Notes 10/2

Tuesday, October 02, 2007
10:00 AM

Amino Acids: General Properties

Oct. 2, 2007

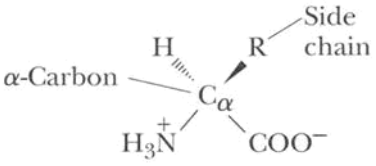
Review

- Ice: lattice, each water interacts with 4 waters
- Liquid Water: H-bonds present but transient
- Ionization of water: hydrogen ion (proton), hydroxyl ion, hydronium ion (protonated water)
- Strong electrolytes: salts, strong acids, strong bases
- Weak electrolytes: do not fully dissociate
- Buffers

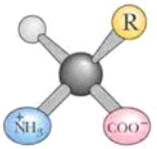
What Are the Structures and Properties of Amino Acids, the Building Blocks of Proteins?

- Amino acids contain a central tetrahedral carbon atom
- There are 20 common amino acids
- Amino acids can join via peptide bonds
- Several amino acids occur only rarely in proteins
- Some amino acids are not found in proteins

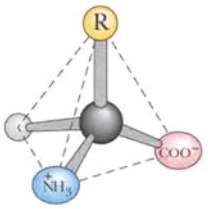
Amino Acids
Building Blocks of Proteins



Amino group | Carboxyl group

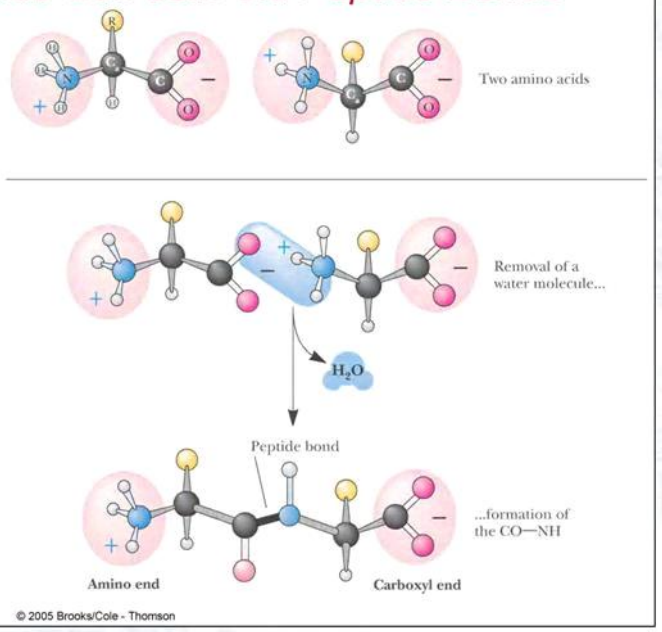


Ball-and-stick model



Amino acids are tetrahedral structures

Amino Acids Can Join Via Peptide Bonds

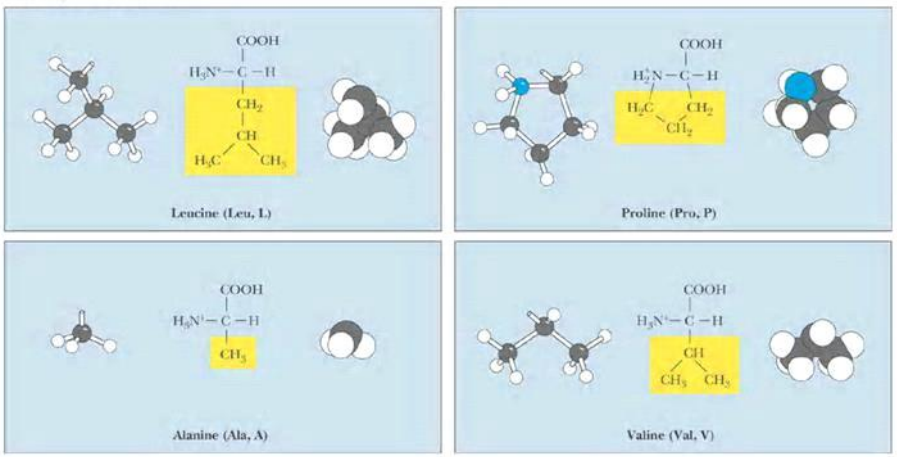


20 Common Amino Acids

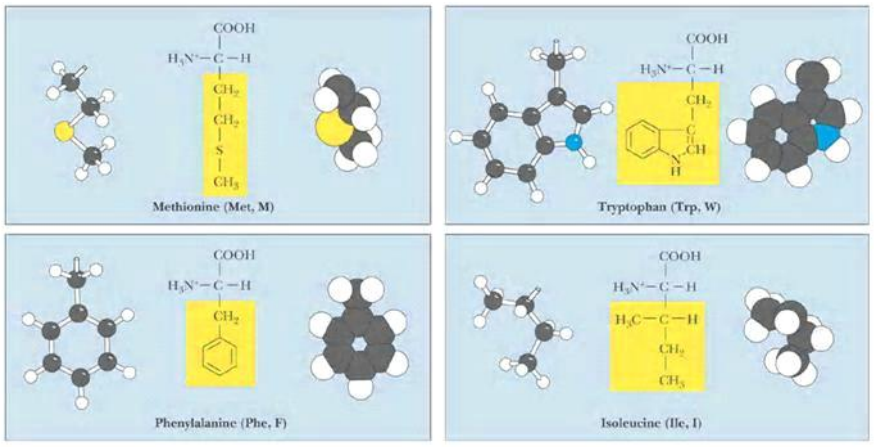
You should know names, structures, pK_a values, 3-letter and 1-letter codes

- Non-polar amino acids
- Polar, uncharged amino acids
- Acidic amino acids
- Basic amino acids

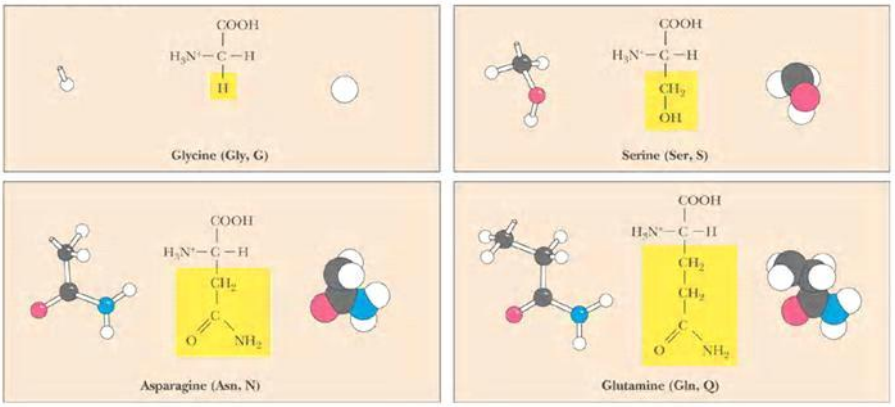
Nonpolar, hydrophobic



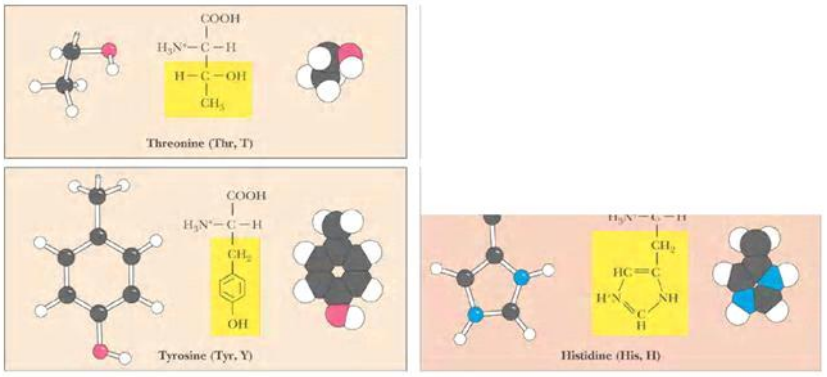
Hydrophobic



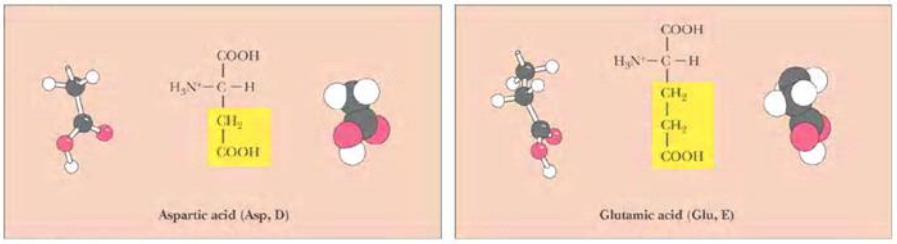
Polar, uncharged



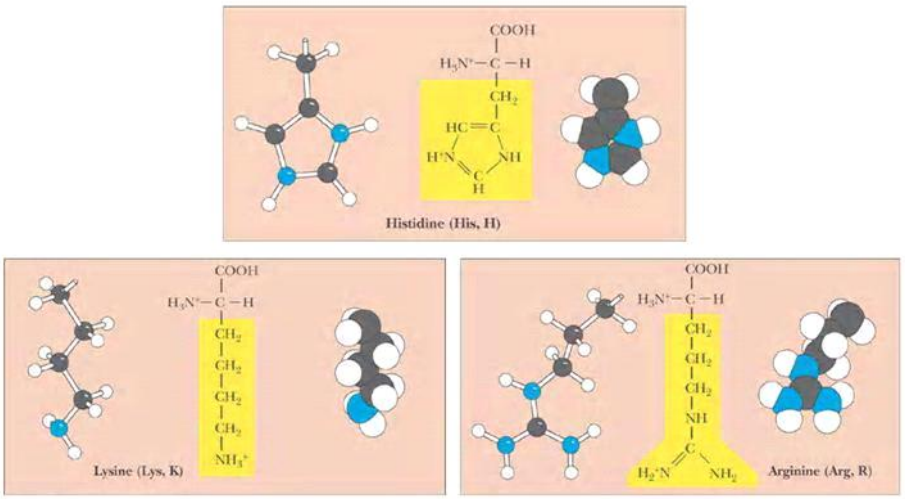
Polar, neutral



Acidic



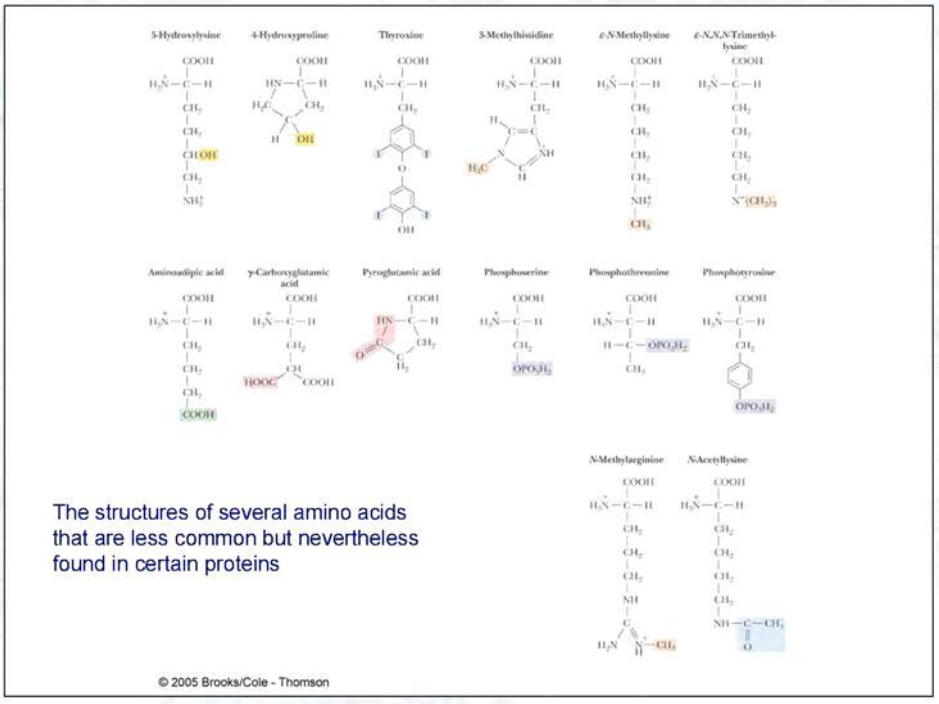
Basic



Several Amino Acids Occur Rarely in Proteins

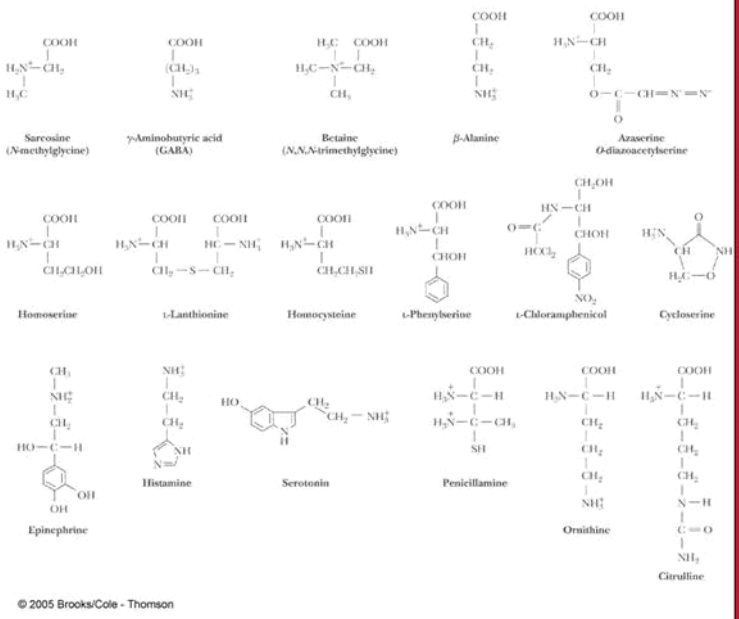
We'll see some of these in later

- Hydroxylysine, hydroxyproline - collagen
- Carboxyglutamate - blood-clotting proteins
- Pyroglutamate – in bacteriorhodopsin
- Phosphorylated amino acids – a signaling device



The structures of several amino acids that are less common but nevertheless found in certain proteins

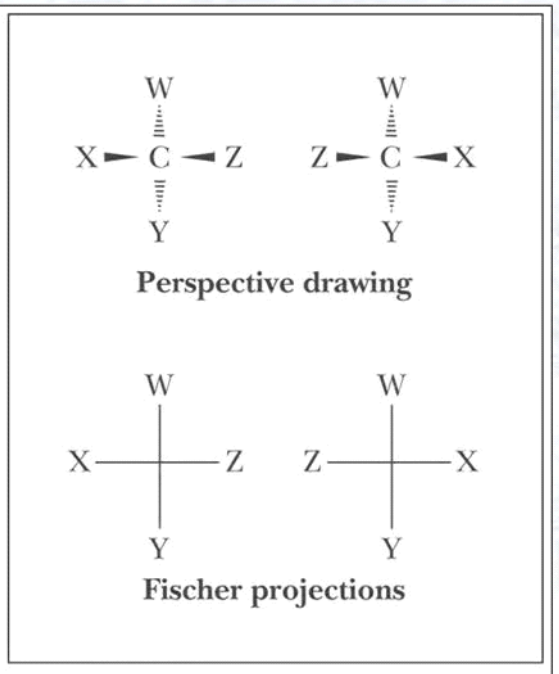
- The structures of some amino acids that are not normally found in proteins but that perform other important biological functions



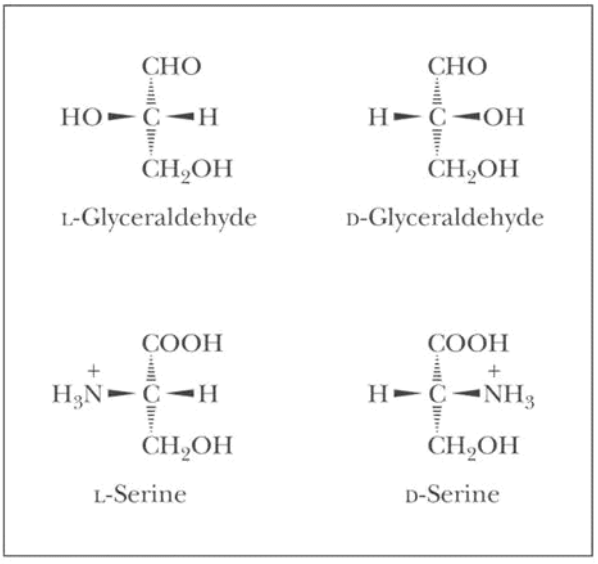
Stereochemistry of Amino Acids

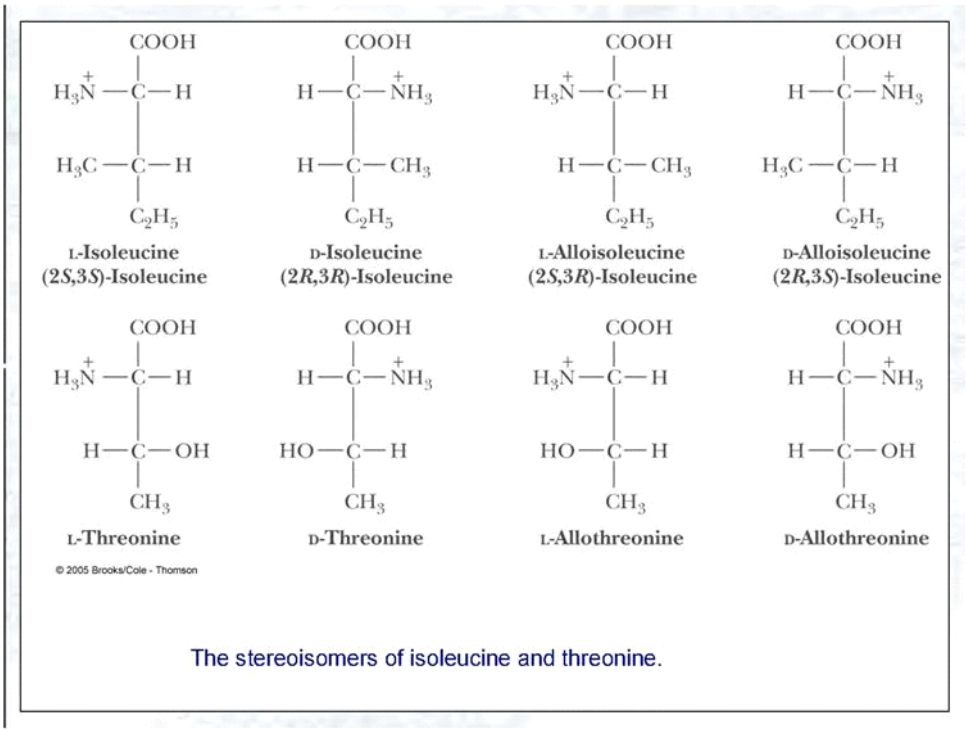
- All but glycine are chiral
- L-amino acids predominate in nature
- D,L-nomenclature is based on D- and L-glyceraldehyde
- R,S-nomenclature system is superior, since amino acids like isoleucine and threonine (with two chiral centers) can be named unambiguously

Enantiomeric molecules based on a chiral carbon atom

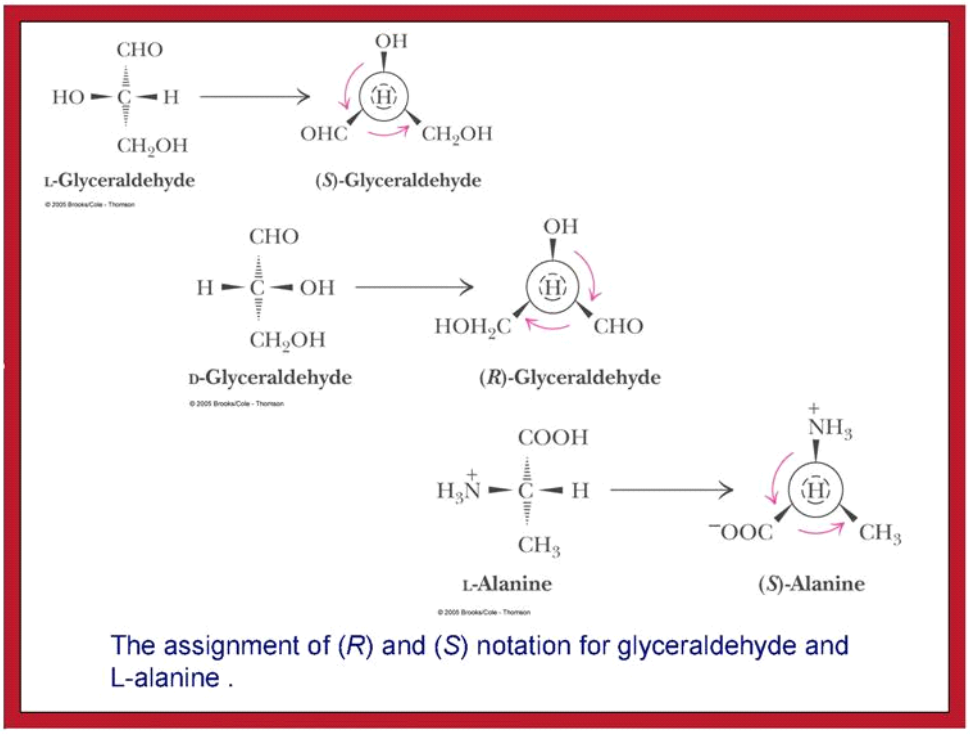


The configuration of the common L-amino acids can be related to the configuration of L(-)-glyceraldehyde as shown





The stereoisomers of isoleucine and threonine.



The assignment of (*R*) and (*S*) notation for glyceraldehyde and L-alanine .

Spectroscopic Properties

- All amino acids absorb at infrared wavelengths
- Only Phe, Tyr, and Trp absorb UV
- Absorbance at 280 nm is a good diagnostic device for amino acids
- NMR spectra are characteristic of each residue in a protein, and high resolution NMR measurements can be used to elucidate three-dimensional structures of proteins