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 / Protein; Peptide Bonds, 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. – Anticodon - tRNA
- Some codons serve as "start" and "stop" signals for protein synthesis.

AUG

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. – transmission
- 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.

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

Amino Acids: monomers For proteins 20

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

CODONS OF mRNA

3. For which amino acid is AAA a codon?

Lysine

4. What is the codon for tryptophan?

UGG 64

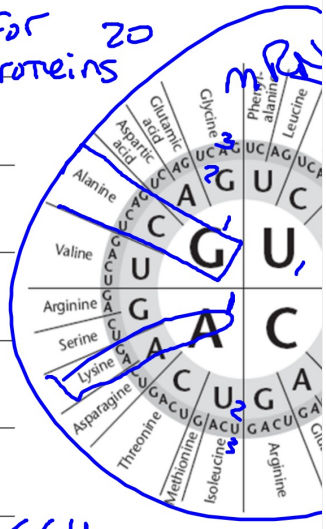
5. For which amino acid is GGA a codon? 3 letters

GLYCINE 4

6. What is a codon for alanine?

GCC

7. What are three other codons for alanine? GCG, GCA, GCU



Translation

Use the diagram to answer Questions 8–10.

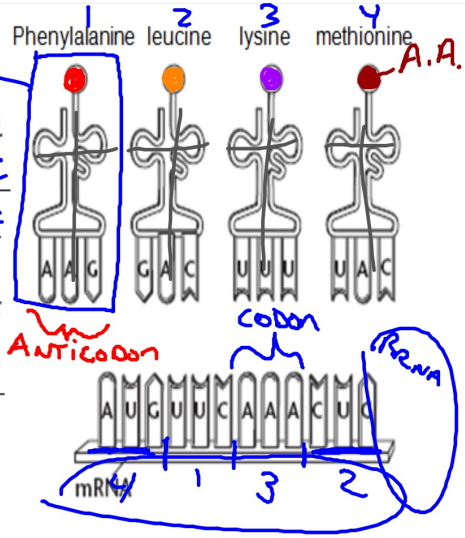
8. What is the anticodon for leucine? GAC

9. What is the codon for leucine? CUG

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

UAC - AAG - UUU -

METH - phen - lysine



DNA

1. STORE
2. COPY
3. TRANSMIT → DNA - mRNA - Protein

11. What is the difference between transcription and translation?

TRANSCRIPTION - REWRITTEN CODE FOR DNA TO BUILD PROTEIN.

TRANSLATION = mRNA GOES TO CYTOPLASM TO RIBOSOMES AND GET READ FOR PROTEIN BUILDING

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

Step	Description
Beginning of translation	
Assembly of polypeptide	
Completing the polypeptide	

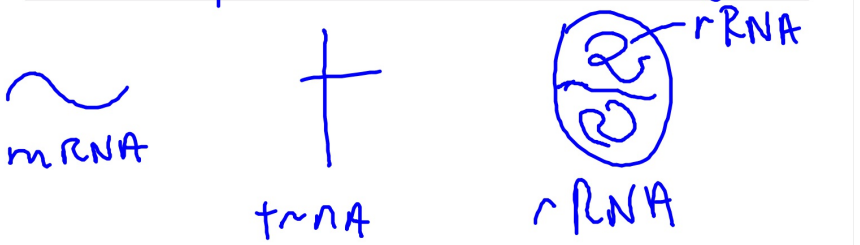
CENTRAL DOGMA

DNA - RNA - PROTEIN.

13. Describe the role of rRNA during translation.

rRNA IS THE SUBUNITS OF RIBOSOMES

IT MAY BE INVOLVED IN ATTACHING mRNA



_____ 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.

DNA 1. copy 2. store 3. transmit

_____ 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.

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?

DNA is the same in construct but different in content → gene expression will vary by organism.