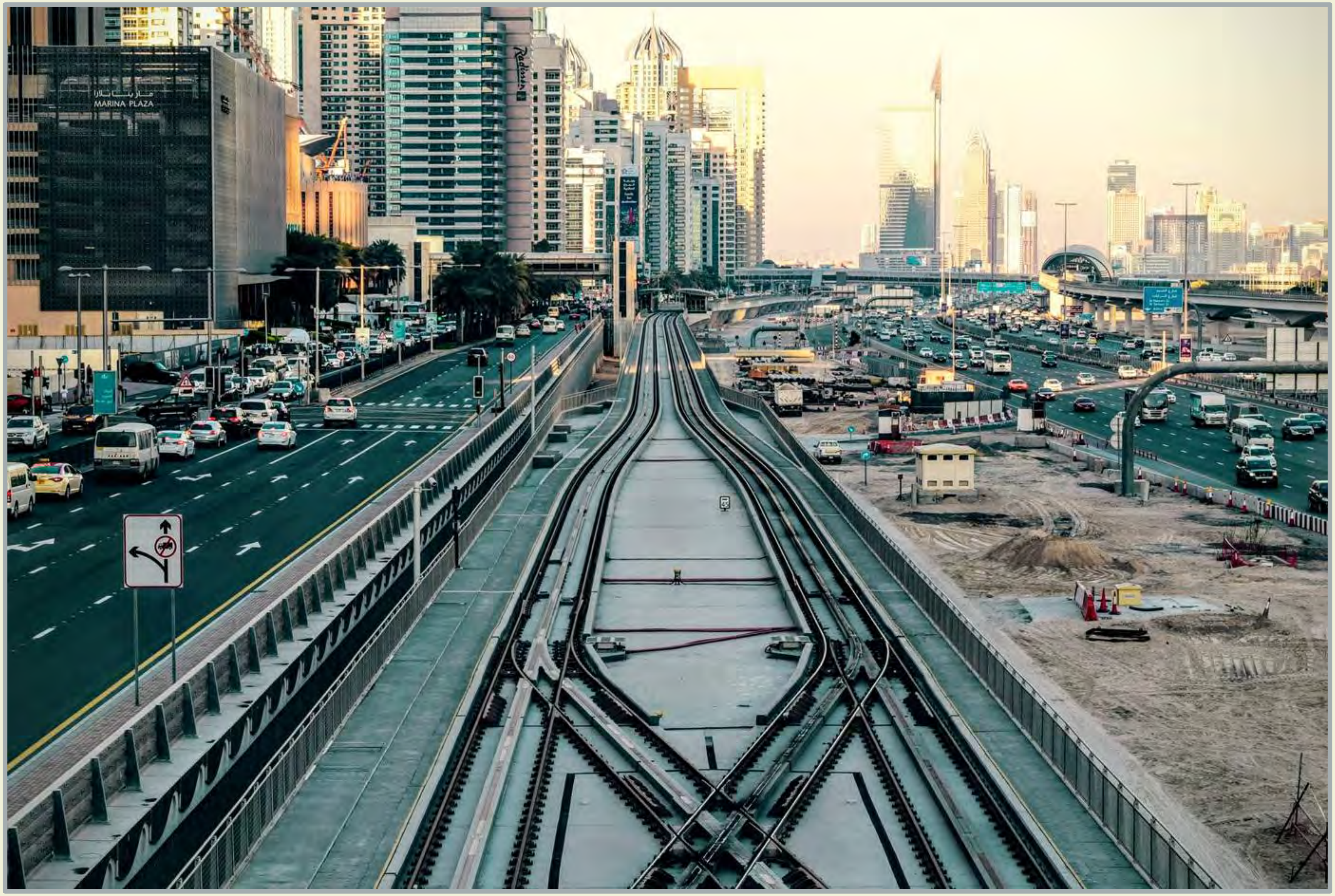
Absorption – Alimentary tract



http://schulelewis.blogspot.com/

5

Block 8

4 sessions

1. Mammary gland and nipple
2. Oral cavity
3. Alimentary canal
4. Glands (+gallbladder)

Image sources

- http://virtualmicroscopydatabase.org/
- http://audilab.bme.mcgill.ca/HA/
- https://openstax.org/books/anatomy-and-physiology/
- Own

Mammary gland and nipple

- Mammary gland – slide 57
- Nipple – slide 15

Questions are distributed throughout the presentation. Attempt to answer and annotate before going to the next slide. For answers, go down.

General structure of the Alimentary canal

General structure of the GIT

Use

- A Mind map

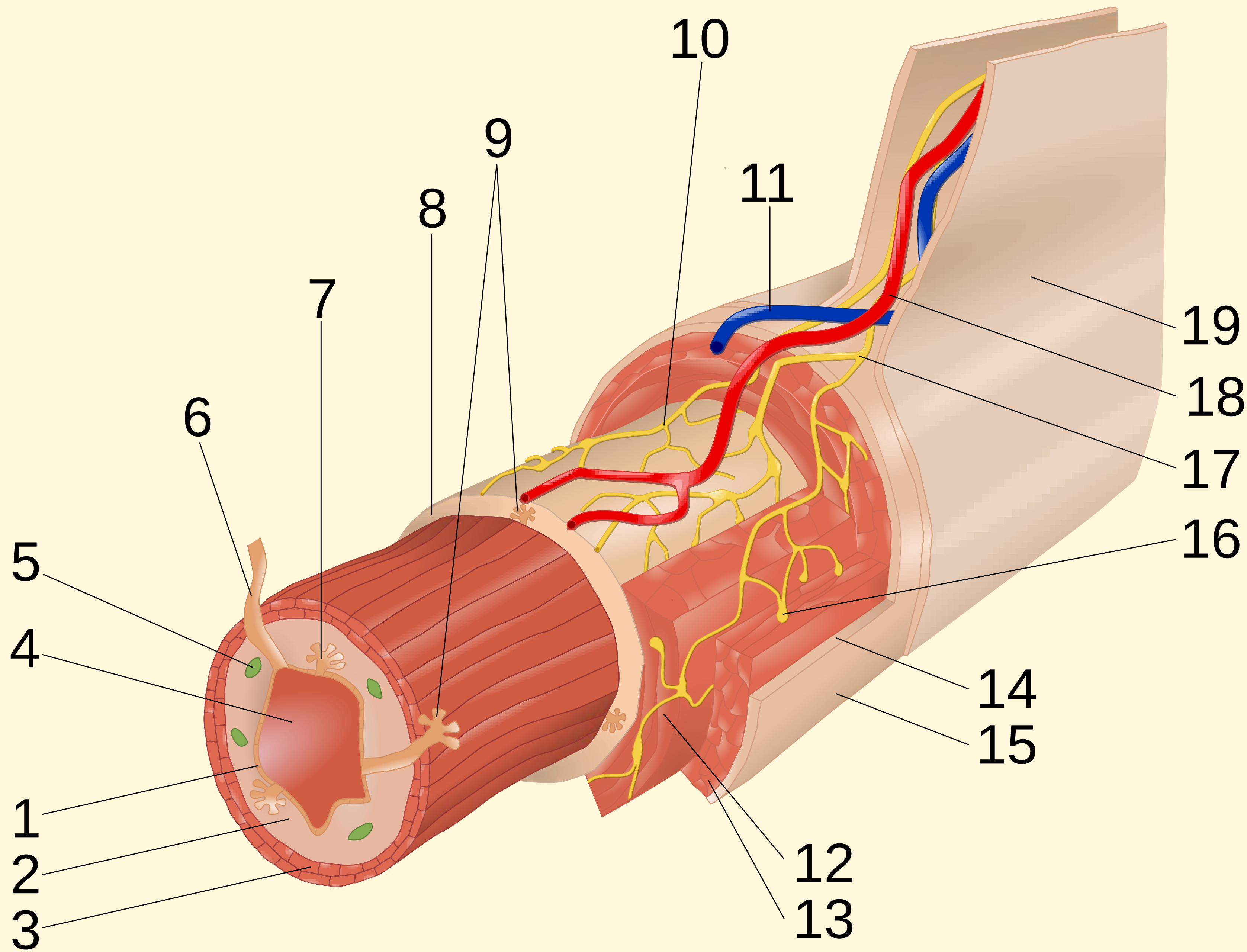
  OR

- A Concept map

  OR

- An annotated Drawing

To show the basic generalized structure of the digestive tract



1
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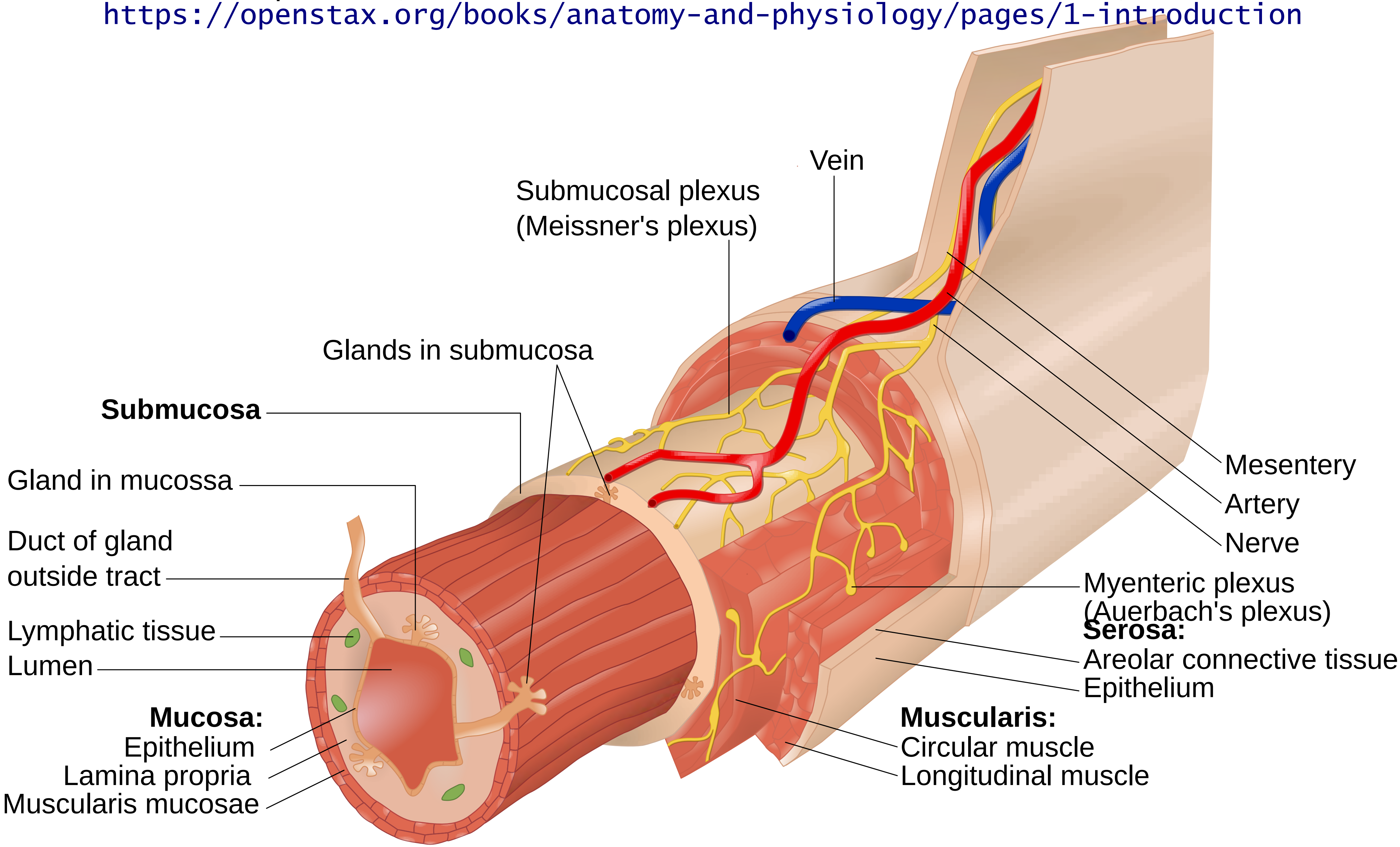
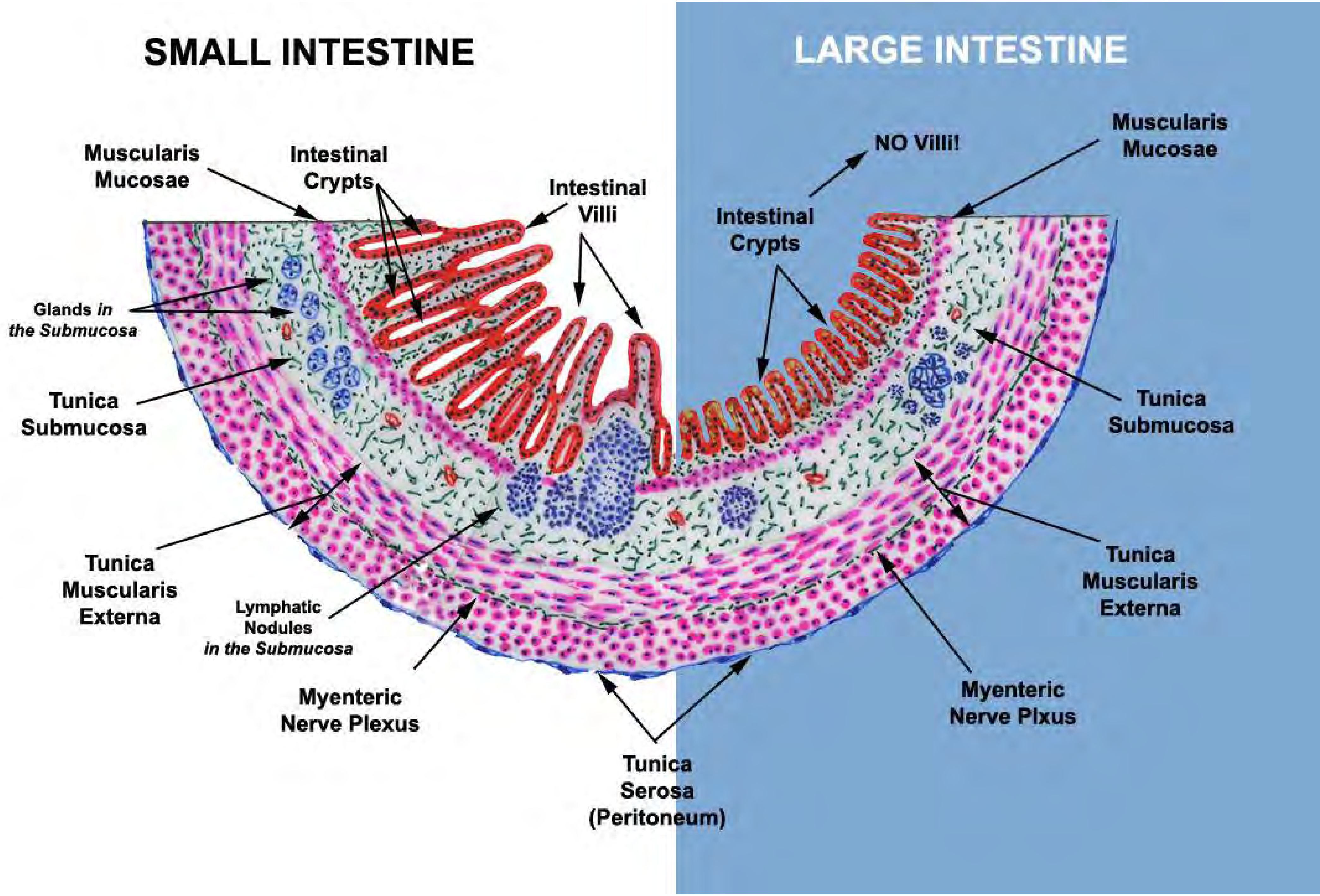
Figure 23.3 Layers of the Alimentary Canal; Anatomy and Physiology 25 April 2013; OpenStax; Creative Commons Attribution License 4.0; https://openstax.org/books/anatomy-and-physiology/pages/1-introduction




SMALL INTESTINE
LARGE INTESTINE
Muscularis Mucosae
Intestinal Crypts
Intestinal Villi
Glands in the Submucosa
Tunica Submucosa
Tunica Muscularis Externa
Lymphatic Nodules in the Submucosa
Myenteric Nerve Plexus
Tunica Serosa (Peritoneum)
NO Villi!
Muscularis Mucosae
Intestinal Crypts
Tunica Submucosa
Tunica Muscularis Externa
Myenteric Nerve Plxus

General structure

- Mucosa (Mucous Membrane)
- Submucosa
- Muscularis Externa
- Adventitia or Serosa

General structure

- Mucosa (Mucous Membrane)
- Submucosa
- Muscularis Externa
- Adventitia or Serosa
  - Adventitia = loose connective tissue with dispersed collagen and elastic fibers (retroperitoneal organs, e.g. ascending colon)
  - Serosa = same as adventitia but covered by a visceral peritoneum (intraperitoneal, e.g. stomach)

General structure

- Mucosa (Mucous Membrane)
  - Lines the lumen of the digestive tract
  - Mucous membrane - epithelium, connective tissue, and a very thin layer of smooth muscle
  - Blood and lymphatics – absorb nutrients
  - Lymphatic nodules – pathogens.
- Submucosa
- Muscularis Externa
- Adventitia or Serosa

General structure

- Mucosa (Mucous Membrane)
- Submucosa
  - Connective tissue
  - Blood and lymphatics – receive absorbed food molecules
  - Lymphatic tissue
  - Nerve plexus – regulate movements and secretions
  - Esophagus & duodenum – submucosa also has mucin-secreting glands
- Muscularis Externa
- Adventitia or Serosa

General structure

- Mucosa (Mucous Membrane)
- Submucosa
- Muscularis Externa
  - Skeletal muscle or smooth muscle
  - Mouth, pharynx & superior and middle parts of the esophagus, and anus contain skeletal muscle.
  - Lower part of oesophagus & rest of the GI tract contain 2 or 3 layers of smooth muscle.
  - Nerve plexus here that controls the frequency and strength of contraction of smooth muscle.
- Adventitia or Serosa

List 3 types of tissues

1. ____________ covers things
2. ____________ is the stuffing
3. ____________ does things

List 3 types of tissues

1. Epithelia covers things
2. Connective tissue is the stuffing
3. Specialised CT does things

List the 7 functions of the Digestive Track.

The digestive track has 7 main functions. Give an area where each of the functions take place.

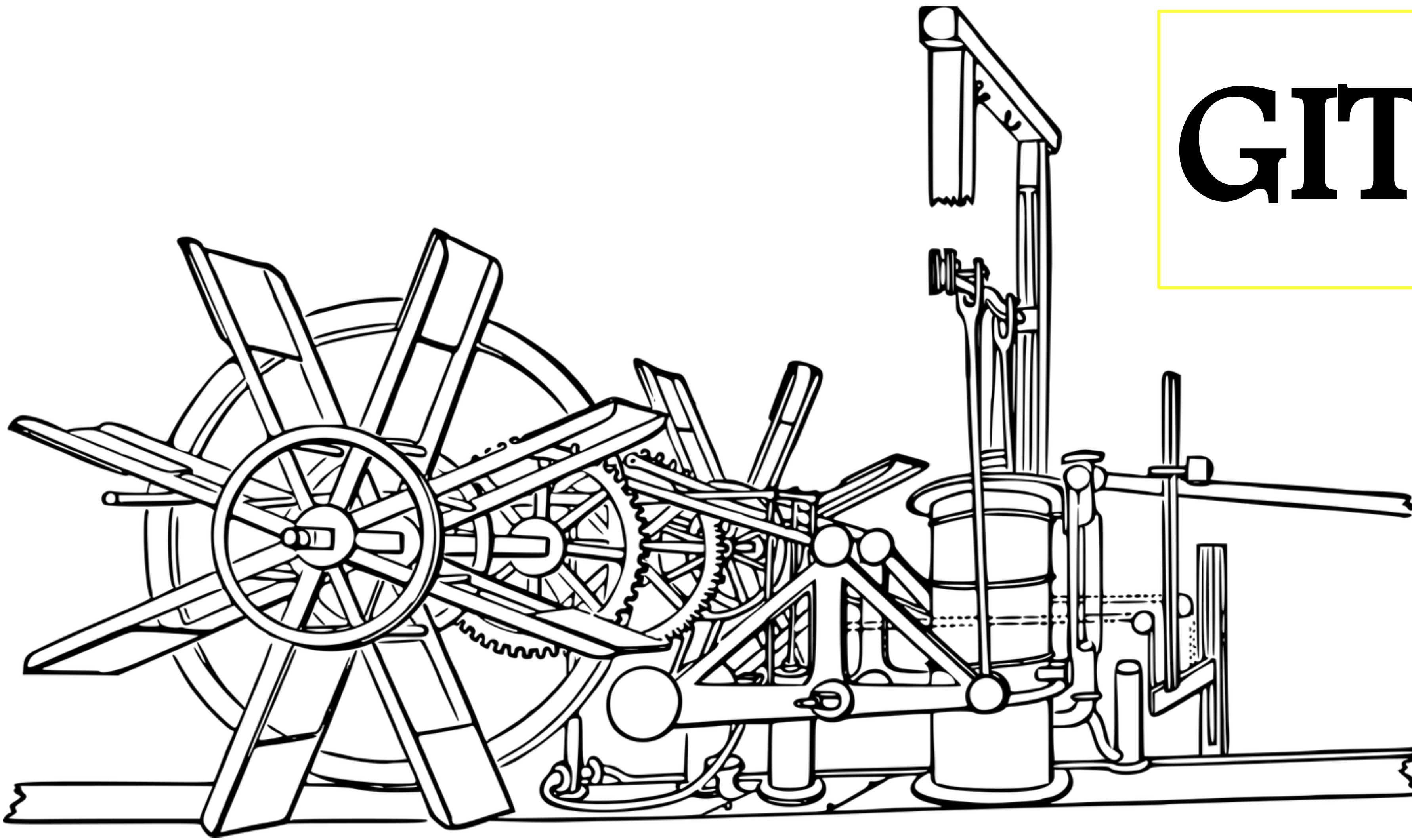
Ingestion

Mechanical digestion

Mouth

Stomach

Propulsion



GIT

Secretion

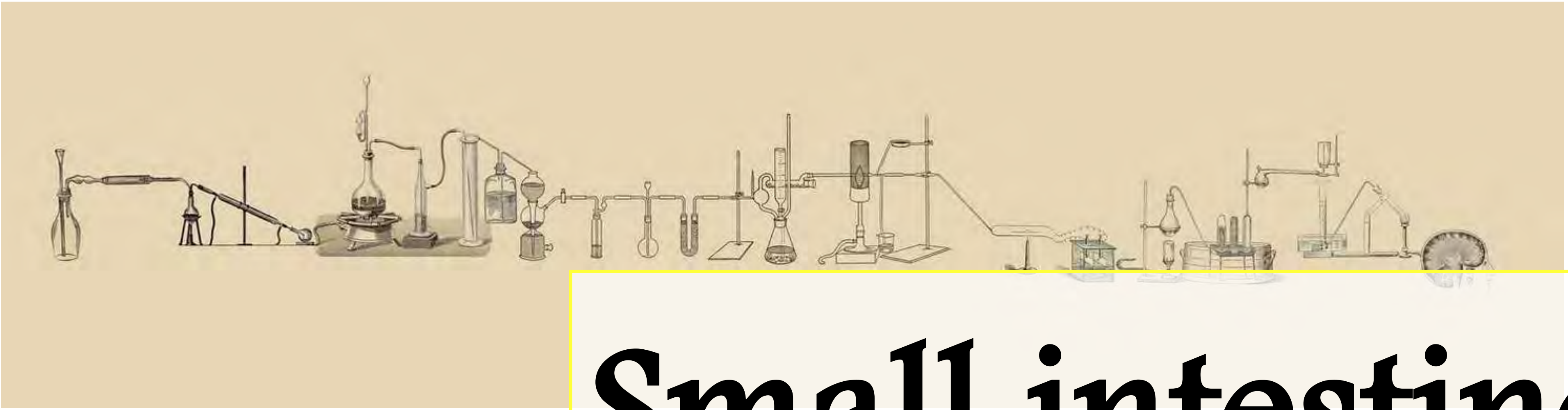
Chemical digestion

Mouth

Stomach

Small intestine

Absorption



Small intestine

Colon

Excretion

Functions of the GIT

- Ingestion
- Mechanical Digestion
- Propulsion (motility)
- Secretion
- Chemical Digestion
- Absorption
- Excretion

Functions of the GIT

- Ingestion
- Mechanical Digestion – muscle & nerves
- Propulsion (motility) – muscle & nerves
- Secretion – glands & blood vessels
- Chemical Digestion – epithelium & glands
- Absorption – epithelium & blood vessels
- Excretion – muscle & nerves

Missing function?

Can you add 2 more functions to the previous list?

Protection

Via Lymphatics

http://schulelewis.blogspot.com/

35

Hormonal

Enteroendocrine cells spread throughout the digestive system.

Stomach to Anus

Transitions

Keep in mind the various transitions that takes place throughout the alimentary canal. Where transitions takes place, functional considerations are at the root of pathology in many cases.

List the epithelium of all the parts of the gastrointestinal tract.

Stratified squamous keratinized
Stratified squamous
Simple columnar

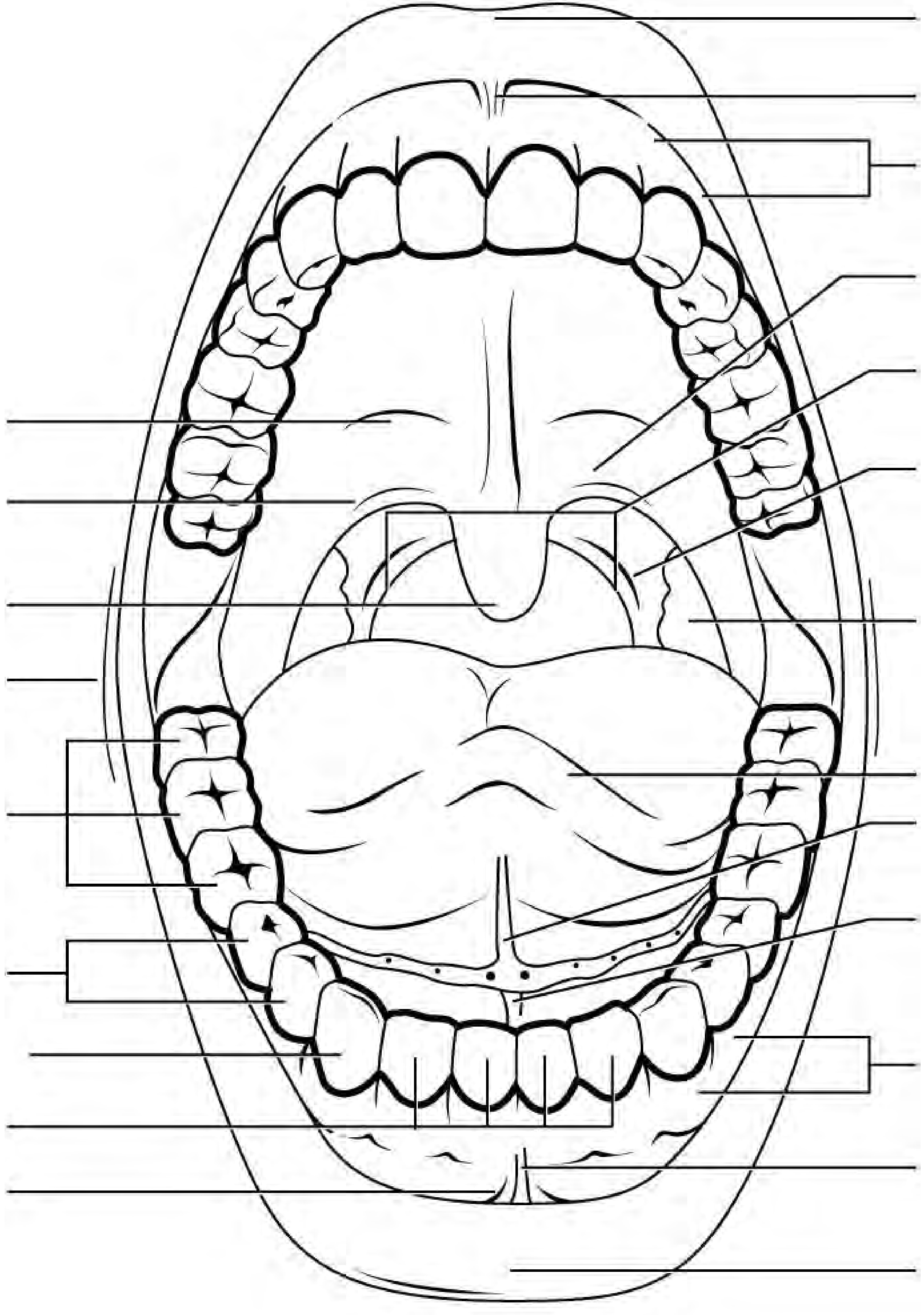
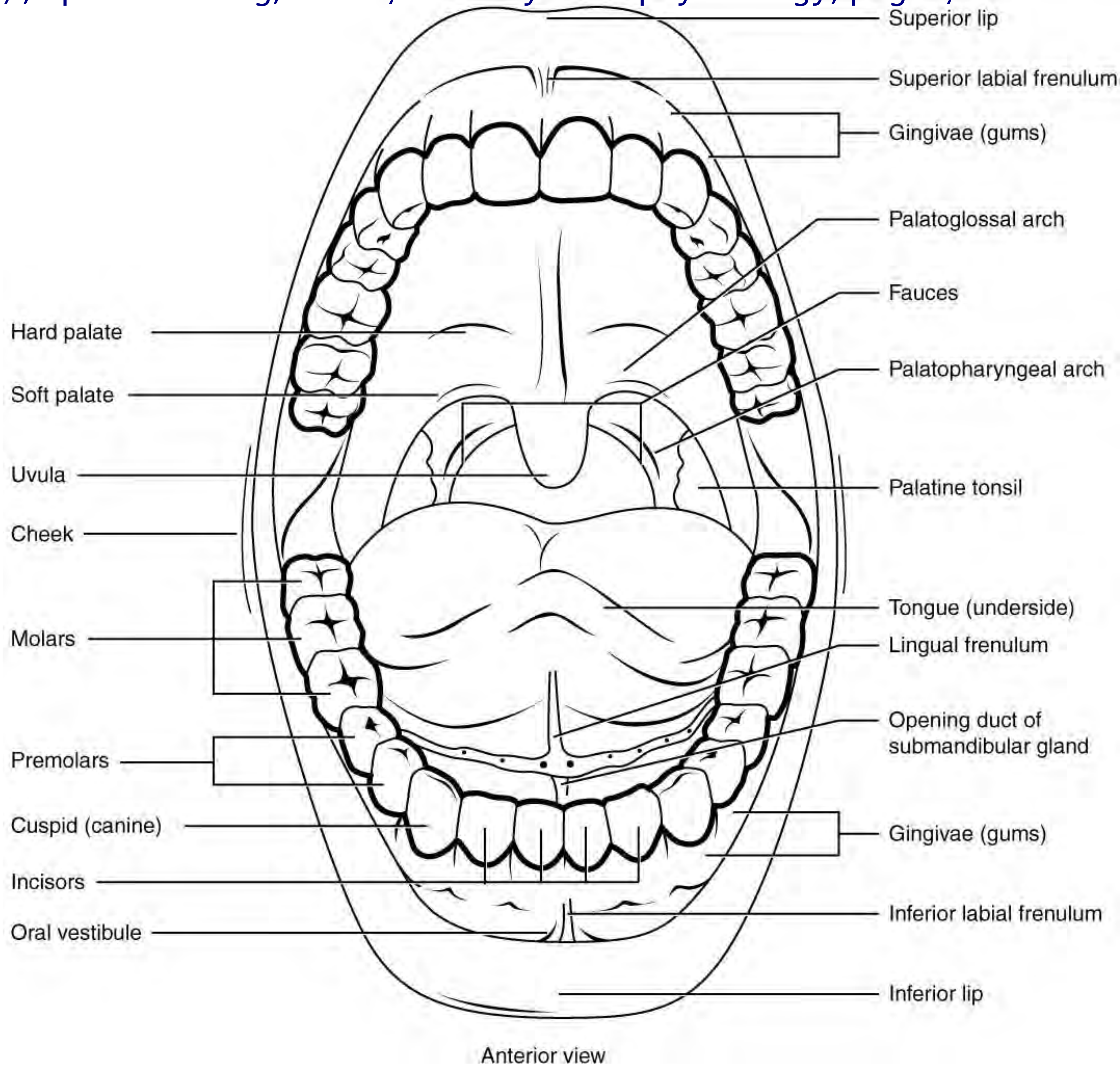


Figure 23.7 Mouth The mouth includes the lips, tongue, palate, gums, and teeth; Anatomy and Physiology 25 April 2013; OpenStax; Creative Commons Attribution License 4.0;
https://openstax.org/books/anatomy-and-physiology/pages/1-introduction



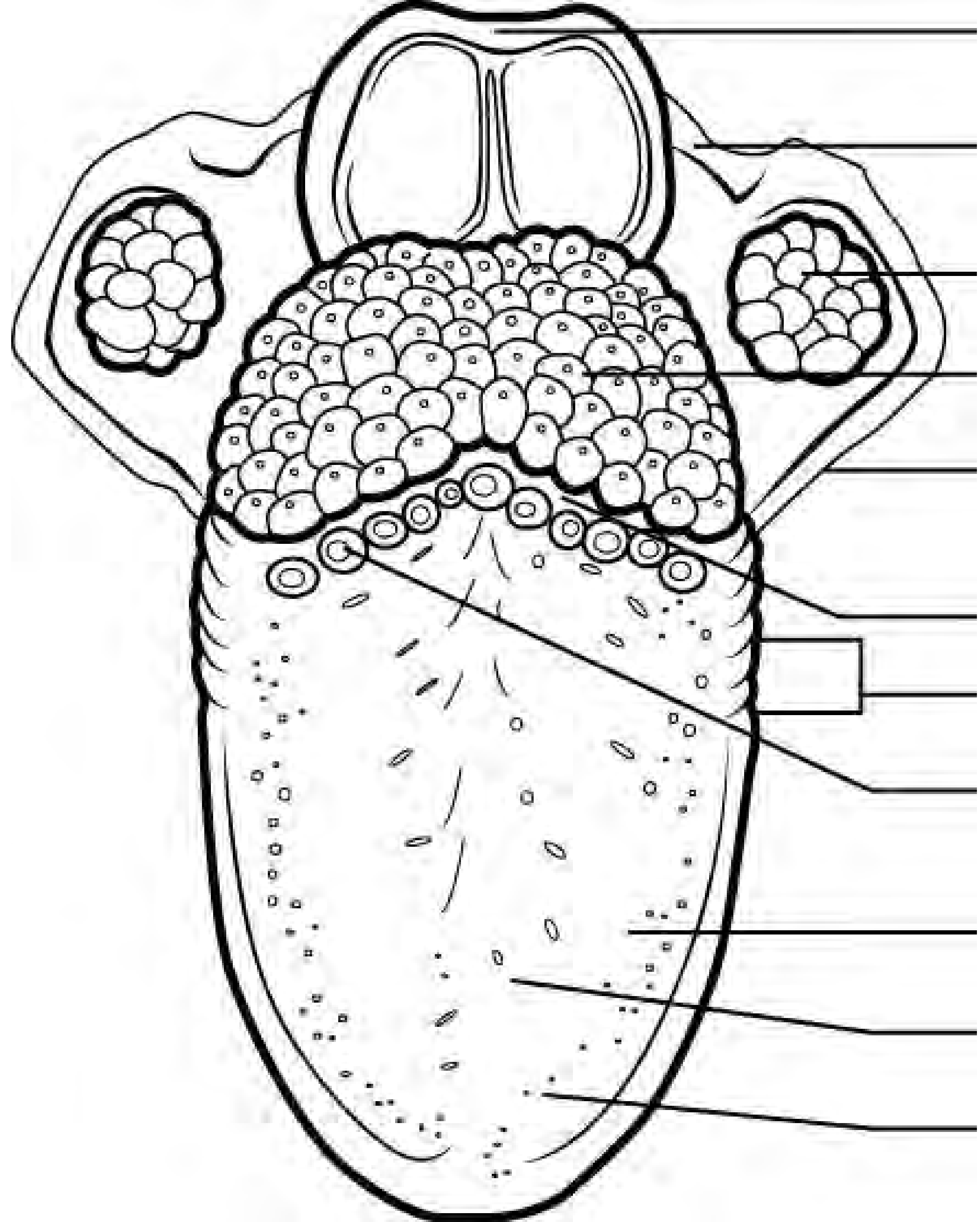
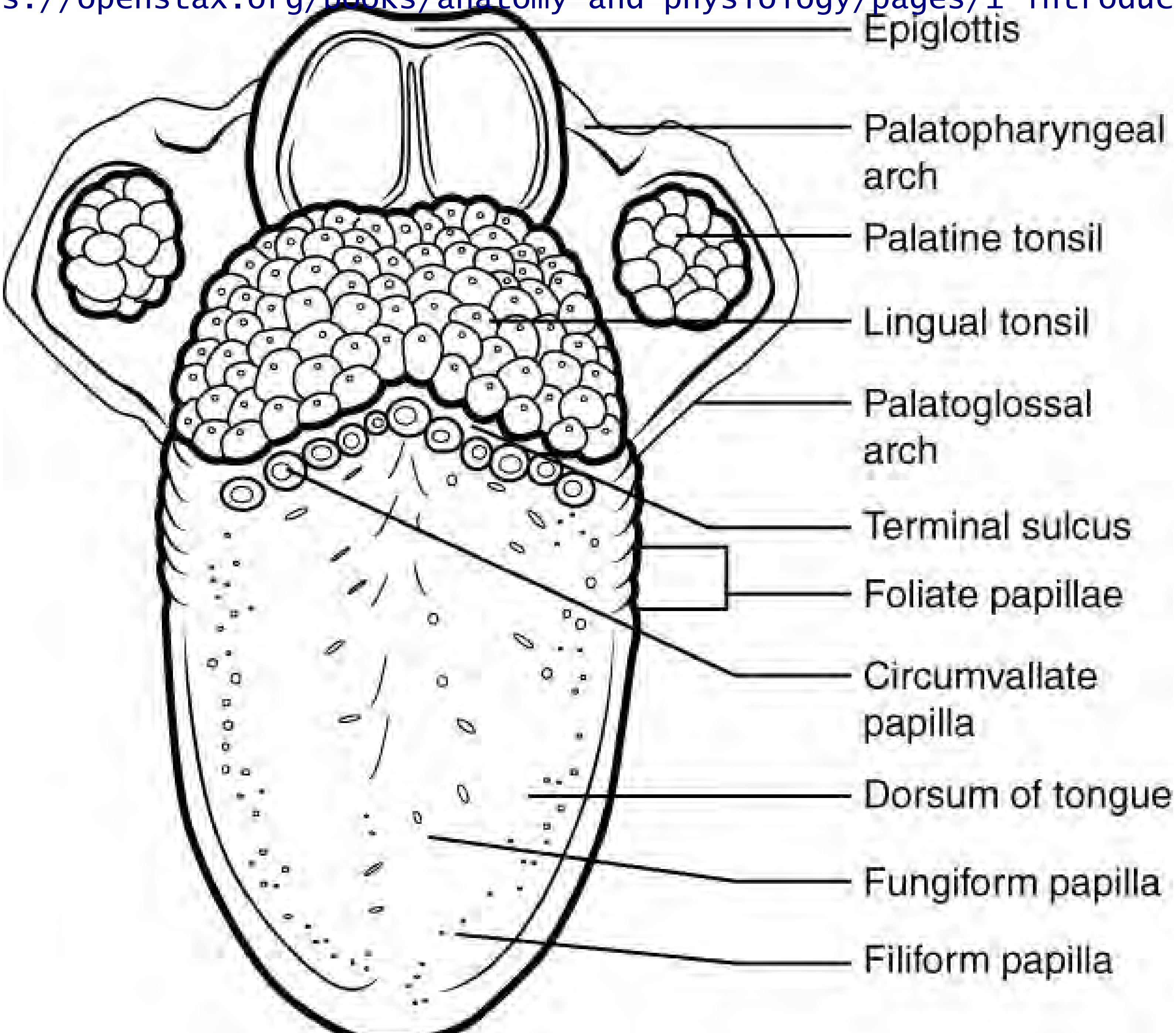
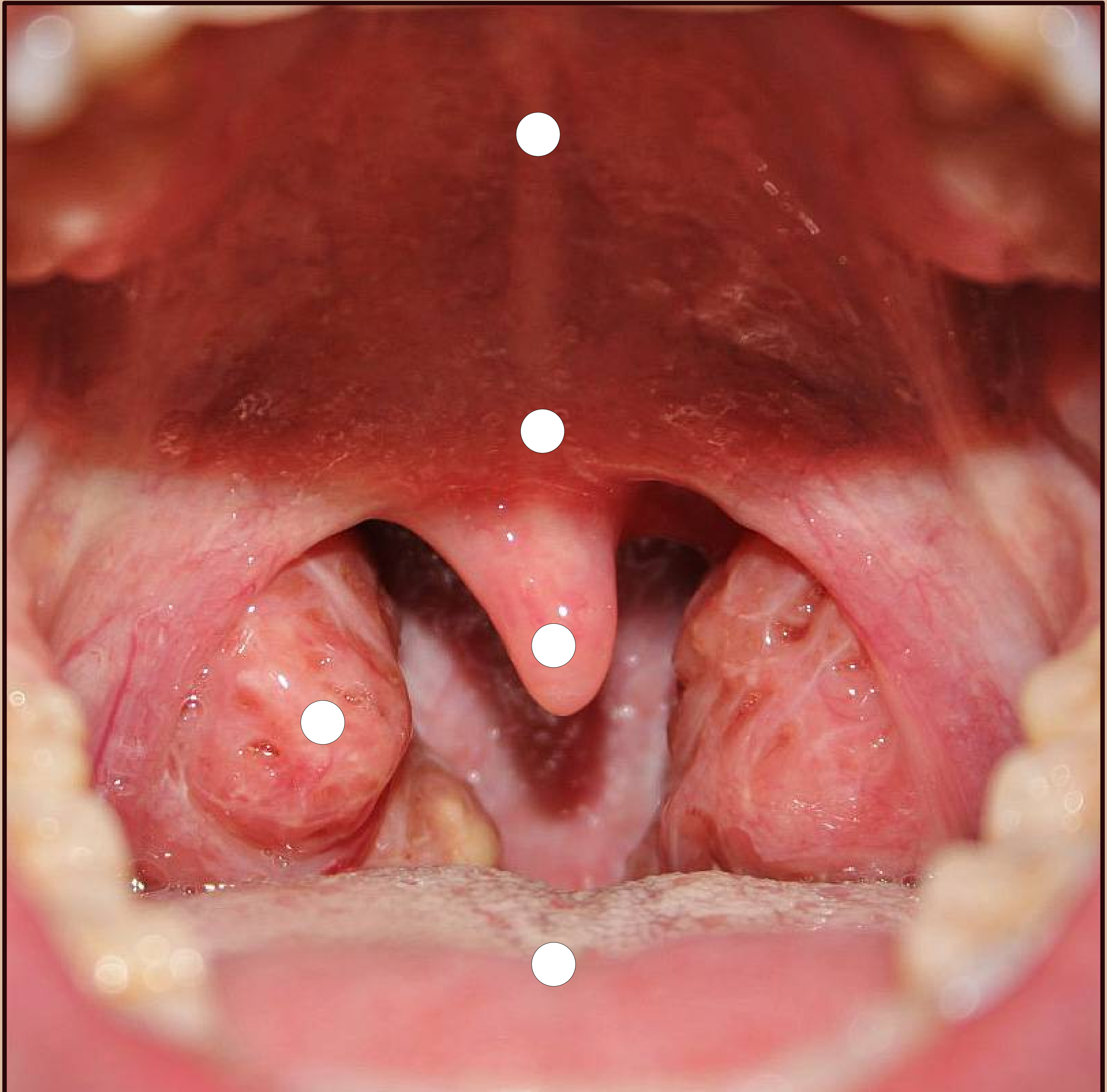
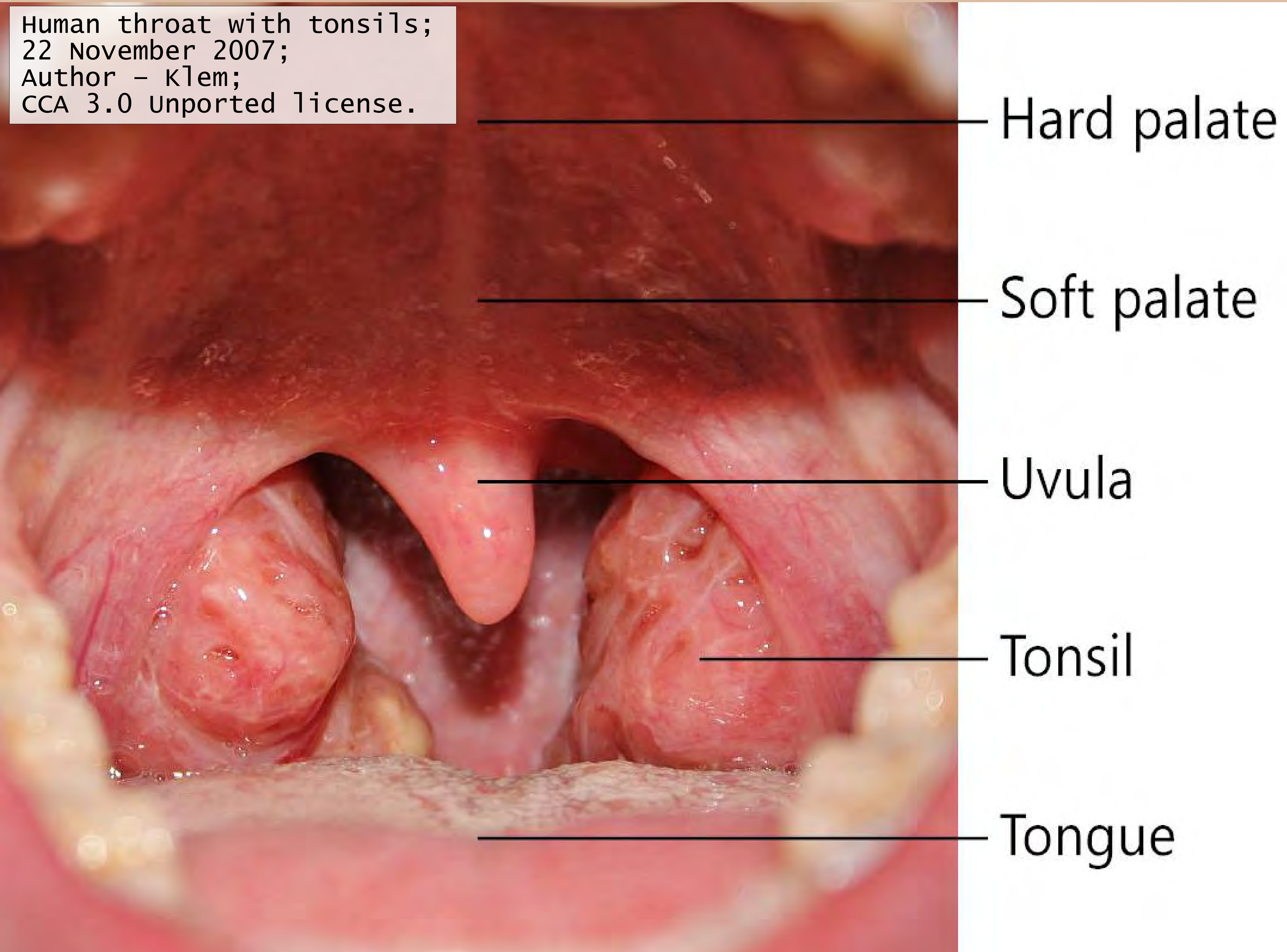


Figure 23.8 Tongue This superior view of the tongue shows the locations and types of lingual papillae; Anatomy and Physiology 25 April 2013; OpenStax; Creative Commons Attribution License 4.0;
https://openstax.org/books/anatomy-and-physiology/pages/1-introduction






Human throat with tonsils;
22 November 2007;
Author – Klem;
CCA 3.0 Unported license.
Hard palate
Soft palate
Uvula
Tonsil
Tongue

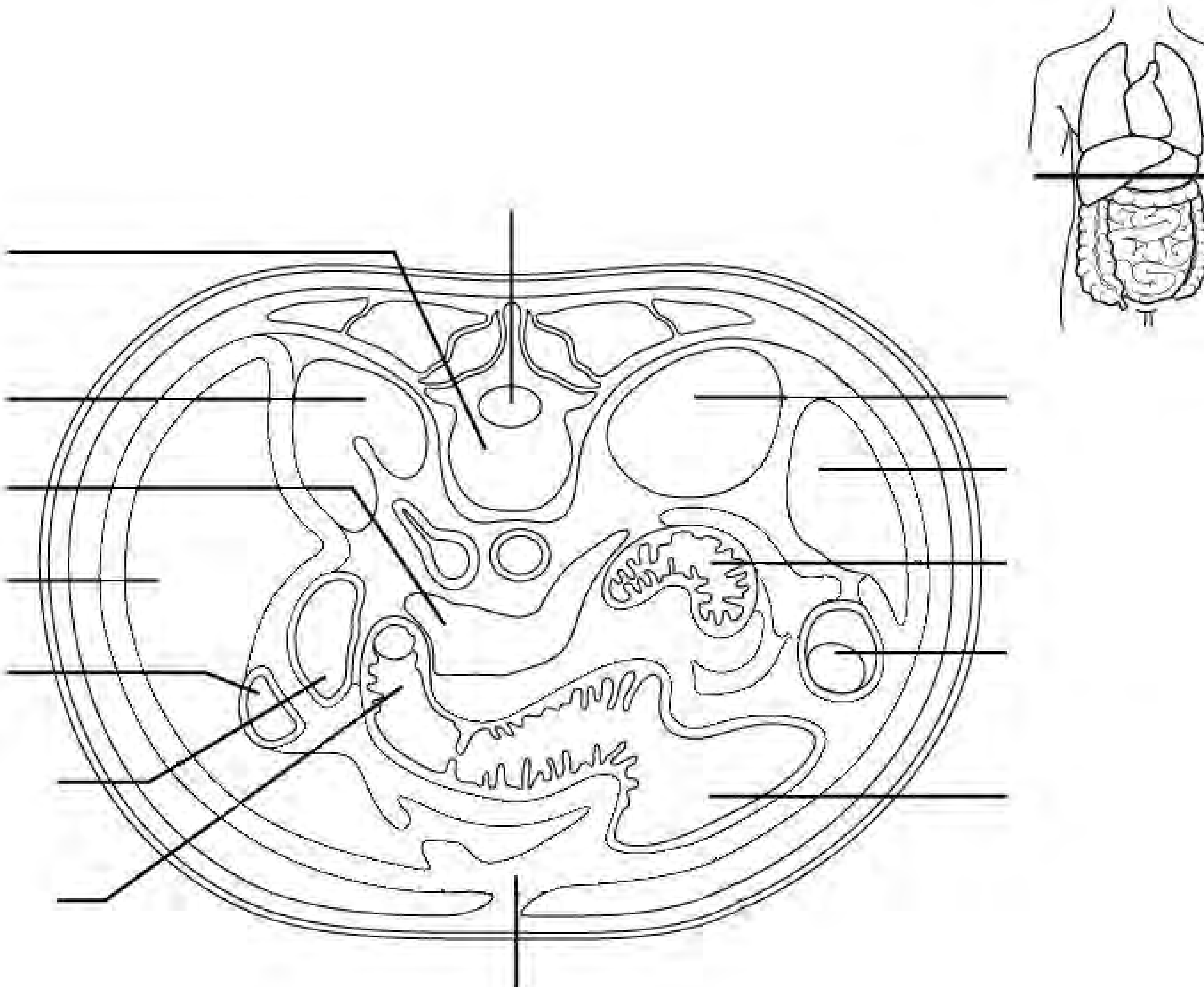
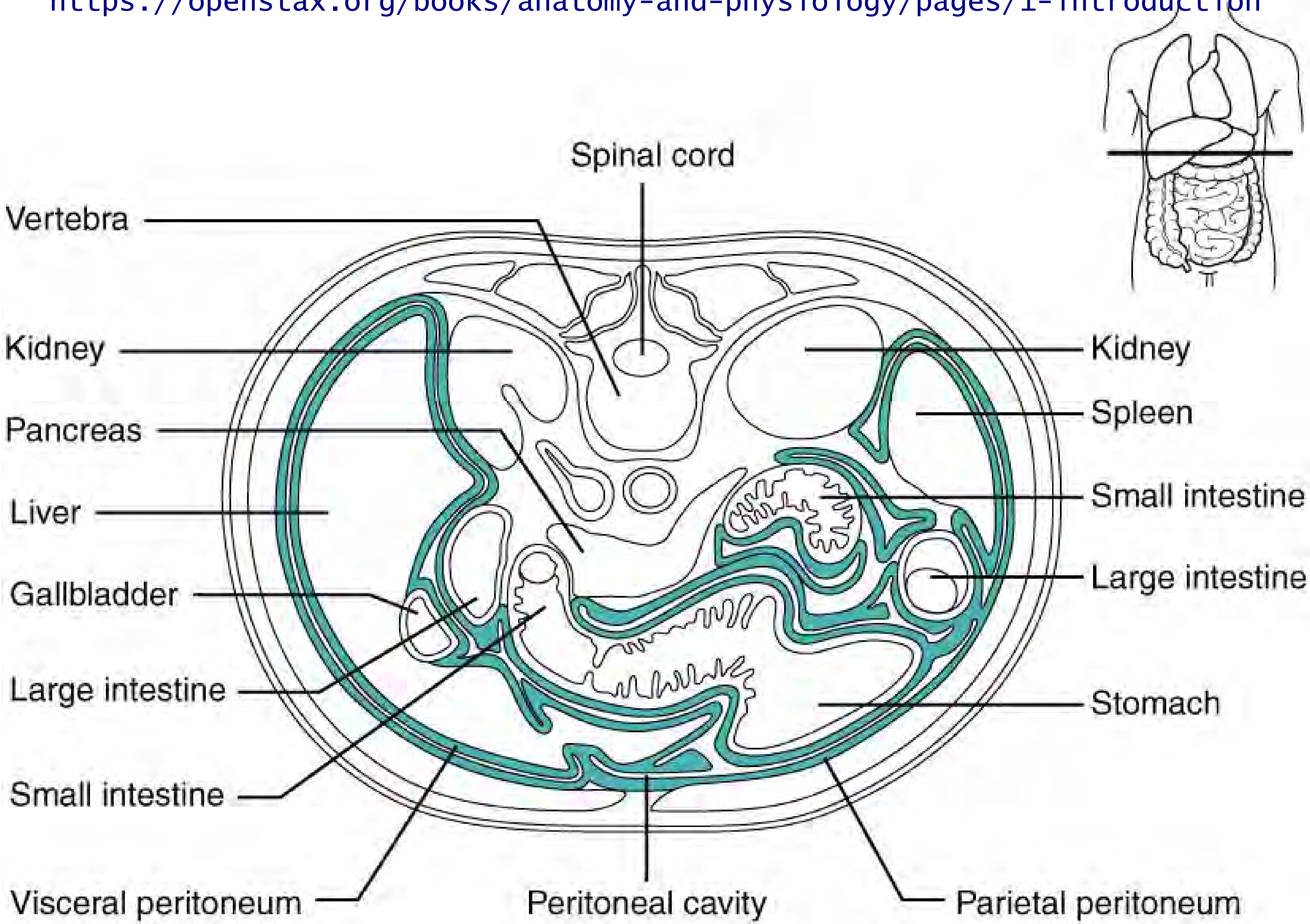
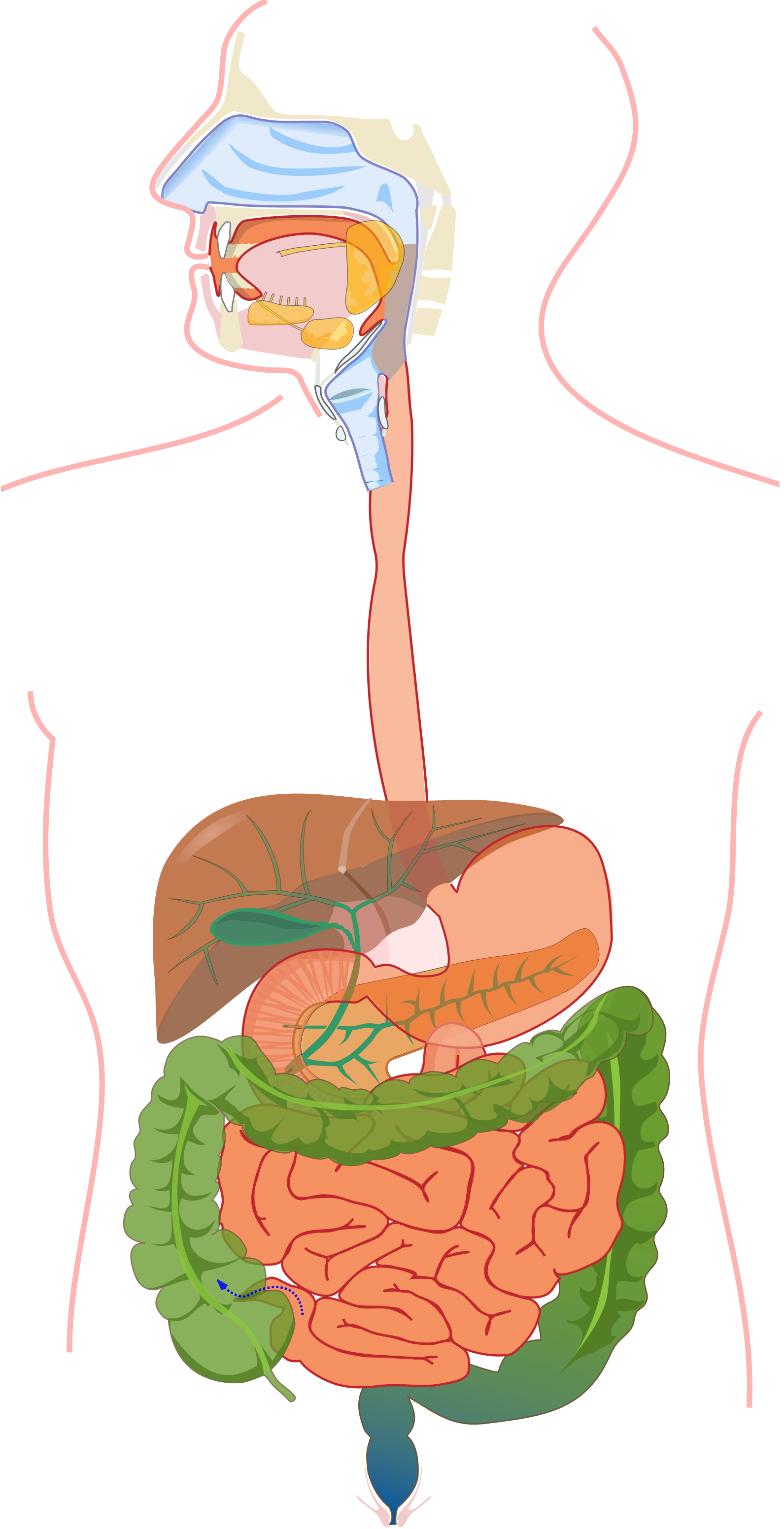


Figure 23.4 The Peritoneum A cross-section of the abdomen shows the relationship between abdominal organs and the peritoneum (darker lines).; Anatomy and Physiology 25 April 2013; OpenStax; Creative Commons Attribution License 4.0; https://openstax.org/books/anatomy-and-physiology/pages/1-introduction



The following slide can be printed and used to assist in revision.



Digestive Track

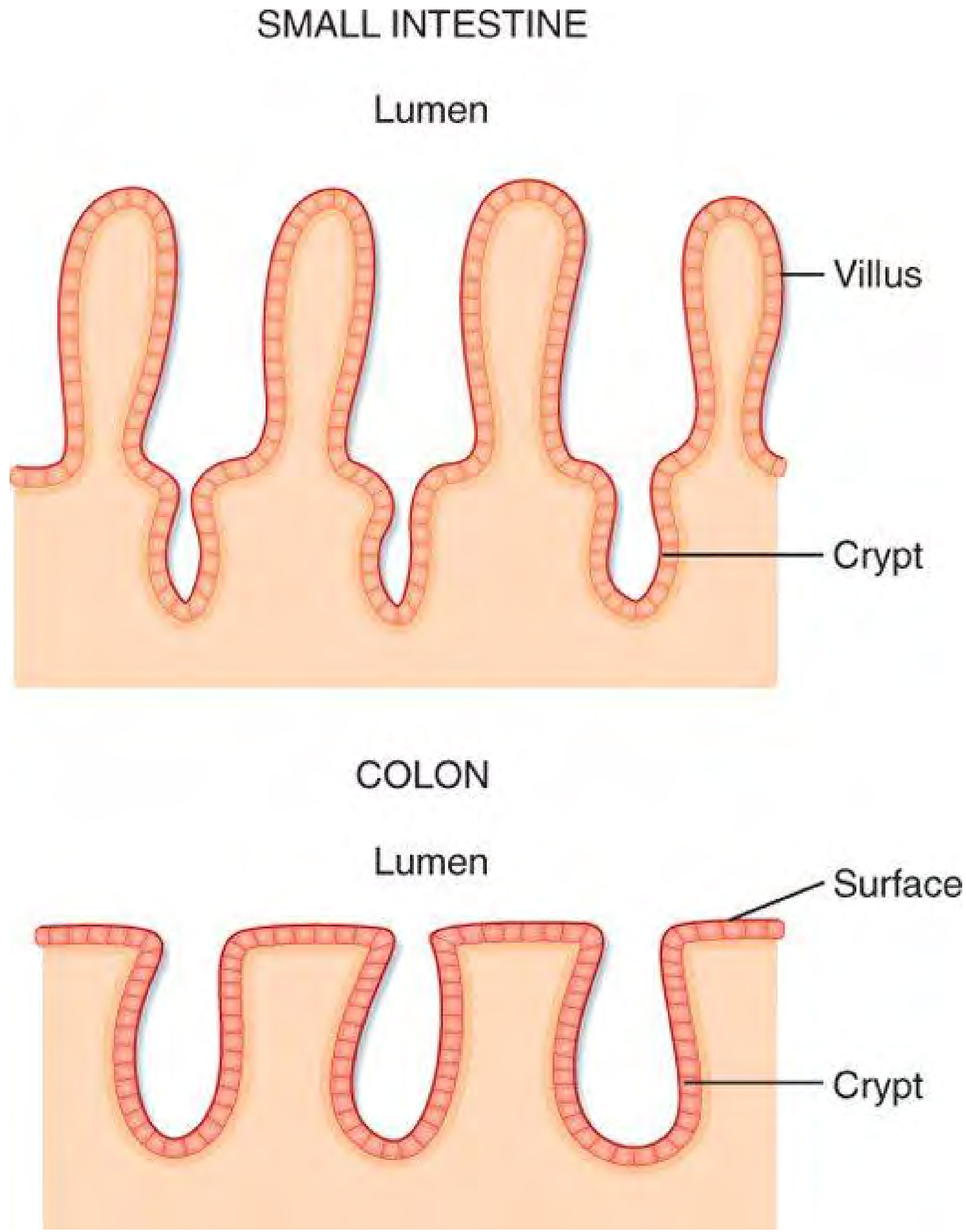
	Mucosa					
	Epithelium	Lamina propria	Muscularis mucosa	Submucosa	Muscularis externa	Serosa / Adventitia
Oral cavity						
Oesophagus						
Stomach						
Small intestine						
Colon						
Rectum						

Digestive Track

	Mucosa					
	Epithelium	Lamina propria	Muscularis mucosa	Submucosa	Muscularis externa	Serosa / Adventitia
Oral cavity	str sq	x	x	x	x	x
Oesophagus	str sq		thick		thick striated +smooth	yes
Stomach	columnar	pits	yes	yes	3 layers	yes
Small intestine	columnar	crypts plicae villi	yes	glands lymph nodules	circ longit	yes
Colon	columnar		yes	less glands	circ longit	yes
Rectum	columnar /str sq					

List and make a diagram of the surface modifications found in the GIT.

Modifications of the surface



Oral cavity

- Lip – slide 51
- Tooth – slides 16, 23, 25 & 27
- Tongue – 7, 33 & 53
- Parotid gland – slide 85
- Submandibular gland – 35
- Sublingual gland - 107

Alimentary canal 1/2

- Esophagus – slide 31
- Esophagus-stomach junction – slide 101
- Stomach – slides 37 & 38
- Stomach-duodenal junction – slide 36
- Duodenum – slide 40

Alimentary canal 2/2

- Ileum – slide 41
- Appendix – slide 43
- Colon – slide 42
- Rectum-anal-skin junction – slide 45

Glands (+gallbladder)

- Glands of the oral cavity
- Liver – slides 46, 48, 68 & 110
- Pancreas – slide 50
- Gallbladder – slide 58

Slides will be added as they are completed. The last completed slide will be marked with a history of edits.

Oral cavity

- Lip – slide 51
- Tooth – slides 16, 23, 25 & 27
- Tongue – 7, 33 & 53
- Parotid gland – slide 85
- Submandibular gland – 35
- Sublingual gland - 107

Glands of the GIT

- Salivary glands
  - Parotid
  - Sublingual
  - Submandibular
- Pancreas
- Liver

+ Gallbladder

Question

What are the two types of exocrine secretions in the respiratory and digestive tracks?

Supply technical and common terms.

Two types of secretions of the respiratory and digestive track?

Mucinous = sticky / slimy
Serous = watery

Structures of the salivary glands

- Capsule
- Septa
- Ducts
- Acini

Capsule

- Surrounds the gland
- Collagenous
- Form septa that divides glands into lobes

Septa

- Divides gland
  - Lobes
  - Lobules
- Connective tissue
- Lobules contain secretory units
- Carry AVNL+ducts into gland

Ducts

- Intercalated ducts
  - simple low cuboidal epithelium
  - surrounded by myoepithelial cells
- Striated ducts
  - ?cuboidal epithelium
- Interlobular ducts
  - Tall columnar epithelium

Acini

- Serous
  - generally spherical
  - watery
- Mucinous
  - generally tubular
  - sticky/slimy
- Mixed
  - serous halfmoon

Cells

- Mucous cells
- Serous cells

Mucous cells

- Pale staining
- Bubbly cytoplasm
- Nucleus pushed agains basal cell membrane

Serous cells

- Eosinophilic zymogen granules
- spherical nucleus

Tasks

Find:

- Serous & mucinous acini
- Serous demilunes
- Myoepithelial cells

Parotid gland

Slide 85

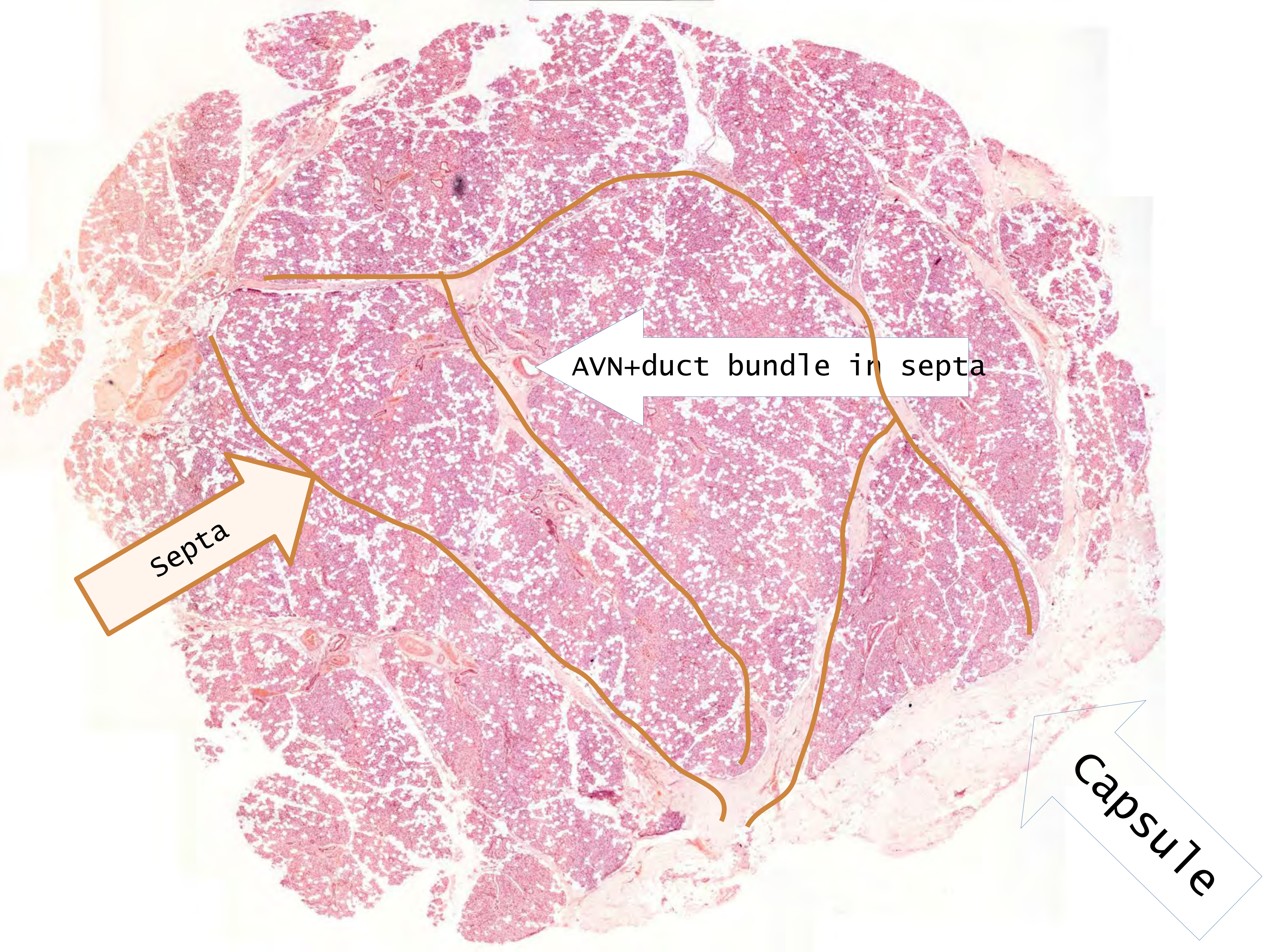
Parotis

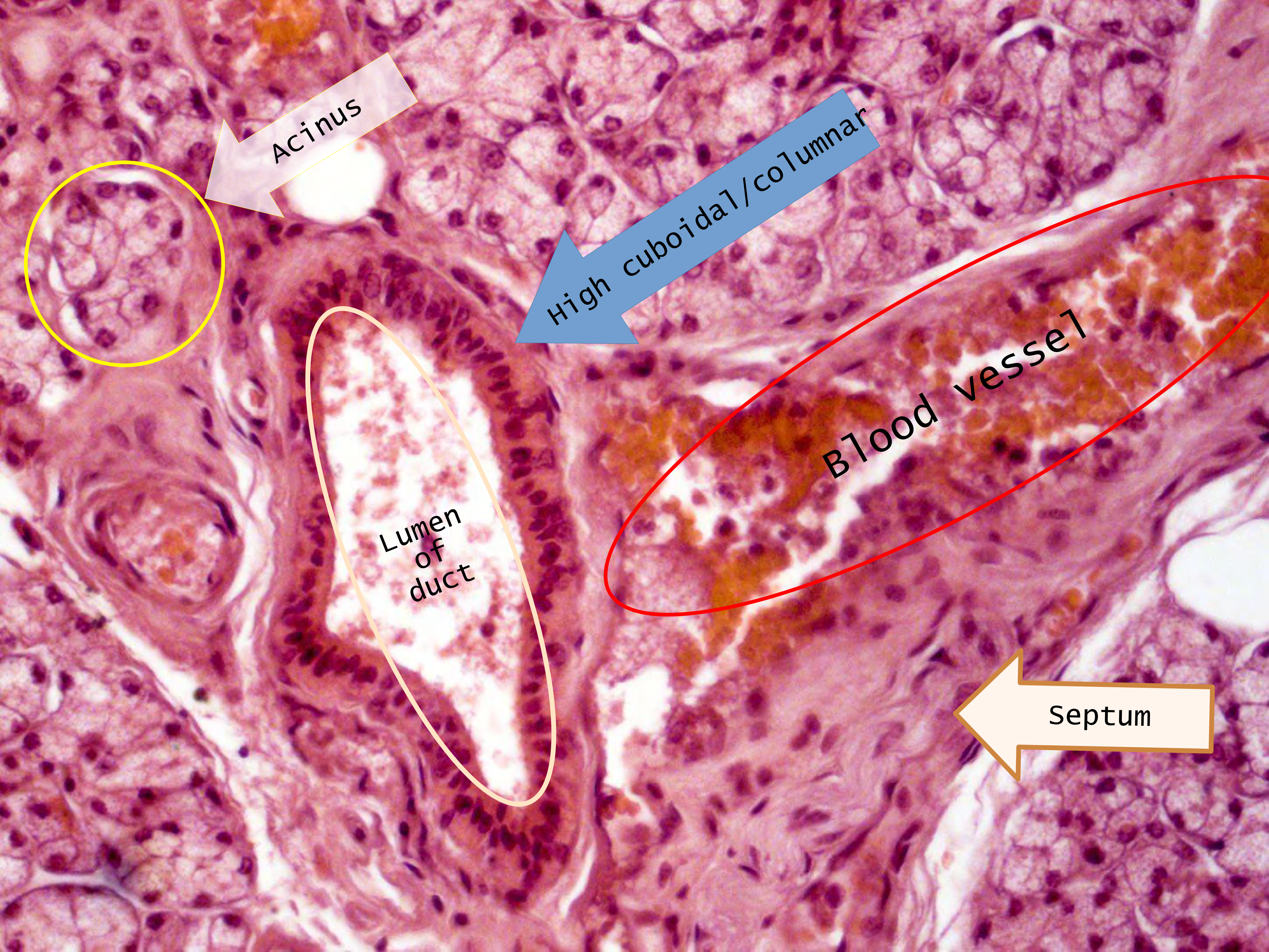
Identify microscopically:
Secretory units
Secretory ducts
Connective tissue septae and blood vessels

Draw and annotate:
A number of secretory units and ducts.

Parotid

- Classification
  - Serous compound tubuloalveolar
- Capsule
  - From cervical fascia
  - Mostly collagenous
  - Form septa
  - Septa carries AVNL+ducts into gland


AVN+duct bundle in septa
Septa
Capsule

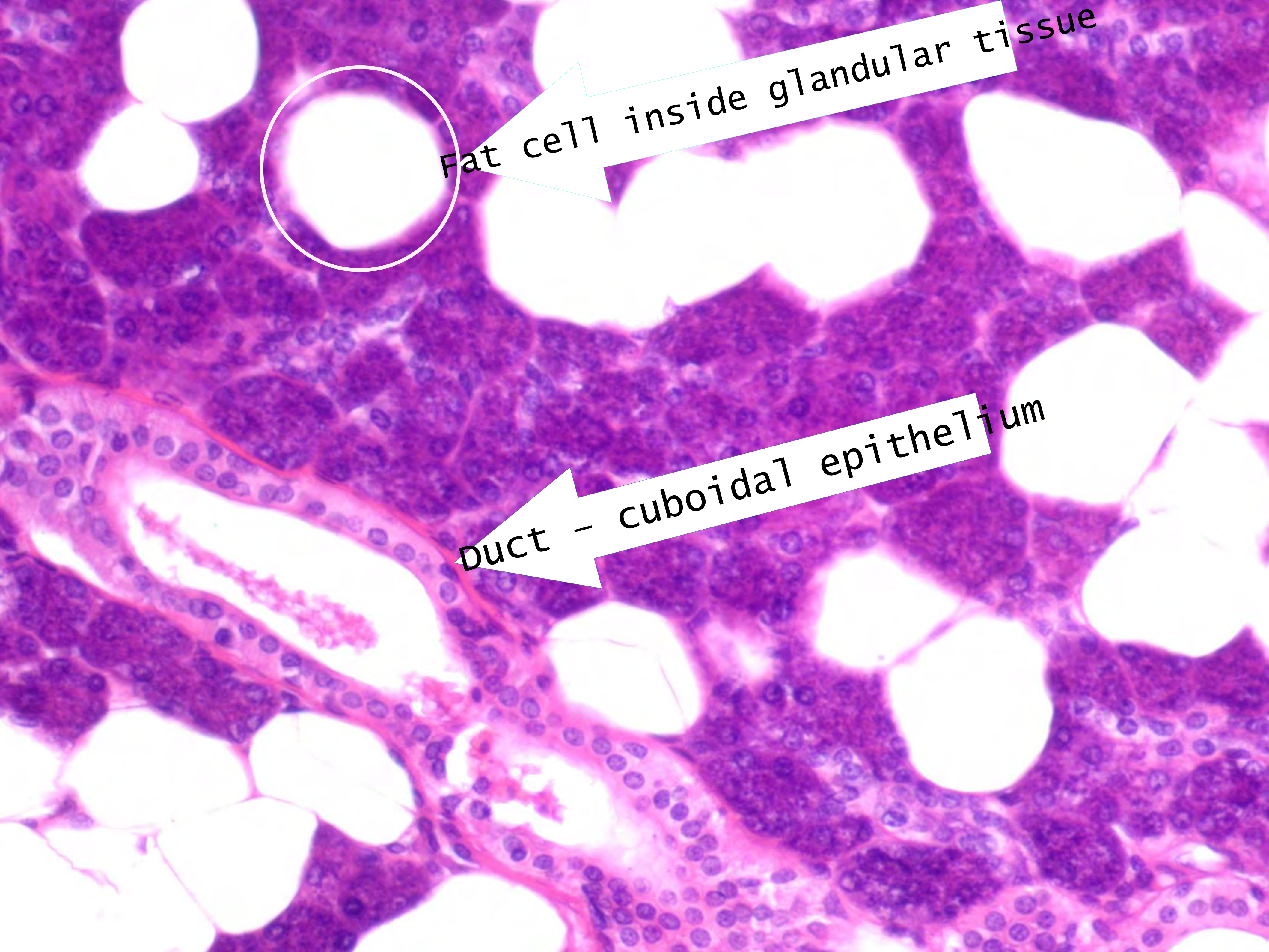

Acinus
High cuboidal/columnar
Blood vessel
Lumen
of
duct
Septum

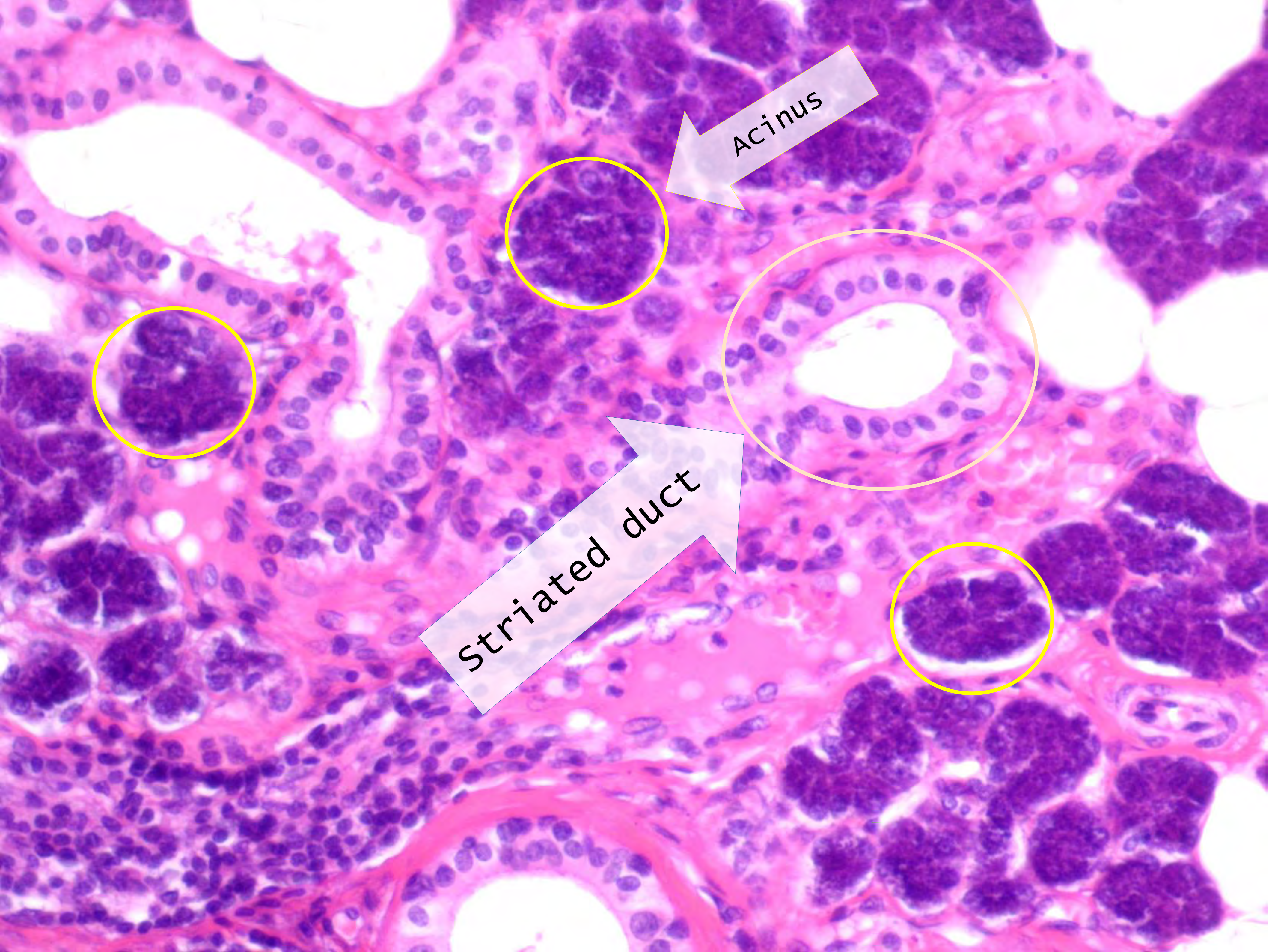
Acini

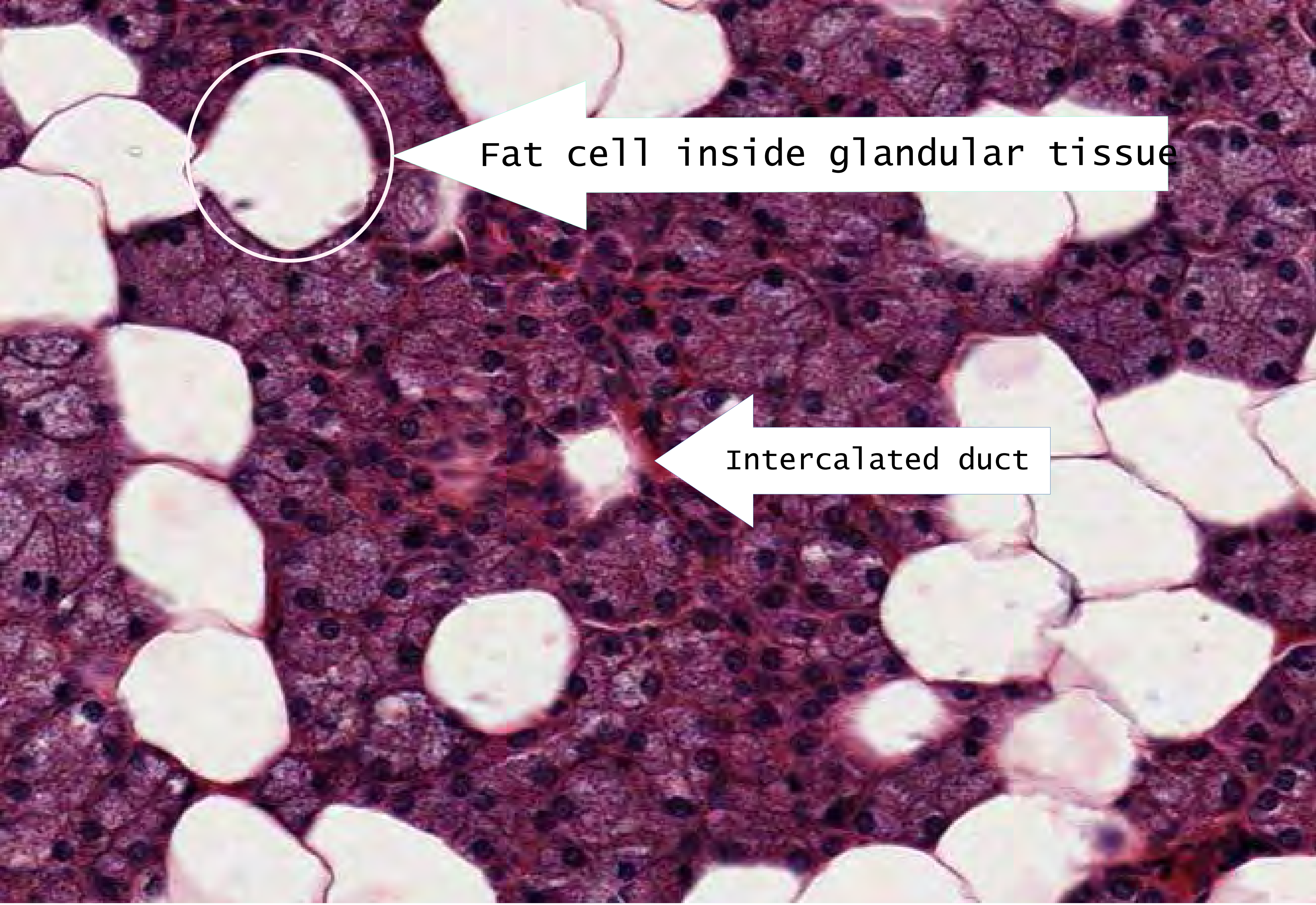
- Seromucous
- Serous cells predominate
- Secretions mainly serous
- Surrounded by myoepithelial cells
- Lumen in centre
- Fat cells with age

Acinar cells

- Pyramidal cells
- Round nucleus at base
- Secretory granules in apex

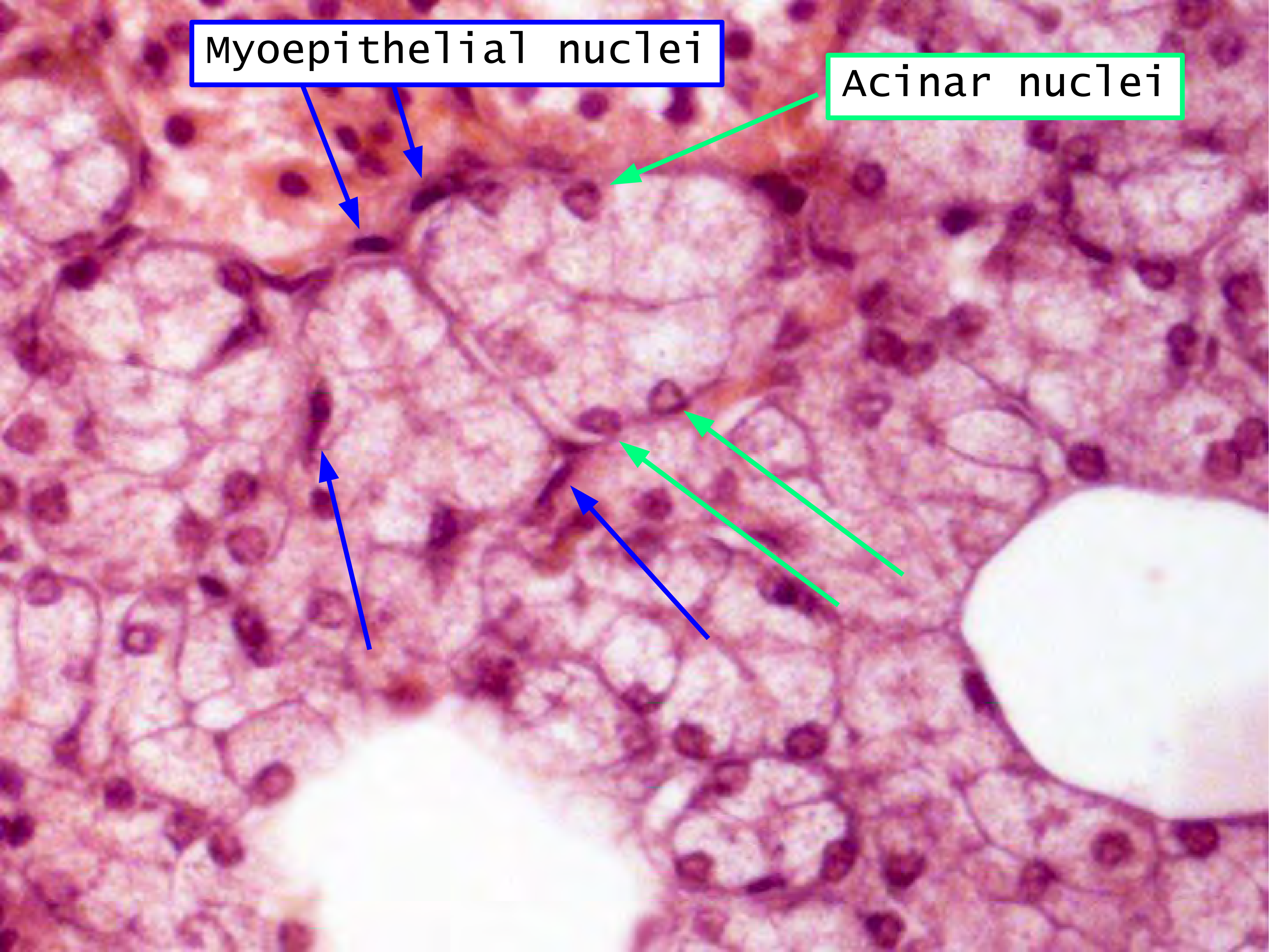

Fat cell inside glandular tissue
Duct - cuboidal epithelium


Acinus
Striated duct


Fat cell inside glandular tissue
Intercalated duct

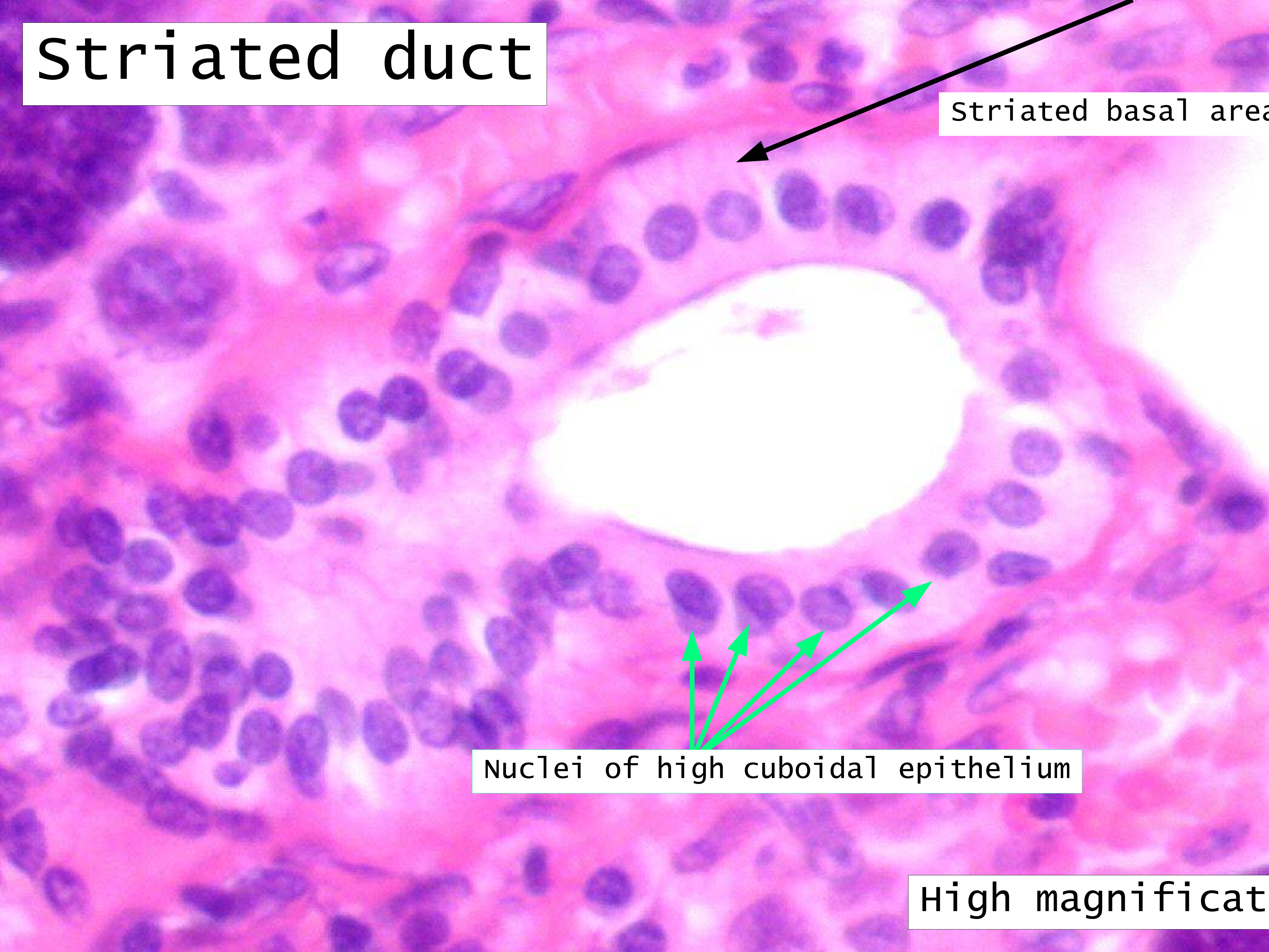
Myoepithelial cells

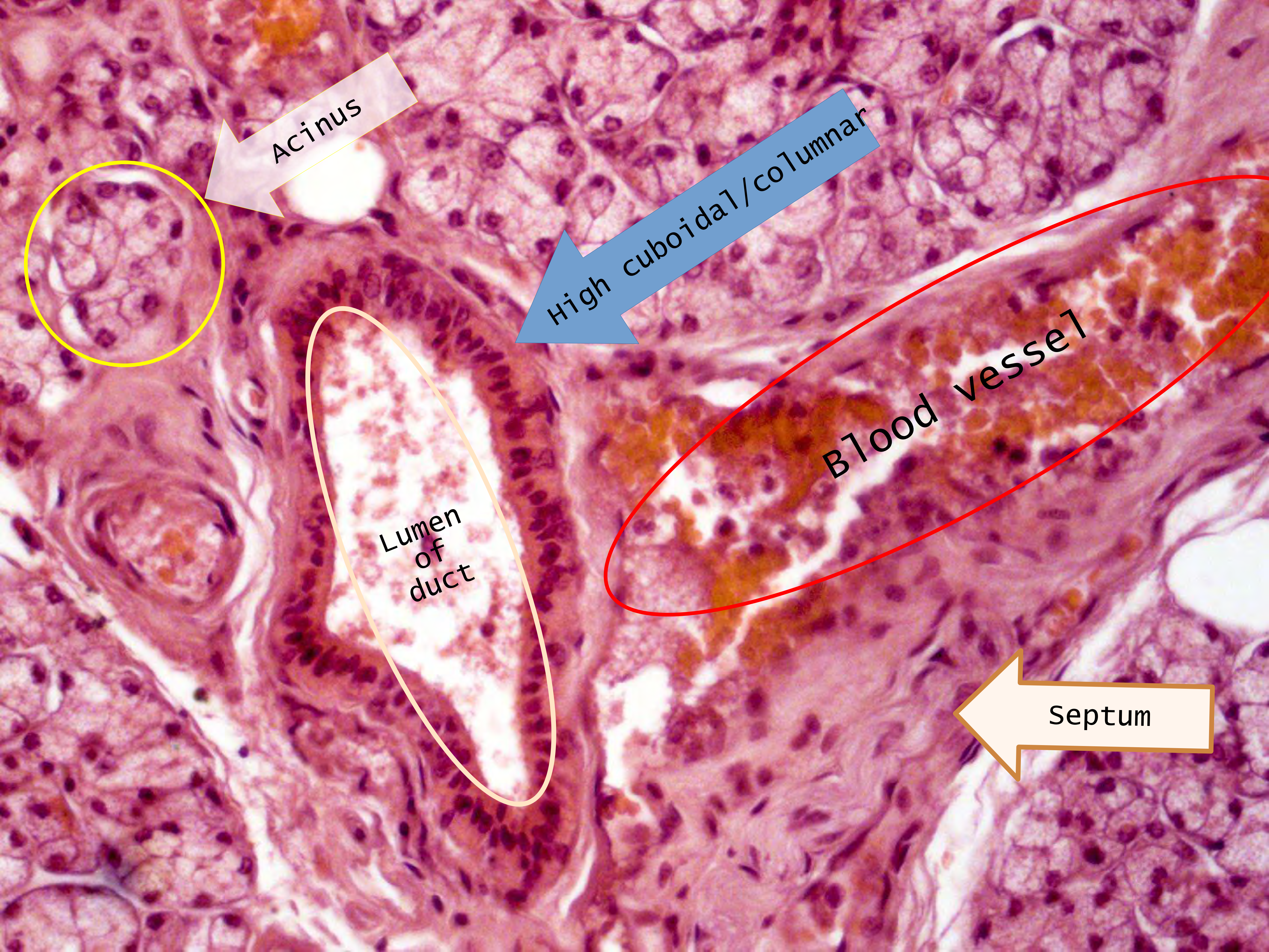
- Stellate shape
- Cytoplasma difficult to see


Myoepithelial nuclei
Acinar nuclei

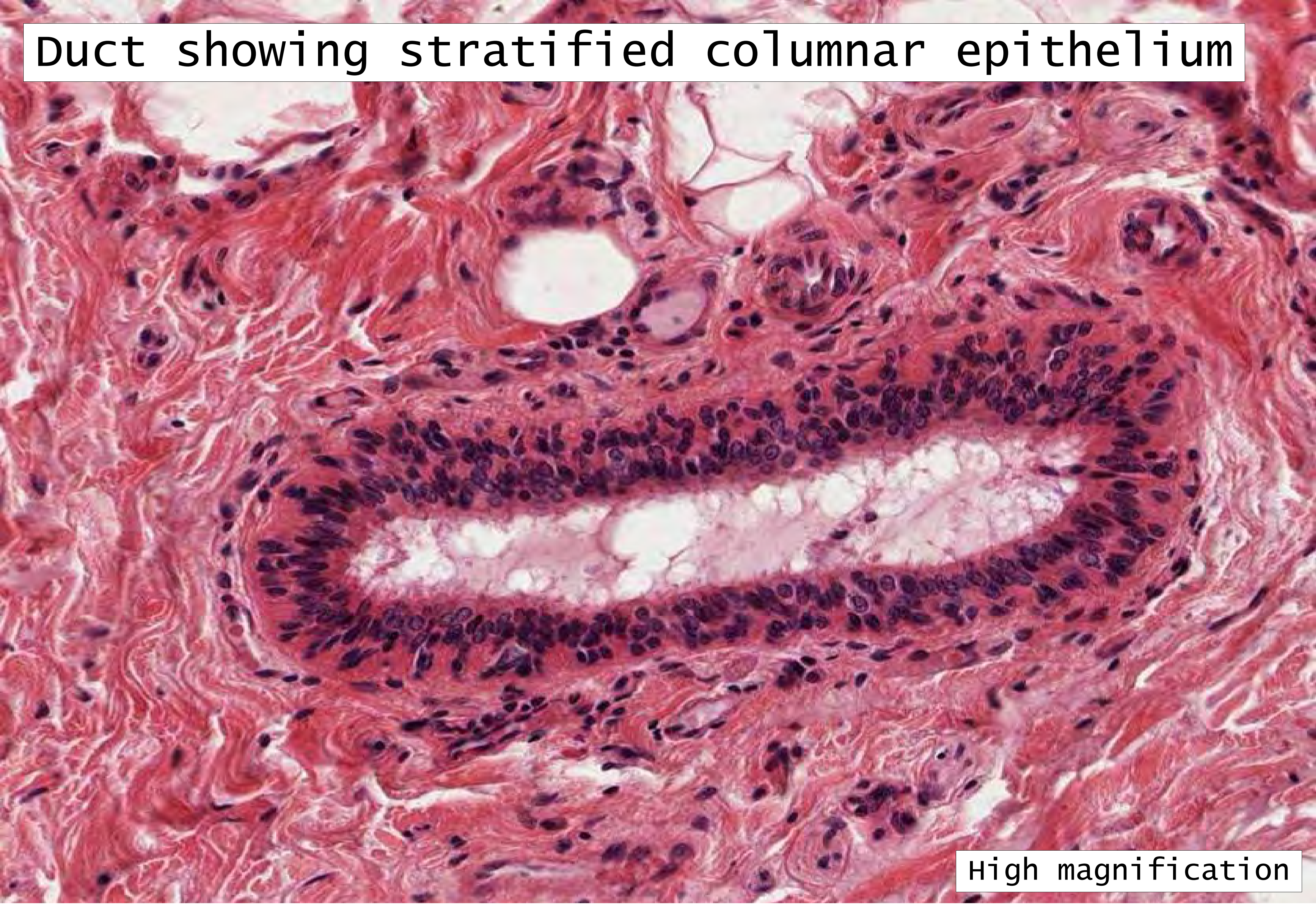
Ducts

- Main parotid duct
  - largest
  - simple columnar or
  - pseudostratified epithelium
  - Opens on surface
- Striated duct
  - high cuboidal
  - basal striations
  - folded basement membrane
  - Between lobules in septae
- Intercalated duct
  - smallest
  - simple cuboidal
  - between acini


Striated duct
Striated basal are
Nuclei of high cuboidal epithelium
High magnificat


Acinus
High cuboidal/columnar
Blood vessel
Lumen of duct
Septum

Duct showing stratified columnar epithelium



Sublingual gland

Slide 107

Sublingual gland

Identify microscopically:
Secretory units
Secretory ducts
Connective tissue septae and blood vessels

Draw and annotate:
A number of secretory units and ducts.

Sublingual

- Classification
  - Mixed compound tubuloalveolar
- Capsule
  - From cervical fascia
  - Mostly collagenous
  - Form septa
  - Septa carries AVNL+ducts into gland

Acini

- Mostly mucous capped with serous demilunes
- Sometimes pure mucous
- Never pure serous – only demilunes
- Surrounded by myoepithelial cells
- Lumen in centre

Acinar cells

- Pyramidal cells
- Round nucleus at base
- Pale cell
- bubbly/frothy/woolly/cloudy appearance

Serous demilunes

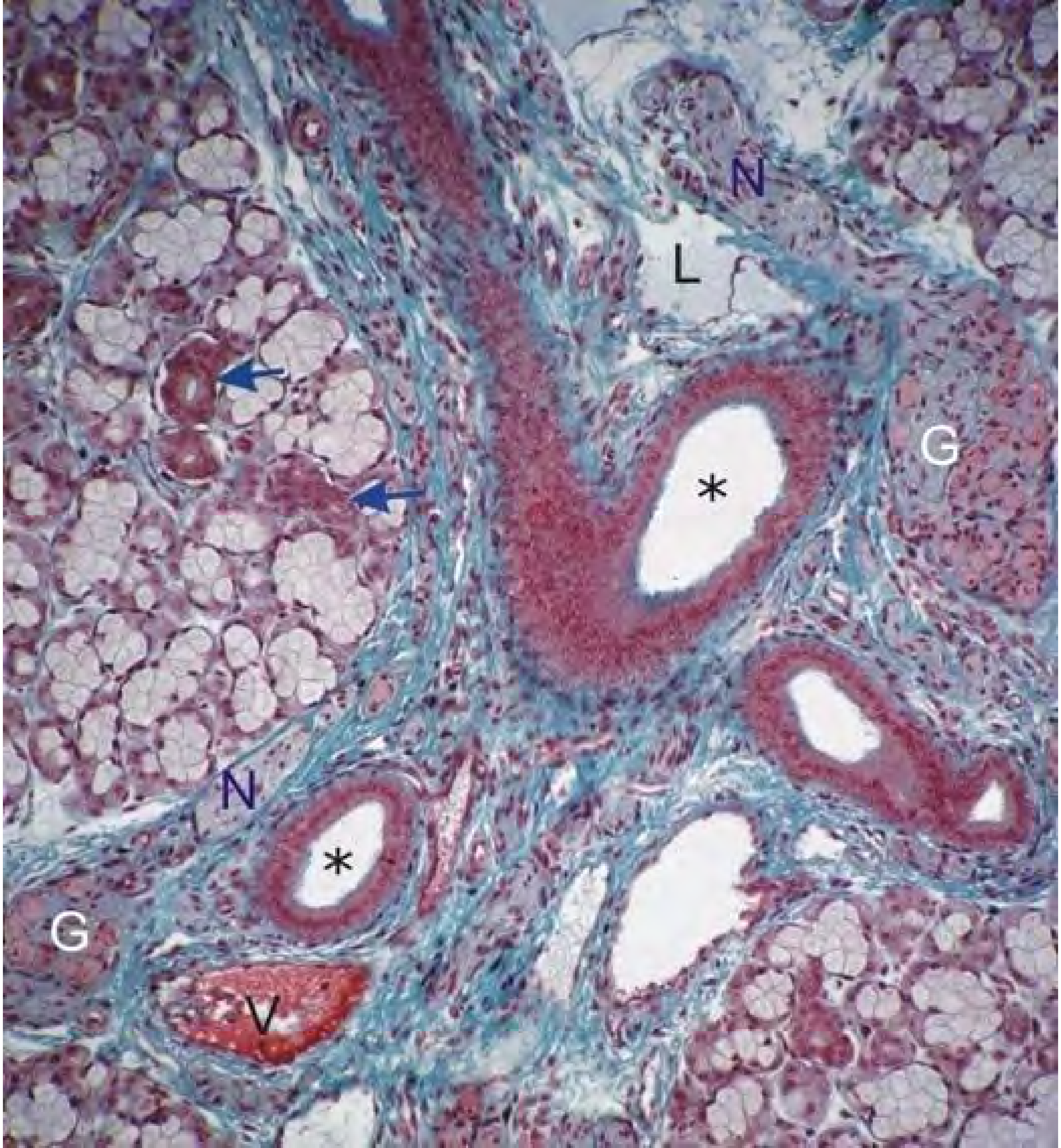
- Peripheral to mucous acini

Myoepithelial cells

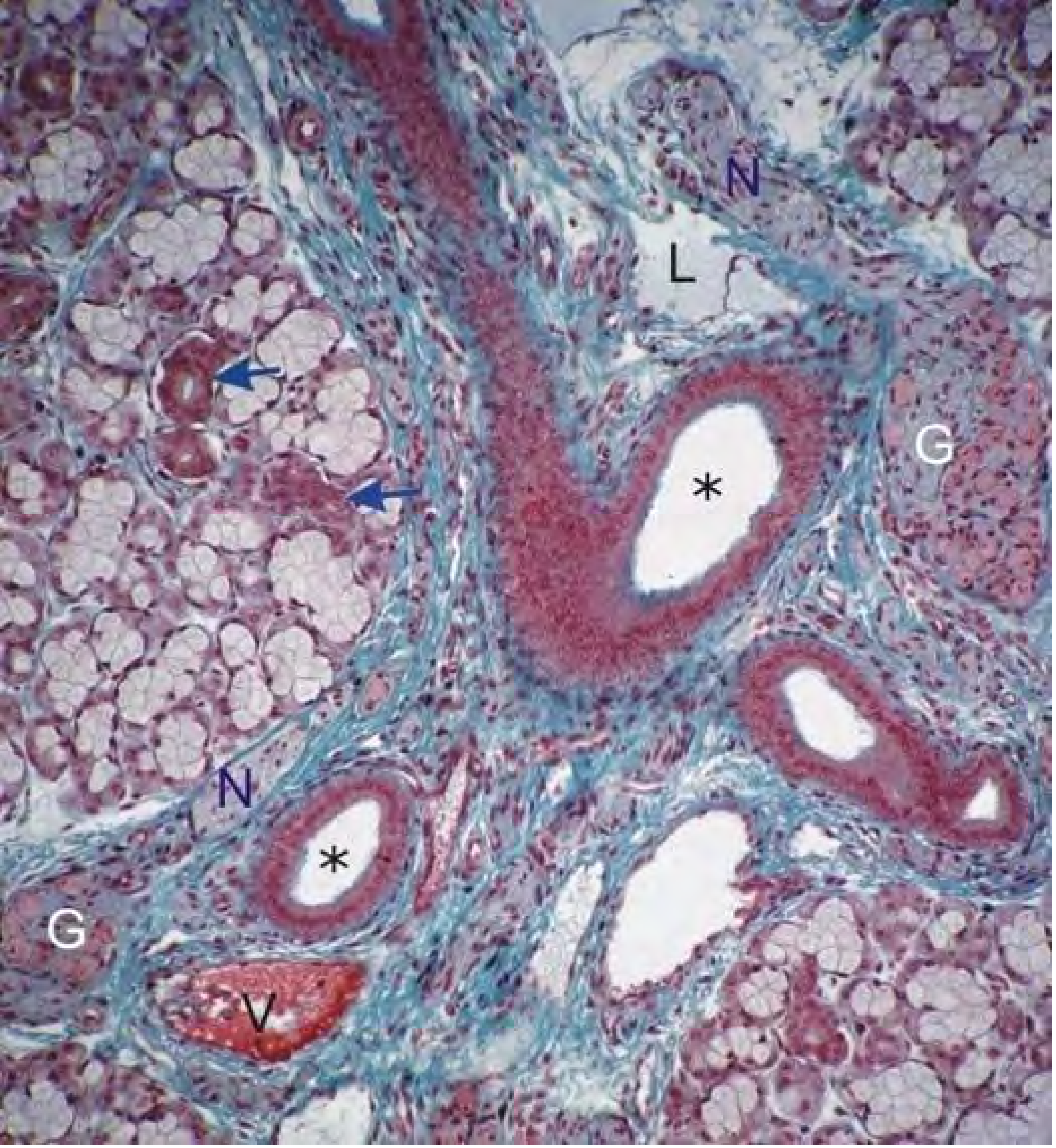
- Stellate shape
- Cytoplasma difficult to see

Ducts

- Two types but few
- Striated duct
  - high cuboidal
  - basal striations
  - folded basement membrane
  - Between lobules in septae
- Intercalated duct
  - smallest
  - simple cuboidal
  - between acini



N
L
G
*
N
*
G
V



* = interlobular ducts in a connective tissue septum

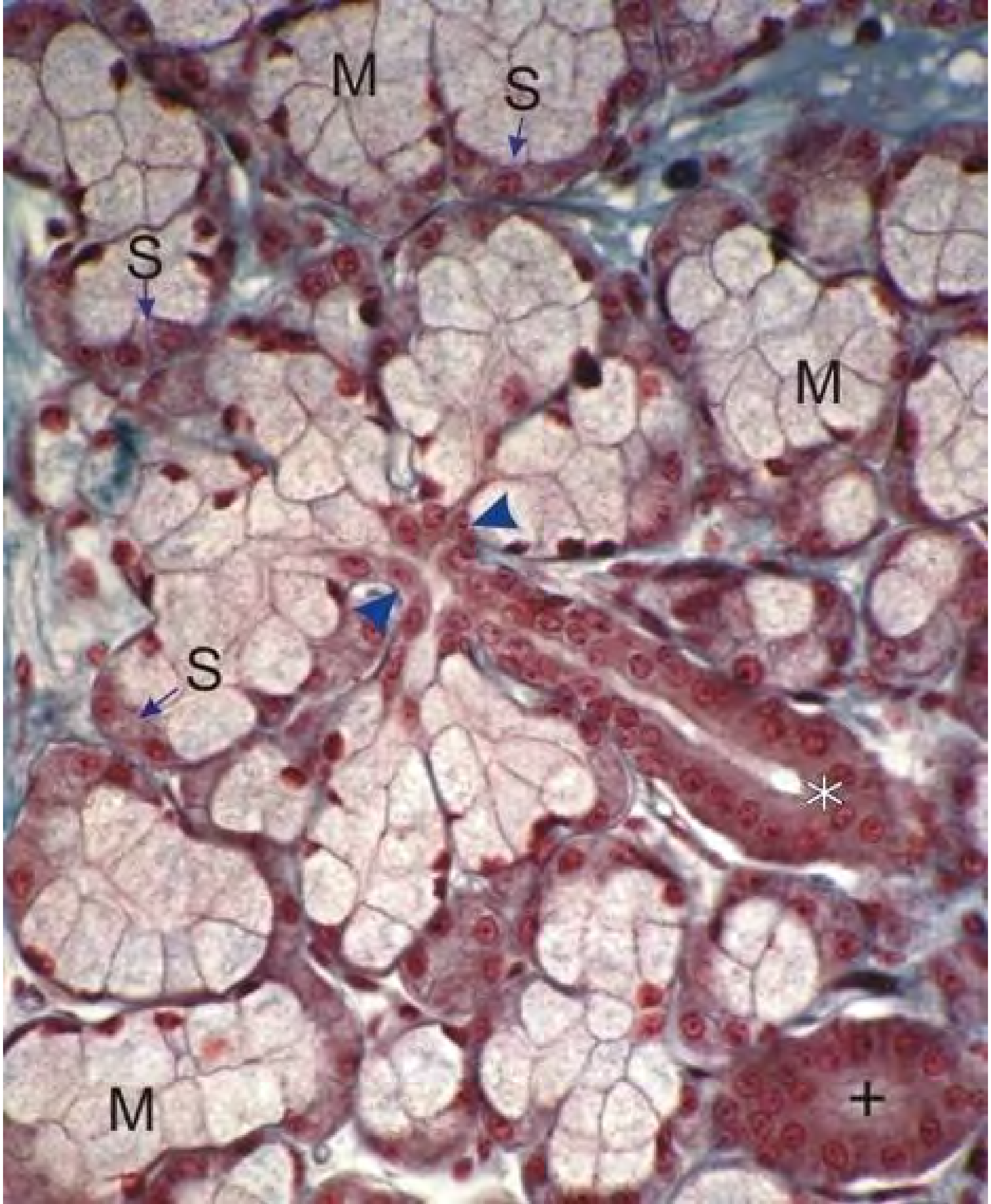
V = vein

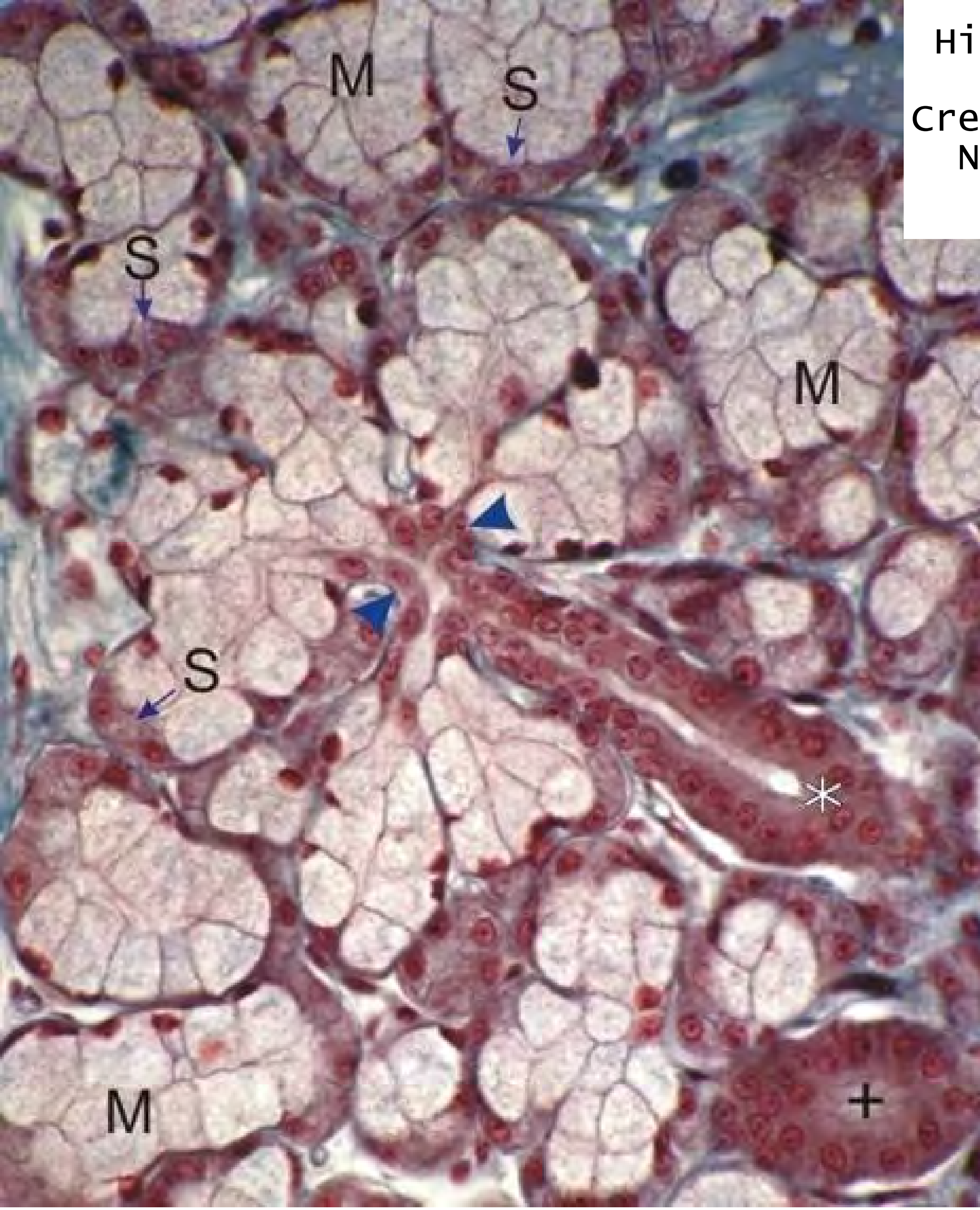
L = lymphatic

N= nerves

G = ganglia

Arrows = acidophilic intralobular ducts among mixed acini


M
S
S
M
S
M
+



M = pale mucous cells

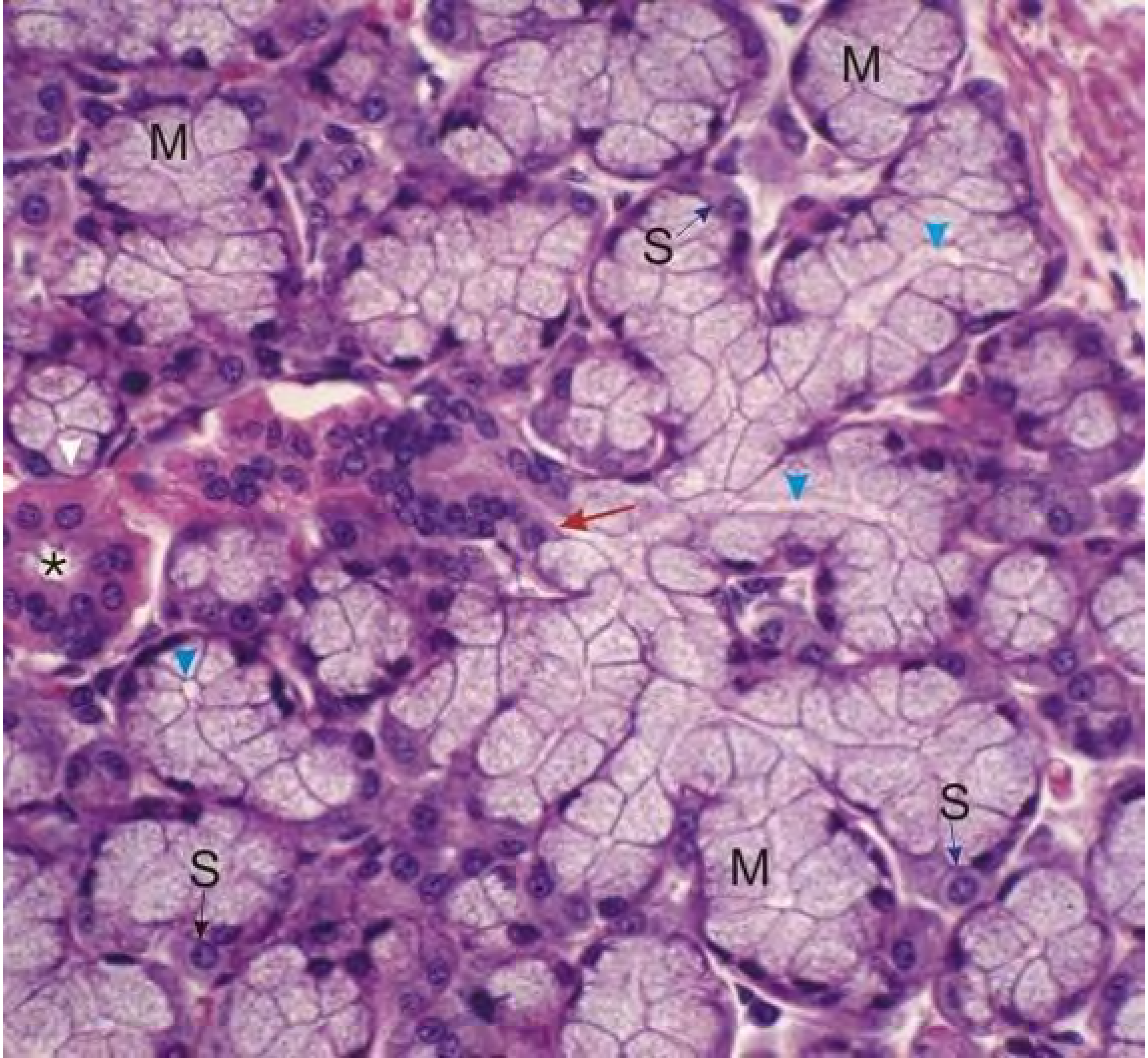
S = deeply stained serous demilune cells

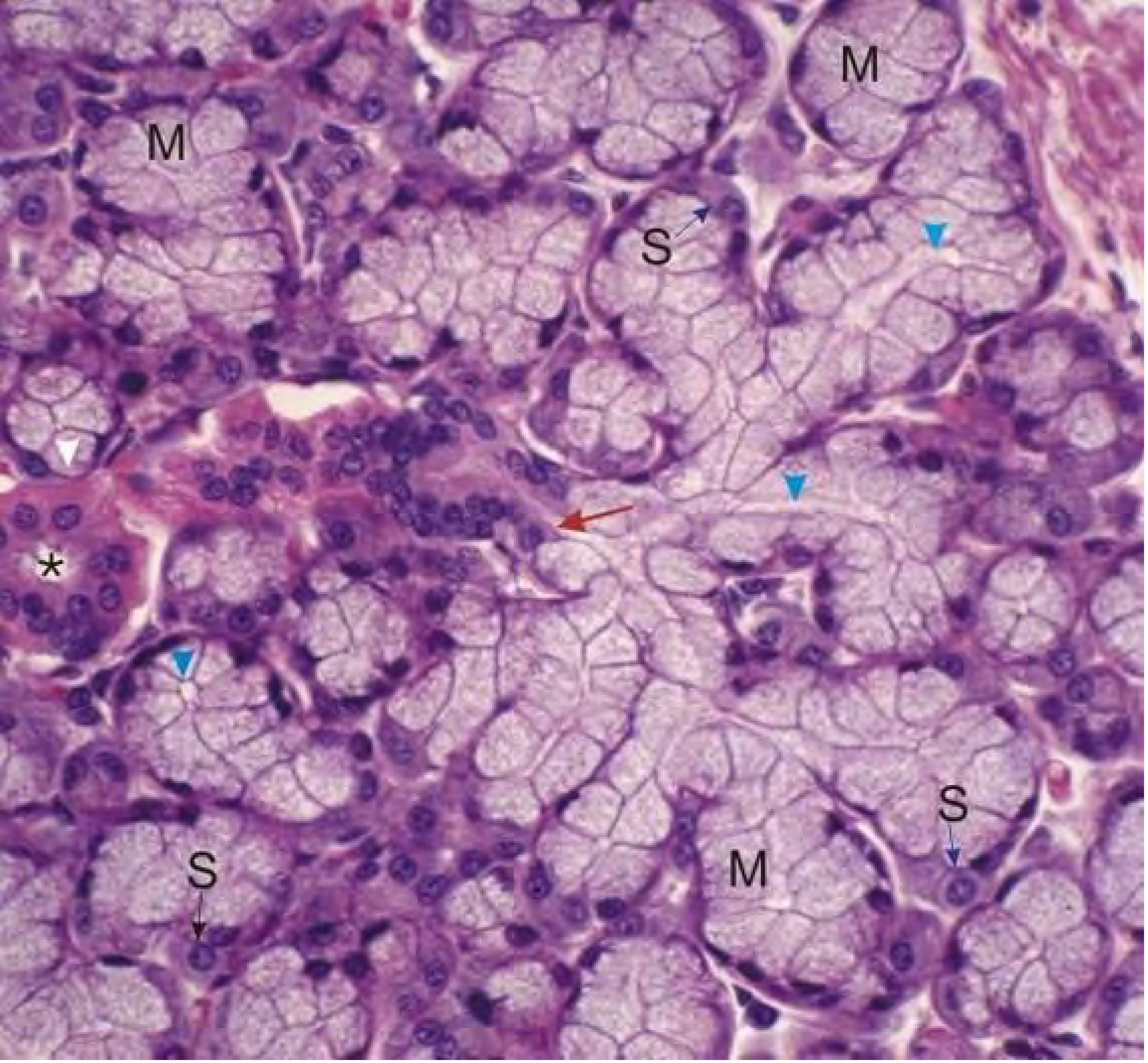
Arrowheads = mixed acini radiating from a short intercalated duct

continuous with a more

* = acidophilic striated duct

+ = striated duct cut obliquely


M
M
S
*
S
S
M



Arrowheads = mixed acini with distinct lumina

connected to

red arrow = short intercalated duct

M = mucous cells

C = crescent-shaped serous cells

* = small chromophilic striated duct

Submandibular gland

Slide 35

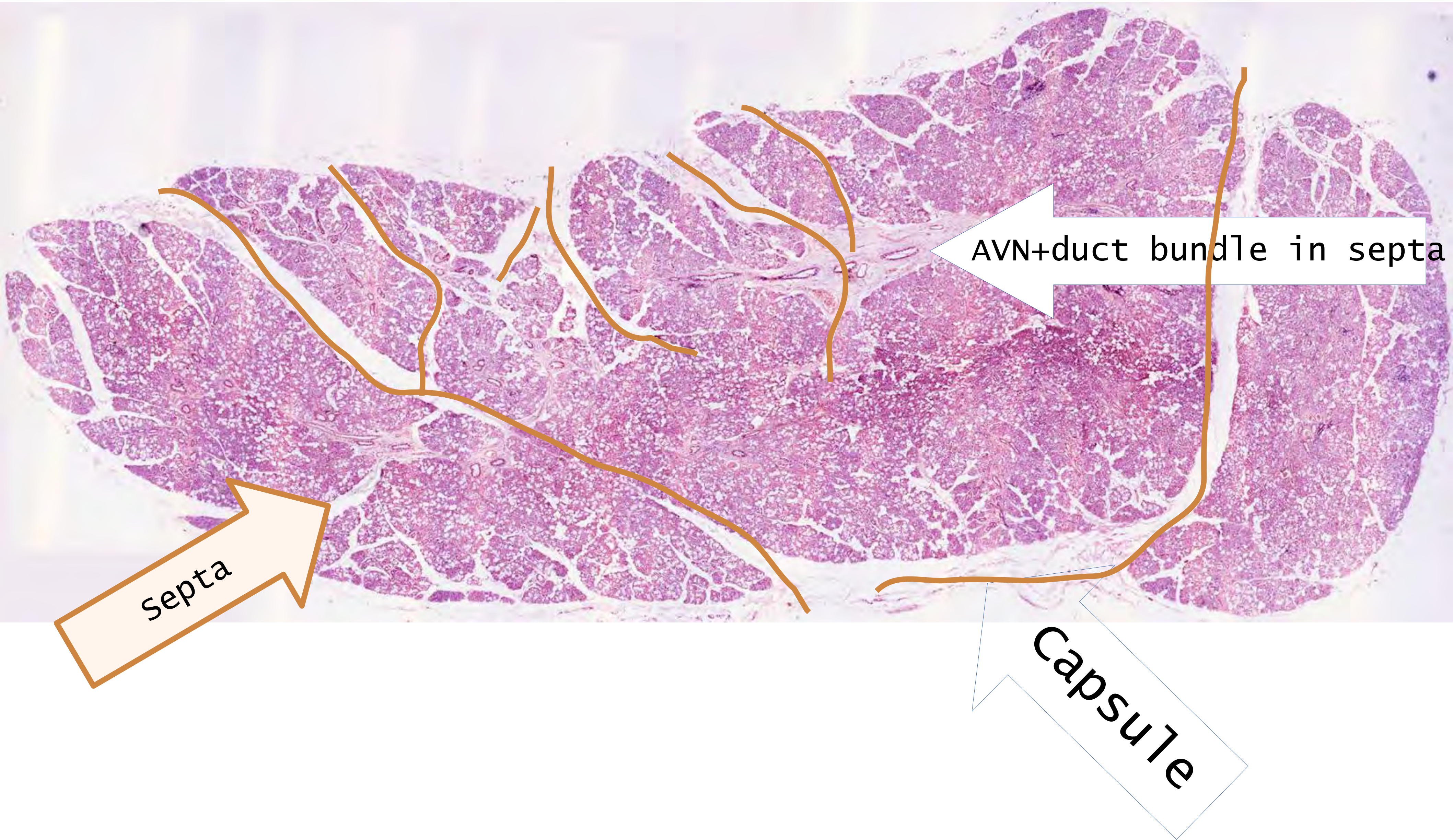
Submandibular gland

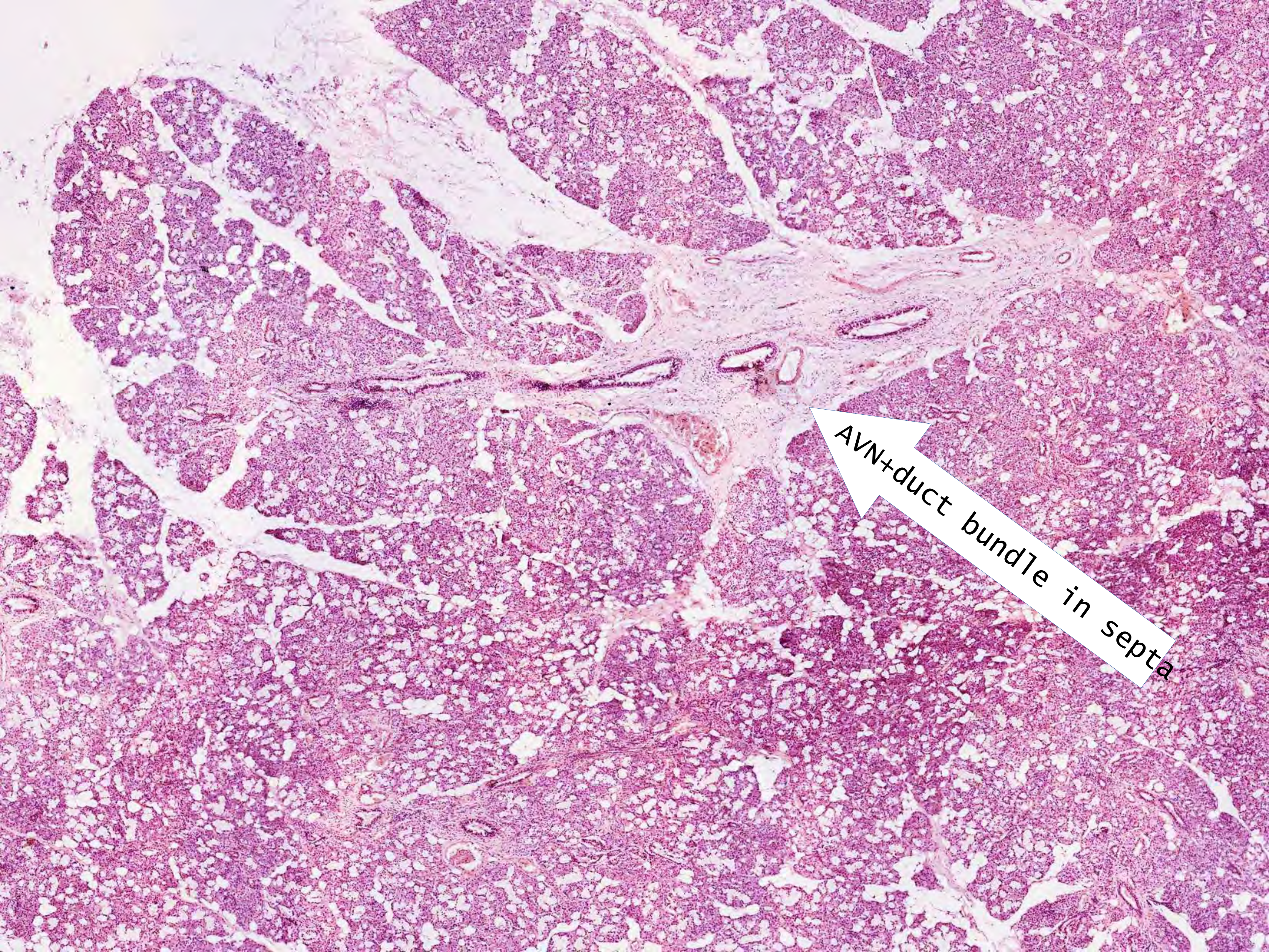
Identify microscopically:
Secretory units
Secretory ducts
Connective tissue septae and blood vessels

Draw and annotate:
A number of secretory units and ducts.

Submandibular

- Classification
  - Mixed compound tubuloalveolar
- Capsule
  - From cervical fascia
  - Mostly collagenous
  - Form septa
  - Septa carries AVNL+ducts into gland


AVN+duct bundle in septa
Septa
Capsule


AVN+duct bundle in septa

Acini

- Mostly serous with mucous acini with serous demilunes
- Surrounded by myoepithelial cells
- Lumen in centre
- Fat cells with age

Acinar cells

- Pyramidal cells
- Round nucleus at base
- Secretory granules in apex

Serous demilunes

- Peripheral to mucous acini

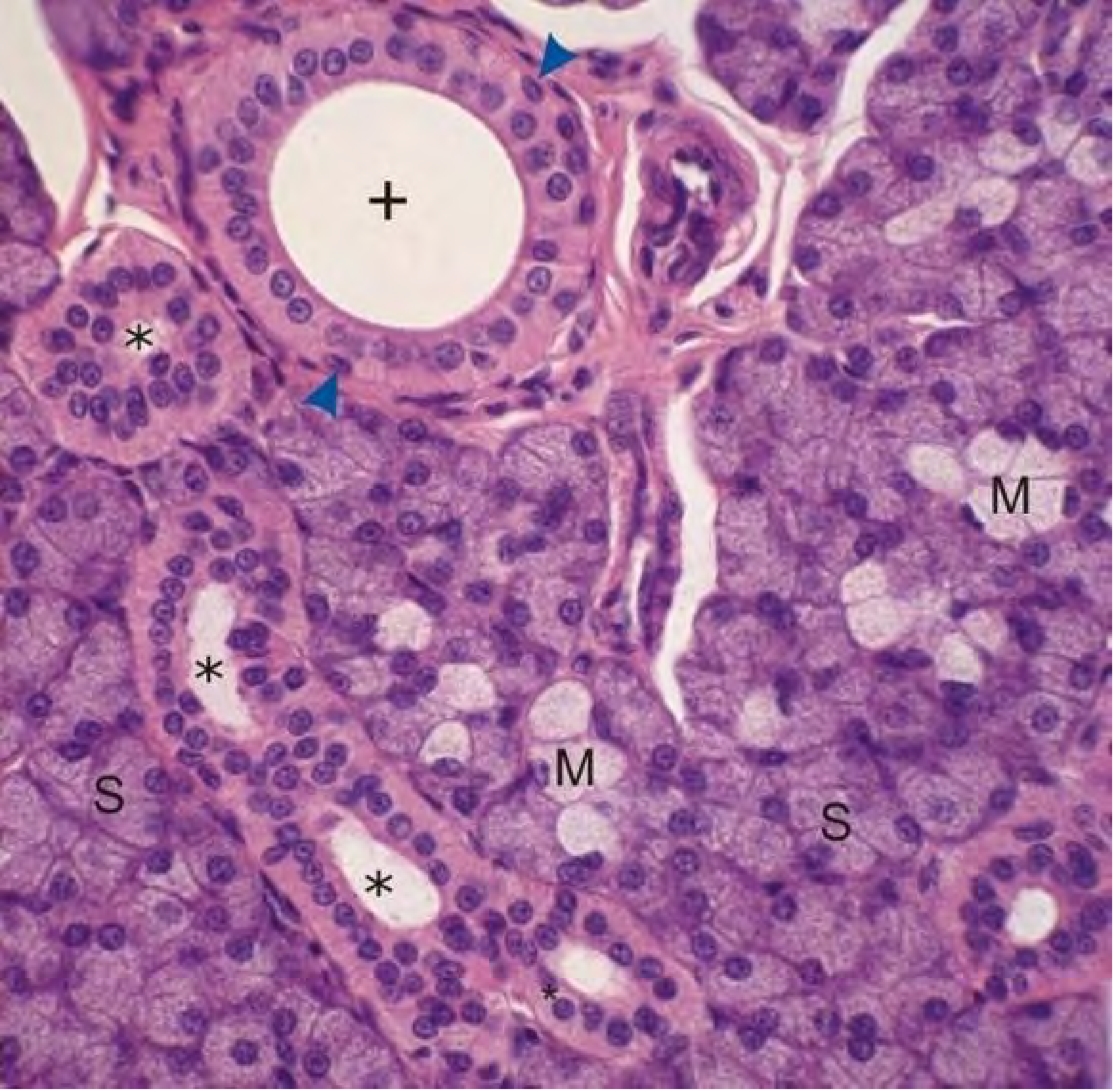
Myoepithelial cells

- Stellate shape
- Cytoplasma difficult to see

Ducts

- Intercalated short but present
- Striated long prominent
- Striated duct
  - high cuboidal
  - basal striations
  - folded basement membrane
  - Between lobules in septae
- Intercalated duct
  - smallest
  - simple cuboidal
  - between acini


+
*
*
*
*
M
M
S
S



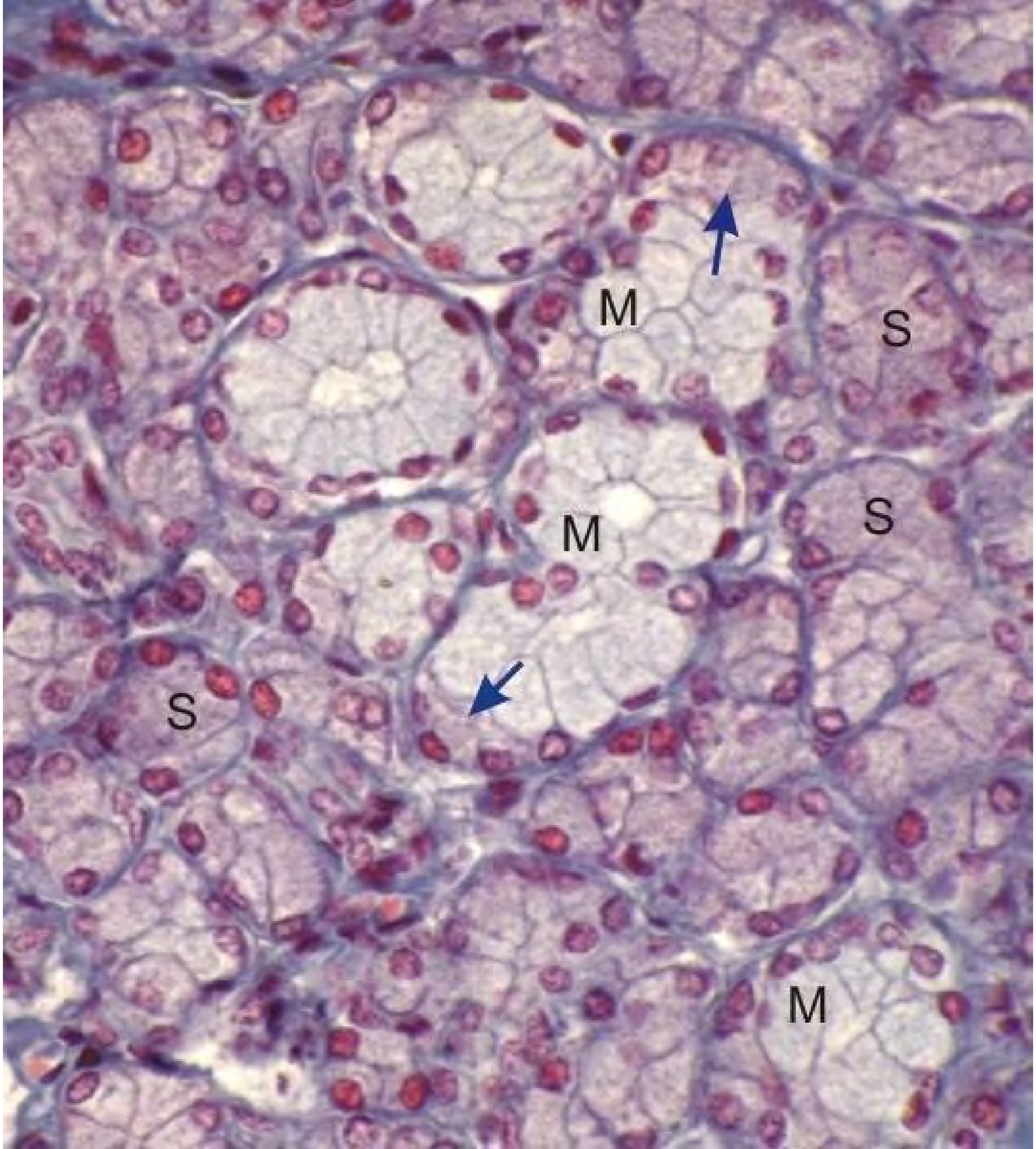
S = serous acini

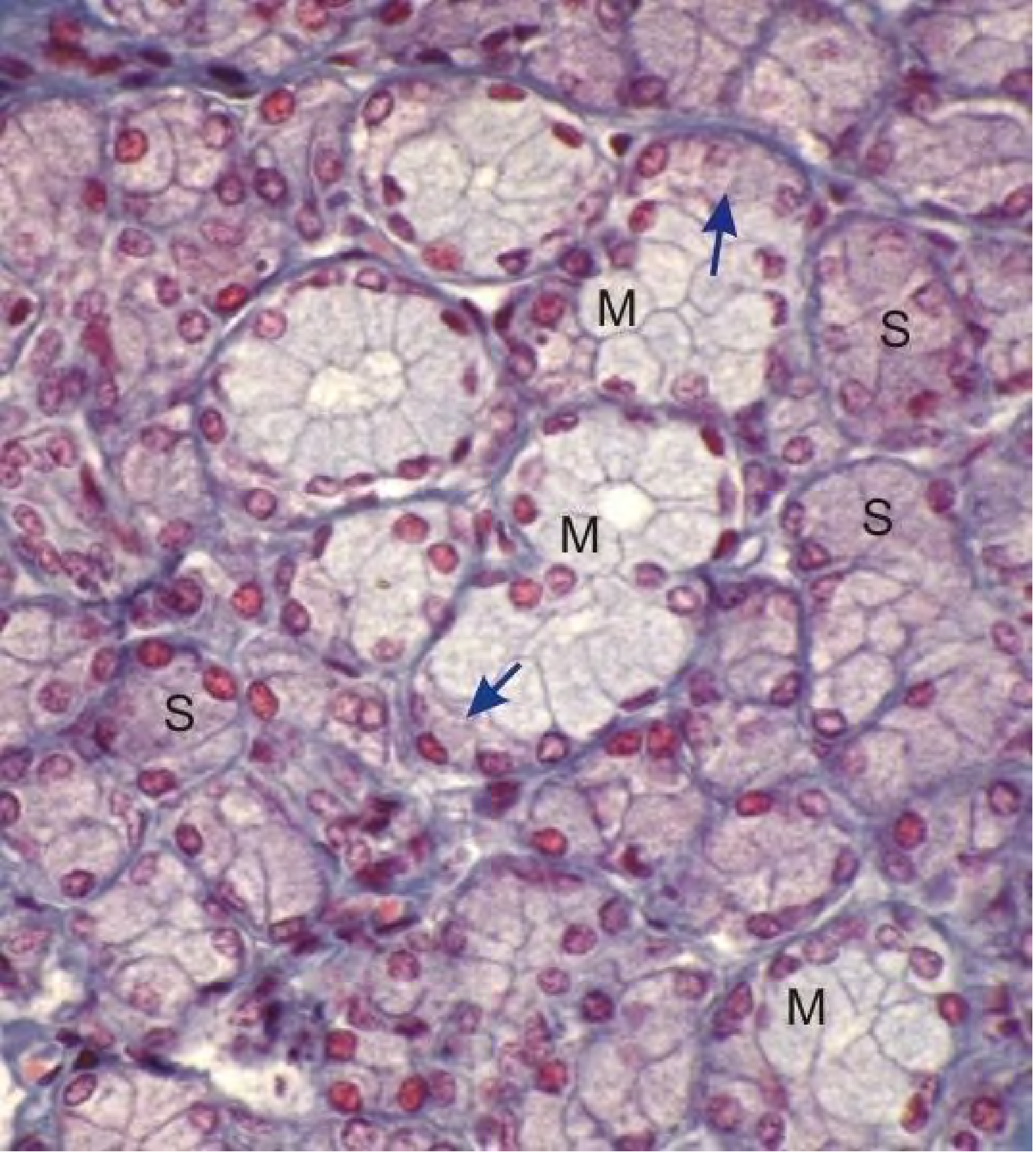
Some acini are mixed and show both serous and mucous cells (M)

* = striated ducts

+ = larger non-striated intralobular duct

Arrowheads = basal cells among the columnar epithelial cells


M
S
S
M
S
M



S = pure serous acini

M = mixed acini with mucous cells (M) and serous demilune cells (arrows).

Tooth

Slides 16, 23, 25, 27

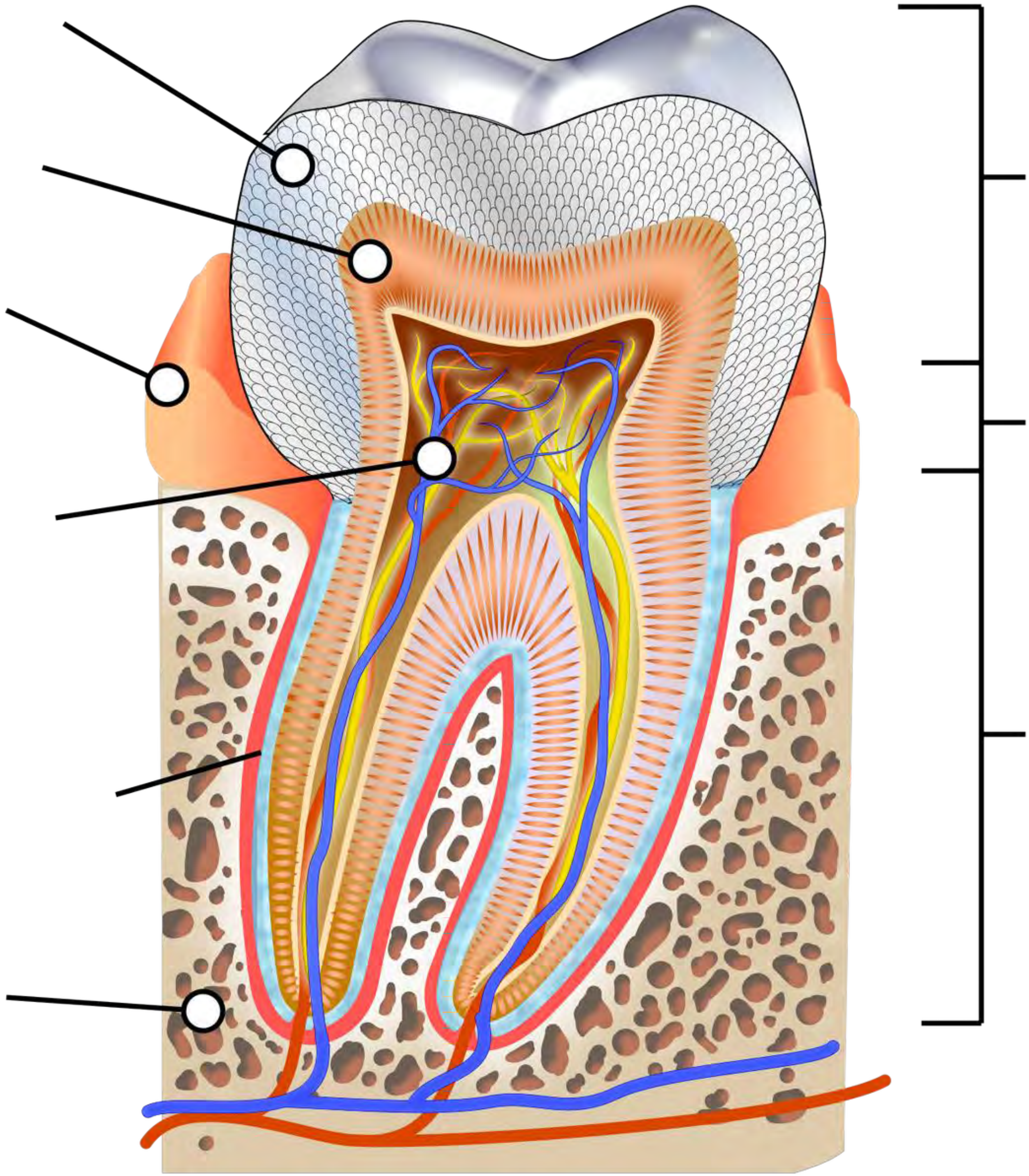
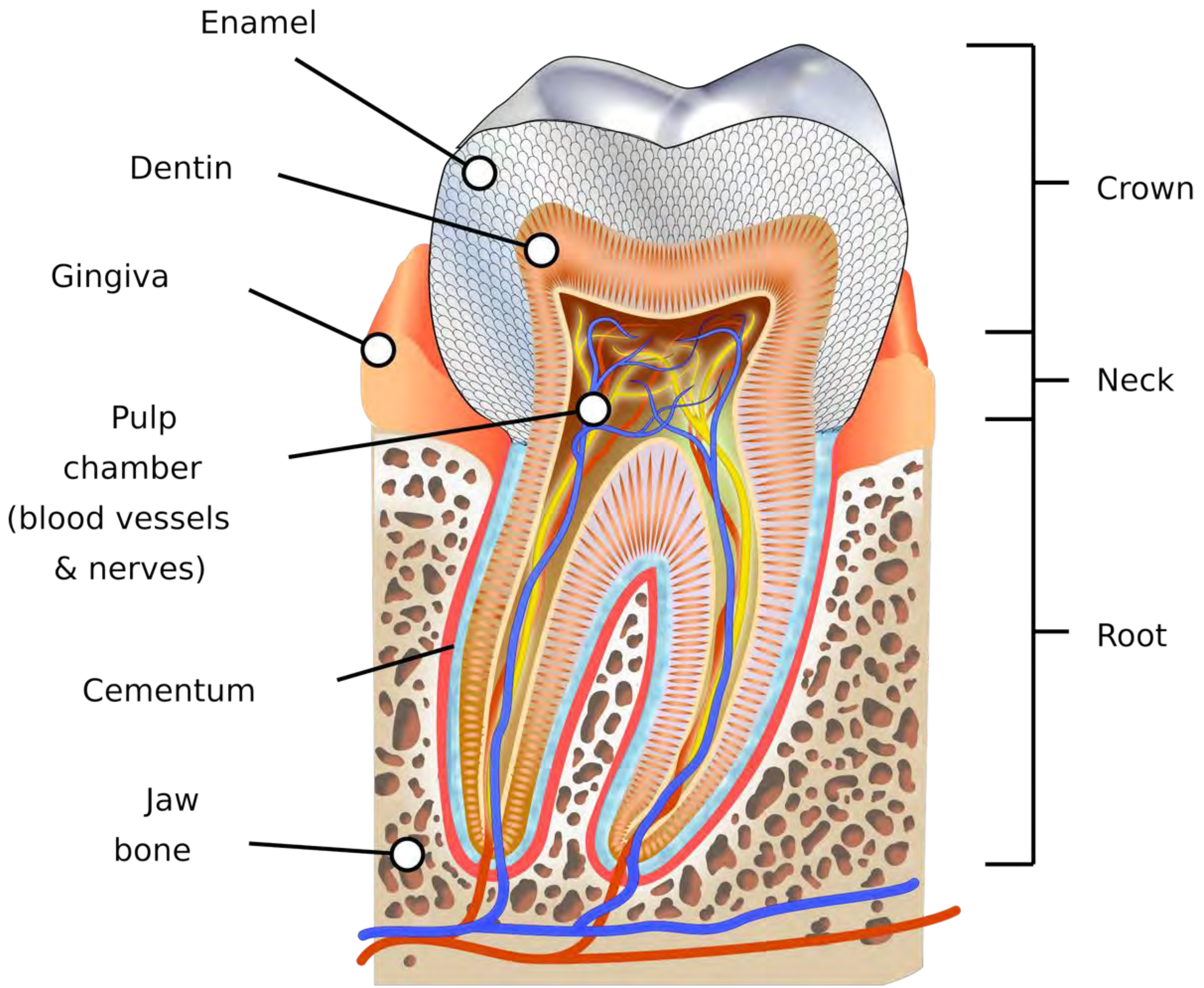


Diagram of a healthy human molar showing the enamel, cementum, pulp, and dentin which make up the structure, as well as the surrounding tissues



Anatomy

- Three regions
  - Enamel covered crown
  - Cementum covered root
  - Neck = enamel-cementum junction
- Bulk = dentin
- Dentin
  - Surrounds central pulp chamber
  - And root canal

Four components to find

- Tissues of the tooth
- Periodontal ligament
- Gingiva
- Alveolar bone

Tissues of the tooth

- Enamel
- Dentin
- Odontoblast processes
  - Present within dentil tubules in dentin
- Dentil tubules
  - S-shaped curve from dentin to enamel/cement
- Cemementum
- Cells
  - Cementoblasts and cementocyts
- Pulp
- Inside pulp chamber
- Gelatinous CT with rich vascular, neural & lymphatic supply

Periodontal ligament

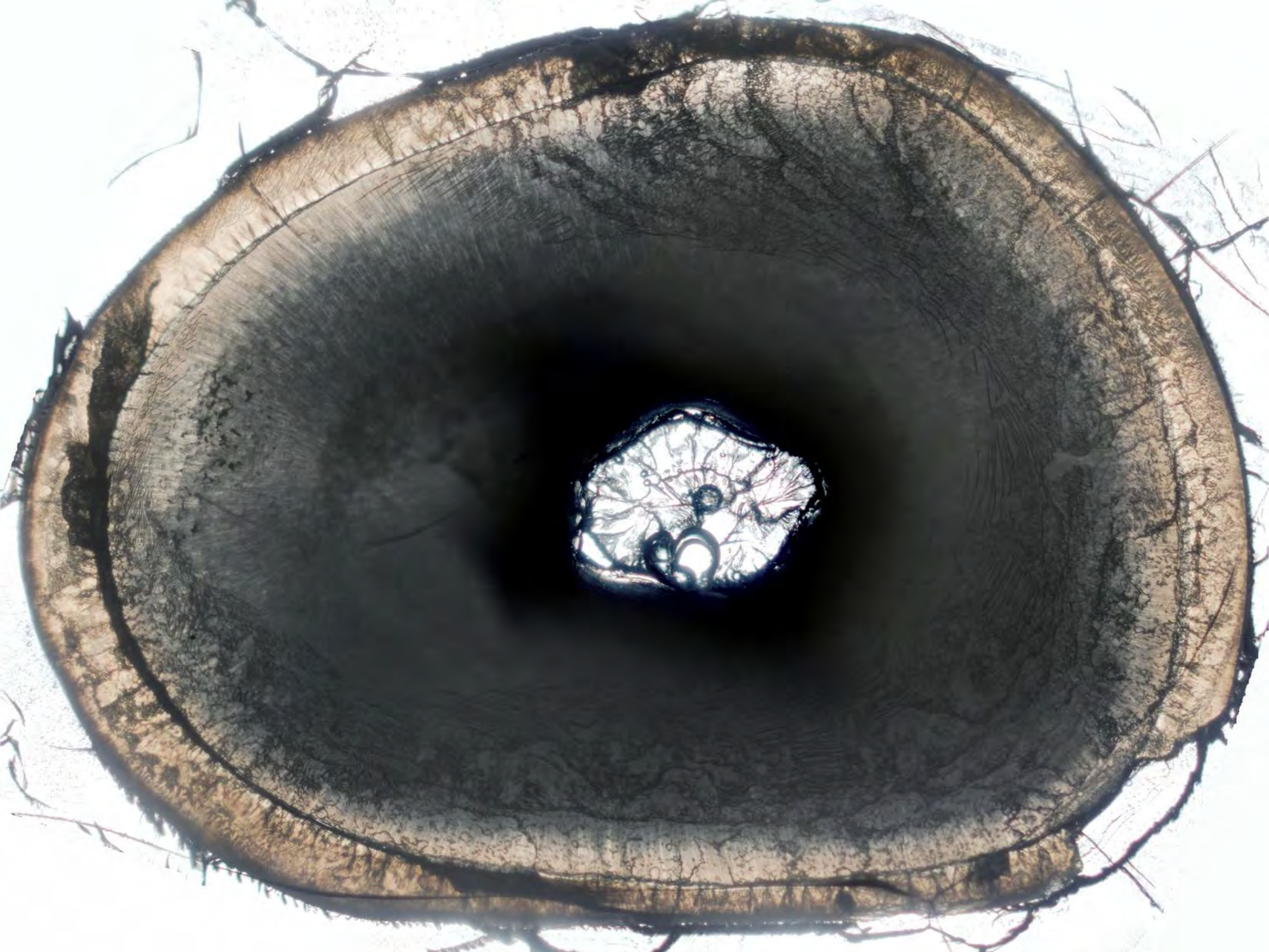
- Thick collagen fibre bundles
- Suspend tooth in alveolus
- Extend cementum to bone
- End points = Sharpey's fibres
- Cells
  - cementoblasts, fibroblasts, mast cells, WBC, fat cells, osteoblasts

Gingiva

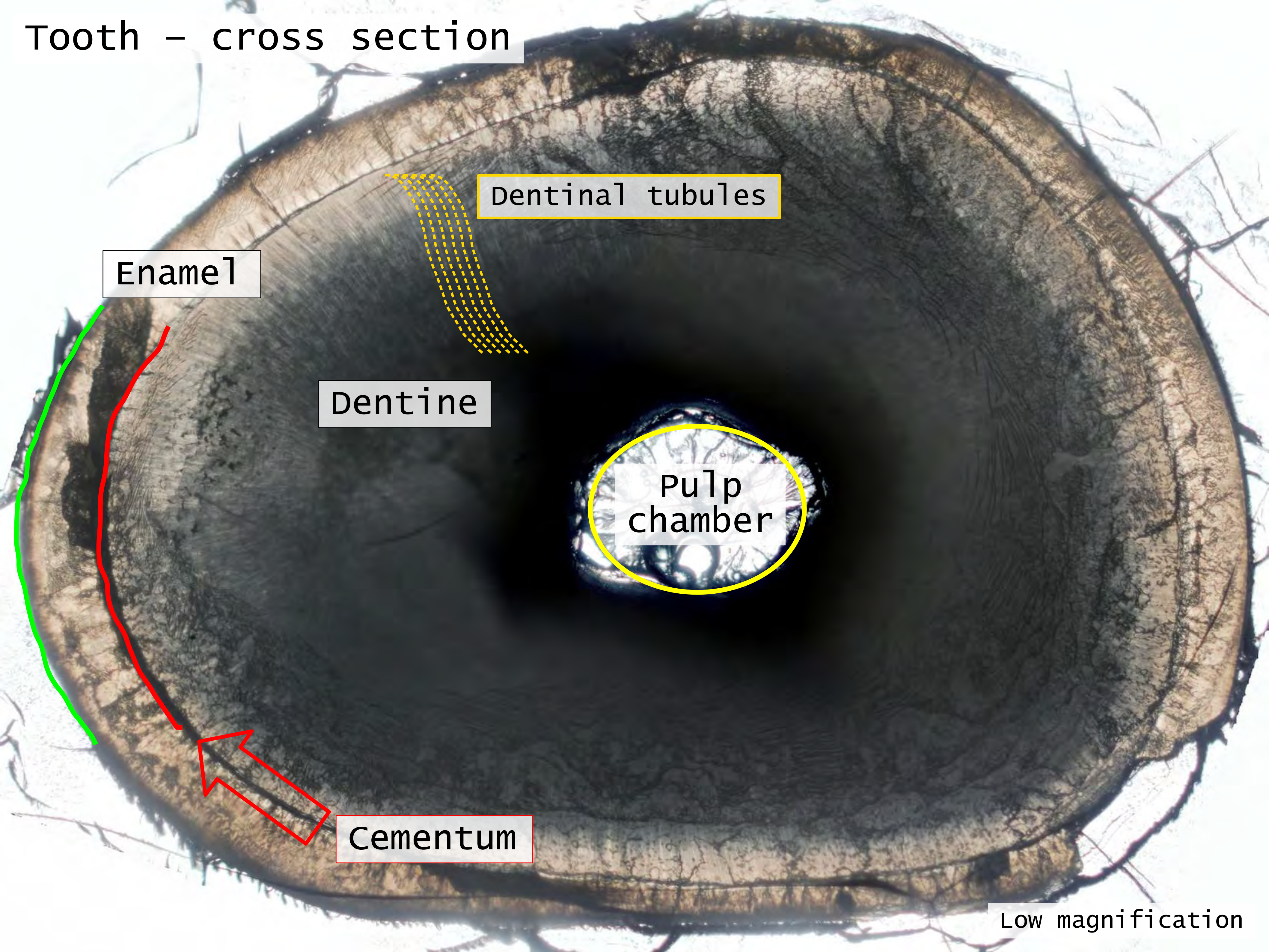
- Epithelium
  - Stratified squamous keratinized
- Connective tissue
  - Dense irregular collagenous CT

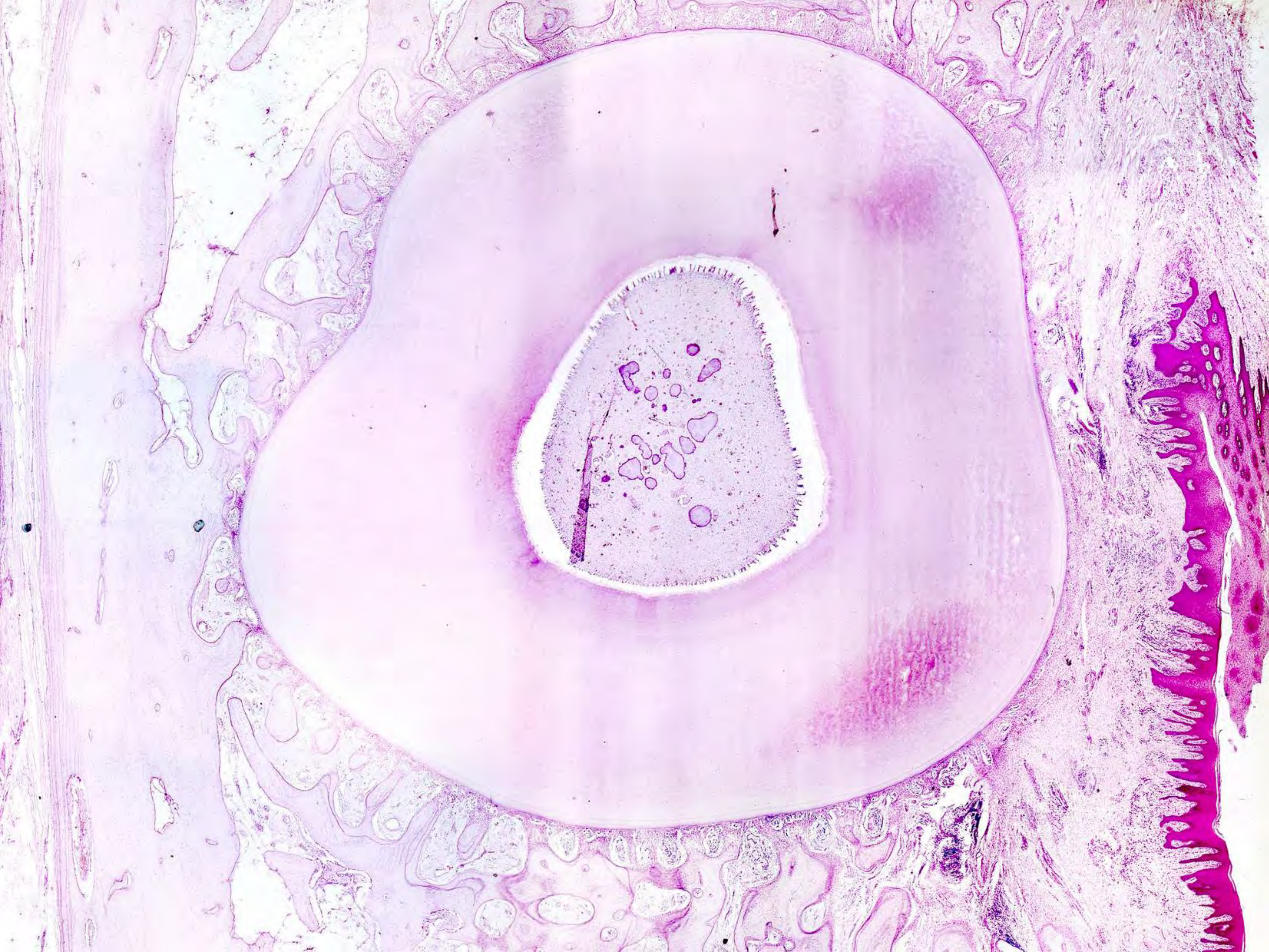
Alveolar bone

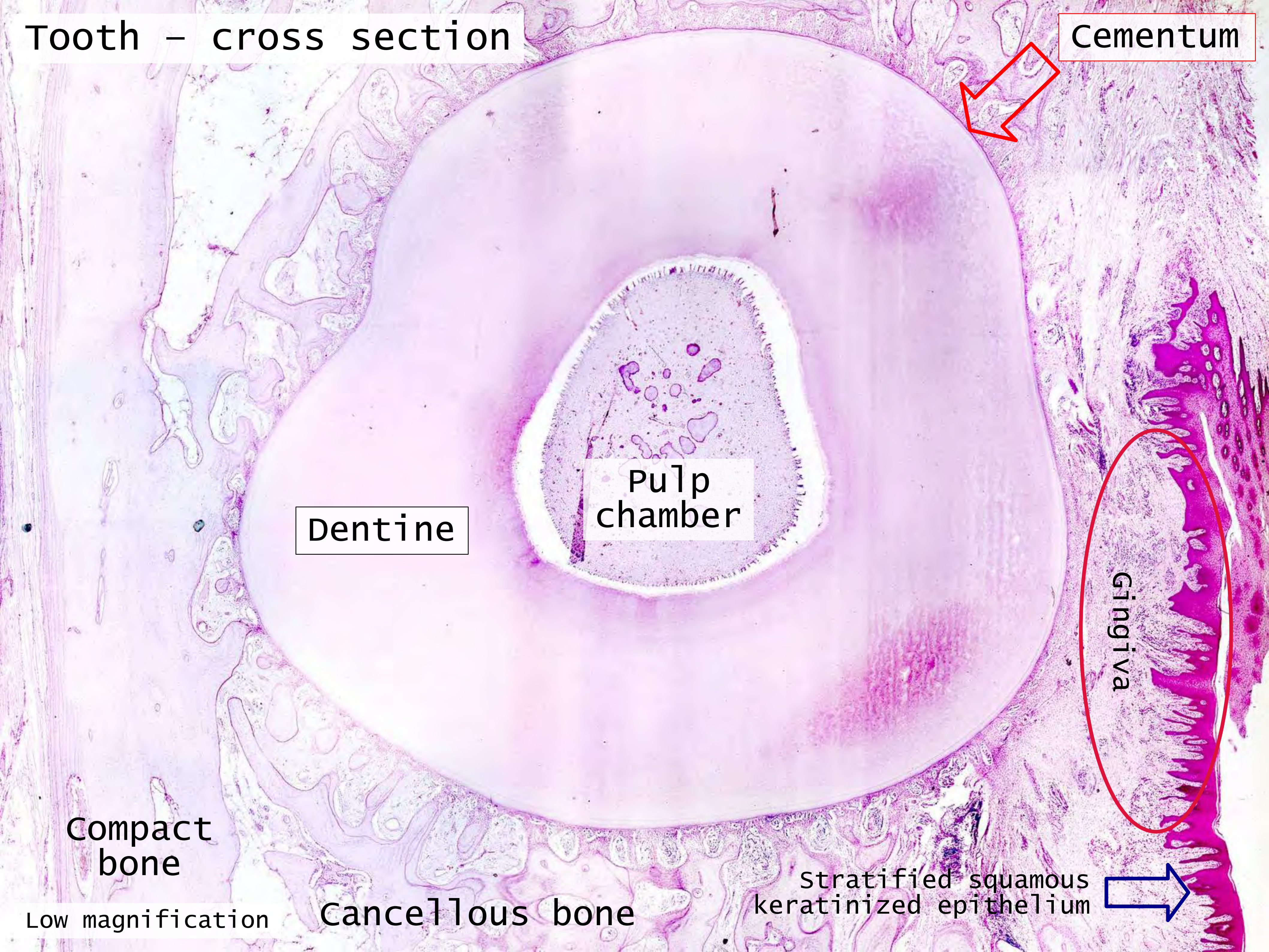
- Inner + Outer compact bone
- Intervening cancellous bone
- Cribriform plate
  - Inner layer surrounding tooth
  - Periodontal ligament embedded via Sharpey's fibres suspending tooth in alveolus



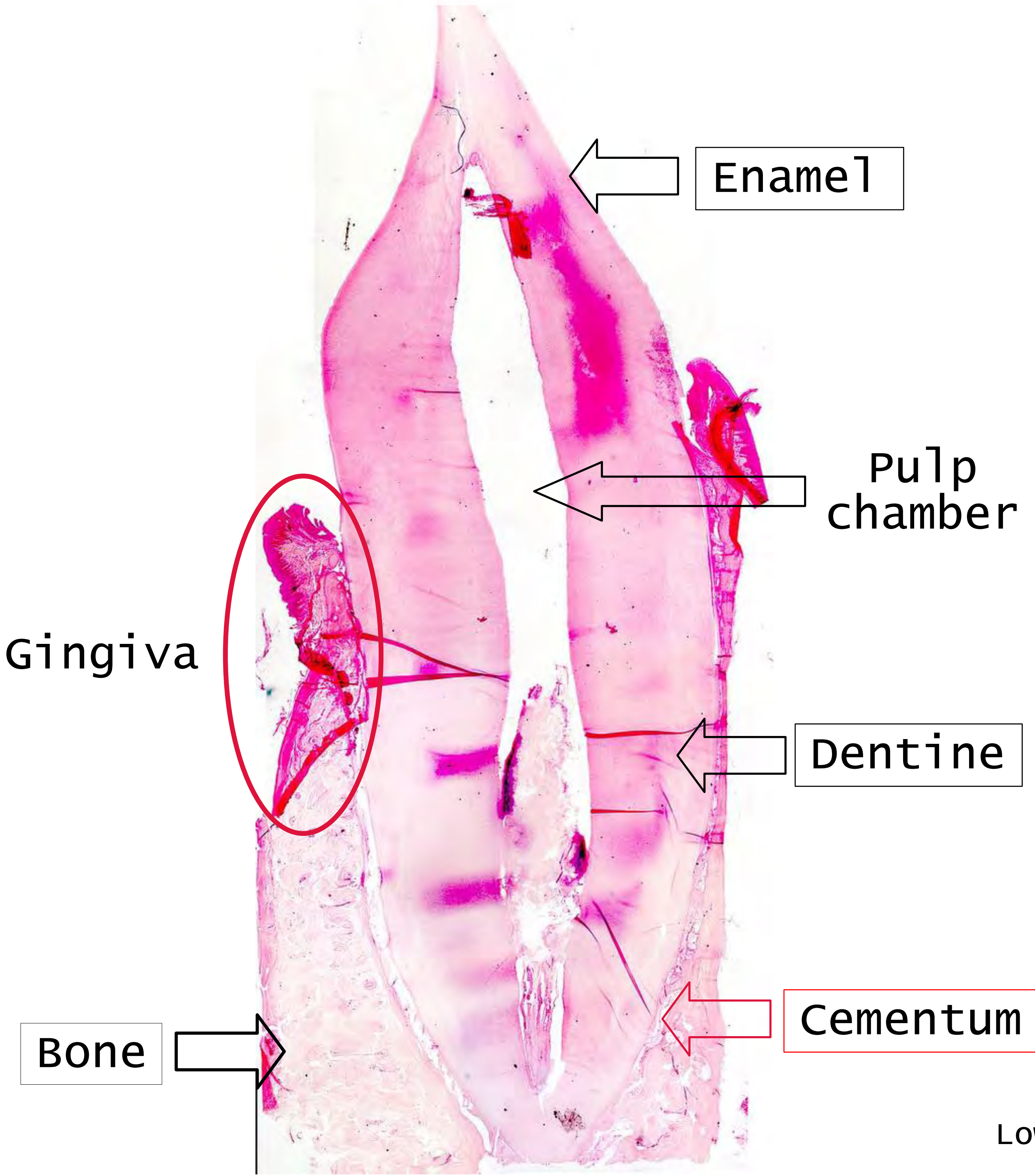
Tooth – cross section





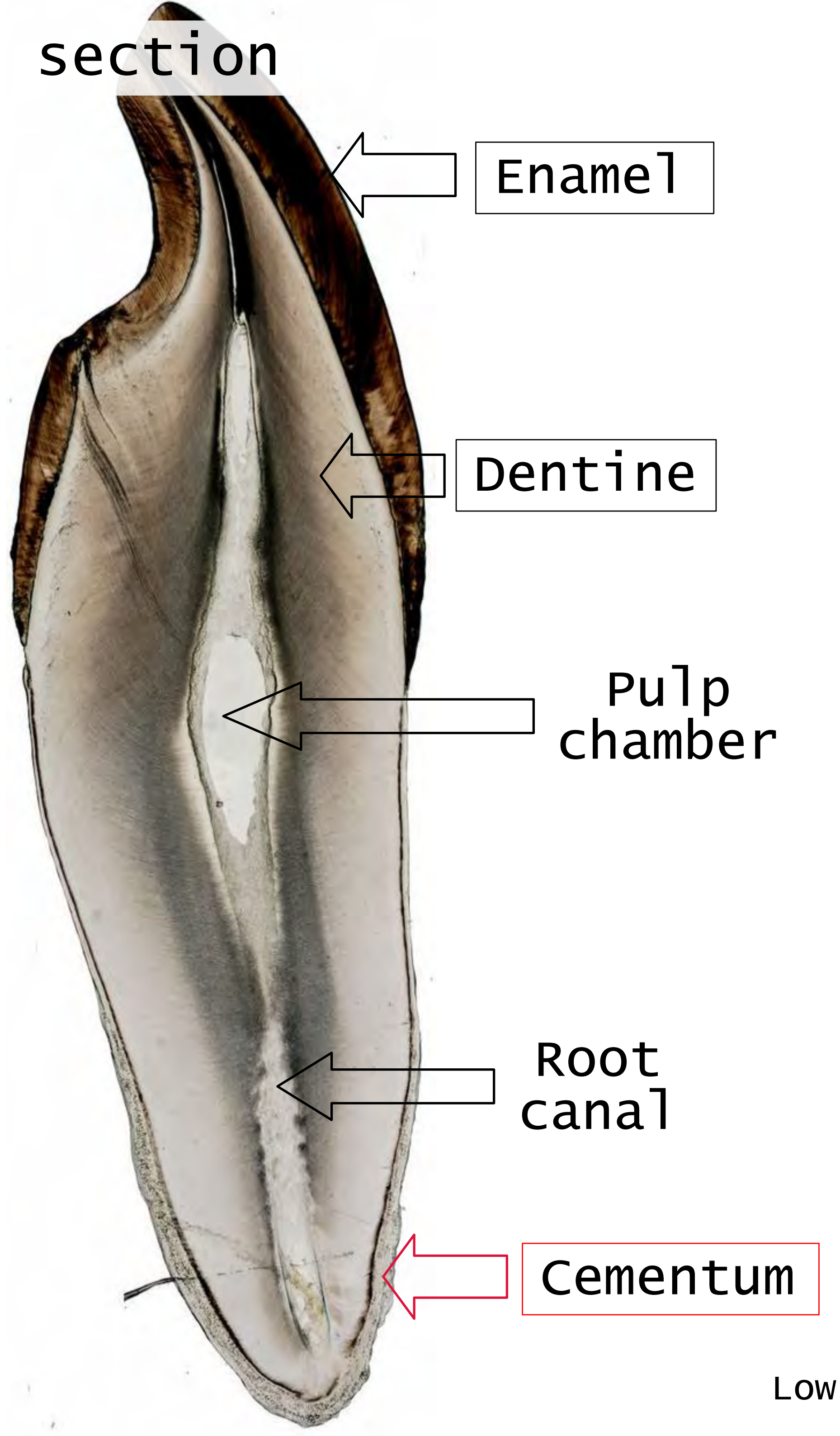

Tooth – cross section
Cementum
Pulp chamber
Dentine
Gingiva
Compact bone
Cancellous bone
Stratified squamous keratinized epithelium
Low magnification

Tooth – longitudinal section

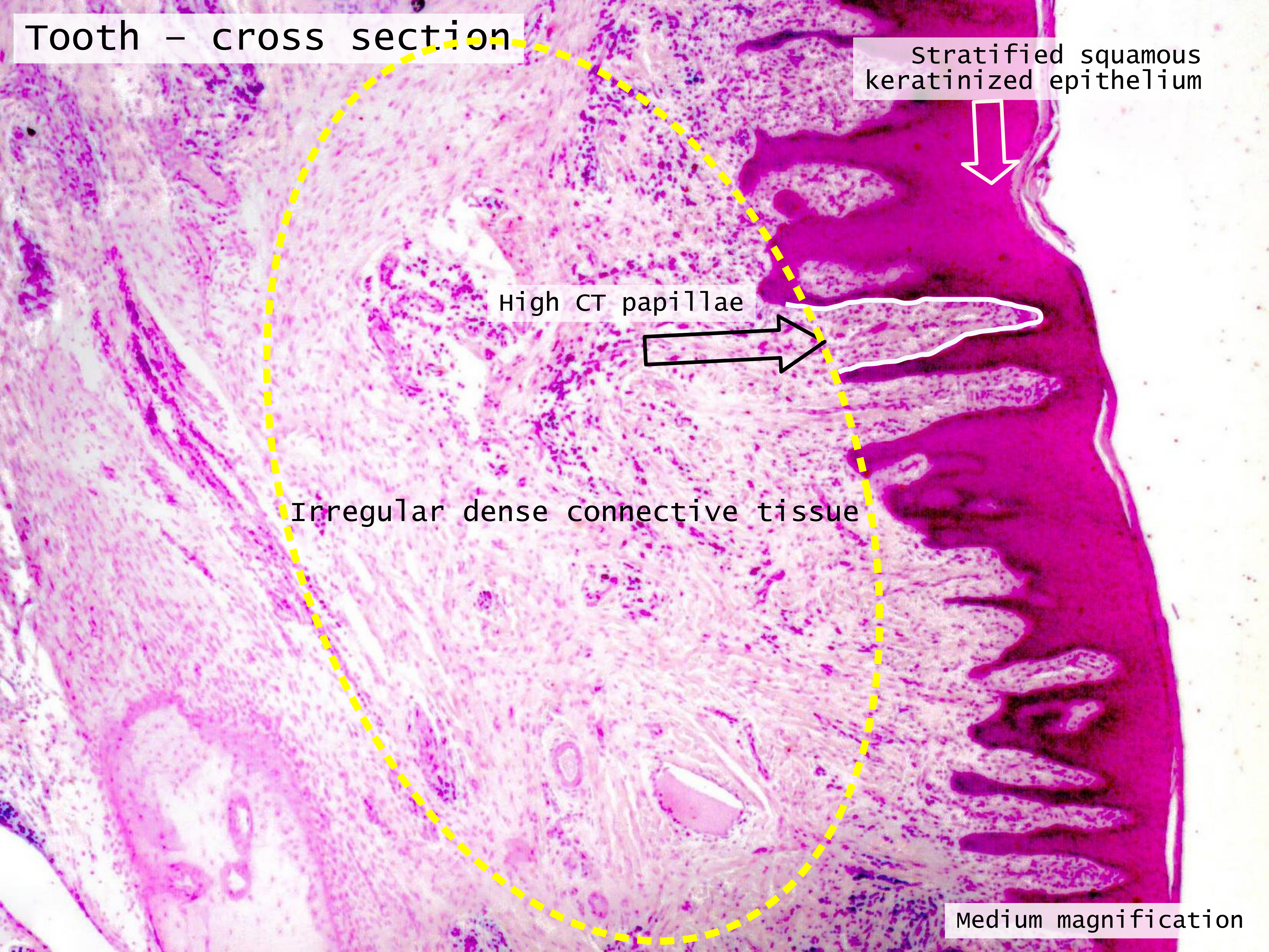


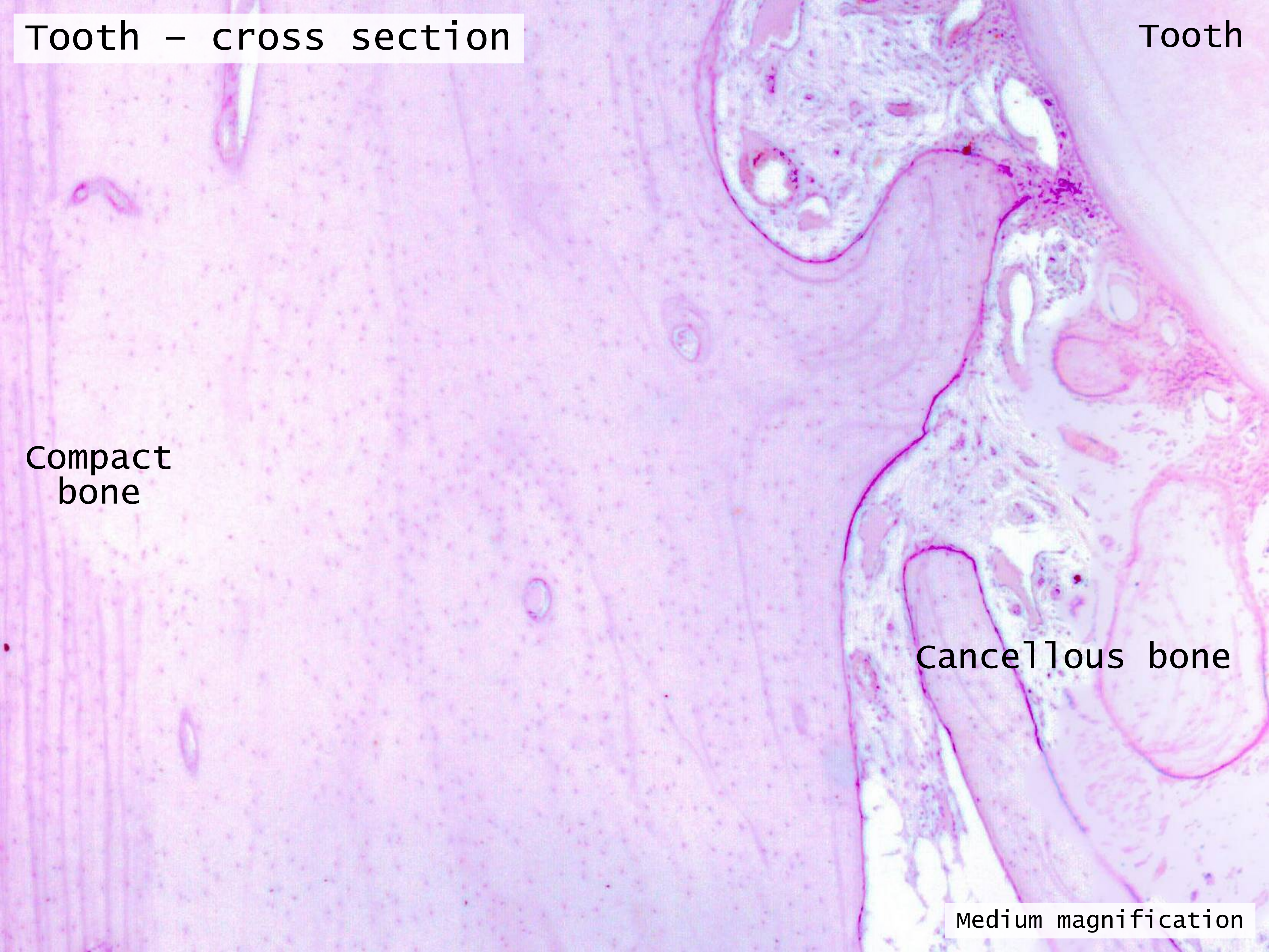
Low magnification

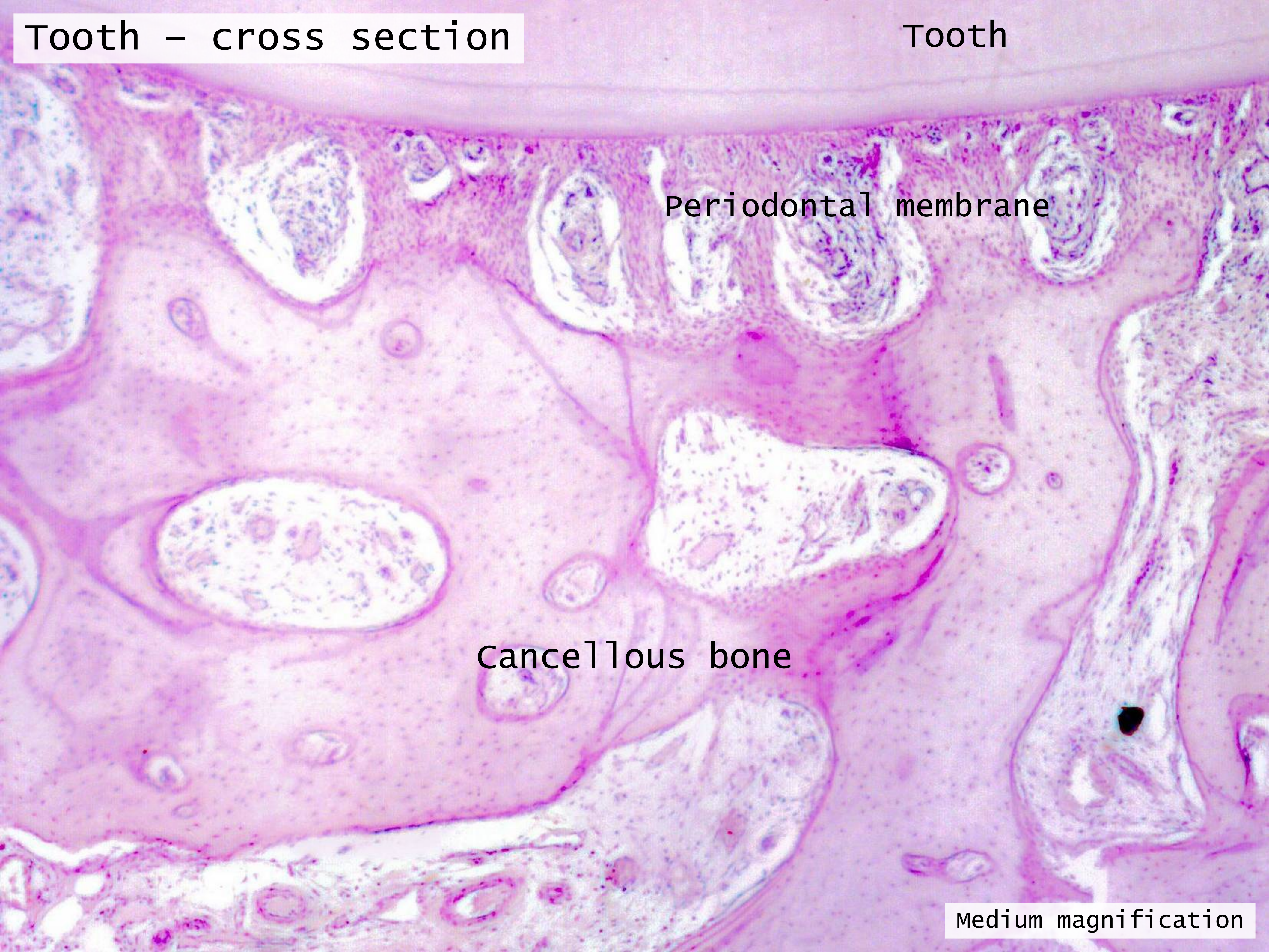
Tooth – longitudinal section



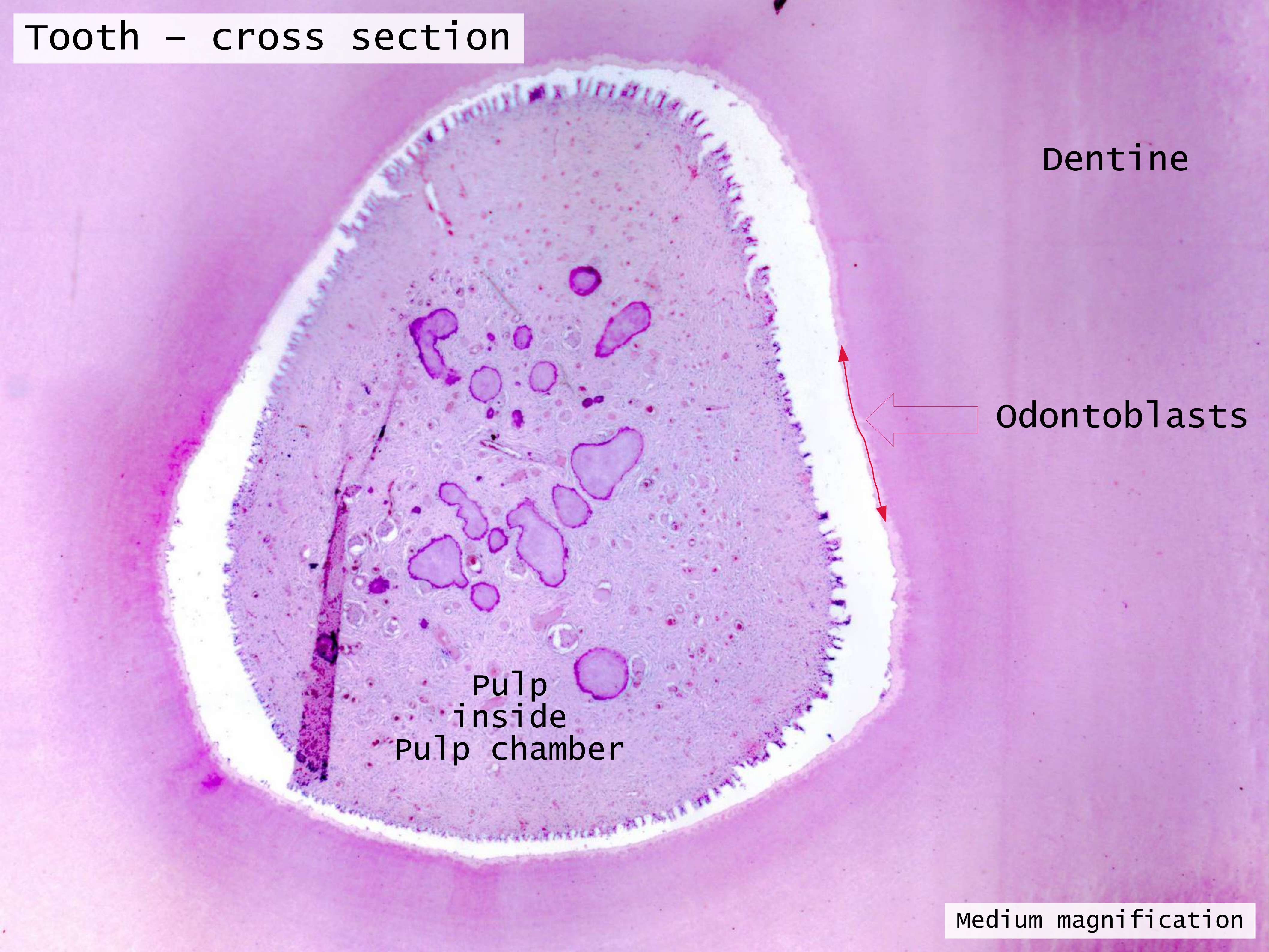
Low magnification

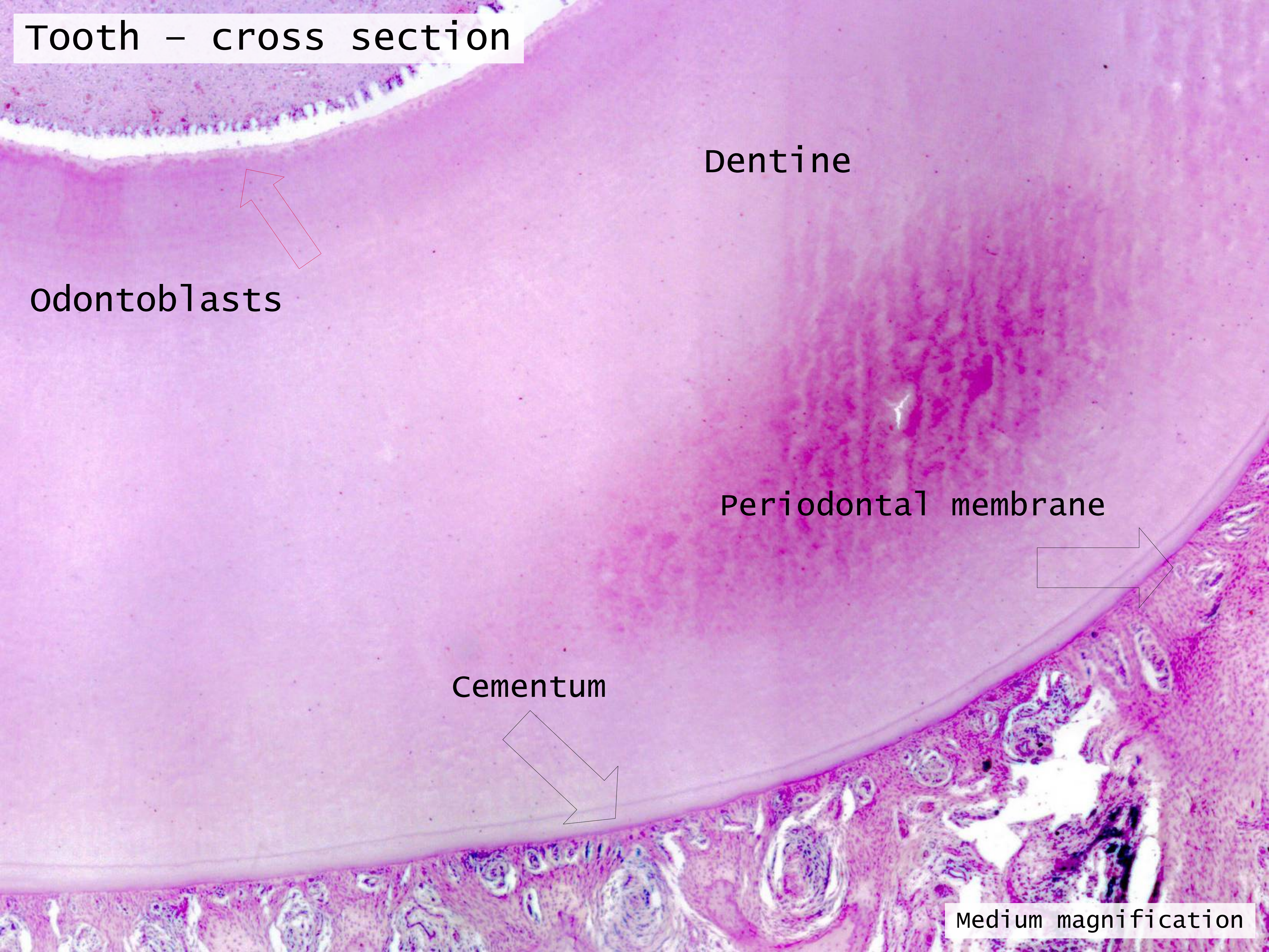

Tooth – cross section
Stratified squamous keratinized epithelium
High CT papillae
Irregular dense connective tissue
Medium magnification


Tooth – cross section
Tooth
Compact bone
Cancellous bone
Medium magnification

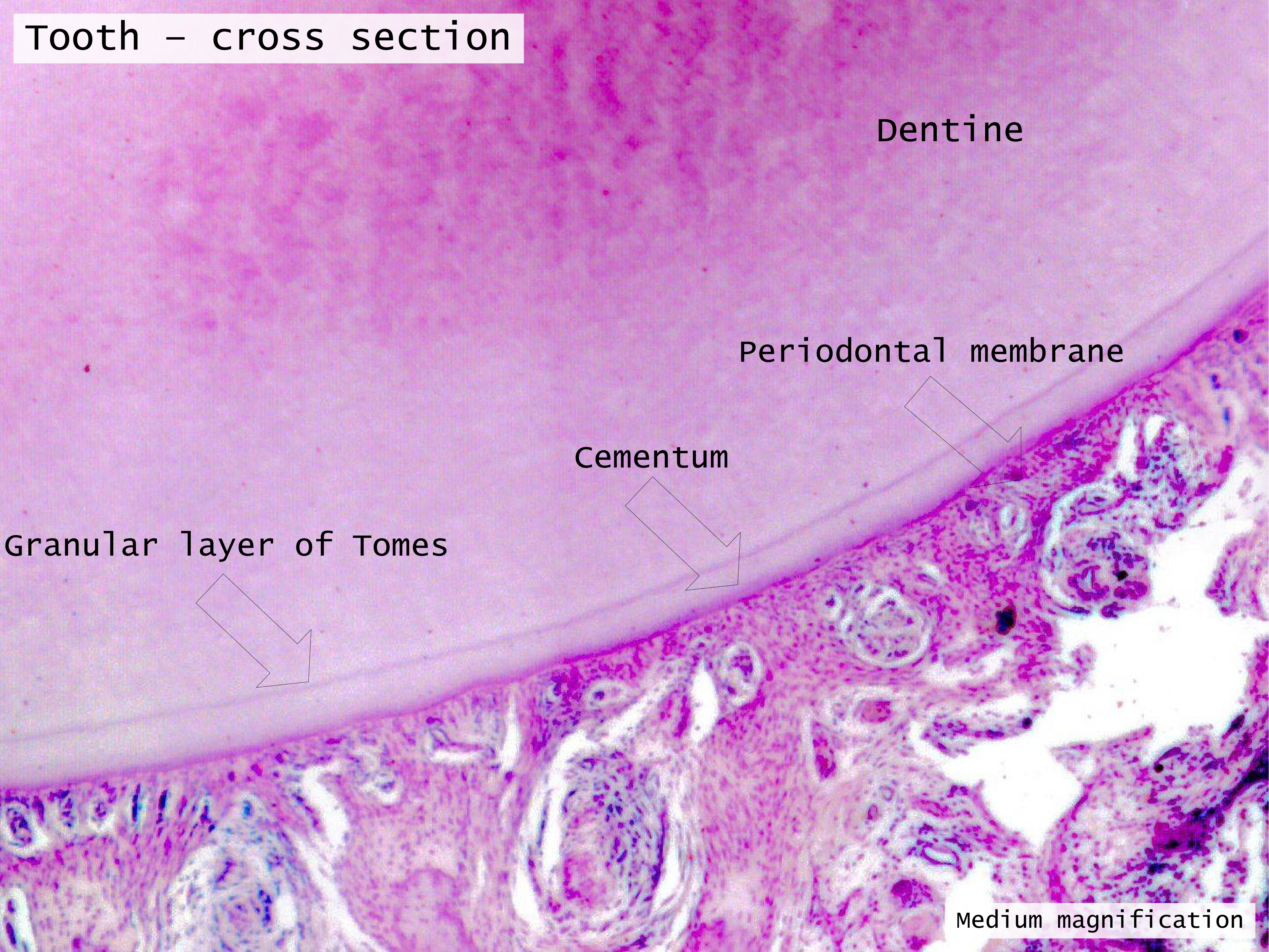

Tooth – cross section
Tooth
Periodontal membrane
Cancellous bone
Medium magnification

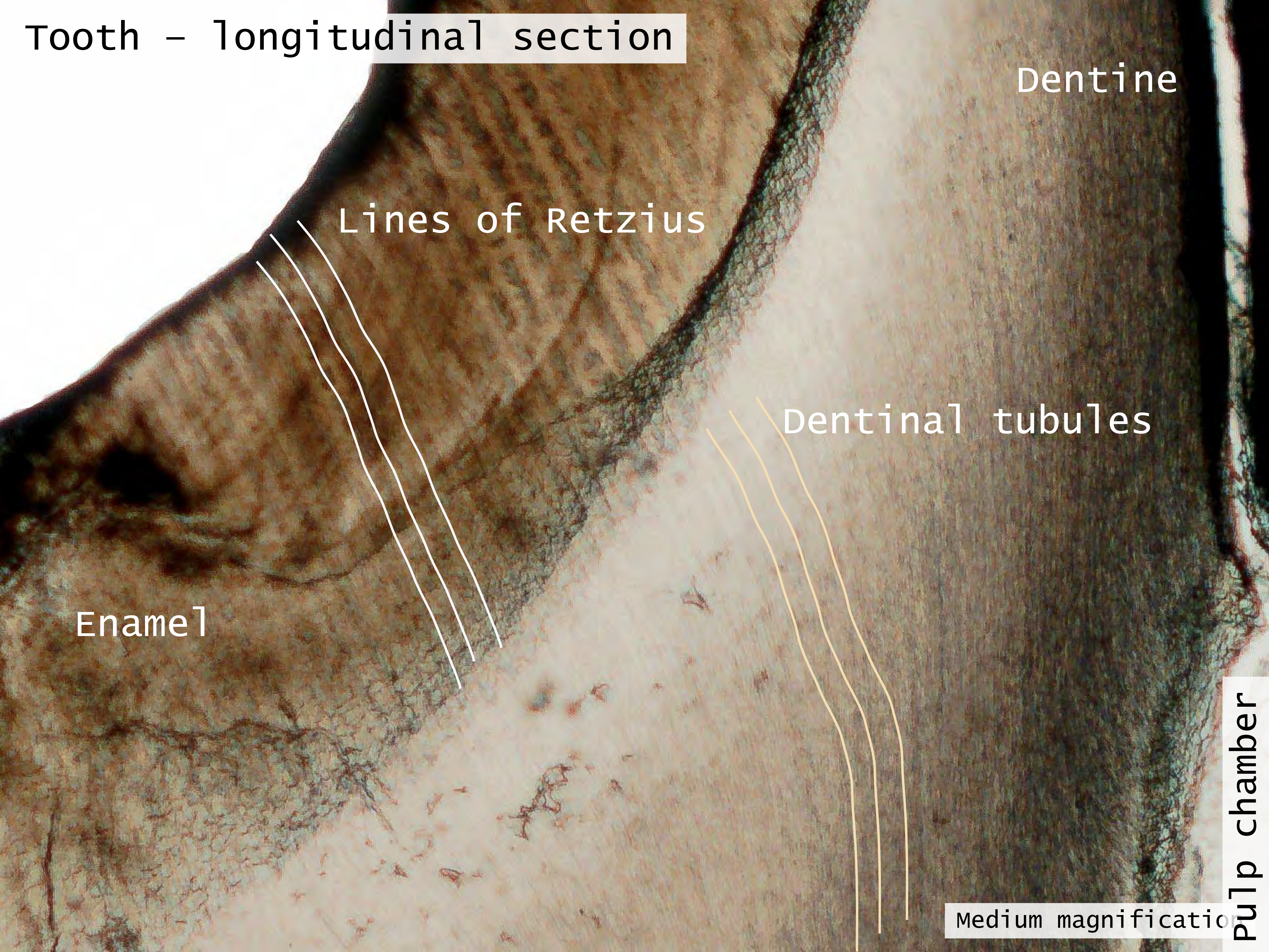
Tooth – cross section




Tooth – cross section
Dentine
Odontoblasts
Periodontal membrane
Cementum
Medium magnification

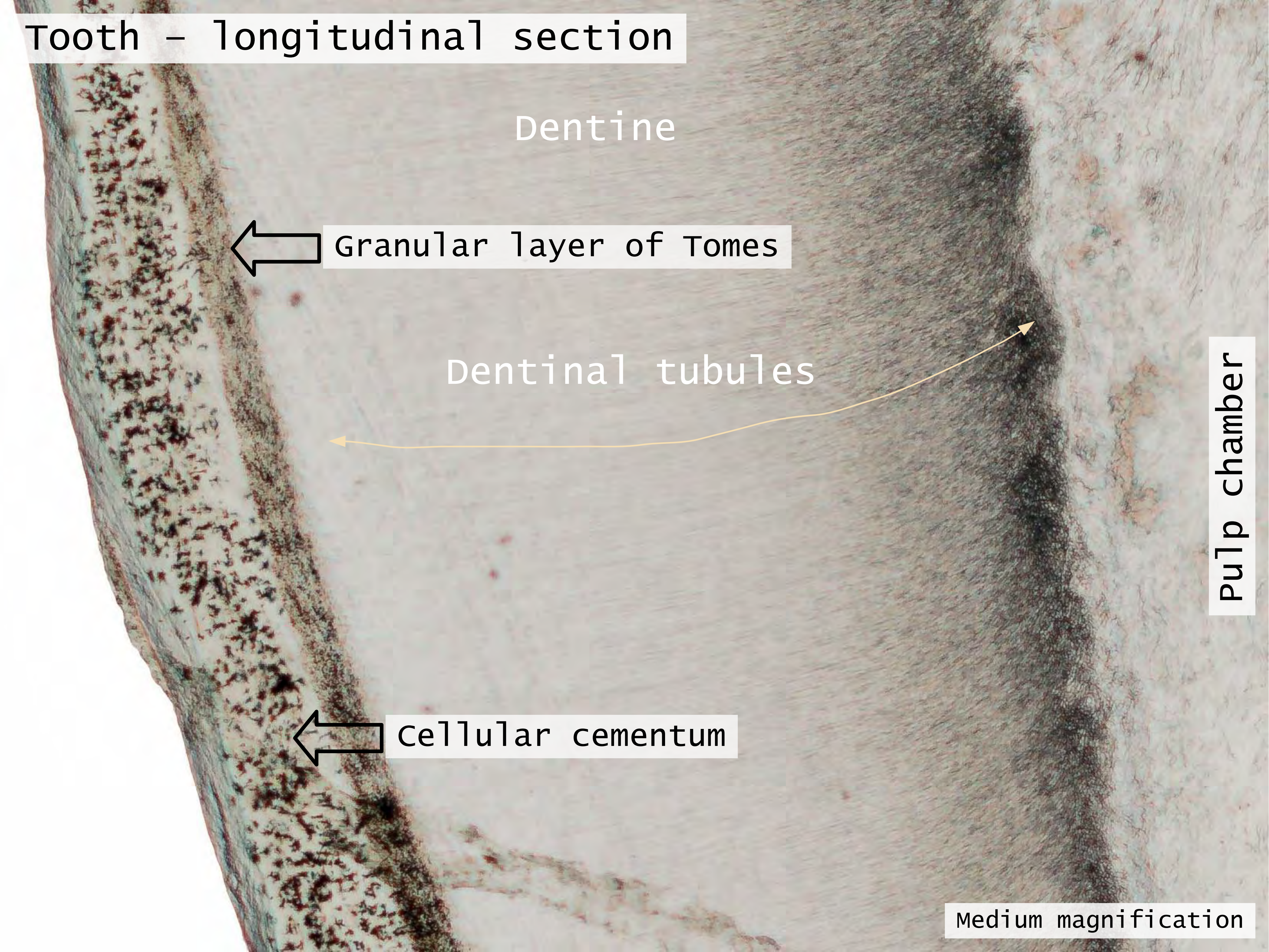
Tooth – cross section




Tooth – longitudinal section
Dentine
Lines of Retzius
Dentinal tubules
Enamel
Pulp chamber
Medium magnification


Tooth – longitudinal section
Dentine
Dentinal tubules
Pulp chamber
Medium magnification


Tooth – longitudinal section
Dentinal tubules
Medium magnification

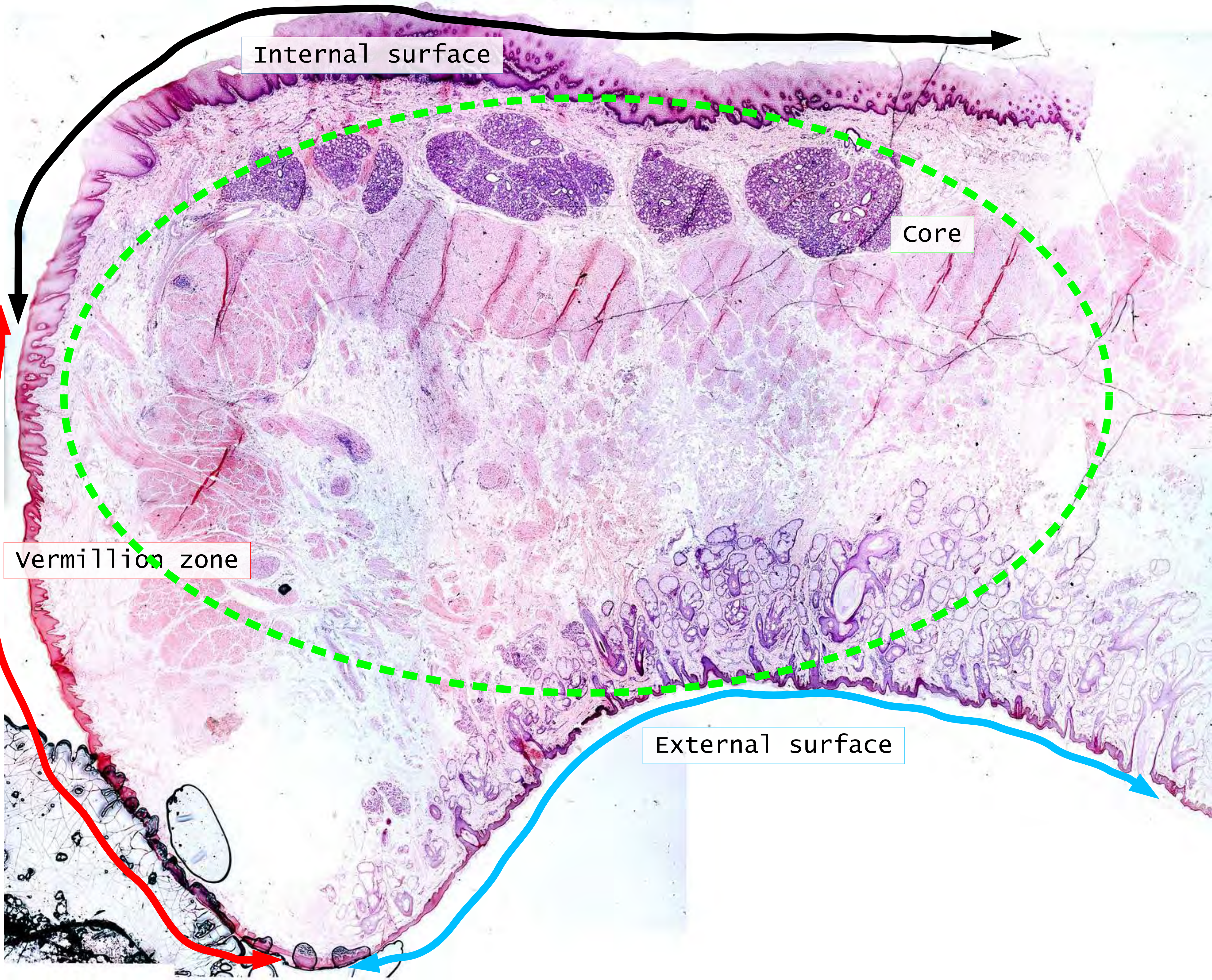

Tooth – longitudinal section
Dentine
Granular layer of Tomes
Dentinal tubules
Cellular cementum
Pulp chamber
Medium magnification

Lip

Slide 51

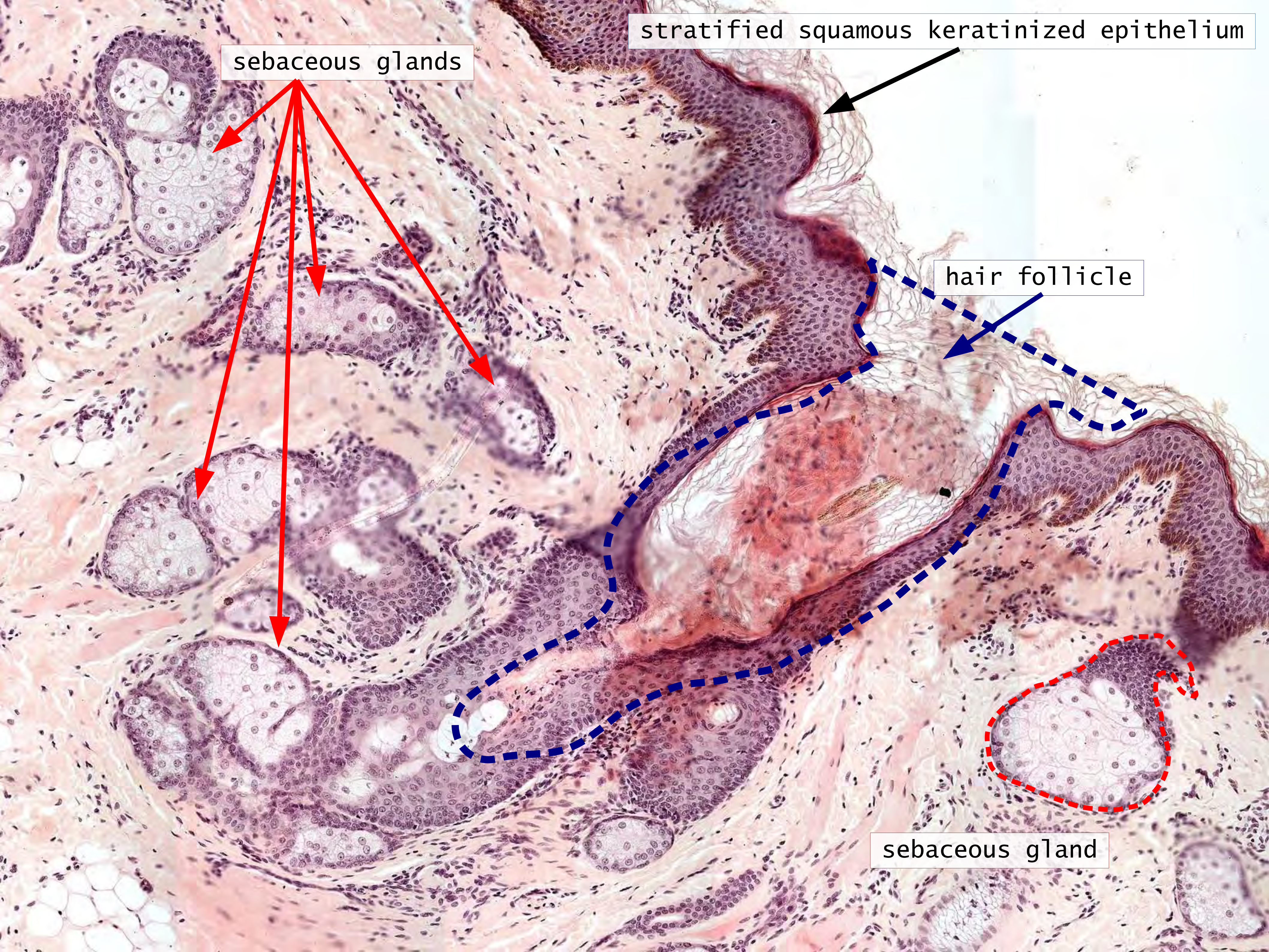
Lip

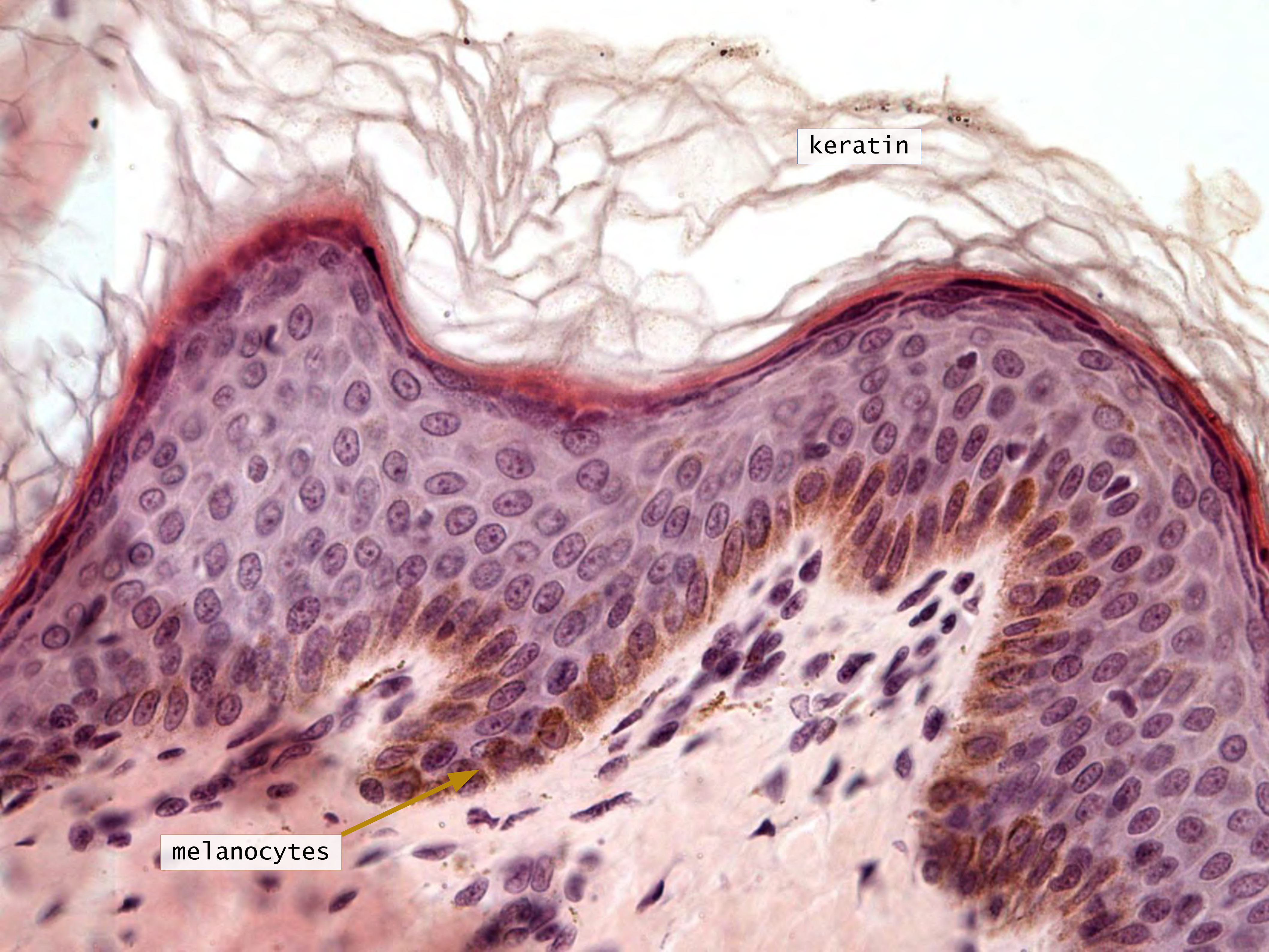
- External surface
- Vermillion zone
- Internal surface
- Core

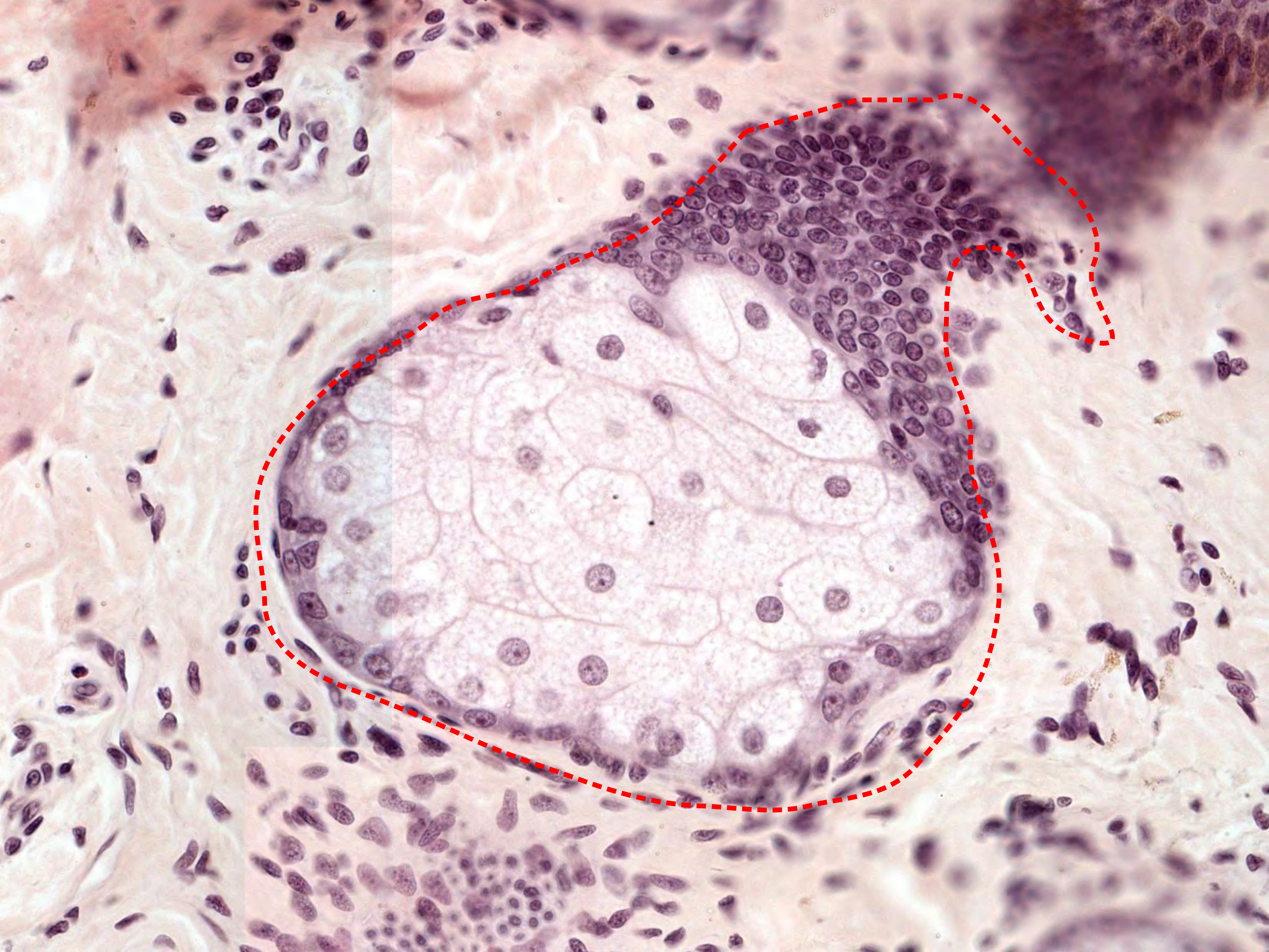

Internal surface
Core
Vermillion zone
External surface

External surface

- Covered with skin
- Contains
  - Hair follicles
  - Sebaceous glands
  - Sweat glands

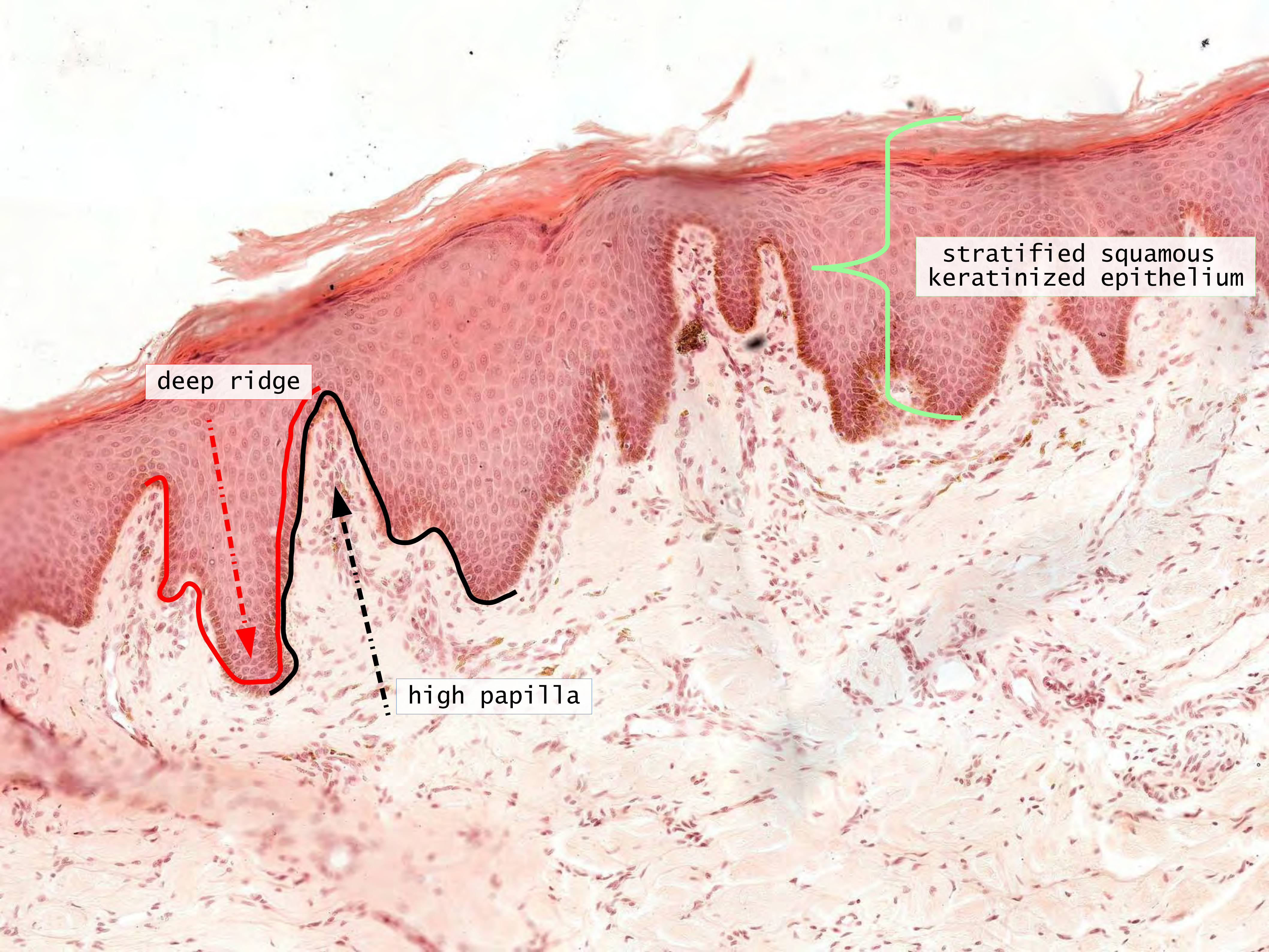

sebaceous glands
stratified squamous keratinized epithelium
hair follicle
sebaceous gland


keratin
melanocytes

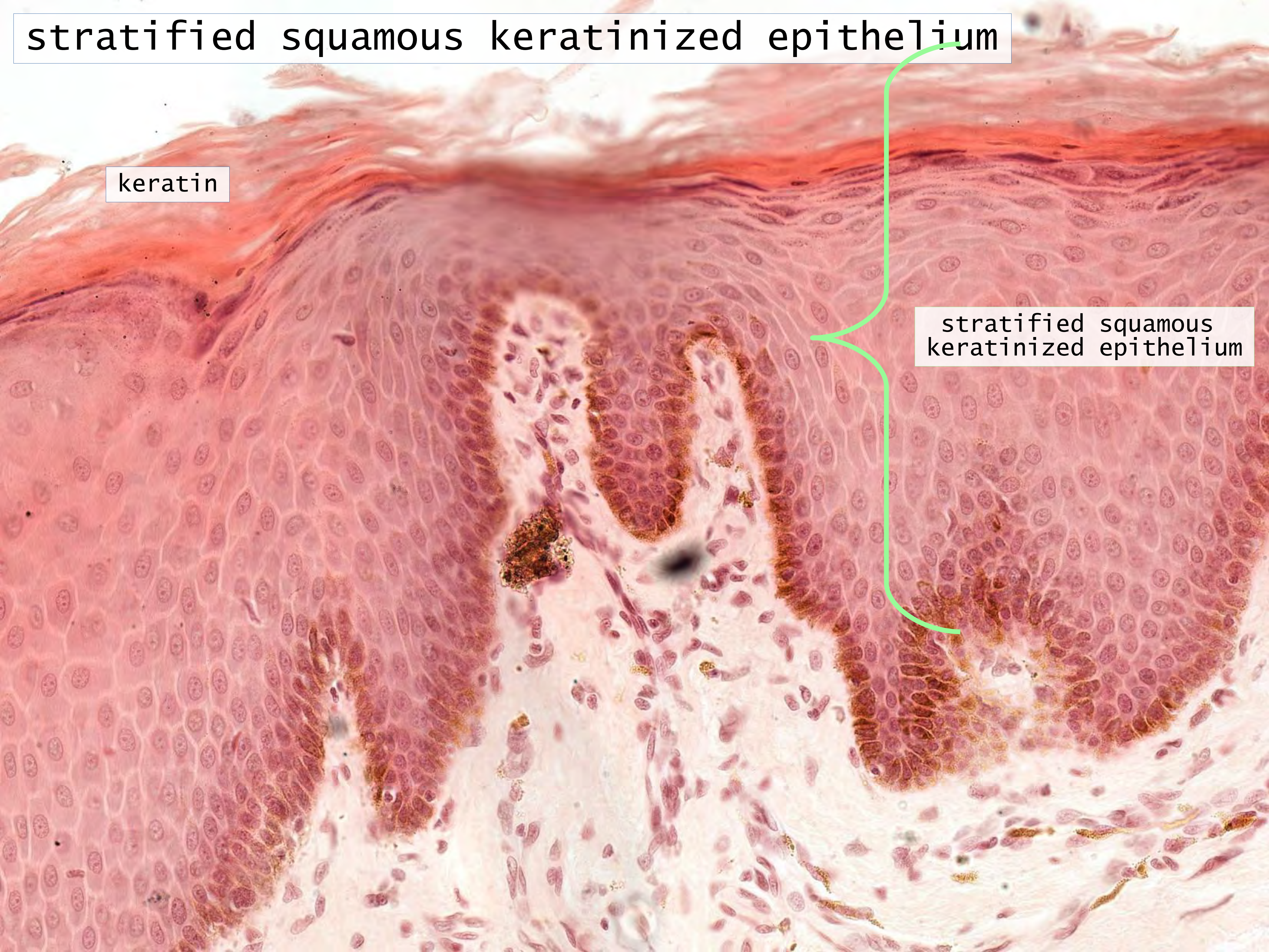


Vermillion zone

- Red portion of lip
- Stratified squamous keratinized epithelium
- Deep ridges and high papillae
- No hair follicles, glands
- Occasionally sebaceous glands

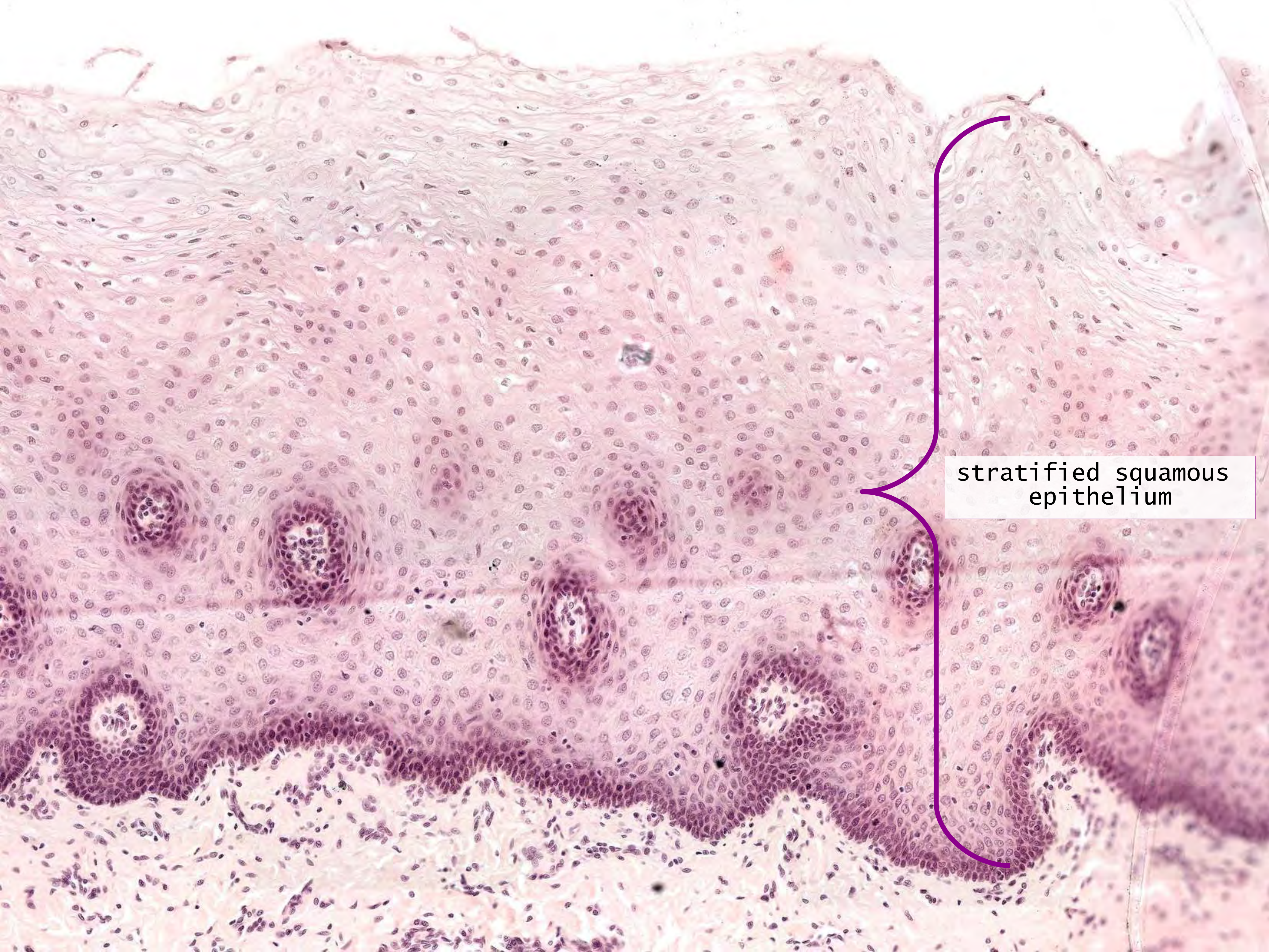

stratified squamous keratinized epithelium
deep ridge
high papilla

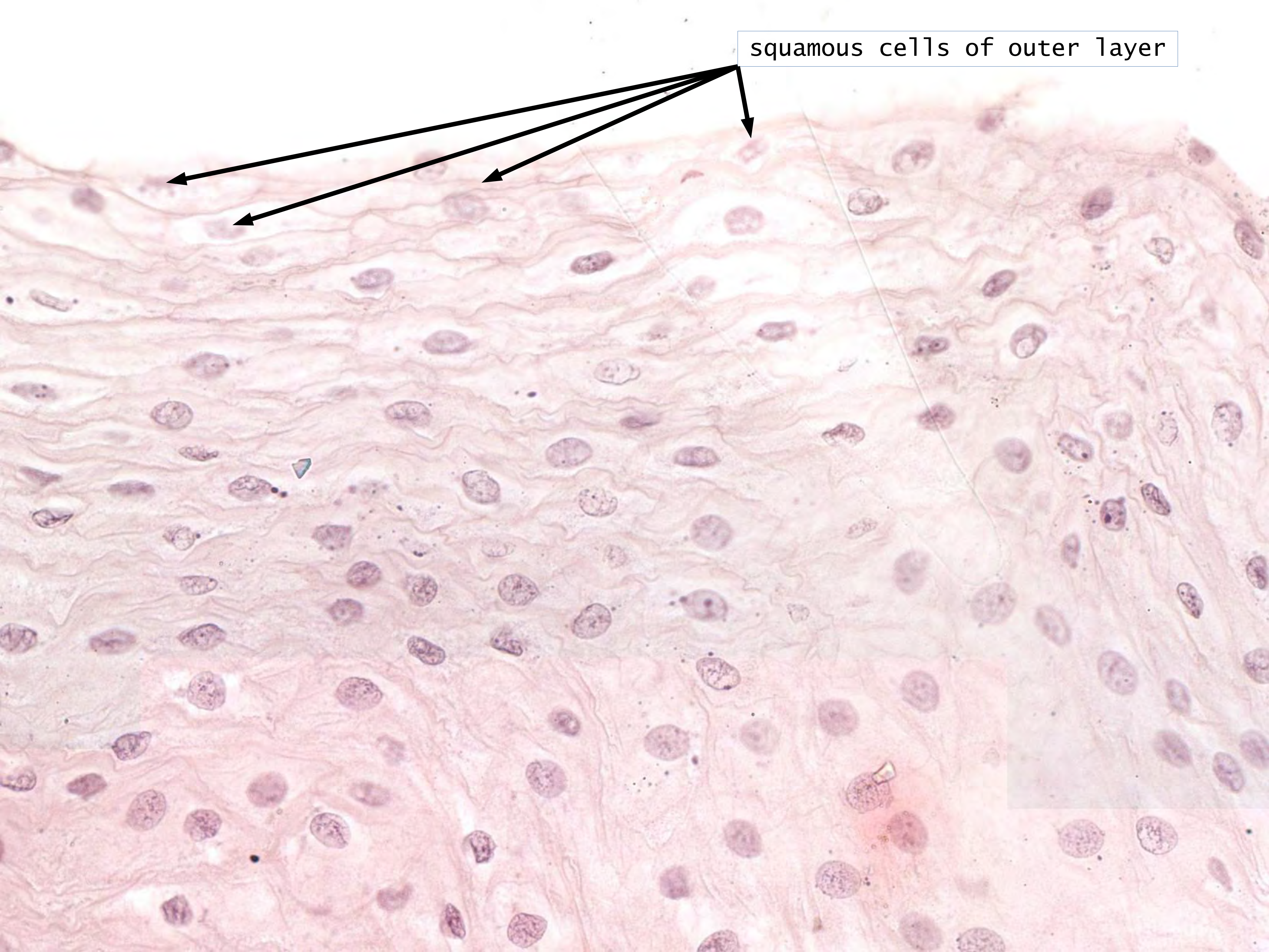
stratified squamous keratinized epithelium



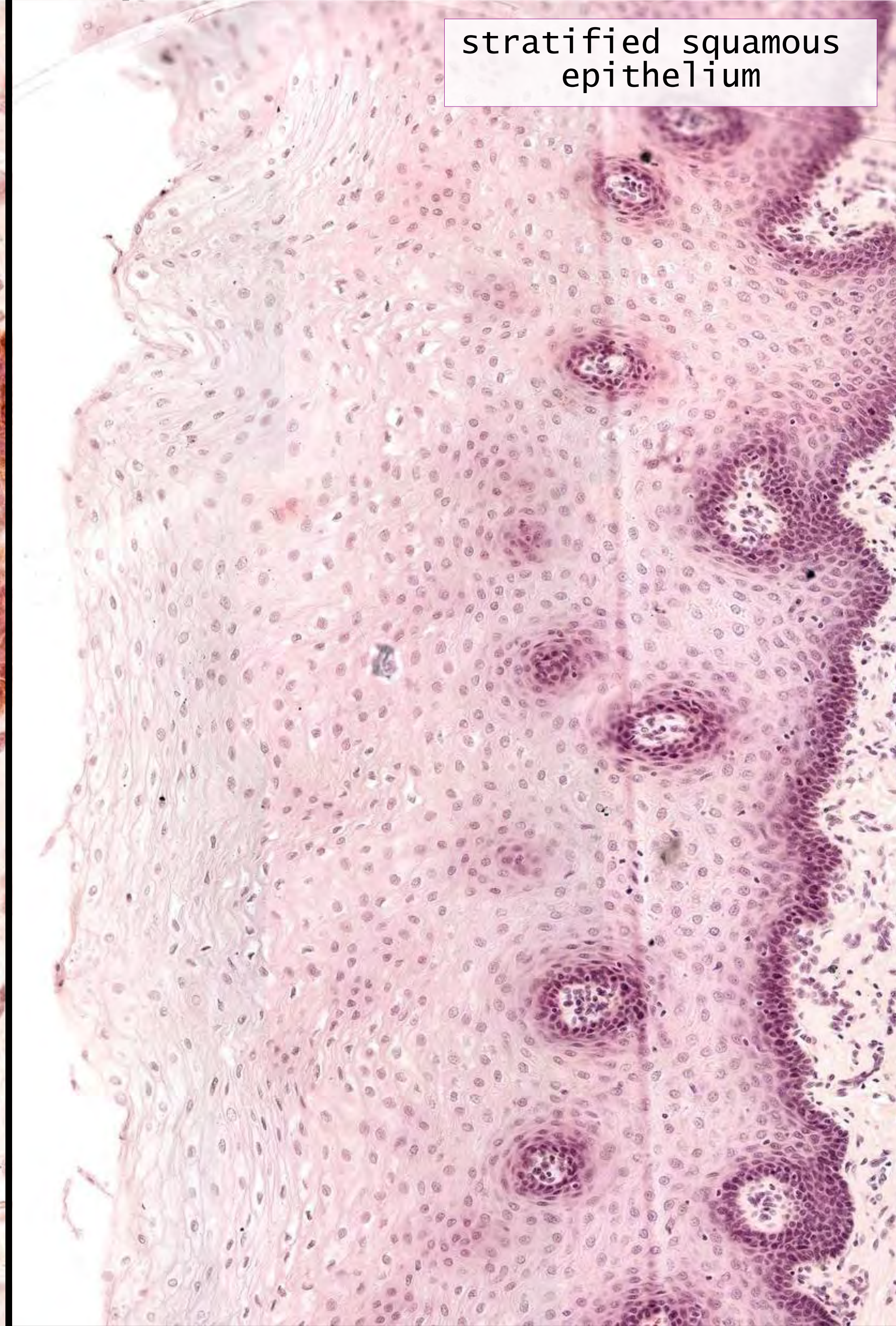
Internal surface

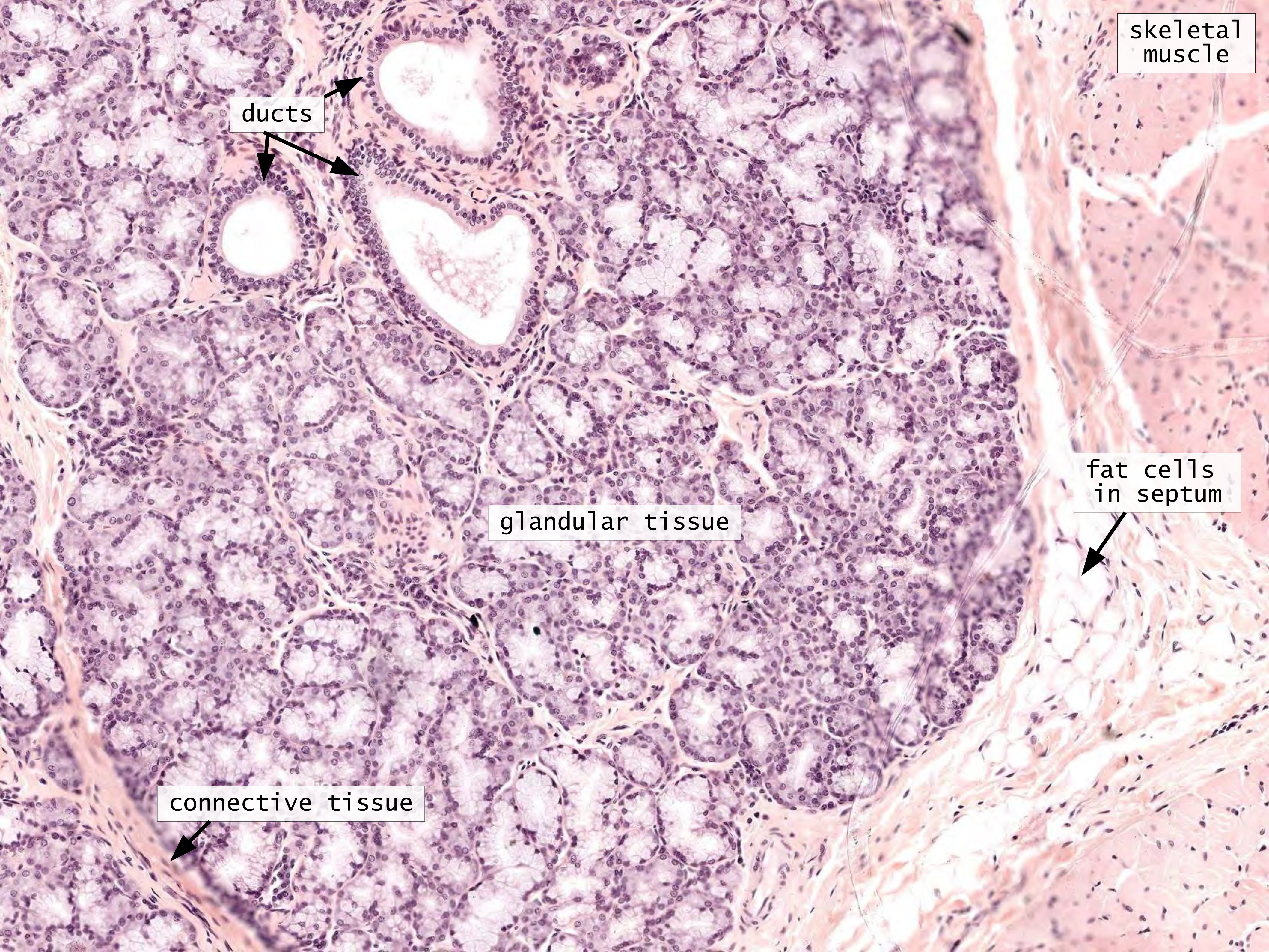
- Stratified squamous non-keratinized epithelium
- Seromucous salivary glands in mucosa & submucosa

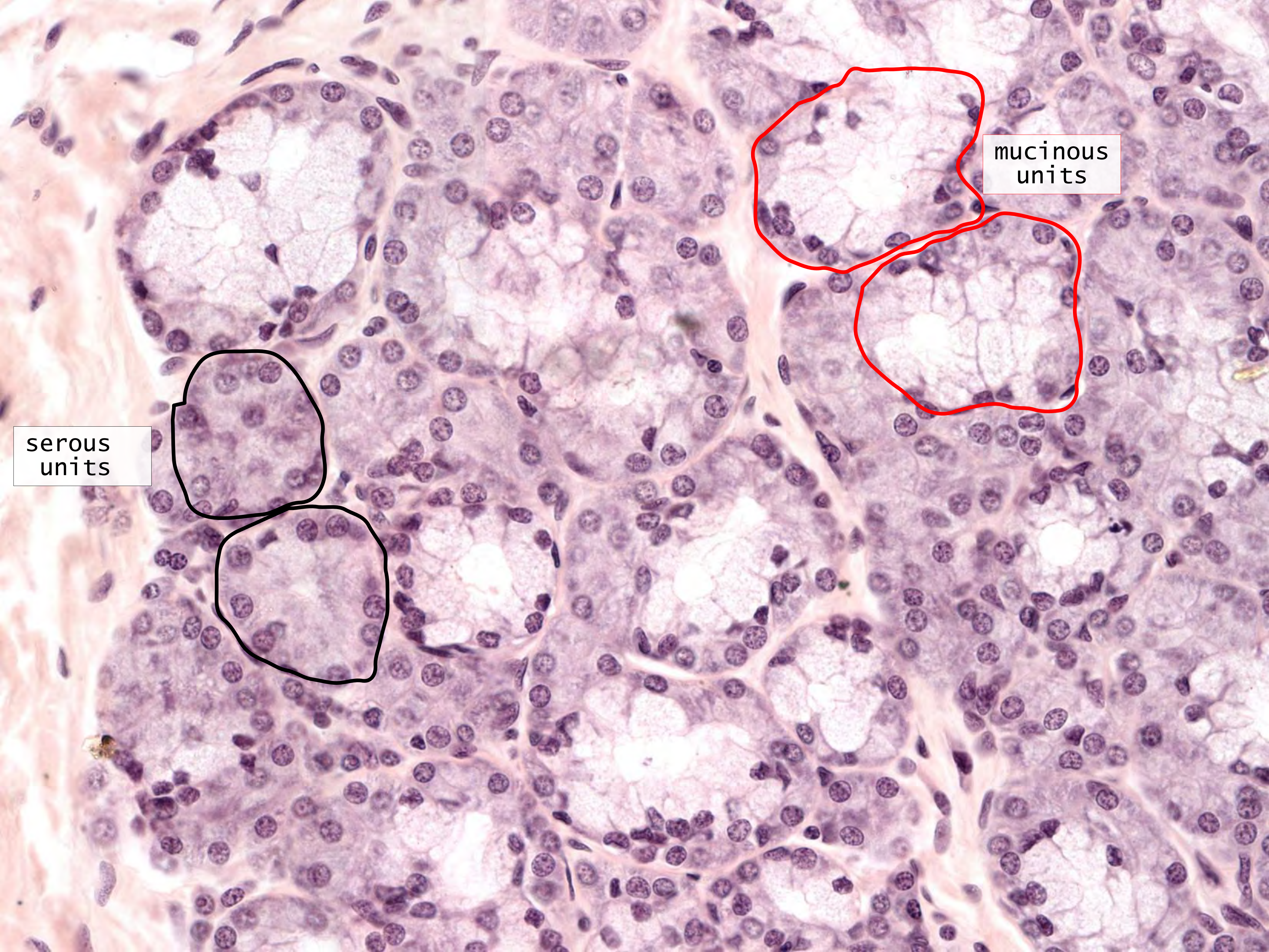

stratified squamous epithelium

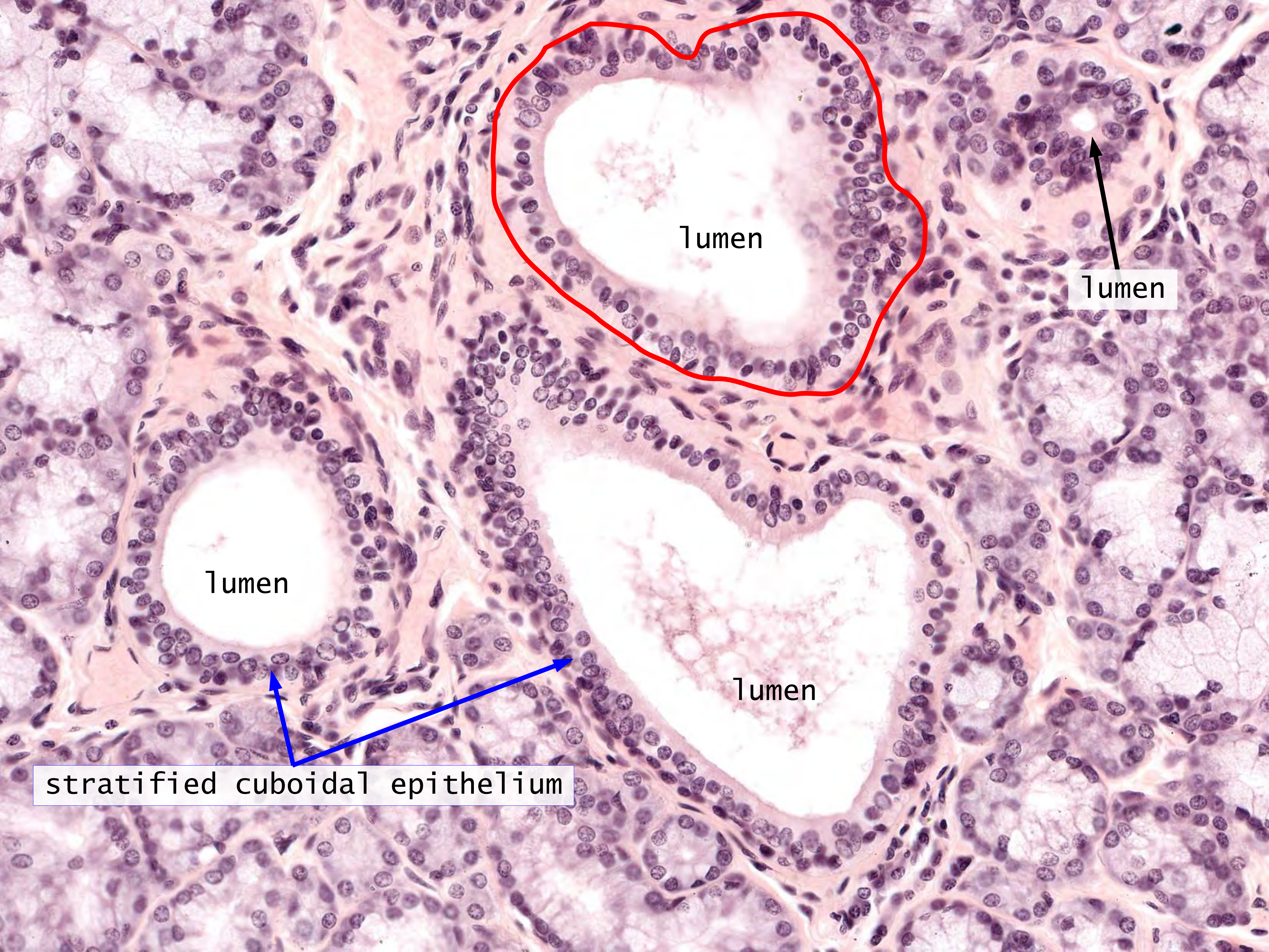

squamous cells of outer layer


stratified squamous
keratinized epithelium


stratified squamous
epithelium


skeletal muscle
ducts
fat cells in septum
glandular tissue
connective tissue


mucinous units
serous units

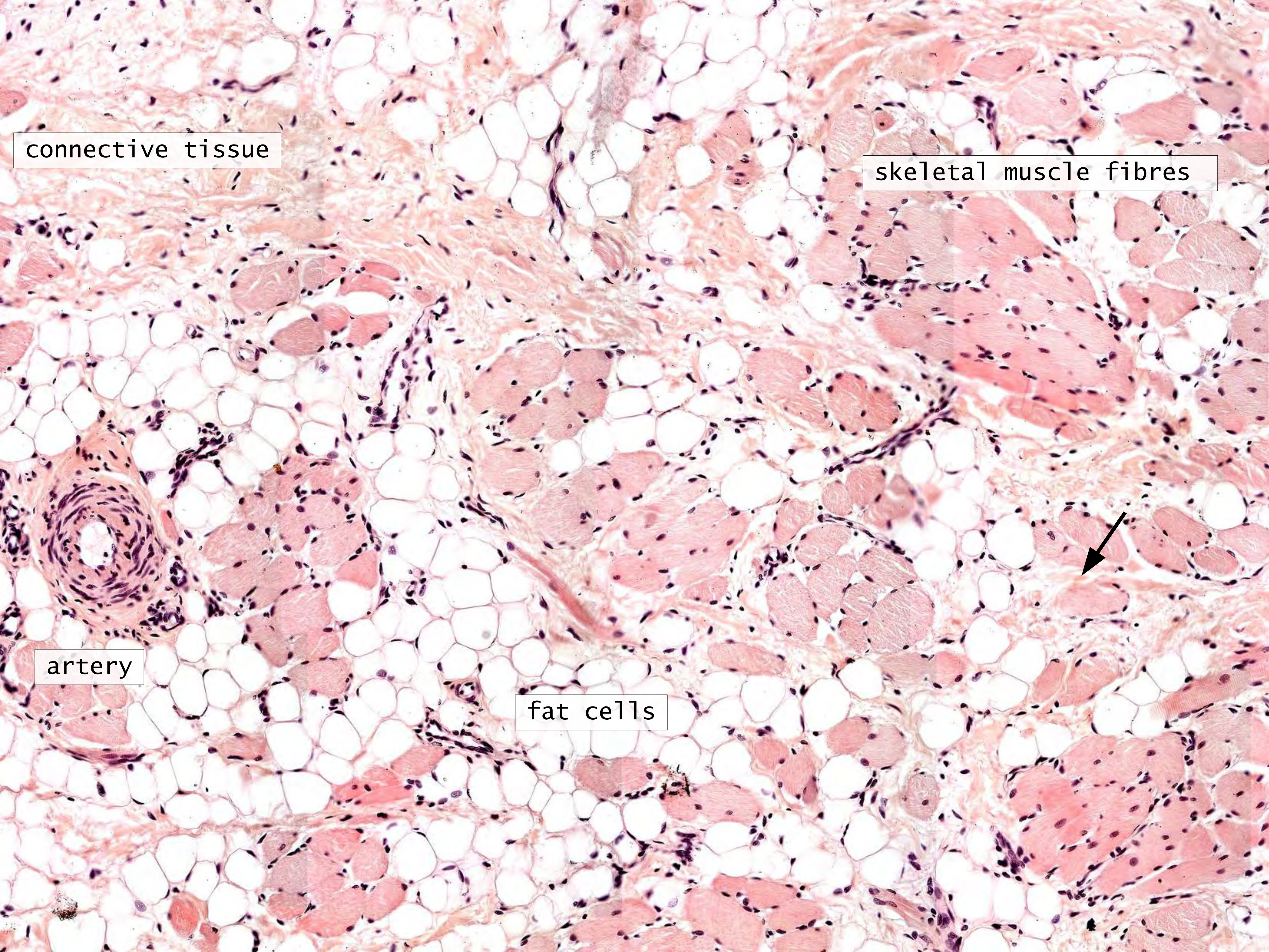

lumen
lumen
lumen
lumen
stratified cuboidal epithelium

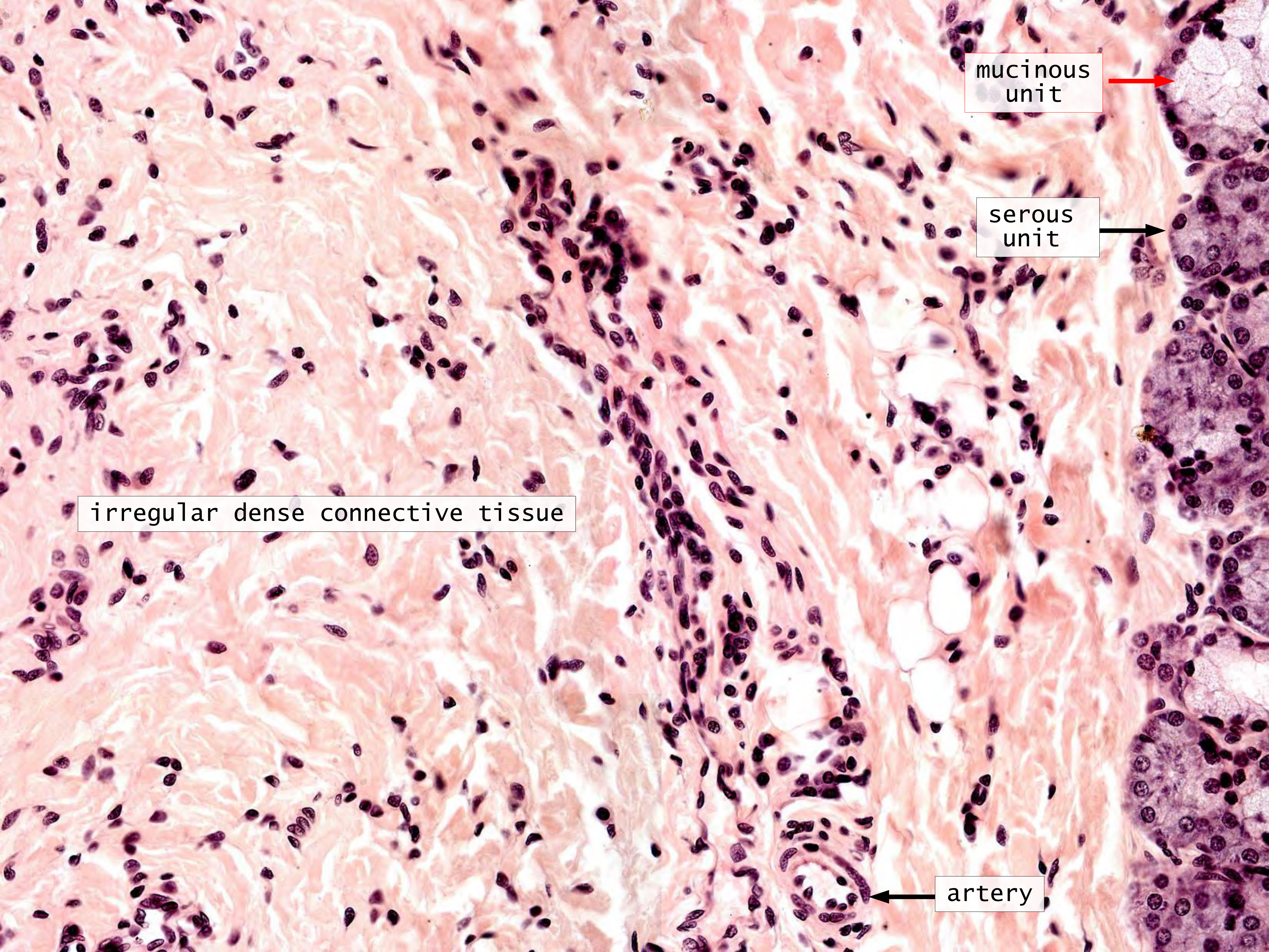
Core

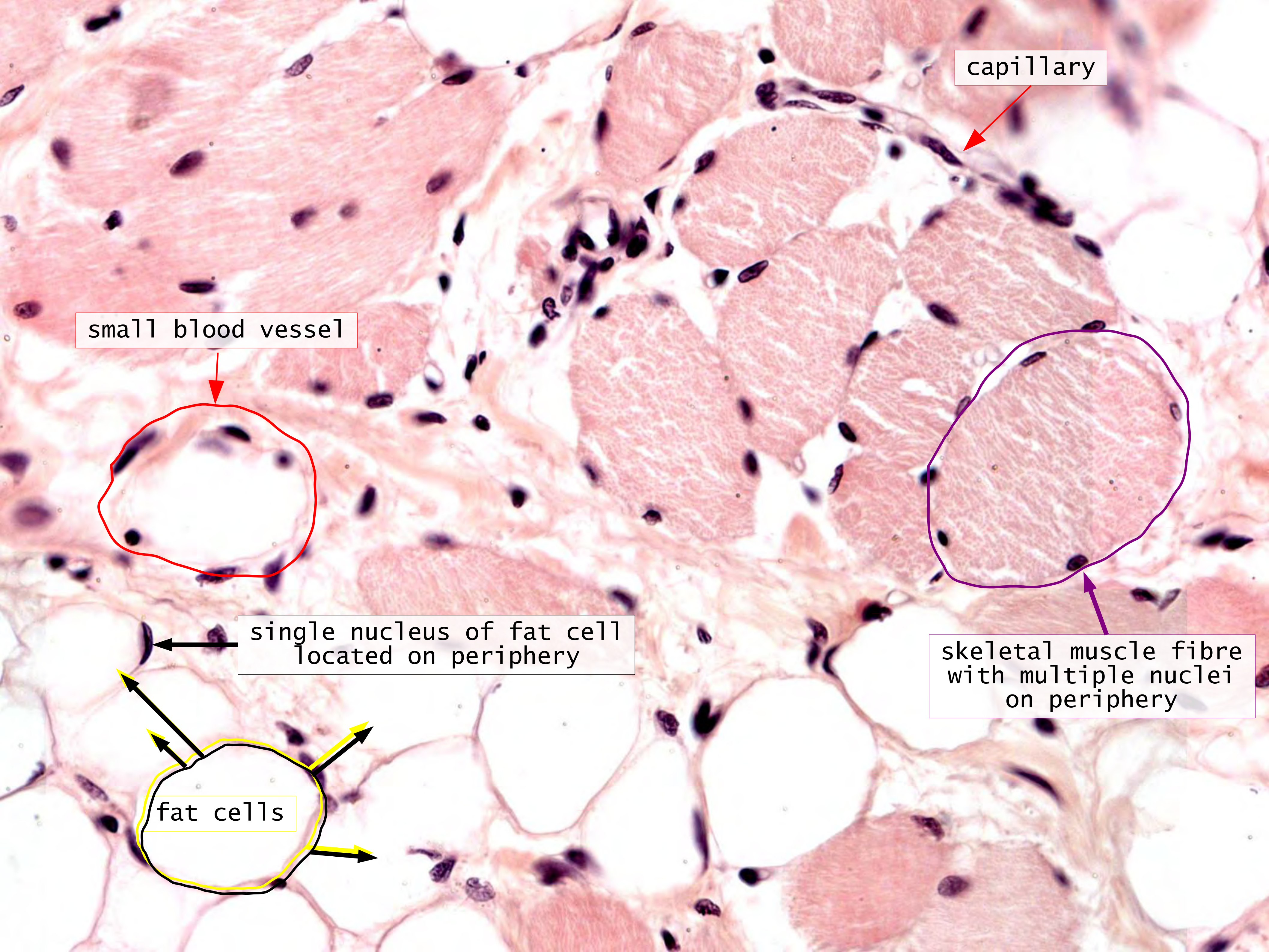
- Dense irregular collagenous CT

  surrounding

- Skeletal muscle


connective tissue
skeletal muscle fibres
artery
fat cells


mucinous unit
serous unit
irregular dense connective tissue
artery


capillary
small blood vessel
single nucleus of fat cell located on periphery
skeletal muscle fibre with multiple nuclei on periphery
fat cells

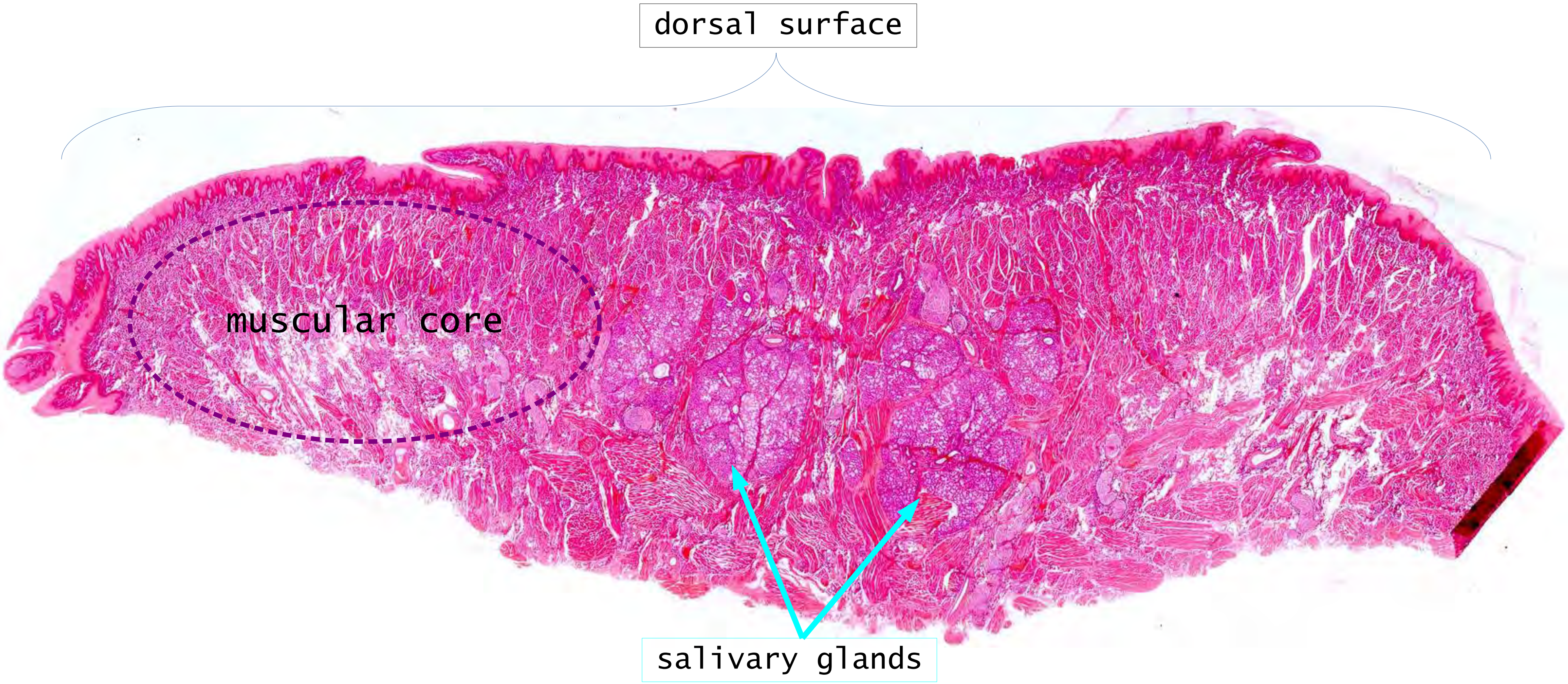

fat cells
artery
skeletal muscle fibres
with multiple nuclei on
periphery

Tongue

Slides 7, 33 & 53

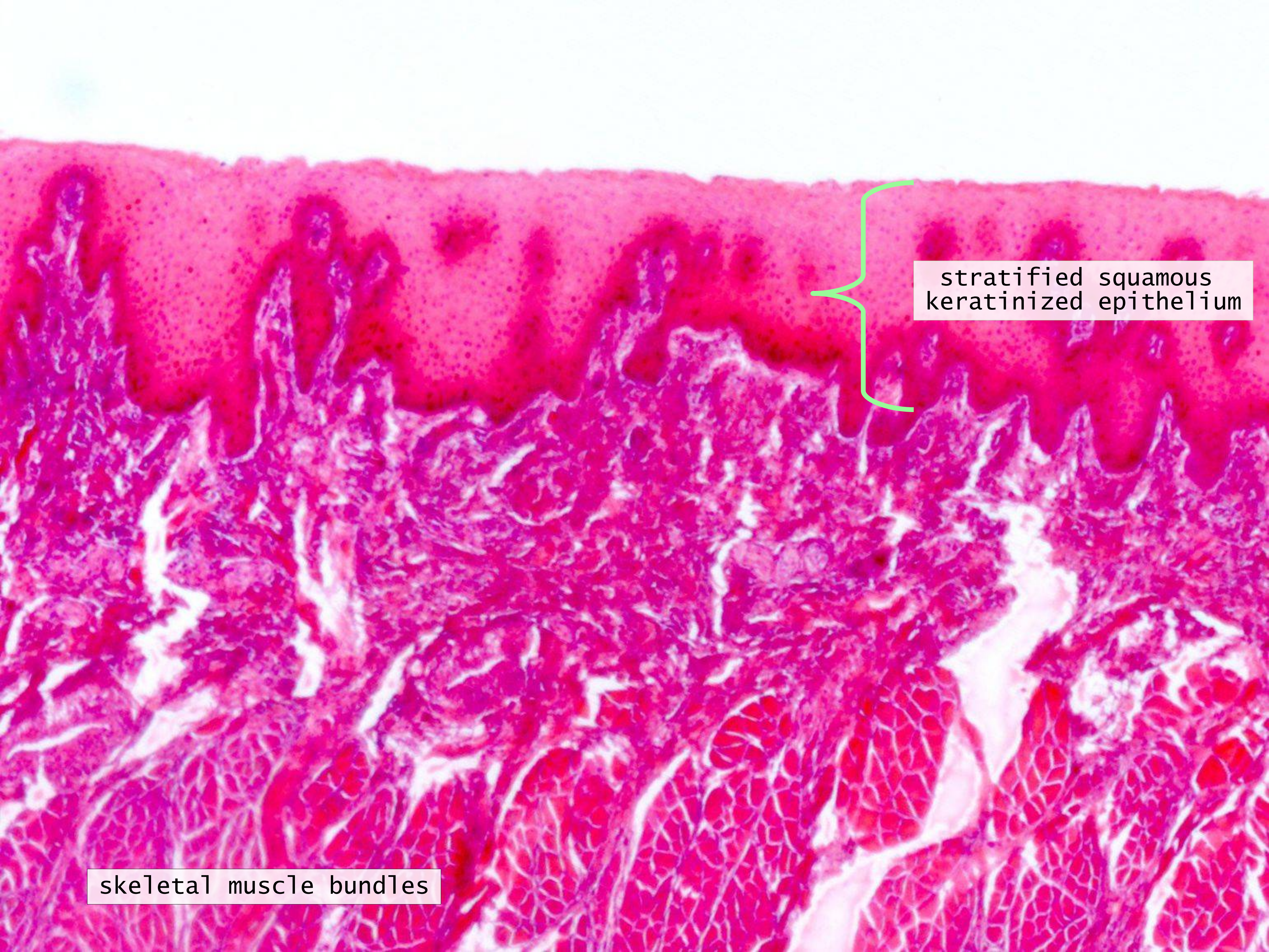
Tongue

- Dorsal surface
  - With papillae
  - And taste buds
- Muscular core
- Minor salivary glands
- Ventral surface
- Posterior third


dorsal surface
muscular core
salivary glands

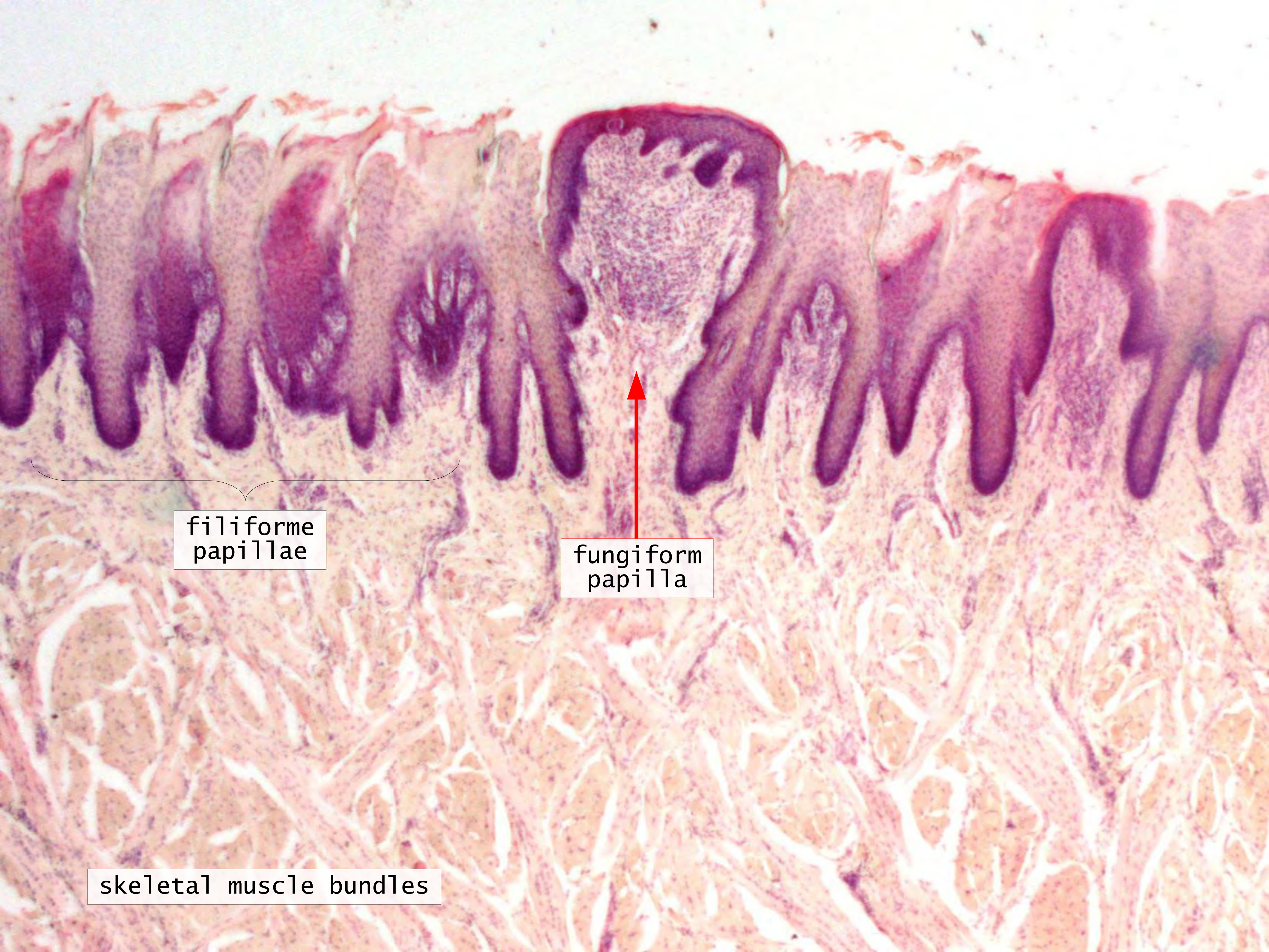
Dorsal surface

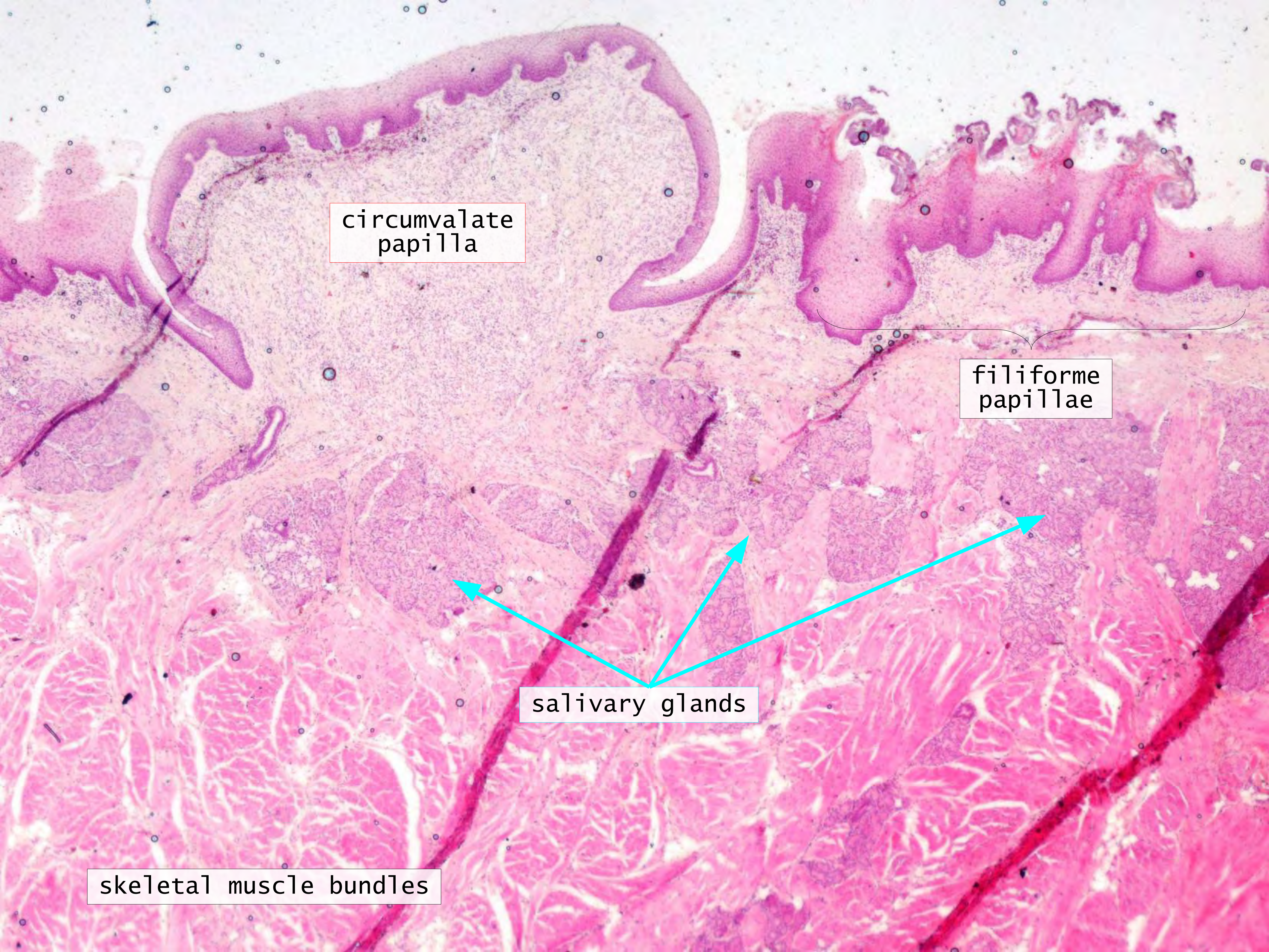
- Stratified squamous keratinized epithelium
- Contains four types of papillae


stratified squamous
keratinized epithelium
skeletal muscle bundles

Dorsal surface

- Papillae
  - Filiform papillae
  - Fungiform papillae
  - Foliate papillae
  - Circumvallate papillae
- Taste buds

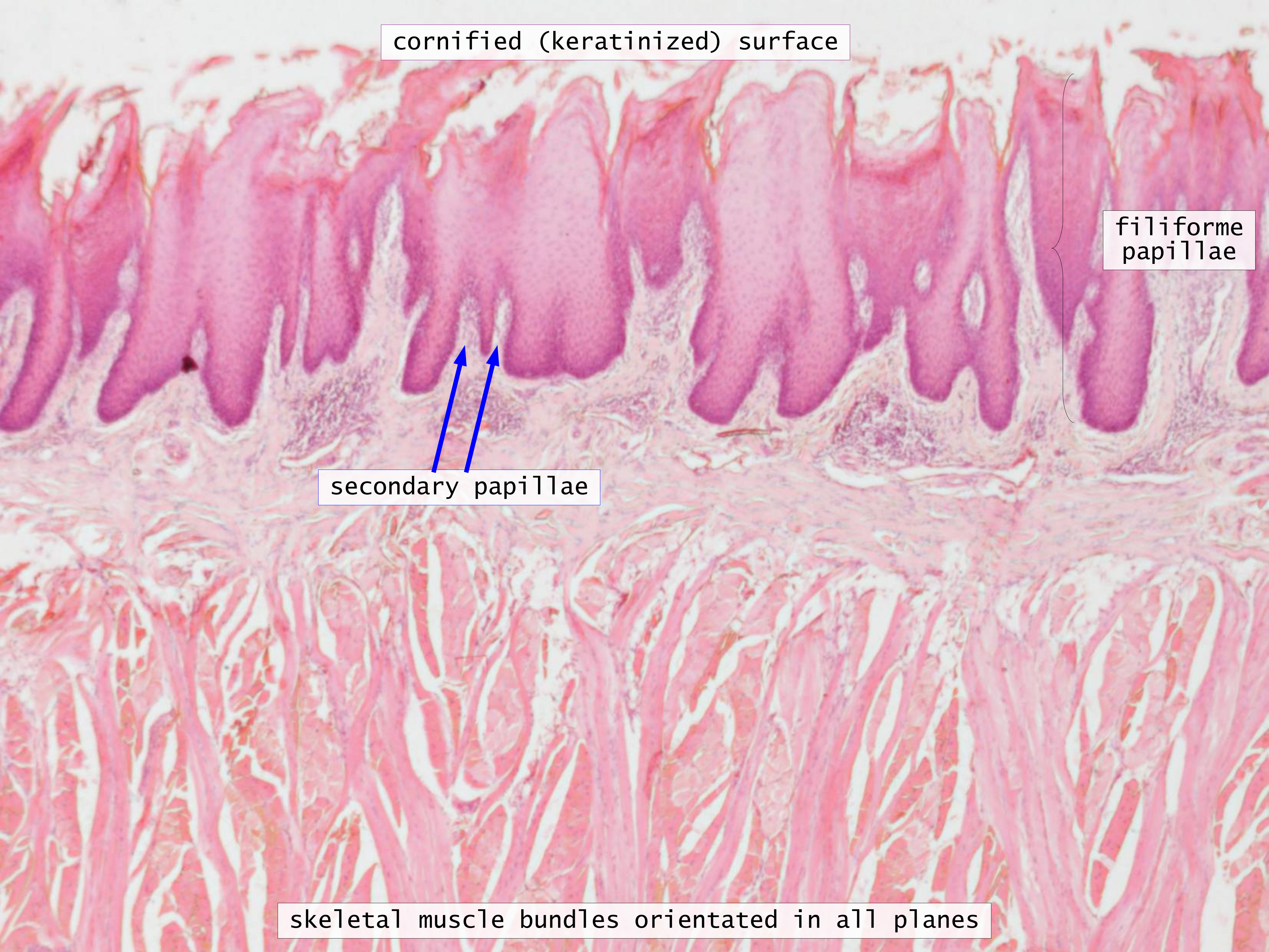

filiforme papillae
fungiform papilla
skeletal muscle bundles

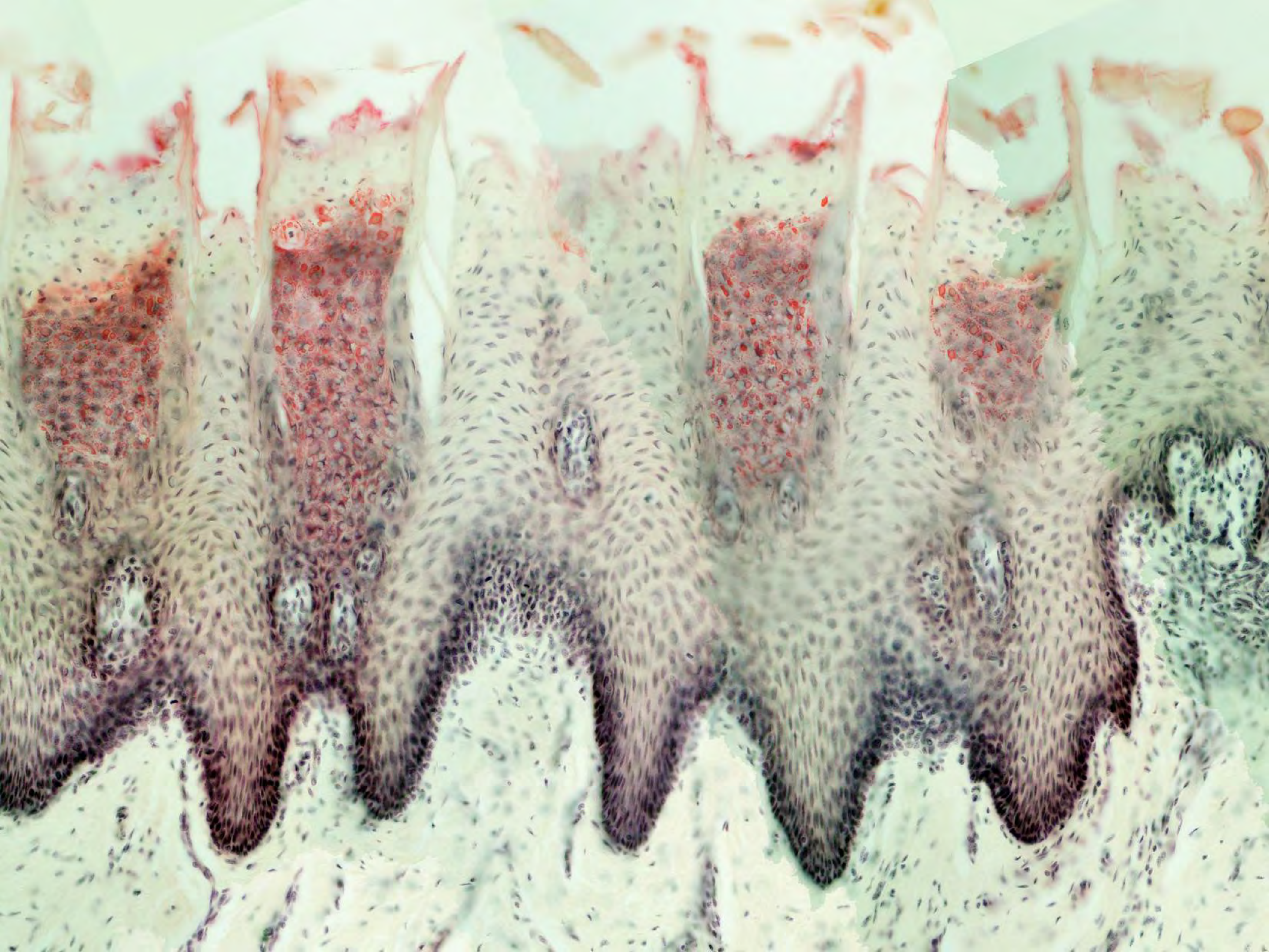

circumvalate papilla
filiforme papillae
salivary glands
skeletal muscle bundles

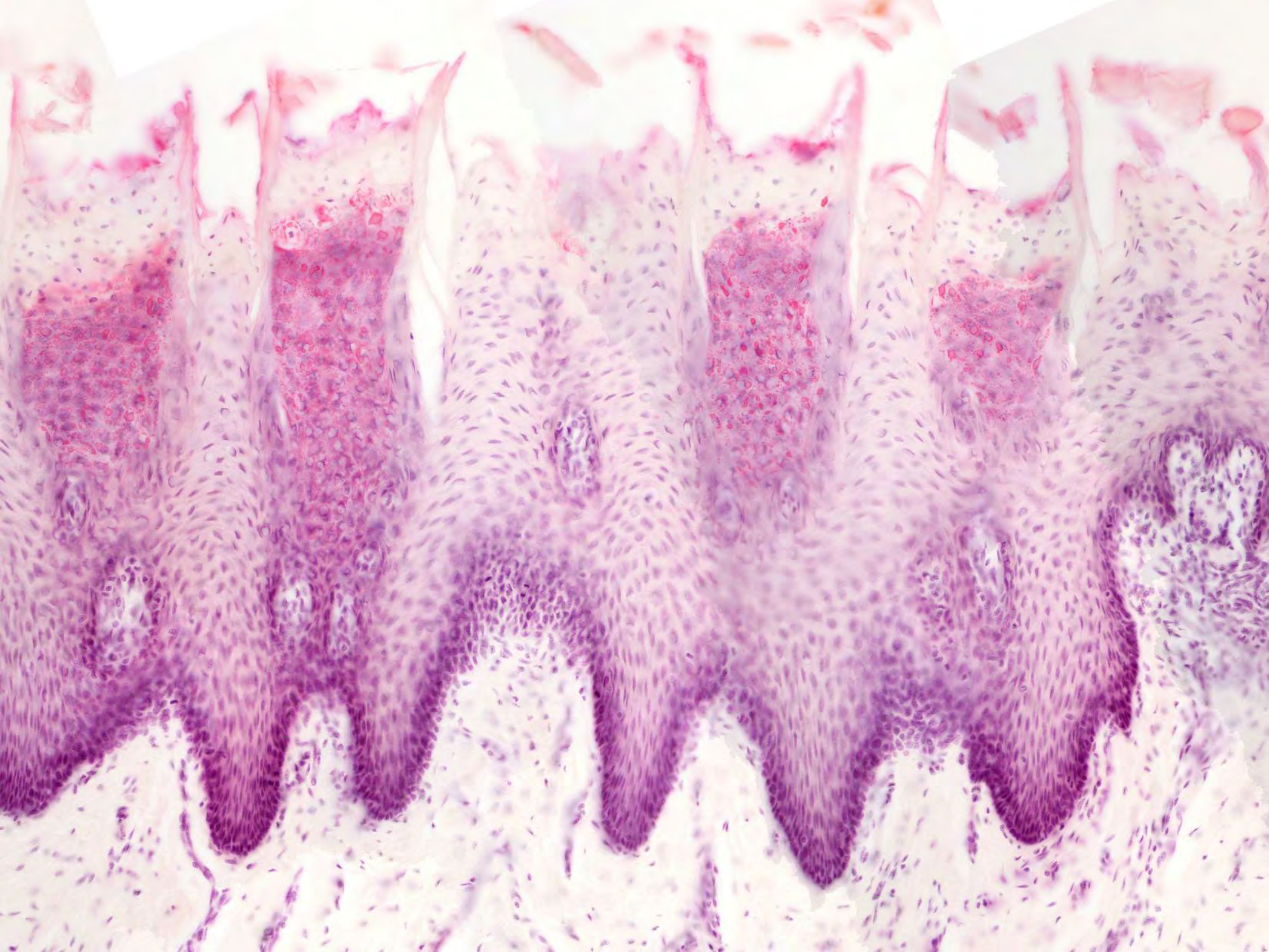
Filiform papillae

- Short, narrow
- Project above surface
- Cornified surface
- CT core forms secondary papillae


cornified (keratinized) surface
filiforme papillae
skeletal muscle bundles orientated in all planes

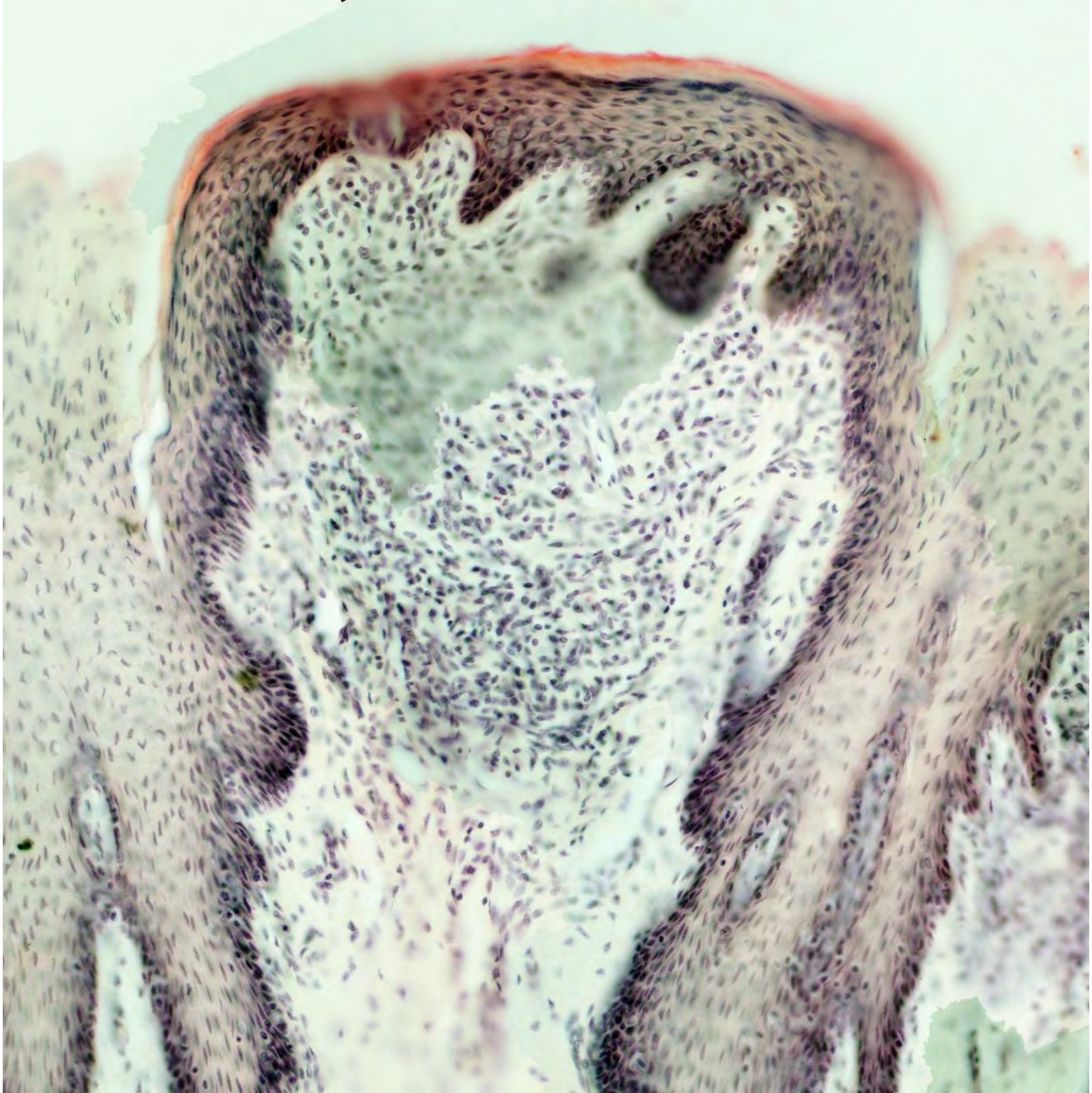

cornified (keratinized) surface
filiforme papillae
secondary papillae
skeletal muscle bundles orientated in all planes

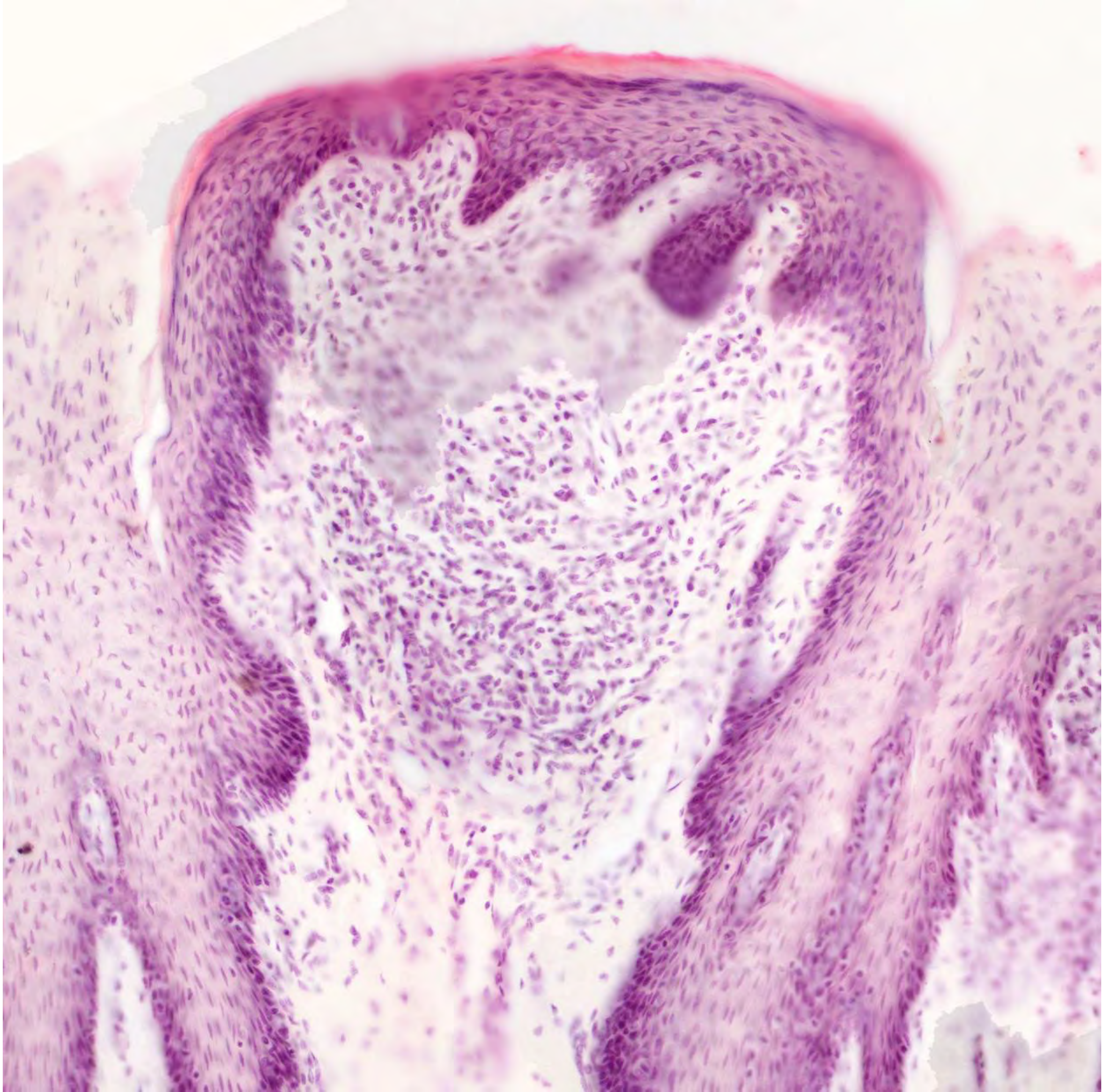




Fungiform papillae

- Mushroom-shaped
- Project above surface
- Occasionally contains taste buds





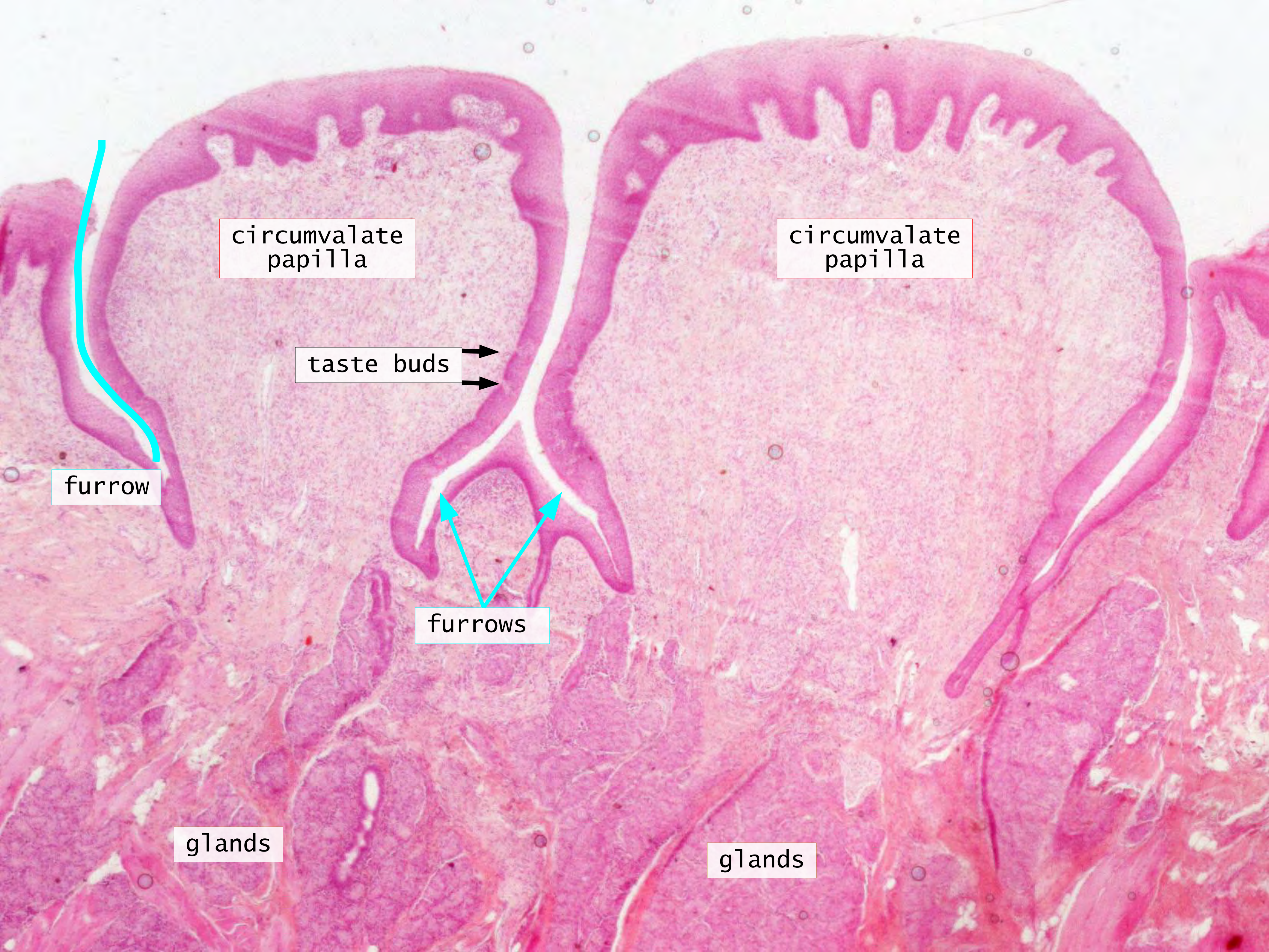
Foliate papillae

- Lateral aspect of tongue
- <u>Not well developed adults</u>
- Appears as shallow, longitudinal furrows
- Serous glands open in furrows

Circumvallate papillae

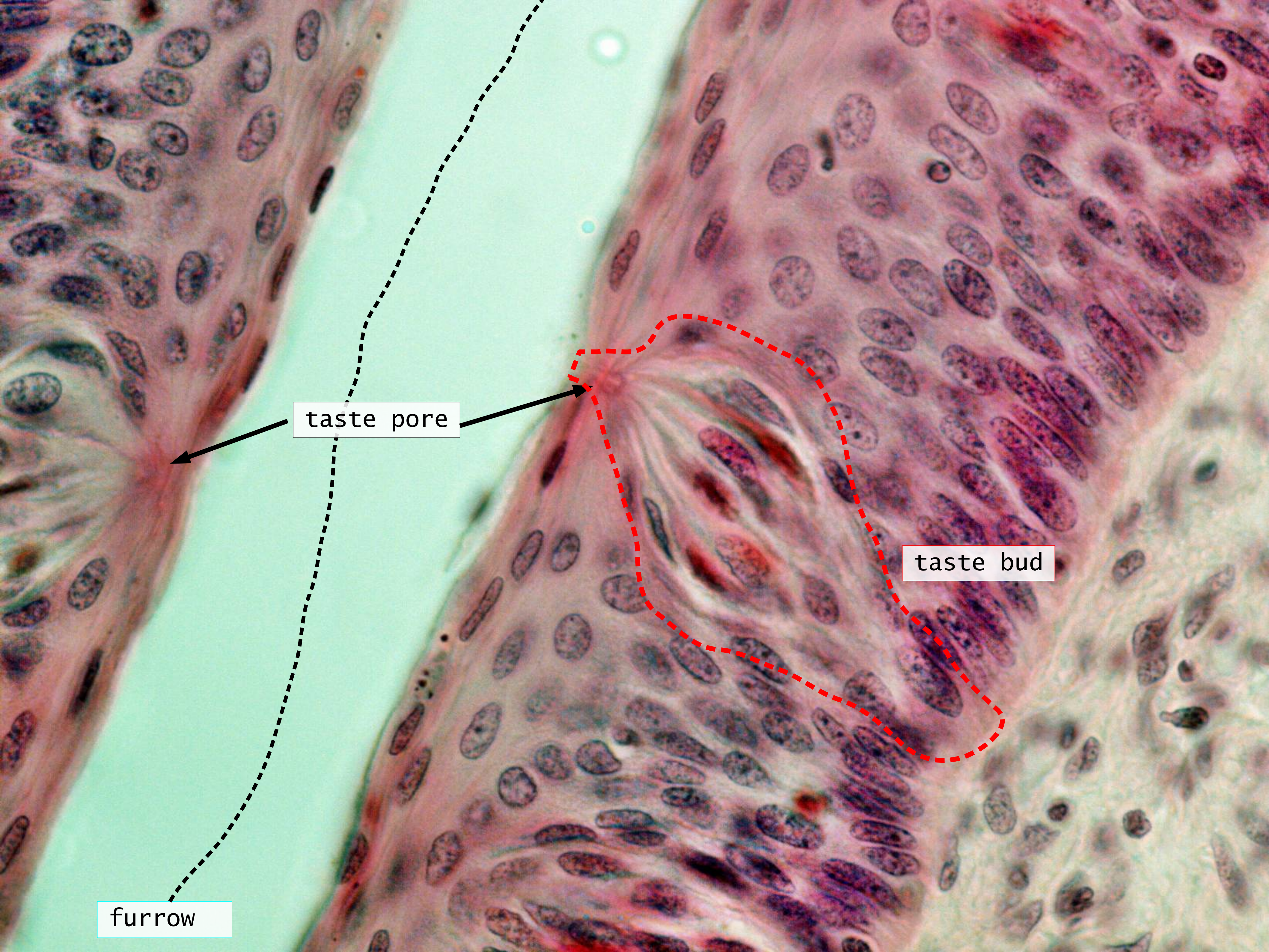
- 10 – 15 in front of sulcus terminalis
- Embedded in surface of tongue
- Surrounded by furrow
- Lateral surface contains taste buds in epithelium
- Von Ebner glands open in base of furrow

filiforme papillae
circumvalate papillae
skeletal muscle bundles orientated in all planes


circumvalate papilla
circumvalate papilla
taste buds
furrow
furrows
glands
glands

Taste buds

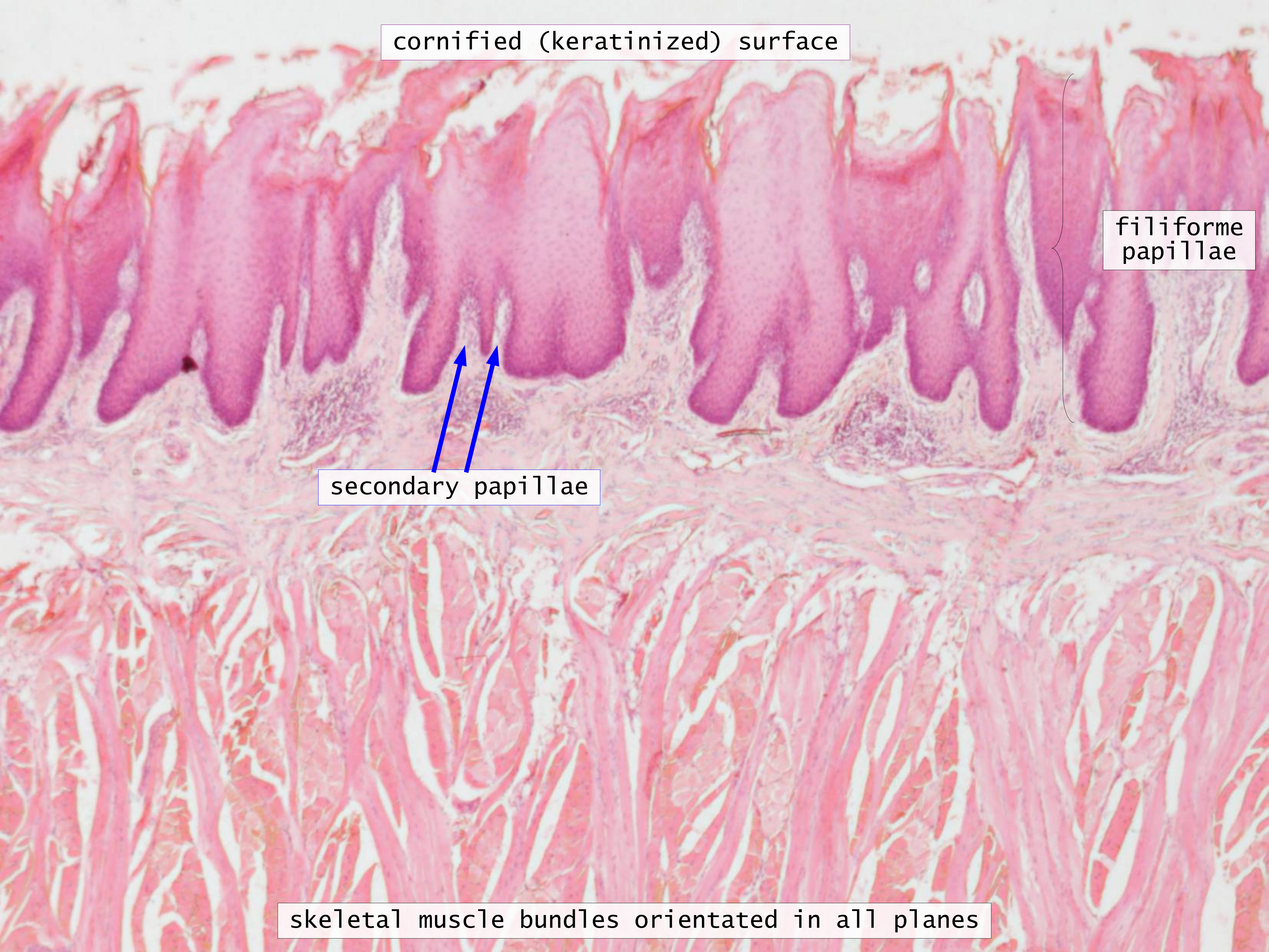
- Small structures inside epithelium
- Perception of taste
- Three cell types
- Sustentacular cells
- Neuroepithelial cells
- Basal cells
  - Regenerative
- Taste pore

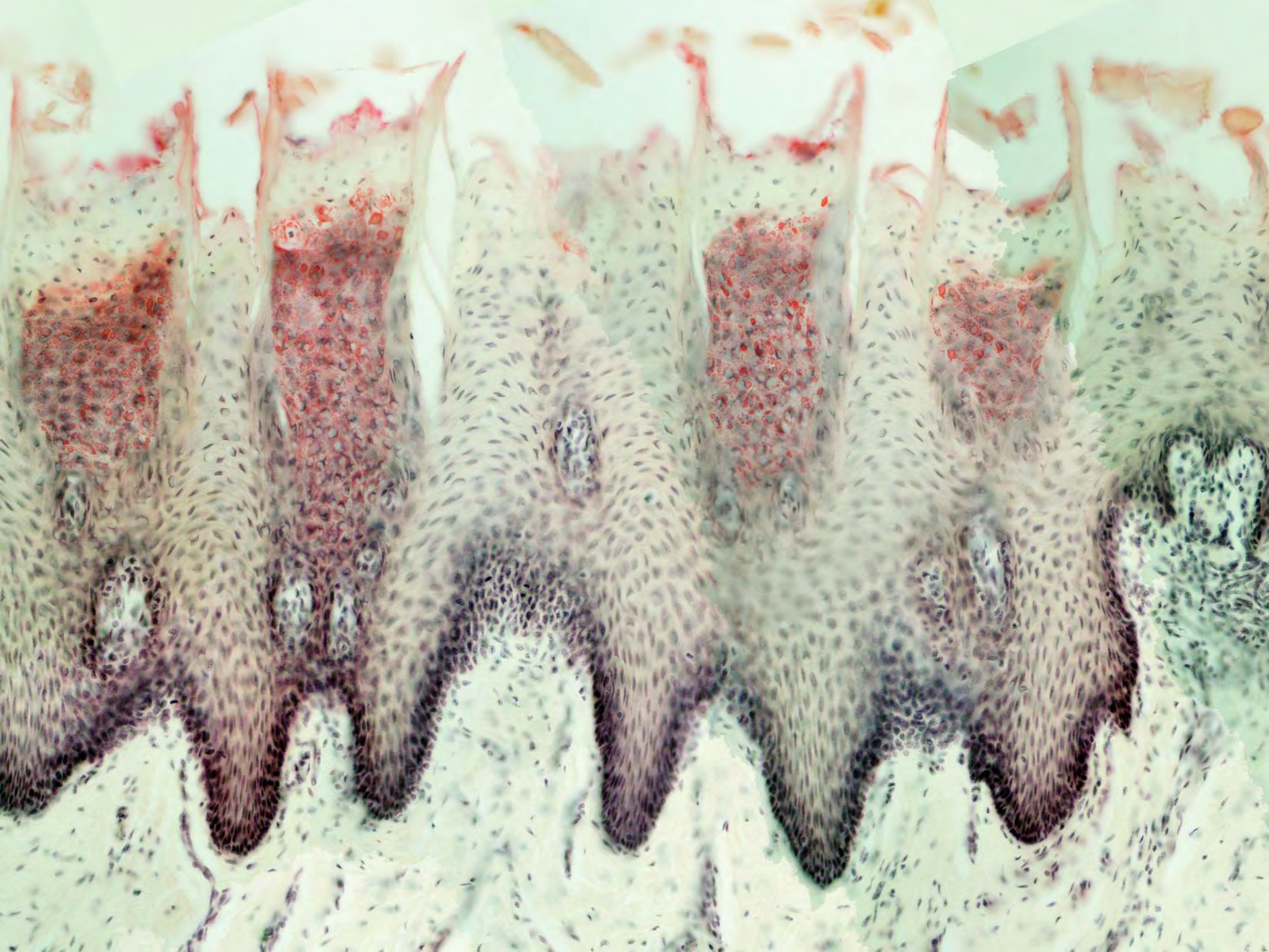

taste pore
taste bud
furrow

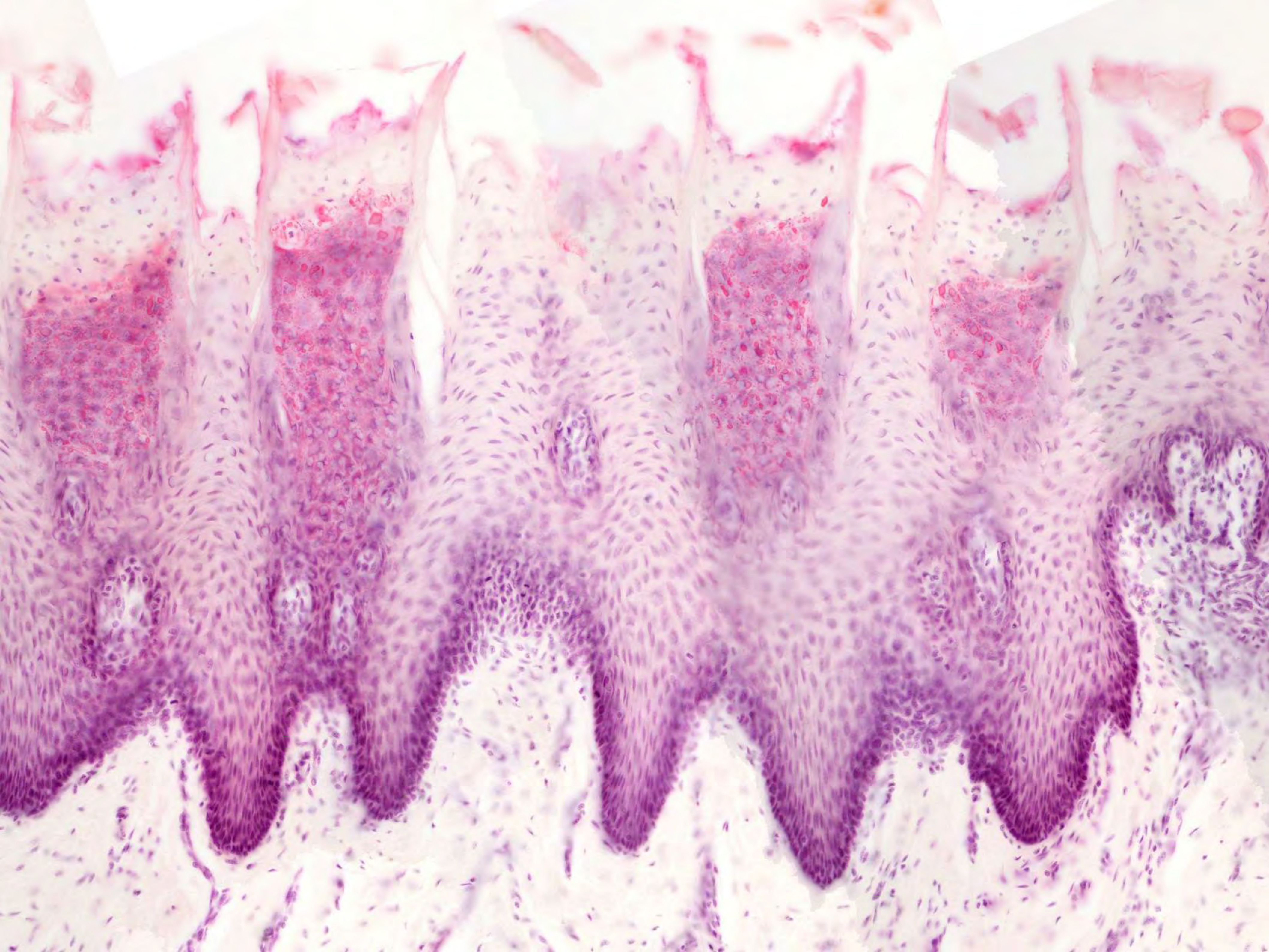
Filiform papillae

- Short, narrow
- Project above surface
- Cornified surface
- CT core forms secondary papillae


cornified (keratinized) surface
filiforme papillae
skeletal muscle bundles orientated in all planes

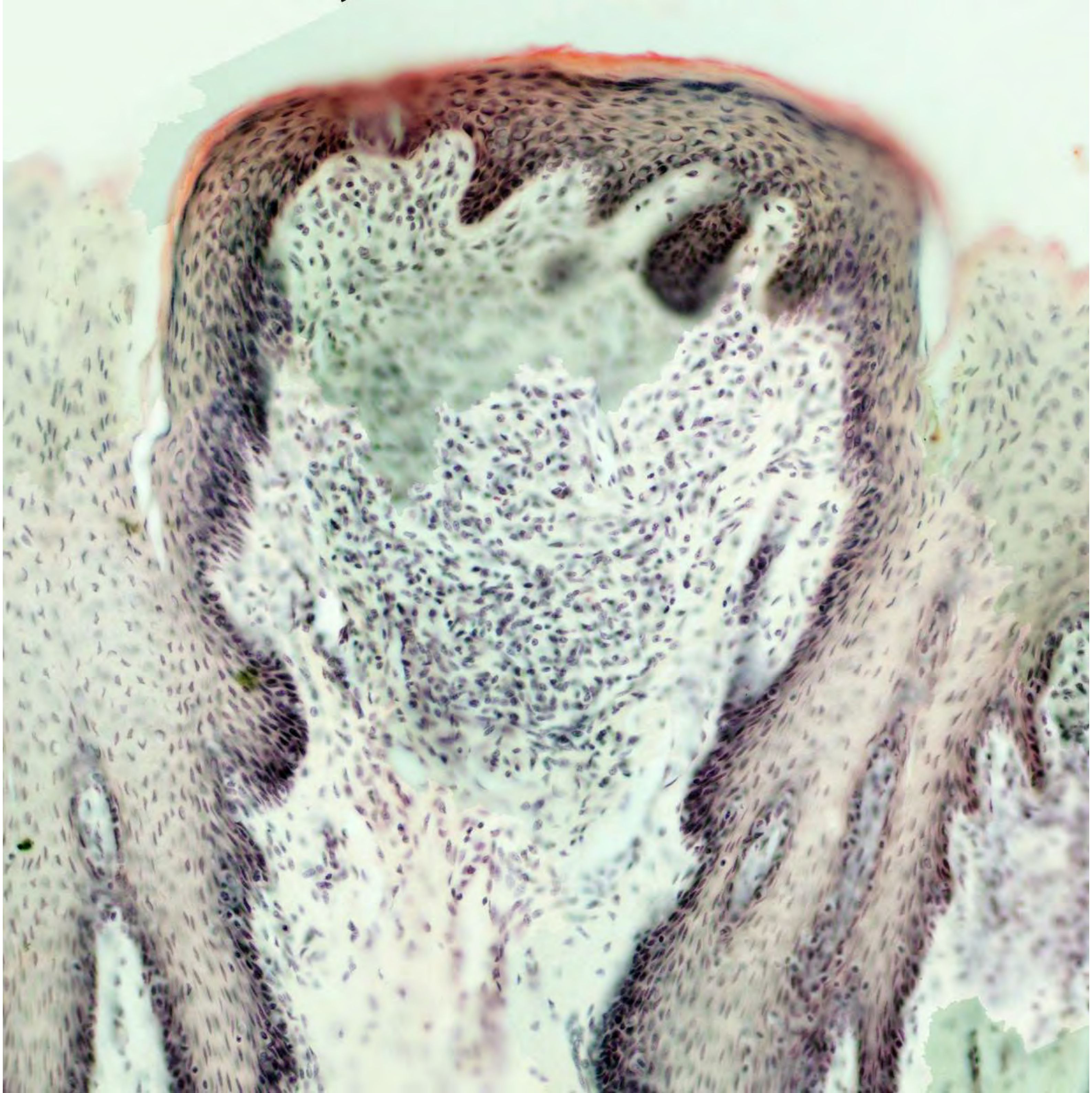

cornified (keratinized) surface
filiforme papillae
secondary papillae
skeletal muscle bundles orientated in all planes

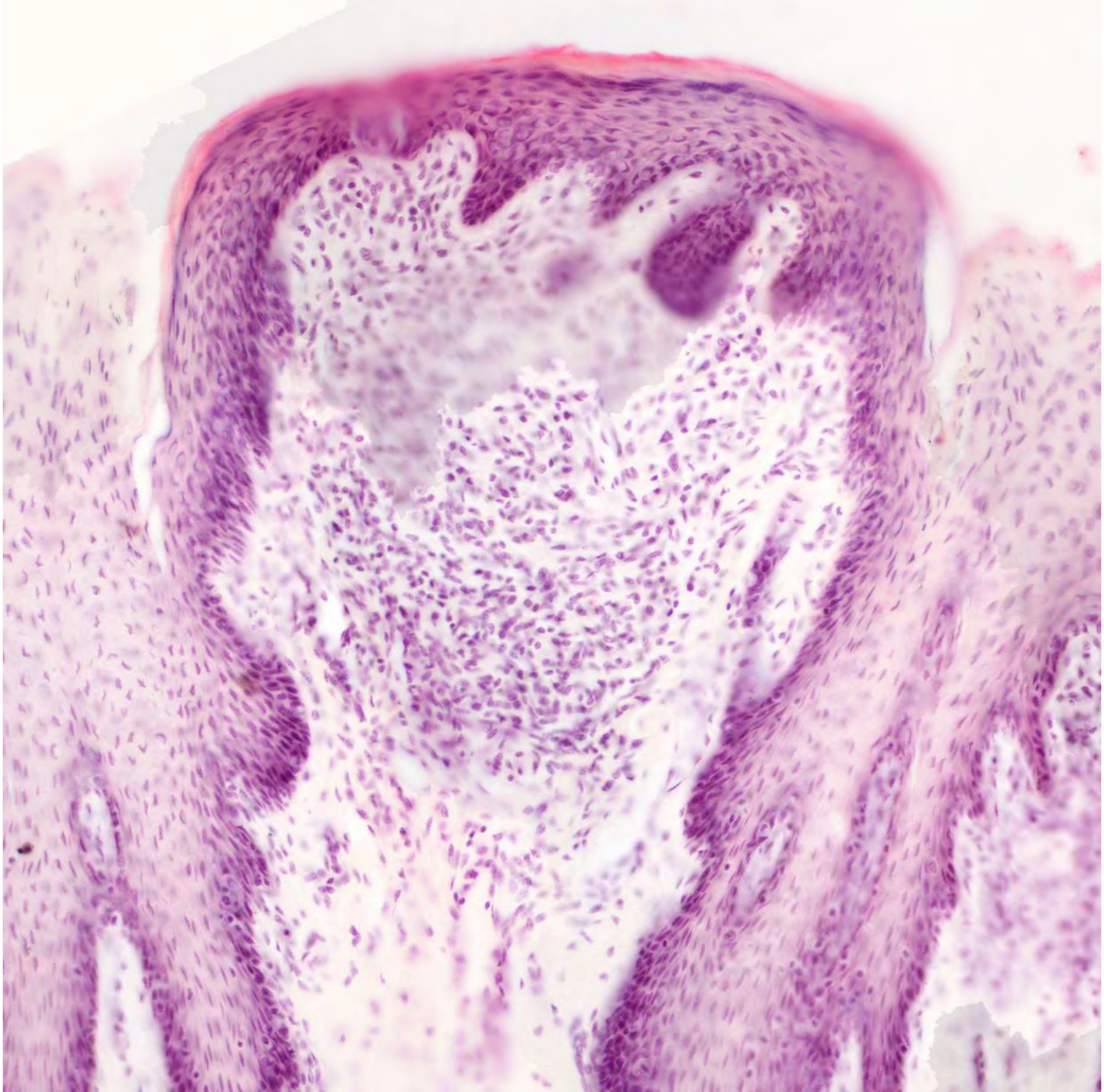




Fungiform papillae

- Mushroom-shaped
- Project above surface
- Occasionally contains taste buds





Foliate papillae

- Lateral aspect of tongue
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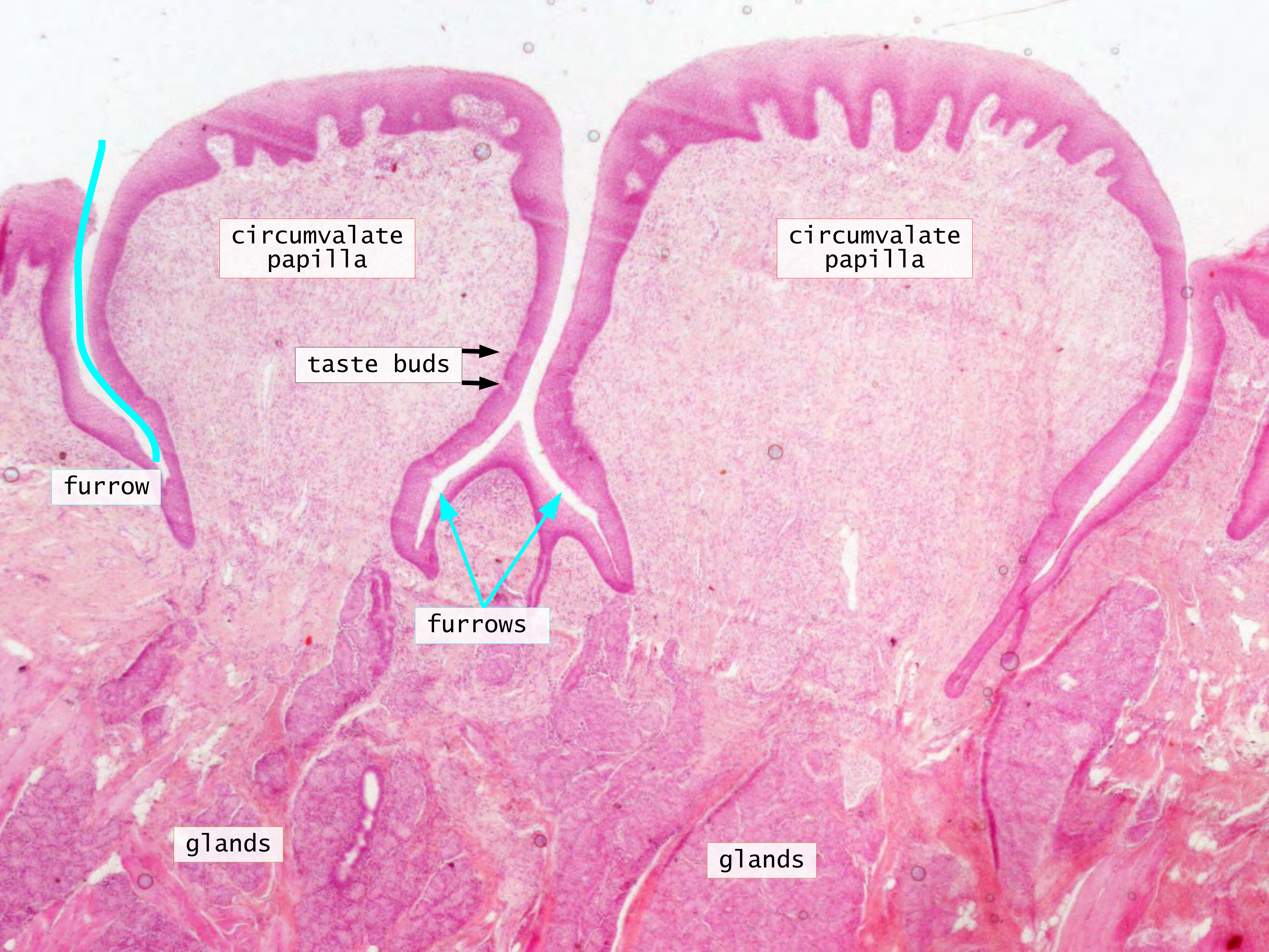
- Serous glands open in furrows

Circumvallate papillae

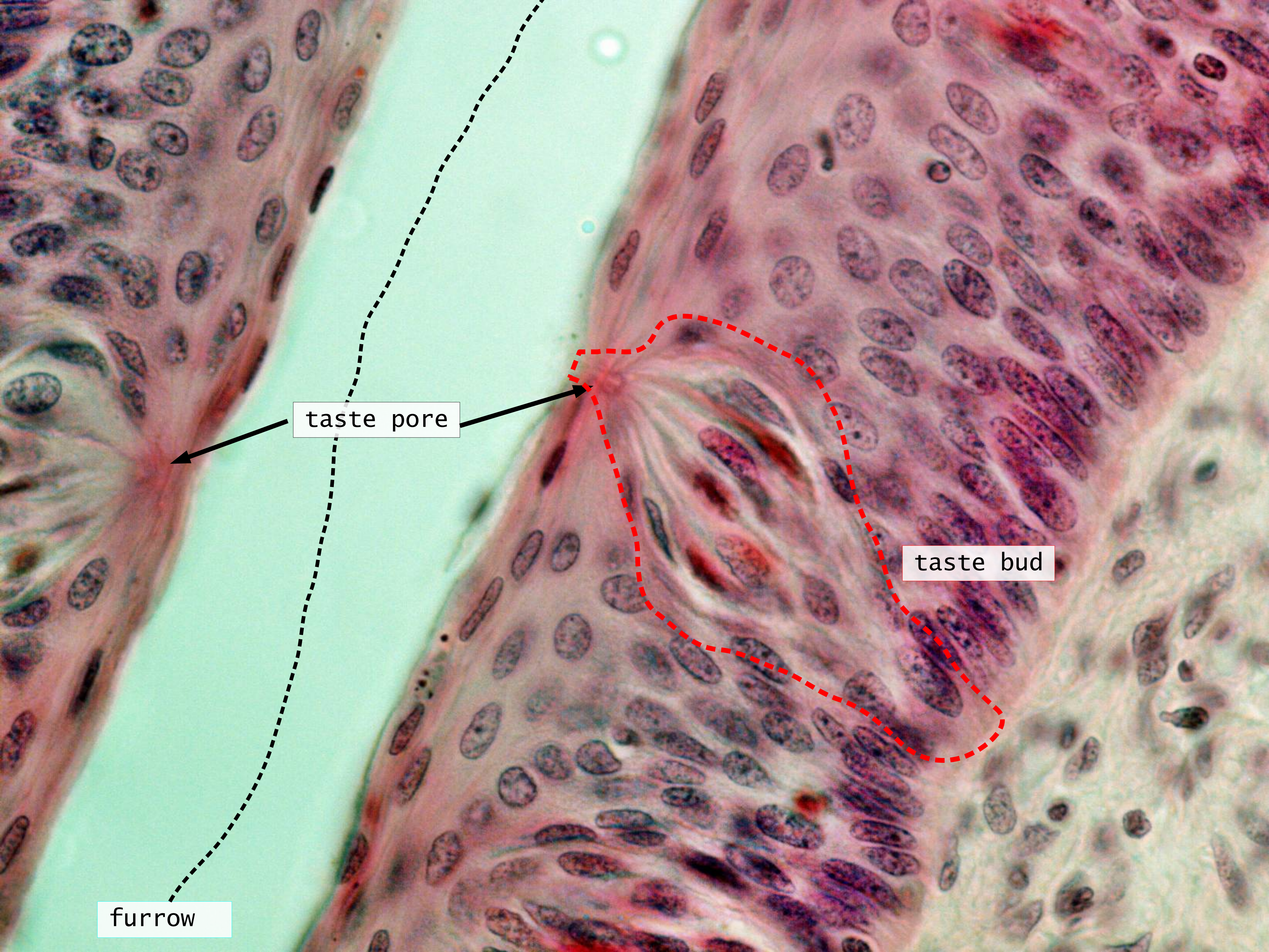
- 10 – 15 in front of sulcus terminalis
- Embedded in surface of tongue
- Surrounded by furrow
- Lateral surface contains taste buds in epithelium
- Von Ebner glands open in base of furrow


circumvalate papillae
filiforme papillae
skeletal muscle bundles orientated in all planes

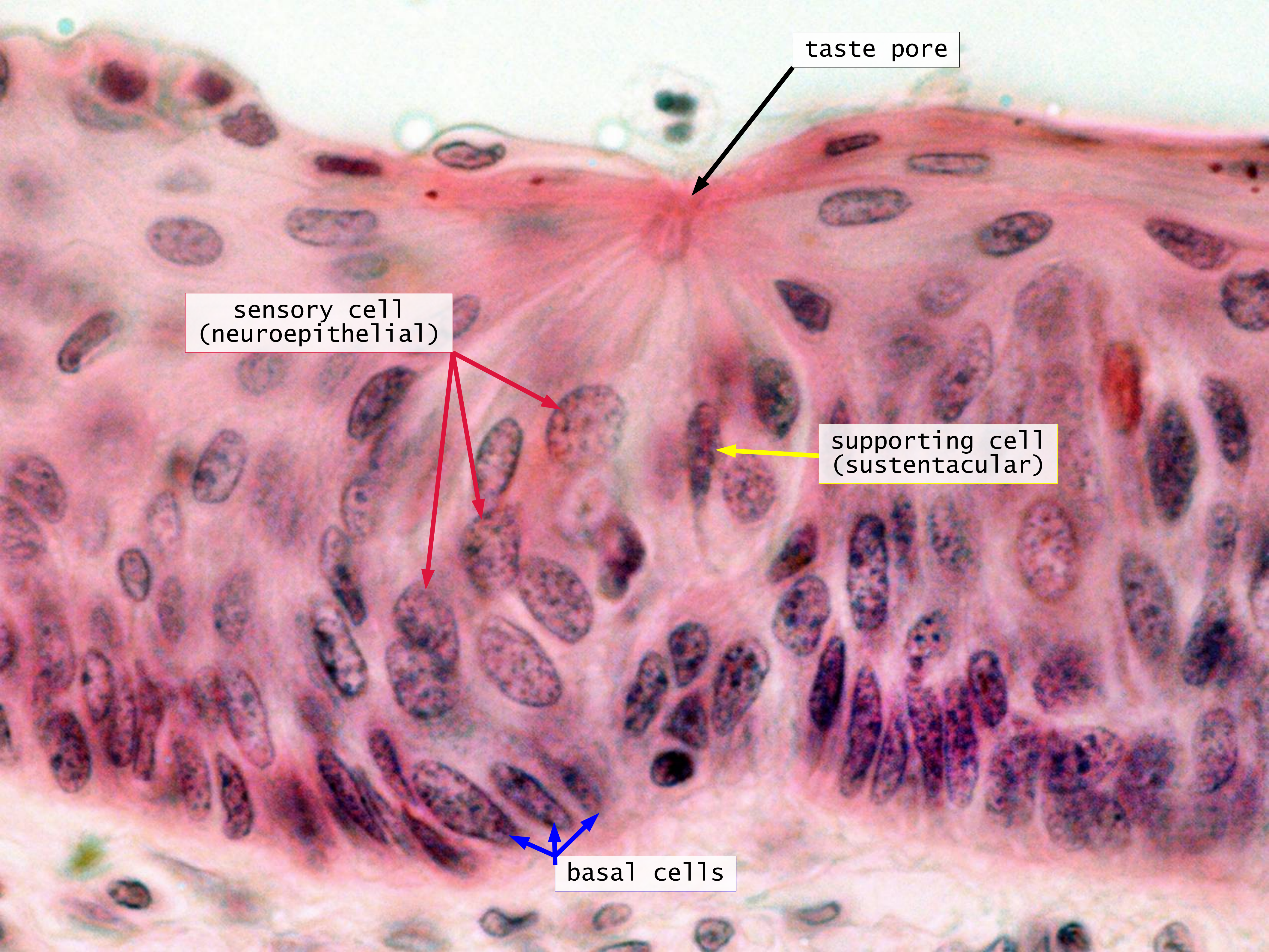

circumvalate papilla
circumvalate papilla
taste buds
furrow
furrows
glands
glands

Taste buds

- Small structures inside epithelium
- Perception of taste
- Three cell types
- Sustentacular cells
- Neuroepithelial cells
- Basal cells
  - Regenerative
- Taste pore



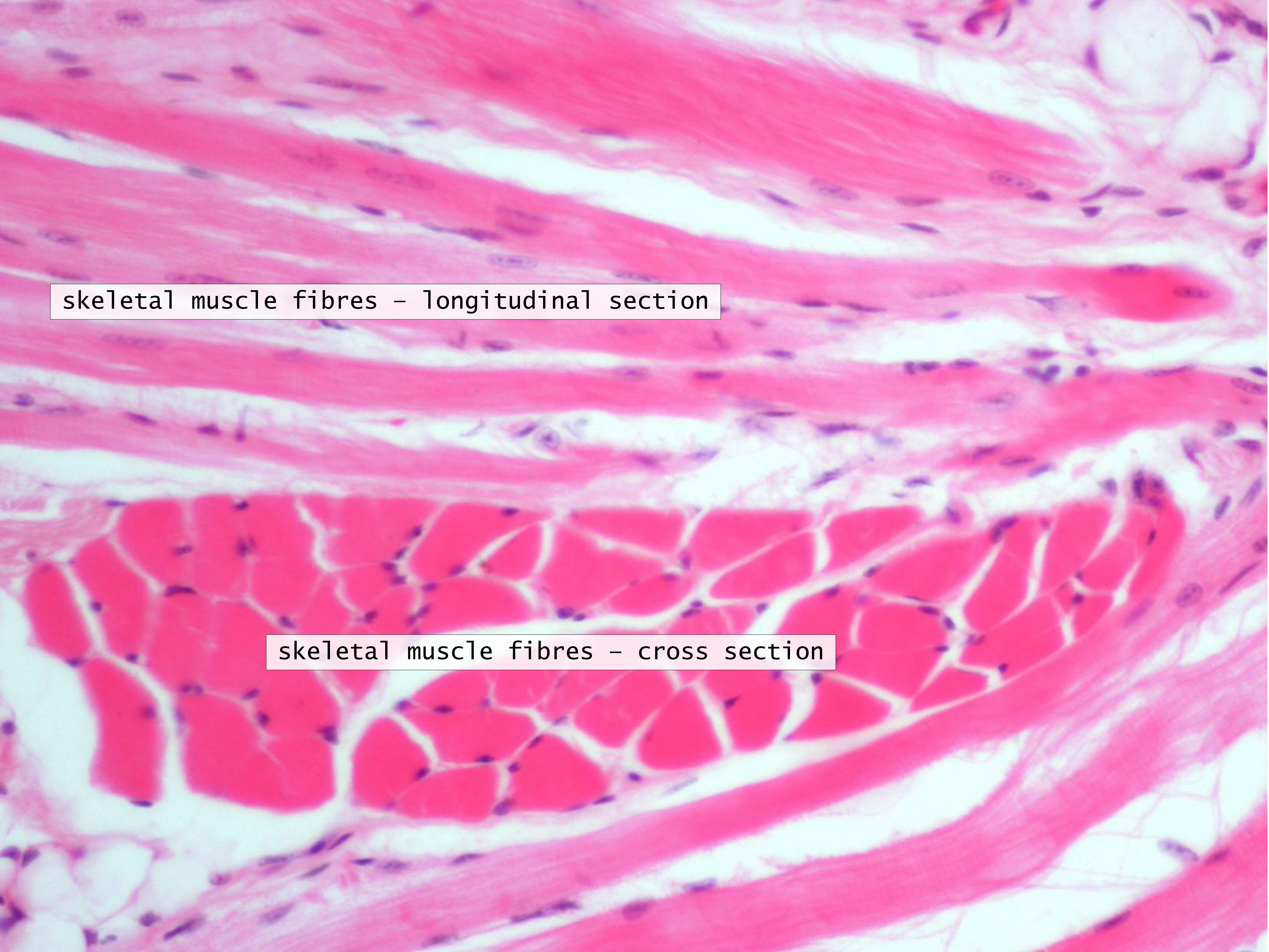
taste pore
taste bud
furrow

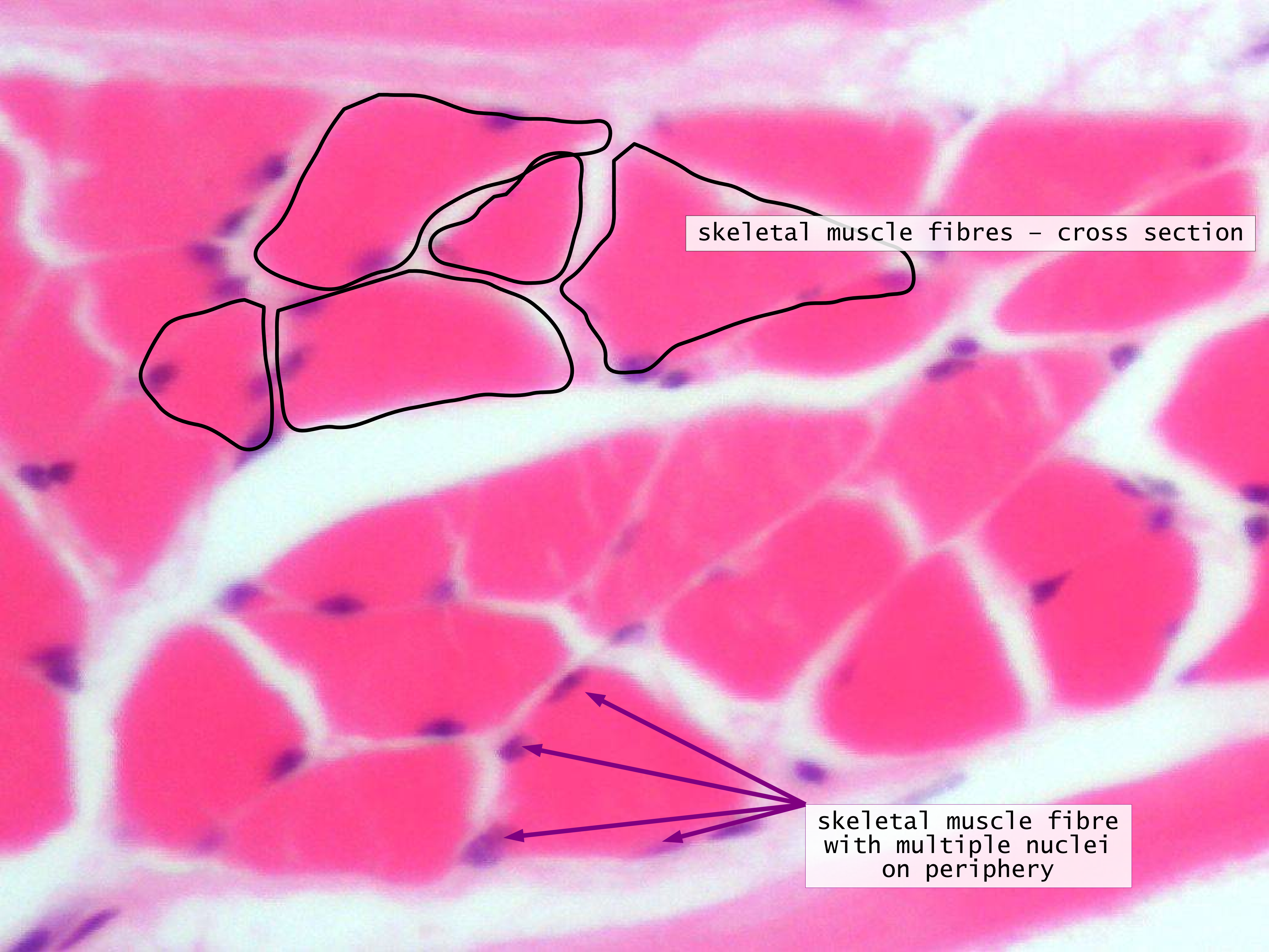

taste pore
sensory cell
(neuroepithelial)
supporting cell
(sustentacular)
basal cells


sensory cell
supporting cell

Muscular core

- Bulk of tongue
- Bundles skeletal muscle fibres
- All planes
- Interlaced with CT elements

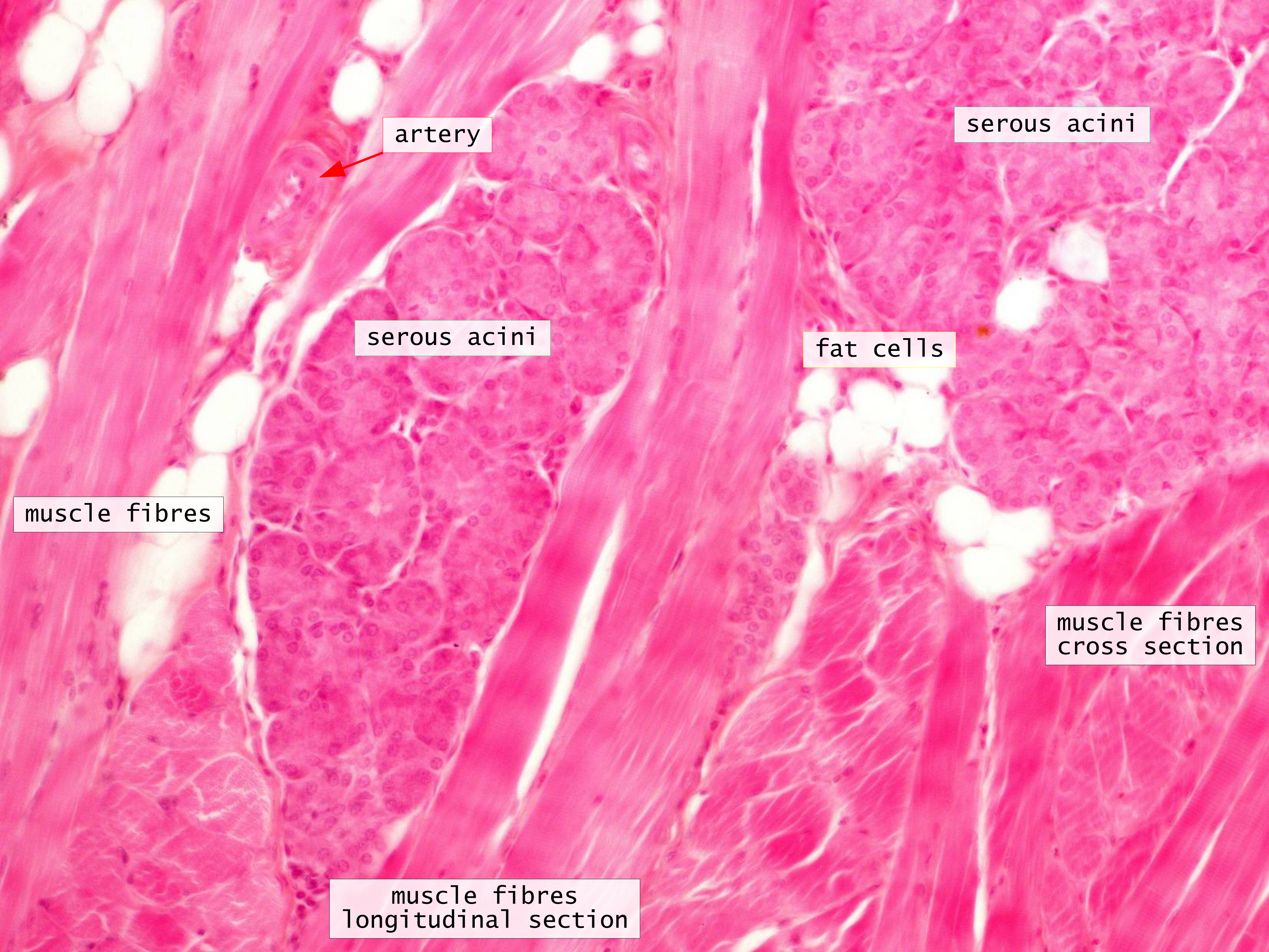

skeletal muscle fibres – longitudinal section
skeletal muscle fibres – cross section


skeletal muscle fibres – cross section
skeletal muscle fibre
with multiple nuclei
on periphery


skeletal muscle fibre
with multiple nuclei
on periphery

Minor salivary glands

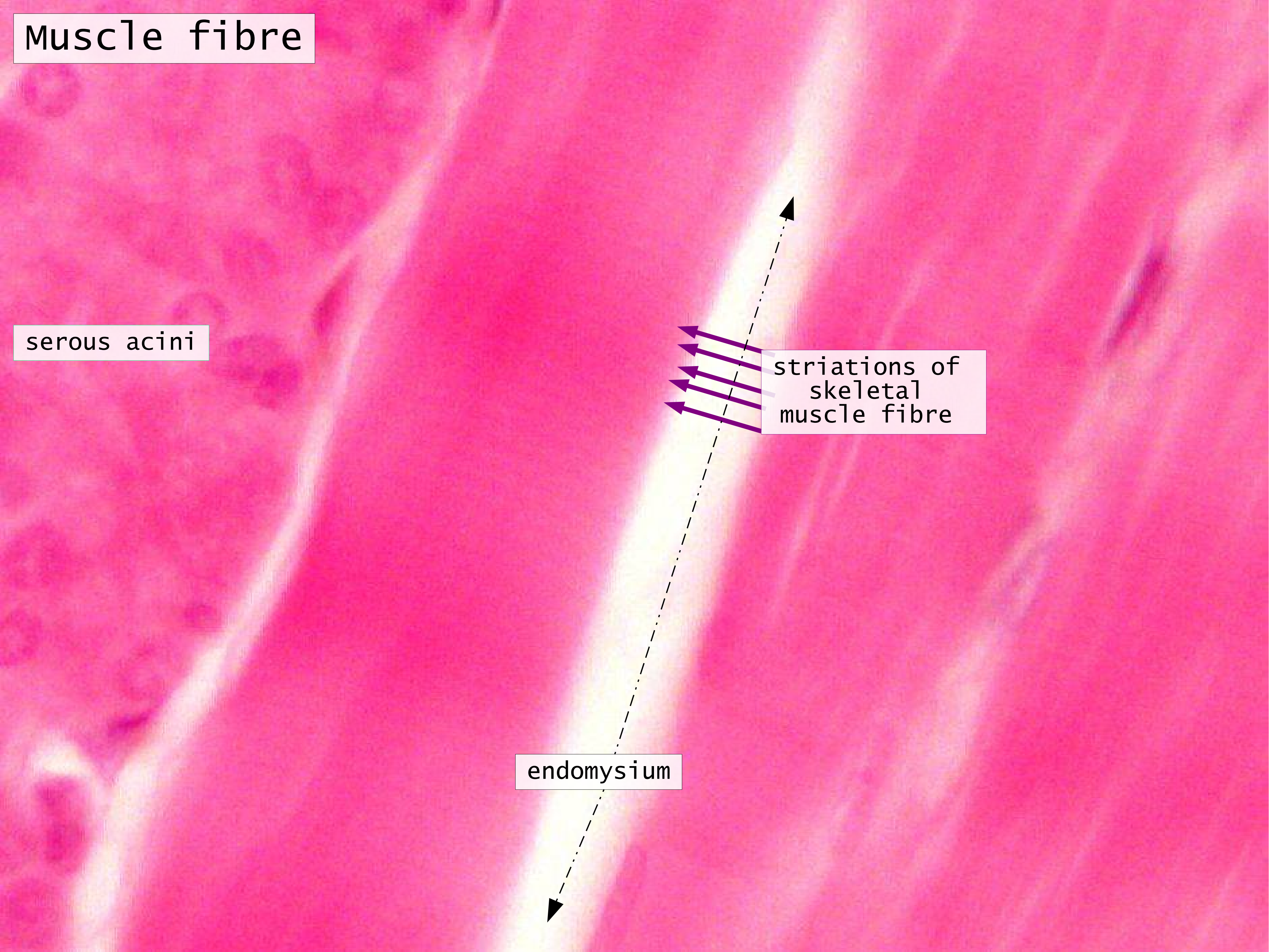
- Interspersed between muscle fibres
- Serous glands
  - Von Ebner
- Mixed glands
  - Anterior
- Mucous glands
  - Posterior lingual glands

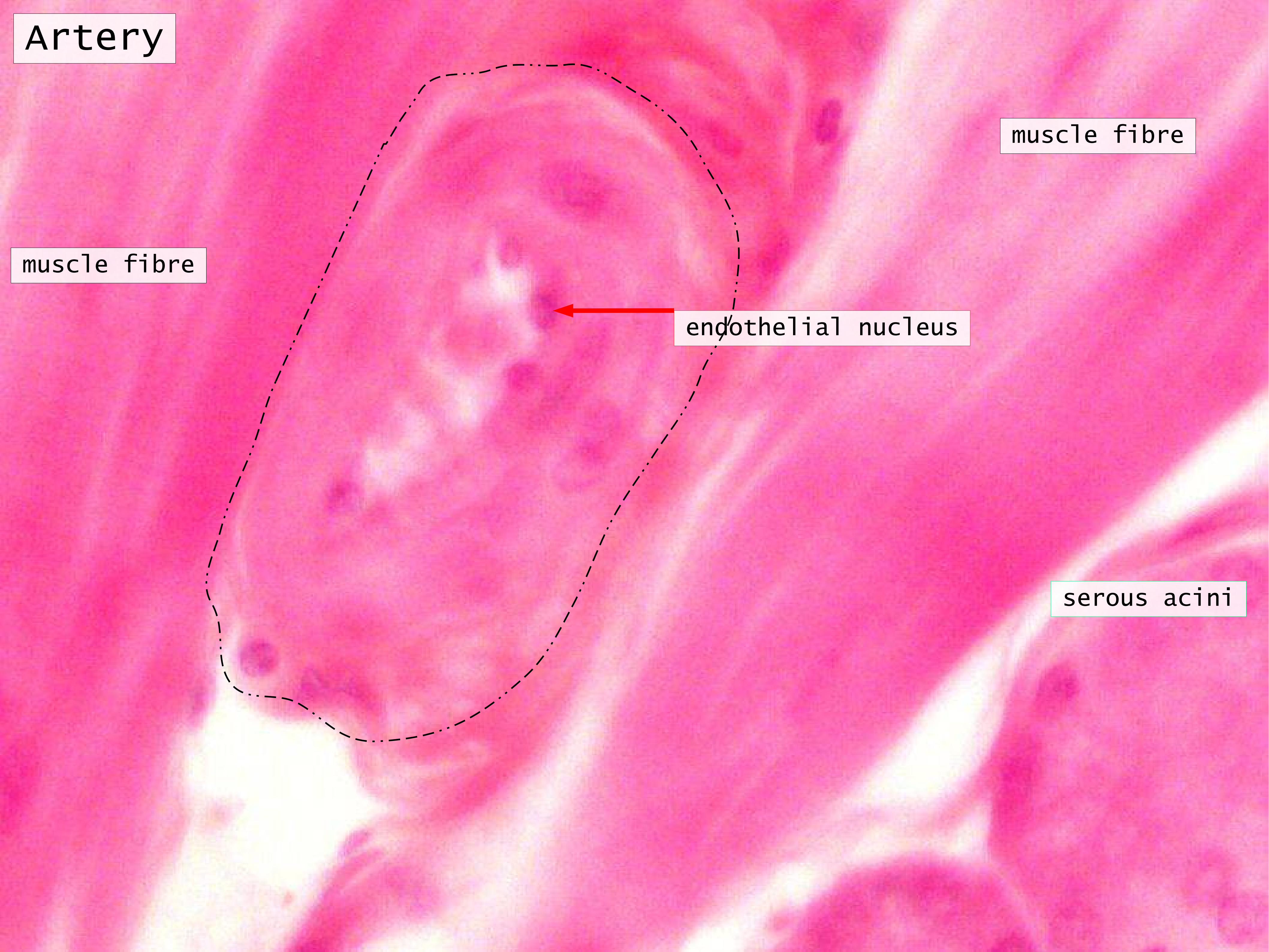

artery
serous acini
serous acini
fat cells
muscle fibres
muscle fibres
cross section
muscle fibres
longitudinal section

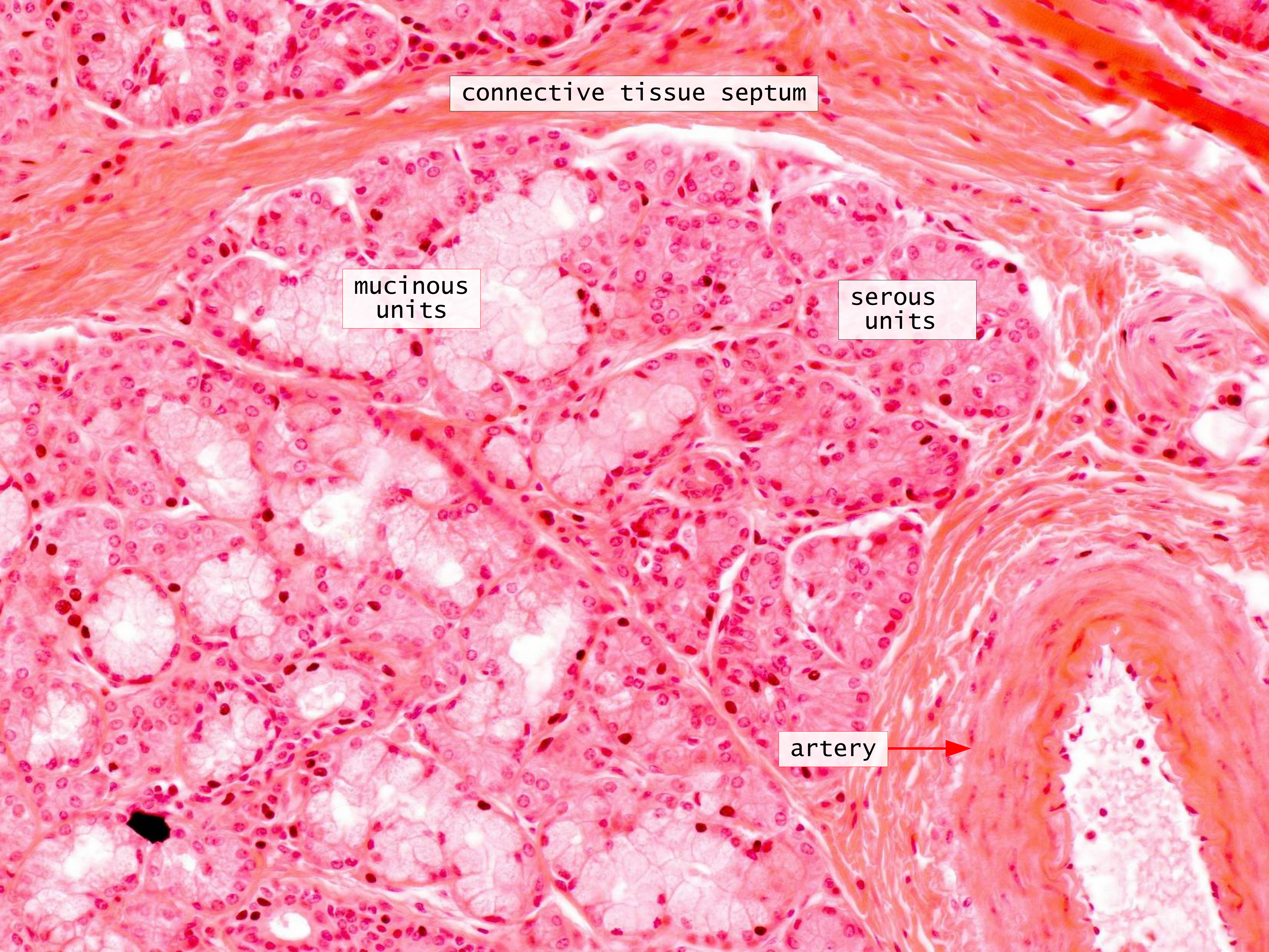

artery
serous acini
fat cell
muscle fibres

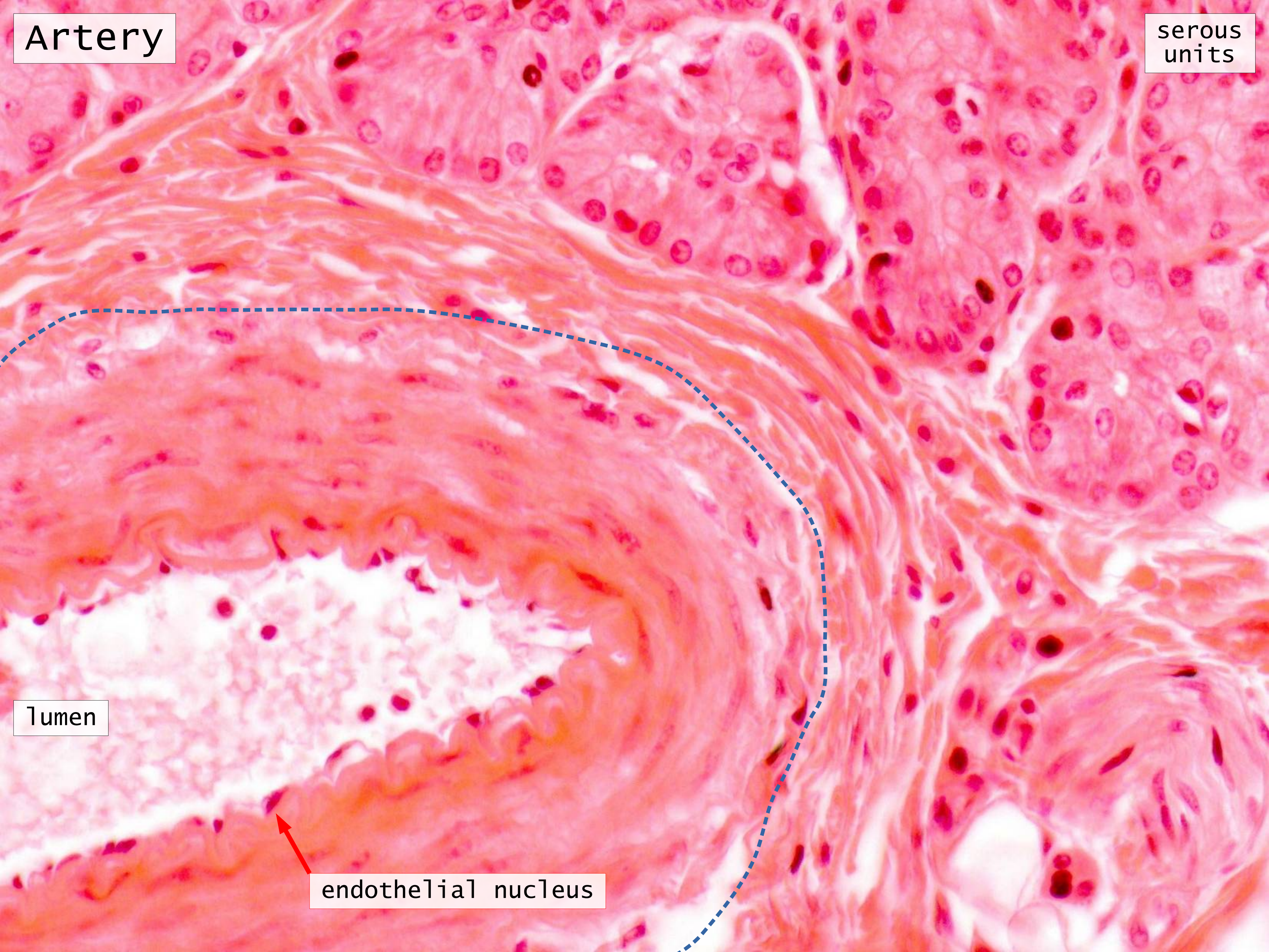

serous acinus
lumen

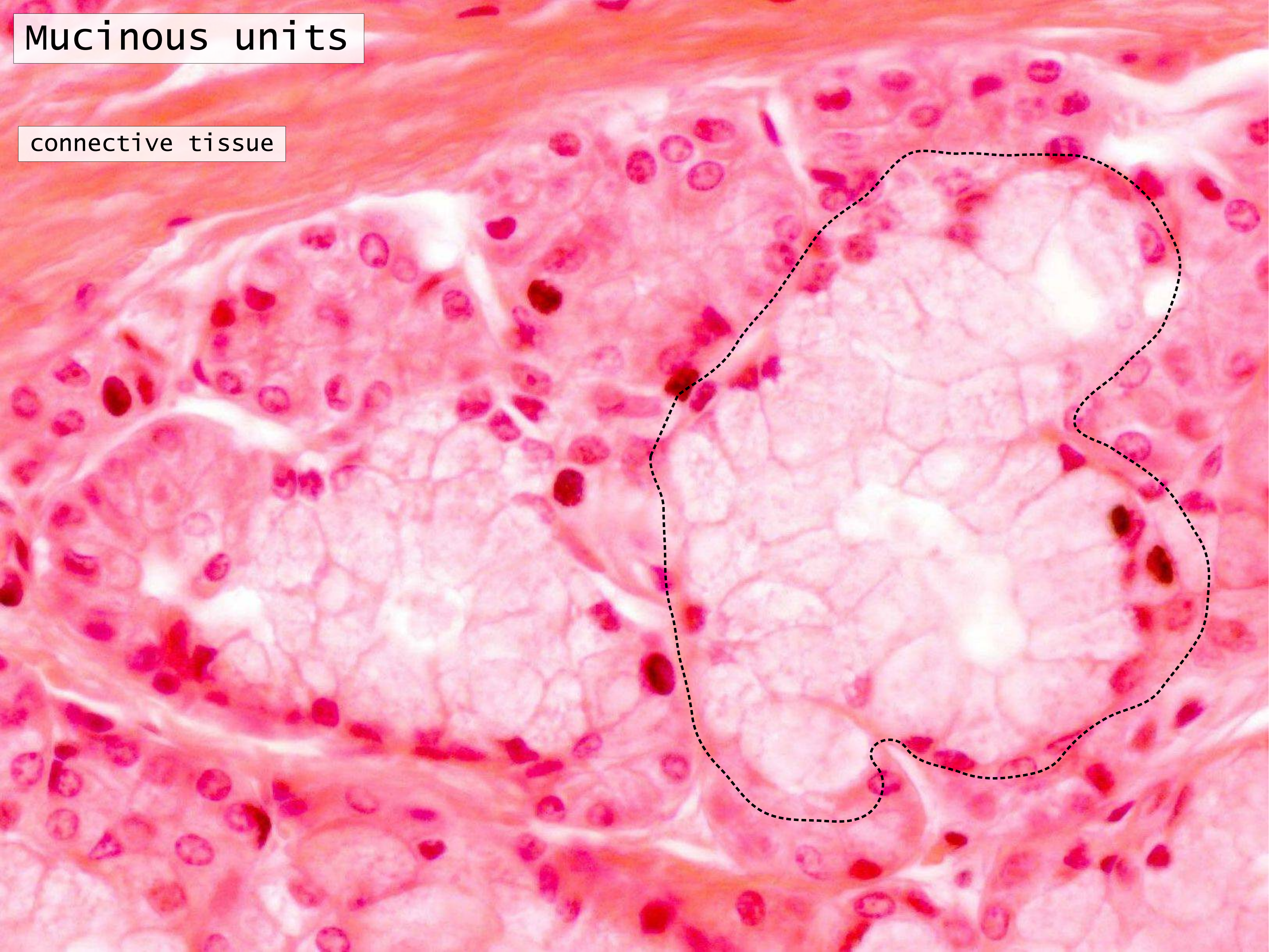
Muscle fibre

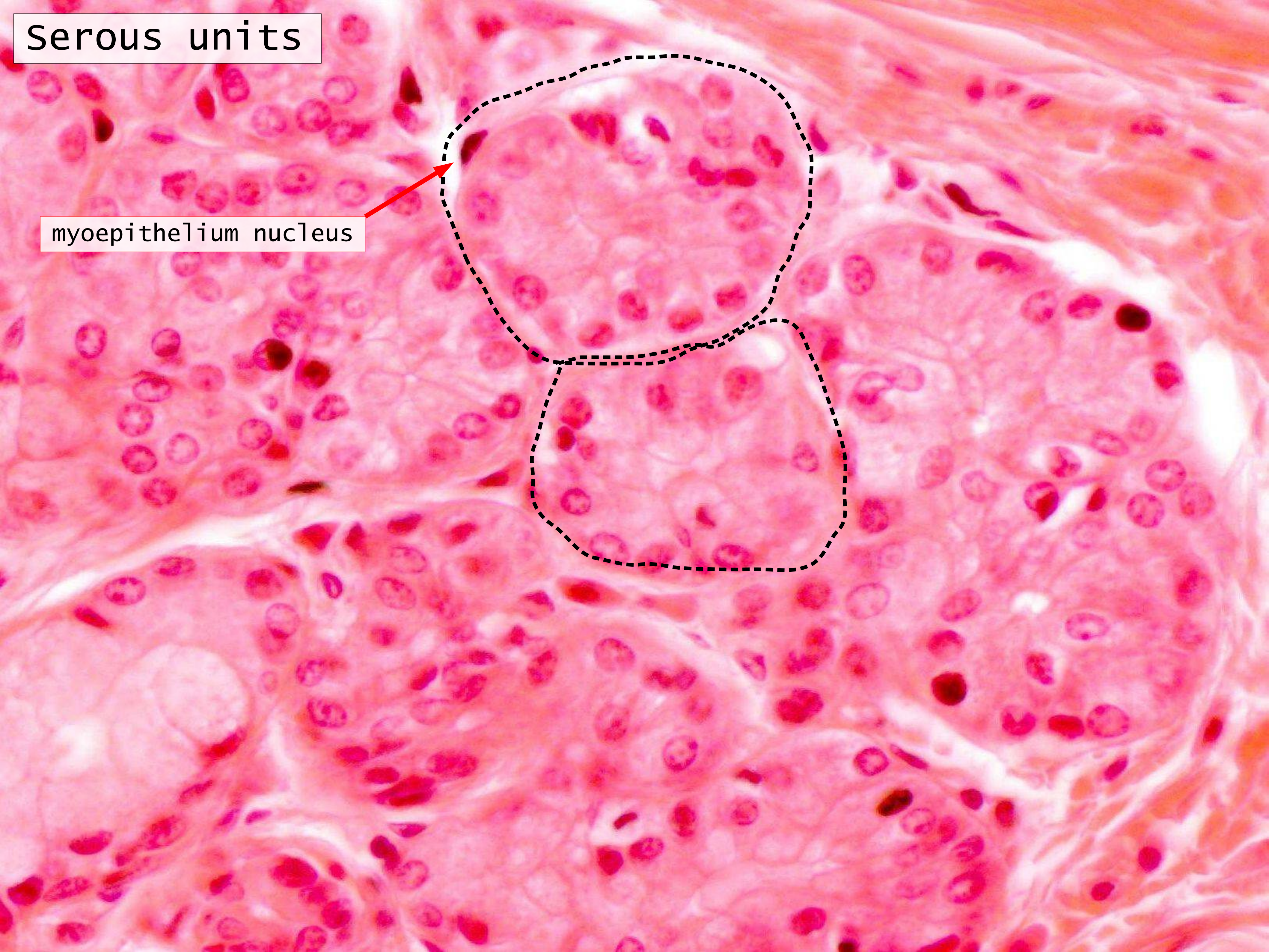



Artery
muscle fibre
muscle fibre
endothelial nucleus
serous acini

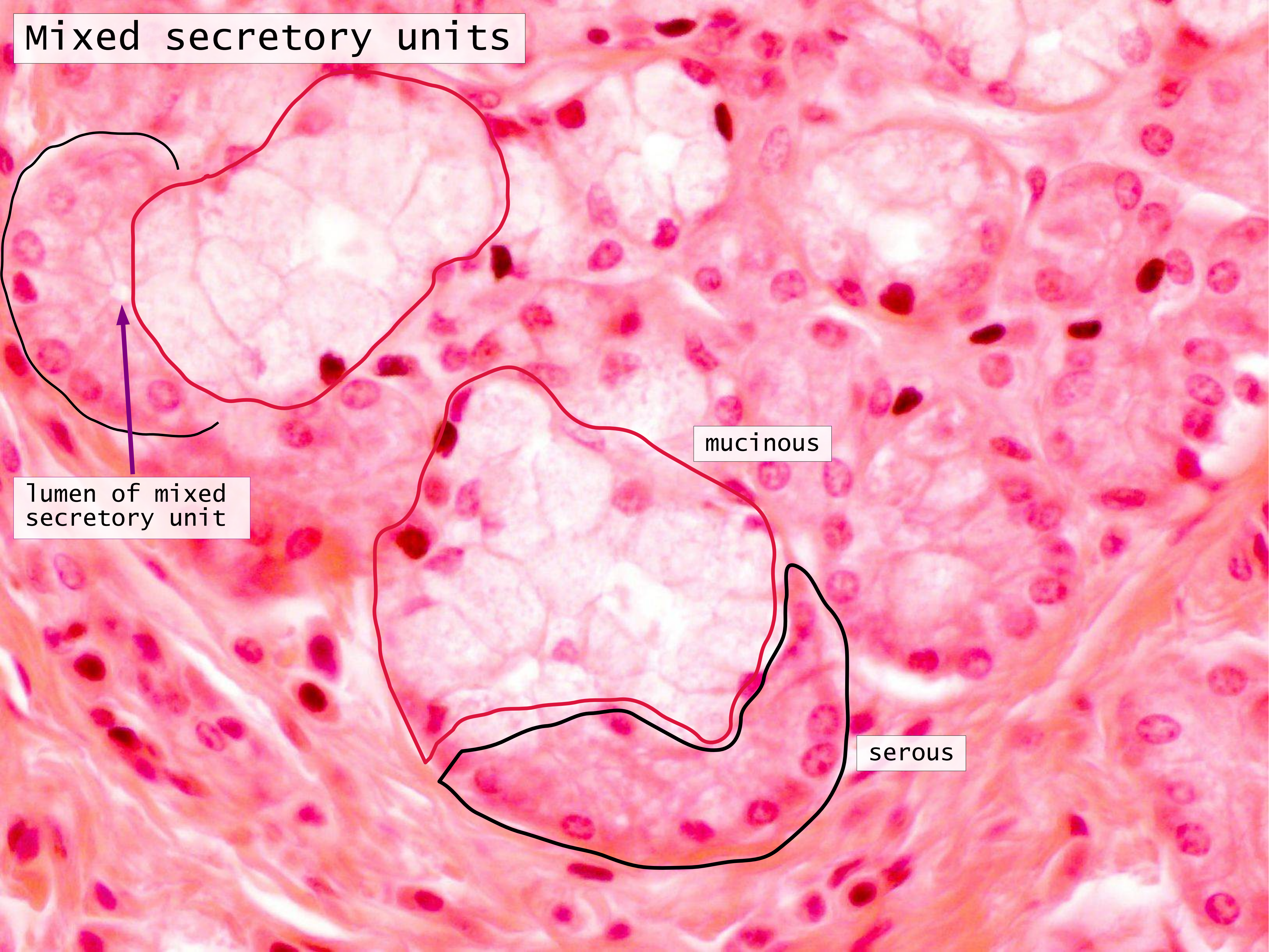

connective tissue septum
mucinous units
serous units
artery

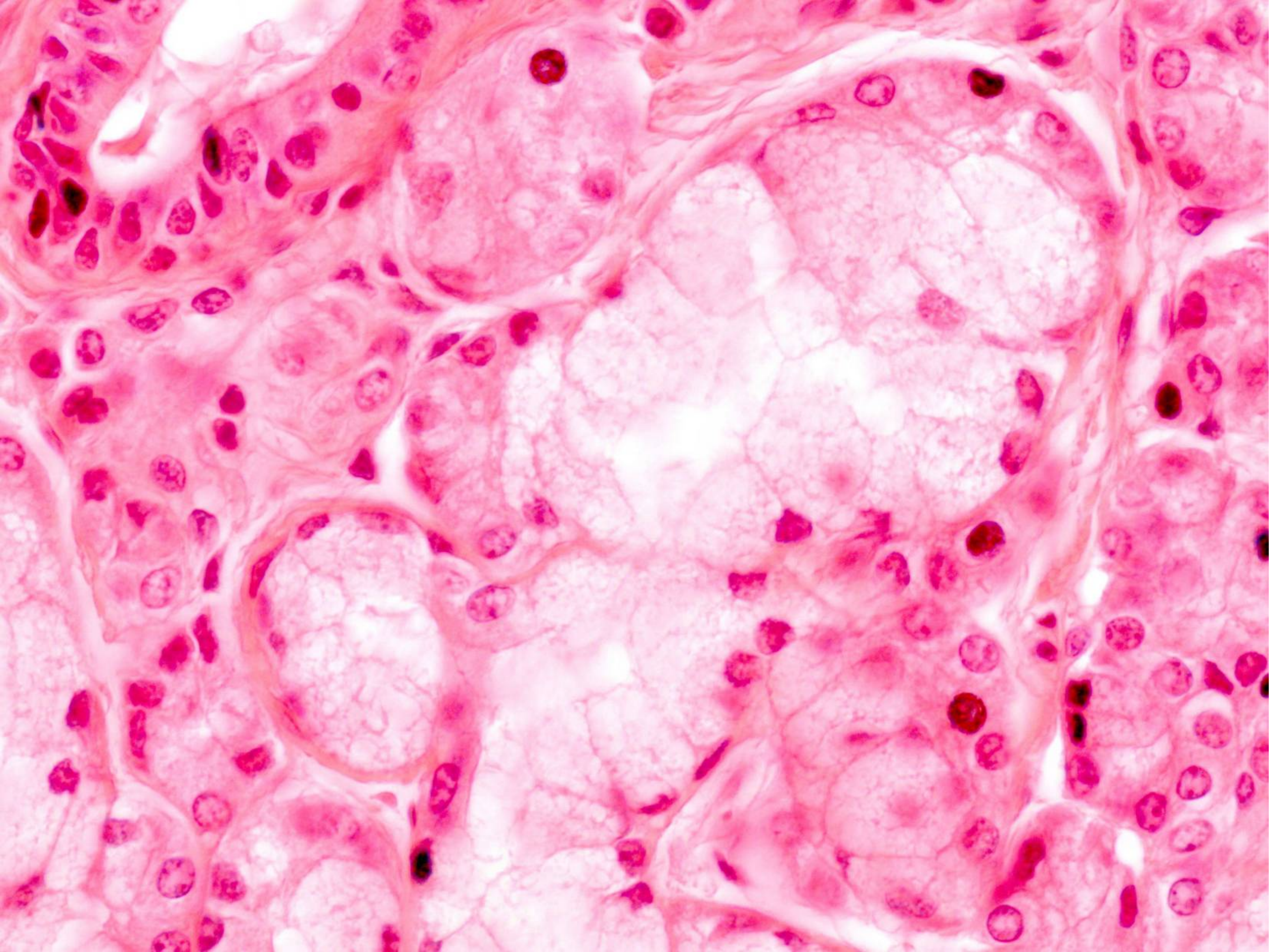

Artery
serous units
lumen
endothelial nucleus

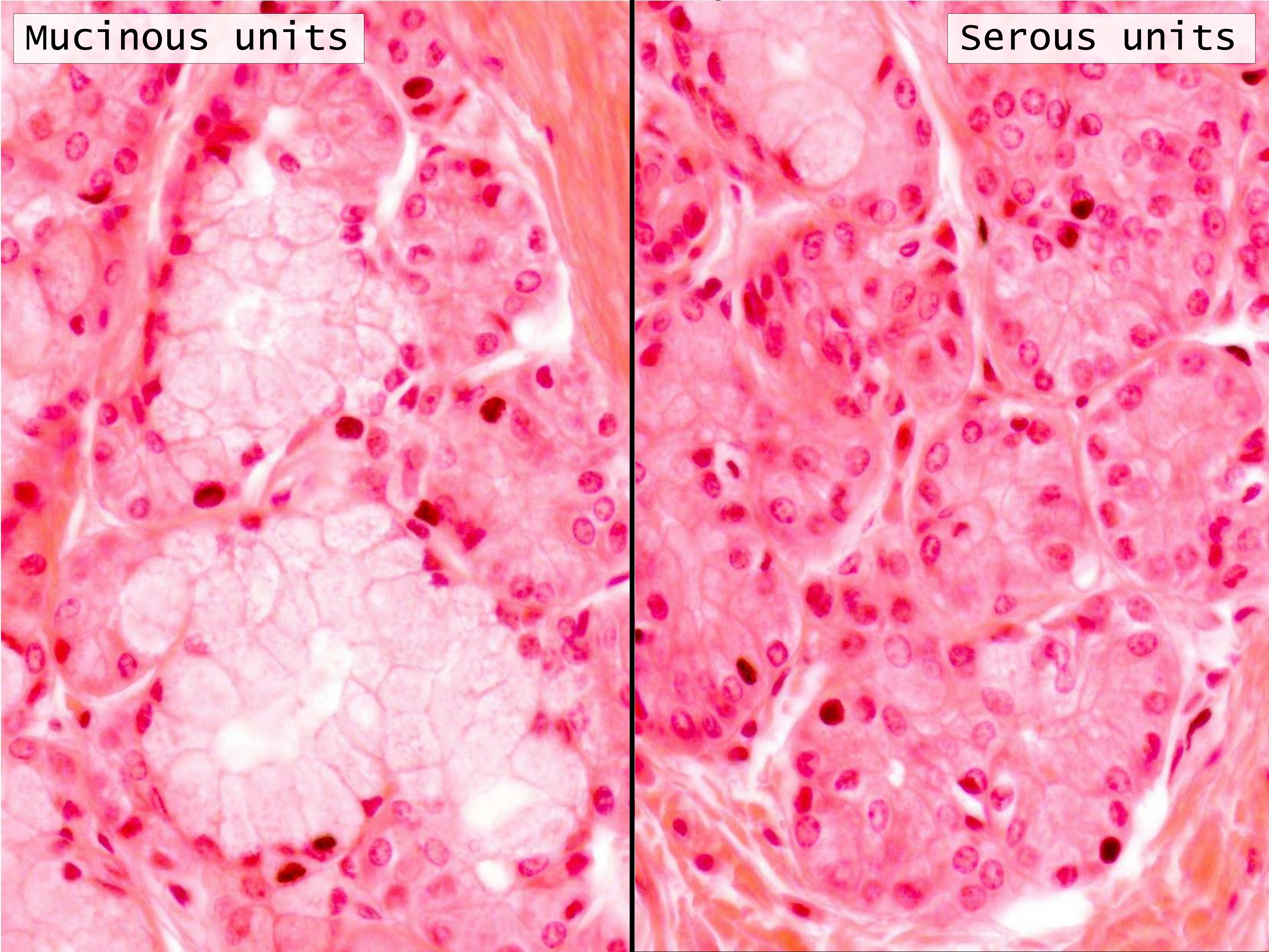

Mucinous units
connective tissue


Serous units
myoepithelium nucleus

Mixed secretory units





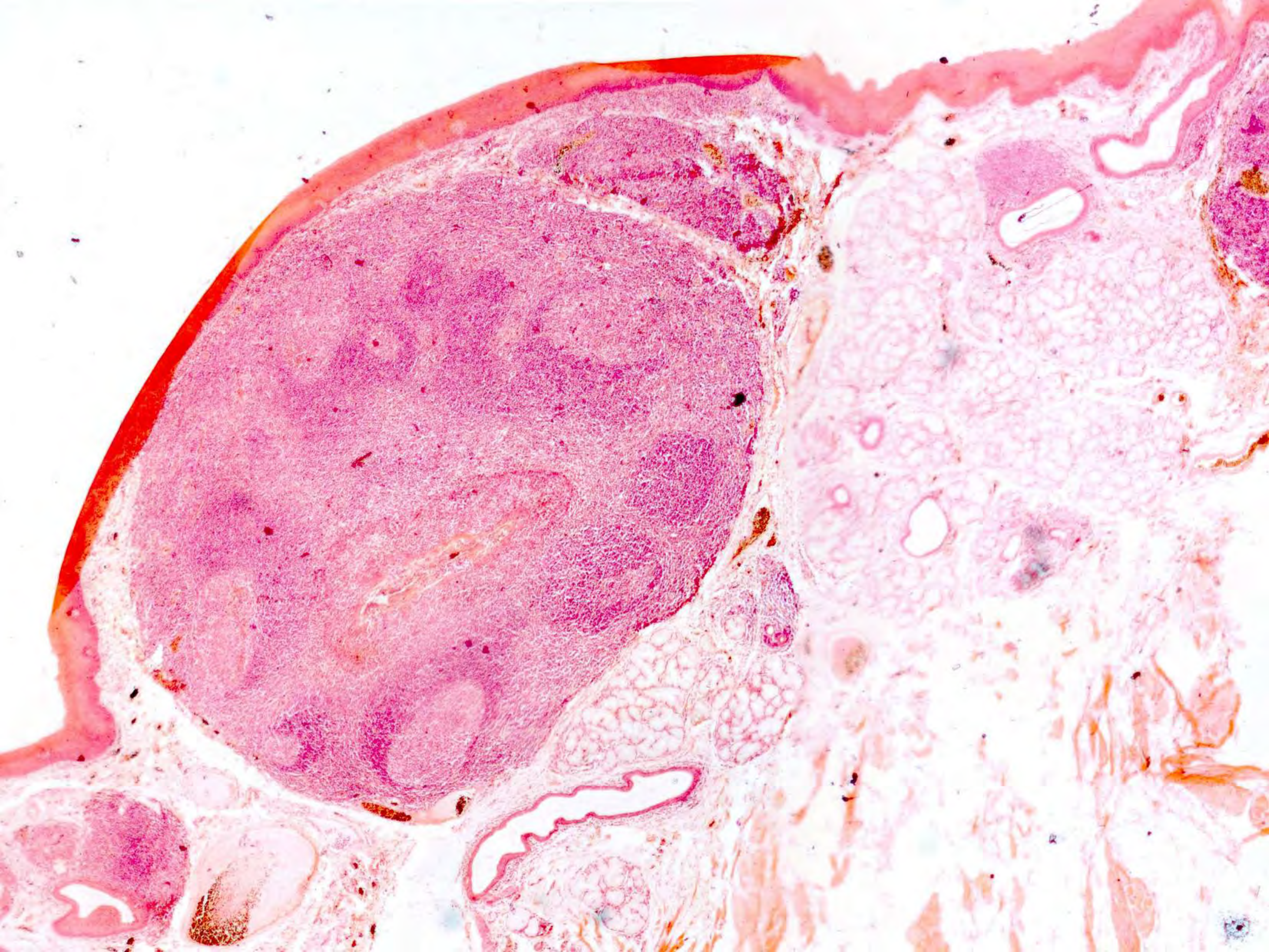

Mucinous units
Serous units

Ventral surface

- Stratified nonkeratinized squamous epithelium
- Lamina propria
  - Dense irregular CT
- Submucosa
  - Dense irregular CT

Posterior third

- Lingual tonsils



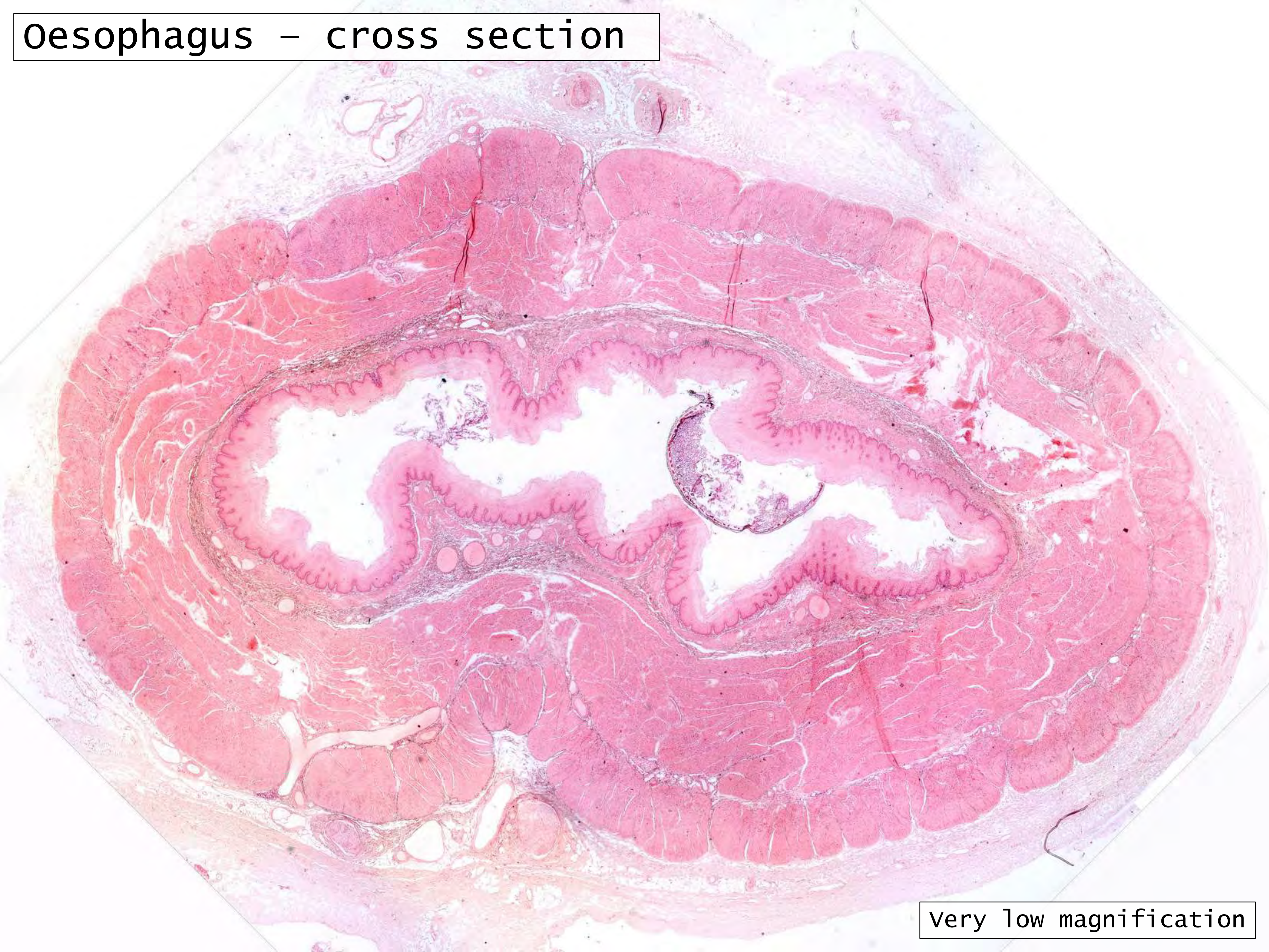
Alimentary canal 1/2

- Esophagus – slide 31
- Esophagus-stomach junction – slide 101
- Stomach – slides 37 & 38
- Stomach-duodenal junction – slide 36
- Duodenum – slide 40

Oesophagus

Slide 31

Oesophagus – cross section



Very low magnification

Oesophagus – cross section

Very low magnification

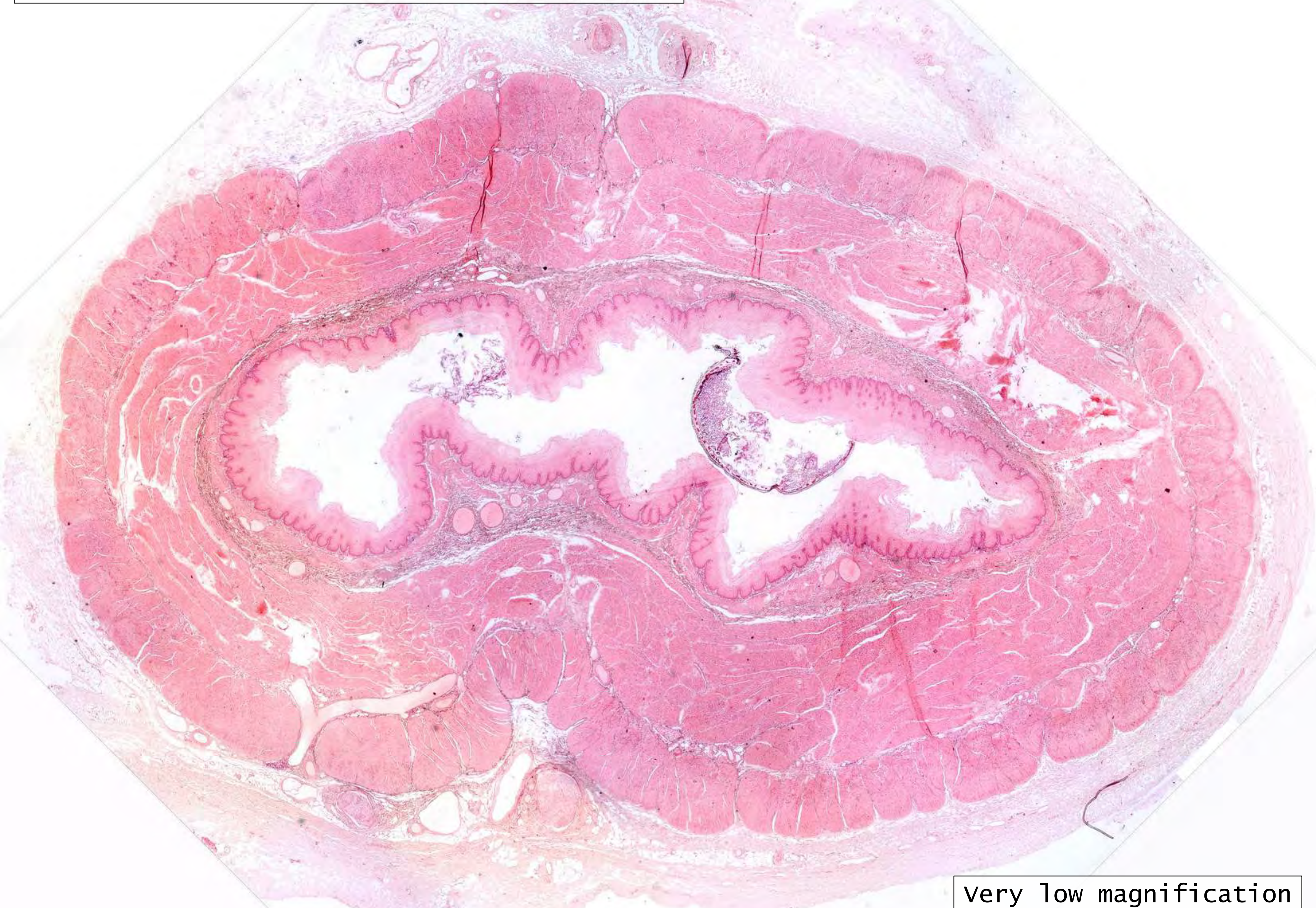
Oesophagus – longitudinal section

Very low magnification

Oesophagus

- Muscular tube
- Connects pharynx with stomach
- Four layers
  - Mucosa
  - Submucosa
  - Muscularis externa
  - Adventitia

Oesophagus – cross section

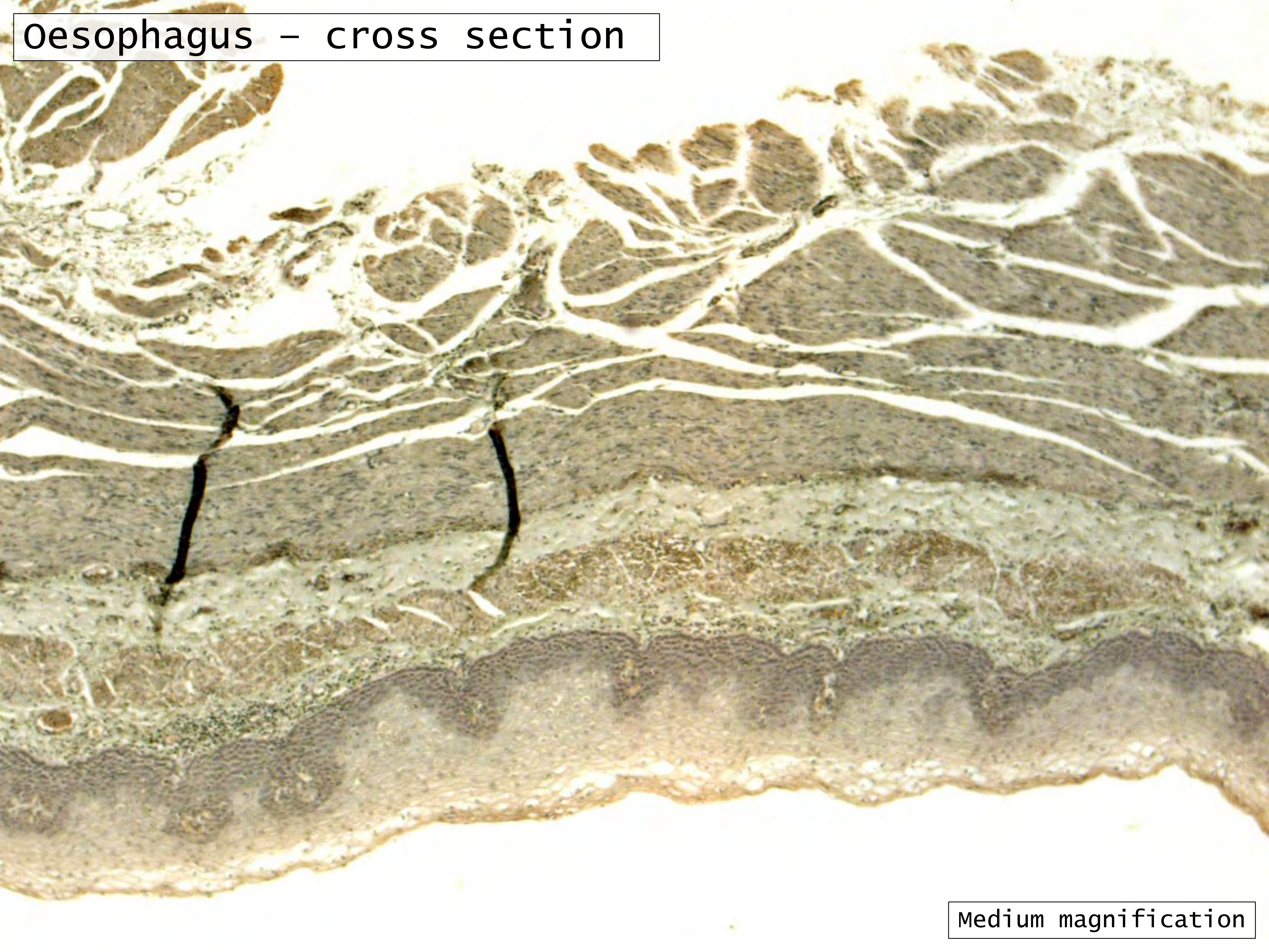


Very low magnification


Oesophagus – cross section
Medium magnification

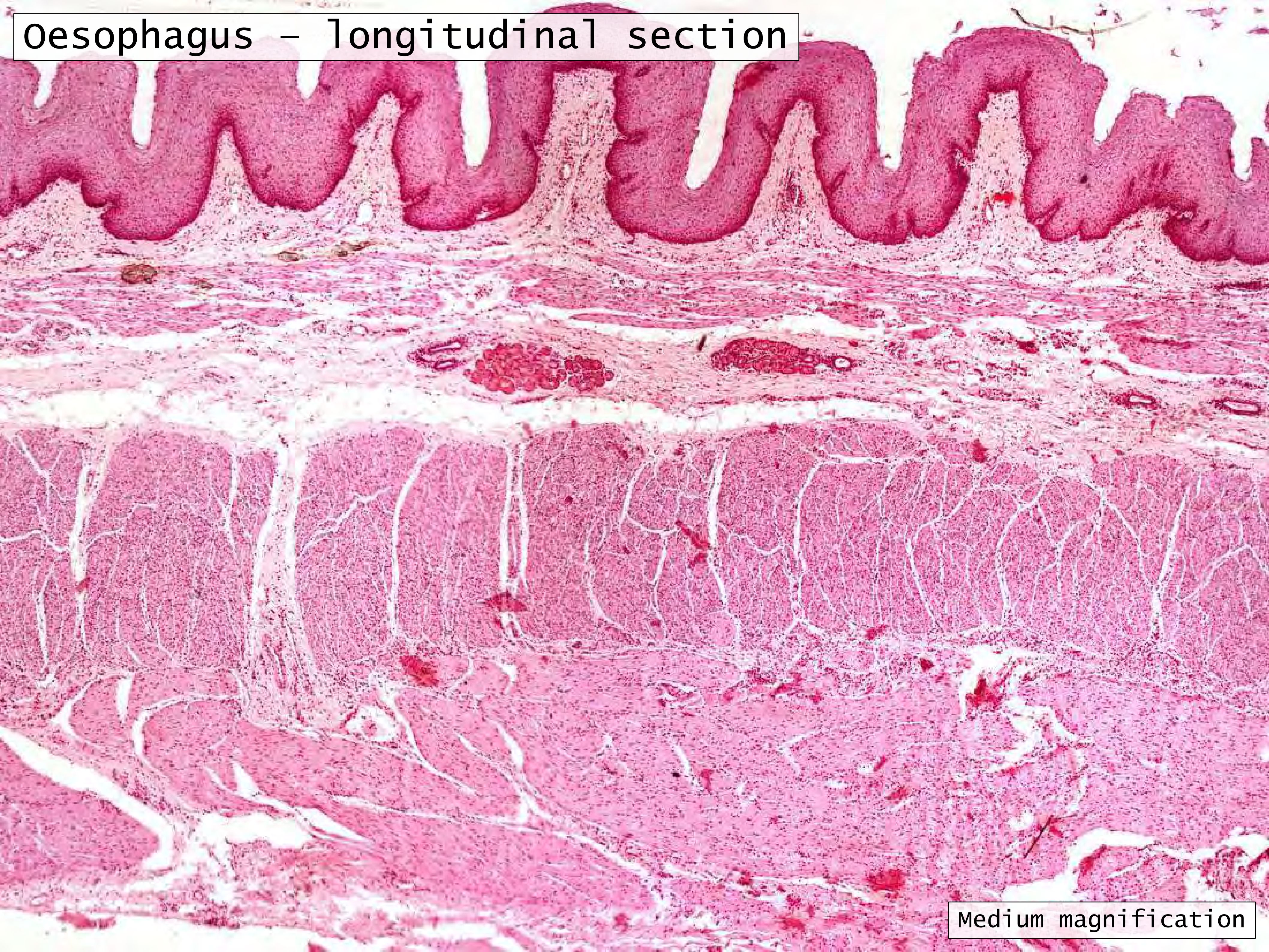
Oesophagus – cross section

Very low magnification

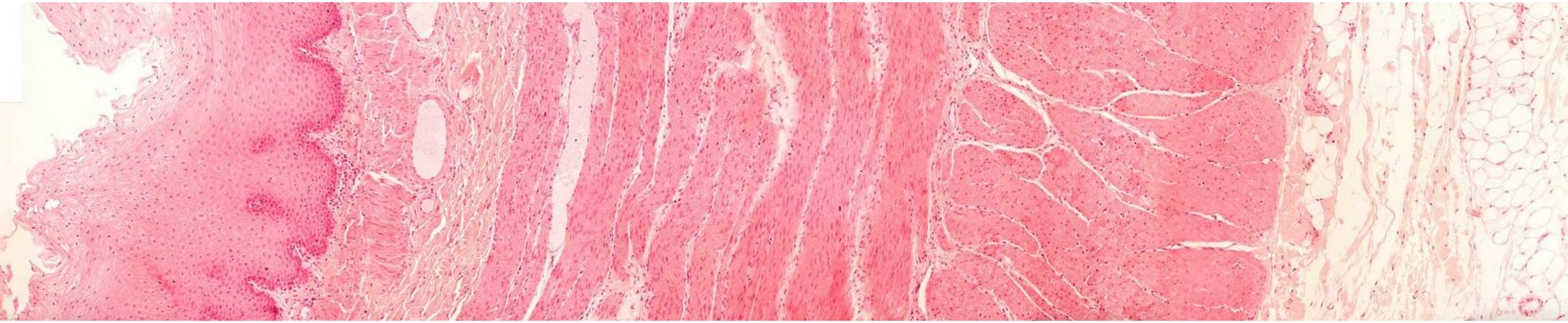

Oesophagus – cross section
Medium magnification

Oesophagus – longitudinal section

Very low magnification


Oesophagus – longitudinal section
Medium magnification

Oesophagus – cross section

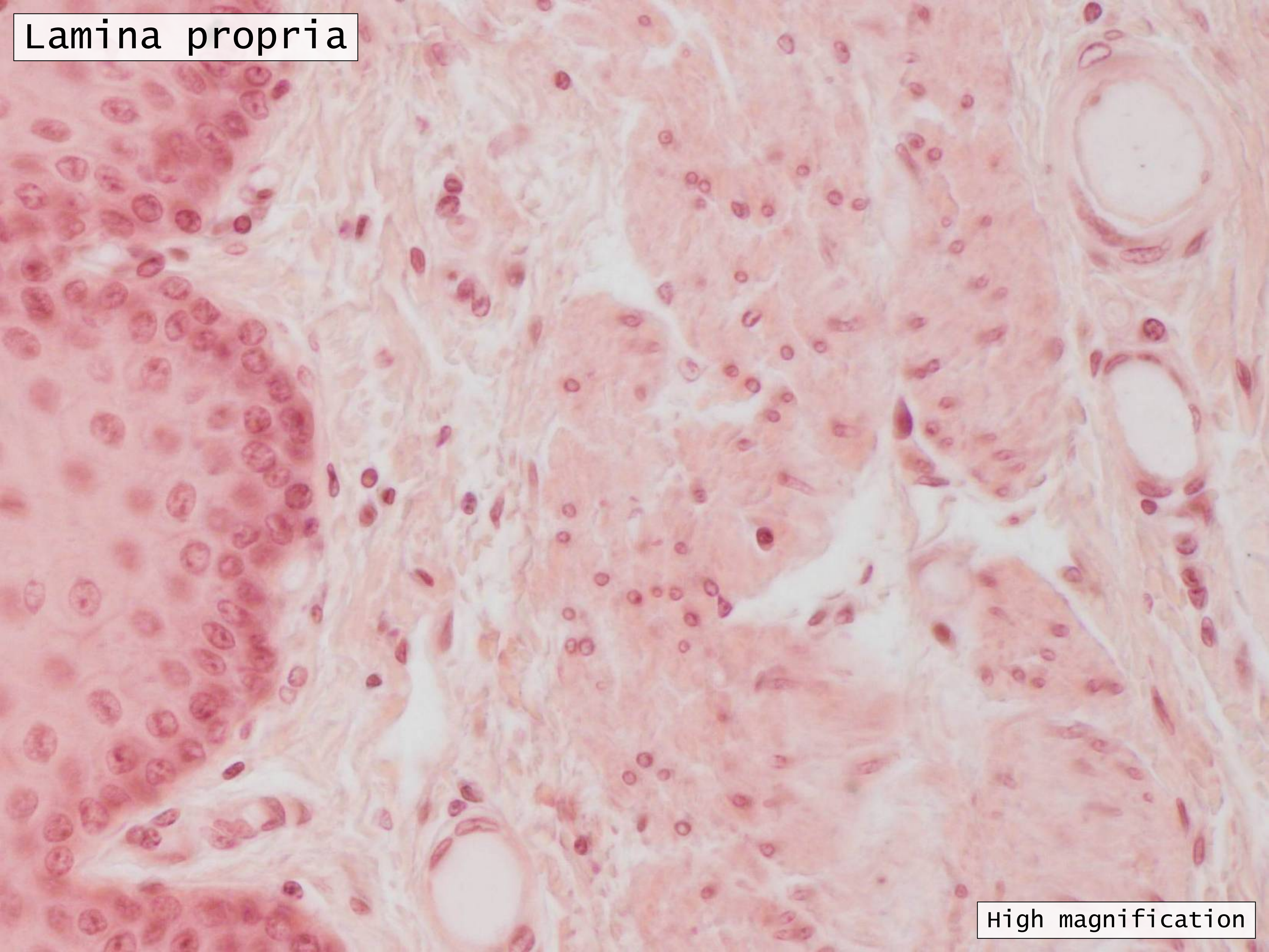


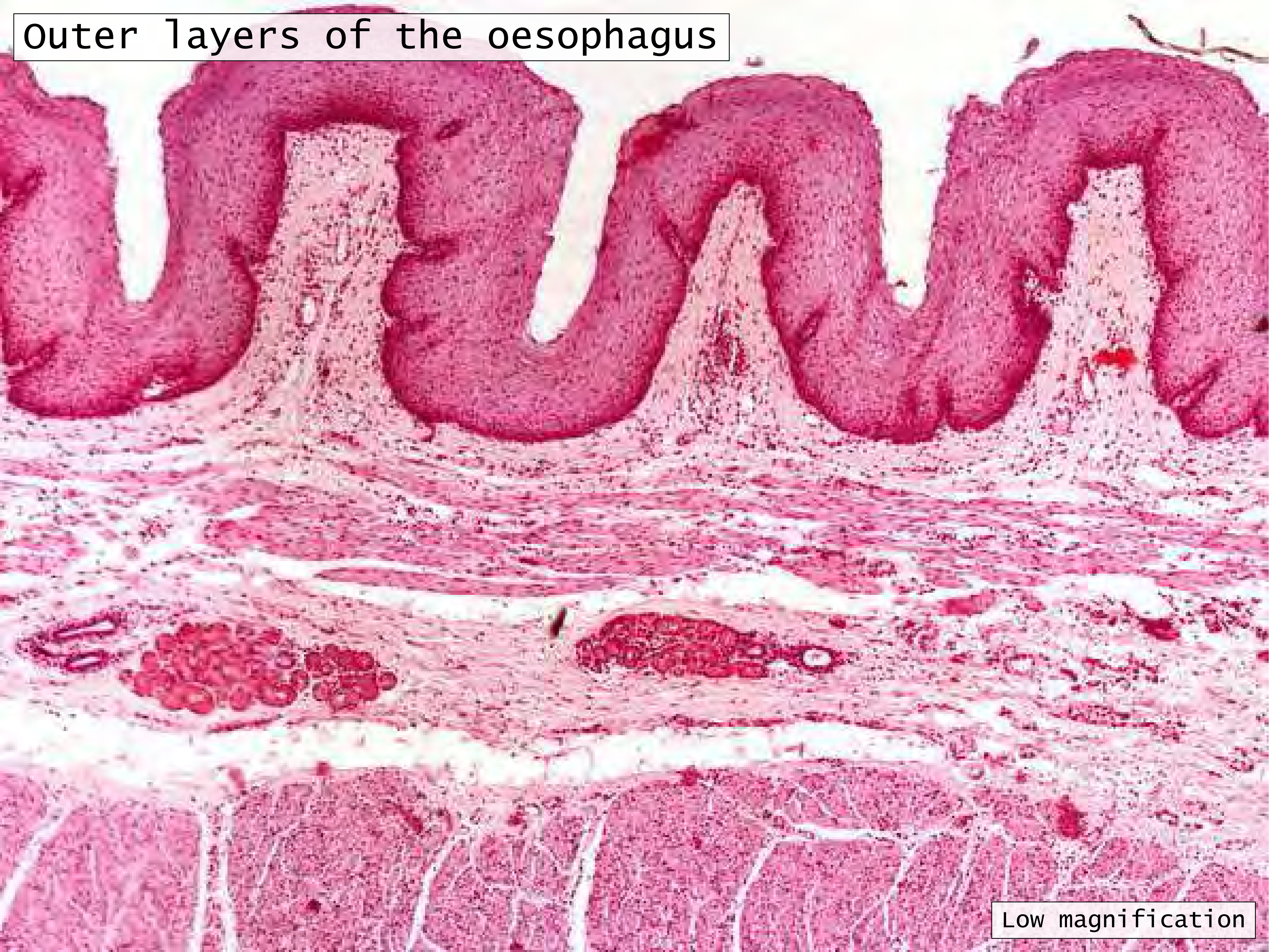
Low magnification

Mucosa

- Thick stratified squamous epithelium
- Lamina propria
  - Loose CT
  - Oesophageal cardiac glands
    - Mucus-producing
- Muscularis mucosae
  - Longitudinal
  - Smooth muscle fibres

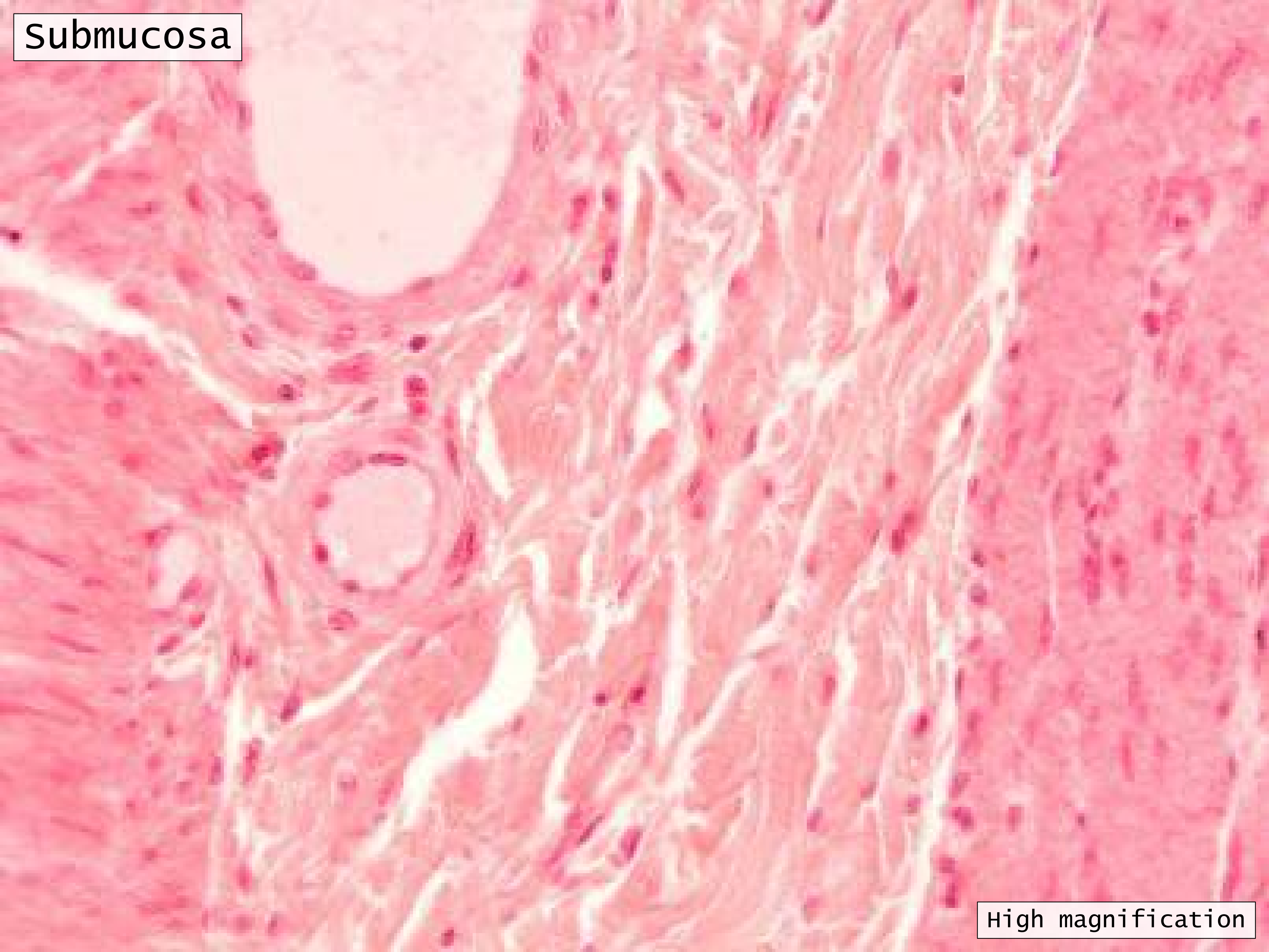

Epithelium of the oesophagus
High magnification

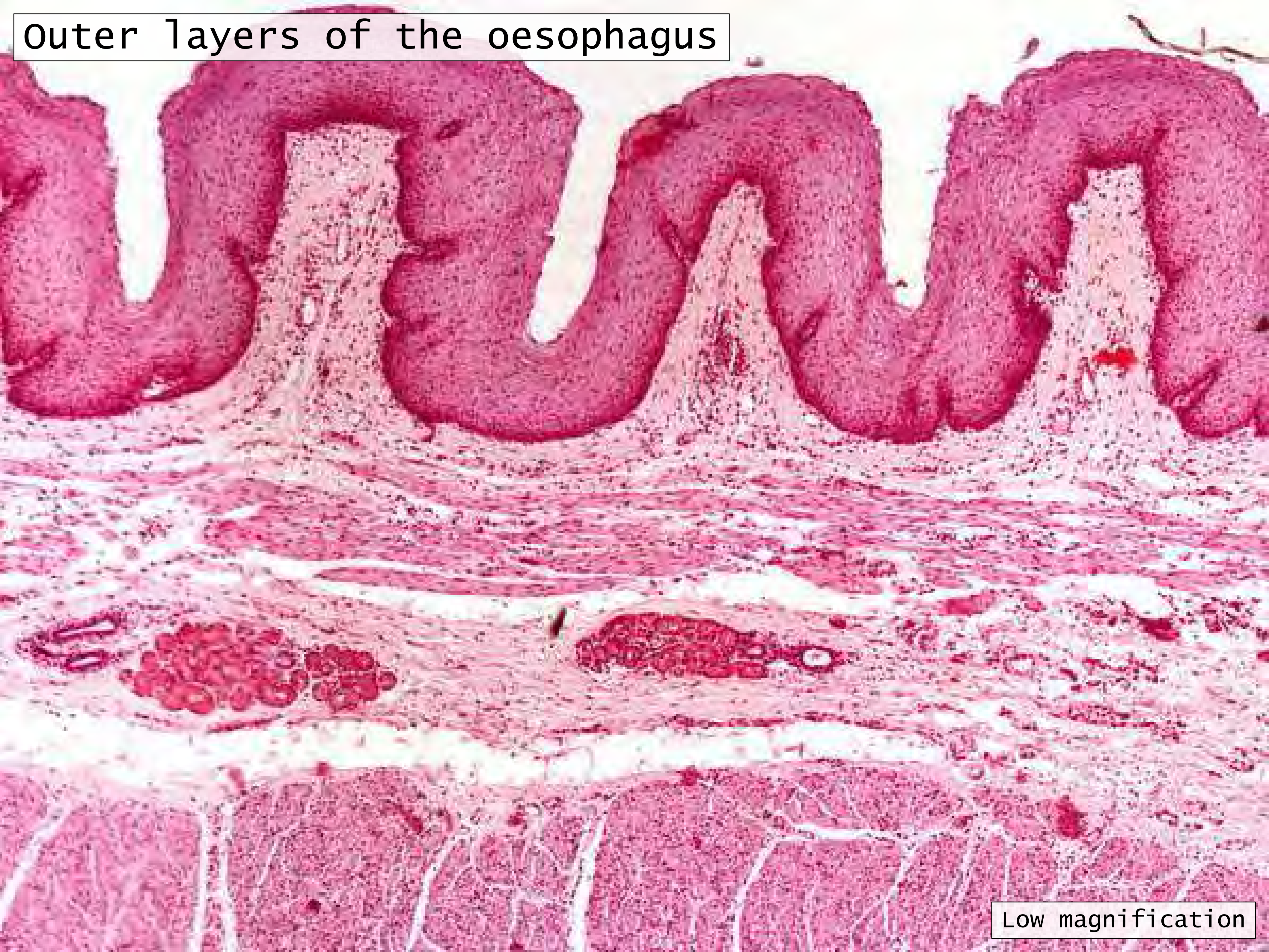

Lamina propria
High magnification

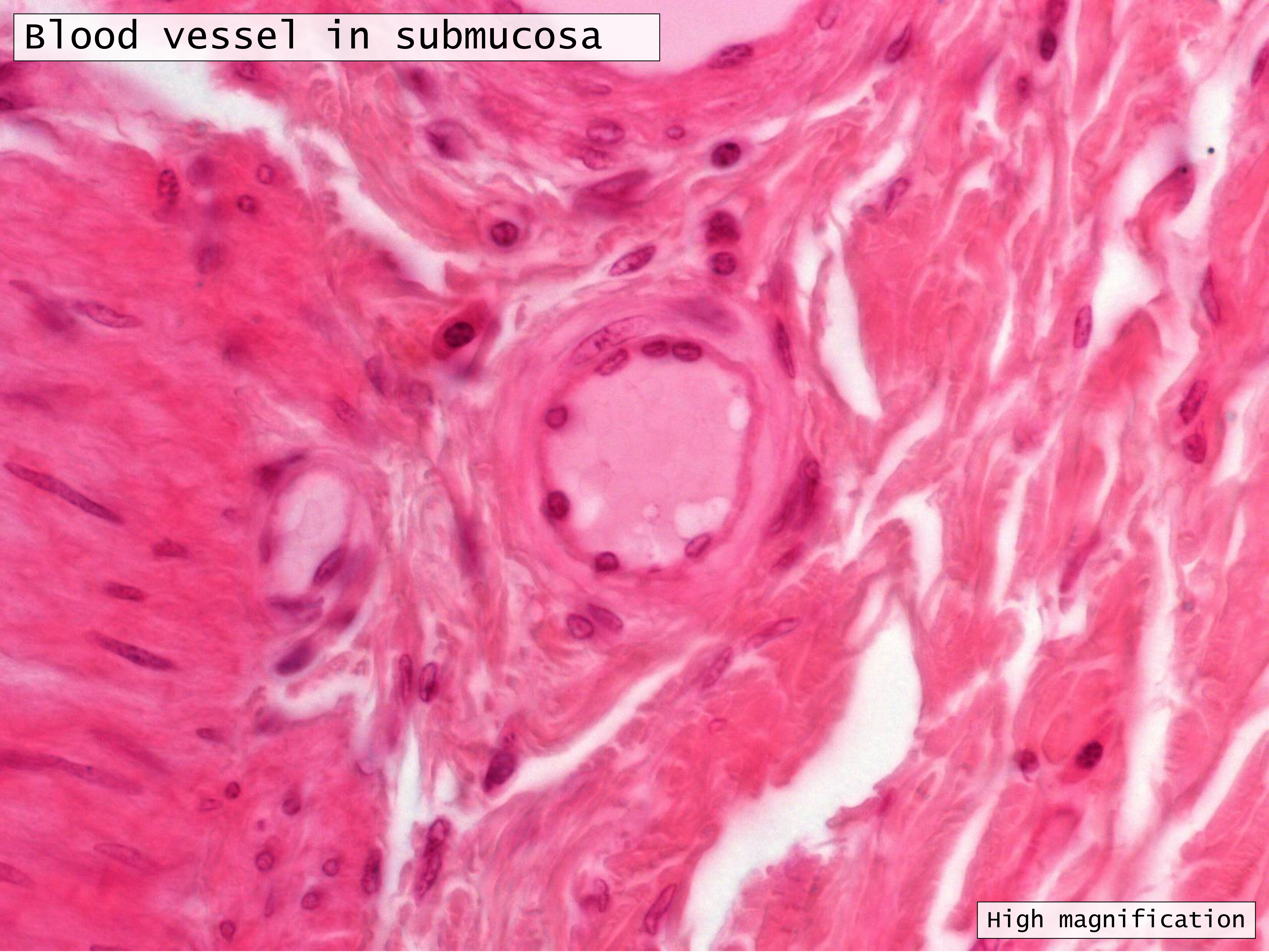

Outer layers of the oesophagus
Low magnification

Submucosa

- Dense irregular CT
- Tubuloalveolar glands
- Oesophagus+Duodenum = glands in submucosa
- Submucosal nervous plexus


Submucosa
High magnification

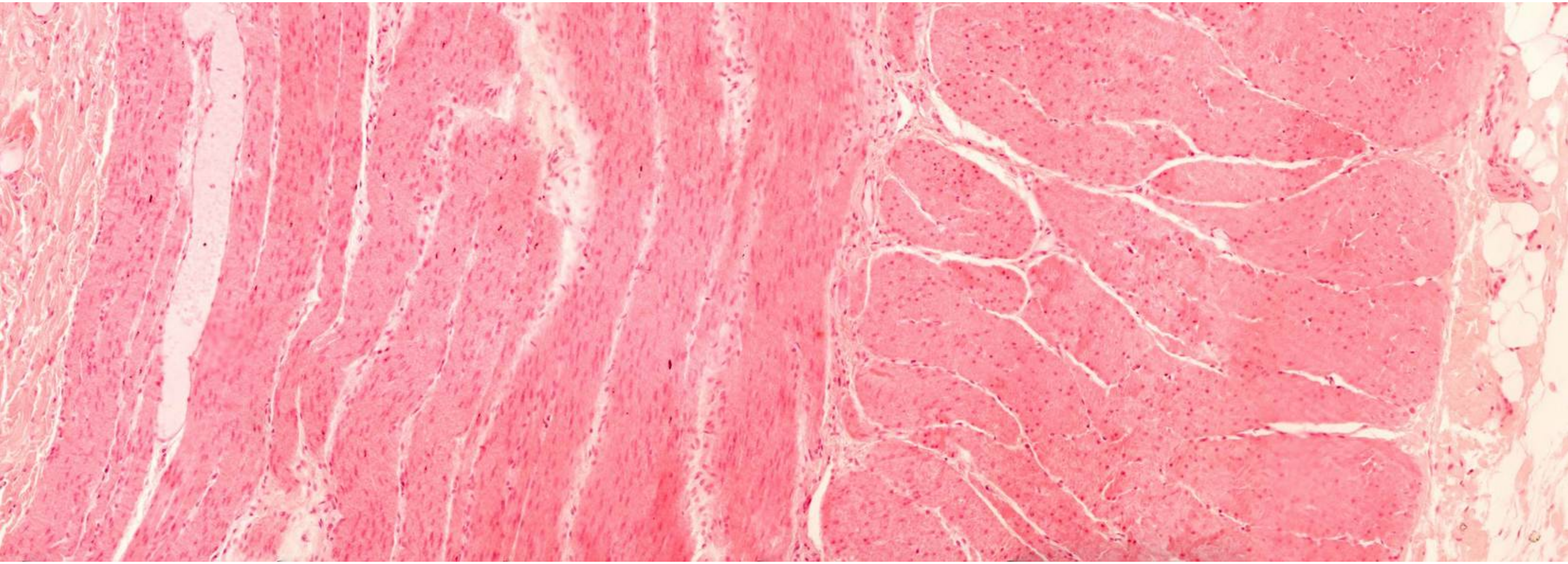

Outer layers of the oesophagus
Low magnification


Blood vessel in submucosa
High magnification

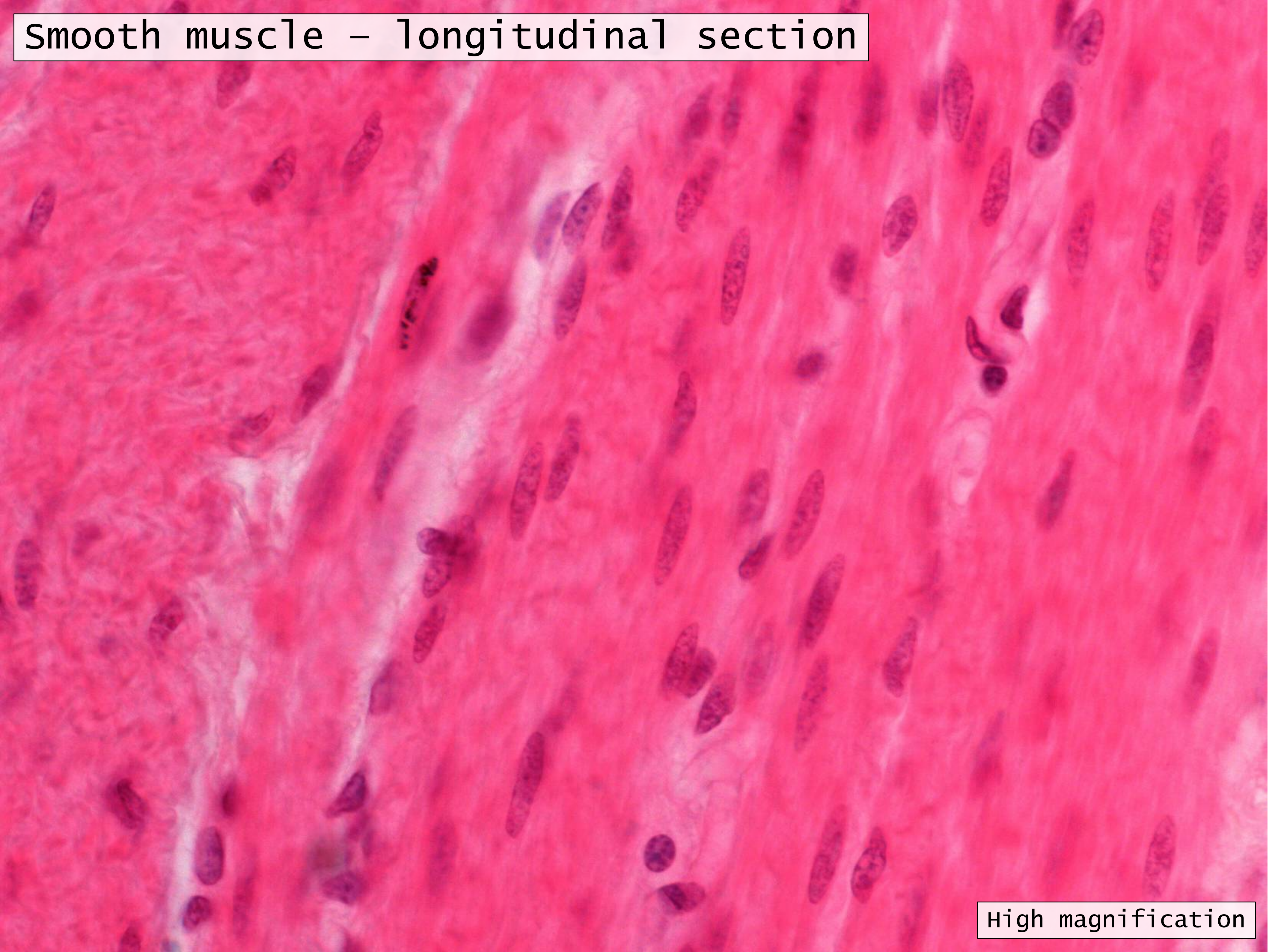
Muscularis externa

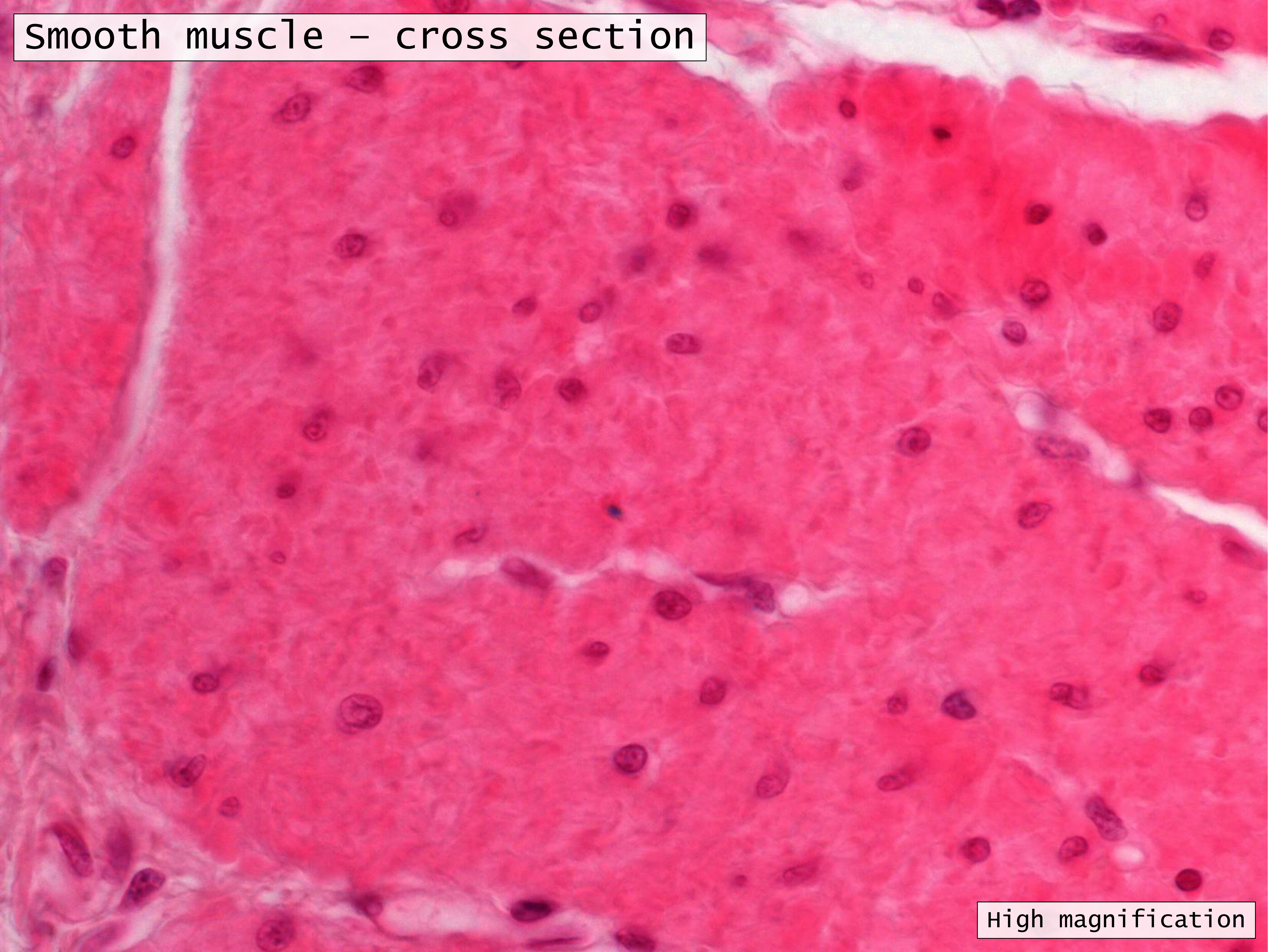
- Inner circular
  - Tight helix
- Outer longitudinal
  - Loose helix
- Muscle type
  - Upper third = skeletal
  - Middle third = mixed
  - Lower third = smooth
- Myenteric nervous plexus between inner & outer muscle layers

Muscle layers of the oesophagus



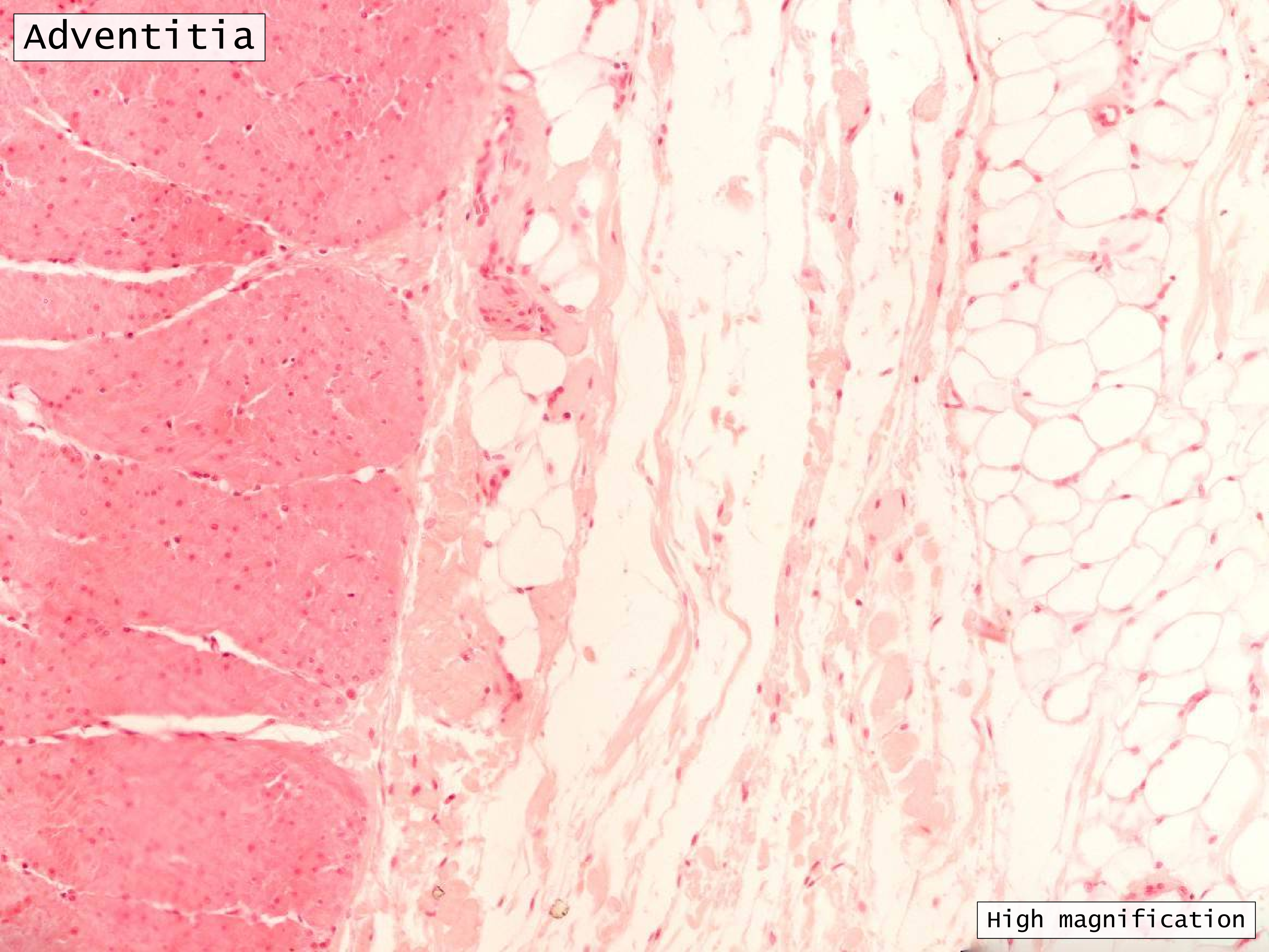
Low magnification


Smooth muscle – longitudinal section
High magnification

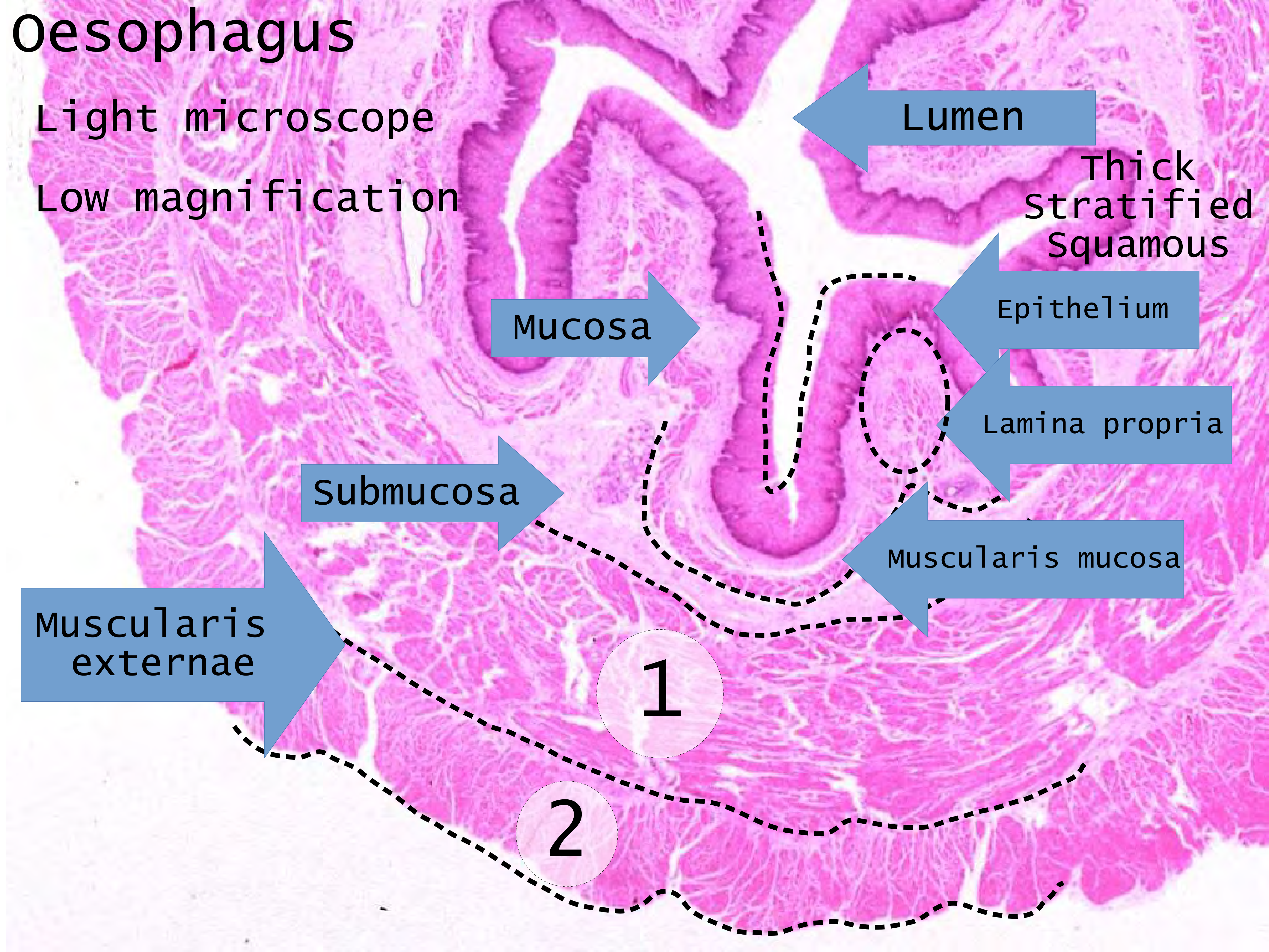

Smooth muscle – cross section
High magnification

Adventitia/Serosa

- Above diaphragm
  - Adventitia
  - Loose CT – binding to surrounds
- Below diaphragm
  - Serosa
  - Mesothelium covering of loose CT


Adventitia
High magnification

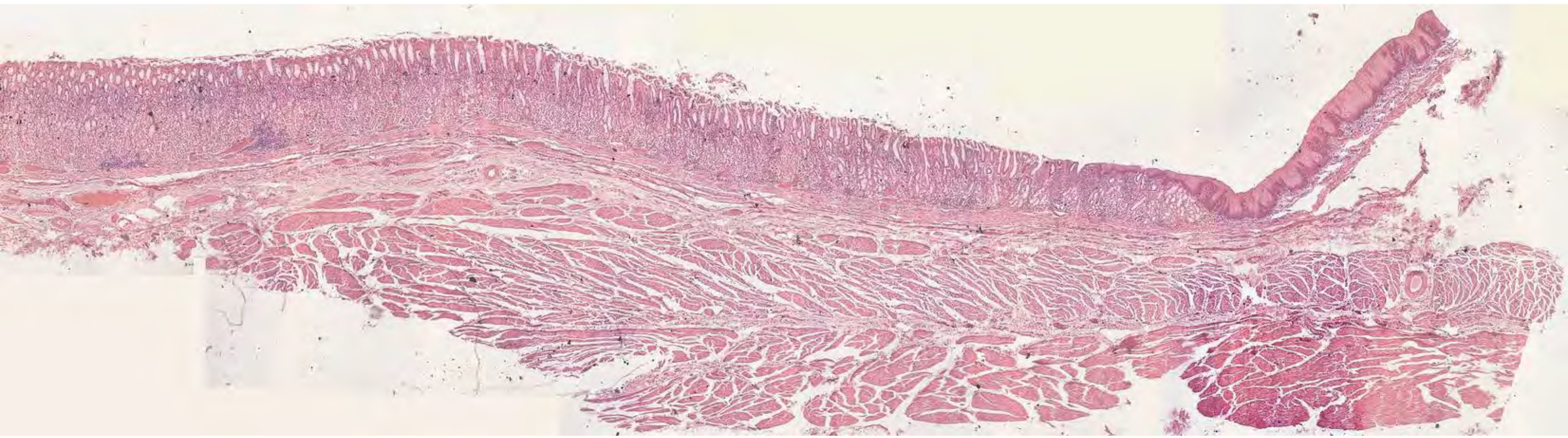

Fat cells
Very High magnification


Oesophagus
Light microscope
Low magnification
Lumen
Thick
Stratified
Squamous
Epithelium
Mucosa
Lamina propria
Submucosa
Muscularis mucosa
Muscularis
externae
1
2

Esophagus-stomach junction

Slide 101

Oesophagus-stomach junction



Very low magnification

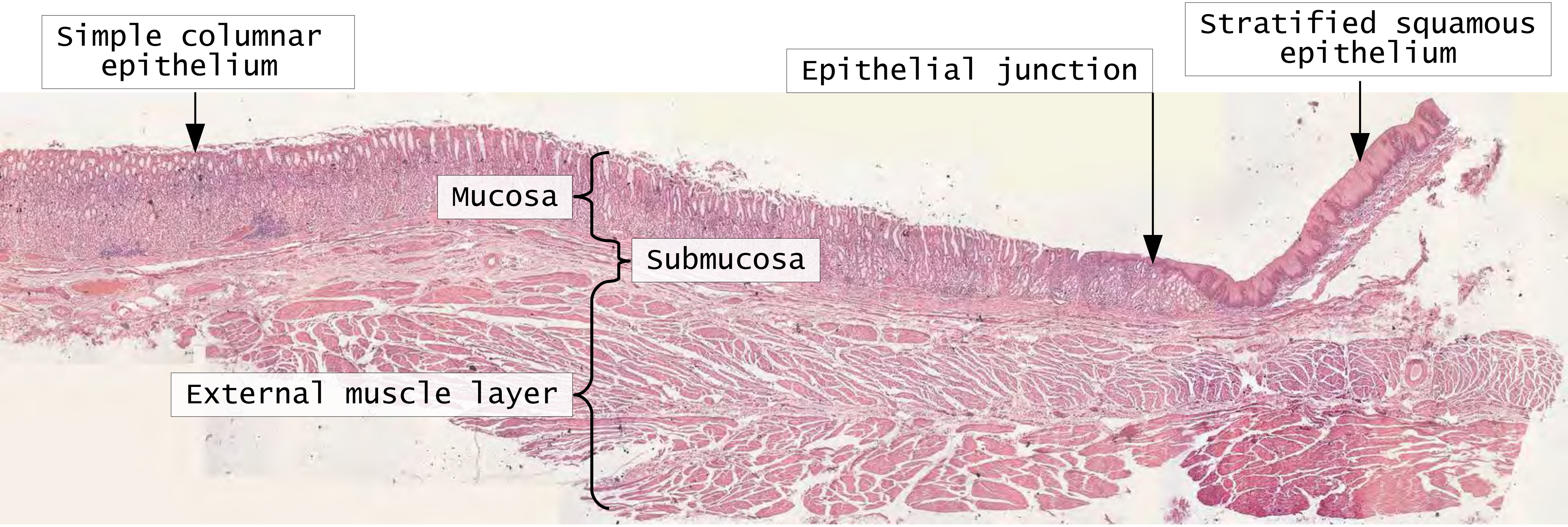
Functional transitions

- Oesophagus
  - Transport
    - Muscle layers
    - Lubrication from glands
- Stomach
  - Chemical digestion
    - Acid from glands
  - Mechanical digestion
    - Muscle layers

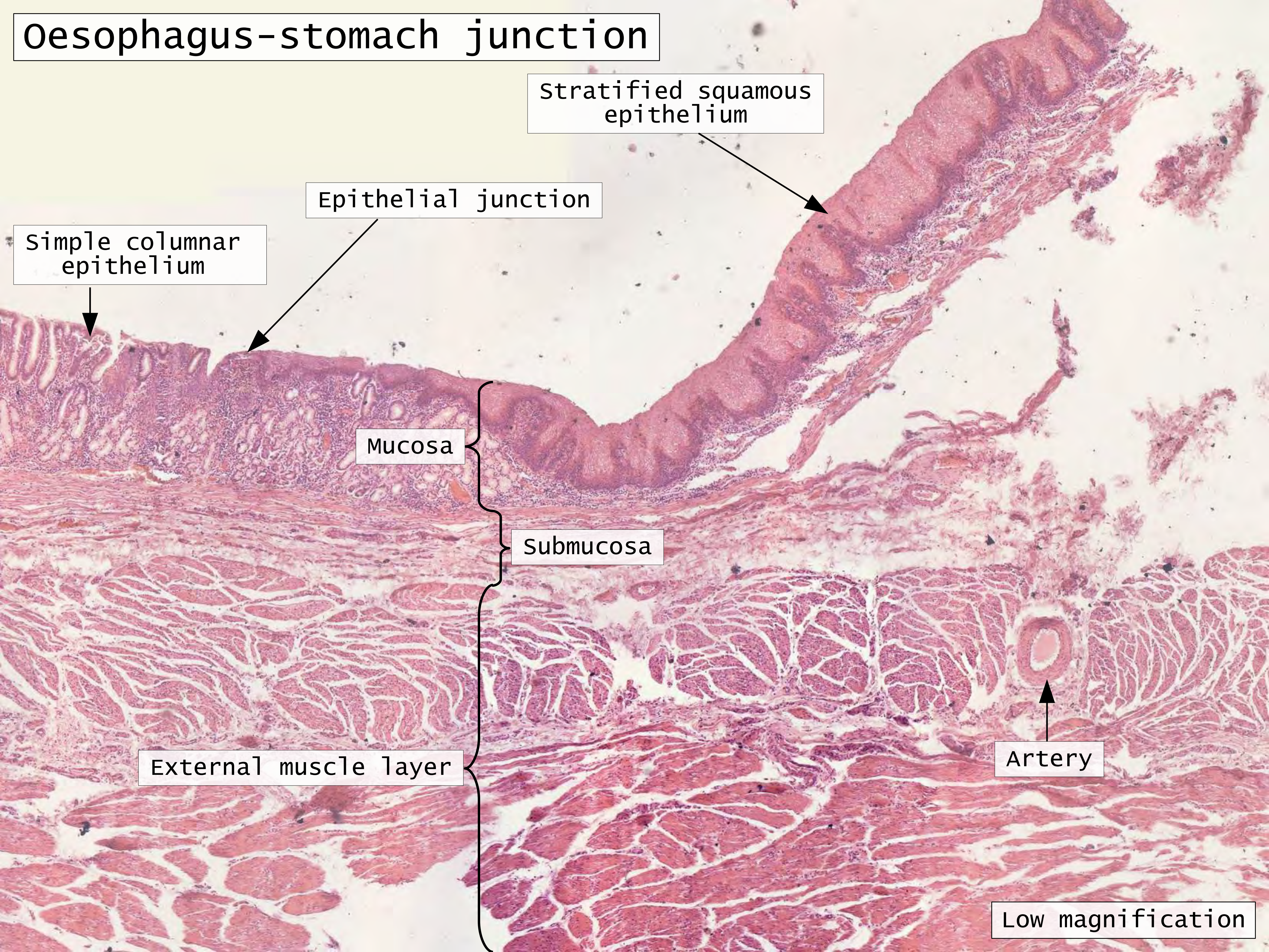
Identify on both sides

- Mucosa
- Submucosa
- External muscle layer
- Adventitia
- Two types of epithelium and the junction

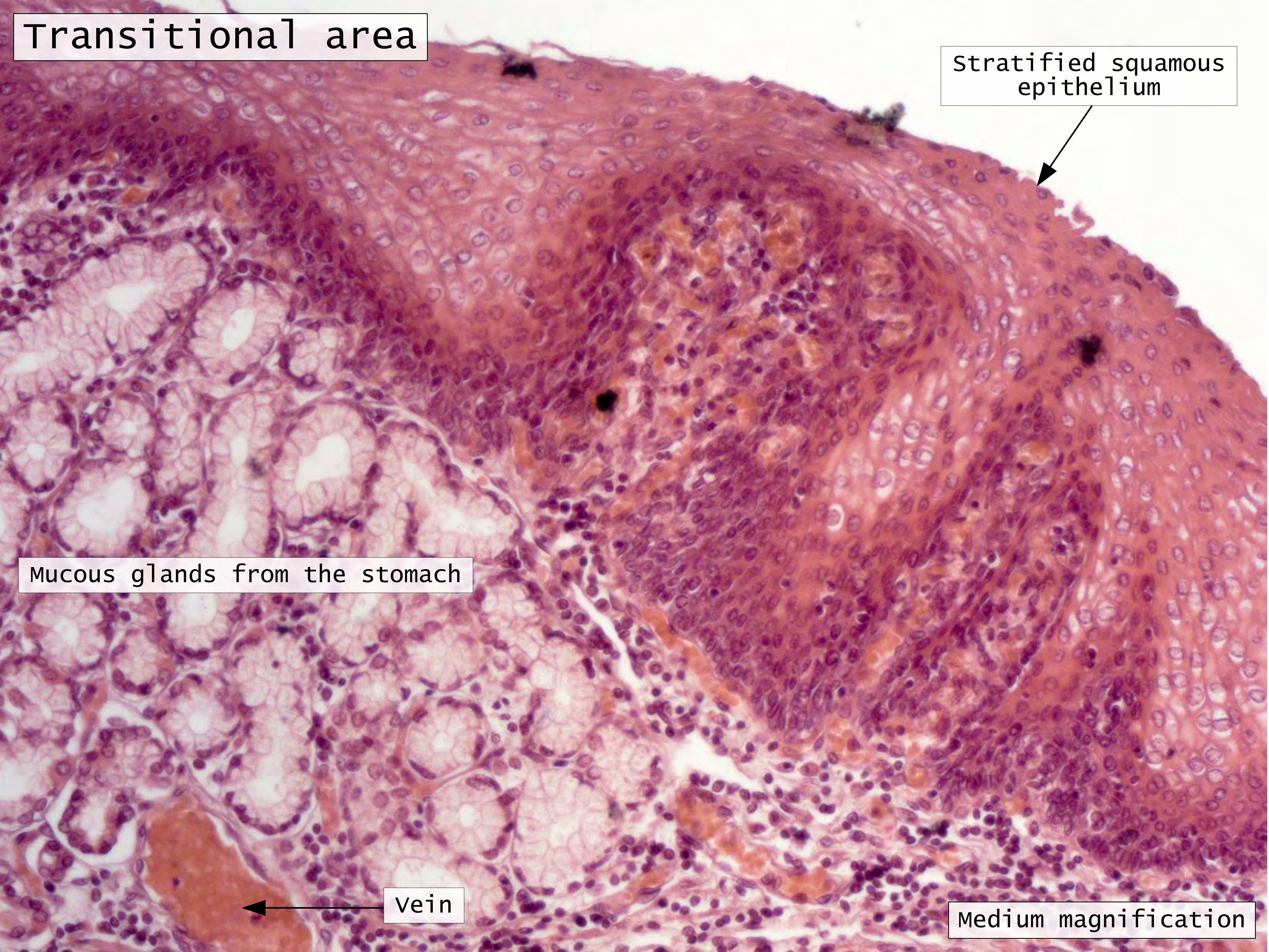
Oesophagus-stomach junction



Very low magnification

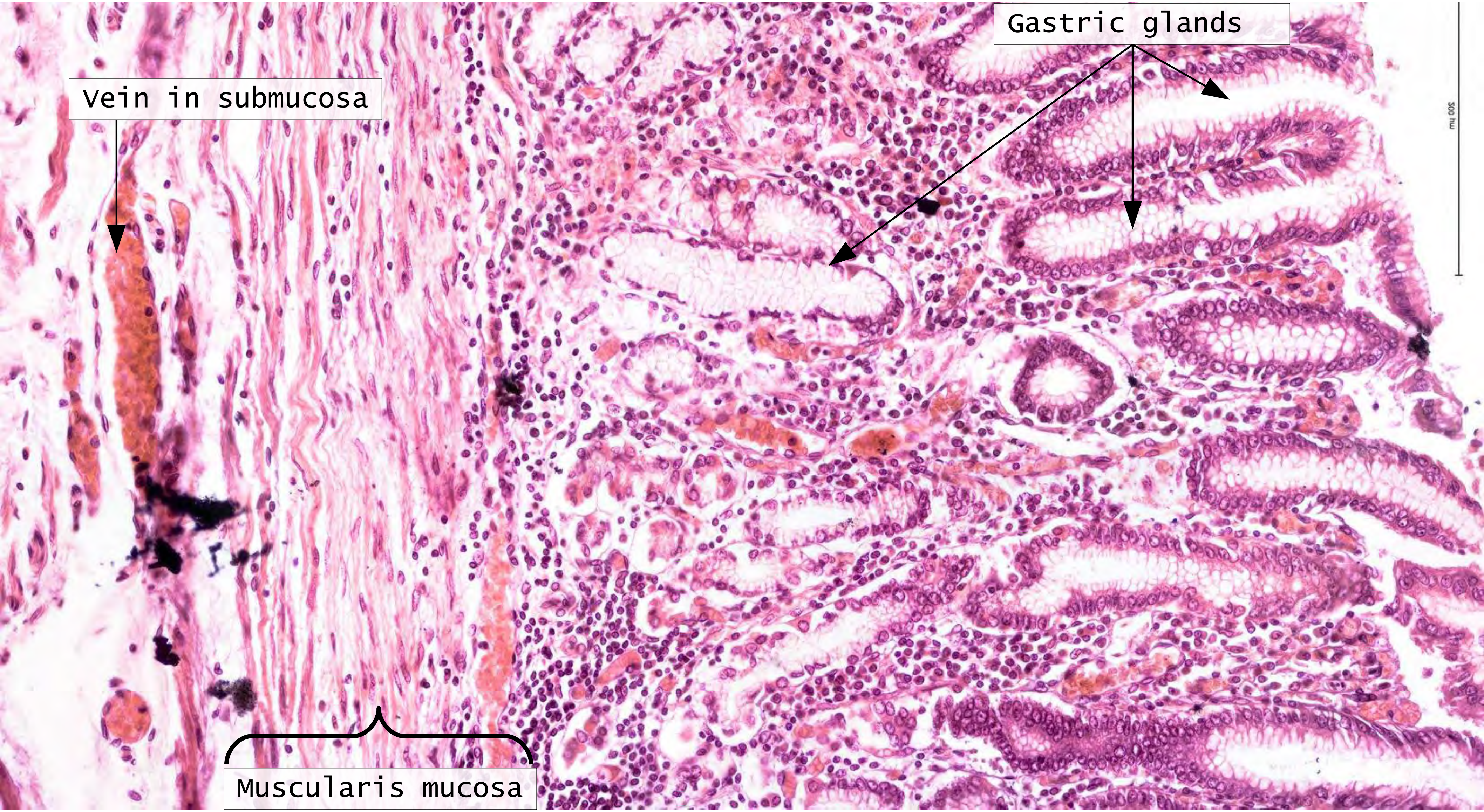

Oesophagus-stomach junction
Stratified squamous epithelium
Epithelial junction
Simple columnar epithelium
Mucosa
Submucosa
External muscle layer
Artery
Low magnification


Stratified squamous epithelium
High magnification

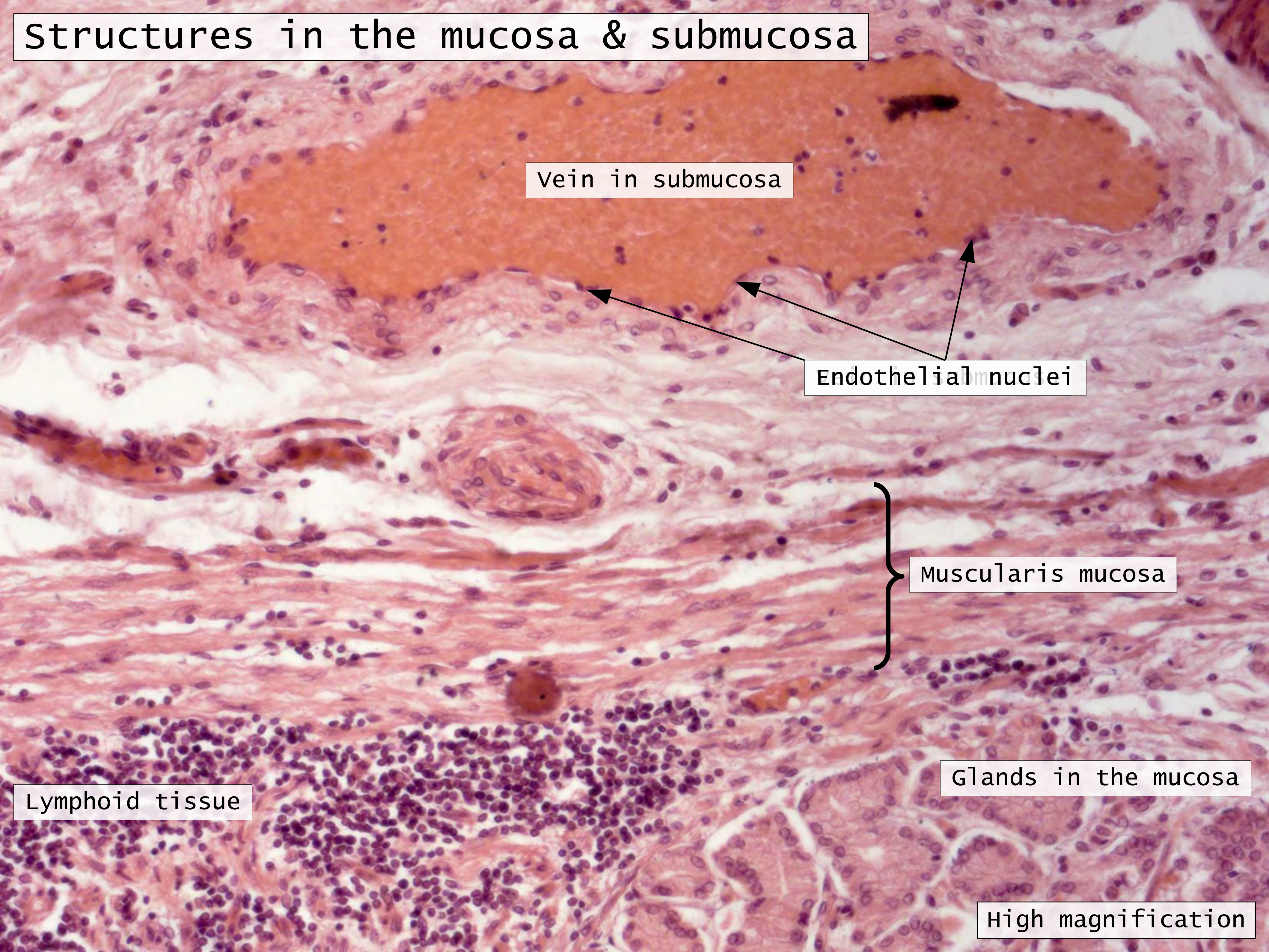

Transitional area
Stratified squamous epithelium
Mucous glands from the stomach
Vein
Medium magnification

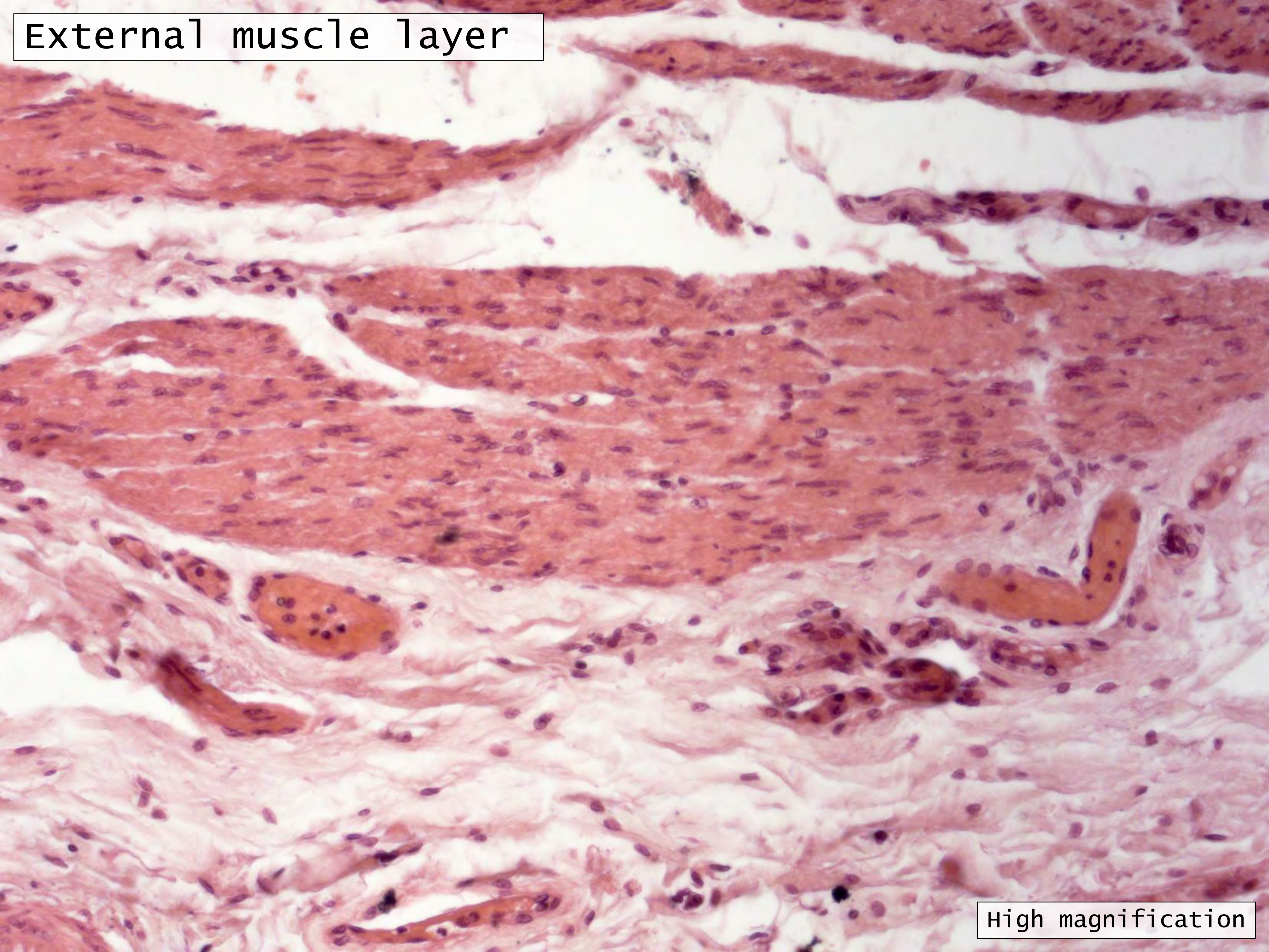

Simple columnar epithelium
Medium magnification

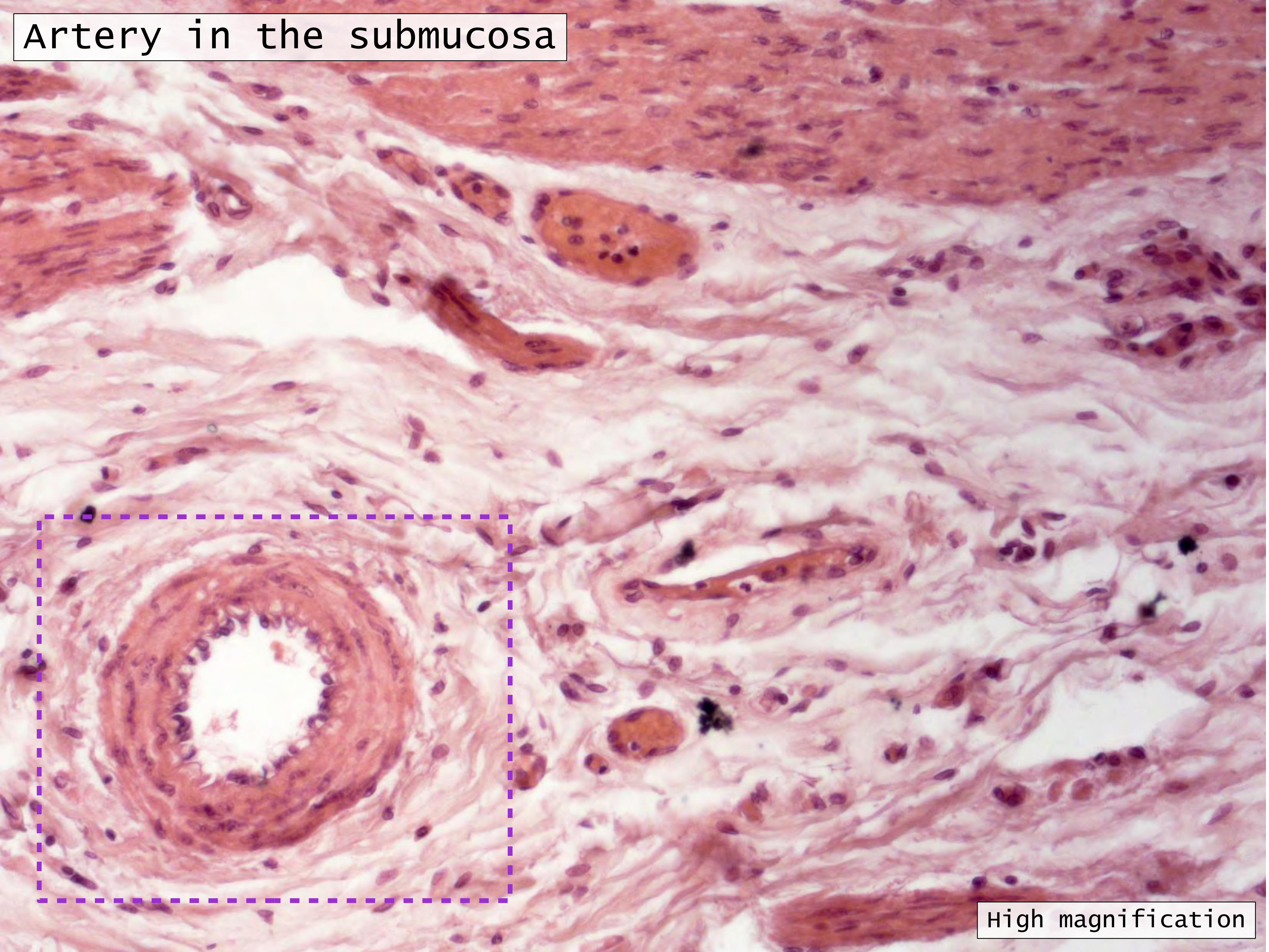
Mucosa of the stomach

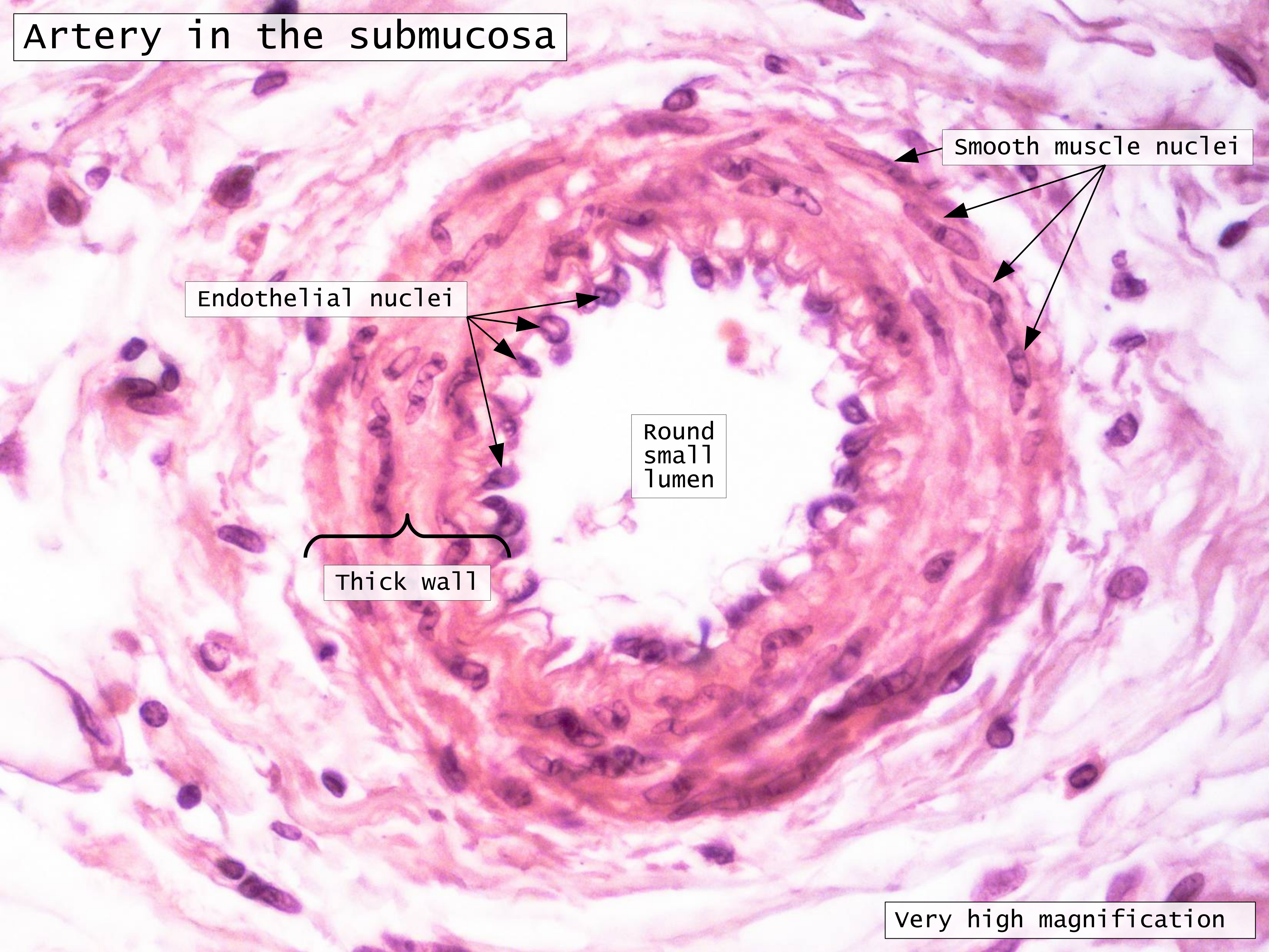


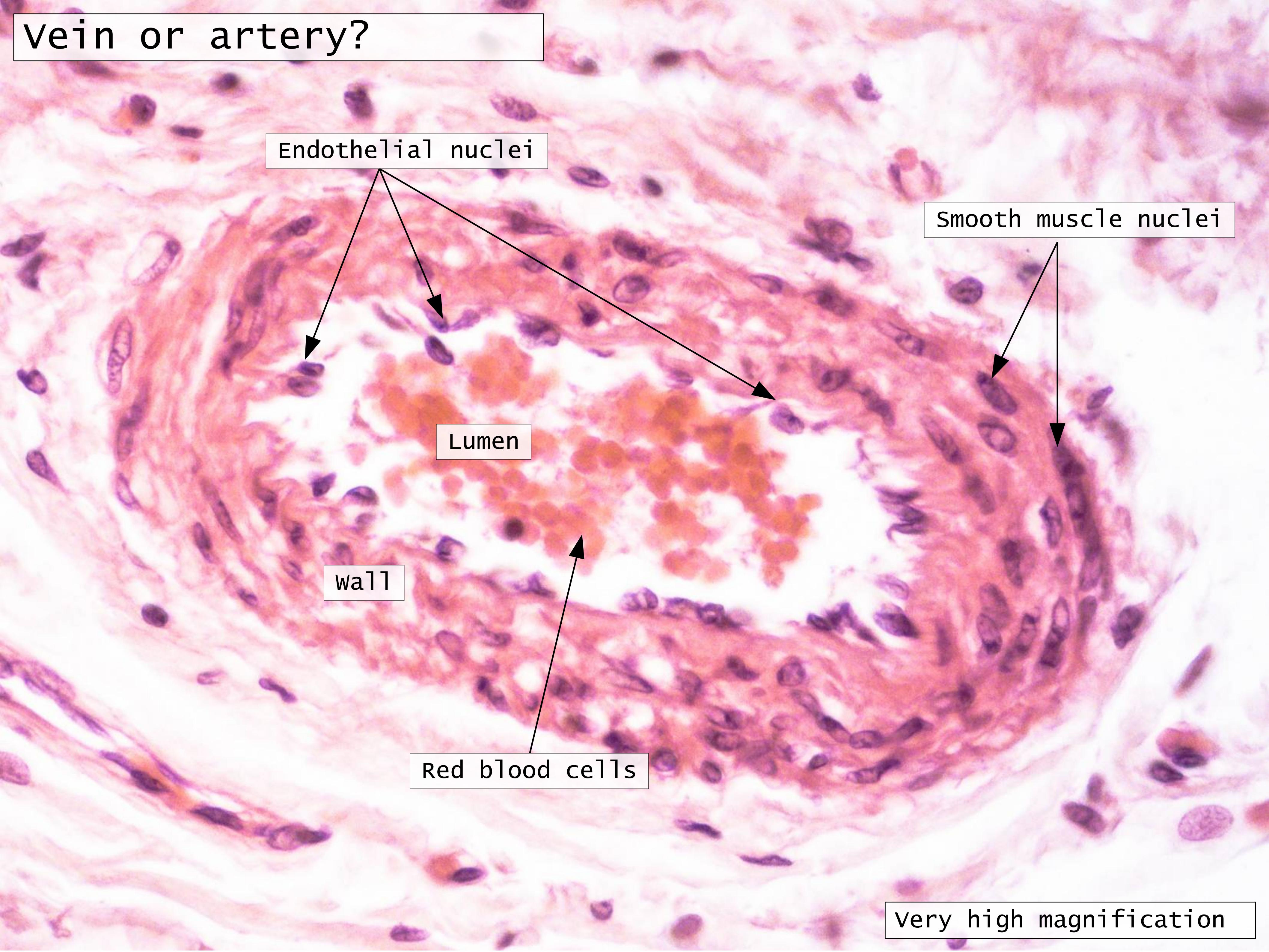
Medium magnification


Structures in the mucosa & submucosa
Vein in submucosa
Endothelial nuclei
Muscularis mucosa
Glands in the mucosa
Lymphoid tissue
High magnification

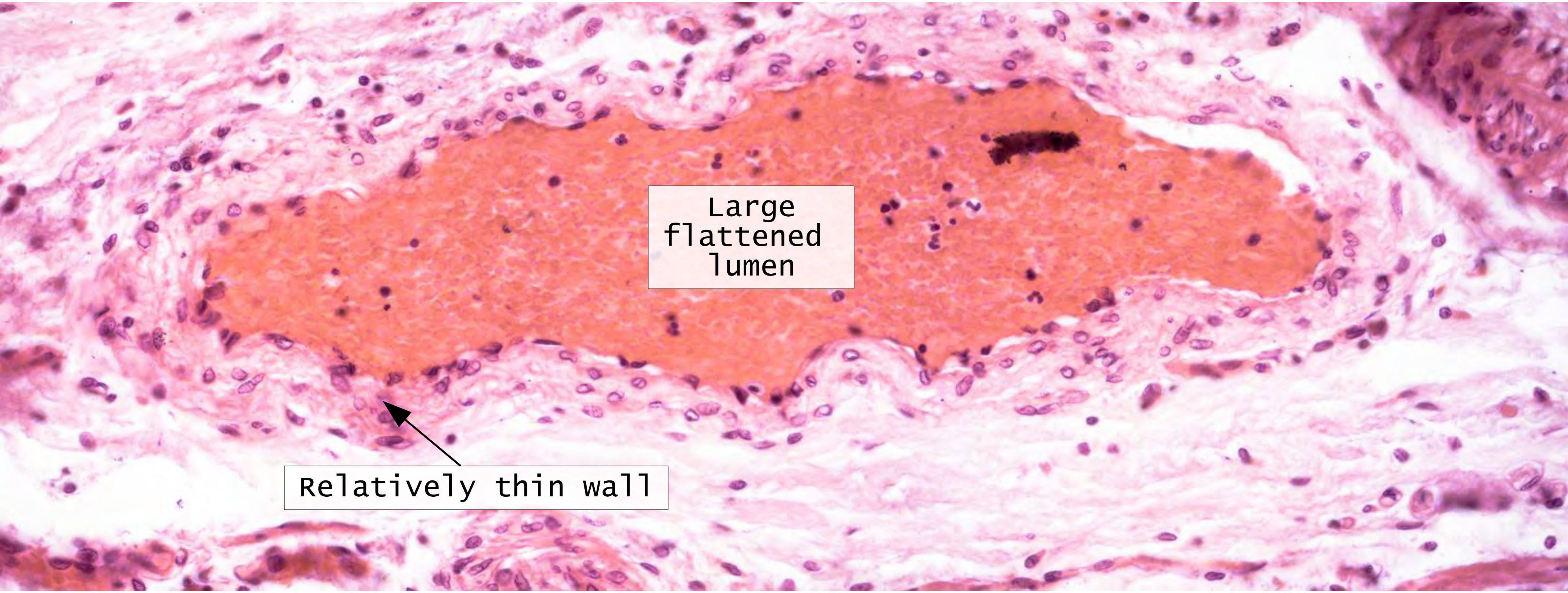

External muscle layer
High magnification


Artery in the submucosa
High magnification


Artery in the submucosa
Smooth muscle nuclei
Endothelial nuclei
Round small lumen
Thick wall
Very high magnification


Vein or artery?
Endothelial nuclei
Smooth muscle nuclei
Lumen
Wall
Red blood cells
Very high magnification

Vein in the submucosa



High magnification

Stomach

Slides 37 & 38

Stomach

- Anatomically 4 regions
  - Narrow cardia
  - Dome-shaped fundus
  - Large body
  - Funnel-shaped pylorus
- Histologically 3 regions
  - Cardiac region
  - Fundus
  - Pyloric region
  - Based on glands of lamina propria

Stomach

- Mucosa
- Submucosa
- Muscularis externa
- Serosa

Mucosa

- Epithelium
- Lamina propria
- Muscularis mucosa

Epithelium

- Simple columnar epithelium
- Secretory
- Mucus protect against autodigestion
- NOT goblet cells

Lamina propria

- Loose CT
  - Collagen + Reticular fibres
- CT cells
  - smooth muscle, lymphocytes, plasma cells, mast cells, fibroblasts
- Simple branched tubular gastric glands

Gastric glands

- Three parts
  - Isthmus
  - Neck
  - Base
- Five cells
  - Parietal
  - Chief
  - Mucous neck
  - Regenerative
  - APUD

Gastric gland cells 1/2

- Chief cells
  - Pyramidal
  - Lower ½ fundic glands
  - Secrete pepsinogen, rennin, lipase
  - Apically located secretory granules
- Mucous neck cells
  - Columnar cells
  - Neck of glands
  - Mucous granules

Gastric gland cells 2/2

- Parietal cells
  - Pyramidal
  - Secrete HCl & gastric intrinsic factor
- Undifferentiated adult stem cells
  - Narrow columnar cells
  - In neck, isthmus; sometimes gastric pits
  - Replace cells in glands, pits, luminal surface
- APUD cells
  - Clear pyramidal cells
  - Basally located granules
  - Paracrine & endocrine function

Gastric glands

- Fundic glands
  - All 5 cells
- Cardiac & Pyloric
  - No chief cells

Gastric glands

- Pyloric glands
  - Most coiled
- Gastric pits
  - Pyloric – deep ½+ of LP
  - Cardiac – short ¼ of LP

Muscularis mucosa

- Inner circular
- Outer longitudinal
- Sometimes outer circular

Submucosa

- Irregular dense CT
  - Mast cells & lymphoid tissue
- Neurovascular plexus
  - Arterial, venous & lymphatic
  - Submucosal nervous plexus (Meissner)

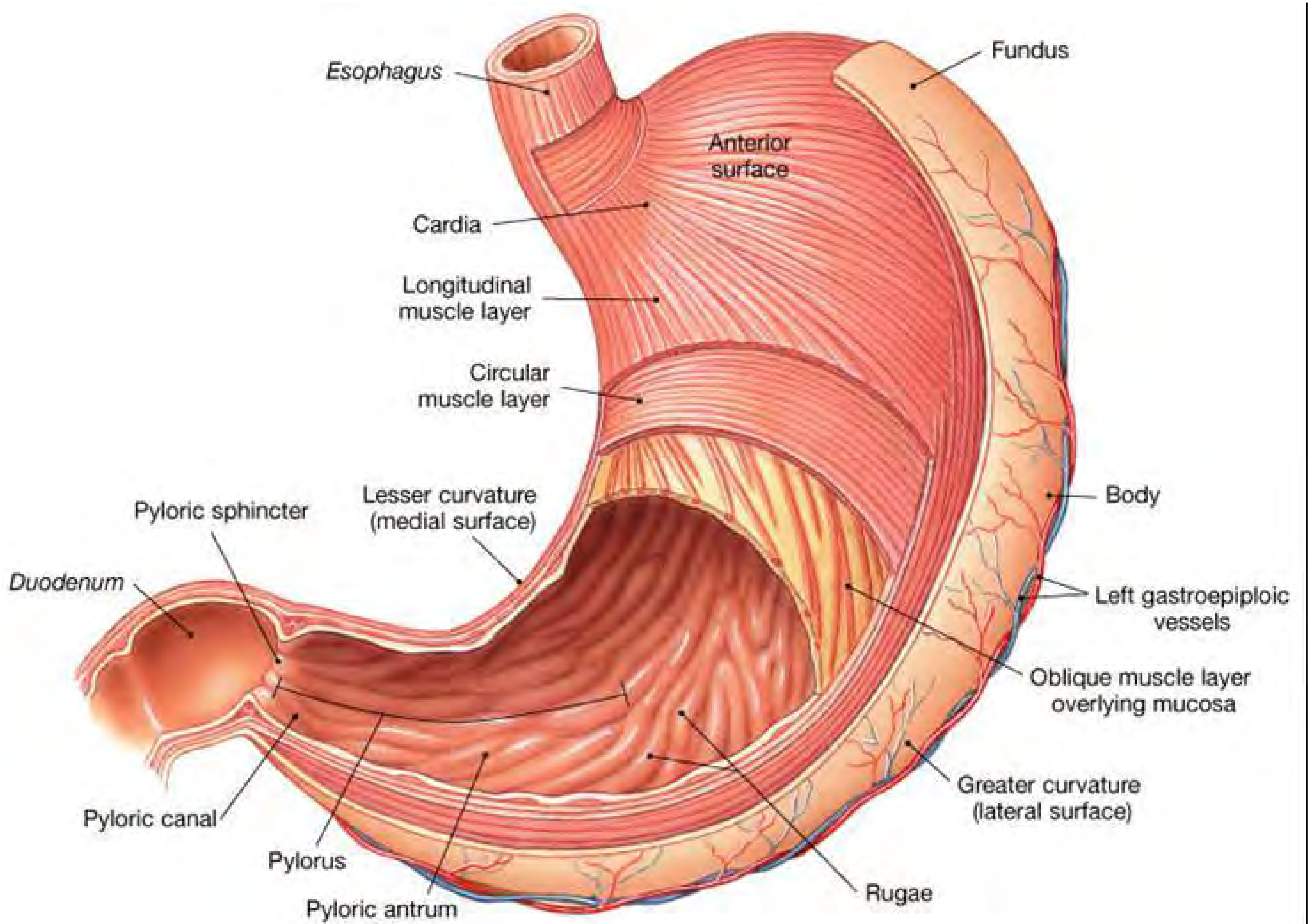
Muscularis externa

- Inner oblique
- Middle circular
  - Myenteric plexus (Auerbach)
- Outer longitudinal

Serosa

- Loose CT
- Covered mesothelium

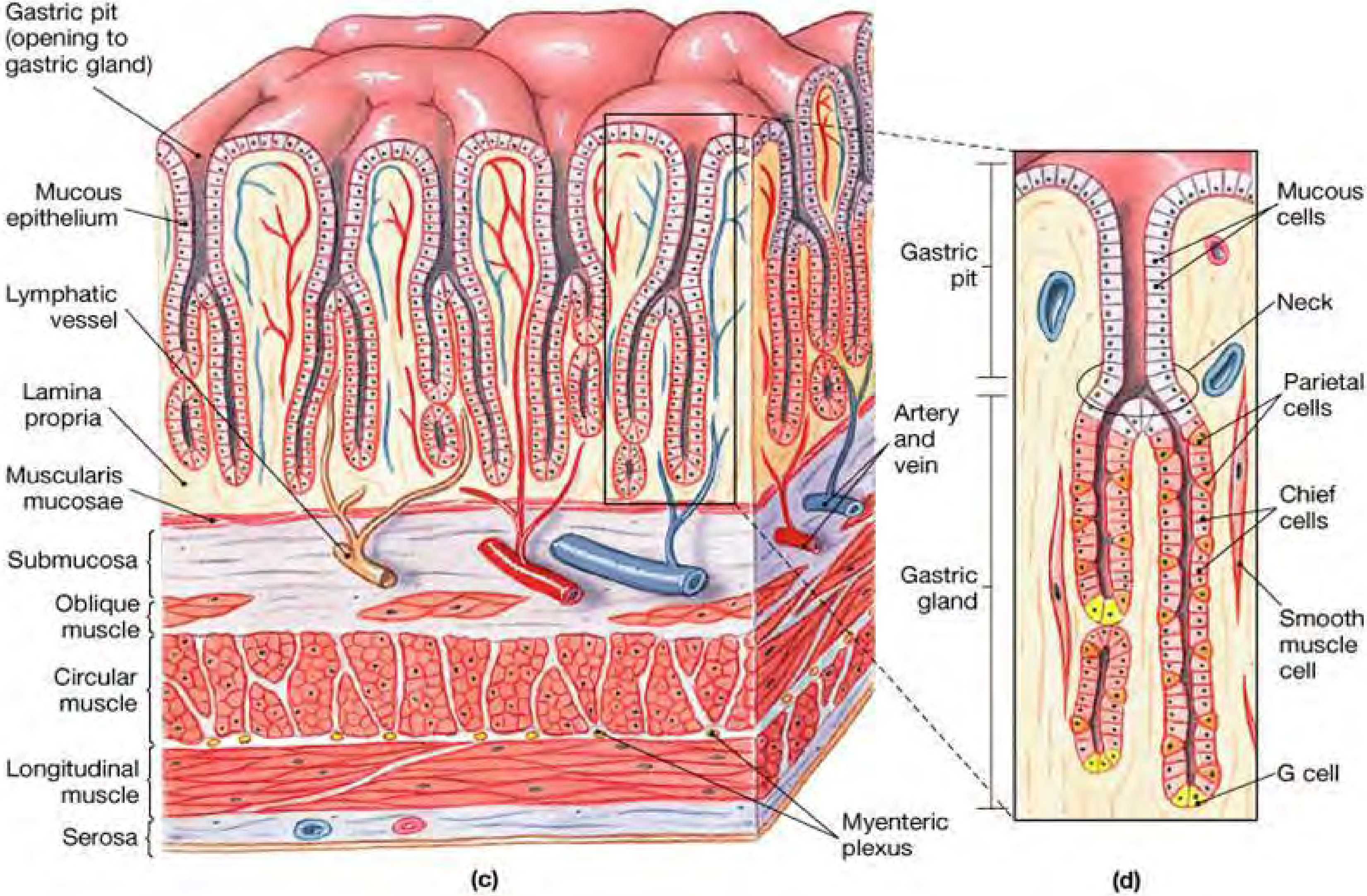
Stomach



Esophagus
Fundus
Anterior surface
Cardia
Longitudinal muscle layer
Circular muscle layer
Lesser curvature (medial surface)
Pyloric sphincter
Duodenum
Body
Left gastroepiploic vessels
Oblique muscle layer overlying mucosa
Greater curvature (lateral surface)
Pyloric canal
Pylorus
Pyloric antrum
Rugae

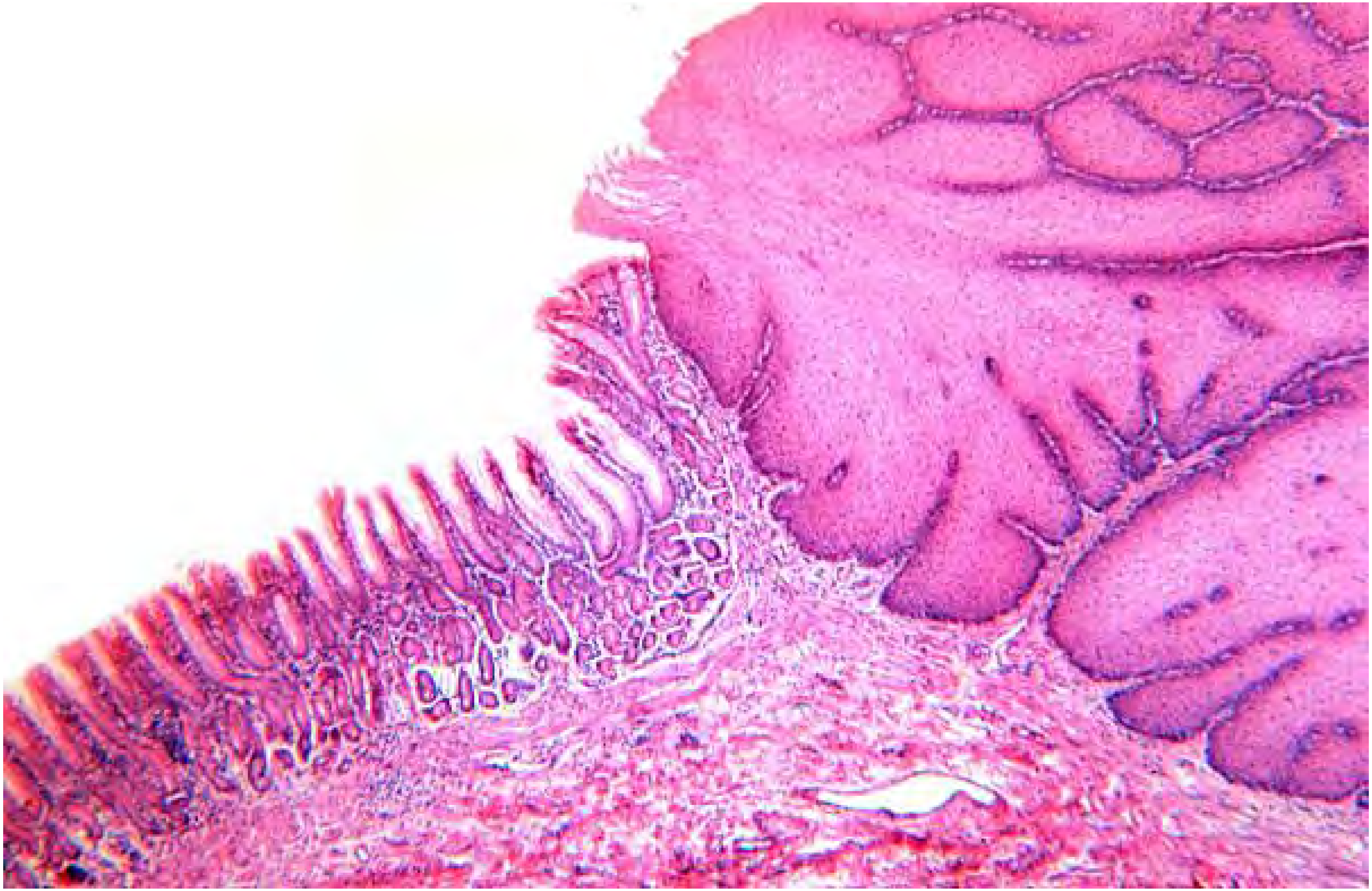
(b)

Stomach

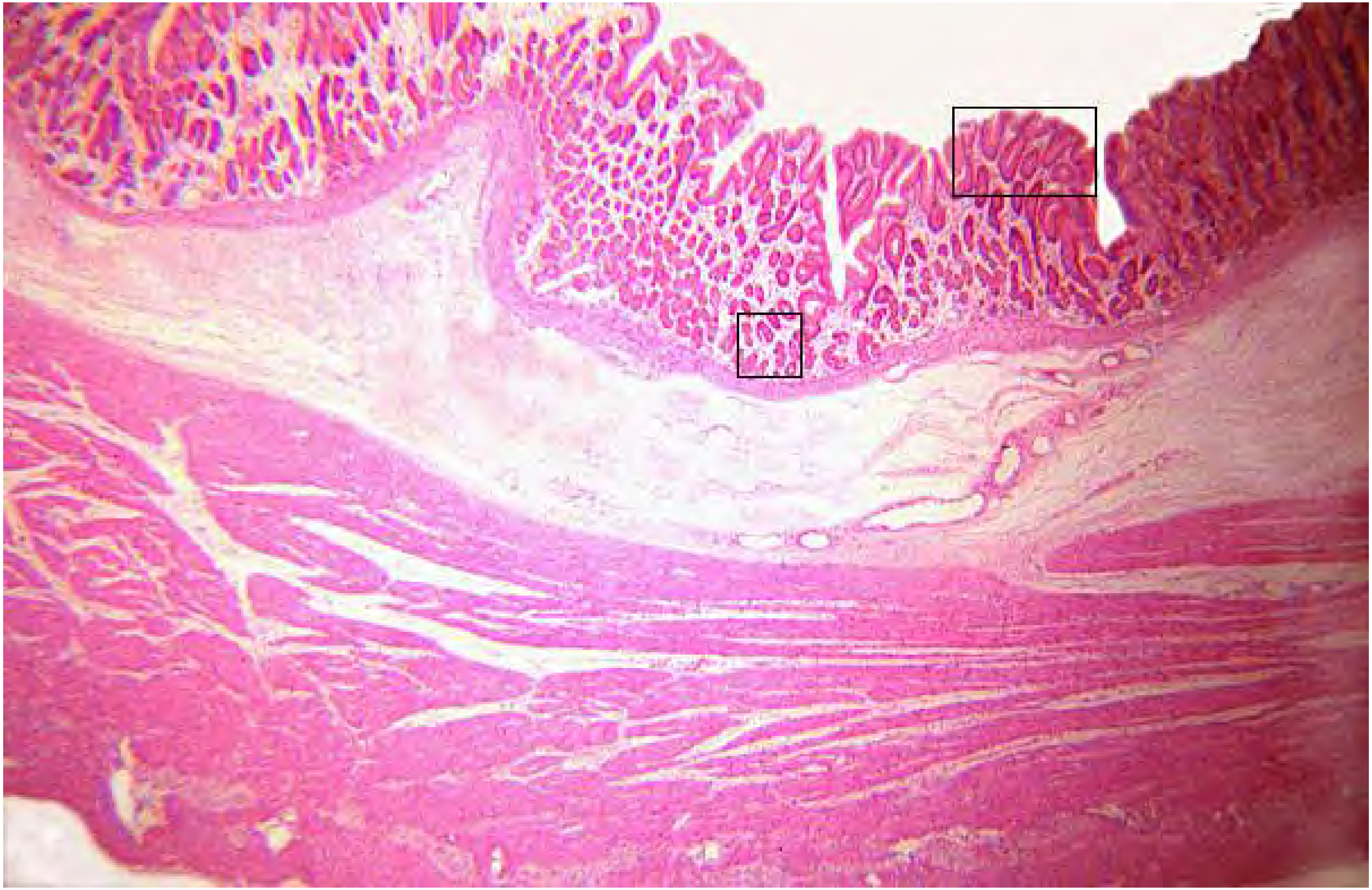


Gastric pit (opening to gastric gland)
Mucous epithelium
Lymphatic vessel
Lamina propria
Muscularis mucosae
Submucosa
Oblique muscle
Circular muscle
Longitudinal muscle
Serosa
Artery and vein
Myenteric plexus
Gastric pit
Gastric gland
Mucous cells
Neck
Parietal cells
Chief cells
Smooth muscle cell
G cell
(c)
(d)

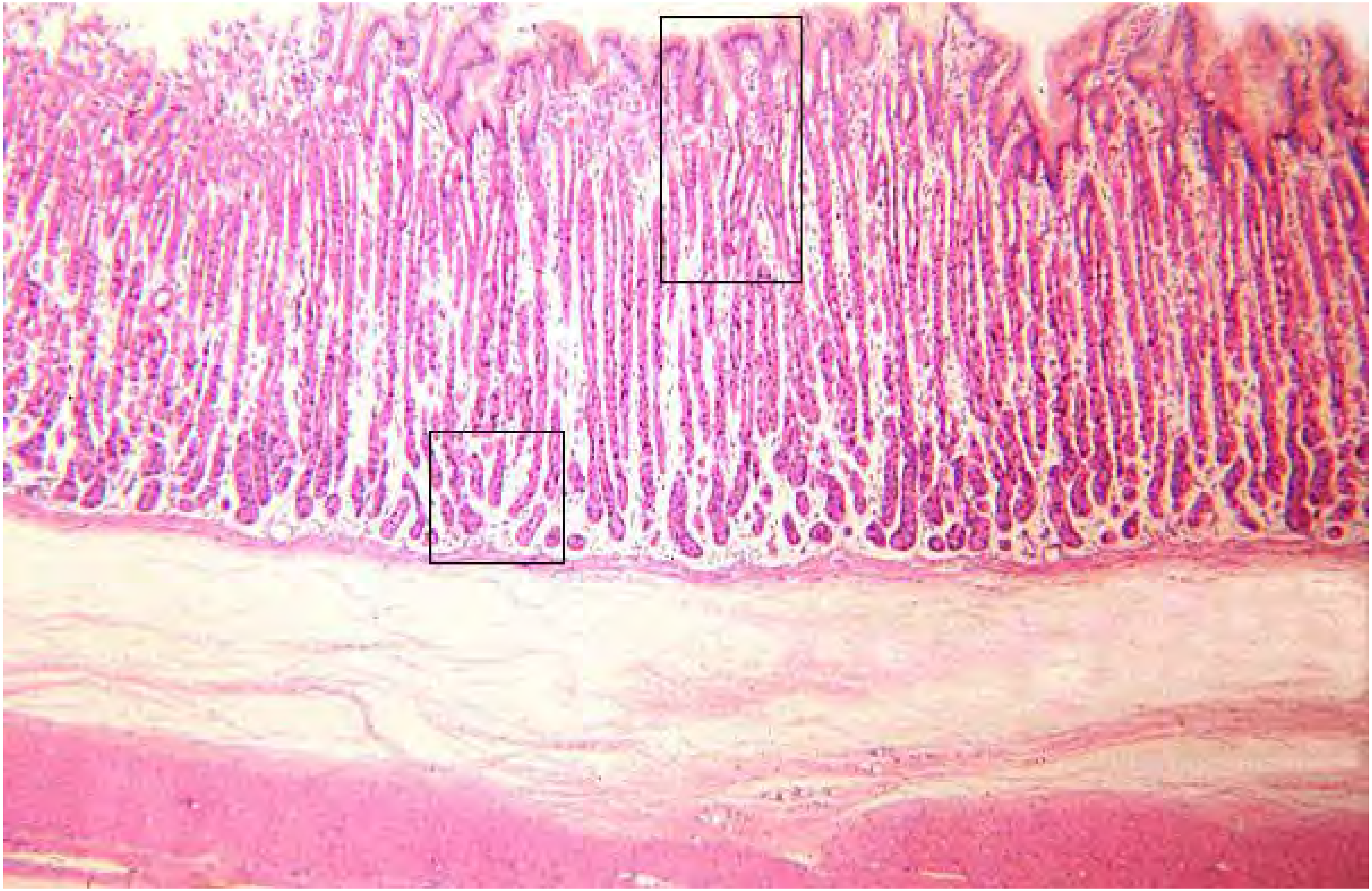
Stomach

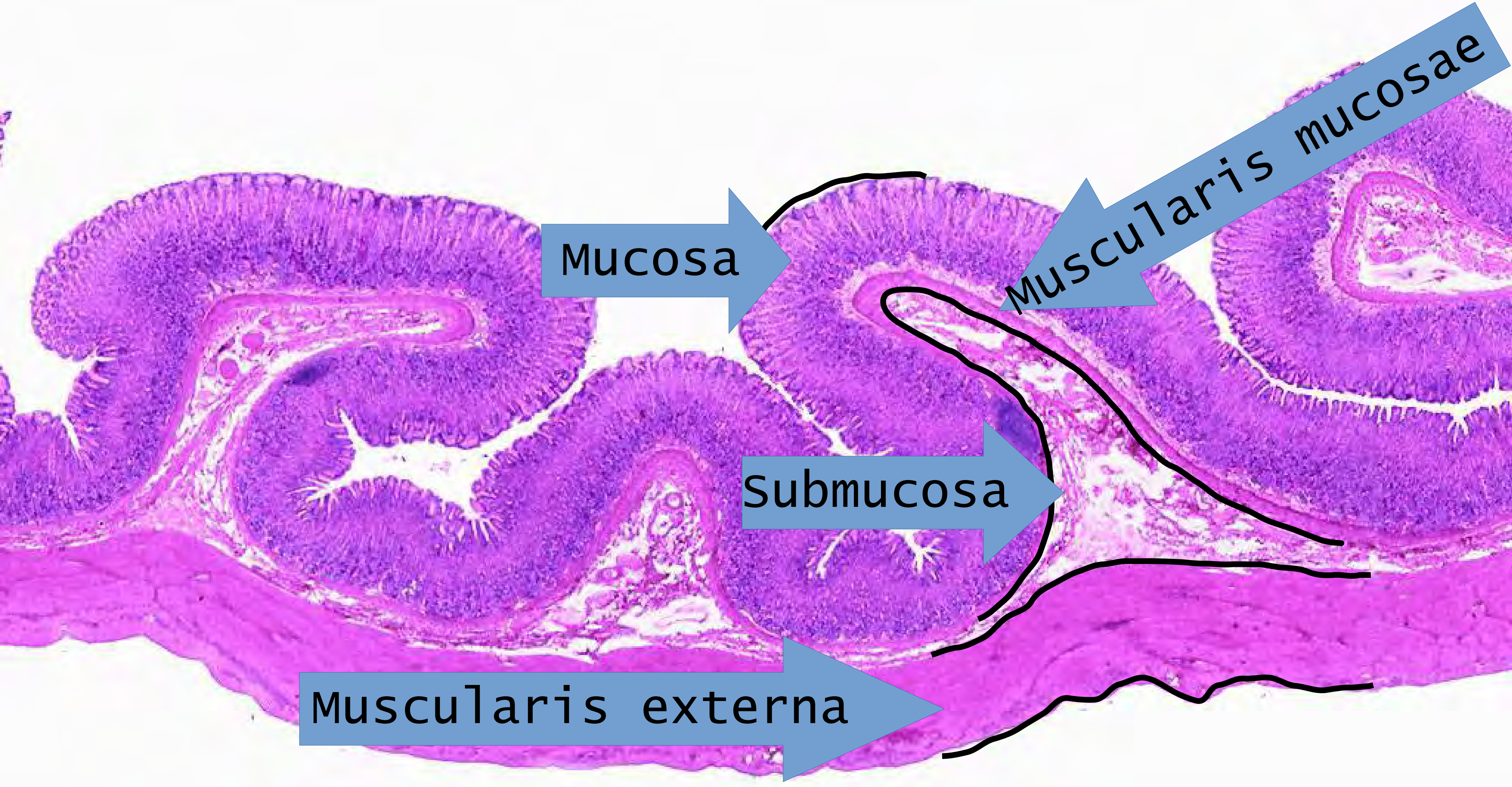


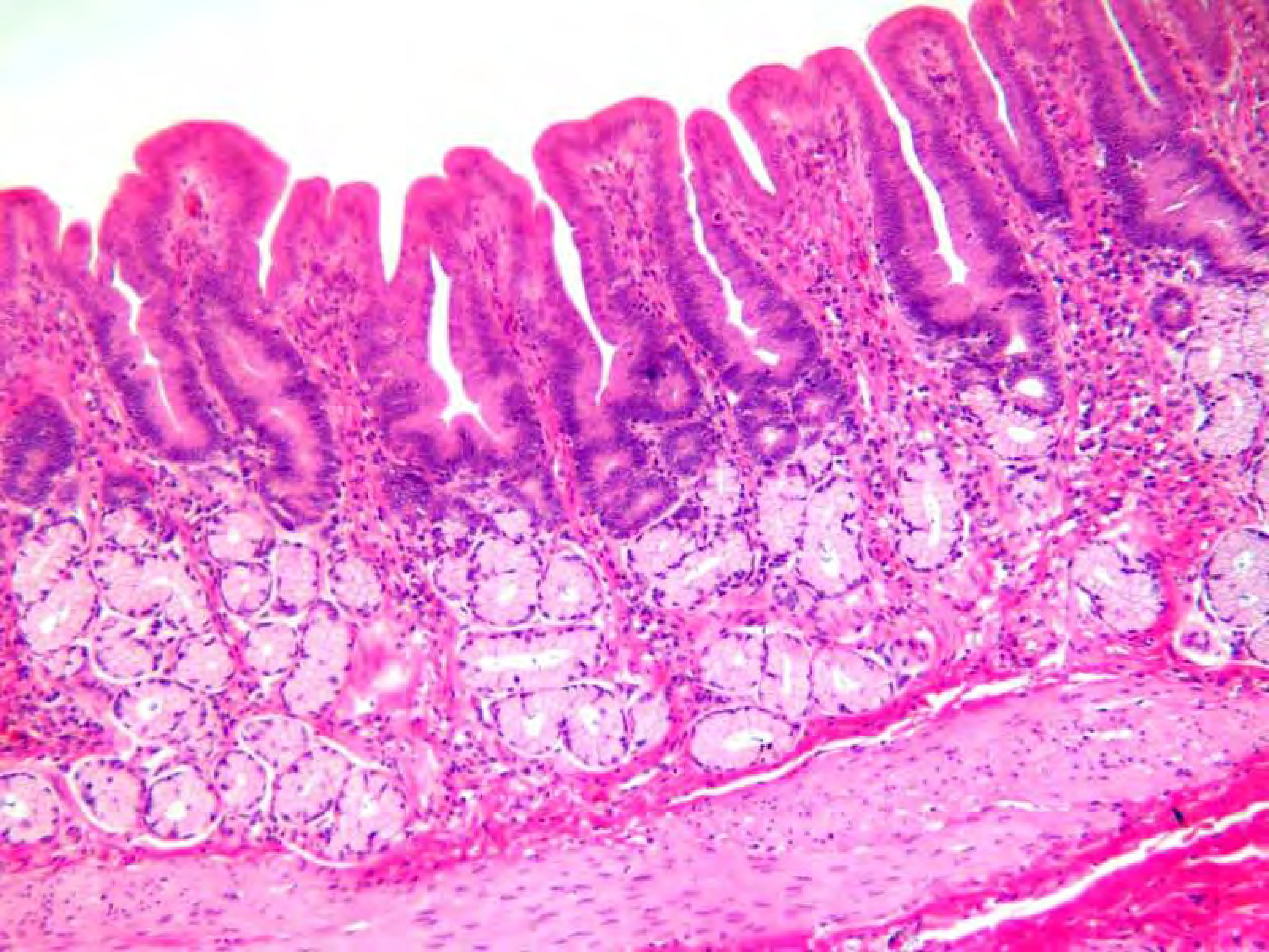
Stomach

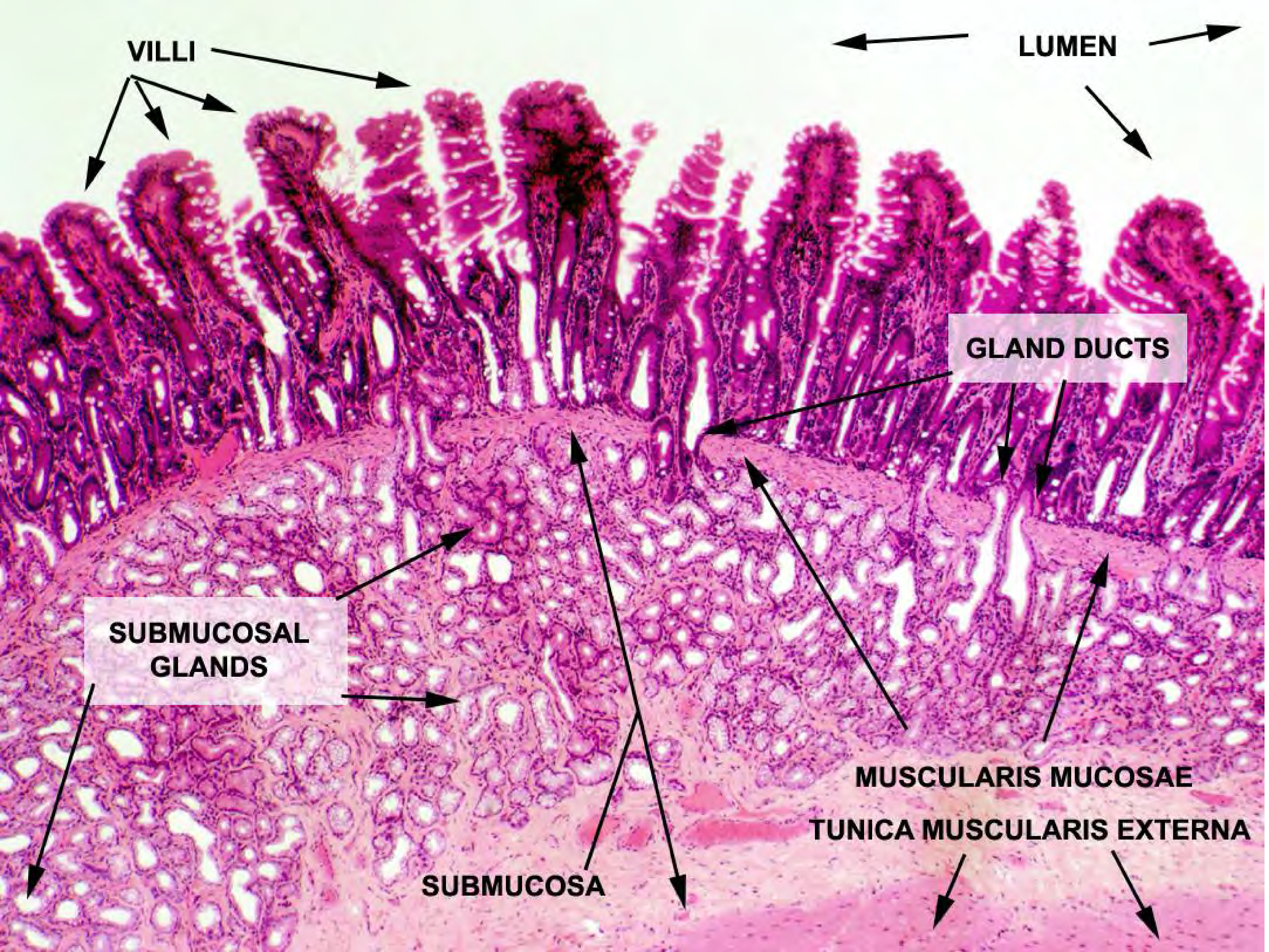


Stomach




Mucosa
Muscularis mucosae
Submucosa
Muscularis externa




VILLI
LUMEN
GLAND DUCTS
SUBMUCOSAL GLANDS
MUSCULARIS MUCOSAE
TUNICA MUSCULARIS EXTERNA
SUBMUCOSA

Stomach-duodenal junction

Slide 36

See HistoWeb

Small intestine

- 3 Regions
  - Duodenum
  - Jejenum
  - Ileum
- Mucosa
- Submucosa
- Muscularis externa
- Serosa/Adventitia

Mucosa

- 3 type of luminal surface modifications
  - Plicae circularis
  - Intestinal villi
  - Microvilli
- Epithelium
- Lamina propria core
- Muscularis mucosa

Surface modifications

- Plicae circularis
  - Spiral folds of mucosa & submucosa
  - From 2^{nd} quarter duodenum
  - Progressively smaller up to 1^{st} ½ ileum
  - Surface area x2,3
- Intestinal villi
  - Finger-like evaginations of mucosa
  - Tall (duodenum 1½ mm) to short (ileum ½ mm)
  - Surface area x10
- Microvilli
  - Apical surface of simple columnar epithelium
  - Surface area x20

Epithelium

- Simple columnar epithelium
- Goblet cells
  - Unicellular glands
  - Mucinogen as granules in apical region
  - On release → mucus protective lining
- Duodenum < Jejenum < Ileum
  - Surface absorptive cells
    - Tall columnar with microvilli
  - APUD cells
    - Basally located granules
    - Enteroendocrine
    - Paracrine & Endocrine

Lamina propria

- Loose CT
- Core of villus & spaces between mucosa glands (Crypts Lieberkühn)
- Lymphoid cells, especially plasma cells
- Fibroblasts, smooth muscle
- Possesses lymph nodules
- Capillary loops
- Lacteals
  - Blind ending lymphatic channels

Crypts of Lieberkühn

- Simple tubular glands
- Intervillous space → Muscularis mucosa
- Several epithelial cell types
  - Goblet cells
  - Columnar cells
  - APUD cells
  - Regenerative cells
  - Paneth cells

Goblet cells

- Unicellular glands
- Mucinogen as granules in apical region
- On release → mucus protective lining

Columnar cells

- Surface absorptive cells
- Tall columnar with microvilli

APUD cells

- Basally located granules
- Enteroendocrine
- Paracrine & Endocrine

Regenerative cells

- Thin columnar cells
- Basal half of crypts
- Stem cells of crypts

Paneth cells

- Pyramidal cells
- Located at base
- Secrete anti-bacterial enzyme

Lymphatic nodules

- Duodenum & Jejenum
  - Small solitary
- Ileum
  - Large contiguous aggregates
  - =Peyer's patches
  - Through m mucosa into submucosa

Nodule associated cells

- M cells
  - Overlie large lymphatic nodules
  - Role in immune function
- Activated B-cells
  - Populate LP
  - Differentiate into plasma cells
  - Manufacture IGA → Secretory IgA

Muscularis mucosa

- Smooth muscle
- Inner circular
- Outer longitudinal

Submucosa

- Fibroelastic CT
- AVNL
- Submucosal plexus (Meissner)
- Duodenum
  - Dudodenal glands

Duodenal glands

- Submucosa of duodenum
- Secrete alkaline mucine
- Protect against stomach acid
- Via ducts
  - Base of crypts
  - Direct into intervillar spaces

Muscularis externa

- Inner circular
- Myenteric plexus (Auerbach)
- Outer longitudinal

Serosa/Adventitia

- Serosa/Adventitia
  - Duodenum anterior aspect
- Serosa
  - Jejenum/Ileum

Duodenum

Slide 40

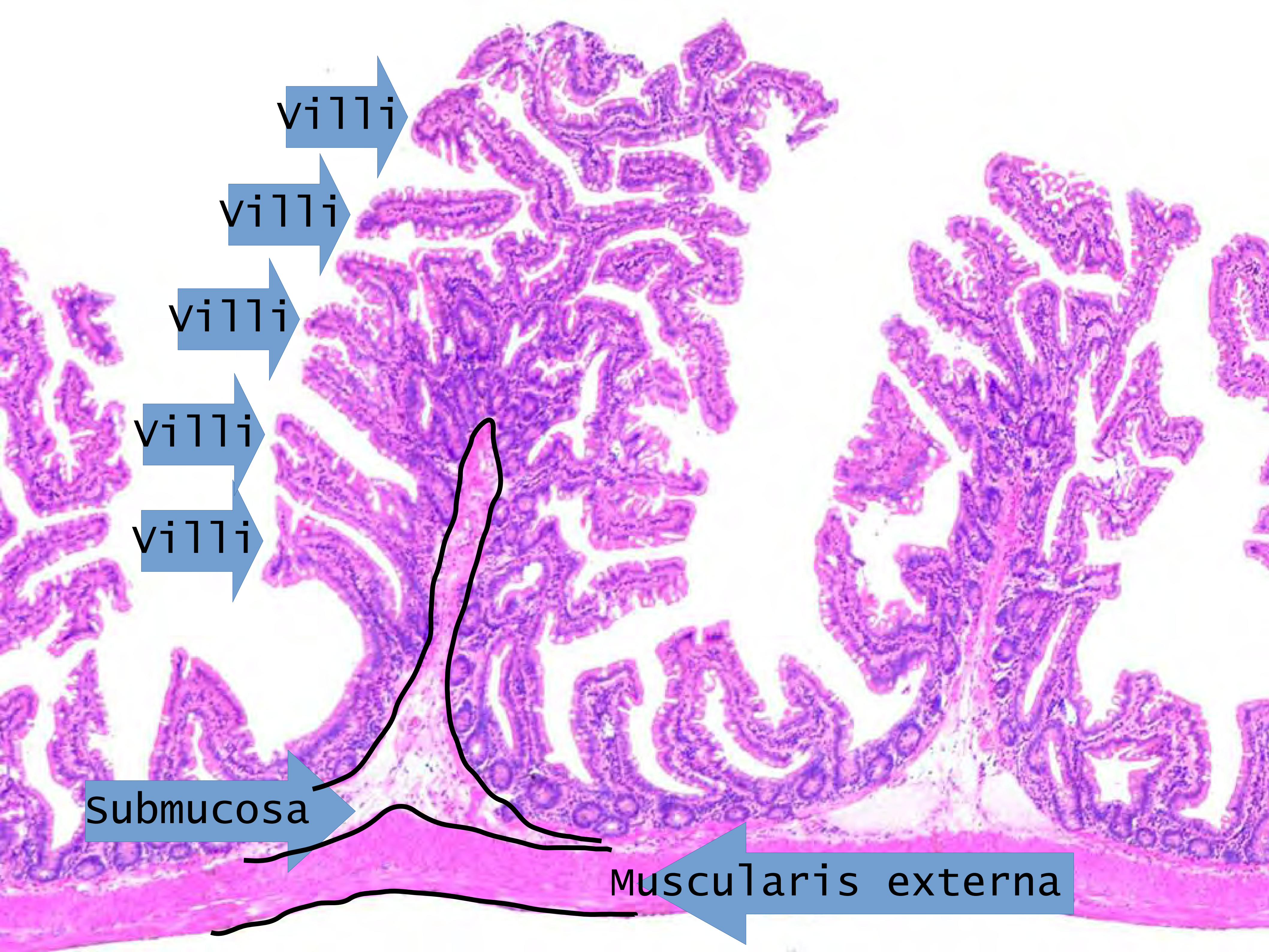
See HistoWeb

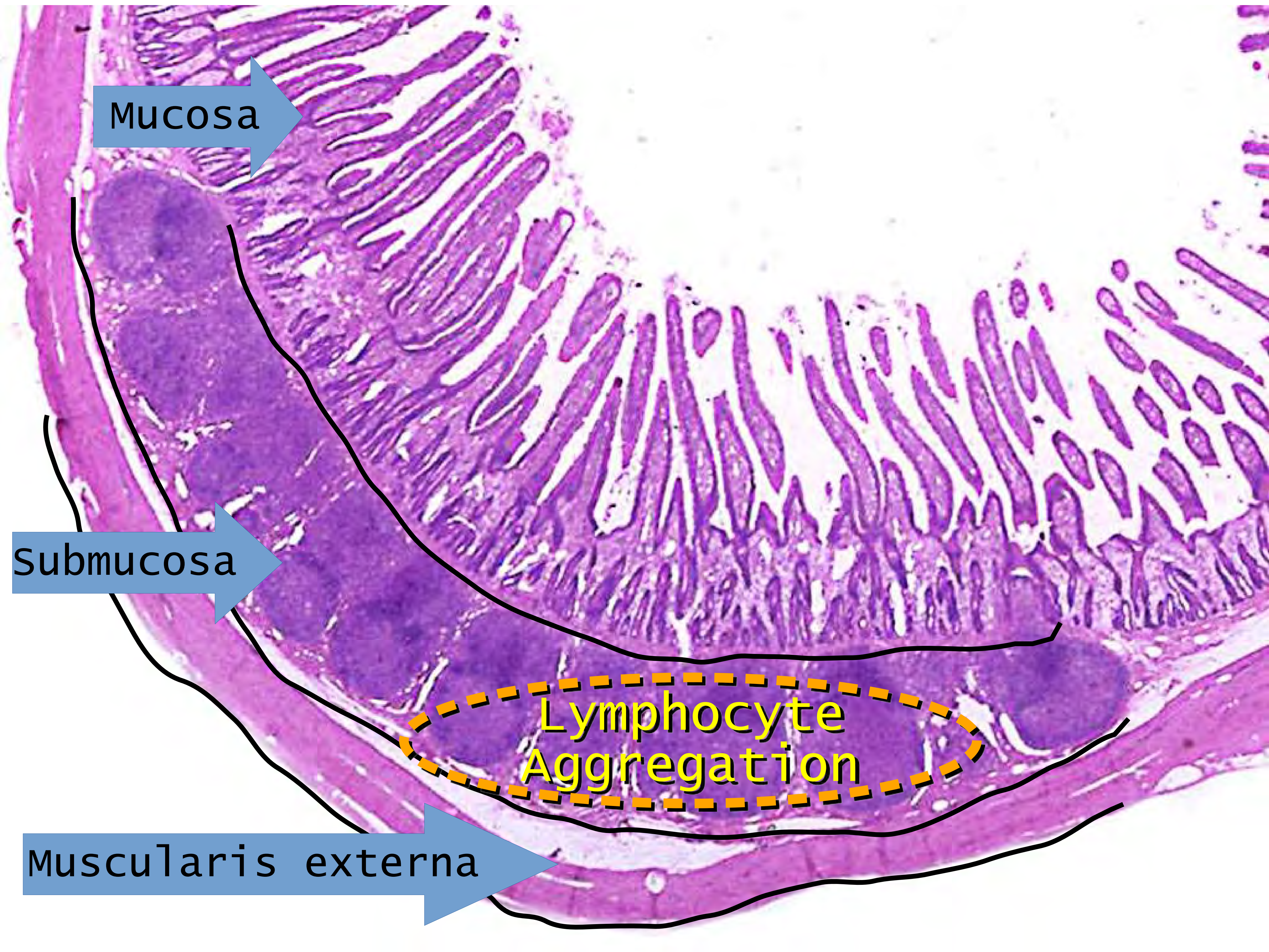
Alimentary canal 2/2

- Ileum – slide 41
- Appendix – slide 43
- Colon – slide 42
- Rectum-anal-skin junction – slide 45

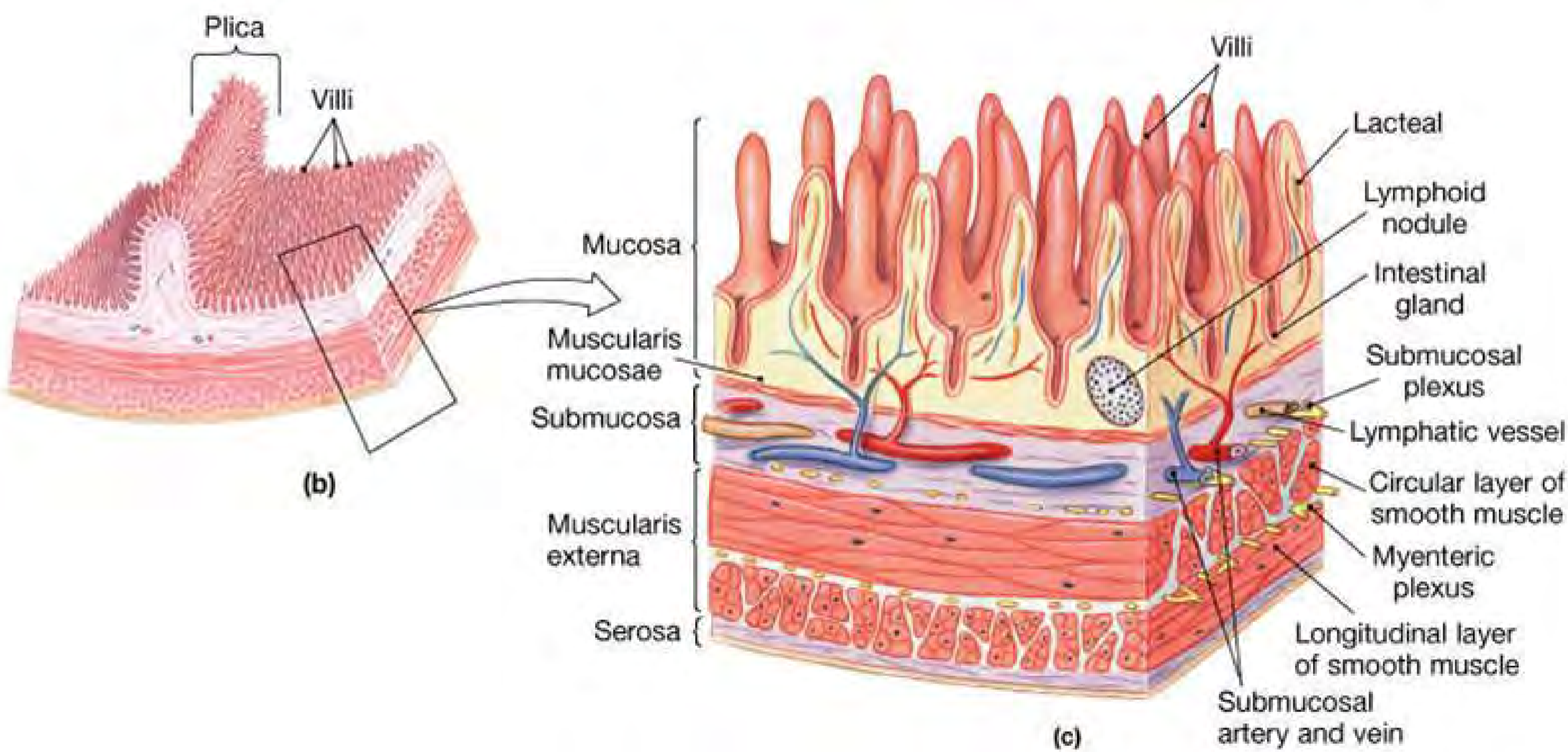
Ileum

Slide 41

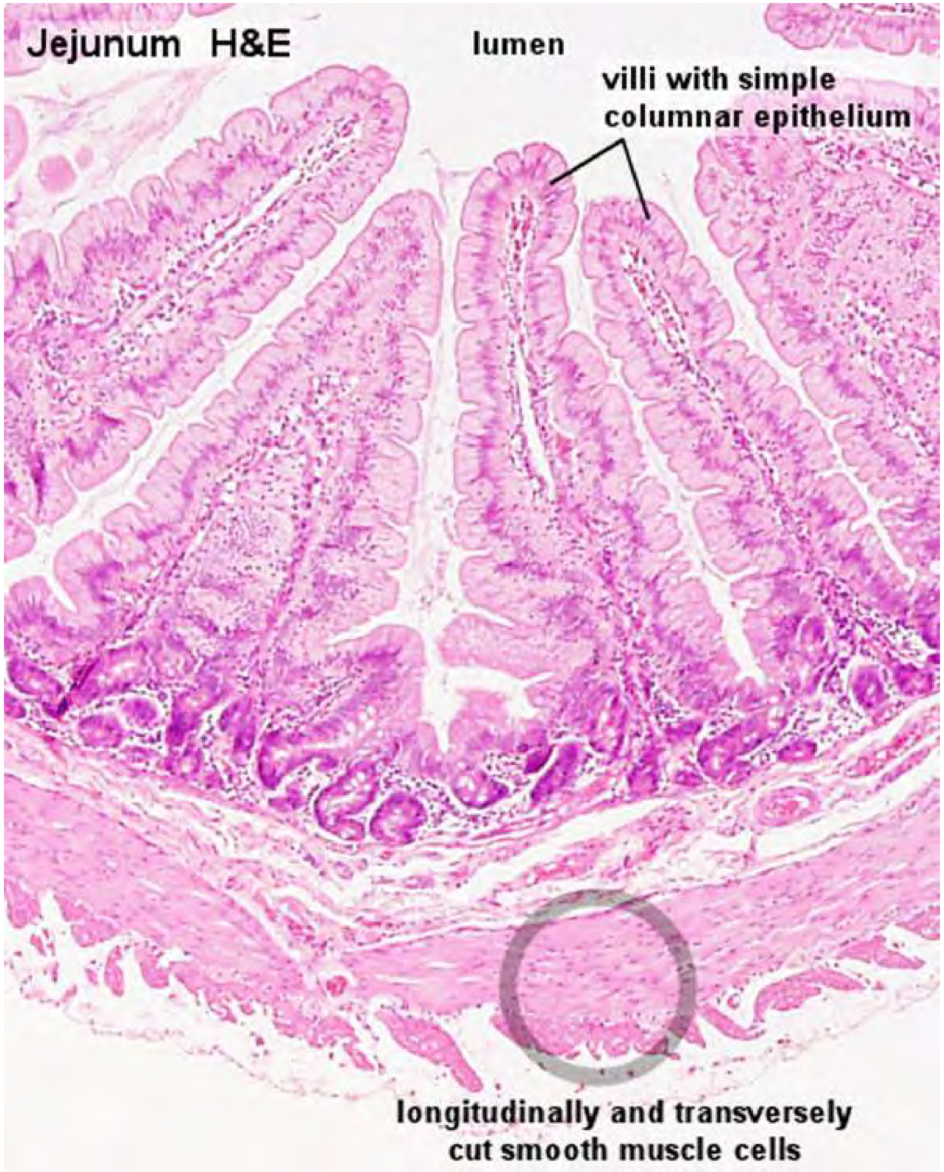

villi
villi
villi
villi
villi
Submucosa
Muscularis externa


Mucosa
Submucosa
Lymphocyte
Aggregation
Muscularis externa

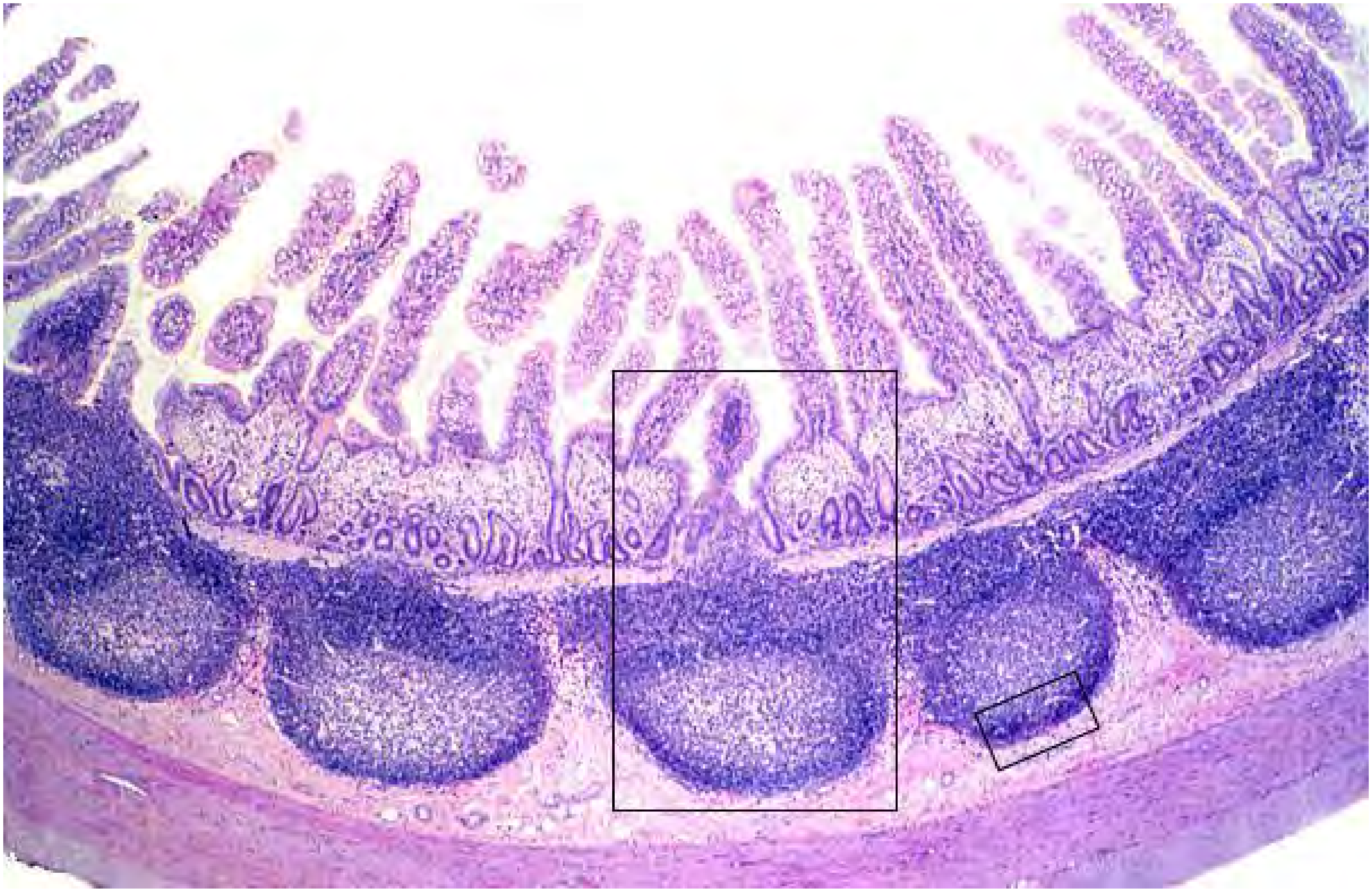
Small intestine



Small intestine



Small intestine



Appendix

Slide 43

Appendix

Very low magnification

Appendix

- Mucosa
- Submucosa
- Muscularis externa
- Serosa

Mucosa

- Epithelium
  - Simple columnar
  - Columnar cells
  - Goblet cells
- Crypts of Lieberkühn
  - Shallow
  - Goblet, columnar, Paneth, APUD cells
  - Lamina propria
  - Lymphoid nodules & lymphoid cells
- Muscularis mucosa
  - Inner circular
  - Outer longitudinal

Submucosa

- Fibroelastic CT
- Lymphatic nodules
- No glands
- Sometimes fat cells

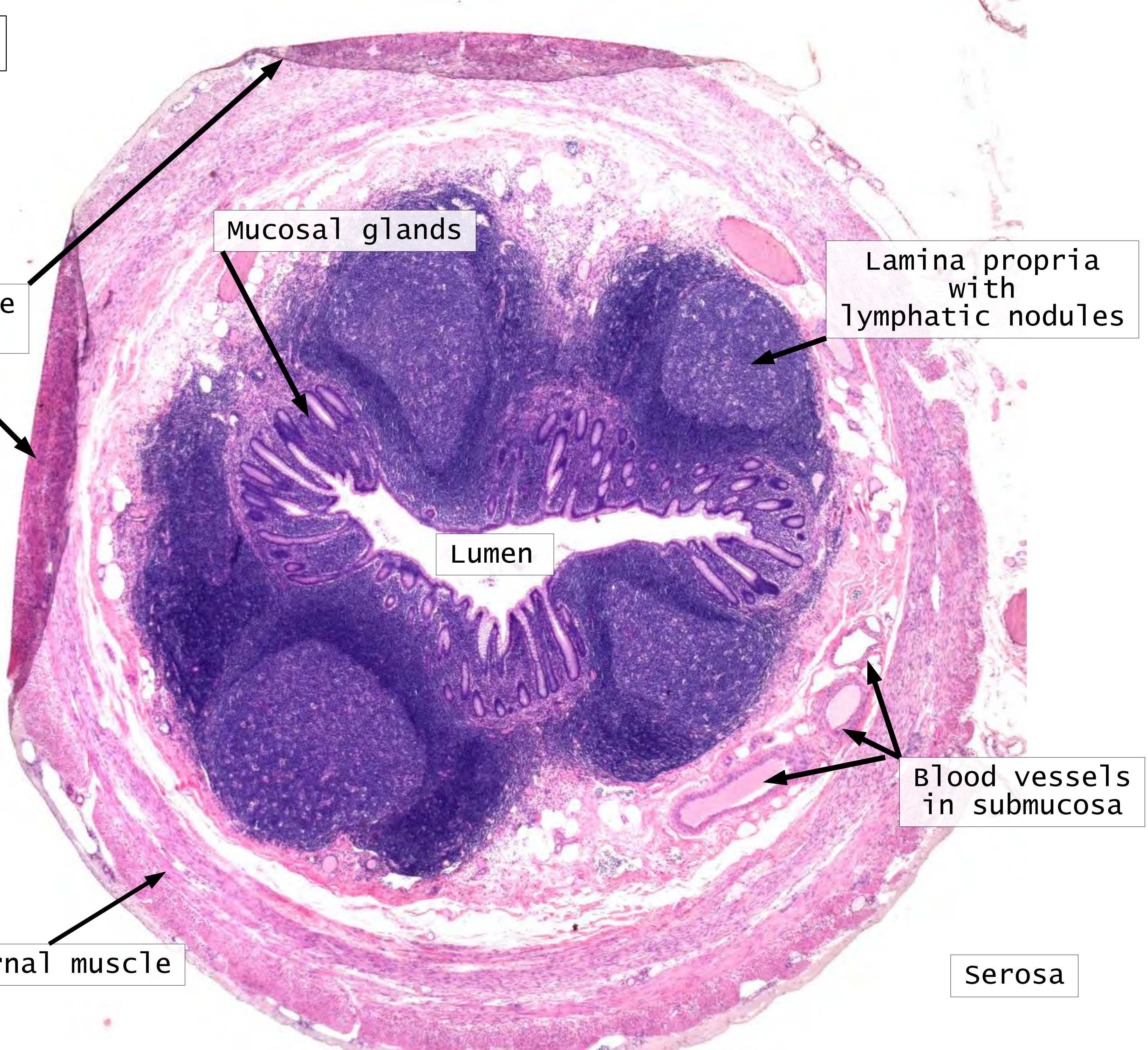
Muscularis externa

- Inner circular
- Outer longitudinal

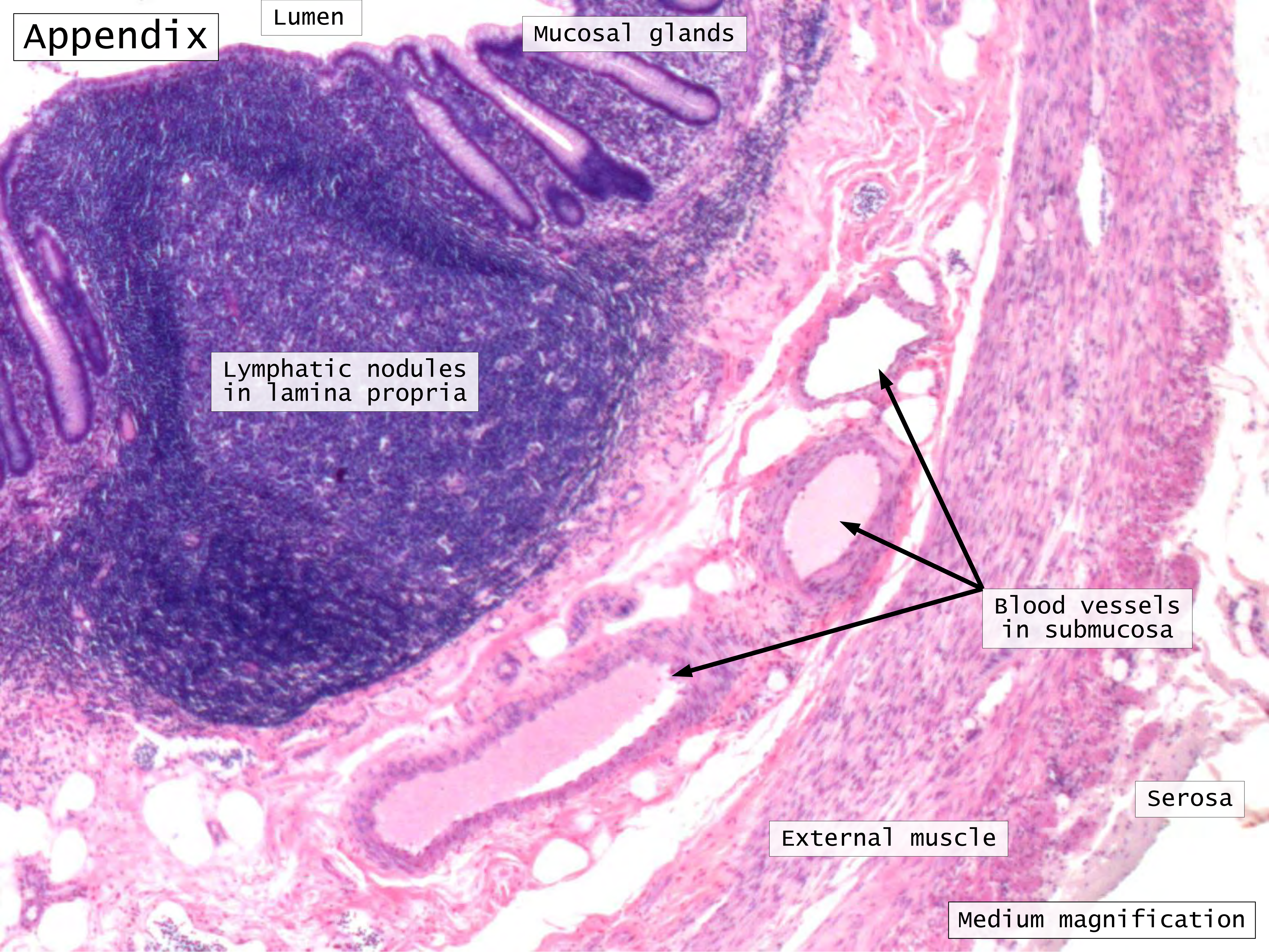
Serosa

- Covered with mesothelium

Appendix

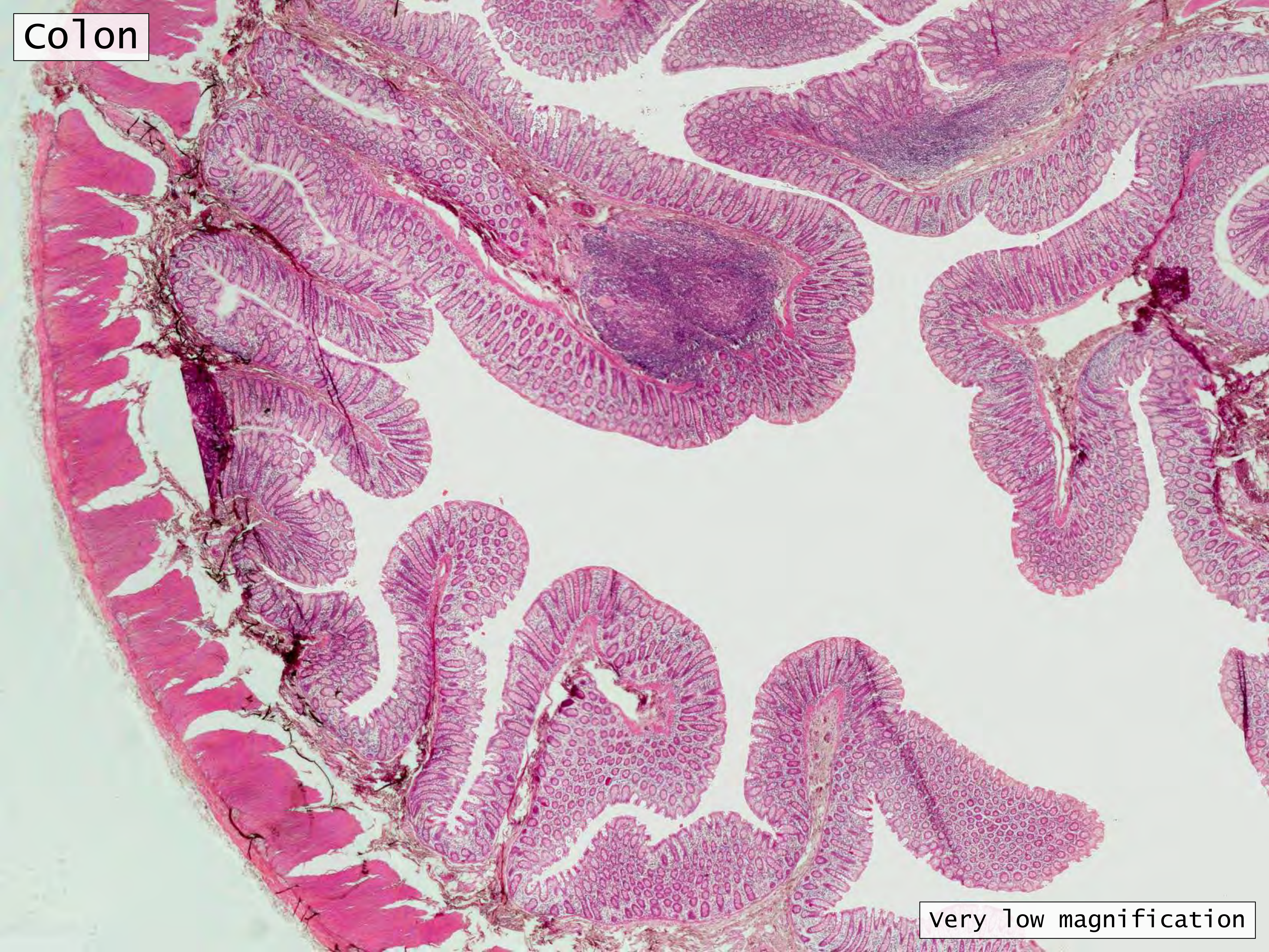


Very low magnification


Appendix
Lumen
Mucosal glands
Lymphatic nodules in lamina propria
Blood vessels in submucosa
Serosa
External muscle
Medium magnification

Colon

Slide 42


Colon
Very low magnification

Large intestine

- Ascending
- Transverse
- Descending
- Sigmoid
- Rectum
- Anal canal
- All histologically similar

Mucosa

- No folds
- No villi
- Simple columnar epithelium
  - Goblet cells
  - Absorptive cells
  - APUD cells

Mucosa

- Lamina propria
  - Crypts of Lieberkühn
  - Closely packed
  - No Paneth cells
  - Lymphoid & vascular elements

Mucosa

- Muscularis mucosa
- Inner circular
- Outer longitudinal

Submucosa

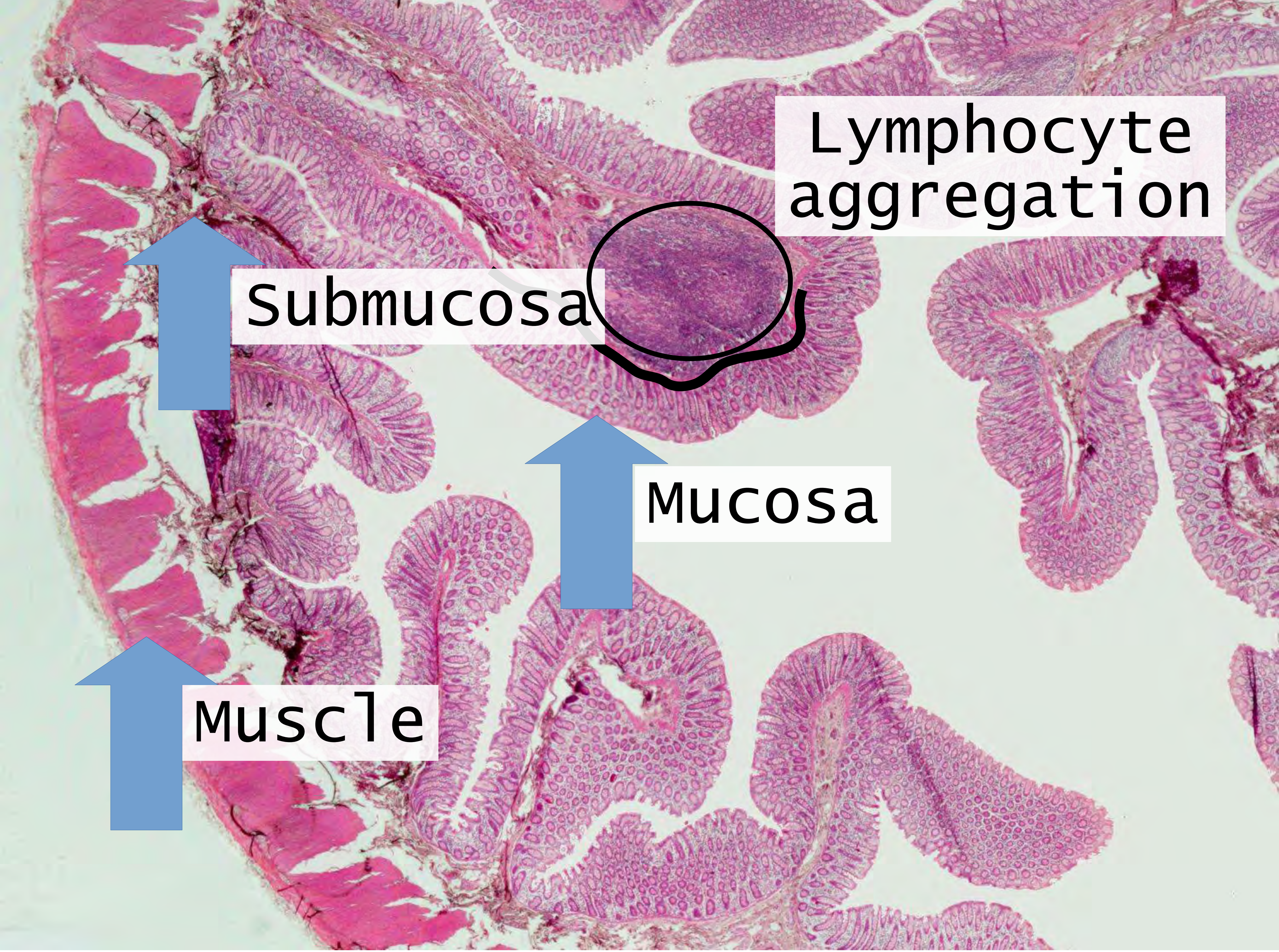
- Fibroelastic CT
- AVNL
- Submucosal plexus (Meissner)
- No glands

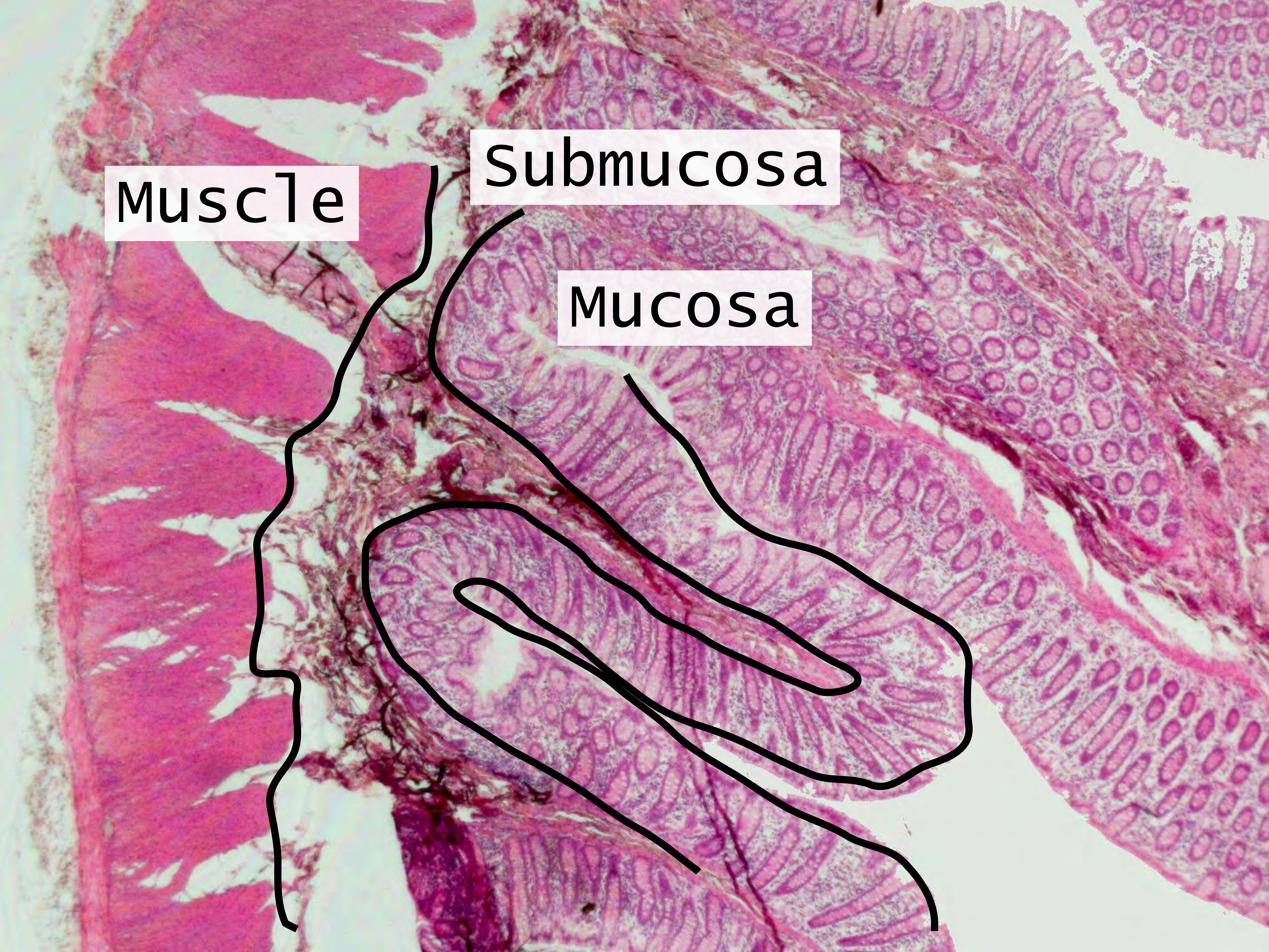
Muscularis externa

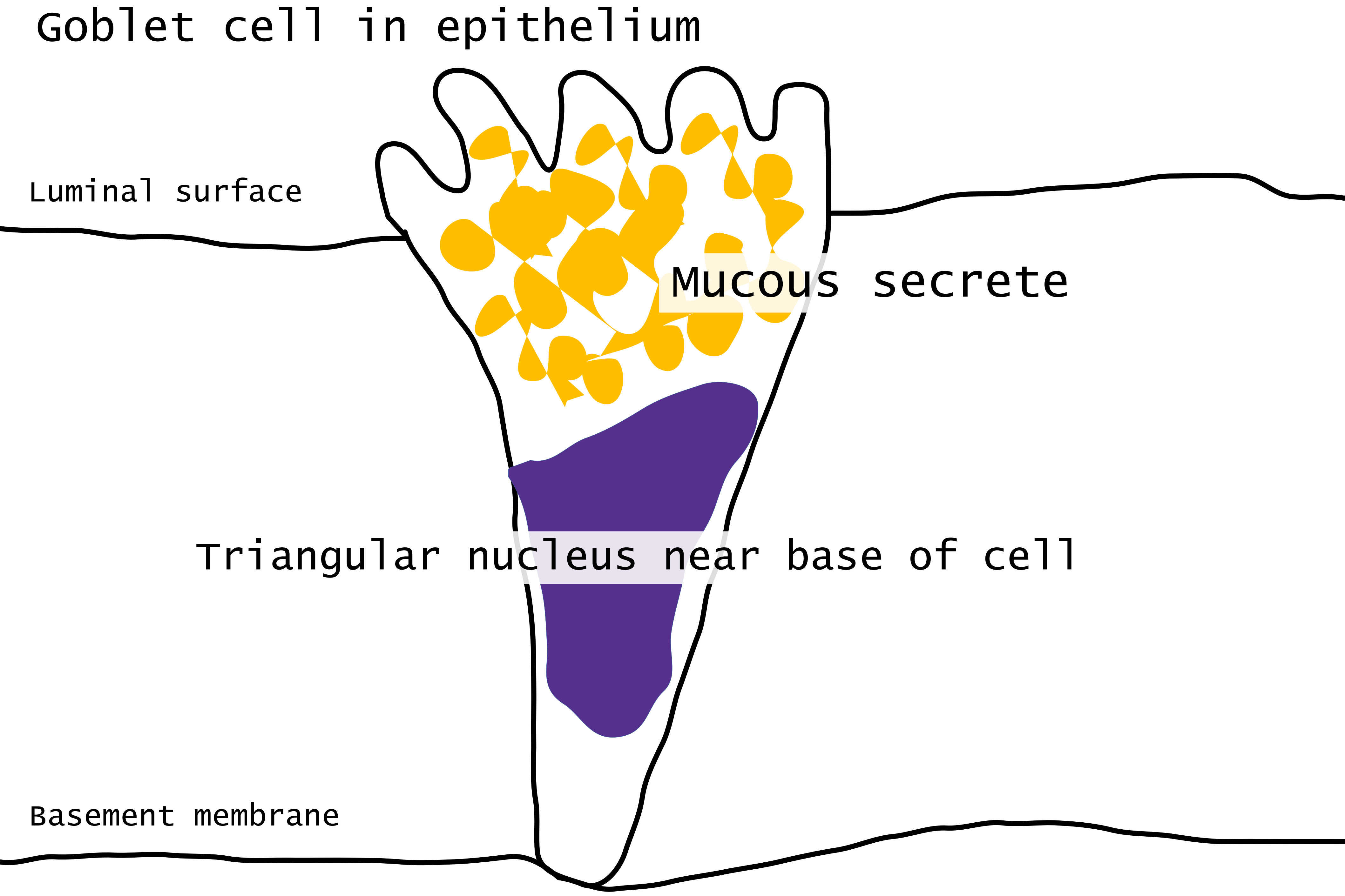
- Inner circular
- Myenteric plexus (Auerbach)
- Modified outer longitudinal
  - 3 flat ribbons
  - Taenia coli

Serosa/Adventitia

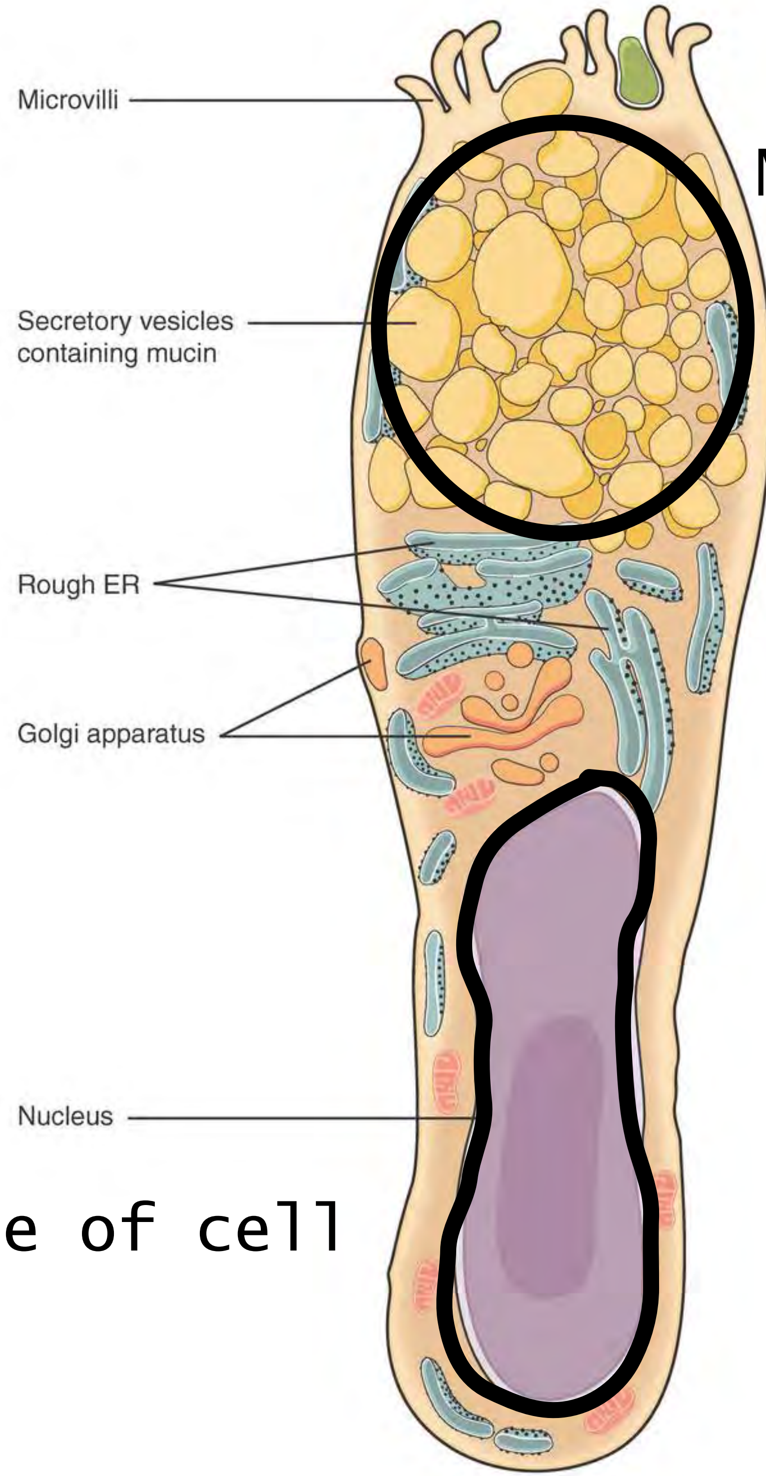
- Adventitia
  - Ascending & Descending colon
- Serosa
  - Caecum and rest
  - Contains appendicices epiploicae


Lymphocyte
aggregation
Submucosa
Mucosa
Muscle


Muscle
Submucosa
Mucosa


Goblet cell in epithelium
Luminal surface
Mucous secrete
Triangular nucleus near base of cell
Basement membrane

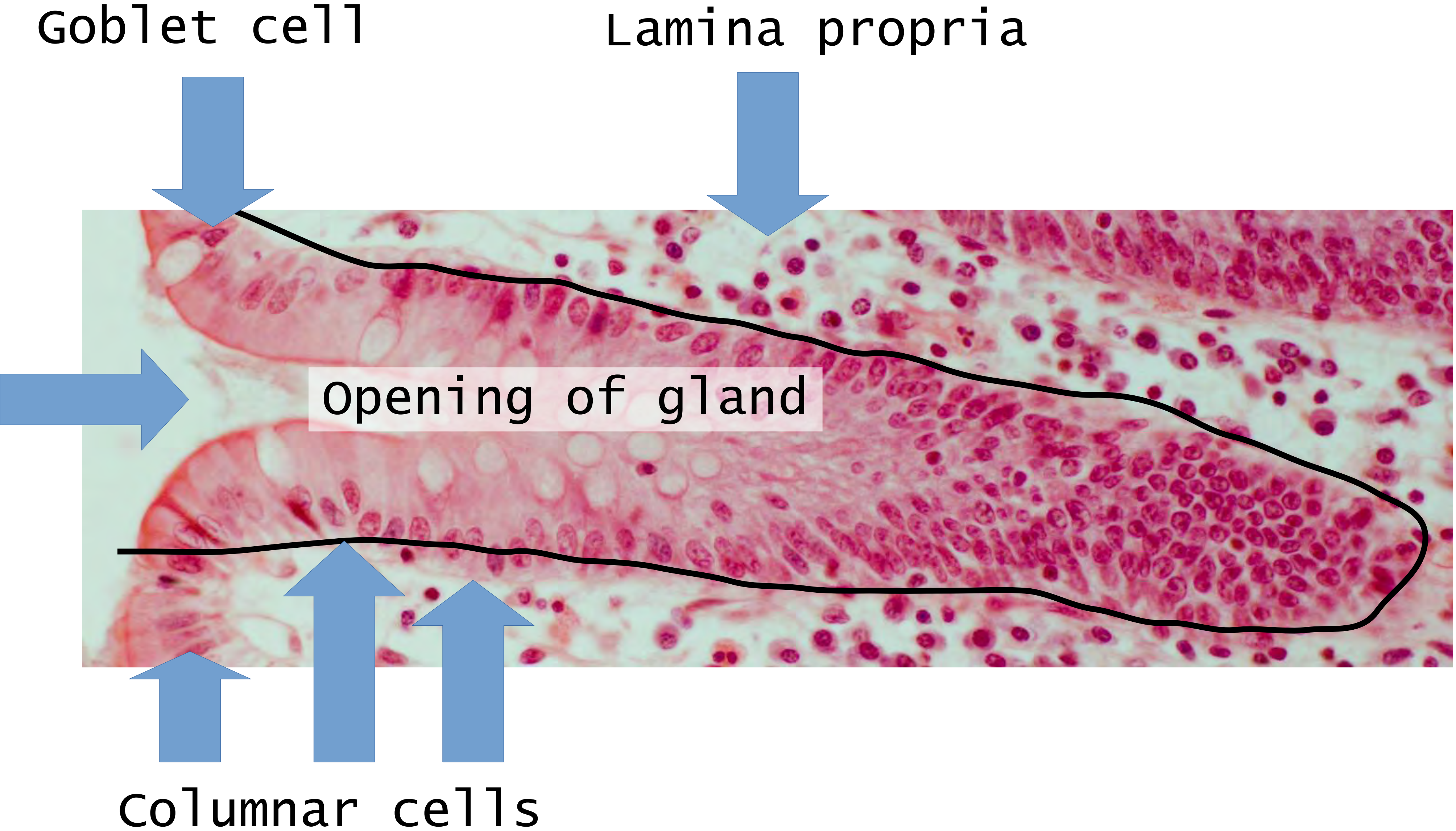
Goblet cell

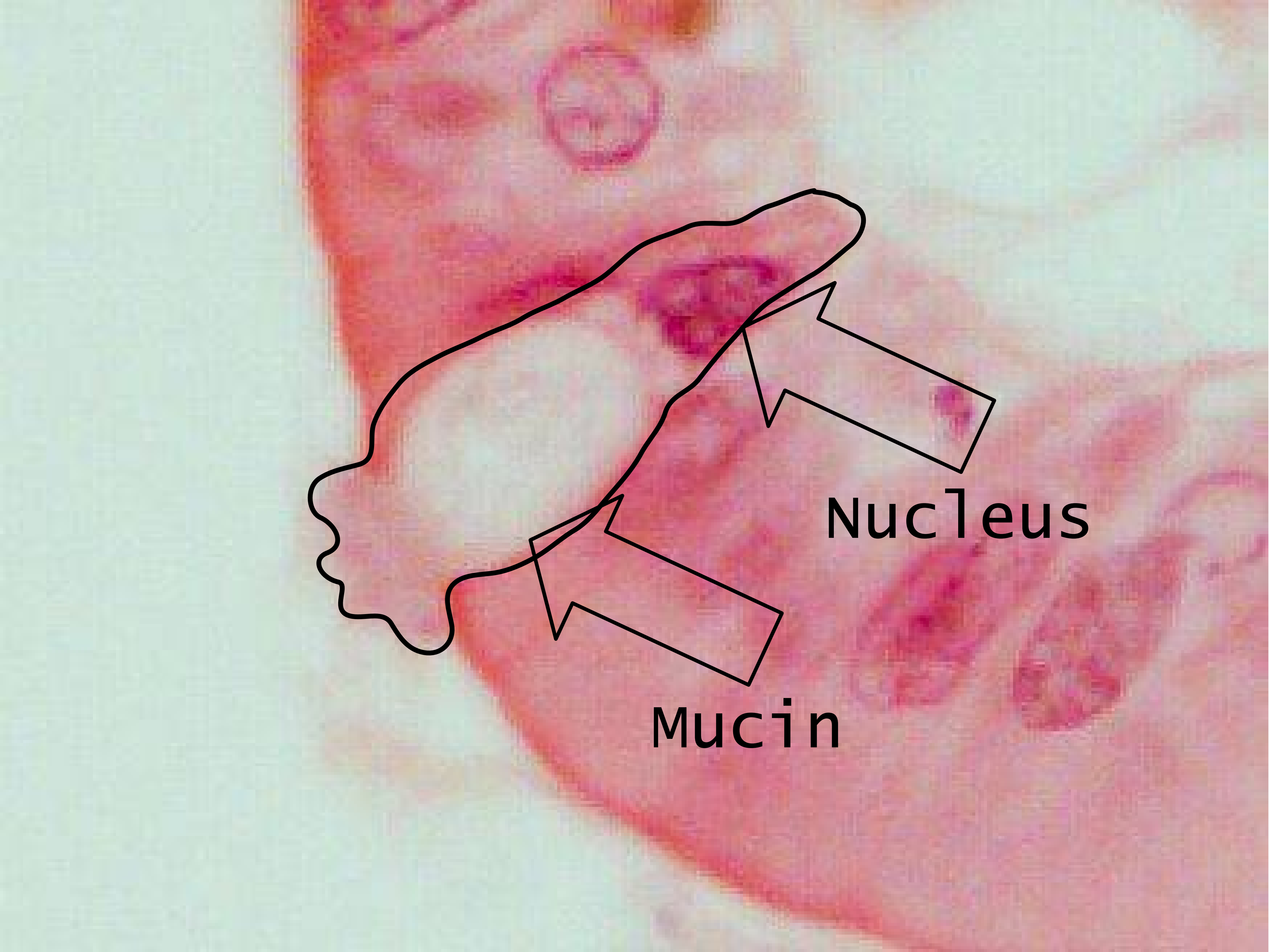


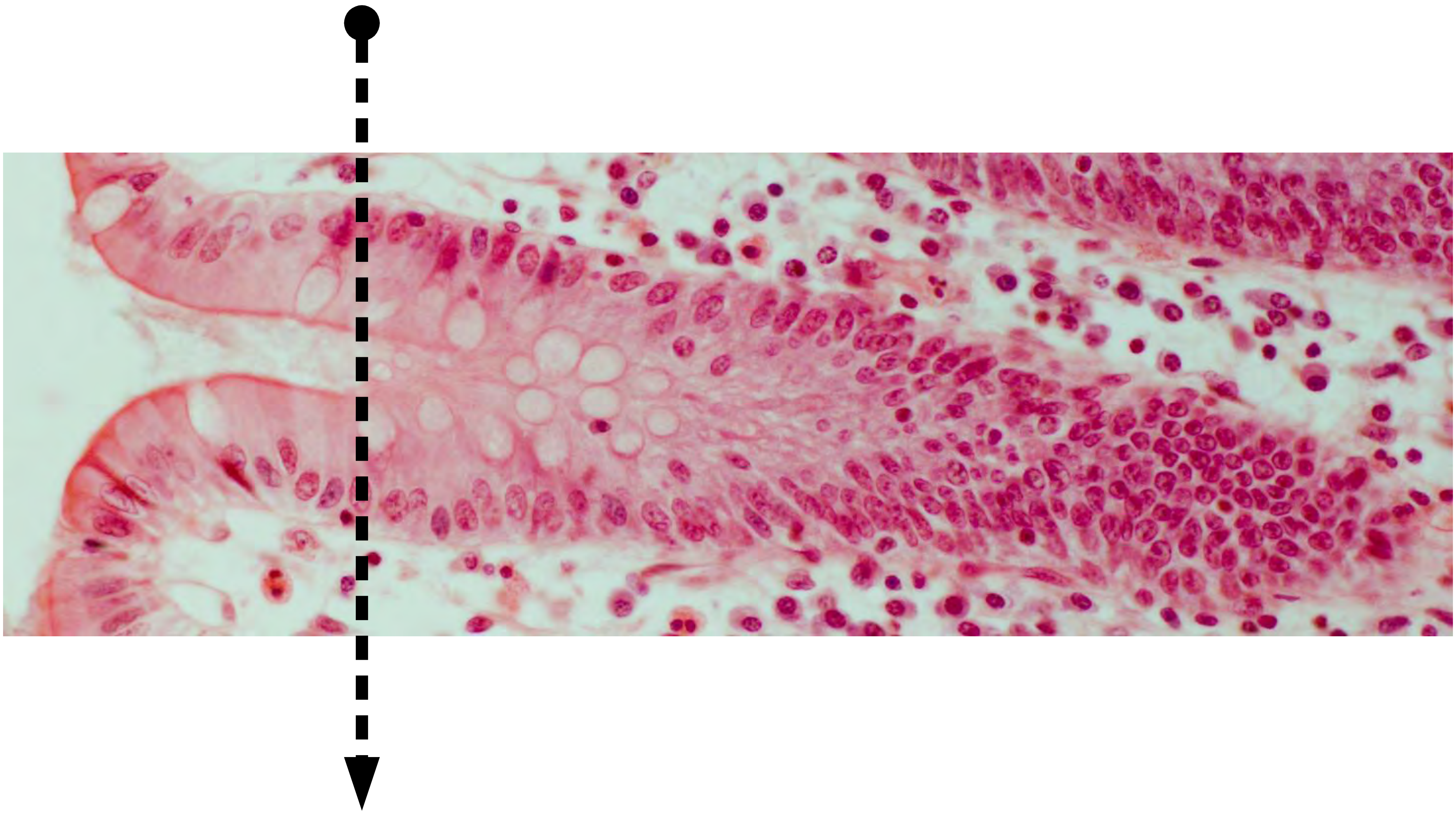
Mucous secrete

Nucleus near base of cell

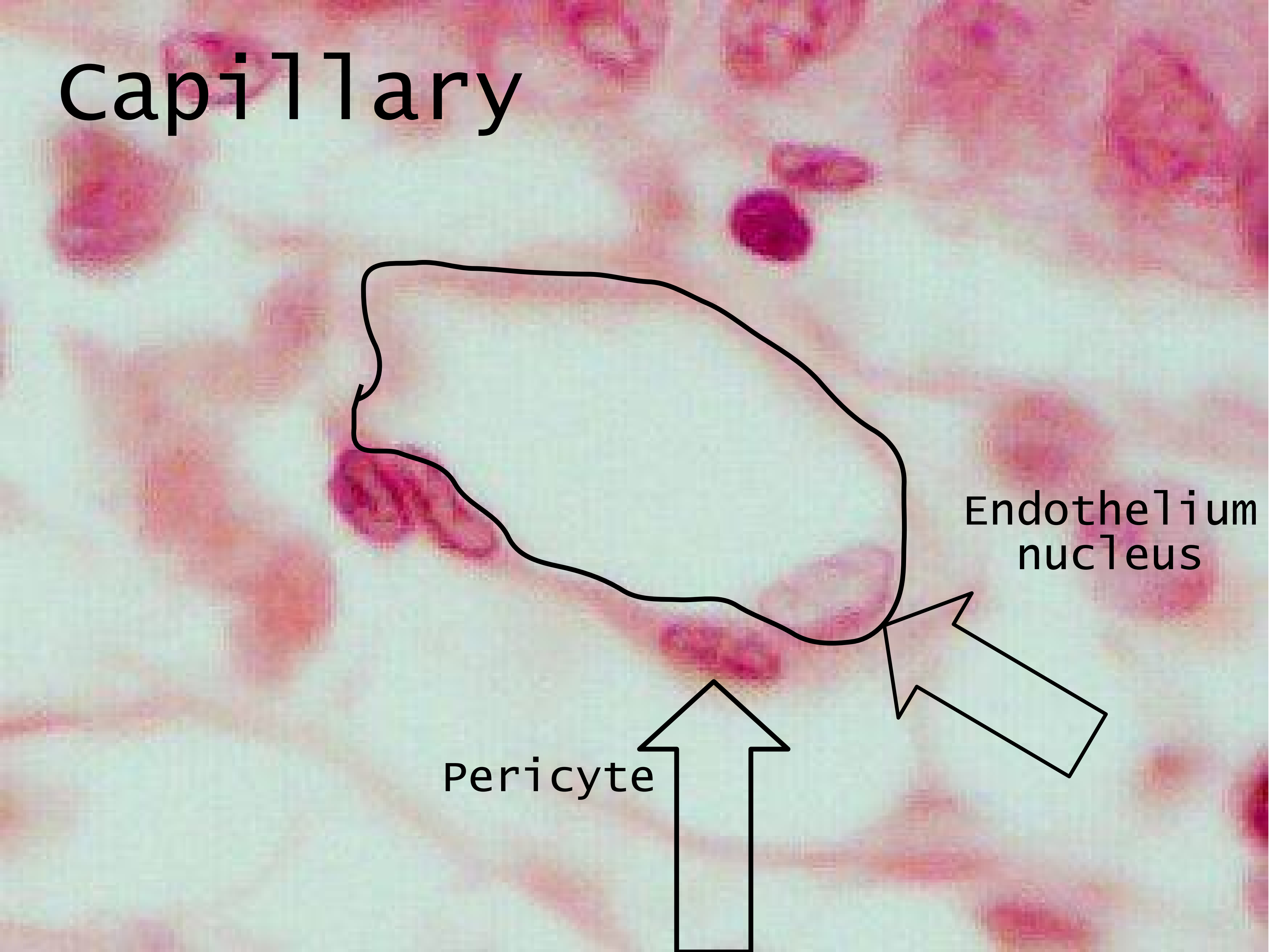

Simple
Tubular
Gland

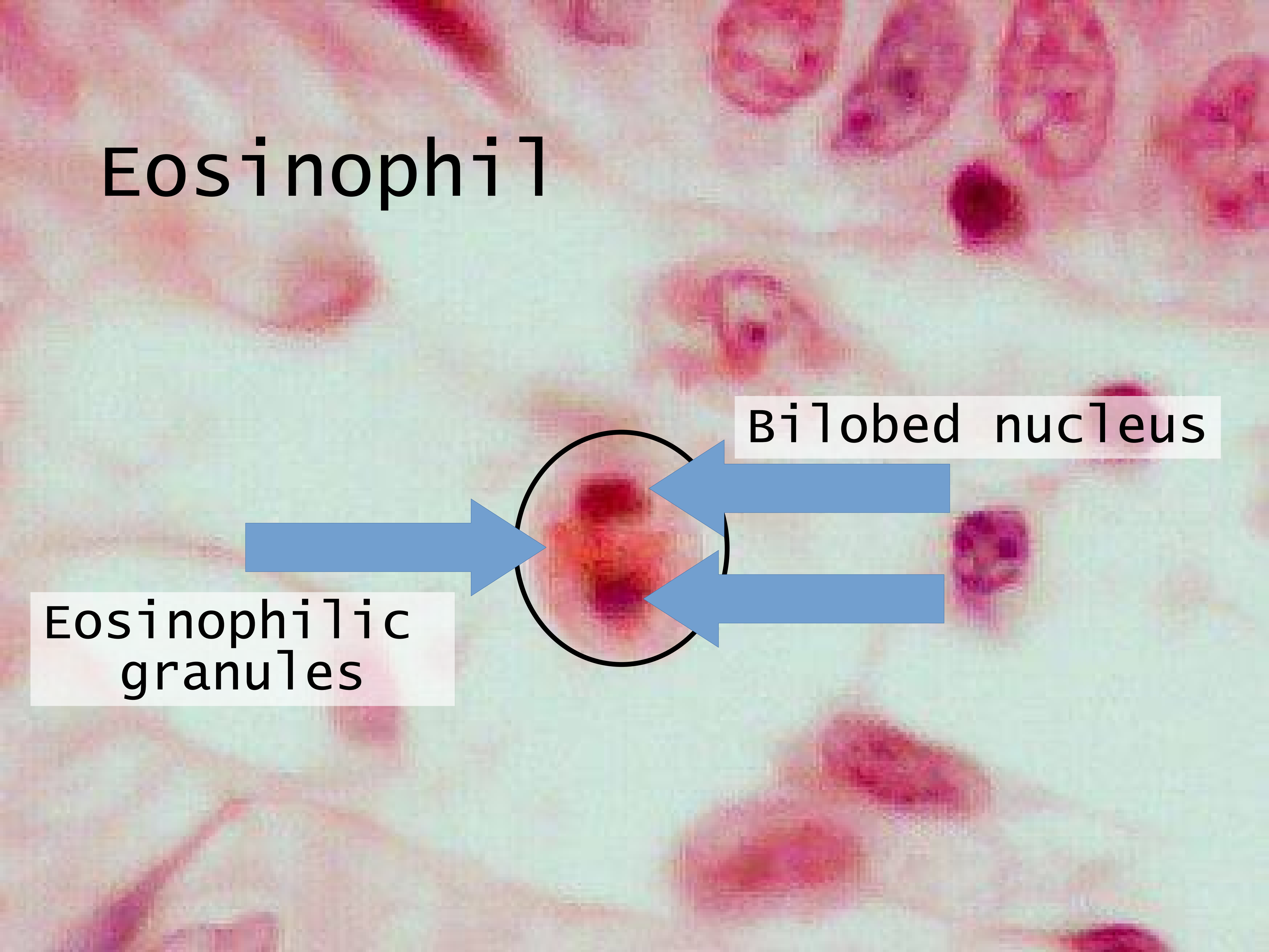

Goblet cell
Lamina propria
Opening of gland
Columnar cells


Nucleus
Mucin

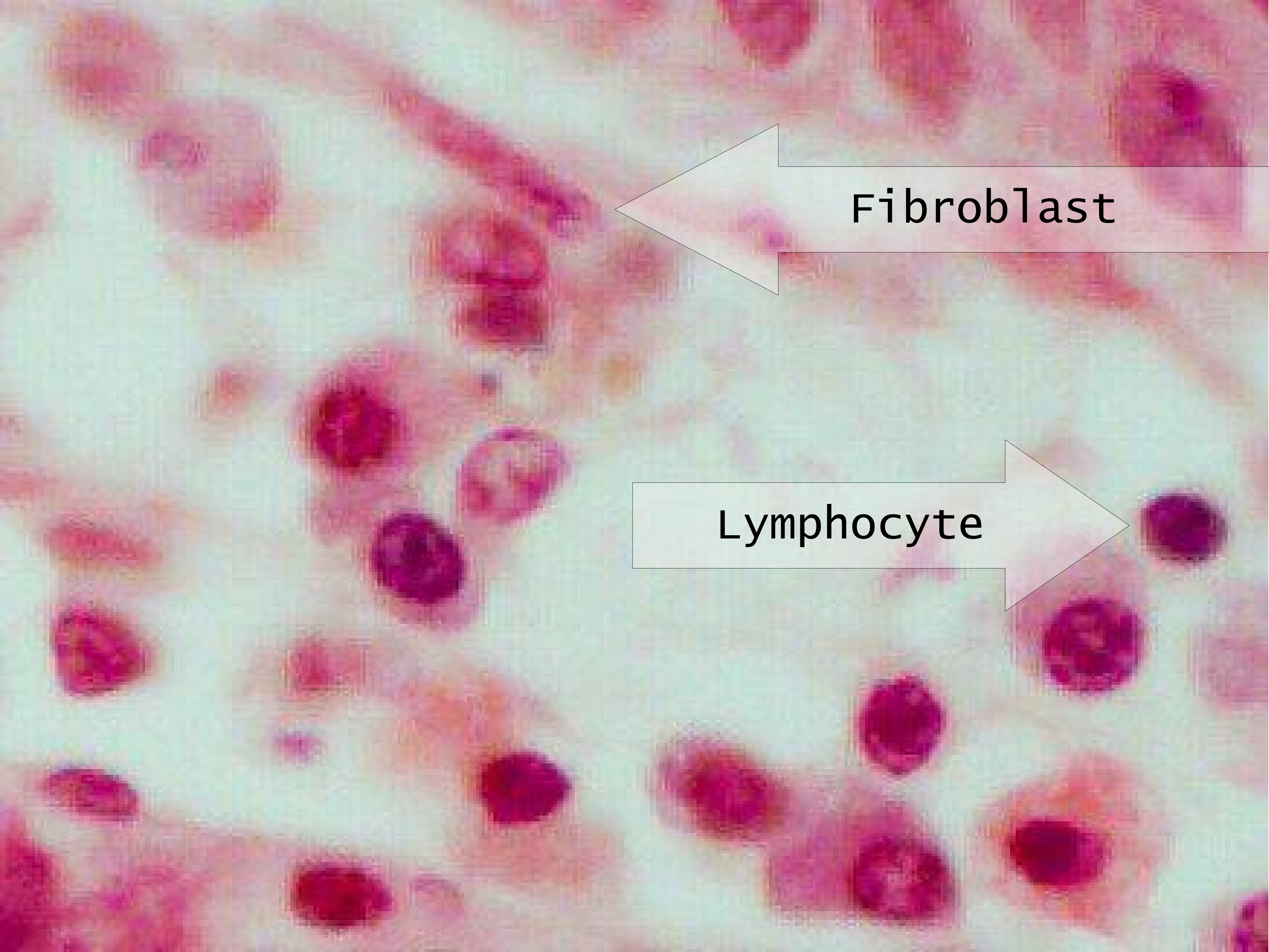


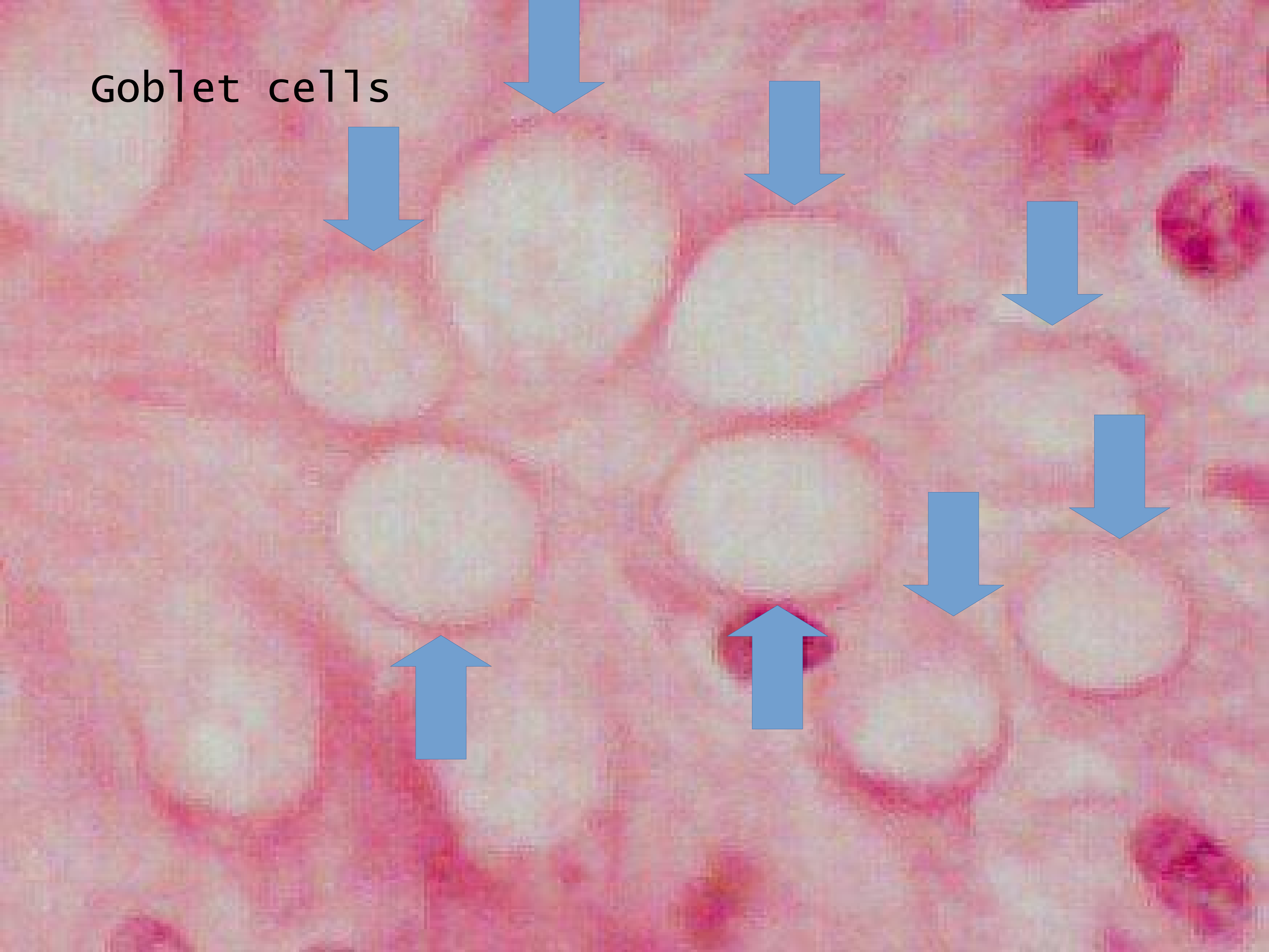

Lumen


Capillary
Endothelium nucleus
Pericyte



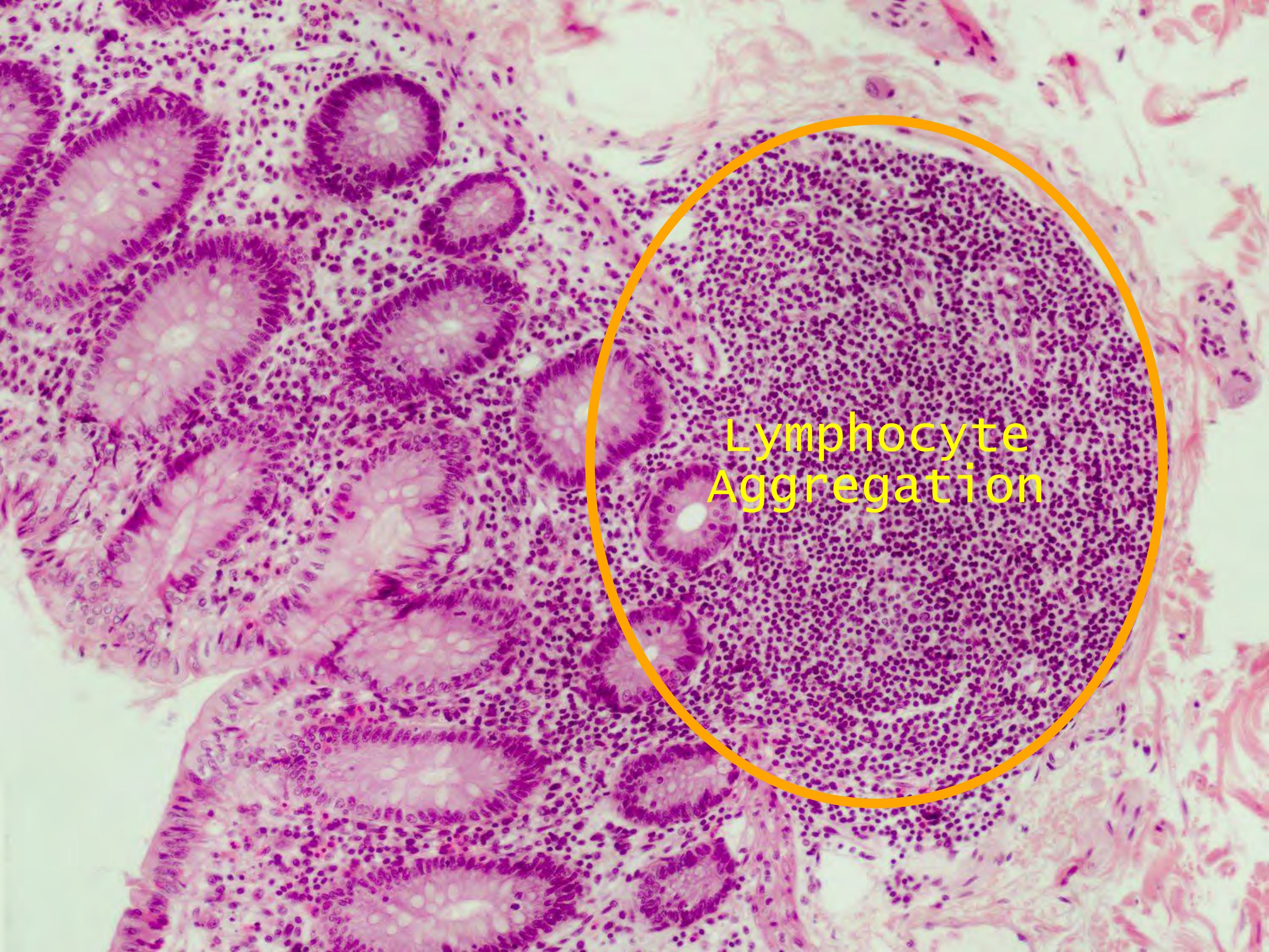
Eosinophil
Bilobed nucleus
Eosinophilic granules


Fibroblast
Lymphocyte

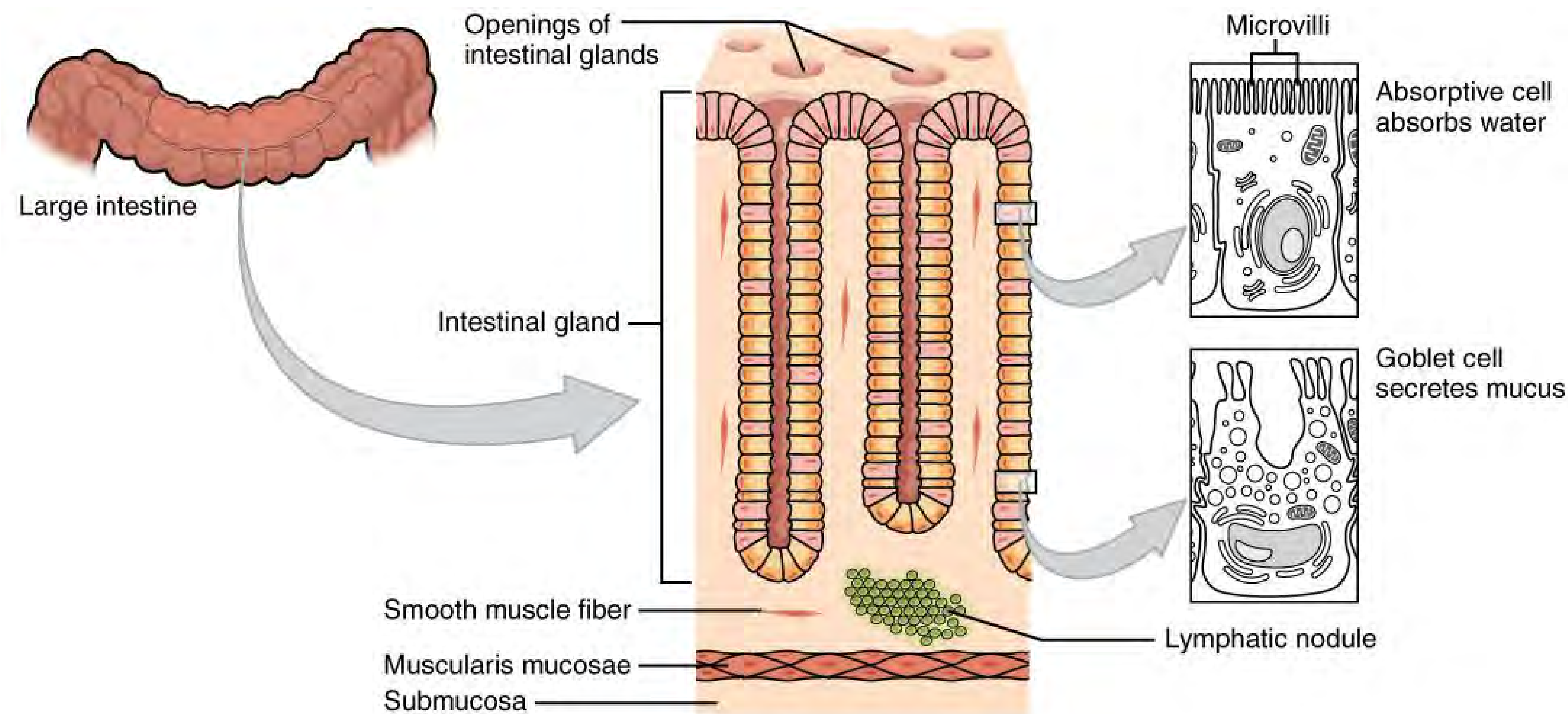

Goblet cells


Goblet cells
Nuclei cut across near base of epitelium


Squamous cell
Red blood cells

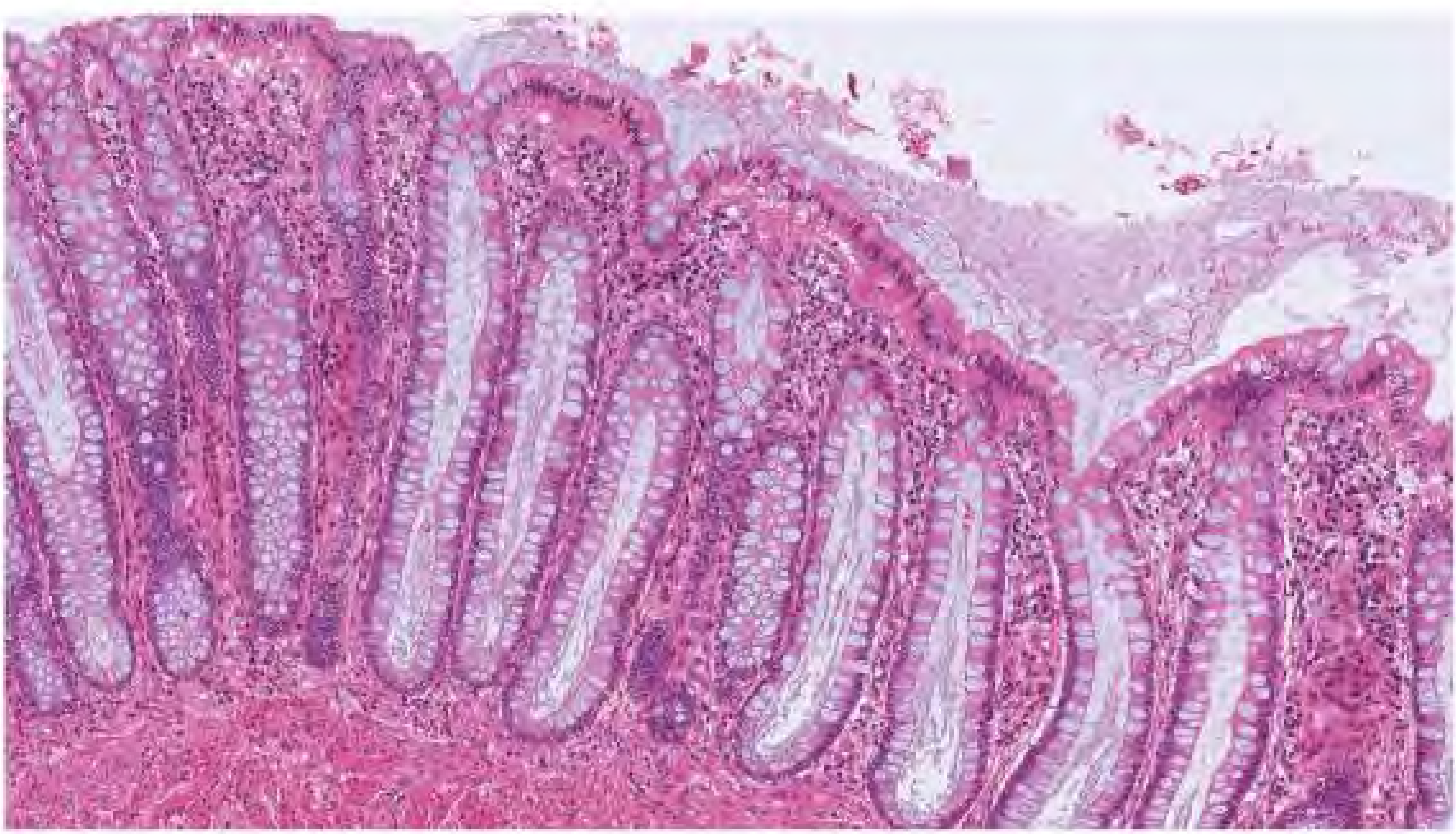

Lymphocyte
Aggregation

Colon

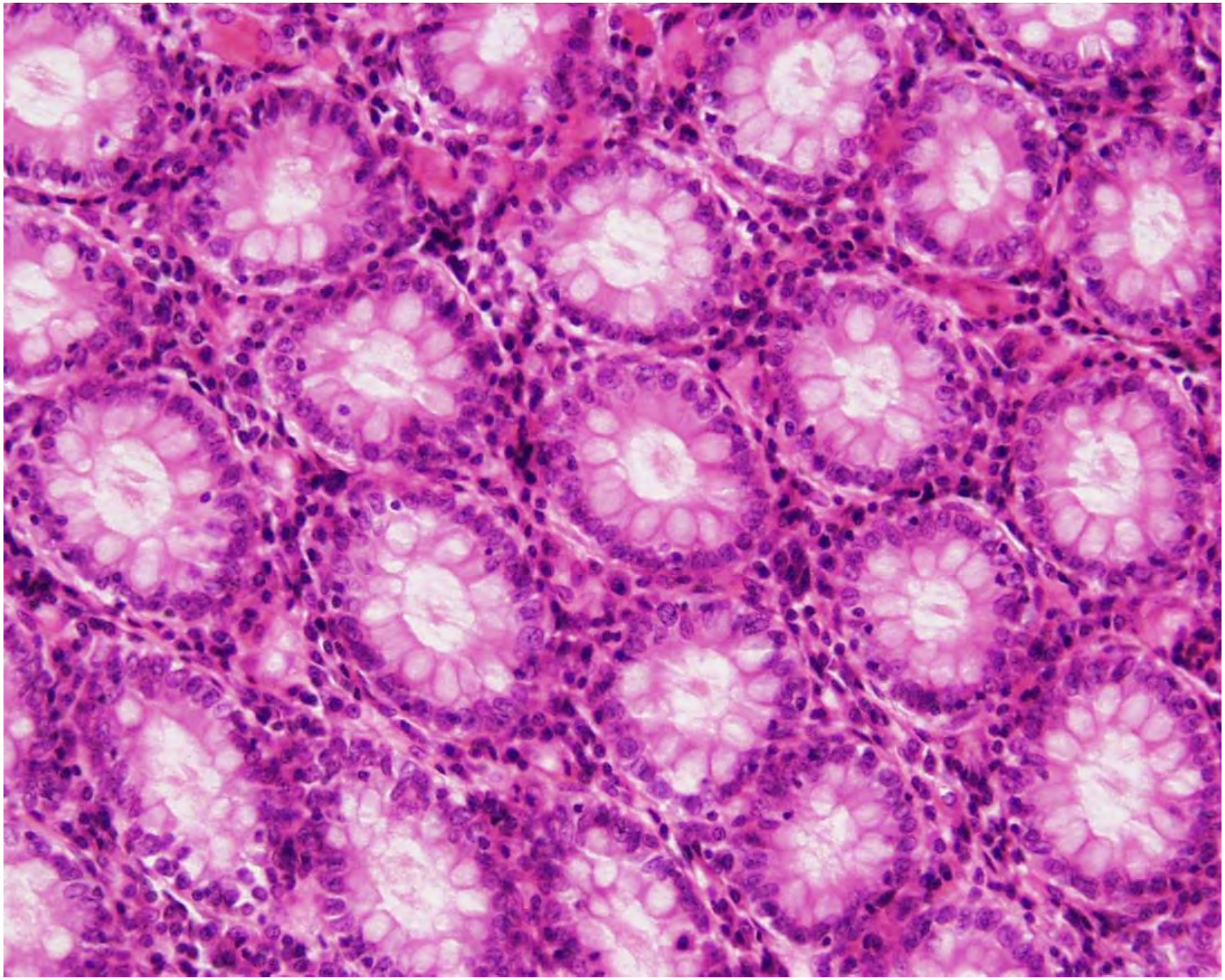


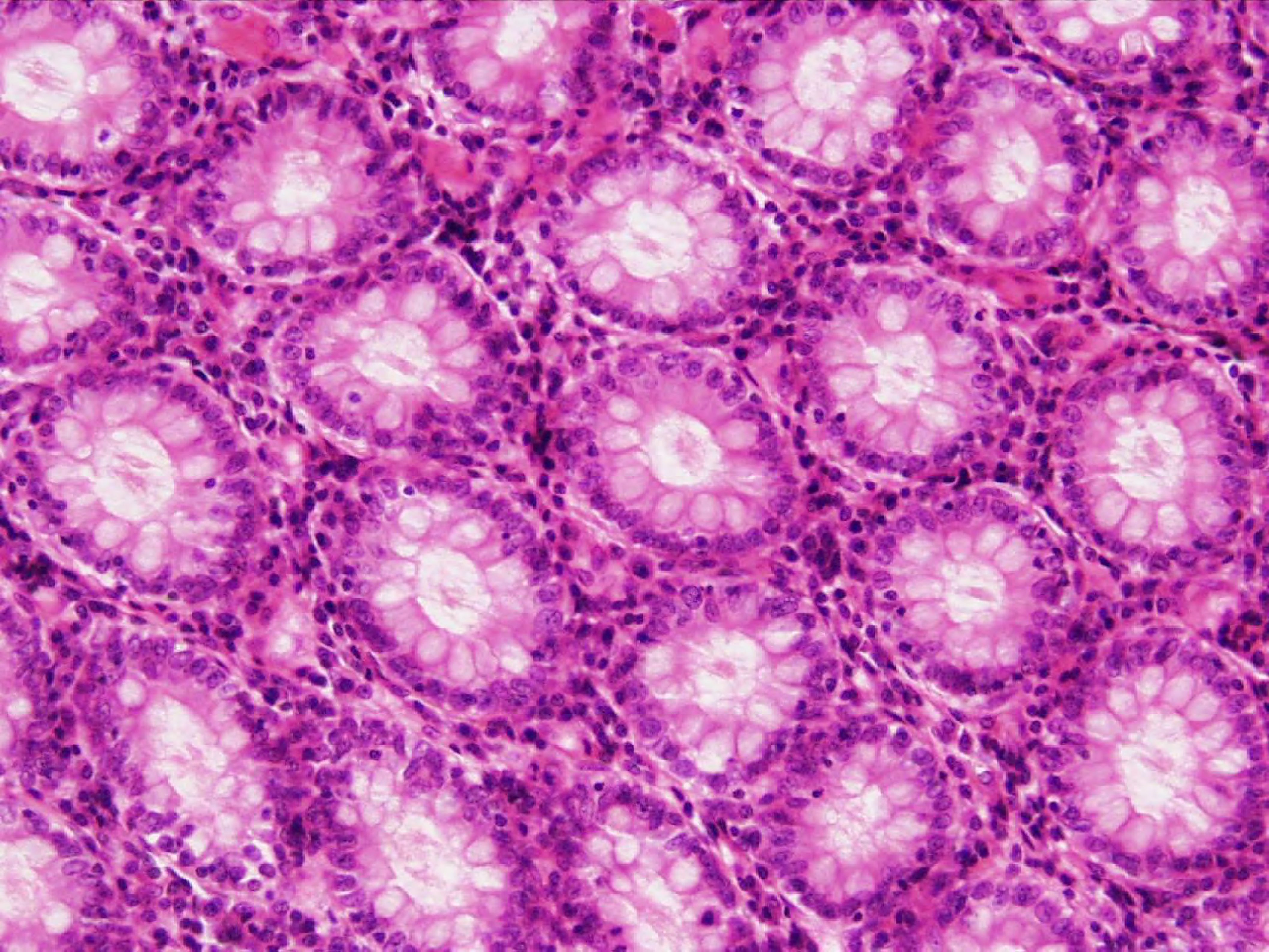
Large intestine
Openings of intestinal glands
Intestinal gland
Smooth muscle fiber
Muscularis mucosae
Submucosa
Lymphatic nodule
Microvilli
Absorptive cell absorbs water
Goblet cell secretes mucus

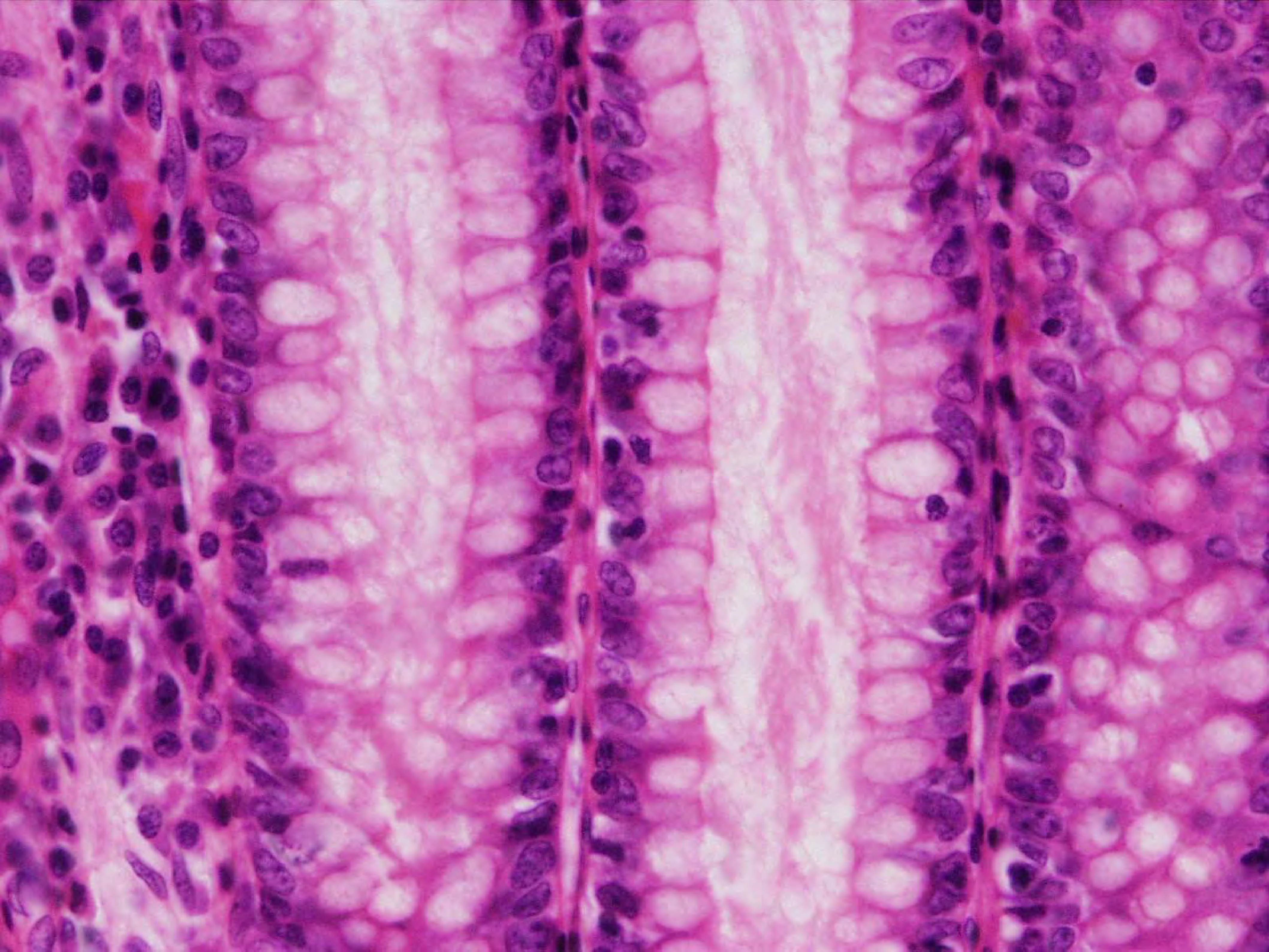
Colon

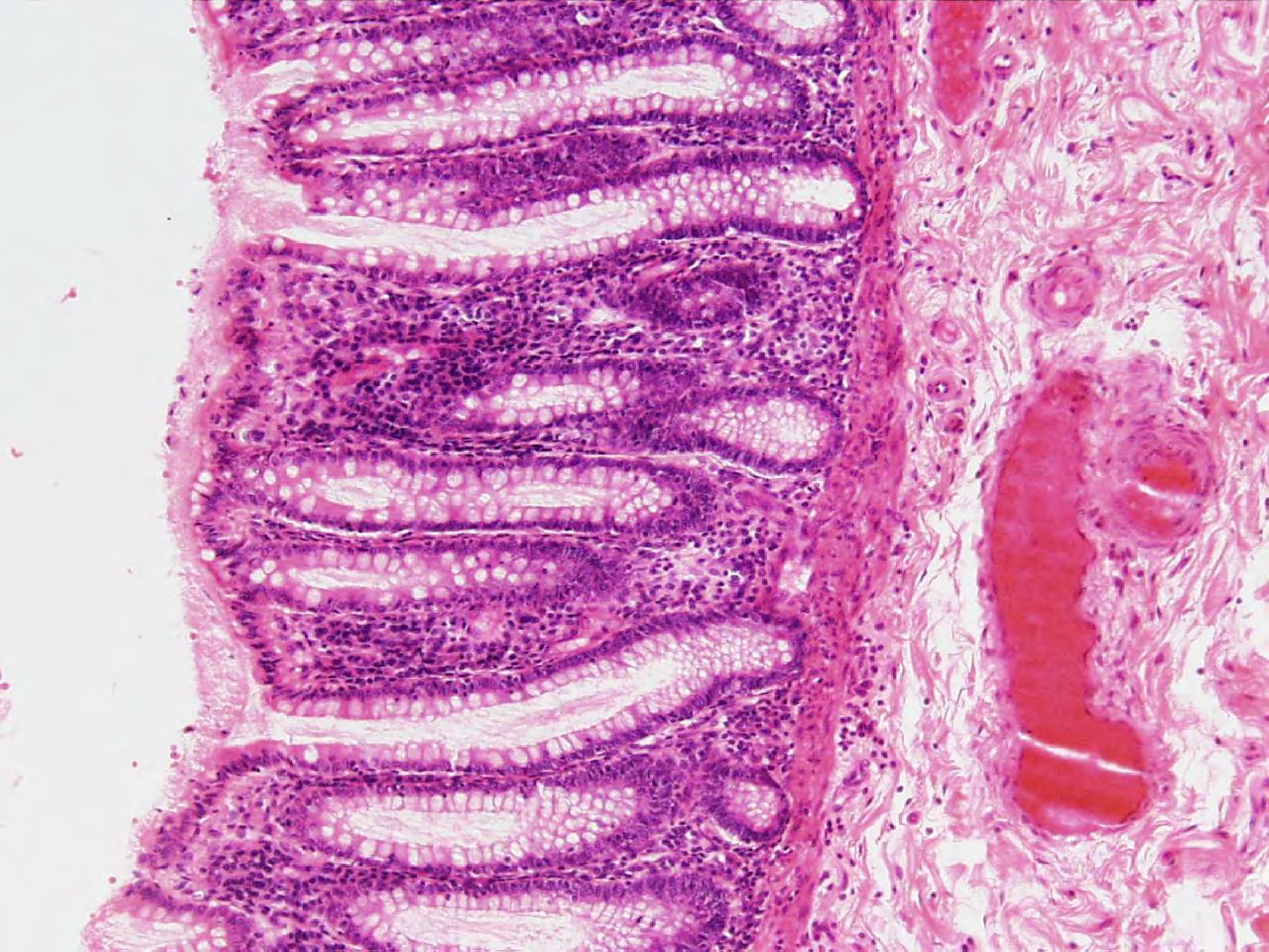


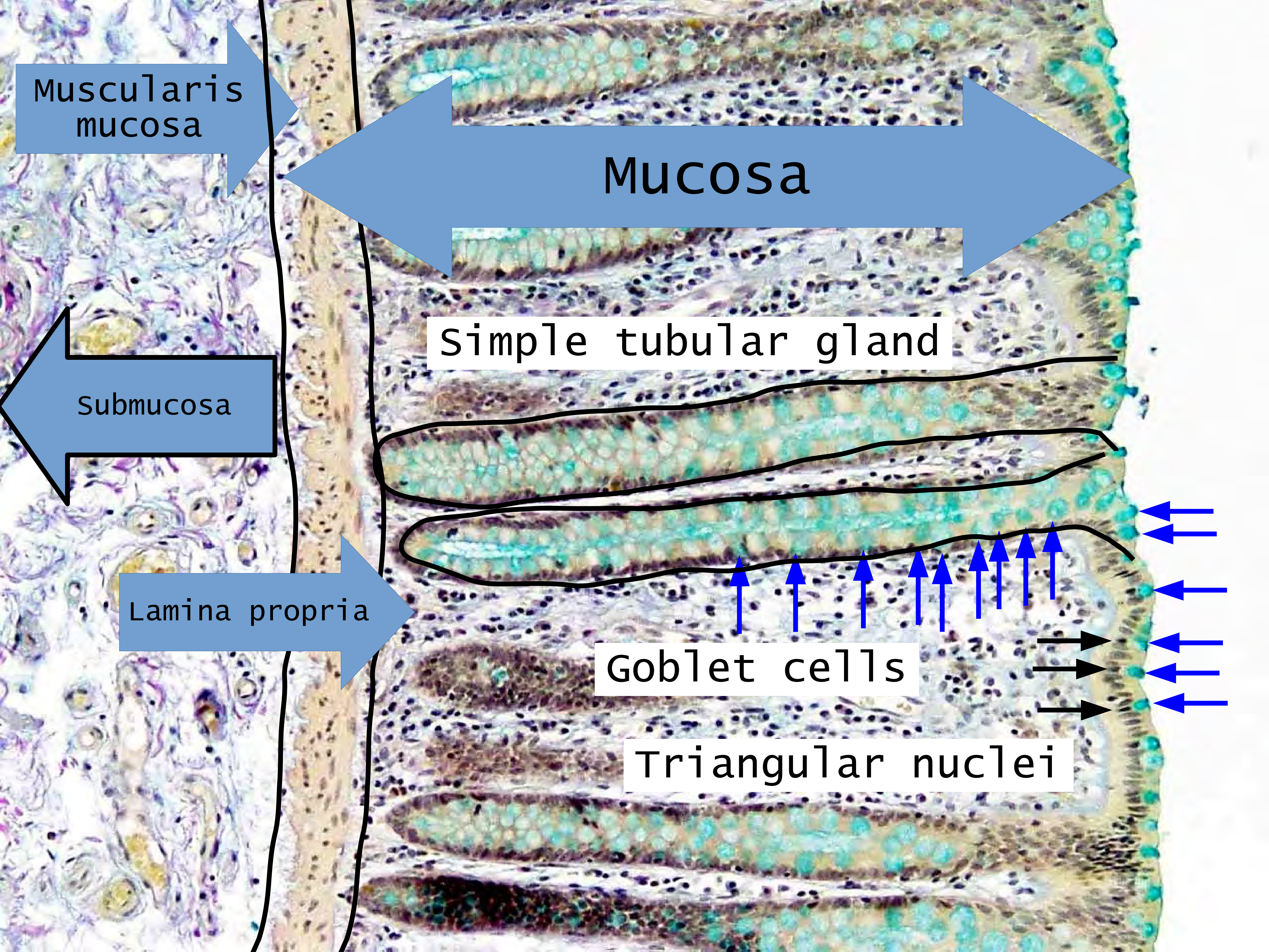
Colon











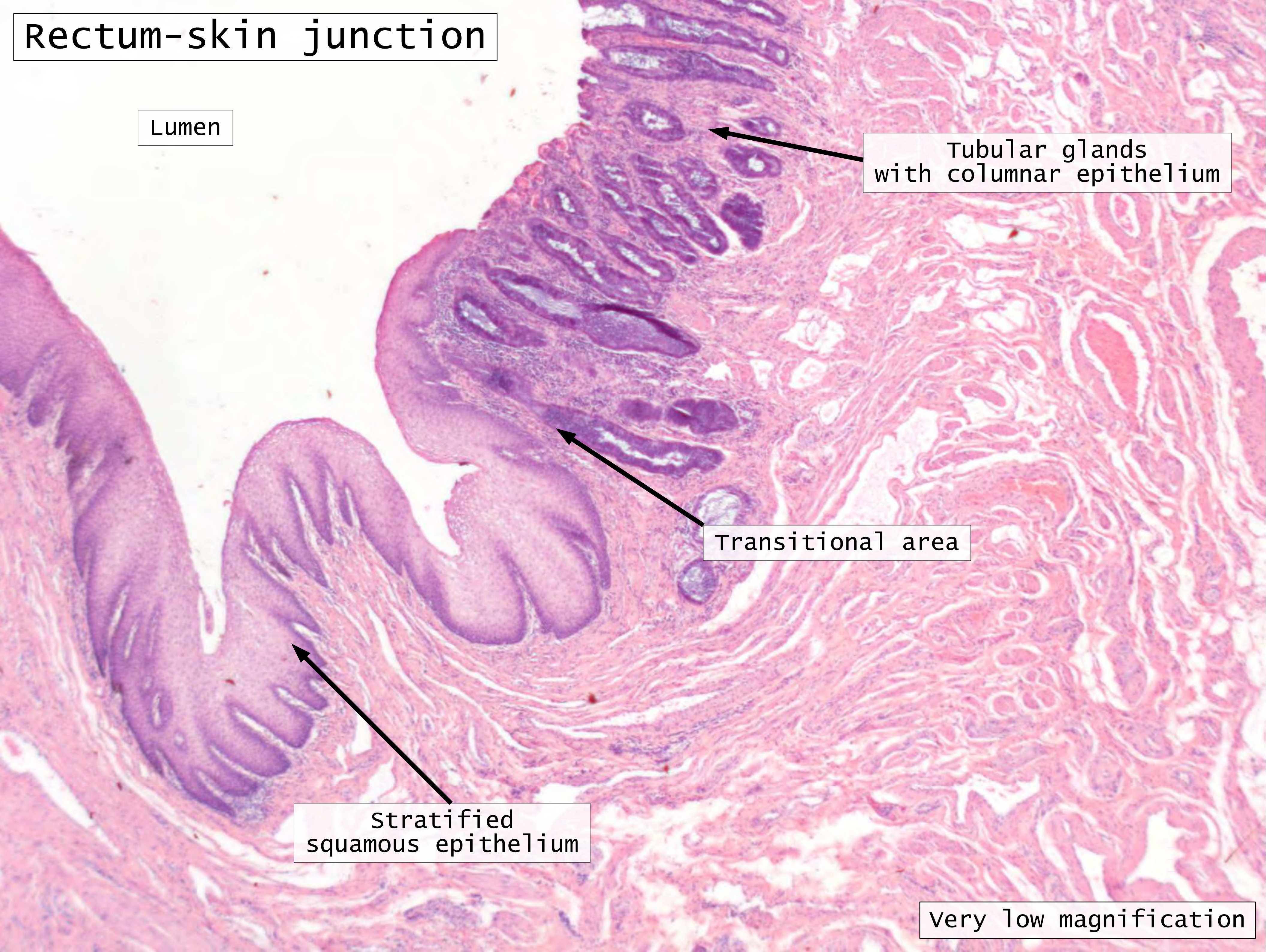
Muscularis mucosa
Mucosa
Submucosa
Simple tubular gland
Lamina propria
Goblet cells
Triangular nuclei

Rectum-anal-skin junction

Slide 45

Rectum-anal-skin junction

- All expected layers present
  - Mucosa
  - Submucosa
  - External muscle layer
  - Serosa and/or adventitia
- Important feature
  - Transition
  - Colon
    - Tubular glands with columnar epithelium
  - Skin
    - Stratified squamous epithelium


Rectum-skin junction
Lumen
Tubular glands
with columnar epithelium
Transitional area
Stratified
squamous epithelium
Very low magnification

Glands of the GIT

- Salivary glands
  - Parotid
  - Sublingual
  - Submandibular
- Pancreas – slide 50
- Liver – slides 46, 48, 68 & 110

  \+ Gallbladder as associated structure

Question

What are the two types of exocrine secretions in the respiratory and digestive tracks?

Supply technical and common terms.

Two types of secretions of the respiratory and digestive track?

Mucinous = sticky / slimy
Serous = watery

Liver

Slides 46, 48, 68 & 110

Pancreas

Slide 50

Pancreas

Identify microscopically:
Exocrine section
Acini
Centro-acinar cells
Lobules and ducts, blood vessels and connective tissue septae
Endocrine section
Draw and annotate:
A lobe in which part of the exocrine acini are shown in detail.

Pancreas

- Capsule
  - Surrounds the organ
- Exocrine
  - Digestive enzymes into GIT
- Endocrine
  - Hormones into blood

Capsule

- Delicate CT
- Divide into lobules

Exocrine pancreas

- Serous compound tubuloalveolar gland
- Acini
  - Serous cells
- Ducts
  - Begins as centro-acinar cells

Acinar cells

- Pyramidal
- Round basally located nucleus
- Basal area
  - strong basophilic
- Apical region
  - secretory granules
  - = zymogen granules
- No myoepithelial cells

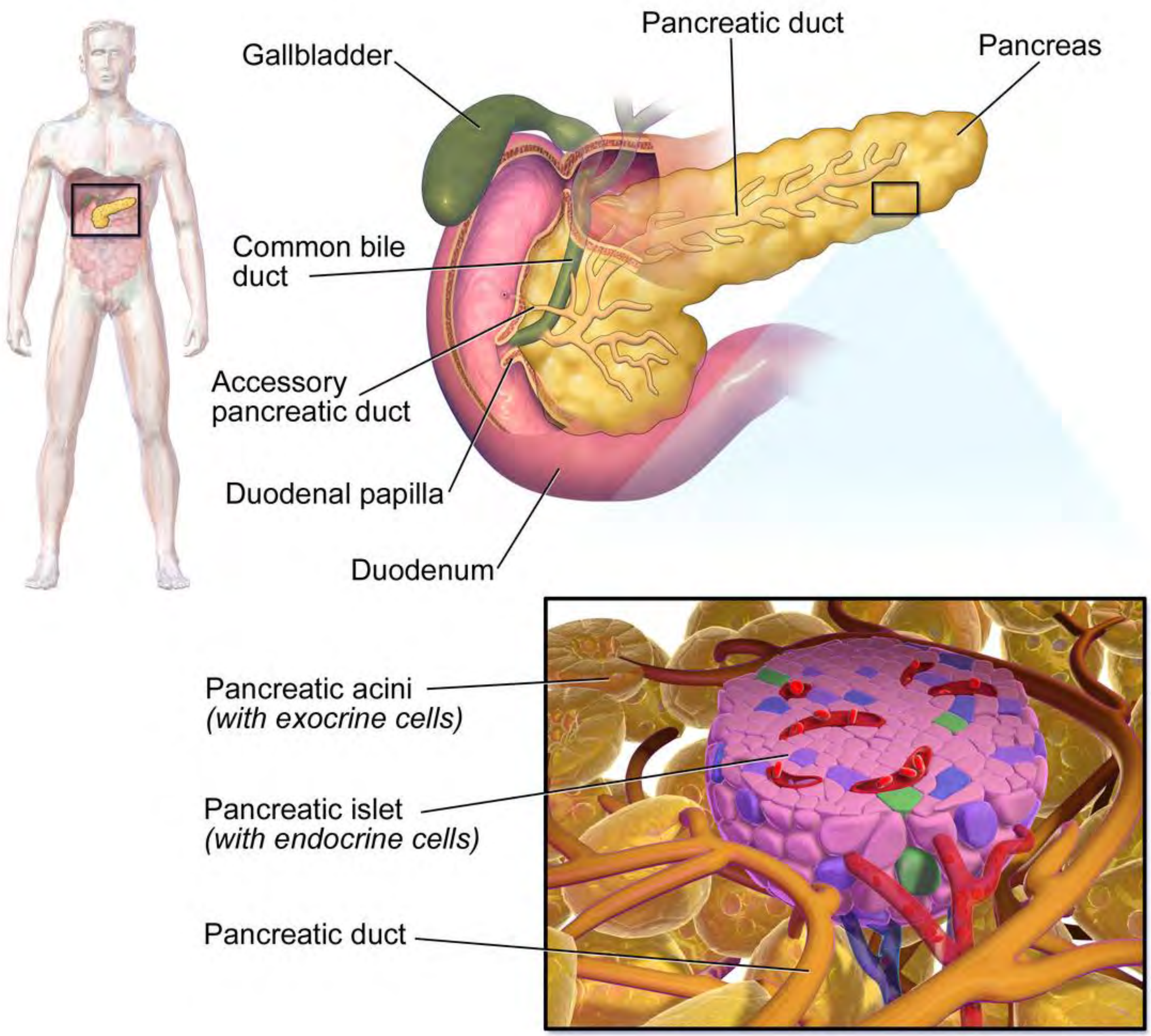
Ducts

- From within acini → duodenum
- Centroacinar cells
  - Low cuboidal
  - Adjacent to lumen of acinus
- Intercalated ducts
- Intralobular ducts
- Interlobular ducts
- Pancreatic duct

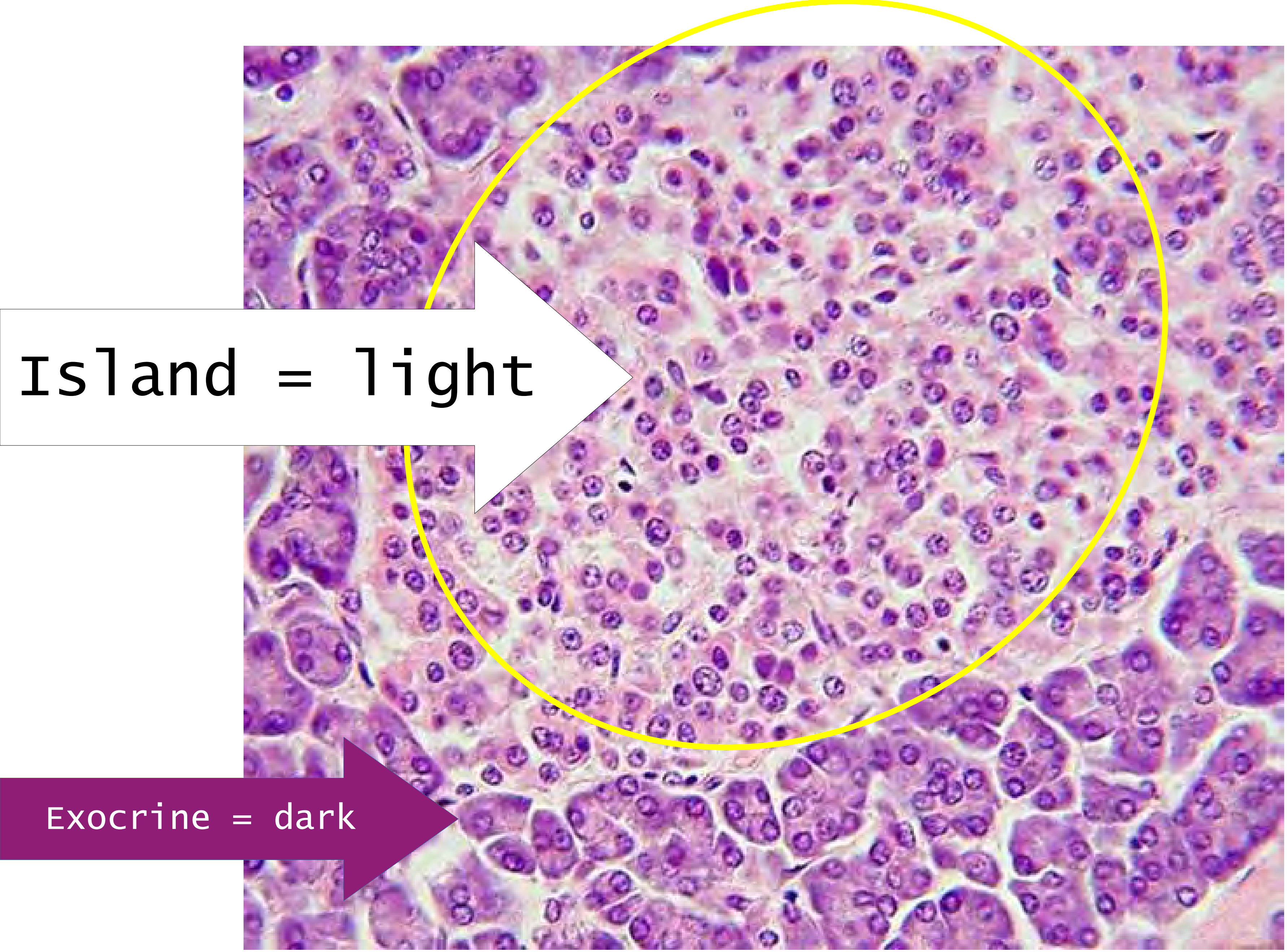
Exocrine pancreas

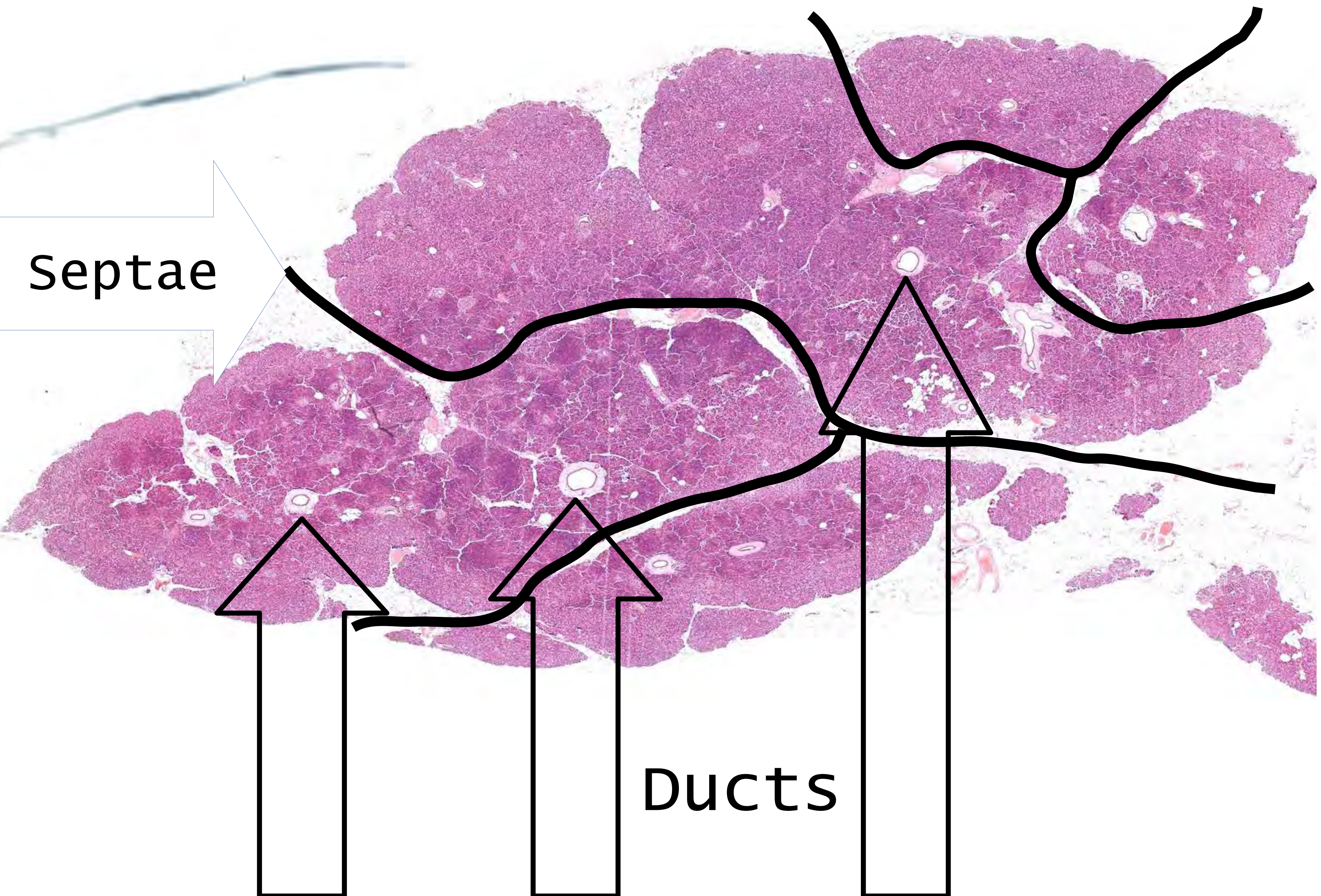
- Islets of Langerhans
  - Spherical clumps
  - Richly vascularized
  - Endocrine cells
  - Embedded in exocrine tissue
- Several cell types – different functions
  - Special stains to differentiate
  - Alpha, Beta, Delta, C, E, G, PP

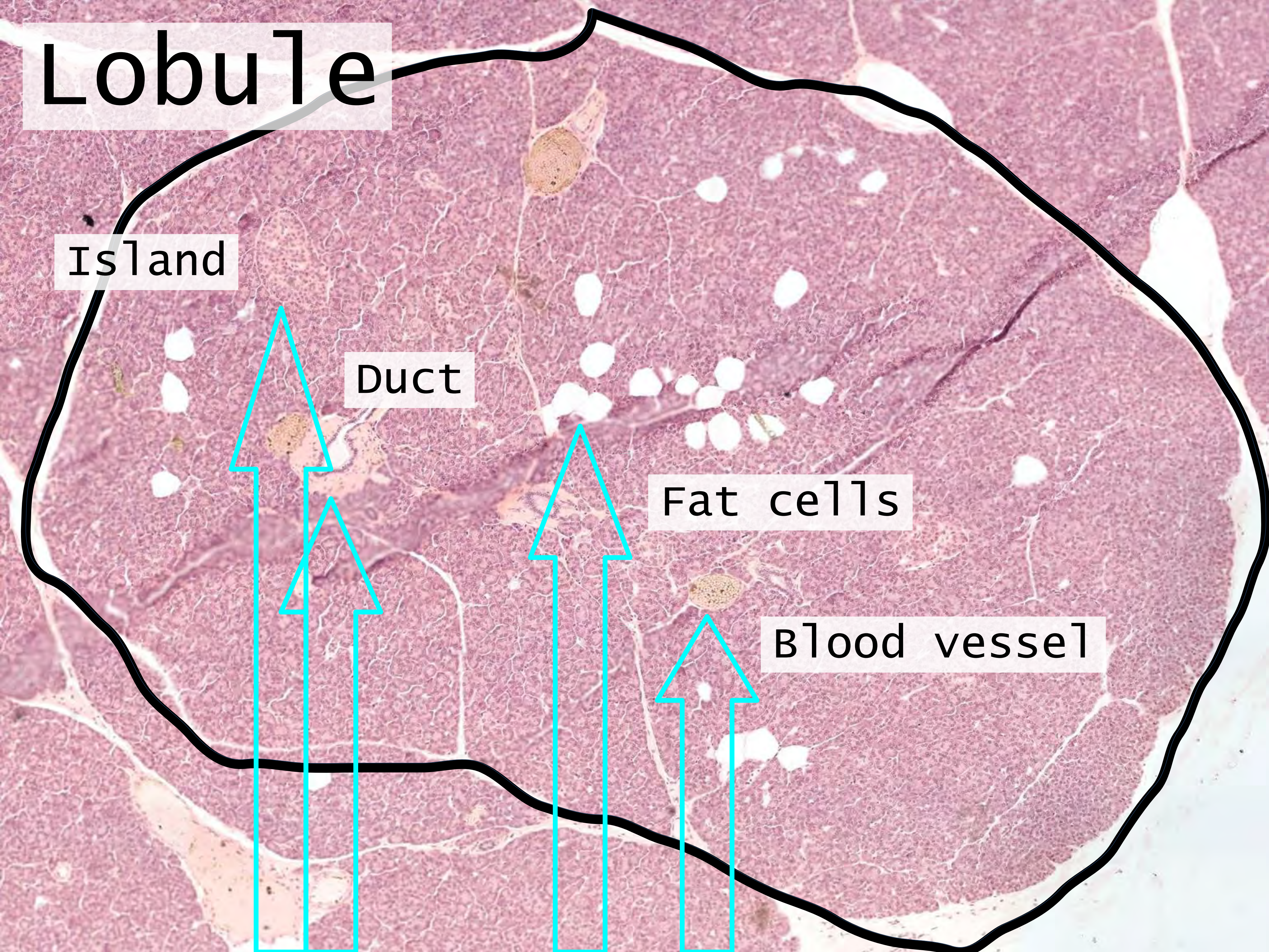
Pancreas

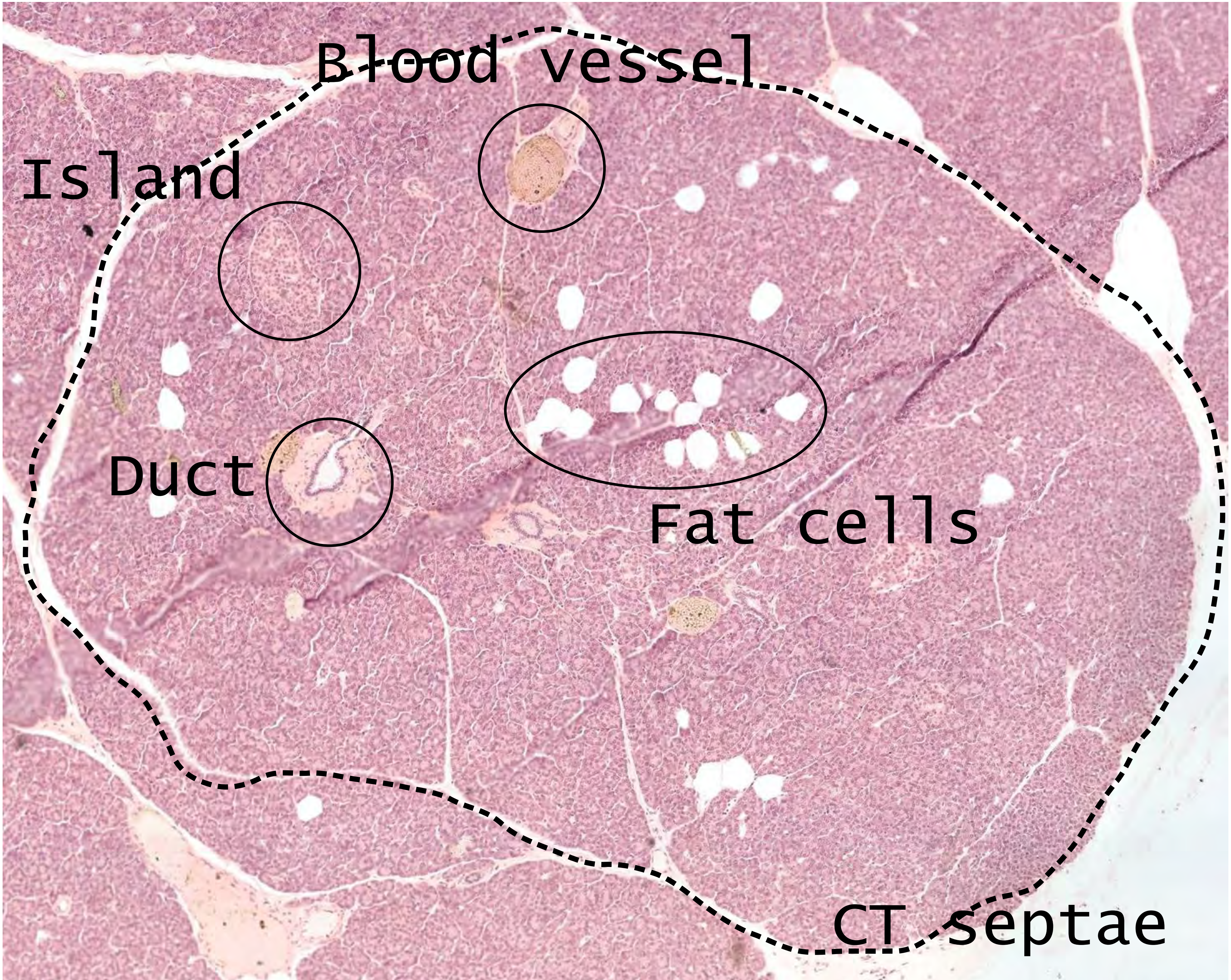

Gallbladder
Pancreatic duct
Pancreas
Common bile duct
Accessory pancreatic duct
Duodenal papilla
Duodenum
Pancreatic acini
(with exocrine cells)
Pancreatic islet
(with endocrine cells)
Pancreatic duct

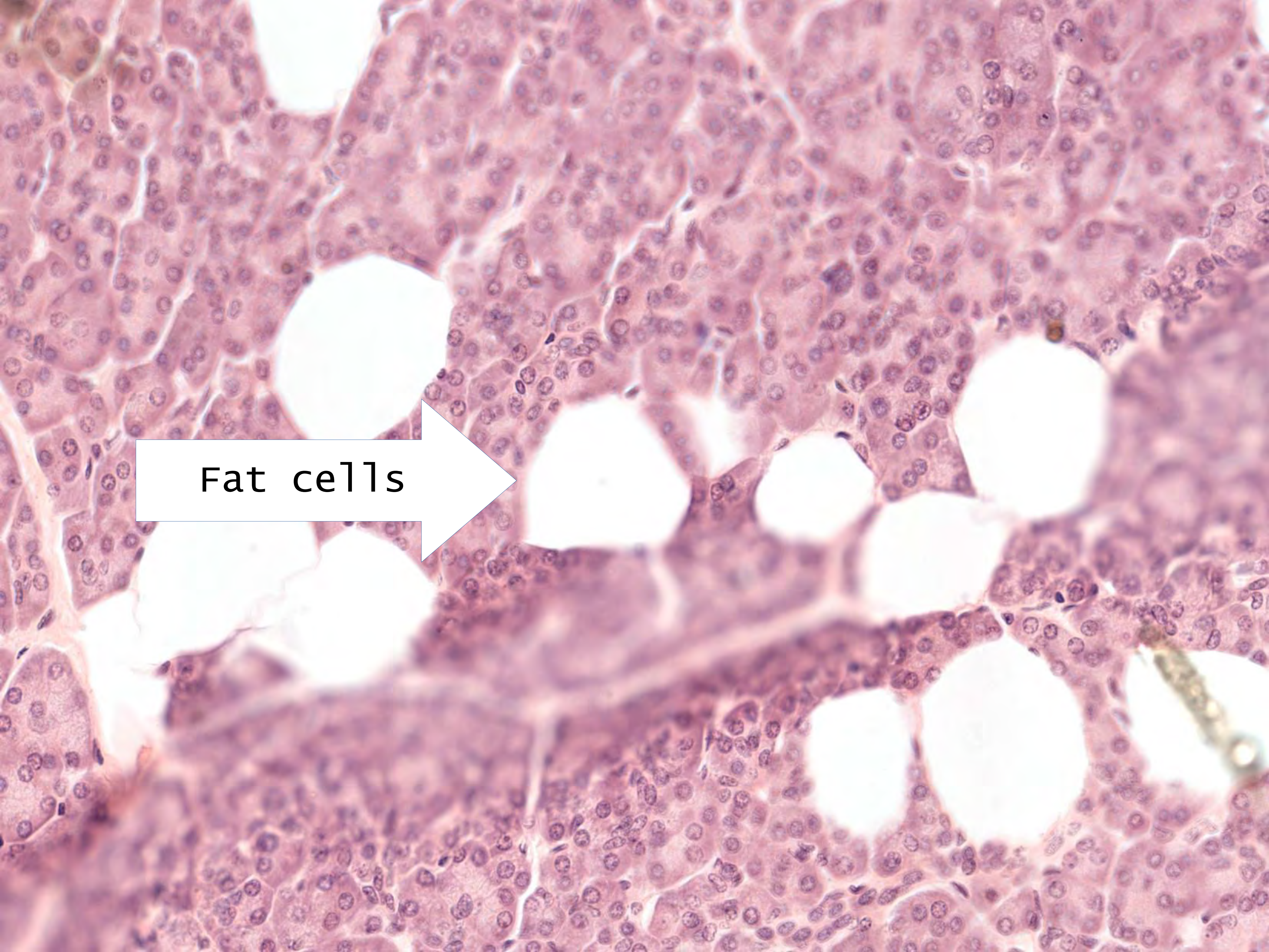
Pancreas

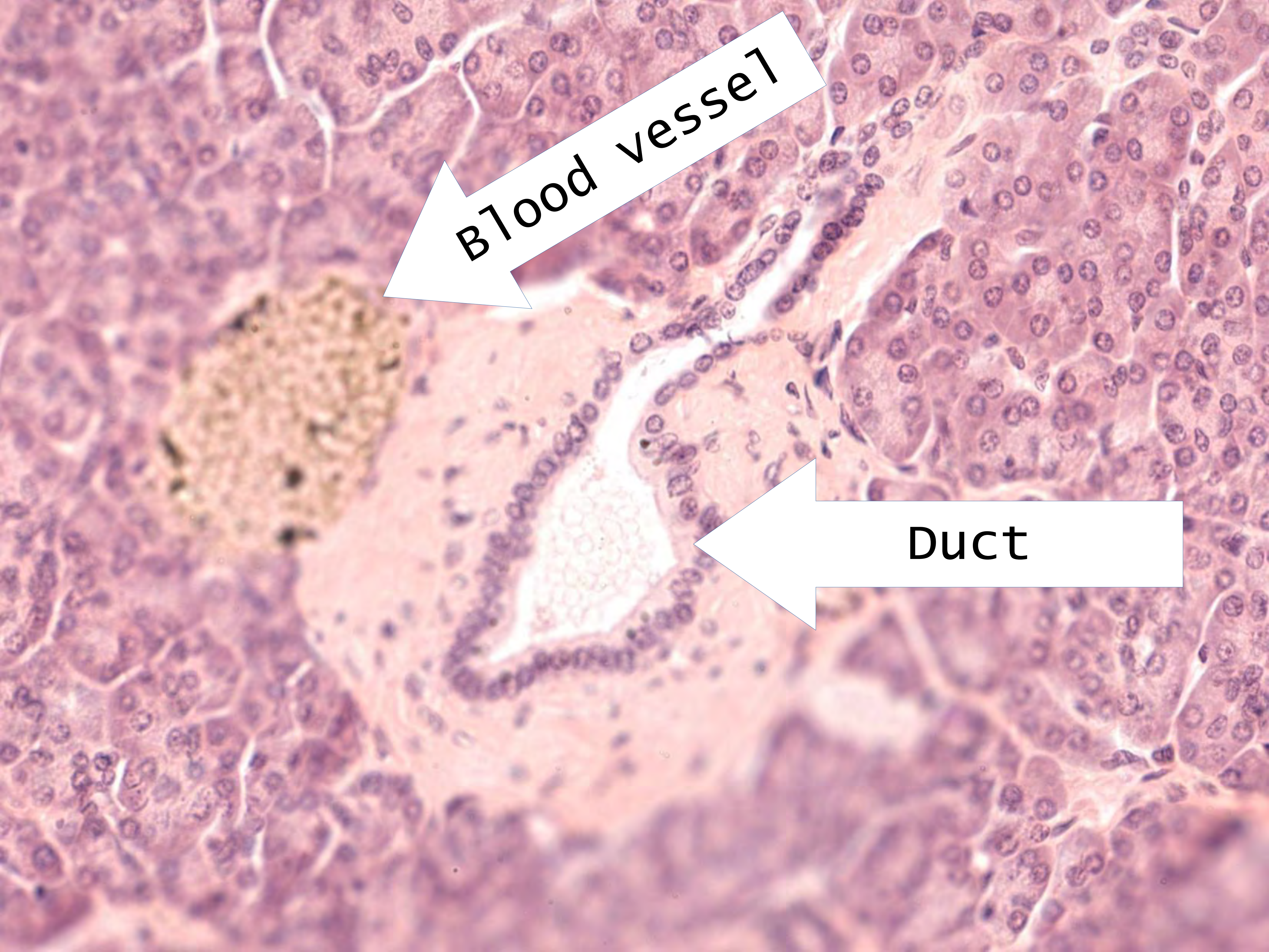


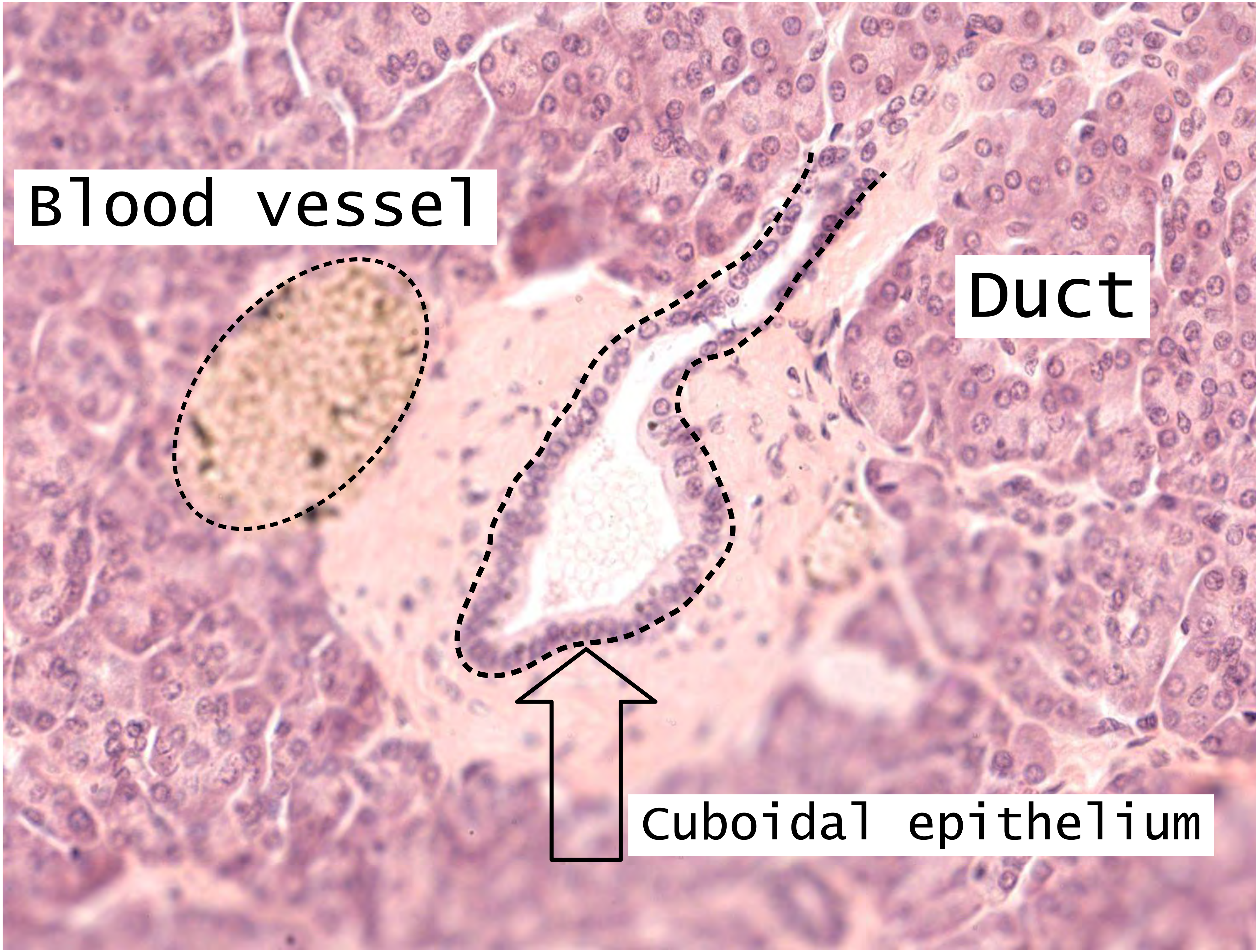

Septae
Ducts


Lobule
Island
Duct
Fat cells
Blood vessel

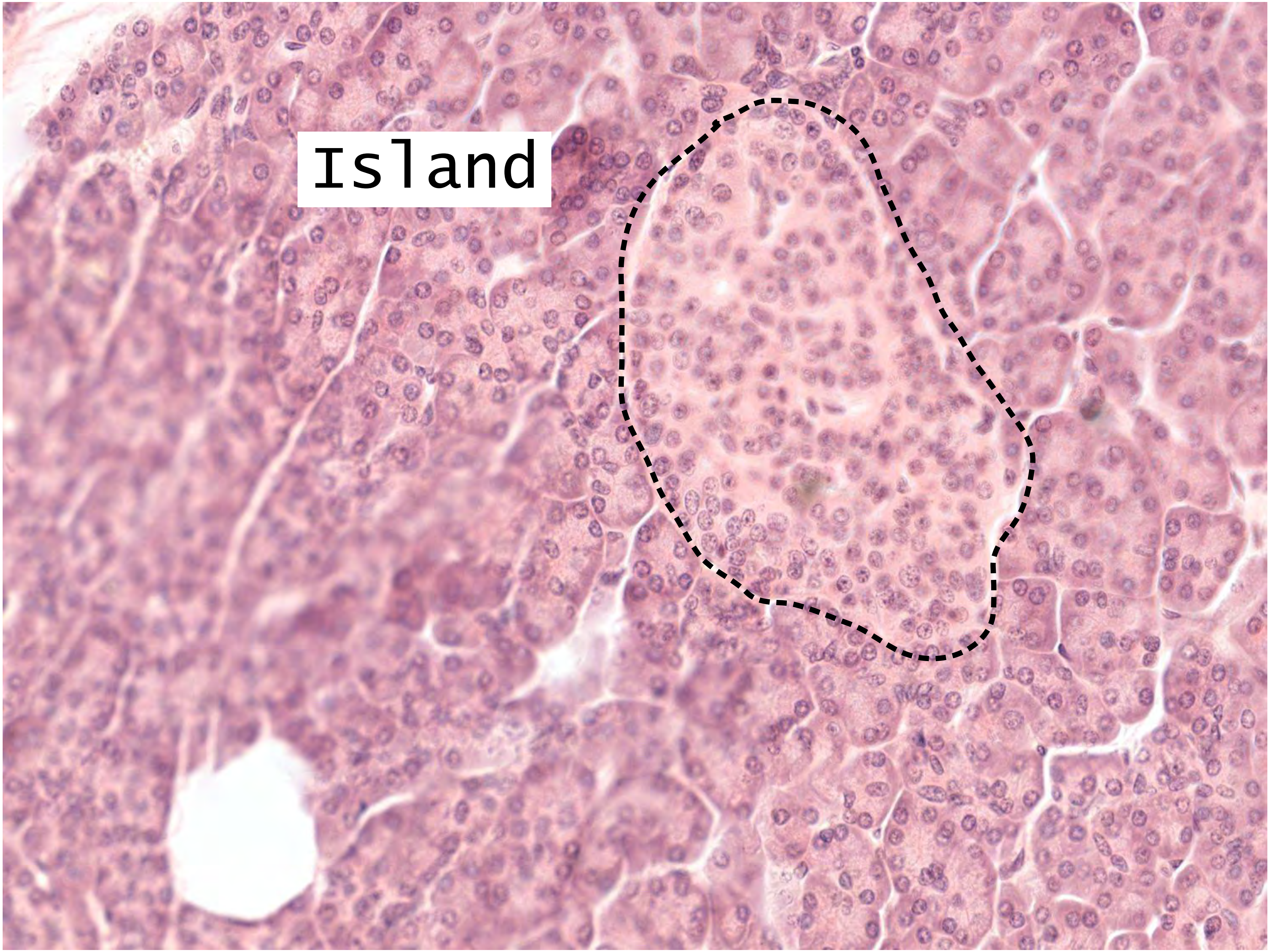

Blood vessel
Island
Duct
Fat cells
CT septae


Fat cells


Blood vessel
Duct


Blood vessel
Duct
Cuboidal epithelium

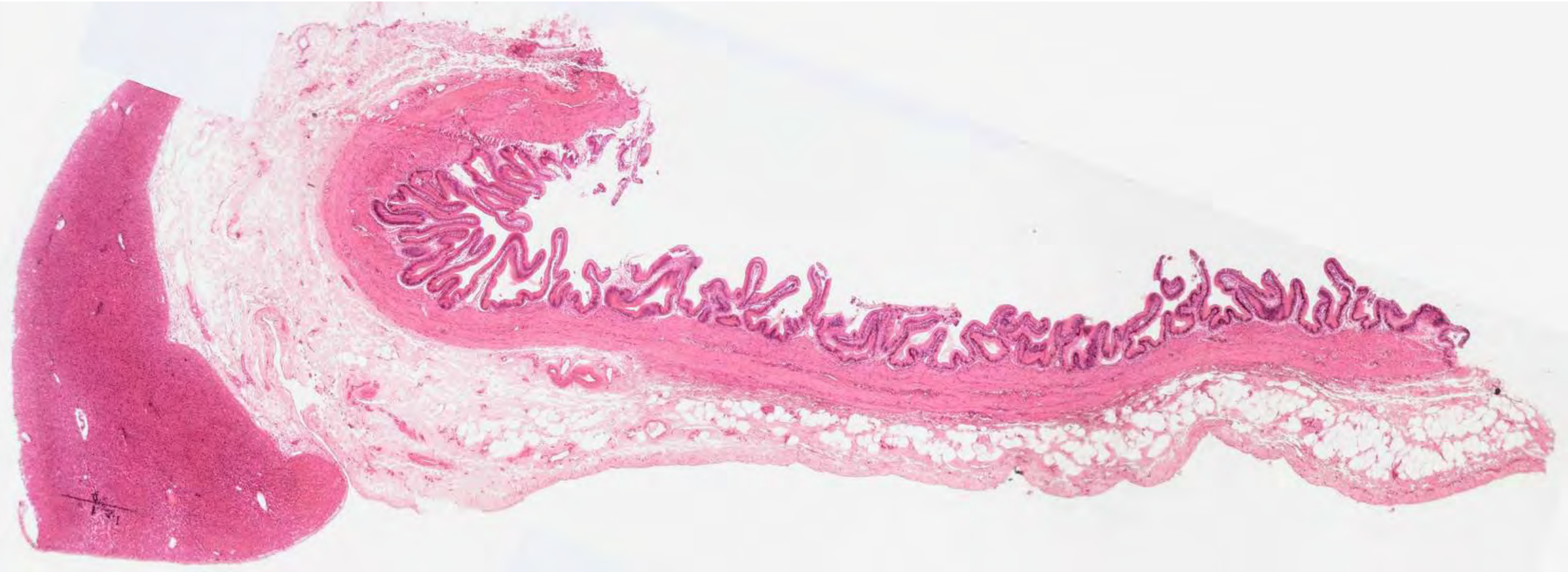

Island
Endocrine tissue


Island

Gallbladder

Slide 58

Gallbladder

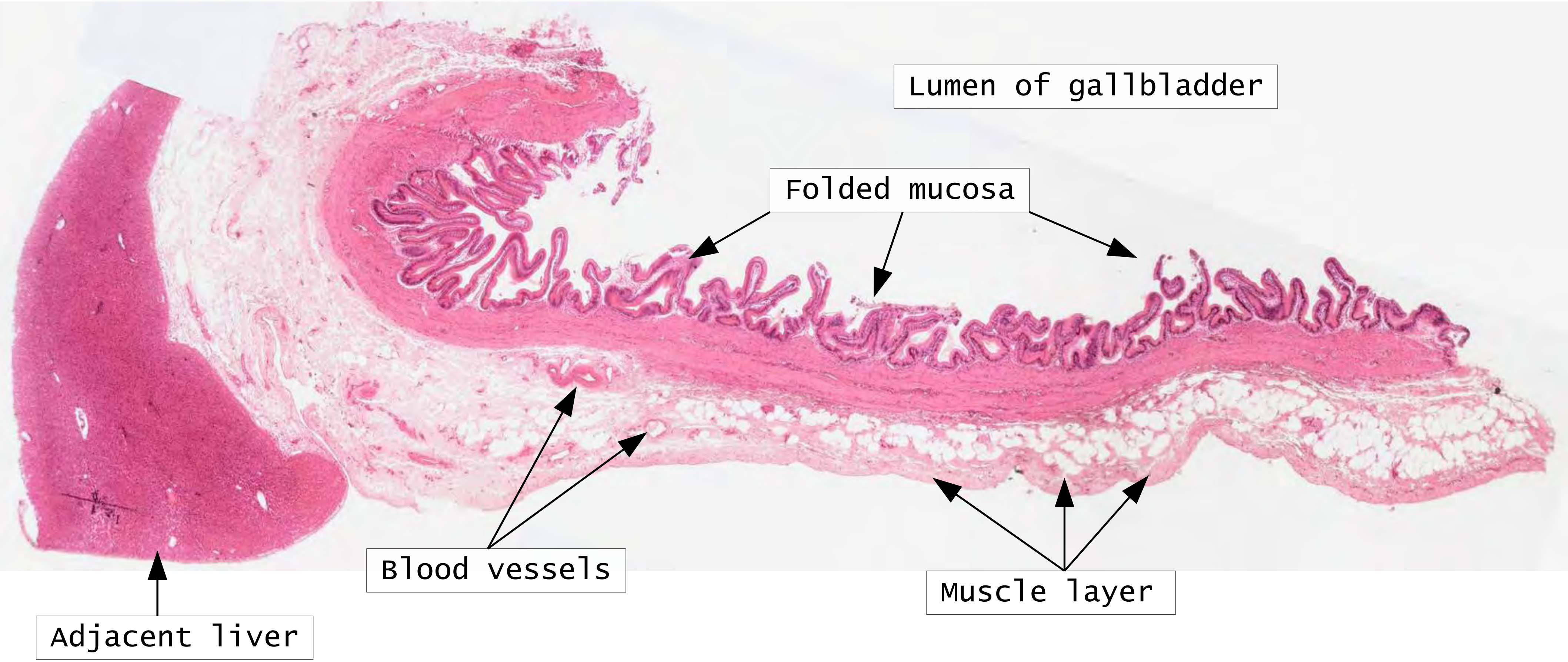


Very low magnification

Gallbladder

- Concentrate – blood vessels
- Store – folds
- Expel bile – muscle layer
- into GIT

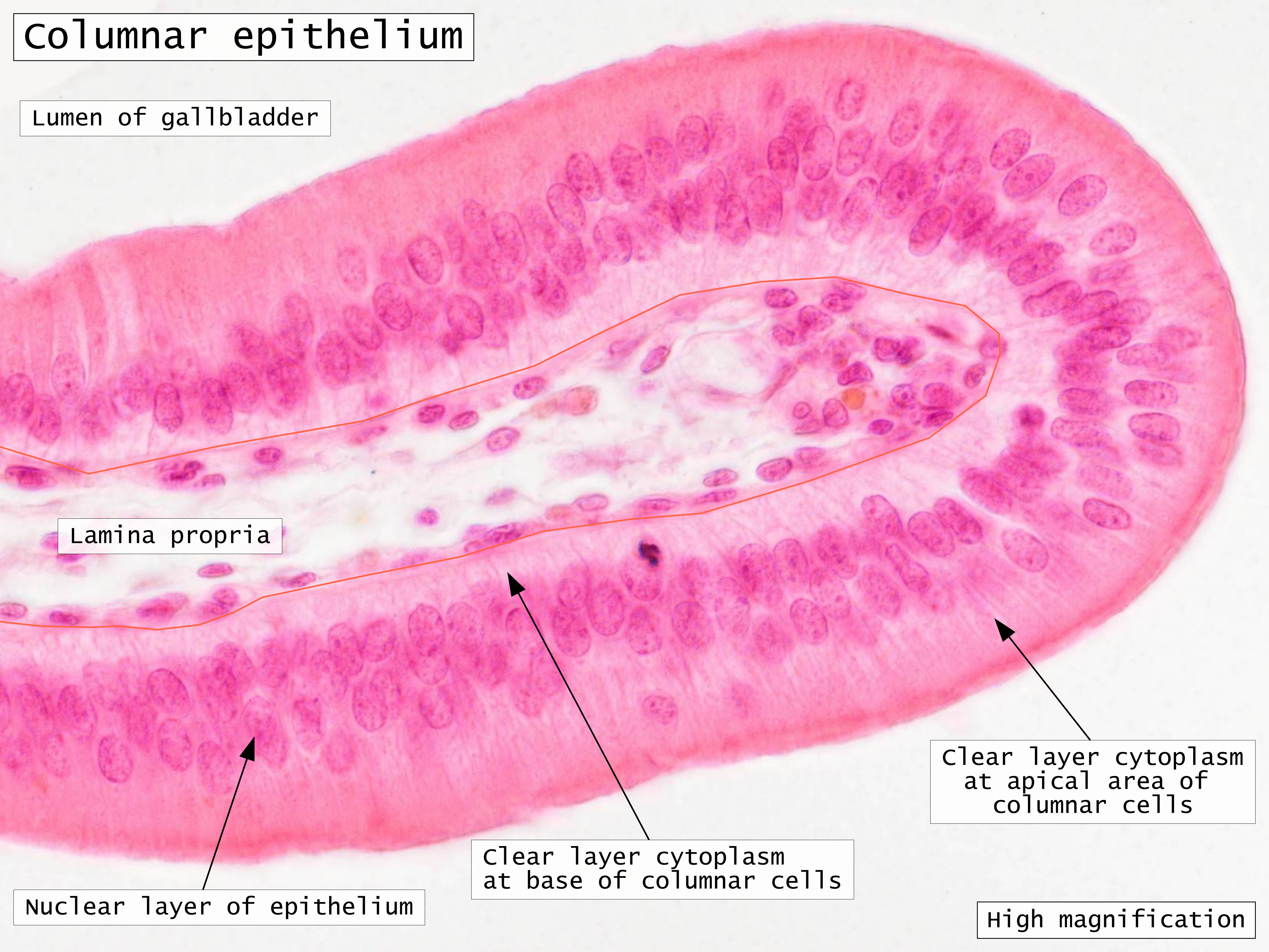
Gallbladder



Very low magnification

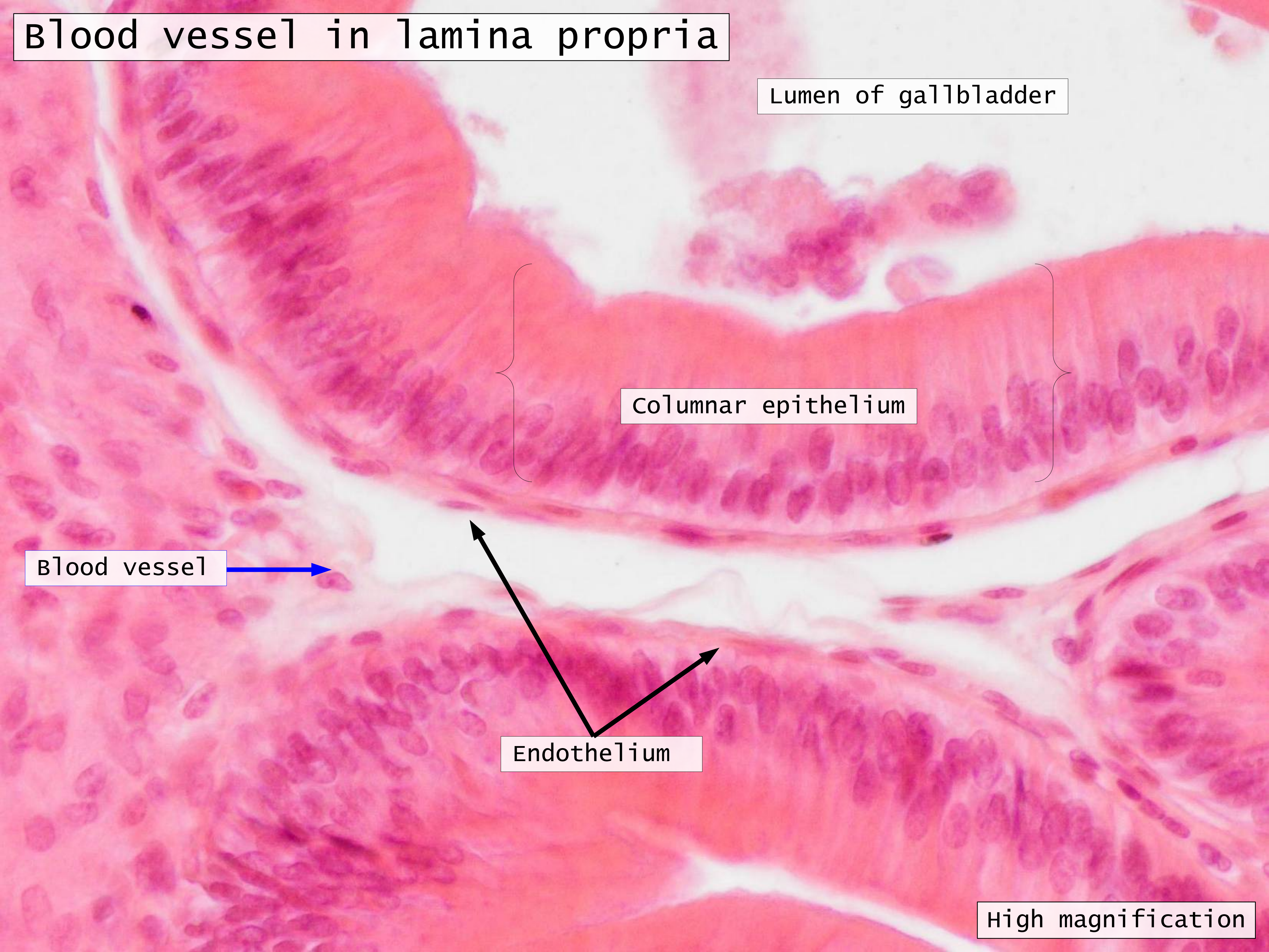
Gallbladder

- Mucosa
  - Simple columnar epithelium
  - Richly vascularized lamina propria
  - Highly convoluted
  - Near systic duct – tubuloalveolar mucous glands
- Smooth muscle layer
  - Thin layer oblique smooth muscle cells
- Dense CT layer
  - Dense irregular CT with nerves & blood vessels
- Serosa
  - Peritoneum
  - Mesothelium with loose CT

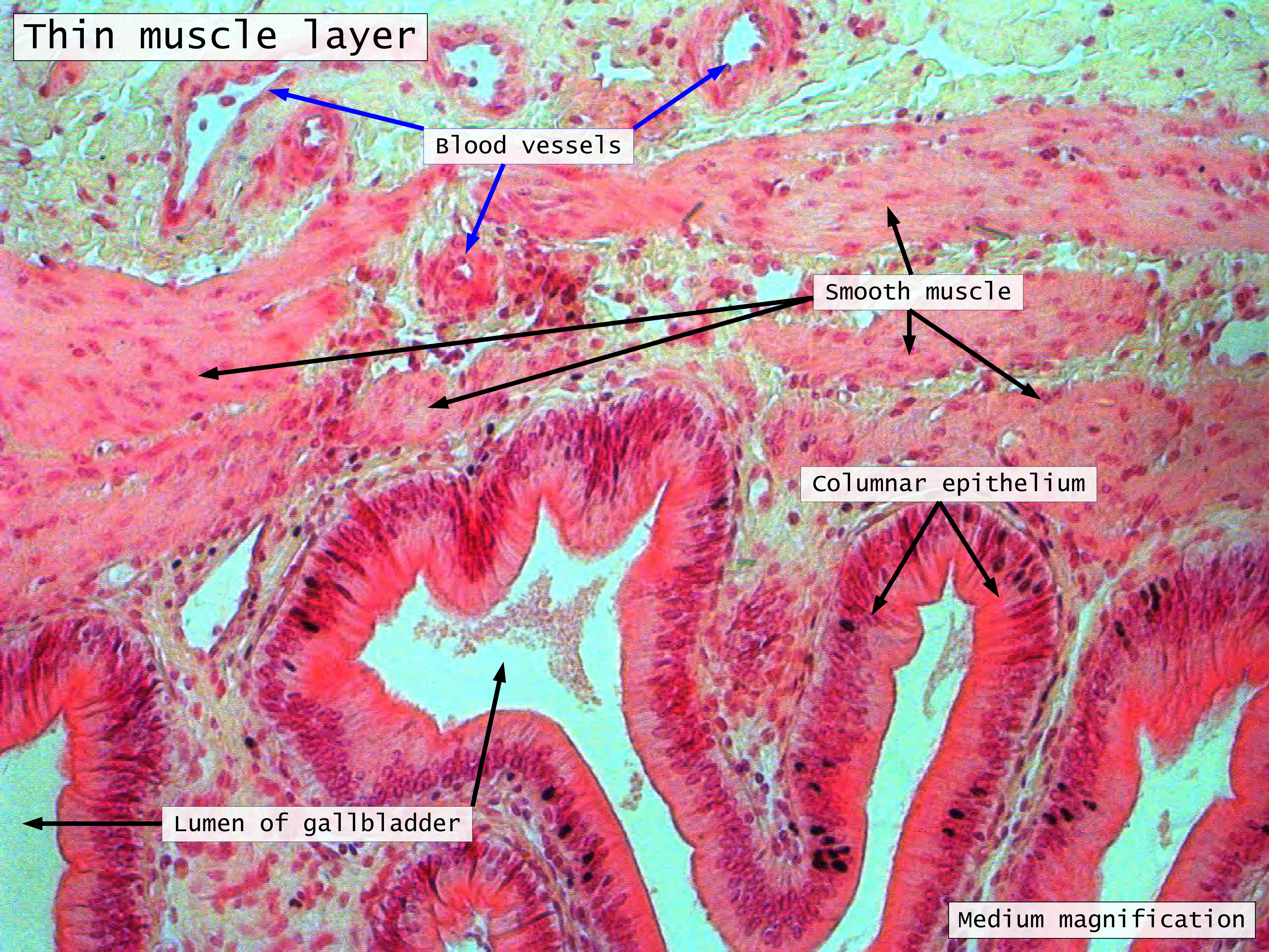

Columnar epithelium
Lumen of gallbladder
Lamina propria
Clear layer cytoplasm at apical area of columnar cells
Clear layer cytoplasm at base of columnar cells
Nuclear layer of epithelium
High magnification

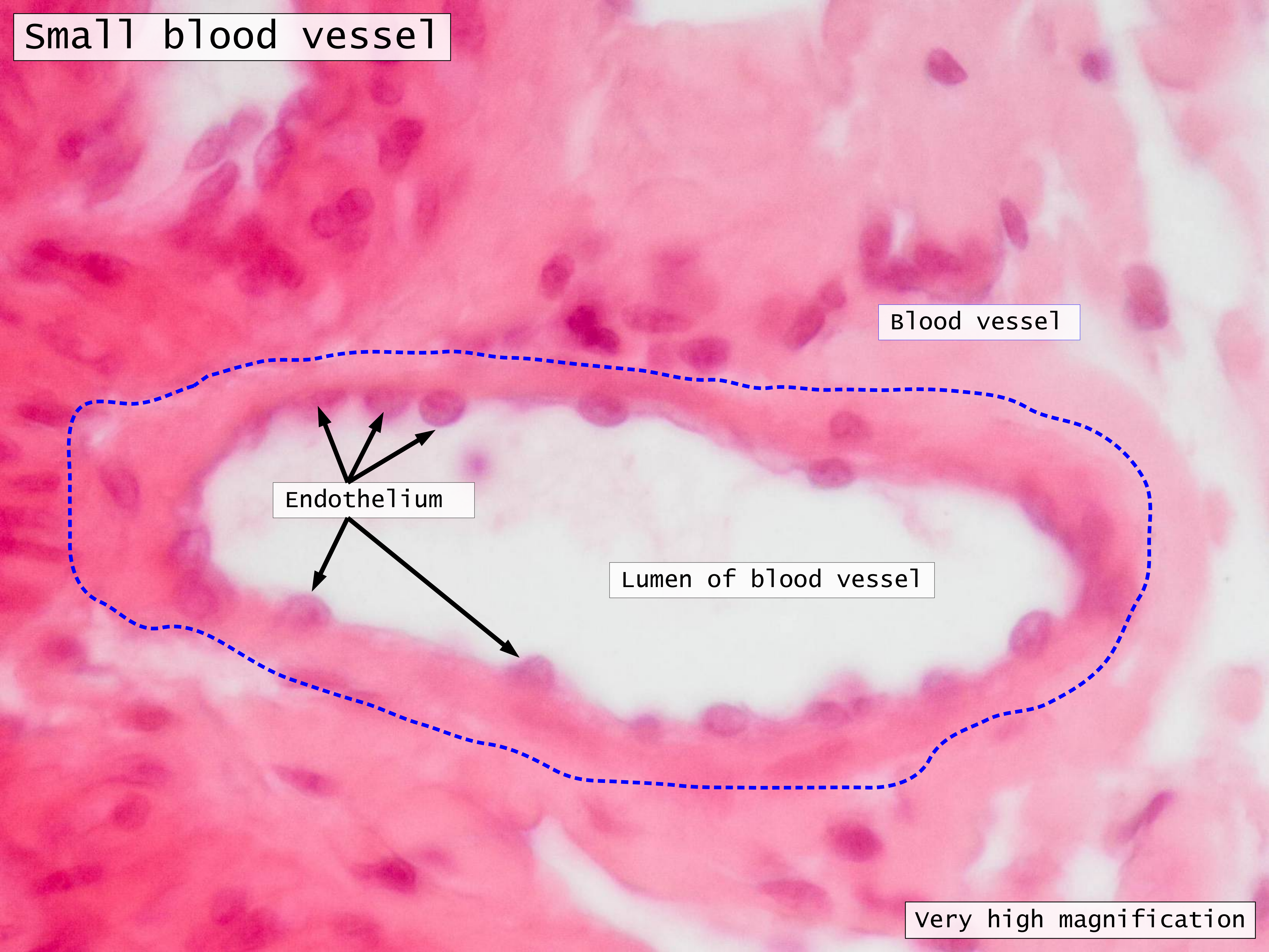
Fold of lamina propria

Medium magnification

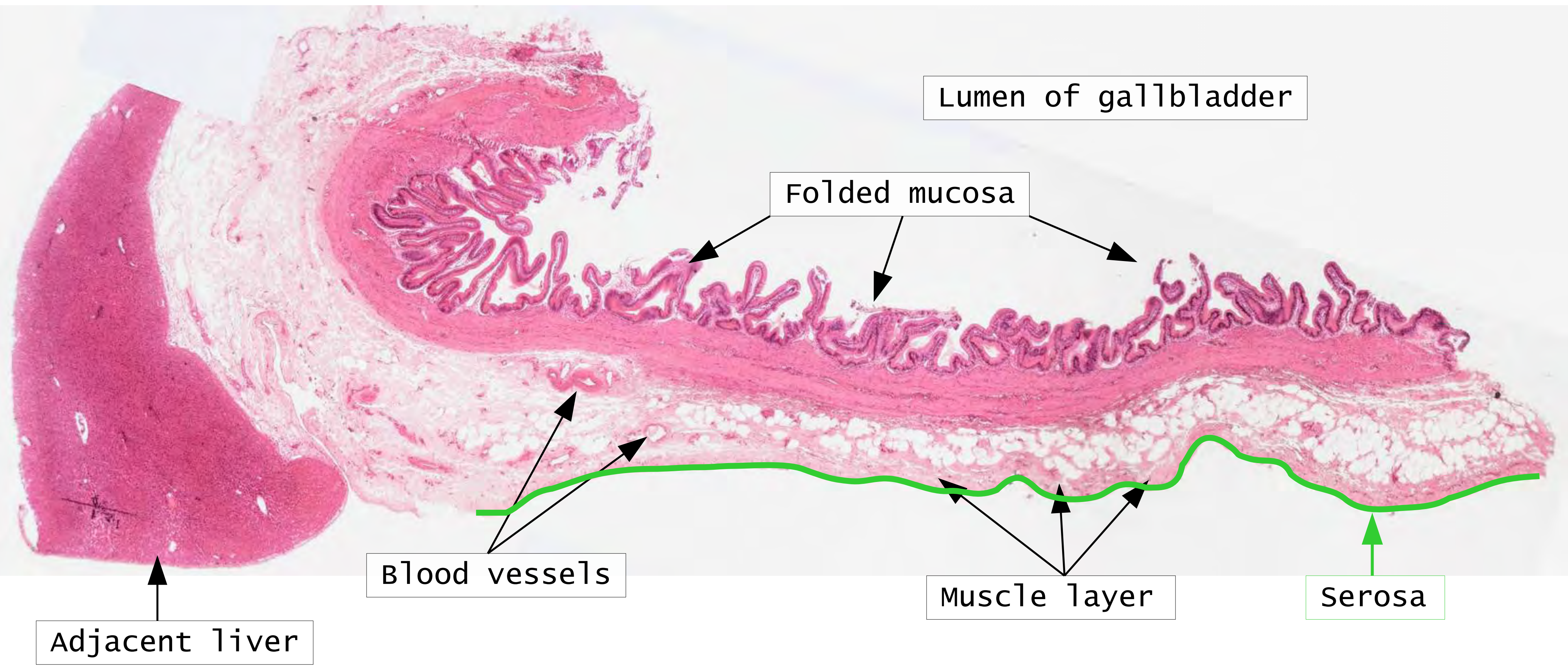

Blood vessel in lamina propria
Lumen of gallbladder
Columnar epithelium
Blood vessel
Endothelium
High magnification


Convoluted lamina propria
Lumen of gallbladder
Medium magnification


Thin muscle layer
Blood vessels
Smooth muscle
Columnar epithelium
Lumen of gallbladder
Medium magnification


Small blood vessel
Blood vessel
Endothelium
Lumen of blood vessel
Very high magnification

Gallbladder



Very low magnification

Liver

46, 48, 68, 110

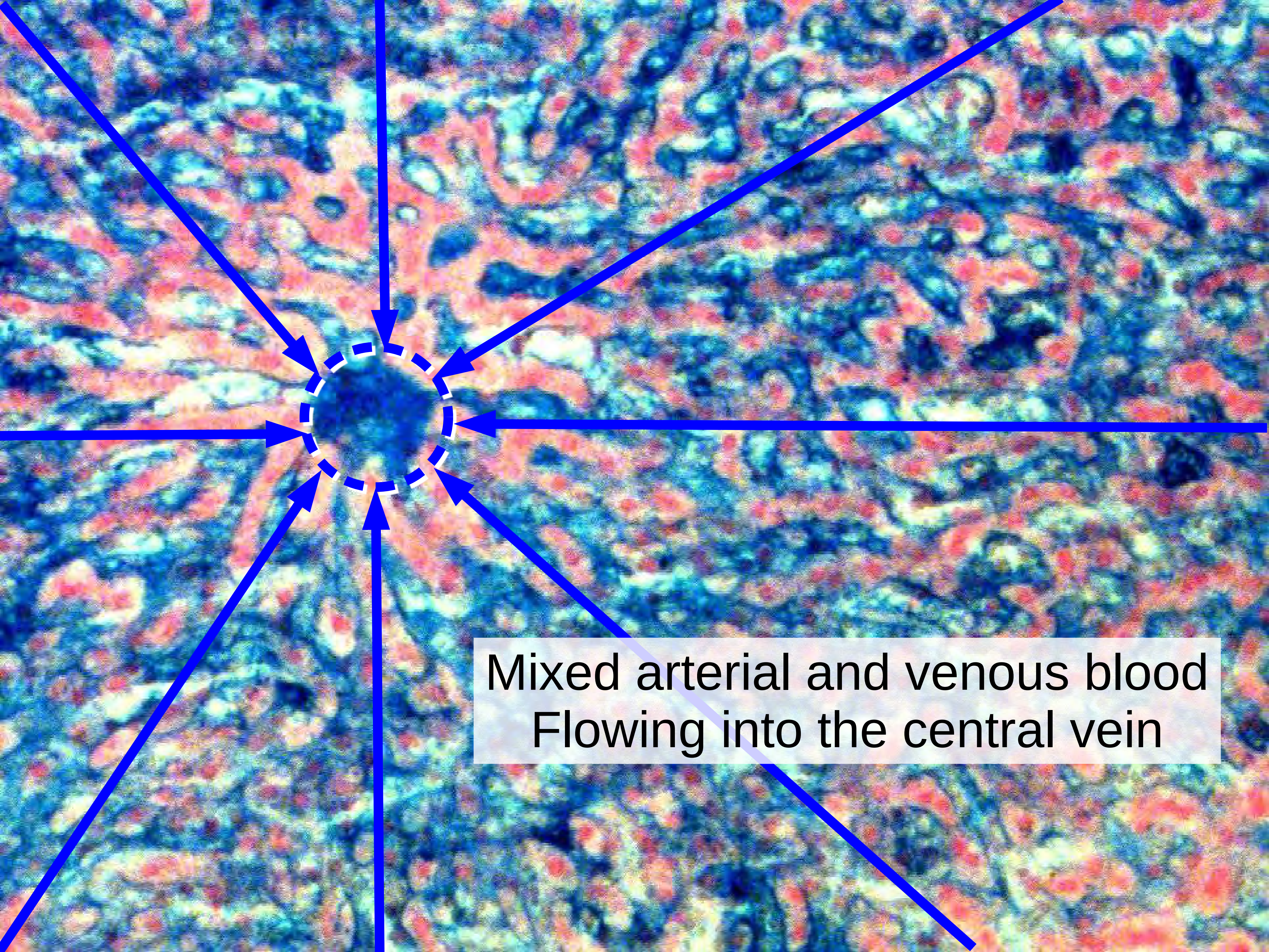
Tasks: Liver

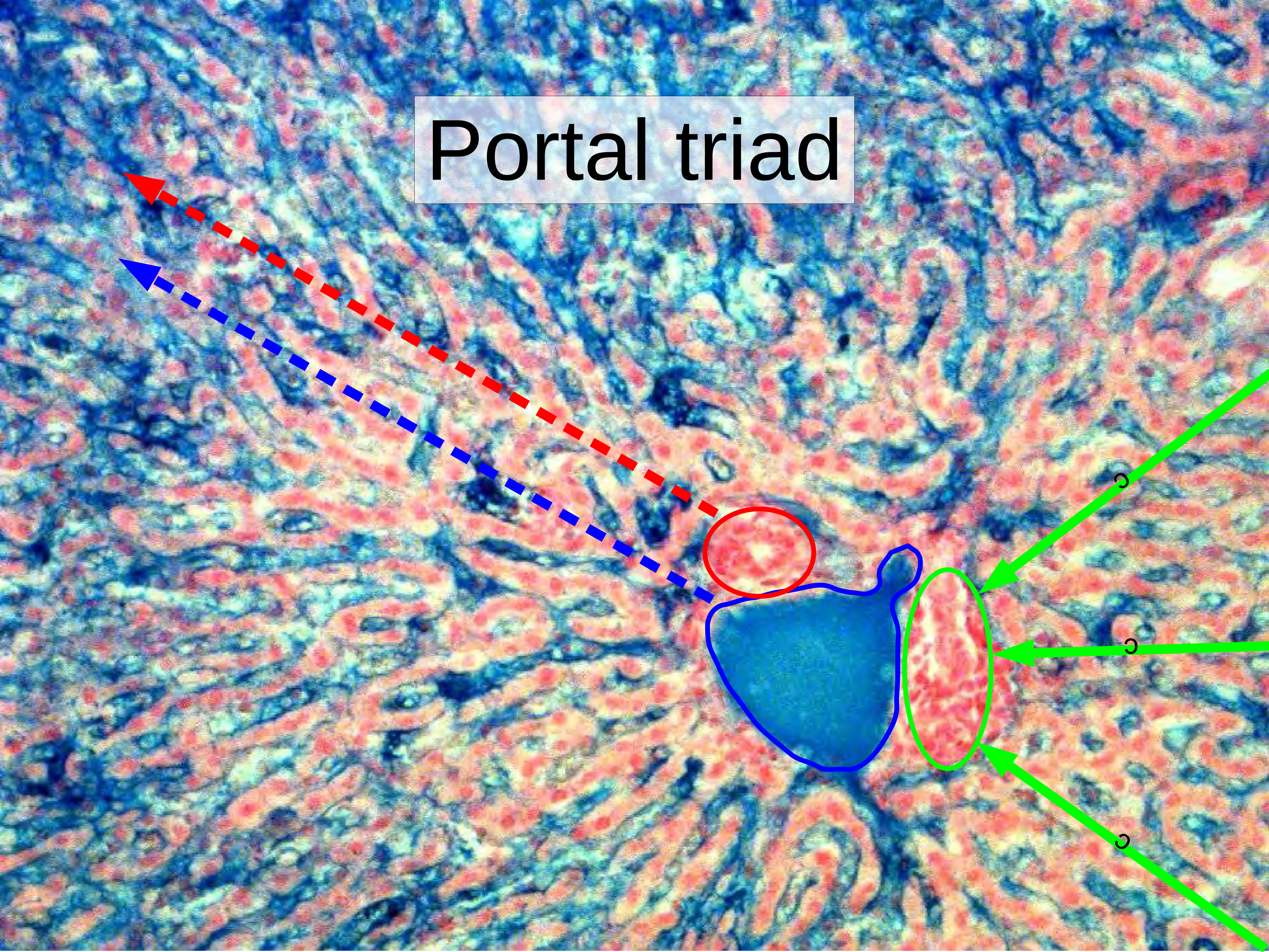
1. Make annotated diagrams of the three alternative views of liver structure.
2. Explain the relevance of each structural unit of the liver.
3. Using the relevant structural unit, explain liver damage seen in the liver.
4. Compare and correlate the annotated diagrams with the histological view of the liver.
5. Complete the drawings for each slide in the practical workbook.

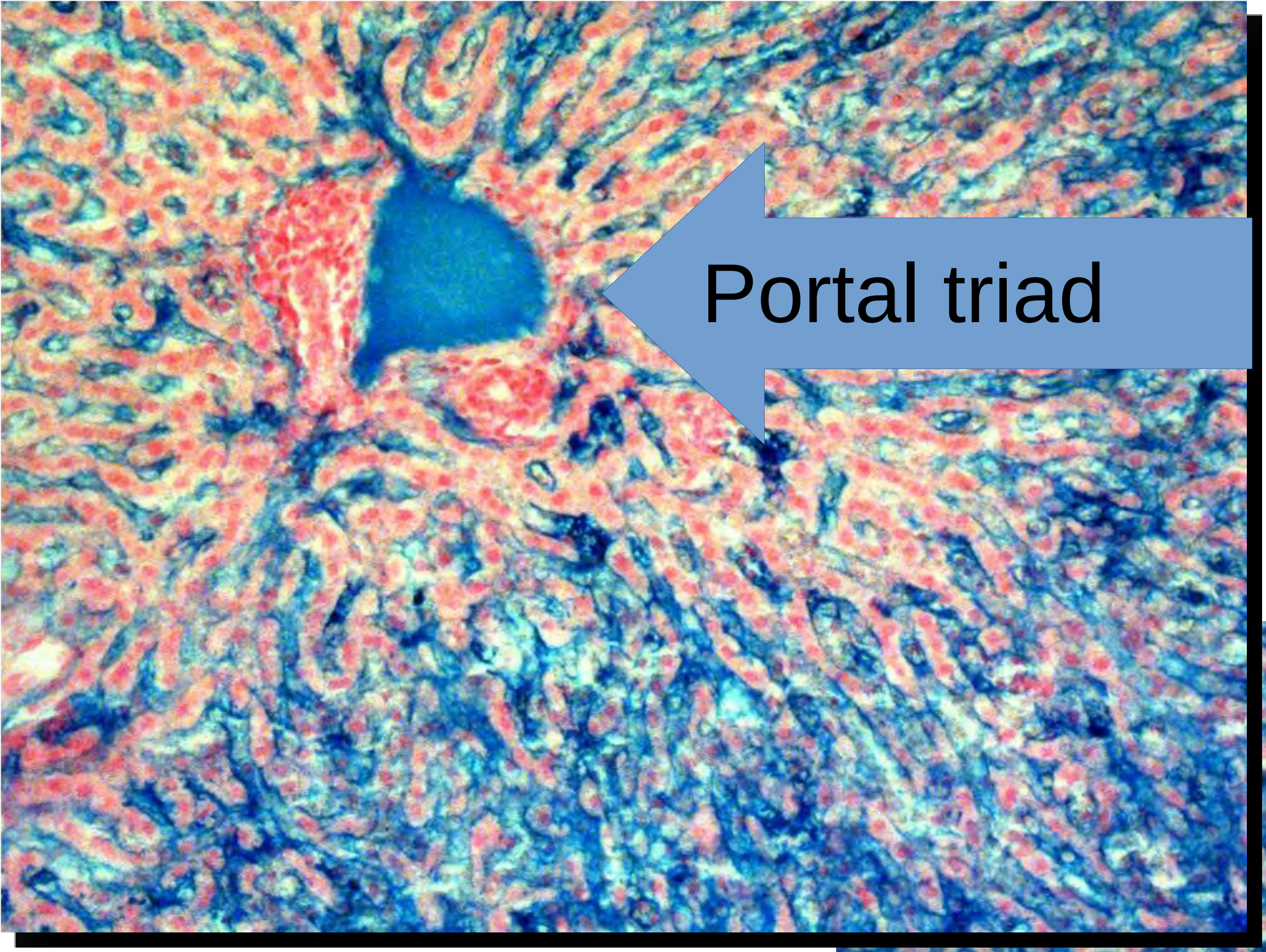
Liver

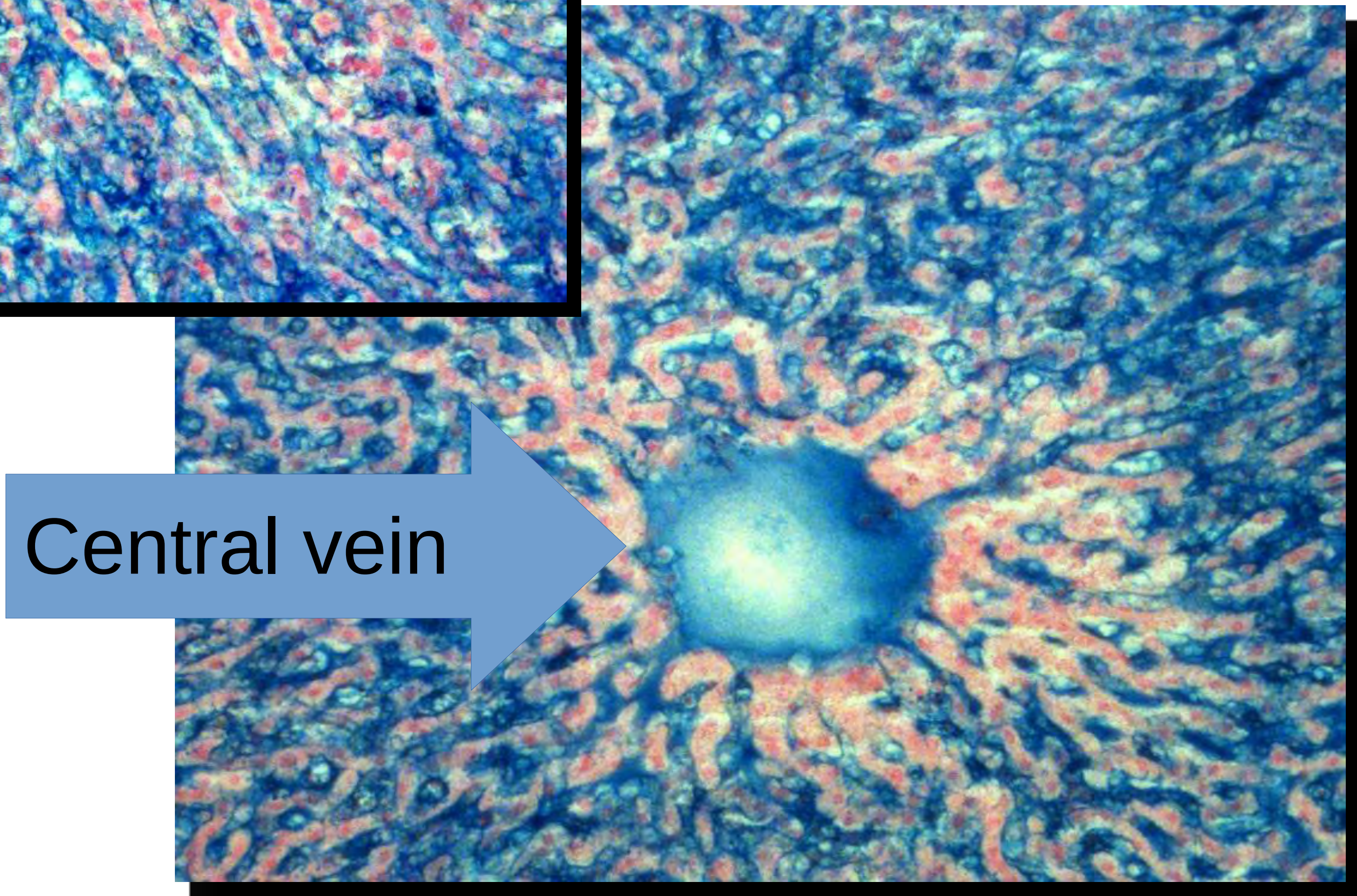
Liver

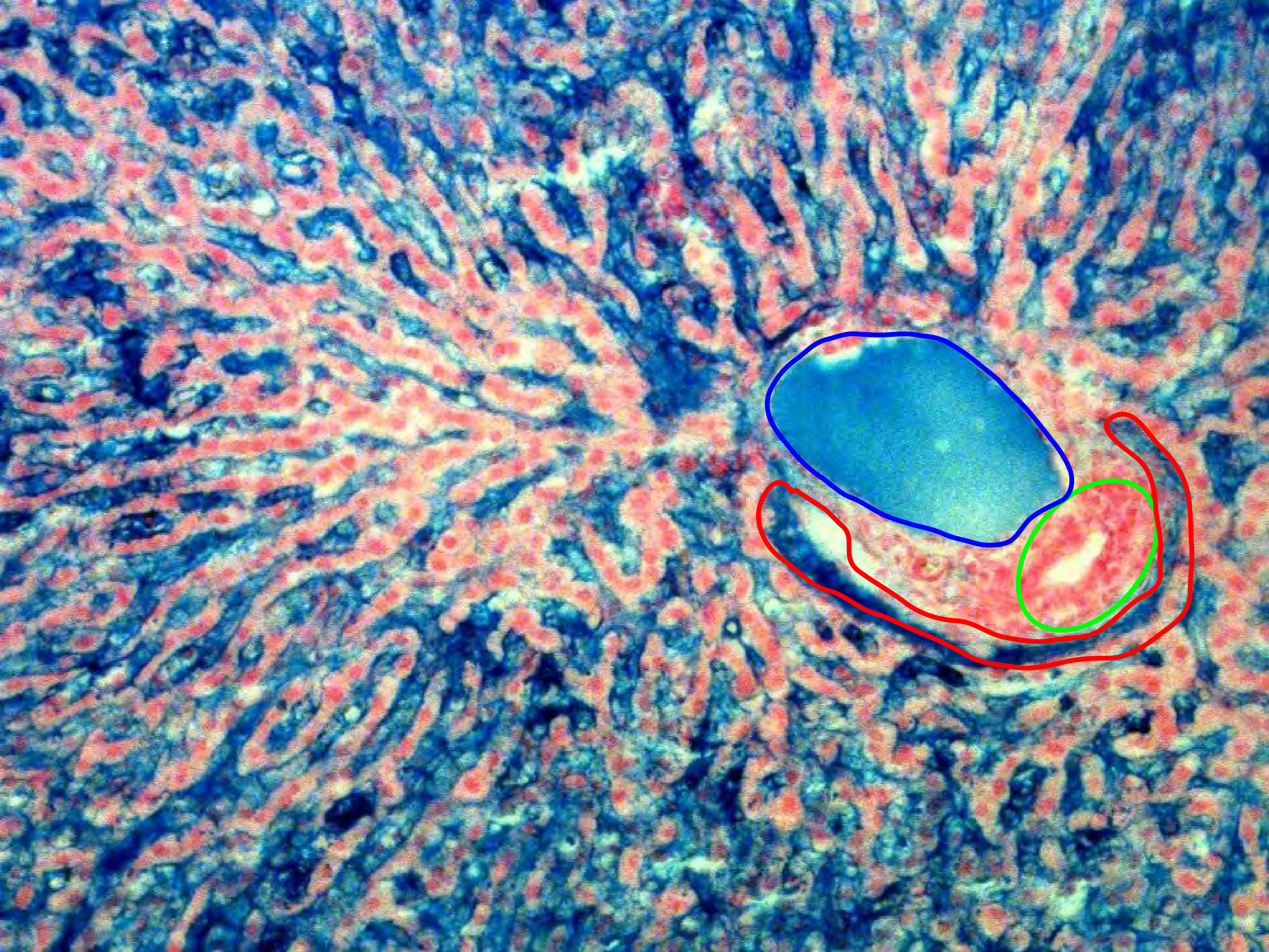
- Liver slides 46, 48, 68 & 110
- Liver arrangement
  - Classic
  - Portal
  - Acinus
- Structures
  - Central vein
  - Portal triad
- Cells in the liver


Mixed arterial and venous blood
Flowing into the central vein

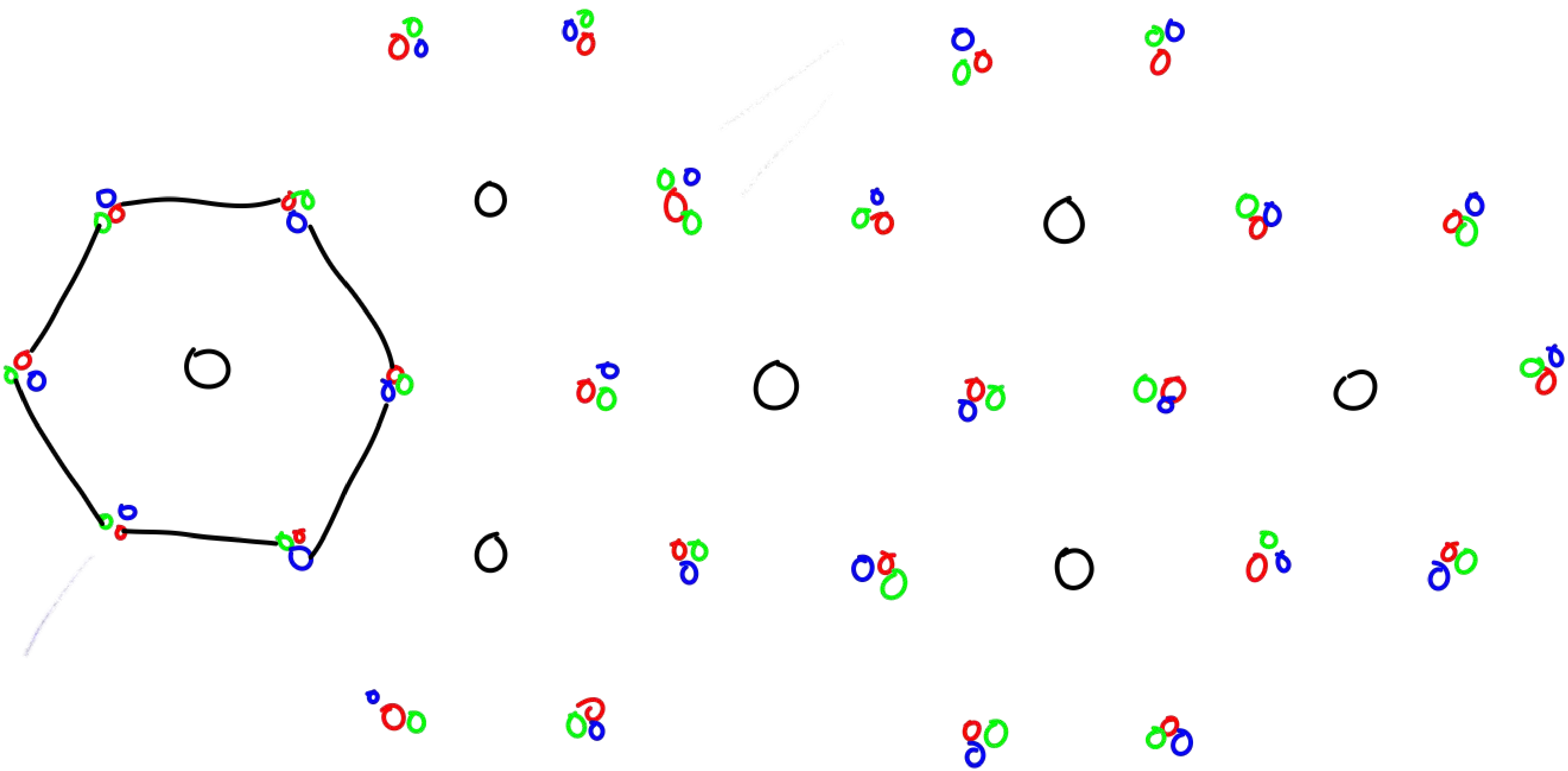

Portal triad


Portal triad

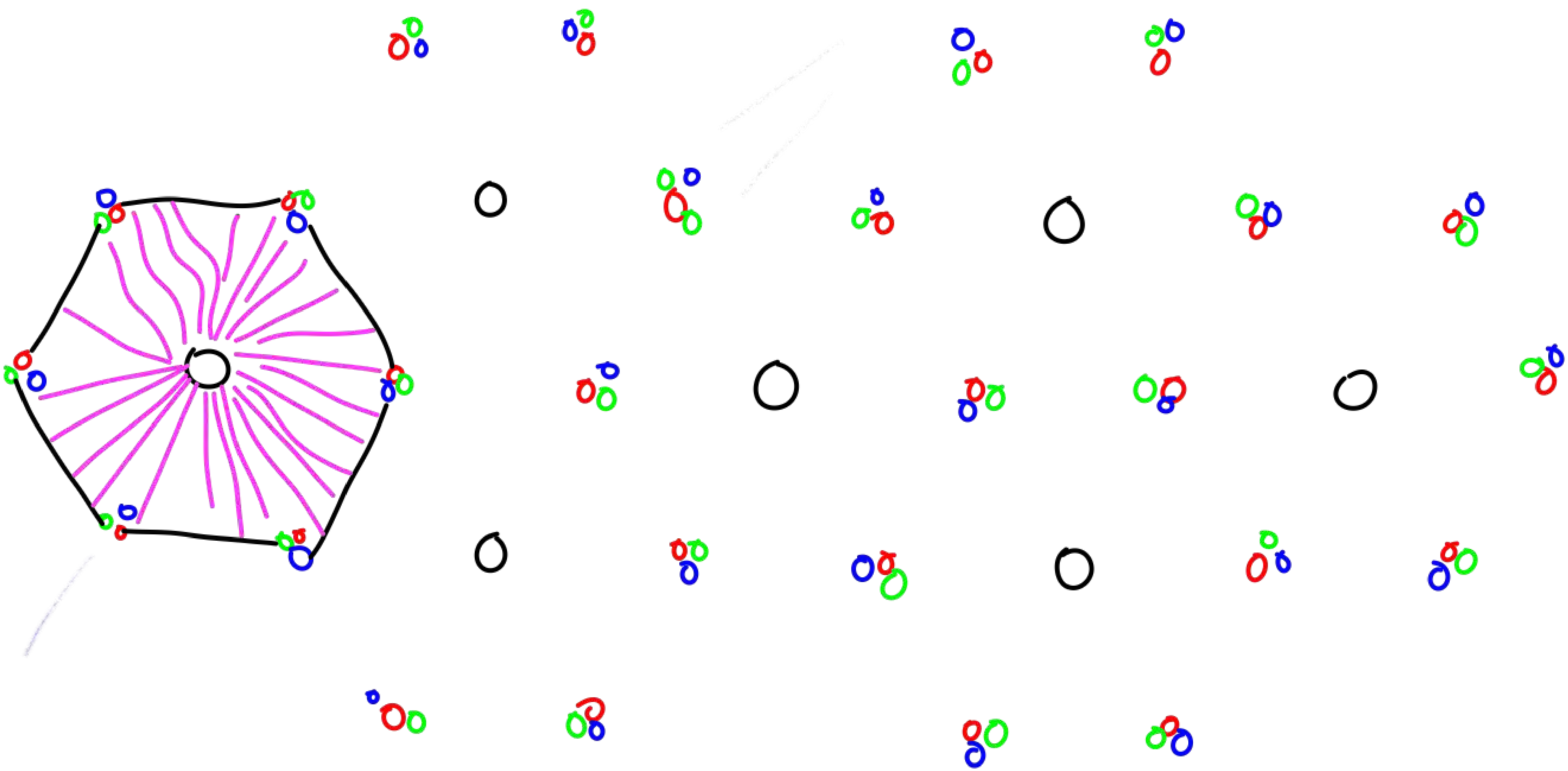

Central vein



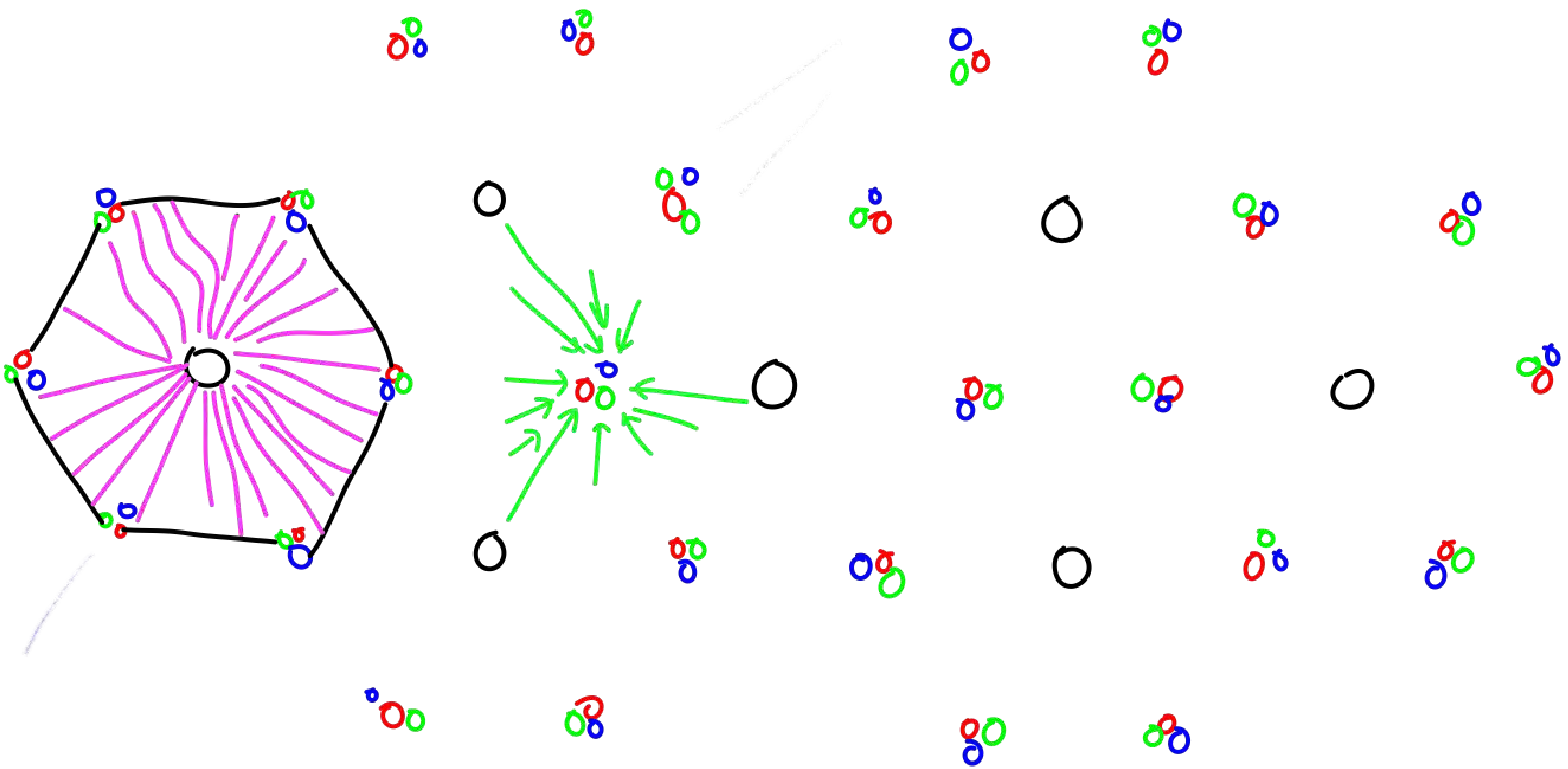
Classic lobule



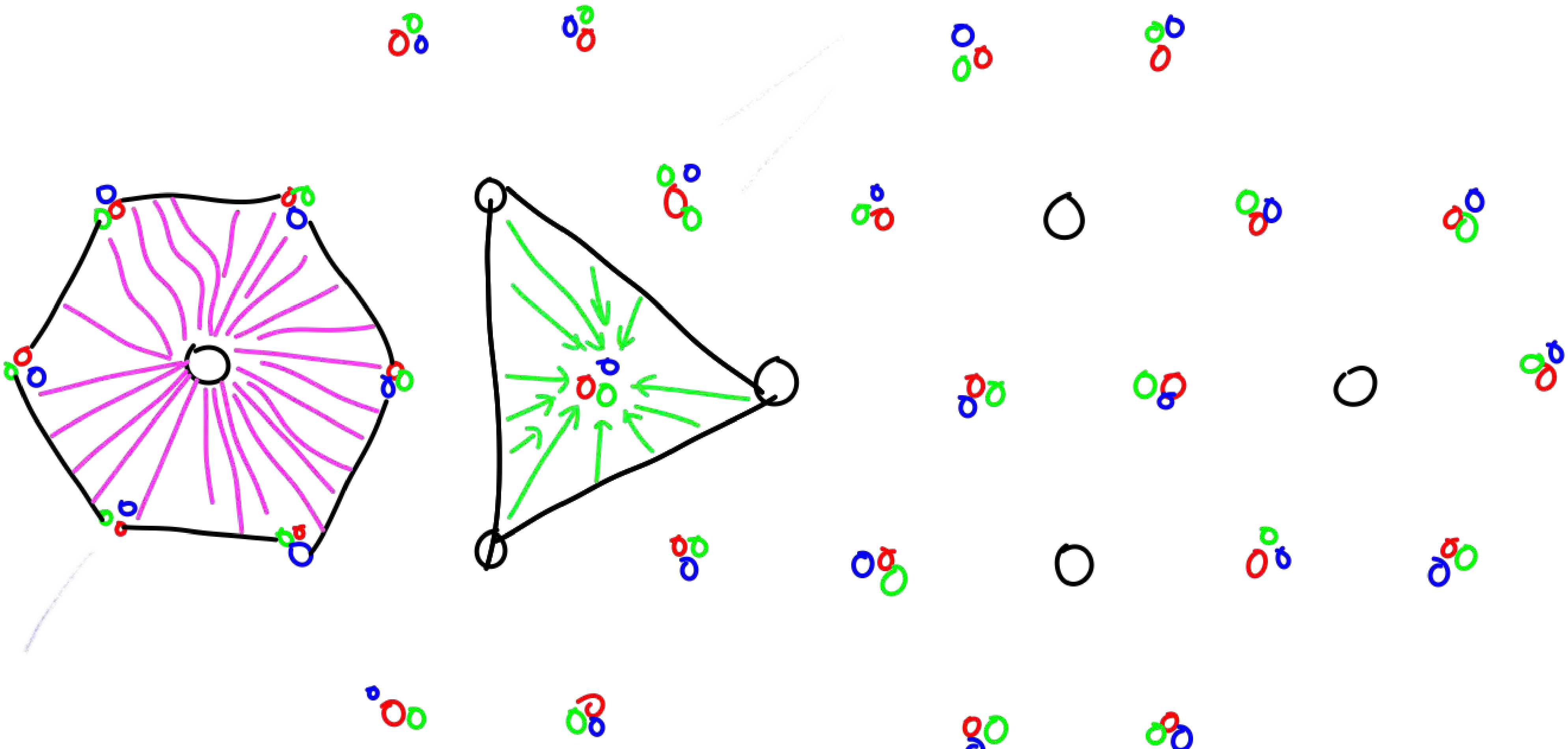
Classic lobule

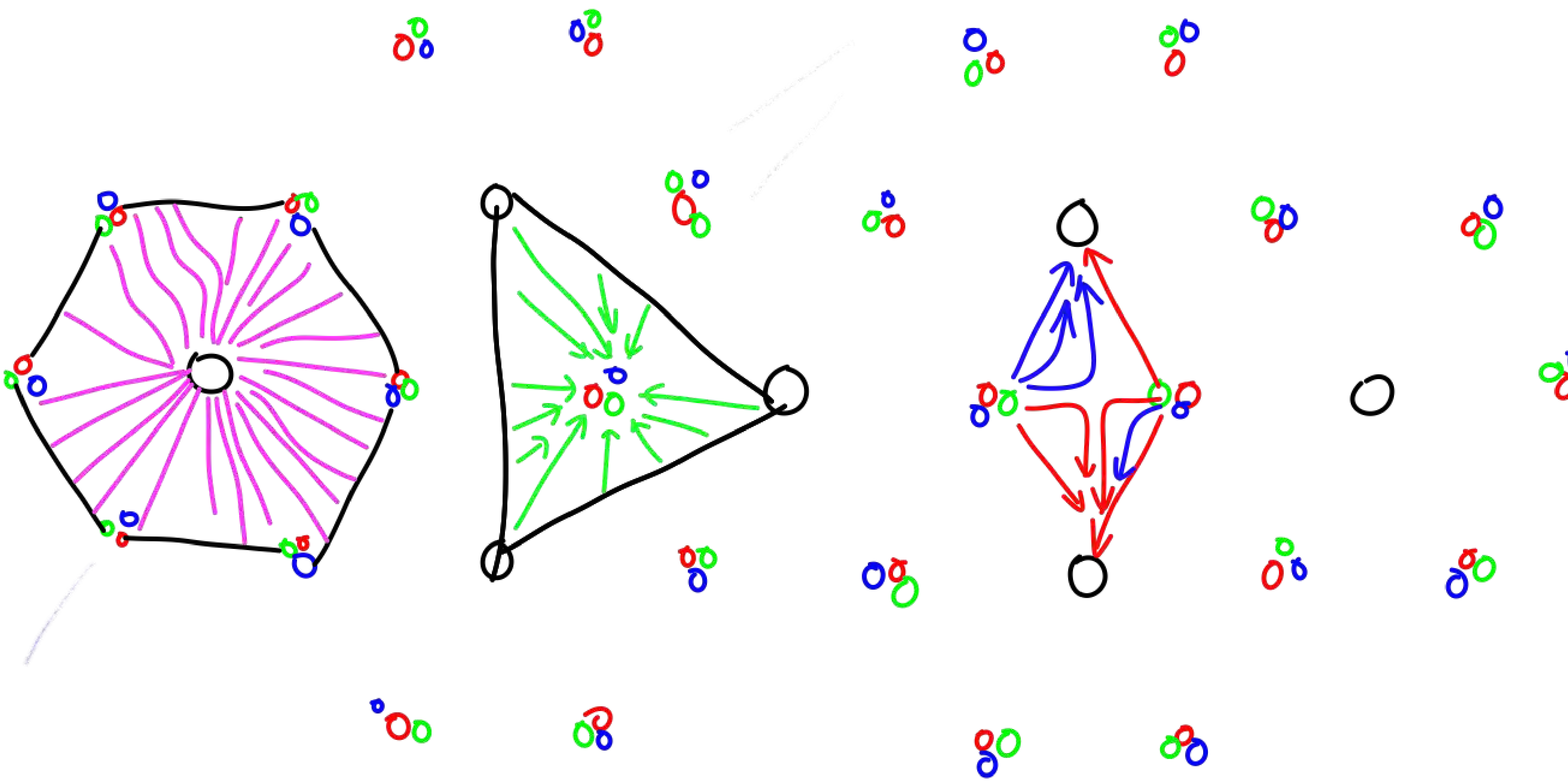


Bile – away from V centralis towards portal triad

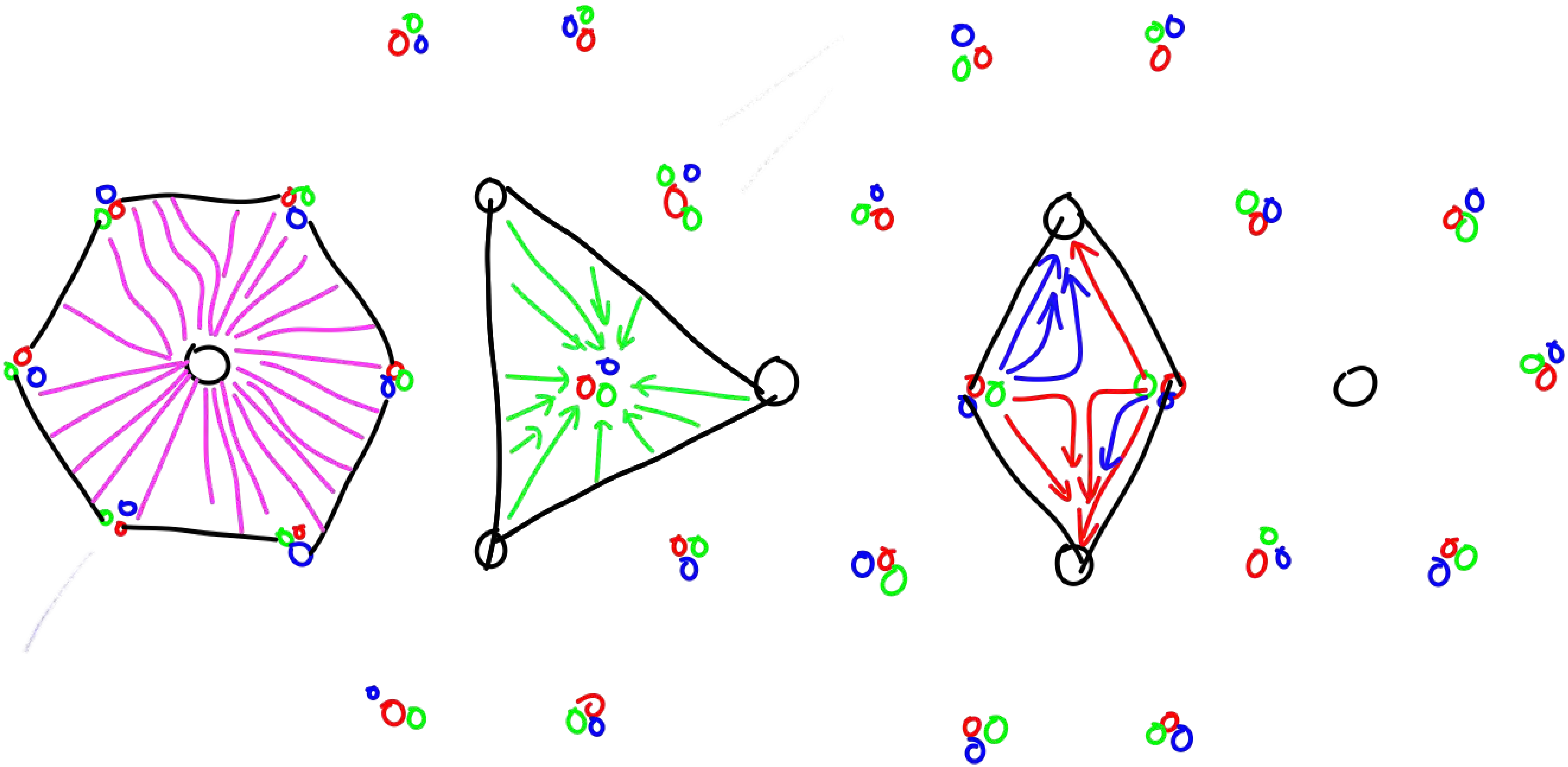


Portal lobule

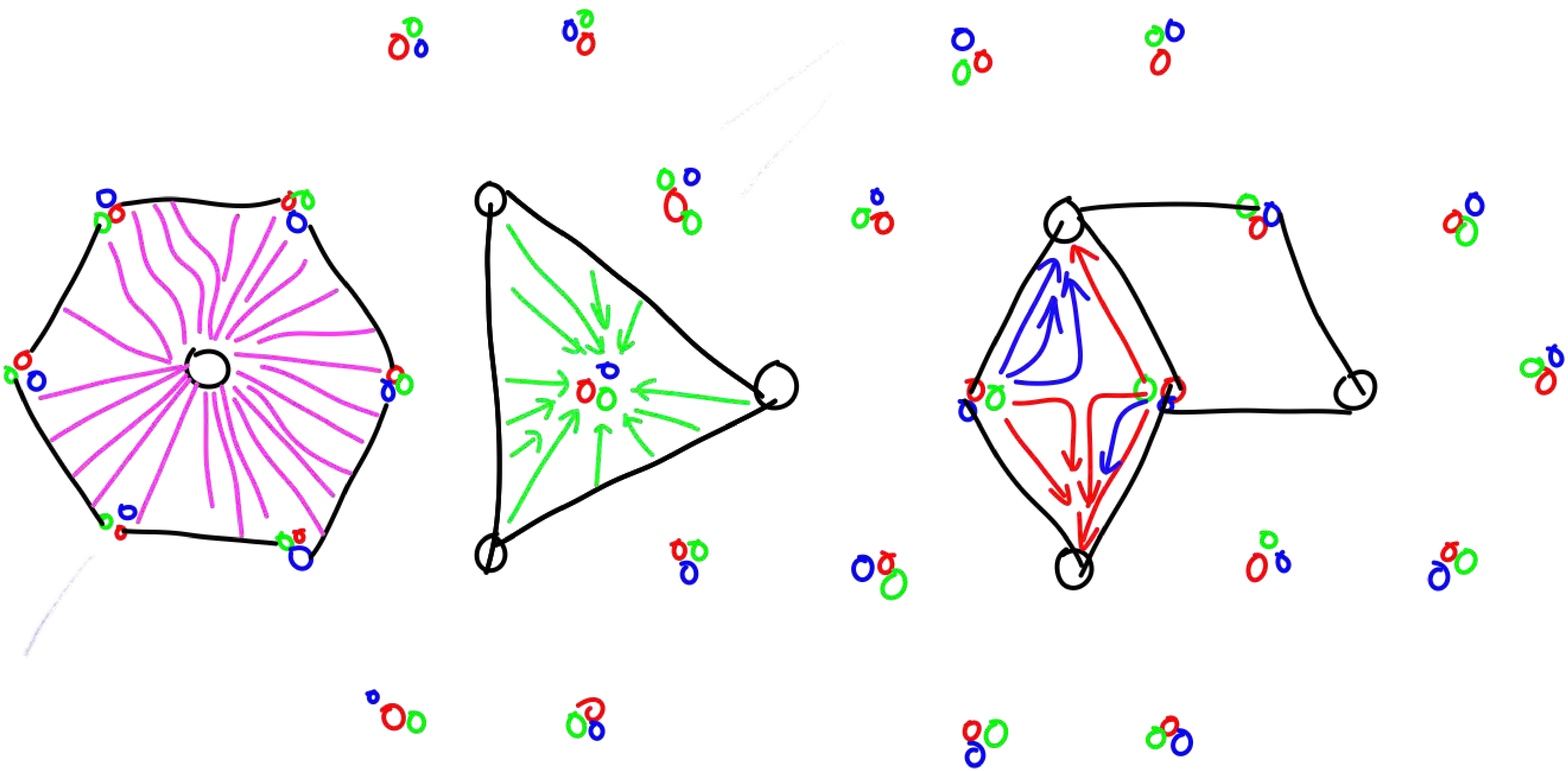




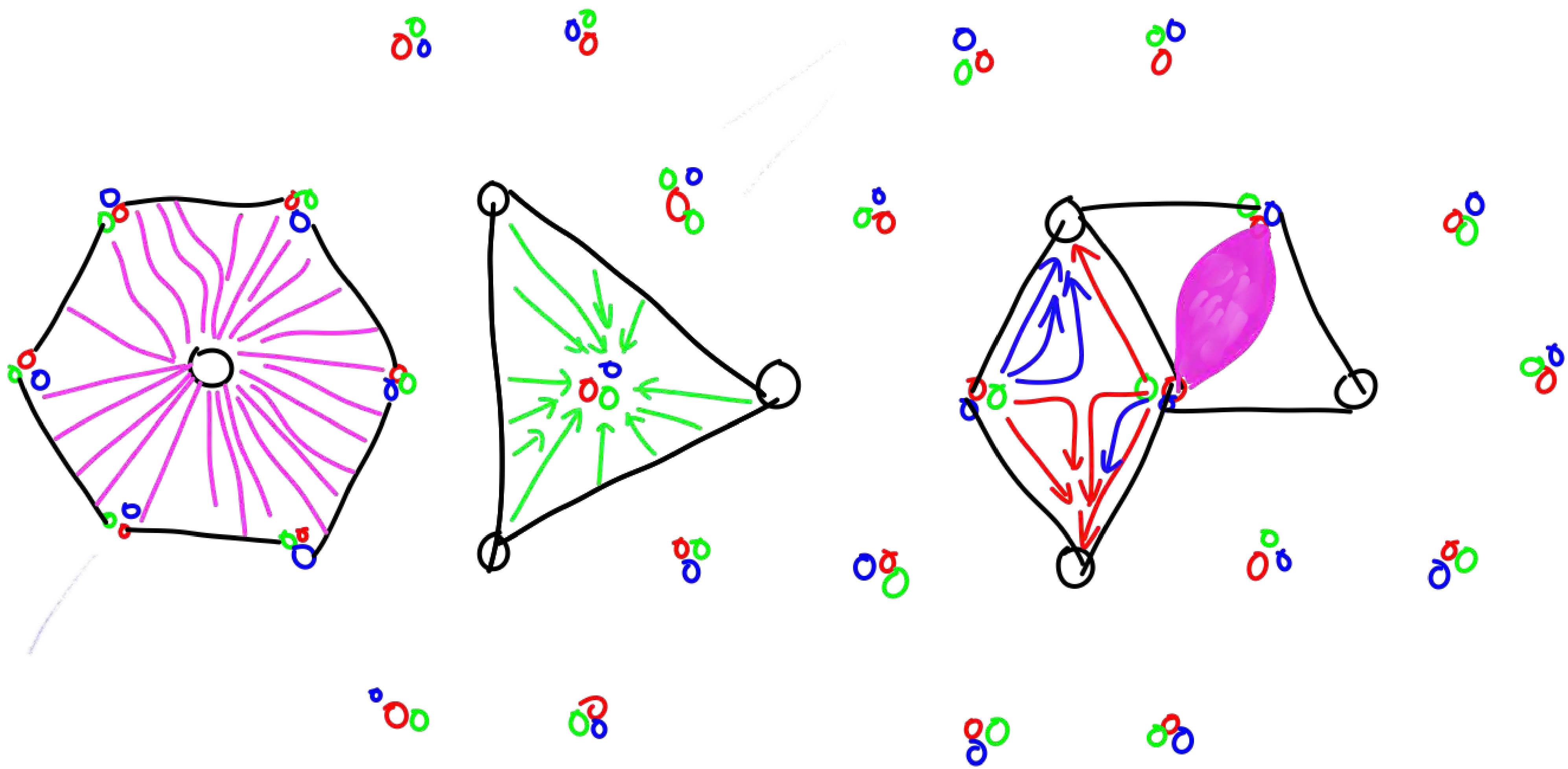
Acinus



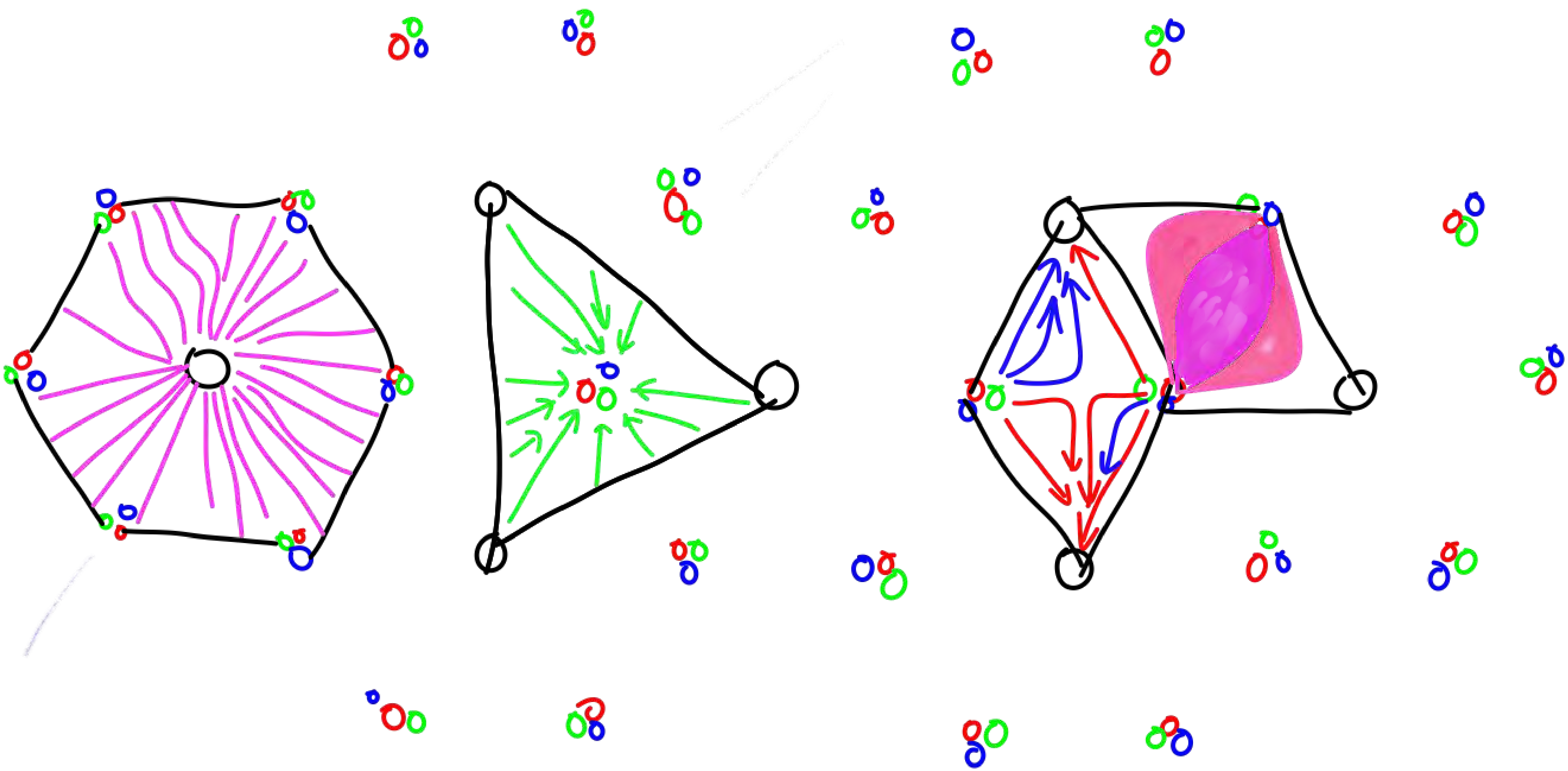
And another acinus



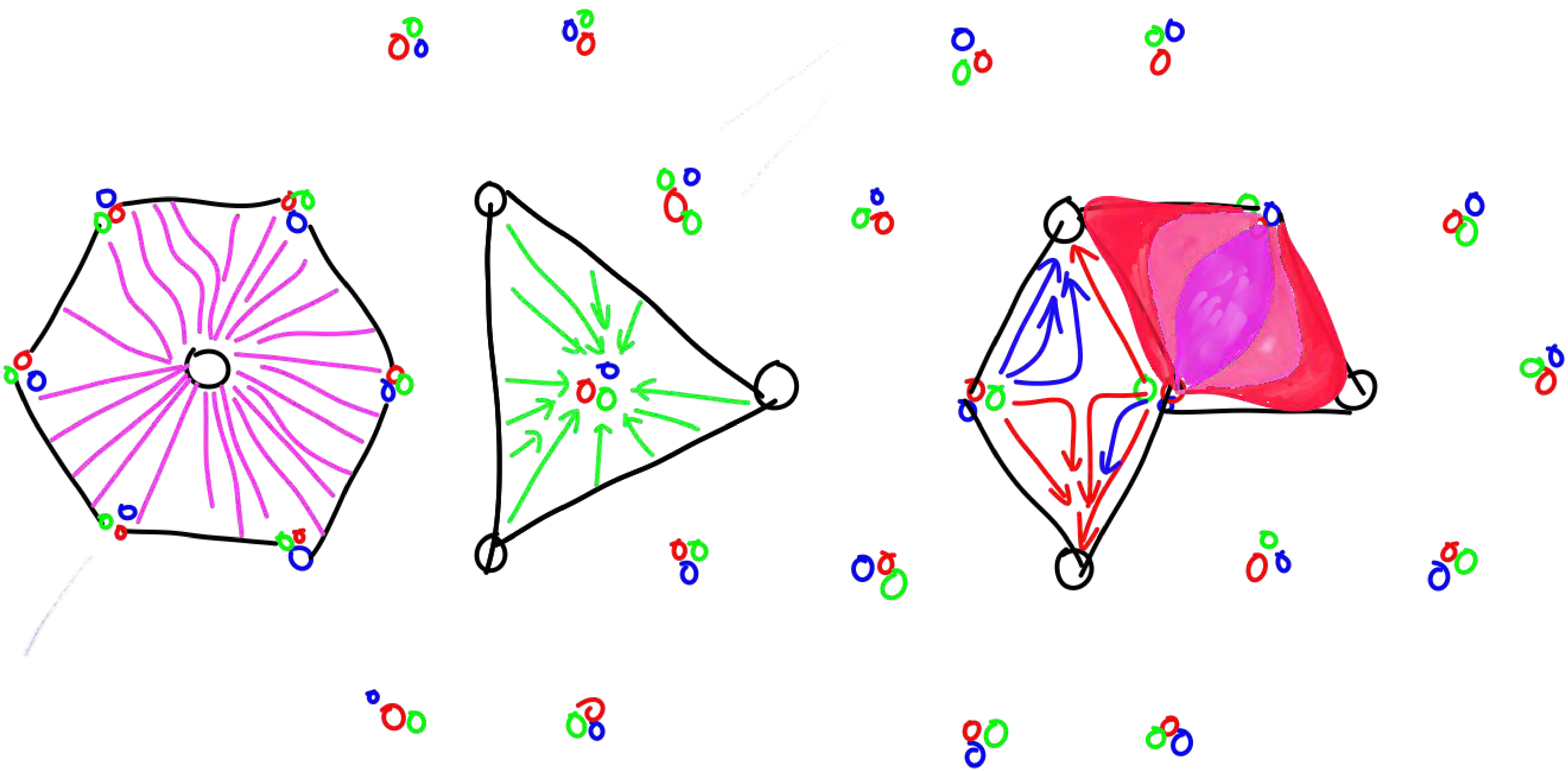
Zone 1



Zone 2



Zone 3



Liver

Five tasks

Liver task 1

1. Label two diagrams.
2. Give the definition of each labelled structure.

Diagram 1

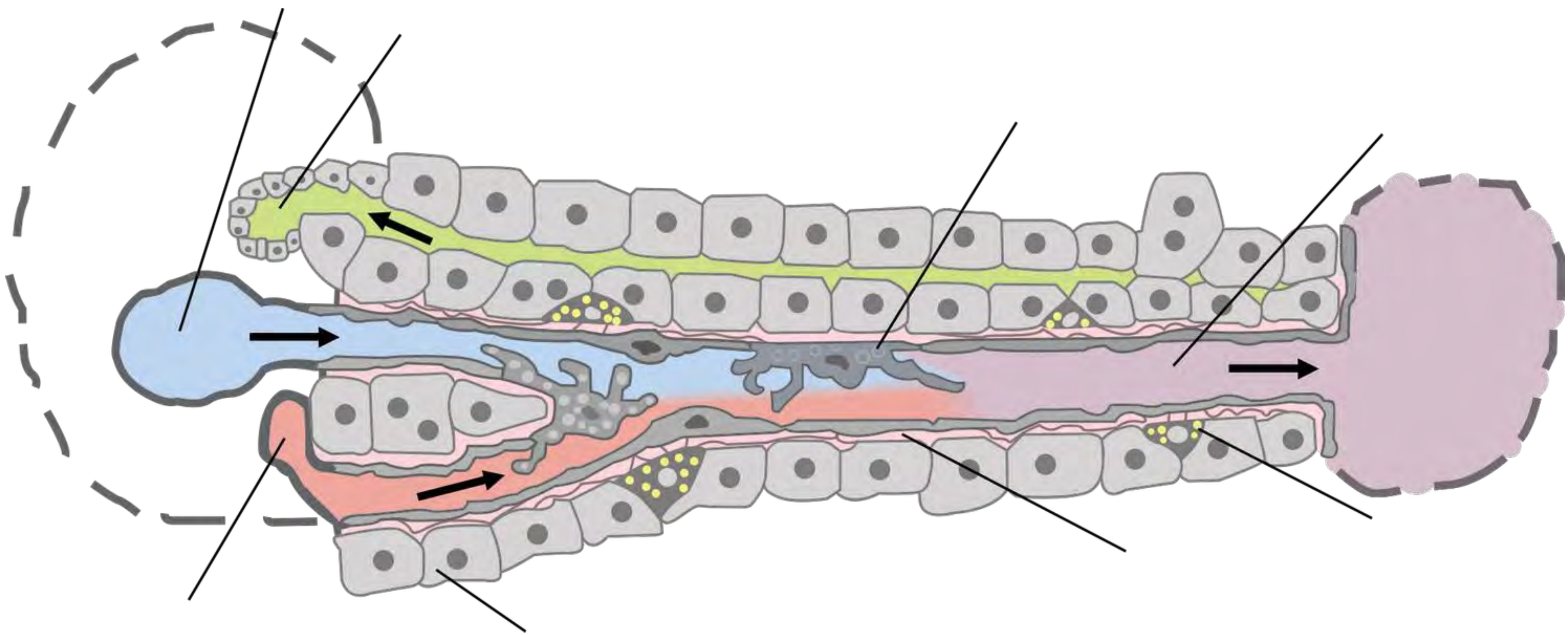
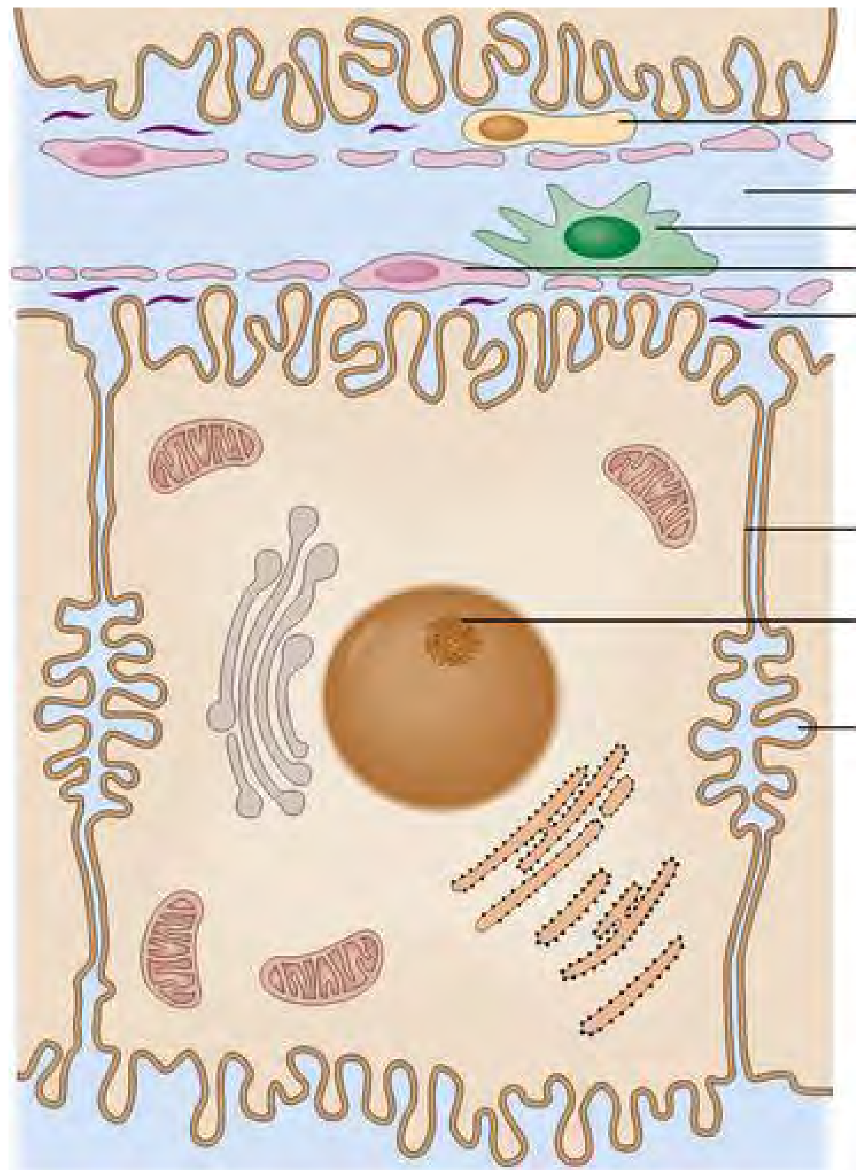


Diagram 2



Liver task 2

Draw diagram of:

Classic lobule
Portal lobule
Liver acinus

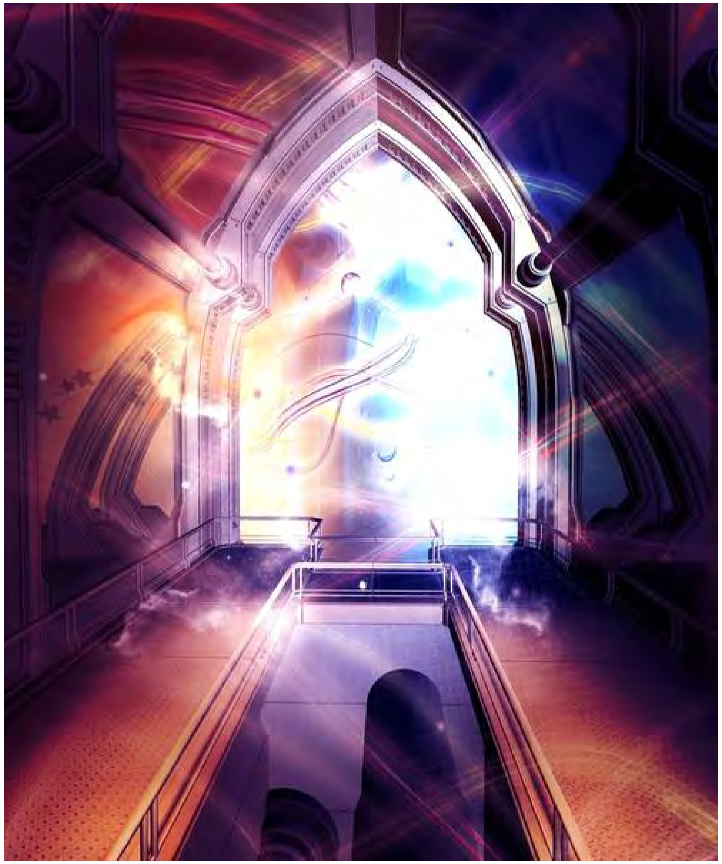
On diagram 3

Liver

- Classic lobule

Liver

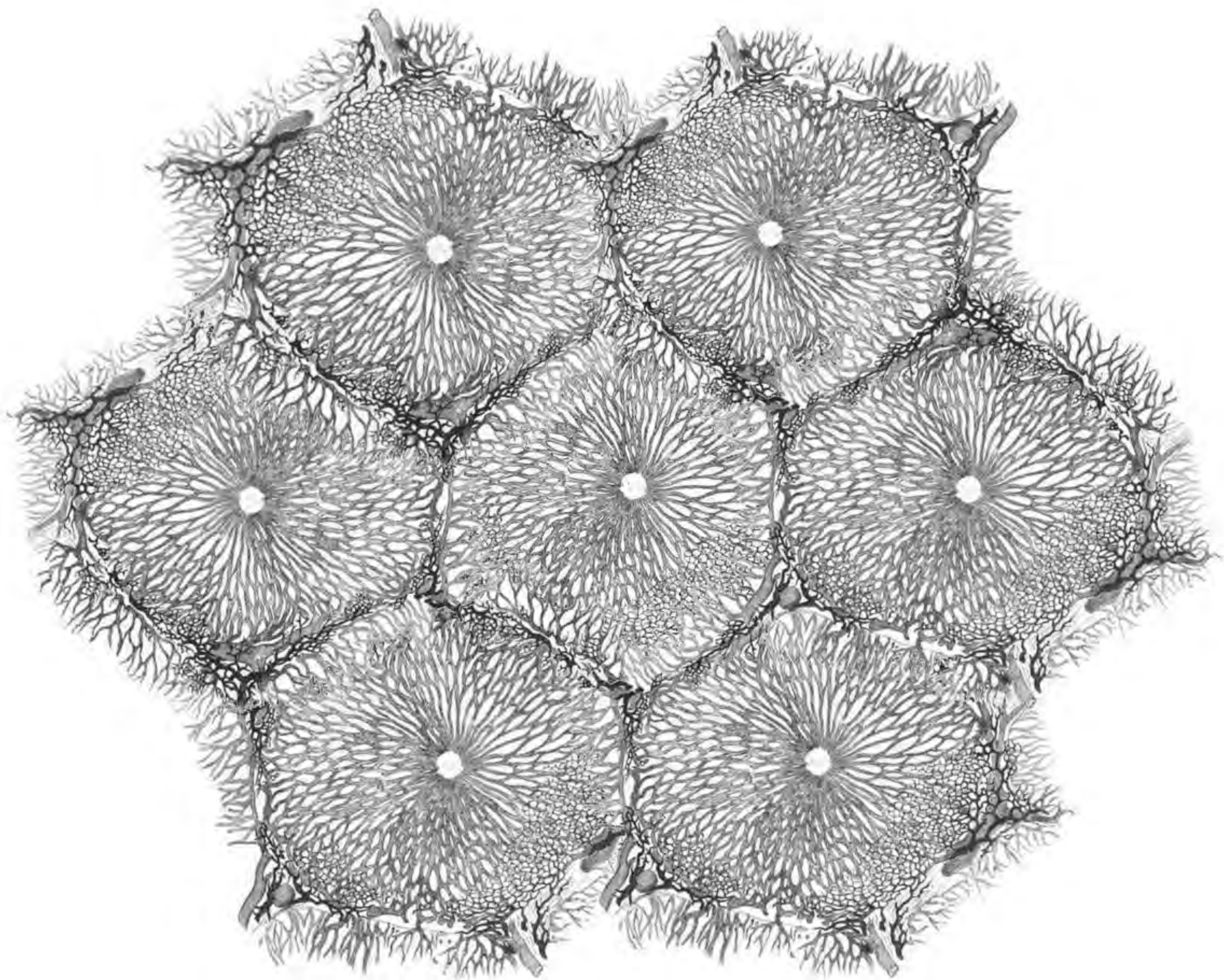
- Portal lobule



Liver

- Liver acinus

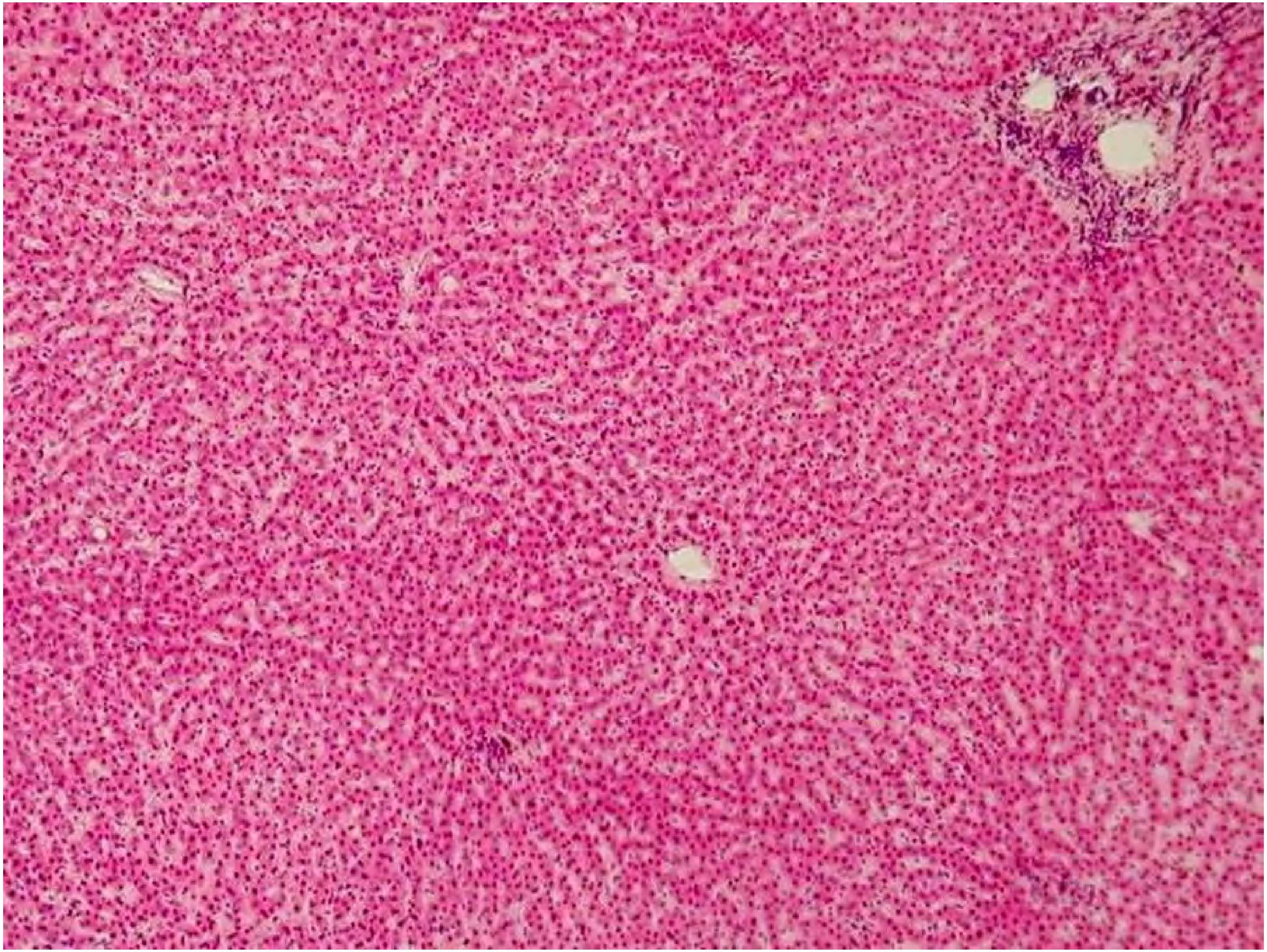
Diagram 3



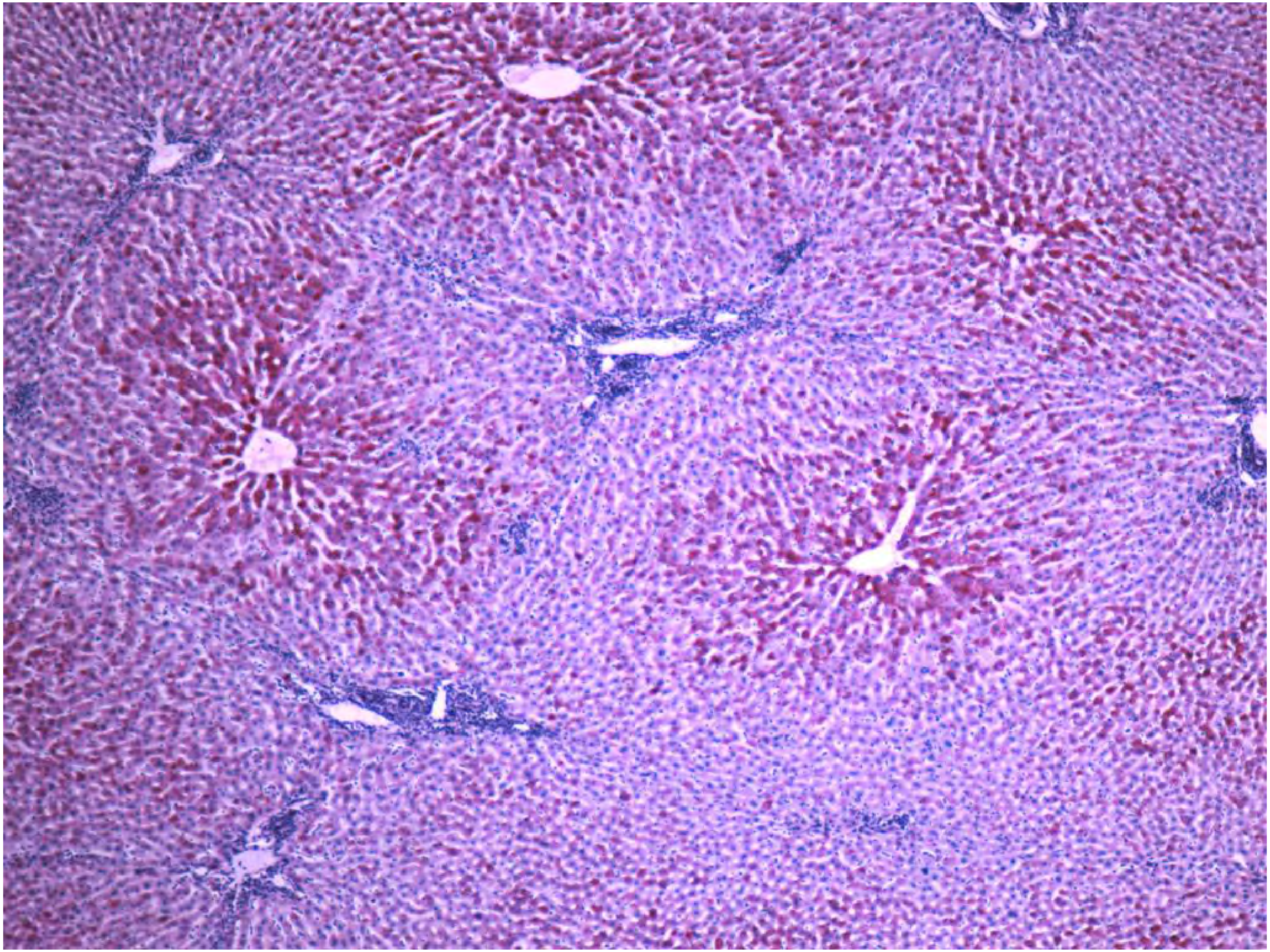
Liver task 3

Annotate 2 liver slides

Slide 1



Or Slide 2



Liver task 4

Cross-correlate

Diagrams
Slide

You decide how

Cross-correlate

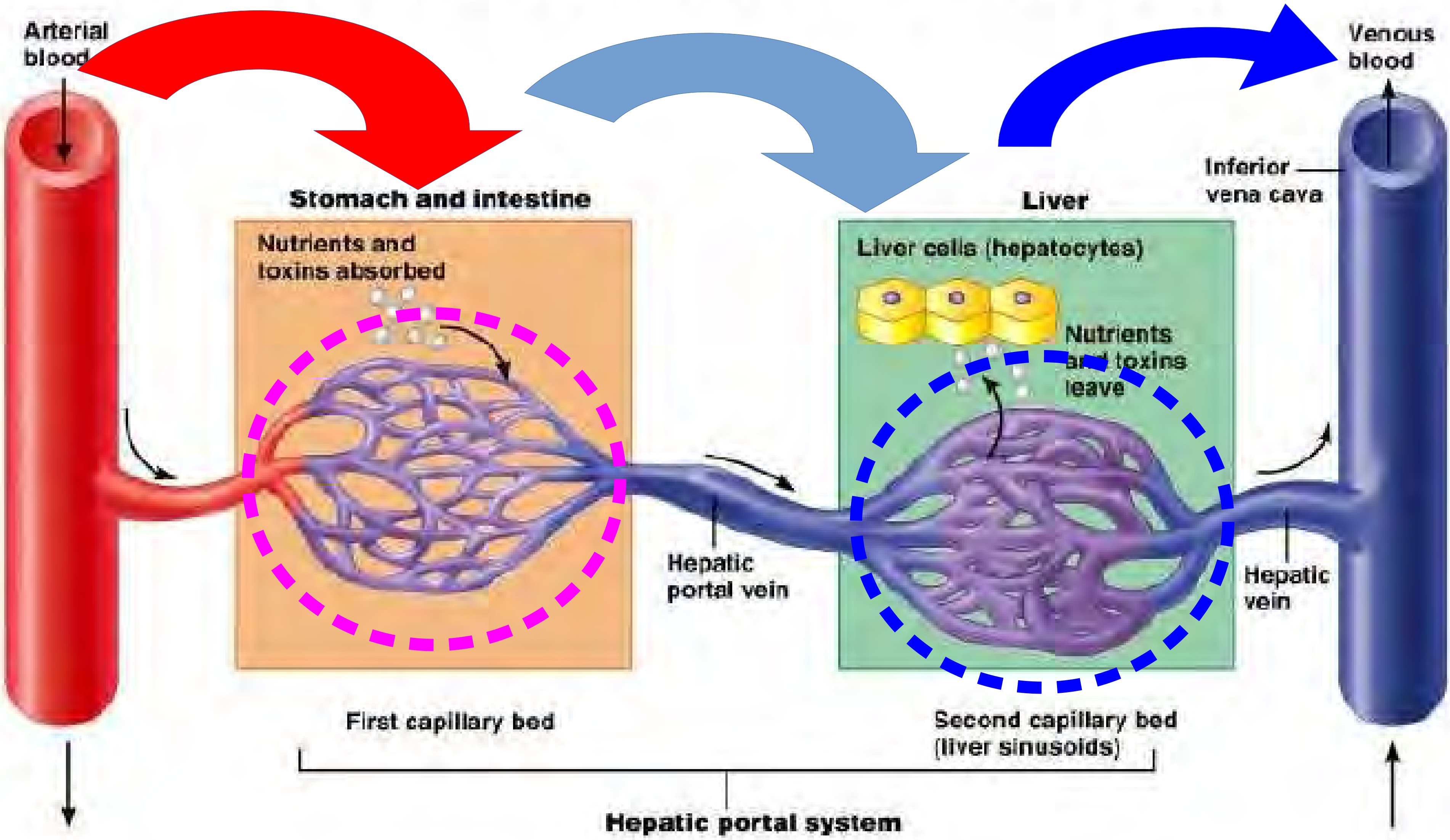
What part of the drawing correspond to which part of the slide?

Task 5

Describe how we get from normal healthy liver to fibrosis/cirrhosis Via obesity.

Cells and tissues involved.

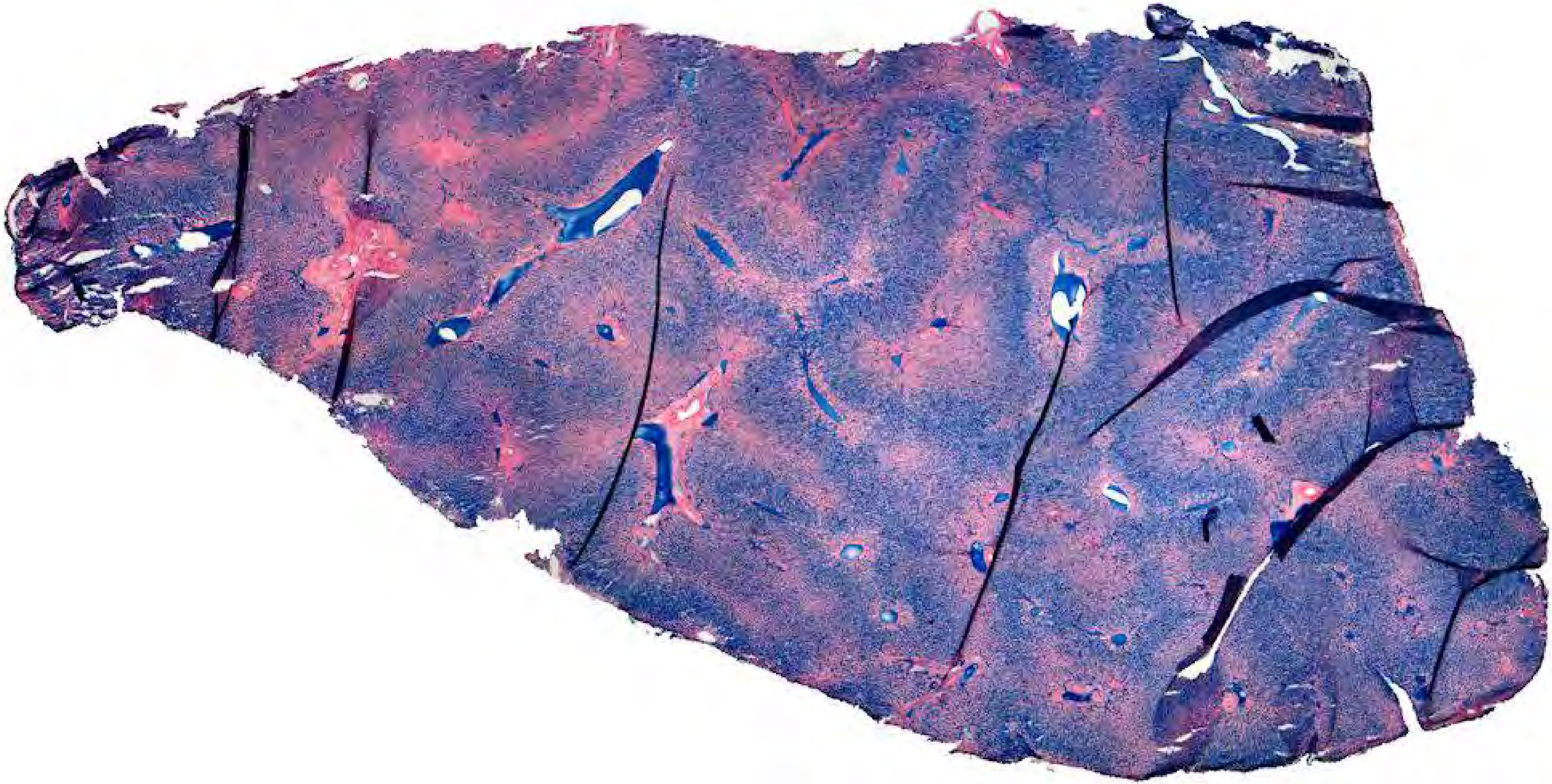
Hepatic Portal System



21-42

Figure 19.22

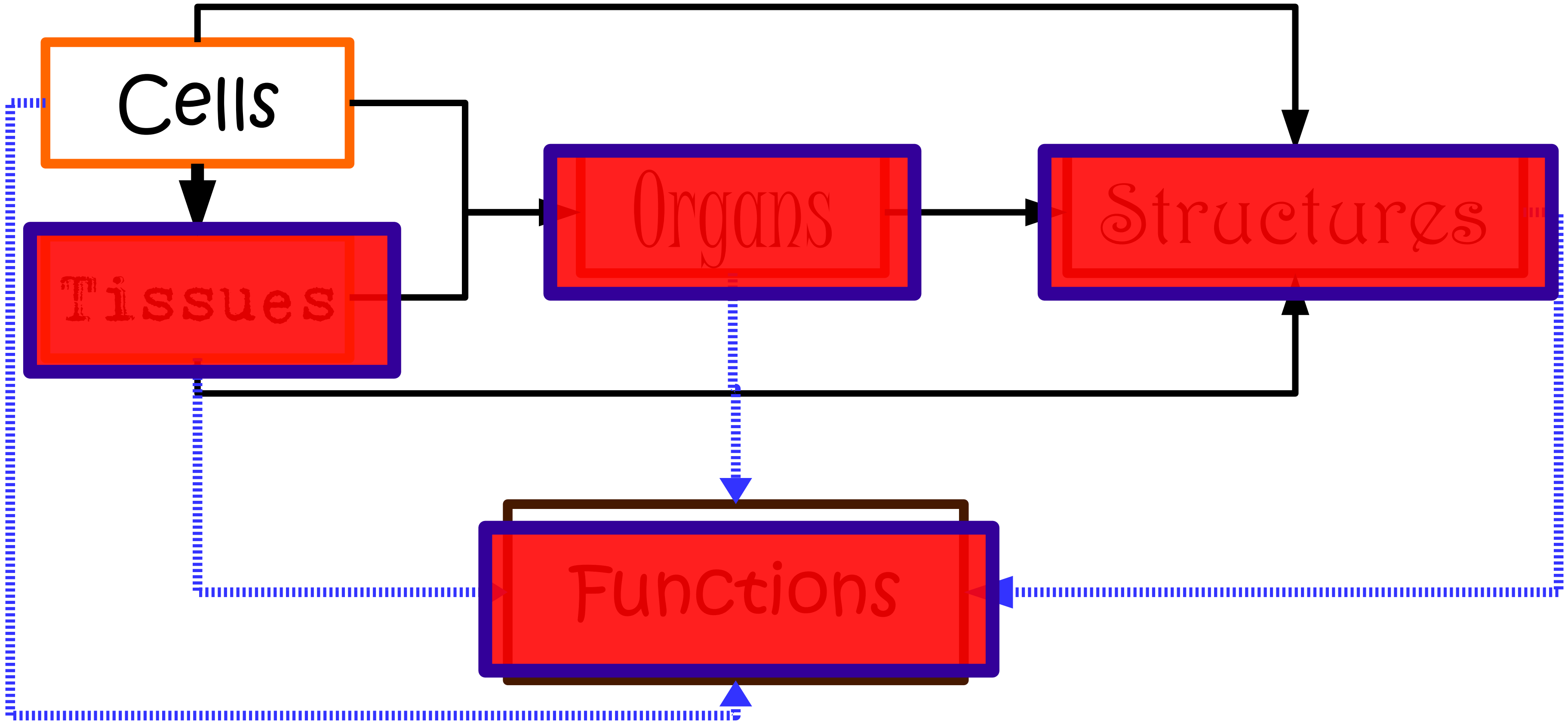
Identify the **STUFF** on the slide.



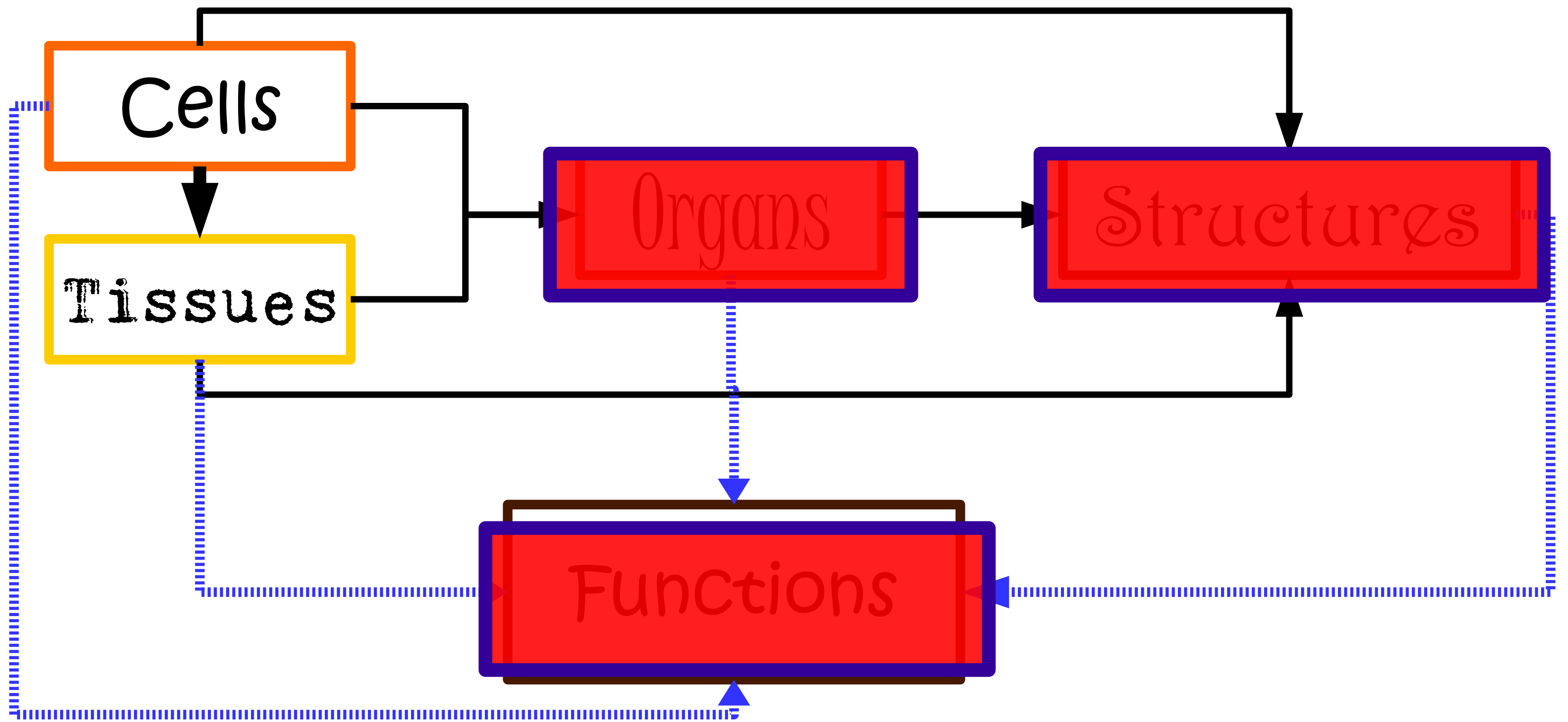
Cells + Tissues
make
.
V
Organs
which contains
.
V
Structures

What stuff could there be?

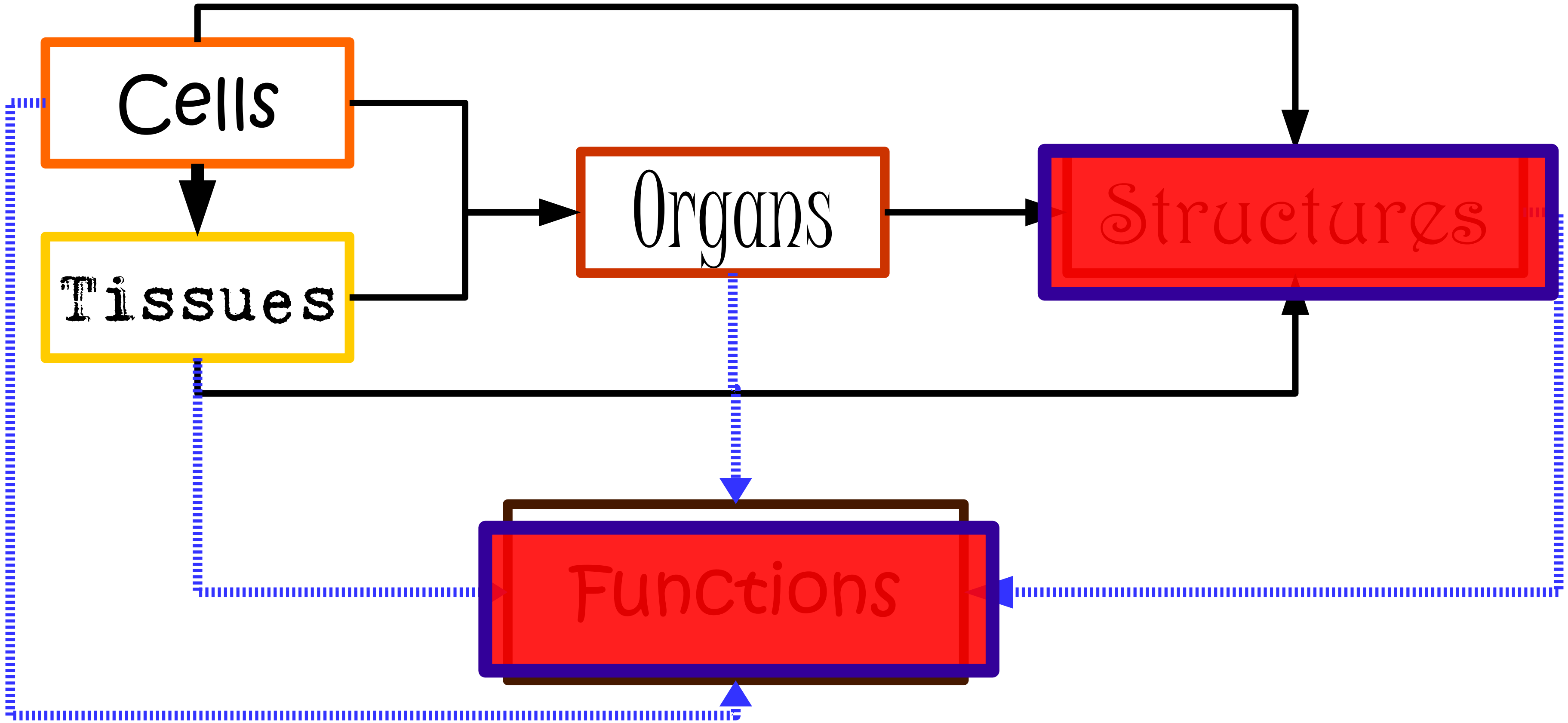
What stuff could there be?



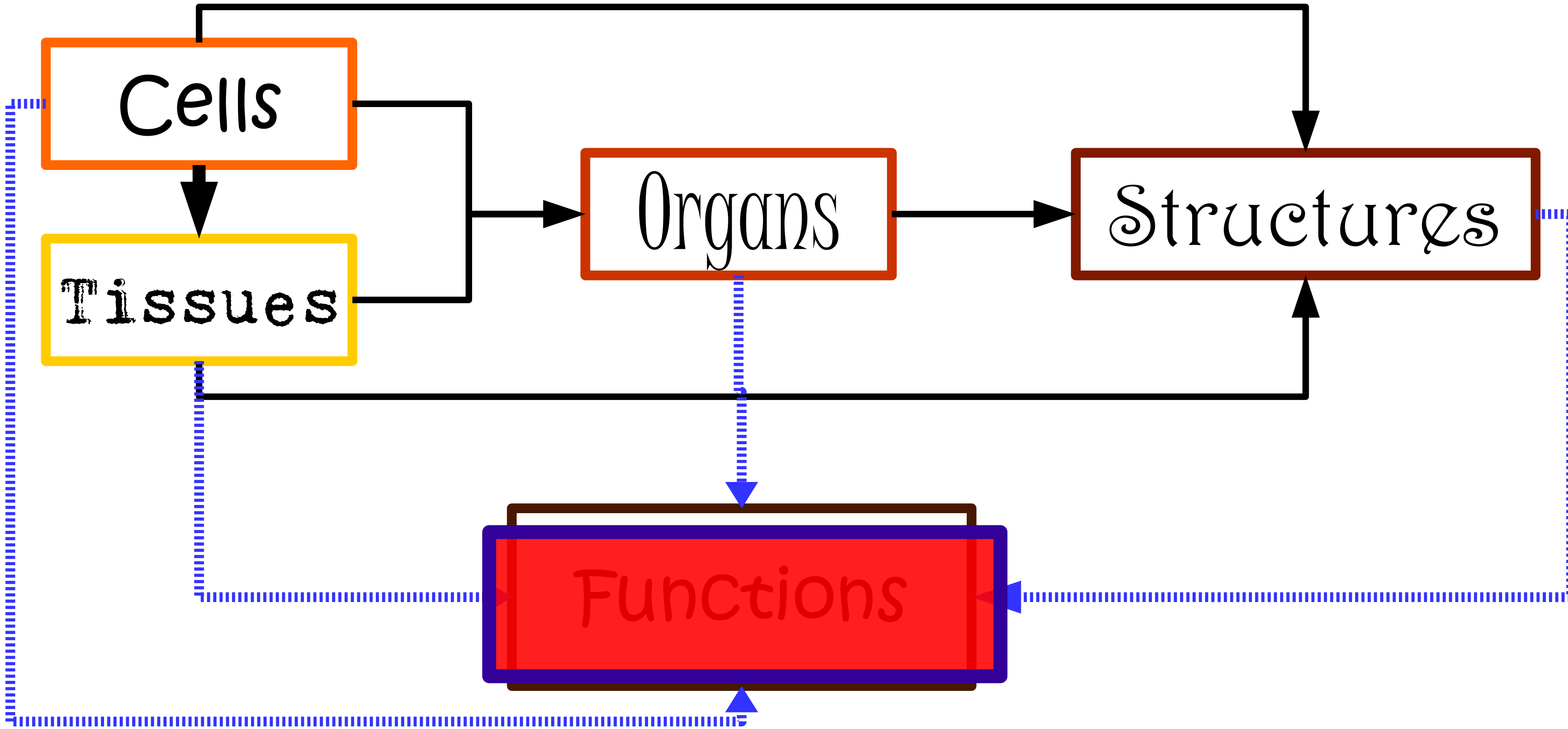
What stuff could there be?



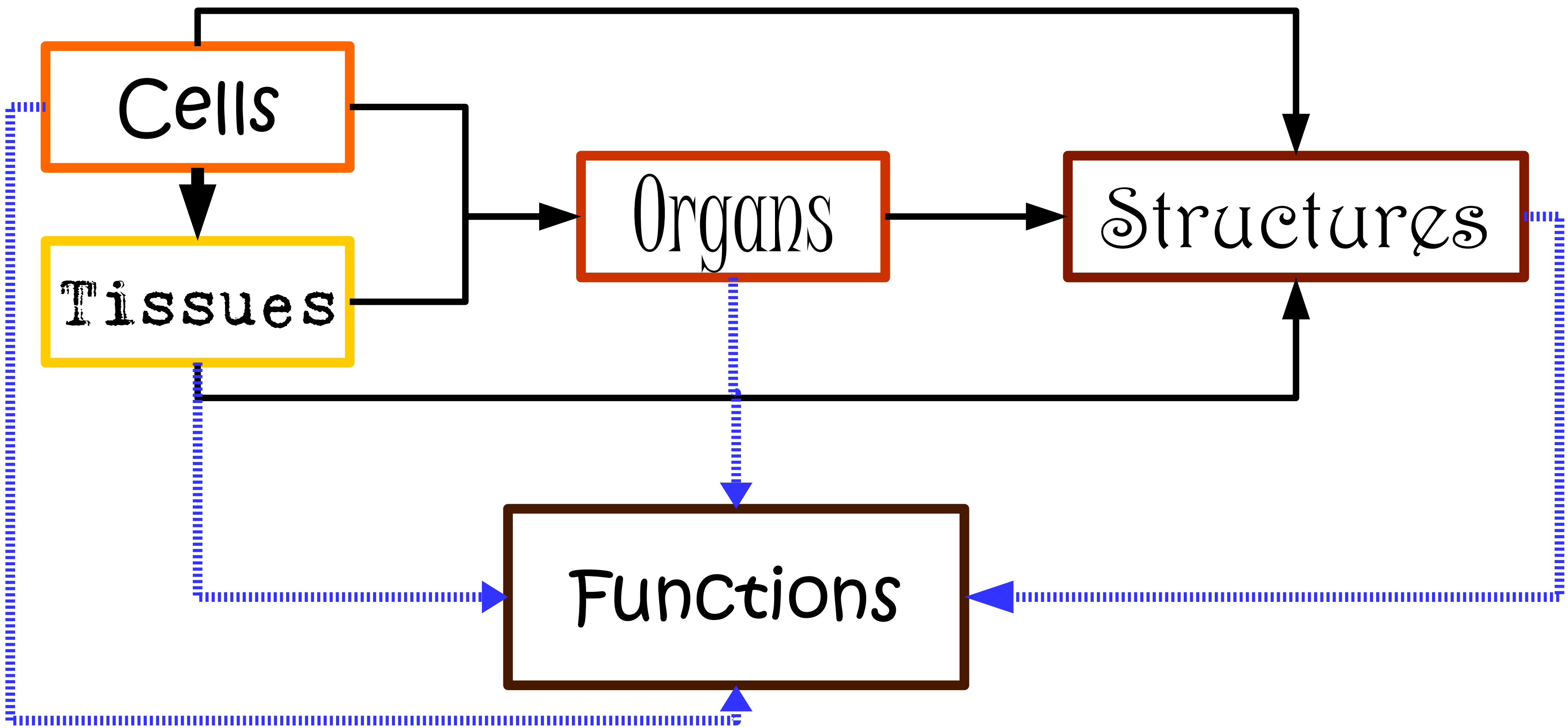
What stuff could there be?



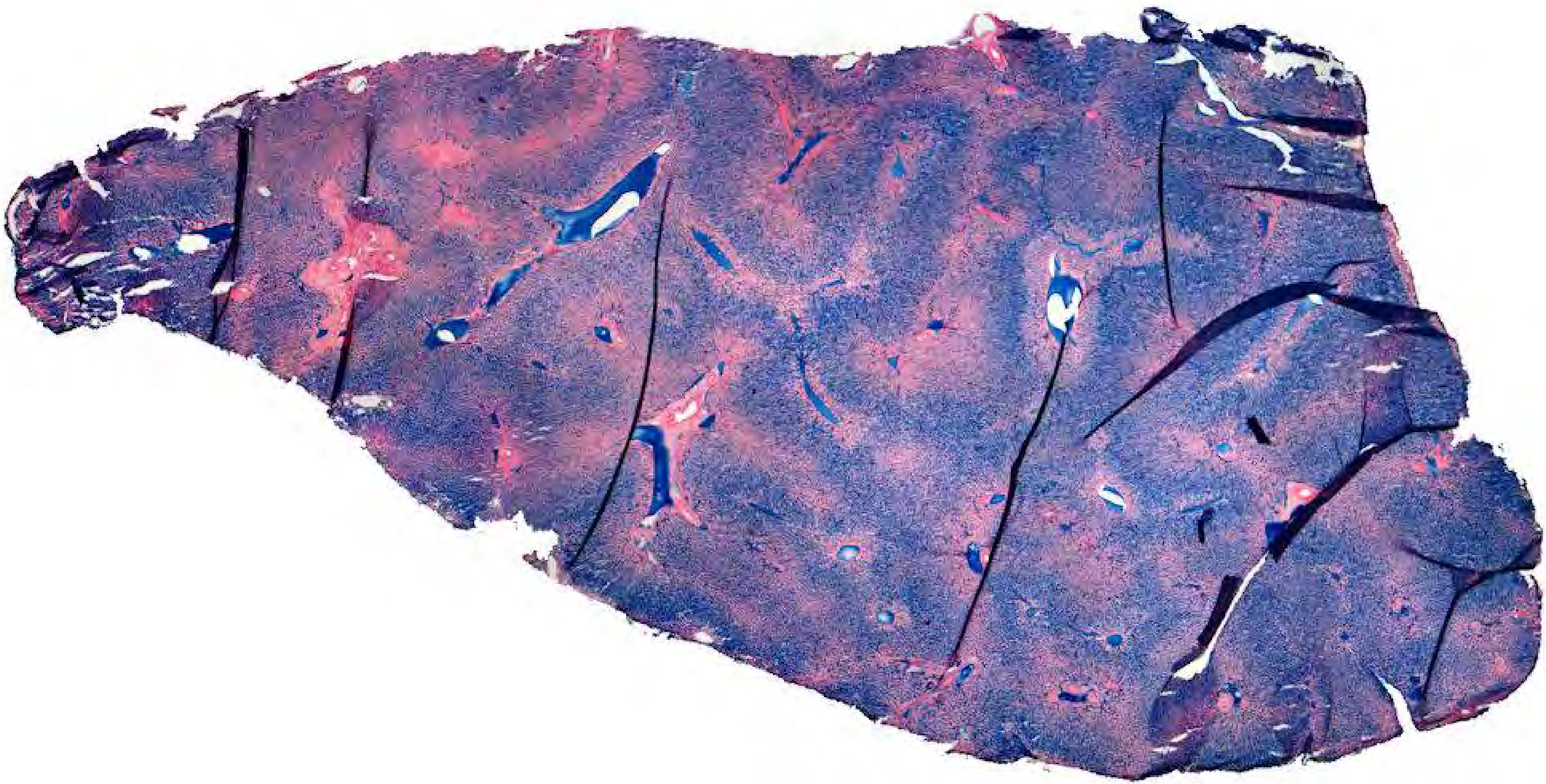
What stuff could there be?



What stuff could there be?



Making sense of this



Liver Structure

3 Views

Histology

What do we know about the liver?

Think in general

Dissection?

What do we know?

Stuff in

Stuff out

What stuff goes in and out?

What do we know?

Blood in
Arterial + Venous

Blood out
Venous

Bile out

What do we know?

Blood in

From where – Arterial - heart

From where – Venous - GIT

Blood out

Where to – Venous - heart

Where to - Bile out – gall bladder

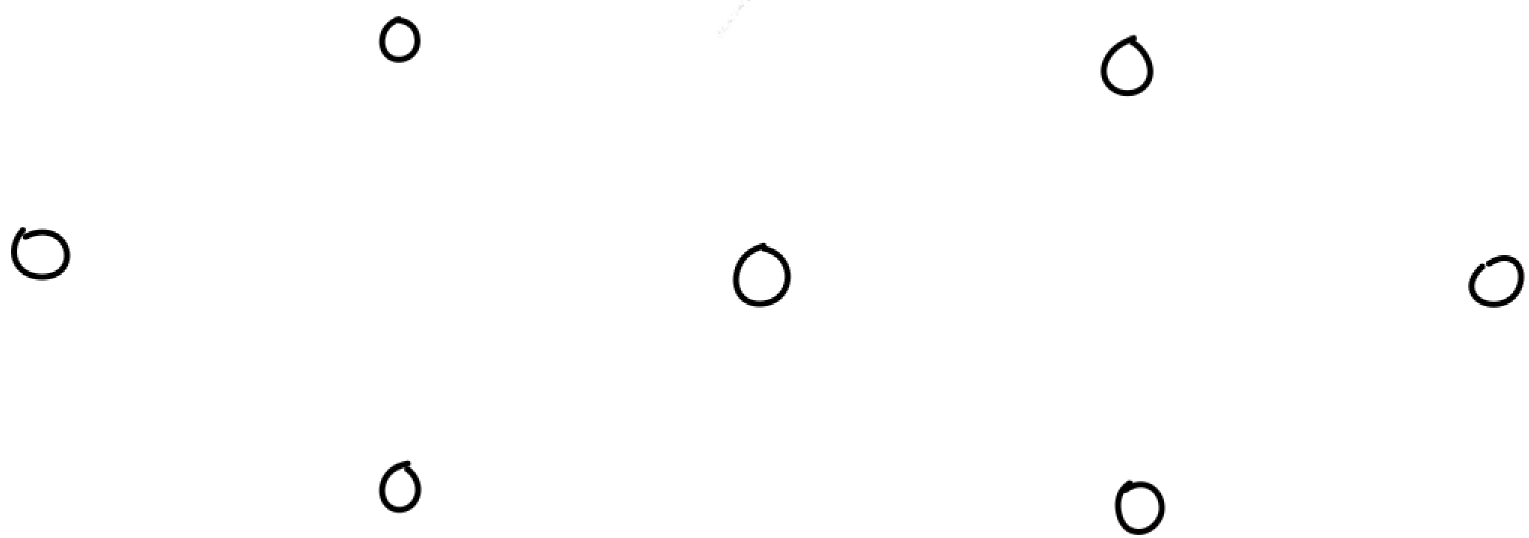
Compare

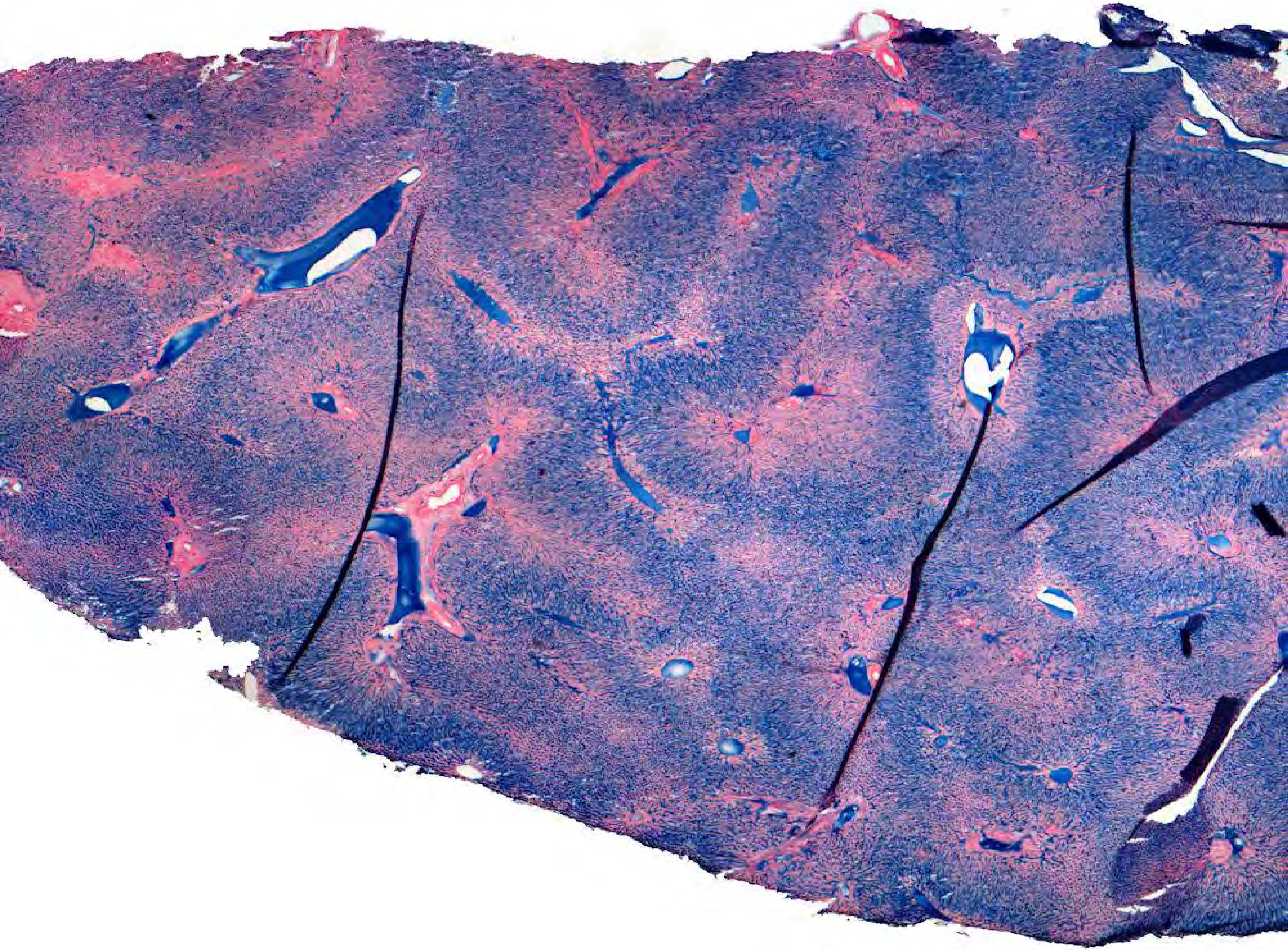
Theoretical view

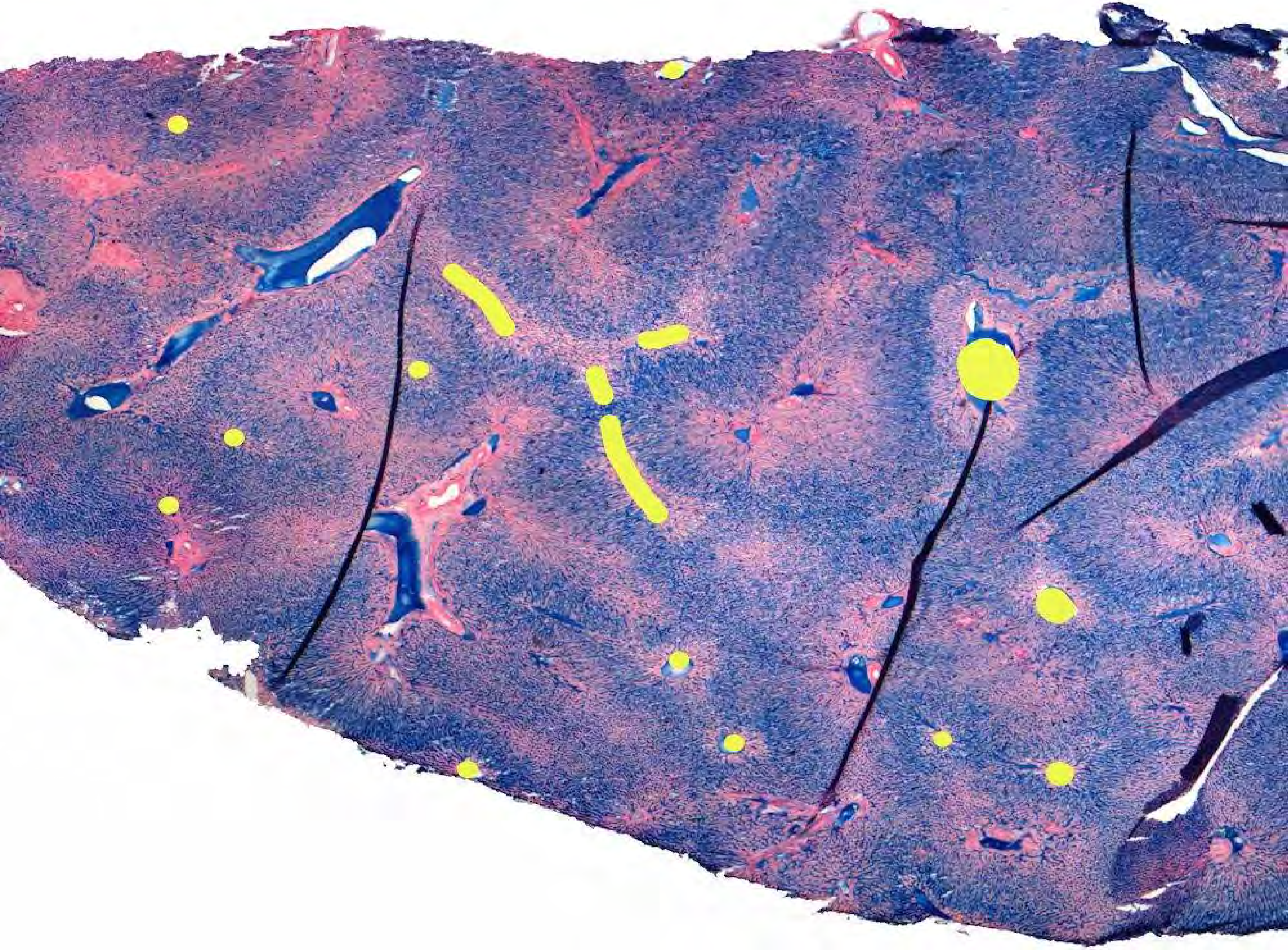
and related

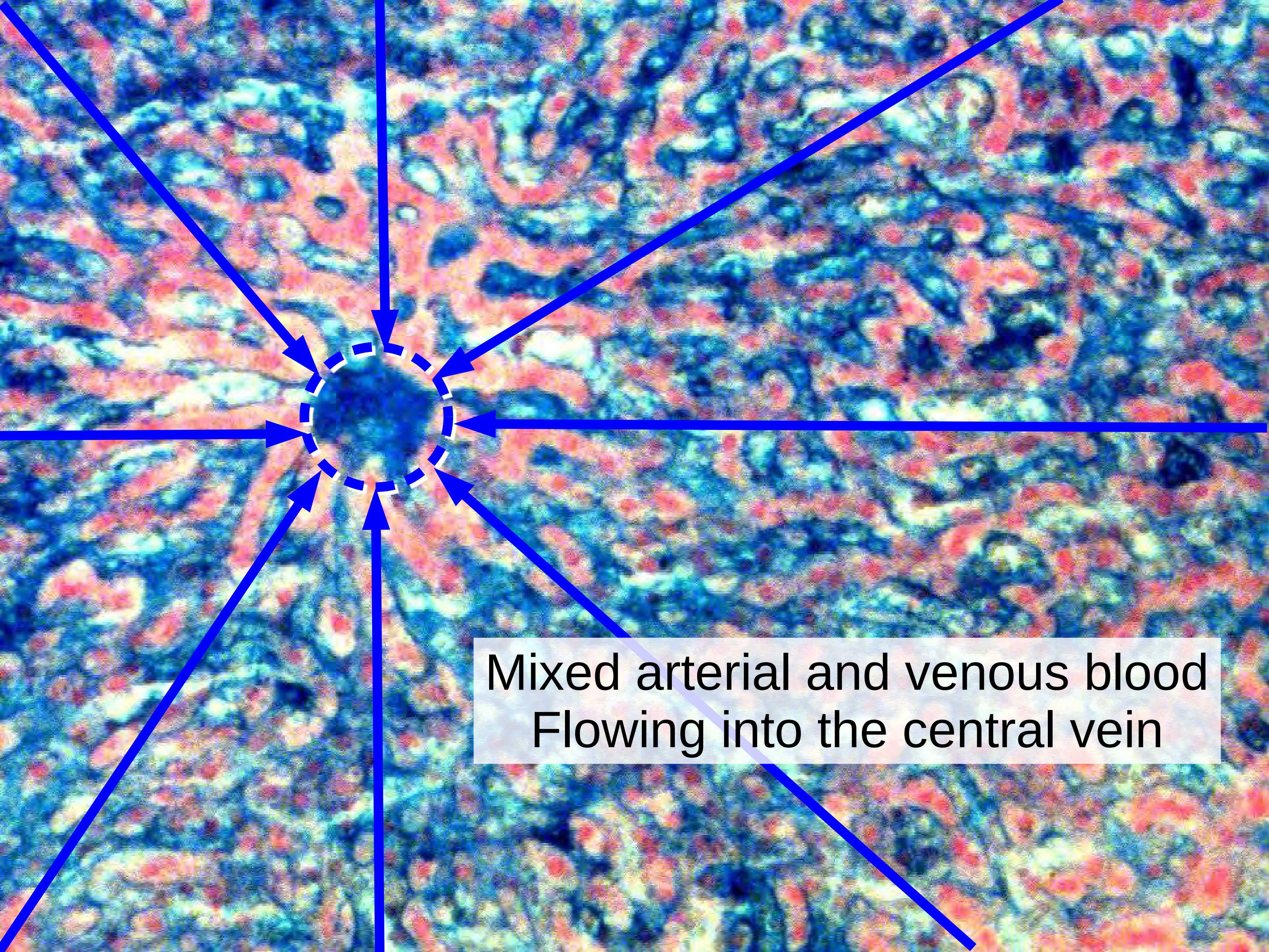
Microscopic view

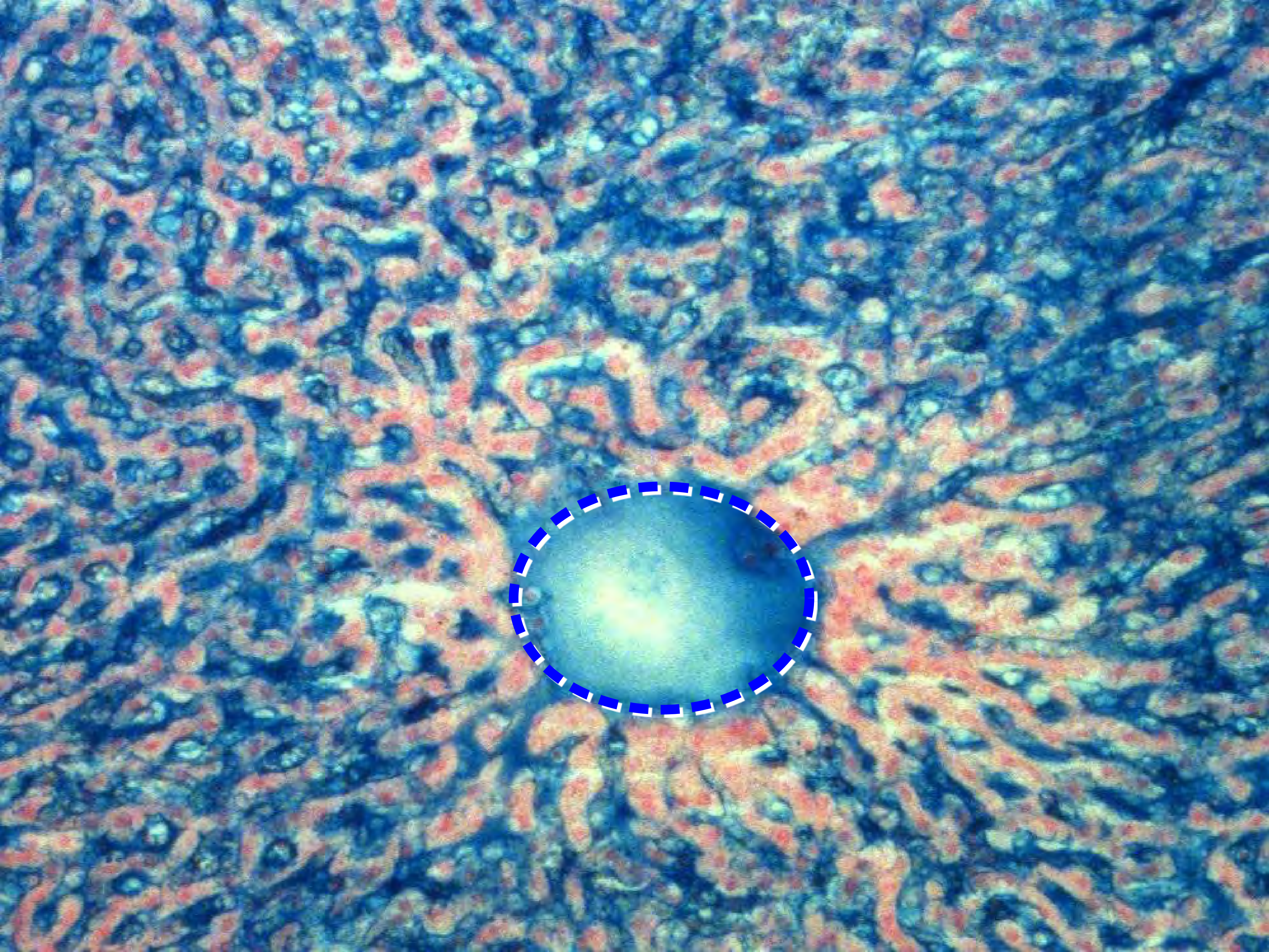
Vena centralis



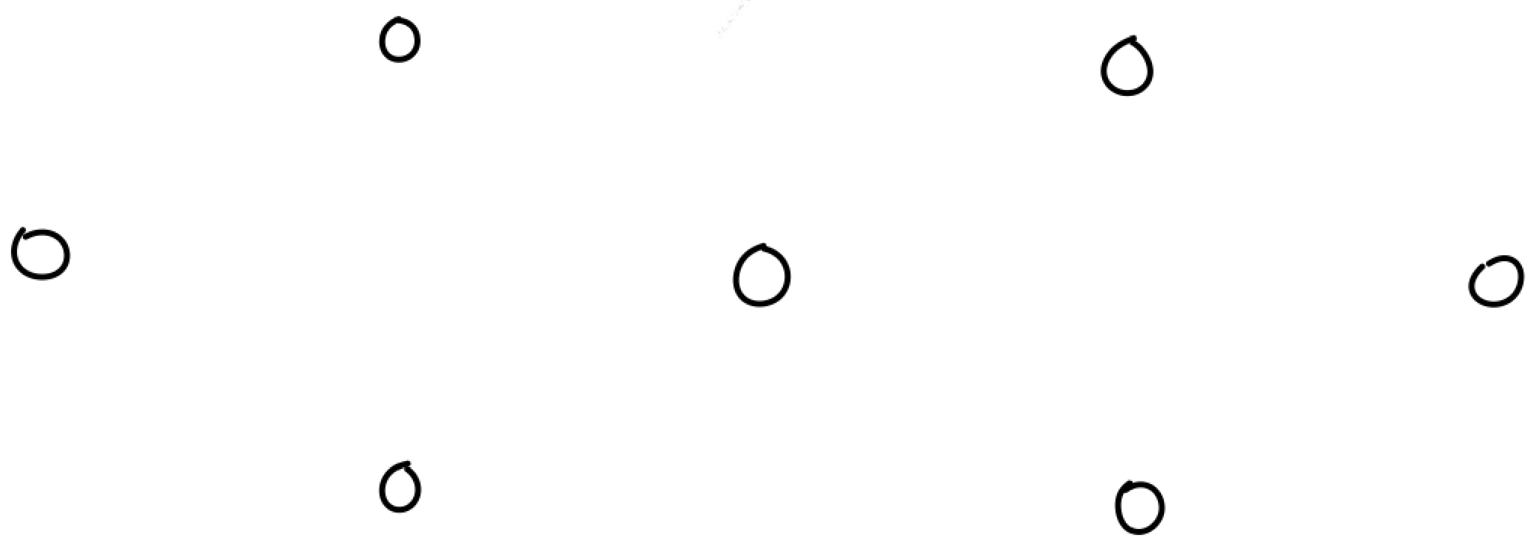


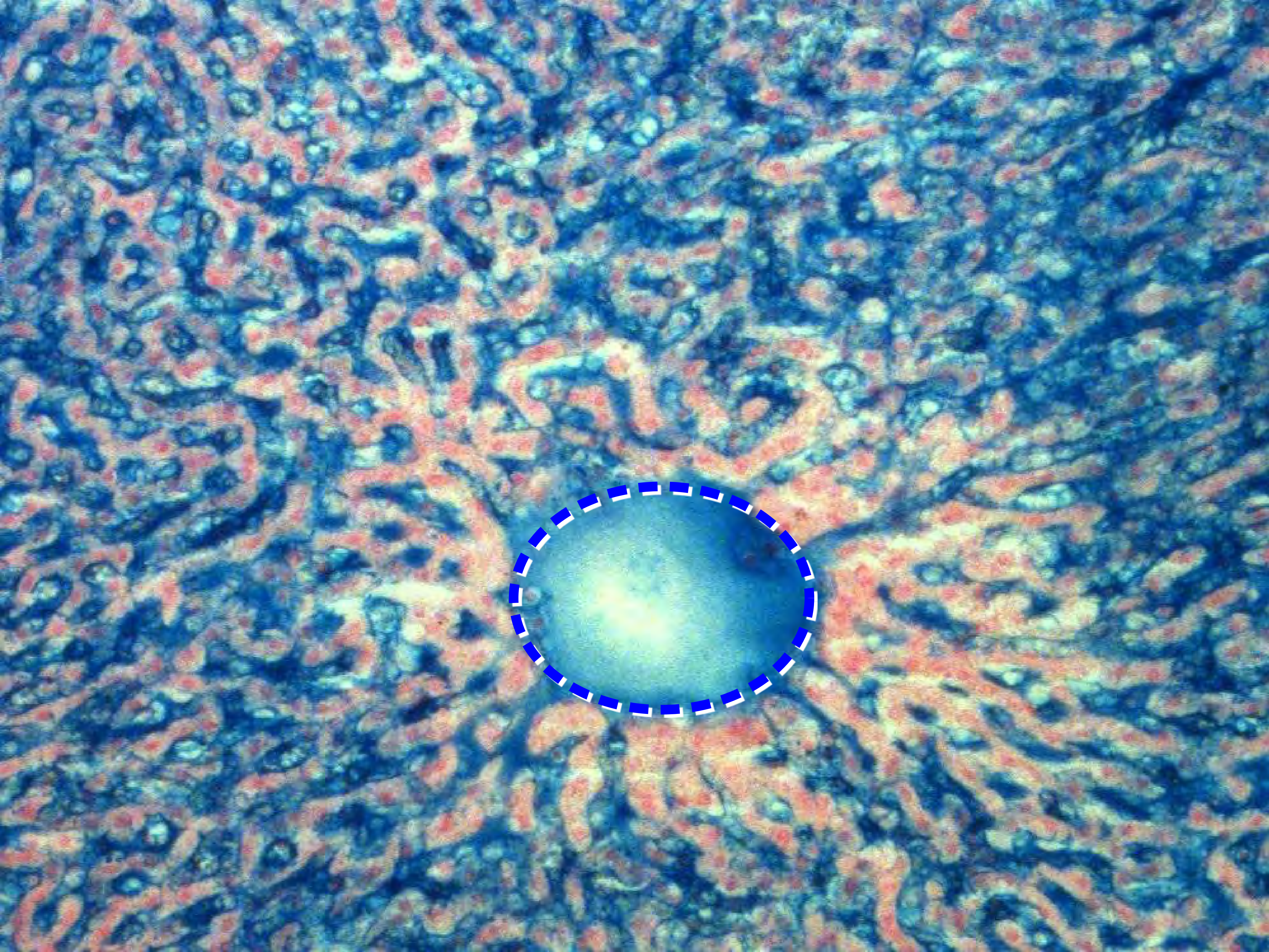



Mixed arterial and venous blood
Flowing into the central vein



Vena centralis





What is with the vena centralis?

What is with the vena centralis?

Arteries – Yes/No?
Bile ducts – Yes/No?
Lymph vessels – Yes/No?

What is with the vena centralis?

Arteries – No
Bile ducts – No
Lymph vessels – No

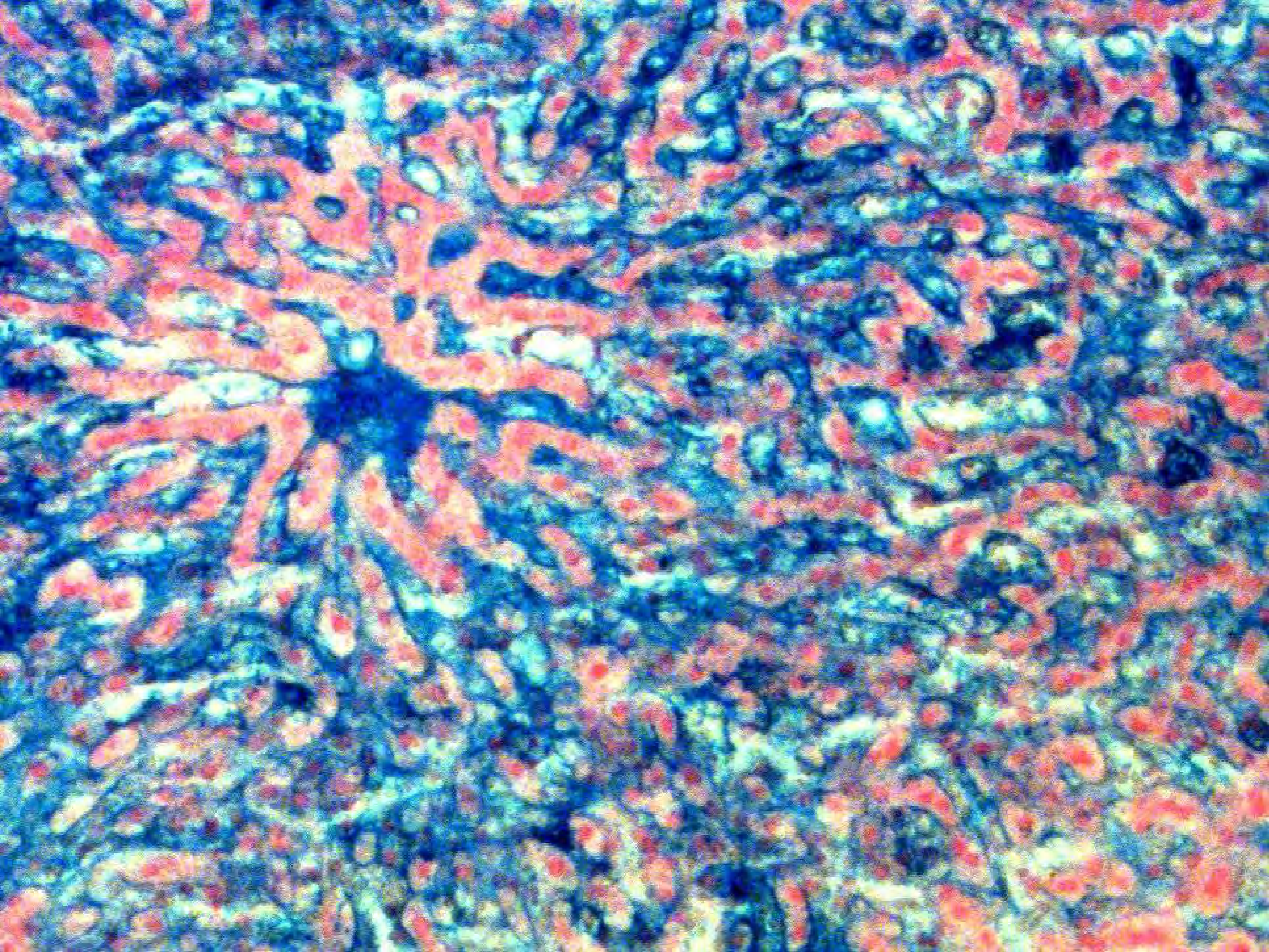
Where do we find these 3 structures?

What is with the vena centralis?

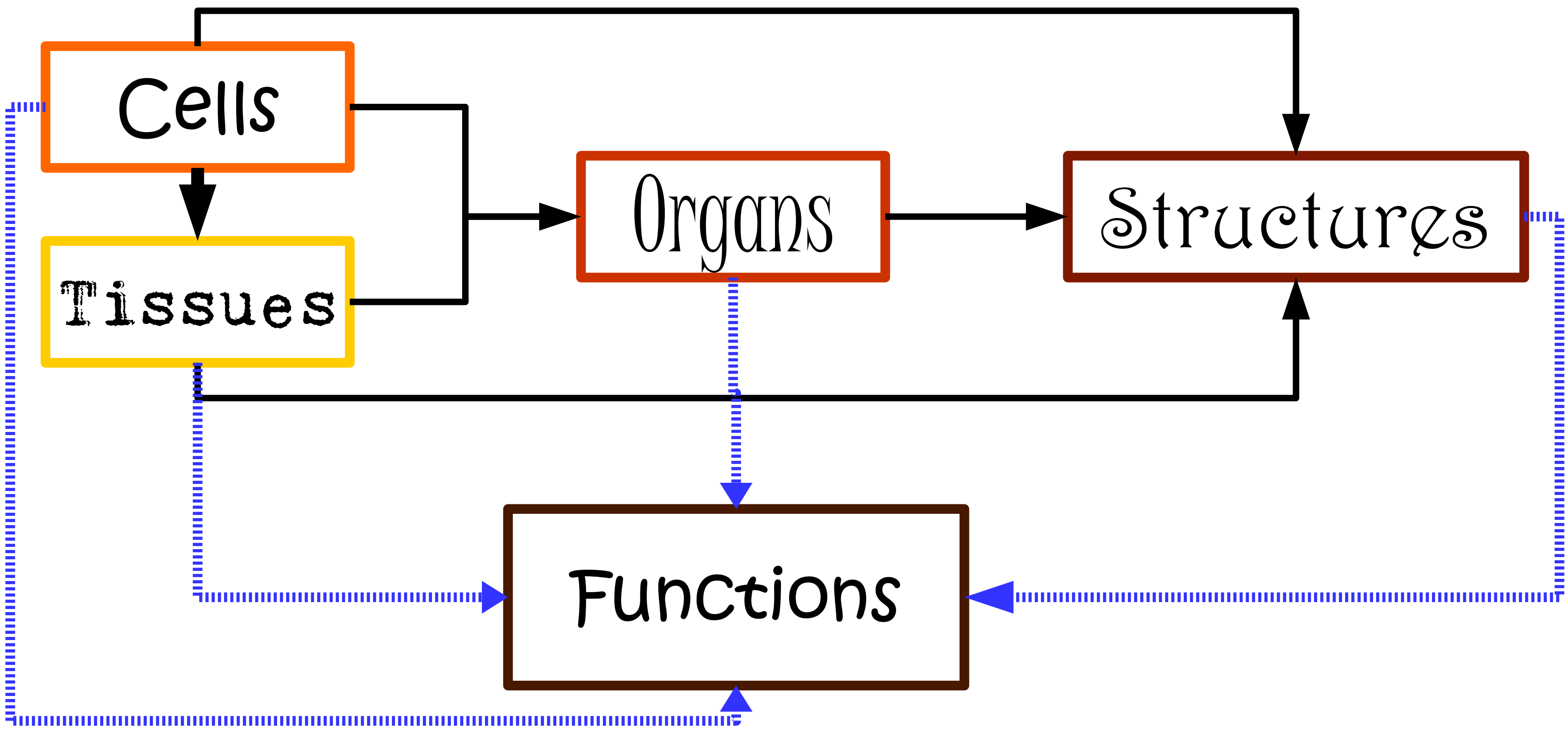
Arteries – No
Bile ducts – No
Lymph vessels – No

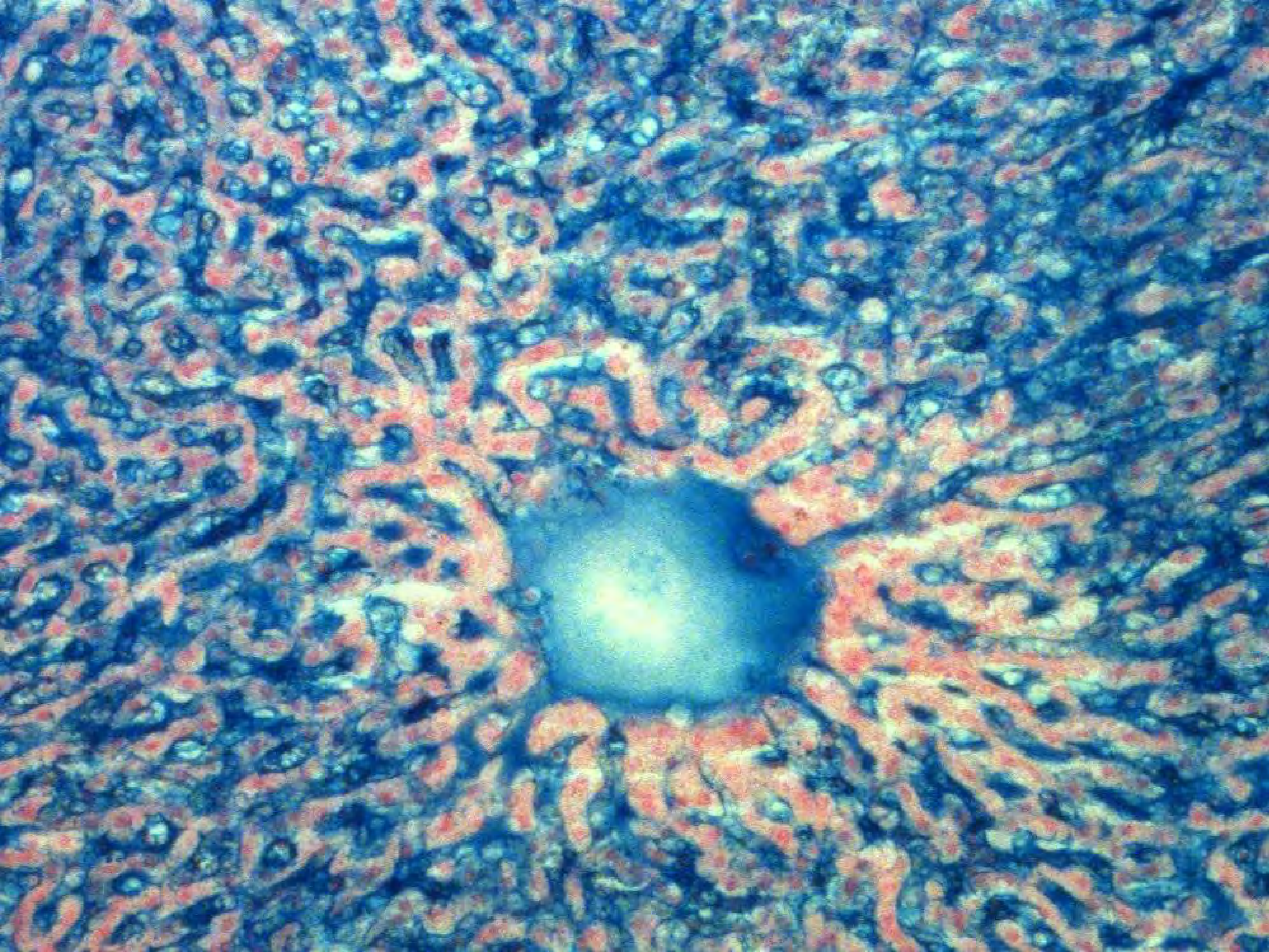
Where do we find these 3 structures?

Portal Triad

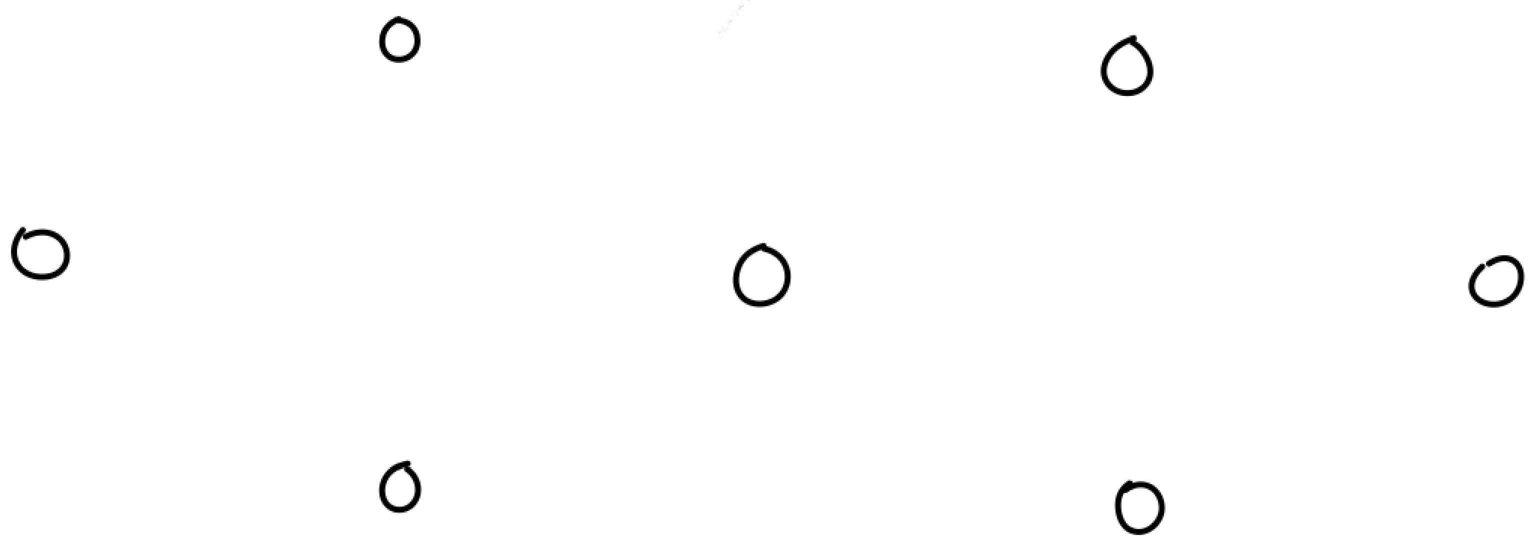


What stuff could there be?





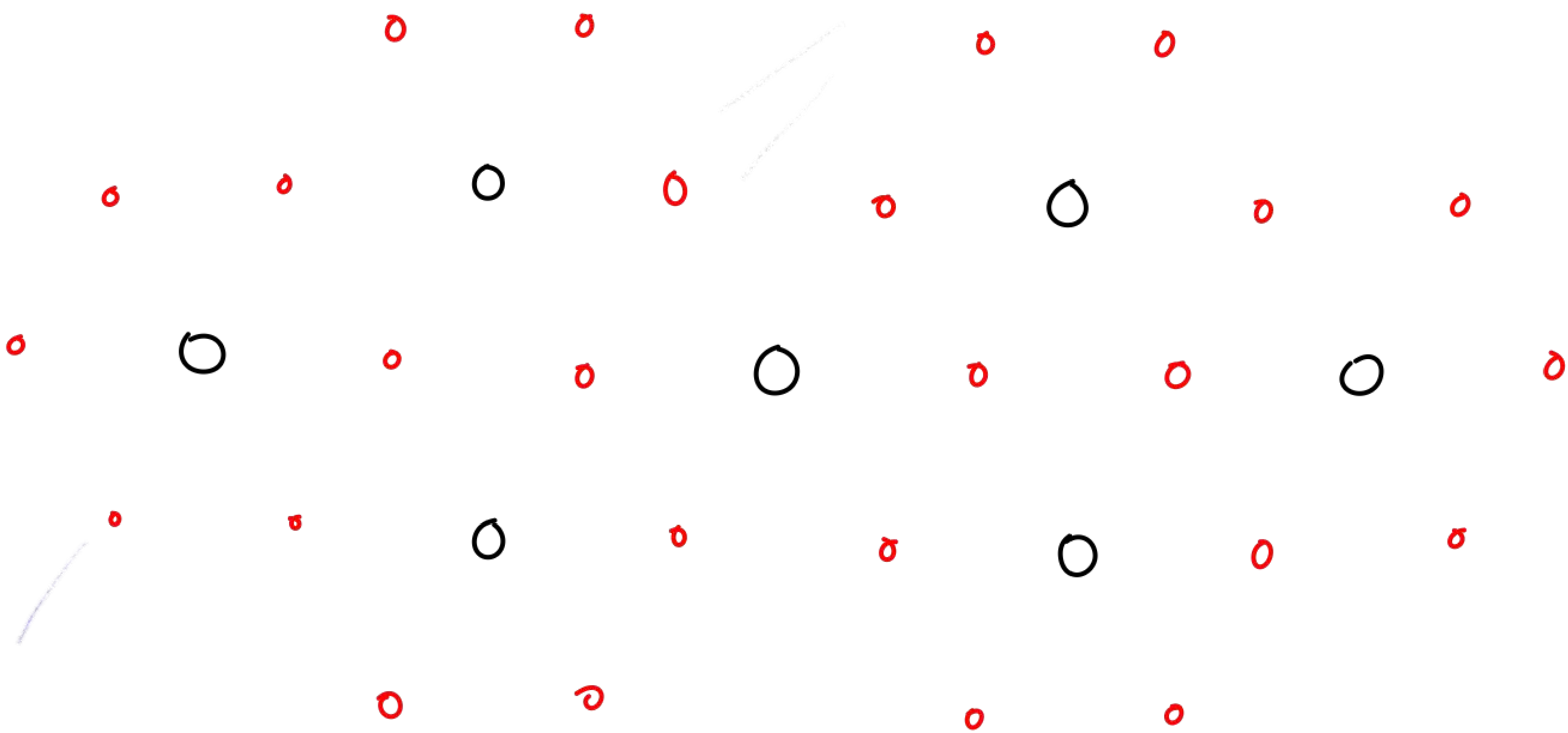
Vena centralis



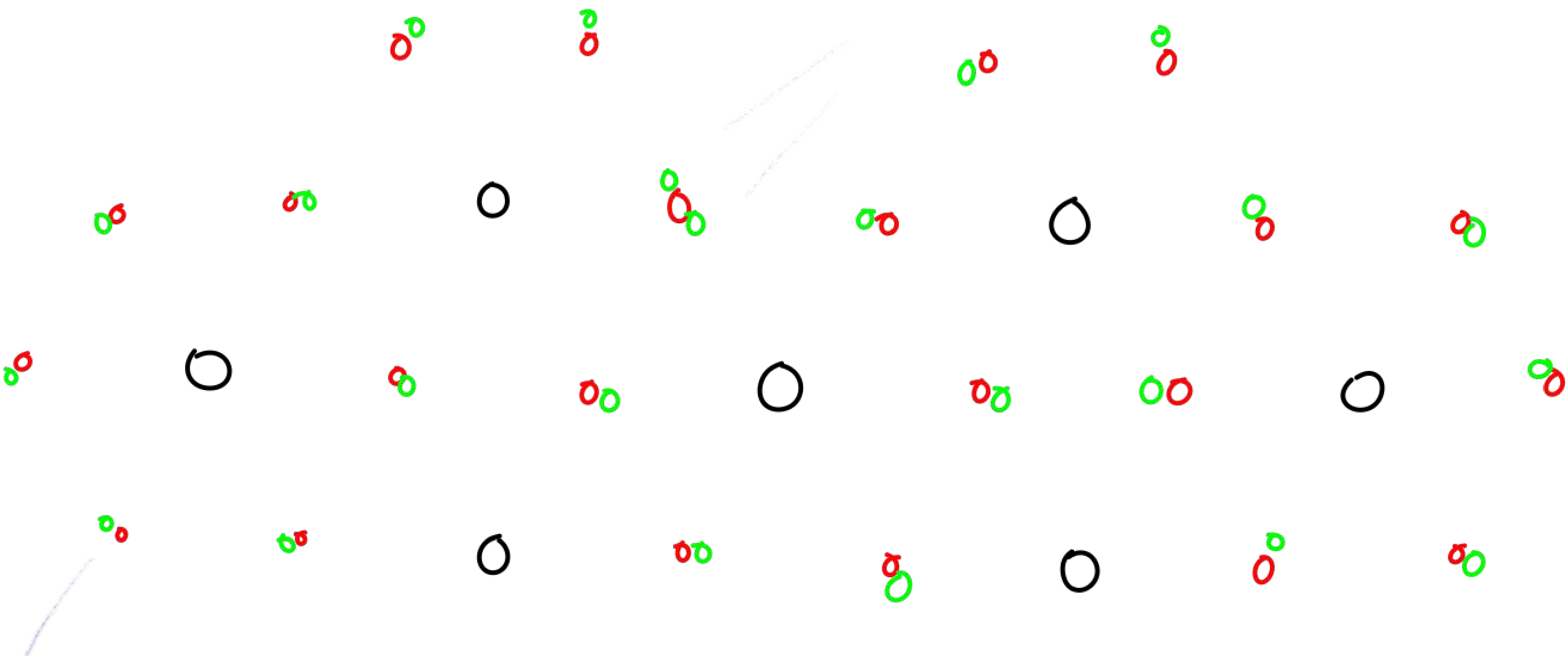
So what about the portal artery, vein, bile duct?

PS: There is a lymph vessel as well

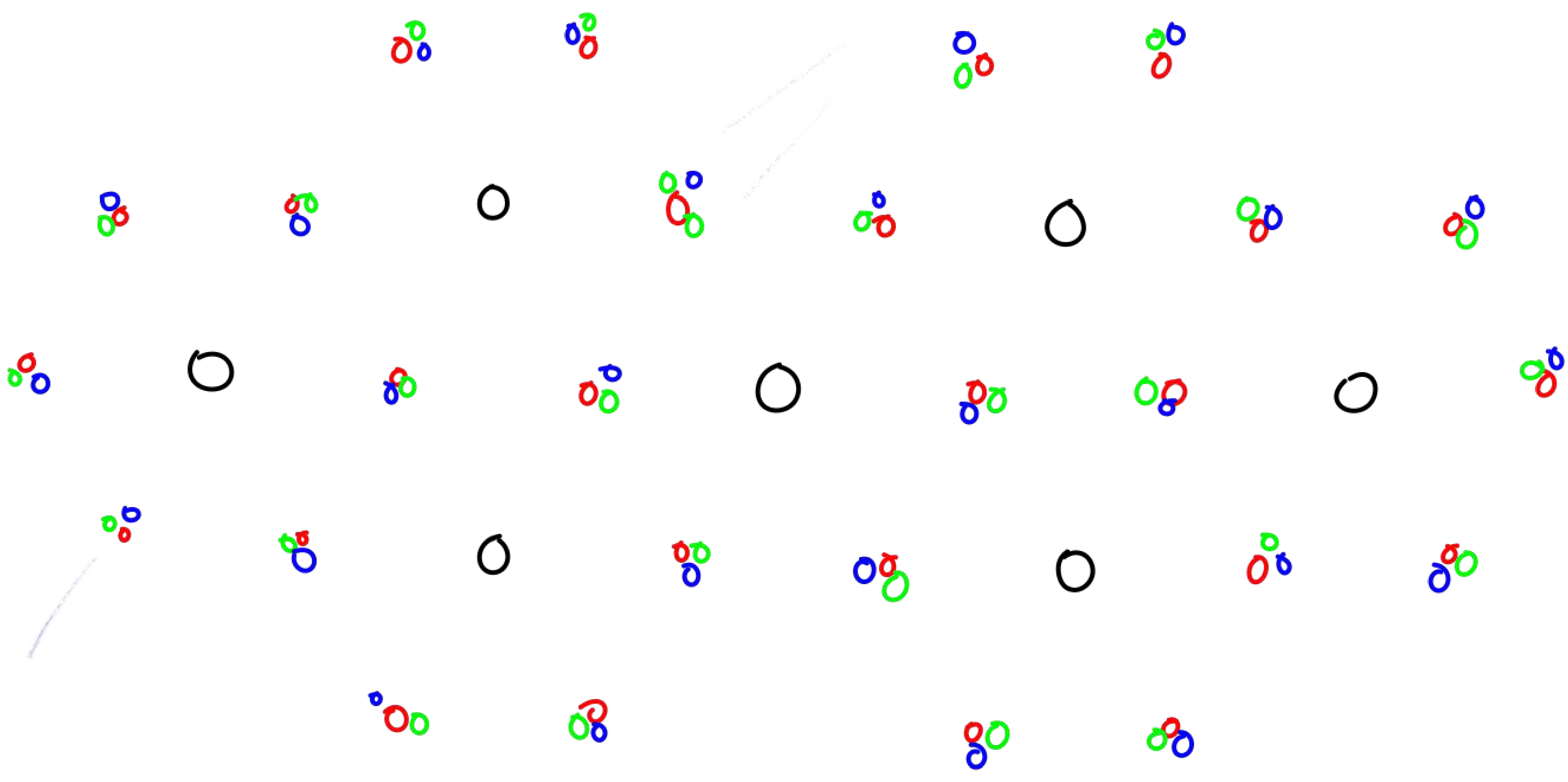
Portal artery

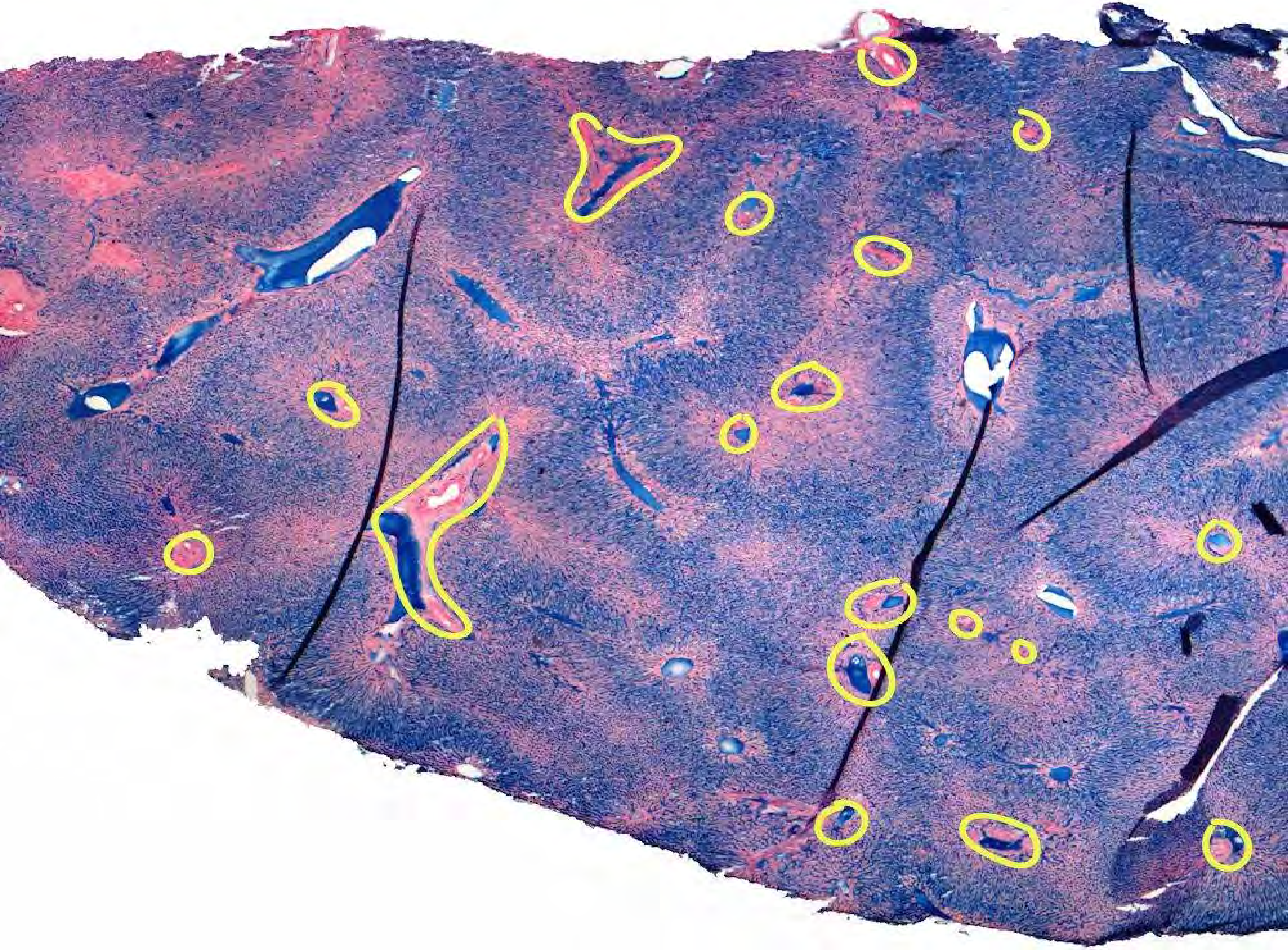


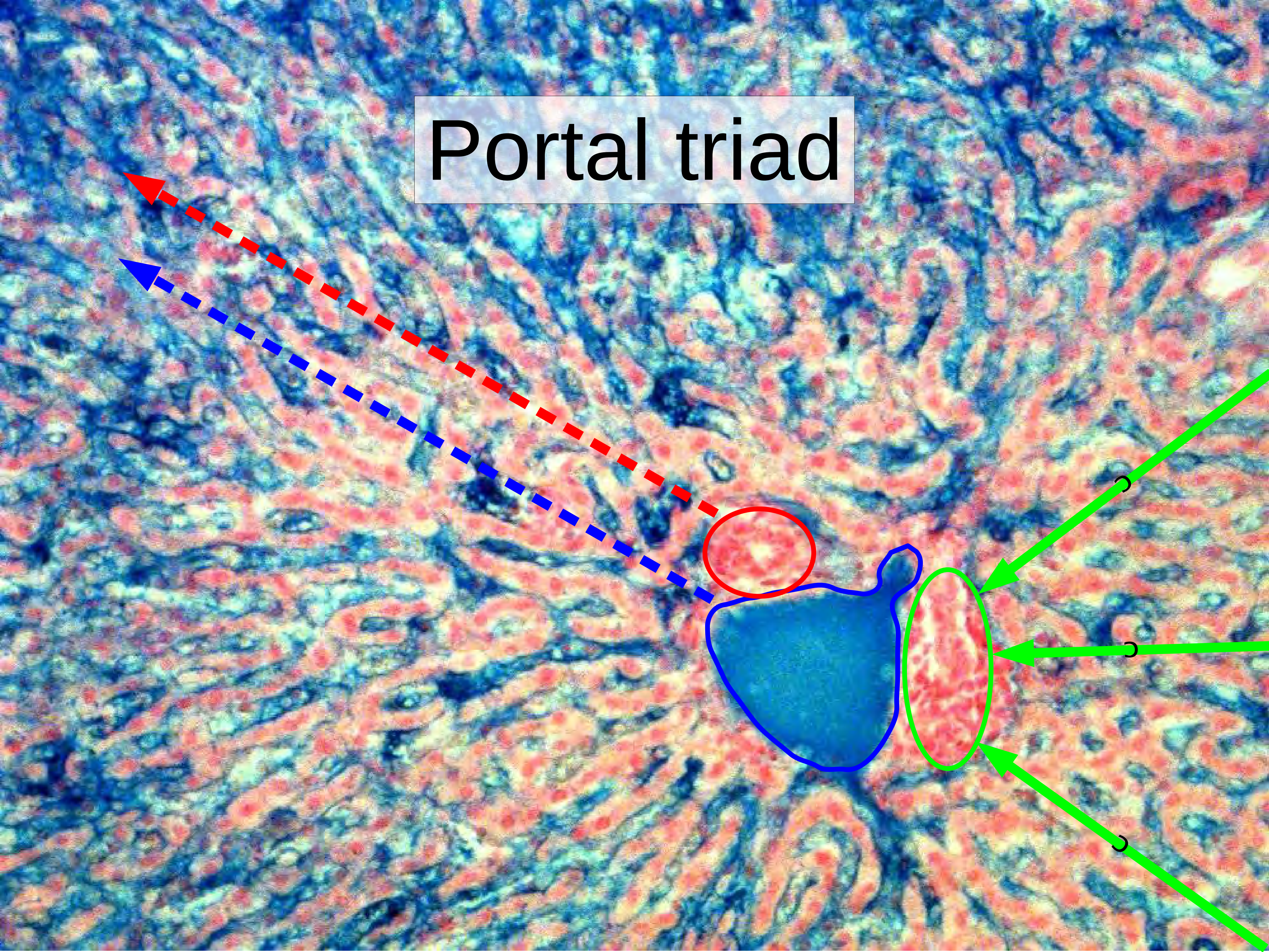
Bile ducts



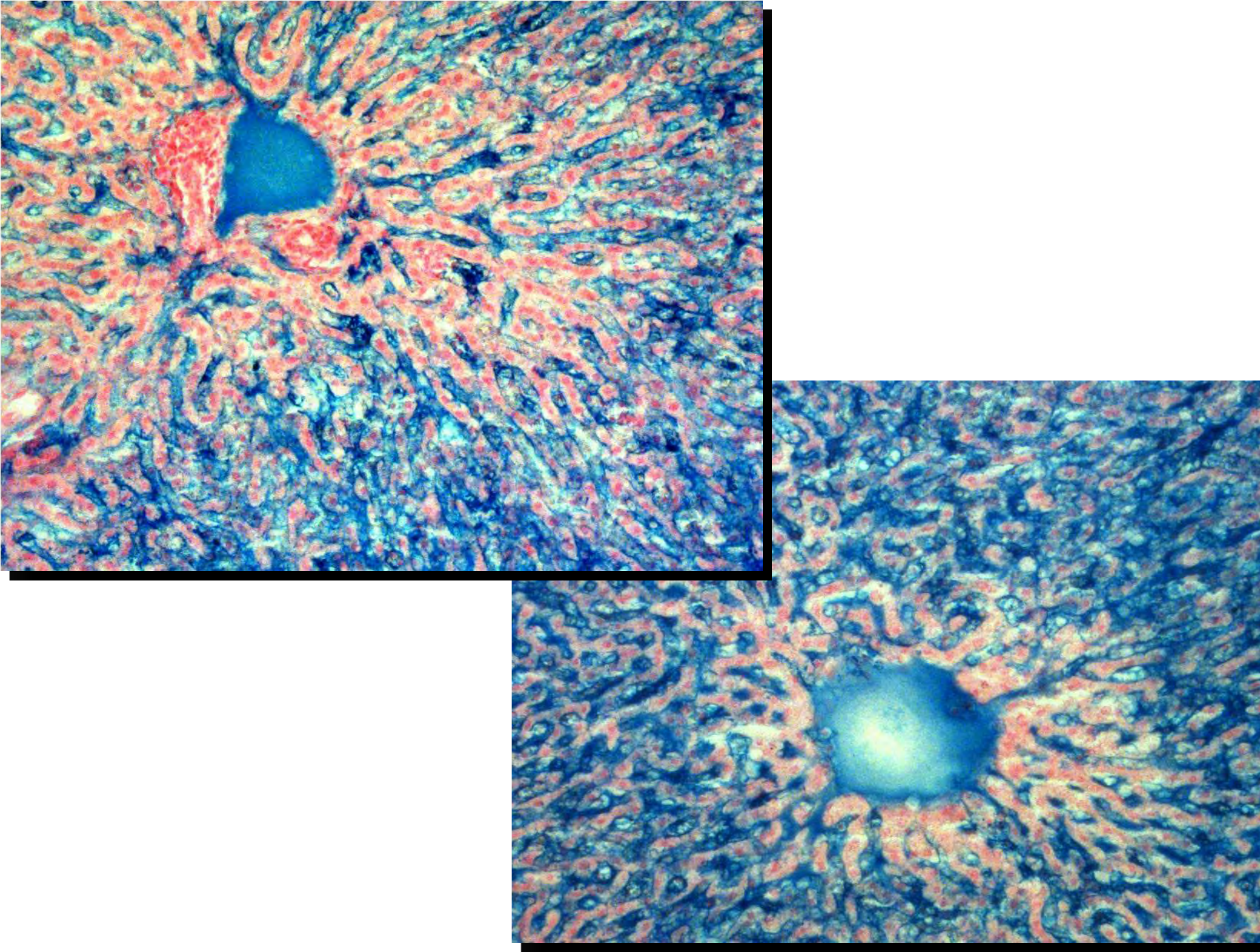
Portal veins

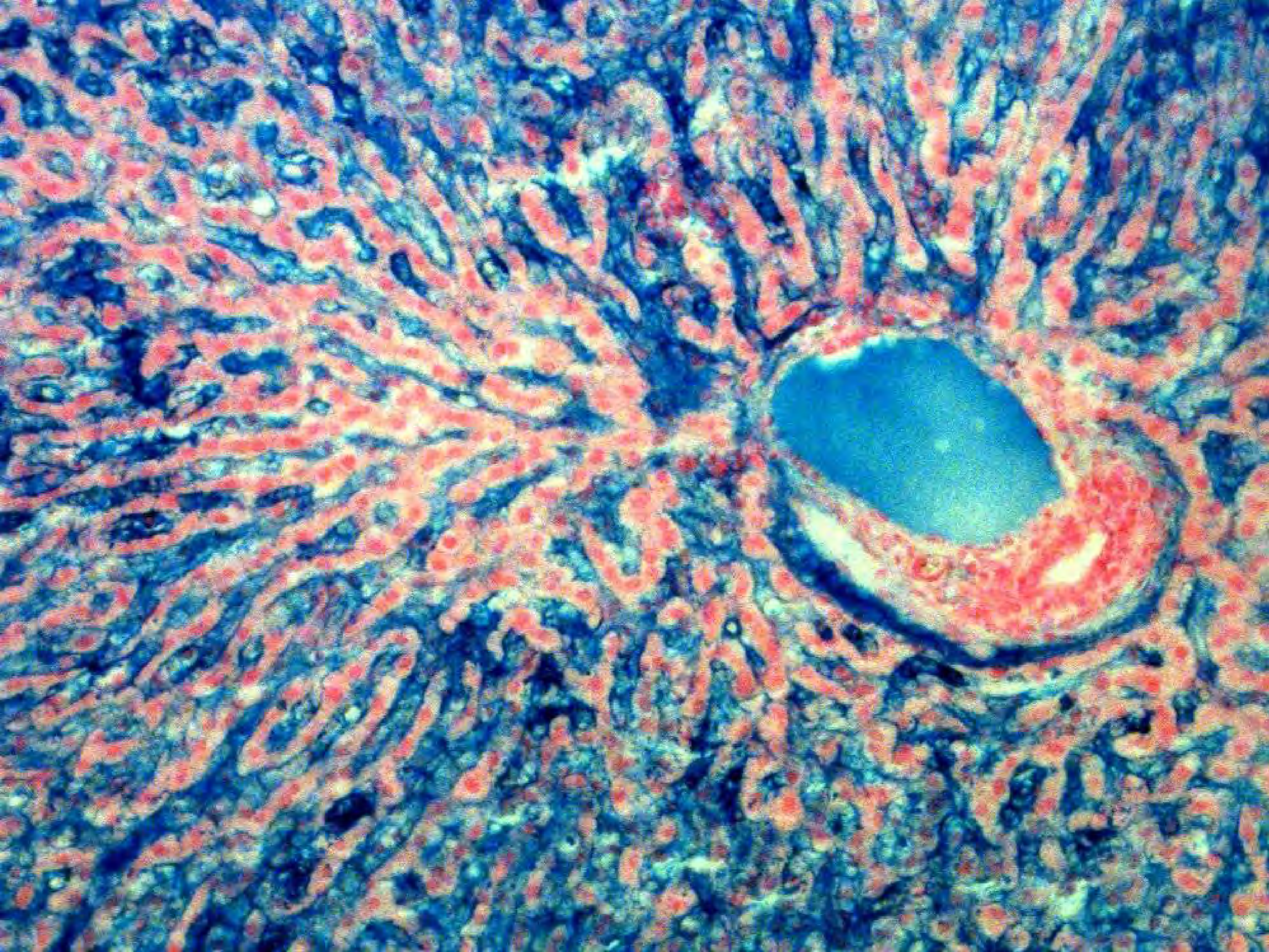




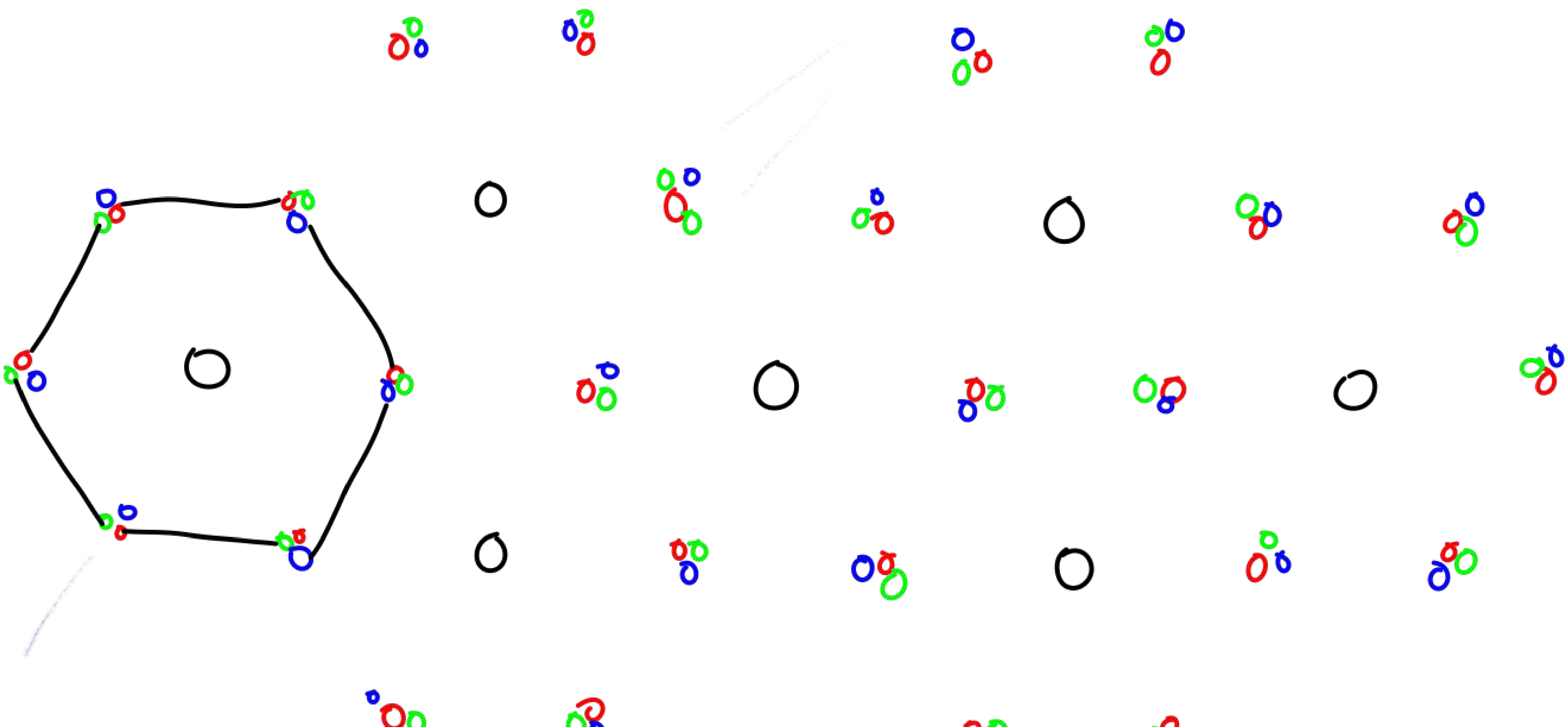

Portal triad

Compared to the central vein...

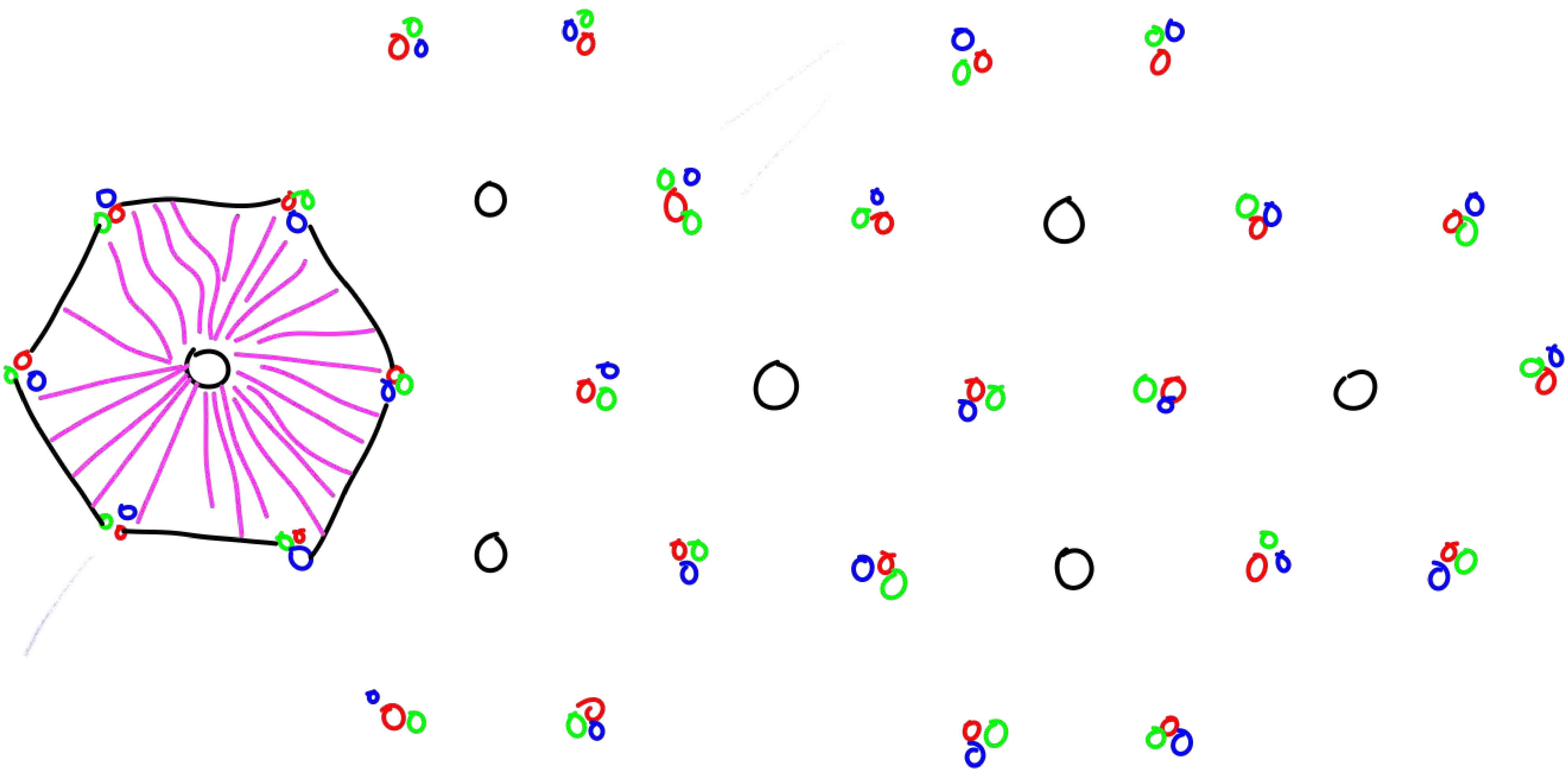


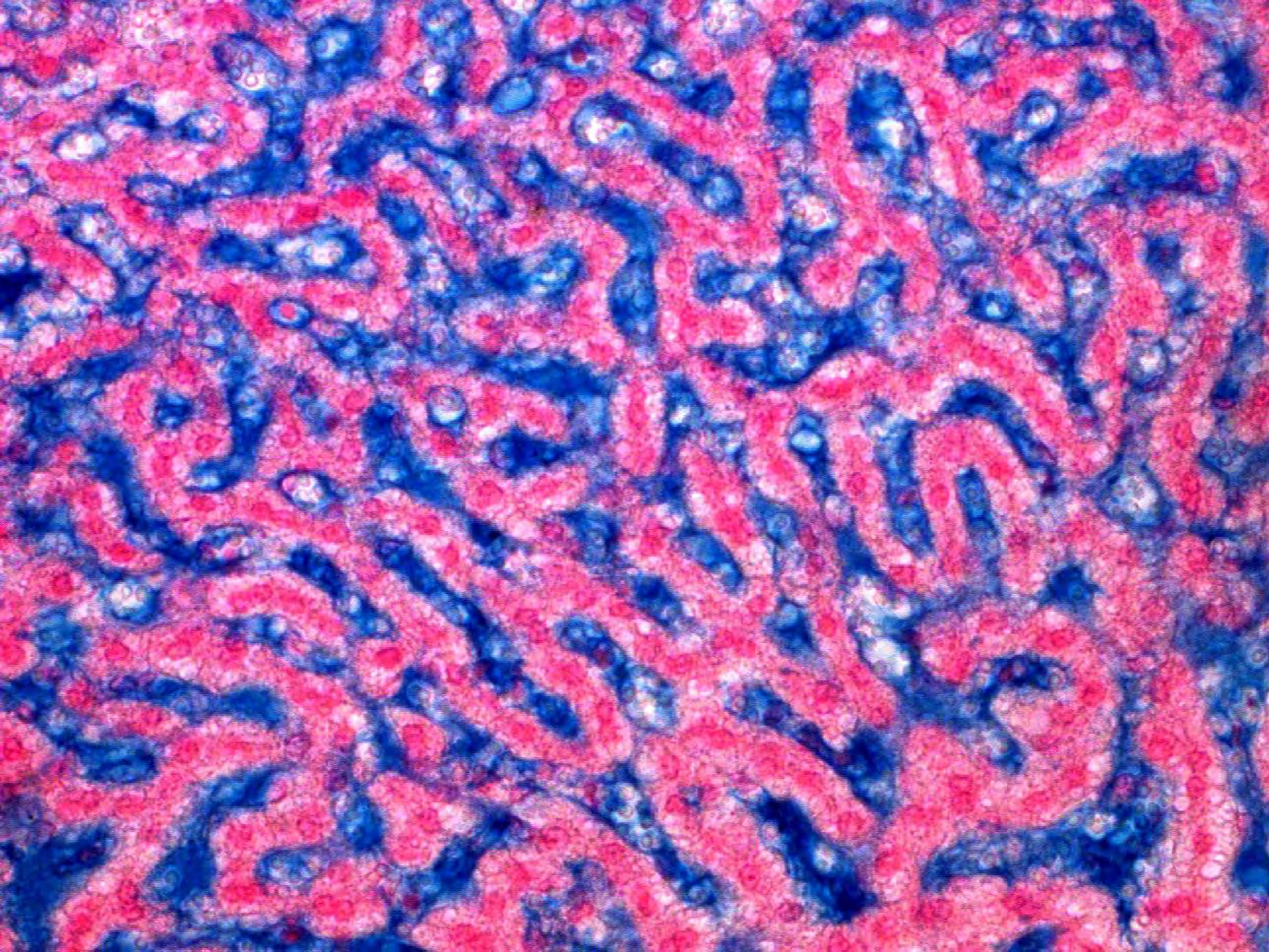


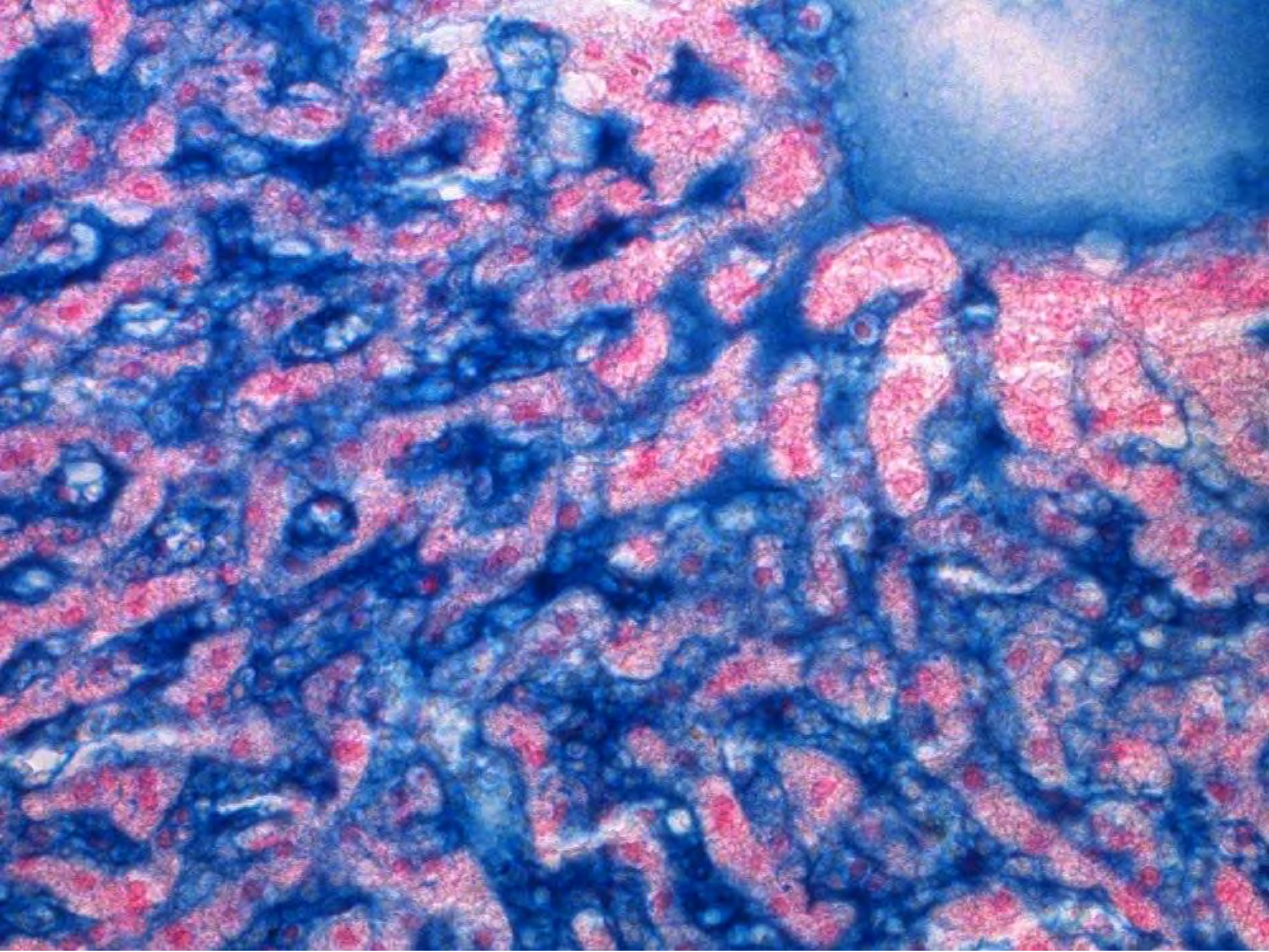
Classic lobule



Classic lobule







What is the function of liver cells?

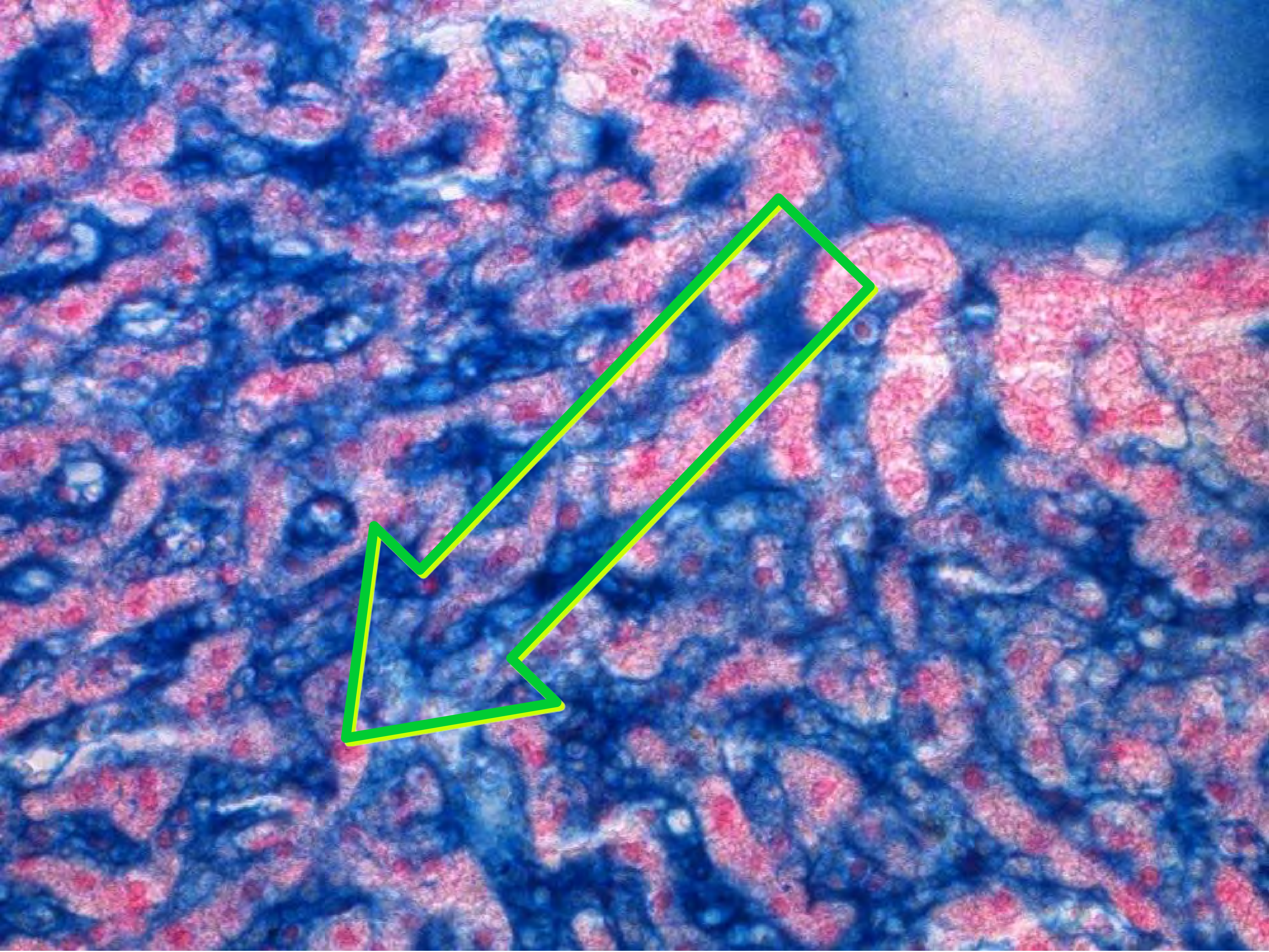
What is the function of liver cells?

Detoxify
Make bile

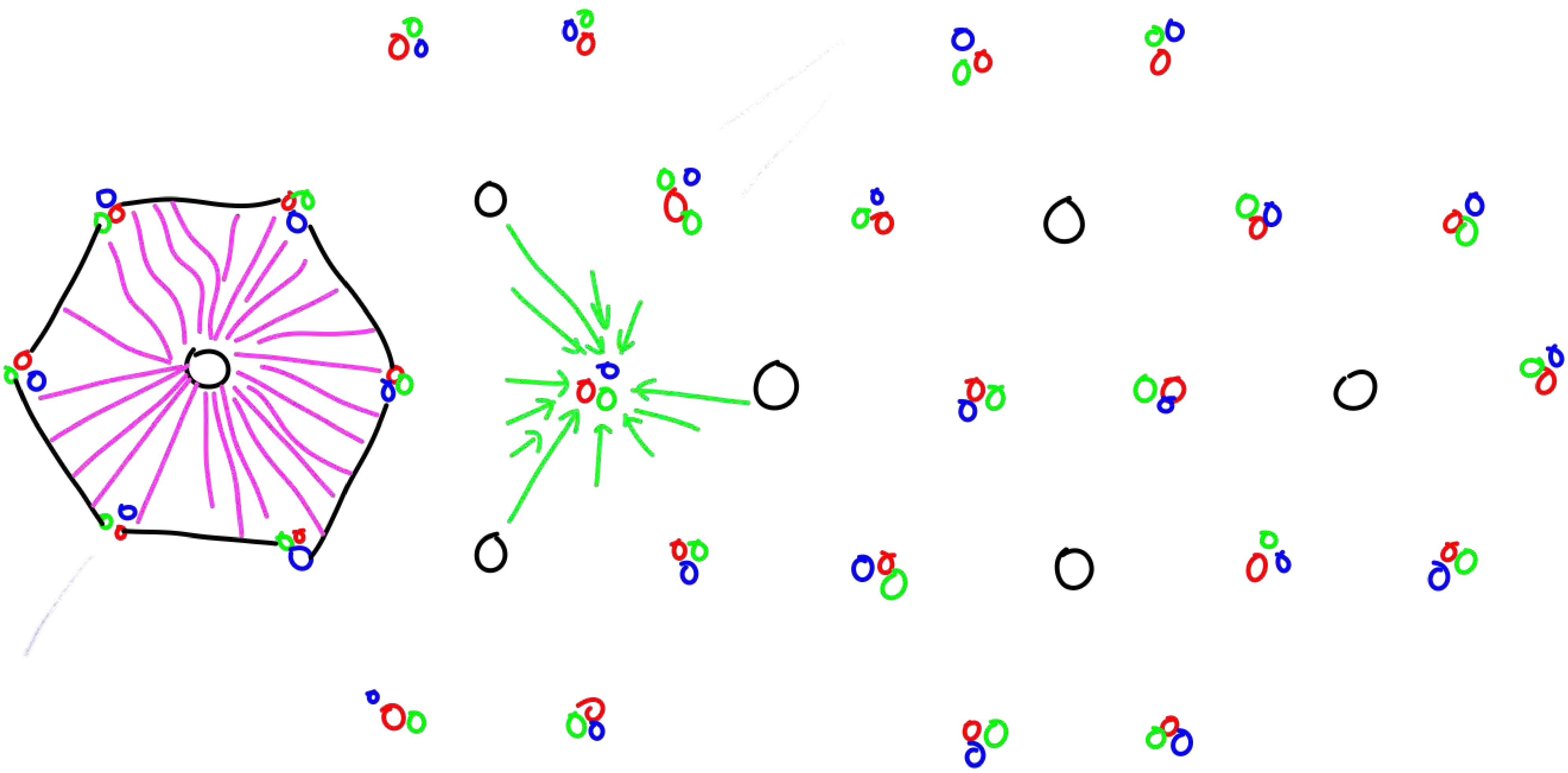
What is the function of liver cells?

Detoxify
Make bile

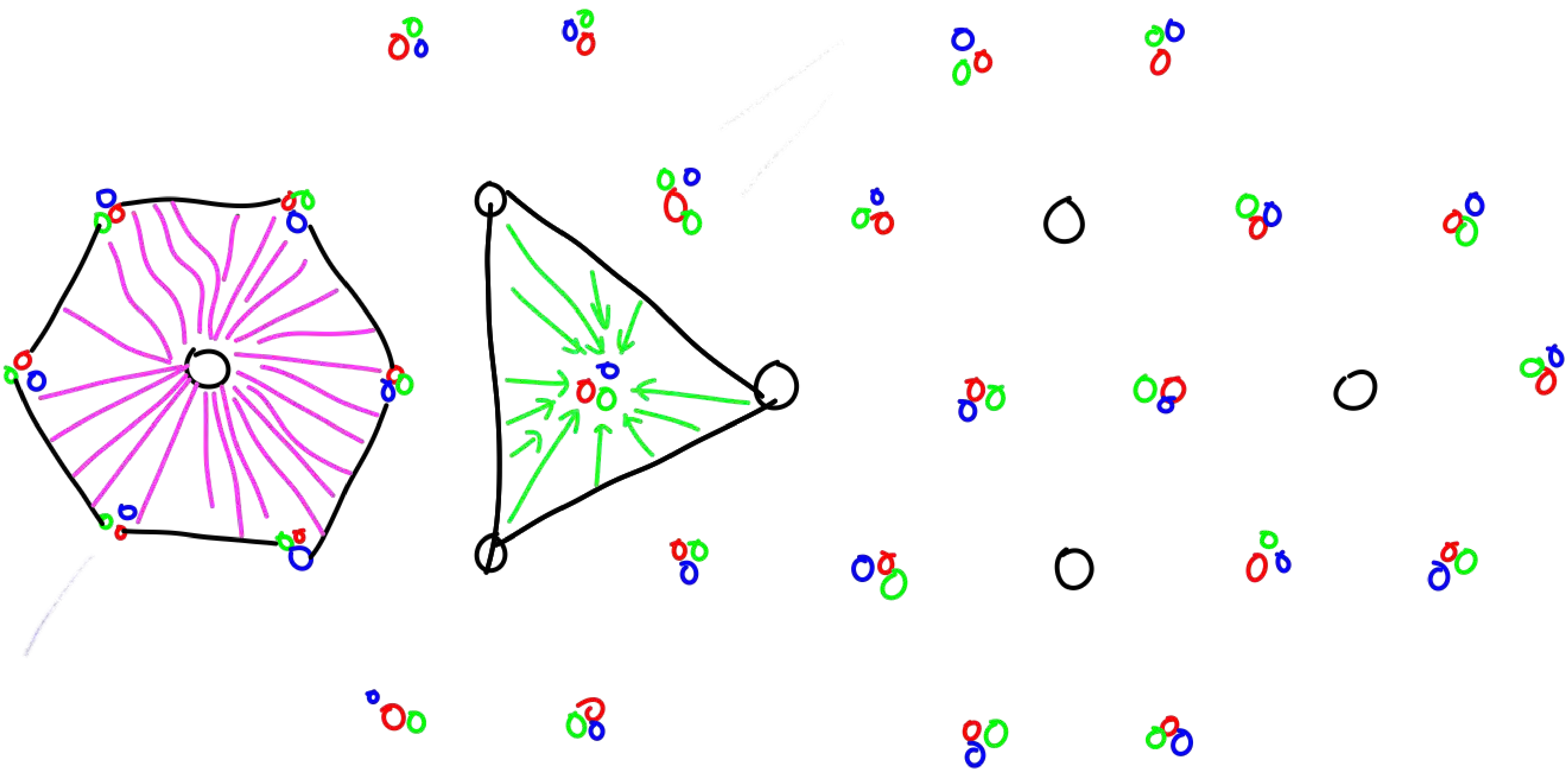
Where does the bile come from?
Where does bile go to?



Bile – away from V centralis



Portal lobule



Blood flow

What happens

to blood

going

into the liver?

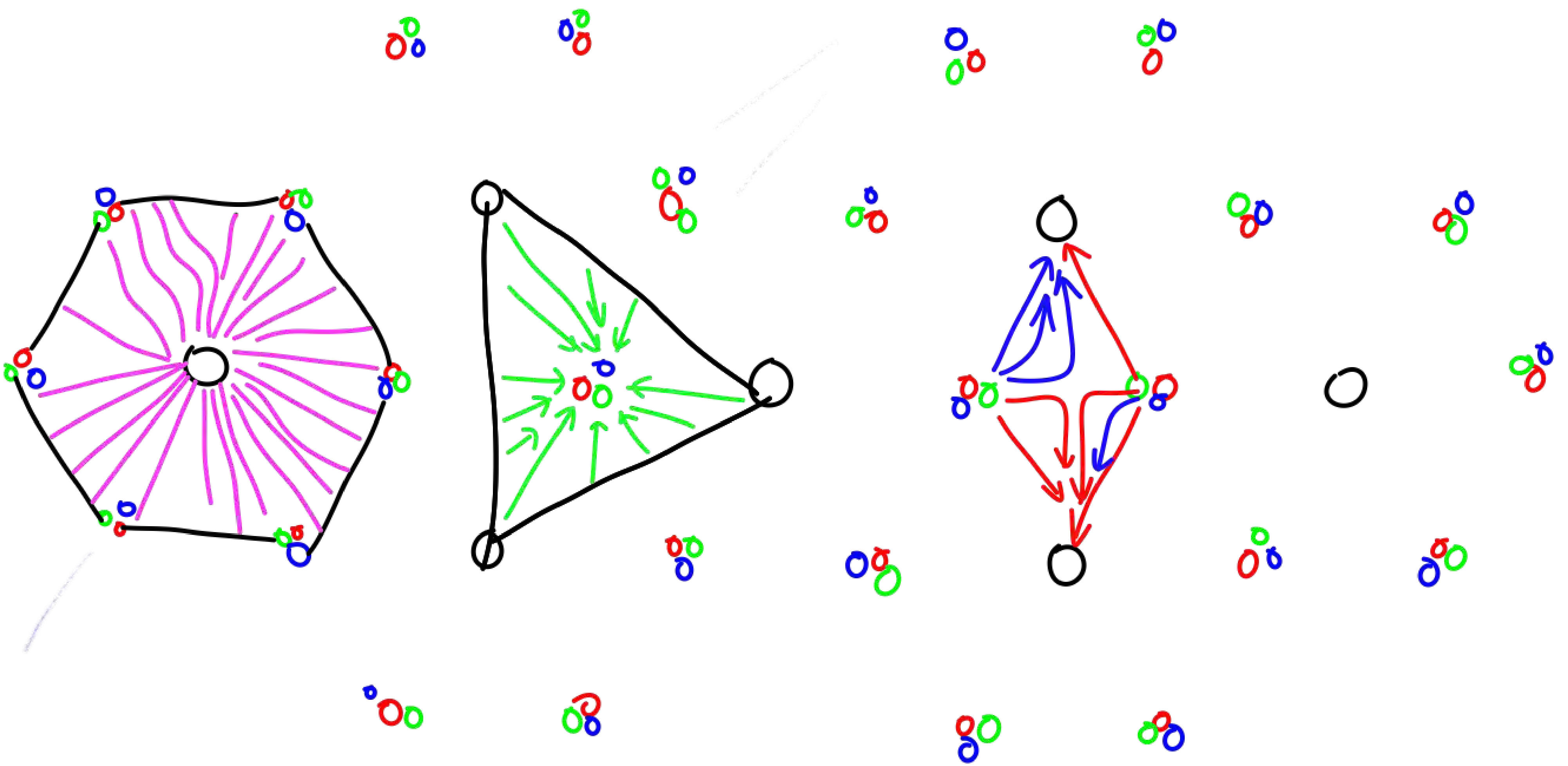
Blood flow

From A&V

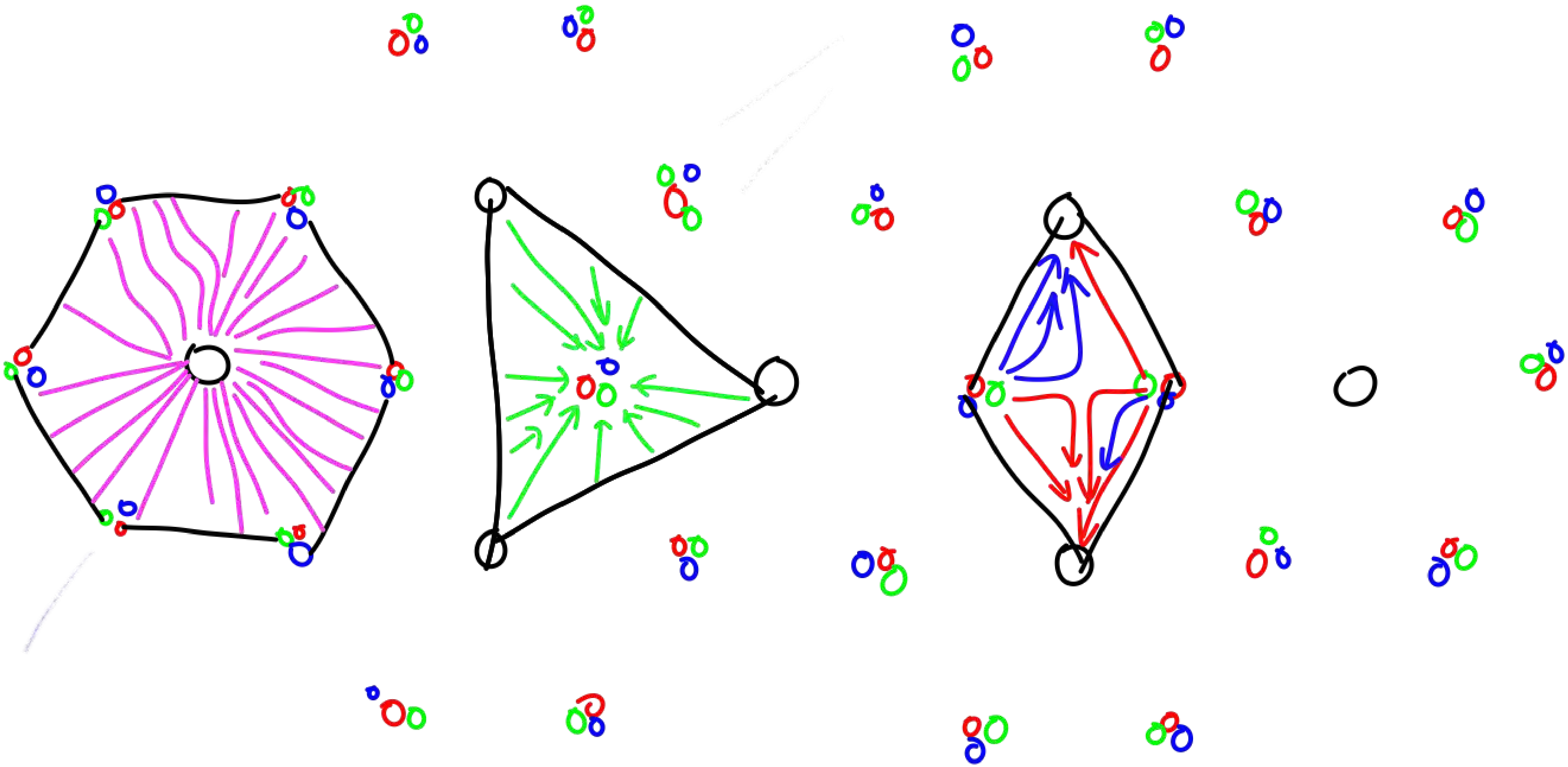
Mix

Towards central vein

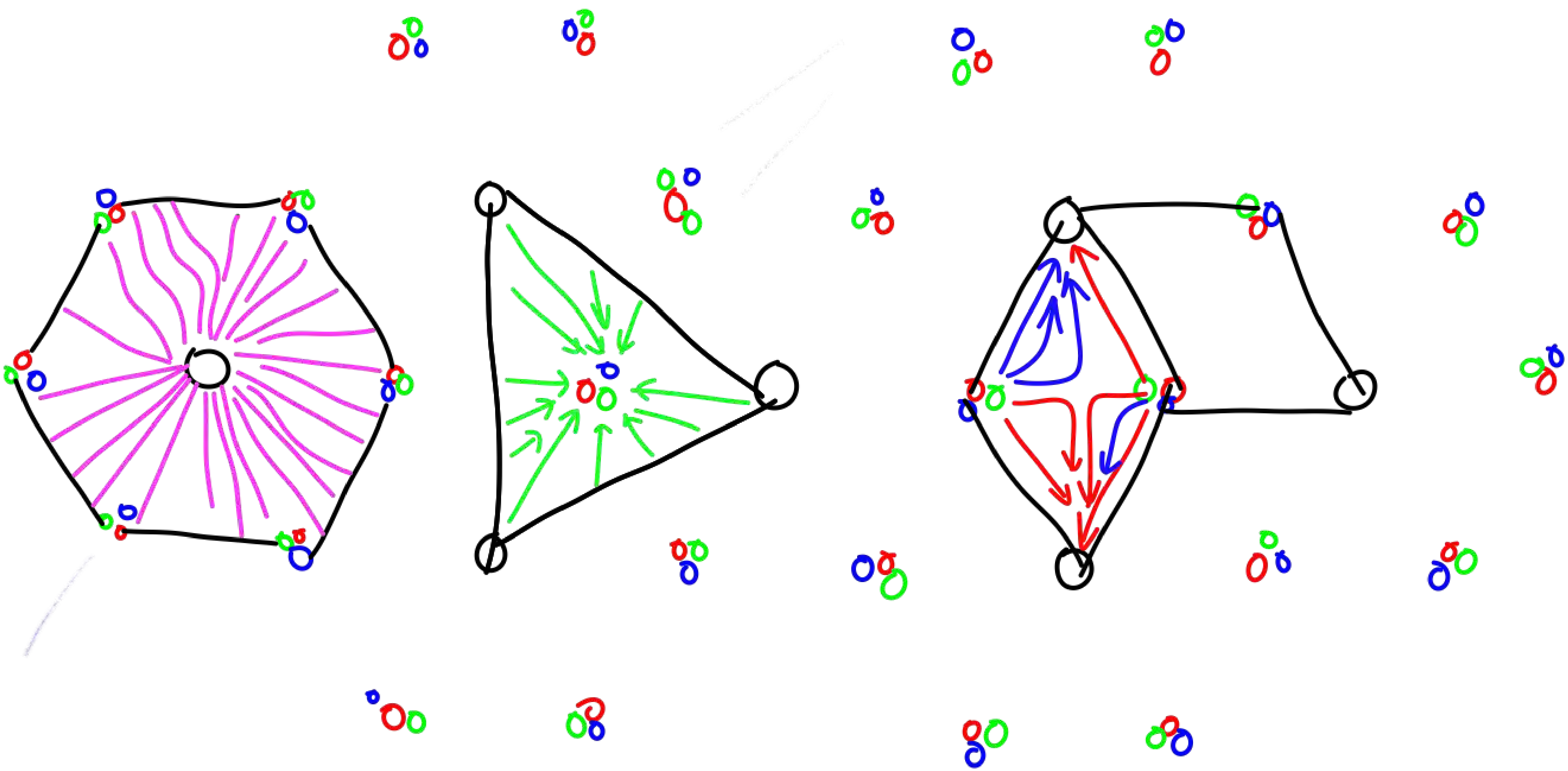
Artery & Vein -> Vein



Acinus



And another acinus

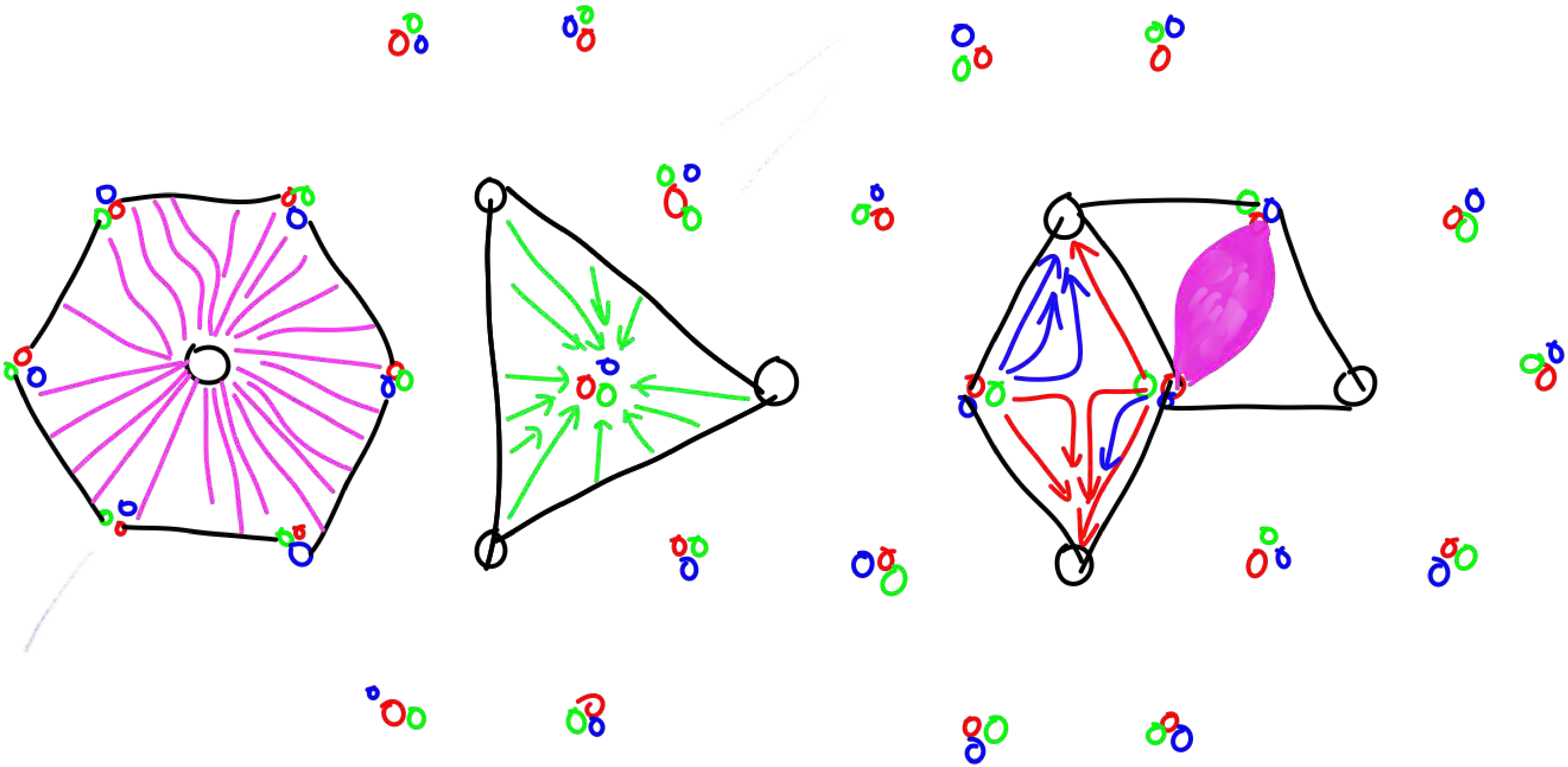


Blood flow

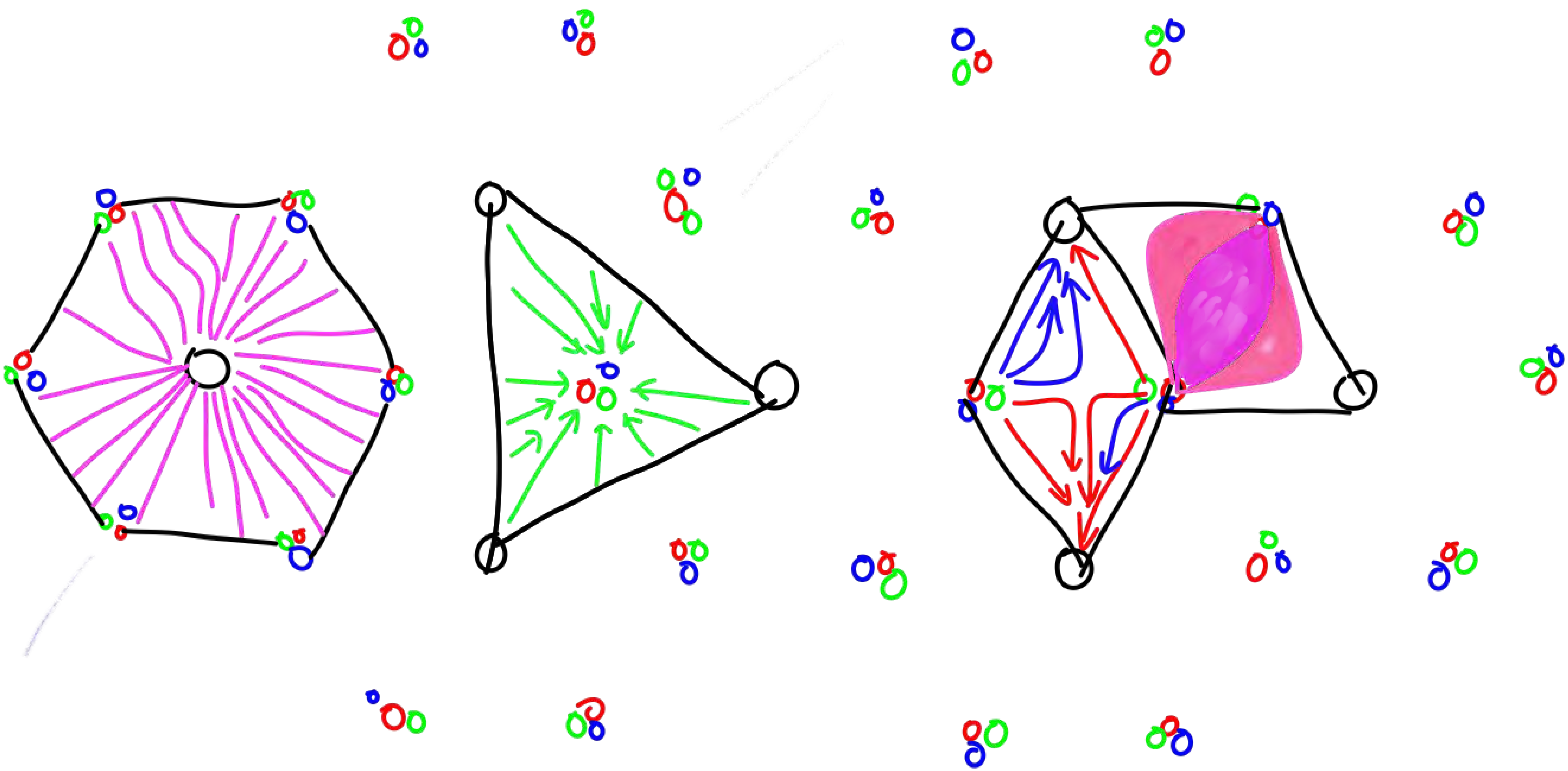
Clinical implications?

Critical concentrations

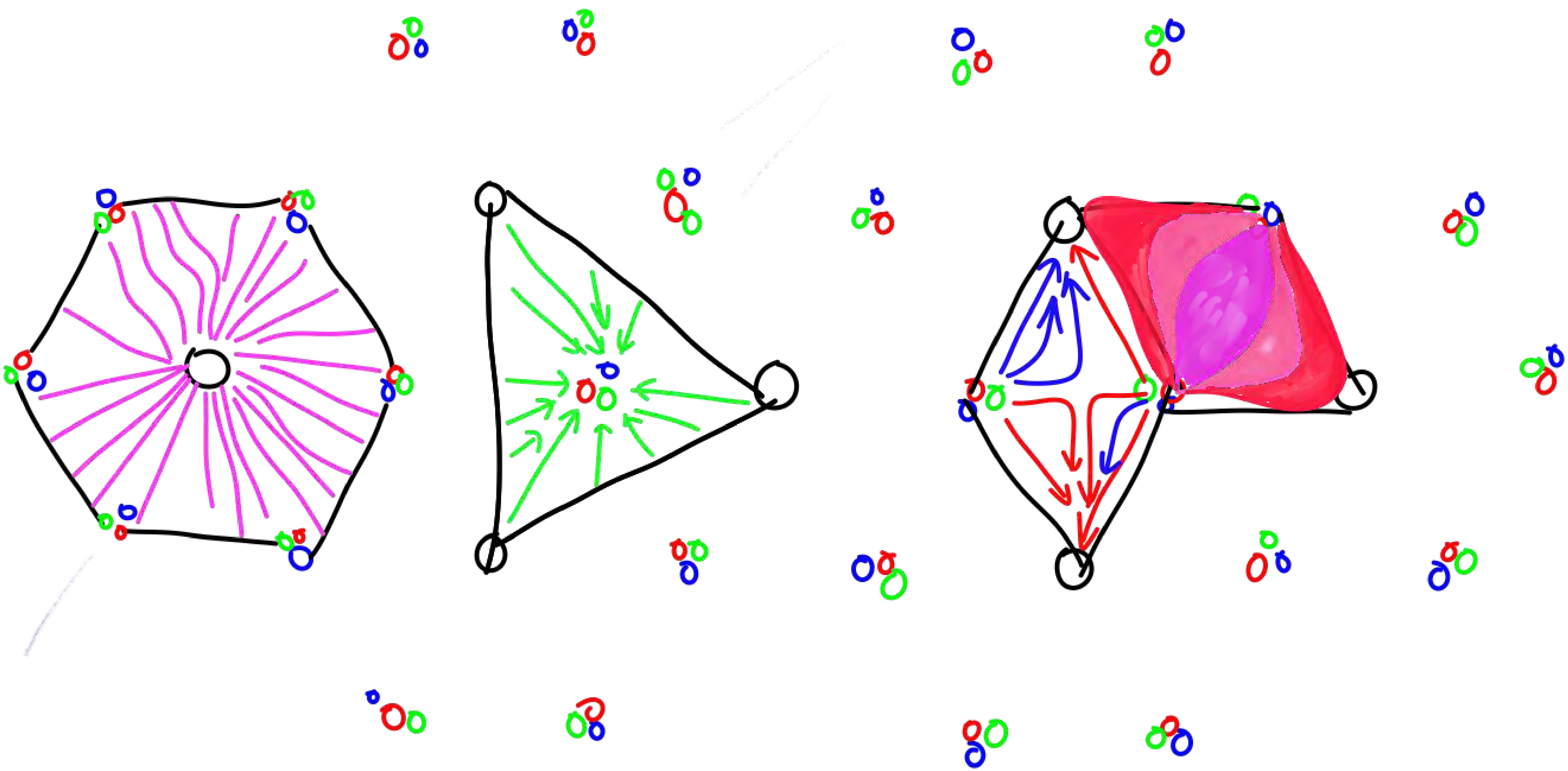
Zone 1



Zone 2

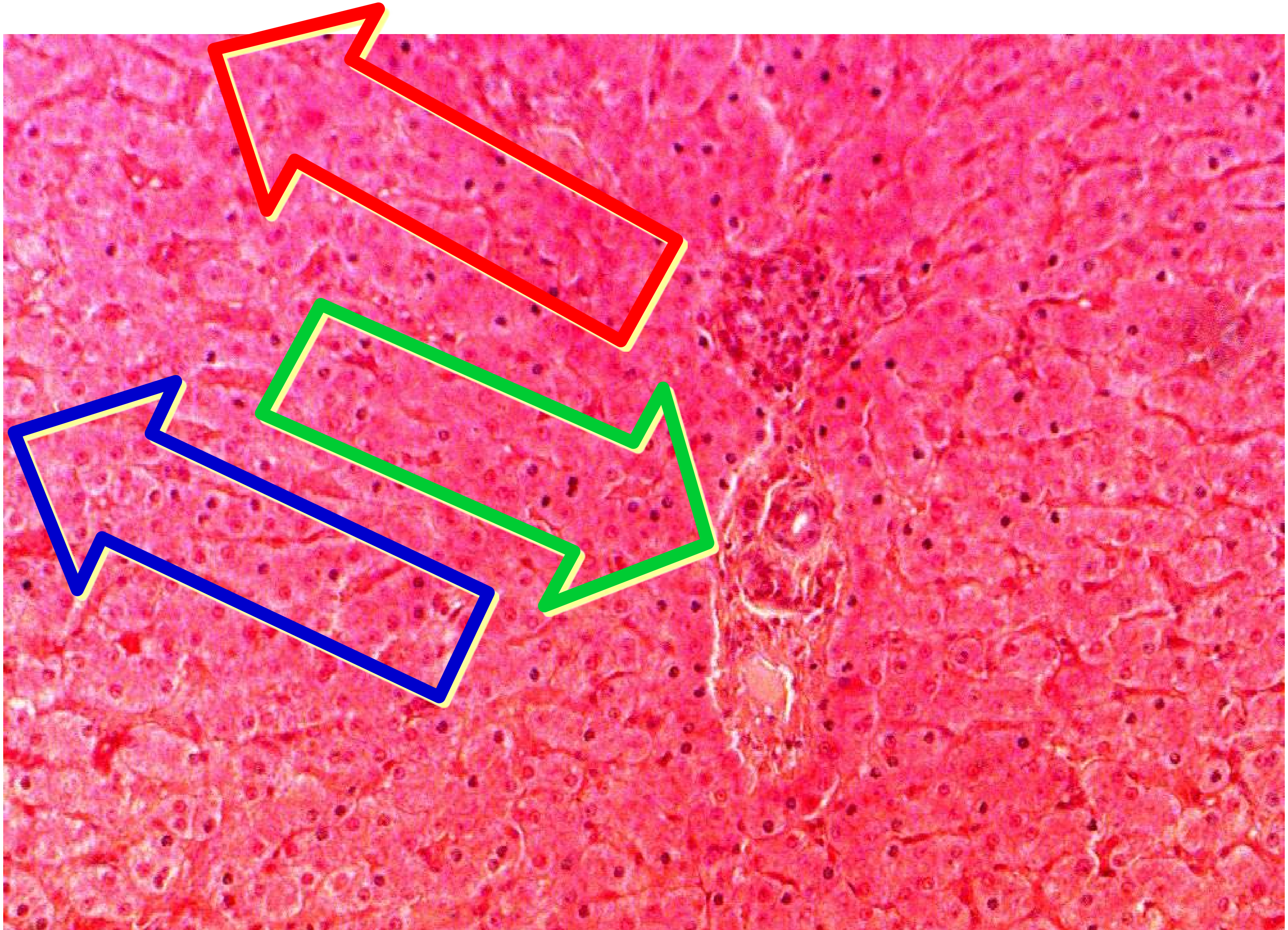


Zone 3

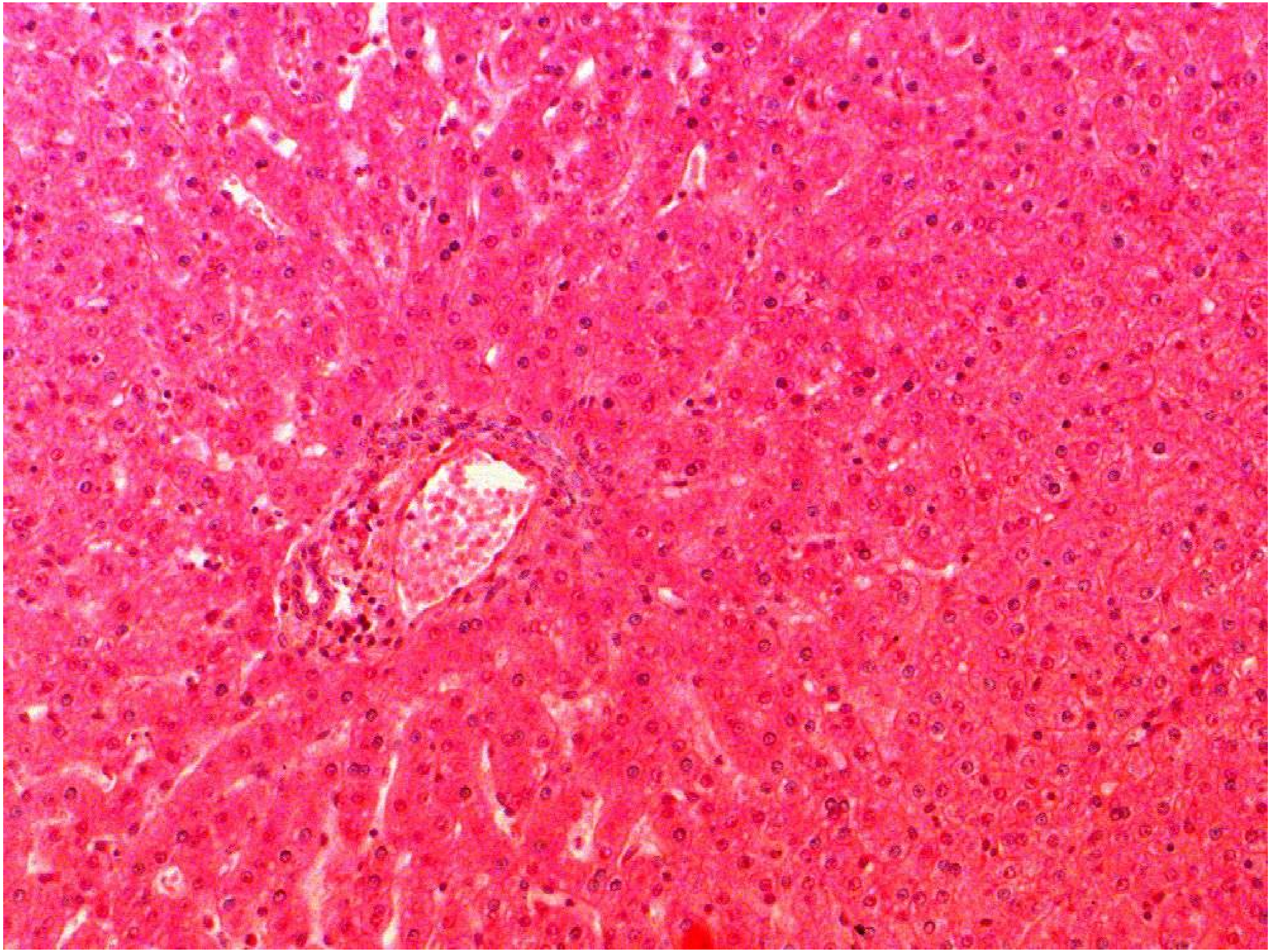


Imagine poison gas

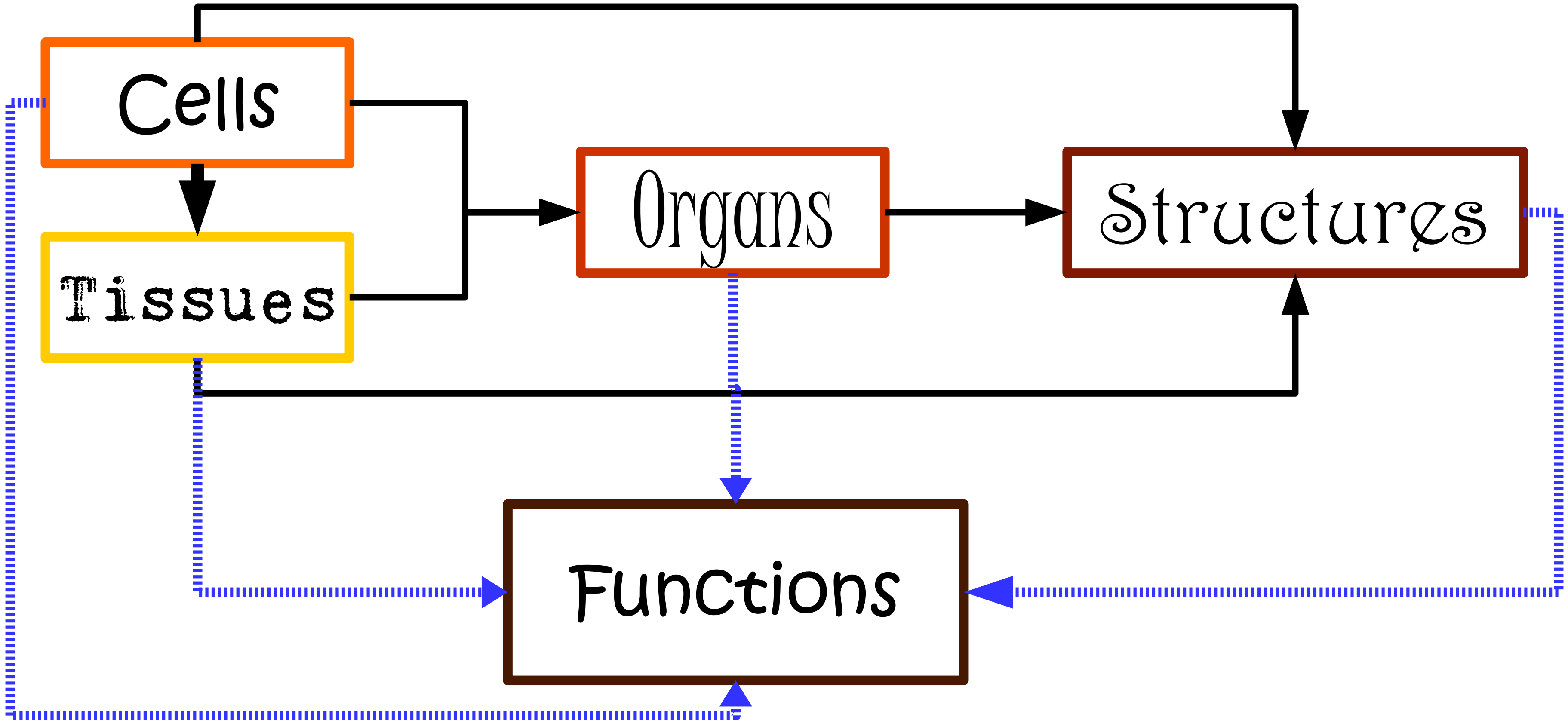
Portal triad



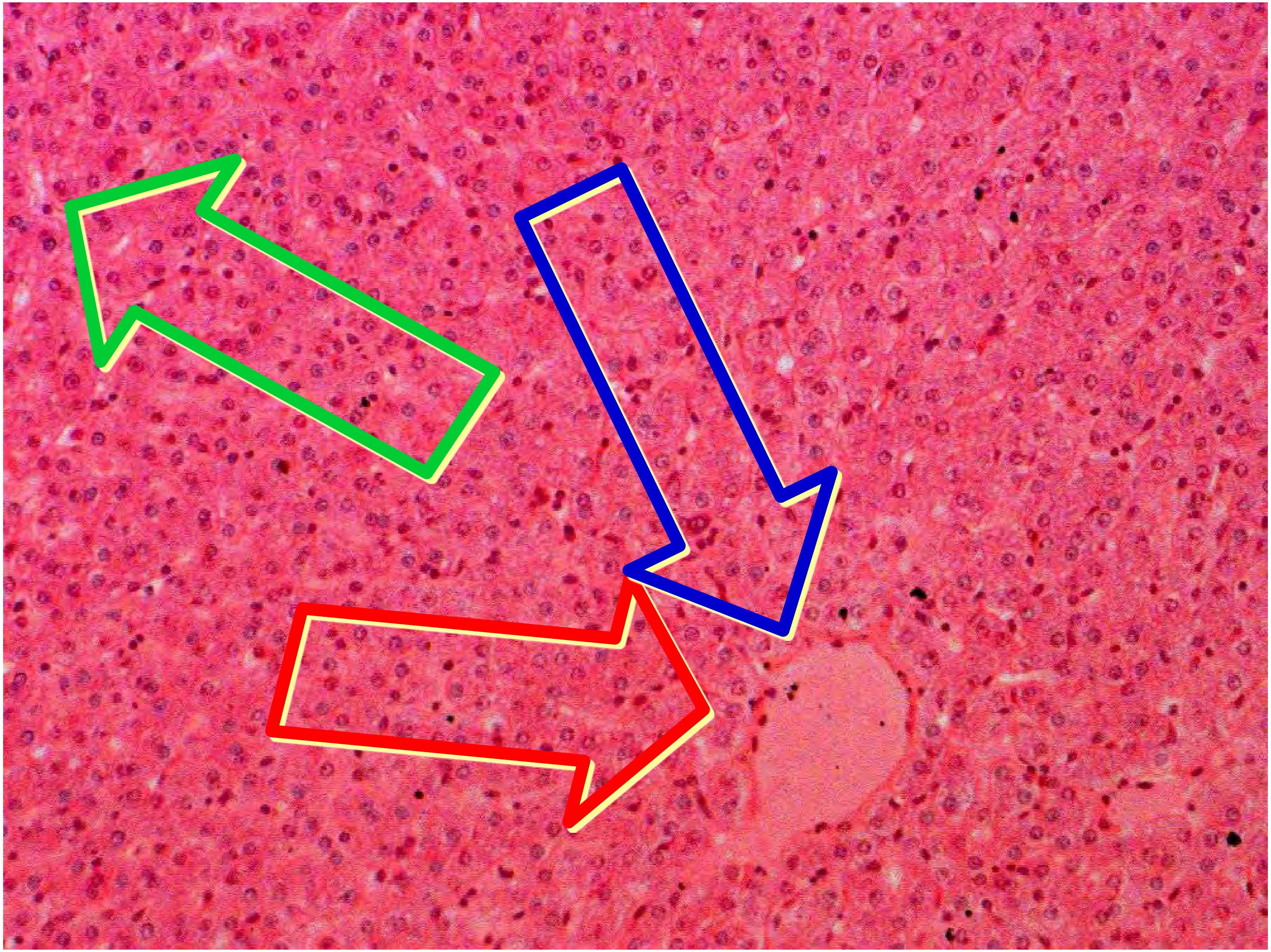
Portal triad



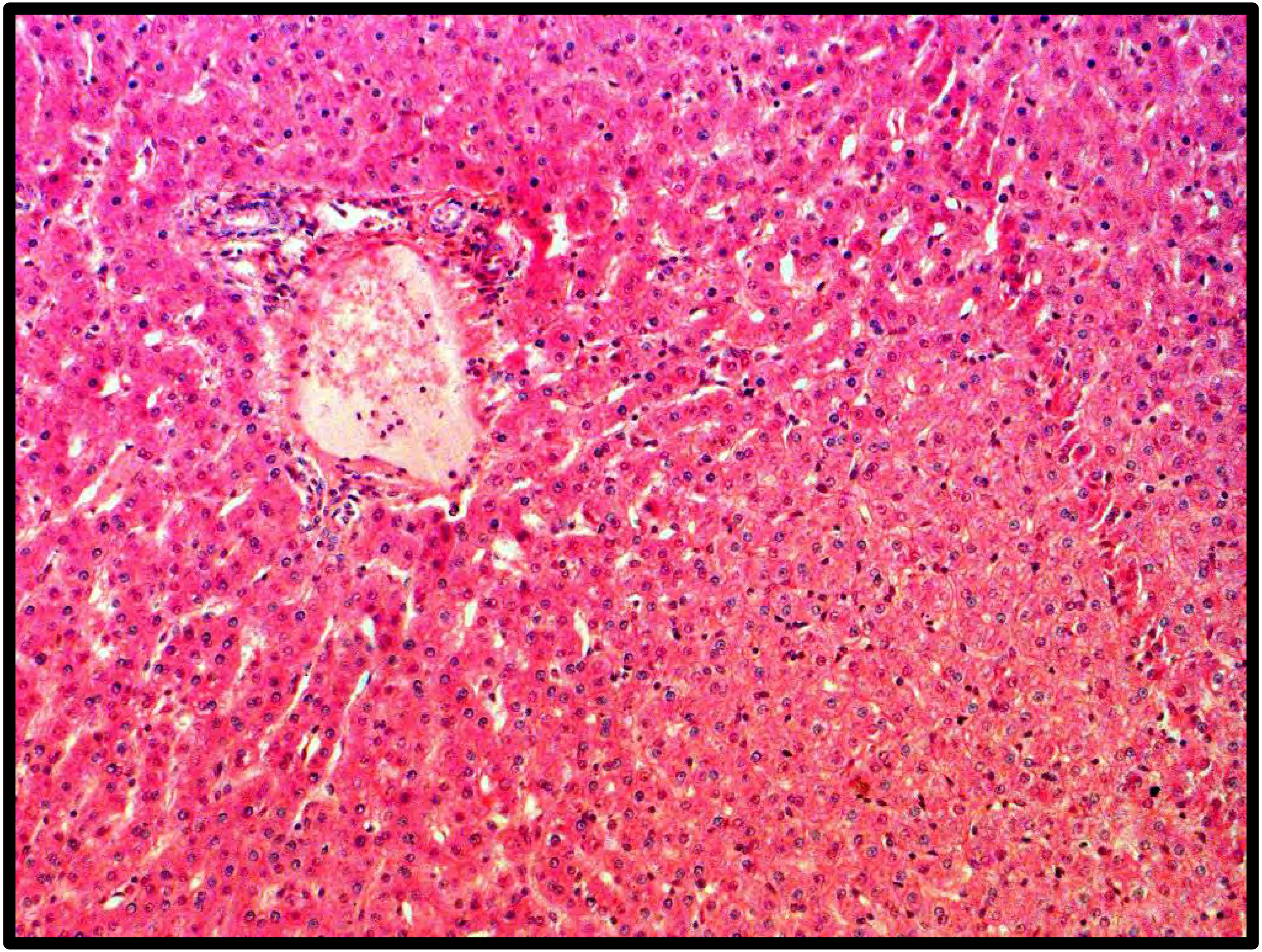
What stuff could there be?



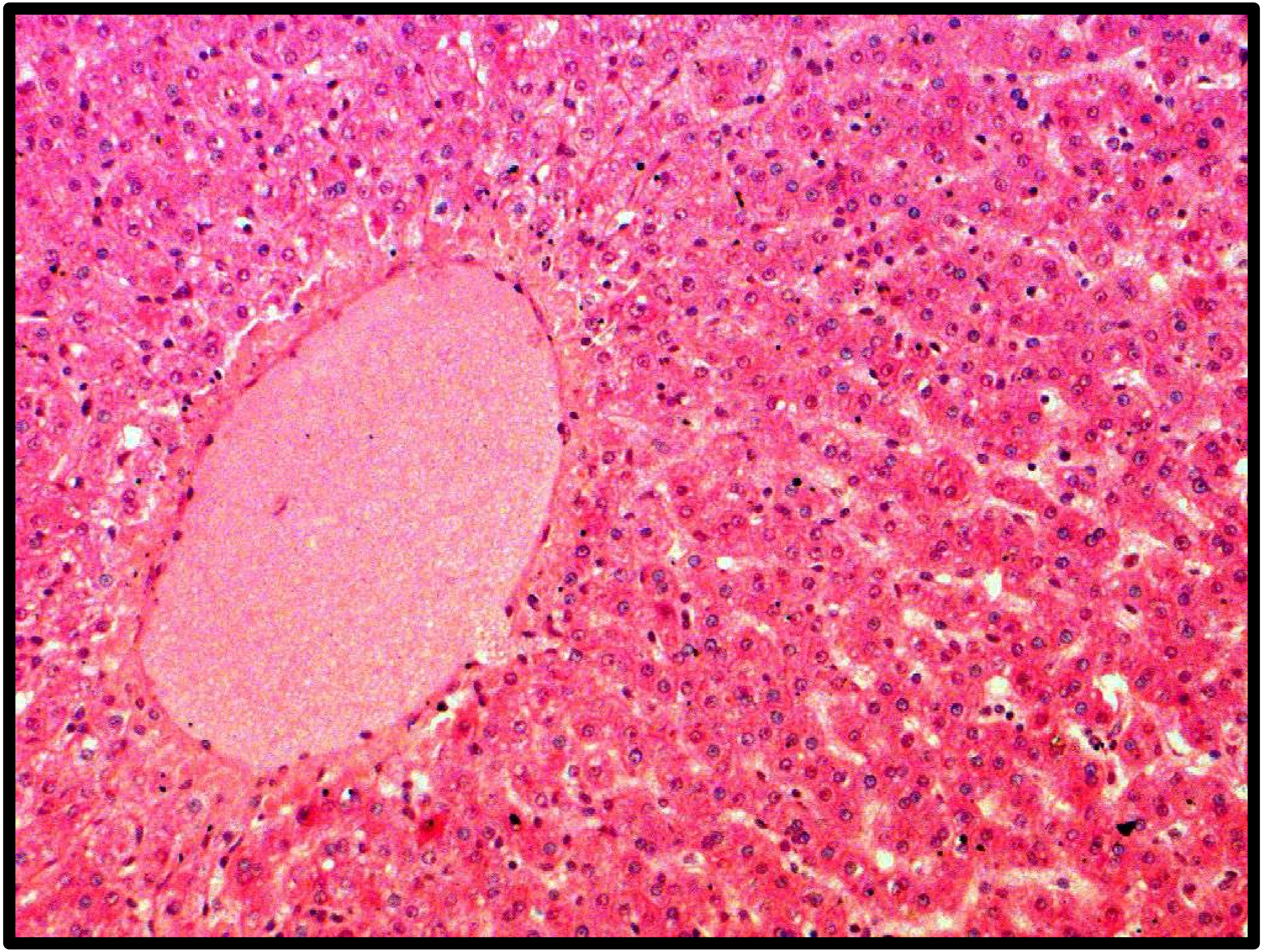
Central vein



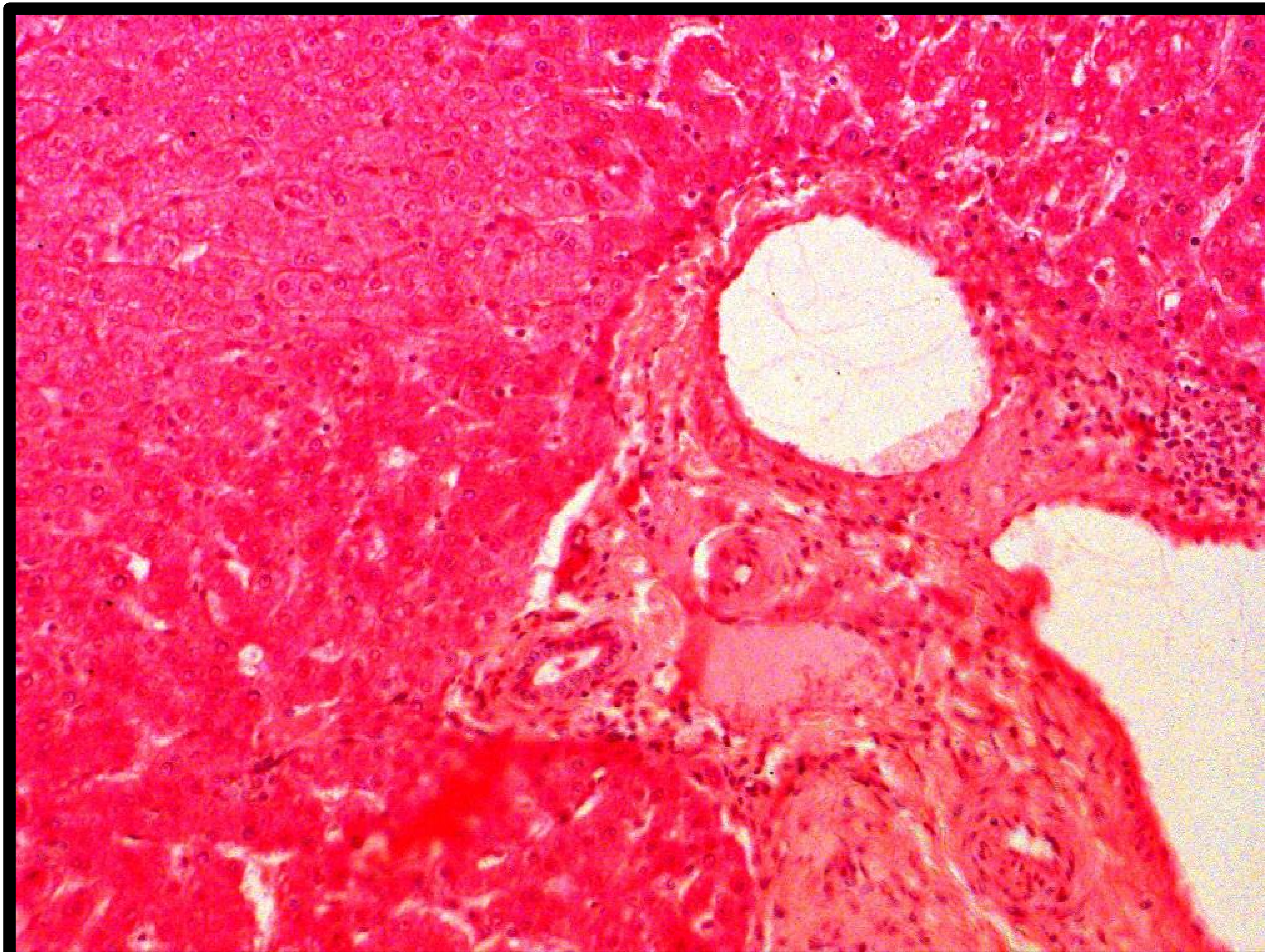
Portal triad

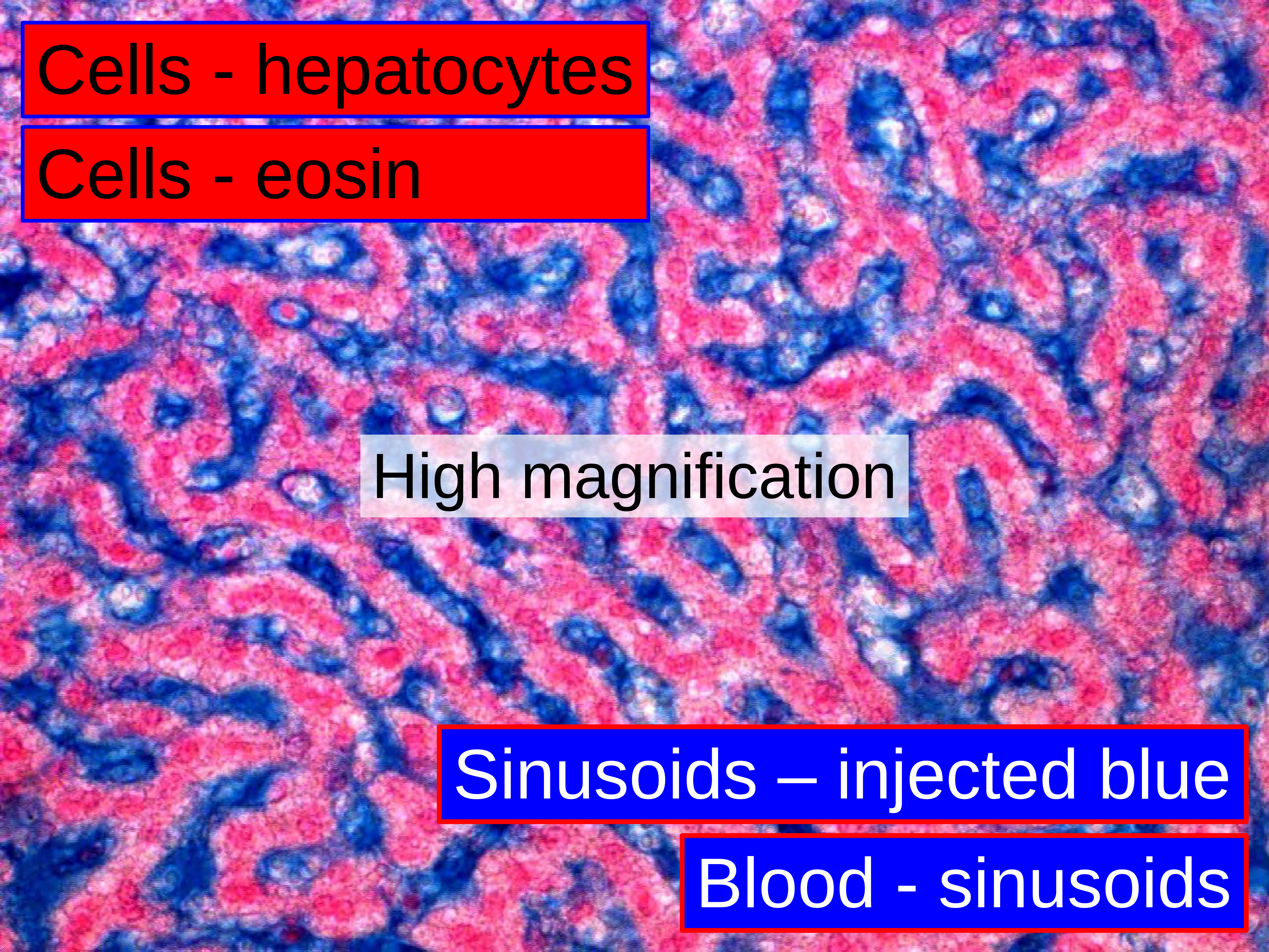


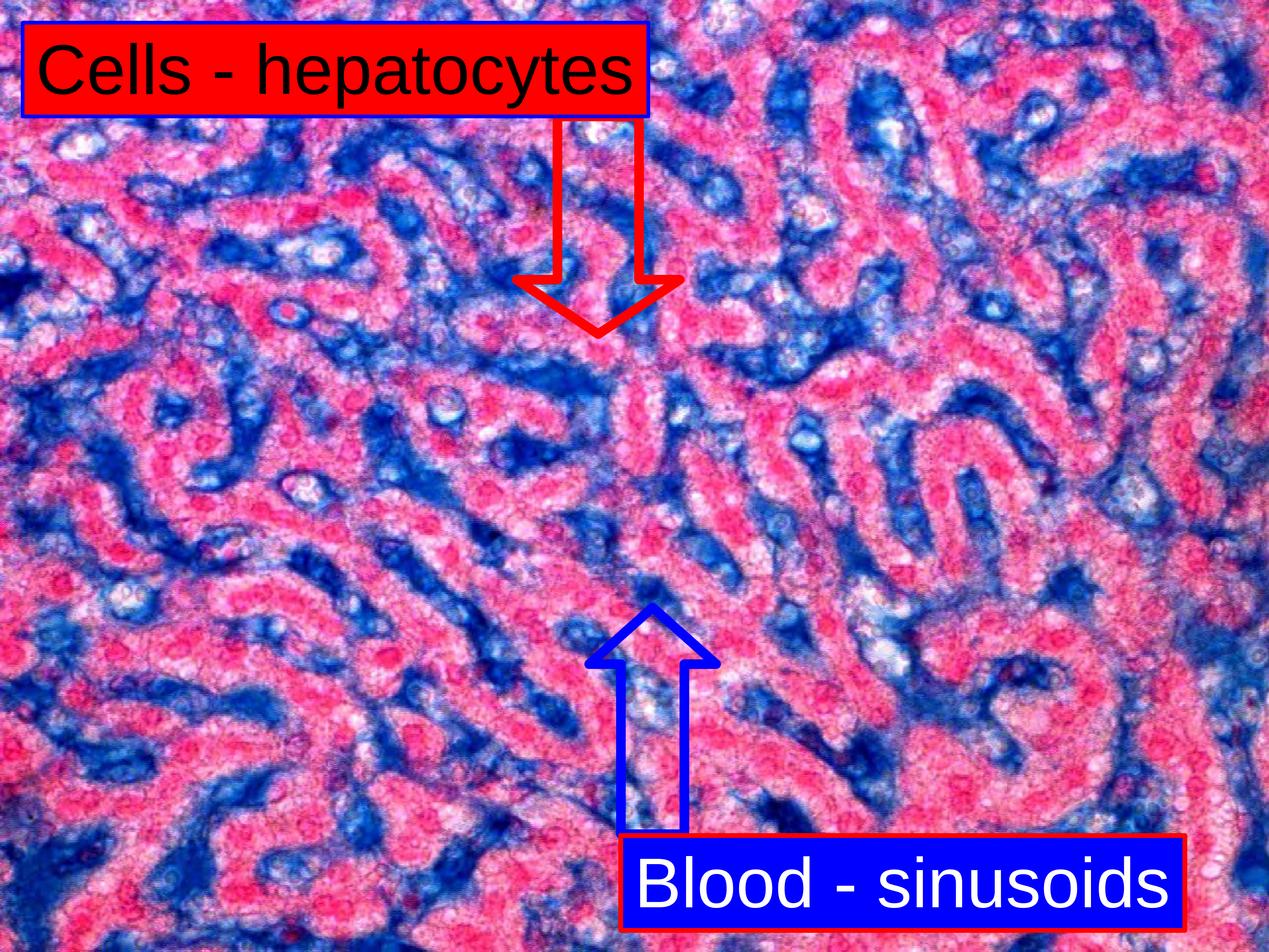
Portal vein

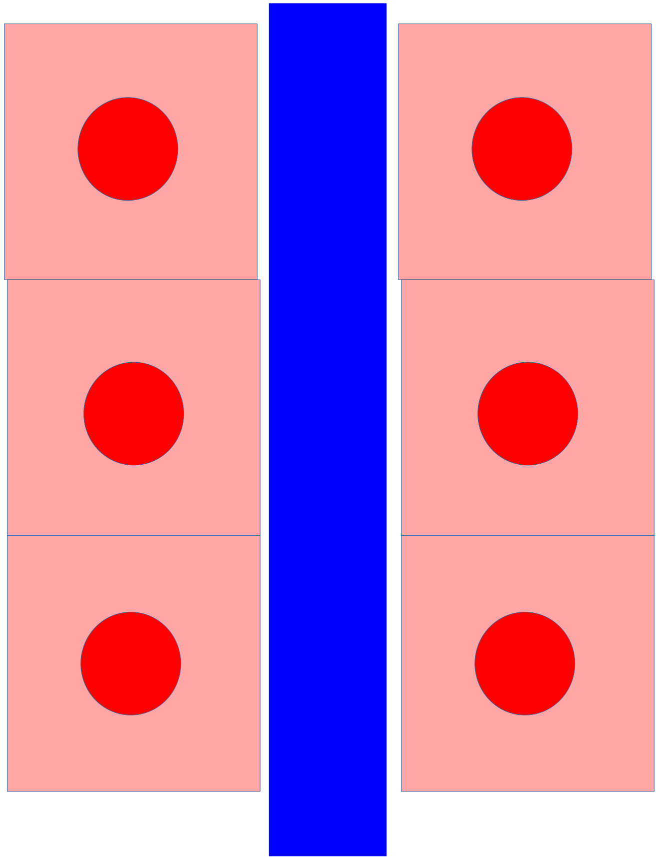


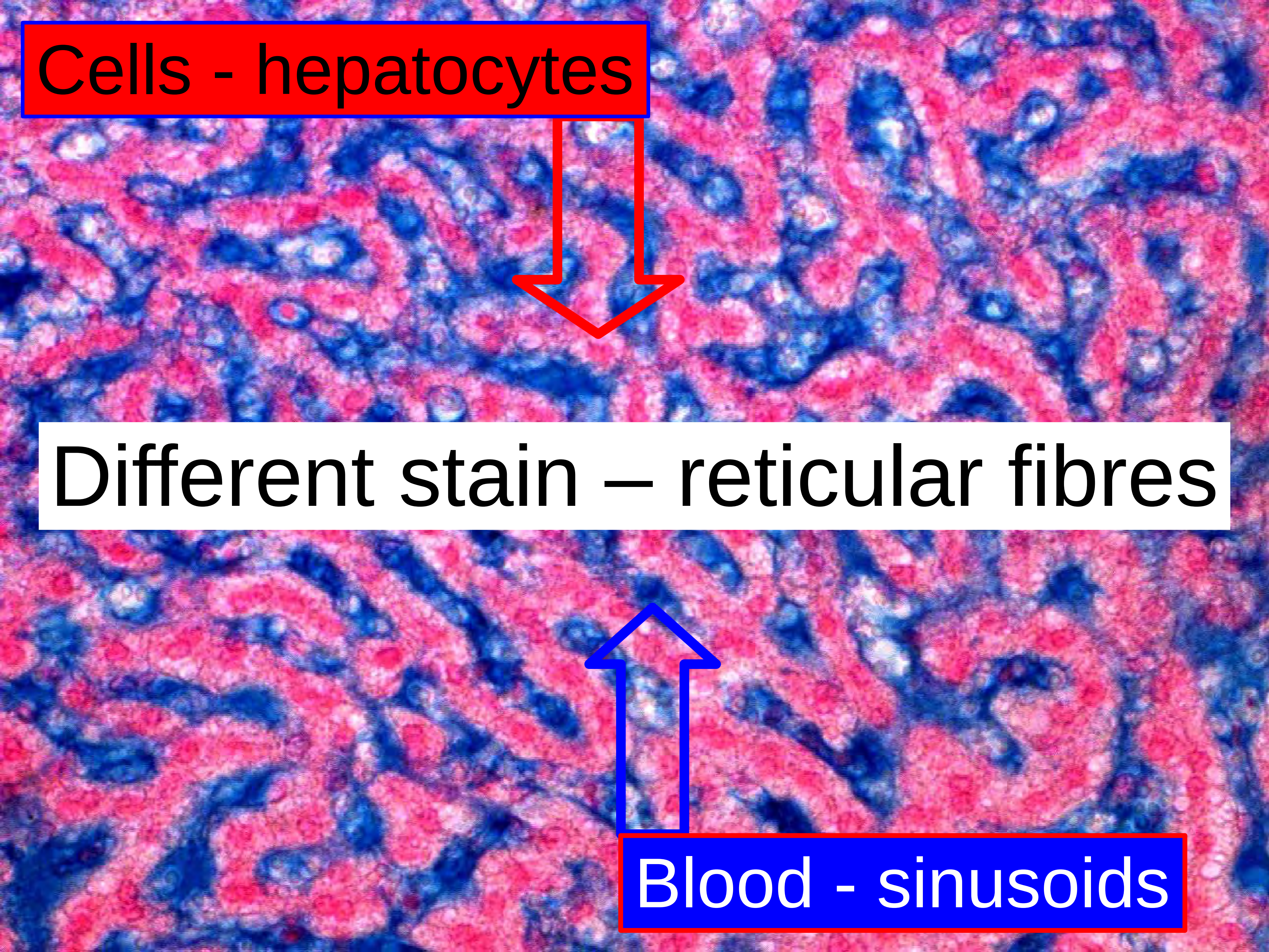
Portal triad – larger branches

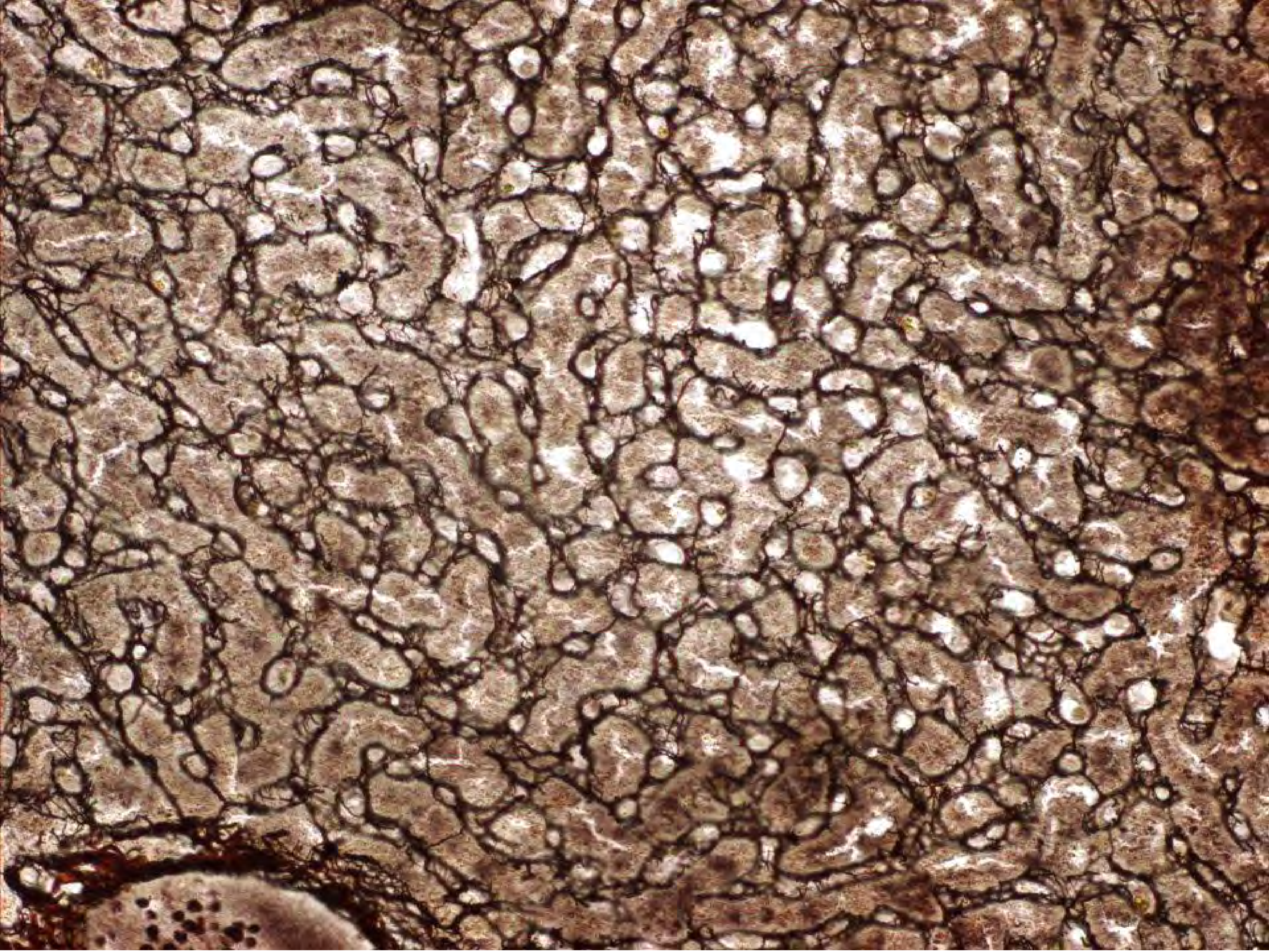


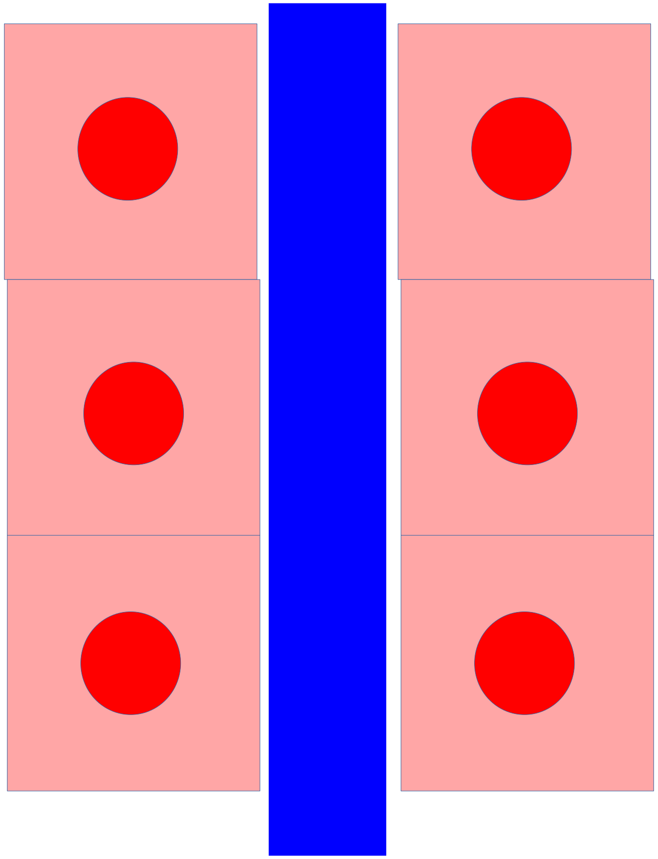

Cells - hepatocytes
Cells - eosin
High magnification
Sinusoids – injected blue
Blood - sinusoids

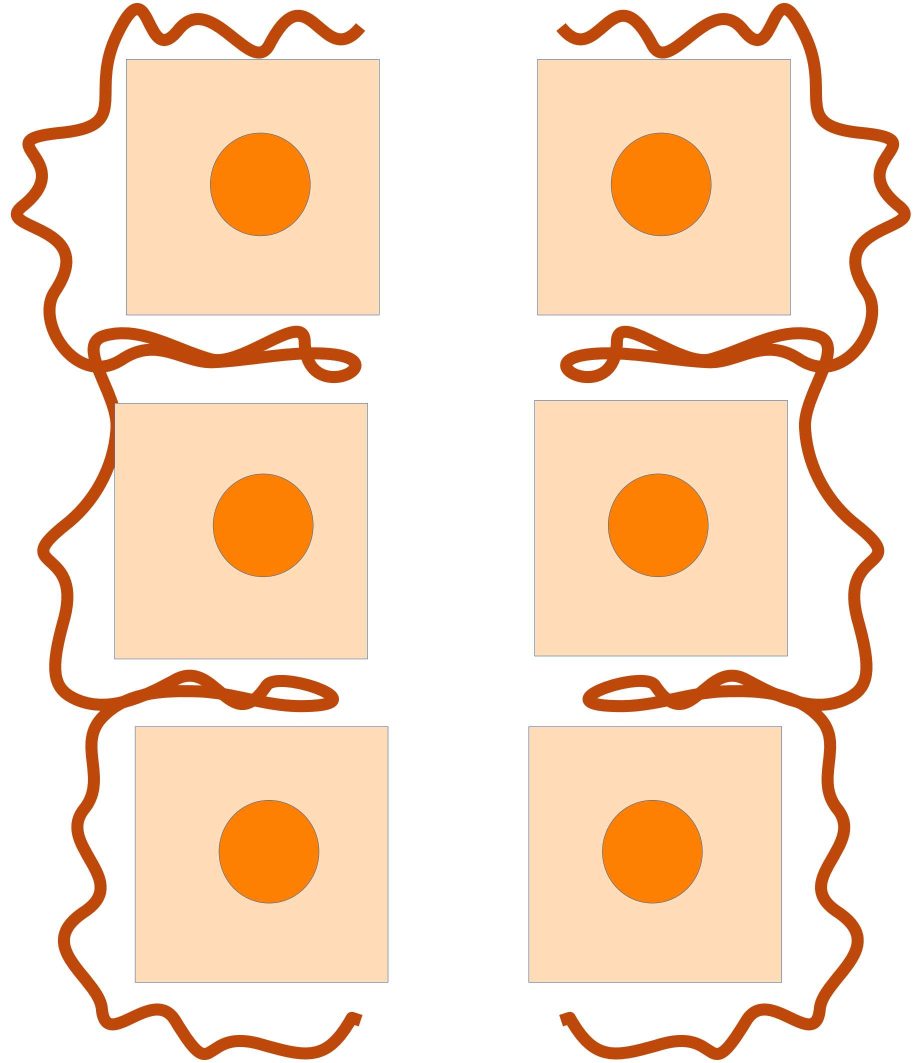

Cells - hepatocytes
Blood - sinusoids

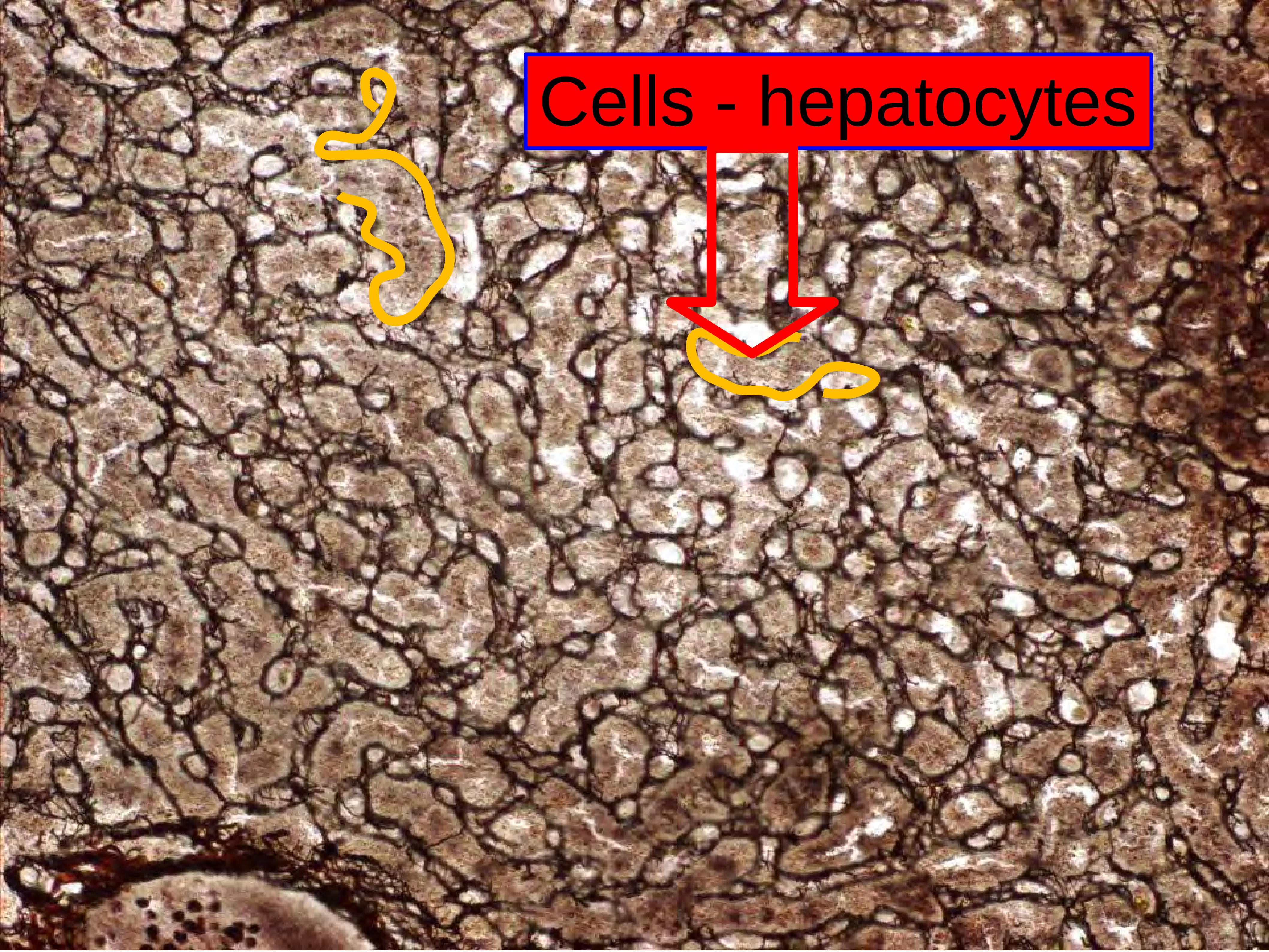



Cells - hepatocytes
Different stain – reticular fibres
Blood - sinusoids








Cells - hepatocytes

Traumatic events in the liver

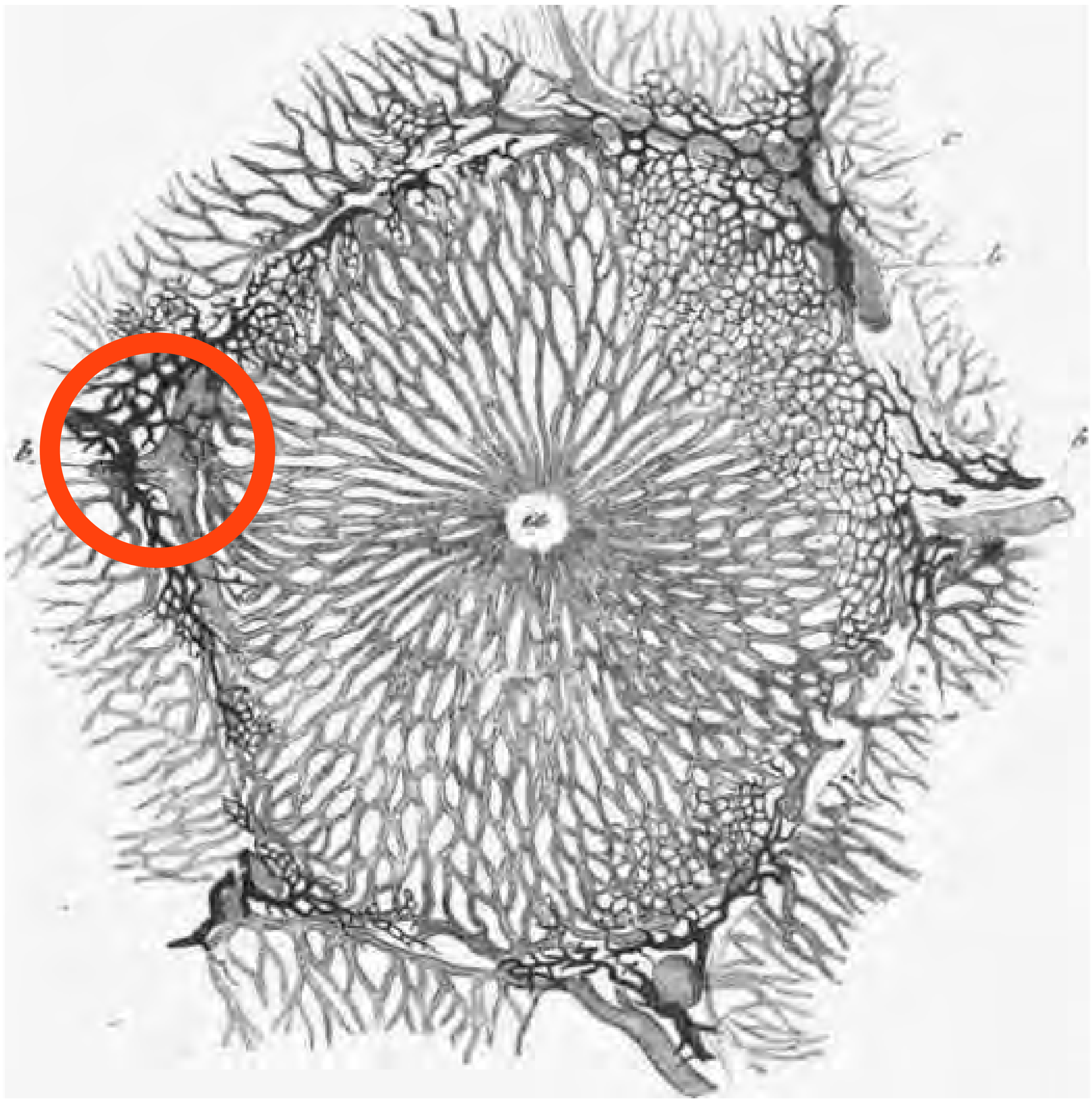
Illustrate the damaged area of Liver acinus

Visible histologically

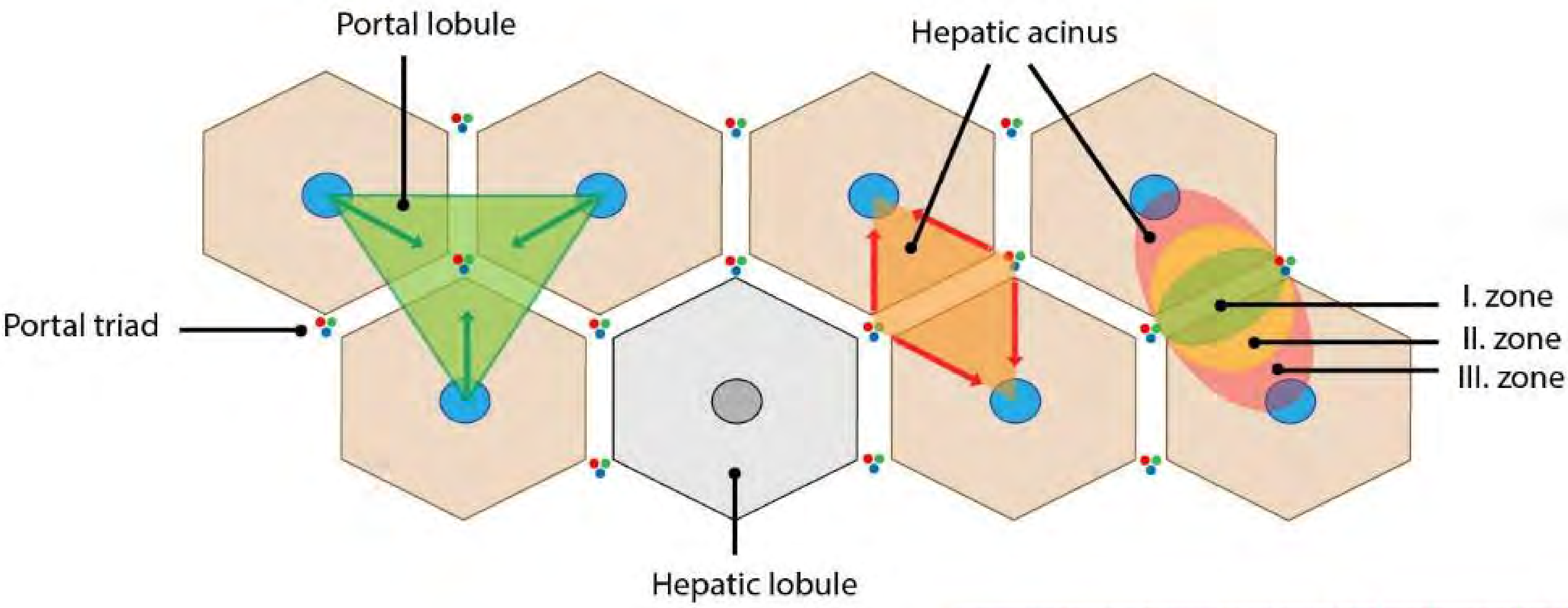
Caused By Various Agents / Diseases

- Describe the mechanism
- Identify and explain the area
- Indicate zones of damage on black and white sketch
- Correlate with slide

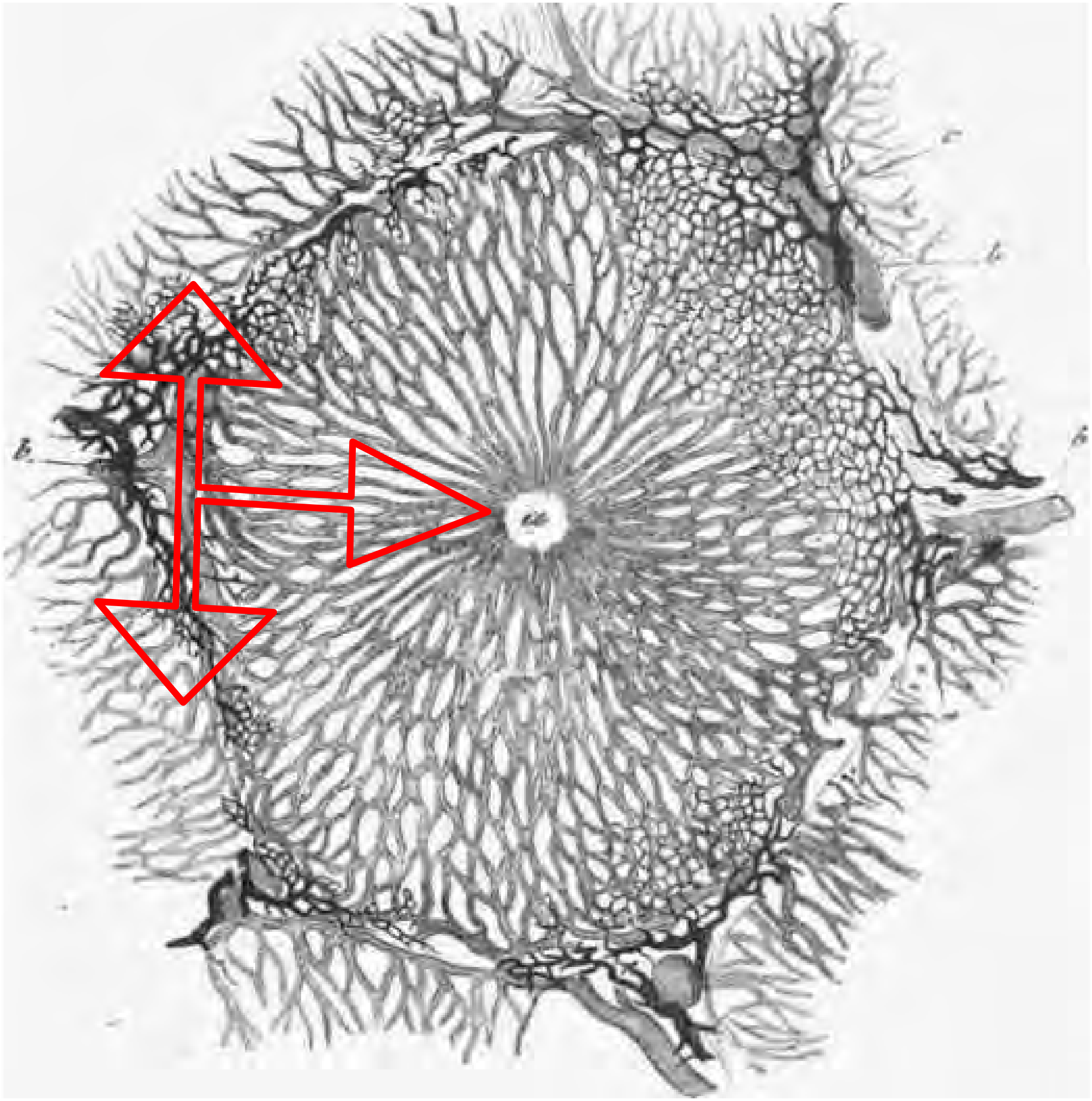
Liver damage



Liver damage



Liver damage



Toxic substances

Indicate areas sensitive to ingested toxic substances.

Ischemia

Indicate areas sensitive to ischemia.

Oxygen

Indicate areas least sensitive to ischemia.

Pathogens

Indicate areas susceptible to viral hepatitis.

Medication

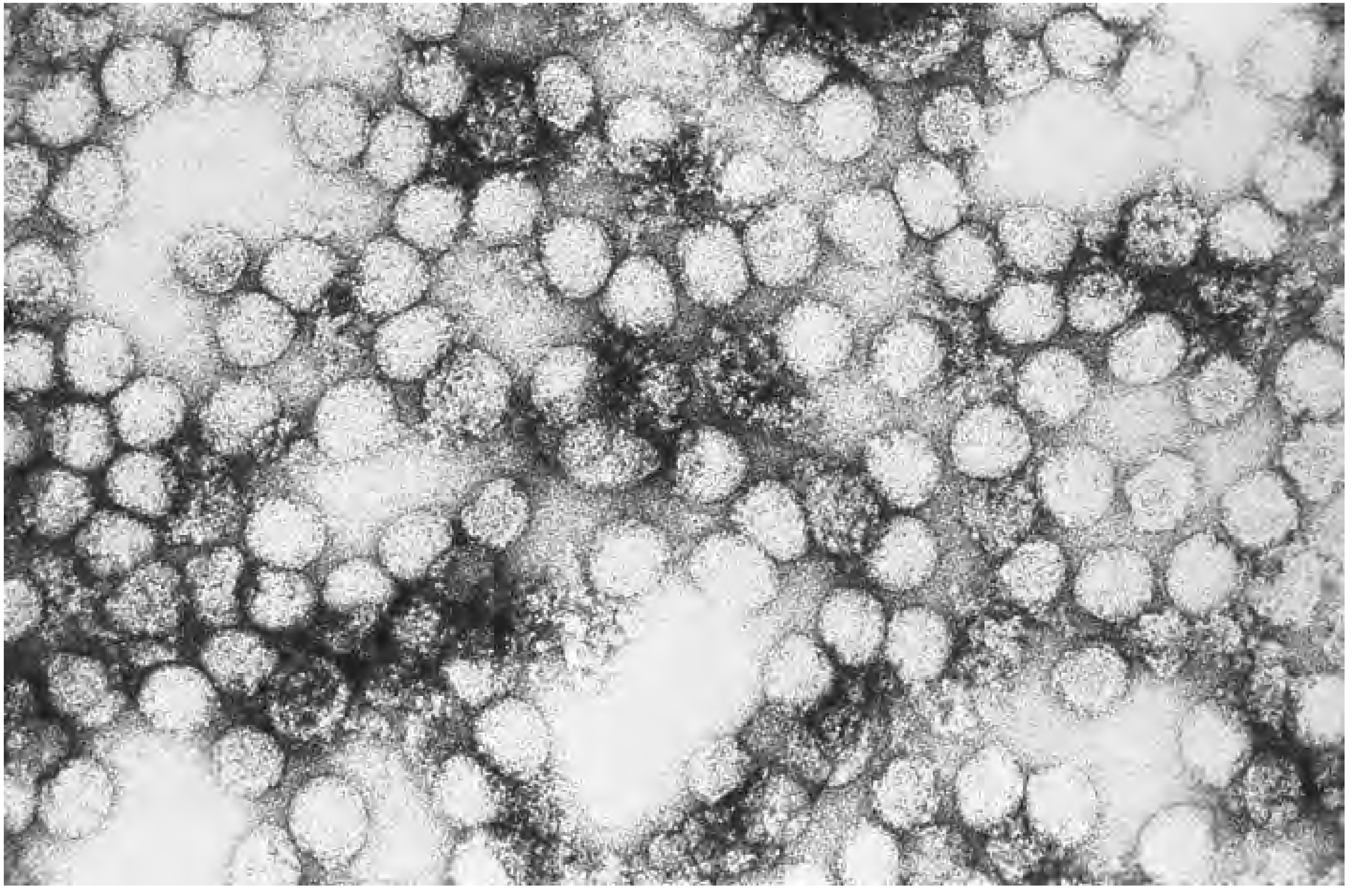
Indicate areas susceptible to paracetamol.

Iron

In which area does haemosiderin accumulate?

Pathology

In which area will *Flavivirus* cause necrosis?



Zonal necrosis

Centri-lobular

Peri-portal

Centri-lobular

Around central vein
Acinar zone 3

Ischaemia
Drugs

Peri-portal

Around portal area
Acinar zone 1

Hepatitis