



IIT Guwahati

Lecture 3

Course BT 631

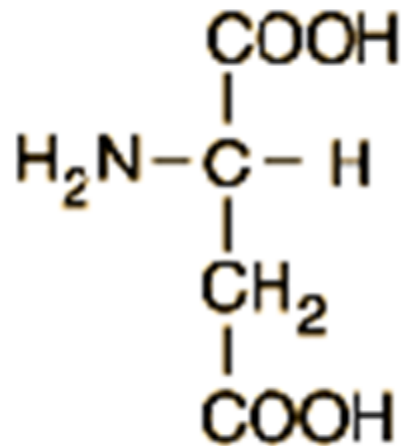
Protein Structure function and Crystallography

Prof. Arun Goyal

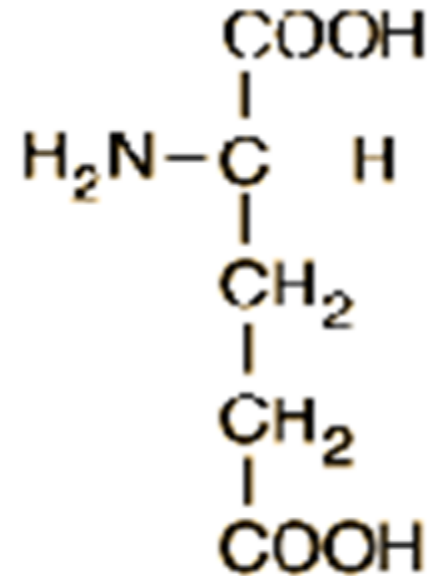
Dept. of Biosciences and Bioengineering



Di-Carboxylic Amino Acid & its Derivatives:



Aspartic Acid Asp or D



Glutamic Acid Glu or E

Negatively charged under physiological conditions exhibit chemical reaction, including esterification with alcohol coupling with amine, chelators of divalent metal ions.

Amides

Name	Symbol	Structure
Asparagine	Asn or N	$\begin{array}{c} \text{COOH} \\ \\ \text{H}_2\text{N}-\text{C}-\text{H} \\ \\ \text{CH}_2 \\ \\ \text{CONH}_2 \end{array}$
Glutamine	Gln or Q	$\begin{array}{c} \text{COOH} \\ \\ \text{H}_2\text{N}-\text{C}-\text{H} \\ \\ \text{CH}_2 \\ \\ \text{CH}_2 \\ \\ \text{CONH}_2 \end{array}$

Polar uncharged group acts as donor and acceptor for hydrogen bond and are labile at alkaline pH or extreme temperature.

Basic Amino Acids:

Lysine is strongly basic and interact with negatively charged atoms. Lysine can also undergo methylation, acetylation arylation and acylation. Methylation preserve the positive charge on the side chain. **Lysine can also react with aldehyde to form a Schiff base this reaction is important within cell because pyridoxal phosphate react with amino group of lysine which is found in active site of enzyme.**

Arginine contains the most basic side chain, the guanidium group.

Histidine has imidazole ring. It acts as proton donor and acceptor hence it acts as a biological buffer. Histidine is also found at the active site.

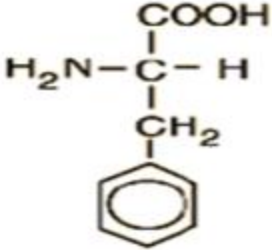
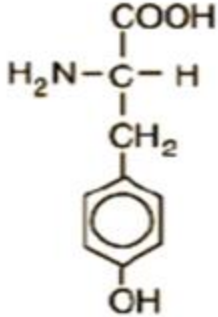
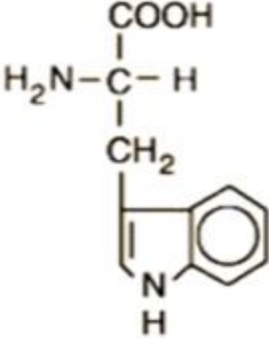
Name	Symbol	Structure
Lysine	Lys or K	
Arginine	Arg or R	
Histidine	His or H	

Aromatic amino acids

Phenylalanine: Aromatic ring of phenylalanine is chemically inert and thus resistant to chemical modification. However, it forms pi-pi interaction.

Tyrosine: is more reactive than phenylalanine due to the presence of -OH Group nucleophile such as, a nitrating agent or activated form of iodide react with tyrosine side chain in protein and change the acid-base properties of the ring.

Tryptophan: The **Indole side chain** is the largest side chain occurring in protein and it is responsible for most of the intrinsic absorbance and fluorescence.

Name	Symbol	Structure
Phenylalanine	Phe or F	
Tyrosine	Tyr or Y	
Tryptophan	Trp or W	

Aromatic amino acids

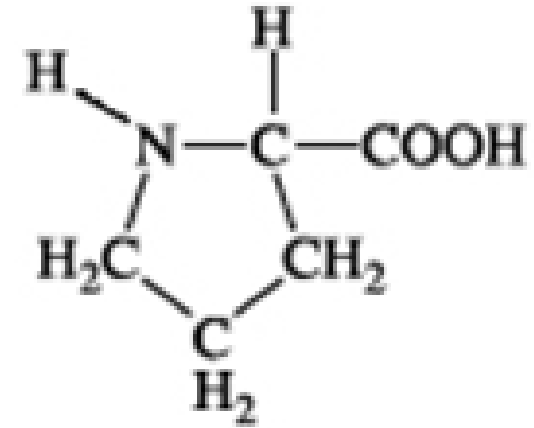
Absorbance and Fluorescence

Amino acid	Absorbance		Fluorescence	
	λ_{max} (nm)	ϵ M^1cm^{-1}	λ_{max} (nm)	Quantum yield
Phe	257.4	197	282	0.04
Tyr	274.6	1420	303	0.21
Trp	279.8	5600	348	0.20

Heterocyclic Amino Acid:

Proline

Pro or P



Proline has an aliphatic side chain, bonded to α -Nitrogen, forming pyrrolidine ring. It is the only **imino acid** found in protein.

Some uncommon Amino Acids

- A. 4-Hydroxyproline:** - Present in plant cell wall and collagen.
- B. 5-Hydroxylysine:** - Present in collagen.
- C. 6-N-Methyllysine:** - present in myosin.
- D. Carboxyglutamate:** - Present in Blood clotting protein prothrombin and calcium binding protein.
- E. Desmosine:** - A Derivatives of four lysine- e.g. Elastin.

Some uncommon Amino Acids

F. Selenocysteine: Introduced during protein synthesis rather than created through post synthetic modification. It contains selenium instead of sulfur in cysteine. It is present in catalytic site of Glutathione Peroxidase, Formate dehydrogenase.

G. Azaserine: - Act as antibiotic.

H. Pyrrolysine: - Bacterial protein.

I. Ornithine and citruline: - key intermediate in biosynthesis of arginine and urea cycle.