AP Biology
Protein Synthesis – Part 3
(Associated Learning Objectives: 1.14, 1.15, 1.16, 2.22, 2.24, 3.1, 3.4, 3.5, 3.6, 3.18, 3.25, 4.1, 4.2, 4.3, 4.7, 4.24)

Important concepts from previous units:

1) A *change* in the nucleotide sequence is called a **mutation.**
2) Some mutations can cause cancer (abnormal growth) in organisms.
3) Prokaryotes would have, over millions of years, given rise to Eukaryotes. (Endosymbiant Hypothesis)

I. Types of RNA

II. Prokaryotes vs. Eukaryotes

A. Prokaryotes DO NOT have **introns** that need to be removed prior to Translation. The 1' transcript goes *straight to the ribosome* for Translation.

B. **Genetic engineering**? We can take a 2' transcript out of a *Eukaryotic organism*. Use the enzyme **reverse transcriptase** to turn the mRNA molecule *back into* a DNA molecule. *Insert* the new DNA strand into bacteria. The bacteria will then be able to Transcribe and Translate off of this new inserted DNA and thus *make that protein*. This has been done for numerous human medicines such as Insulin or Human Growth Hormone.

C. Eukaryotes DO have **introns**. This allows them to take out the introns and *rearrange the important exon pieces* to make an *almost unlimited number of different* proteins. This simple fact is the reason that humans are so vastly more complex than simple bacteria.

D. The two types of cells basically do the *same process* of Transcription and Translation to make proteins. This *indicates* common ancestry among all organisms. (Unity *again*.)

III. Mutations

A. *Change in the nucleotide sequence* of DNA or mRNA that code for a protein.

B. Caused by **Mutagens** (Means to "**gen**erate a **muta**tion".)

1. These are a *physical or chemical interactions* that changes the nucleotide sequence of DNA.
2. Examples of mutagens:
   a. Ultraviolet radiation (UV Radiation) from the sun
   b. Cigarette Smoke
   c. Alcohol in excess
   d. Viruses
   e. Car Exhaust
   f. Chemicals (Laboratory, Pesticides, insecticides, poisons)

C. Two major types of Mutations:

1. **POINT mutations** - A *single nucleotide* mutates thus affecting *a single codon*.
   a. **Silent** Point Mutation– The mutation causes *no change in the amino acid* coded for. (We would never know because it has no effect. This can happen because the codon coding is *redundant,* remember?)
   b. **Missense** Point Mutation – The mutation *changes the amino acid* coded for. (MIStake) (This is best seen in the mutation that causes Sickle cell.)
   c. **Nonsense** Point Mutation – The mutation *changes from coding for an amino acid to coding for a STOP codon* . NO protein will be made. (NO sense)
2. **READING FRAMESHIFT Mutation** (The whole DNA "sentence" is changed)
   a. These mutations alter the *codon sequence*.
   b. **Insertion** – *adding nucleotides* to the sequence.
      For Example: THE BIG TAN DOG RAN
      with *Inserted* Letter**:** THE B**O**I GTA NDO GRA N
   c. **Deletion** – *taking out nucleotides* from the sequence.
      For Example: THE BIG TAN DOG RAN
      with *Deleted* Letter: THE BGT AND OGR AN

D. Gametes vs. Somatic – Who is affected? If a mutation occurs in somatic cells, the only one affected by the mutation is *the person that the mutation occurred to*. If the mutation occurs in gametes (sex cells), the only one affected will be the organism *"created"* from that sex cell. This is how *future generations* may be affected and *this is a cause of evolution*. CHANGE in DNA over TIME.