

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.

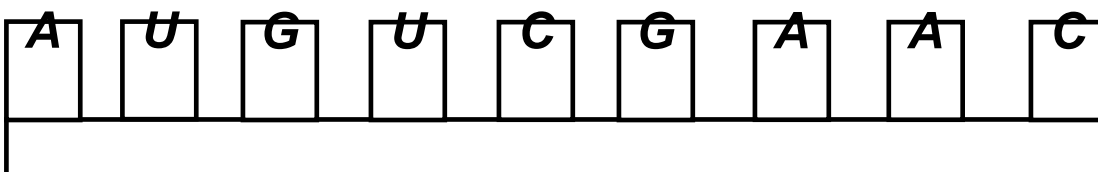
- ▶ The central dogma of molecular biology is that information is transferred from DNA to RNA to protein.
- ▶ **Gene expression** is the way in which DNA, RNA, and proteins are involved in putting genetic information into action in living cells.
- ▶ The genetic code is generally the same in all organisms.

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.

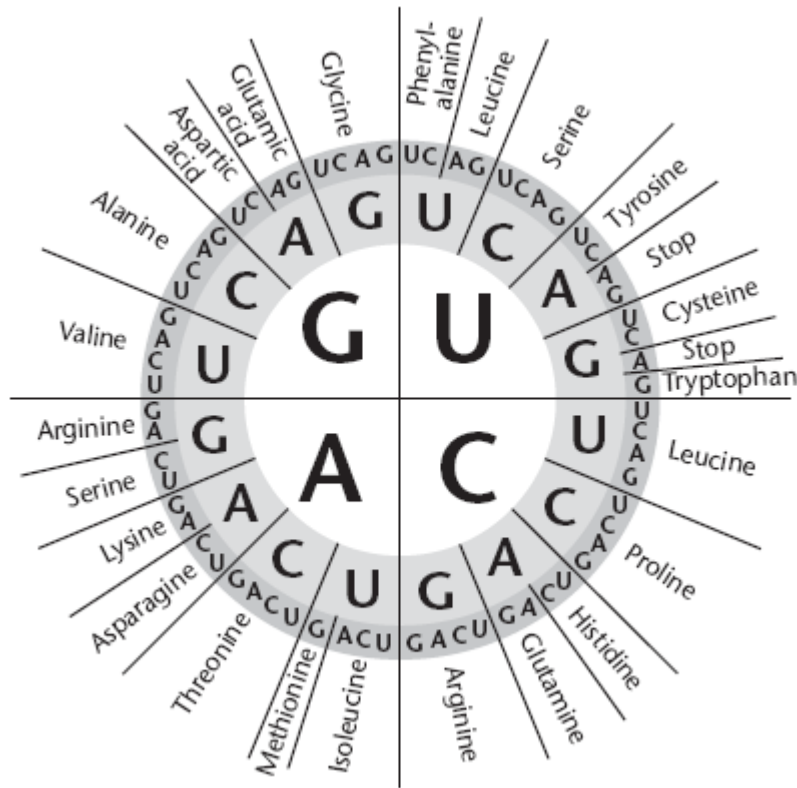
1. Circle each codon in the diagram of RNA below.



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?

6. For which amino acid is AAA a codon?

7. What is the codon for tryptophan?

8. For which amino acid is GGA a codon?

6. What is a codon for alanine?

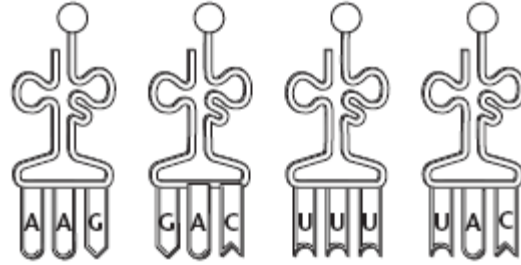
9. What are three other codons for alanine?

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>