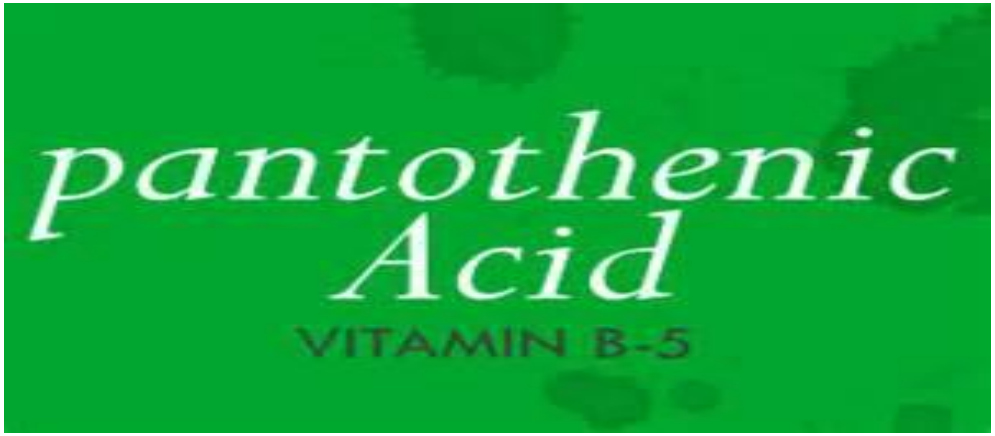
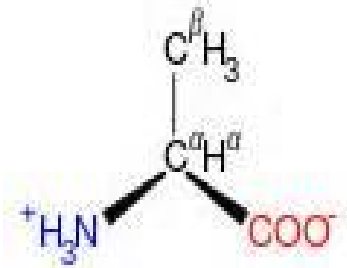
B-COMPLEX VITAMINS



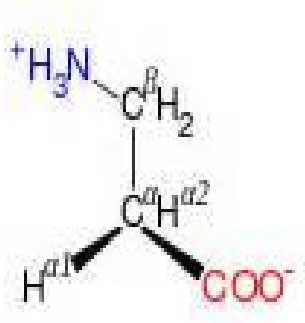
Chemistry

- Beta alanine in peptide linkage with a di-hydroxy di-methyl butyric acid (pantoic acid) = Pantothenic acid
- Acid is water soluble, hydrolyzed by acid/alkali
- Thermolabile, destroyed by heat

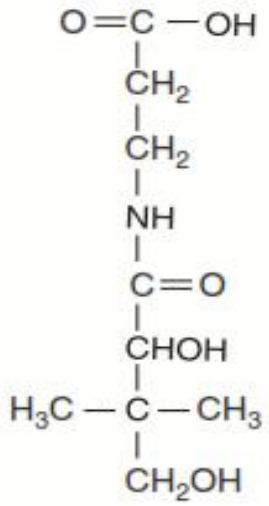
β-Alanine (or ***beta*-alanine**): a naturally occurring beta a.a. in which the amino group is at the β-position from the carboxylate group



L-α-alanine



β-alanine



Pantothenic acid

- Biologically active – Coenzyme A (Co-acetylase), bound to apoproteins
- Represented as CoA-SH (reduced –SH/oxidized –S-S- Forms)

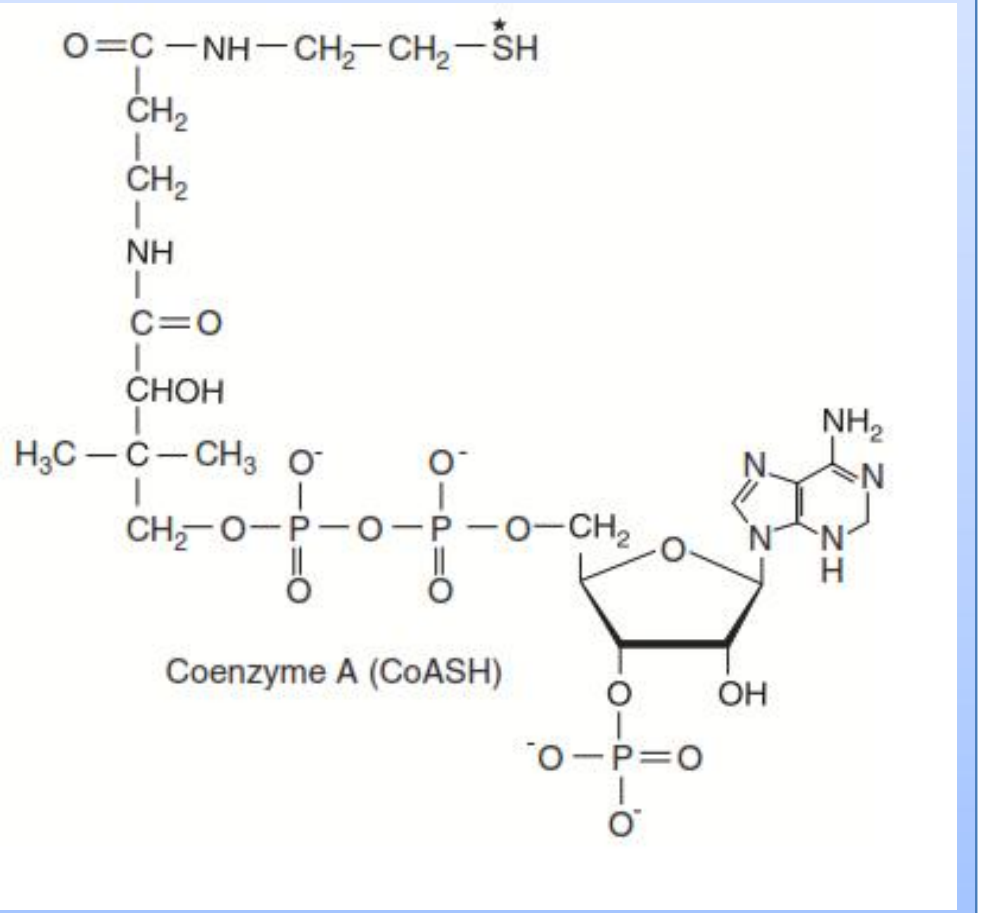


Figure 45–18. Pantothenic acid and coenzyme A. * Shows the site of acylation by fatty acids.

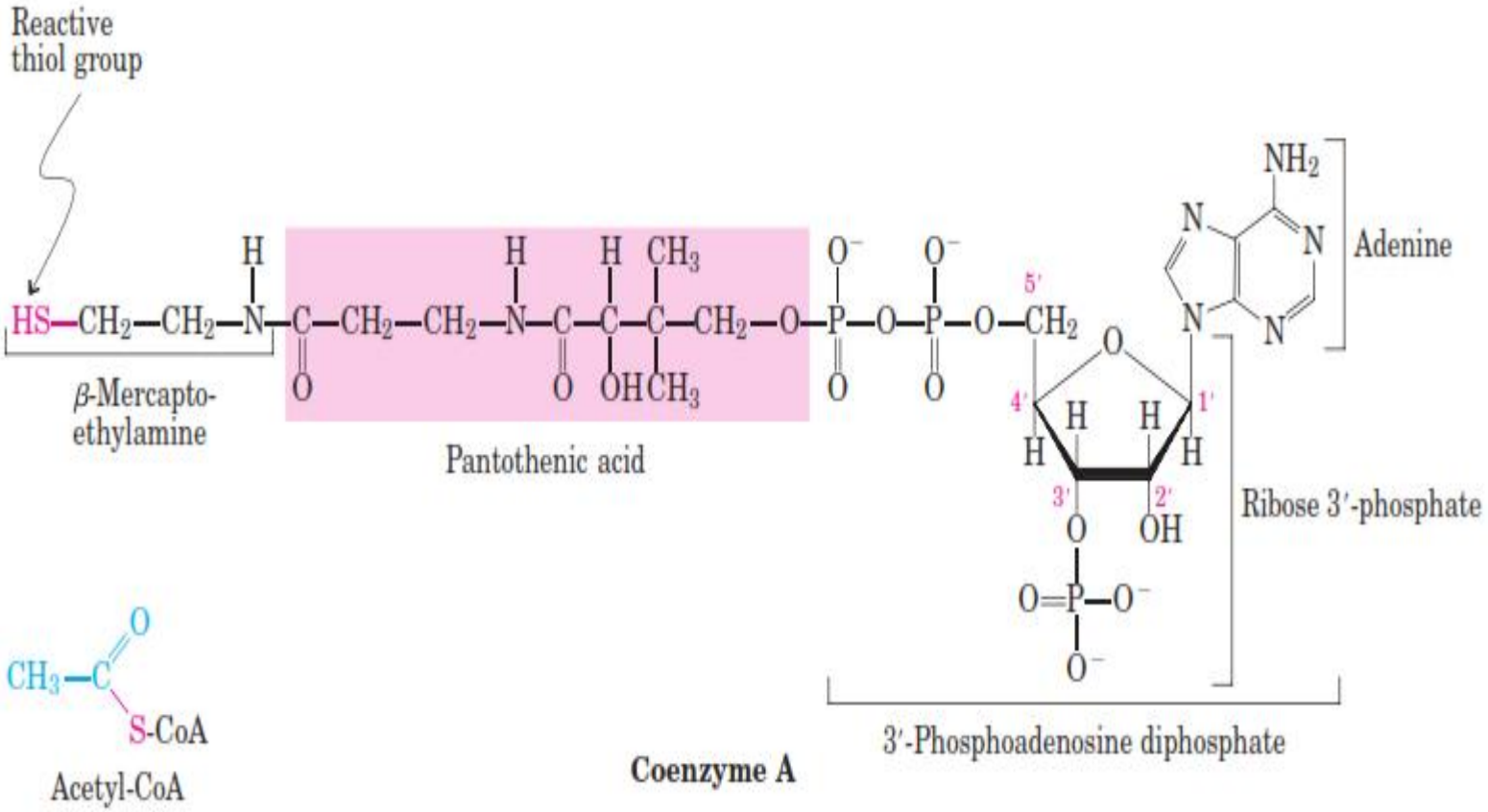


FIGURE 16-3 Coenzyme A (CoA). A hydroxyl group of pantothenic acid is joined to a modified ADP moiety by a phosphate ester bond, and its carboxyl group is attached to β-mercaptoethylamine in amide linkage. The hydroxyl group at the 3′ position of the ADP moiety has a phosphoryl group not present in free ADP. The —SH group of the mercaptoethylamine moiety forms a thioester with acetate in acetyl-coenzyme A (acetyl-CoA) (lower left).

Biosynthesis/RDA

- Microorganisms can synthesize
- HUMANS: cannot synthesize, intestinal bacteria can

- RDA: Adults 5-12 mg/2500 cal
  Children 4-5 mg

Requirement increase in severe stress, burns, injury, oral antibiotics intake, pregnancy, lactation

- Humans can synthesis Coenzyme A

- Vit.B5 levels
- Whole blood= 15-45 µg/100 mL
- Liver = 40 µg/ g
- Kidney = 30 µg/ g

- Excretion: Catabolic products not known for vit.B5
- Urine: 2.5-5 mg excreted daily
- Sweat:3-4 µg/ 100 mL

Occurrence & Sources

- Widely distributed in animals & plants
- Animal sources: liver, kidney, egg yolk, chicken meat, fish
- Plants sources: cereal, legumes, potatoes
- Most vegetables & fruits are poor source

Metabolic roles

Formation of Acetyl-CoA

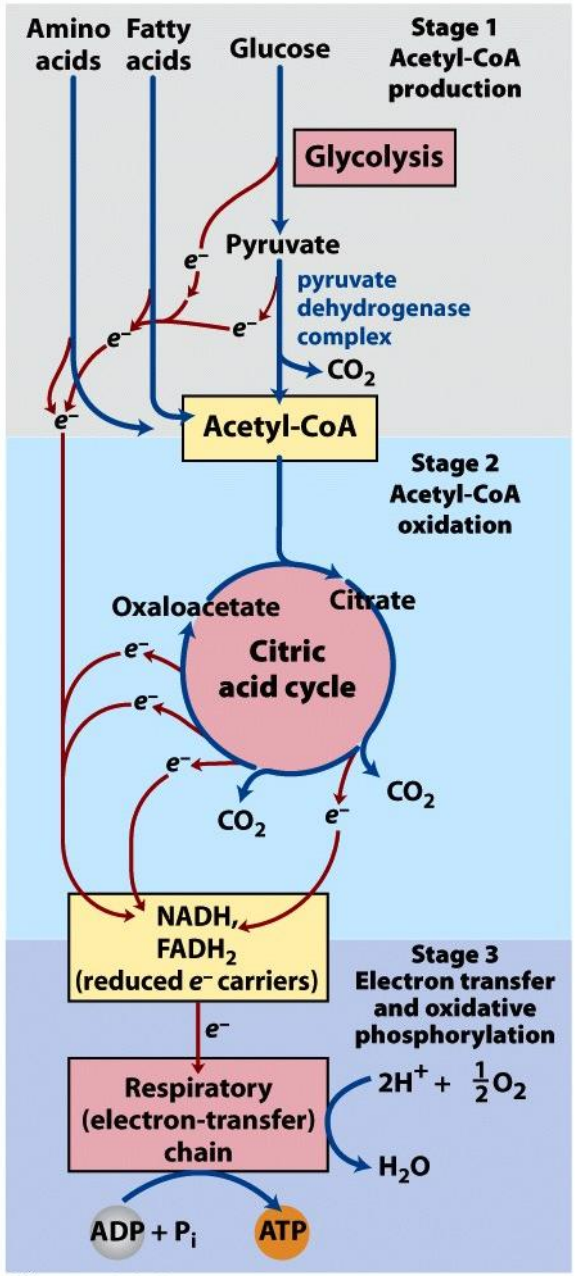


Figure 16-1
Lehninger Principles of Biochemistry, Fifth Edition

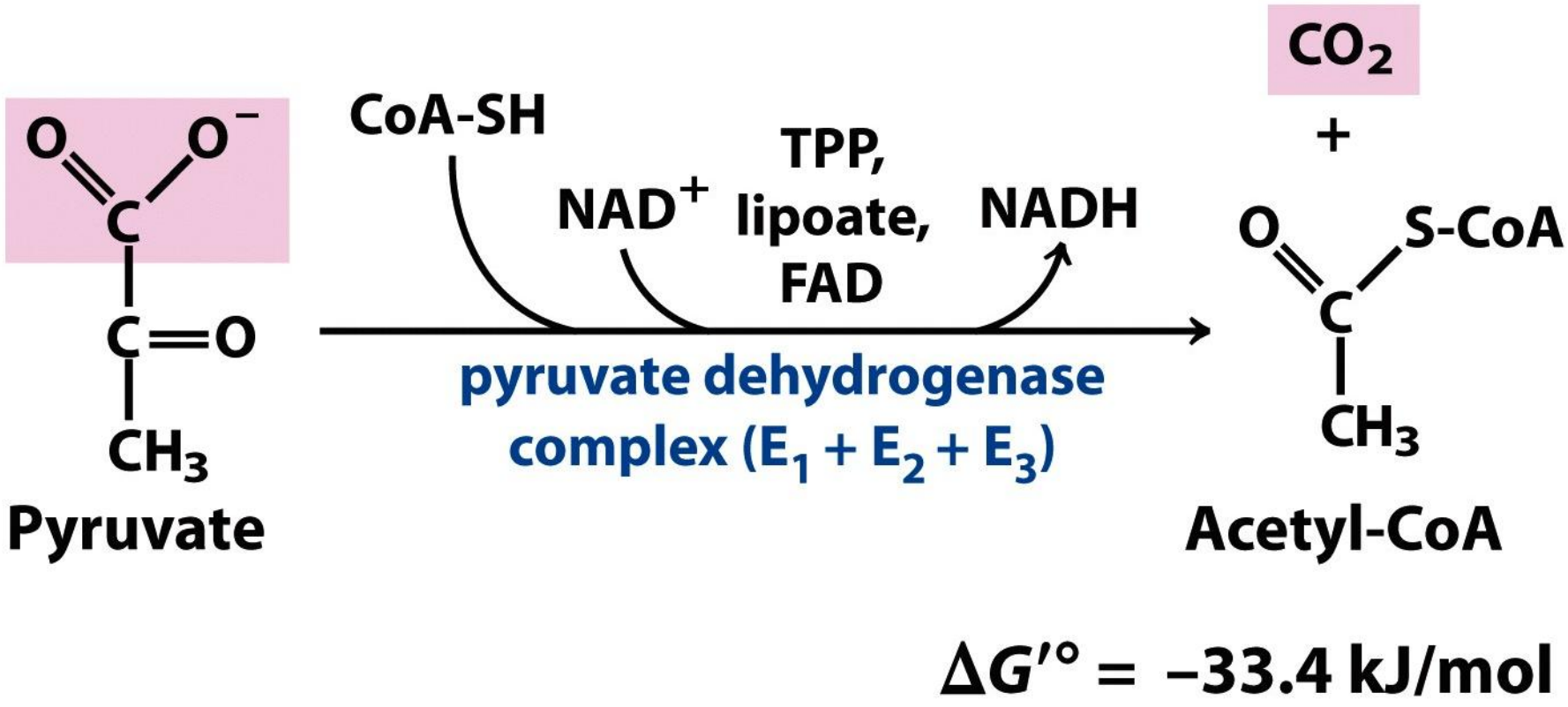


Figure 16-2
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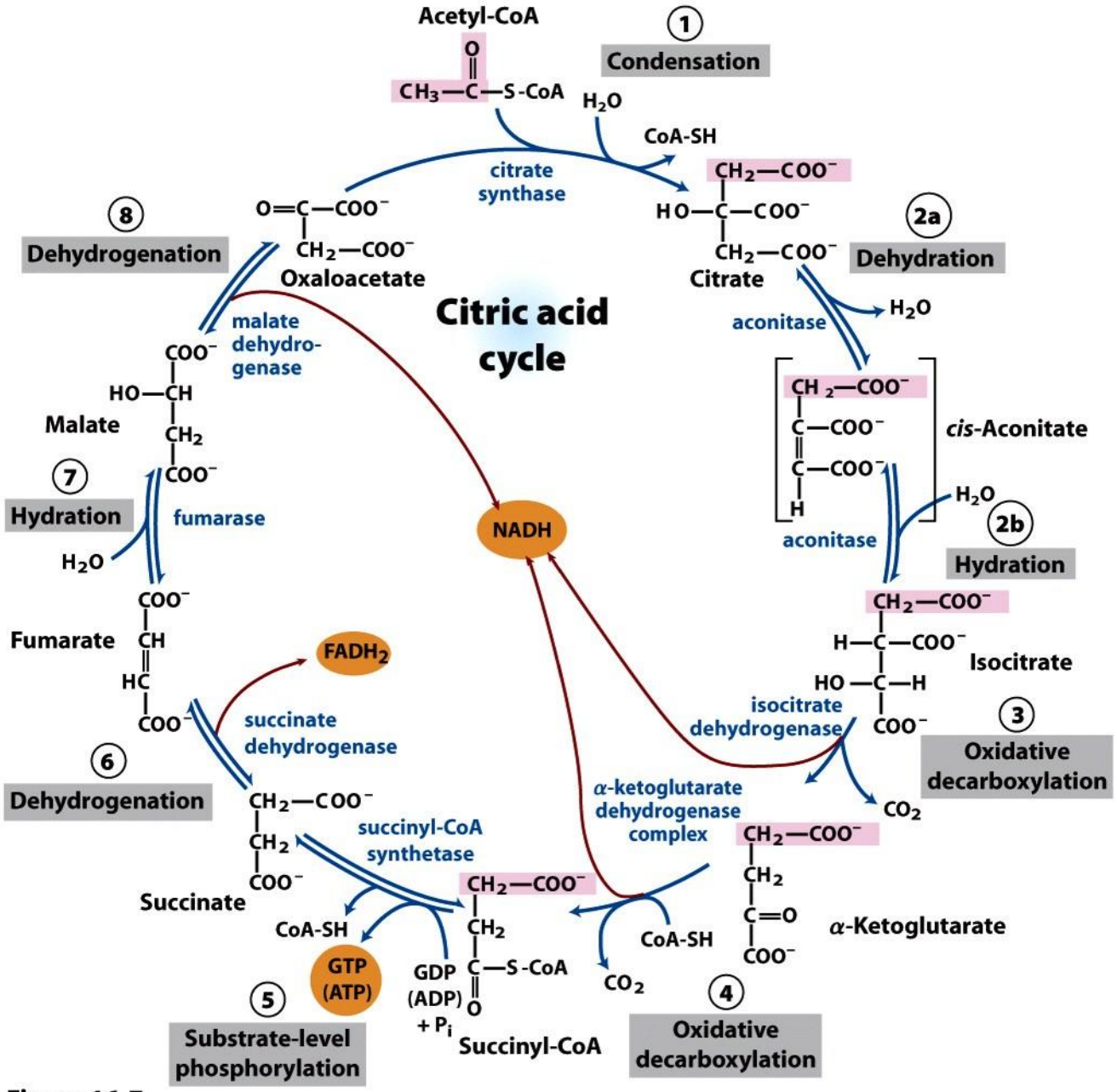

Figure 16-7

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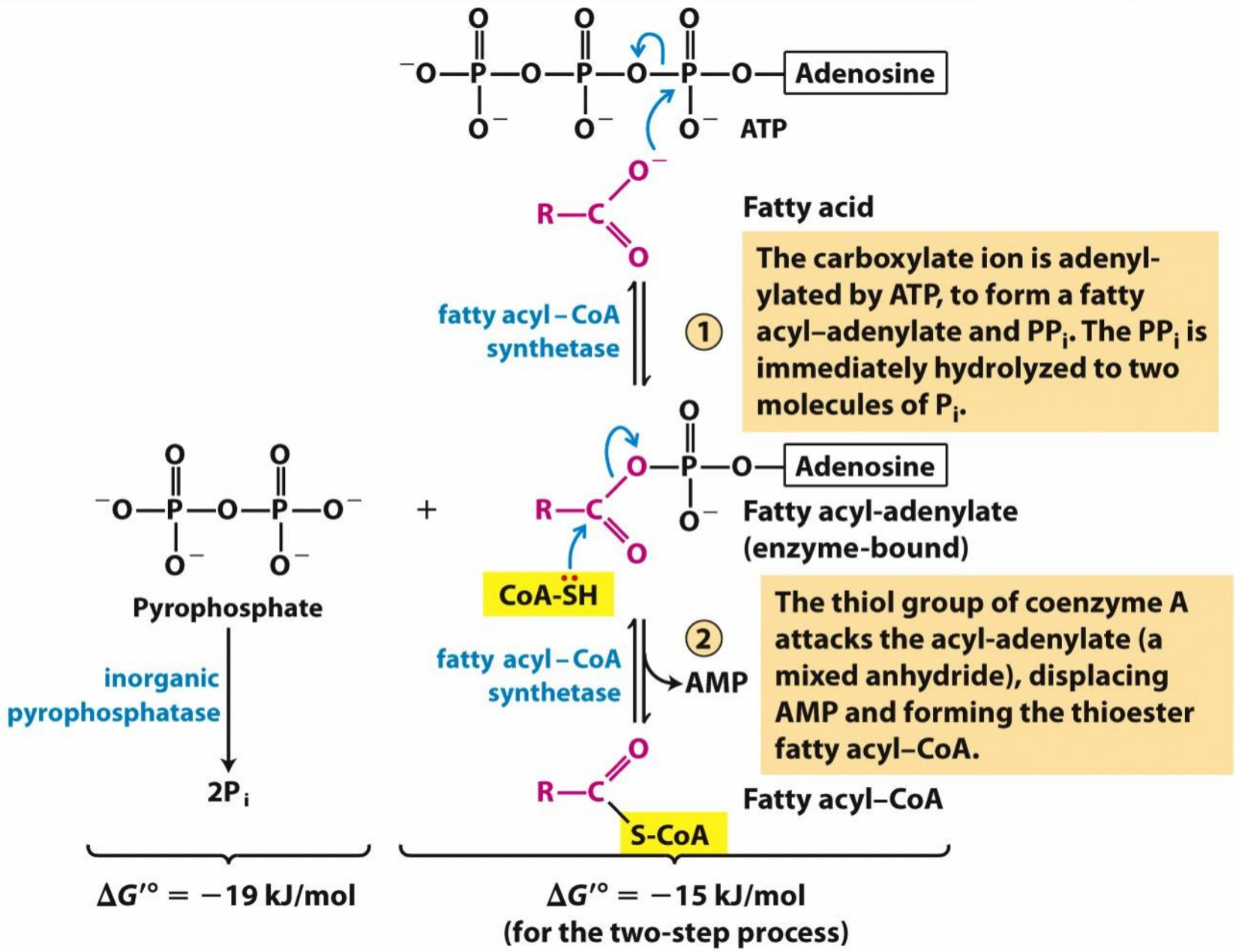

Figure 17-5
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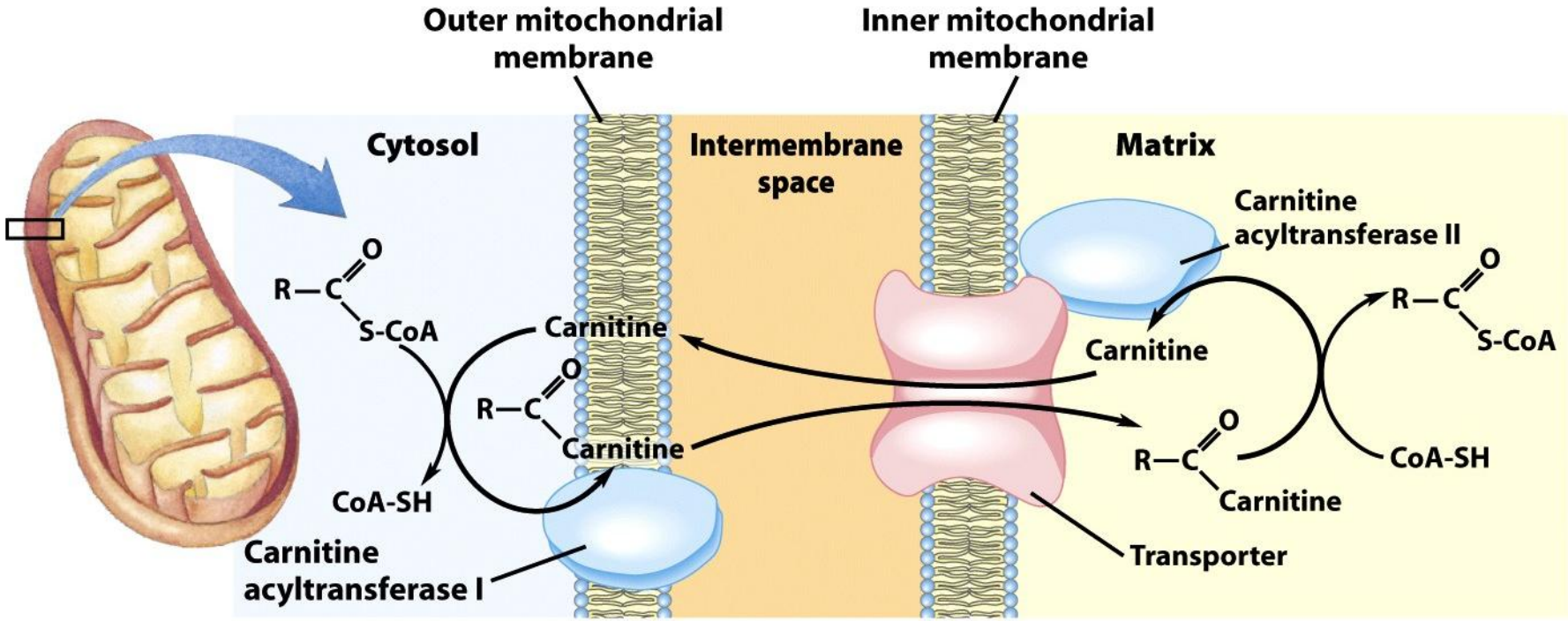

Figure 17-6
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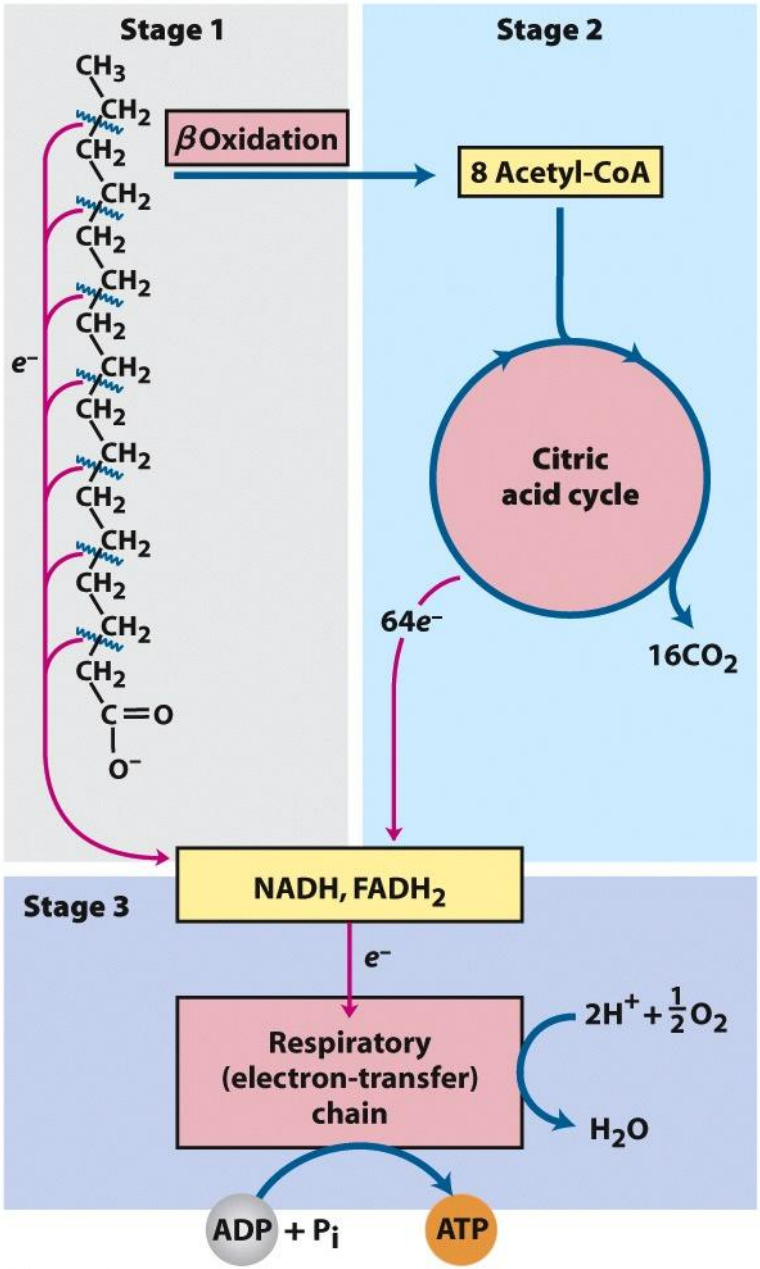

Figure 17-7

Lehninger Principles of Biochemistry, Fifth Edition

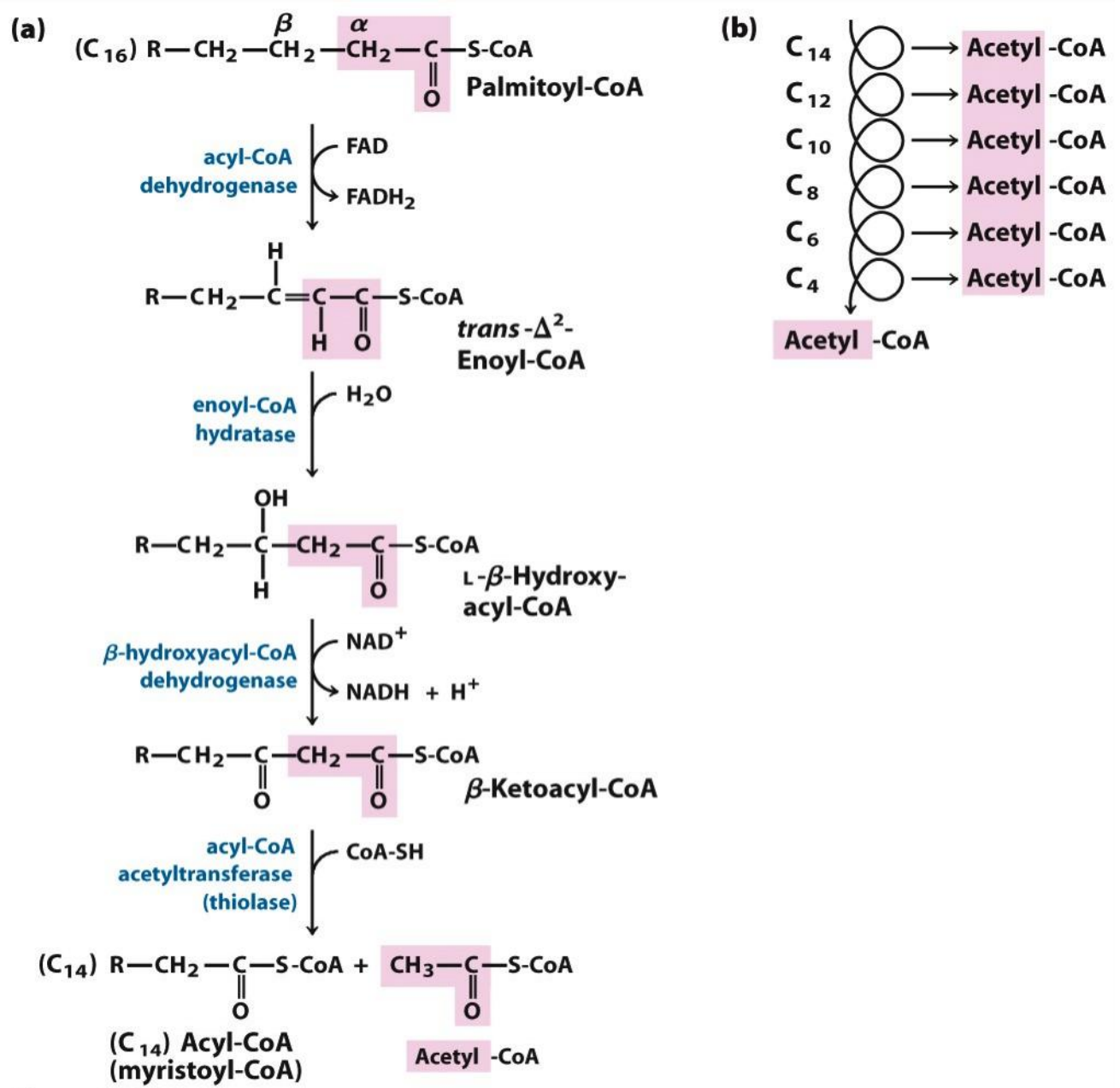

Figure 17-8

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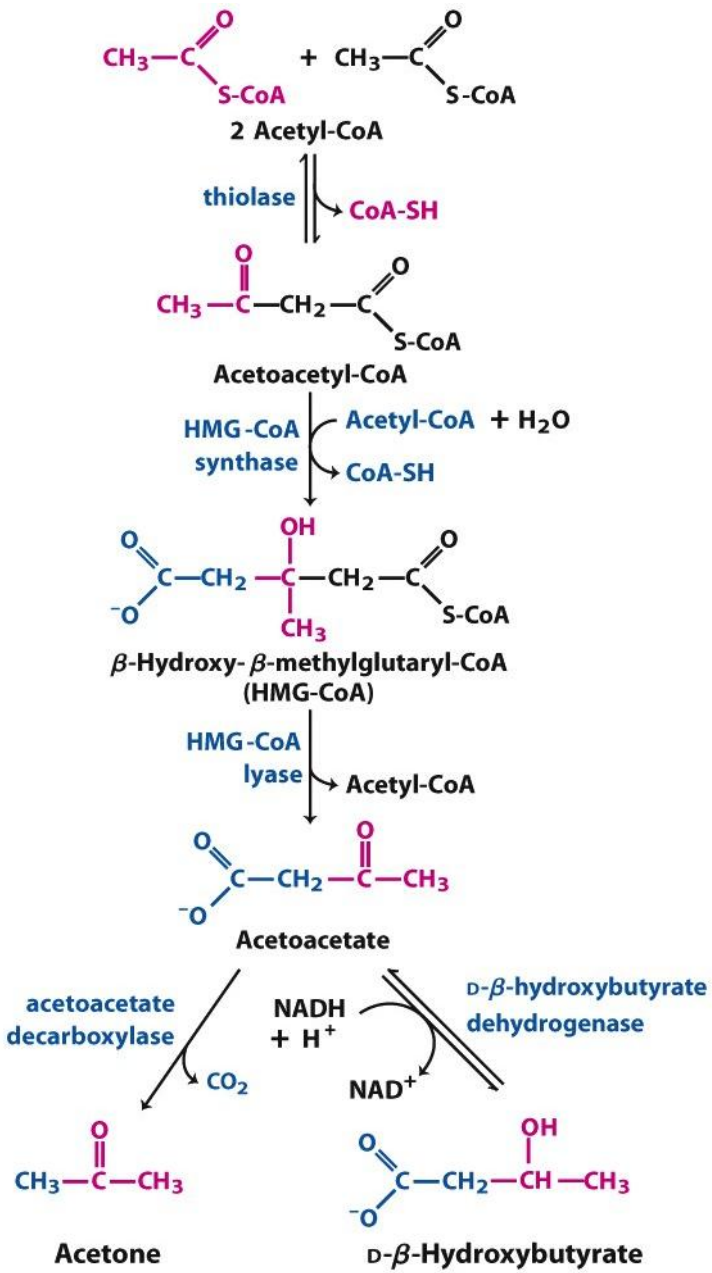

Figure 17-18

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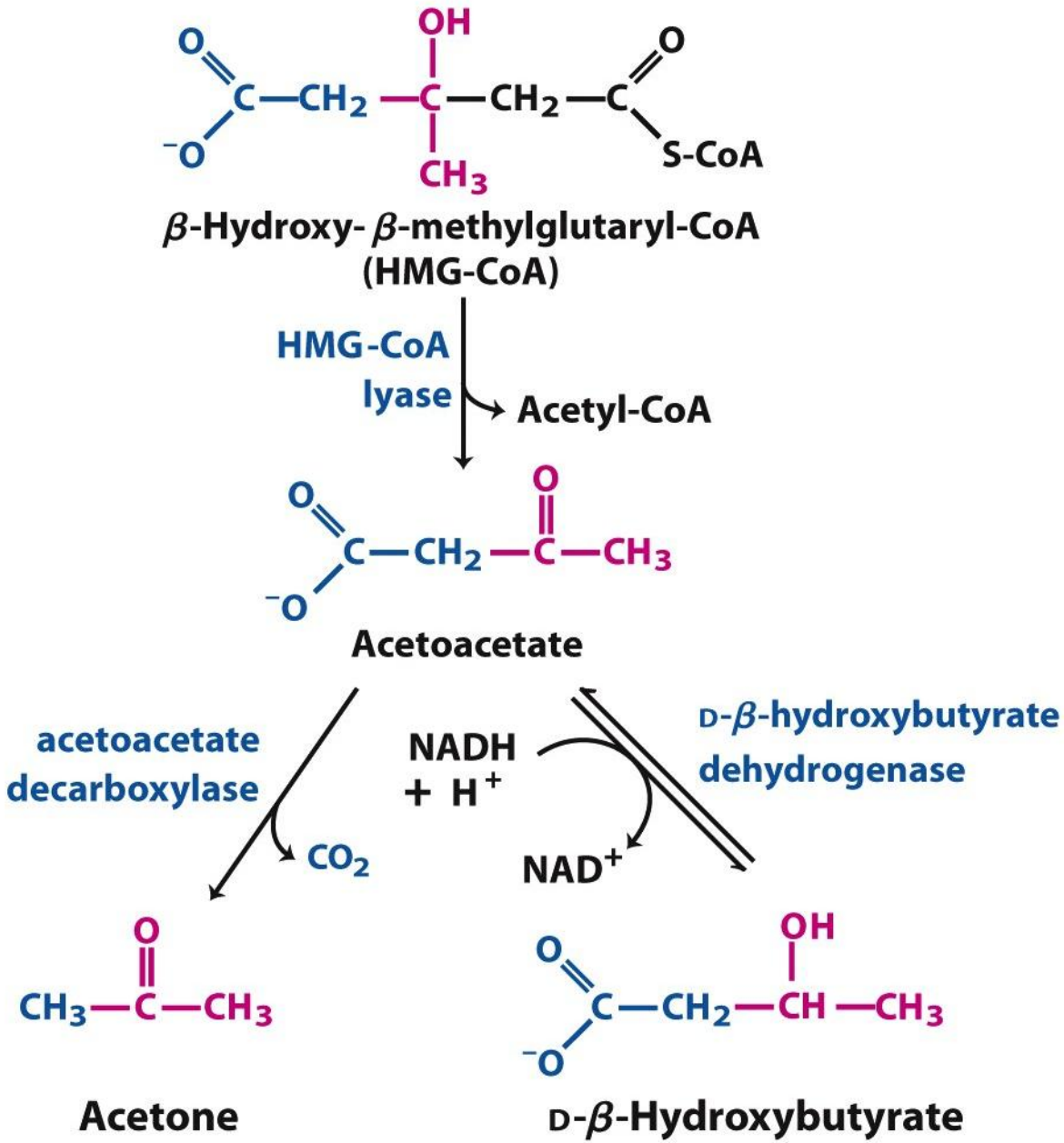

Figure 17-18 part 2
Lehninger Principles of Biochemistry, Fifth Edition

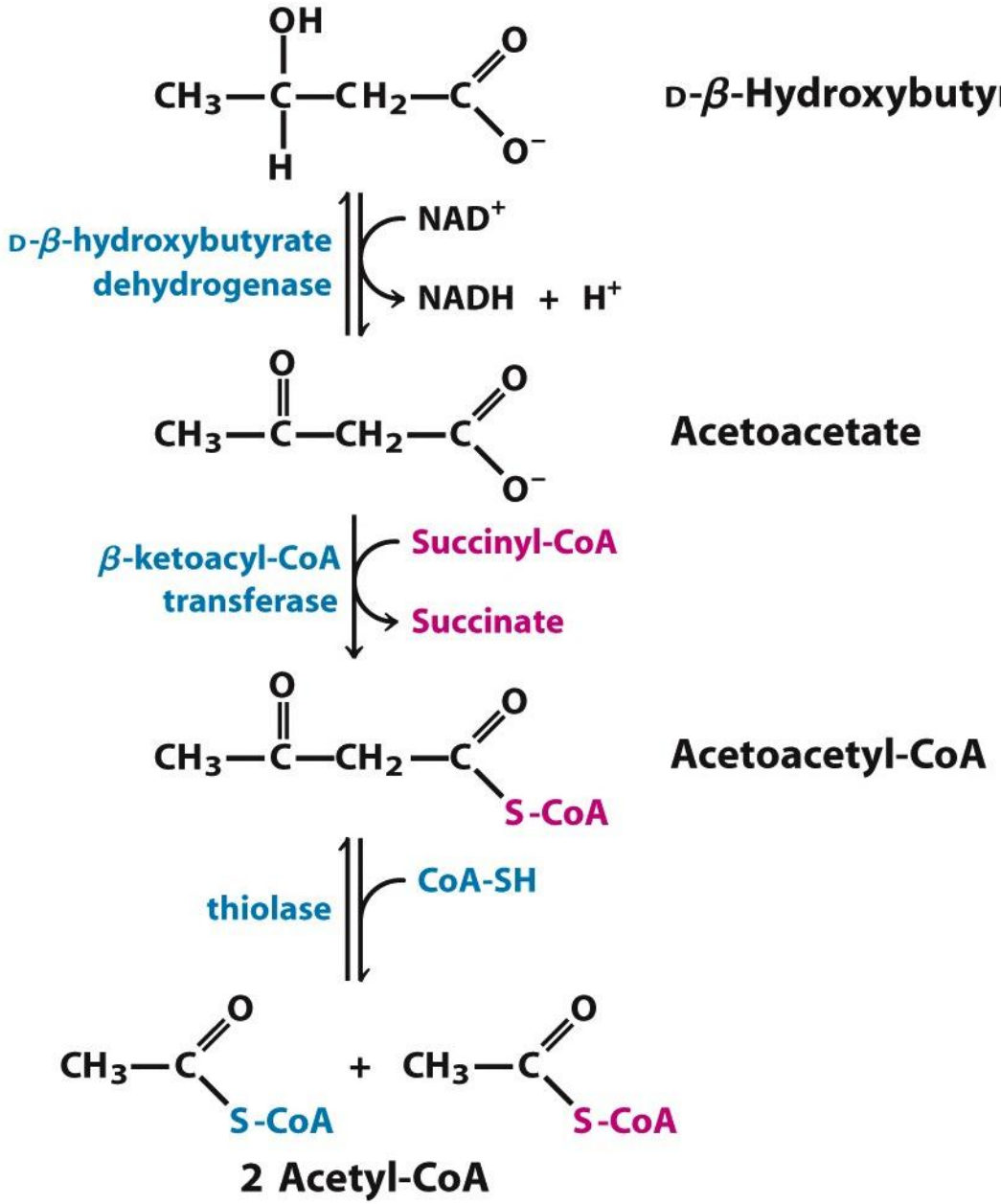

Figure 17-19
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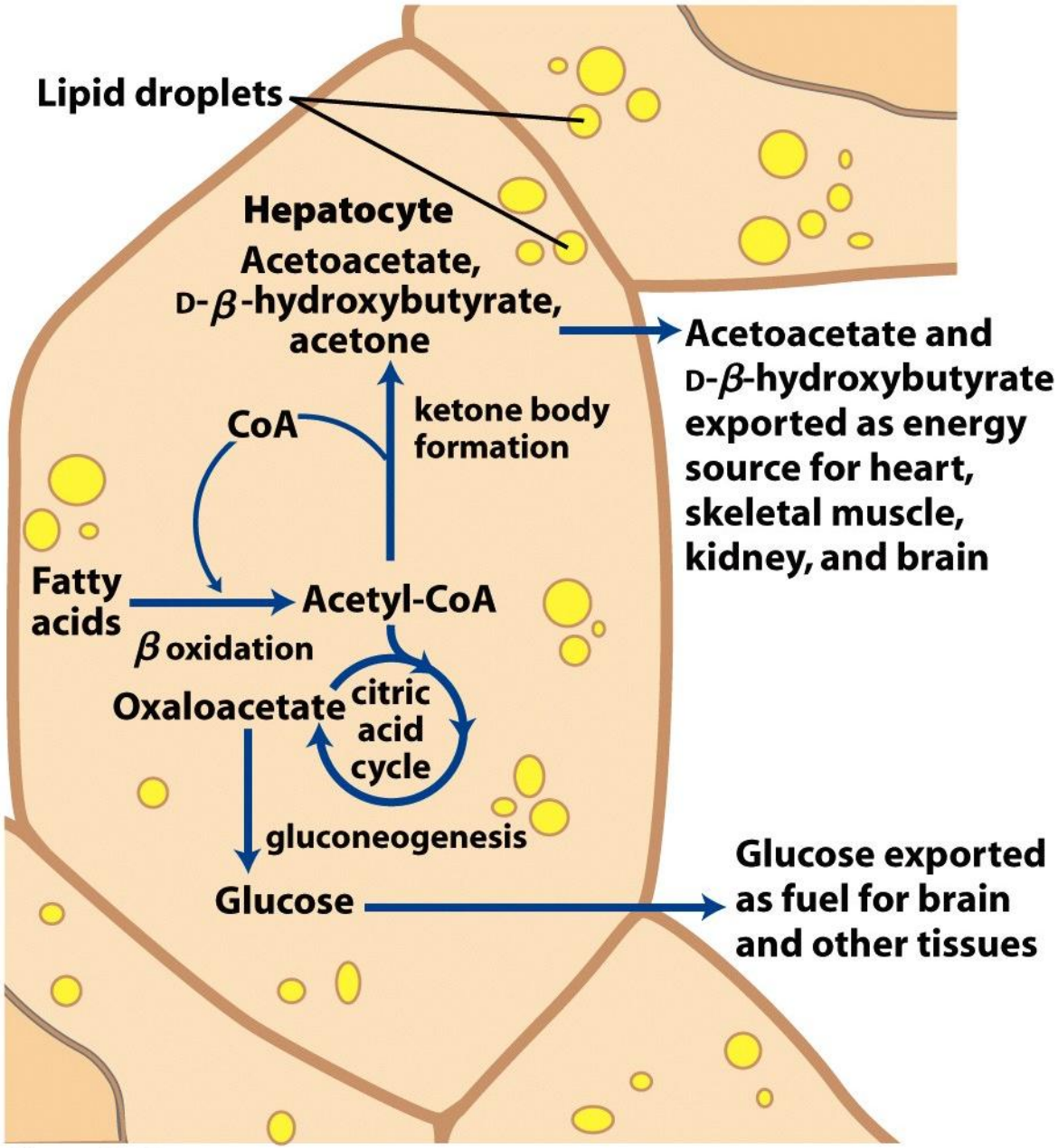

Figure 17-20

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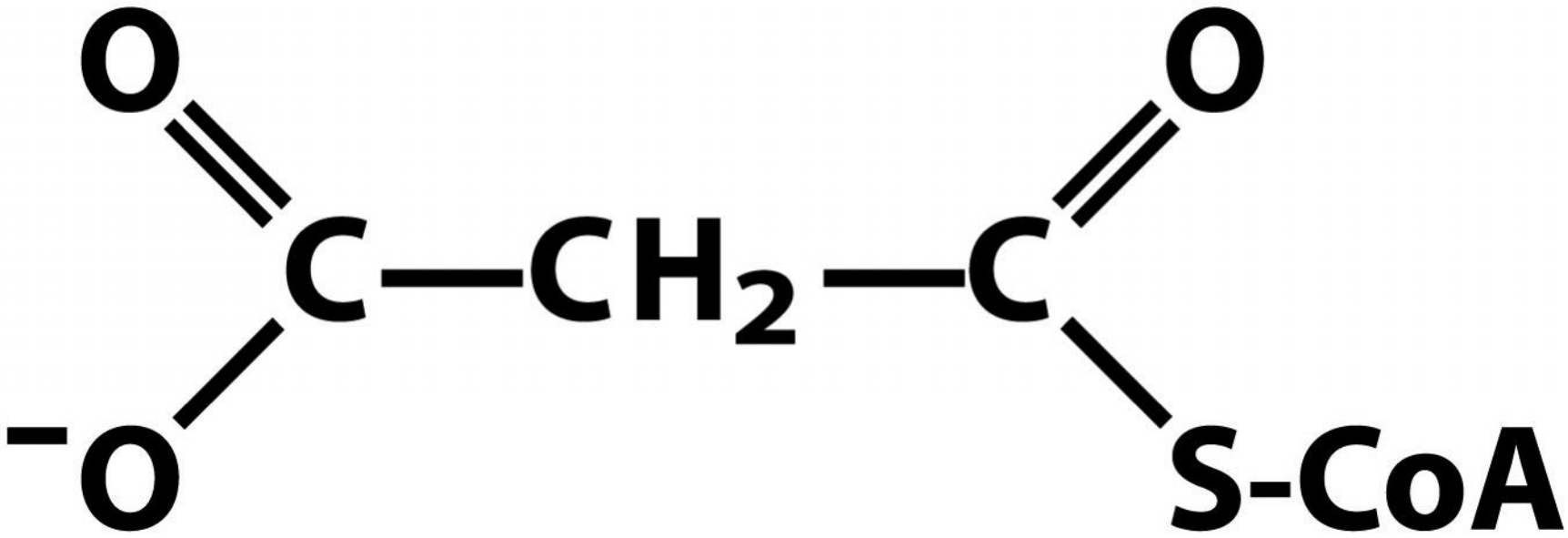

Malonyl-CoA

Unnumbered 21 p805
Lehninger Principles of Biochemistry, Fifth Edition

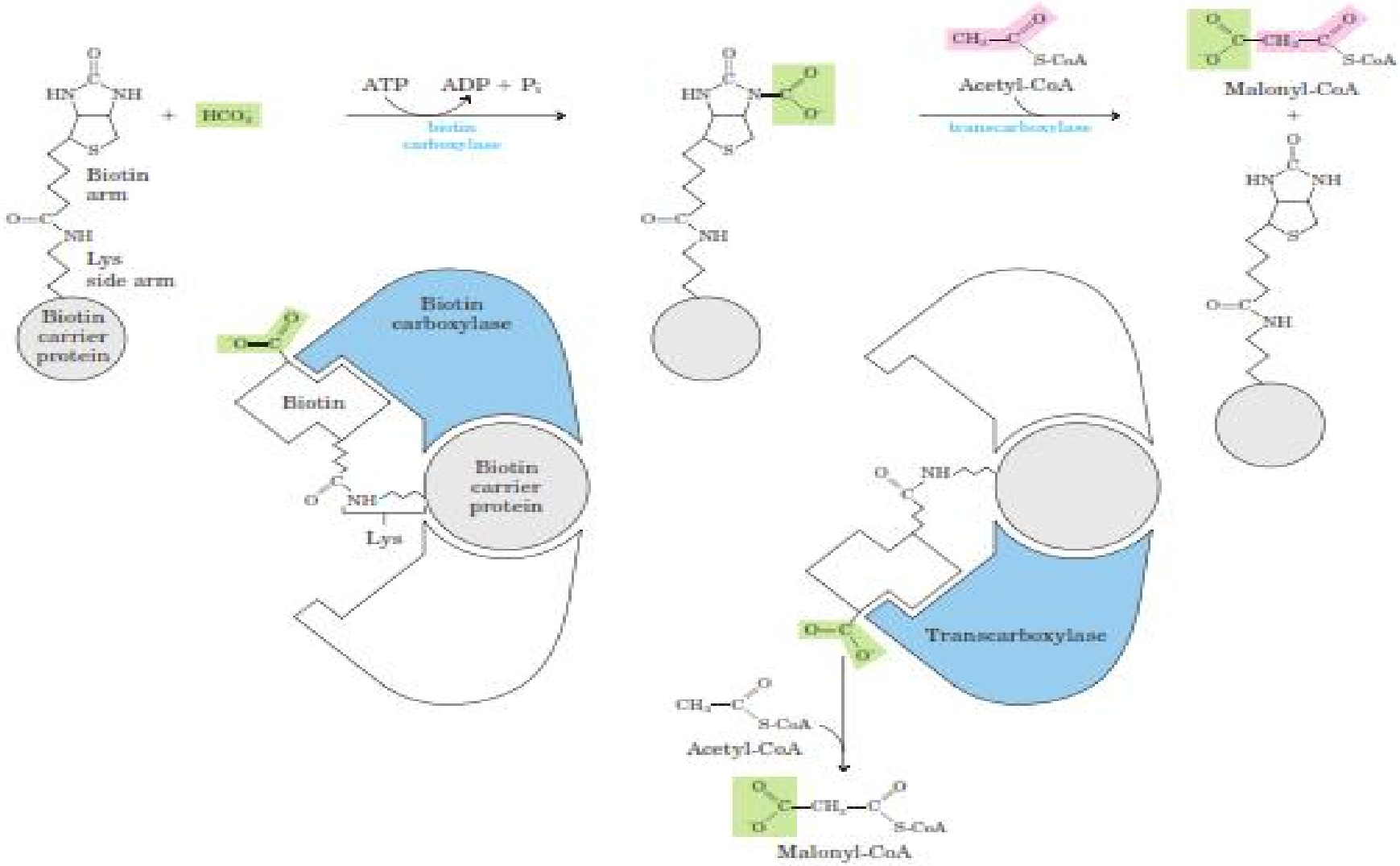

FIGURE 21–1 The acetyl-CoA carboxylase reaction. Acetyl-CoA carboxylase has three functional regions: biotin carrier protein (gray); biotin carboxylase, which activates CO_2 by attaching it to a nitrogen in the biotin ring in an ATP-dependent reaction (see Fig. 16–16); and transcarboxylase, which transfers activated CO_2 (shaded green) from biotin to acetyl-CoA, producing malonyl-CoA. The long, flexible biotin arm carries the activated CO_2 from the biotin carboxylase region to the transcarboxylase active site, as shown in the diagrams below the reaction arrows. The active enzyme in each step is shaded blue.

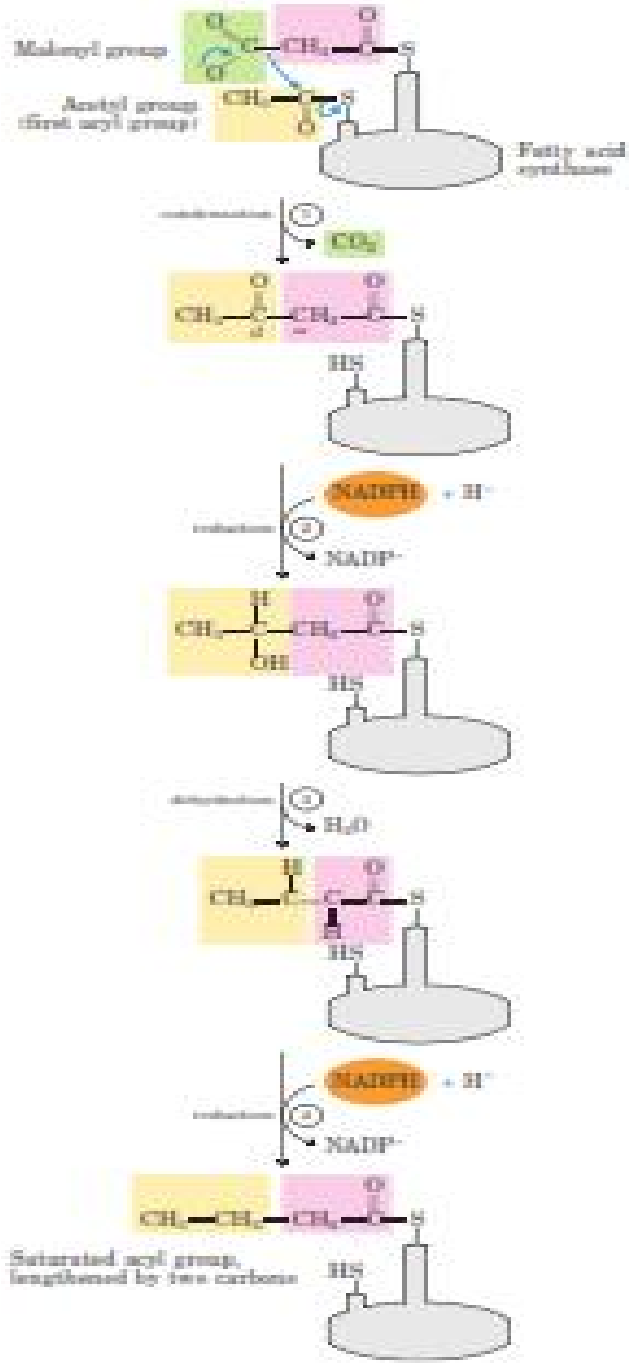

FIGURE 21-2 Addition of two carbons to a growing fatty acyl chain: a four-step sequence. Each malonyl group and acetyl (or longer acyl) group is activated by a thioester that links it to fatty acid synthase, a multienzyme complex described later in the text. (1) Condensation of an activated acyl group (an acetyl group from acetyl-CoA is the first acyl group) and two carbons derived from malonyl-CoA, with elimination of CO_2 from the malonyl group, extends the acyl chain by two carbons. The mechanism of the first step of this reaction is given to illustrate the role of decarboxylation in facilitating condensation. The β-keto product of this condensation is then reduced in three more steps nearly identical to the reactions of β oxidation, but in the reverse sequence: (2) the β-keto group is reduced to an alcohol, (3) elimination of H_2O creates a double bond, and (4) the double bond is reduced to form the corresponding saturated fatty acyl group.

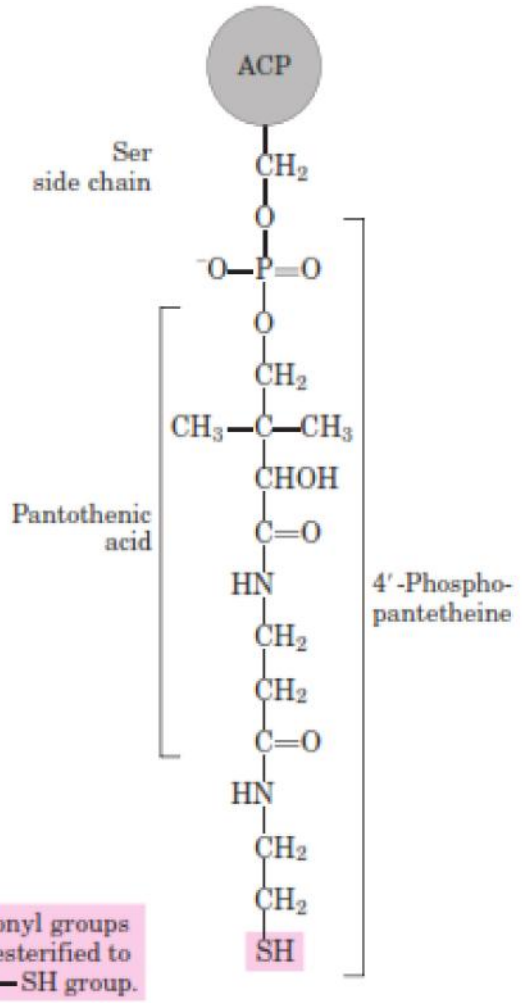

FIGURE 21-4 Acyl carrier protein (ACP). The prosthetic group is 4′-phosphopantetheine, which is covalently attached to the hydroxyl group of a Ser residue in ACP. Phosphopantetheine contains the B vitamin pantothenic acid, also found in the coenzyme A molecule. Its —SH group is the site of entry of malonyl groups during fatty acid synthesis.

FIGURE 21-4 Acyl carrier protein (ACP). The prosthetic group is 4′-phosphopantetheine, which is covalently attached to the hydroxyl group of a Ser residue in ACP. Phosphopantetheine contains the B vitamin pantothenic acid, also found in the coenzyme A molecule. Its —SH group is the site of entry of malonyl groups during fatty acid synthesis.

Deficiency

- No deficiency observed in humans (as it is widely distributed in foods & syn. By intestinal bacteria)
- Experimental deficiency in human volunteers: GIT disturbances, fatigue, mental symptoms

References:

- Nelson, D.L and M.M. Cox. 2013. Lehninger Principles of Biochemistry. 6th Ed. Worth Publishers, NY.
- Chatterjee, M. N. and R. Shinde. 2007. Textbook of Medical Biochemistry. 7th Ed (Indian Edition). Jaypee Brothers, Medical Publishers (P) Ltd, New Delhi, India.