

13.2 Ribosomes and Protein Synthesis

Lesson Objectives

- Identify the genetic code and explain how it is read.
- Summarize the process of translation.
- Describe the “central dogma” of molecular biology.

Lesson Summary

The Genetic Code A specific sequence of bases in DNA carries the directions for forming a **polypeptide**, a chain of amino acids. The types and order of amino acids in a polypeptide determine the properties of the protein. The sequence of bases in mRNA is the **genetic code**. The four bases, A, C, G, and U, act as “letters.”

- ▶ The code is read three “letters” at a time, so that each “word” is three bases long and corresponds to a single amino acid. Each three-letter “word” in mRNA is known as a **codon**.
- ▶ Some codons serve as “start” and “stop” signals for protein synthesis.

Translation Ribosomes use the sequence of codons in mRNA to assemble amino acids into polypeptide chains. The process of decoding of an mRNA message into a protein is **translation**.

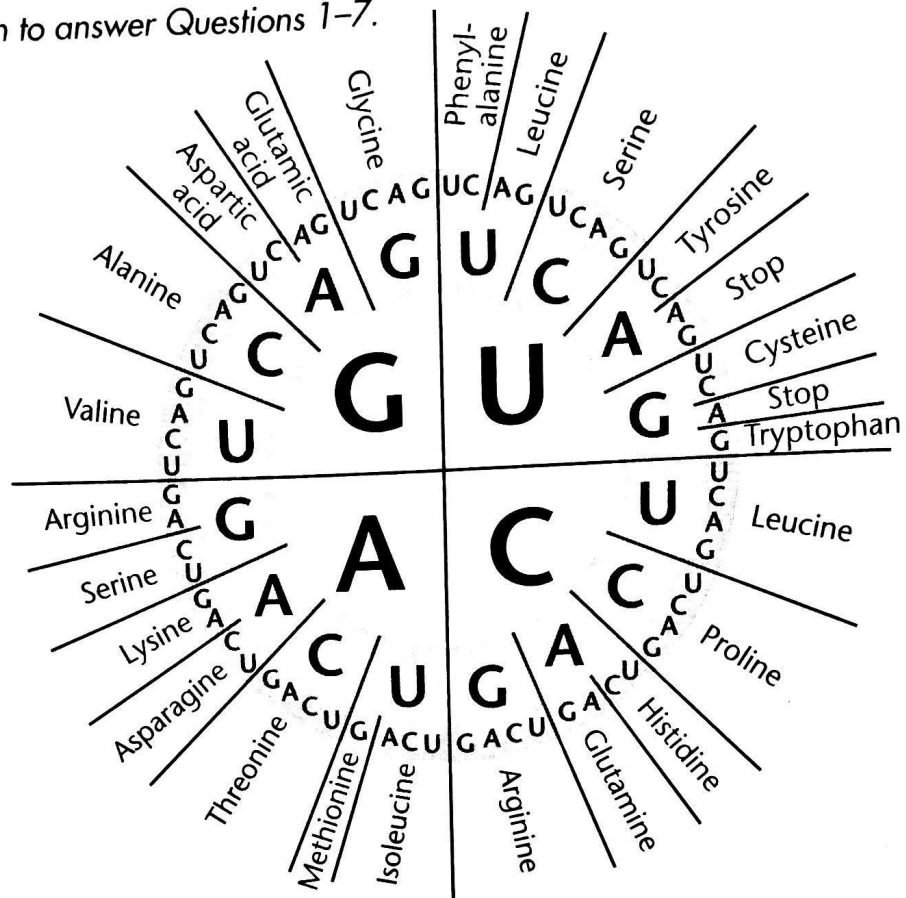
- ▶ Messenger RNA is transcribed in the nucleus and then enters the cytoplasm.
- ▶ On the ribosome, translation begins at the start codon. Each codon attracts an **anticodon**, the complementary sequence of bases on tRNA.
- ▶ Each tRNA carries one kind of amino acid. The match between the codon and anticodon ensures that the correct amino acid is added to the growing chain.
- ▶ The amino acids bond together, each in turn. The ribosome moves along the mRNA, exposing codons that attract still more tRNAs with their attached amino acids.
- ▶ The process concludes when a “stop code” is reached. The newly formed polypeptide and the mRNA molecule are released from the ribosome.

The Molecular Basis of Heredity Molecular biology seeks to explain living organisms by studying them at the molecular level, using molecules like DNA and RNA.

- ▶ The central dogma of molecular biology is that information is transferred from DNA to RNA to protein.
- ▶ **Gene expression** is the way in which DNA, RNA, and proteins are involved in putting genetic information into action in living cells.
- ▶ The genetic code is generally the same in all organisms.

The Genetic Code

Use the diagram to answer Questions 1-7.



1. What are the words along the outside of the circle?

2. What can you find by reading this diagram from the inside out?

3. For which amino acid is AAA a codon?

4. What is the codon for tryptophan?

5. For which amino acid is GGA a codon?

6. What is a codon for alanine?

7. What are three other codons for alanine?

Translation

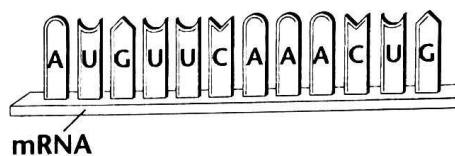
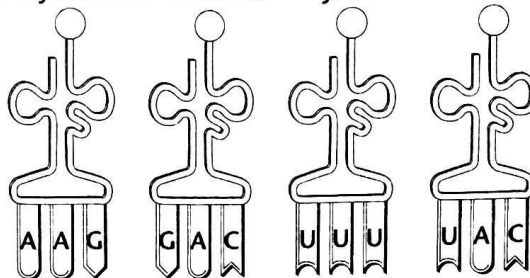
Use the diagram to answer Questions 8–10.

8. What is the anticodon for leucine? _____

9. What is the codon for leucine? _____

10. List the amino acids in the order they would appear in the polypeptide coded for by this mRNA.

phenylalanine leucine lysine methionine



11. What is the difference between transcription and translation?

12. Complete the table to describe the steps in protein synthesis.

Step	Description
Beginning of translation	
Assembly of polypeptide	
Completing the polypeptide	

13. Describe the role of rRNA during translation.

The Molecular Basis of Heredity

For Questions 14–18, write the letter of the correct answer on the line at the left.

- _____ 14. The instructions for assembling proteins are contained in the
- A. genes.
 - B. ribosomes.
 - C. exons.
 - D. introns.
- _____ 15. The central dogma of molecular biology is that information is transferred from
- A. RNA to protein to DNA.
 - B. DNA to protein to RNA.
 - C. protein to DNA to RNA.
 - D. DNA to RNA to protein.
- _____ 16. An exception to the central dogma is
- A. the infection of a virus by a bacteriophage.
 - B. the ability of some viruses to transfer information from RNA to DNA.
 - C. the expression of different genes during different stages of development.
 - D. the translation of the codon into the anticodon of tRNA.
- _____ 17. The way in which DNA, RNA, and proteins are all involved in putting genetic information into action in living cells is called
- A. translation.
 - B. transcription.
 - C. gene expression.
 - D. viral transfer.
- _____ 18. All organisms are mostly the same in
- A. the proteins they make on their ribosomes.
 - B. how their proteins catalyze chemical reactions.
 - C. the size of their genes.
 - D. the molecular biology of their genes.

Apply the Big idea

19. Whether the organism is a pea plant or a human being, the information in the DNA of the cell's nucleus directs synthesis of proteins in the cytoplasm. Why, then, are pea plants and human beings so different?
