DNA, RNA, and Proteins Chapter 13

The Structure of DNA

Section 1

DNA: The Genetic Material

Key Idea: DNA is the primary material that causes inheritable characteristics in related groups of organisms.

- A gene is the instructions for inherited traits.
- DNA is a simple molecule, composed of only four different subunits.

The Genetic Material

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Searching For The Genetic Material

Key Idea: Three major experiments led to the conclusion that DNA is the genetic material in cells. These experiments were performed by Griffith, Avery, and Hershey and Chase.

Griffith's Discovery of Transformation

- Griffith's experiment led to the conclusion that genetic material could be transferred between cells.

Avery's Experiment with Nucleic Acids

- Avery's experiments led to the conclusion that DNA is responsible for transformation in bacteria.

Hershey-Chase Experiments

- By using radioactive isotopes, Hershey and Chase showed that DNA not protein, is the genetic material in viruses.

The Shape of DNA

Key Idea: A DNA molecule is shaped like a spiral staircase and is composed of two parallel strands of linked subunits.

- Nucleotide is made up of three parts: a phosphate group, a five-carbon sugar group, and a nitrogen-containing base.

A Winding Staircase

- The spiral shape of DNA is known as a *double helix*.

Parts of the Nucleotide Subunits

- The phosphate groups and the sugar molecules link together to form s "backbone".
- The five-carbon sugar in DNA is called deoxyribose.

DNA

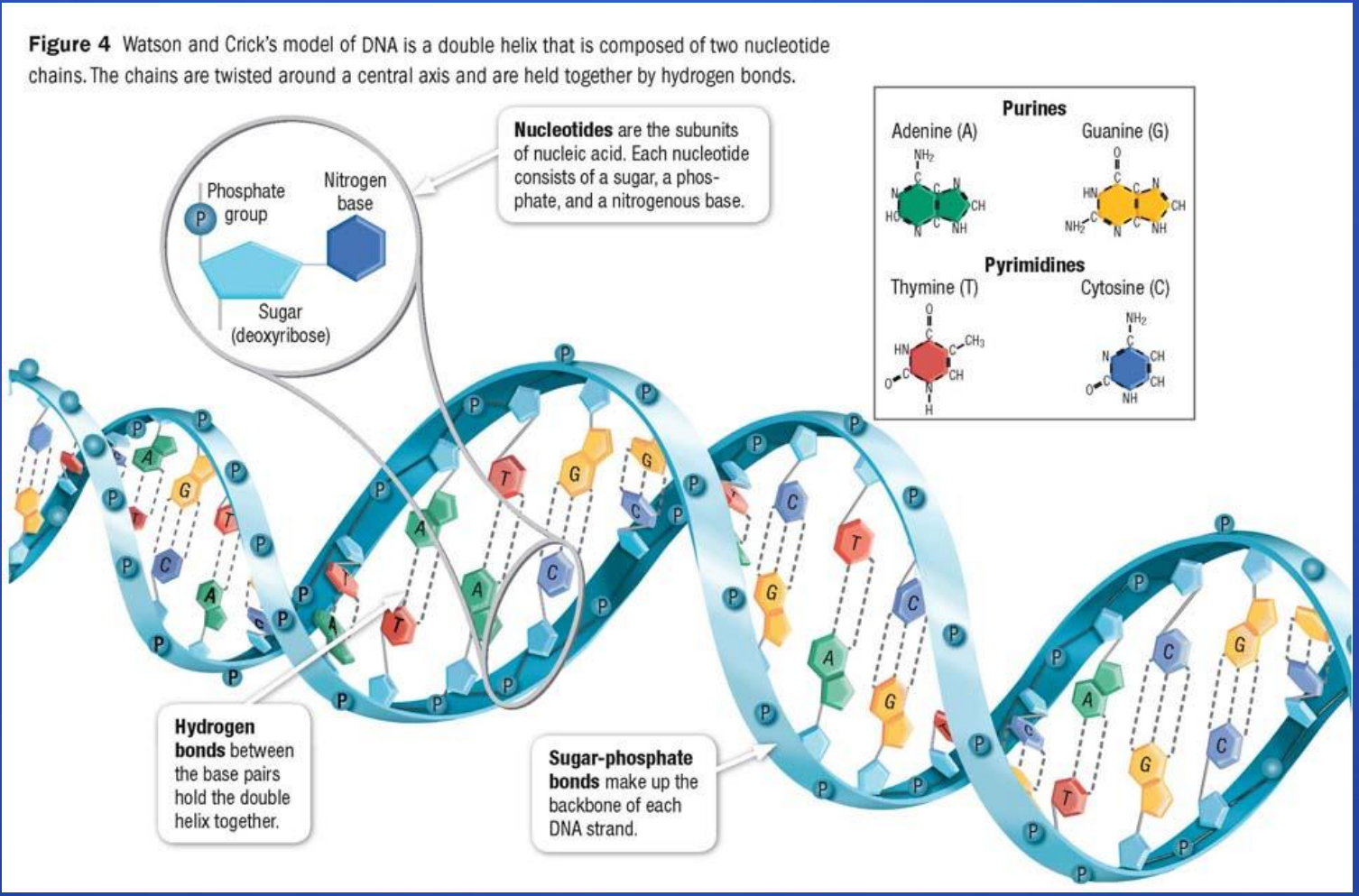

Figure 4 Watson and Crick's model of DNA is a double helix that is composed of two nucleotide chains. The chains are twisted around a central axis and are held together by hydrogen bonds.

The Information In DNA

Key Idea: The information in DNA is contained in the order of the bases, while the base-pairing structure allows the information to be copied.

- A purine is a double-ring structure and has bases Adenine (A) and Guanine.
- A pyrimidine is a single-ring structure and has bases Thymine (T) and Cytosine (C).
- The word complementary means "fitting together like puzzle pieces".

Nitrogenous Bases

- The information in DNA is contained in the order of the bases.
- Each nucleotide can have one of four nitrogenous bases.

Base-Pairing Rules

- Adenine always pairs with thymine.
- Guanine always pairs with cytosine.

Complementary Sides

- The sequence of bases is known for one strand of DNA, then the sequence of bases for the complementary strand can be quickly identified.

Discovering DNA's Structure

Key Idea: Watson and Crick used information from experiments by Chargaff, Wilkins, and Franklin to determine the three-dimensional structure of DNA.

Observing Patterns: Chargaff's Observations

- Chargaff showed that the amount of adenine always equaled the amount of thymine, and the amount of guanine always equaled the amount of cytosine.

Using Technology: Photographs of DNA

- Franklin and Wilkins developed X-ray diffraction images of strands of DNA that suggested the DNA molecule resembled a tightly coiled helix.

Watson and Crick's Model of DNA

- The three-dimensional model of DNA showed a "spiral staircase" in which two strands of nucleotides twisted around a central axis.