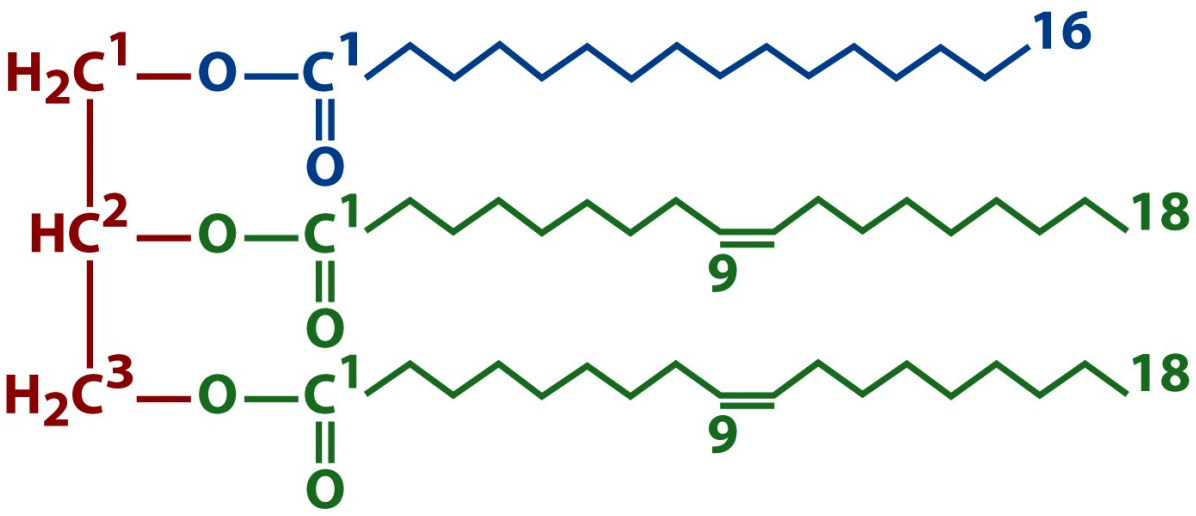
BioChem 330 - Course Outline

- **Metabolism and Bioenergetics (II)**
  - ENZYME CATALYSIS:
    - kinetic constants k_{cat}, K_m
    - Catalytic strategies, the serine proteases
  - CATABOLISM (*breakdown*)
    - Carbohydrates
      - Glycolysis
      - Tricarboxylic Acid Cycle
      - Electron Transport
      - Chemiosmosis and ATPase
    - Fatty acids and amino acids

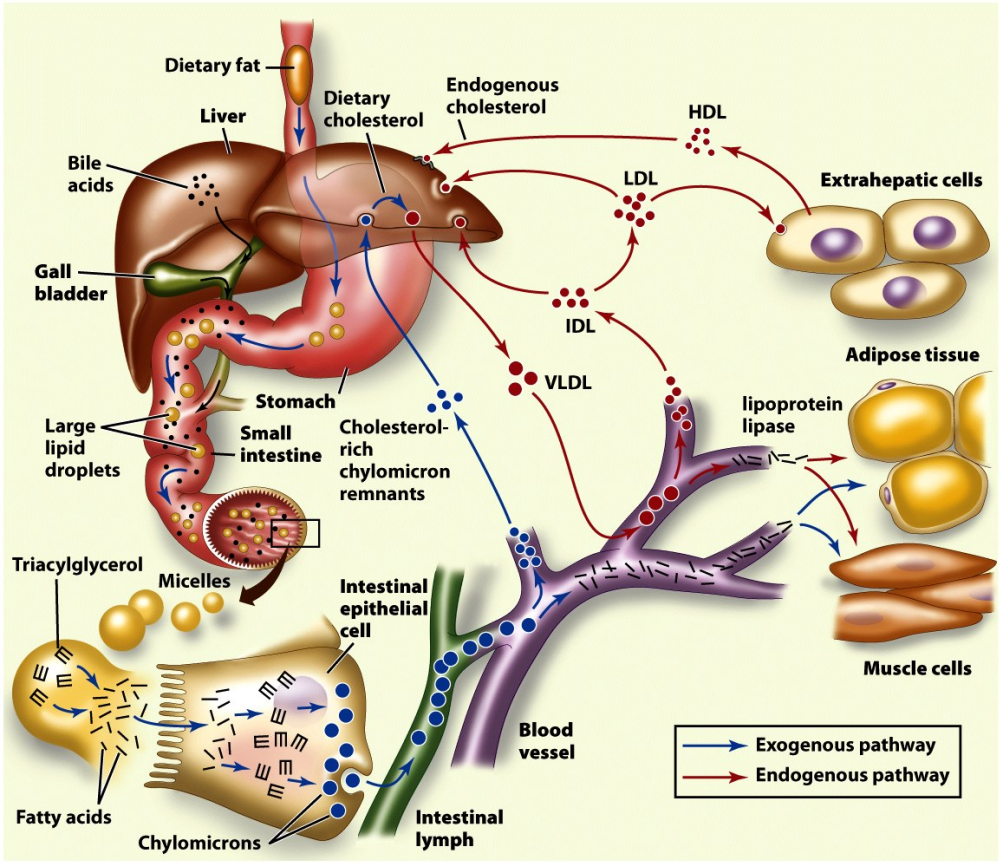
Oxidation of Fats Provide Metabolic Energy



1-Palmitoyl-2,3-dioleoyl-glycerol

- Lipids are a large class of glycerol derivatives
- Triacylglycerols comprise 90% of our dietary fats
- C_{18} monounsaturated fatty acid is oleic acid

Digestion of Fats Starts with Peristalsis…..

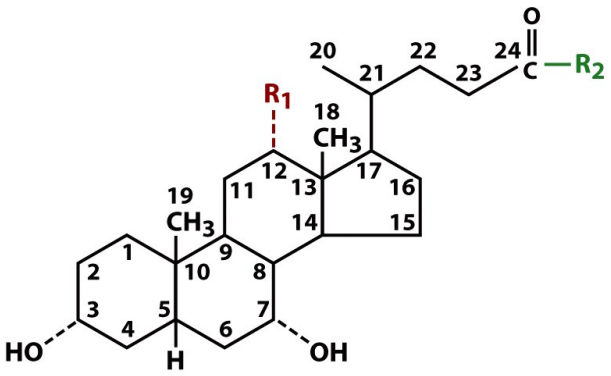


- Dilemma: dietary fat is not very soluble, but must be digested by soluble enzymes

- Enzymes access the lipids at water/lipid interfaces that are favored by the actions of peristalsis

Figure 20-4

Absorption of Fat Occurs in small Intestines



	$R_1 = OH$	$R_1 = H$
$R_2 = OH$	Cholic acid	Chenodeoxycholic acid
$R_2 = NH—CH_2—COOH$	Glycocholic acid	Glycochenodeoxycholic acid
$R_2 = NH—CH_2—CH_2—SO_3H$	Taurocholic acid	Taurochenodeoxycholic acid

Bile Acids:

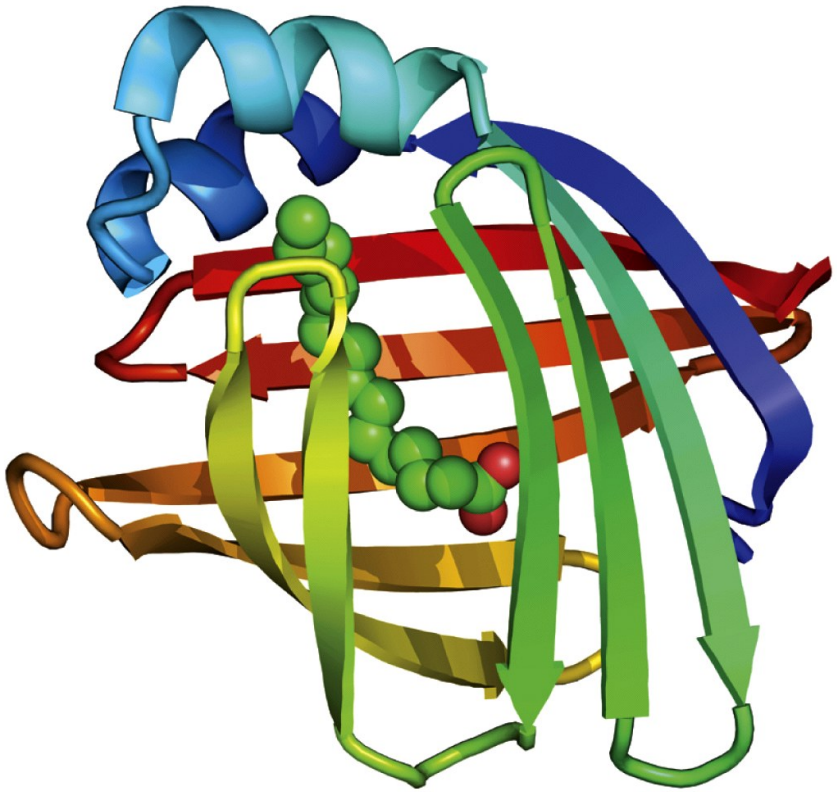
are derived from cholesterol

are secreted into small intestines from liver through bile duct

Help free fatty acids to be absorbed by intestinal mucosa

Figure 20-1

Absorption of Fat Occurs in small intestines



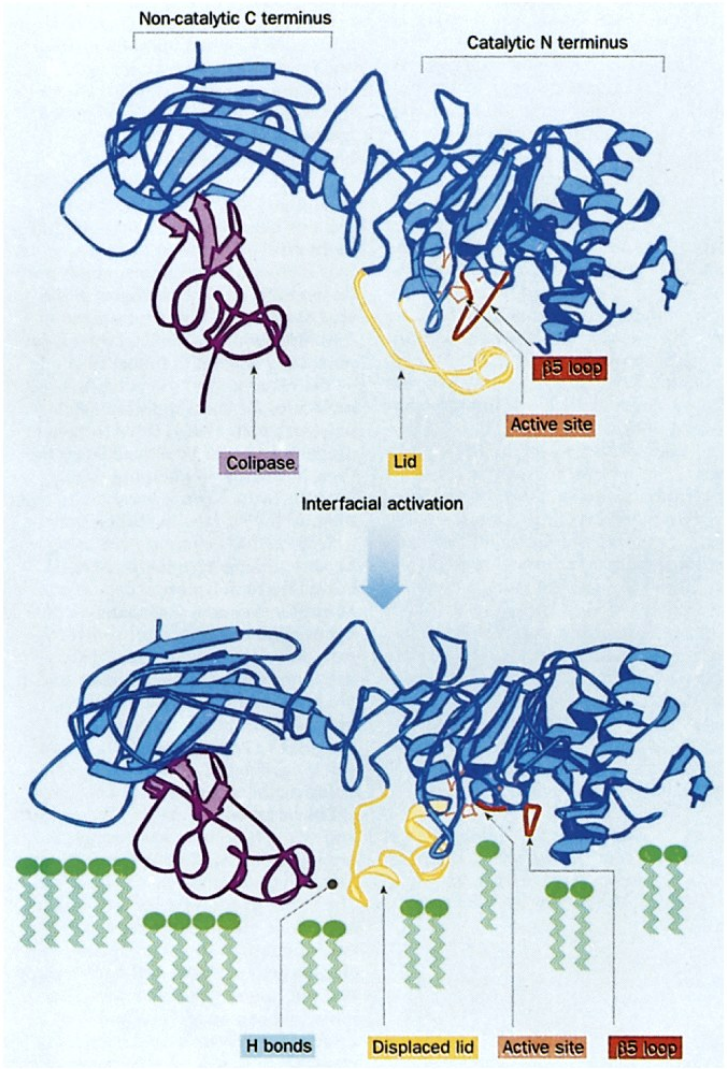
Intestinal fatty acid binding protein (I-FABP)

FA fills the strand gap in the top beta sheet

Binding motif called a beta clam structure

Figure 20-4

Interfacial Enzymatic hydrolysis of TAG ester bond



From *Nature* 362, 793 (1993). Reproduced with permission.

Figure 20-2

Strategy 1: Pancreatic Lipase

hydrolysis of TAG

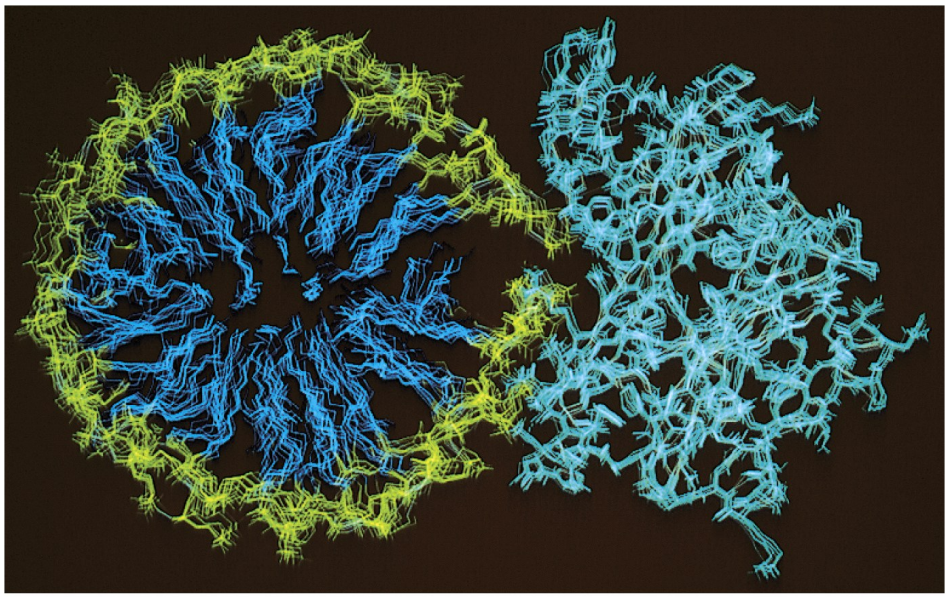
Specific to positions 1,3

Access to binding site (oxyanion hole) regulated by co-lipase

catalytic triad at active site

Interfacial Enzymatic hydrolysis of TAG ester bond

Strategy 2: Phospholipase A2

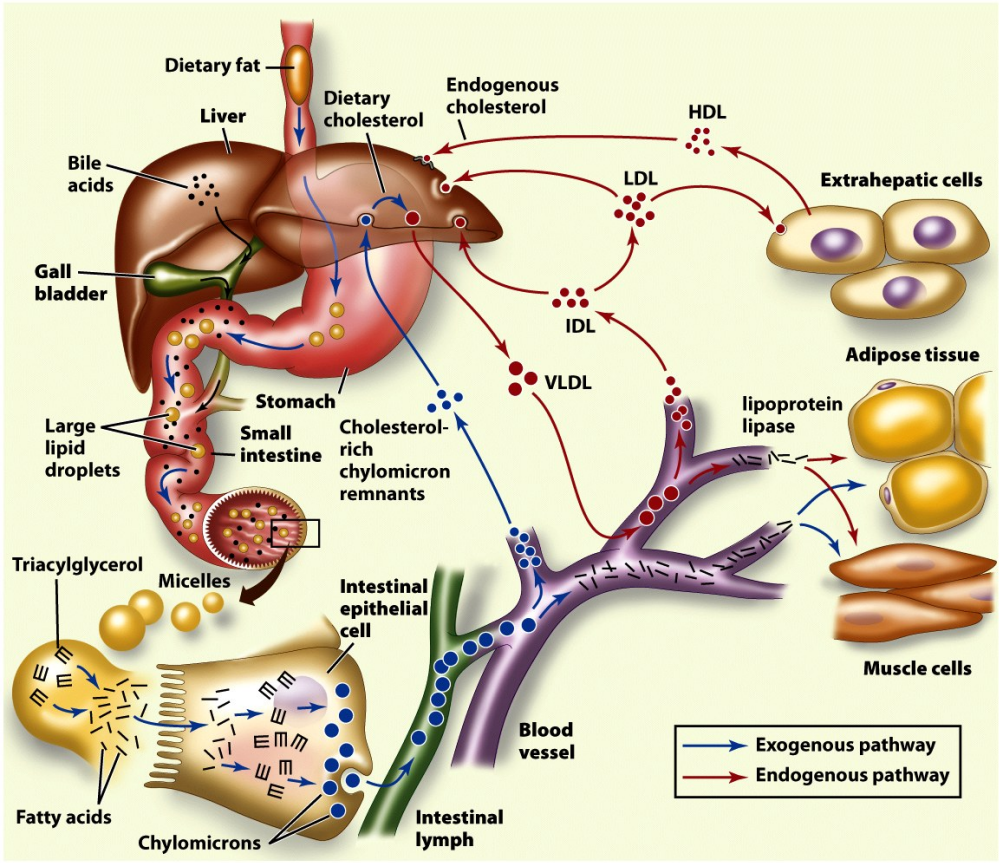


Courtesy of Raymond Salemme, E. I. du Pont de Nemours & Company

Enzyme binds to micelle, opening up a channel through which it can bind to hydrolyze a phospholipid

Figure 20-3a,b

Transportation of fats in lymph and blood…..



- Exogenous pathways for dietary fats and cholesterol

- Endogenous pathways for fats, cholesterol moving internally from one place to another

Figure 20-4

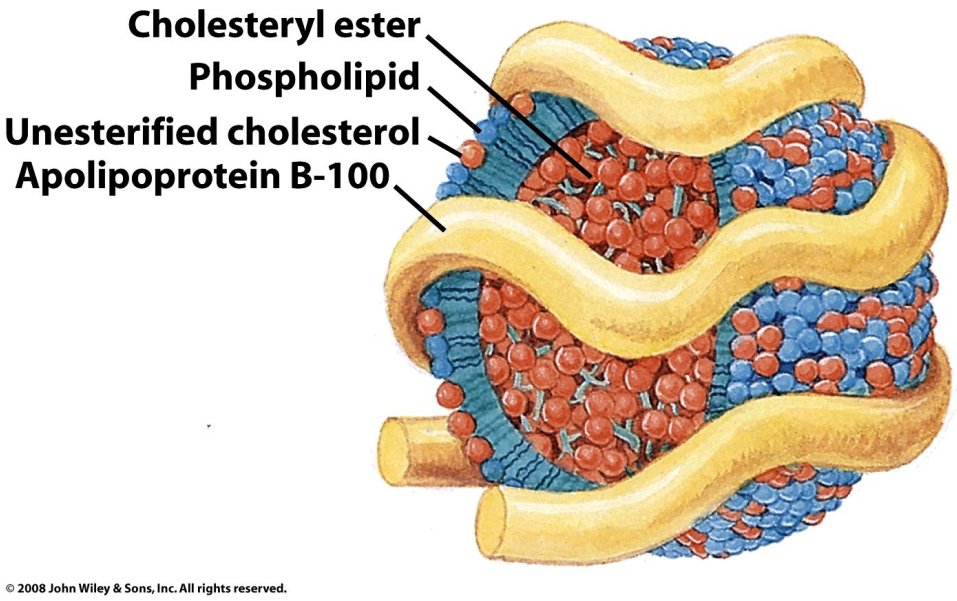
TAGs are transported within lipoprotein vessicles

Table 20-1 Characteristics of the Major Classes of Lipoproteins in Human Plasma

	Chylomicrons	VLDL	IDL	LDL	HDL
Density ($g \cdot cm^{-3}$)	<0.95	<1.006	1.006–1.019	1.019–1.063	1.063–1.210
Particle diameter (Å)	750–12,000	300–800	250–350	180–250	50–120
Particle mass (kD)	400,000	10,000–80,000	5000–10,000	2300	175–360
% Protein[a]	1.5–2.5	5–10	15–20	20–25	40–55
% Phospholipids[a]	7–9	15–20	22	15–20	20–35
% Free cholesterol[a]	1–3	5–10	8	7–10	3–4
% Triacylglycerols[b]	84–89	50–65	22	7–10	3–5
% Cholesteryl esters[b]	3–5	10–15	30	35–40	12
Major apolipoproteins	A-I, A-II, B-48, C-I, C-II, C-III, E	B-100, C-I, C-II, C-III, E	B-100, C-I, C-II, C-III, E	B-100	A-I, A-II, C-I, C-II, C-III, D, E

[a]Surface components
[b]Core lipids.

Transportation of fats in lymph and blood…..



Lipoproteins are micellar assemblies

LDL: Nonpolar core; TAG, cholesterol esters

Amphiphillic surface: protein (i.e. apolipoprotein B-100), phospholipid, cholesterol

As size ↑ the density ↓

Figure 20-4

Transportation of fats in lymph and blood…..

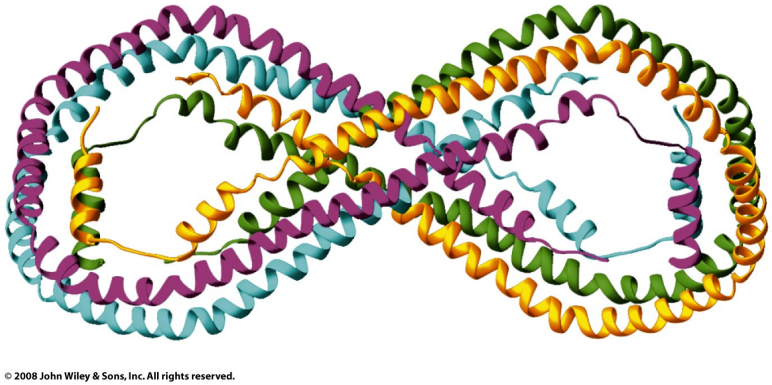


Figure 20-6a,b

Apolipoprotein A1

Occurs in chylomicrons/ HDL

Protein is loosely associated with the micelle

243 amino acid 29 kD peptide

Assembles as homotetramer

Amphipathic nature of helix

Uptake of LDL by Endocytosis…..

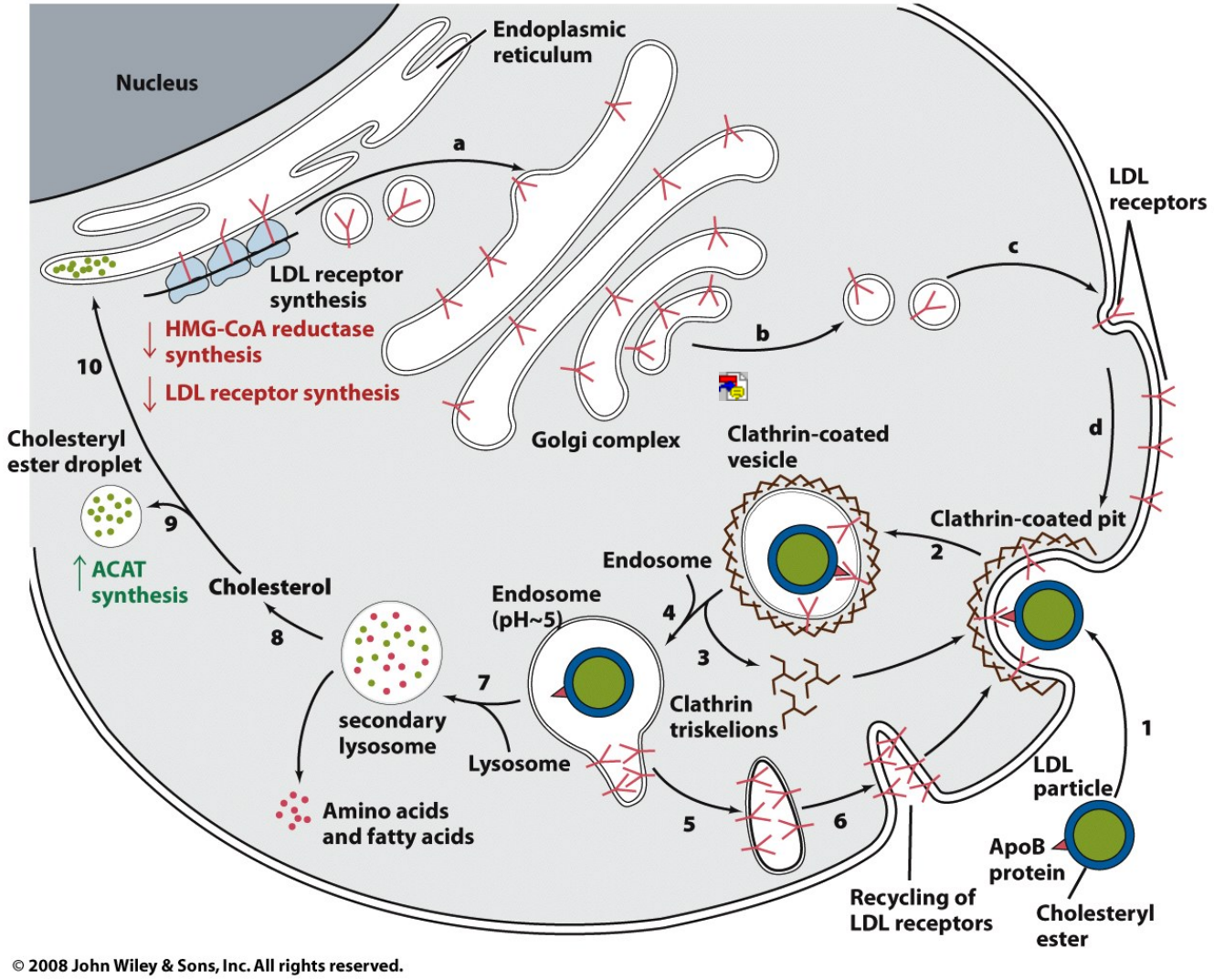


Figure 20-8