

CHAPTER 16

THE MOLECULAR BASIS OF INHERITANCE

Learning objectives

DNA as the Genetic Material

1. Explain why researchers originally thought protein was the genetic material.
2. Explain how the experiments performed by the following scientists provided evidence that DNA is the genetic material:
 - a. Frederick Griffith
 - b. Oswald Avery, Maclyn McCarty, and Colin MacLeod
 - c. Alfred Hershey and Martha Chase
 - d. Erwin Chargaff
3. Explain how Watson and Crick deduced the structure of DNA and describe the evidence they used. Explain the significance of the research of Rosalind Franklin.
4. Describe the structure of DNA. Explain the base-pairing rule and describe its significance.

DNA Replication and Repair

5. Describe the semiconservative model of replication and the significance of the experiments of Matthew Meselson and Franklin Stahl.
6. Describe the process of DNA replication, including the role of the origins of replication and replication forks.
7. Explain the role of DNA polymerases in replication.
8. Explain what energy source drives the polymerization of DNA.
9. Distinguish between the leading strand and the lagging strand.
10. Explain how the lagging strand is synthesized even though DNA polymerase can add nucleotides only to the 3' end. Describe the significance of Okazaki fragments.
11. Explain the roles of DNA ligase, primer, primase, helicase, topoisomerase, and single-strand binding proteins.
12. Define "antiparallel" and explain why continuous synthesis of both DNA strands is not possible.
13. Explain the roles of DNA polymerase, mismatch repair enzymes, and nuclease in DNA proofreading and repair.
14. Describe the structure and function of telomeres.
15. Explain the possible significance of telomerase in germ cells and cancerous cells.

Bacterial and Eukaryotic Chromosomes

16. Compare a bacterial chromosome and a eukaryotic chromosome.
17. Describe how the packing of chromatin changes during the course of the cell cycle.
18. Distinguish between heterochromatin and euchromatin.