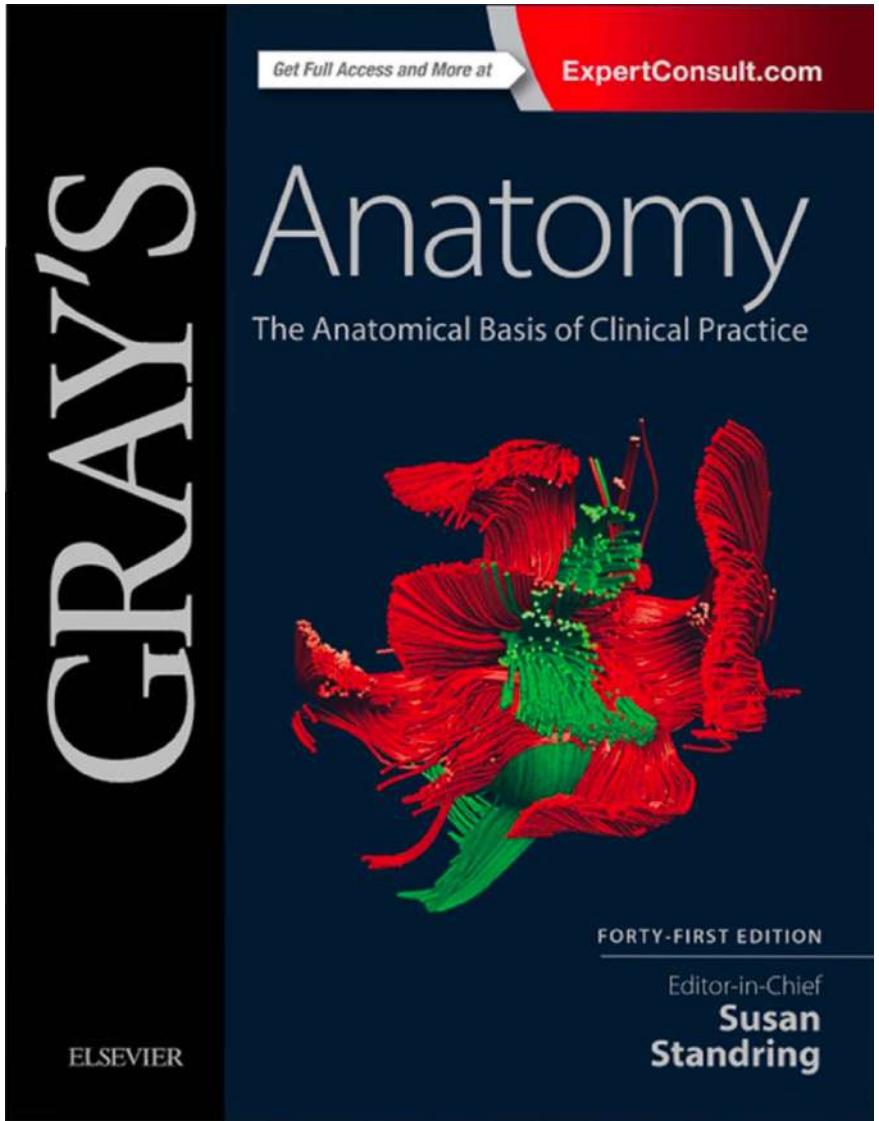
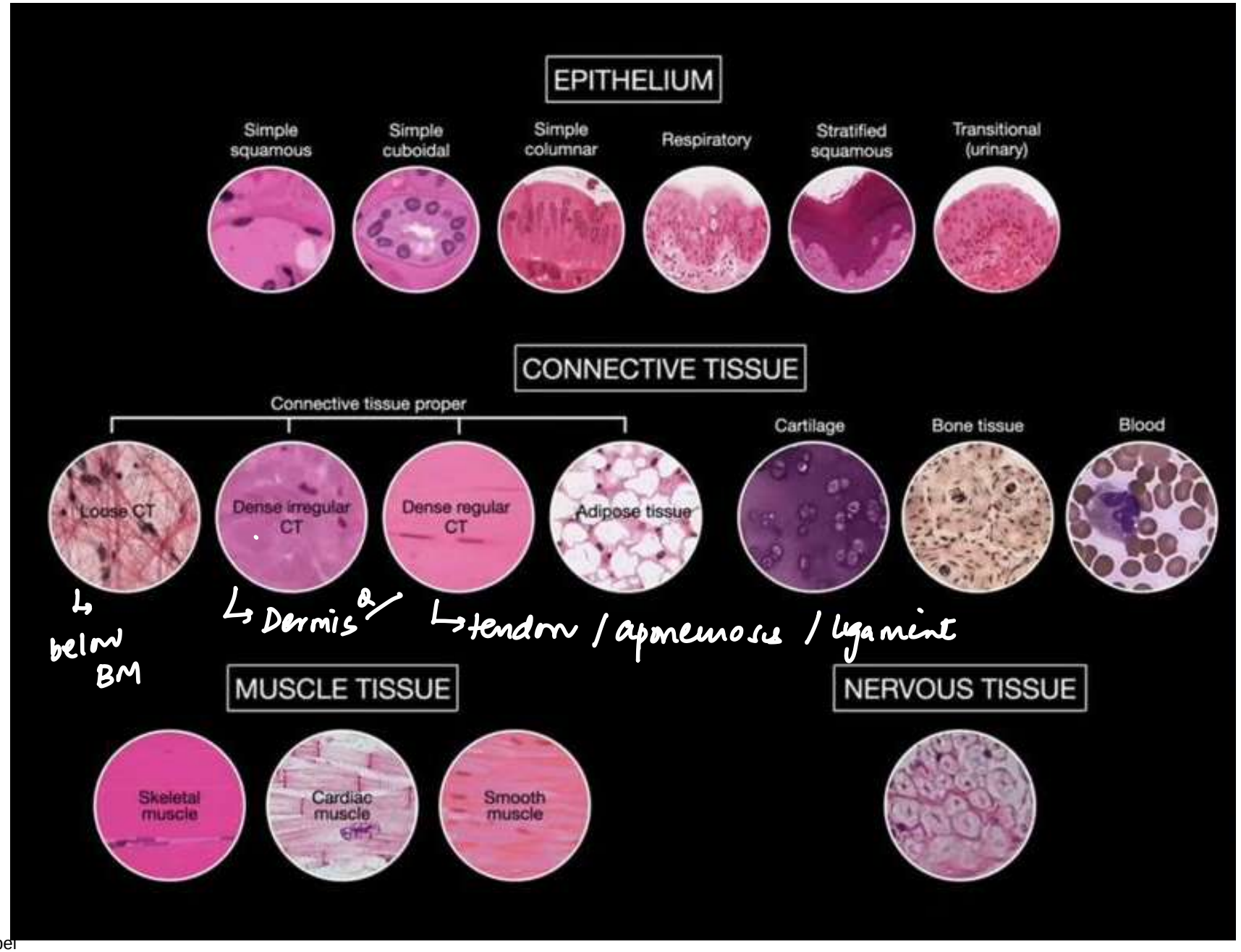
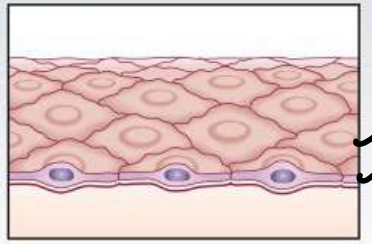
COMPILED MODULE: GRAY'S SPECIAL





UNILAMINAR (SIMPLE)

Squamous

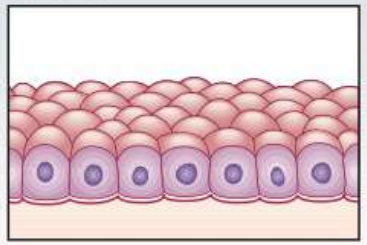


- alveoli / Bowman's capsule

See also:

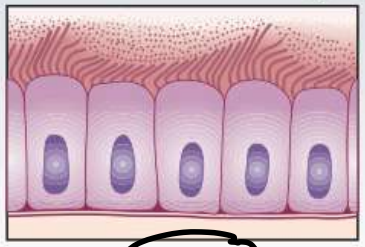
- Mesothelium – lining body cavities
- Endothelium – lining blood and lymphatic vessels

Cuboidal



PCT / DCT / CD, Thyroid, ovary, receptor

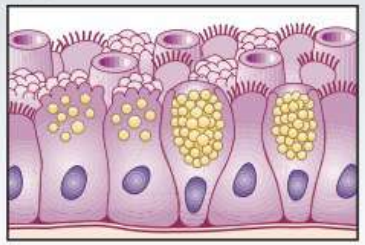
Specializations



Ciliated

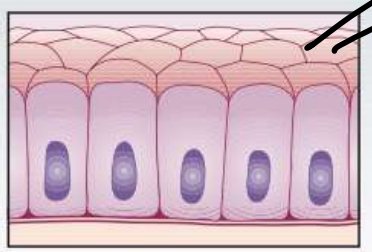
C-terminal bronchiole

FT / urethra



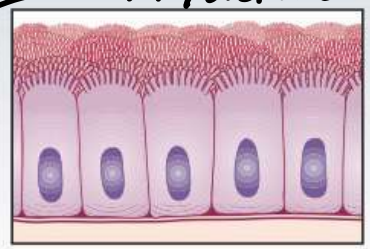
Secretory

Columnar

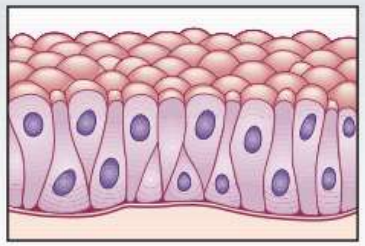


Without surface specialization

- uterus
- GIT: villi → stomach
  - ↳ SI
  - ↳ LI



With microvilli (brush/striated border)



Pseudostratified columnar + cilia

↳ Respiratory tract

MULTILAMINAR

Stratified squamous

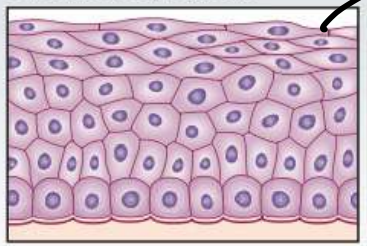
esophagus, oral cavity

↳ anal / vagina

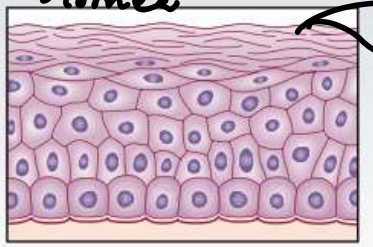
↳ cornea

skin

HP / gingiva

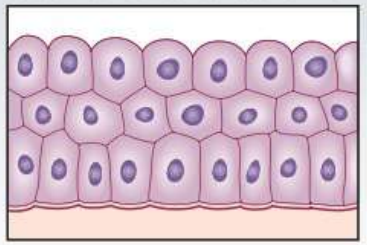


Non-keratinizing



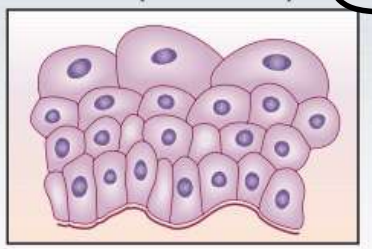
Keratinizing

Stratified cuboidal/columnar

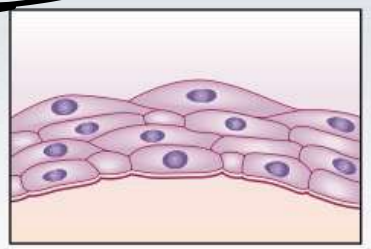


Urothelial (transitional)

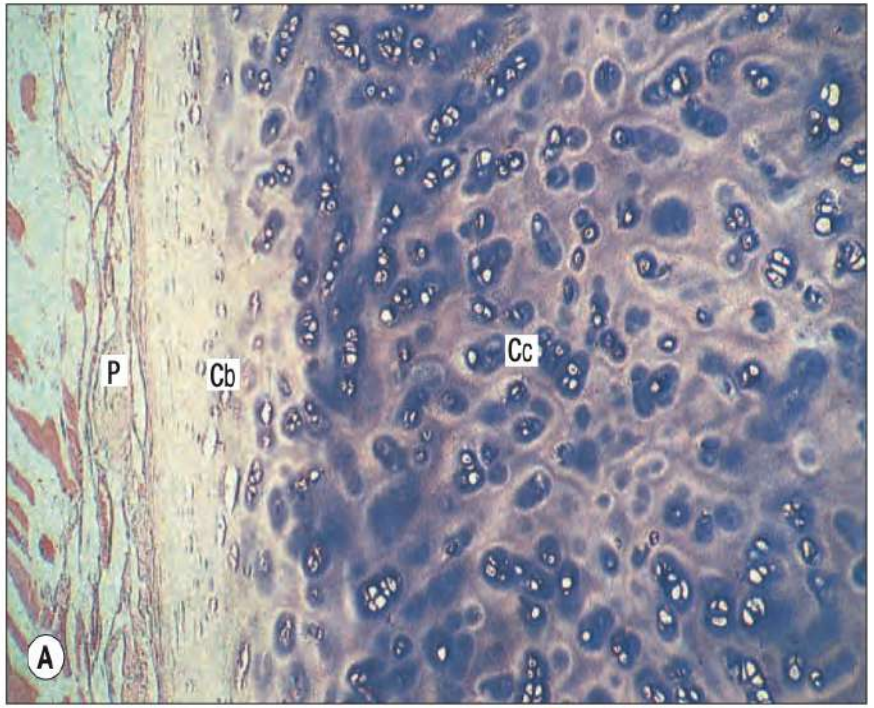
TCC

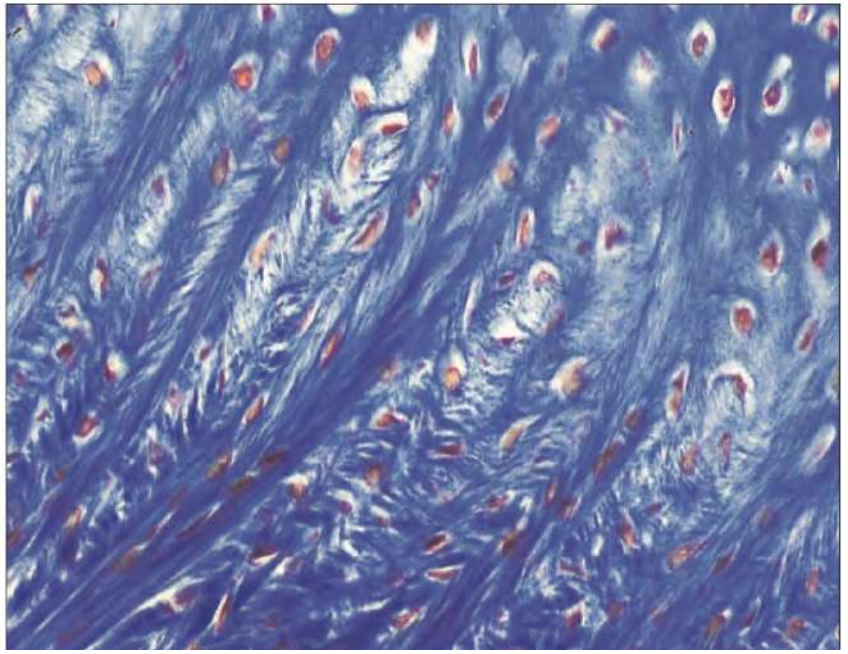


Relaxed



Stretched





Hyaline cartilage

FIBRO

Elastic

Cricoid, thyroid, arytenoid, trachea
articular — (x) perichondr
L (x) regenerate

— nests
— ground glass
TM / ITM

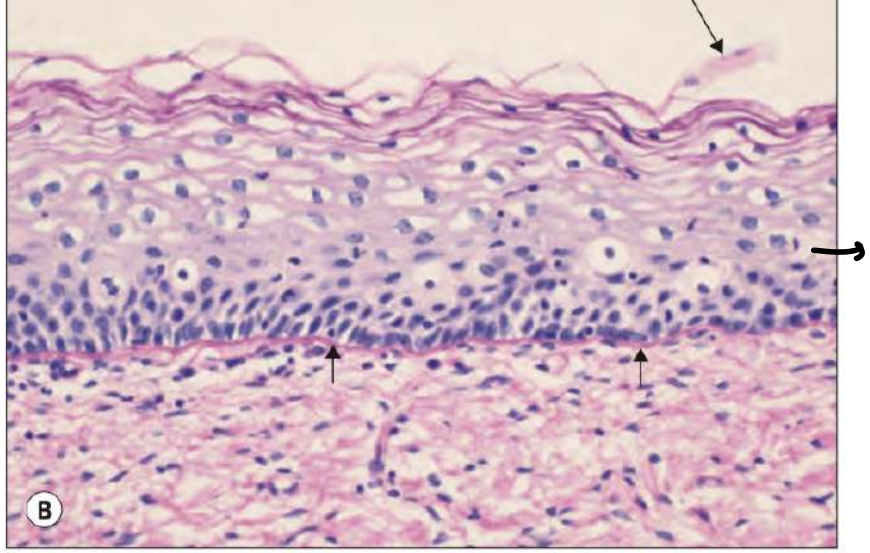
IVD, symphysis, Labrum, articular disc, menisci

Coll I
(x) perichondr

Epiglottis, Cuneiform, Corniculate, ET, Pinna, EAC

— x Ca^{2+}

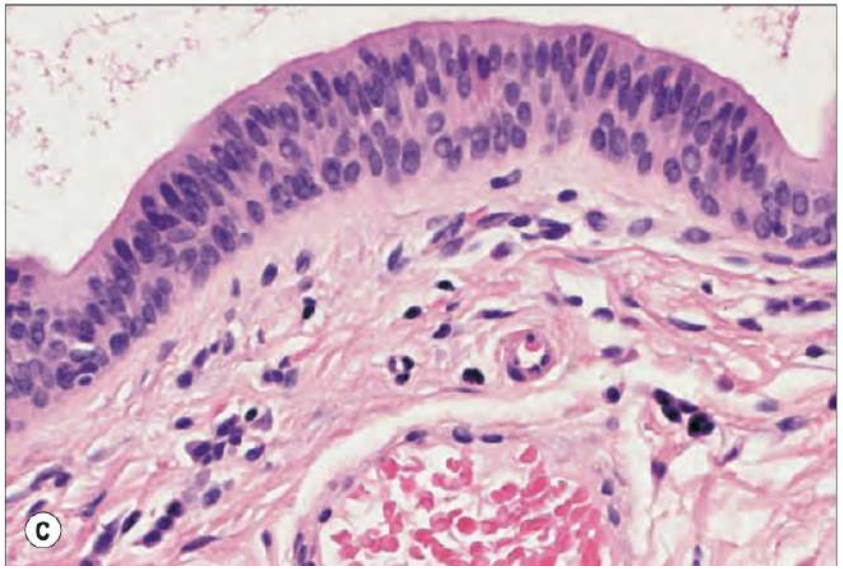
Coll II

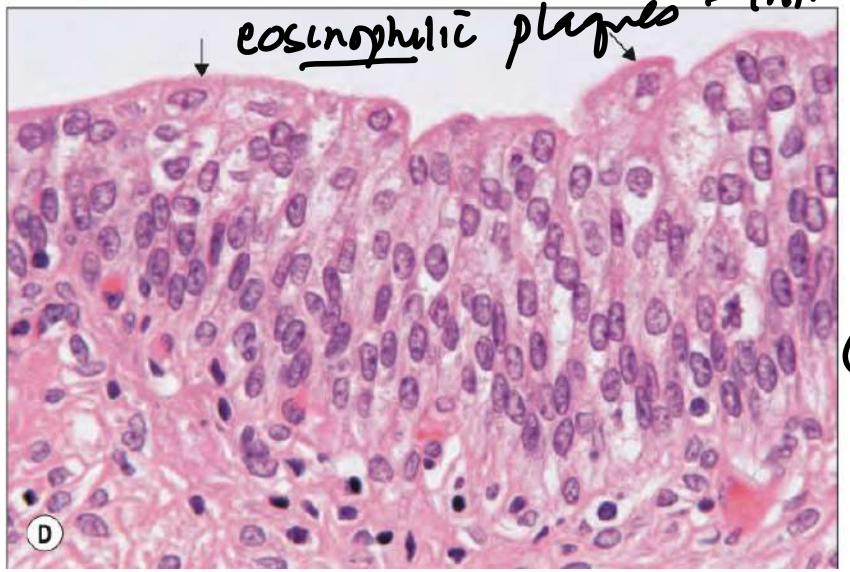


→ ecto cervix

Stratified Squamous -

- intramembranous





Umbrella cells

↓

TC

Stratified columnar

↓

intercalated ducts → salivary gland

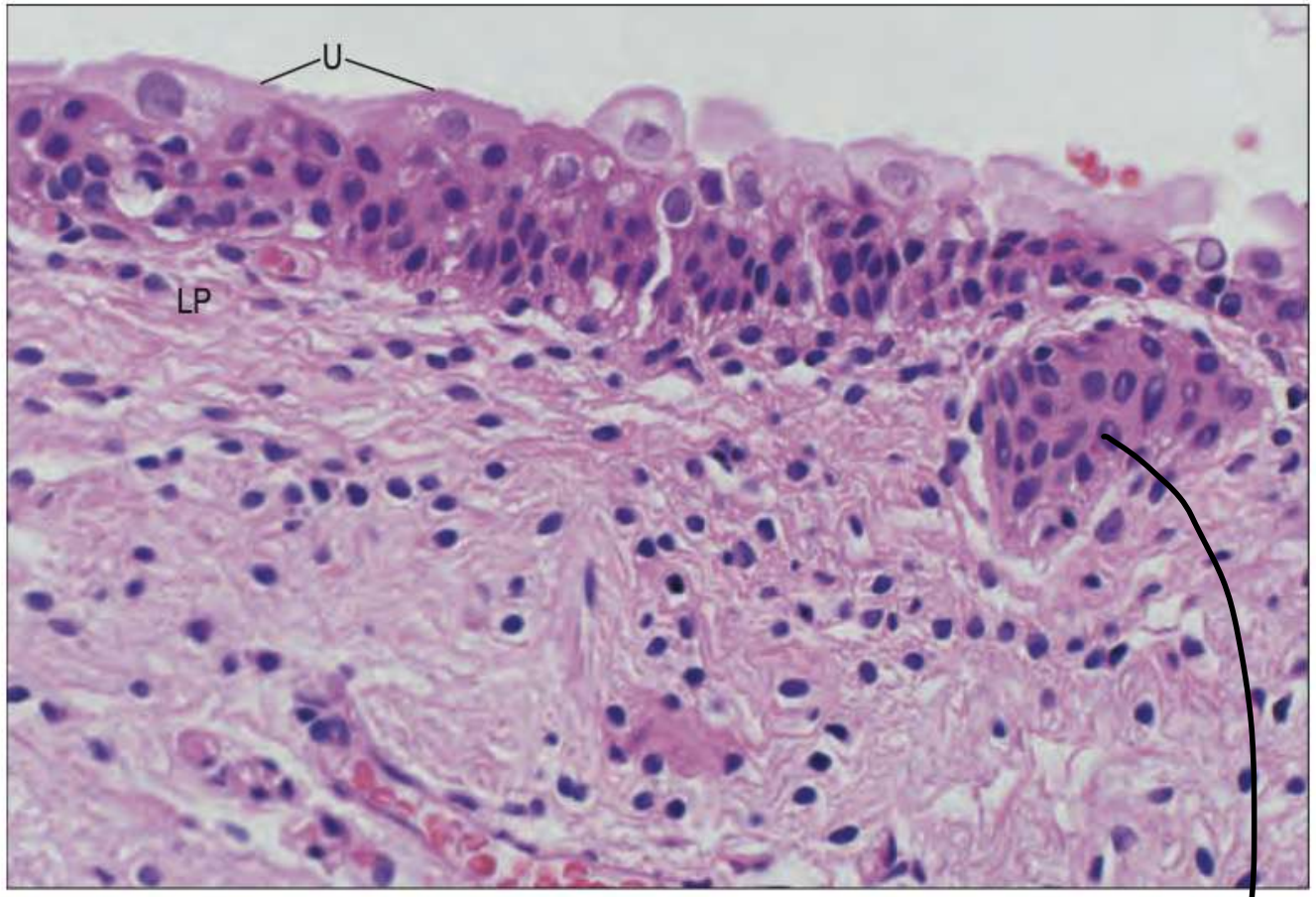
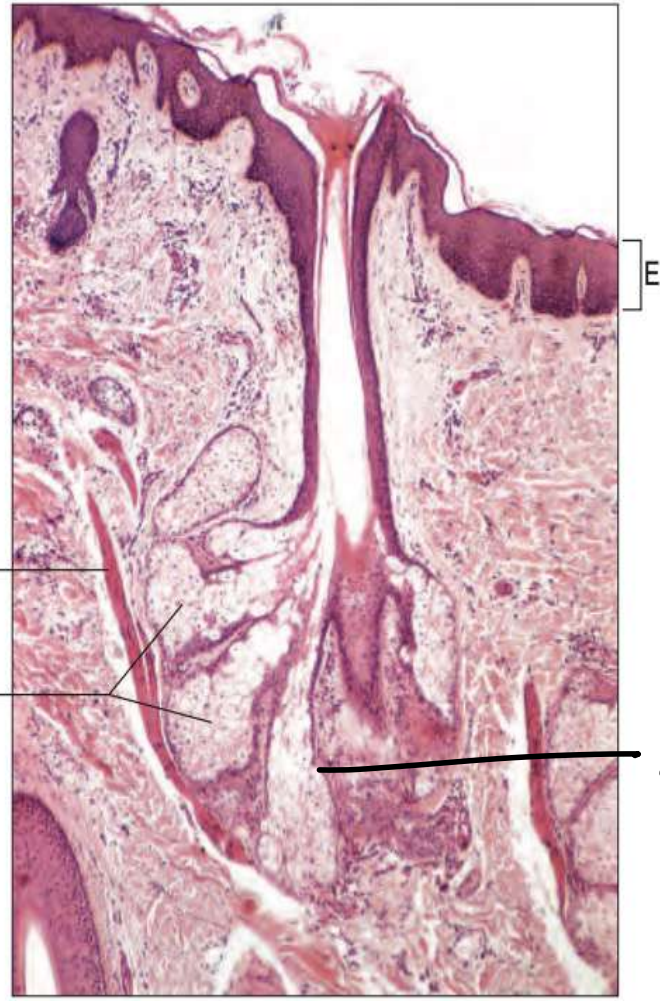


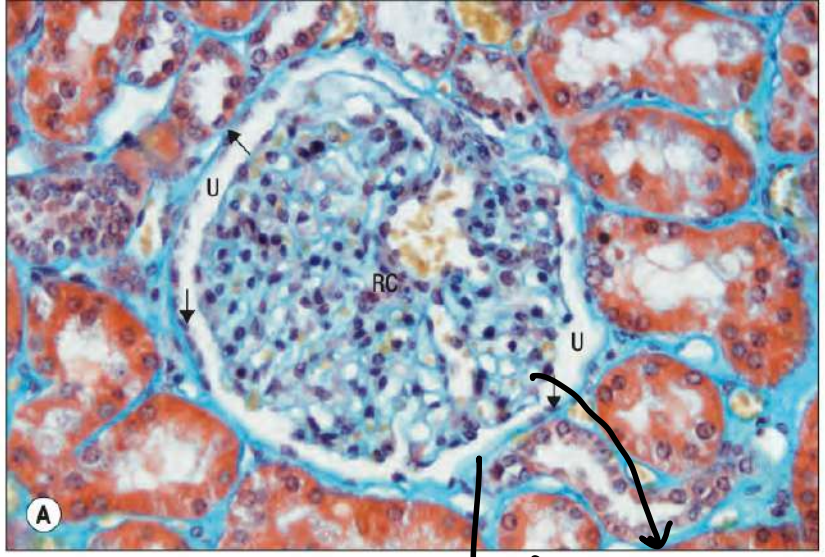
Fig. 75.15 The bladder is lined by urothelium with a surface 'umbrella cell' layer (U) and a layer of intermediate cells (3–5 cells thick). The lamina propria (LP) consists of stroma with blood vessels and von Brunn's nests.

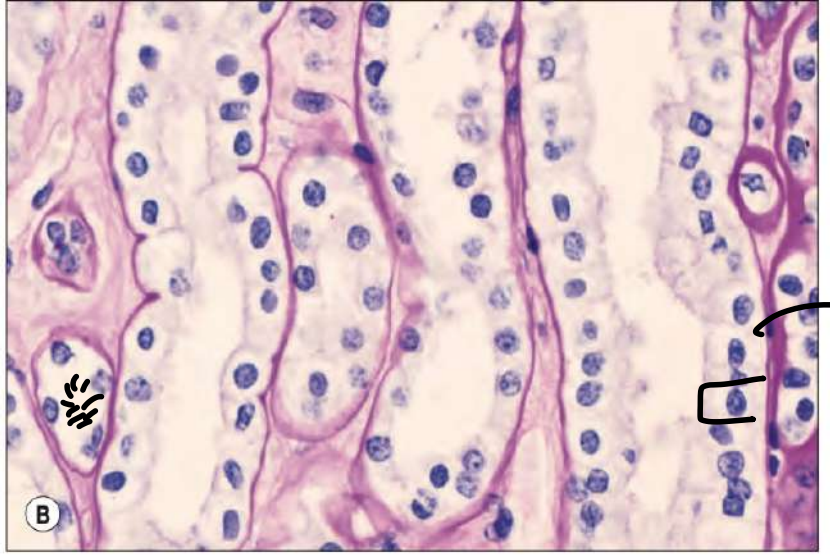


Arrector pili

sebaceous gland ↓ Holocrine

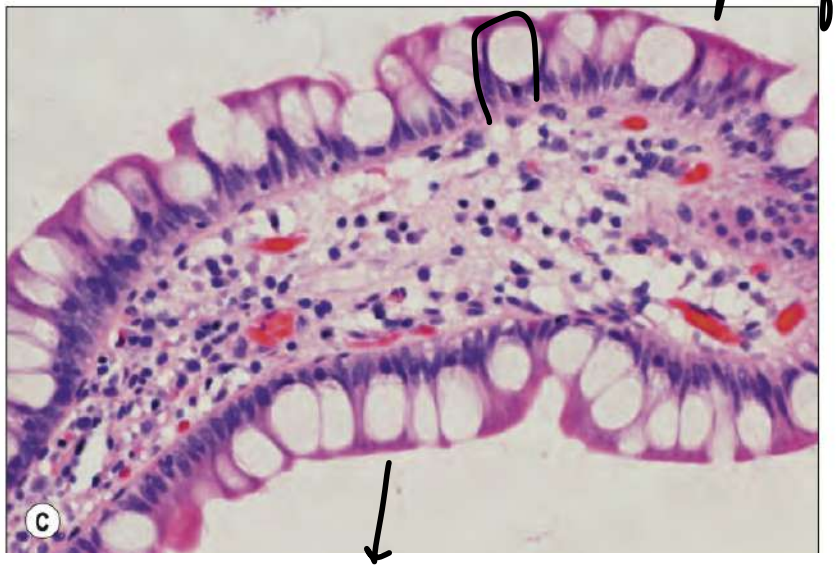
premalignant ??





Simple cuboidal
↓
CD

BC → Simple squamous



pseudostratified ciliated columnar
+
respiratory system

exc term / resp br
↓ ↓
ciliated c colum

Simple columnar
↓
Goblet cells → LI

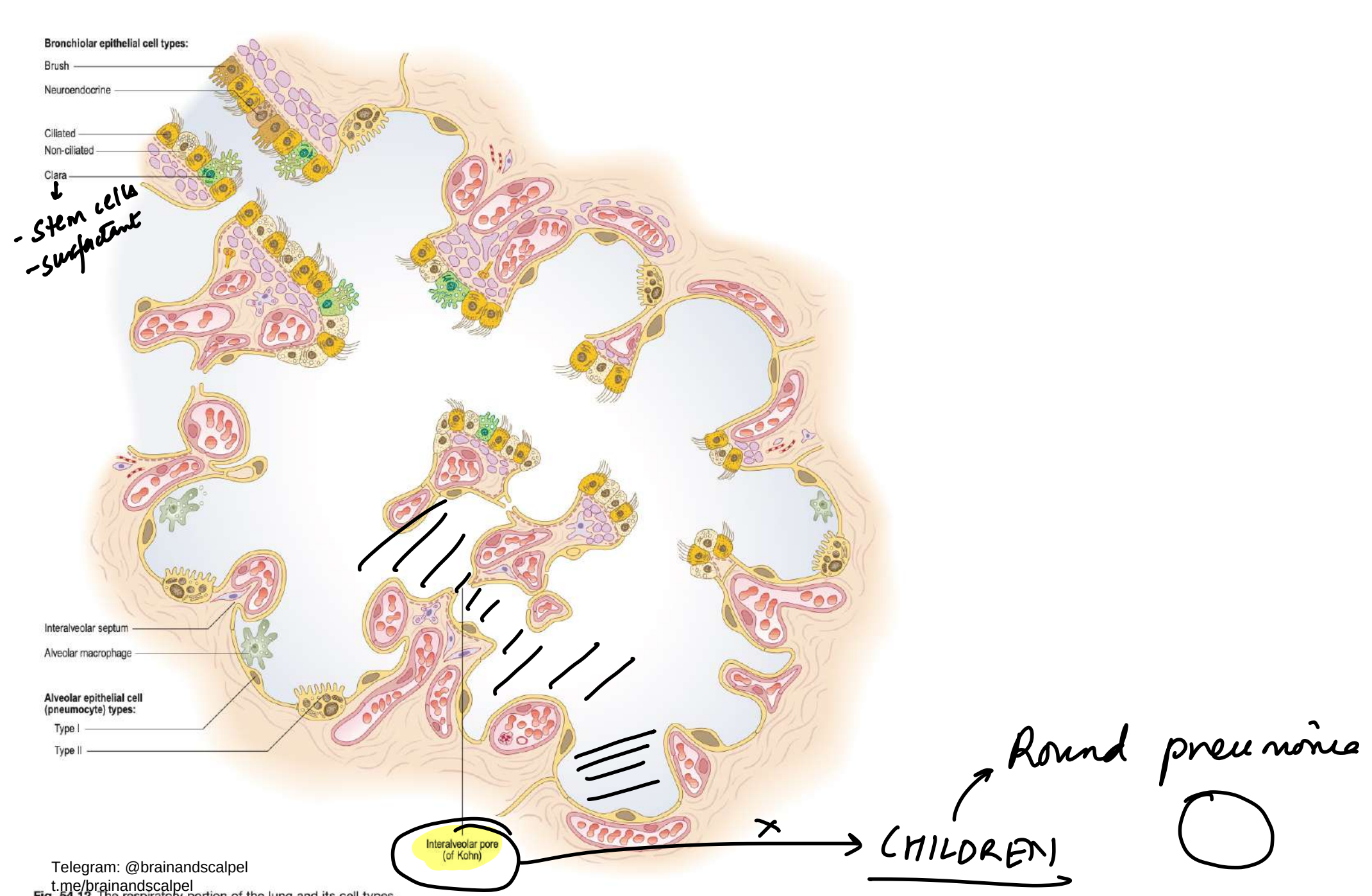
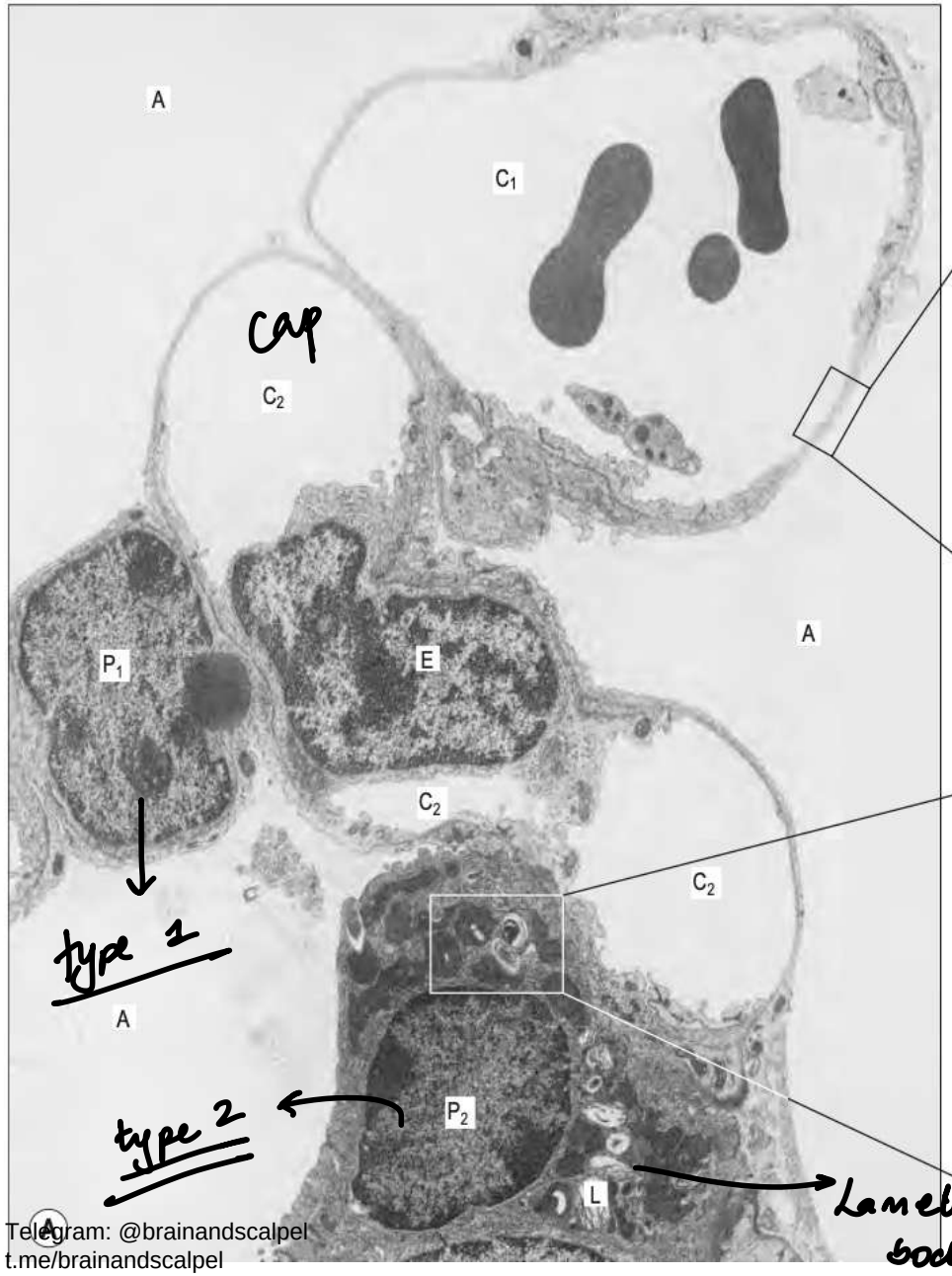
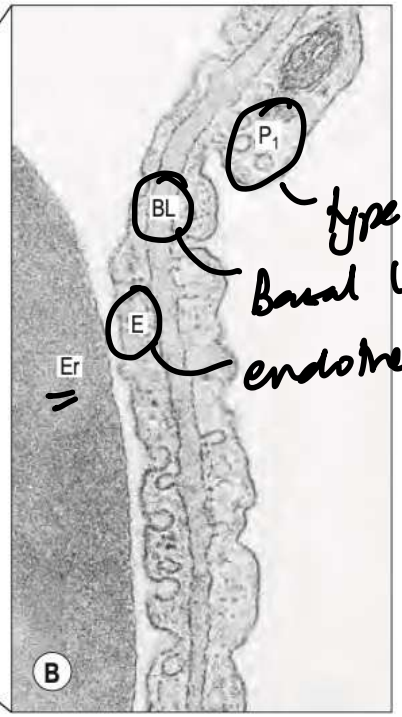


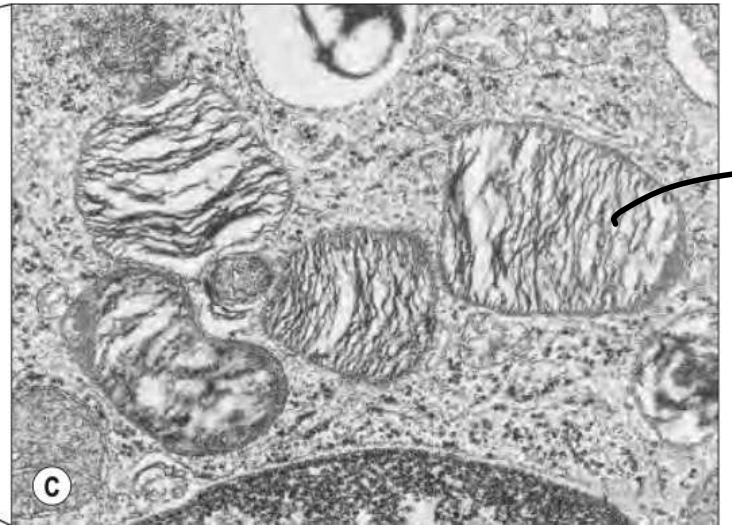
Fig. 54.12 The respiratory portion of the lung and its cell types.

E/M





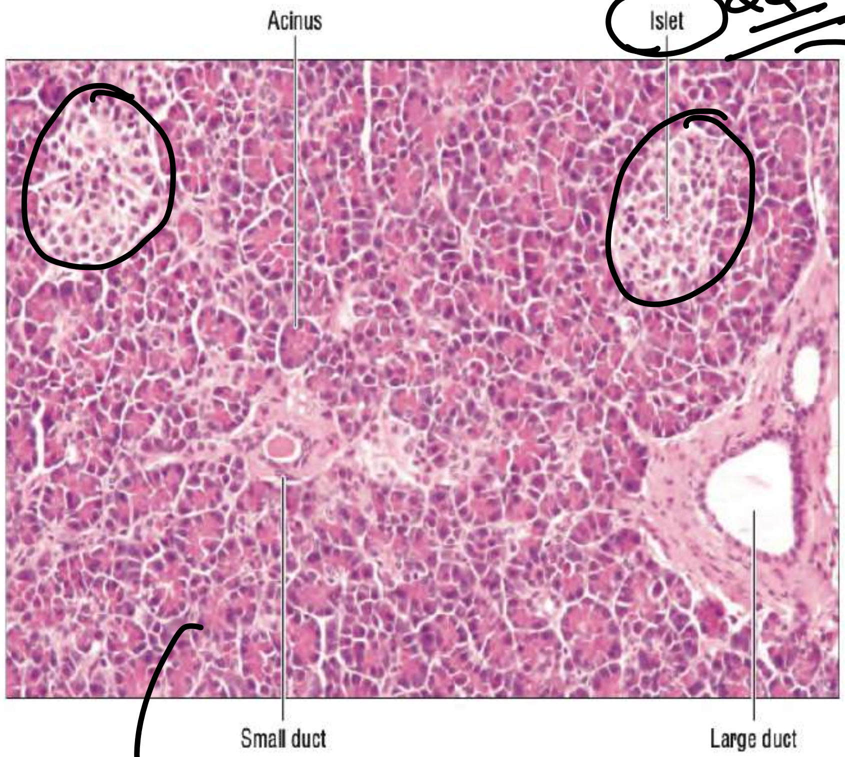
type 1
Basal lamina
endothelial



PL - Lecithin

DPPC

Lamellar bodies

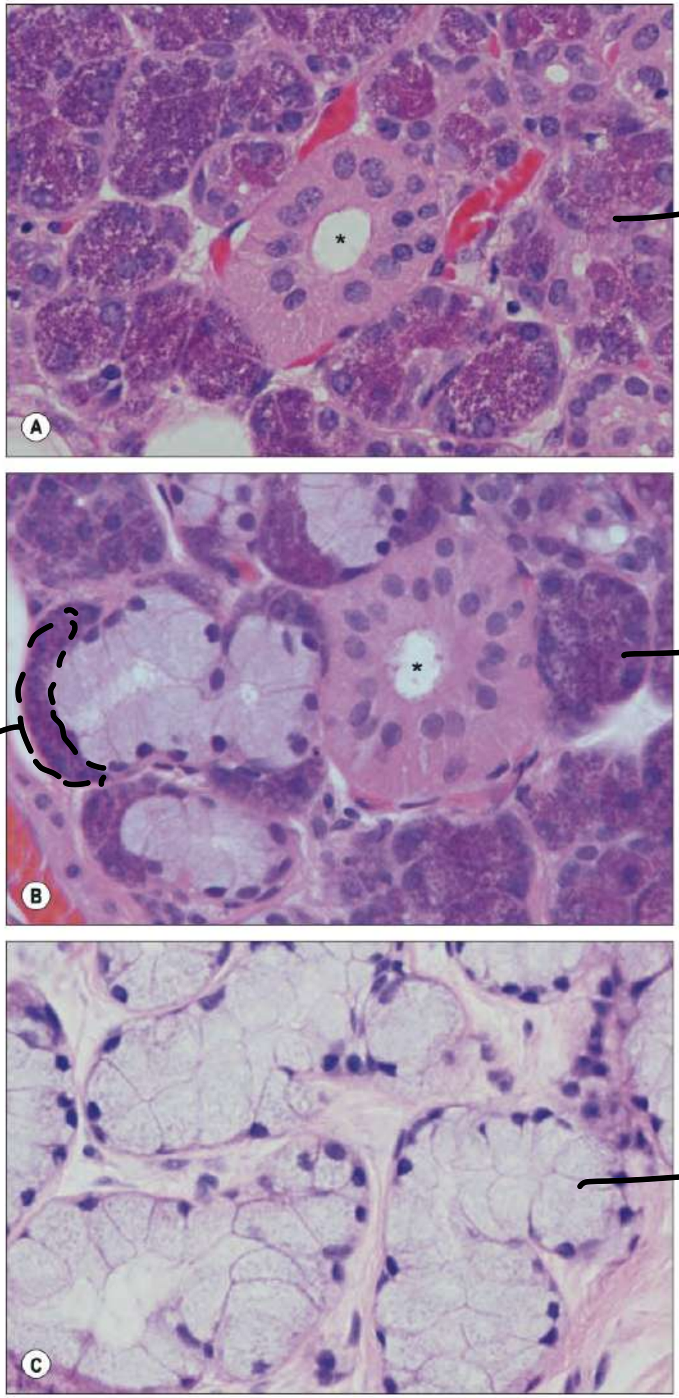


QQ

tail ↑↑

Serous

Pancreas



Striated duct ↑

Serous → Parotid

SM

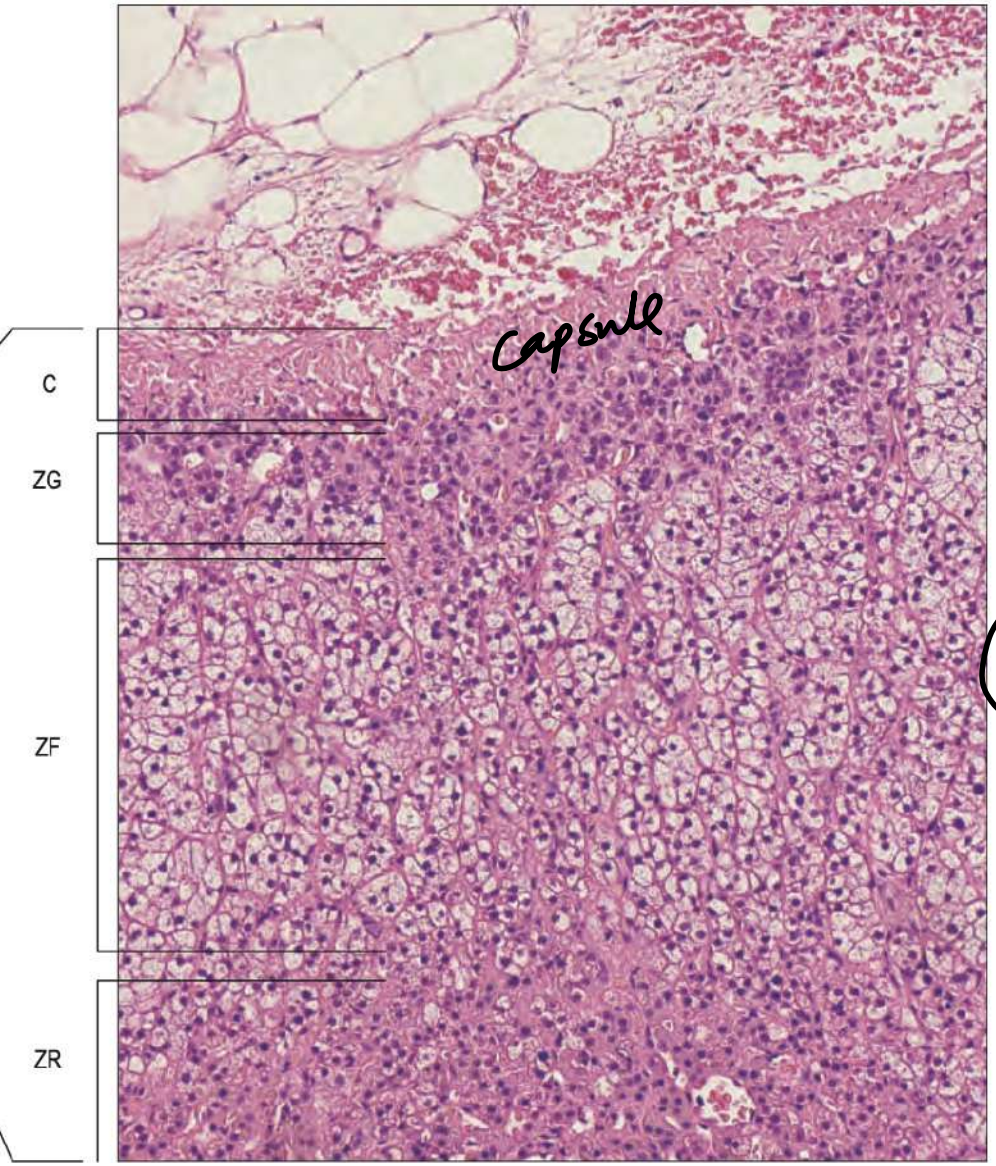
Mixed (↑ Serous) + mucous

Serous demilune

SL

(Mucous ↑) Mixed

Adrenal

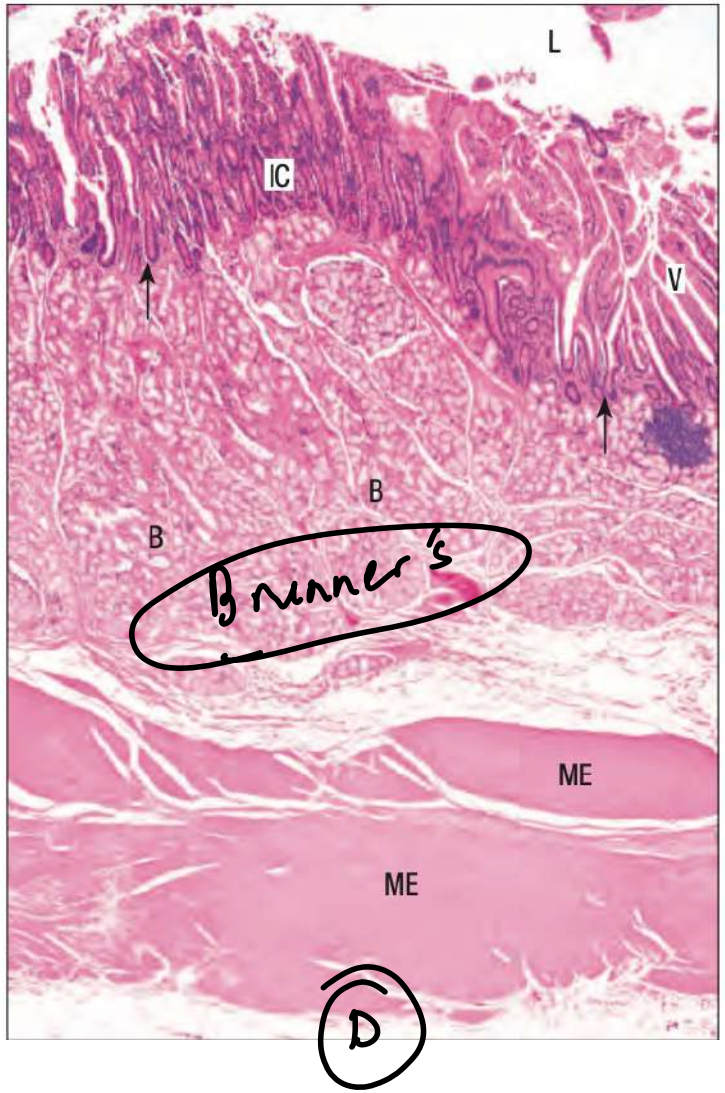


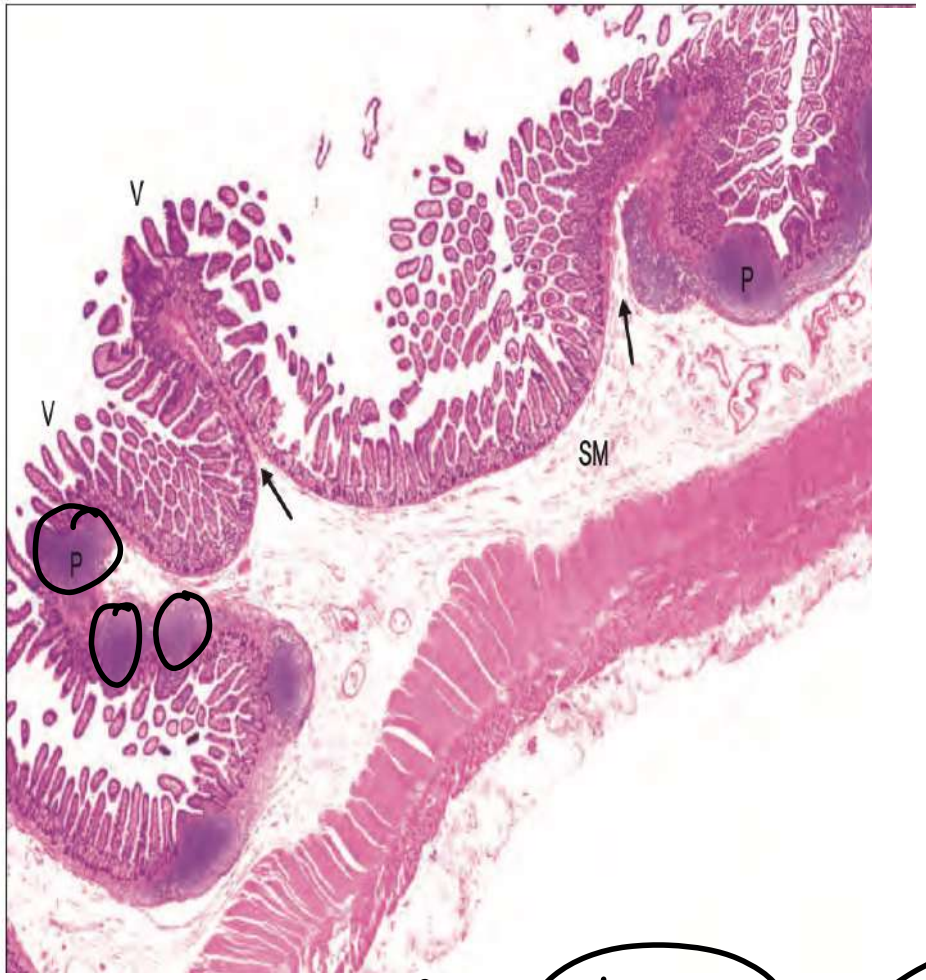
G → mc ← RAAS

F → gc

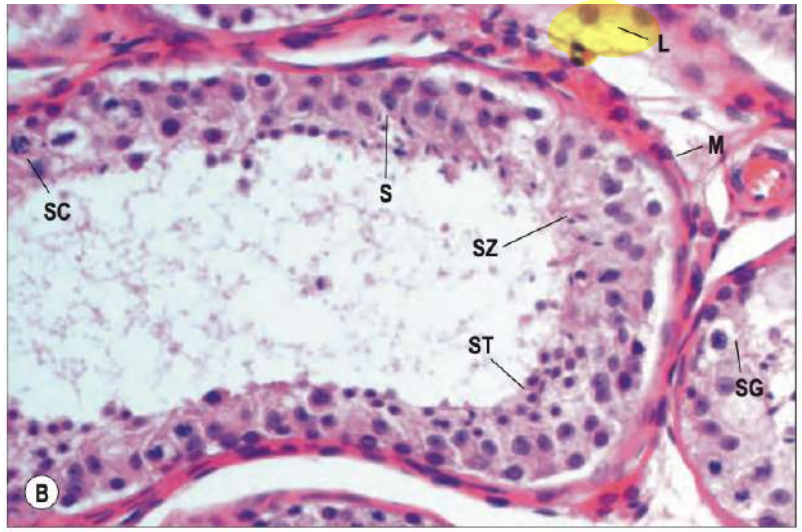
ACTH

R → sex ct





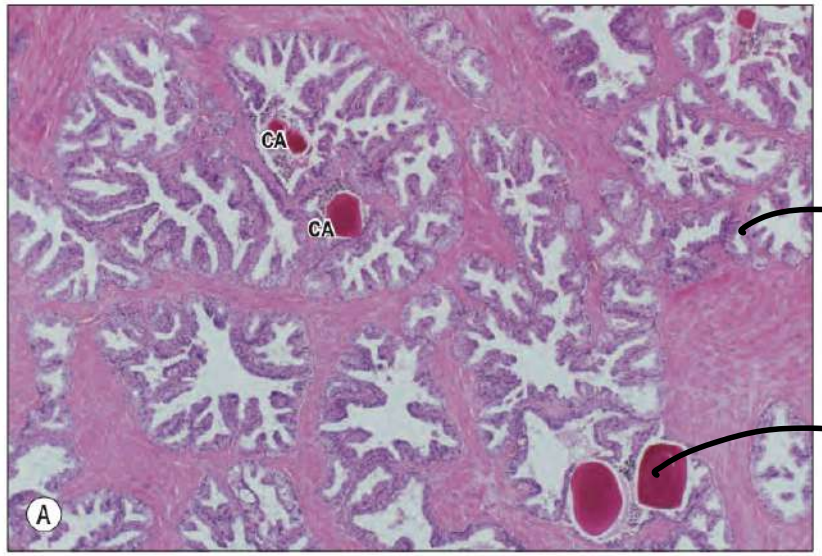
PP ileum ileal appendix



Non-spermatogenic cells are the Sertoli cells. **B**, A human seminiferous tubule showing the differentiation sequence of spermatozoa from basally situated spermatogonia (SG). Large primary spermatocytes (SC) have characteristic thread-like chromatin in various stages of prophase of the first meiotic division. Smaller haploid spermatids (ST) have round nuclei initially, but mature to possess the dense, elongated nuclei and flagella of spermatozoa (SZ). Sertoli cells (S) are identified from their oval or pear-shaped nuclei, orientated perpendicular to the basal lamina, and from their prominent nucleoli. The tubule is surrounded by peritubular myoid cells (M). Clusters of large endocrine Leydig cells (L) are seen in the interstitial connective tissue.

Mypepithelial
↓
SG
↓
1° spermatocyte
↓
Spermatids
↓
Spermatozoa

pseudostr
Columnar



prostate

CA

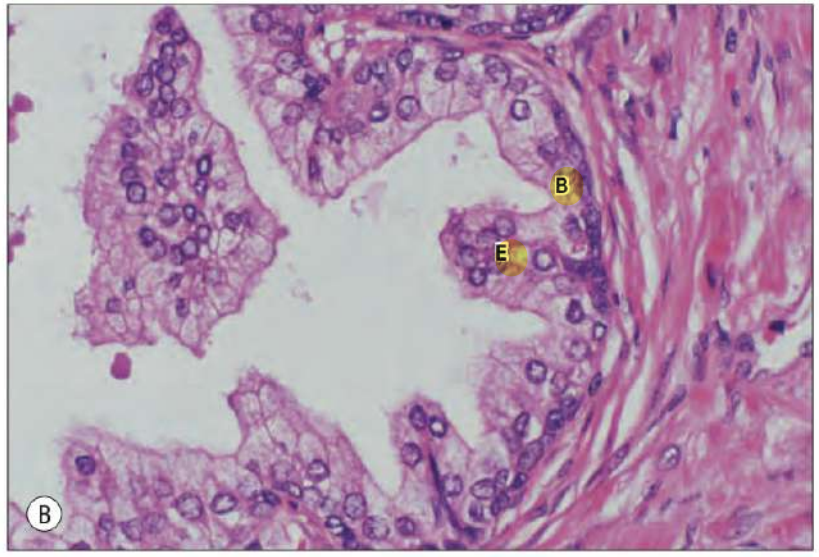
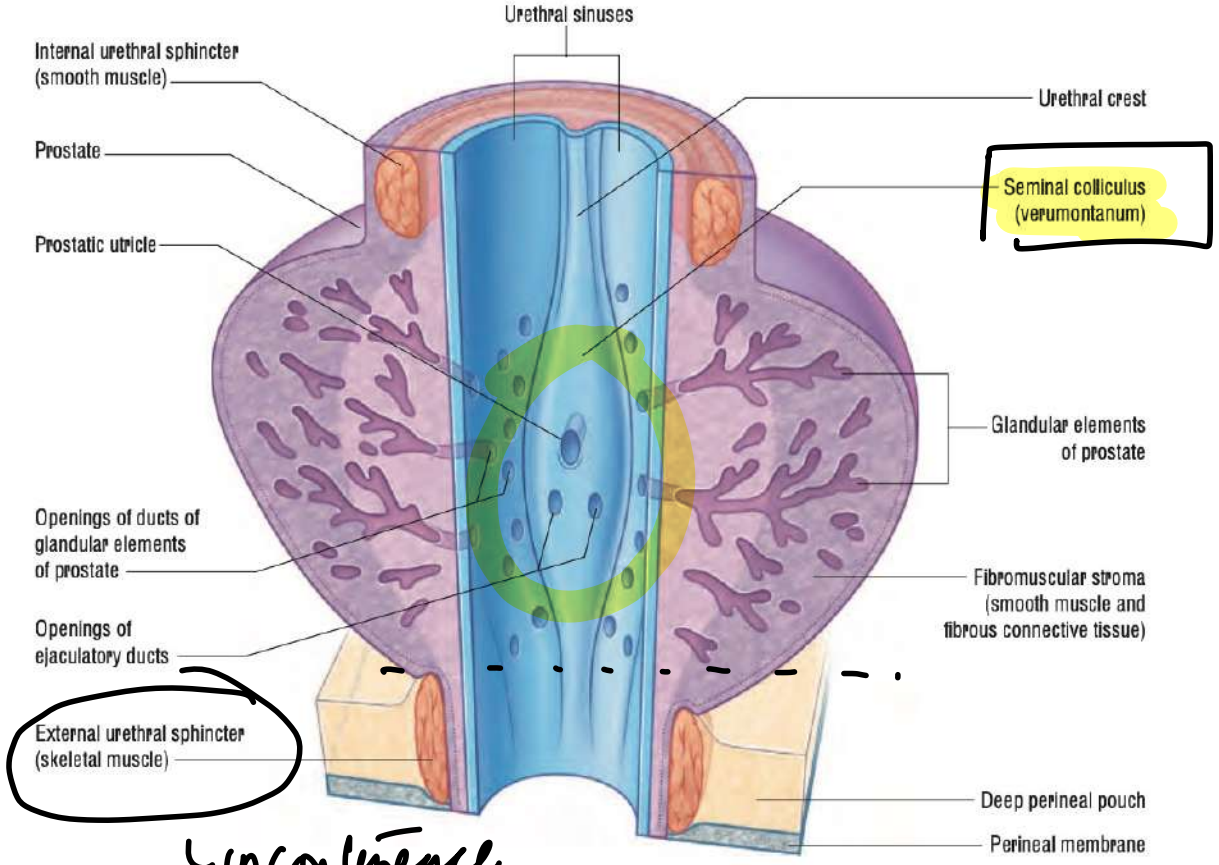


Fig. 75.23 A, Prostatic acini show papillary infoldings at the base of the gland (central zone). They are irregularly divided by fibromuscular stroma. Some acini contain eosinophilic (pink) secretions called corpora amylacea (CA) (×10, haematoxylin and eosin stain). **B**, Prostatic acini consist of a double layer of epithelial cells (E), which line the lumen, and basal cells (B), which give rise to epithelial cells.



Incontinence

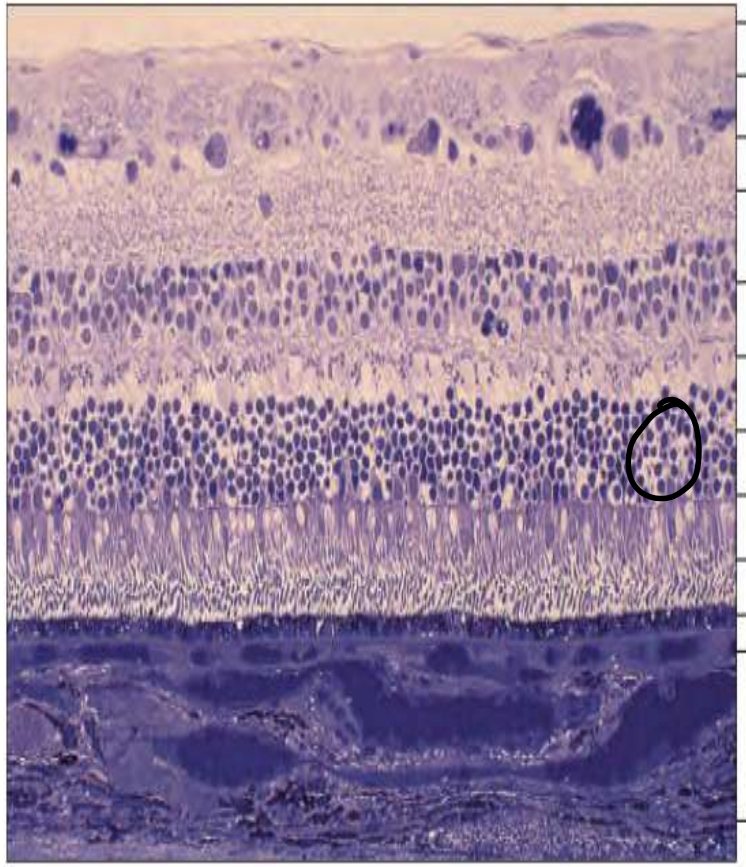
distal limit

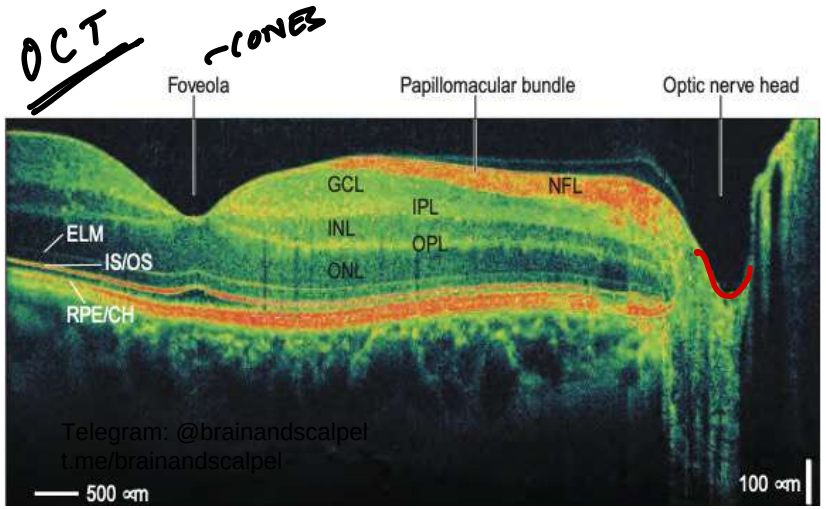
The verumontanum is important for reproduction because it contains the ejaculatory ducts, which are essential for eliminating semen.

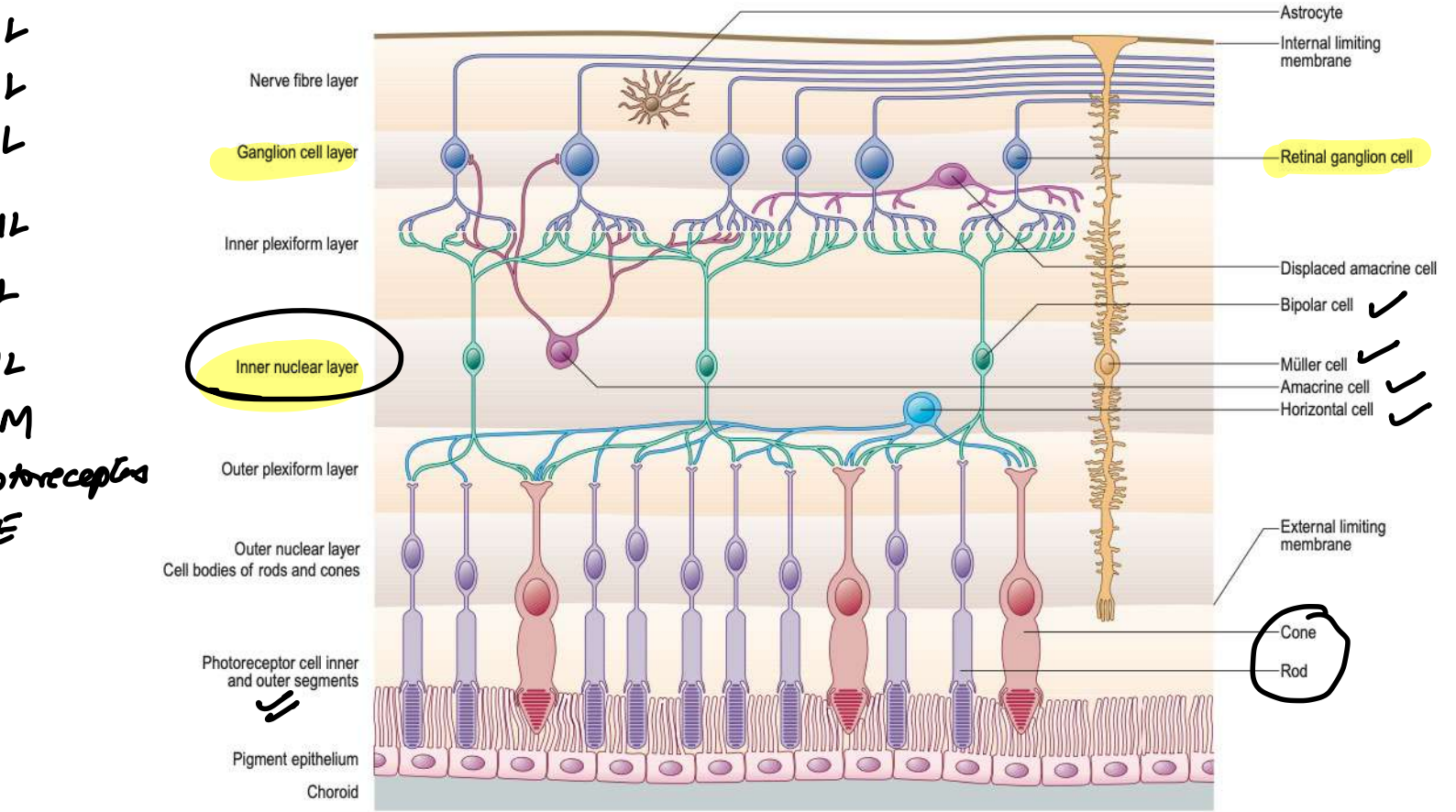
Urologists use the verumontanum as a landmark during transurethral resection of the prostate (TURP) to locate the urethral sphincter.

TURP

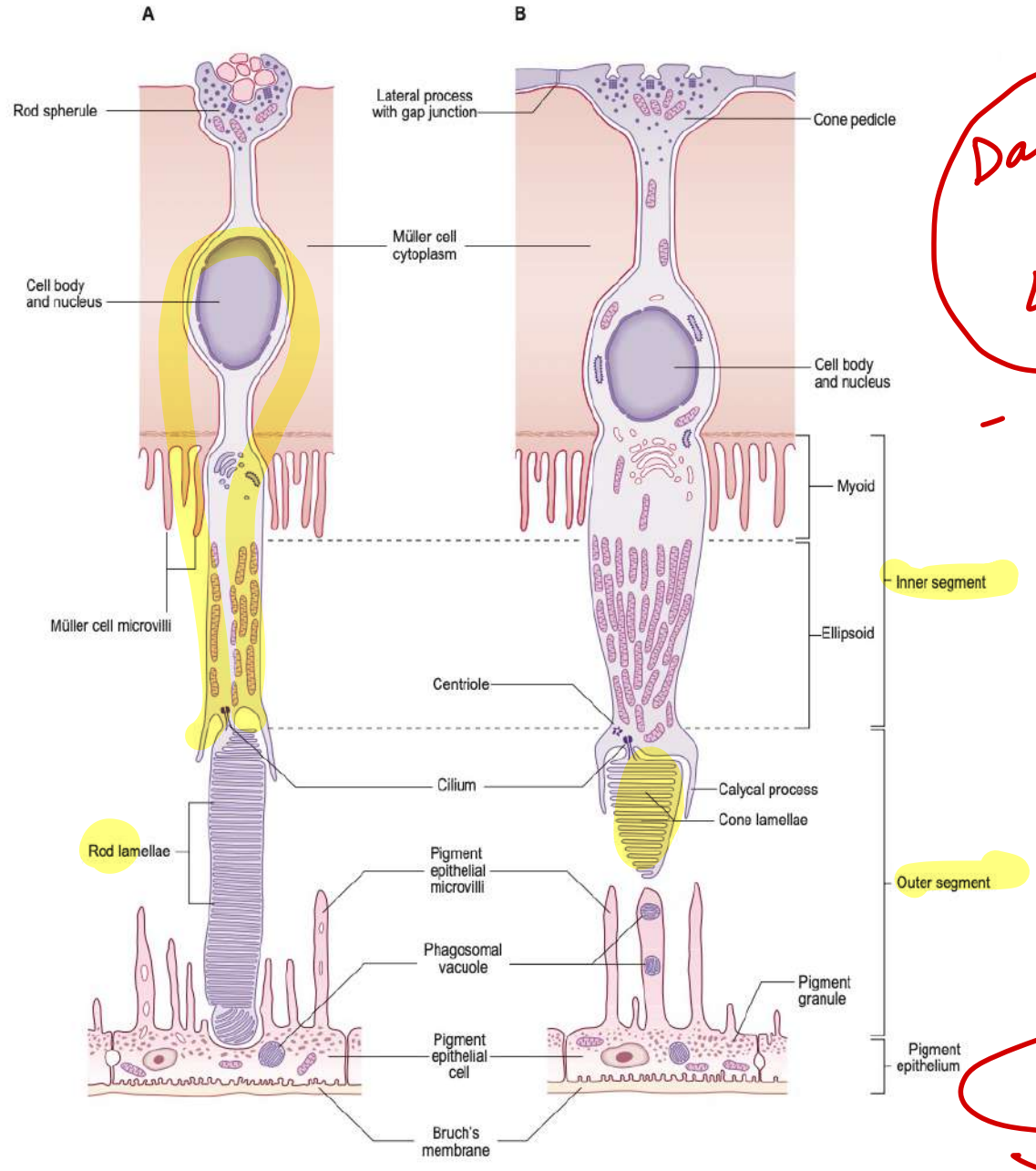
mc s/e → Retrograde ejacul°


10 ILM
9 NFL
8 GCL
7 IPL
6 INL
5 OPL
4 ONL
3 ELM
2 Photoreceptors
1 RPE
CC
SC


OCT
Cones
Foveola
Papillomacular bundle
Optic nerve head
GCL
INL
ONL
IPL
OPL
NFL
ELM
IS/OS
RPE/CH
Telegram: @brainandscalpel
t.me/brainandscalpel
500 μm
100 μm

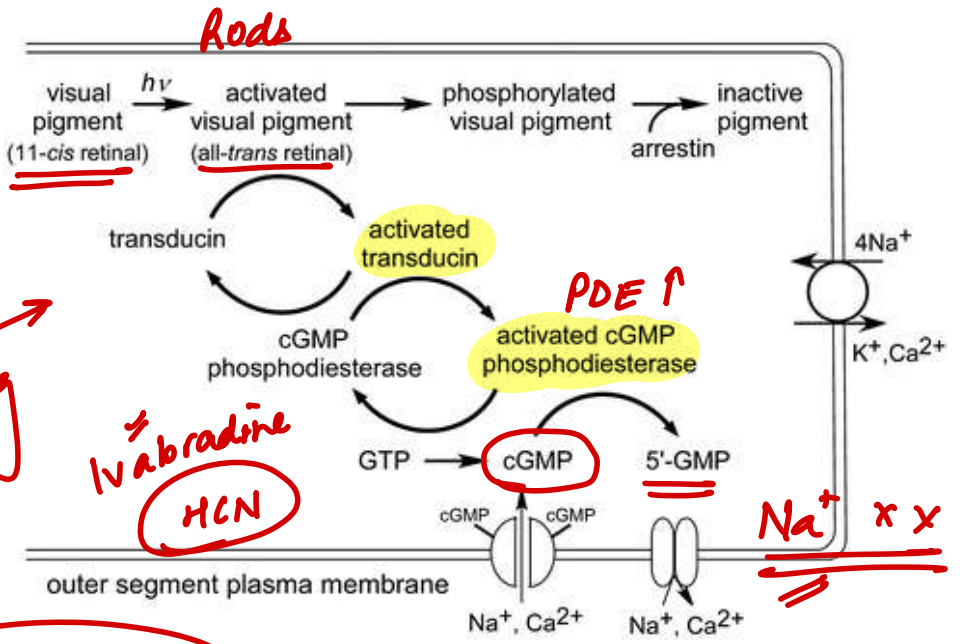

Nerve fibre layer
Ganglion cell layer
Inner plexiform layer
Inner nuclear layer
Outer plexiform layer
Outer nuclear layer
Cell bodies of rods and cones
Photoreceptor cell inner and outer segments
Pigment epithelium
Choroid
Astrocyte
Internal limiting membrane
Retinal ganglion cell
Displaced amacrine cell
Bipolar cell
Müller cell
Amacrine cell
Horizontal cell
External limiting membrane
Cone
Rod


↑↑no.
Cones → ↑↑VA
Rods



Dark → Light

- FLASH
- Bleaching
- Miosis



Hyperpolarisation -> Glutamate release decreases

Rod ↓

Light → dark - mydriasis

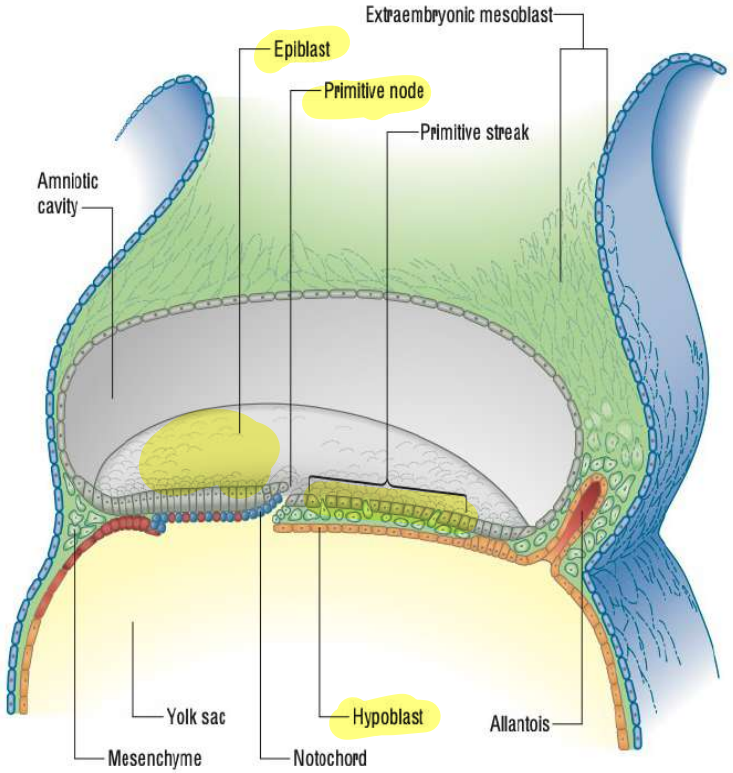


Fig. 10.1 A longitudinal section through an early conceptus. Ingression of mesoblast is occurring at the primitive streak and the notochord is ingressing via the primitive (Hensen's) node.

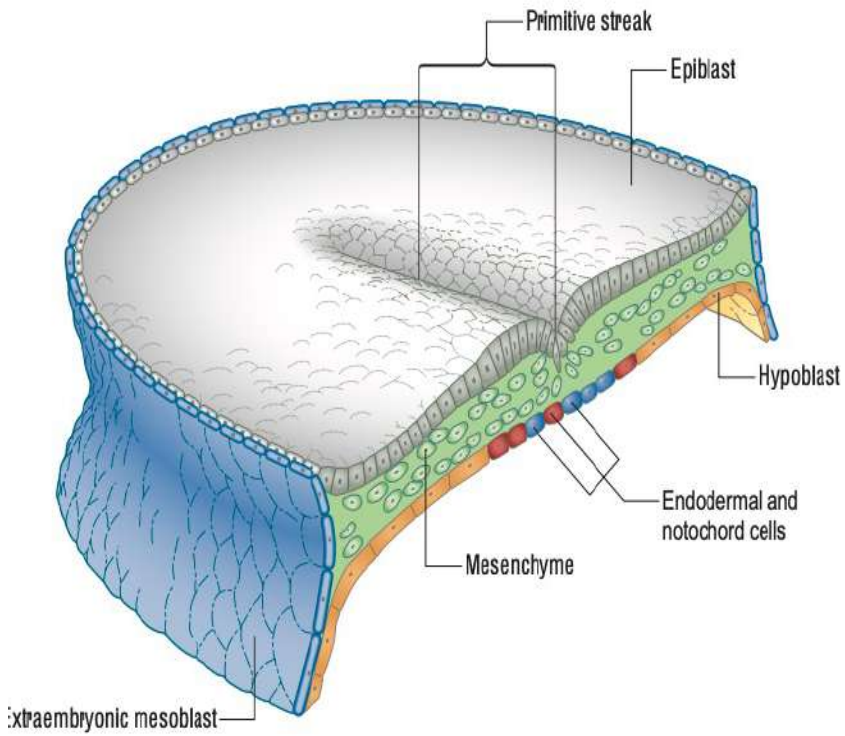
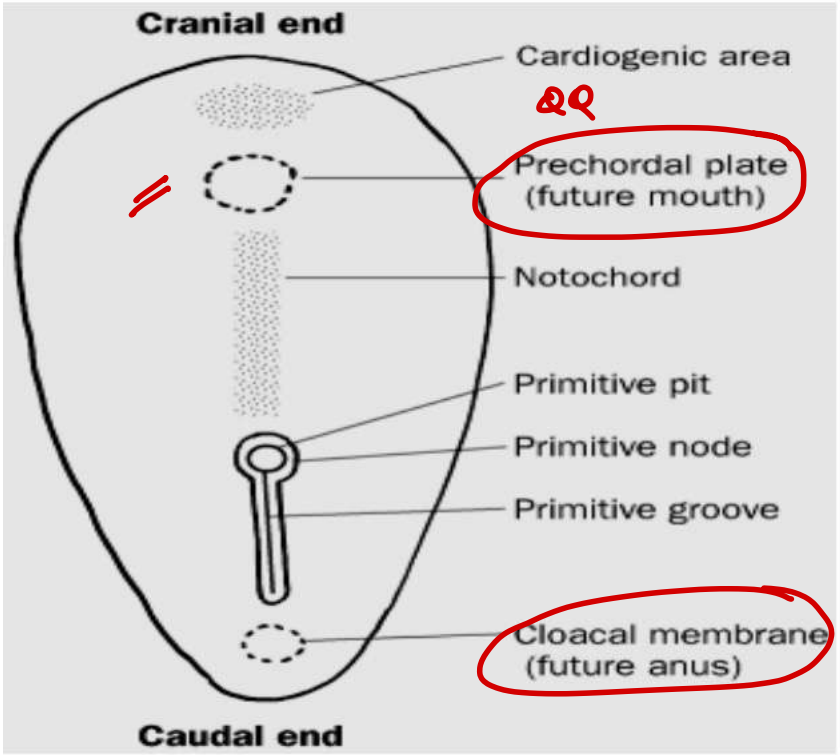


Fig. 10.2 A transverse section through the embryonic plate at the level of he primitive streak to show the early movement of mesoblast between he epiblast and underlying hypoblast.

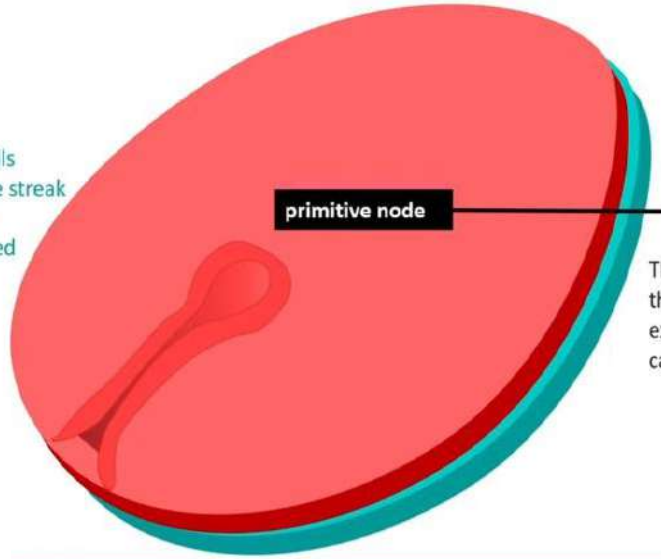


The primitive streak is first seen in the caudal region of the embryonic disc at this stage as a collection of pluripotent cells, orientated along its long axis in the median position, conferring the future craniocaudal axis of the embryo

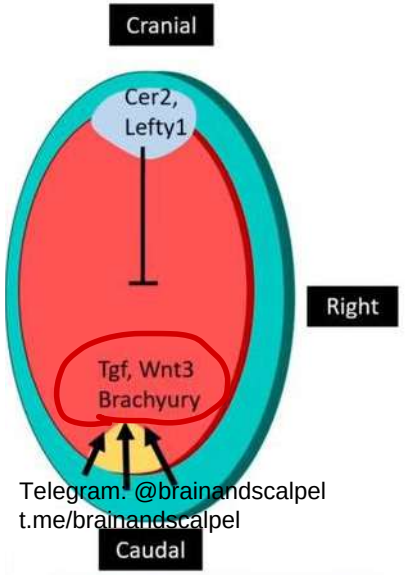
The primitive node, or Hensen's node, is the most rostral region of the primitive streak. Cells ingressing from the ridge pass into the primitive pit (the most rostral part of the primitive groove), and then migrate rostrally beneath the epiblast.

Formation of the primitive streak defines all major **body axes**

The movement of cells through the primitive streak and into the interior of the embryo is called **ingression.**

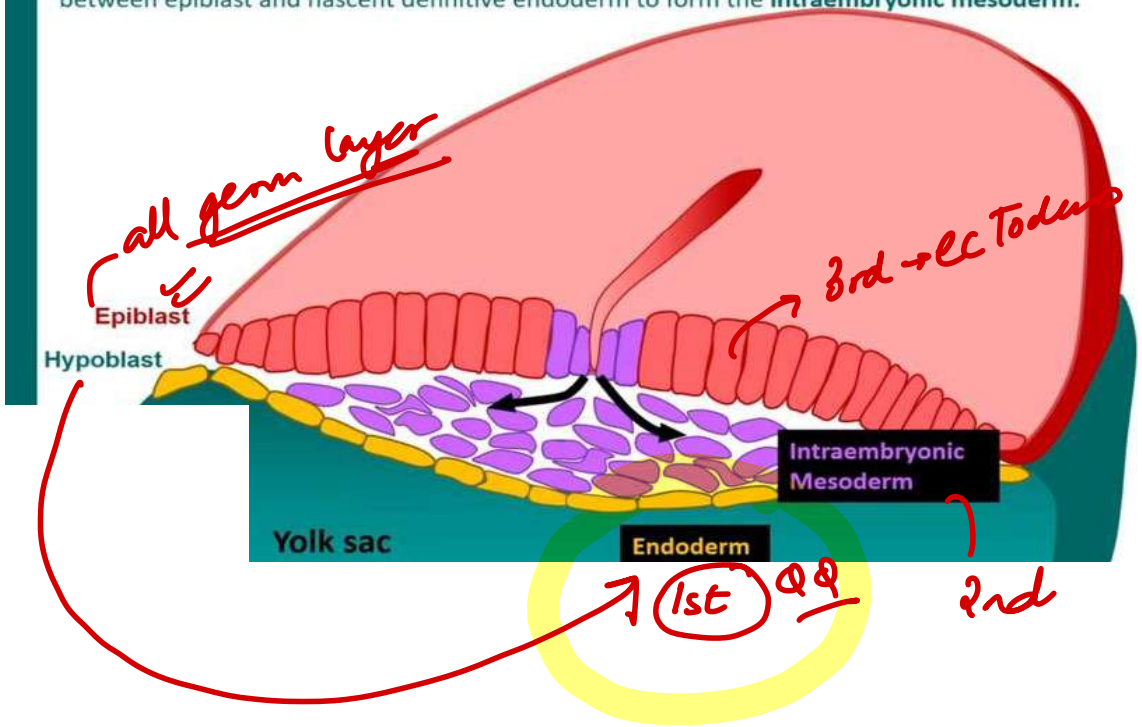


The cranial end of the primitive streak is expanded into a structure called the **primitive node.**



FORMATION OF INTRAEMBRYONIC MESODERM

Some epiblast cells migrating through the primitive streak diverge into the space between epiblast and nascent definitive endoderm to form the **intraembryonic mesoderm.**



E
H
→ Ecto
Meso
Endo

Epithelial to mesenchymal transition

SNAIL / TWIST ← EMT

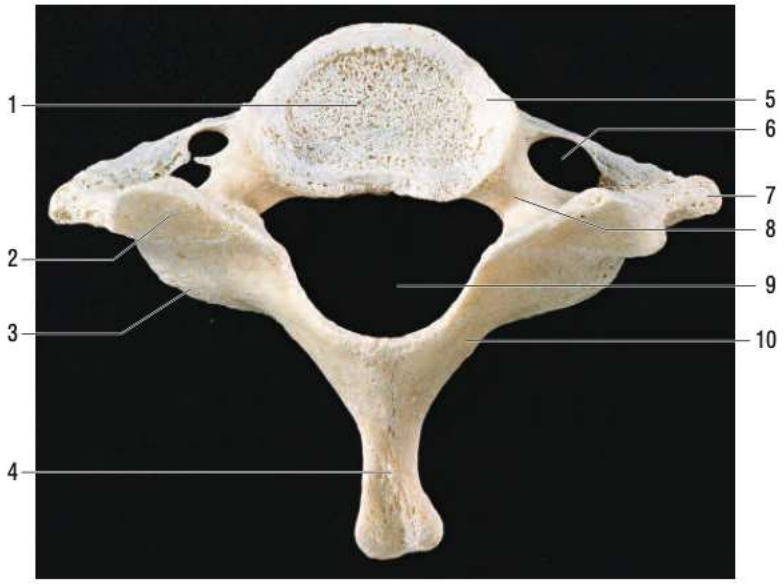


Fig. 43.40 The seventh cervical vertebra, superior aspect. Key: 1, body; 2, superior articular facet; 3, inferior articular process; 4, spinous process; 5, uncinate process; 6, foramen transversarium (foramina are asymmetrical in this specimen); 7, transverse process; 8, pedicle; 9, vertebral foramen; 10, lamina.

FT

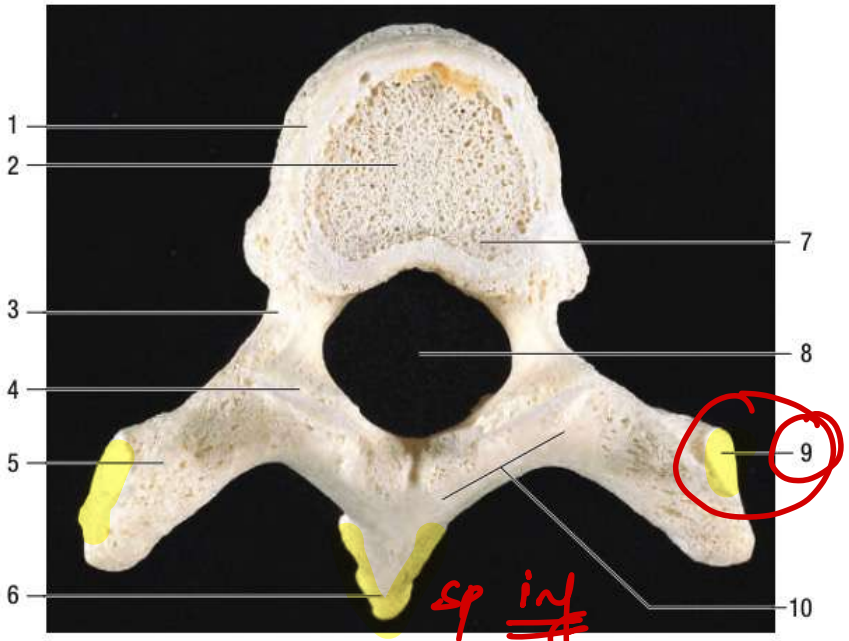


Fig. 43.22 The fourth thoracic vertebra, superior aspect. Key: 1, bone derived from anular epiphysis; 2, vertebral body – bone derived from centrum; 3, pedicle; 4, superior articular facet; 5, transverse process; 6, spinous process; 7, vertebral body – bone derived from neural arch; 8, vertebral foramen; 9, costal facet; 10, lamina.

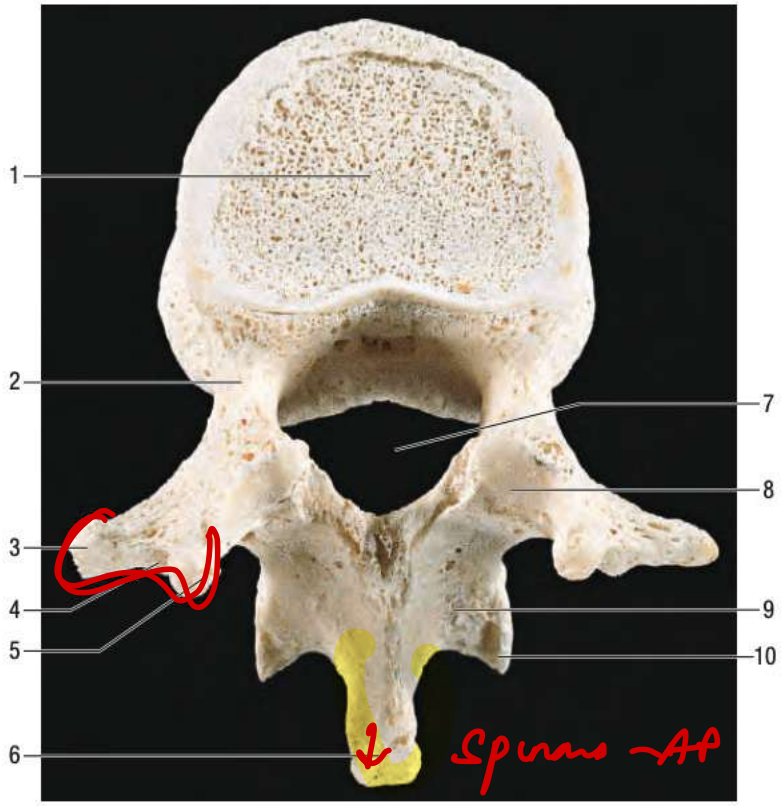


Fig. 43.43 The first lumbar vertebra, superior aspect. Key: 1, body; 2, pedicle; 3, transverse process; 4, accessory process; 5, mammillary process; 6, spinous process; 7, vertebral foramen; 8, superior articular facet; 9, lamina; 10, inferior articular facet.

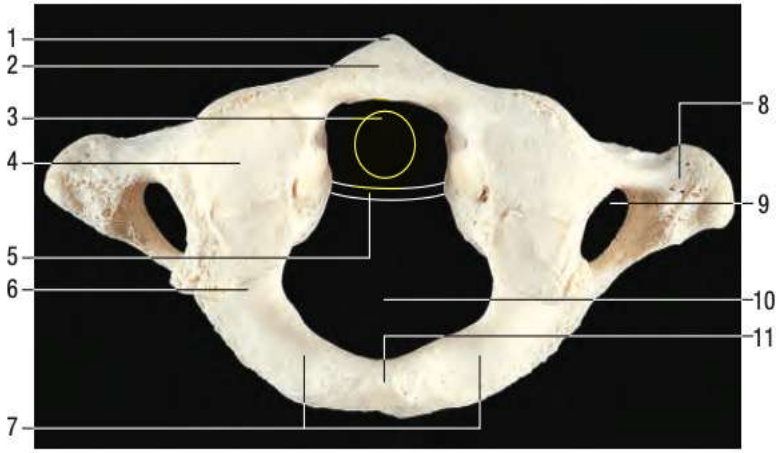


Fig. 43.32 The first cervical vertebra (atlas), superior aspect. Key: 1, anterior tubercle; 2, anterior arch; 3, outline of dens; 4, superior articular facet, on lateral mass (bipartite facet in this specimen); 5, outline of transverse ligament; 6, groove for vertebral artery and C1 (beneath bony overhang from lateral mass here); 7, posterior arch; 8, transverse process; 9, foramen transversarium; 10, vertebral foramen; 11, posterior tubercle.

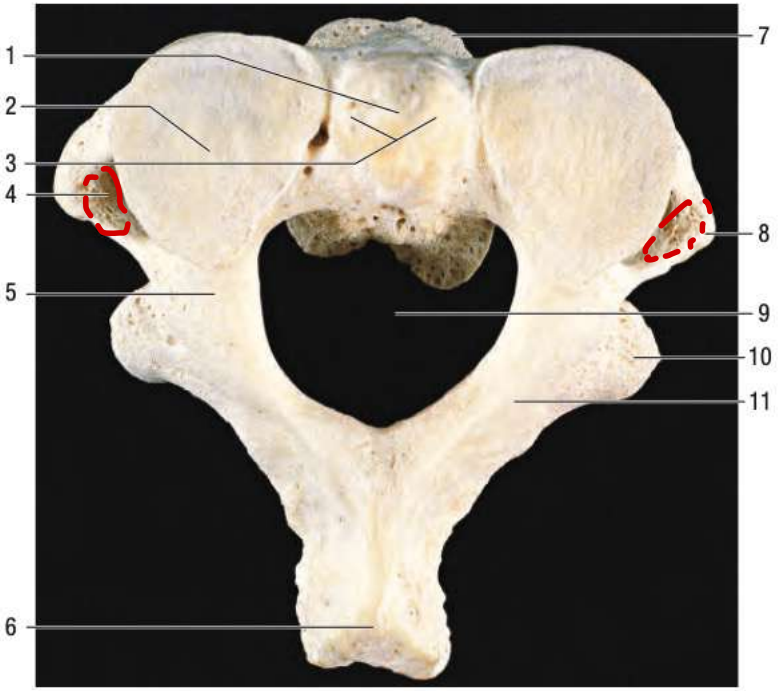


Fig. 43.36 The second cervical vertebra (axis), superior aspect. Key: 1, dens – attachment of apical ligament; 2, superior articular facet on lateral mass; 3, dens – attachments of alar ligaments; 4, foramen transversarium; 5, pedicle; 6, spinous process; 7, body; 8, transverse process; 9, vertebral foramen; 10, inferior articular process; 11, lamina.

C2

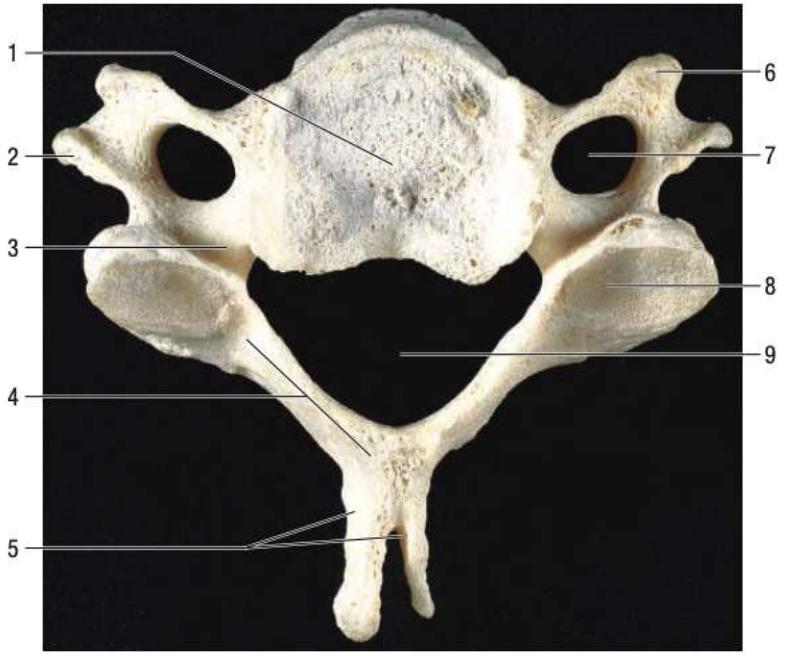
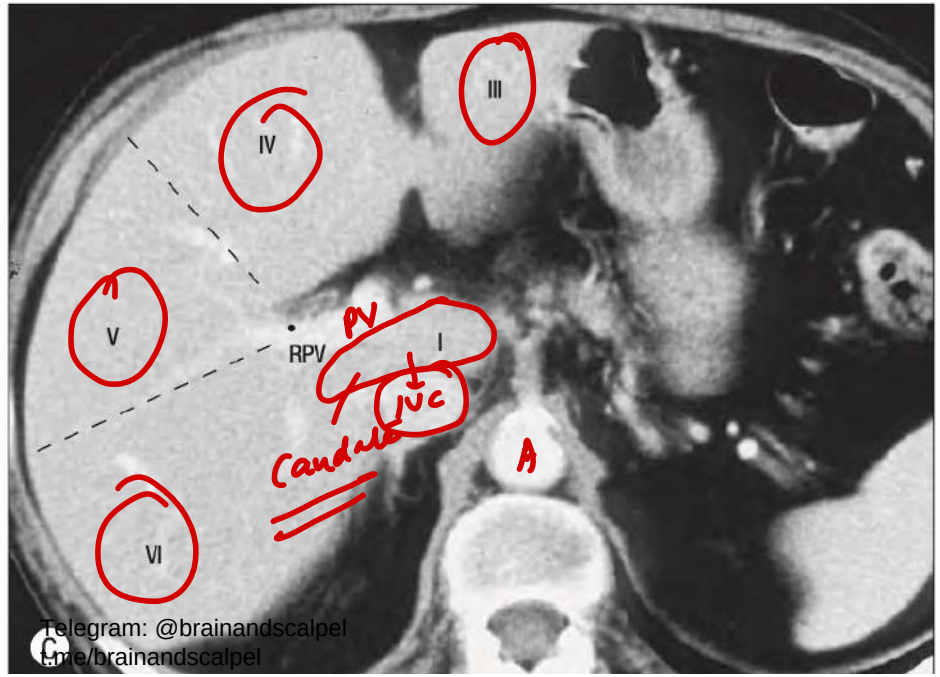
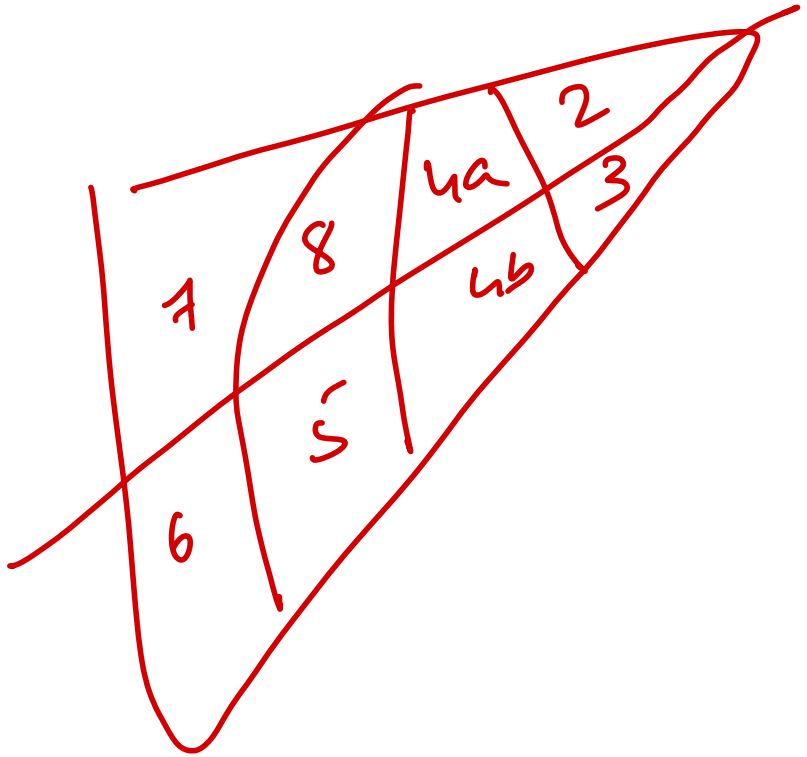
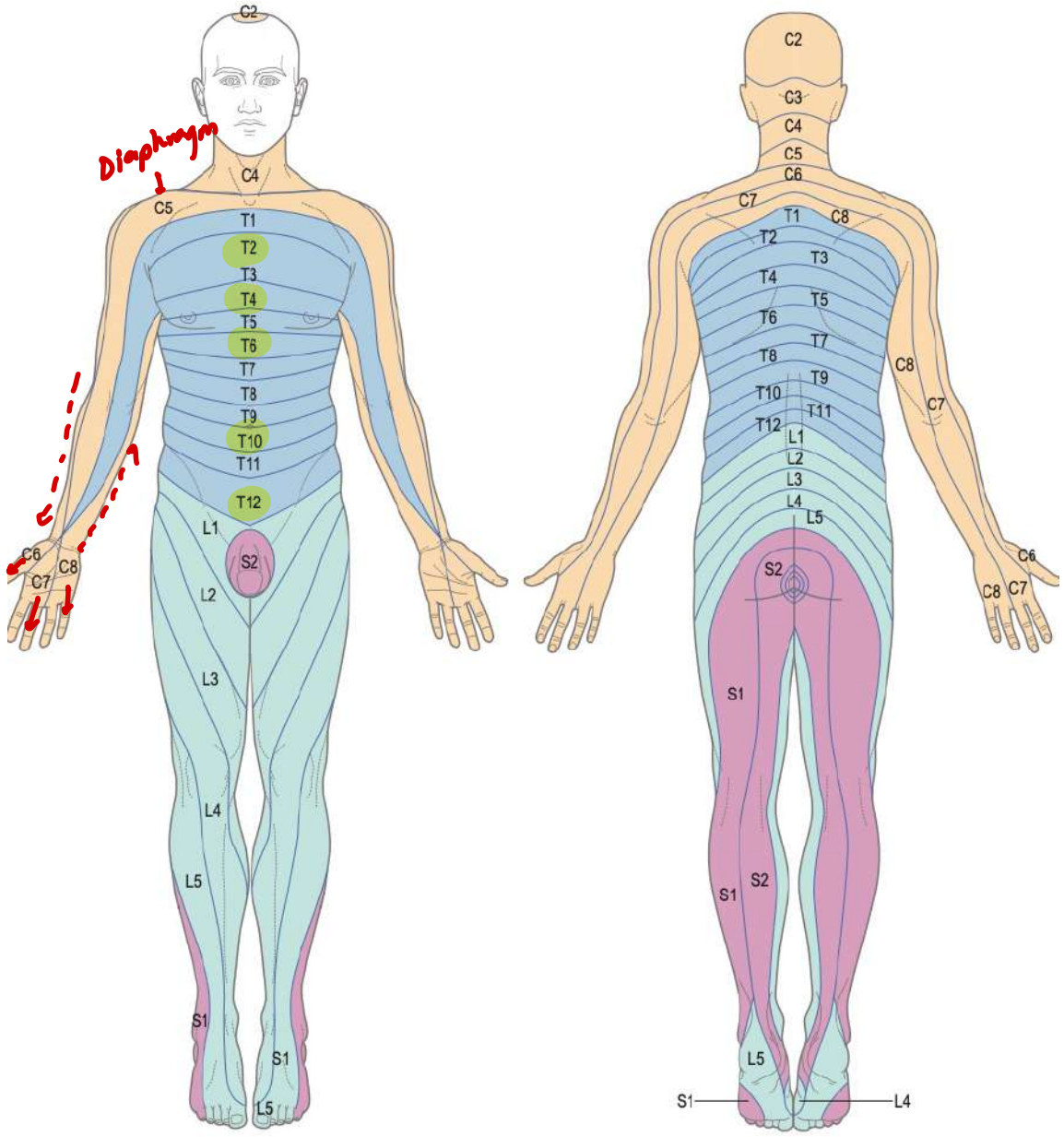


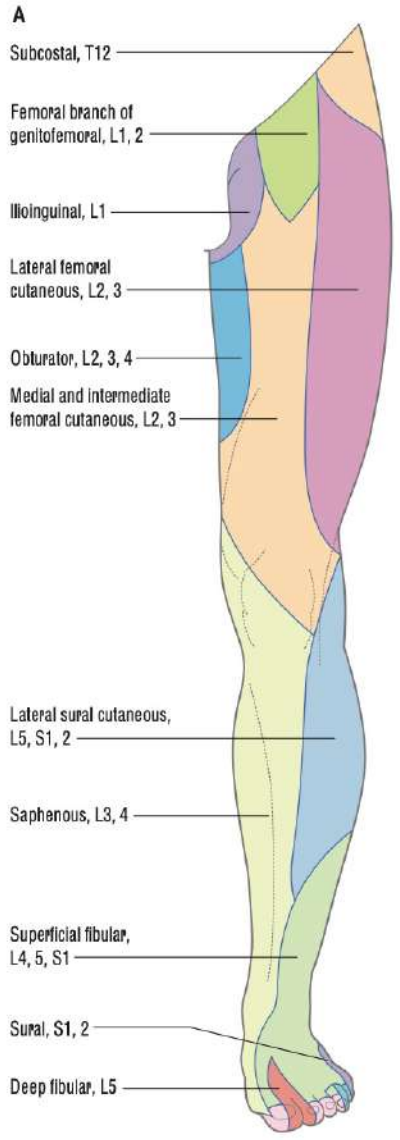
Fig. 43.29 The fourth cervical vertebra, superior aspect. Key: 1, body; 2, posterior tubercle of transverse process; 3, pedicle; 4, lamina; 5, bifid spinous process; 6, anterior tubercle of transverse process; 7, foramen transversarium; 8, superior articular facet; 9, vertebral foramen.

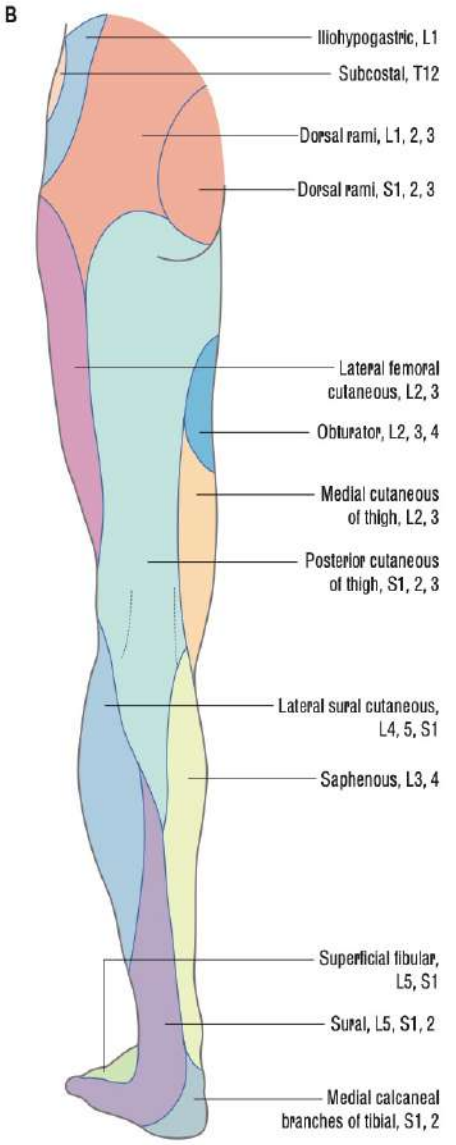
C3 - C7

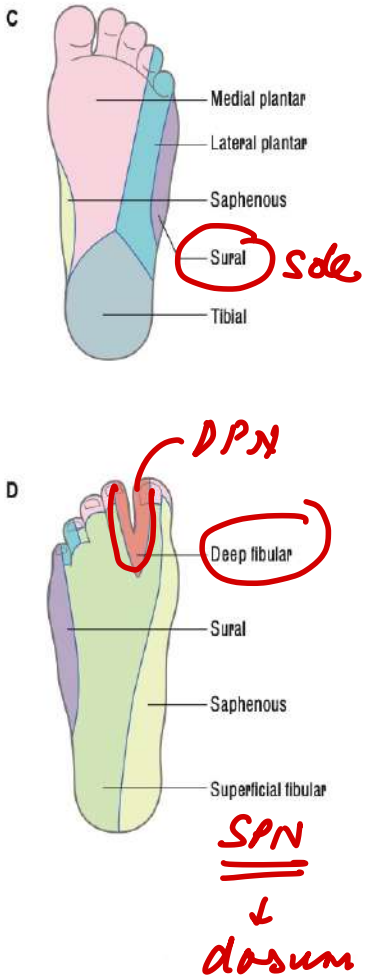


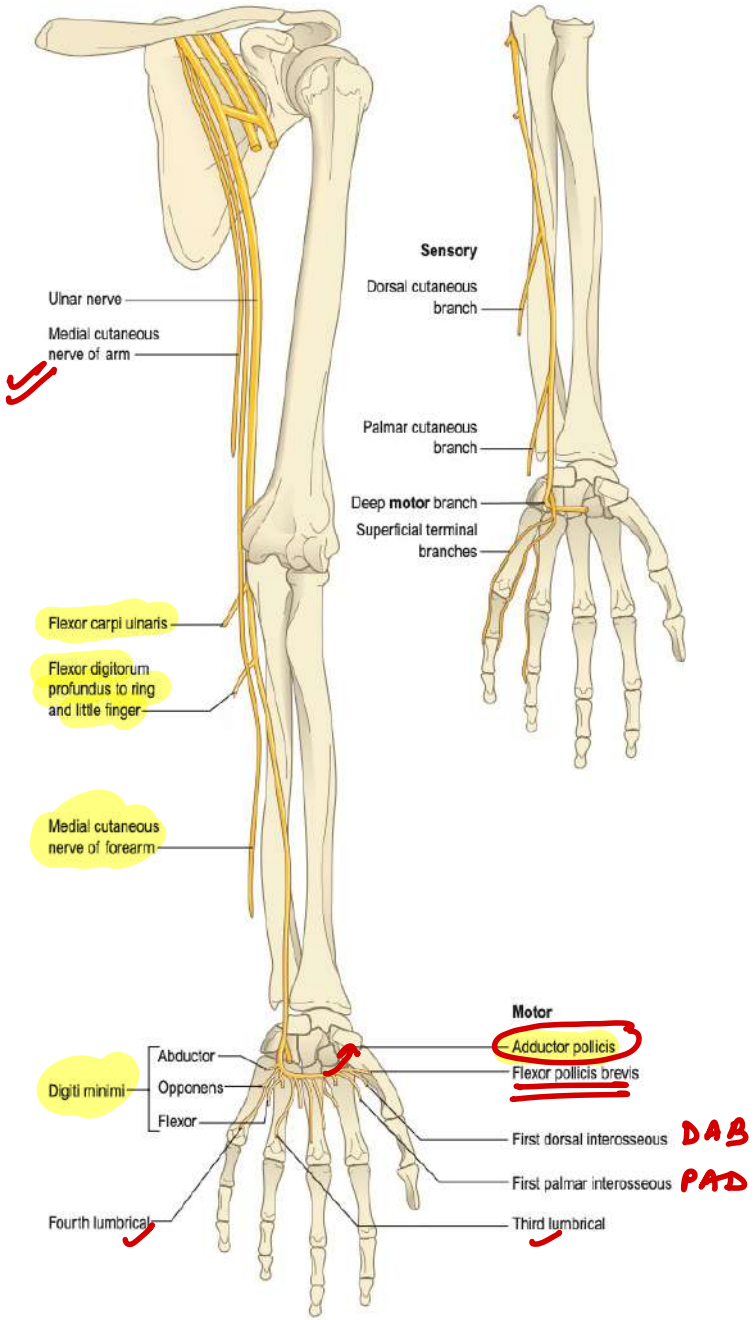


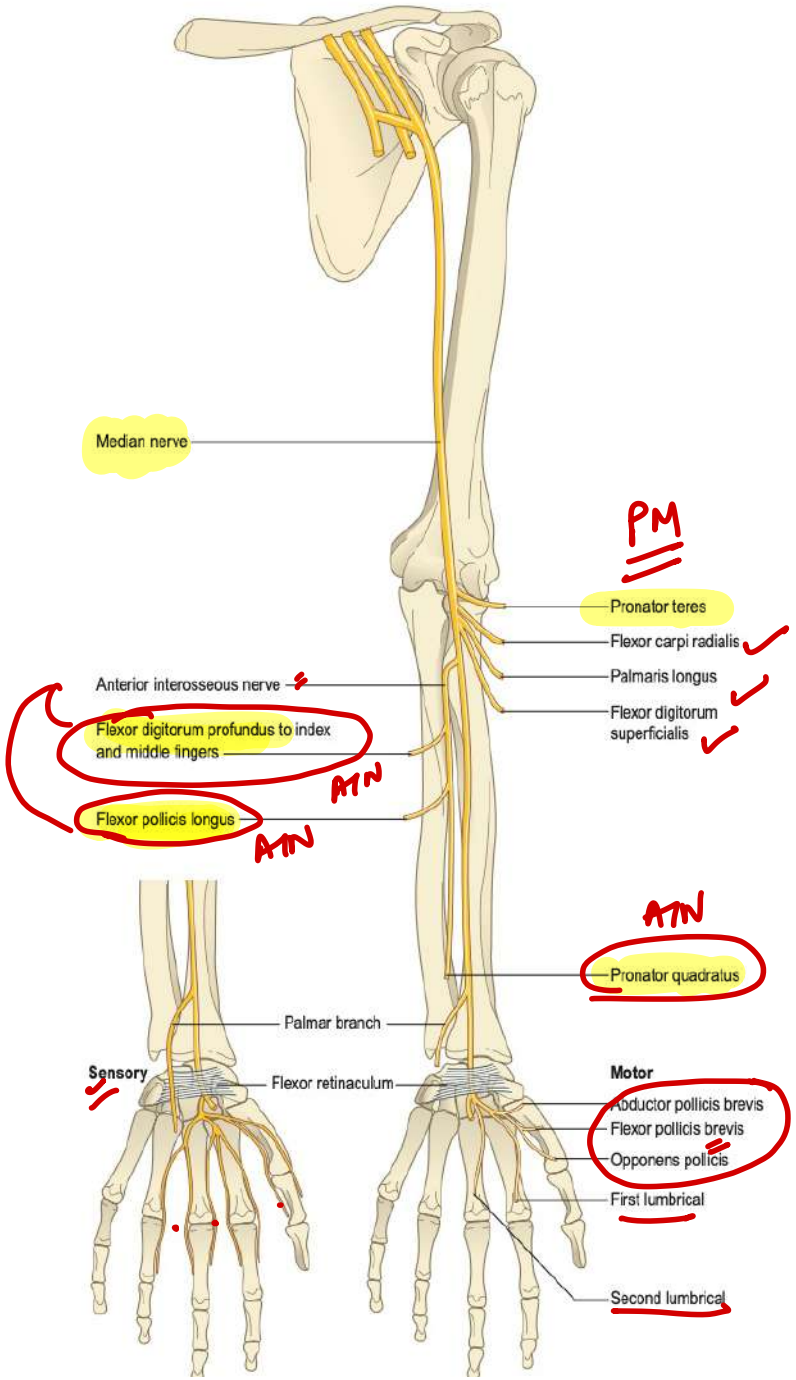












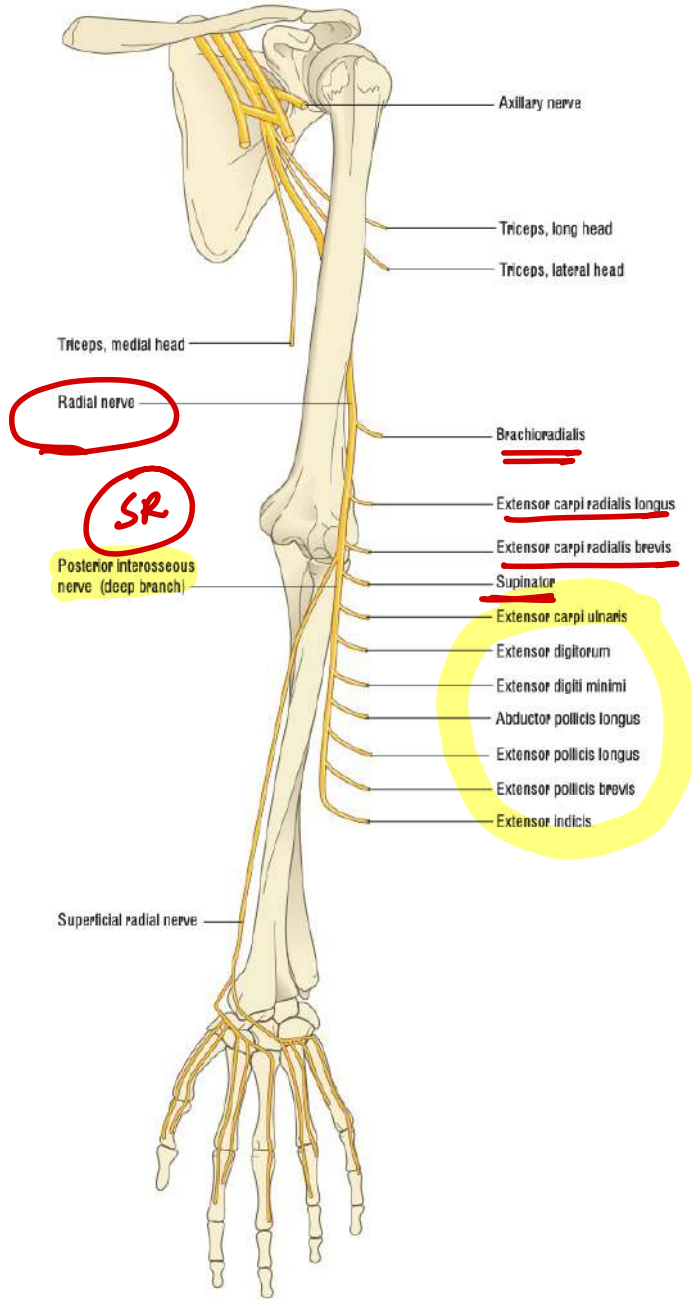
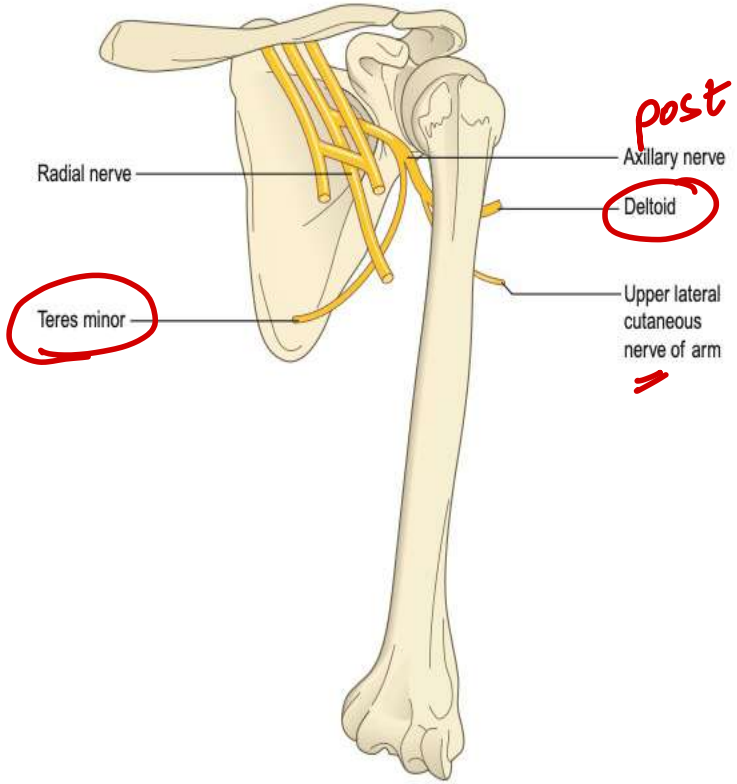
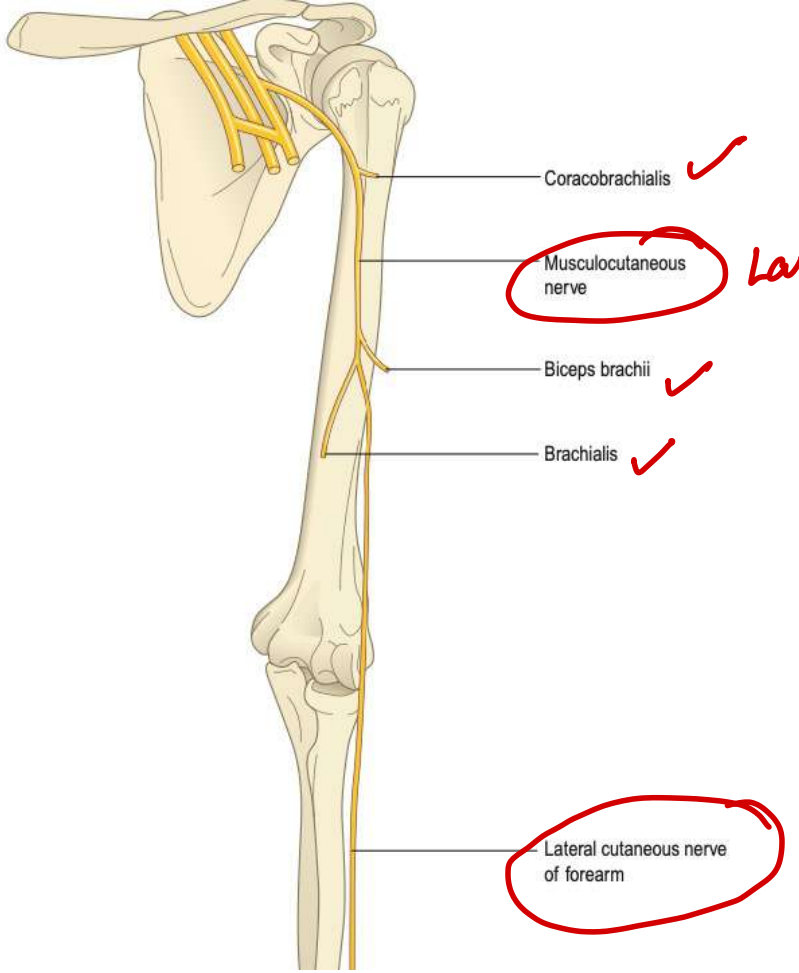


Fig. 46.8 Motor and sensory branches of the ulnar nerve and the medial cutaneous nerve of the arm and the forearm. Flexor pollicis brevis may be supplied by both median and ulnar nerves. (With permission from

Fig. 46.9 Motor and sensory branches of the radial nerve. Variation exists in the cutaneous innervation of the dorsal aspects of the digits. Here, the radial nerve is shown to supply all five digits; the skin of the dorsum of the ring and little fingers is frequently innervated by the dorsal branch of the ulnar nerve. (With permission from O'Brien M, Aids to the Examination





medial

Long thoracic N of Bell (C5/C6/C7) → Serratus ant - ROOTS

trapez

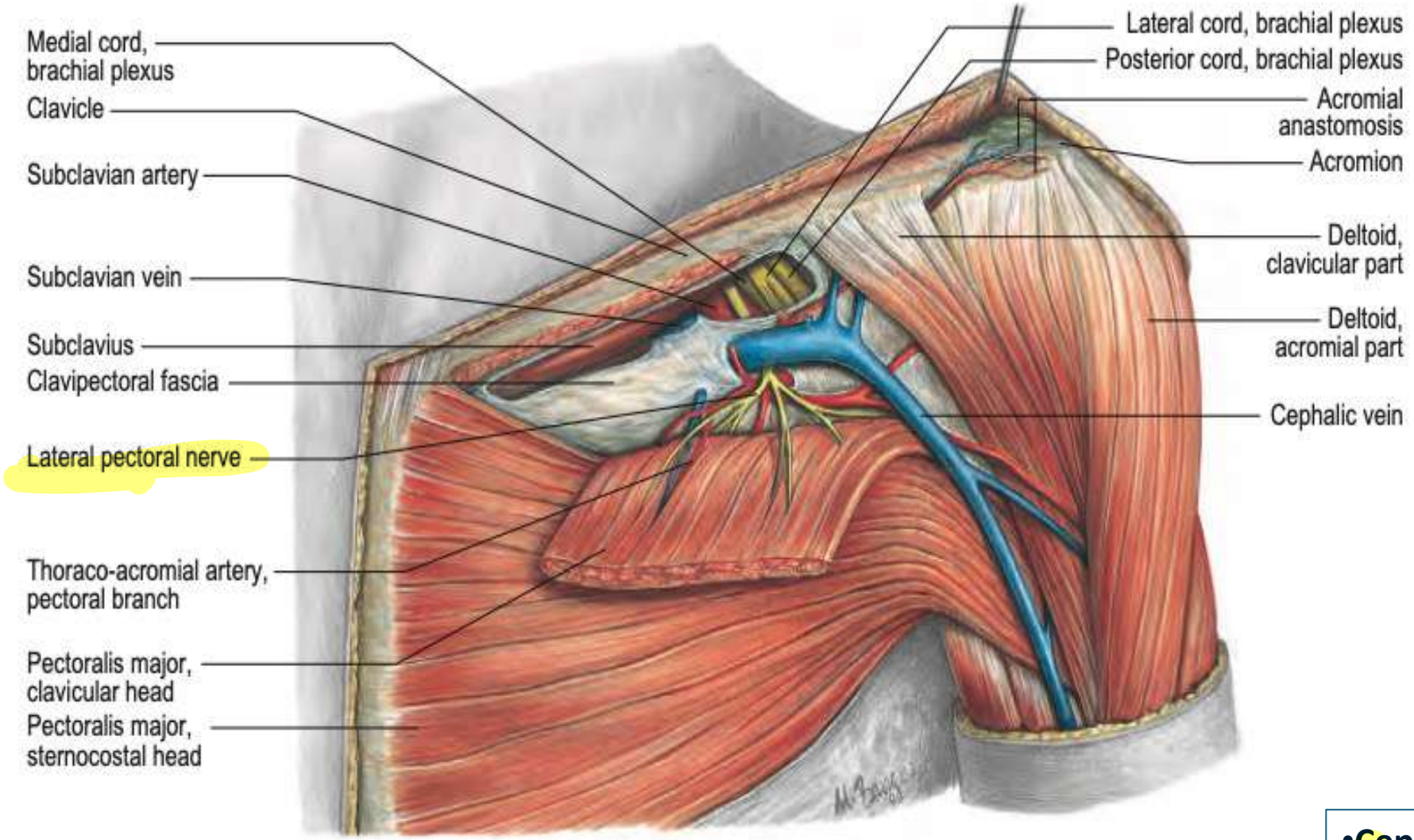
abdn

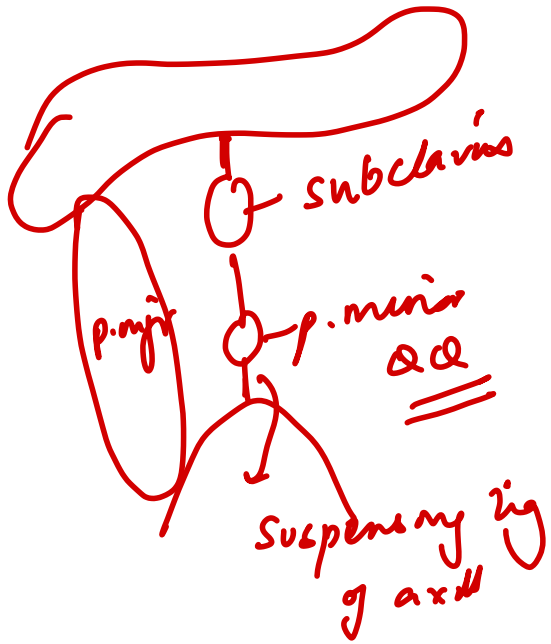
lat

Spinal acc N

QQ

Winging + Horner's syndrome : Preganglionic

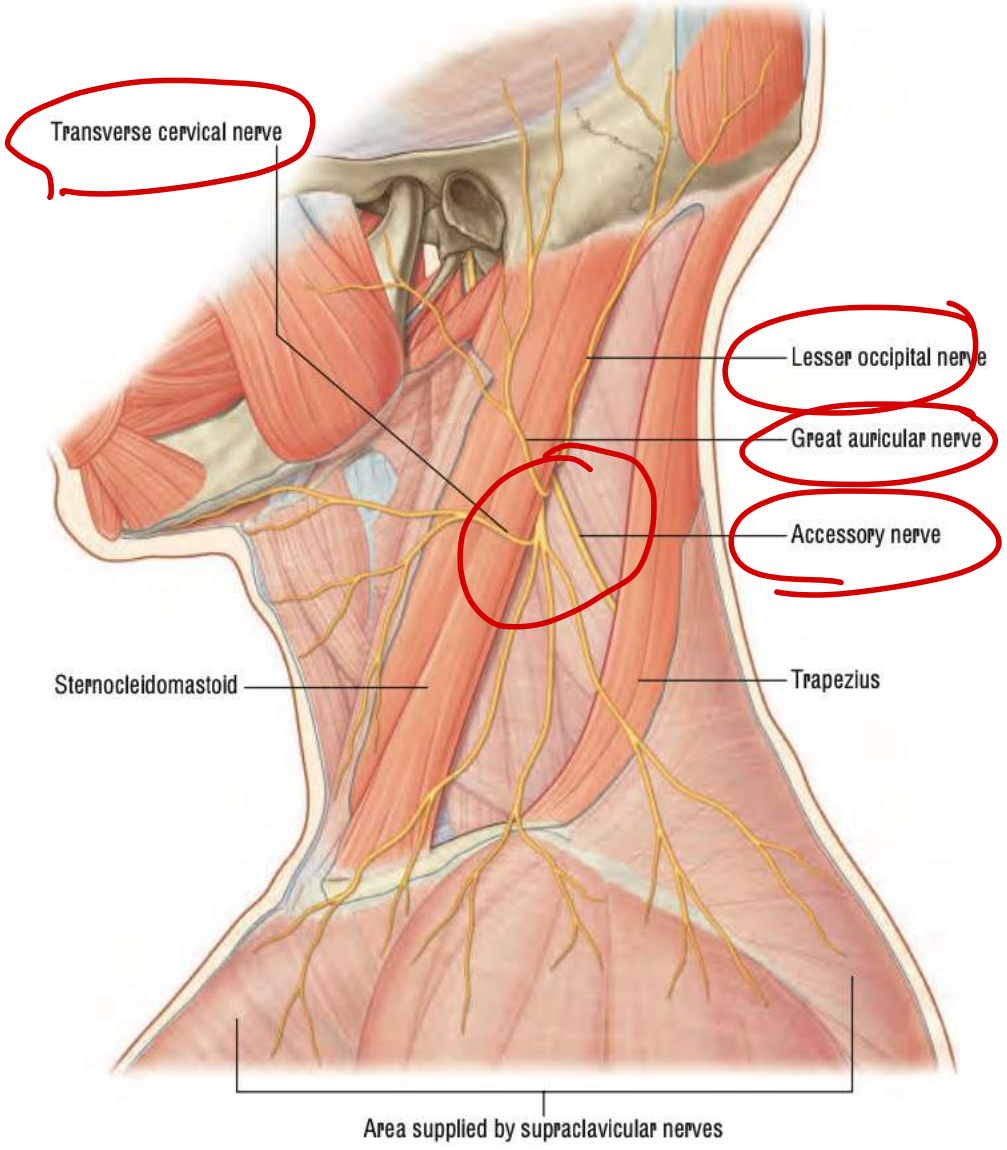




Clavipectoral fascia

Encloses subclavius and P.minor

- Cephalic vein
- Lateral pectoral nerve
- Branches of the thoracoacromial artery
- Lymphatics



- Upper trunk of brachial plexus
- About 2–3 cm above the clavicle
- Outside the posterior border of the sternocleidomastoid muscle

In front of the transverse process of the sixth cervical vertebra

ERB'S POINT

UT

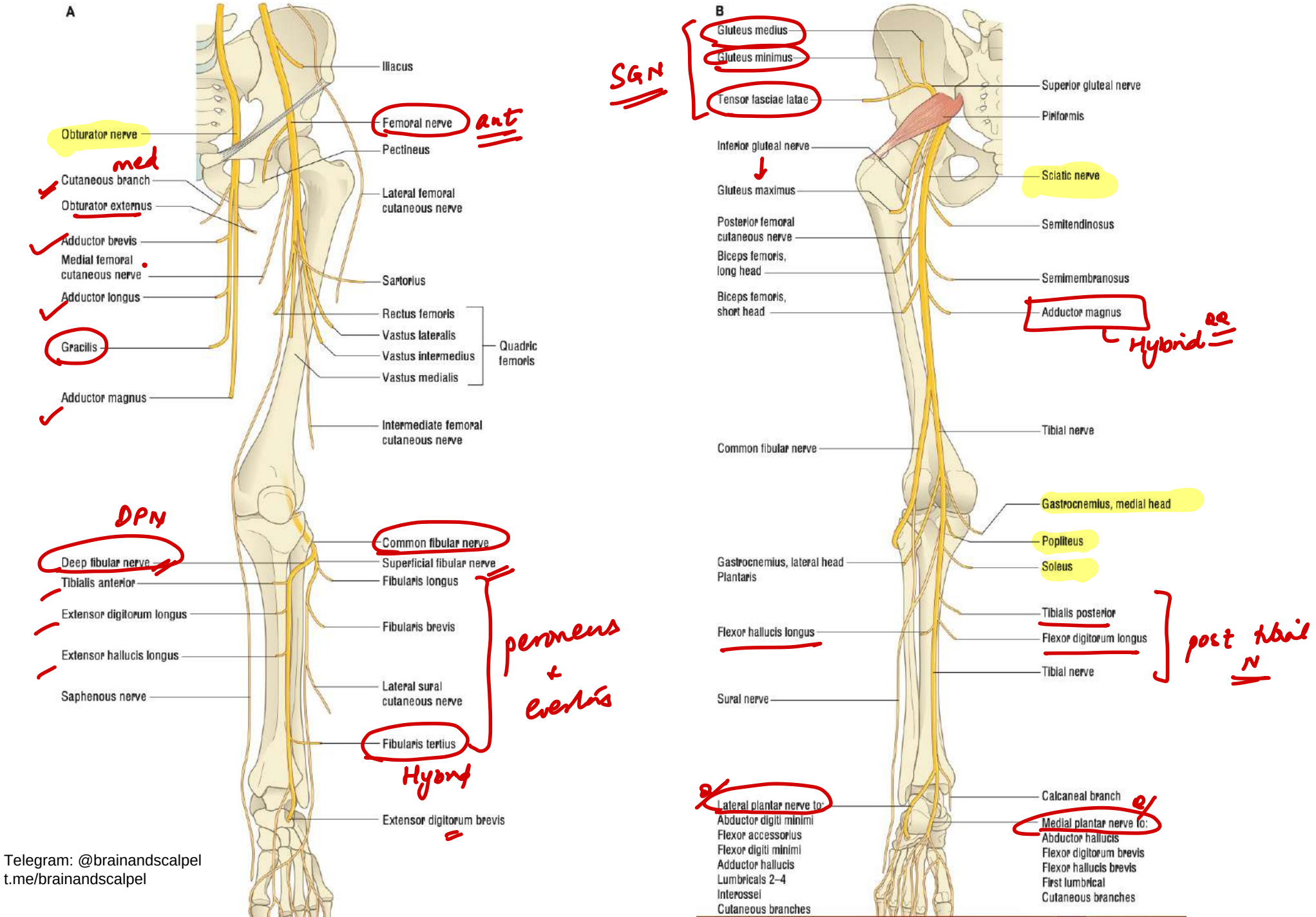
XI

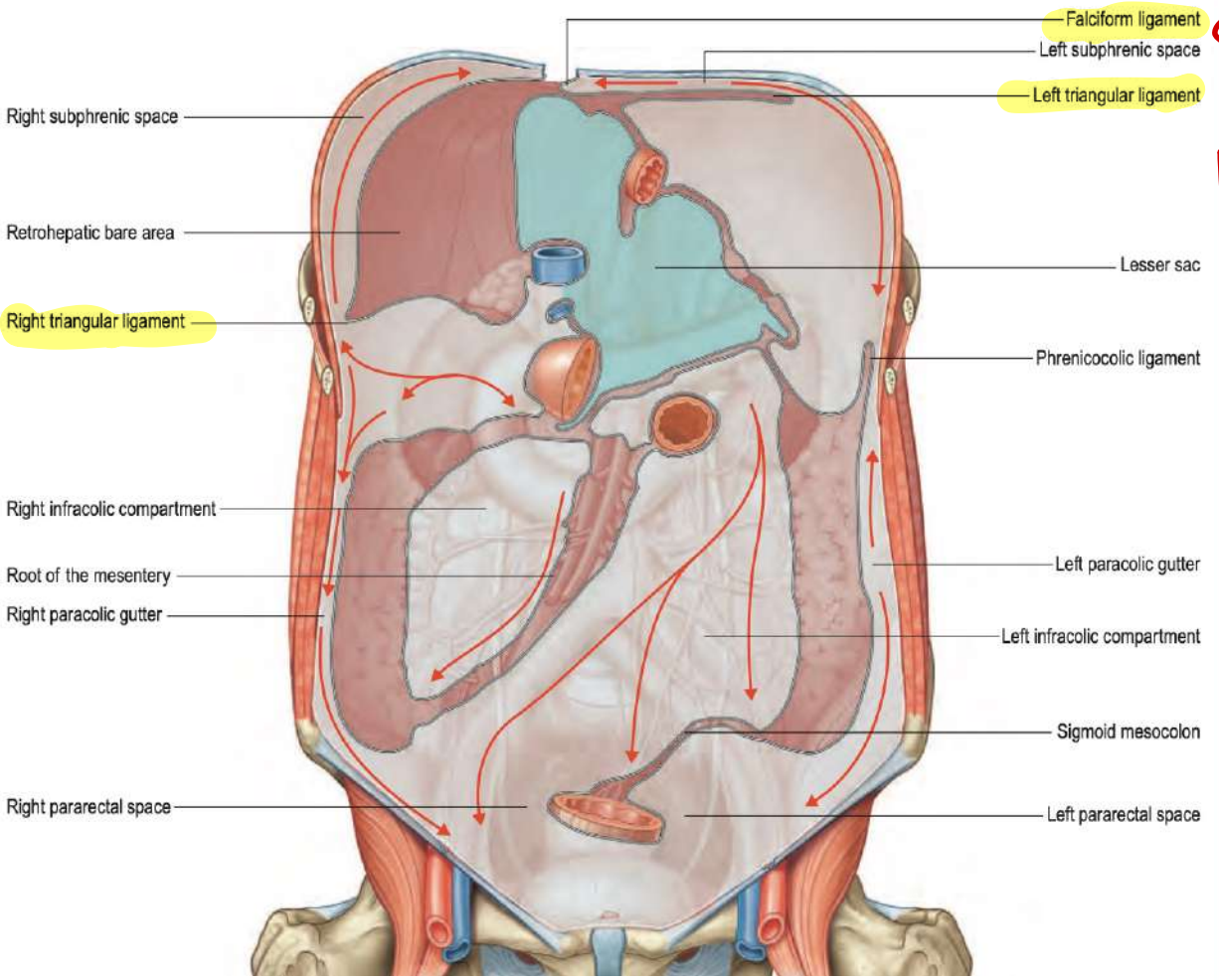
Lesser occipital

Great auricular

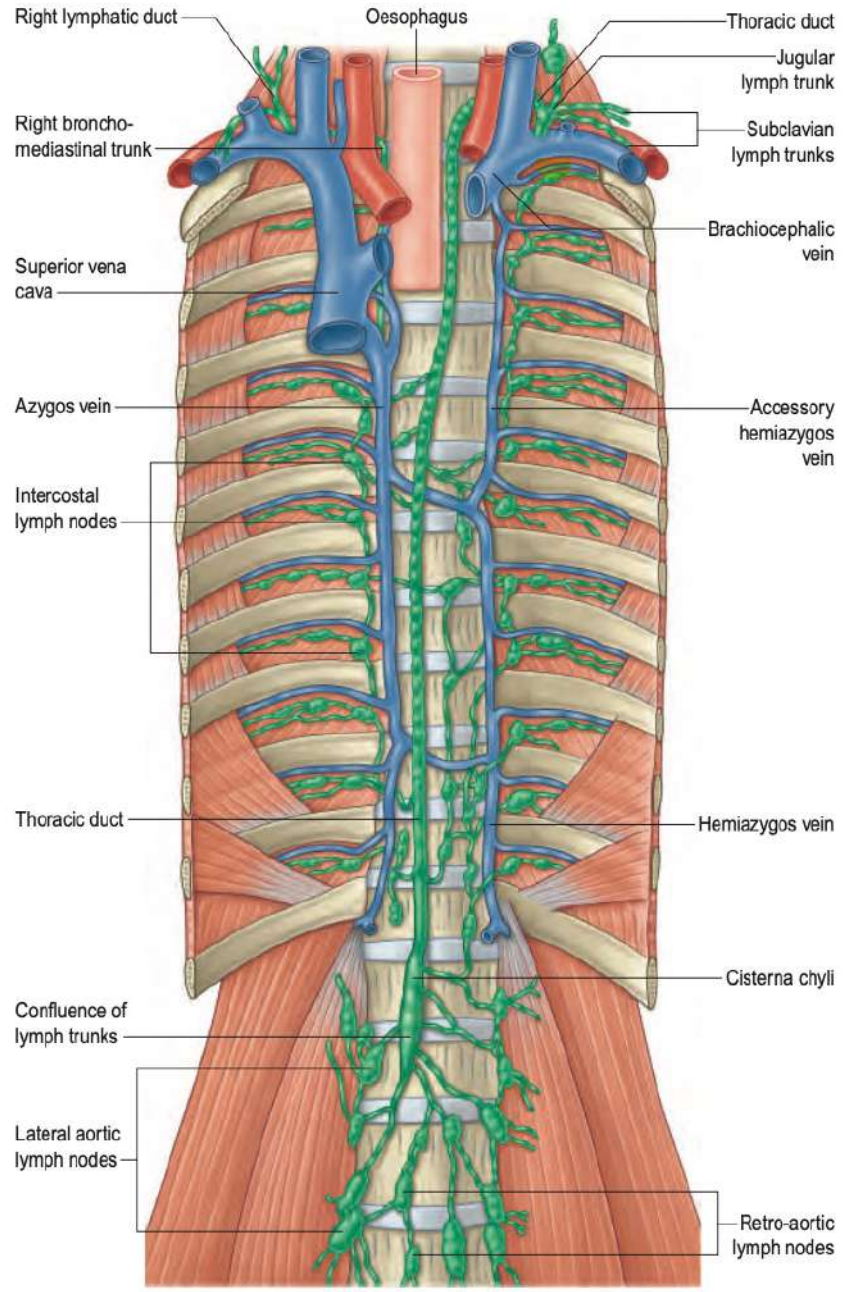
transverse cervical N

C5-C6





LIGAMENT	CONNECTS	STRUCTURES CONTAINED	NOTES
Falciform ligament	Liver to anterior abdominal wall	Ligamentum teres hepatis (derivative of fetal umbilical vein), patent paraumbilical veins	Derivative of ventral mesentery
Hepatoduodenal ligament	Liver to duodenum	Portal triad: proper hepatic artery, portal vein, common bile duct	Derivative of ventral mesentery Pringle maneuver—ligament is compressed manually or with a vascular clamp in omental foramen to control bleeding from hepatic inflow source (portal vein, hepatic artery) vs outflow (hepatic veins, IVC) Borders the omental foramen, which connects the greater and lesser sacs Part of lesser omentum
Hepatogastric ligament	Liver to lesser curvature of stomach	Gastric vessels	Derivative of ventral mesentery Separates greater and lesser sacs on the right May be cut during surgery to access lesser sac Part of lesser omentum
Gastrocolic ligament	Greater curvature and transverse colon	Gastroepiploic arteries	Derivative of dorsal mesentery Part of greater omentum
Gastrosplenic ligament	Greater curvature and spleen	Short gastrics, left gastroepiploic vessels	Derivative of dorsal mesentery Separates greater and lesser sacs on the left Part of greater omentum
Splenorenal ligament	Spleen to left pararenal space	Splenic artery and vein, tail of pancreas	Derivative of dorsal mesentery



AAT
12
Aortic

- THORACIC DUCT — Azygos
- Cisterna chyli
L1-L2

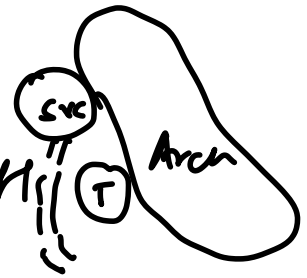
Rt Subcostal | Rt asc lumbar
Rt post ic veins
4-12th

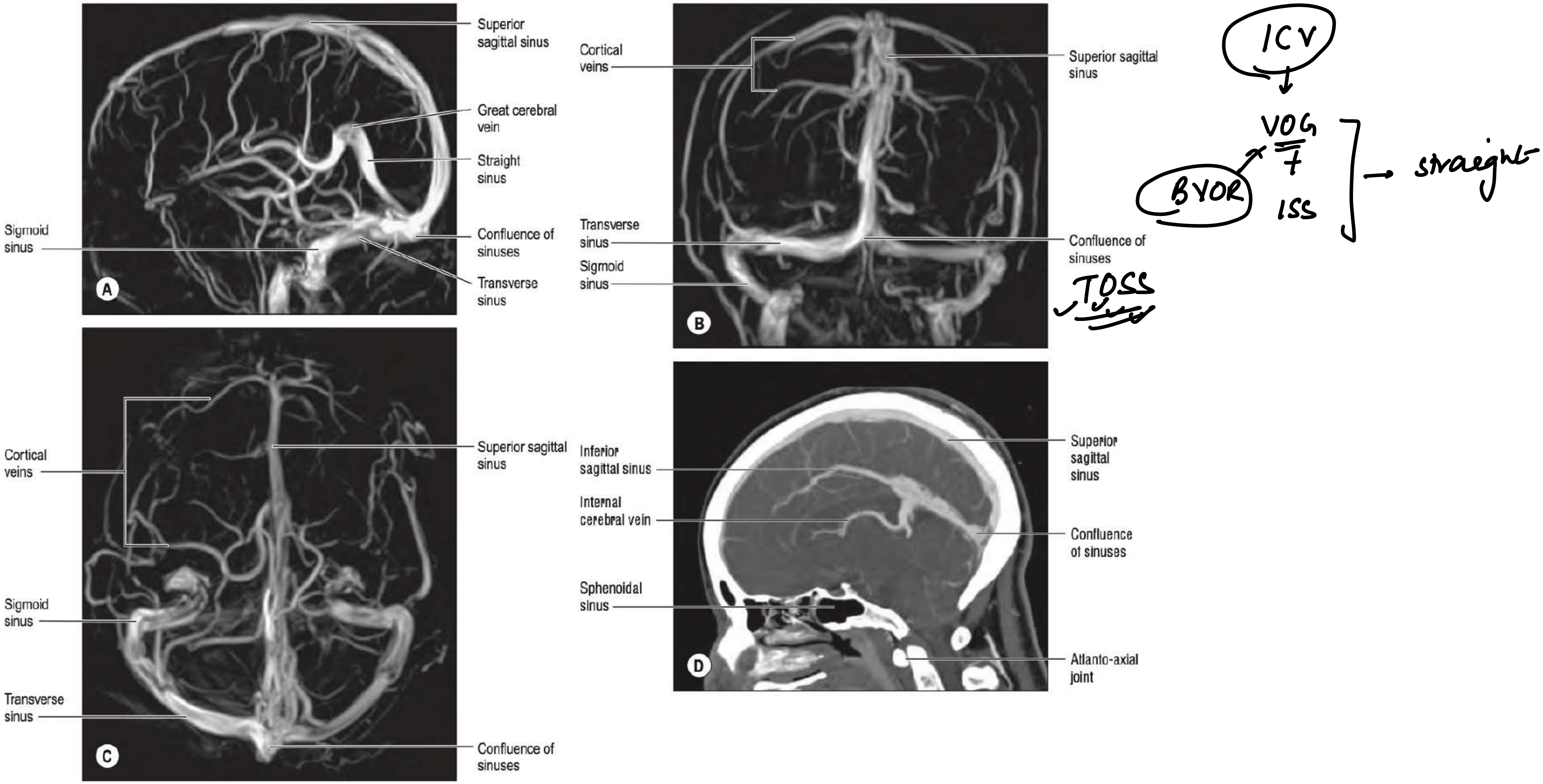
- Rt side : T5
Lt Lt
- Lt IJV — Subcl vein

T9
Hemiazygos
9-12th
Lt ic post

T8
Accessory hemiazygos
5-8th
Lt post ic

SVC at T4





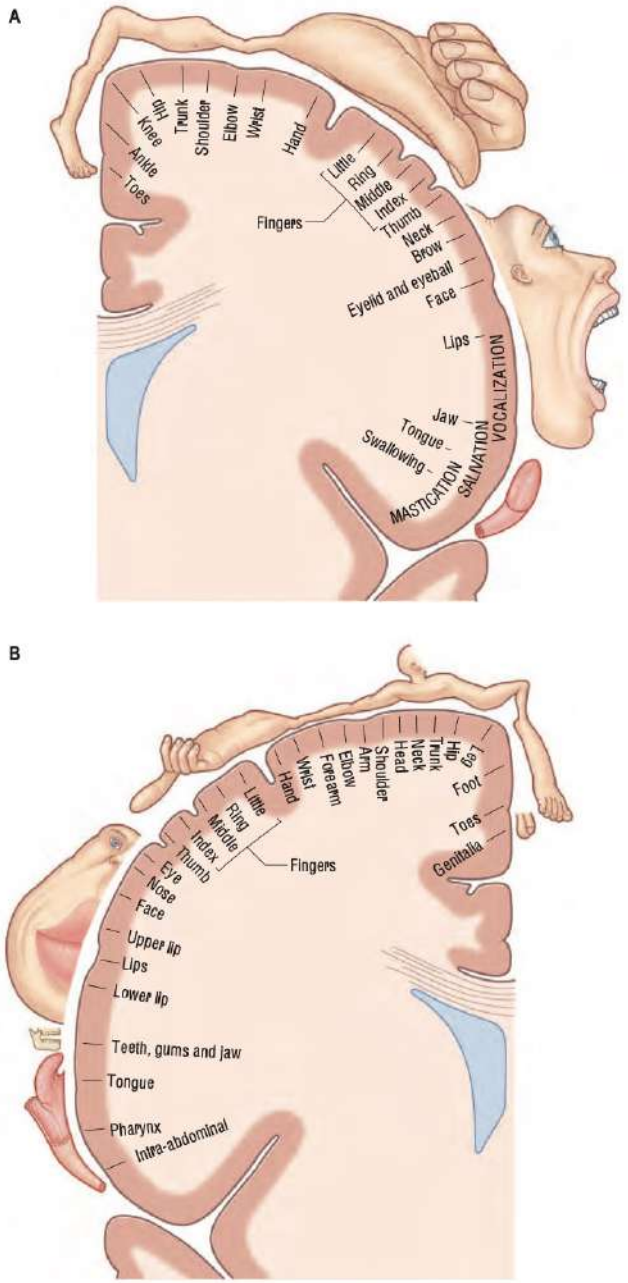
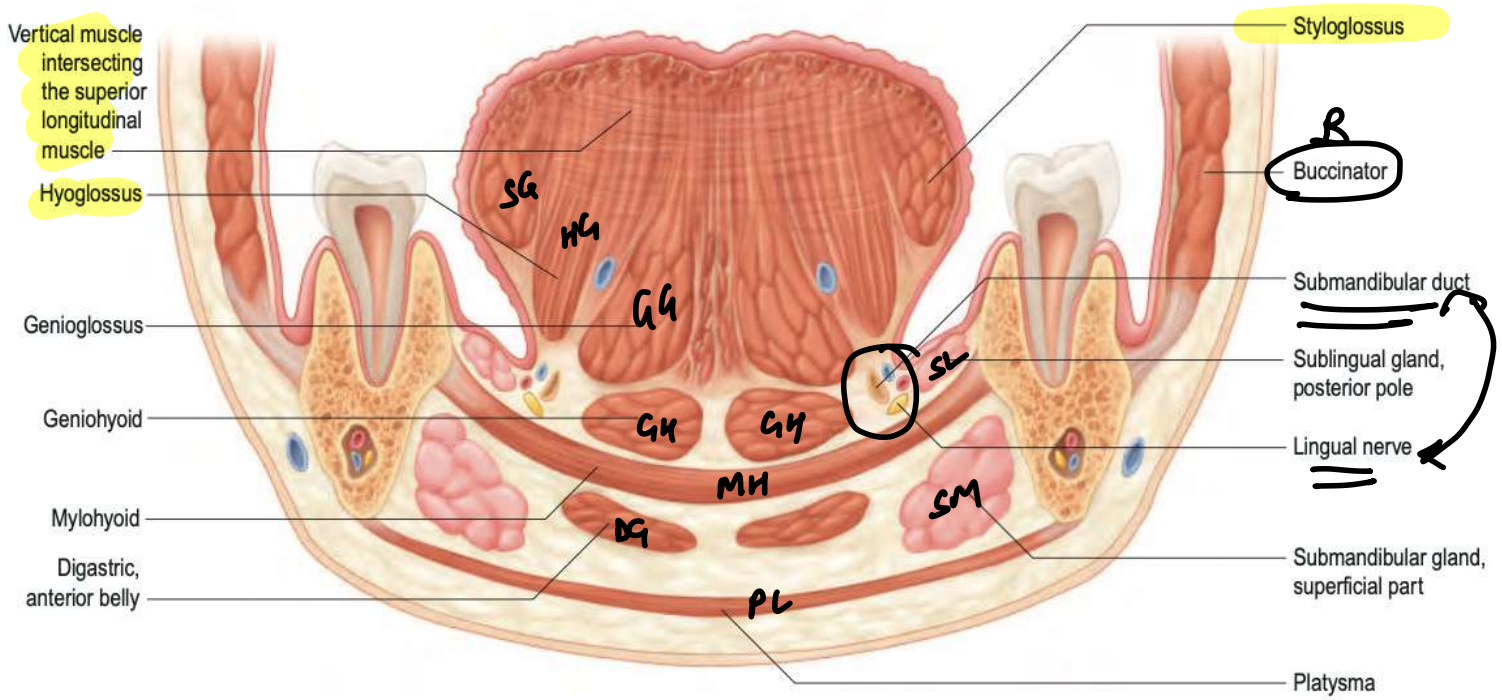
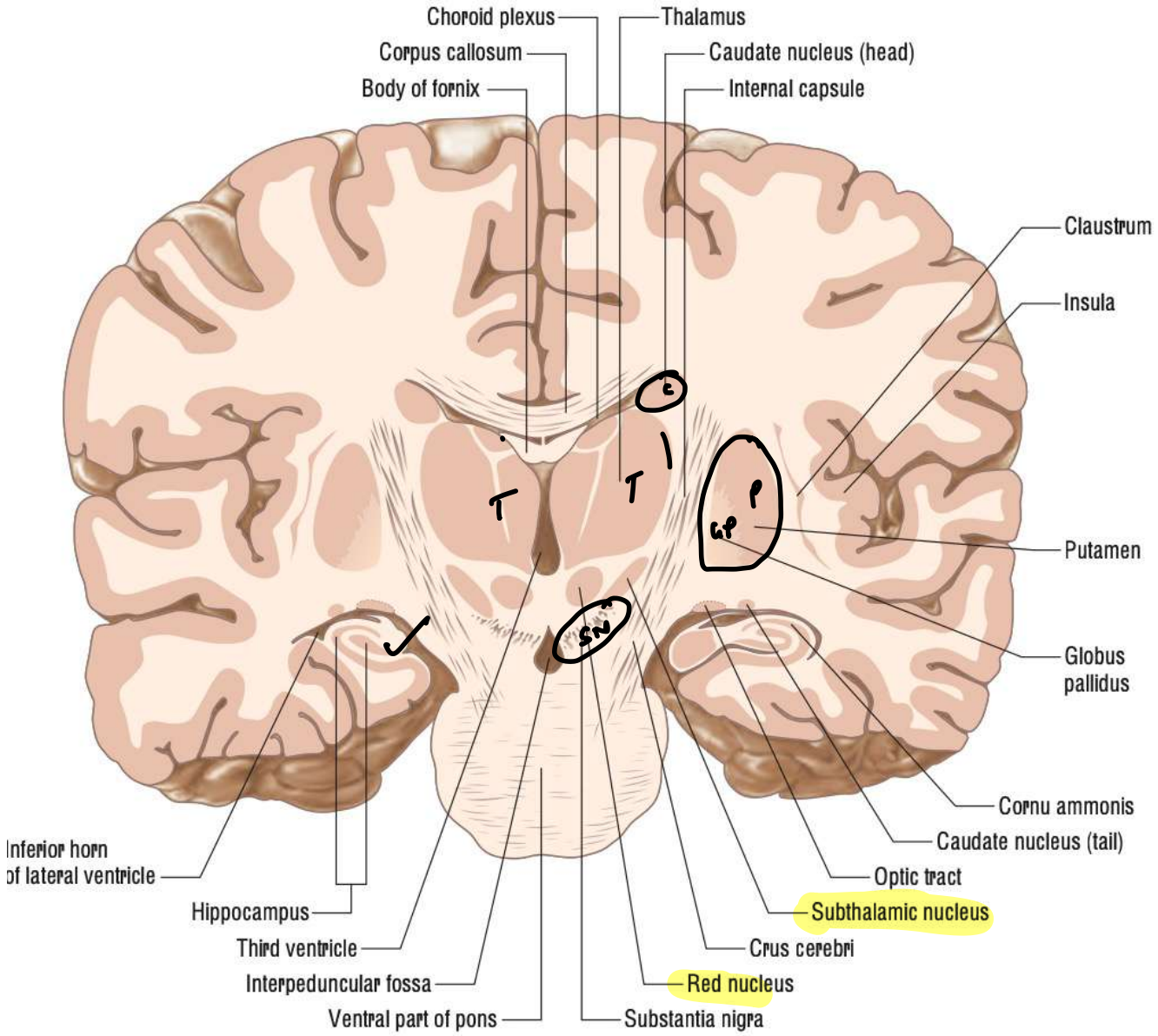


Fig. 25.15 A, The motor homunculus showing proportional somatotopical representation in the main motor area. **B**, The sensory homunculus showing proportional somatotopical representation in the somaesthetic cortex.





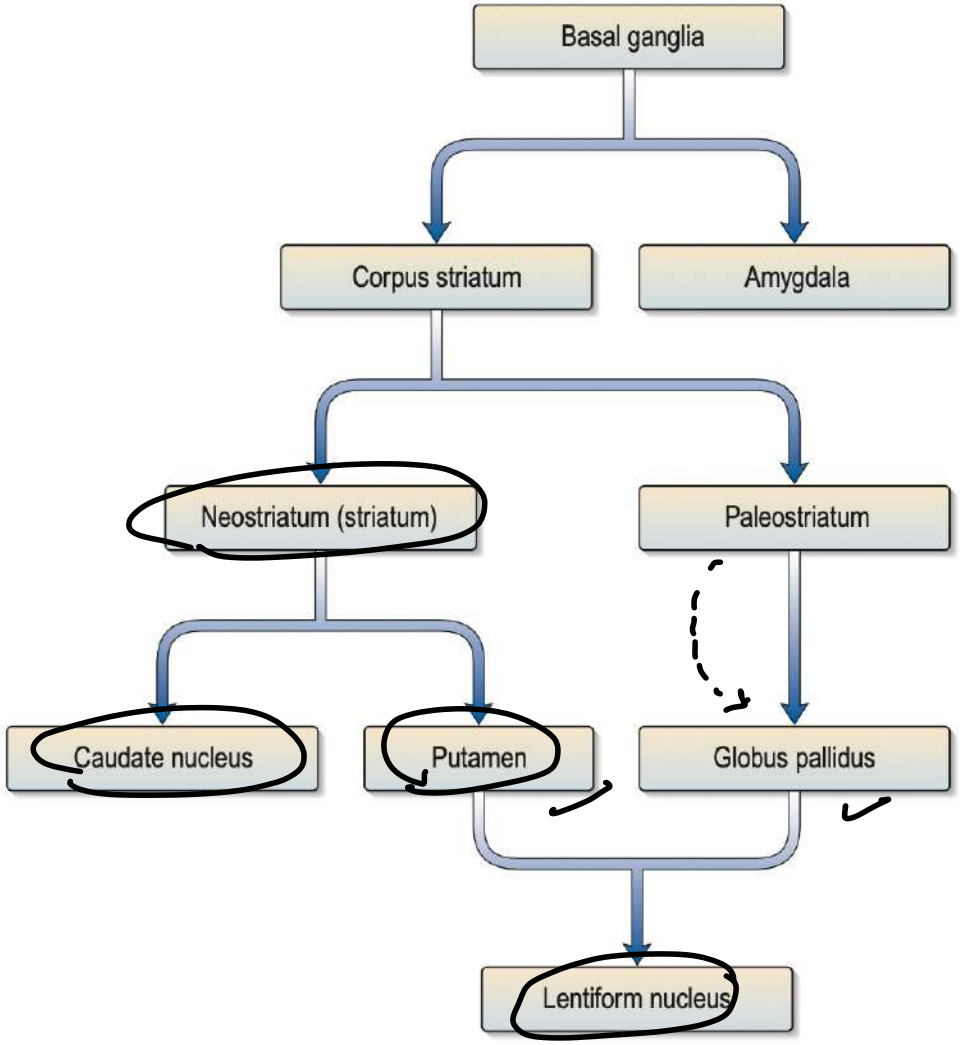
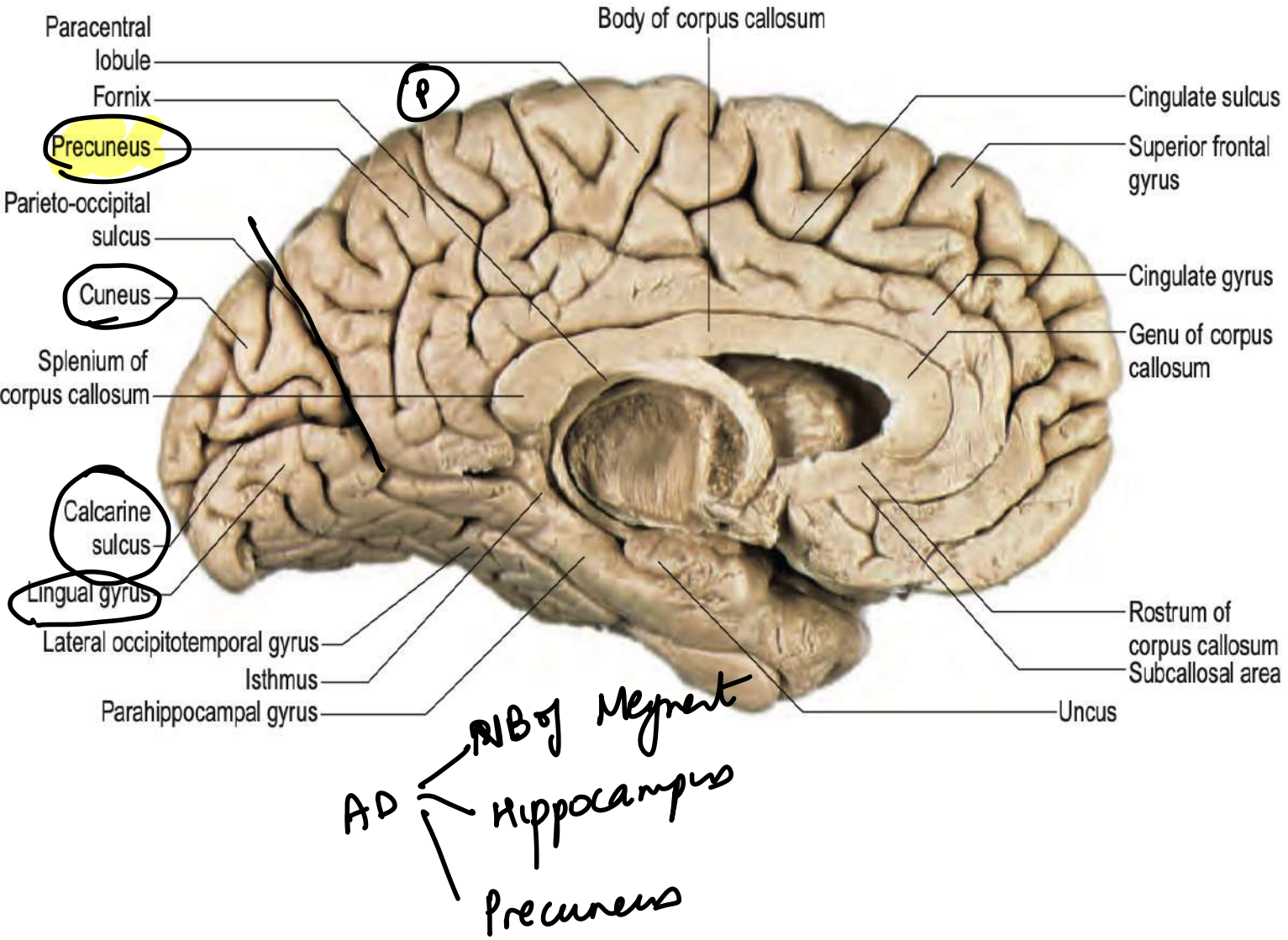


Fig. 24.2 Terminology and relationships of structures forming the basal ganglia.



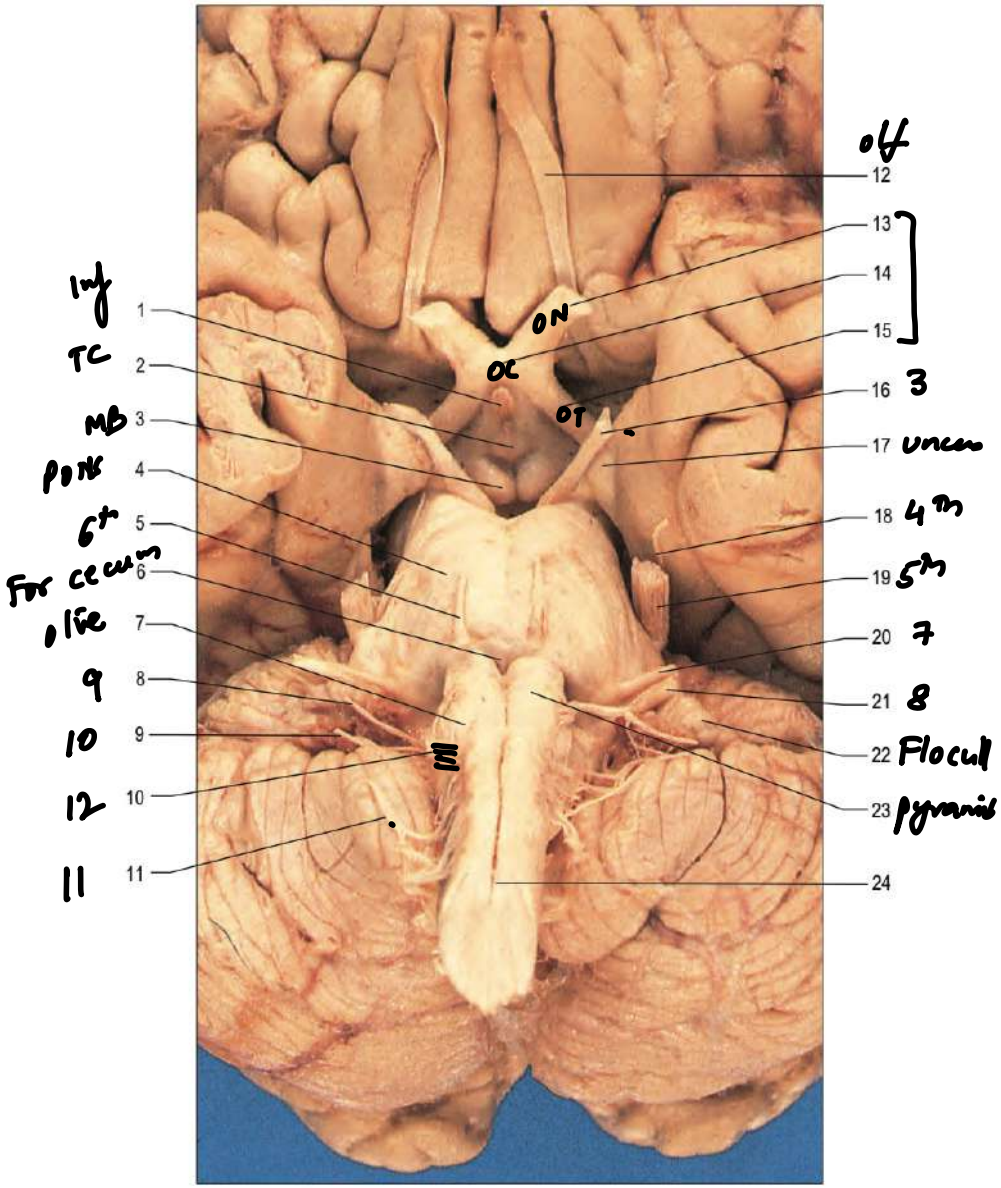
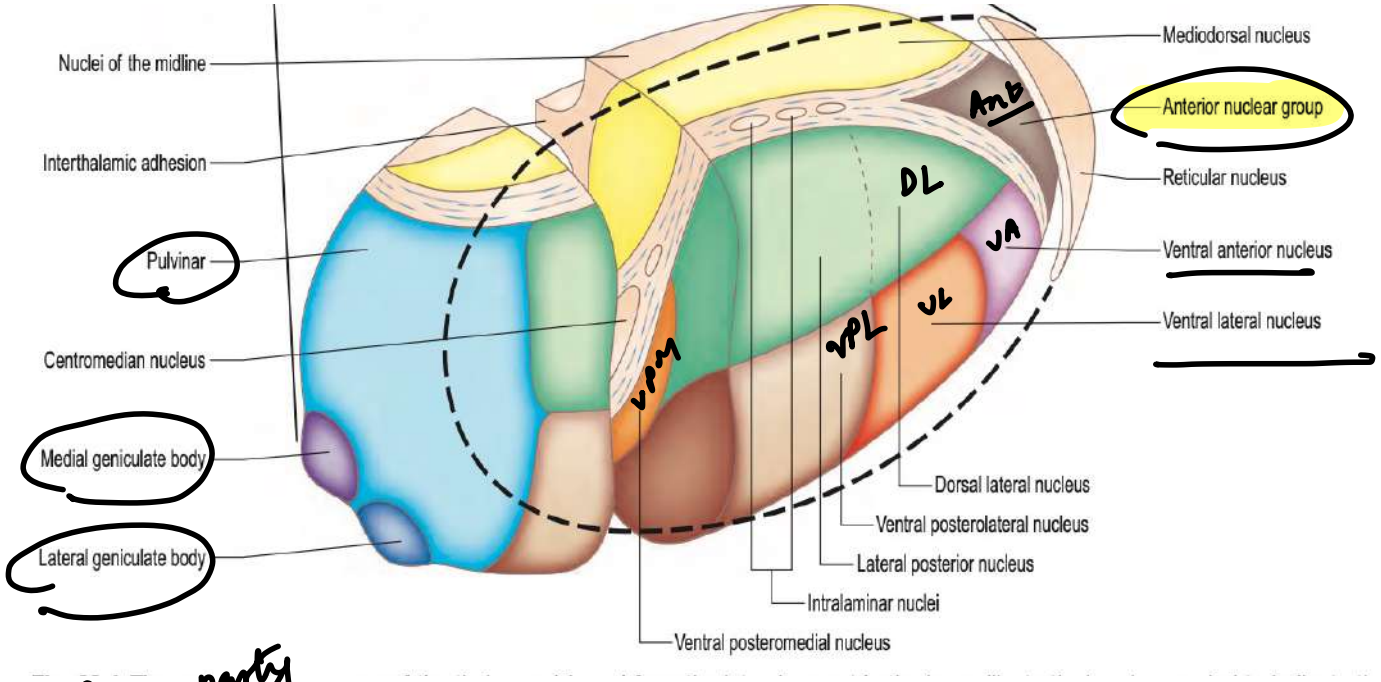


Fig. 21.4 The ventral aspect of the brainstem. Key: 1, infundibulum; 2, tuber cinereum; 3, mammillary body; 4, basilar pons; 5, abducens nerve; 6, foramen caecum; 7, olive; 8, glossopharyngeal nerve; 9, vagus nerve; 10, rootlets of hypoglossal nerve; 11, accessory nerve; 12, olfactory tract; 13, optic nerve; 14, optic chiasma; 15, optic tract; 16, oculomotor nerve; 17, uncus; 18, trochlear nerve; 19, trigeminal nerve; 20, facial nerve; 21, vestibulocochlear nerve; 22, flocculus; 23, pyramid; 24, motor decussation (decussation of pyramids).



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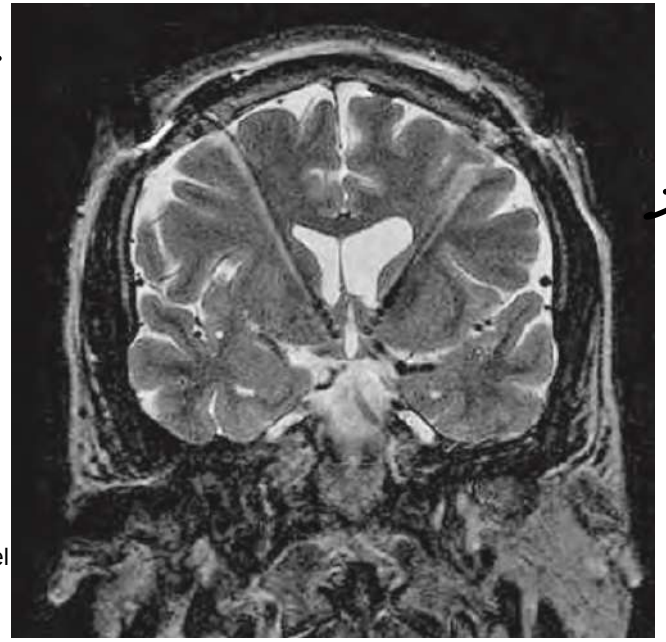

DBS
↳ STN

Group	Nucleus	Major subcortical connection	Major cortical connections	System
Anterior	Anterior	Mammillary bodies (MTT)	Cingulate and parahippocampal gyrus	Relay limbic
Medial	Dorsomedial	Amygdala, thalamic nuclei	Prefrontal cortex	Association
Lateral				
Ventral	VA	GPi, SNr	Premotor cortex	Relay motor
	VL	Ipsilateral GPi, contralateral cerebellum	Supplementary and primary motor cortex	Relay motor
	VPl, VPm	STT to VPl, TTT to VPm, MLT to anterior surface	Somatosensory cortex, insula	Relay sensory
	LGB	Optic tract	Visual cortex	Visual
	MGB	Auditory pathway (inferior brachium)	Auditory cortex	Auditory
Dorsal	Pulvinar – LP	Superior colliculus	Parieto-occipito-temporal	Association
	LD	Pretectum and superior colliculus	Cingulate, parahippocampus	
Intralaminar	CM	GPi, cerebellum	Striatum, motor cortex	
Reticular		Widespread connections	Widespread connections	

PRION

Abbreviations: CM, centromedian nucleus of thalamus; GPi, internal segment of globus pallidus; LD, lateral dorsal nucleus of thalamus; LGB, lateral geniculate body; LP, lateral posterior nucleus of thalamus; MGB, medial geniculate body; MLT, medial lemniscal tract; MTT, mammillothalamic tract; SNr, substantia nigra pars reticularis; STT, spinothalamic tract; TTT, trigeminothalamic tract; VA, ventral anterior nucleus; VL, ventral lateral nucleus; VPl, ventral posterolateral nucleus; VPm, ventral posteromedial nucleus.

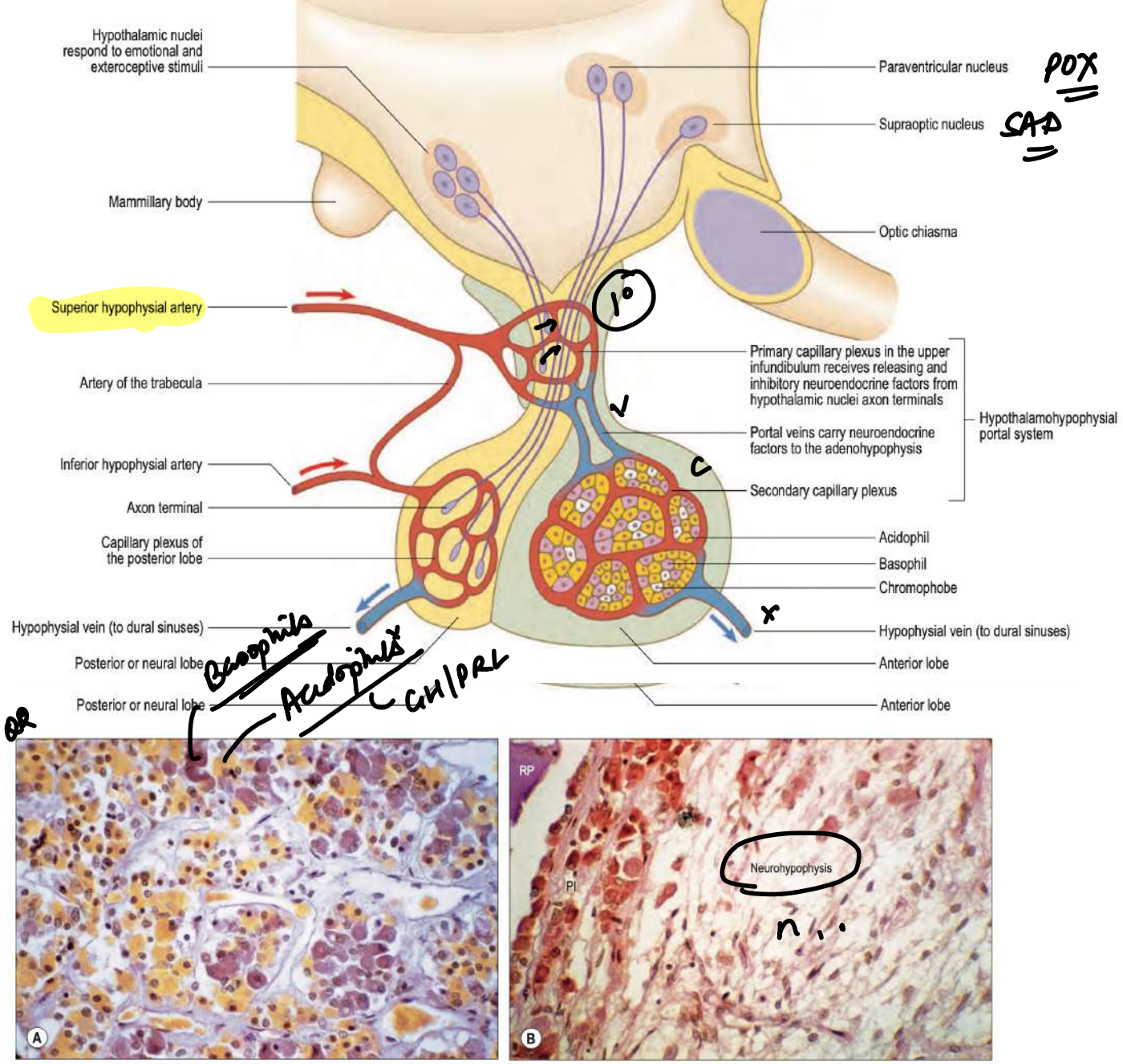

Fig. 23.12 The pituitary gland (trichrome-stained). **A**, The endocrine cells of the adenohypophysis. Chromophils can be distinguished as acidophils (yellow) and basophils (pink). Chromophobes are pale-staining cells. A network of sinusoids is seen between clusters of secretory cells. **B**, The neurohypophysis (right), with nerve fibres and pituicytes. To the left is the pars intermedia (PI) with scattered, deeper-staining secretory cells and a cyst containing colloid (top left), representing the remnants of Rathke's pouch (RP).