

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. Chromosomes are microscopic, threadlike strands composed of the chemical DNA (short for deoxyribonucleic acid). 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.

Chromosomes are composed of genes, which are segments of DNA that code 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. 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.

Color all the phosphates pink (one is labeled with a "p").

Color all the deoxyriboses blue (one is labeled with a "D") .

The rungs of the ladder are pairs of 4 types of nitrogen bases. 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.)

Color the thymine orange.

Color the adenine green.

Color the guanine purple.

Color the cytosine yellow.

The DNA helix is actually made of repeating units called nucleotides. Each nucleotide consists of three molecules: a sugar (deoxyribose), a phosphate which links the sugars together, and then one of the four bases. Two of the bases are purines - adenine and guanine. The pyrimidines are thymine and cytosine.

The two sides of the DNA ladder are held together loosely by hydrogen bonds. 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 hydrogen bonds are represented by small circles.

Color the hydrogen bonds grey.

Name _____ Period _____ Date _____

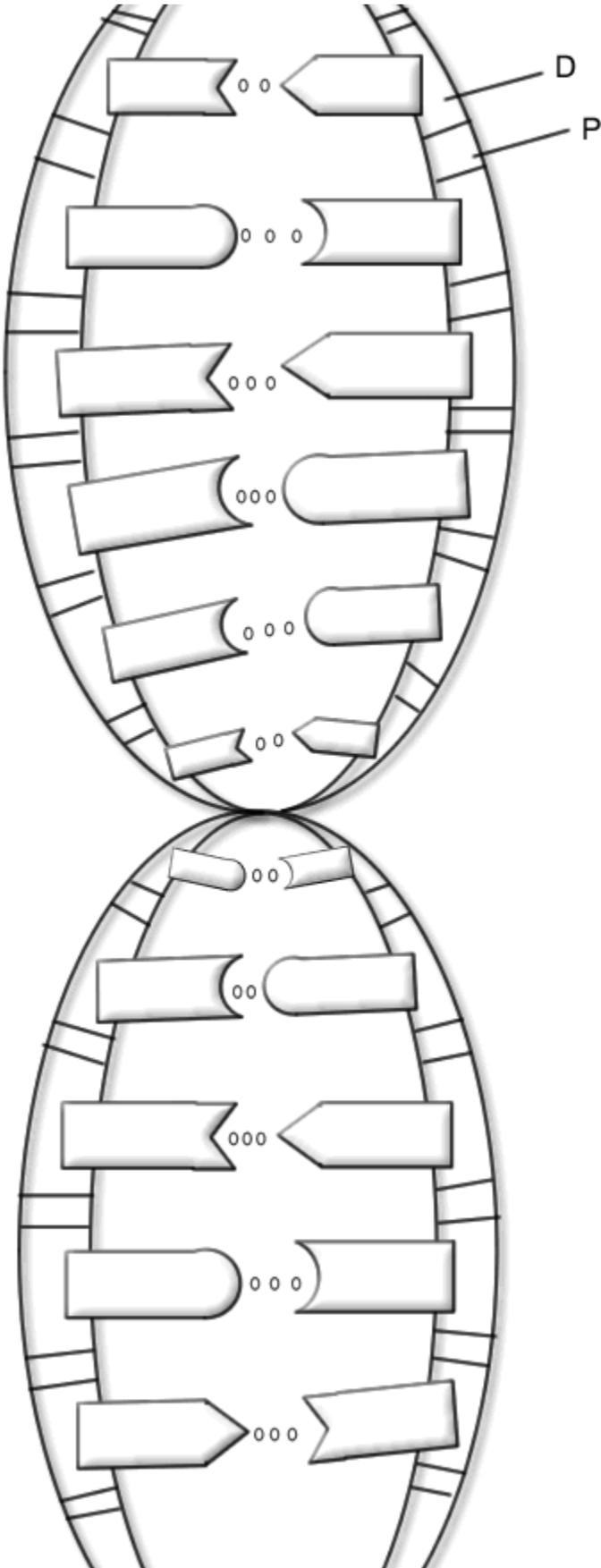
1. What is the full name for DNA? _____
2. What is a gene? _____
3. Where in the cell are chromosomes located? _____
4. What two scientists established the structure of DNA? _____
5. What is the shape of DNA? _____
6. What are the sides of the DNA ladder made of? _____
7. What are the "rungs" of the DNA ladder made of? _____
8. What sugar is found in DNA? _____ In RNA? _____
9. How do the bases bond together? A bonds with _____ G bonds with _____
10. The two purines in DNA are _____.
11. DNA is made of repeating units called _____
12. Why is RNA necessary to act as a messenger? Why can't the code be taken directly from the DNA?

13. Proteins are made where in the cell?

14. How do some cells become brain cells and others become skin cells, when the DNA in ALL the cells is exactly the same. In other words, if the instructions are exactly the same, how does one cell become a brain cell and another a skin cell?

15. Why is DNA called the "Blueprint of Life"?

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Messenger RNA

