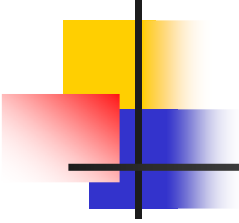
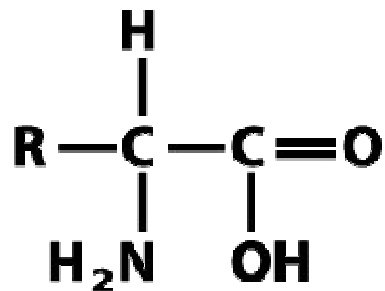


- 
- 學習目標 (p. 78-85):
 - 熟悉胺基酸在水溶液中的化學性質；
 - 瞭解胺基酸如何聚合形成蛋白質；
 - 瞭解蛋白質的各級結構及其特性。

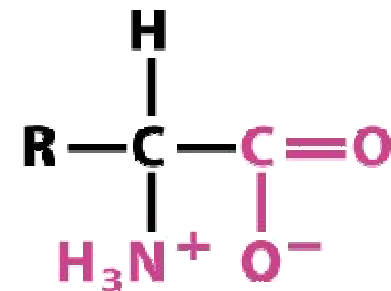


Amino acid in H₂O

- Ampholyte (amphorteric)
- Zwitterion (zwitterionic)
- Dipolar ion



Nonionic form

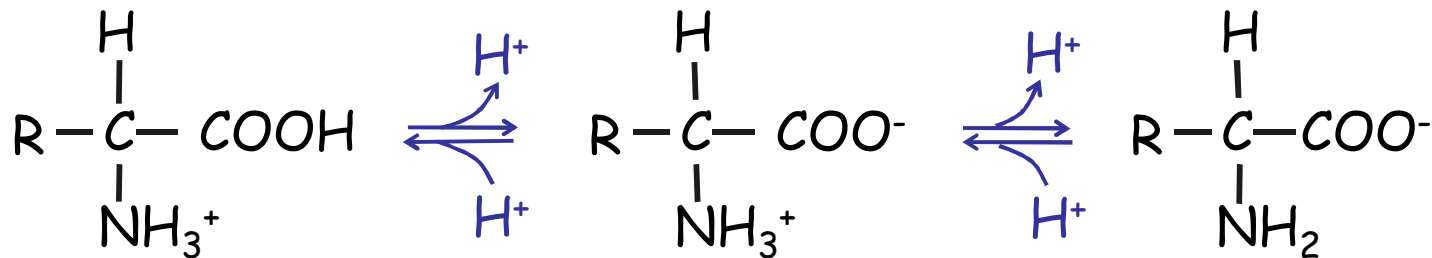


Zwitterionic form

Fig 3-9, p.79

Chemical properties of A.A.

- Can act as *an acid* or *a base* - zwitterion
- Min. 2 proton yielding groups per a.a.



Net charge:

+ 1

0

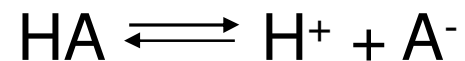
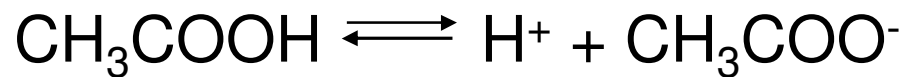
- 1

p. 79



K_a : dissociation constant

- Review Henderson-Hasselbalch Equation (p. 60)



$$K_{\text{eq}} = \frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]} = K_a$$

兩邊倒數，取 log

$$\log \frac{[\text{HA}]}{[\text{H}^+][\text{A}^-]} = \log \frac{1}{K_a}$$

At K_{eq} , $[\text{HA}] = [\text{A}^-]$

$$\rightarrow \text{At } K_{\text{eq}}, \text{pH} = \text{p}K_a$$

$\text{p}\square = -\log \square$

Titration curve of Gly (I)

- Titrate 0.1 M Gly with 0.1 M KOH

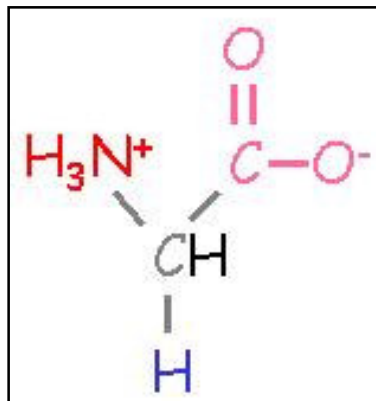
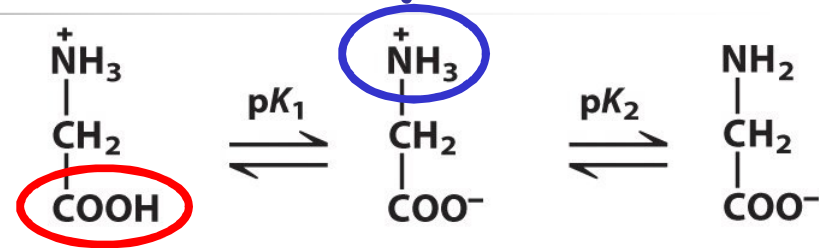
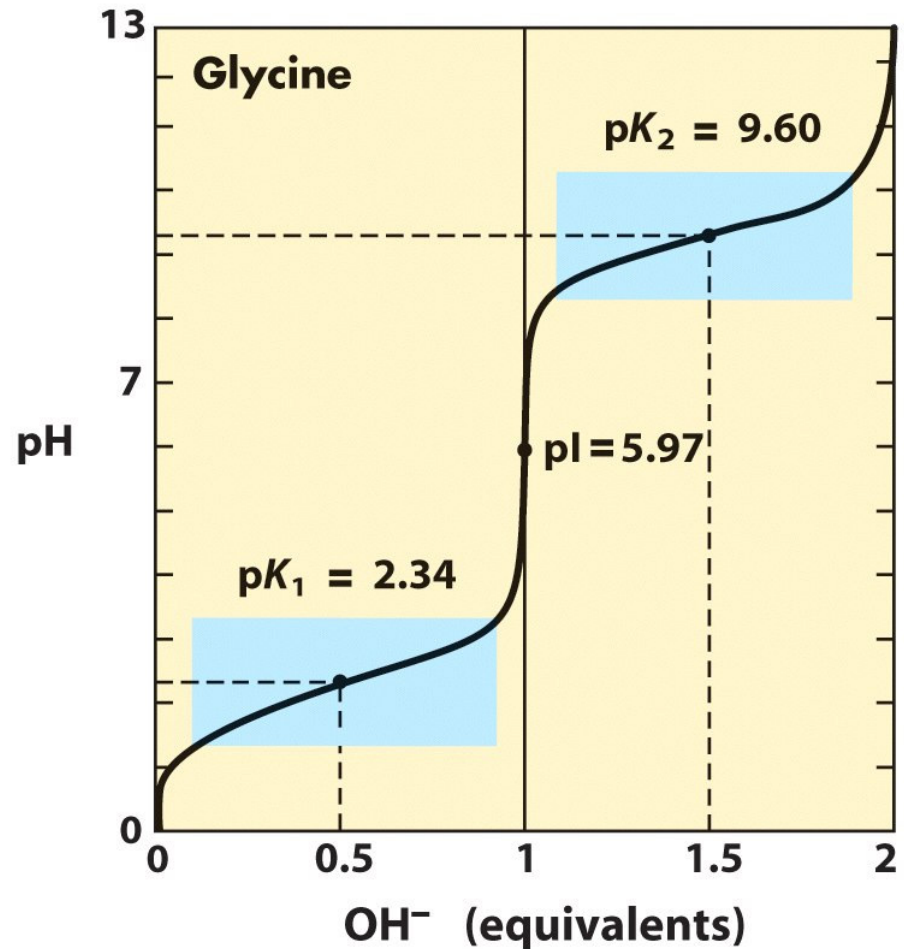


Fig 3-10, p.79



Titration curve of Gly (II)

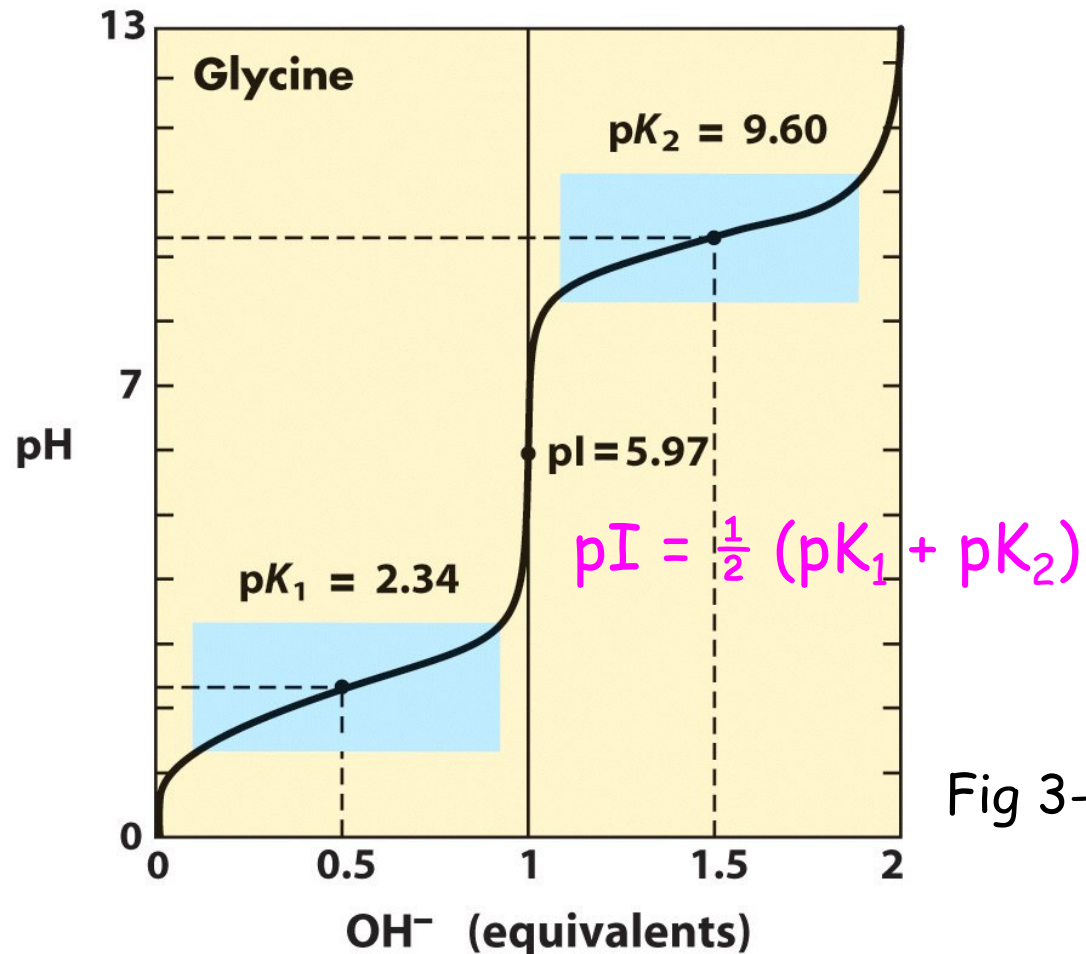
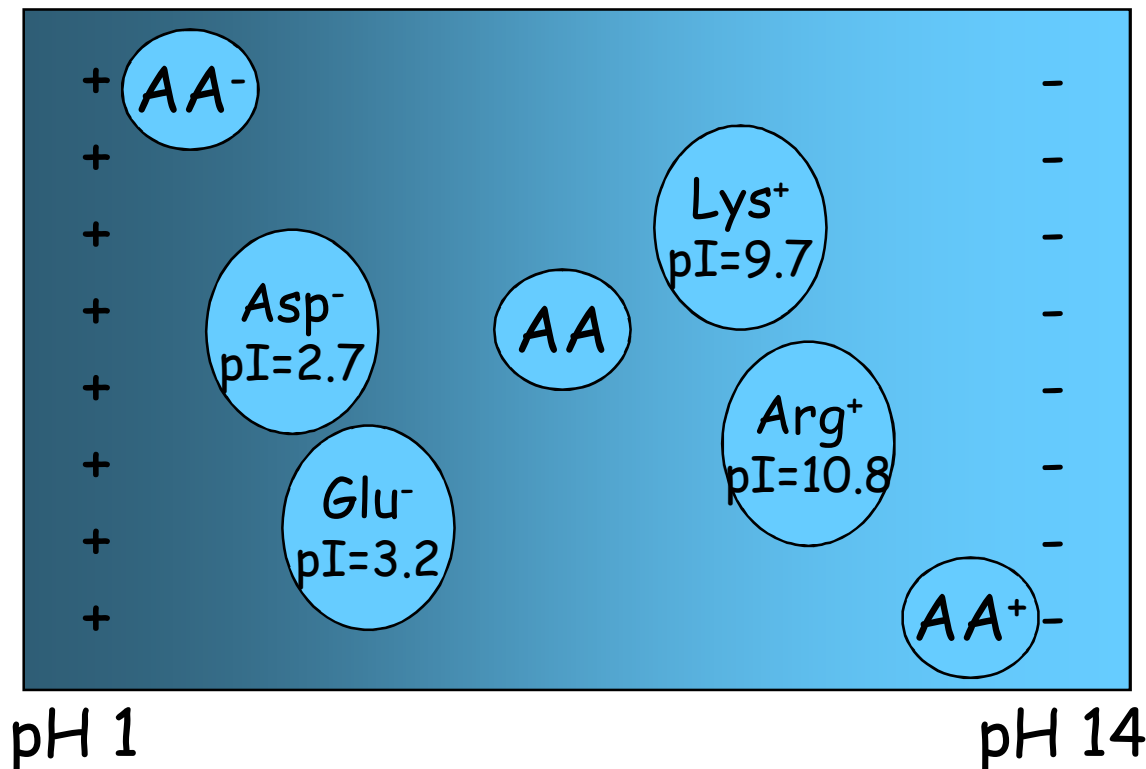


Fig 3-10

- The pKa of a.a. with no ionizing R group.
- Two buffer zones
- Net charge and pH relationship → isoelectric point or pH (pI)

What is isoelectric point (pI)?

- pI = The pH at which the net charges on an amino acid equal zero (等電點)
- At its pI, the amino acid will no longer move in an electrical field



Titration curve of Glu

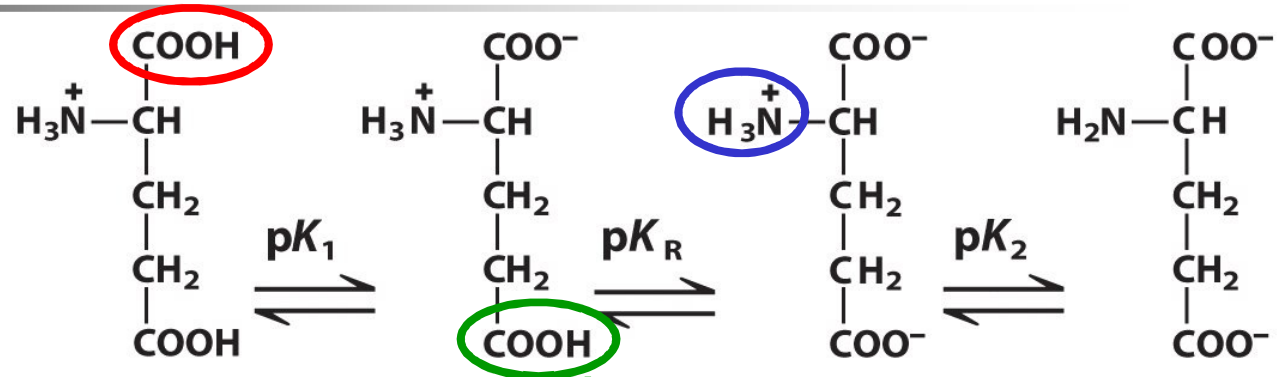
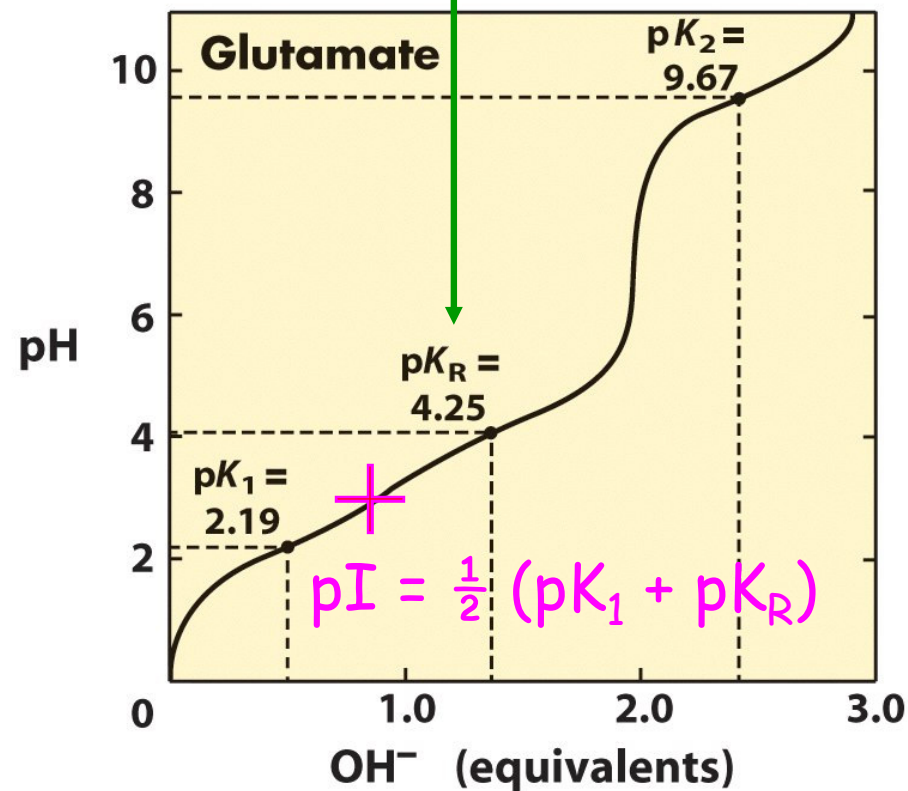


Fig 3-12a, p.81

- An ionizable R group (carboxyl)



Titration curve of His

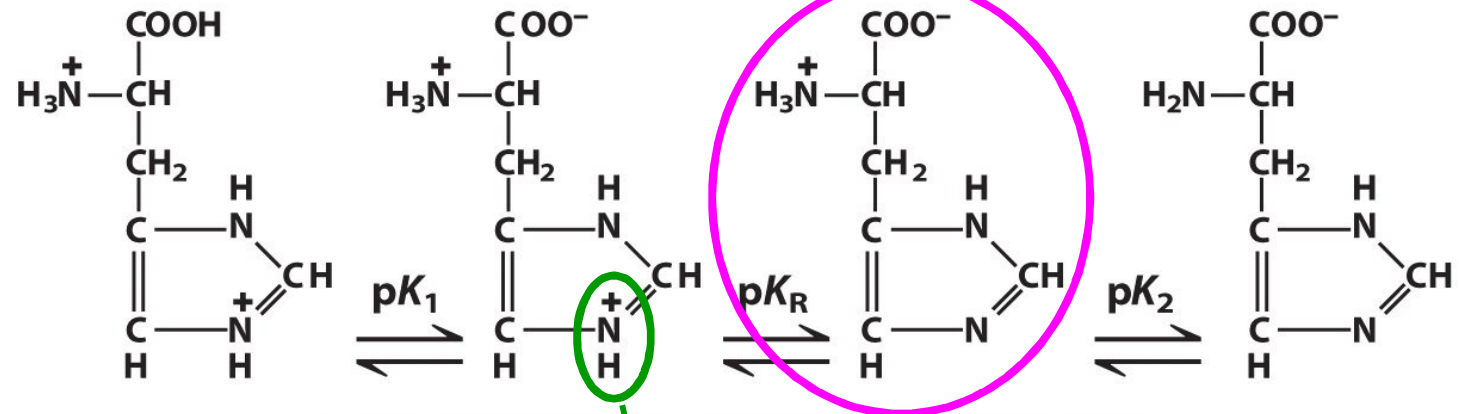
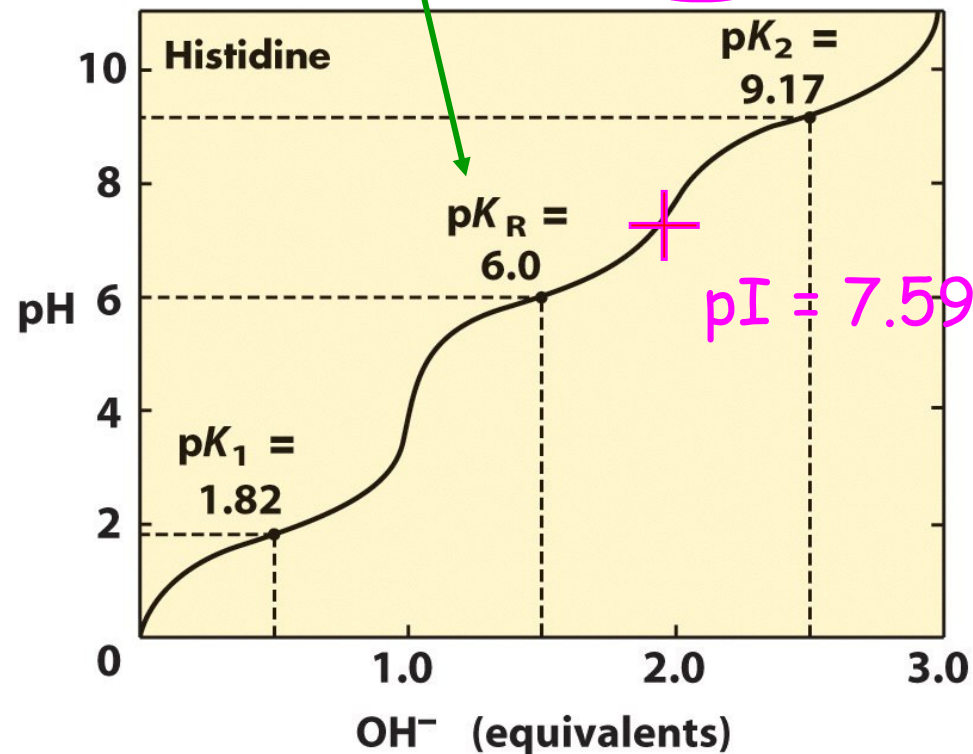
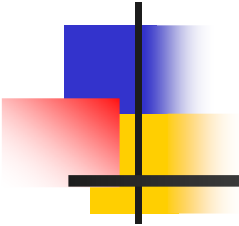


Fig 3-12b, p.81



- An ionizable R group (imidazole)
- pK_R near 7



Monomer → Polymer

Amino Acid → Peptide,
Polypeptide,
Protein

The Peptide Bond

1. Two amino acids
2. Removal of one water molecule (**condensation**)
3. Formation of the **CO-NH**

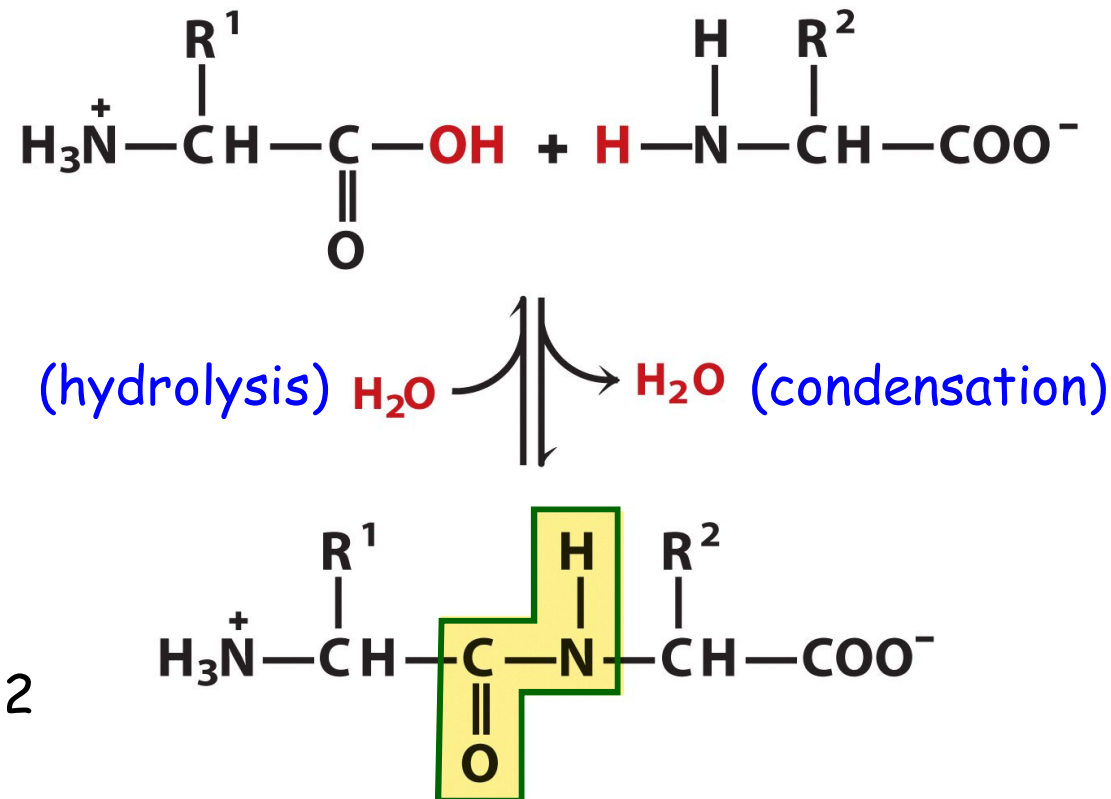
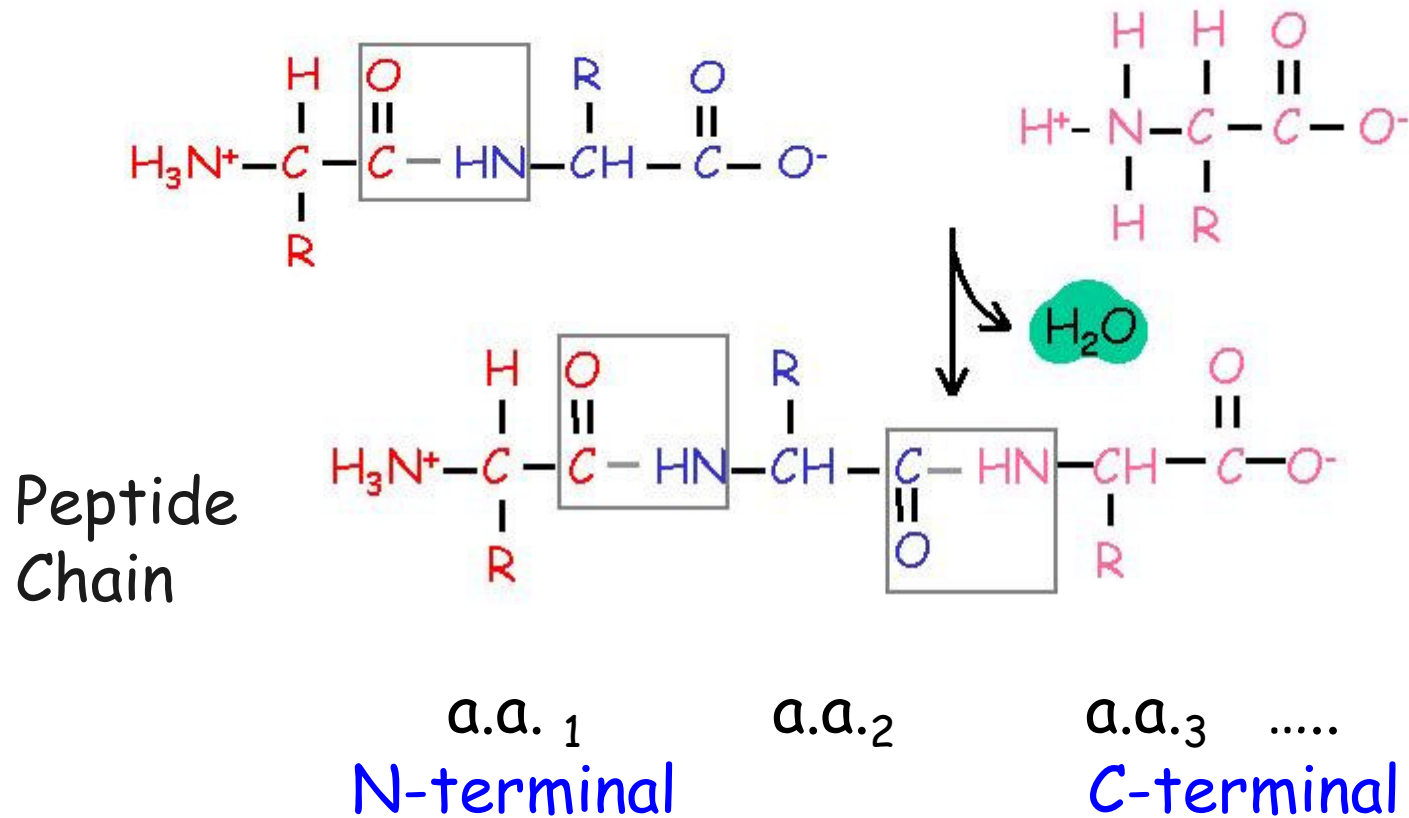


Fig 3-13, p.82

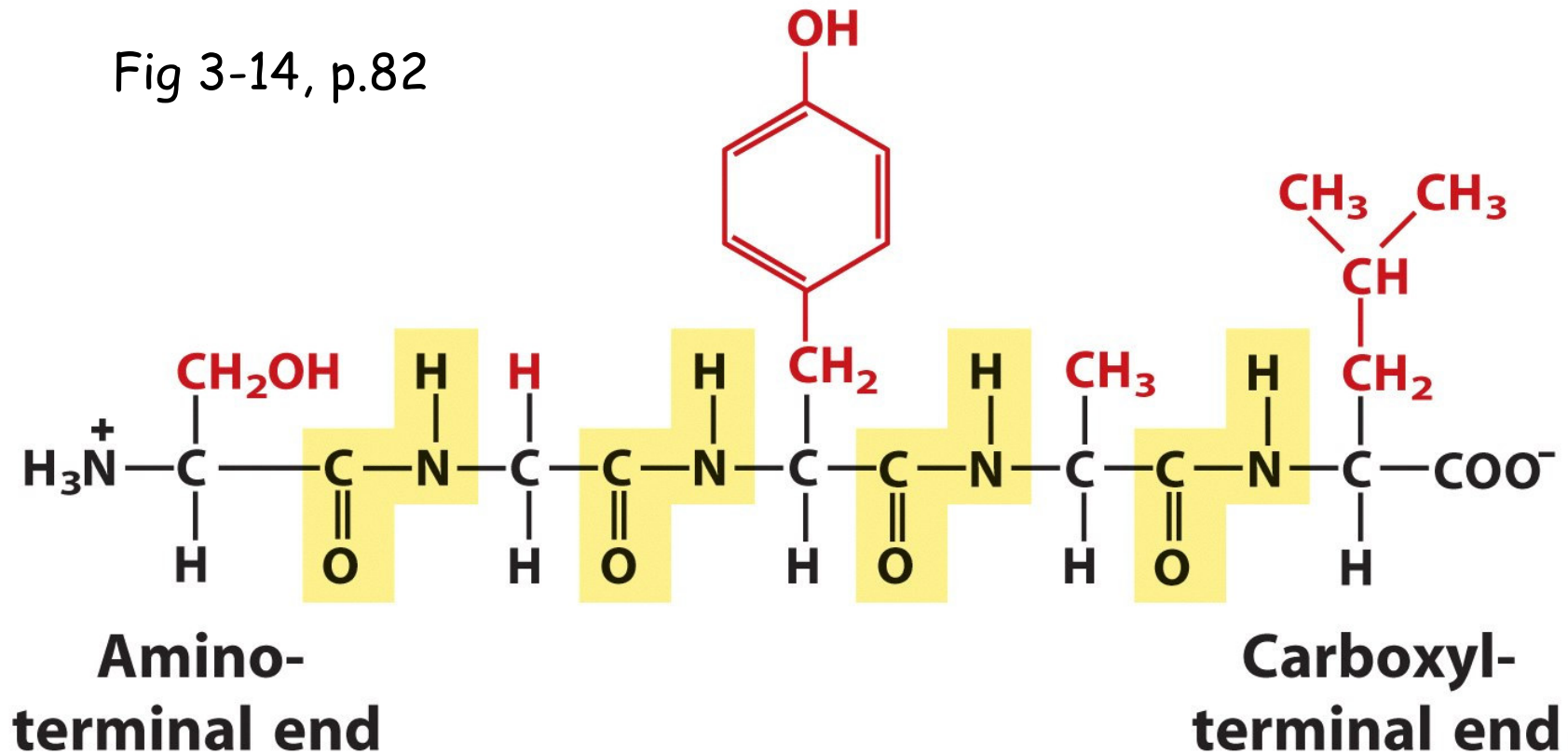
Peptide and Polypeptide



- Amino acid sequence: $aa_1-aa_2-aa_3\dots$
- Each unit is called a **residue**
- Dipeptide, tripeptide, ..., **Oligopeptide** (12-20 residues), **polypeptide**

Peptide chain

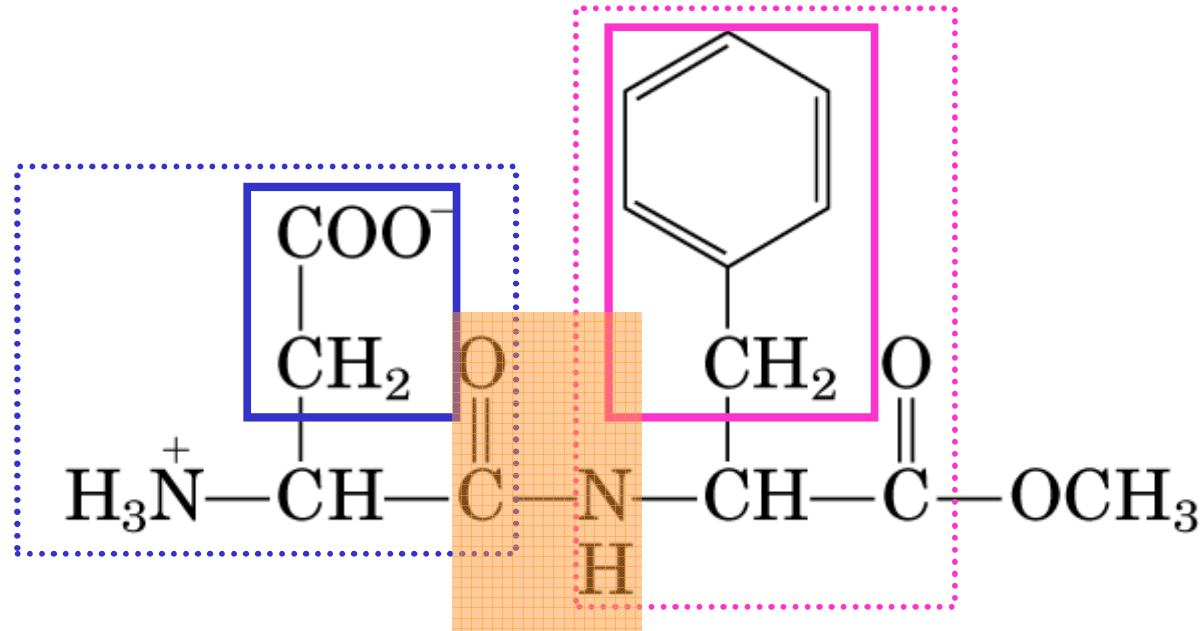
Fig 3-14, p.82



Ser - Gly - Tyr - Ala - Leu

NutraSweet (aspartame)

p. 83



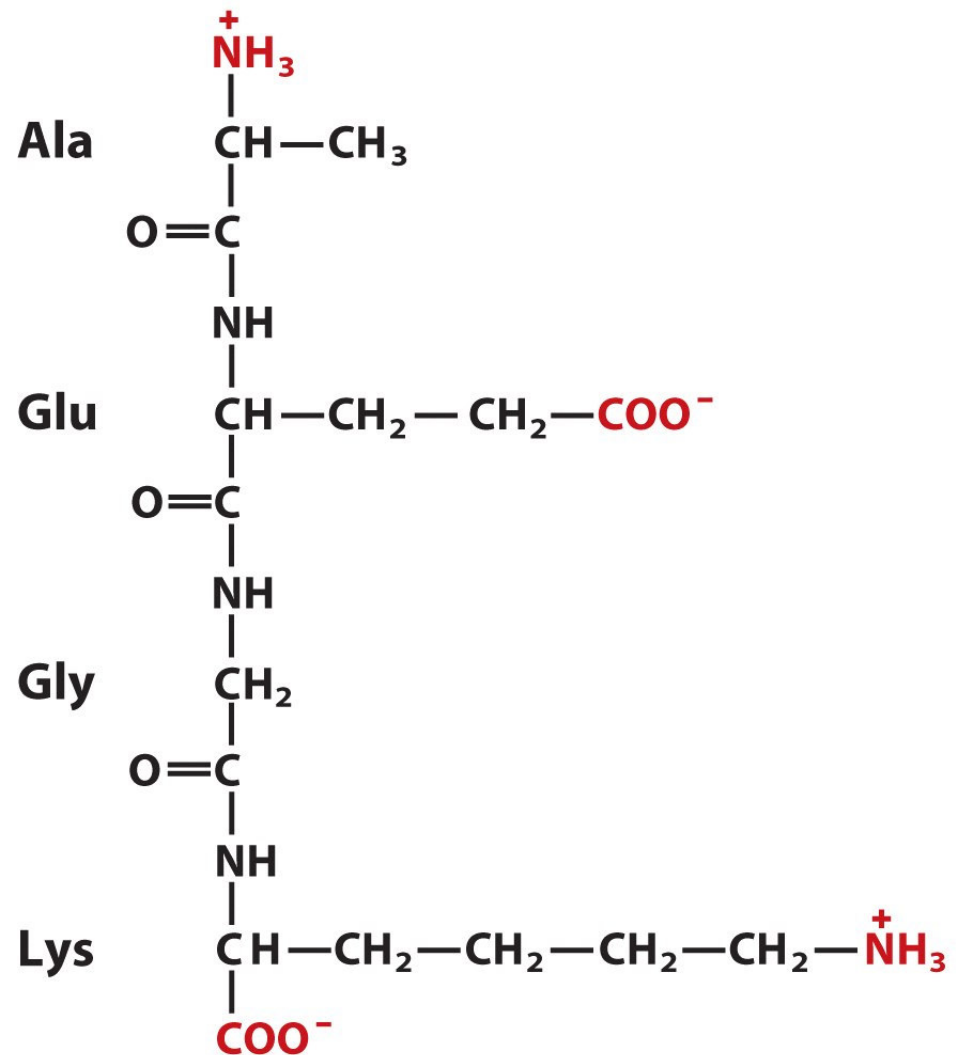
- Dipeptide (made of 2 amino acids)
- A.A. sequence: **Aspartate** + **phenylalanine**
- Artificial sweetener

Chemical properties of peptides

Determined by

1. Free α -amino
2. Free α -carboxyl
3. Nature and number of ionizable R groups

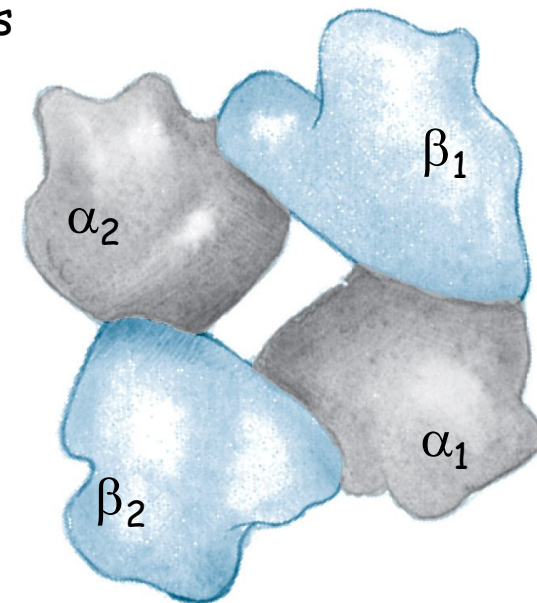
Fig 3-15, p.83



“Protein”

One or more polypeptide chains

- One polypeptide chain - a monomeric protein
- More than one - multimeric protein
 - Homomultimer - one kind of chain
 - Heteromultimer - two or more different chains
 - Hemoglobin, for example, is a heterotetramer
 - It has two α chains and two β chains



p. 86-87

Table 3-1 modified

- For 20 a.a.
 - Average $M_r \sim 138$
- The smaller a.a. predominate in most proteins.
 - Average $M_r \sim 128$
- Average M_r of an a.a. in a protein
 - **110** (= 128-18)

p.84, right column

Amino acid	M_r	Occurrence %
Gly	75	7.2
Ala	89	7.8
Val	117	6.6
Leu	131	9.1
Ile	131	5.3
Met	149	2.3
Phe	165	3.9
Tyr	181	3.2
Trp	204	1.4
Ser	105	6.8
Pro	115	5.2
Thr	119	5.9
Cys	121	1.9
Asn	132	4.3
Gln	146	4.2
Lys	146	5.9
His	155	2.3
Arg	174	5.1
Asp	133	5.3
Glu	147	6.3
Average	136.8	129.0





Conjugated proteins

Prosthetic group : non-amino acid part

Table 3-4 (p. 85)

- **Lipid** + protein = lipoprotein
- **Sugar** + protein = glycoprotein
- **Metal** + protein = metalloprotein

- Hemoglobin (heme = iron porphyrin)
- Alcohol dehydrogenase (Zn)