

第一單元：胺基酸 Amino Acids

- 1.1 標準胺基酸之分類 Amino acid classification
- 1.2 胺基酸名稱、縮寫與非標準胺基酸 Standard and nonstandard amino acids
- 1.3 胺基酸的立體結構與物理、化學性質 Amino acid stereochemistry and chemical properties
- 1.4 胺基酸脫水聚合形成胜肽 Peptide is formed by amino acids condensation

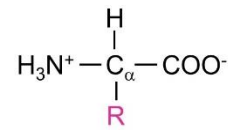
學習目標：

1. 認識胺基酸的基本結構。
2. 熟悉標準胺基酸的名稱及 3 個字母的縮寫。
3. 熟悉標準胺基酸的分類與物理、化學性質。
4. 熟悉胺基酸脫水聚合形成胜肽鏈之反應。

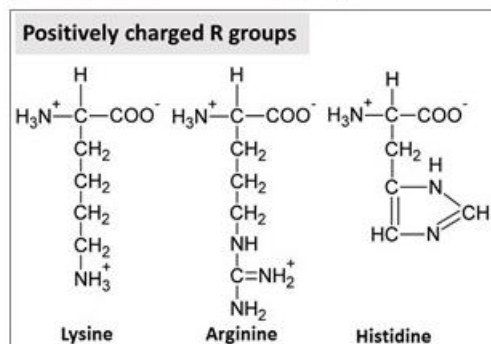
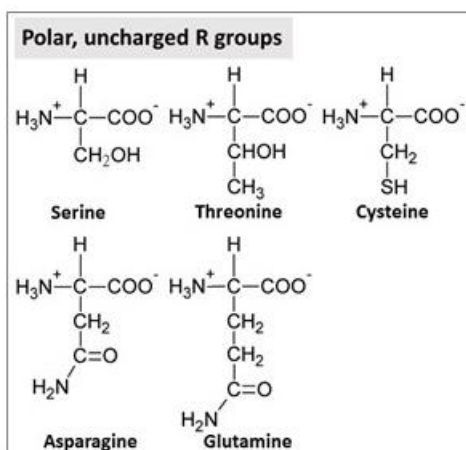
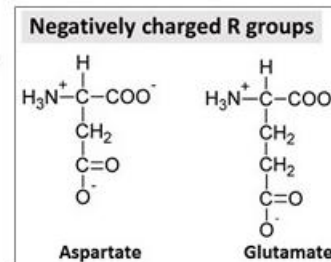
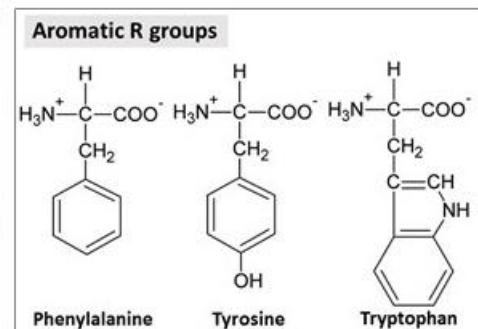
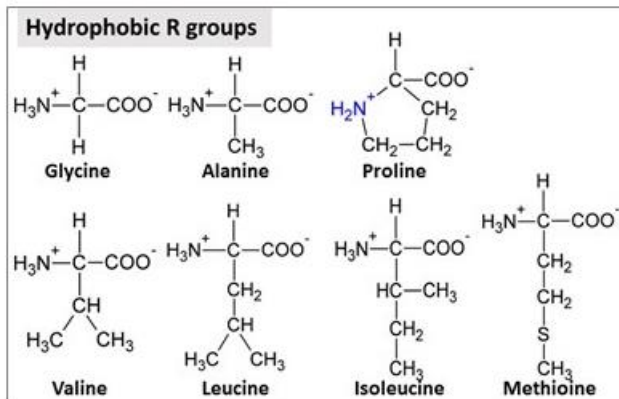
魔法筆記：

1. Basic amino acid structure and property:

- C_{α} : (chiral center): D-, L-form (stereoisomer, enantiomer)
 - **D-form: found only in few small peptides of bacterial cell wall, antibiotics.**
- Amino group
- Carboxyl group
- Side chain (R-group)



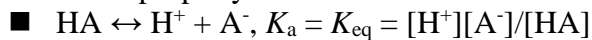
2. 20 standard amino acids:



英文名稱	縮寫		說明	中文名稱
Glycine	Gly	G		甘胺酸
Alanine	Ala	A		丙胺酸
Valine	Val	V		纈胺酸
Leucine	Leu	L		白胺酸
Iso l eu c ine	Ile	I		異白胺酸
Proline	Pro	P		脯胺酸
Methionine	Met	M		甲硫胺酸
Phenylalanine	Phe	F	“Fenylalanine”	苯丙胺酸
Tyrosine	Tyr	Y	“tYrosine”	酪胺酸
Try pt ophan	Trp	W	Double ring	色胺酸
Serine	Ser	S		絲胺酸
Threonine	Thr	T		蘇胺酸
Cysteine	Cys	C		半胱胺酸
Asparagine	Asn	N	Contains N	天門冬醯胺
Glutamine	Gln	Q	“Q-tamine”	麩胺醯胺
Lysine	Lys	K	Near L	離胺酸
Arginine	Arg	R	“aRginine”	精胺酸
Histidine	His	H		組織胺酸
Aspar t ate	Asp	D	“asparDic”	天門冬酸
Glutamate	Glu	E	“gluEamate”	麩胺酸

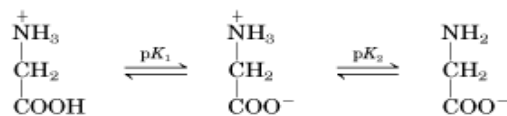
- Branched Chain Amino Acid (BCAA): Val, Leu, Ile
- Aromatic amino acids absorb UV light: $\epsilon_{280\text{nm}}$: Trp > Tyr >> Phe

3. Chemical property:

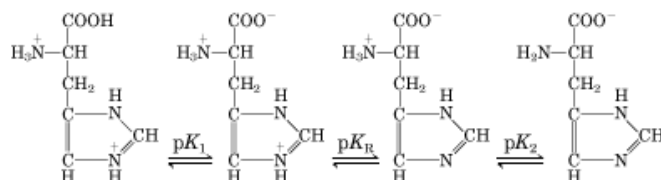


- ◇ $\text{p}K_a = \log(1/K_a) = -\log K_a$
- ◇ $\text{pH} = \text{p}K_a + \log([\text{A}^-]/[\text{HA}])$

- **Gly**: Two ionizable groups: $-\text{NH}_3^+$, and $-\text{COO}^-$; $\text{pI} = \frac{1}{2}(\text{p}K_1 + \text{p}K_2)$



- **His**: Plus an ionizable R group (imidazole), $\text{p}K_R$ near 7; $\text{pI} = \frac{1}{2}(\text{p}K_2 + \text{p}K_R)$



4. Peptide and polypeptide:

- Peptide bond: 2 amino acids joined to form the **CO-NH** upon removal of one H_2O molecule.
- Chemical property determined by: free N-terminal, free C-terminal, and all ionizable R-groups

魔咒關鍵詞：

Amino acid:

Alpha carbon (C_{α})
Amino group;
Carboxyl group (acid);
R-group (side chain)

20 standard amino acids

Hydrophobic;
Aromatic;
Polar uncharged;
Positively charged;
Negatively charged.

Chiral center (C_{α}) : Enantiomers (stereoisomer), D-form and L-form

Amino acid titration curve ; net charge ; isoelectric point (pI)

Peptide bond ; peptide ; polypeptide

Simple protein and conjugated protein (protein + prosthetic group)

魔法參考書目：

1. 台大莊榮輝教授教學網頁: <http://juang.bst.ntu.edu.tw/BCbasics/index.htm>
2. Lehninger Principles of Biochemistry (2013), 6th ed, David L. Nelson, and Michael M. Cox, Freeman and Company, New York.
3. Principles of Biochemistry (2013) 4th ed. Voet, Voet, and Pratt. Wiley.
4. Biochemistry, a short course. (2015) John L. Tymoczko, Jeremy M. Berg, Lubert Stryer (3rd ed) W.H. Freeman & Company.

魔法練習題：

1. 標準胺基酸可分為那五類？請描述各類胺基酸之結構特徵。
2. 20個標準胺基酸中，含有硫元素的是哪些？
3. 哪些胺基酸能吸收紫外線 280 奈米(nm)波長的光？請寫出它的 3 個字母的縮寫。
4. 哪些胺基酸又稱為支鏈胺基酸？請寫出它的 3 個字母的縮寫。
5. 哪個胺基酸不具有光學異構物(enantiomer)？
6. 請畫出胜肽 Gln-Ile-Cys-Glu 的化學結構式。