

Protein Synthesis and Mutations

Primary TEKS Supported

5C – [Reporting Category 1] – describe the roles of DNA, ribonucleic acid (RNA), and environmental factors in cell differentiation

6C – [Reporting Category 2] – explain the purpose and process of transcription and translation using models of DNA and RNA

6D – [Reporting Category 2] – recognize that gene expression is a regulated process

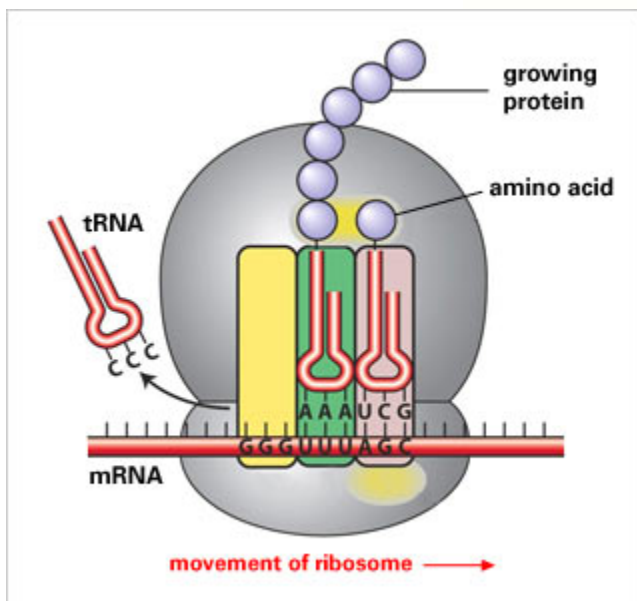
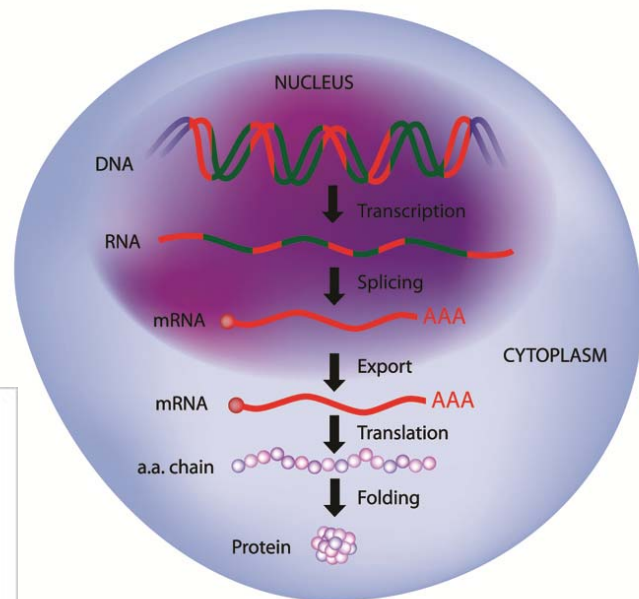
6E – [Reporting Category 2] – identify and illustrate changes in DNA and evaluate the significance of these changes [mutations]

TEKS Also Supported

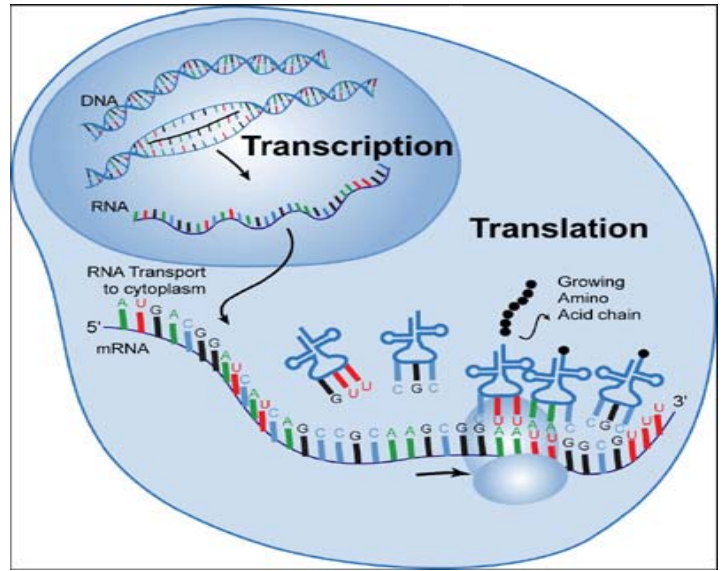
4B investigate and explain cellular processes, including ~~homeostasis, energy conversions, transport of molecules, and~~ synthesis of new molecules [RNA/protein]

Contents of This Packet

- I. Review and Practice
- II. Vocabulary Cards
- III. Practice Items
- IV. Sapling Instructions



Protein Synthesis: Making new proteins (like hormones and enzymes) for the body. Protein Synthesis occurs in two steps and in two areas of the cell. This happens because DNA cannot leave the nucleus of the cell.



Transcription: (writing mRNA = the message of how to make proteins); occurs in Nucleus of cell

1. Part of DNA unwinds and creates mRNA (messenger) in the nucleus with the help of RNA polymerase.
2. When transcribing from DNA to RNA, Thymine is replaced by Uracil.
3. Only one side of the DNA is transcribed into mRNA.
4. mRNA leaves the nucleus and travels to the ribosome in the cytoplasm

Translation: (translating for an amino acid); occurs using ribosome floating in the cytoplasm of cells

5. With the help of the ribosome, mRNA is translated
6. tRNA transfers the complimentary anticodon with the amino acid attached to each codon on mRNA
7. Polypeptide chain is created where each amino acid is joined by a peptide bond = protein
8. Protein either stays in the cell or gets packaged.

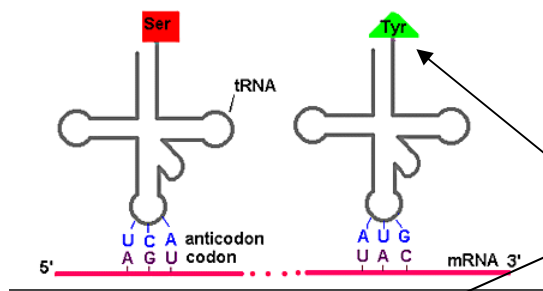
Quick Practice

DNA Strand: T A C - C A A - T G T - C A G - A T A - A T C - T A C - G A T - A A A - T G A - A T C

mRNA codons : _____

tRNA anti-codons: _____

Amino Acid Sequence = Protein (use mRNA codon and the chart below to find the amino acid)



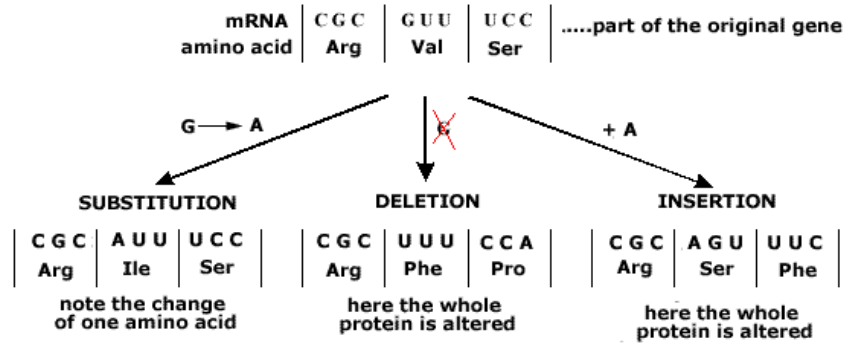
READ the mRNA codon, NOT the tRNA anticodon, to find the amino acid!
 Note how **UAC (codon) = Tyr (amino acid)** and **AGU (codon) = Ser (amino acid)**

		2nd base in codon				
		U	C	A	G	
1st base in codon	U	Phe Phe Leu Leu	Ser Ser Ser Ser	Tyr Tyr STOP STOP	Cys Cys STOP STOP	U C A G
	C	Leu Leu Leu Leu	Pro Pro Pro Pro	His His Gln Gln	Arg Arg Arg Arg	U C A G
	A	Ile Ile Ile Met	Thr Thr Thr Thr	Asn Asn Lys Lys	Ser Ser Arg Arg	U C A G
	G	Val Val Val Val	Ala Ala Ala Ala	Asp Asp Glu Glu	Gly Gly Gly Gly	U C A G
						3rd base in codon

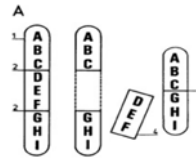
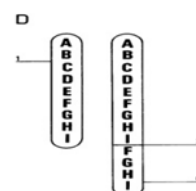
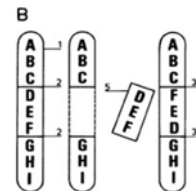
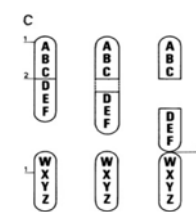
The Genetic Code

Gene Mutation: Mutations that occur in the gene (DNA) and causes changes to occur in the protein.

1. Point Mutation: Where one nucleotide is changed so only one amino acid may be affected
 - a. Substitution – One nucleotide takes the place of another in the sequence of the code
 - b. Substitution point mutations can result in either an expressed mutation or a silent mutation
2. Frameshift Mutation: Where a nucleotide is deleted or inserted into the DNA, shifting everything up or down
 - a. Insertion
 - b. Deletion



Chromosomal Mutation: Mutations that occur in the structure of chromosomes.

Deletion	A portion of the chromosome is missing or deleted.		<p>Mutated Chromosome</p> <table border="1" style="margin: auto;"> <tr><td>1</td><td>2</td><td>4</td><td>5</td><td>6</td></tr> </table>	1	2	4	5	6				
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Duplication	A portion of a chromosome is duplicated, resulting in extra genetic material.		<p>Mutated Chromosome</p> <table border="1" style="margin: auto;"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>6</td></tr> </table>	1	2	3	4	5	6	6		
1	2	3	4	5	6	6						
Inversion	A portion of the chromosome has broken off, turned upside down and reattached, therefore the genetic material is backward.		<p>Mutated Chromosome</p> <table border="1" style="margin: auto;"> <tr><td>1</td><td>2</td><td>4</td><td>3</td><td>5</td><td>6</td></tr> </table>	1	2	4	3	5	6			
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Translocation	When a portion of one chromosome is transported to another chromosome.		<p>Mutated Chromosomes</p> <table border="1" style="margin: auto;"> <tr><td>1</td><td>2</td><td>3</td><td>4</td></tr> </table> <table border="1" style="margin: auto;"> <tr><td>5</td><td>6</td><td>18</td><td>19</td><td>20</td></tr> </table>	1	2	3	4	5	6	18	19	20
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Nondisjunction	If this occurs, abnormal numbers of chromosomes may find their way into gametes (sperm or egg), and a disorder of chromosome numbers may result.	