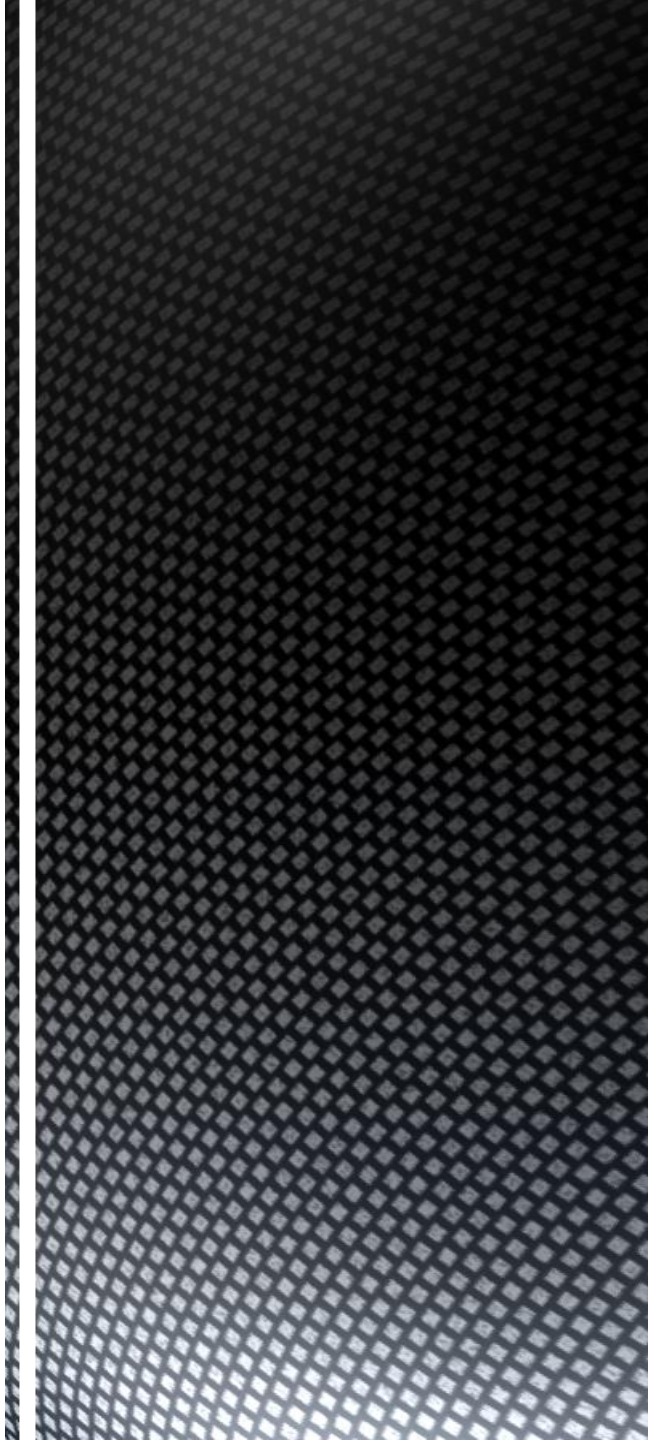
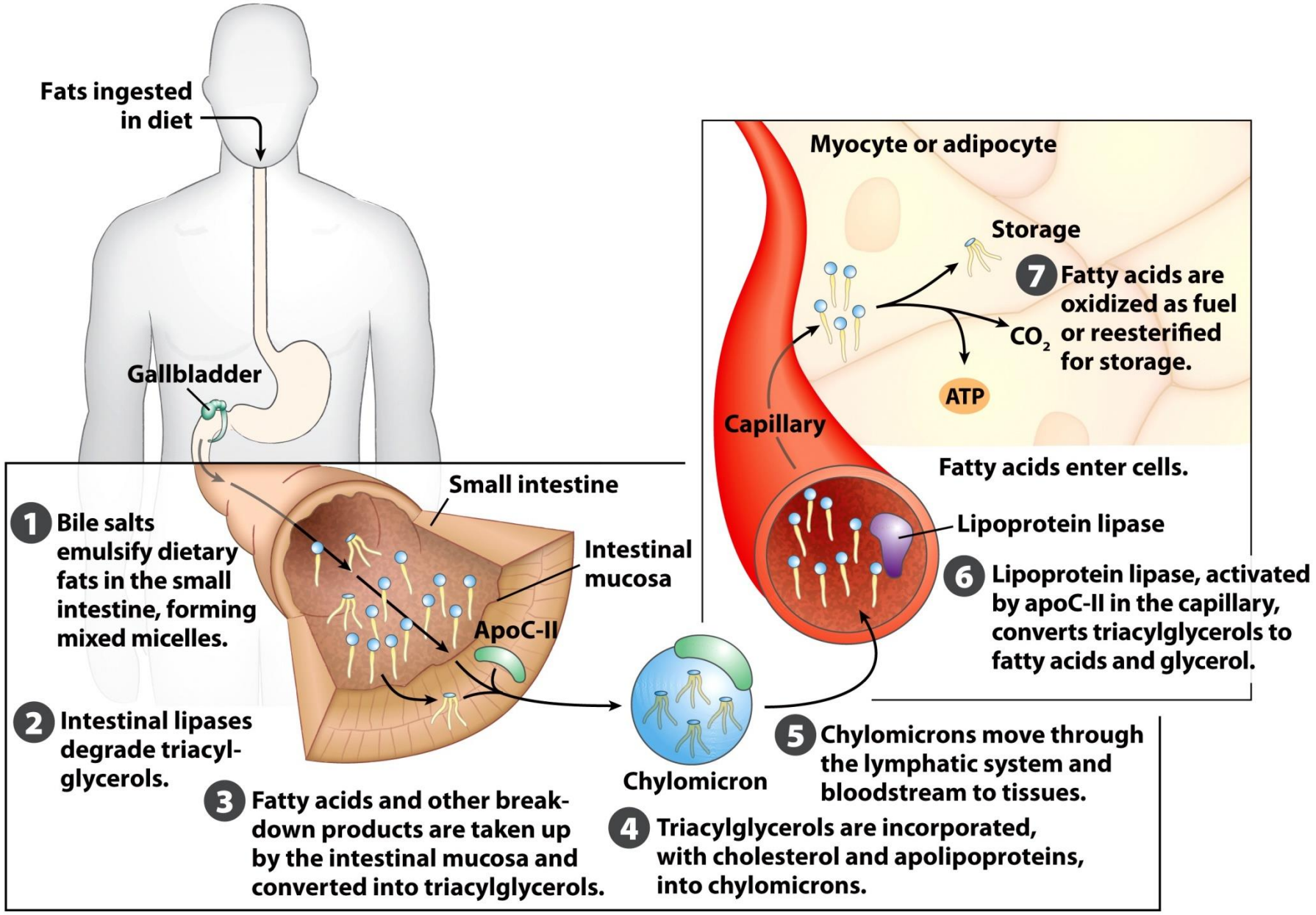
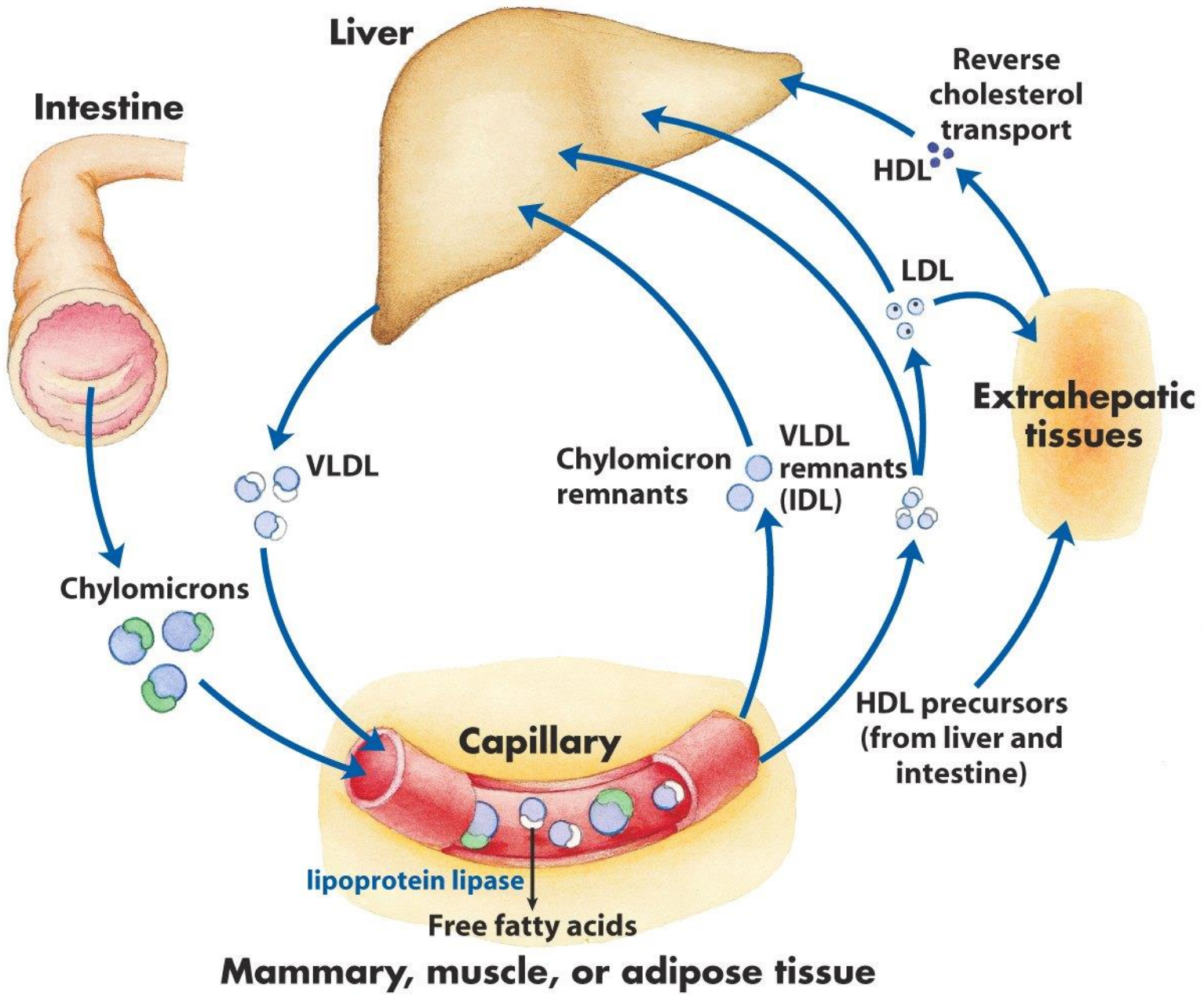
Lipid metabolism I.



Processing of dietary lipids



Lipid and cholesterol transport



Major classes of human plasma lipoproteins

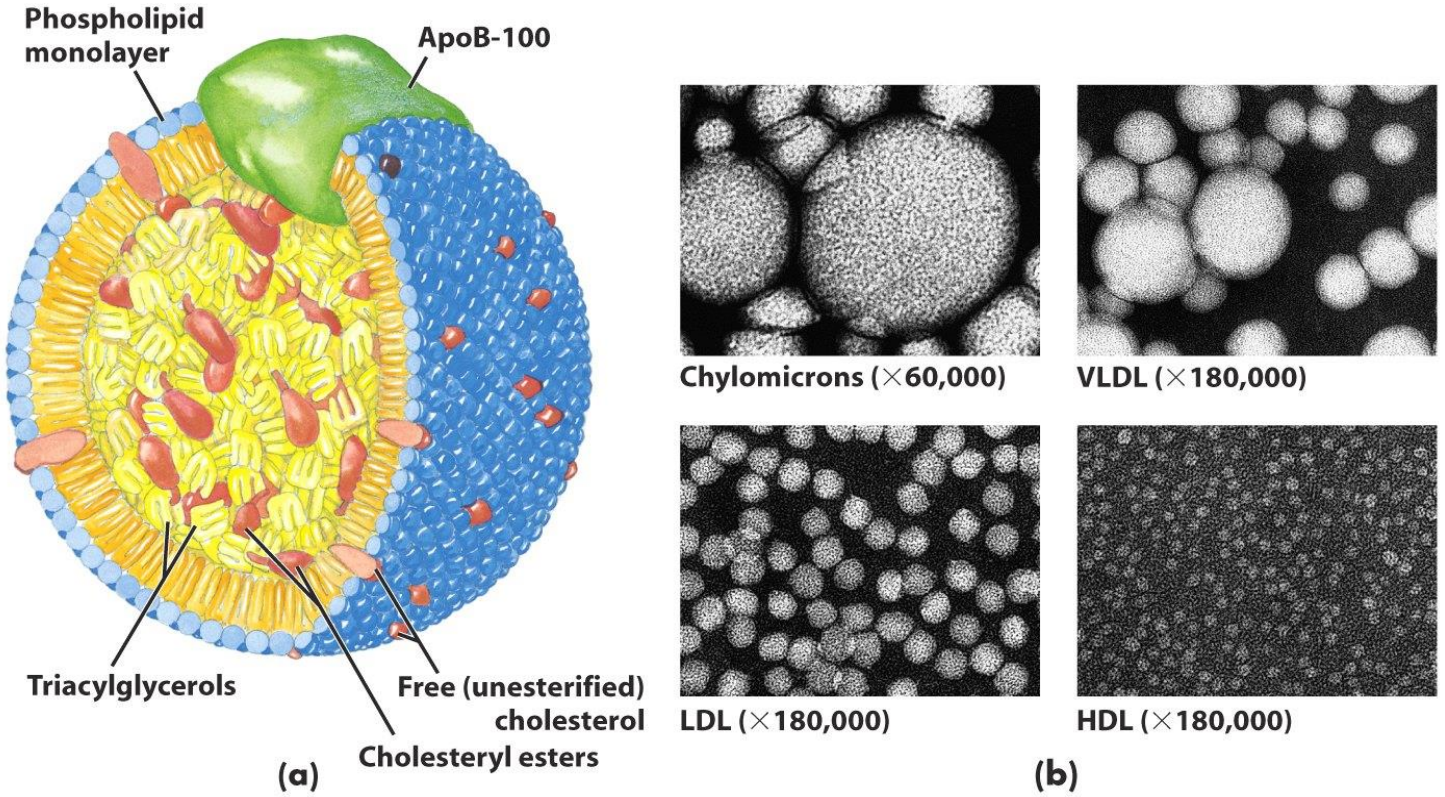
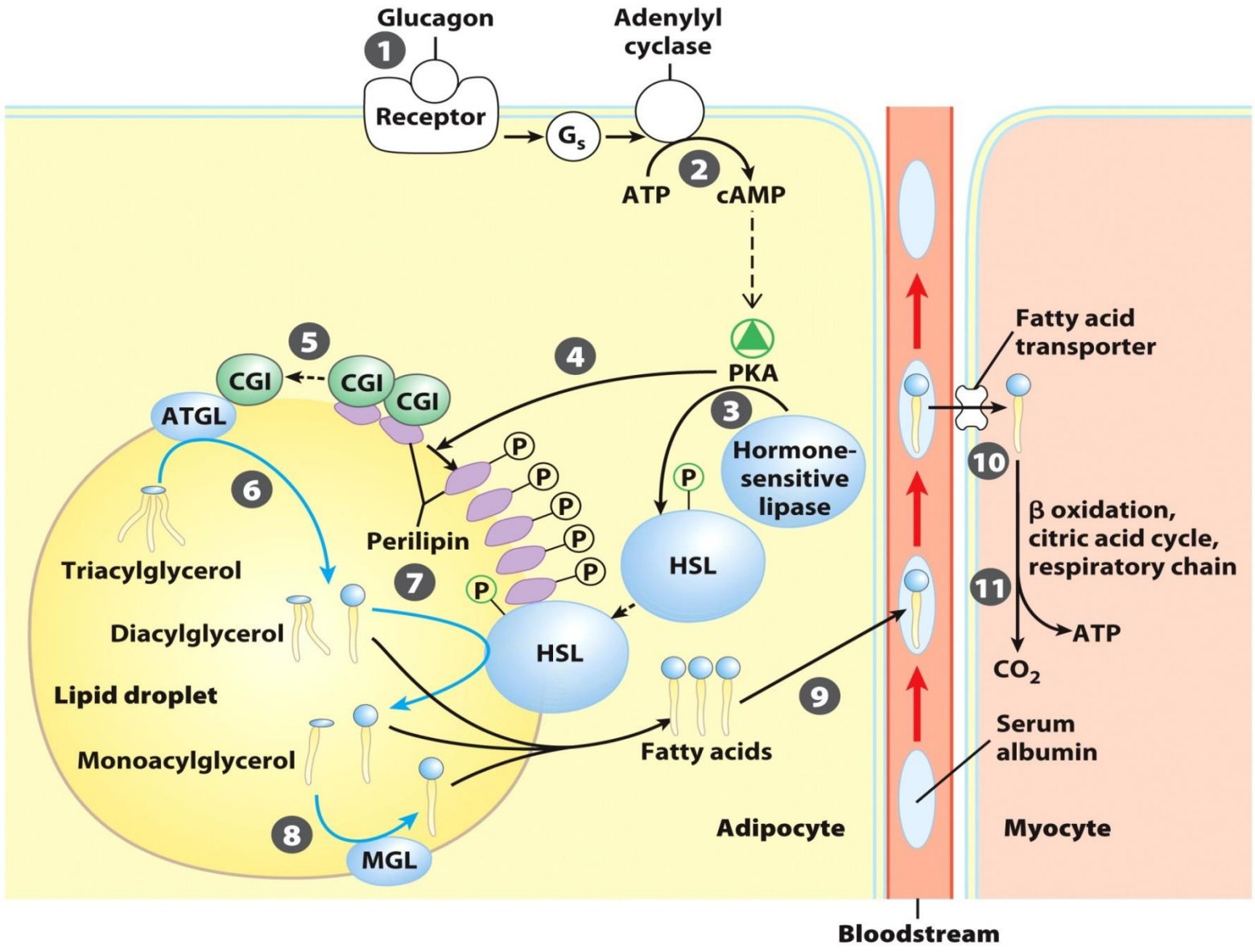


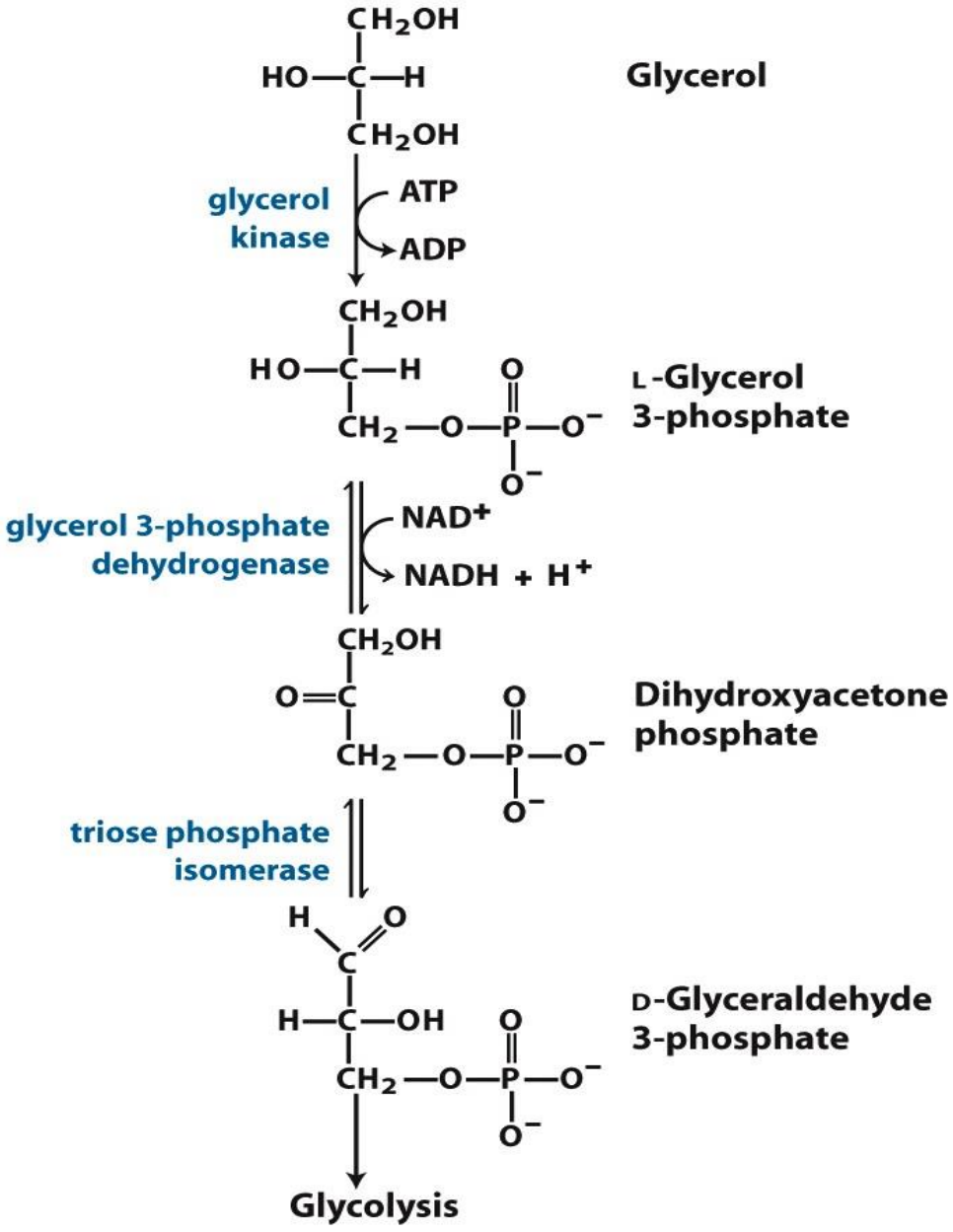
TABLE 21–2 Major Classes of Human Plasma Lipoproteins: Some Properties

		Composition (wt %)				
Lipoprotein	*Density (g/mL)*	*Protein*	*Phospholipids*	*Free cholesterol*	*Cholesteryl esters*	*Triacylglycerols*
Chylomicrons	<1.006	2	9	1	3	85
VLDL	0.95–1.006	10	18	7	12	50
LDL	1.006–1.063	23	20	8	37	10
HDL	1.063–1.210	55	24	2	15	4

Mobilization of triacylglycerols

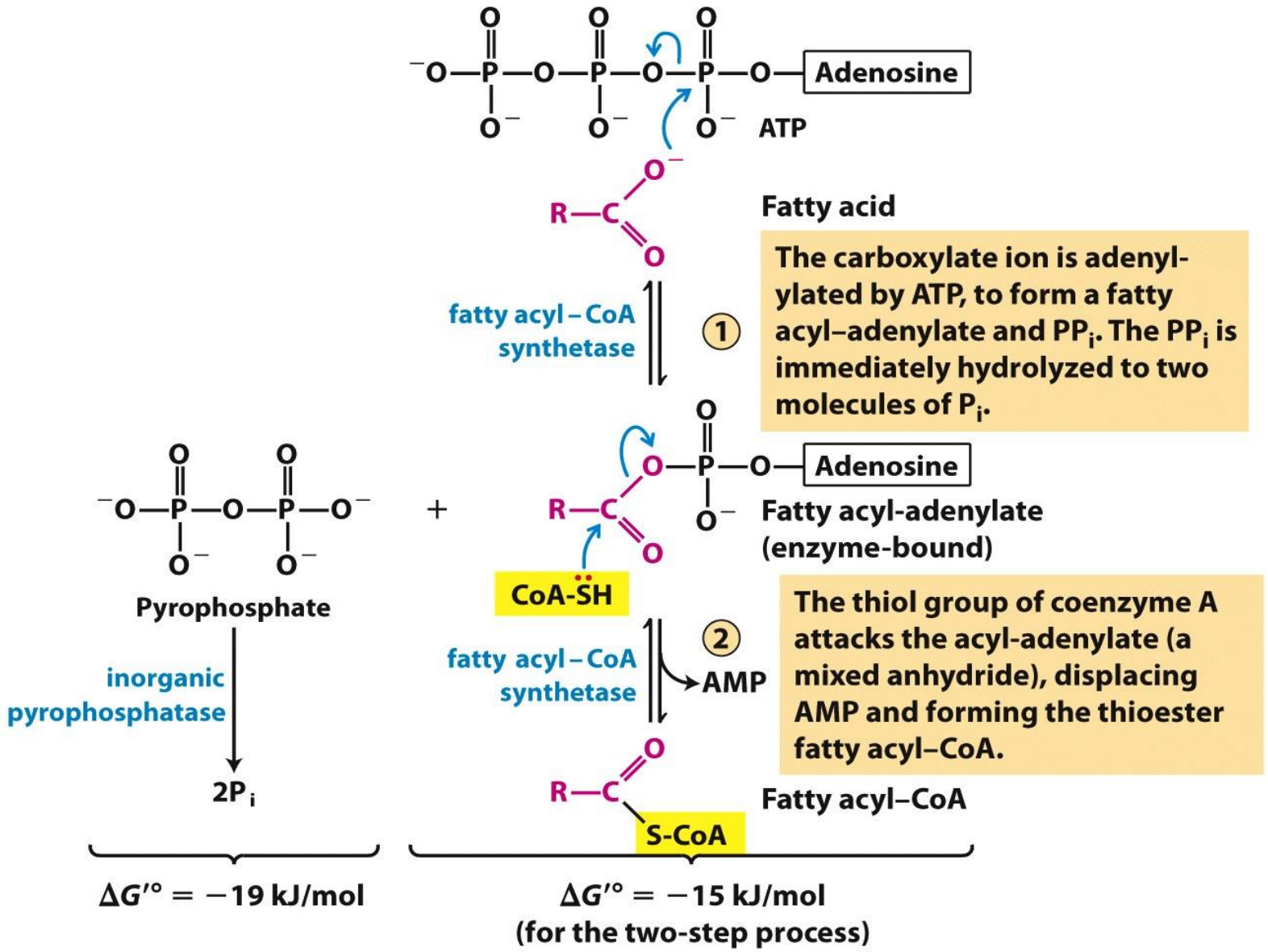


Entry of glycerol into glycolysis

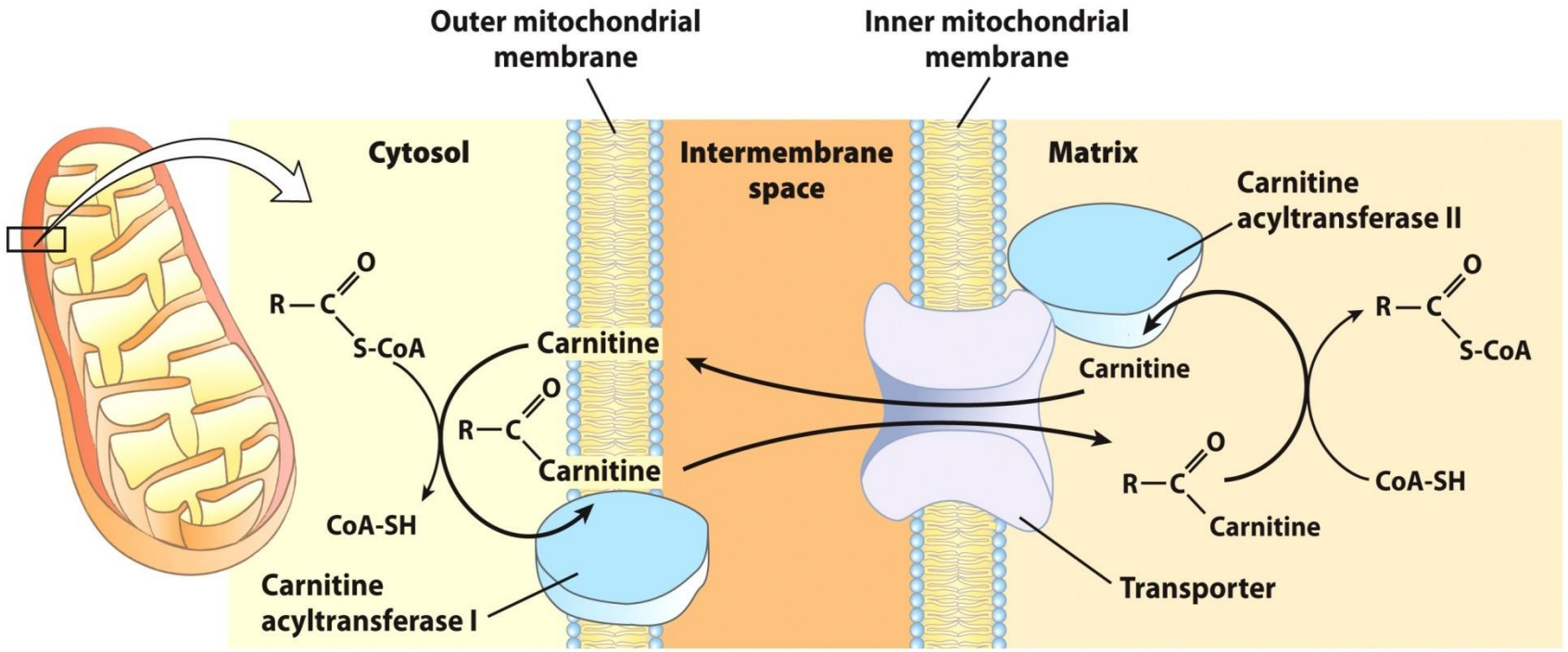


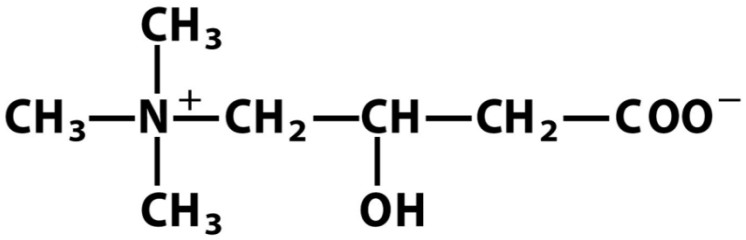
About 95% of the biologically available energy of triacylglycerols resides in their three long-chain fatty acids; only 5% is contributed by the glycerol moiety.

Activation of fatty acids



Fatty acid entry into mitochondrion





Carnitine

Stages of fatty acid oxidation

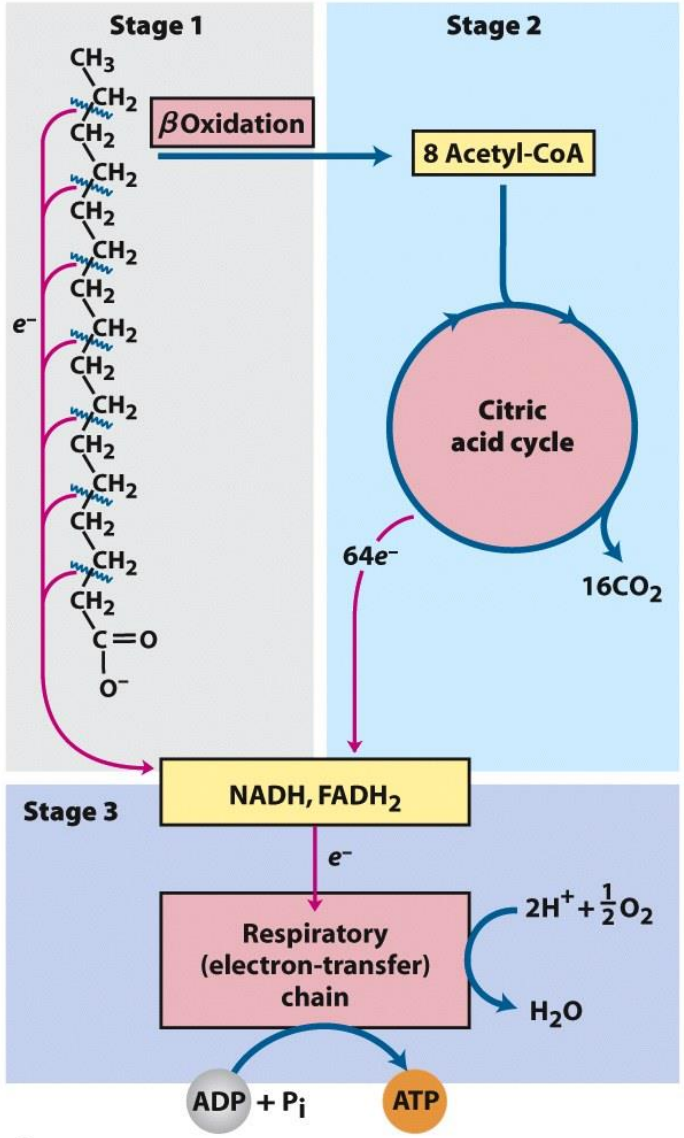
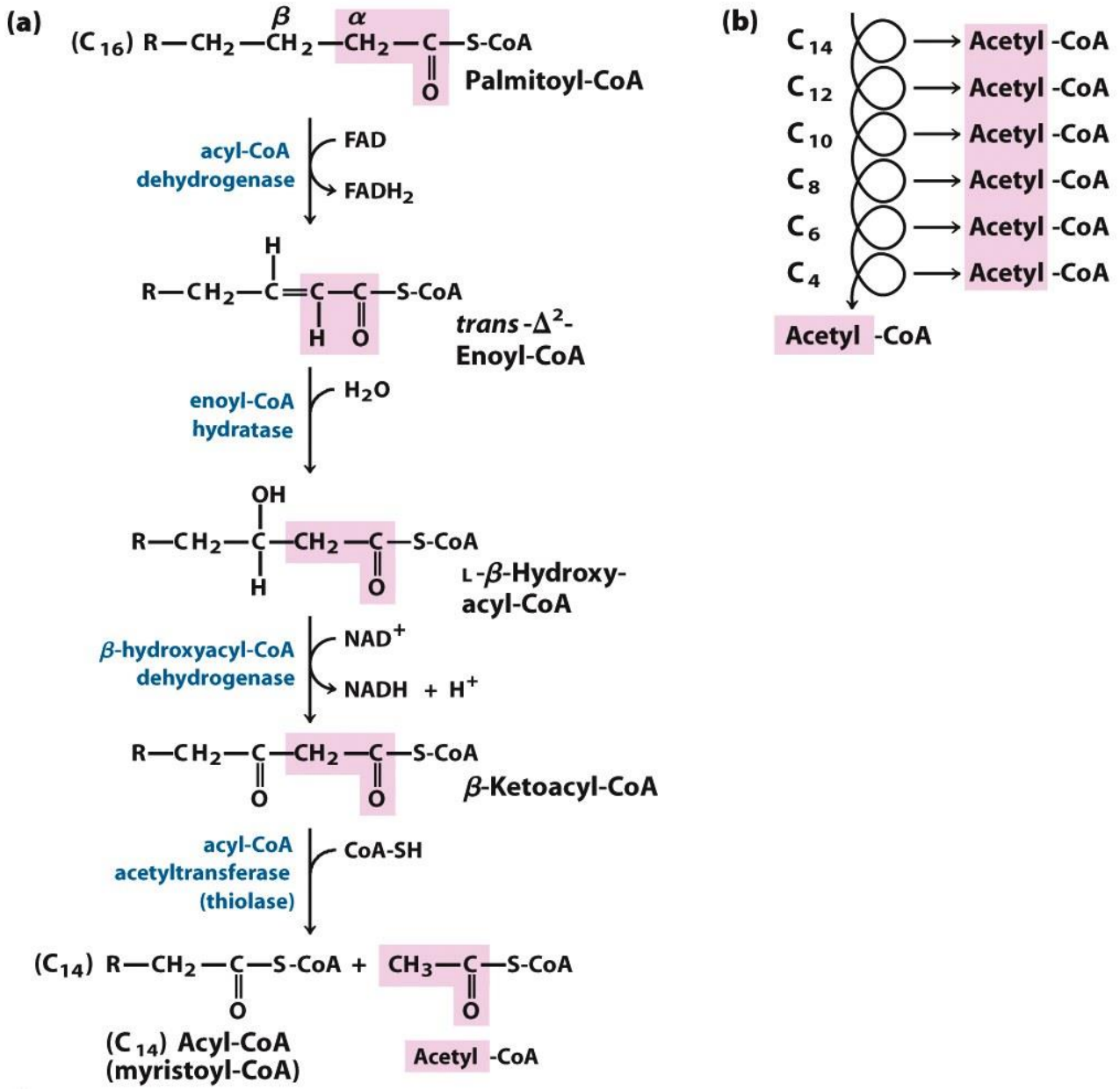


Figure 17-7
Lehninger Principles of Biochemistry, Fifth Edition

Reactions of β-oxidation



ATP yield of palmitoyl-CoA oxidation

palmitoyl-CoA + 23 O_2 + 108 P_i + 108 ADP → CoA + 108 ATP + 16 CO_2 + 23 H_2O

TABLE 17–1 Yield of ATP during Oxidation of One Molecule of Palmitoyl-CoA to CO_2 and H_2O

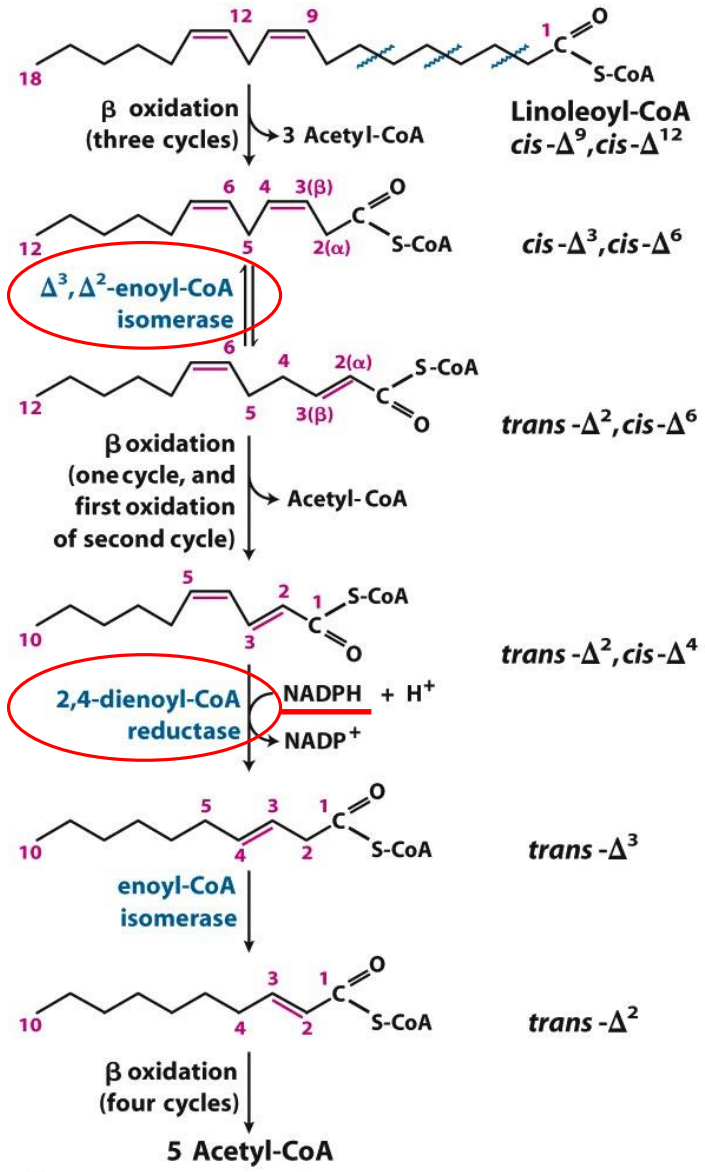
Enzyme catalyzing the oxidation step	Number of NADH or $FADH_2$ formed	Number of ATP ultimately formed*
Acyl-CoA dehydrogenase	7 $FADH_2$	10.5
β-Hydroxyacyl-CoA dehydrogenase	7 NADH	17.5
Isocitrate dehydrogenase	8 NADH	20
α-Ketoglutarate dehydrogenase	8 NADH	20
Succinyl-CoA synthetase		8†
Succinate dehydrogenase	8 $FADH_2$	12
Malate dehydrogenase	8 NADH	20
Total		108

*These calculations assume that mitochondrial oxidative phosphorylation produces 1.5 ATP per $FADH_2$ oxidized and 2.5 ATP per NADH oxidized.

†GTP produced directly in this step yields ATP in the reaction catalyzed by nucleoside diphosphate kinase (p. 510).

The energetic cost of activating a fatty acid is equivalent to two ATP, and the net gain per molecule of palmitate is 106 ATP.

Oxidation of polyunsaturated fatty acids



Oxidation of odd-number fatty acids

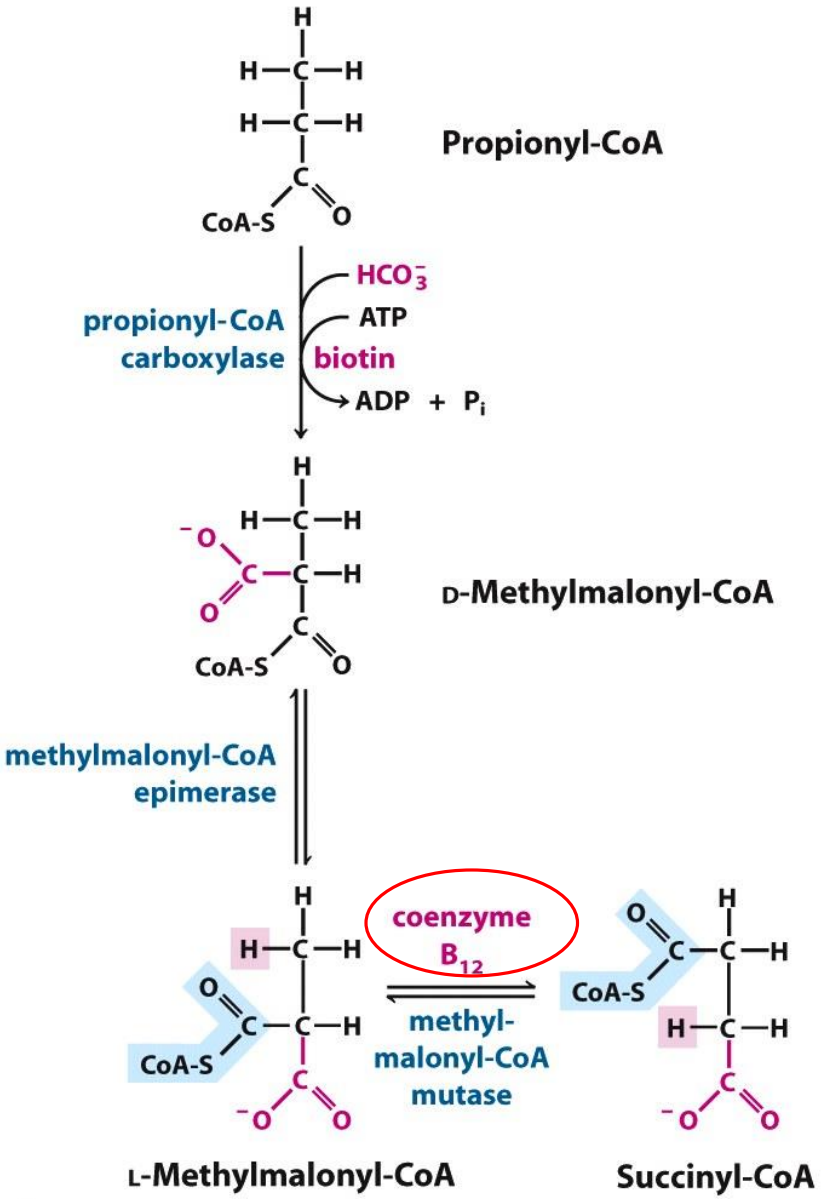
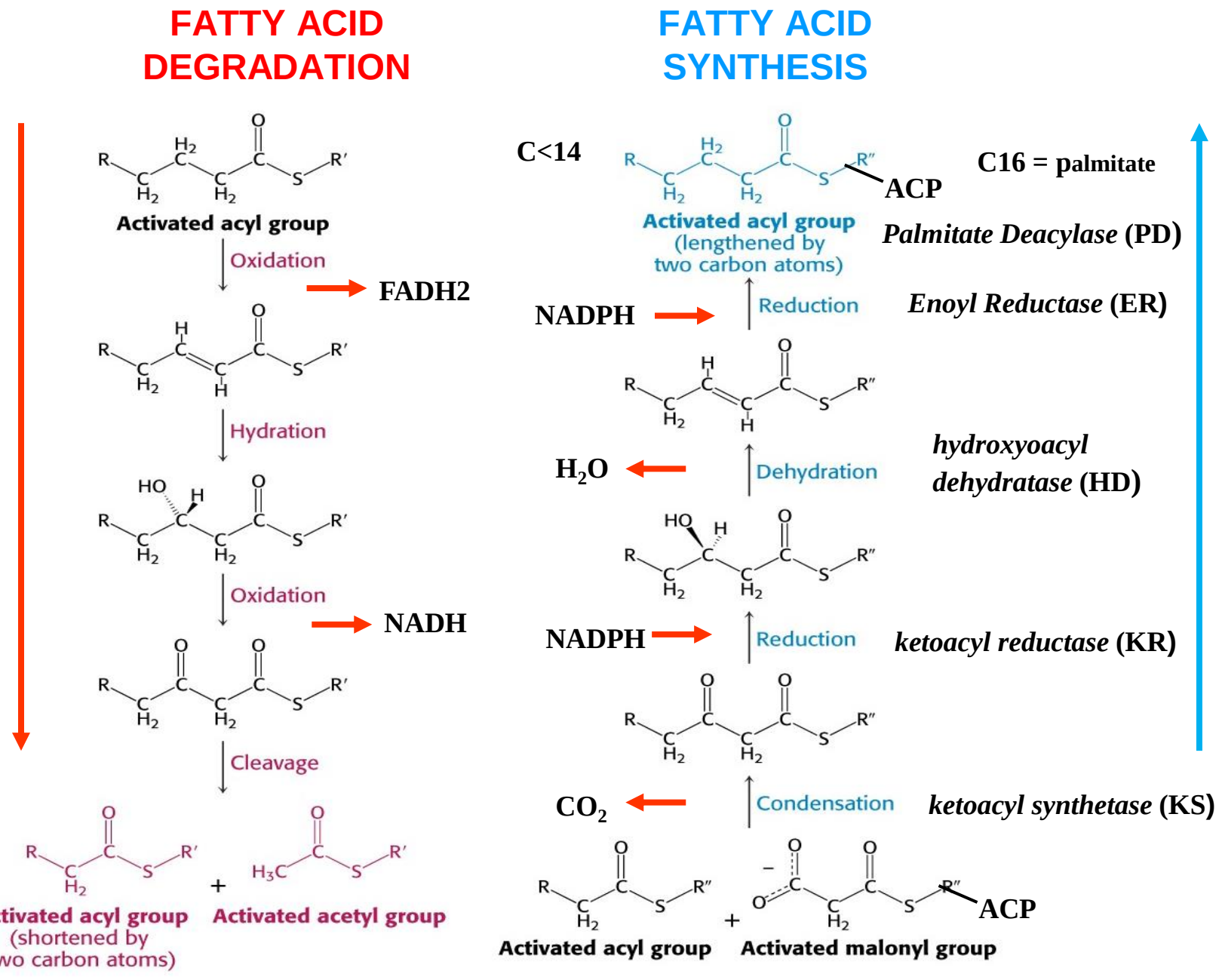
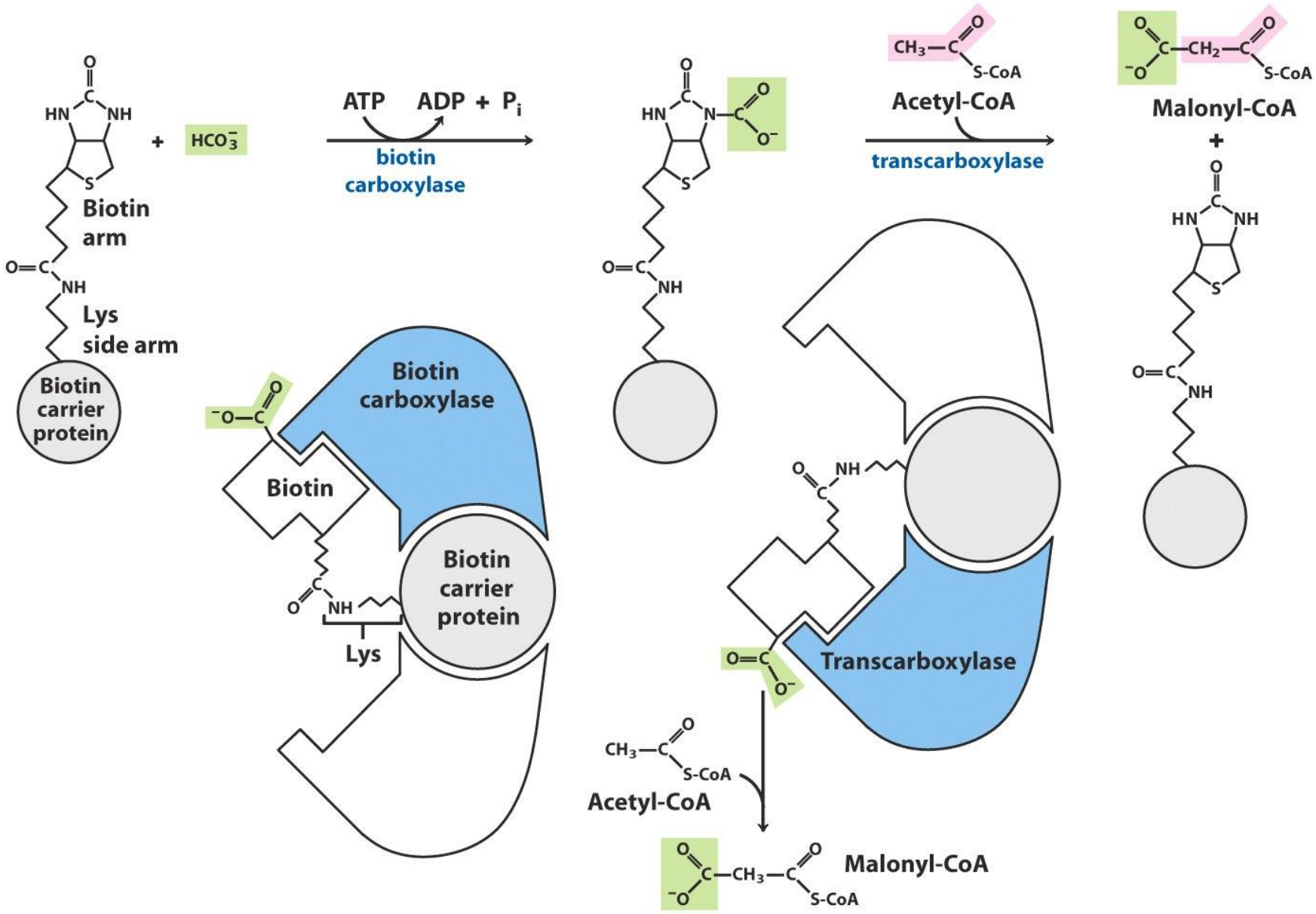


Figure 17-11
Lehninger Principles of Biochemistry, Fifth Edition

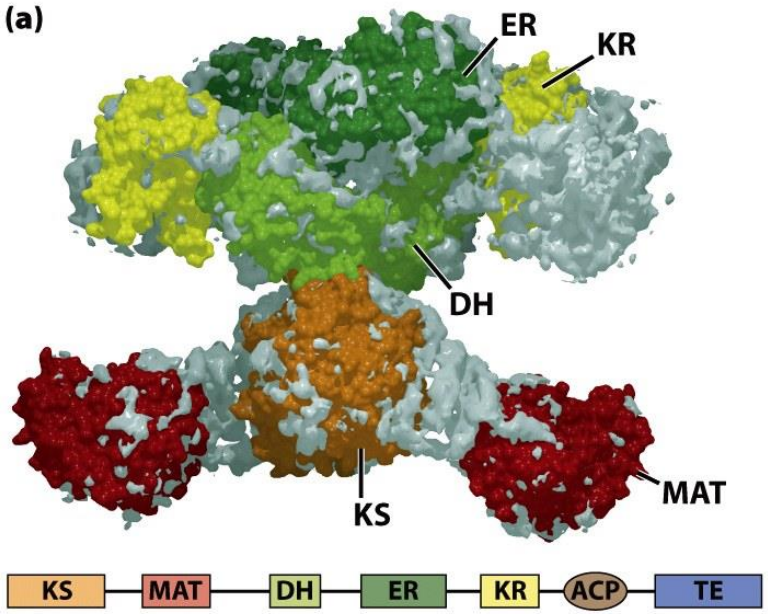
Comparison of fatty acid oxidation and synthesis



Synthesis of malonyl-CoA: Acetyl-CoA carboxylase reaction



Fatty acid synthase



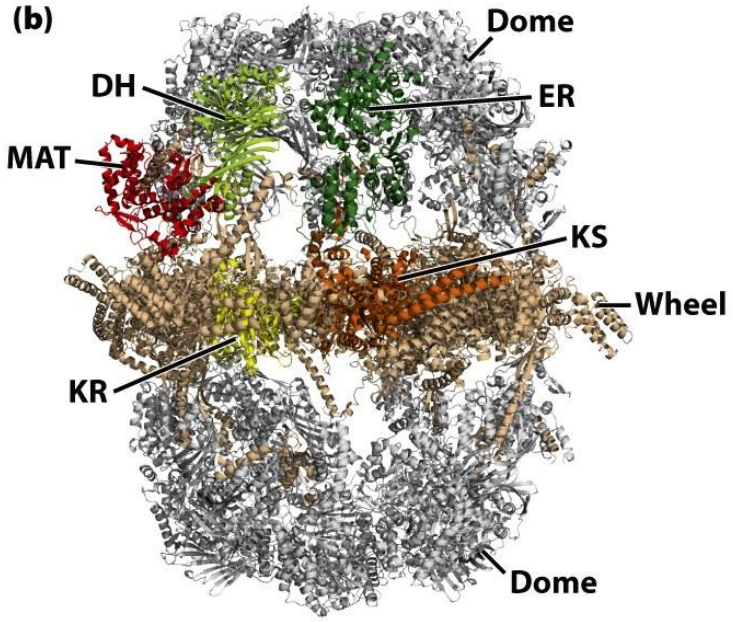
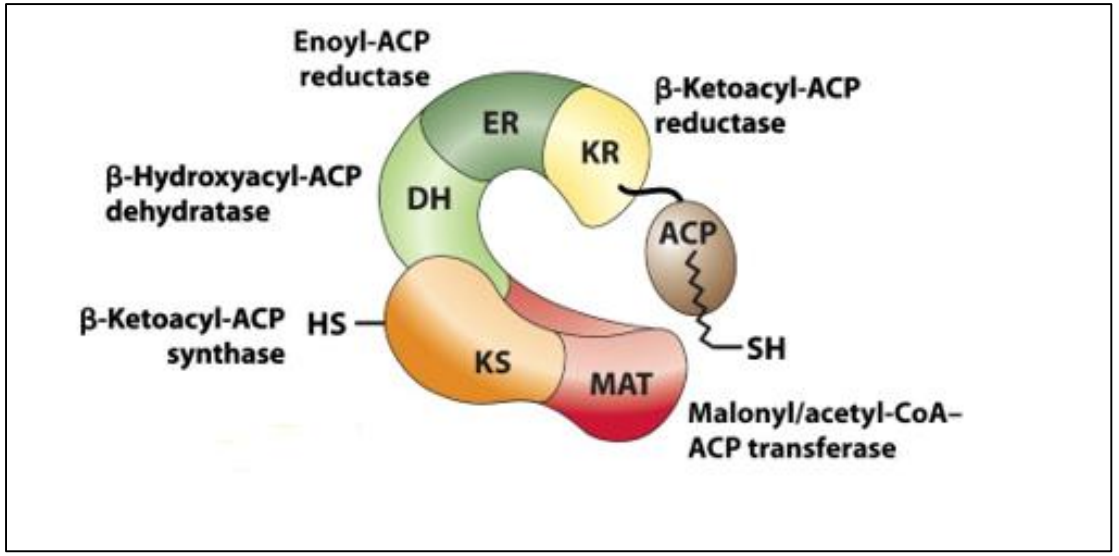
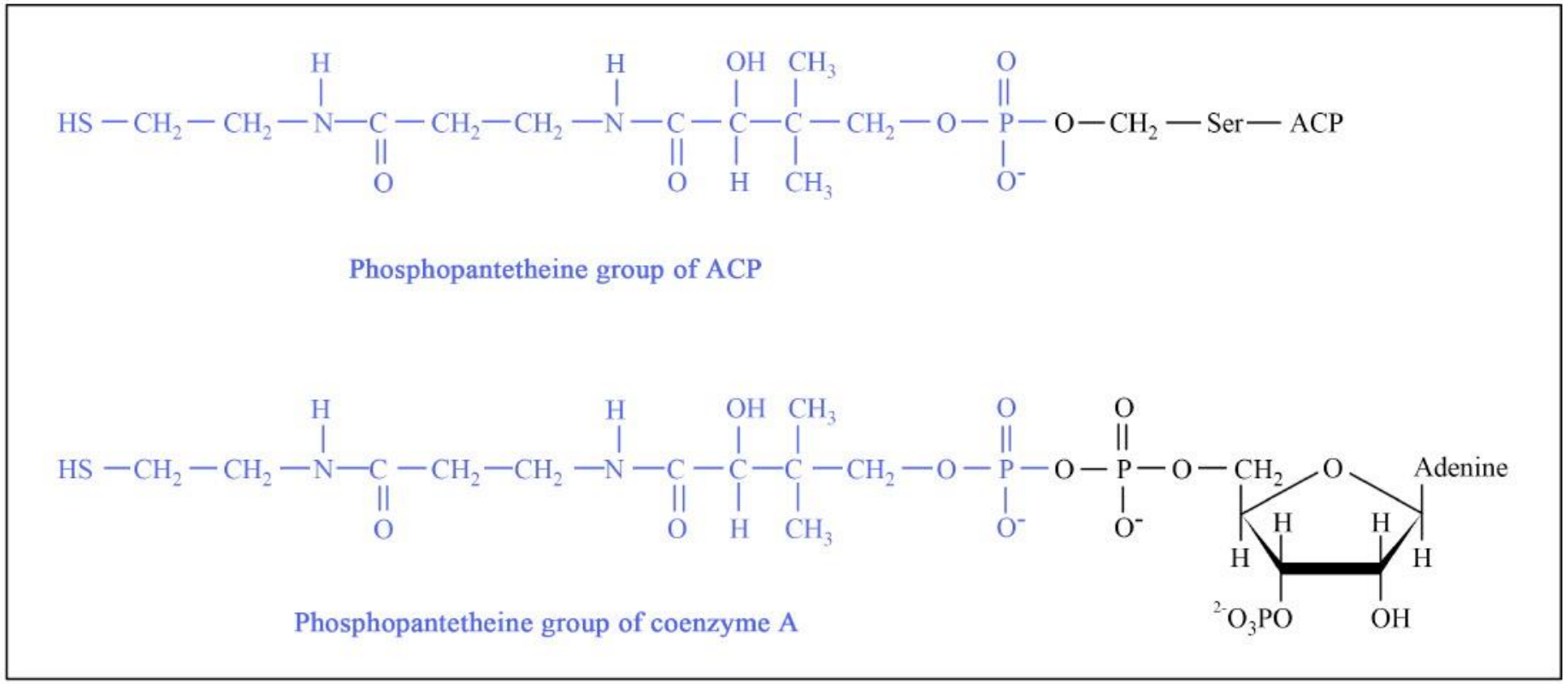


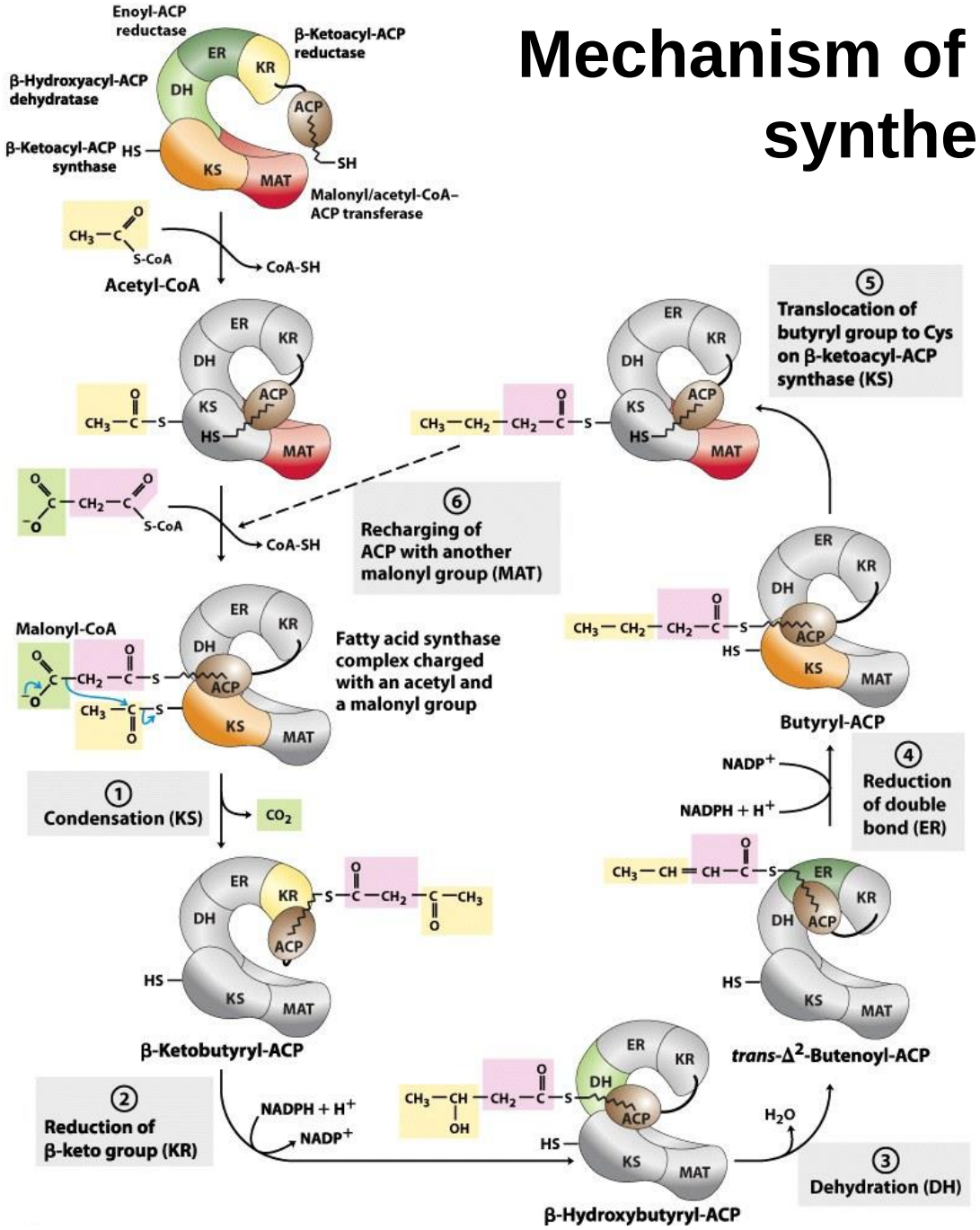
Figure 21-3
Lehninger Principles of Biochemistry, Fifth Edition



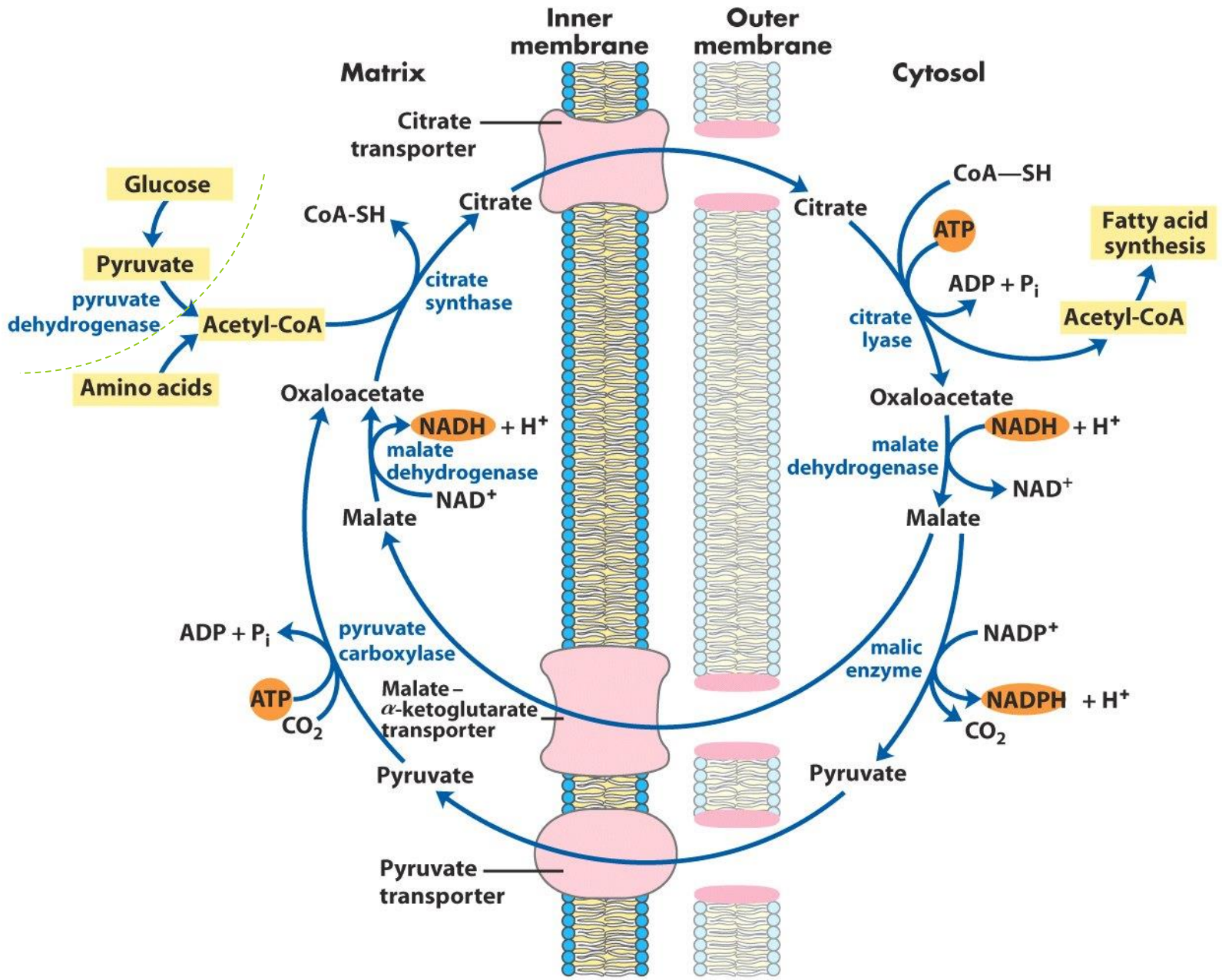
4'-phosphopantetheine group of ACP and Co-A



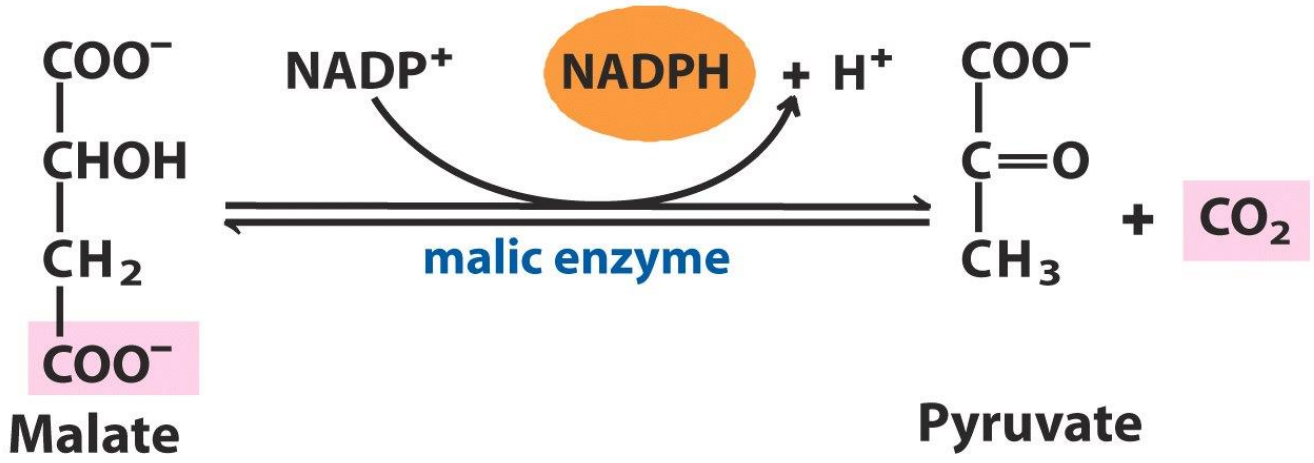
Mechanism of fatty acids synthesis

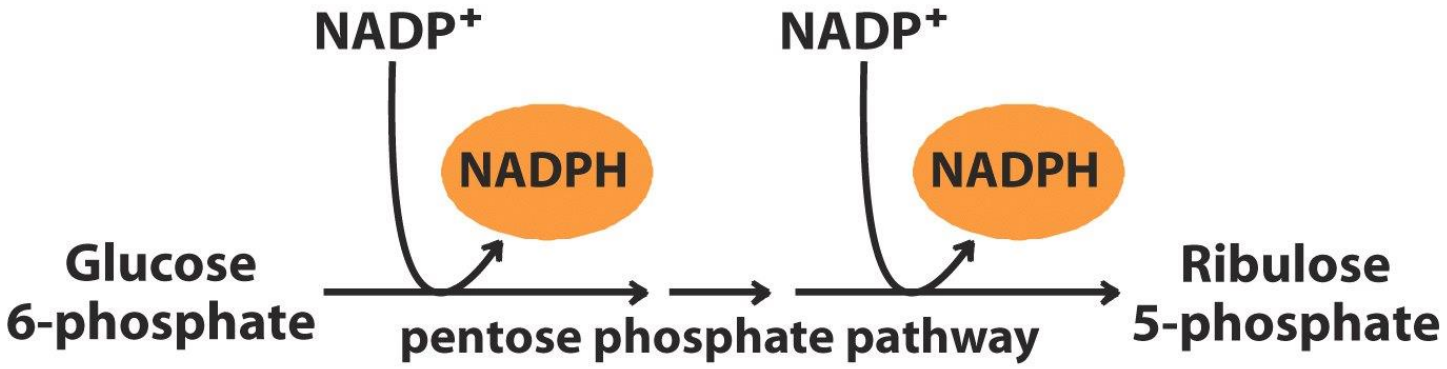


Acetyl-CoA transport to cytosol



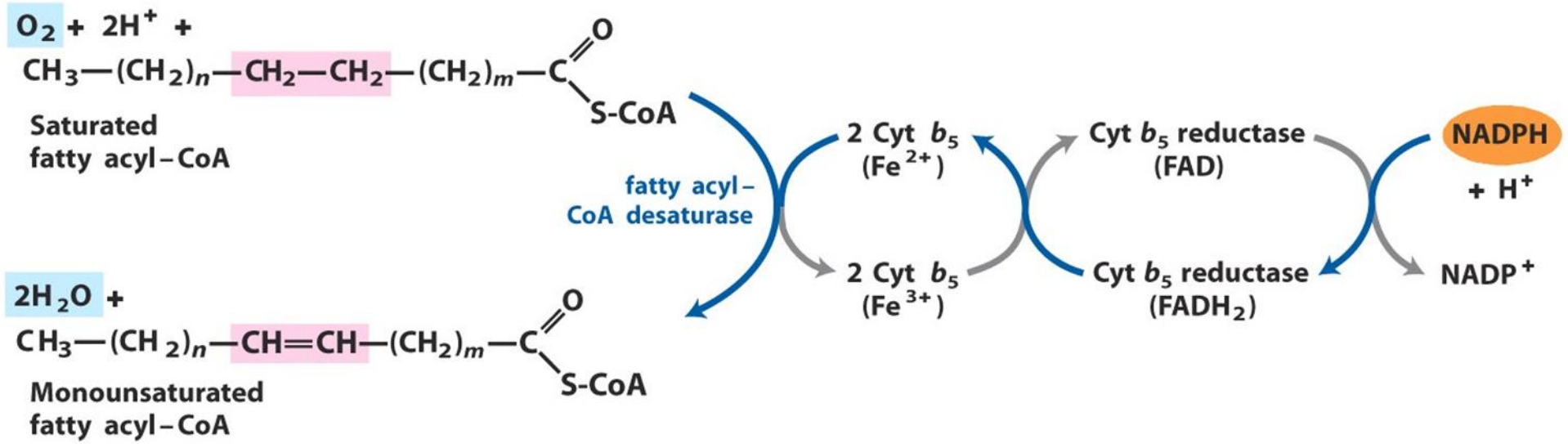
Sources of cytosolic NADPH



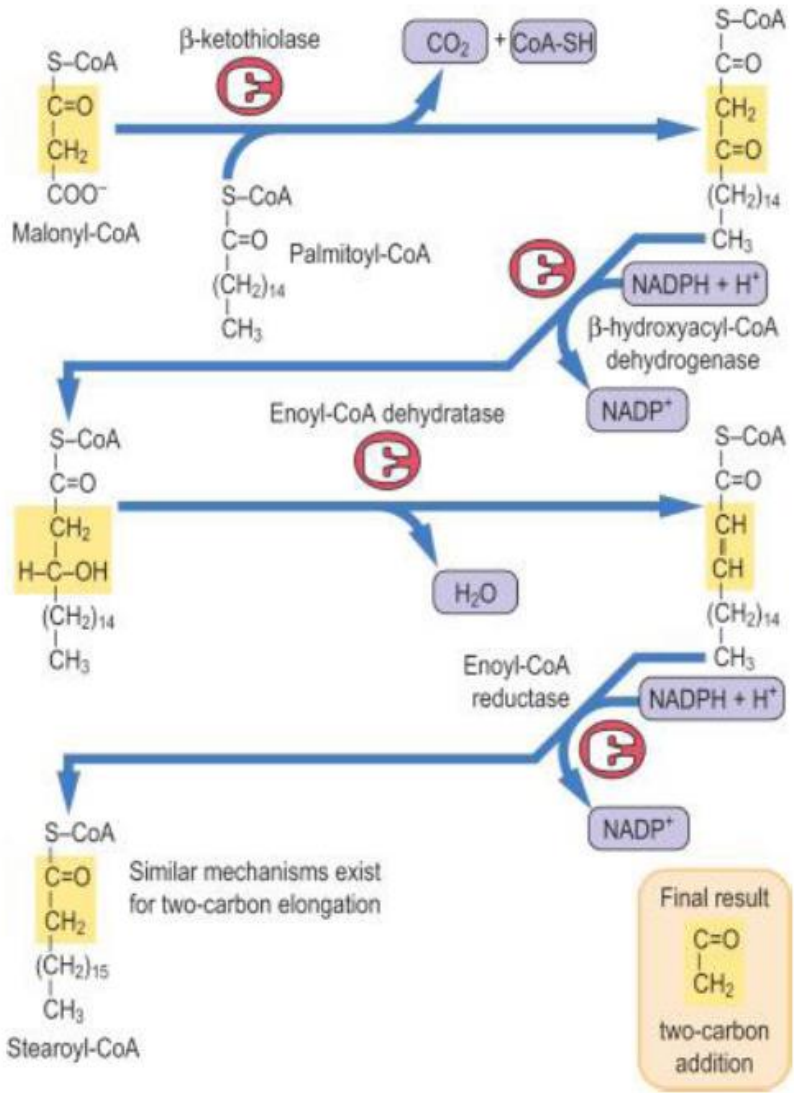


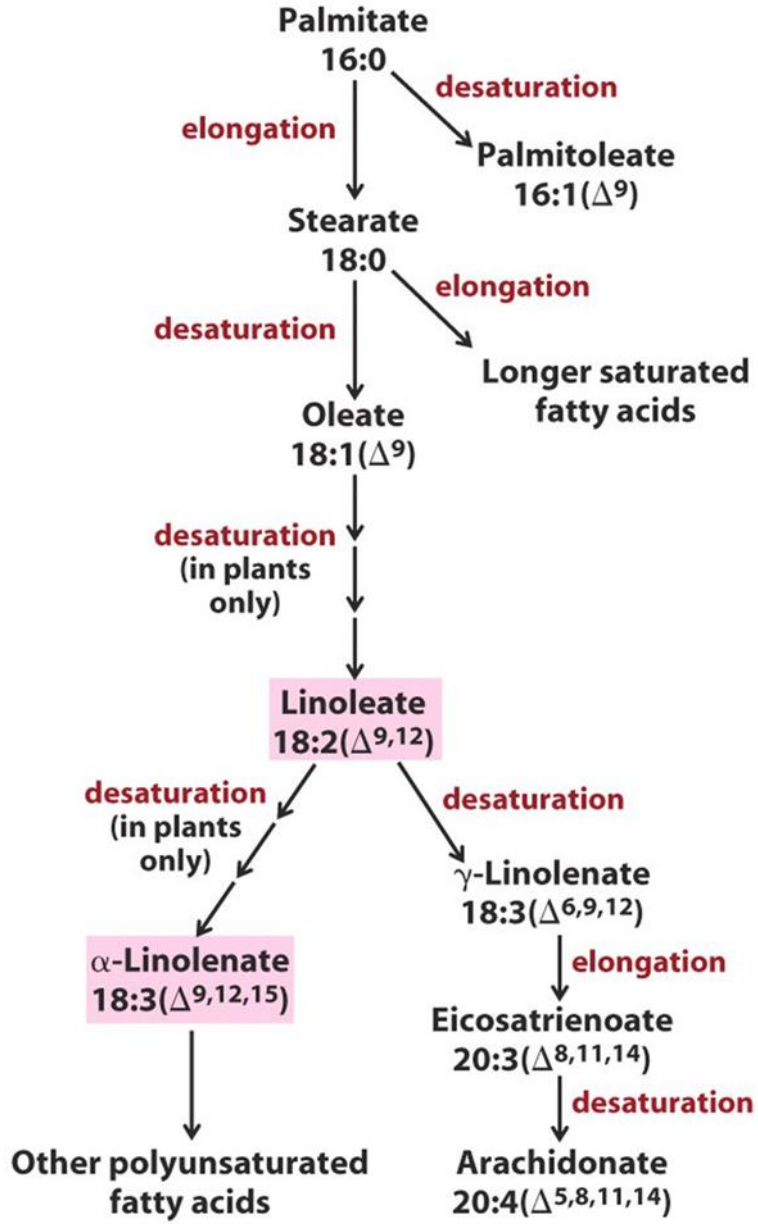
Cytosolic coenzyme	NADPH/NADP⁺ ~75
levels in hepatocytes:	NADH/NAD⁺ ~8x10^{-4}

Synthesis of unsaturated fatty acids

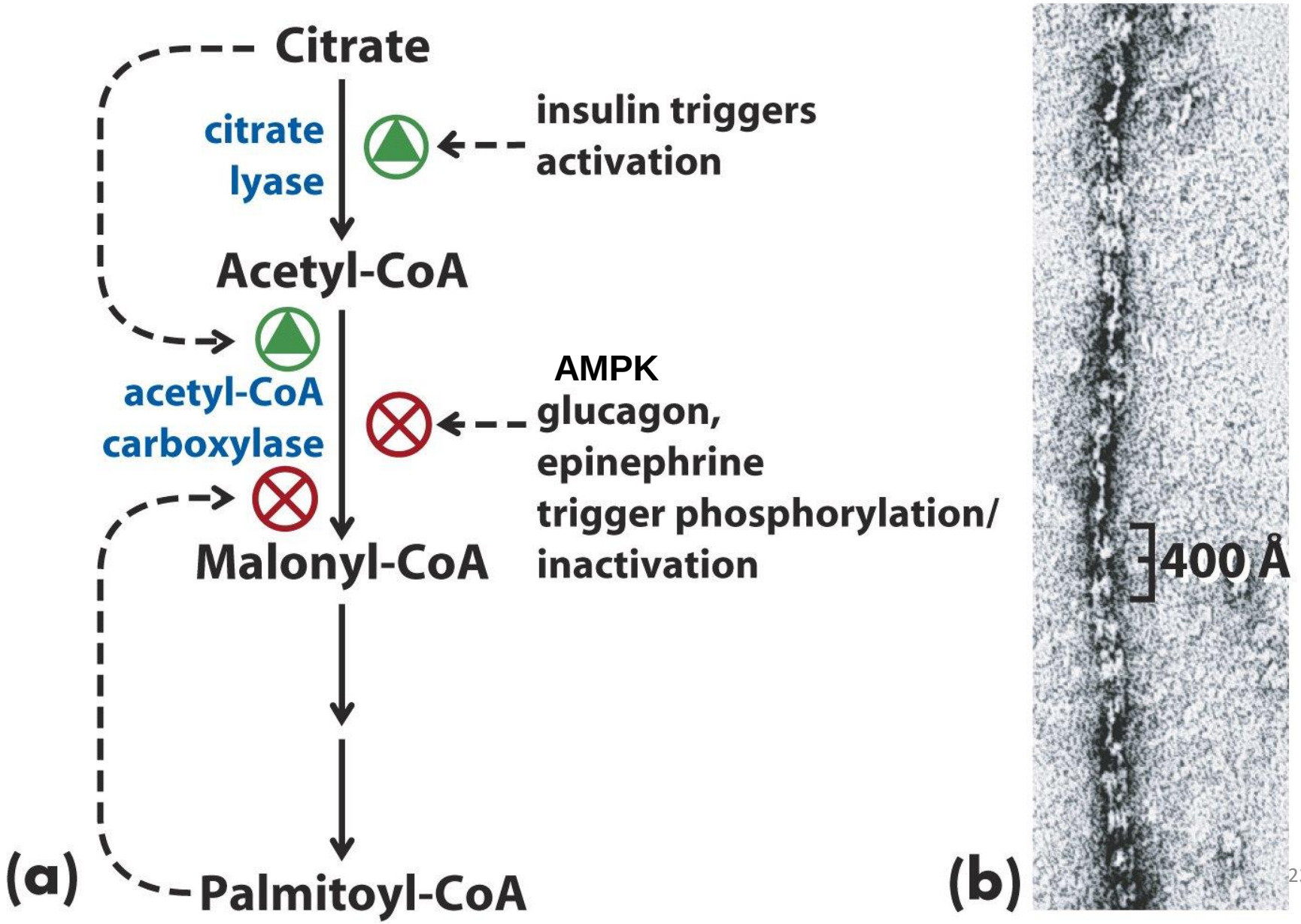


Elongation of fatty acids

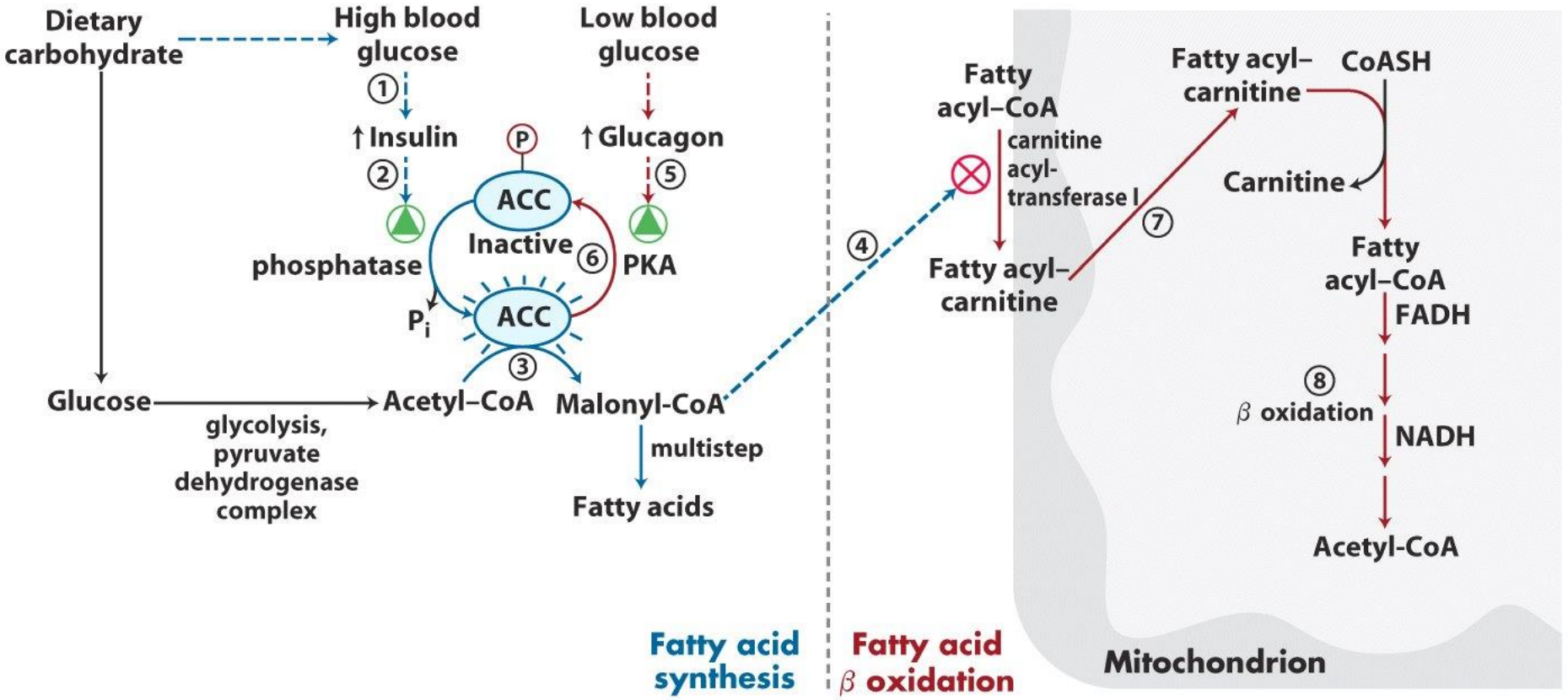




Regulation of acetyl-CoA carboxylase



Coordinated regulation of fatty acid synthesis and breakdown



Transcriptional regulation

TABLE 15–5 Some of the Genes Regulated by Insulin

Change in gene expression	Pathway
Increased expression	
Hexokinase II	Glycolysis
Hexokinase IV	Glycolysis
Phosphofructokinase-1 (PFK-1)	Glycolysis
Pyruvate kinase	Glycolysis
PFK-2/FBPase-2	Regulation of glycolysis/gluconeogenesis
Glucose 6-phosphate dehydrogenase	Pentose phosphate pathway (NADPH)
6-Phosphogluconate dehydrogenase	Pentose phosphate pathway (NADPH)
Pyruvate dehydrogenase	Fatty acid synthesis
Acetyl-CoA carboxylase	Fatty acid synthesis
Malic enzyme	Fatty acid synthesis (NADPH)
ATP-citrate lyase	Fatty acid synthesis (provides acetyl-CoA)
Fatty acid synthase complex	Fatty acid synthesis
Stearoyl-CoA dehydrogenase	Fatty acid desaturation
Acyl-CoA–glycerol transferases	Triacylglycerol synthesis
Decreased expression	
PEP carboxykinase	Gluconeogenesis
Glucose 6-phosphatase (catalytic subunit)	Glucose release to blood

Table 15-5
Lehninger Principles of Biochemistry, Fifth Edition

Transcriptional regulation

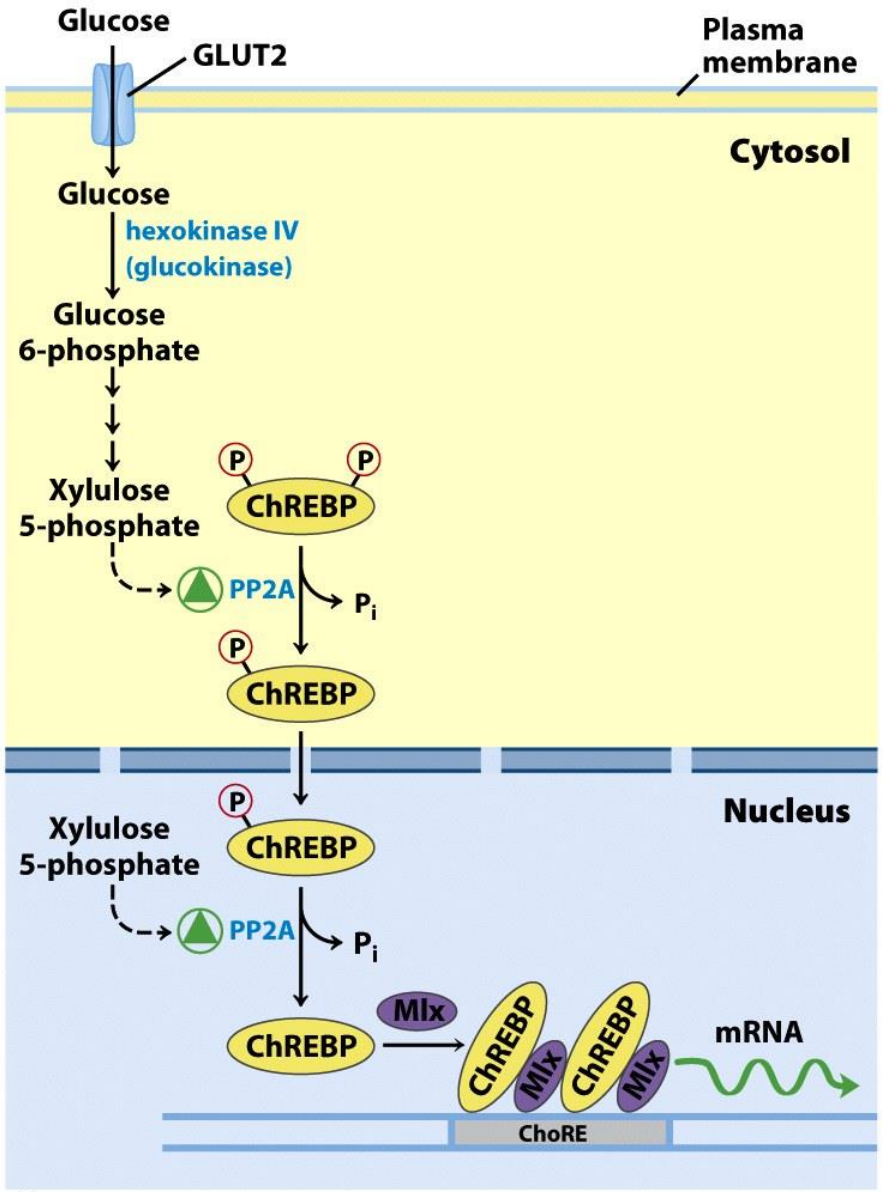
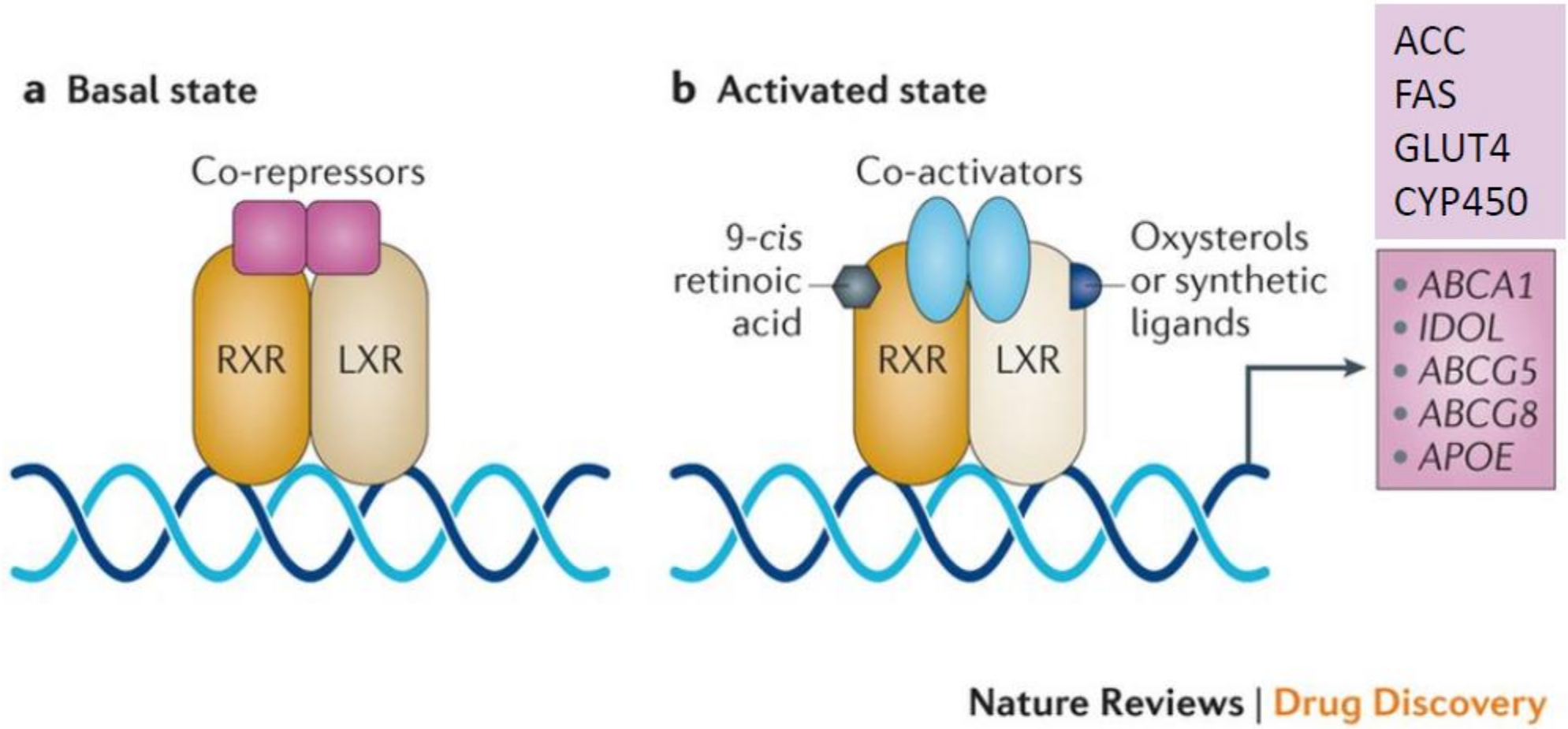


Figure 15-21
Lehninger Principles of Biochemistry, Fifth Edition

Transcriptional regulation



Transcriptional regulation

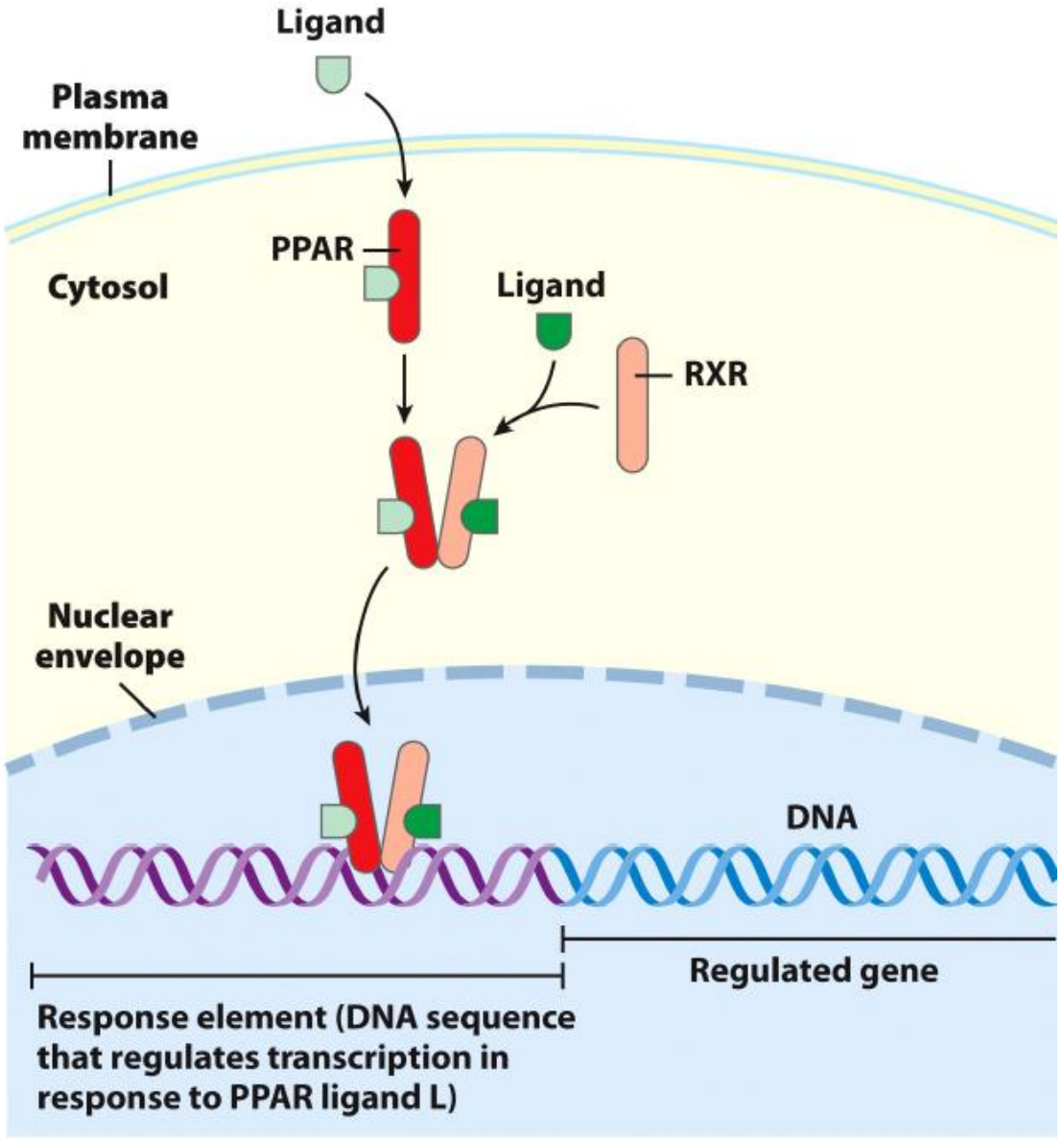
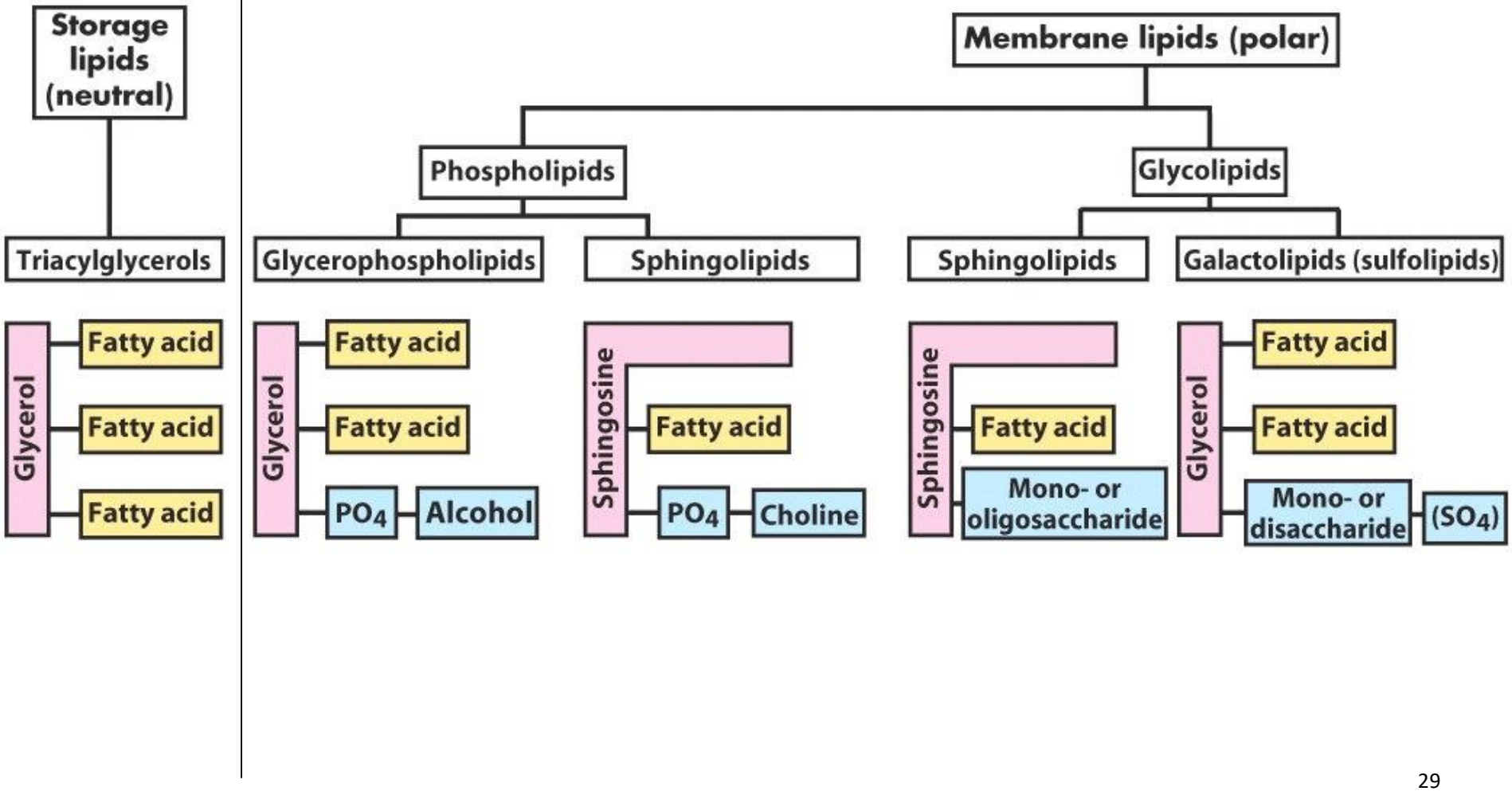


Figure 23-41
Lehninger Principles of Biochemistry, Sixth Edition

PPAR α
PPAR β/δ
PPAR γ

Complex lipids



Synthesis of phosphatidic acid and triacylglycerols

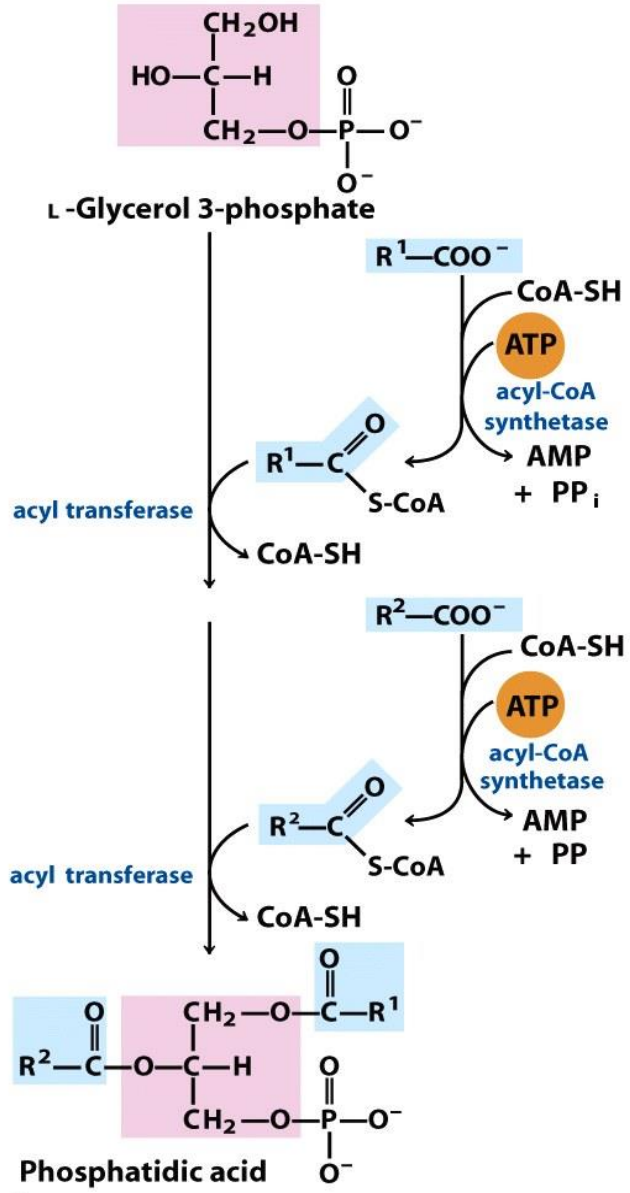


Figure 21-17 part 2
Lehninger Principles of Biochemistry, Fifth Edition

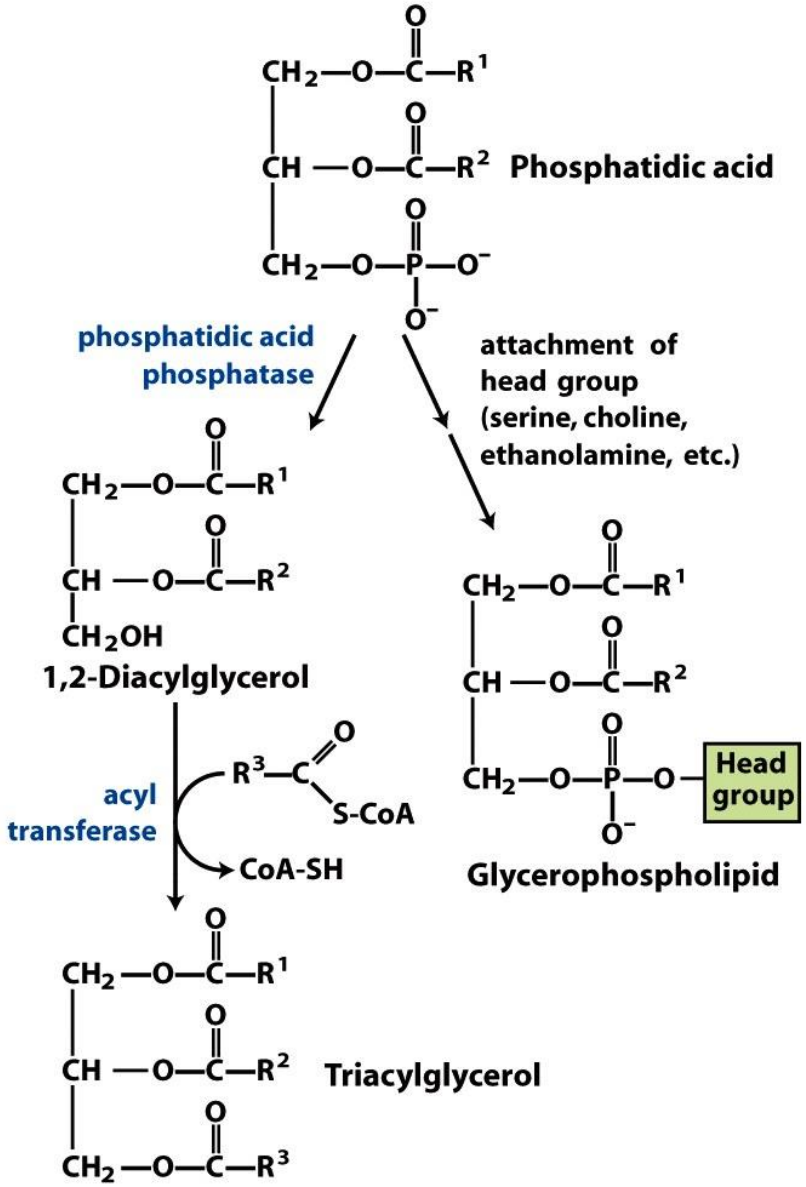


Figure 21-18
Lehninger Principles of Biochemistry, Fifth Edition

Production of glycerol-3-phosphate

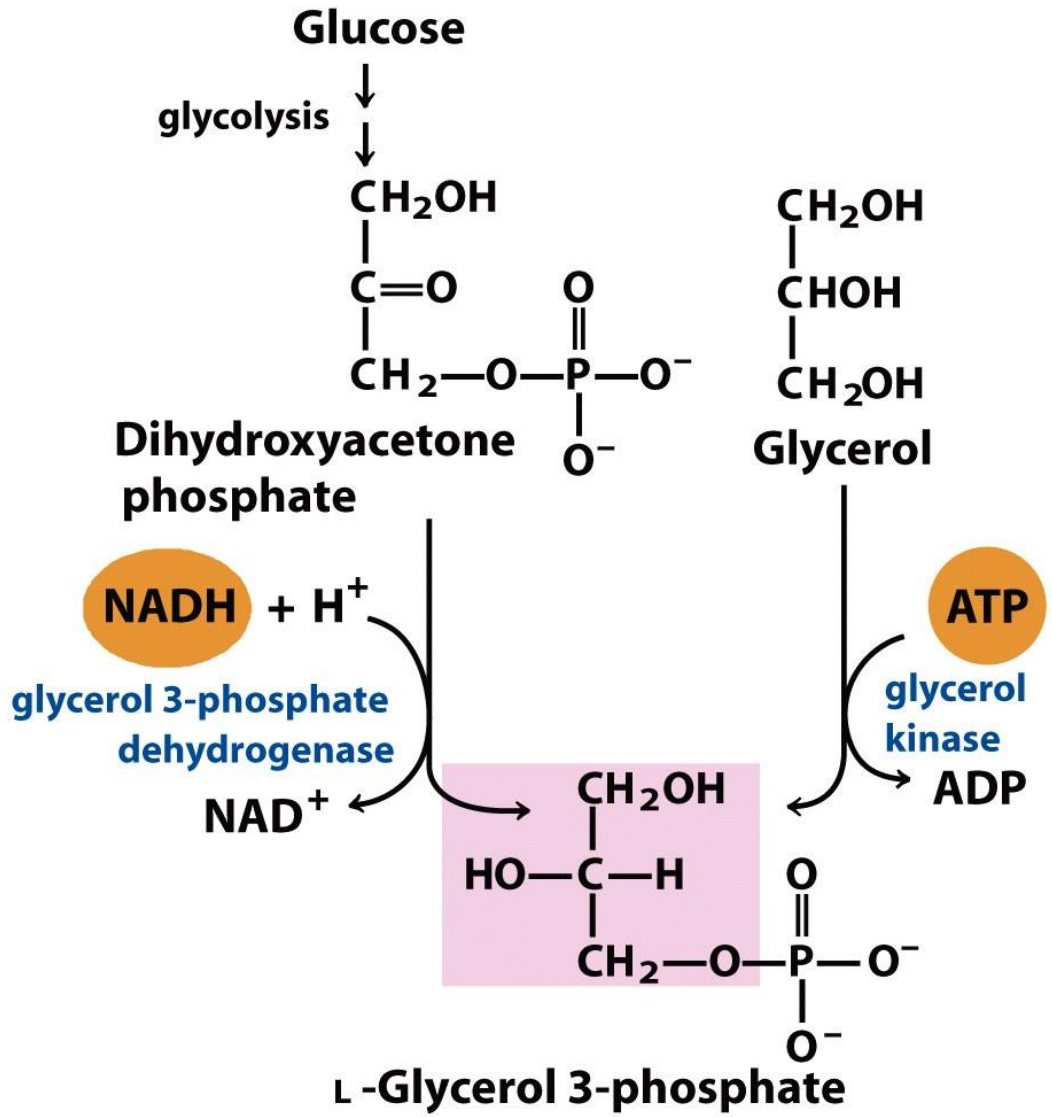


Figure 21-17 part 1
Lehninger Principles of Biochemistry, Fifth Edition

Glyceroneogenesis

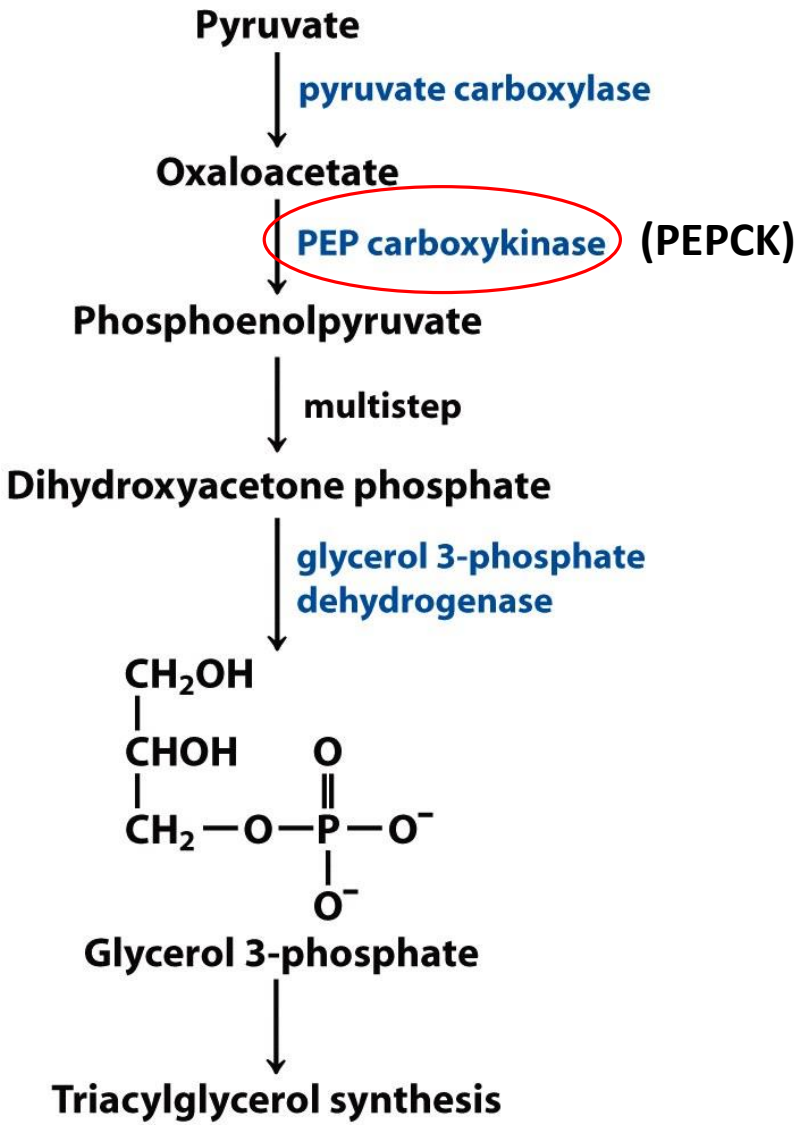
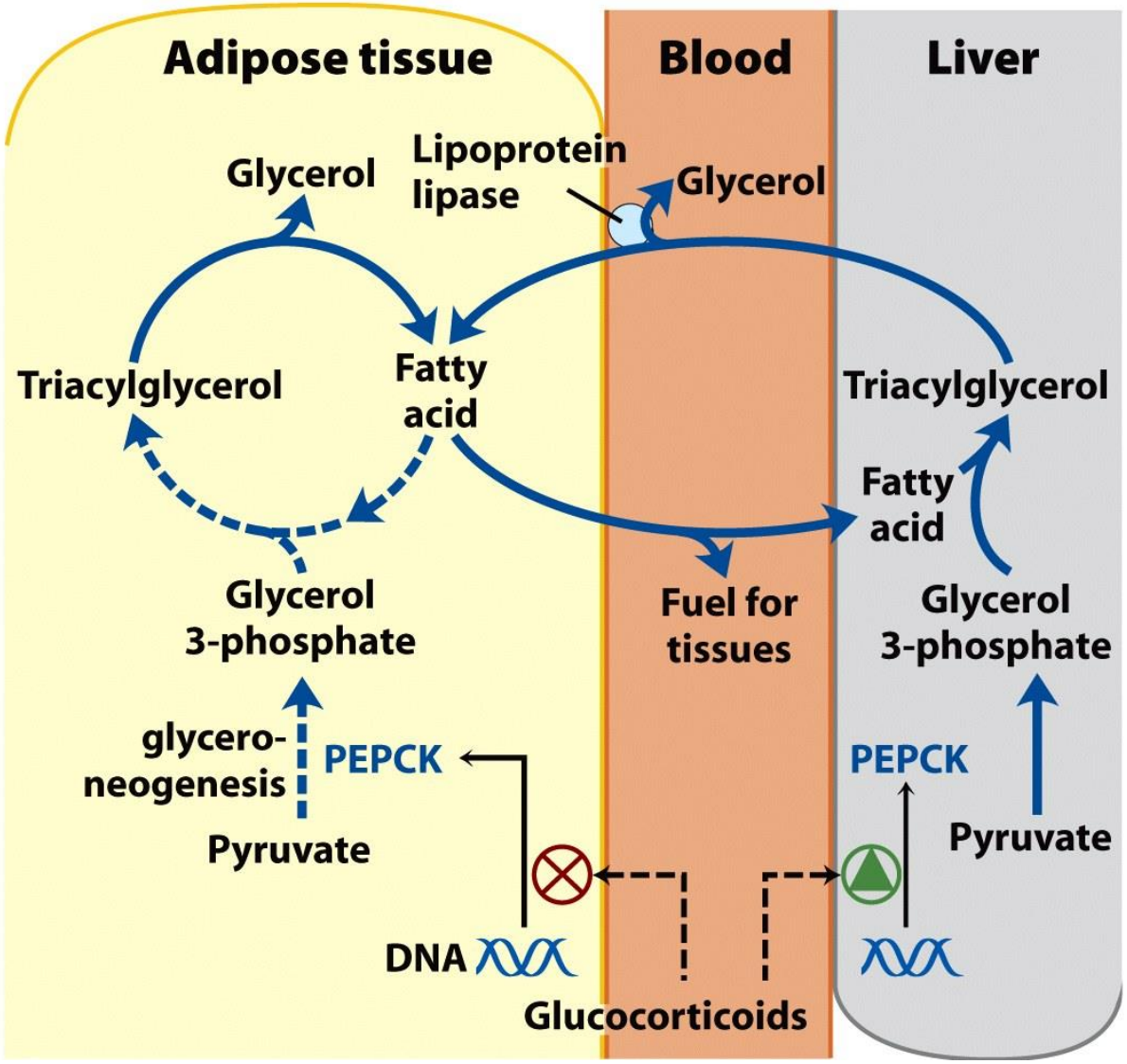
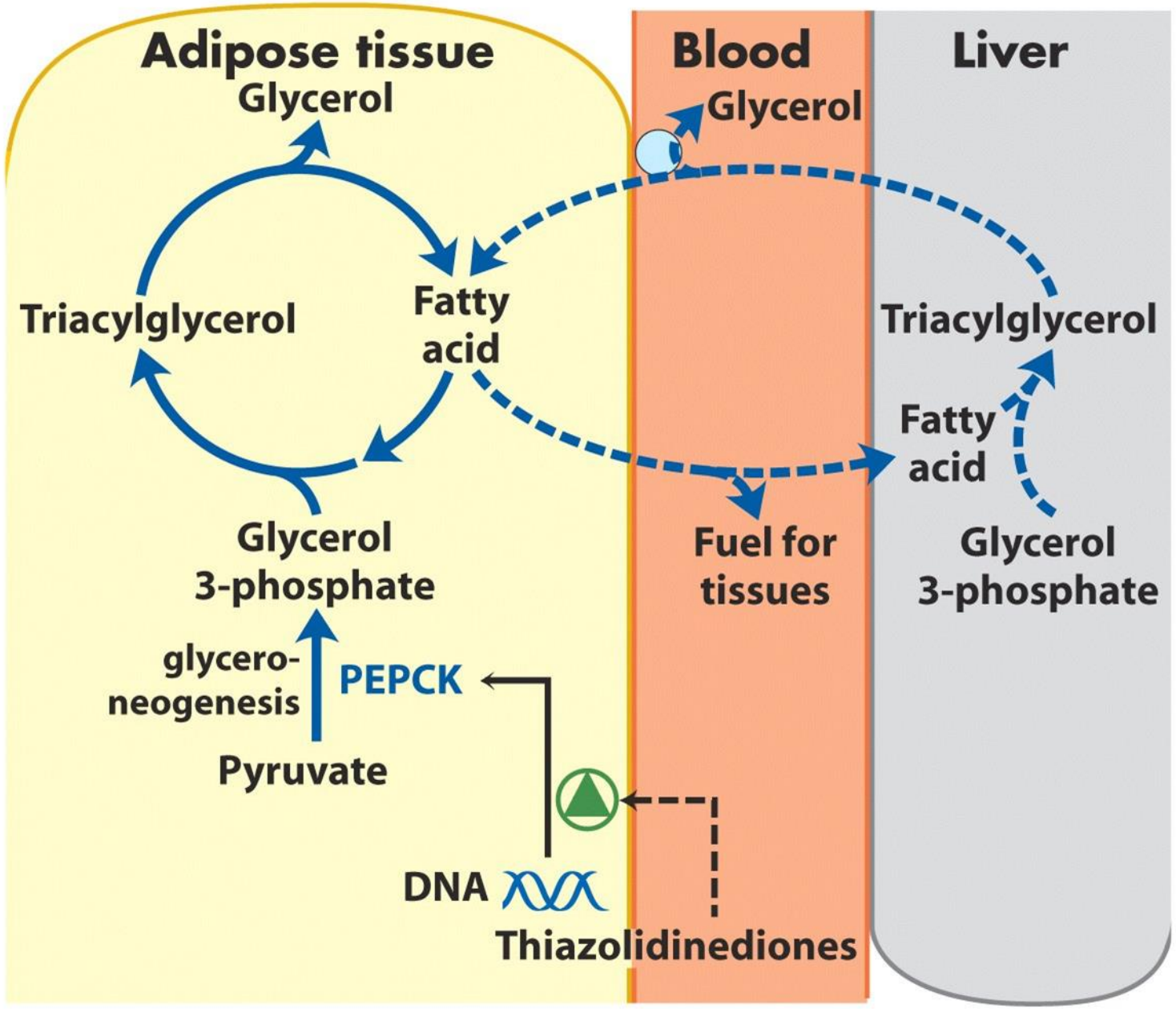


Figure 21-21
Lehninger Principles of Biochemistry, Fifth Edition

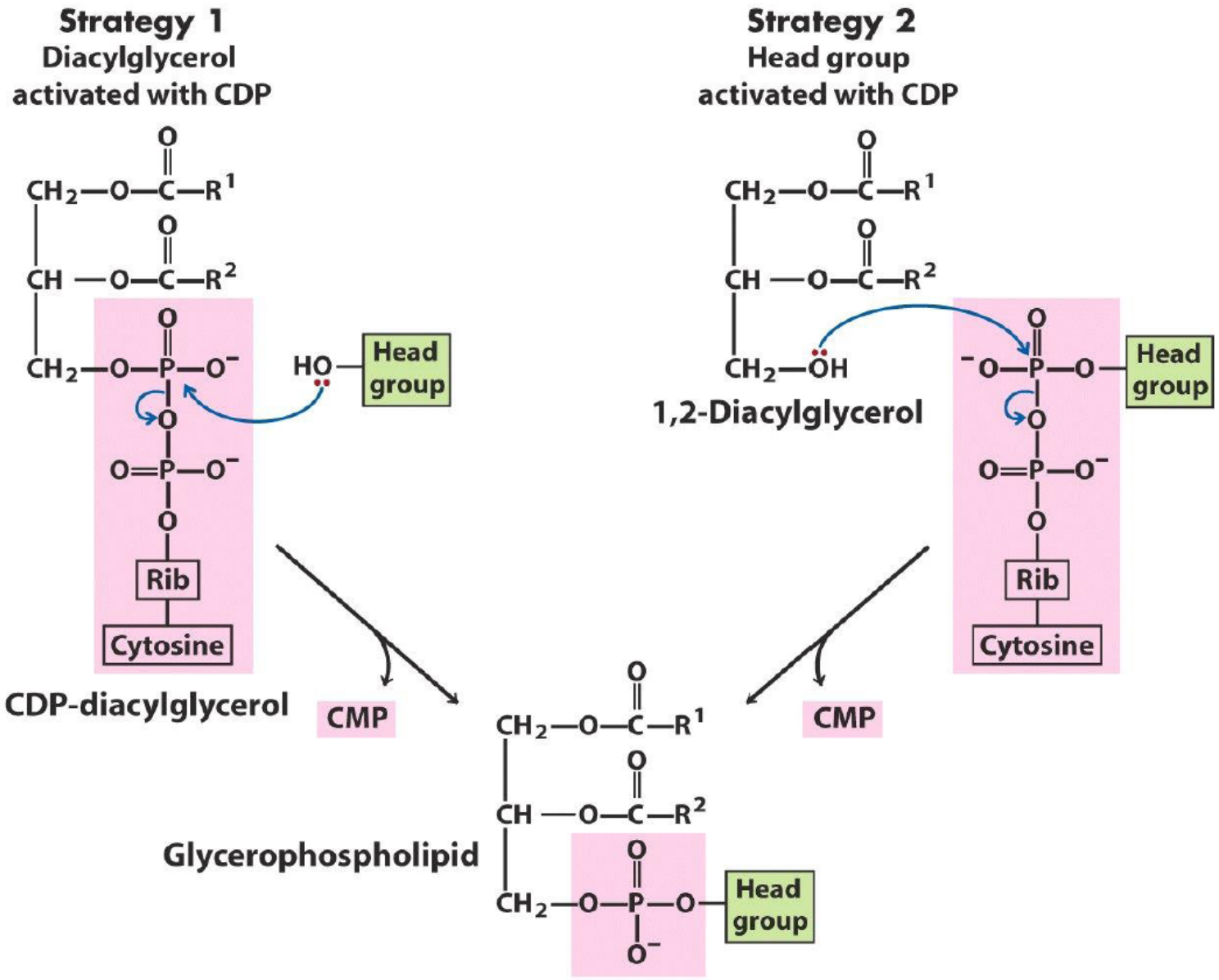
Effect of glucocorticoids on glyceroneogenesis



Effect of thiazolidinediones on glyceroneogenesis



Complex lipids



Sphingolipids

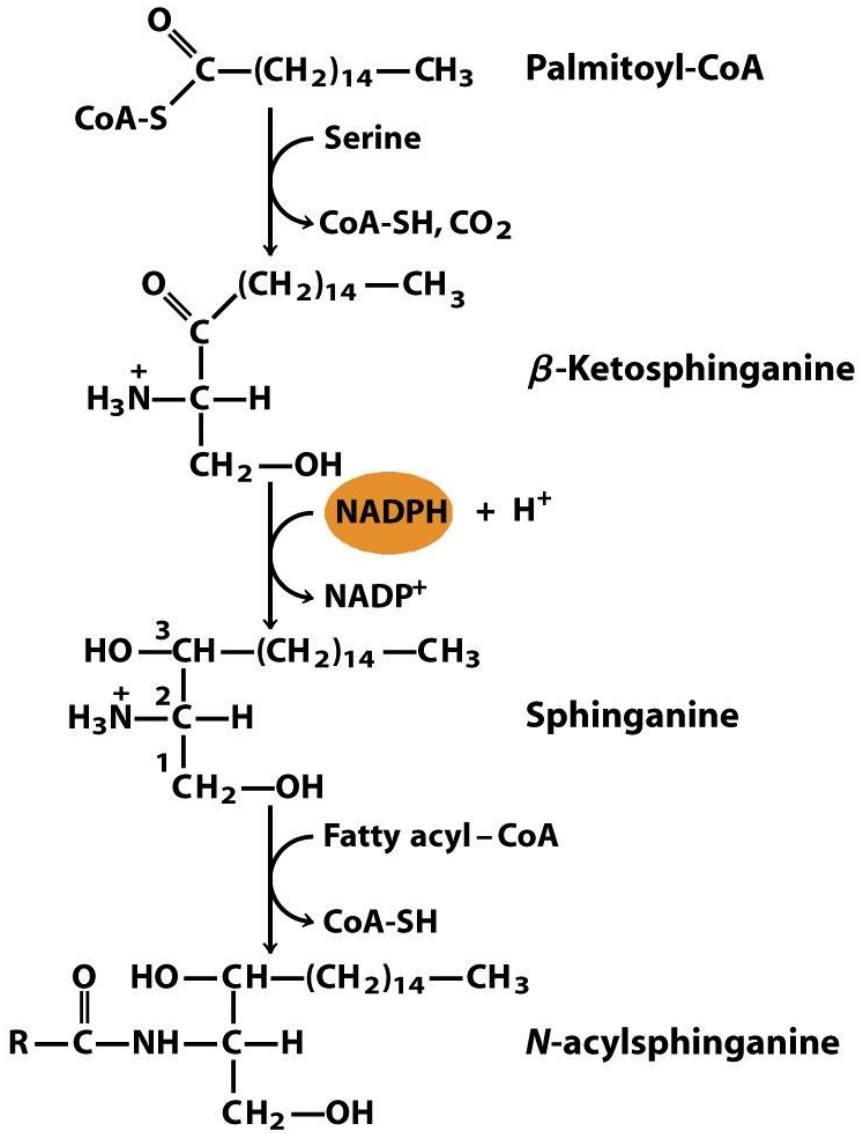


Figure 21-31 part 1
Lehninger Principles of Biochemistry, Fifth Edition

Sphingolipids

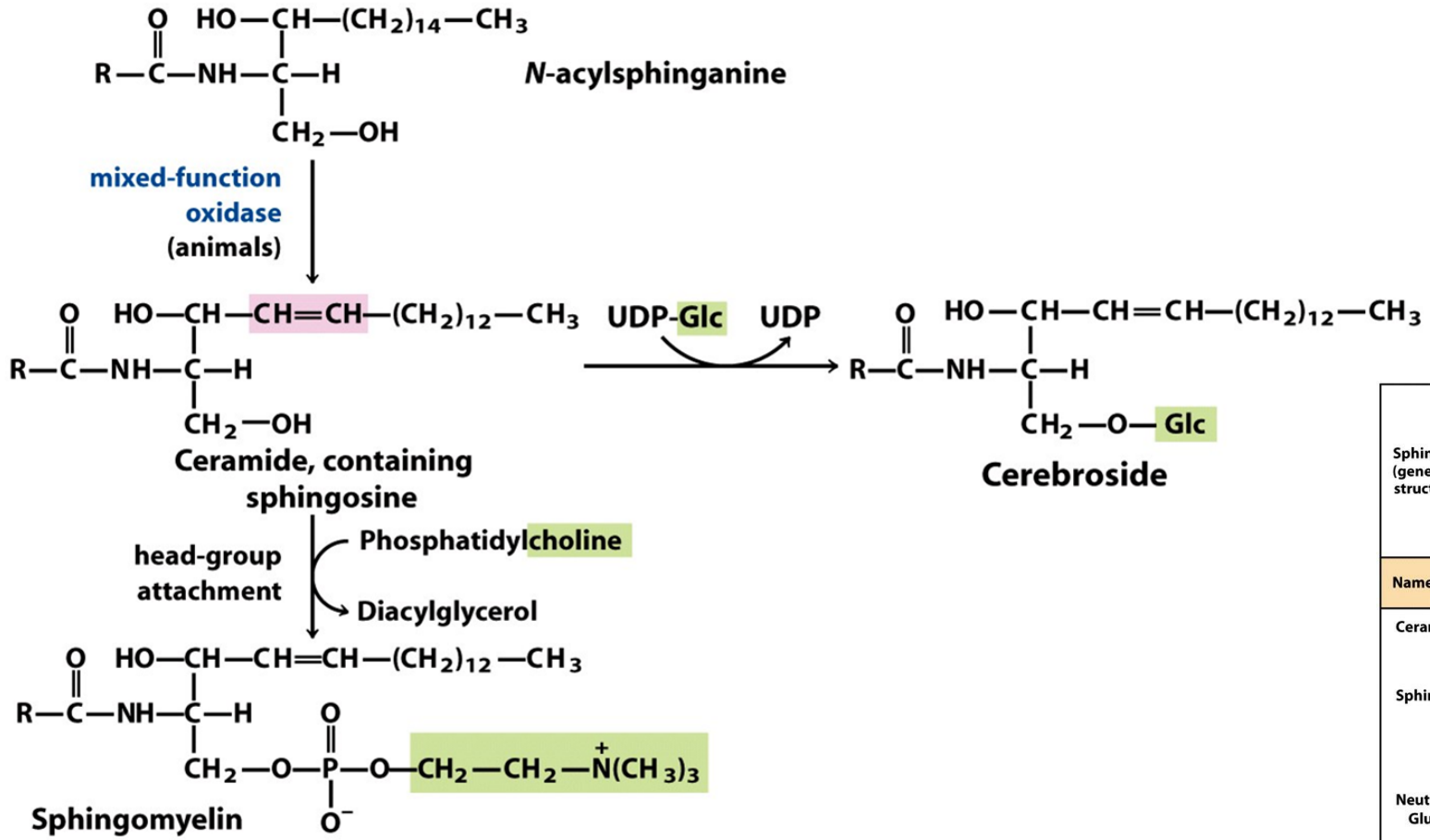


Figure 21-31 part 2
Lehninger Principles of Biochemistry, Fifth Edition

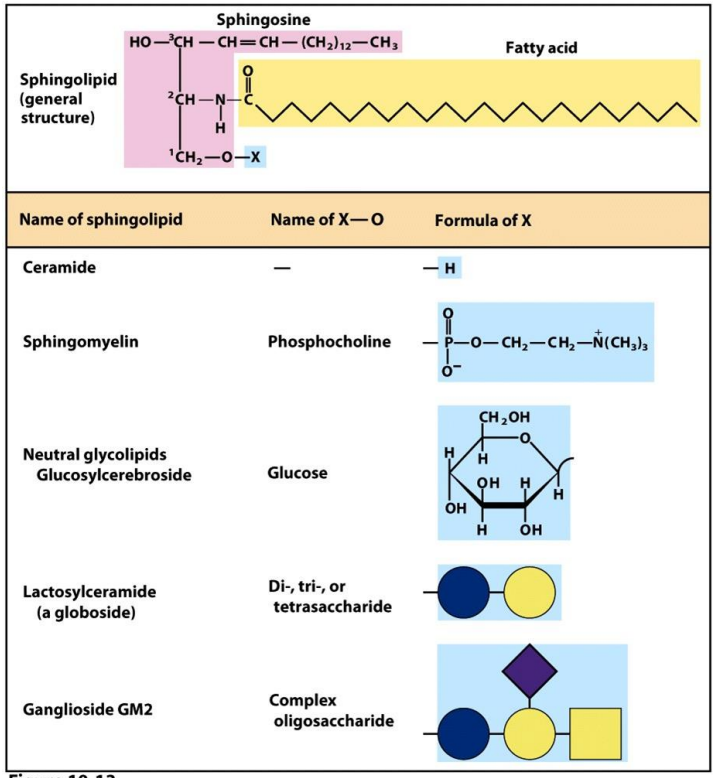


Figure 10-13
Lehninger Principles of Biochemistry, Fifth Edition