**PROTEIN SYNTHESIS KIT**

1. **PREPARATION:**

***DIRECTIONS:***

1. Arrange the “nuclear membrane” and “ribosome surface” strips on your desk as in the diagram on the back of this page. Place the original DNA molecule to the right of the nuclear membrane (“in the nucleus”); now add the RNA-nucleotides, which makes up the “RNA-nucleotide pool” in the nucleus.
2. Put the Transfer-RNA molecules (tRNA) together with the amino acids that fit into them (do not glue) and distribute them randomly in the “cytoplasm” (to the left of the nuclear membrane.)
3. **THE PROCESS OF PROTEIN SYNTHESIS**

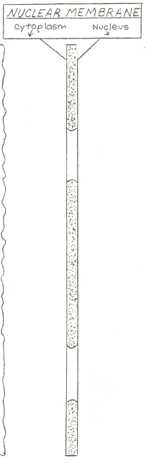
***DIRECTIONS: Read all steps first.***

1. The process starts when the enzyme unzips the weak bonds in the center of the DNA molecule (as in DNA Replication). Now separate the two DNA strands, so that the right-hand strand remains in position in the nucleus for the next step (you can put the left-hand strand aside to give more room).
2. Now the RNA nucleotides in the nucleotide pool move in and pair up with the complementary bases along the exposed DNA strand: match RNA nucleotides with each of the exposed DNA base-ends, until all of the DNA base-ends are matched (there will be some nucleotides left over in the nucleotide pool). Once the RNA-nucleotide sequence is complete, glue these RNA-nucleotides together, forming a *Messenger-RNA* (mRNA) molecule. (use the “paste” tabs on each nucleotide).
3. The mRNA molecule now “unzips” from the DNA strand, passes “thru” the nuclear membrane carrying the “message” (the protein “recipe” copied from the DNA) and attaches to the surface of a ribosome, with the base ends pointing upwards.
4. In the cytoplasm, each Transfer-RNA (tRNA) molecule holds a specific amino acid on one end, and is “coded” with 3 bases at the other end to fit a specific 3-base sequence of the mRNA molecule. Move the tRNA’s with their amino acid “passengers” into position according to which ones fit with the mRNA sequence exposed on the ribosome. Continue until all of the base-ends of the mRNA have been matched. (This will require three tRNA molecules).
5. The previous step brings three amino acids together in a row, in a particular order specified by the mRNA. Glue those amino acids together in that order, then separate them from their tRNA “taxis”. The bond between amino acids is so important that it has a special name – it is a *peptide bond*. The sequence of three amino acids represents the start of a chain of amino acids that will continue to grow until it eventually is a complete protein. The number of amino acids is specific to each protein but the average is about 500.
6. If you did the steps correctly, the first letters of the three amino acids in your sequence should spell a “secret” word. Be prepared to supply this word to your teacher, but do not tell anyone else; let them discover it for themselves. *Secret word*\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. There will be extra amino acids and tRNA molecules.
8. In a cell, the mRNA would stay in position on the ribosome and be used over and over, forming as many copies of the protein as the cell needs.

***Be prepared to explain the process of protein synthesis to the teacher using the terms on the list on the back of the paper.***

* **nucleus**
* **DNA molecule**
* **strong bonds**
* **weak bonds**
* **enzyme**
* **unzip**
* **RNA nucleotides**
* **nucleotide pool**

**DESK LAYOUT FOR MODEL CELL**



NUCLEUS

CYTOPLASM



* **mRNA**
* **nuclear membrane**
* **cytoplasm**
* **ribosome**
* **tRNA**
* **amino acid**
* **peptide bond**
* **protein**