Workshop #1 Amino Acids & Proteins

medpathwaymcat

Med-pathway

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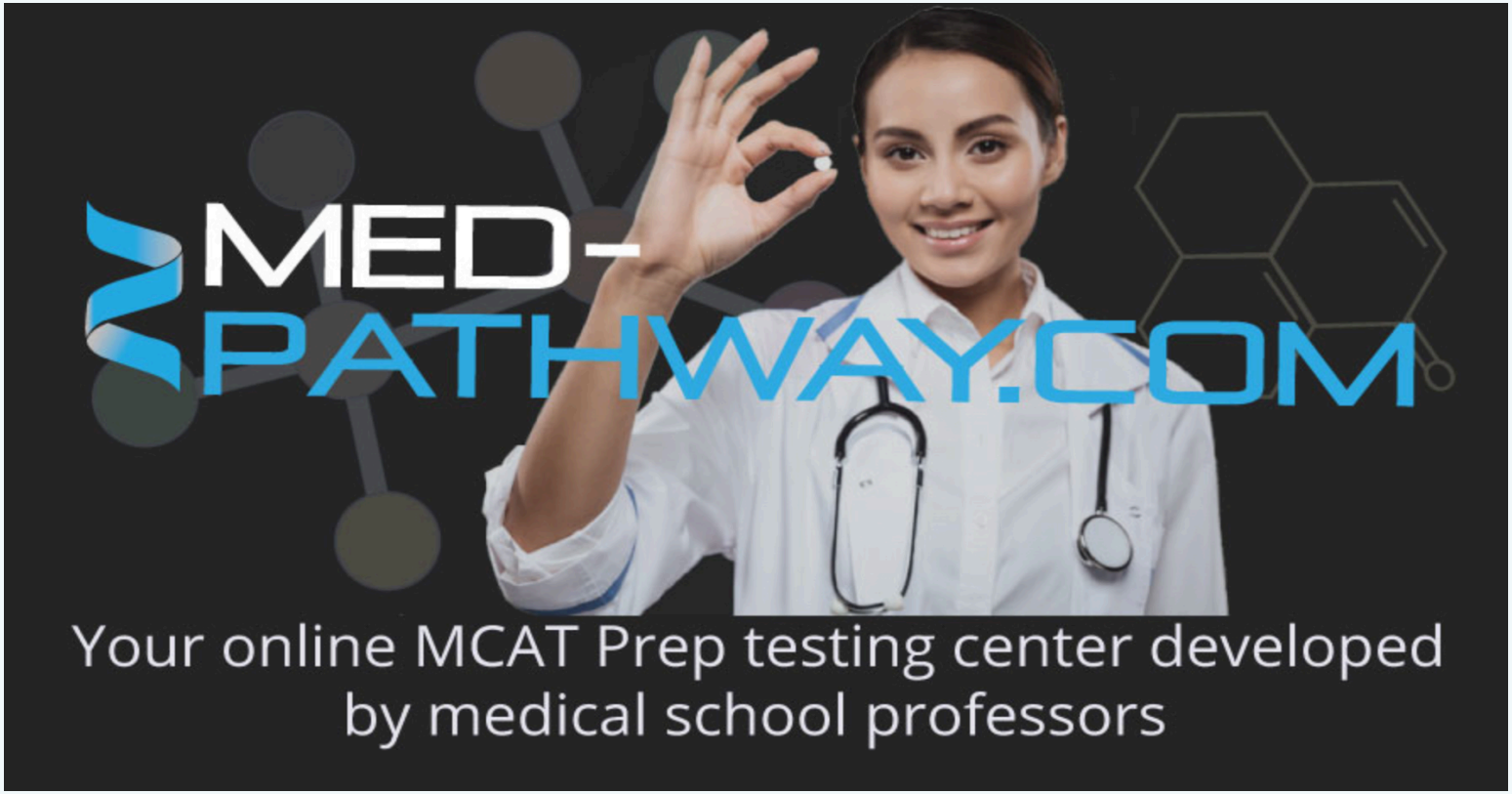


OUTLINE

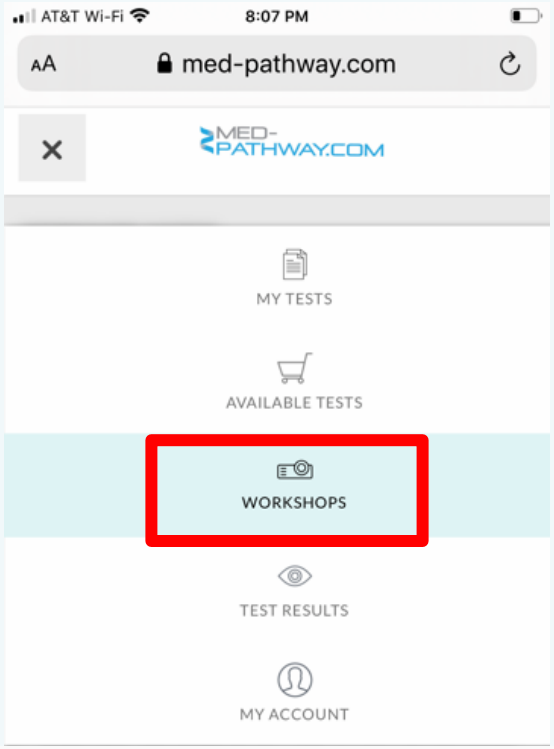
Content Review
2 Passages

Amino Acids, Peptides & Proteins Diagnostic Test

Questions : 86 **Expires :** 6 Months

See Description Add to Cart : $8.95

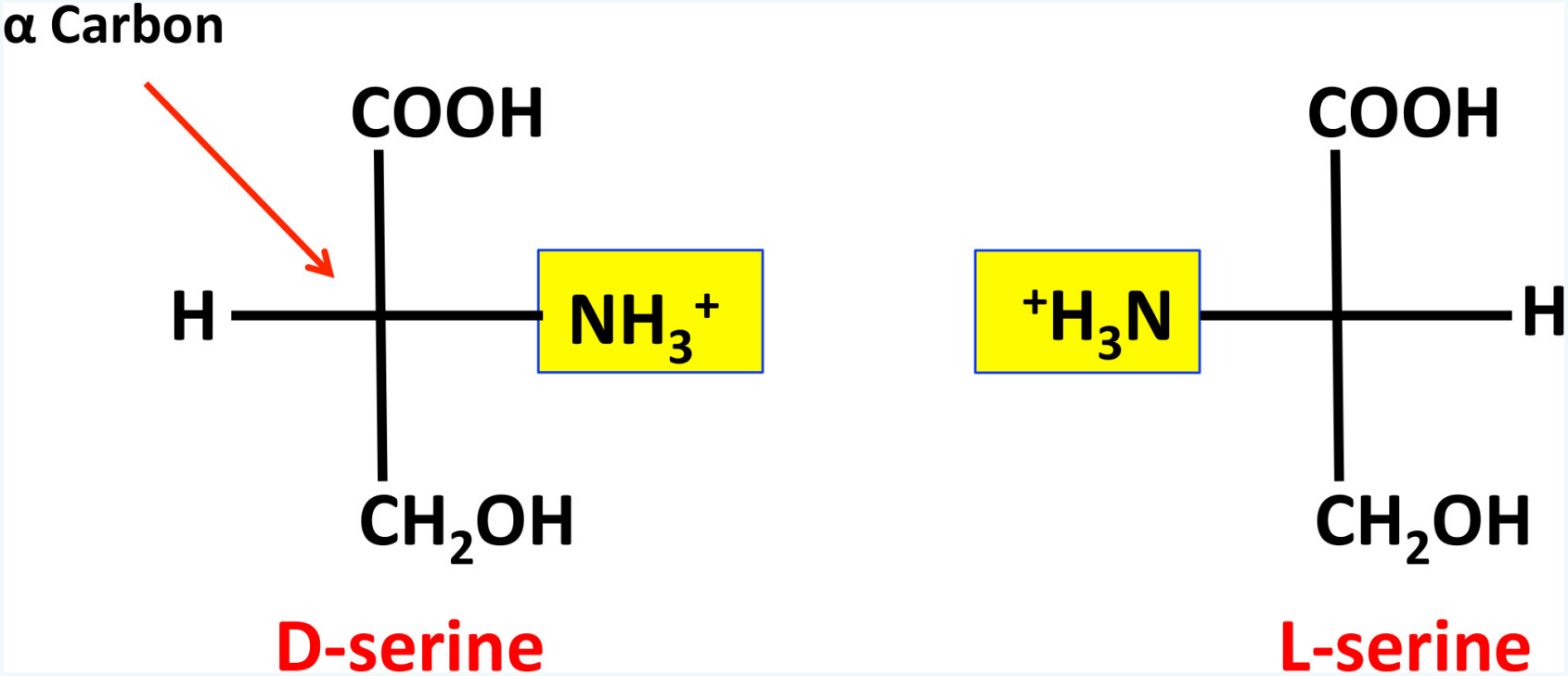
BIG PICTURE: The MCAT loves the high yield topic of amino acids and proteins because of their high relevance in research and clinical medicine. This testing module consists of challenging passages and free standing questions that focus on multiple biochemical aspects of amino acids and proteins. Free Content Review designed around the AAMC MCAT Content Outline is also available on our web site.



Hemoglobin Structure & Function

DNA Polymerase Structure & Function

Amino Acid Structure

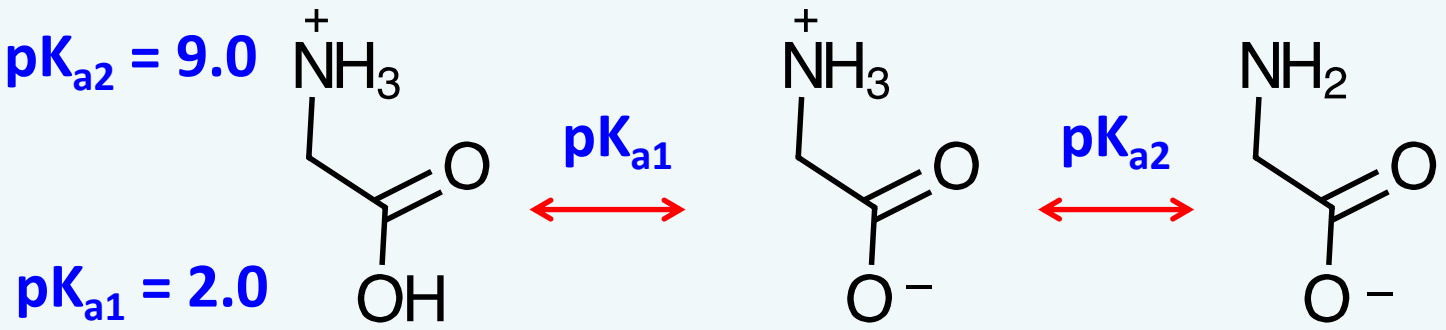


Fischer Projections

Amino Acids & Acid/Base Chemistry

$$HA = H^+ + A^- \quad K_a = \frac{[H^+][A^-]}{[HA]} \quad pK_a = -\log K_a$$

INCREASING pH



Increasing Cationic Character ← **pI** → **Increasing Anionic Character**

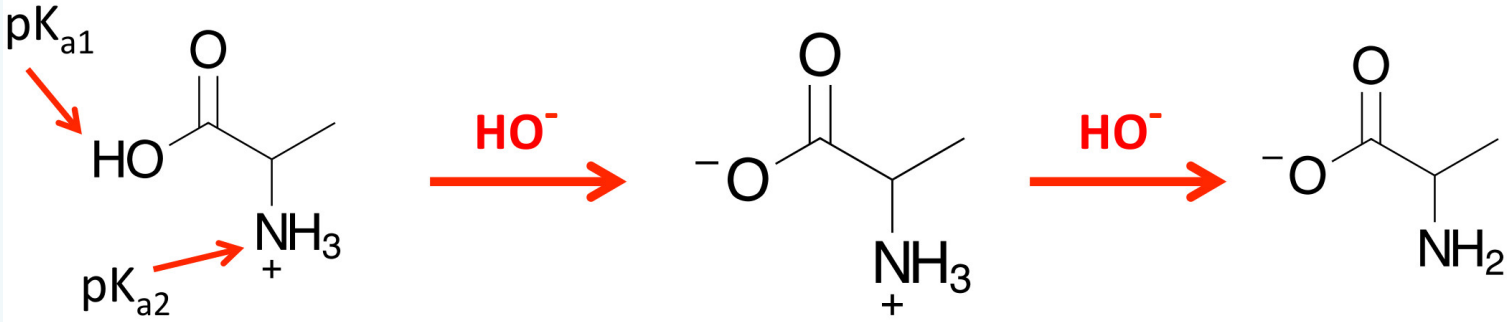
pH < pI | **pH > pI**

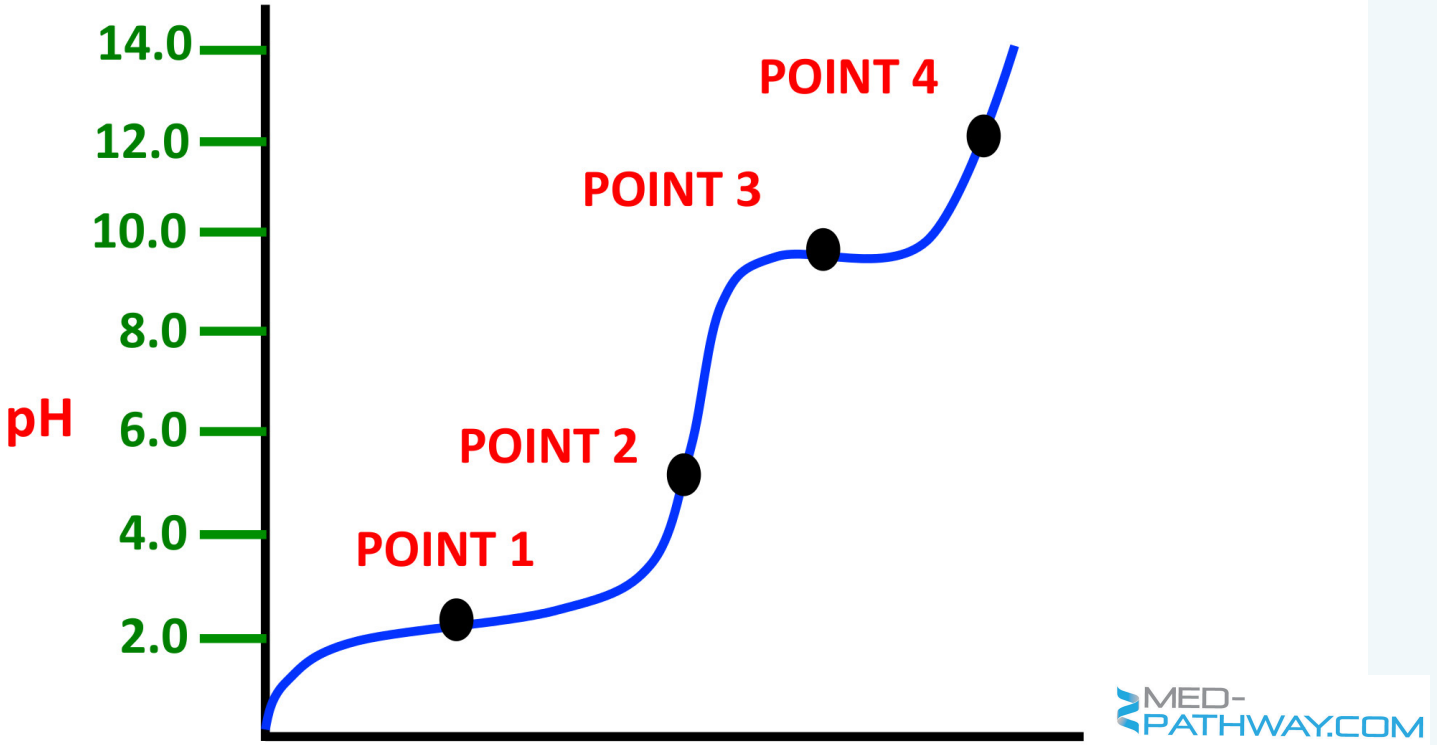
↓

Zwitterionic

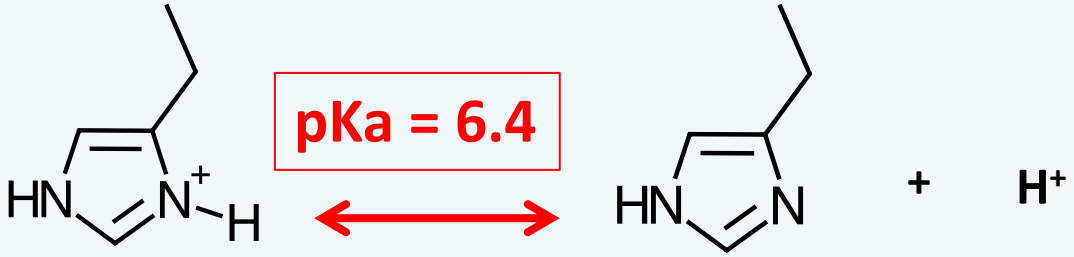
Alanine Titration Curve

Form A: +1 charge | **Form B: no charge** | **Form C: -1 charge**





Henderson Hasselbalch



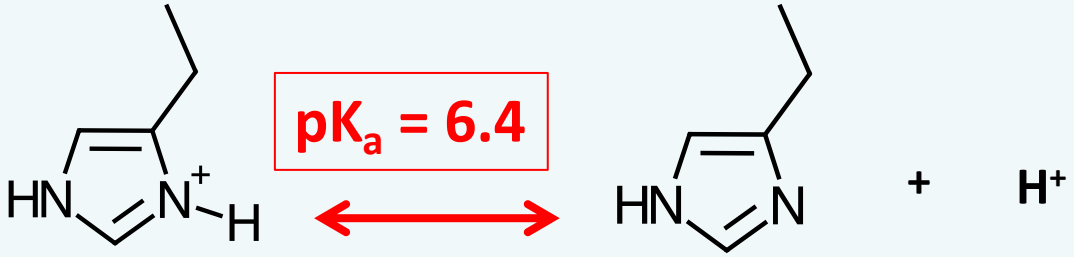
HA
(Acid)

A^-
(Conjugate Base)

$$HA = H^+ + A^- \longrightarrow pH = pK_a + \log[Base]/[Acid]$$

Q: What is the fraction of histidine residues that are positively charged at pH = 7.4?

Henderson Hasselbalch



HA
(Acid)

A-
(Conjugate Base)

$$pH = pK_a + \log[Base]/[Acid]$$

Q: What is the fraction of histidine residues that are positively charged at pH = 7.4?

$HA = H^+ + A^-$

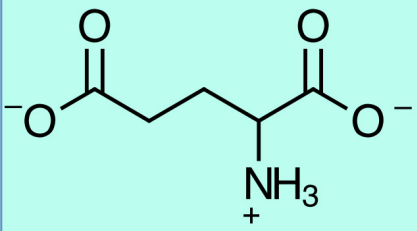
$pH = pK_a + \log[Base]/[Acid]$
$7.4 = 6.4 + \log[Base]/[Acid]$
$1 = \log[Base]/[Acid]$
$10 = [Base]/[Acid]$
$pH > pK_a$ Therefore, 90% of histidine is in form of conjugate base
Answer: 10% positively charged

Survey of Amino Acid Classes

Understand Chemistry of Side Chains

Acidic

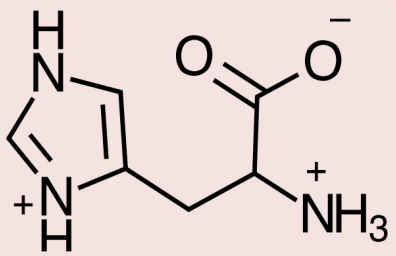
Aspartate (D)



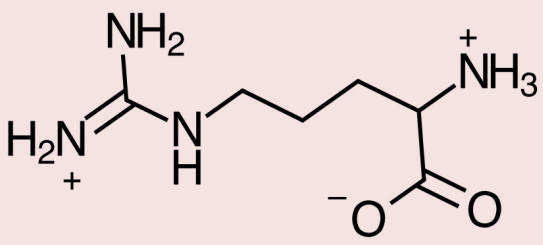
Glutamate (E)

(Nitrogen carrier)

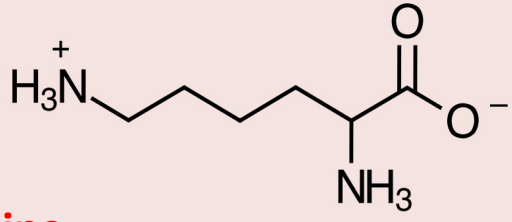
Basic



Histidine (H)



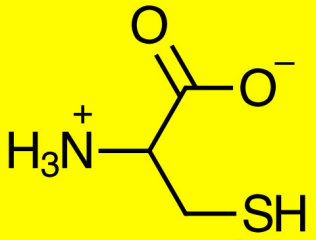
Arginine (R)



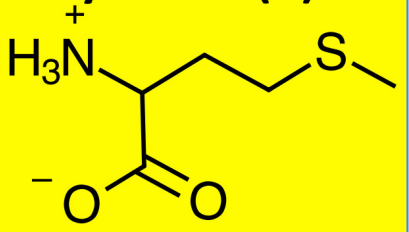
1° Amine

Lysine (K)

Sulfur



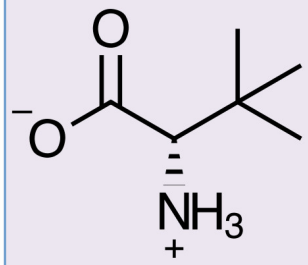
Cysteine (C)



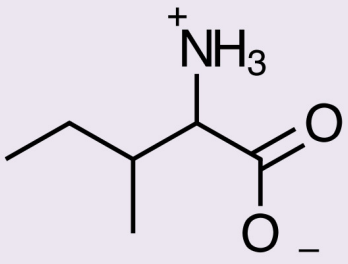
Methionine (M)

Aliphatic

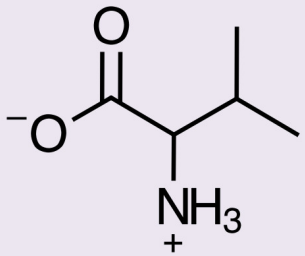
Hydrophobic effect



Leucine (L)



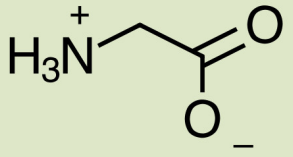
Isoleucine (I)



Valine (V)

Alanine (A)

Achiral

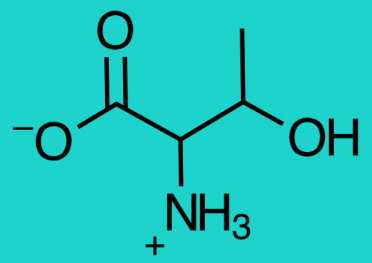


1° Amine

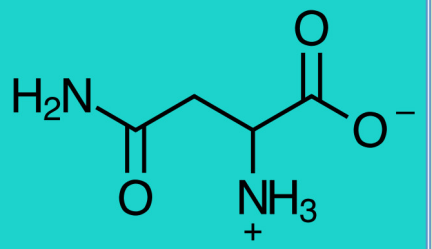
Glycine (G)

Amino Acid Classes

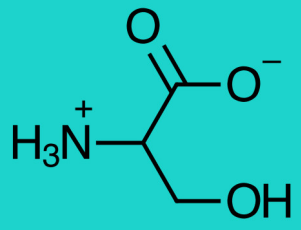
Polar, uncharged



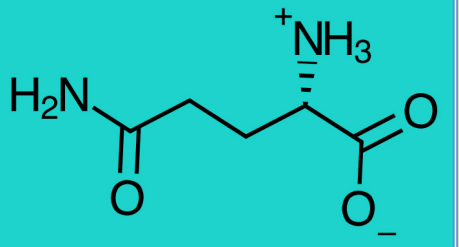
Threonine (T)



Asparagine (N)

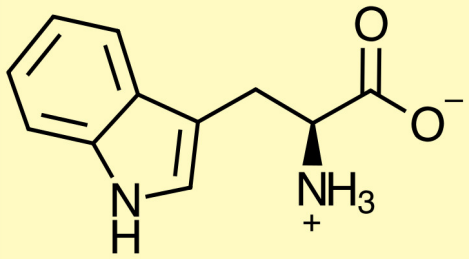


Serine (S)

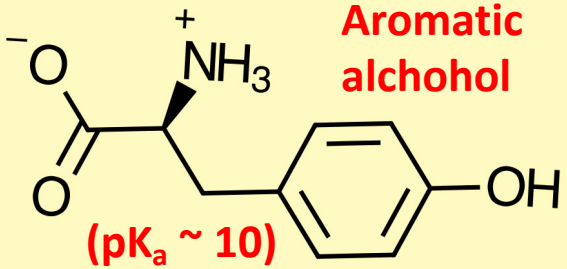


Glutamine (Q)

Aromatic



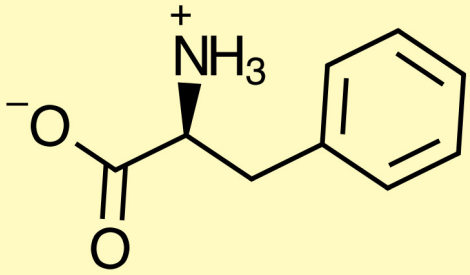
Tryptophan (W)



Aromatic alchohol

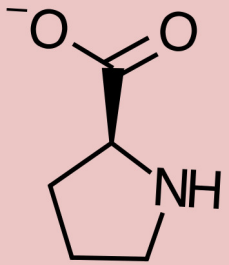
(pK_a ~ 10)

Tyrosine (Y)



Phenylalanine (F)

Imino



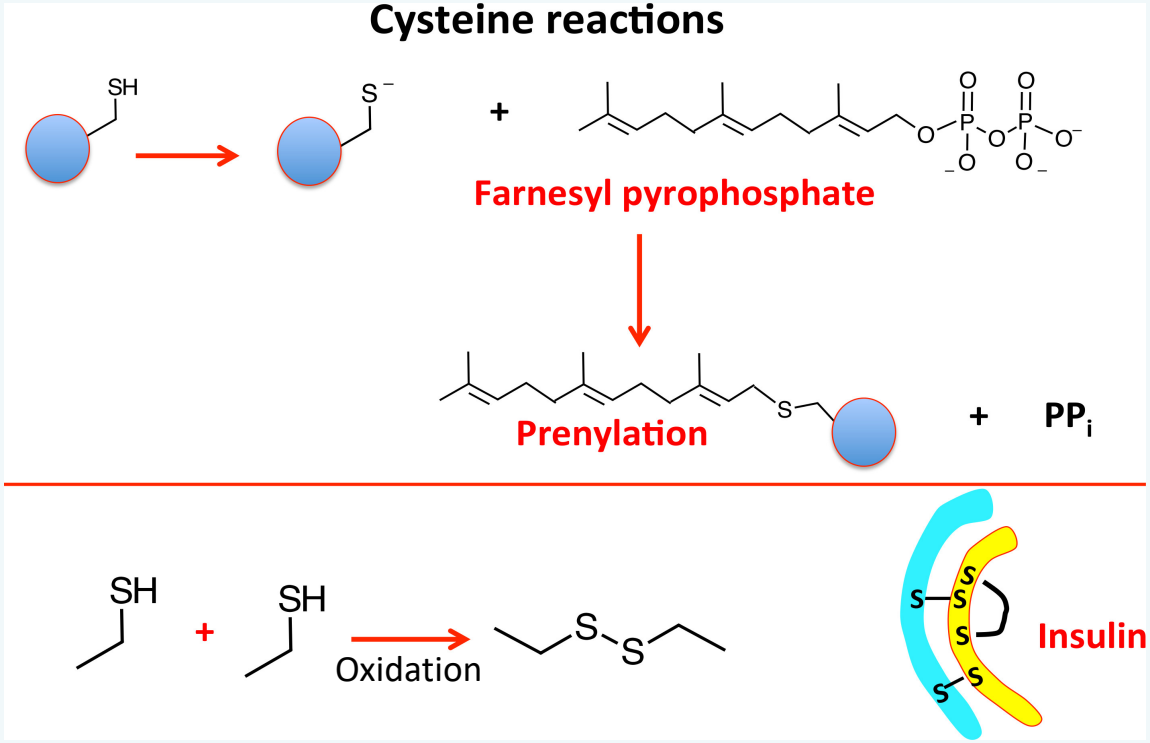
Proline (P)

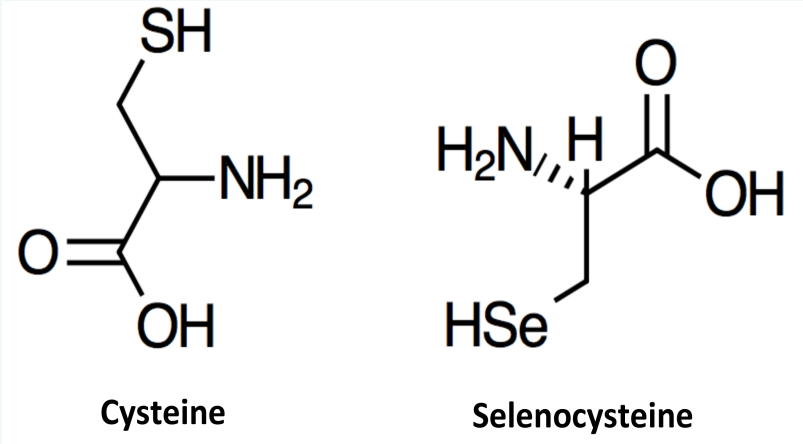
Alcohol (pK_a ~ 13)

Amide

2° Amine

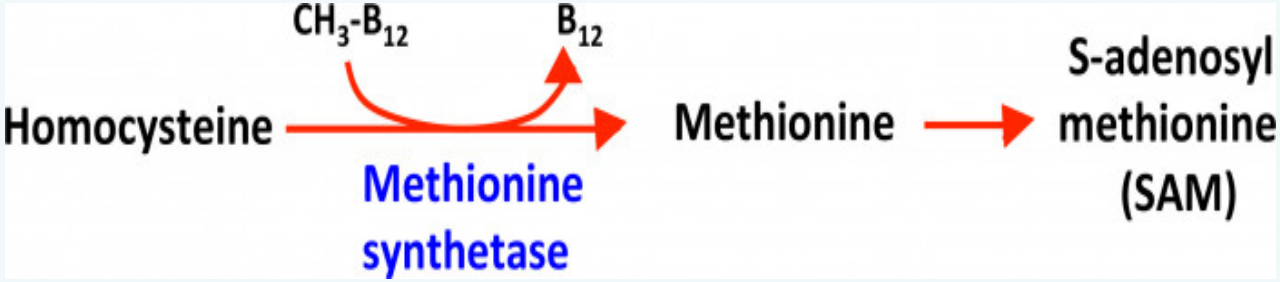
Cysteine Reactions



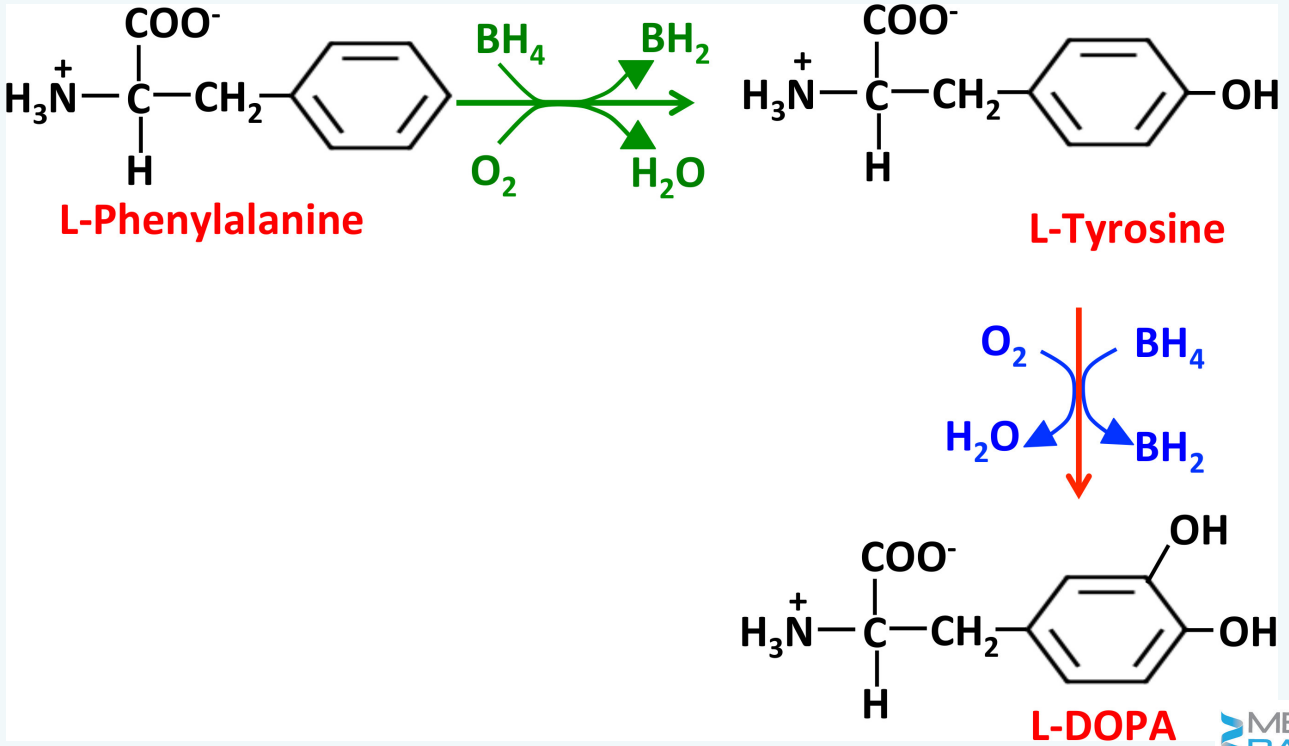


Essential vs Non-Essential AA

Methionine

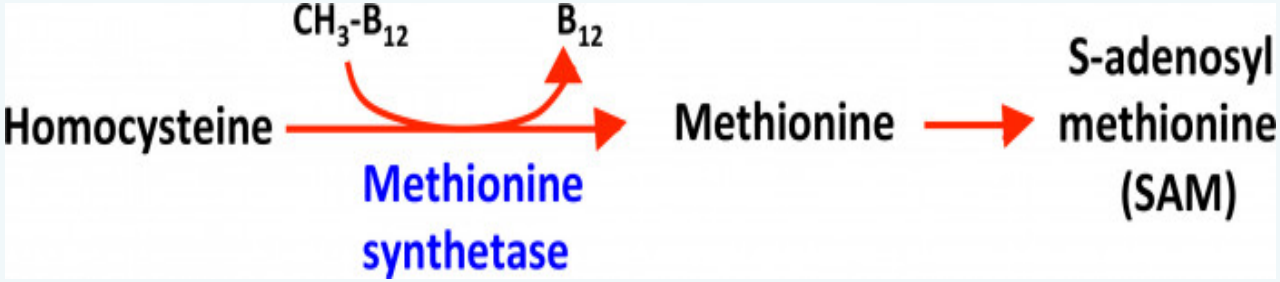


Tyrosine

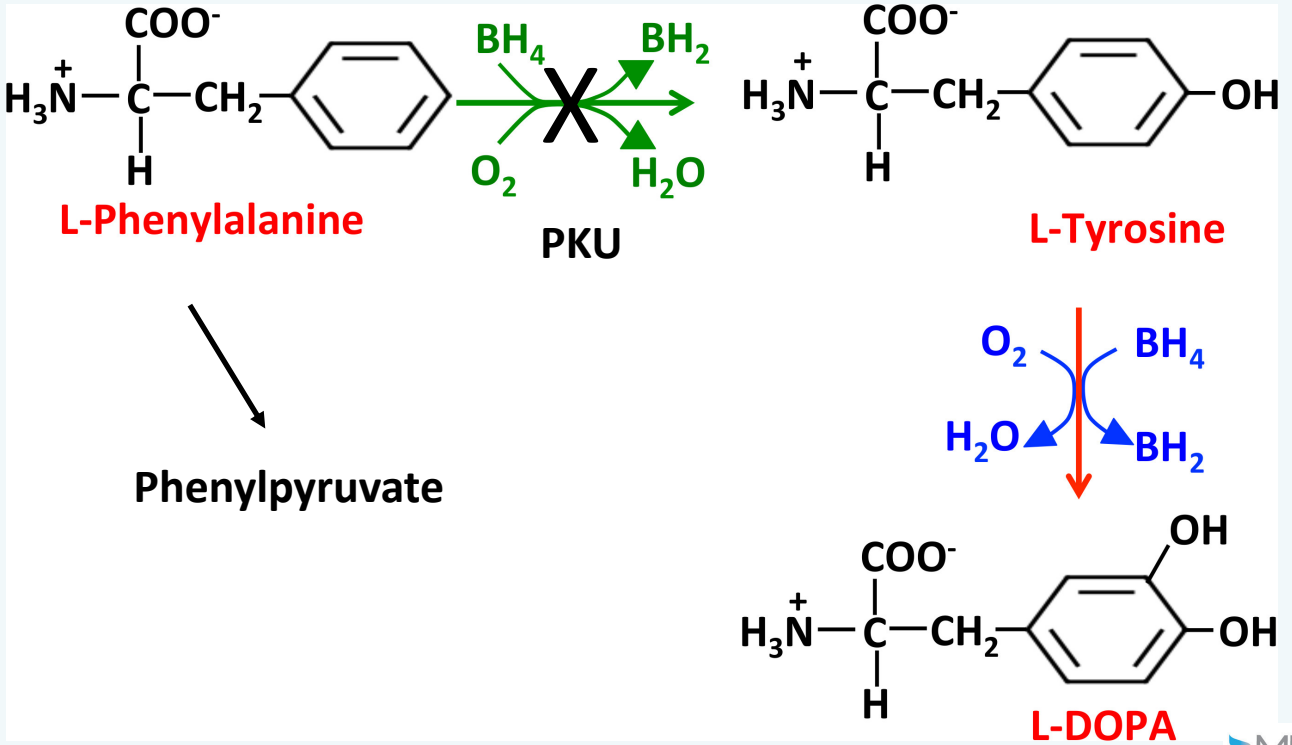


Essential vs Non-Essential AA

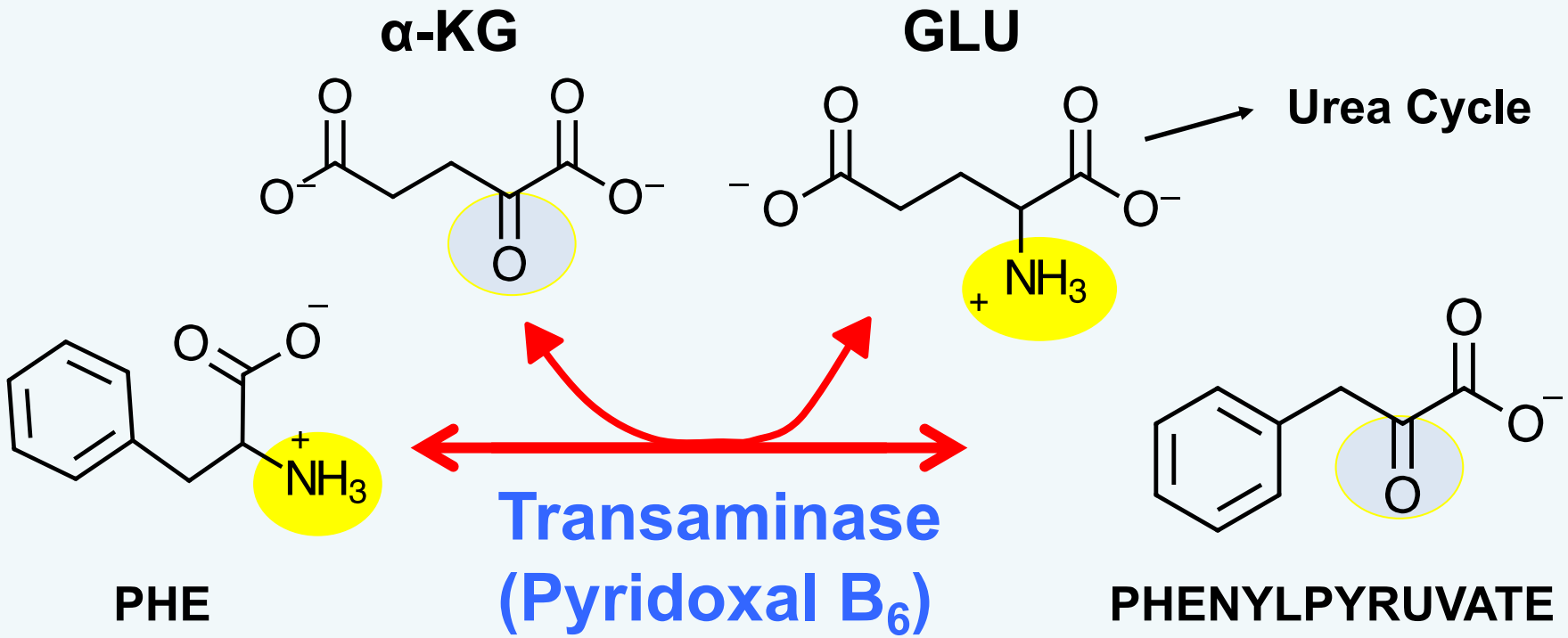
Methionine

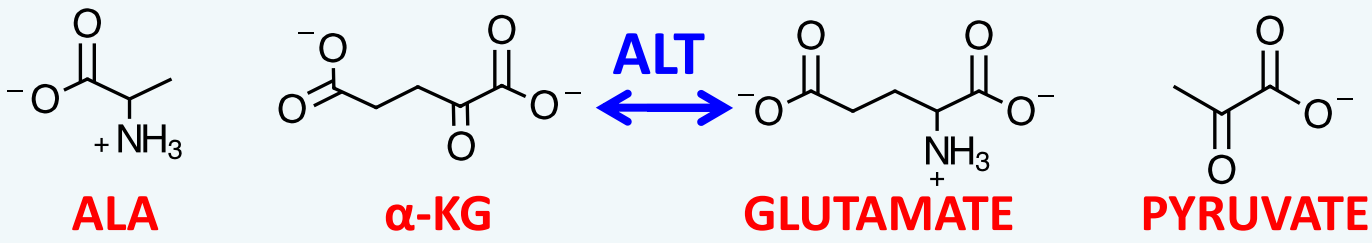


Tyrosine

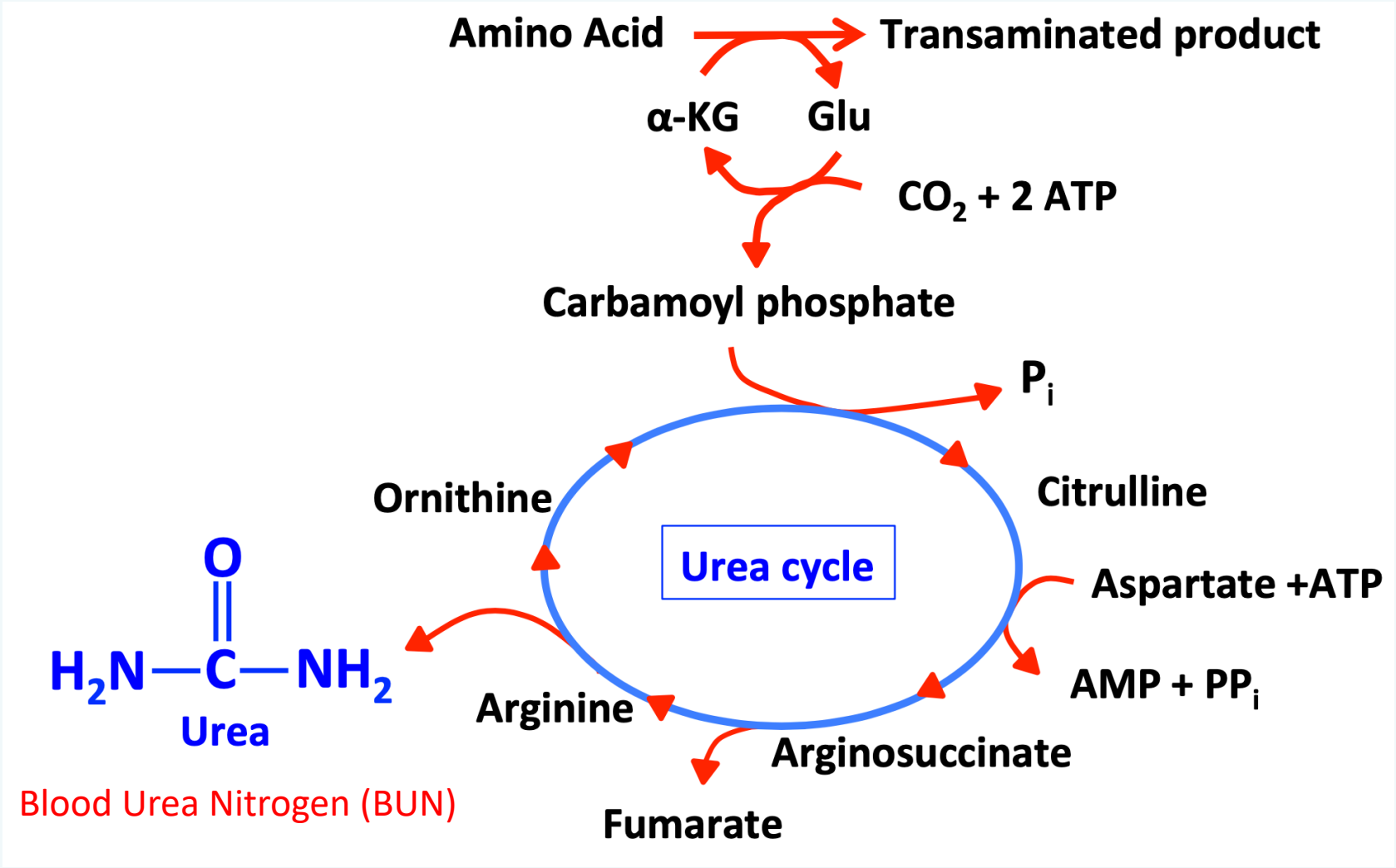


Nitrogen Balance

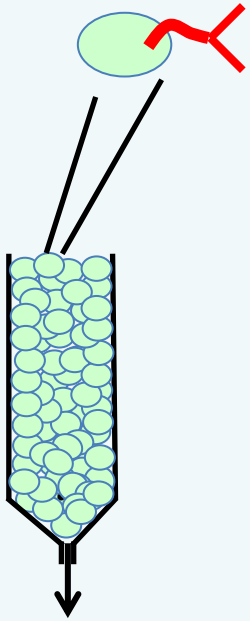


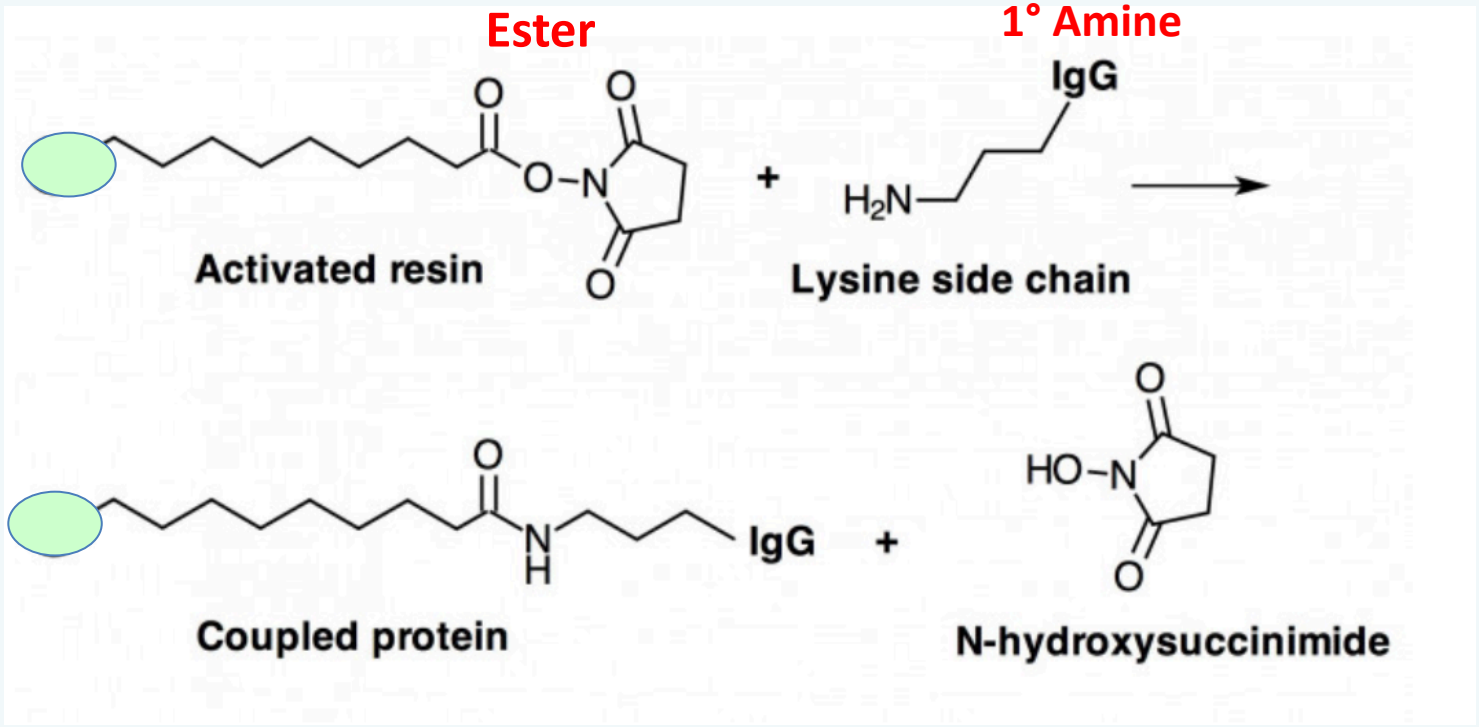


Nitrogen Balance & Arginine

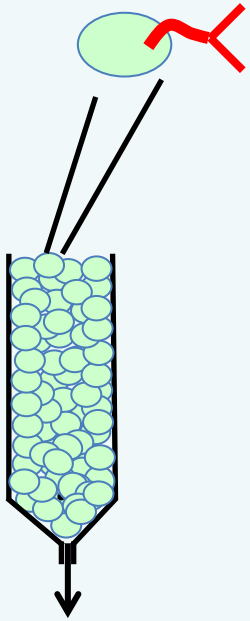


Use of Lysine in Affinity Columns

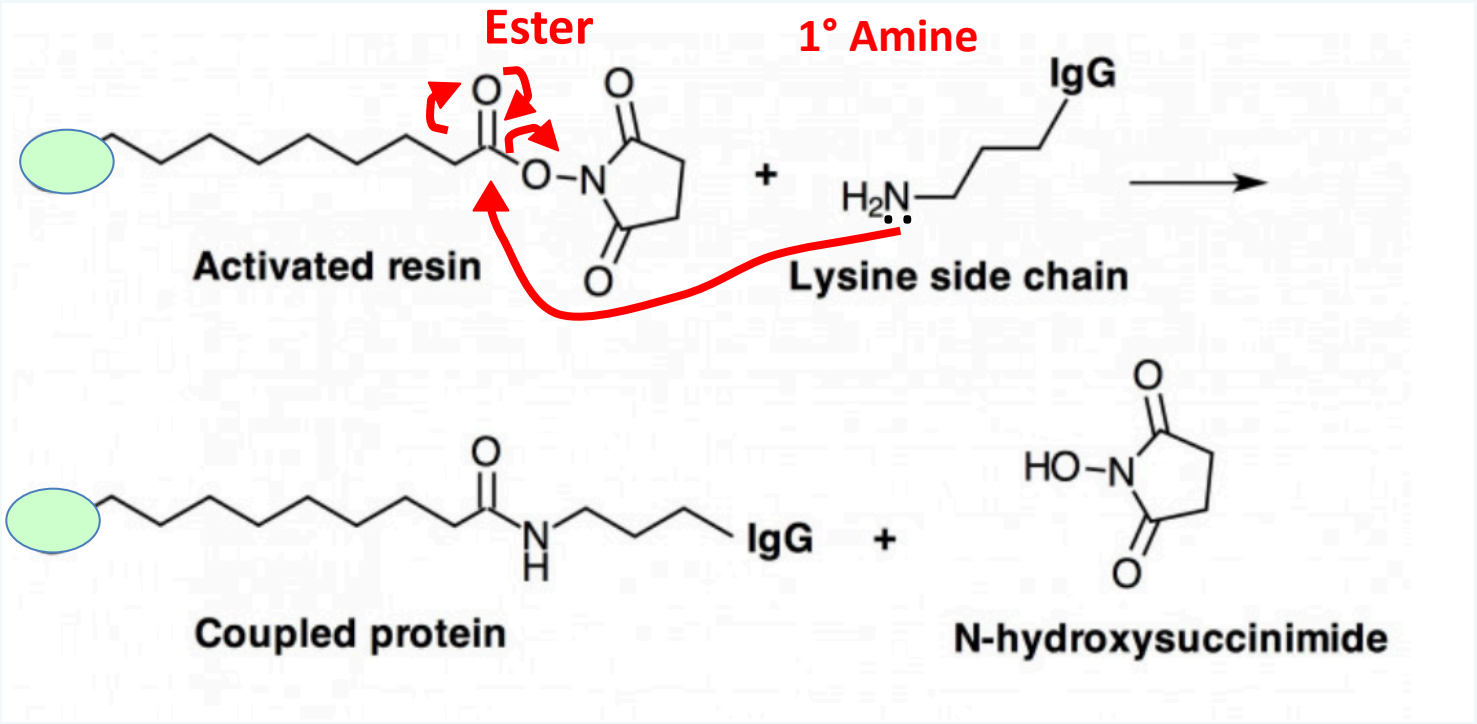




Use of Lysine in Affinity Columns



Basic pH



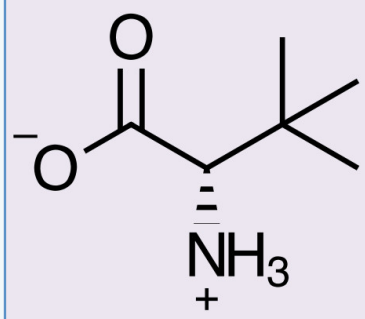
Amide

Alcohol

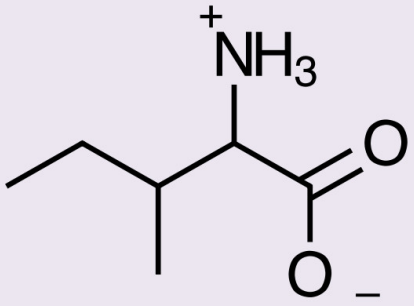
Ester + Amine = Amide + Alcohol

Branched Chain AA (BCAA)

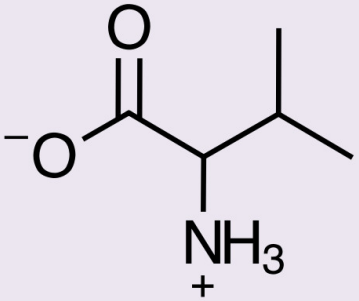
Aliphatic



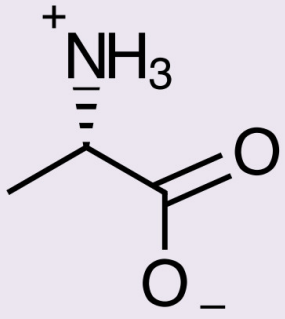
Leucine (L)



Isoleucine (I)



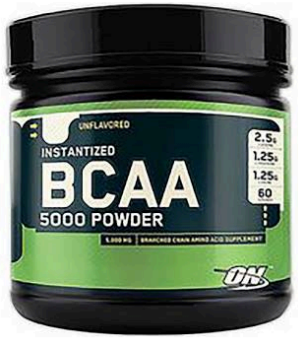
Valine (V)



Alanine (A)

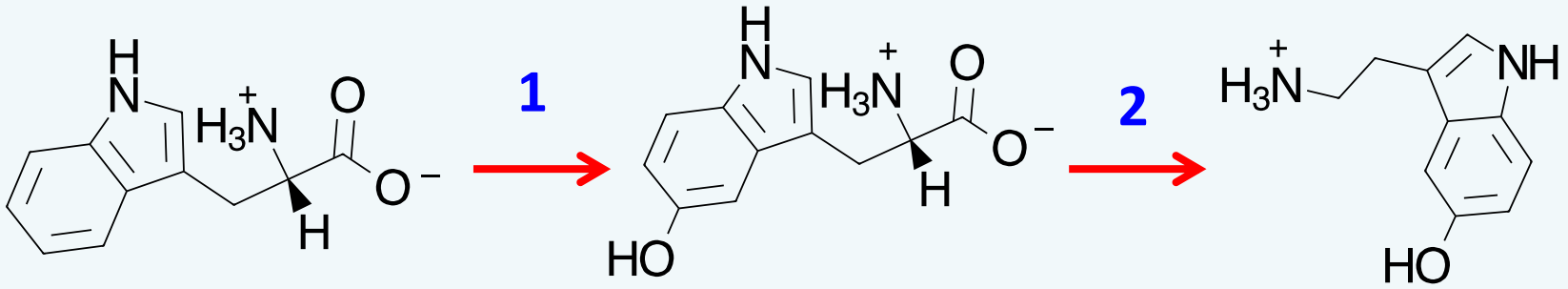
Best BCAA - Best BCAA Supplement...
$26.99
BPI Sports Nutritio...
★★★★½ (1k+)

BCAA's Nutrition Supplement | Blue...
$42.99
1st Phorm



Optimum Nutrition BCAA 5000 -...
$32.99
GNC
★★★★☆ (304)

Aromatic Amino Acids as Precursors

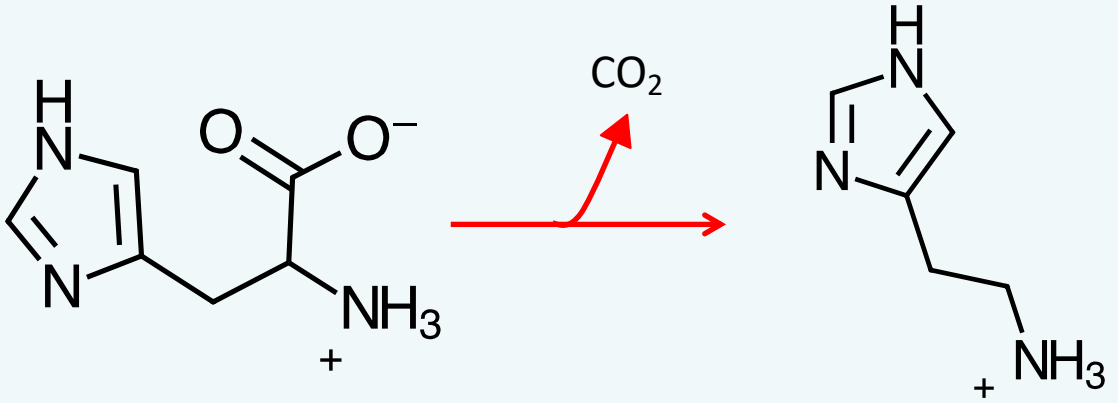


L-tryptophan

L-5 hydroxytryptophan

Serotonin

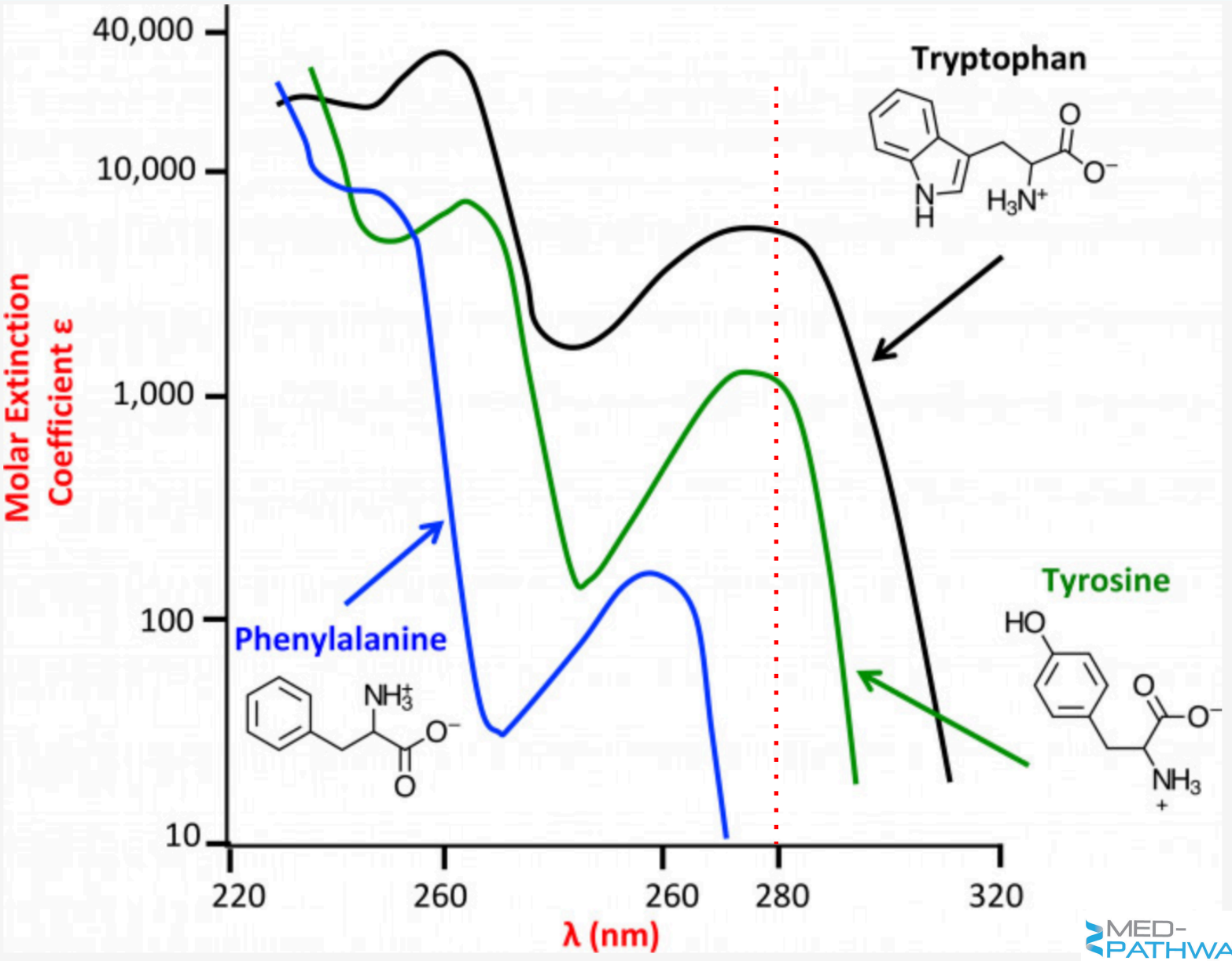
5-HT



L-Histidine

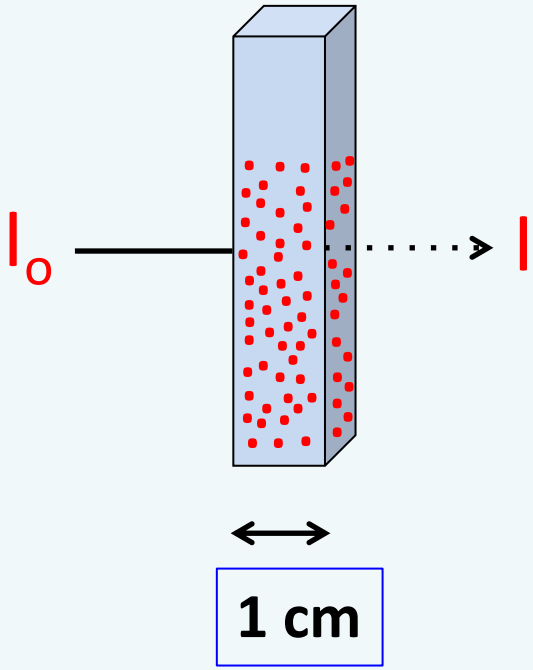
Histamine

UV Absorbance of AA



Beer Lambert Law

Linear relationship between concentration and absorbance



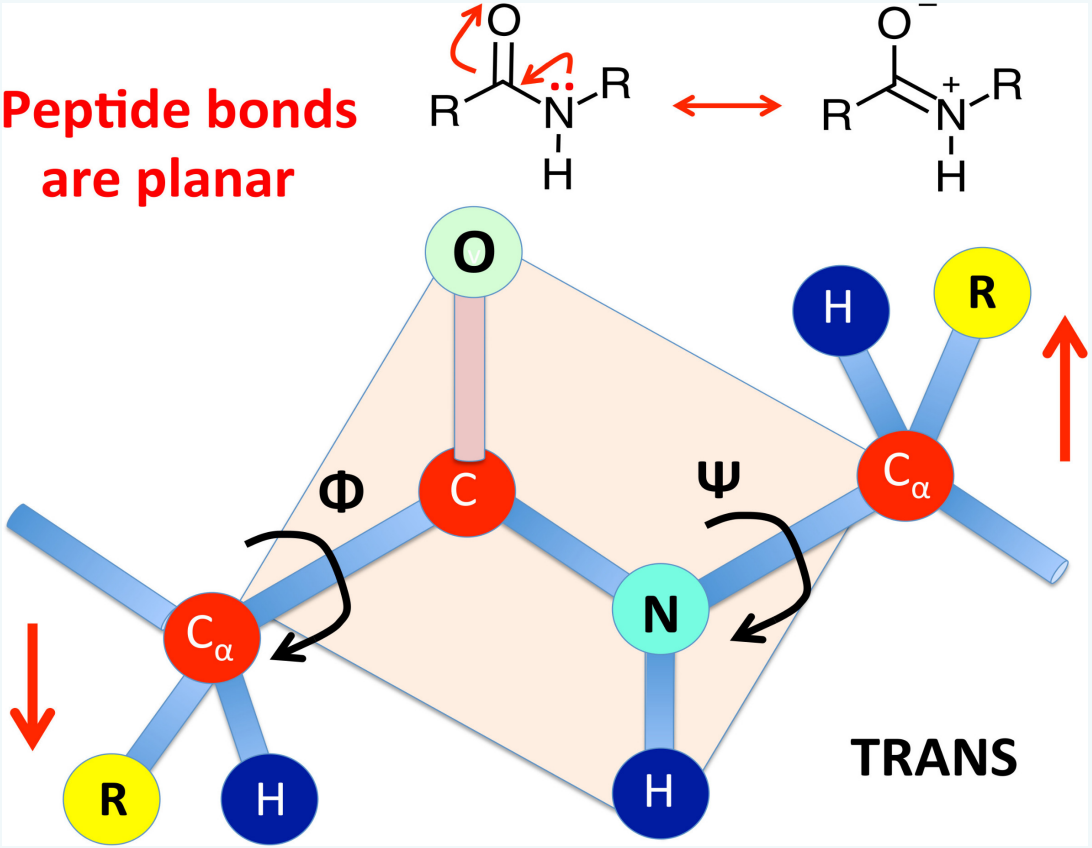
$$A = \text{Log}\frac{I_o}{I} = \varepsilon\, c\, l$$

Molar extinction Coefficient

Concentration

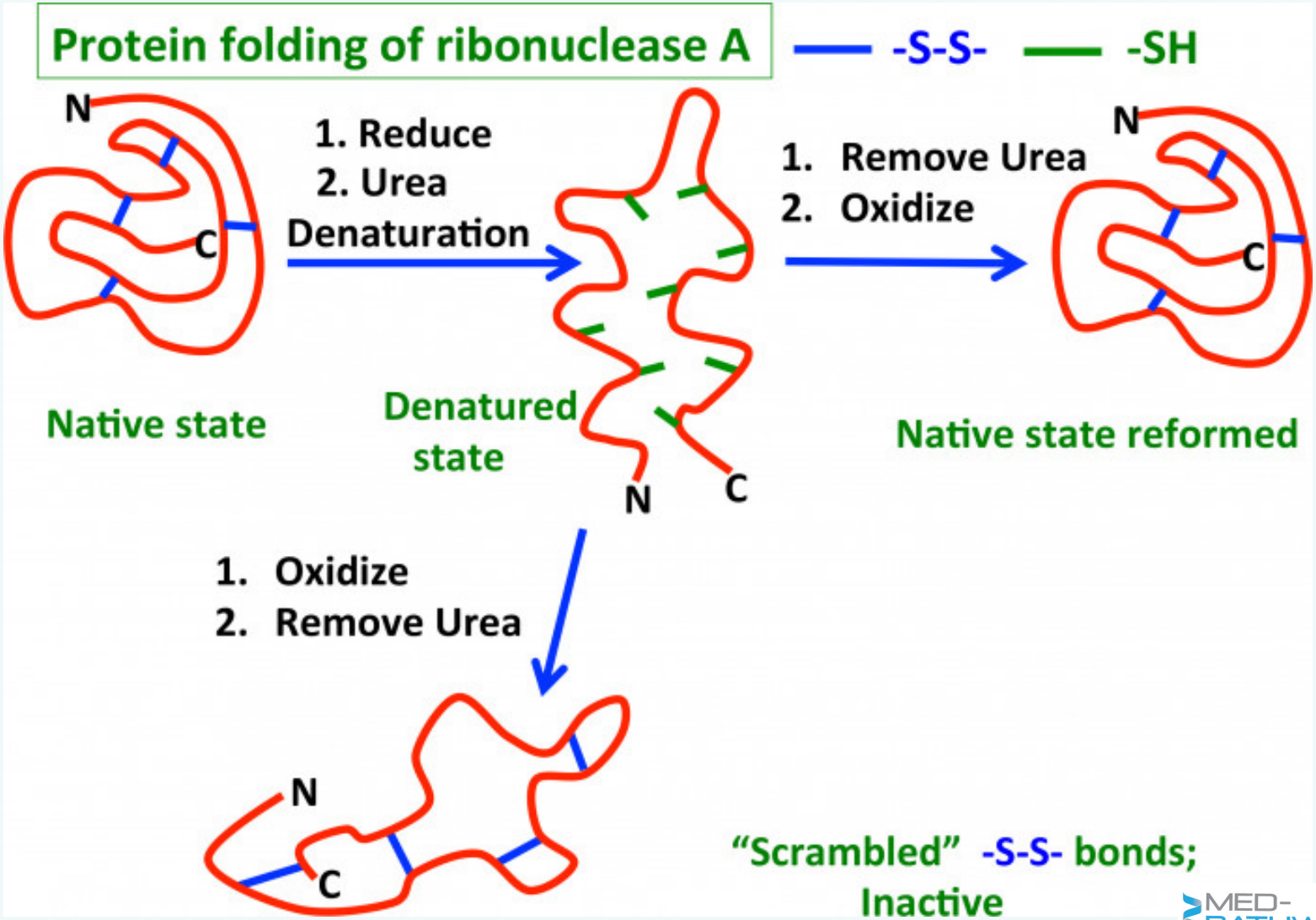
Length

Peptide Bonds

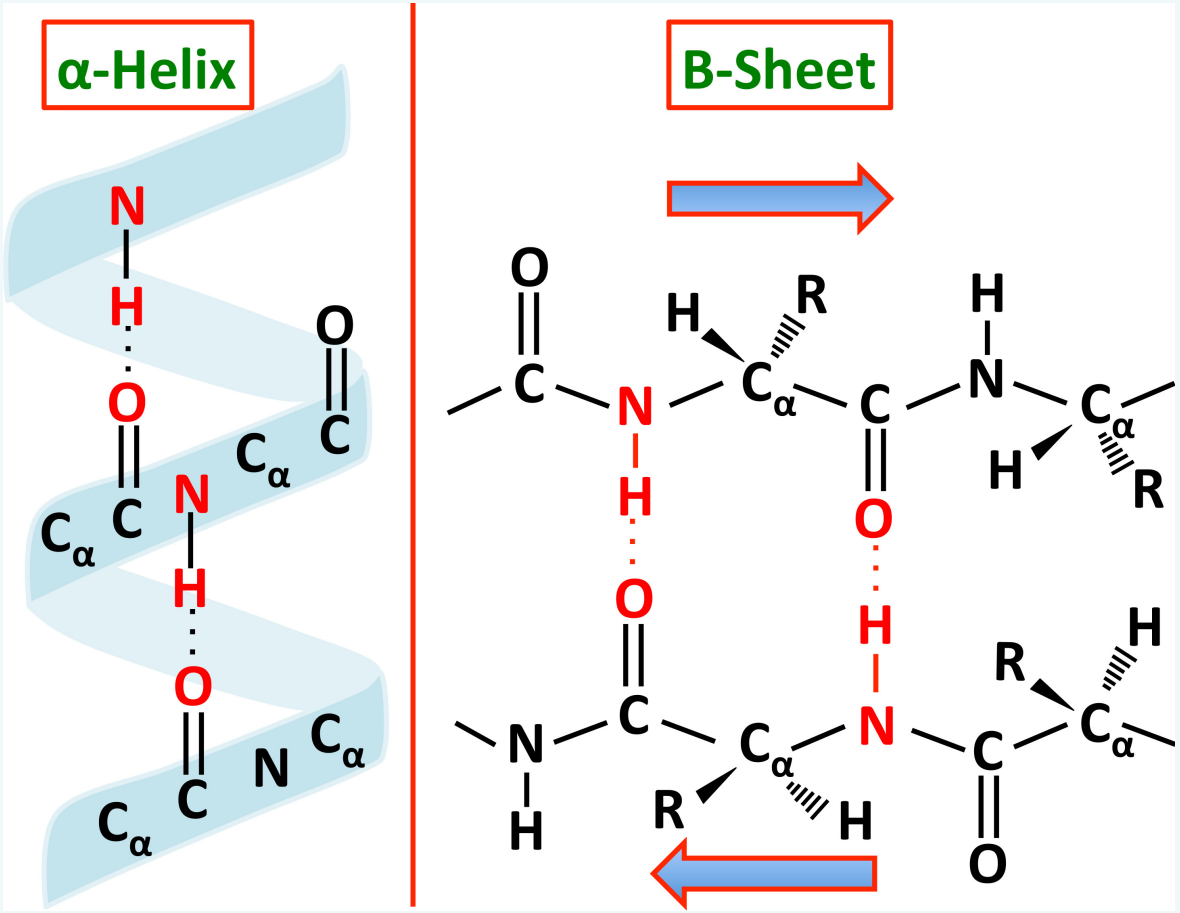


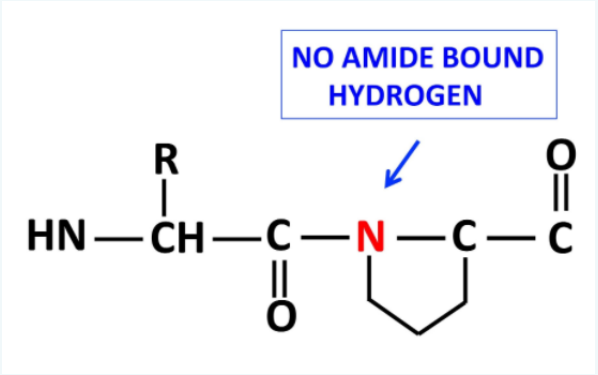
Primary Protein Structure

The Anfinsen Experiment



Secondary Structure/Function

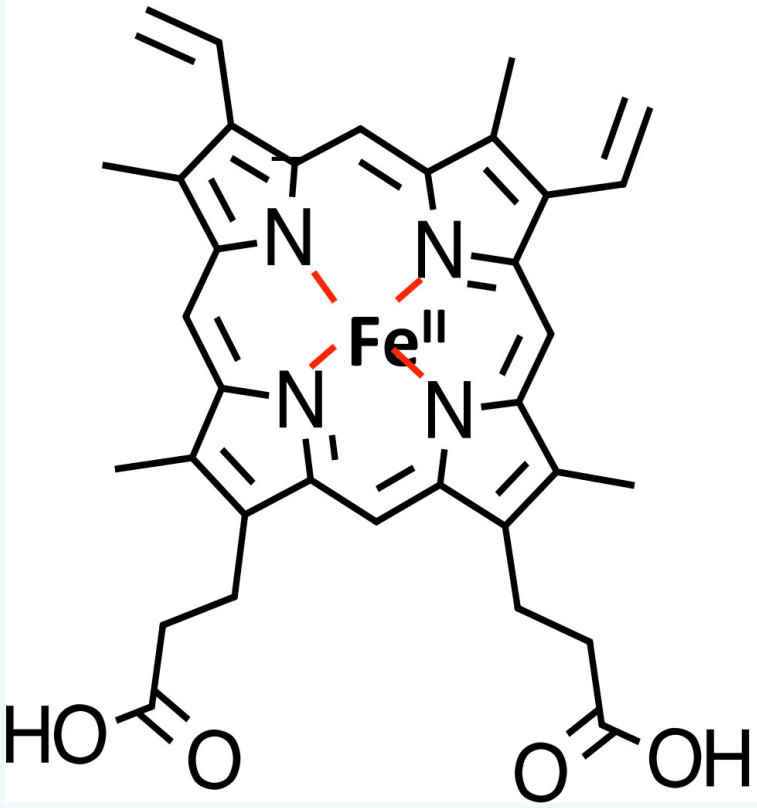




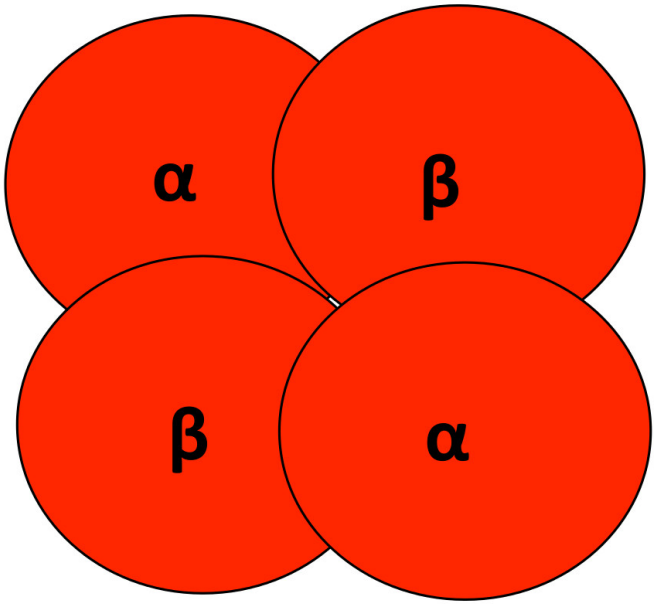
Proline

Hemoglobin (3° & 4° structure)

Heme



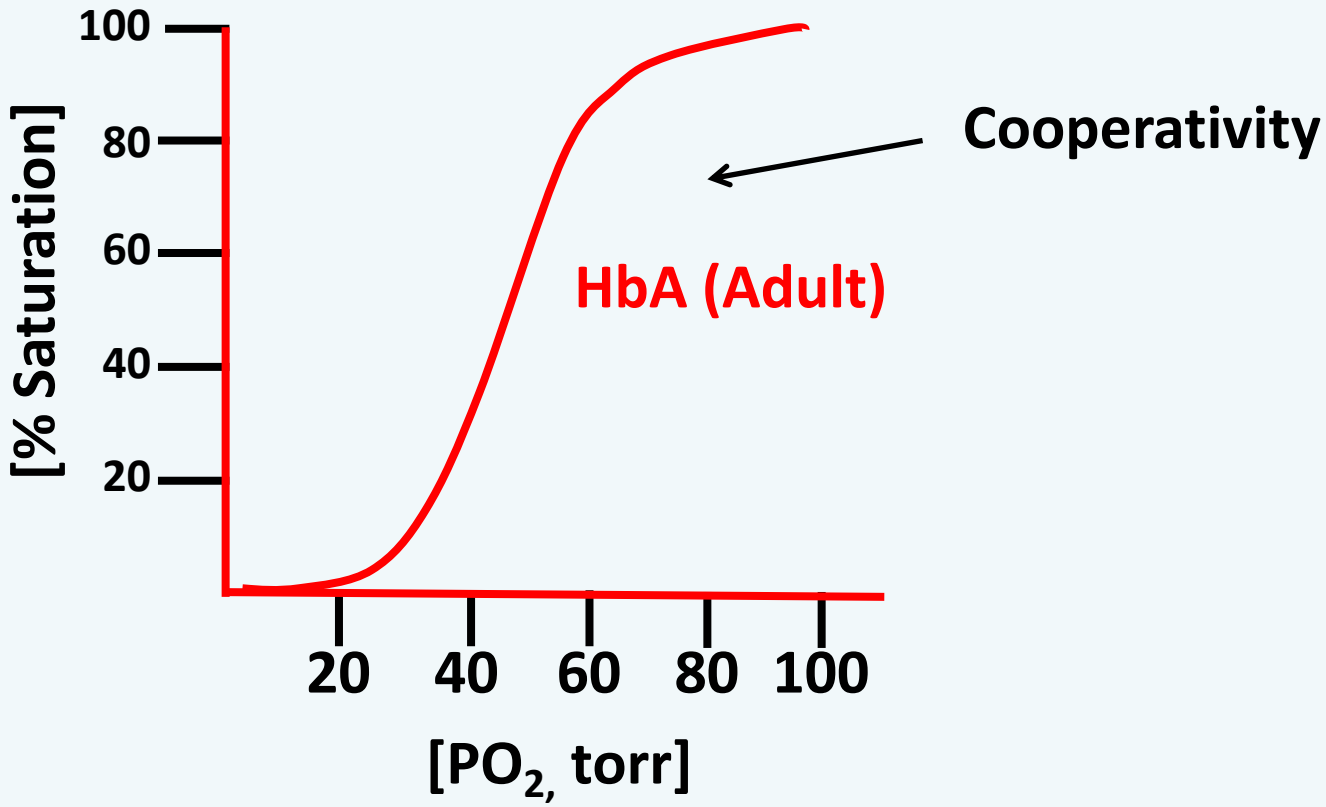
Hemoglobin tetramer



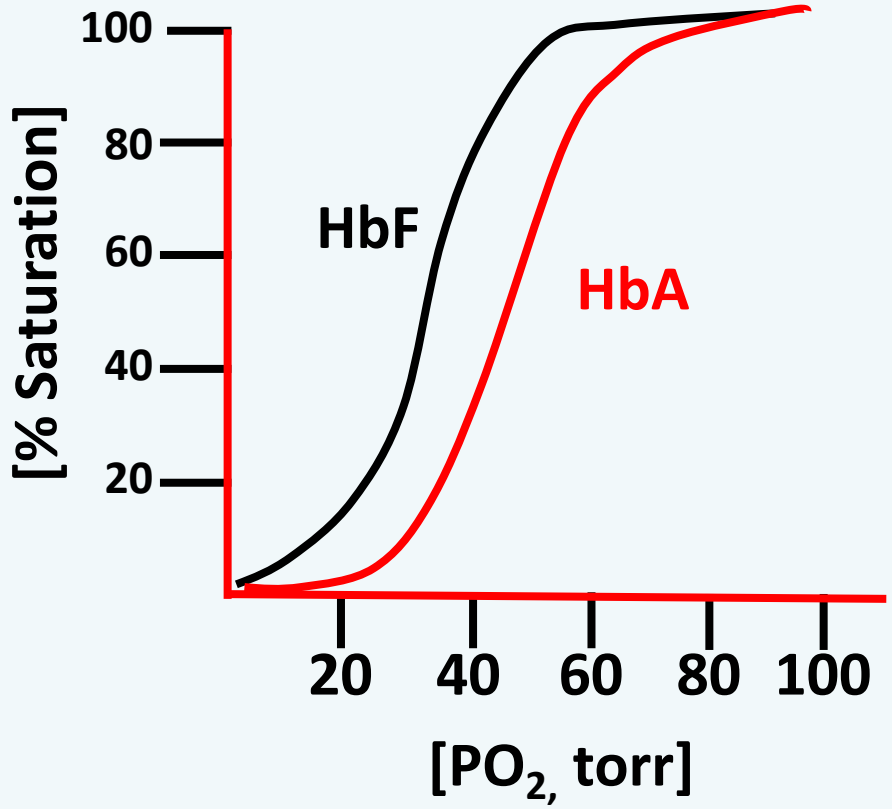
HbA = $\alpha_2\beta_2$

(95% of the mass of RBC)

Oxygen Binding Curves



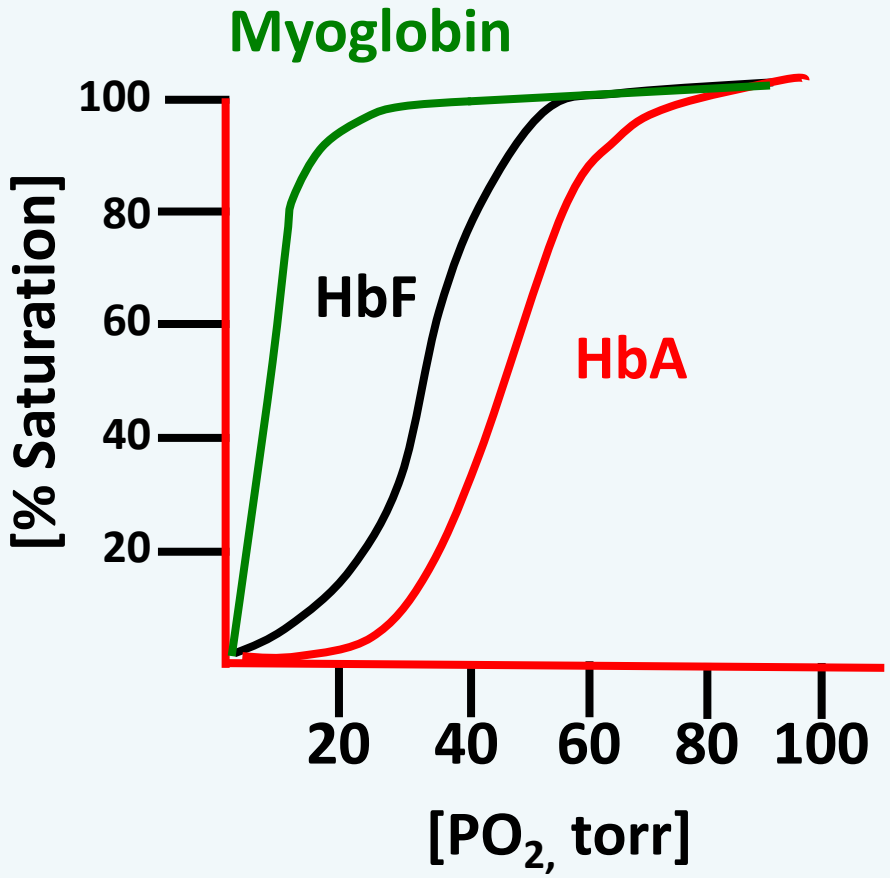
Oxygen Binding Curves



$HbF = \alpha_2\gamma_2$

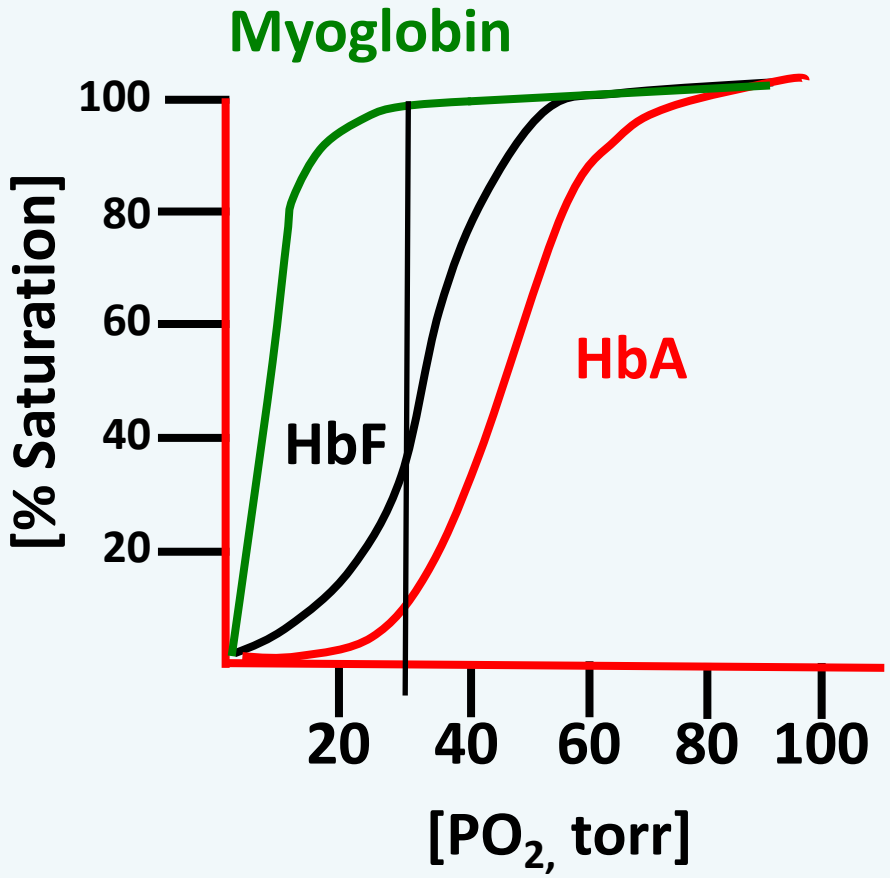
$HbA = \alpha_2\beta_2$

Oxygen Binding Curves



Oxygen Binding Curves

Left Shifted = Higher Affinity



Hemoglobin & Cooperative Binding

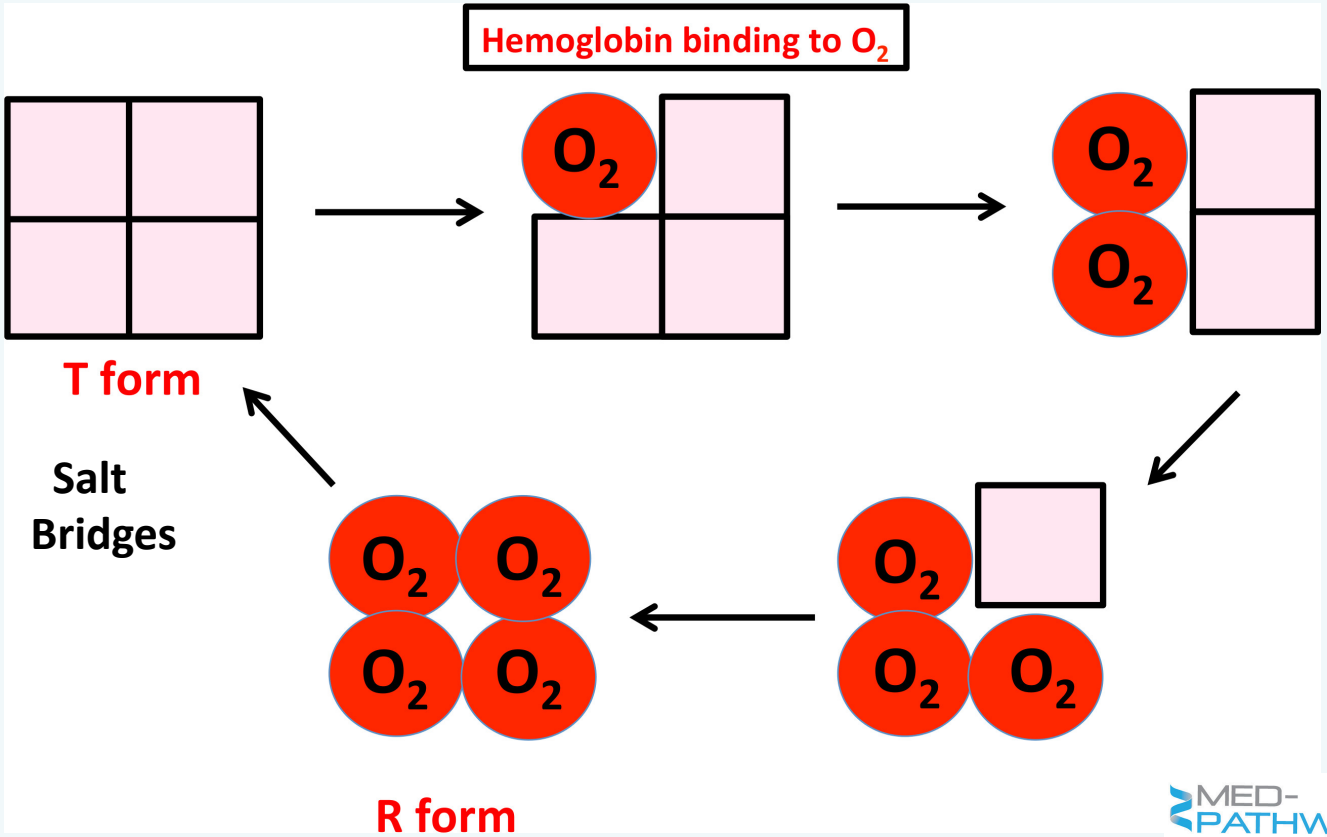
$$Hb + O_2 = Hb(O_2) + H^+$$

Lungs

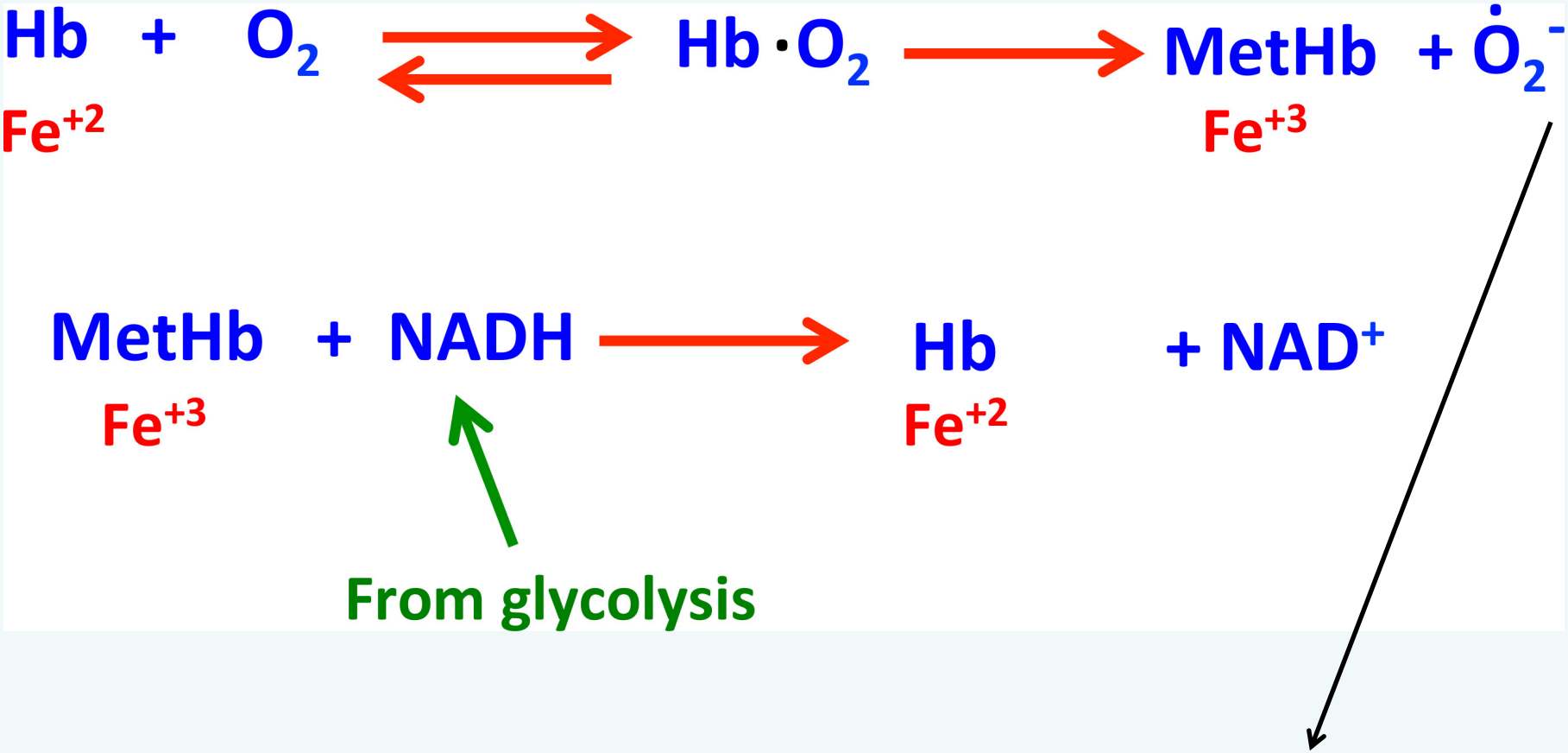
CA

$$CO_2 + H_2O = H_2CO_3 = HCO_3^- + H^+$$

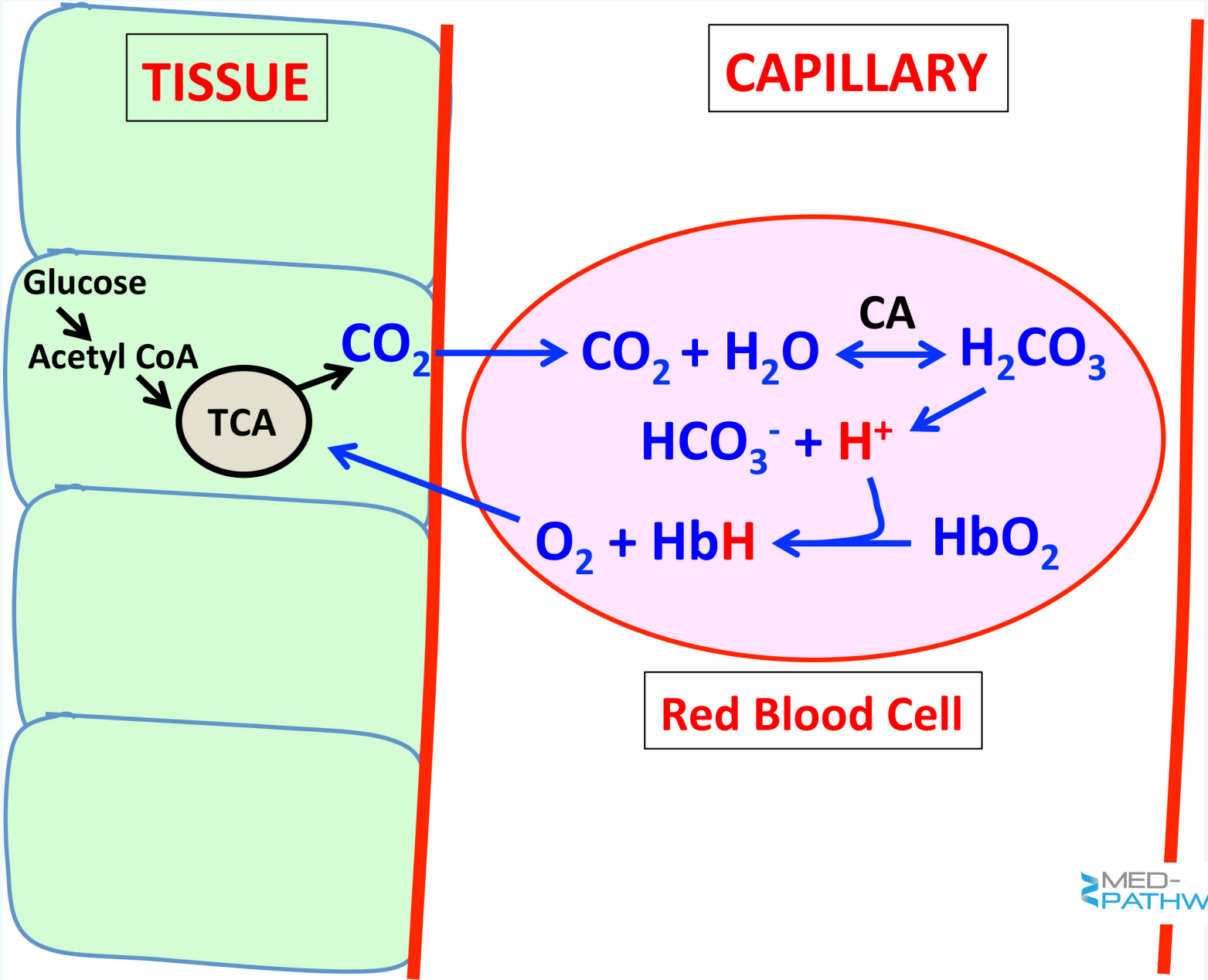
CA = carbonic anhydrase



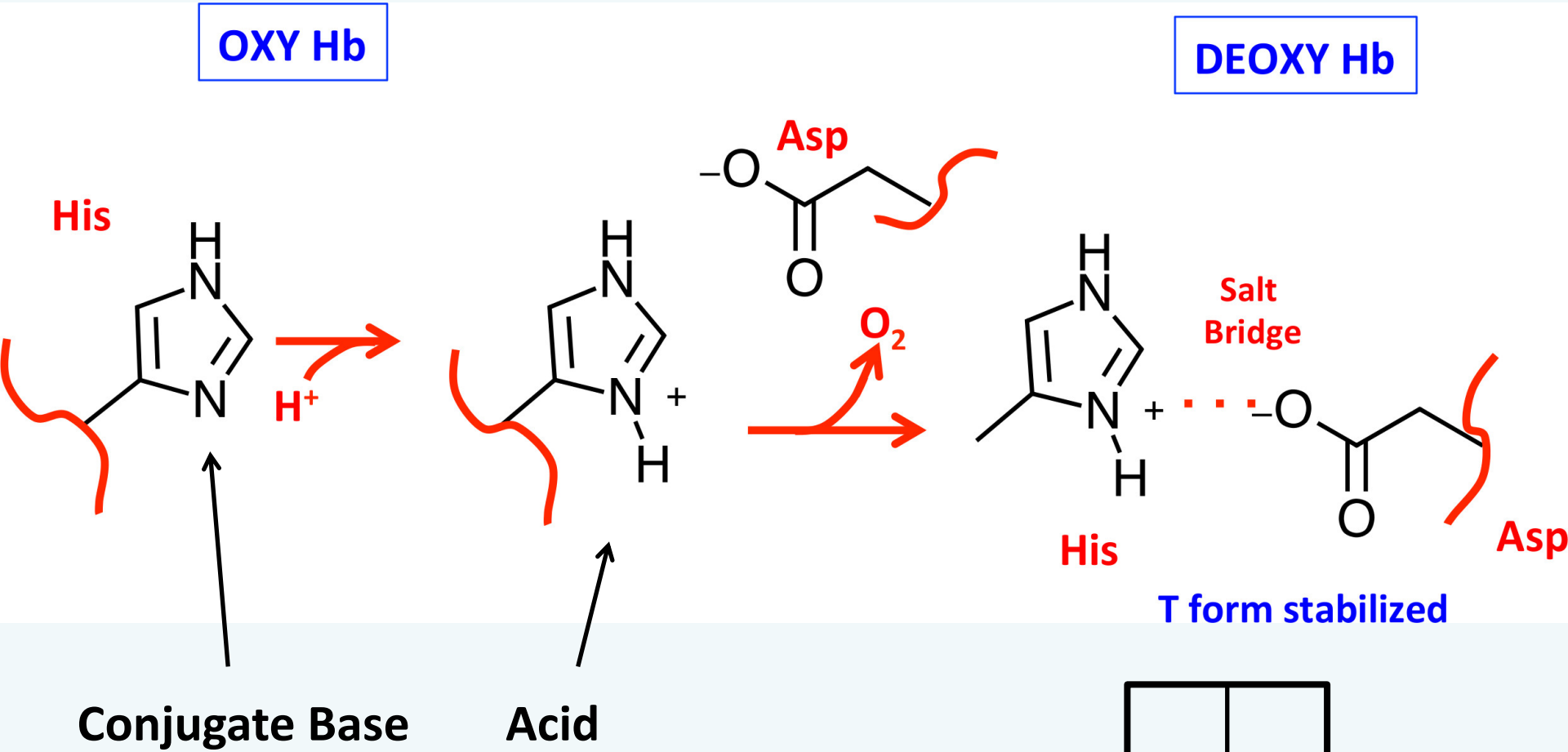
Methemoglobin



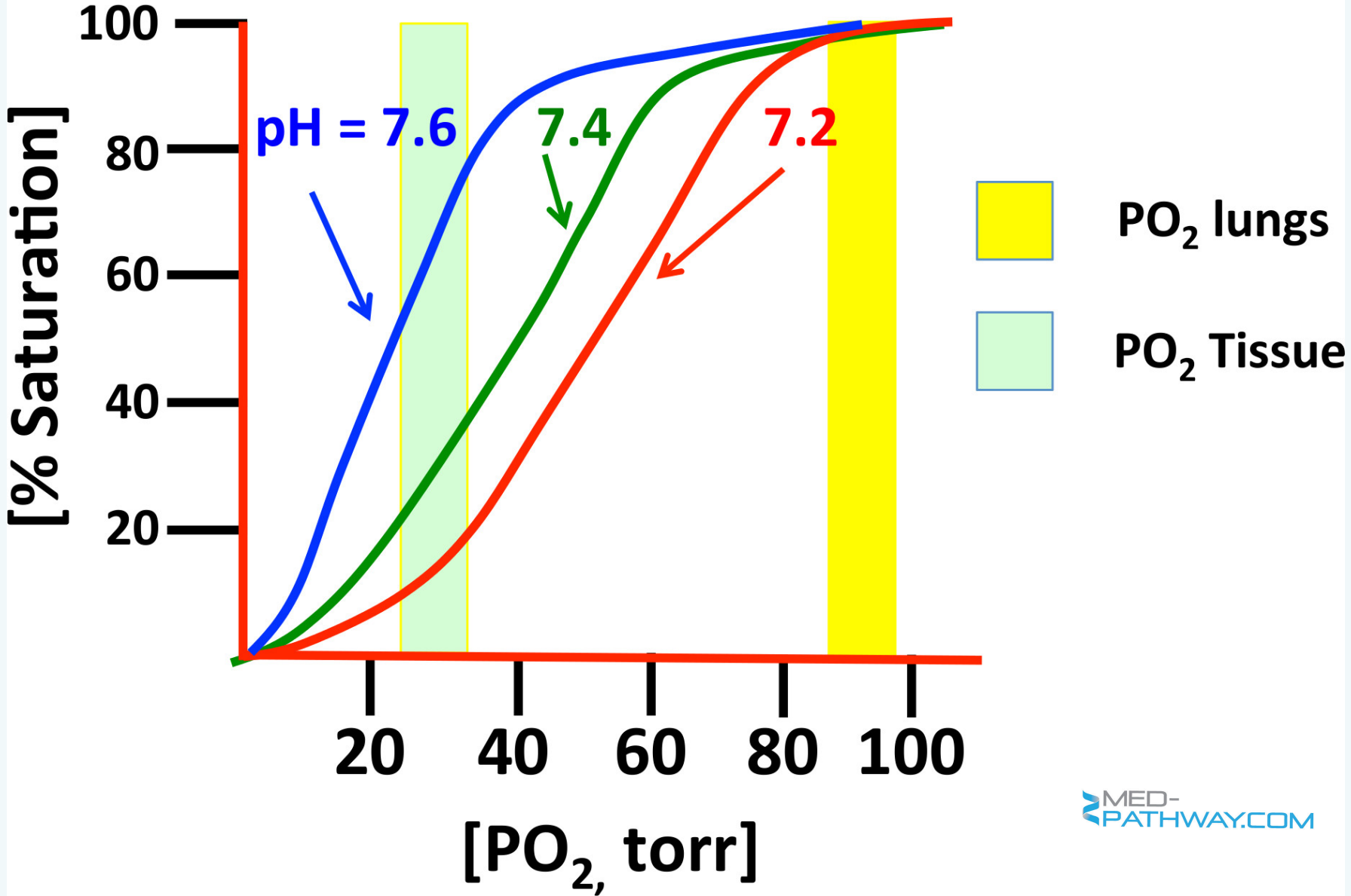
Hemoglobin & The Bohr Effect



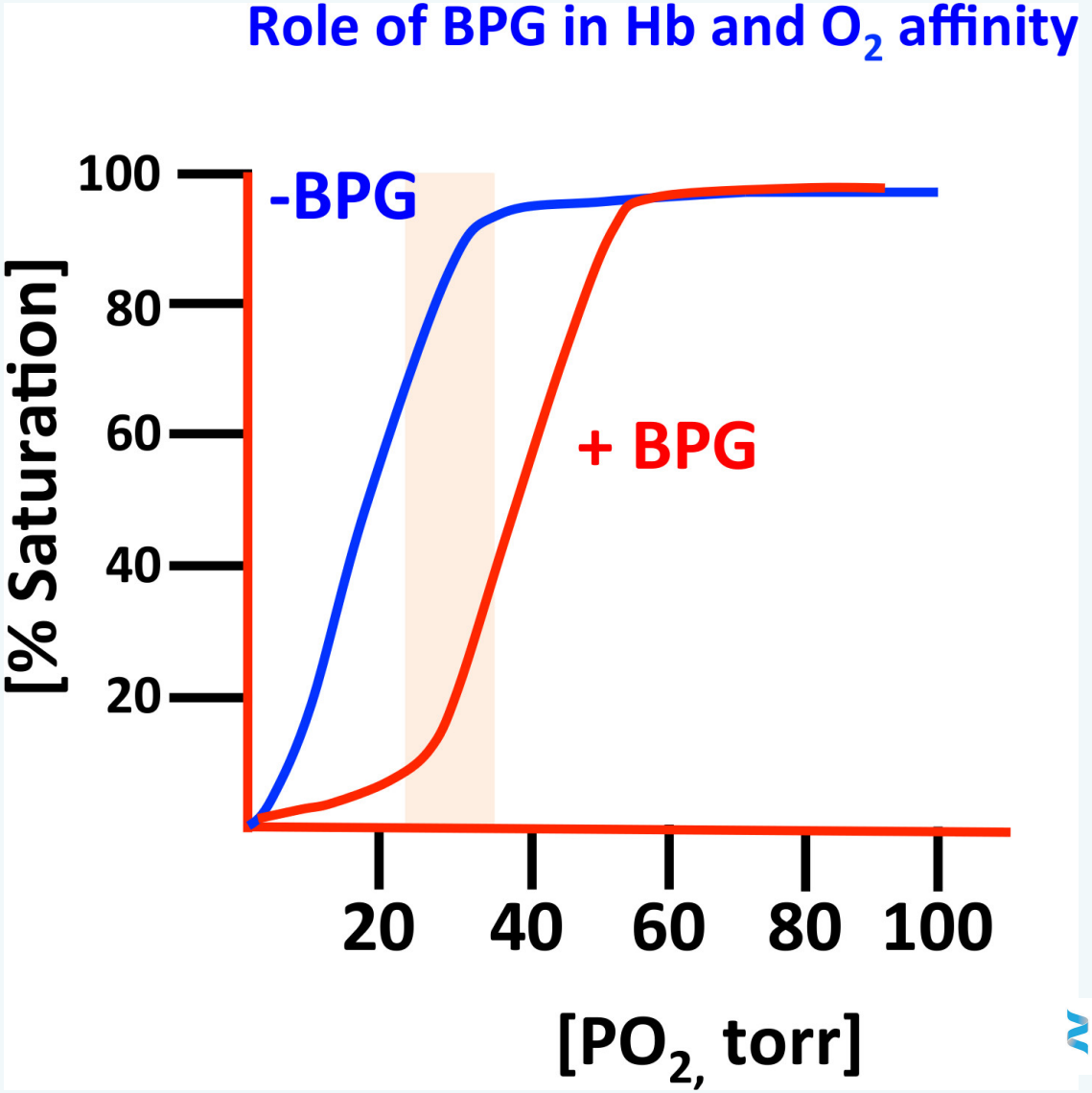
Histidine & The Bohr Effect



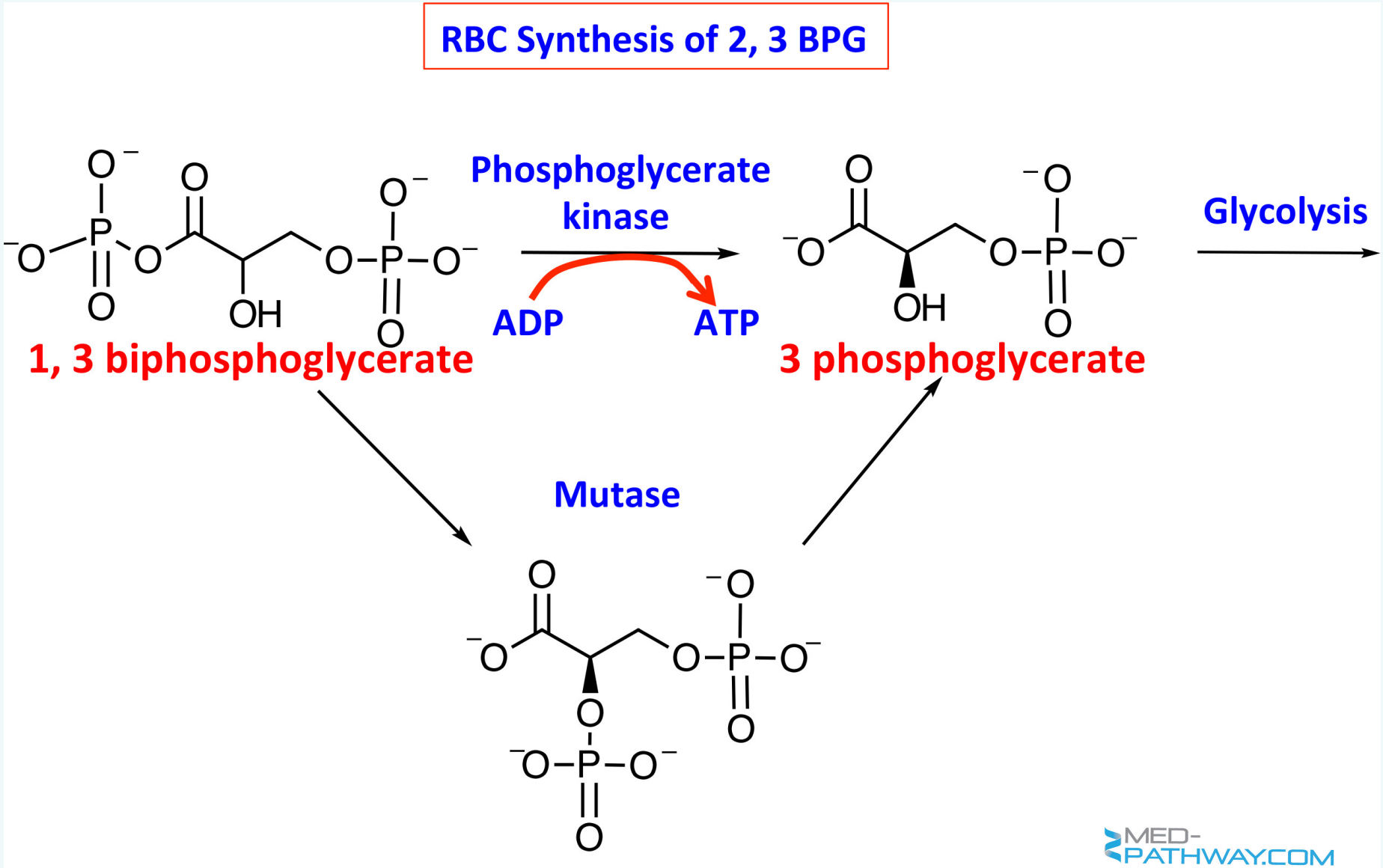
Hemoglobin Binding & pH



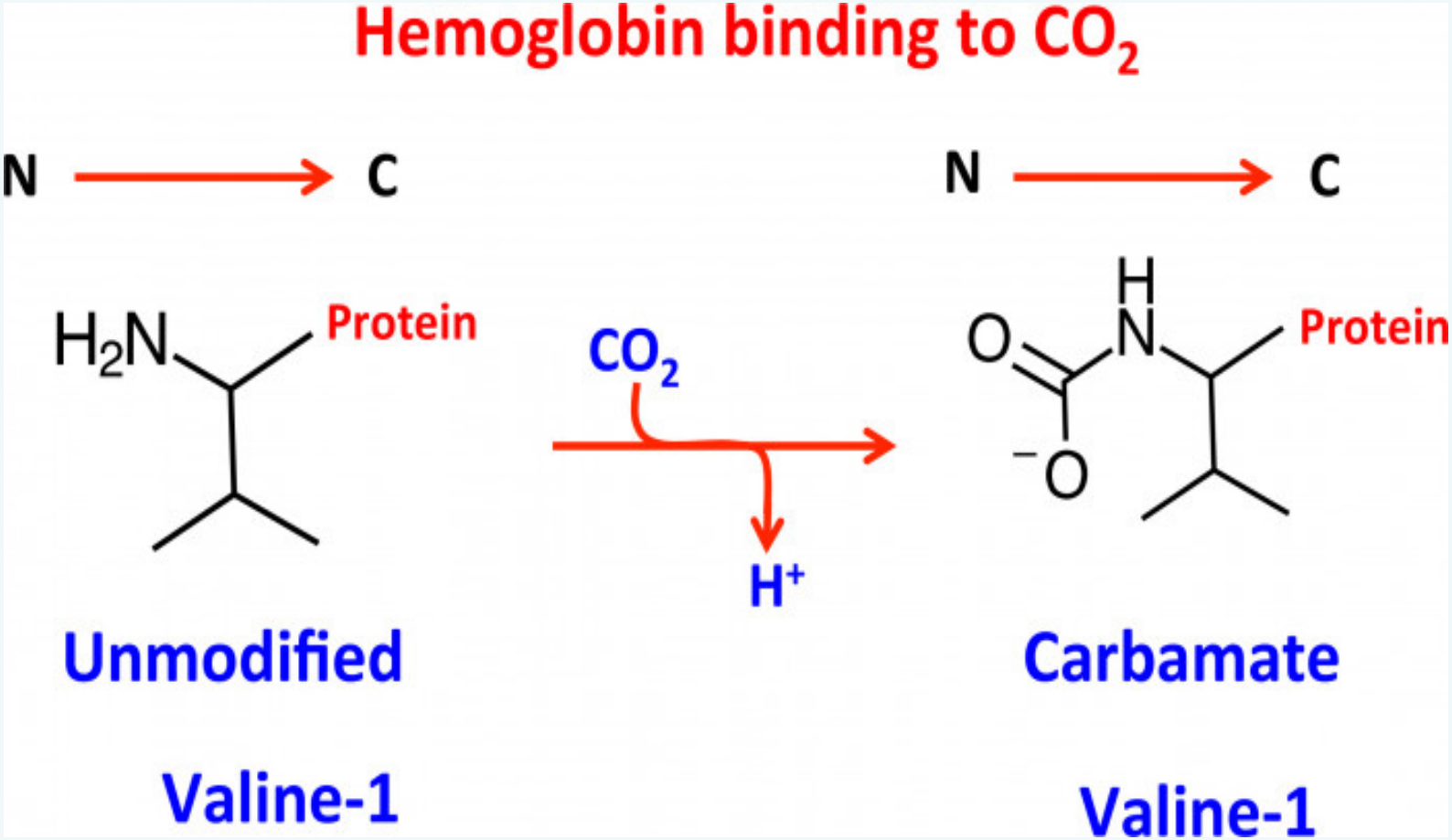
Hemoglobin & BPG



BPG is derived from glycolysis in RBC



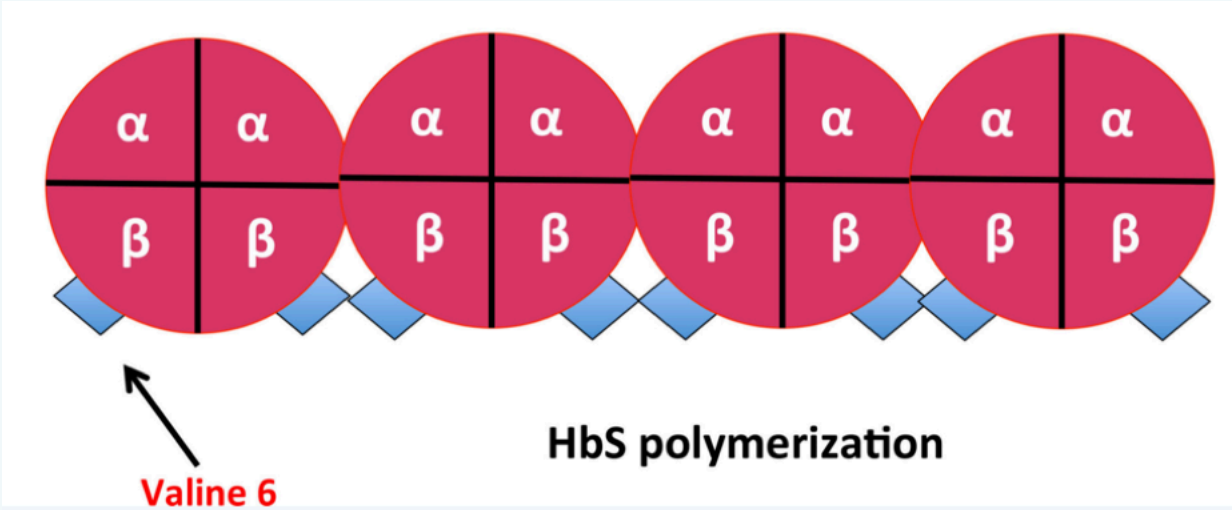
Hemoglobin is a CO_2 Carrier



Hemoglobinopathy: Sickle Cell Anemia

Glu6 mutated to Valine: E6V

Only affects the Deoxy HB form



Workshop Passages

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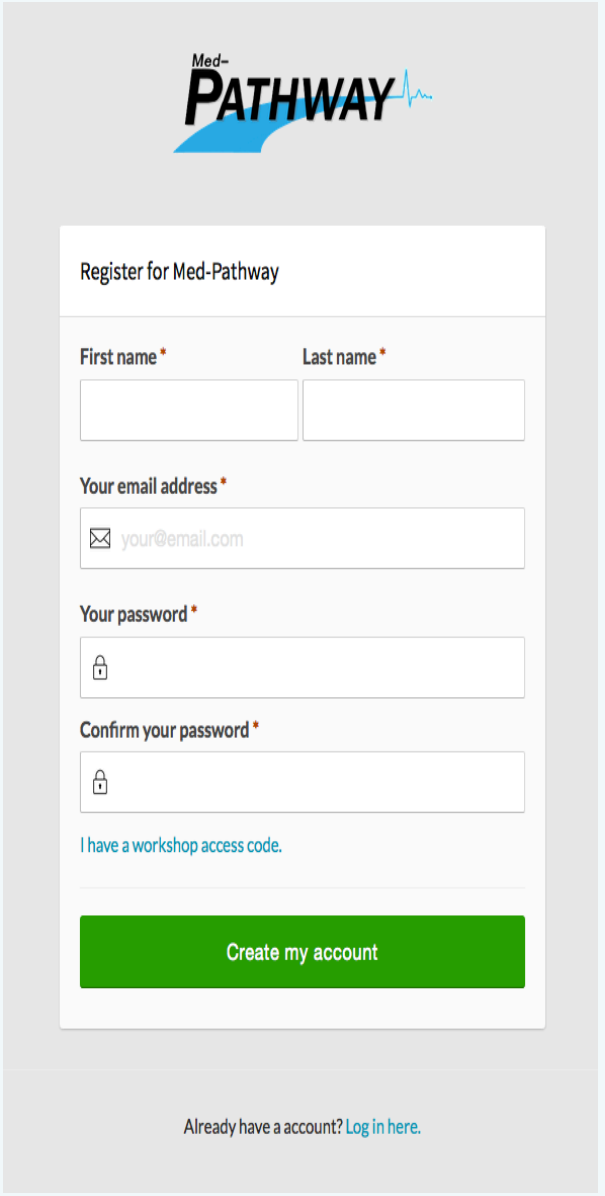

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Lab Techniques Including Protein Purification & Separation Techniques