Name _____Chapter 12: DNA: The Carrier of Genetic Information

Mrs. Laux AP Biology Take home test #10 on Chaps. 12 and 13

DUE: MONDAY, DECEMBER 14, 2009

MULTIPLE CHOICE QUESTIONS

1. In the experiments of Griffith, the conversion of nonlethal R-strain bacteria to lethal S-strain bacteria:

   A. was the result of genetic mutation.
   B. was an example of the genetic exchange known as transformation.
   C. supported the case for proteins as the genetic material.
   D. could not be reproduced by other researchers.
   E. was an example of conjugation.

2. Chargaff determined that DNA from any source contains about the same amount of guanine as _____.

   A. uracil
   B. thymine
   C. adenine
   D. cytosine
   E. guanine

3. _____ used x-ray diffraction to provide images of DNA.

   A. Watson and Crick
   B. Crick and Wilkins
   C. Franklin
   D. Franklin and Crick
   E. Watson and Wilkins

4. X-ray diffraction studies are used to determine:

   A. the sequence of amino acids in protein molecules.
   B. the sequence of nucleic acids in nucleic acid molecules.
   C. the distances between atoms of molecules.
   D. the type of chemical under investigation.
   E. the wavelength of light emitted by chemicals.

5. The information carried by DNA is incorporated in a code specified by the:

   A. phosphodiester bonds of the DNA strand.
   B. number of separate strands of DNA.
   C. size of a particular chromosome.
   D. specific nucleotide sequence of the DNA molecule.
   E. number of bases in a DNA strand.

6. Why is DNA able to store large amounts of information?

   A. It contains a large number of different nucleotides.
   B. Its nucleotides can be arranged in a large number of possible sequences.
   C. It is capable of assuming a wide variety of shapes.
   D. The sugar and phosphates can be arranged in many different sequences.
   E. The nucleotides can be altered to form many different letters in the sequence.

7. Two chains of DNA must run in _____ direction(s) and must be _____ if they are to bond with each other.

   A. the same; uncomplementary
   B. opposite; uncomplementary
   C. parallel; uncomplementary
   D. parallel; complementary
   E. antiparallel; complementary

8. Which of the following nucleotide sequences represents the complement to the DNA strand 5´ – AGATCCG- 3´?

   A. 5´ – AGATCCG- 3´
   B. 3´ – AGATCCG- 5´
   C. 5´ – CTCGAAT- 3´
   D. 3´ – CTCGAAT- 5´
   E. 3´ – TCTAGGC- 5´

9. Which of the following best describes semiconservative replication?

   A. The translation of a DNA molecule into a complementary strand of RNA.
   B. A DNA molecule consists of one parental strand and one new strand.
   C. The number of DNA molecules is doubled with every other replication.
   D. The replication of DNA never takes place with 100% accuracy.
   E. The replication of DNA takes place at a defined period in the cell cycle.

10. The final product of DNA replication is:

    A. mRNA, tRNA, and rRNA molecules.
    B. a wide variety of proteins.
    C. DNA fragments.
    D. two DNA molecules, each of which contains one new and one old DNA strand.
    E. the enzymes needed for further processes, such as DNA polymerase.

11. Who first confirmed that the replication of DNA was semiconservative?

    A. Chargaff and Hershey
    B. Watson and Crick
    C. Avery and Griffith
    D. Meselson and Stahl
    E. Watson, Crick, and Wilkins

12. Meselson and Stahl separated DNA from different generations using:

    A. density gradient centrifugation.
    B. gel electrophoresis.
    C. an electron microscope.
    D. differential radioisotope labeling.
    E. None of these.

13. Which of the following cause the unwinding of the DNA double helix?

    A. DNA polymerase
    B. DNA helicase
    C. RNA primer
    D. primosome
    E. RNA polymerase

14. A replication fork:

    A. is only seen in prokaryotic chromosomes.
    B. is only seen in bacterial cells.
    C. is a Y-shaped structure where both DNA strands are replicated simultaneously.
    D. is a site where one DNA strand serves as a template, but the other strand is not replicated.
    E. is created by the action of the enzyme RNA polymerase.

15. In replication, once the DNA strands have been separated, reformation of the double helix is prevented by:

    A. DNA helicase enzyme.
    B. single-strand binding proteins.
    C. DNA polymerases.
    D. ATP.
    E. GTP.

16. Enzymes called _____ form breaks in the DNA molecules to prevent the formation of knots in the DNA helix during replication.

    A. topoisomerases
    B. single-strand binding proteins
    C. DNA polymerases
    D. RNA polymerases
    E. DNA ligases

17. Which of the following adds new nucleotides to a growing DNA chain?

    A. DNA polymerase
    B. DNA helicase
    C. RNA primer
    D. primase
    E. RNA polymerase

18. Why does DNA synthesis only proceed in the 5´ to 3´ direction?

    A. Because DNA polymerases can only add nucleotides to the 3´ end of a polynucleotide strand.
    B. Because the 3´ end of the polynucleotide molecule is more electronegative than the 5´ end.
    C. Because that is the direction in which the two strands of DNA unzip.
    D. Because that is the only direction that the polymerase can be oriented.
    E. Because the chromosomes are always aligned in the 5´ to 3´ direction in the nucleus.

19. The 5´ end of each Okazaki fragment begins with:

    A. the same RNA primer that began synthesis on the leading strand.
    B. a DNA primer binding to the template DNA.
    C. DNA polymerase binding to the template DNA.
    D. a separate RNA primer.
    E. a small DNA primer.

20. Primase is the enzyme responsible for:

    A. unwinding the DNA double strand to allow DNA polymerase access to the template DNA.
    B. introducing nicks into the DNA double strand in order to prevent the formation of knots.
    C. hydrolyzing ATP to facilitate DNA unwinding.
    D. making short strands of RNA at the site of replication initiation.
    E. forming a replication fork in the DNA double helix.

21. Okazaki fragments are joined together by:

    A. RNA polymerase.
    B. DNA ligase.
    C. DNA polymerase.
    D. RNA ligase.
    E. primase.

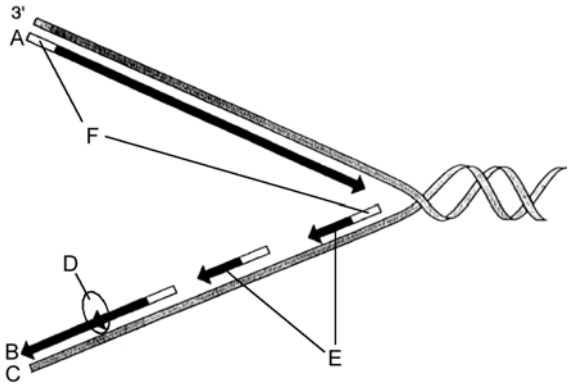
22. How is the chromosome of a bacterial cell replicated?

    A. The linear DNA molecule is replicated from multiple origins of replication bidirectionally.
    B. The linear DNA molecule is replicated from one origin of replication bidirectionally.
    C. The circular DNA molecule is replicated from multiple origins of replication bidirectionally.
    D. The circular DNA molecule is replicated from one origin of replication bidirectionally.
    E. The circular DNA molecule is replicated from one origin of replication unidirectionally.

23. How are the chromosomes of a eukaryote cell replicated?

    A. The linear DNA molecules are replicated from multiple origins of replication bidirectionally.
    B. The linear DNA molecules are replicated from one origin of replication bidirectionally.
    C. The circular DNA molecules are replicated from multiple origins of replication bidirectionally.
    D. The circular DNA molecules are replicated from one origin of replication bidirectionally.
    E. The linear DNA molecules are replicated from one origin of replication unidirectionally.

24–27. Use the figure to answer the corresponding questions.



24. The correct designation for the DNA strand labeled C is:

    A. the leading strand.
    B. 3´.
    C. Okazaki fragments.
    D. polymerase.
    E. None of these.

25. The segments labeled F are responsible for:

    A. linking short DNA segments.
    B. synthesizing the leading strand.
    C. forming the replication fork.
    D. initiating DNA synthesis.
    E. unwinding the DNA double helix.

26. The enzyme represented by the letter D is responsible for:

    A. linking short DNA segments.
    B. synthesizing the leading strand.
    C. forming the replication fork.
    D. forming nucleosomes.
    E. unwinding the DNA double helix.

27. The structures represented by the letter E are called:

    A. leading fragments
    B. Okazaki fragments.
    C. replication forks.
    D. nucleosomes.
    E. DNA polymerases.

28. Which of the following statements concerning nucleotide excision repair is FALSE?

    A. It is a type of mismatch repair.
    B. It involves a nuclease.
    C. It involves a DNA polymerase.
    D. It involves DNA ligase.
    E. It is implicated in xeroderma pigmentosum.

29. _____, the ends of eukaryotic chromosomes, shorten with every cell replication event.

    A. Centromeres
    B. Telomeres
    C. Kinetochores
    D. Primosomes
    E. Nucleosomes

30. The ends of eukaryotic chromosomes can be lengthened by:

    A. apoptosis.
    B. reverse transcriptase.
    C. primase.
    D. telomerase.
    E. DNA polymerase.

31. When cultured normal human cells were infected with a virus that carried the genes that coded for a subunit of telomerase:

    A. the cells underwent more cell divisions than normal.
    B. the cells underwent fewer cell divisions than normal.
    C. the cells died almost immediately.
    D. the cells underwent gene expression more vigorously.
    E. the cell cycle shortened.

32. Cancer cells differ from noncancerous cells in that:

    A. they have elevated levels of telomerase.
    B. they are virtually immortal.
    C. they have the ability to resist apoptosis.
    D. they can maintain telomere length as they divide.
    E. All of these.

33. Why was it important in the studies of Beadle and Tatum that *Neurospora* is haploid?

    A. Because it is easier to grow haploid molds in the laboratory.
    B. Because haploid molds have simpler nutritional requirements than do diploid molds.
    C. Because a mutation that arises is not masked by a normal allele on a homologous chromosome.
    D. Because haploid *Neurospora* will always mutate.
    E. Because diploid *Neurospora* will always mutate.

34. Beadle and Tatum irradiated *Neurospora* and initially grew the mutant strains on complete medium. How were they able to determine what type of mutation each strain had?

    A. By growing the mold on a complete medium with extra vitamins and nutrients.
    B. By growing the mold on minimal media supplemented with different combinations of amino acids, vitamins, etc.
    C. By growing the mold in its diploid form to see which traits were masked.
    D. By comparing *Neurospora* to other species of mold.
    E. By observing the marked differences in morphology between the different strains.

35. What conclusions did Beadle and Tatum reach with their studies of *Neurospora*?

    A. Each mutant gene affected several enzymes.
    B. Each mutant gene affected a pair of enzymes.
    C. Each mutant gene affected only one enzyme.
    D. Mutant genes had no effect on the enzymes produced by the cells.
    E. None of these.

36. Linus Pauling demonstrated that:

    A. the structure of hemoglobin was altered by a mutation of a single gene.
    B. mutations only caused defects in enzymes.
    C. mutations alter the structure of RNA, but not proteins.
    D. mutations were inherited.
    E. the structure of hemoglobin was altered by mutations in any of a dozen genes.

37. Uracil forms a complementary pair with _____ in RNA and _____ in DNA.

    A. adenine; adenine
    B. adenine; thymine
    C. thymine; thymine
    D. uracil; adenine
    E. adenine; uracil

38. RNA synthesis is also known as:

    A. elongation.
    B. reverse transcription.
    C. termination.
    D. translation.
    E. transcription.

39. All RNA except for _____ is made from DNA.

    A. tRNA
    B. mRNA
    C. rRNA
    D. snRNA
    E. None of these.

40. Which of the following serves as an "adapter" in protein synthesis and bridges the gap between mRNA and proteins?

    A. tRNA
    B. cDNA
    C. rRNA
    D. promoter sequences
    E. DNA

41. During protein synthesis, ribosomes:

    A. attach to the mRNA molecule and travel along its length.
    B. attach to the DNA molecule and travel along its length to produce an mRNA molecule.
    C. translate mRNA into tRNA.
    D. transcribe mRNA to tRNA.
    E. translate mRNA into DNA.

42. How is the 4-letter language of nucleic acids converted into the 20-word language of amino acids?

    A. The 4 nucleic acid bases combine in 2-letter combinations that define different amino acids.
    B. The 4 nucleic acid bases combine in 3-letter sequences that define different amino acids.
    C. Triplets of the 2-letter nucleic acid bases are translated into the 20 different amino acids.
    D. The 4 bases each specify 1 amino acid, which give rise to the remaining 16 amino acids.
    E. The 4 bases are first converted into tRNA molecules, which can each attach to 5 amino acids.

43. The total number of different three-base combinations of the four nucleic acid bases is:

    A. 12.
    B. 16.
    C. 20.
    D. 64.
    E. 256.

44. One of the mRNA codons specifying the amino acid leucine is 5´-CUA-3´. Its corresponding anticodon is:

    A. 5´-GAT-3´.
    B. 3´-AUC-5´.
    C. 3´-GAU-5´.
    D. 3´-GAT-5´.
    E. 5´-GAU-3´.

45. The wobble hypothesis states that:

    A. more than one ribosome can bind to an mRNA molecule.
    B. some amino acids are coded for by more than one codon.
    C. there is more than one stop codon in the genetic code.
    D. a particular amino acid may be linked to more than one type of tRNA molecule.
    E. certain tRNA anticodons can pair with more than one codon sequence.

46. A sequence of bases located *upstream* from a reference point occurs:

    A. towards the 3´ end of the amino acid sequence.
    B. towards the 5´ end of the mRNA sequence.
    C. towards the 3´ end of the mRNA sequence.
    D. towards the 5´ end of the transcribed DNA strand.
    E. towards the carboxyl end of the amino acid sequence.

47. Initiation of transcription requires:

    A. a promoter sequence.
    B. DNA polymerase.
    C. an RNA primer.
    D. a DNA primer.
    E. Okazaki fragments.

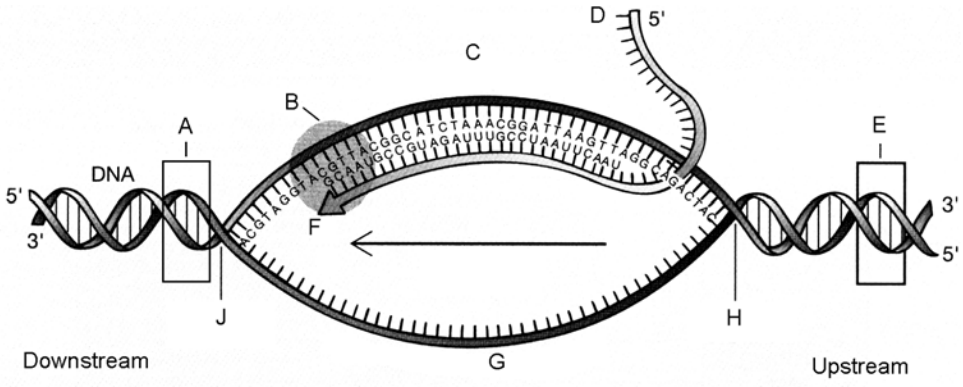
48. How does the first nucleotide at the 5´ end of a new mRNA chain differ from the other nucleotides in the chain?

    A. The first nucleotide is always a uracil.
    B. The first nucleotide is always a cytosine.
    C. The first nucleotide retains its triphosphate group, while the others do not.
    D. The first nucleotide does not retain its triphosphate group, while the others in the chain do.
    E. The first nucleotide is always a modified cytosine.

49. Why is only one strand of DNA transcribed into mRNA?

    A. Because mRNA is only required in small quantities.
    B. Because transcribing both DNA strands would produce different amino acid sequences.
    C. Because the other strand would produce the same amino acid sequence in reverse order.
    D. Because all genes are located on the same DNA strand, while the other strand acts as protection.
    E. Because the other strand is transcribed directly into amino acids.

50–52. Use the figure to answer the corresponding questions.



50. The transcription process begins at the area labeled:

A. A.
B. D.
C. E.
D. G.
E. None of these.

51. The component labeled B is:

A. DNase.
B. DNA polymerase.
C. RNA primase.
D. RNA polymerase.
E. reverse transcriptase.

52. The process illustrated in the associated figure is:

A. DNA synthesis.
B. translation.
C. transcription.
D. a frame shift mutation.
E. protein synthesis.

53. Which of the following numbered terms represents the correct order of sequences in a prokaryotic mRNA molecule as it was synthesized?

1) 3´ trailing sequences
2) coding sequences
3) leader sequences
4) termination signals

A. 1 → 2 → 3 → 4
B. 3 → 2 → 4 → 1
C. 2 → 1 → 4 → 3
D. 4 → 2 → 1 → 3
E. 3 → 4 → 2 → 1

54. Leader sequences contain signals that:

    A. prevent enzymes from degrading the newly synthesized mRNA.
    B. inhibit ribosome binding until the appropriate time.
    C. initiate chain termination.
    D. allow the ribosomes to be properly positioned to translate the message.
    E. allow tRNA molecules to successfully bind to mRNA.

55. Aminoacyl-tRNA synthetases _____ link _____ to their respective tRNA molecules.

    A. ionically; mRNAs
    B. loosely; mRNAs
    C. terminally; codons
    D. covalently; amino acids
    E. enzymatically; codons

56. The tRNA:

    A. must be recognized by ribosomes.
    B. must have an anticodon.
    C. must have an attachment site for the amino acid.
    D. must be recognized by a specific aminoacyl-tRNA synthetase that adds the correct amino acid.
    E. All of these.

57. Where is the amino-acid binding site located on the tRNA molecule?

    A. in the middle of the loop
    B. at the end of the 3´ end of the molecule
    C. in the first loop
    D. along the longest stretch of base pairing in the molecule
    E. on the 5´ end of the molecule

58. Proteins synthesized in *E. coli* have which of the following at their amino terminal end?

    A. N-formyl-methionine
    B. N-acetyl-adenine
    C. adenine triphosphate
    D. the AUG codon
    E. the UUU codon

59. In all organisms, the AUG codon codes for:

    A. the initiation of translation.
    B. the termination of transcription.
    C. the termination of chain elongation.
    D. the amino acid valine.
    E. a termination tRNA molecule.

60. Which of the following numbered events represents the correct sequence of events of prokaryotic translation initiation?
    1) large ribosomal subunit binds to initiation complex
    2) initiation tRNA binds small ribosomal subunit
    3) initiation complex binds to ribosome recognition sequence on mRNA

    A. $1 \rightarrow 2 \rightarrow 3$
    B. $1 \rightarrow 3 \rightarrow 2$
    C. $2 \rightarrow 1 \rightarrow 3$
    D. $2 \rightarrow 3 \rightarrow 1$
    E. $3 \rightarrow 2 \rightarrow 1$

61. Translocation is the process whereby the _____ moves in order to place the tRNA bound to the growing polypeptide chain in the _____ site, thereby freeing the _____ site for a new aminoacyl-tRNA.

    A. mRNA; A; P
    B. ribosome; P; A
    C. tRNA; P; A
    D. ribosome; A; P
    E. tRNA; A; P

62. The enzyme peptidyl transferase, which catalyzes the transfer of the polypeptide chain attached to the tRNA in the _____ site to the aminoacyl-tRNA in the _____ site, is thought to be a(n) _____ molecule and *not* a protein.

    A. A; P; rDNA
    B. P; A; tRNA
    C. A; P; mRNA
    D. P; A; rRNA
    E. P; A; sugar

63. Following peptide bond formation between the amino acid in the A site on the ribosome and the growing polypeptide chain, the tRNA in the A site:

    A. releases the growing polypeptide chain.
    B. picks up another amino acid to add to the chain.
    C. moves to the P site of the ribosome.
    D. forms a peptide bond with A site of the ribosome.
    E. forms a covalent bond with the P site of the ribosome.

64. If a human gene mRNA were placed into a cell of yeast, it would be:

    A. degraded immediately.
    B. translated into a repeating amino acid chain.
    C. translated into a chain of random amino acids not resembling the protein in humans.
    D. translated into the protein that is found in humans.
    E. integrated into the genome of the yeast.

65. Binding of the appropriate aminoacyl-tRNA to the A site requires:

    A. no additional energy.
    B. the input of two ATP molecules to supply the needed energy.
    C. energy supplied by GTP.
    D. activation of the A site.
    E. phosphorylation of the tRNA molecule.

66. Translocation in translation requires:

A. no additional energy.
B. activation of the P site.
C. the input of two ATP molecules to supply the needed energy.
D. energy supplied by GTP.
E. phosphorylation of the mRNA molecule.

67. A polyribosome is:

A. a complex of many ribosome and an mRNA.
B. a complex of many ribosomes in eukaryotes.
C. an initiation complex in eukaryotes.
D. an elongation complex in eukaryotes.
E. a complex of a ribosome with its two subunits and several mRNAs.

68. An mRNA "5´ cap":

A. prevents translation.
B. facilitates binding of ribosomes.
C. marks the mRNA for degradation.
D. decreases the half-life of the mRNA.
E. protects newly synthesized mRNA from degradation.

69. The 3´ end of eukaryotic pre-mRNAs are changed by:

A. removing the last phosphate group.
B. adding a "cap."
C. copying the last few bases so that it can form a duplex structure.
D. cutting and adding 100–250 adenine nucleotides.
E. phosphorylation of the mRNA molecule.

70. Introns in pre-mRNA are known to:

A. code for specific protein domains.
B. undergo excision, whereby they are spliced out of the message.
C. be able to move within the mRNA, thereby giving rise to new exon combinations.
D. protect pre mRNA from enzyme degradation.
E. code for important amino acid sequences.

71. Interrupted coding sequences include long sequences of bases that do *not* code for amino acids. These noncoding sequences, called _____, are found in _____ cells.

A. exons; prokaryotic
B. introns; prokaryotic
C. exons; eukaryotic
D. introns; eukaryotic
E. None of these.

72. Walter Gilbert proposed that exons are:

A. remnants of older life forms.
B. sequences that code for protein domains that are shuffled to form new proteins.
C. the result of mutation of introns.
D. not present in prokaryotes.
E. sequences that interrupt the coding sequences of proteins.

73. A gene can now be defined as:

    A. a DNA sequence that carries information to produce a specific RNA or protein product.
    B. a DNA nucleotide sequence that carries information to produce a specific polypeptide.
    C. a DNA or RNA sequence that carries information to produce a single polypeptide.
    D. a DNA nucleotide sequence that carries information to produce an enzyme.
    E. a DNA or RNA sequence that carries information to produce a specific polypeptide.

74. Retroviruses or RNA tumor viruses use _____ to make DNA:

    A. DNA polymerase
    B. DNA-dependent RNA polymerase
    C. RNA polymerase
    D. primase
    E. reverse transcriptase

75. A mutation that replaces one amino acid in a protein with another is called a _____ mutation.

    A. frameshift
    B. recombinant
    C. nonsense
    D. missense
    E. neutral

76. Substitution of one base pair for another can result in a _____ mutation that results in the conversion of an amino acid specifying codon to a termination codon.

    A. nonsense
    B. frameshift
    C. chromosomal
    D. missense
    E. None of these.

77. Frameshift mutations result from:

    A. the substitution of one base pair for another.
    B. the substitution of more than one base pair.
    C. the insertion or deletion of one or two base pairs.
    D. the substitution of a stop codon for an amino acid-specifying codon.
    E. the substitution of a start codon for an amino acid codon.

DISCUSSION OR THOUGHT QUESTIONS-Please type your thoughtful answers on a separate sheet of paper.

1. What evolutionary role is served by the redundancy of the genetic code?

2. Eukaryotic mRNA has a significantly longer half life that its prokaryotic counterpart. How is this accomplished in eukaryotes? What processes tend to degrade mRNA molecules in both eukaryotes and prokaryotes, and why are these processes needed?