

Biology

Name: _____

DNA reading assignment

Date: _____ Hour: _____

Adapted from "Nucleic Acids and Protein Synthesis" found in Modern Biology by Holt, Rinehart and Winston

What enables cells to have different forms and to perform different functions? Ultimately the genetic source of this amazing diversity is deoxyribonucleic acid (DNA). The primary function of DNA in organisms is to store and transmit the genetic information that tells cells which proteins to make and when to make them. Proteins in turn form the structural units of cells and help control chemical processes within cells.

What is the primary function of DNA in organisms?

Recall that nucleic acid DNA is an organic compound. DNA is made up of repeating subunits called nucleotides. Each DNA molecule consists of two long chains of nucleotides.

What element is in all organic compounds?

A DNA nucleotide has three parts: a sugar molecule called deoxyribose; a phosphate group, which consists of a phosphorus, P, atom surrounded by oxygen, O, atoms; and a molecule that is referred to as a nitrogen-containing base because it contains a nitrogen, N, atom. The deoxyribose sugar and the phosphate group are identical in all DNA nucleotides. However, the nitrogen-containing base may be any one of four different kinds.

What stays the same in every DNA molecule?

How many nitrogen-containing bases are possible?

The four nitrogen-containing bases found in DNA nucleotides are adenine, guanine, cytosine, and thymine. It is customary to represent nucleotides by the abbreviations for their nitrogen-containing bases. A nucleotide containing adenine is represented by an A. Likewise, C= cytosine, G = guanine, and T = thymine.

Nucleotide structure can differ. Adenine and guanine have two rings of carbon, C, and nitrogen, N, atoms. In contrast, cytosine and thymine have only one ring of carbon and nitrogen atoms. Bases that

have two rings of carbon and nitrogen atoms, such as adenine and guanine, are called purines. Pyrimidines are bases that have one ring of carbon and nitrogen atoms, such as cytosine and thymine.

Name the two purines in DNA:

Name the two pyrimidines in DNA:

In 1953, James Watson and Francis Crick suggested a model for the structure of DNA. The model proposed that DNA is composed of two nucleotide chains that wrap around each other to form a double spiral- similar to a spiral staircase. This shape is called a double helix.

Watson and Crick relied heavily on scientific evidence reported by other scientists to construct the model. The model was inspired in part by X-ray photographs of DNA crystals that had been studied by Rosalind Franklin and Maurice Wilkins. In addition, the model provided an explanation for how copies of DNA could be made and how genetic information might be stored and used within cells. IN 1962, Watson, Crick, and Maurice Wilkins received the Nobel Prize in Medicine for their work on DNA. Rosalind Franklin had died in 1958 and thus was not recognized.

Do you feel it was right that Rosalind Franklin, the only female on the team, was not recognized? Why or why not?

Individual nucleotides are connected by covalent bonds between the deoxyribose sugar and phosphate molecules. The alternating deoxyribose sugar and phosphate molecules form a “backbone” to which the nitrogen-containing bases attach. Note also the nitrogen-containing bases face toward the center of the helix and that they are perpendicular to the sugar-phosphate backbone.

Why do you think they call it a “backbone”?

By facing toward the center, the bases on one chain of DNA face the bases on the other chain of DNA, with which they form bonds called hydrogen bonds. The locations of the hydrogen bonds are usually shown by dotted lines. The hydrogen bonds help hold the two chains together. Hydrogen bonds are different from covalent bonds and ionic bonds. A hydrogen bond is a relatively weak bond that usually forms between molecules. Hydrogen bonds form when two atoms share a hydrogen nucleus - one proton. The hydrogen bonds that form between the bases in DNA form between a hydrogen atom and either an oxygen or a nitrogen atom.

How does a hydrogen bond form?

The base pairs are of uniform length because in each case one base is a double-ringed purine and the other is a single-ringed pyrimidine. The form of DNA that is most commonly found in living organisms has a right-hand twist, with each full turn consisting of ten base pairs.

What do you think the authors mean by a “right-hand twist”? How would that be different than a “left-hand twist”? Include a sketch with your answer:
