

Chapter 17

HOW GENES ARE EXPRESSED

OVERVIEW: Is DNA really the hereditary material? Let's find out, and learn how genes exercise metabolic control in cells through synthesis of specific proteins.

STRATEGY: Read in Chapter 17, pages 393-401. Note that Section 17-A reviews our earlier encounters with "Genes and Genetics." Use this section to review these concepts because review will improve your comprehension of Chapter 17 *and* allow you to prepare for the Final Exam bit-by-bit during these final days. The subsequent sections describe the marvelous theory of how the DNA exerts "metabolic authority" in cells when the DNA nucleotide sequence *codes* for a precise sequence of amino acids in protein molecules. Proteins then exert their "authority" by acting as hormones, membrane components, and enzymes.

VOCABULARY:

gene	<u>Processes:</u>	ribosome
RNA (ribonucleic acid)	DNA duplication	ribosomal RNA (rRNA)
RNA polymerase	gene expression	codon
messenger RNA (mRNA)	transcription	anticodon
transfer RNA (tRNA)	translation	protein

LEARNING GOALS:

1. You should be able to “solve” the “puzzling problem” below and write out your response.
2. Describe the structure of DNA and explain how it carries “information” or code.
3. In general terms, what is a gene and how are genes “expressed?”
4. Compare the structure of proteins with that of nucleic acids with respect to the units (monomers) that make up each of these two polymers.
5. Distinguish DNA from messenger RNA in structure and function. Describe *transcription* as to location, and products.
6. Describe *translation* (protein synthesis) using each of the VOCABULARY words above and Figures 17-2 and 17-3.

NETWORKING: Visit the BIO 100 “Internet Sites” page for graphics of DNA–RNA–Protein Synthesis

INSTRUCTIONS FOR TOMORROW’S LECTURE -- Please come prepared to sit with your Cooperative Learning Group, and to present your answer to the following in a brief group discussion:

A PUZZLING PROBLEM: If all of the cells of a person's body originate from the zygote by mitosis and cytoplasmic division, how is it that body cells can have so many different forms and functions?

STUDY OUTLINE: GENE EXPRESSION – “HOW DNA WORKS”

A. TWO MAJOR QUESTIONS:

1. How are genes expressed?
2. How is gene expression controlled?

B. REVIEW OF DNA (Deoxyribonucleic Acid):

1. DNA is an “Information Molecule”
 - a. Four NUCLEOTIDES –
 - b. Complementary Pairing –
2. NUCLEOTIDE SEQUENCE DETERMINES “CODE”:
3. GENE =
4. PROTEIN = chain of ...
 - a. Up to _____ different amino acids may be found in a protein polymer
 - b. Sequence is prescribed by ...
 - c. Carries authority of the gene that coded for it.

Question: How does the DNA code direct the sequencing of _____ to form a _____

C. DNA to RNA

1. DNA stays in the nucleus as a “_____”
2. mRNA (messenger RNA) –
3. TRANSCRIPTION (Figure 17-2) –
4. RNA differs from DNA in that RNA
 - a. Is _____, not double-stranded
 - b. Has _____, instead of THYMINE (T)
 - c. Can leave the nucleus and enter the cytoplasm

D. RNA to PROTEIN – Figure 17-3

Messenger RNA attaches to ribosome and codes for an amino acid sequence → Specific Protein Molecule

TAKE-AT-HOME QUIZ #8

Lab Section (Day of Week and Hour – e.g. W-3) = _____

INSTRUCTIONS: Select the correct choice in response to each question and, in the correspondingly numbered box near the bottom of the quiz, write the UPPER CASE letter of the correct choice. Do NOT score your answers by circling or otherwise making marks on the letters of the individual choices. Otherwise, you may write on the quiz if it helps your thinking process. **You should have this quiz completed and ready to hand in when requested during lecture either on or after the date of the assignment to which this quiz is attached. You may complete the quiz alone or work with others, but be sure you are mentally involved in answering the questions. You must be present on the day the quiz is requested to receive credit.**

- Which of the following membrane transport processes is essential for the movement of macromolecules such as proteins and lipids across the membrane?
 - osmosis
 - diffusion
 - endocytosis
 - active transport
 - passive transport
- One must distinguish intercellular transport throughout an organism via a circulatory system from intracellular transport (within cells). Which of the following is concerned with intracellular transport of substances?
 - veins
 - phloem
 - capillaries
 - Golgi bodies
 - lymph fluids
- Which of the following is *not* associated directly with translation?
 - DNA
 - mRNA
 - tRNA
 - ribosomes
 - amino acids
- Which of the following represents the greatest quantity of genetic information.
 - gene
 - nucleus
 - chromosome
 - DNA molecule
 - nitrogen base pair

Score Answers Here -->	1.	2.	3.	4.
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- Bacterial cells of Kingdom Monera have been regarded by evolutionary biologists as being the most closely related to the first cells to have evolved by undirected natural causes on the primordial earth. Describe one characteristic of these prokaryotic cells from Ch. 16 and discuss the likelihood that such a characteristic could have evolved by time/chance processes alone. Use reverse side if necessary, but be concise.