

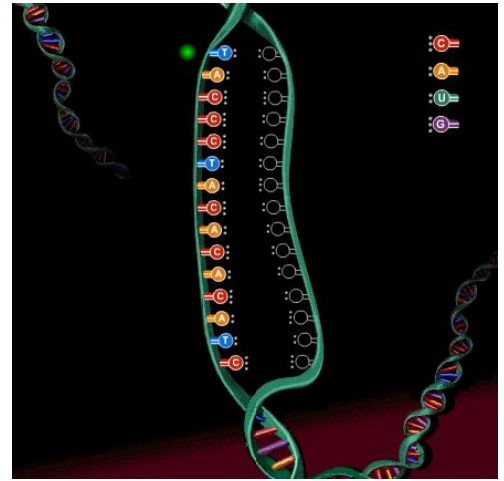
Lab: What is the role of DNA and RNA in protein synthesis?

HONORS BIOLOGY: UNIT 5

OBJECTIVES:

- Describe the structure and function of the DNA molecule.
- Explain how the genetic information in the DNA molecule is transcribed into mRNA.
- Explain how mRNA is translated into a specific sequence of amino acids in a protein molecule.

BACKGROUND: The genetic material of all living things is made of a molecule called **deoxyribonucleic acid**, or **DNA**. The traits of an organism are determined by the genetic code contained in its DNA. Every cell in an organism's body contains DNA which is unique to that organism. The DNA molecule is made up of two twisted strands of sugar and phosphate molecules attached to each other by nitrogen bases- adenine (**A**), guanine (**G**), cytosine (**C**), and thymine (**T**). The four nitrogen bases always bond in the following way: adenine pairs with thymine, and guanine pairs with cytosine. The pairs of nitrogen bases form bridges between the two strands of the DNA molecule. The sequence of the bases on the DNA molecule is an organism's genetic code.



DNA contains the information for building **amino acids**. The order of nitrogen bases in DNA determines the type and order of amino acids in a **protein**. There are twenty different amino acids, but DNA contains only four types of bases. A sequence of three bases, called a **triplet code**, forms a code for a single amino acid.

Ribosomes in the cytoplasm are sites where proteins are made. Because the genetic code for a protein is in the DNA in the nucleus of a cell, the code must be moved from the nucleus to the cytoplasm.

Before DNA moves from the nucleus to the cytoplasm, the code is **transcribed** into a messenger RNA (**mRNA**) molecule. The mRNA molecule is formed by free nitrogen bases attaching to nitrogen bases on an unwound segment of DNA. The nitrogen bases of RNA bond in the same way as in DNA except uracil (**U**) takes the place of thymine (**T**). Then the mRNA breaks away from the DNA and carries the genetic information to a ribosome in the cytoplasm.

The ribosome is where the genetic information in the mRNA is converted into a sequence of amino acids that make up a protein. This process is called **translation**. Transfer RNA (**tRNA**) brings amino acids to the ribosome so they can be assembled into proteins. The nitrogen bases of the tRNA pair with the appropriate nitrogen bases of the mRNA. The amino acids on the tRNA bond to adjacent amino acids, break off from the tRNA, and form a protein molecule.

In this Virtual Lab you will build a mRNA molecule by pairing free nitrogen bases in the nucleus with nitrogen bases on an unwoven strand of DNA. Then you will examine how a mRNA molecule is translated into a protein molecule.

PROCEDURE:

1. Go to http://www.glencoe.com/sites/common_assets/science/virtual_labs/LS04/LS04.html
2. Observe the unwoven DNA molecule. One of the DNA strands is exposed, showing a sequence of nitrogen bases.
3. **Click** the **Legend** button for information about the nitrogen bases pair.
4. Build a mRNA molecule by pairing up free nitrogen bases on the exposed strand of DNA. Start at the top where there is a blinking dot. Determine which free nitrogen base pairs up with the nitrogen base on the DNA. Drag a free nitrogen base to its corresponding nitrogen base on the DNA. If you chose the correct nitrogen base, the base will bond. Continue pairing all of the bases.
5. When you have finished building the mRNA molecule, watch the animation of the mRNA carrying the genetic information from the nucleus to a ribosome in the cytoplasm. As nitrogen bases on tRNA pair with nitrogen bases on mRNA, amino acids link together. A protein molecule is formed.
6. **Click** the **Show Labels** button to see labels of the major structures involved in protein synthesis.
7. Enter your data in the Table. Starting with the first amino acid in the protein molecule, record the amino acid number. Record the mRNA triplet code (three nitrogen bases) that corresponds to the amino acid. The mRNA triplet code for the first amino acid consists of the first three nitrogen bases on the mRNA molecule
8. Using the mRNA code, deduce the DNA code. Use the Legend if you need assistance. Record your data in the Table.
9. Using the mRNA code, deduce the tRNA code. Remember that RNA is different from DNA in that it contains uracil (U) in place of thymine (T). Record you data in the Table.
10. **Click** the **Reset** button to synthesize another protein.
11. Complete the Journal Questions. (*Glencoe.com*)

DATA TABLE: GENETIC CODE

Amino Acids	aa#	DNA Code	mRNA Code	tRNA code
Amino Acid				
Amino Acid				
Amino Acid				
Amino Acid				
Amino Acid				

JOURNAL QUESTIONS:

1. Describe the structure and appearance of DNA.
2. What is the function of DNA?
3. What is the function of mRNA?
4. What is the function of tRNA?
5. Describe a protein molecule.

