

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

رَبِّ اشْرَحْ لِي صَدْرِي 0 وَيَسِّرْ لِي أَمْرِي 0  
وَ اَخْلُ عُقْدَةً مِّنْ لِّسَانِي 0 يَفْقَهُوا قَوْلِي 0

اے میرے رب! میرا سینہ کھول دے اور میرے لیے میرا کام آسان کر دے اور  
میری زبان کی گرہ کھول دے تاکہ لوگ میری بات سمجھ سکیں

رَبِّ زِدْنِي عِلْمًا

MY LORD! INCREASE ME IN KNOWLEDGE.

# FST-311. L # 24:

## PROTEINS IN FOOD BIOCHEMISTRY: BASICS

- **PROTEINS; FUNCTIONS**
- **R GROUP DETERMINES Aas**

# PROTEINS; FUNCTIONS

- Greek : “of first importance”
- Structure : skin, bones, hair, fingernails
- Catalysis: biological catalysts are enzymes
- Movement: muscle: actin and myosin
- Transport: hemoglobin, transport through membranes

# PROTEINS; FUNCTIONS

- 9000 different proteins in a cell
- Individual human being > 100,000 different
- Fibrous protein
- Insoluble in H<sub>2</sub>O (used mainly for structural purposes)
- Globular protein
- Partly soluble in H<sub>2</sub>O (usually not used for structural purposes)

# R GROUP DETERMINES AAs

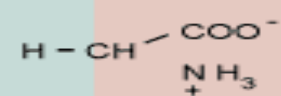
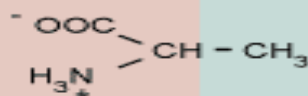
R group	Amino acid	Side chain
- H	Glycine	Non-polar
- CH <sub>3</sub>	Alanine	Non-polar
- CH <sub>2</sub> OH	Serine	Uncharged polar
- CH <sub>2</sub> SH	Cysteine	Uncharged polar
- CH <sub>2</sub> COOH	Aspartic acid	Acidic (-ve) Charged polar
-CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> NH <sub>2</sub>	Lysine	Basic (+ve) Charged polar

**NONPOLAR, HYDROPHOBIC**

**POLAR, UNCHARGED**

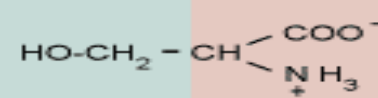
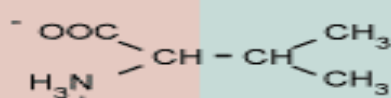
**R GROUPS**

Alanine  
Ala  
A  
MW = 89



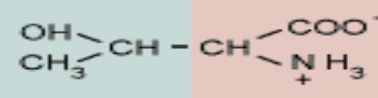
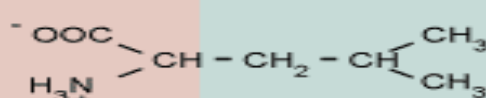
Glycine  
Gly  
G  
MW = 75

Valine  
Val  
V  
MW = 117



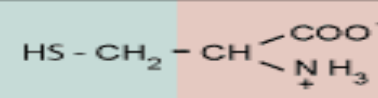
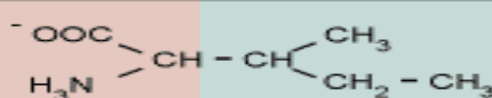
Serine  
Ser  
S  
MW = 105

Leucine  
Leu  
L  
MW = 131



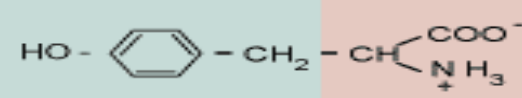
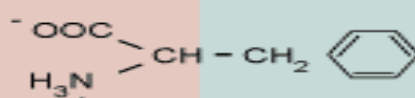
Threonine  
Thr  
T  
MW = 119

Isoleucine  
Ile  
I  
MW = 131



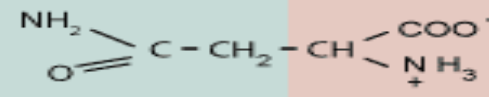
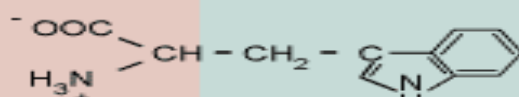
Cysteine  
Cys  
C  
MW = 121

Phenylalanine  
Phe  
F  
MW = 131



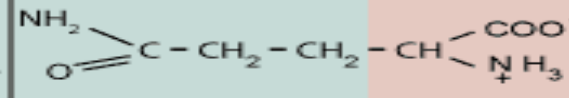
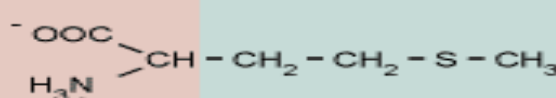
Tyrosine  
Tyr  
Y  
MW = 181

Tryptophan  
Trp  
W  
MW = 204



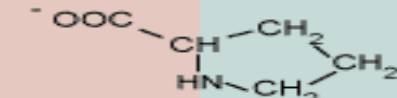
Asparagine  
Asn  
N  
MW = 132

Methionine  
Met  
M  
MW = 149

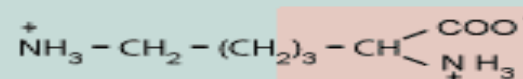


Glutamine  
Gln  
Q  
MW = 146

Proline  
Pro  
P  
MW = 115



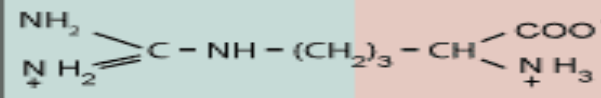
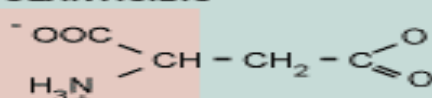
**POLAR BASIC**



Lysine  
Lys  
K  
MW = 146

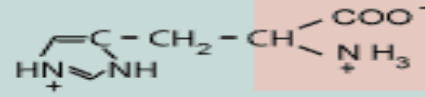
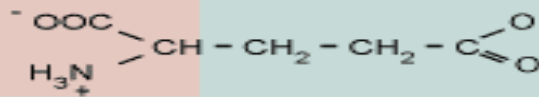
**POLAR ACIDIC**

Aspartic acid  
Asp  
D  
MW = 133



Arginine  
Arg  
R  
MW = 174

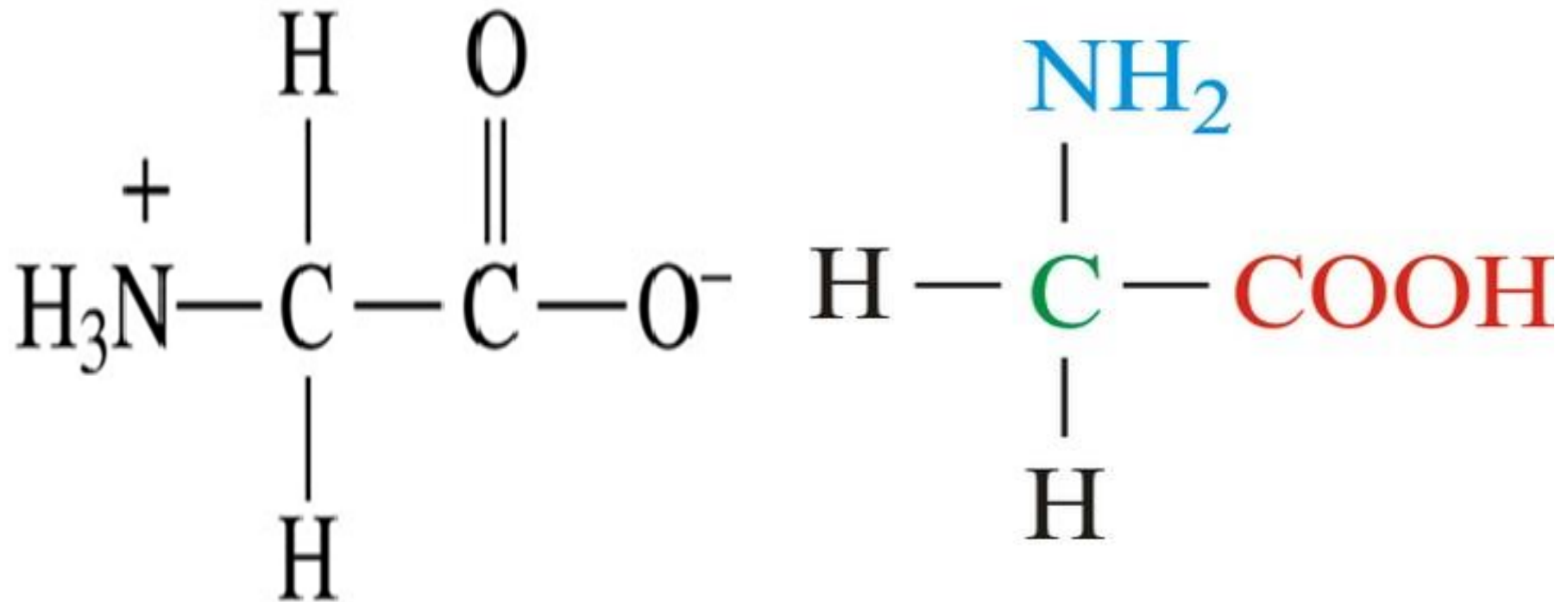
Glutamic acid  
Glu  
E  
MW = 147



Histidine  
His  
H  
MW = 155

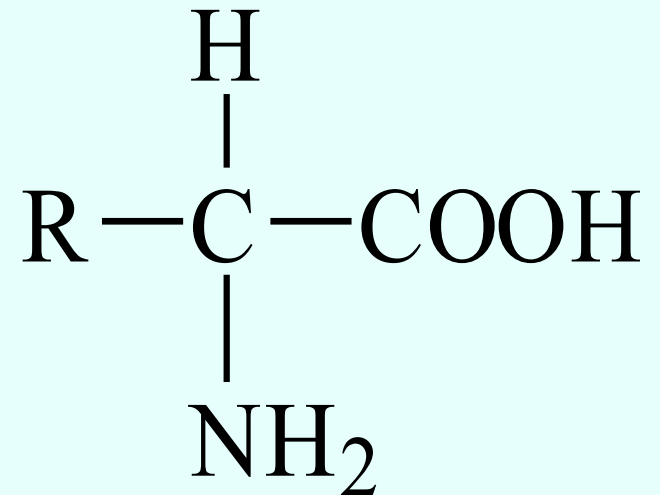
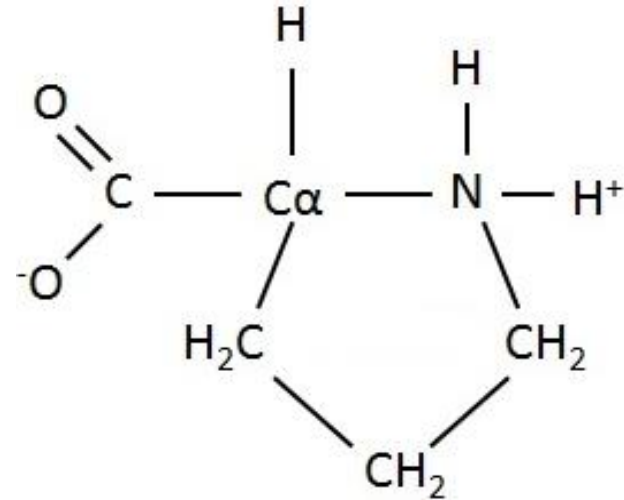
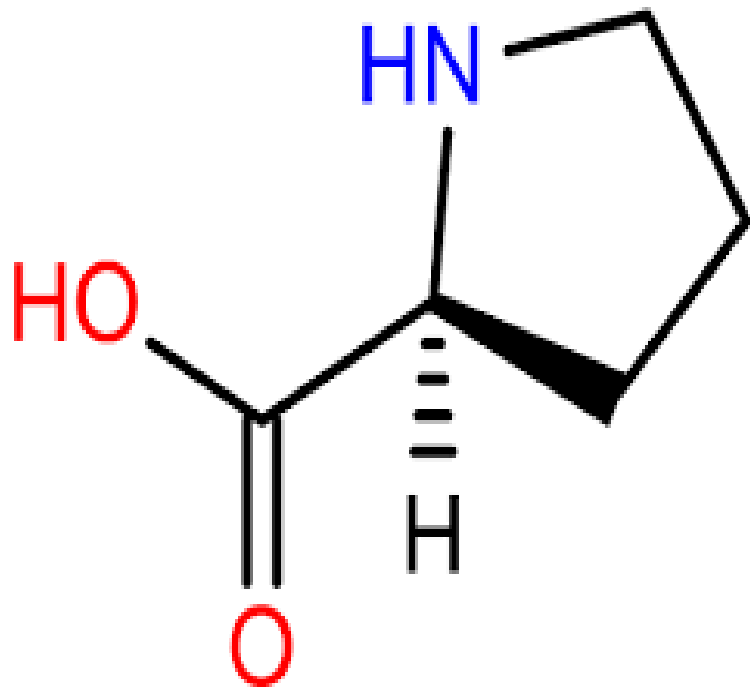
# PROTEINS: AAs WITH EXCEPTIONS

GLYCINE??



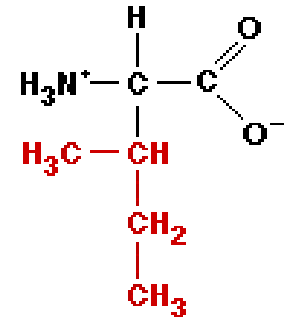
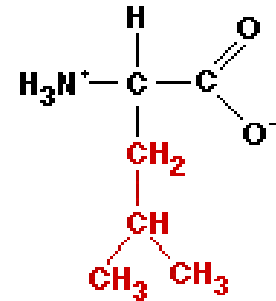
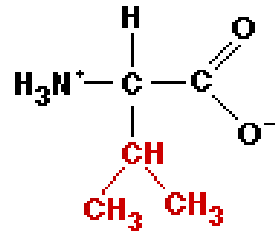
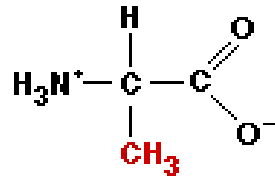
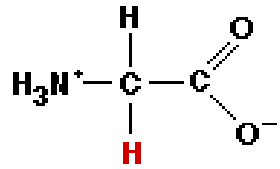
# PROTEINS: AAs WITH EXCEPTIONS

PROLINE??





# AMINO ACIDS



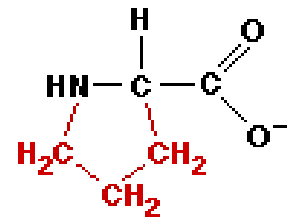
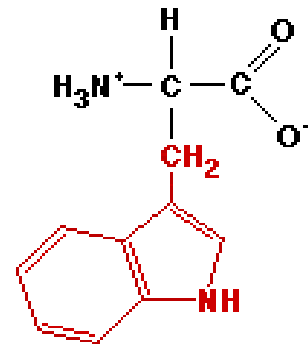
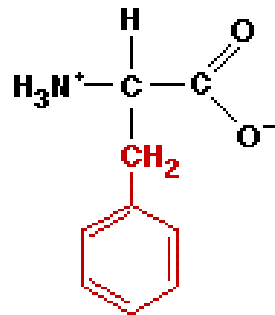
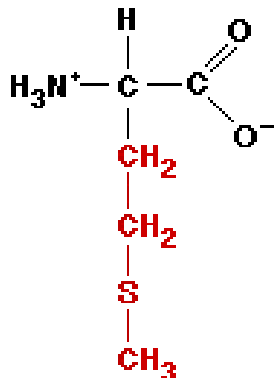
Glycine (Gly)

Alanine (Ala)

Valine (Val)

Leucine (Leu)

Isoleucine (Ile)



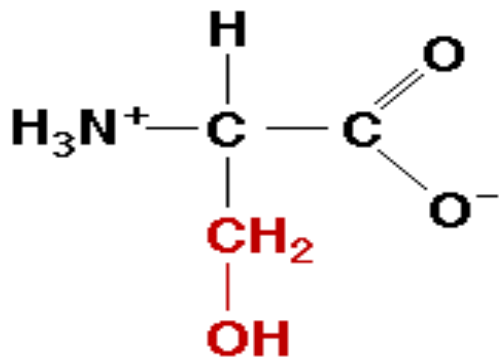
Methionine (Met)

Phenylalanine (Phe)

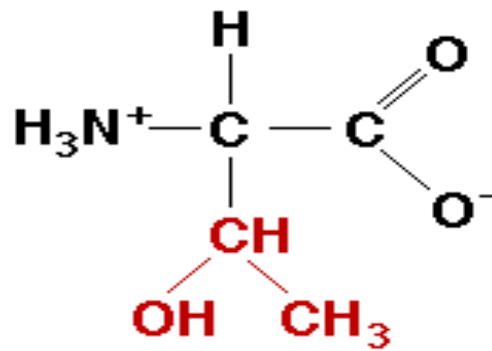
Tryptophan (Trp)

Proline (Pro)

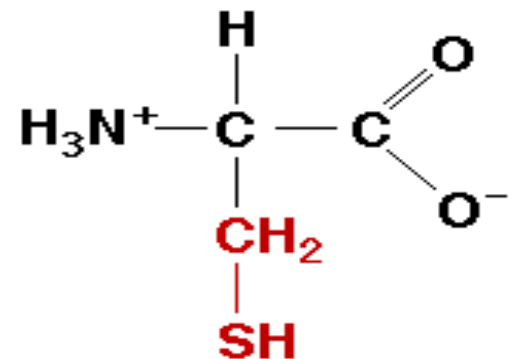
# AMINO ACIDS



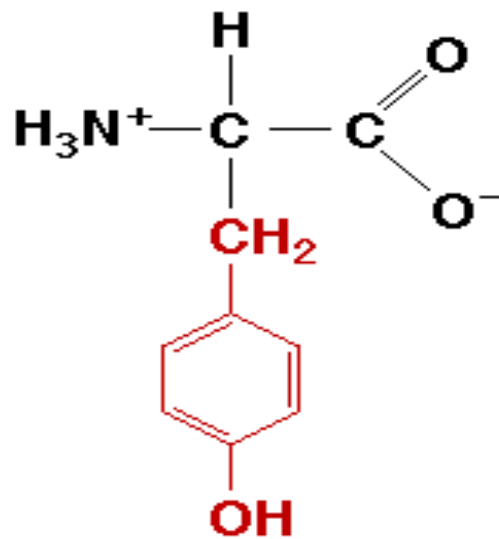
Serine (Ser)



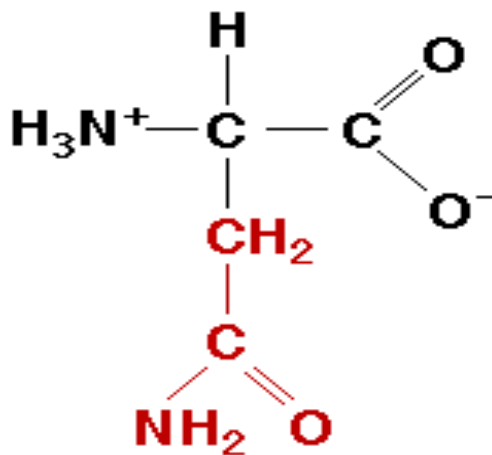
Threonine (Thr)



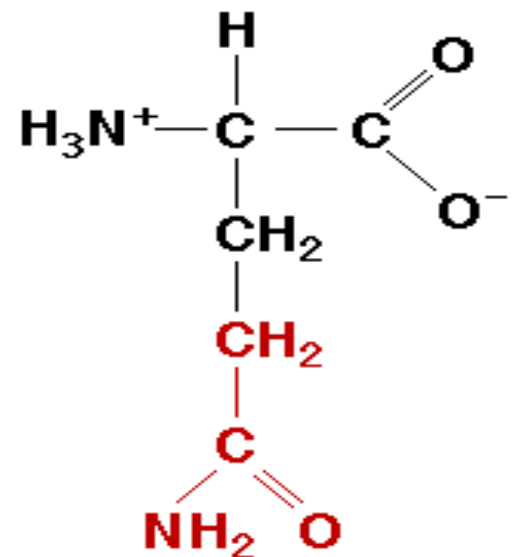
Cysteine (Cys)



Tyrosine (Tyr)

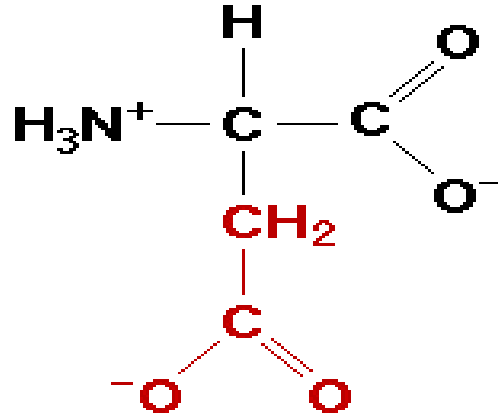


Asparagine (Asn)

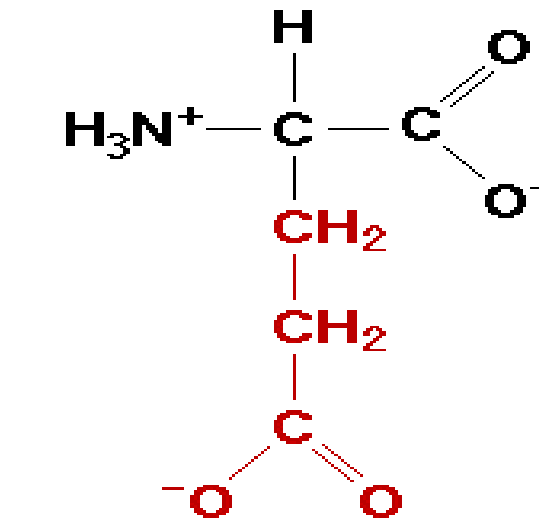


Glutamine (Gln)

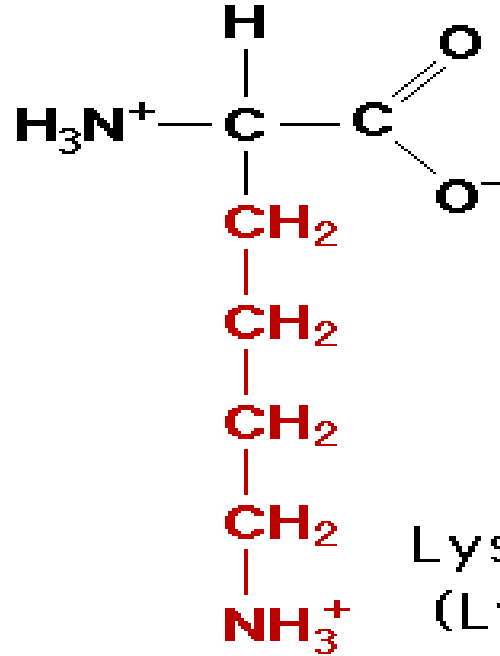
# AMINO ACIDS



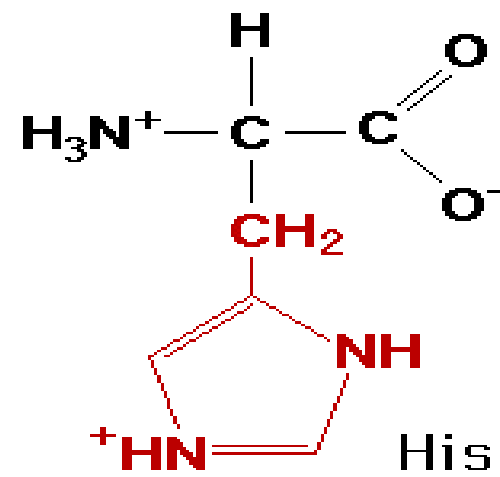
Aspartic acid (Asp)



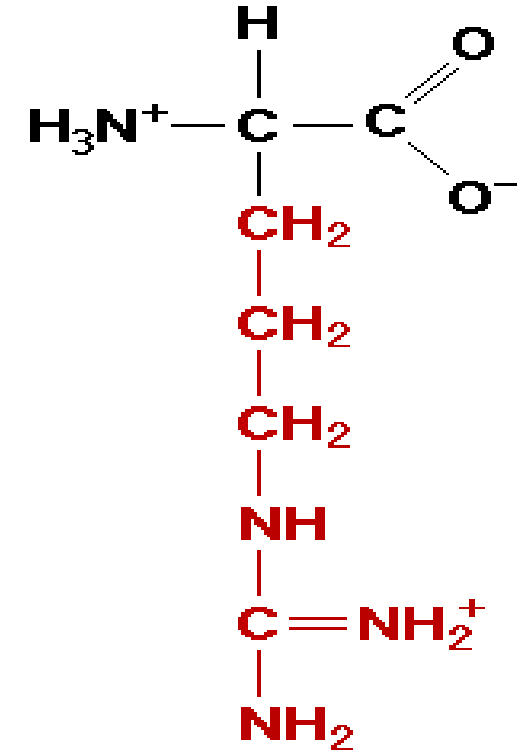
Glutamic acid (Glu)



Lysine (Lys)

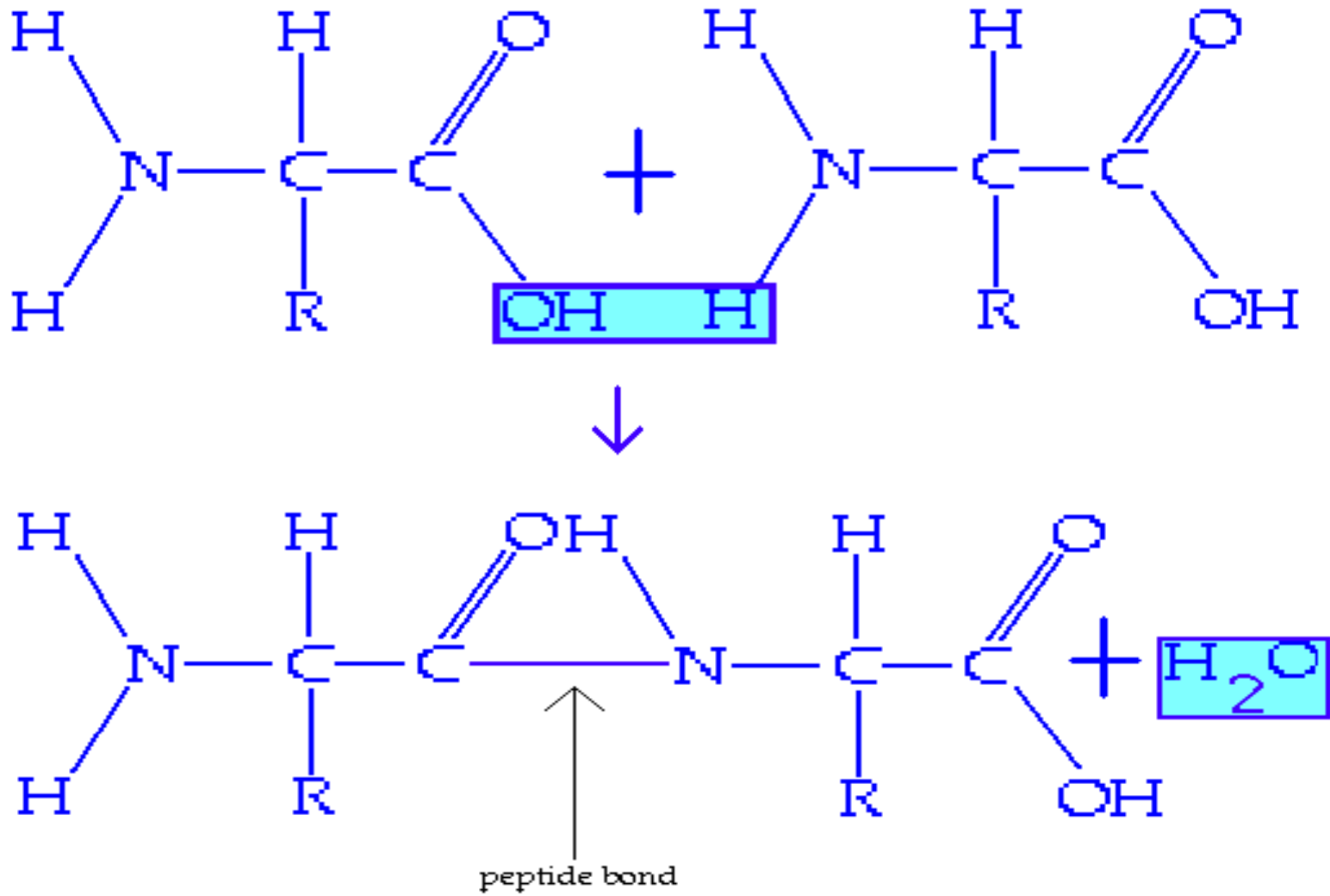


Histidine (His)



Arginine (Arg)

# FORMATION OF A PEPTIDE

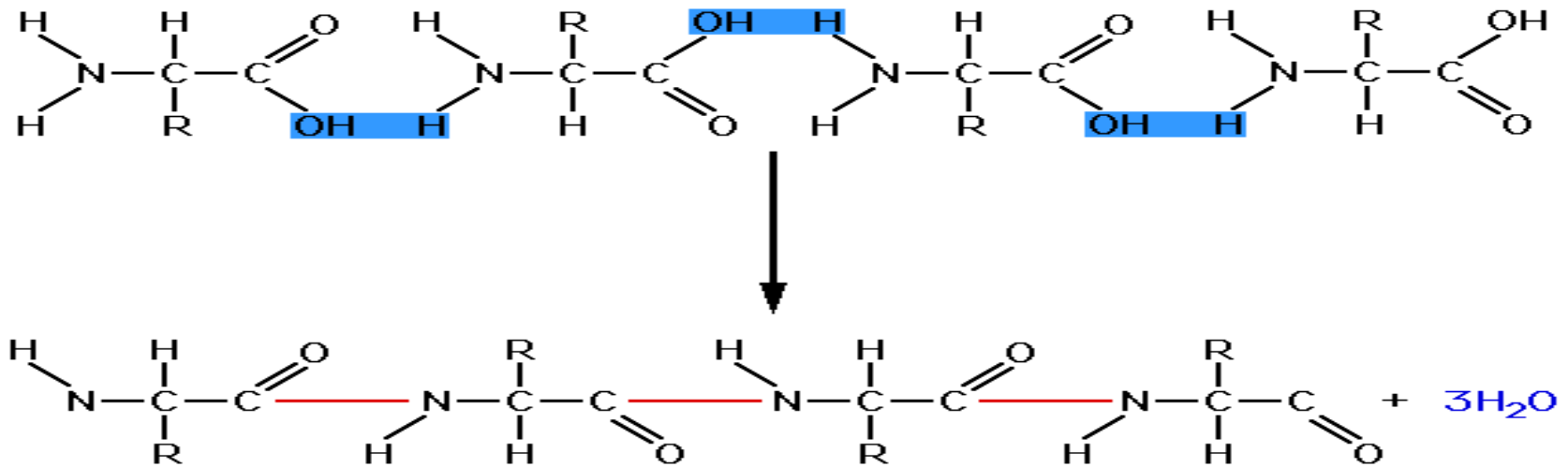


# FORMATION OF A PEPTIDE

Amino Acid + Amino Acid  $\longrightarrow$  Dipeptide

Amino Acid + Dipeptide  $\longrightarrow$  Tripeptide

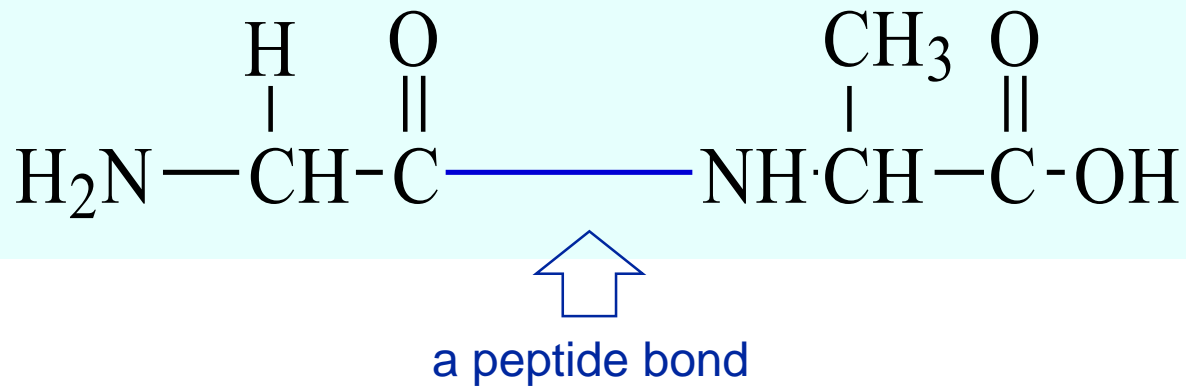
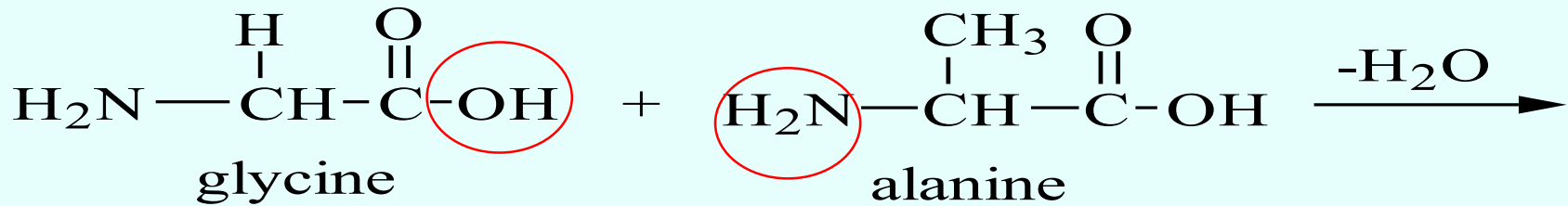
A.A. + A.A. + --- + Tripeptide  $\longrightarrow$  Polypeptide



# FORMATION OF A PEPTIDE

- AA are also called **Peptides**

## Glycylalanine (Gly-Ala)



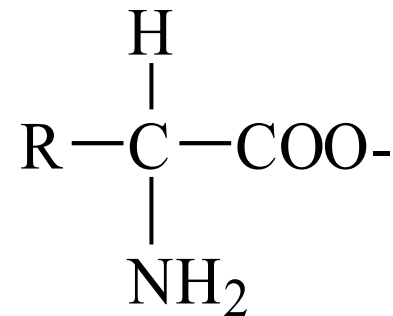
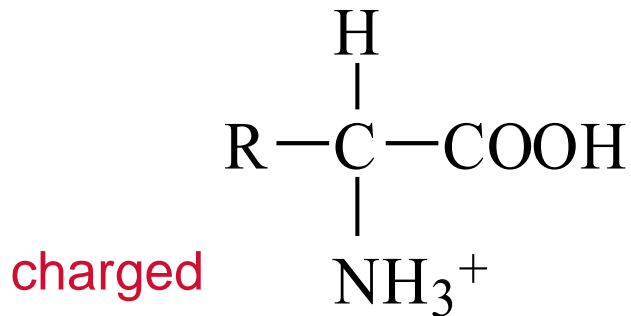
AA's

# CHARGE & SOLUBILITY OF PROTEINS

# SOLUBILITY

## Polypeptides or Proteins

- If there is a **charge** on a polypeptide, it is **more soluble** in **aqueous** solution
- If there is **no charge** (neutral at pI), it is **least soluble** in solution



**charged**

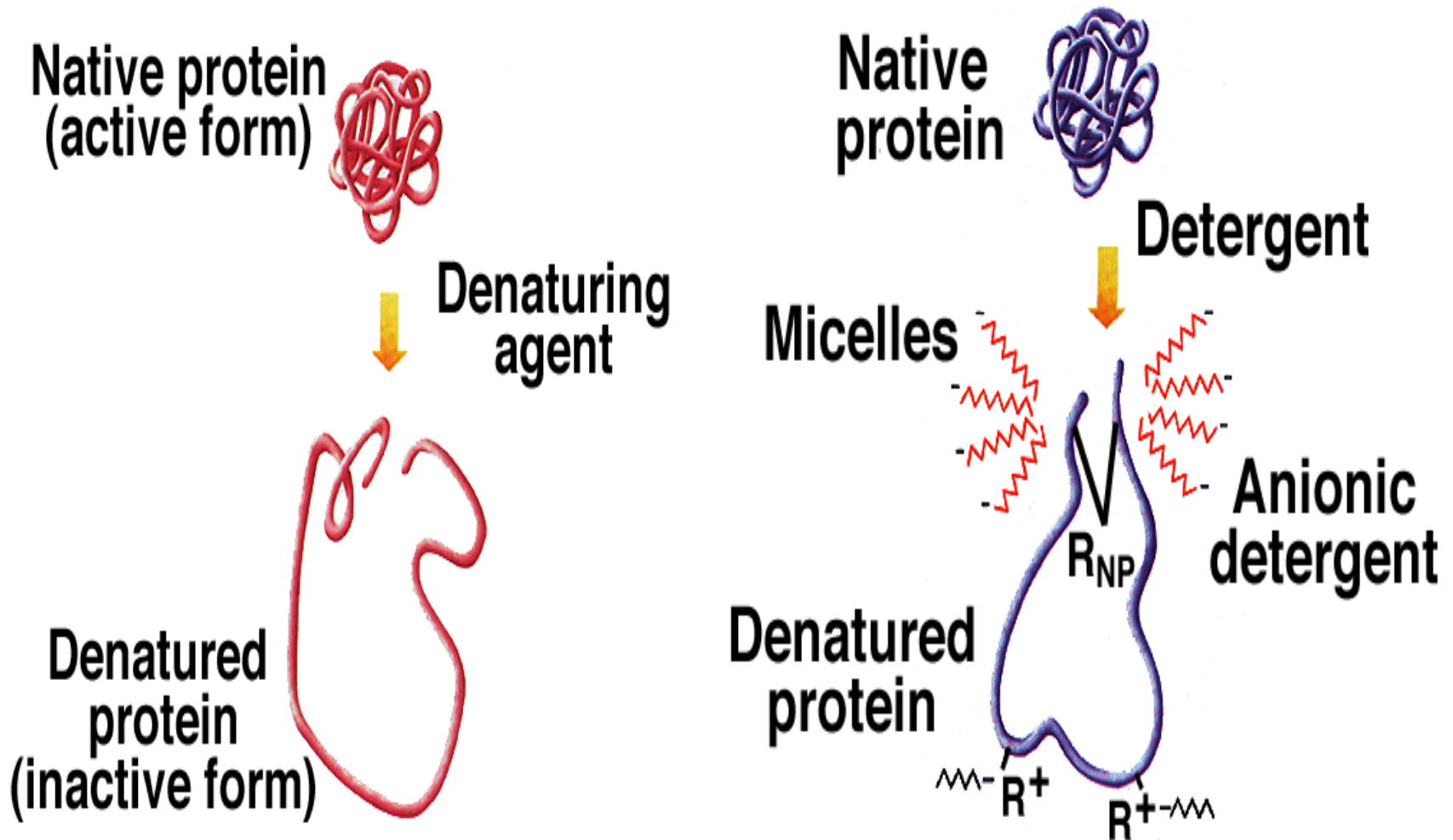


# DENATURATION

Any **physical** or **chemical** agent that destroys the **conformation** of a protein is said to “**denature**” it.

- **Heat** (boil an egg) to gelatin
- **Addition** of 6 M Urea (breaks H bonds)
- **Detergents** (surface-active agents)
- **Reducing** agents (break -S-S- bonds)
- **Acids / Bases / Salts** (affect salt bridges)
- **Heavy** metal ions ( $\text{Hg}^{2+}$ ,  $\text{Pb}^{2+}$ )
- **Its may be reversible or irreversible**

# DENATURATION



# ALTERATION OF FOOD PROTEINS

THE PROPERTIES OF FOOD PROTEINS ARE ALTERED BY

- ENVIRONMENTAL CONDITIONS
- PROCESSING TREATMENTS
- INTERACTIONS WITH OTHER INGREDIENTS

## Processing Methods

HEATING  
FREEZING  
DRYING  
SHEARING OR MIXING  
PRESSURE

## Protein Structure

AMINO ACID COMPOSITION  
AMINO ACID SEQUENCE  
REGULAR FOLDING OF PROTEIN  
CONFORMATION  
SUBUNIT COMPOSITION  
MOLECULAR MASS

## Environmental Conditions

pH  
IONIC STRUCTURE  
TYPE OF SALTS  
MOISTURE CONTENT  
OXIDATION-REDUCTION  
POTENTIAL

## Physicochemical Properties

SURFACE CHARGE  
HYDROPHOBICITY  
THERMAL STABILITY  
FLEXIBILITY  
ASSOCIATION / DISSOCIATION  
BEHAVIOR

## Functional Properties