

## Workshop for Visiting High School Students

### Proteins as Machines

The project will entail several examples demonstrating the power of Proteins as Machines. This will be accomplished using five workstations as described below:

- Station 1:** The power of proteins in **MUSCLE CONTRACTION** will be shown using this station. You will visualize the working of the several important proteins, including actin and myosin skeletal muscle.
- Station 2:** Demonstrating the power of fluorescent proteins and how they have become a work force in studying living cells and animals. You will visualize the structure of the **GREEN FLUORESCENT PROTEIN (GFP)** as well as purify the protein on a column.
- Station 3:** Demonstrating the power of proteins in lymphocyte **CELL SIGNALING** and how they control switching on or off the immune system. You will visualize the intricate workings of many proteins in passing a signal from the surface of the cell to the DNA in the nucleuse.
- Station 4:** You will spool and isolate long strands of **GENOMIC DNA** using a glass rod to twist and make DNA insoluble in ethanol. The genomic DNA was isolated from chromosomes found in thymic tissue cells. This long and unmanageable DNA can become workable only after cutting it into fragments using tiny protein scissors (restriction enzymes).
- Station 5:** Demonstrating the power of **RESTRICTION ENZYMES** (protein scissors) in cutting DNA into fragments. These protein enzymes helped map the huge human genome for the sequencing project. You will not only visualize the enzyme protein screening DNA, you will also see the DNA fragments that it generates when separated on agarose gel and visualized directly under UV light.

Central Dogma

**DNA>>RNA>>PROTEIN>>TRAIT**

Our bodies contain thousands of different proteins which perform many different jobs. The information for assembling a protein is carried in our DNA. The section of DNA which contains the code for making a protein is called a GENE. There are over 30,000 genes in the human genome. Each gene codes for a unique protein: one gene-one protein and many machines. The genes that are expressed in your muscle cells are different than those made in your brain or the pigments that color your eyes.

Organisms regulate expression of their genes and ultimately the amounts and kinds of proteins present within their cells for development, structure, function, specialization and adaptation to the environment.

Regulation of the expression of proteins often occurs at the level of transcription from DNA into RNA.

The DNA code of the pGLO plasmid (GFP) has been engineered to be expressed in many different cell types, including bacteria.

Cells express a brilliant green bioluminescent color as they produce more and more GFP protein. When the GFP protein is not made, bacteria colonies will appear to have a wild type (natural) phenotype - of white colonies with no florescence.

This is one example of the central dogma in life sciences that demonstrates;

**DNA Genome>>RNA Expression/Regulation>>Translation:  
Protein Machines**

Moving Muscle Proteins  
Bioluminescent Green Fluorescent Protein  
Triggering Cell Signal Proteins  
Antibodies Protecting us From Disease are Proteins  
Histones Holding DNA Together in the Chromosome are Proteins  
Restriction Enzymes that Cut DNA into Fragments are Proteins