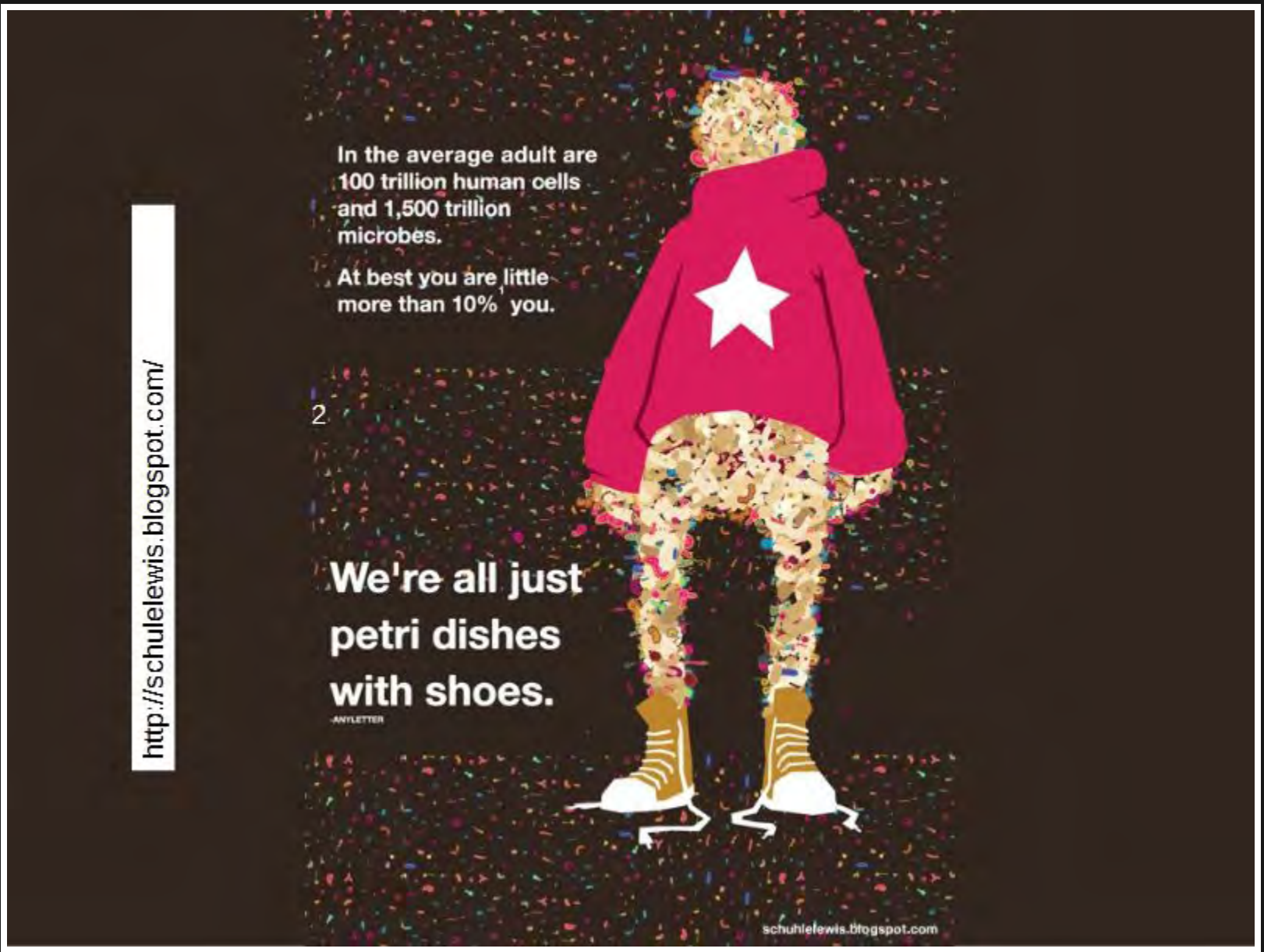
Oral Cavity

- esc key shows all the slides
- arrows le right advance the slide
- or click on the bottom right icons
- mobile device swipe le right
- ? gives instant help

How to get the most from the revision slides

- Have a pen & paper ready
- Answer every question
- Mark your answer a er answering
- Elaborate on each answer
- Add relevant clinical content
- If you have trouble, ask

Absorption - Alimentary tract


In the average adult are 100 trillion human cells and 1,500 trillion microbes.
At best you are little more than 10% you.
2
We're all just petri dishes with shoes.
-ANYLETTER
http://schulelewis.blogspot.com/
schuhlelewis.blogspot.com

Alimentary canal

General structure

Oral Cavity

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

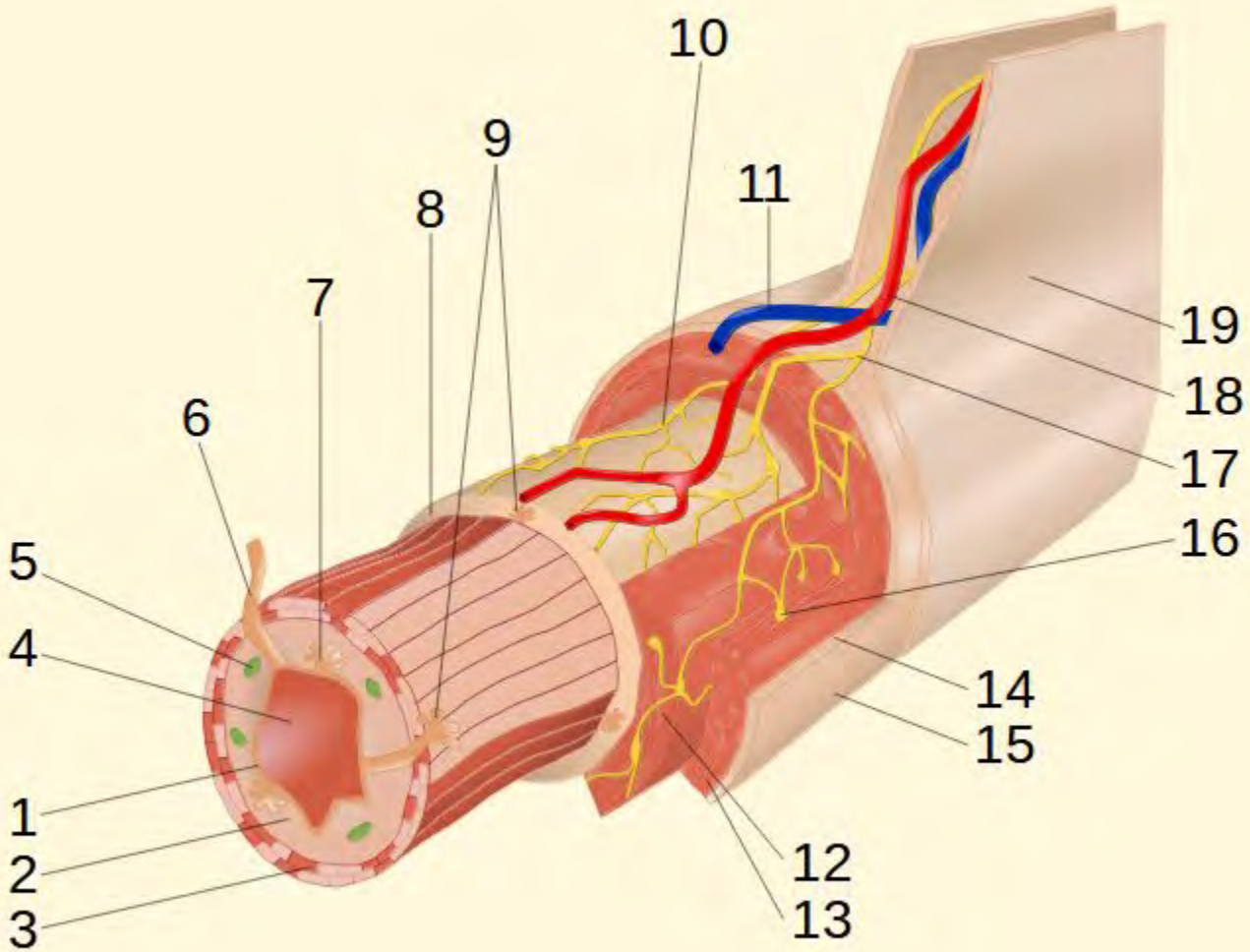
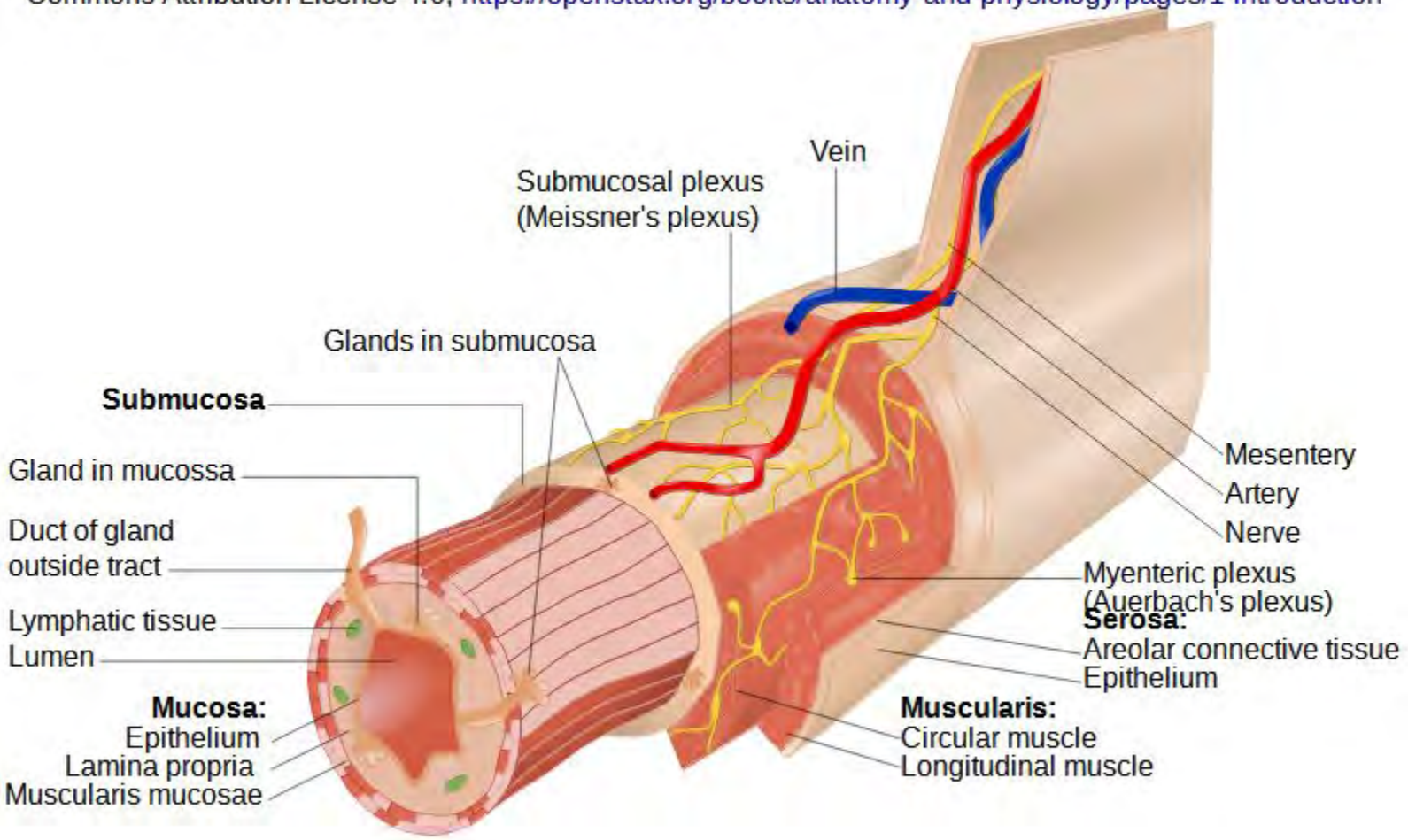
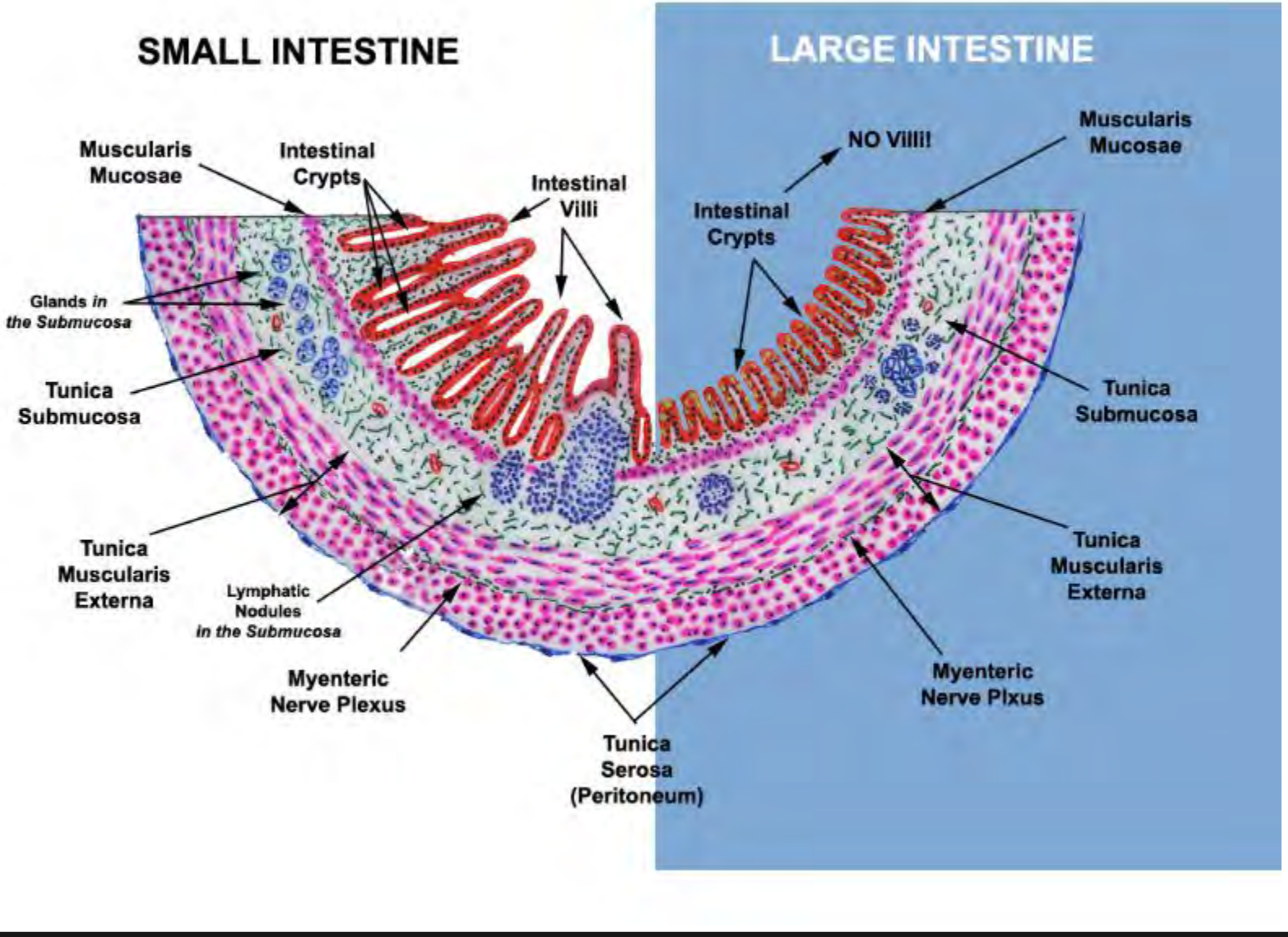

10
9
11
8
7
19
18
6
17
16
5
4
14
15
1
12
2
13
3

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!
Intestinal Crypts
Muscularis Mucosae
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

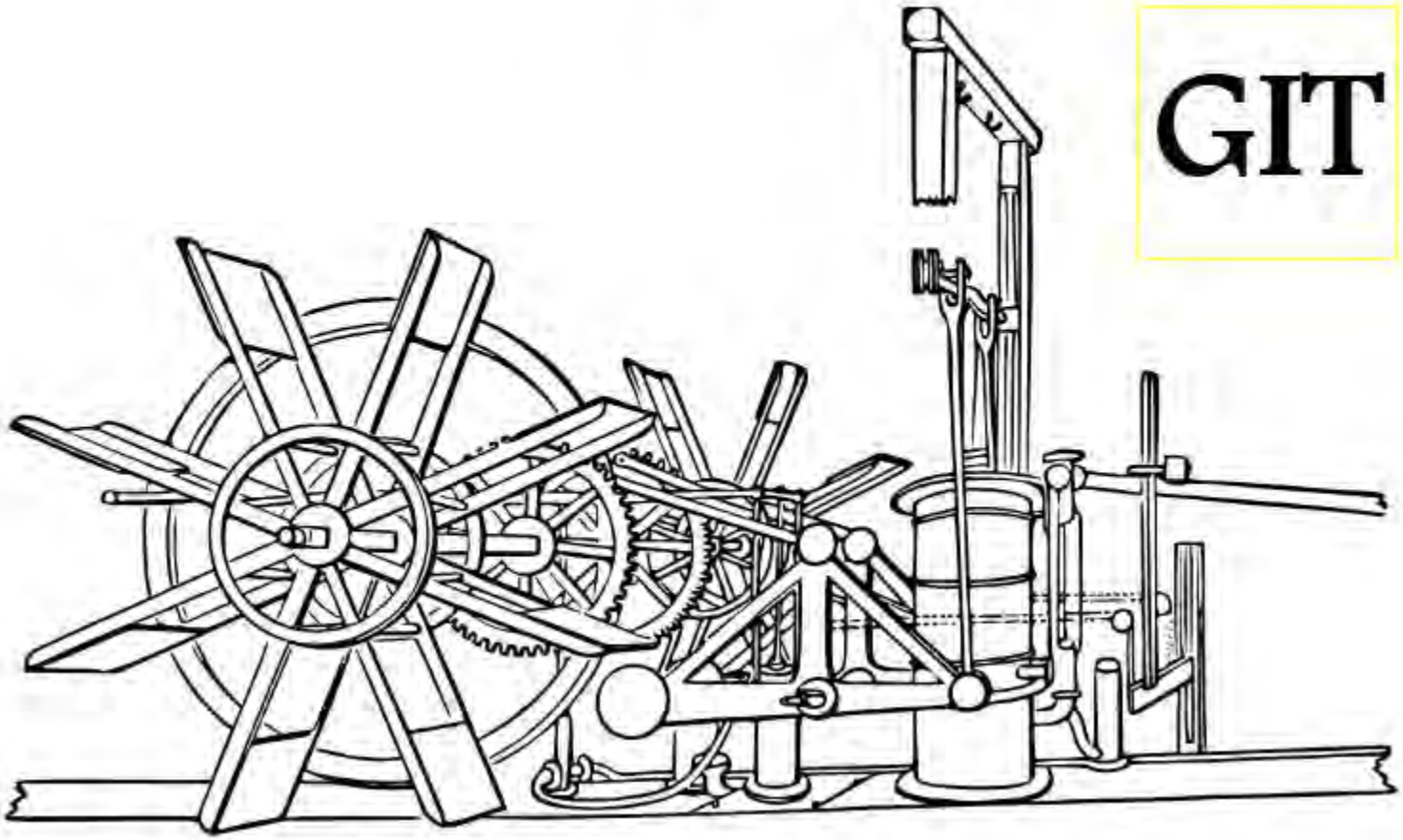
List the 7 functions of the Digestive Track.

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

Ingestion

Mechanical digestion

Propulsion



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

Hormonal

Enteroendocrine cells spread throughout the digestive system.

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

Stratified squamous keratinized
Stratified squamous

Simple columnar

Stratified squamous
Stratified squamous keratinized

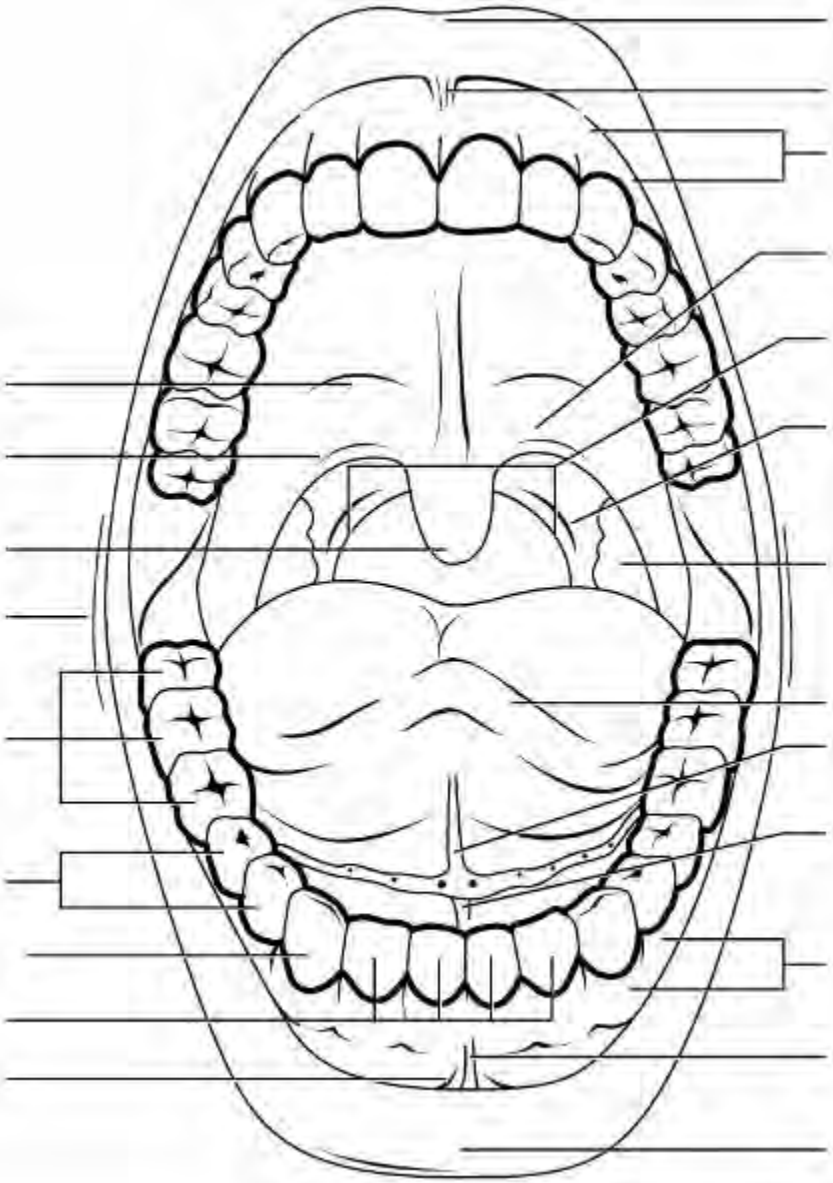
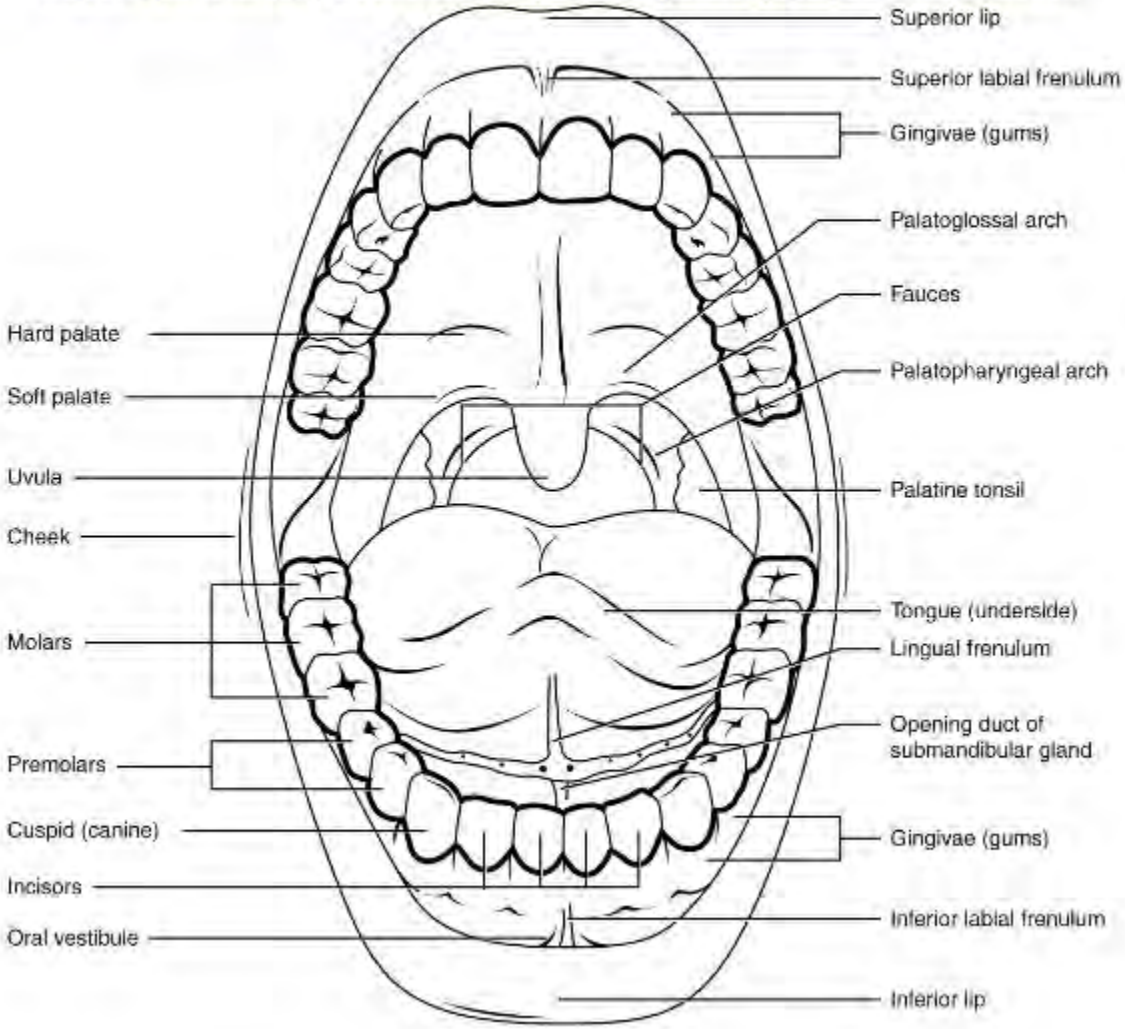


Figure 23.7 Mouth The mouth includes the lips, tongue, palate, gums, and teeth; Anatomy and Physiology 25 April 2013; OpenStax; Creative Commons Attribution License 4.0; https://openstax.org/books/anatomy-and-physiology/pages/1-introduction



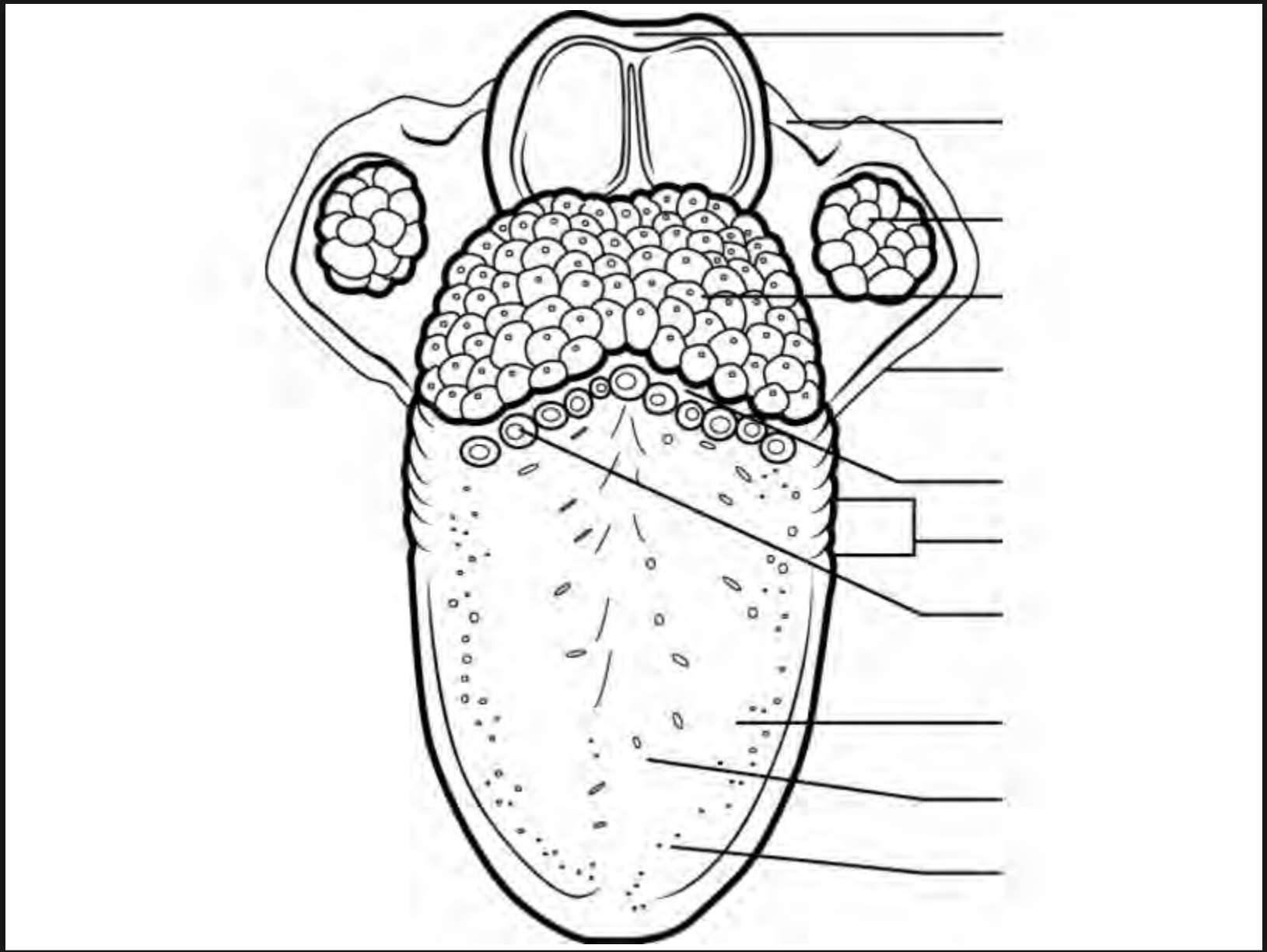
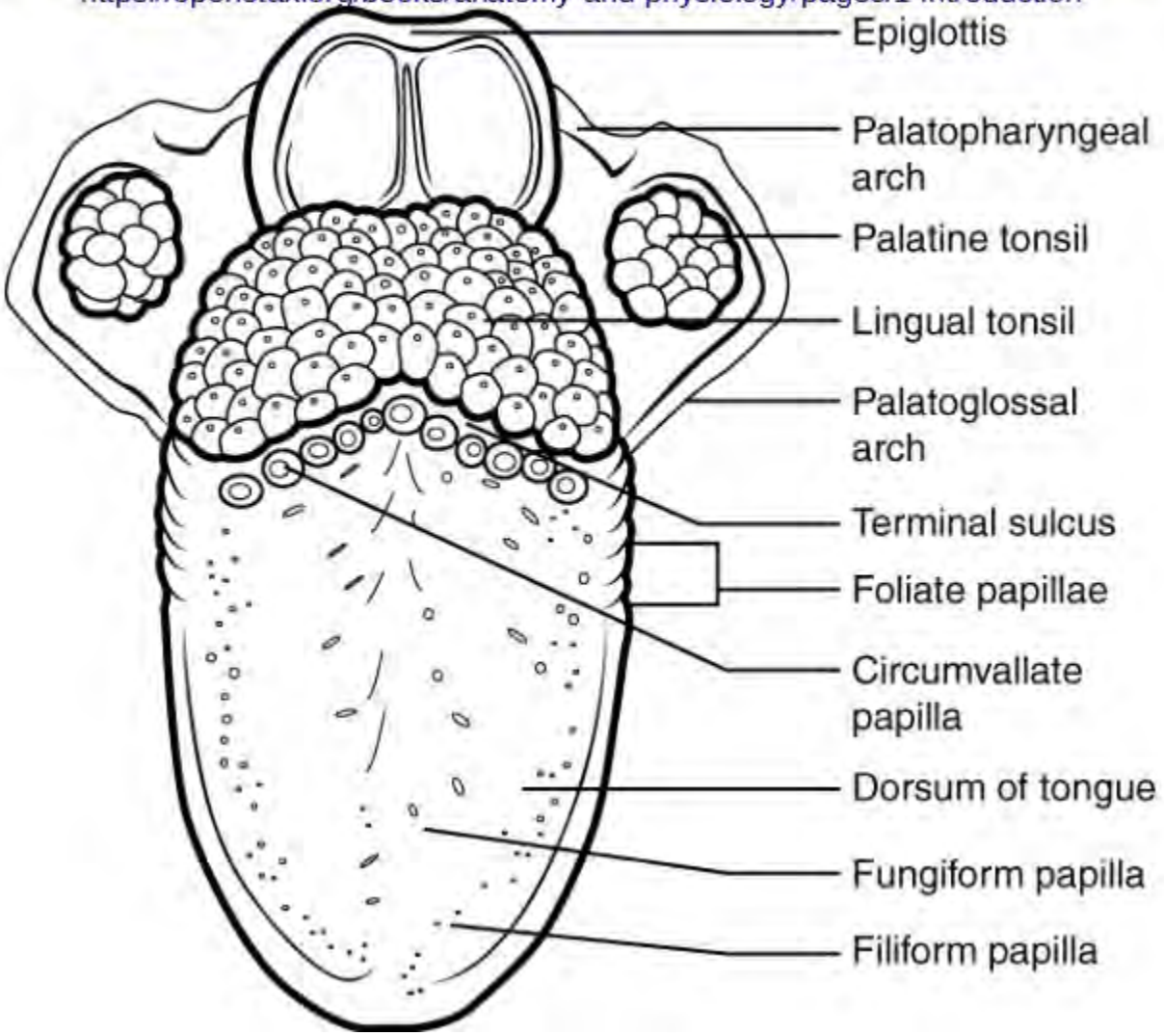
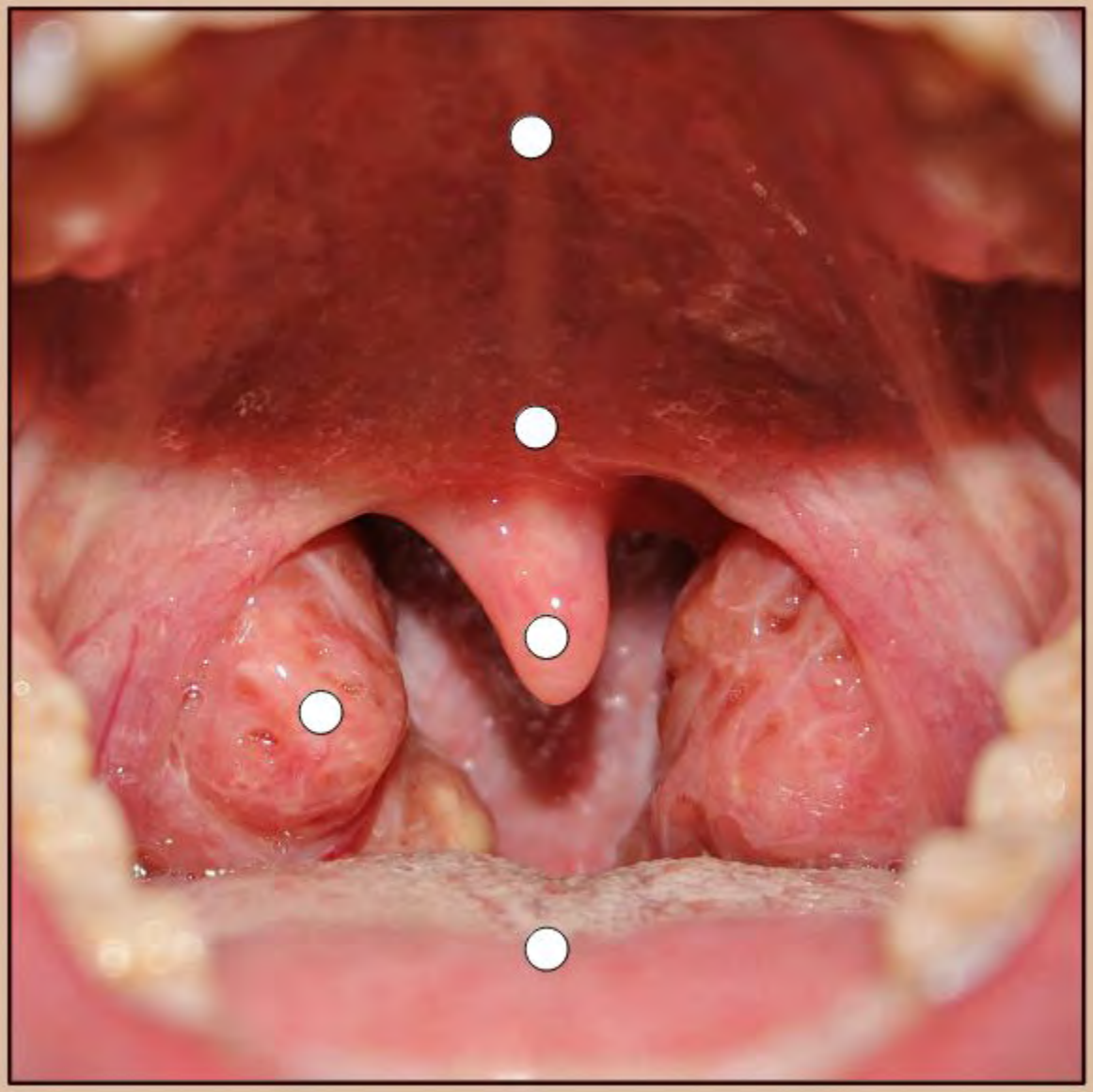
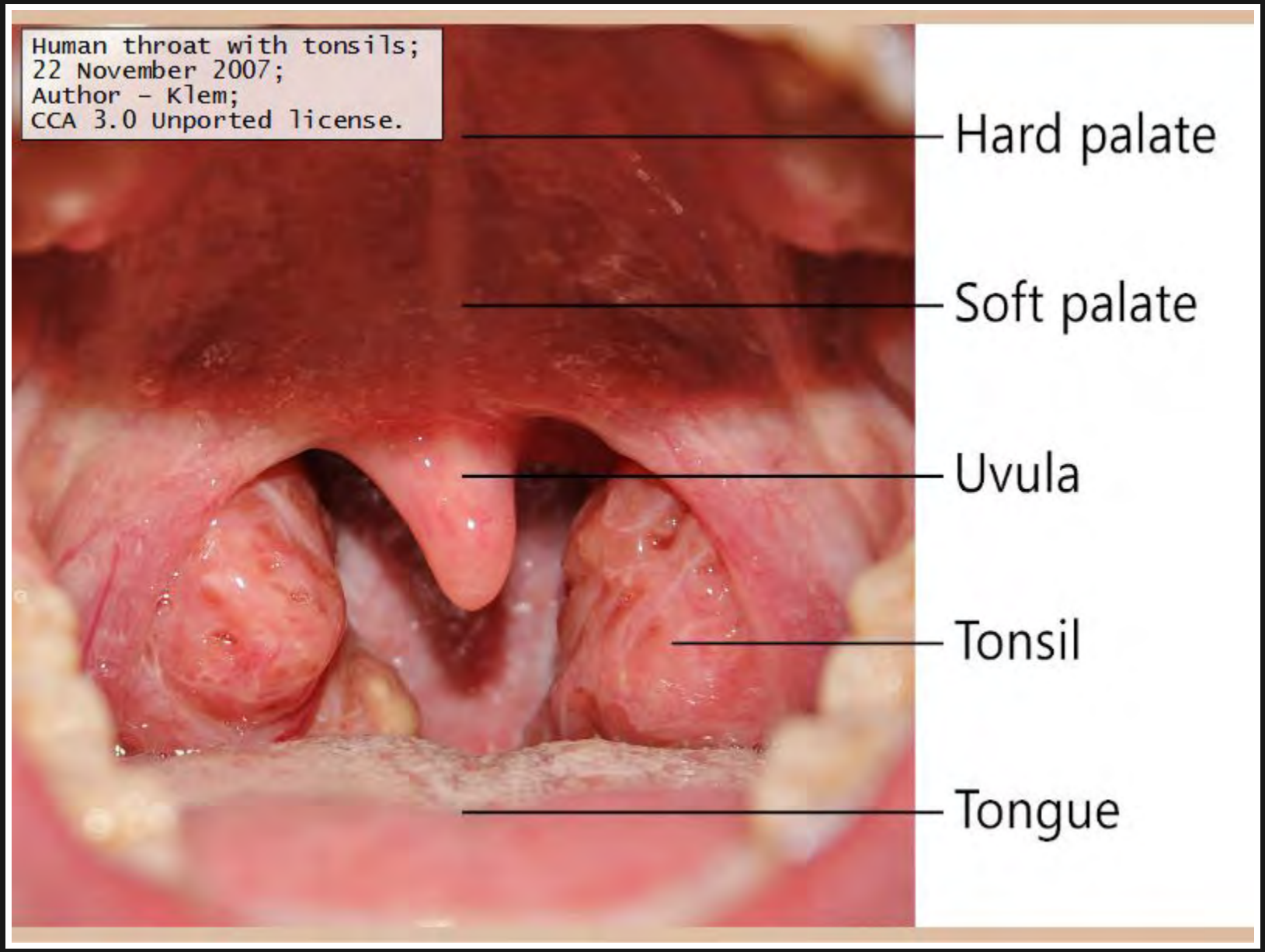


Figure 23.8 Tongue This superior view of the tongue shows the locations and types of lingual papillae; Anatomy and Physiology 25 April 2013; OpenStax; Creative Commons Attribution License 4.0; https://openstax.org/books/anatomy-and-physiology/pages/1-introduction






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

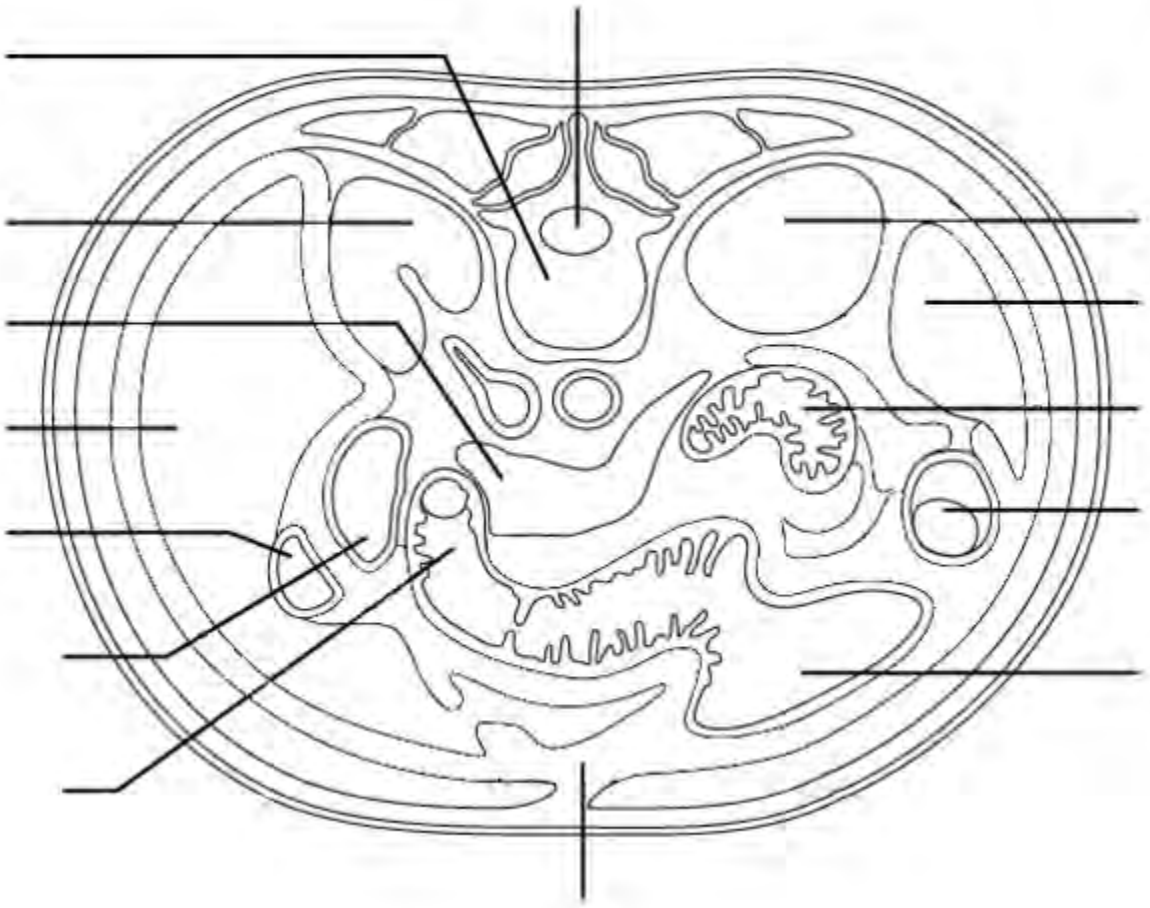
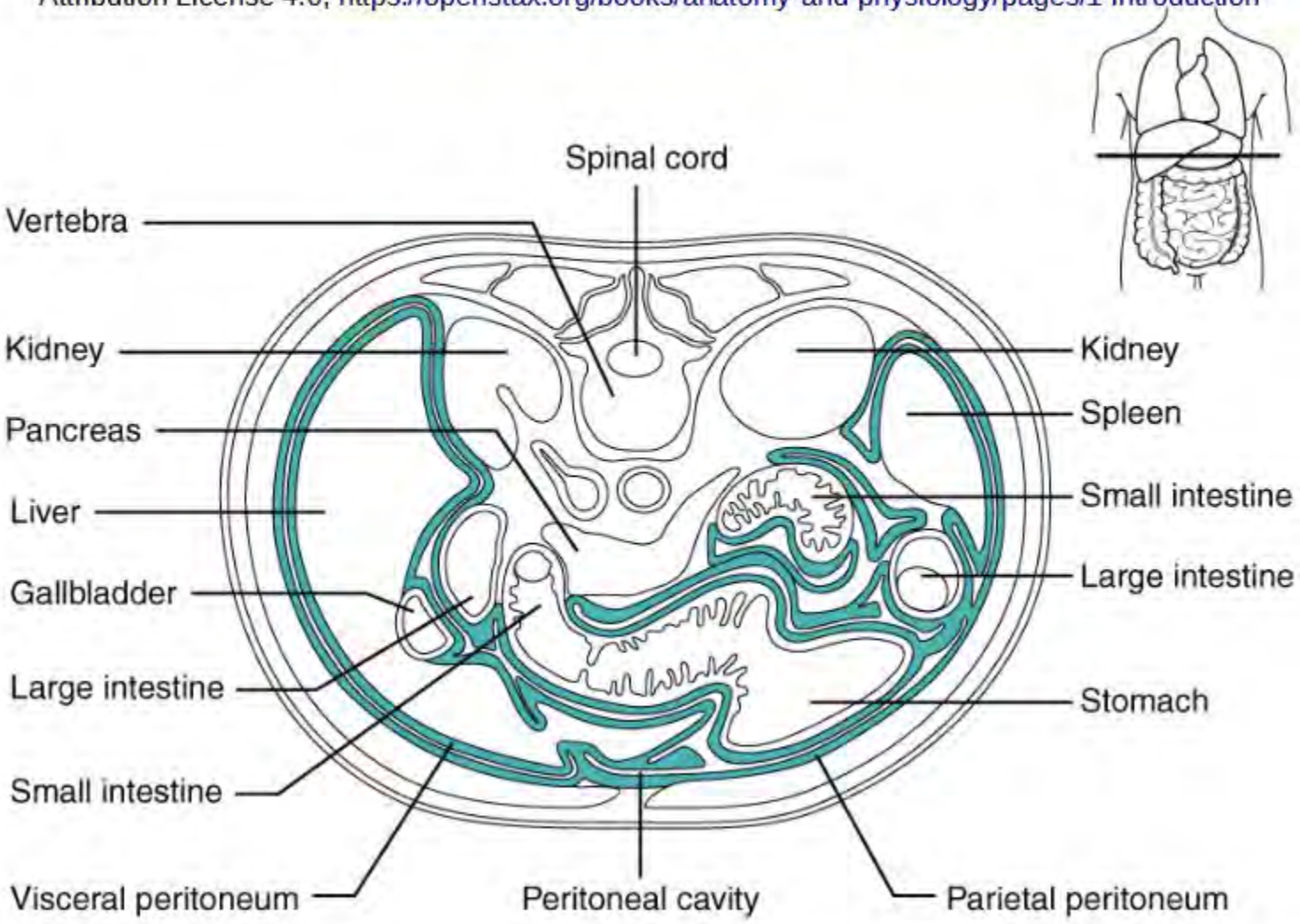
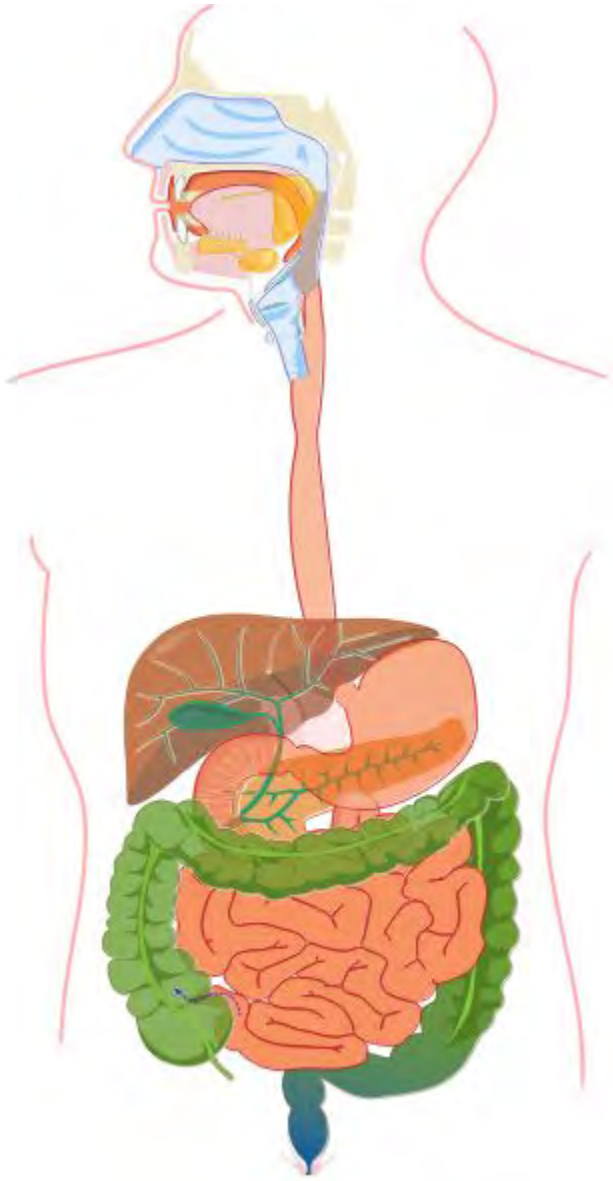


Figure 23.4 The Peritoneum A cross-section of the abdomen shows the relationship between abdominal organs and the peritoneum (darker lines).; Anatomy and Physiology 25 April 2013; OpenStax; Creative Commons Attribution License 4.0; https://openstax.org/books/anatomy-and-physiology/pages/1-introduction



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



Digestive Track

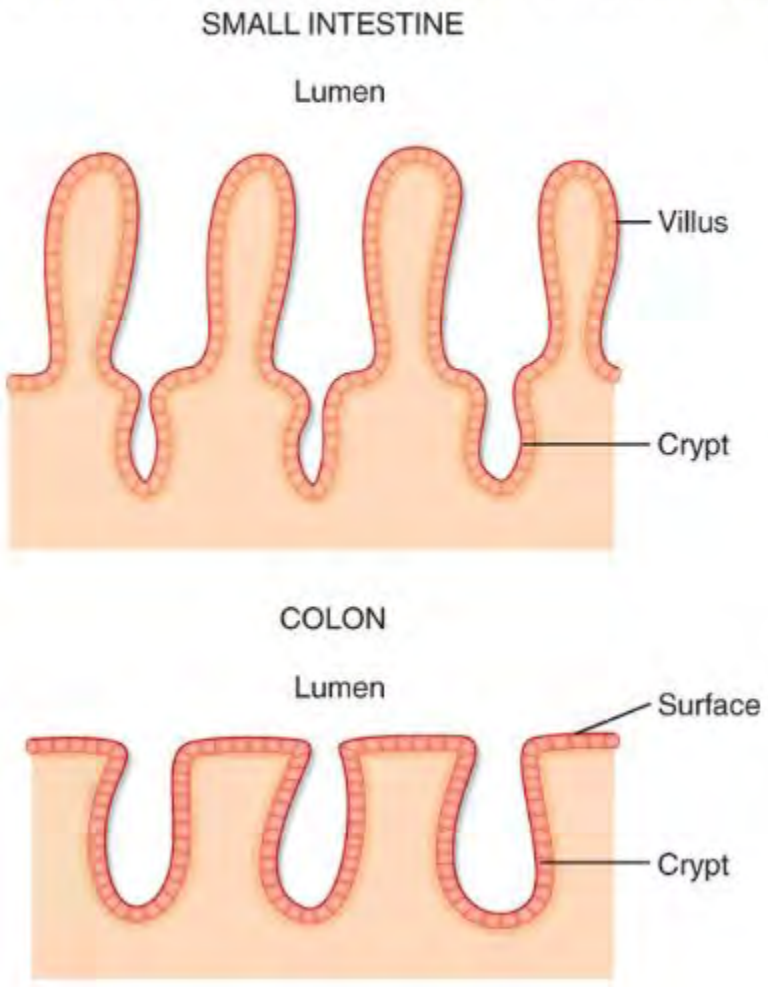
	Mucosa					
	Epithelium	Lamina propria	Muscularis mucosa	Submucosa	Muscularis externa	Serosa / Adventitia
Oral cavity						
Oesophagus						
Stomach						
Small intestine						
Colon						
Rectum						

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

Alimentary canal

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

Glands of the GIT

- Salivary glands
  - Parotid – slide 85
  - Sublingual – 107
  - Submandibular – 35
- Pancreas – slide 50
- Liver - slides 46, 48, 68 & 110

  \+ Gallbladder – slide 58

Oral lymphoid tissue

- Lingual tonsil – slide 22
- Palatine tonsil – slide 63

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 half-moon

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

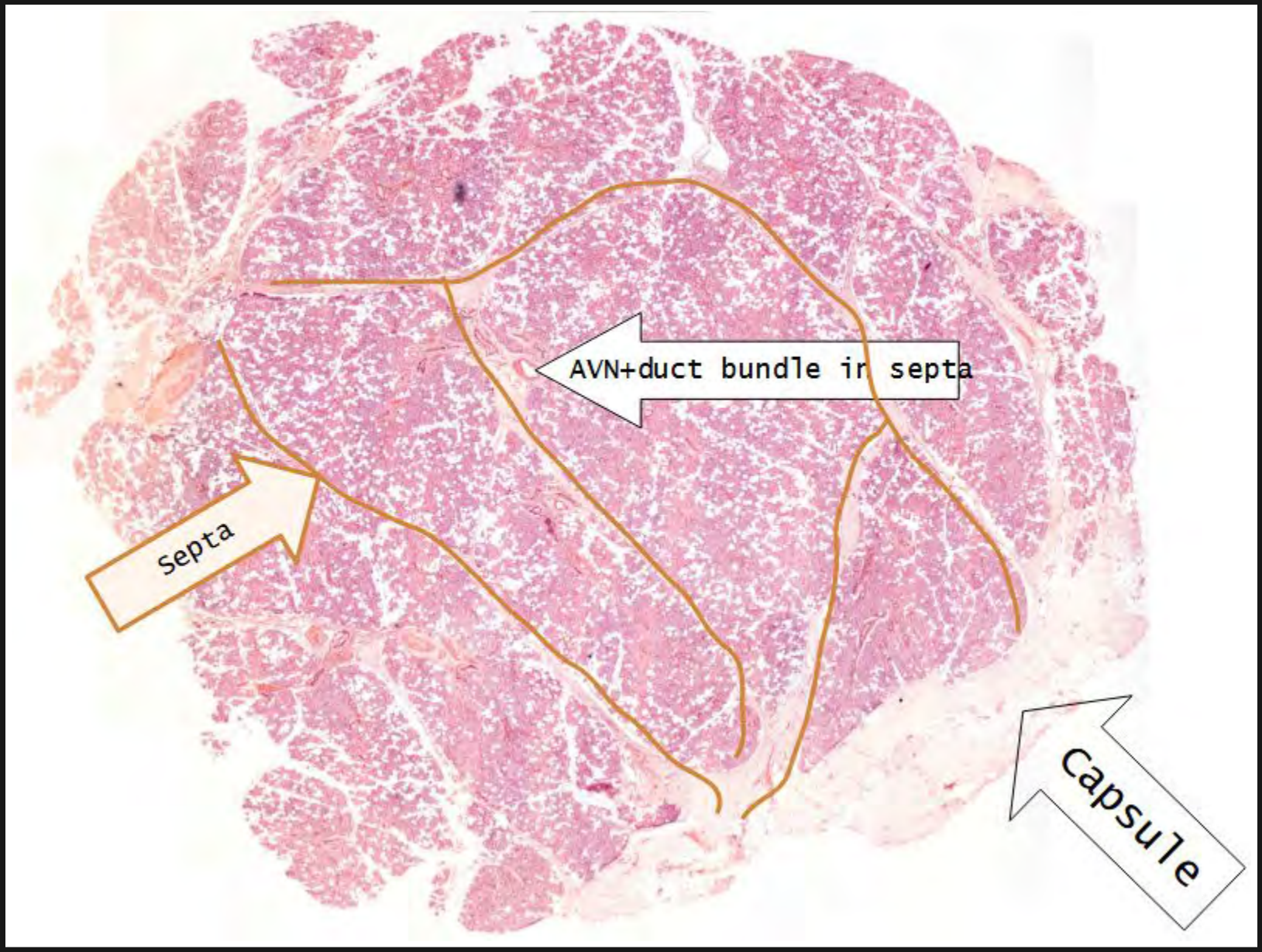
Parotis

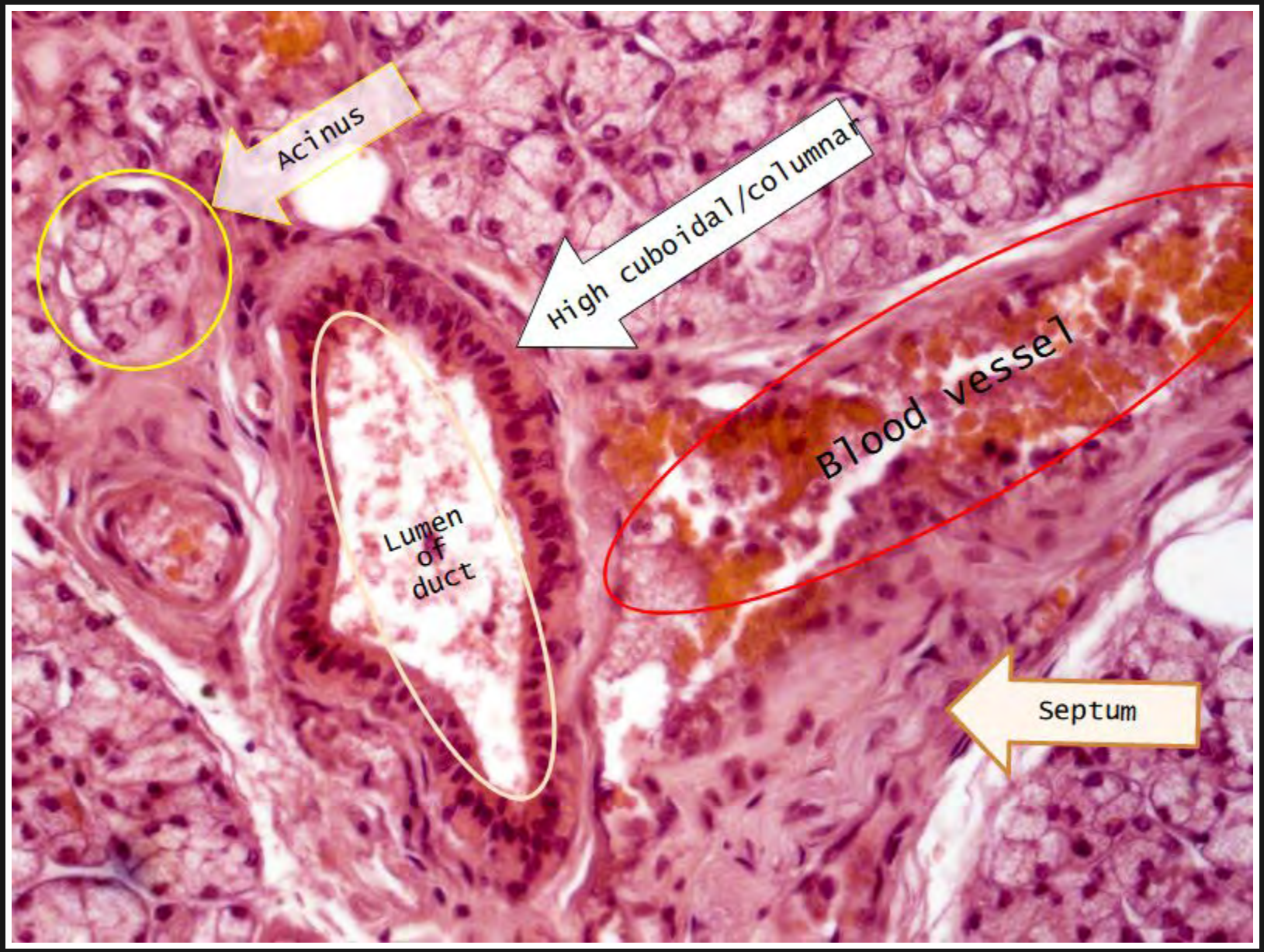
Identify microscopically:
Secretory units
Secretory ducts
Connective tissue septae and blood vessels

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

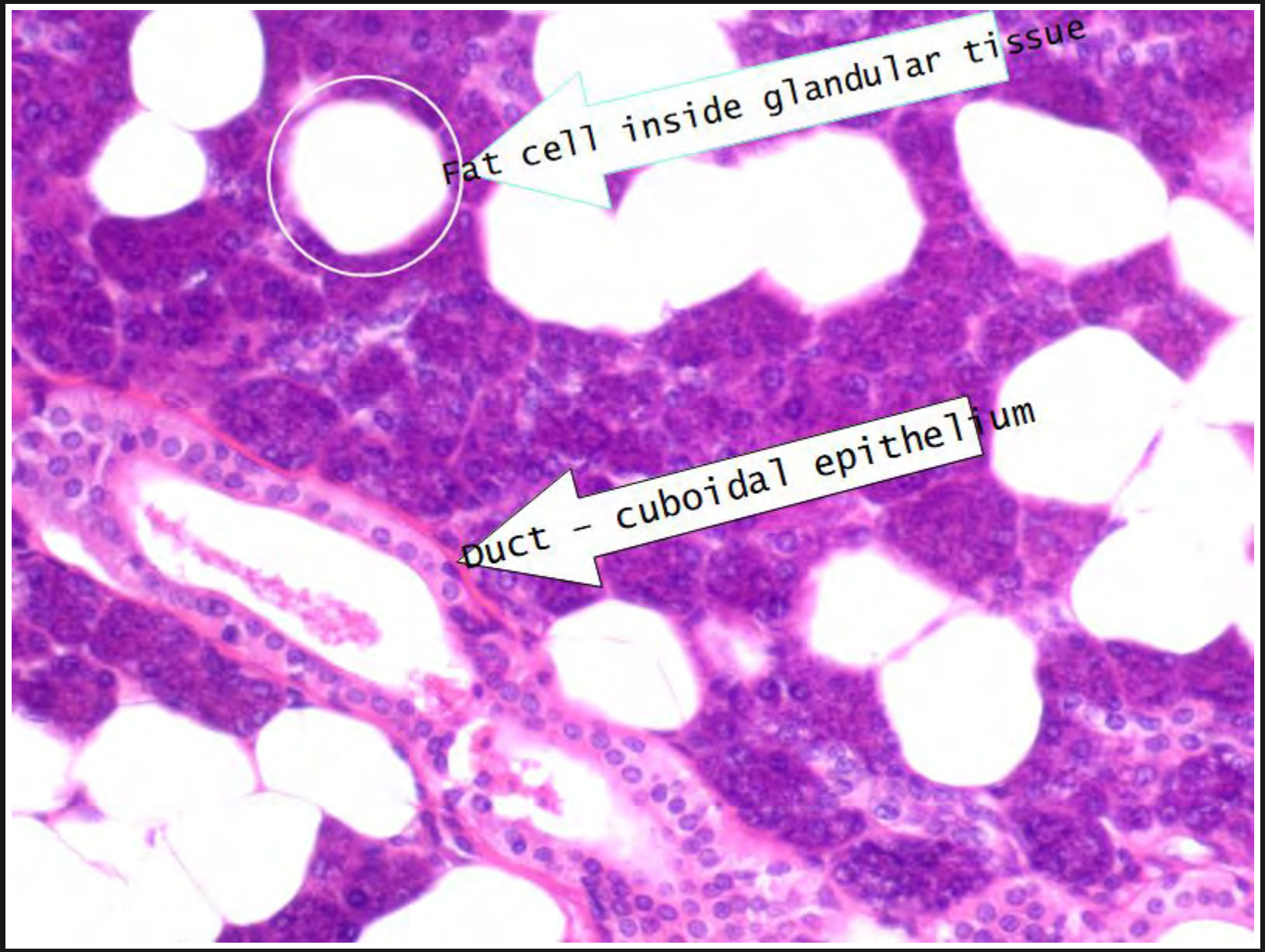

Acinus
High cuboidal/columnar
Blood vessel
Lumen of duct
Septum

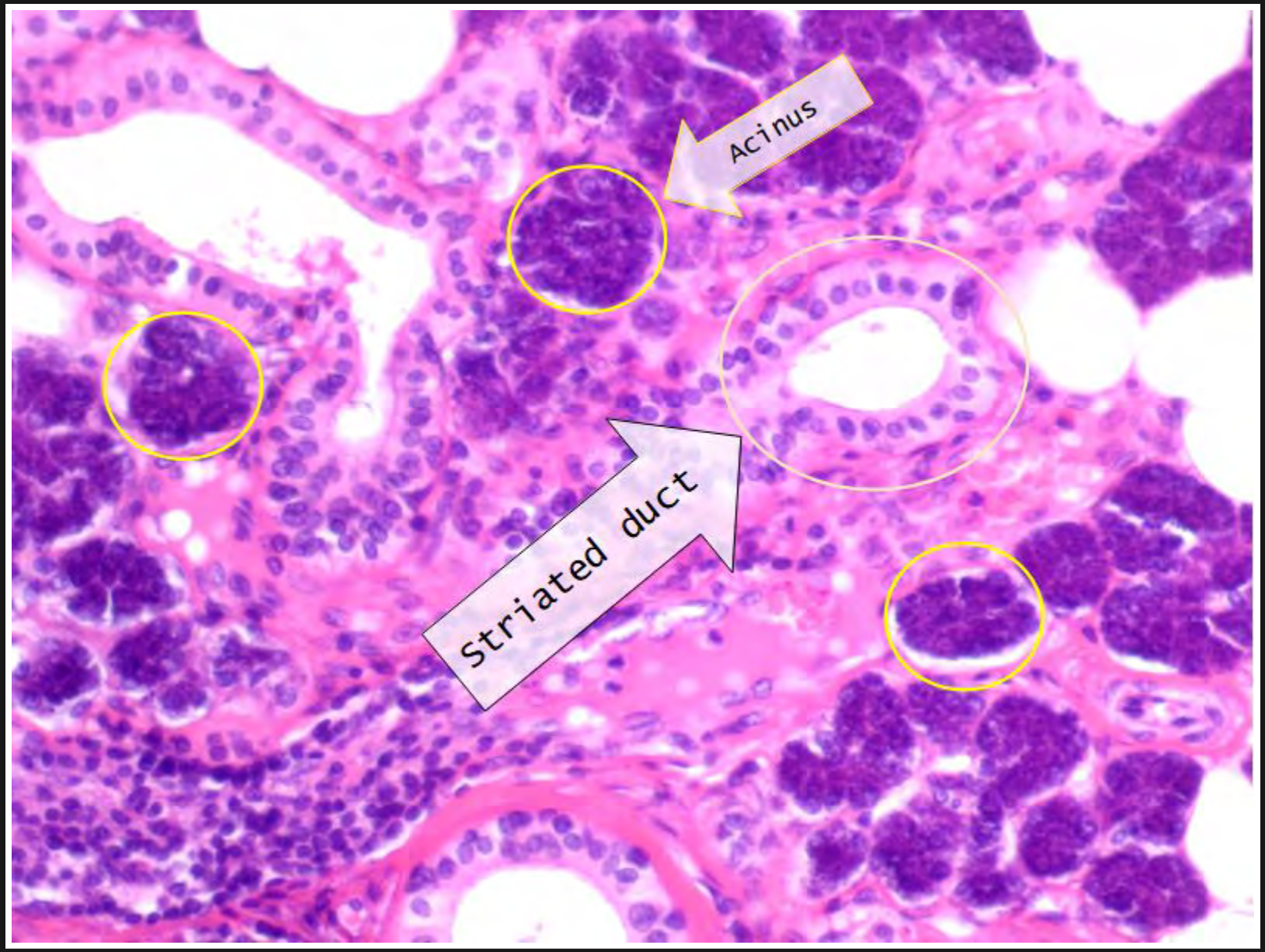
Acini

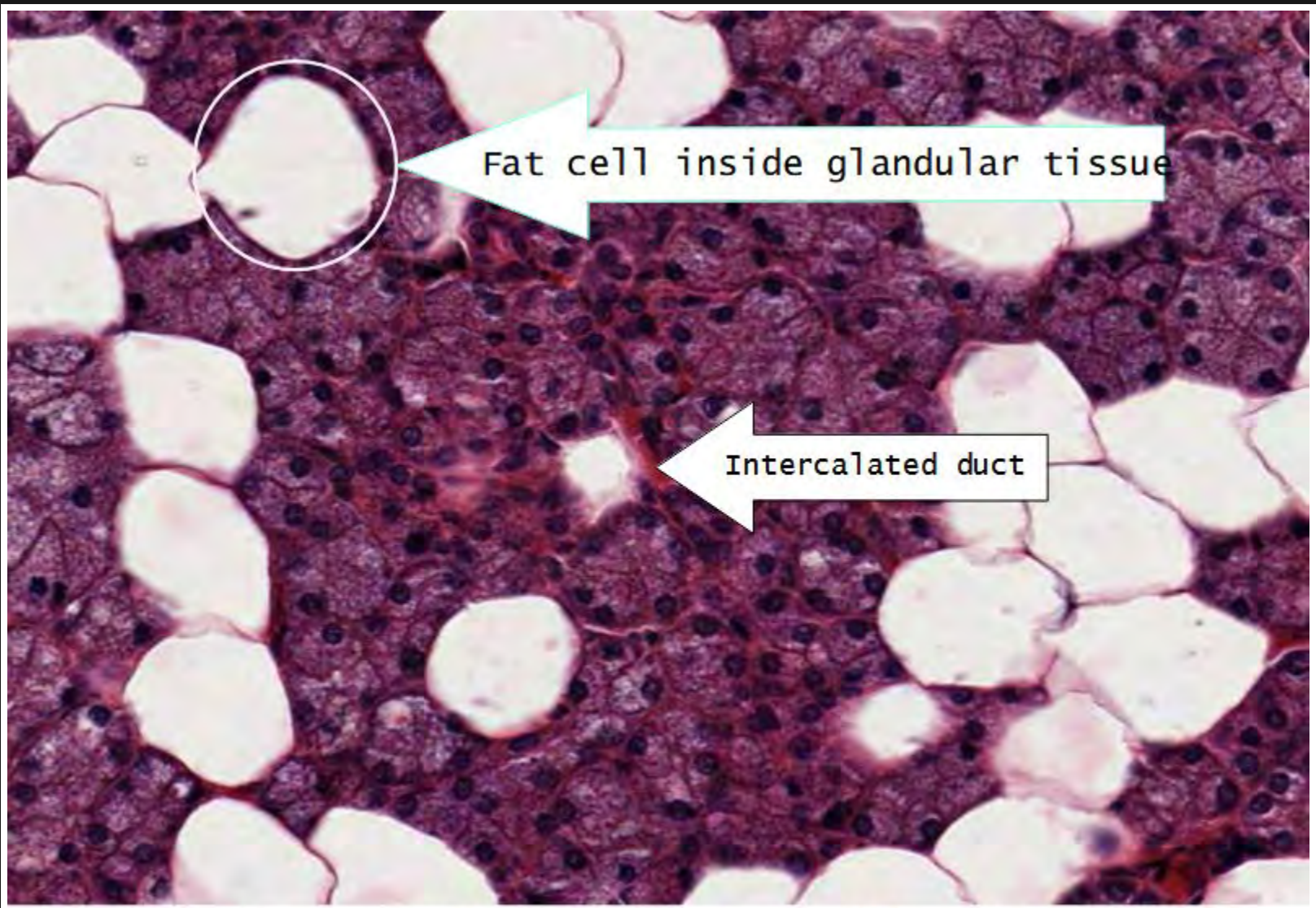
- Seromucous
- Serous cells predominate
- Secretions mainly serous
- Surrounded by myoepithelial cells
- Lumen in centre
- Fat cells with age

Acinar cells

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


Fat cell inside glandular tissue
Duct - cuboidal epithelium

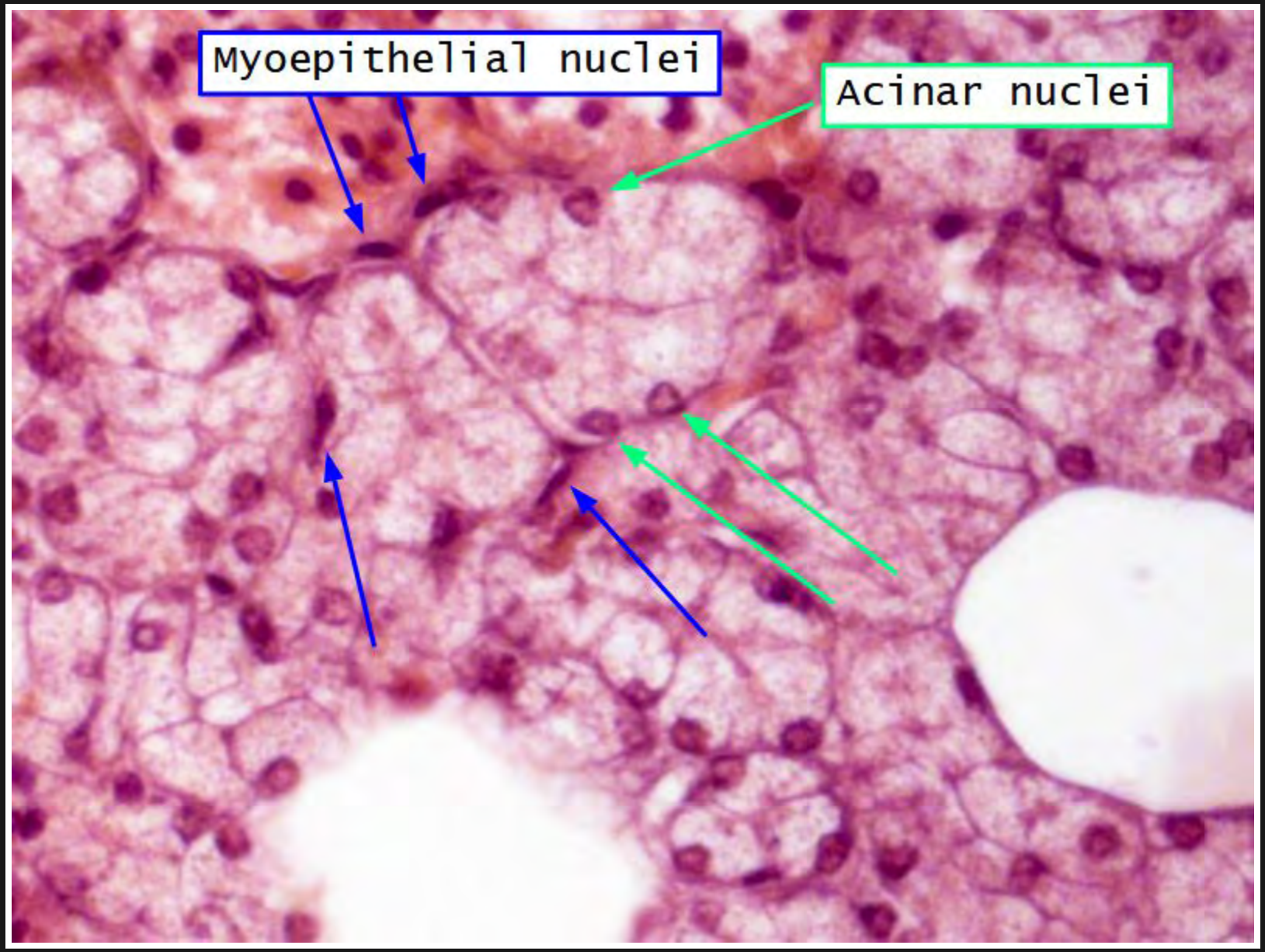

Acinus
Striated duct



Drexel University - Gastrointestinal System; H GOldman; Creative Commons Attribution Non-Commercial ShareAlike 4.0; http://virtualmicroscopydatabase.org/

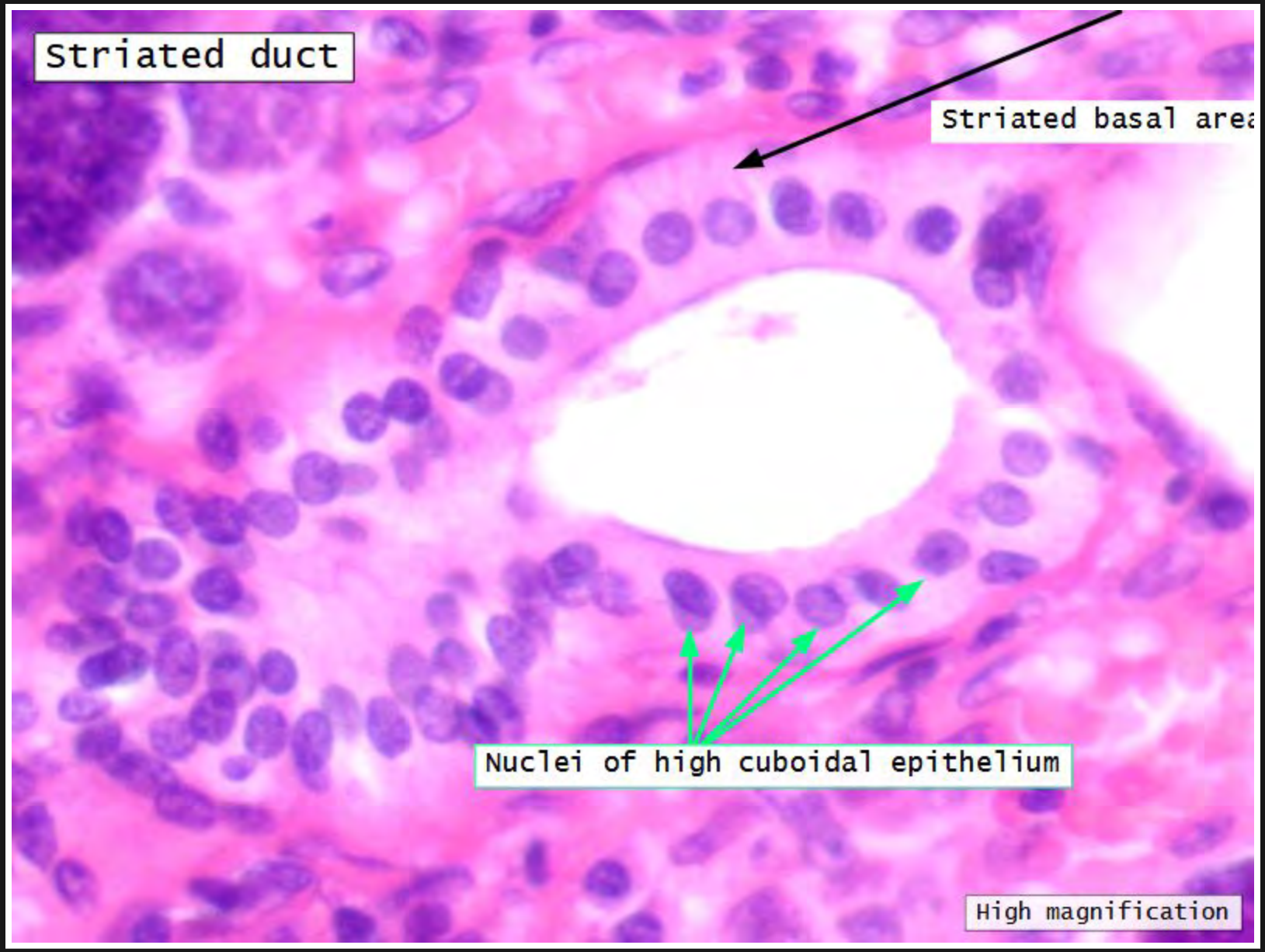
Myoepithelial cells

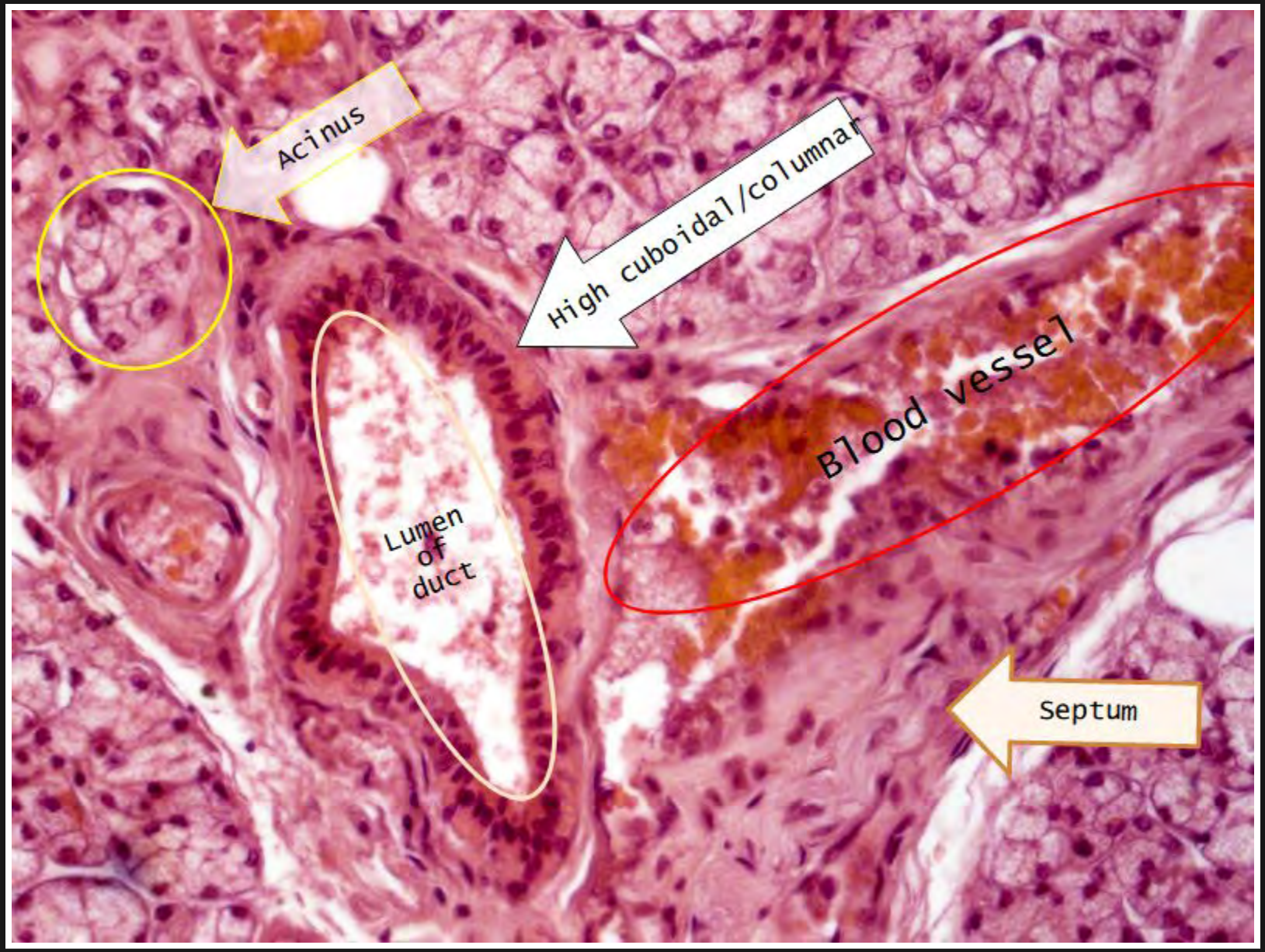
- Stellate shape
- Cytoplasma difficult to see

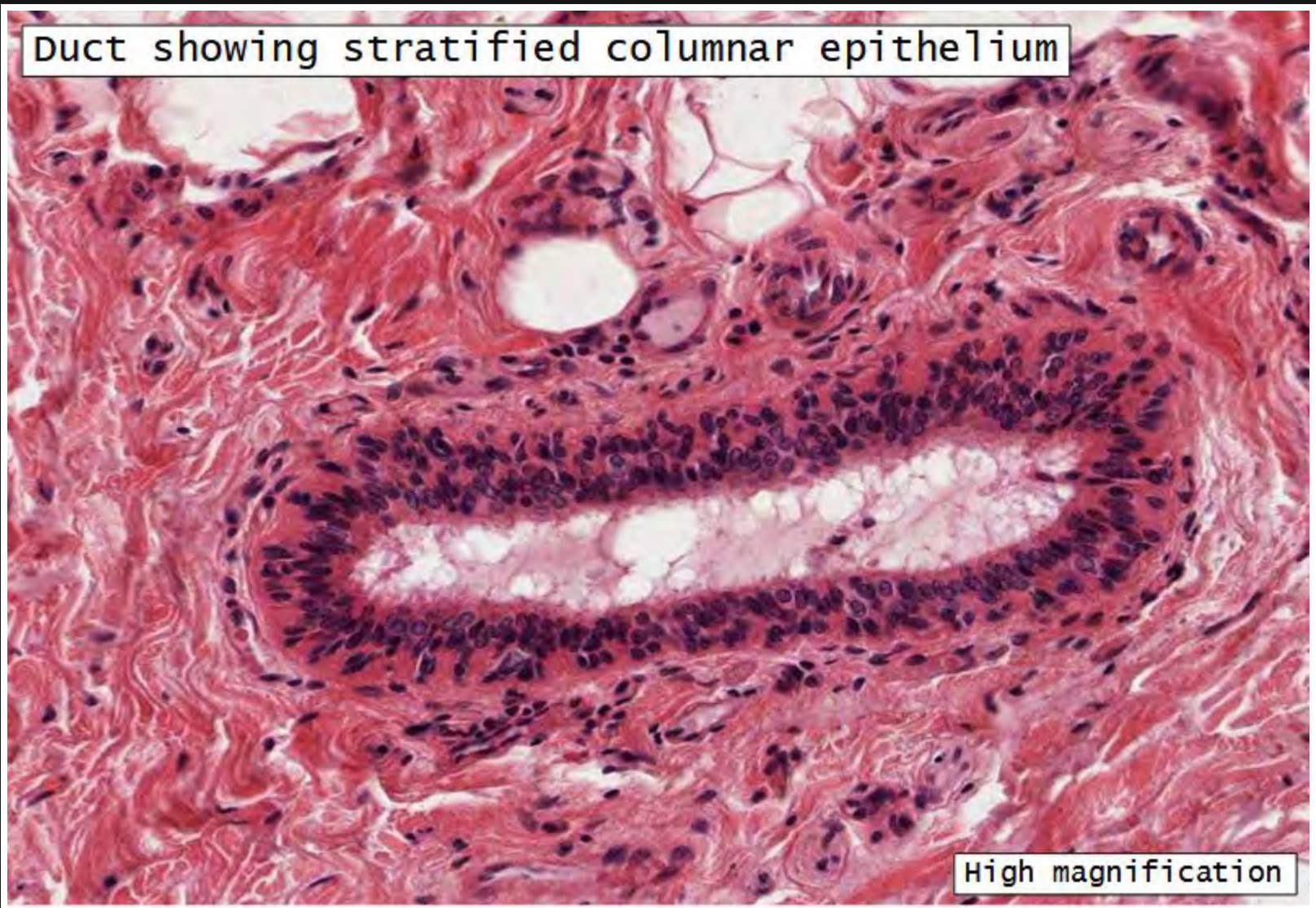

Myoepithelial nuclei
Acinar nuclei

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 area
Nuclei of high cuboidal epithelium
High magnification


Acinus
High cuboidal/columnar
Blood vessel
Lumen of duct
Septum



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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

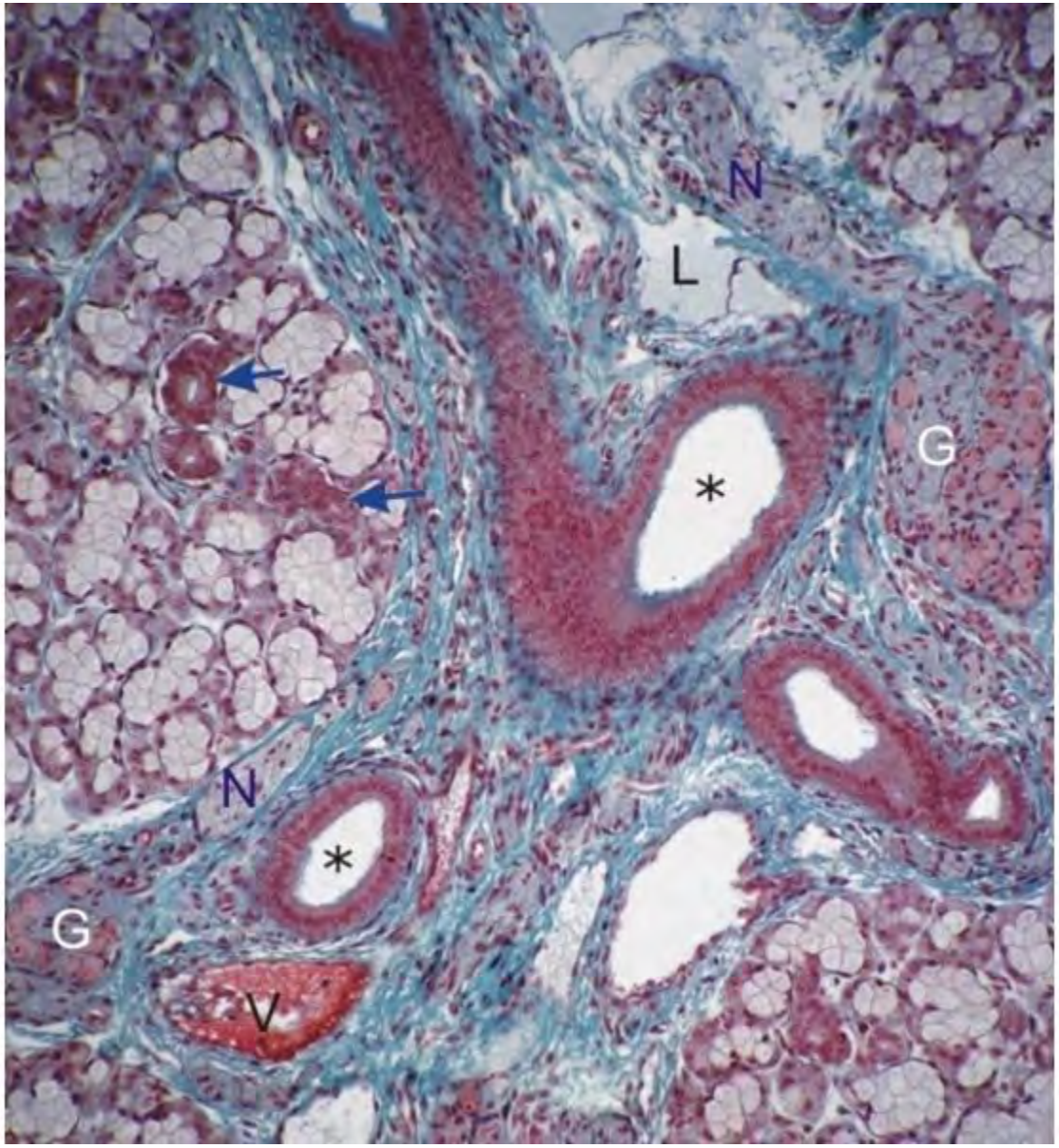
- Peripheral to mucous acini

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
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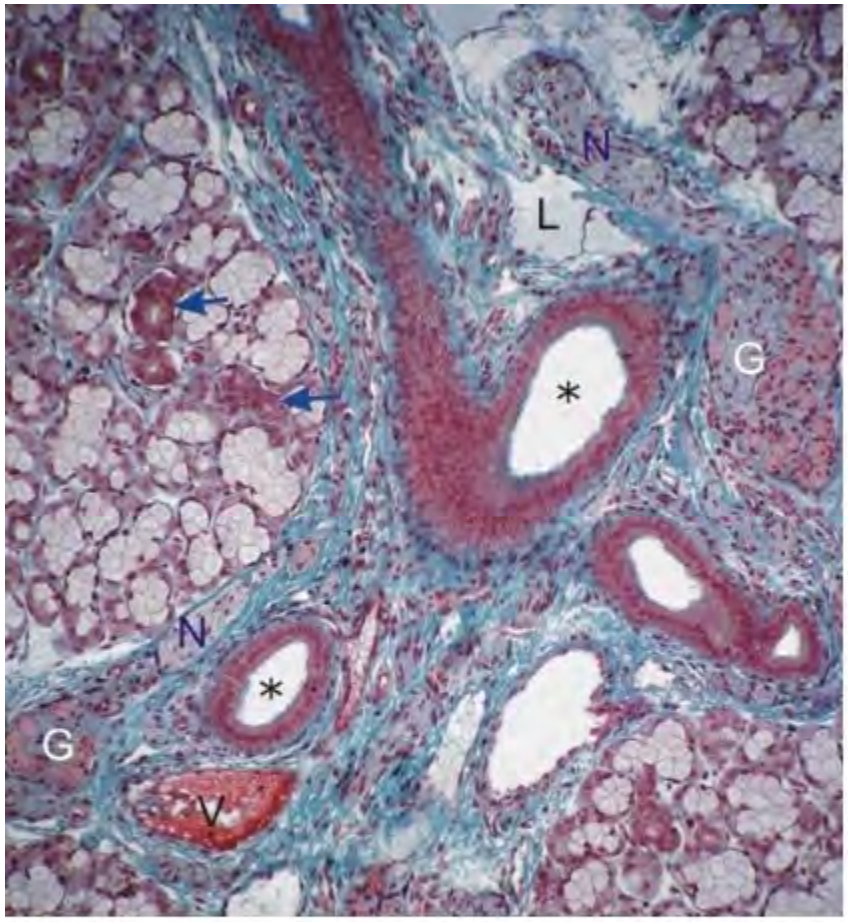
G
*
N
*
G
V



Histology Atlas, by Yves Clermont, Michael Lalli & Zsuzsanna Bencsath-Makkai; Creative Commons Attribution-Noncommercial-No Derivative Works 2.5 Canada Licence; http://audilab.bme.mcgill.ca/HA/

* = interlobular ducts in a connective tissue septum

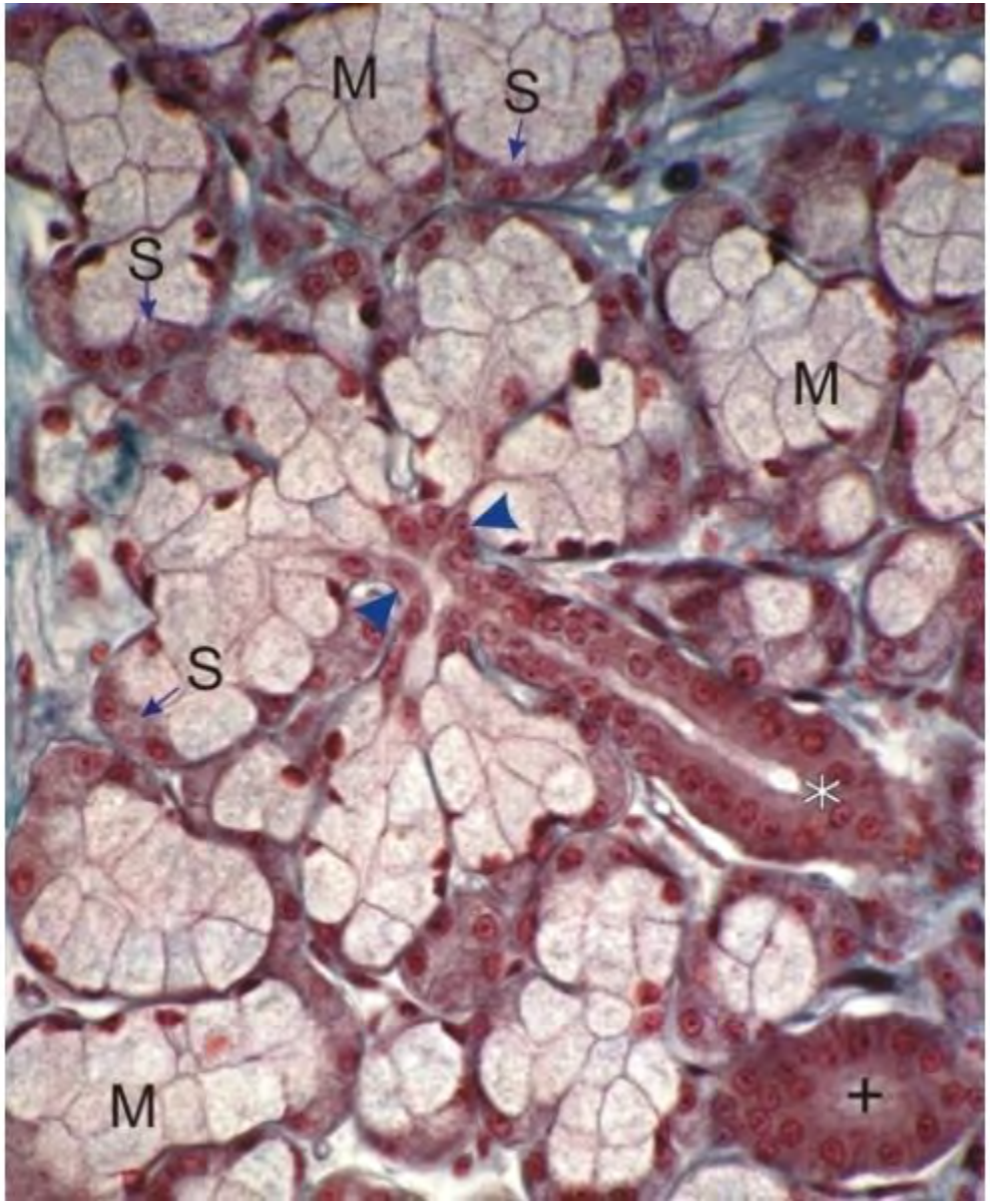
V = vein

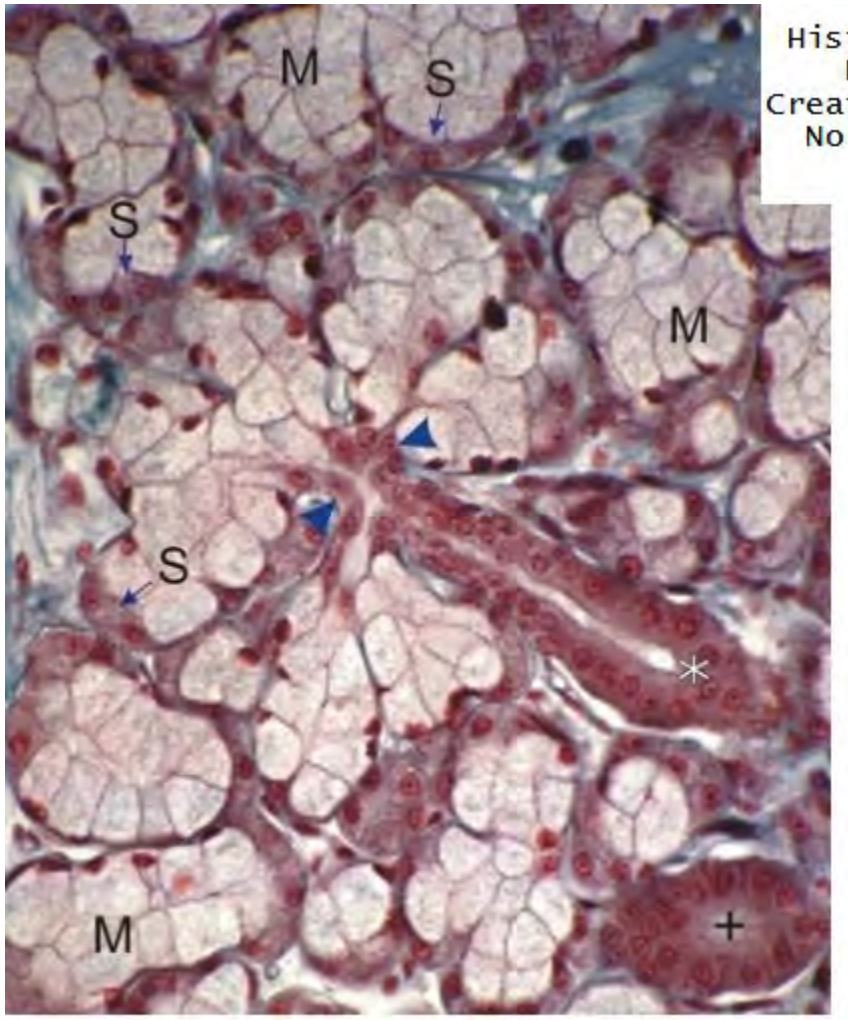
L = lymphatic

N= nerves

G = ganglia

Arrows = acidophilic intralobular ducts among mixed acini


M
S
S
M
S
M
+



M = pale mucous cells

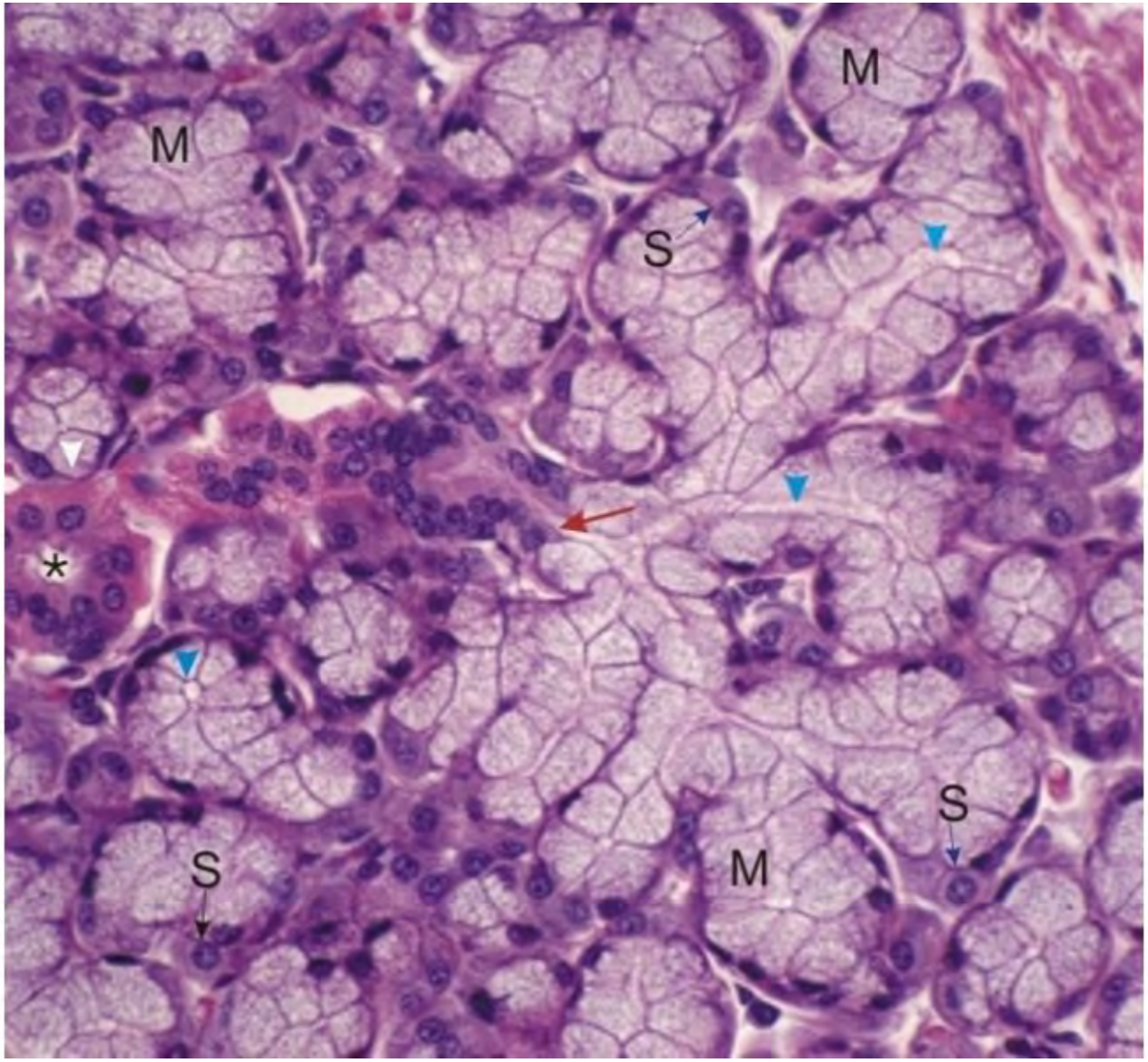
S = deeply stained serous demilune cells

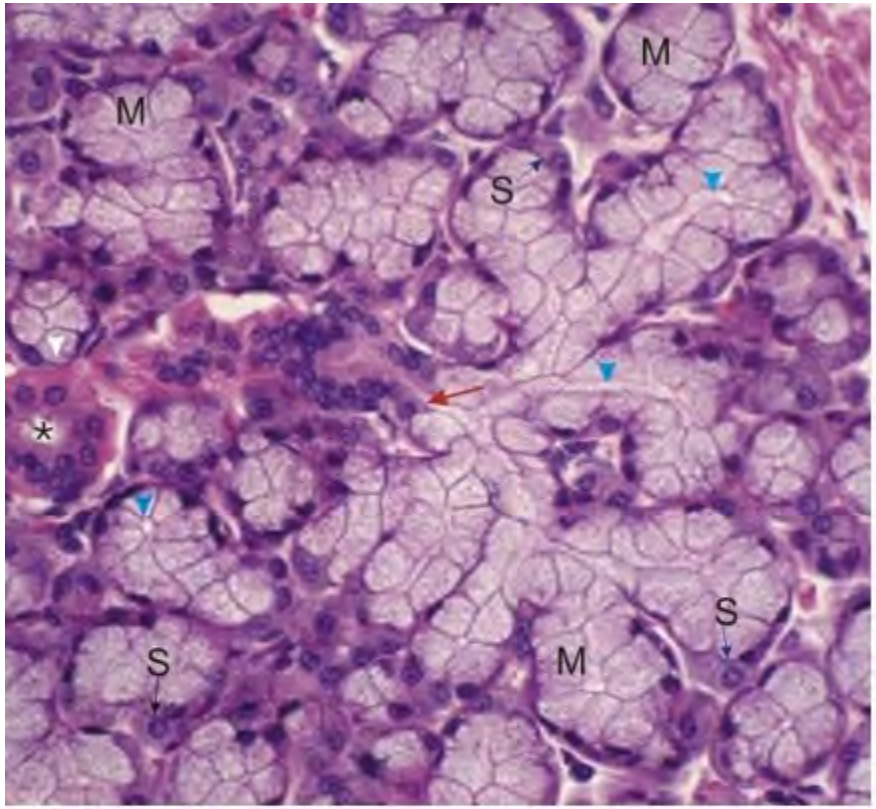
Arrowheads = mixed acini radiating from a short intercalated duct

continuous with a more

* = acidophilic striated duct

+ = striated duct cut obliquely


M
M
S
*
S
M
S



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

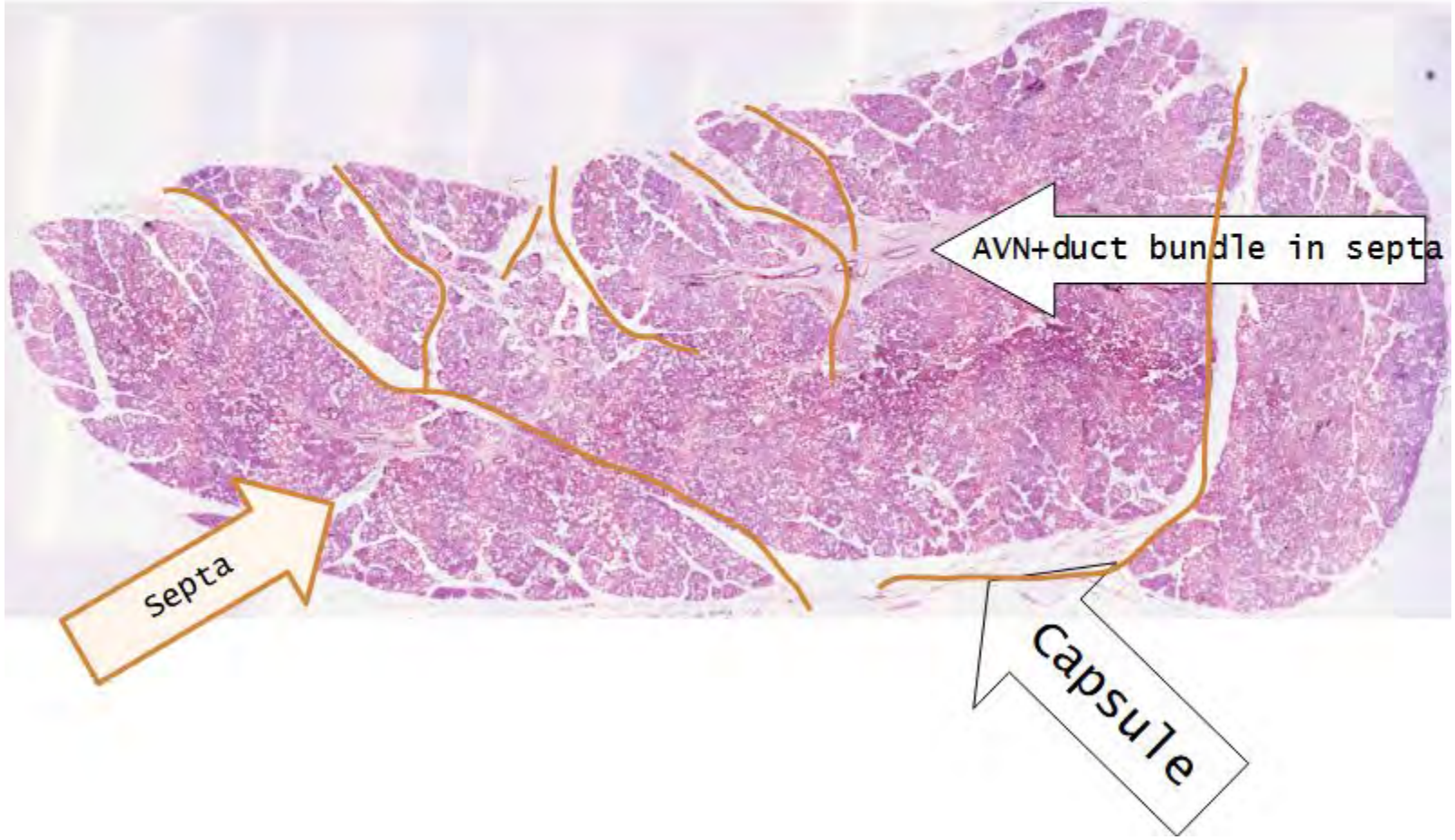
Submandibular gland

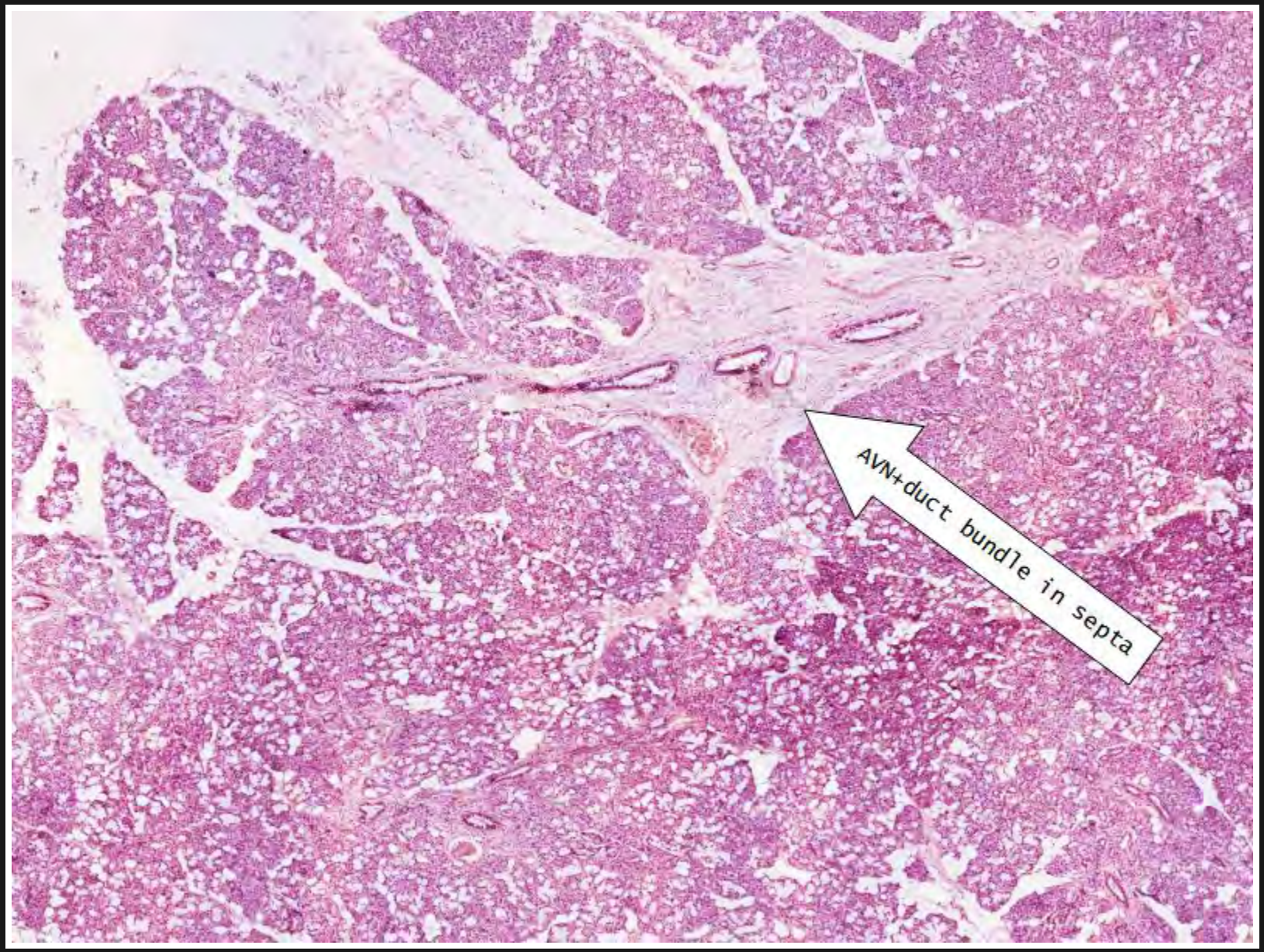
Identify microscopically:
Secretory units
Secretory ducts
Connective tissue septae and blood vessels

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

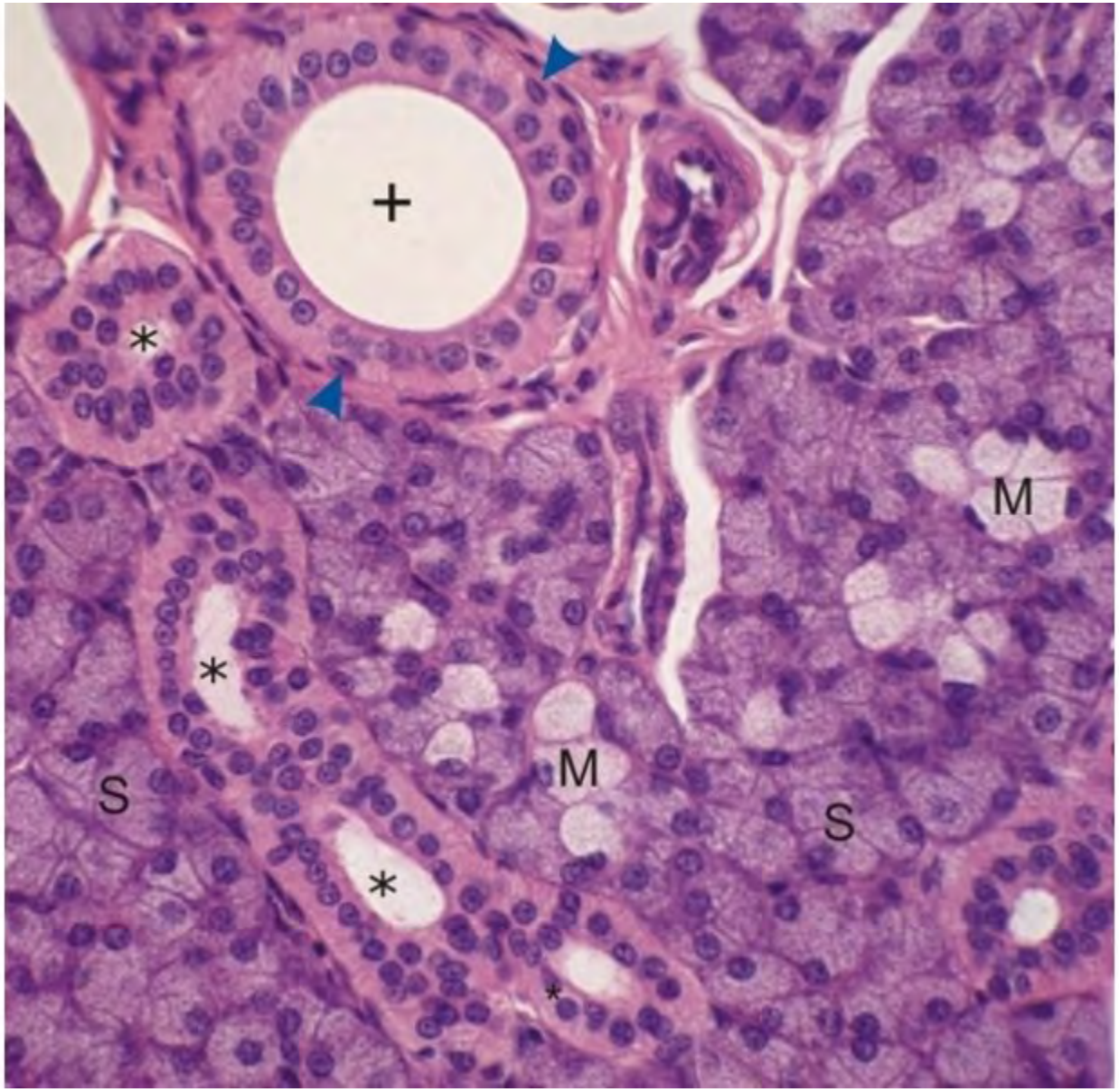
- Peripheral to mucous acini

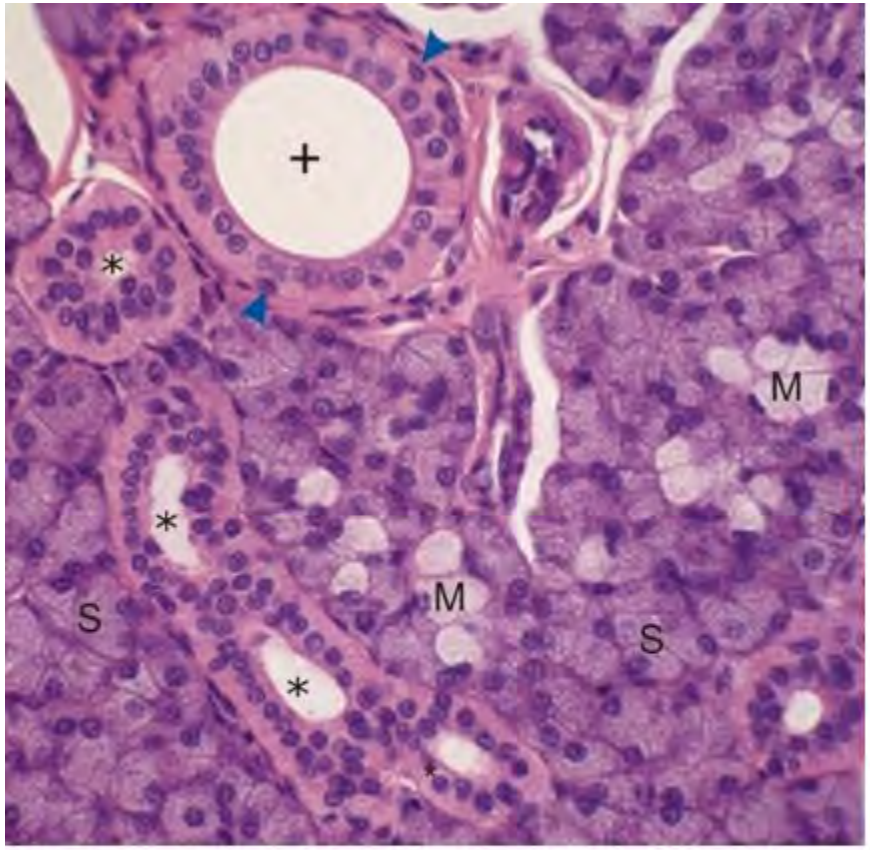
Myoepithelial cells

- 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



Histology Atlas, by Yves Clermont, Michael Lalli & Zsuzsanna Bencsath-Makkai; Creative Commons Attribution-Noncommercial-No Derivative Works 2.5 Canada Licence; http://audilab.bme.mcgill.ca/HA/

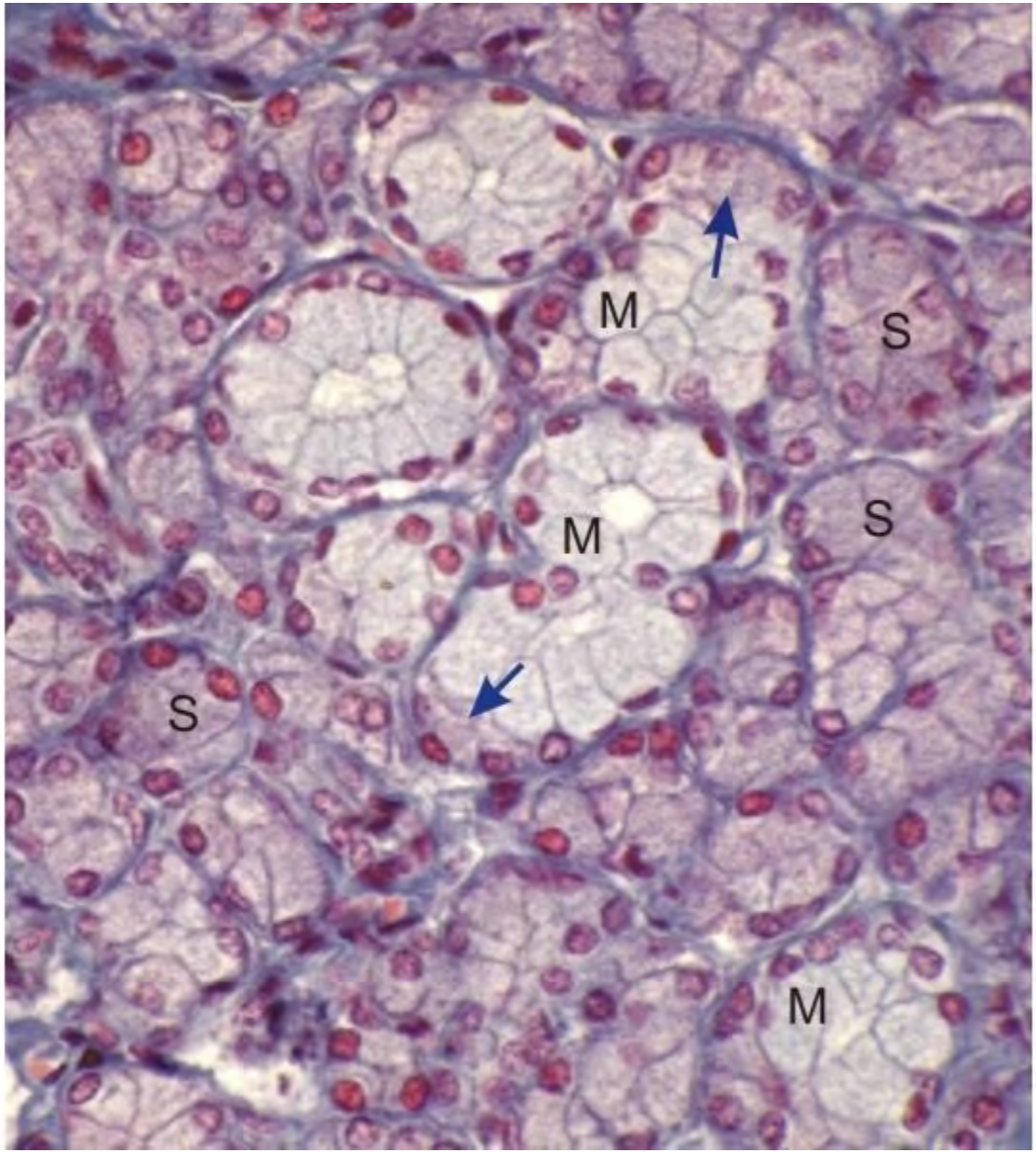
S = serous acini

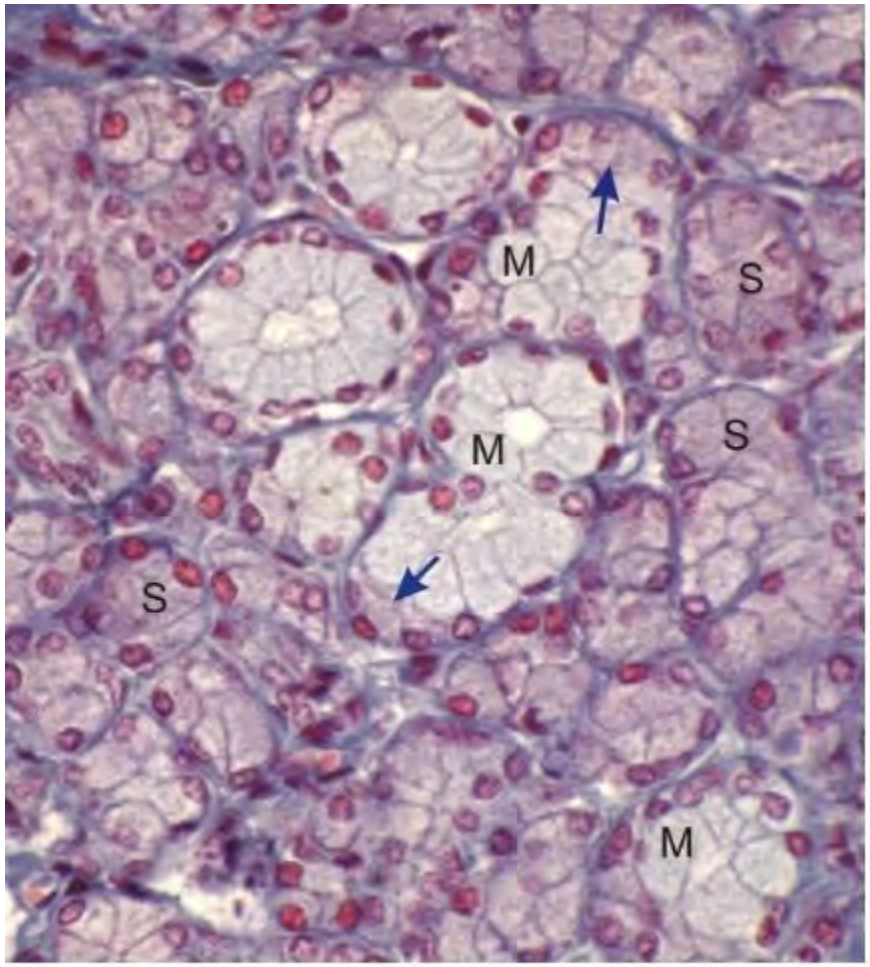
Some acini are mixed and show both serous and mucous cells (M)

* = striated ducts

+ = larger non-striated intralobular duct

Arrowheads = basal cells among the columnar epithelial cells


M
S
M
S
S
M



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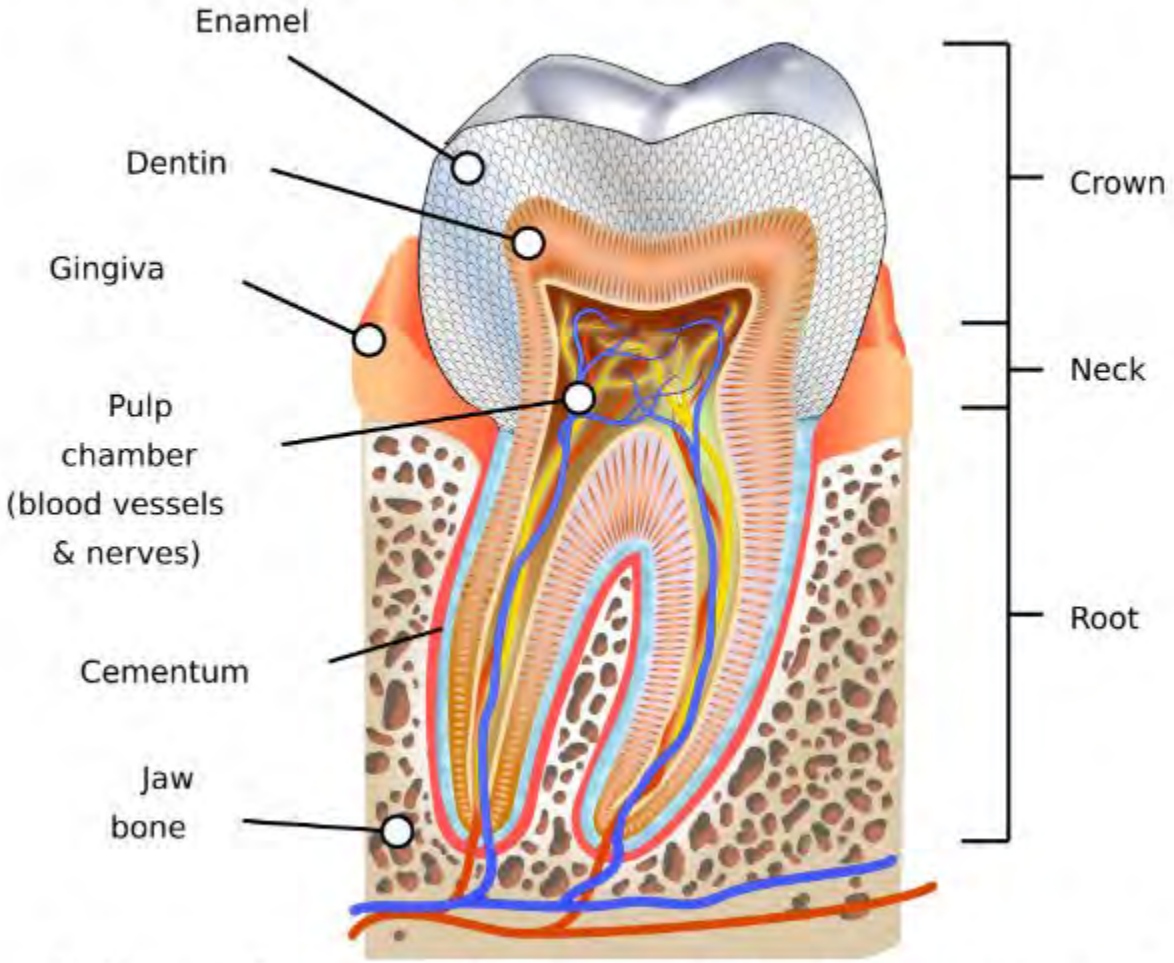
S = pure serous acini

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



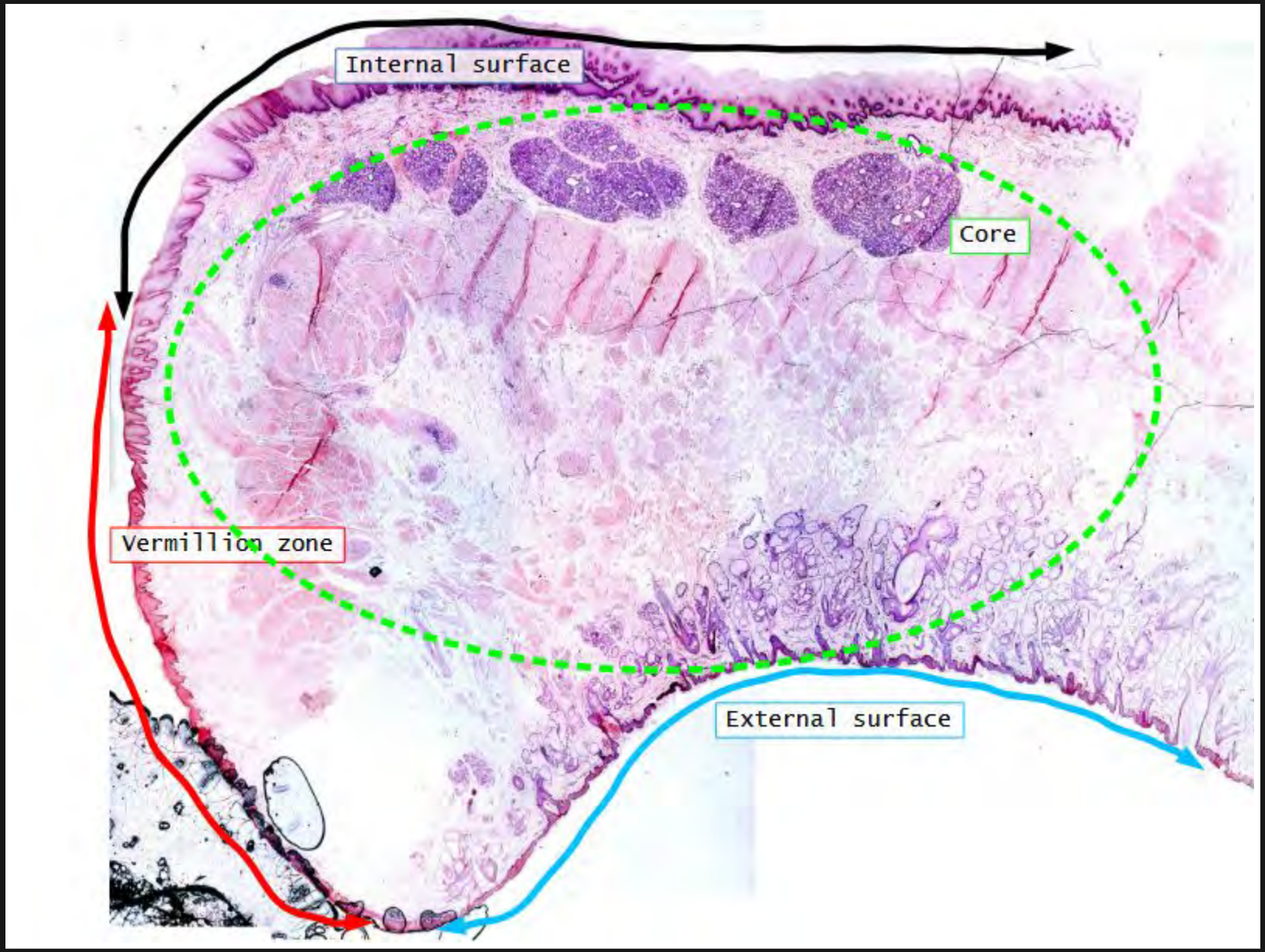
Human tooth diagram from Wikimedia Commons by K. D. Schroeder, CC-BY-SA 4.0

Lip

Slide 51

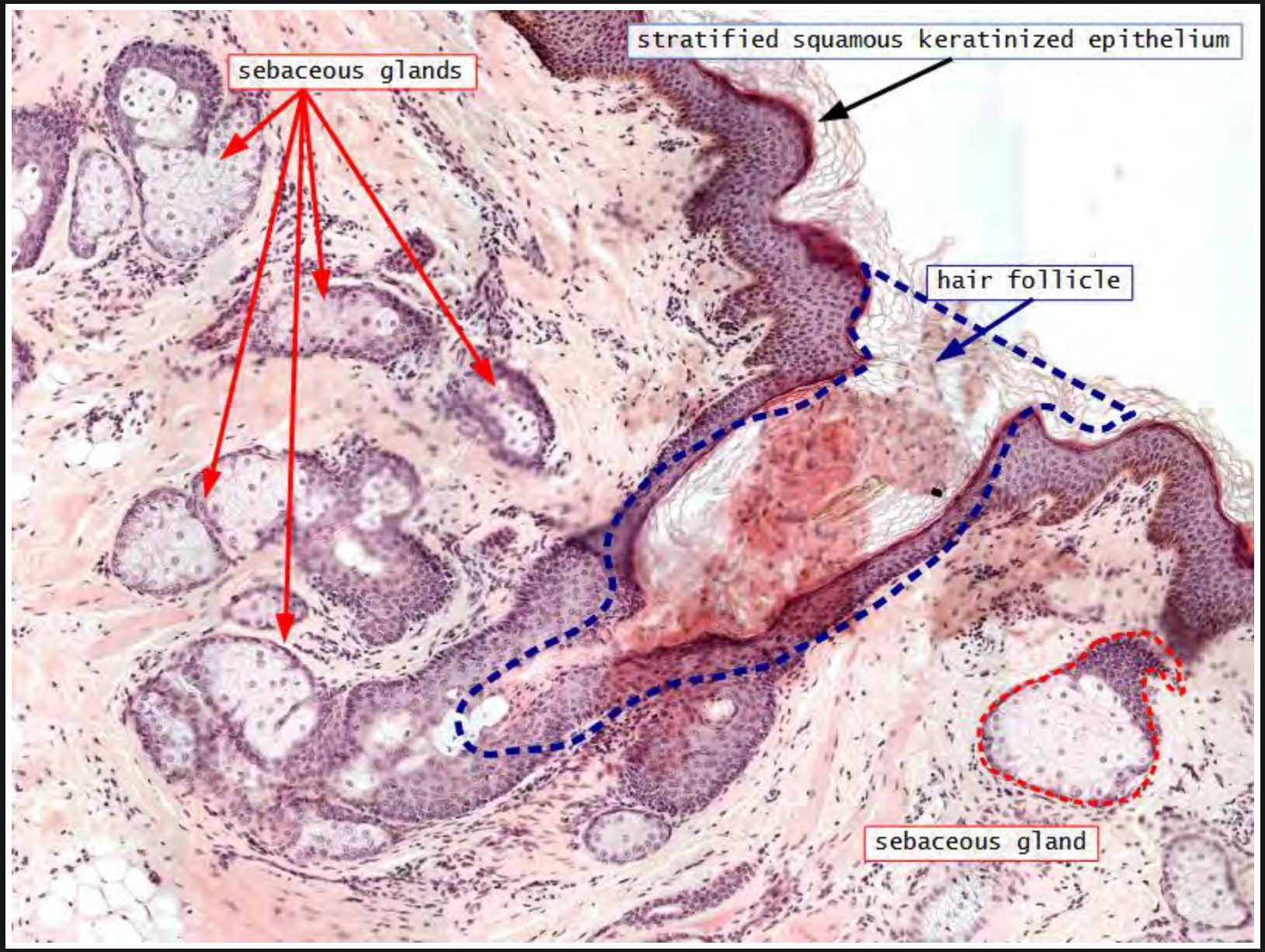
Lip

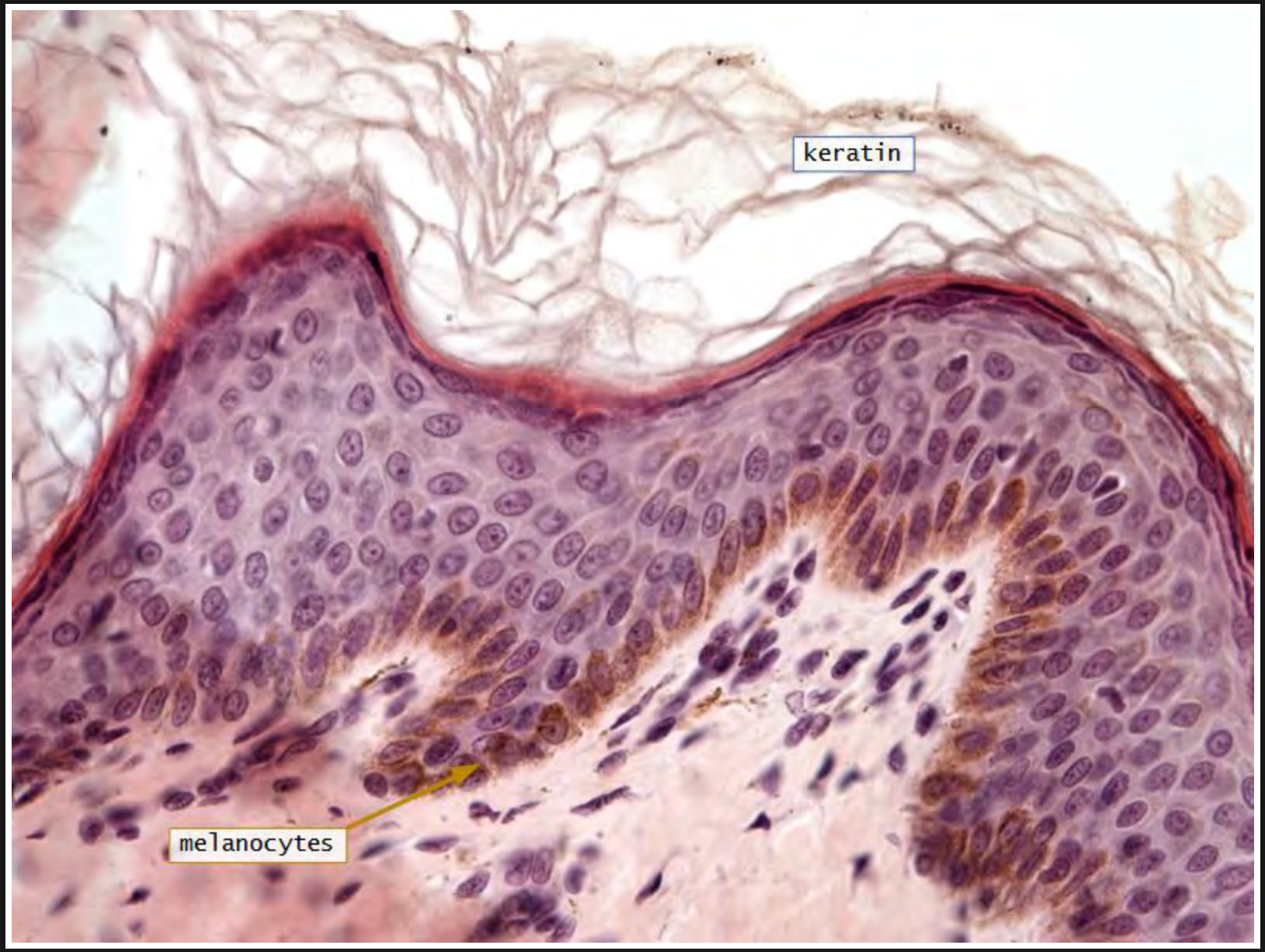
- External surface
- Vermillion zone
- Internal surface
- Core

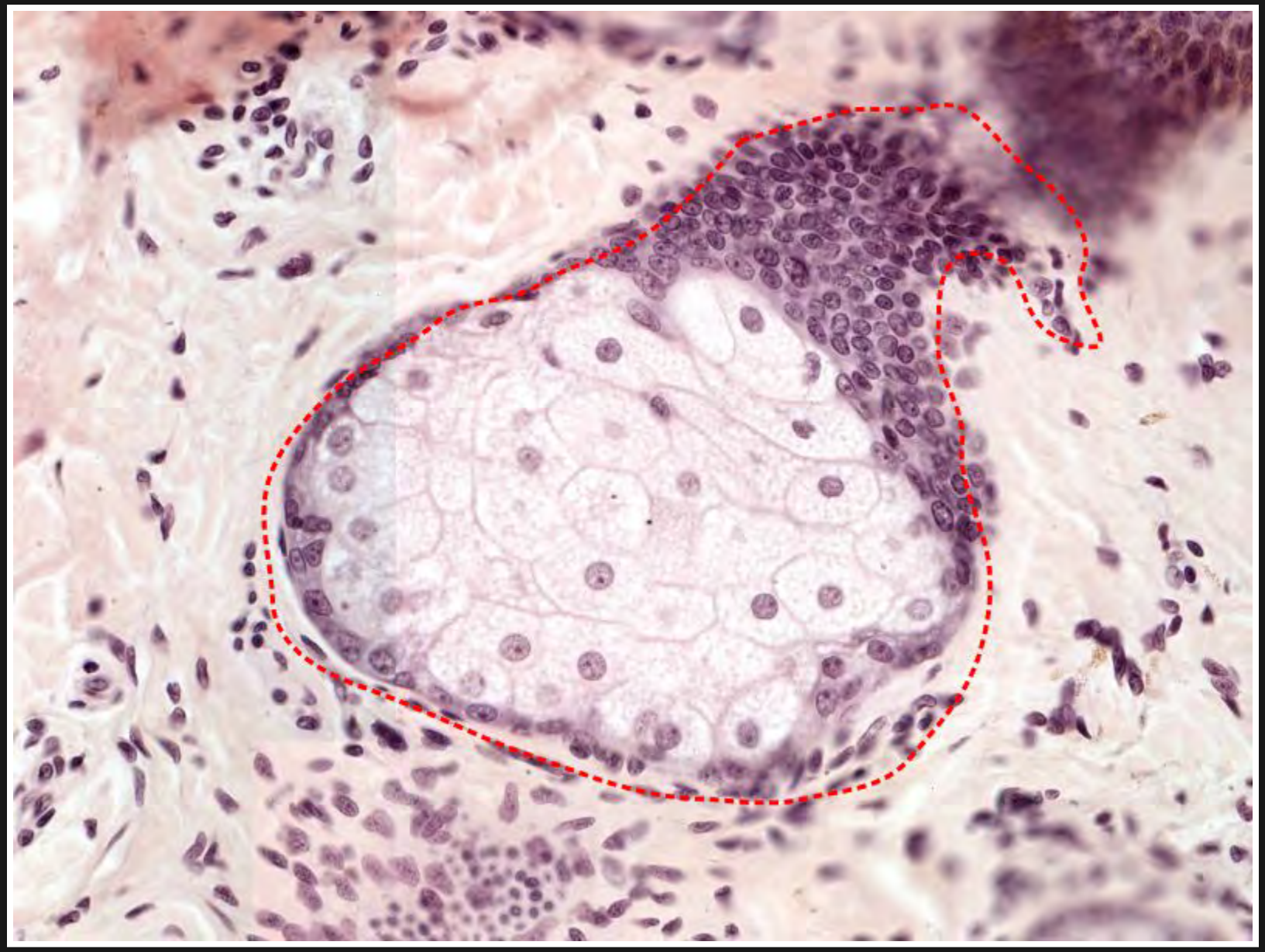

Internal surface
Core
Vermillion zone
External surface

External surface

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

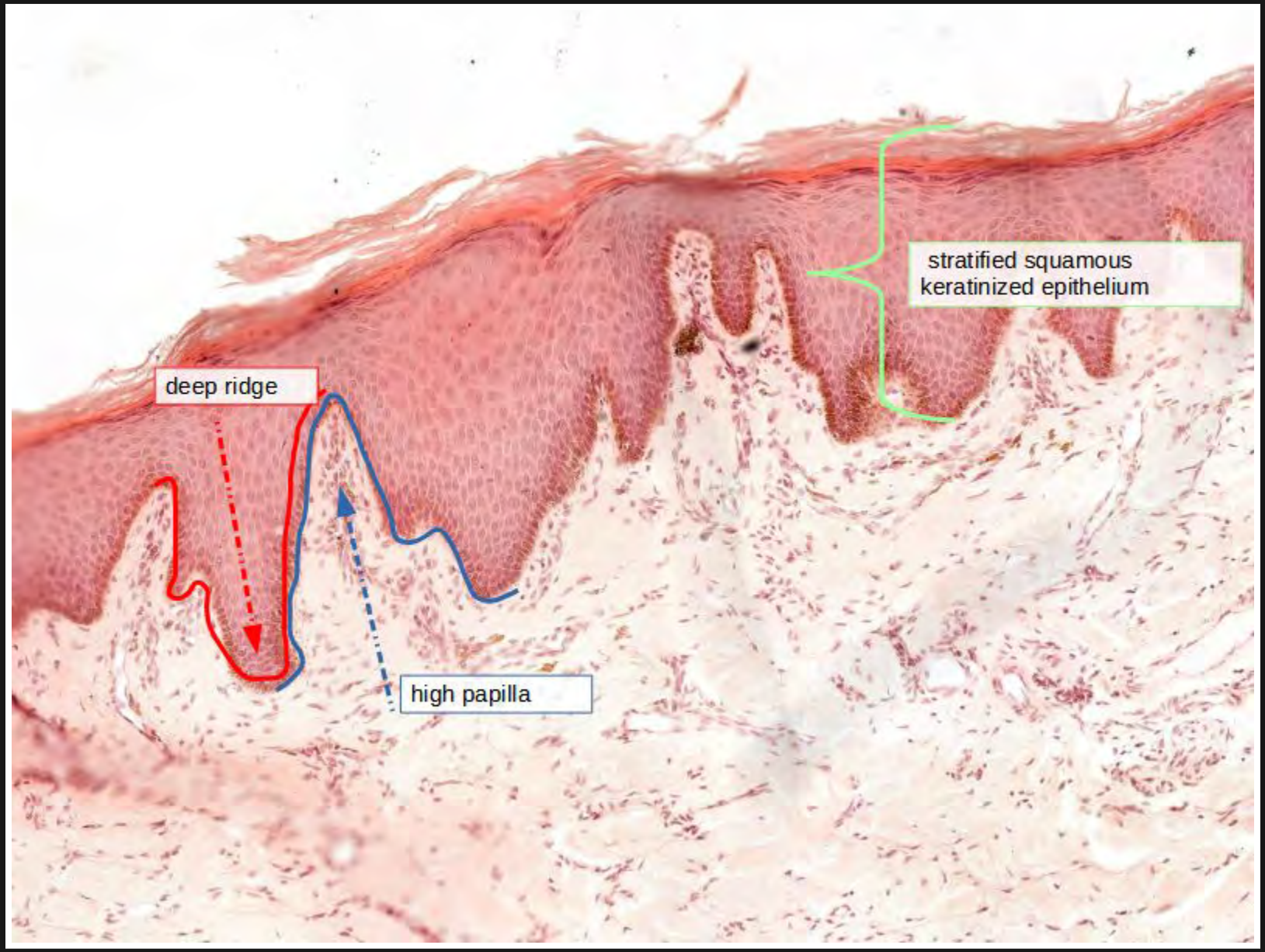

stratified squamous keratinized epithelium
sebaceous glands
hair follicle
sebaceous gland

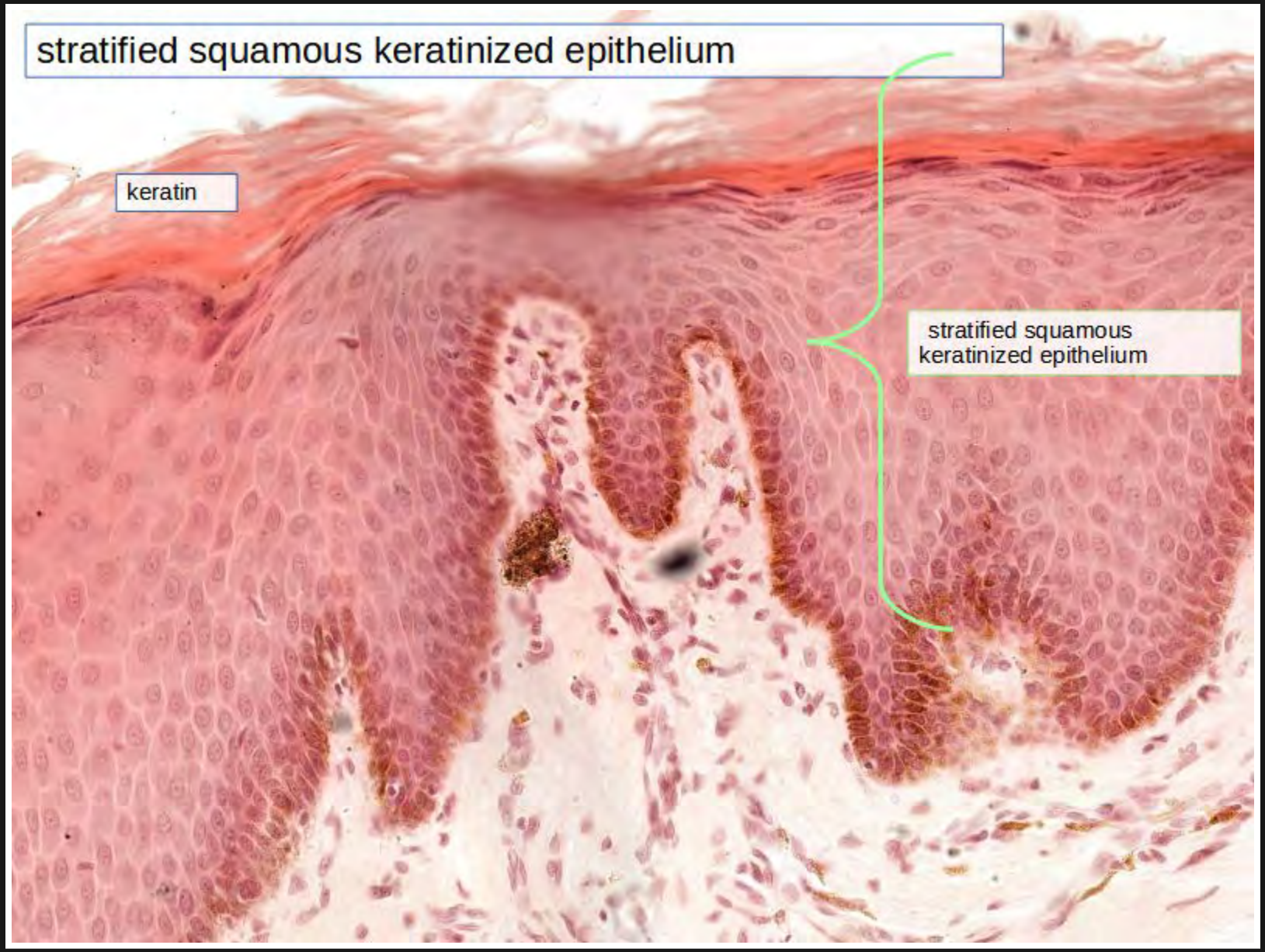

keratin
melanocytes



Vermillion zone

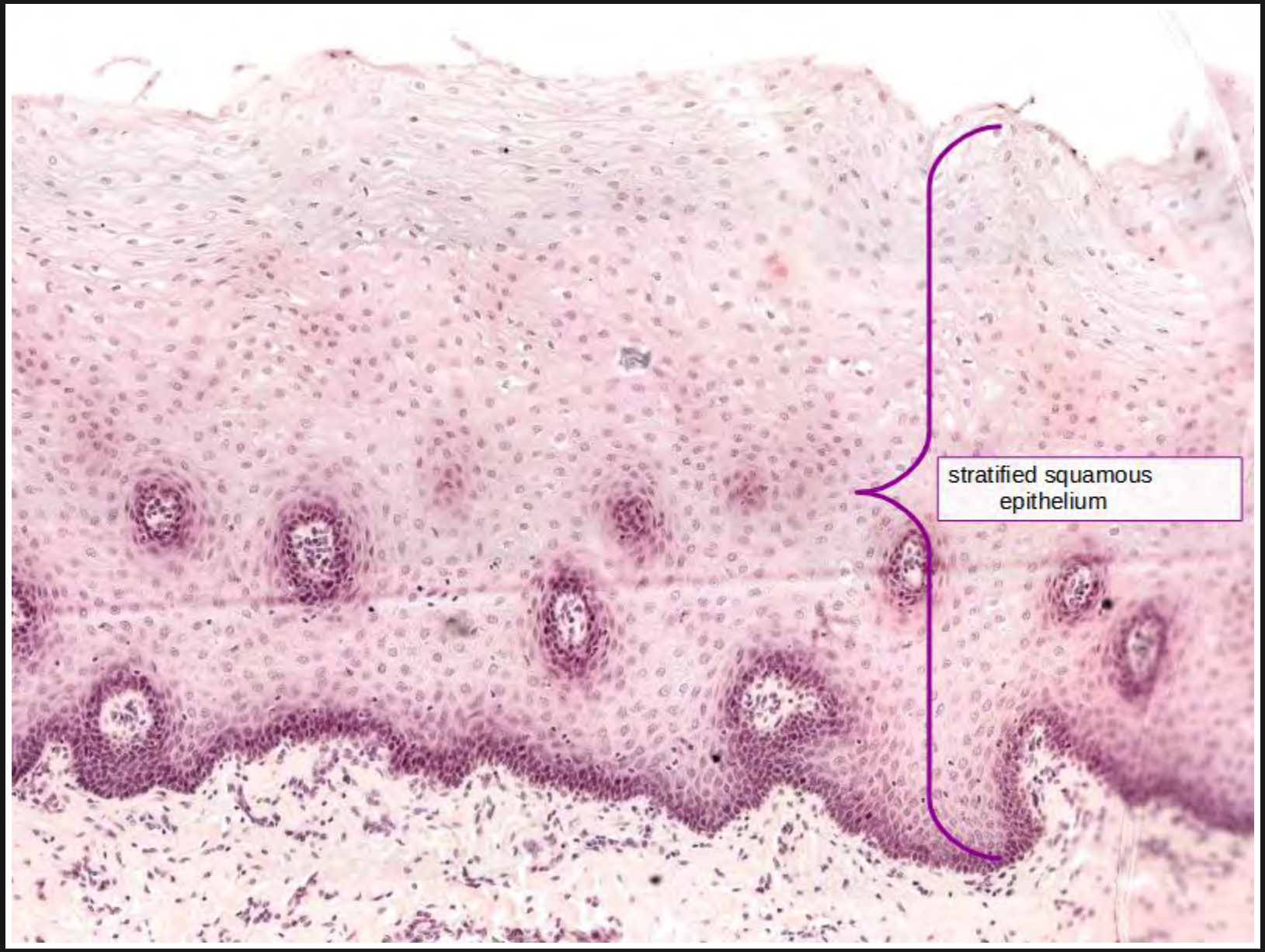
- Red portion of lip
- Stratified squamous keratinized epithelium
- Deep ridges and high papillae
- No hair follicles, glands
- Occasionally sebaceous glands

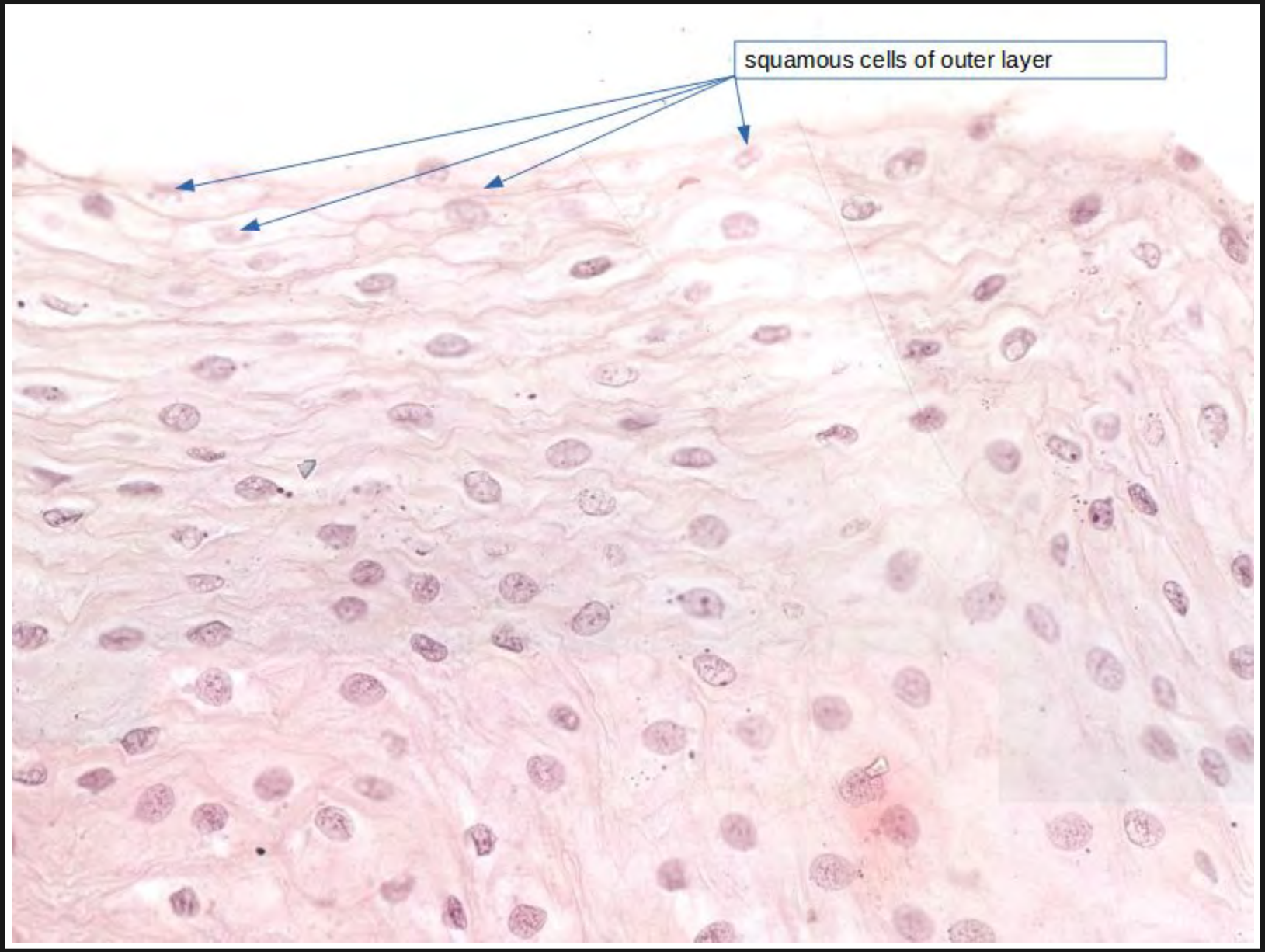

stratified squamous
keratinized epithelium
deep ridge
high papilla

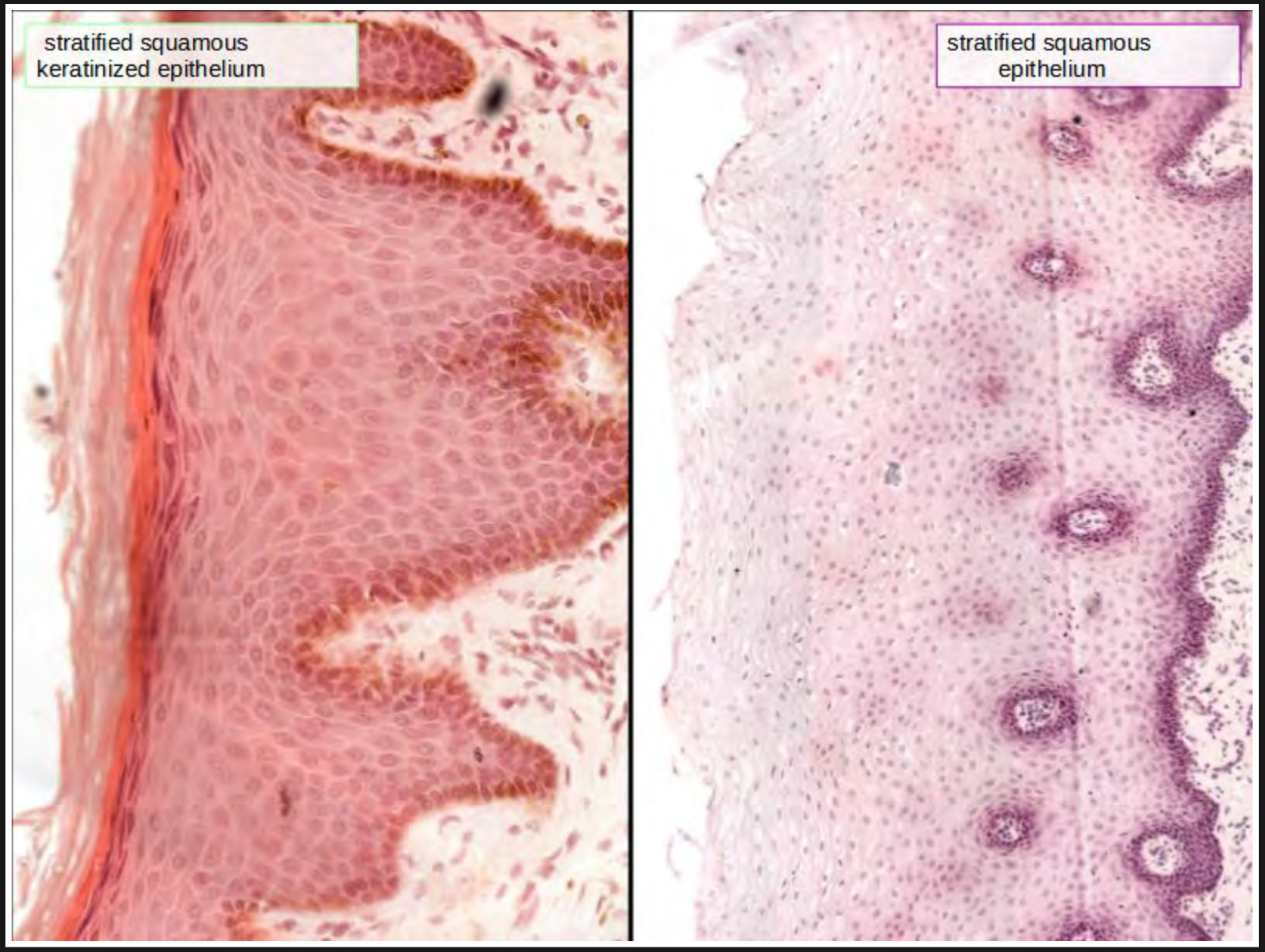

stratified squamous keratinized epithelium
keratin
stratified squamous
keratinized epithelium

Internal surface

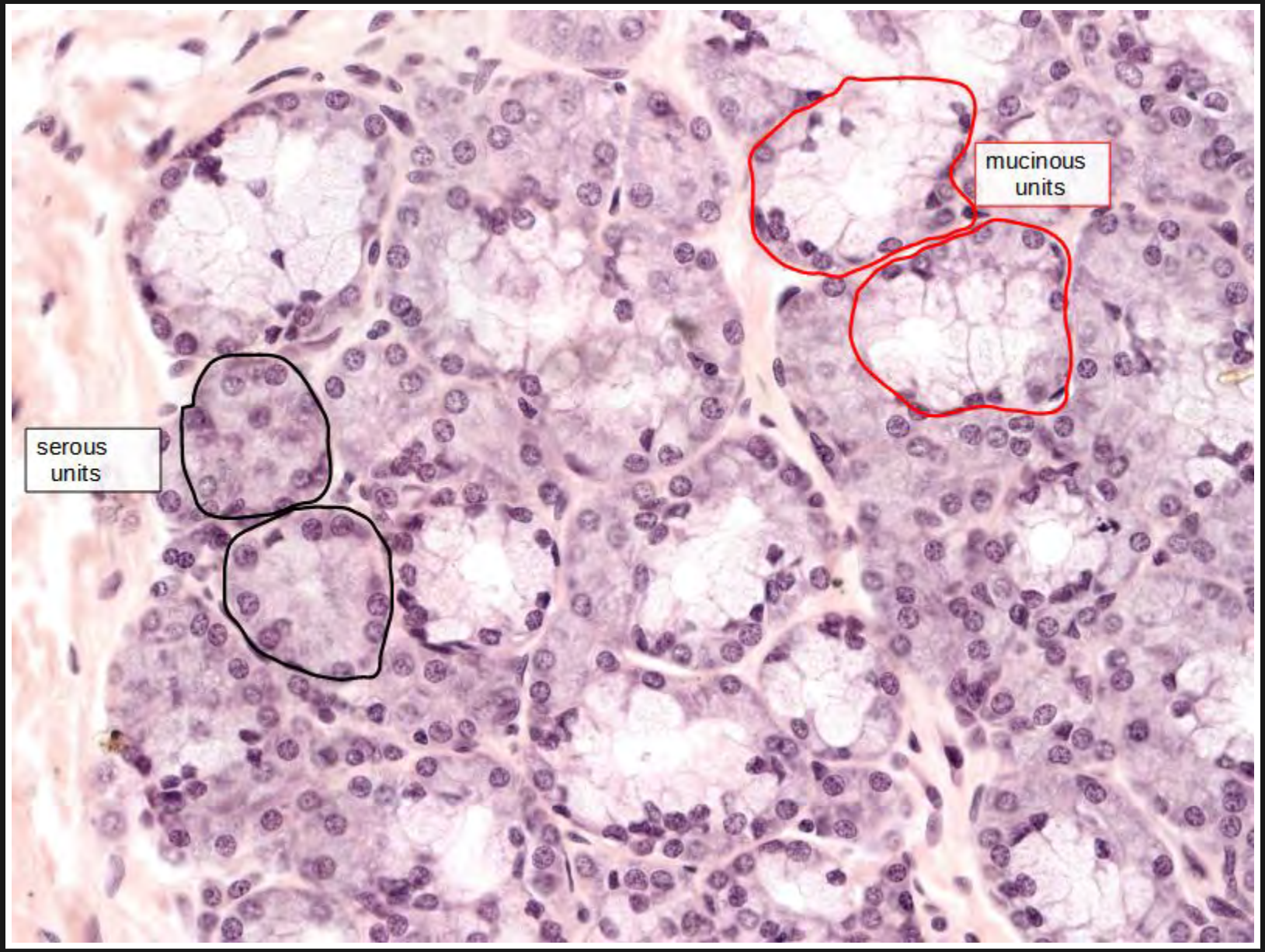
- Stratified squamous non-keratinized epithelium
- Seromucous salivary glands in mucosa & submucosa

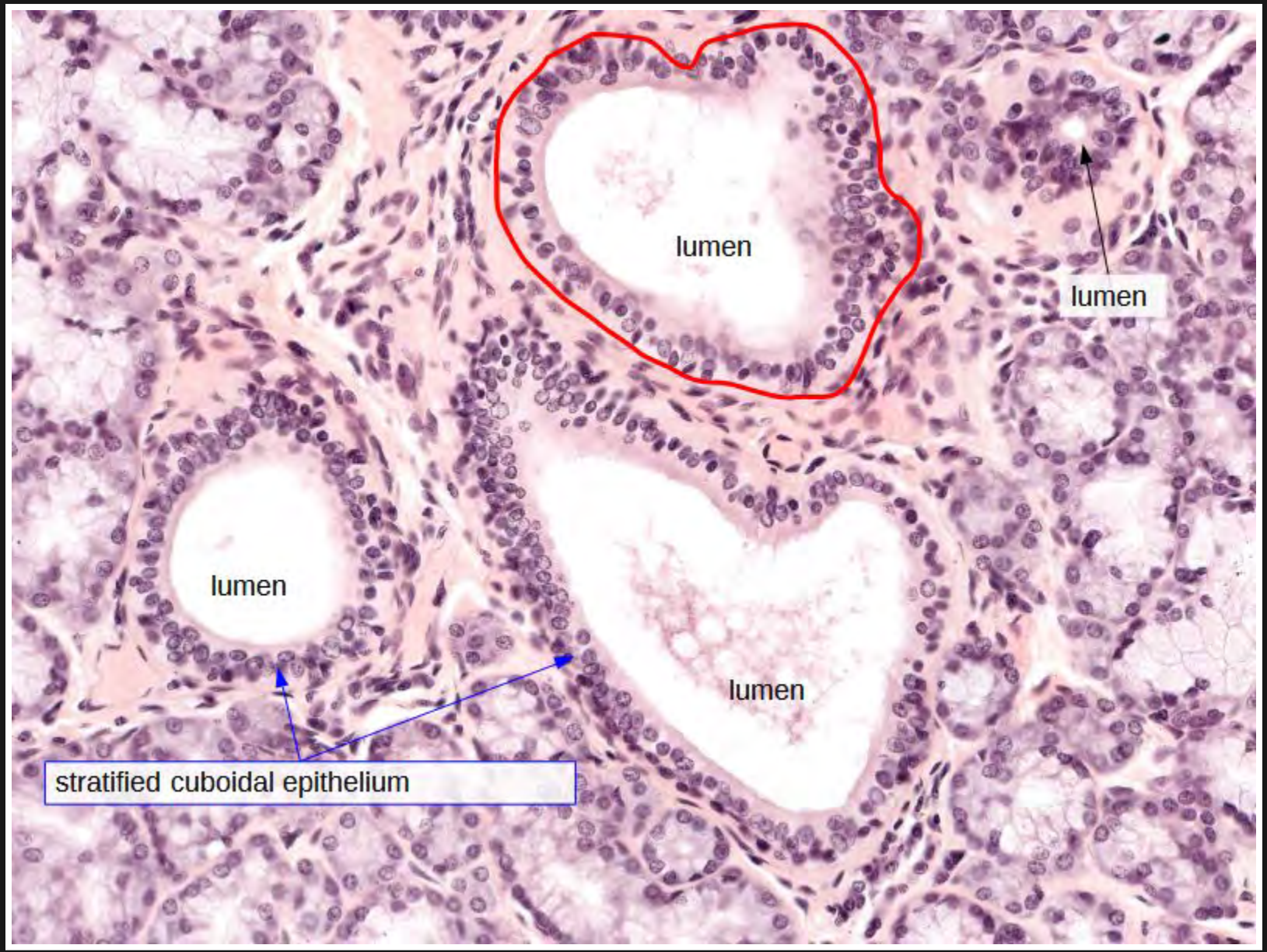

stratified squamous
epithelium


squamous cells of outer layer


stratified squamous
keratinized epithelium
stratified squamous
epithelium

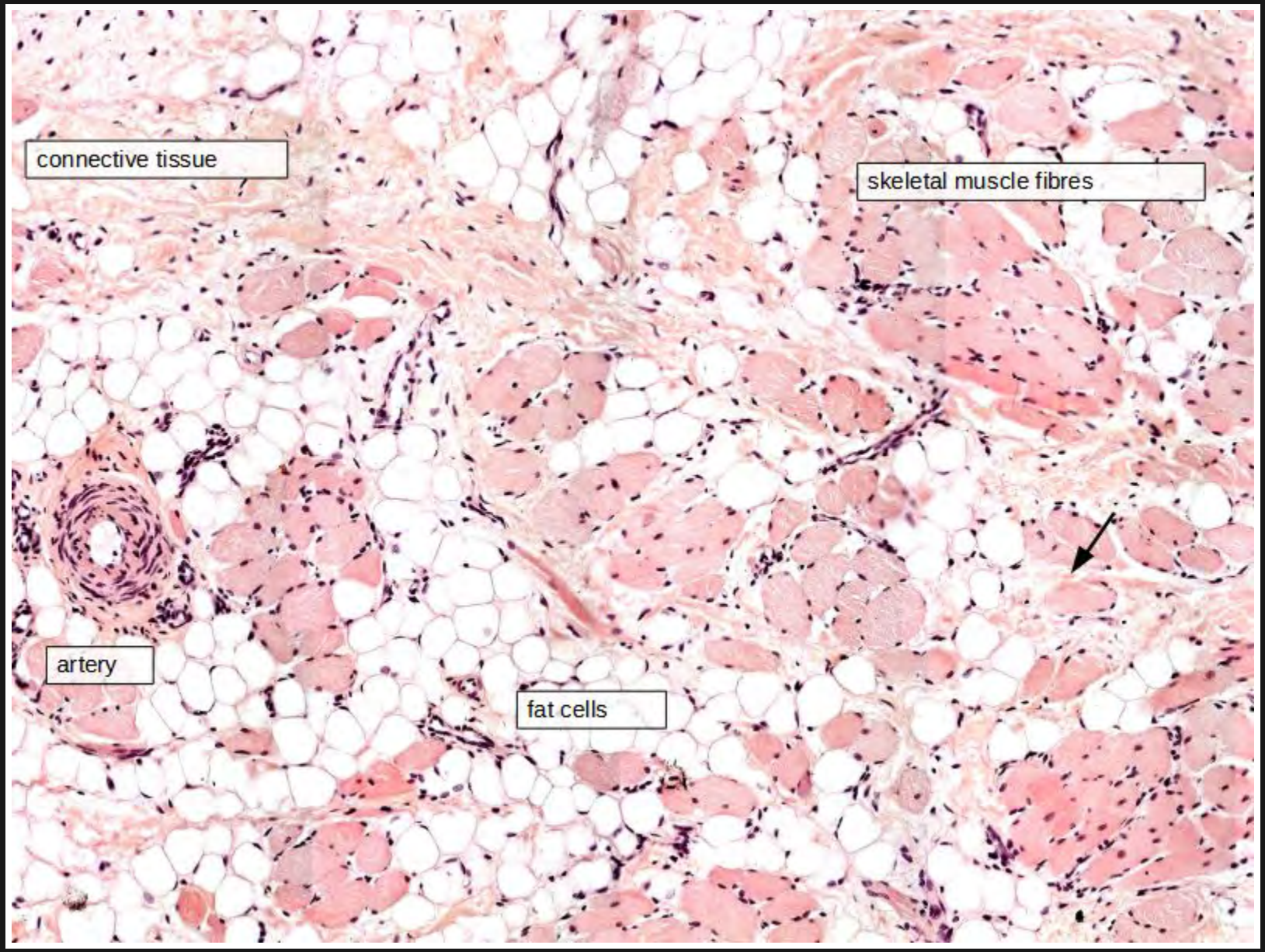

skeletal muscle
ducts
fat cells in septum
glandular tissue
connective tissue

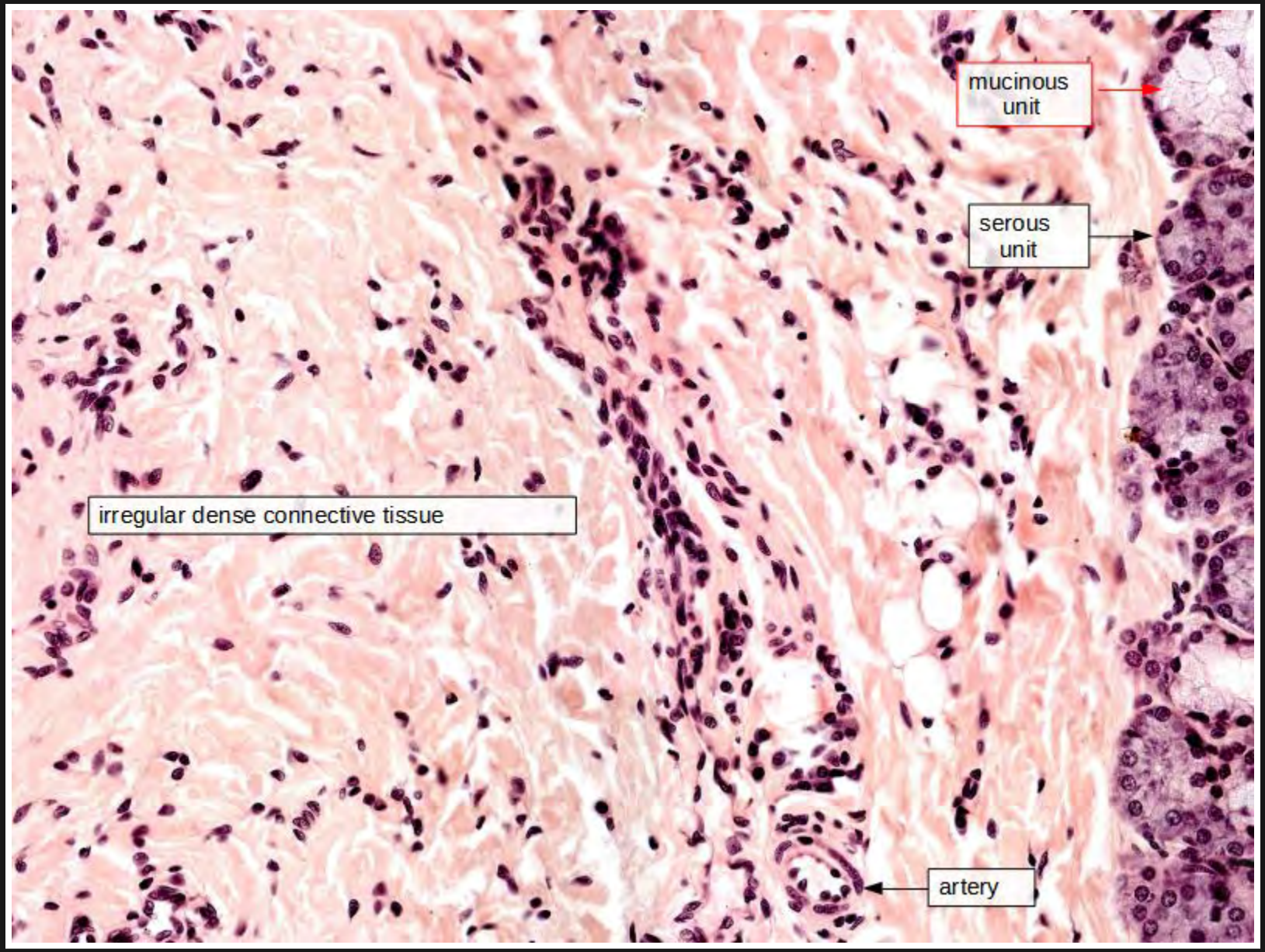

mucinous units
serous units

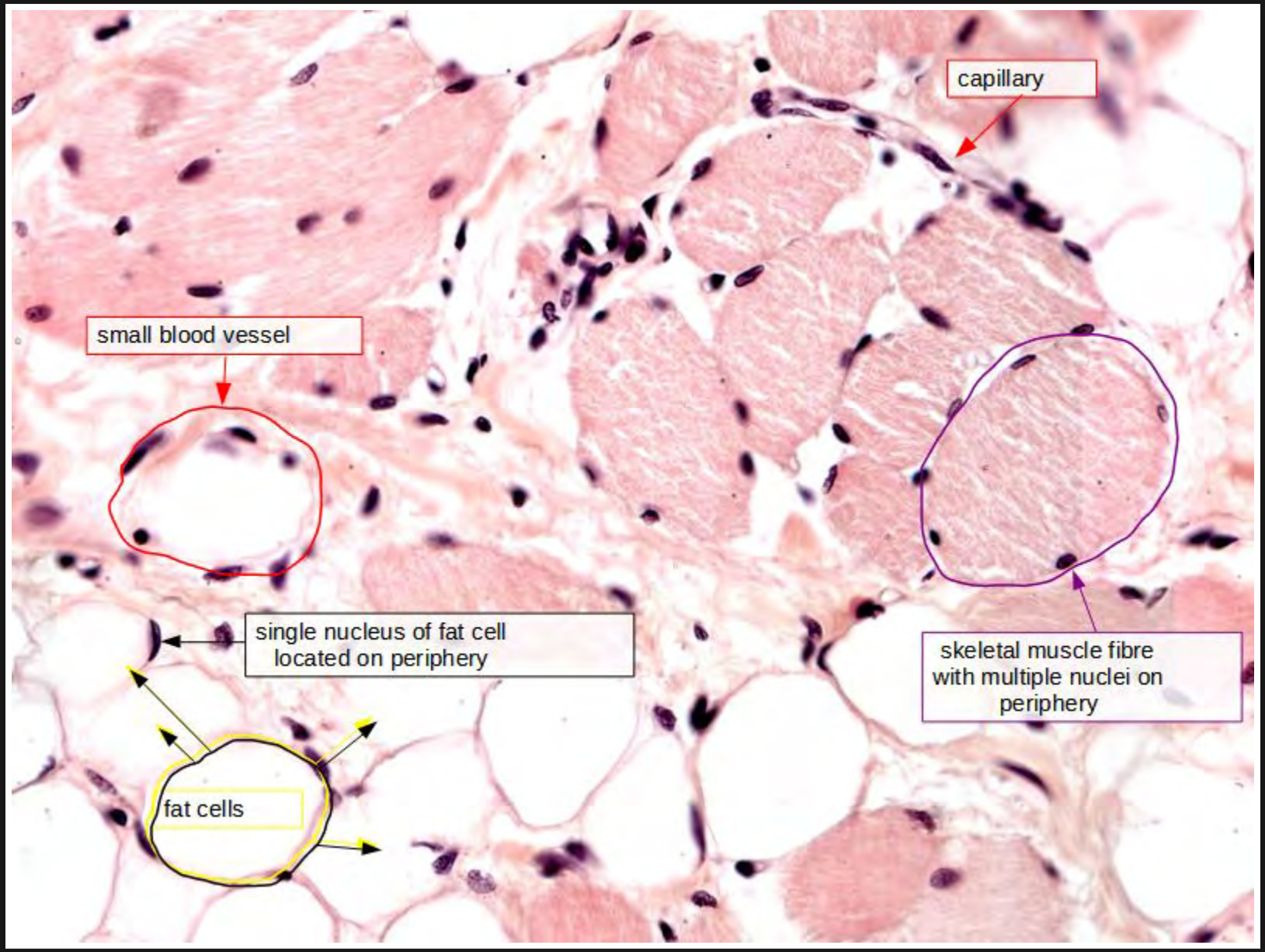

lumen
lumen
lumen
lumen
stratified cuboidal epithelium

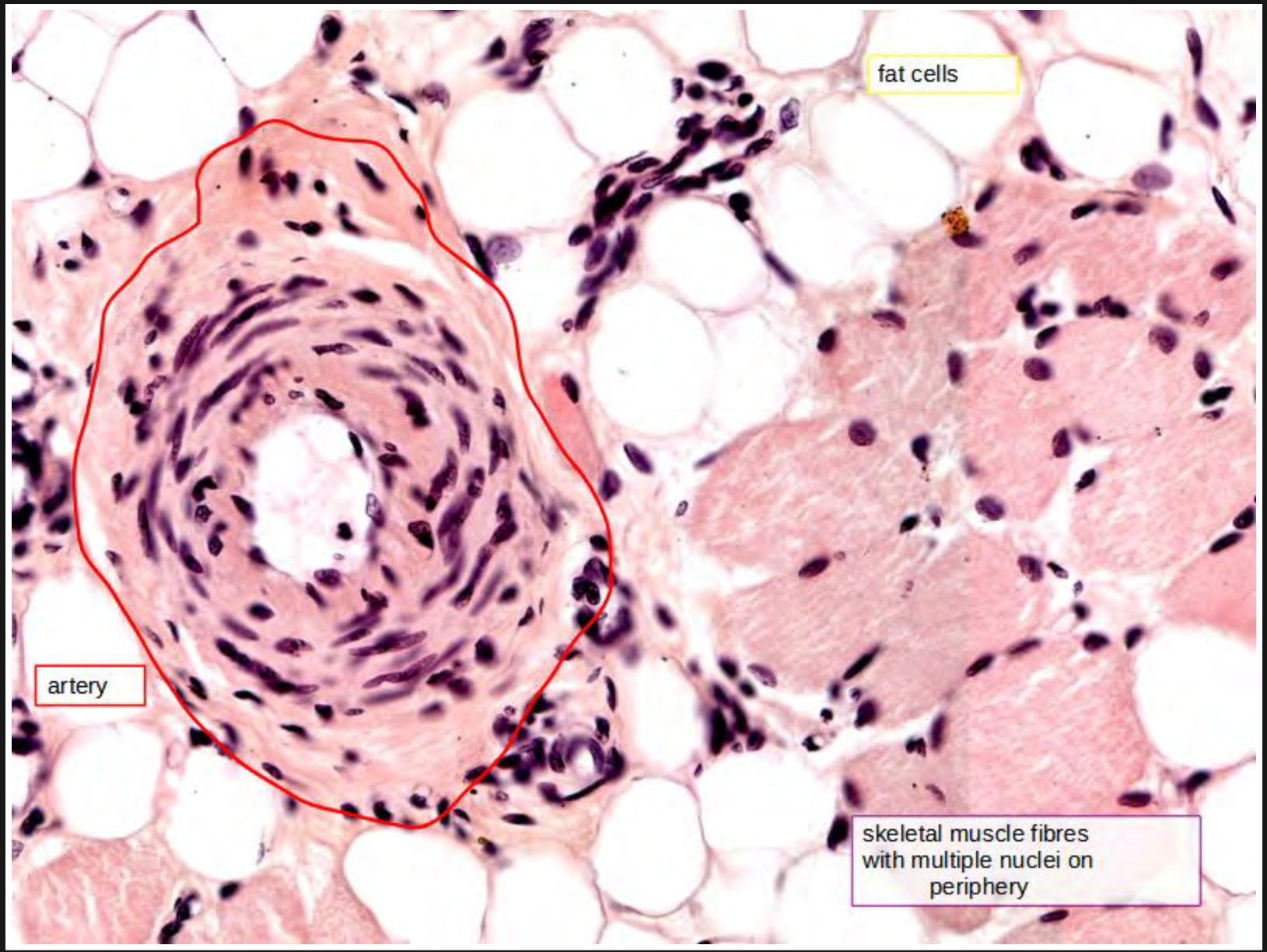
Core

- 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

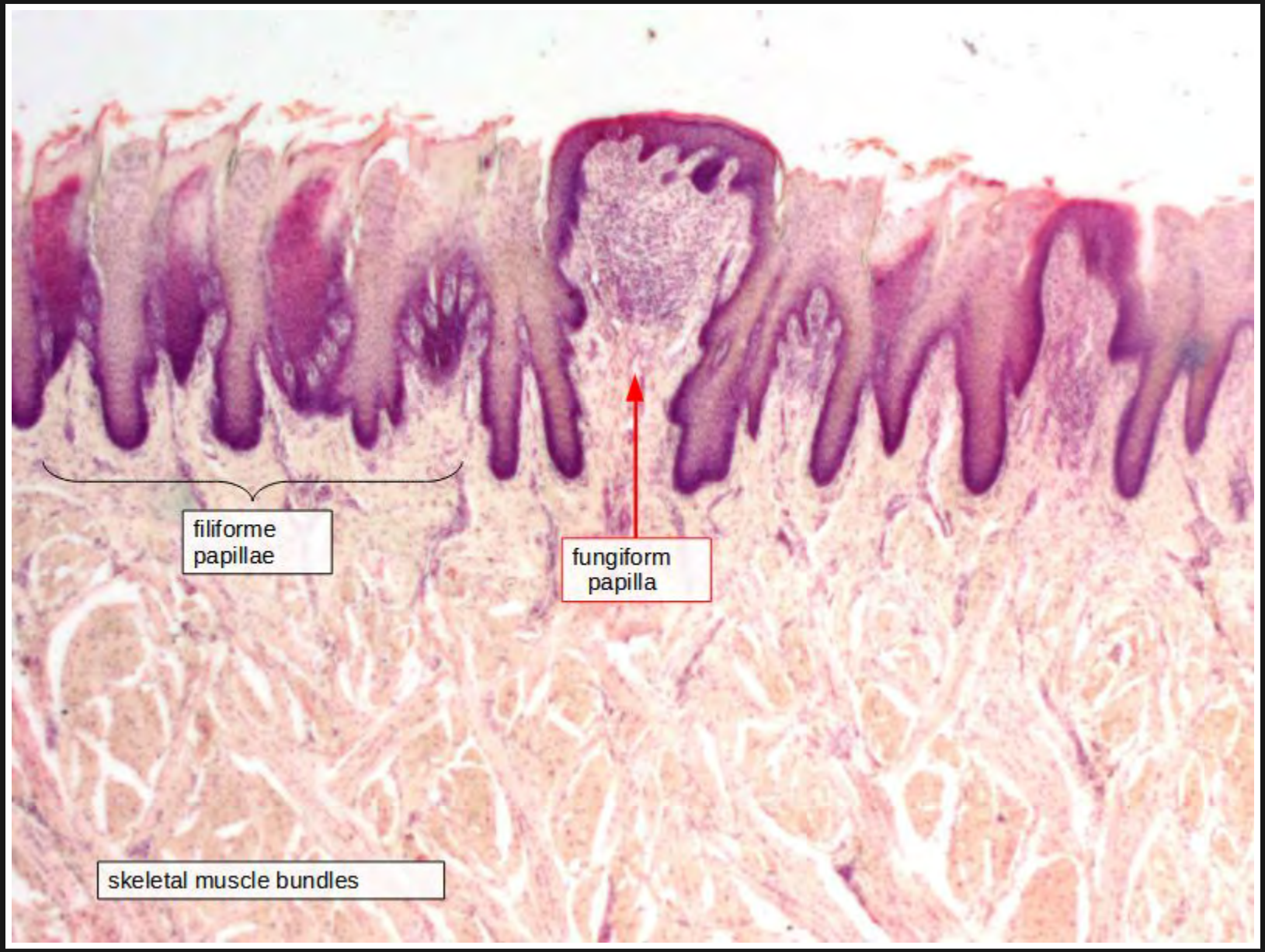
Dorsal surface

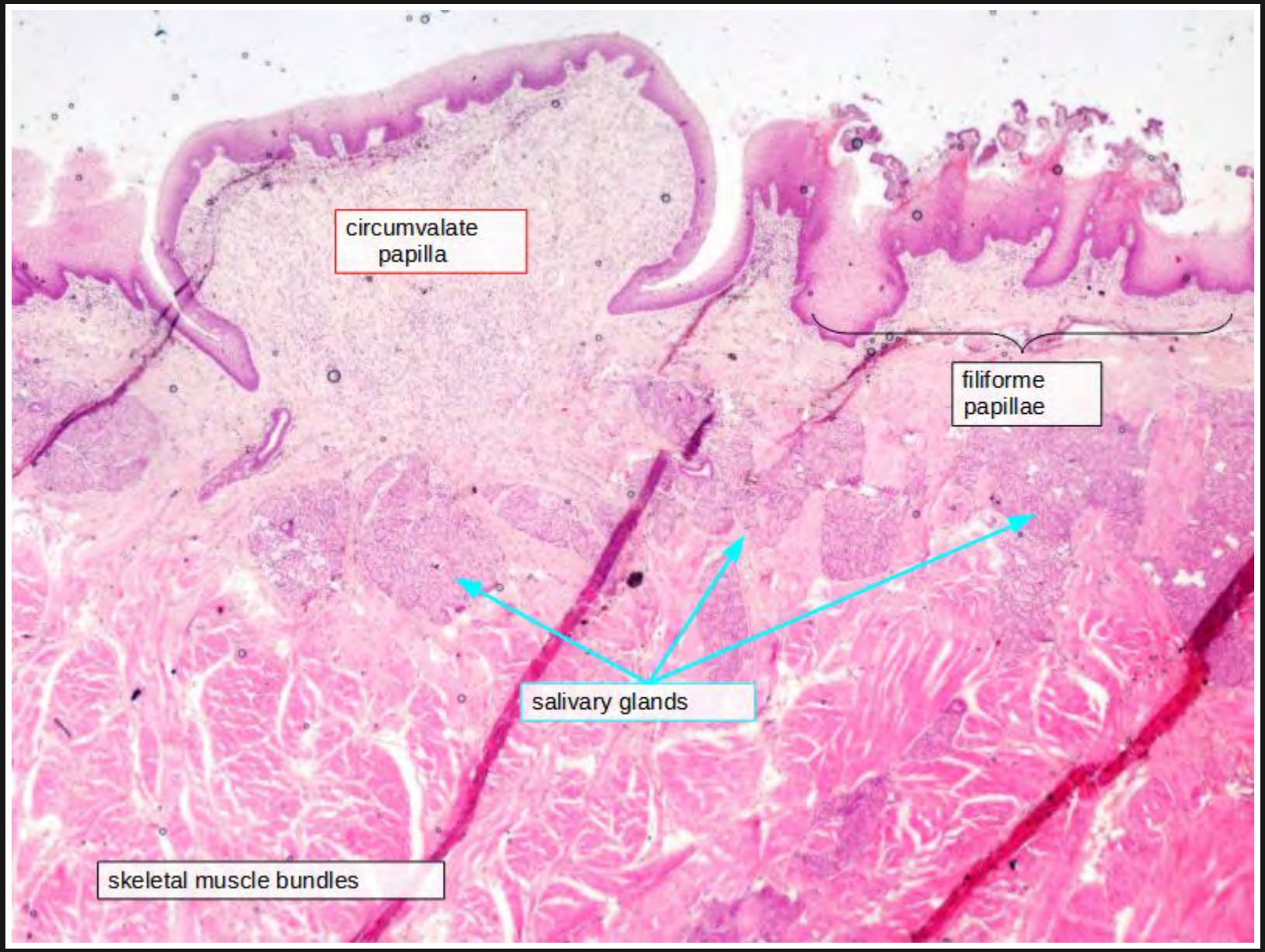
- Stratified squamous keratinized epithelium
- Contains four types of papillae


stratified squamous
keratinized epithelium
skeletal muscle bundles

Dorsal surface

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

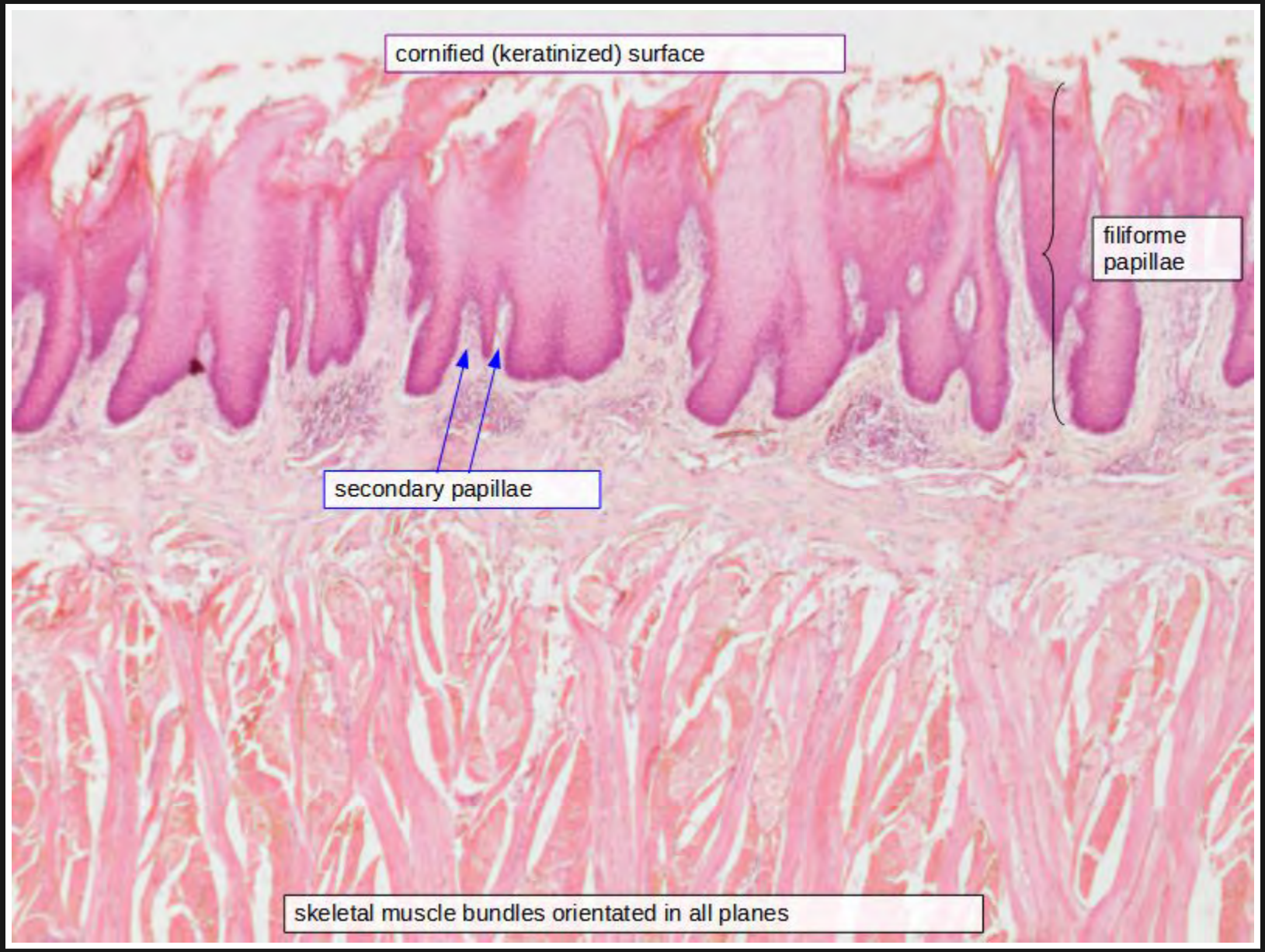

filiforme
papillae
fungiform
papilla
skeletal muscle bundles

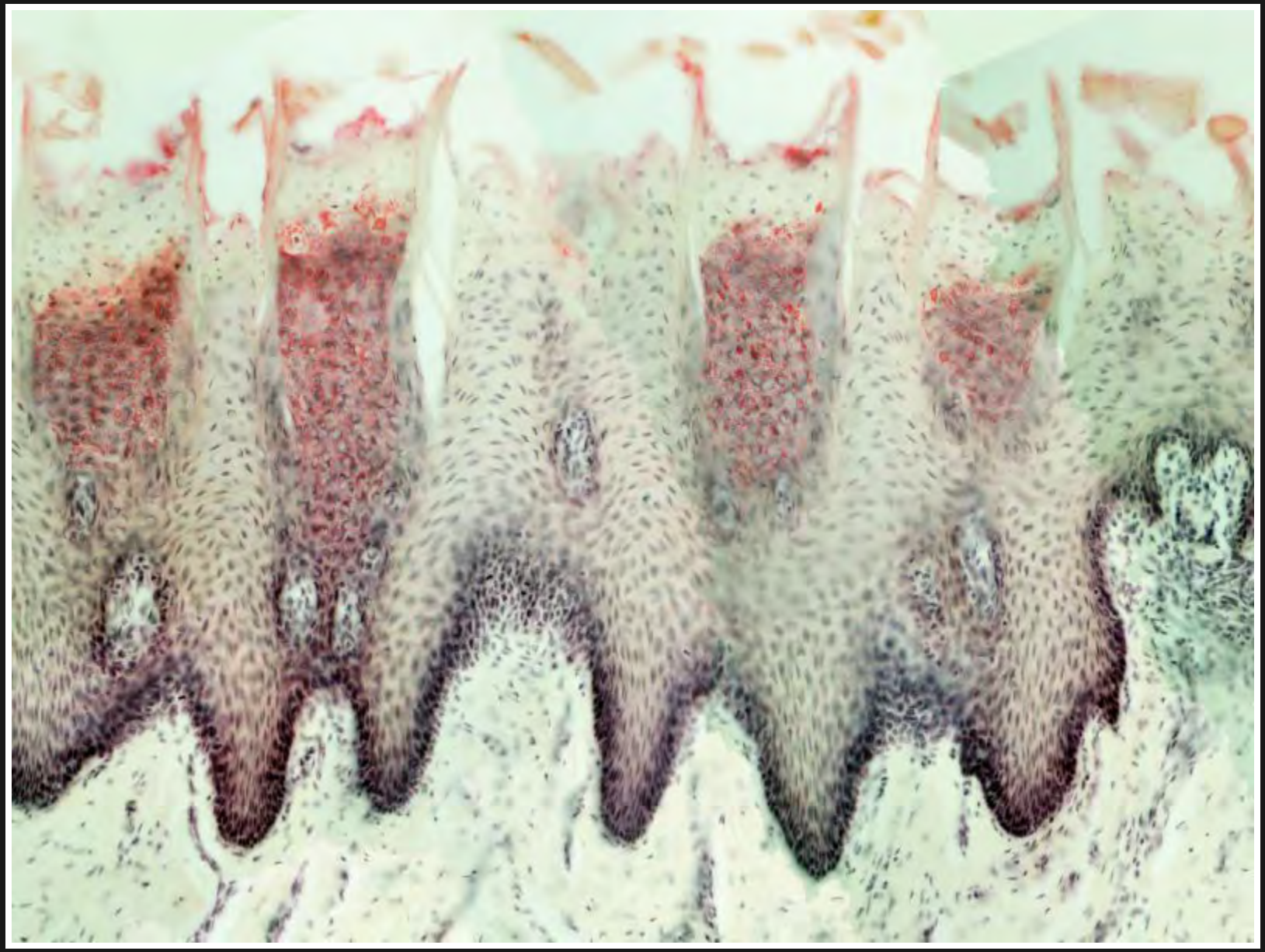

circumvalate papilla
filiforme papillae
salivary glands
skeletal muscle bundles

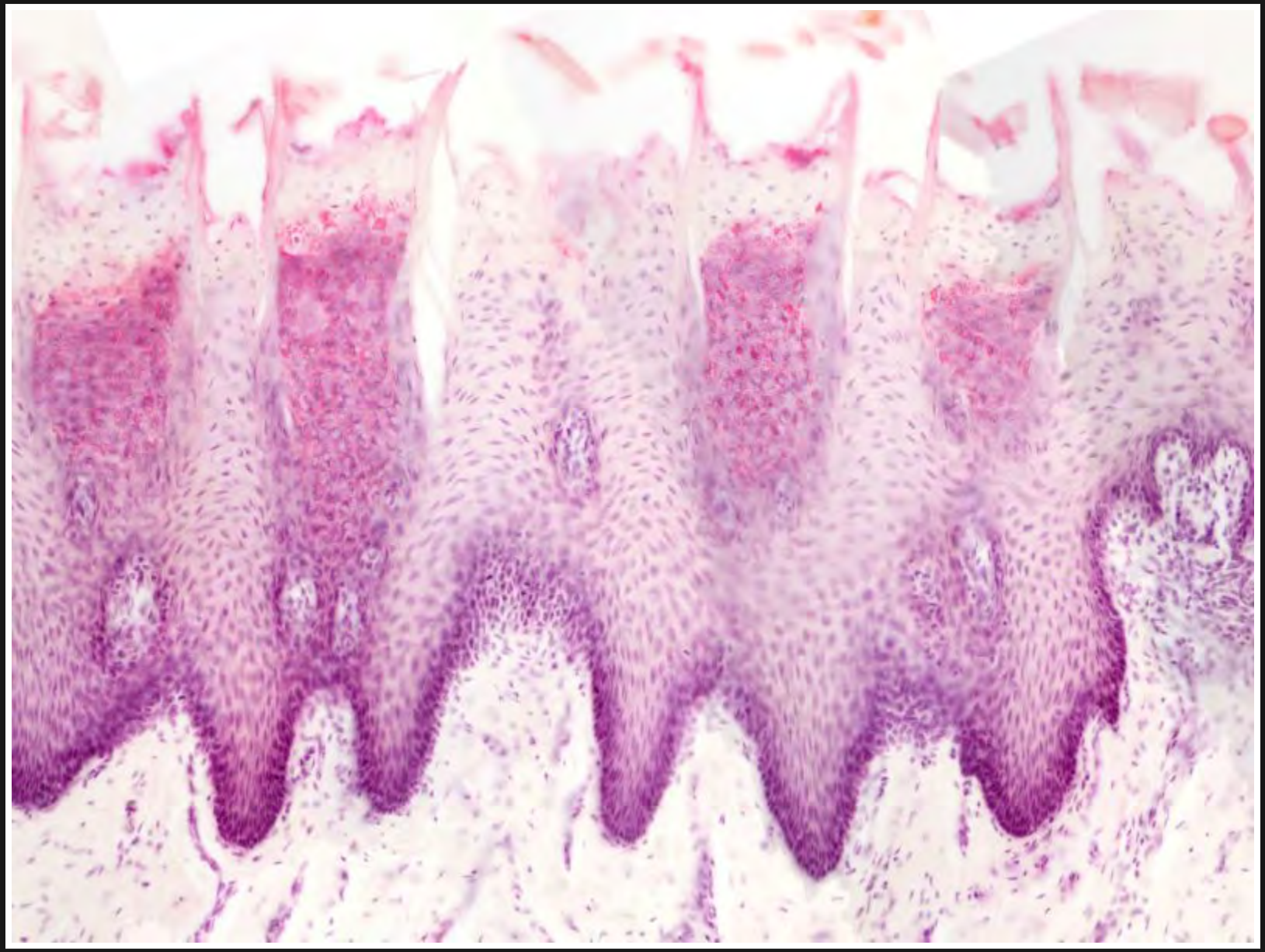
Filiform papillae

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


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

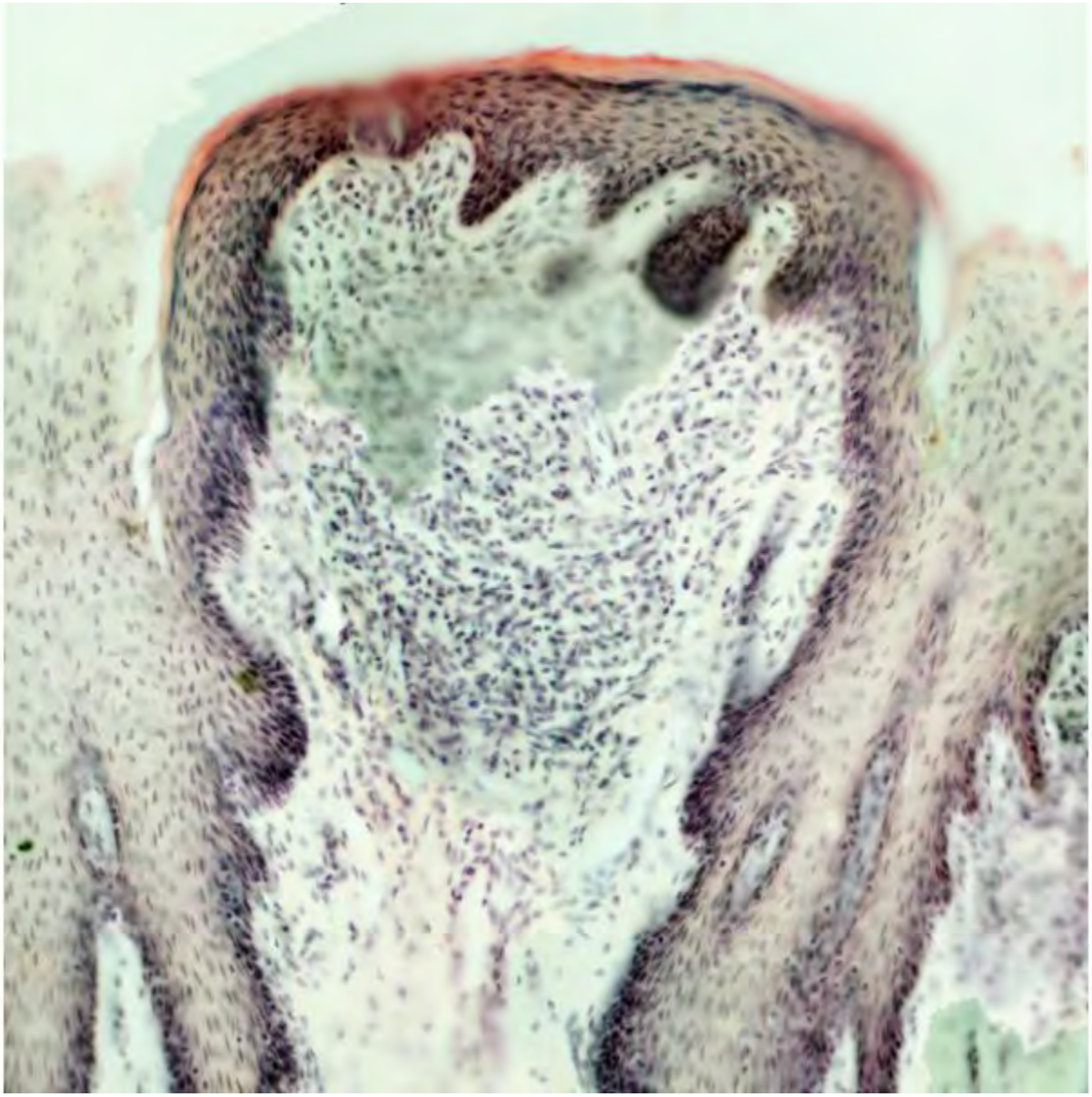

cornified (keratinized) surface
filiforme papillae
secondary papillae
skeletal muscle bundles orientated in all planes

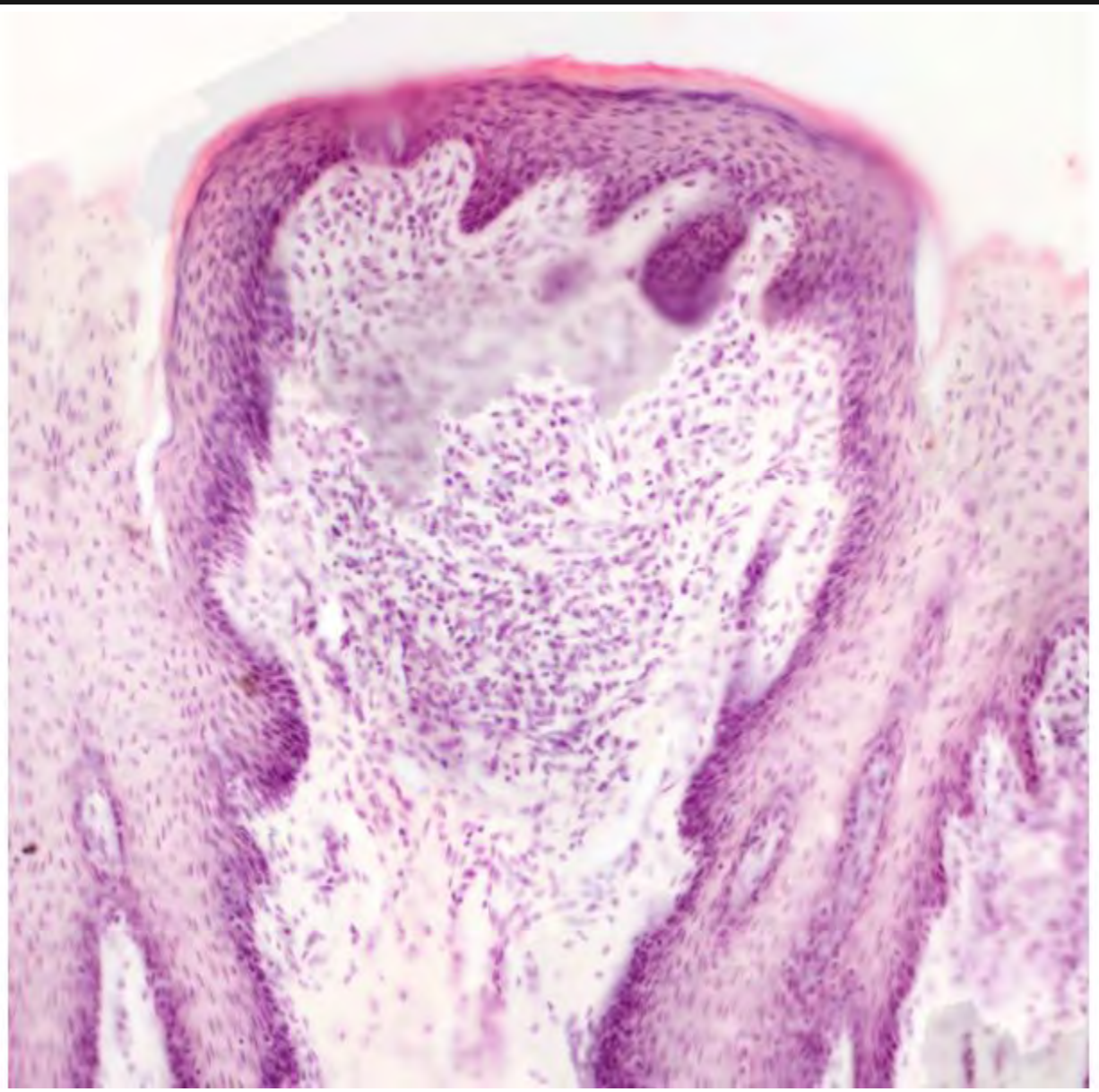




Fungiform papillae

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





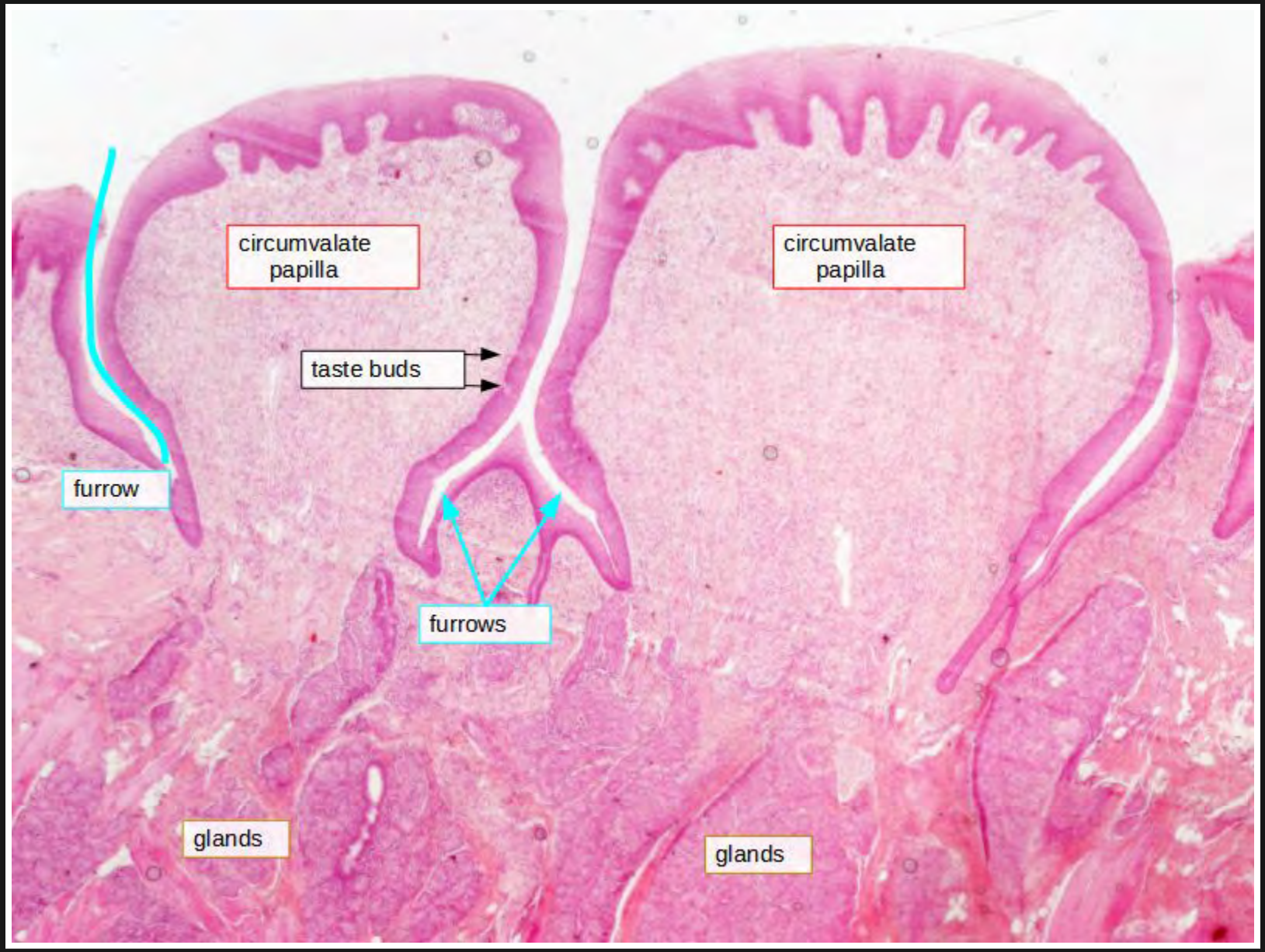
Foliate papillae

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

Circumvallate papillae

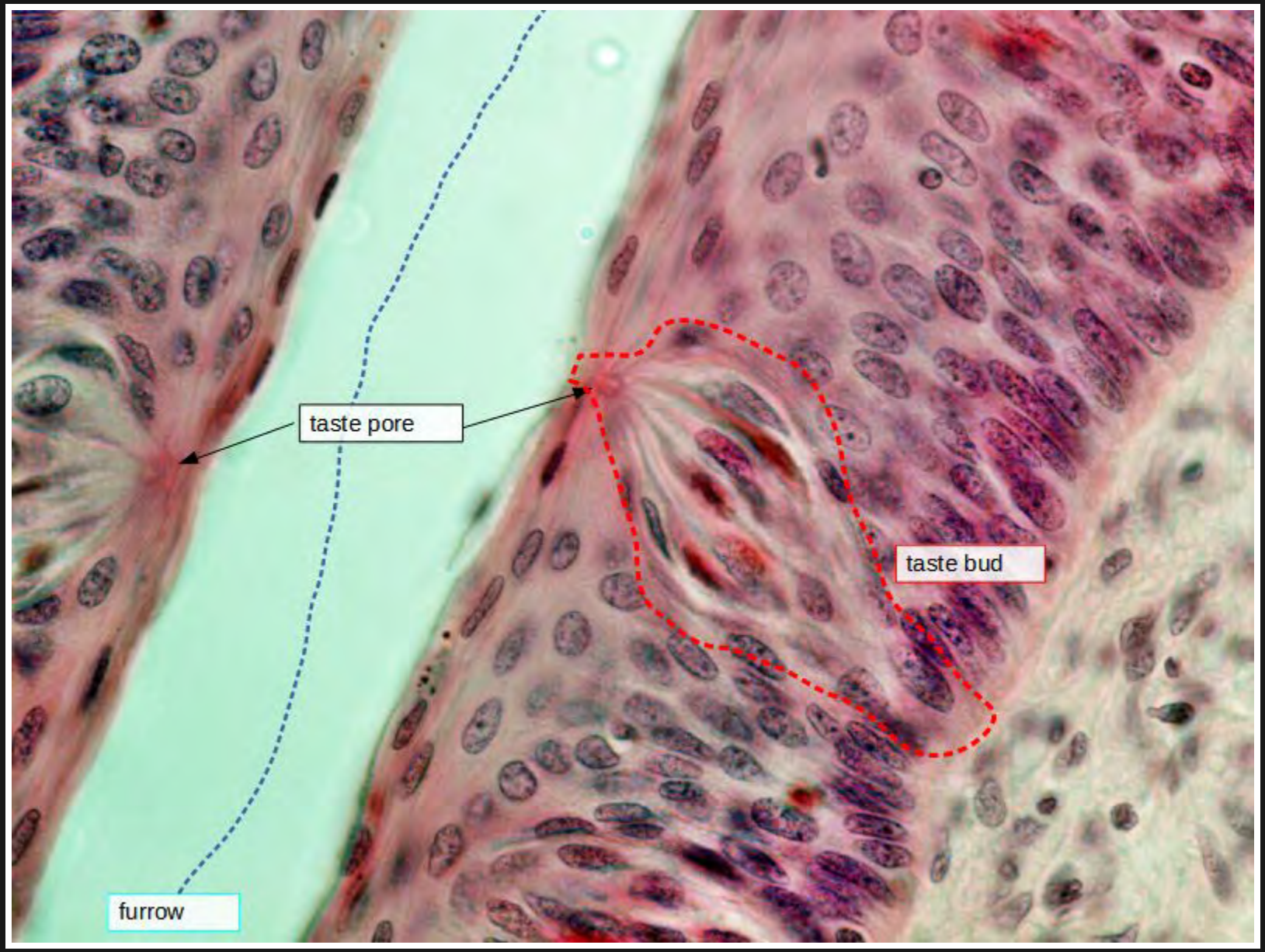
- 10 – 15 in front of sulcus terminalis
- Embedded in surface of tongue
- Surrounded by furrow
- Lateral surface contains taste buds in epithelium
- Von Ebner glands open in base of furrow

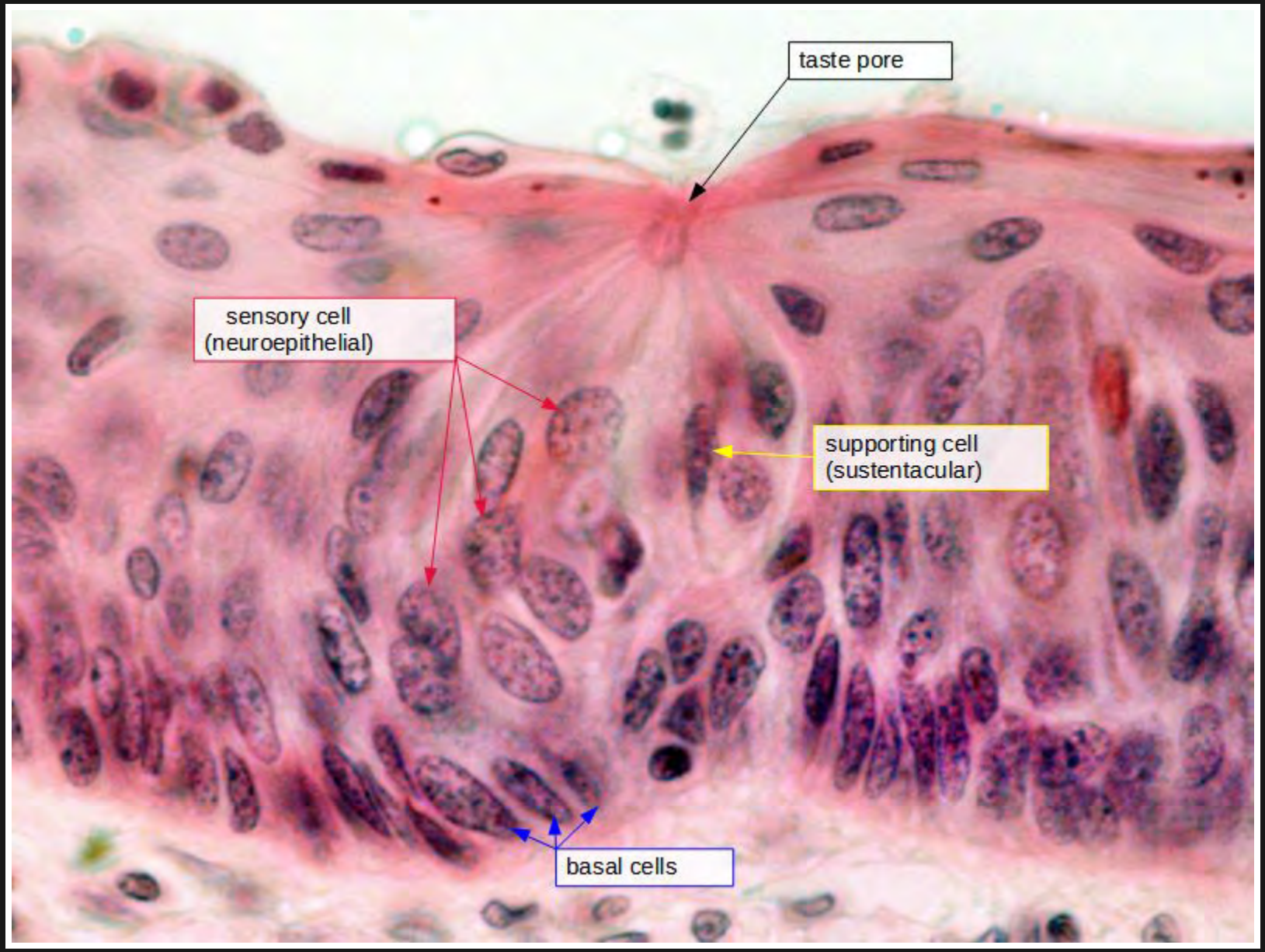

circumvalate papillae
filiforme papillae
skeletal muscle bundles orientated in all planes


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

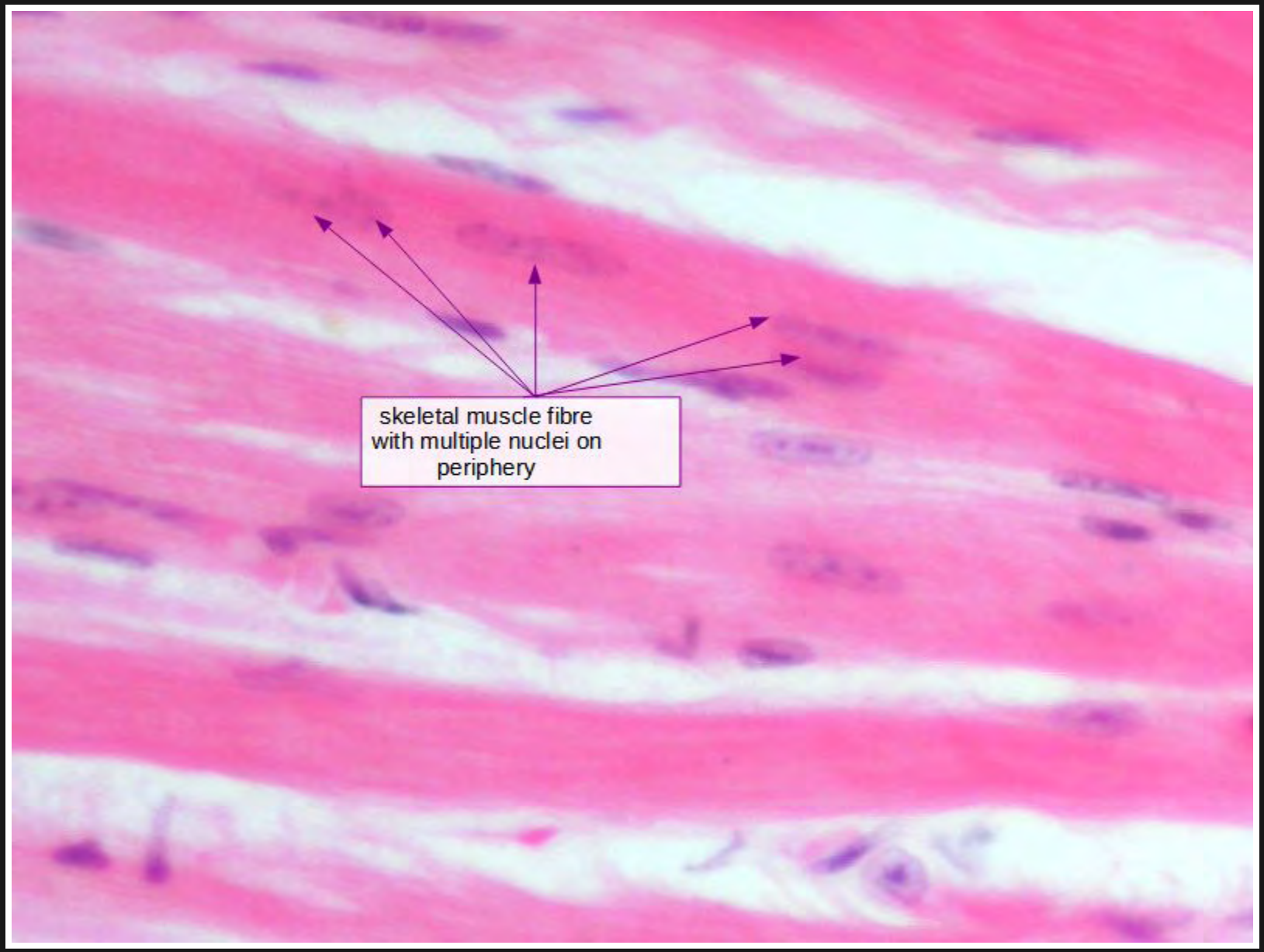

sensory cell
supporting cell

Muscular core

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

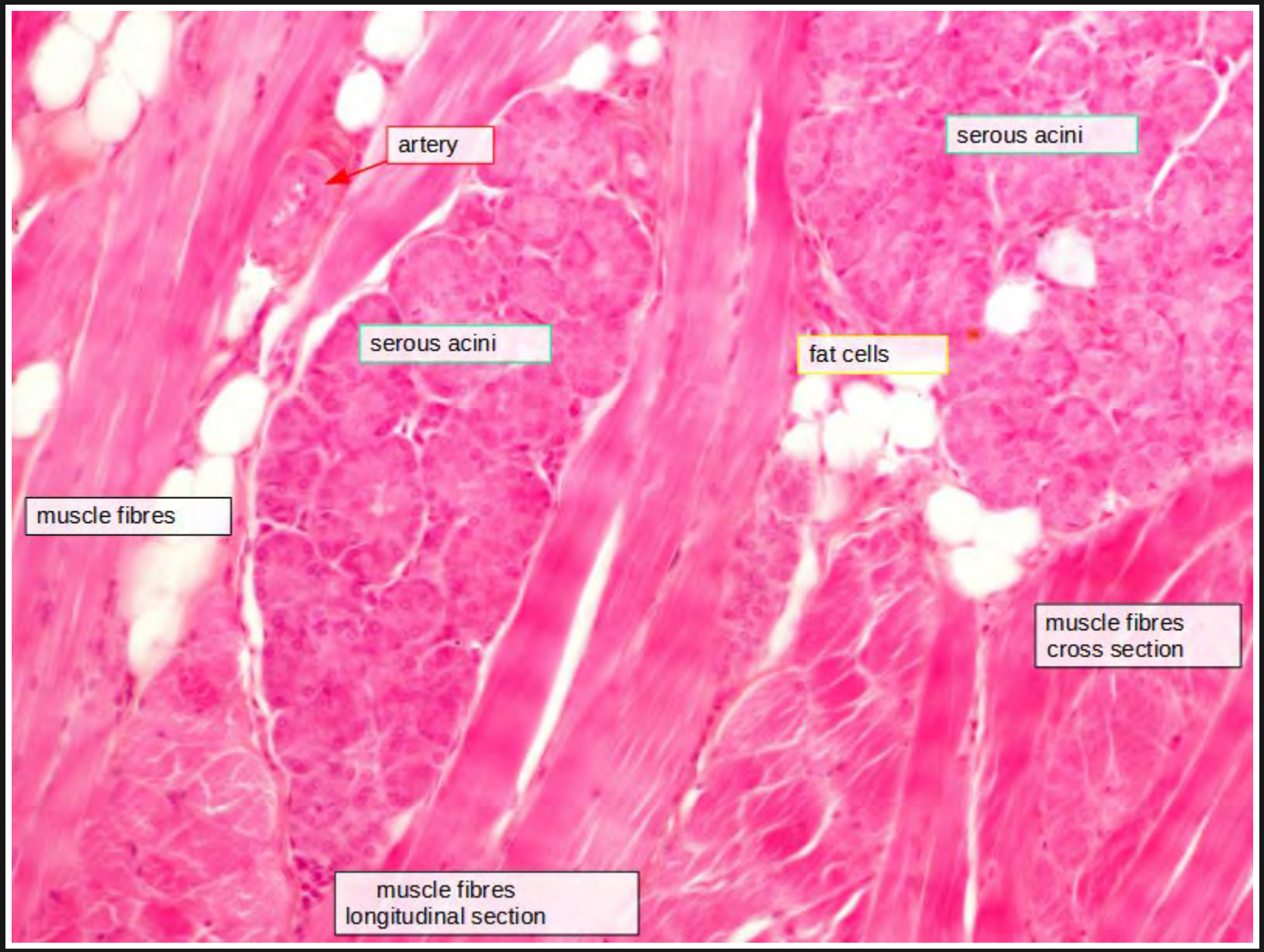

skeletal muscle fibres – longitudinal section
skeletal muscle fibres – cross section


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


skeletal muscle fibre
with multiple nuclei on
periphery

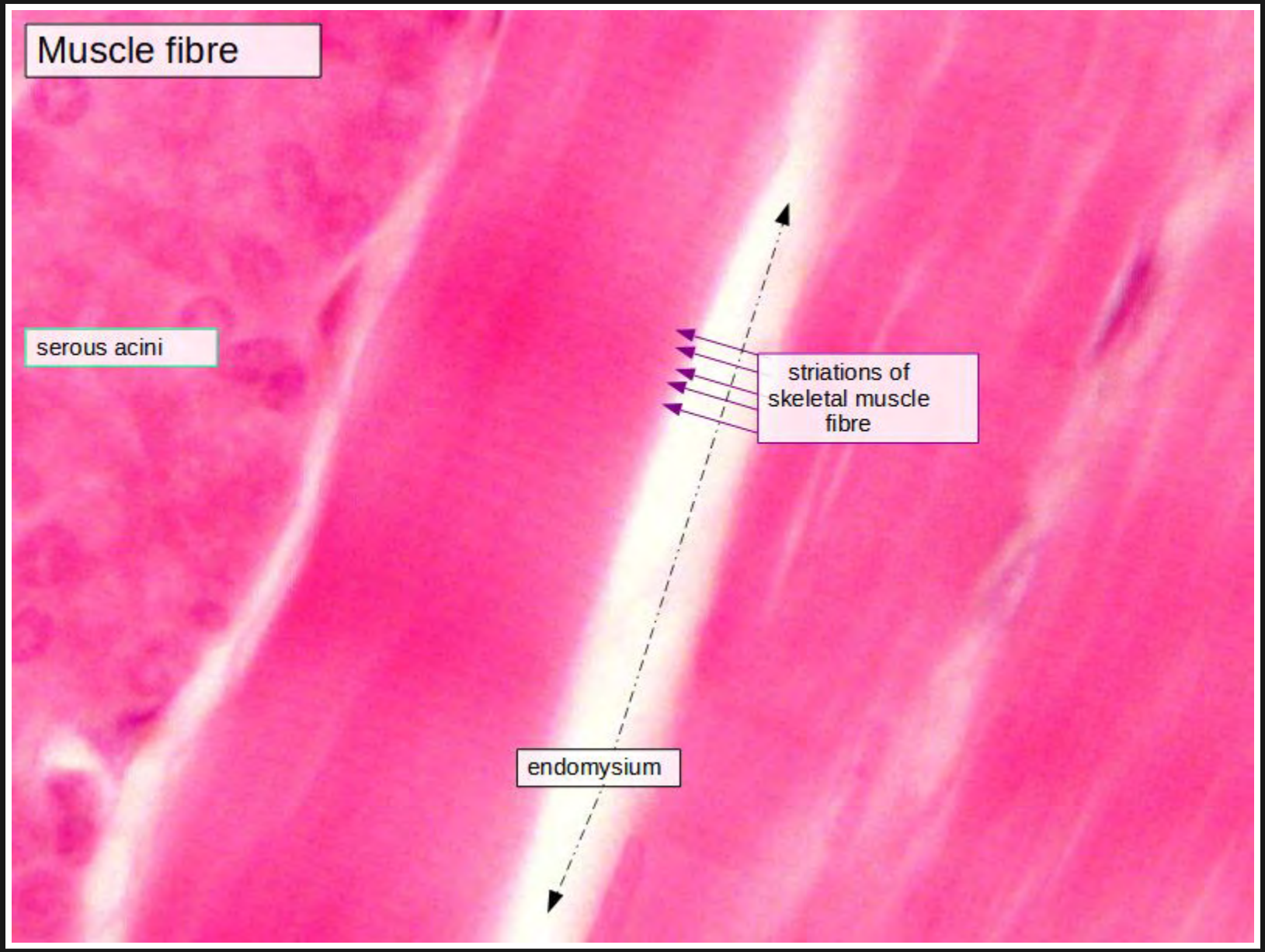
Minor salivary glands

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

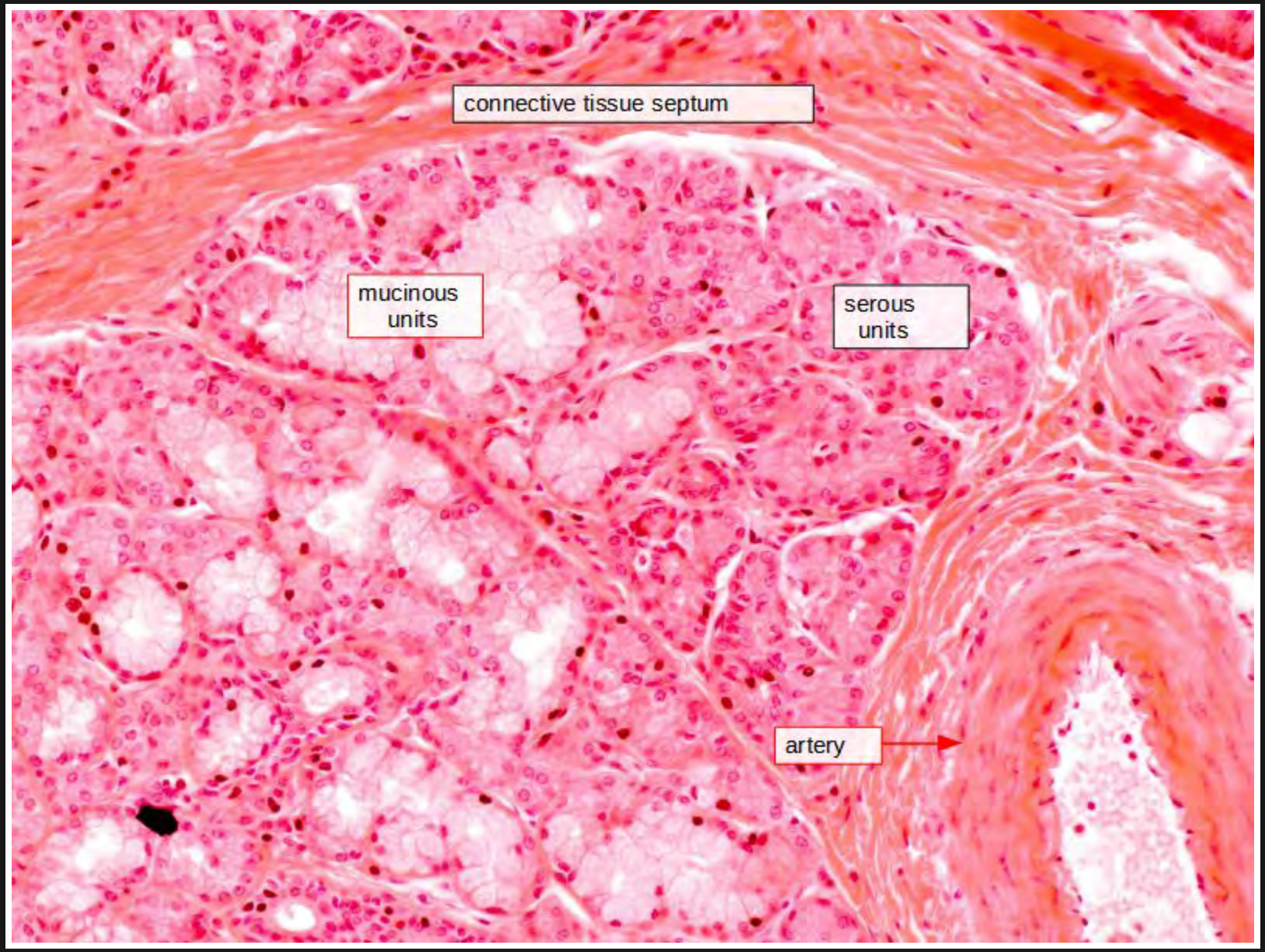

artery
serous acini
serous acini
fat cells
muscle fibres
muscle fibres
cross section
muscle fibres
longitudinal section

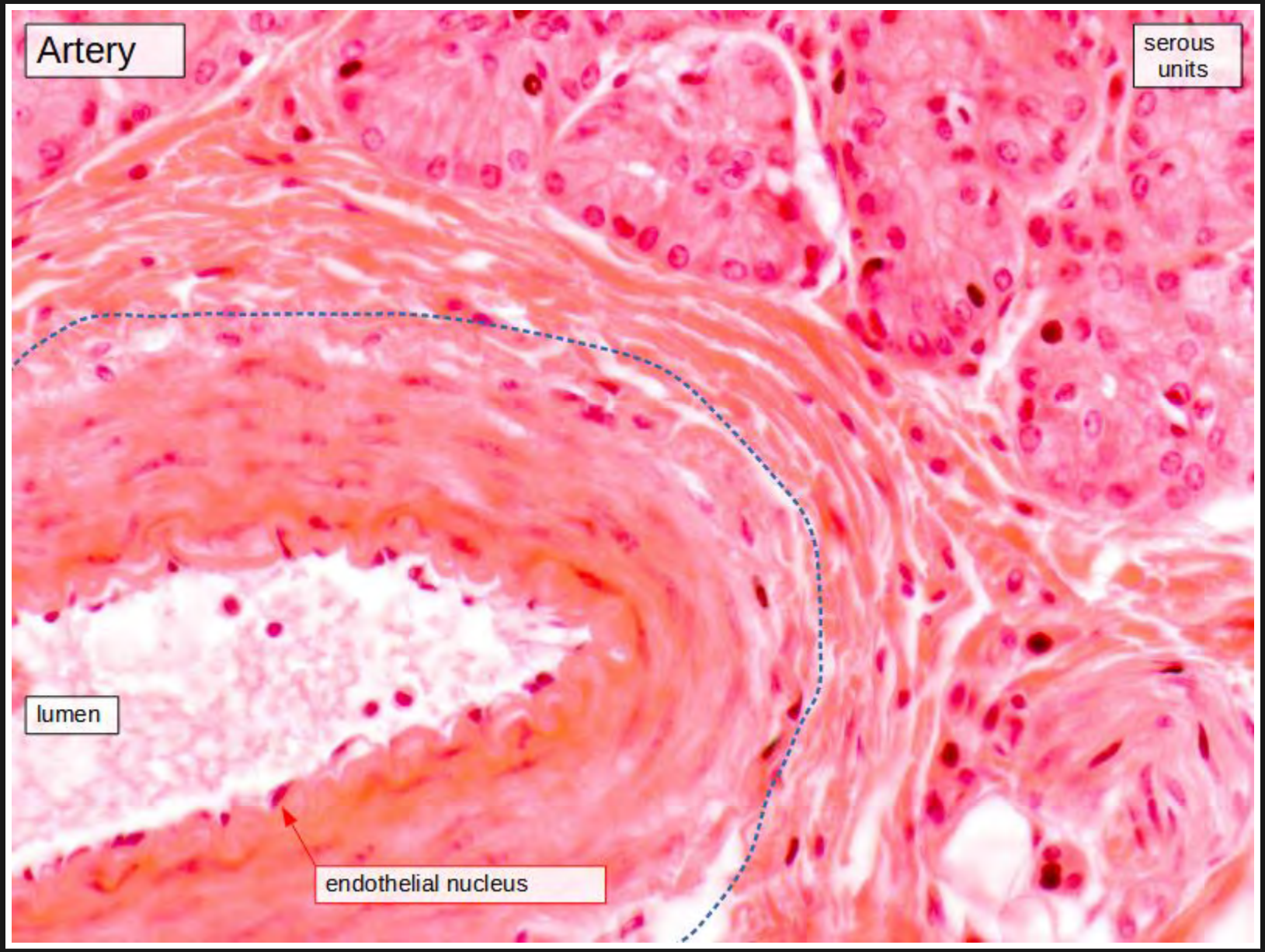

artery
serous acini
fat cell
muscle fibres


serous acinus
lumen


Muscle fibre
serous acini
striations of skeletal muscle fibre
endomysium

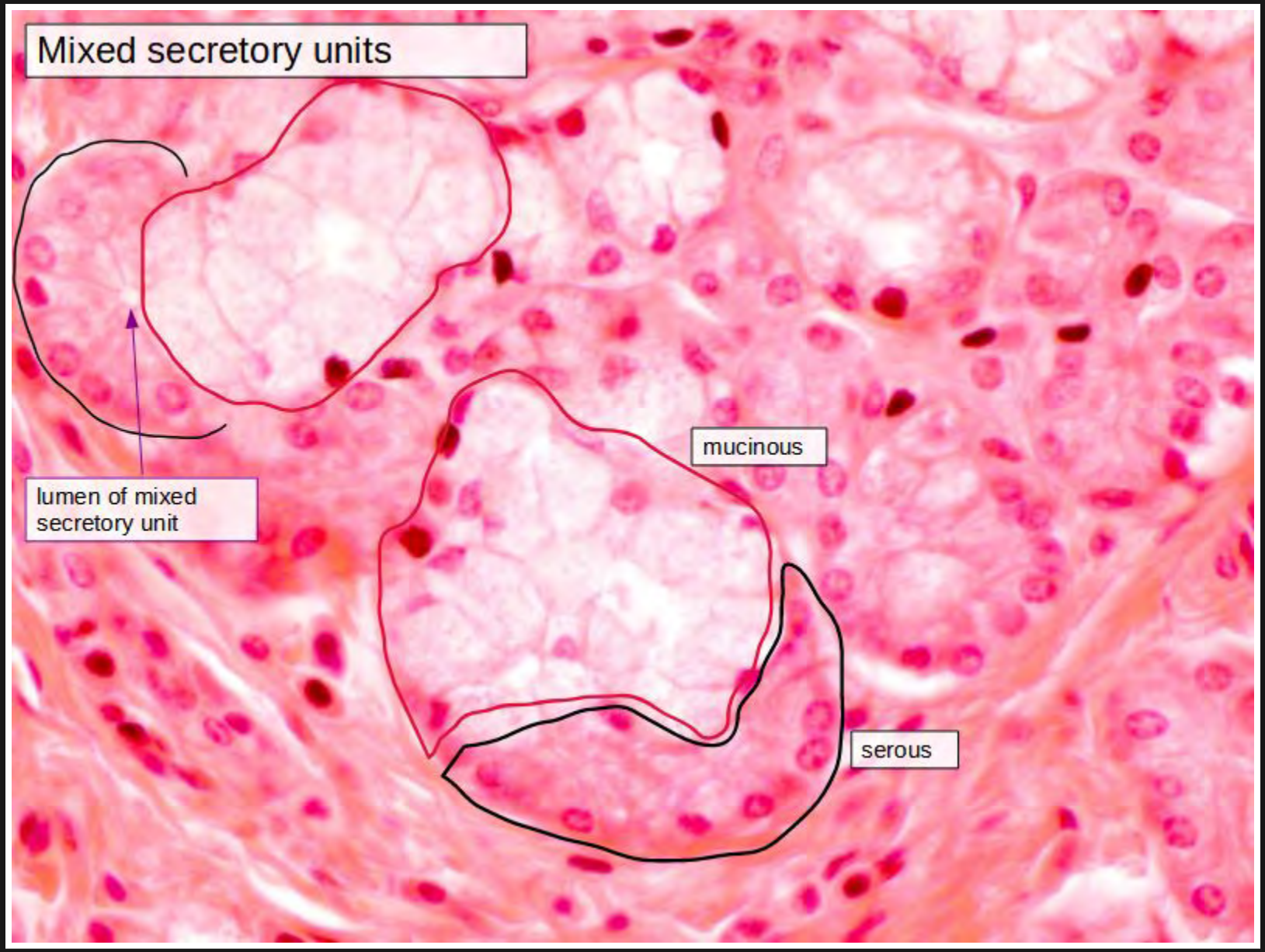

Artery
muscle fibre
muscle fibre
endothelial nucleus
serous acini

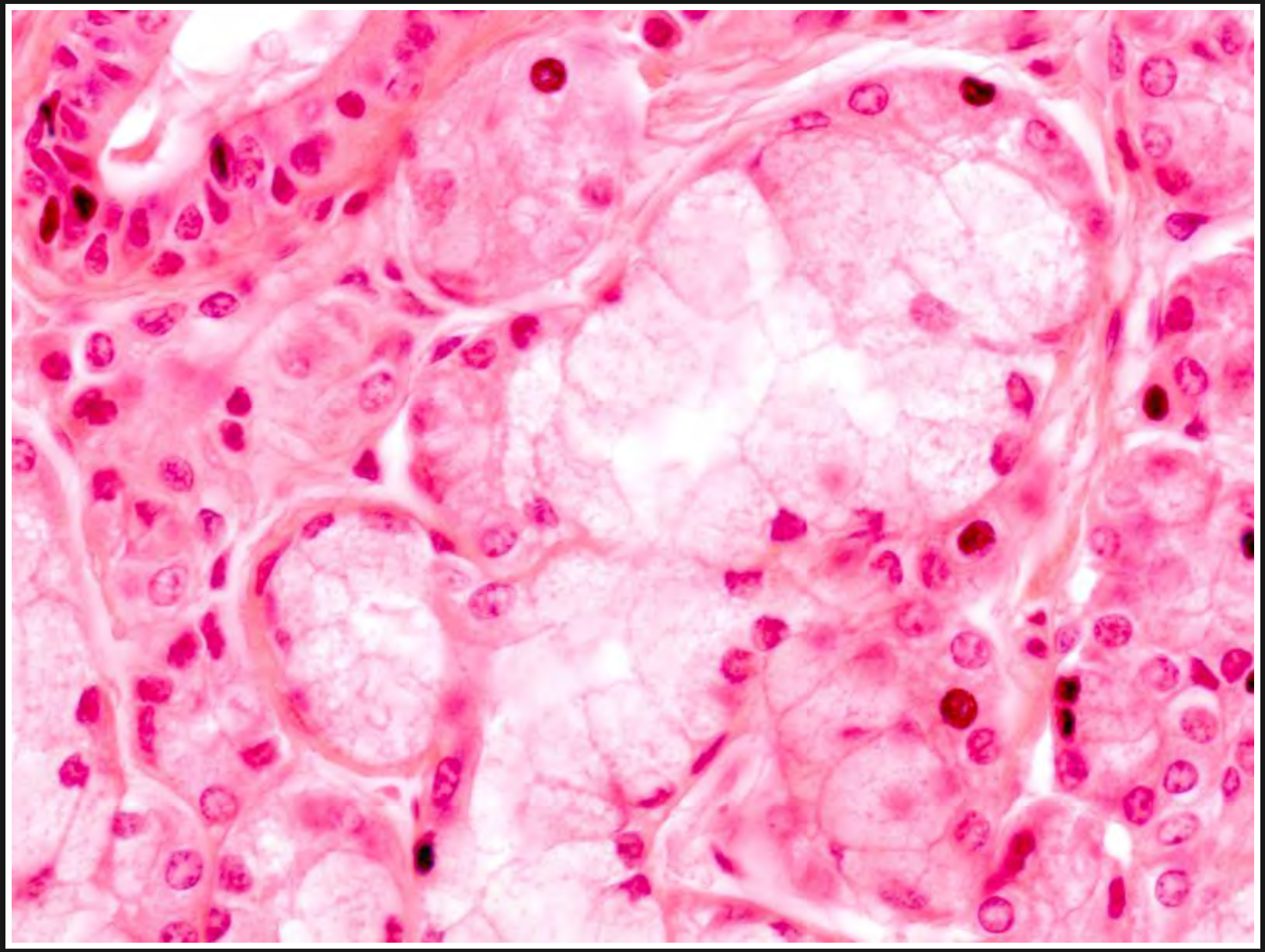

connective tissue septum
mucinous units
serous units
artery

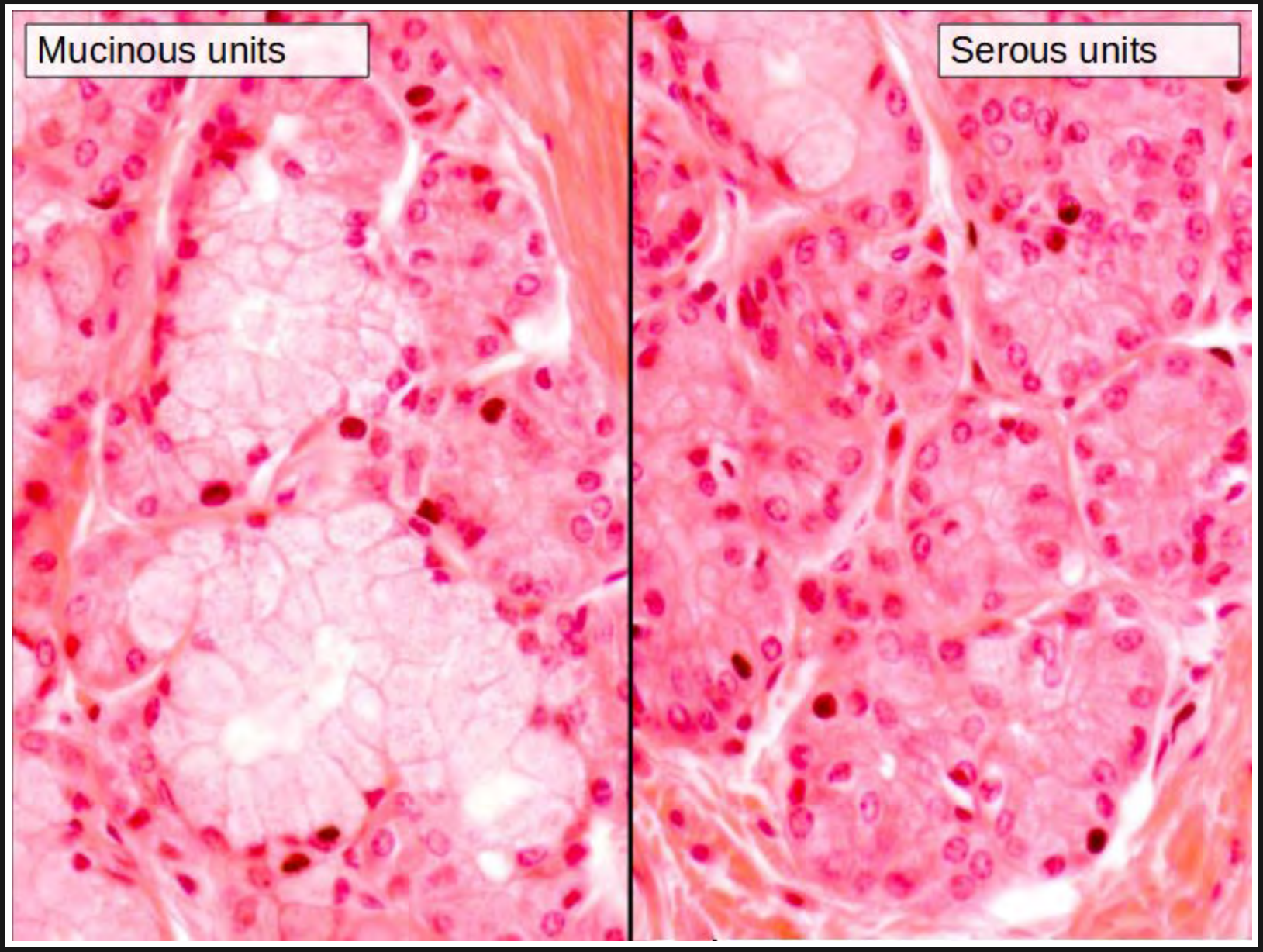

Artery
serous units
lumen
endothelial nucleus


Mucinous units
connective tissue


Serous units
myoepithelium nucleus


Mixed secretory units
lumen of mixed secretory unit
mucinous
serous



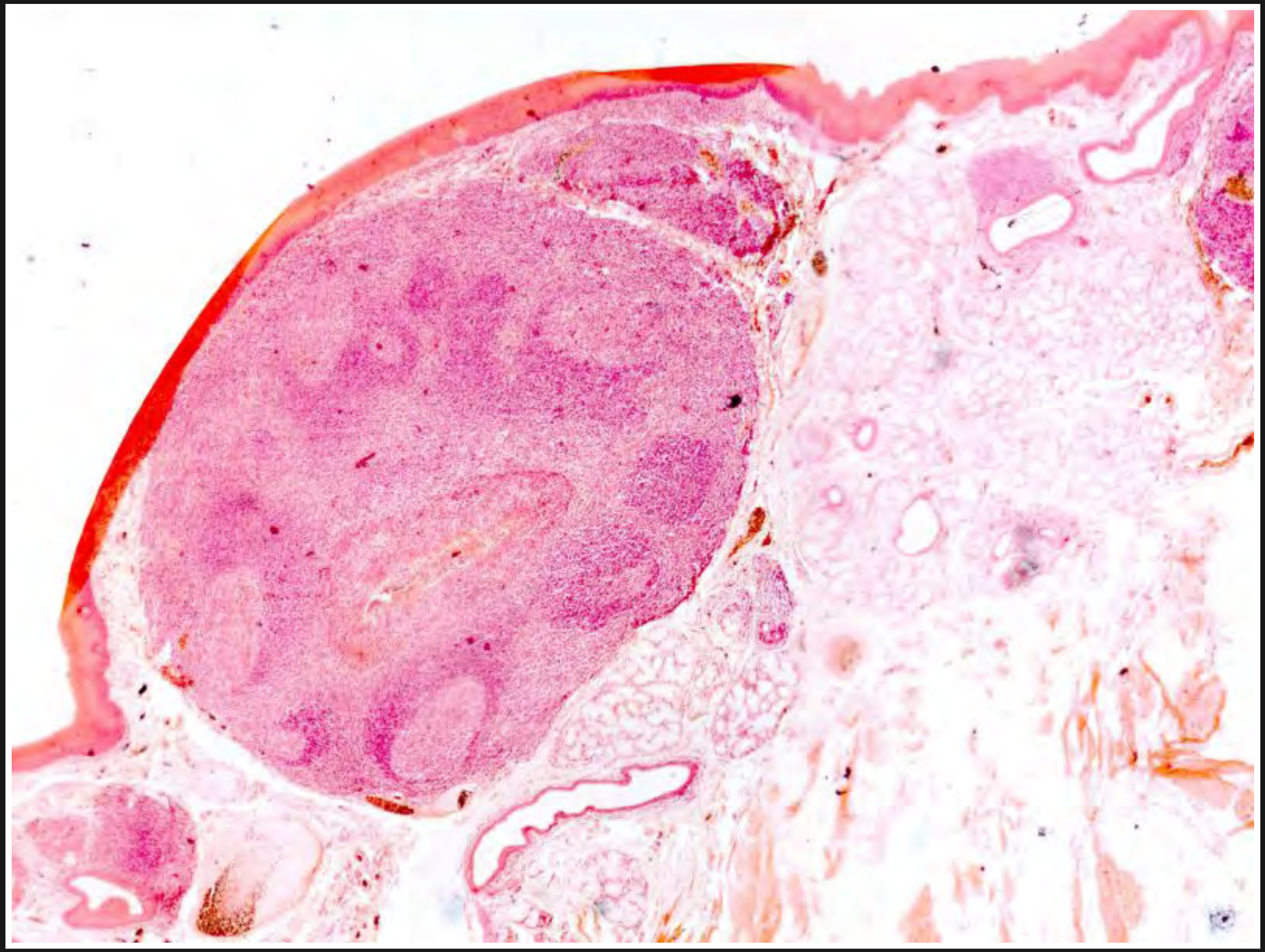

Mucinous units
Serous units

Ventral surface

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

Posterior third

- Lingual tonsils

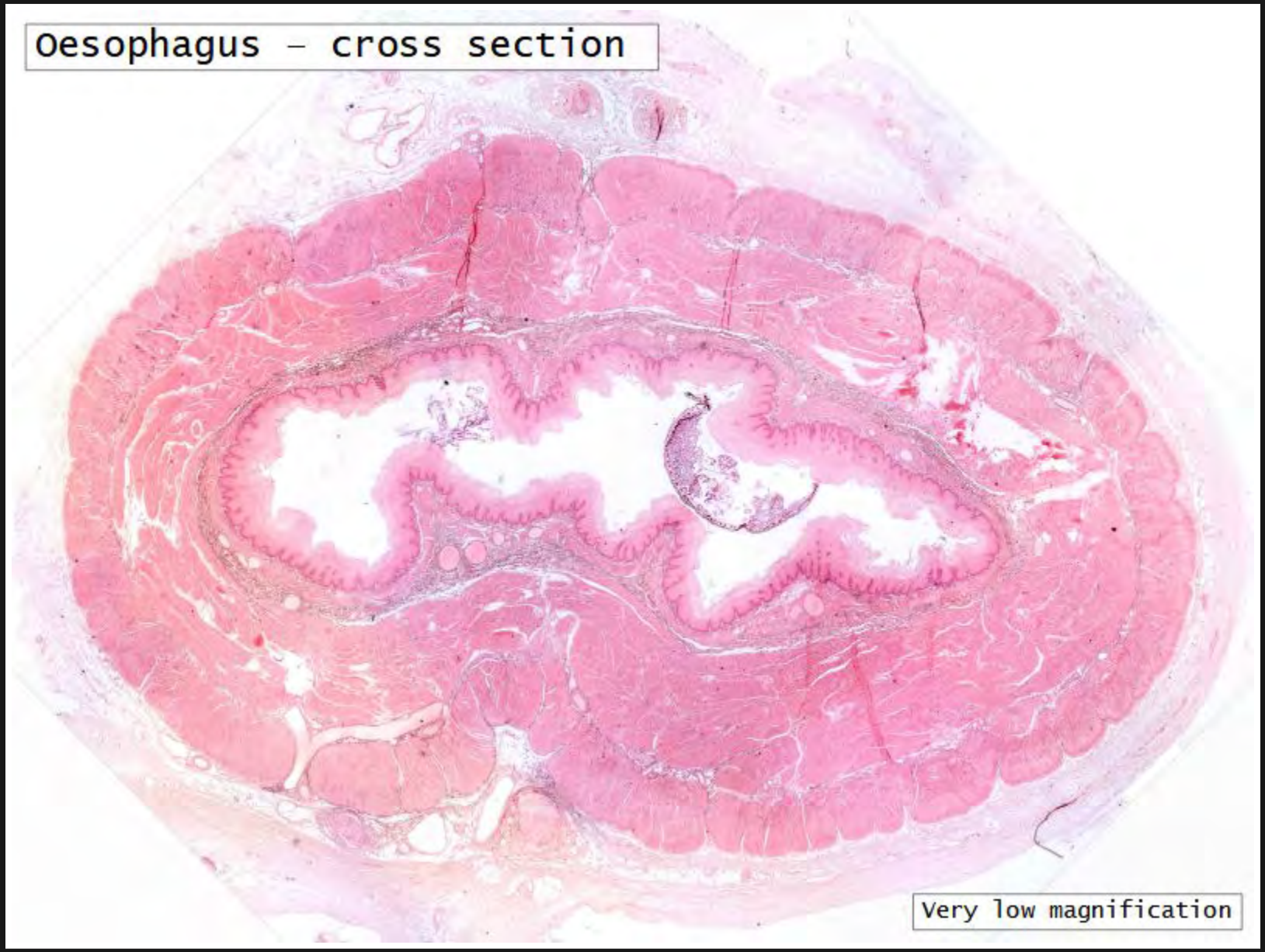


Alimentary canal

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

Oesophagus

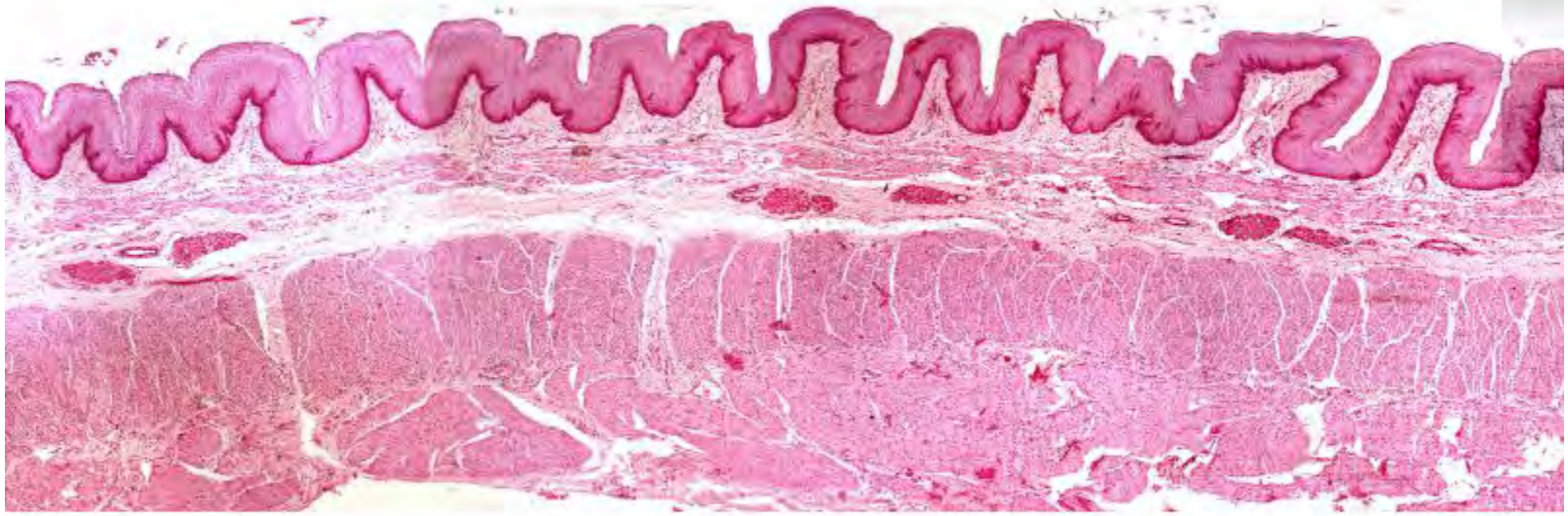
Slide 31


Oesophagus – cross section
Very low magnification

Oesophagus – cross section

Very low magnification

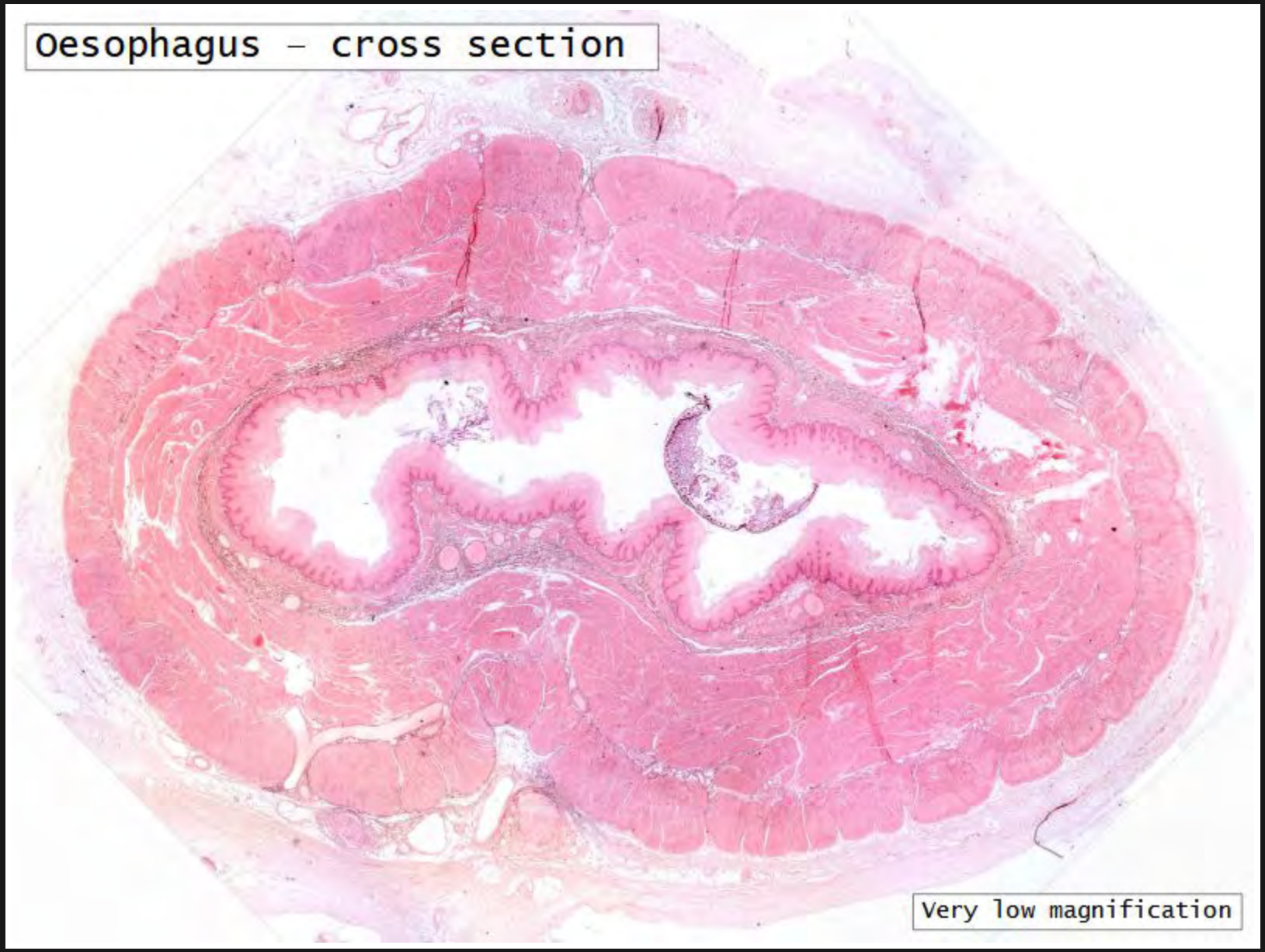
Oesophagus – longitudinal section

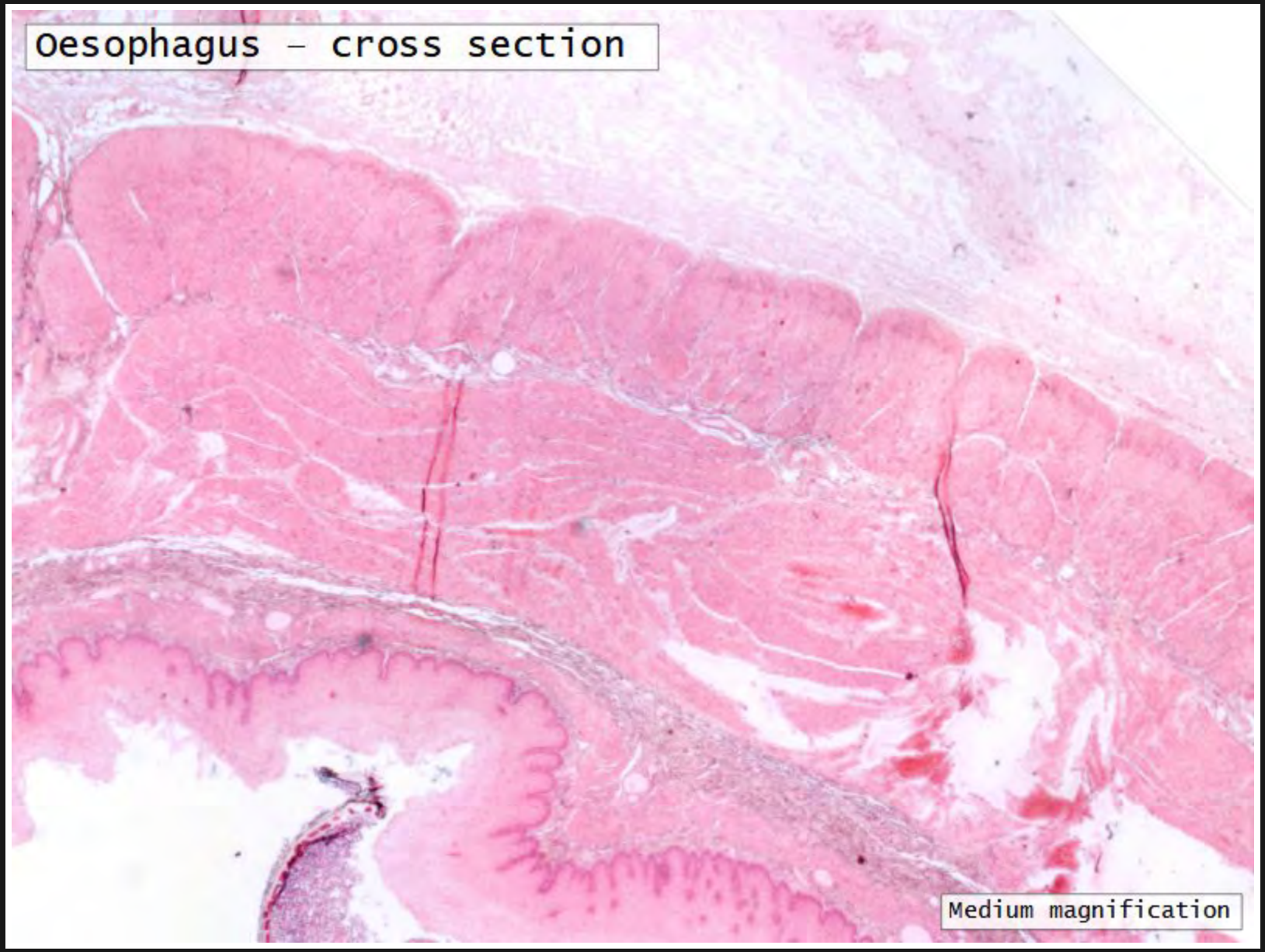


Very low magnification

Oesophagus

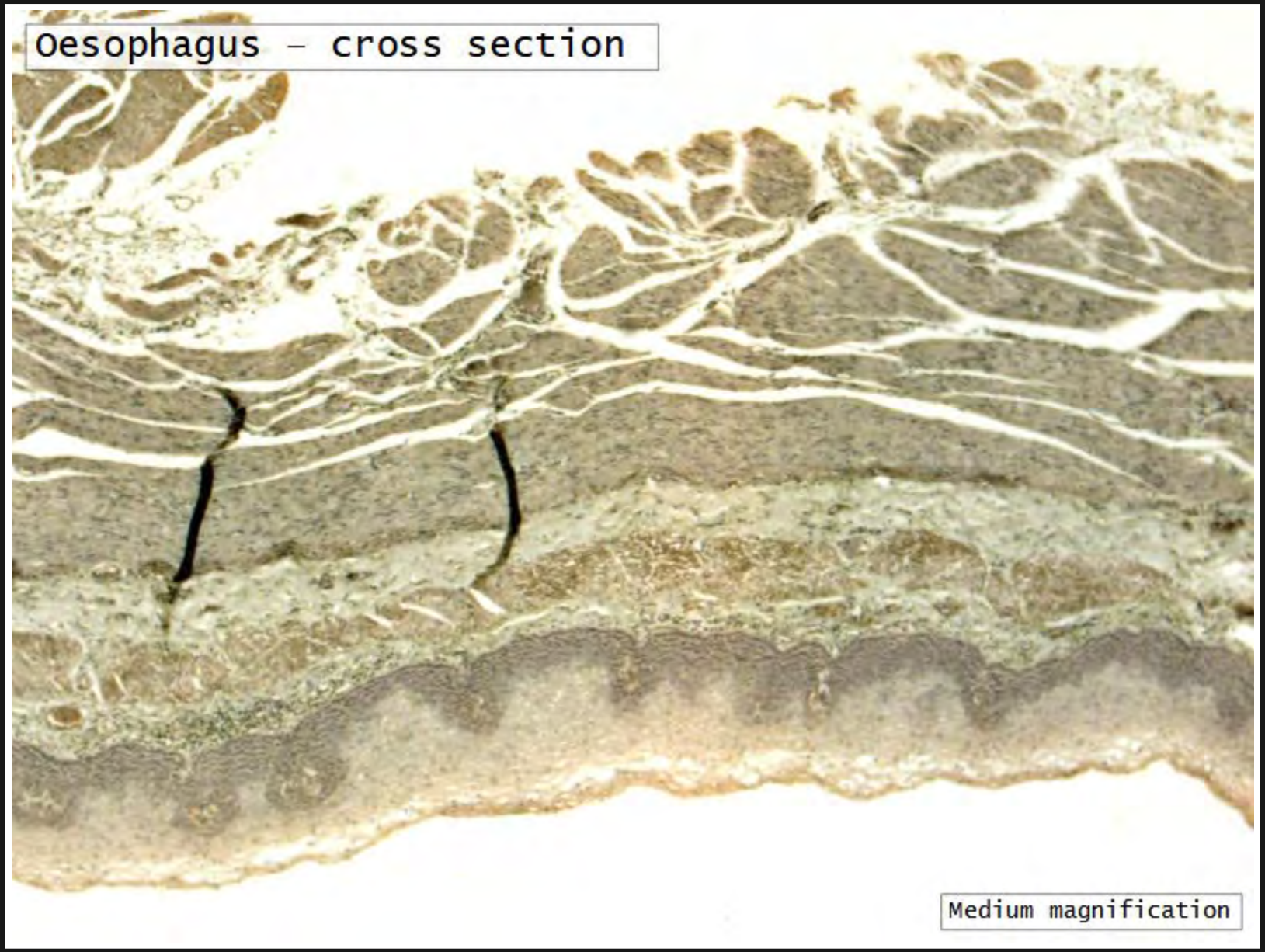
- Muscular tube
- Connects pharynx with stomach
- Four layers
  - Mucosa
  - Submucosa
  - Muscularis externa
  - Adventitia


Oesophagus – cross section
Very low magnification

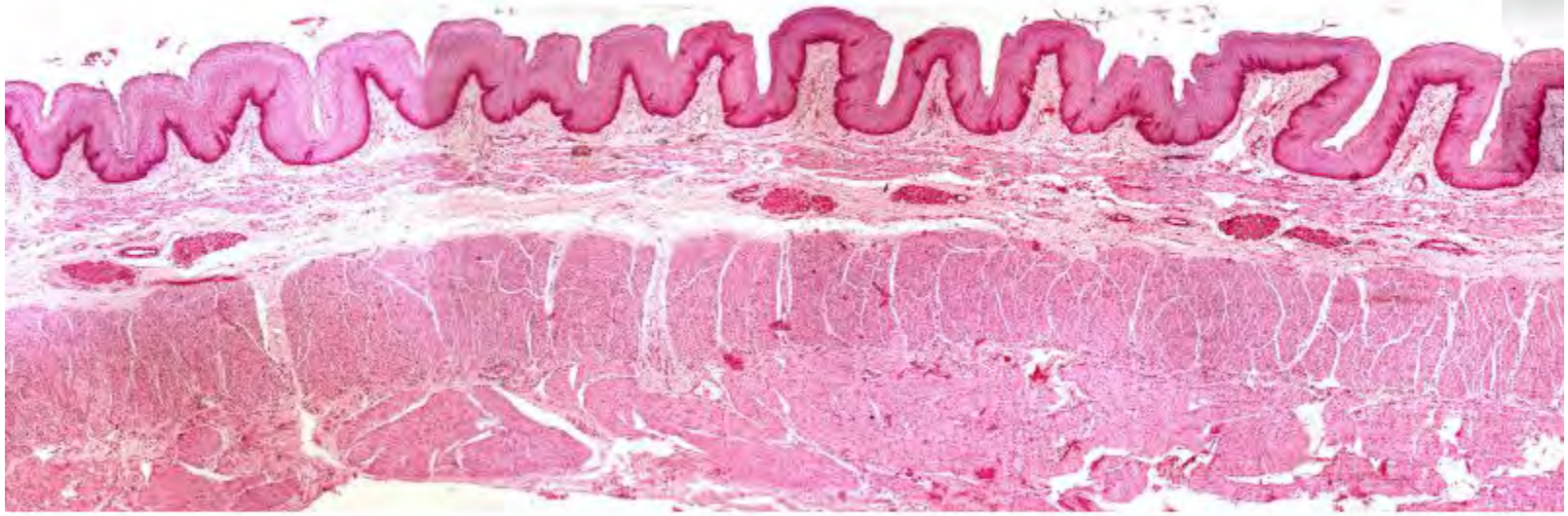

Oesophagus – cross section
Medium magnification

Oesophagus – cross section

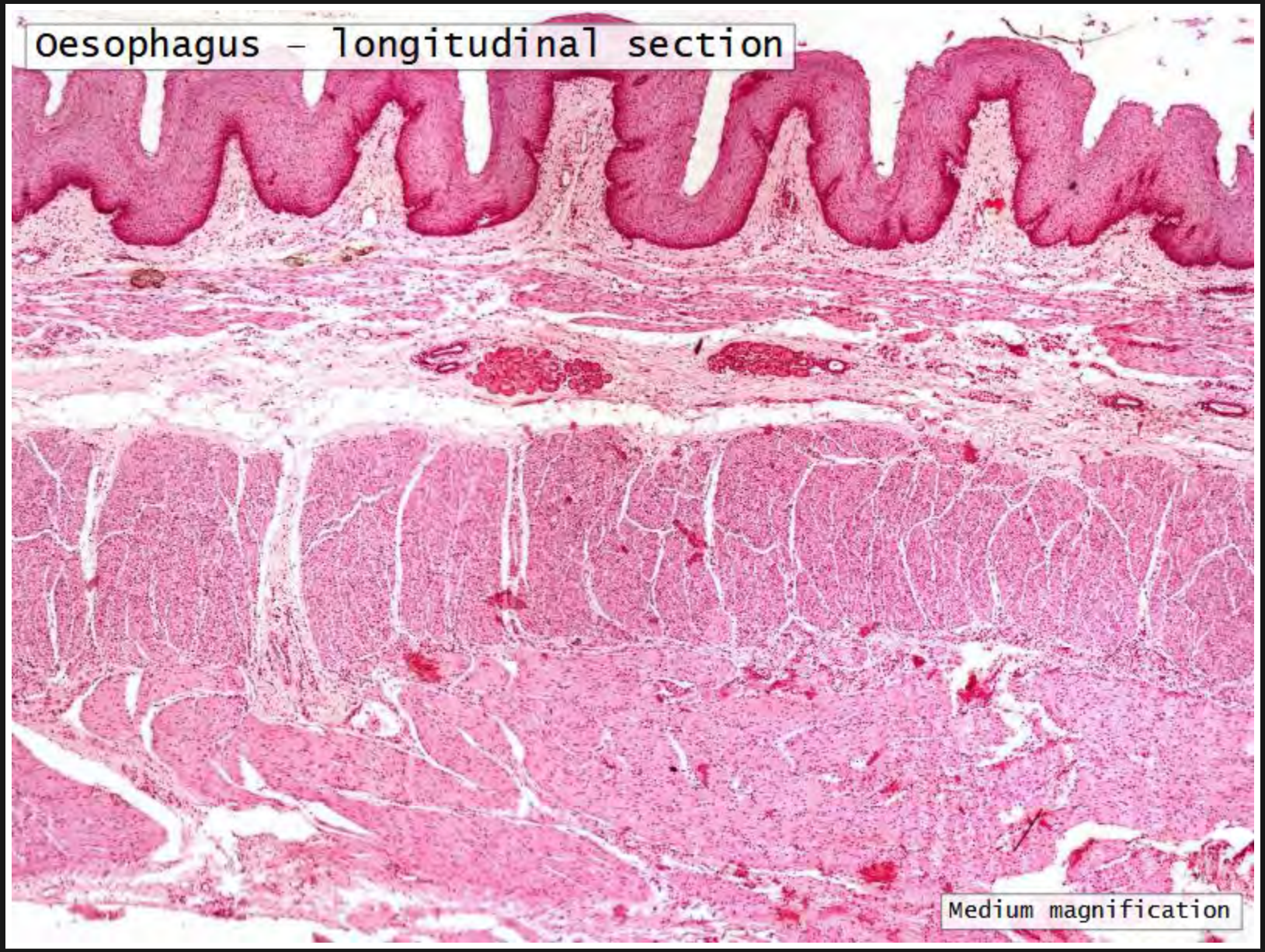
Very low magnification


Oesophagus – cross section
Medium magnification

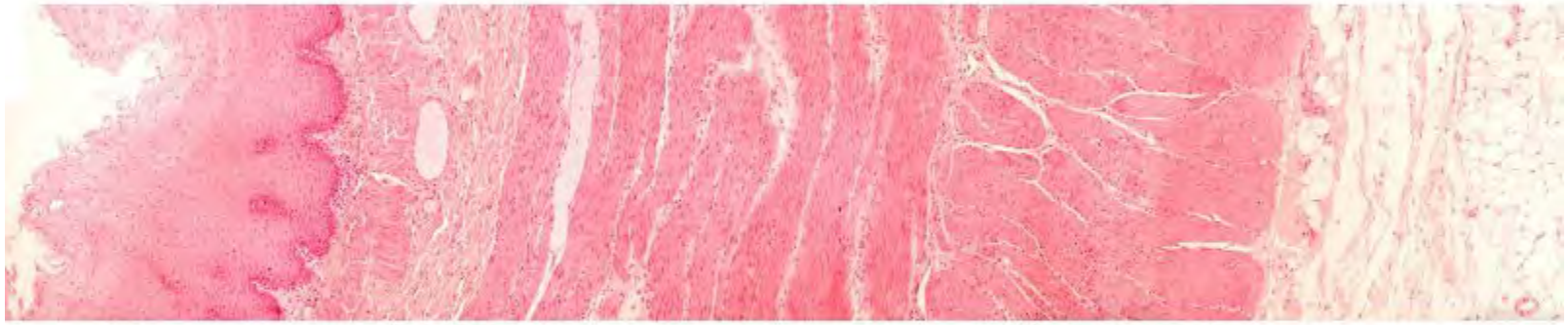
Oesophagus – longitudinal section



Very low magnification


Oesophagus – longitudinal section
Medium magnification

Oesophagus – cross section

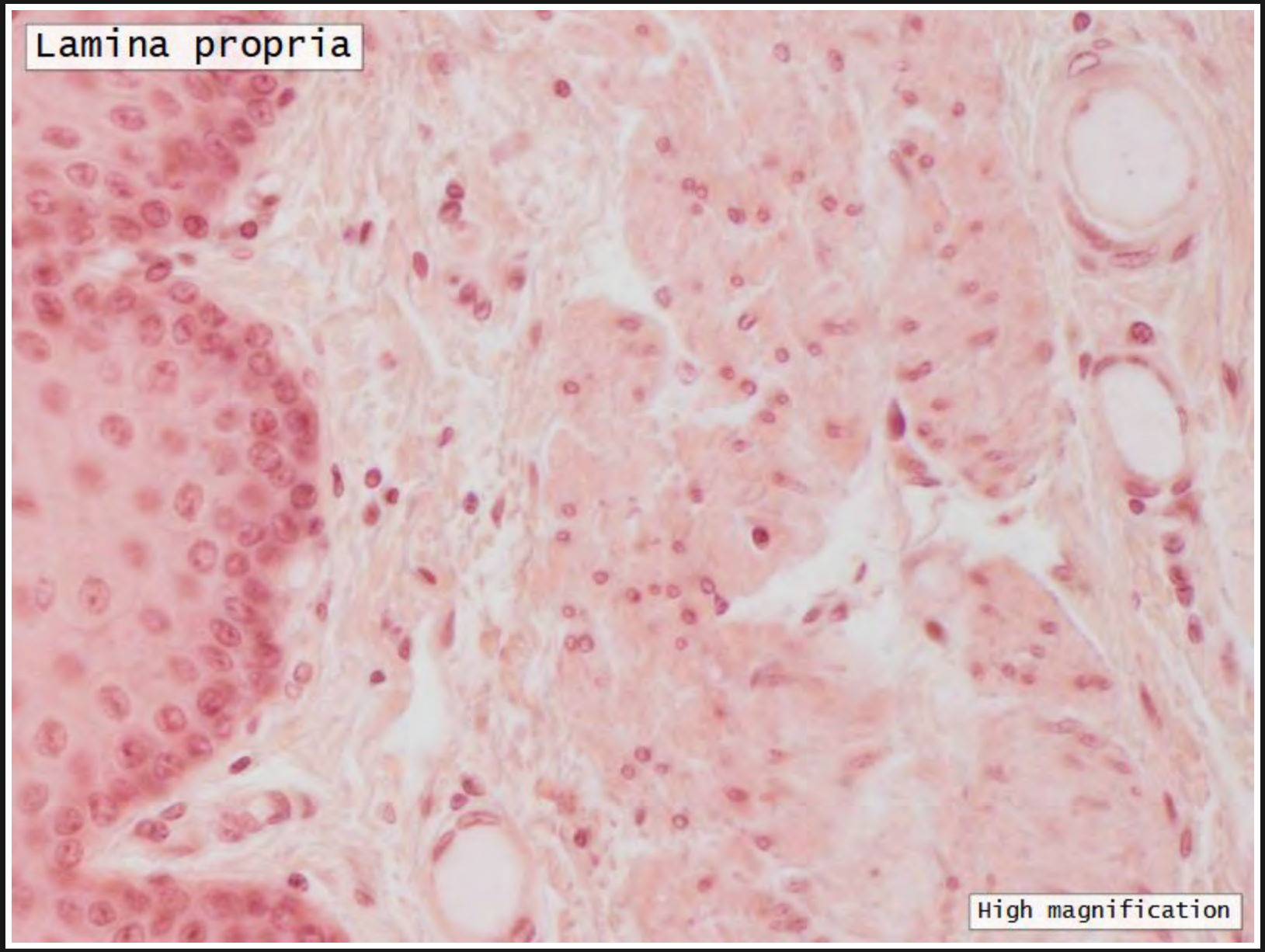


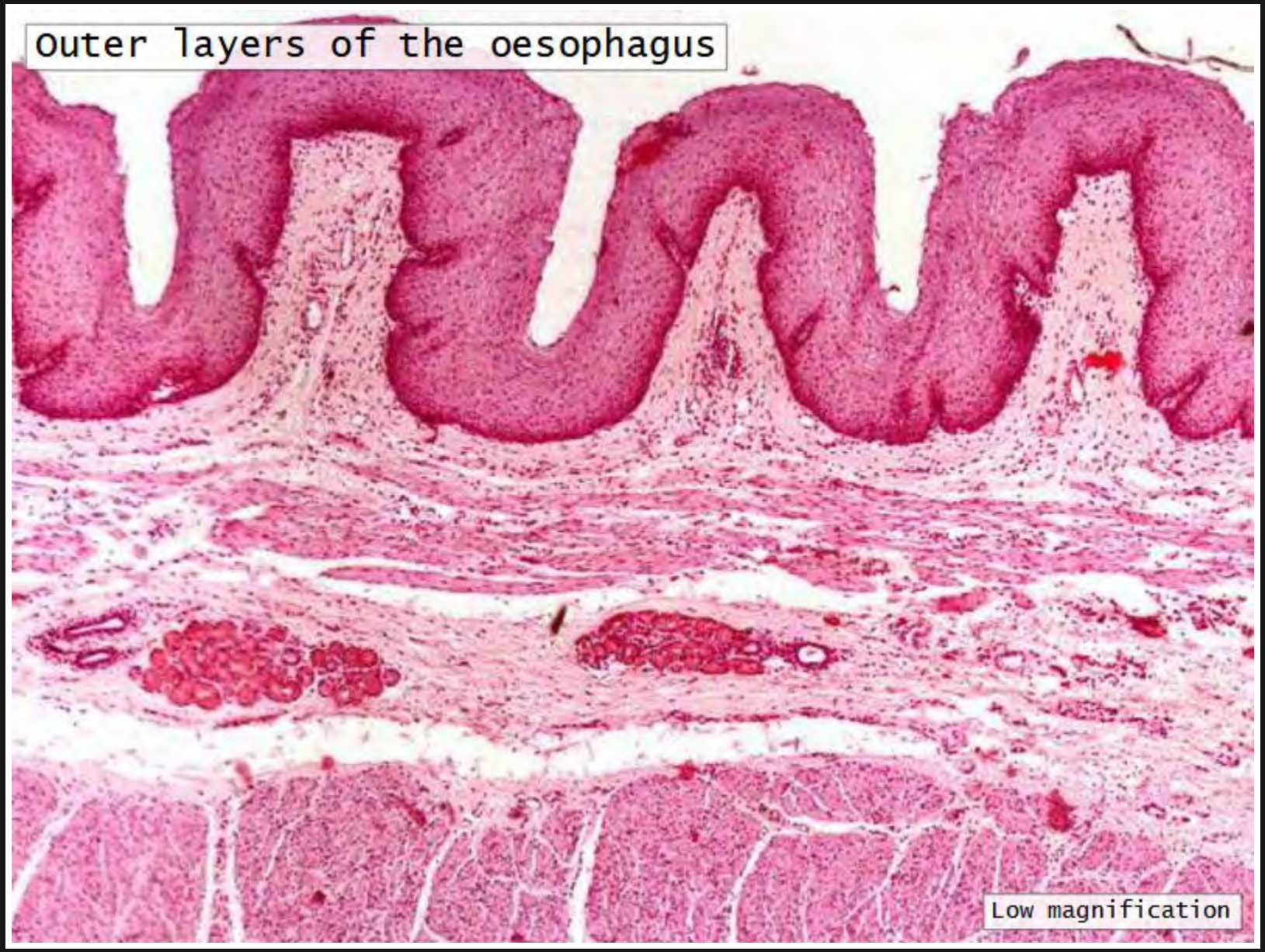
Low magnification

Mucosa

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

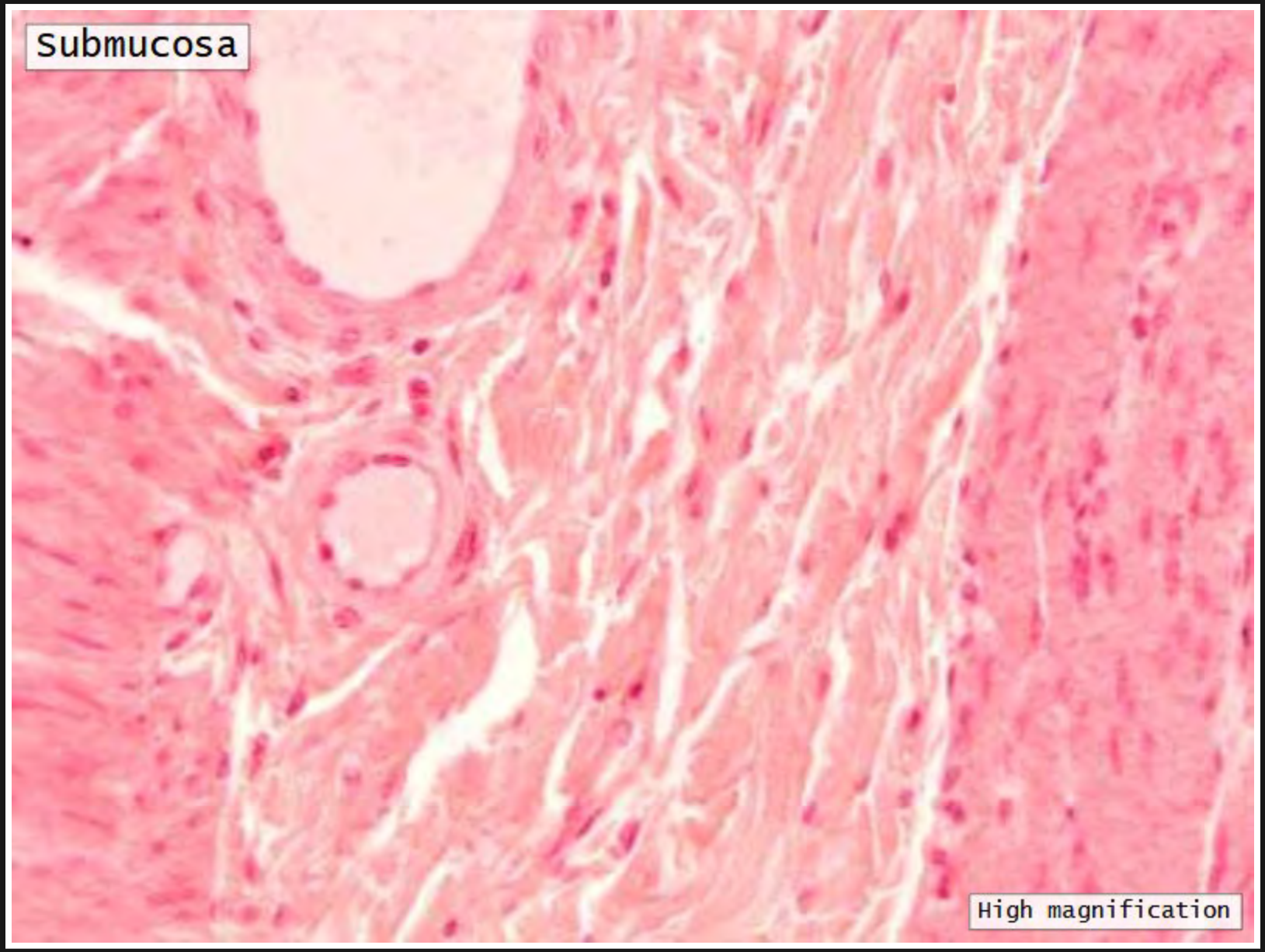

Epithelium of the oesophagus
High magnification

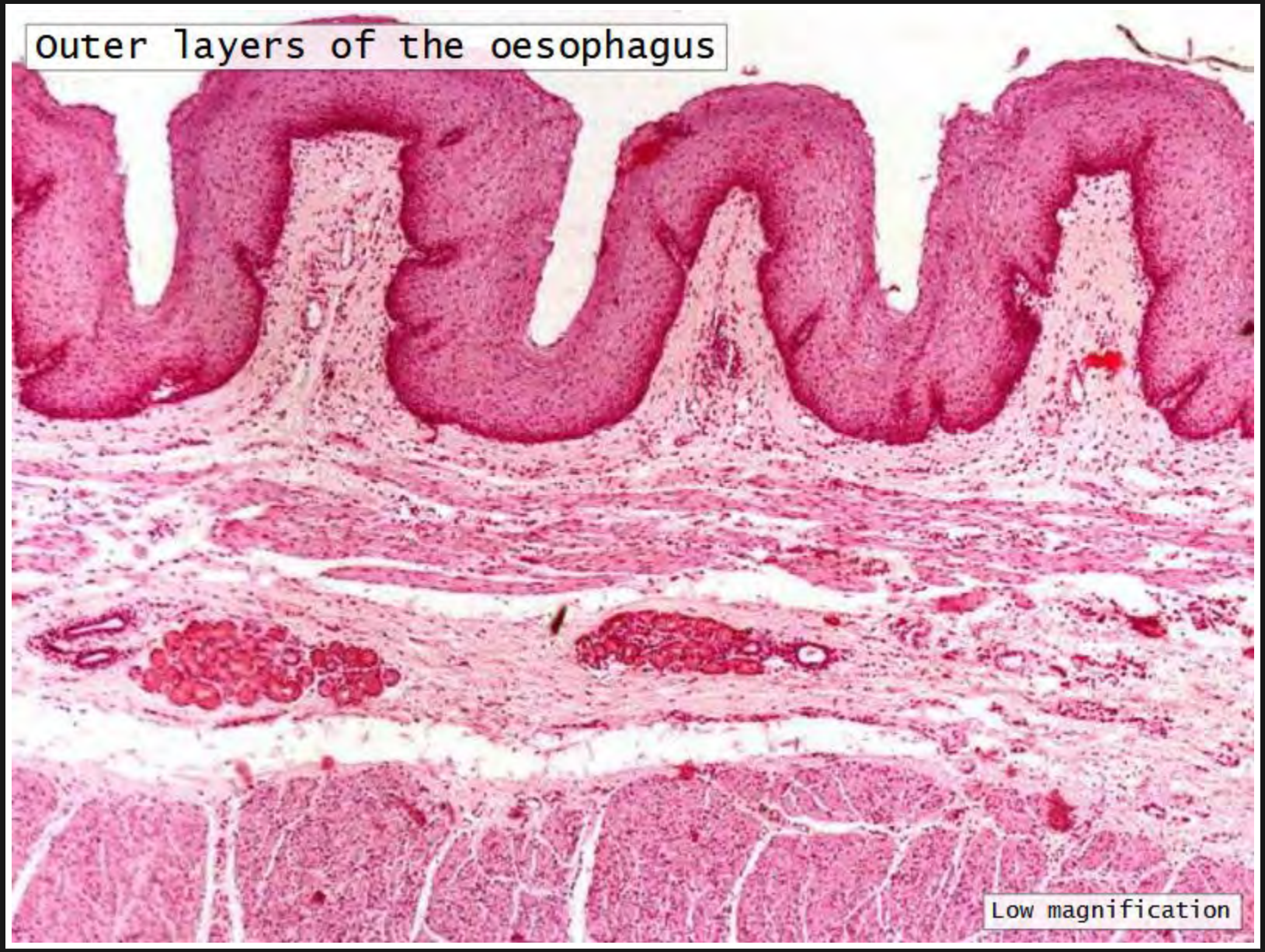

Lamina propria
High magnification


Outer layers of the oesophagus
Low magnification

Submucosa

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


Submucosa
High magnification

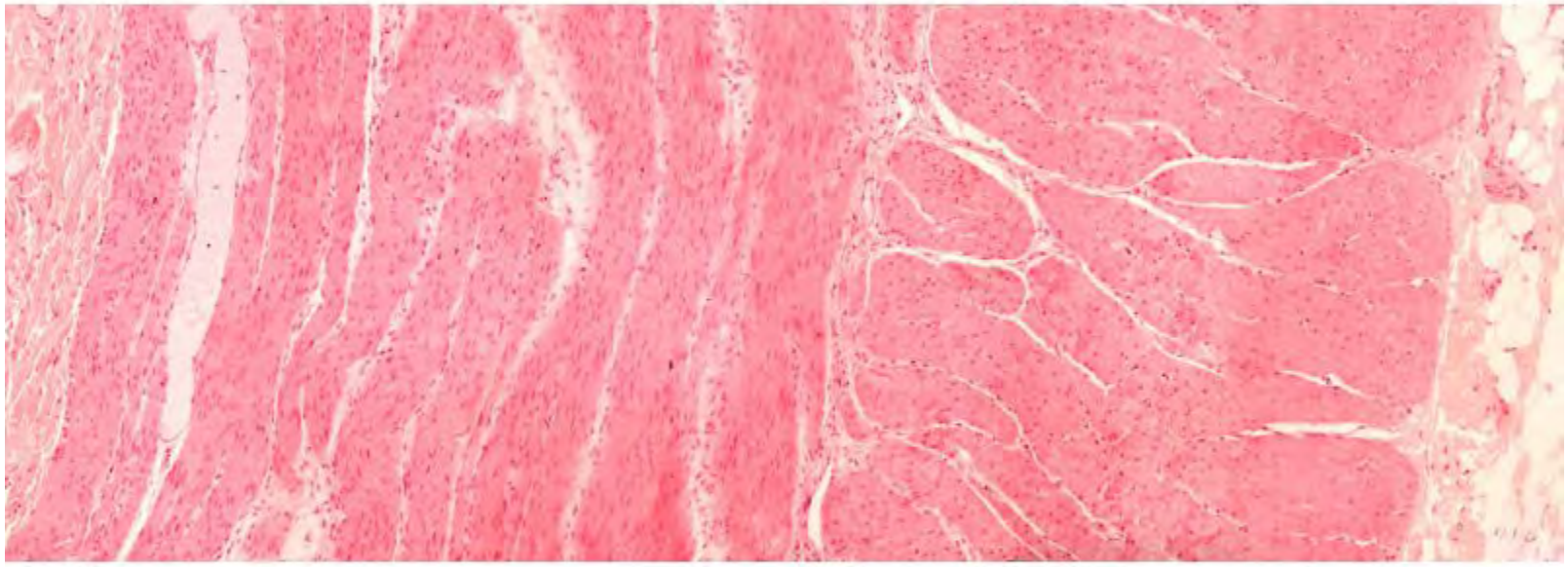

outer layers of the oesophagus
Low magnification


Blood vessel in submucosa
High magnification

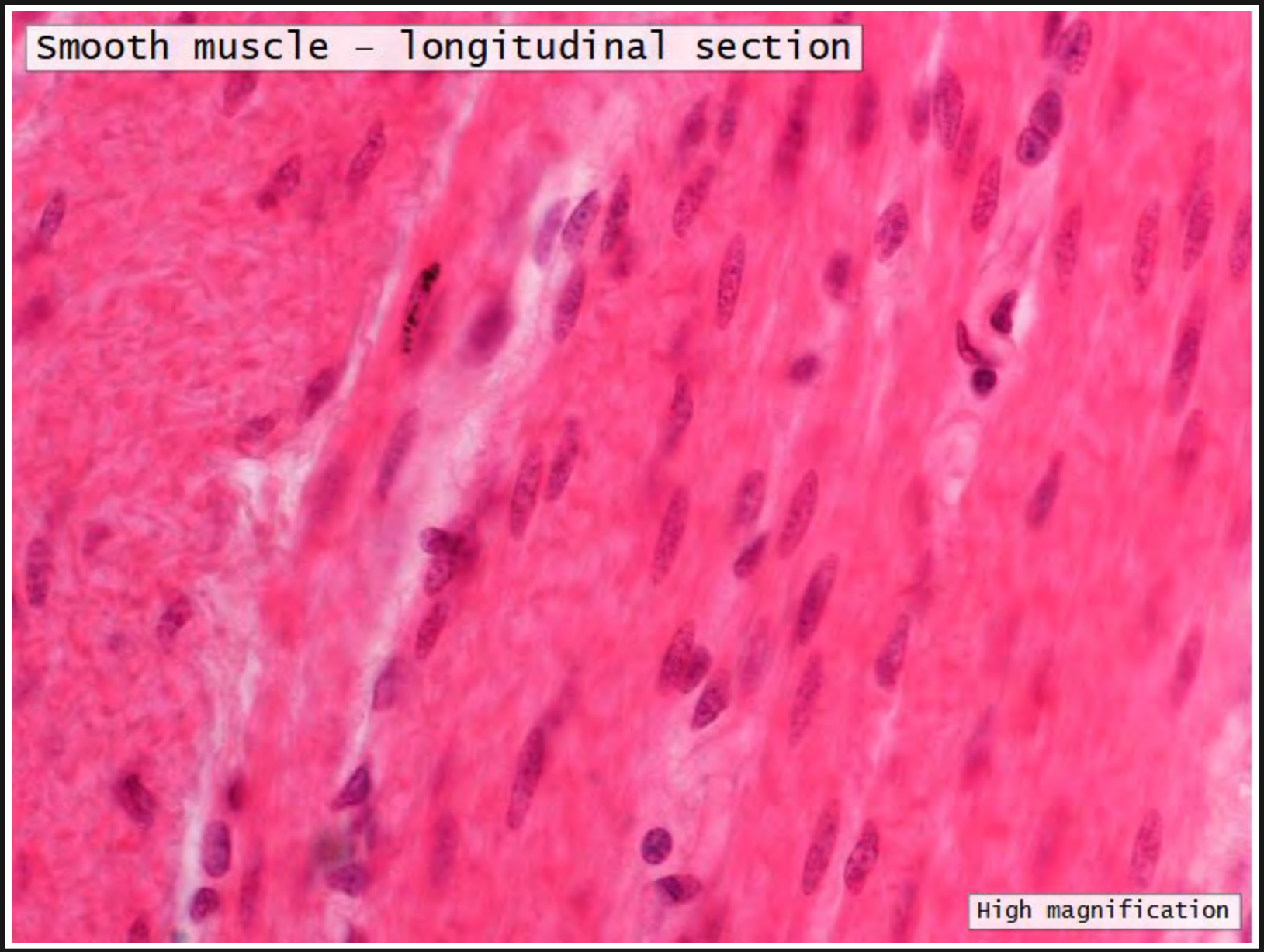
Muscularis externa

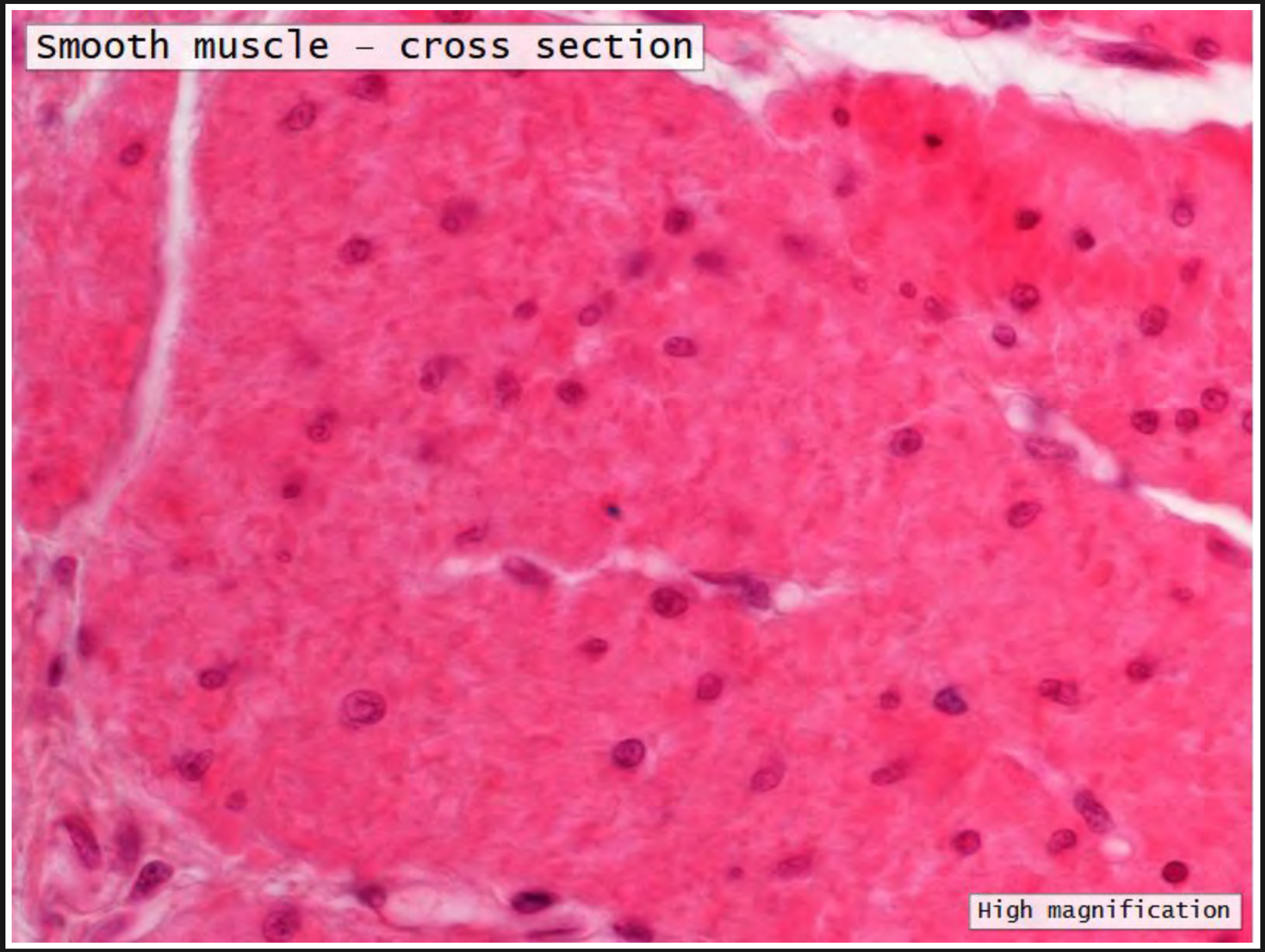
- Inner circular
  - Tight helix
- Outer longitudinal
  - Loose helix
- Muscle type
  - Upper third = skeletal
  - Middle third = mixed
  - Lower third = smooth
- Myenteric nervous plexus between inner & outer muscle layers

Muscle layers of the oesophagus



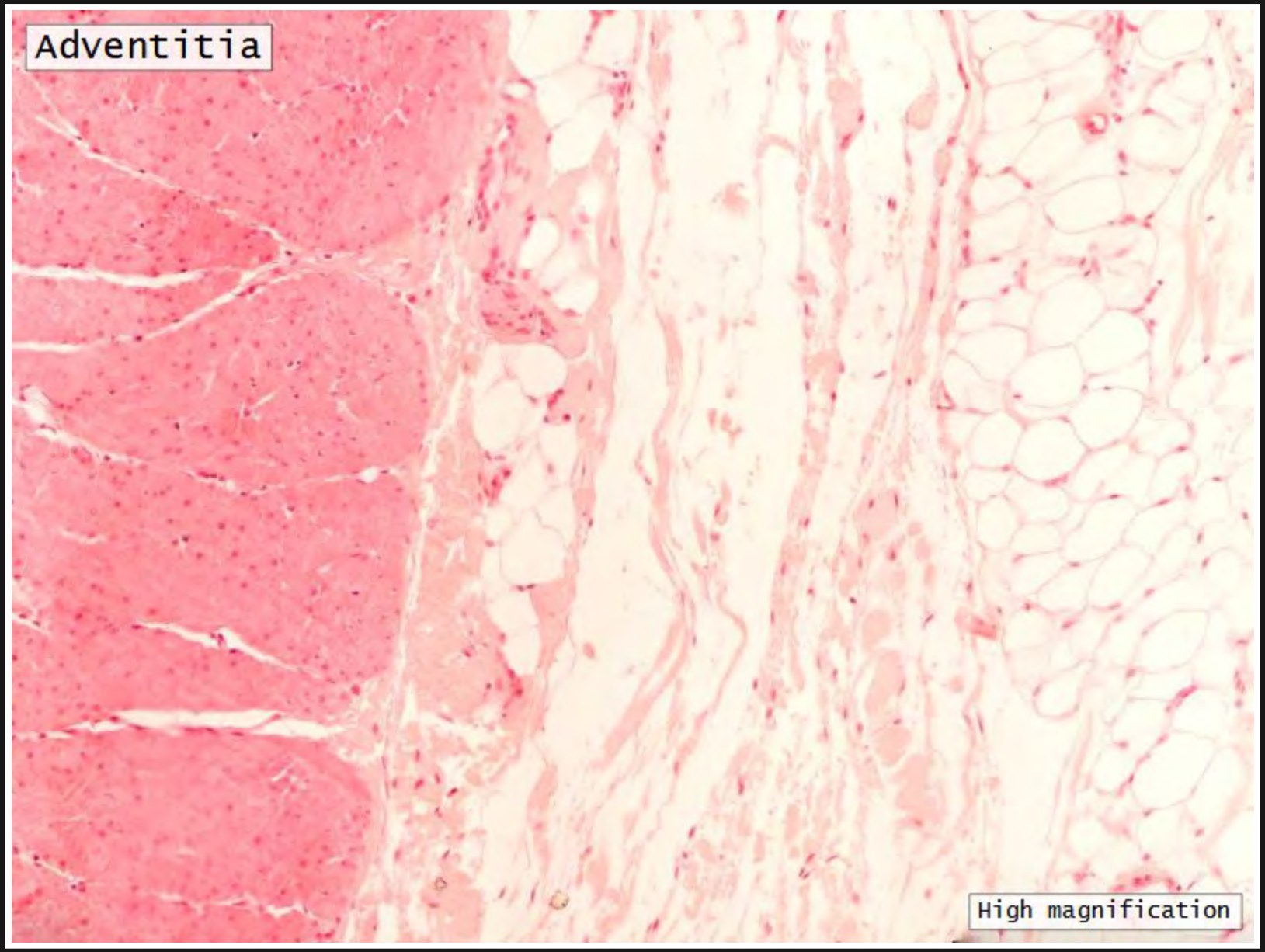
Low magnification


Smooth muscle – longitudinal section
High magnification

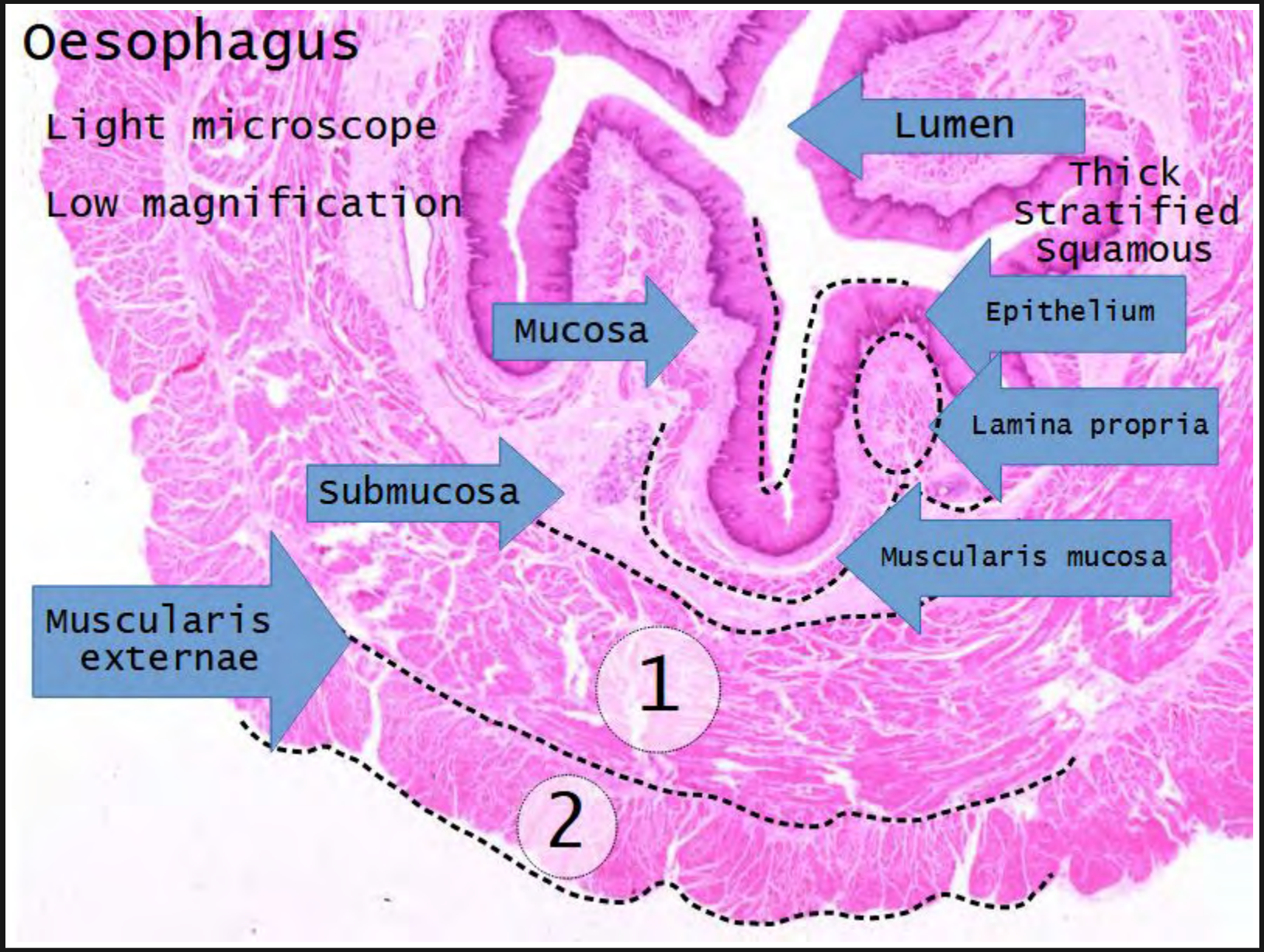

Smooth muscle – cross section
High magnification

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

The End

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