

MCAT Biomolecules: Water & Fat Soluble Vitamins



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medpathwaymc



Med-pathway



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by medical school professors

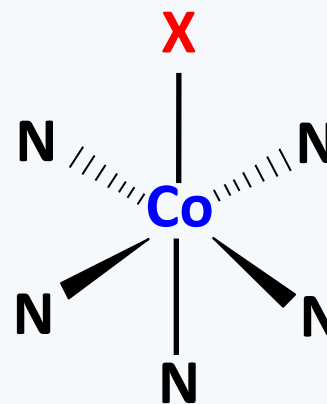
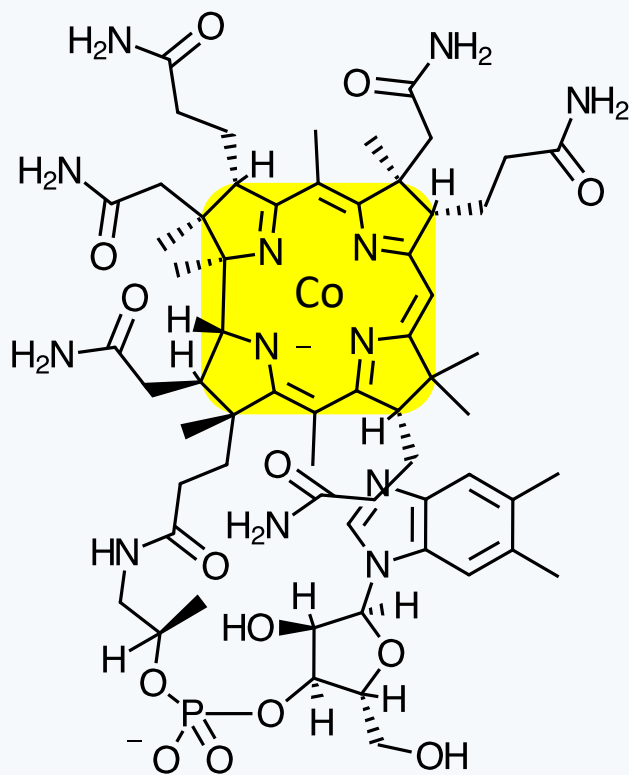
Vitamins/Co-factors

Water Soluble: Vitamin B₁, B₆, B₇, B₁₂, C

Fat Soluble: A, D, E, K

Vitamin B₁₂ or Cobalamin

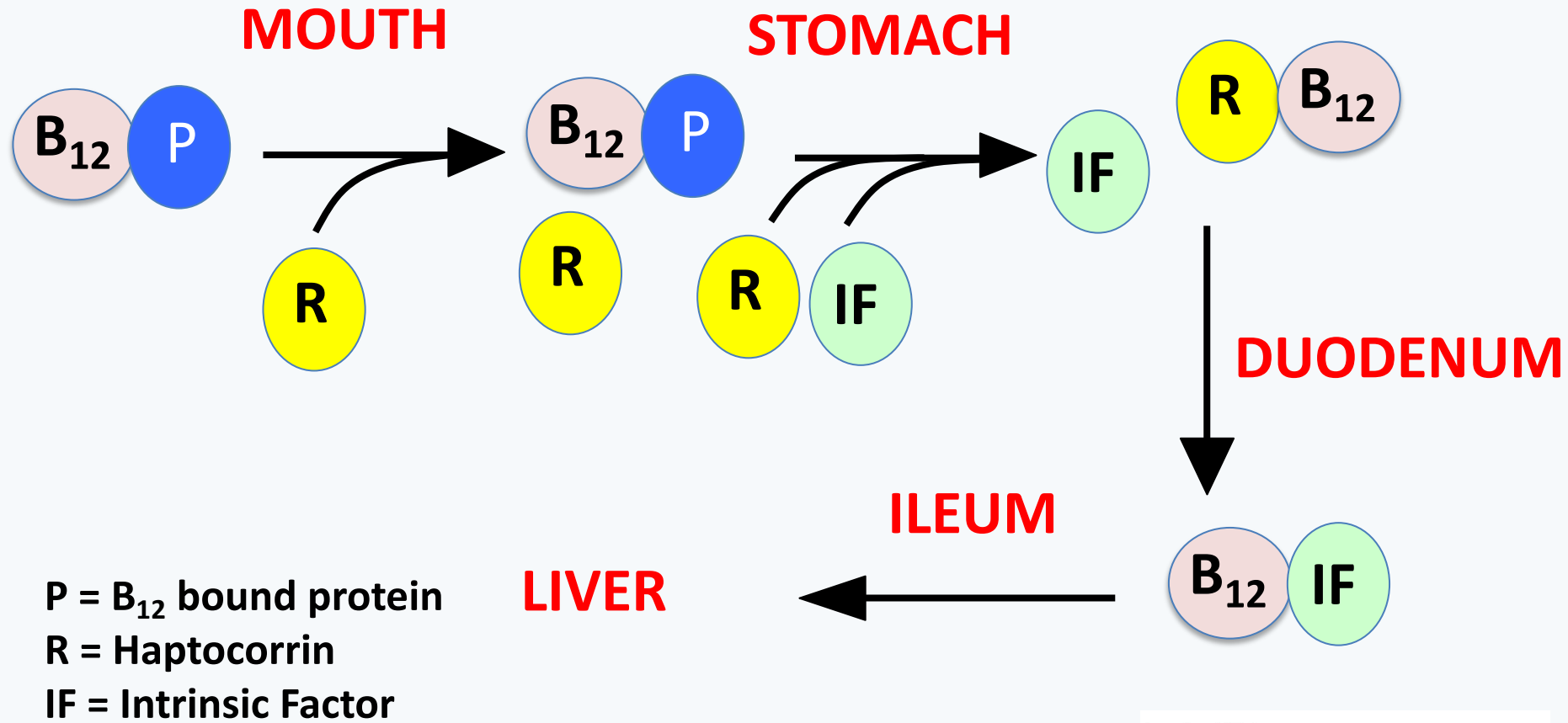
1. Methionine Synthase 2. Methylmalonyl Co A mutase



X = CH₃ (1)
= 5' Deoxyadenosine (2)
= CN⁻

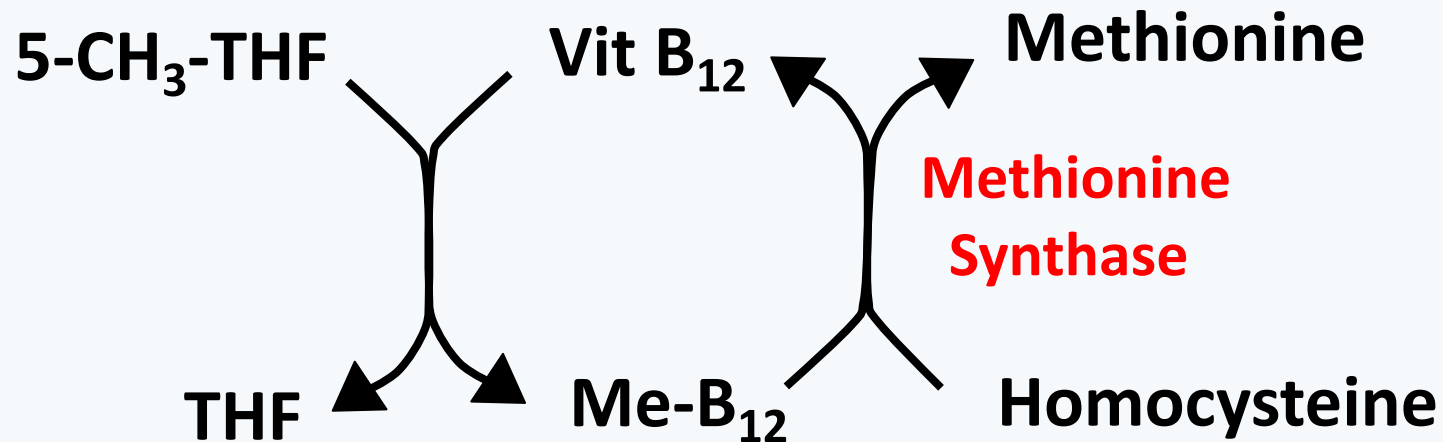
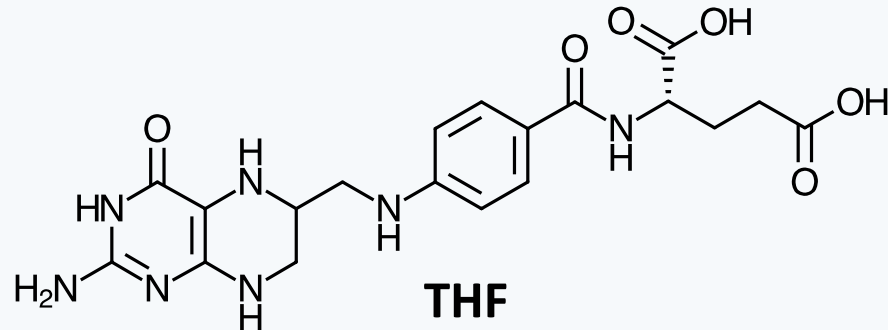
Corrin Ring with 4 Pyrrole Groups

B₁₂ & The GI Tract



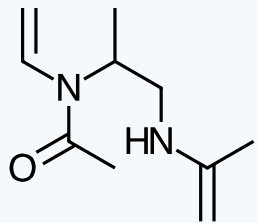
Vitamin B₁₂ & Tetrahydrofolate

One Carbon Transfer

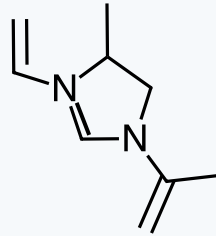


THF & One Carbon Transfer

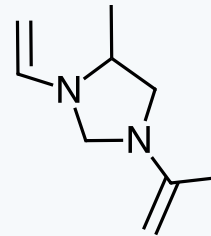
N⁵ Formyl THF



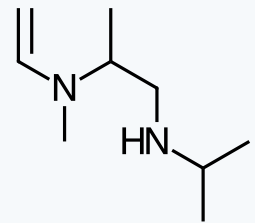
N⁵ N¹⁰ Methylene THF



N⁵ N¹⁰ Formyl THF



N⁵ methyl



Irreversible
Step

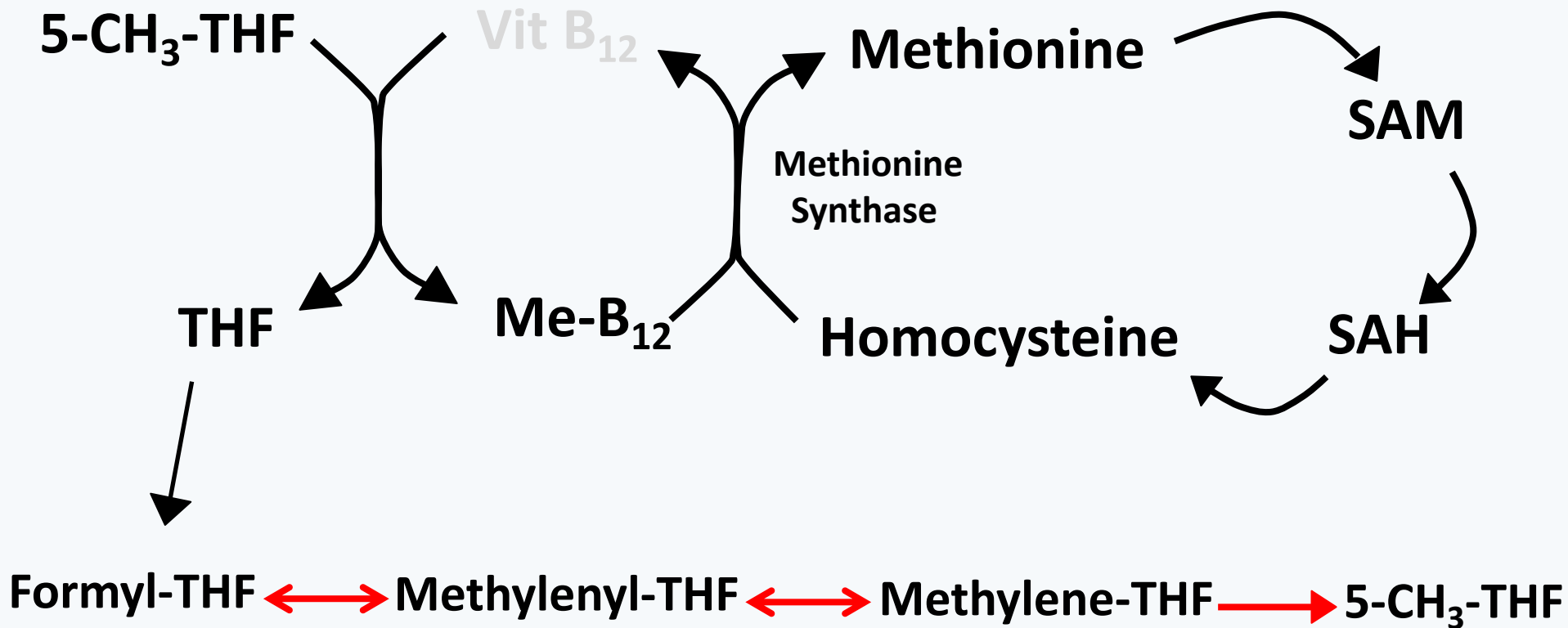
Folate Trap

Formyl-THF: Methionyl-tRNA formyltransferase

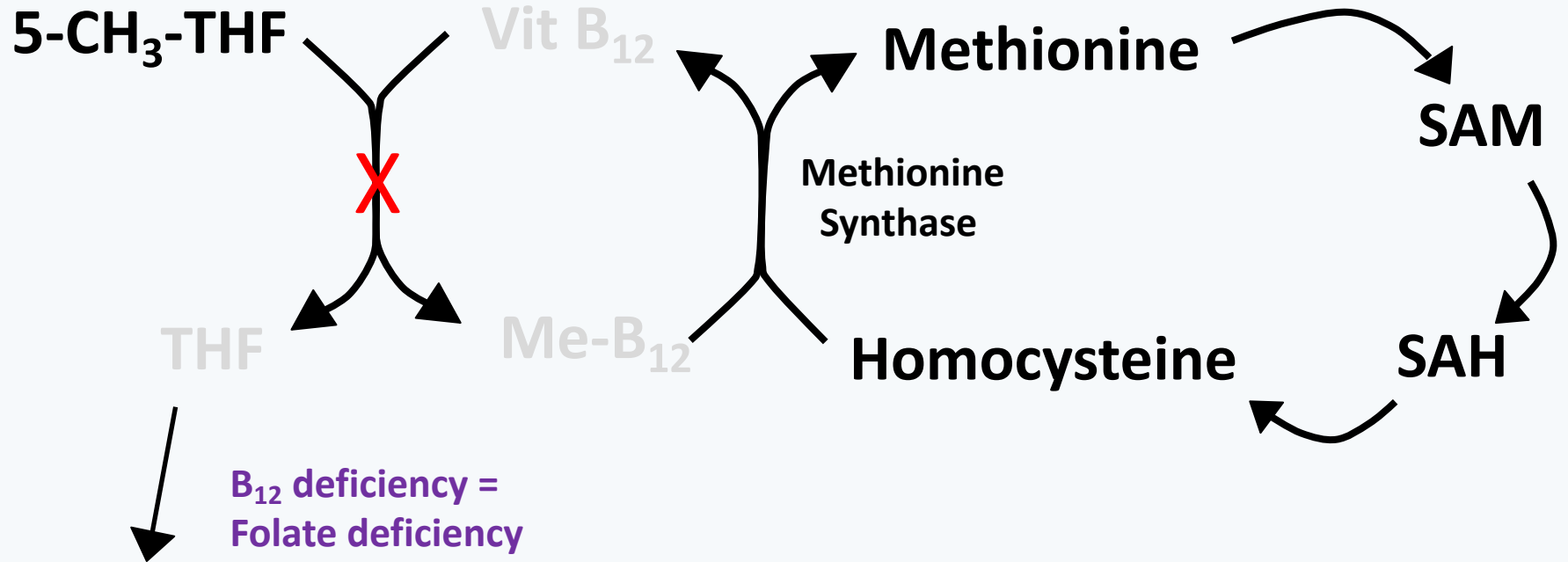
Methylene-THF: Thymidylate synthase

5-CH₃-THF: Methionine synthase

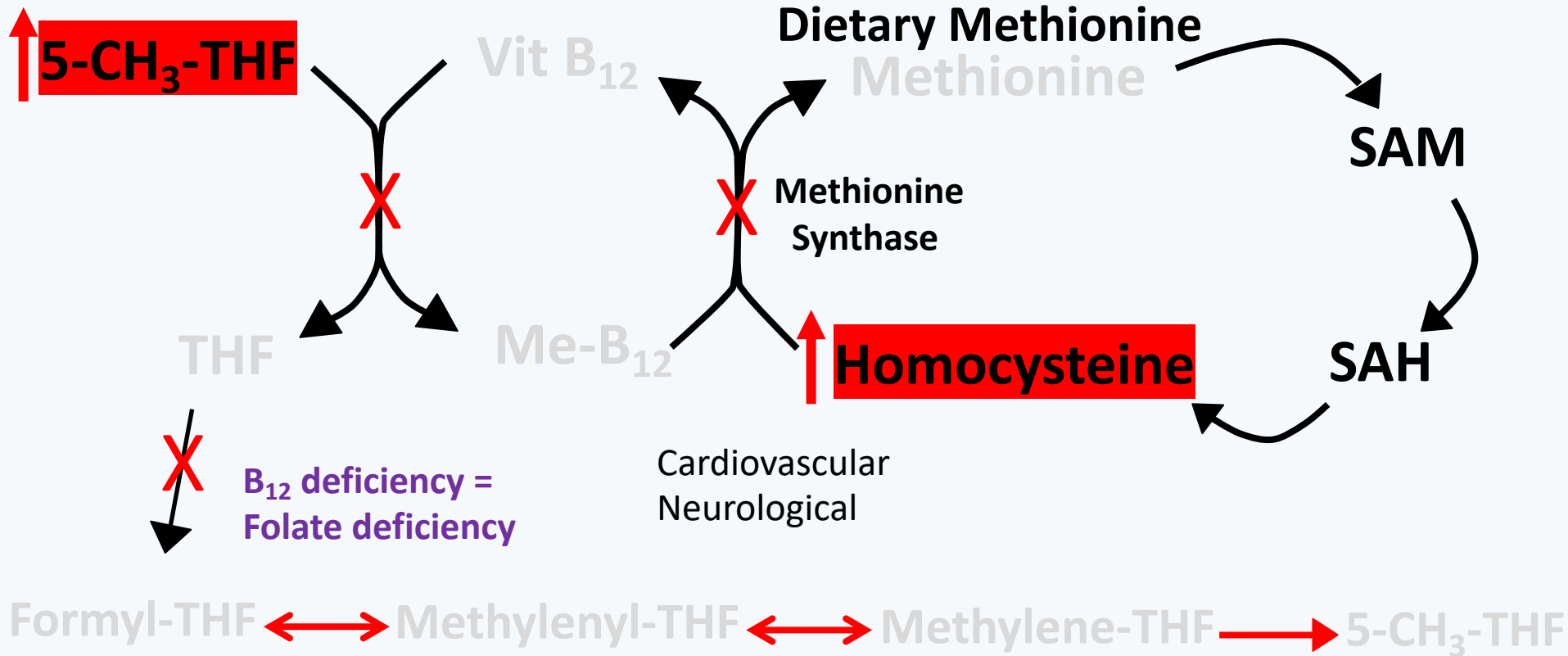
B₁₂ Deficiency



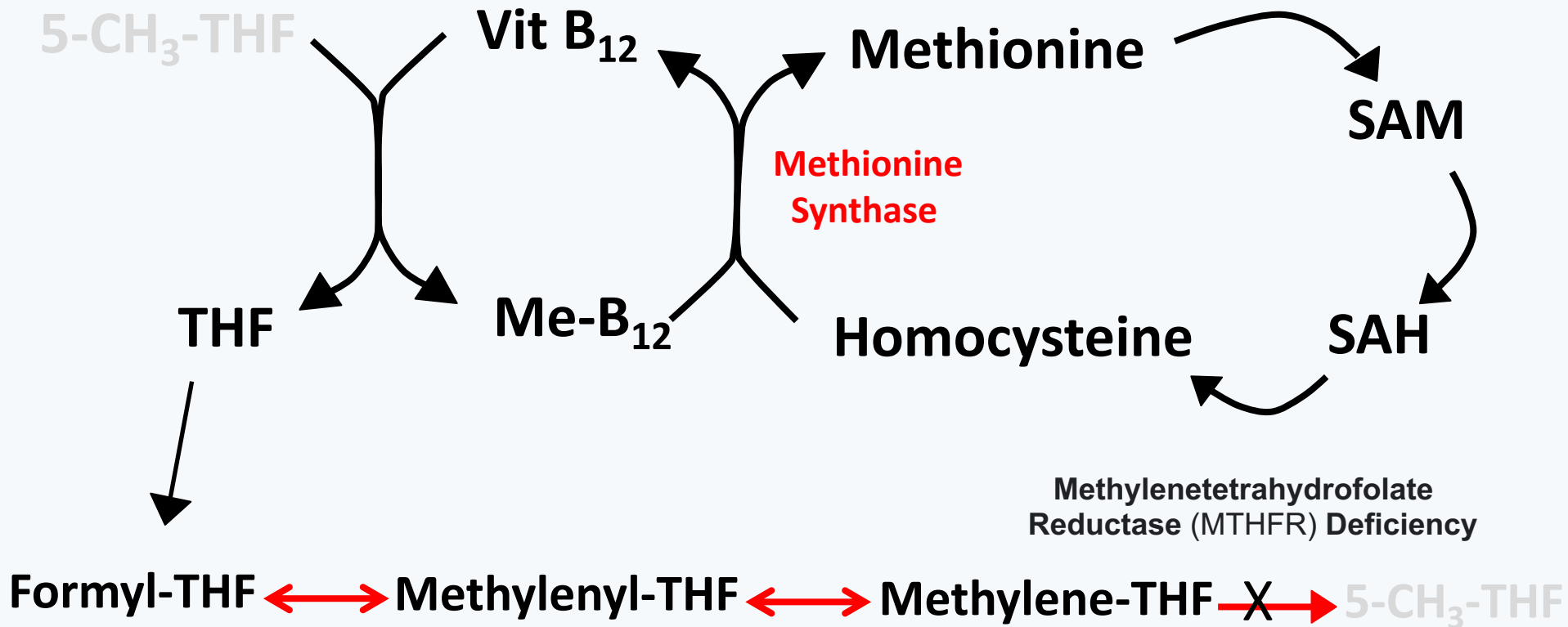
B₁₂ Deficiency



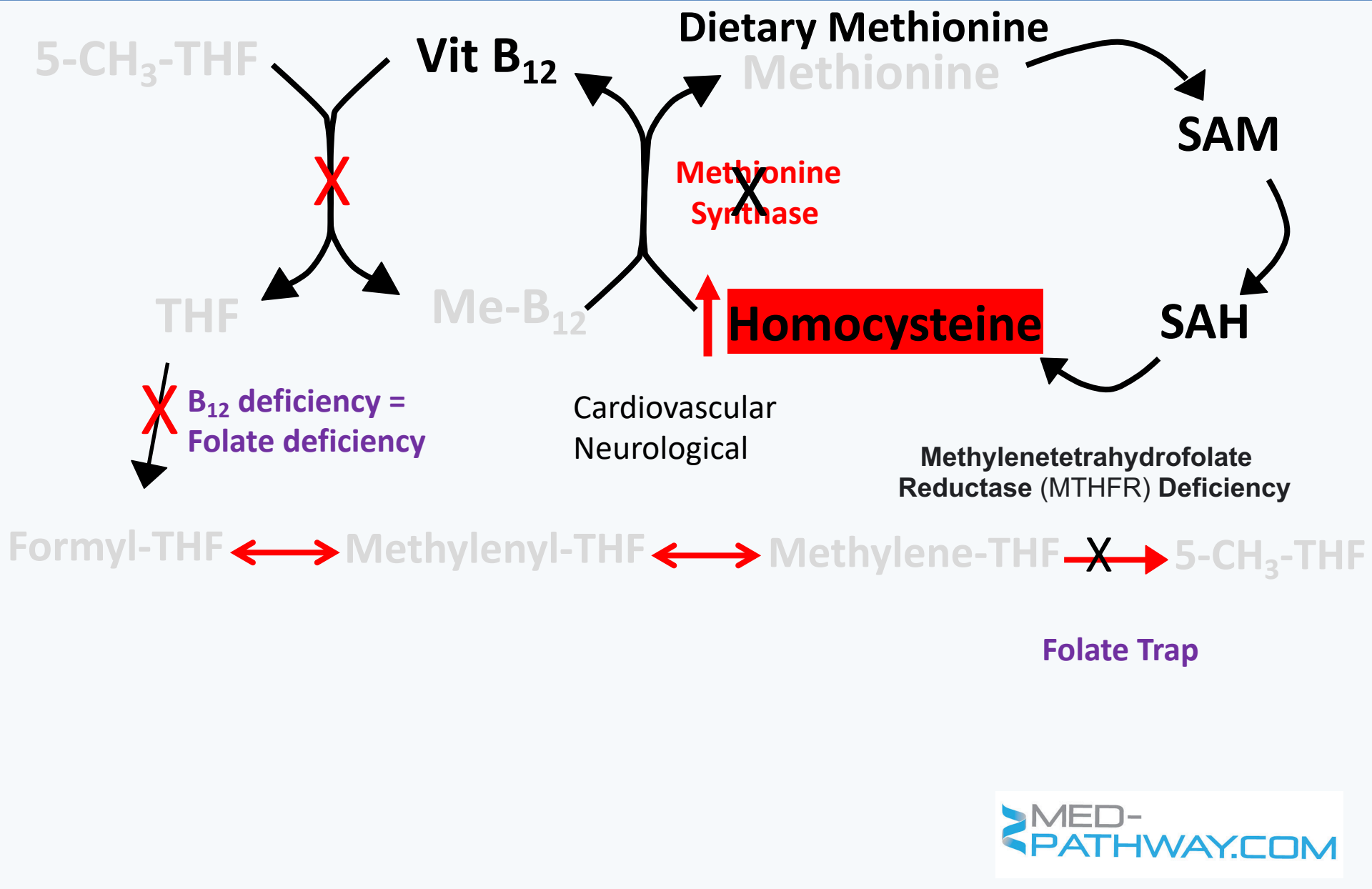
B₁₂ Deficiency & Homocystinuria



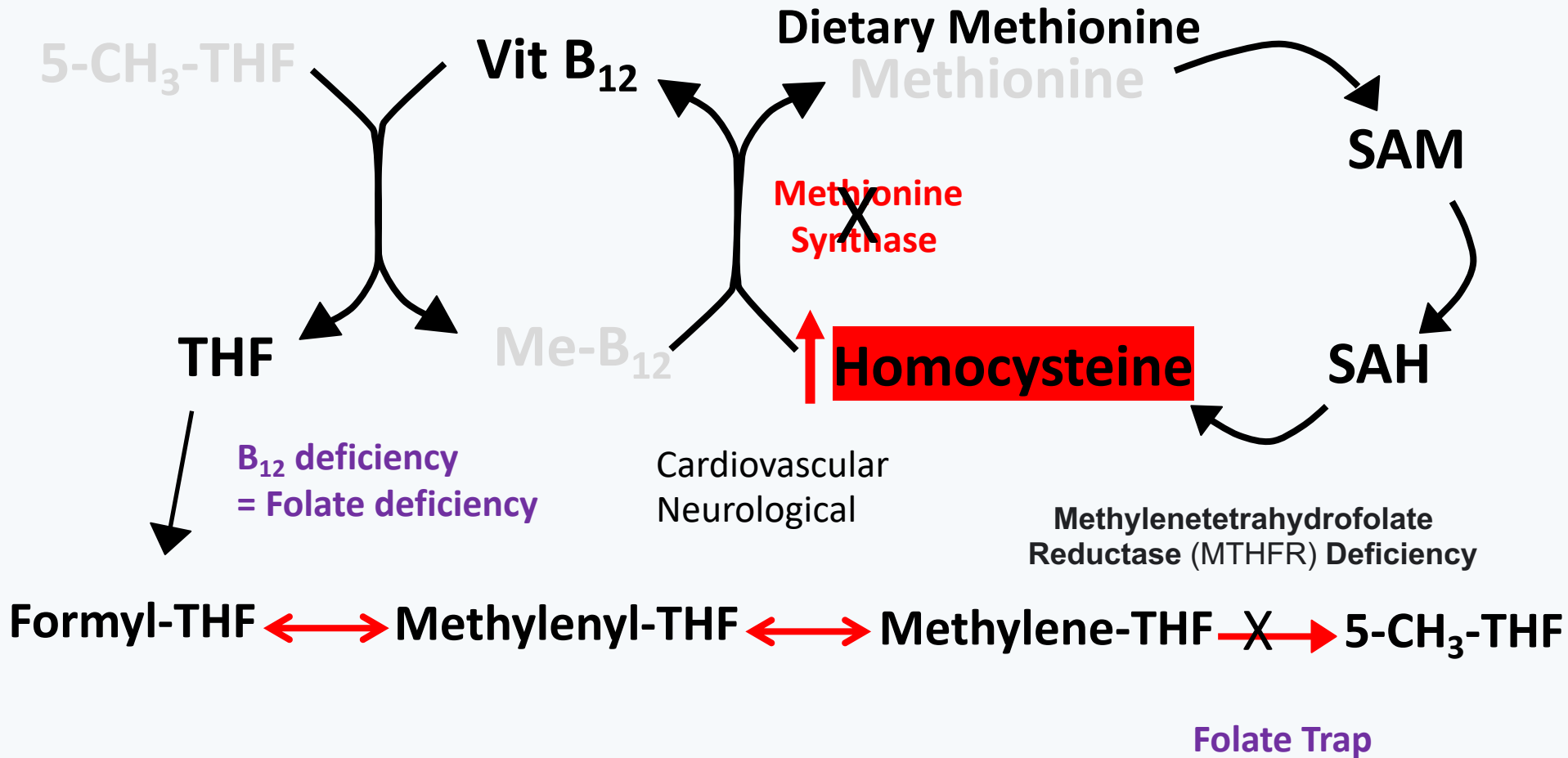
MTHFR Deficiency



MTHFR Deficiency & Homocystinuria

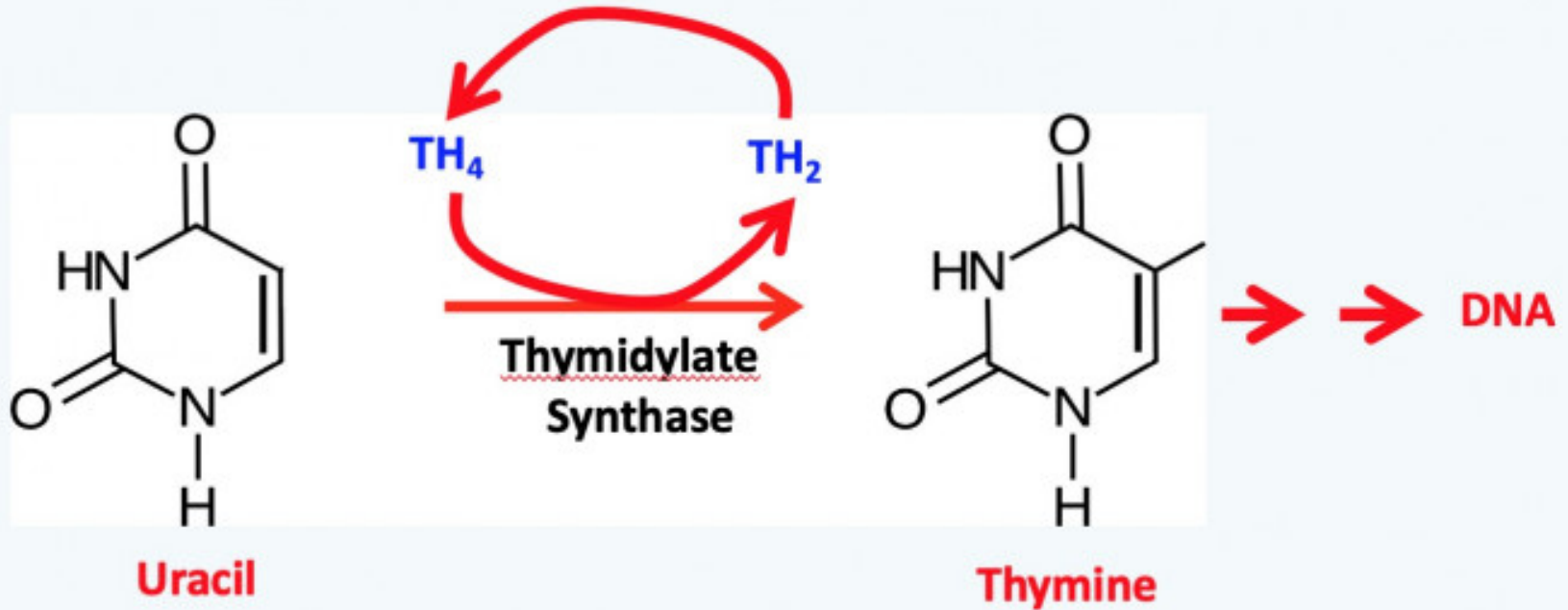


MTHFR Deficiency & Homocystinuria



Folate & DNA Synthesis

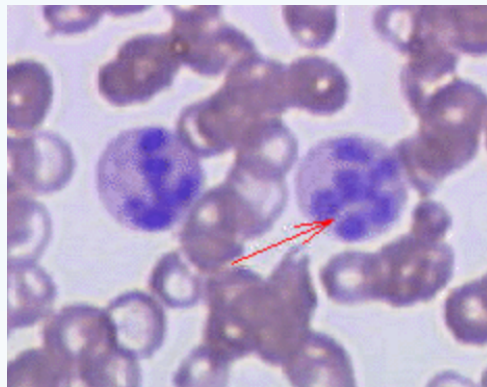
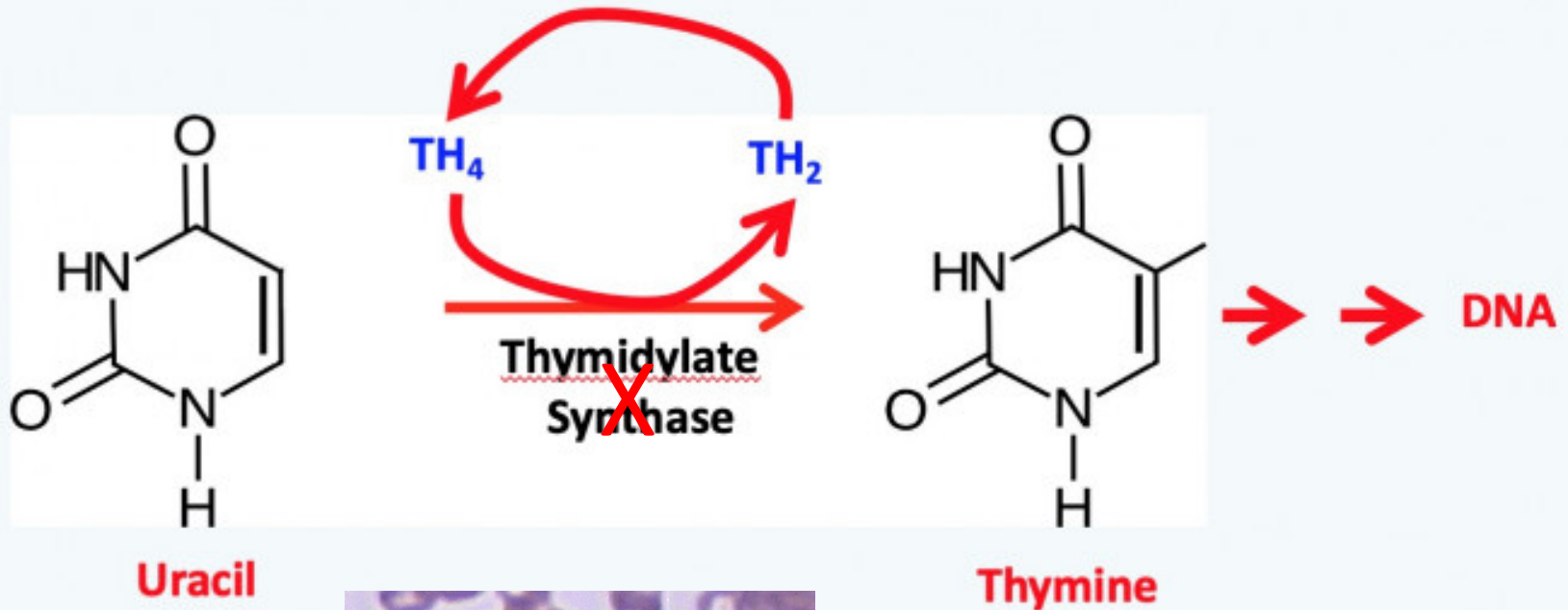
Dihydrofolate reductase (DHFR)



Folate & DNA Synthesis

Methotrexate

~~Dihydrofolate reductase (DHFR)~~



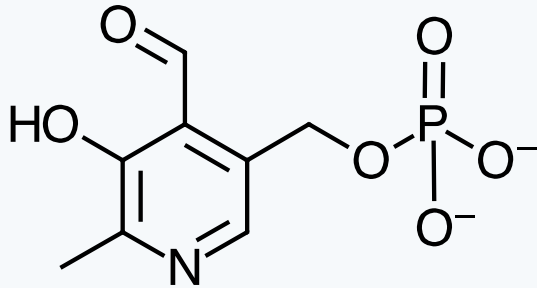
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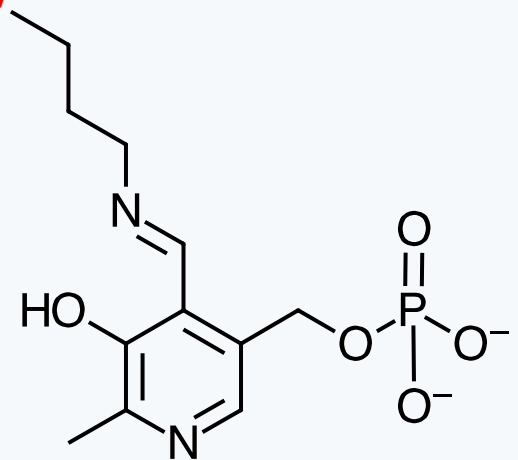
<http://www.va.gov/telepathvisn6/megalops.GIF>

Pyridoxal phosphate (PLP or Vitamin B₆)

Catalyzes over 140 reactions!



Lys



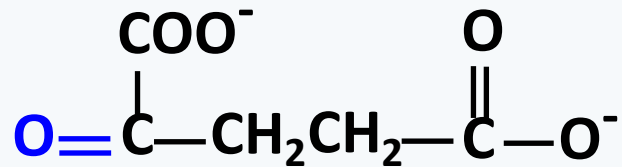
Commonly linked to Lysine

Reaction Types on AA substrates

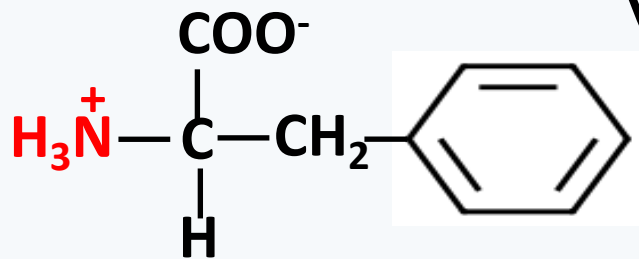
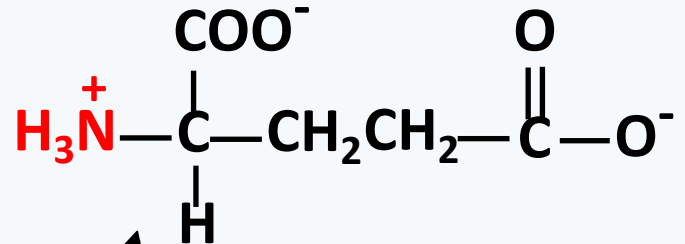
1. Decarboxylation
2. Transamination
3. Racemization
4. Deamination

TRANSAMINATION

α -ketoglutarate

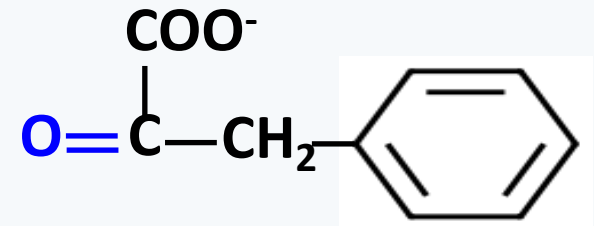


Glutamate



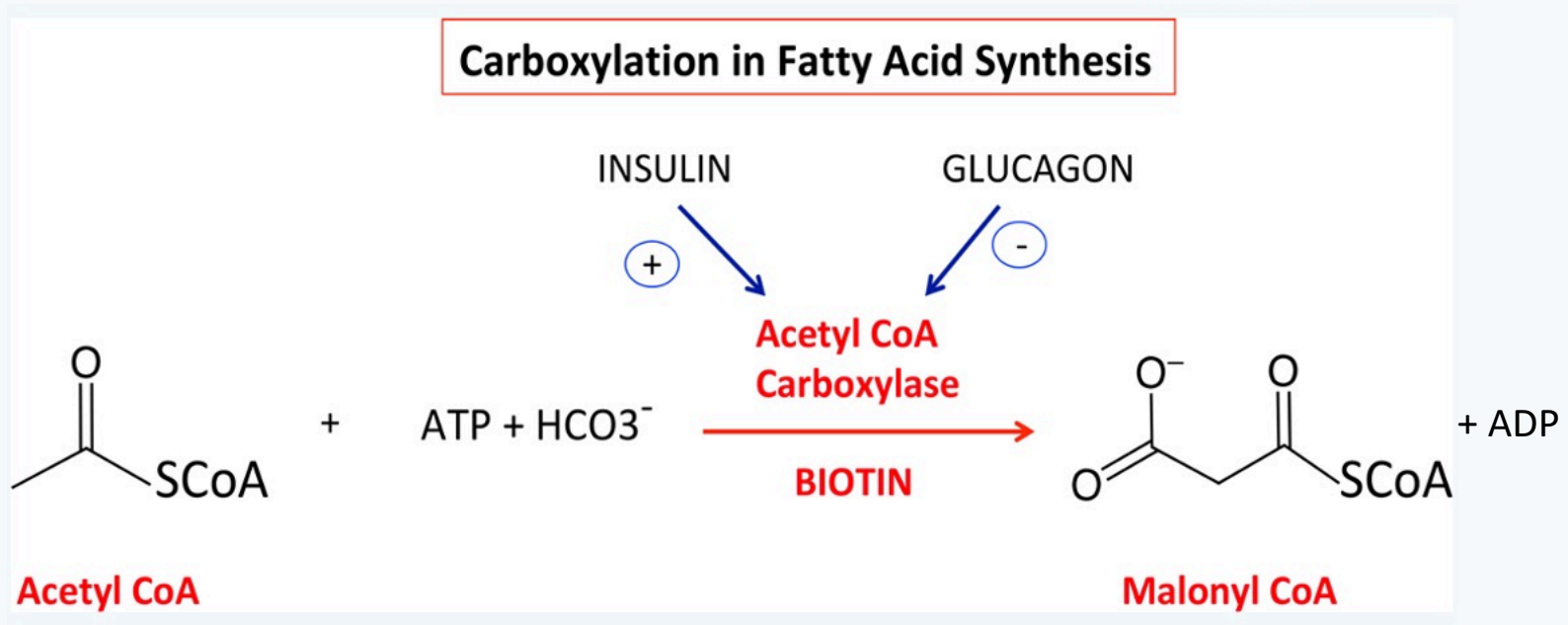
L-Phenylalanine

Transaminase



Phenylpyruvate

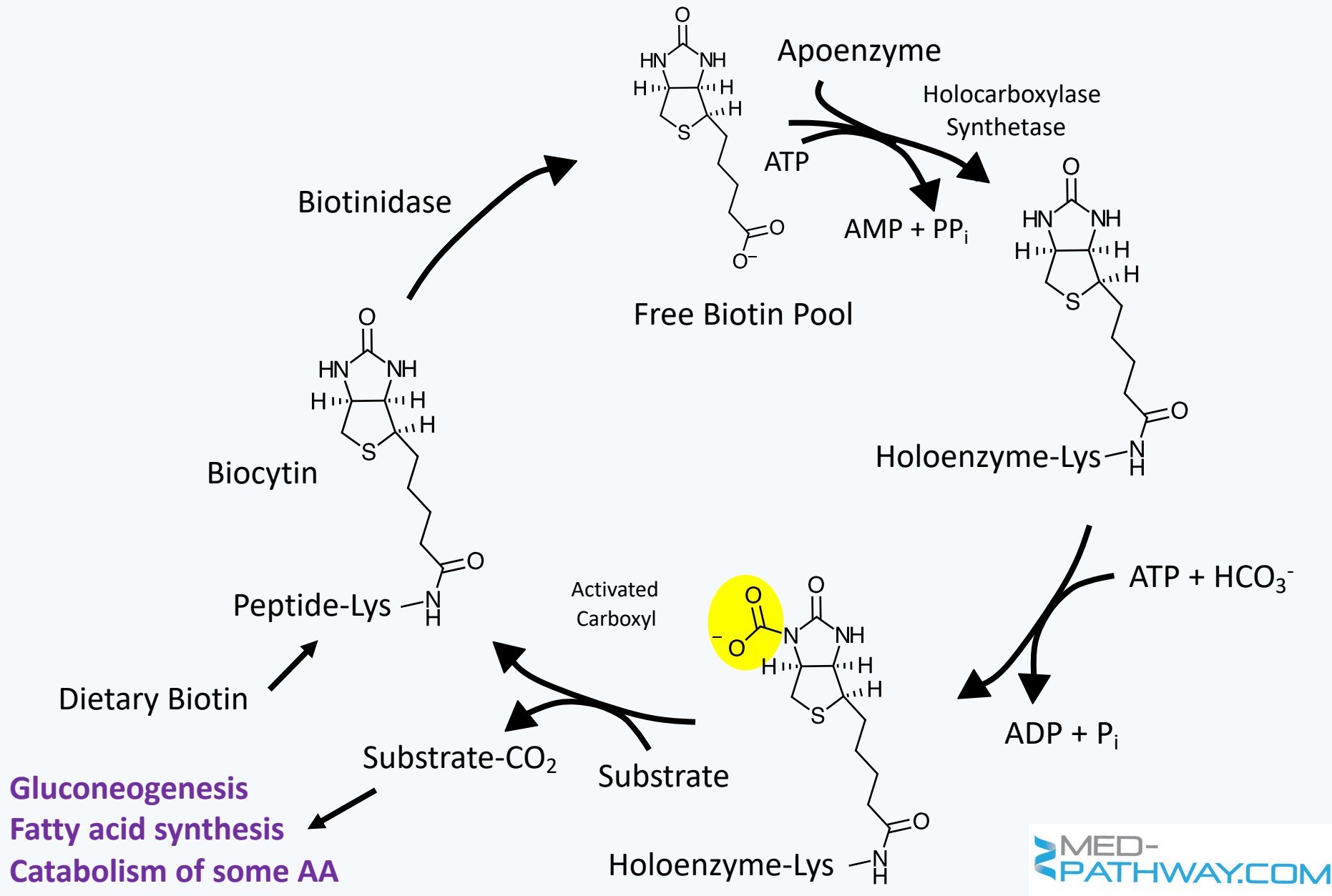
Biotin



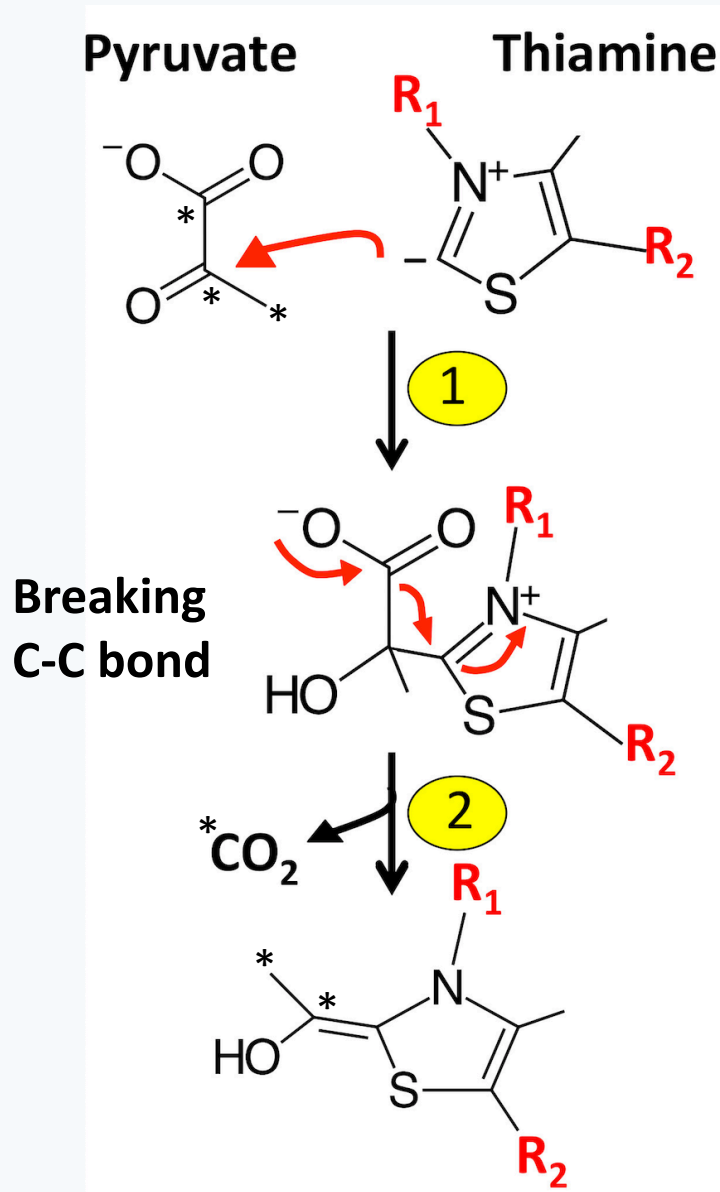
The Biotin Cycle



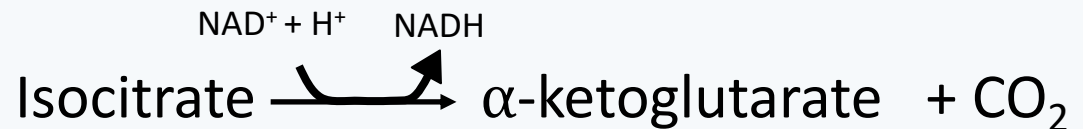
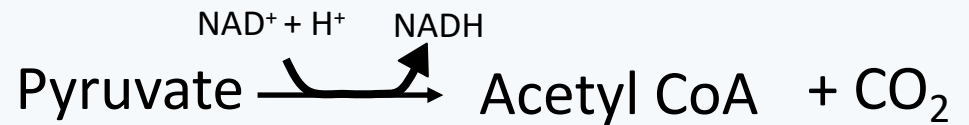
The Biotin Cycle



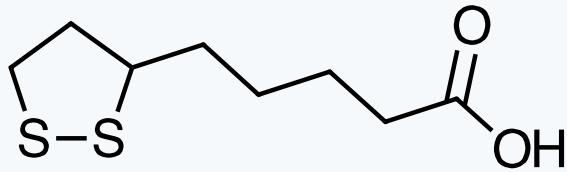
Thiamine Vitamin B₁



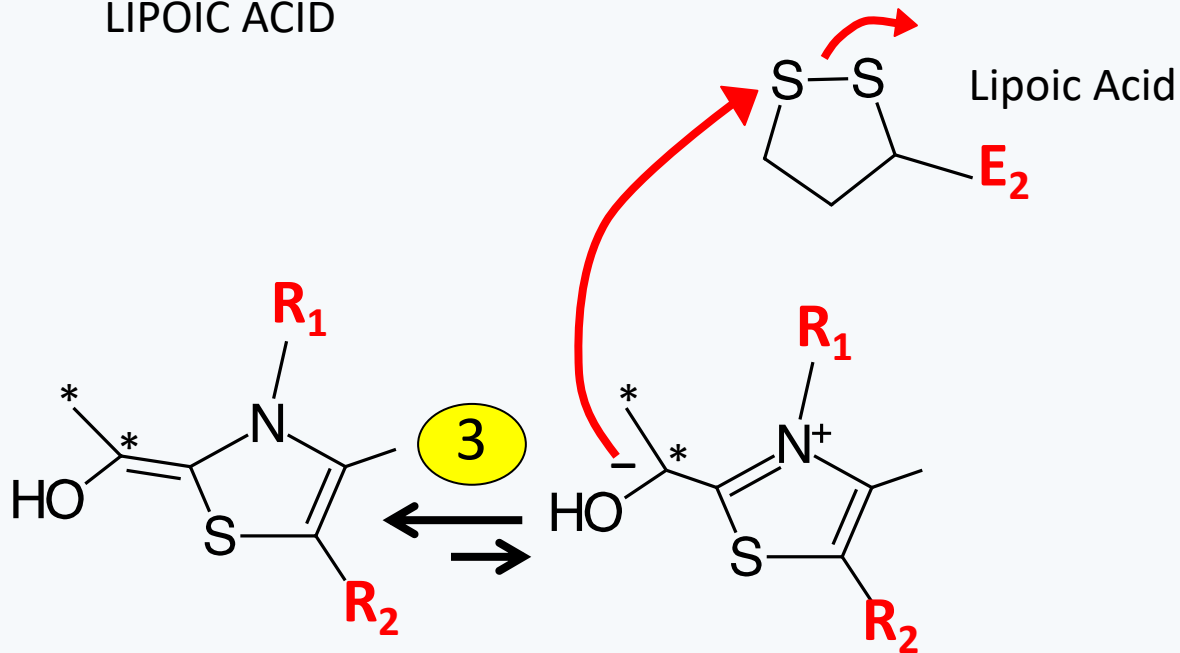
Pyruvate Dehydrogenase Complex (PDC)



Lipoic Acid

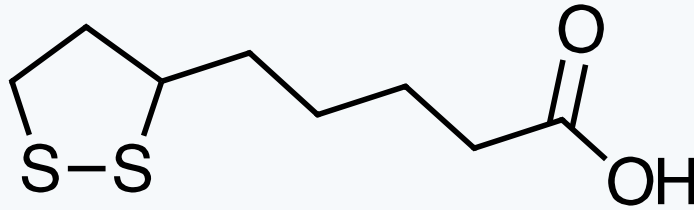


LIPOIC ACID



Resonance Stabilized
Carbanion

Lipoic Acid



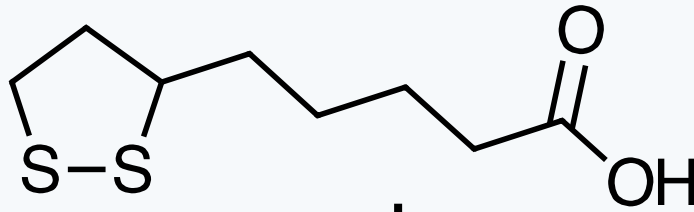
LIPOLIC ACID

Lipoic Acid

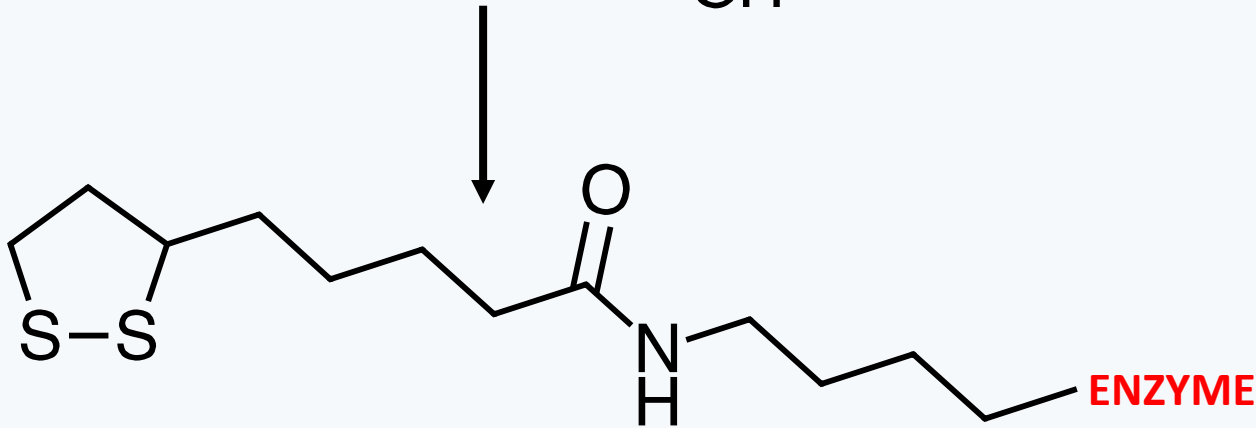


LIPOLIC ACID

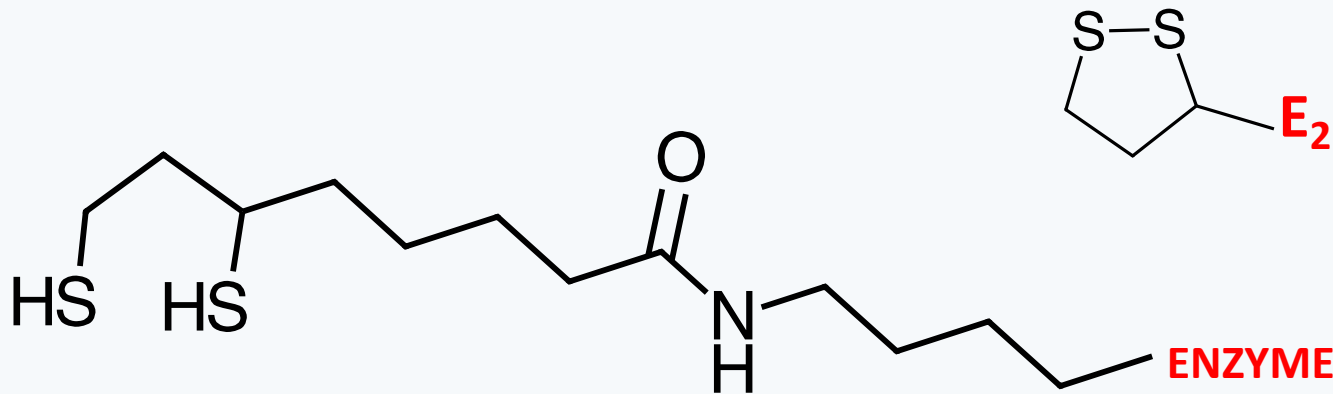
Lipoic Acid



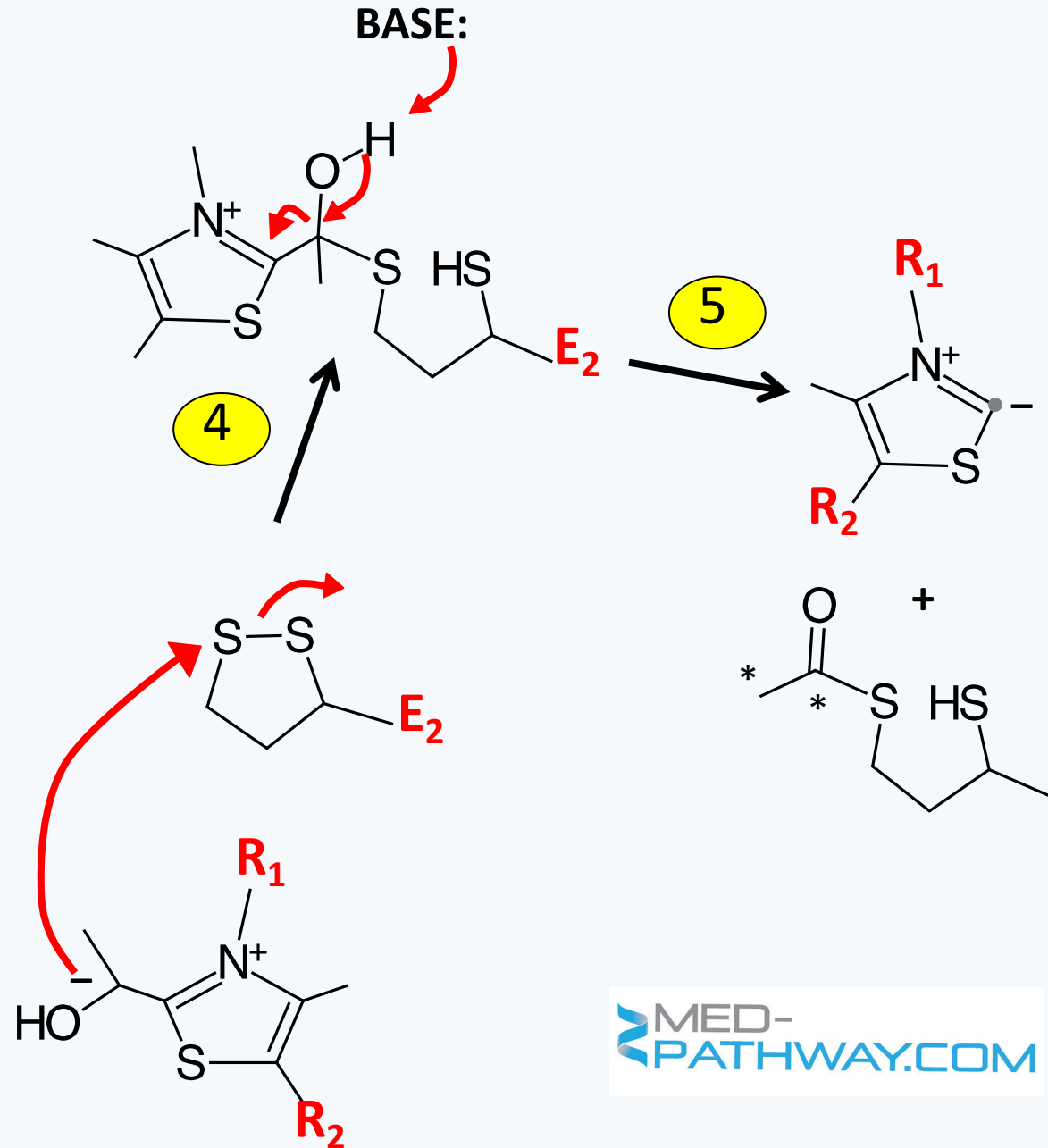
LIPOIC ACID



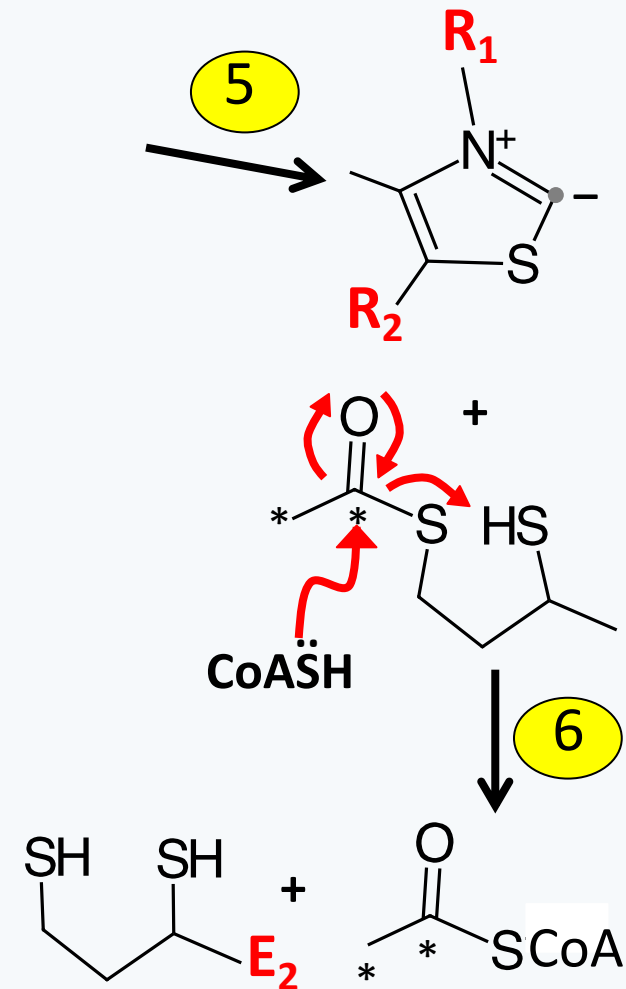
LIPOYLLYSINE



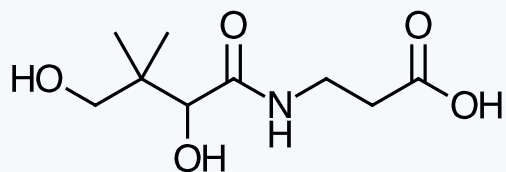
Pyruvate Dehydrogenase Complex



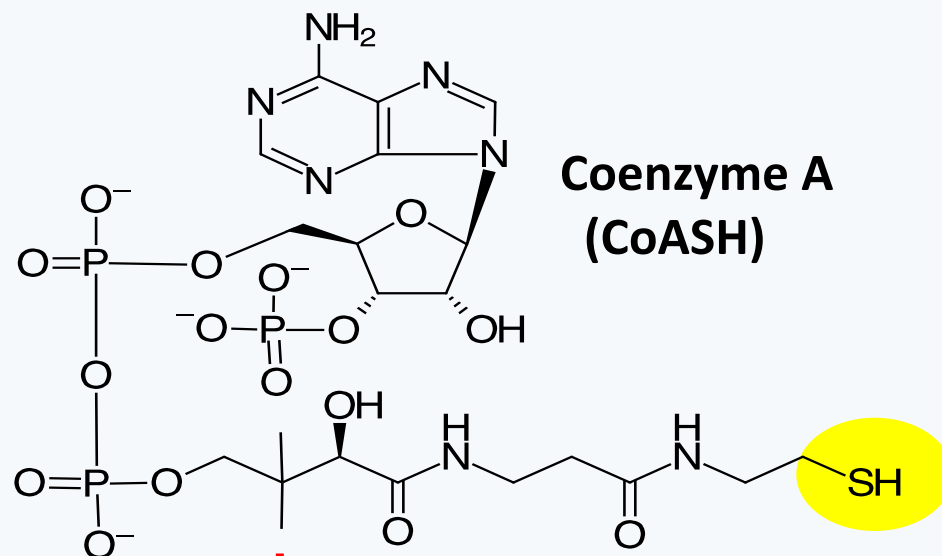
Pyruvate Dehydrogenase Complex



Pantothenic Acid

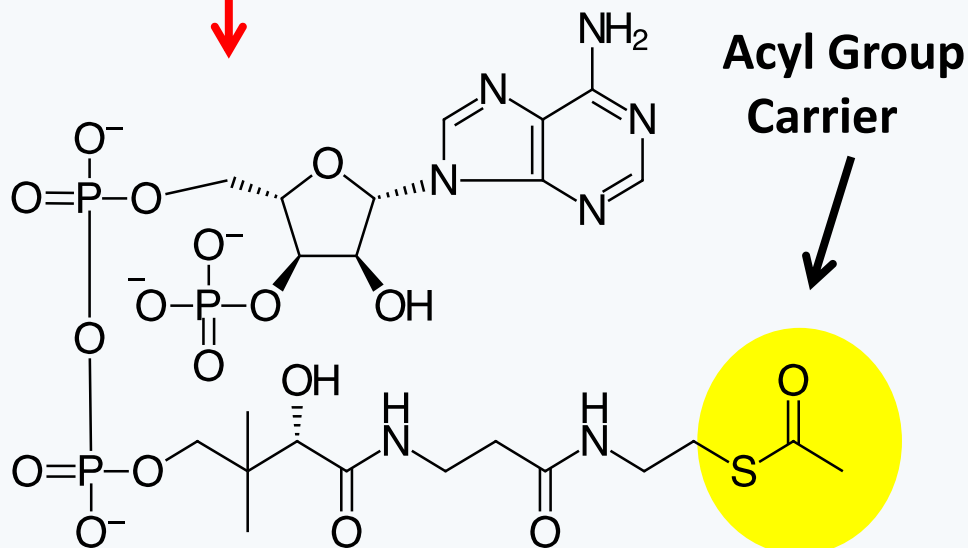


**Pantothenic
Acid
(Vitamin B5)**



**Coenzyme A
(CoASH)**

Acetylation

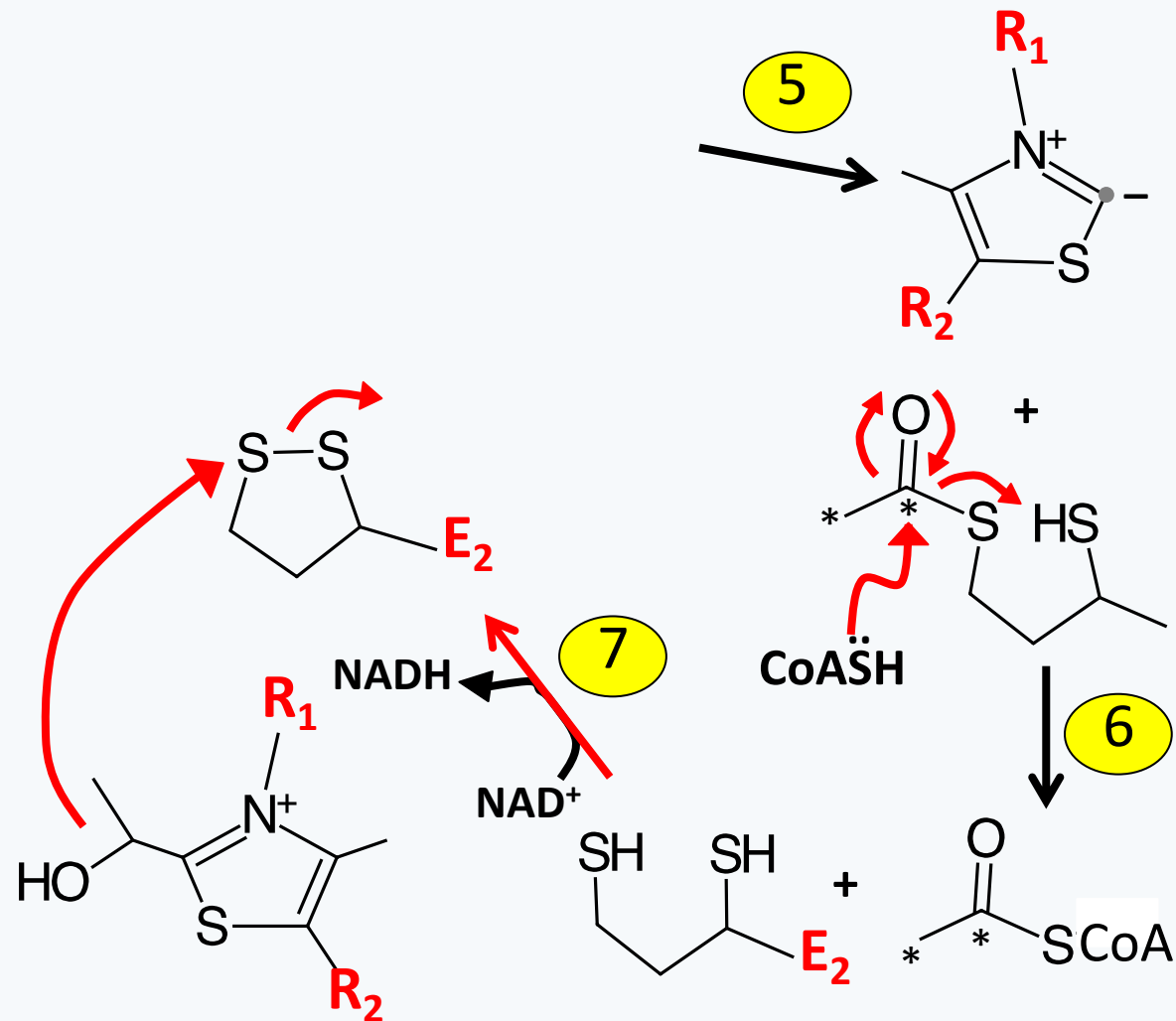


**Acyl Group
Carrier**



Acetyl CoA

Coenzyme A

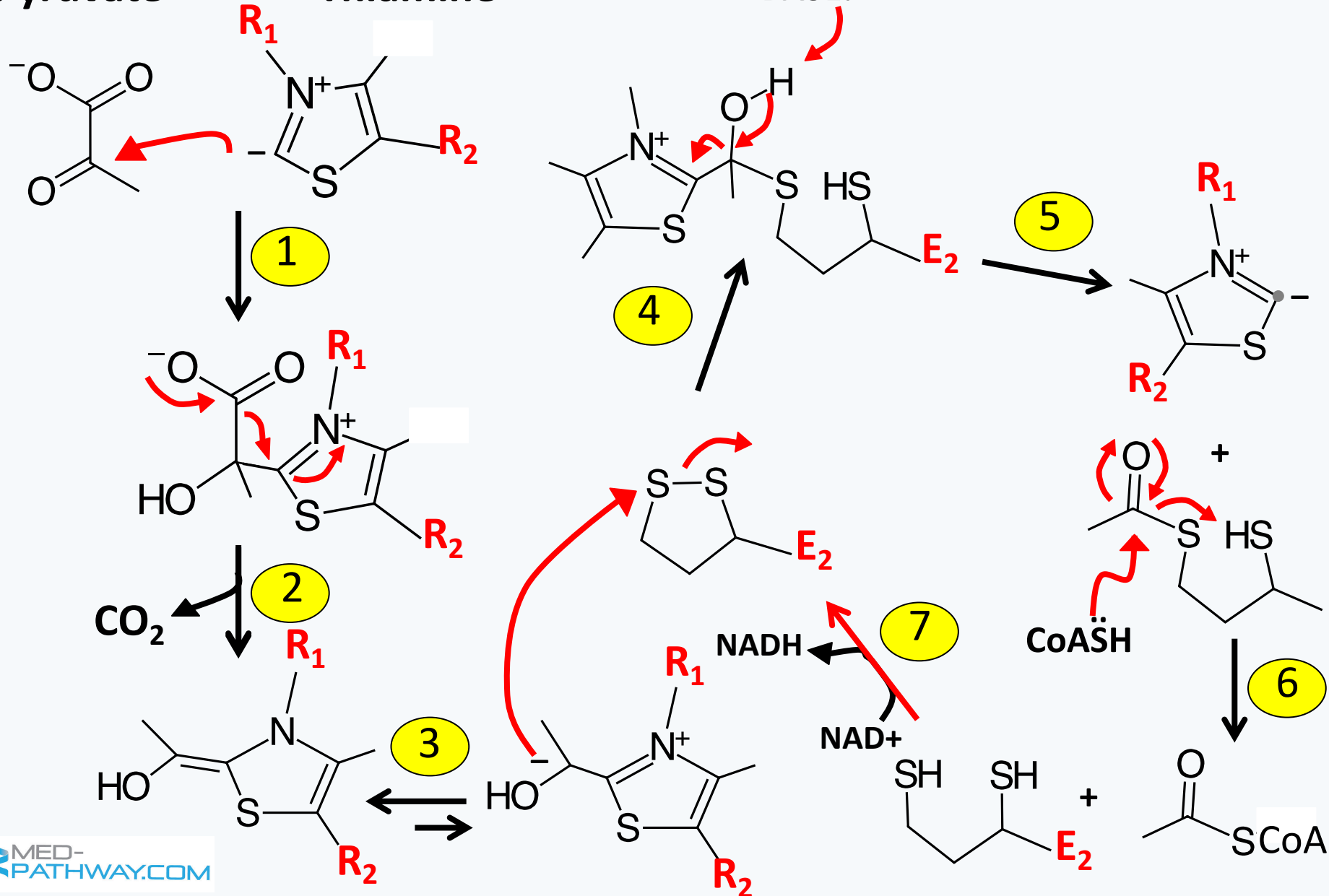


Pyruvate Dehydrogenase Complex

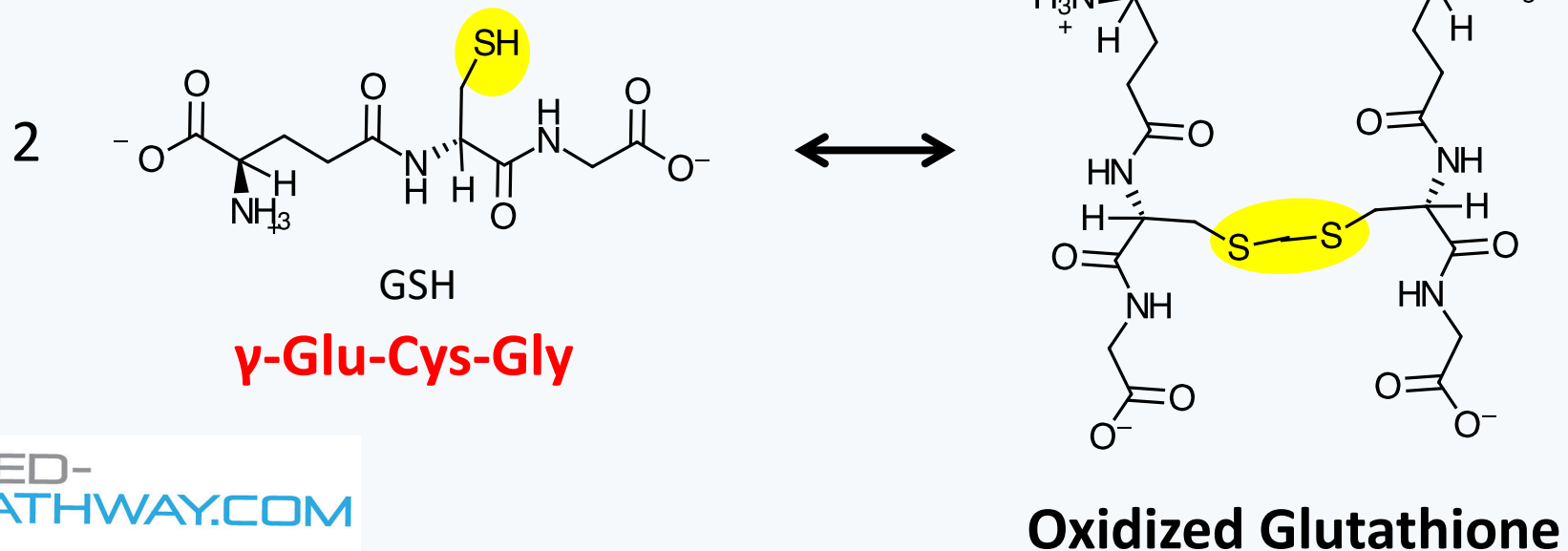
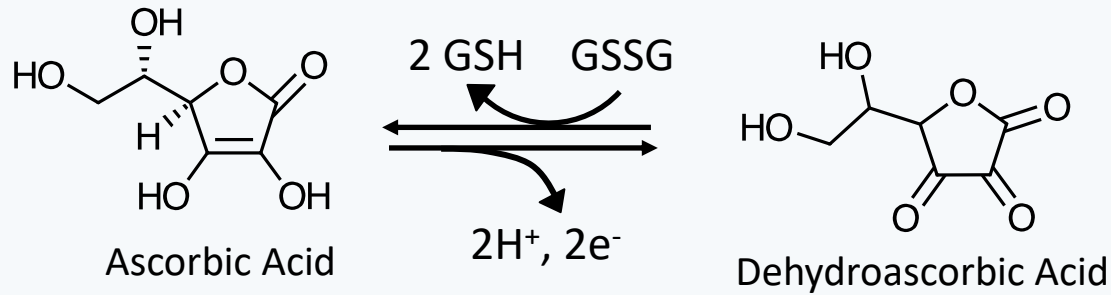
Pyruvate

Thiamine

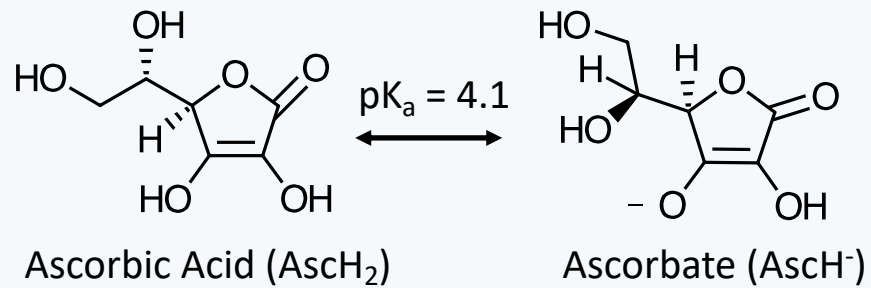
BASE:



Vitamin C

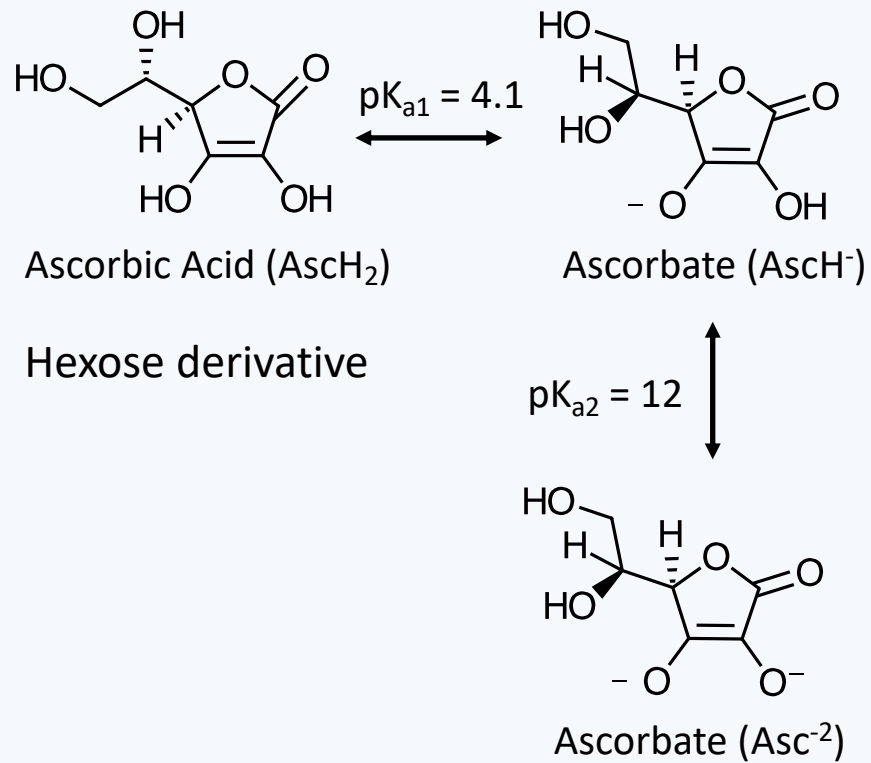


Vitamin C

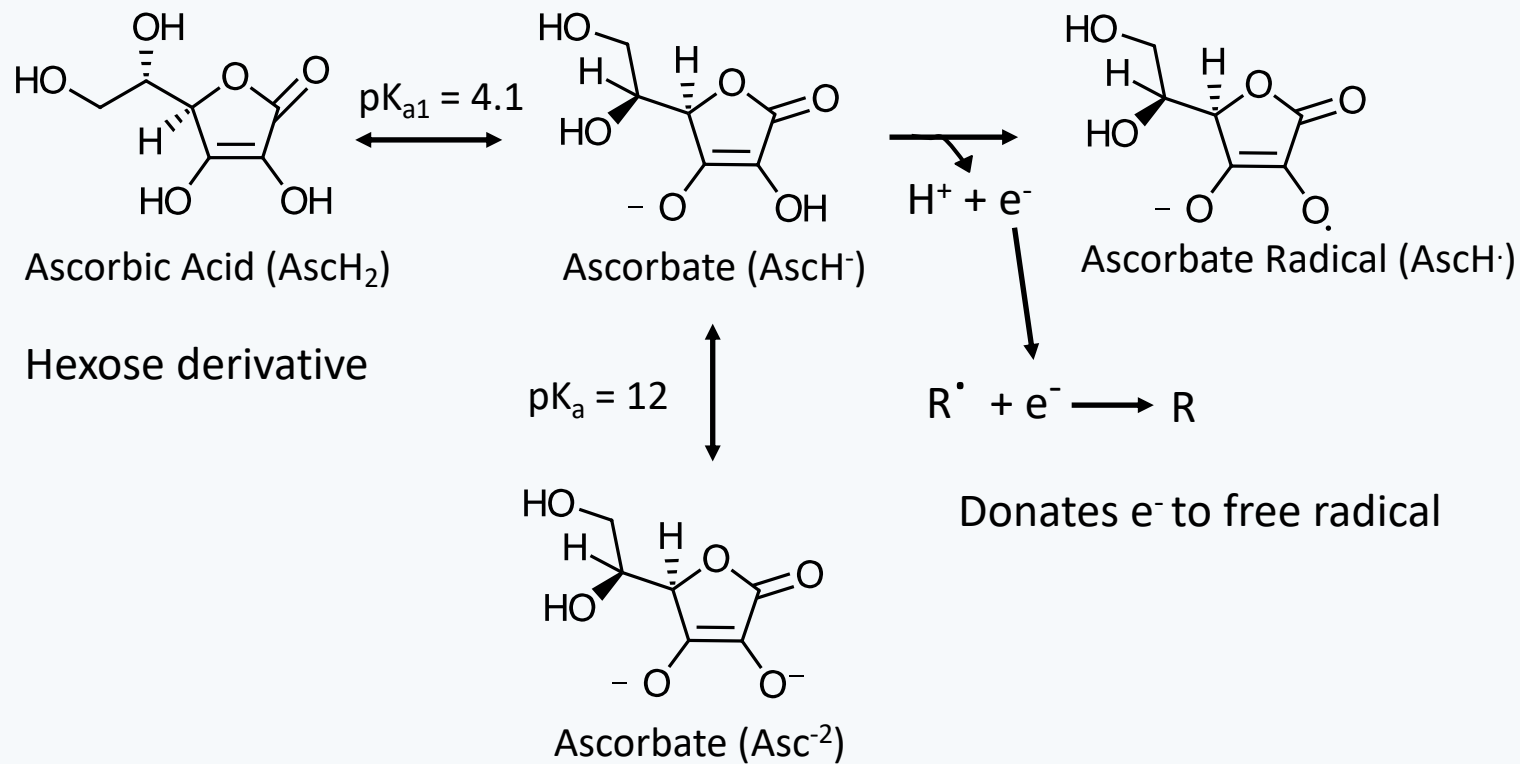


Hexose derivative

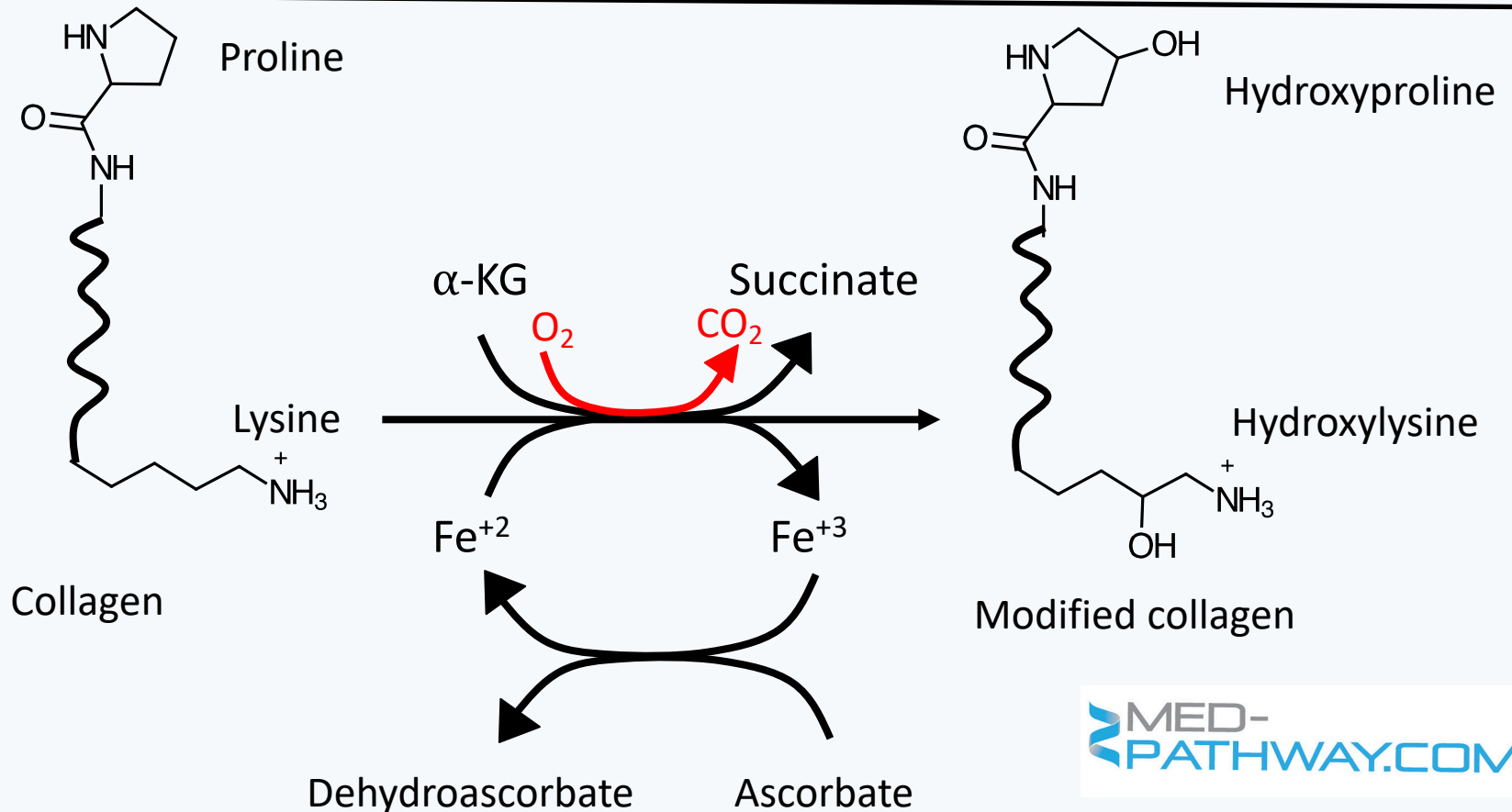
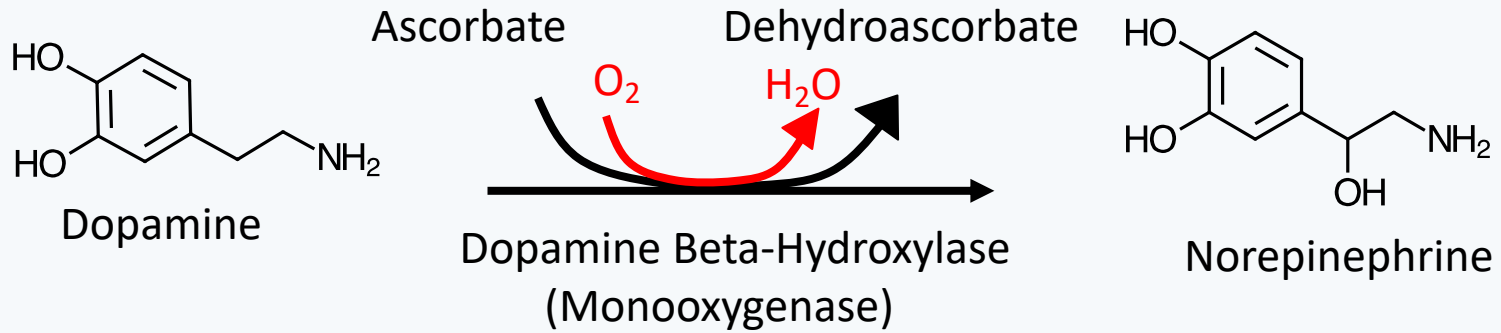
Vitamin C



Vitamin C



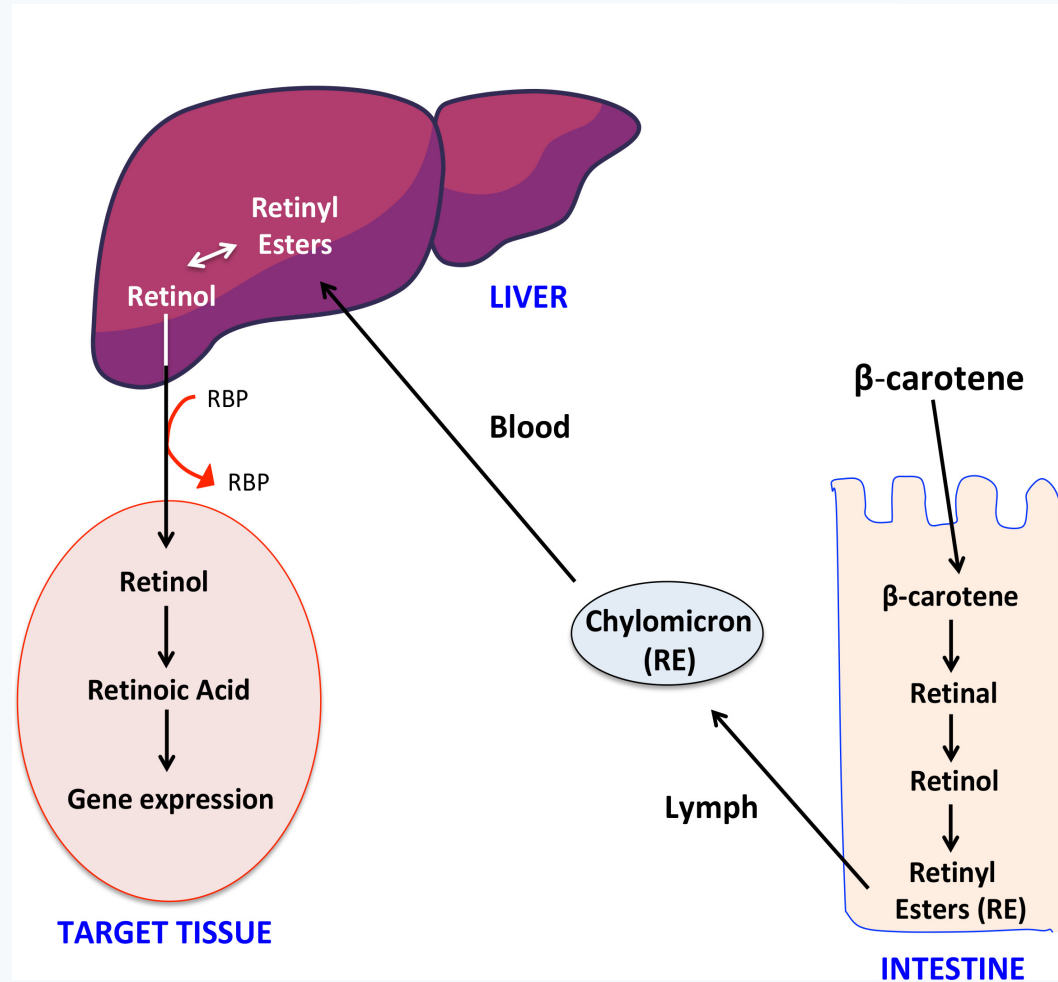
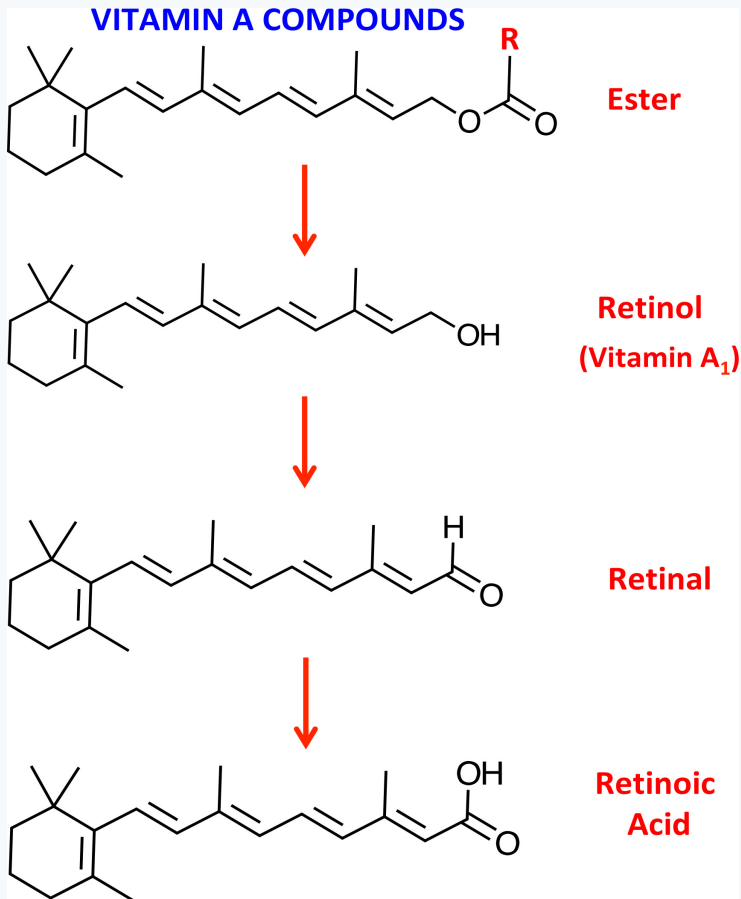
Vitamin C Reactions



Fat Soluble Vitamins

Vitamins A, K, E, D

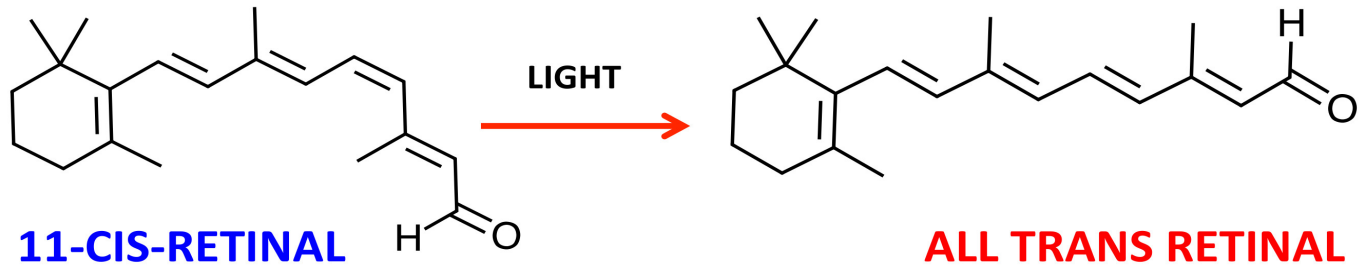
Vitamin A



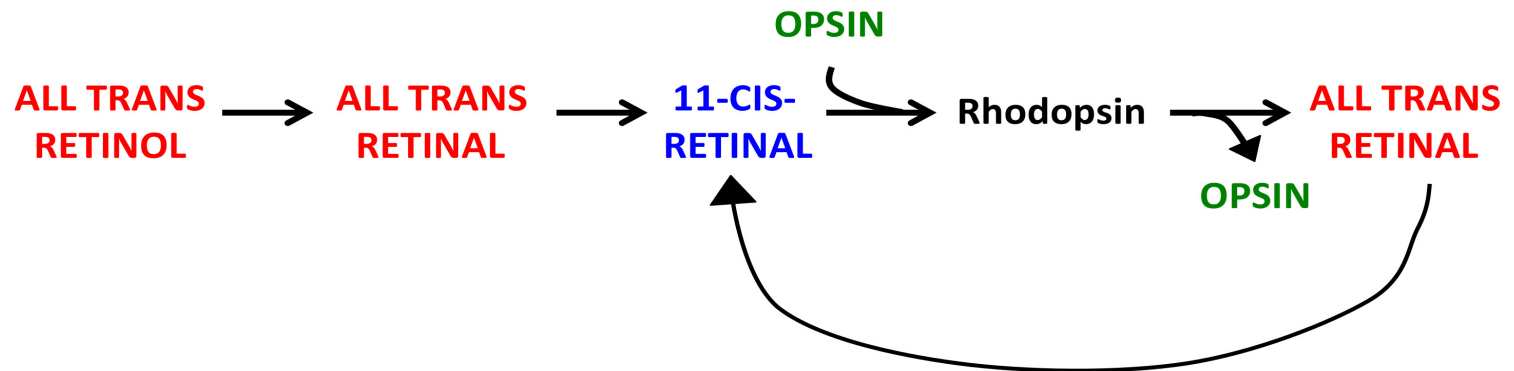
Vitamin A & Vision

THE VISUAL CYCLE

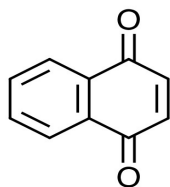
A



B

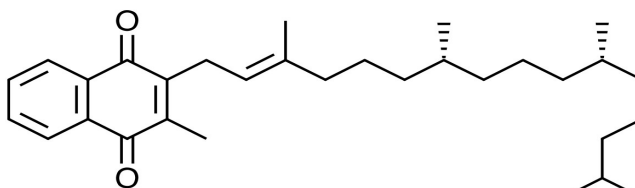


Vitamin K



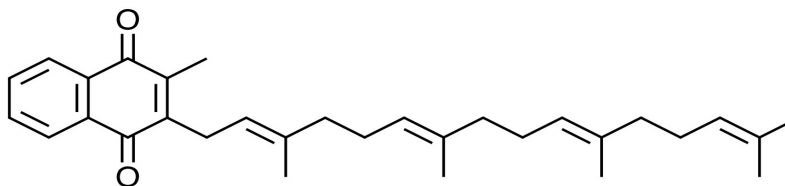
1, 4 Naphthoquinone

Vitamin K₁



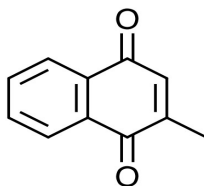
Phylloquinone

Vitamin K₂



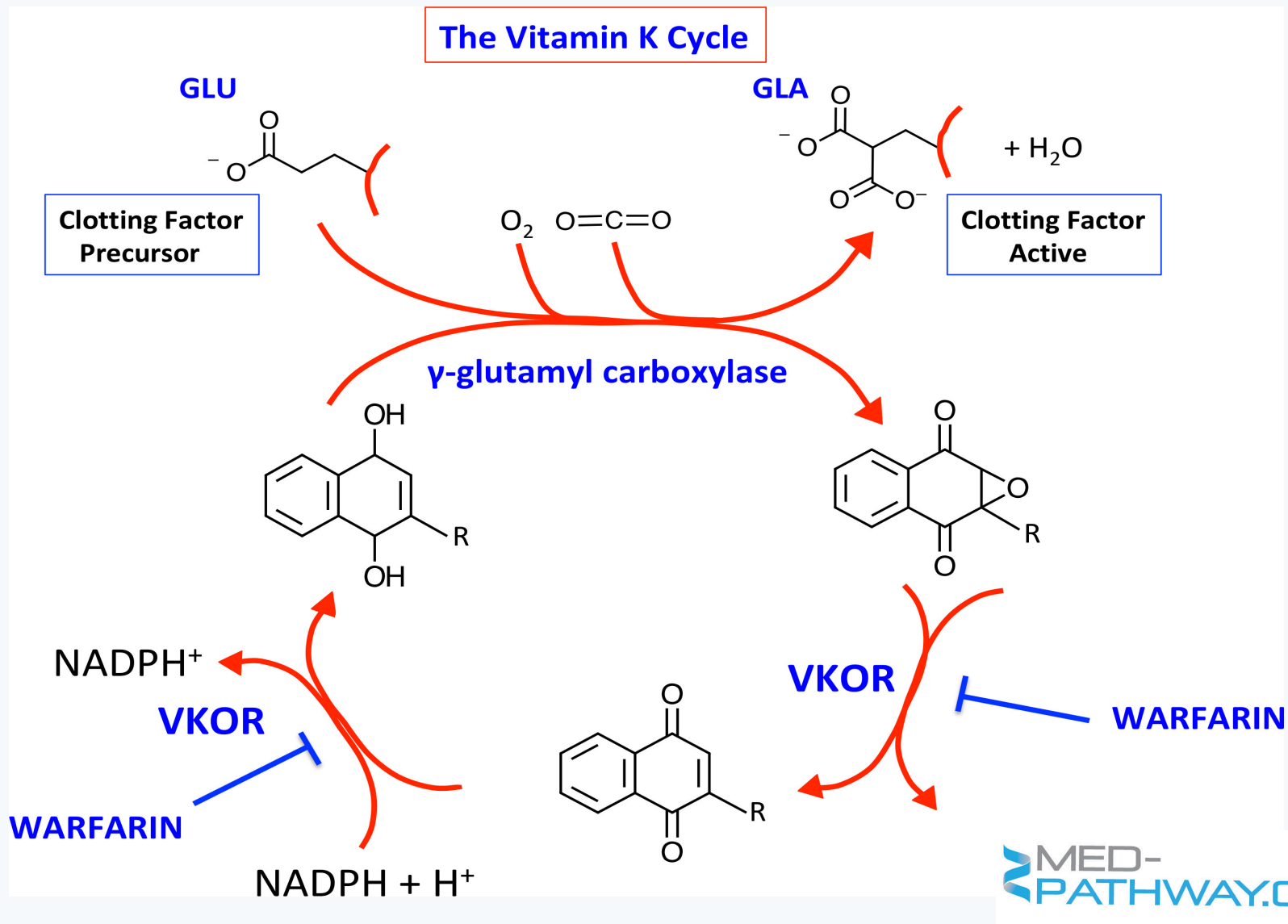
Menaquinone

Vitamin K₃

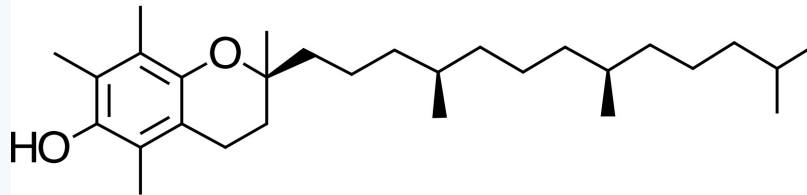


Menadinone

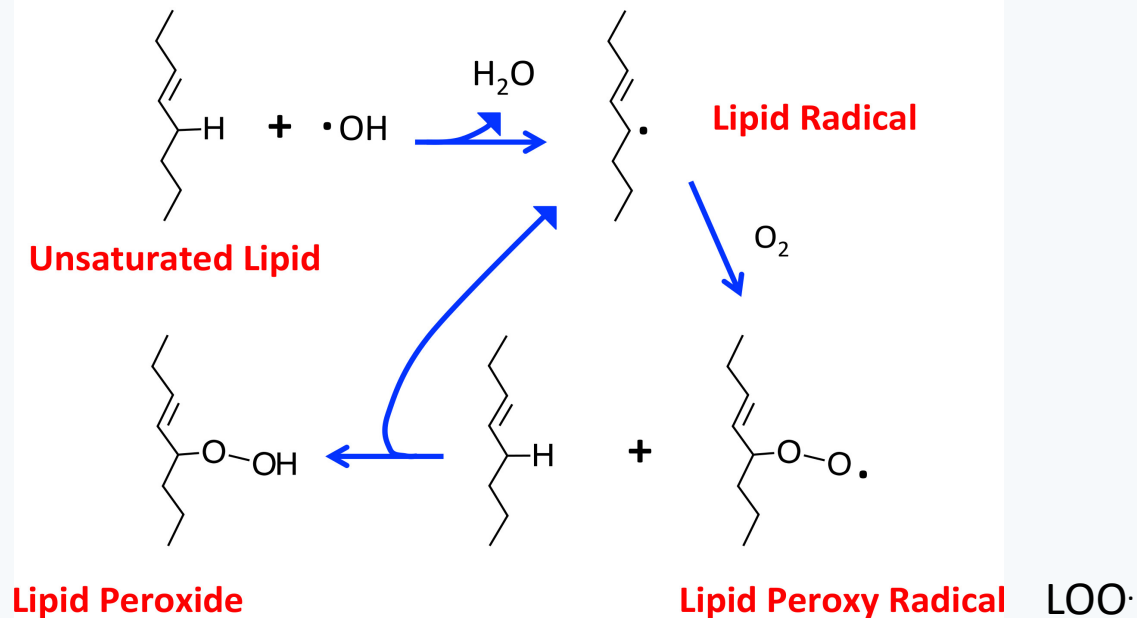
Vitamin K & Clotting



Vitamin E (Tocopherols)

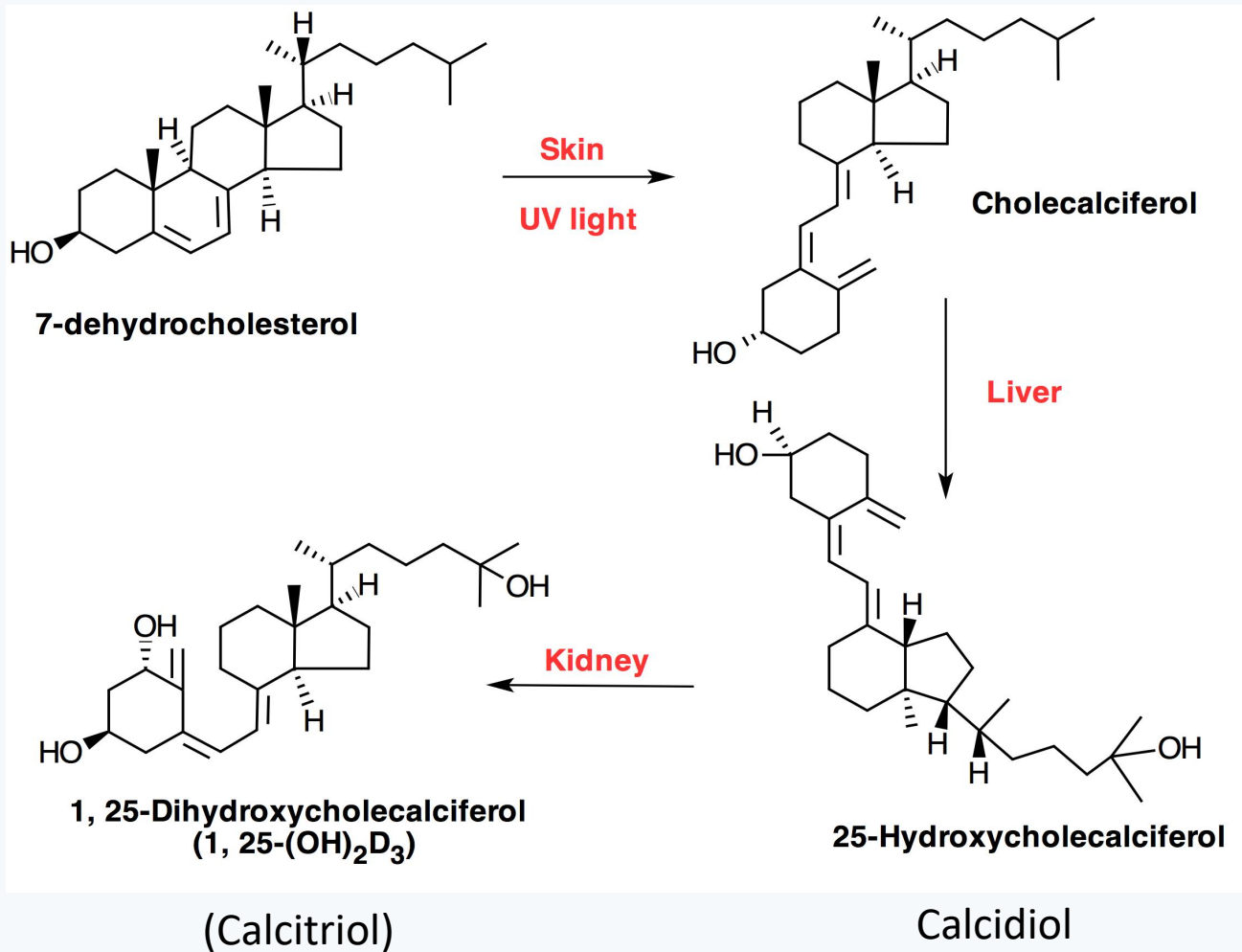


FORMATION OF LIPID PEROXIDES



Vitamin D

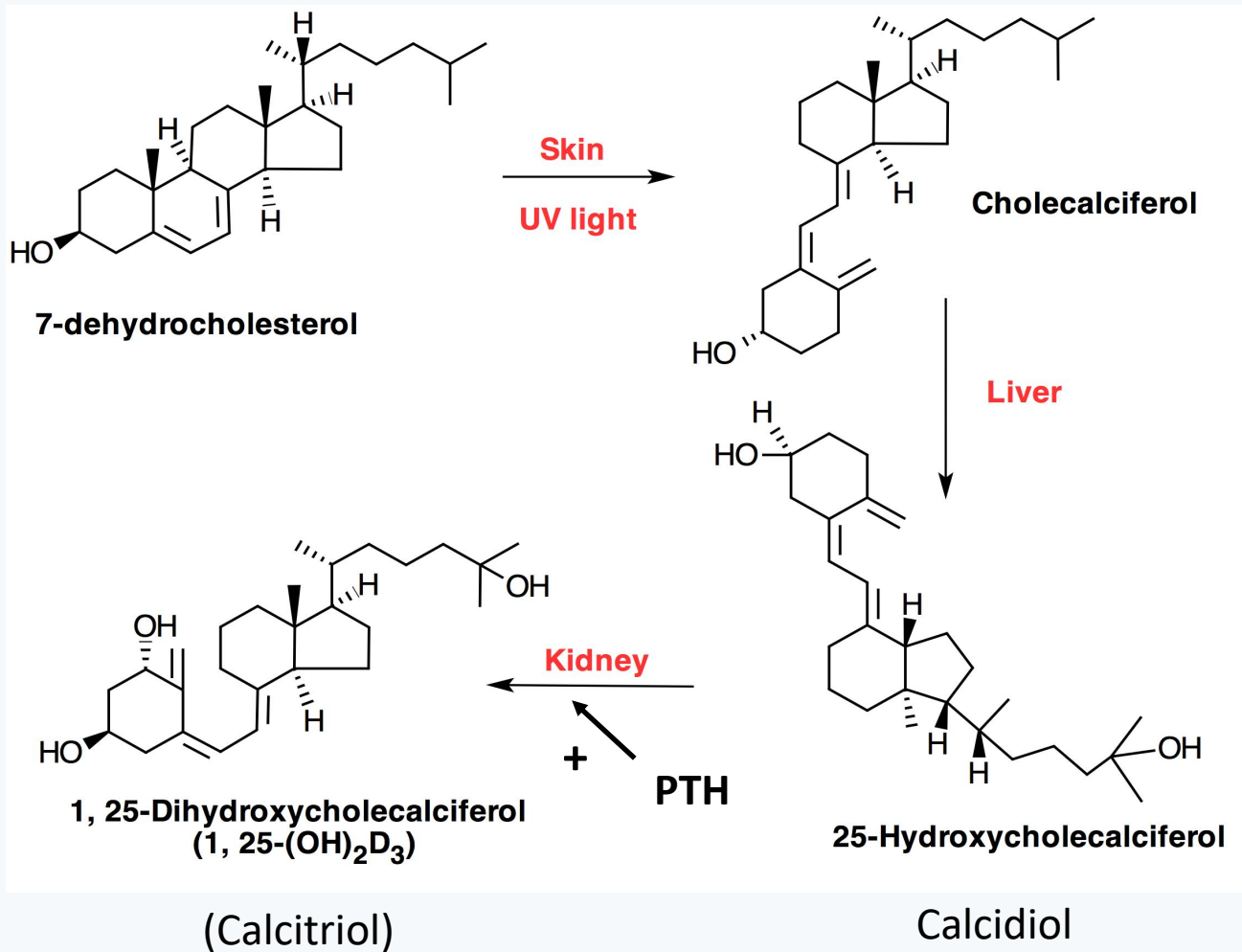
Stimulates uptake of Ca^{+2} , PO_4 in intestines



Vitamin D binds to the Vitamin DBP

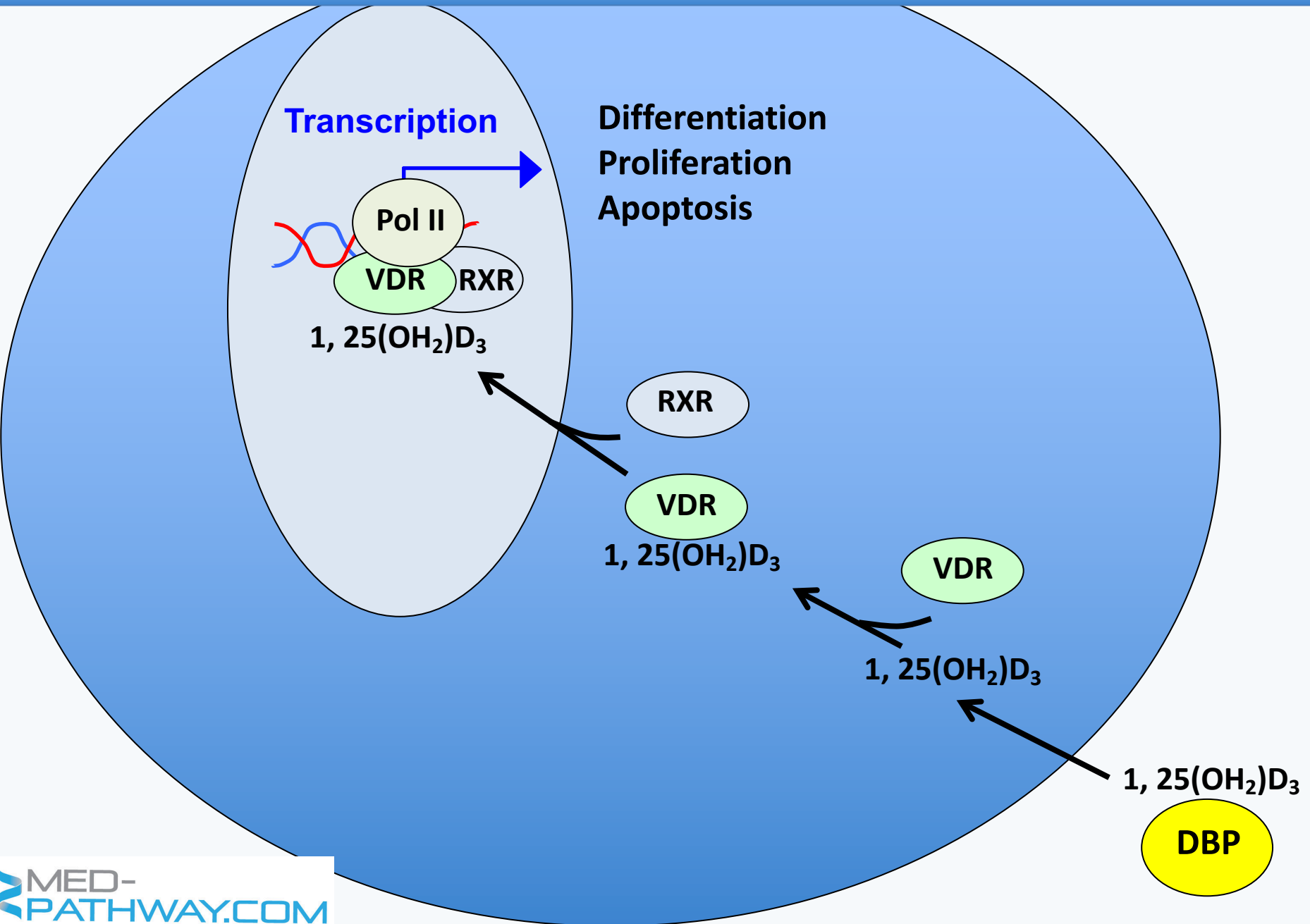
Vitamin D

Stimulates uptake of Ca^{+2} , PO_4 in intestines



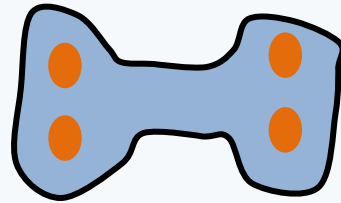
Vitamin D binds to the Vitamin DBP

Vitamin D



Parathyroid Hormone

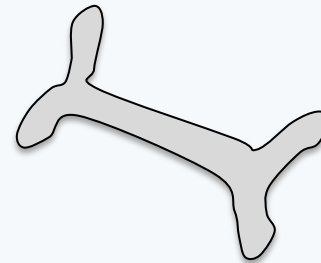
4 Parathyroids



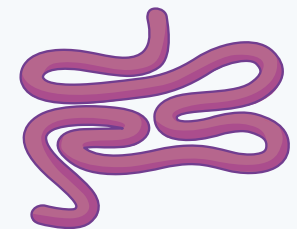
Low serum
 Ca^{+2}

↑ PTH

Osteoclasts



Ca^{+2} and PO_4^{-3}
released from bone



Intestines:
absorbs Ca^{+2}
and PO_4^{-3}



Kidneys



Liver

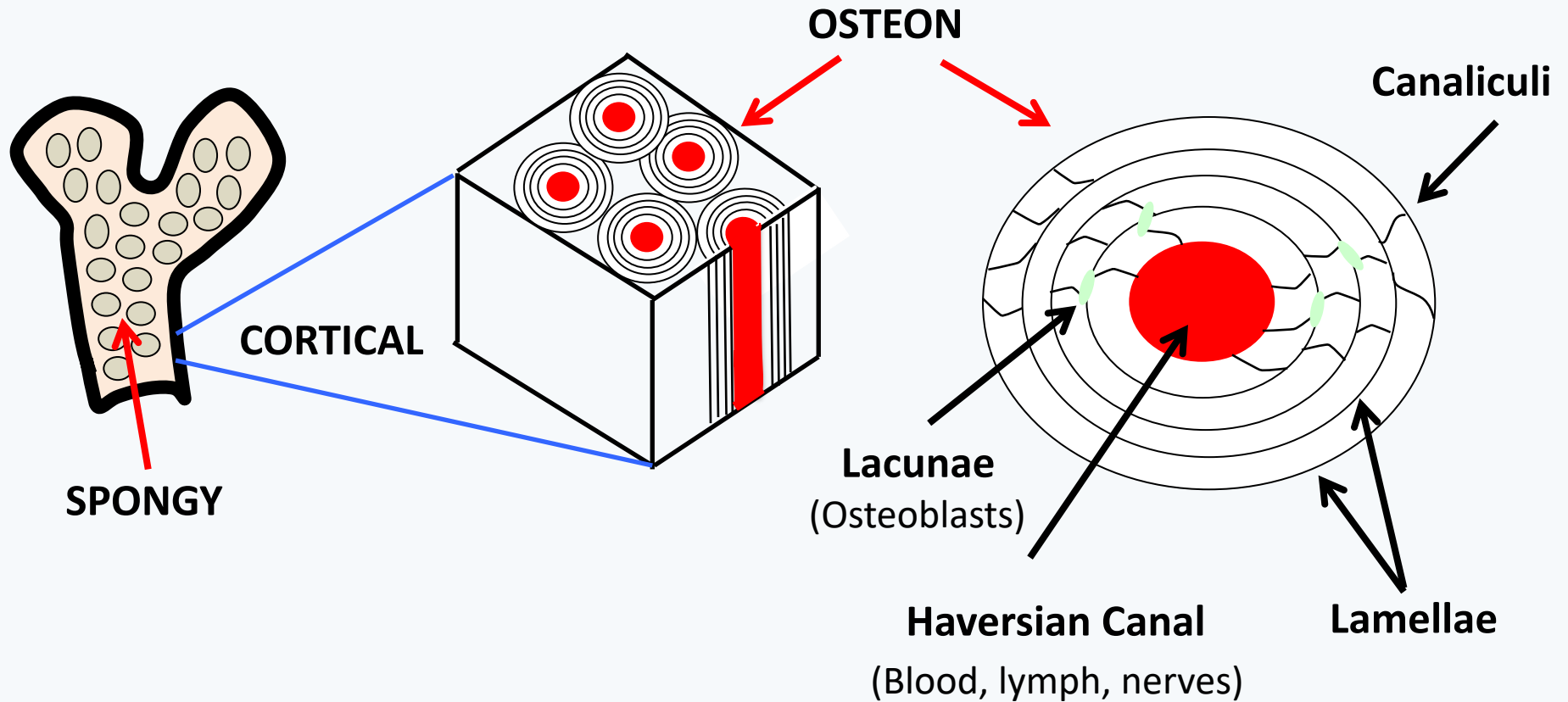
$25(\text{OH})\text{D}_3$

$1, 25(\text{OH})_2\text{D}_3$

$1, 25(\text{OH})_2\text{D}_3$

↓ Urine Ca^{+2}
↑ Urine PO_4^{-3}

Bone Structure



Workshop Passages

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Last name *

Your email address *

Your password *

Confirm your password *

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