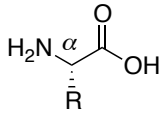
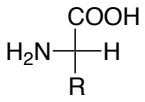
Amino Acids, Peptides, and Proteins
Learning Objectives

As we study this chapter, you should...

1) **Be familiar with the structures of α-Amino acids.** Amino acids are a type of bioorganic compound. They are classified as α-amino acids because their amino groups are attached to the carbon α to the carboxyl group. Most naturally occurring amino acids are *L* (when drawn in a Fisher projection).

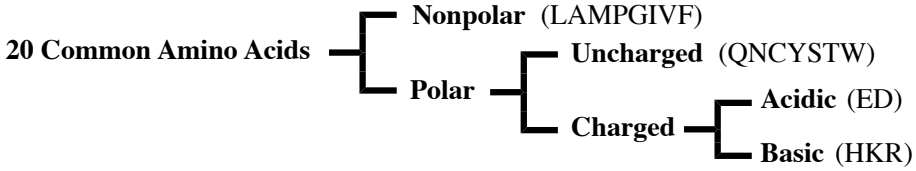


a generic α-amino acid



Fisher Projection of an *L*-amino acid

2) **Be familiar with the 20 common naturally occurring amino acids and their properties.** Understand that the 20 amino acids are commonly categorized based on the properties of their side chains. (see p 2)

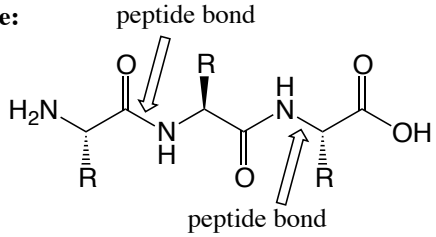


2) **Be able to predict the structure of any amino acid based on its pK_a values and the p*H* of the surrounding solution.** The Henderson-Hasselbalch equation can be used to determine the major form of an amino acid at any p*H*. In general, if the pK_a < p*H* a protic functional group will be "more acidic than the surrounding solution" and will be predominantly deprotonated. If the pK_a > p*H* a protic functional group will be "less acidic than the surrounding solution" and will be predominantly protonated.

3) **Know the various classifications of amino acid polymers.**
   A. a compound of 2-10 amino acids linked together is called a **di, tri, tetra, ... or decapeptide**.
   B. a compound of more than 10 amino acids linked together is referred to as a **polypeptide**
   C. a compound with many amino acids linked together where its mol. weight is greater than 5000 g/mol is generally referred to as a **protein**

4) **Be able to draw peptides and understand the significance of the peptide bond.** Peptide bonds are amide bonds. Due to conjugation (and resonance), the peptide bond has restricted rotation.

a tripeptide:

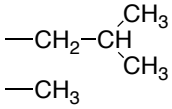
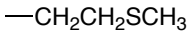
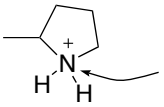
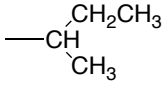
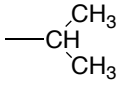
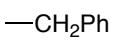
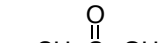
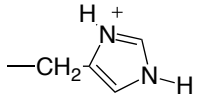
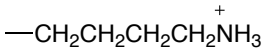
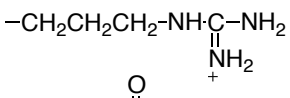
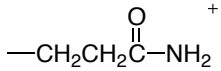
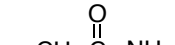
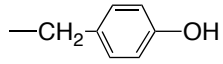
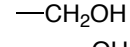
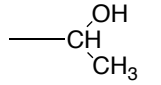
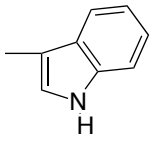


5) **Know the following terms and their significance.**
   A. N-terminus and C-terminus
   B. Zwitterion
   C. Isoelectric point
   D. Disulfide bonds. (can link same chain or different chains)
   E. Primary structure
   F. Secondary structure
      i. α-helix
      ii. β-pleated sheet
   G. Tertiary structure
   H. Quaternary structure.

6) **Understand the technique and theory of electrophoresis.**

7) **Be familiar with how polypeptides are synthesized.** In class, we will discuss the use of solid-phase synthesis to create polypeptides up to 70 amino acids long.

Amino acids arranged Mnemonically (and by physical/chemical properties)

	Name	3-letter Abbr.	1-letter Abbr.	Side Chain (protonated form)	pK_a α-COOH	pK_a α-NH_3^+	pK_a of the protonated side chain
nonpolar	leucine	Leu	L		2.4	9.6	---
	alanine	Ala	A		2.3	9.9	---
	methionine	Met	M		2.3	9.2	---
	proline	Pro	P	 this is the backbone amino group.	2.0	10.6	---
	glycine	Gly	G		2.4	9.8	---
	isoleucine	Ile	I		2.4	9.7	---
	valine	Val	V		2.3	9.6	---
	phenylalanine	Phe	F		1.8	9.1	---
acidic	glutamic acid	Glu	E		2.2	9.7	4.3
	aspartic acid	Asp	D		2.0	10.0	3.9
basic	histidine	His	H		1.8	9.2	6.0
	lysine	Lys	K		2.2	9.2	10.8
	arginine	Arg	R		1.8	9.0	12.5
polar	glutamine	Gln	Q		2.2	9.1	---
	asparagine	Asn	N		2.0	8.8	---
	cysteine	Cys	C		1.8	10.8	8.3
	tyrosine	Tyr	Y		2.2	9.1	10.9
	serine	Ser	S		2.1	9.2	---
	threonine	Thr	T		2.6	10.4	---
	tryptophan	Trp	W		2.4	9.4	---