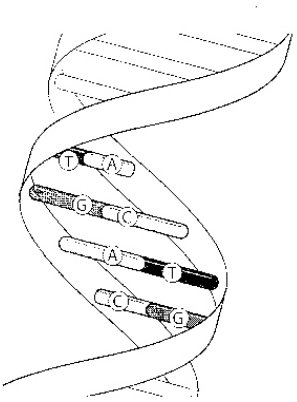
Advisement Teacher & Room #_____

Student Name_____Tutor:_____

Biology Teacher's Name_____Period_____

Biology Tutorial #13

CA State Standard 4e: Students know proteins can differ from one another in the number and sequence of amino acids. 4b: Students know how to apply the genetic coding rules to predict the sequence of amino acids from a sequence of codons in RNA. 5a: Students know the general structures and functions of DNA, RNA and proteins.



DNA stores encoded information cells use to build proteins. It is a double-stranded molecule that looks like a twisted ladder, with alternating sugar and phosphate groups making up each side arid paired bases forming its "rungs." The strands are held together by hydrogen bonds between pairs of bases.

Bases always pair the same way: adenine (A) to thymine (T) and cytosine (C) to guanine (G). This makes the two strands complementary-they fit together and are the opposite of one another.

RNA is a single-stranded molecule that takes information from DNA and uses this information to build proteins. Three different forms of RNA work to do this.

1. **Messenger RNA (mRNA)** is a long, polymer that is the complement of a gene. mRNA does not have thymine (T), so it matches uracil (U) to adenine (A) instead. mRNA acts as a link→ it is the **template** that carries the code for a protein from DNA in the nucleus to ribosomes in the cytoplasm.
2. **Transfer RNA's (tRNA)** are folded molecules that bind to amino acids and bring them to ribosomes during protein synthesis.
3. **Ribosomal RNA (rRNA)** forms one part of ribosomes, the sites of protein synthesis.

Similarities between DNA and RNA

DNA and RNA are both nucleic acids, long **polymers** built of **monomers** called **nucleotides**. Each nucleotide has three parts: a phosphate group, a ring-shaped sugar built of five carbons, and one nitrogen-containing base. There are five bases: adenine (A), guanine (G), cytosine (C), thymine (T), and uracil (U). However, T is only found in DNA, and U is only found in RNA.

Only four DNA nucleotides store the codes for all of the proteins in a cell, and only 20 different types of amino acids are used to build the proteins. Reading DNA sequences can allow you to determine the amino acids that the DNA codes for.

Base-Pairing Rules

DNA	mRNA	tRNA
A	U	A
T	A	U
C	G	C
G	C	G

The Amino Acid Code

Most three-nucleotide sequences in the genetic code are translated into one of 20 amino acids. The three-nucleotide sequence in an mRNA molecule is called a **codon,** that codes for a specific amino acid. During translation, complementary tRNA molecules that have three-nucleotide sequences called **anticodons** bind to an mRNA molecule that is bound to a ribosome. Each tRNA molecule carries a specific amino acid.

Proteins

Proteins are polymers built out of a series of amino acids. Each amino acid has an amino group (NH_2), carboxyl group (COOH), and a unique side chain ("R"). Covalent bonds, called polypeptide bonds, form between the amino and carboxyl groups to produce a polypeptide. Each protein has a unique amino acid sequence which determines its three-dimensional structure. Its **function** in the organism depends on the specific properties of its **shape**. Proteins may be enzymes, hormones, transport molecules, antibodies, or the structural components of cells and tissues.

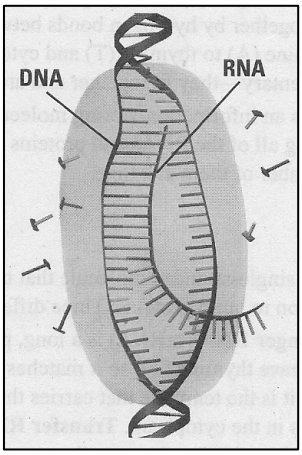
Answer the questions on the following page:

1. What three parts make up a nucleotide?

2. How do nucleotides found in DNA differ from those found in RNA? In what other ways does DNA differ from RNA?

3. One type of polymer is responsible for taking genetic information <u>from the nucleus</u> and delivering this information into the cytoplasm. What molecule in the cell performs this task?
   A) DNA B) mRNA C) tRNA D) protein

4. Proteins are polymers that can have one of many different roles in the body. Some proteins function as enzymes and others give cells a specific structure. Proteins' roles are often determined by their
   A) shape. B) bases. C) cells. D) sugars.



5. In the cytoplasm, molecule #1 carries amino acids to the ribosome. At the ribosome, these amino acids are joined together to form molecule#2. The identity of molecule #1 is_____.
   A) rRNA B) tRNA C) mRNA D) DNA

6. The diagram at the right shows how DNA matches up with a type of RNA. These two molecules can match up because they both have
   A) complementary bases C) ribose sugars.
   B) two strands of nucleotides D) phosphate groups.

7. What is the maximum number of different ***amino acids*** that might be present in a protein?
   A) 20,000 B) 2,000 C) 200 D) 20

8. Suppose you have an mRNA molecule that has the following sequence: **AUA GGU CCC**. Which of the following best represents the complementary tRNA anticodons?
   A) TAT CCA TTT B) GAG TTC UUU C) ATG CCA AAA D) UAU CCA GGG

9. Codons are sequences of three nucleotides in an mRNA molecule. Each codon codes for one
   A) Amino acid B) protein C) gene D) lipid

10. Draw and label the parts of a protein:

11. Draw and label the parts of a nucleotide: