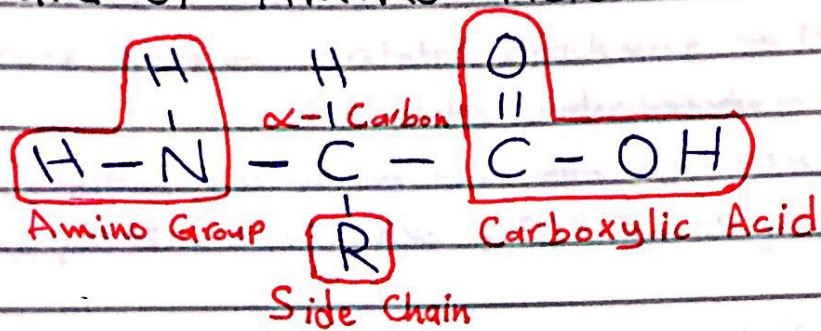


# \* Amino Acids 1

P.1

⇒ The structure of Amino Acids:

\* Key elements  
{C, N, O, H}



Note: Usually Amino group ( $\text{NH}_2$ ) is attached to  $\alpha$ -carbon

⇒ Biological significance of Amino Acids

1. Source of nitrogen
2. Source of energy
3. Monomers of proteins
4. Precursors of many biomolecules like neurotransmitters (non-protein role)

\* النقا مرفوعة بشكل بسيط ومعتاد  
وقد يكون من الأفضل مراجعة الملائمة هنا

⇒ Isomerization:

\* لا يعطيان ال isomers إلا التوقع

Stereoisomers → Enantiomers: are two stereoisomers that are mirror images to each other but not superimposable

- \* Nomenclature: D- (dexter) : amino group on the "Right"
- L- (laevus) : amino group on the "Left"

Note: \* Most naturally occurring **sugars** are D-isomers

\* Most naturally occurring **amino acids** are L-isomers

Note 2: D-amino acids polypeptides are components of **bacterial cell walls** to resist digestion by other organisms

- 1) Amino acids with non-polar R groups
- 2) Amino acids with charged polar R groups
- 3) Amino acids with uncharged polar R groups

# ⇒ Optical Activity :

هذا الاختار يستخدم للتفرقة بين الenantiomers

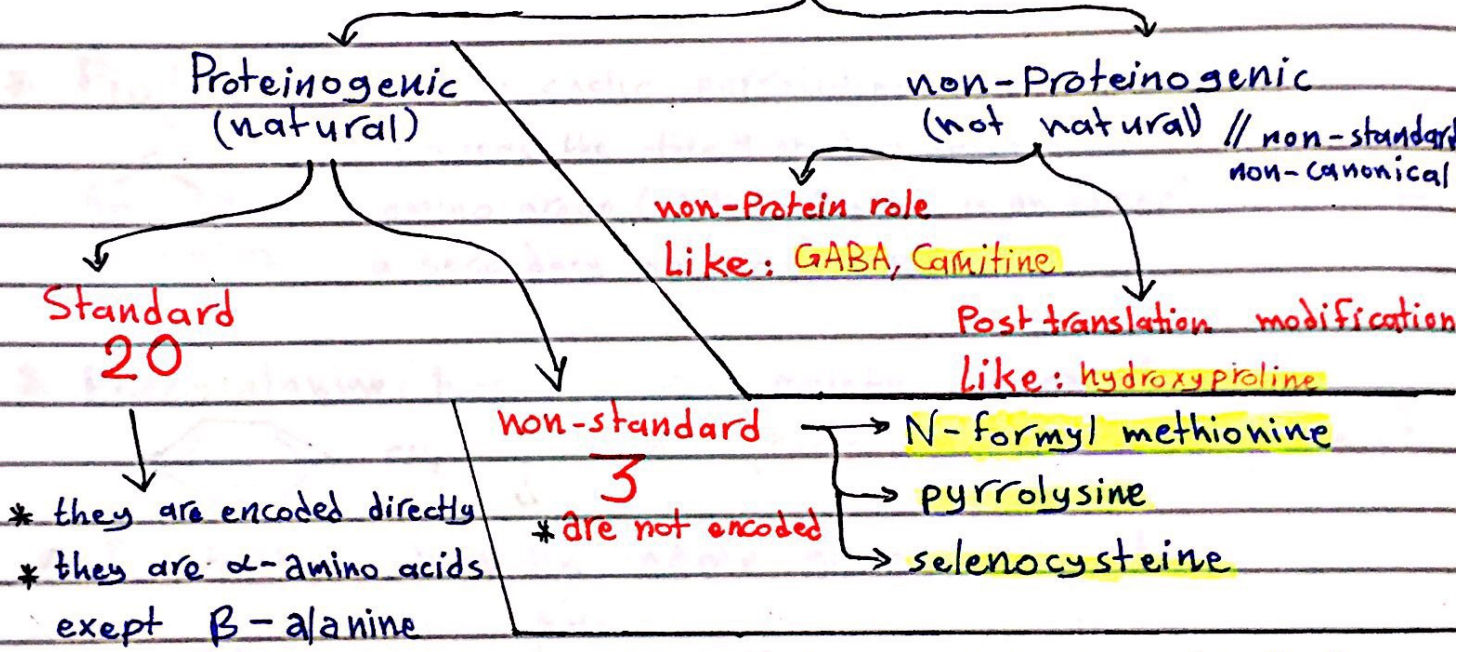
- \* Enantiomers are optically active and can rotate polarized light plane either clockwise (+)(d) or counterclockwise (-)(l)
- \* Nomenclature system: if rotates clockwise → (+) or (d) if it rotates counterclockwise → (-) or (l)
- \* Note: D/L system has nothing to do with + / - system

بالعربي: نظام التسمية D/L و نظام + / - لا علاقة لهم ببعضهما أبدا

\* Note: **Racemic mixture**: contains equal amount of each enantiomer

# ⇒ Classification :

## Amino Acids



\* they are encoded directly  
 \* they are α-amino acids except β-alanine

\* are not encoded  
 N-formyl methionine  
 pyrrolysine  
 selenocysteine

\* they are all chiral molecules except glycine which has achiral C  
 \* the all have primary amino group (NH<sub>2</sub>) except proline which has a secondary amino group (-NH-)

Note: β-peptides are artificial peptides except β-alanine  
 used ↓ in antibiotics      [for more details check the slides]      used ↓ in synthesis of vitamin B<sub>5</sub> (pantothenic acid)

# ⇒ Categories of standard Amino Acids

- 1) Amino acids with non-polar R groups
- 2) Amino acids with charged polar R groups
- 3) Amino acids with uncharged polar R groups

standard

## → Amino acids with non-polar R groups:

- \* **Glycine**: 1. has the simplest side chain: H atom only  

$$\text{H}_3\text{N}^+ - \overset{\text{COO}^-}{\underset{\text{H}}{\text{C}}} - \text{H}$$
2. has achiral C in other words has **NO** isomers  
3. has aliphatic (acyclic) hydrocarbon side chains

- \* **Alanine, Valine, leucine and isoleucine**: have aliphatic hydrocarbon side chains
- |  |   |  |   |  |
|--|---|--|---|--|
| $\text{H}_3\text{N}^+ - \overset{\text{COO}^-}{\underset{\text{CH}_3}{\text{C}}} - \text{H}$ | $\text{H}_3\text{N}^+ - \overset{\text{COO}^-}{\underset{\text{CH}(\text{CH}_3)_2}{\text{C}}} - \text{H}$ | $\text{H}_3\text{N}^+ - \overset{\text{COO}^-}{\underset{\text{CH}_2\text{CH}(\text{CH}_3)_2}{\text{C}}} - \text{H}$ | $\text{H}_3\text{N}^+ - \overset{\text{COO}^-}{\underset{\text{CH}(\text{CH}_3)_2}{\text{C}}} - \text{H}$ |  |
|--|---|--|---|--|

- \* **Methionine**: 1. has aliphatic hydrocarbon side chain  

$$\text{CH}_3 - \text{S} - \text{CH}_2 - \text{CH}_2 - \overset{\text{NH}_3^+}{\underset{\text{H}}{\text{C}}} - \text{COO}^-$$
2. has a thioether side chain (sulfur atom)

- \* **Proline**: 1. has a cyclic pyrrolidine side chain  

$$\begin{array}{c} \text{COO}^- \\ | \\ \text{C} - \text{H} \\ / \quad \backslash \\ \text{NH} \quad \text{CH}_2 \\ | \quad \quad | \\ \text{CH}_2 - \text{CH}_2 \end{array}$$
2. Whereas the other 19 standard amino acids has primary amino group (-NH<sub>2</sub>), Proline is an exception which has a secondary amino (group).

- \* **Phenylalanine**: has a phenyl moiety, aromatic  

$$\text{C}_6\text{H}_5 - \text{CH}_2 - \overset{\text{NH}_3^+}{\underset{\text{H}}{\text{C}}} - \text{COO}^-$$
{ Phenylalanine = alanine + phenyl moiety }

- \* **Tryptophan**: has an indole group, aromatic  

$$\text{Indole} - \text{CH}_2 - \overset{\text{NH}_3^+}{\underset{\text{H}}{\text{C}}} - \text{COO}^-$$
{ Tryptophan = alanine + indole group }

## → Amino acids with charged polar R groups:

- 3 Amino acids → + charge → basic (NH<sub>3</sub><sup>+</sup>)
- 2 Amino acids → - charge → acidic (COO<sup>-</sup>)

توضيح: أول 3 أمينو أسيدس يحتويون في السلسلة الجانبية (R) على مجموعة أمين (NH<sub>2</sub>) القاعدية التي تتحول إلى (NH<sub>3</sub><sup>+</sup>) وبالتالي تكسب البجوة إيجابية (الأمينو أسيد) الشحنة الموجبة بينما في حالة الأمينو أسيدس الأخرين فهنا يرتويان على (COOH) في (R) التي تتحول إلى (COO<sup>-</sup>) سالبة الشحنة

ملاحظة: الرجاء الرجوع إلى السلايدات و دراسة زهابي من هناك