairings.
   D) Ligases and polymerases function in the vicinity of replication forks.

48. Which of the following would not be found in a DNA molecule?
   A) Purines
   B) Ribose sugars
   C) Phosphates
   D) Sulfur

49. If a nucleotide lacking a hydroxyl group at the 3′ end were added to a PCR reaction, what would be the outcome?
   A) No additional nucleotides would be added to a growing strand containing that nucleotide.
   B) Strand elongation would proceed as normal.
   C) Nucleotides would only be added at the 5′ end.
   D) *T. aquaticus* DNA polymerase would be denatured.

50. Transcription in prokaryotic cells
    A) occurs in the nucleus, whereas translation occurs in the cytoplasm.
    B) is initiated at a start codon with the help of initiation factors and the small subunit of the ribosome.
    C) is initiated at a promoter and uses only one strand of DNA, the template strand, to synthesize a comple mentary RNA strand.
    D) is terminated at stop codons.

51. Which of the following about RNA polymerase is not true?
    A) It synthesizes mRNA in a 5′-to-3′ direction reading the DNA strand 3′-to-5′.
    B) It synthesizes mRNA in a 3′-to-5′ direction reading the DNA strand 5′-to-3′.
    C) It binds at the promoter and unwinds the DNA.
    D) It does not require a primer to initiate transcription.

52. Translation of messenger RNA into protein occurs
    A) in a 3′-to-5′ direction and from N terminus to C terminus.
    B) in a 5′-to-3′ direction and from N terminus to C terminus.
    C) in a 3′-to-5′ direction and from C terminus to N terminus.
    D) in a 5′-to-3′ direction and from C terminus to N terminus.

53. If a codon were read two bases at a time instead of three bases at a time, how many different possible amino acids could be specified?
    A) 16
    B) 64
    C) 8
    D) 32

54. Translate the following mRNA:
    3′-G A U G G U U U U A A A G U A- 5′
    A) NH_2 met—lys—phe—leu—stop COOH
    B) NH_2 met—lys—phe—trp—stop COOH
    C) NH_2 asp—gly—phe—lys—val COOH
    D) NH_2 asp—gly—phe—lys—stop COOH

55. What would happen if a mutation occurred in DNA such that the second codon of the resulting mRNA was changed from UGG to UAG?
    A) Nothing. The ribosome would skip that codon and translation would continue.
    B) Translation would continue, but the reading frame of the ribosome would be shifted.
    C) Translation would stop at the second codon, and no functional protein would be made.
    D) Translation would continue, but the second amino acid in the protein would be different.

56. If the following synthetic RNA were added to a test tube containing all the components necessary for protein translation to occur, what would the amino acid sequence be?
    5′-A U A U A U A U A U A U - 3′
    A) Polyphenylalanine
    B) Isoleucine-tyrosine-isoleucine-tyrosine
    C) Isoleucine-isoleucine-isoleucine-isoleucine
    D) Tyrosine-tyrosine-tyrosine-tyrosine

57. What part of the tRNA base-pairs with the codon in the mRNA?
   A) The 3′ end, where the amino acid is covalently attached
   B) The 5′ end
   C) The anticodon
   D) The promoter

58. Peptidyl transferase is an
   A) enzyme found in the nucleus of the cell that assists in the transfer of mRNA to the cytoplasm.
   B) enzyme found in the large subunit of the ribosome that catalyzes the formation of the peptide bond in the growing polypeptide.
   C) RNA molecule that is catalytic.
   D) Both b and c

59. Termination of translation requires
   A) release factor, initiator tRNA, and ribosomes.
   B) initiation factors, the small subunit of the ribosome, and mRNA.
   C) elongation factors and charged tRNAs.
   D) a stop codon positioned at the A site of the ribosome, peptidyl transferase, and release factor.

60. Which of the following mutations would probably be the most deleterious?
   A) A missense mutation in the second codon
   B) A frame-shift mutation in the second codon
   C) A nonsense mutation in the last codon
   D) A silent mutation in the second codon

61. If the DNA encoding a nuclear signal sequence were placed in the gene for a cytoplasmic protein, what would happen?
   A) The protein would be directed to the lysosomes.
   B) The protein would be directed to the nucleus.
   C) The protein would be directed to the cytoplasm.
   D) The protein would stay in the endoplasmic reticulum.

62. Auxotrophs are mutant strains that
   A) can grow on a minimal medium.
   B) require the addition of an essential nutrient to grow on a minimal medium.
   C) behave like wild-type strains.
   D) can only grow if arginine is added to the growth medium.

63. The central dogma of molecular biology states that _______ is transcribed into _______, which is translated into _______.
   A) genes; polypeptides; gene product
   B) protein; DNA; RNA
   C) DNA; mRNA; tRNA
   D) DNA; RNA; protein

64. A gene product can be a(n)
   A) enzyme.
   B) polypeptide.
   C) RNA.
   D) All of the above

65. The enzyme that catalyzes the synthesis of RNA is
   A) DNA polymerase.
   B) tRNA synthetase.
   C) ribosomal RNA.
   D) RNA polymerase.

<u>SHORT ANSWER/ESSAY QUESTIONS</u>

66. How is cell division different in prokaryotic cells and eukaryotic cells?

67. By administering a drug that inhibits cytokinesis, you have created peaches that are tetraploid. How many sets of chromosomes do these peaches have? (What is the ploidy of these chromosomes?) Will these peaches produce gametes that are fertile? What if the peaches were triploid?

68. How does cytokinesis differ in animal and plant cells?

69. Describe how two meters of DNA in a typical human cell can fit into the nucleus, which is 5 μm in diameter.

70. Describe two ways that the genetic diversity of organisms is increased during meiosis.

71. Draw a pedigree for three generations in which the grandfather has red–green color blindness and his daughter is a carrier. This daughter has four sons. Predict how many of the sons will be color-blind.

72. Draw a sample pedigree with three generations in which the paternal grandfather has a rare dominant autosomal trait. What is the probability that one of his children will have the disease? That one of his grandchildren will have the disease?

73. Draw a sample pedigree with three generations in which the maternal grandmother and paternal grandfather are carriers of a rare recessive autosomal trait. What is the probability that one of their children will be carriers of this trait? What is the probability that the grandchild with these grandparents would have the disease?

74. Cytoplasmic traits in certain species of trees are passed from the male plant to all of its progeny. Compare this observation to cytoplasmic inheritance in humans.

75. You are a genetics counselor who is working with a 21-year-old pregnant woman who has just discovered that her father has Huntington's chorea, a rare dominant autosomal trait. This disease usually develops in middle-aged individuals, so people carrying this trait do not find out they have this genetic disorder until midlife. What are the chances that the child she is carrying will develop Huntington's chorea? (Assume that her husband's family has no history of Huntington's chorea.) What is the chance that she has Huntington's chorea?

76. Given the following parent strand sequence, what would the daughter strand sequence look like?
    5′ – G C T A A C T G T G A T C G T A T A A G C T G A – 3′

77. Diagram the double helix. Be sure to label those properties that make it most suited as the genetic material.

78. Diagram a replication fork as it would be seen in a replicating segment of DNA. In your diagram label the 5′ and 3′ ends of each parent strand and daughter strand. Indicate which new strand is the leading strand and which is the lagging strand of the daughter DNA. Include all necessary proteins that help with replication.

79. Explain the difference between conservative and semiconservative models of DNA replication. What results supported the semiconservative model? What would the results have looked like had the conservative model of DNA replication been accurate? Are there any other potential hypotheses?

80. Explain the role of Okazaki fragments in the synthesis of the lagging strand.

81. Differentiate between proofreading, mismatch repair, and excision repair. Which of these repair mechanisms is responsible for repairing a mutation that occurs in an adult cell from overexposure to the sun? Explain your answer.

82. Explain how modified nucleotides are used in DNA sequencing.

83. What would be the effect of a deletion of the DNA encoding the targeting sequence for that gene product? (Imagine that this protein was targeted to go to the mitochondria and the signal sequence was removed as a result of this deletion.)

84. What would happen if the tRNA synthetase for tryptophan actually added a phenylalanine to the trp tRNAs instead of tryptophan?

85. Mutations can be very harmful to an organism, yet without them life as we know it today would not exist. Explain.

86. Suppose that two different mutant strains of a bacterium are unable to grow on a minimal medium without the addition of the amino acid lysine. Explain how this phenotype might be caused by different mutations in each strain, perhaps on the same gene and perhaps in two different genes.

87. When fed the same biochemical intermediate, two auxotrophic mutants that had been isolated were able to grow. According to the experiments of Beadle and Tatum, the mutations in each of these auxotrophs should be in the same gene, because they were blocked at the same step in a biochemical pathway. Yet, these two auxotrophs had mutations that mapped in different genes. How do you explain this?

Answer Key

1. D
2. A
3. D
4. C
5. D
6. D
7. C
8. D
9. C
10. D
11. C
12. C
13. E
14. B
15. D
16. B
17. A
18. D
19. B
20. A
21. C
22. C
23. B
24. D
25. C
26. D
27. D
28. A
29. C
30. A
31. C
32. D
33. B
34. D
35. D
36. C
37. C
38. D
39. A
40. D
41. B
42. A
43. C
44. B
45. B
46. C
47. A
48. D

49. A
50. C
51. B
52. B
53. A
54. B
55. C
56. B
57. C
58. D
59. D
60. B
61. B
62. B
63. D
64. D
65. D
66. In most prokaryotic cells there is only one circular chromosome. As the cell enlarges to prepare for division, the newly replicated daughter chromosomes are separated at opposite sides of the cell. During fission, the cell membrane pinches in, and cell wall components are synthesized between the daughter cells. In eukaryotic cells, there are more chromosomes, and they are linear. The cell undergoes a sequential set of steps called the cell cycle, in which the chromosomes are replicated and then separated to opposite poles of the cell. Microtubules are used to segregate the chromosomes equally into the daughter cells, and actin filaments and myosin cause the cell membrane to form a contractile ring and separate to form two daughter cells.
67. Peaches that are tetraploid have four sets of chromosomes. Because there are an even number of chromosomes ($4n$), each replicated homologous chromosome will be able to find a replicated homolog to pair with at meiosis and will produce fertile gametes. These gametes will be diploid. Triploid cells will not be fertile because one of the three homologs will not find its pair during prophase of meiosis I, and the single homologs will be segregated randomly into the daughter cells.
68. In animal cells, cytokinesis results from the interaction of actin filaments and myosin, which causes the cell membrane to pinch in and divide the cytoplasm into two cells. In plant cells, a cell plate forms between the newly segregated chromosomes, and Golgi vesicles fuse at that site to form the new cell membranes. Cell wall components are then secreted between the plasma membranes to complete cytokinesis.
69. See Figure 9.8.
70. Genetic diversity is increased during crossing over of prophase I of meiosis so that each gamete has chromosomes with different combinations of alleles. During meiosis, each homologous chromosome is randomly segregated to one of the two poles, resulting 2^{23} different possible combinations of homologous chromosomes per gamete.
71. See Figure 10.24, generations II, III, and IV. One-half of her sons could be color-blind.
72. See Figure 10.10A. One-half of his children could get the disease; one-fourth of his grandchildren could get the disease.
73. See Figure 10.10B, generations III, and IV. One-half of the children of these grandparents could be carriers. One-sixteenth of the children could have the disease.

74. In humans, the gamete with the largest cytoplasmic contribution is the egg, so cytoplasmic inheritance is passed from the female parent to all her children. In certain tree species, the male gamete contributes the majority of the cytoplasm to the zygote, so that all the mitochondria and chloroplasts in the zygote are inherited from the male parent.
75. She has a 50 percent chance that she will develop Huntington's chorea. Because the trait is an autosomal dominant allele, one-half of her father's gametes will contain the homologous chromosome carrying that allele and one-half of his gametes will contain the homologous chromosome that carries the wild-type allele. If she received the Huntington's allele, her child has a 50 percent chance of receiving this allele from her. The product rule is used to predict the probability that her child will inherit the Huntington's allele: 1/2 (the probability that she has the Huntington's allele) × 1/2 (the probability her child will inherit this allele from her) = 1/4 (the probability her child has the allele). Her child has a 25 percent chance of carrying the Hunting ton's chorea allele and thus of developing the disease. She has a 50 percent chance of carrying the Huntington's chorea allele.
76. 3' – C G A T T G A C A C T A G C A T A T T C G A C T – 5'
77. See Figure 11.6 in the text.
78. See Figure 11.15 and 11.16 in the text.
79. In the conservative model of DNA replication, the parent DNA remains intact, and a newly synthesized molecule consists of two newly replicated daughter strands. Had this been DNA's method of replication, Meselson and Stahl would not have seen the intermediate density band in the first generation of replication. They would have seen a heavy band corresponding to the parental DNA and a light band corresponding to the daughter DNA. Because they saw an intermediate band, they knew one strand was heavy and one was light; therefore, replication was semiconservative, with each new molecule consisting of one parental strand and one daughter strand. A third hypothesis was the dispersive model, with each new molecule containing bits and pieces of both old and new strands.
80. See Figure 11.17 in the text.
81. Proofreading occurs during synthesis of the DNA molecule, mismatch repair occurs after synthesis, and excision repair removes any abnormalities in “mature” DNA. DNA damage due to UV exposure is generally repaired via excision repair mechanisms.
82. Refer to Figure 11.21 in your textbook for an explanation of DNA sequencing.
83. Because the protein lacked its targeting sequence, it would no longer be moved to the mitochondria and would remain in the cytoplasm after it had been translated.
84. If the tRNA synthetase for tryptophan added phenyla lanine to the trp tRNAs, everytime a tryptophan codon was read by these trp tRNAs, phenylalanine would be added to the polypeptide. This would create proteins that were nonfunctional, and the cell would die.
85. Mutations very often have damaging effects on a gene, rendering that gene product nonfunctional. Some mutations actually create gene products that are better for the cell or organism and may increase its ability to survive. Mutations over the course of evolutionary time have created new organisms that could survive in different environments or compete more effectively for limited resources. Without mutations evolution does not occur.
86. The mutations in these two strains of bacteria apparently interfere with lysine synthesis. The mutations might both be in the same gene coding for an enzyme necessary for lysine synthesis, but one could be a nonsense mutation in the fifth codon and the other a frame-shift mutation in the twenty-third, for example (the number of mutations that can disable a gene is enormous). If lysine synthesis in this bacterium requires more than one enzyme (as is likely), the two mutations could be in different genes coding for different enzymes. In this case, the phenotypes would not be strictly identical; it should be possible to distinguish the two by trying to grow them on minimal media to which different intermediates in the synthesis of lysine have been added (see Figure 12.1).

87. These two genes must encode different polypeptides that are both subunits for the same enzyme in this biochemical pathway.