

2.3 Carbon-Based Molecules

KEY CONCEPT

Carbon-based molecules are the foundation of life.

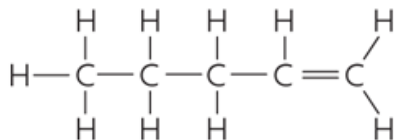


2.3 Carbon-Based Molecules

► Carbon atoms have unique bonding properties.

- Carbon forms covalent bonds with up to four other atoms, including other carbon atoms.
- Carbon-based molecules have three general types of structures.
 - straight chain
 - branched chain
 - ring

Straight chain

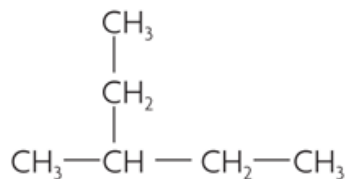


A simplified structure can also be shown as:



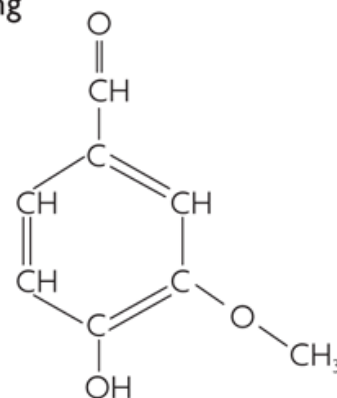
Pentene

Branched chain



Hexane

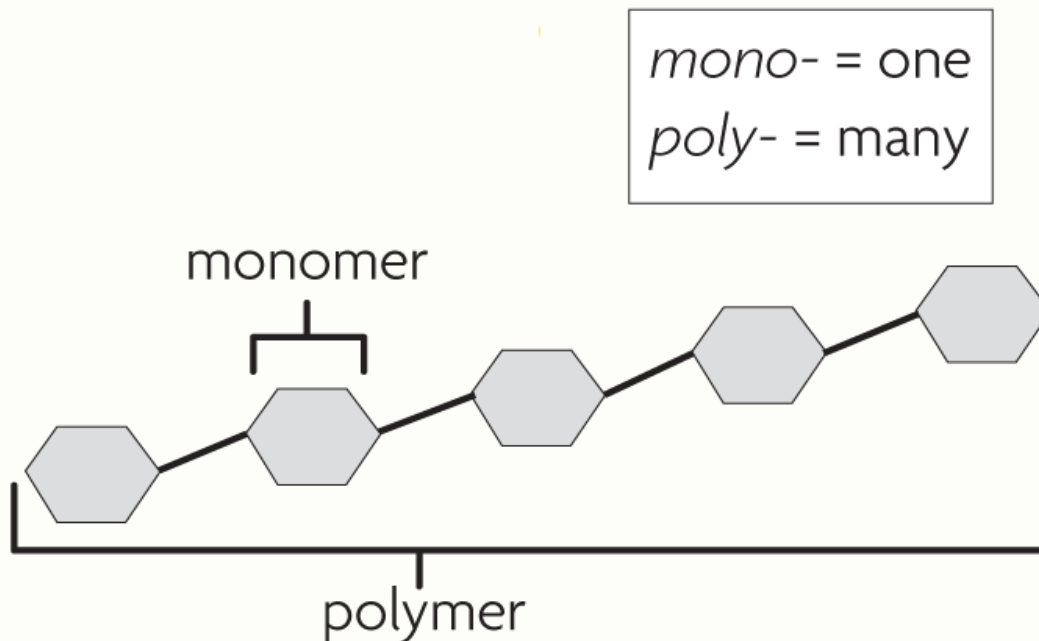
Ring



Vanillin

2.3 Carbon-Based Molecules

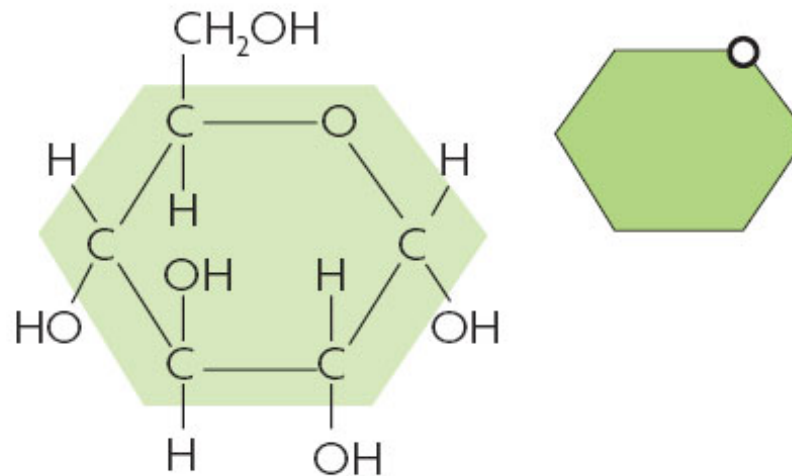
- Many carbon-based molecules are made of many small subunits bonded together.
 - Monomers are the individual subunits.
 - Polymers are made of many monomers.



2.3 Carbon-Based Molecules

► **Four main types of carbon-based molecules are found in living things.**

- Carbohydrates are made of carbon, hydrogen, and oxygen.



Glucose (C₆H₁₂O₆) can be ring shaped and is often shown as a simplified hexagon.

2.3 Carbon-Based Molecules

► Four main types of carbon-based molecules are found in living things.

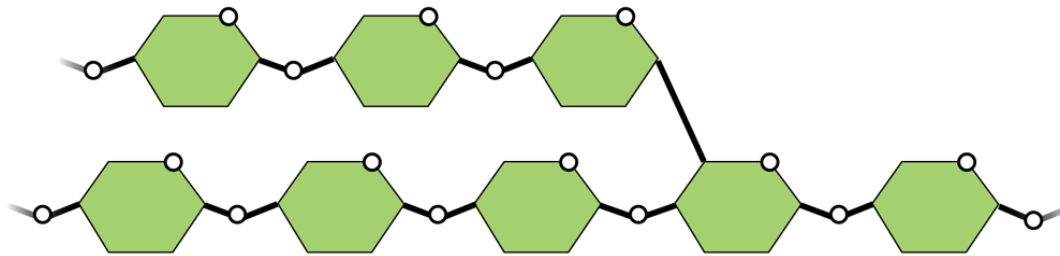
- Carbohydrates are made of carbon, hydrogen, and oxygen.
 - Carbohydrates include sugars and starches.
 - Monosaccharides are simple sugars.
 - Polysaccharides include starches, cellulose, and glycogen.



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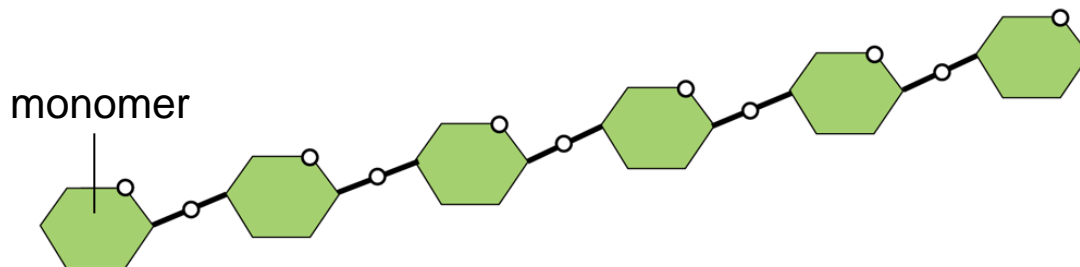
- Carbohydrates can be broken down to provide energy for cells.
- Some carbohydrates are part of cell structure.

Polymer (starch)



Starch is a polymer of glucose monomers that often has a branched structure.

Polymer (cellulose)



Cellulose is a polymer of glucose monomers that has a straight, rigid structure

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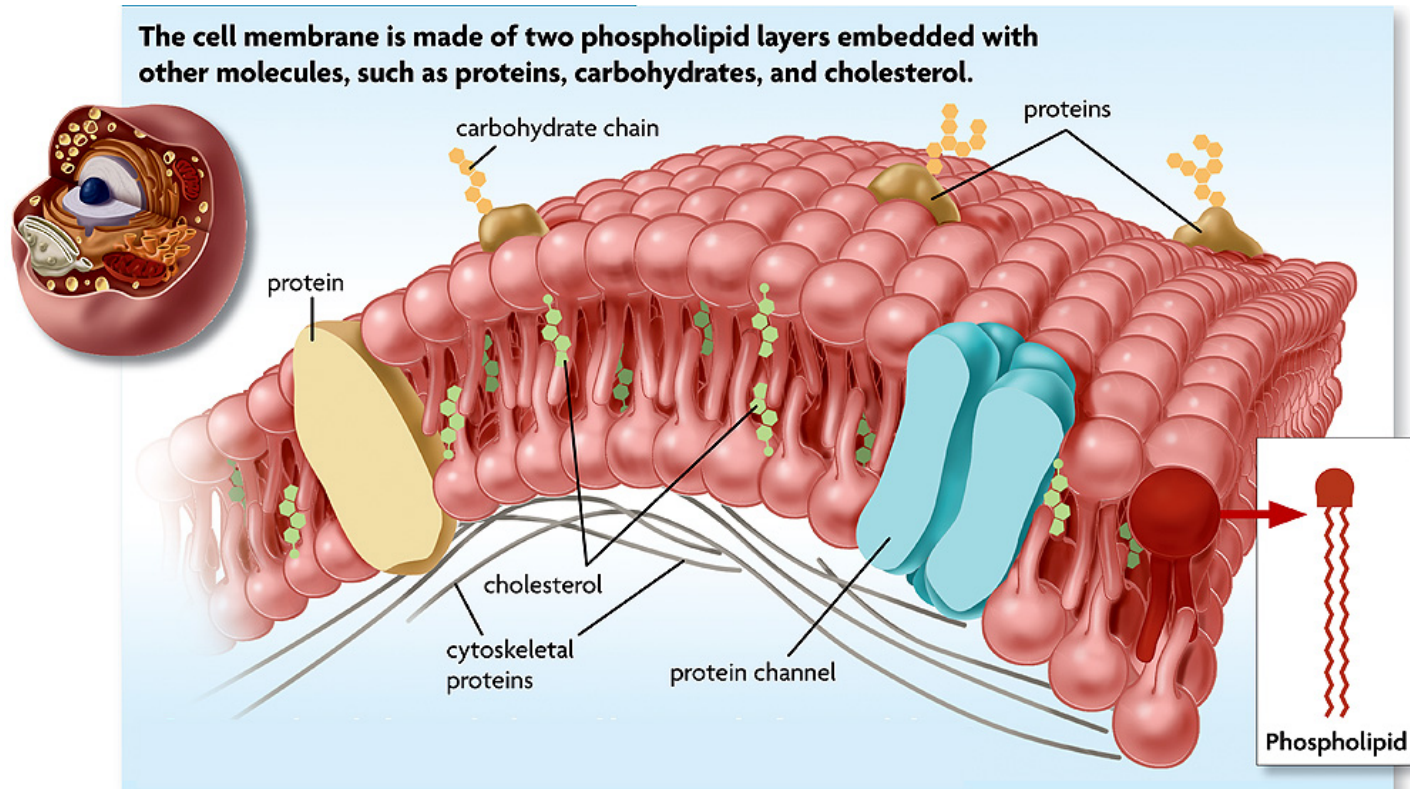
- Lipids are nonpolar molecules that include fats, oils, and cholesterol.
 - Many contain carbon chains called fatty acids.
 - Fats and oils contain fatty acids bonded to glycerol.

Triglyceride



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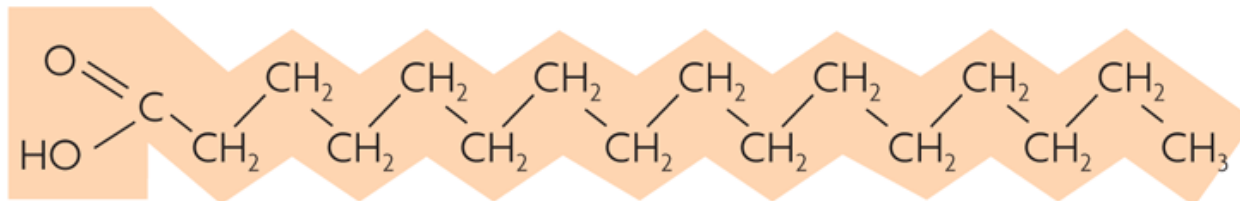
- Lipids have several different functions.
 - broken down as a source of energy
 - make up cell membranes
 - used to make hormones



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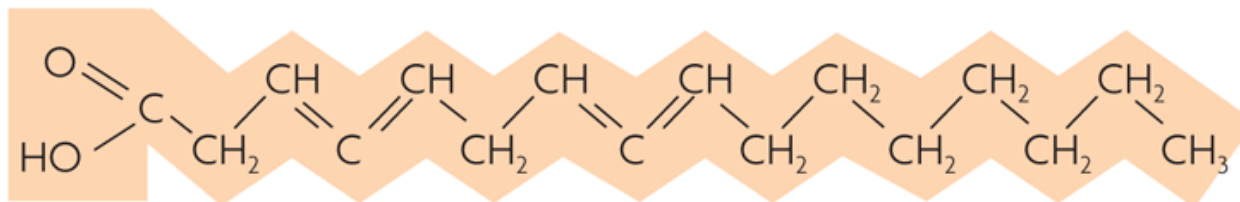
- Fats and oils have different types of fatty acids.
 - saturated fatty acids
 - unsaturated fatty acids

Saturated fatty acid



Saturated fats contain fatty acids in which all carbon–carbon bonds are single bonds.

Unsaturated fatty acid



Unsaturated fats have fatty acids with at least one carbon–carbon double bond.

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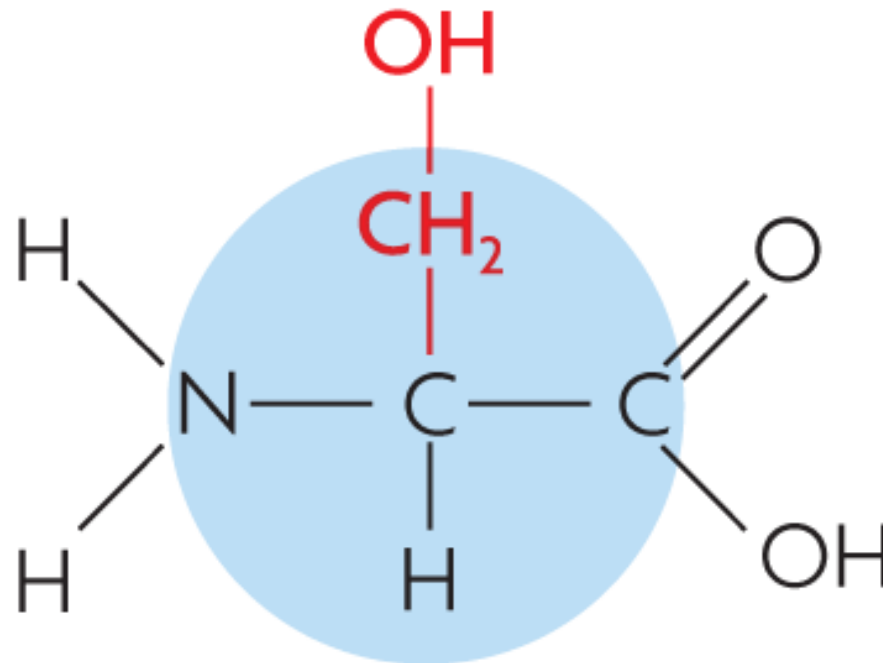
- Phospholipids make up all cell membranes.
 - Polar phosphate “head”
 - Nonpolar fatty acid “tails”

Phospholipid



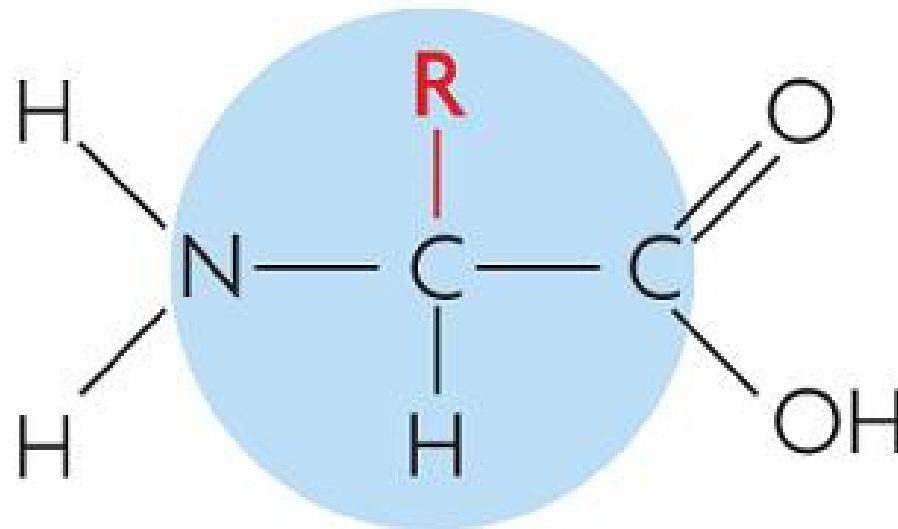
2.3 Carbon-Based Molecules

- Proteins are polymers of amino acid monomers.
 - Twenty different amino acids are used to build proteins in organisms.



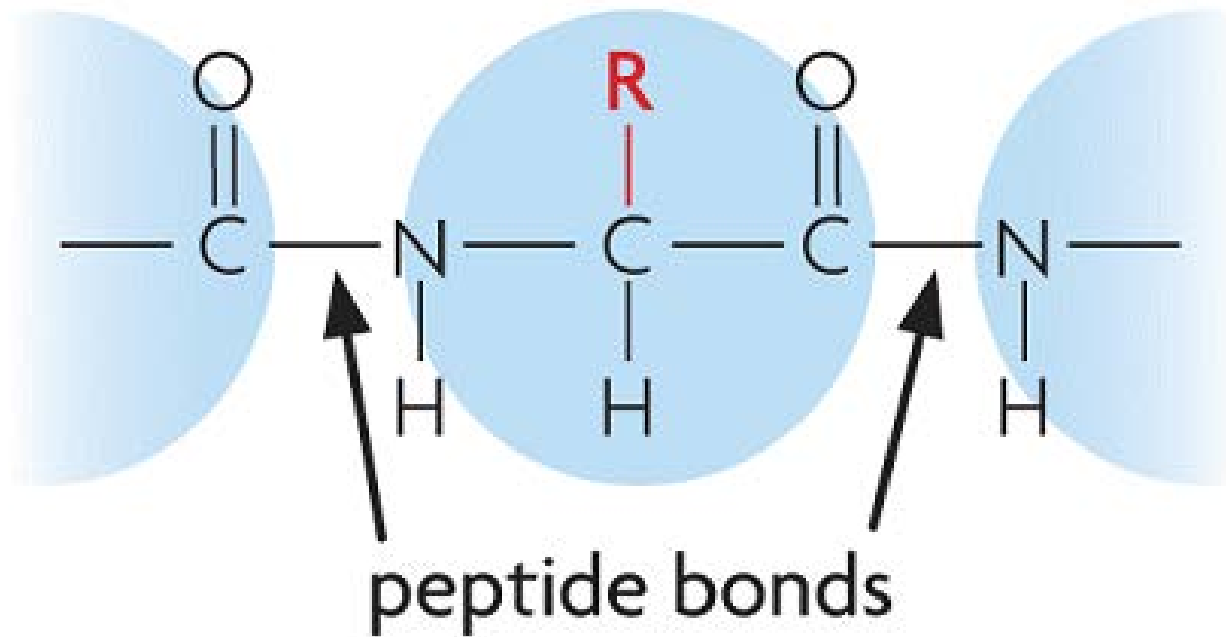
2.3 Carbon-Based Molecules

- Proteins are polymers of amino acid monomers.
 - Twenty different amino acids are used to build proteins in organisms.
 - Amino acids differ in side groups, or R groups.



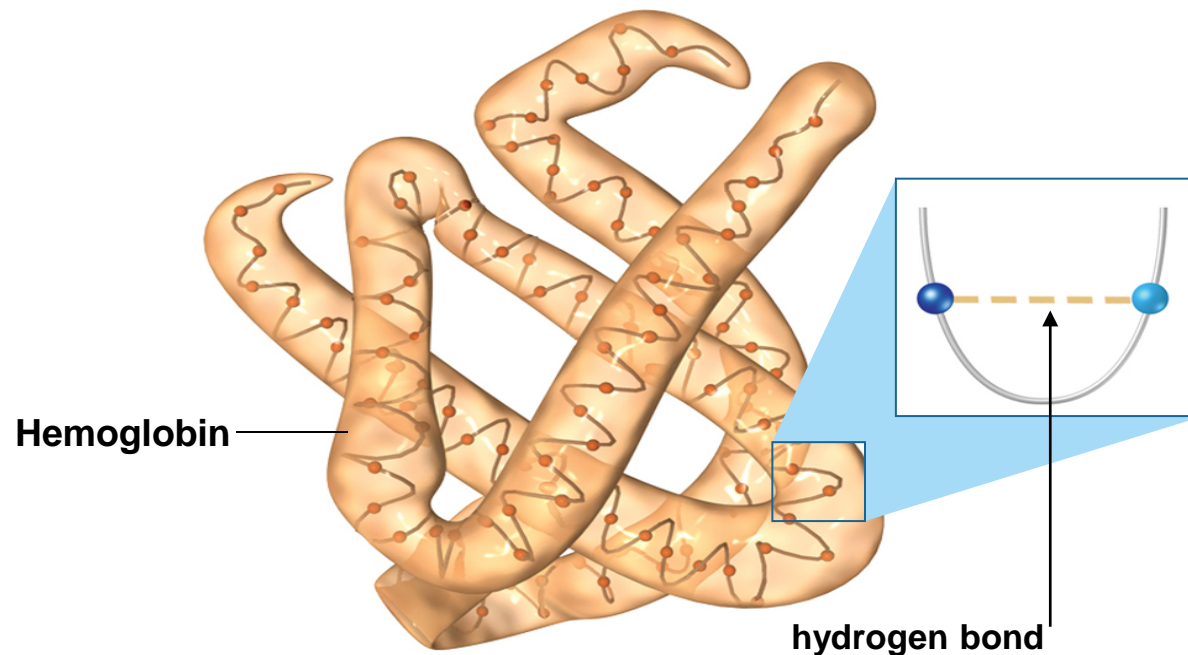
2.3 Carbon-Based Molecules

- Proteins are polymers of amino acid monomers.
 - Twenty different amino acids are used to build proteins in organisms.
 - Amino acids differ in side groups, or R groups.
 - Amino acids are linked by peptide bonds.



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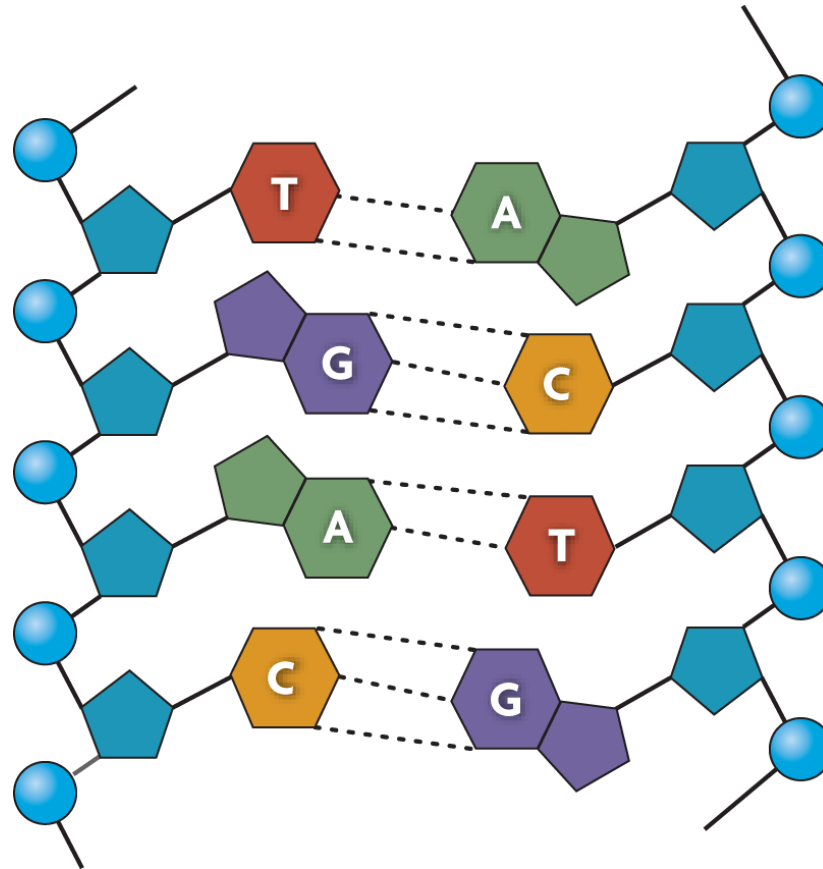
- Proteins differ in the number and order of amino acids.
 - Amino acids interact to give a protein its shape.



- Incorrect amino acids change a protein's structure and function.

2.3 Carbon-Based Molecules

- Nucleic acids are polymers of monomers called nucleotides.

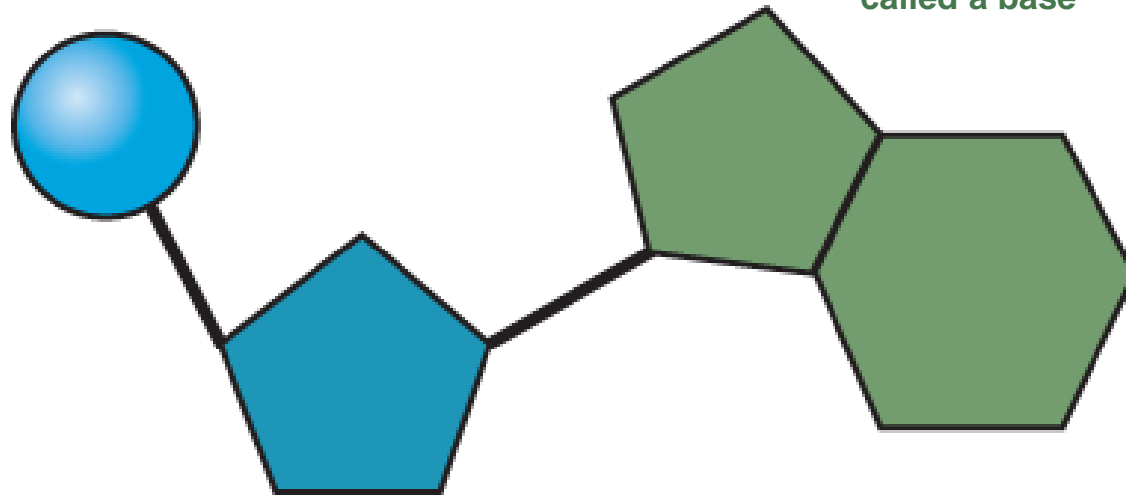


2.3 Carbon-Based Molecules

- Nucleic acids are polymers of monomers called nucleotides.
 - Nucleotides are made of a sugar, phosphate group, and a nitrogen base.

A phosphate group

nitrogen-containing molecule,
called a base



deoxyribose (sugar)

2.3 Carbon-Based Molecules

- Nucleic acids are polymers of monomers called nucleotides.
 - Nucleotides are made of a sugar, phosphate group, and a nitrogen base.
 - DNA stores genetic information.
 - RNA builds proteins.

