

## 13.2 Ribosomes and Protein Synthesis

**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.

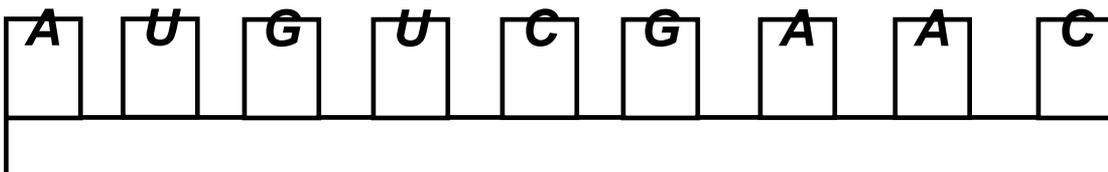
- ▶ The central dogma of molecular biology is that information is transferred from DNA to RNA to protein.
- ▶ **Gene expression** is the way in which DNA, RNA, and proteins are involved in putting genetic information into action in living cells.
- ▶ The genetic code is generally the same in all organisms.

### The Genetic Code

A codon is a group of three nucleotide bases in messenger RNA. Each codon corresponds to one amino acid.

*Follow the directions.*

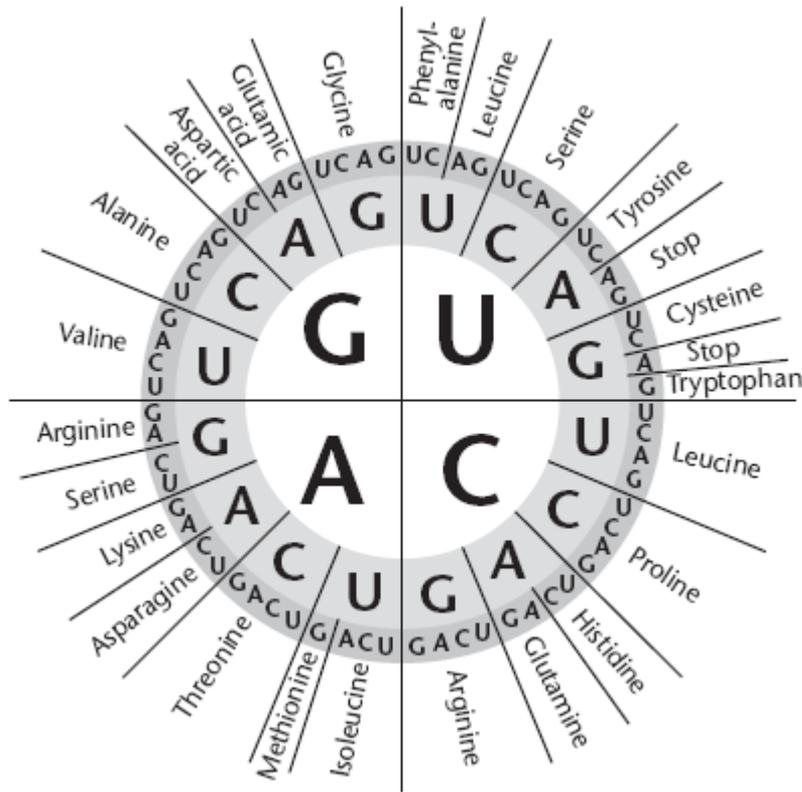
1. Circle each codon in the diagram of RNA below.



Answer the questions. Circle the letter of the correct answer.

2. What is a polypeptide?  
A. a chain of amino acids  
B. a chain of enzymes
3. What does the letter A stand for in the genetic code?  
A. amino acid  
B. adenine
4. Can a codon contain two of the same nucleotide bases?  
A. yes  
B. no

Use the diagram to answer Questions 1–7.



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

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6. For which amino acid is AAA a codon?

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7. What is the codon for tryptophan?

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8. For which amino acid is GGA a codon?

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6. What is a codon for alanine?

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9. What are three other codons for alanine?

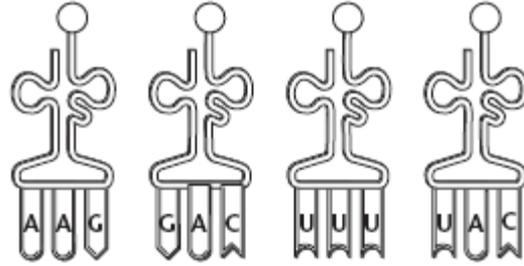
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# Translation

Use the diagram to do Questions 10–12.

10. What is the anticodon for leucine? \_\_\_\_\_
11. What is the codon for leucine? \_\_\_\_\_
12. List the amino acids in the order they would appear in the polypeptide coded for by this mRNA.  
\_\_\_\_\_

Phenylalanine    leucine    lysine    methionine



13. What is the difference between transcription and translation?  
\_\_\_\_\_  
\_\_\_\_\_

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

Step	Description
Beginning of translation	
Assembly of polypeptide	
Completing the polypeptide	

15. Describe the role of rRNA during translation.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# The Molecular Basis of Heredity

- \_\_\_\_\_ 16. The instructions for assembling proteins are contained in the
- A. genes.
  - B. ribosomes.
  - C. exons.
  - D. introns.
- \_\_\_\_\_ 17. 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.
- \_\_\_\_\_ 18. 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.
- \_\_\_\_\_ 19. 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.
- \_\_\_\_\_ 20. 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.

**Two-Column Table** A two-column table is a way to take notes about what you have read. Complete the table with the main idea of each section.

Section Heading	Main Idea
<i>The Genetic Code</i>	<i>The genetic code is read three “letters” at a time. Each “word” is three bases long and corresponds to a single amino acid.</i>