Hepathobiliary Function

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Liver Functions

- Exocrine (digestive) functions:

1. Synthesizes and secrets bile salts
2. Secrets into the bile a bicarbonate-rich solution

Liver Functions

- Endocrine functions:

1. Secrets insulin-like growth factor I (IGF-I)
2. Contributes to the activation of vitamin D
3. Metabolizes hormones
4. Secretes cytokines involved in immune defenses

Liver Functions

- Clotting functions:

  -Produces many of the plasma clotting factors

- Plasma protein

  -Synthesizes and secretes plasma albumin

Liver Functions

Organic metabolism

- ***Converts plasma glucose into glycogen***
- ***Converts plasma amino acids to fatty acids***
- ***Synthesizes triacylglycerols and secrets them as lipoproteins***
- ***Produces glucose from glycogen (glycogenolysis)***
- ***Converts fatty acids to keones during fasting***
- ***Produces urea***

Liver Functions

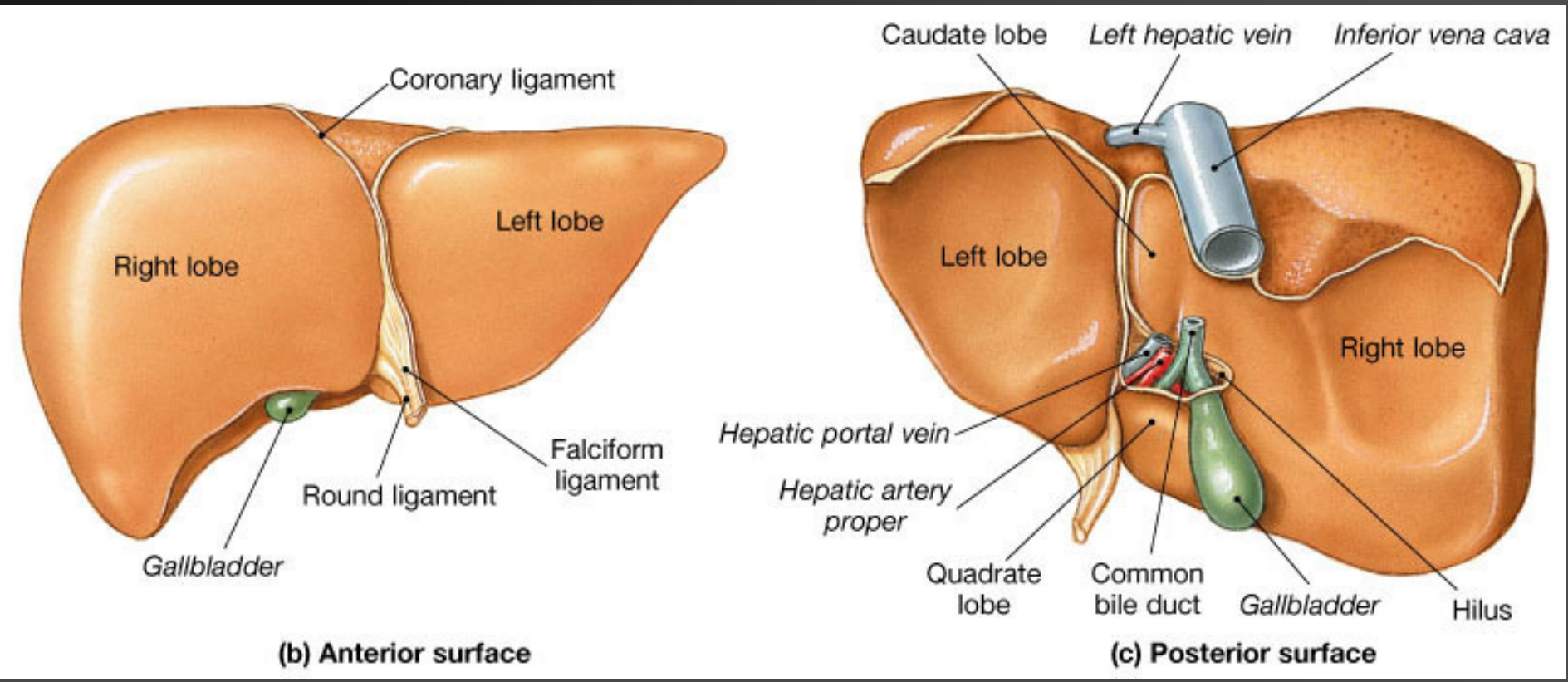
Cholesterol metabolism

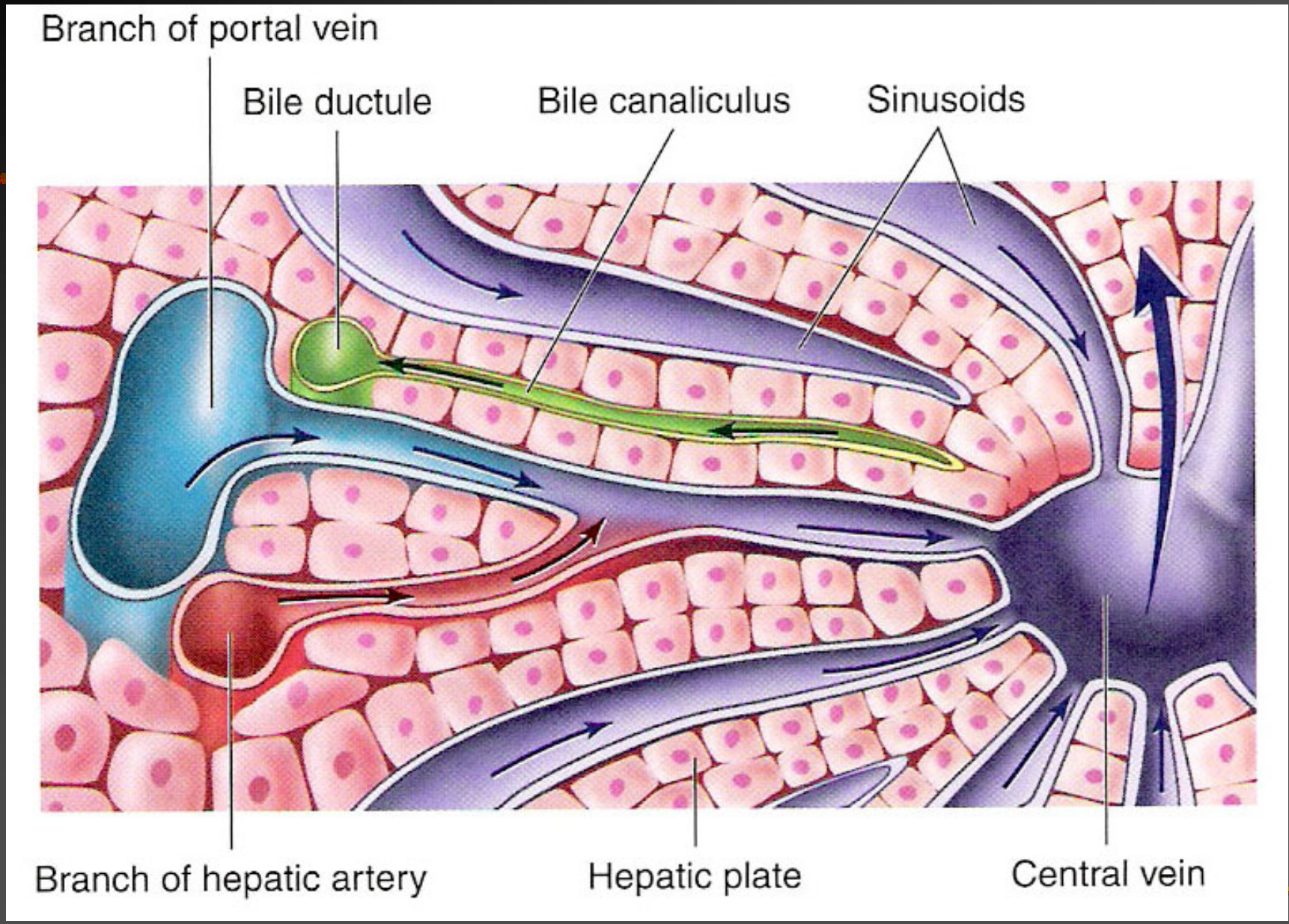
1. Synthesizes cholesterol and releases it into the blood
2. Secretes plasma cholesterol into the bile
3. Converts plasma cholesterol into bile salts

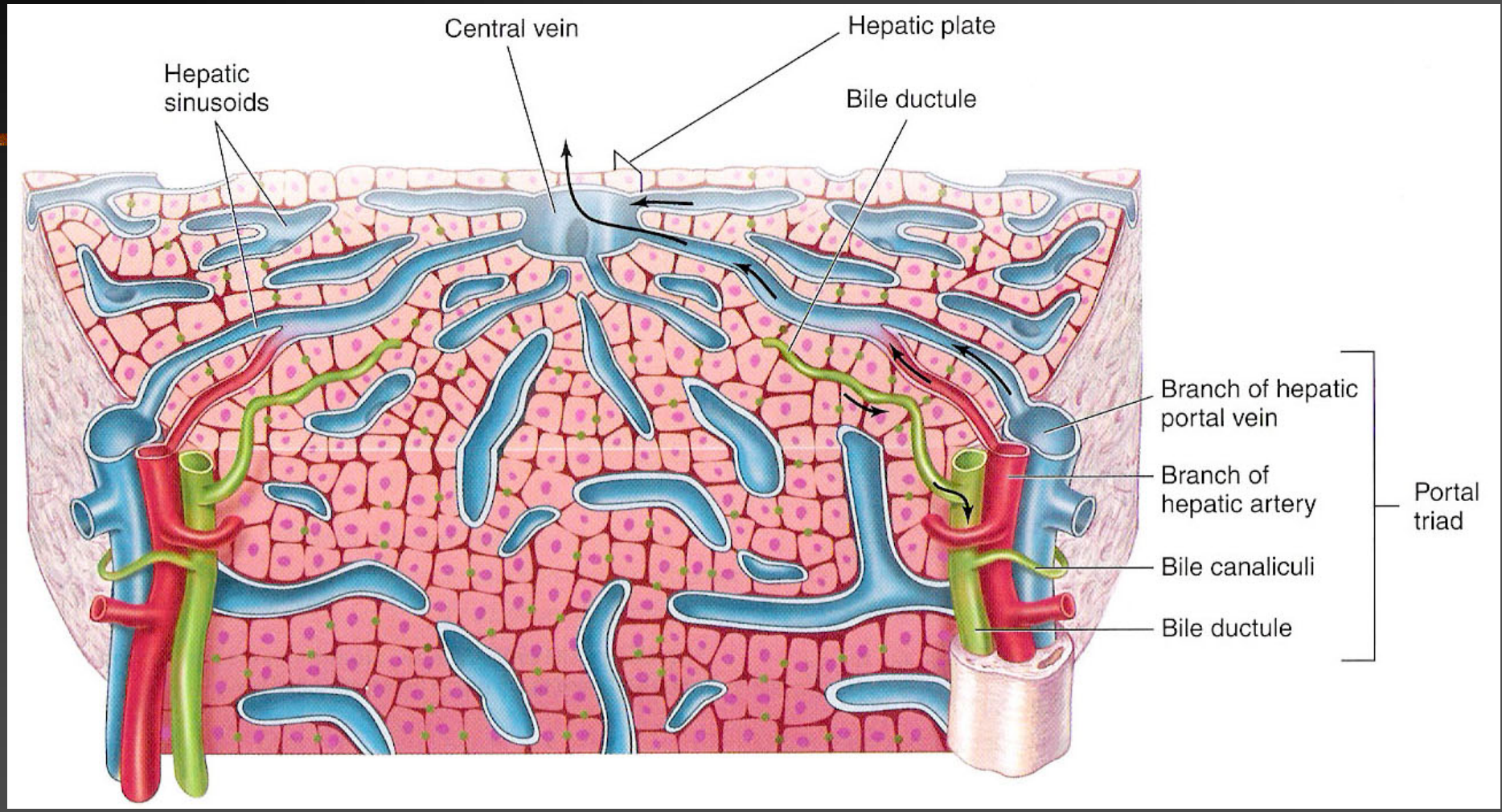
Liver Functions

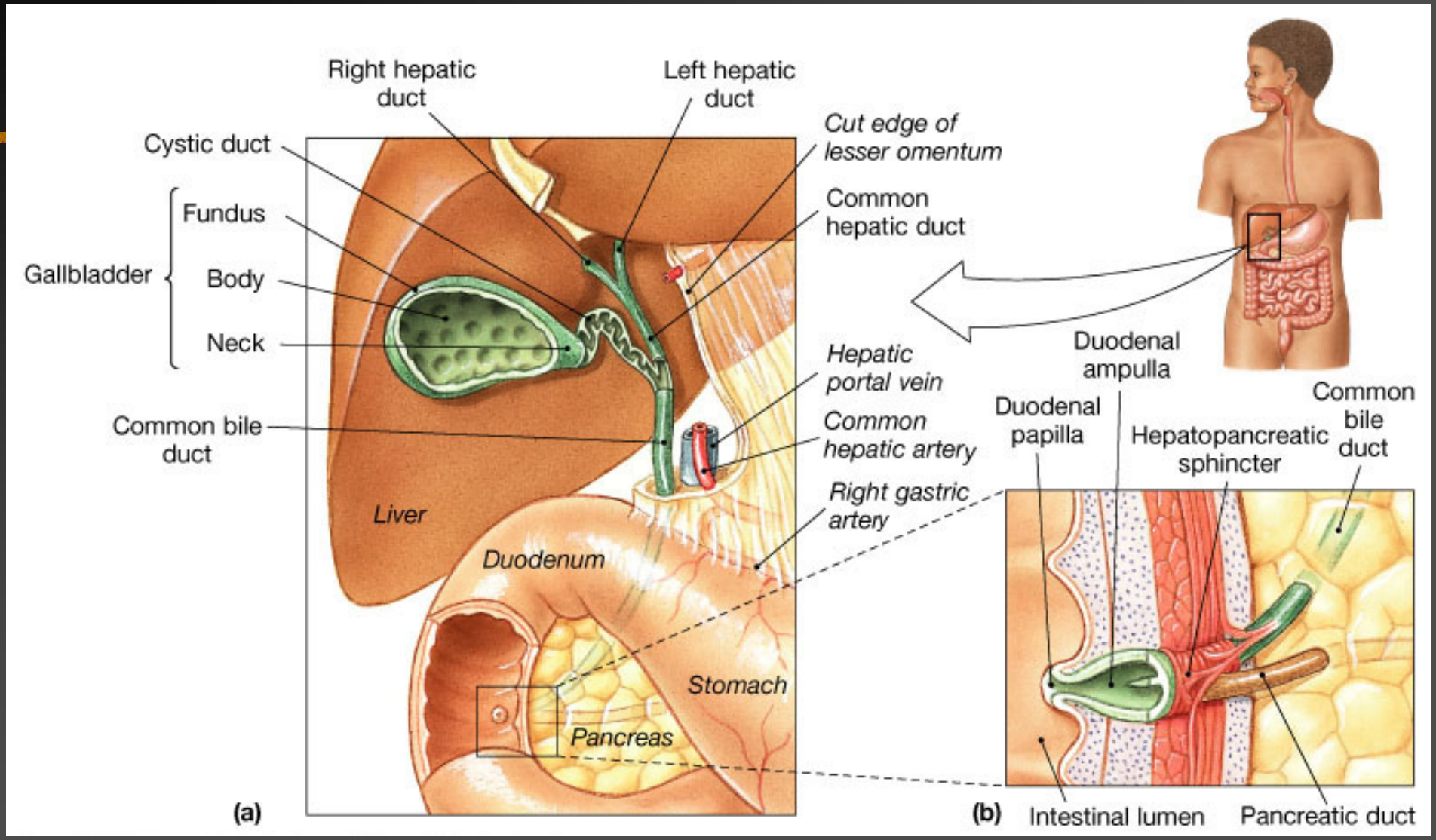
- Excretory function:

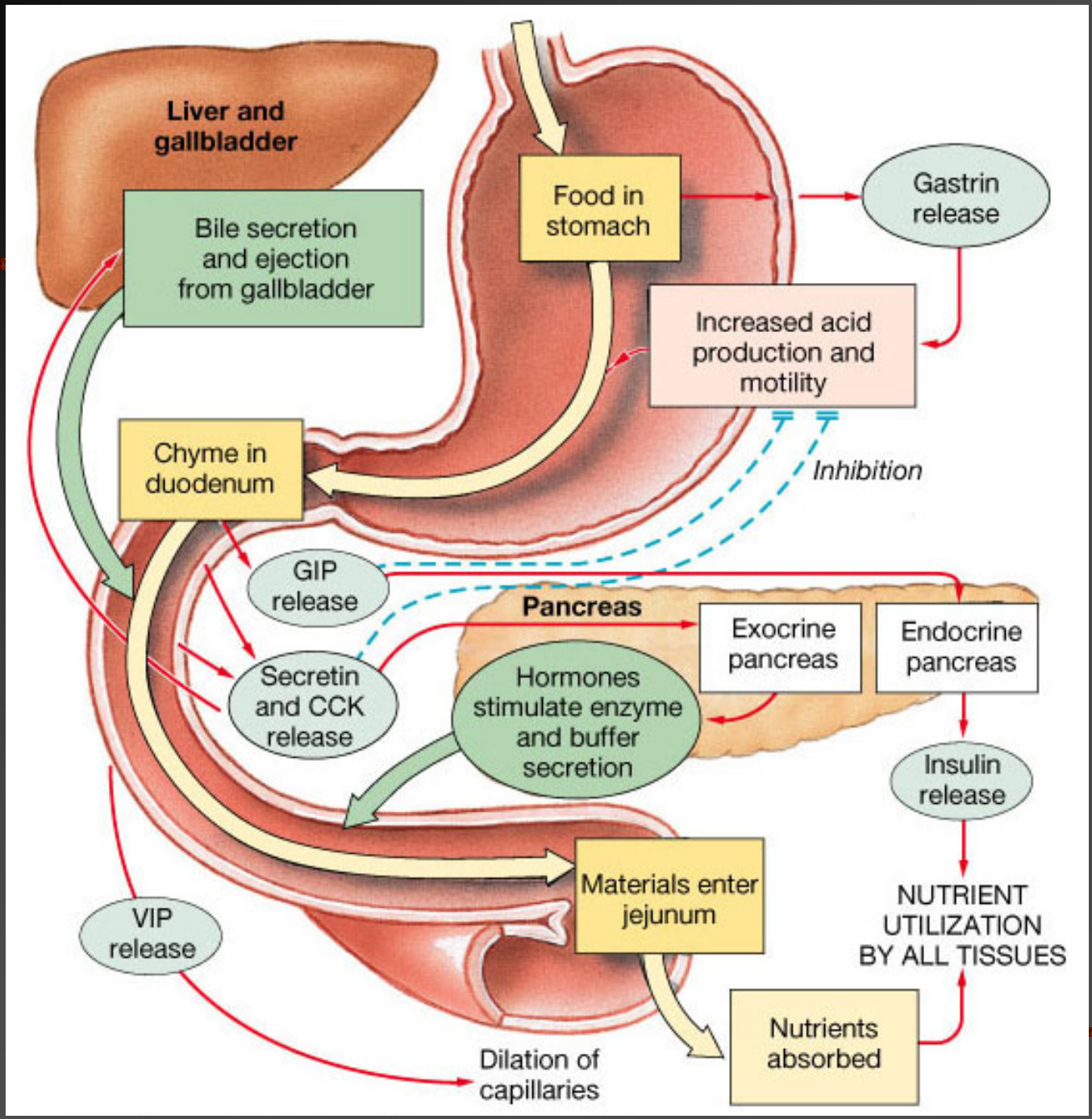
1. Secrets bilirubin and other bile pigments into the bile
2. Destroys old erythrocytes


Coronary ligament
Left lobe
Right lobe
Falciform ligament
Round ligament
Gallbladder
(b) Anterior surface
Caudate lobe
Left hepatic vein
Inferior vena cava
Left lobe
Right lobe
Hepatic portal vein
Hepatic artery proper
Quadrate lobe
Common bile duct
Gallbladder
Hilus
(c) Posterior surface


Branch of portal vein
Bile ductule
Bile canaliculus
Sinusoids
Branch of hepatic artery
Hepatic plate
Central vein


Central vein
Hepatic plate
Hepatic sinusoids
Bile ductule
Branch of hepatic portal vein
Branch of hepatic artery
Bile canaliculi
Bile ductule
Portal triad


Right hepatic duct
Left hepatic duct
Cystic duct
Cut edge of lesser omentum
Fundus
Common hepatic duct
Gallbladder
Body
Neck
Duodenal ampulla
Hepatic portal vein
Common bile duct
Duodenal papilla
Hepatopancreatic sphincter
Common bile duct
Common hepatic artery
Right gastric artery
Liver
Duodenum
Stomach
Pancreas
(a)
(b)
Intestinal lumen
Pancreatic duct


Liver and gallbladder
Bile secretion and ejection from gallbladder
Food in stomach
Gastrin release
Increased acid production and motility
Inhibition
Chyme in duodenum
GIP release
Pancreas
Exocrine pancreas
Endocrine pancreas
Secretin and CCK release
Hormones stimulate enzyme and buffer secretion
Insulin release
Materials enter jejunum
NUTRIENT UTILIZATION BY ALL TISSUES
VIP release
Nutrients absorbed
Dilation of capillaries

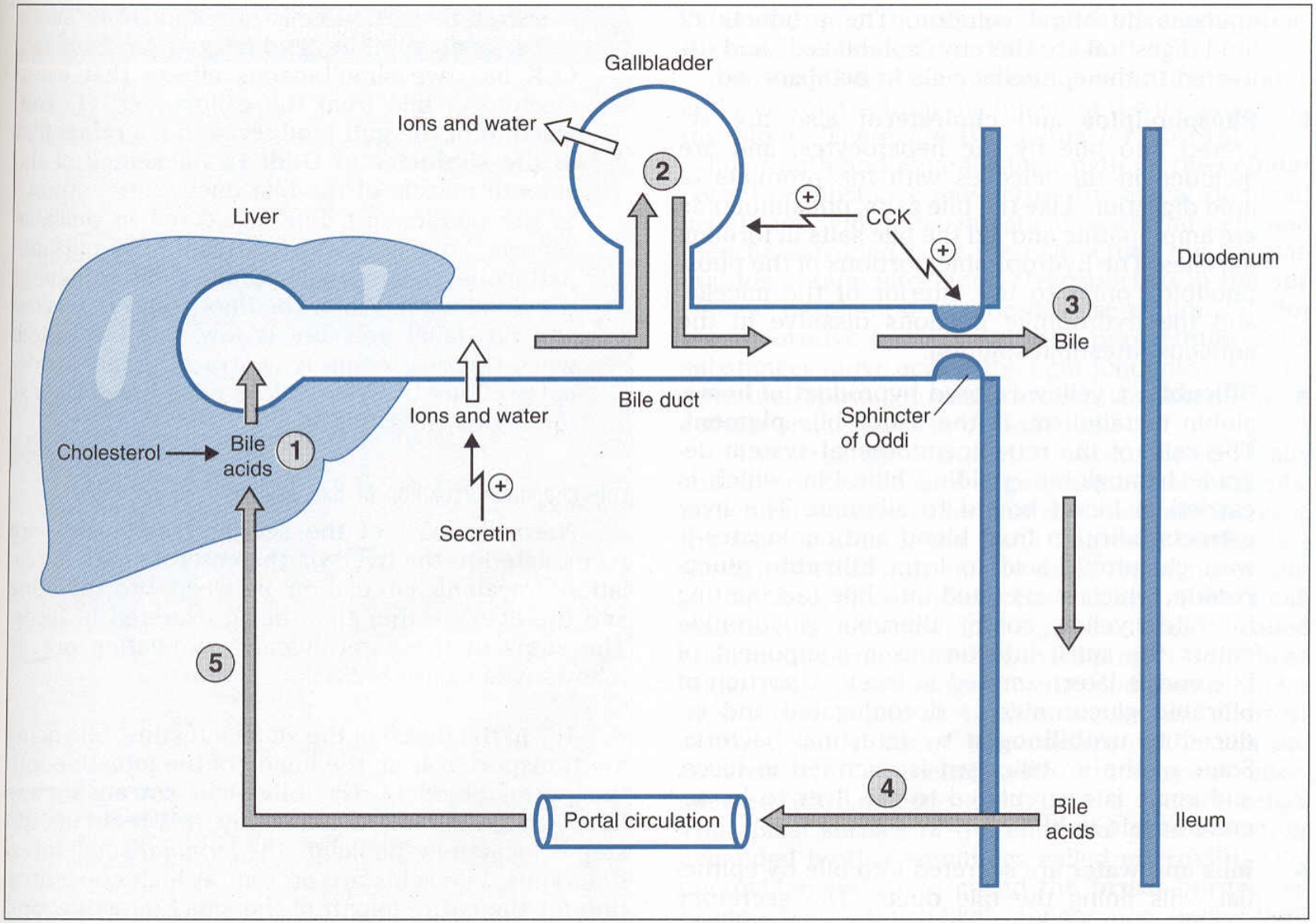


FIGURE 8–22. Secretion and enterohepatic circulation of bile acids. Filled gray arrows show the path of bile flow; open arrows show the movement of ions and water. CCK, cholecystokinin.

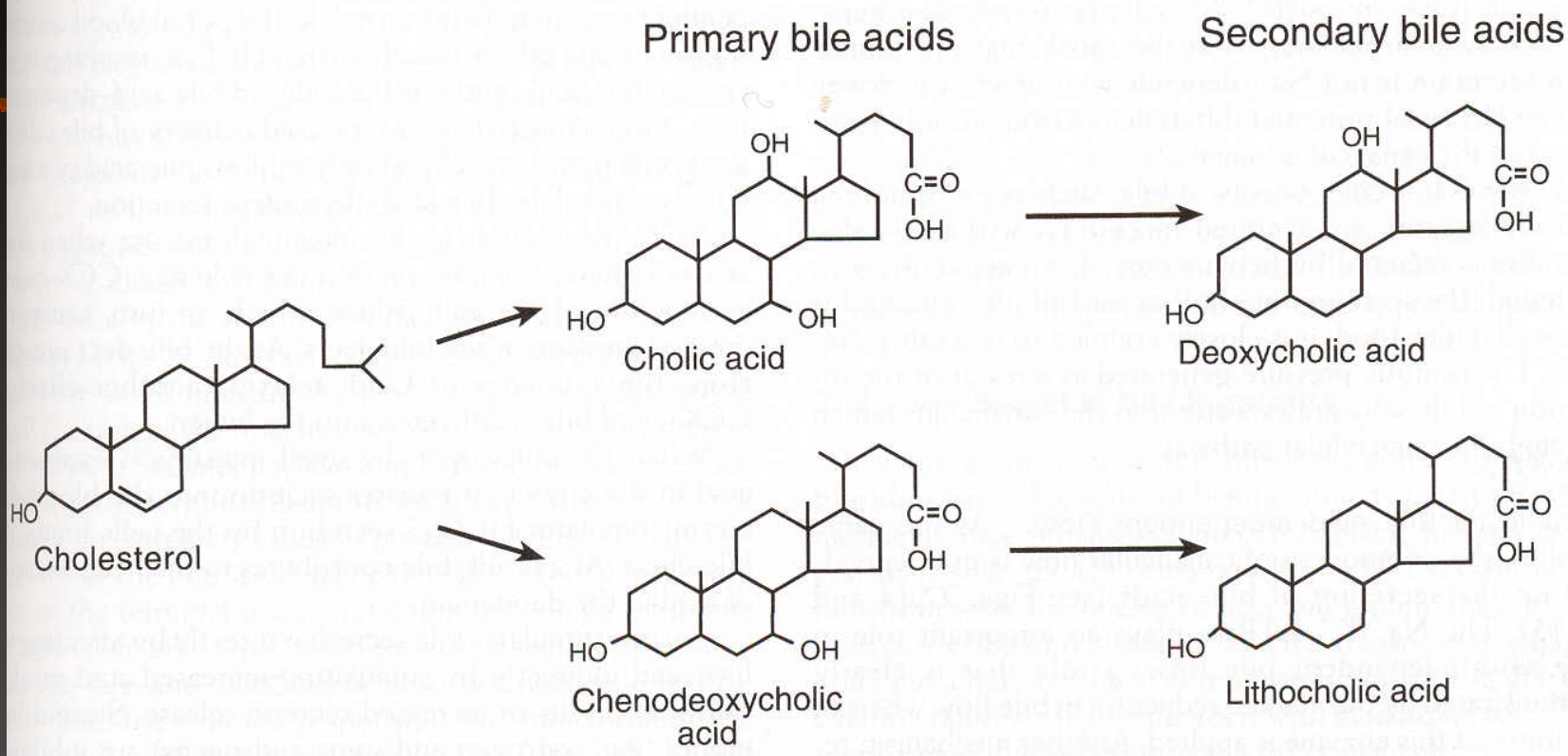


FIGURE 27.13 **The formation of bile acids.** Bile acids are conjugated with the amino acids glycine and taurine in the liver.

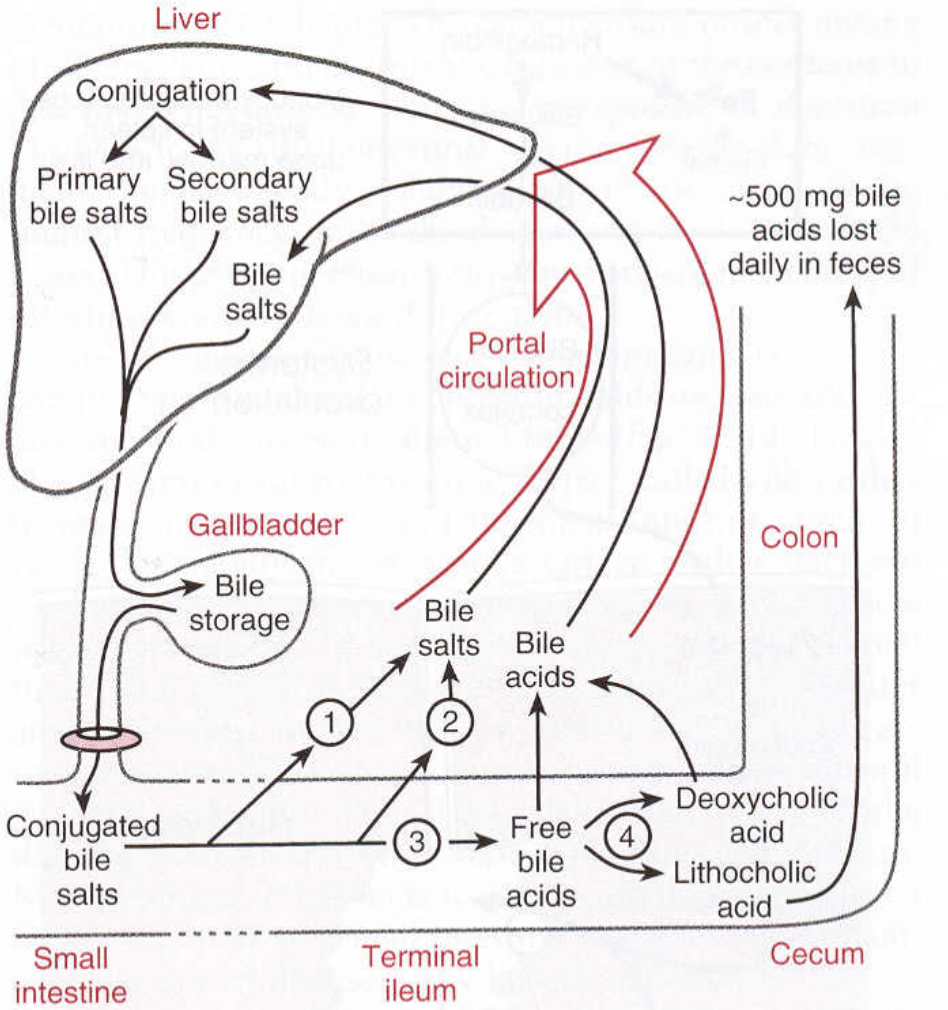
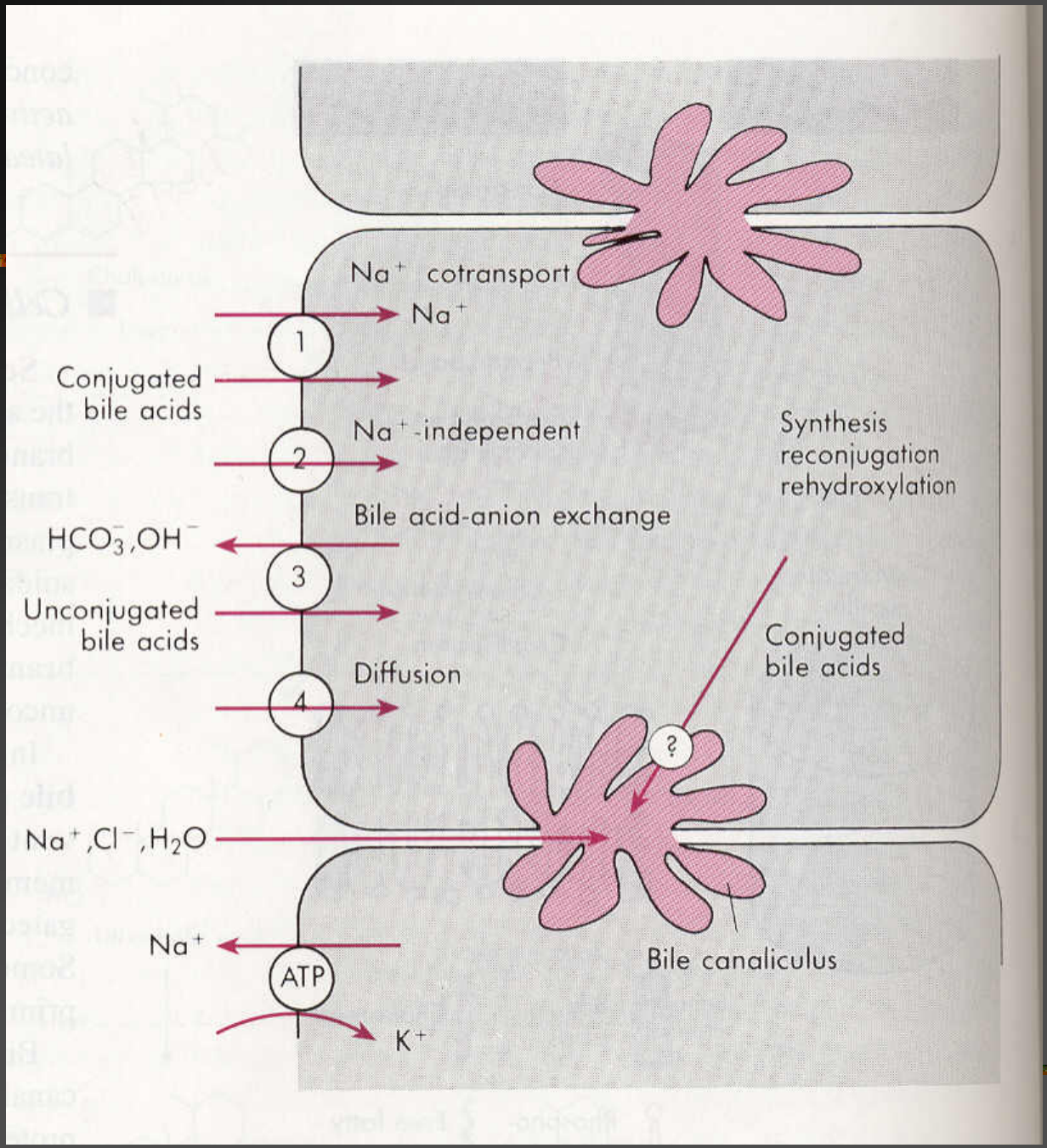
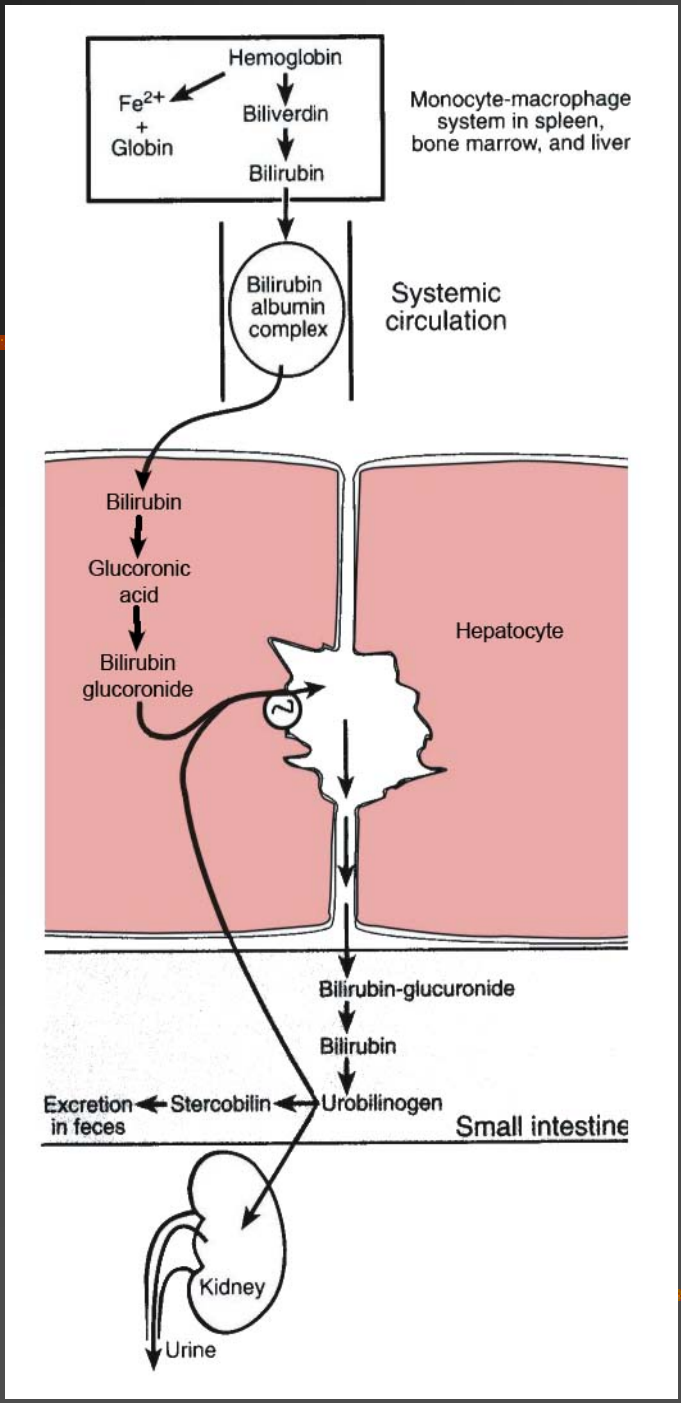
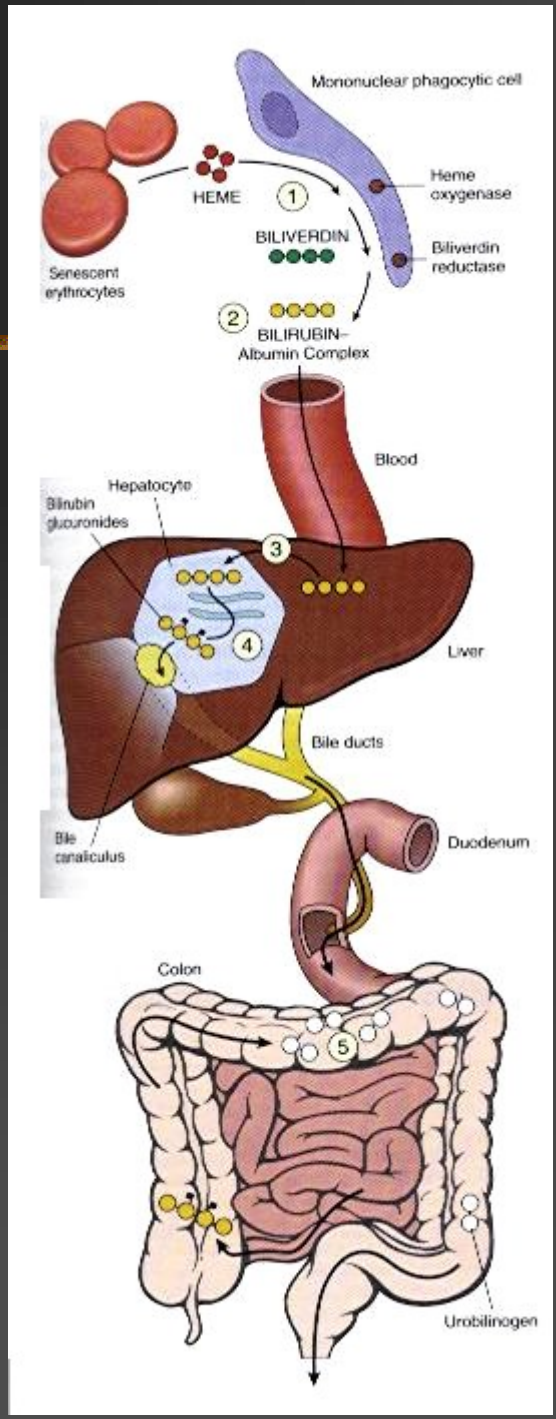


FIGURE 27.16 **The enterohepatic circulation of bile salts.** Bile salts are recycled out of the small intestine in four ways: (1) passive diffusion along the small intestine (plays a relatively minor role); (2) carrier-mediated active absorption in the terminal ileum (the most important absorption route); (3) deconjugation to primary bile acids before being absorbed either passively or actively; (4) conversion of primary bile acids to secondary bile acids with subsequent absorption of deoxycholic acid.


Na+ cotransport
Na+
1
Conjugated bile acids
Na+-independent
2
Synthesis reconjugation rehydroxylation
Bile acid-anion exchange
HCO3−,OH−
3
Unconjugated bile acids
Conjugated bile acids
Diffusion
4
?
Na+,Cl−,H2O
Na+
ATP
K+
Bile canaliculus


Hemoglobin
Fe^{2+} + Globin
Biliverdin
Bilirubin
Monocyte-macrophage system in spleen, bone marrow, and liver
Bilirubin albumin complex
Systemic circulation
Bilirubin
Glucoronic acid
Bilirubin glucoronide
Hepatocyte
Bilirubin-glucuronide
Bilirubin
Excretion in feces
Stercobilin
Urobilinogen
Small intestine
Kidney
Urine


Mononuclear phagocytic cell
Heme oxygenase
Biliverdin reductase
HEME
1
BILIVERDIN
Senescent erythrocytes
2
BILIRUBIN–Albumin Complex
Blood
Hepatocyte
Bilirubin glucuronides
3
4
Liver
Bile ducts
Bile canaliculus
Duodenum
Colon
5
Urobilinogen

Bilirubin

Bilirubin: - is the end product of heme degredation derived from breakdown senescent erythrocytes by mononuclear phagocytes system specially in the spleen, liver and bone marrow

Unconjugated

- Insoluble in water
- Tightly complex to albumin
- Cannot be excreted in urine
- Toxic substance

Conjugated

- Water soluble
- Loosely bound to albumin
- Excreted in urine
- Non-toxic

Bilirubin

- Normal serum bilirubin is 0.3-1.2mg
- 2.0-2.5mg causes Jaundice

Main causes of Jaundice:

1. Excessive production of bilirubin
2. ↓ hepatocyte uptake
3. Impaired conjugation
4. ↓ hepatocyte excretion of bilirubin glucuronides
5. Impaired bile flow (obstruction of bile duct)