Chapter 14 Exercises

Review Questions

1. If DNA of a particular species were analyzed and contained 27% A, what would be the percentage of C?
a. 27% **b.** 30% **c.** 23% **d.** 54%

2. The experiments by Hershey and Chase helped confirm that DNA was the hereditary material based on the finding that _____.
a. radioactive phage were found in the pellet
b. radioactive cells were found in the supernatant
c. radioactive sulfur was found inside the cell
d. radioactive phosphorus was found in the cell

3. Bacterial transformation is a major concern in many medical settings. Why might health care providers be concerned?
a. Pathogenic bacteria could introduce disease-causing genes in nonpathogenic bacteria.
b. Antibiotic resistance genes could be introduced to new bacteria to create "superbugs."
c. Bacteriophages could spread DNA encoding toxins to new bacteria.
d. all of these

4. DNA double helix does not have which of the following?
a. antiparallel configuration **c.** major and minor grooves
b. complementary base pairing **d.** uracil

5. In eukaryotes, what is the DNA wrapped around?
a. single-stranded binding proteins **c.** polymerase
b. sliding clamp **d.** histones

6. Meselson and Stahl's experiments proved that DNA replicates by which mode?
a. conservative **c.** dispersive
b. semiconservative **d.** none of these

7. If the sequence of the 5′-3′ strand is AATGCTAC, then the complementary sequence has the following sequence:
a. 3′-AATGCTAC-5′ **c.** 3′-TTACGATG-5′
b. 3′-CATCGTAA-5′ **d.** 3′-GTAGCATT-5′

8. How did Meselson and Stahl support Watson and Crick's double-helix model?
a. They demonstrated that each strand serves as a template for synthesizing a new strand of DNA.
b. They showed that the DNA strands break and recombine without losing genetic material.
c. They proved that DNA maintains a double-helix structure while undergoing semiconservative replication.
d. They demonstrated that conservative replication maintains the complementary base pairing of each DNA helix.

9. Which of the following components is *not* involved during the formation of the replication fork?
a. single-strand binding proteins **c.** origin of replication
b. helicase **d.** ligase

10. Which of the following does the enzyme primase synthesize?
a. DNA primer **c.** Okazaki fragments
b. RNA primer **d.** phosphodiester linkage

11. In which direction does DNA replication take place?
a. 5′-3′ **b.** 3′-5′ **c.** 5′ **d.** 3′

12. A scientist randomly mutates the DNA of a bacterium. She then sequences the bacterium's daughter cells and finds that the daughters have many errors in their replicated DNA. The parent bacterium likely acquired a mutation in which enzyme?

a. DNA ligase
b. DNA pol II
c. primase
d. DNA pol I

13. The ends of the linear chromosomes are maintained by which of the following?

a. helicase
b. primase
c. DNA pol
d. telomerase

14. Which of the following is *not* a true statement comparing prokaryotic and eukaryotic DNA replication?

a. Both eukaryotic and prokaryotic DNA polymerases build off RNA primers made by primase.
b. Eukaryotic DNA replication requires multiple replication forks, while prokaryotic replication uses a single origin to rapidly replicate the entire genome.
c. DNA replication always occurs in the nucleus.
d. Eukaryotic DNA replication involves more polymerases than prokaryotic replication.

15. During proofreading, which of the following enzymes reads the DNA?

a. primase
b. topoisomerase
c. DNA pol
d. helicase

16. The initial mechanism for repairing nucleotide errors in DNA is _____.

a. mismatch repair
b. DNA polymerase proofreading
c. nucleotide excision repair
d. thymine dimers

17. A scientist identified an abnormally shortened protein in a fruit fly. She then determined that the abnormal protein was the result of a single base pair substitution in the gene that codes for the protein. What type of mutation is this?

a. silent
b. nonsense
c. missense
d. frameshift

Critical Thinking Questions

18. Explain Griffith's transformation experiments. What did he conclude from them?

19. Why were radioactive sulfur and phosphorus used to label bacteriophage in Hershey and Chase's experiments?

20. When Chargaff was performing his experiments, the tetranucleotide hypothesis, which stated that DNA was composed of GACT nucleotide repeats, was the most widely accepted view of DNA's composition. How did Chargaff disprove this hypothesis?

21. Provide a brief summary of the Sanger sequencing method.

22. Describe the structure and complementary base pairing of DNA.

23. Prokaryotes have a single circular chromosome, while eukaryotes have linear chromosomes. Describe one advantage and one disadvantage to the eukaryotic genome packaging compared to the prokaryotes.

24. How did the scientific community learn that DNA replication takes place in a semiconservative fashion?

25. Imagine the Meselson and Stahl experiments had supported conservative replication instead of semiconservative replication. What results would you predict to observe after two rounds of replication? Be specific regarding percent distributions of DNA incorporating ^{15}N and ^{14}N in the gradient.

26. DNA replication is bidirectional and discontinuous; explain your understanding of these concepts.

27. What are Okazaki fragments and how they are formed?

28. If the rate of replication in a particular prokaryote is 900 nucleotides per second, how long would it take 1.2 million base pair genomes to make two copies?

29. Explain the events taking place at the replication fork. If the gene for helicase is mutated, what part of replication will be affected?

30. What is the role of a primer in DNA replication? What would happen if you forgot to add a primer in a tube containing the reaction mix for a DNA sequencing reaction?

31. Quinolone antibiotics treat bacterial infections by blocking the activity of topoisomerase. Why does this treatment work? Explain what occurs at the molecular level.

32. How do the linear chromosomes in eukaryotes ensure that its ends are replicated completely?

33. What is the consequence of mutation of a mismatch repair enzyme? How will this affect the function of a gene?

34. An adult with a history of tanning has his genome sequenced. The beginning of a protein coding region of his DNA reads ATGGGGATATGGCAT. If the protein coding region of a healthy adult reads ATGGGGATATGAGCAT, identify the site and type of mutation.