

# Lesson 5.3 Protein Synthesis: Translation

Name \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

## Key Terms

anticodon

codon

transfer RNA (tRNA)

translation



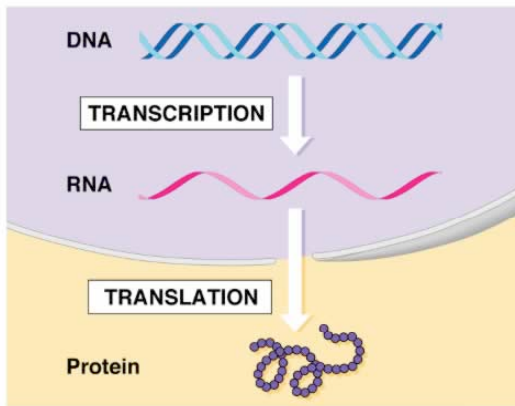
**Engage I:** Your instructor will pass out cards, which represent the process of translation. With your group members, determine the sequence of events shown on the card and write the sequence below.

	Step #1	Step #2	Step #3	Step #4	Step #5	Step #6	Step #7	Step #8	Step #9	Step #10
Corresponding Letter										

Your instructor will now show you the video. (<http://www.lew-port.com/10712041113402793/lib/10712041113402793/Animations/Protein%20Synthesis%20%20long.swf>) Check to make sure your sequence is in order. If it is not in order, put the cards into the correct order as shown on the video.



## Explore I – The Process of Converting information in DNA base pairs into PROTEINS



©Addison Wesley Longman, Inc.

The process of converting the information stored in DNA as a sequence of base pairs into proteins involves two major steps:

### TRANSCRIPTION

Transcription is the process in which the sequence of base pairs on a DNA molecule is copied and stored temporarily in a molecule of **RNA** (ribonucleic acid). This special RNA molecule is called MESSENGER RNA or mRNA.

and

### TRANSLATION

Translation is the process in which the mRNA is used as a guide for linking amino acids together in a polypeptide (protein) chain. Smaller molecules of RNA called TRANSFER RNA or tRNA match up to the mRNA and release amino acids during the construction of the protein molecule.

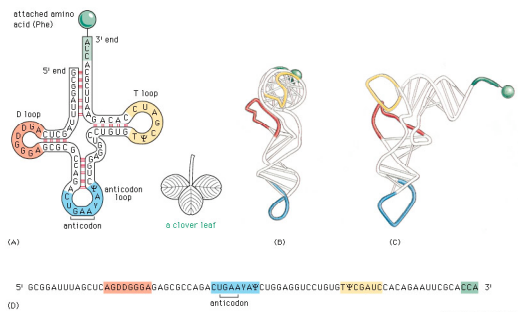
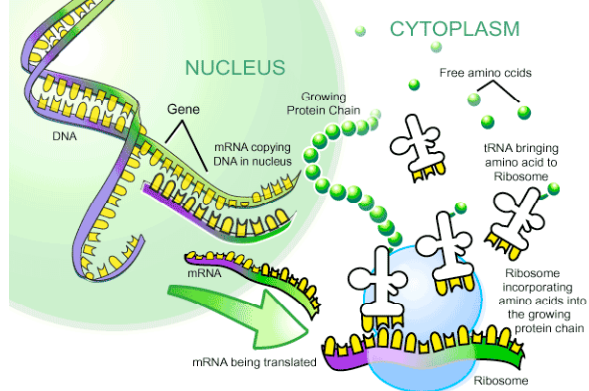


## Explain I

1. What are the two major steps in converting the information in DNA into a PROTEIN?
2. What happens in transcription?
3. What happens in translation?
4. What is the end product of translation?



## Explore II – Translation in Greater Detail



		Second base					
		U	C	A	G		
First base	U	UUU } Phenylalanine F UUC } UUA } Leucine L UUG }	UCU } Serine S UCC } UCA } UCG }	UAU } Tyrosine Y UAC } UAA } Stop codon UAG } Stop codon	UGU } Cysteine C UGC } UGA } Stop codon UGG } Tryptophan W	U C A G	
	C	CUU } Leucine L CUC } CUA } CUG }	CCU } Proline P CCC } CCA } CCG }	CAU } Histidine H CAC } CAA } Glutamine Q CAG }	CGU } Arginine R CGC } CGA } CGG }	U C A G	
	A	AUU } Isoleucine I AUC } AUA } AUG } Methionine start codon M	ACU } Threonine T ACC } ACA } ACG }	AAU } Asparagine N AAC } AAA } Lysine K AAG }	AGU } Serine S AGC } AGA } Arginine R AGG }	U C A G	
	G	GUU } Valine V GUC } GUA } GUG }	GCU } Alanine A GCC } GCA } GCG }	GAU } Aspartic acid D GAC } GAA } Glutamic acid E GAG }	GGU } Glycine G GGC } GGA } GGG }	U C A G	

In TRANSCRIPTION, the DNA information was converted to information stored on the mRNA molecule.

The mRNA molecule leaves the nucleus and moves out into the cytoplasm.

In the cytoplasm, the mRNA molecule enters a RIBOSOME.

Small t – shaped loops of RNA bring amino acids to the ribosome. These t – shaped loops of RNA are called TRANSFER RNA or tRNA.

The tRNAs have a set of three nitrogenous bases that extend from the bottom of the T. These bases form a key that matches up to the mRNA. If the tRNA key does not match the mRNA sequence, it will not enter the ribosome.

The THREE base sequence on the tRNA is called an ANTICODON. The matching THREE bases on the mRNA form a group called the CODON.

The diagram on the left shows a tRNA molecule with its anticodon.

Each mRNA codon is translated into a specific amino acid. The chart on the left describes codon sets and their corresponding amino acids.

As the tRNAs enter the ribosome and drop off amino acids, a polypeptide chain is constructed. This polypeptide chain coils and folds to form the final protein.

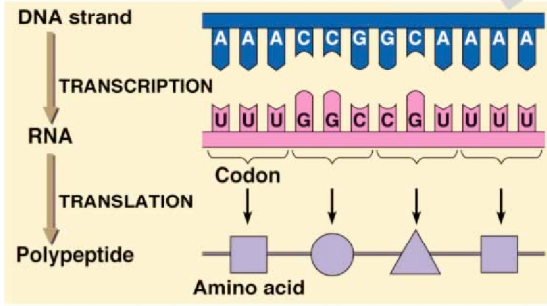
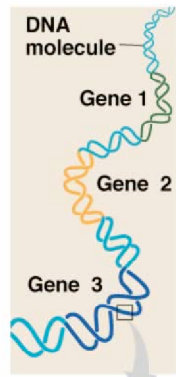


## Explain It

- Where does the mRNA go once transcription is completed?
- What attaches to the mRNA in the cytoplasm to begin the process of translation?
- What clover or t-shaped RNA objects bring amino acids to the ribosome?
- What is the 3-base sequence at the base of a tRNA called?
- What is 3-base segment of an mRNA molecule that codes for an amino acid called?
- If the codon for an mRNA molecule is CUU, what is the tRNA anticodon?
- What amino acid does the mRNA codon CUU code for?
- As amino acids are linked together at the ribosome, what kind of molecule is formed?
- If a single nitrogenous base error is made in the mRNA sequence, will the affects be noticed? Given an example to support your thinking.

Review

# Protein Synthesis



©Addison Wesley Longman, Inc.

The process of protein synthesis involves two major steps.

First the information stored in the DNA for a given gene is **transcribed** into an mRNA molecule.

The mRNA molecule leaves the nucleus and enters a ribosome in the cytoplasm of the cell.

Then this information is **translated** into an amino acid chain or protein.

The specific sequence of bases in the DNA ultimately codes for the type of protein to be produced.

The proteins of an organism define its physical attributes, much of its behavior and its biochemical homeostasis.

Errors or alterations in DNA replication result in **mutations** that affect the structure and function of proteins.

The gene coding for sickle cell anemia is an example of a possible mutation of a single base that results in a dramatic change in a protein that affects the survivability of an organism.

**Practice**

14. Shown below is a sequence of DNA. This sequence of DNA is a gene that codes for an important enzyme *glucagon*. Glucagon instructs cells to release sugar into the bloodstream.

TRANSCRIBE this sequence into **mRNA**, then TRANSLATE the mRNA sequence into a sequence of **amino acids**.

**CAT TCA CAG GGC ACA TTC ACC AGT GAC TAC AGC AAG TAT CTG GAC TCC AGG CGT GCC CAA GAT TTA GTG CAG**

Transcribe

\_\_\_\_\_

\_\_\_\_\_

Translate

\_\_\_\_\_

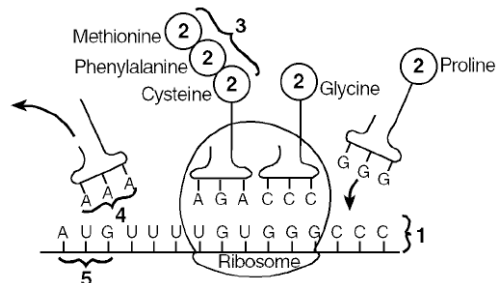
\_\_\_\_\_

15. The coded information in a DNA molecule directly determines the formation of

- a) polysaccharides
- b) lipids
- c) monosaccharides
- d) polypeptides

16. The function of transfer RNA molecules is to

- a) transport amino acids to DNA in the nucleus
- b) transport amino acids to messenger RNA
- c) synthesize more transfer RNA molecules
- d) provide a template for the synthesis of messenger RNA molecules



17. The molecules indicated by number 2 are

- a) fatty acids
- b) amino acids
- c) monosaccharides
- d) glycerides

18. The process shown in the diagram is known as

- a) replication
- b) photosynthesis
- c) enzymatic hydrolysis
- d) protein synthesis