Genes to Proteins

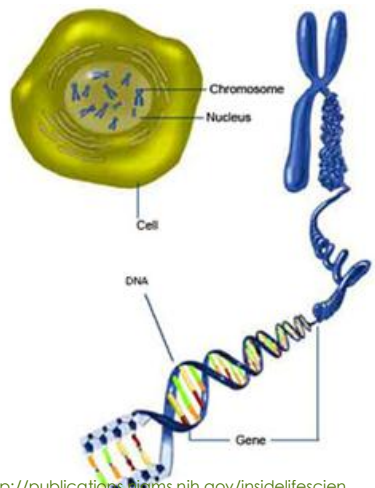
Text Mark Up Directions:

1. Preview and number the paragraphs.
2. Read once and circle the unknown vocabulary terms; then look them up and define or write a synonym in the margin next to the word.
3. Re-read a second time and highlight the main points (per paragraph) and annotate (paraphrase) in the margin.

Before humans even knew of the existence of DNA, they recognized that certain traits were inherited. Through observation they saw that the offspring of cows that produced large amounts of milk often produced large amounts of milk themselves. This led to selective breeding and domestication of plants and animals 2,000 years ago, while the existence of DNA was not discovered until the mid 1950's.

Genes, Chromosomes, and Proteins

We now know that more than 100,000 **proteins** in the human body are created using the recipes stored in **deoxyribonucleic acid** or **DNA**. Each of the trillions of cells in a human has a complete set of DNA stored in its nucleus to make proteins. Proteins can function as enzymes to speed up chemical reactions, muscles that allow body movement, hormones that control growth, hemoglobin that carry oxygen, transport proteins in cell membranes and much more.



http://publications.nigms.nih.gov/insidelifescience/images/dna-structure.jpg

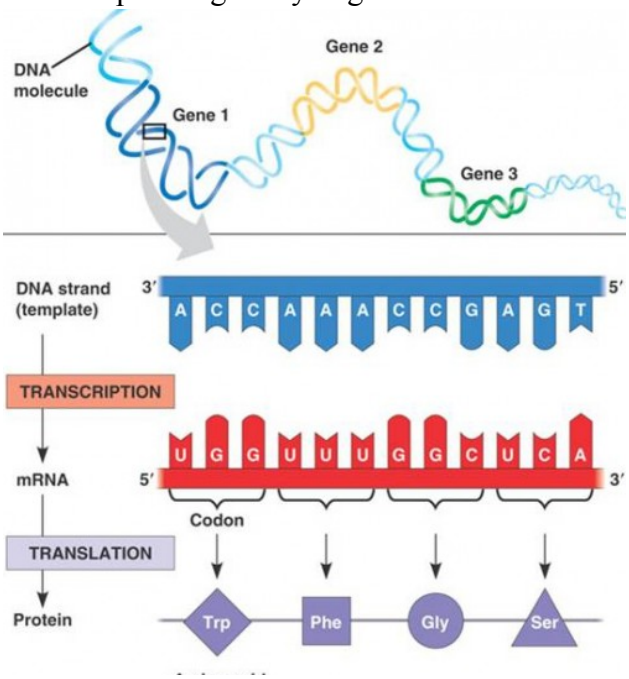
DNA recipes used to make a specific protein are called **genes**. The coded instructions are written in the order of four different nucleotide bases – adenine (A), thymine (T), cytosine (C), and guanine (G). The order of the nucleotide bases in DNA determines the order of the 20 possible **amino acids**, which build proteins.

Chromosomes are strands of DNA wound up and organized to make it easier for cells to find the directions, or genes, to make a specific protein. Humans normally have two sets of 23 chromosomes. One set from each parent with different versions of the same genes. Your traits like eye color are determined by the combination of the two copies of genes you get from both parents.

From DNA to Protein

Fragile DNA must not be damaged so RNA Polymerase enzyme makes a copy and DNA can stay in the protection of the nucleus. The gene copy made of RNA, is called **messenger RNA**, or **mRNA**. This copying process is called **transcription** and occurs in the nucleus.

During **translation** the mRNA gene copy will leave the safety of the nucleus and be read by the **ribosome** to build a protein. The ribosome reads three nucleotide monomers



as one piece of code (or a codon) and translates it into a single amino acid. These amino acids then bond to form a protein polymer chain.

The protein chain may range from a hundred to hundreds of thousands of amino acids long. These protein chains can then be modified in the **endoplasmic reticulum (ER)** by adding carbohydrates or lipids and finally folding them into their functioning shape.

Genes to Proteins Follow Up Questions (*Answer in full sentences)*

1. *What are genes? What are chromosomes? How are the two related?*

2. *How many chromosomes do humans have in total and where do they come from? How are they different?*

3. *Where is the DNA kept? Why?*

4. *What is transcription and what is the product called?*

5. *What is DNA translated into and what molecule does the translating?*

6. *How much of the mRNA code is translated at a time? What is that piece of code called?*

7. *Where is the protein modified after it is created? What must be done to the protein to make it function?*