VIVEKANANDA COLLEGE
THAKURPUKUR
KOLKATA-700063

NAAC ACCREDITED 'A' GRADE

Topic: Lipid Metabolism
Course Title: Biochemistry and Genetic Engineering
Paper: ZCT-211
Unit:
Semester: PG 2nd semester
Name of the Teacher: Dr. Samita Kundu
Name of the Department: Zoology

Lipid Metabolism

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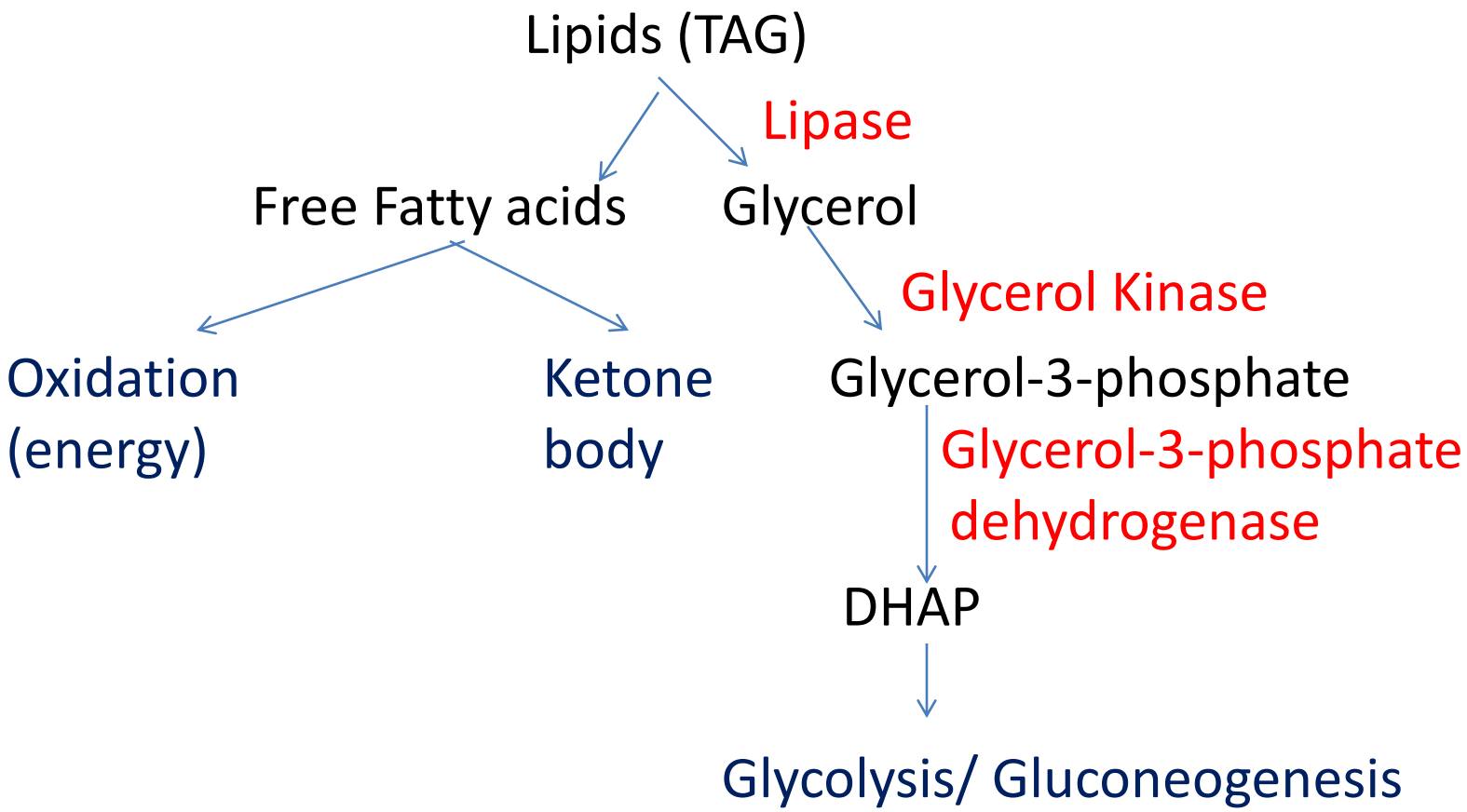
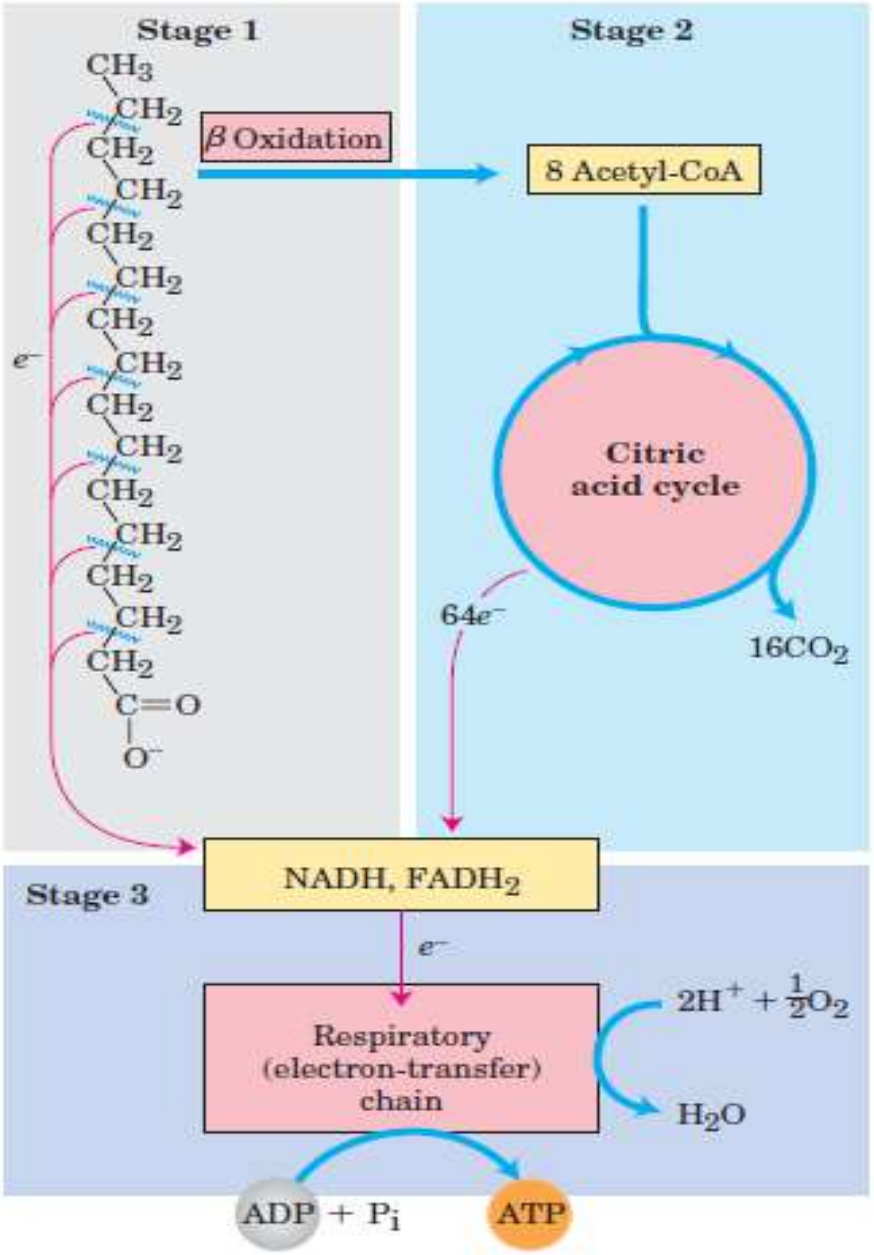
Lipid digestion



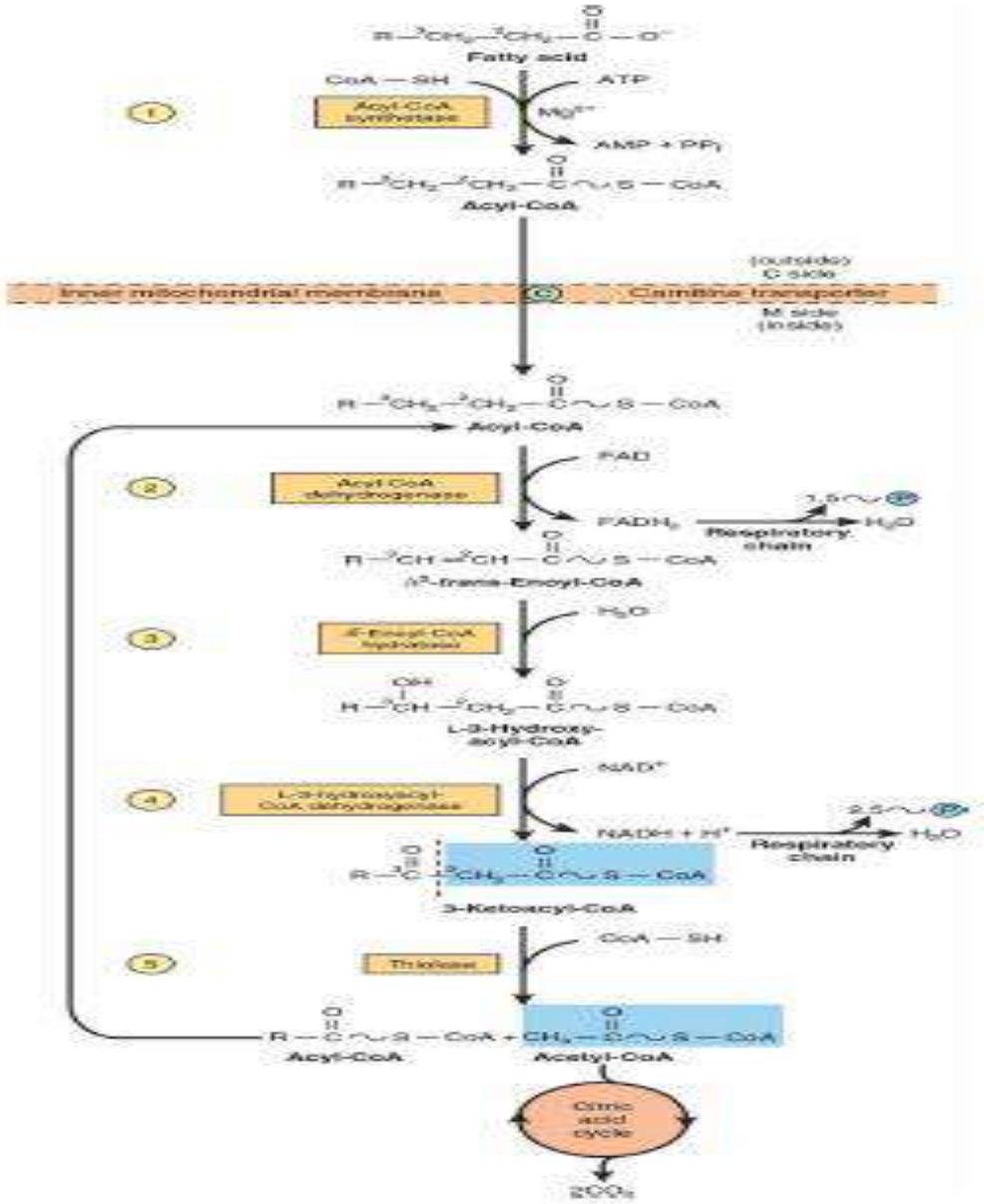
Fatty acid degradation

- The complete oxidation of fatty acids to CO_2 and H_2O takes place in three stages:
  1. Oxidation of long-chain fatty acids to 2-C fragments, in the form of acetyl-CoA (β oxidation)
  2. Oxidation of acetyl-CoA to CO_2 in the citric acid cycle
  3. Transfer of electrons from reduced electron carriers to the mitochondrial respiratory chain

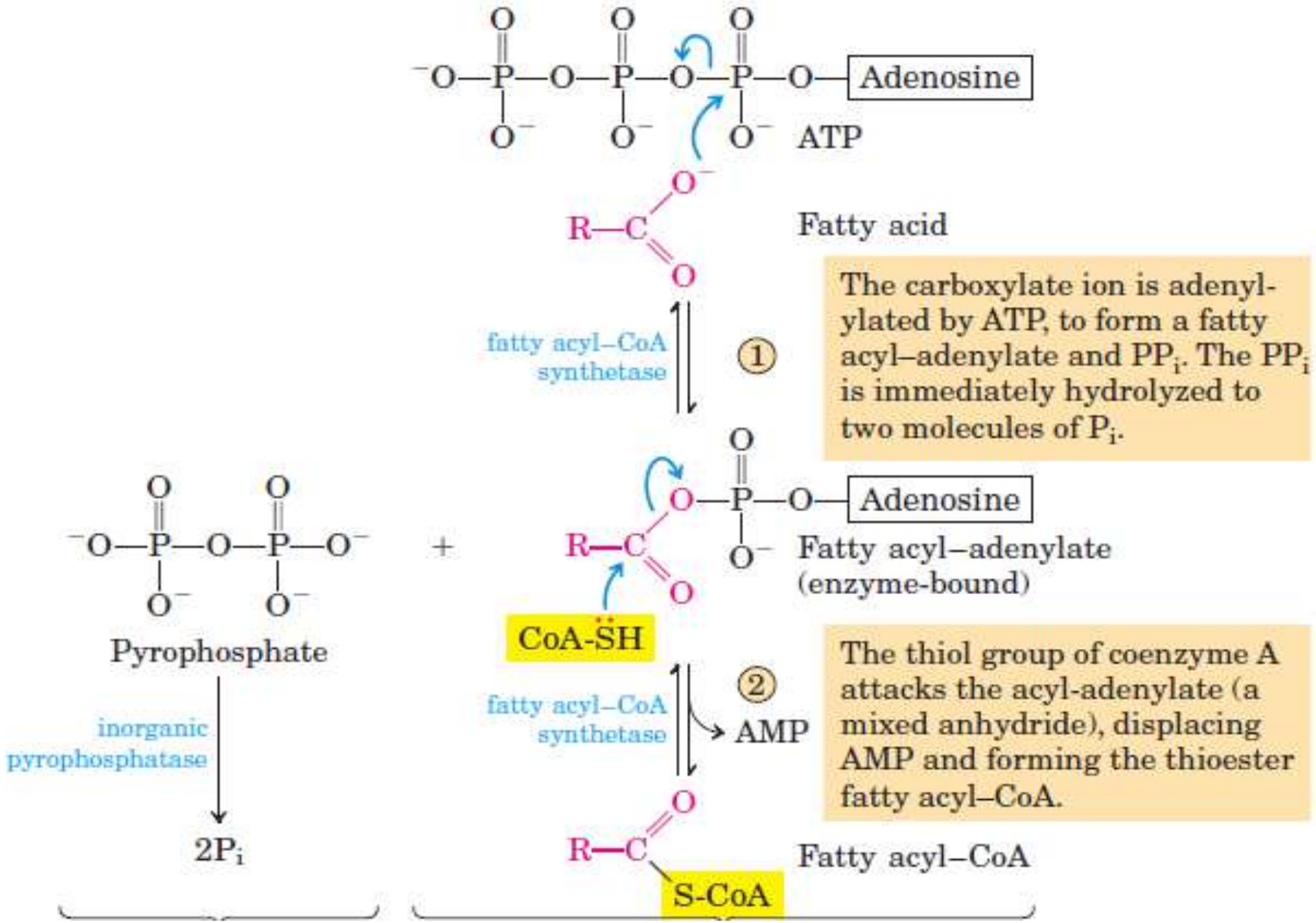


β-Oxidation of fatty acids

- β-oxidation is a mitochondrial pathway in which 2-C fragments are successively removed from the carboxyl end of the fatty acyl CoA, producing acetyl CoA, NADH, and $FADH_2$

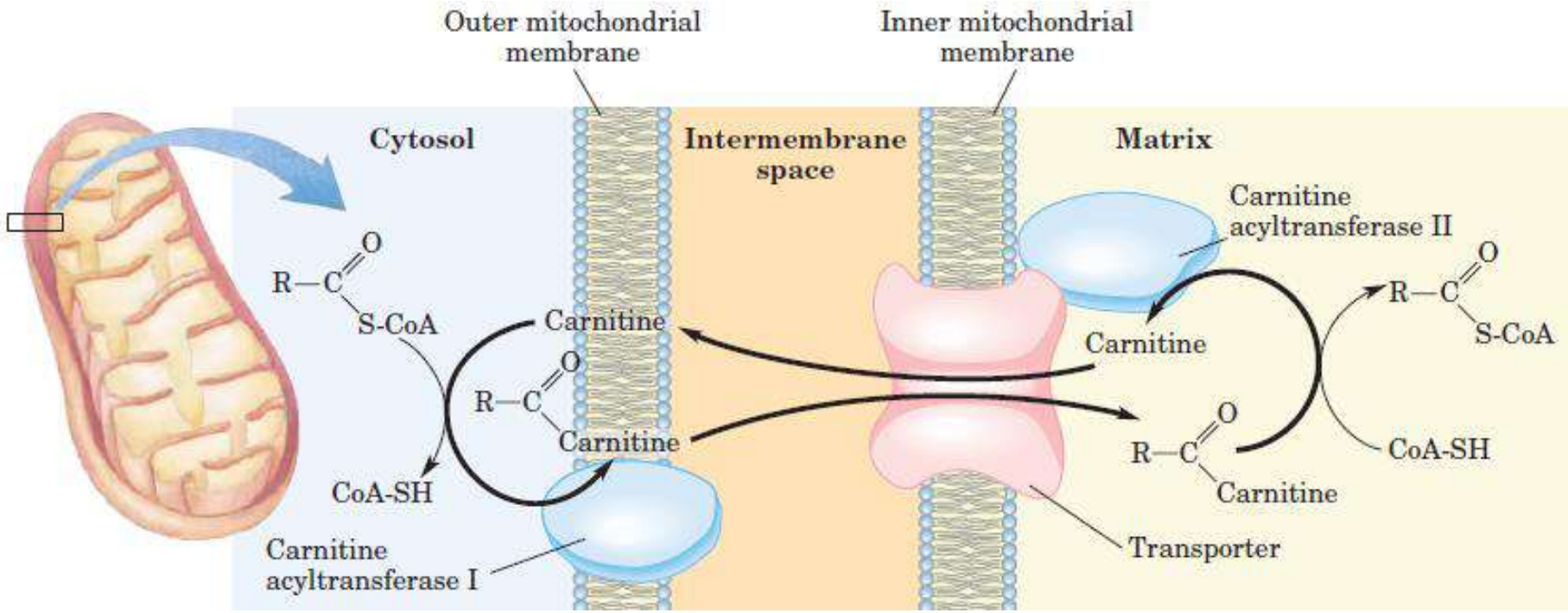


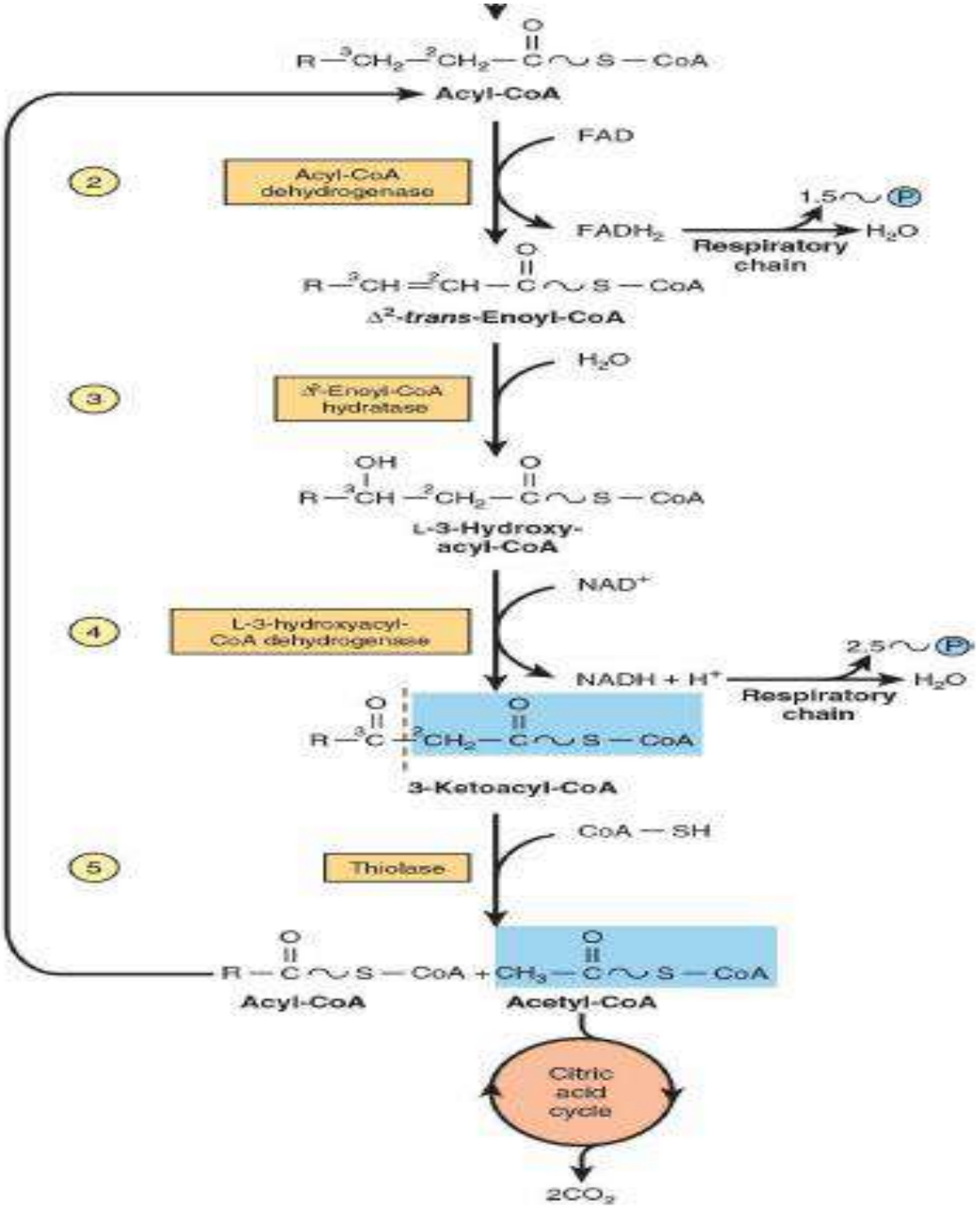
- **Conversion of a fatty acid to a fatty acyl–CoA.**

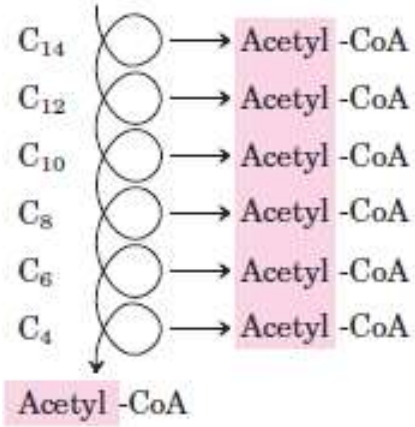


Carnitine shuttle

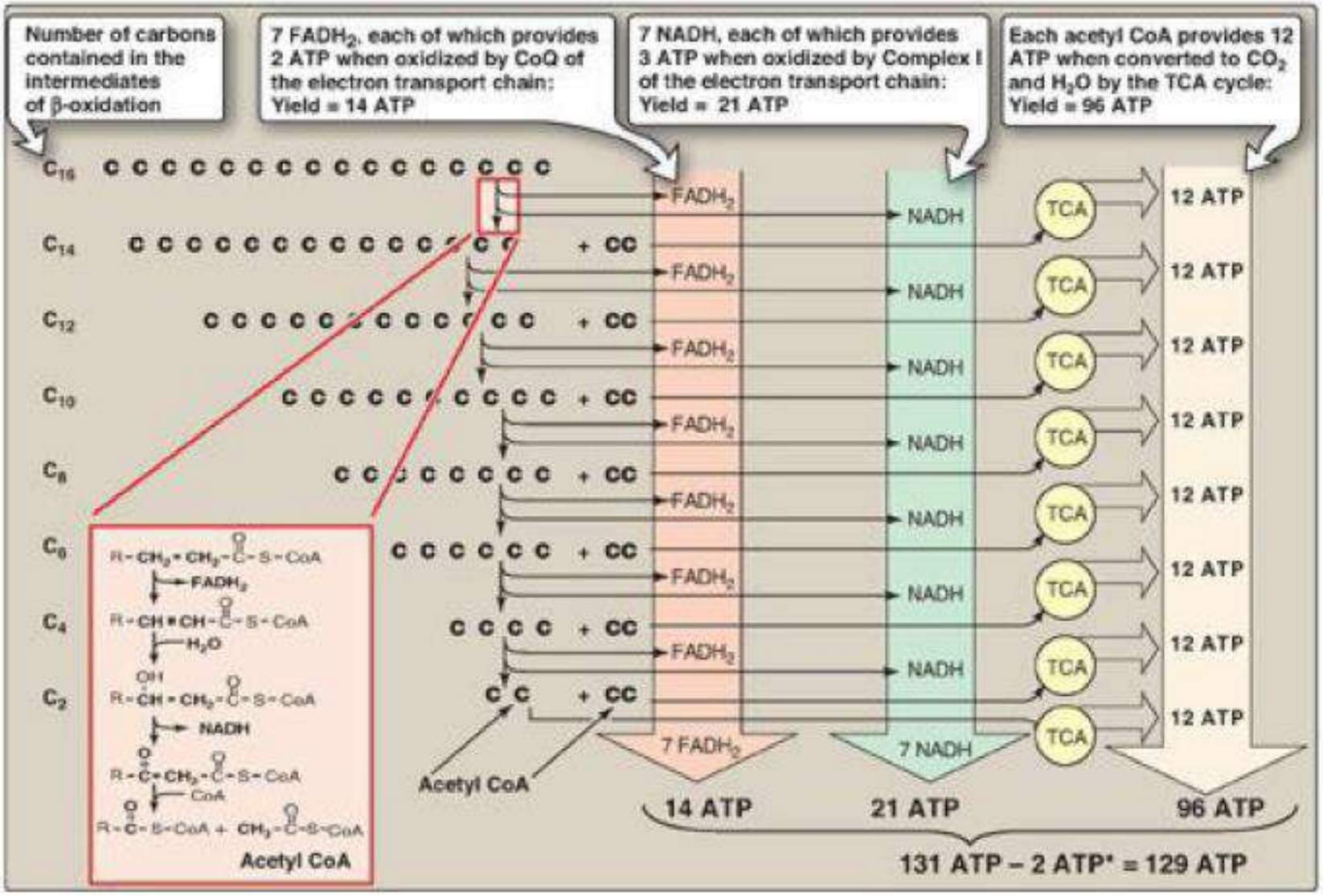
- Transport of Acyl CoA from cytosol to mitochondrial matrix




Acyl-CoA
FAD
2
Acyl-CoA dehydrogenase
1.5 ~ P
FADH2
H2O
Respiratory chain
Δ2-trans-Enoyl-CoA
H2O
3
Δ2-Enoyl-CoA hydratase
L-3-Hydroxy-acyl-CoA
NAD+
4
L-3-hydroxyacyl-CoA dehydrogenase
2.5 ~ P
NADH + H+
H2O
Respiratory chain
3-Ketoacyl-CoA
CoA — SH
5
Thiolase
Acyl-CoA
Acetyl-CoA
Citric acid cycle
2CO2

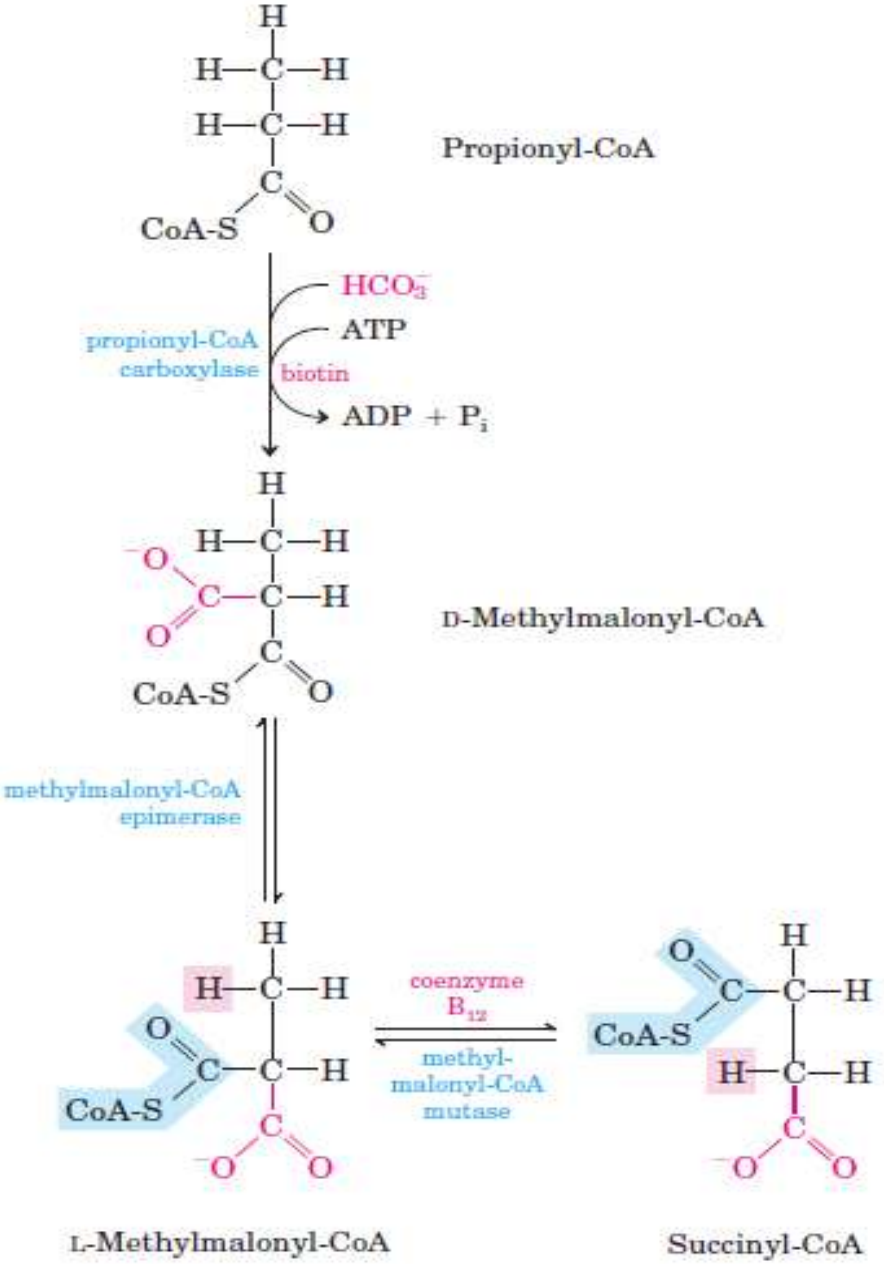

C14 → Acetyl -CoA
C12 → Acetyl -CoA
C10 → Acetyl -CoA
C8 → Acetyl -CoA
C6 → Acetyl -CoA
C4 → Acetyl -CoA
Acetyl -CoA

- Energy yield in β-Oxidation of palmitic acid



β-Oxidation of saturated odd-carbon fatty acid

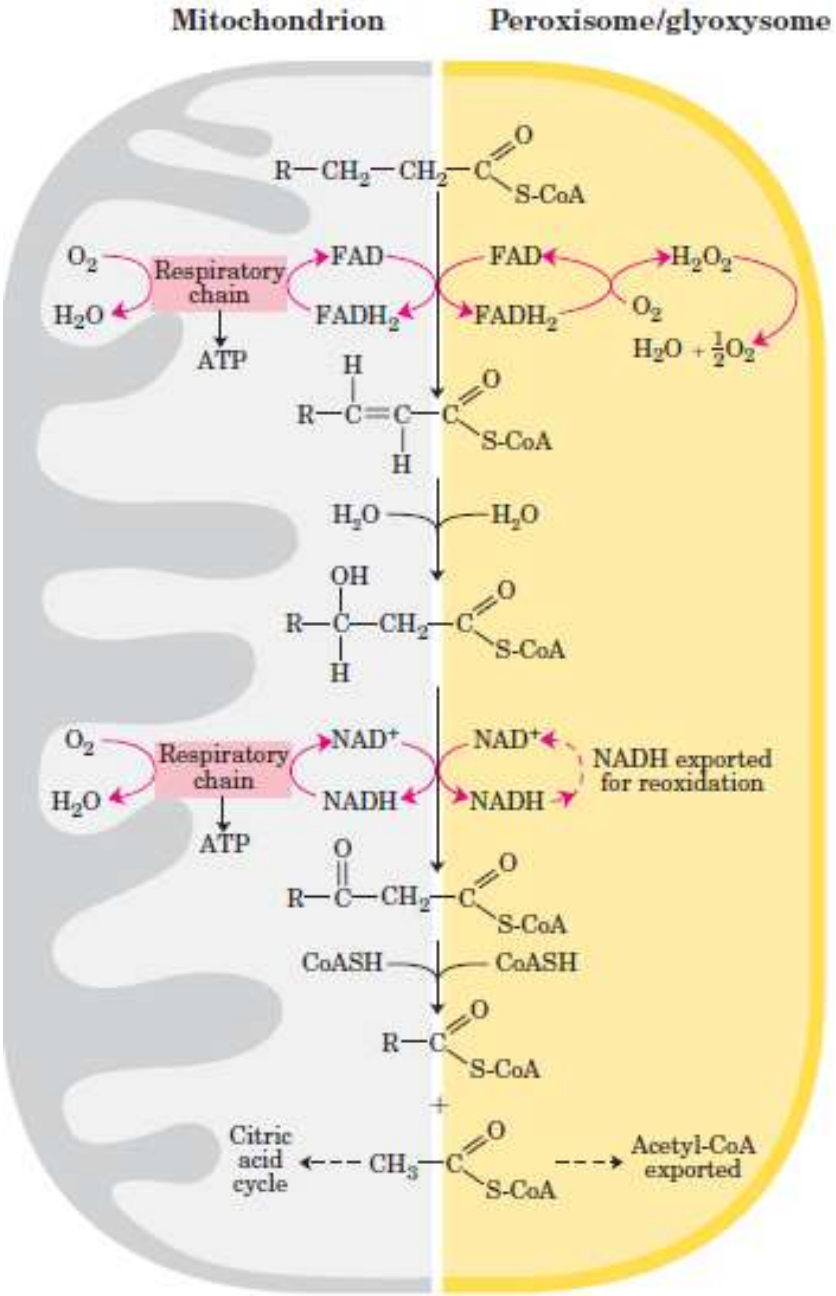
- Produces acetyl CoA and propionyl CoA at the end
- Oxidation of propionyl-CoA forms Succinyl CoA that is an intermediate of the TCA cycle



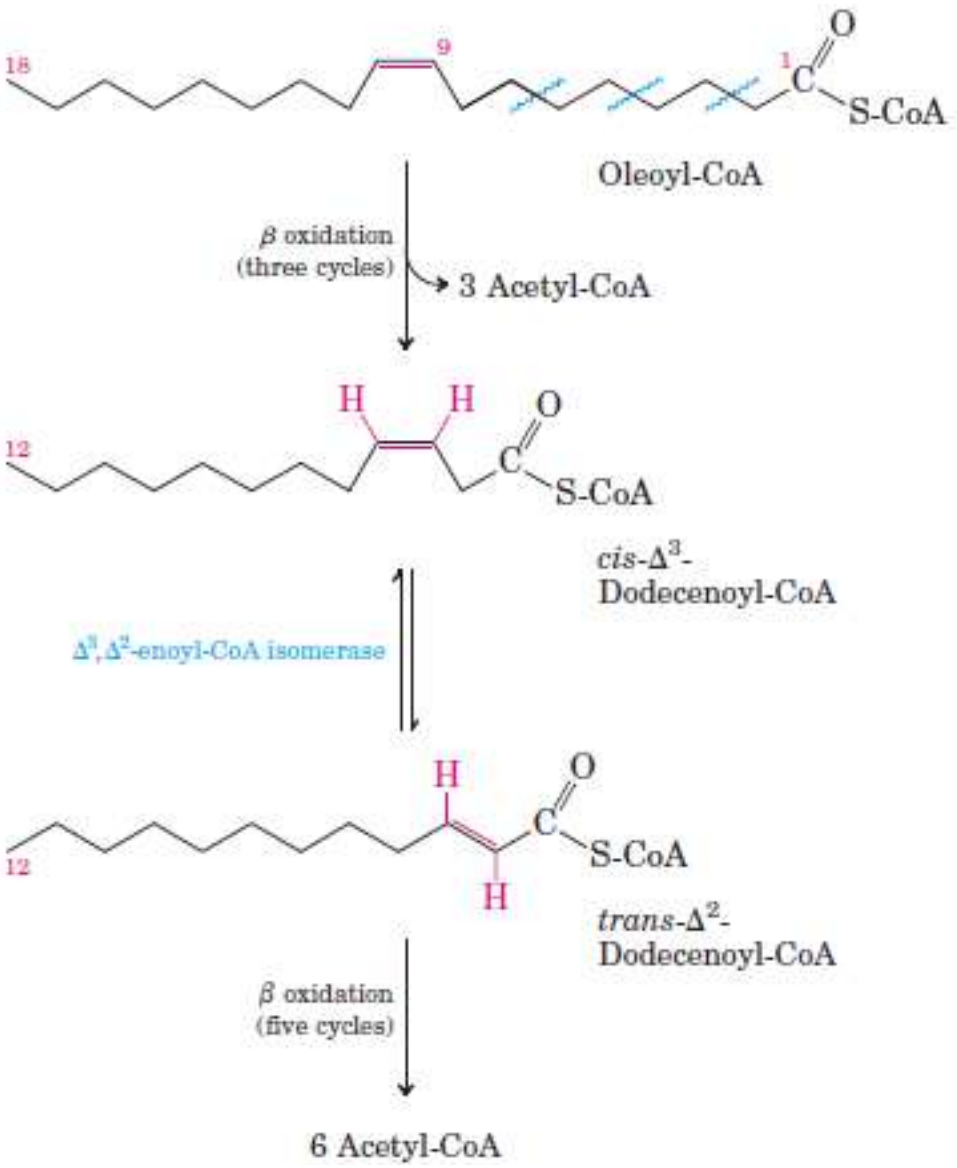
Peroxisomal β-Oxidation

- For very long chain fatty acids

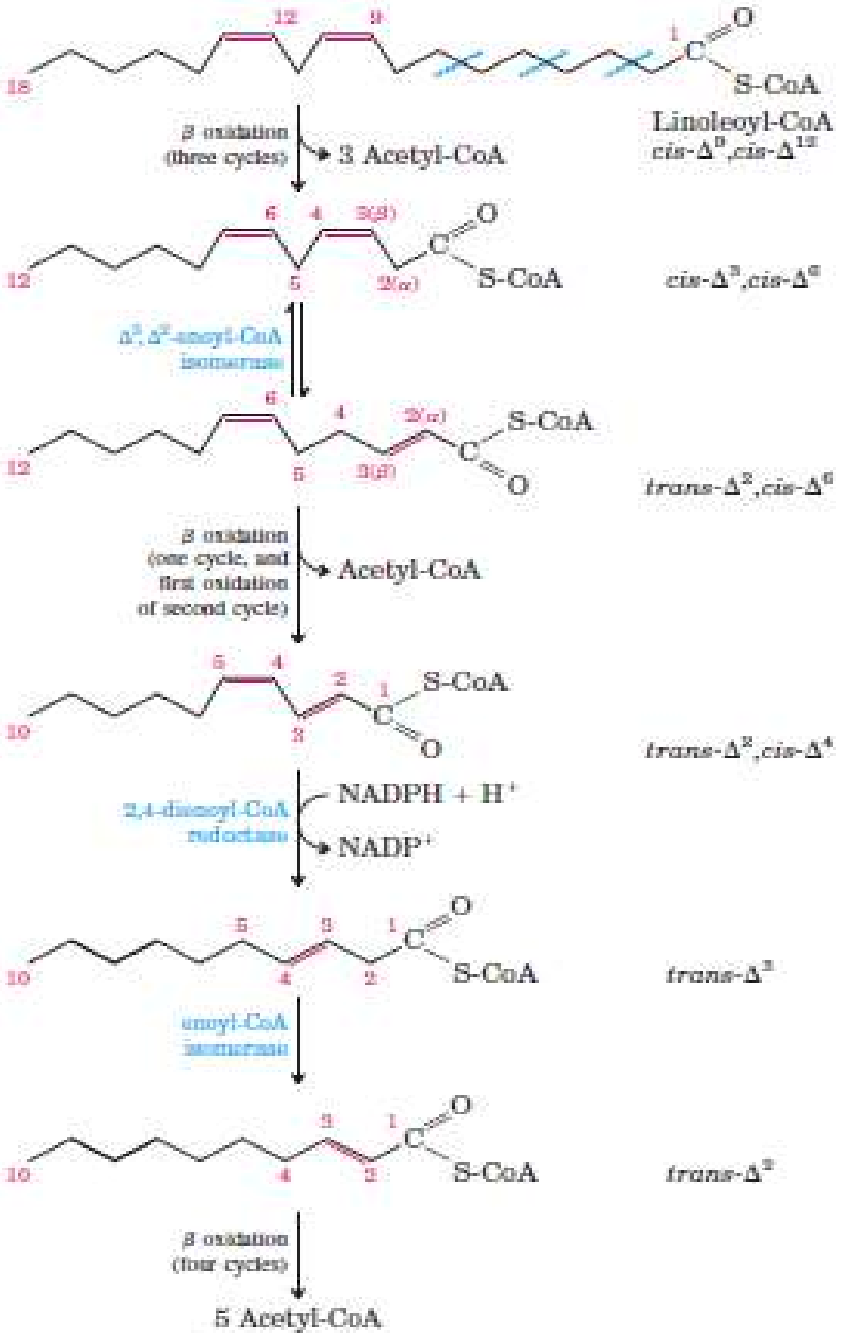
- Comparison of oxidation in mitochondria and in peroxisomes



- **Oxidation of a monounsaturated fatty acid.**

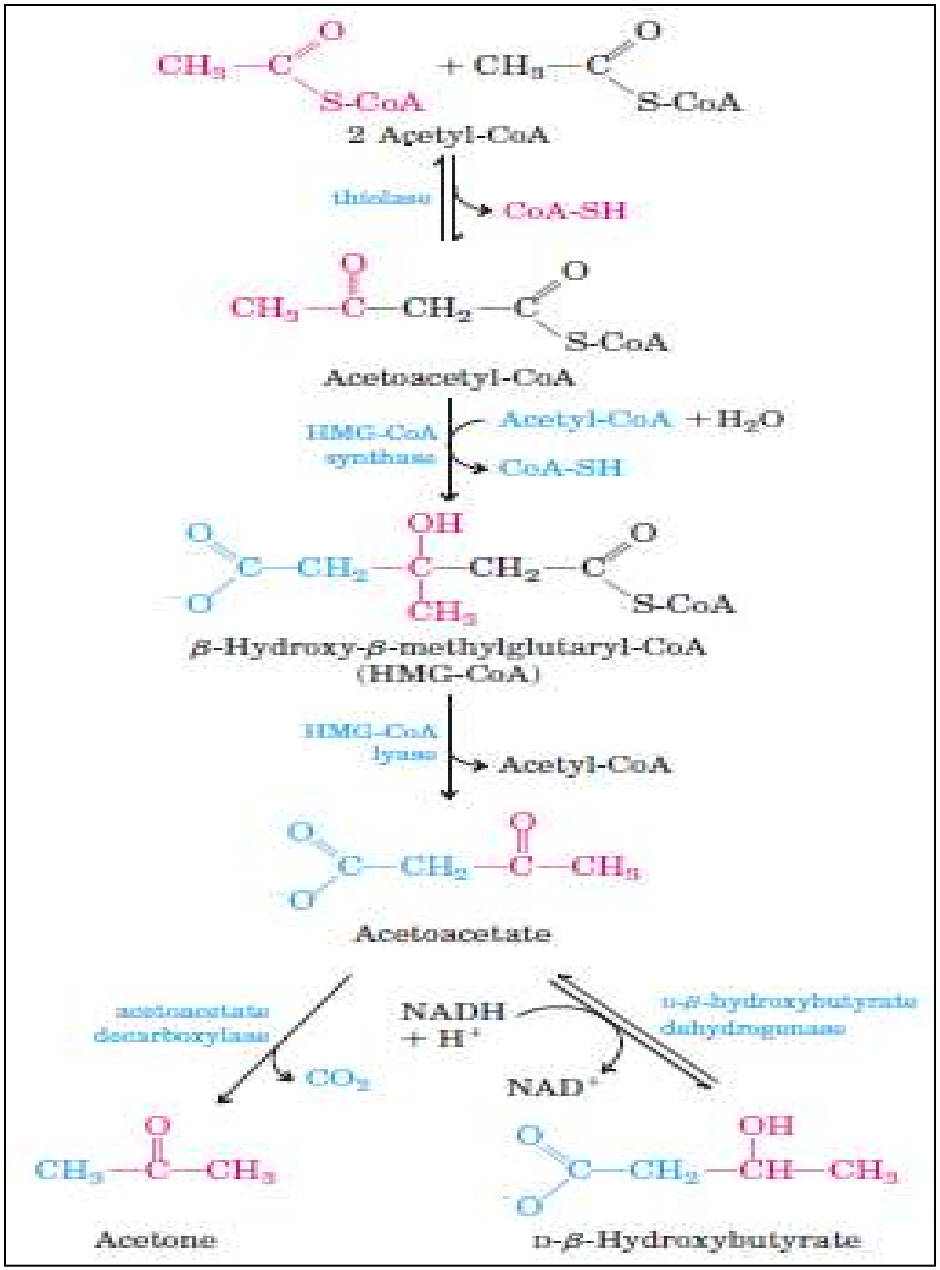


Oxidation of a polyunsaturated fatty acid



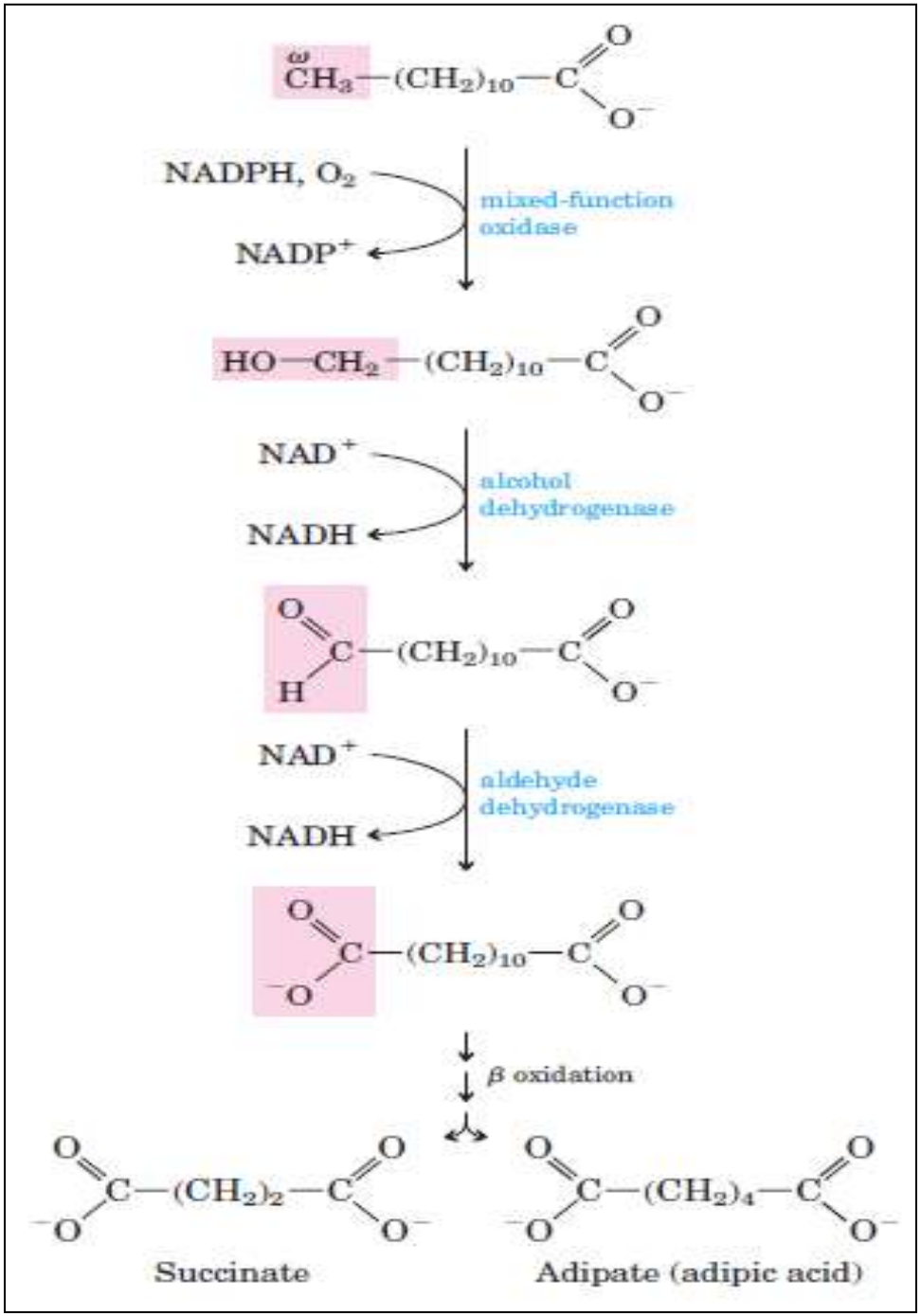
Formation of Ketone Bodies

- Acetoacetate, d-3-hydroxybutyrate and acetone are ketone bodies.



ω- oxidation

- Oxidation of the ω (omega) carbon—
  the carbon most distant from the carboxyl group.
- Enzymes are located in the endoplasmic reticulum of liver and kidney,
- Preferred substrates are fatty acids of 10 or 12 carbon atoms



α- oxidation

- For branched chain fatty acids
- These are not substrates for acyl CoA dehydrogenase because of the methyl group on its β-carbon