CHAPTER 5
DNA AND CHROMOSOMES

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The Structure and Function of DNA

5-1 Using terms from the list below, fill in the blanks in the following brief description of the experiment with *Streptococcus pneumoniae* that identified which biological molecule carries heritable genetic information. Some terms may be used more than once.

Cell-free extracts from S-strain cells of *S. pneumoniae* were fractionated to _____ DNA, RNA, protein, and other cell components. Each fraction was then mixed with _____ cells of *S. pneumoniae*. Its ability to change these into cells with _____ properties resembling the _____ cells was tested by injecting the mixture into mice. Only the fraction containing _____ was able to _____ the _____ cells to _____ (or _____) cells that could kill mice.

carbohydrate	lipid	R-strain
DNA	nonpathogenic	RNA
identify	pathogenic	S-strain
label	purify	transform

5-2 Many of the breakthroughs in modern biology came after Watson and Crick published their model of DNA in 1953. In what decade did scientists first identify chromosomes?

(a) 1880s
(b) 1920s
(c) 1940s
(d) 1780s

5-3 Mitotic chromosomes were first visualized in the 1880s with the use of very simple tools: a basic light microscope and some dyes. Which of the following characteristics of mitotic chromosomes reflects how they were named?

(a) motion
(b) color
(c) shape
(d) location

5-4 In a DNA double helix, _____.

(a) the two DNA strands are identical

(b) purines pair with purines
(c) thymine pairs with cytosine
(d) the two DNA strands run antiparallel

5-5 Indicate whether the following statements are true or false. If a statement is false, explain why it is false.

A. DNA molecules, like proteins, consist of a single, long polymeric chain that is assembled from small monomeric subunits.
B. The polarity of a DNA strand results from the polarity of the nucleotide subunits.
C. There are five different nucleotides that become incorporated into a DNA strand.
D. Hydrogen bonds between each nucleotide hold individual DNA strands together.

5-6 Several experiments were required to demonstrate how traits are inherited. Which scientist or team of scientists first demonstrated that cells contain some component that can be transferred to a new population of cells and permanently cause changes in the new cells?

(a) Griffith
(b) Watson and Crick
(c) Avery, MacLeod, and McCarty
(d) Hershey and Chase

5-7 Several experiments were required to demonstrate how traits are inherited. Which scientist or team of scientists obtained definitive results demonstrating that DNA is the genetic molecule?

(a) Griffith
(b) Watson
(c) Crick
(d) Hershey and Chase

5-8 Which of the following chemical groups is *not* used to construct a DNA molecule?

(a) five-carbon sugar
(b) phosphate
(c) nitrogen-containing base
(d) six-carbon sugar

5-9 Which of the following sequences can fully base-pair with itself?

(a) 5′-AAGCCGAA-3′
(b) 5′-AAGCCGTT-3′
(c) 5′-AAGCGCAA-3′
(d) 5′-AAGCGCTT-3′

5-10 The DNA from two different species can often be distinguished by a difference in the _____.

(a) ratio of A + T to G + C
(b) ratio of A + G to C + T
(c) ratio of sugar to phosphate

(d) presence of bases other than A, G, C, and T

5-11 For a better understanding of DNA structure, it helps to be able to compare physical characteristics evident from a side view of double-stranded DNA with those of individual base pairs.

A. Use brackets to designate the major and minor grooves on Figure Q5-11A and shade in the surface that will be exposed in the major grove in Figure Q5-11B.

B. If base pairs were aligned and stacked directly on top of each other, the major and minor grooves would be linear depressions all along the DNA. Explain why this is not the actual conformation of a DNA molecule.

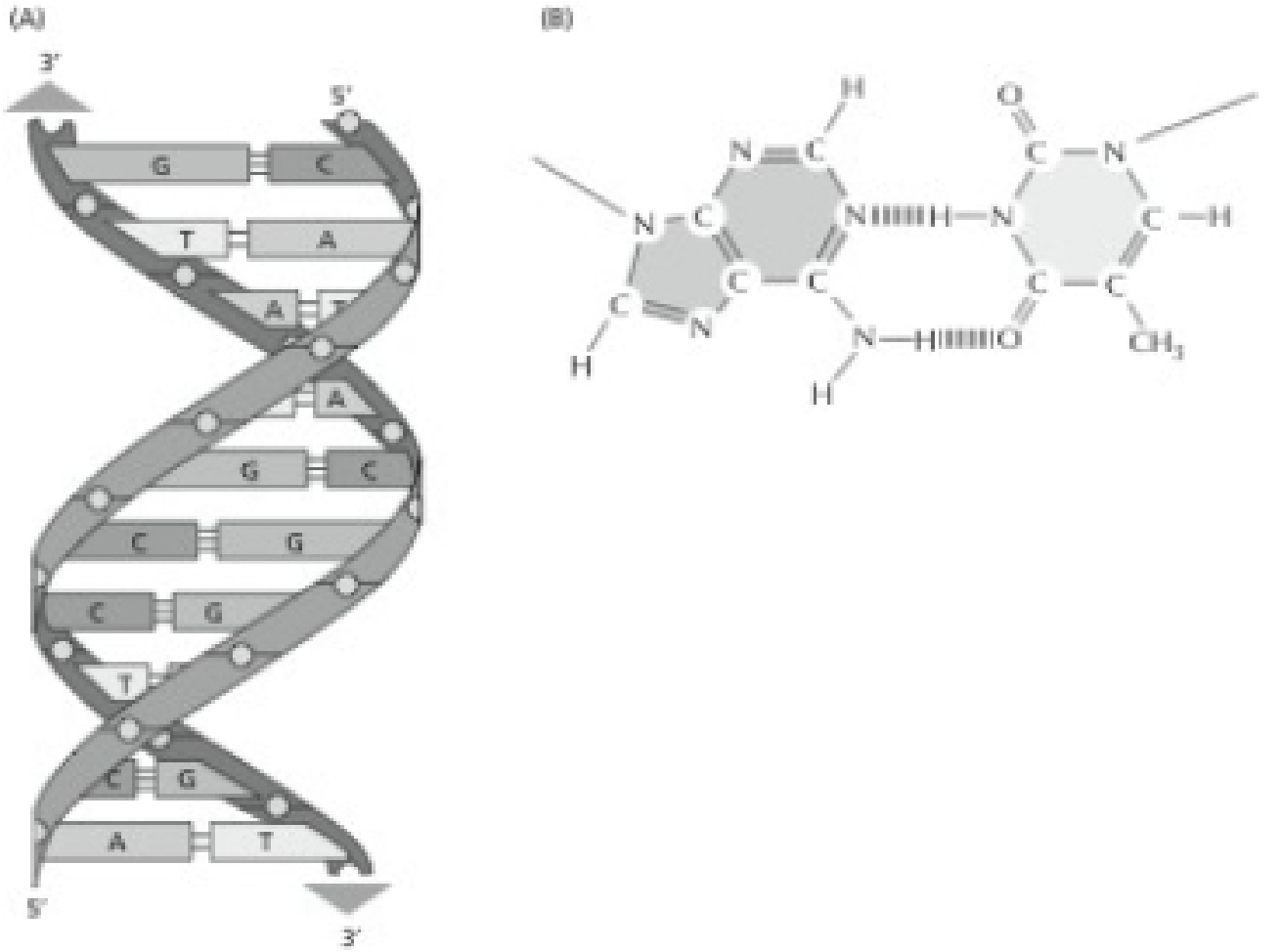

Figure Q5-11

5-12 Which DNA base pair is represented in Figure Q5-12?

(a) A-T
(b) T-A
(c) G-C
(d) C-G