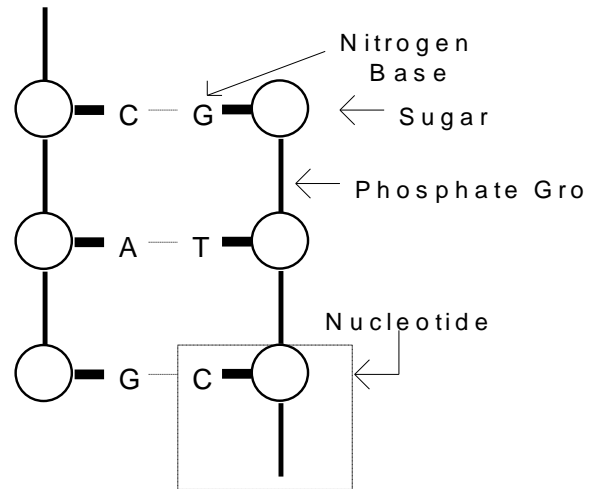


Constructing Nucleic Acids

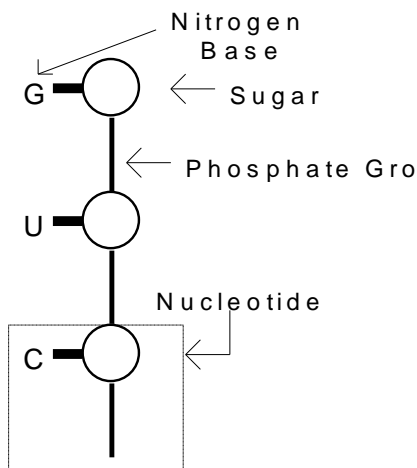
Background:

The three-dimensional structure of DNA was discovered in 1953 by James Watson and Francis Crick. Using x-ray crystallography studies and research on the chemical properties of DNA, they assembled the first model of the molecular structure of DNA which showed it as a double helix. For this accomplishment they were awarded the Nobel Prize.

The DNA molecule consists of two complimentary strands each of which is a chain of nucleotide monomers. Each nucleotide consists of three parts; 1) a five-carbon sugar called deoxyribose, 2) a phosphate group, and 3) a nitrogen base. There are four different kinds of nitrogen bases that can be found on DNA. These bases are adenine, guanine, thymine, and cytosine. Complimentary strands of DNA are held together by hydrogen bonds between the bases. Only cytosine can bond with guanine and only adenine can bond with thymine.



DNA Molecule

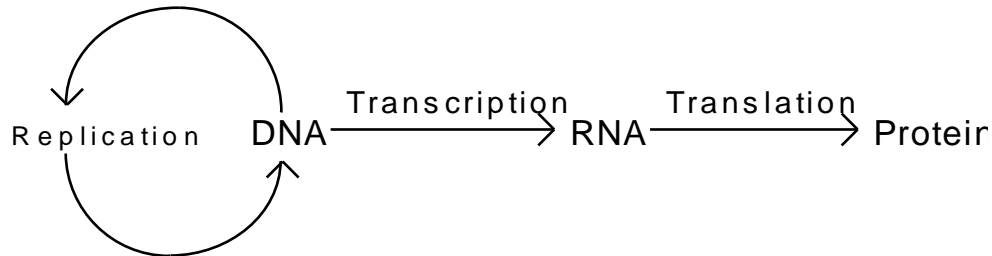


RNA Molecule

A segment of DNA that codes for a particular trait is called a gene. When a gene is expressed, one strand of DNA is copied into a molecule of mRNA through a process called transcription. Like DNA, RNA is a chain of nucleotide monomers. However, RNA differs from DNA in three ways. First, RNA is a single strand. Second, RNA has ribose as its sugar. Finally, RNA has the nitrogen base uracil instead of thymine.

During transcription, a single strand of DNA serves as a template for the complementary bases of the RNA nucleotides that are floating in the nucleus. RNA bases pair up with the DNA bases and an enzyme called RNA polymerase establishes the sugar-to-phosphate bonds that form an RNA strand. The RNA strand then leaves the nucleus and enters the cytoplasm where translation occurs.

Translation is where specific groups of three sequential bases of mRNA(called codons) match up with three sequential bases of tRNA(called anticodons). The tRNA carries with it an amino acid that is specific for the mRNA codon. Ribosomes help to hold the mRNA and tRNA together while the amino acid from the tRNA is linked to the last amino acid translated. A long chain of amino acids form a polypeptide, several polypeptides form a protein, and it is the function of the particular proteins that ultimately leads to the expression of a trait.



Problem:

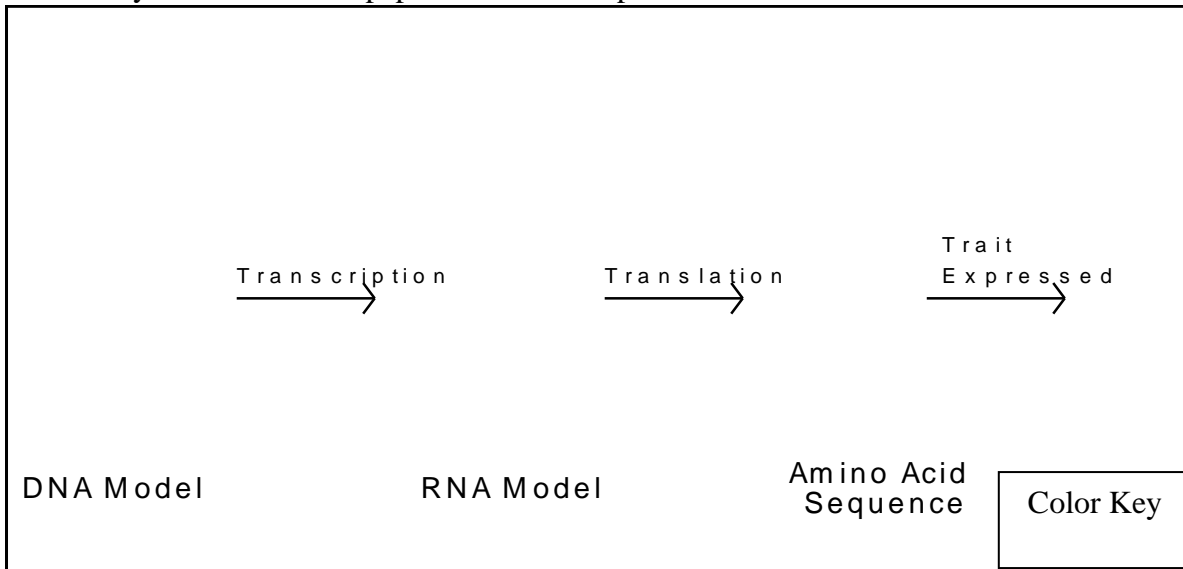
How does DNA store and use information to direct the activities of a cell, and how does the information stored in DNA lead to the expression of traits.

Materials:

Various objects used to represent deoxyribose, ribose, phosphate, adenine, thymine, guanine, cytosine, and uracil. 12x18 construction paper. Glue. Modern Biology Text.

Procedure:

1. Obtain a DNA sequence and construction paper from your instructor.
2. Label your construction paper like the example below.



3. Construct a model of your DNA strand with its complementary strand in the appropriate place on your construction paper.
4. Construct a model of the RNA strand that would be transcribed from your original DNA sequence in the appropriate place on your construction paper.

5. Use a copy of the genetic code to translate the two mRNA codons found on your RNA sequence.
6. Write the names of the amino acid sequence that these codons translate to in the appropriate place on your construction paper.
7. Use the following list to find out what trait your DNA sequence codes for and write the trait in the appropriate place on your construction paper.

Amino Acid Sequence	Trait
Phenylalanine-Glycine	Hairy
Phenylalanine-Arginine	Bald
Leucine-Serine	Short
Leucine-Asparagine	Tall
Isoleucine-Tryptophan	Brown Eyes
Isoleucine-Cysteine	Blue Eyes
Methionine-Glutamic Acid	Blond Hair
Methionine-Aspartic Acid	Black Hair
Valine-Lysine	Dark Skin
Valine-Glutamine	Light Skin

8. Construct a color key on your construction paper showing the materials you used and what part of the nucleic acid molecules they represent.
9. Make sure you have identified the following structures : mRNA, tRNA, Codon, Anticodon, 5' end, 3' end.
10. Don't forget to attach the essays from the instruction sheet.

