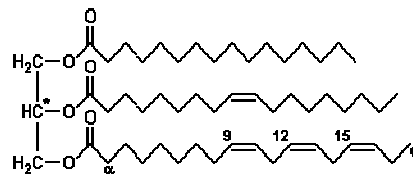


Metabolism of lipids

Classification of lipids

Simple lipids

- Triacylglycerols TAG (fats) →
- Waxes



Complex lipids

- Phospholipids
- Sphingophospholipids
- Glycolipids

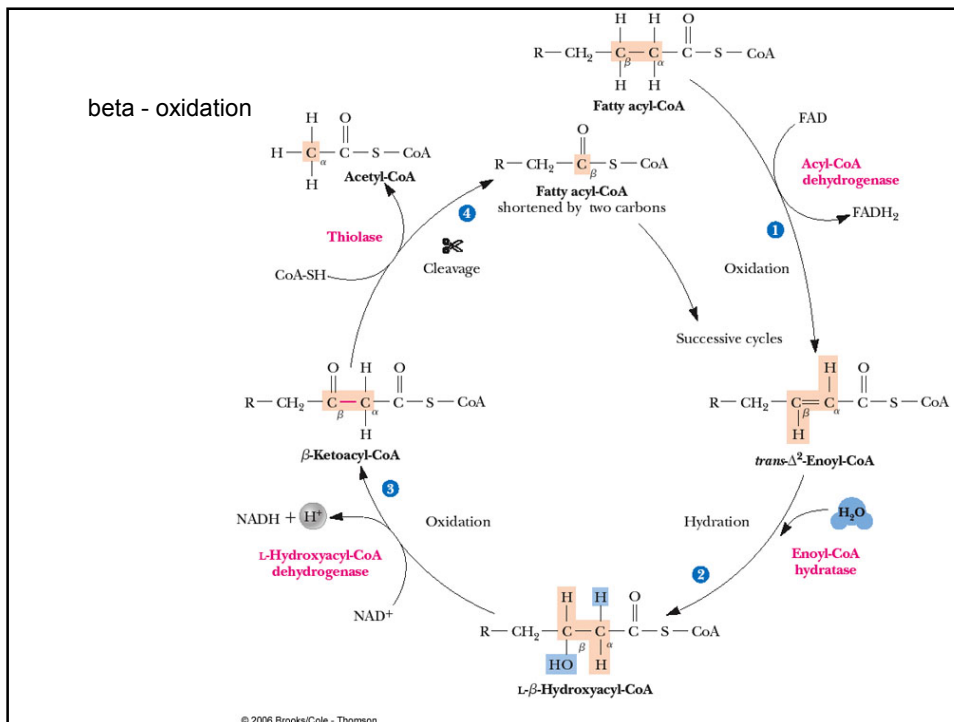
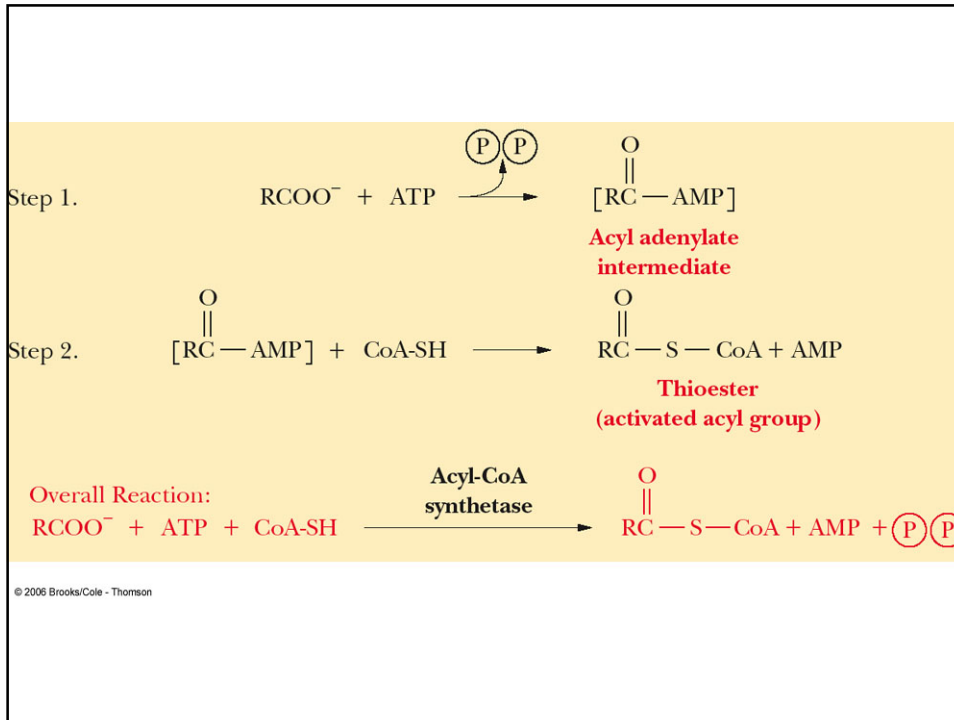
Fatty acids (FA)

A. Carboxylic acids

Name	Number of carbons	Number of double bonds Position of double bonds	
Formic acid	1 : 0	0	Not contained in lipids
Acetic acid	2 : 0	0	
Propionic acid	3 : 0	0	
Butyric acid	4 : 0	0	
Valerianic acid	5 : 0	0	
Caproic acid	6 : 0	0	HOOC—CH ₂ —CH ₂ —CH ₂ —CH ₂ —CH ₃
Caprylic acid	8 : 0	0	Caproic acid
Capric acid	10 : 0	0	
Lauric acid	12 : 0	0	
Myristic acid	14 : 0	0	
Palmitic acid	16 : 0	0	
Stearic acid	18 : 0	0	
Oleic acid	18 : 1; 9	1	
★ Linoleic acid	18 : 2; 9,12	2	
★ Linolenic acid	18 : 3; 9,12,15	3	
Arachidic acid	20 : 0	0	
★ Arachidonic acid	20 : 4; 5,8,11,14	4	
Behenic acid	22 : 0	0	
Erucic acid	22 : 1; 13	1	
Lignoceric acid	24 : 0	0	
Nervonic acid	24 : 1; 15	1	

★ Essential in human nutrition





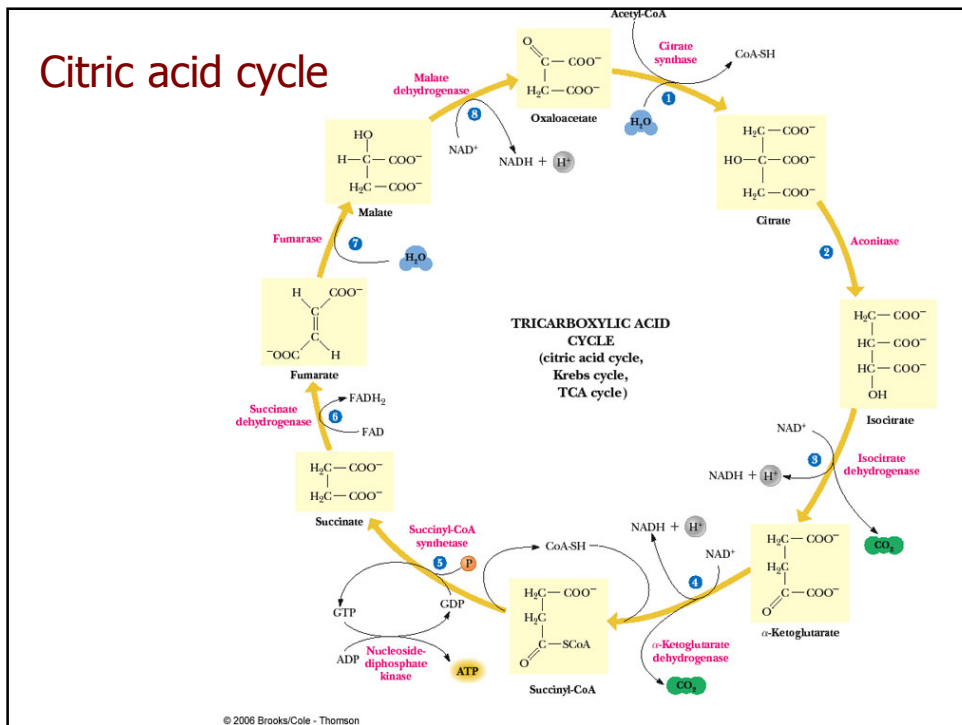
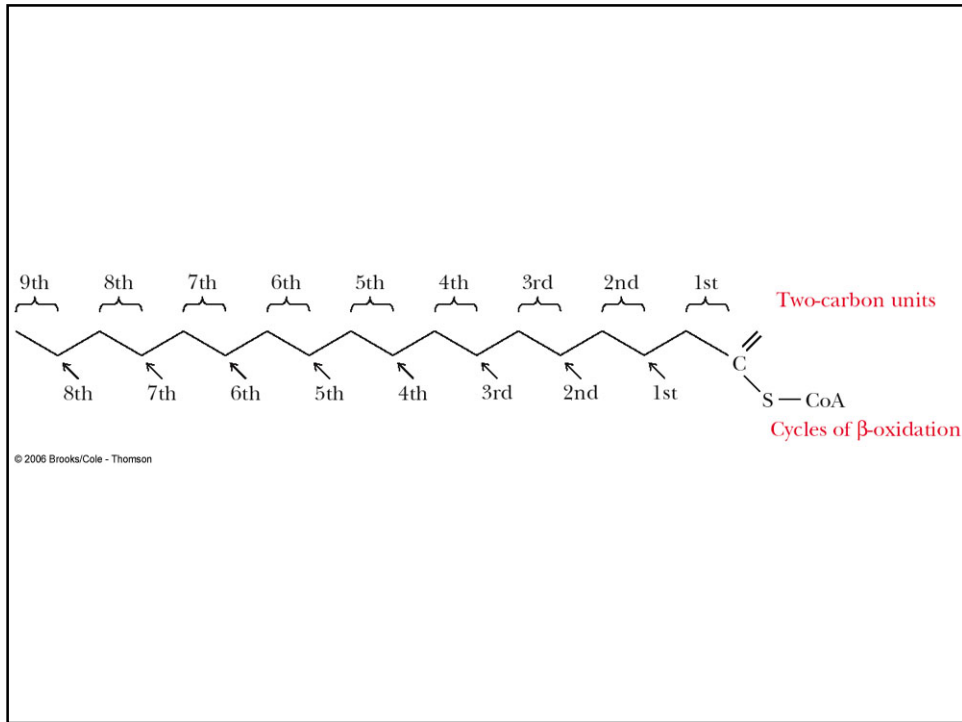
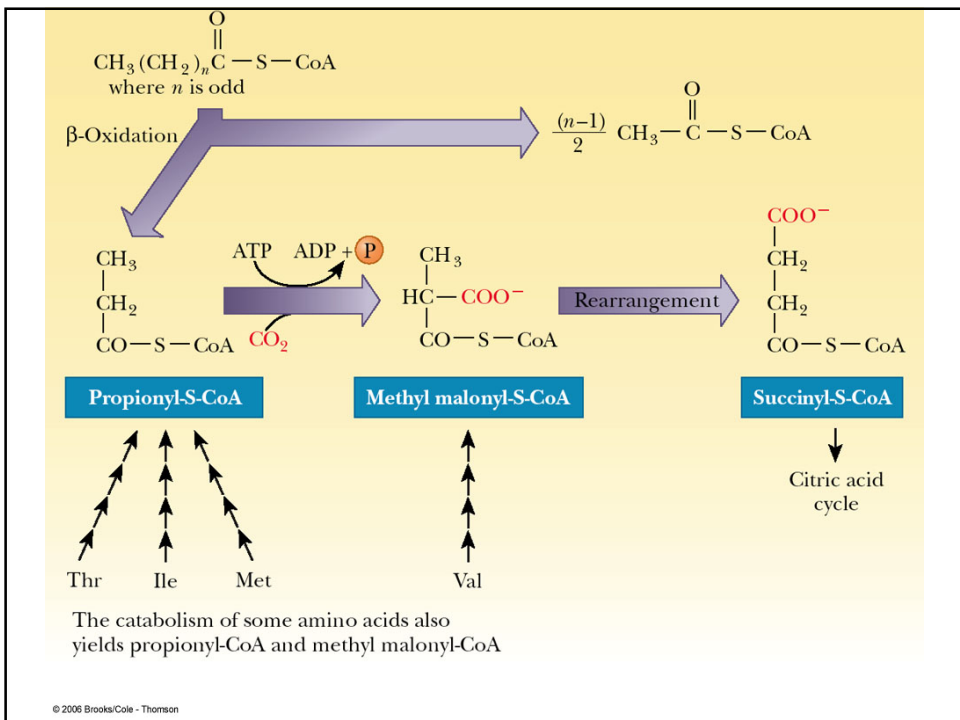


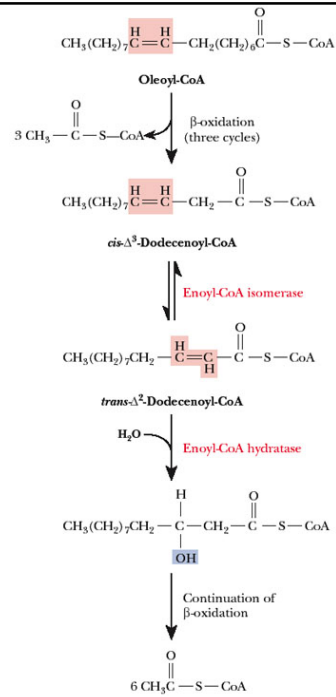
Table 21.1
The Balance Sheet for Oxidation of One Molecule of Stearic Acid

Reaction	NADH Molecules	FADH ₂ Molecules	ATP Molecules
1. Stearic acid → Stearyl-CoA (activation step)			-2
2. Stearyl-CoA → 9 acetyl-CoA (8 cycles of β-oxidation)	+8	+8	
3. 9 Acetyl-CoA → 18 CO ₂ (citric acid cycle); GDP → GTP (9 molecules)	+27	+9	+9
4. Reoxidation of NADH from β-oxidation cycle	-8		+20
5. Reoxidation of NADH from citric acid cycle	-27		+67.5
6. Reoxidation of FADH ₂ from β-oxidation cycle		-8	+12
7. Reoxidation of FADH ₂ from citric acid cycle		-9	+13.5
	0	0	+120

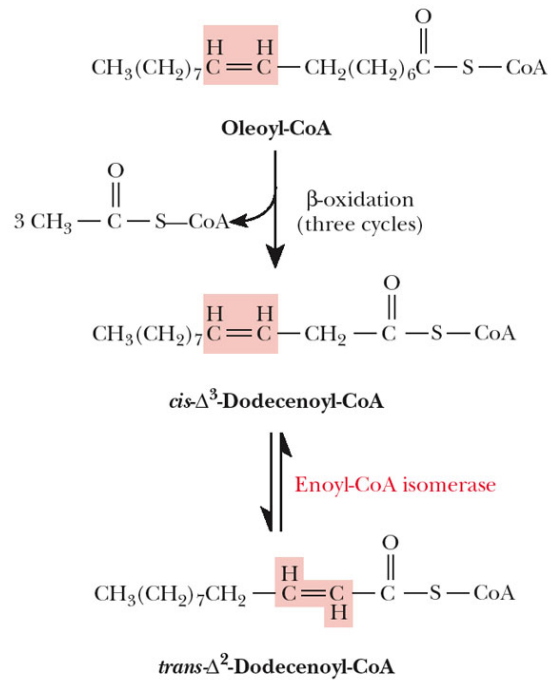
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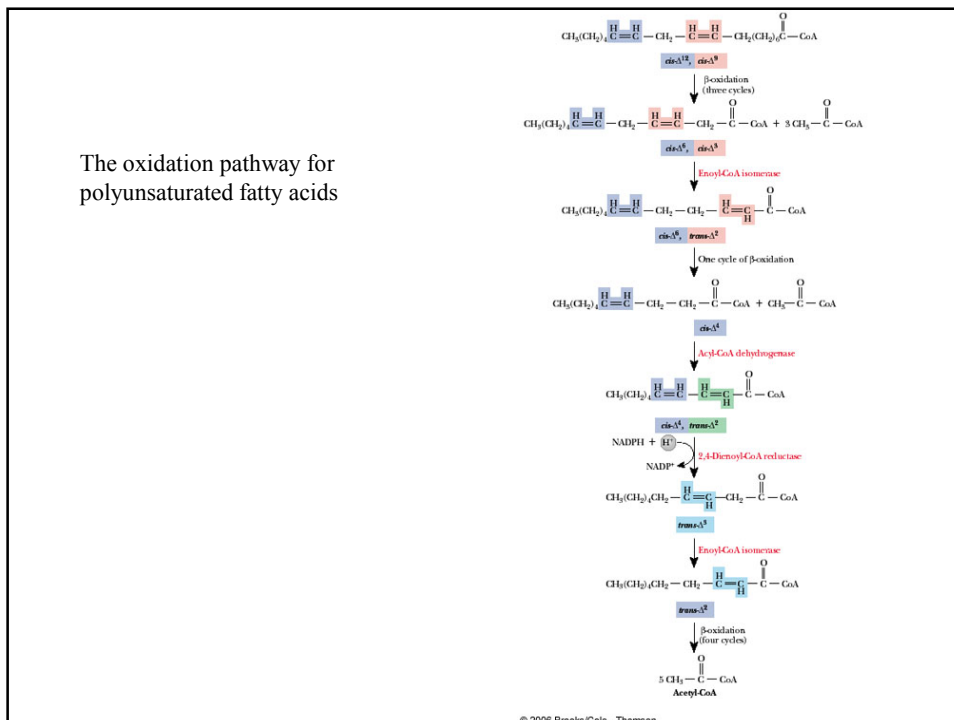
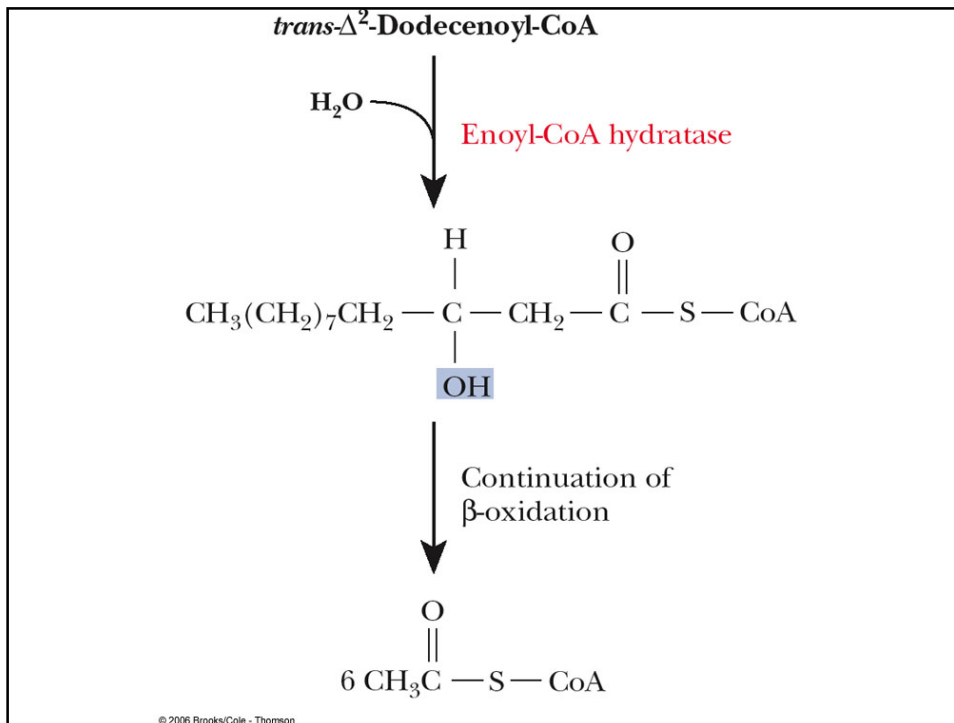
β-oxidation of unsaturated fatty acids

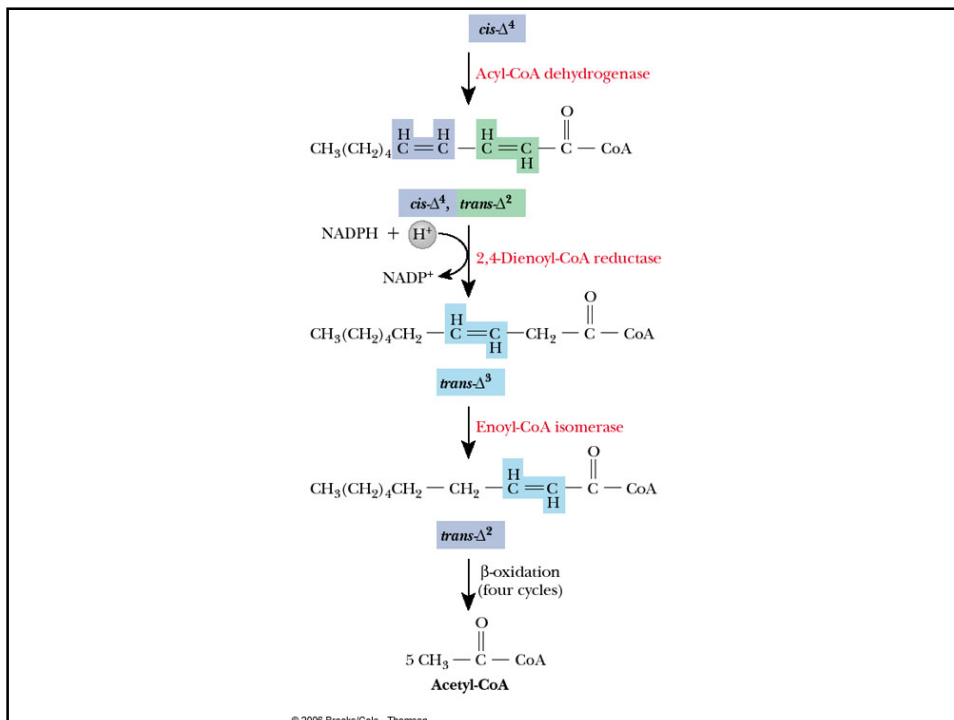
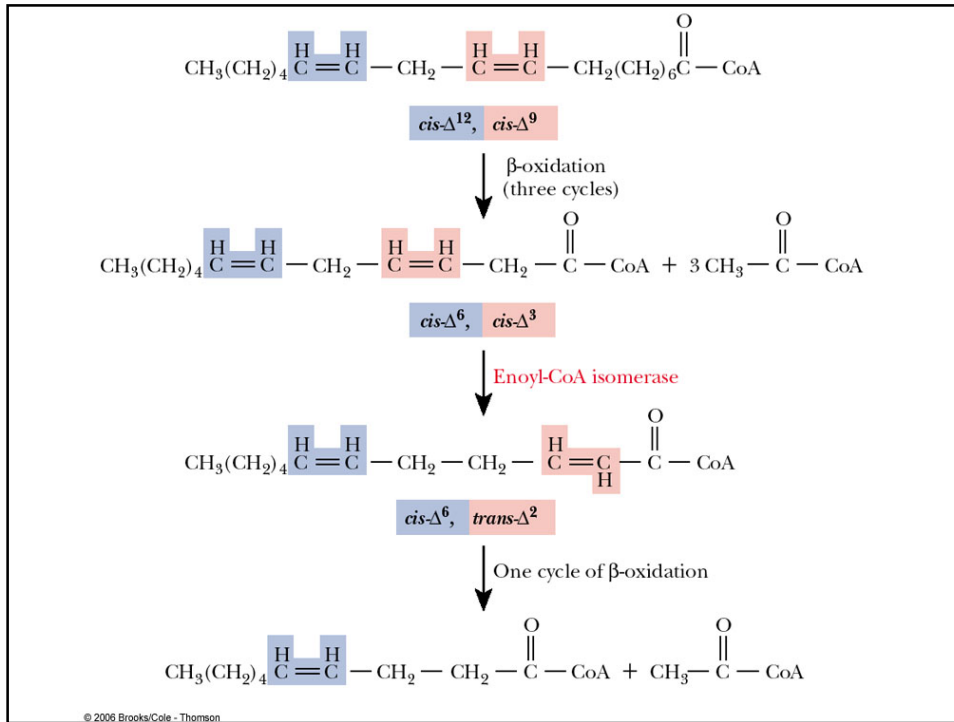


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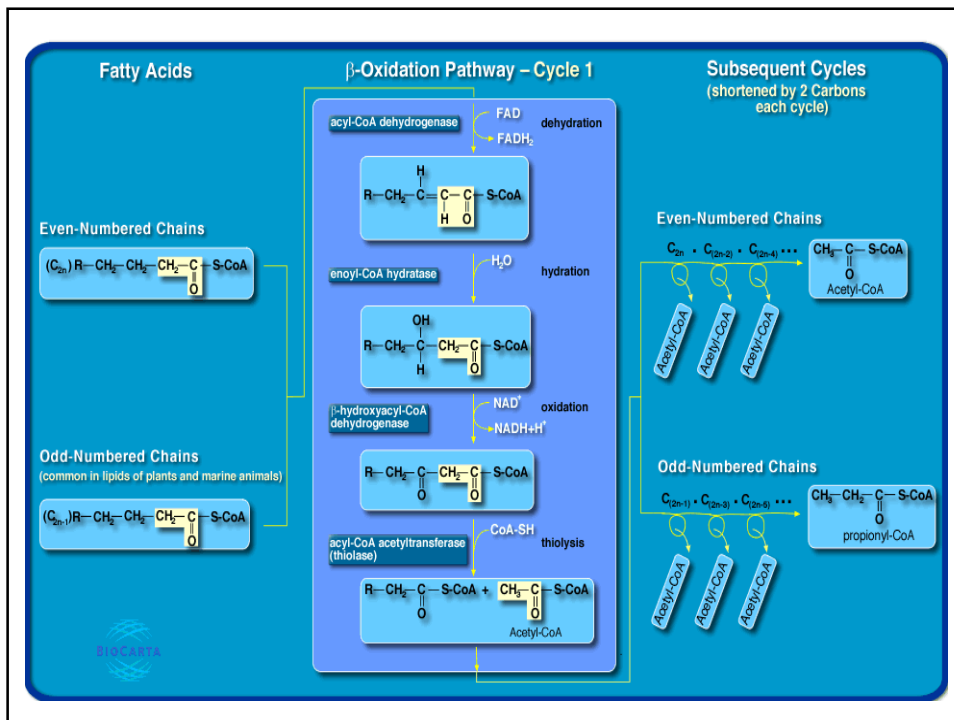
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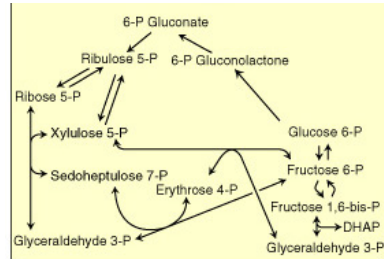
β-oxidation of fatty acids

- **substrate:** acyl-CoA
- **product:** n acetyl-CoA, n NADH + H⁺, n FADH₂
- **function:** gain of energy from fatty acids



Pentose Phosphate Pathway

- **Starting point:** Glucose 6-phosphate
- **Function:** This pathway generates two principal products:
 - **Ribose 5-phosphate**, necessary for nucleotide biosynthesis.
 - **NADPH**, necessary for biosynthetic reactions.



NADPH

- NADP⁺ differs from NAD⁺ by a single phosphate on one of the riboses
- Certain enzymes of biosynthetic pathways are NADPH-specific
- Ratios of reduced/oxidized forms in cytosol:
 - **Reductive biosynthetic role** for NADPH
 - **Oxidative role** for NAD⁺

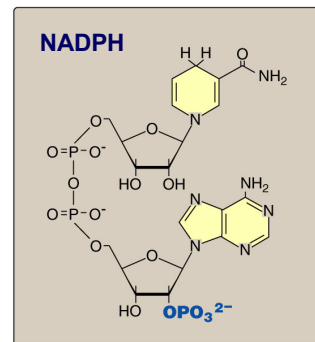


Figure 13.4 Structure of NADPH.

$$\frac{\text{NADPH}}{\text{NADP}^+} = \frac{10}{1}$$

$$\frac{\text{NADH}}{\text{NAD}^+} = \frac{1}{1000}$$