Chapter 27
Amino Acids, Peptides, and Proteins.
Nucleic Acids
27.1 Classification of Amino Acids
While their name implies that amino acids are compounds that contain an —―NH₂ group and a —―CO₂H group, these groups are actually present as —―NH₃⁺ and —―CO₂⁻ respectively.

They are classified as α, β, γ, etc. amino acids according the carbon that bears the nitrogen.
Amino Acids

an α-amino acid that is an intermediate in the biosynthesis of ethylene

a β-amino acid that is one of the structural units present in coenzyme A

a γ-amino acid involved in the transmission of nerve impulses
More than 700 amino acids occur naturally, but 20 of them are especially important. These 20 amino acids are the building blocks of proteins. All are $\alpha$-amino acids. They differ in respect to the group attached to the $\alpha$ carbon. These 20 are listed in Table 27.1 (p 1054-1055).
The amino acids obtained by hydrolysis of proteins differ in respect to \( R \) (the side chain).

The properties of the amino acid vary as the structure of \( R \) varies.
Glycine is the simplest amino acid. It is the only one in the table that is achiral. In all of the other amino acids in the table the $\alpha$ carbon is a stereogenic center.
### Table 27.1

<table>
<thead>
<tr>
<th>Alanine</th>
<th>(Ala or A)</th>
</tr>
</thead>
</table>
| ![Alanine Structure](image)
|            |

The structure of Alanine is shown above. It consists of a nitrogen atom bonded to three hydrogen atoms (H₃N⁺), a carbon atom bonded to a carboxyl group (C O⁻⁻), and a methyl group (CH₃).
Table 27.1

Valine
(Val or V)
Table 27.1

Leucine
(Leu or L)

\[
\begin{align*}
\text{H}_3\text{N}^+ & \text{C} \quad \text{C} \quad \text{C} \quad \text{O}^- \\
\text{CH}_2\text{CH} & \text{(CH}_3) \_2 \\
\end{align*}
\]
Table 27.1

Isoleucine
(Ile or I)
Table 27.1

\[
\begin{align*}
\text{CH}_3\text{SCH}_2\text{CH}_2 & \\
\text{H}_3\text{N} & \\
+ & \\
\text{C} & \\
\text{C} & \\
\text{O} & \\
\text{O}^- & \\
\text{Methionine} & \\
\text{(Met or M)} & 
\end{align*}
\]
Table 27.1

Proline
(Pro or P)
Table 27.1

Phenylalanine
(Phe or F)
Table 27.1

Tryptophan
(Trp or W)
Table 27.1

Asparagine
(Asn or N)
<table>
<thead>
<tr>
<th>Table 27.1</th>
</tr>
</thead>
</table>

Glutamine (Gln or Q)

\[
\text{H}_3\text{N}^+\text{C}--\text{C}--\text{O}^-
\]

\[
\text{H}_2\text{N}\text{CCH}_2\text{CH}_2
\]

\[
\text{O}
\]
Table 27.1

Serine
(Ser or S)
Table 27.1

\[
+ \quad H_3N\text{C} \quad C \quad C \quad O^- \\
\text{CH}_3\text{CHOH}
\]

Threonine

(Thr or T)
Table 27.1

Aspartic Acid
(Asp or D)
Glutamic Acid
(Glu or E)
Table 27.1

Tyrosine (Tyr or Y)

\[
\begin{align*}
&\text{H}_3\text{N}^+\text{C} = \text{C} = \text{O}^- \\
&\text{CH}_2 \\
&\text{OH}
\end{align*}
\]
Table 27.1

Cysteine

(Cys or C)
Table 27.1

Lysine
(Lys or K)
Arginine (Arg or R)
Table 27.1

Histidine
(His or H)
27.2
Stereochemistry of Amino Acids
Glycine is achiral. All of the other amino acids in proteins have the L-configuration at their $\alpha$ carbon.

Configuration of $\alpha$-Amino Acids