

Amino Acids

Most amino acids = S configuration

20 amino acids occur in nature

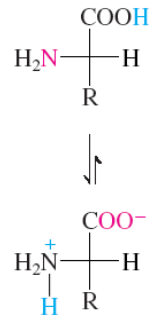
Humans can only synthesize 12, remaining 8 are called the **essential amino acids**.

Amino acids are acidic and basic: zwitterions.

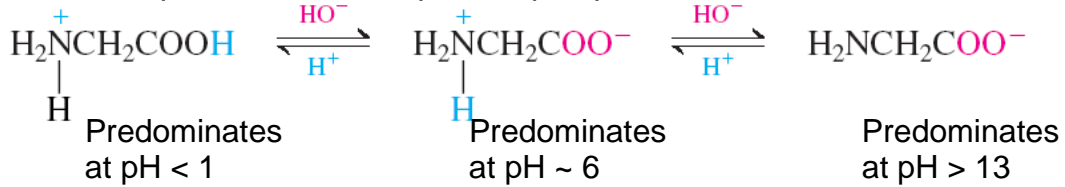
Amino group (basic)

Carboxylic acid (acid)

Neutral molecule with positive/negative charges = **zwitterion**



Amino acid structure in aqueous solution depends upon pH:



Isoelectric point = neutral pH for each amino acid

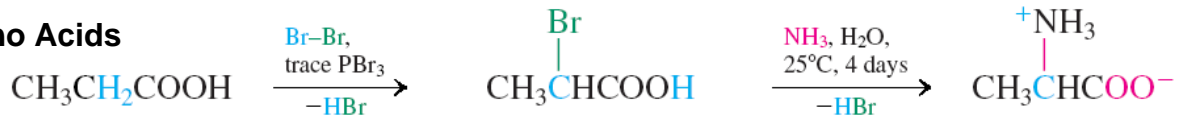
To calculate isoelectric pH (pI):

No ionizable group = average of 2 pK_a values

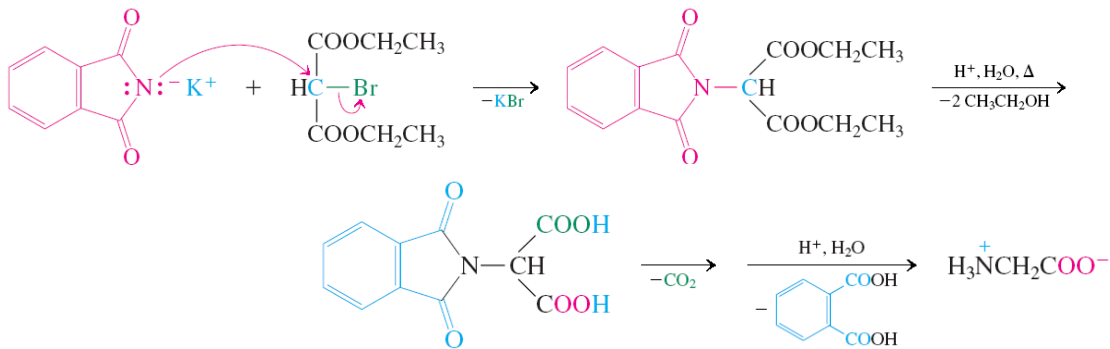
4 acidic side chains = average of two lowest pK_a values

3 basic side chain = average of the two highest pK_a values

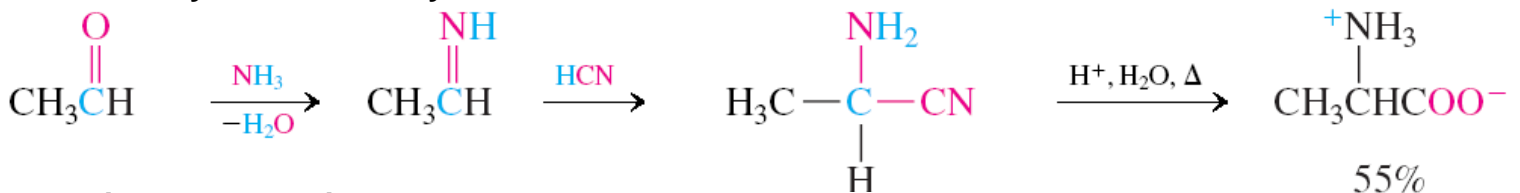
Synthesis of Amino Acids



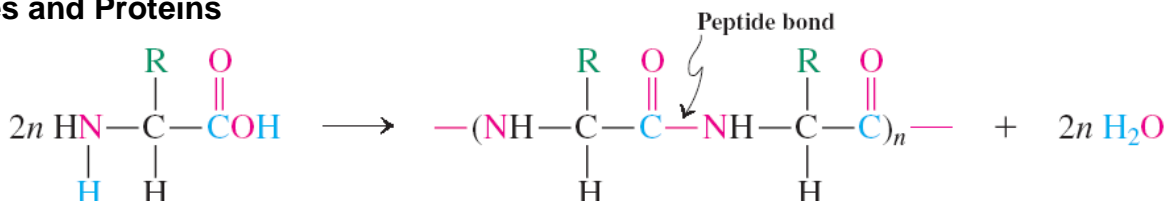
Gabriel synthesis can be adapted to produce AAs



Strecker synthesis: Aldehydes → AAs



Peptides and Proteins



Protein Structure

Primary structure: AA sequence

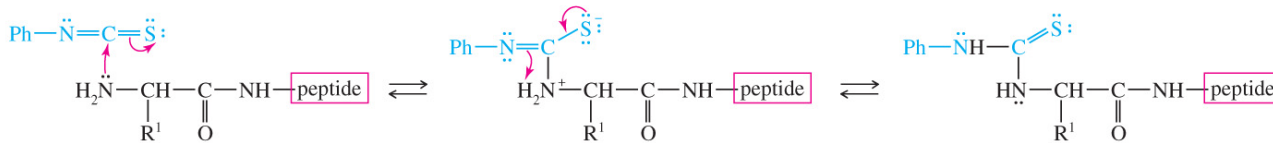
Tertiary structure: hydrophobic interactions (3-D)

Secondary structure: β-sheet and α-helix

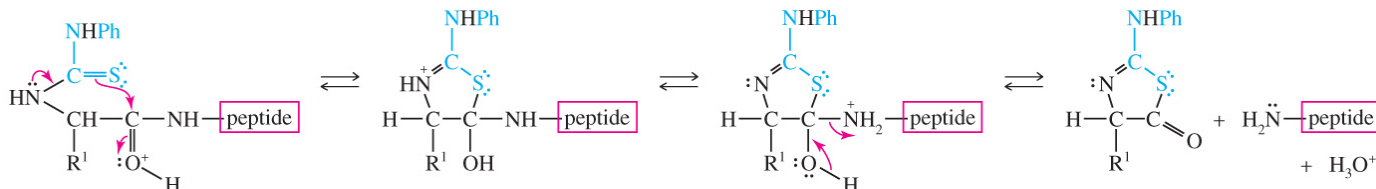
Quaternary structure: PP interactions

Edman Degradation – remove AA from peptide

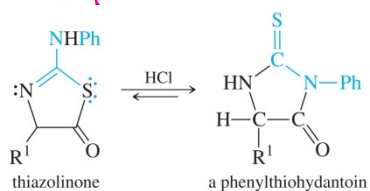
Step 1: Nucleophilic attack by the free amino group on phenyl isothiocyanate, followed by a proton transfer, gives a phenylthiourea.



Step 2: Treatment with HCl induces cyclization to a thiazolinone and expulsion of the shortened peptide chain.

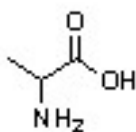
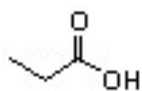


Last Step of the Edman Degradation

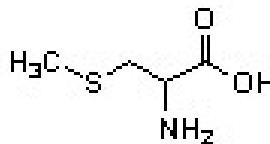


Practice

- 1) Br₂/PBr₃
- 2) H₂O
- 3) Excess NH₃



- 1) NH₃, HCN, H₂O
- 2) H₃O⁺, heat



Mechanism

