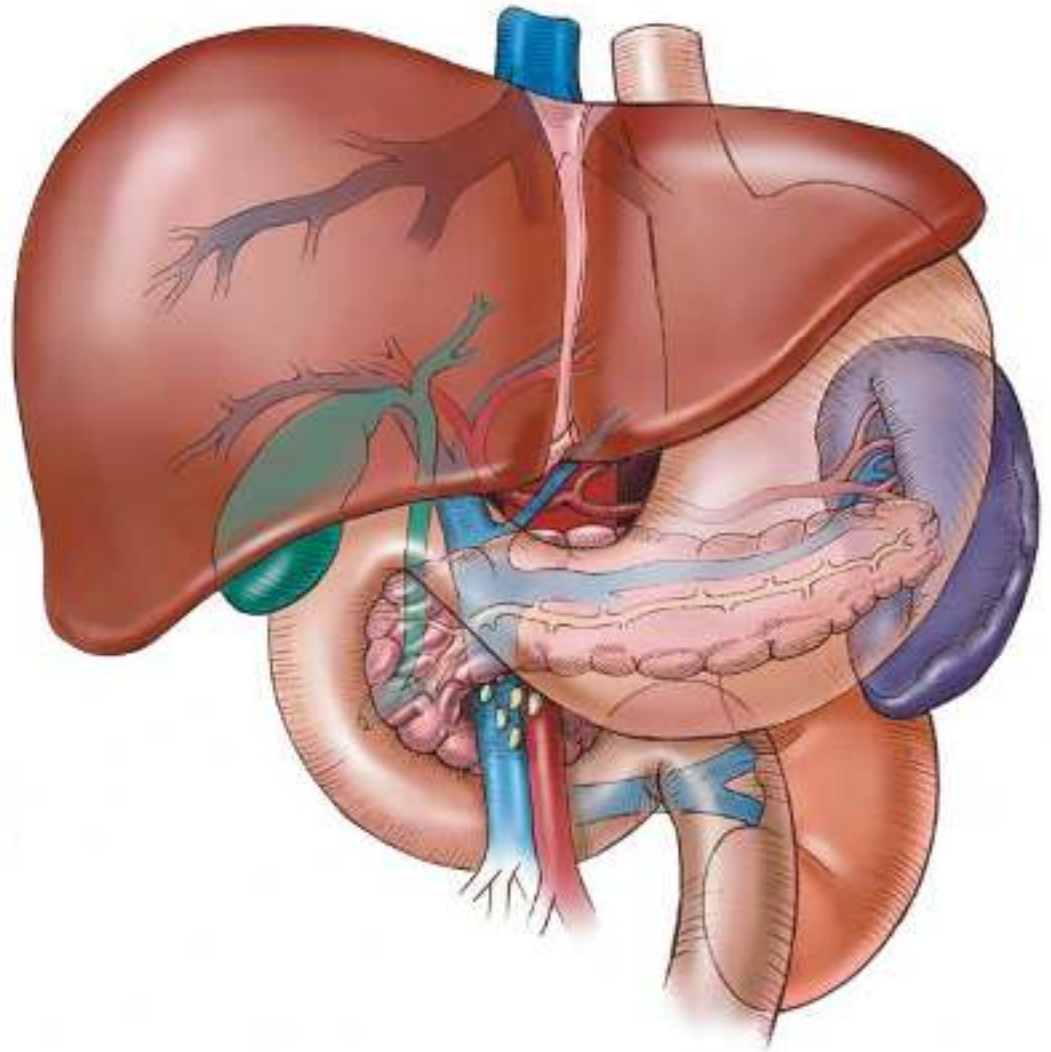


Gross Anatomy

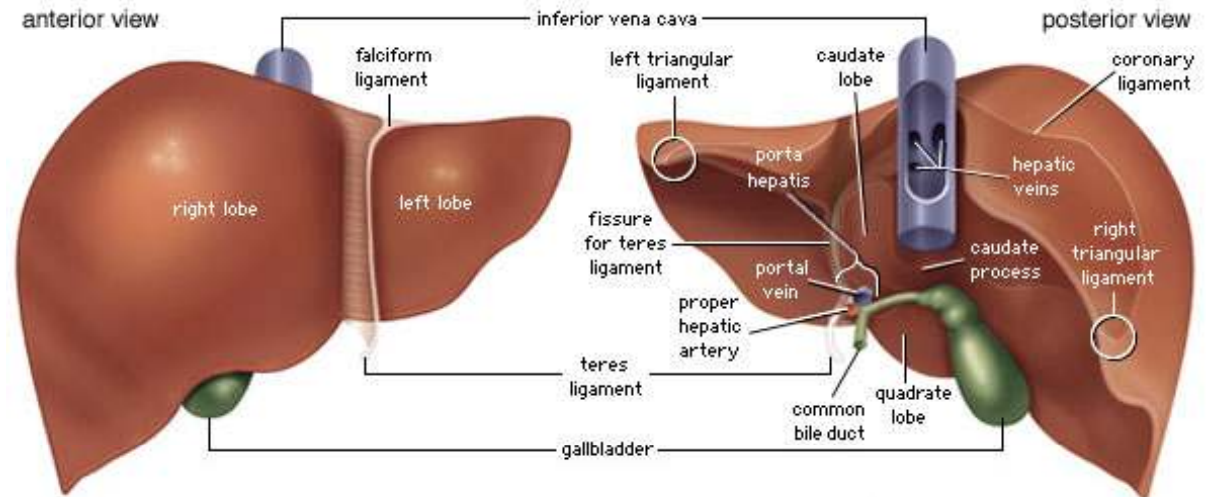
Liver

- The largest single organ in the human body.
- In an adult, it weighs about three pounds and is roughly the size of a football.
- Located in the upper right-hand part of the abdomen, behind the lower ribs.



Gross Anatomy

- The liver is divided into four lobes: the **right** (the largest lobe), **left**, **quadrate** and **caudate** lobes.
- Supplied with blood via the portal vein and hepatic artery.
- Blood carried away by the hepatic vein.
- It is connected to the diaphragm and abdominal walls by five ligaments.
- Gall Bladder
 - Muscular bag for the storage, concentration, acidification and delivery of bile to small intestine

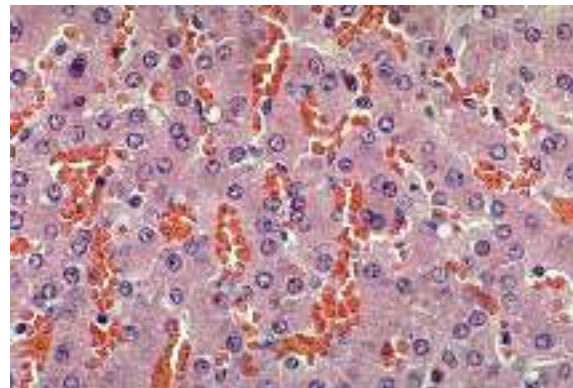
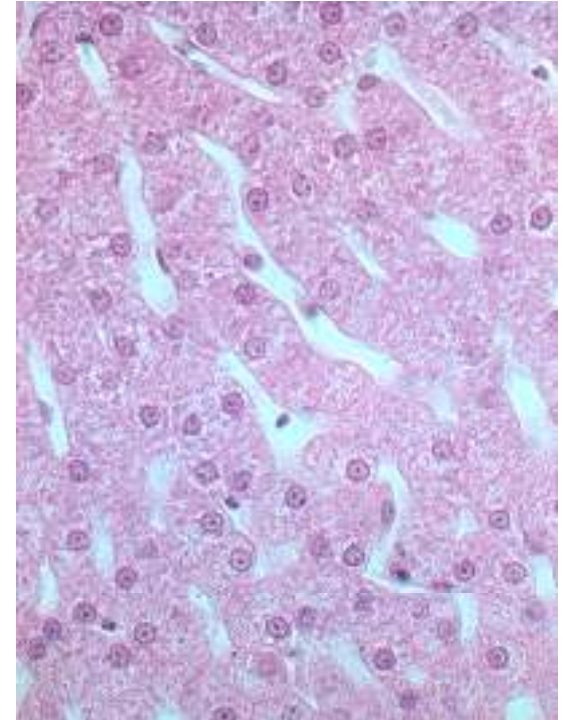
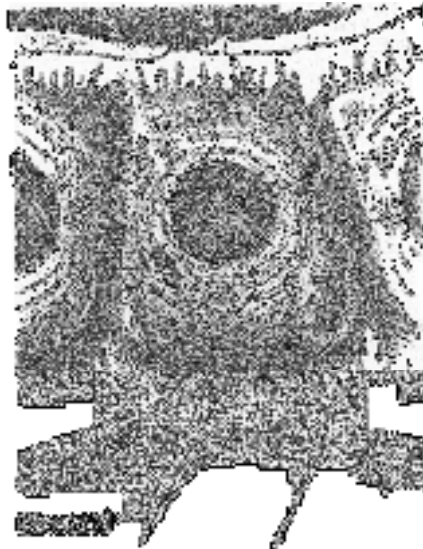


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- The liver is the only human organ that has the remarkable property of self-regeneration. If a part of the liver is removed, the remaining parts can grow back to its original size and shape.

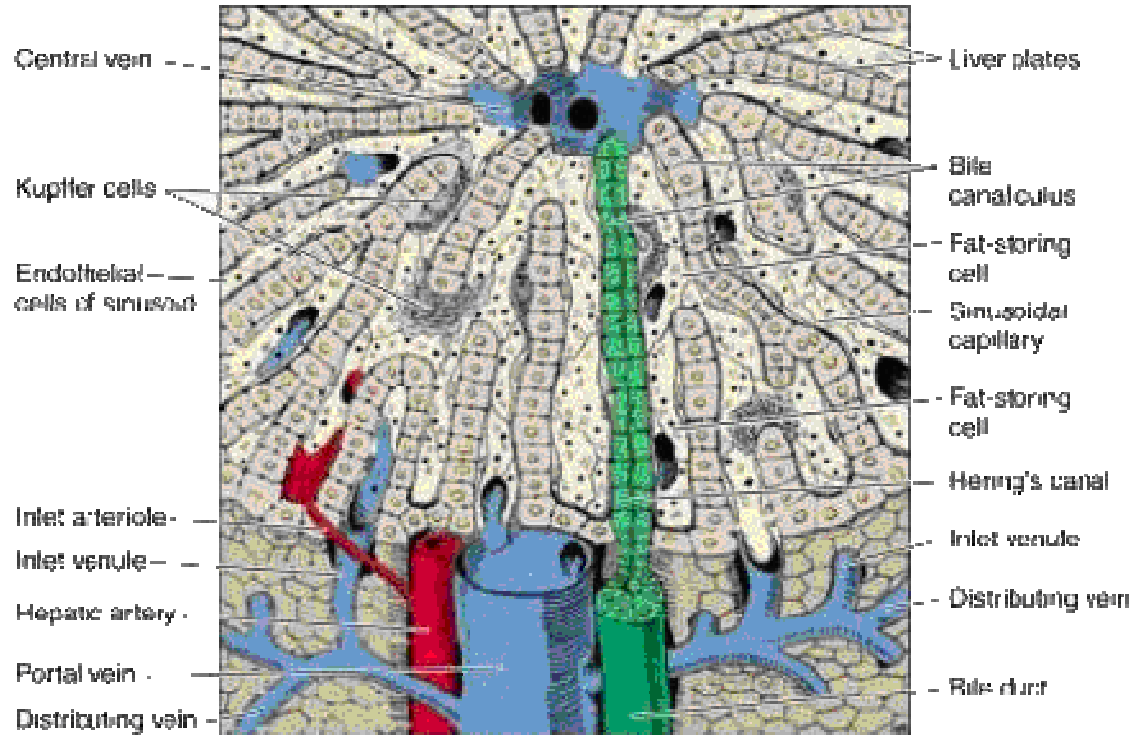
Microscopic Anatomy

- Hepatocyte—functional unit of the liver
 - Cuboidal cells
 - Arranged in plates → lobules
 - Nutrient storage and release
 - Bile production and secretion
 - Plasma protein synthesis
 - Cholesterol Synthesis

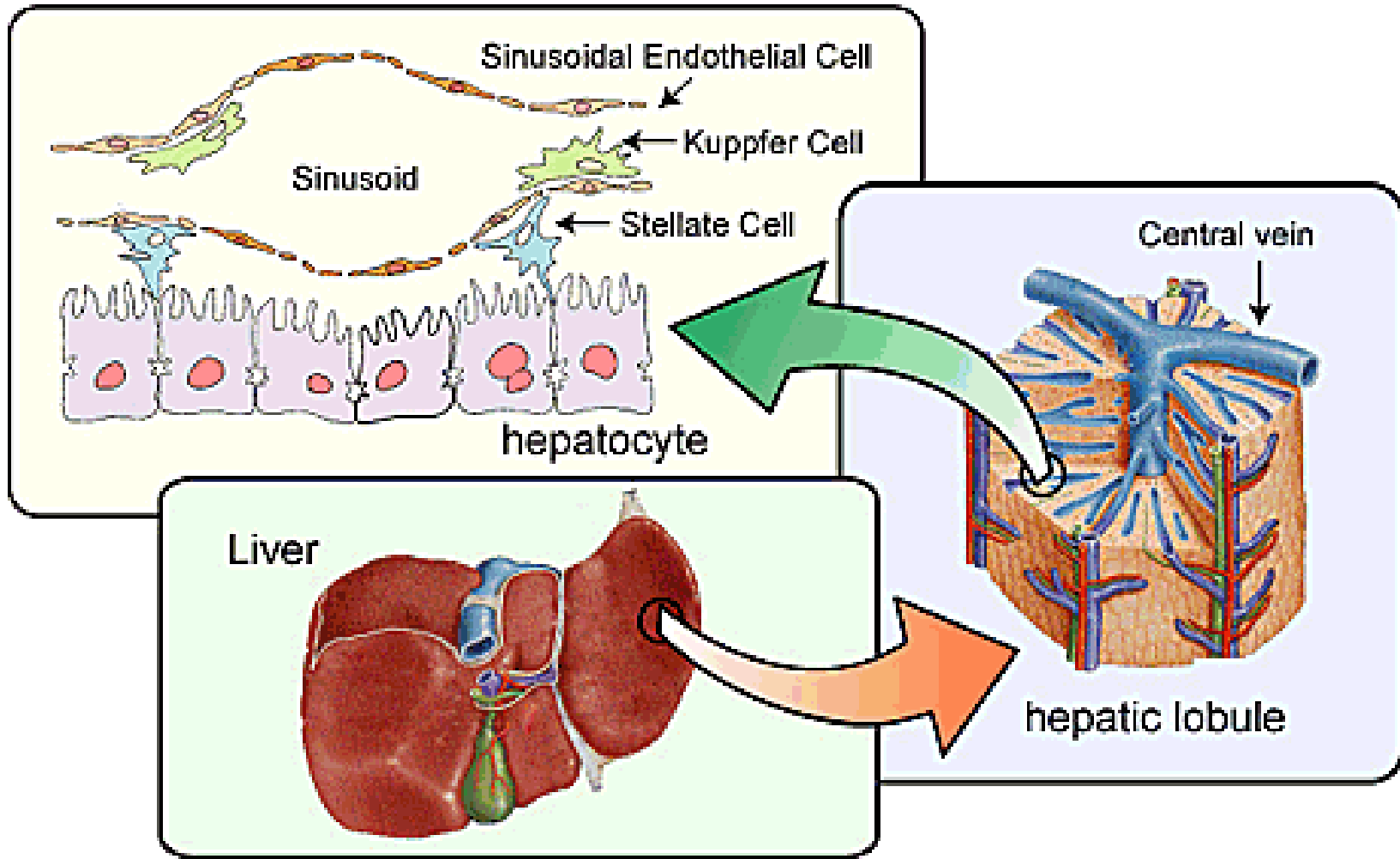


Microscopic Anatomy

- Kupffer cells
 - Phagocytic cells
- Fat Storing Cells
- Sinusoids
 - Fenestrated vessel
 - Wider than capillaries
 - Lined with endothelial cells
 - Blood flow
- Branches of the hepatic artery
- Branches of the Hepatic portal vein, central vein
- Bile canaliculi



Microscopic Anatomy

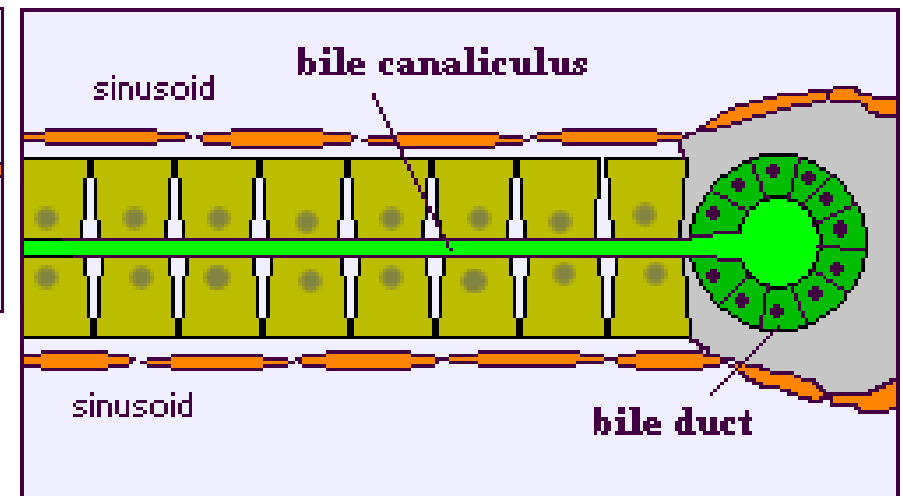


Blood and Bile Flow in Opposite Directions

- **Blood Flow**



- **Bile Flow**

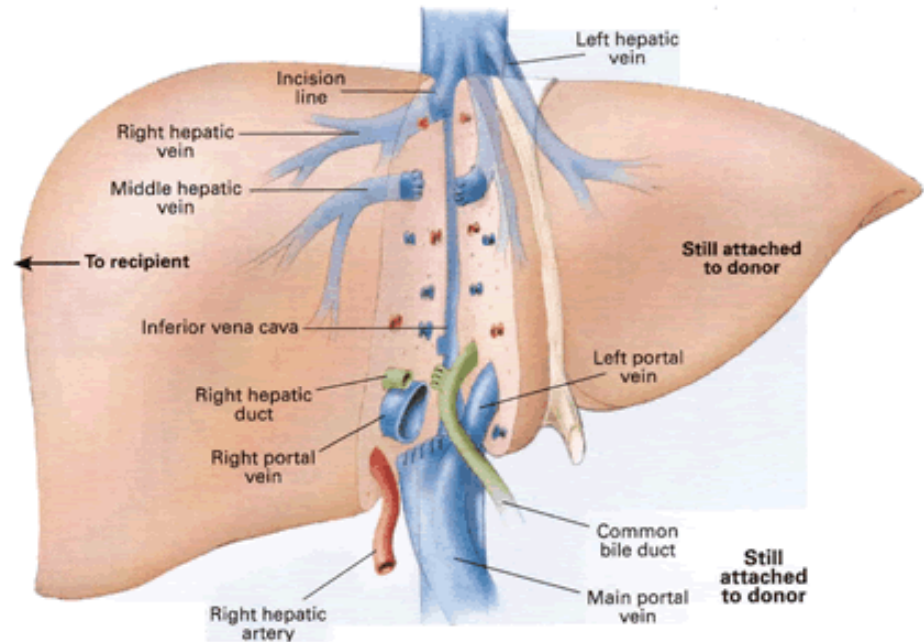


- Deoxygenated blood from stomach or small intestine → Hepatic Portal Vein → venules → sinusoids → central vein → hepatic vein → vena cava

- Bile produced in hepatocytes → secreted into canaliculus → bile ductules → common duct → gall bladder → bile duct → small intestine

Functions

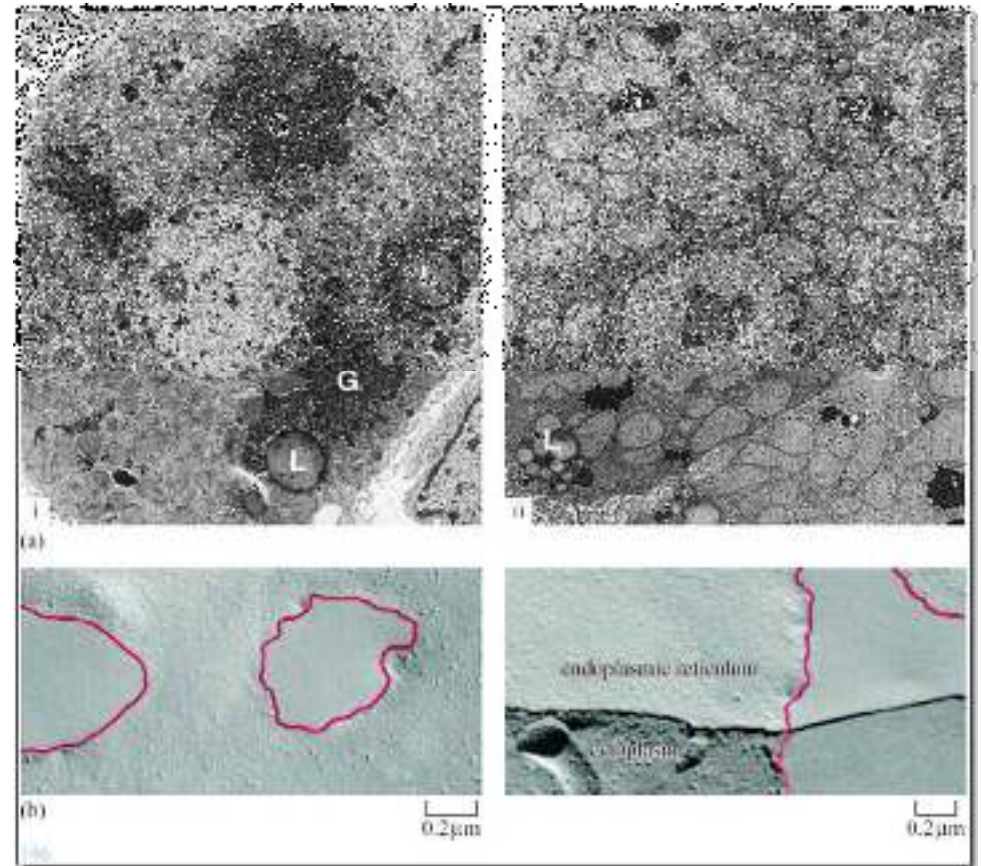
- The liver has more than 200 functions, including:
 - Storage of Nutrients
 - Breakdown of erythrocytes
 - Bile Secretion
 - Synthesis of plasma Proteins
 - Synthesis of cholesterol



Trotter, Wachs, Everson, Kam; *Medical Progress: Adult-to-Adult Transplantation of the Right Hepatic Lobe*. The New England Journal of Medicine. April 4, 2002. Vol. 346. Page 1074-1082. Copyright 2002, Massachusetts Medical Society. All rights reserved.

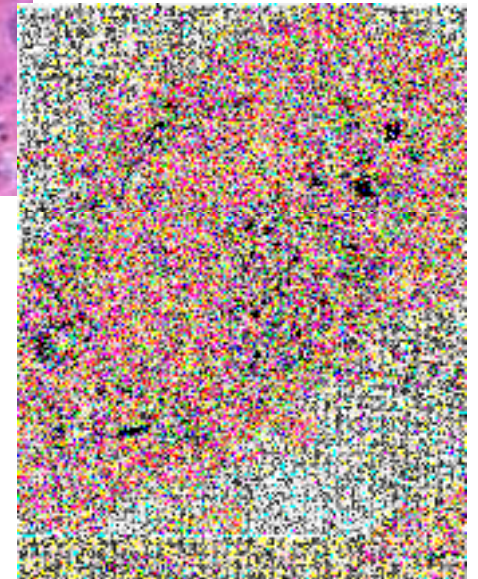
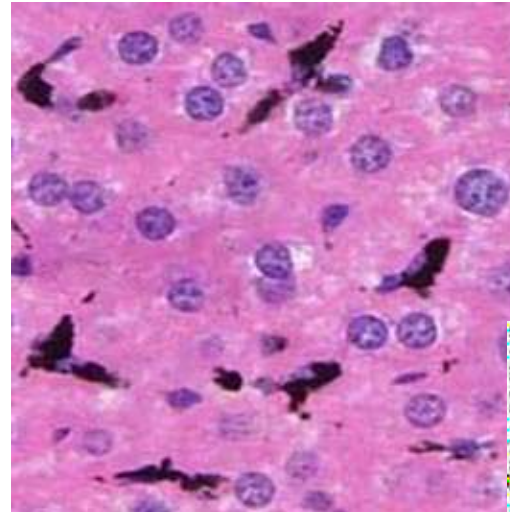
Storage of Nutrients

- Hepatocytes absorb and store excess nutrients in the blood
 - Glucose (glycogen)
 - Iron
 - Retinol (Vitamin A)
 - Calciferol (Vitamin D)
- Nutrients released when levels are too low



Breakdown of Erythrocytes

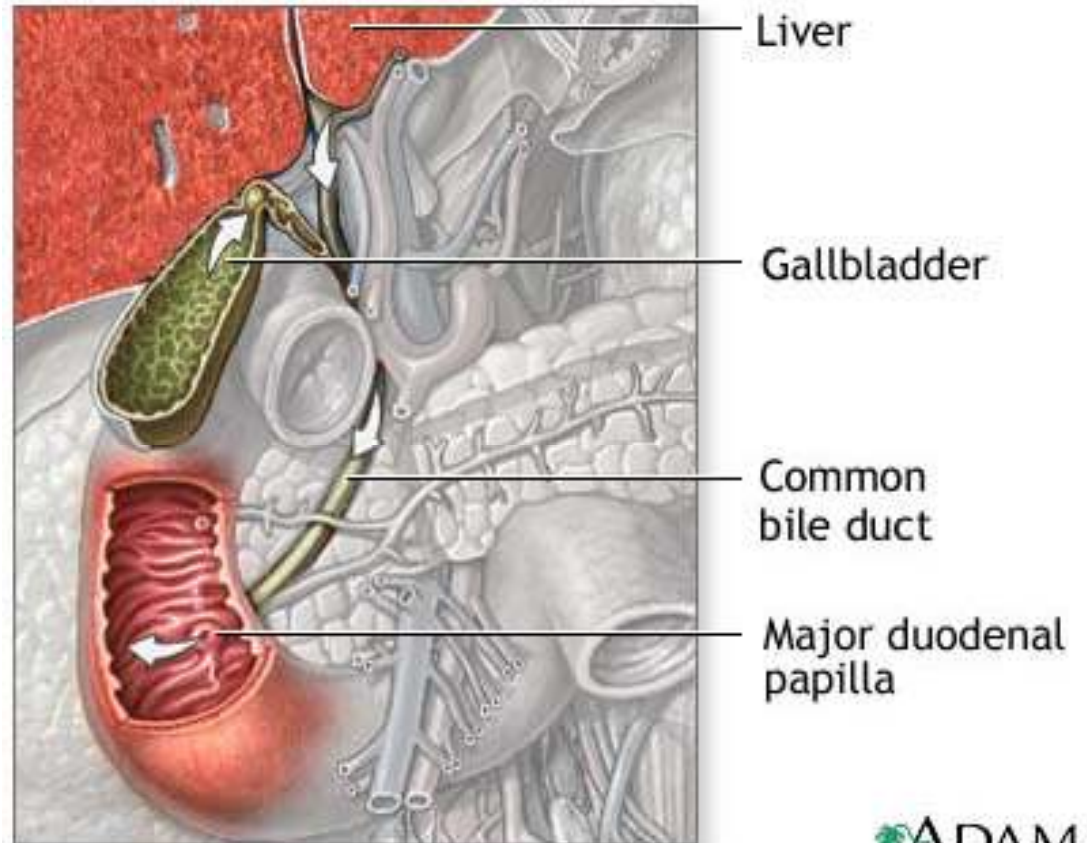
- RBC's have a life span of 120 days.
- RBC's weaken and rupture, releasing hemoglobin into the blood plasma.
- Hemoglobin is absorbed by phagocytosis by Kupffer cells in the liver.
- Hemoglobin is split into
 - Heme groups
 - Iron is removed from heme leaving a substance called bilirubin (bile pigment).
 - Iron is carried to bone marrow where it is used to new hemoglobin for RBC's
 - Bilirubin becomes a component of bile
 - Globins
 - Hydrolysed to amino acids and returned to the blood



- An electron micrograph of a Kupffer cell from the liver. The Golgi apparatus (marked with arrows and *) is well developed. The dark granules associated with the Golgi saccules are lysosomes. At the cell surface, identify the filopodial processes.

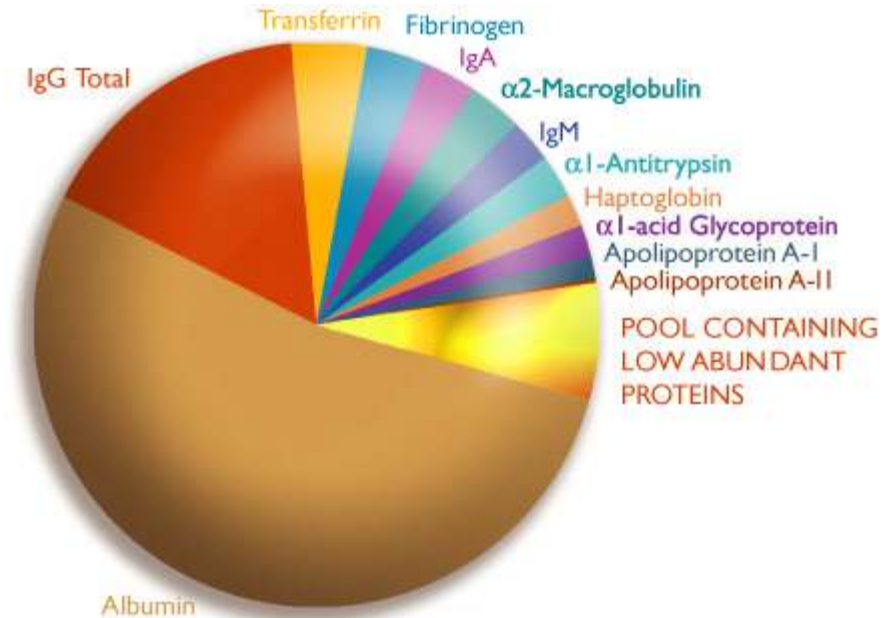
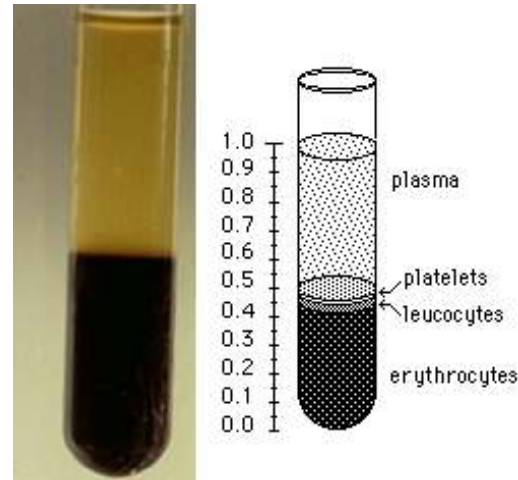
Bile Secretion

- Bile Contents
 - HCO_3^- (Bicarbonate)
 - Bile salts
 - Bile pigment
 - Cholesterol
- Stored in gall bladder
 - Concentrated
 - acidified
- Discharged into small intestine via bile duct



Synthesis of Plasma Proteins

- Produced by RER of Hepatocytes
- 3 main types
 - Albumin
 - Globulin
 - Fibrinogen



Synthesis of Cholesterol

- Produced by hepatocytes
- Some used for bile production
- Some transported for use in the rest of the body
 - Synthesis and repair of cell membranes or stored in the liver.
 - Precursor by testis, ovaries or the adrenal gland to make steroid hormones.
 - progestins
 - glucocorticoids
 - androgens
 - estrogens
 - mineralocorticoids
 - It is also a precursor to vitamin D.

