

Amino Acids Found in Proteins - Part 1

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FAMILIES OF AMINO ACIDS

The common amino acids are grouped according to whether their side chains are

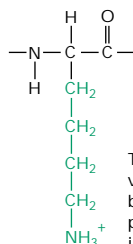
acidic
basic
uncharged polar
nonpolar

These 20 amino acids are given both three-letter and one-letter abbreviations.

Thus: alanine = Ala = A

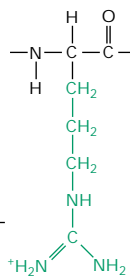
BASIC SIDE CHAINS

lysine
(Lys, or K)

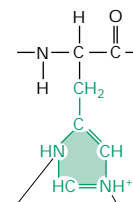


This group is very basic because its positive charge is stabilized by resonance.

arginine
(Arg, or R)



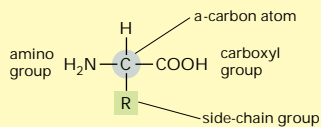
histidine
(His, or H)



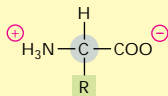
These nitrogens have a relatively weak affinity for an H⁺ and are only partly positive at neutral pH.

THE AMINO ACID

The general formula of an amino acid is

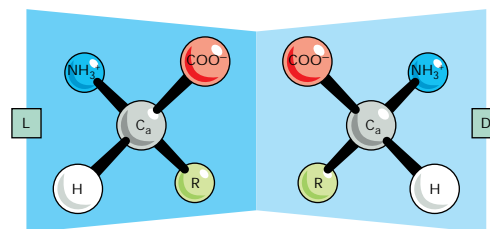


R is commonly one of 20 different side chains. At pH 7 both the amino and carboxyl groups are ionized.



OPTICAL ISOMERS

The α -carbon atom is asymmetric, which allows for two mirror image (or stereo-) isomers, L and D.

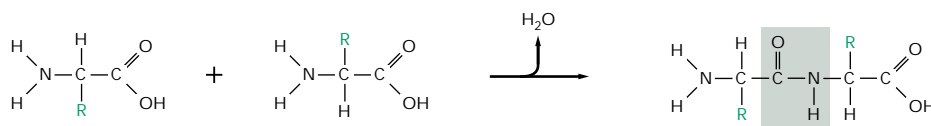


Proteins consist exclusively of L-amino acids.

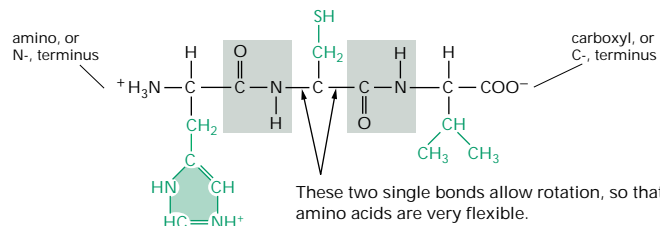
PEPTIDE BONDS

Amino acids are commonly joined together by an amide linkage, called a peptide bond.

Peptide bond: The four atoms in each *gray box* form a rigid planar unit. There is no rotation around the C-N bond.



Proteins are long polymers of amino acids linked by peptide bonds, and they are always written with the N-terminus toward the left. The sequence of this tripeptide is histidine-cysteine-valine.



These two single bonds allow rotation, so that long chains of amino acids are very flexible.

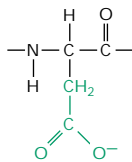
Amino Acids Found in Proteins - Part 2

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ACIDIC SIDE CHAINS

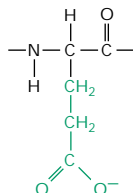
aspartic acid

(Asp, or D)



glutamic acid

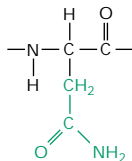
(Glu, or E)



UNCHARGED POLAR SIDE CHAINS

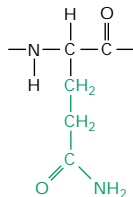
asparagine

(Asn, or N)



glutamine

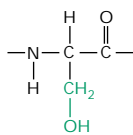
(Gln, or Q)



Although the amide N is not charged at neutral pH, it is polar.

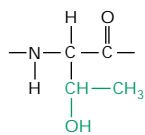
serine

(Ser, or S)



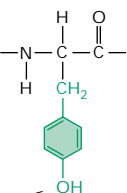
threonine

(Thr, or T)



tyrosine

(Tyr, or Y)

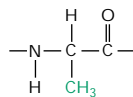


The -OH group is polar.

NONPOLAR SIDE CHAINS

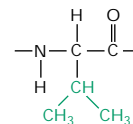
alanine

(Ala, or A)



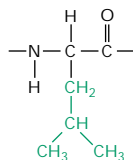
valine

(Val, or V)



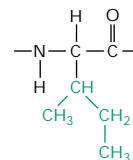
leucine

(Leu, or L)



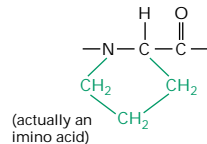
isoleucine

(Ile, or I)



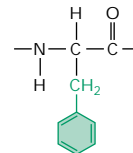
proline

(Pro, or P)



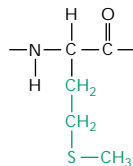
phenylalanine

(Phe, or F)



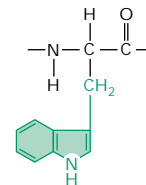
methionine

(Met, or M)



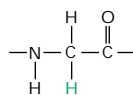
tryptophan

(Trp, or W)



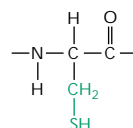
glycine

(Gly, or G)



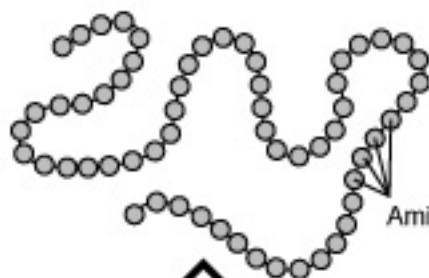
cysteine

(Cys, or C)



Disulfide bonds can form between two cysteine side chains in proteins.





Primary protein structure

is sequence of a chain of amino acids

Amino Acids



Pleated sheet



Alpha helix



Pleated sheet

Alpha helix

Tertiary protein structure

occurs when certain attractions are present between alpha helices and pleated sheets.



Quaternary protein structure

is a protein consisting of more than one amino acid chain.

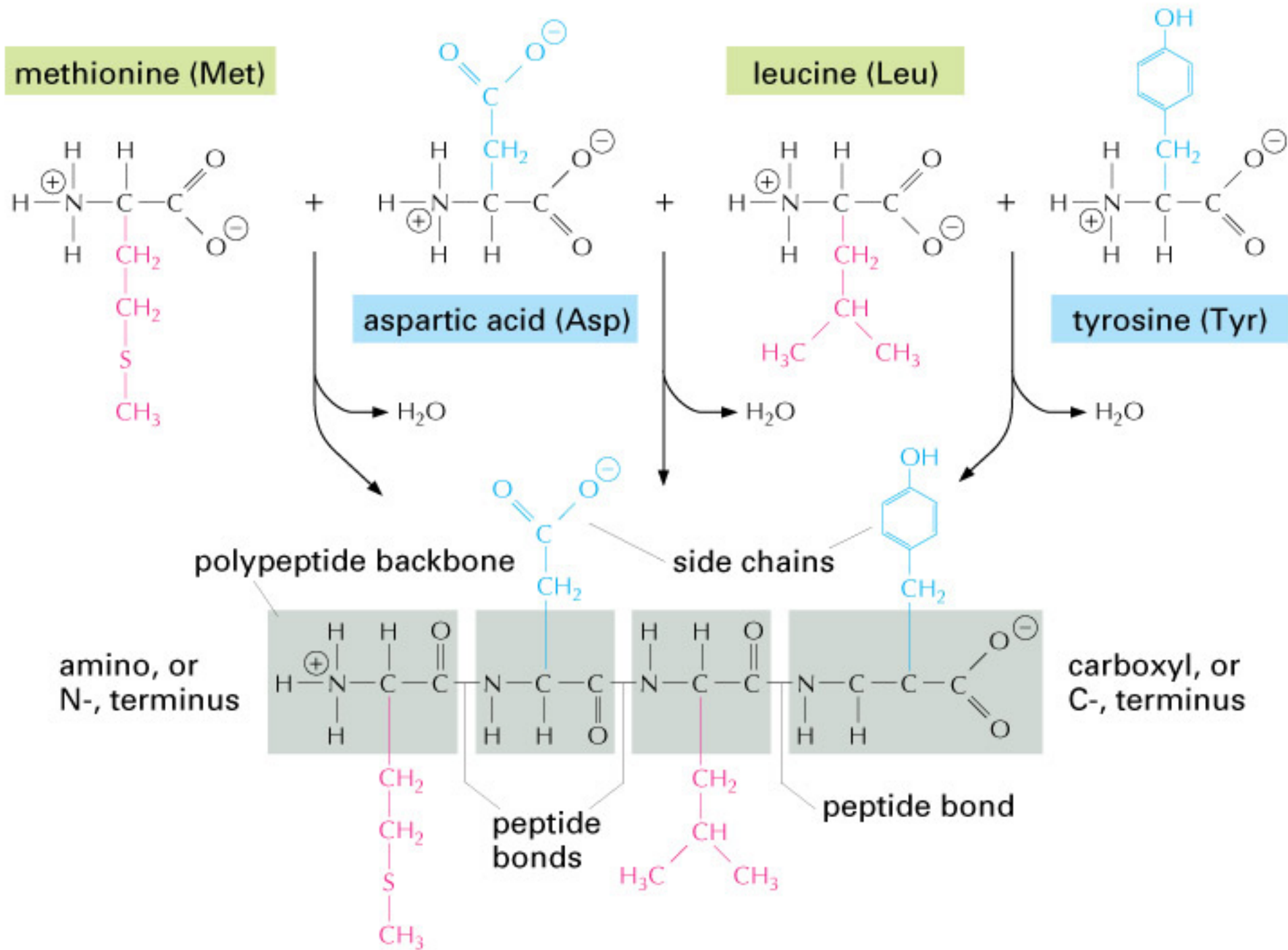


Figure 4-2 Essential Cell Biology, 2/e. (© 2004 Garland Science)