الكيمياءالحياتيه
المرحله الاولى
اعداد د. أيمان عبد الوهاب
المحاضره (٤)
1013 - 2012

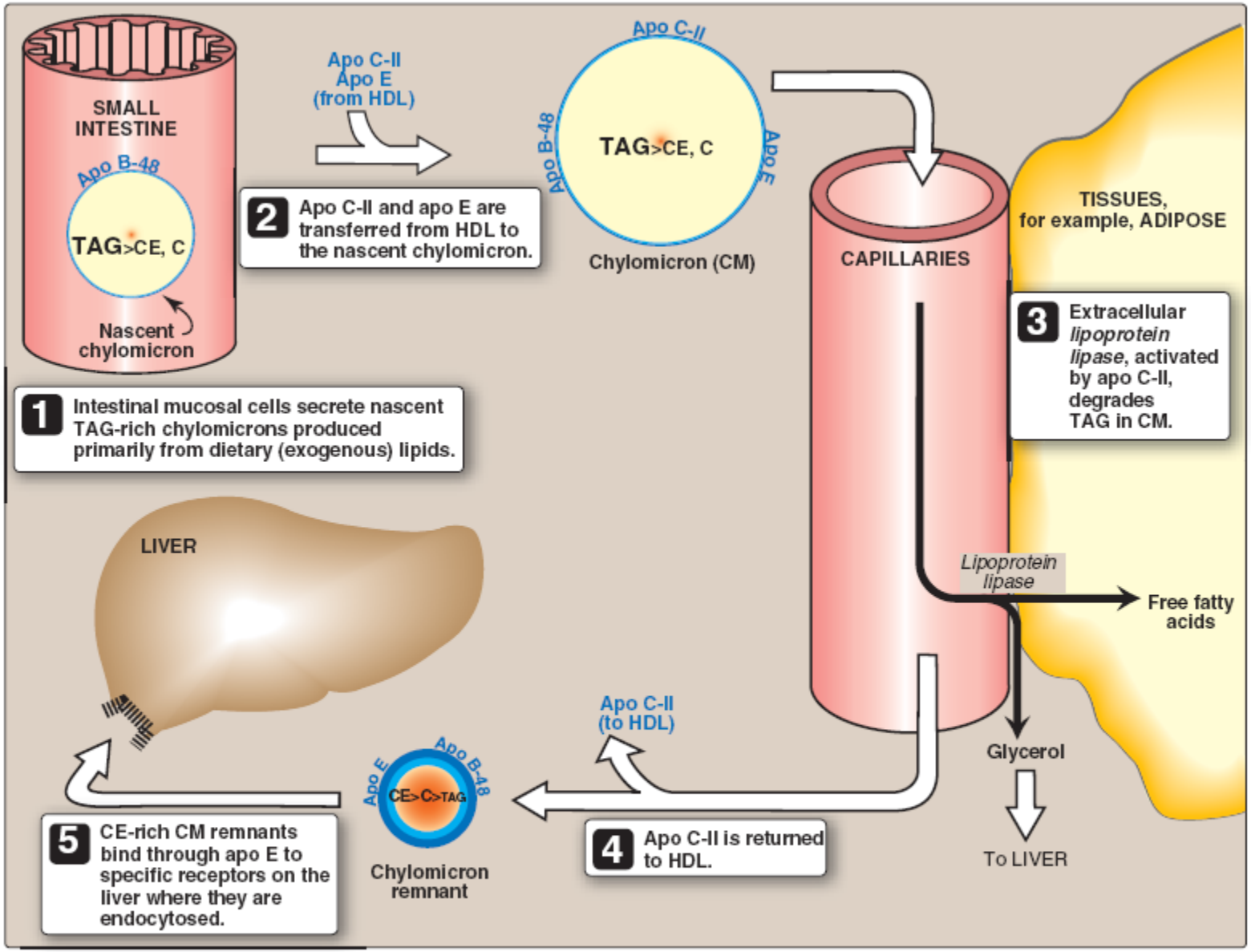

Figure 18.16

Metabolism of chylomicrons. CM = chylomicron; TAG = triacylglycerol; C = cholesterol; CE = cholesteryl esters. Apo B-48, apo C-II, and apo E are apolipoproteins found as specific components of plasma lipoproteins. The lipoproteins are not drawn to scale (see Figure 18.12 for details of the size and density of lipoproteins).

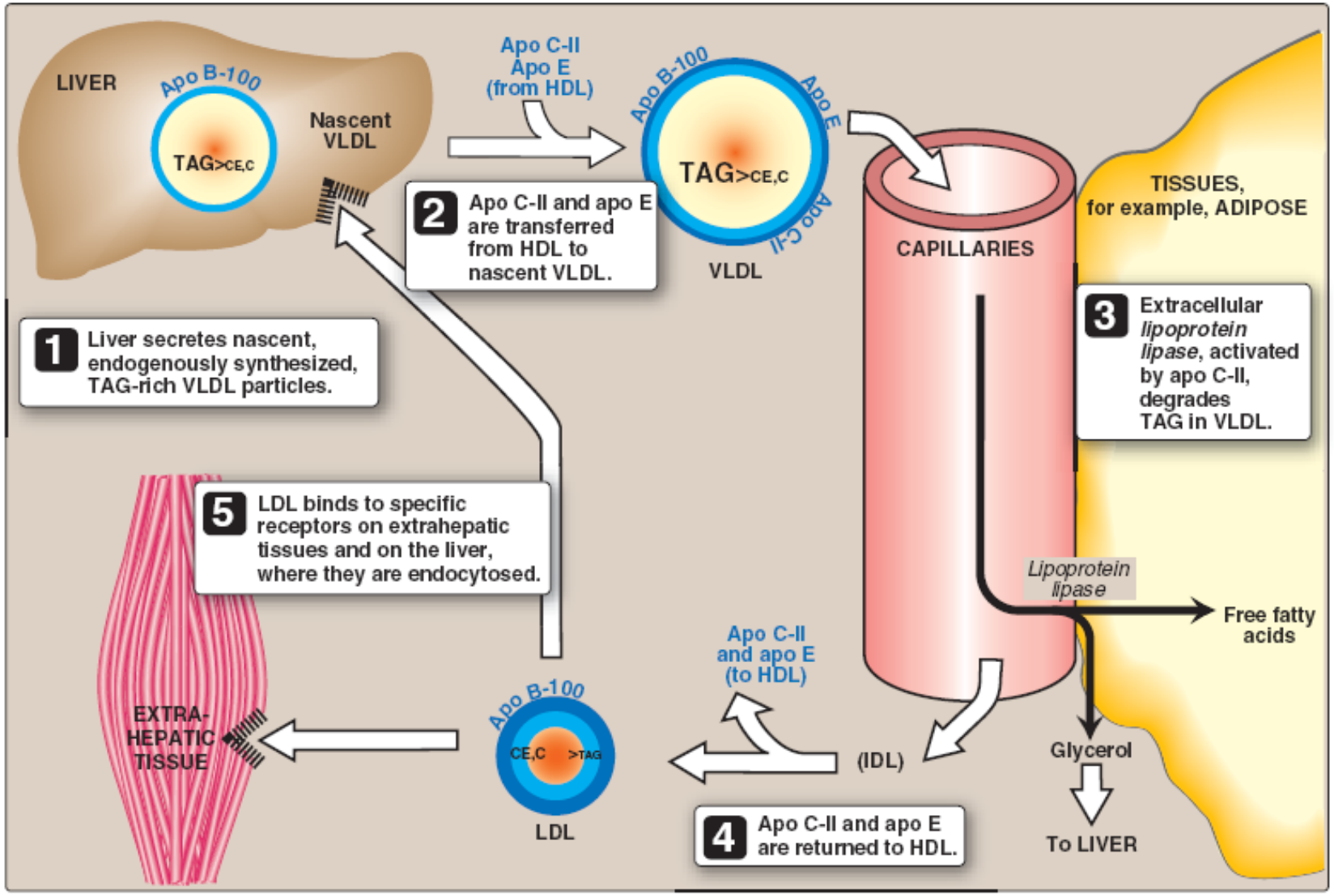

Figure 18.17

Metabolism of VLDL and LDL. TAG = triacylglycerol; VLDL = very-low-density lipoprotein; LDL = low-density-lipoprotein; IDL = intermediate-density lipoprotein; C = cholesterol; CE = cholesteryl esters. Apo B-100, apo C-II, and apo E are apolipoproteins found as specific components of plasma lipoproteins. Lipoproteins are not drawn to scale (see Figure 18.13 for details of the size and density of lipoproteins).

Transportation of plasma lipids

- Fat (TG) insoluble in water(hydrophobic)
- To transport in the blood need to combine with more polar compounds like **phospholipids**, **cholesterol** and **protein** to form **hydrophillic lipoprotein complex called chylomicron.**

- **TG synthesis in the liver** is transport to the blood as complex lipoproteins called VLDL.
- **TG in adipose tissue** hydrolysis to FFA and glycerol. FFA in the blood is combined with albumin.

Digestion and Absorption

1. Mouth and Stomach:

No significant of digestion is seen **in the mouth**. The lingual lipase in the mouth has low PH 2.5- 6 .

In the stomach the lingual lipase acts on short chain triglycerides present in milk of newborn infants.

2. Small intestine

a. The major site of digestion of fat .

b. The important materials are bile salts and pancreatic lipase.

Bile acid

- **Define:** as watery mixture of organic and inorganic compounds. Lecithin and bile salts are the most important organic components of bile.

Bile acid synthesis in **liver**, then pass through **bile duct** to the **duodenum** for digestion and absorption of fat, or be stored in **gallbladder** when needed for **digestion(not immediately).**

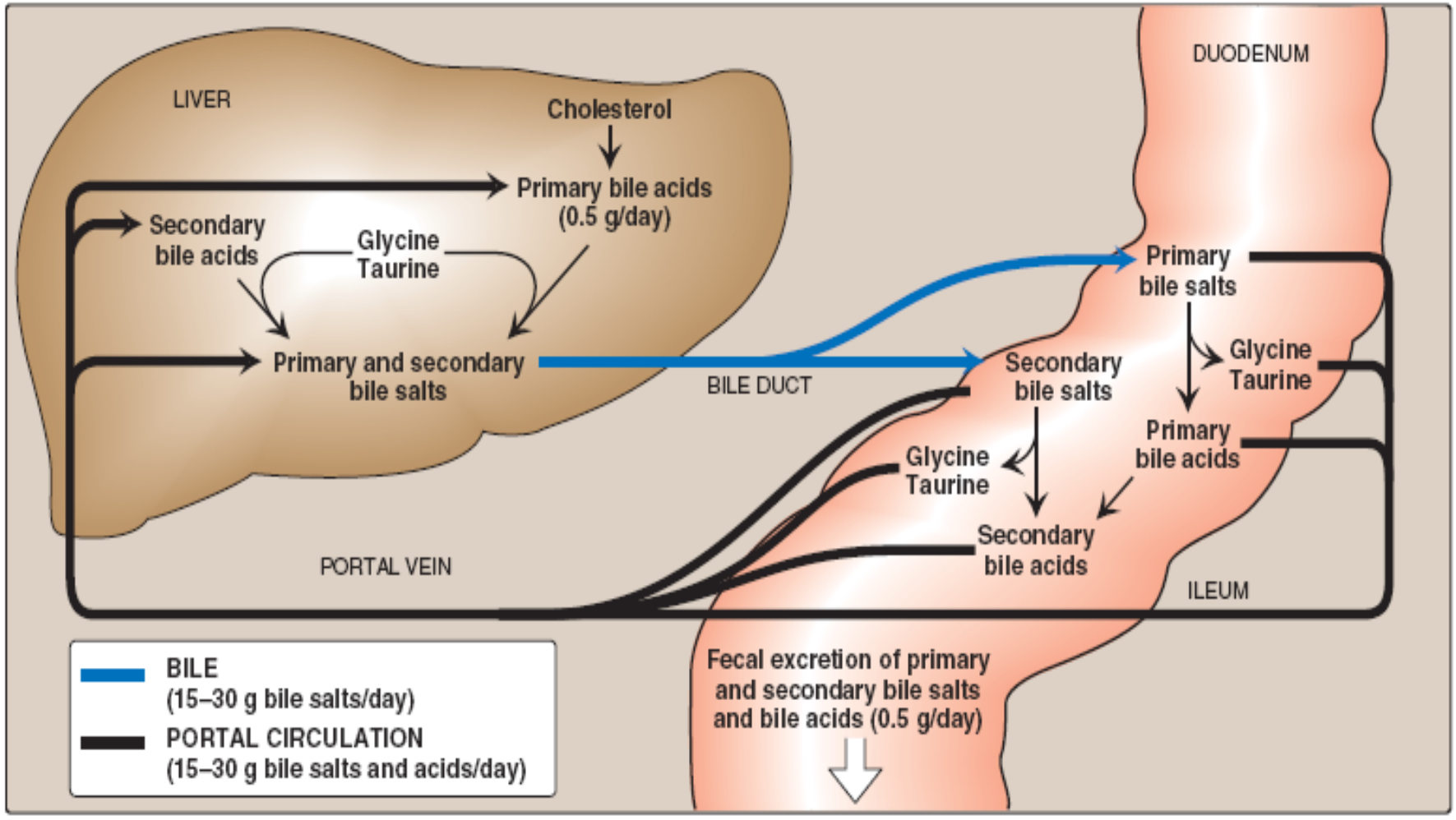

Figure 18.11
Enterohepatic circulation of bile salts and bile acids.

***Types of bile acids*:**

1. **Primary bile acid**: Synthesis in liver from cholesterol. ex: **cholic acid**

2. **Secondary bile acid**: produced in intestine from primary bile acids by the action of bacteria. ex: **deoxycholic acid** and **lithocholic acid**.

Primary bile acid acts as emulsifying agents.

Before bile acids leave the liver, they are conjugated with **glycine or taurine** producing **bile salts glycocholic acid** and **taurocholic acid.**

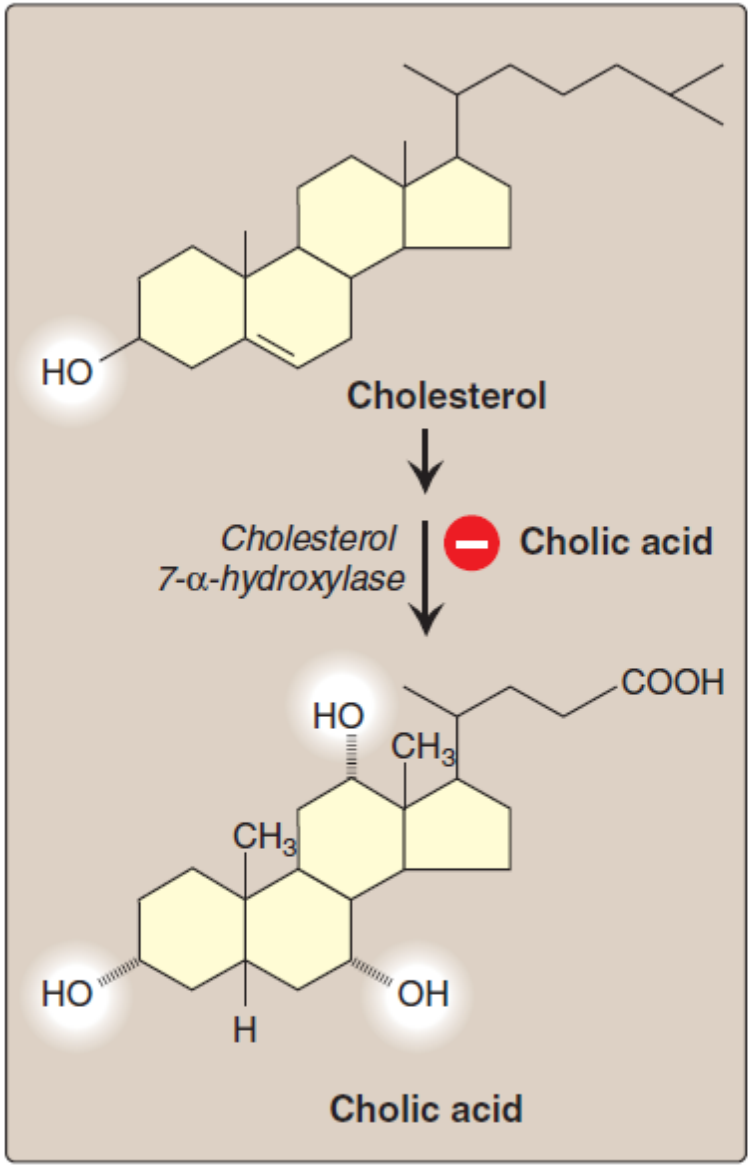

Figure 18.9
Synthesis of cholic acid, a bile acid.

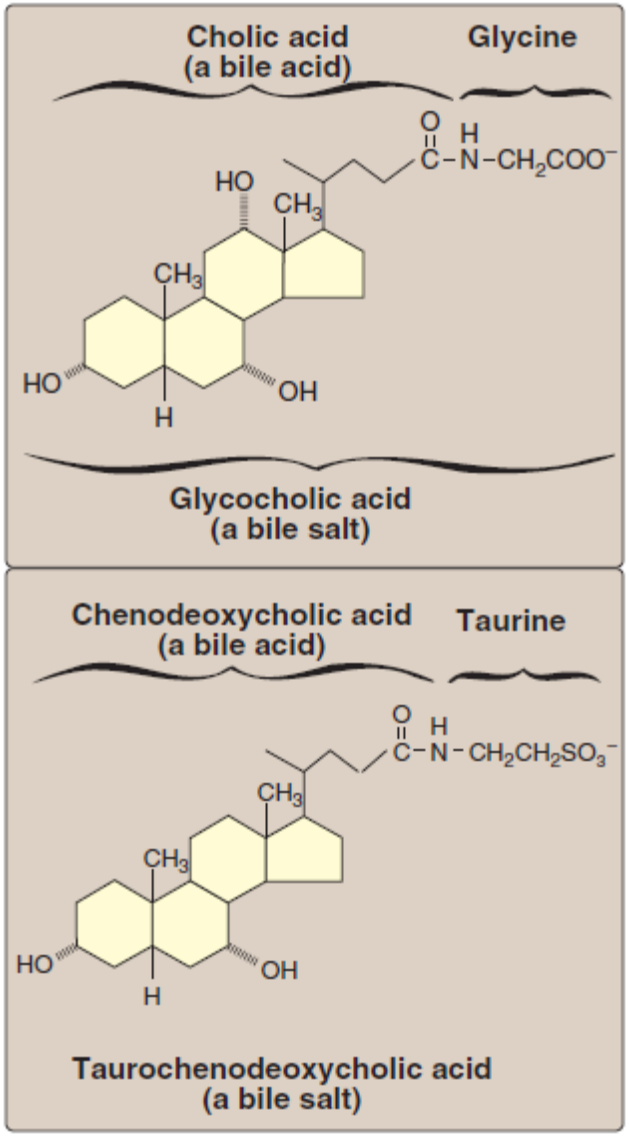

Figure 18.10
Bile salts. [Note "cholic" in the names.]

Note:

If more cholesterol enters the bile than can be solubilized by the bile salts and lecithin present, then cholesterol precipitate in gallbladder lead to gall stone disease cholelithiasis.

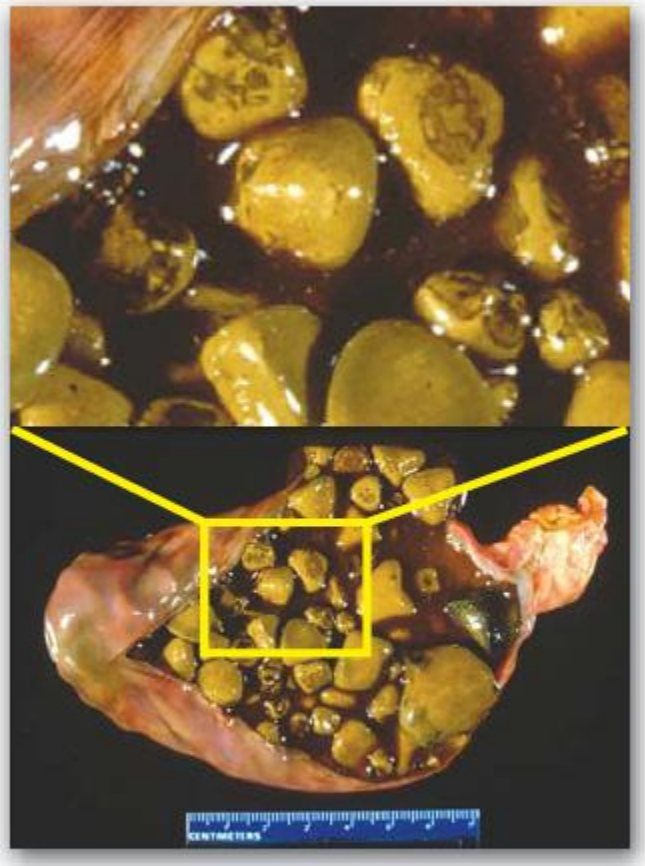

Figure 18.12
Gallbladder with gallstones.

Function of bile salts:

c. Bile salts have ability to lower surface tension to emulsify fat.

d. The alkaline content of pancreatic biliary secretions shift the PH of food to make alkaline

e. Bile facilitate the action of lipase to hydrolyze TG into their derivatives in intestine.

When the PH of food make alkaline the lipase become hydrolysis the fats in to diglyceride + monoglyceride + fatty acid + glycerol.

Absorption

1. F.a and glycerol are easily absorbed and carried away by blood.
2. monoglyceride hydrolyze in to F.a + glycerol.
3. diglyceride used for synthesis of TG.
4. higher fatty acids utilized for TG synthesis and carried as chylomicron.

Metabolism

Metabolism: Is the set of chemical reactions that happen in living organisms to maintain life and to allow **1**. grow **2**. reproduce

3. maintain their structure **4**. respond to their environments.

Metabolism divided in to two categories:

1. **Catabolism** : Breaking down of large molecules into small particles producing energy as ATP.

   ex: Breaking down and oxidizing food molecules.

2. **Anabolism** : Constructive of large molecules from small molecules using energy produce from catabolism. Ex: Synthesis of fats , glucose and DNA.

Lipolysis

Break down of TG to fatty acid and glycerol as an energy source in adipose tissue by the effect of lipase enzyme and hormone sensitive TG.

Hormones increase TG hydrolysis are:

epinephrine, nor epinephrine and glucagon.

Lipogenesis： synthesis of TG from primary substances fatty acids and glycerol.

Hormones increase the rate of esterfication (lipogenesis) in adipose tissues.

1. insuline 2. prolactin

Benefits of insulin:

1. **enhanced the uptake of glucose into adipose tissues.**
2. **inhibit the release of FFA from adipose tissues.**

B - Oxidation of fatty acids

Oxidation is occurs in the mitochonderia

(power houses).

1. Long chain fatty acids first activated to acyl COA in the cytosol by the enzyme acyl-COA synthetase ,ATP, COA and Mg ion.
2. Carnitine is a carrier transport acyl-COA from cytoplasm to mitochondria.
3. acyl-COA convert to B- keto acyl need FAD and NAD and multiple enzyme.

4. B-ketoacyl COA splits to acetyl-COA and acyl-COA. The latest compound undergoes further oxidation until completely oxidized. Each acetyl-COA liberate is oxidized by Krebs cycle to CO2, H_2O and ATP within mitochondria.

Q: Why it is named B-oxidation.

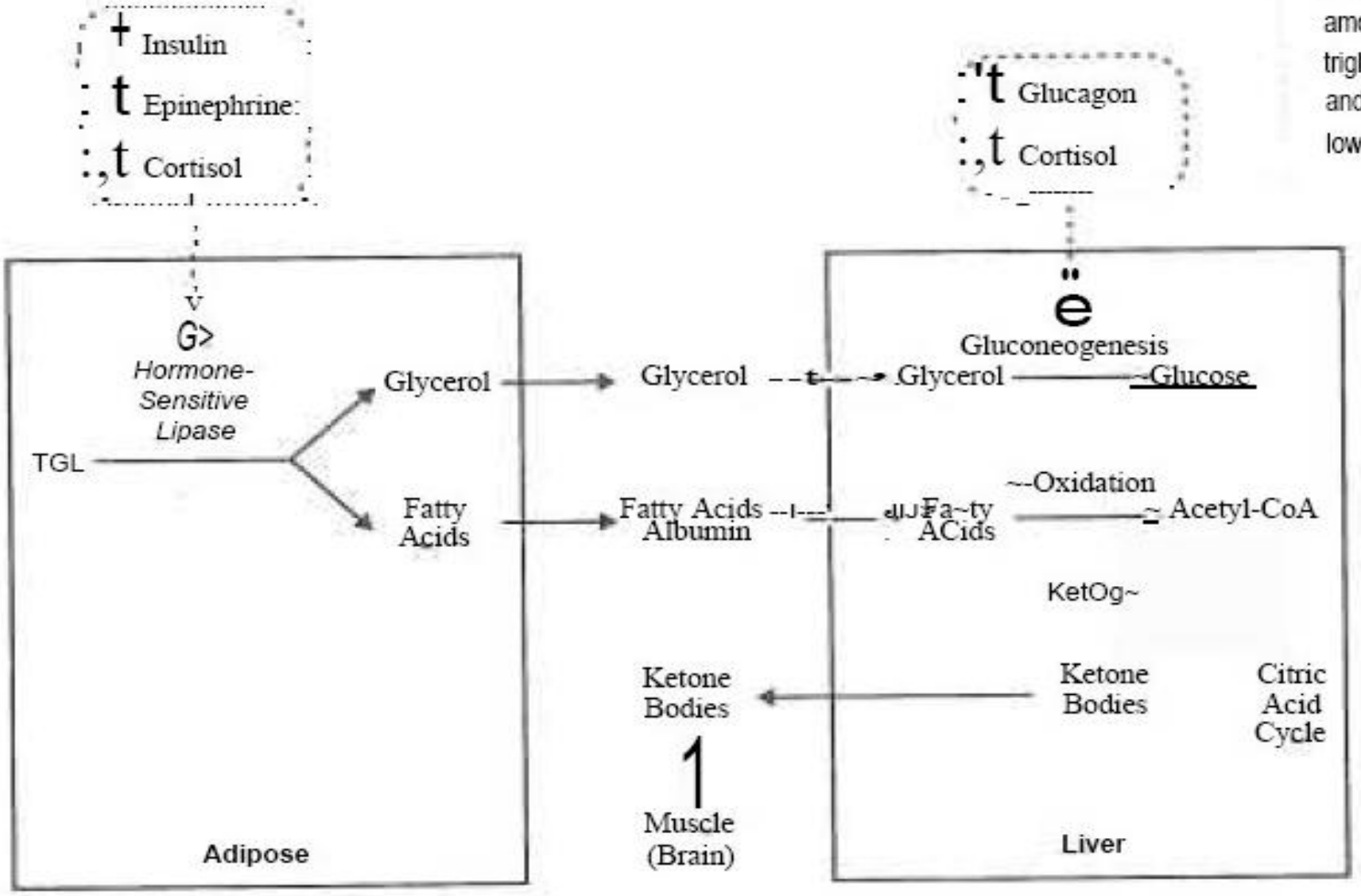

Figure 1·16·1. Lipolysis of Triglyceride in Response to Hypoglycemia and Stress

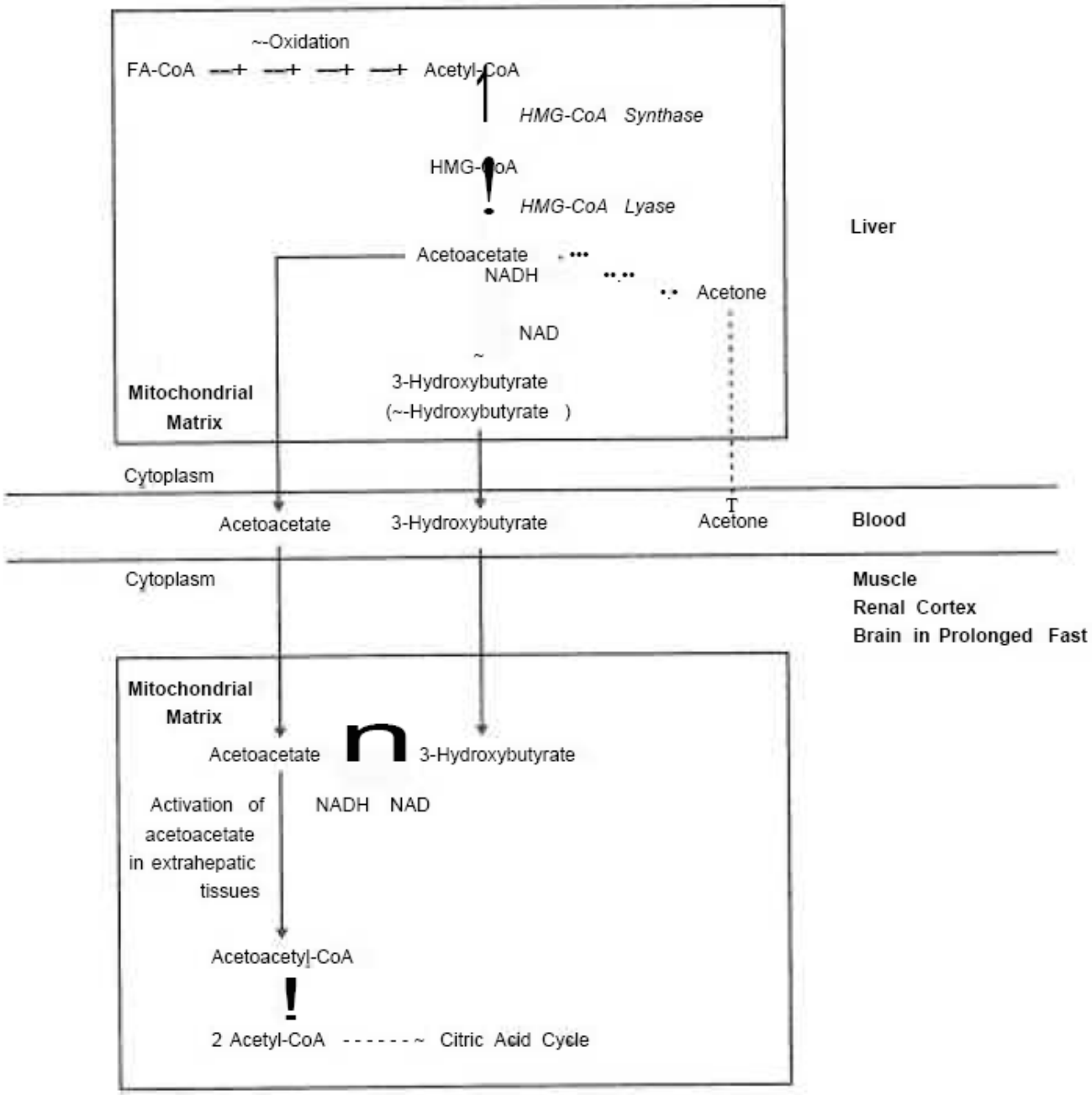

Figure 1-16-4. Ketogenesis (Liver) and Ketogenolysis (Extrahepatic)