

DNA - The Double Helix

Recall that the nucleus is a small spherical, dense body in a cell. It is often called the "control center" because it controls all the activities of the cell including cell reproduction, and heredity. How does it do this? The nucleus controls these activities with chromosomes. Chromosomes are microscopic, threadlike **strands composed of the chemical DNA**. In simple terms, DNA controls the production of proteins within the cell. These proteins in turn, form the structural units of cells and control all chemical processes within the cell. Think of proteins as the building blocks for an organism, proteins make up your skin, your hair, and parts of individual cells. How you look is largely determined by the proteins that are made. The proteins that are made is determined by the sequence of DNA in the nucleus.

Chromosomes are composed of genes. A **gene is a segment of DNA** that codes for a particular protein, which in turn codes for a trait. Hence you hear it commonly referred to as the gene for baldness or the gene for blue eyes. Meanwhile, DNA is the chemical that genes and chromosomes are made of. It stands for deoxyribonucleic acid. DNA is called a **nucleic acid** because it was first found in the nucleus. We now know that DNA is also found in organelles, the mitochondria and chloroplasts, though it is the DNA in the nucleus that actually controls the cell's workings.

In 1953, James Watson and Francis Crick established the structure of DNA. The shape of DNA is a double helix, which is like a twisted ladder. The sides of the ladder are made of alternating sugar and phosphate molecules. The sugar is deoxyribose.

The rungs of the ladder are pairs of 4 types of nitrogen bases. Two of the bases are purines- **adenine** and **guanine**. The pyrimidines are **thymine** and **cytosine**. The bases are known by their coded letters **A, G, T, C**. These bases always bond in a certain way. **Adenine will only bond to thymine. Guanine will only bond with cytosine.** This is known as the "**Base-Pair Rule**". The bases can occur in any order along a strand of DNA. The order of these bases is the code that contains the instructions. For instance, ATGCACATA would code for a different gene than AATTACGGA. A strand of DNA contains millions of bases. (For simplicity, the image only contains a few.)

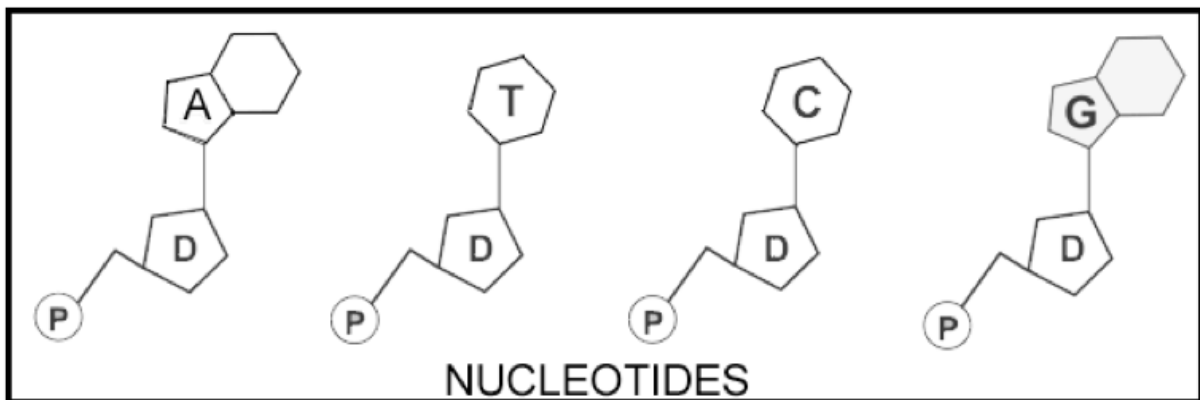
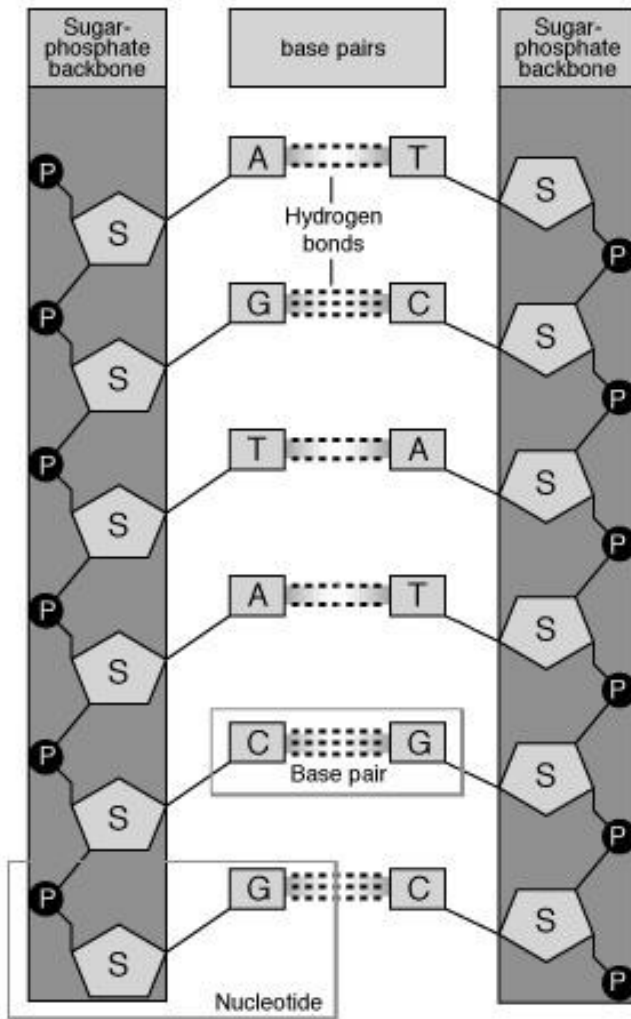
Note that that the bases attach to the sides of the ladder at the sugars and not the phosphate.

The DNA helix is actually made of repeating units (monomers) called nucleotides. The combination of a **single base, a deoxyribose sugar, and a phosphate make up a nucleotide**. Color the nucleotides in the box using the same colors you used for the double helix.

The two sides of the DNA ladder are held together loosely by hydrogen bonds between the bases (see the small dots down the middle of the double helix). The DNA can actually "unzip" when it needs to replicate - or make a copy of itself. DNA needs to copy itself when a cell divides, so that the new cells each contain a copy of the DNA. Without these instructions, the new cells wouldn't have the correct information.

The DNA Double Helix

Study the images below.



Name: _____ Date: _____ Period: _____

DNA - The Double Helix

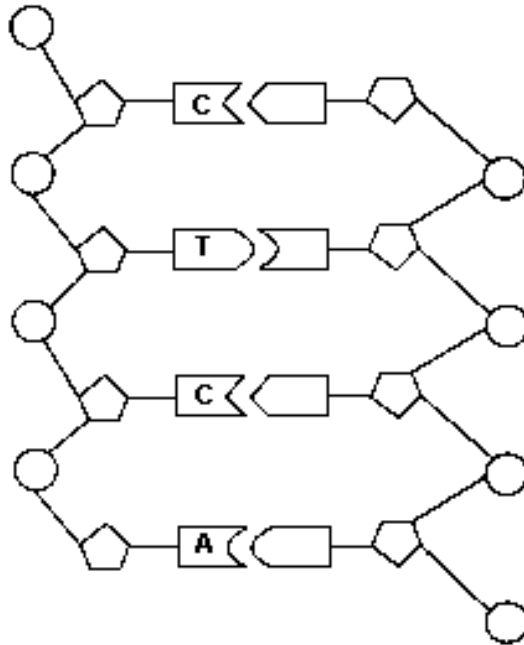
Questions:

1. Write out the full name for DNA.
2. Why is the nucleus called the “control center” of the cell?
3. Where in the cell are the chromosomes located?
4. What is a gene?
5. What do proteins do for your body?
6. What two scientists established the structure of DNA?
7. What are the sides of the DNA ladder made of?
8. What three parts make up a single nucleotide?
9. What are the 4 bases that make up the rungs of the DNA ladder?
10. What sugar is found in DNA?
11. How do the bases bond together in DNA (base pair rule)?
12. What type of bonds hold the bases together?
13. What is the shape of DNA?
14. Why is DNA called the “Blueprint of Life”?
15. What make up the two backbones of DNA?

More on back . . .

Label the DNA structure below:

Write a (P) on the phosphates, a (S) on the sugars and the matching bases (A,T,C or G) where they belong.



Use the terms Phosphate, Nitrogen Base, Sugar and Nucleotide to label A – D below.

