

Synthetic and Natural Organic Polymer

Chapter 25



A **polymer** is a high molar mass molecular compound made up of many repeating chemical units.

Naturally occurring polymers

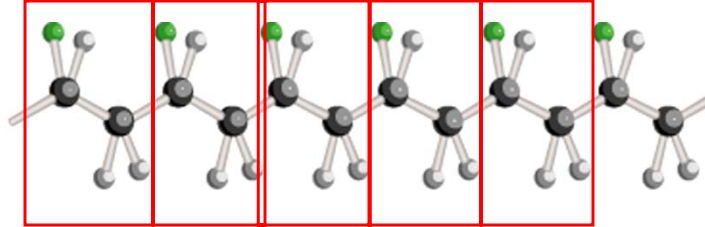
- Proteins
- Nucleic acids
- Cellulose
- Rubber

Synthetic polymers

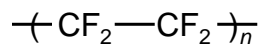
- Nylon
- Dacron
- Lucite



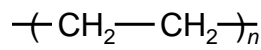
The simple repeating unit of a polymer is the **monomer**.



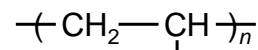
Homopolymer is a polymer made up of only one type of monomer



Teflon



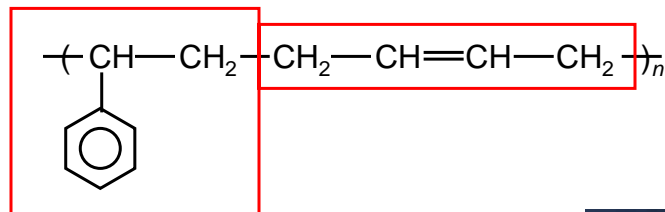
Polyethylene



PVC

3

Copolymer is a polymer made up of two or more monomers



Styrene-butadiene rubber



4

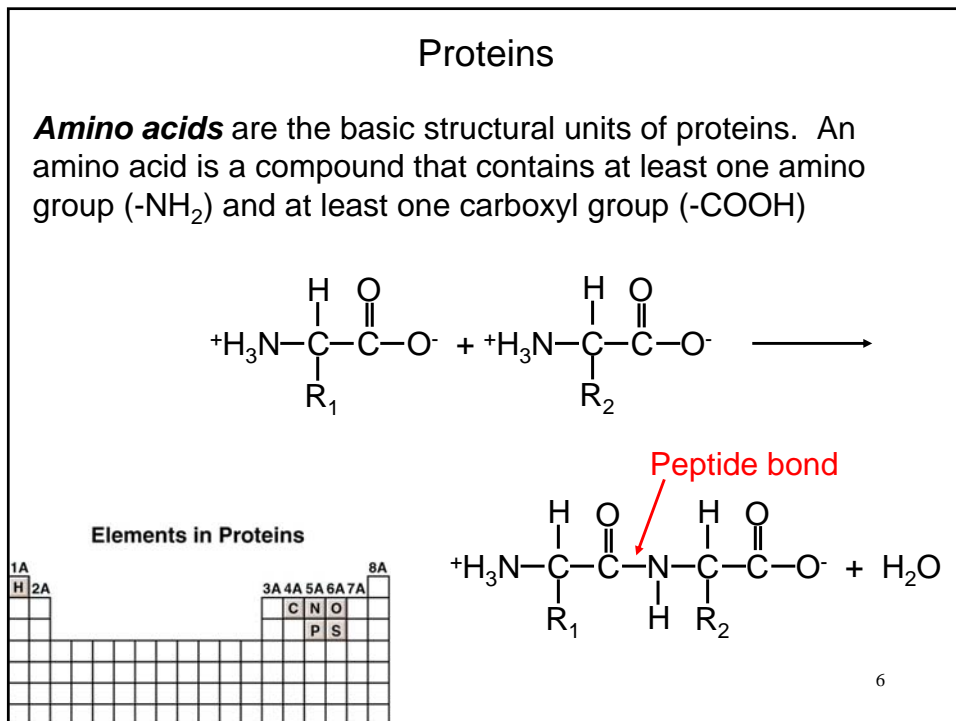
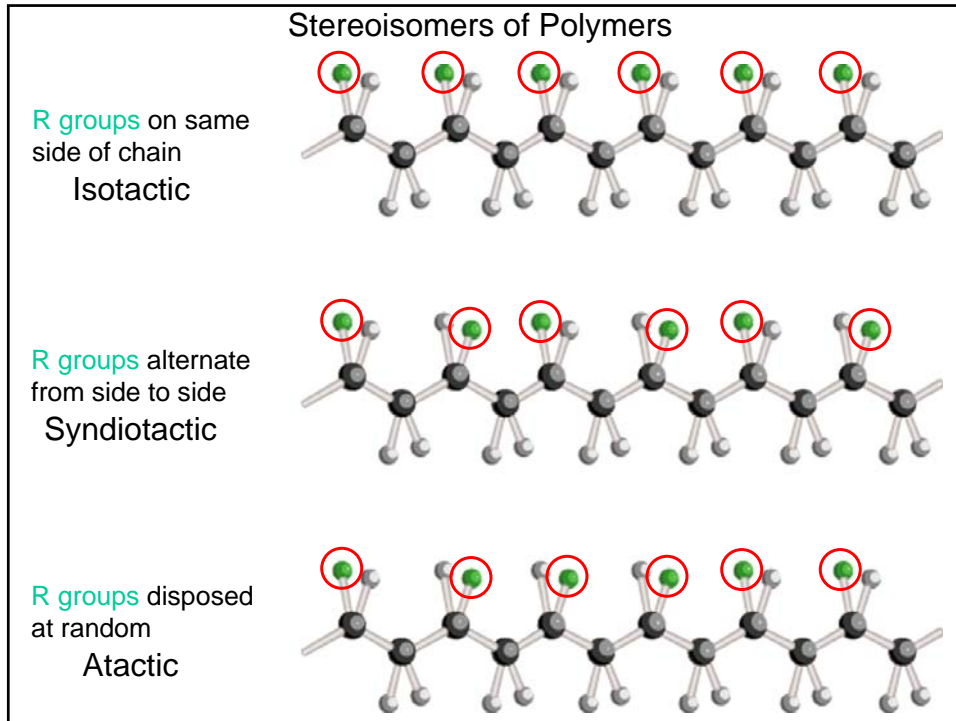
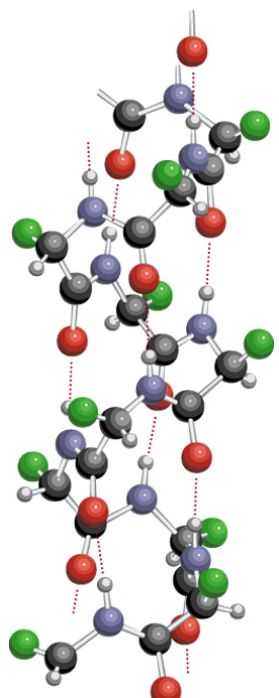


TABLE 25.2 The 20 Amino Acids Essential to Living Organisms*		
Name	Abbreviation	Structure
Alanine	Ala	$\begin{array}{c} \text{H} \\ \\ \text{H}_3\text{C}-\text{C}-\text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$
Arginine	Arg	$\begin{array}{c} \text{H} & \text{H} \\ & \\ \text{H}_2\text{N}-\text{C}-\text{N}-\text{CH}_2-\text{CH}_2-\text{CH}-\text{C}-\text{COO}^- \\ & \\ \text{NH} & \text{NH}_3^+ \end{array}$
Asparagine	Asn	$\begin{array}{c} \text{O} & \text{H} \\ & \\ \text{H}_2\text{N}-\text{C}-\text{CH}_2-\text{C}-\text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$
Aspartic acid	Asp	$\begin{array}{c} \text{H} \\ \\ \text{HOOC}-\text{CH}_2-\text{C}-\text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$
Cysteine	Cys	$\begin{array}{c} \text{H} \\ \\ \text{HS}-\text{CH}_2-\text{C}-\text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$
Glutamic acid	Glu	$\begin{array}{c} \text{H} \\ \\ \text{HOOC}-\text{CH}_2-\text{CH}_2-\text{C}-\text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$
Glutamine	Gln	$\begin{array}{c} \text{O} & \text{H} \\ & \\ \text{H}_2\text{N}-\text{C}-\text{CH}_2-\text{CH}_2-\text{C}-\text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$
Glycine	Gly	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$
Histidine	His	$\begin{array}{c} \text{H} \\ \\ \text{HC}=\text{C}-\text{CH}_2-\text{C}-\text{COO}^- \\ & \\ \text{N} & \text{NH}_3^+ \\ \\ \text{H} \end{array}$
Isoleucine	Ile	$\begin{array}{c} \text{CH}_3 & \text{H} \\ & \\ \text{H}_3\text{C}-\text{CH}_2-\text{C}-\text{C}-\text{COO}^- \\ & \\ \text{H} & \text{NH}_3^+ \end{array}$

TABLE 25.2 The 20 Amino Acids Essential to Living Organisms—Cont.		
Name	Abbreviation	Structure
Leucine	Leu	$\begin{array}{c} \text{H}_3\text{C} & \text{H} \\ & \\ \text{H}_3\text{C}-\text{CH}-\text{CH}_2-\text{C}-\text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$
Lysine	Lys	$\begin{array}{c} \text{H} \\ \\ \text{H}_2\text{N}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{C}-\text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$
Methionine	Met	$\begin{array}{c} \text{H} \\ \\ \text{H}_3\text{C}-\text{S}-\text{CH}_2-\text{CH}_2-\text{C}-\text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$
Phenylalanine	Phe	$\begin{array}{c} \text{H} \\ \\ \text{C}_6\text{H}_5-\text{CH}_2-\text{C}-\text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$
Proline	Pro	$\begin{array}{c} \text{H} \\ \\ \text{H}_2\text{N}-\text{C}-\text{COO}^- \\ \\ \text{C}_5\text{H}_9 \end{array}$
Serine	Ser	$\begin{array}{c} \text{H} \\ \\ \text{HO}-\text{CH}_2-\text{C}-\text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$
Threonine	Thr	$\begin{array}{c} \text{OH} & \text{H} \\ & \\ \text{H}_3\text{C}-\text{C}-\text{C}-\text{COO}^- \\ & \\ \text{H} & \text{NH}_3^+ \end{array}$
Tryptophan	Trp	$\begin{array}{c} \text{H} \\ \\ \text{C}_6\text{H}_4-\text{CH}_2-\text{C}-\text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$
Tyrosine	Tyr	$\begin{array}{c} \text{H} \\ \\ \text{HO}-\text{C}_6\text{H}_4-\text{CH}_2-\text{C}-\text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$
Valine	Val	$\begin{array}{c} \text{H}_3\text{C} & \text{H} \\ & \\ \text{H}_3\text{C}-\text{CH}-\text{C}-\text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$

*The shaded portion is the R group of the amino acid. (Continued)

Protein Structure



Carbon

Nitrogen

Oxygen

R group

Hydrogen

The structure is held in position by intramolecular hydrogen bonds (.....)

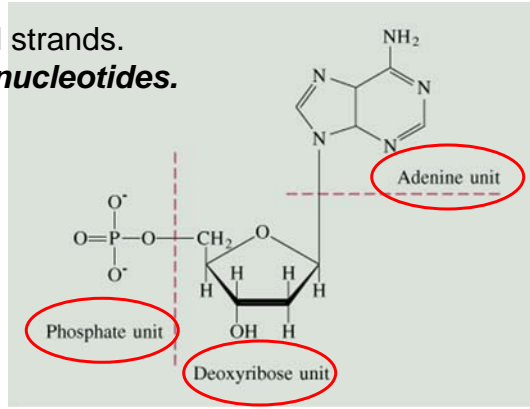
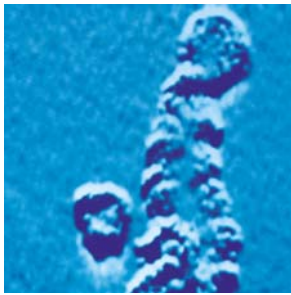
8

Nucleic Acids

Nucleic acids are high molar mass polymers that play an essential role in protein synthesis.

1. **Deoxyribonucleic acid (DNA)**
2. **Ribonucleic acid (RNA)**

DNA molecule has 2 helical strands.
Each strand is made up of **nucleotides**.



The Components of the Nucleic Acids DNA and RNA

	Found only in DNA	Found in both DNA and RNA	Found only in RNA
Purines		<p>Adenine Guanine</p>	
Pyrimidines	<p>Thymine</p>	<p>Cytosine</p>	<p>Uracil</p>
Sugars	<p>Deoxyribose</p>		<p>Ribose</p>
Phosphate		<p>Phosphate</p>	