

CHAPTER 6 GENETICS BEYOND MENDEL

6.1 DNA AND THE CODE OF LIFE p. 228

In 1952, why did Hershey and Chase believe that DNA was the hereditary material?

They saw that viruses only need to inject bacteria with DNA to produce more viruses and then believed that DNA directs the production of new viruses (hereditary material)

What are the three components of DNA:

1. A pentose sugar (5-carbon, cyclic sugar)
 - Nucleotides - repeating DNA units with 4 possible bases
 - Adenine, Guanine, Thymine, Cytosine
2. Phosphate group with a negative charge
3. Nitrogenous base

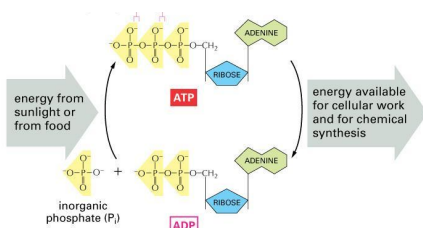
There are four possible bases. In 1940, Chargaff found that $A = T$ and $G = C$

Look at the structure of the bases above. What do you notice about Chargaff's pairs?

Pairs are symmetrical

The Structure of the DNA molecule

In 1951, Rosalind Franklin's X-ray diffraction of DNA allowed a diffraction pattern to determine that DNA was a helix-shaped molecule. In 1953, Watson and Crick solved the structure of DNA based on the research of scientists: Levene, Chargoff and Franklin.

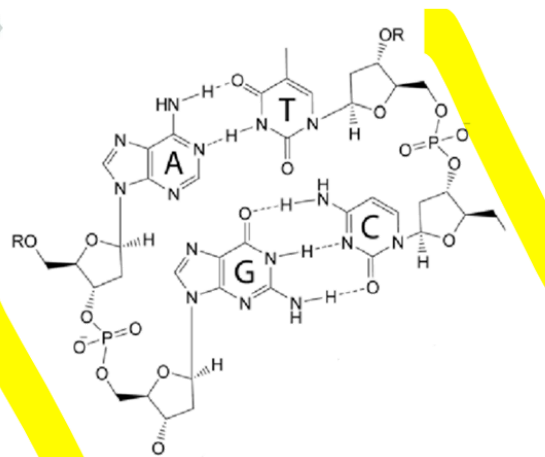


ATP is adenosine triphosphate. It is the energy molecule of the cell.

Take a look at the portion of DNA to the right. It is double-stranded. The lines on the outside highlight the sugar-phosphate repeating backbone of the two DNA complementary strands since we know if the strand on the left is AG, the strand on the right must be TC.

The two backbones are connect by "hydrogen bonds".

In grade 9, you learned of two different bonds. Define them:



RNA is single-stranded with nucleotides A, U, C, G. It is a copy of DNA for ribosomes to make proteins.

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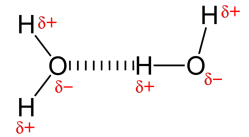
Ionic bonds - complete transfer of electrons

Covalent bonds - electrons are shared

Every time you share food with a friend, is the relationship the same? No. This is the same for atoms that share electrons.

Electronegativity describes the ability of an atom to attract electrons

In general, electronegativity increases from left to right along a period, and decreases descending a group because a decreasing radius lets the nucleus have a greater attracting force on the valence electrons and other electrons.



Oxygen is more electronegative than hydrogen, so in the covalent bond, electrons are shared unequally, resulting in slight charges on these atoms.

Dashed lines connect each pair of nucleotides. A has an N ---- H bond. T has an O ---- H bond.

Show the partial charges on the atoms N, H, O, H shown in the bonds above due to their different electronegativities. Add these charges to the diagram at the bottom of page 1. The partial charges are opposite, and opposite charges attract, creating a weak bond, called a hydrogen-bond.

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6.2 MUTATIONS p. 234

List causes of mutations and types of mutations including insertion, deletion, substitution, point mutations and chromosomal mutations.

Point mutations: Damaging radiation, chemicals, cell division error

Chromosomal Mutations: Different proteins, assembled proteins, inherited mutations

Of the three types of mutations depicted to the right, which one would you think would be the most lethal? Explain.

Deletion may be the most lethal point mutation since necessary proteins will not be produced at all. With an insertion point mutation, there is a chance that the inserted base will be removed.

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6.3 GENOMES p. 240

DEFINE human genome project, coding vs non-coding DNA, model organisms

Human genome project: A worldwide project to collect and complete the nitrogenous bases in human DNA

Coding DNA: A gene, DNA region with nucleotide sequence that will be expressed

Non-Coding DNA: A DNA region without a nucleotide sequence that will be expressed

Model Organism: There is a genetic similarity between two organisms, allowing scientists to study another organism to understand the function of the target organism (i.e. lab mice)

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DNA FINGERPRINTING is a technique used to match people to DNA signatures.

- It is unique to each person

6.4 MANIPULATING THE GENOME p. 245

What is recombinant DNA and why is it useful?

Recombinant DNA are fragments with nucleotide sequences from 2 not normally accompanied sources cut with the same restriction enzyme. It is useful to transfer DNA fragments with the gene of interest from 1 species to another

6.5 GENE THERAPY p. 249

What is gene therapy? And *briefly* outline the 3 steps of the process

Gene therapy is the technique of replacing defective genes with the normal gene copy

1. Remove latter viral DNA so that a virus cannot harm humans
2. DNA copies with the normal gene inserted into the virus' own DNA
3. Target cell infected with the virus - this inserts normal DNA into the target cell genome

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