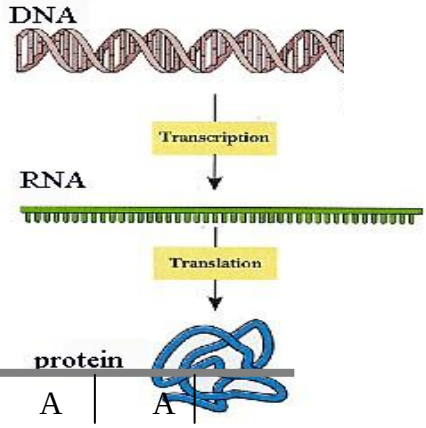
Name _____ Period _____ Date _____

Protein Synthesis Simulation Lab

Part 1: Introduction

DNA is a very long, thin molecule located in the nucleus. The DNA in one chromosome has 10s of millions of base pairs and hundreds or thousands of genes. Yet an individual cell will only use a small portion of those genes in its lifetime.

Another peculiar thing about DNA is that it is located inside the nucleus, and pretty much stays inside the nucleus, yet the proteins that DNA helps to make are produced OUTSIDE of the nucleus. So how does the cell solve this problem? It sends a "messenger" from the nucleus to the ribosomes in the cytoplasm.



In a process called transcription, the DNA code is transcribed (copied) into mRNA, following rules similar to DNA replication we saw earlier (see below). mRNA moves out of the nucleus into the cytoplasm where it links up with ribosomes in a process called translation and begins churning out proteins.

In DNA code, a "word" is always 3 letters long and is called a "codon." Consider the following DNA segment:

A	T	C	G	T	C	C	A	A	A
T	A	G	C	A	G	G	T	T	T

"ATC" is a codon. "GTC" is a codon. "CAA" is a codon. Etc.

In transcription, the DNA code is transcribed (copied) into RNA code, following rules similar to DNA replication we saw earlier EXCEPT that:

DNA RNA
Matches with
A……U
T……A
C……G
G……C

1. Transcribe the following DNA sequence into mRNA. Draw a line separating each codon:

A T C G T C C A A A ….

_____

Activity: There are 4 letters of the mRNA code: U-A-C-G. How many possible combinations are there? In other words, how many "words" can you make with those 4 letters if any combination of letters is possible but all "words" are only 3 letters long? Hint – start with a single letter, how many codons can be produced that start with, for example, the letter "A?" You can infer the rest. I'll get you started…

AAA
AAC
AAU
AAG

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Part 2: Questions

1. At this point, you should have figured out that there are _____ possible codons using 4 letters with 3 letters per codon in any order. However, there are only 20 amino acids, and each codon "codes" for one amino acid – so what does this mean?

_____

Use the codon chart on page 307:

2. What does UAC code for?

_____

3. CAG? _____

4. AGG? _____

5. GAU? _____

6. UUU? _____

7. List the codons for Valine:

_____

8. Stop? _____

9. Methionine is a "Start" signal. What is its codon?

_____

Each amino acid is matched with one or more 3-letter "words." The **words** are analogous to an amino acid. When the words are put together they make a sentence. The **sentence** is analogous to a protein. So, let's break the following code.

10. Given the following DNA code, how would this segment be transcribed into mRNA?

T A C C C G A T A C T C C C T T C A A T T

_____

11. Give the 3-letter abbreviation (*see p. 4*) for the amino acids coded for in that sequence:

_____

12. What is the silly little sentence that this codes for (*see p. 4*)?

_____

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Amino Acid – English word Table

MET START	GLY THE	ALA SAD	VAL RAT	ILE MET
PHE RAN	HIS OLD	TRP FOE	PRO SLY	SER CAT
THR WHO	GLU SAW	CYS MAD	ARG ATE	TYR DOG
ASN AND	GLN HIS	ASP FOR	LEU DAY	LYS BIG
		STOP .		

Abbreviation Table

NAME	CODE
Alanine	ALA
Cysteine	CYS
Aspartic Acid	ASP
Glutamic Acid	GLU
Phenylalanine	PHE
Glycine	GLY
Histidine	HIS
Isoleucine	ILE
Lysine	LYS
Leucine	LEU
Methionine	MET
Asparagine	ASN
Proline	PRO
Glutamine	GLN
Arginine	ARG
Serine	SER
Threonine	THR
Valine	VAL
Tryptophan	TRP
Tyrosine	TYR

In the remaining space, create your own messages (BE APPROPRIATE!) and, working backwards, determine what the DNA sequence would be:

Your message: _____

Amino acid (3 letter): _____

mRNA sequence: _____

DNA Sequence: _____

Your message: _____

Amino acid (3 letter): _____

mRNA sequence: _____

DNA Sequence: _____