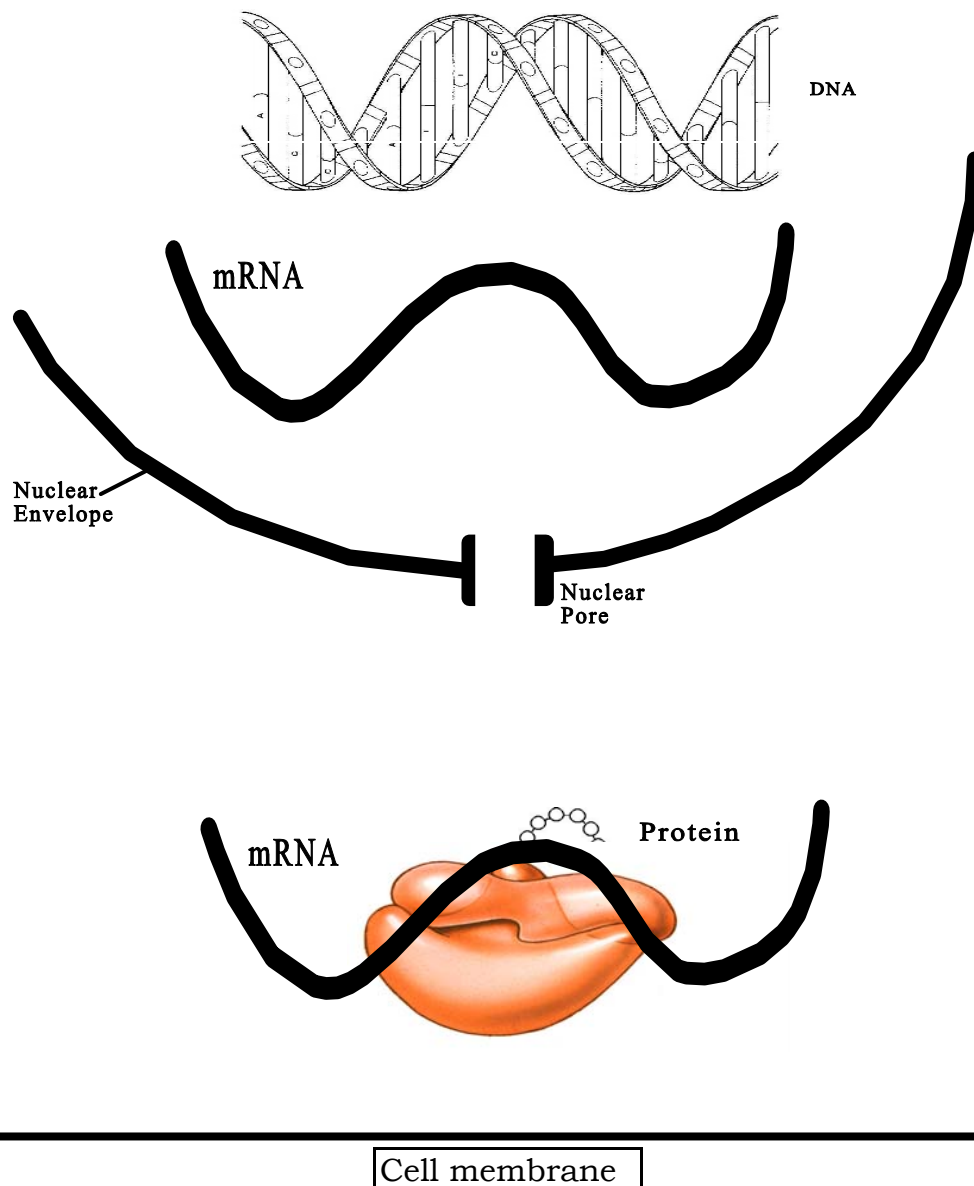


CONVERTING THE GENETIC CODE TO PROTEINS

I. An Overview

Why does DNA store the genetic code in the nucleus?

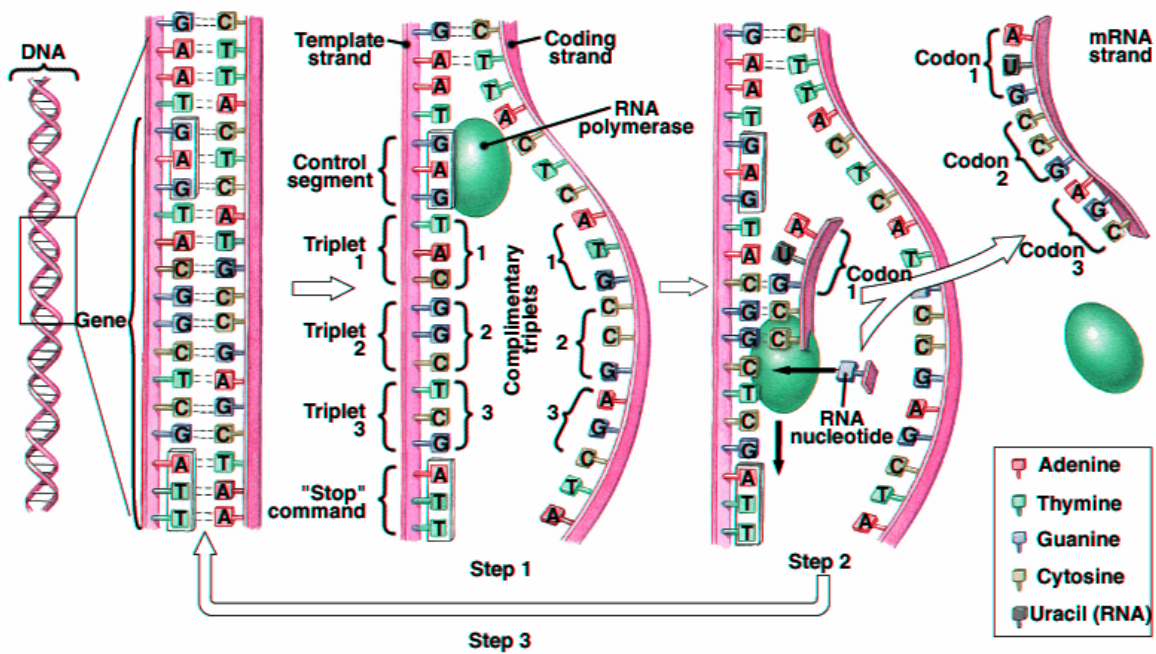
Why are the directions for protein synthesis so carefully encoded in the cell?



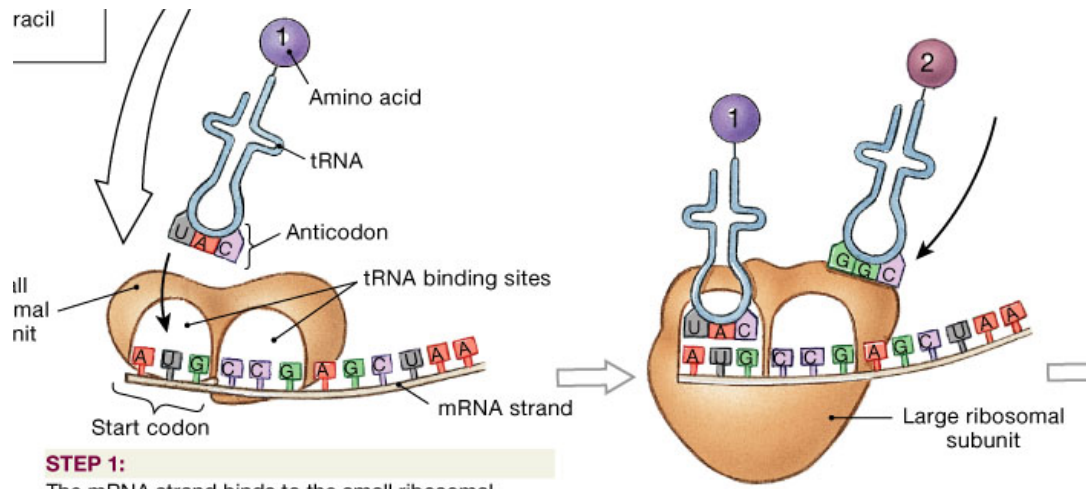
II. Organization of the Genetic Code: The Gene



III. Transcription



IV. Translation



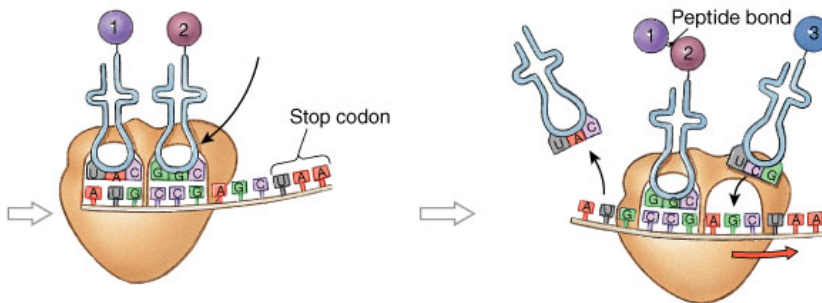
STEP 1:

The mRNA strand binds to the small ribosomal subunit and is joined at the start codon by the first tRNA, which carries the amino acid methionine. Binding occurs between complementary base pairs of the codon and anticodon.

STEP 2:

The small and large ribosomal subunits interlock around the mRNA strand.

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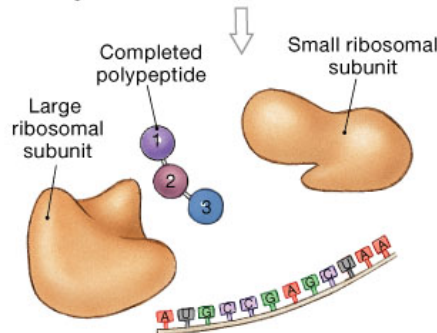


STEP 3:

A second tRNA arrives at the adjacent binding site of the ribosome. The anticodon of the second tRNA binds to the next mRNA codon.

STEP 4:

The first amino acid is detached from its tRNA and is joined to the second amino acid by a peptide bond. The ribosome moves one codon farther along the mRNA strand; the first tRNA detaches as another tRNA arrives.



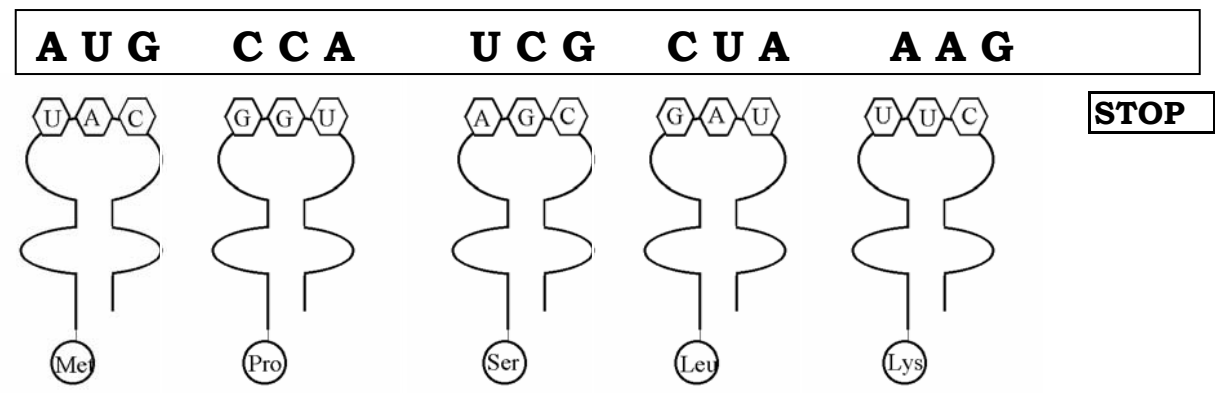
STEP 5:

The chain elongates until the stop codon is reached; the components then separate.

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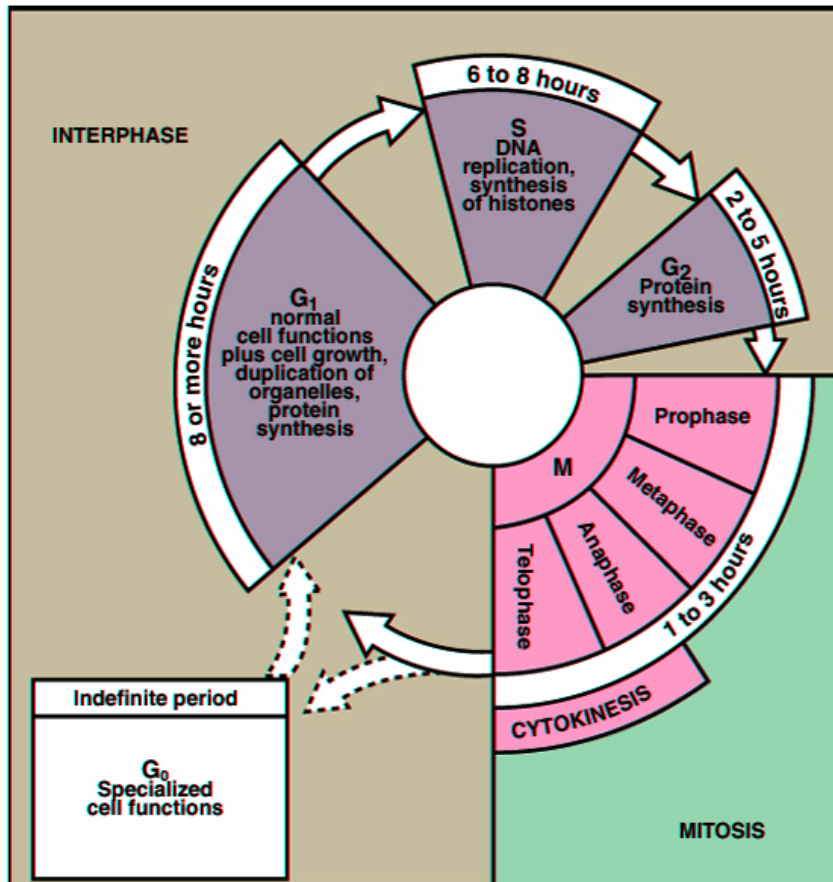
THE CENTRAL DOGMA: THE FLOW OF GENETIC INSTRUCTION FROM DNA \rightarrow RNA \rightarrow PROTEIN

T A C G G T A G C G A T T T C A C T



V. CELL GROWTH AND REPRODUCTION

A. The Cell Cycle



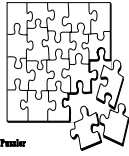
G₁

S

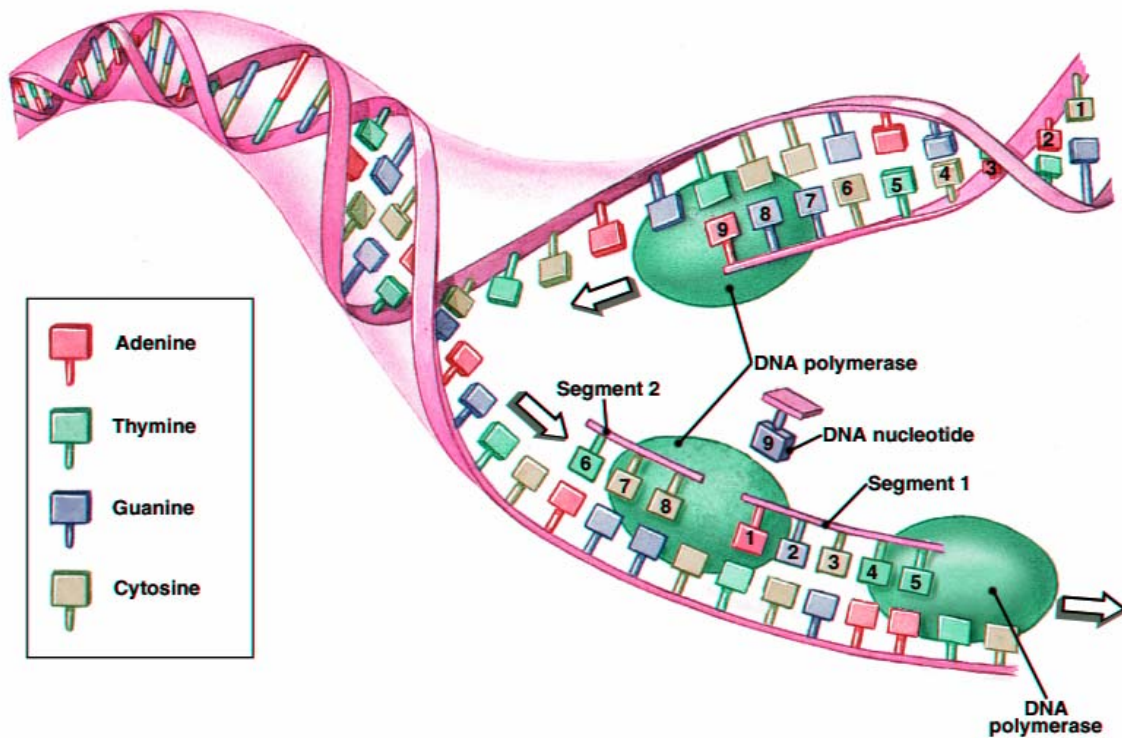
G₂

Mitosis

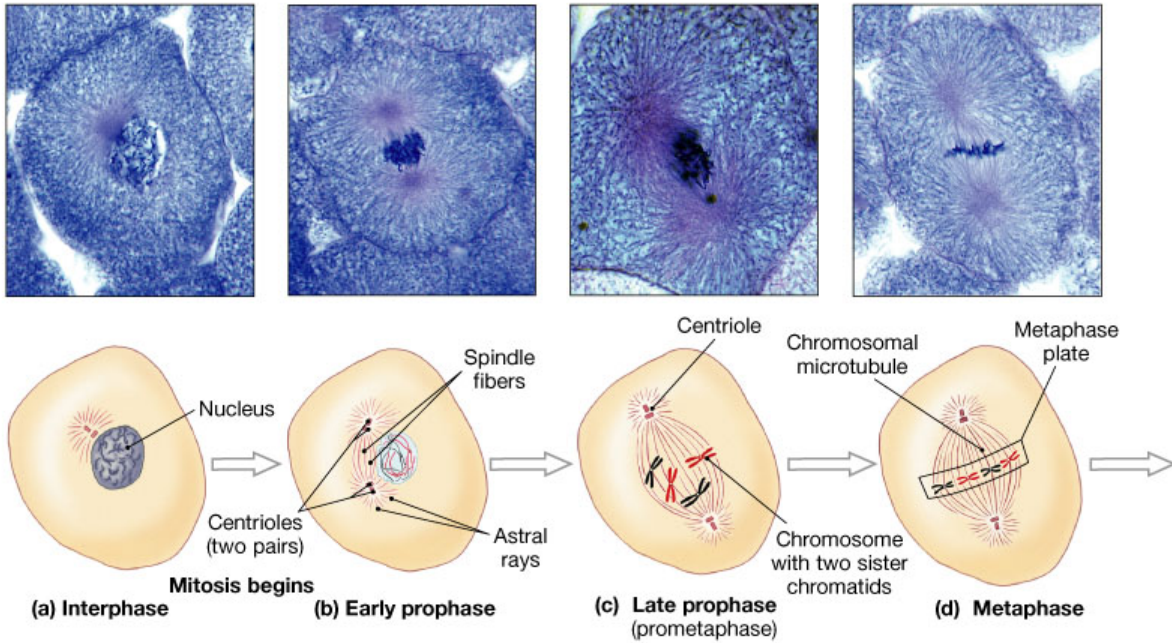
Cytokinesis



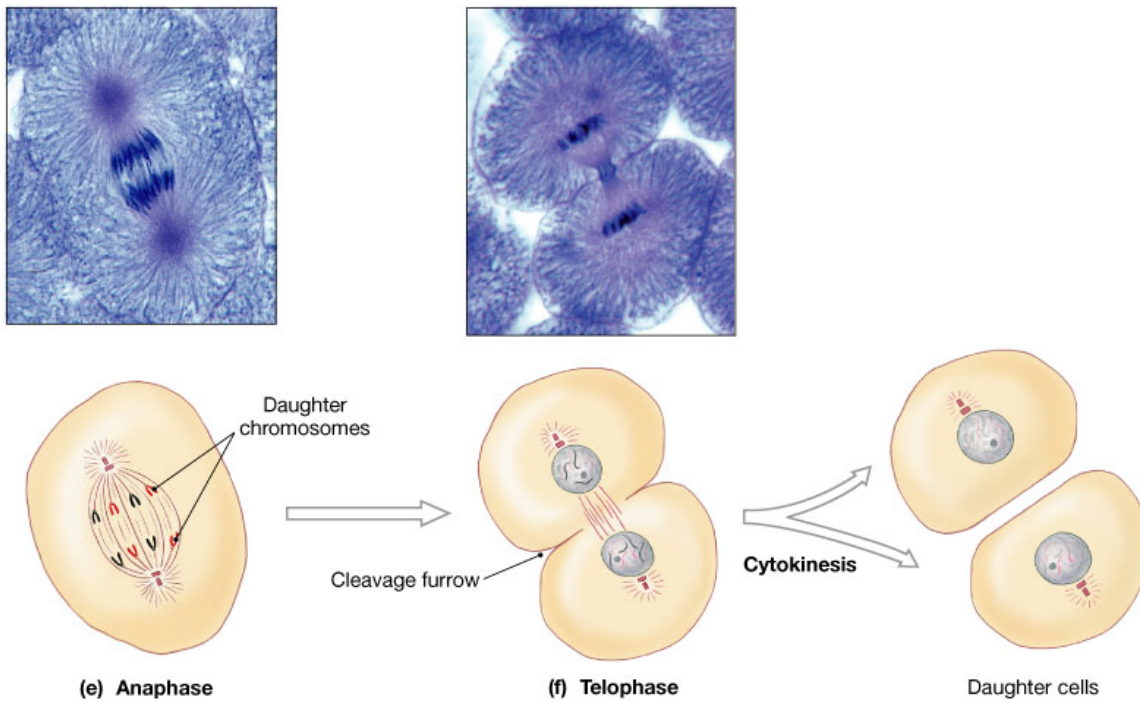
When the nucleus of cell divides by mitosis, the DNA is halved. How does the dividing cell ensure that each daughter cell receives an exact copy of the parent cell DNA?



B. Mitosis and Cytokinesis



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Assignments

Lecture Guide

- 1) What is cytology? What is a cell? Name and describe the major components of an animal cell.
- 2) What are the three major components of the cell membrane? How do these components come together to form the cell membrane? Are organelle membranes similar to the cell membrane?
- 3) How are simple diffusion and facilitated diffusion similar? How are they different? How are facilitated diffusion and active transport similar? How are they different?
- 4) Define each of the following terms: diffusion, osmosis, concentration gradient, chemical equilibrium, carrier-mediated transport, passive transport, active transport, facilitated diffusion, vesicular transport, endocytosis, exocytosis, receptor-mediated endocytosis, phagocytosis, pinocytosis. Be able to describe the key characteristics of each mechanism of transport and distinguish them from one another.
- 5) What is cytoplasm? Cytosol? An organelle?
- 6) Discuss the structure and function of the nucleus?
- 7) Where are ribosomes located in the cell? What is their function?
- 8) What is the function of the mitochondrion?
- 9) Describe the process of transcription. Describe the process of translation. How are these two processes different? How do these two processes work together to allow proteins to be synthesized from the genetic code?
- 10) In what molecule(s) are codons located in the cell? Anticodons?
- 11) Where in the cell does each of the following processes occur? Replication, translation, transcription, aerobic metabolism.
- 12) Human red blood cells lack organelles (nucleus, ribosomes, mitochondria, endoplasmic reticulum, etc) but liver cells have all of these organelles. What processes can the liver cell perform that the RBC cannot? How would the metabolism of the liver cell and RBC differ?
- 13) Define: cell cycle, G1, S, G2, mitosis, and cytokinesis.
- 14) How are mitosis and cytokinesis different? How does each contribute to the larger process of cell division?
- 15) Compare the functions of transfer RNA, ribosomal RNA, and messenger RNA.

Textbook: Chapter 3 (pages 108-109)

Level 1: Reviewing Facts and Terms: 1, 2, 5, 6, 8, 9, 11-13, 15

Level 2: Reviewing Concepts: 16, 18-26

Level 3: Critical Thinking and Application: 28, 30

Study Guide: Chapter 3 (pages 40-59)

- (L-1) Multiple Choice: 1-24, 29-31
Completion: 2-11, 14
Matching: 1-10, 12, 13, 18
Drawing Illustration Labeling: Fig 3.1, 3.2, 3.3
- (L-2) Concept Map: I, II, III
Body Trek: all
Multiple Choice: 2, 4, 6-9, 11-13, 17-24
Completion: 1, 2, 4-7, 10-15
Short Essay: 2-5
- (L-3) Critical Thinking and Application: 2, 7, 8

Answers to questions are located on pages 595-597 in the study guide.