

Name: \_\_\_\_\_

## Protein Synthesis – what you should know!

How are proteins synthesized?

### Answer questions 1-4.

1. When a protein is made in a cell, it requires a copy of a **gene** from DNA. Which of the following processes is responsible for obtaining this copy?

- (1) Transcription      (2) Replication      (3) Translation      (4) Reproduction

2. Complete the sequence below if mRNA were copying DNA.

DNA template      **A T A T G G C C A**

mRNA      \_\_\_\_\_

3. State the function of each organelle listed below:

- Nucleus: \_\_\_\_\_
- Ribosome: \_\_\_\_\_

4. Identify the building block (monomer) of proteins. \_\_\_\_\_

## Protein Synthesis

### Step 1: Transcription

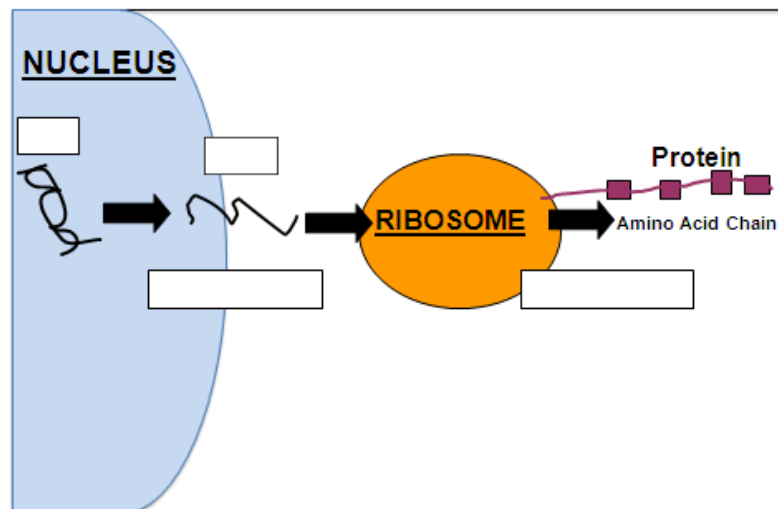
The double stranded DNA code is used as a template to create \_\_\_\_\_ stranded mRNA code. The mRNA is a message that leaves the \_\_\_\_\_ and instructs the ribosome on how to make a certain protein. mRNA is made up of nucleotides like DNA but instead of having T's it has \_\_\_\_\_'s.

### Step 2: Translation

During translation the ribosome uses mRNA to make a protein. Every 3 nucleotides in mRNA (called a codon) is a code for a certain \_\_\_\_\_. The ribosome "reads" the codons and uses tRNA to put the corresponding amino acids together to make a \_\_\_\_\_.

### Label:

Transcription  
DNA  
mRNA  
Translation



## More about Transcription

During transcription DNA must be transcribed into a single stranded mRNA and sent to the ribosome. When mRNA is made, base pairings change slightly...

**DNA: T-A, C-G**

**mRNA: A-U, C-G**

**Practice: Transcribe the DNA base sequences below into mRNA codons.**

5. DNA Base Sequence      T A T    G G C    A T T  
mRNA codon                    \_\_\_\_\_

6. DNA Base Sequence      A C T    C T A    A T G  
mRNA codon                    \_\_\_\_\_

## More about Translation

The second step in protein synthesis is called translation because the ribosome reads the mRNA codons and “translates” the bases into amino acids, which is like a whole other language! To determine what amino acid the mRNA codes for—simply look it up in the Universal Genetic Code chart!

Universal Genetic Code Chart  
Messenger RNA Codons and the Amino Acids for Which They Code

|            |   | Second Base                                       |                                      |   |   |                  |
|------------|---|---|--------------------------------------|---|---|------------------|
|            |   | U   | C                                    | A   | G   |                  |
| First Base | U | UUU } PHE<br>UUC }<br>UUA } LEU<br>UUG }          | UCU }<br>UCC } SER<br>UCA }<br>UCG } | UAU } TYR<br>UAC }<br>UAA } STOP<br>UAG } | UGU } CYS<br>UGC }<br>UGA } STOP<br>UGG } TRP | U<br>C<br>A<br>G |
|            | C | CUU }<br>CUC } LEU<br>CUA }<br>CUG }              | CCU }<br>CCC } PRO<br>CCA }<br>CCG } | CAU } HIS<br>CAC }<br>CAA } GLN<br>CAG }  | CGU }<br>CGC } ARG<br>CGA }<br>CGG }          | U<br>C<br>A<br>G |
|            | A | AUU }<br>AUC } ILE<br>AUA }<br>AUG } MET or START | ACU }<br>ACC } THR<br>ACA }<br>ACG } | AAU } ASN<br>AAC }<br>AAA } LYS<br>AAG }  | AGU } SER<br>AGC }<br>AGA } ARG<br>AGG }      | U<br>C<br>A<br>G |
|            | G | GUU }<br>GUC } VAL<br>GUA }<br>GUG }              | GCU }<br>GCC } ALA<br>GCA }<br>GCG } | GAU } ASP<br>GAC }<br>GAA } GLU<br>GAG }  | GGU }<br>GGC } GLY<br>GGA }<br>GGG }          | U<br>C<br>A<br>G |

**Practice: Translate the mRNA codons into a chain of amino acids to make a protein!**

mRNA codon -            AUA-AGU-CAU-UUC-UGA

tRNA anticodon -        \_\_\_\_\_

Amino Acids-            \_\_\_\_\_ (DON'T use tRNA!! Use mRNA codons to look these up!)

Did you use the mRNA codons or the tRNA anticodons to look up your amino acids?

\_\_\_\_\_ Which ones should you use on the codon chart? \_\_\_\_\_ If you didn't use mRNA you need to look up your amino acids again.

7. Which three codons would code for a different amino acid sequence than the one coded for by the mRNA base sequence: GGU-CGA-CUG

- (1) GGU-AGA-CUG
- (2) GGC-CGA-CUA
- (3) GGU-CGU-CCG
- (4) GGA-CGC-CUC

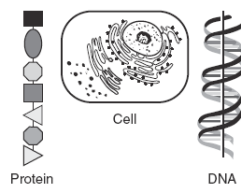
**THINK about it:**

1. Suppose you knew the makeup of specific protein in a cell (you knew the amino acid sequence). How would you determine the particular DNA code that coded for them? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2. Three structures are represented in the diagram below.



What is the relationship between these three structures?

- (1) DNA is made up of proteins that are synthesized in the cell.
- (2) Protein is composed of DNA that is stored in the cell.
- (3) DNA controls the production of protein in the cell.
- (4) The cell is composed only of DNA and protein.

3. Which of the following bases will not be present in a molecule of mRNA?

- (1) Adenine
- (2) Guanine
- (3) Uracil
- (4) Thymine
- (5) Cytosine

4. What is the role of DNA molecules in the synthesis of proteins?

- (1) They catalyze bond formation between amino acids.
- (2) They determine the sequence of amino acids in a protein
- (3) They supply energy for protein synthesis.
- (4) They transfer amino acids to the nucleus

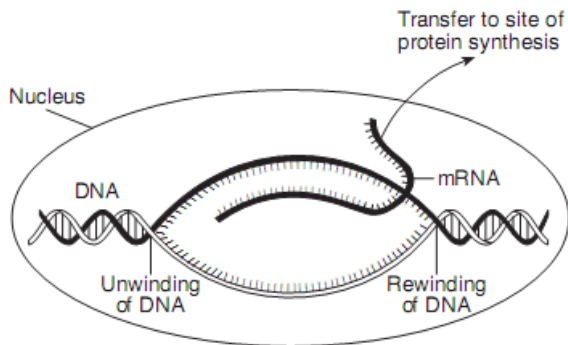
5. The end result of the process of translation is the production of

- (1) DNA
- (2) Proteins
- (3) RNA
- (4) Inherited traits

6. The sequence of amino acids that makes up a protein is determined by the sequence of

- (1) bases in DNA
- (2) amino acids in DNA
- (3) ribosomes in cytoplasm
- (4) glucose in the chloroplast

7. The diagram below shows some steps in a cellular process.



a. The section of DNA being used to make the strand of mRNA is known as a

- (1) Carbohydrate
- (2) Ribosome
- (3) Gene
- (4) Chromosome

b. The process depicted is best described as

- (1) Replication
- (2) Transcription
- (3) Translation
- (4) Mutation