## PROTEIN SYNTHESIS

### The Flow of Genetic Information

A gene is a segment of DNA that is located on a chromosome and that codes for a particular trait. The trait is expressed by the actions of the protein which is produced when the gene is used. For example, a person's hair color is determined by a gene which directs the making of the protein *melanin* in hair follicle cells. In all eukaryotic cells, chromosomes always remain in the nucleus, protected by the nuclear membrane. Therefore, in order for the instructions encoded in DNA to be used, a "working copy" of the DNA, called RNA, is first created in a process called transcription. RNA then directs the assembly of proteins in a process called translation.

### RNA Structure

RNA (Ribonucleic Acid) is very similar to DNA in that it is made up of nucleotides, however, the structure of RNA differs in three basic ways. First, RNA contains the sugar ribose. Also, RNA exists as a single strand (and not the double stranded double helix of DNA). RNA also includes the bases, adenine, guanine and cytosine, however, there is no thymine found in RNA, but instead there is a similar compound called uracil. Use the following key to color the bases in the diagram:

Thymine = orange
Adenine = dark green
Guanine = purple
Cytosine = yellow
Uracil = brown

### Transcription

Transcription is the process by which RNA is made from DNA. During transcription, DNA acts as a template for the synthesis of RNA. As it involves DNA, this process occurs in the nucleus. Label the process on the diagram and color the strand of DNA dark blue (D) and the strand of RNA light blue (R). Color the nuclear membrane (E) gray.

During transcription, three different types of RNA are created, each with a specific role in the production of proteins. Messenger RNA (mRNA) carries the instructions from a gene to make a protein. The second type of RNA is ribosomal RNA (rRNA) which composes the structure of a ribosome (the organelle of protein synthesis). The third type of RNA is transfer RNA (tRNA), a carrier molecule which transfers amino acids to the ribosome to make a protein.

### Translation

Decoding of the genetic message in mRNA to form a protein takes place in translation. The mRNA made in the nucleus travels out to the ribosome to carrying the message it transcribed from the DNA. Here at the ribosome, that massage will be translated into an amino acid sequence, the primary structure of a protein. Label the process of translation on the diagram. Color the ribosome light green (Y) and note how the RNA strand threads through the ribsosome like a tape measure and the amino acids are assembled. The RNA strand in the translation area should also be colored light blue, as it was colored in the nucleus.

Notice that the tRNA (F) are carrying the amino acids to the ribosome. Color the tRNA red. A tRNA has two important areas: The anticodon, which compliments the codon on the RNA strand. Codons are sets of three nucleotide bases in the mRNA that code for a single amino acid. Circle and label a codon and its complimentary anticodon on the diagram. Make sure you color the bases of the anticodon the same color as the bases on your DNA and RNA strand - they are the same type of molecule!

At the top of the tRNA is the amino acids. There are twenty amino acids that can combine together to form proteins of all kinds; these are the proteins that are used in life processes. Each tRNA has a different amino acid which link together in a dehydration synthesis reaction forming peptide bonds. Color all the amino acids (M) pink.

**Protein Synthesis** Name:

Period: Date:

Use the diagram and/or the reading to answer the following questions.

1. What is a gene?
2. Create a Venn Diagram to compare & contrast the molecules RNA and DNA.
3. Describe the two step process of protein synthesis in a paragraph below.
4. What is the name of the molecule that delivers the genetic instructions?
5. What is the name of the molecule that delivers amino acids?
6. What is the organelle where translation takes place?
7. What is a codon and where are they found?
8. Where are anticodons found? Describe the relationship between an codon and an anticodon.
9. How many amino acids are attached to each tRNA?
10. How many different amino acids are there?
11. What type of reaction links amino acids together?
12. What type of bond is formed between amino acids?

# Transcription and Translation

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