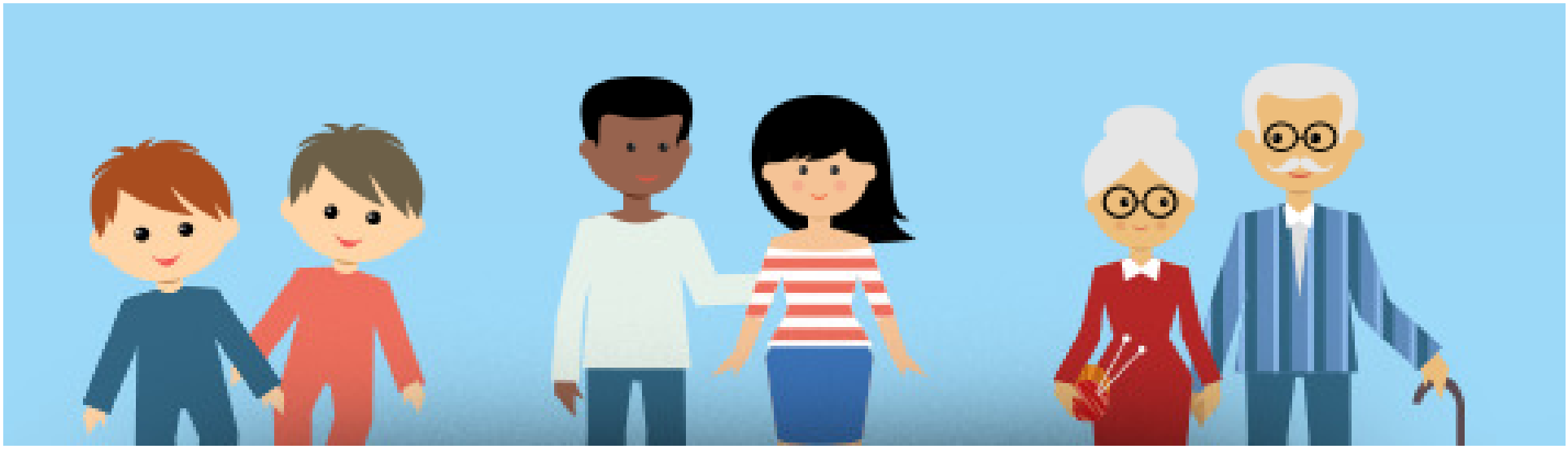
Bio-Molecule
&
Relation with Medical Science

DR PIYUSH B.TAILOR
Associate Professor
Department of Biochemistry
Govt. Medical College,
Surat,Gujarat

What is the difference in these ?

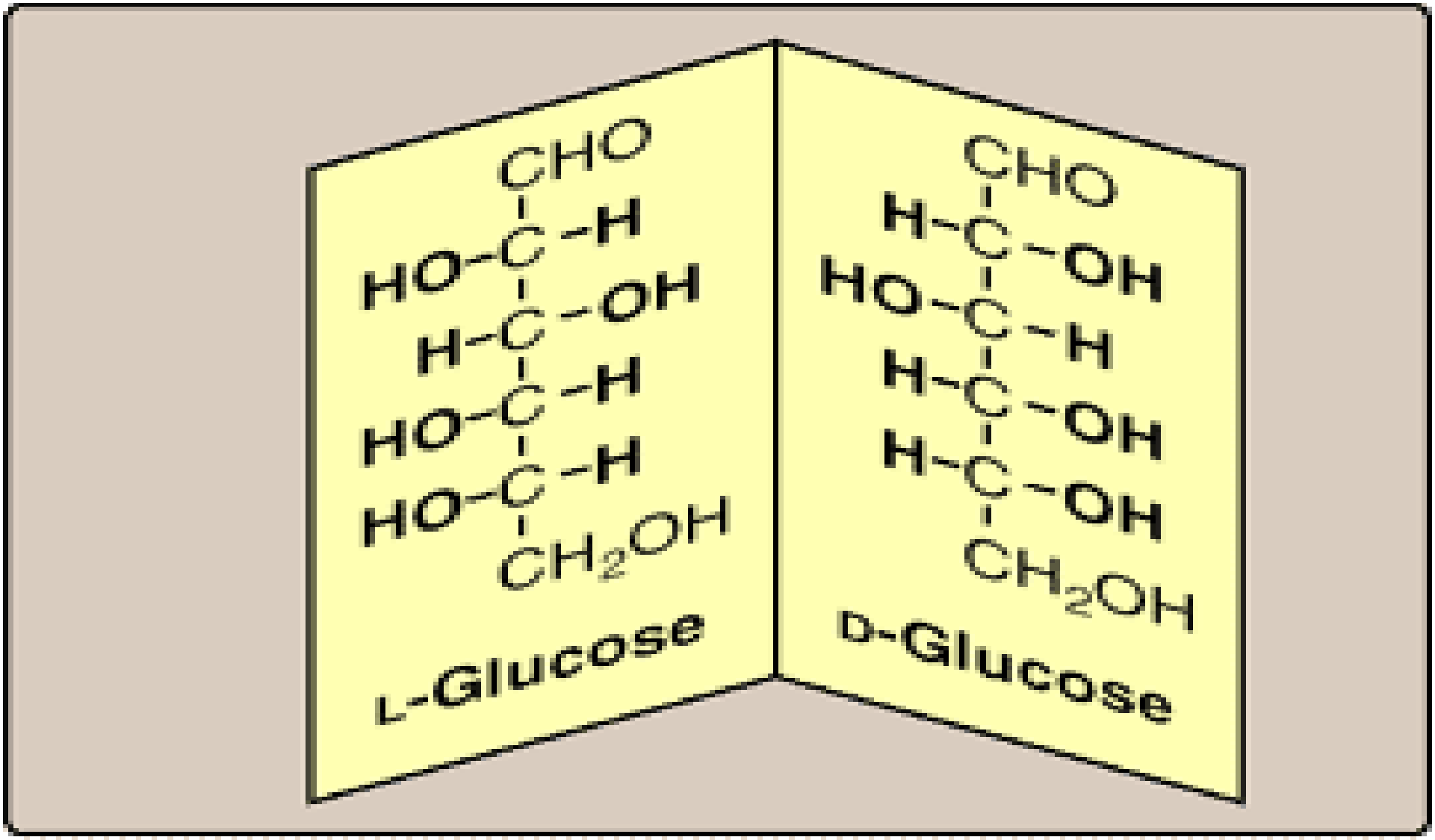


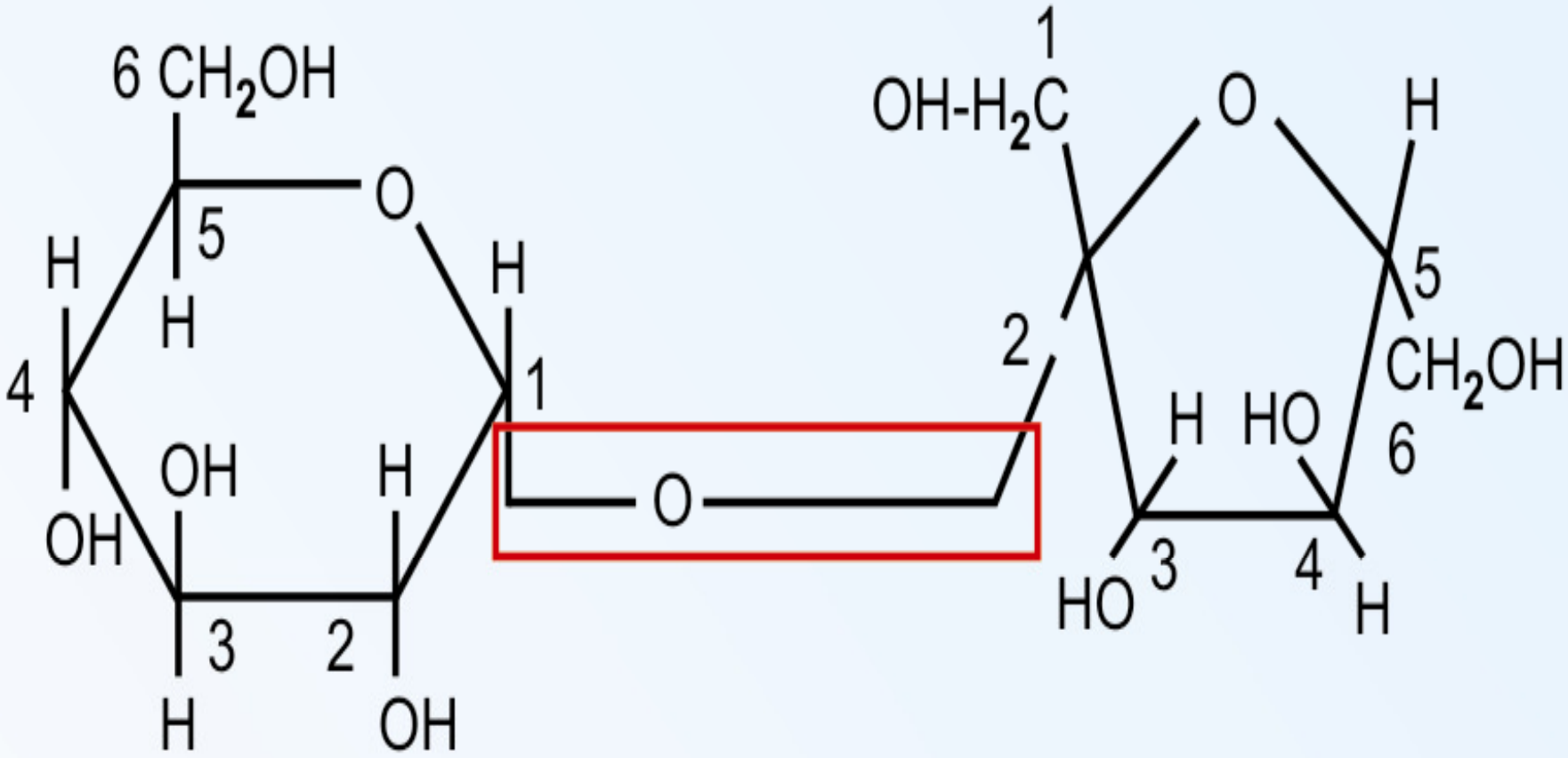
- Does they all have different “Bio-Molecule”?
- Does there have change in structure of “Bio-molecules” ?
- Does there have change in concentration of “Bio-molecules “?

How “Bio-Molecule” came In Human?

- Food
  - Which one is major component ?
- Anabolism
- Catabolism
- Medication
- Exposer to Toxin – Gas – Chemical

Are we taking this as food ?



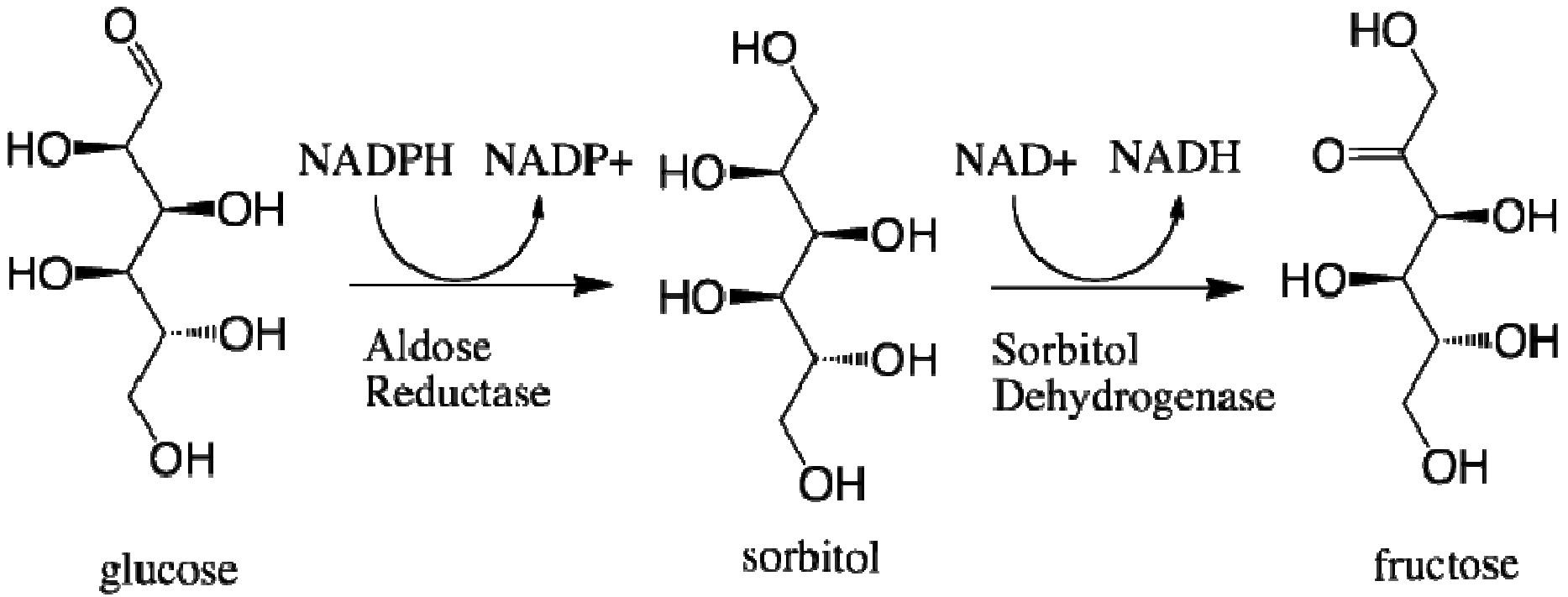


Glucose component **Fructose component**

Alpha-D-glucosyl-beta-D-fructoside


I used to think drinking was bad for me... so I gave up thinking.
–Anonymous
Quotabulary.com

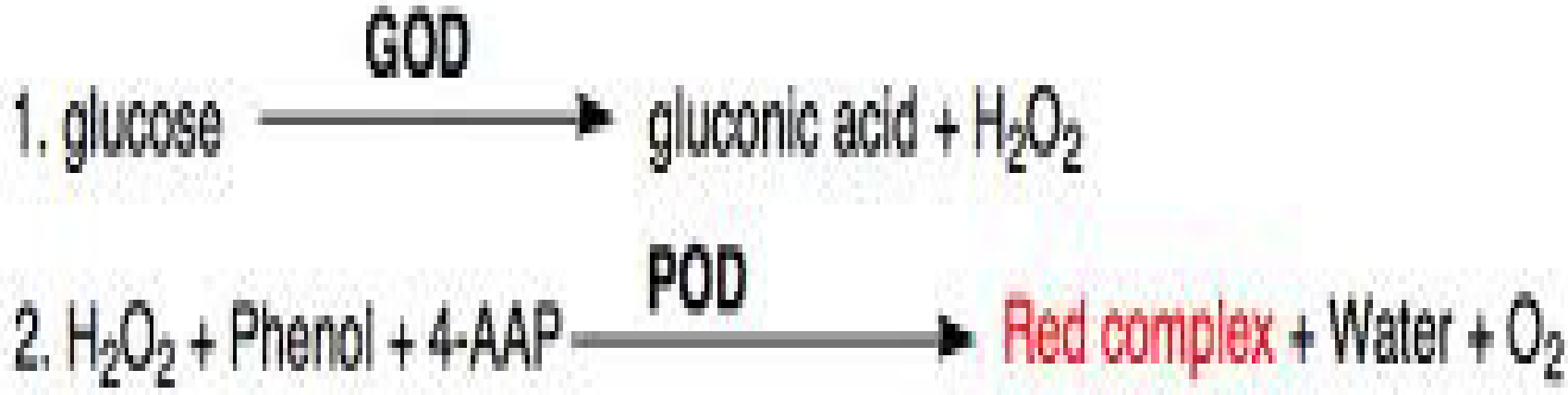
Polyol Pathway



My face..

when my blood sugar won't do what i want it to do

GOD – POD Reaction

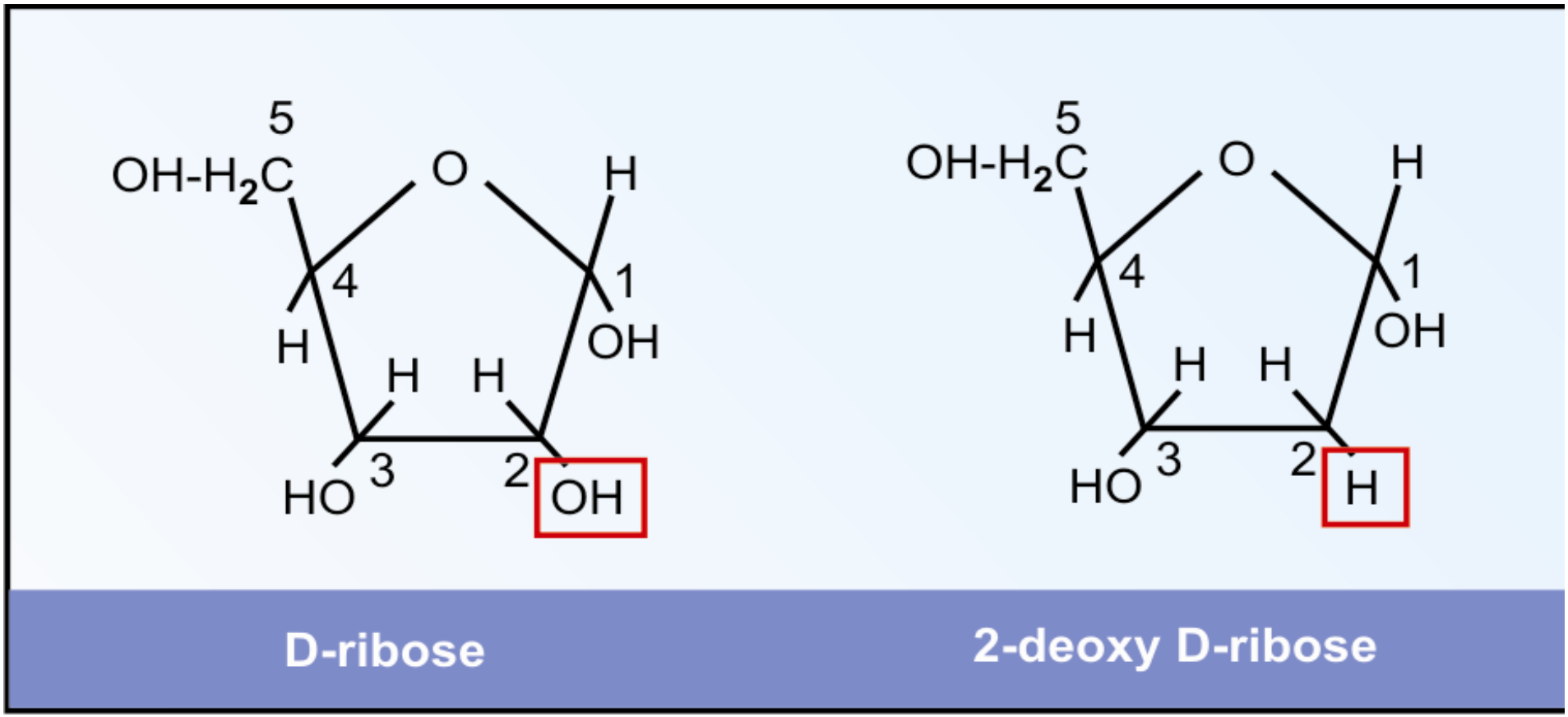


Benedict's Reaction

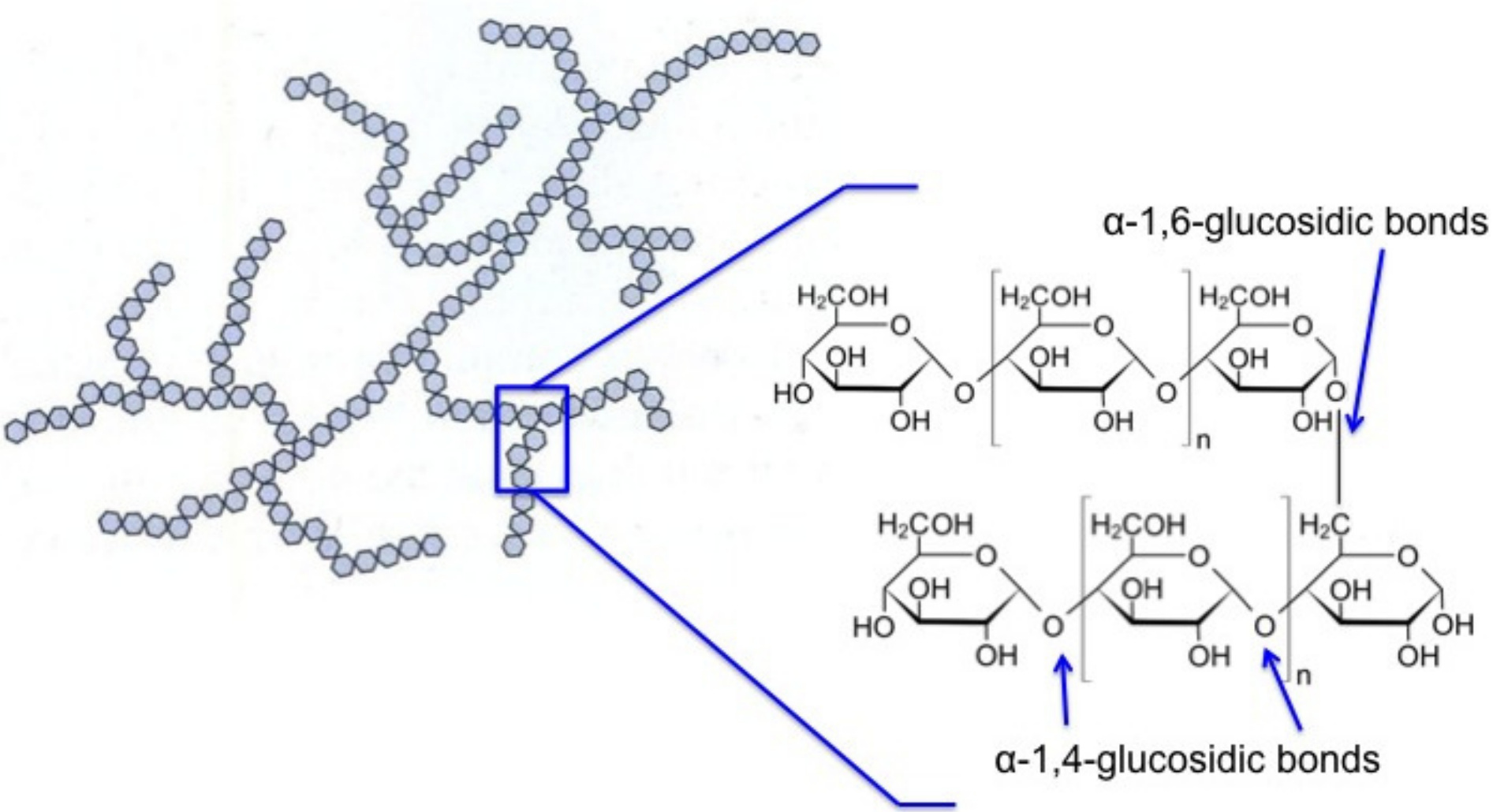
- It is semiqualitative test
- to detect the reducing sugar in urine.
- Benedict's reagent contain
  - Sodium carbonate – alkaline medium
  - Copper sulfate -
  - Sodium citrate – stabilizing agent
- Copper is reduce to produce precepitation
- Green = 0.5 gm %
- Yellow = 1.0 gm %
- Orange = 1.5 gm %
- Red = 2.0 gm %

Benedict Test

Deoxy Sugars

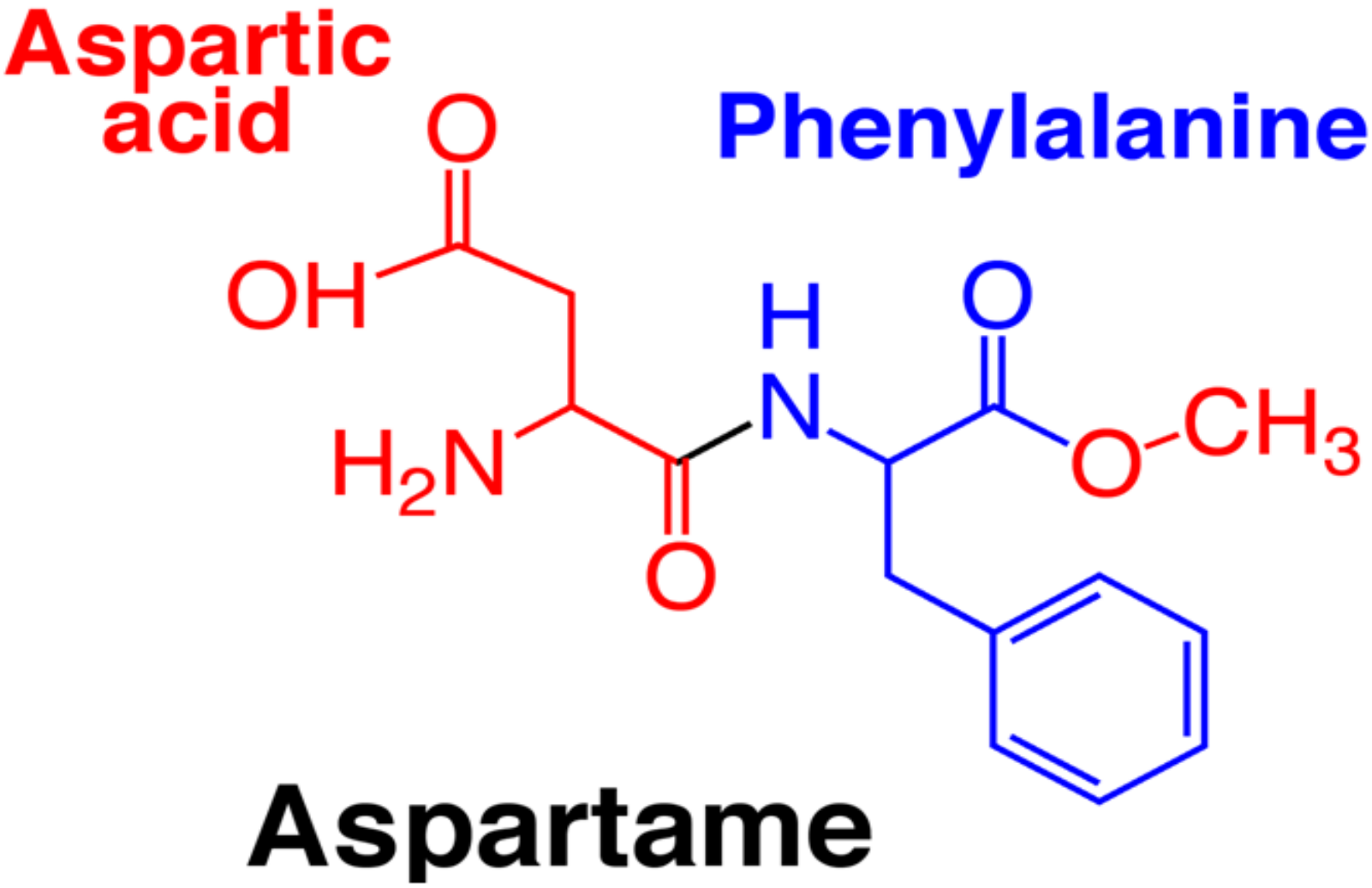


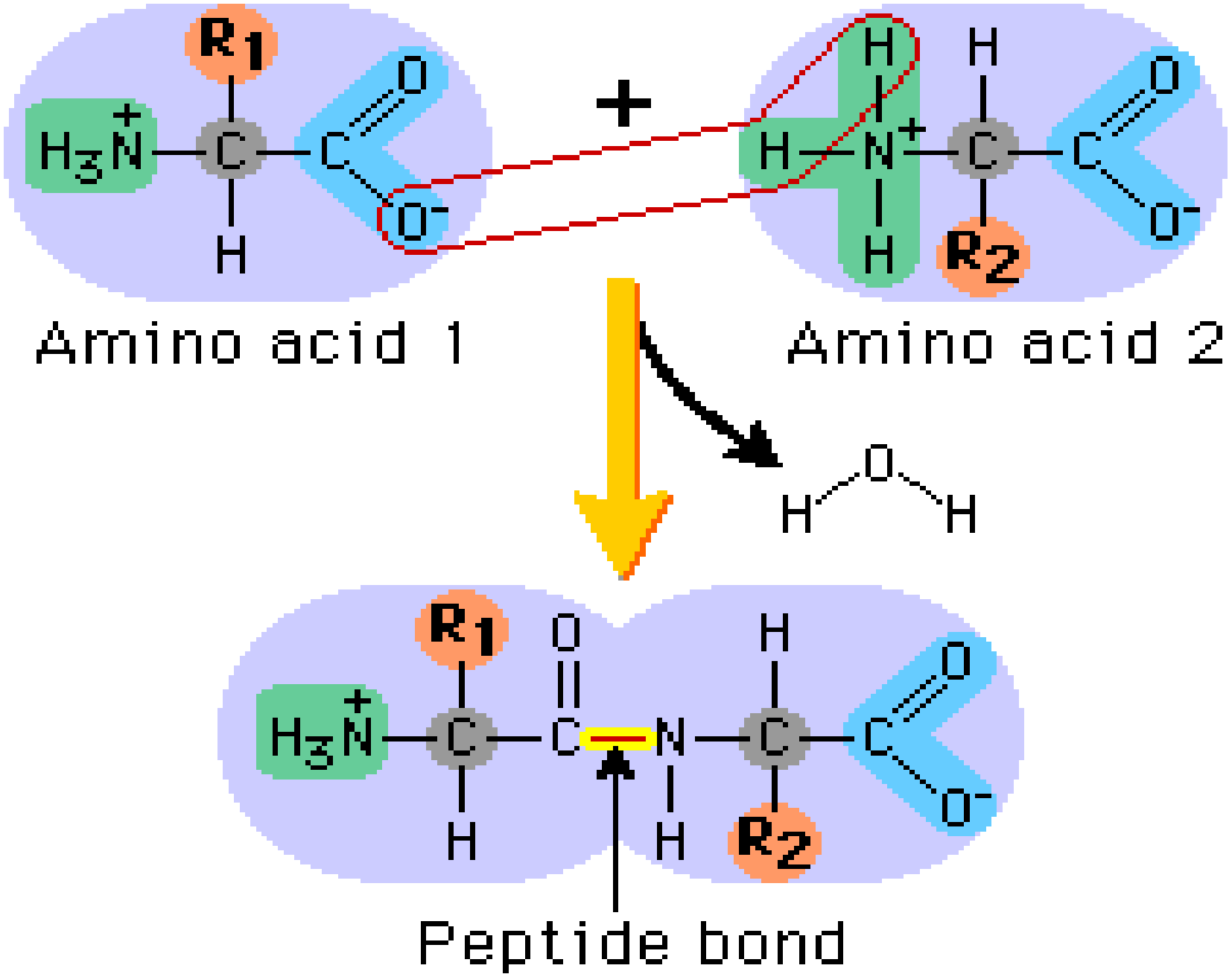
What can be a name of this “Bio-Molecule”?

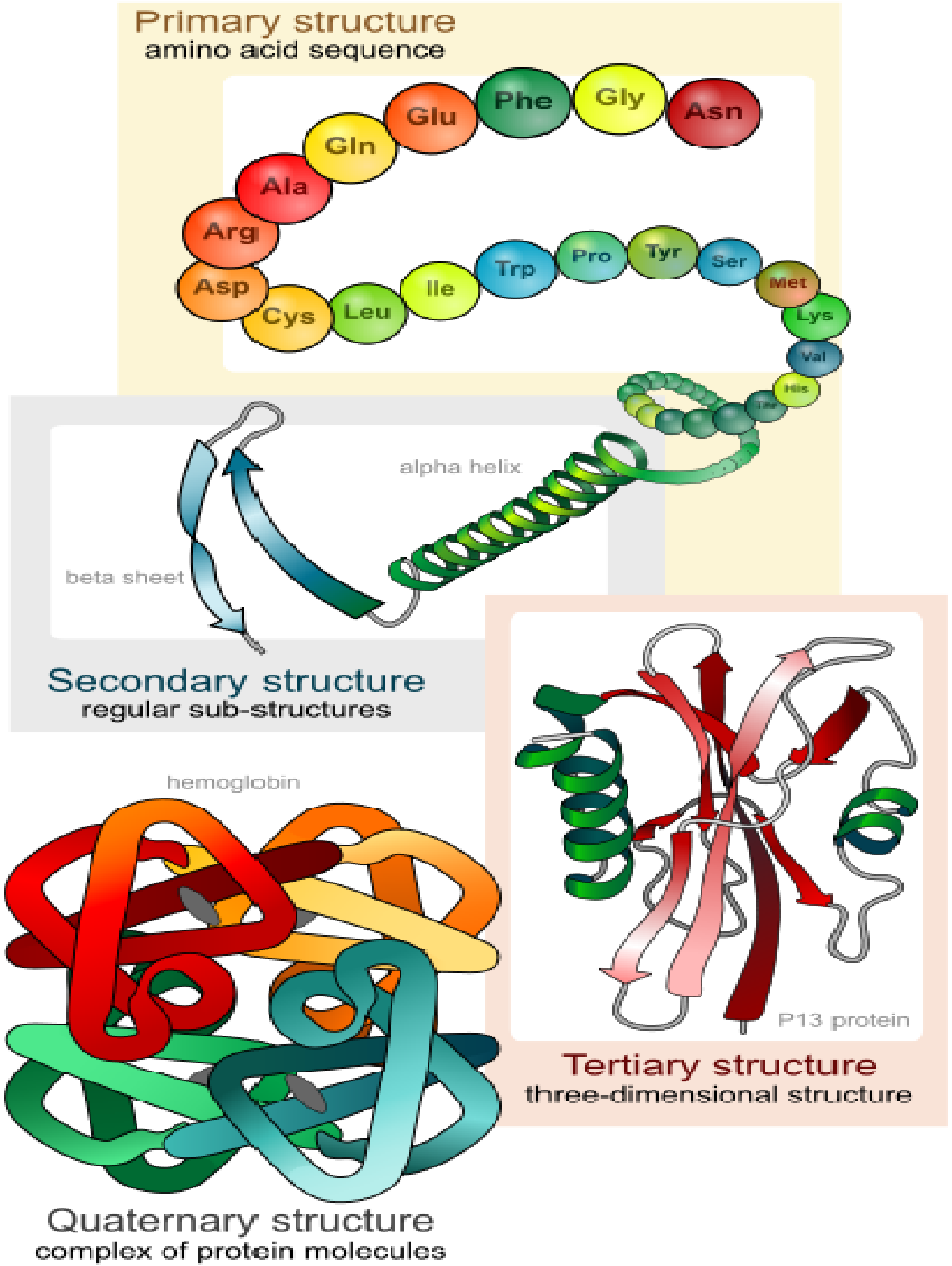



FREE
10% Extra
300 Pellets +
30 Pellets Free
Sugar Free
~Gold~
Low calorie sugar substitute
India's No. 1 sweetener
New
Sugar Free
~Gold~
Low Calorie Sugar Substitute

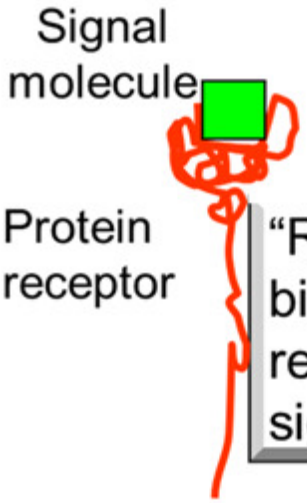
Aspartame



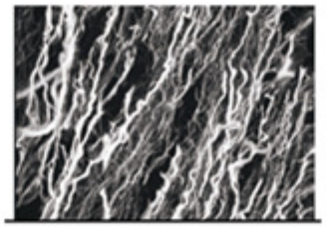

R1
H3N+
C
C
O
O-
H
+
H
H
H
N+
C
C
O
O-
R2
H
Amino acid 1
Amino acid 2
O
H
H
R1
O
H
H3N+
C
C
N
C
C
O
O-
H
H
R2
Peptide bond


Primary structure
amino acid sequence
Phe
Gly
Asn
Glu
Gln
Ala
Arg
Asp
Cys
Leu
Ile
Trp
Pro
Tyr
Ser
Met
Lys
Val
His
alpha helix
beta sheet
Secondary structure
regular sub-structures
P13 protein
Tertiary structure
three-dimensional structure
hemoglobin
Quaternary structure
complex of protein molecules

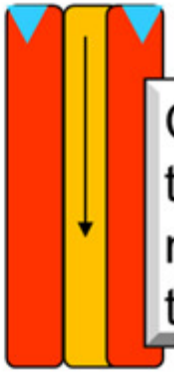
Proteins Shape Dictates Function



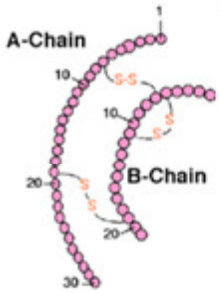
"Receptors" with binding sites that recognize chemical signals



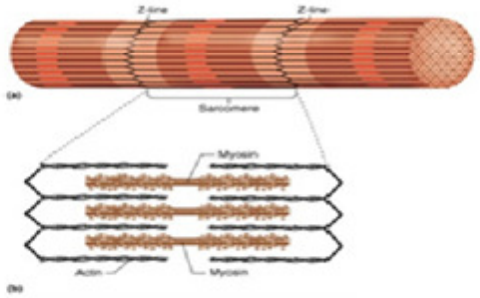
Collagen fibers

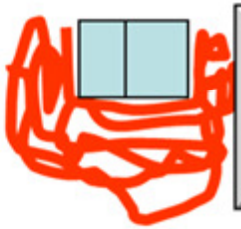


Cylindrical tubes to transport large molecules across the cell membrane

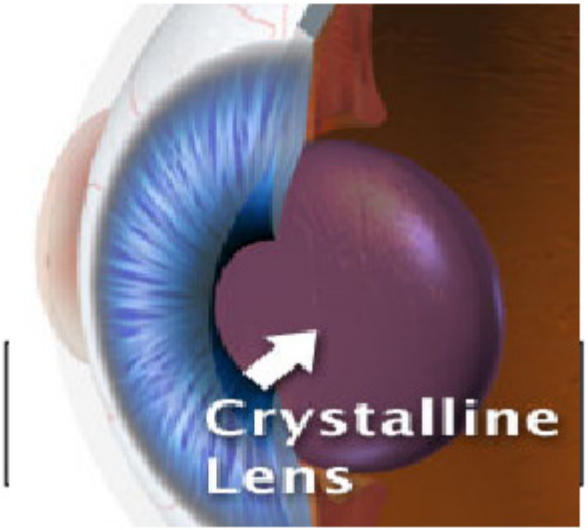


Peptide hormones (insulin)



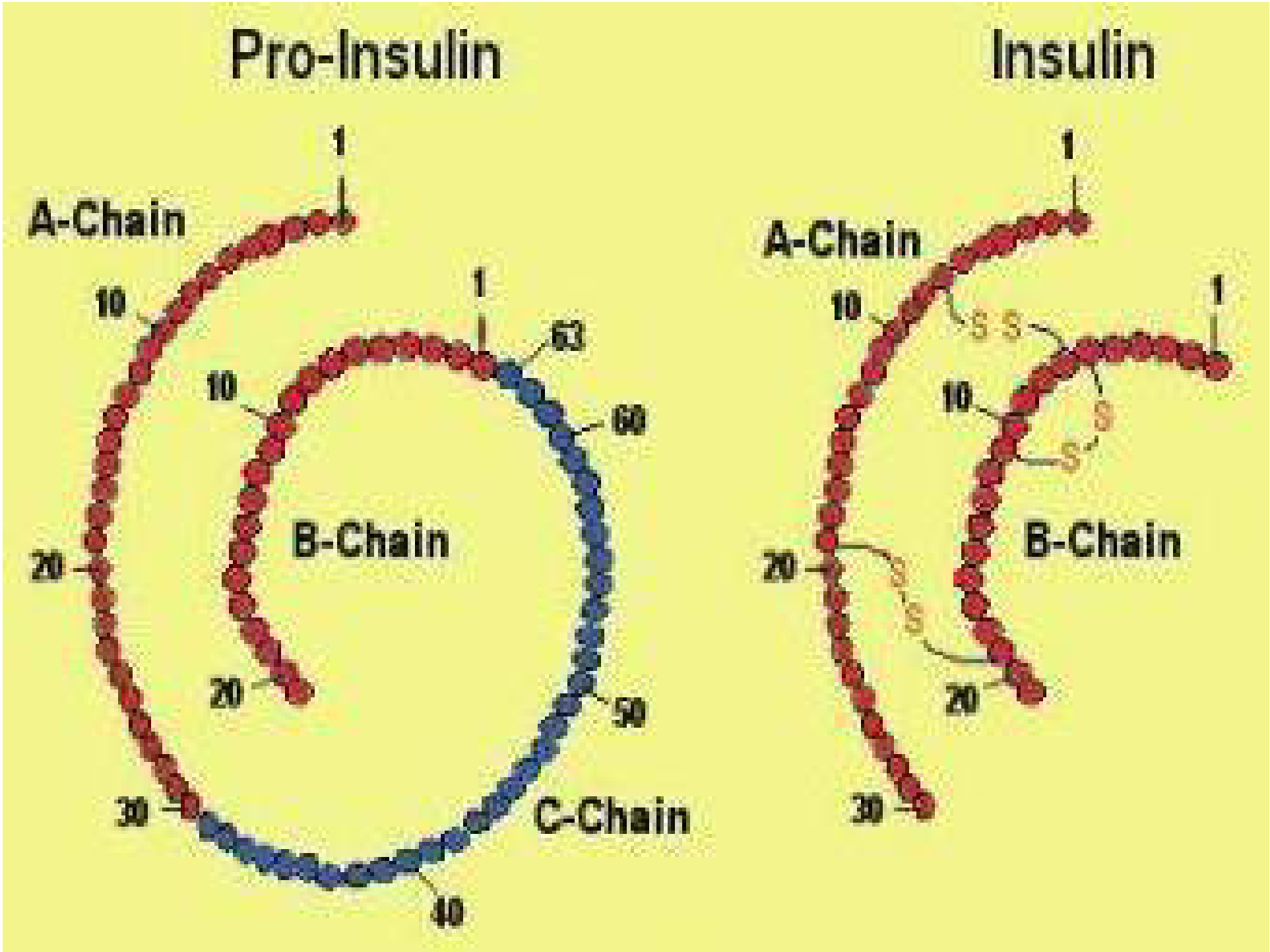


Enzymes that join or split other molecules

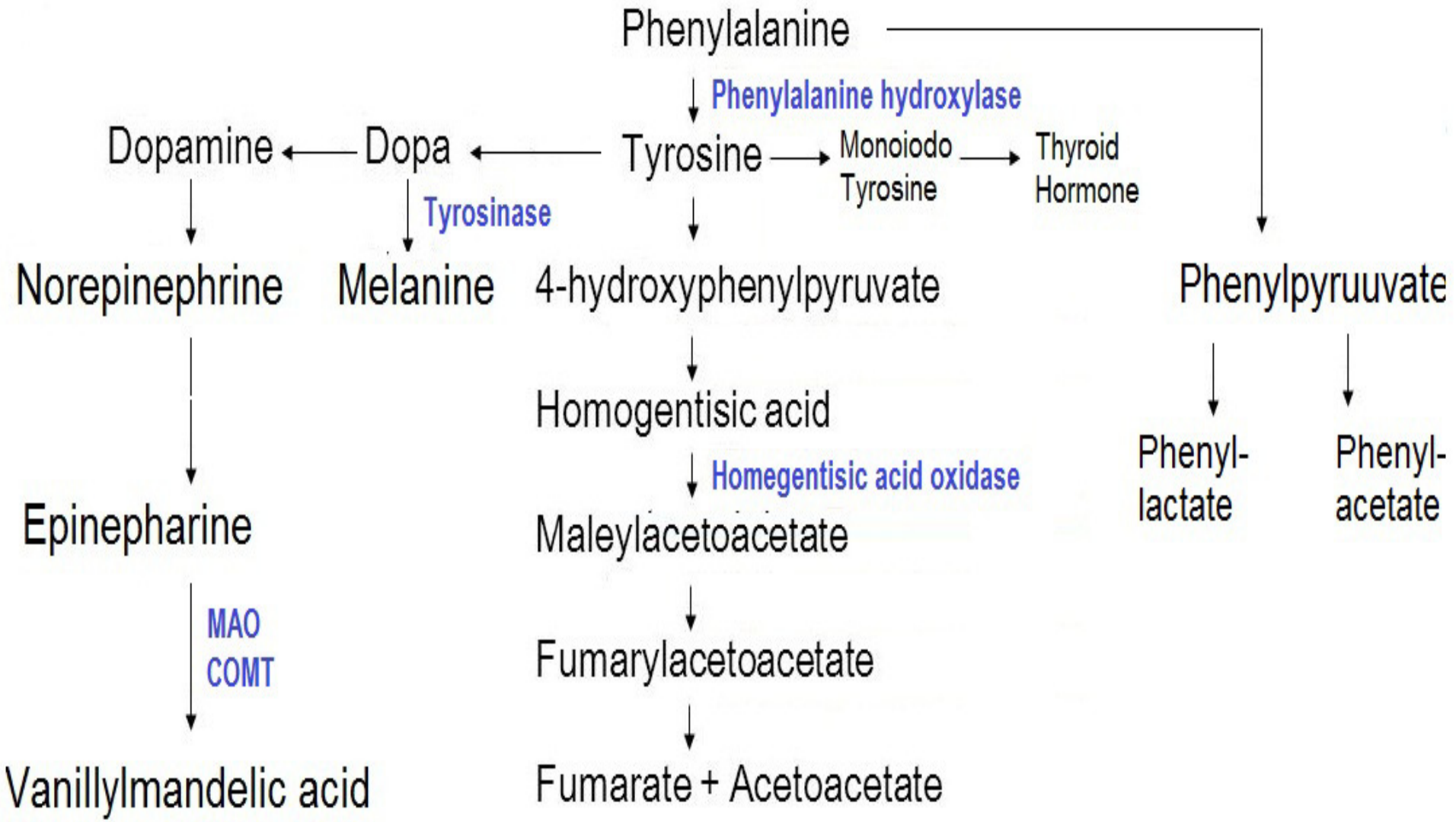


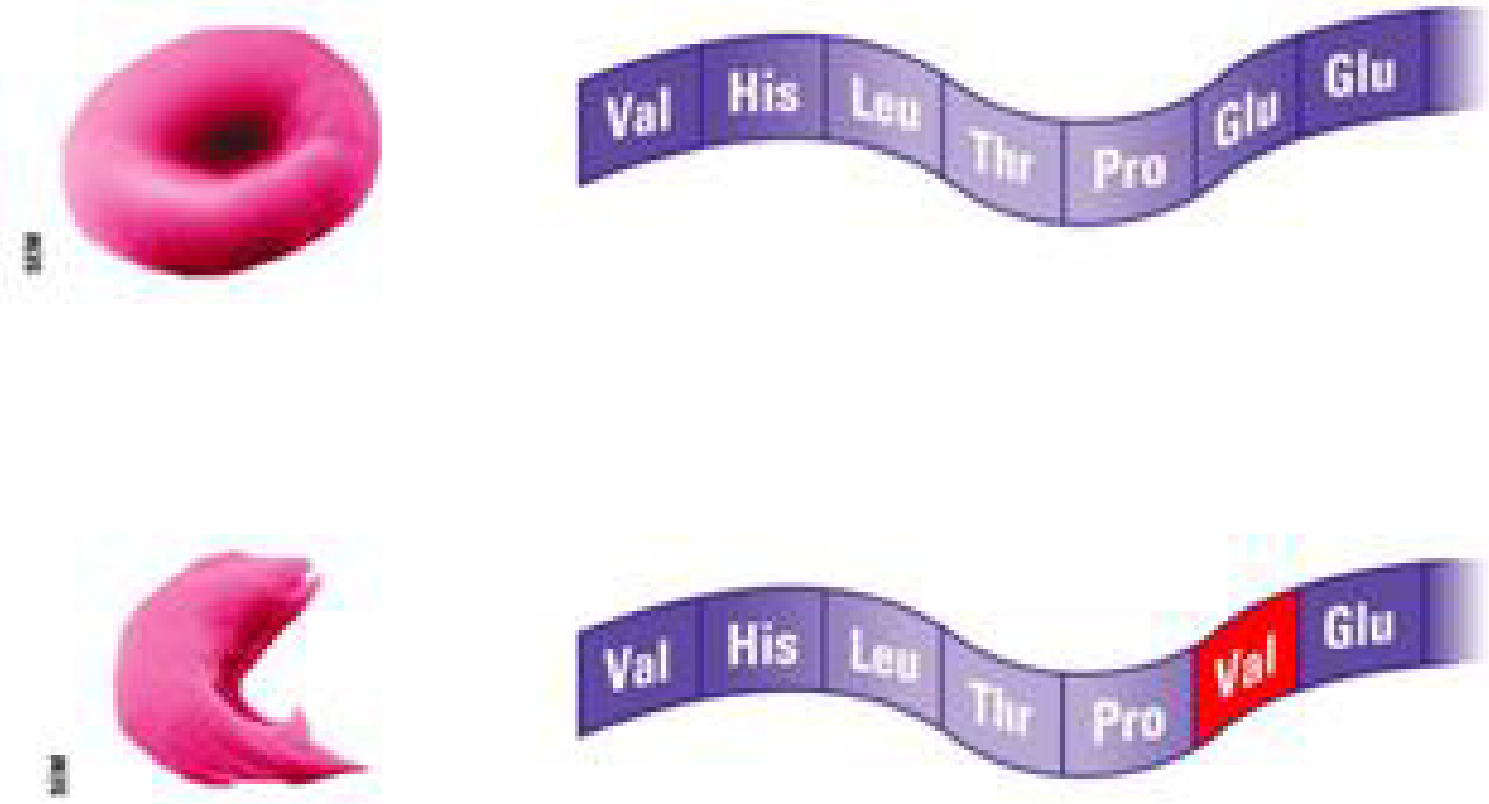
Hemoglobin to transport oxygen

Antibodies - chains bound with binding sites for antigens

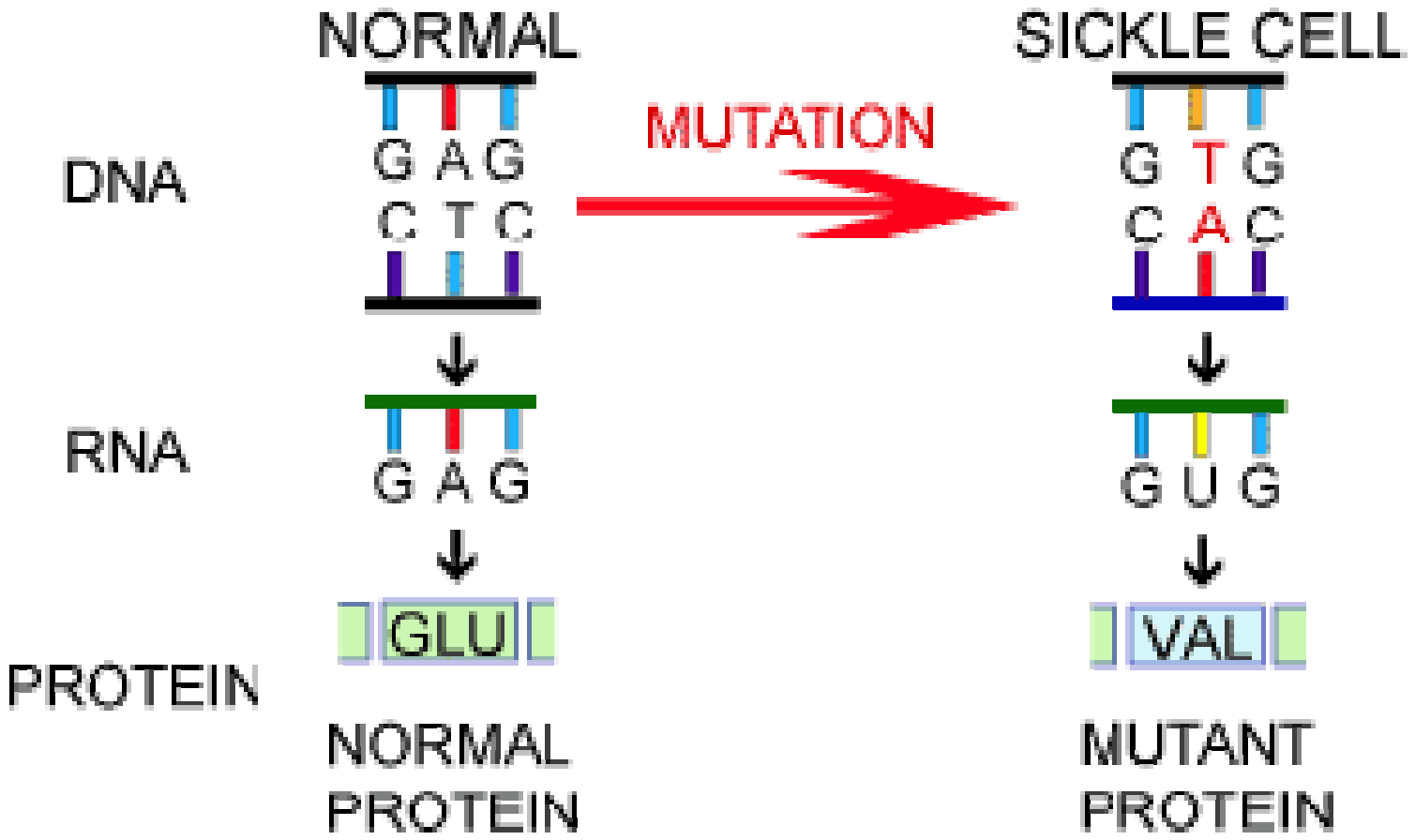

Pro-Insulin
A-Chain
1
10
20
30
40
B-Chain
1
10
20
C-Chain
1
30
60
63
90
Insulin
A-Chain
1
10
20
30
B-Chain
1
10
20
S S
S S
S S

Overview of Phenylalanine & Tyrosine Metabolism




Val
His
Leu
Thr
Pro
Glu
Glu
Val
His
Leu
Thr
Pro
Val
Glu

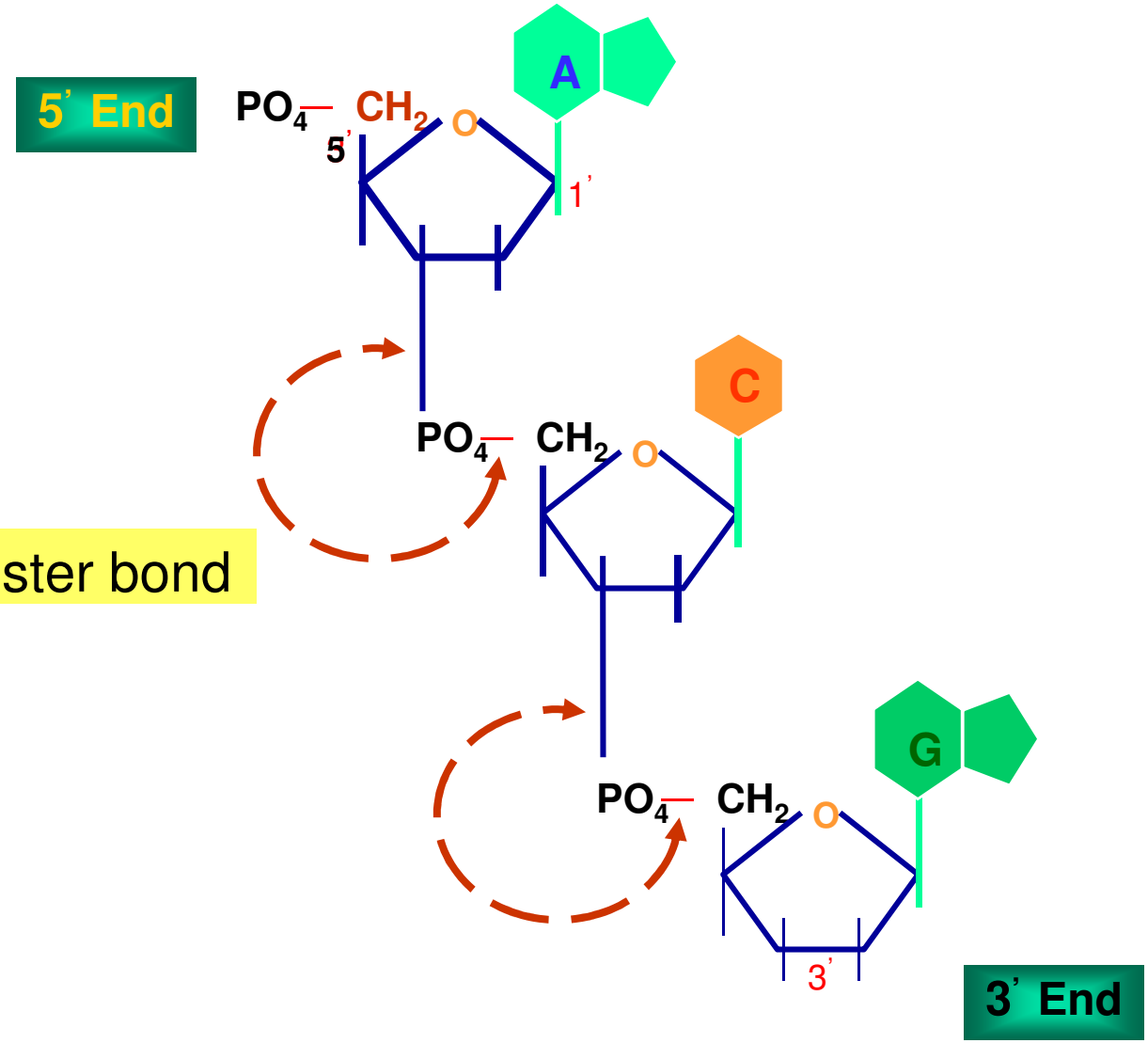
Point Mutation



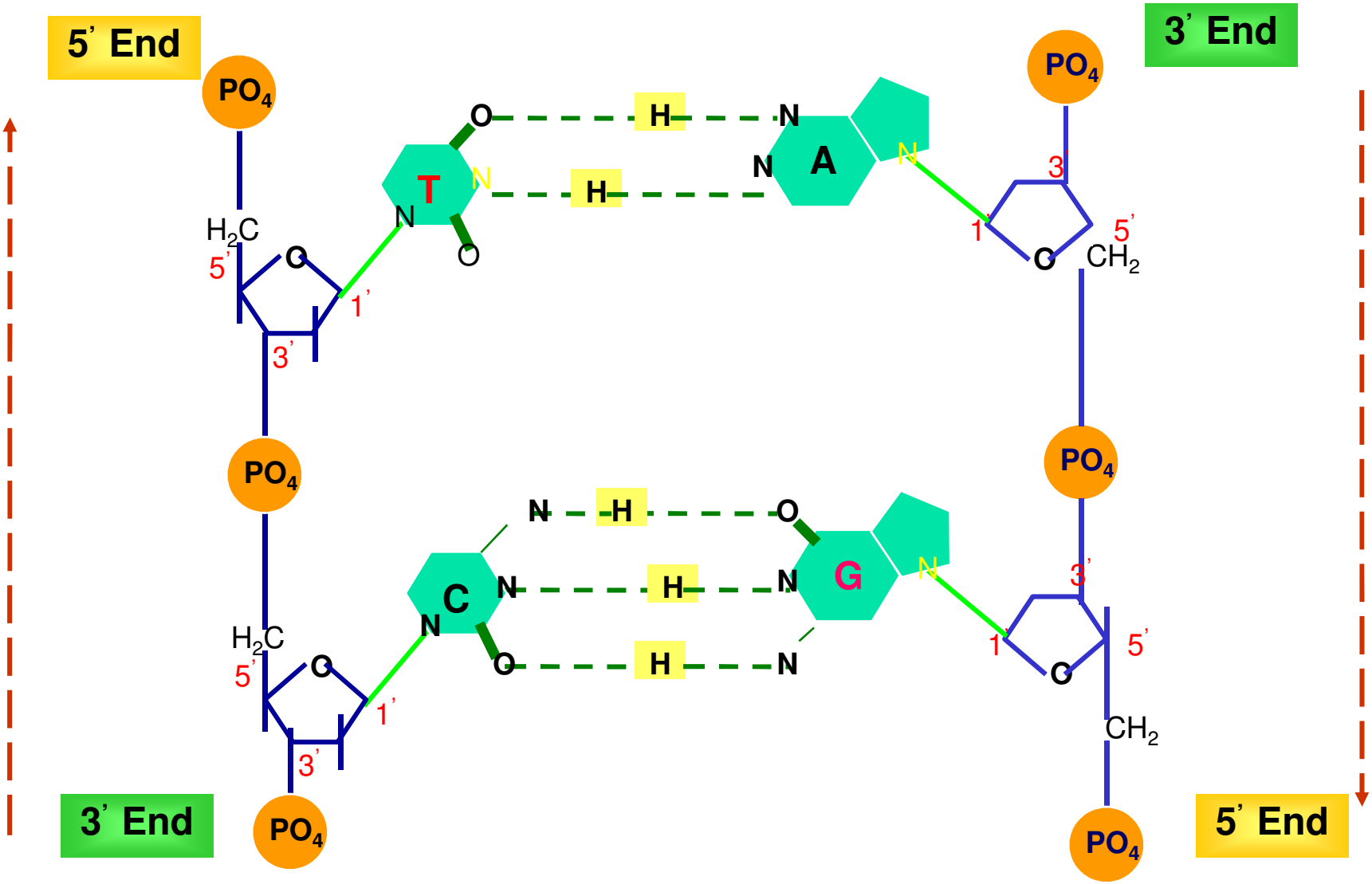
Genetic Code

first position	second position: U	second position: C	second position: A	second position: G
U	UUU Phe (F)	UCU Ser (S)	UAU Tyr (Y)	UGU Cys (C)
	UUC Phe (F)	UCC Ser (S)	UAC Tyr (Y)	UGC Cys (C)
	UUA Leu (L)	UCA Ser (S)	UAA STOP	UGA STOP
	UUG Leu (L)	UCG Ser (S)	UAG STOP	UGG Trp (W)
C	CUU Leu (L)	CCU Pro (P)	CAU His (H)	CGU Arg (R)
	CUC Leu (L)	CCC Pro (P)	CAC His (H)	CGC Arg (R)
	CUA Leu (L)	CCA Pro (P)	CAA Gln (Q)	CGA Arg (R)
	CUG Leu (L)	CCG Pro (P)	CAG Gln (Q)	CGG Arg (R)
A	AUU Ile (I)	ACU Thr (T)	AAU Asn (N)	AGU Ser (S)
	AUC Ile (I)	ACC Thr (T)	AAC Asn (N)	AGC Ser (S)
	AUA Ile (I)	ACA Thr (T)	AAA Lys (K)	AGA Arg (R)
	AUG Met (M)	ACG Thr (T)	AAG Lys (K)	AGG Arg (R)
G	GUU Val (V)	GCU Ala (A)	GAU Asp (D)	GGU Gly (G)
	GUC Val (V)	GCC Ala (A)	GAC Asp (D)	GGC Gly (G)
	GUA Val (V)	GCA Ala (A)	GAA Glu (E)	GGA Gly (G)
	GUG Val (V)	GCG Ala (A)	GAG Glu (E)	GGG Gly (G)

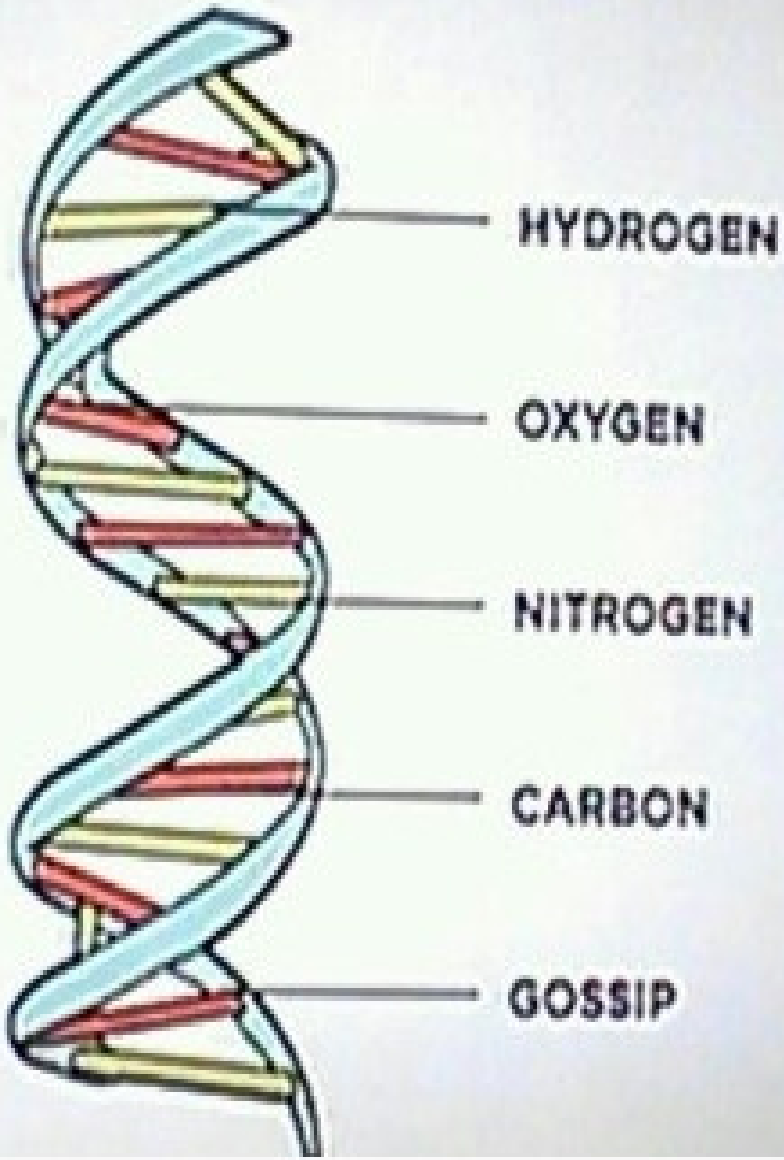
NUCLEIC ACID

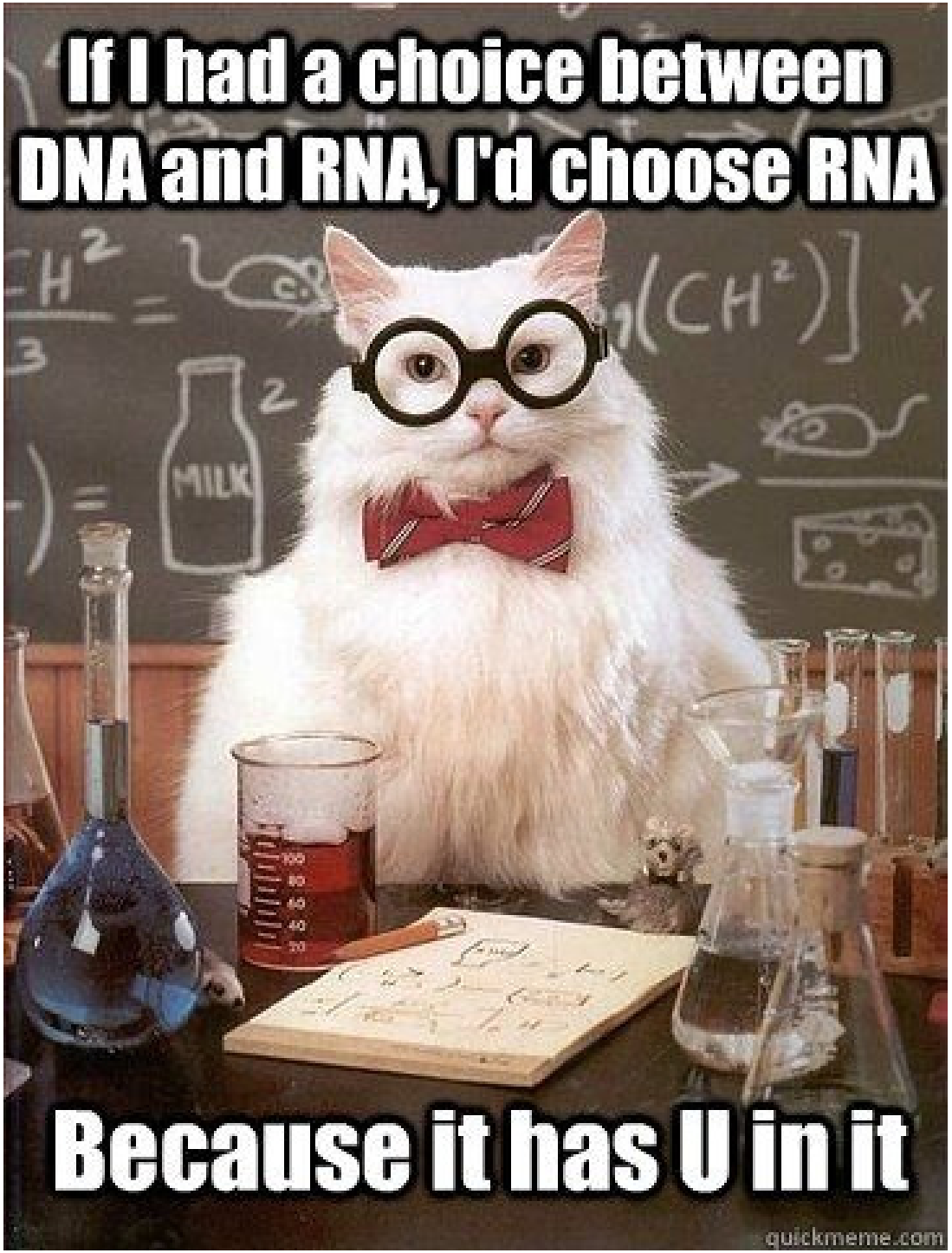


DNA

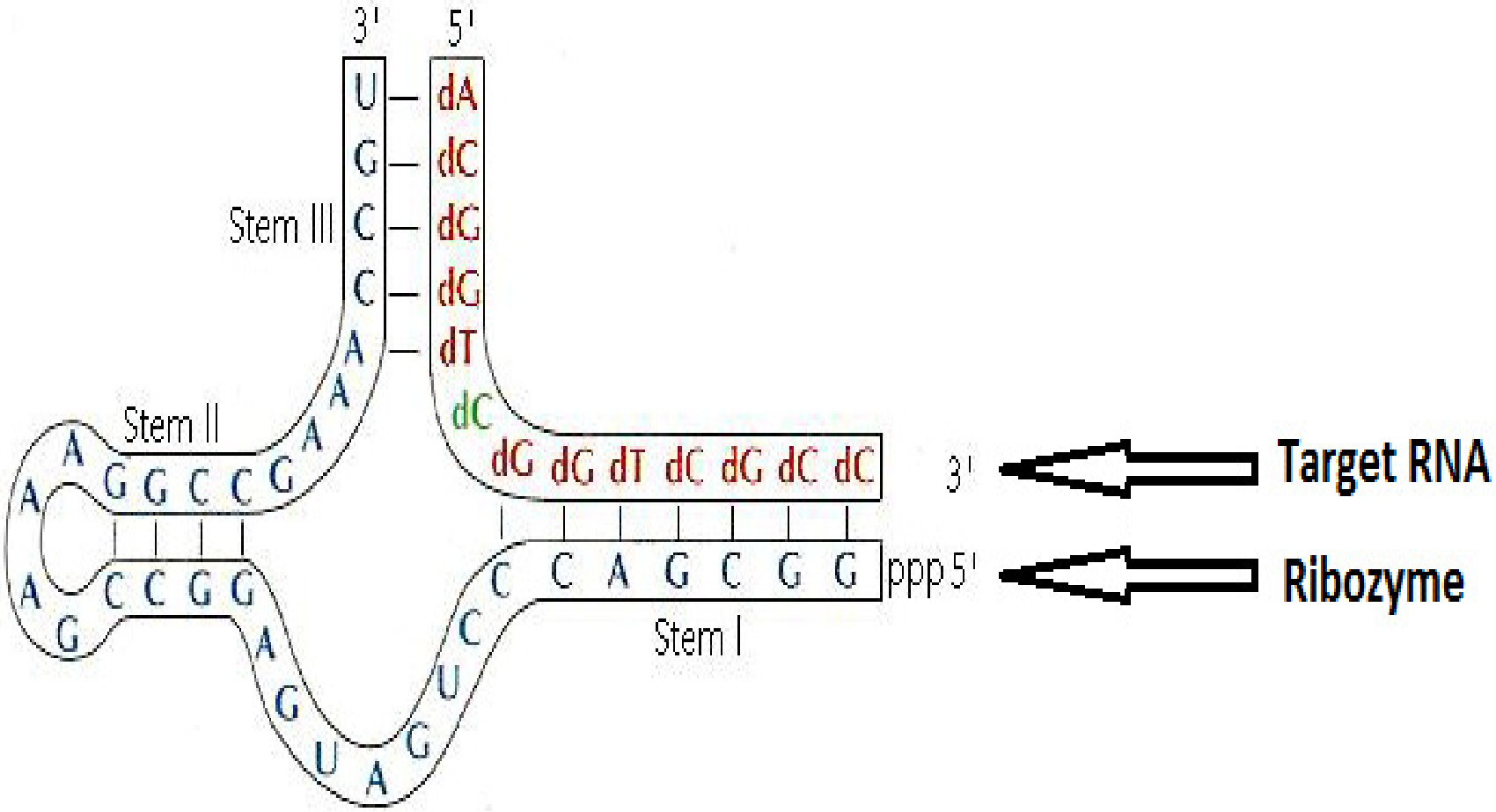


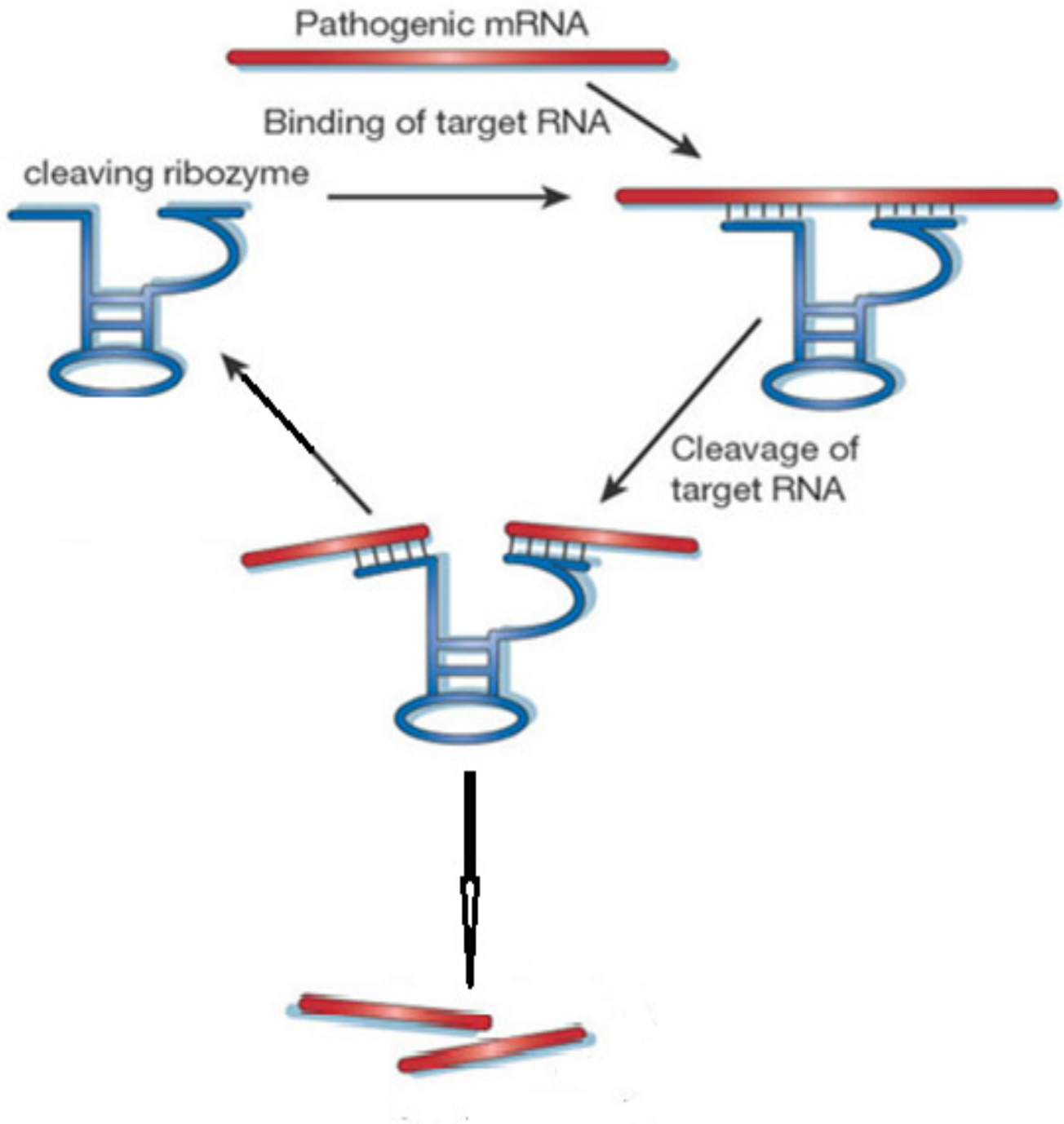
WOMEN'S DNA



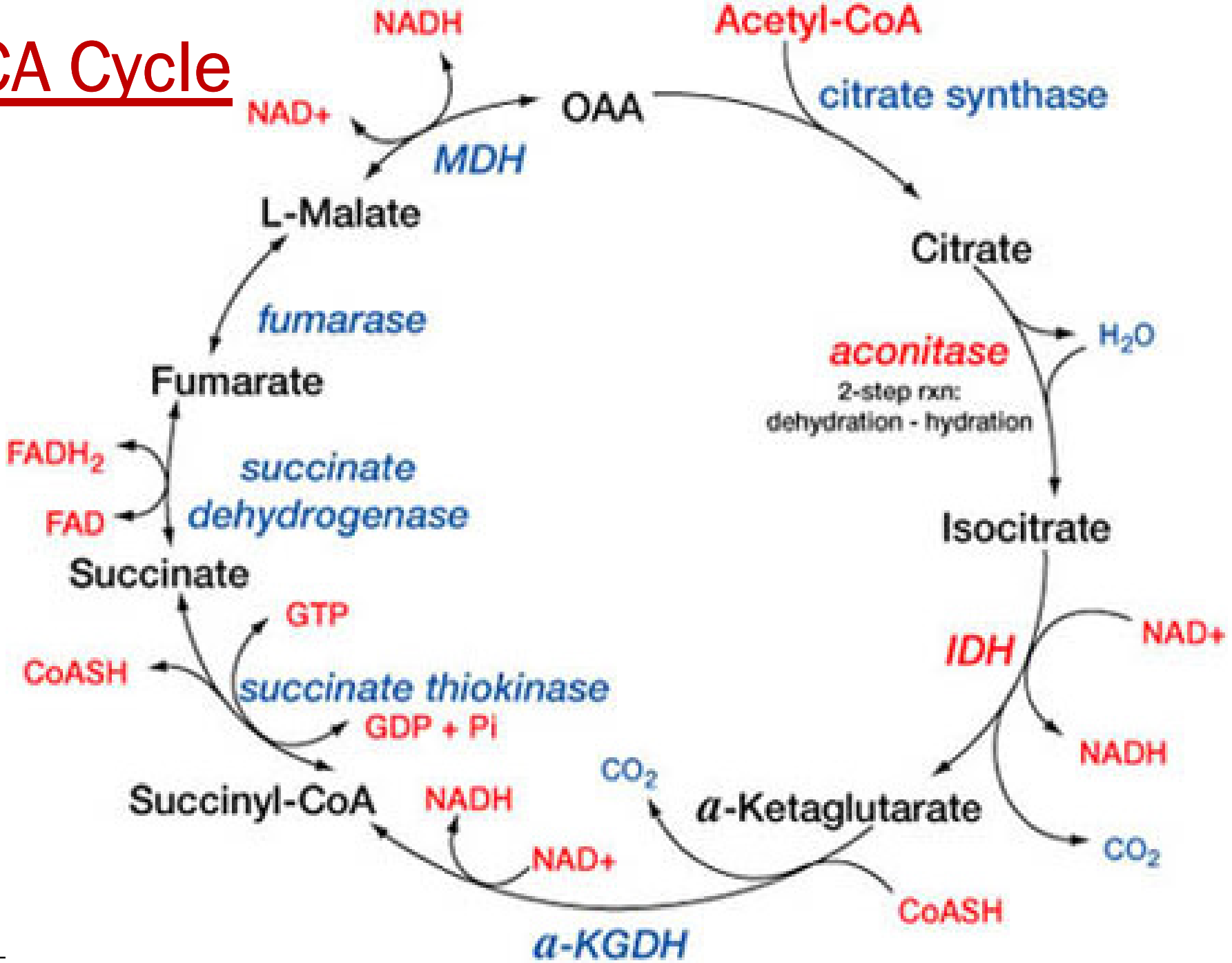

If I had a choice between
DNA and RNA, I'd choose RNA
MILK
Because it has U in it
quickmeme.com

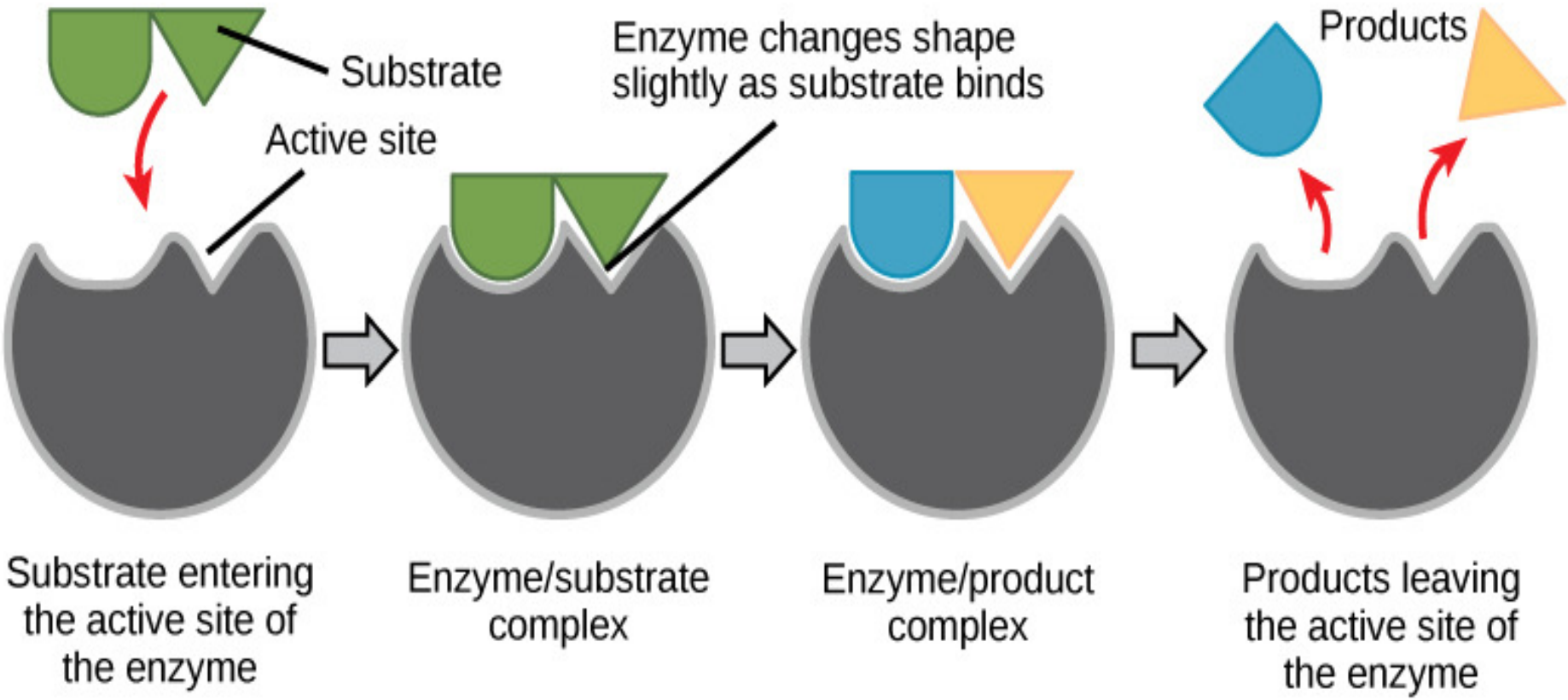
Ribozyme


3'
5'
Stem III
Stem II
Stem I
U
G
C
C
A
dA
dC
dG
dG
dT
dC
dG dG dT dC dG dC dC
3'
Target RNA
C C A G C G G ppp 5'
Ribozyme

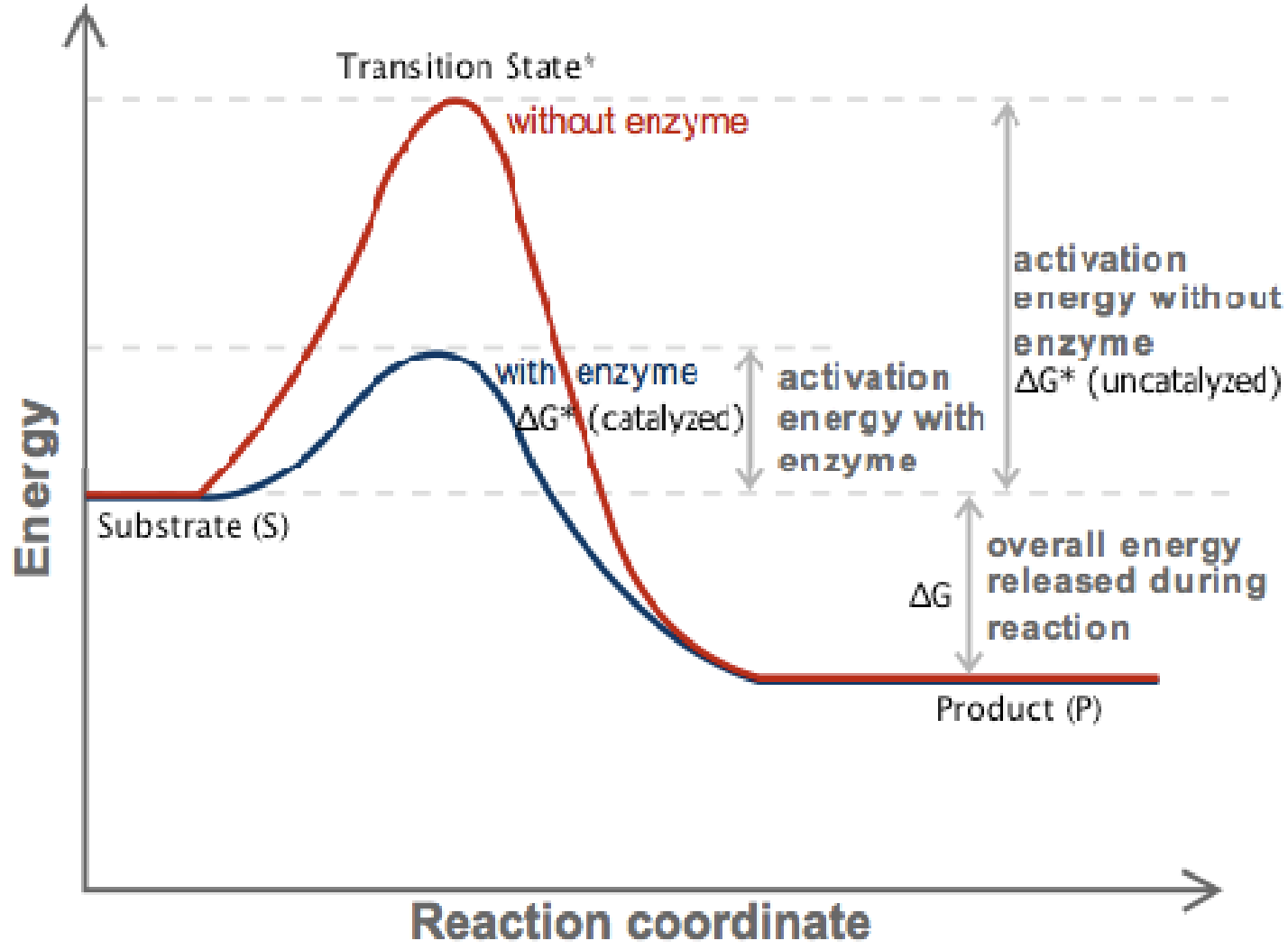

Pathogenic mRNA
Binding of target RNA
cleaving ribozyme
Cleavage of
target RNA

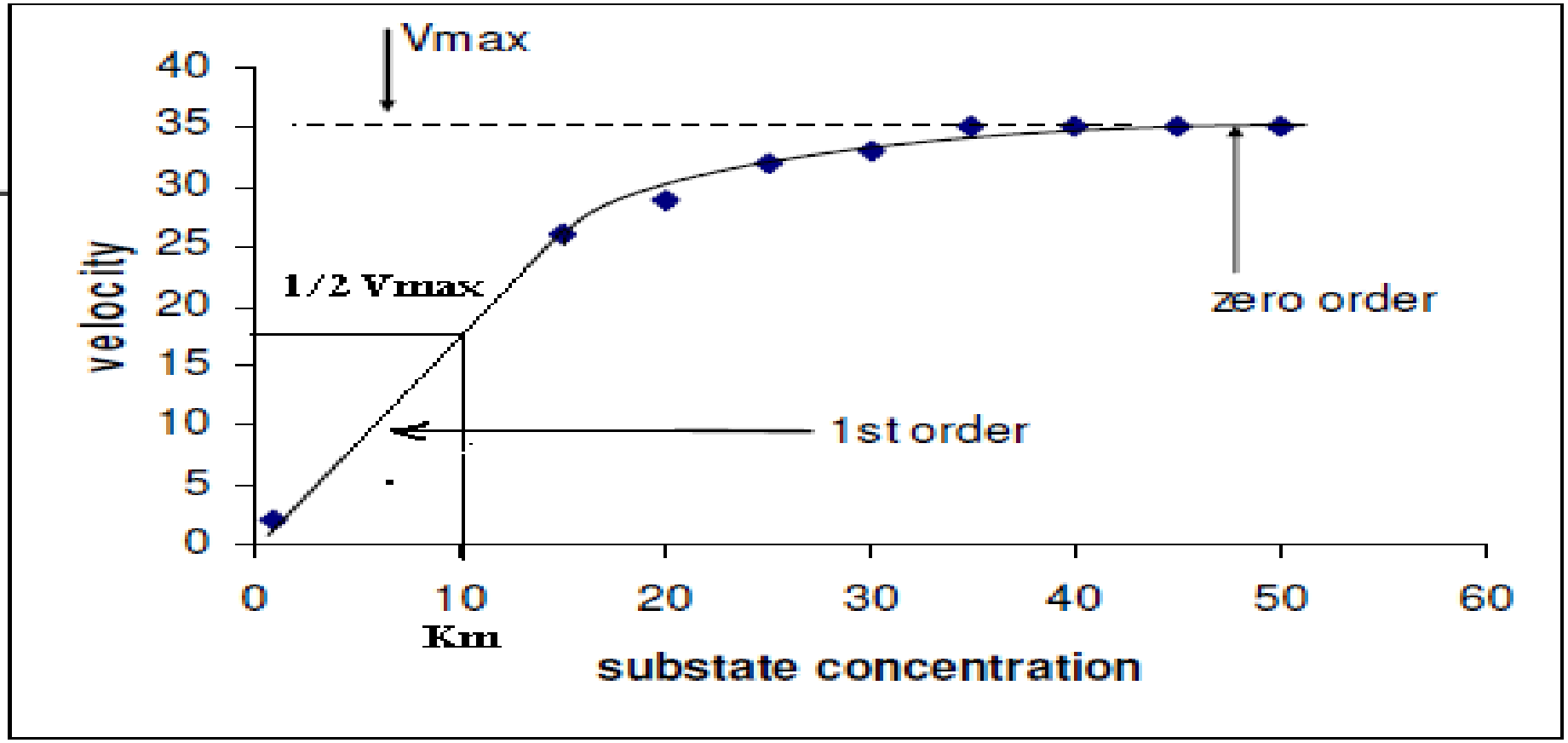
TCA Cycle


NADH
Acetyl-CoA
NAD+
OAA
citrate synthase
MDH
L-Malate
Citrate
fumarase
aconitase
H_2O
2-step rxn:
dehydration - hydration
Fumarate
$FADH_2$
succinate
FAD
dehydrogenase
Isocitrate
Succinate
GTP
NAD+
IDH
CoASH
succinate thiokinase
GDP + Pi
NADH
CO_2
Succinyl-CoA
NADH
α-Ketaglutarate
CO_2
NAD+
CoASH
α-KGDH


Substrate
Active site
Enzyme changes shape slightly as substrate binds
Products
Substrate entering the active site of the enzyme
Enzyme/substrate complex
Enzyme/product complex
Products leaving the active site of the enzyme

Mode of action of Enzymes





- **Kcat** = Turnover number of 'S' to 'P'
- **Km** = Affinity of Enzyme towards substrate
- **Kcat / Km** = Catalytic Efficiency of Enzyme

Factors Affecting Enzyme Reaction Activity and It's Velocity

pH

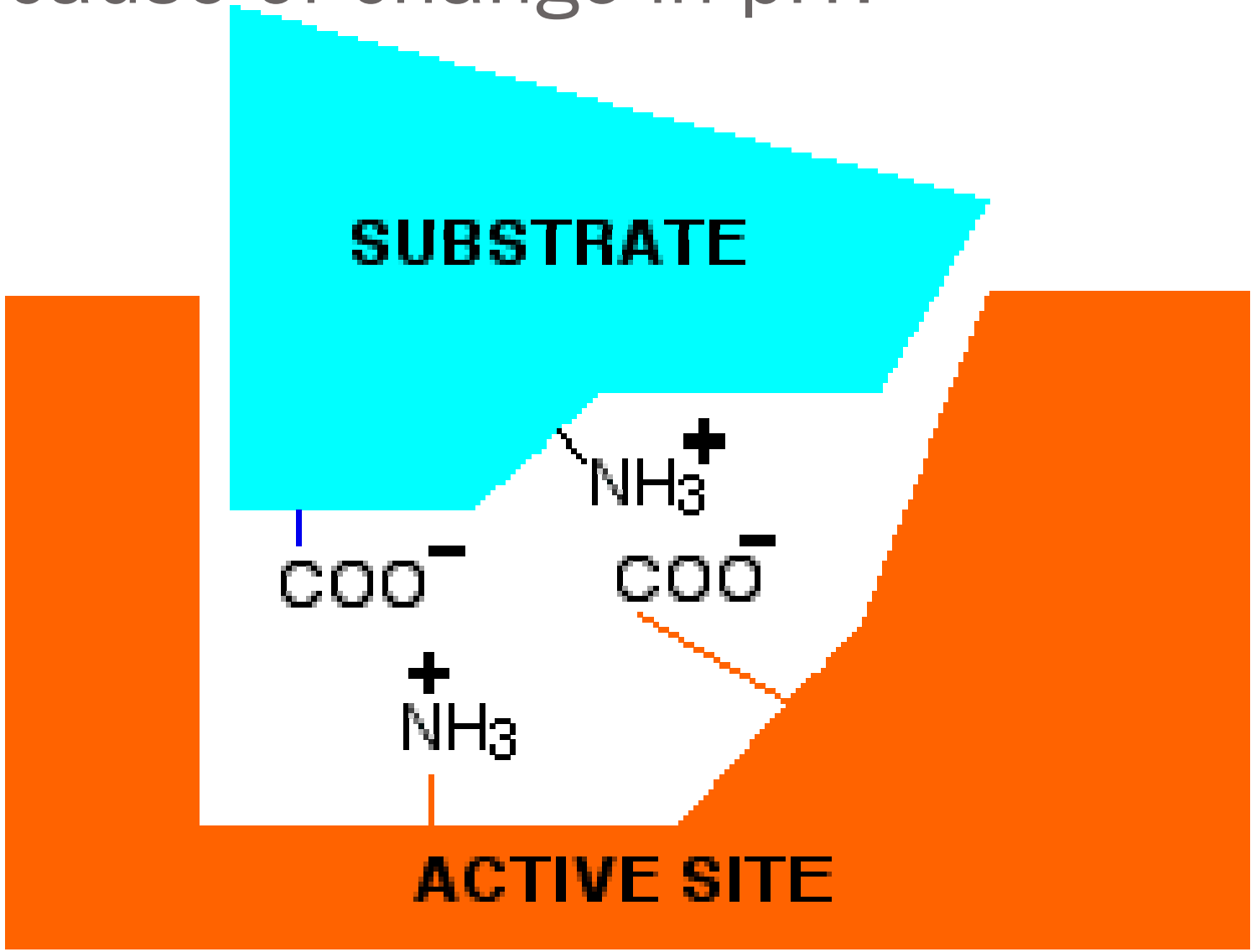
- [H^+]
  - **Change Active site & Bonds**
  - **Configuration change**
  - **Change Velocity**
  - **Can denature enzyme**

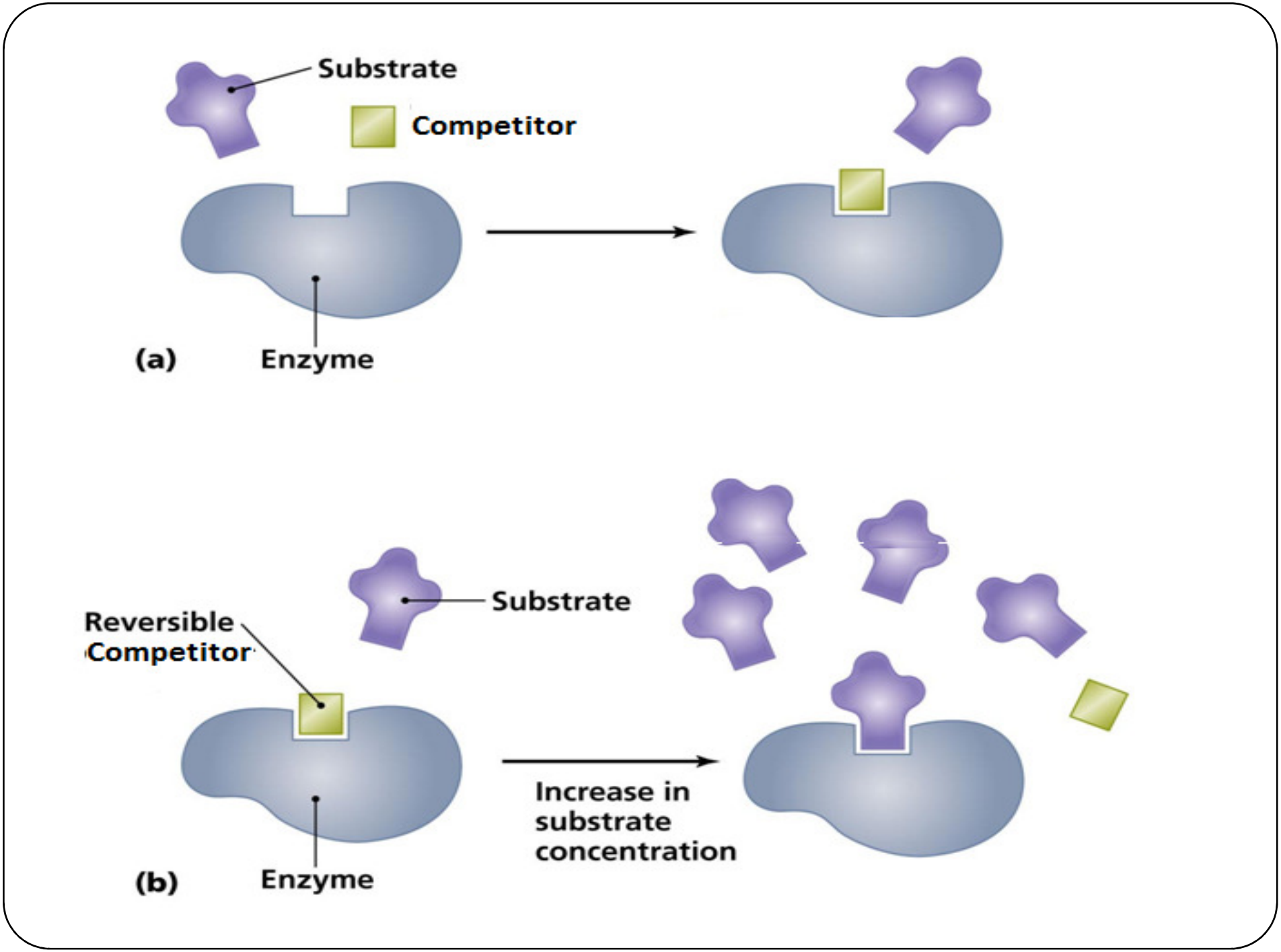
Different Optimum pH

for

Different enzyme.

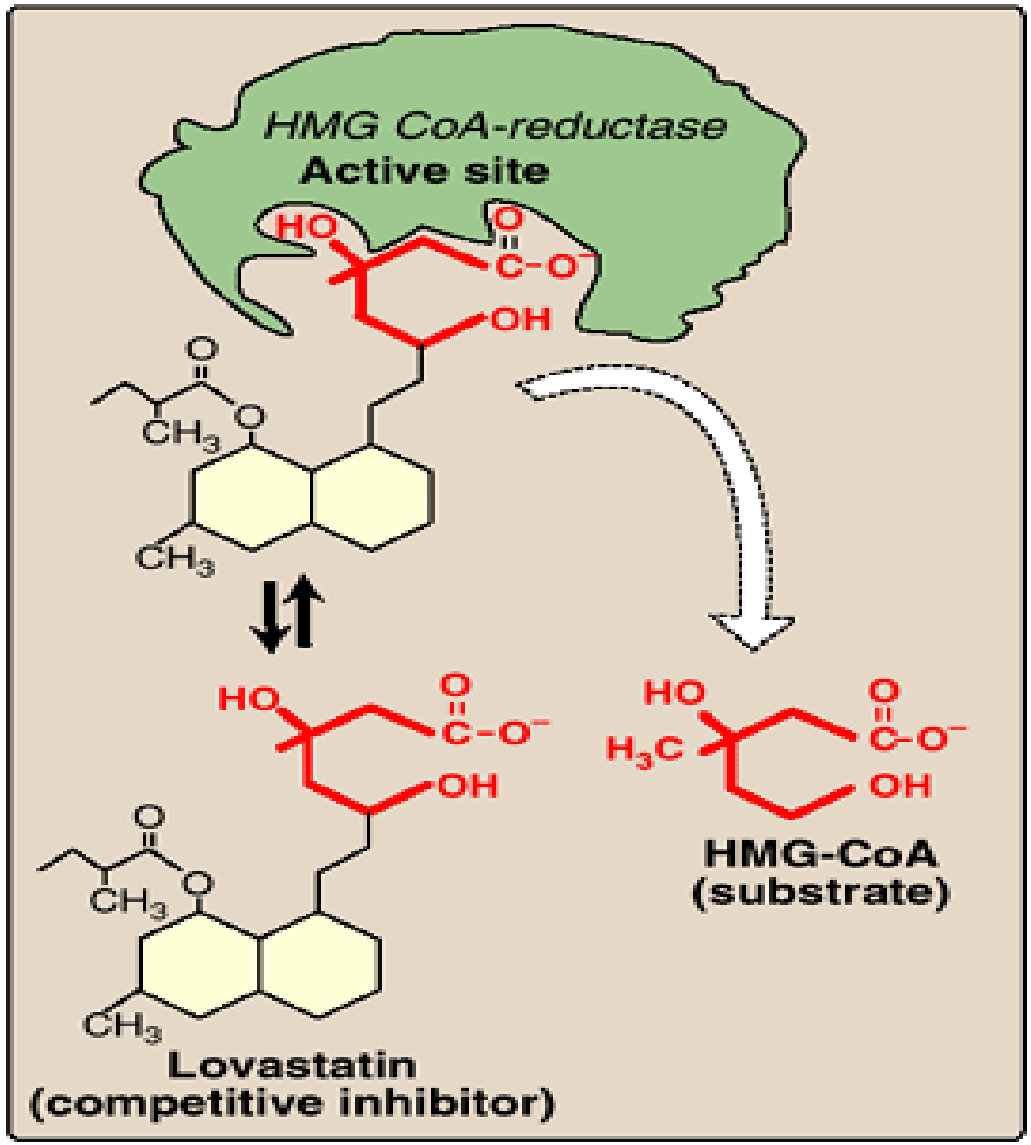
What change can occur at active site, because of change in pH?



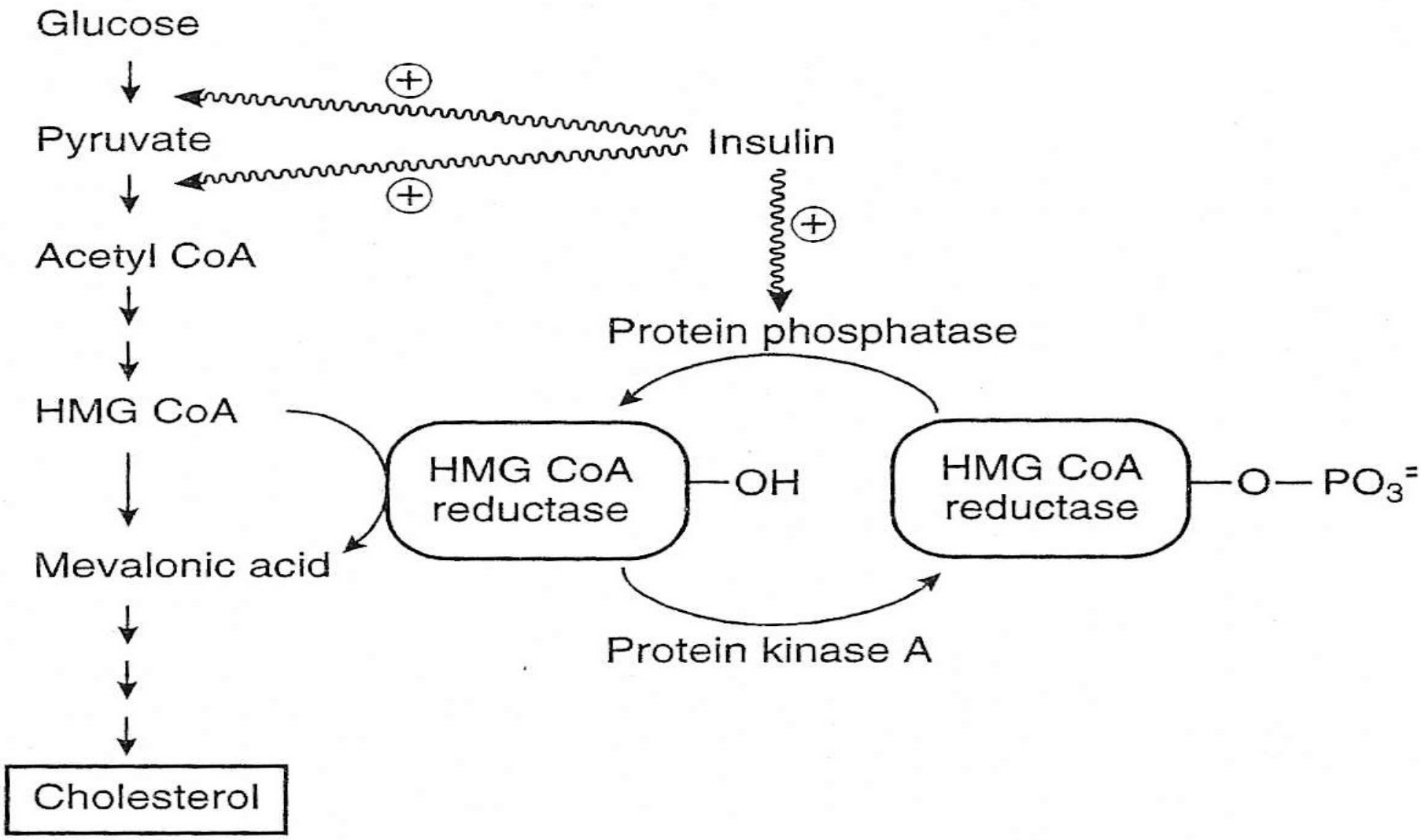

Substrate
Competitor
(a)
Enzyme
Reversible Competitor
Substrate
Increase in substrate concentration
(b)
Enzyme

Enzyme Inhibition

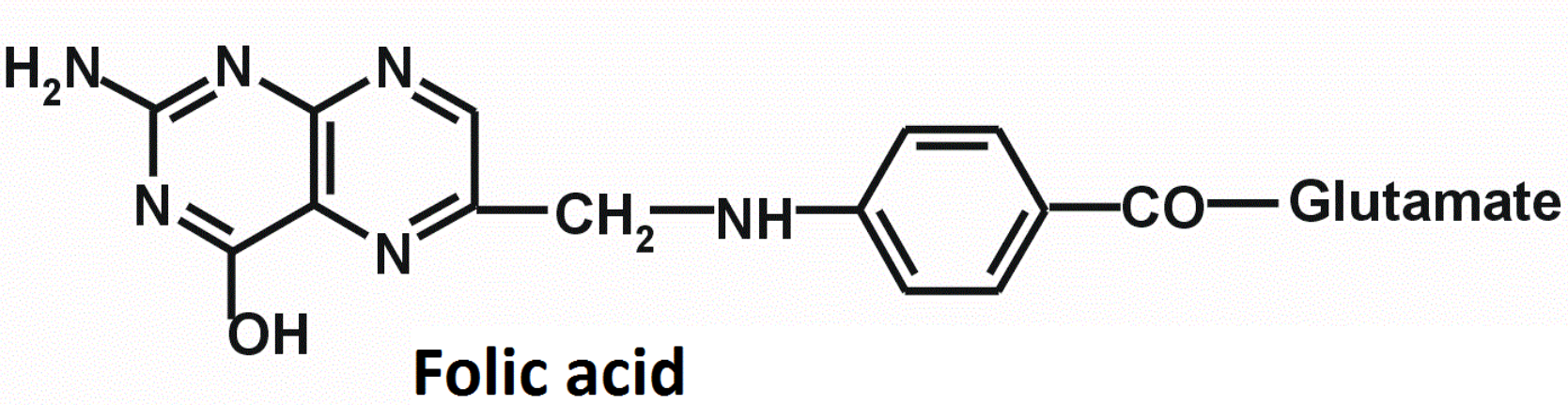
Competitive Inhibition



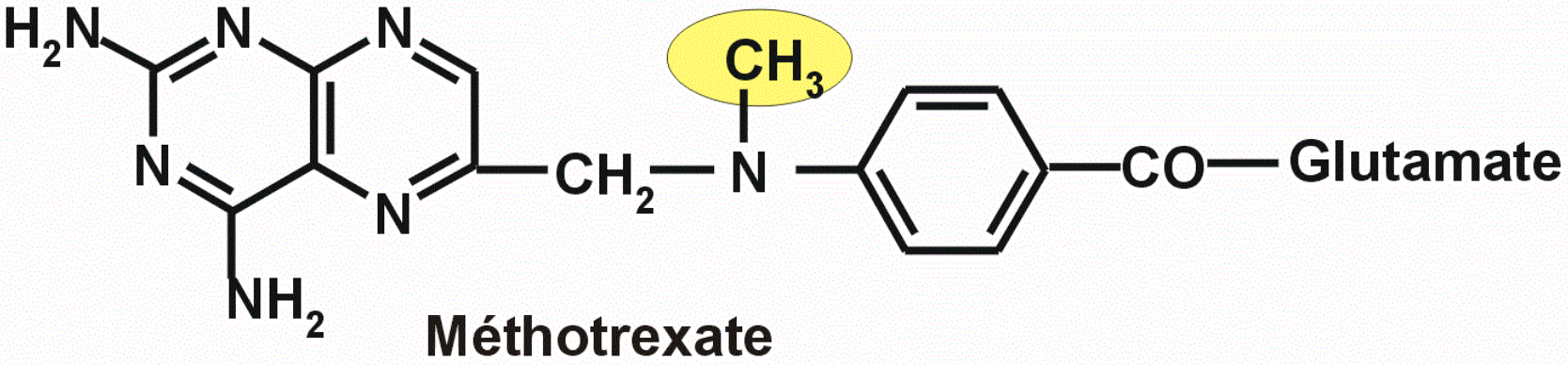
Cholesterol Synthesis & Regulation



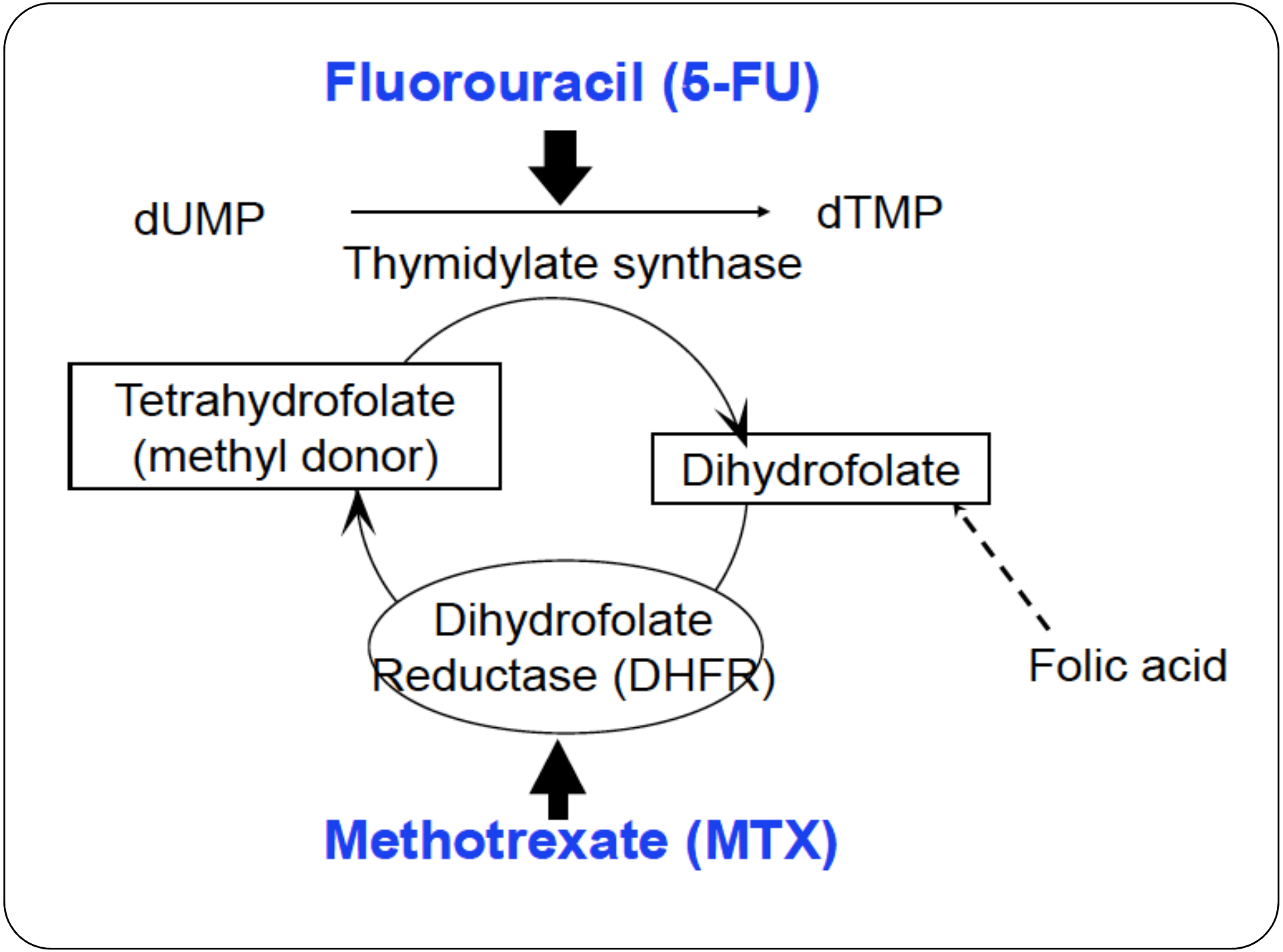
Methotrexate =Folic Acid Analogues



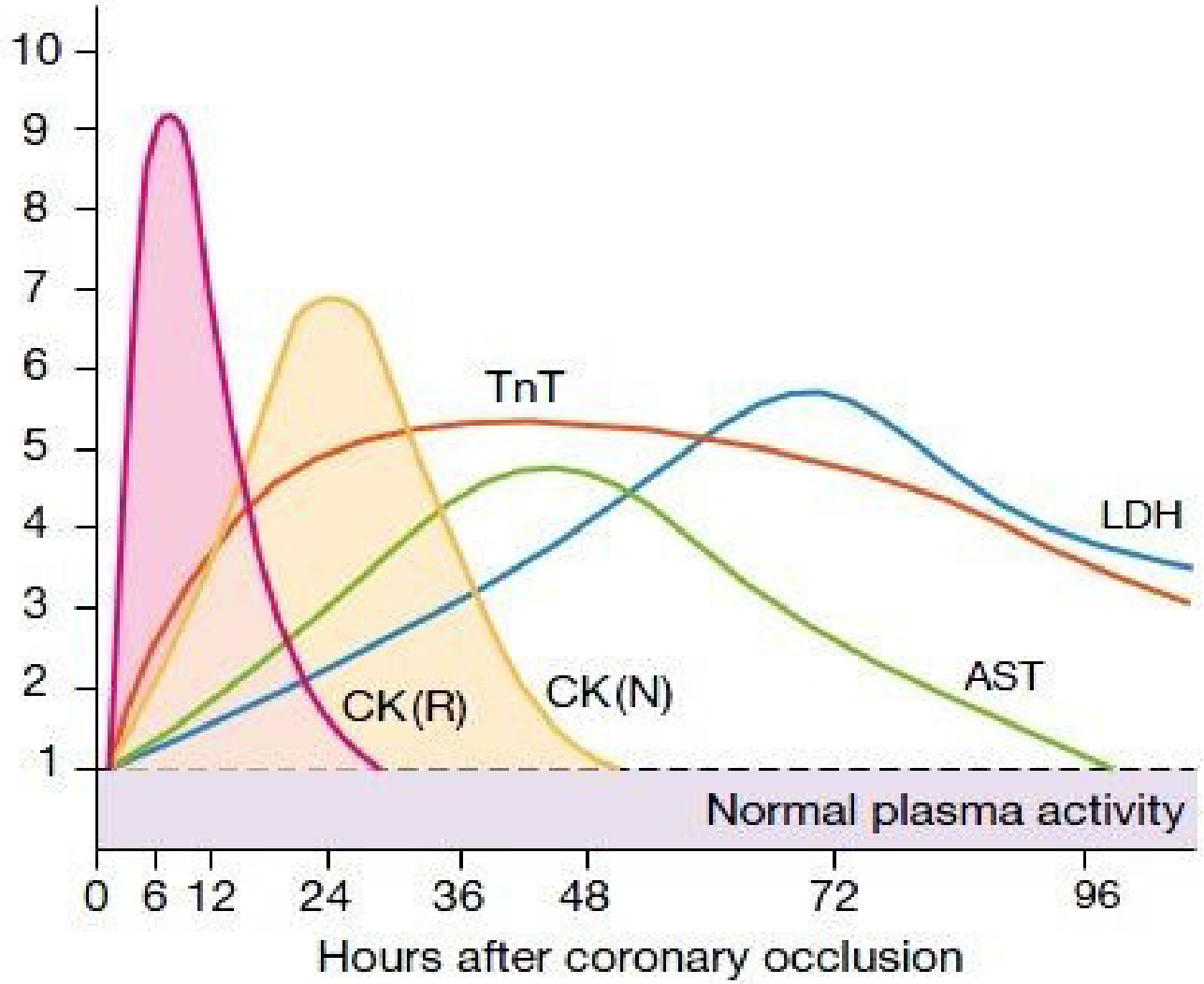
Folic acid



Méthotrexate


Fluorouracil (5-FU)
dUMP
dTMP
Thymidylate synthase
Tetrahydrofolate
(methyl donor)
Dihydrofolate
Dihydrofolate
Reductase (DHFR)
Folic acid
Methotrexate (MTX)

Diagnostic Important of Enzyme



Organ Specific Enzyme	
Heart	CK-MB , AST (GOT) , LDH
Liver	ALT , AST , LDH , Alkaline Phosphatase Gamma Glutamyl Transferase
Pancrease	Lipase ,Amylase
Muscle	Aldolase , CK-MM , CK-Total , AST
Bone	Alkaline Phosphatase
Prostate	Acid Phosphatase (Prostate isoform – inhibited by Tartrate)
RBC	LDH Acid Phosphatase (Erythrocyte isoform – inhibited by formaldehyde & cupric ion)


THANK
YOU