營養學 Nutrition

~ Pantothenic Acid ~

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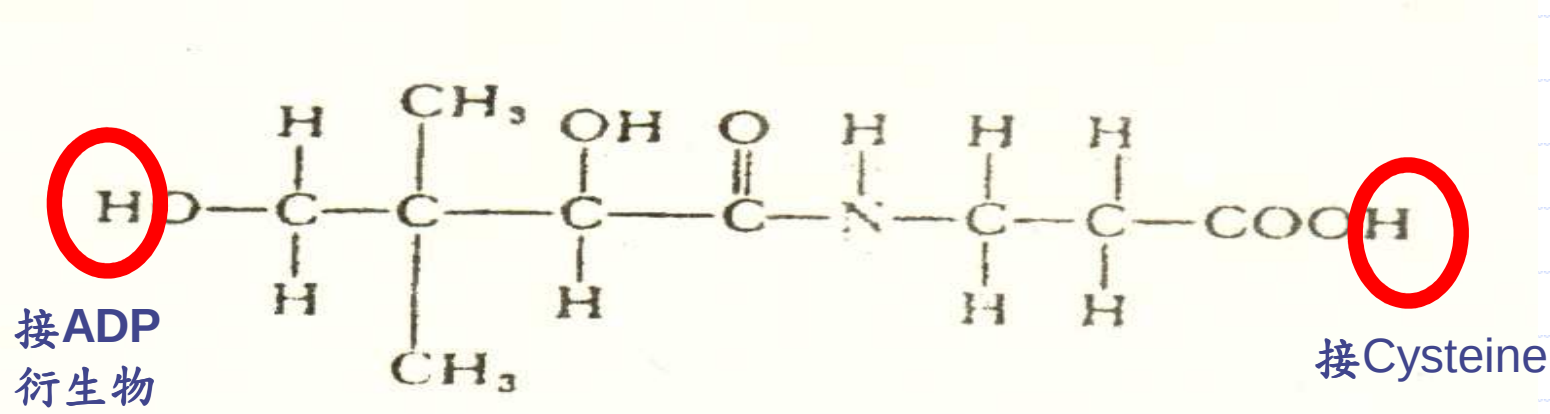
Outline

- Classification
- Function
- Digestion, absorption and metabolism
- Assessment
- Deficiency syndrome

Pantothenic Acid

- Vit B_5
- Vit B_3

  Greek "Pantothen"= 1 **everywhere**.



1931 Ringrose

chick →pellagra-like[2] dermatitis .

1933 Williams “yeast growth factor”

1938 Williams isolation

1940 structure and synthesis

1946 Lipmann

role of [3] CoA .

§Chemistry and Characteristics

1. optically active
2. pale yellow viscous oil (unstable)
3. commercially Na or Ca salt (stable)
4. stable to acid and alkaline solutions
5. alcohol form (panthenol) is more easily absorbed

§Physiology

absorption by diffusion

↓

(alc. Form → PA)

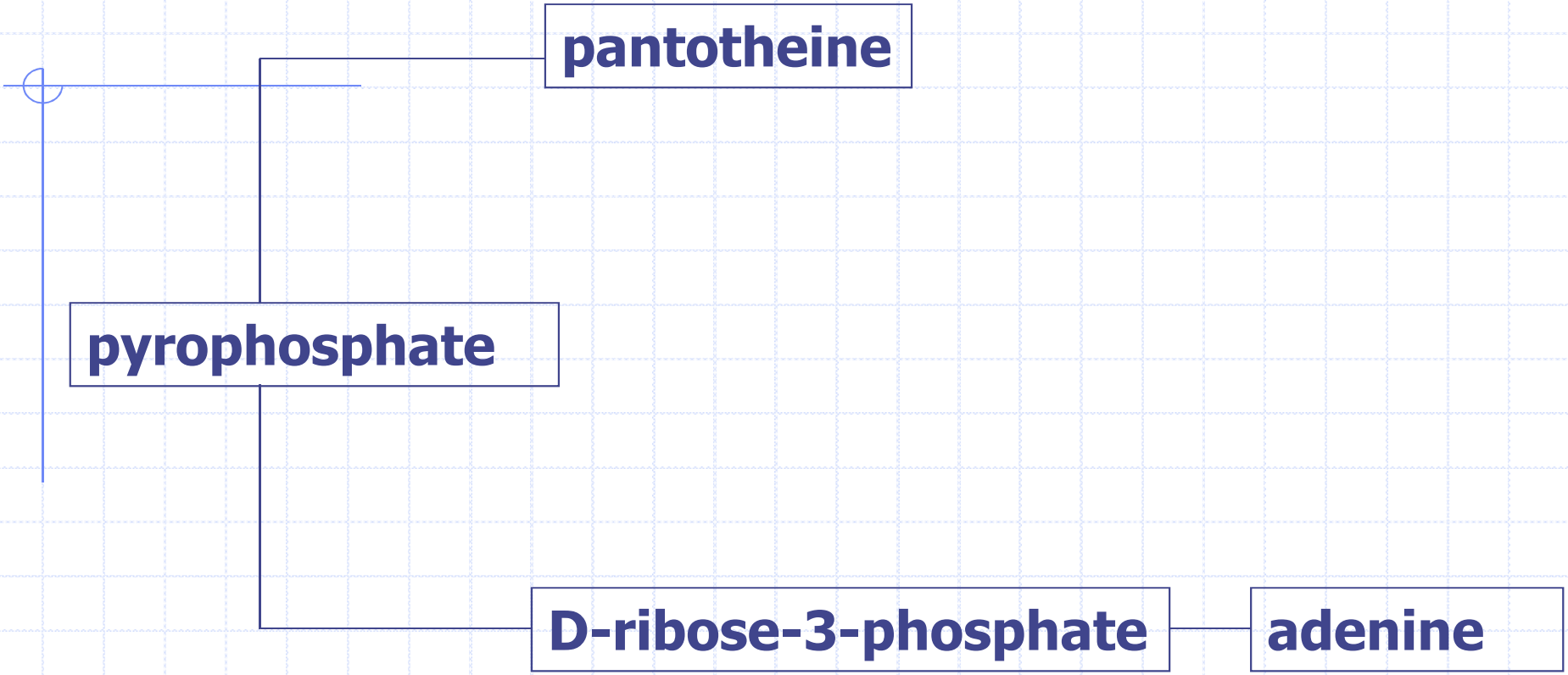
↓

tissue

↓

[4]Coenzyme A .

Coenzyme A (CoA-SH, CoA)



此種輔酶是由pantothenic acid和ADP的衍生物，以及cysteine結合在一起而形成的。Cysteine提供硫原子，成為輔酶的功能部位。即Pantothenic acid與Cysteine一部份結合，再加上ADP的衍生物形成Coenzyme A 。

Antagonists:

- **Microorganism:**

Salicylic acid

Mandelic acid

- **Animals:**

Omega-methyl pantothenic acid

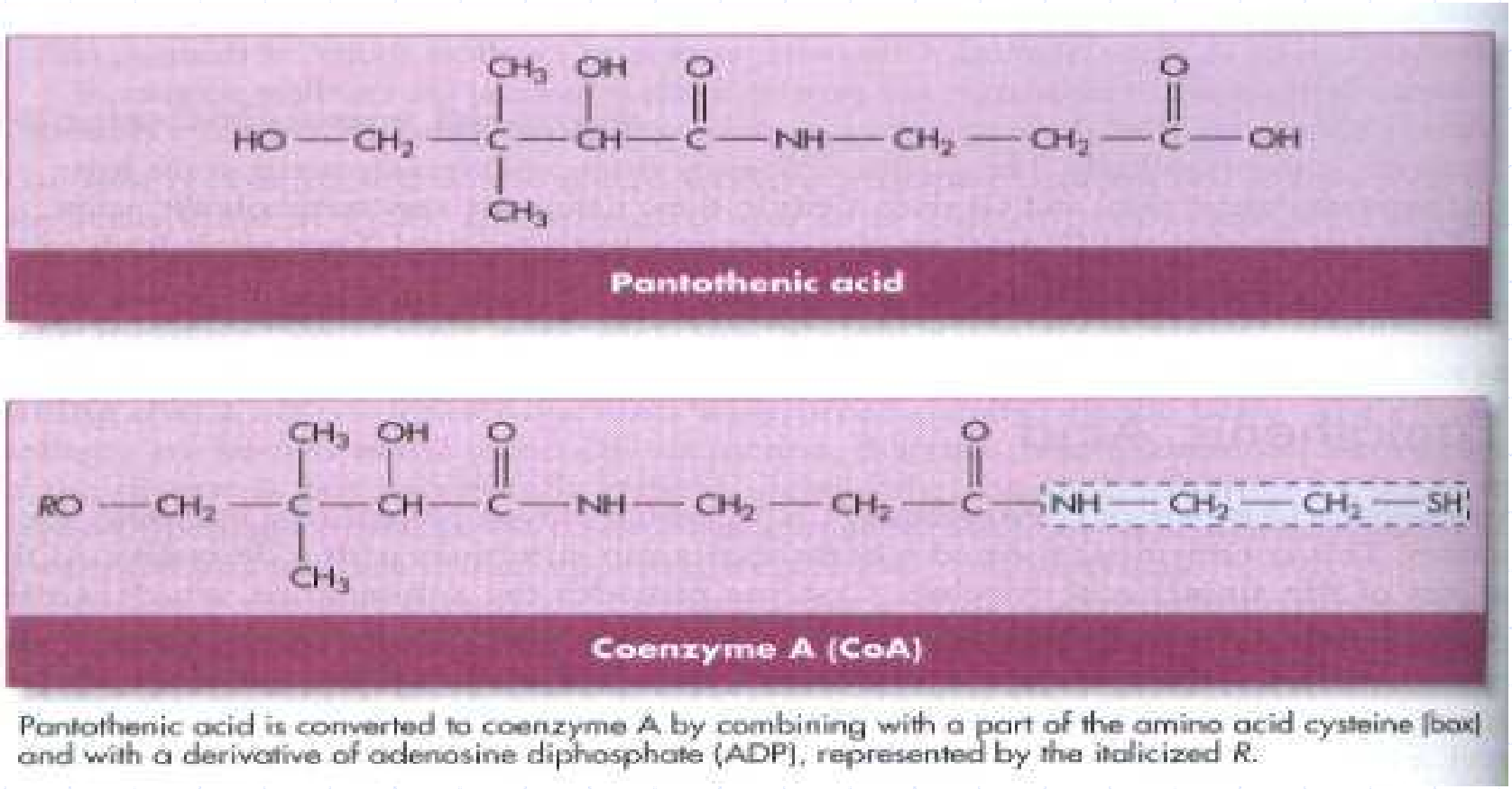
Pantoyltaurine

6-mercaptopurine

thiol

§Functions

- **As component of coenzyme A (CoA)**



Pantothenic acid is converted to coenzyme A by combining with a part of the amino acid cysteine (box) and with a derivative of adenosine diphosphate (ADP), represented by the italicized *R*.

§Functions

- As a prosthetic group on the [5] acyl carrier protein and [6] Guanosine-5-triphosphate(GTP)-dependent acyl CoA synthetase.

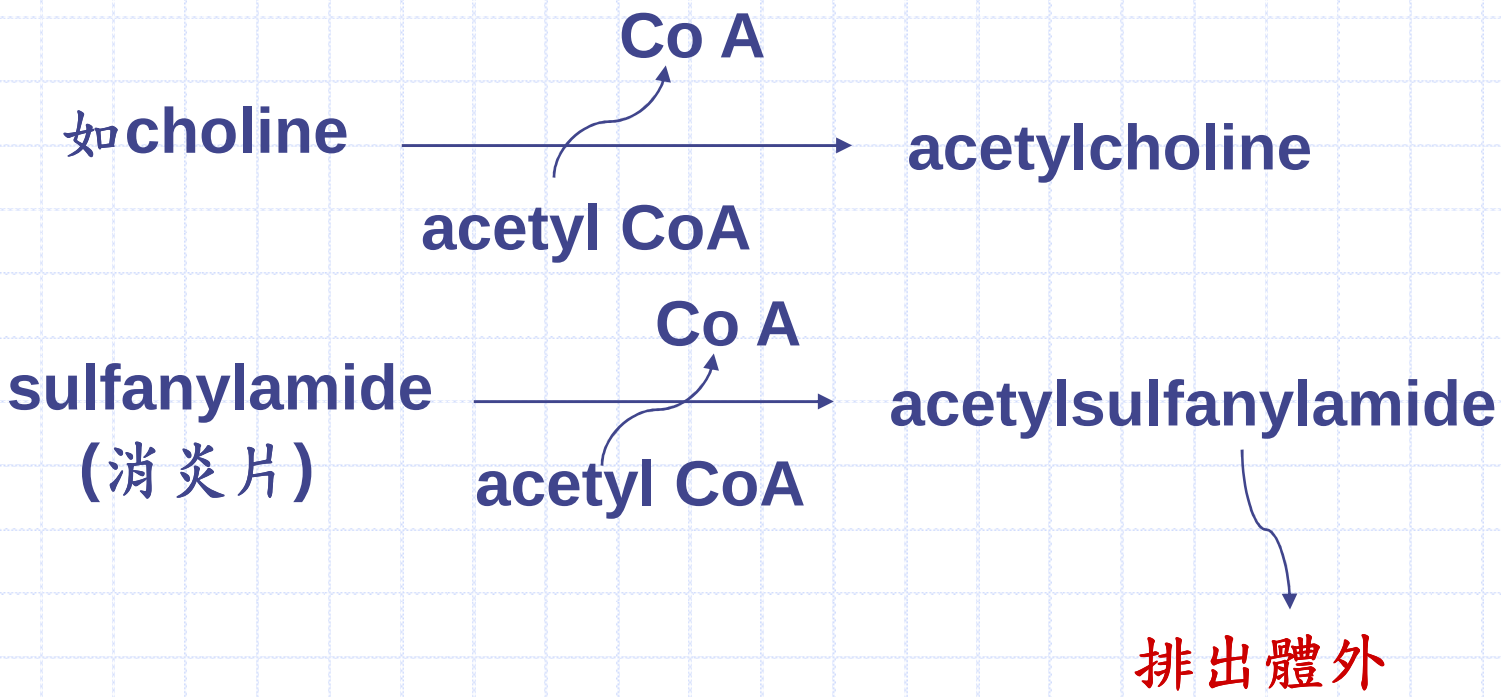
Acyl carrier protein與fatty acid結合，
在代謝途徑中來回載運它們以增加他的碳鏈。

1. Pantothenic acid 變成 Coenzyme A 後與等反應，可合成為 **Actyl CoA** . 其具有以下之功能:

1). Acetyl CoA可形成citric acid的重要因素:

acetyl CoA可將oxaloacetic acid變成citric acid,然後進行citric acid cycle.此循環專司脂肪,醣類及部分胺基酸之代謝作用.故acetyl CoA對脂肪及醣類之代謝極為重要.

2).Acetylation



3).脂肪酸的合成與分解作用

脂肪酸的合成:

1.以acetyl CoA為基礎在以2個C為單位,慢慢加長.而成為身體所需的fatty acid.

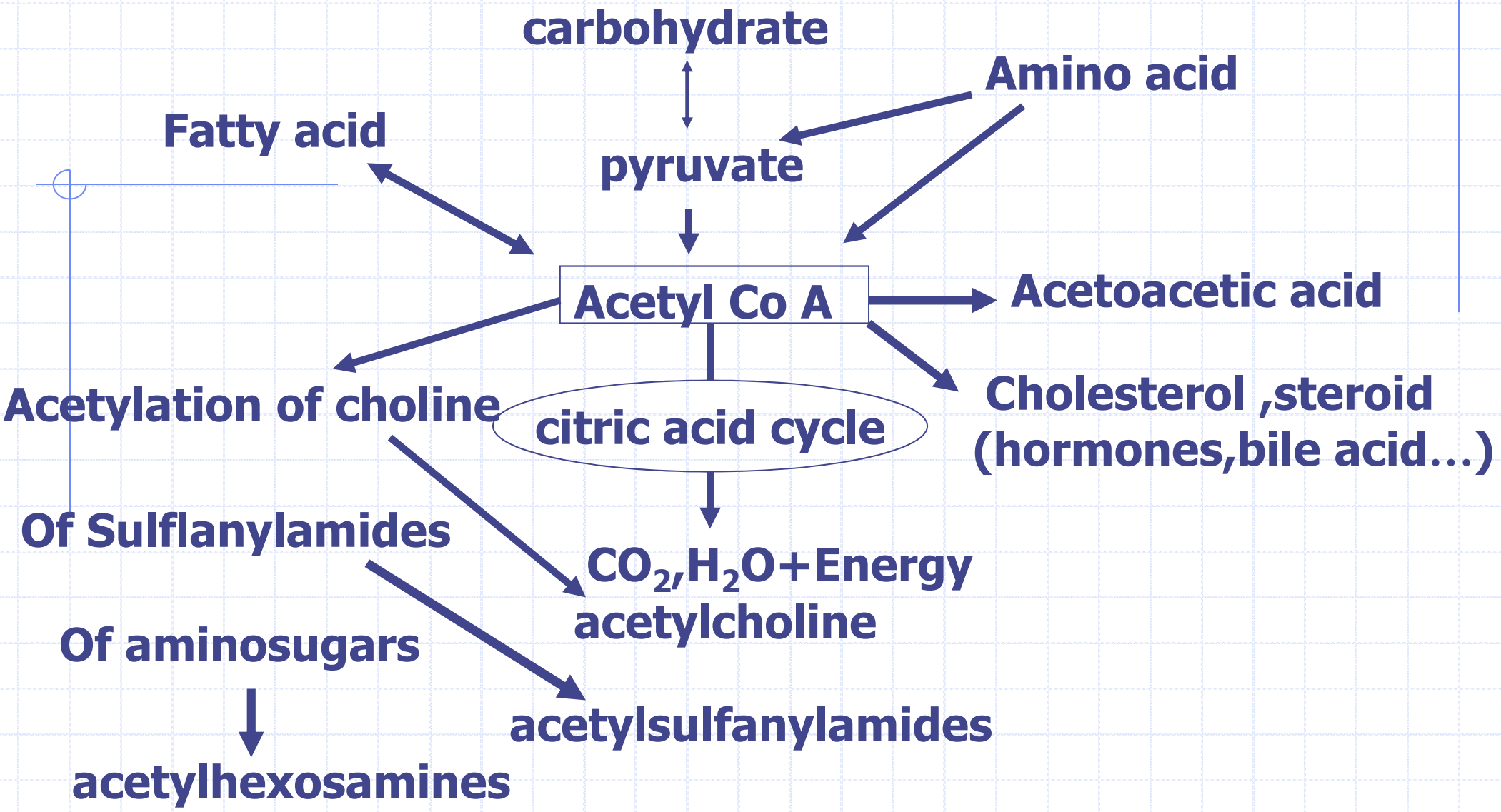
2.以身體原有的短鏈脂肪酸:再以兩個碳為單位,逐漸加長而成.

脂肪酸的分解:

在ATP存在下,與co A~SH結合.一次以兩個碳為單位,逐漸切去(β-oxidation),形成n/2個acetyl CoA(n為fatty acid之碳數),每個acetyl CoA進入citric acid cycle,代謝產生能量.

4).Cholesterol synthesis

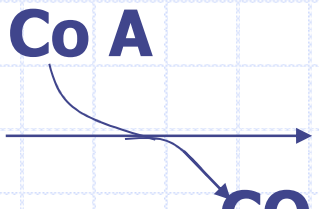
人體肝臟可合成cholesterol，其係由18個acetyl CoA代謝而成，而Cholesterol則為合成Bile acid 及各種Steroid hormone的先質。



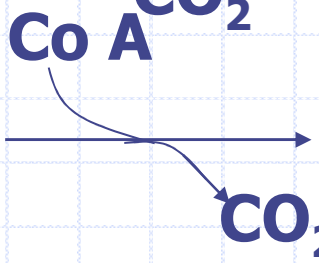
Acetylation reaction

2.其他類CoA 催化之生化反應

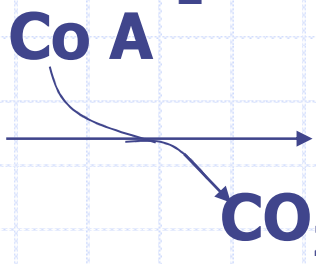
如:

1). α – KG 

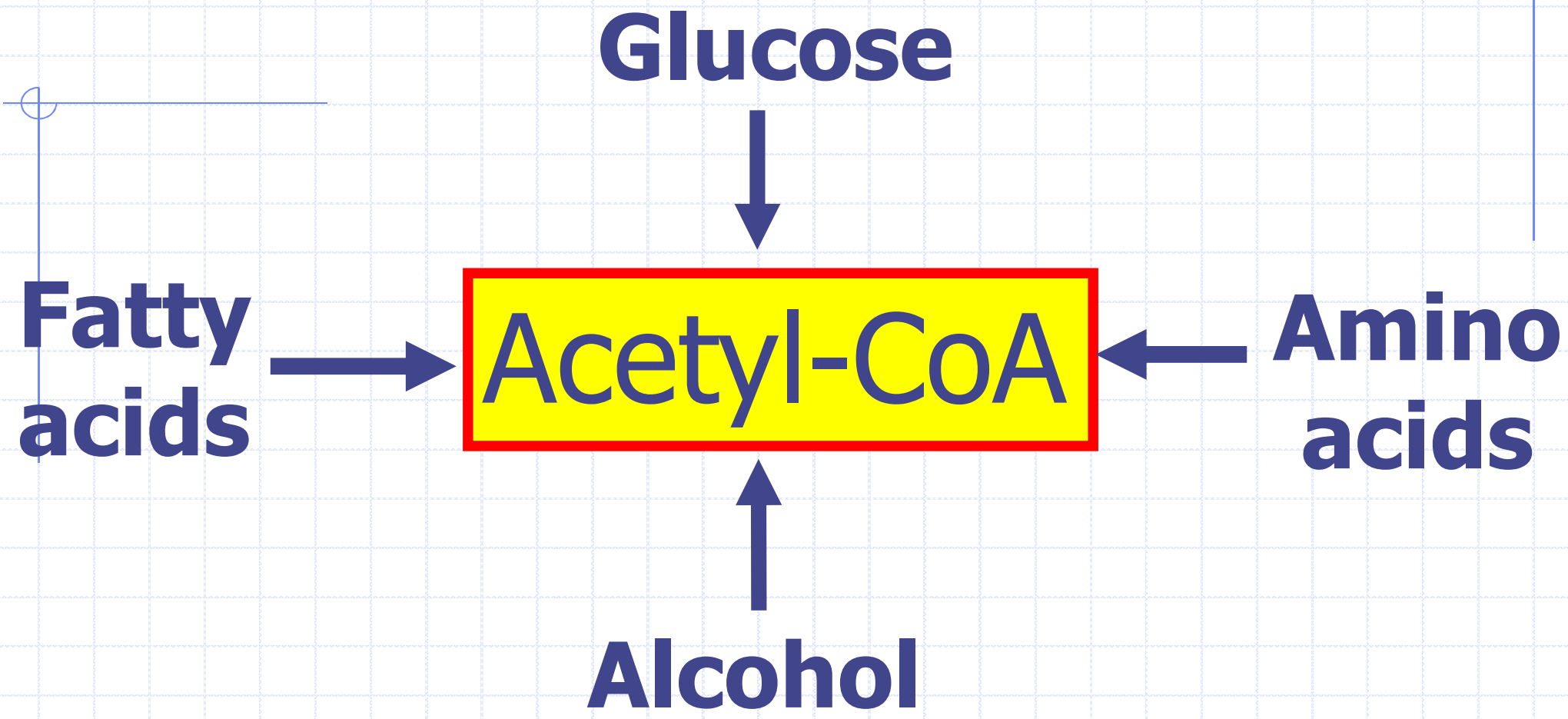
succinyl Co A

2). Acetyl coA 

HMG Co A

3). Propionyl Co A 

methymalonyl Co A


Glucose
Fatty acids
Acetyl-CoA
Amino acids
Alcohol

Selected Biochemical Rex catalyzed by CoA

Enzymes	PA derivatives	Reactant(s)	Product(s)	Site
Pyr DHase	CoA	Pyr	Acetyl CoA	mitochondria
α—KG DHase	CoA	α—KG	11 succinate	mitochondria
FA oxidase	CoA	16:0	12 Acetyl CoA	mitochondria
FA synthetase	acyl carrier protein	Acetyl CoA Malonyl CoA	13 16:0	microsome
HMG CoA synthetase	CoA	14 Acetyl CoA 15 Acetoaceyl CoA	HMG CoA	microsome
Propionyl CoA carboxylase	CoA	propionyl CoA CO_2	16 Methylmalonyl CoA	microsome
Acetyl CoA synthetase	phospho-pantetheine	succinyl CoA GDP + Pi	17 succinate 18 GTP +CoA	mitochondria

§ Effects of Deficiency

- **Animal:** slow growth, skin lesions, ulceration of intestine, weakness, gray fur, death,

§ Effects of deficiency

人體試驗

給予**antagonist**（如**omega-methyl pantothenic acid**）
配合**deficient diet**

症狀:

- **loss of appetite**
- **indigestion**
- **abdominal pain**
- **sullenness**
- **mental depression**
- **peripheral neuritis**
- **headache**

- 症狀:
- **burning sensation in the feet**
- **insomnia**
- **respiratory infection**
- **increased sedimentation rate for erythocytes**
- **marked decrease in antibody formation**
- **heart-tachycardia**
- **staggering gait**
- **orthostatic hypotension**

§ Clinical uses

其alcohol form 用以治療

- Burning feet syndrome
- Bed sores
- Varicose ulcers
- Paralytic ileus
- Speeds healing in radiation and allergies
- Prolong life?

§RDNA

No RDNA

4-7 mg (Adequate intake)

NO UL

泛酸不具毒性，因此沒有上限攝取量

		AI
營養素		泛酸
單位		毫克
年齡		(mg)
0 月~		1.8
3 月~		1.8
6 月~		1.9
9 月~		2.0
1 歲~		2.0
(稍低)		
(適度)		
4 歲~		2.5
(稍低)		
(適度)		
7 歲~		3.0
(稍低)		
(適度)		
10 歲~		4.0
(稍低)		
(適度)		
13 歲~		4.5
(稍低)		
(適度)		
16 歲~		5.0
(低)		
(稍低)		
(適度)		
(高)		
19 歲~		5.0
(低)		
(稍低)		
(適度)		
(高)		
31 歲~		5.0
(低)		
(稍低)		
(適度)		
(高)		
51 歲~		5.0
(低)		
(稍低)		
(適度)		
(高)		
71 歲~		5.0
(低)		
(稍低)		
(適度)		
懷孕	第一期	+1.0
	第二期	+1.0
	第三期	+1.0
哺 乳 期		+2.0

NO UL

§Sources

廣泛的存在各種食物，一般來源包括：

- **animal foods(liver, meat, egg yolk, milk) whole grains, legumes, peanut, mushroom**

Summary

- **Pantothenic acid** 變成 **Coenzyme A** 後與 等反應,可合成為**Acetyl CoA**，在人體內扮演 產能的重要角色