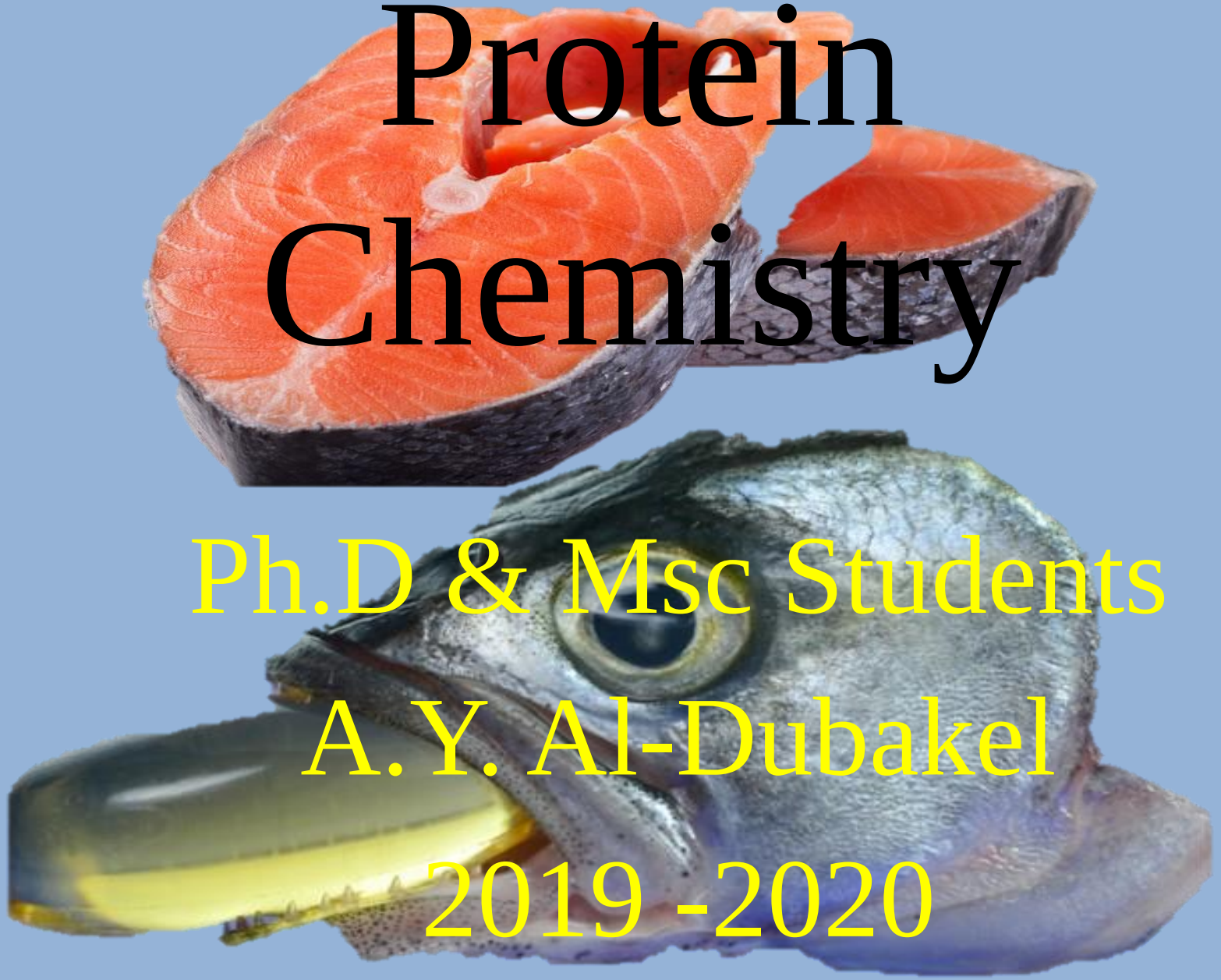
Protein Chemistry



Ph.D & Msc Students

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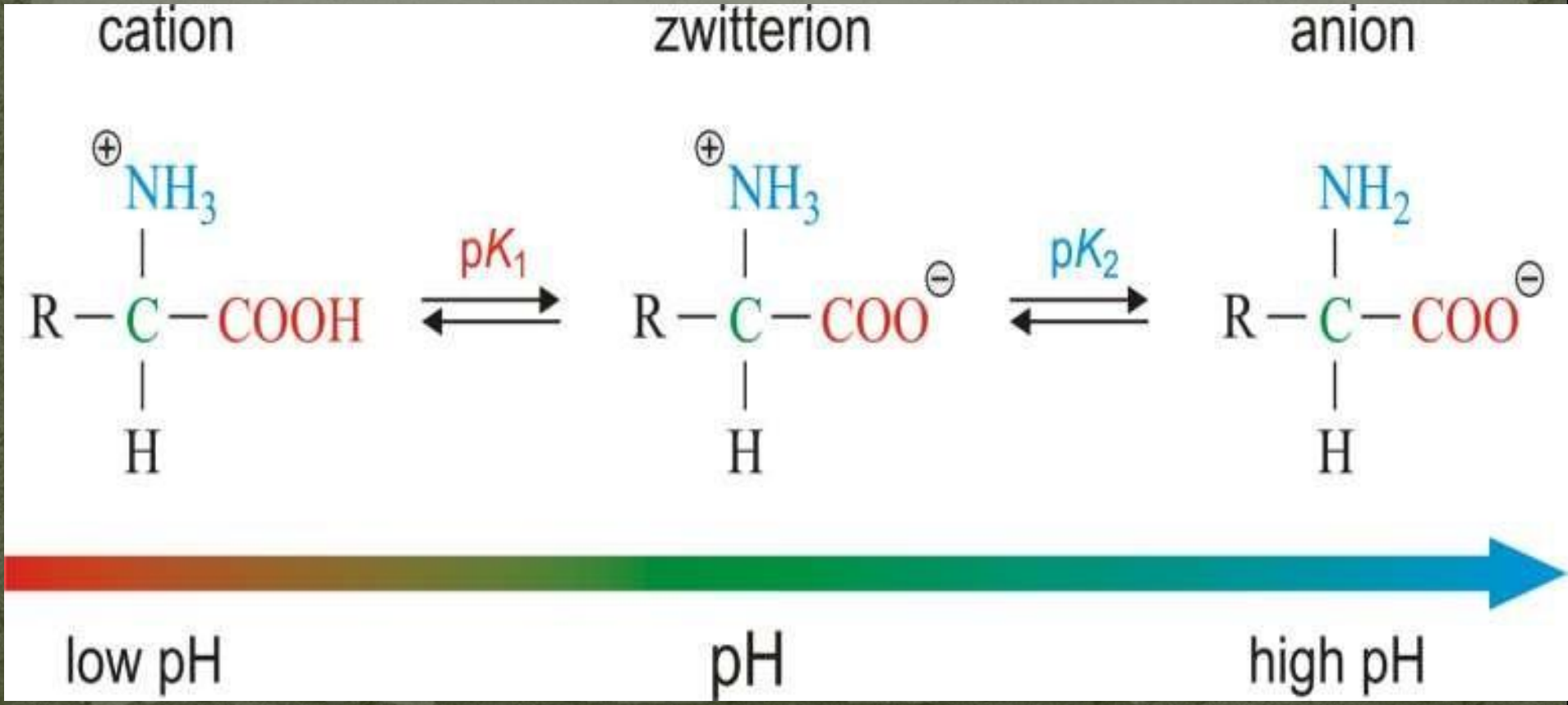
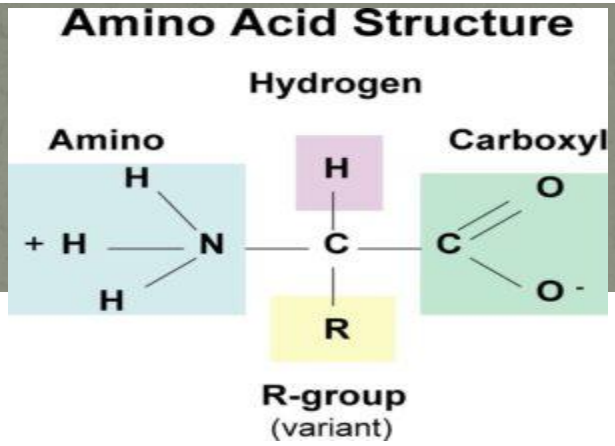
2019 -2020

- At pH 7,all amino acids are **zwitterionic** having positively charged amino group and a negatively charged carbooxylate group hence amino acids.

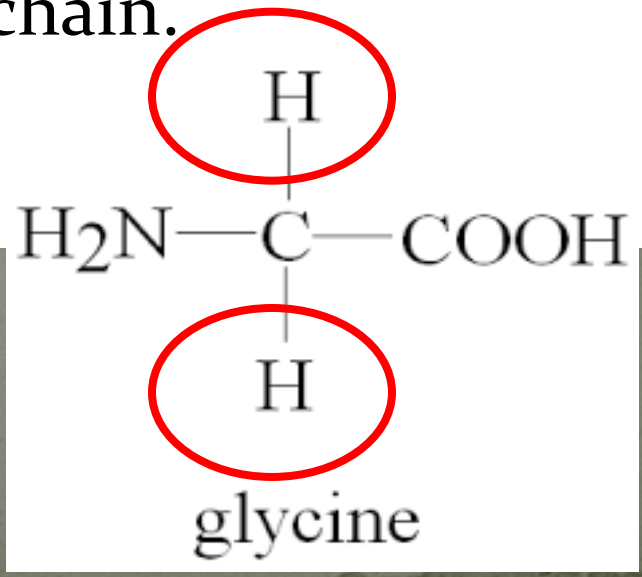


All 20 of the common amino acids are alpha-amino acids. They contain a carboxyl group, an amino group, and a side chain (R group), all attached to the α-carbon.



Exceptions are:

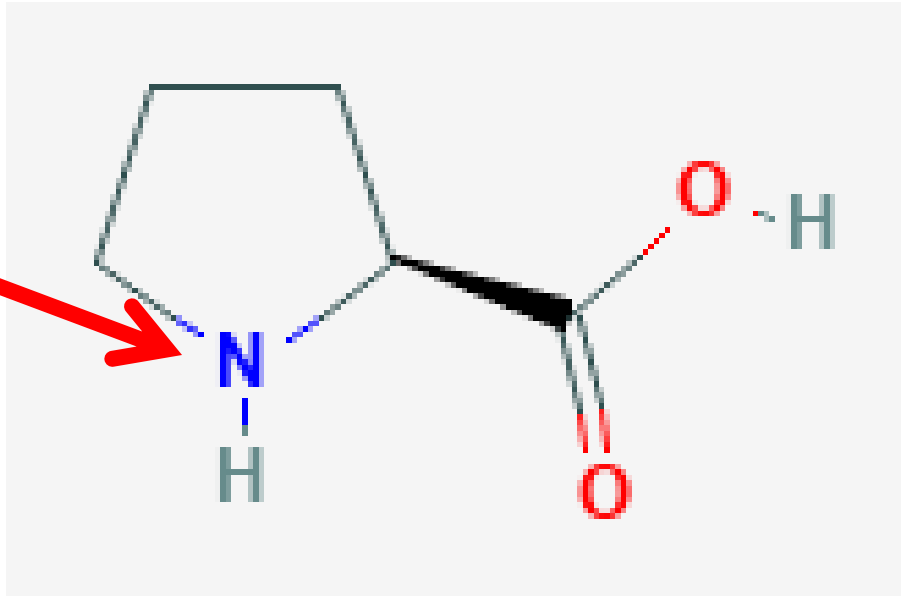
Glycine, which does not have a side chain.
Its α-carbon contains two hydrogen.



The R groups have a variety of shapes, sizes, charges, and reactivities. This allows amino acids to be grouped according to the chemical properties of their side chains.

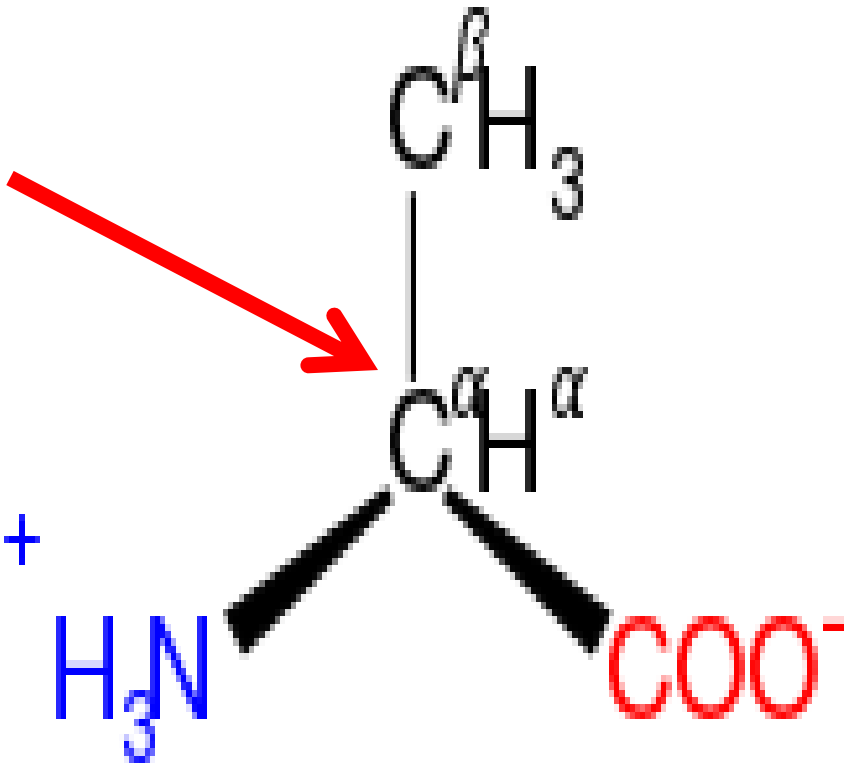
Exceptions are:

Proline, in which the nitrogen is part of a ring.



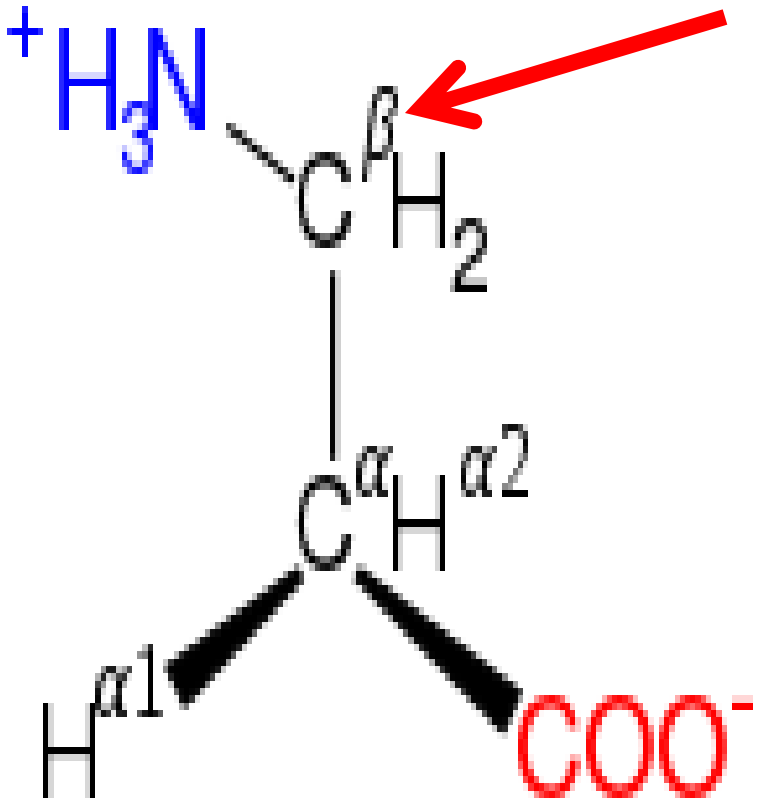
All of the 20 amino acids except "glycine" are of the L-configuration, as for all but one amino acid the α-carbon is an asymmetric carbon. Because glycine does not contain an asymmetric carbon atom, it is not optically active and, thus, it is neither D nor L.

Alpha-amino acid



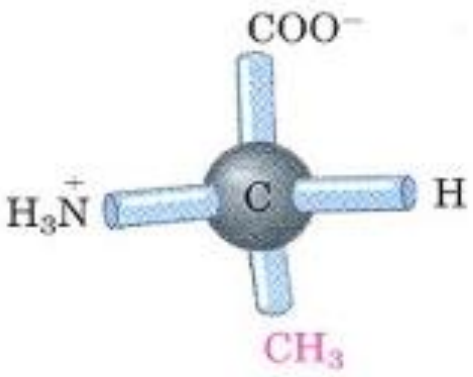
α-alanine

Beta-amino acid

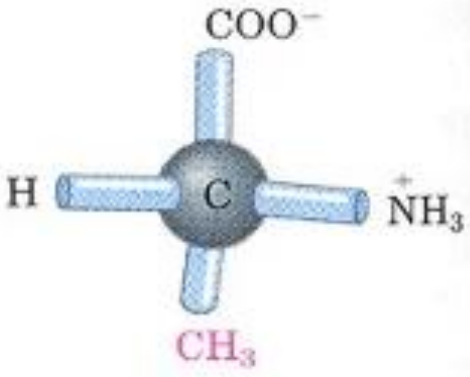


β-alanine

All are optical active and exist in D and L forms because α-carbon is an asymmetric carbon

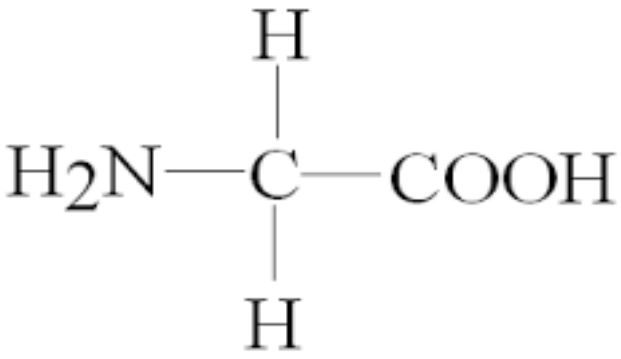


L-Alanine



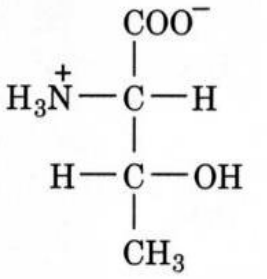
D-Alanine

except "glycine"

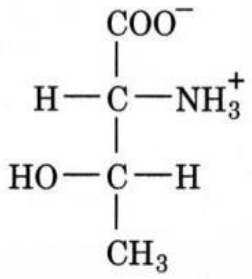


glycine

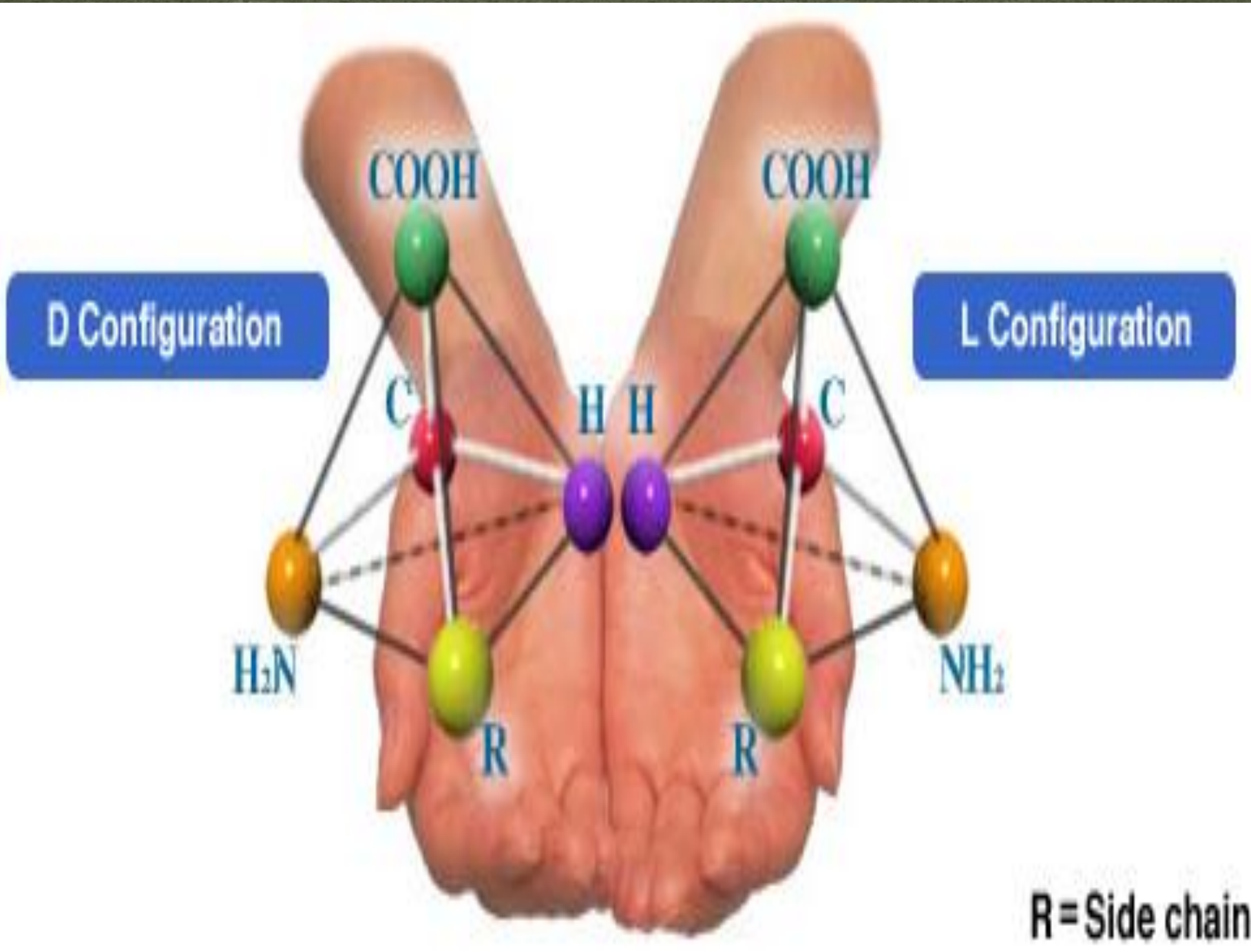
An example of an amino acid with two asymmetric carbons



L-Threonine



D-Threonine


D Configuration
L Configuration
COOH
COOH
C
C
H H
H₂N
NH₂
R
R
R = Side chain

Functions of Amino acids

20 very important amino acids are crucial for life as they contain peptides and proteins and are known to be the building blocks for all living things. The linear sequence of amino acid residues in a polypeptide chain determines the three-dimensional configuration of a protein, and the structure of a protein determines its function.

Functions of Amino acids

Amino acids are imperative for sustaining the health of the organisms body.

They largely promote the:

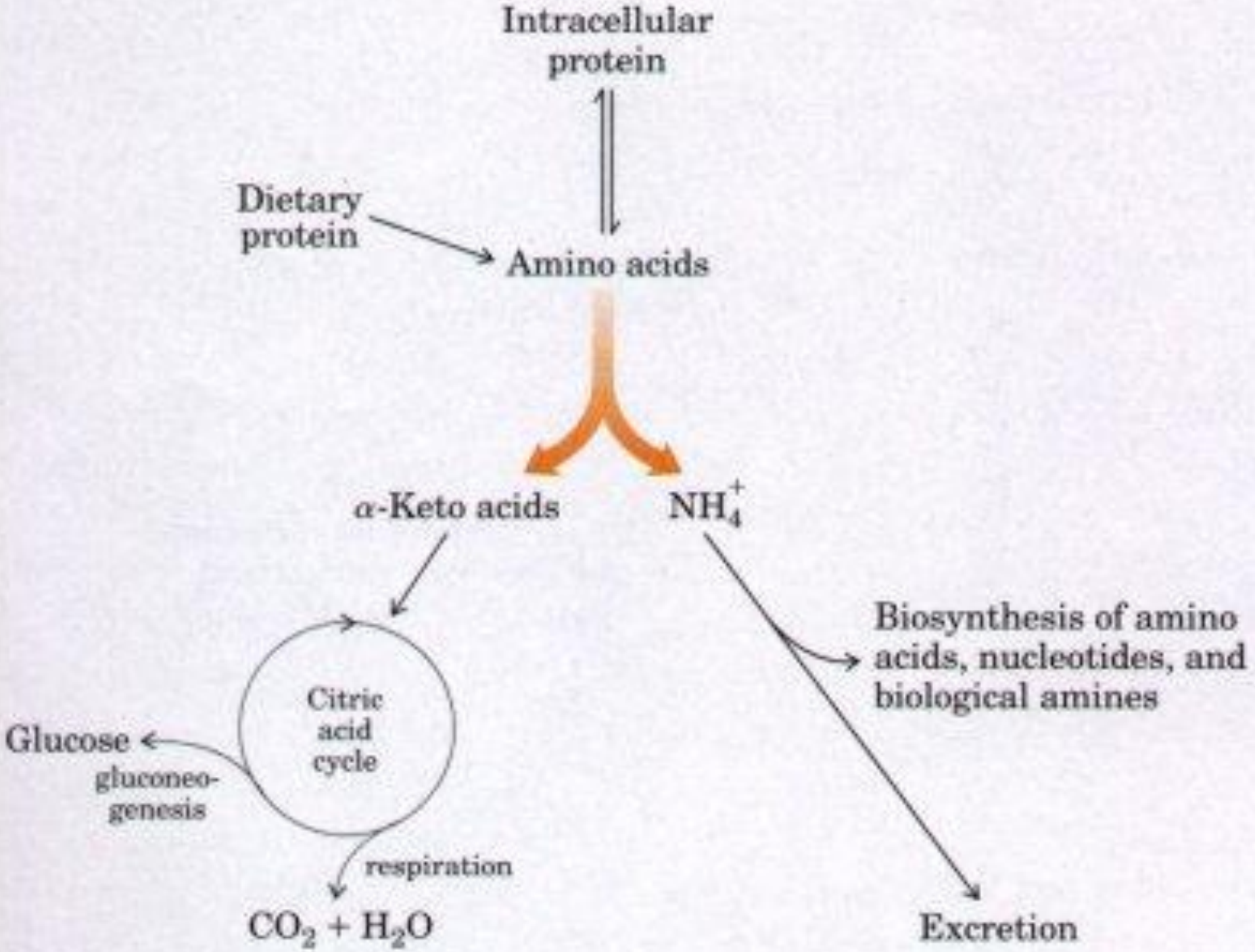
- Production of hormones
- Structure of muscles
- Nervous system's healthy functioning
- The health of vital organs
- Normal cellular structure
- Synthesize proteins
- produce nitrogen-containing compounds (e.g., purines, heme, creatine, epinephrine)
- oxidized to produce energy.

Functions of Amino acids

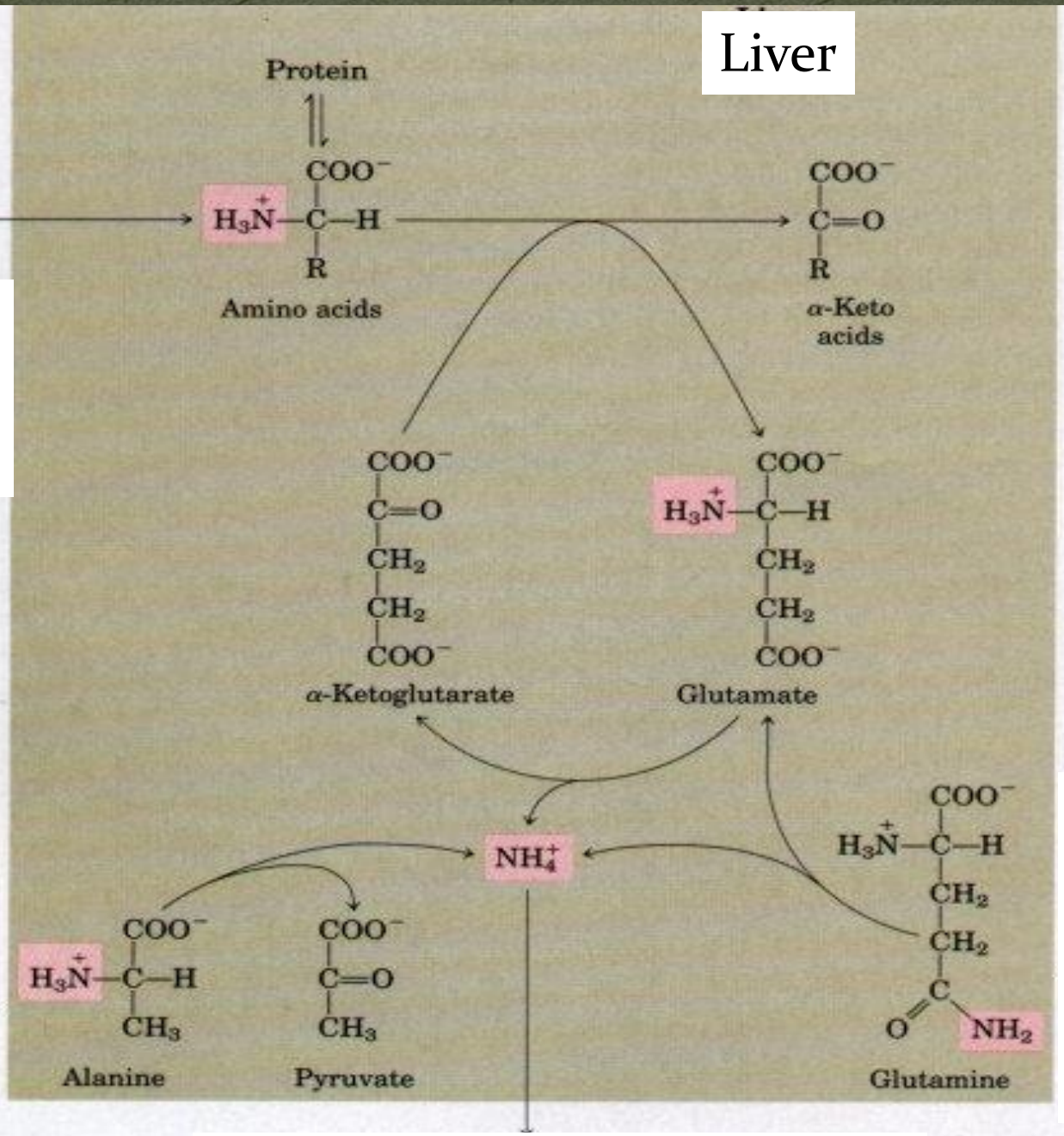
The breakdown of both dietary and tissue proteins yields nitrogen-containing substrates and carbon skeletons.

The nitrogen-containing substrates are used in the biosynthesis of purines, pyrimidines, neurotransmitters, hormones, porphyrins, and nonessential amino acids.

The carbon skeletons are used as a fuel source in the citric acid cycle, used for gluconeogenesis, or used in fatty acid synthesis.


Intracellular protein
Dietary protein
Amino acids
α-Keto acids
NH_4^+
Biosynthesis of amino acids, nucleotides, and biological amines
Citric acid cycle
Glucose
gluconeo-genesis
respiration
$CO_2 + H_2O$
Excretion

Liver



AA from ingested protein

Alanine from muscle

Glutamine from muscle &other tissue

urea or uric acid or ammonia.