

Advisement Teacher & Room # _____

Student Name _____ Tutor: _____

Biology Tutorial #14

Biology Teacher's Name _____ Period _____

CA State Standard 4e - Students know the general pathway by which ribosomes synthesize proteins, using tRNAs to translate genetic information in mRNA.

How does information flow from genes to proteins?

Genetic information is carried by DNA, a molecule made up of double strands of subunits called nucleotides. A **gene** is a sequence of nucleotides within a DNA molecule that codes for the production of a **polypeptide**, or chain of **amino acids**. One or more polypeptides make up a **protein**.

To carry the information stored in DNA from the nucleus to the cytoplasm, where proteins are made, genes are copied into single strands of messenger RNA (**mRNA**).

DNA	mRNA	tRNA
A	→ U	→ A
T	→ A	→ U
C	→ G	→ C
G	→ C	→ G

How is the information in mRNA translated into a polypeptide?

Translation is a process that takes place in ribosomes. There are nucleotide sequences on mRNA strands are converted into amino acids. The strands of mRNA consist of a series of three-nucleotide sequences, called **codons**. Each codon codes for one specific amino acid or function (**start, stop**).

Amino acids that are free-floating in the cytoplasm are brought to ribosomes by special RNA molecules called transfer RNA (**tRNA**). Each tRNA molecule carries one amino acid on one of its ends. Its other end has a three nucleotide "anticodon" that recognizes and pairs with a specific complementary codon on the strand of mRNA.

Translation and Building a Protein

The pairing of codon and anticodon takes place in ribosomes.

1. The small ribosomal subunit binds to an mRNA molecule.
2. A complementary tRNA carrying an amino acid binds to the **start codon**.
3. The ribosome pulls the mRNA strand through itself one codon at a time. As the strand moves, the first bound tRNA moves with it.
4. When a new codon is exposed, another tRNA molecule with a complementary **anticodon** binds to it.
5. The ribosome **attaches the amino acids to one another** (build a protein chain) and breaks the bond between the second tRNA and its amino acid.
6. When the ribosome pulls the mRNA strand again, **exposing another codon, another tRNA with a matching anticodon attaches**.
7. In the meantime, the first tRNA is released.
8. This pattern of reading new codons and adding new amino acids continues until the ribosome reaches a **stop codon** on the mRNA. At this point, the ribosome releases the new protein.

Answer the following questions:

1. What type of molecule transfers the information contained in a DNA molecule to the cytoplasm, where amino acid chains that form proteins are made?
2. How are mRNA and tRNA similar?
3. How are mRNA and tRNA different?
4. Describe two events that happen at the beginning of translation:
5. What signals the end of translation?
6. The "start" codon in a strand of mRNA is AUG and codes for the amino acid methionine. What is the complementary anticodon of the tRNA that carries methionine?
7. During translation, the information in mRNA codons is used to build a protein. What molecules carry amino acids and have the anticodons that match the mRNA codons?
A) rRNAs B) DNA C) tRNAs D) ribosomes
8. Which is responsible for exposing codons and binding amino acids together?
A) Anticodons B) ribosomes C) mRNA D) tRNA
9. Suppose you isolate the following nucleotide sequence in DNA: TACTAATAACAA. How many amino acids are coded for by this DNA sequence?
A) 2 amino acids B) 4 amino acids C) 6 amino acids D) 12 amino acids

Here are steps that occur during translation.

- | |
|--|
| <ol style="list-style-type: none">A. tRNA binds to codonB. tRNA detaches from the mRNAC. Ribosome binds two amino acidsD. Ribosome pulls mRNA through |
|--|

10. Which of the following puts them in the correct order?
A) A-D-C-B B) A-B-D-C C) A-C-D-B D) A-B-C-D