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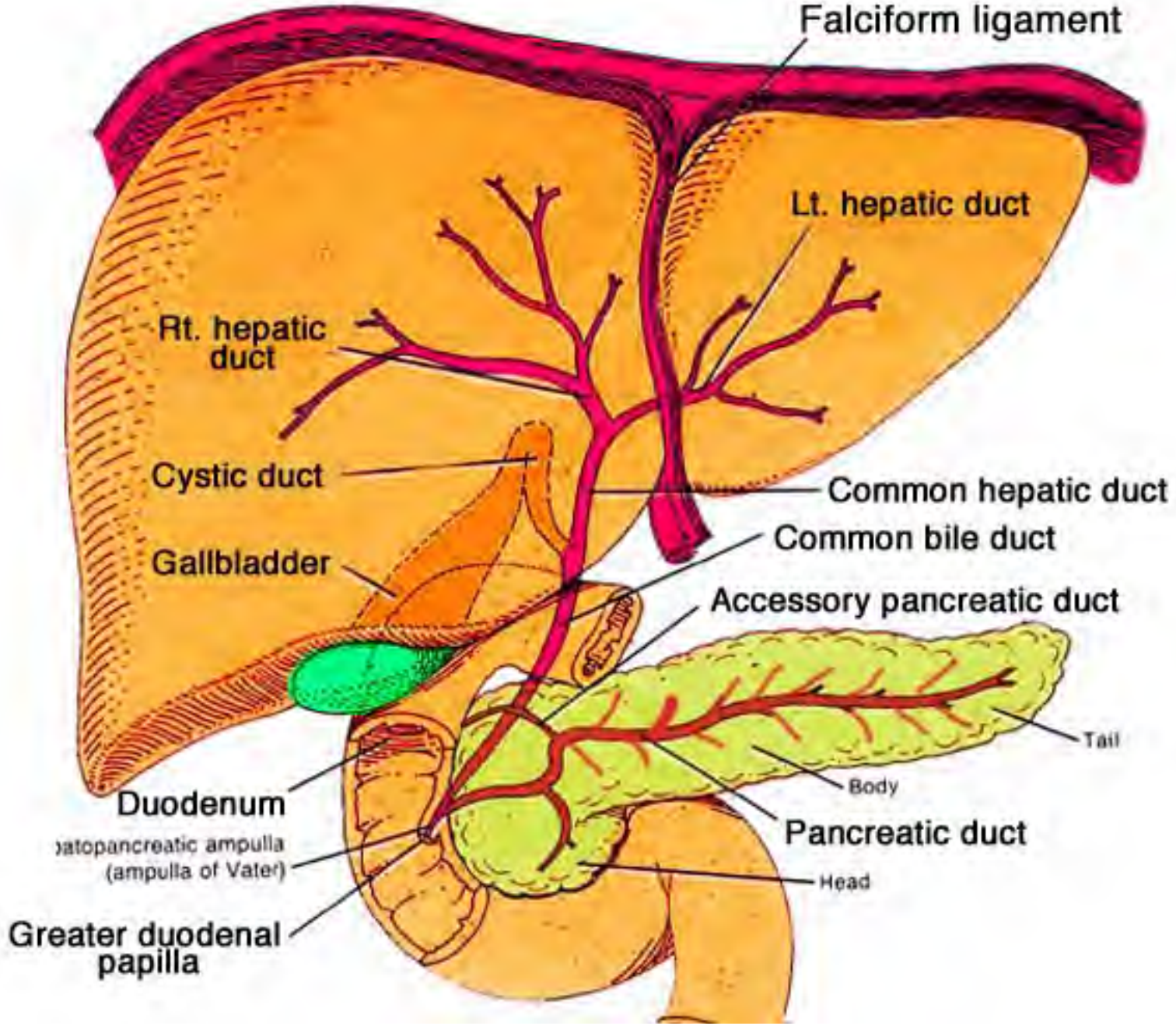
M1 - GI Sequence

Liver, Pancreas, and Gallbladder

January 12, 2009

Winter 2009

University of Michigan Medical School



 Tortora, G., p. 664

Pancreas

Liver

(Glands outside the GI tract)

Endocrine Function

Islets of Langerhans cells:

insulin, glucagon, somatostatin, etc

Exocrine Function:

Acinar cells: **digestive enzymes**

Centroacinar cells: **bicarbonte-rich alkaline fluid**

Ducts: **main and accessory ducts**

Endocrine-like Secretion

Hepatocytes: **albumin, fibrinogen, thrombin, etc**

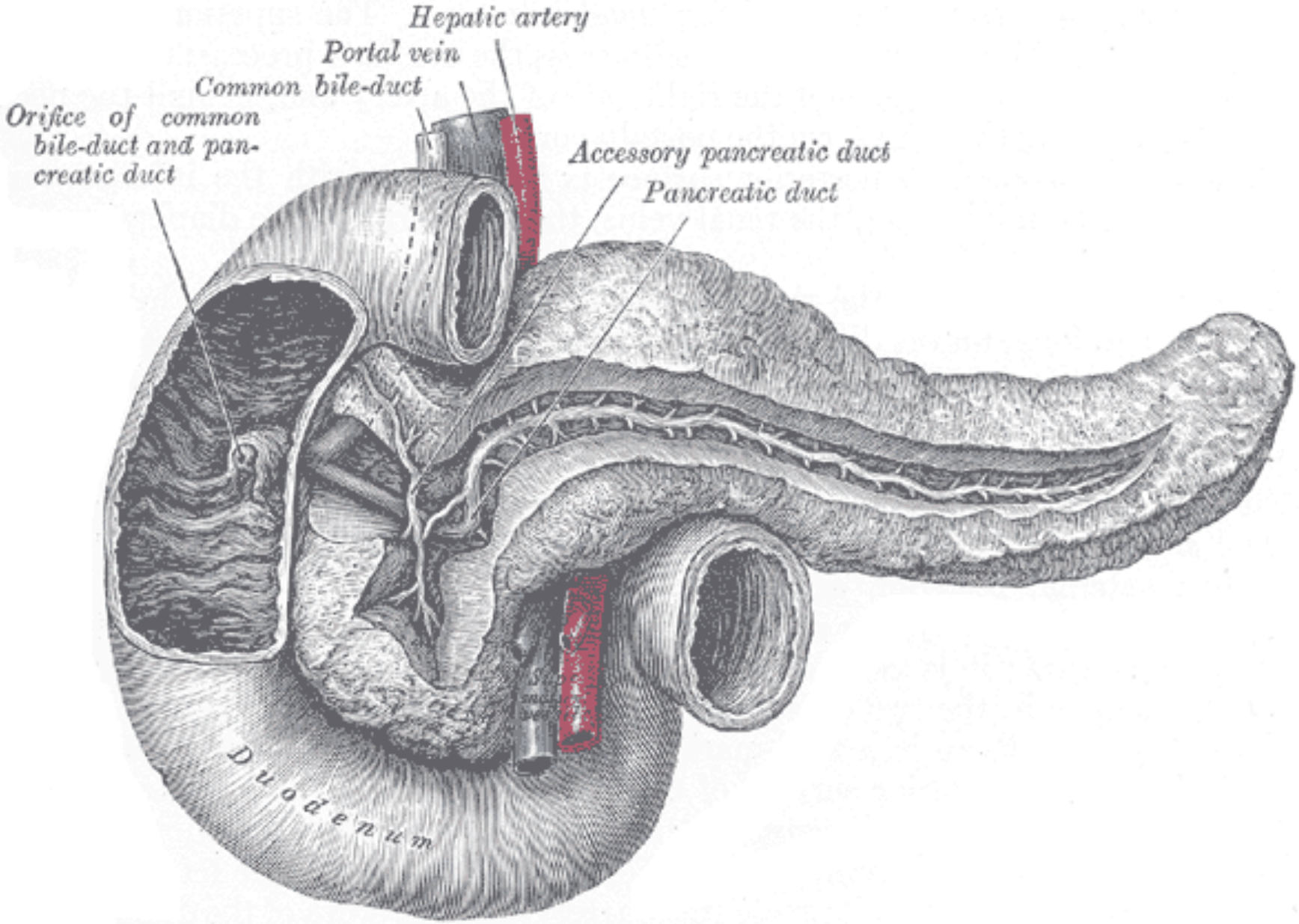
Exocrine Function (digestive):

Hepatocytes: **bile**

[Secretory IgA]

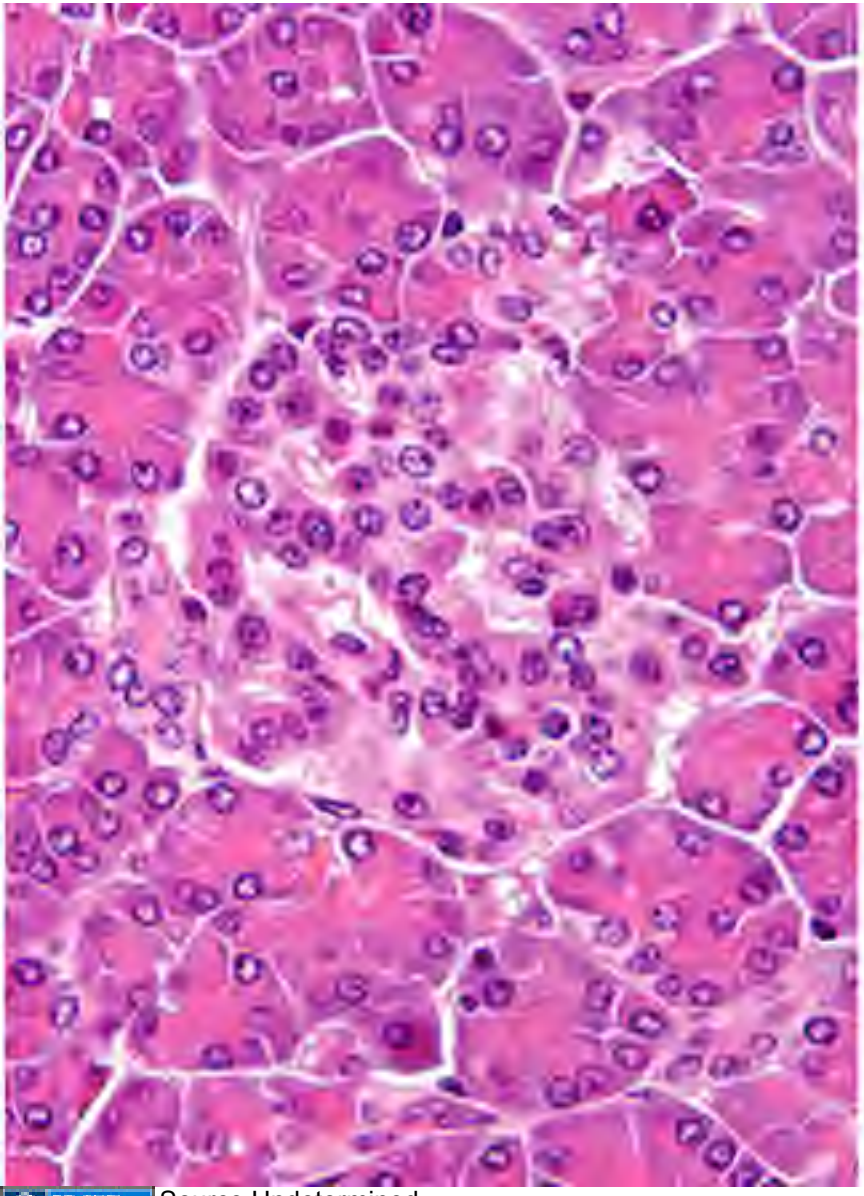
[Bilirubin glucouronide]

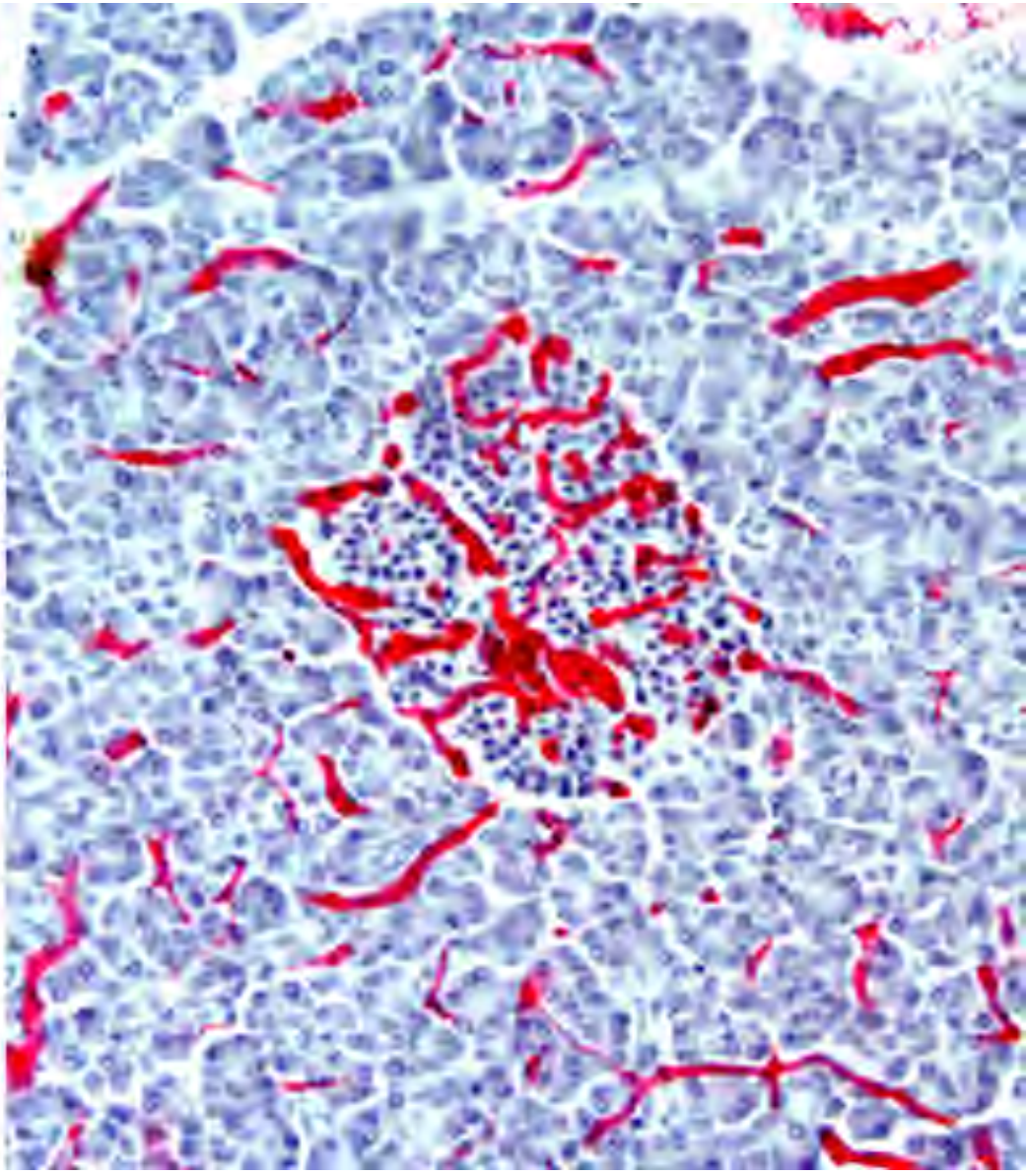
Ducts: **bile canaliculi, bile ducts, hepatic ducts, cystic duct and common bile duct**



The Pancreas

Islets of Langerhans

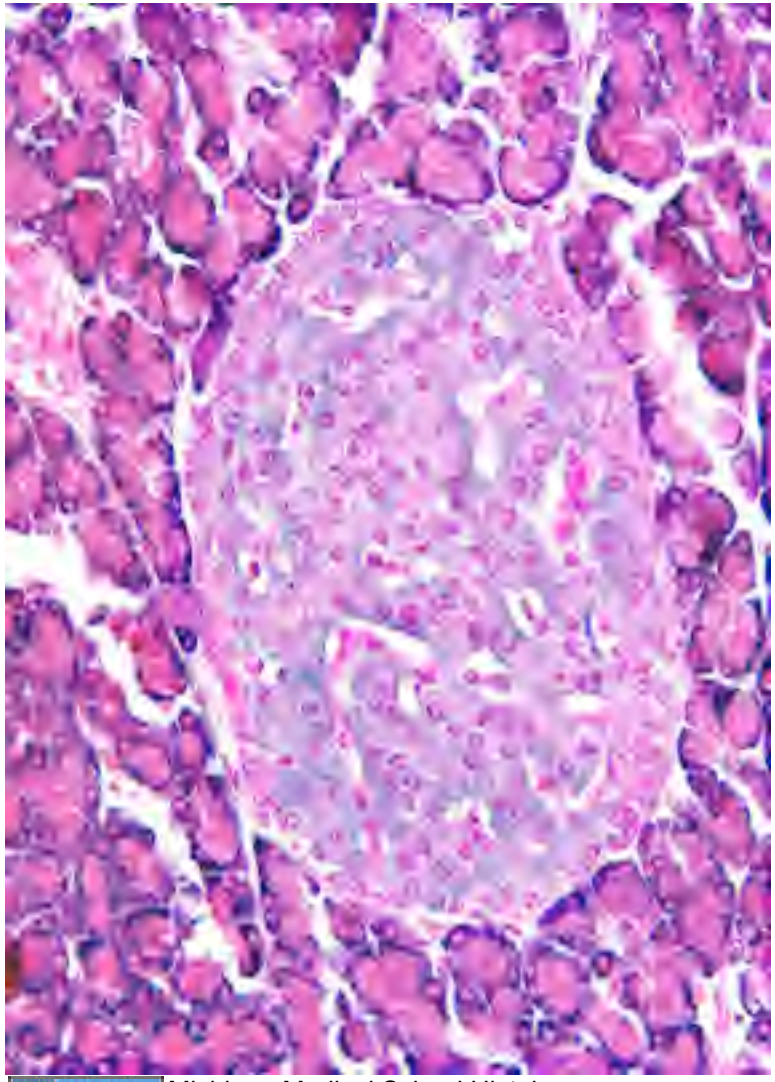




Pancreatic Islet

Stained with Chrome-Alum Hematoxylin and Phloxine

PD-INEL Source Undetermined



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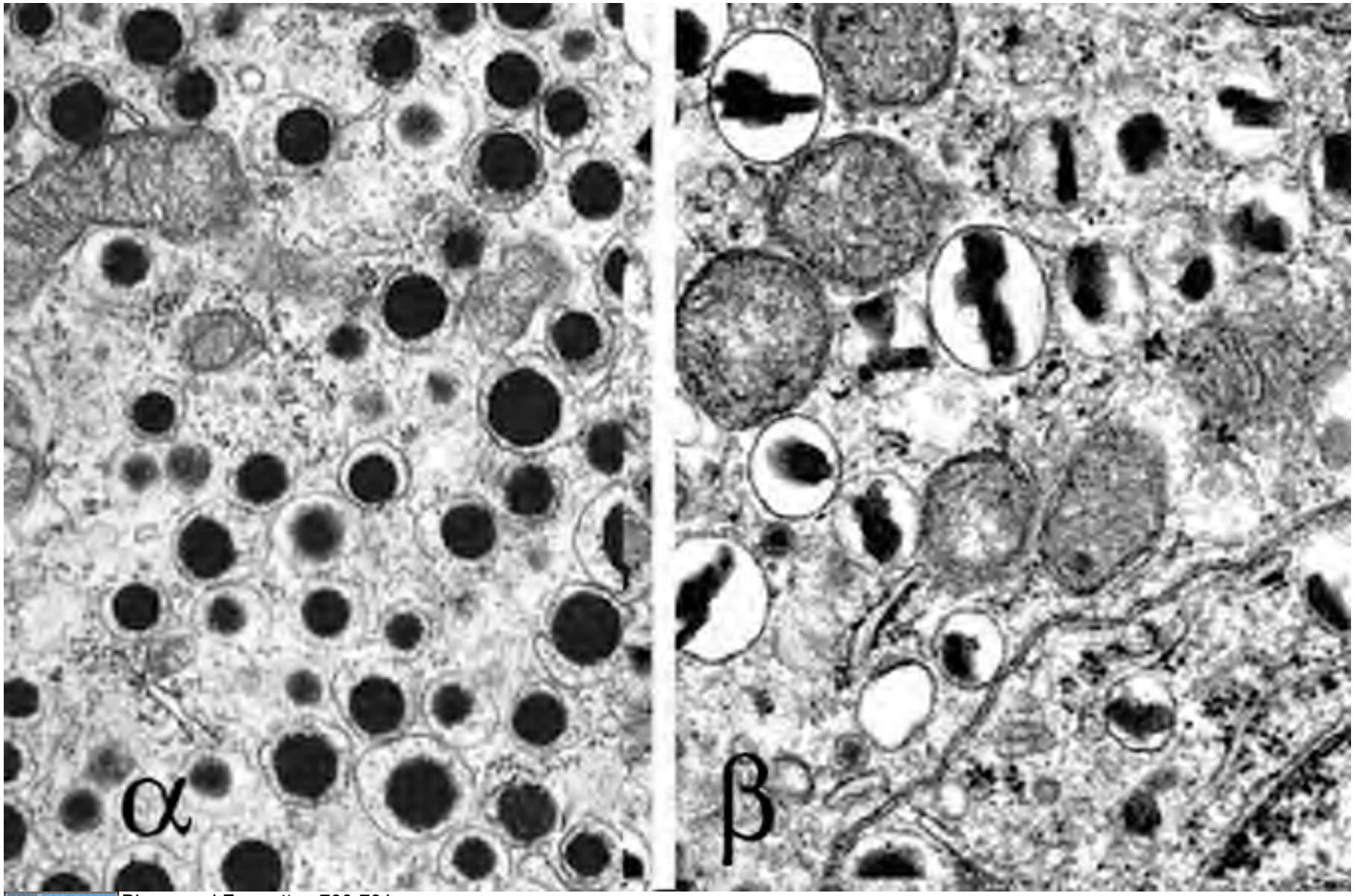
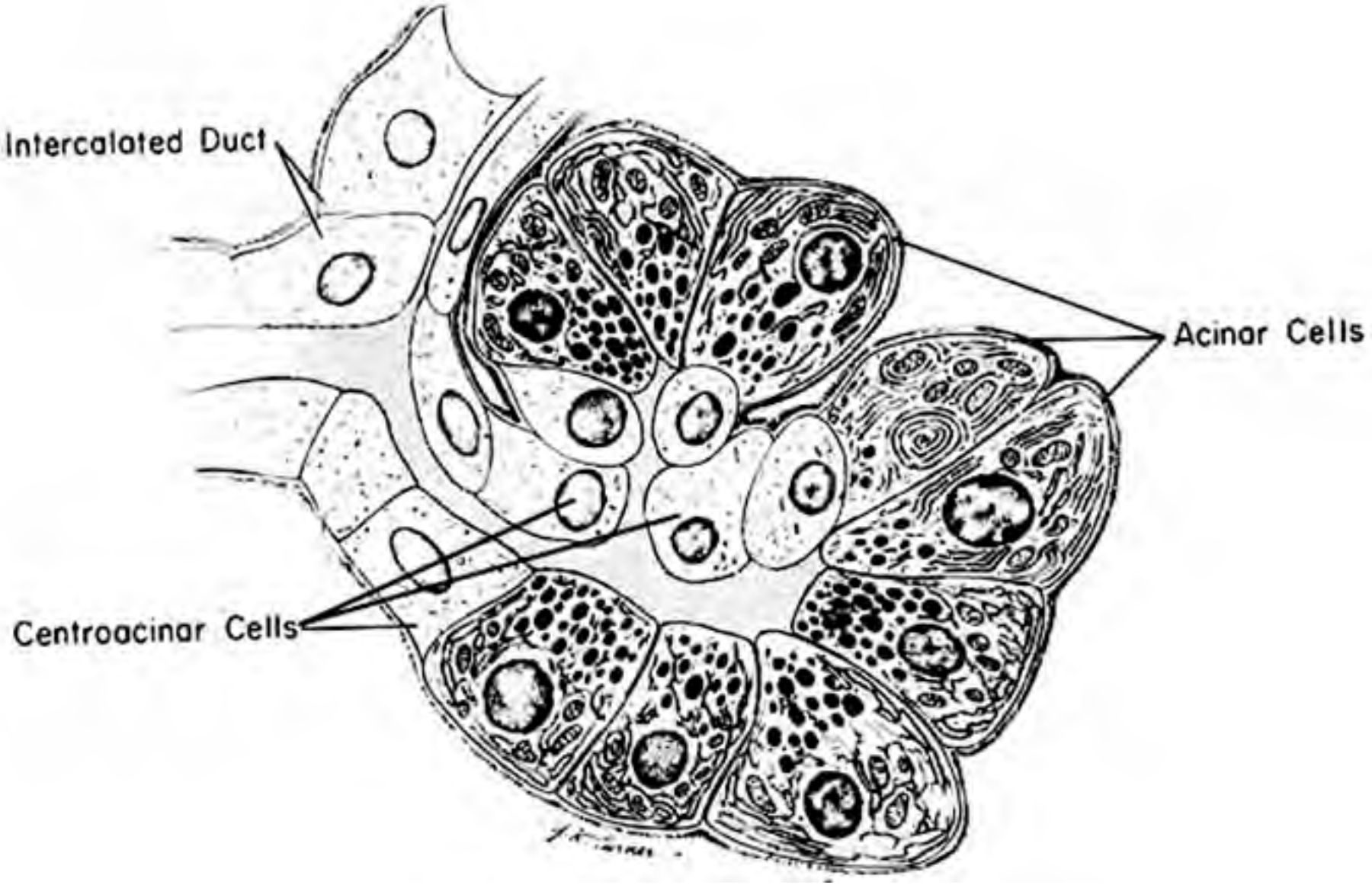
Secretory Granules of the Islet cells

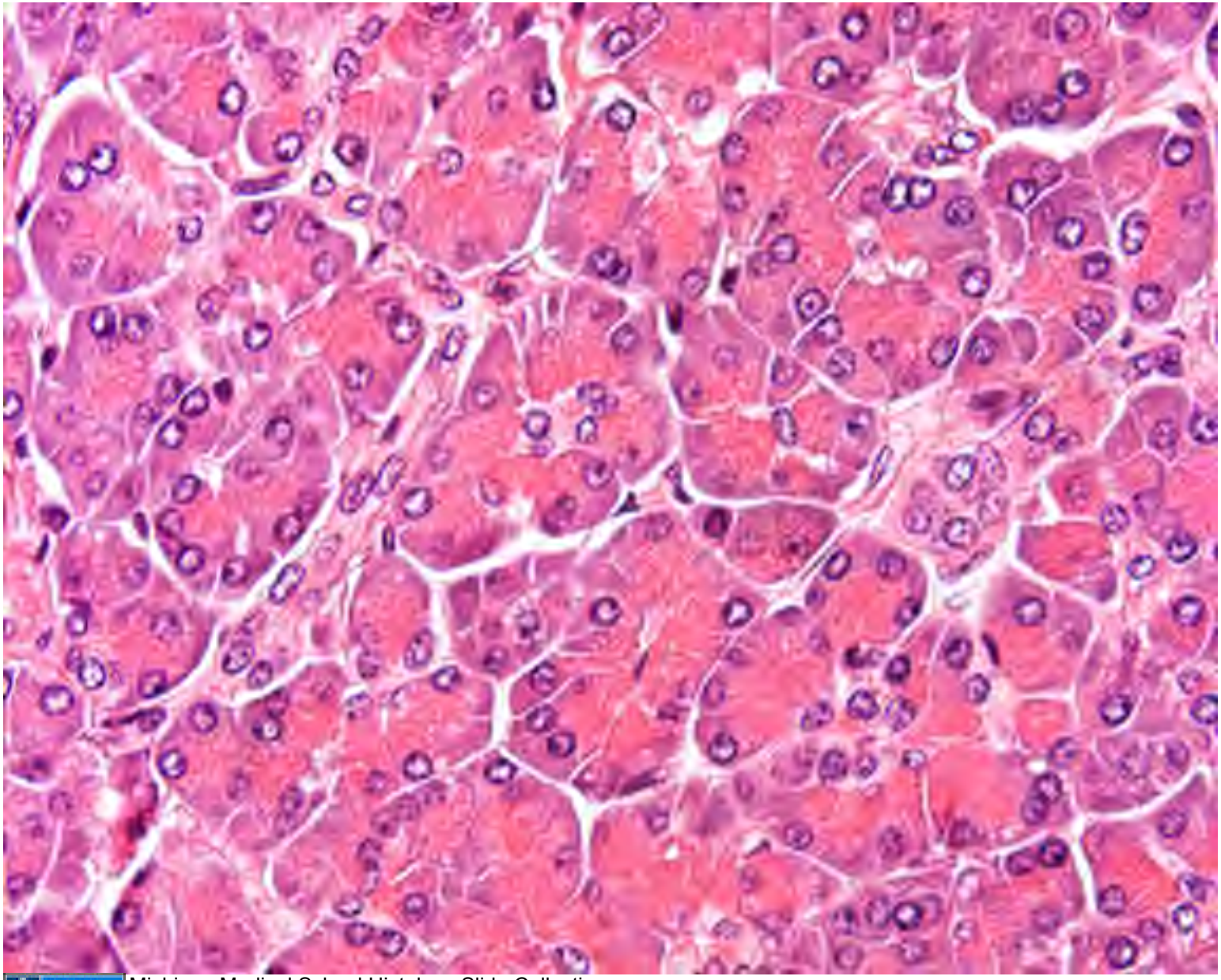


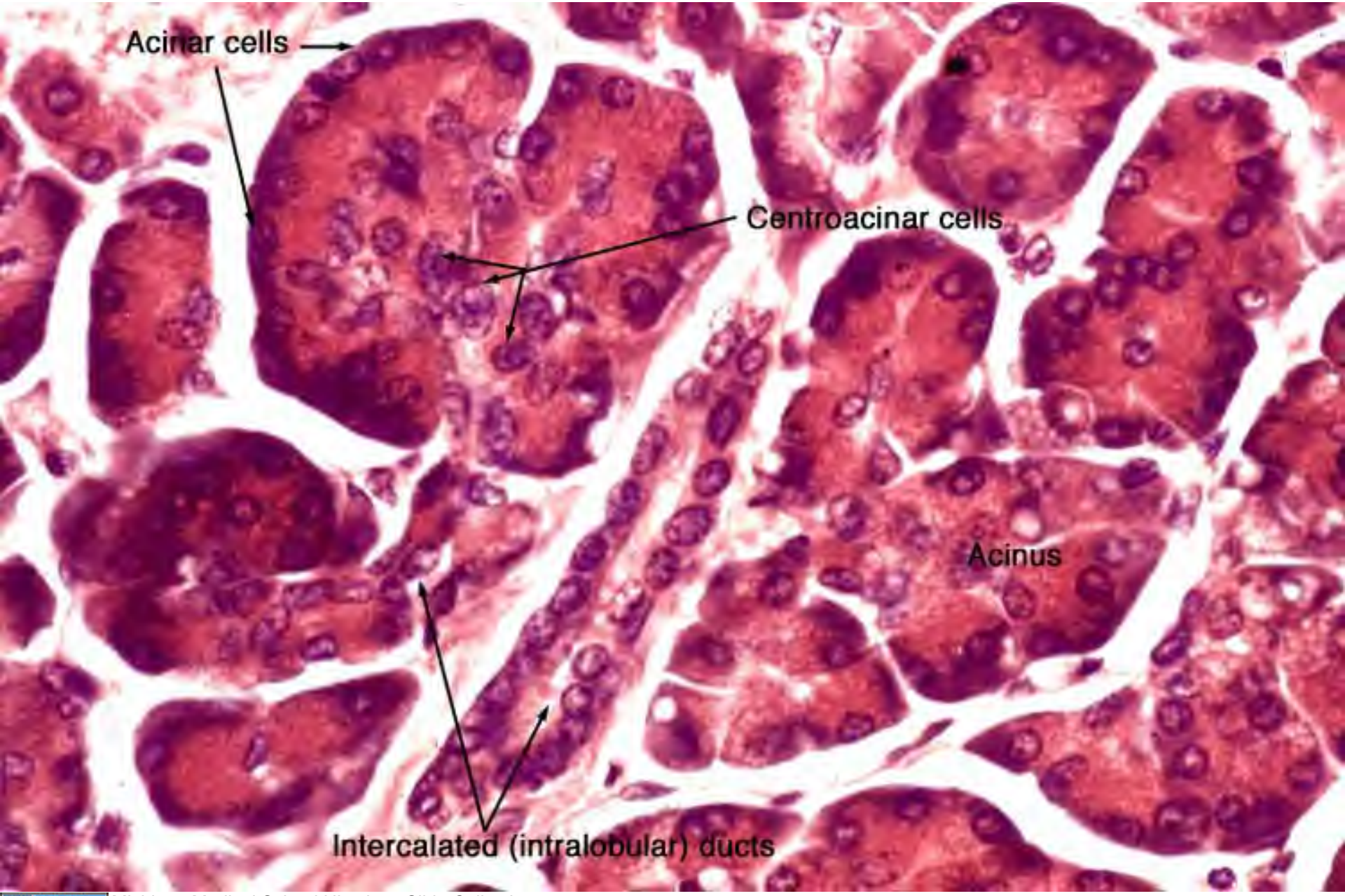
PD-INEL Bloom and Fawcett p. 700-701

Pancreatic Acinus

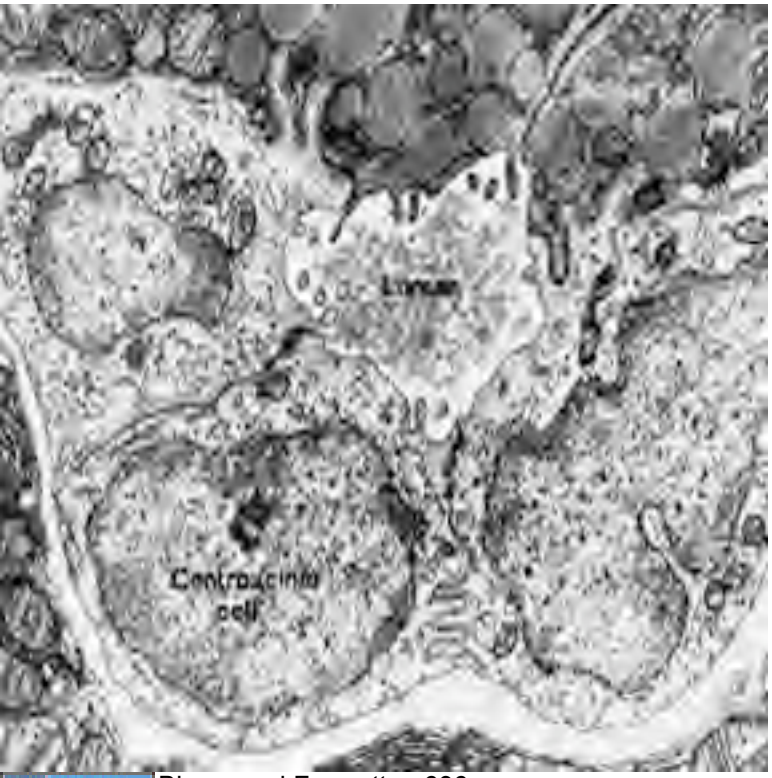


Exocrine Pancreas

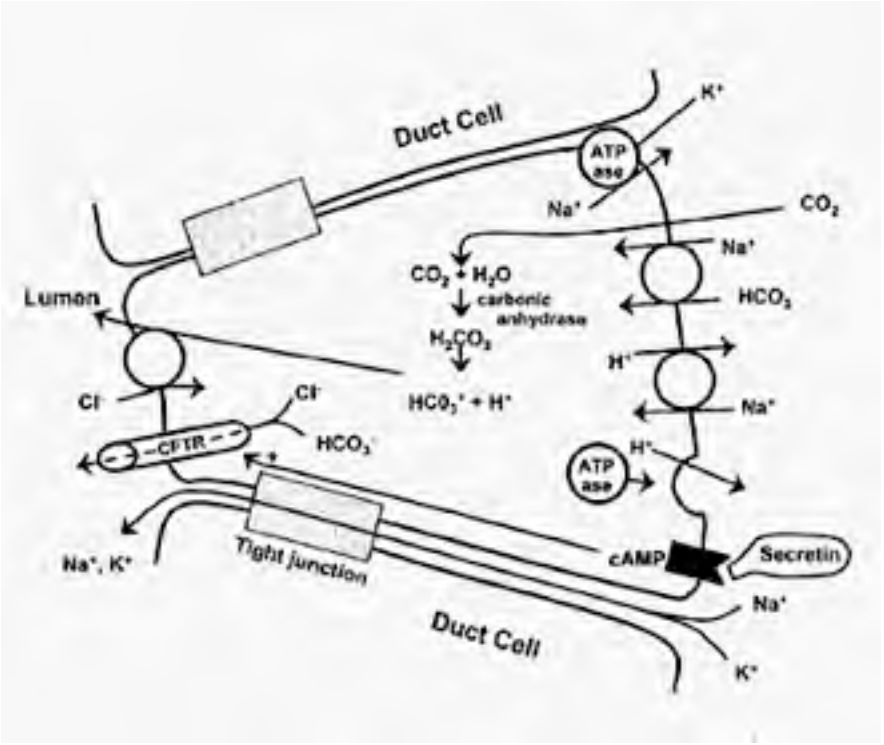




Centroacinar Cells and Bicarbonate Secretion

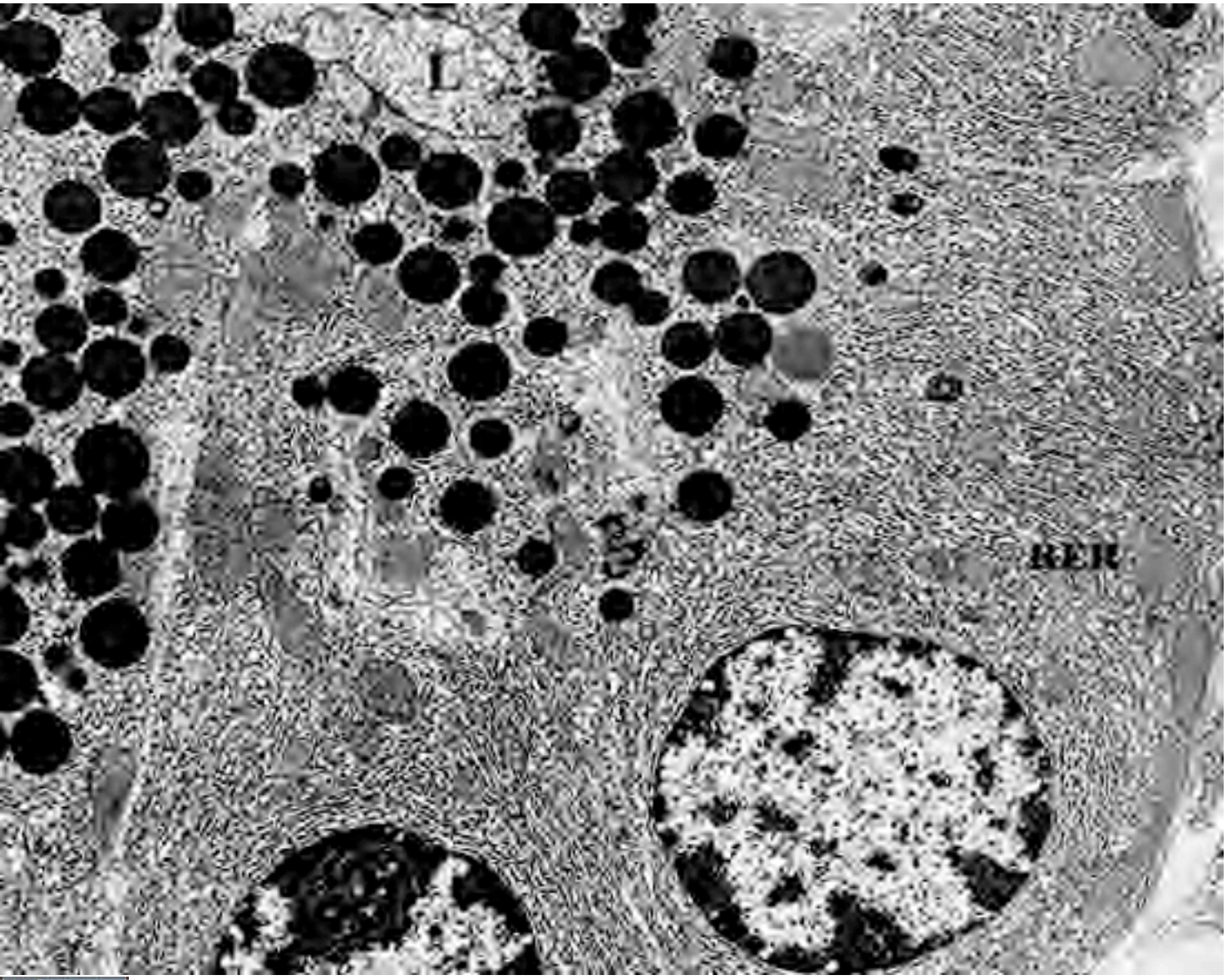


PD-INEL Bloom and Fawcett p. 696

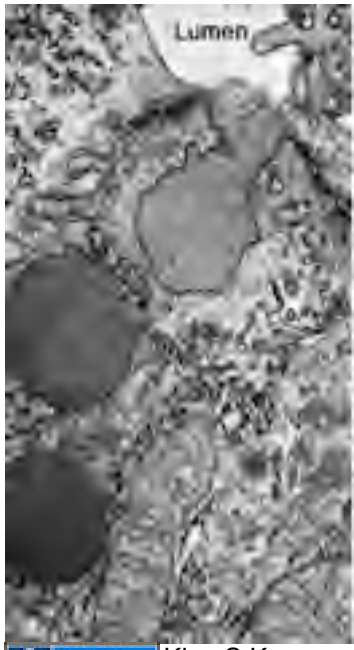


PD-INEL J. Williams

Pancreatic Acinar Cells



PD-INEL Kim, S.K.



PD-INEL Kim, S.K.

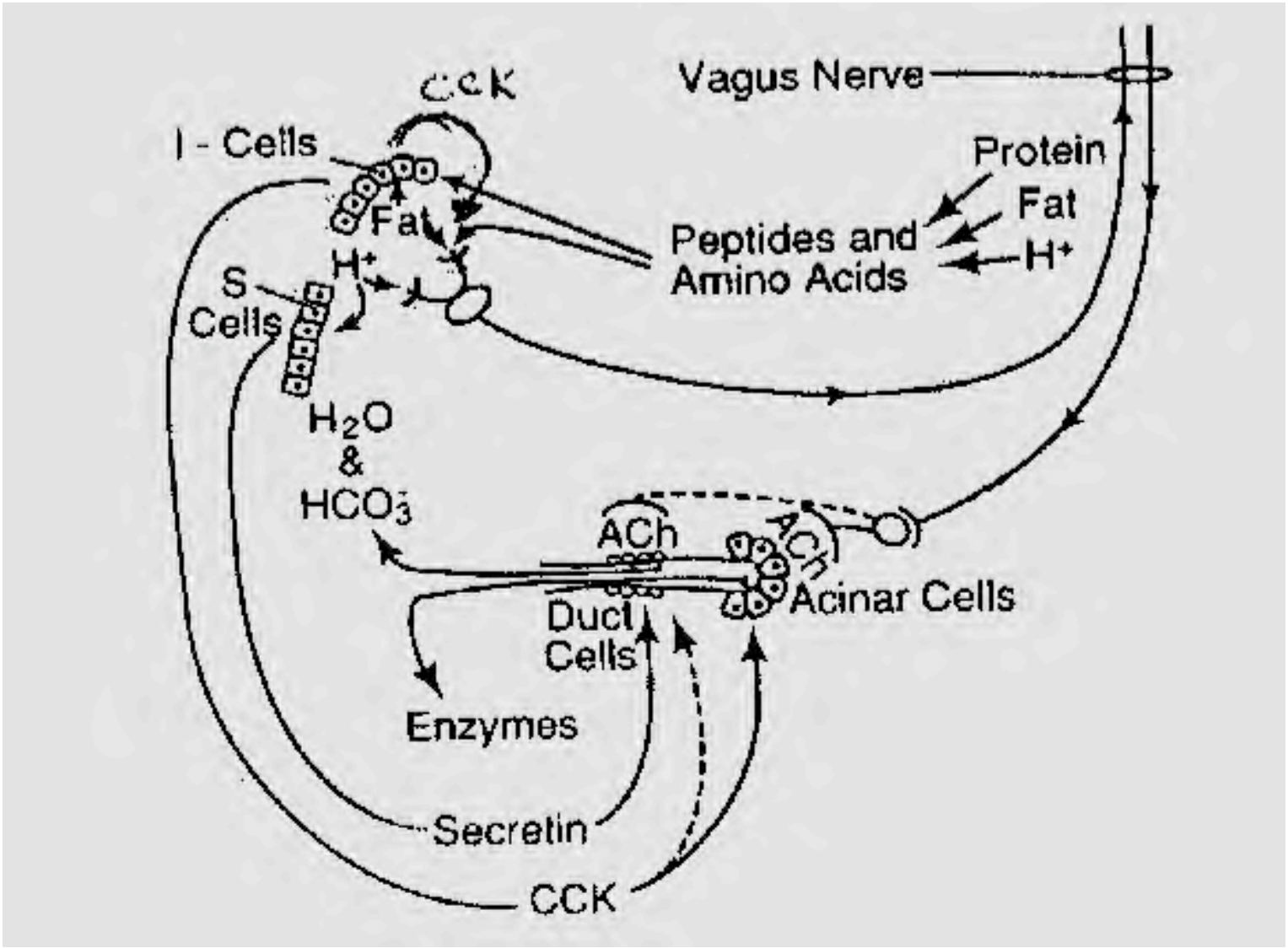
Secretory Proteins Produced by Pancreatic Acinar Cells

Zymogens	M.W.	%
Trypsin(ogen)	30,000	40
Chymotrypsin(ogen)	29,000	2
(Pro)carboxypeptidase	47,000	32
(Pro)elastase	29,700	4
(Pro)phospholipase	17,500	?
Enzymes		
Alpha-amylase	54,800	5
Triacylglycerol lipase	50,500	1
Ribonuclease	13,600	?
Deoxyribonuclease	30,000	?

HORMONES REGULATING EXOCRINE PANCREATIC FUNCTION

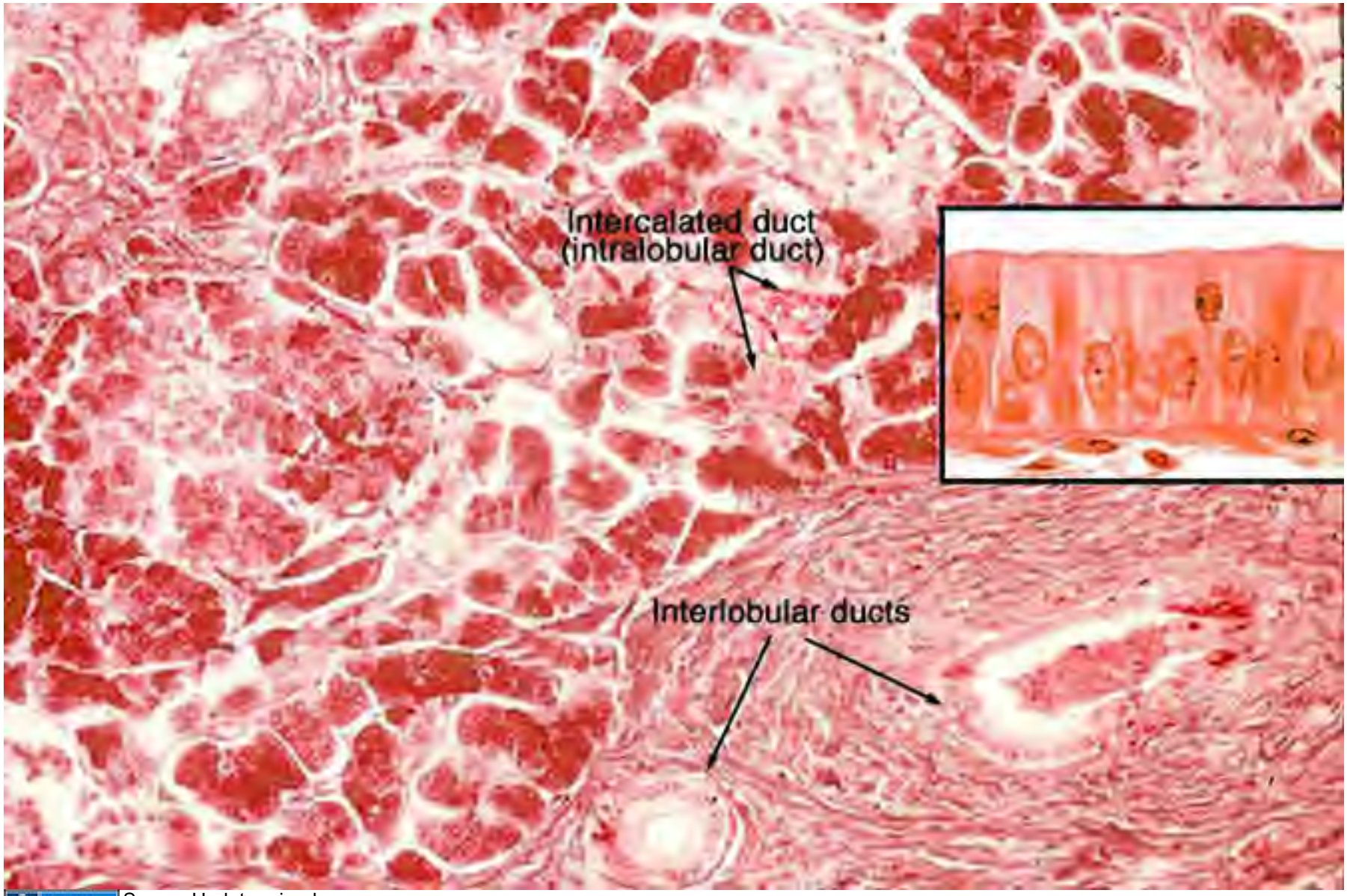
Cholecystokinin (CCK)	Exocytosis stimulation in acinar cell.
Secretin	Secretion of H_2O and electrolytes.
Pncreatic polypeptide (PP)	Opposes action of CCK.
Vasoactiive intestinal polypeptide (VIP)	Stimulates H_2O and electrolyte secretion.
Gastric inhibitory polypeptide (GIP)	Postprandial stimulation of insulin release.

Regulation of Pancreatic Secretion



 J. Williams

Ducts of the Pancreas



Major Functions of the Liver

Synthesis and secretion of Bile (SER)

bile acids from cholesterol
elimination of bilirubin
secretion of secretory IgA

Synthesis and secretion of plasma proteins (RER)

albumin, fibrinogen, thrombin, etc.

Metabolism of carbohydrates (SER, cytosol)

maintenance of normal level of blood glucose

Metabolism of lipid (RER)

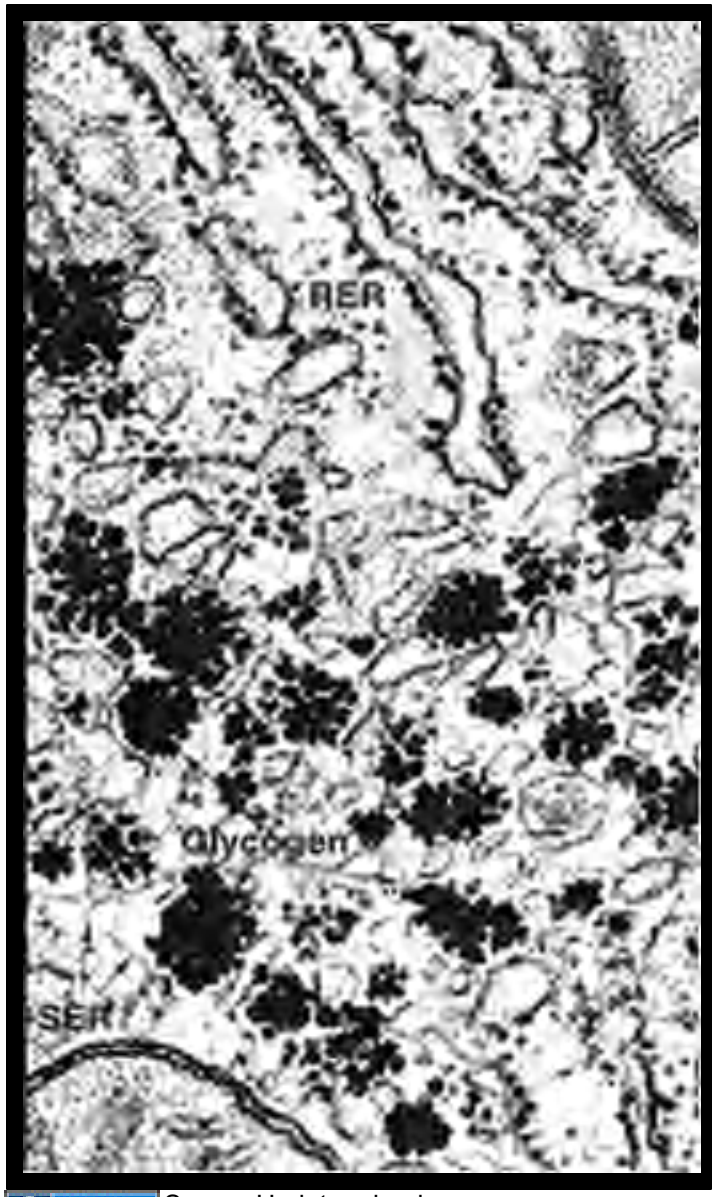
maintenance of normal level of blood lipid - VLDL

Metabolism of lipid soluble drugs and detoxification (SER)

Filtration and storage of blood

Liver regeneration

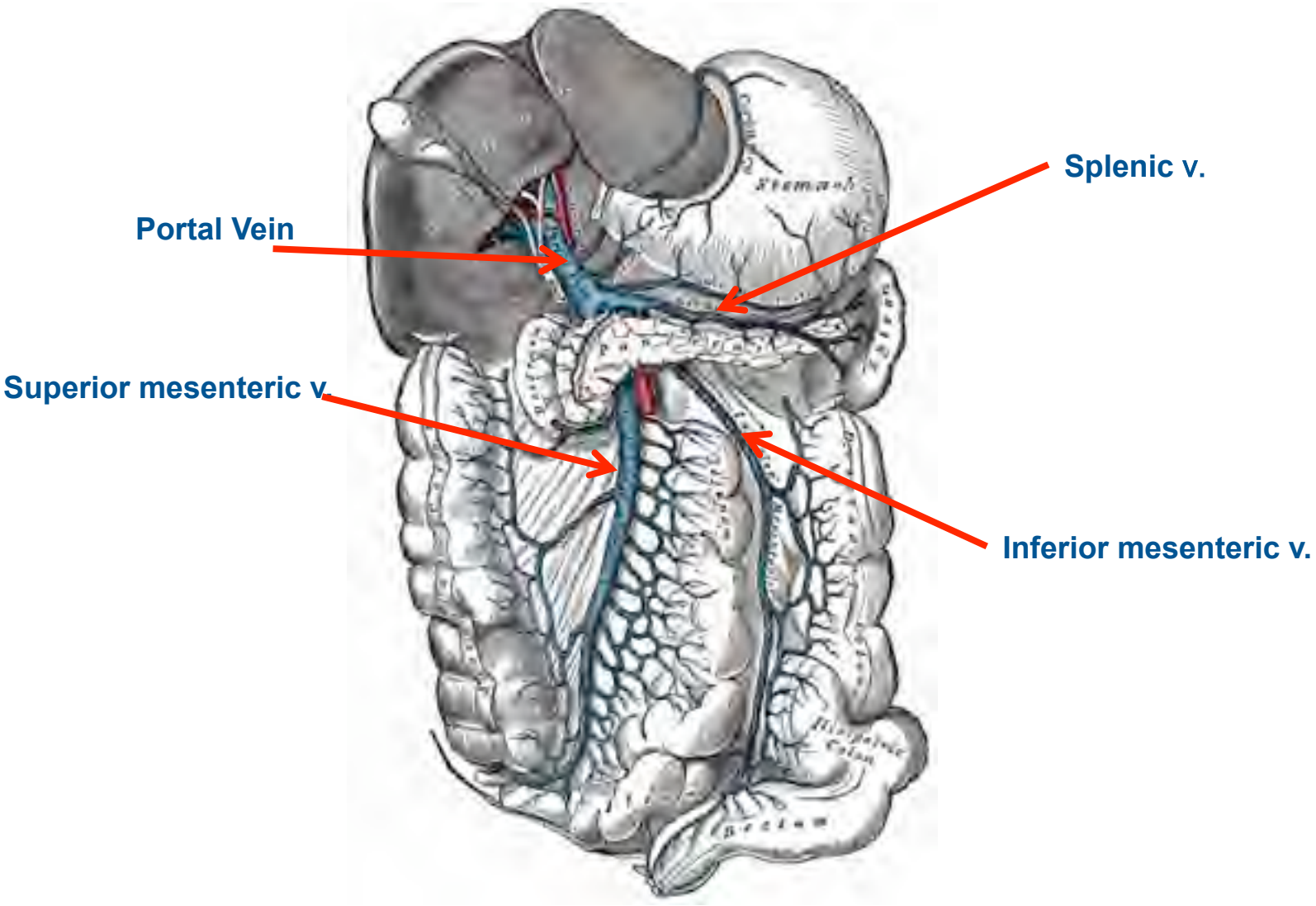
EM of Hepatocyte

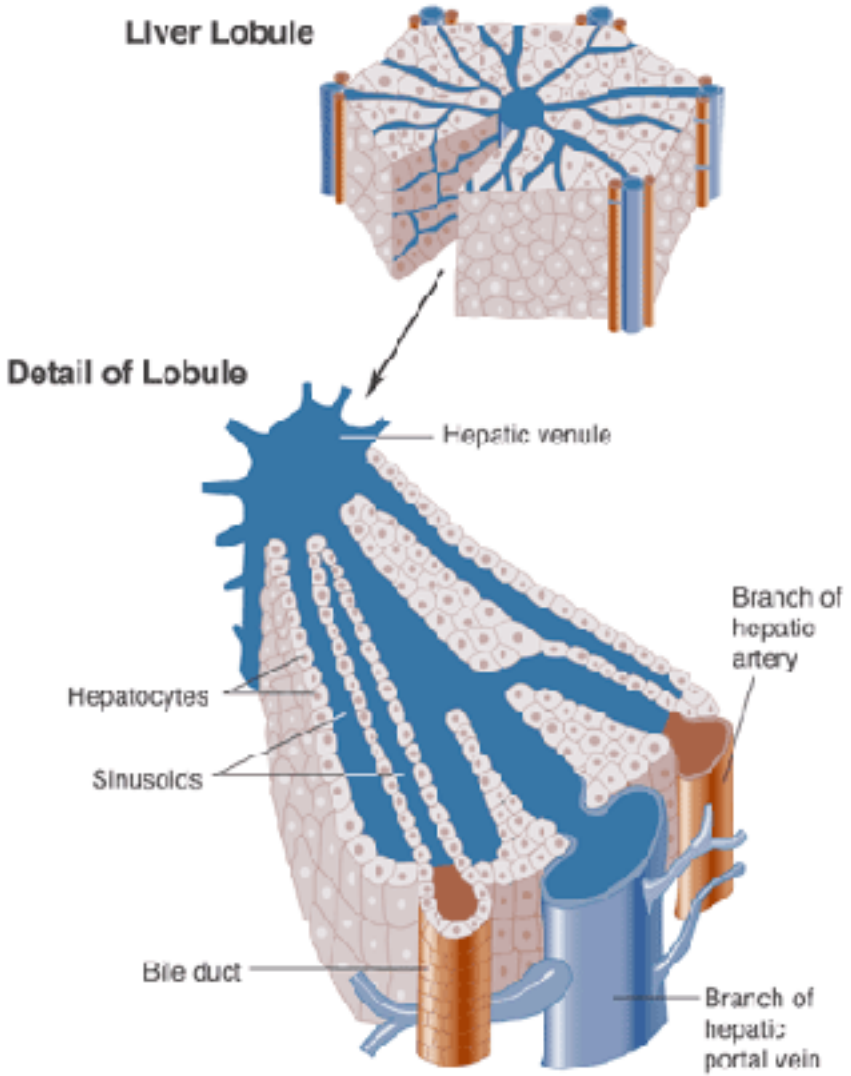


Hepatocyte Cytoplasm

PD-INEL Bloom and Fawcett p. 668

Hepatic Portal Vein Tributaries





PD-GOV National Institute of Alcohol Abuse and Alcoholism

FAIR USE See Netter image

Hepatic Venous Drainage

Inferior Vena Cava

↑

Hepatic Veins

↑

Collecting Vein

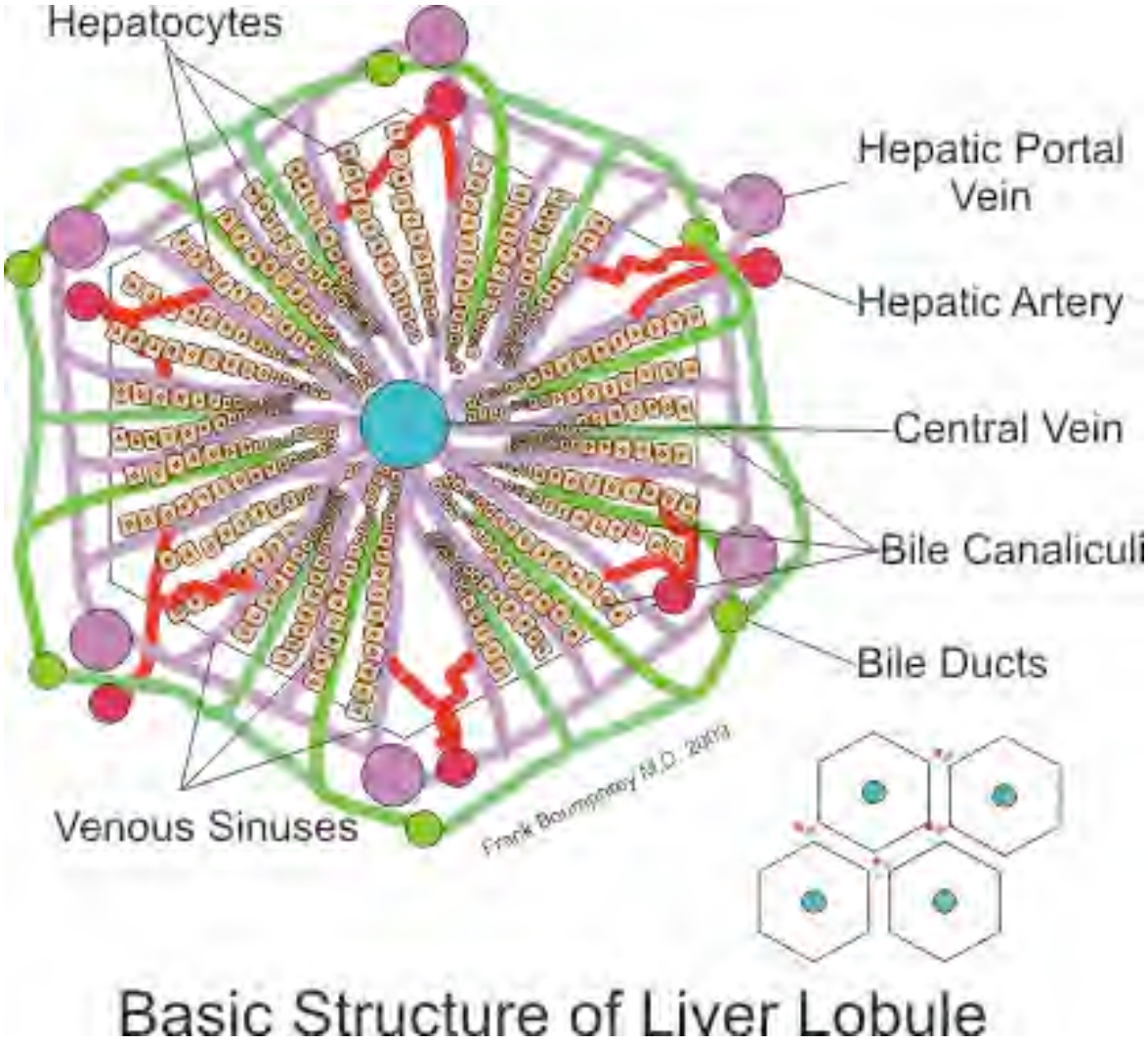
↑

Sublobular Vein

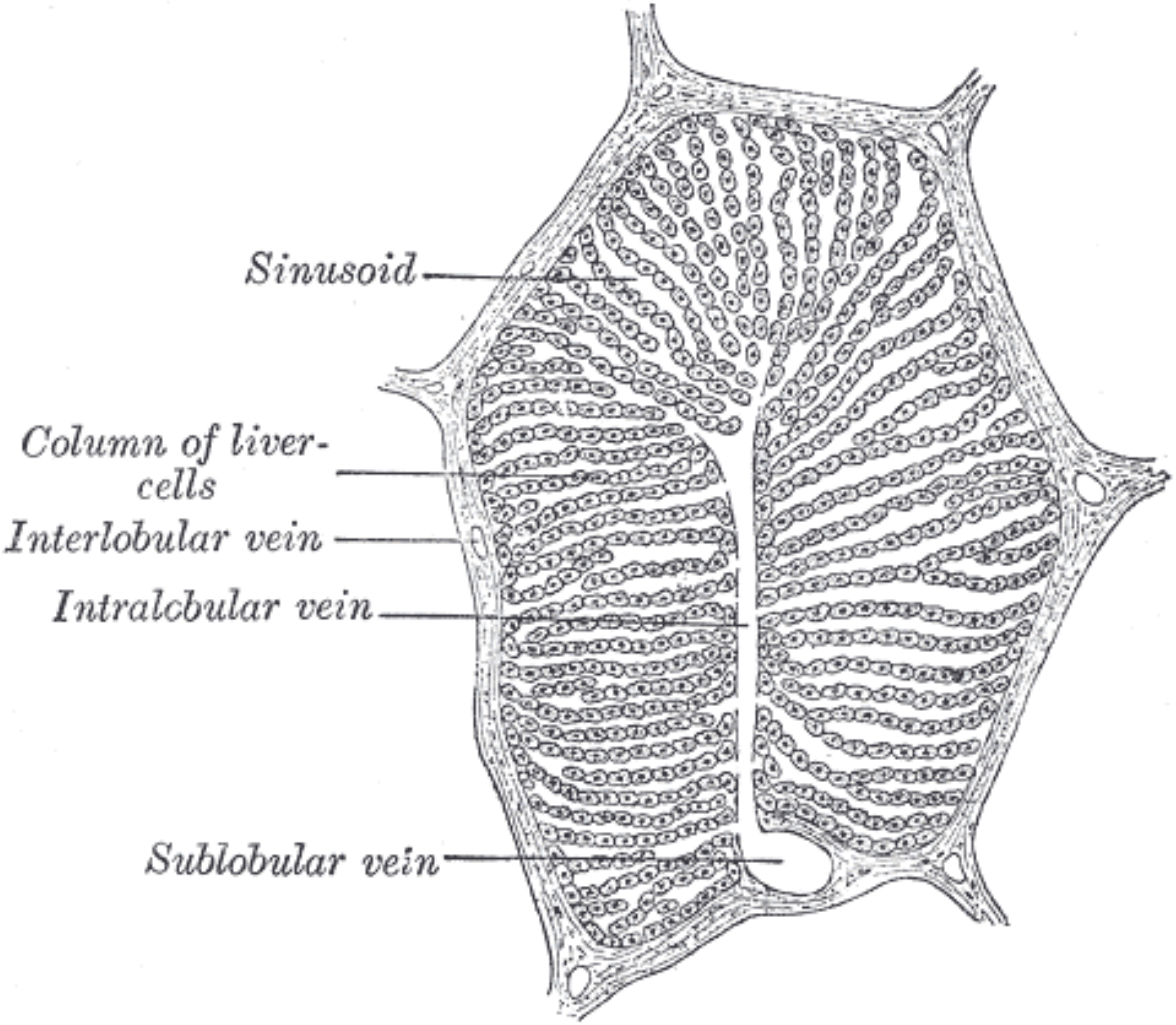
↑

Central Vein

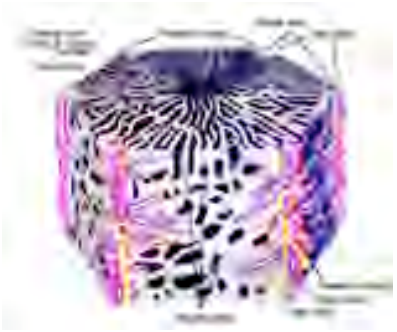
(Terminal Hepatic Venule)



Basic Structure of Liver Lobule



PD-EXP Gray's Anatomy Wikimedia Commons



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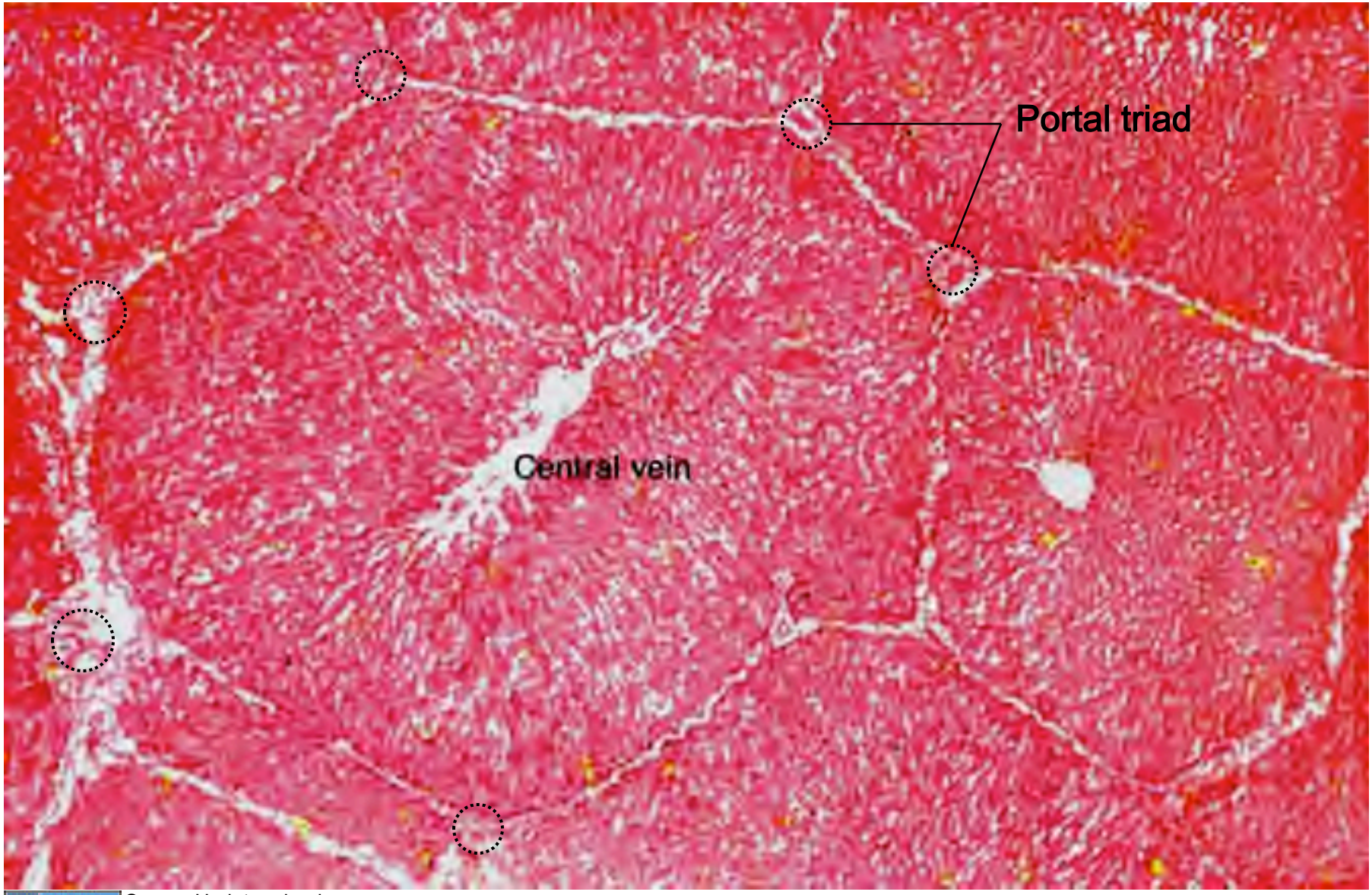
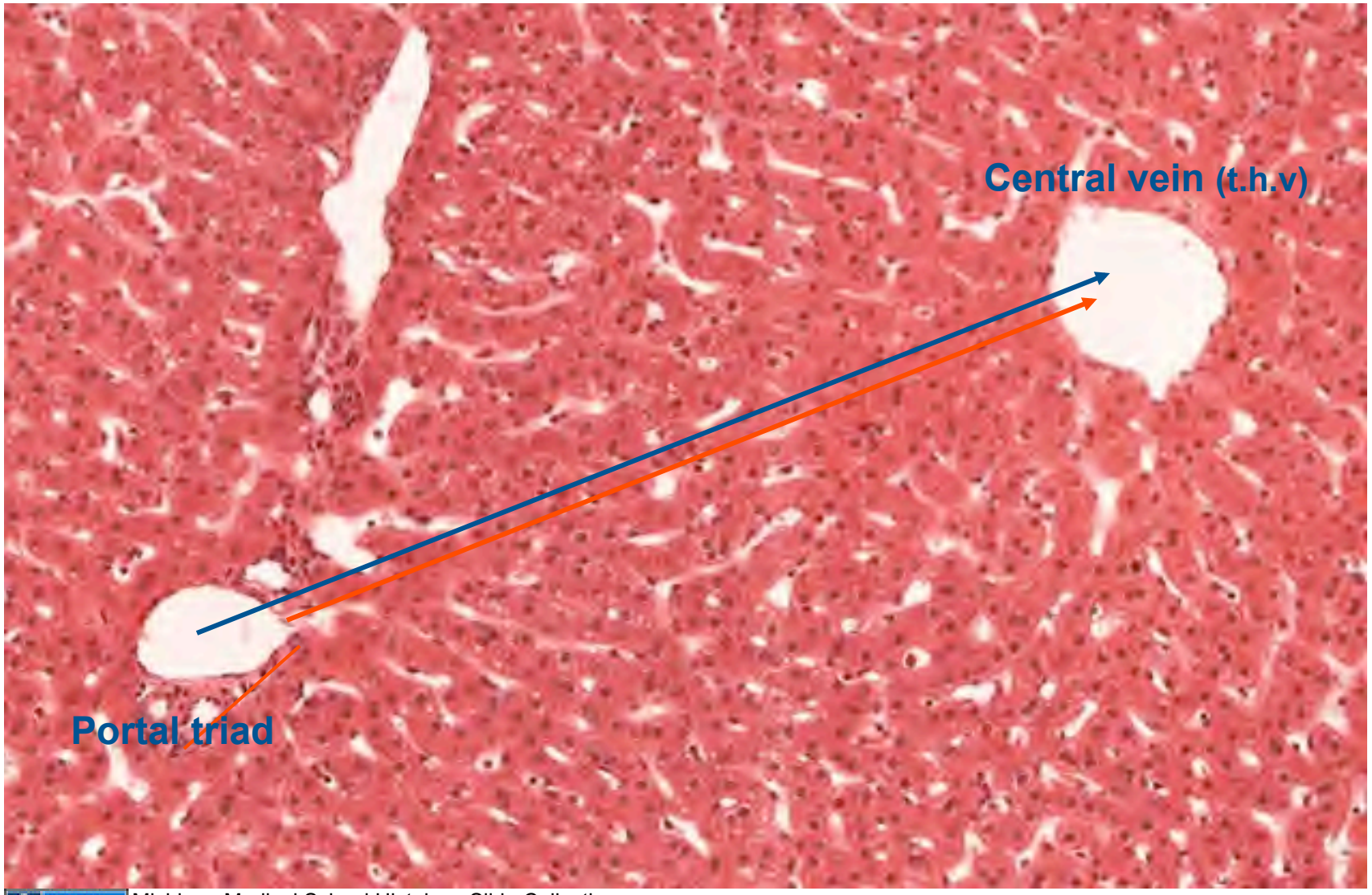
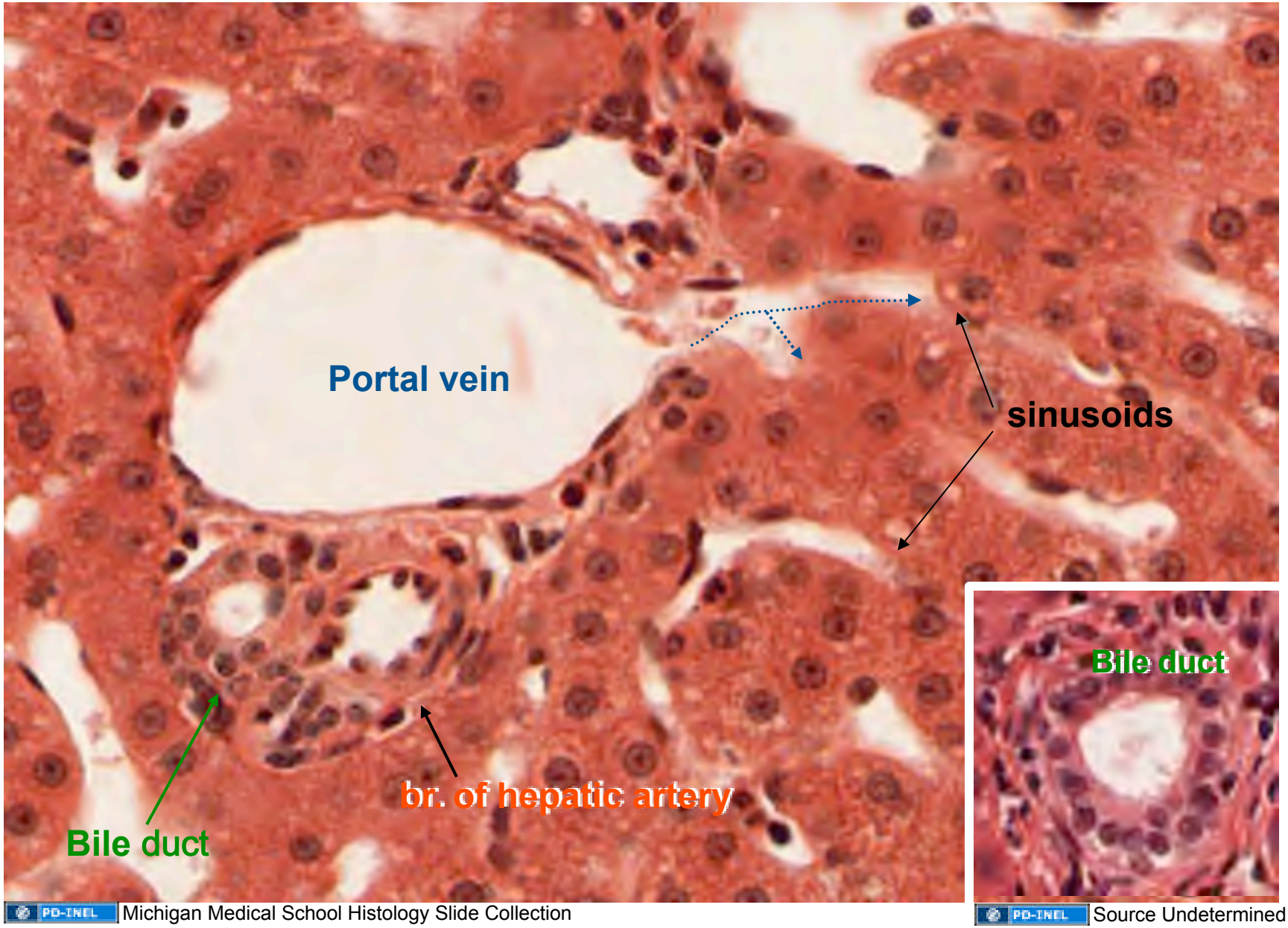
Liver Lobules



Portal triad and central vein



Portal Triad



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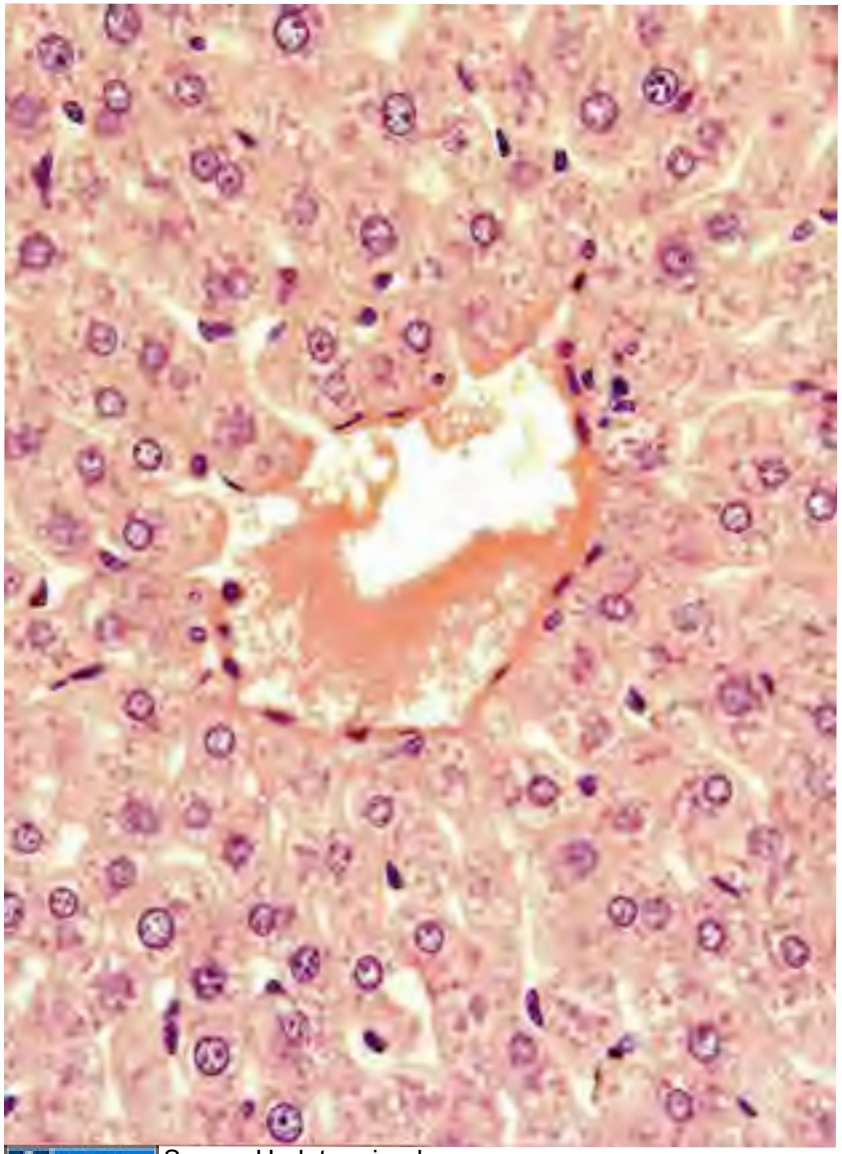
Central Vein (Terminal Hepatic Venule)



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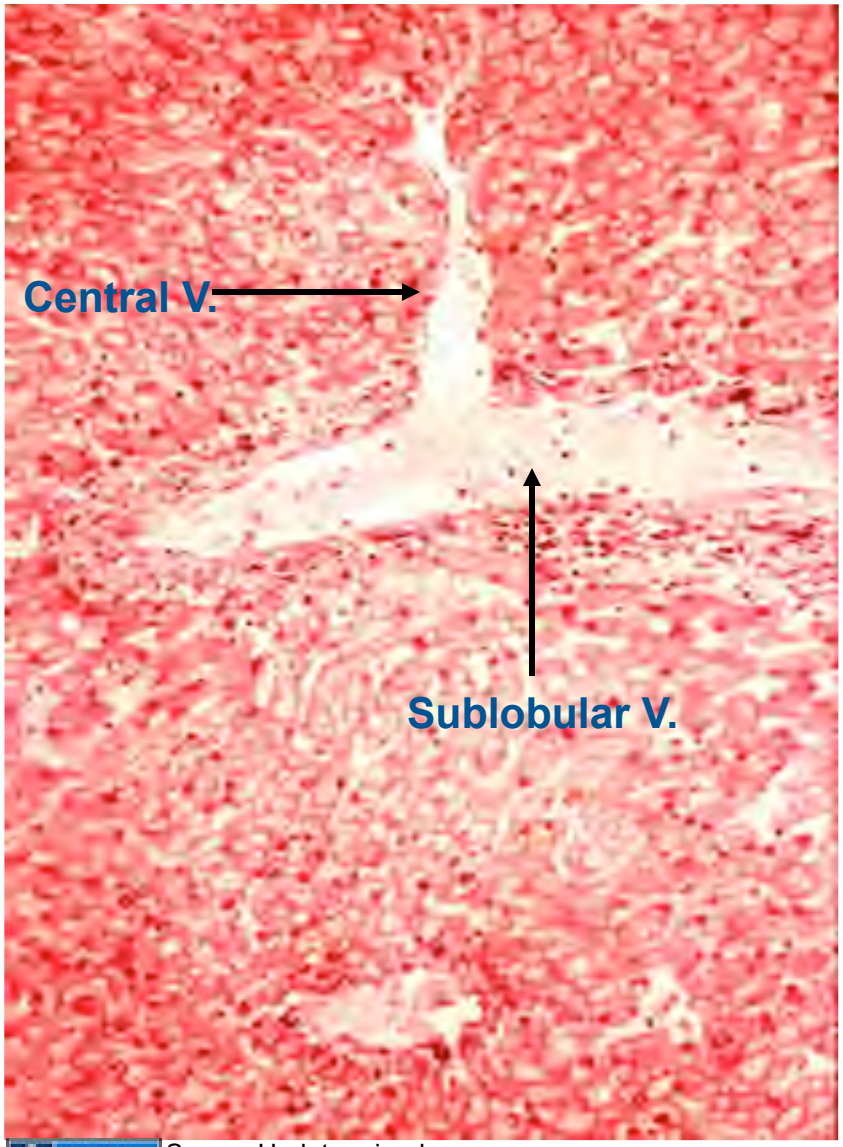

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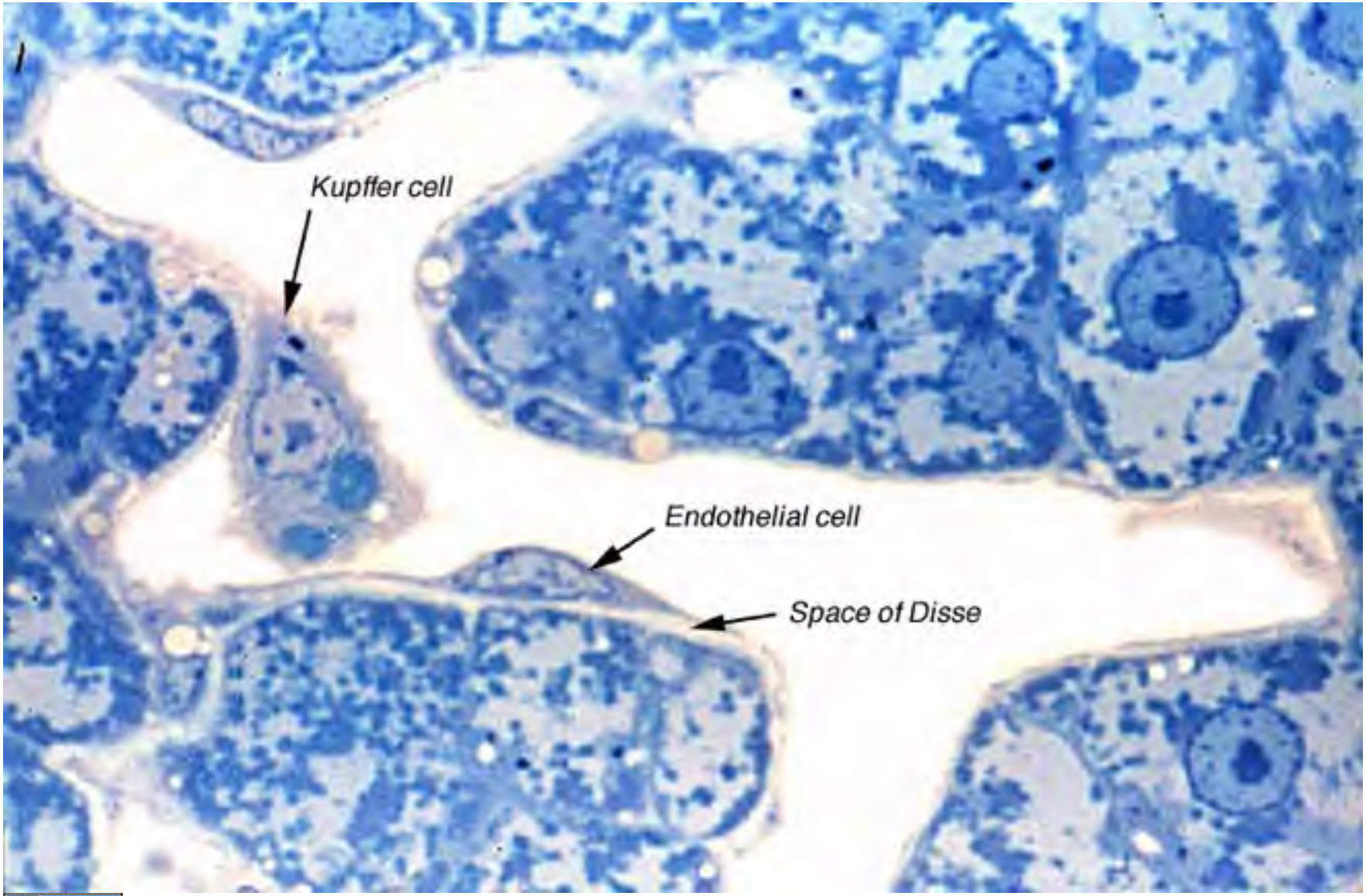
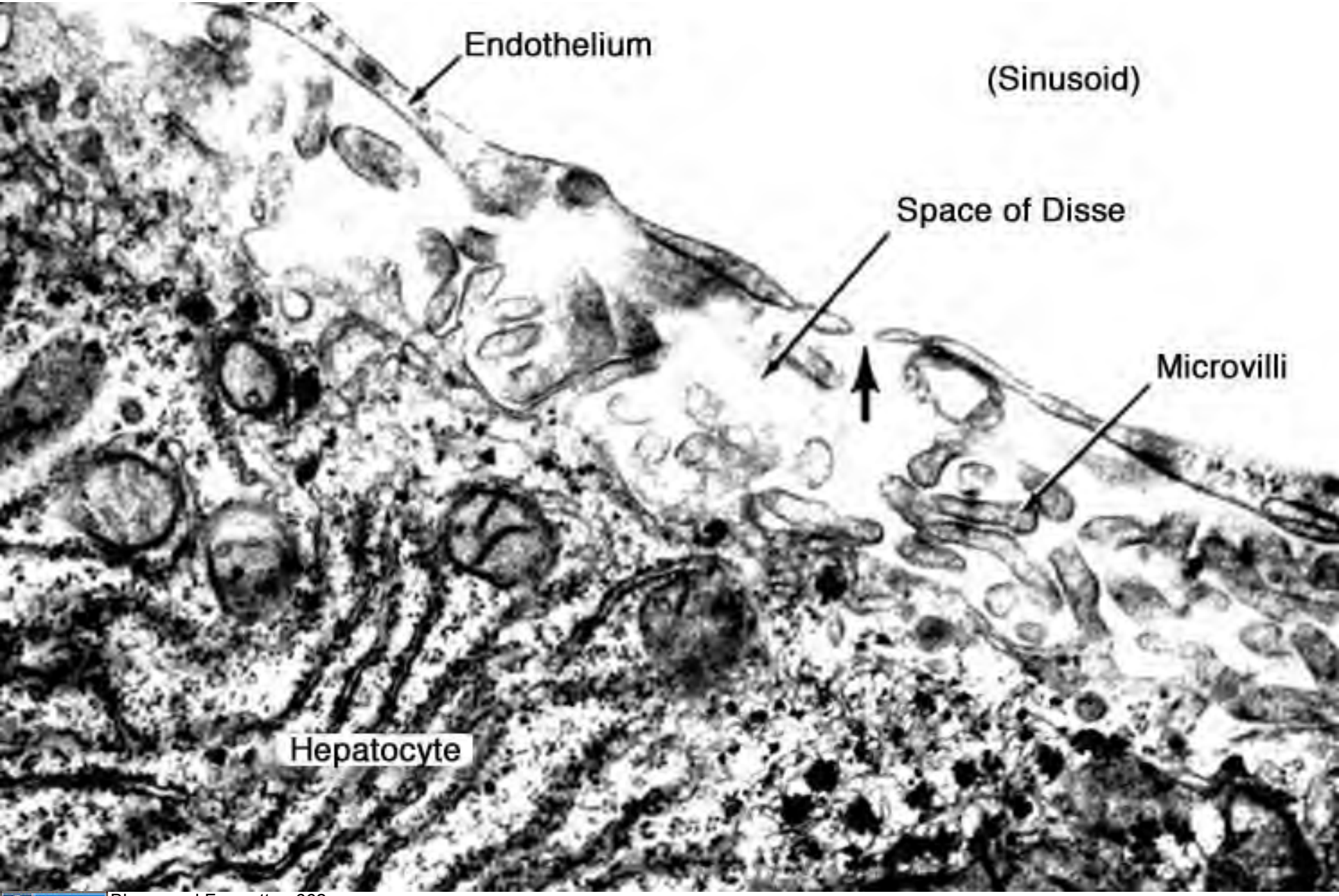
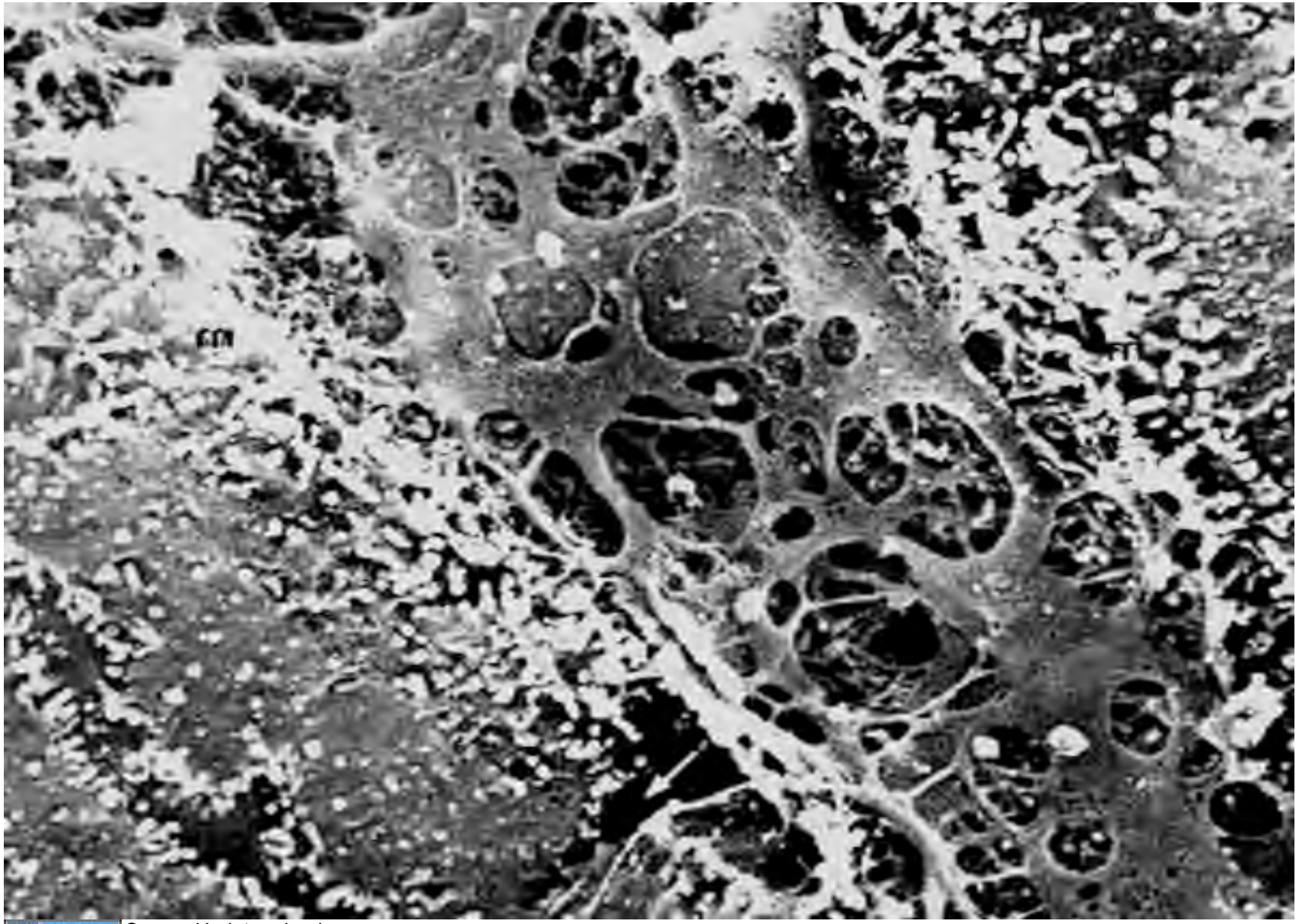
Liver Sinusoid



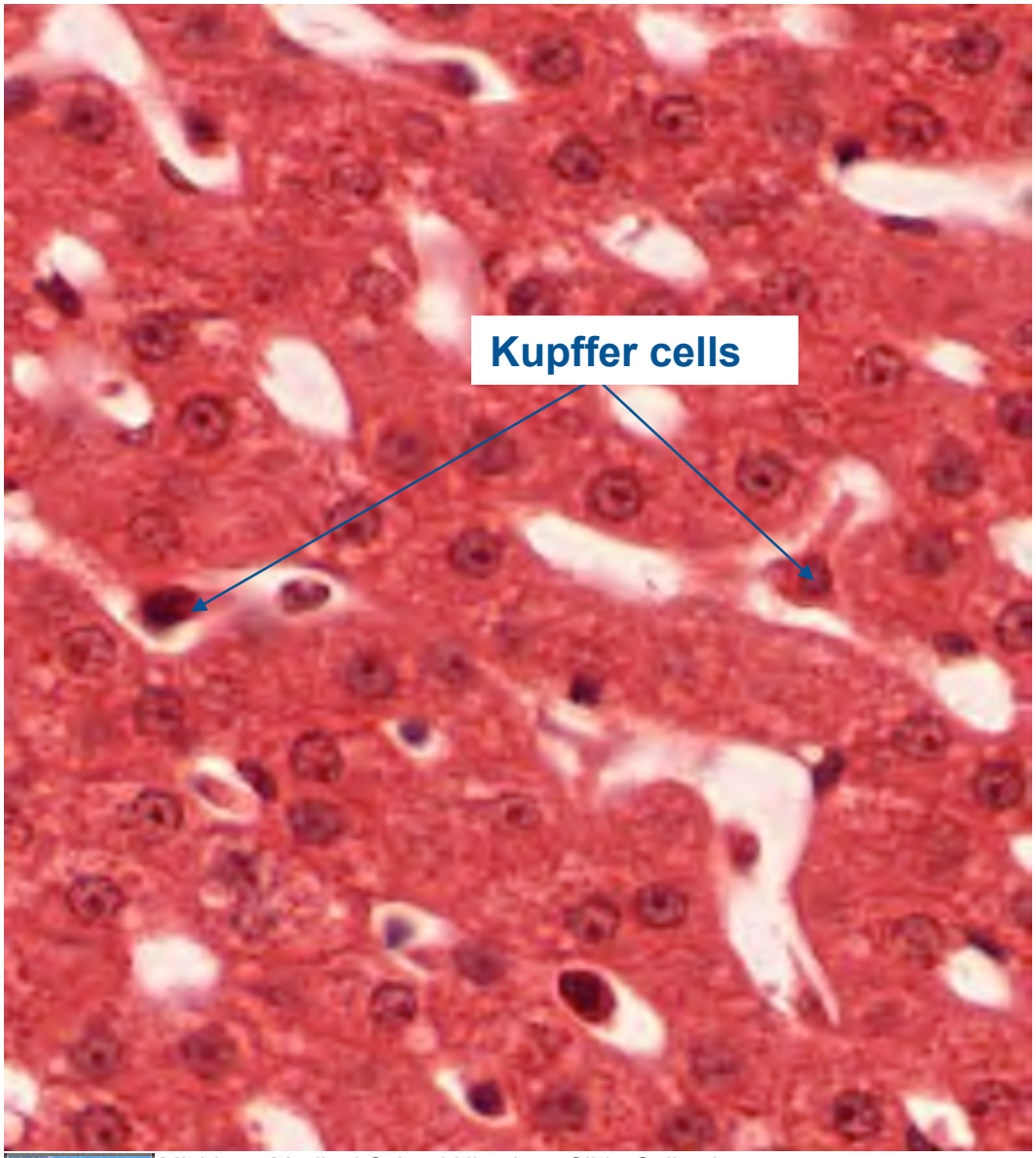


 Bloom and Fawcett p. 662

Liver Sinusoid



Liver sinusoids, space of Disse, and Kupffer cells



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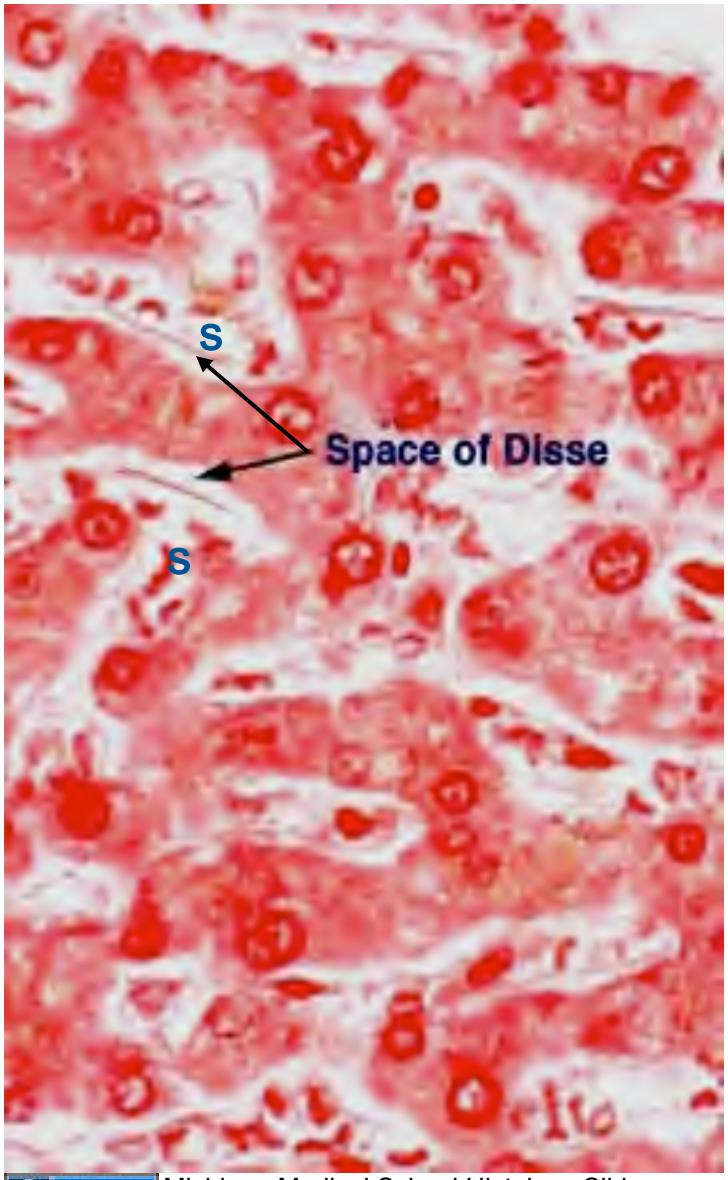

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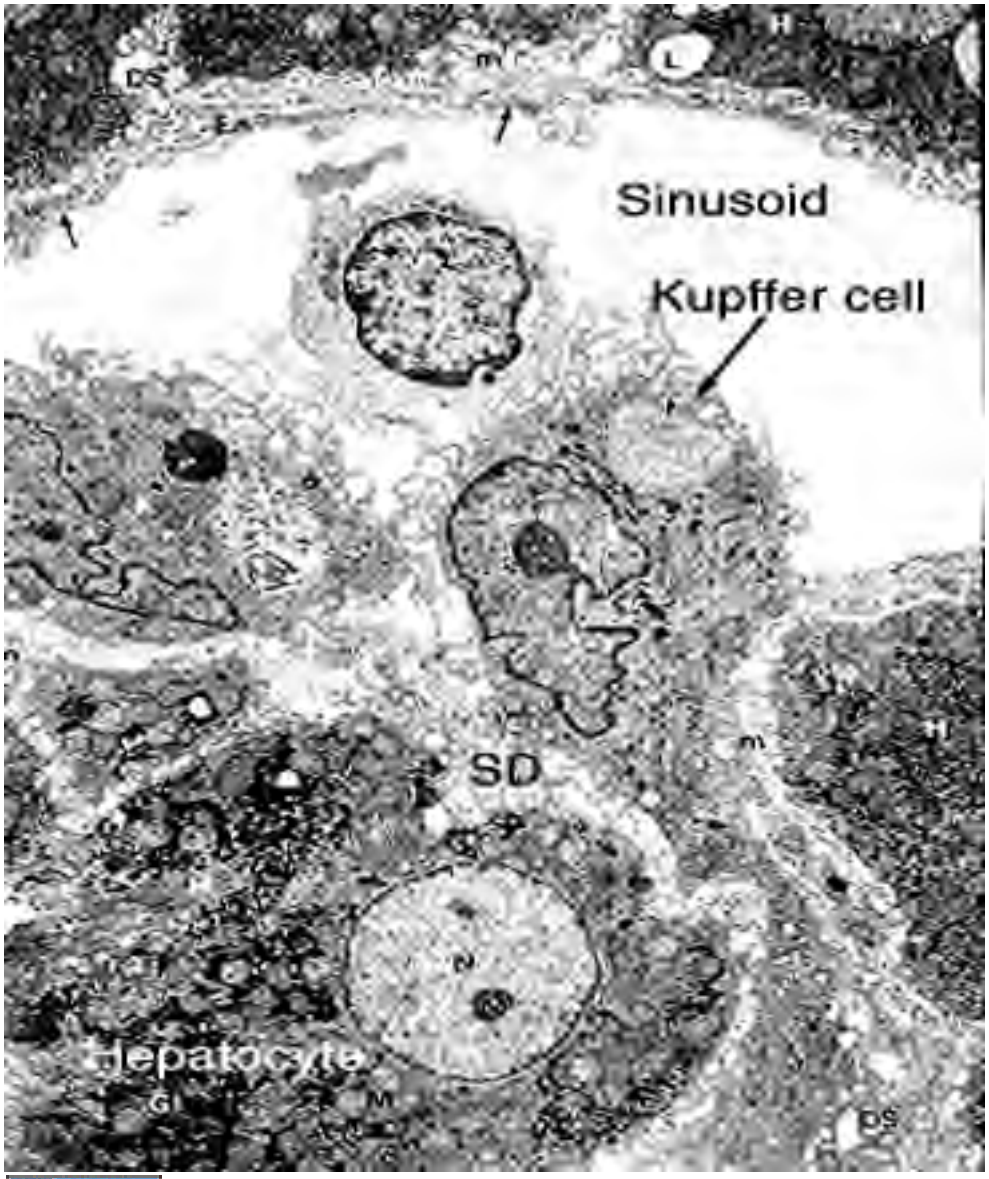
Kupffer cell

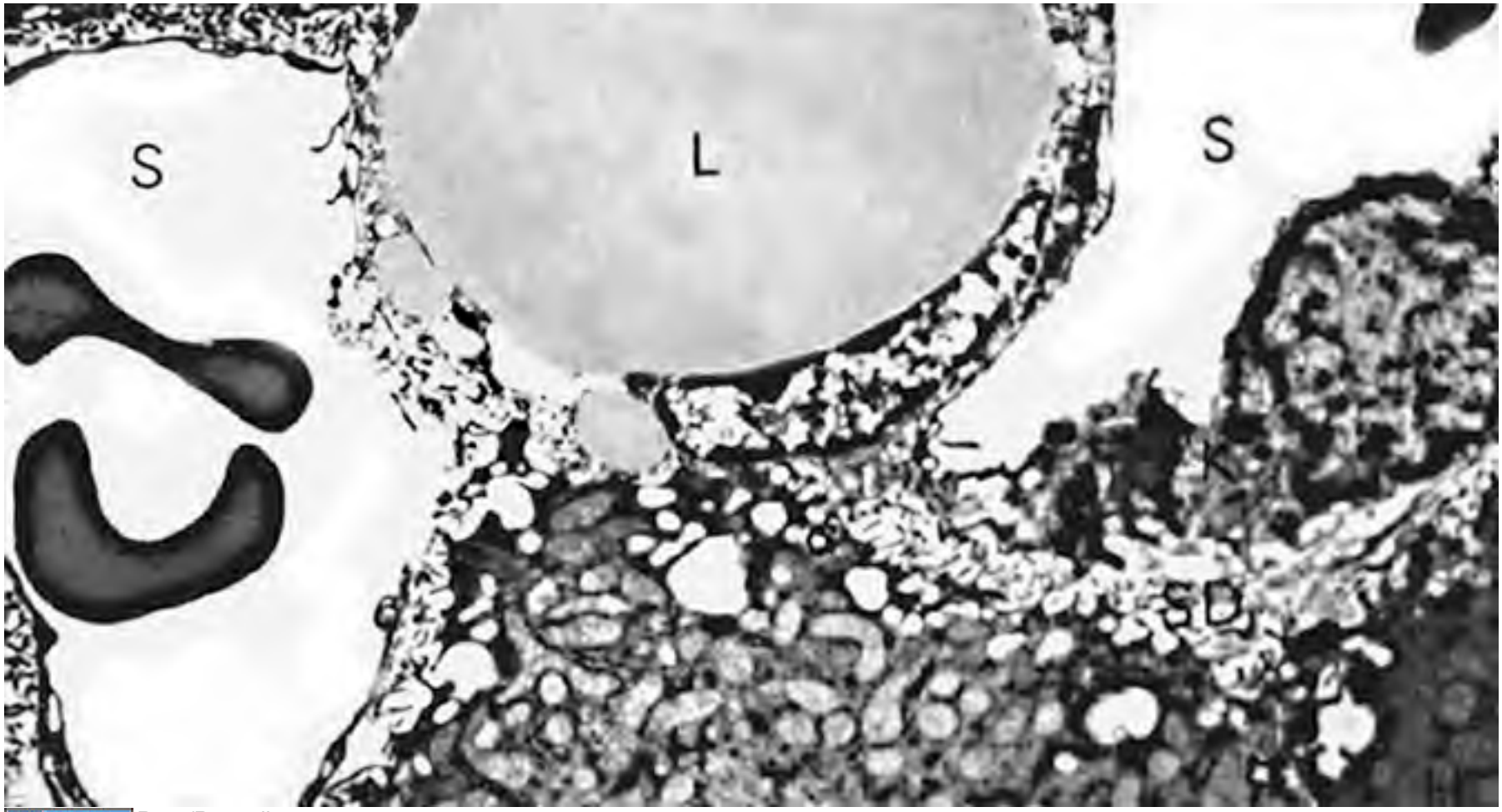


PD-INEL Source Undetermined

Scanning EM

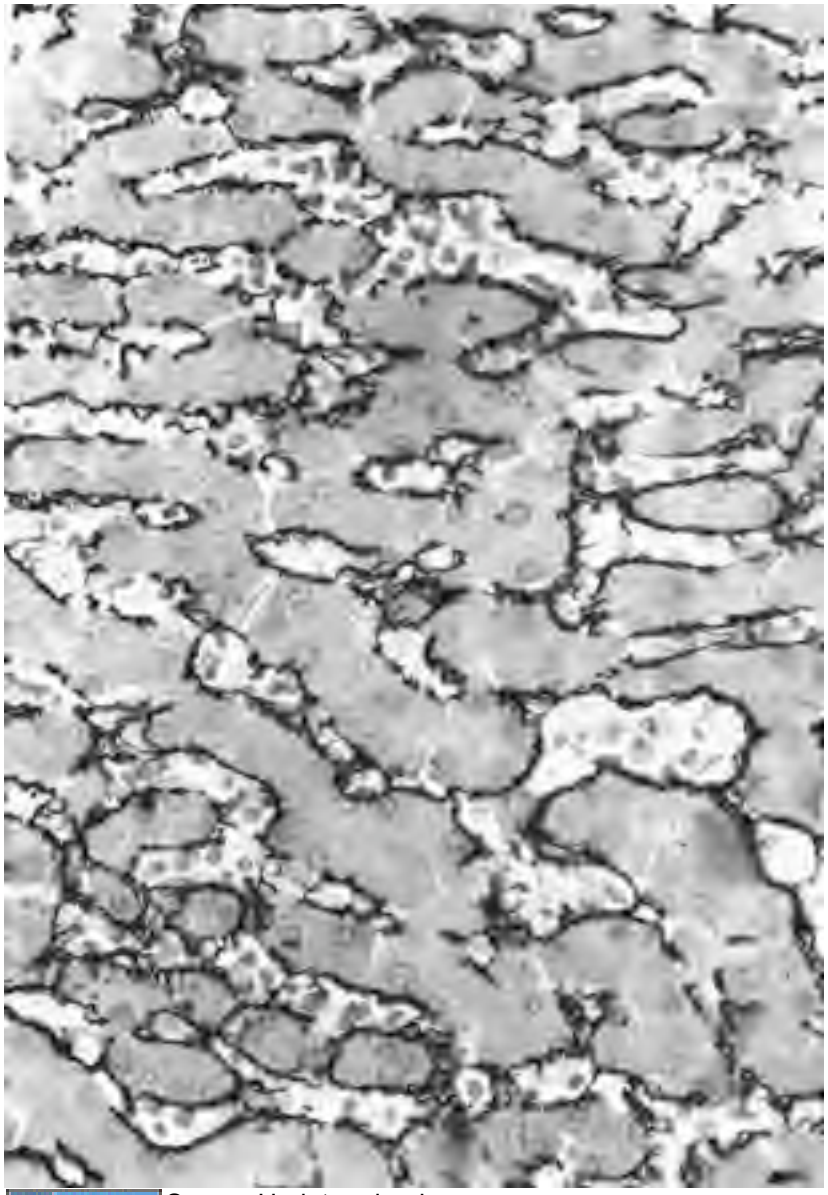
PD-INEL Cormack, D.H. 9th Ed. P. 530

Fat Storing Cells of Ito



PD-INEL Ross/Romrell p. 474

Distribution of Reticular Fibers in the Liver



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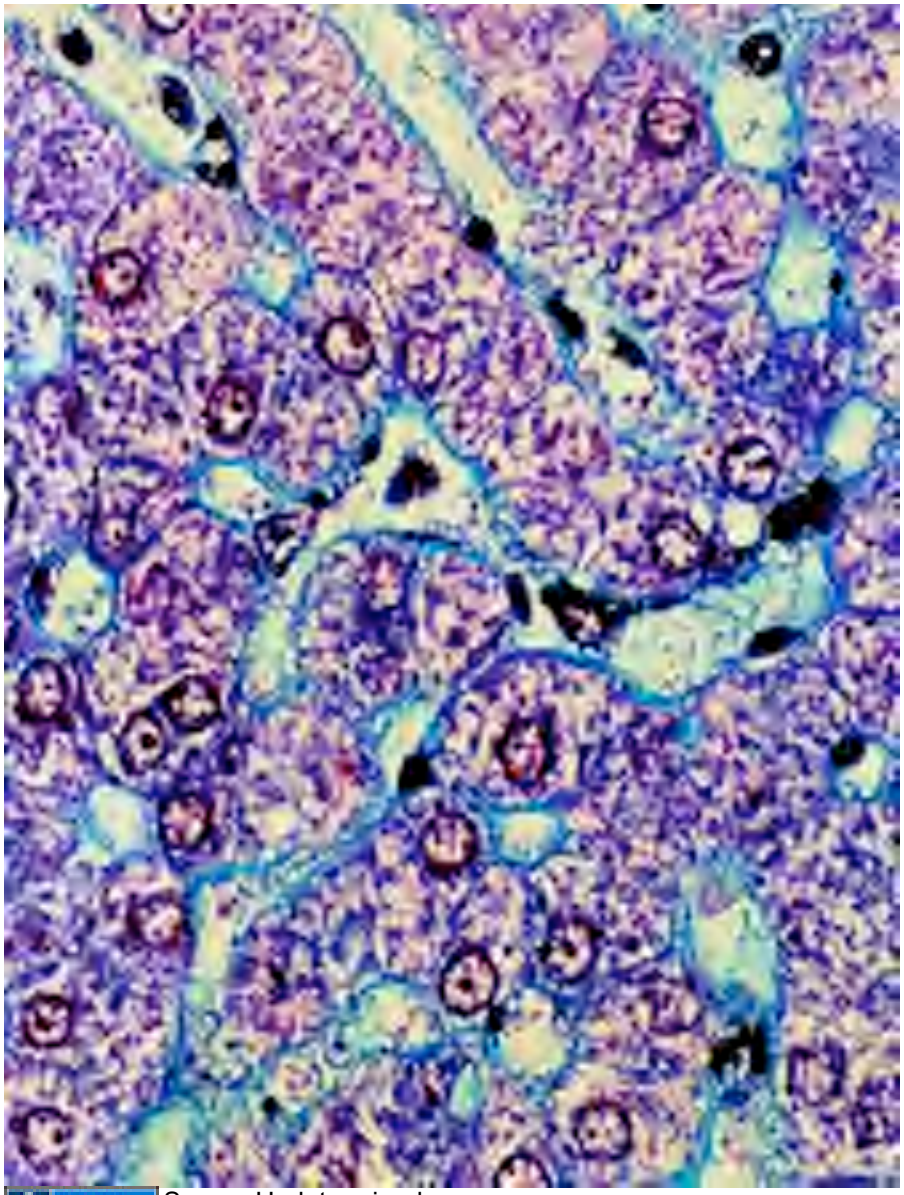
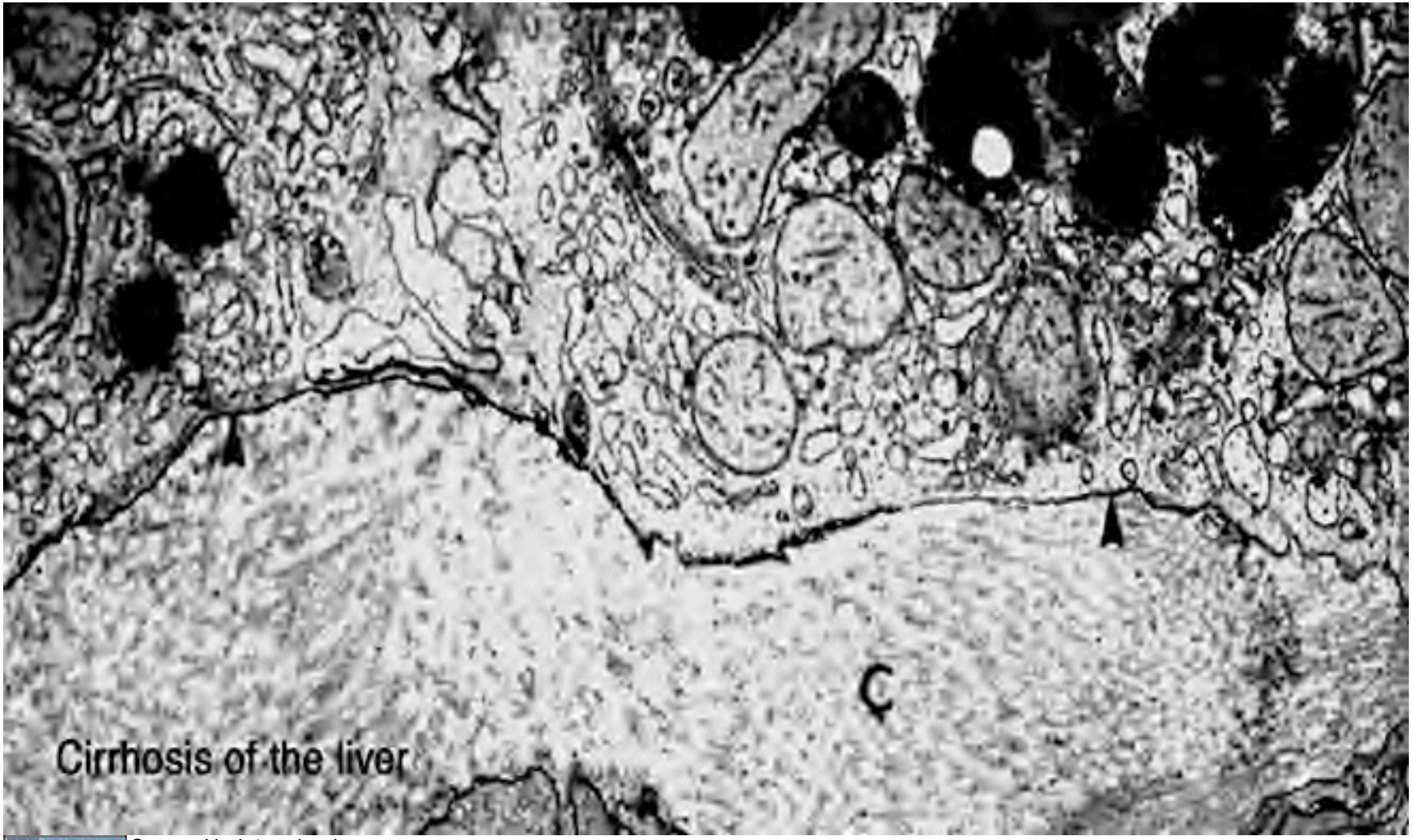
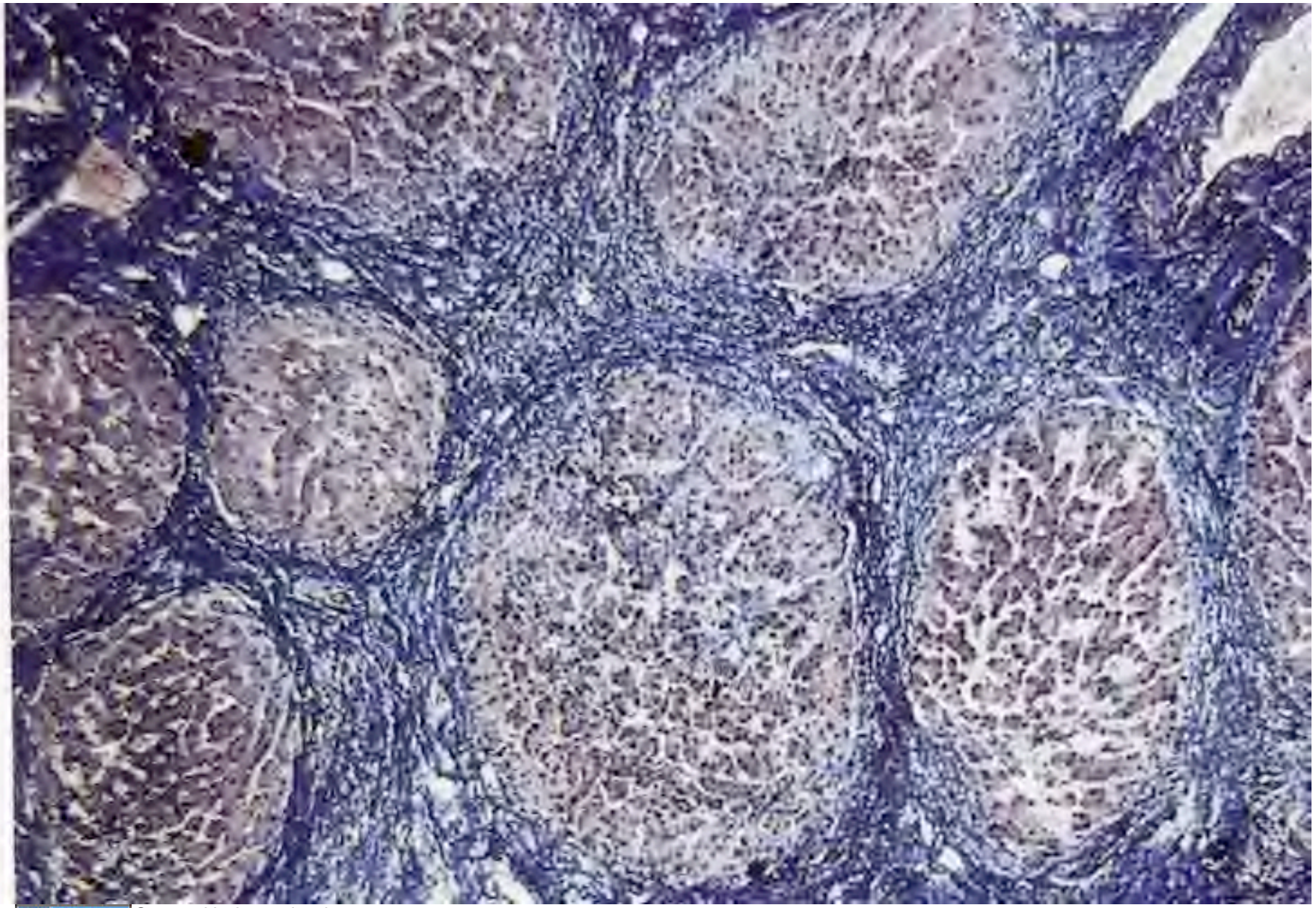


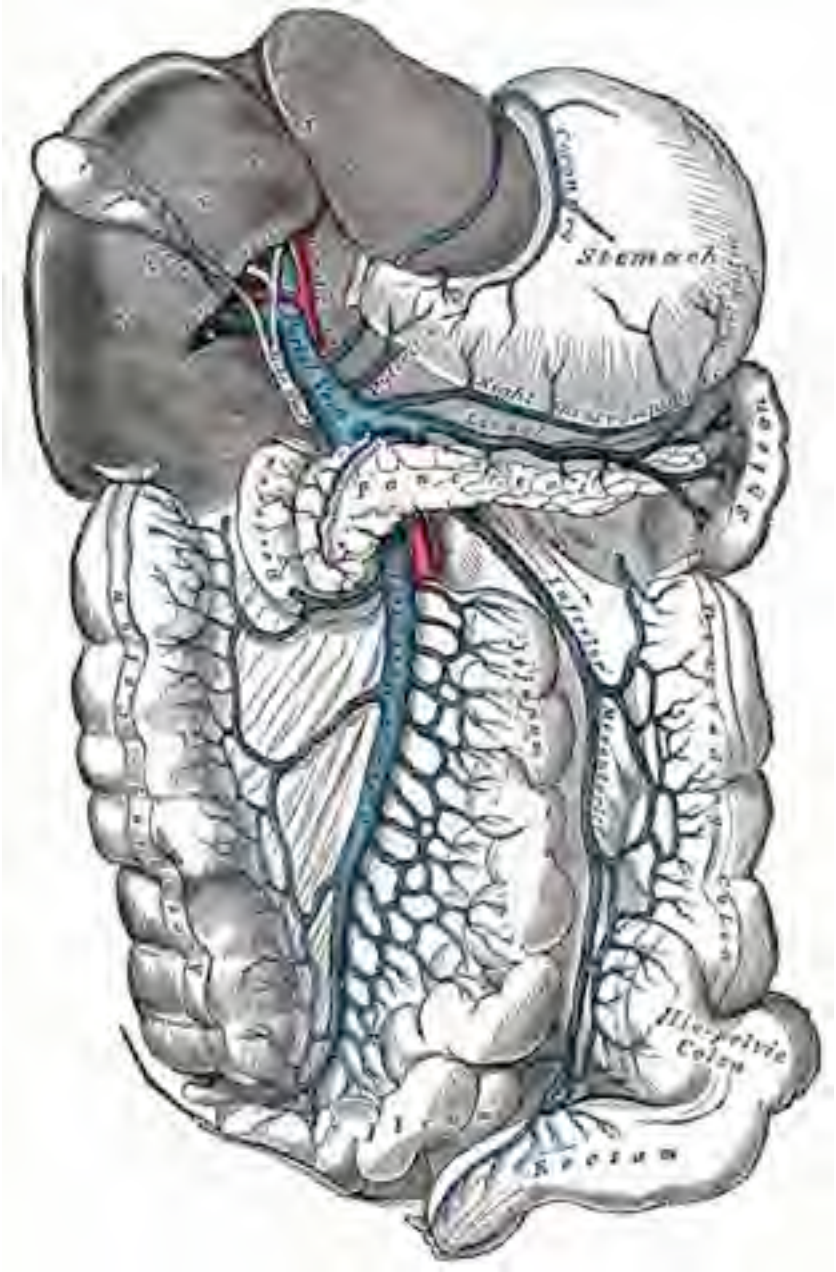
PD-INEL Source Undetermined

Type I Collagen in Space of Disse



Cirrhosis of the Liver





Caval System:

arteries - capillaries - veins -

vena cava - heart

Portal System:

arteries - capillaries - veins -

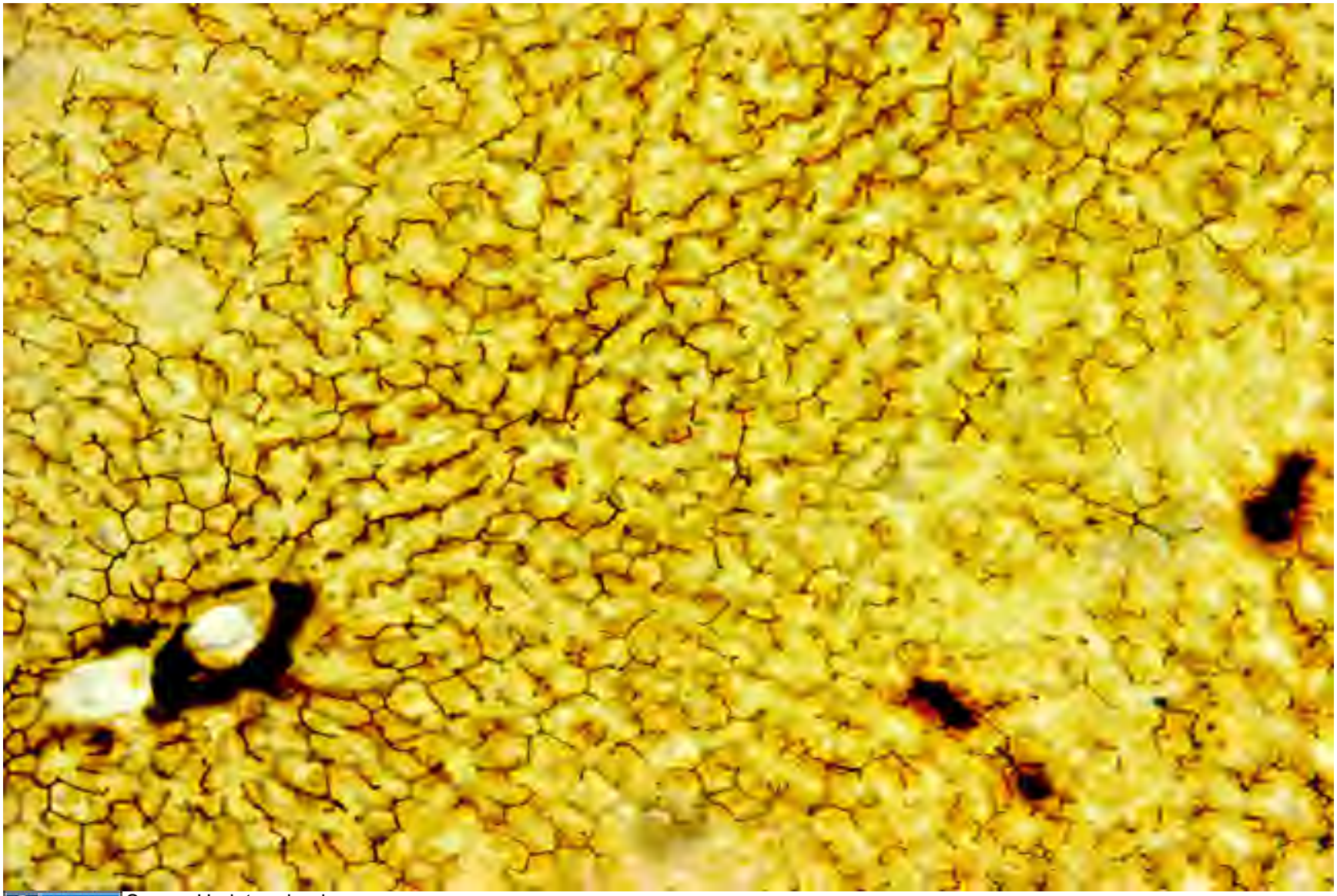
- portal vein - capillaries (sinusoids) - veins -

vena cava - heart

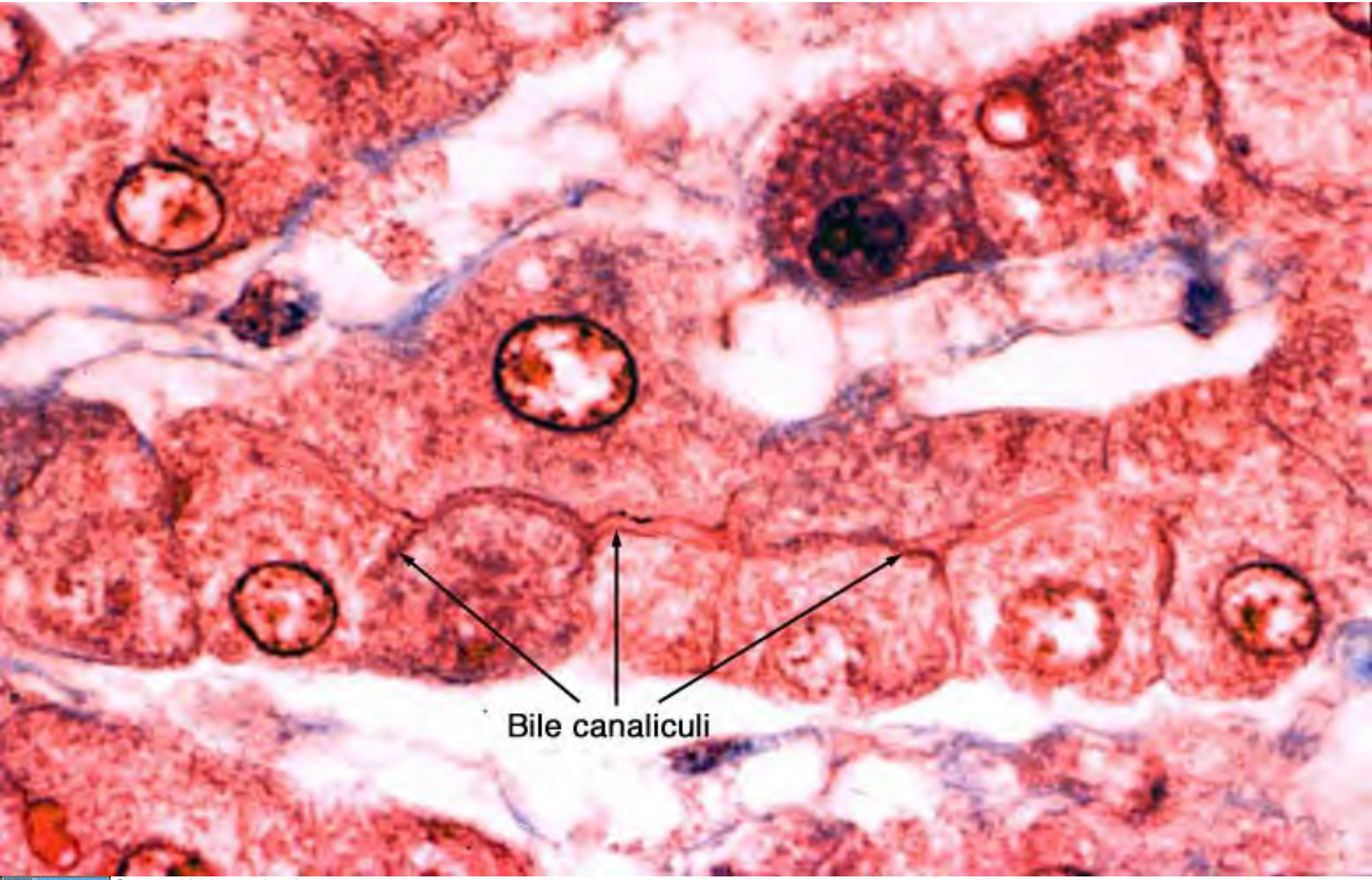
Caput Medusae

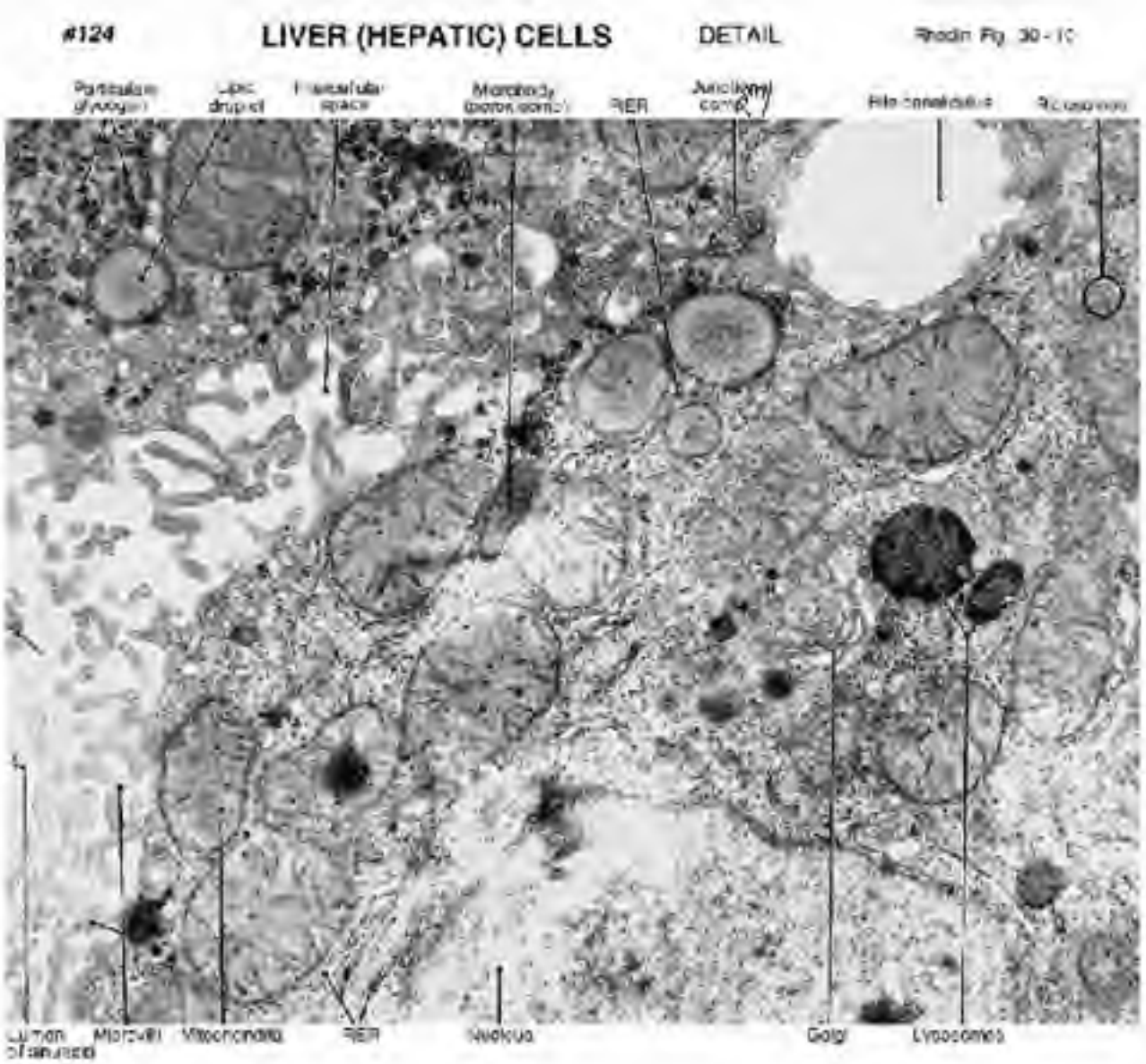
Dilated Paraumbilical Veins

Bile Calaniculi and Ducts

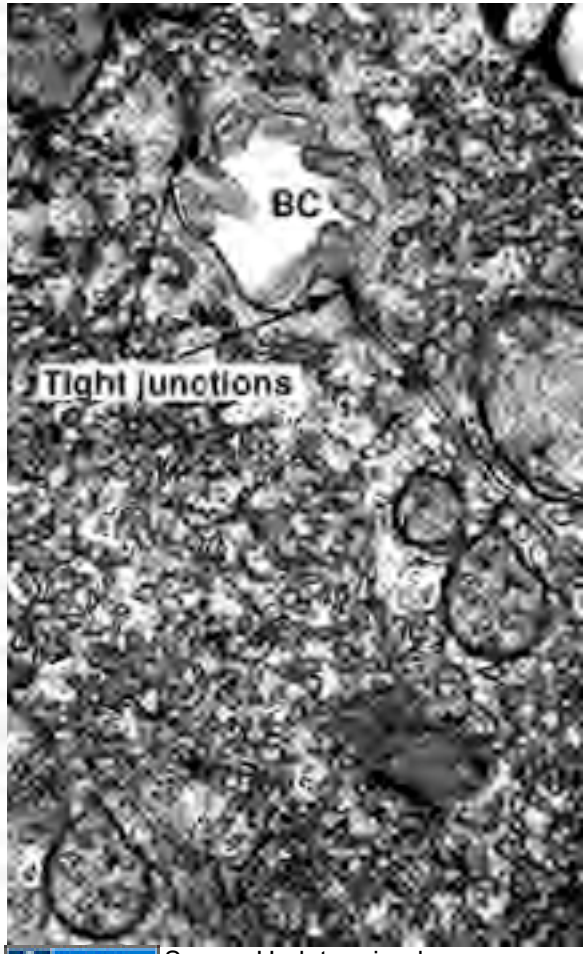


Drawing of a 3D cross-section of liver lobule highlighting the spatial relationship of bile canaliculi, hepatocytes, and sinusoids was removed.





PD-INEL Rhodin Fig. 30-10 Slide # 124



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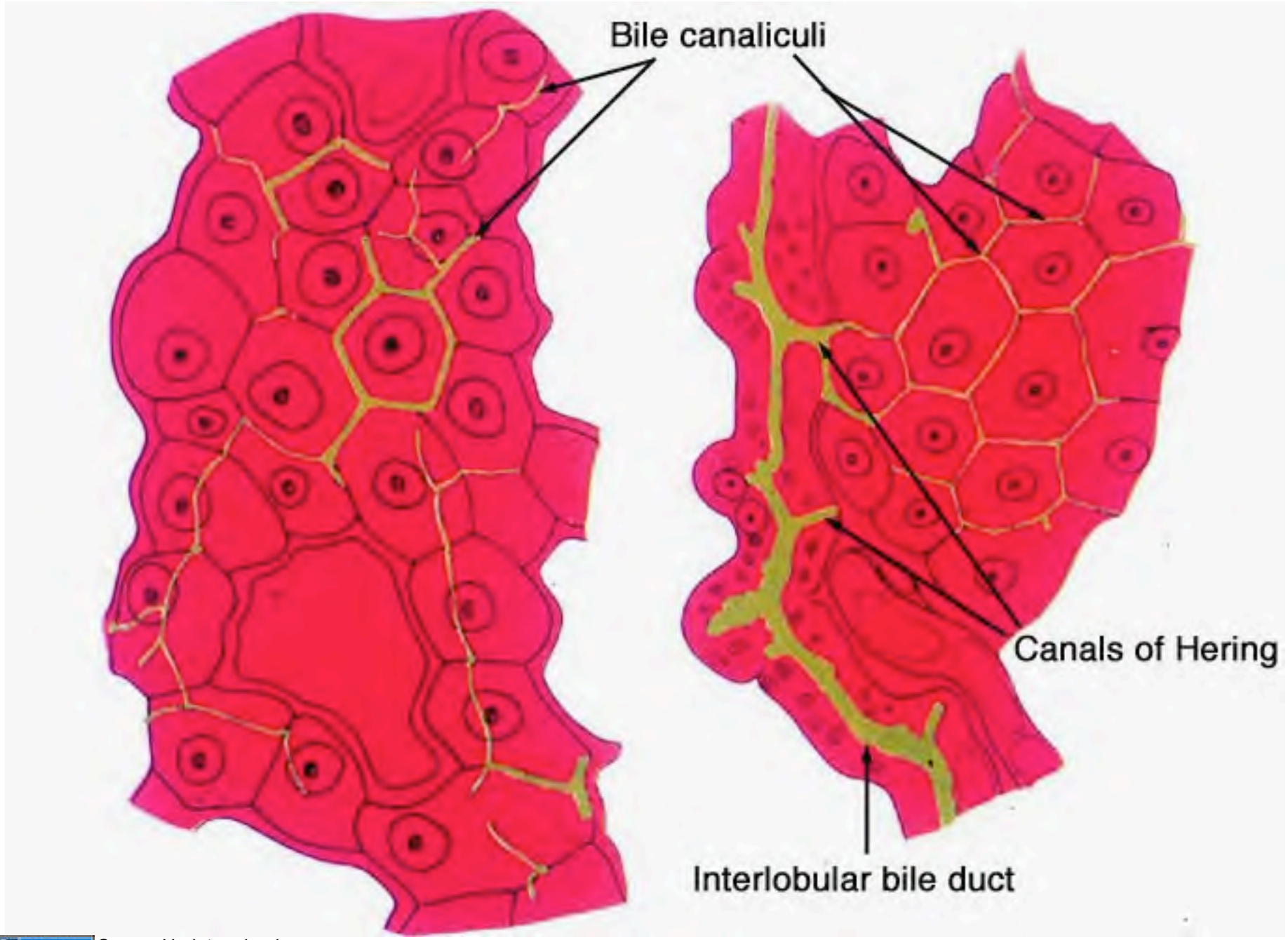


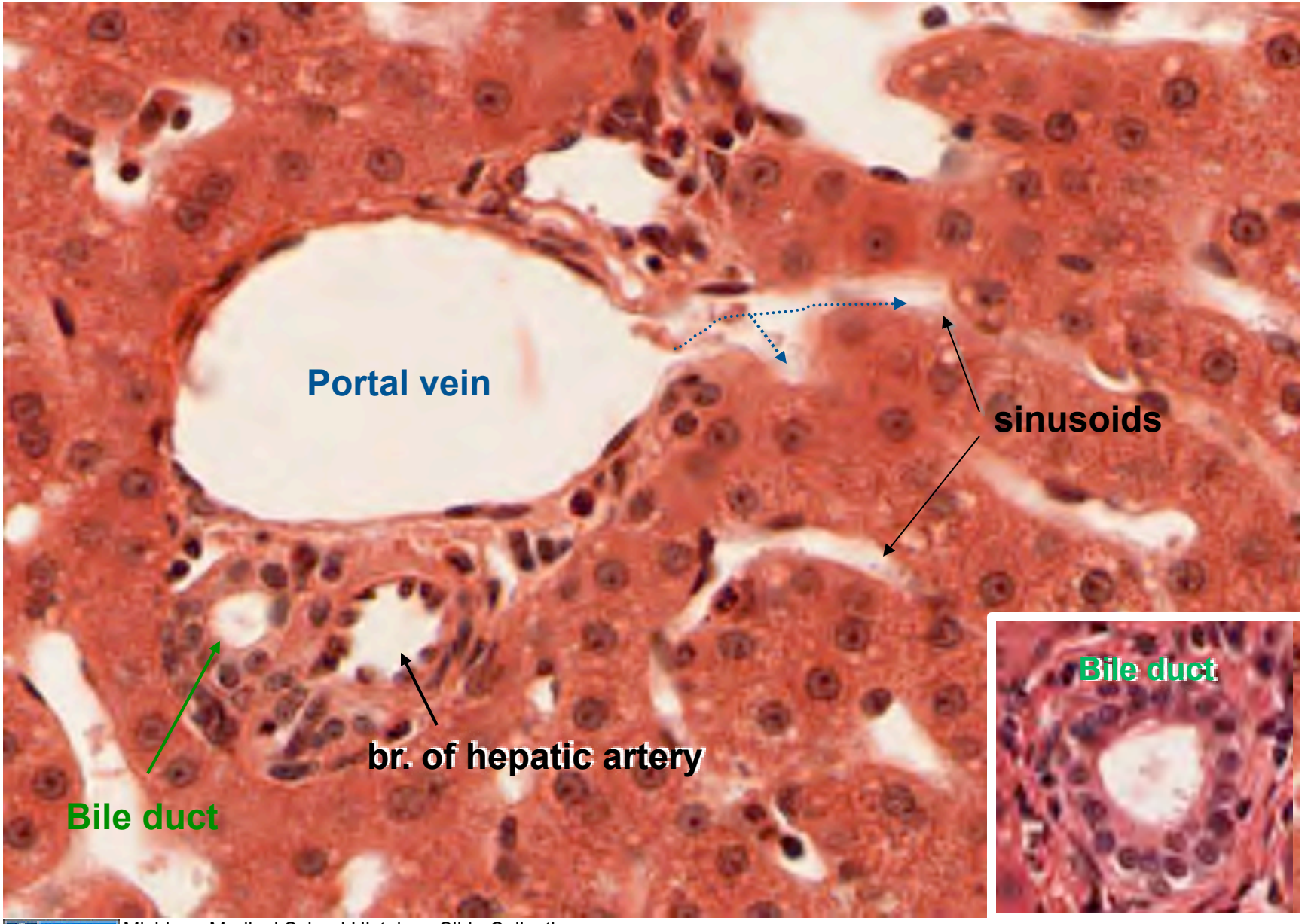
Bile Canaliculus

PD-INEL Cormack, D.H. 9th ed. P. 522

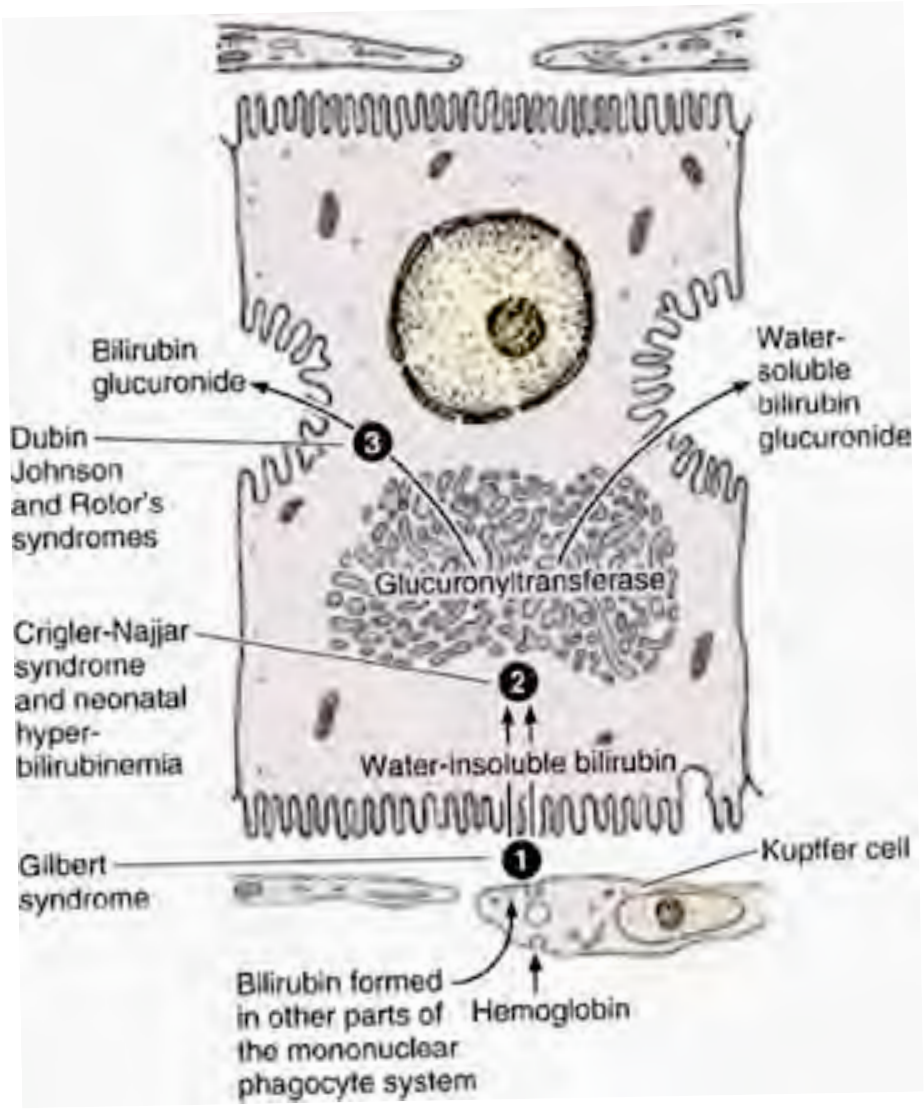
Bile Duct

PD-INEL Weiss, L. 6th ed. P. 709

Portal Triad

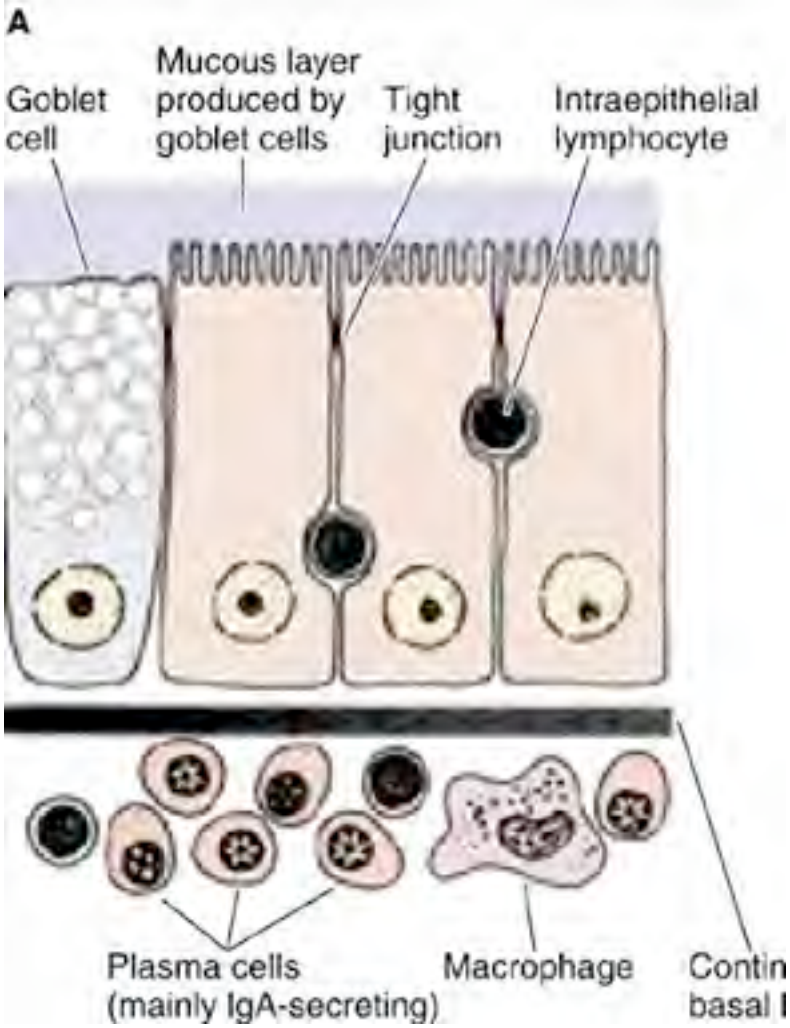


Secretion of Bilirubin



 Basic Histology, Junqueira and Carneiro, p. 347

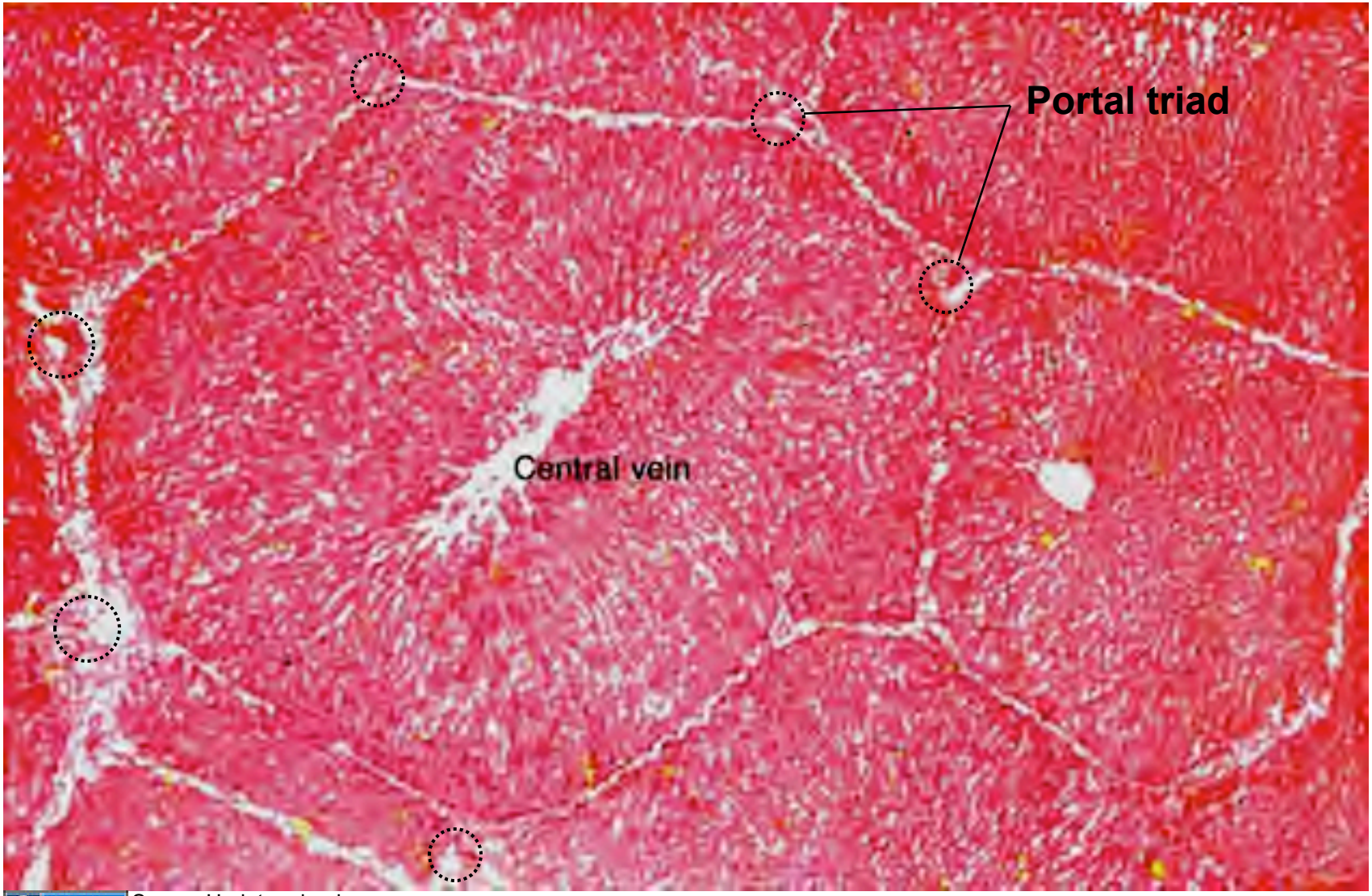
Secretory IgA



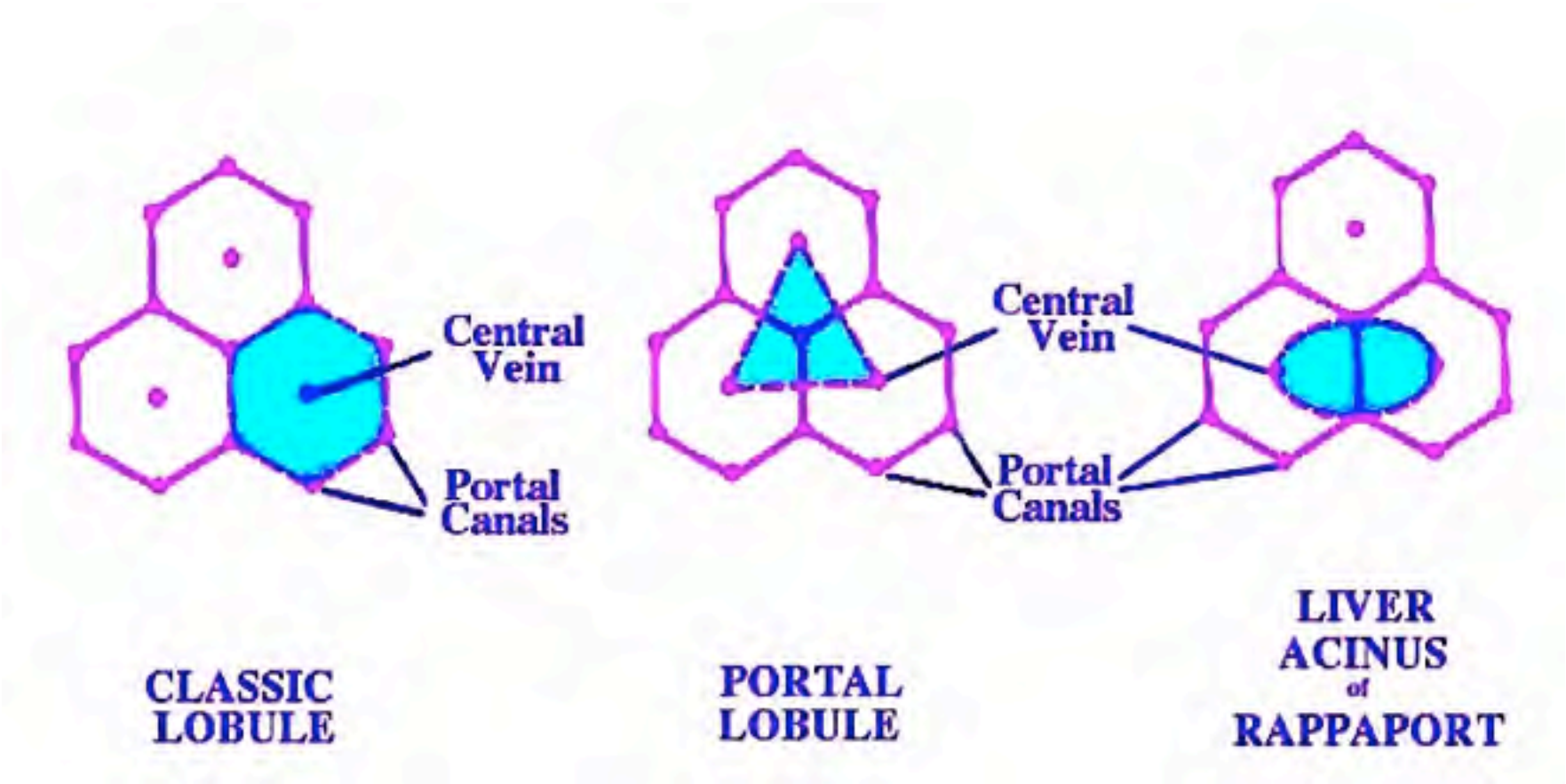
PD-INFL Basic Histology, Junqueira and Carneiro

- IgA is synthesized and secreted by plasma cells in the lamina propria of the gut.
- Some IgA is transported across the intestinal epithelial cells as secretory-IgA and released into the lumen.
- The remainder is carried in the lymph to the thoracic duct, to the general circulation, to the liver.
- IgA is taken up by the hepatocytes as secretory-IgA and is secreted into the bile canaliculi.
- The secretory component is cleaved and the antibody is released into bile for transport to the intestinal lumen.

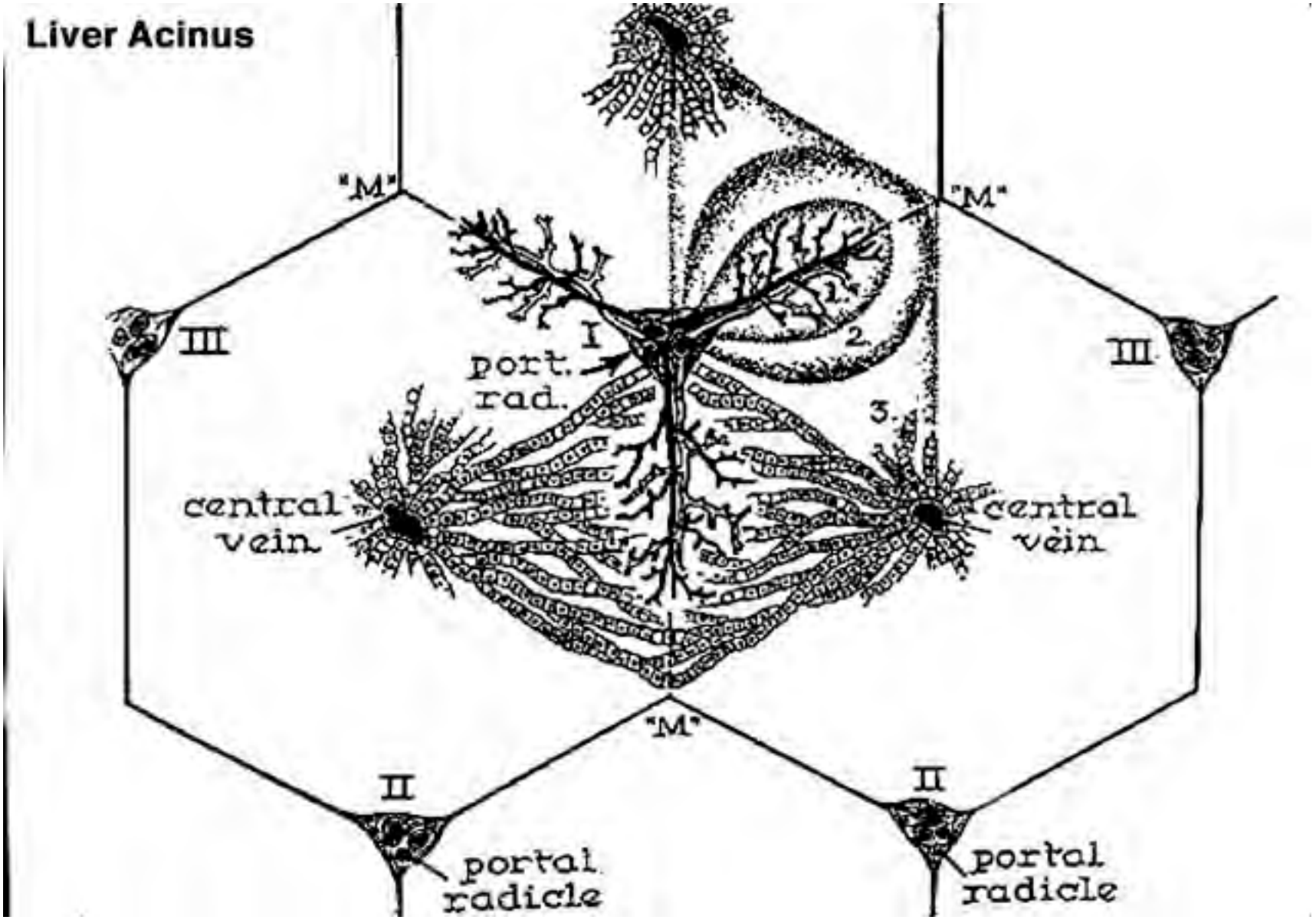
Liver Lobules



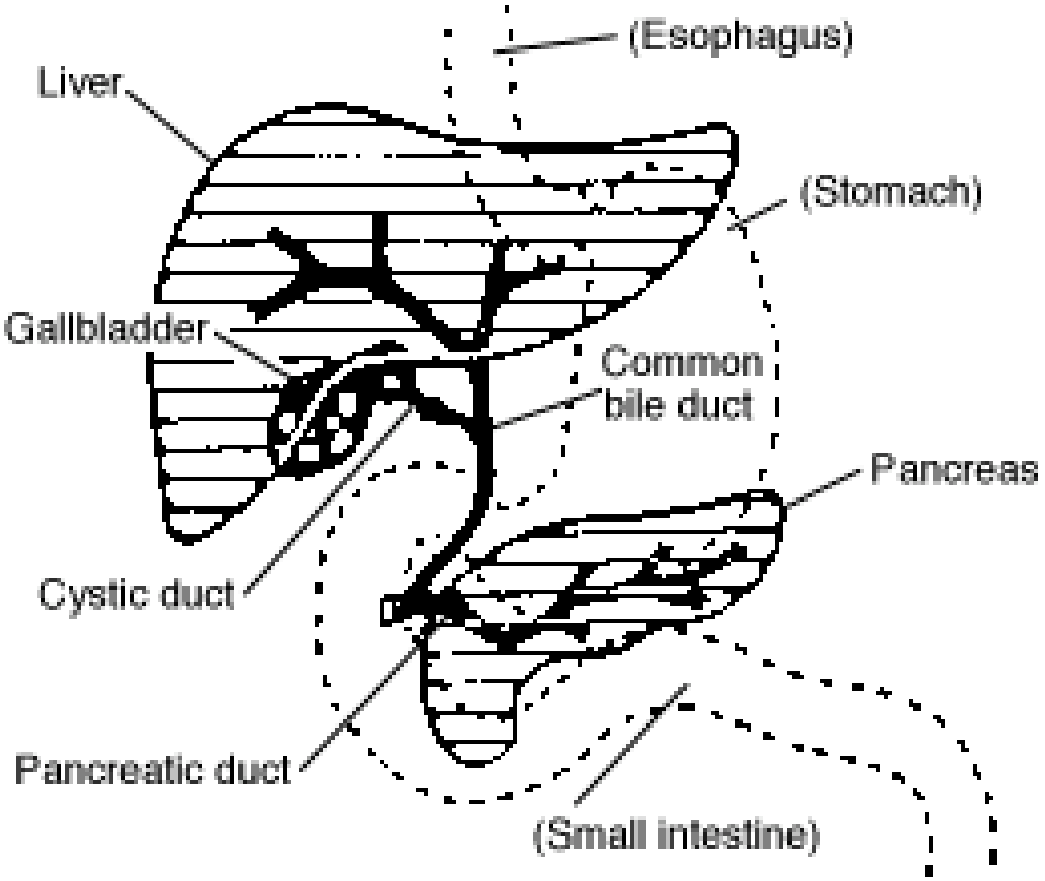
Liver Lobule and Acinus



 Ross/Romrell p. 481



Gallbladder and Extrahepatic Bile Ducts



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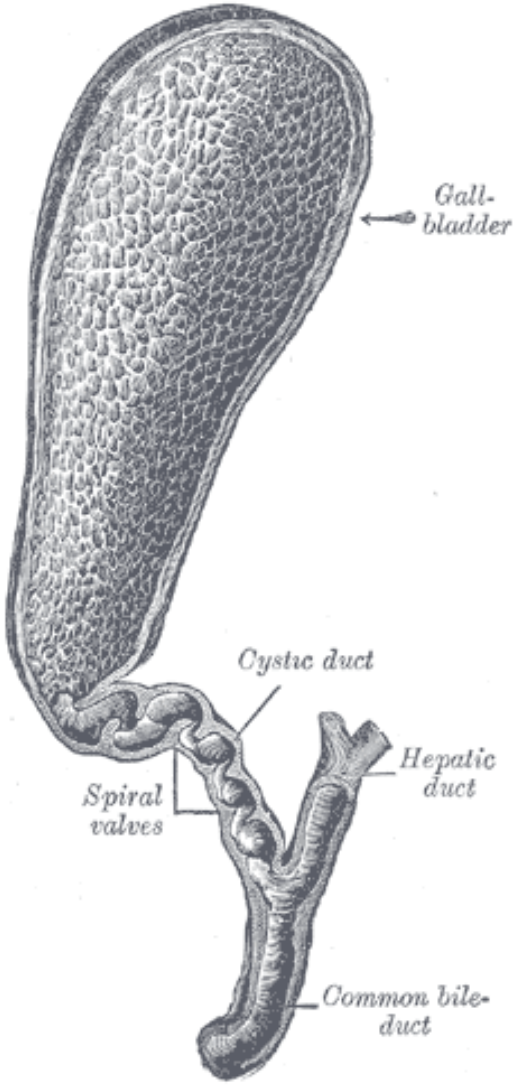

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Mucosal Lining of the Gallbladder

PD-INEL Weiss, L. 6th ed. P. 711

Gallbladder and its Wall

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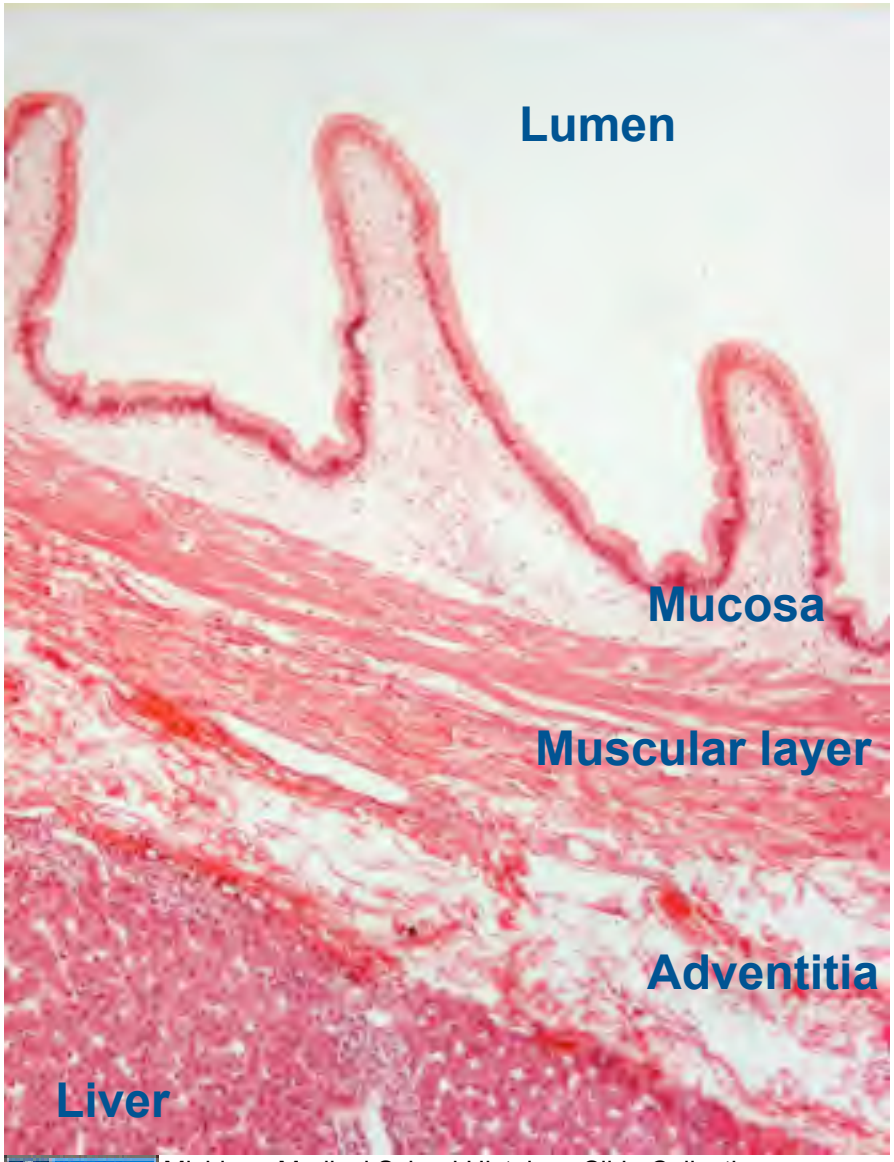

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Epithelial Cells of the Gallbladder

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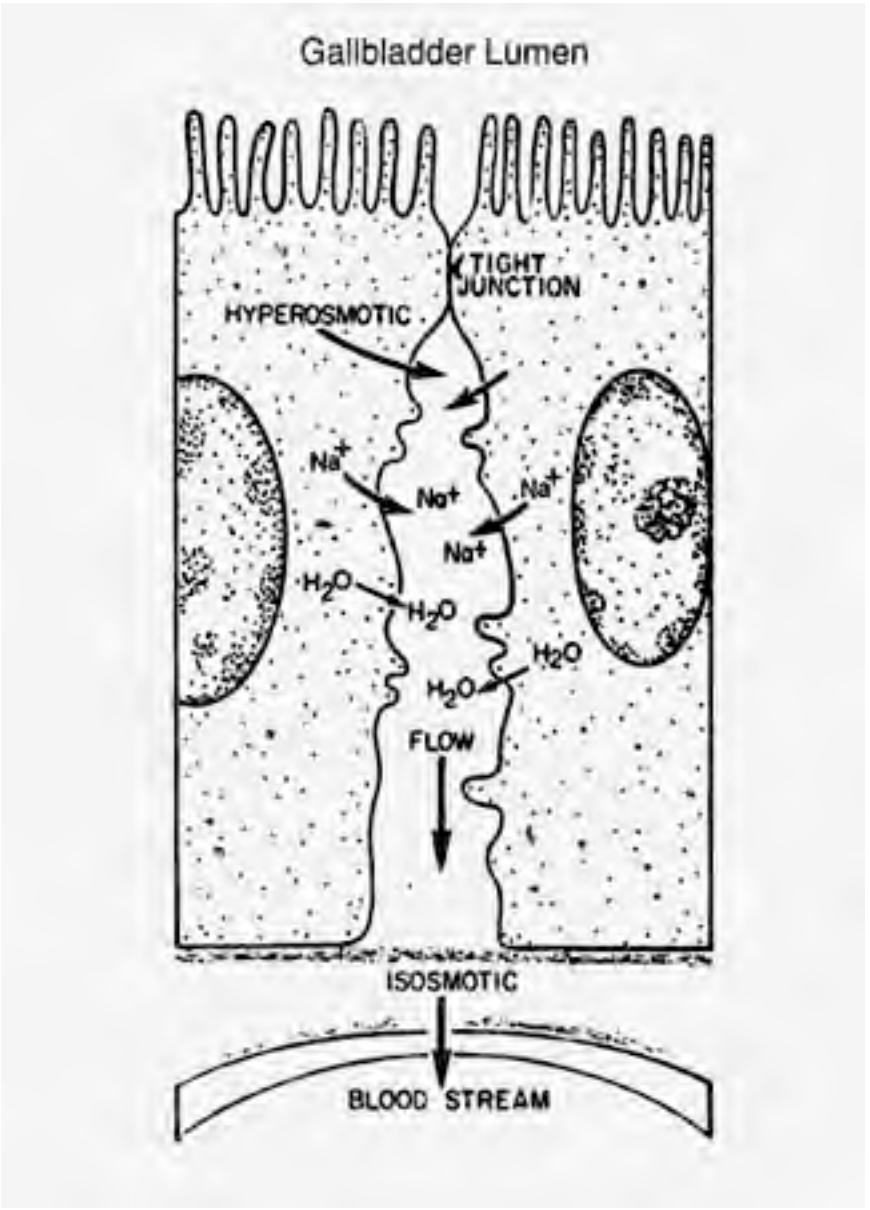

PD-INEL Bloom and Fawcett p.685

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