Warm-Up | Protein Synthesis

Lesson Objectives

By the end of this lesson, you should be able to:

- Explain the relationship between _____ and gene expression.
- Explain the relationship between _____ and gene expression.

Science Practice: Give examples of how _____ led to new experimental methods.

Words to Know

Fill in this table as you work through the lesson. You may also use the glossary to help you.

	the process of converting the sequence of nitrogen bases in messenger RNA (mRNA) into a sequence of amino acids for protein production
	a form of RNA that carries synthesized genetic information from the nucleus of a cell to the ribosomes for protein production
	a form of RNA that brings amino acids to the ribosomes to be assembled into proteins

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Words to Know

	a single-stranded nucleic acid containing the sugar ribose, a phosphate group, and the bases adenine, cytosine, guanine, and uracil
	organelles that produce proteins for a cell
	the synthesis of mRNA (messenger RNA) from a DNA template with the aid of RNA polymerase
	a double-stranded helical polymer containing the sugar deoxyribose, a phosphate group, and the bases adenine, cytosine, guanine, and thymine

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Lesson Question

Slide 2

DNA: Deoxyribonucleic Acid

[ ] (deoxyribonucleic acid): A double-stranded helical polymer that contains:

- the sugar [ ],
- a phosphate group,
- and the bases adenine, cytosine, guanine, and thymine.

DNA

- Contains the [ ] information for living organisms
- [ ] for the synthesis of proteins

RNA: Ribonucleic Acid

[ ] (ribonucleic acid): A single-stranded nucleic acid that contains:

- the sugar [ ],
- a phosphate group,
- and the bases adenine, cytosine, guanine, and uracil

RNA

- [ ] the DNA code for protein synthesis from the nucleus to [ ]

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Protein Synthesis

Proteins:

- are formed from [ ] and are responsible for the structures and functions of organisms.
- are synthesized on [ ], organelles that produce proteins for the cell.

Transcription: Introduction

- [ ] is the synthesis of [ ] (messenger RNA) from a DNA template with the aid of RNA polymerase.
- [ ]: A form of [ ] that carries the synthesized genetic information from the [ ] of the cell to the [ ] for protein production

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Transcription: Process

- An _____ is a segment of DNA that controls when DNA _____ takes place.
- If there is a _____ protein bound to the operator, then RNA polymerase cannot bind to the promoter—and the whole rest of the gene cannot be read.
- The steps of transcription are:
  1. _____ the DNA.
  2. _____ the RNA molecule.
  3. _____ the mRNA molecule.
  4. _____ the DNA molecule.

Francois Jacob and Jacques Monod: Profile

- Proposed the _____ model of gene regulation by studying the lac genes in *E. coli*
- Stated in their original hypothesis that genes had one _____ process
- Tested hypothesis and learned *E. coli* has _____ regulatory processes

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Gene Regulation with E. Coli

REAL-WORLD CONNECTION

The lac operon is what's called an inducible [ ].

- "always [ ]"

But if the inducer is present, it will pull the [ ] off of the operon.

Another kind of operon is called a repressible operon.

- "always [ ]"
- can be repressed, or [ ] off

These operons, both inducible and repressible, are the ones that [ ] whether or not a gene product will be made.

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Translation: Introduction

[ ]: The process of converting the sequence of nitrogen bases in the mRNA (messenger RNA) into a sequence of amino acids for [ ] production

Translation: Overview

- Translation occurs on [ ] and involves [ ] (transfer RNA), a form of RNA that brings amino acids to the ribosomes to be assembled into proteins.
- Each mRNA codon must join with the anticodons of the proper [ ].

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Initiation of Translation

Translation begins with _____ .

- _____ is in 5’ to 3’ orientation.
- mRNA gets _____ to a piece of ribosomal RNA.
- That complex attracts a piece of _____ RNA that brings in the amino acid methionine.

The Steps of Translation

The step that happens after initiation is called _____.

- tRNA molecules bring in a particular amino _____ that is called for by the messenger _____ codon.
- An _____ comes along, and it will attach the amino acids together.
- It forms _____ bonds in between amino acids.
- The process continues until the mRNA has what’s called a _____ codon and the protein is released.

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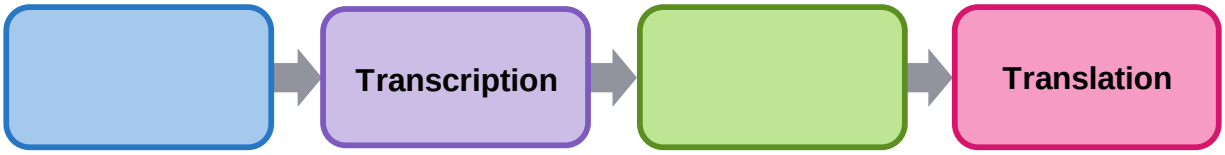
The three steps of translation are:

- _____, when the complex is formed
- elongation, or formation of the amino acid _____
- _____ of the amino acid chain

Protein Synthesis



- DNA: DNA is unzipped with the aid of RNA _____.
- Transcription: One strand of DNA is _____.
- mRNA: mRNA is transcribed from the _____ strand.
- Translation: mRNA codons are joined by tRNA anticodons to _____ chains of amino acids.

Once a protein is formed, the gene for a particular trait is _____.

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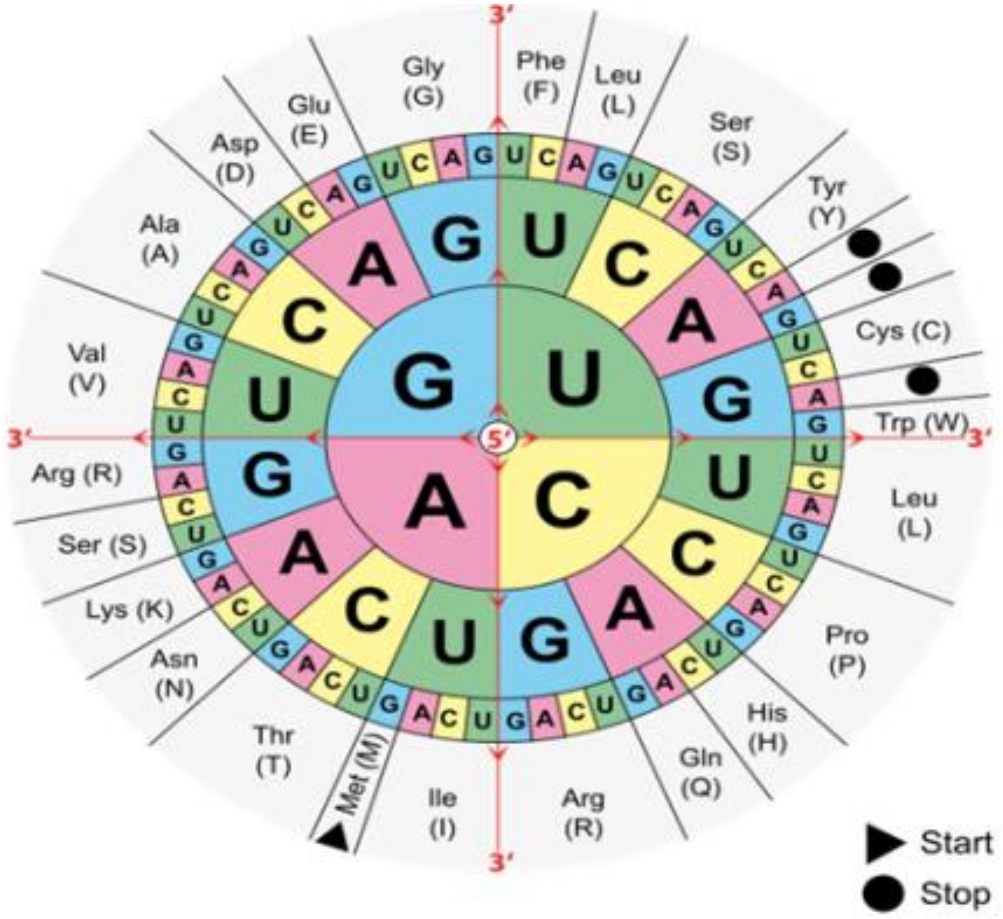
Production of Proteins

Use the wheel to find the abbreviation for the amino acid that is represented by the mRNA shown. Write each abbreviation in the correct box above the mRNA strand.



	Met	Tyr		Arg	
C	A	G	A	U	G	U	A	C	G	G	A	C	G	A	U	A	A

5’ mRNA strand 3’

Summary | Protein Synthesis

Lesson Question

What is the purpose of proteins, and how are they synthesized?

Answer

Slide 2

Review: Transcription

- _____ codes for the production of proteins needed for all structures and functions of organisms.
- _____ transfers the DNA code from the nucleus of the cell to the ribosomes, where proteins are constructed.
- _____ is the process that transcribes a section of DNA to form mRNA (messenger RNA); _____ moves the protein code to the ribosomes.
- The study of *E. coli* led scientists to study the genome sequence of organisms to determine the quantity and organization of _____.

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Review: Translation

- The first codon (AUG) of an mRNA (messenger RNA) strand attaches to a [ ]; a tRNA (transfer RNA) anticodon [ ] with a complementary mRNA codon.
- The second codon pairs with an anticodon from the [ ].
- [ ] bonds are created between amino acids to form a polypeptide chain.
- The polypeptide chain of amino acids forms a [ ]; the protein is released when a stop codon is reached.
- Once the protein is formed, the gene for a particular trait is [ ].

Summary | Protein Synthesis

Use this space to write any questions or thoughts about this lesson.