DNA: The Code of Life

I. Background Information
A. DNA is an abbreviation for deoxyribonucleic acid.
   1. Deoxyribose is a form of sugar found in the structure of the DNA.
      a. -ose is a suffix that usually means the chemical is some form of sugar.
   2. Since it is a “nucleic acid,” DNA is an organic compound containing carbon.

II. Discovering What DNA Looks Like
A. In the 1950s, many scientists were doing research to try to figure out the structure (or shape) of the DNA molecule.
   1. Dr. Rosalind Franklin took “pictures” of DNA using special X-ray techniques.
      a. She discovered that DNA must be in a spiral shape.
   2. After seeing Franklin’s X-ray images and using their own research, James Watson and Francis Crick realized that the DNA molecule must be in the form of a twisted ladder, a shape called a double helix.
      a. Watson and Crick built the first model of DNA which helped explain how it copies itself and functions in the cell.

III. The Structure of DNA
A. The chemical makeup of the DNA molecule is as follows:
   1. The sides of the “ladder” are made up of alternating sugars (deoxyribose) and phosphate groups.
   2. The rungs (or steps) of the “ladder” are made up of 4 nitrogen bases:
      a. Adenine on one side of the rung will only pair up with Thymine on the other side.
      b. Cytosine on one side of the rung will only pair up with Guanine on the other side.
   3. Together, a sugar, a phosphate, and one of the four nitrogen bases make up a subunit of DNA called a nucleotide.
   4. The following is an example of a section from a DNA molecule:

   | A | A | C | T | G | G | A | T |
   | T | T | G | A | C | C | T | A |

   a. The nitrogen bases are held together with a weak hydrogen bond between them.
B. The order of the nitrogen bases in a DNA molecule make up the chemical “code” which provides the information necessary to make proteins and control all of the traits and characteristics in an organism (this is sometimes called the “code of life”).
   1. A gene is a segment of DNA code that provides the proper order of nitrogen bases (like a set of instructions or a recipe) to make one specific kind of protein.
      a. Many of the proteins made in the body help develop the characteristics of an organism, thus determining what it will look like and sometimes how it will behave.
   2. DNA is broken down into sections called chromosomes.
      a. Each chromosome contains unique genes for specific proteins and traits.
      b. Each organism has a unique number of chromosomes in its cells.
         1. Examples: Humans have 46 chromosomes (in 23 pairs), chimpanzees have 48 chromosomes (in 24 pairs), and corn has 20 chromosomes (in 10 pairs).
   3. The nucleus in every body cell in an organism contains a complete set of DNA.
      a. When the cell is ready to divide, the DNA must make a copy of itself so that the 2 new cells will have the correct number of chromosomes and a complete set of DNA.
IV. Making a Copy of the DNA Molecule (DNA Replication)

A. Before the cell can divide into two new cells (mitosis), the DNA must make an exact copy of itself so both cells will have a complete set of information.

B. The steps for DNA replication are:
   1. The DNA molecule untwists.
   2. Enzymes break apart the hydrogen bond holding the nitrogen bases together, causing the two sides of the molecule to separate.
   3. The nitrogen base that is still attached to one side of the DNA pairs up with its “partner” (Cytosine with Guanine; Adenine with Thymine).
      a. The new bases come from the building materials in the cytoplasm.
   4. When all of the nitrogen bases on each side of the separated DNA molecule have been paired with a new base, there will be two identical molecules of DNA.