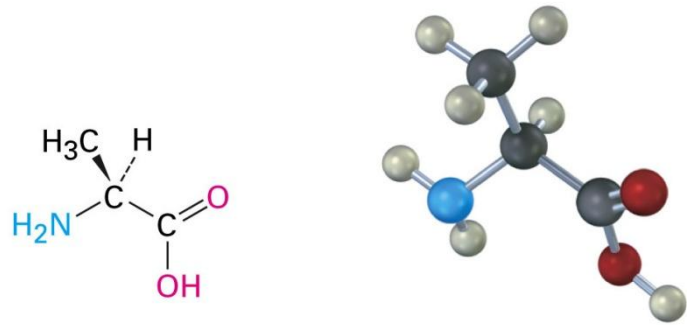
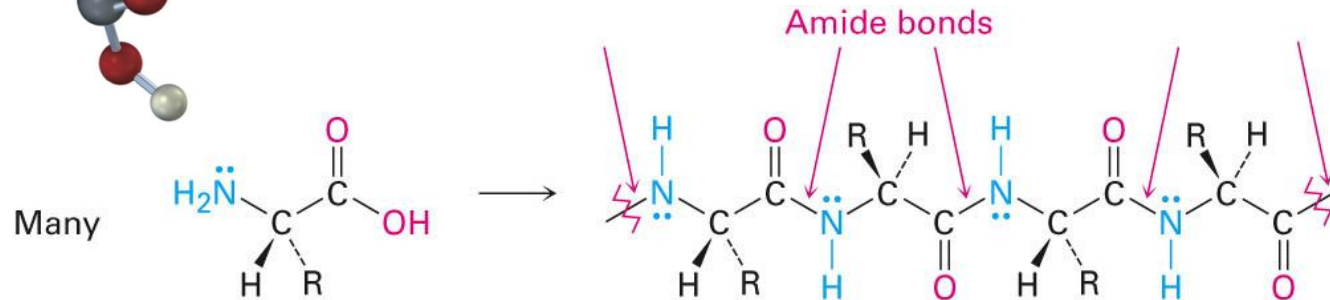


Amino Acids, Peptides, and Proteins

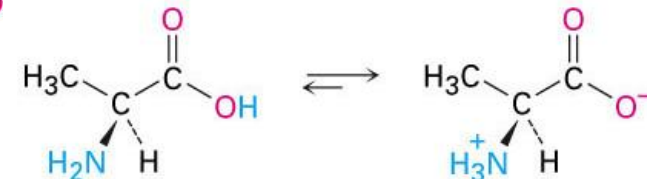
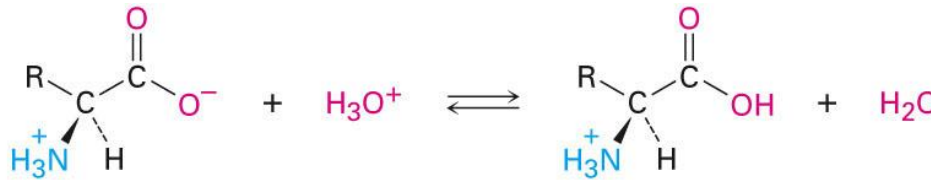


Alanine, an amino acid

Chains of <50 amino acids are called **peptides**, while **protein** refers to longer chains.



In acid solution

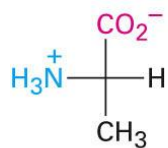


In base solution

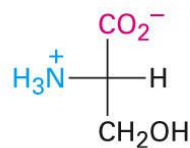


zwitterion

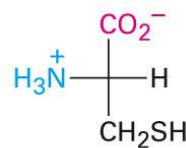
all L- (except glycine)



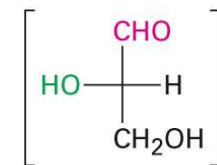
L-Alanine
(S)-Alanine



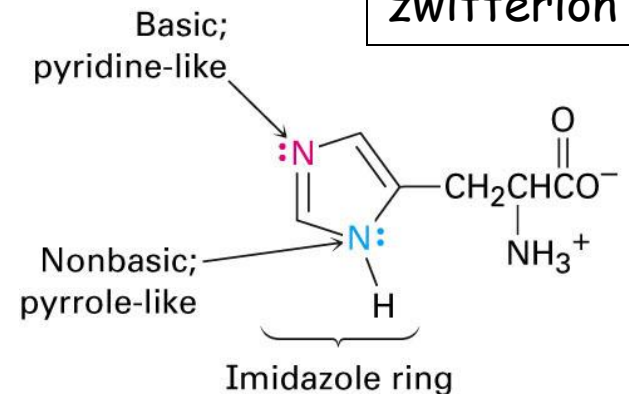
L-Serine
(S)-Serine



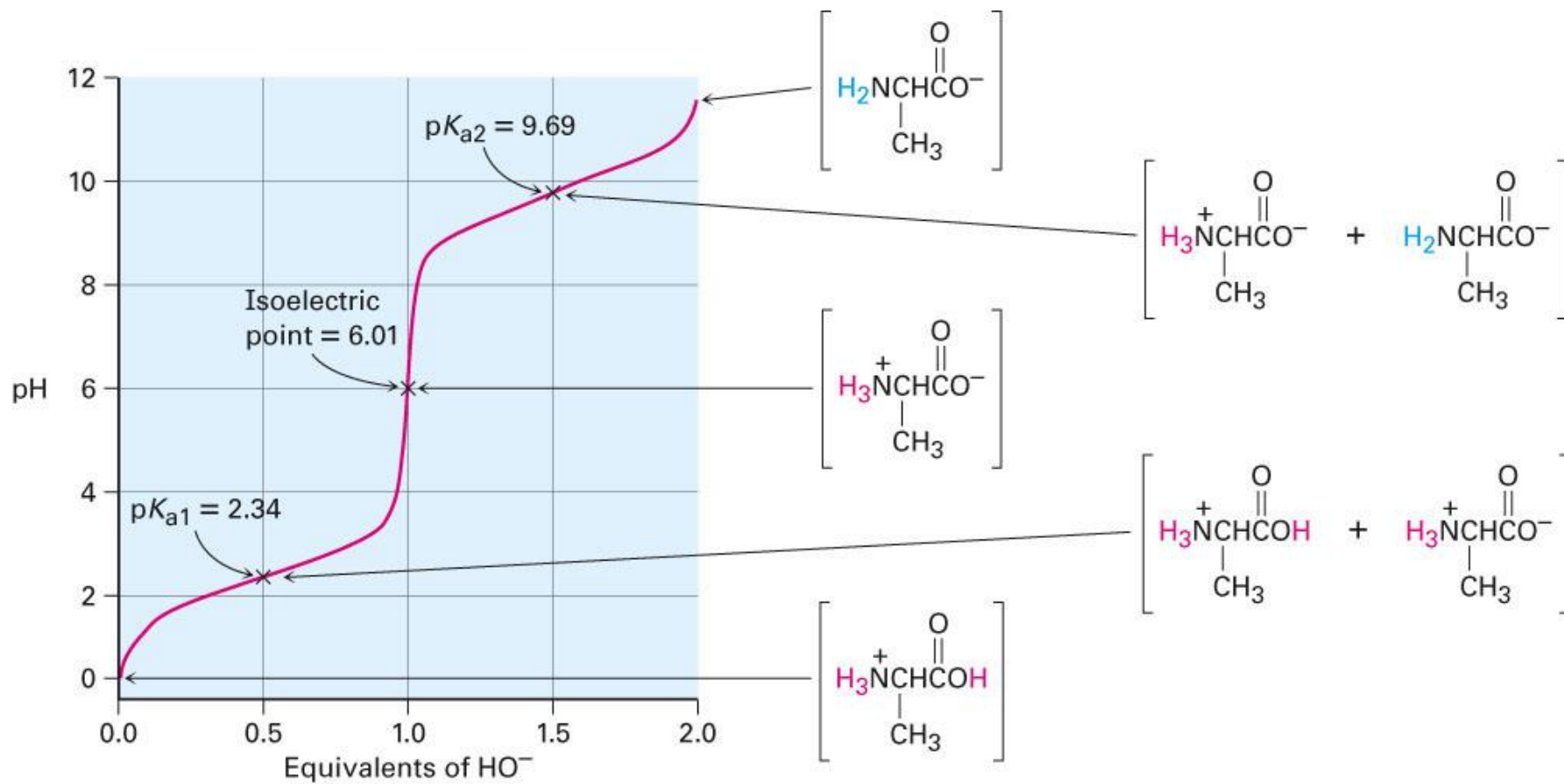
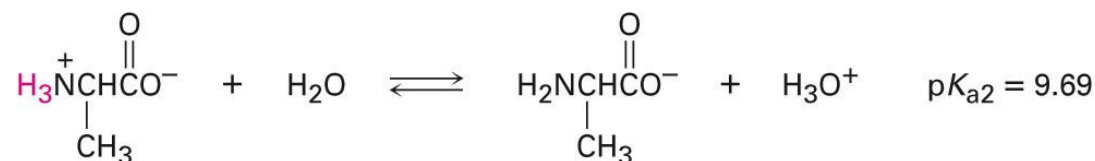
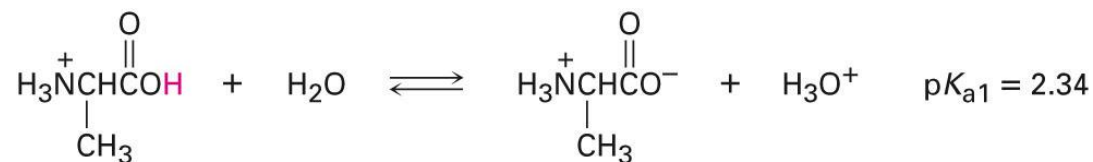
L-Cysteine
(R)-Cysteine



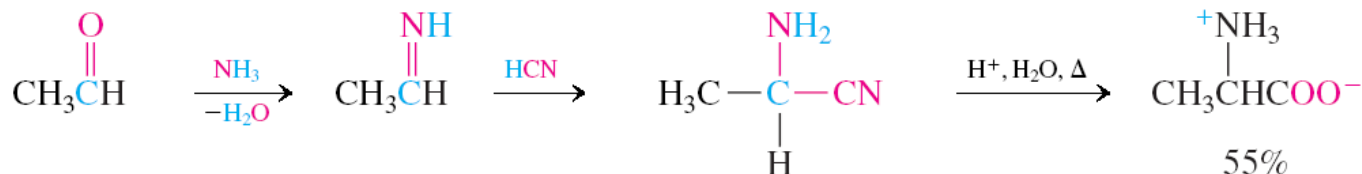
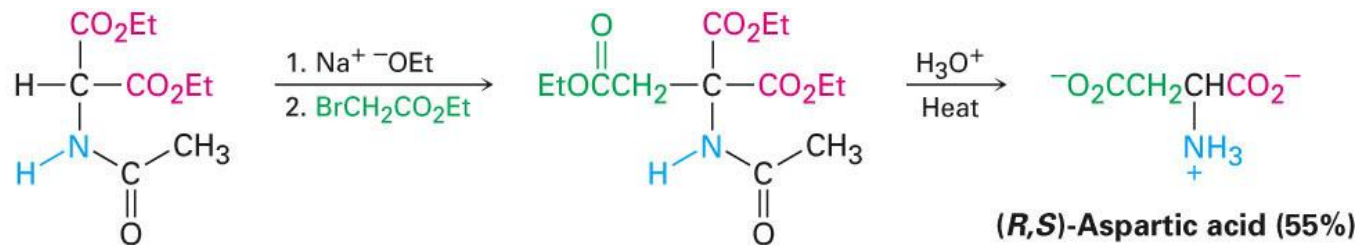
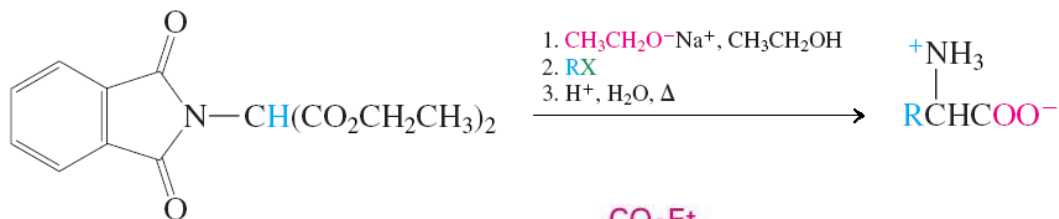
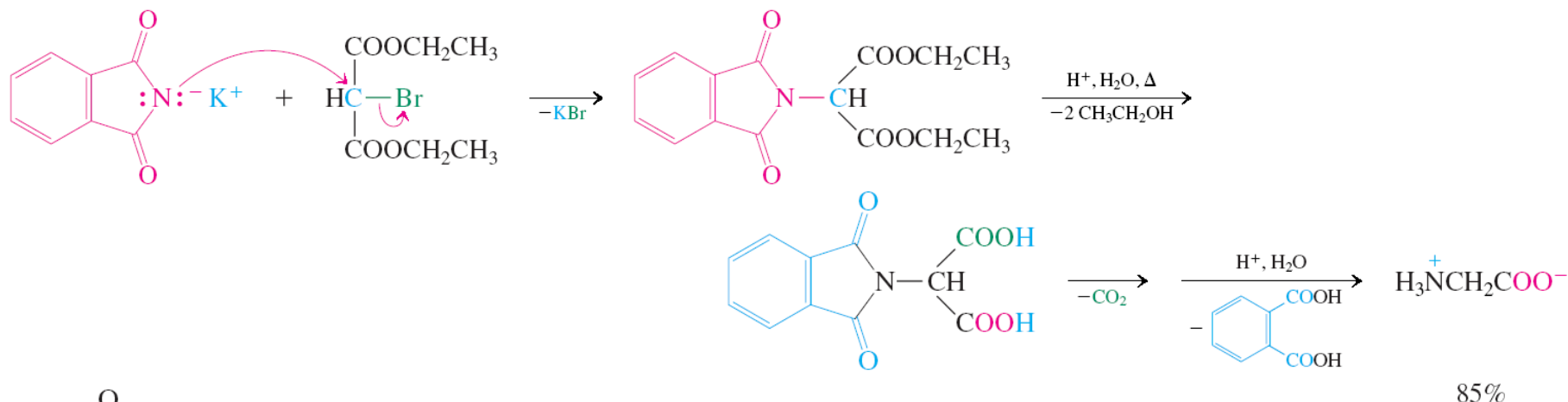
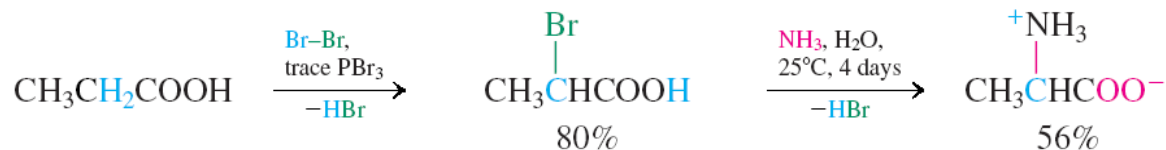
L-Glyceraldehyde



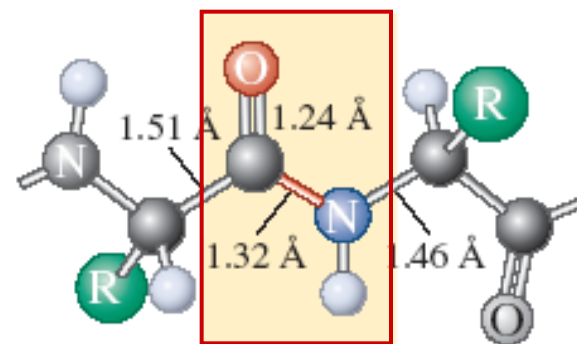
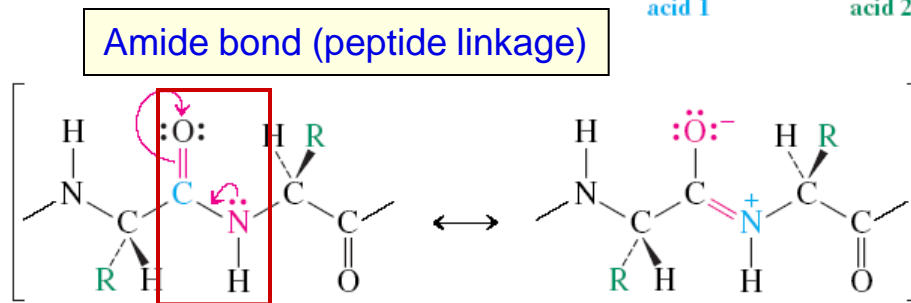
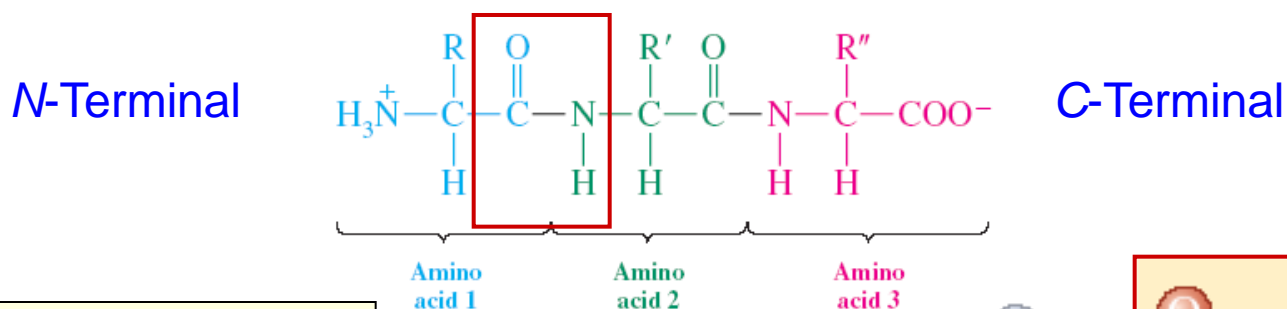
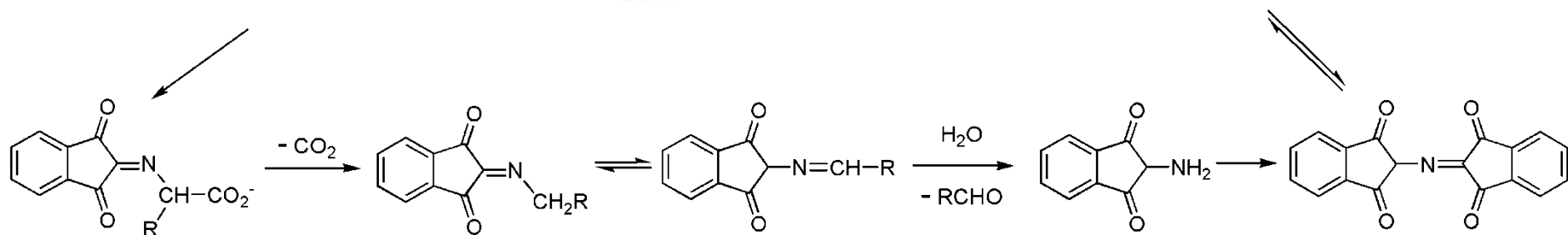
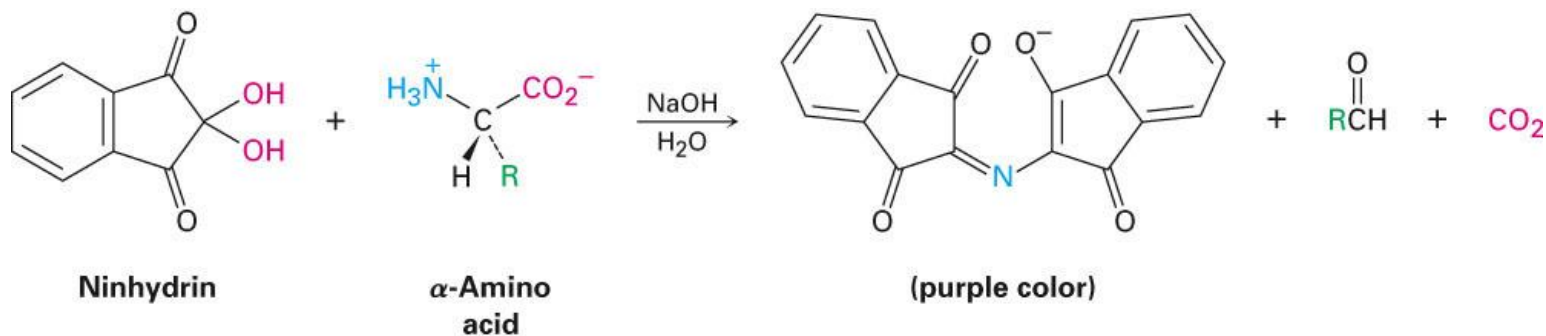
Isoelectric Points of AAs



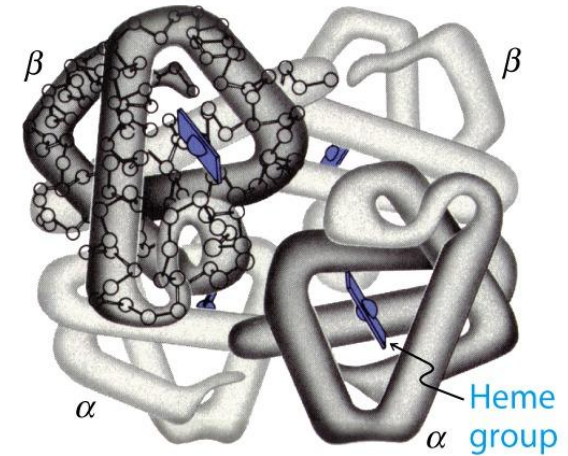
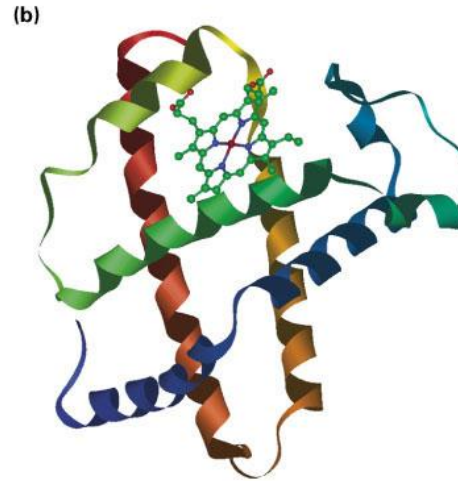
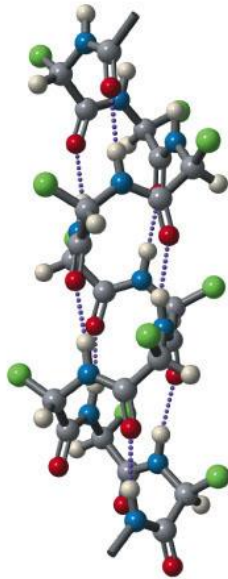
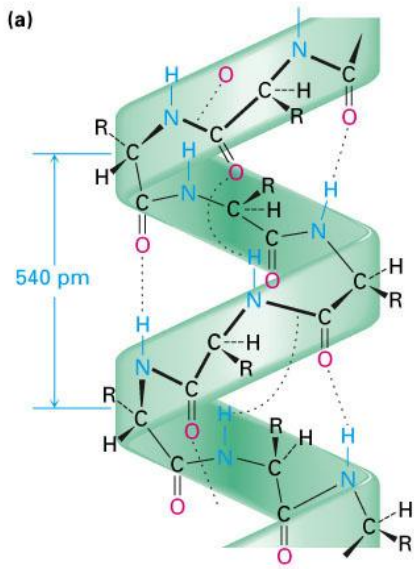
Synthesis of AAs



AA Stain and Peptides

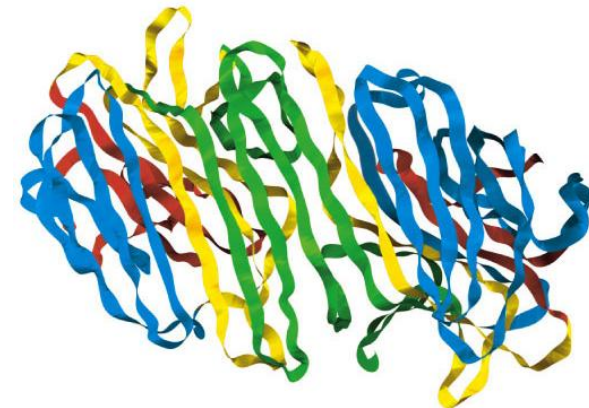
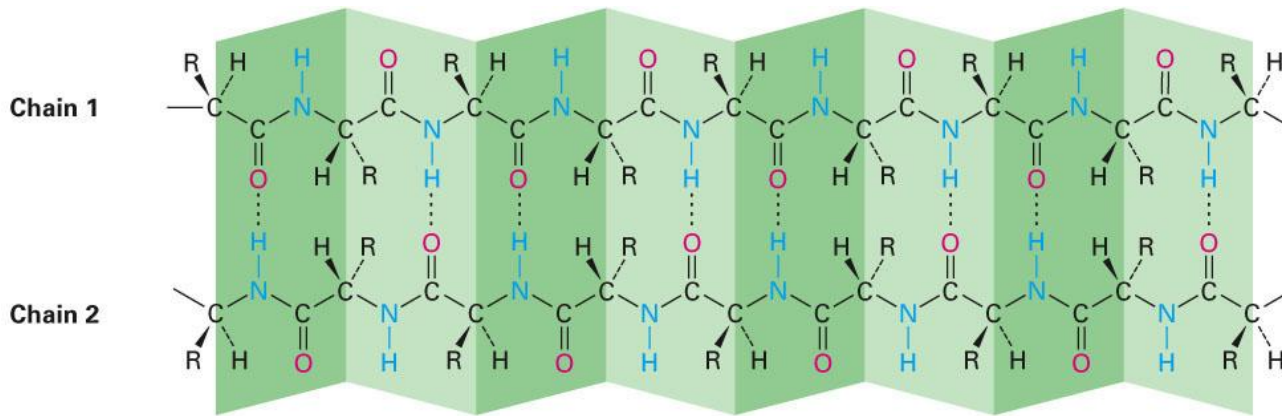


α -Helix and β -Sheets: Secondary Structures

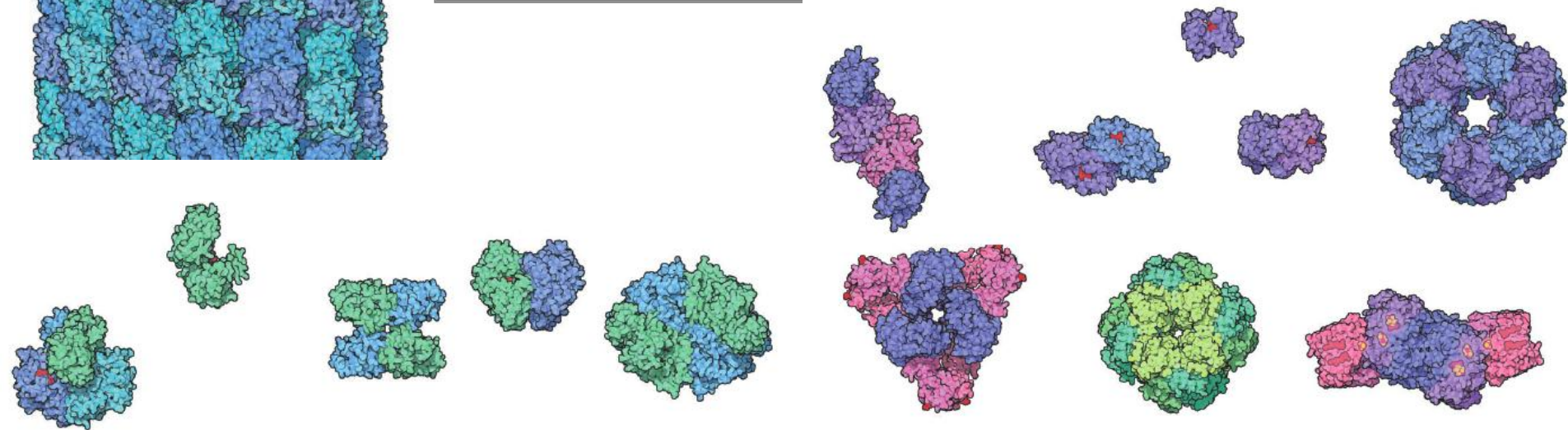
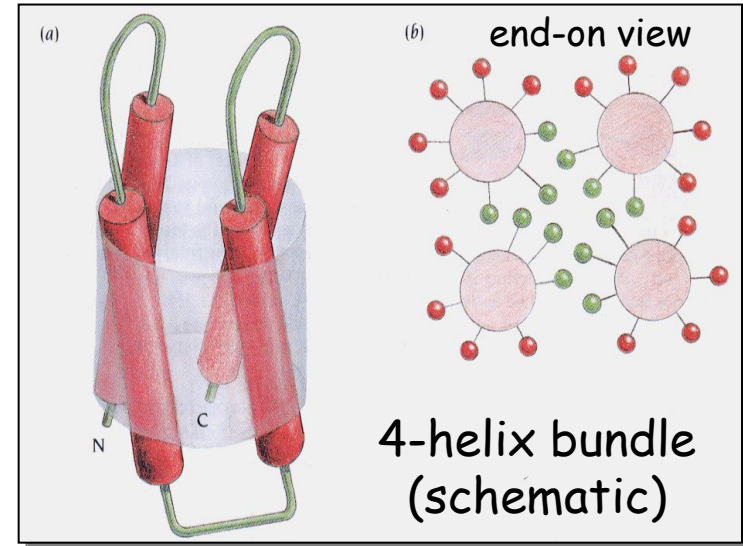
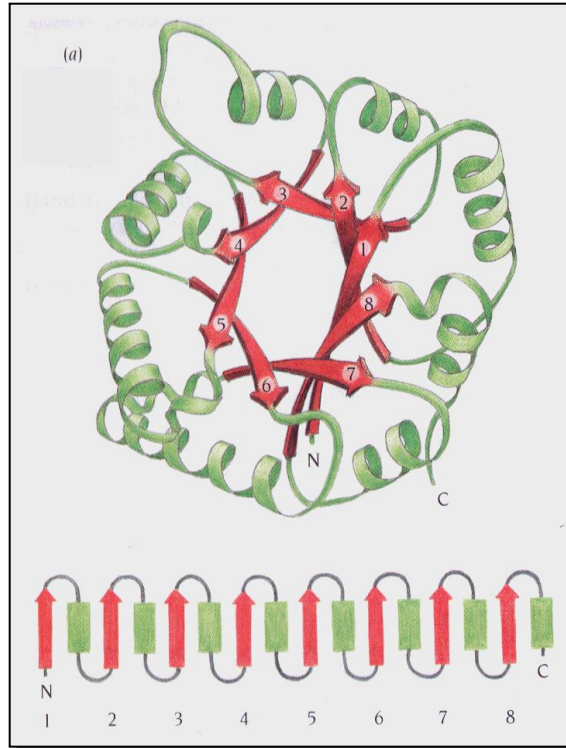
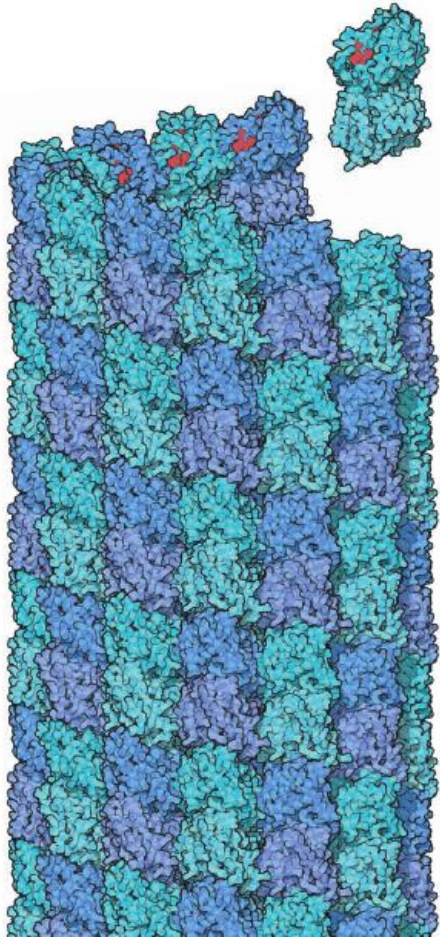


- The **primary** structure of a protein is simply the amino acid sequence.
- The **secondary** structure of a protein describes how segments of the peptide backbone orient into a regular pattern.

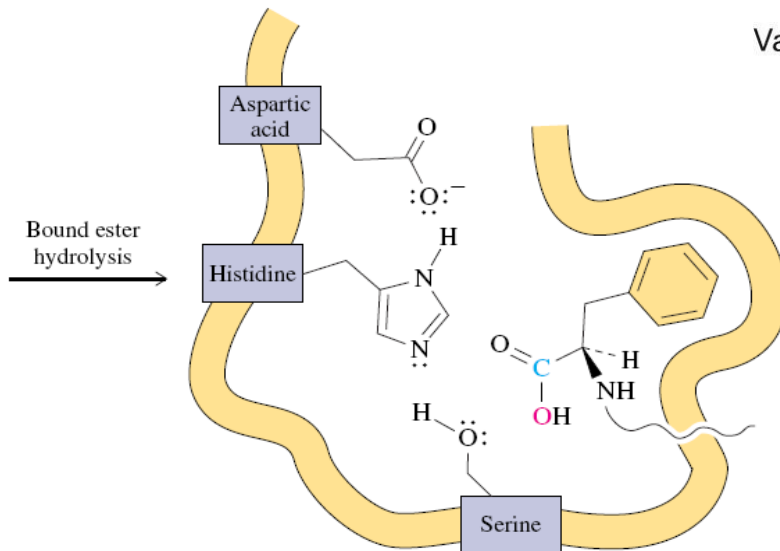
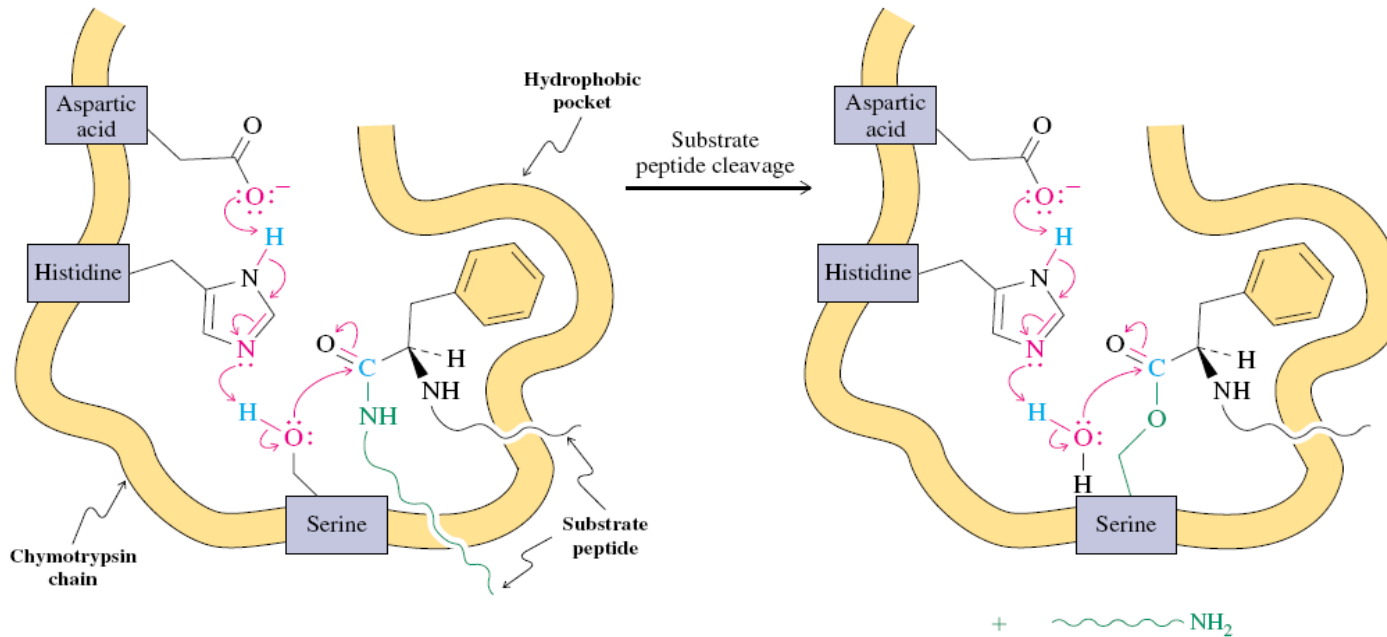
- The **tertiary** structure describes how the entire protein molecule coils into an overall three-dimensional shape.
- The **quaternary** structure describes how different protein molecules come together to yield large aggregate structures



3D Structures of Proteins



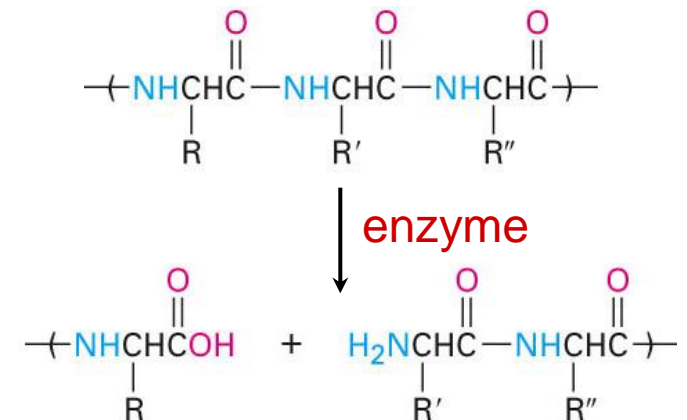
Peptide Degradation

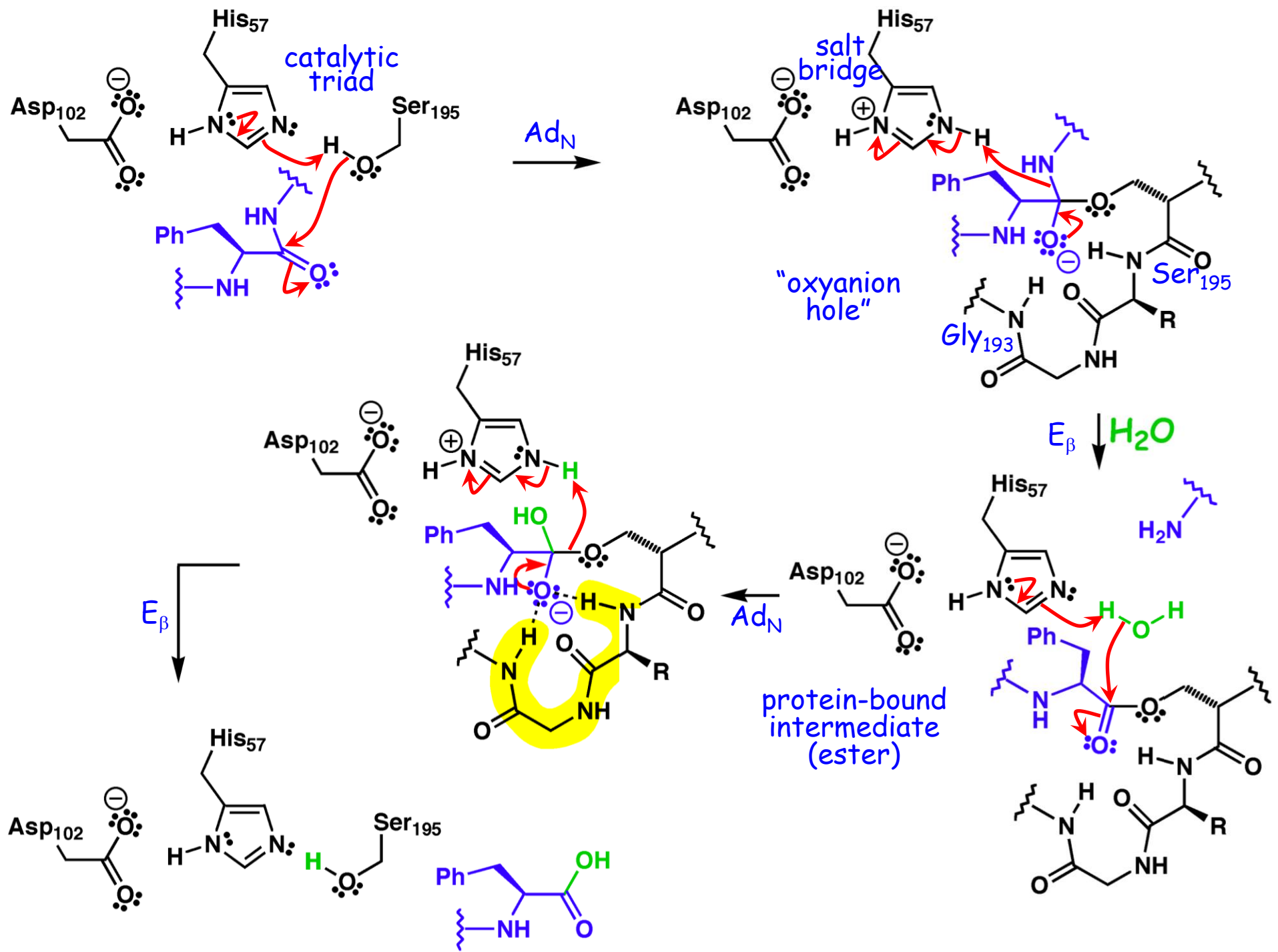


Val-Phe-Leu-Met-Tyr-Pro-Gly-Trp-Cys-Glu-Asp-Ile-Lys-Ser-Arg-His

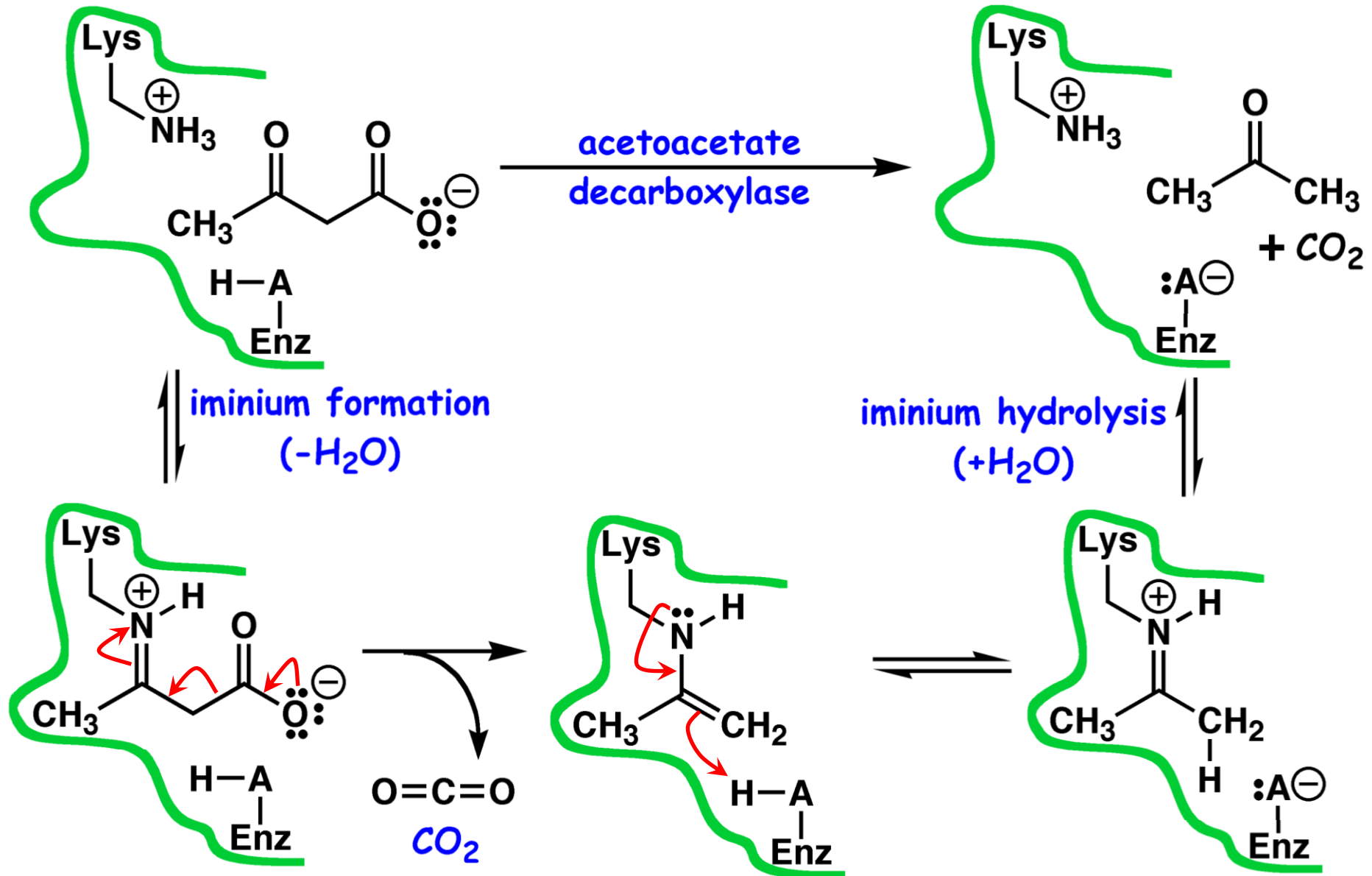
Chymotrypsin cleaves these bonds.

Trypsin cleaves these bonds.



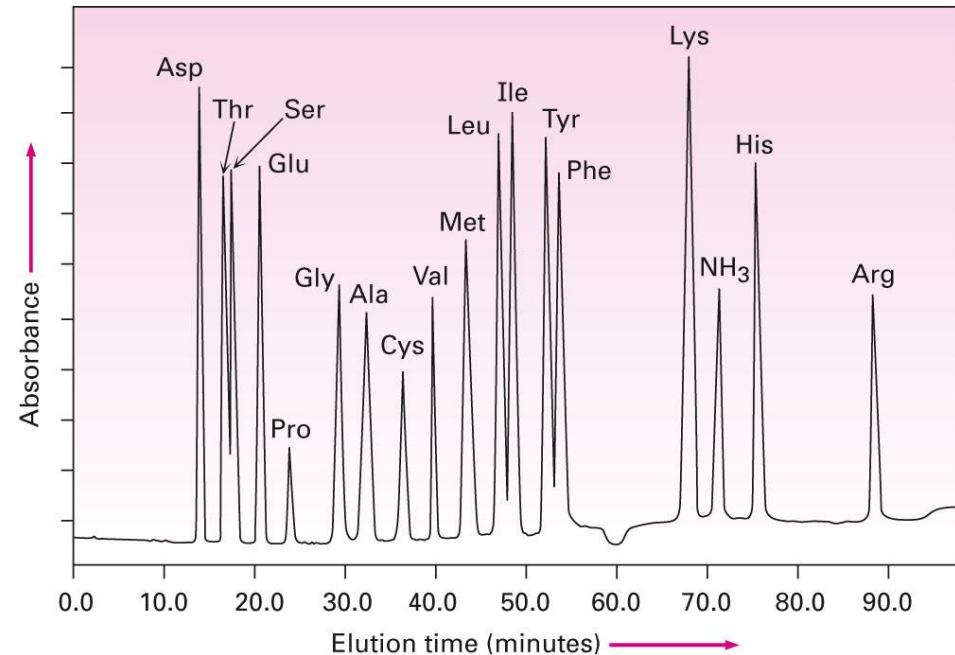


Acetoacetate Decarboxylase

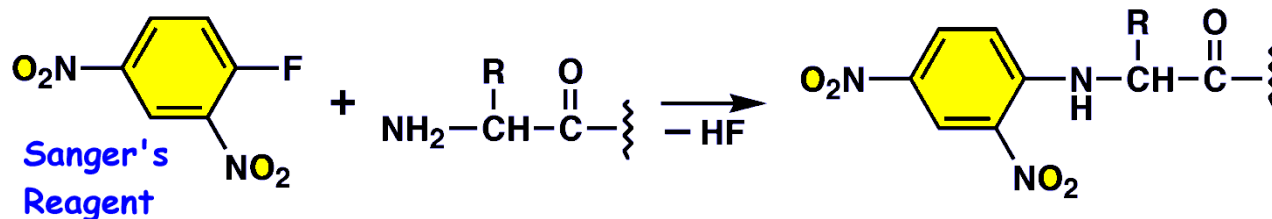
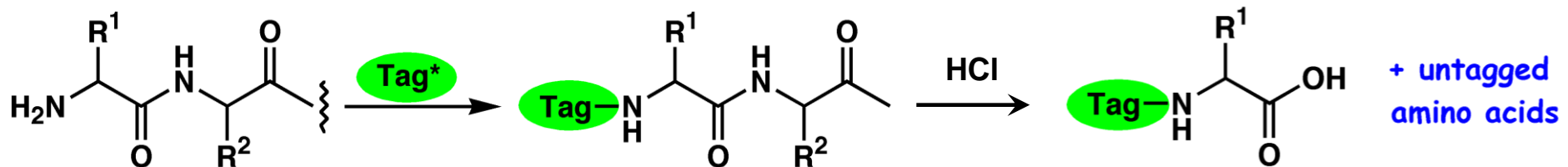


Determination of Primary Structure

1. Purify the polypeptide
2. Determine what amino acids are present
3. Sequence peptide from the N-terminal

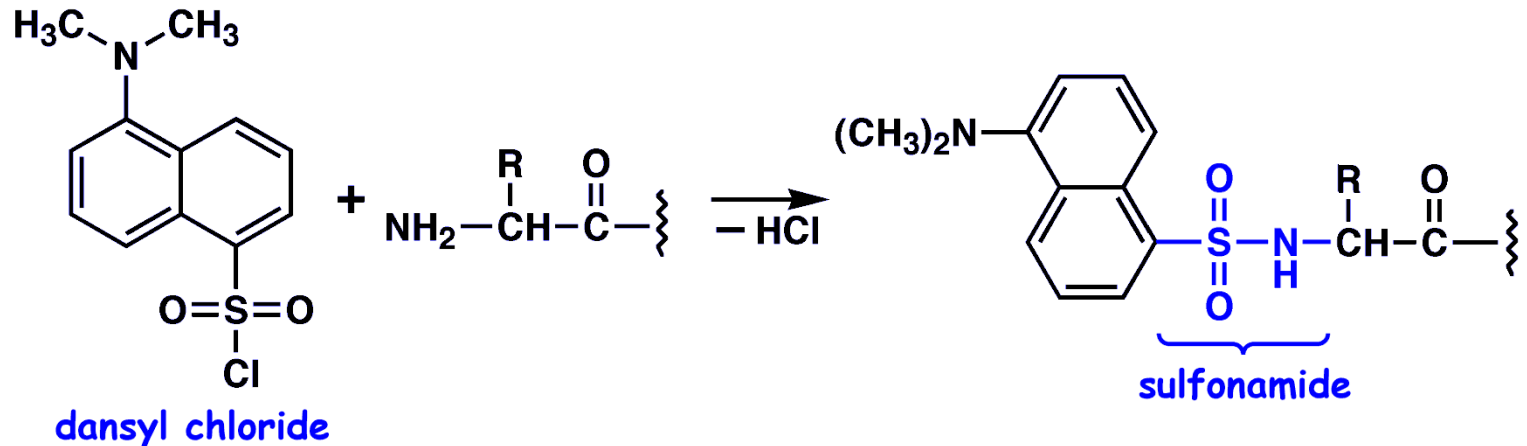


Determination of the *N*-Terminal Residue:
Sanger's reagent

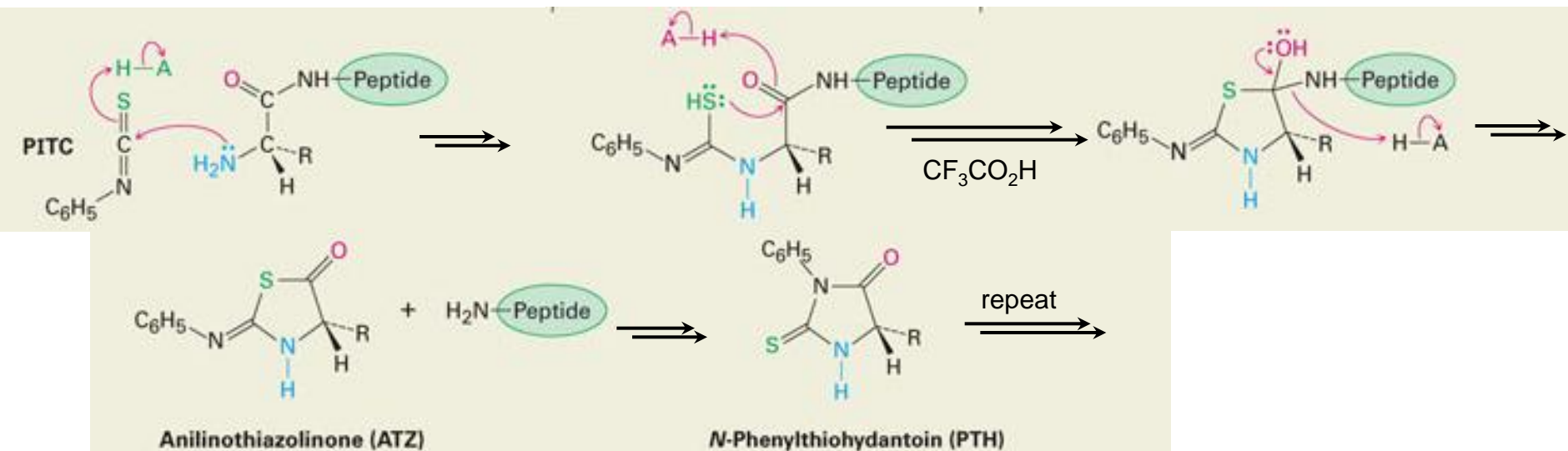


Determination of Primary Structure: AA Sequencing

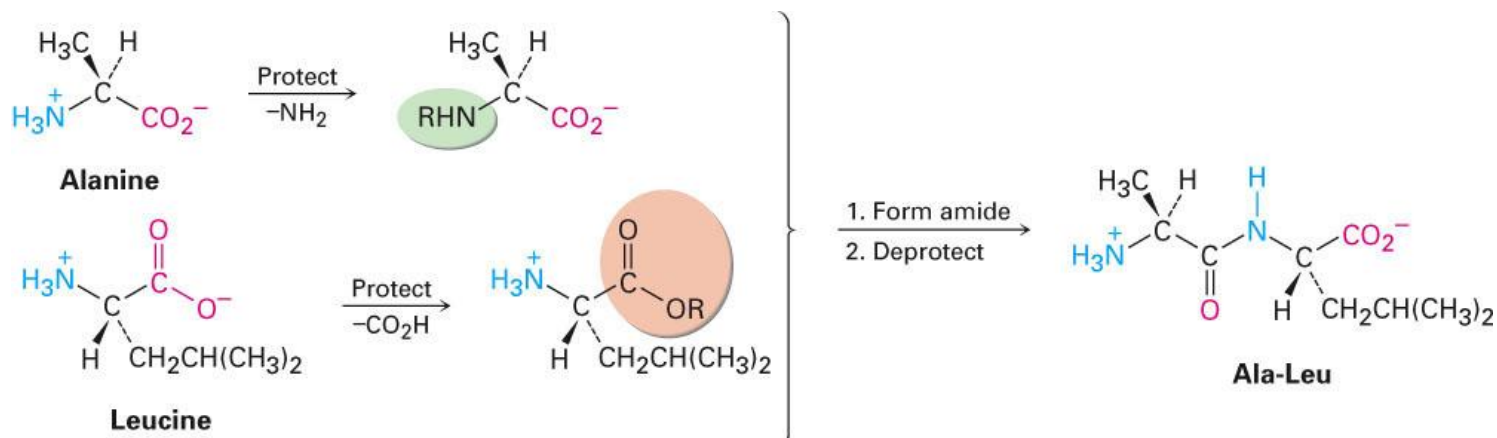
Dansyl Chloride as an N-Terminal Tag:



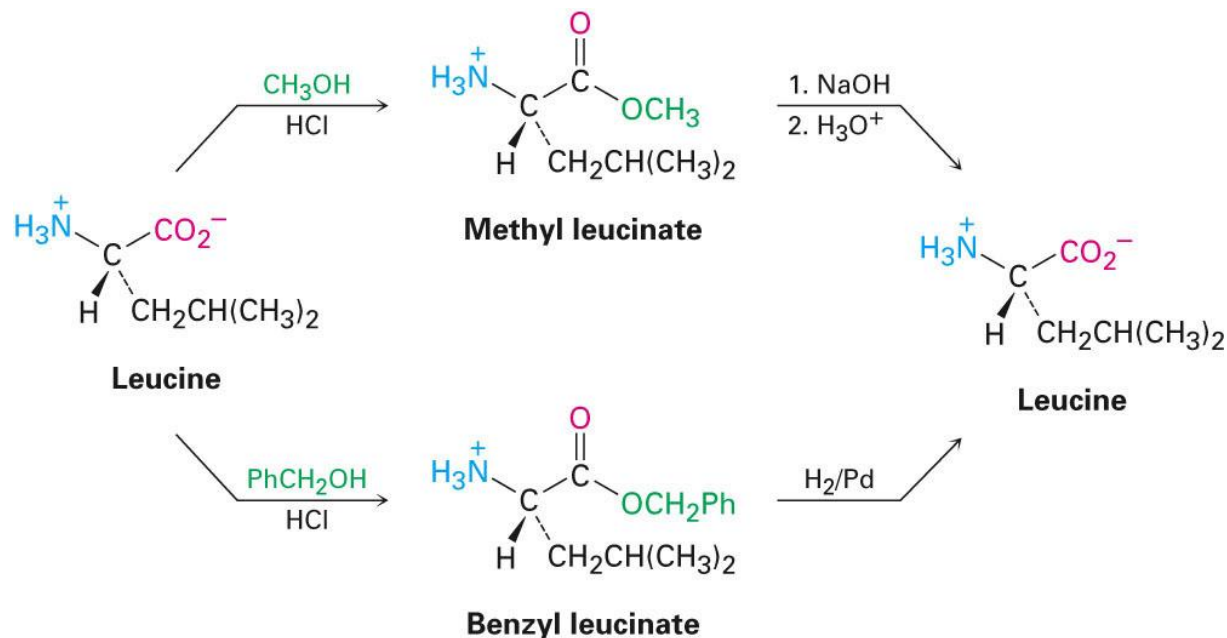
Edman Degradation:



Synthesis of Polypeptides: Application of Protective Groups

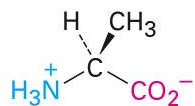


protection and deprotection of the carboxylic acid group:



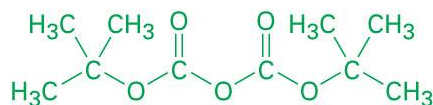
Synthesis of Polypeptides: Application of Protective Groups

protection and deprotection of the amino group

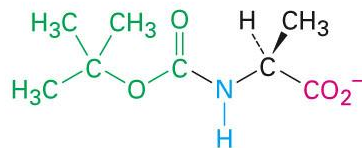
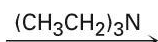


Alanine

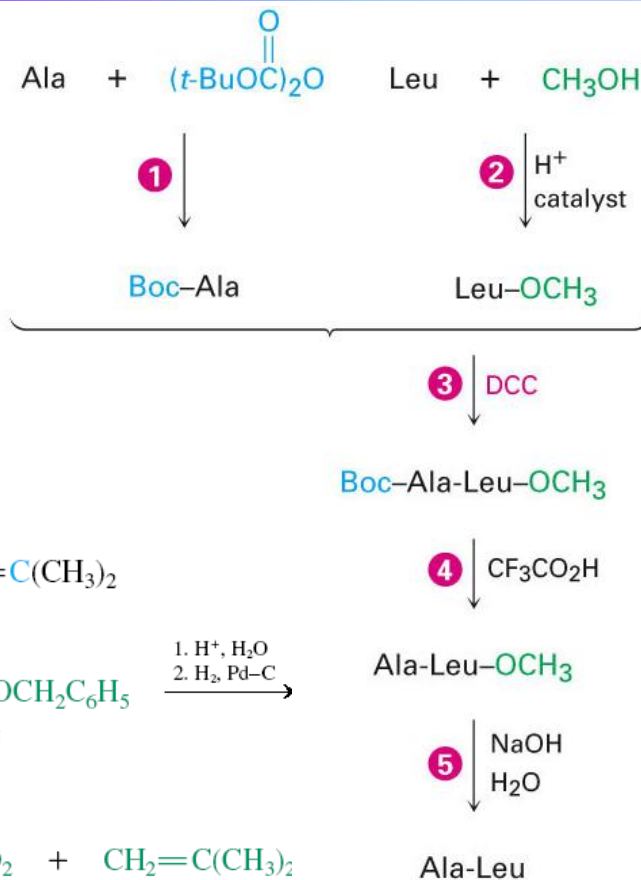
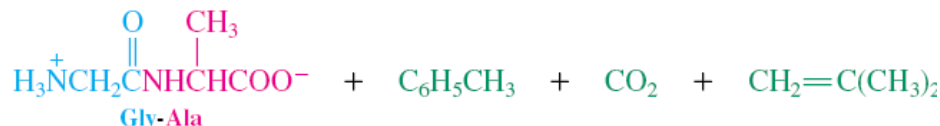
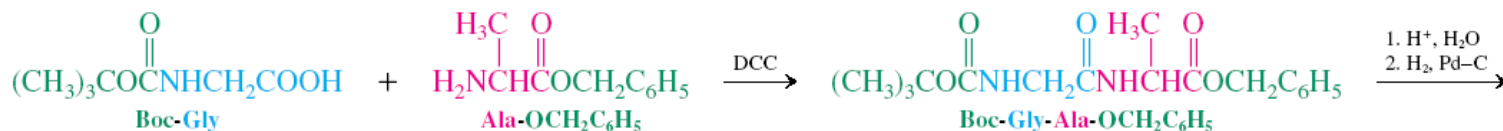
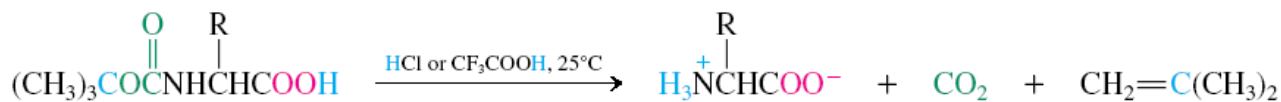
+



Di-*tert*-butyl dicarbonate



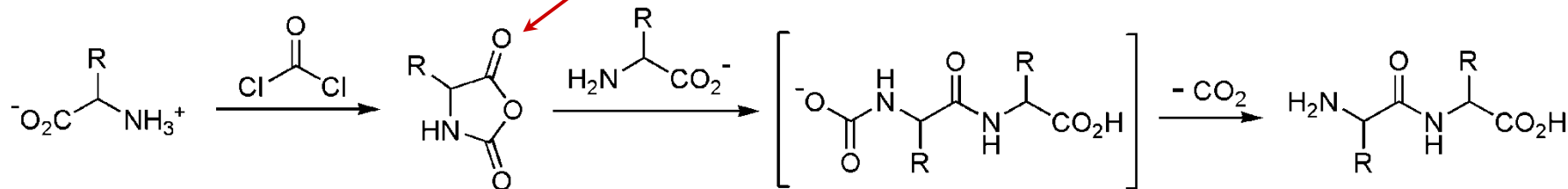
Boc-Ala



Poly(amino acid)s synthesis:

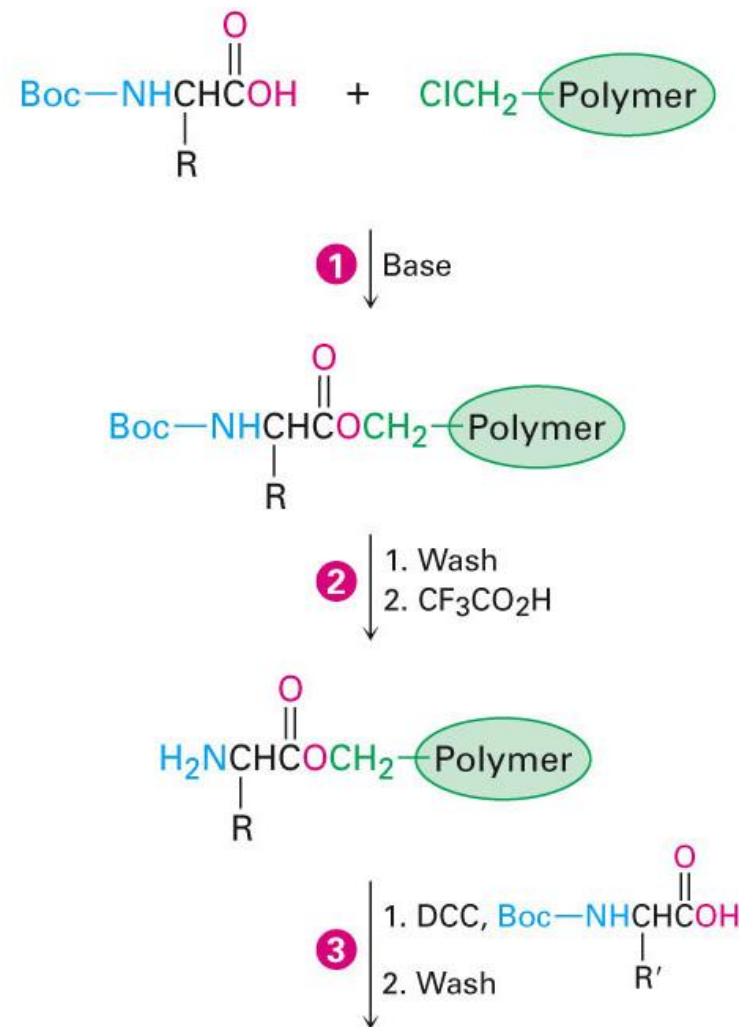
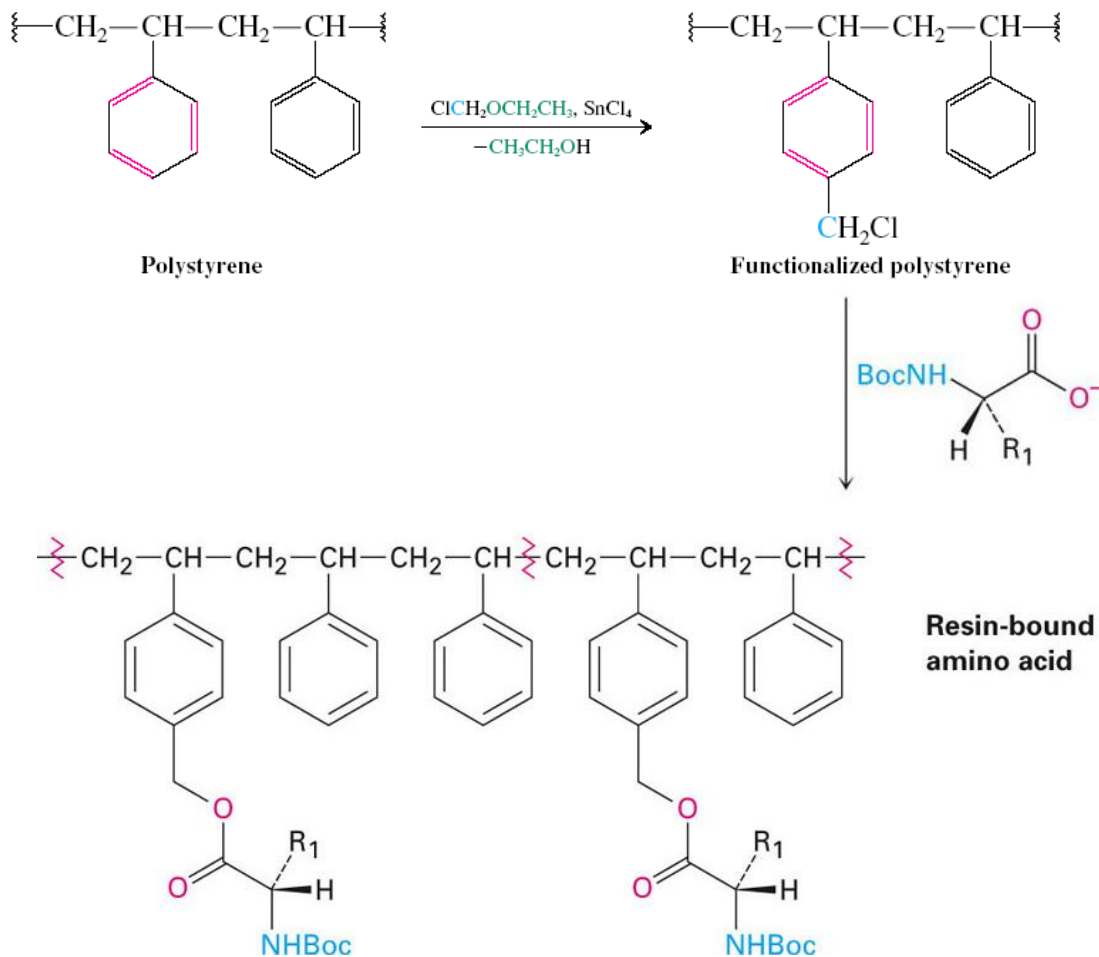
amino acid *N*-carboxyanhydride (**NCA**)

Simultaneous activation of CO and protection of NH

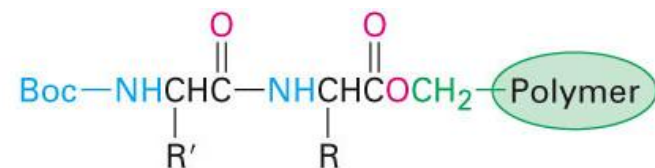
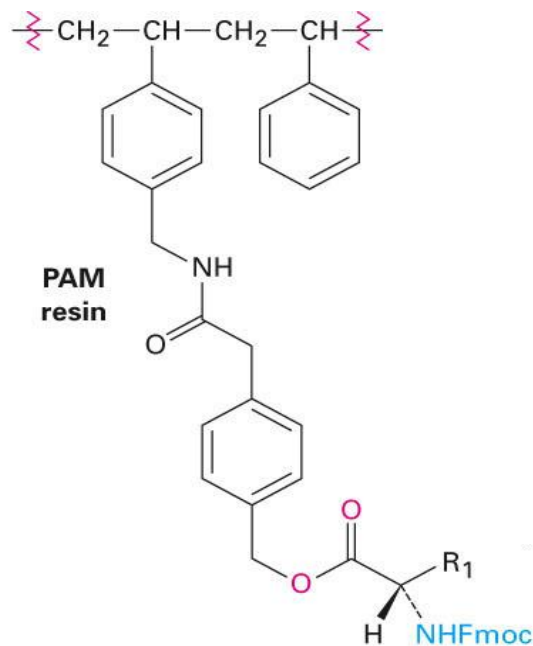
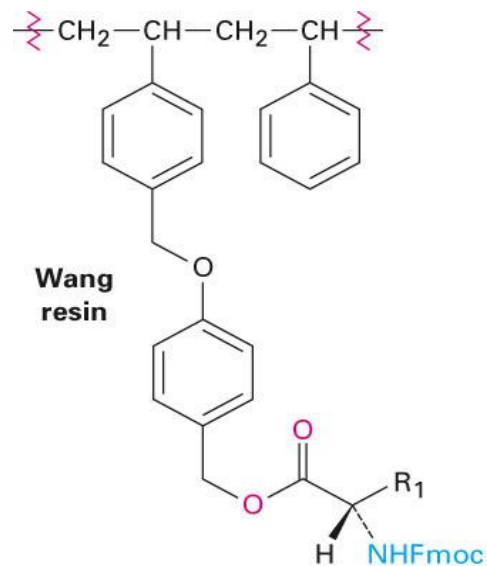


Solid Phase Peptide Synthesis

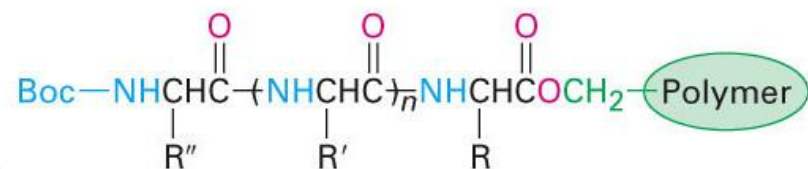
Merrifield Method:



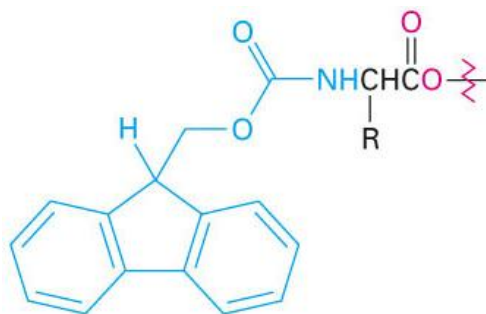
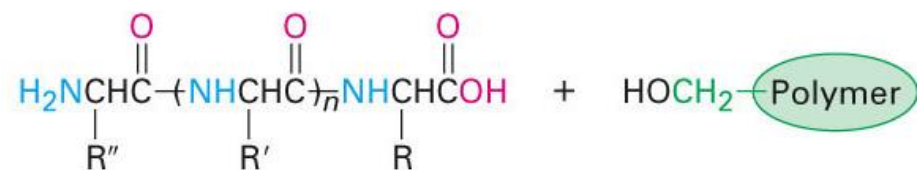
Solid Phase Peptide Synthesis



4 Repeat cycle many times



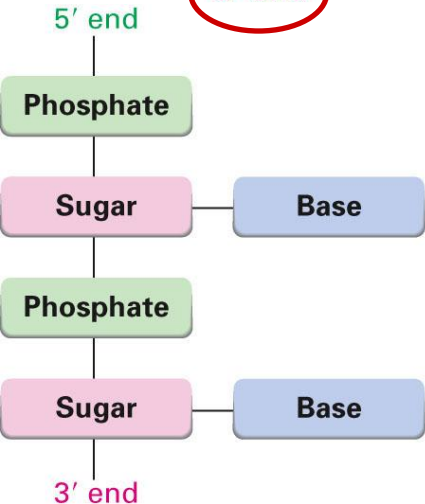
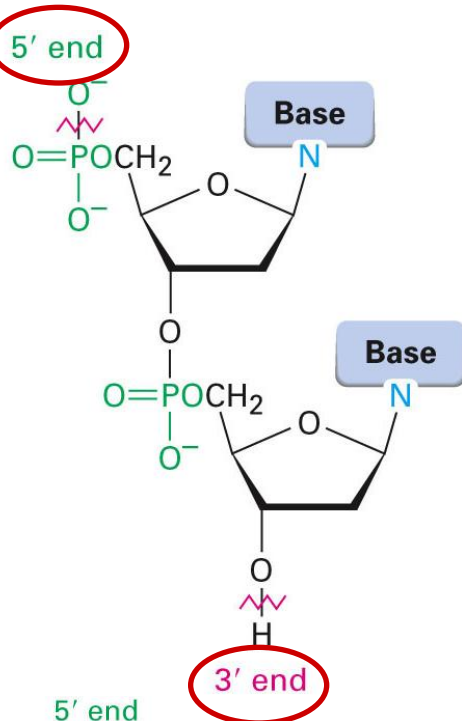
5 HF



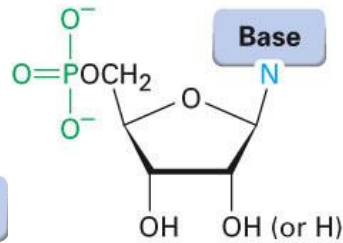
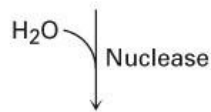
Fmoc-protected amino acid

Nucleic Acids

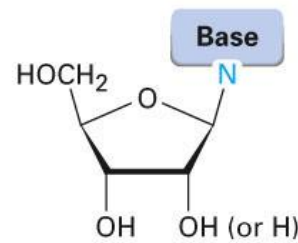
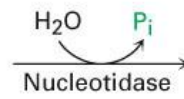
Part of a DNA chain



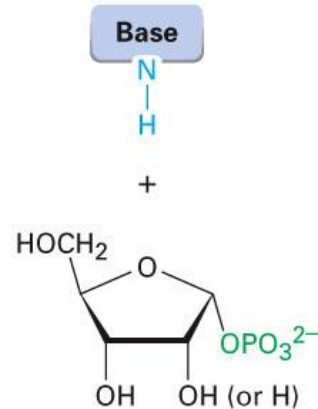
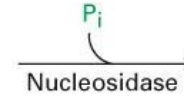
DNA



Nucleotides



Nucleosides



bases



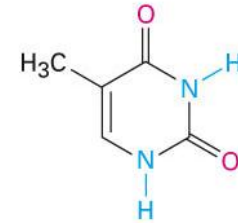
Adenine (A)
DNA, RNA



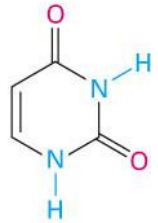
Guanine (G)
DNA, RNA



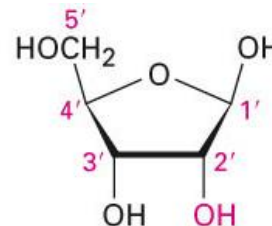
Cytosine (C)
DNA, RNA



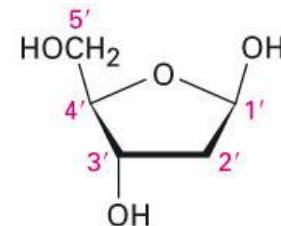
Thymine (T)
DNA



Uracil (U)
RNA

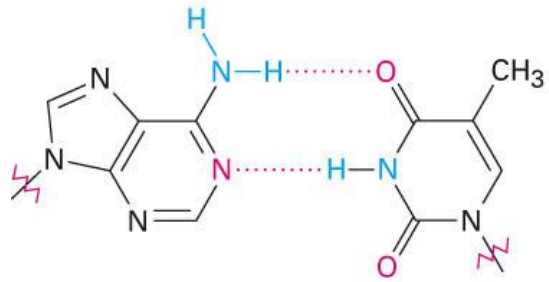


Ribose



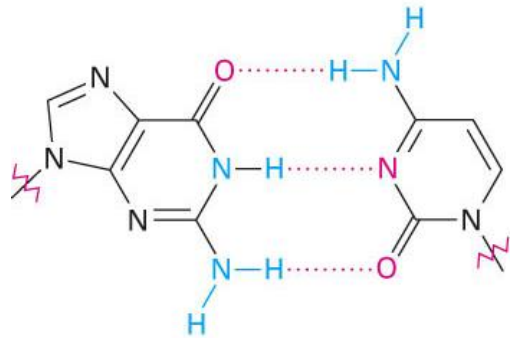
2-Deoxyribose

Base Pairing in DNA: the Watson-Crick Model



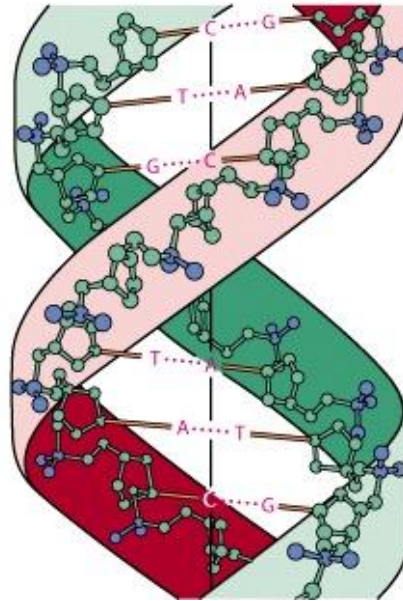
A

T

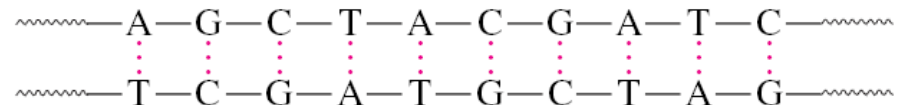
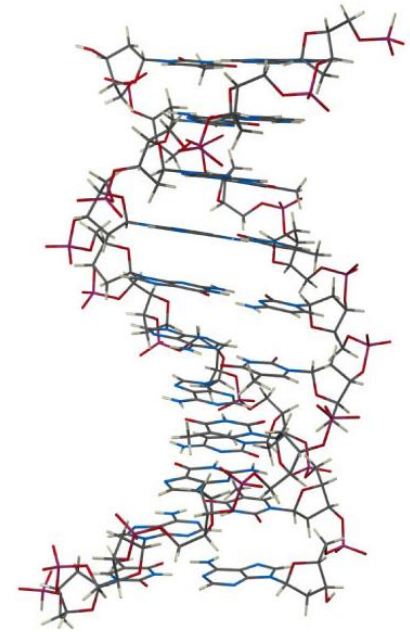


G

C



34 Å



A nucleic acid

DNA

Transcription

RNA

Translation

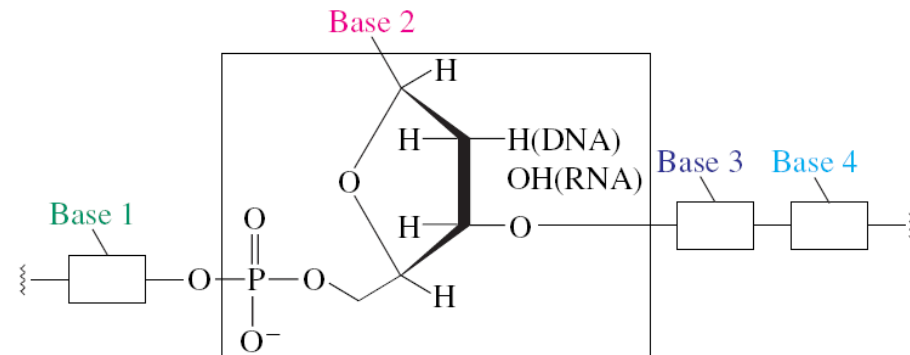
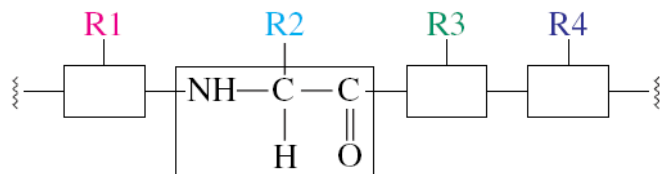
Proteins

DNA → RNA → Proteins

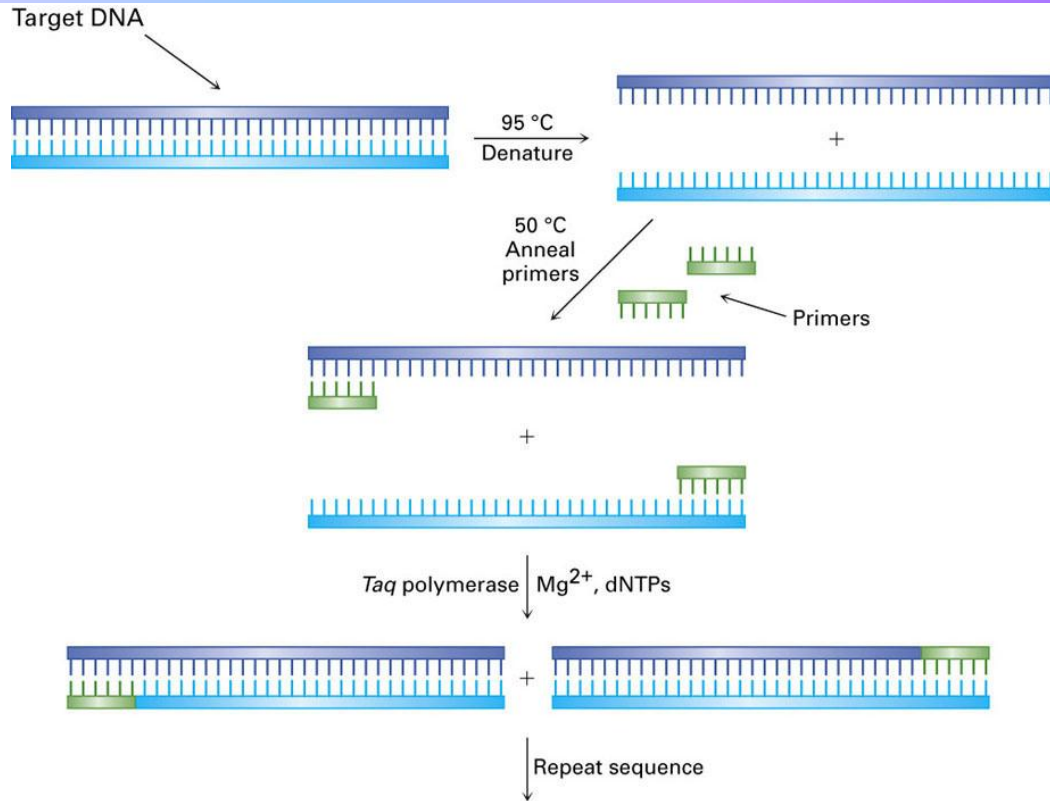
Replication

Information Storage in Polypeptides and Nucleic Acids

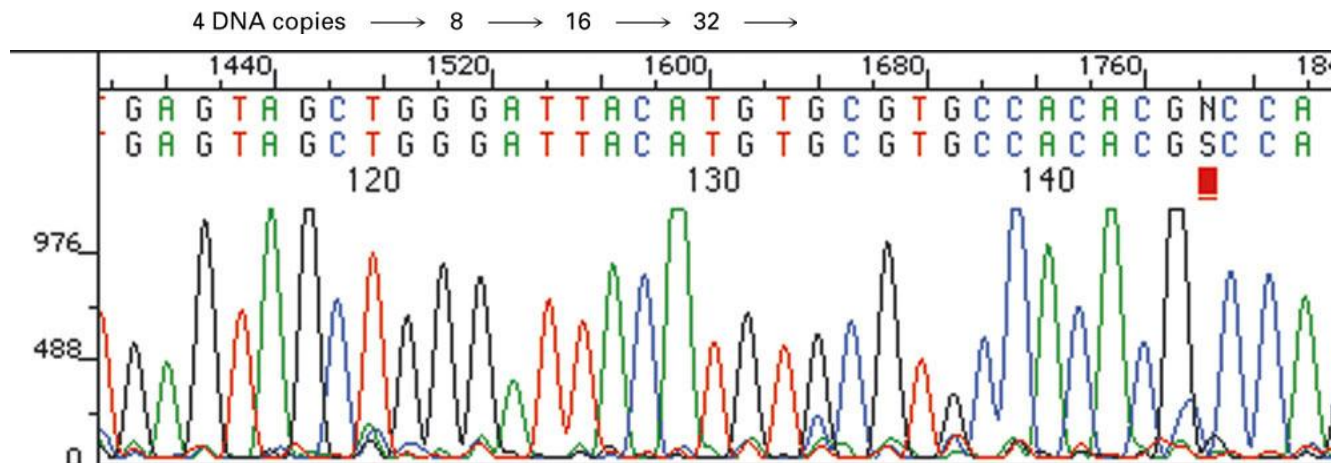
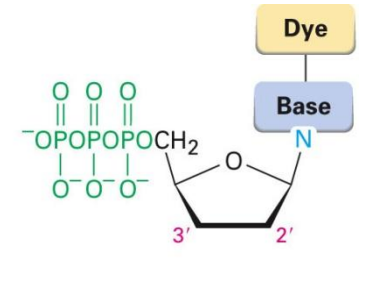
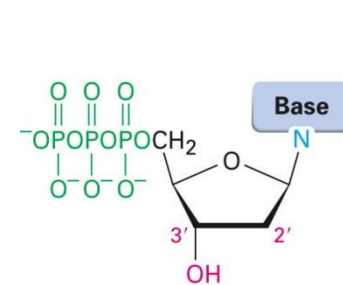
A polypeptide



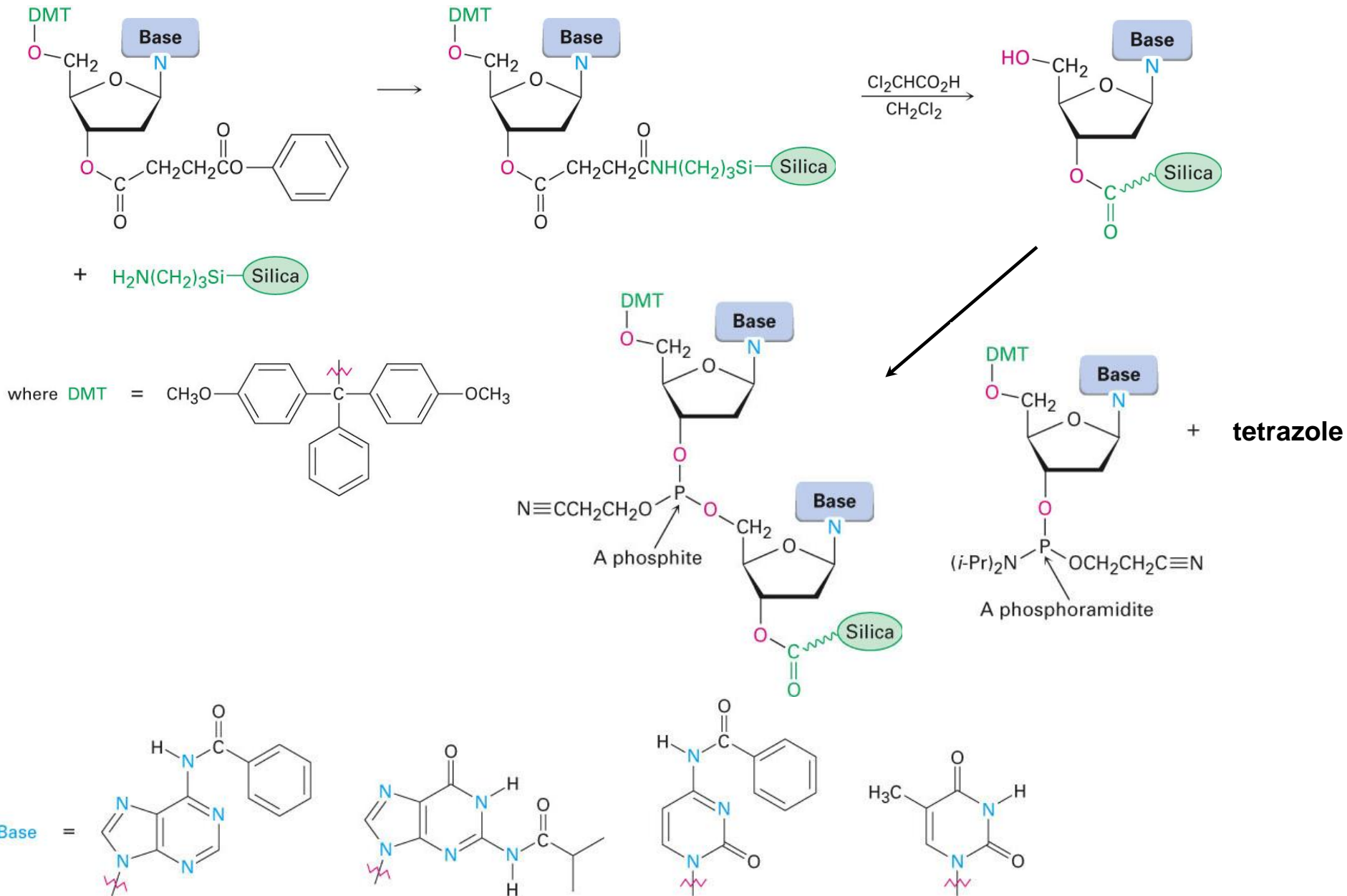
PCR and DNA Sequencing



DNA sequencing: Maxam-Gilbert (chemical) procedure and Sanger (enzymatic) method



DNA Synthesis



DNA Synthesis

