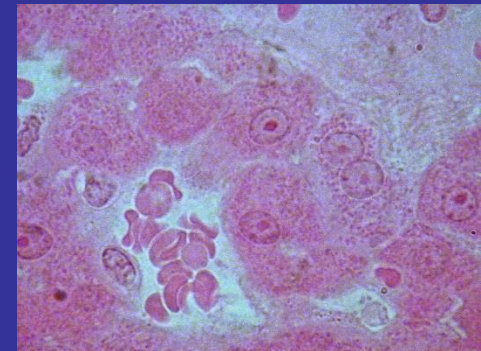
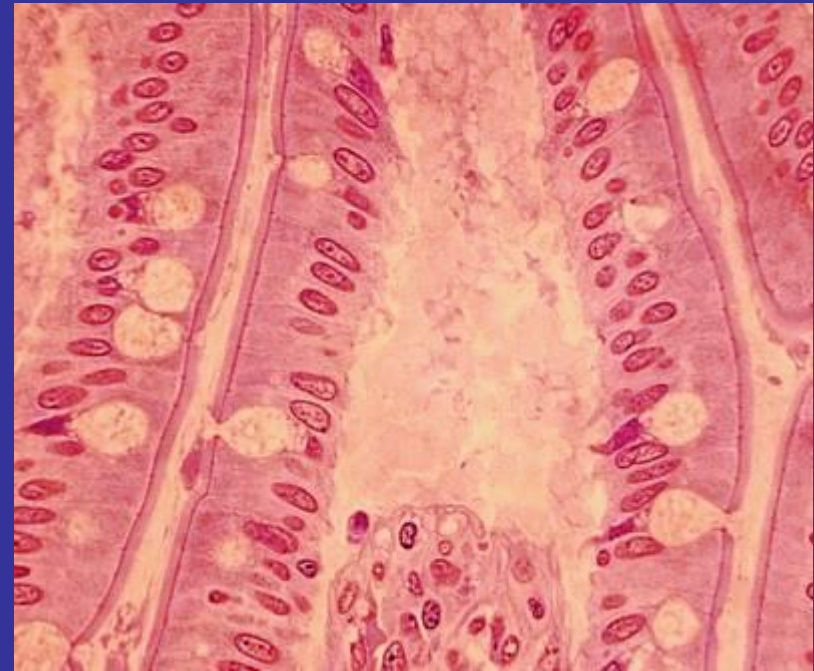
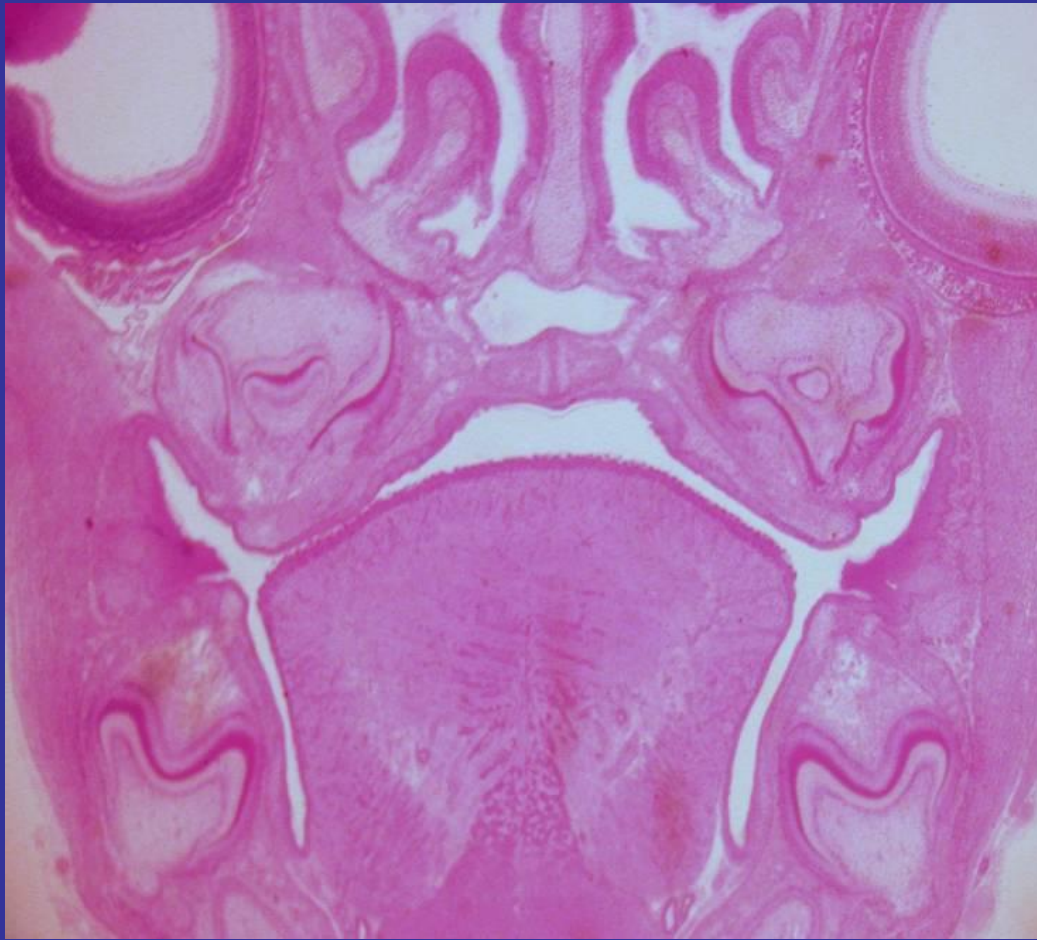
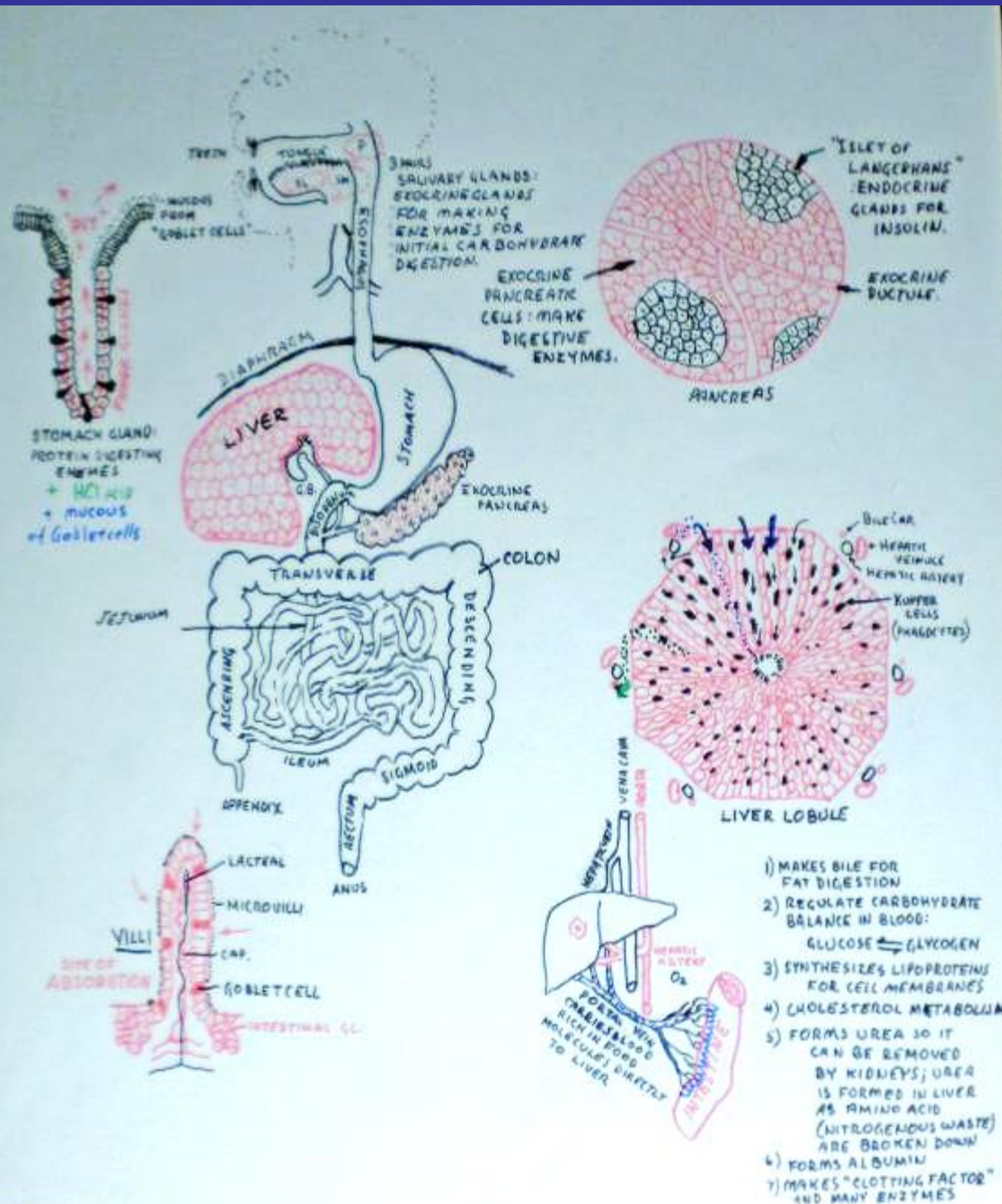


Histology & Anatomy of the Digestive System



John E. B. Baker, mikrogeo



STOMACH GLAND: PROTEIN DIGESTING ENZYMES + HCl acid + mucous of Goblet cells

3 PAIRS SALIVARY GLANDS: ECOCRINE GLANDS FOR MAKING ENZYMES FOR INITIAL CARBOHYDRATE DIGESTION.

EXOCRINE PANCREATIC CELLS: MAKE DIGESTIVE ENZYMES.

"ISLET OF LANGERHANS": ENDOCRINE GLANDS FOR INSULIN.

EXOCRINE DUCTULE.

PANCREAS

DIAPHRAGM
LIVER
STOMACH
G.B.
EXOCRINE PANCREAS
COLON
TRANSVERSE
DESCENDING
SIGMOID
RECTUM
ILEUM
JEJUNUM
ASCENDING
APPENDIX
ANUS

BILE CANAL
HEPATIC VEIN
HEPATIC ARTERY
KUPFER CELLS (PHAGOCYTES)
LIVER LOBULE
VENA CAVA
HEPATIC ARTERY
HEPATIC VEIN

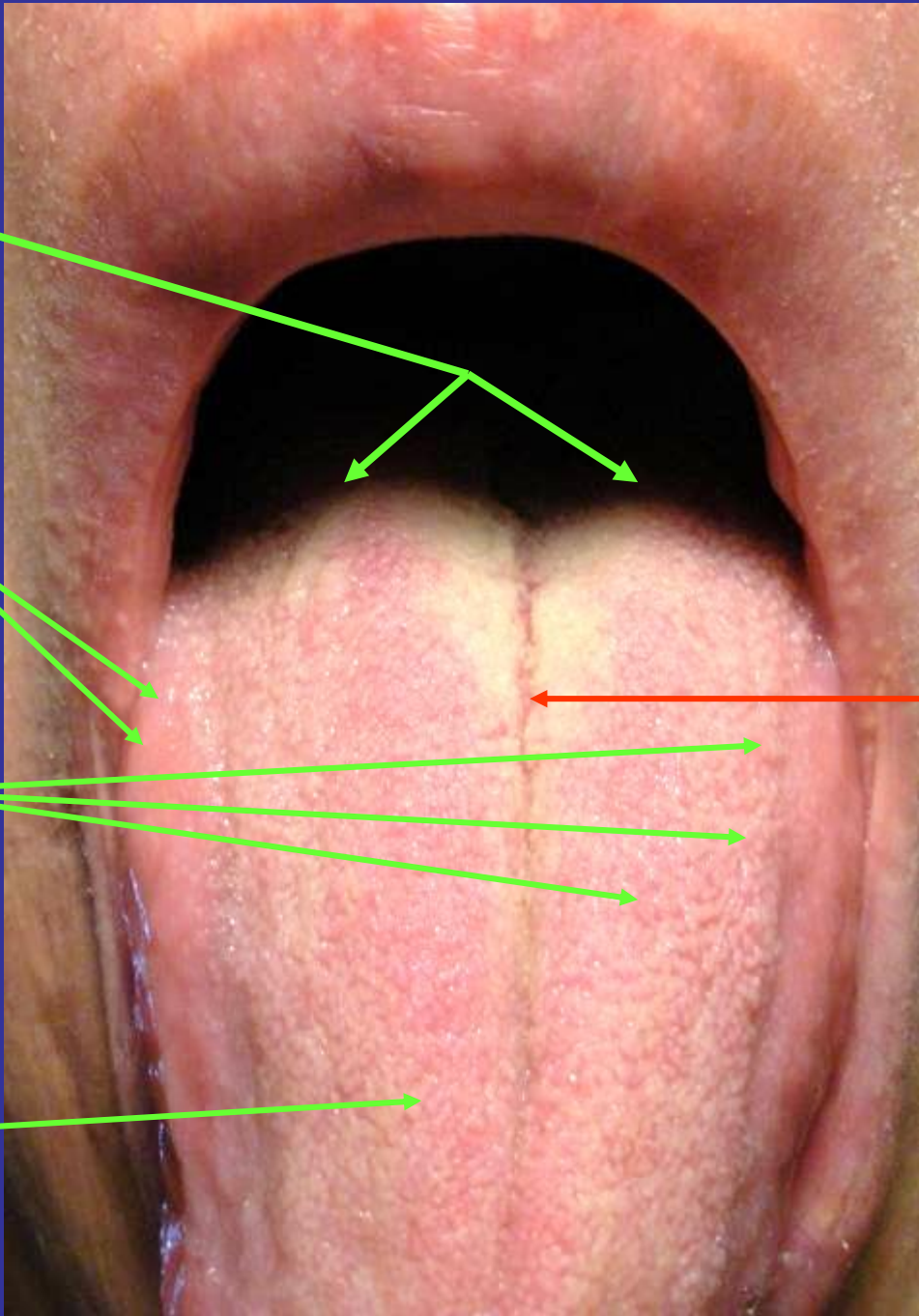
LACTEAL
MICROVILLI
CAP.
GLOBULET CELL
INTESTINAL GL.
VILLI
SITE OF ABSORPTION

HEPATIC VEIN
HEPATIC ARTERY
O₂
FOETAL W/IN PLACENTA
RICH IN FOOD MOLECULES DIRECTLY TO LIVER
HEPATIC VEIN

- 1) MAKES BILE FOR FAT DIGESTION
- 2) REGULATE CARBOHYDRATE BALANCE IN BLOOD:
GLUCOSE \rightleftharpoons GLYCOGEN
- 3) SYNTHESIZES LIPOPROTEINS FOR CELL MEMBRANES
- 4) CHOLESTEROL METABOLISM
- 5) FORMS UREA SO IT CAN BE REMOVED BY KIDNEYS; UREA IS FORMED IN LIVER AS AMINO ACID (NITROGENOUS WASTE) ARE BROKEN DOWN
- 6) FORMS ALBUMIN
- 7) MAKES "CLOTTING FACTOR" AND MANY ENZYMES



TONGUE
coronal
section of rat
face



~ 12 **Vallate**
Papilla at
base of
Tongue

Lingual Papillae:

Foliate Pap.

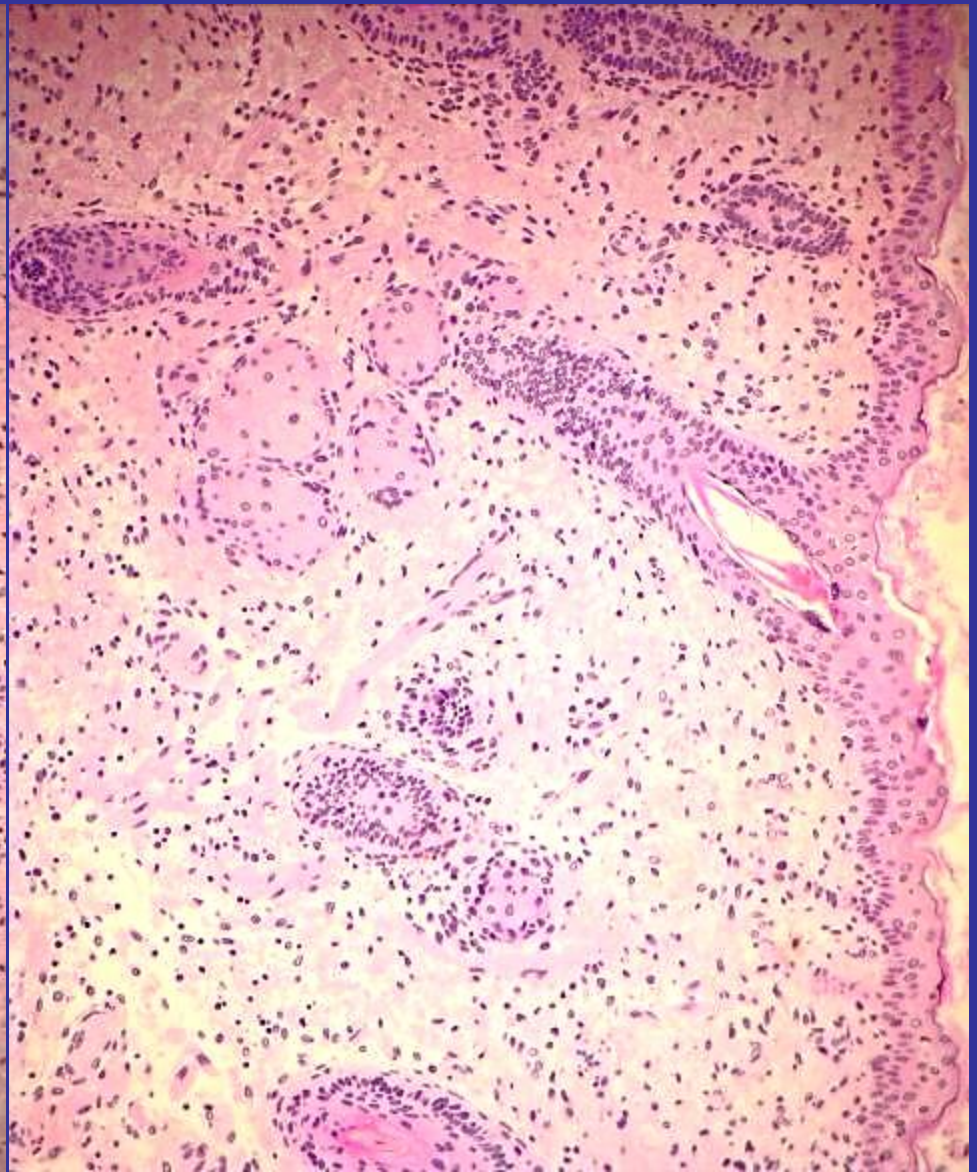
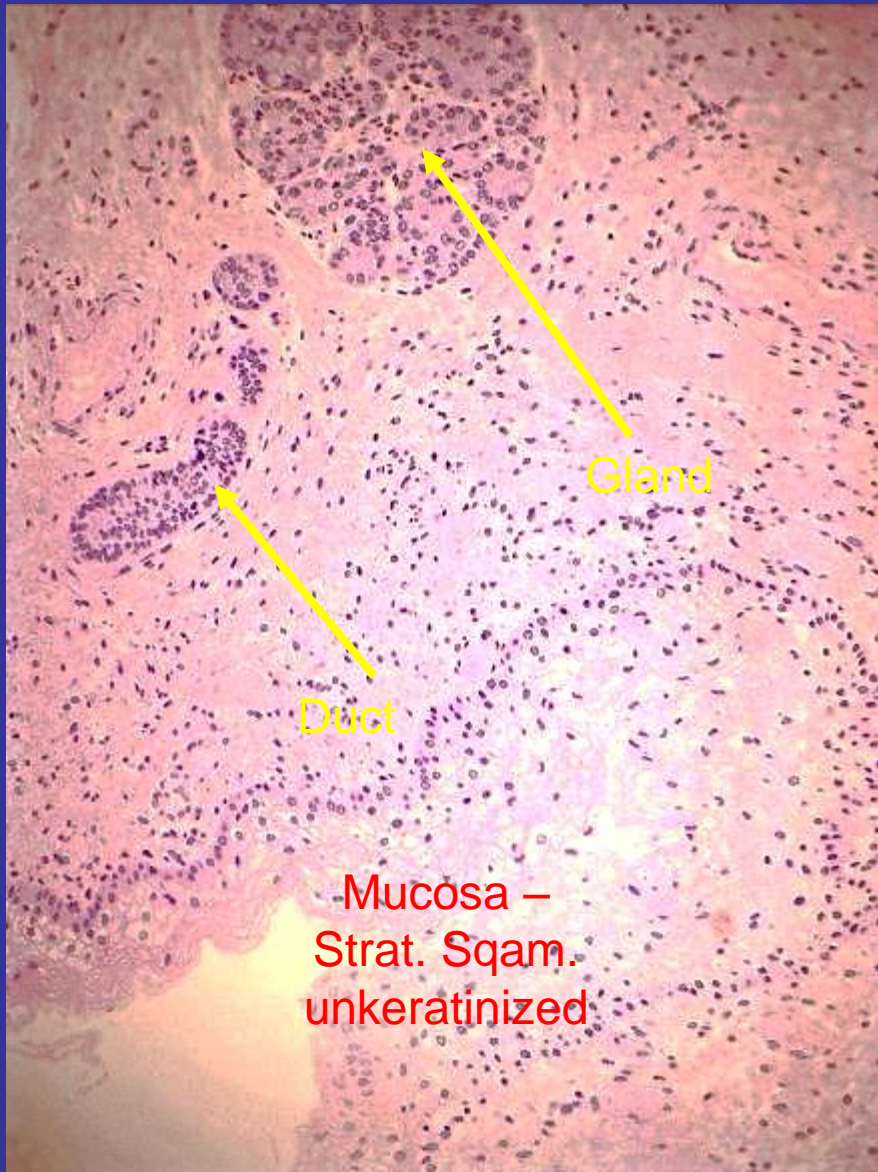
Fungiform
Pap.

Filiform Pap.

Taste Sense –
Anterior 2/3's is by
Lingual part of
Mandibular branch
of CN VII (Facial)
& *Chorda*
Tympani ; Post 1/3
by
Glossopharyngeal
N. (CN IX)

Median
Lingual Sulcus

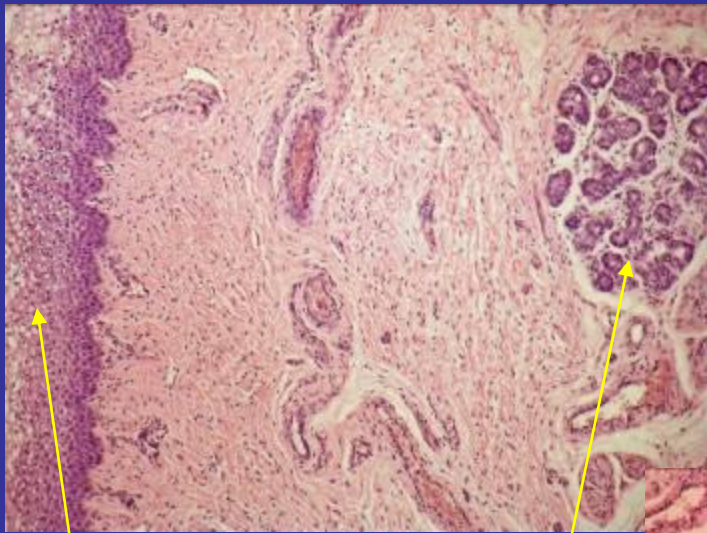
Motor
innervation
by
Hypoglossal
(CN XII)



**Upper Lip – Inner surface w/
labial Glands & Ducts**

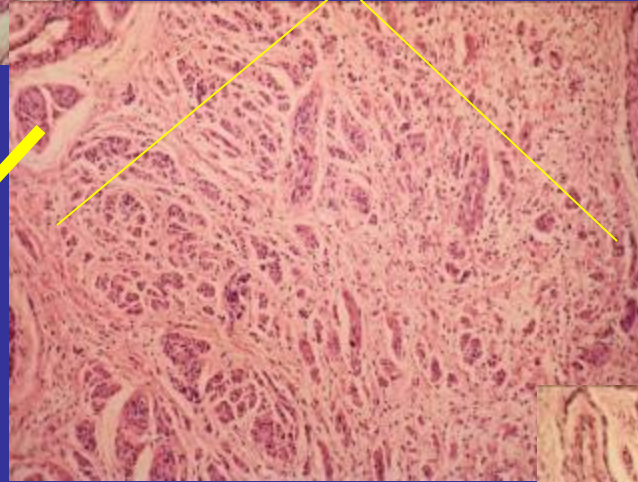
**Upper Lip – Outer Surface
w/ hair follicles**

Lower Lip

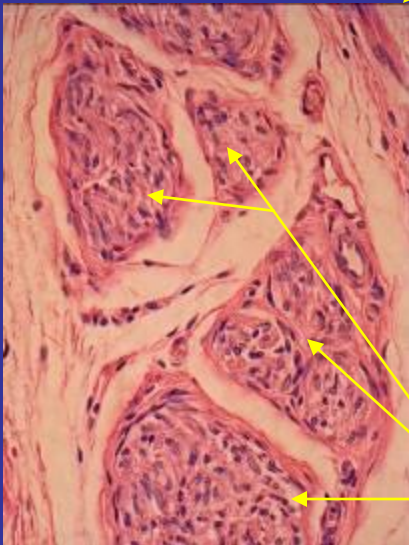


Inner Lip = Strat.
Squam. With Labial
Glands

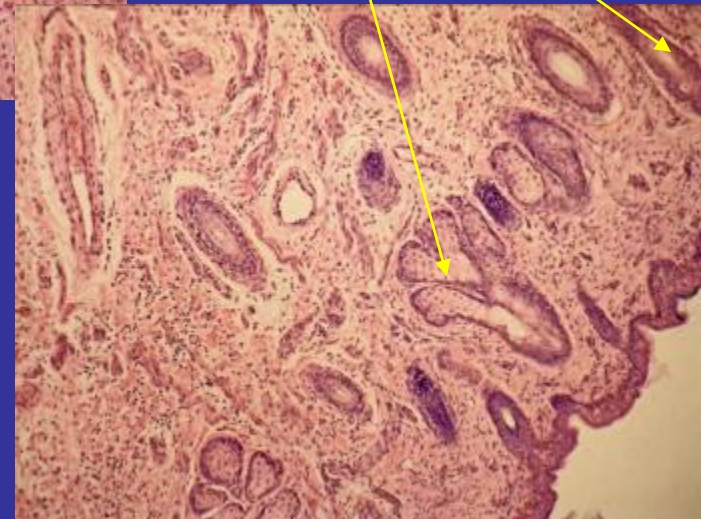
Middle =
Orbiularis
Oris Muscle



Outer part of lip =
Skin w/ sebaceous
Gl. & hair



Myelinated
Nerve



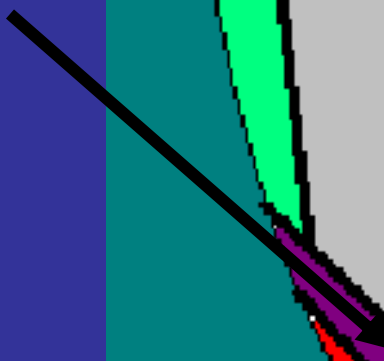
Bitter



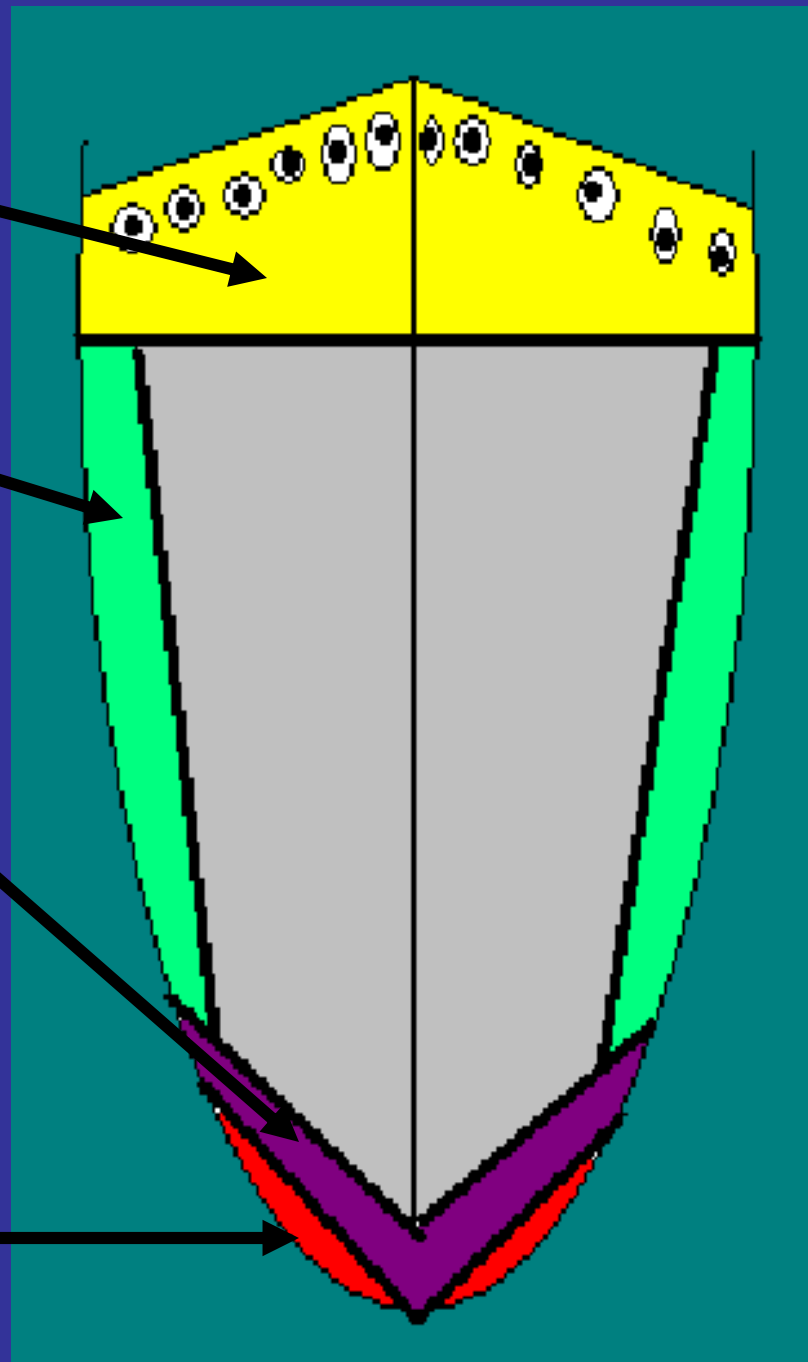
Sour



Sweet



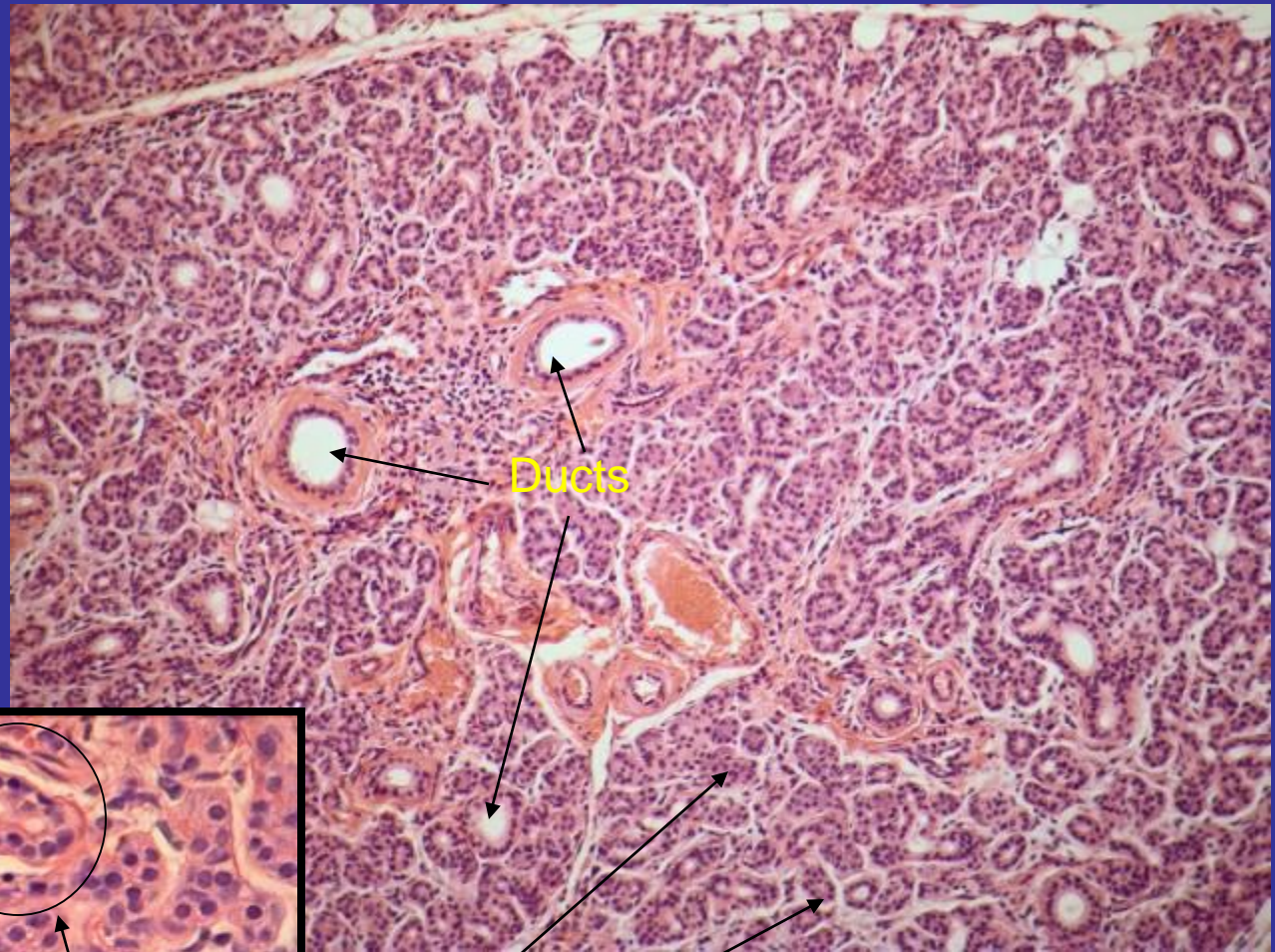
Salt



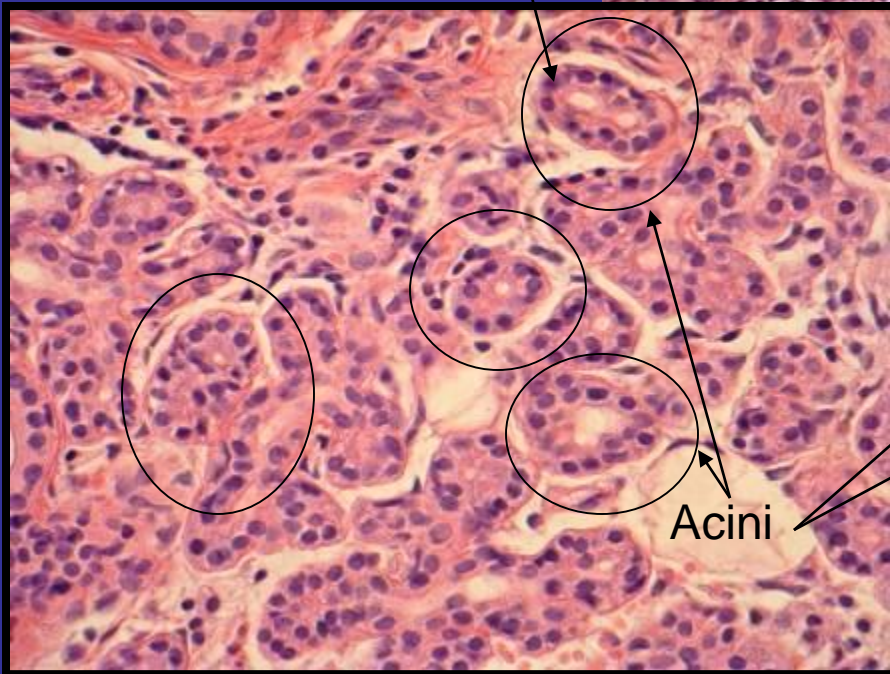
Sense of Taste: **Taste Buds** on sides of **Vallate Papilla** at Back of Tongue



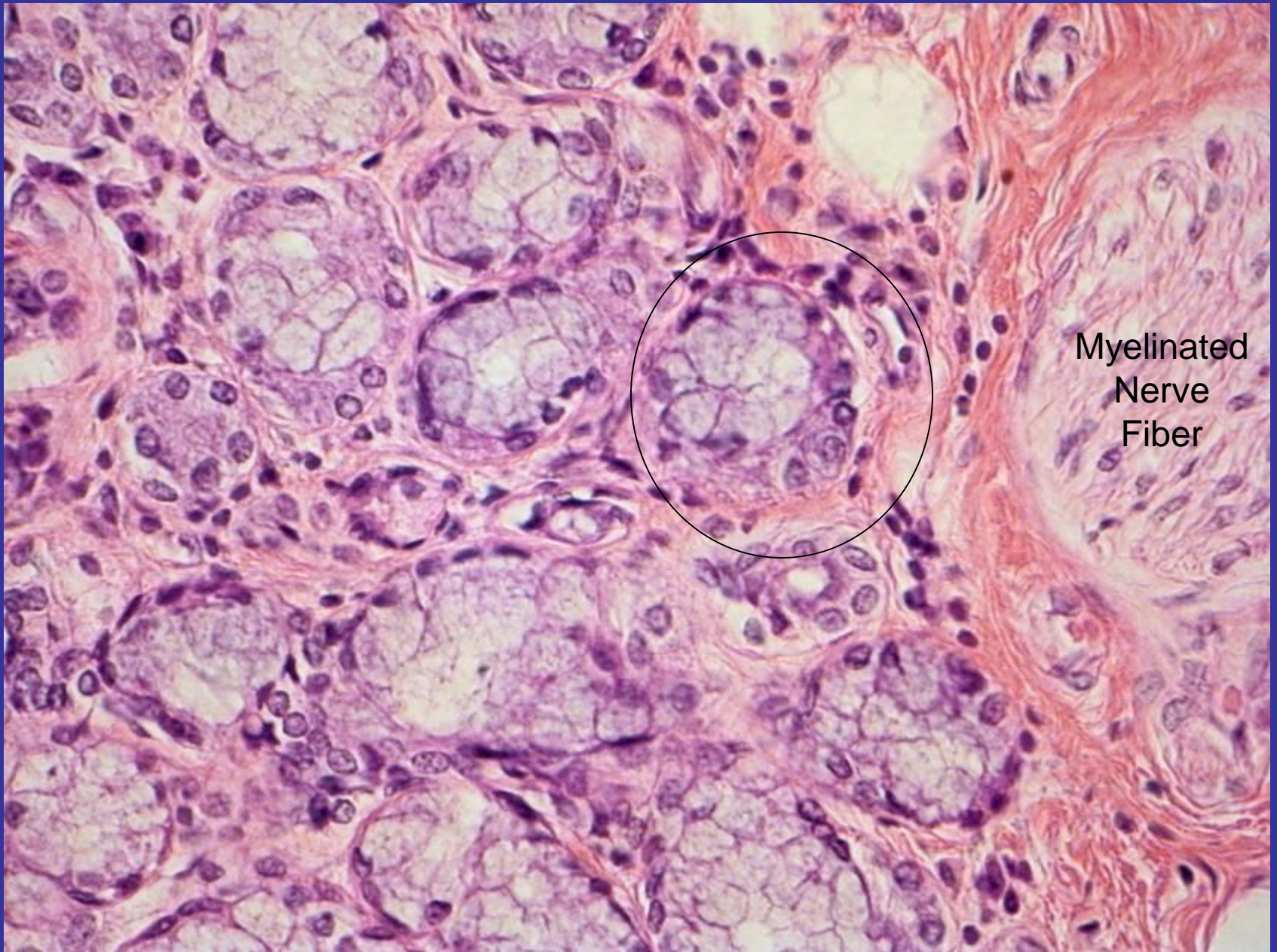
**Submandibular Salivary Gland:
Acini almost all
Serous Cells**



Ducts



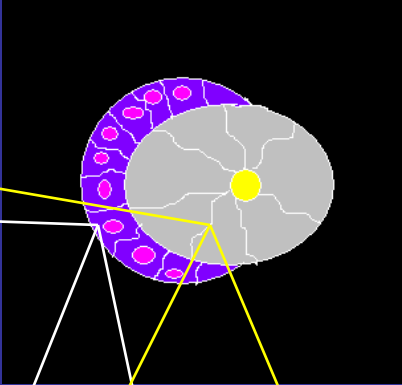
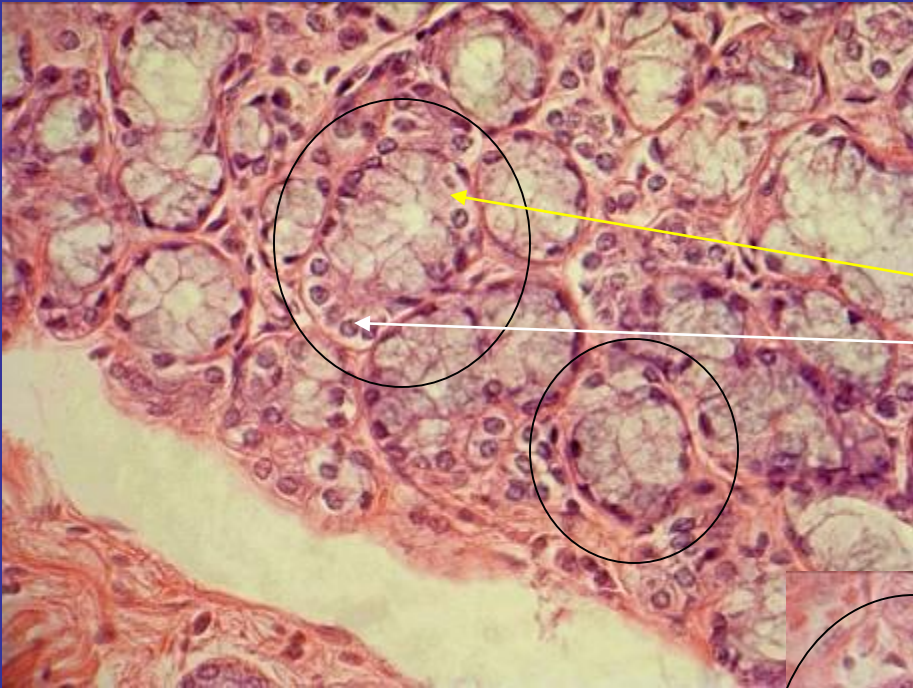
Acini



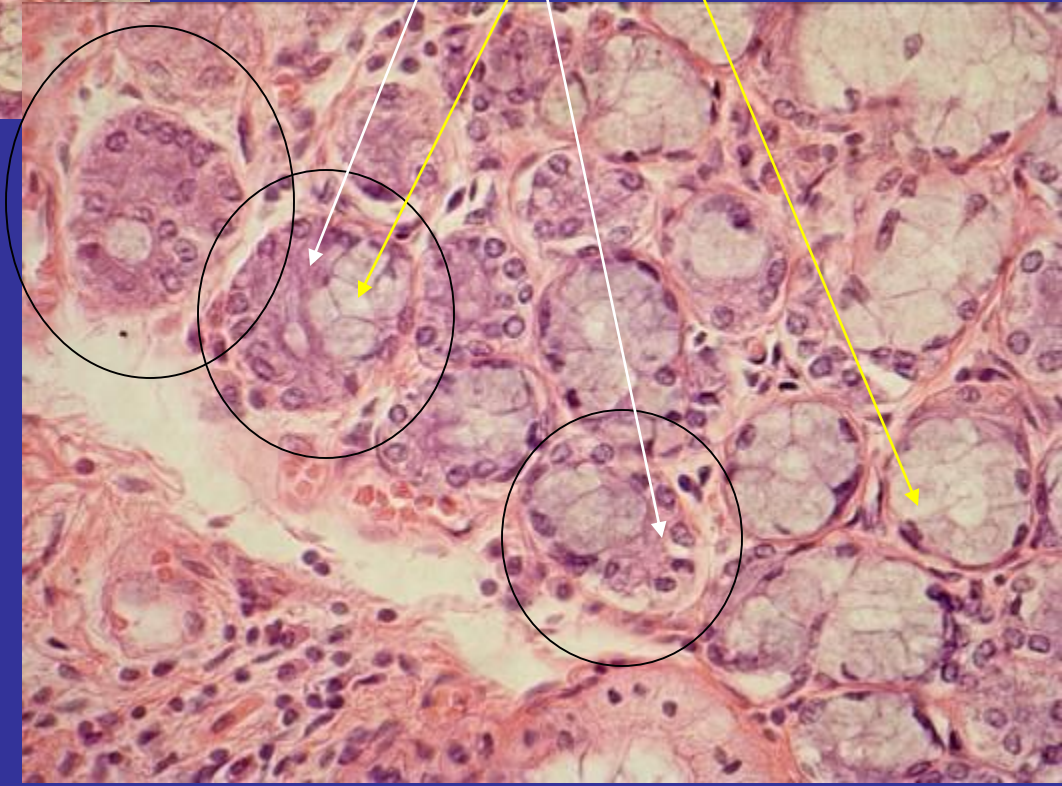
Myelinated
Nerve
Fiber

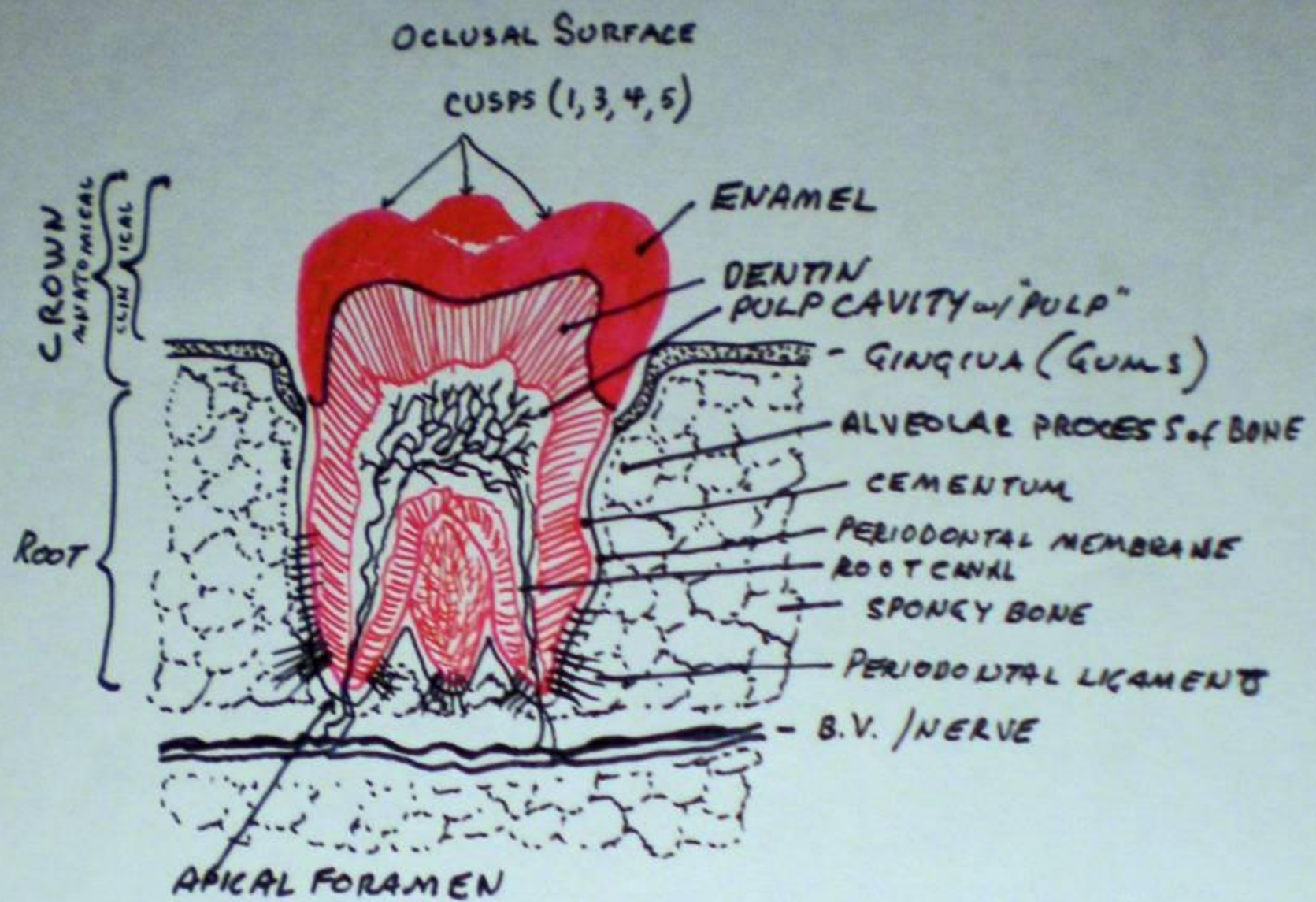
Sublingual Salivary Gland

Sublingual Salivary Gland

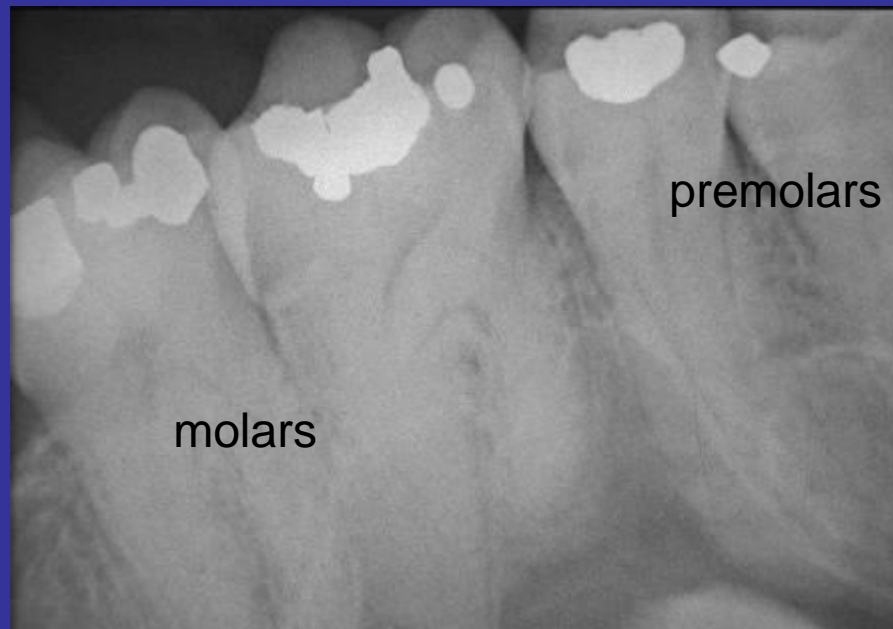
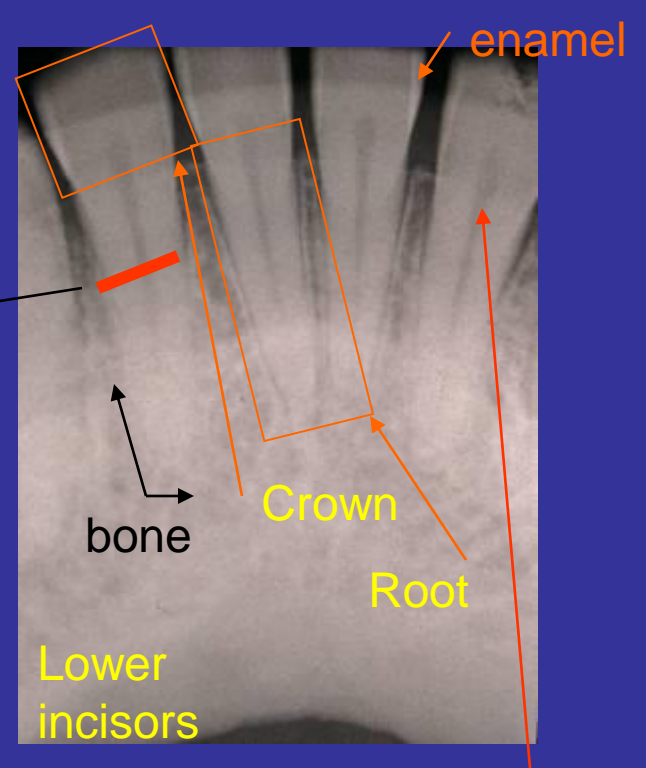
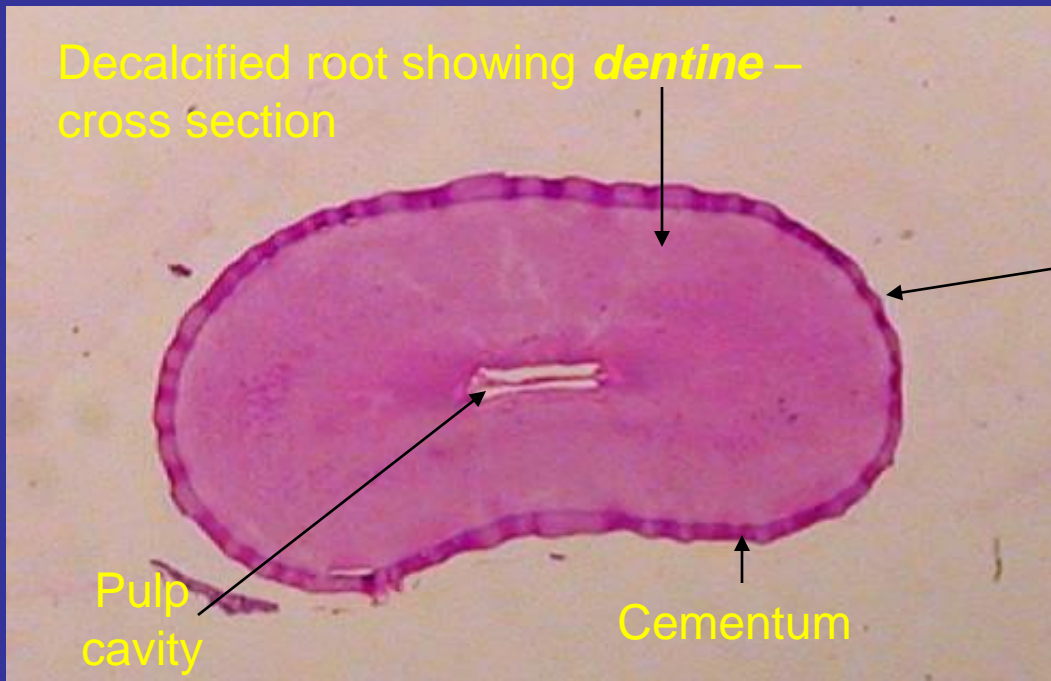


**Demilunes of darker
Serous cells around
one side of Acini of
clearer Mucous cells**





TOOTH STRUCTURE
(MOLAR)



Pulp cavity

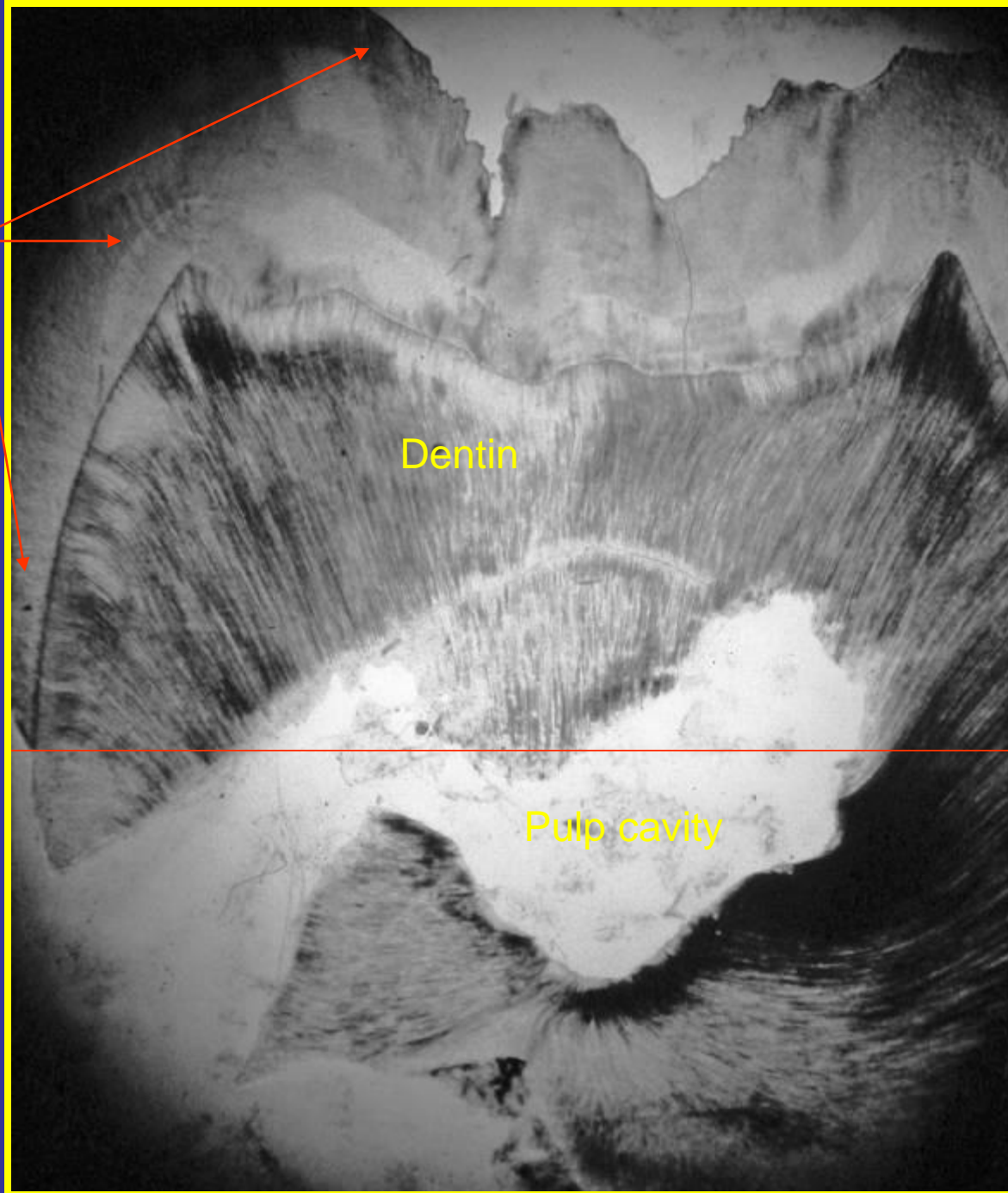
Enamel

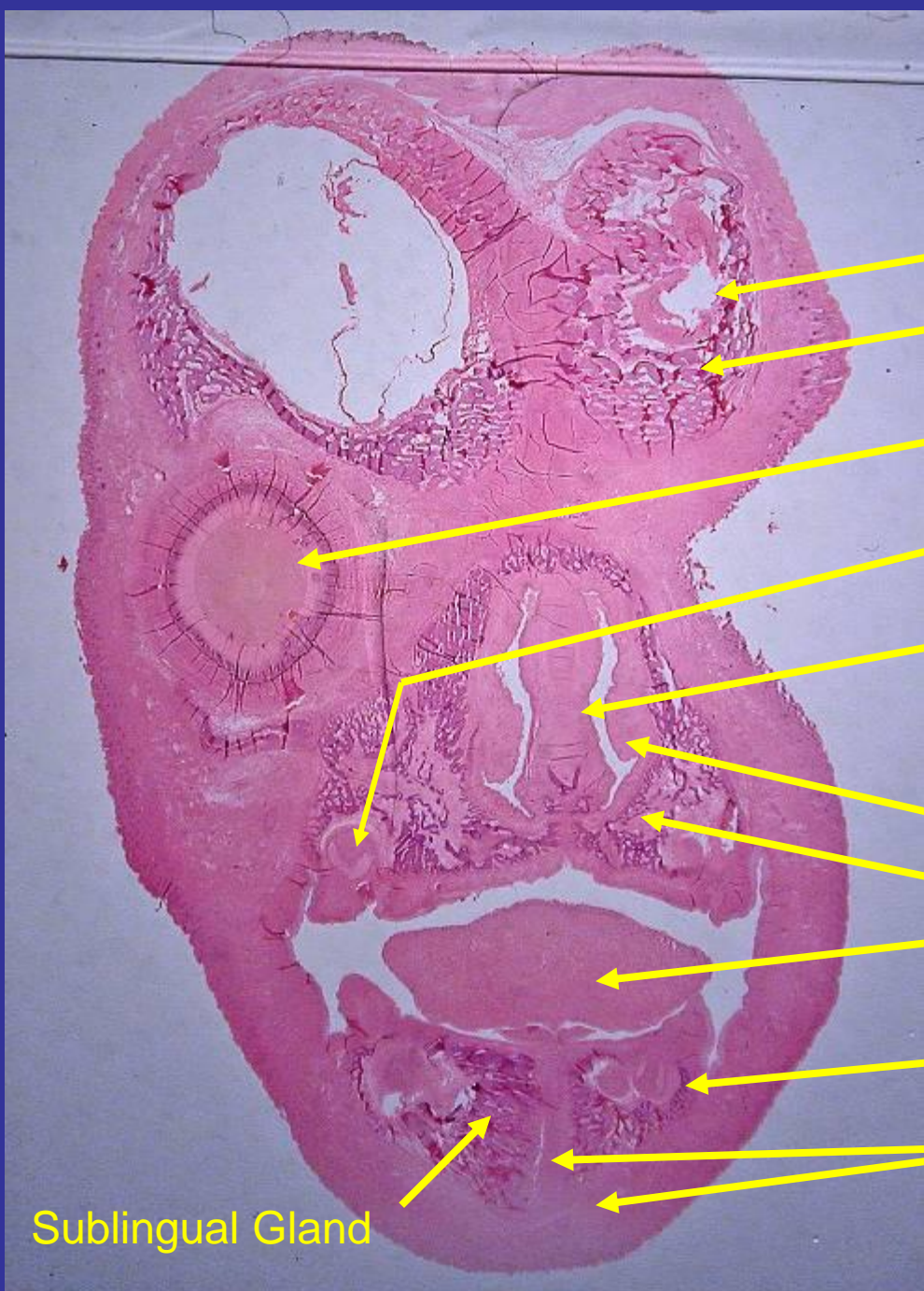
Dentin

Crown

Pulp cavity

Ground thin
section of
3rd Molar





Frontal Lobe- Left Cerebrum

Frontal Bone

Right Eye

Milk Tooth

Nasal Septum

Nasal Concha

Maxillary Bone

Tongue

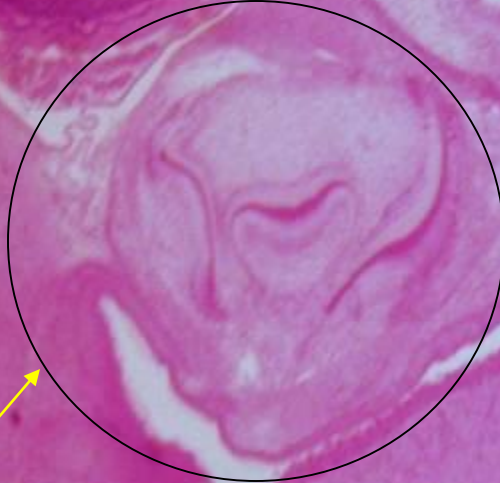
Milk Tooth

**Mandible & Mental
Symphysis**

Sublingual Gland

**Newborn
Rat Face-
Compare
to Human**

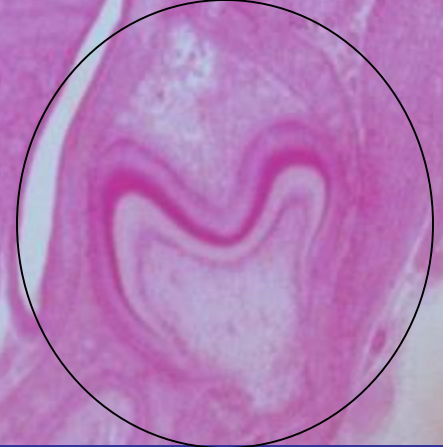
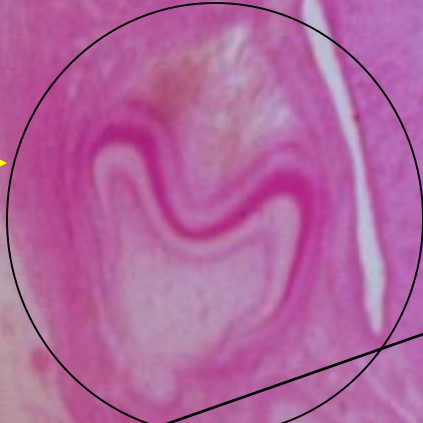
Molars



Maxilla

Tongue

Genioglossus M.



Sublingual Gland

Geniohyoideus M.

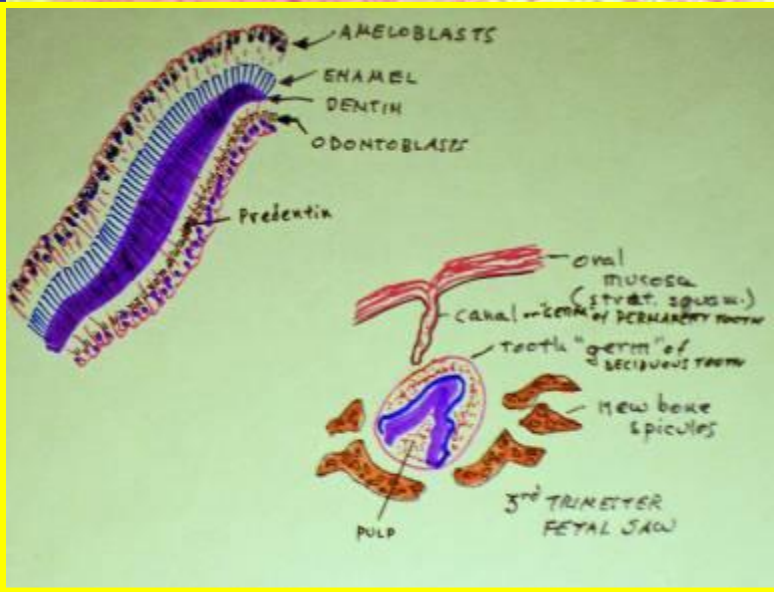




Tooth Primordium

Isthmus to Oral Epithelium

Mesenchymal primordium of Pulp





Ameloblasts

Enamel

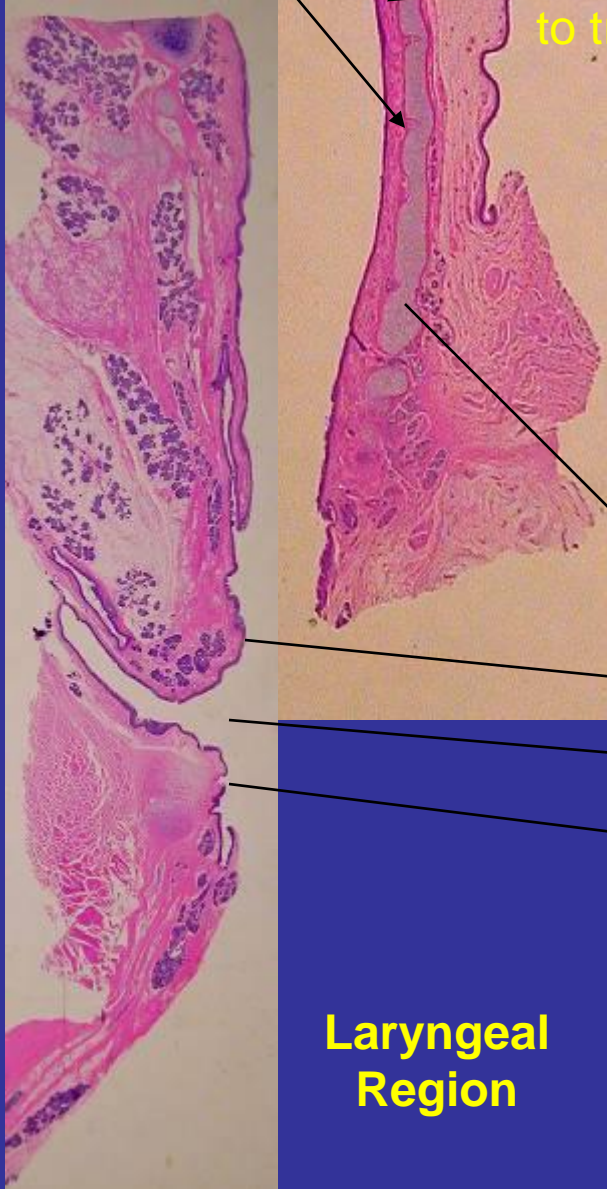
Dentine

Odontoblasts

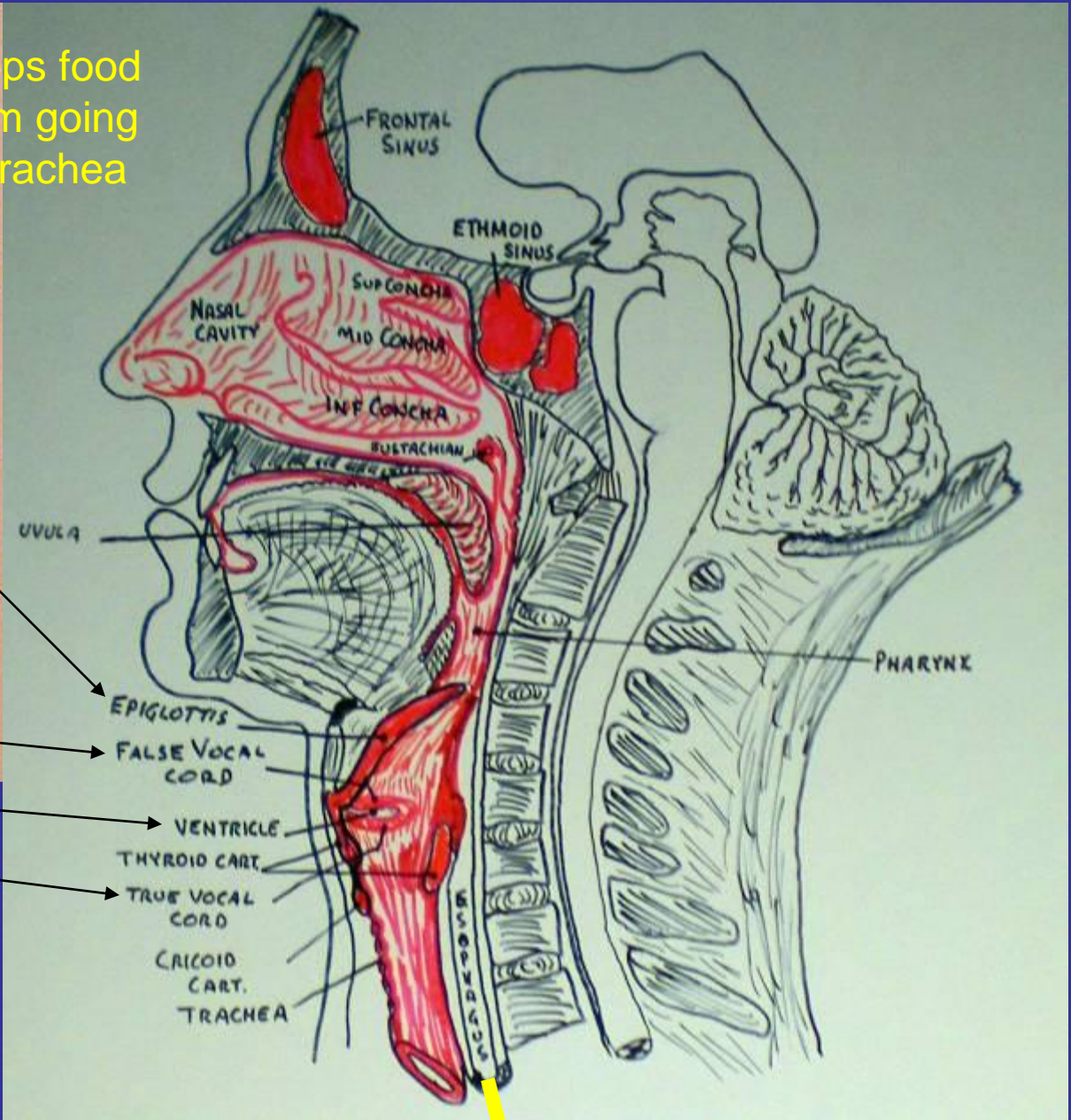
Pulp

Elastic
Cart. Of
Epiglottis

Stops food
from going
to trachea

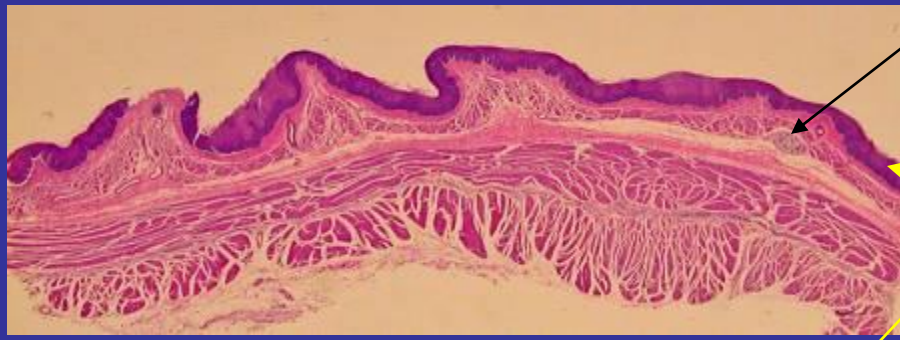


Laryngeal
Region



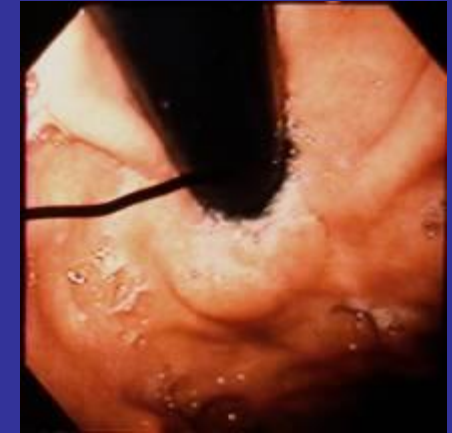
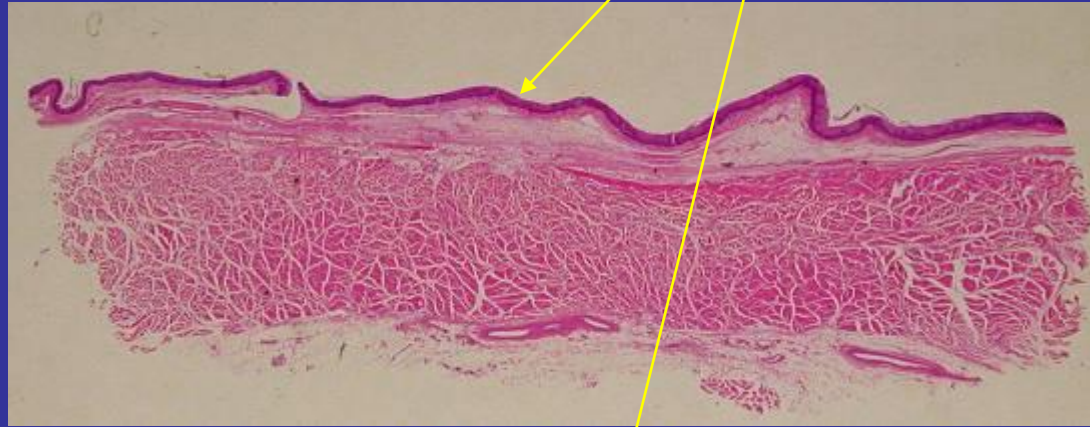
Food

Esophagus

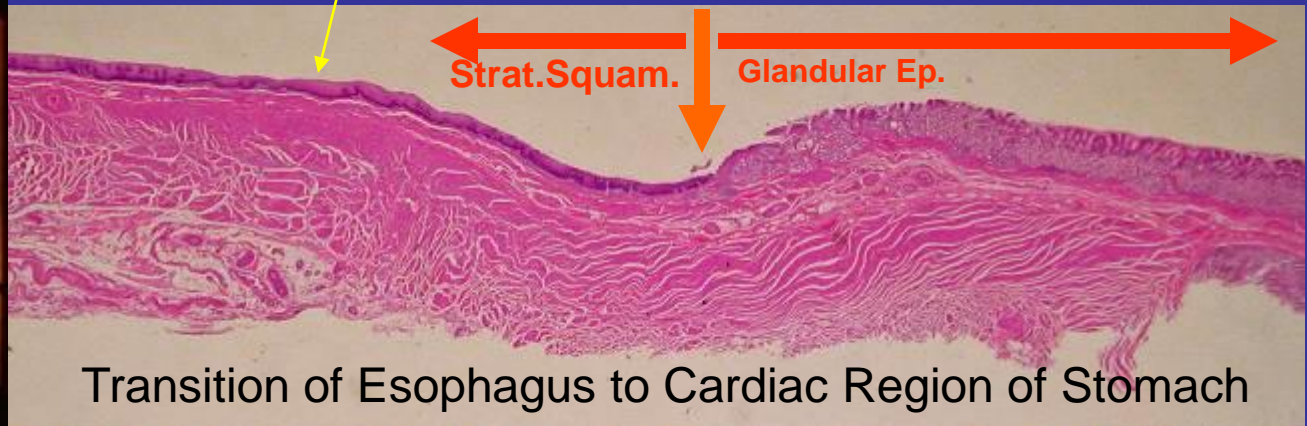


Mucous GI

Unkeratinized, Stratified Squamous Epithelium tops Mucosa



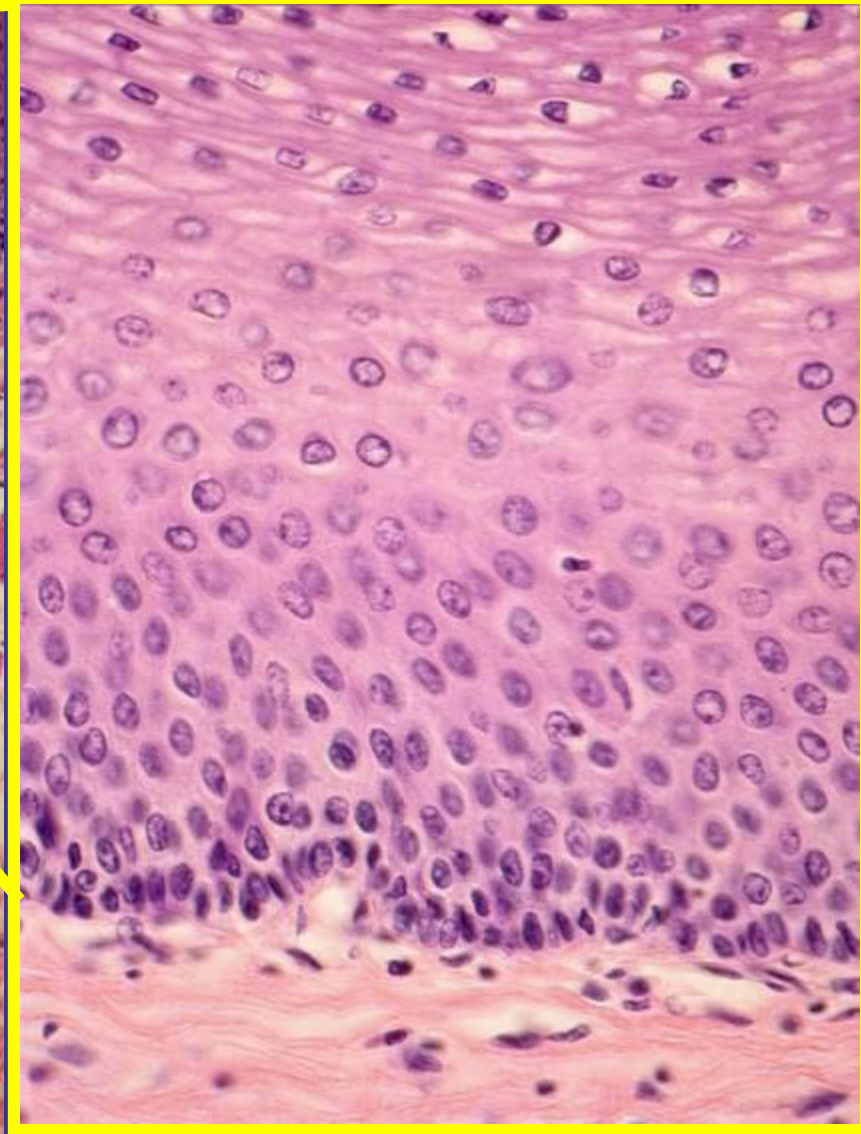
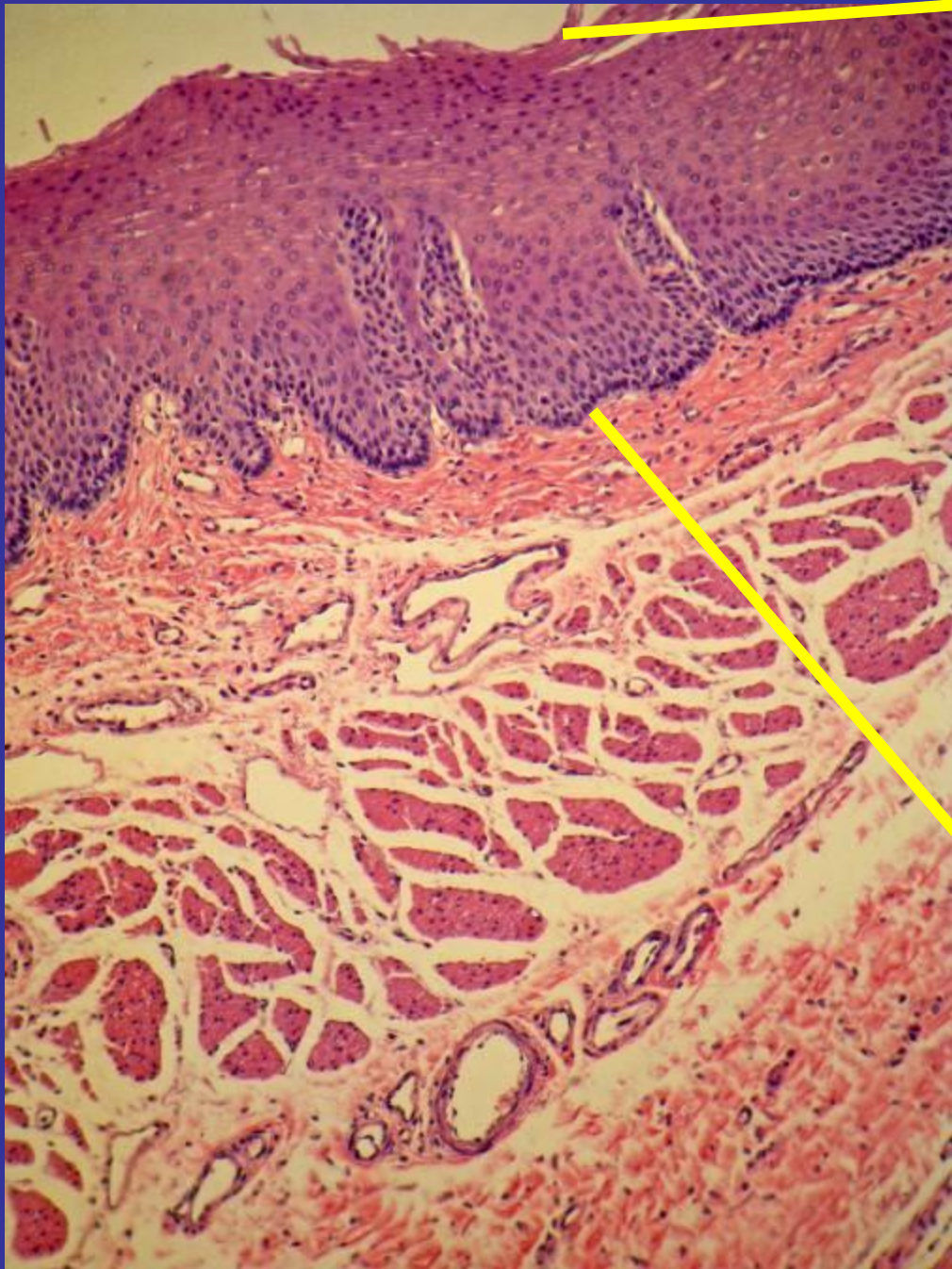
Endoscopic view



Strat. Squam.

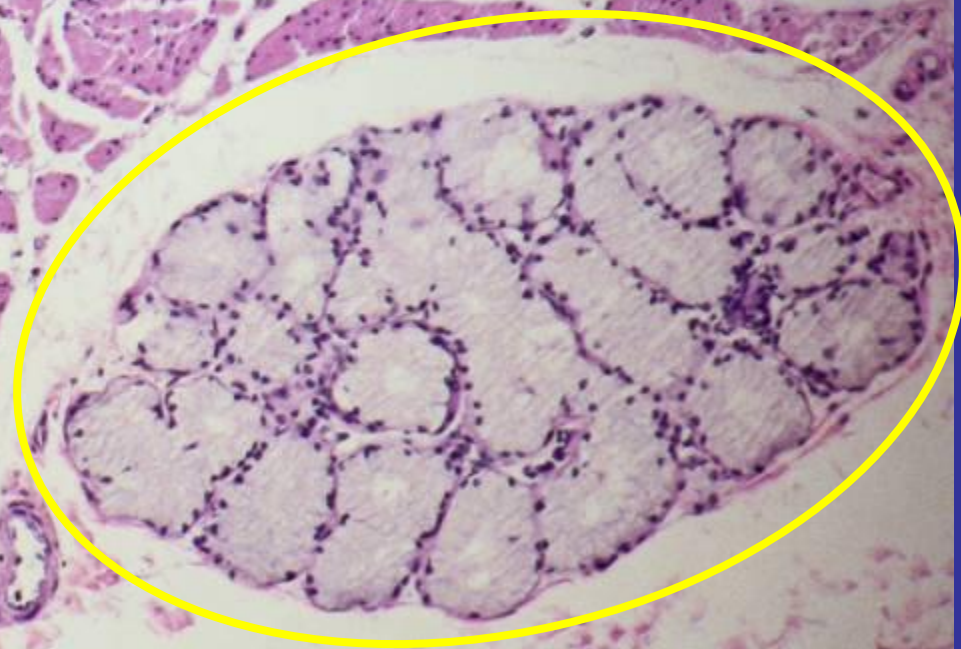
Glandular Ep.

Transition of Esophagus to Cardiac Region of Stomach



**Esophagus with Mucosa of Stratified Squamous Epithelium
– Upper 1/4 is Skeletal Muscle in Muscularis Layer**

Strat Squam



Mucosal Gland in Esophagus

Stomach.

Tunica mucosa oesophagi

Junction of the oesophageal and gastric mucous membranes

Position of the median plane

Tunica mucosa duodeni

Pylorus

Tunica mucosa

M. sphincter pylori

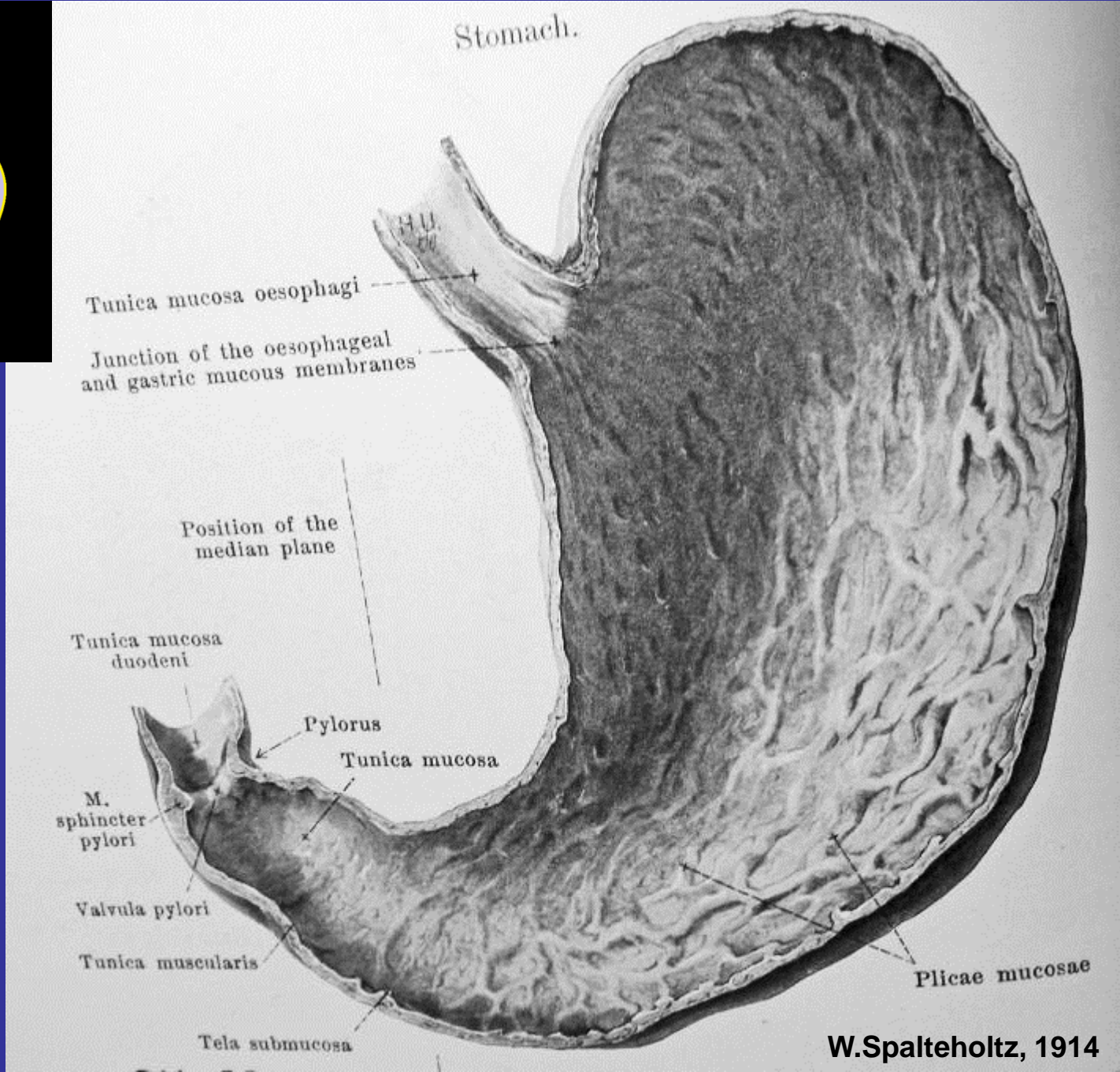
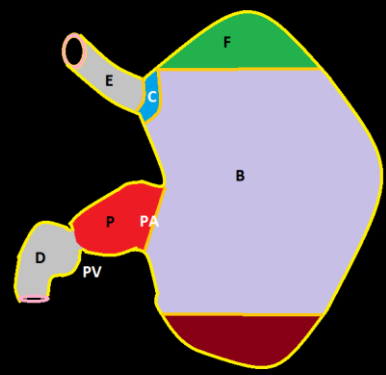
Valvula pylori

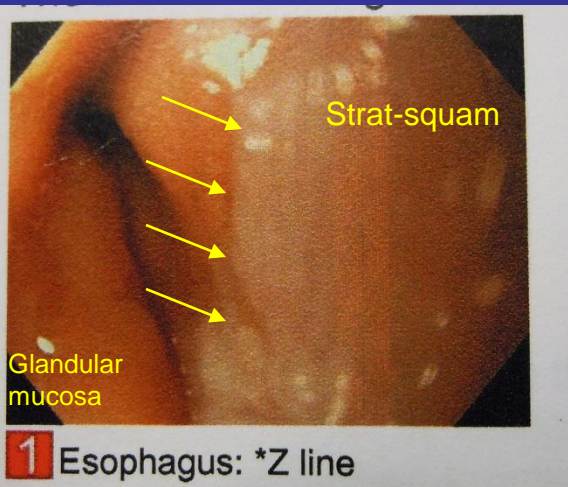
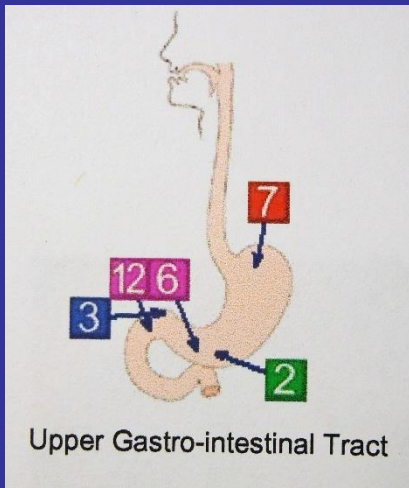
Tunica muscularis

Tela submucosa

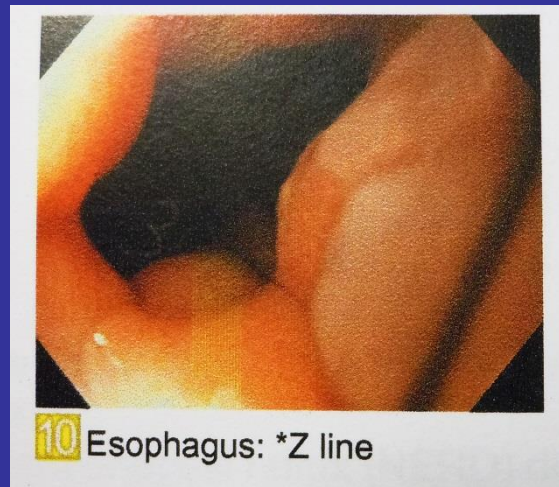
Plicae mucosae

W.Spalteholtz, 1914



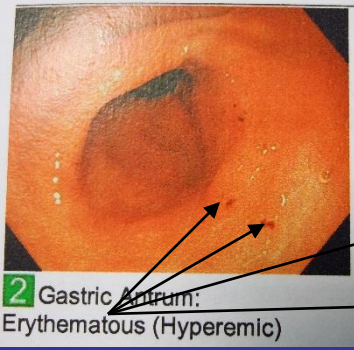


1 Esophagus: *Z line

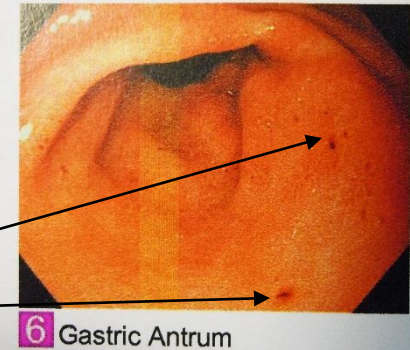


10 Esophagus: *Z line

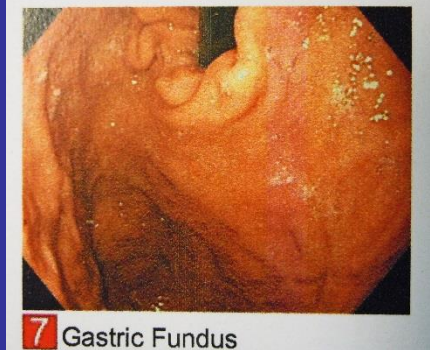
**Esophageo-
gastro-
duodenoscopy**
= endoscopy =
'gastro'



2 Gastric Antrum:
Erythematous (Hyperemic)



6 Gastric Antrum



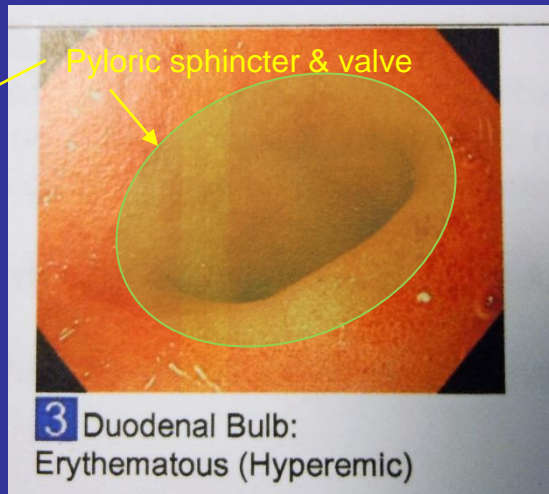
7 Gastric Fundus



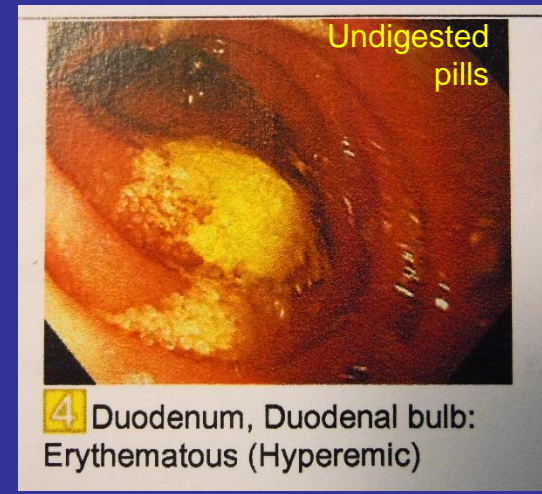
13



12 Duodenal Bulb



3 Duodenal Bulb:
Erythematous (Hyperemic)



4 Duodenum, Duodenal bulb:
Erythematous (Hyperemic)

ALIMENTARY CANAL

ESOPHAGUS, STOMACH, PYLORIC V., DUODENUM, JEJUNUM, ILLIUM, CAECUM (APPENDIX), ASCENDING - TRANSVERSE - DESCENDING - SIGMOID COLON, RECTUM, ANUS.

VISCERAL PERITONEUM:

SEROUS LAYER - DENSE C.T. w/ glands whose FLUID KEEPS OUTSIDE OF ORGANS LUBRICATED

SUBMUCOSA: LYMPHOID TISSUE, B.V., LOOSE C.T., NERVES

MUSCULARIS MUCOSA

MUCOSA - EPITHELIUM:

a) ABSORPTIVE, MICROVILLI-COVERED, COLUMNAR

b) EXOCRINE GLANDS
e.g. HCl
ENZYMES

c) GOBLET CELLS (MUCUS)

d) SQUAMOUS IN UPPER ESOPHAGUS

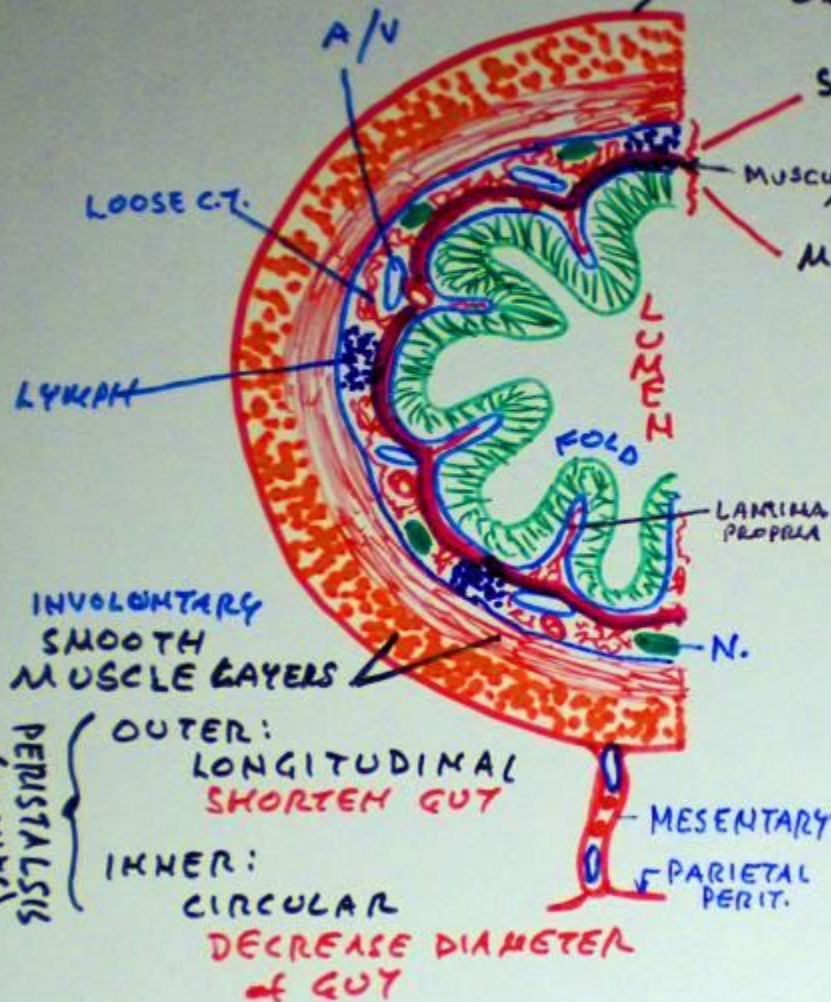
has increased SURFACE AREA; absorbs molecules after DIGESTION increases

Surface area of FOOD

by a) MECHANICAL

b) CHEMICAL

MEANS



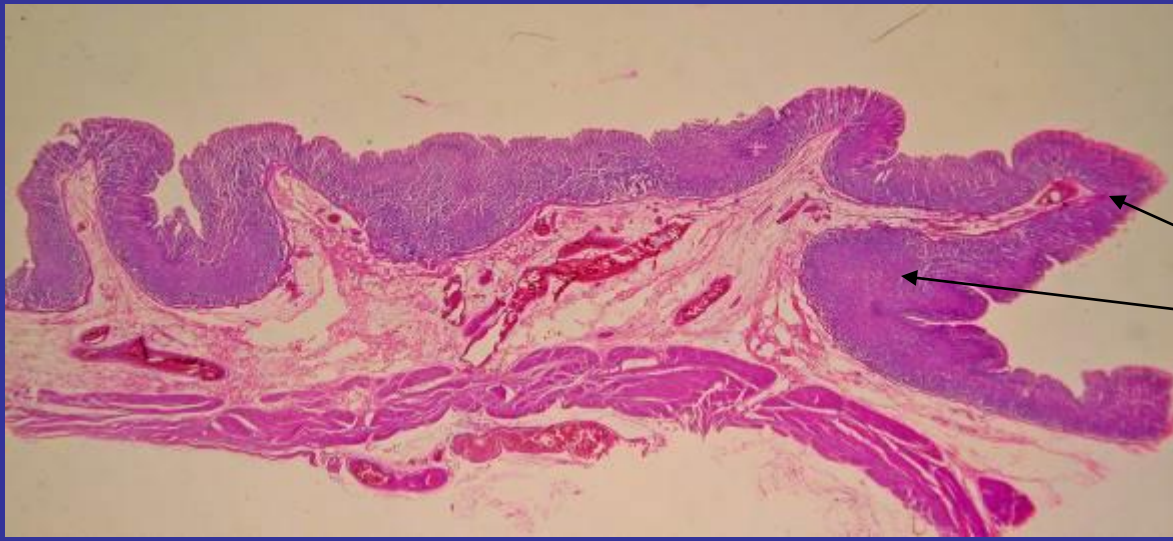
INVOLUNTARY SMOOTH MUSCLE LAYERS

OUTER: LONGITUDINAL SHORTEN GUT

INNER: CIRCULAR DECREASE DIAMETER of GUT

PERISTALSIS (WAVES)

STOMACH



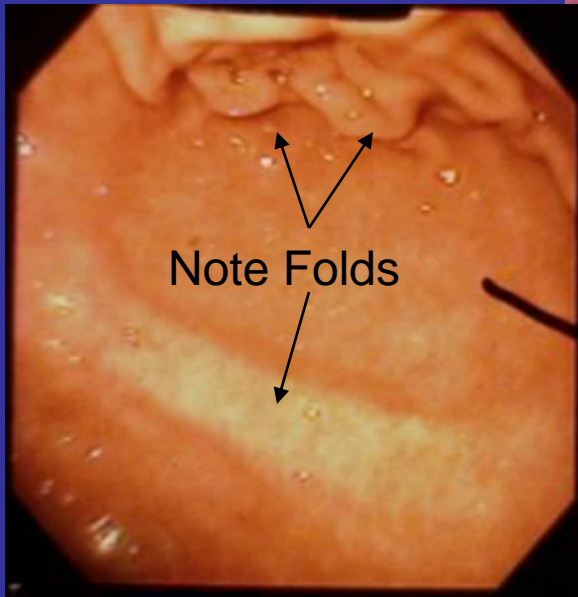
Mucosa

Submucosa
(CT)



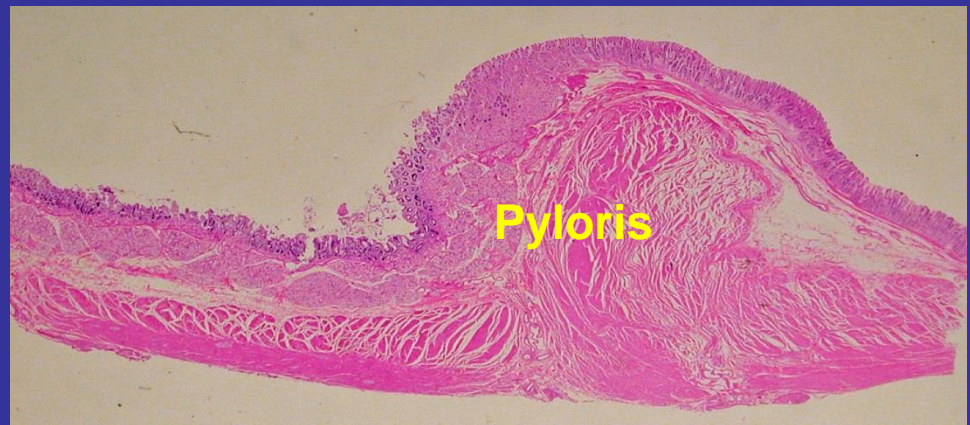
Circular Smooth
Muscle

Longitudinal
Smooth Muscle



Note Folds

Endoscopic view



Pylorus

Junction of Esophagus & Cardiac Part of
Stomach = "Z line"

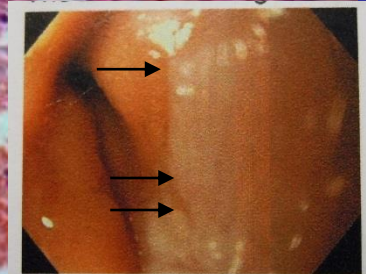
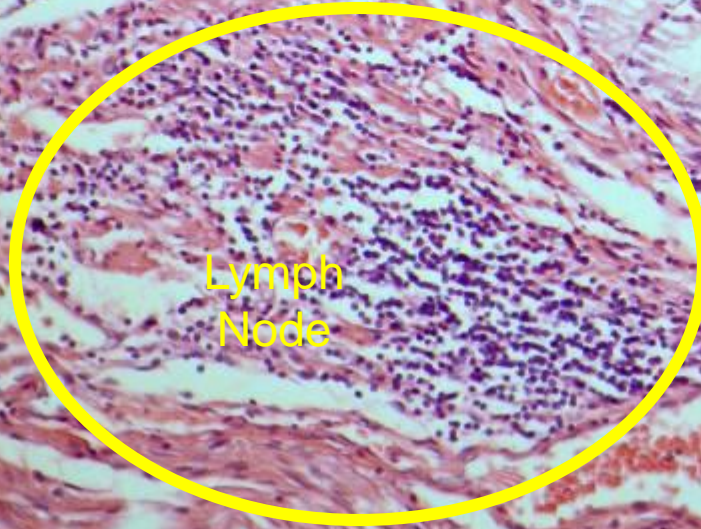
Strat Squam
Ep. Of
Mucosa of
Esophagus

Glandular
mucosa of
Stomach



Submucosa

Lymph
Node

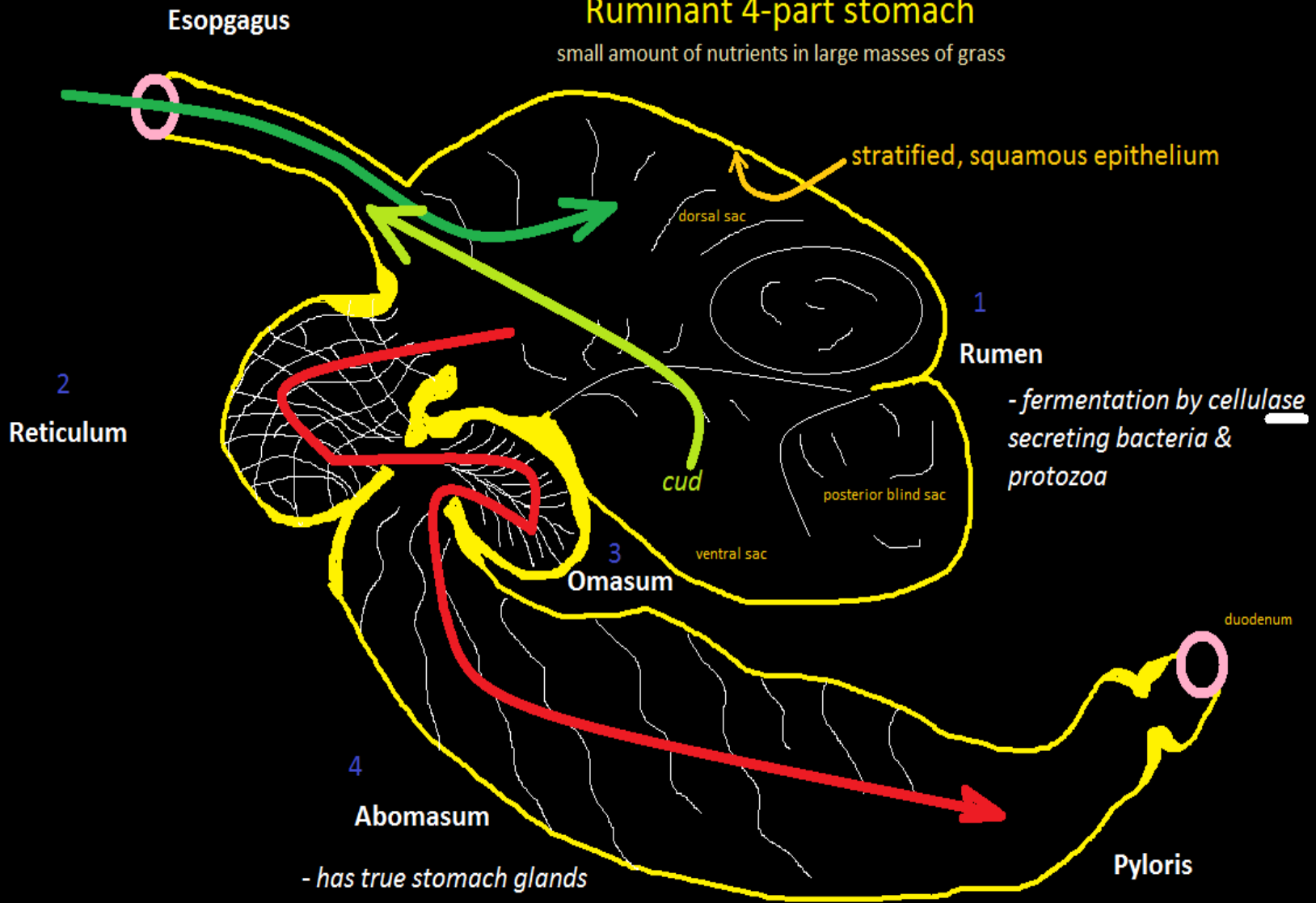


1 Esophagus: *Z line

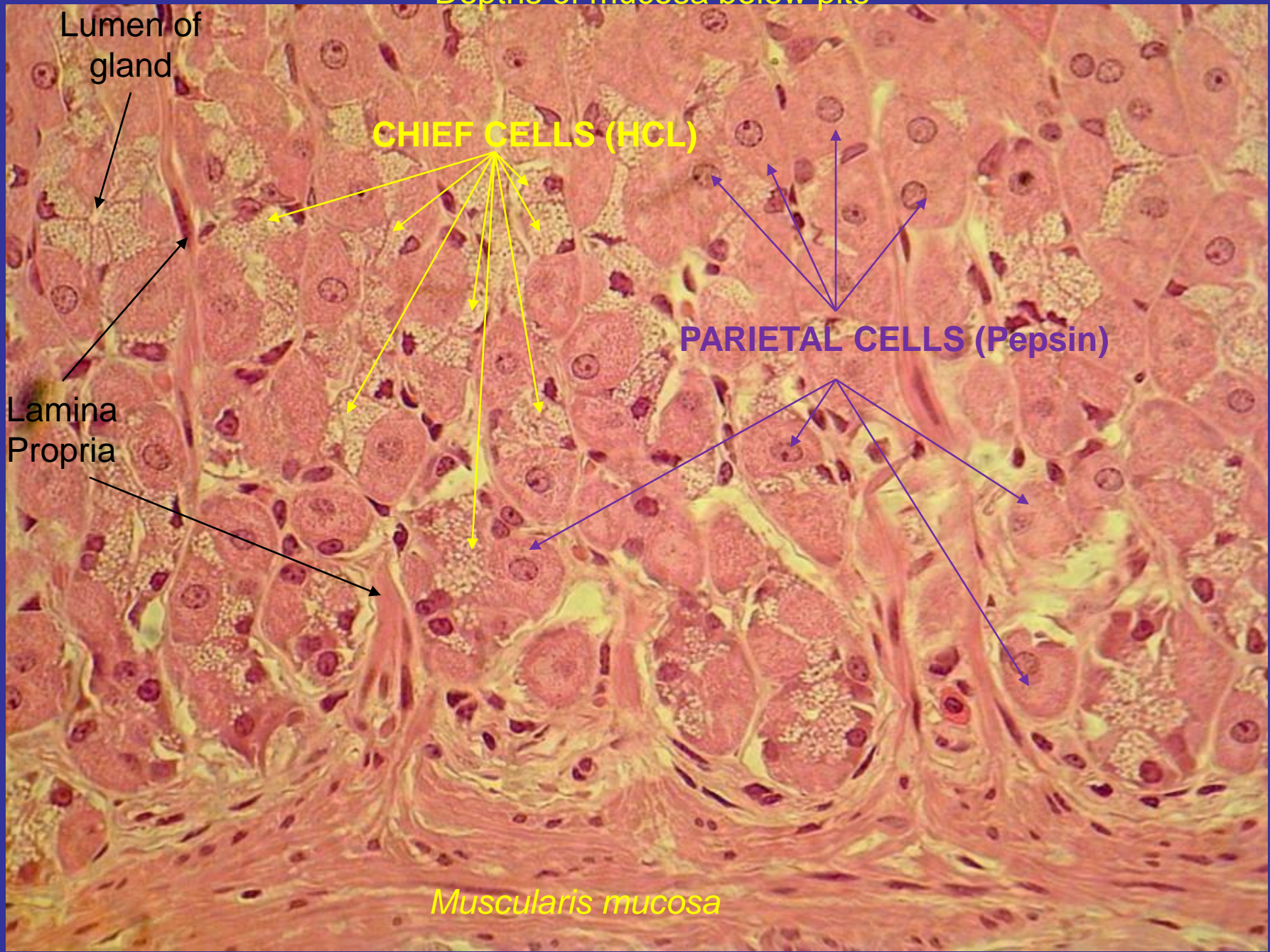


Ruminant 4-part stomach

small amount of nutrients in large masses of grass



Depths of mucosa below pits



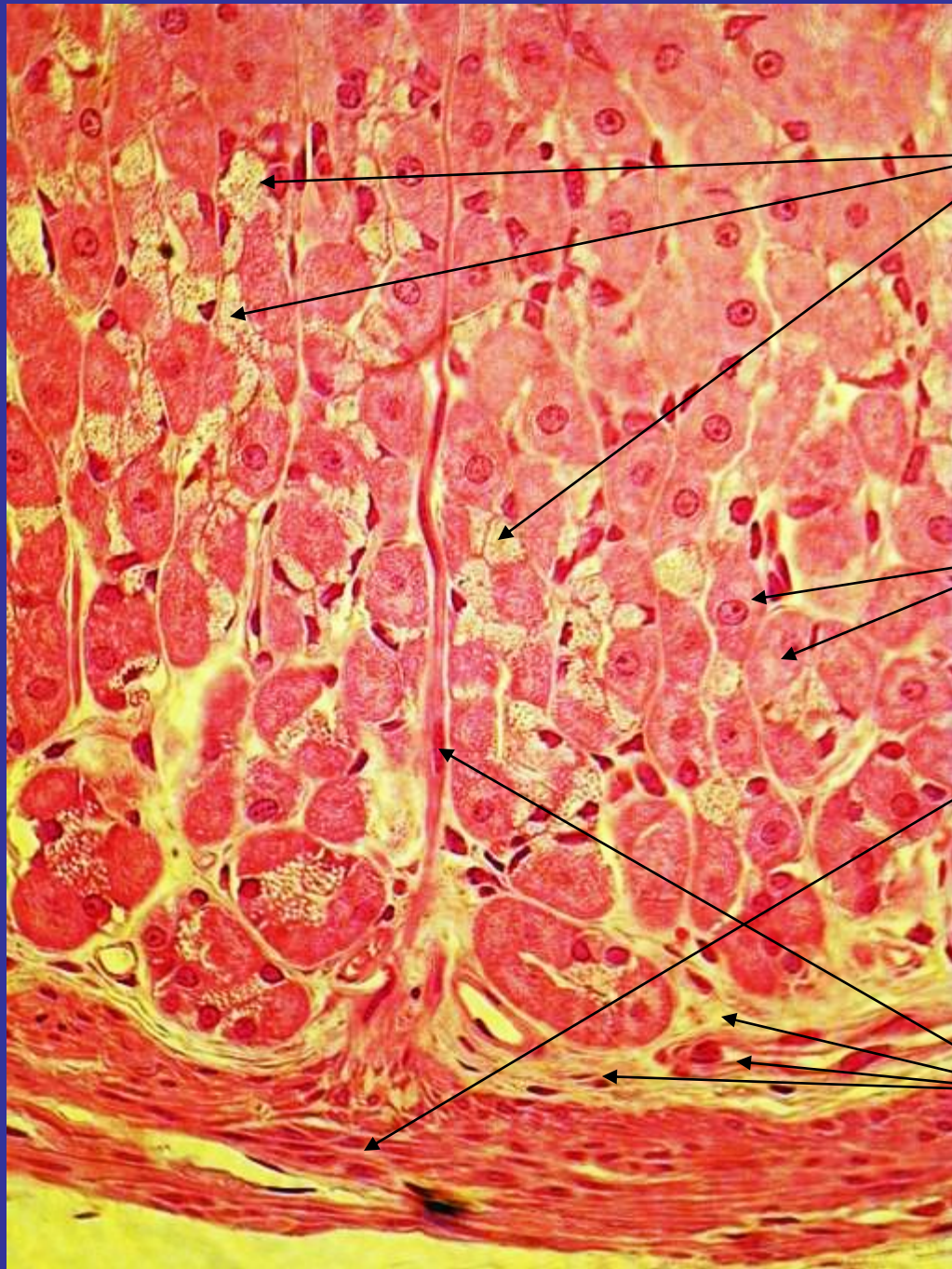
Lumen of gland

CHIEF CELLS (HCL)

PARIETAL CELLS (Pepsin)

Lamina Propria

Muscularis mucosa



CHIEF CELLS

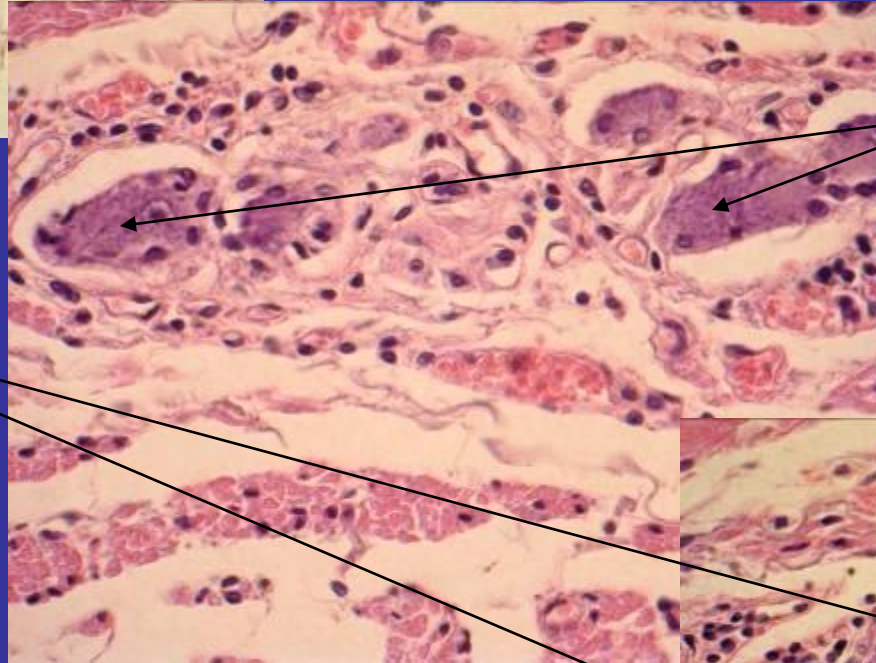
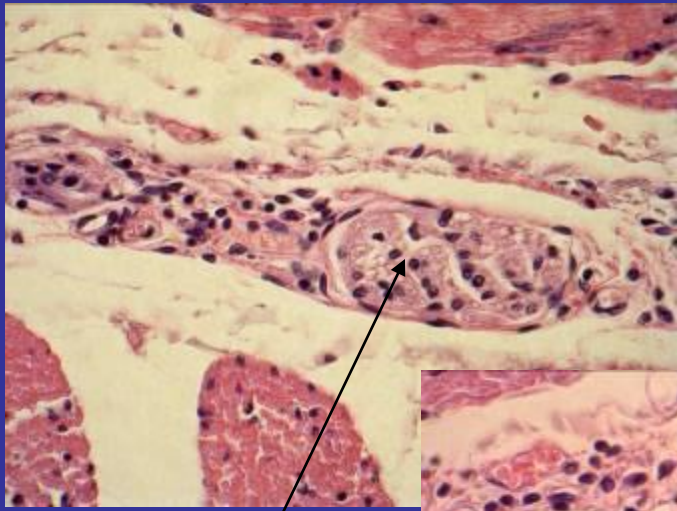
**Lower Part of
Mucosa**

PARIETAL CELLS

*Muscularis Mucosa
(Smooth Muscle) in
the Lamina Propria
(Connective Tissue) of
the Submucosa*

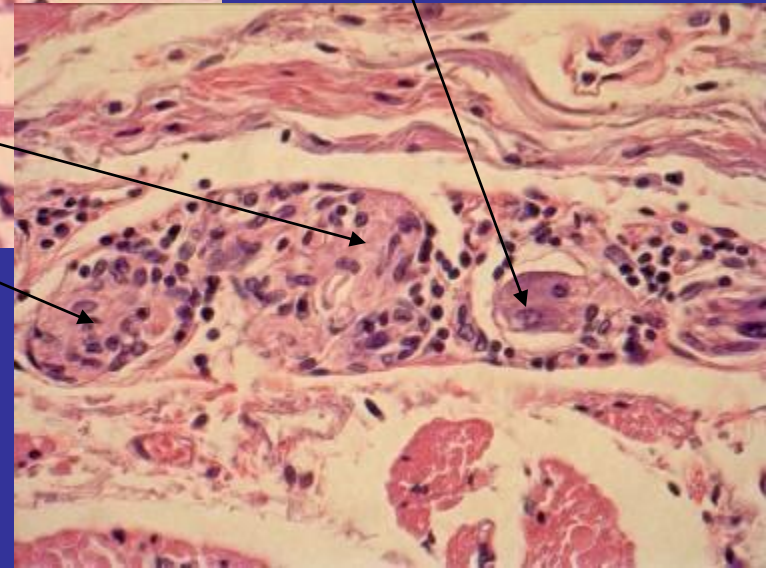
Lamina Propria & BV's

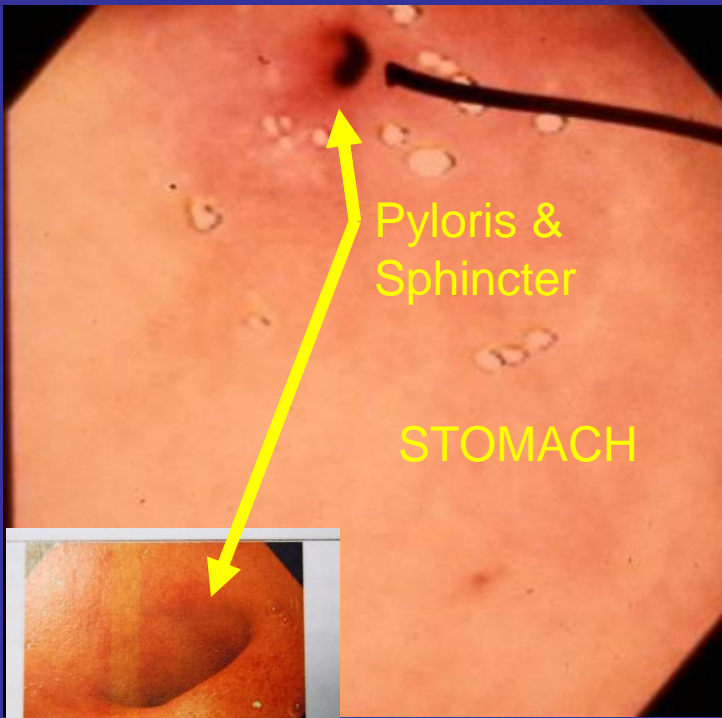
Between Inner Circular Smooth Muscle of *Muscularis* And Outer Longitudinal Smooth Muscle are Nerve & Ganglion Cells (Auerbach's plexus) associated with the Parasympathetic and Sympathetic Systems (ANS)



Ganglion Cells

Nerve cells



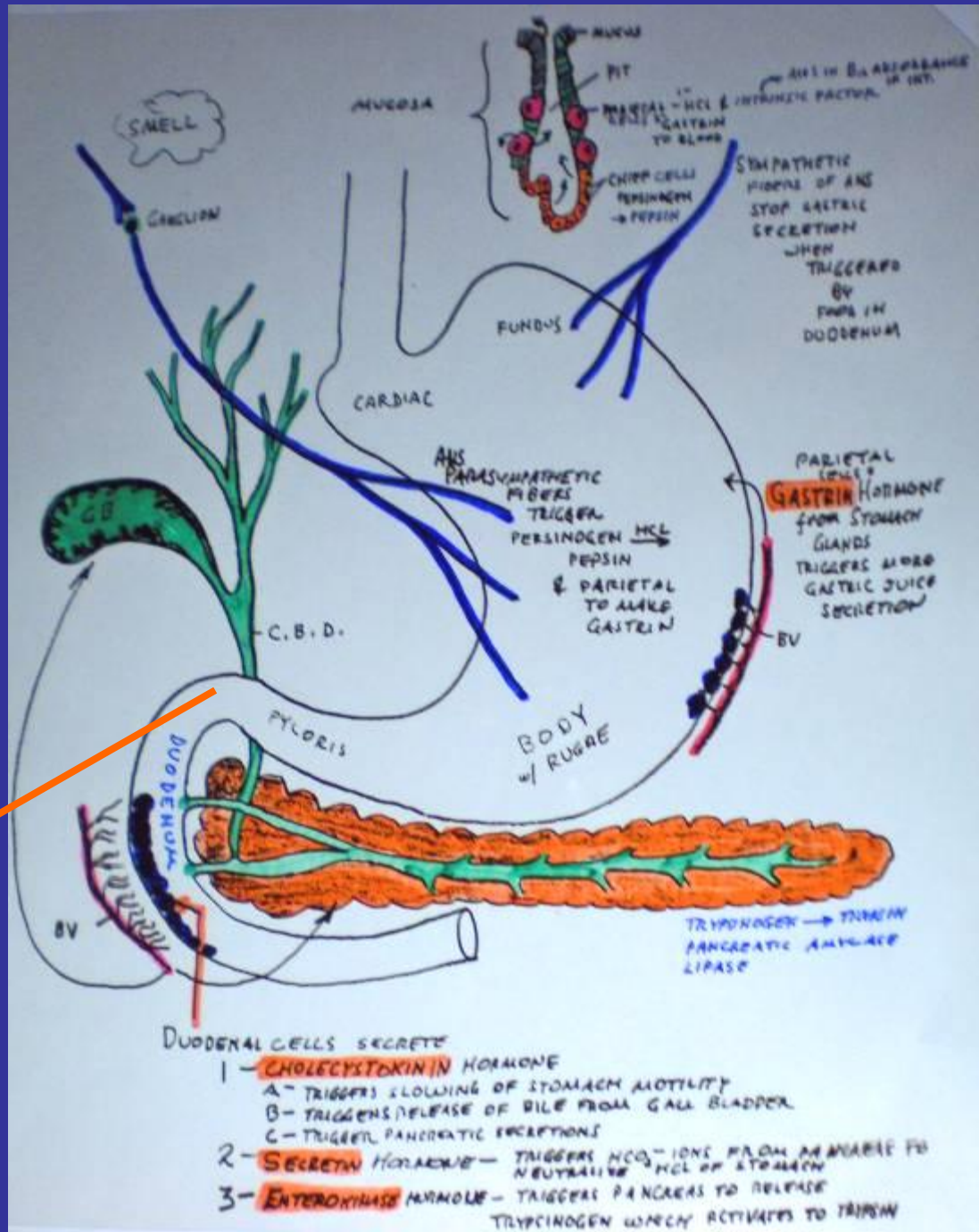
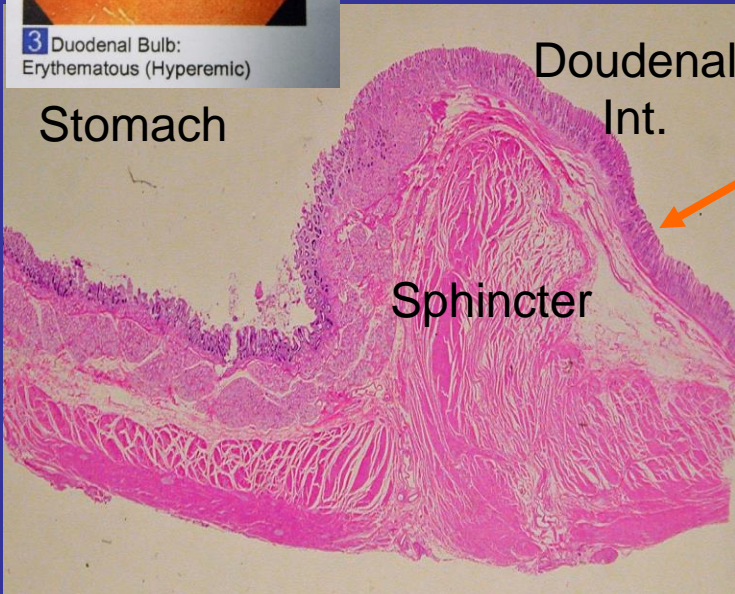


3 Duodenal Bulb: Erythematous (Hyperemic)

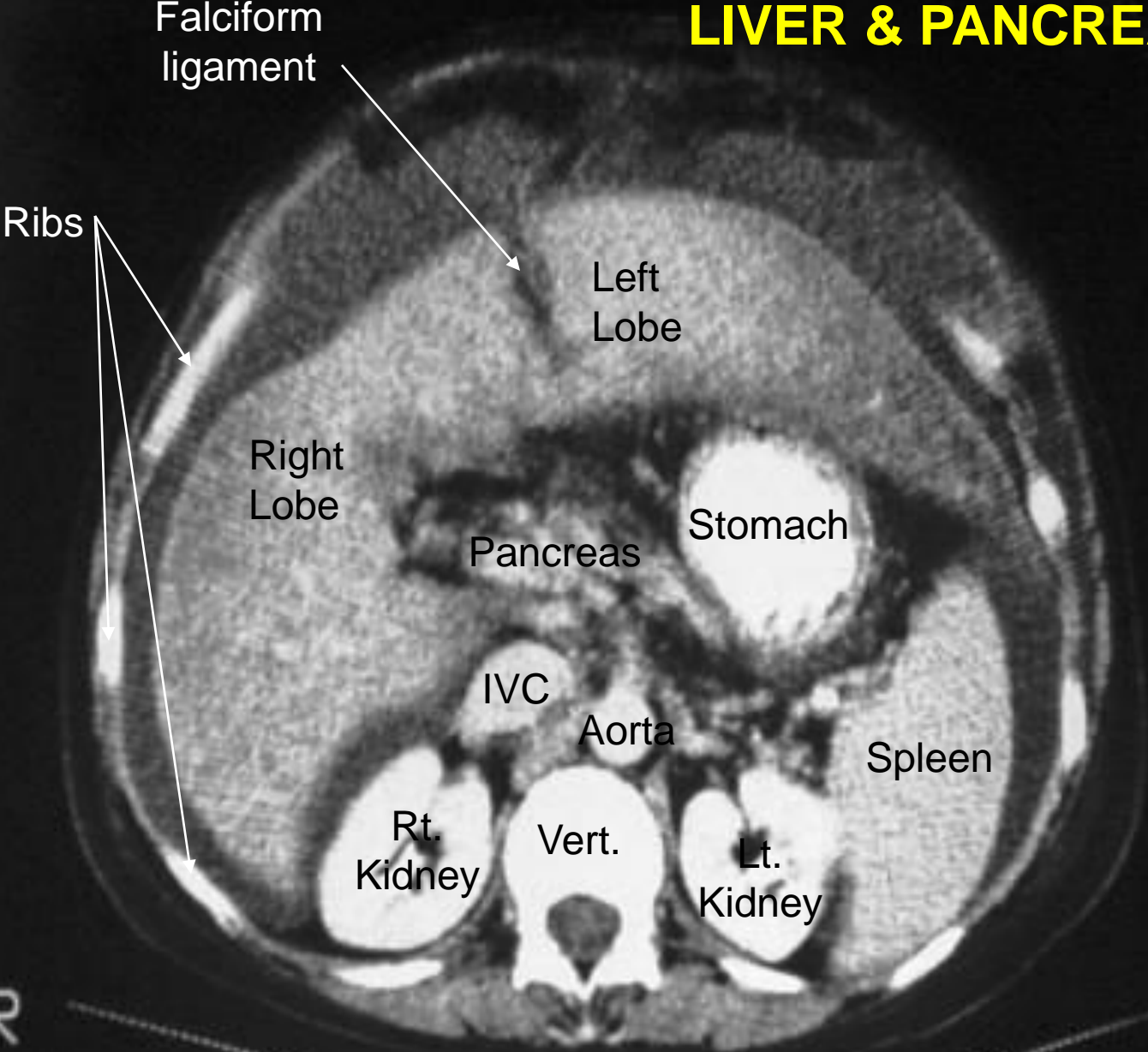
Stomach

Doudenal Int.

Sphincter



LIVER & PANCREAS



Falciform ligament

Ribs

Left Lobe

Right Lobe

Stomach

Pancreas

Spleen

IVC

Aorta

Rt. Kidney

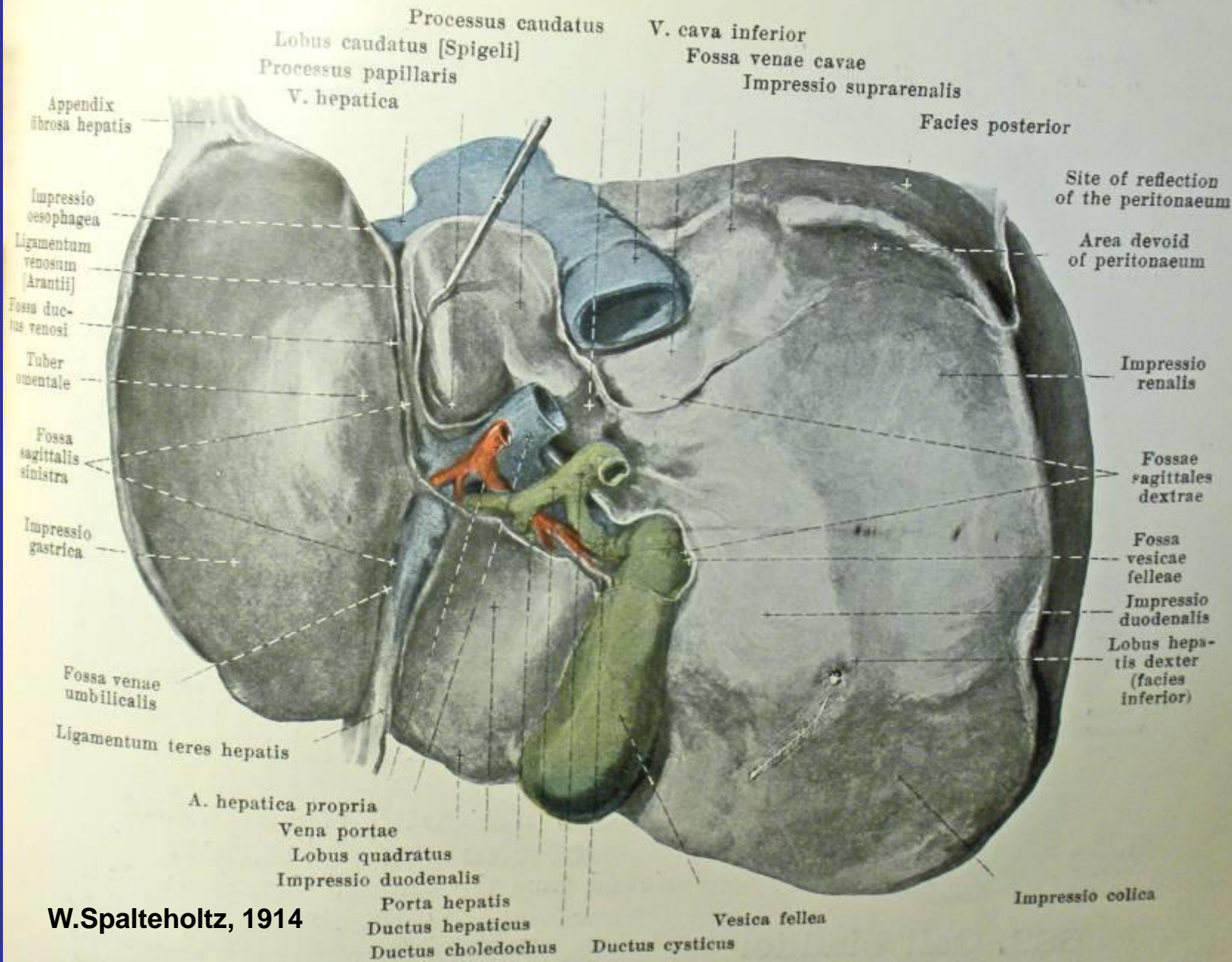
Vert.

Lt. Kidney

R

L

Liver.



Processus caudatus
 Lobus caudatus [Spigeli]
 Processus papillaris
 V. hepatica

V. cava inferior
 Fossa venae cavae
 Impressio suprarenalis

Facies posterior

Site of reflection
 of the peritoneum

Area devoid
 of peritoneum

Impressio
 renalis

Fossae
 sagittales
 dextrae

Fossa
 vesicae
 felleae

Impressio
 duodenalis

Lobus hepatis
 dexter
 (facies
 inferior)

Impressio colica

Appendix
 fibrosa hepatis

Impressio
 oesophagea

Ligamentum
 venosum
 [Arantii]

Fossa duc-
 tus venosi

Tuber
 omentale

Fossa
 sagittalis
 sinistra

Impressio
 gastrica

Fossa venae
 umbilicalis

Ligamentum teres hepatis

A. hepatica propria

Vena portae

Lobus quadratus

Impressio duodenalis

Porta hepatis

Ductus hepaticus

Ductus choledochus

Vesica fellea

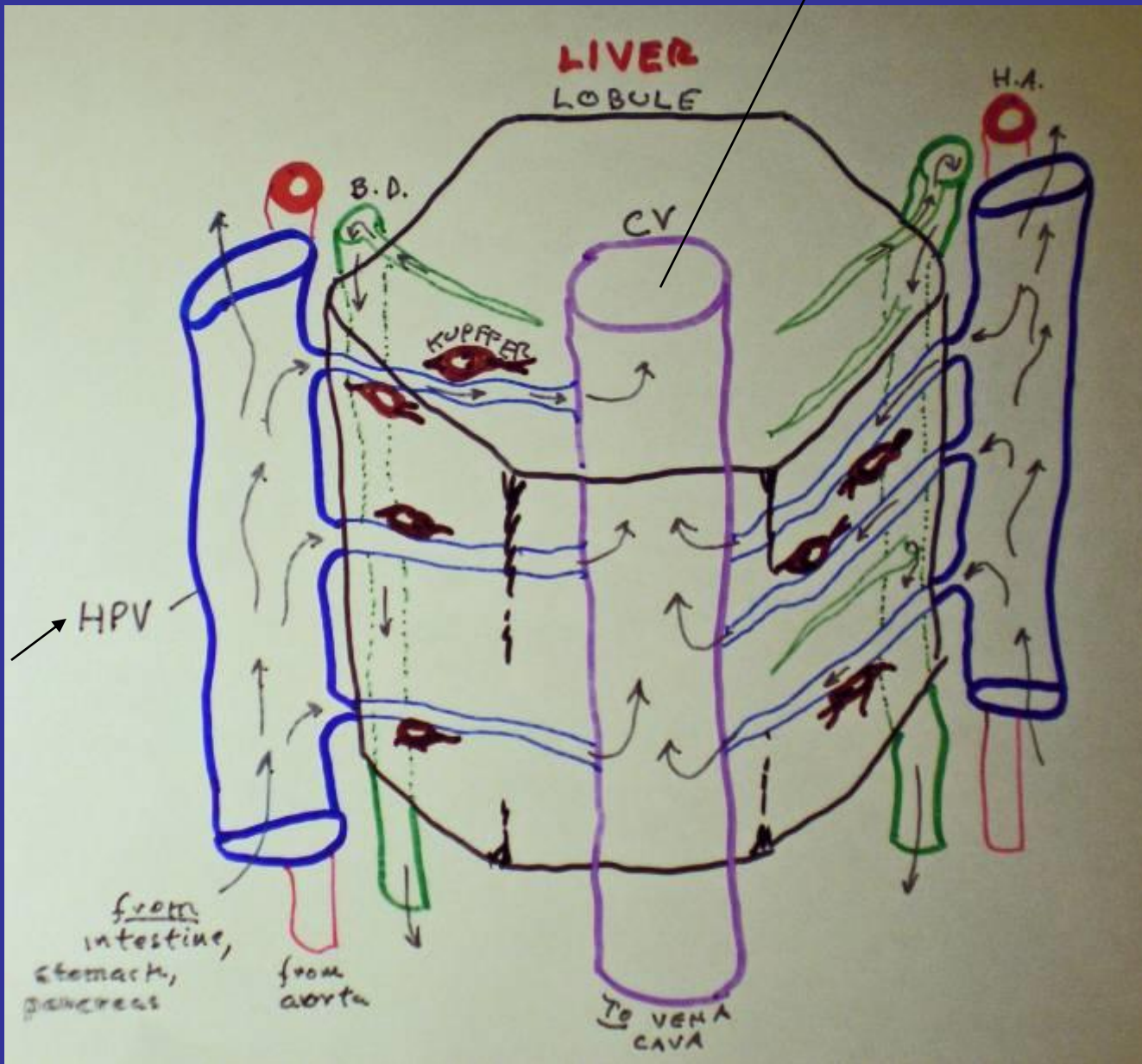
Ductus cysticus

W. Spalteholz, 1914

LIVER

To Inf. Vena Cava

From HEPATIC PORTAL VEIN with food molecules

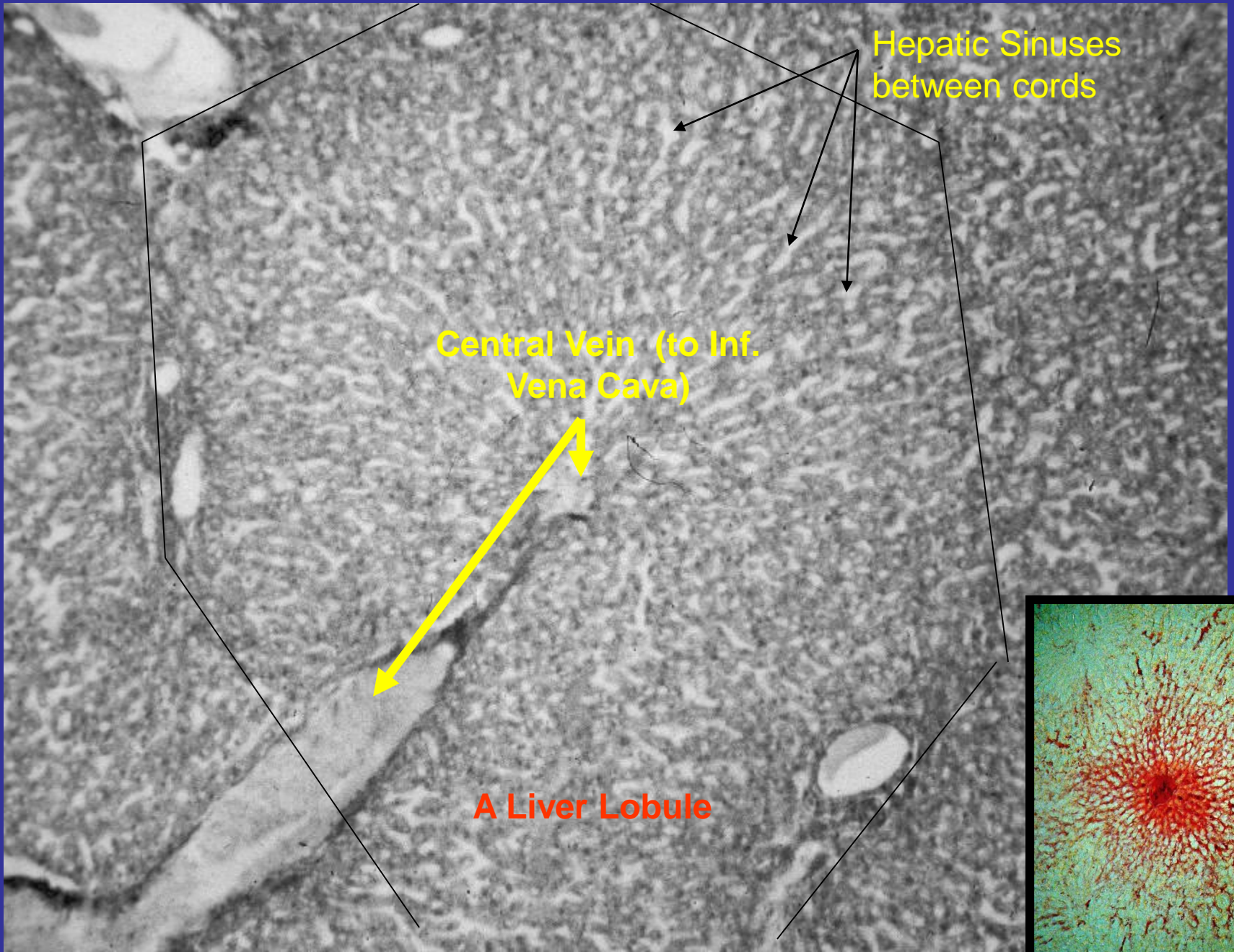


HPV

from intestine,
stomach,
pancreas

from aorta

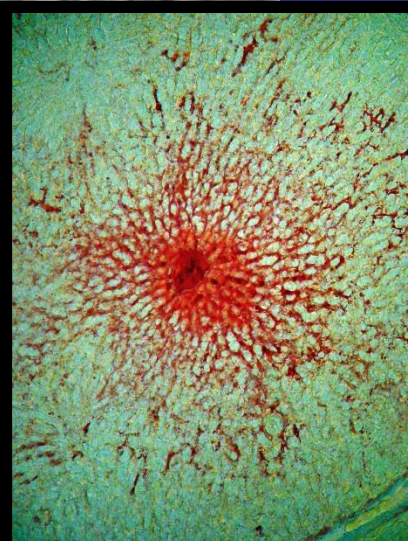
To VENA CAVA



Hepatic Sinuses
between cords

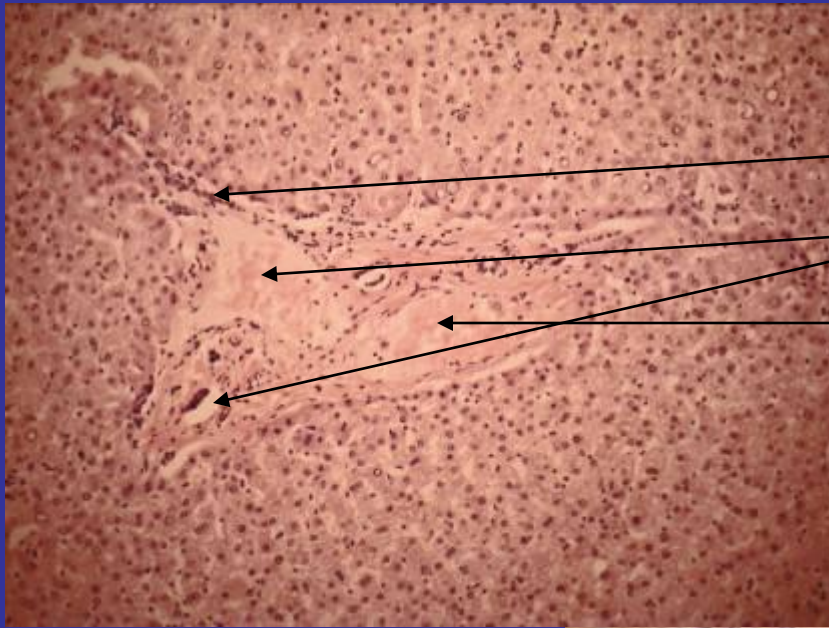
Central Vein (to Inf.
Vena Cava)

A Liver Lobule



Liver 'Lobule' Triads of

- 1) Bile Duct
- 2) Hepatic Artery
- 3) Hepatic Portal Vein





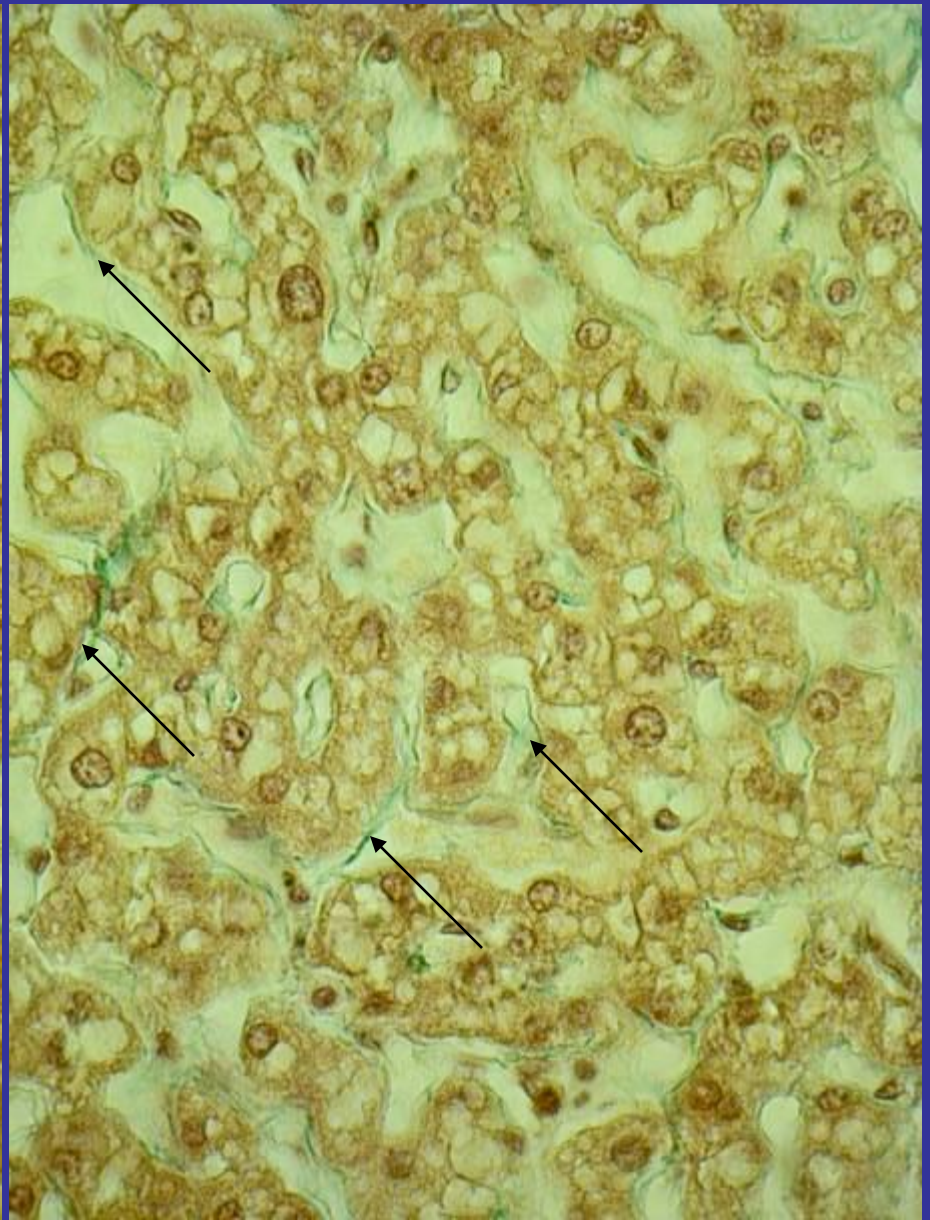
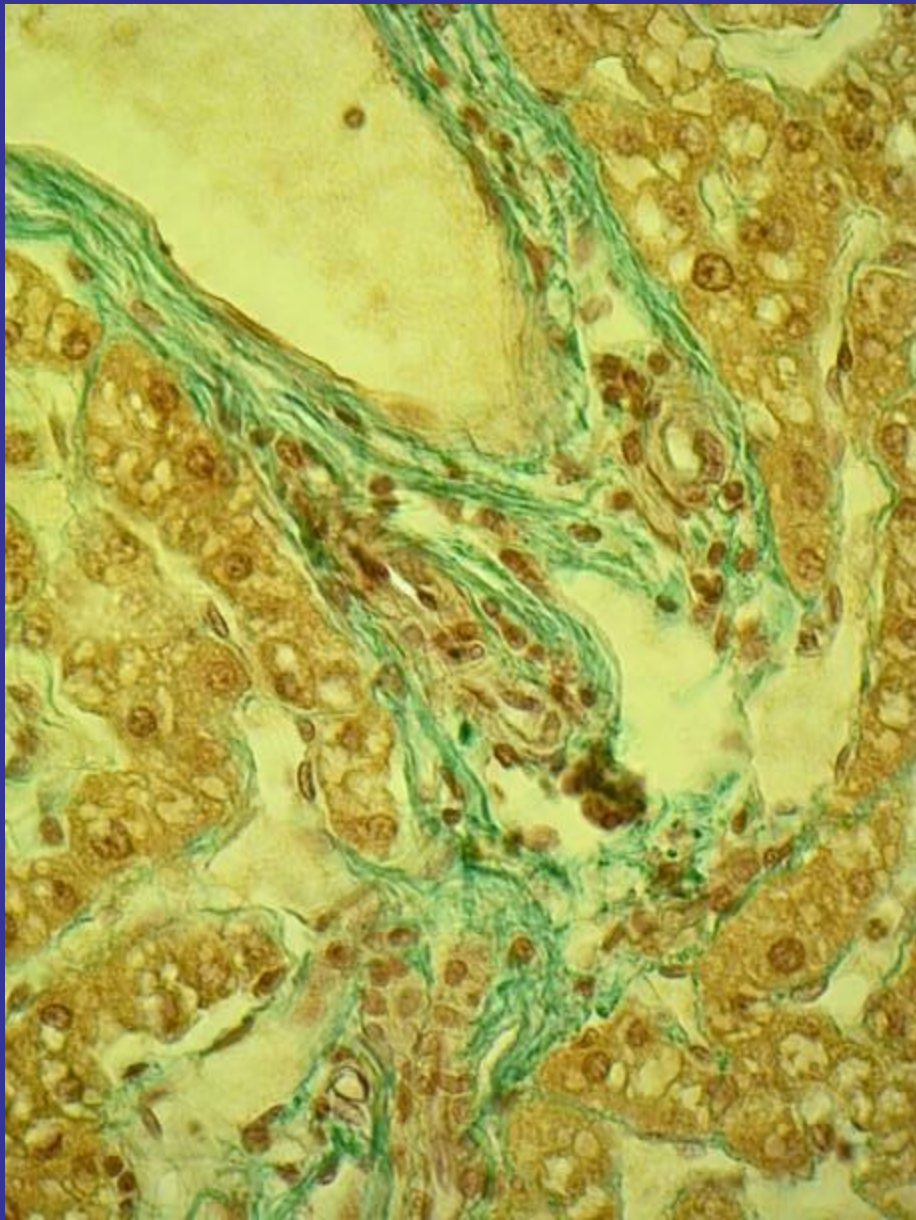
Hepatic Artery

nerve

Hepatic Portal Vein

Bile Ducts

Liver Cords & Sinuses

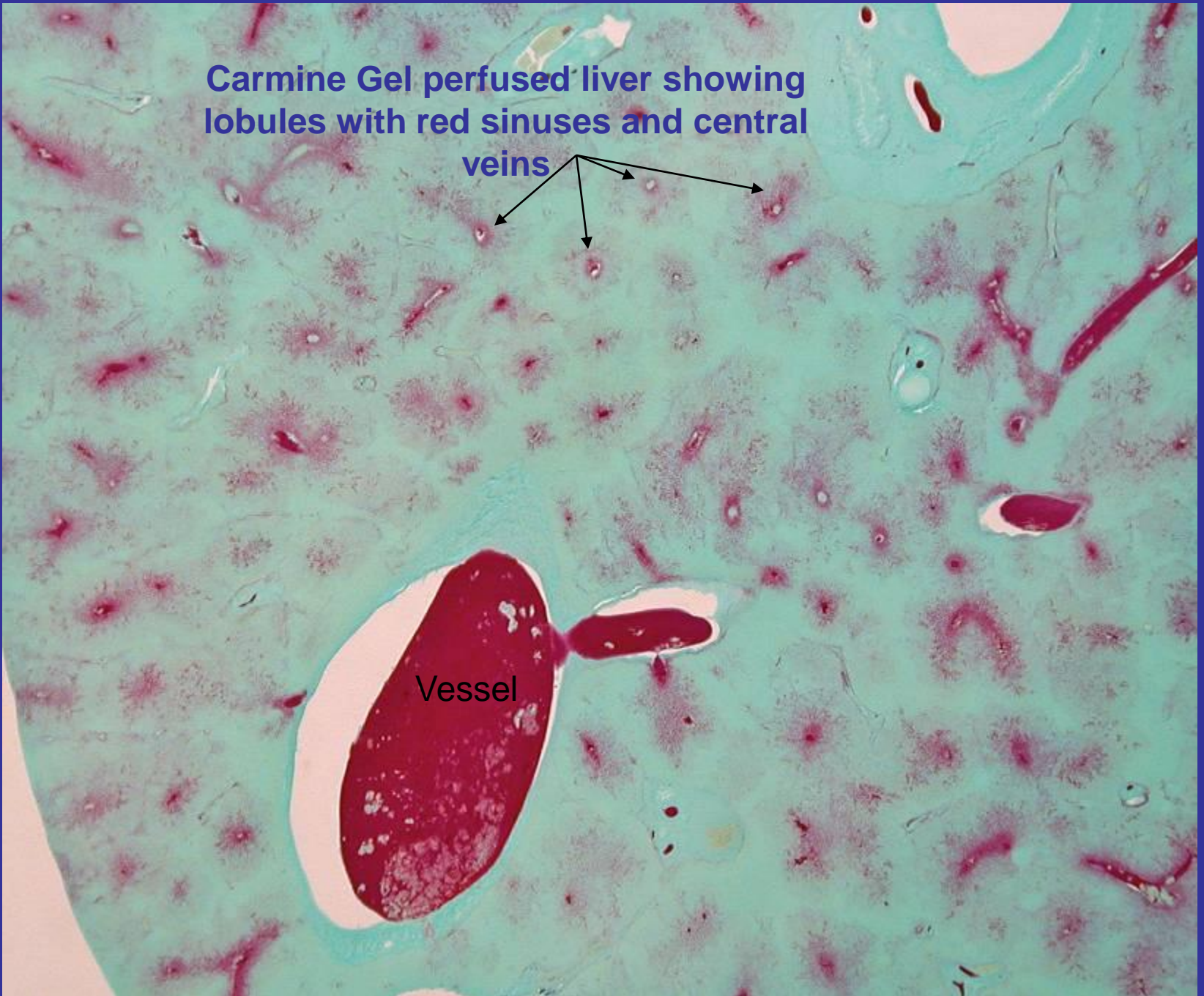


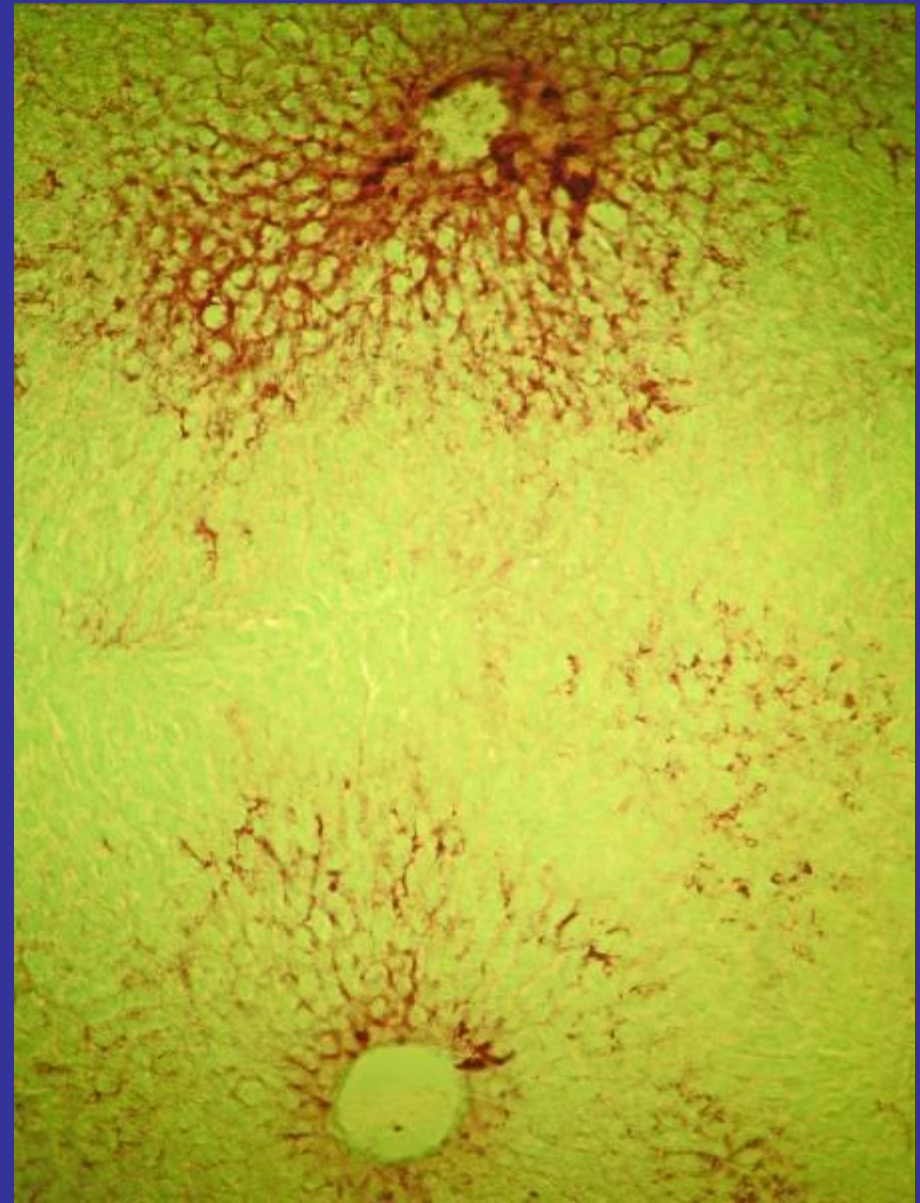
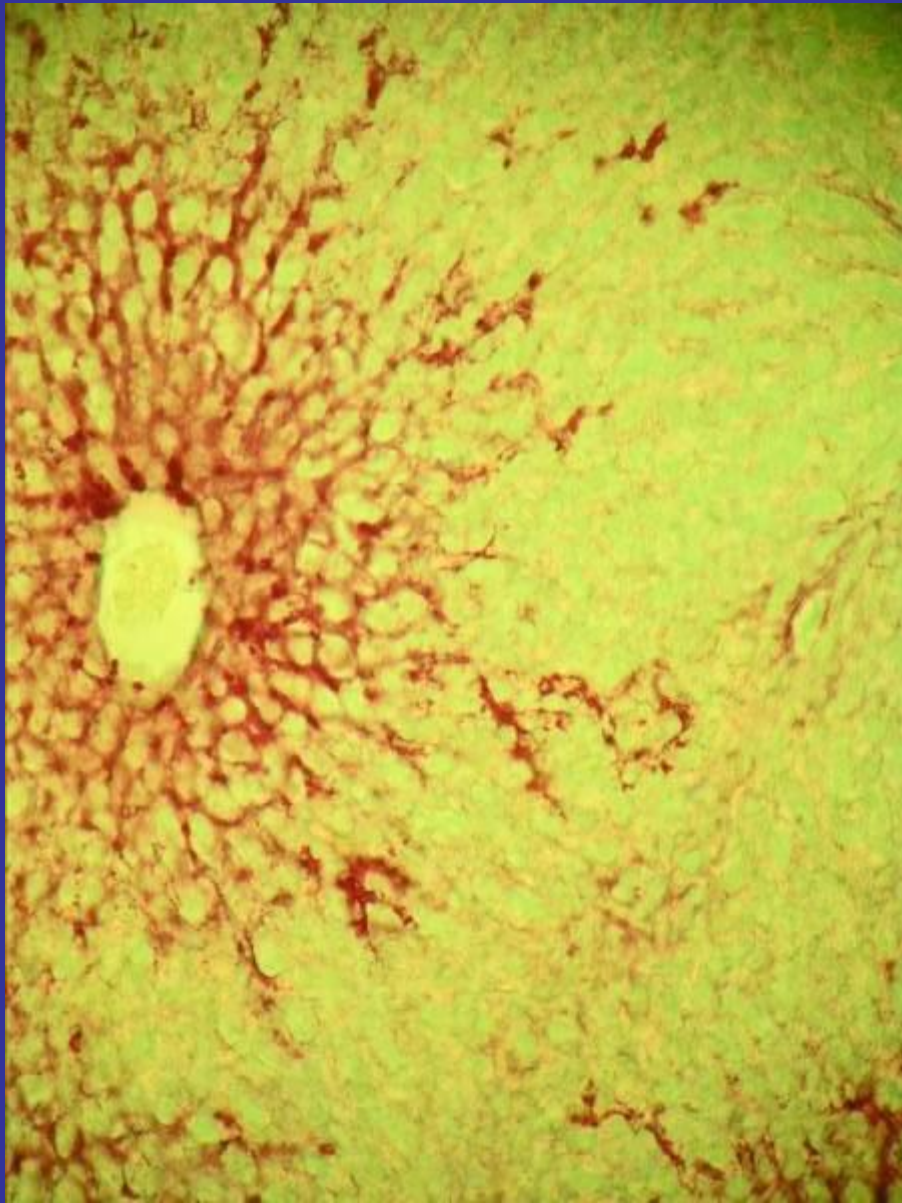
Reticular fibers in liver (note those lining sinuses (green))

Carminic Gel perfused liver showing lobules with red sinuses and central veins

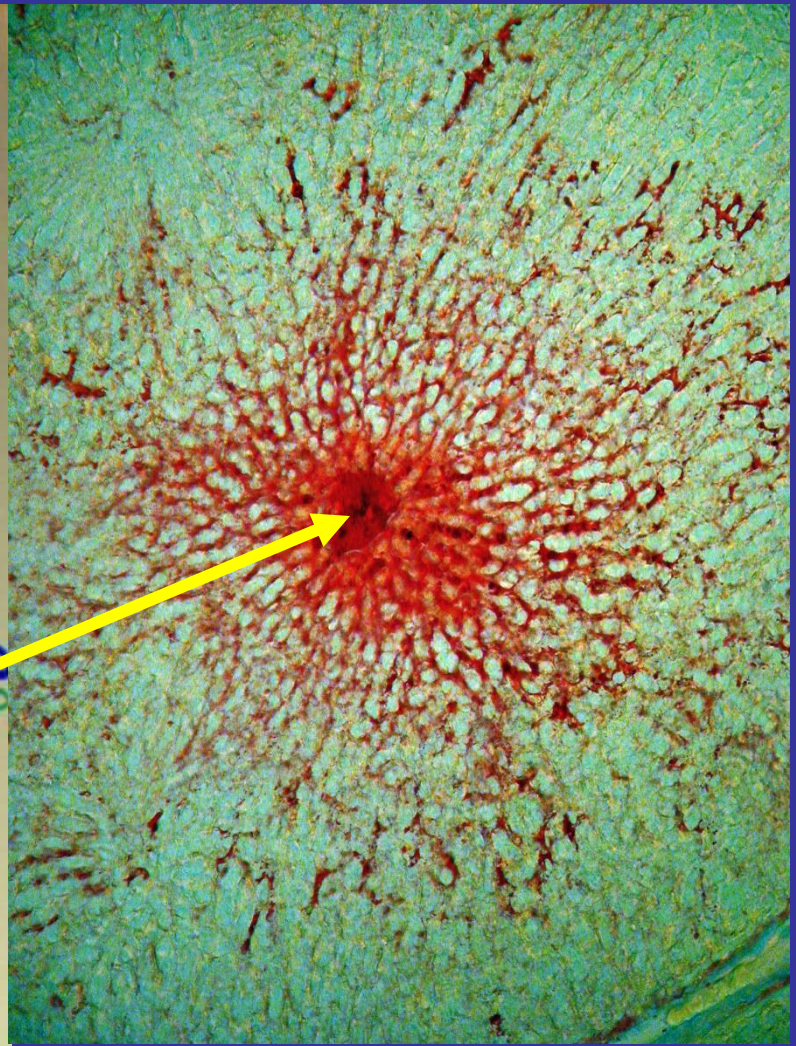
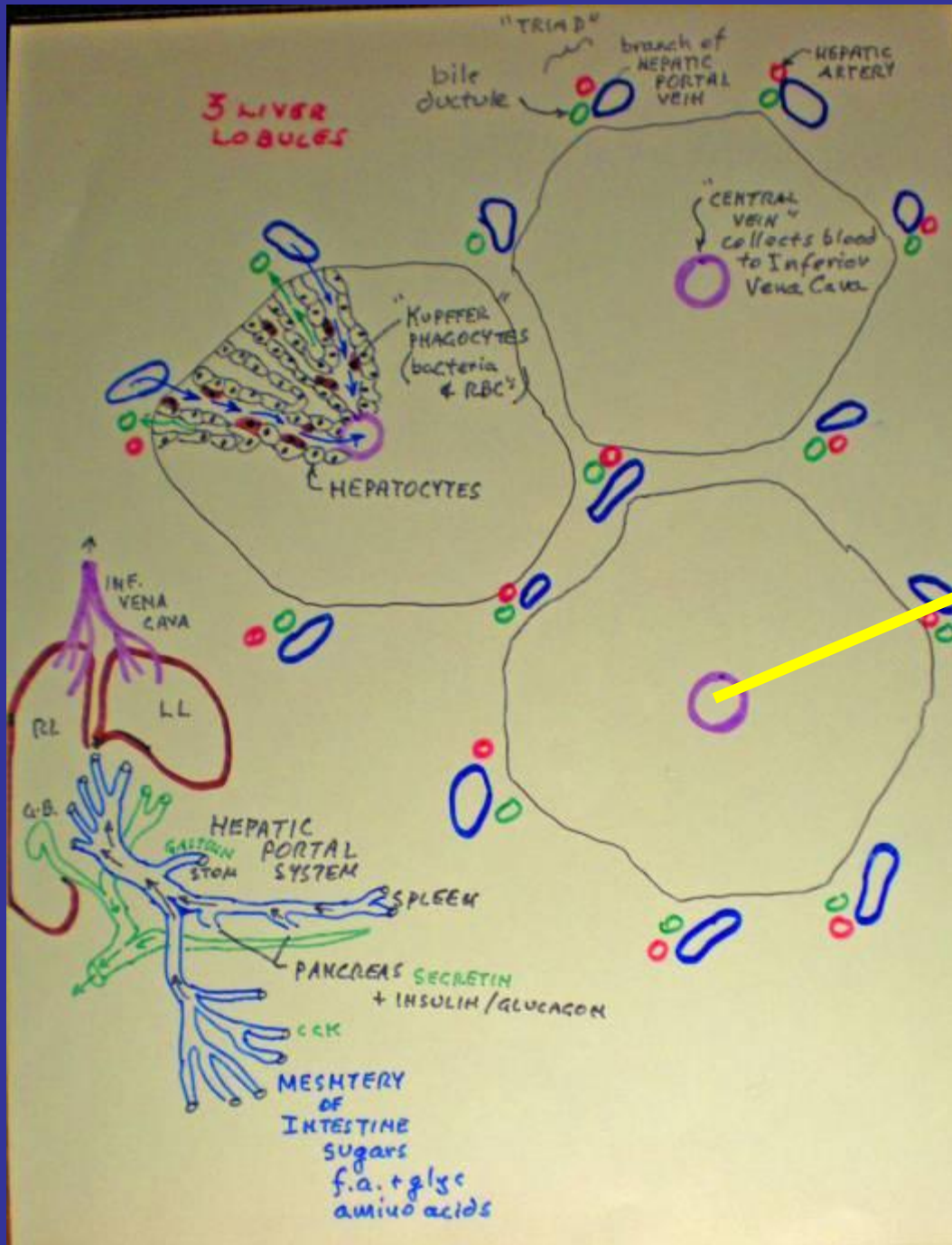
veins

Vessel

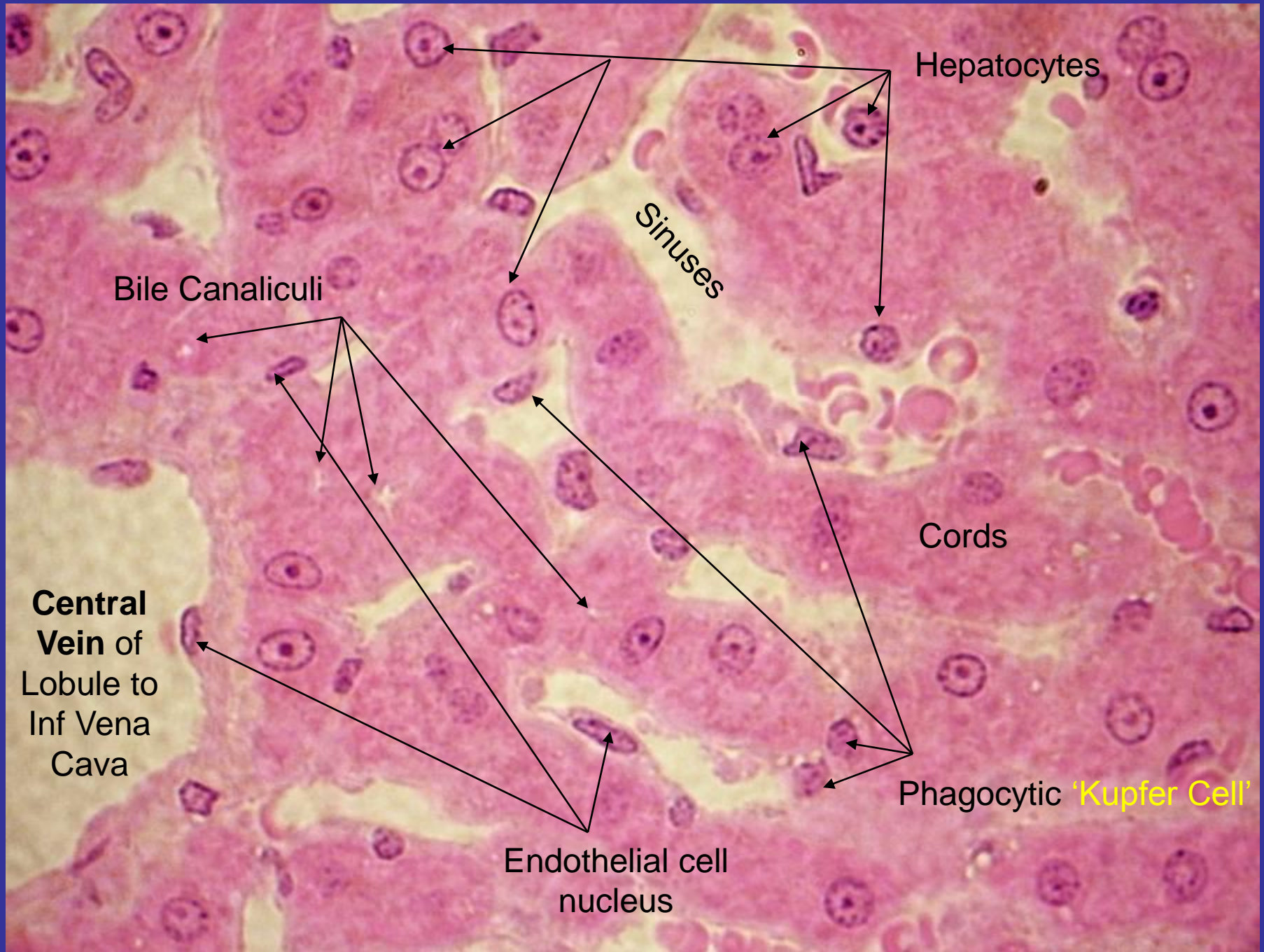




Central Veins receiving blood (from portal veins & intestine)- carmine gel perfusion



Carmine Gel perfused liver showing lobules with red sinusoids leading to Central Vein



Hepatocytes

Sinuses

Bile Canaliculi

Cords

Central Vein of Lobule to Inf Vena Cava

Phagocytic 'Kupfer Cell'

Endothelial cell nucleus

Liver Cell:

TEM — David
DeFouw, UMDNJ

Bile
Canaliculus

RER

Mitochondria

Cell
Memb. →

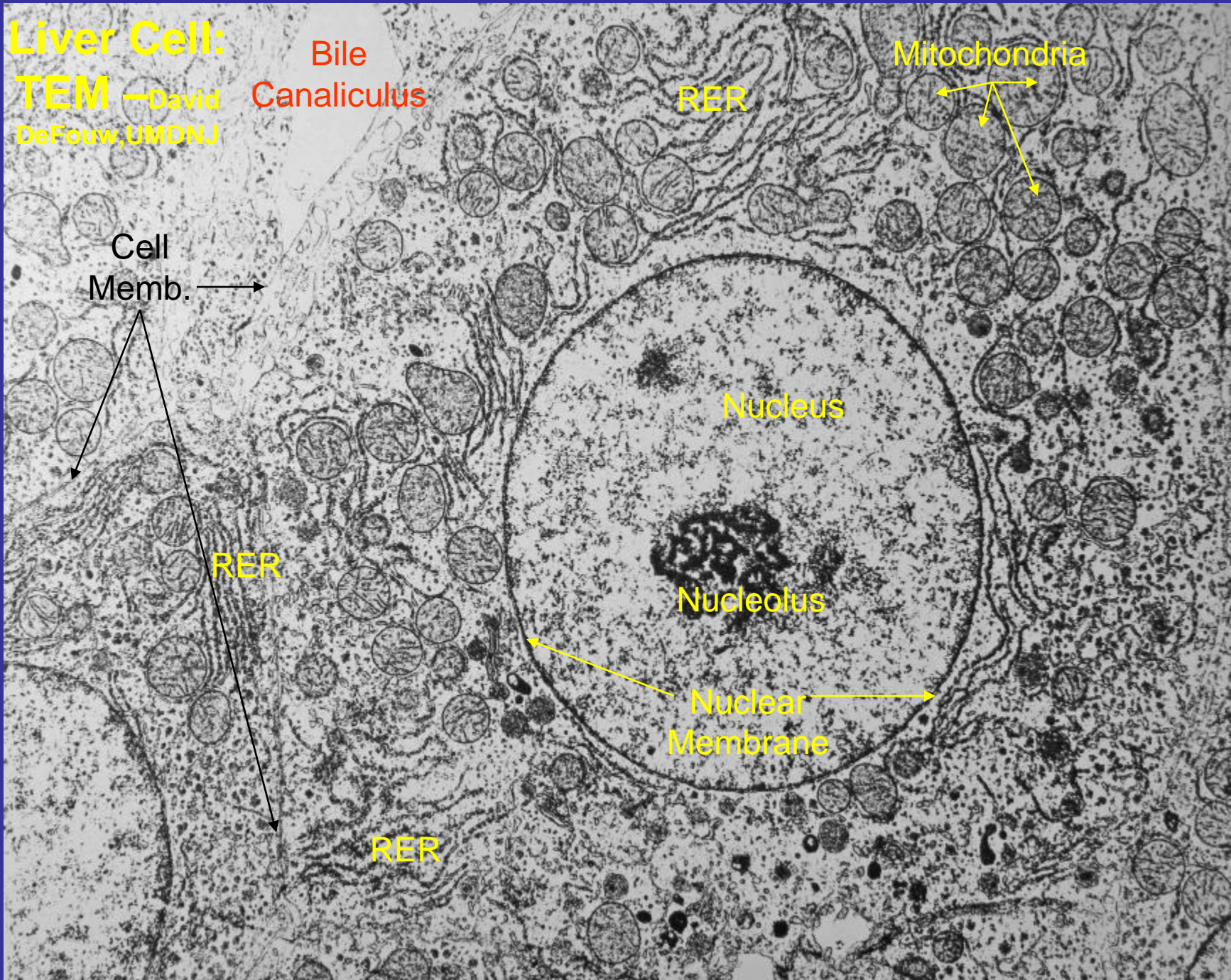
Nucleus

RER

Nucleolus

Nuclear
Membrane →

RER



Liver Cell:
TEM — David
DeFouw, UMDNJ

Bile
Canaliculus

Golgi
Apparatus

Mitochondria

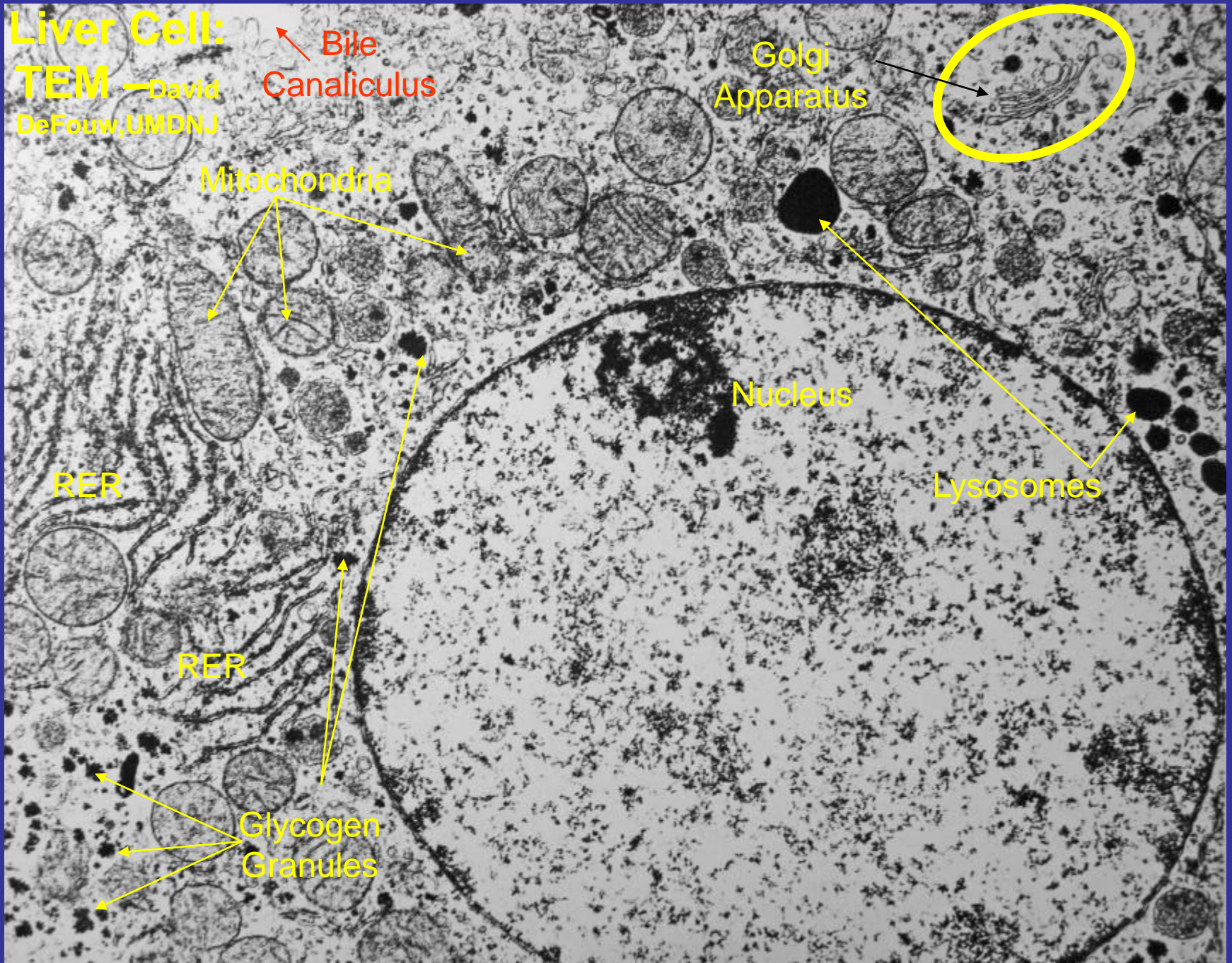
Nucleus

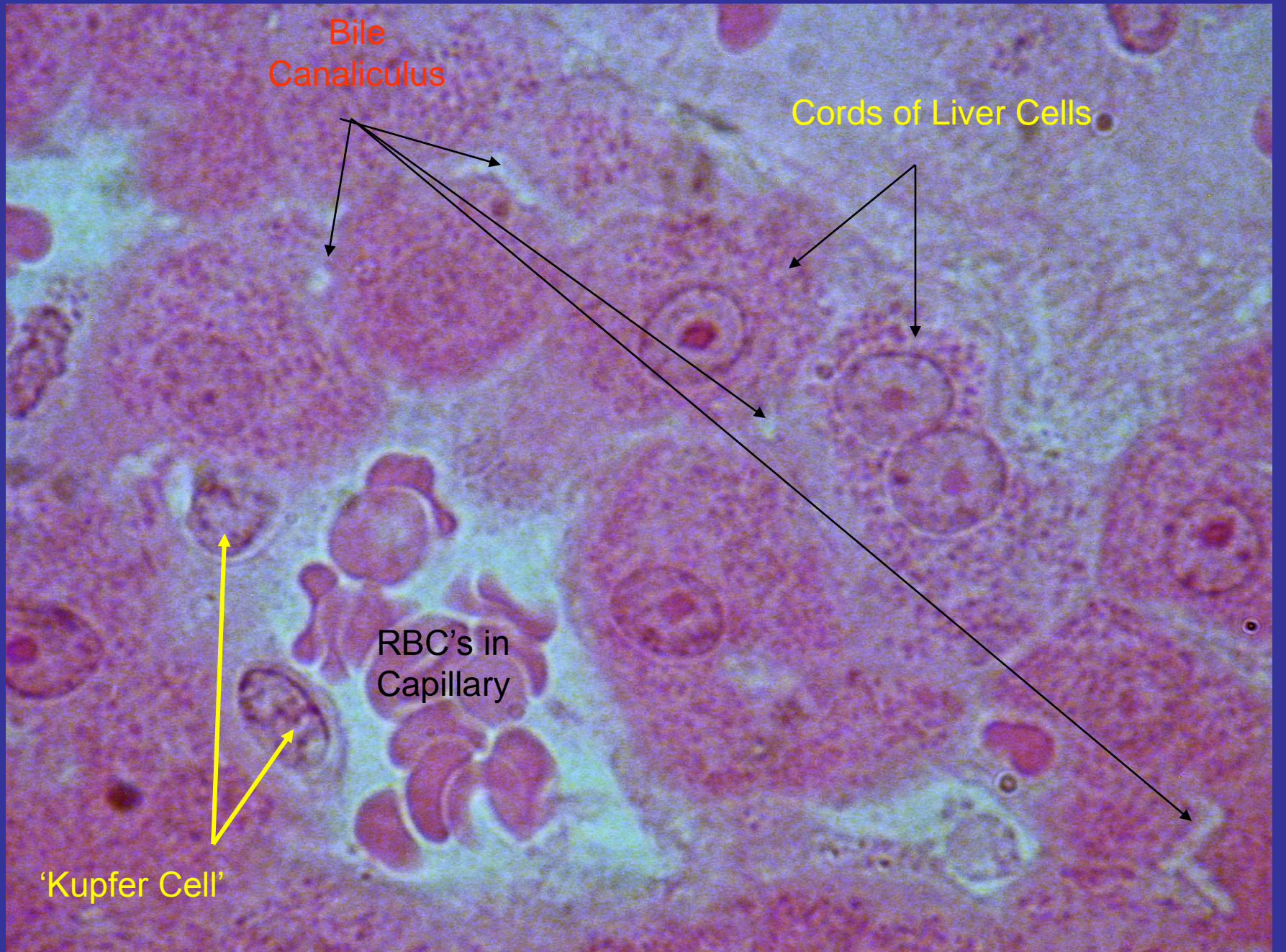
RER

Lysosomes

RER

Glycogen
Granules



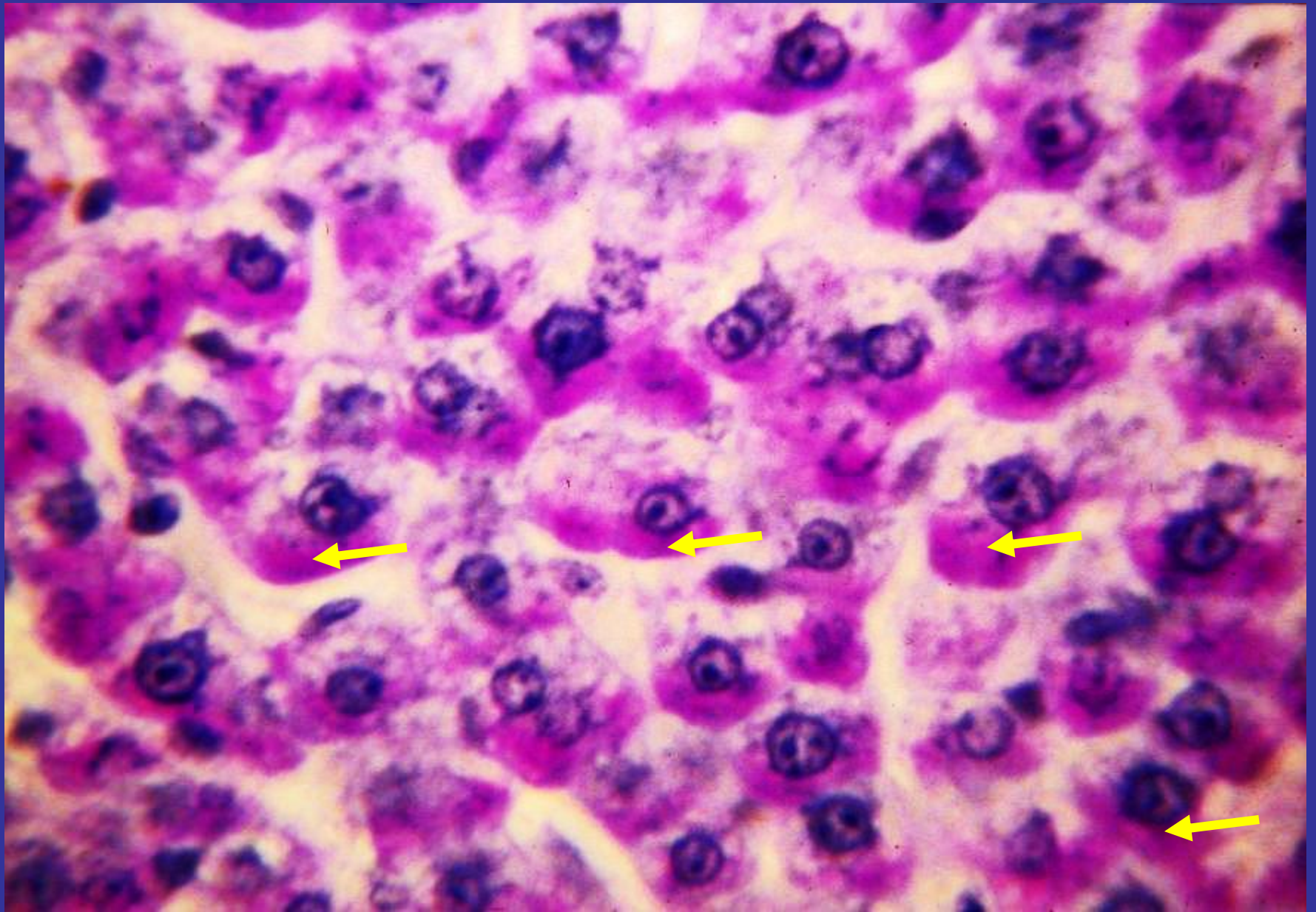


Bile
Canaliculus

Cords of Liver Cells

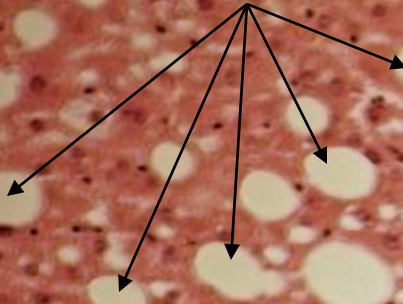
RBC's in
Capillary

'Kupfer Cell'

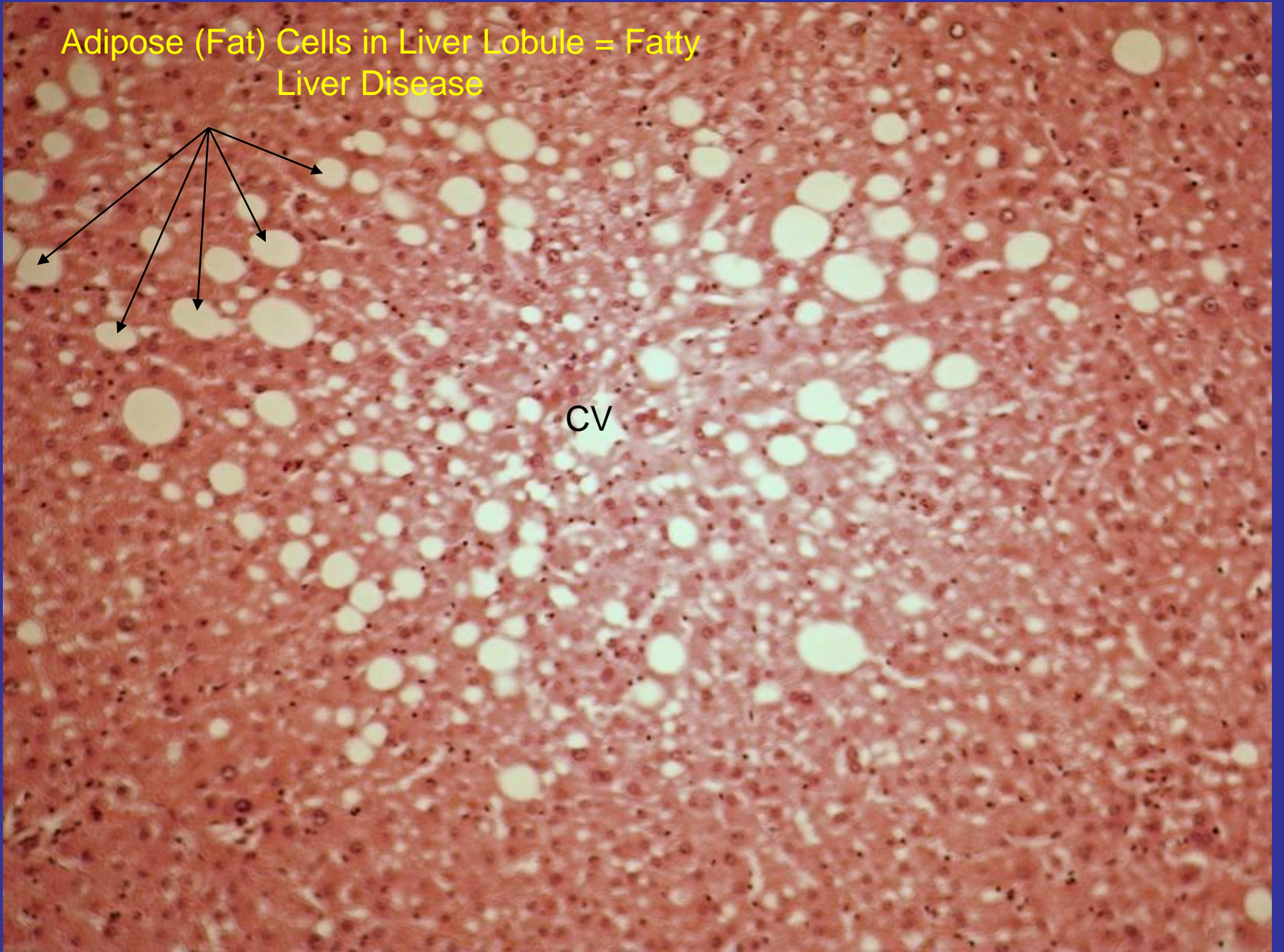


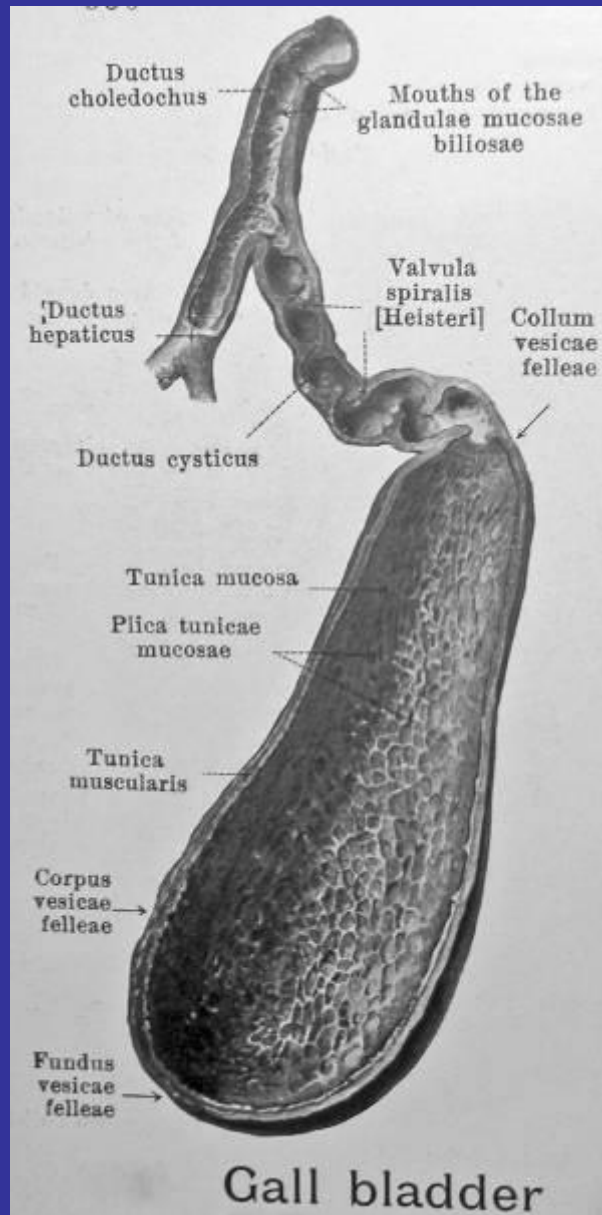
PAS stain to show GLYCOGEN storage (animal starch) - red - in liver cells

Adipose (Fat) Cells in Liver Lobule = Fatty Liver Disease



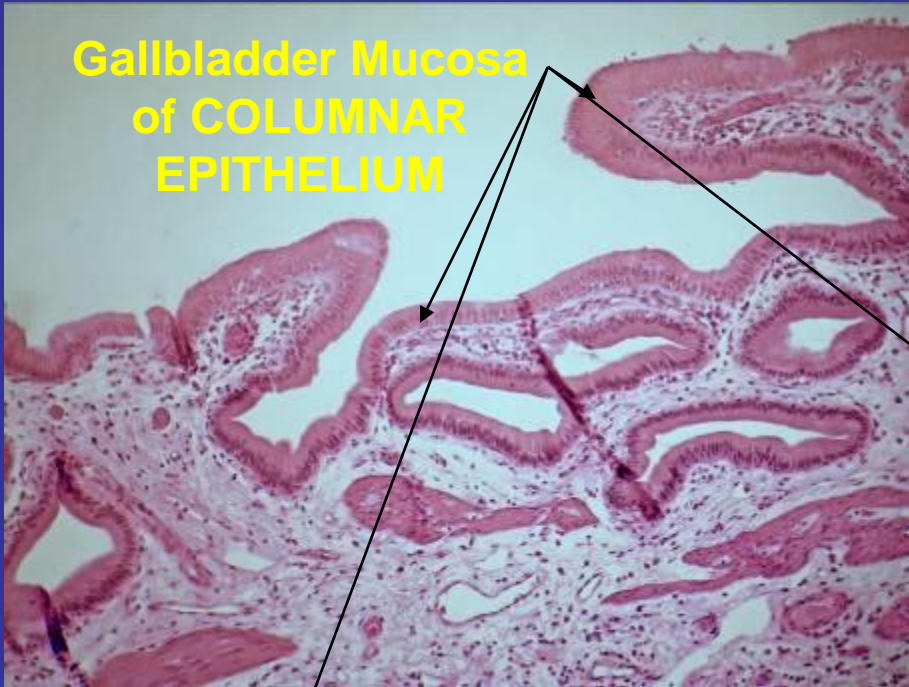
CV



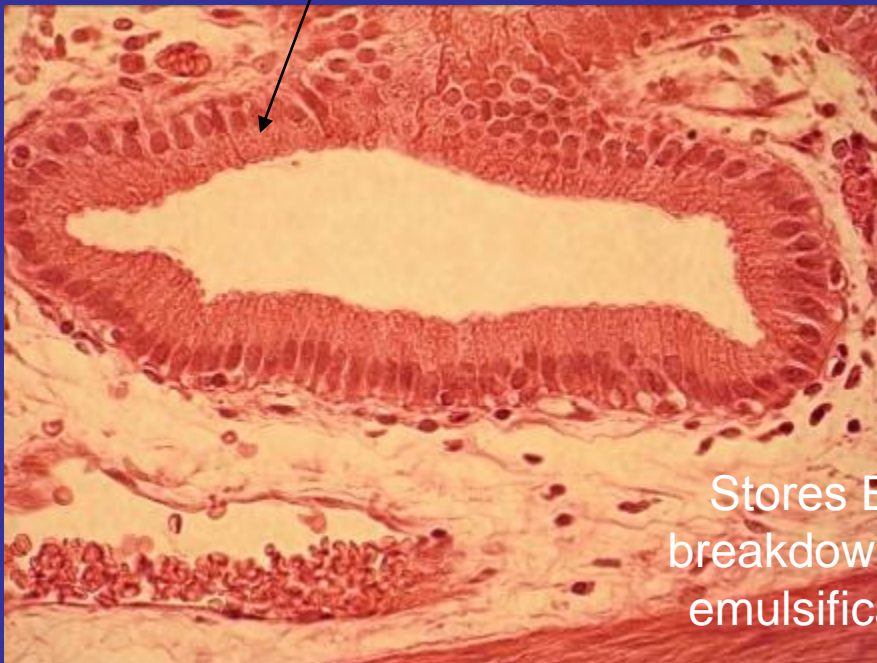


W.Spalteholtz, 1914

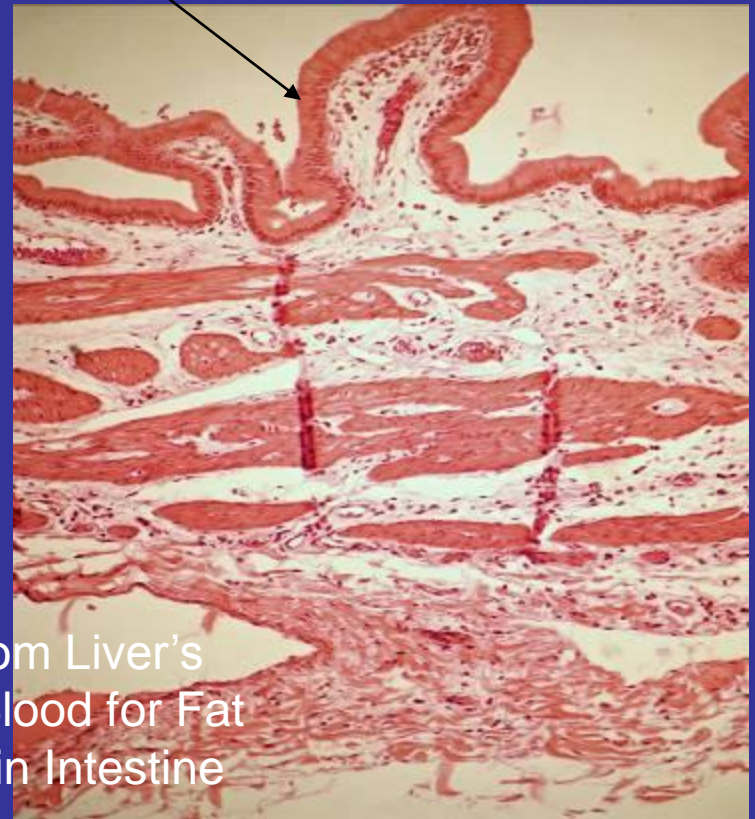
Gallbladder Mucosa
of COLUMNAR
EPITHELIUM

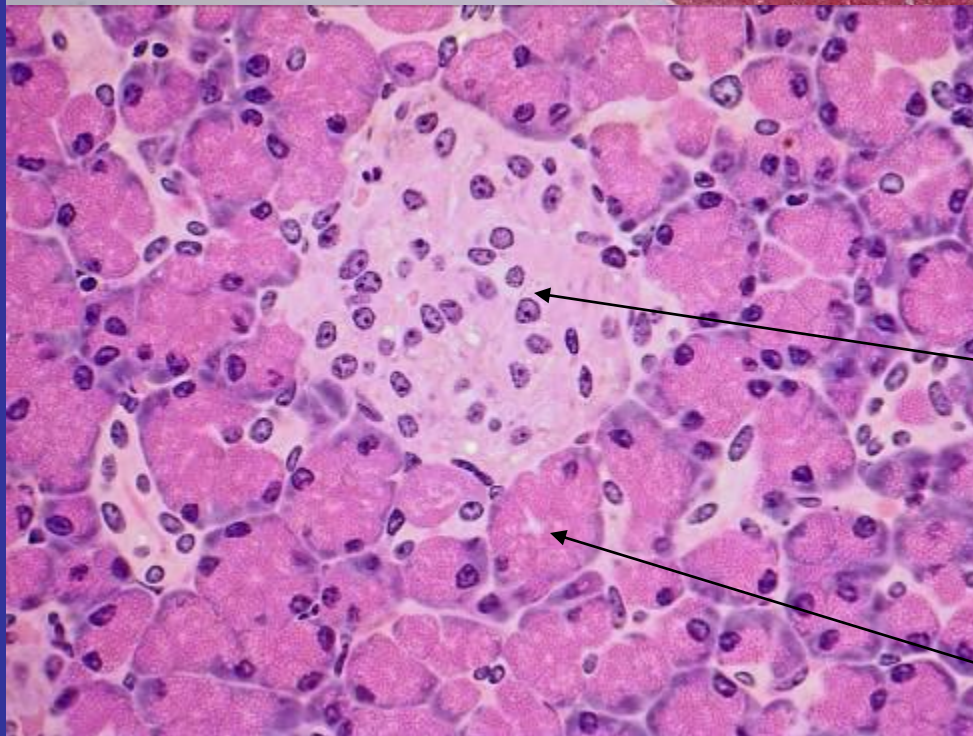
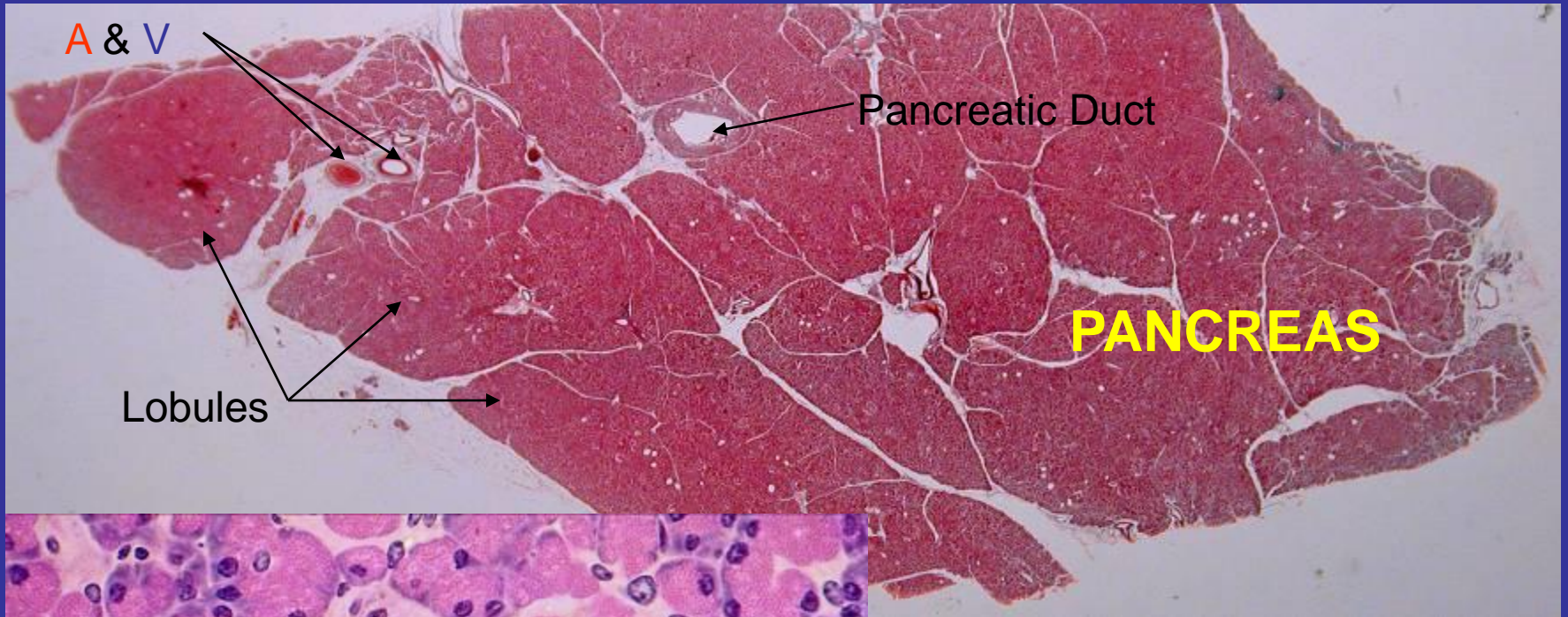


Many tiny mucosal folds



Stores Bile from Liver's
breakdown of Blood for Fat
emulsification in Intestine

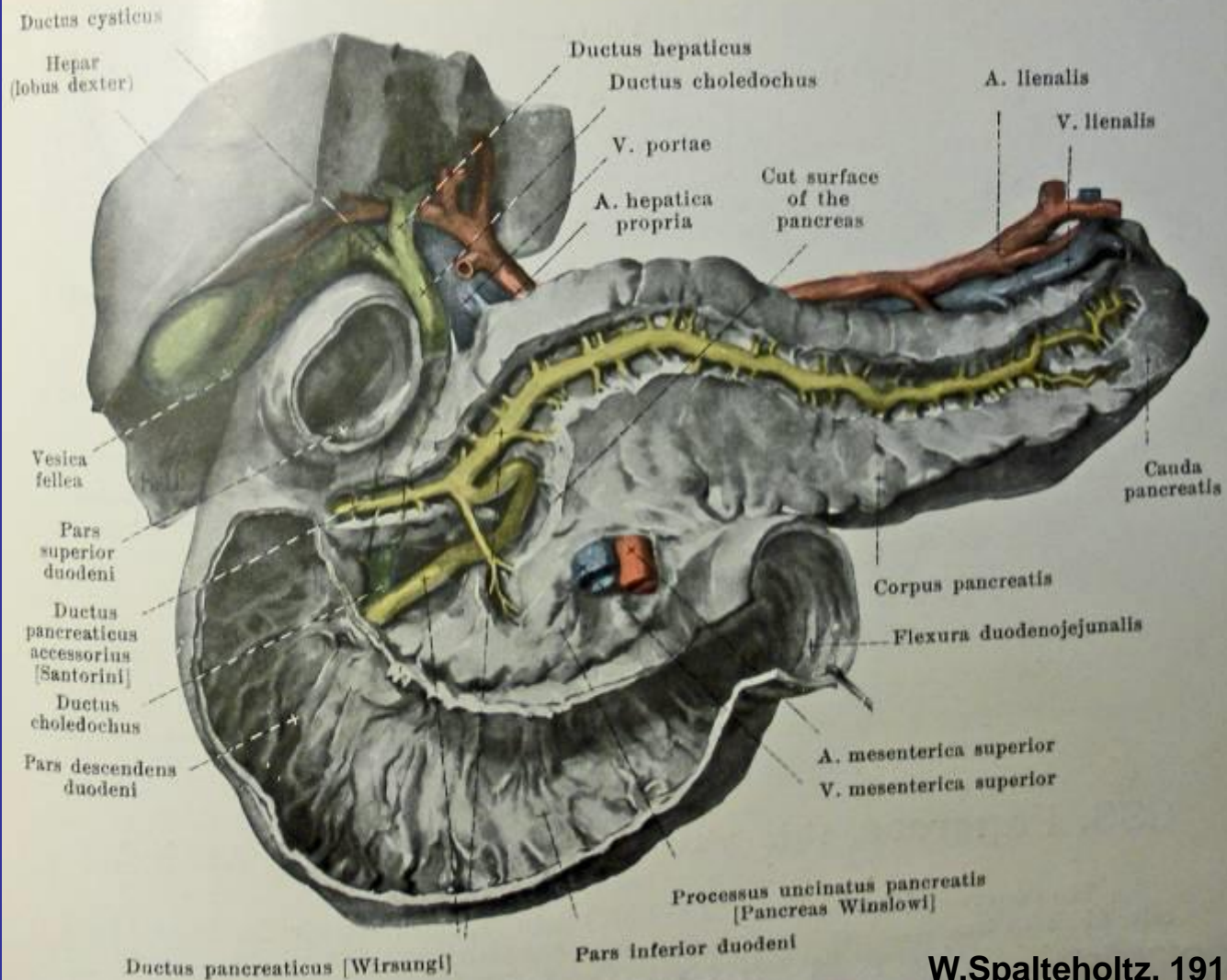




Lobulated **Pancreas** is 2 glands in one: Digestive enzyme secreting acini (majority) & *Islets of Langerhans* (LEFT) that secrete Hormones (insulin & glucagon to regulate storage & release of glucose

Acini

Pancreas.

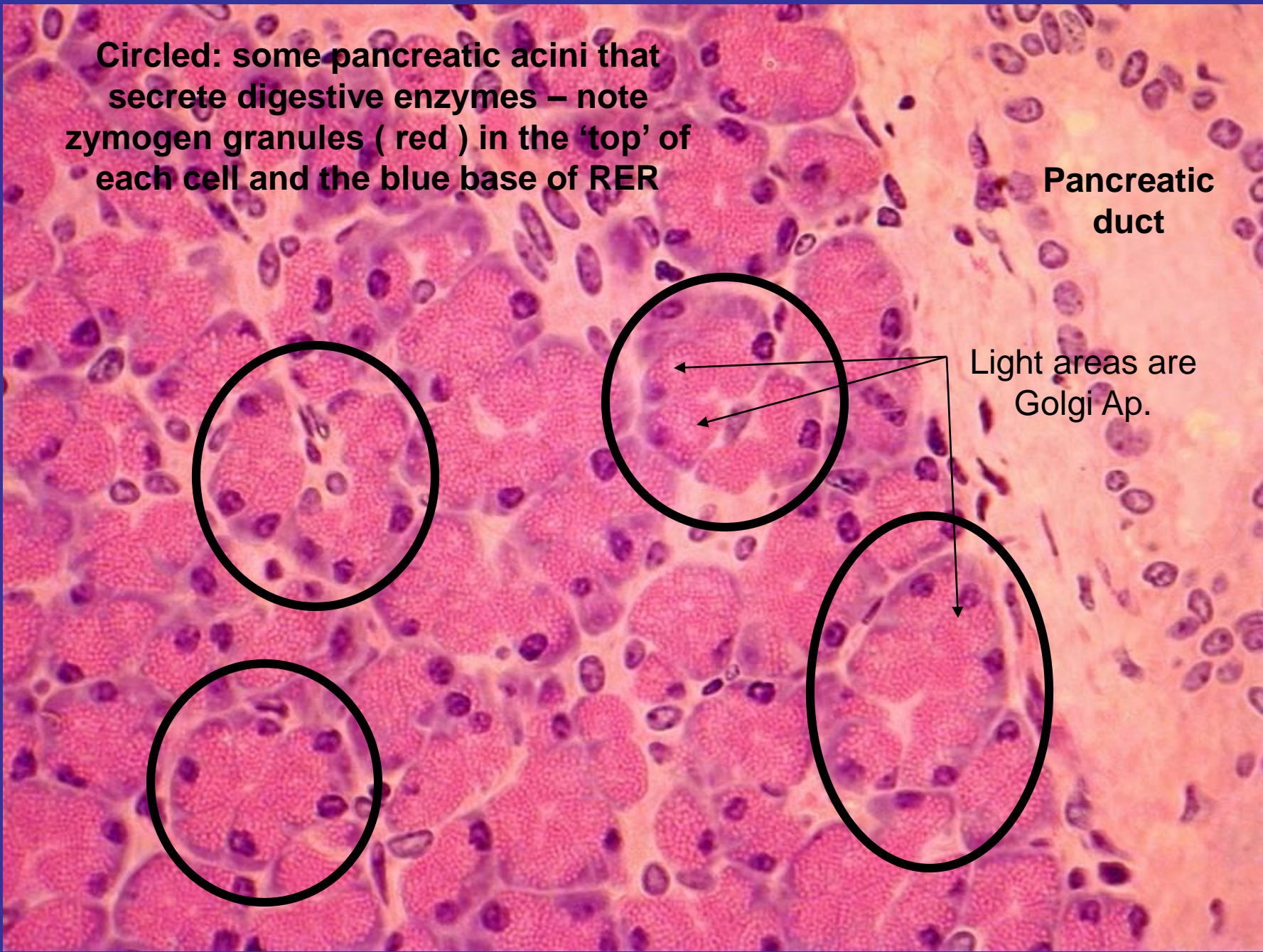


W. Spalteholtz, 1914

Circled: some pancreatic acini that secrete digestive enzymes – note zymogen granules (red) in the ‘top’ of each cell and the blue base of RER

Pancreatic duct

Light areas are Golgi Ap.

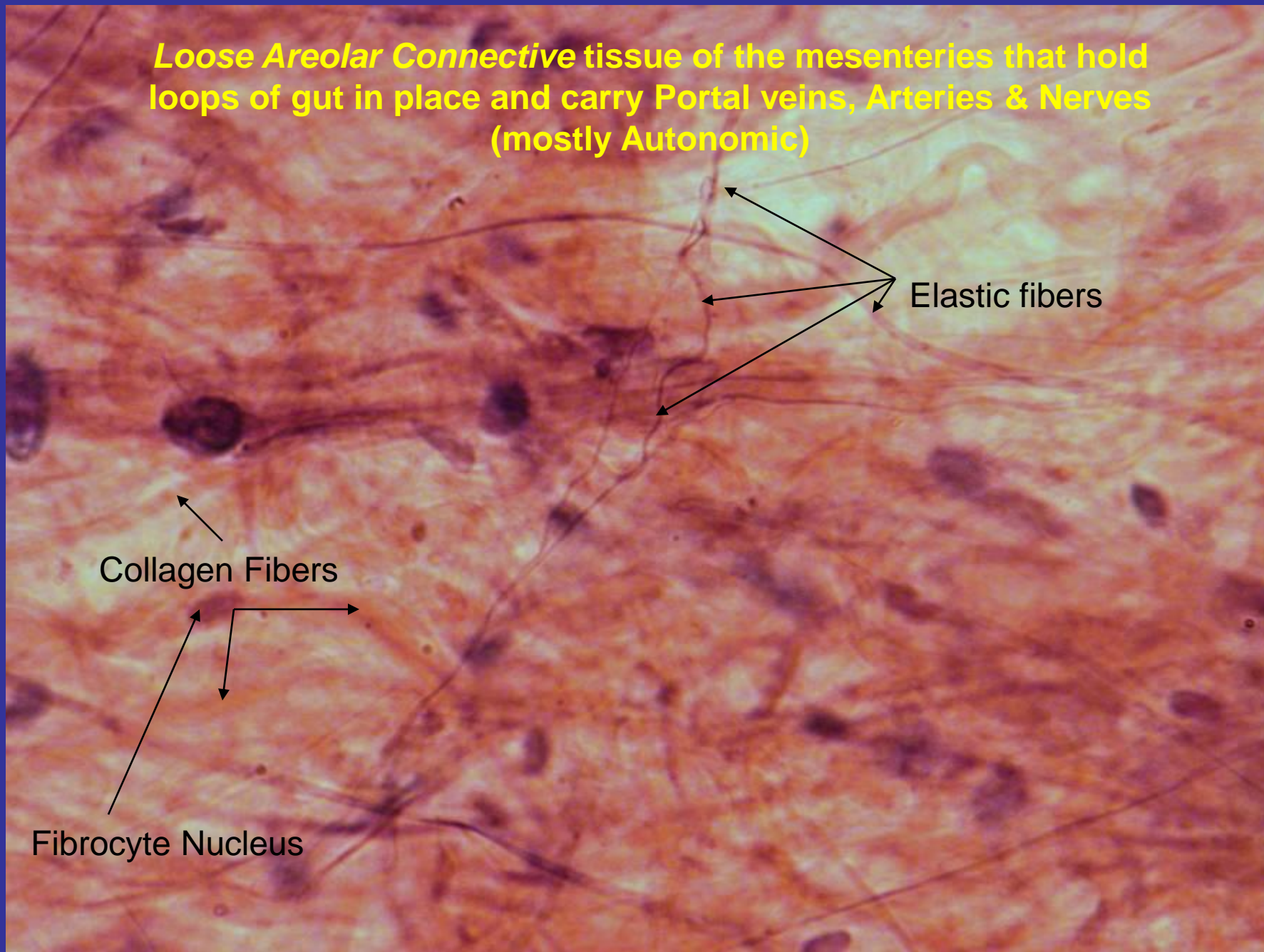


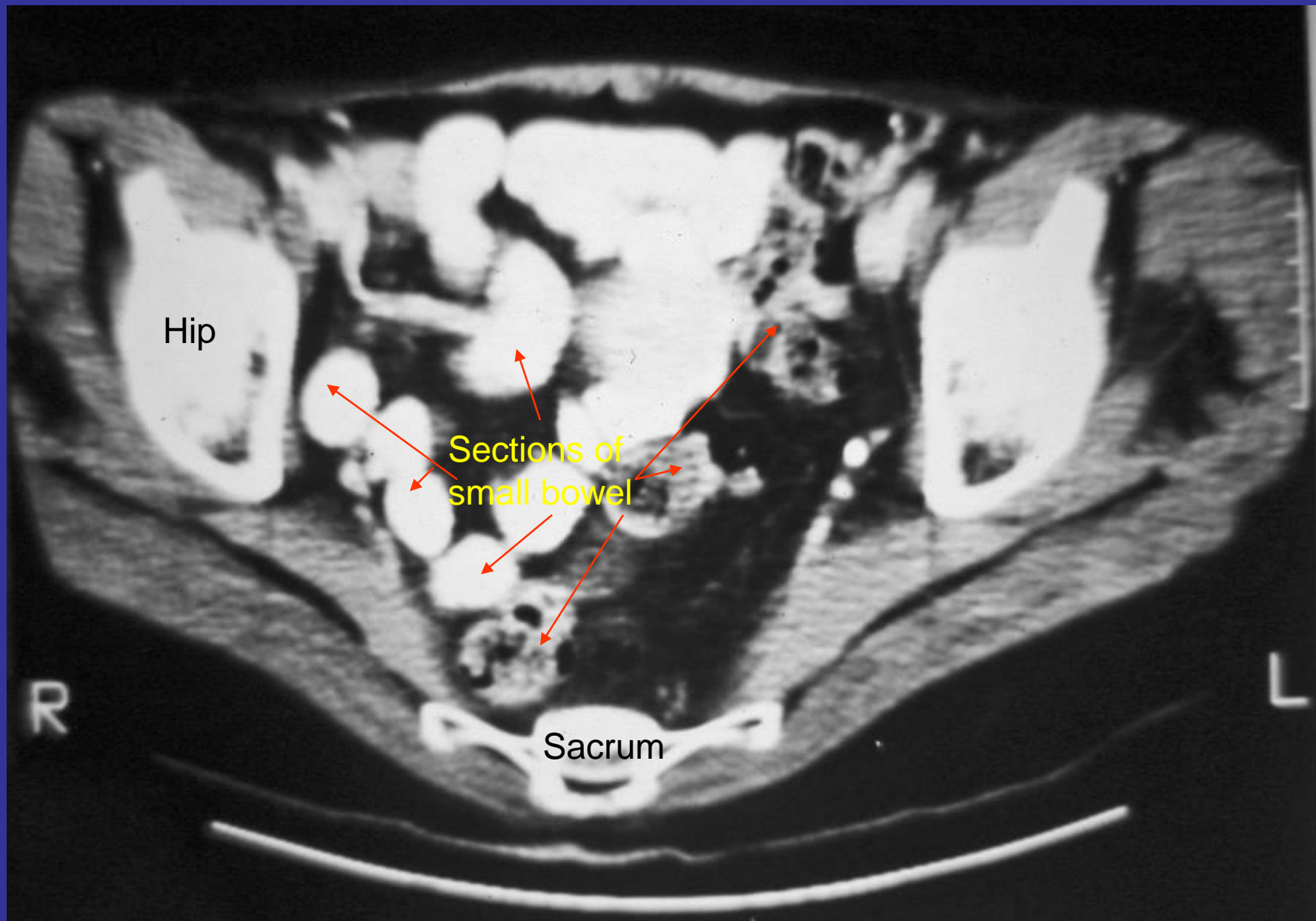
Loose Areolar Connective tissue of the mesenteries that hold loops of gut in place and carry Portal veins, Arteries & Nerves (mostly Autonomic)

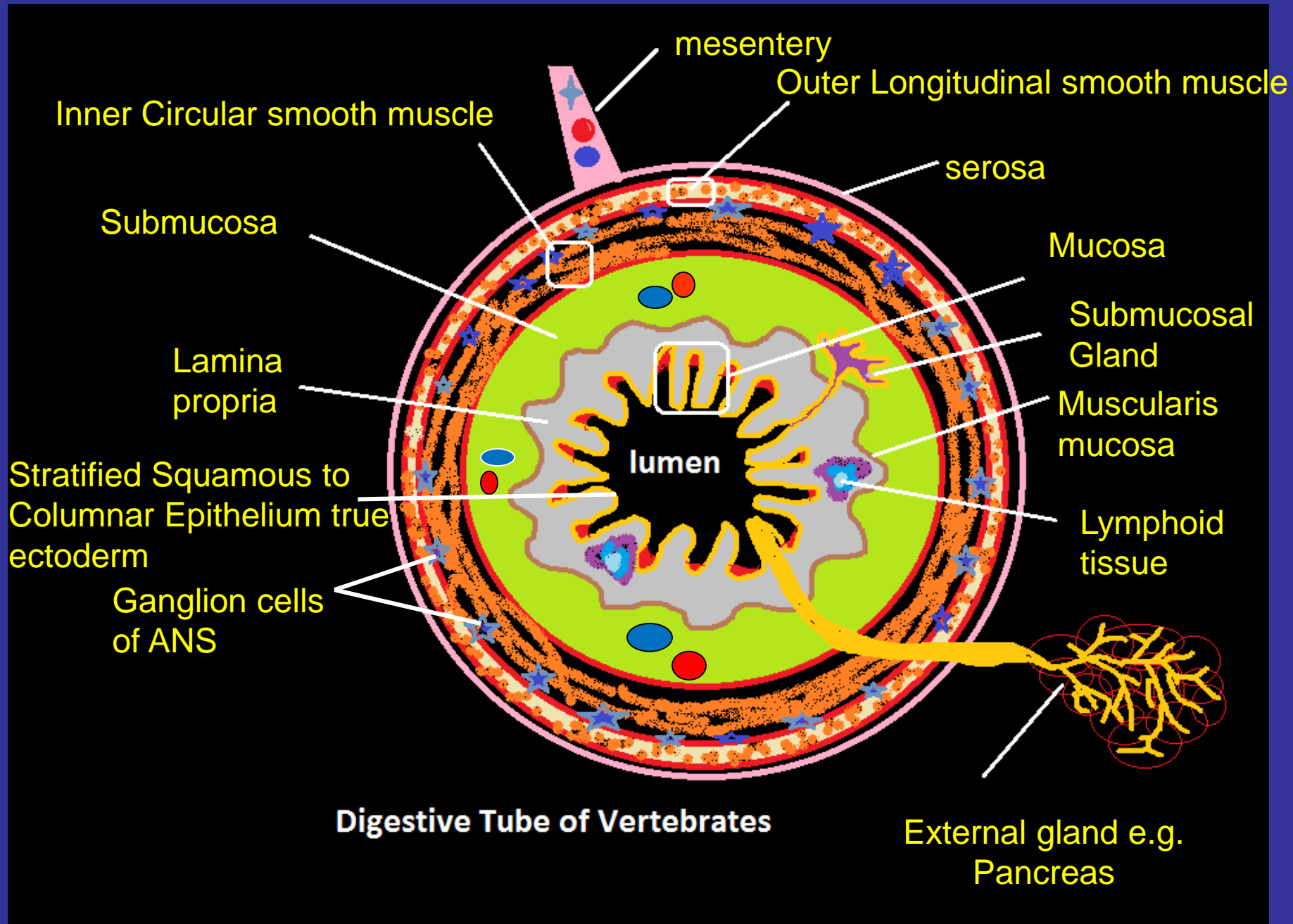
Elastic fibers

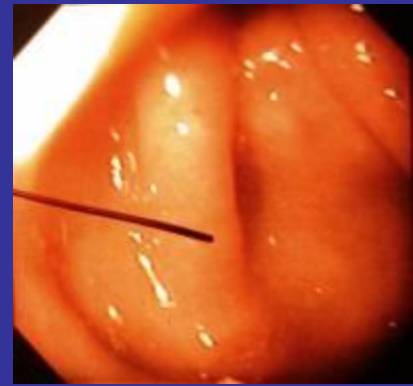
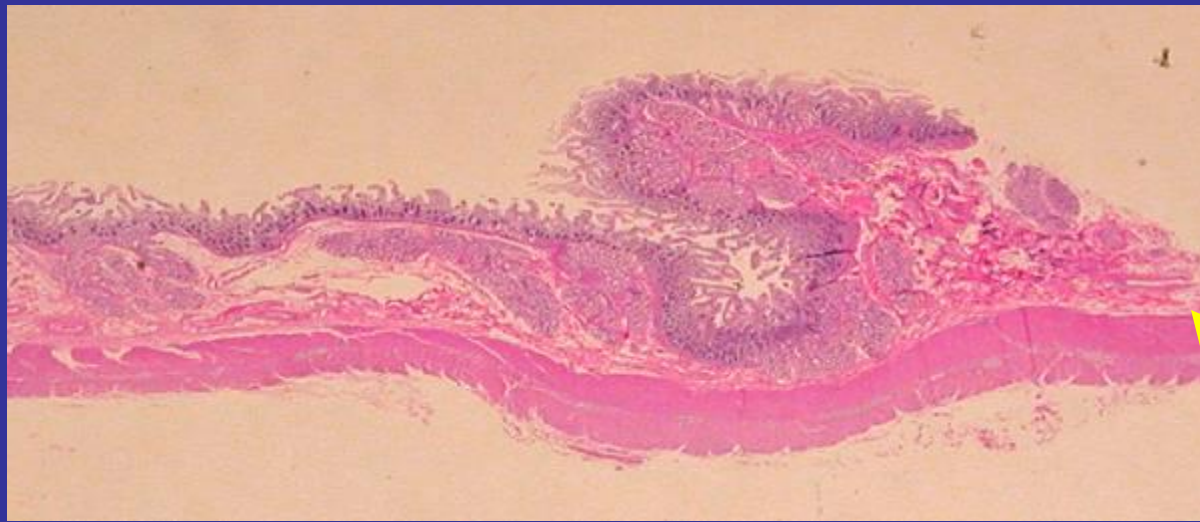
Collagen Fibers

Fibrocyte Nucleus





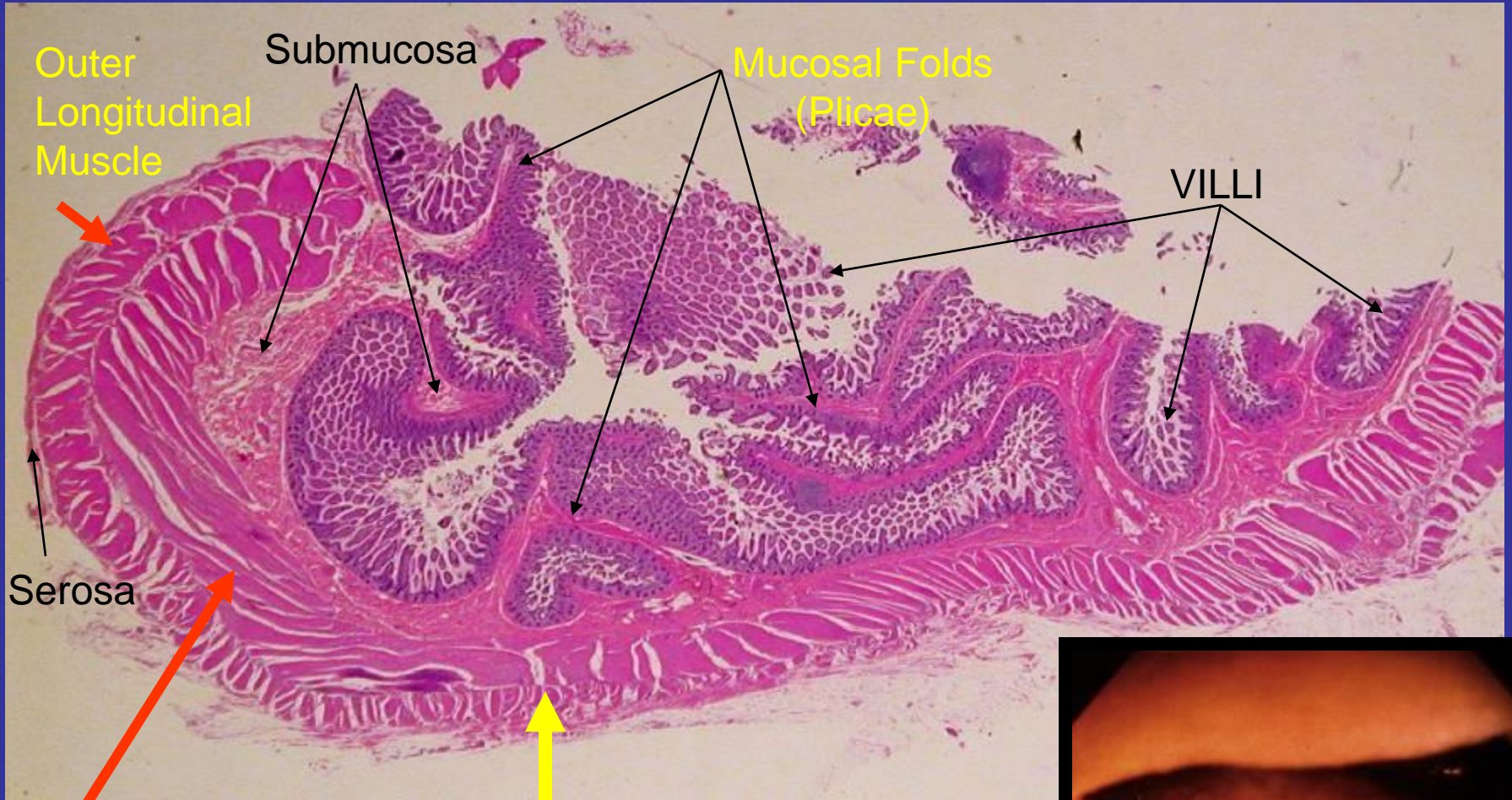




DUODENUM



JEJUNUM



Outer Longitudinal Muscle

Submucosa

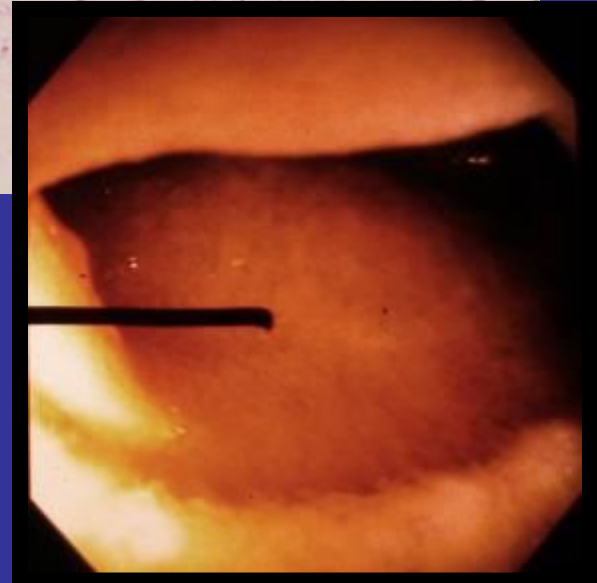
Mucosal Folds (Plicae)

VILLI

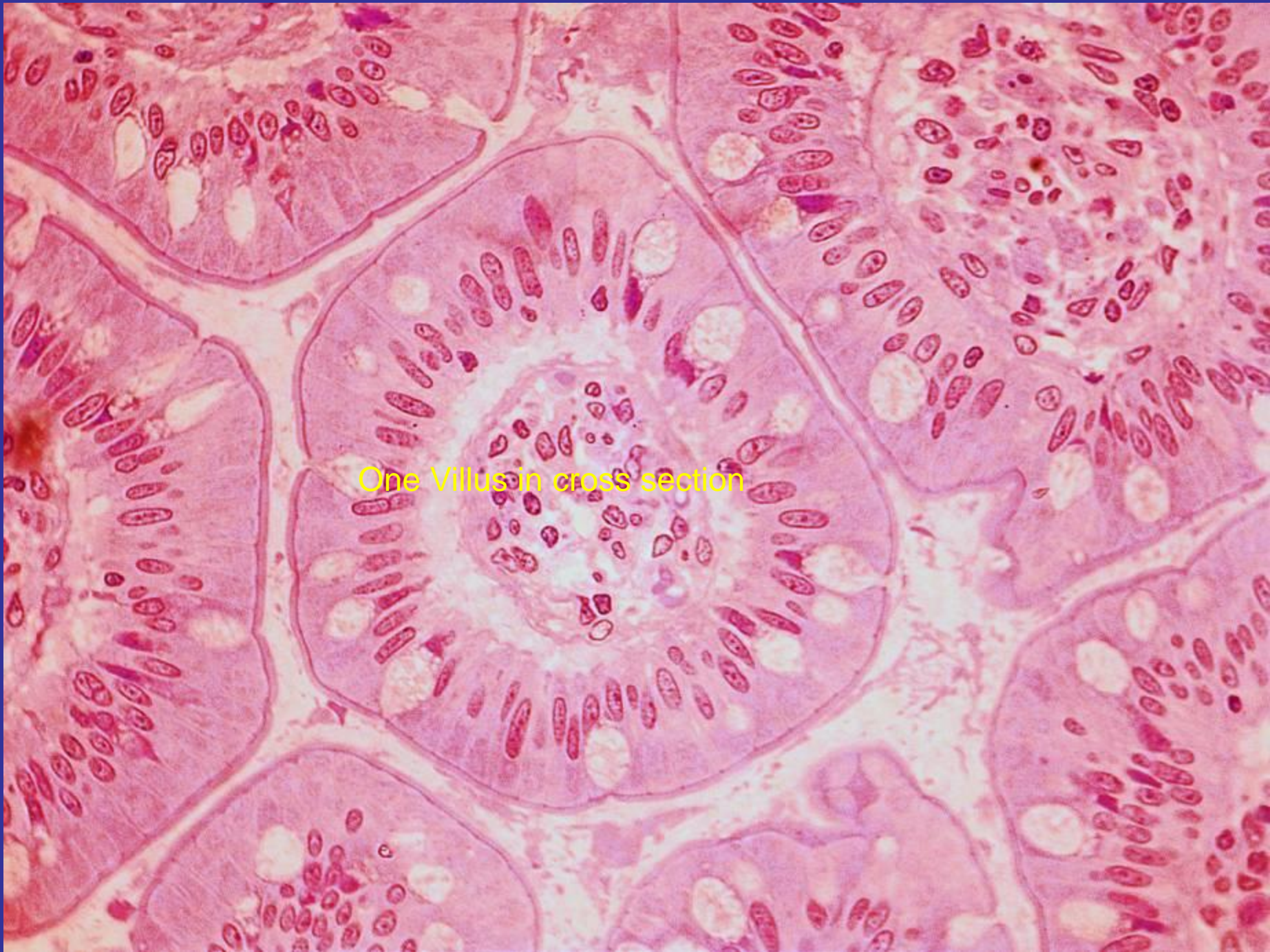
Serosa

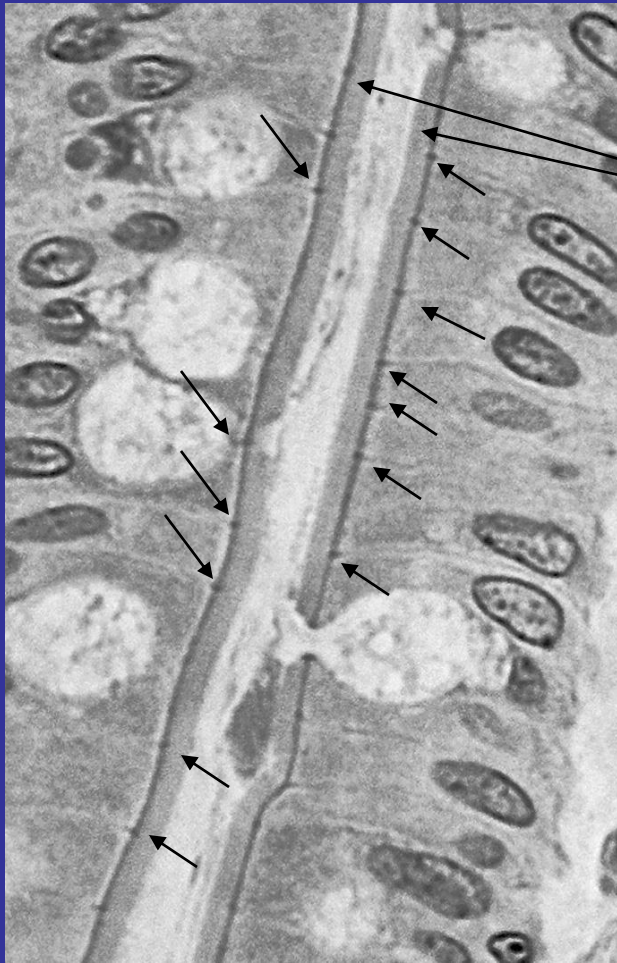
Inner Circular Muscle

Jejunum – between Duodenum and Ileum



One Villus in cross section

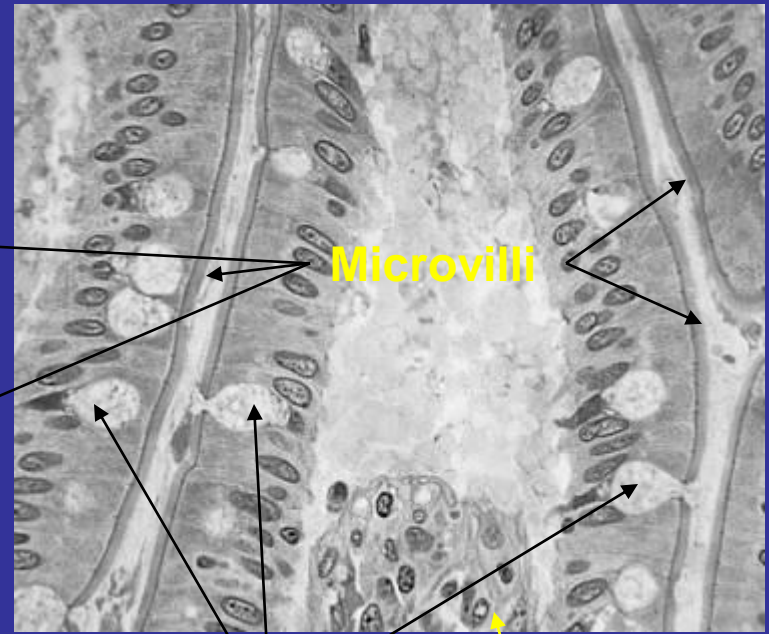




Arrows are junctional complexes (desmosomes, tight junc.) between columnar epithelial cells



One villus in cross section



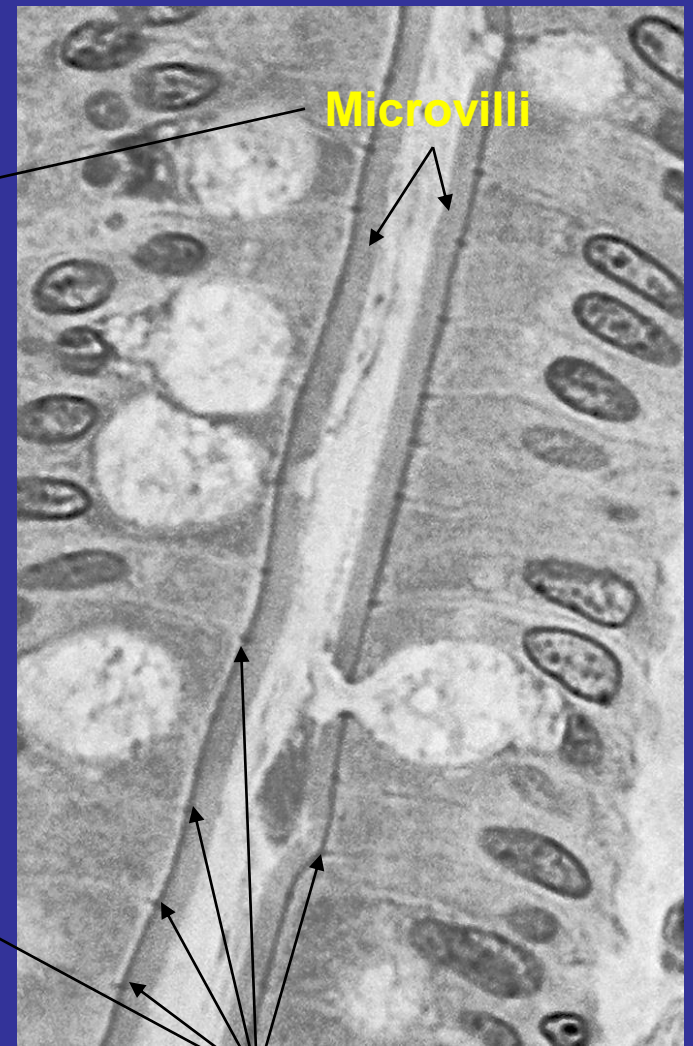
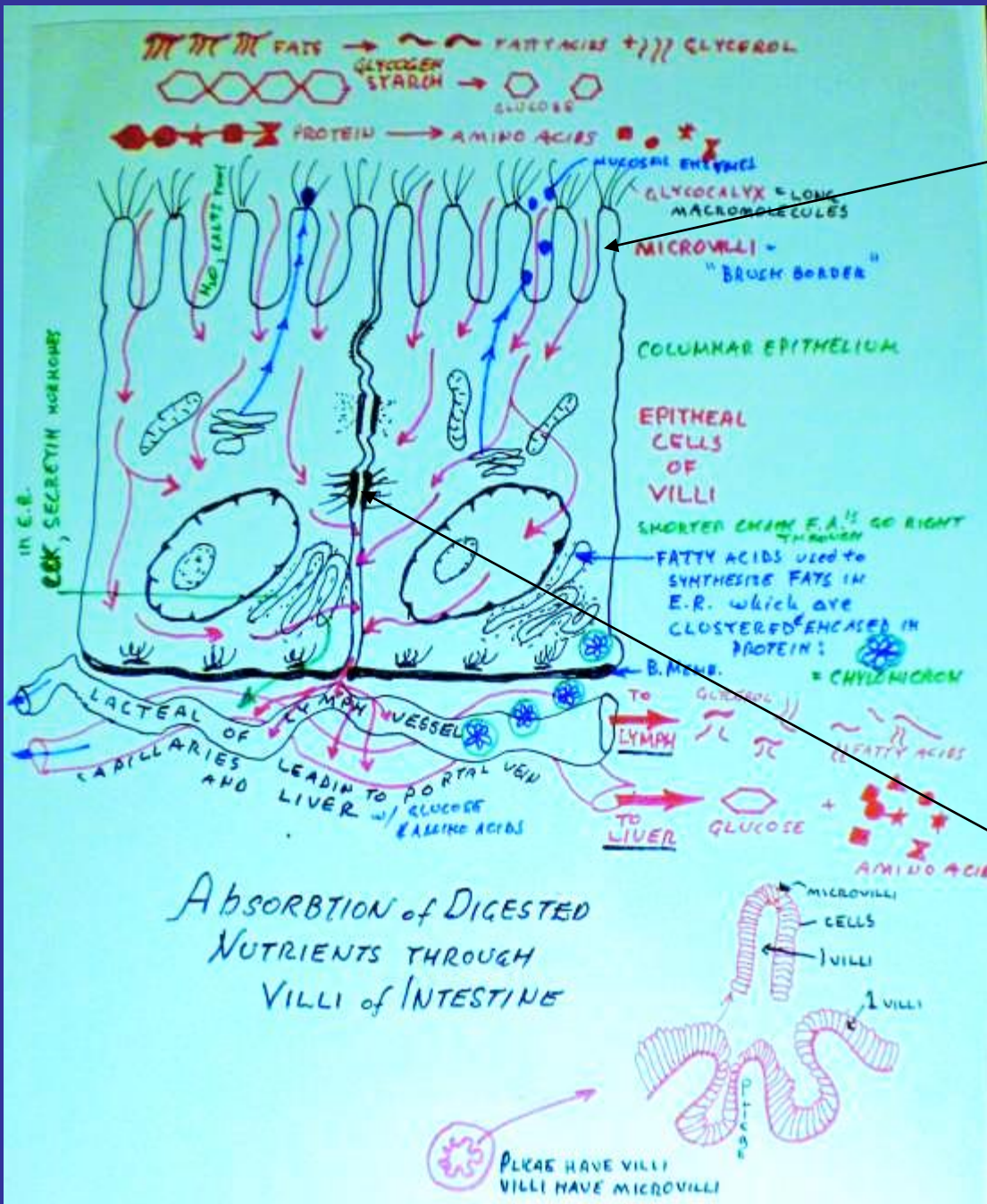
Microvilli

Mucous secreting Goblet Cells

Lacteal & Lamina propria

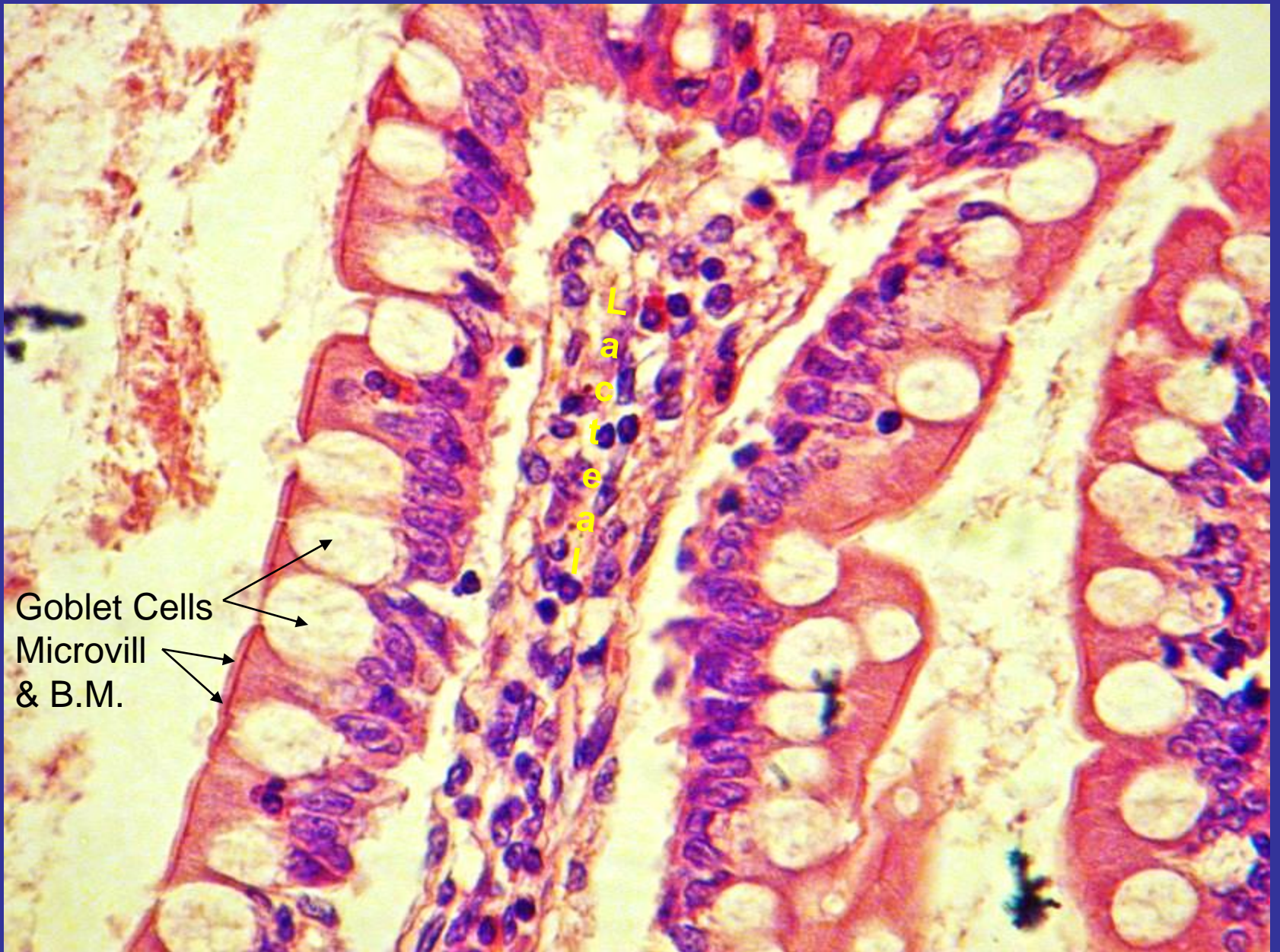
Microvilli of "Brush Border"

Columnar Epithelium



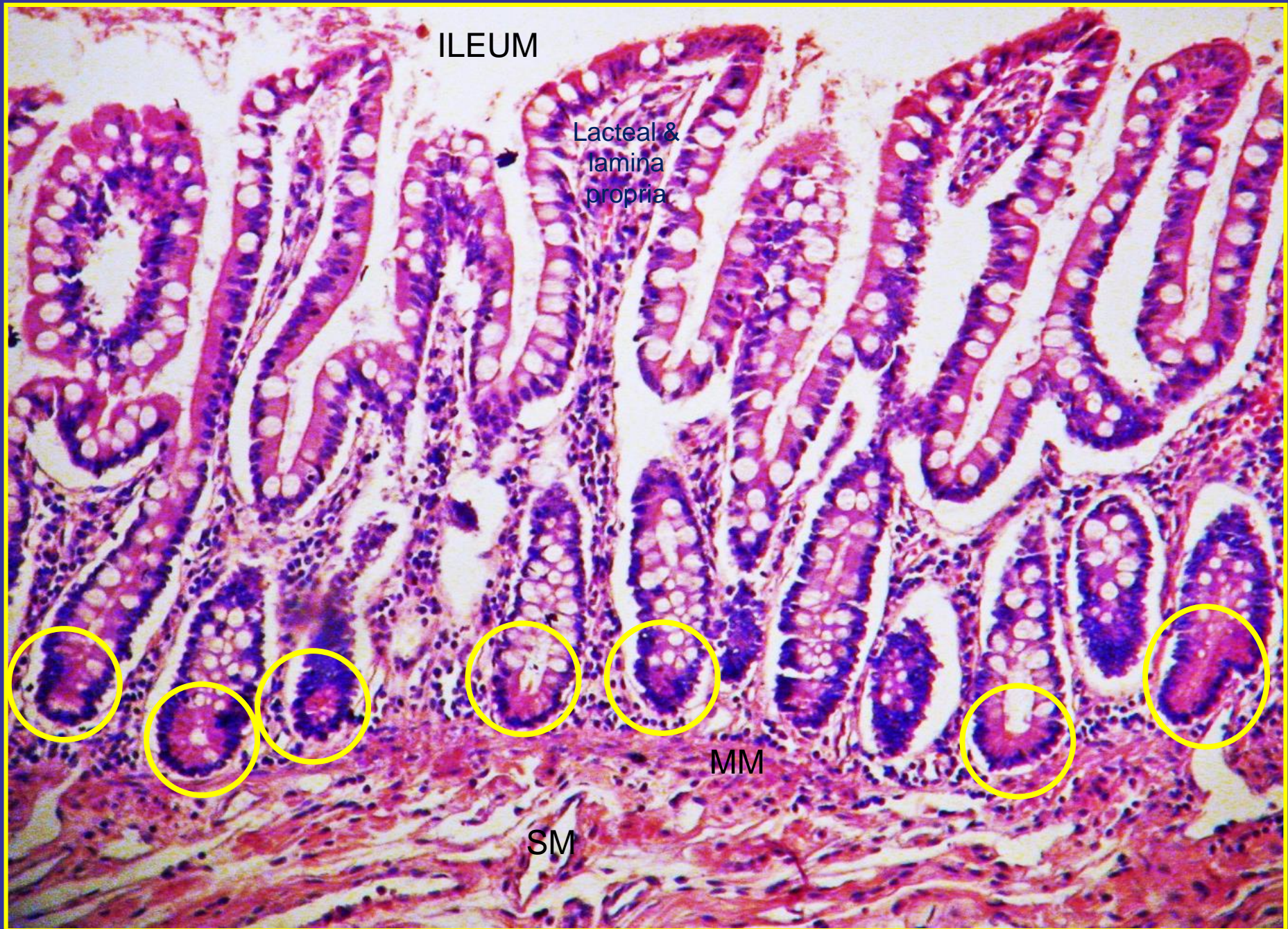
Microvilli

desmosomes

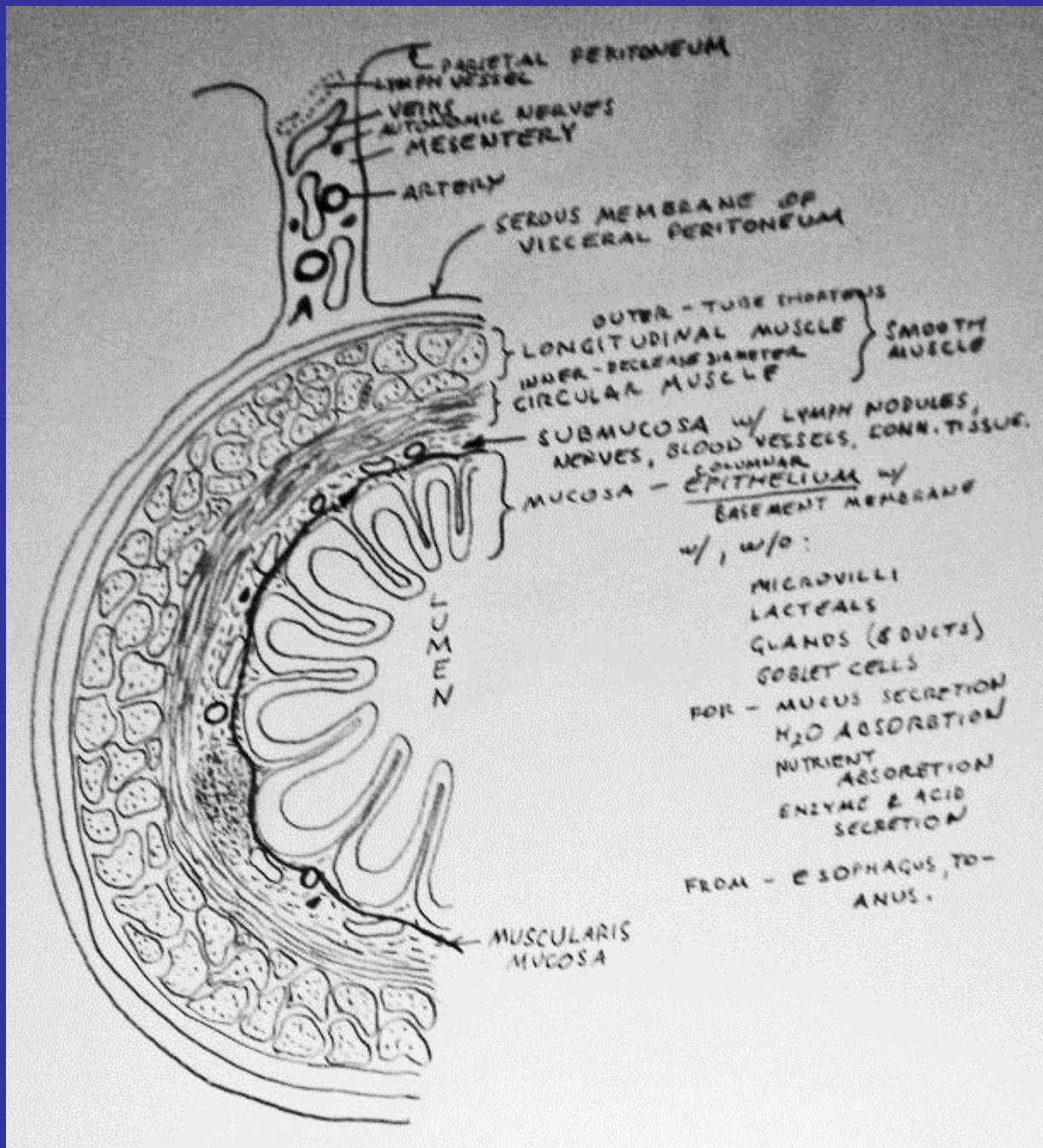


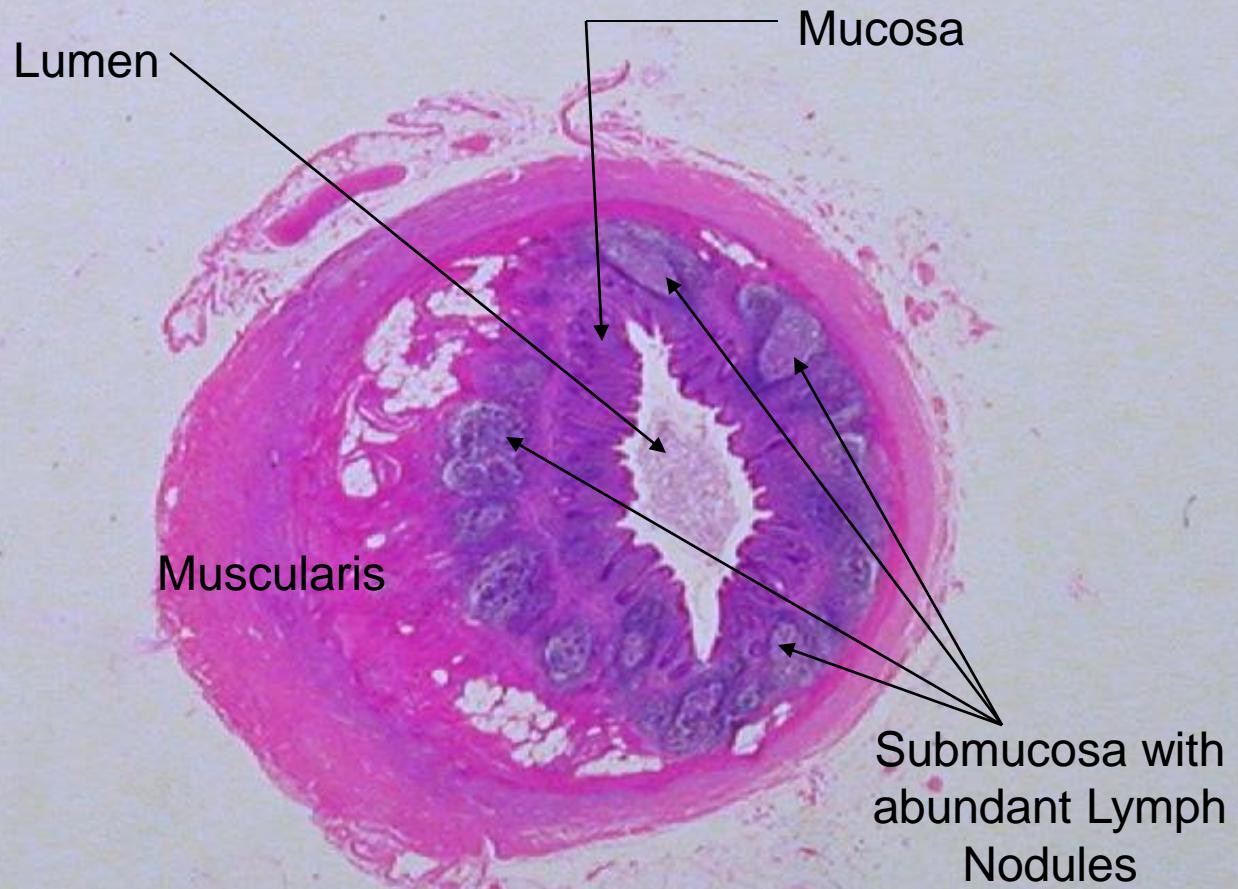
Goblet Cells
Microvill
& B.M.

L
a
c
t
e
a
l

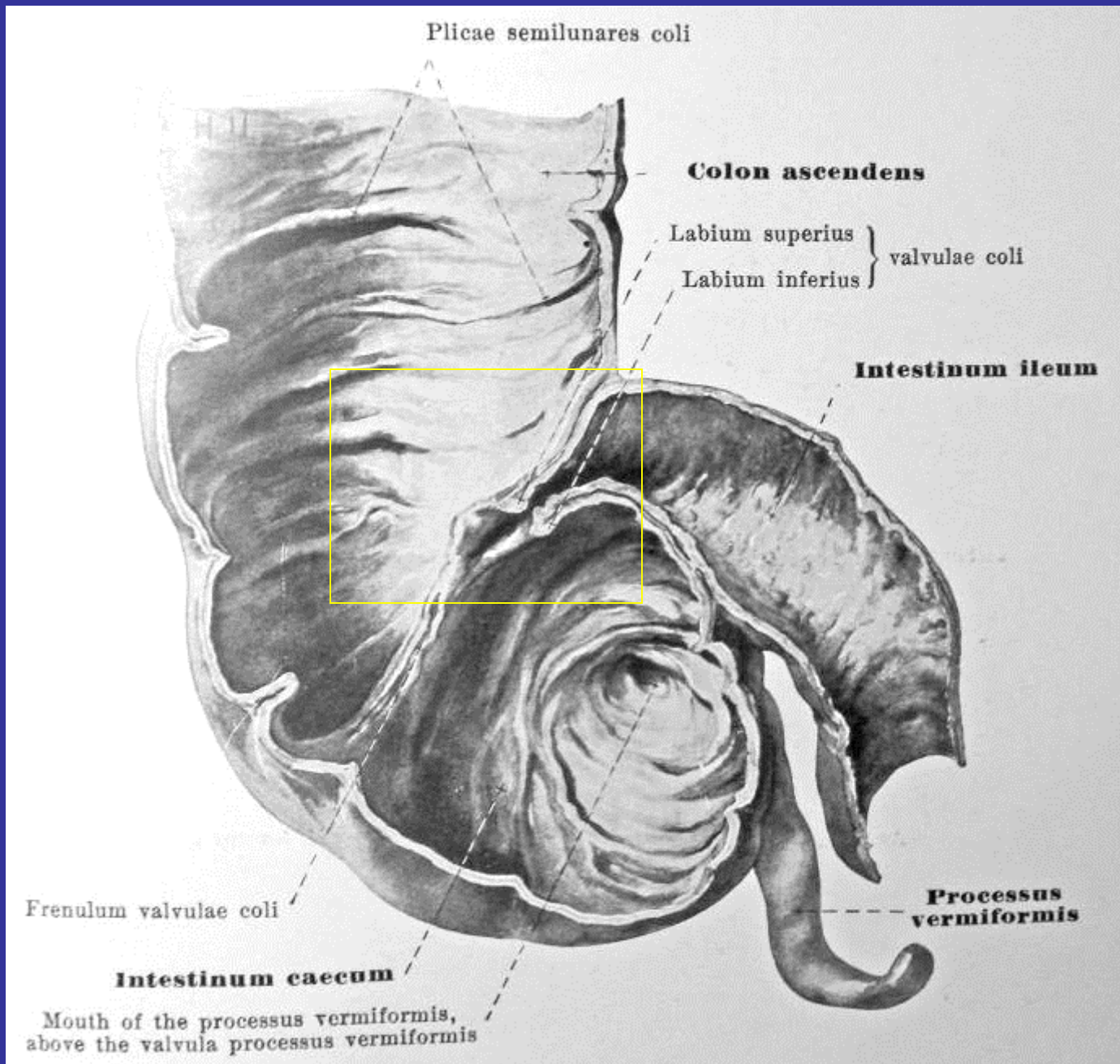


@ bottom of crypts/glands = eosinophilic 'Paneth Cells': antibacterial lysozymes





Appendix



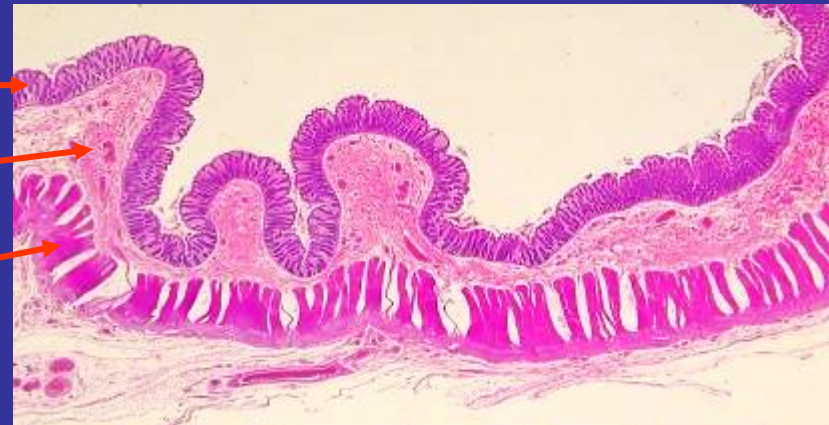


Simple tubular glands
of mucous secreting
cells of mucosa of
Colon

Muscularis Mucosa

Lymph nodule

Mucosa →
Submucosa →
Circular smooth muscle →

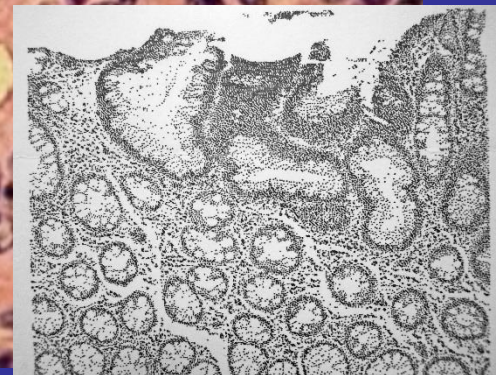
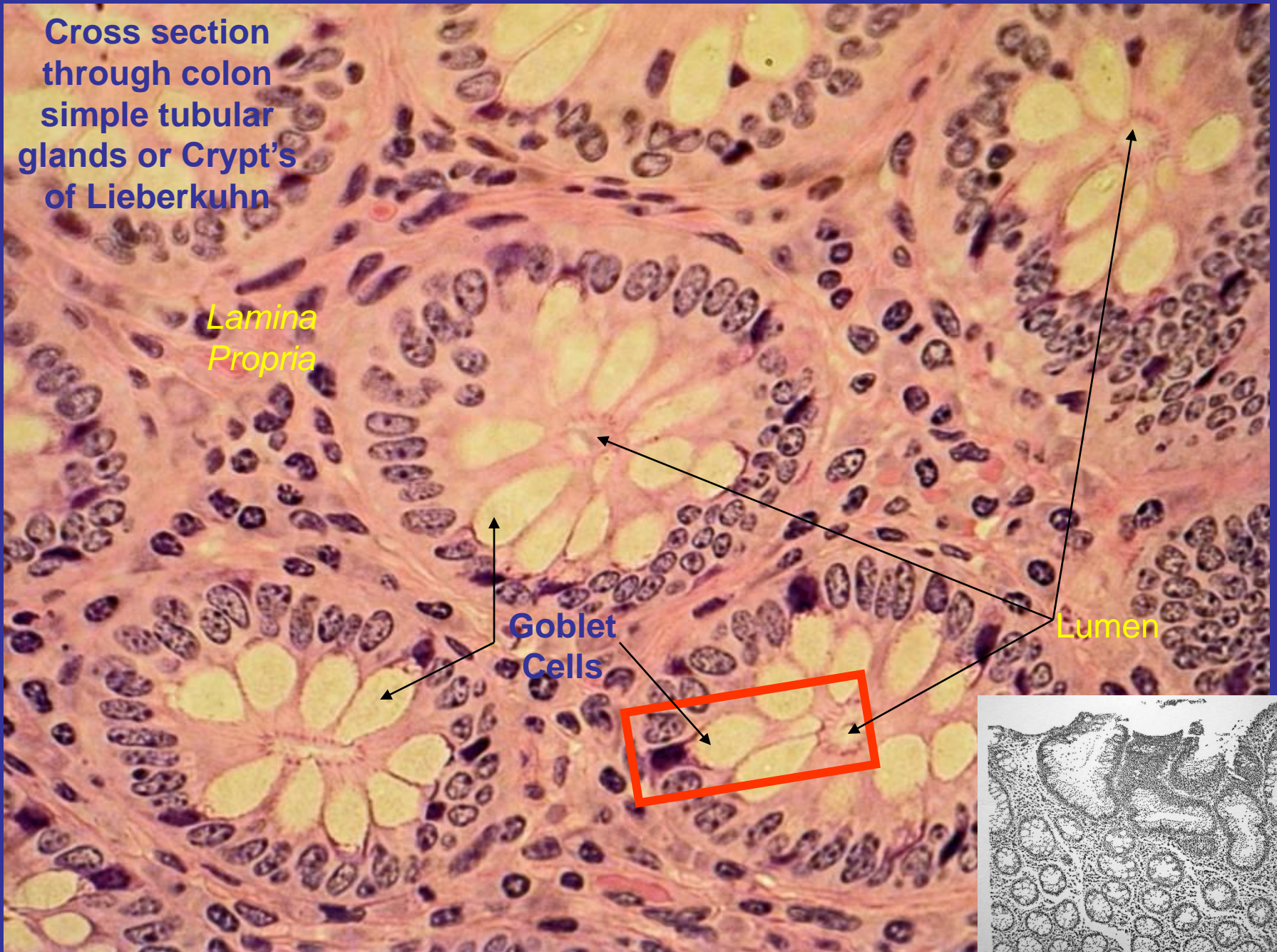


Cross section through colon simple tubular glands or Crypt's of Lieberkuhn

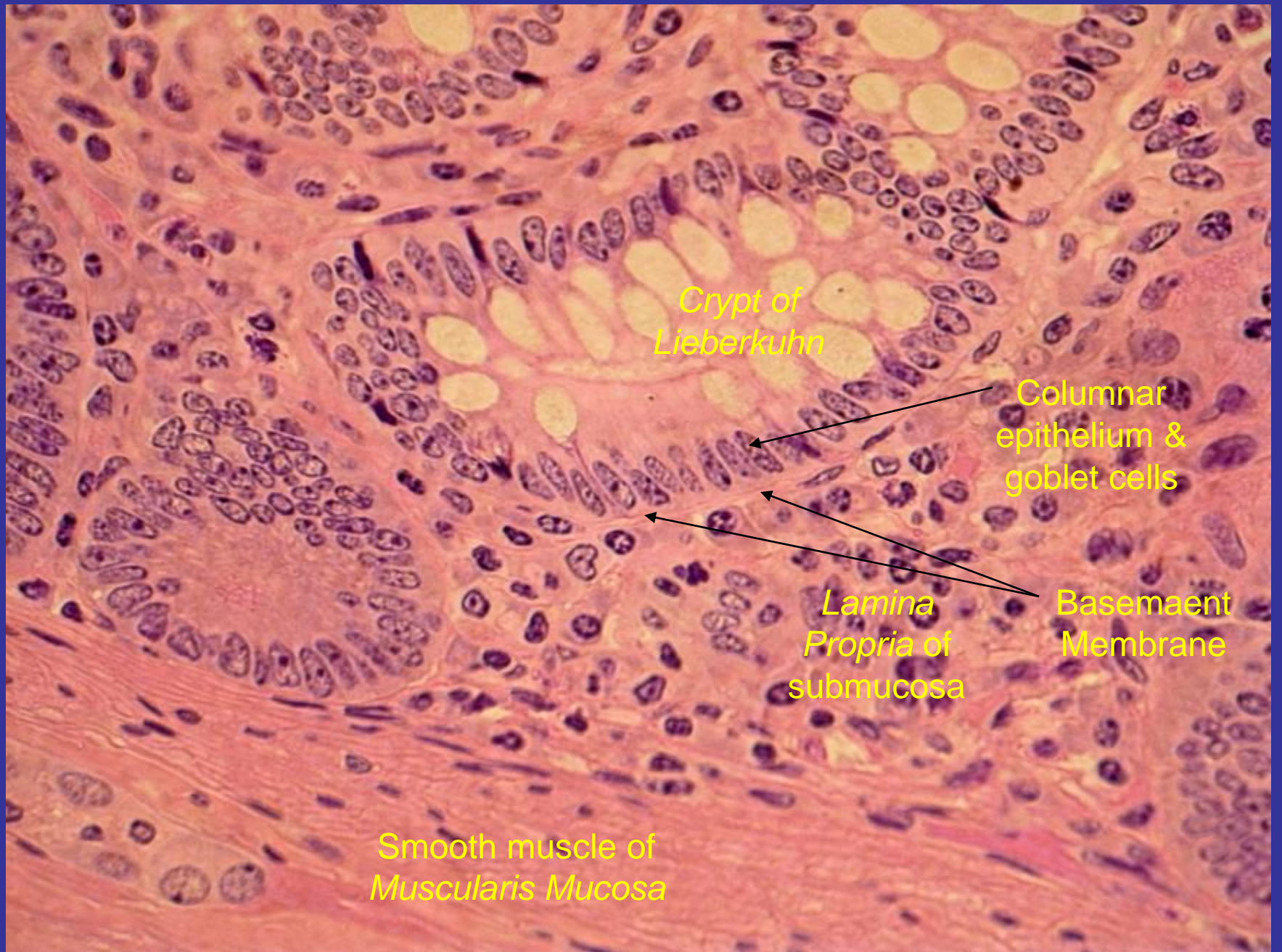
Lamina Propria

Goblet Cells

Lumen



DS11-140511 - A Tubular adenoma



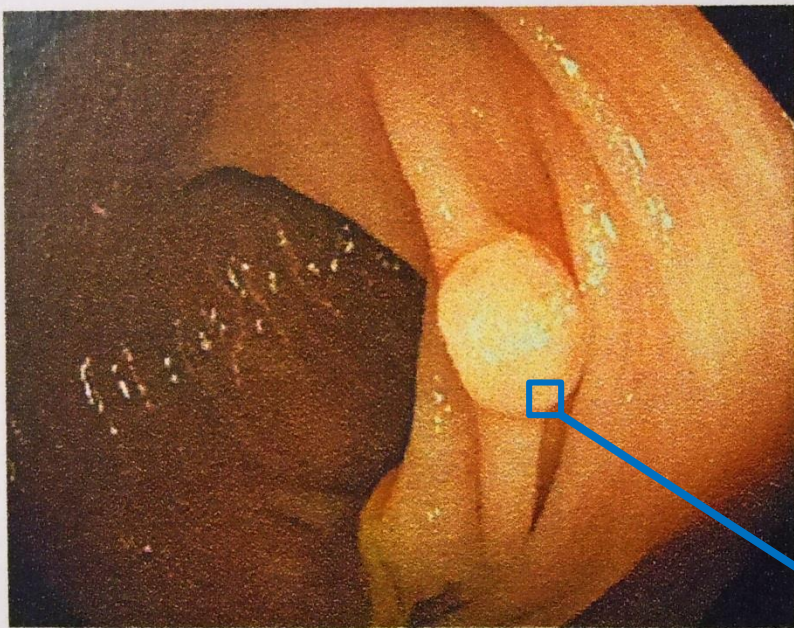
Crypt of
Lieberkuhn

Columnar
epithelium &
goblet cells

Lamina
Propria of
submucosa

Basement
Membrane

Smooth muscle of
Muscularis Mucosa



2 Colon, Transverse Colon:
Single Polyp



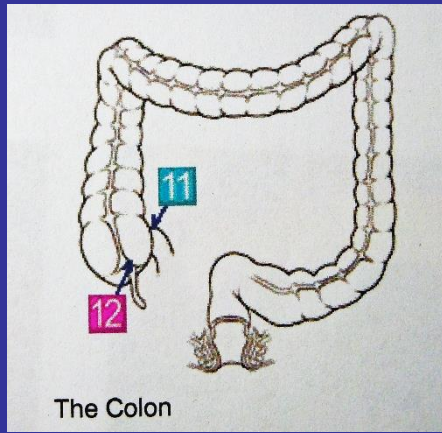
1 Colon, Transverse Colon:
Single Polyp

Adenomatous (pre-cancerous) polyp:
note tubular glands of polyp surface
are microscopically identical to
normal colon mucosa and the crypts
of Lieberkuhn.

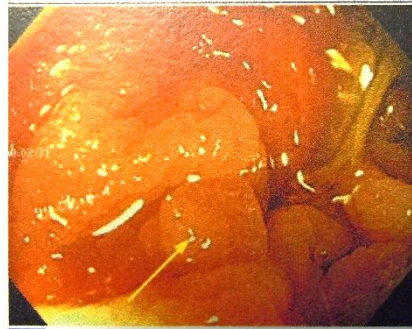


DS11-140511 - A

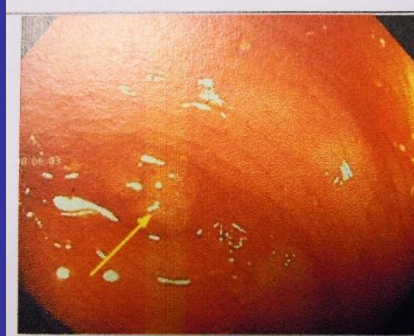
Tubular adenoma



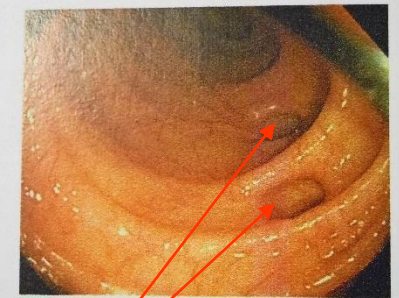
The Colon



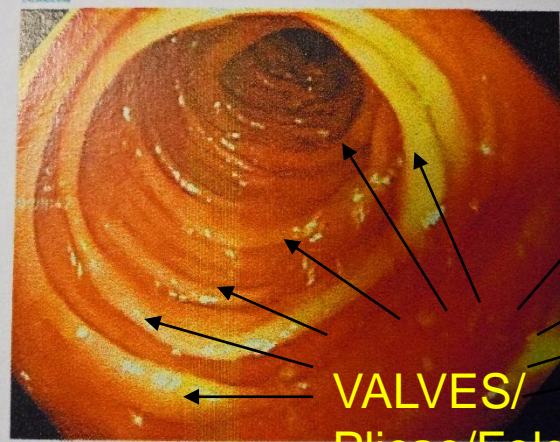
3 Colon, Ascending Colon: Multiple Polyps



4 Colon, Ascending Colon: Multiple Polyps

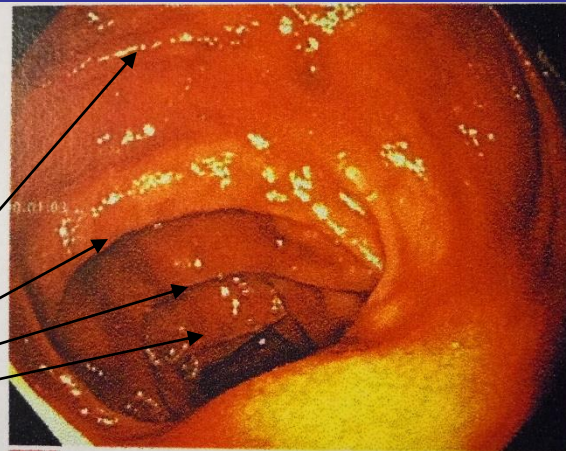


8 Colon, Sigmoid Colon, Descending Colon, Transverse Colon, Ascending Colon: Diverticulum

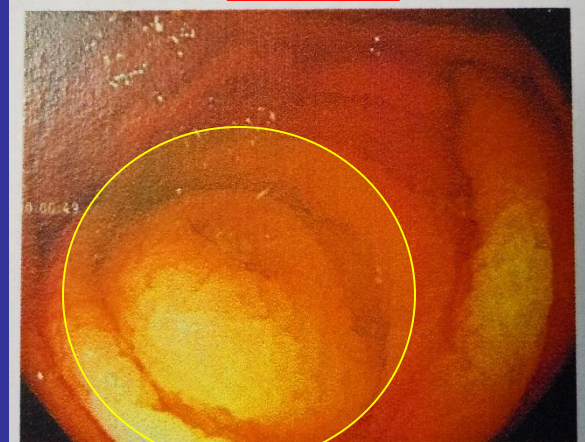


15

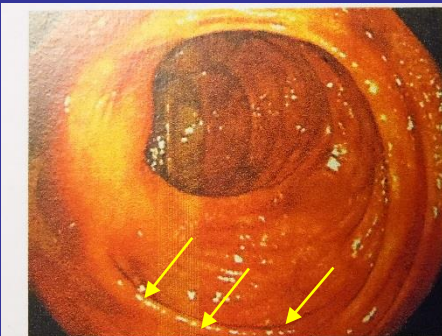
VALVES/
Plicae/Folds



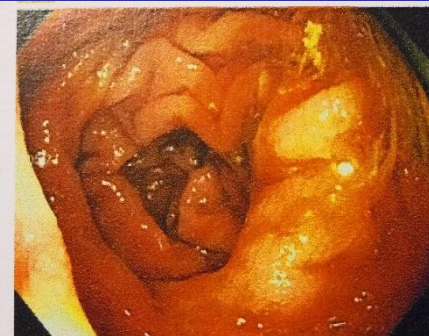
13



12 Appendix



11 Ileo-cecal Valve From Caecum



14

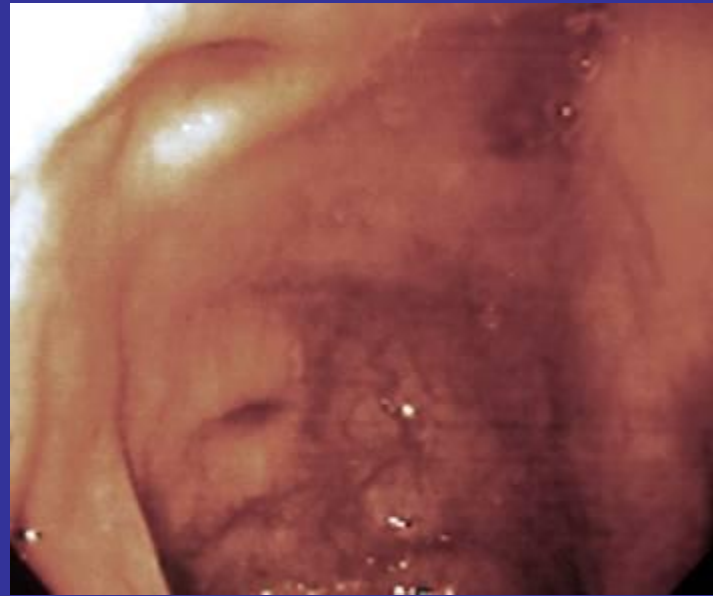
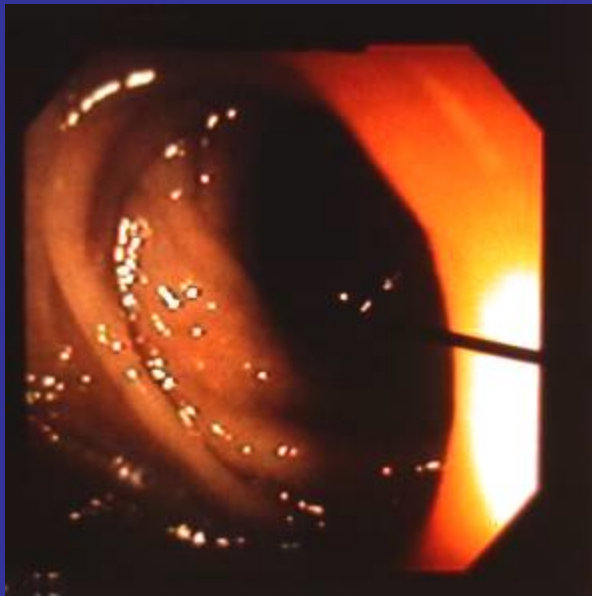


16 Colon: Hemorrhoids

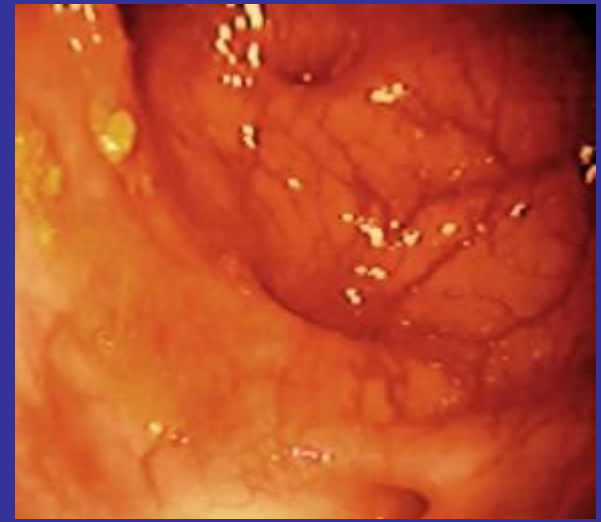
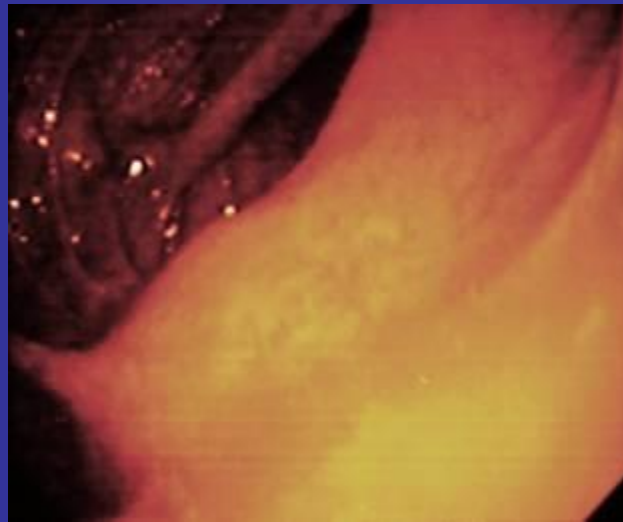


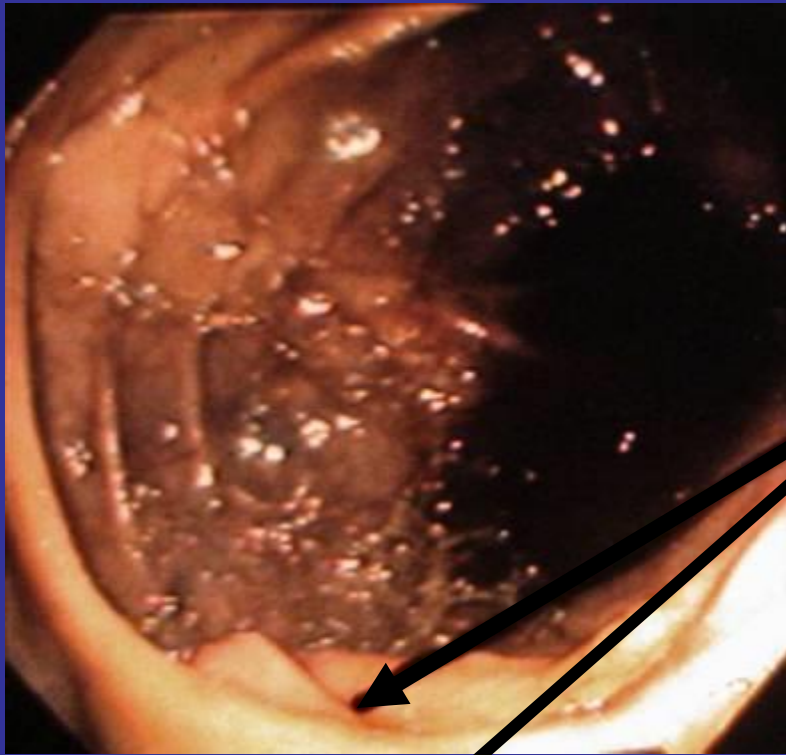
7 Colon, Sigmoid Colon: Evidence of previous surgery

colonoscopy



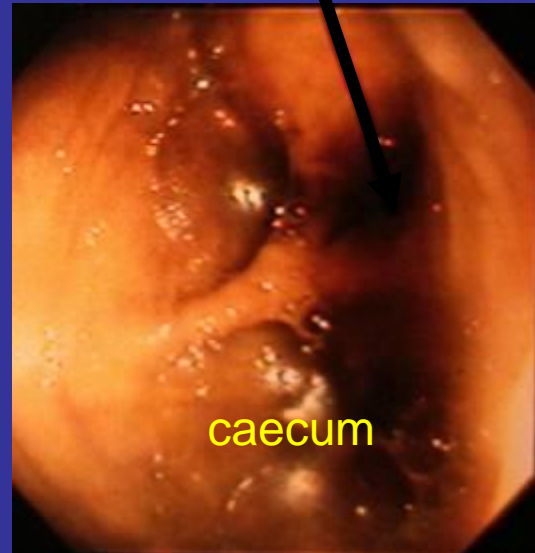
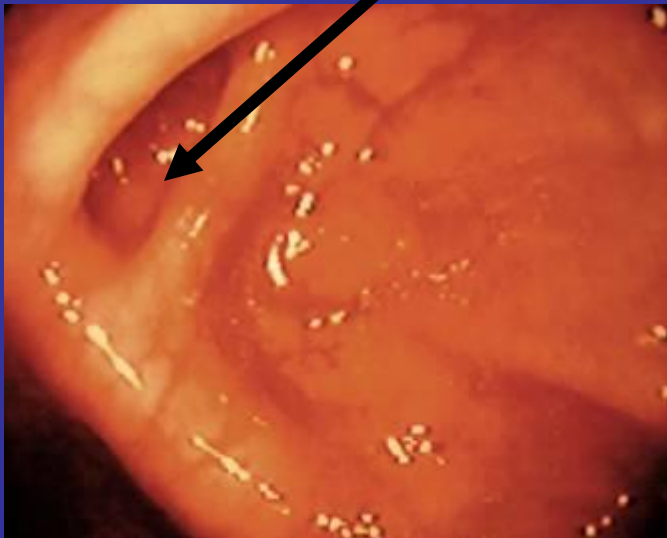
Colon: Colonoscopy





Ileo-cecal valve

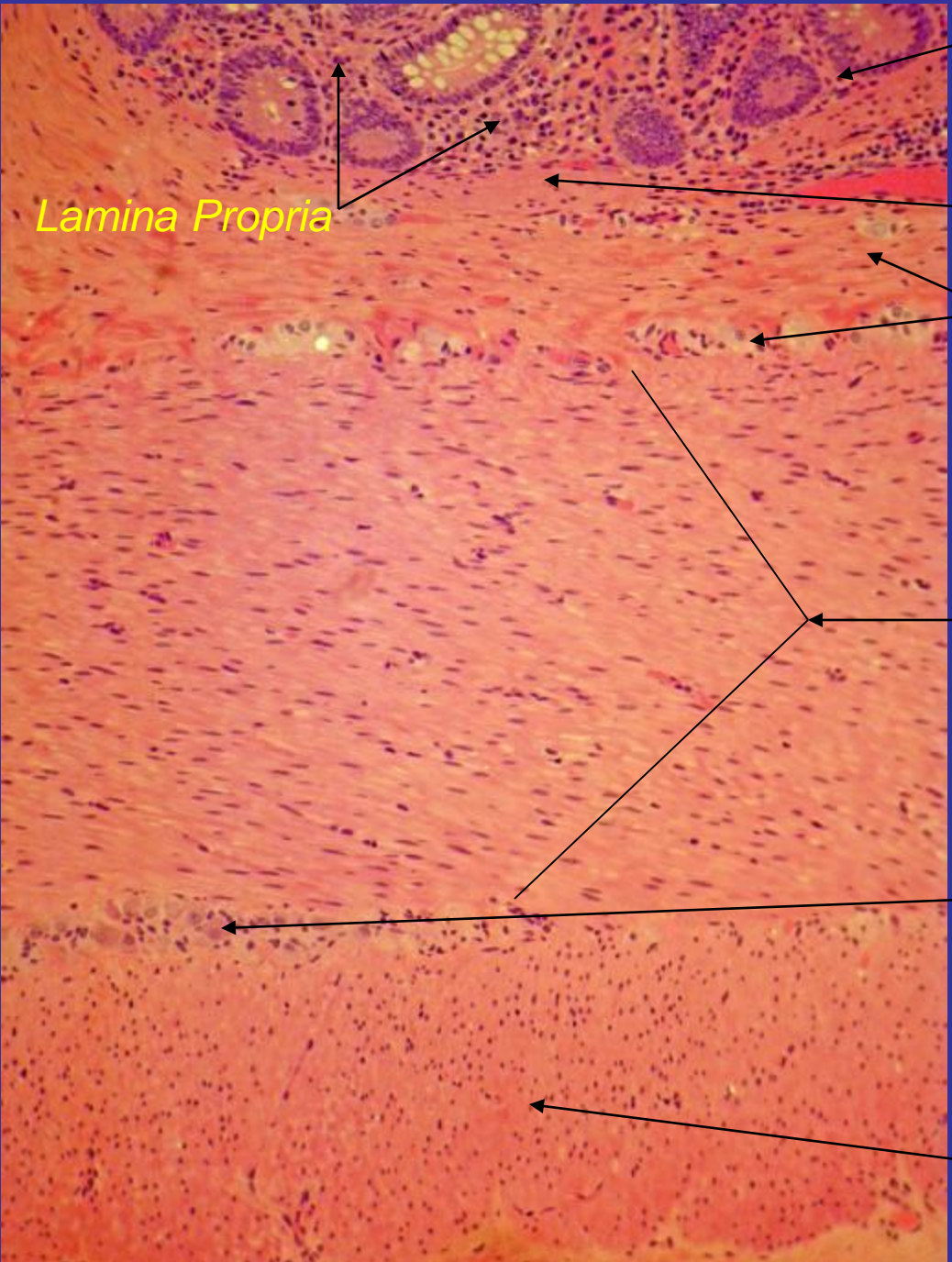
appendix



caecum

Rectum





Lamina Propria

Mucosa with simple glands that absorb water & produce mucous for easy passage

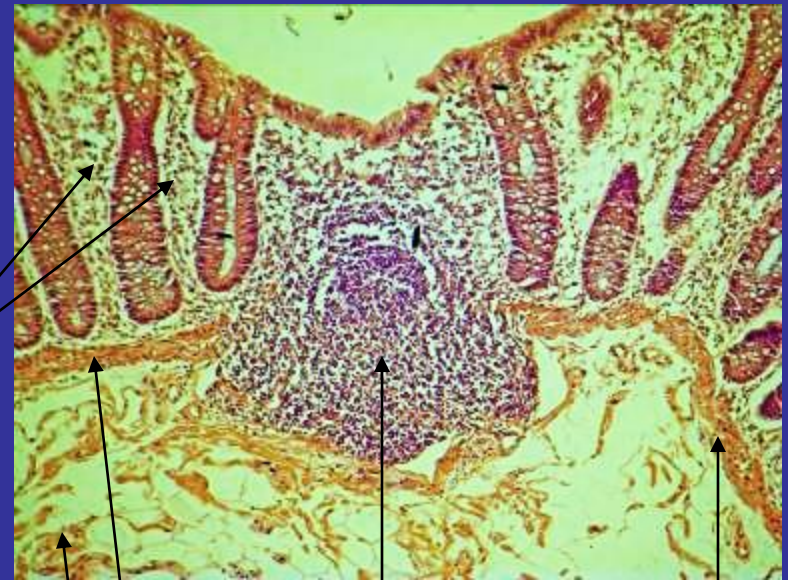
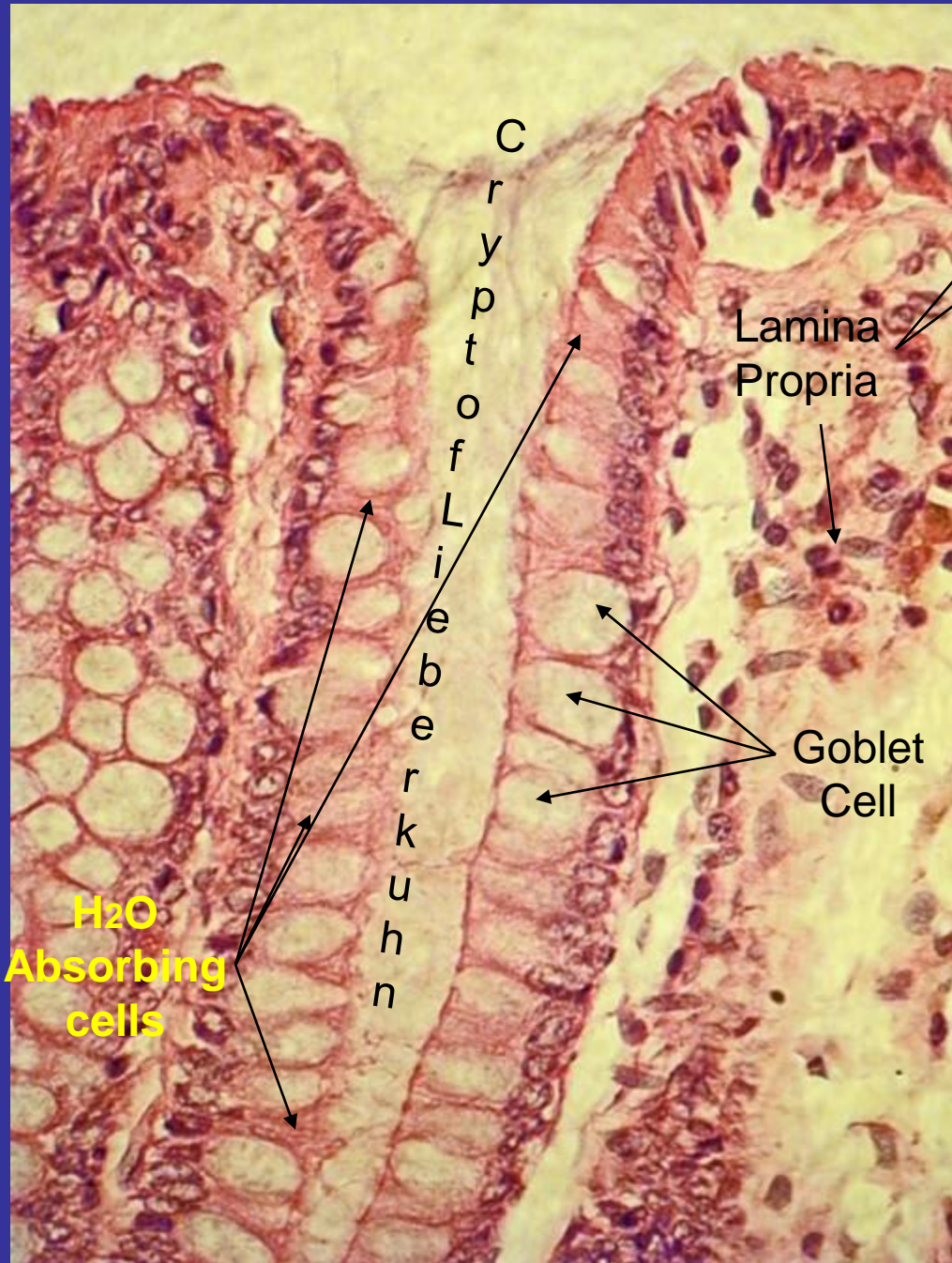
Muscularis Mucosa

Submucosa w/ Blood Vessels and some nerves

Large Layer of Circular Muscle: Inner Muscularis

Nerves & ganglionic cells

Intermittent Band of Longitudinal Muscle – outer Muscularis



Many lymph nodules =
Peyer's Patches

*Muscularis
Mucosa*

Connective Tissue of
Submucosa



Adenomatous or Benign but precancerous Polyps

Colon Cancer is a major killer that is detected early by colonoscopic examination; it doesn't hurt except for the 'cleansing' before you get it!

