

SNS COLLEGE OF PHARMACY AND HEALTH SCIENCES



Affiliated To The Tamil Nadu Dr. MGR Medical University, Chennai

Approved by Pharmacy Council of India, New Delhi.

Coimbatore -641035

COURSE NAME : BIOCHEMISTRY AND CLINICAL PATHALOGY

D.PHARM/ II YEAR

**TOPIC:DEFINITION, CLASSIFICATION OF AMINO ACIDS BASED ON CHEMICAL
NATURE AND NUTRITIONAL REQUIREMENTS WITH EXAMPLES**

DESIGN THINKING STAGES IN CLASSIFICATION

Empathize: Understand the users — in this case, students, pharmacists, or researchers who use the alphabetical classification system.

Define: Clearly define the problem based on the insights from the empathize stage.

Ideate: Generate possible solutions or improvements.

Prototype: Create a tangible version of your solution

Test: Evaluate the prototype with real users.

ABOUT AMINO ACIDS

Amino Acids

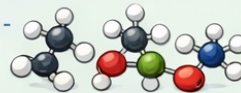
Amino acids are organic compounds containing an **Amino Group** ($\sim\text{NH}_2$) and a **Carboxyl Group** ($\sim\text{COOH}$).
They are the **Building Blocks of Proteins**.

Classification of Amino Acids

Based on Chemical Nature

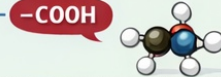
Neutral Amino Acids

- Glycine, Alanine, Valine



Acidic Amino Acids

- Aspartic Acid, Glutamic Acid



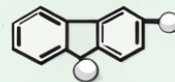
Basic Amino Acids

- Lysine, Arginine, Histidine



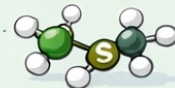
Aromatic Amino Acids

- Phenylalanine, Tyrosine, Tryptophan



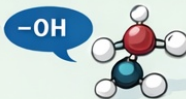
Sulphur-Containing Amino Acids

- Cysteine, Methionine



Hydroxy Amino Acids

- Serine, Threonine



Based on Nutritional Requirements

Essential Amino Acids



Valine, Lysine, Tryptophan

Non-Essential Amino Acids



Glycine, Glutamic Acid, Proline

Semi-Essential Amino Acids



Arginine, Histidine

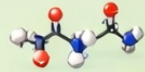
DEFINITION & CLASSIFICATION OF AMINO ACIDS

AMINO ACIDS: DEFINITIONS & CLASSIFICATION

BASED ON CHEMICAL NATURE

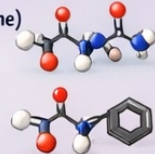
Non-Polar (Hydrophobic)

- Glycine (Gly)
- Alanine (Ala)
- Leucine (Leu)



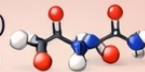
Aromatic

- Phenylalanine (Phe)
- Tyrosine (Tyr)
- Tryptophan (Trp)



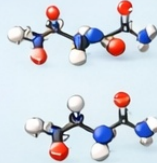
Negatively Charged (Acidic)

- Aspartic Acid (Asp)
- Glutamic Acid (Glu)



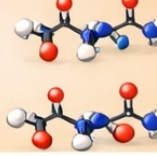
Polar (Hydrophilic)

- Serine (Ser)
- Threonine (Thr)
- Asparagine (Asn)



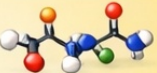
Positively Charged (Basic)

- Lysine (Lys)
- Arginine (Arg)
- Histidine (His)



Sulfur-Containing

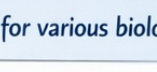
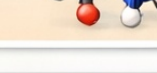
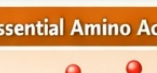
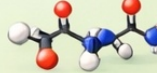
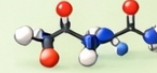
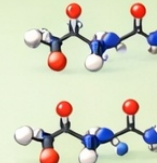
- Cysteine (Cys)
- Methionine (Met)



BASED ON NUTRITIONAL REQUIREMENTS

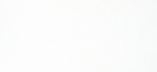
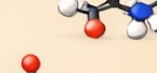
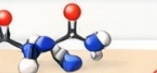
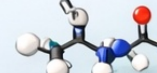
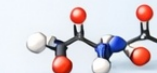
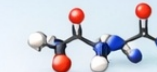
Essential Amino Acids

- Leucine
- Lysine
- Valine
- Phenylalanine
- Tryptophan
- Isoleucine
- Threonine
- Methionine



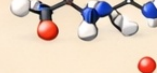
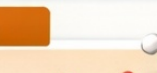
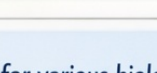
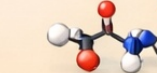
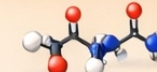
Non-Essential Amino Acids

- Alanine
- Glycine
- Serine
- Asparagine
- Aspartic Acid
- Glutamic Acid
- Proline
- Tyrosine



Conditionally Essential Amino Acids

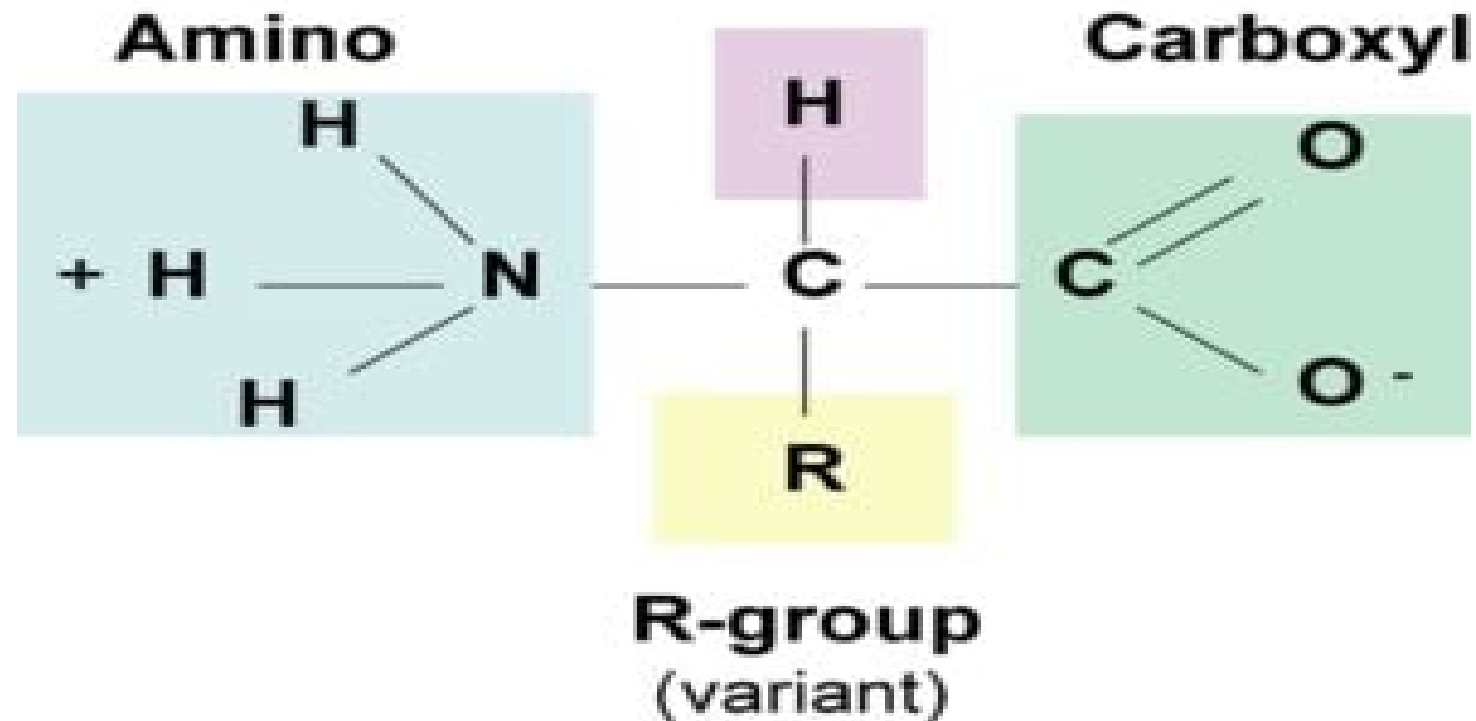
- Arginine
- Cysteine
- Tyrosine
- Glutamine
- Proline



Amino Acids are the building blocks of proteins, essential for various biological functions.

Amino Acid Structure

Hydrogen



BASED ON CHEMICAL NATURE OF AMINO ACIDS

AMINO ACIDS

BASED ON CHEMICAL NATURE

NON-POLAR Hydrophobic

- Glycine, Alanine,
- Valine, Leucine

POLAR Hydrophilic

- Serine,
- Threonine,
- Asparagine

ACIDIC Negatively Charged

- Aspartic Acid,
- Glutamic Acid

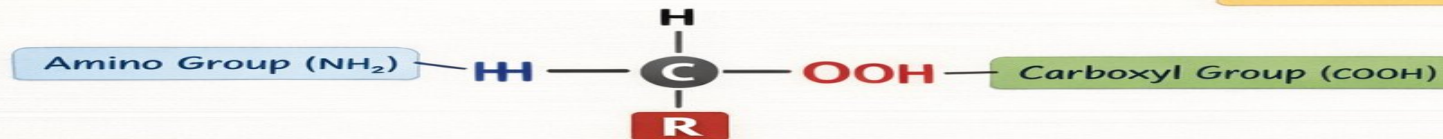
BASIC Positively Charged

- Lysine,
- Arginine,
- Histidine

AROMATIC Ring Structure

- Phenylalanine,
- Tyrosine,
- Tryptophan

- Cysfur-Containing



BASED ON NUTRITIONAL REQUIREMENTS

ESSENTIAL AMINO ACIDS

Cannot be synthesized by the body

- Leucine,
- Isoleucine,
- Lysine,
- Methionine,
- Phenylalanine,
- Threonine,
- Tryptophan,
- Valine

NON-ESSENTIAL AMINO ACIDS

Can be synthesized by the body

- Alanine
- Glycine
- Serine,
- Proline
- Aspartic Acid,
- Glutamic Acid,
- Cysteine,
- Asparagine

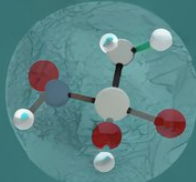
CONDITIONALLY ESSENTIAL

Required during stress or illness

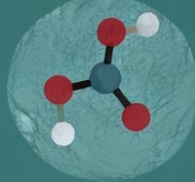
- Arginine,
- Tyrosine,
- Cysteine,
- Glutamine

10 Common Acids

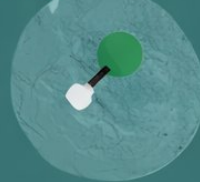
KONTIC
ACID



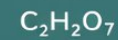
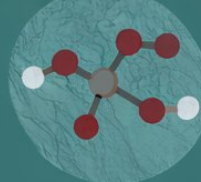
CARBONIC
ACID



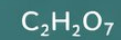
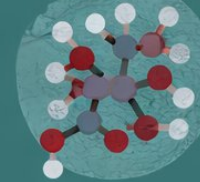
HYDROCHLORIC
ACID



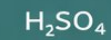
HYDROCHLORIC
ACID



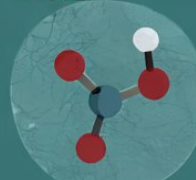
CITRIC
ACID



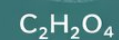
SILFURIC
ACID



NITRIC
ACID



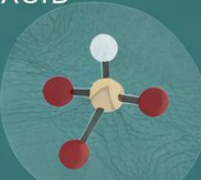
OXALIC
ACID



PHOSPHORIC
ACID



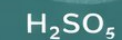
PHOSPHORIC
ACID



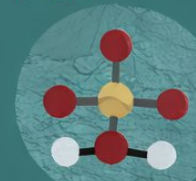
SULFURIC
ACID



ACETIC
ACID



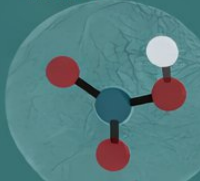
ACETIC
ACID



HYDROFLUORIC
ACID



FORMIC
ACID



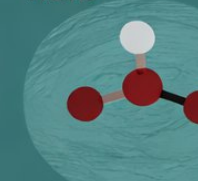
PERCHLORIC
ACID



CHROMIC
ACID

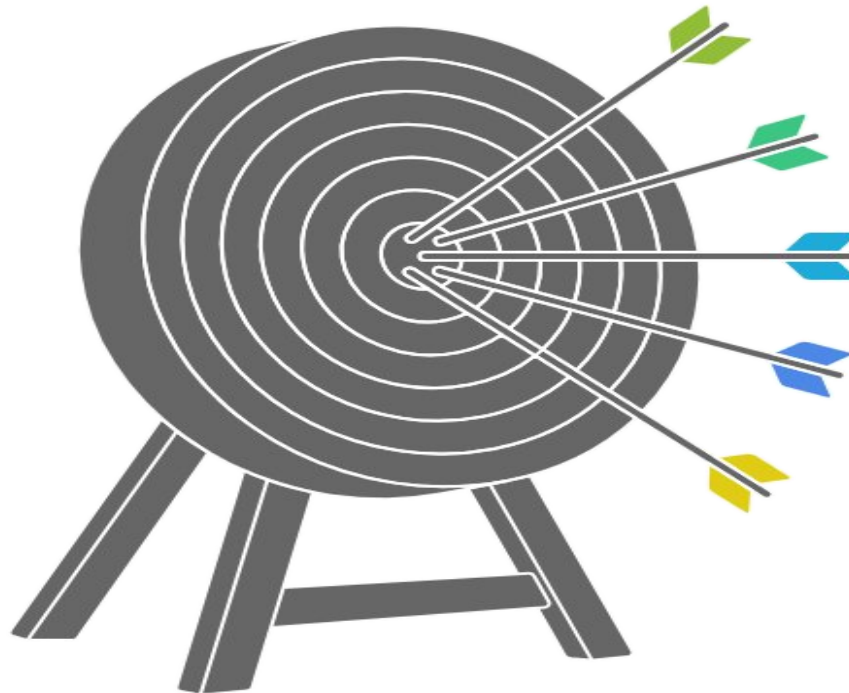


HYPOCHLOROUS
ACID



CLASSIFICATION OF AMINO ACIDS

Amino Acid Classification



Protein Formation

Essential role in building proteins



Functional Groups

Amino and carboxylic acid groups



Structural Classification

Alpha, beta, gamma amino acids



Polarity and Ionization

Properties affecting interactions



Side-Chain Groups

Aliphatic, aromatic, polar types

Made with  Napkin

NOMENCLATURE OF AMINO ACIDS

Amino Acid Nomenclature

What do the systematic names and formulas refer to?

They refer to hypothetical forms where amino groups are unprotonated and carboxyl groups are undissociated.

Why is this convention used?

It avoids nomenclatural problems, but these structures don't represent a significant portion of amino-acid molecules.



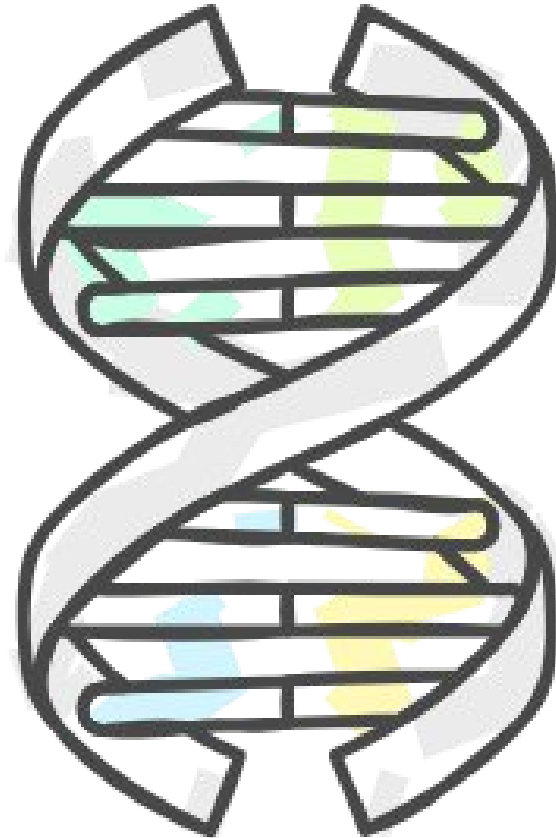
Made with  Napkin

Amino Acid Structure

α -Amino Acids



Chirality



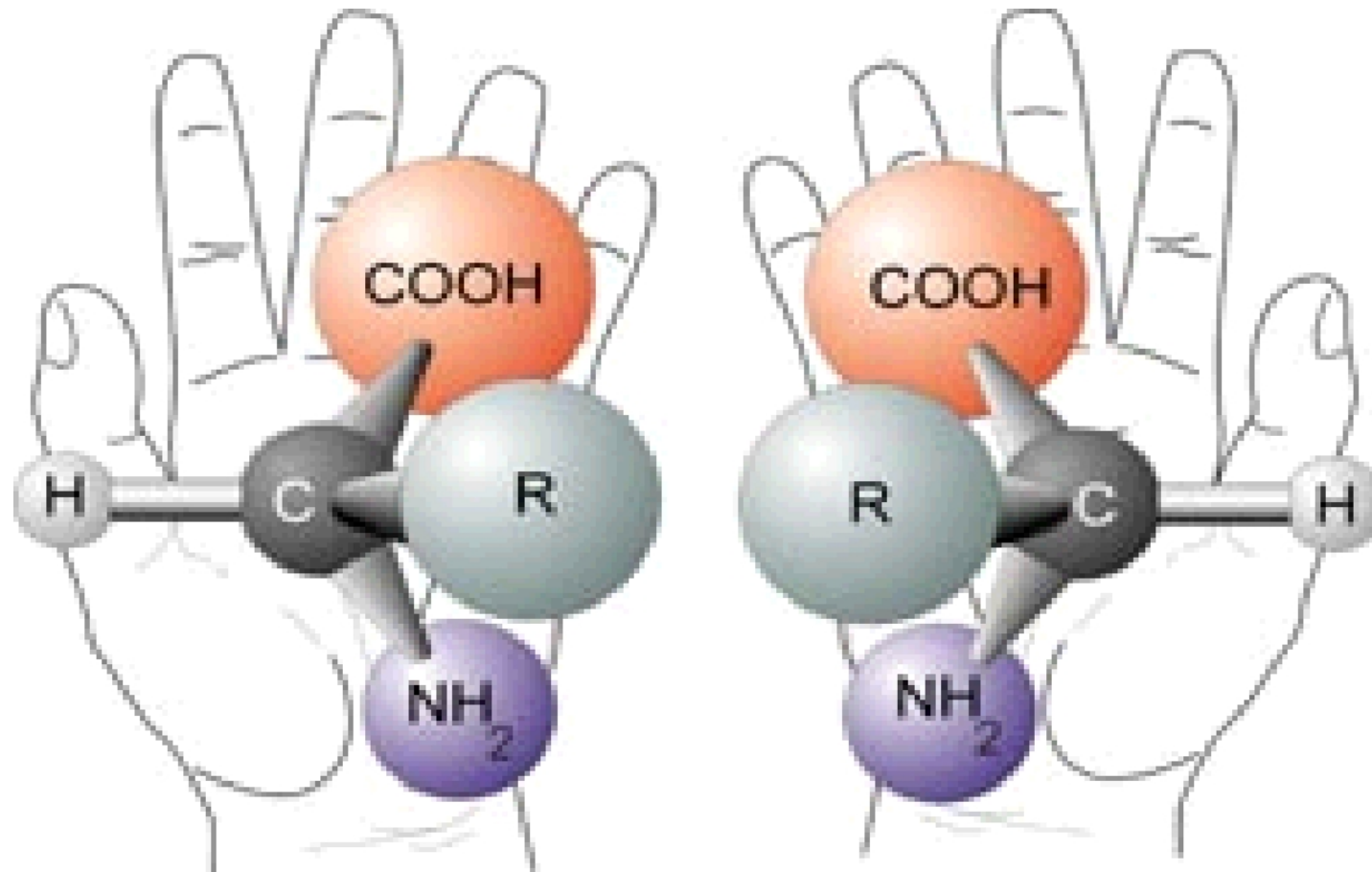
β - and γ -
Amino Acids



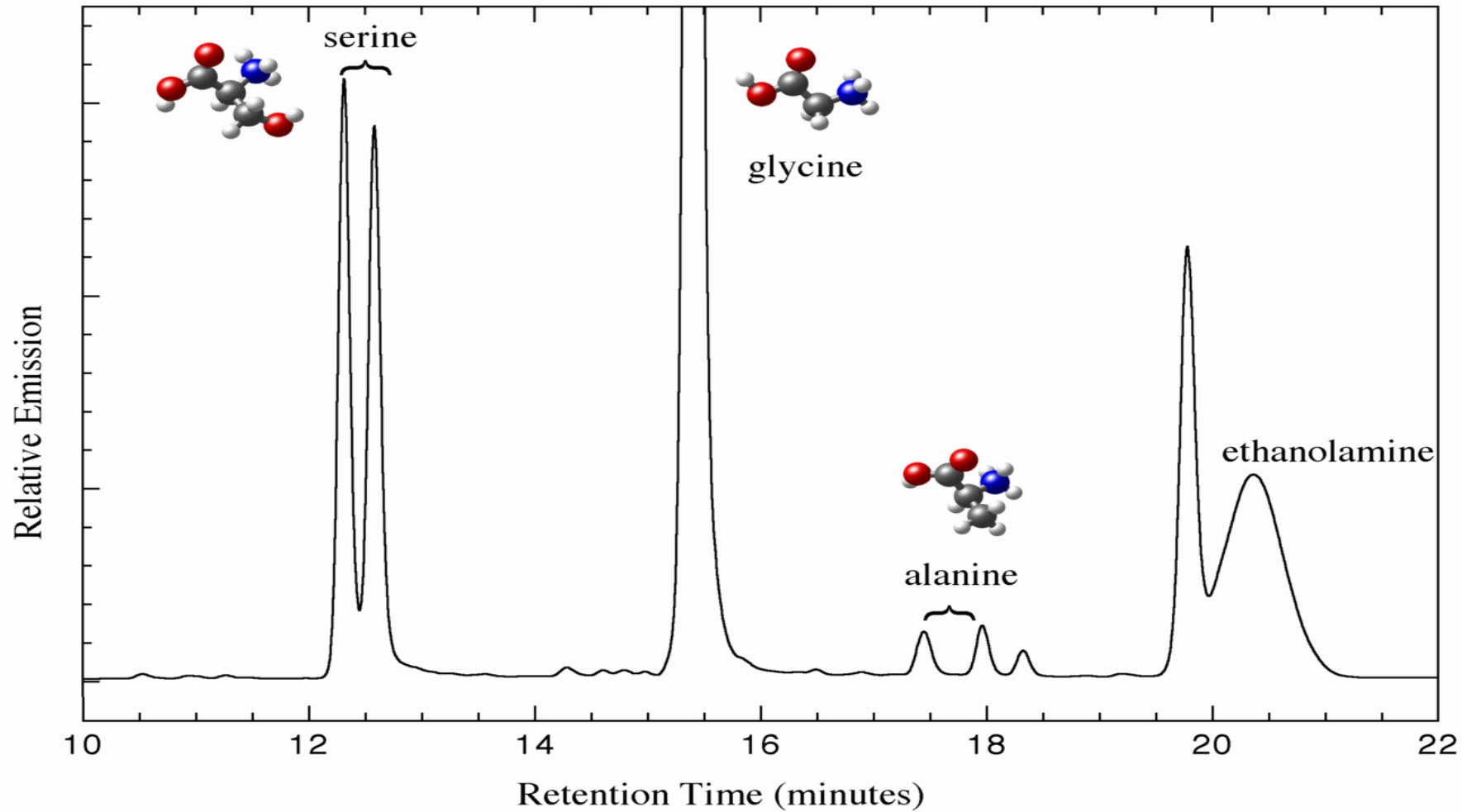
Side Chains

Made with  Napkin

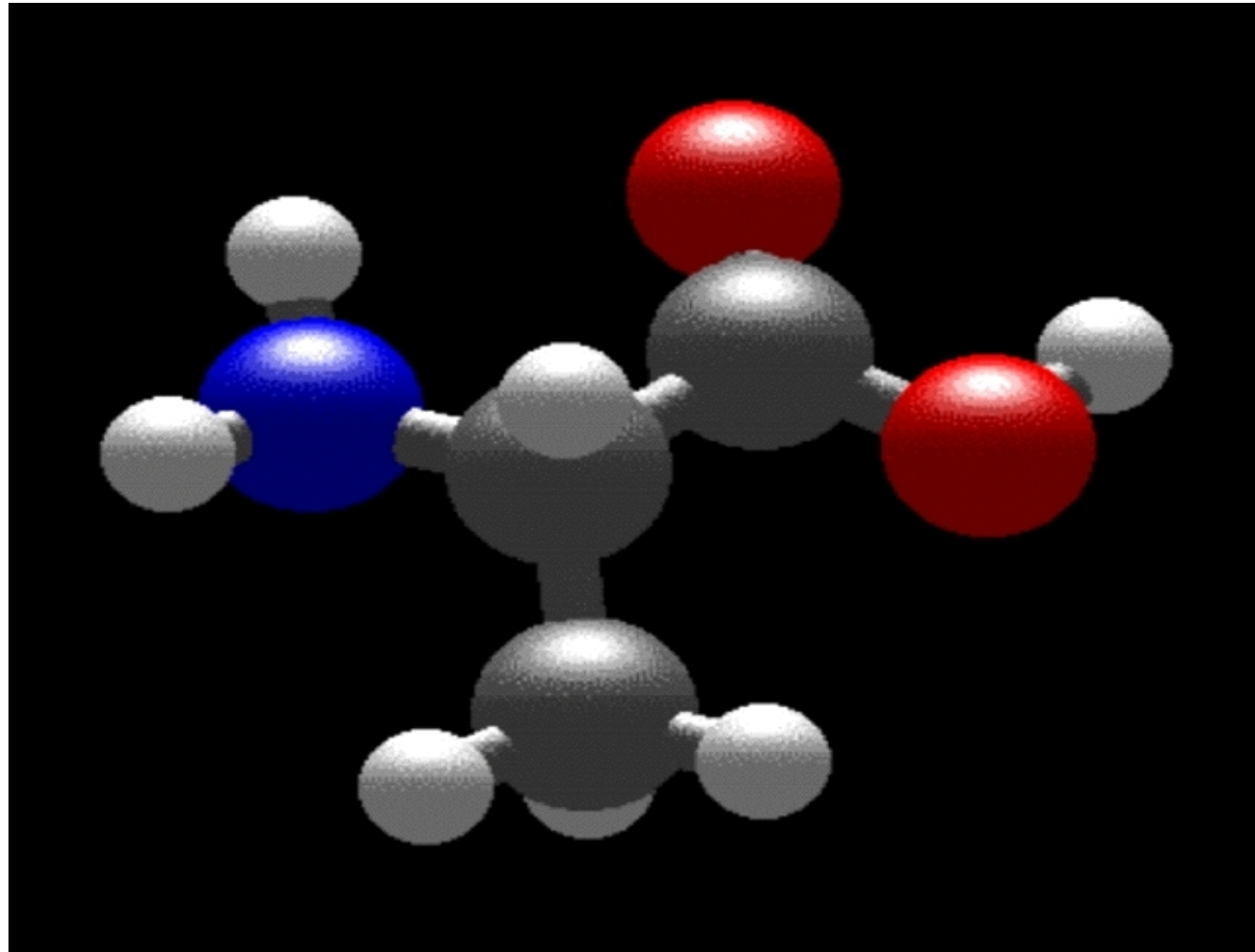
AMINO ACIDS COME IN RIGHT AND LEFT HANDED VERSIONS



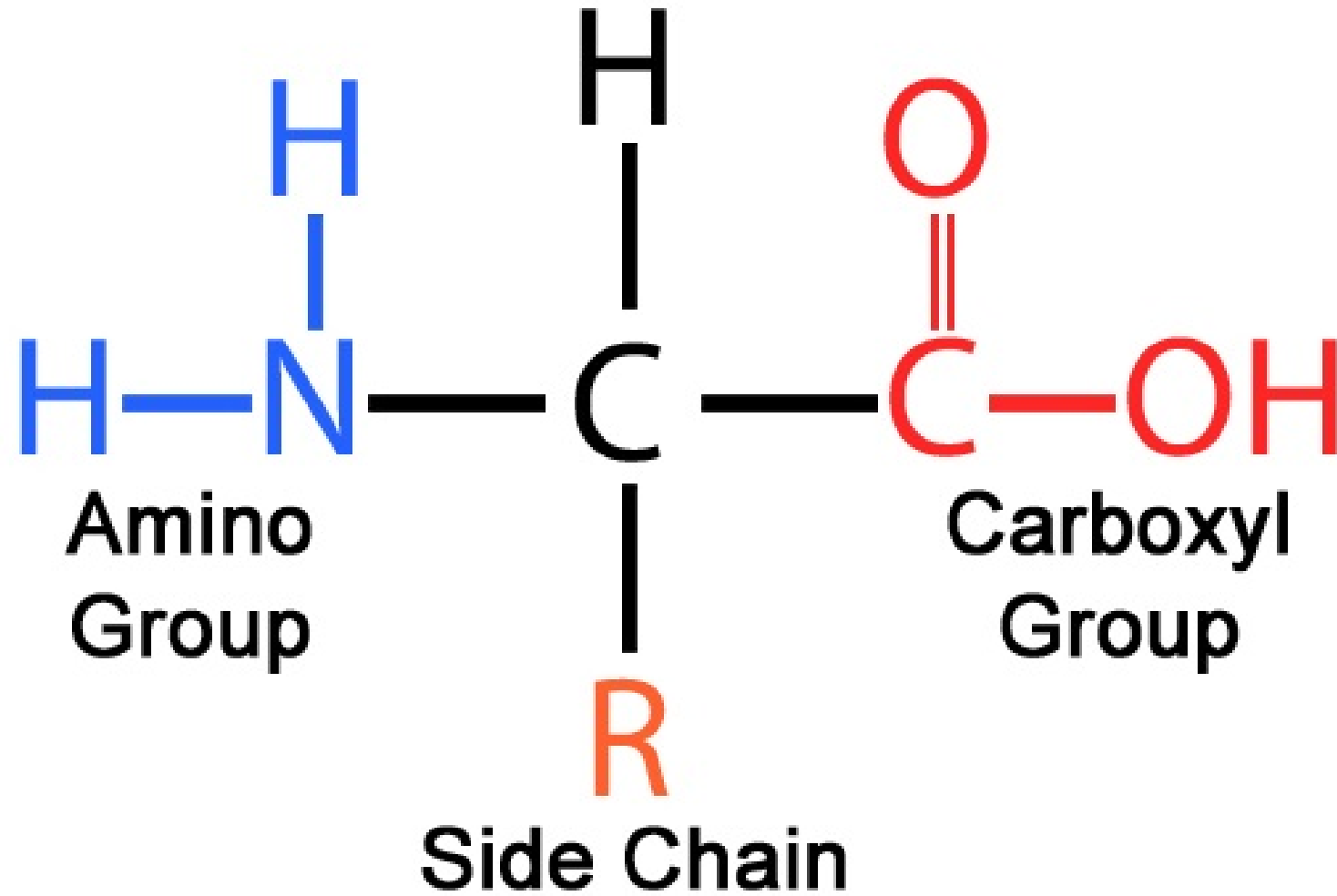
Amino Acids Produced by UV Ice Photolysis



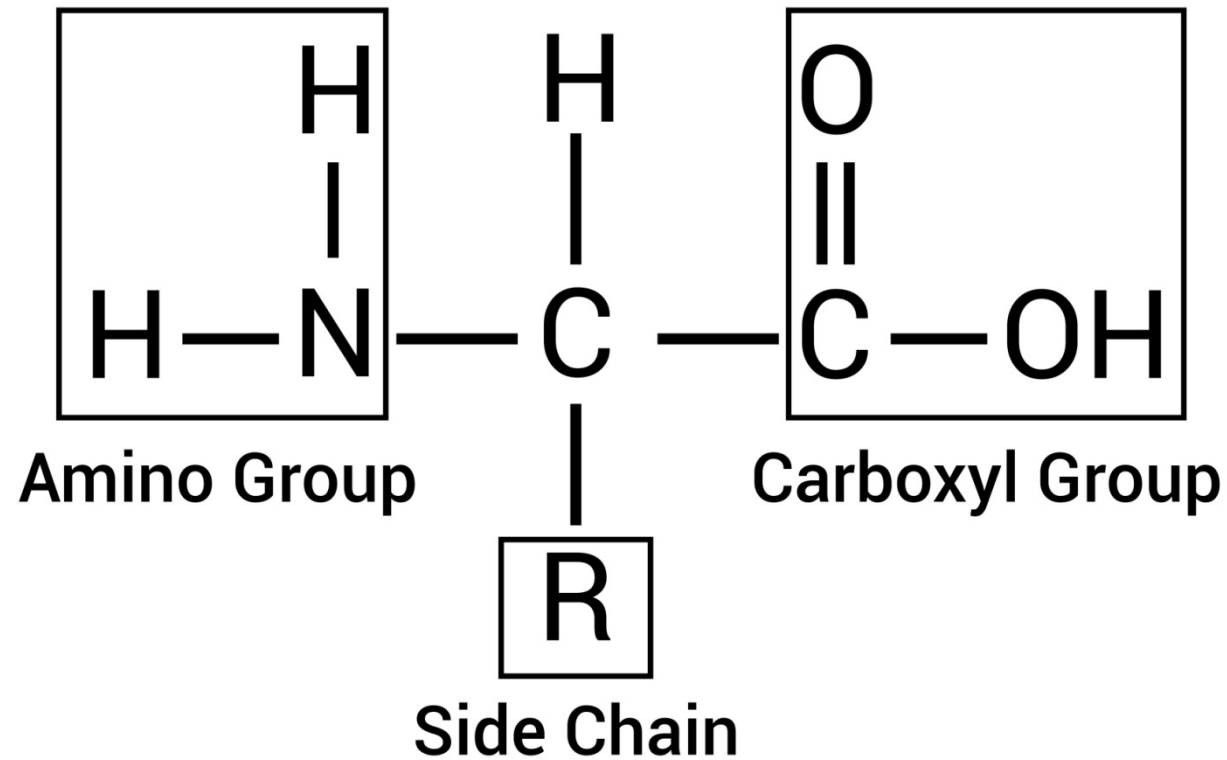
THE STRUCTURES OF THE SIMPLE AMINO ACIDS GLYCINE (LEFT) AND ALANINE (RIGHT)



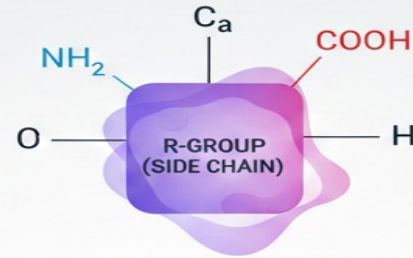
THE BASIC STRUCTURE OF ALL AMINO ACIDS



AMINO ACID CLASSIFICATION: CHEMICAL AND NUTRITIONAL

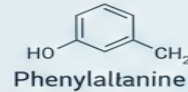
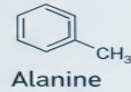


AMINO ACIDS: BUILDING BLOCKS OF LIFE

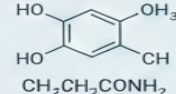
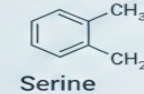


I. CLASSIFICATION BY CHEMICAL NATURE

1. NON-POLAR (HYDROPHOBIC)



2. POLAR BUT UNCHARGED (HYDROPHILIC)



3. CHARGED



Aspartate⁻



BASIC

CH₂CH₂CH₂NH₃⁺

II. CLASSIFICATION BY NUTRITIONAL REQUIREMENTS



Must come from DIET

His, Ile, Leu, Lys, Met, Phe, Thr, Trp, Val



ESSENTIAL

Body can't form from DIET



NON-ESSENTIAL

Ala, Asn, Asp, Glu, Ser



CONDITIONALLY ESSENTIAL

Essential during STRESS/GROWTH

Arg, Cys, Gly, Pro, Tyr

KEY EXAMPLES



Leucine, non-polar



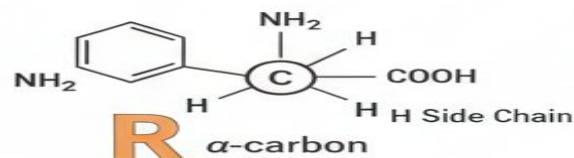
Lysine
Serine, essential, polar



Arginine, ion, basic

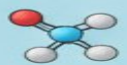
CLASSIFICATION OF CHEMICAL NATURE VS NUTRITIONAL REQUIREMENTS

AMINO ACID CLASSIFICATION



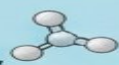
I. CHEMICAL NATURE (R-GROUP PROPERTIES)

Non-polar (Hydrophobic)



Glycine

Glycine, Alanine, Leucine, Isoleucine, Phenylalanine, Tryptophan, Methionine



Leucine

Polar Uncharged (Hydrophilic)



Cysteine

Serine, Threonine, Tyrosine, Cysteine



Aspartate

Charged (pH ~ 7.4)



Acidic (-)

Serine, Threonine, Tyrosine, Asparagine, Glutamine, Cysteine

Basic



Lysine +

II. NUTRITIONAL REQUIREMENTS (HUMANS)

Essential



Histidine, Isoleucine, Leucine, Lysine, Methionine, Tryptophan

Non-Essential



Alanine, Asparagine, Lysine, Phenylalanine, Threonine, Tryptophan, Serine

Conditionally Essential



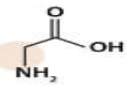
Arginine, Cysteine, Glutamine, Glutamine, Glycine, Proline, Tyrosine

SUMMARY TABLE

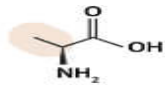
Leucine	Non-polar (Hydrophobic)	Polar Uncharged	Non-essential
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Amino Acid Chart

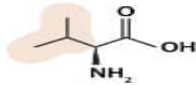
Non-polar side chains



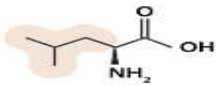
Glycine



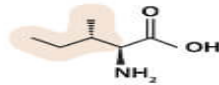
Alanine



Valine



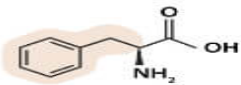
Leucine



Isoleucine



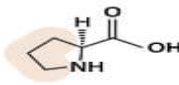
Methionine



Phenylalanine

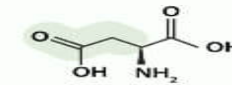


Tryptophan

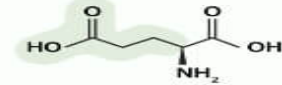


Proline

Electrically charged side chains

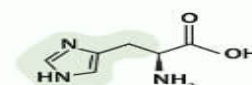


Aspartate



Glutamate

Acidic



Histidine



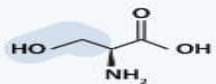
Lysine



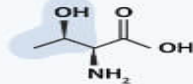
Arginine

Basic

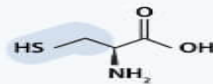
Polar side chains



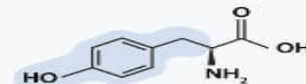
Serine



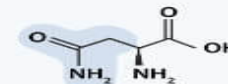
Threonine



Cysteine



Tyrosine



Asparagine



Glutamine

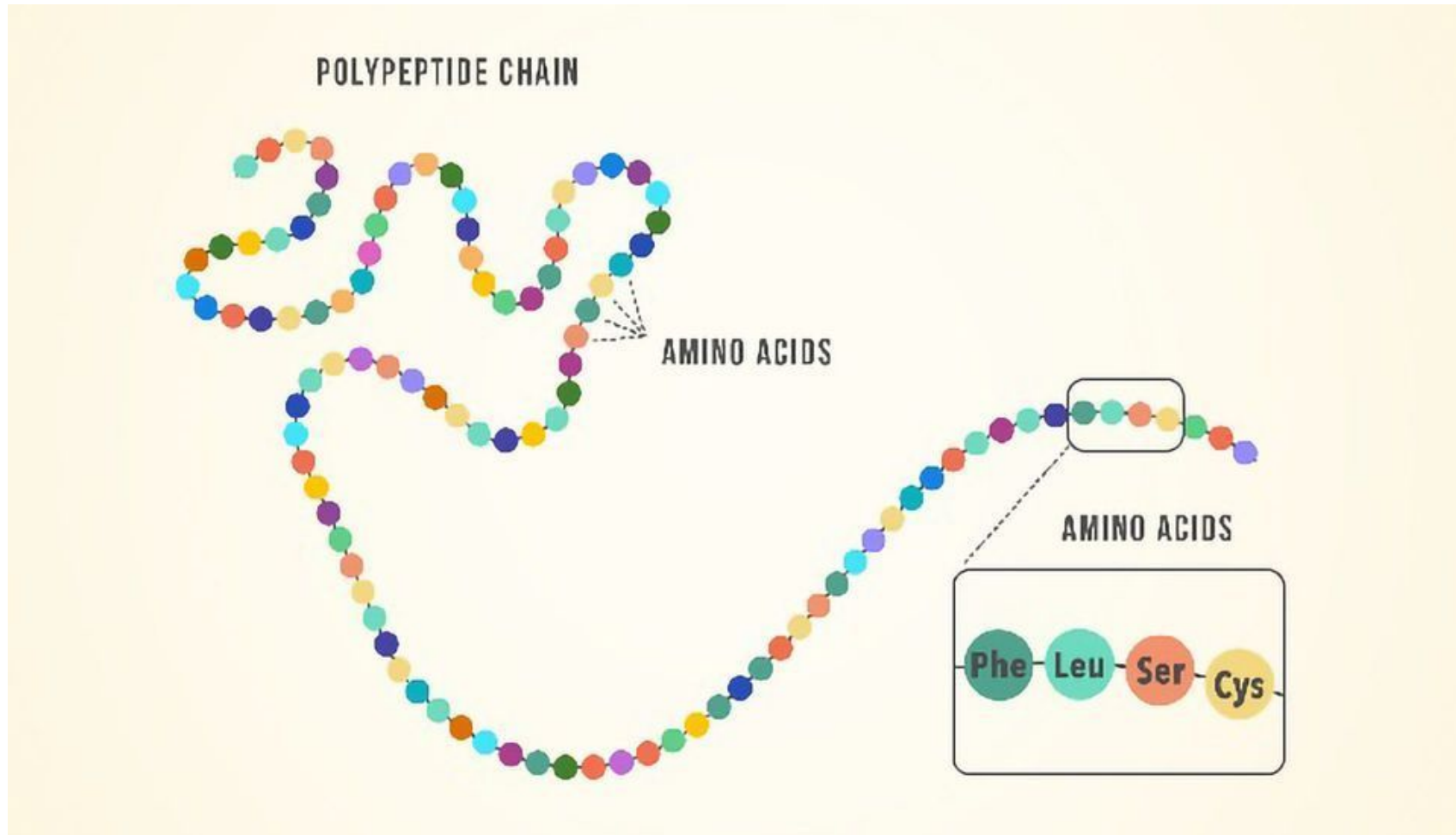


The
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Notes

The
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Thank You

