REVISION OF ENDOCRINE MODULE RESET 2025

Department of human Anatomy and Embryology
Faculty of Medicine
Mansoura National University, Egypt

By

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ANATOMY & DEVELOPMENT OF PITUITARY GLAND

Department of human Anatomy and Embryology
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Anatomy of Pituitary Gland

الطريق الدولي الساحلي - منطقة 15 مايو - مدينة جمصة - محافظة الدقهلية
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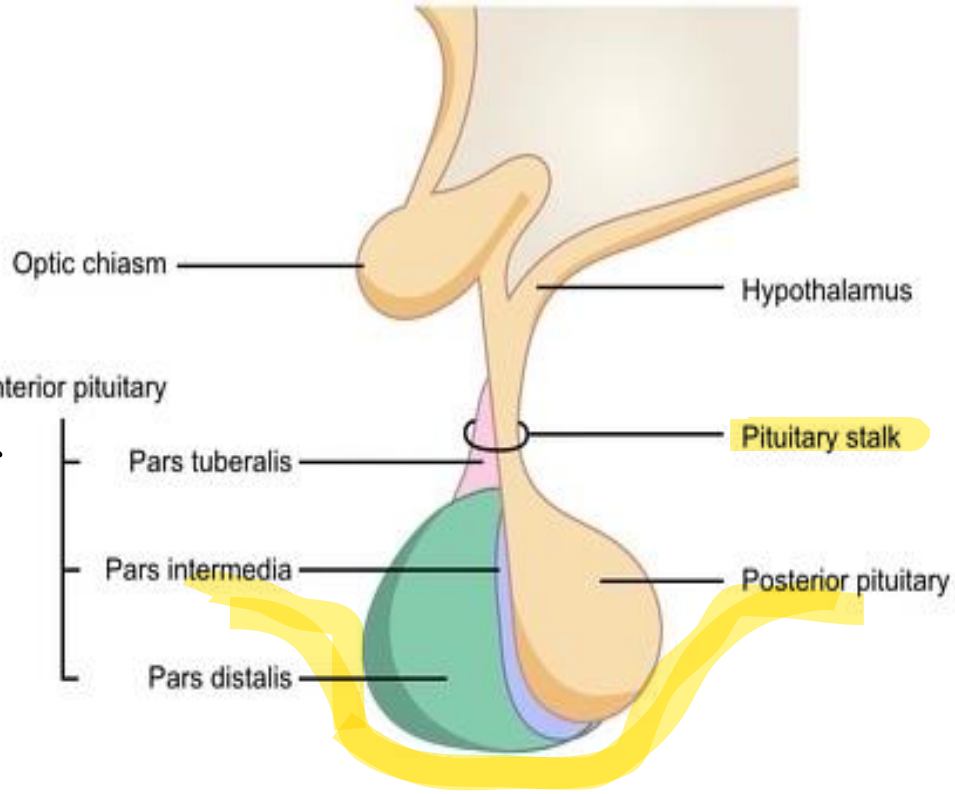
Introduction

- The pituitary gland is an endocrine gland that works to maintain cellular **homeostasis** in the body by the release of **different hormones**. MCQ
- The pituitary gland is also called the **master gland** as it regulates the other endocrine glands. MCQ
- **Regulated by the secretions of the hypothalamus**.
- The pituitary gland is attached to the hypothalamus of the forebrain by a single stalk called the **infundibulum**.
- The term 'pituitary' is derived from the Latin term '**pituita**', meaning **phlegm** or **slime**.
- The gland is present posterior and superior to the sphenoidal sinus in the depression called the **Sella turcica**. MCQ



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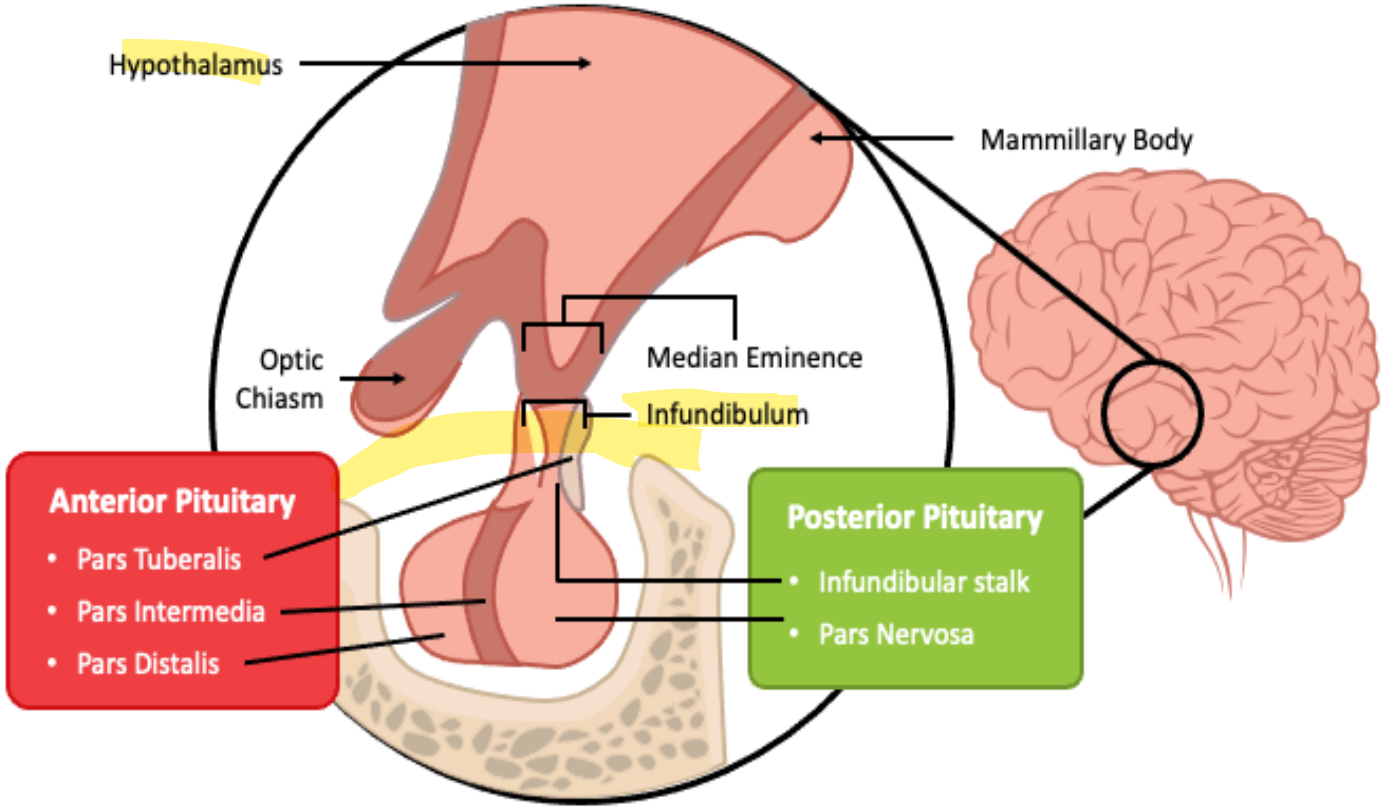
Site: Hypophyseal fossa (**Sella turcica**) covered by Diaphragma Sella MCQ

Shape & Size: oval in outline (12mm X 8mm)

Connected to hypothalamus by infundibulum



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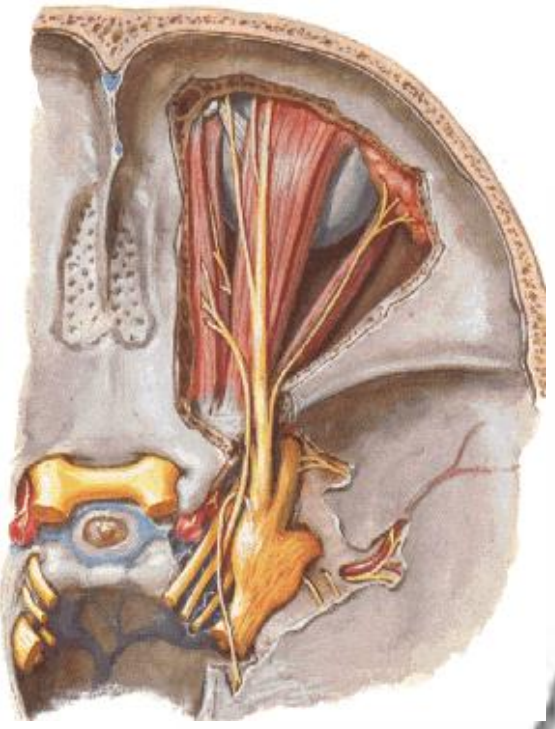
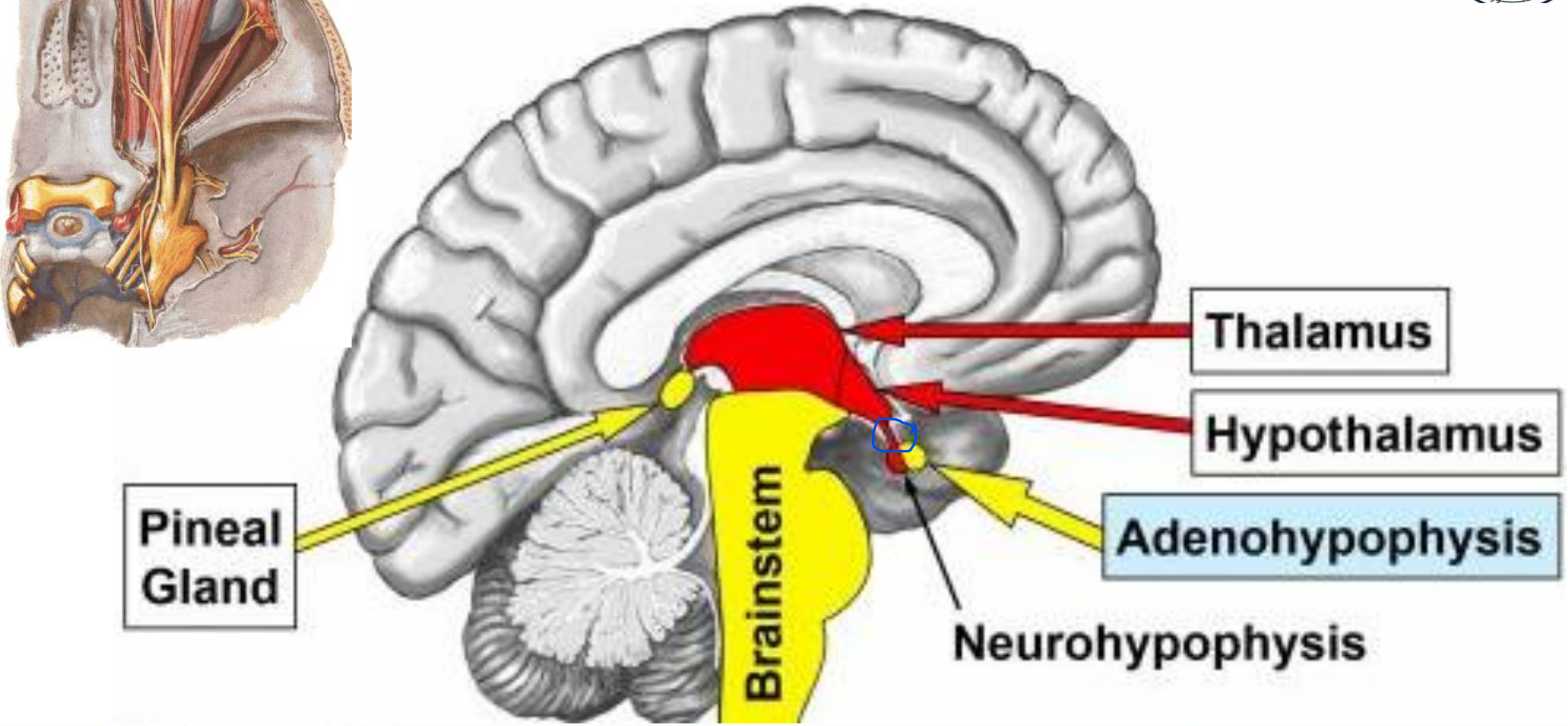
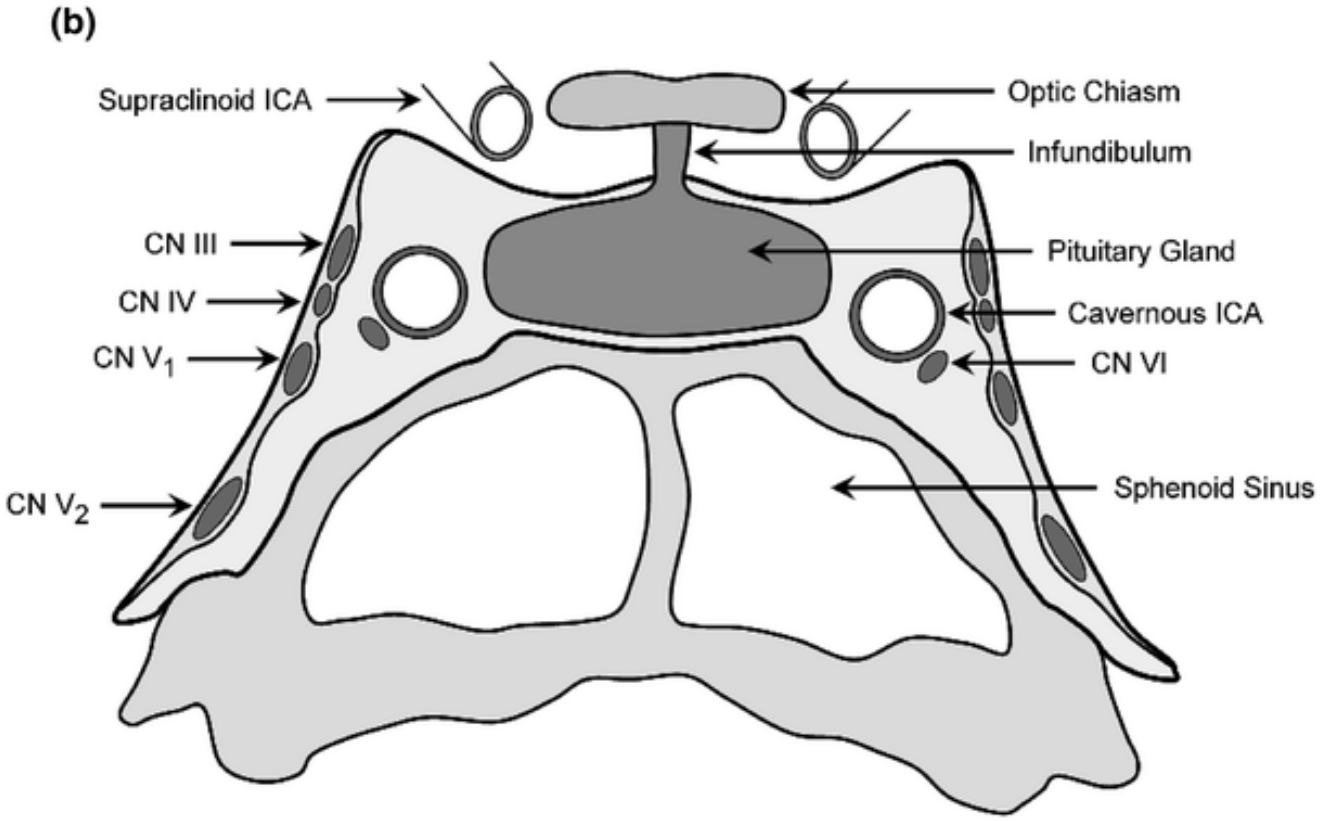
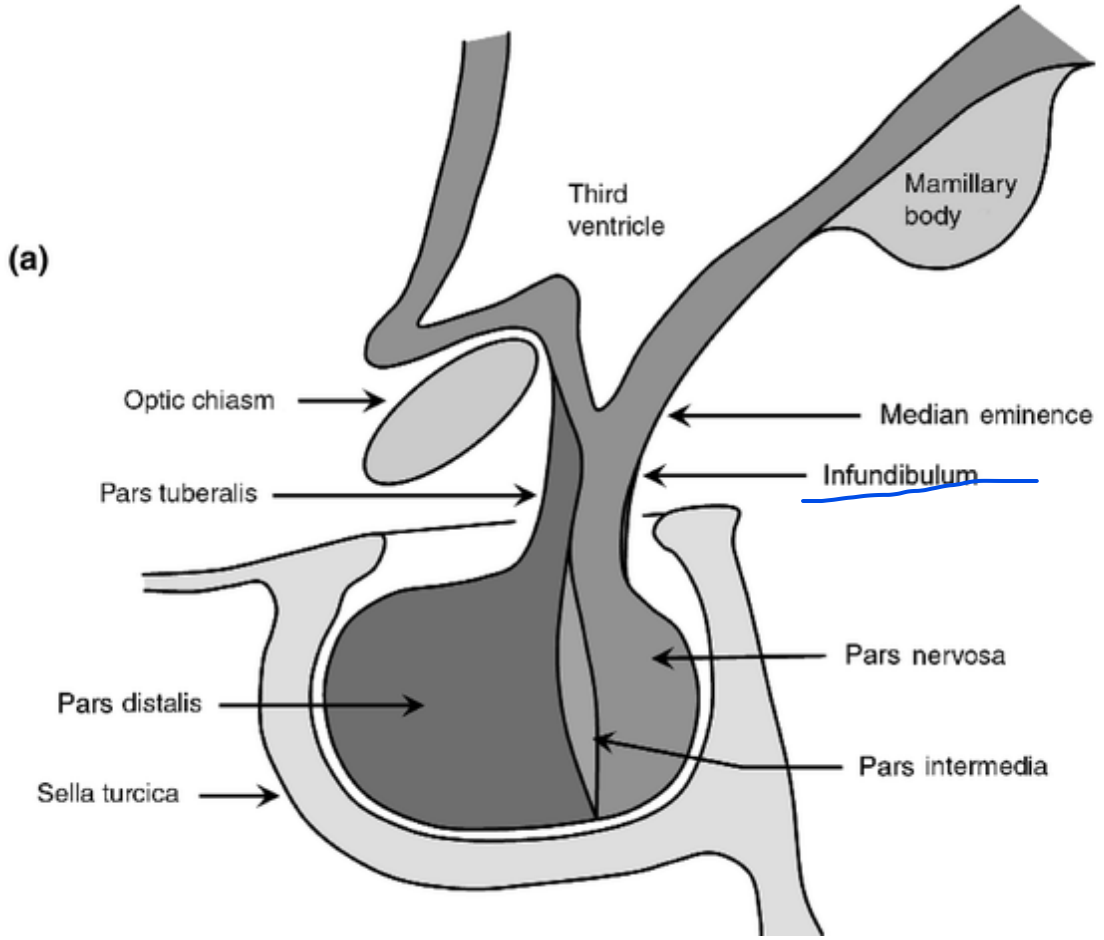



Thalamus
Hypothalamus
Pineal Gland
Adenohypophysis
Brainstem
Neurohypophysis





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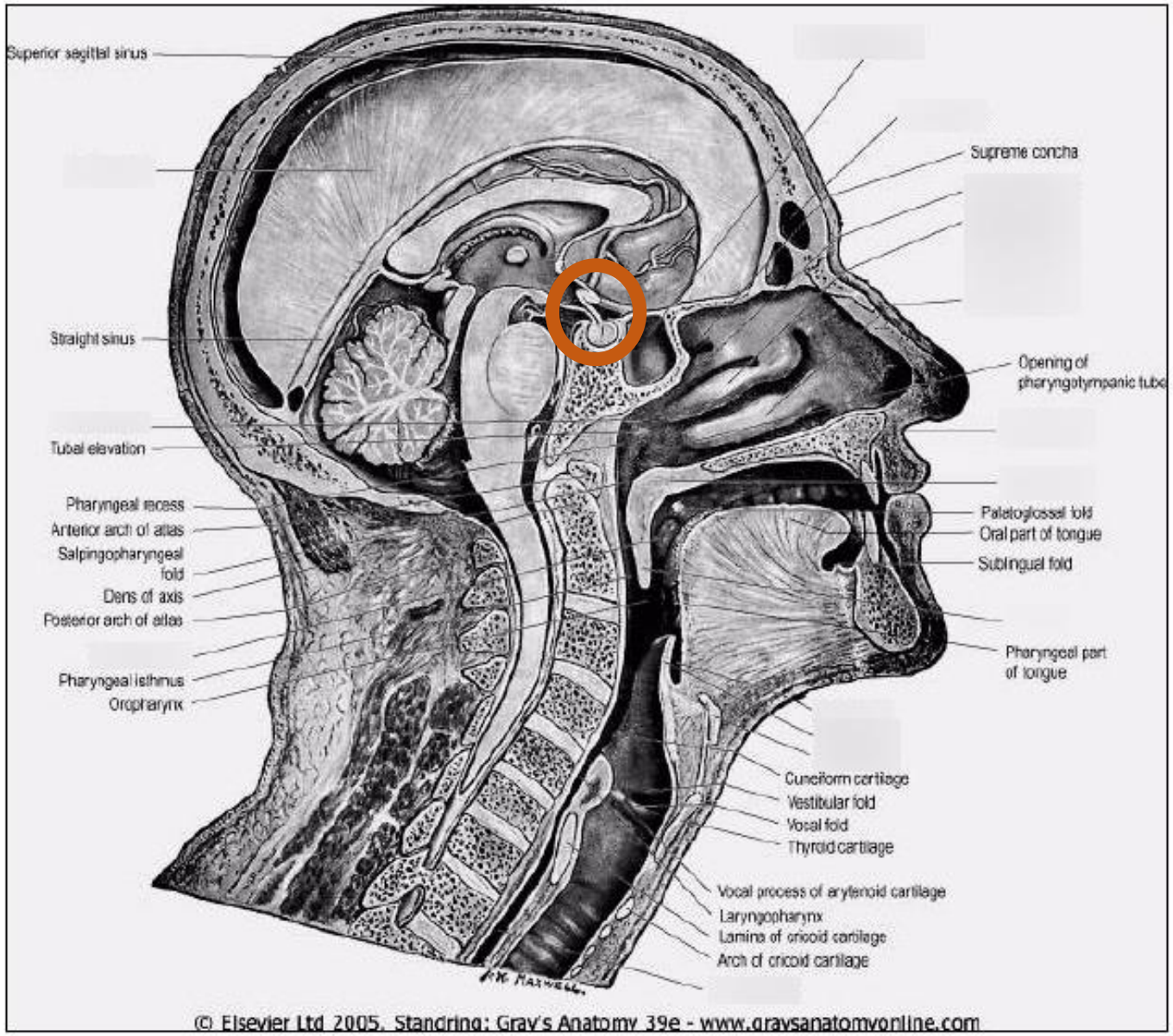

Median sagittal section through the head and neck.

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Lobes of pituitary gland

SAQ

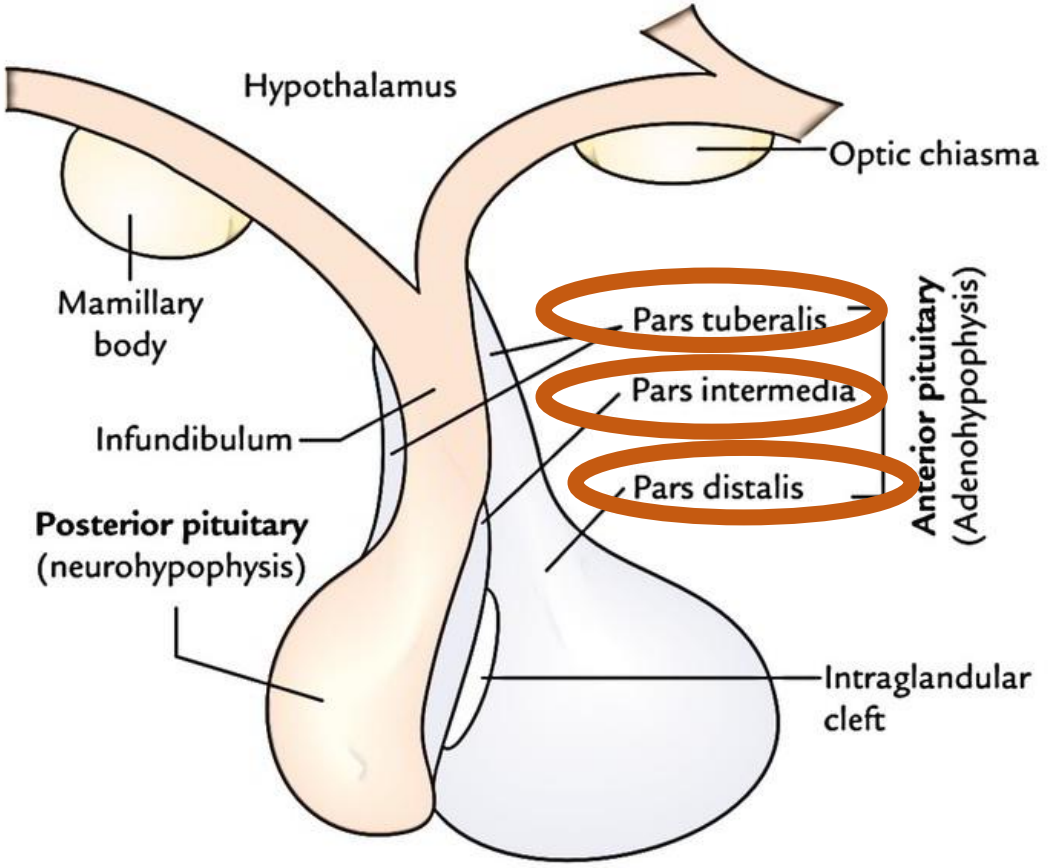
It is composed of two lobes: anterior and posterior

1. **Adenohypophysis (anterior lobe):** composed of:

A. Pars tuberalis: upwards in front of the infundibulum

B. Pars intermedia: (at the back of the cleft)

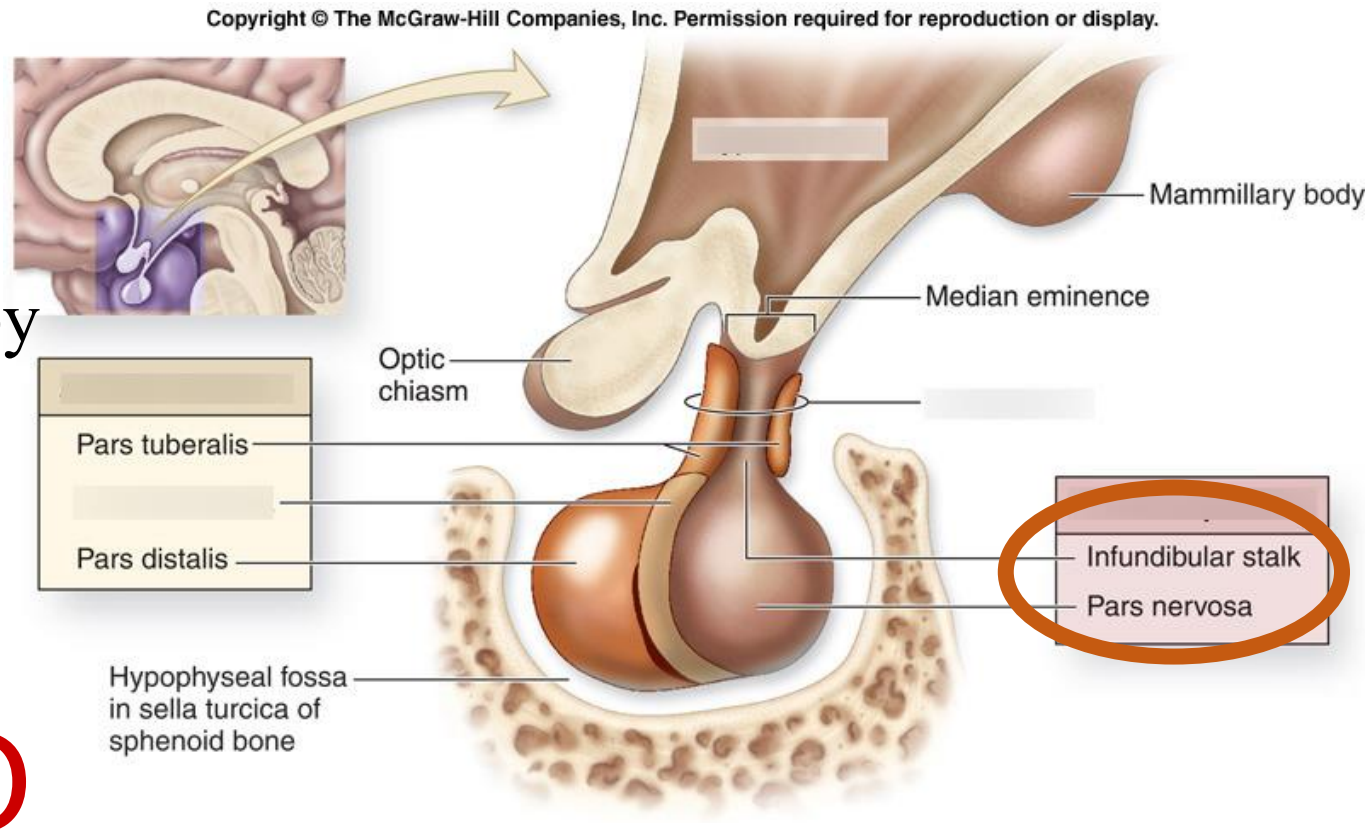
C. Pars distalis: (in front of the cleft)



2. Neurohypophysis (posterior lobe):

- Small and lies at the back of the anterior lobe.
- Connected with the hypothalamus by the **infundibulum** (stalk).
- The stalk pierces the central part of Diaphragma Sellae.
- Its lower end is called **pars nervosa**.

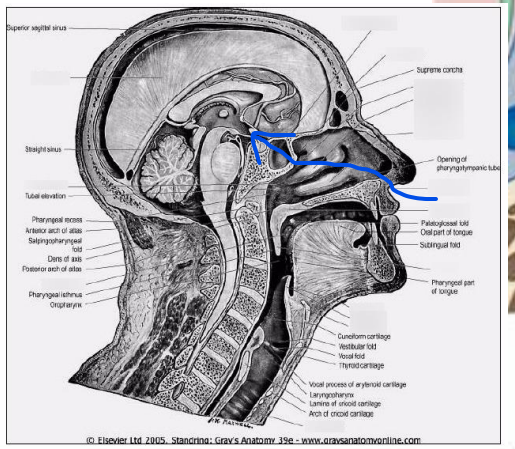
MCQ



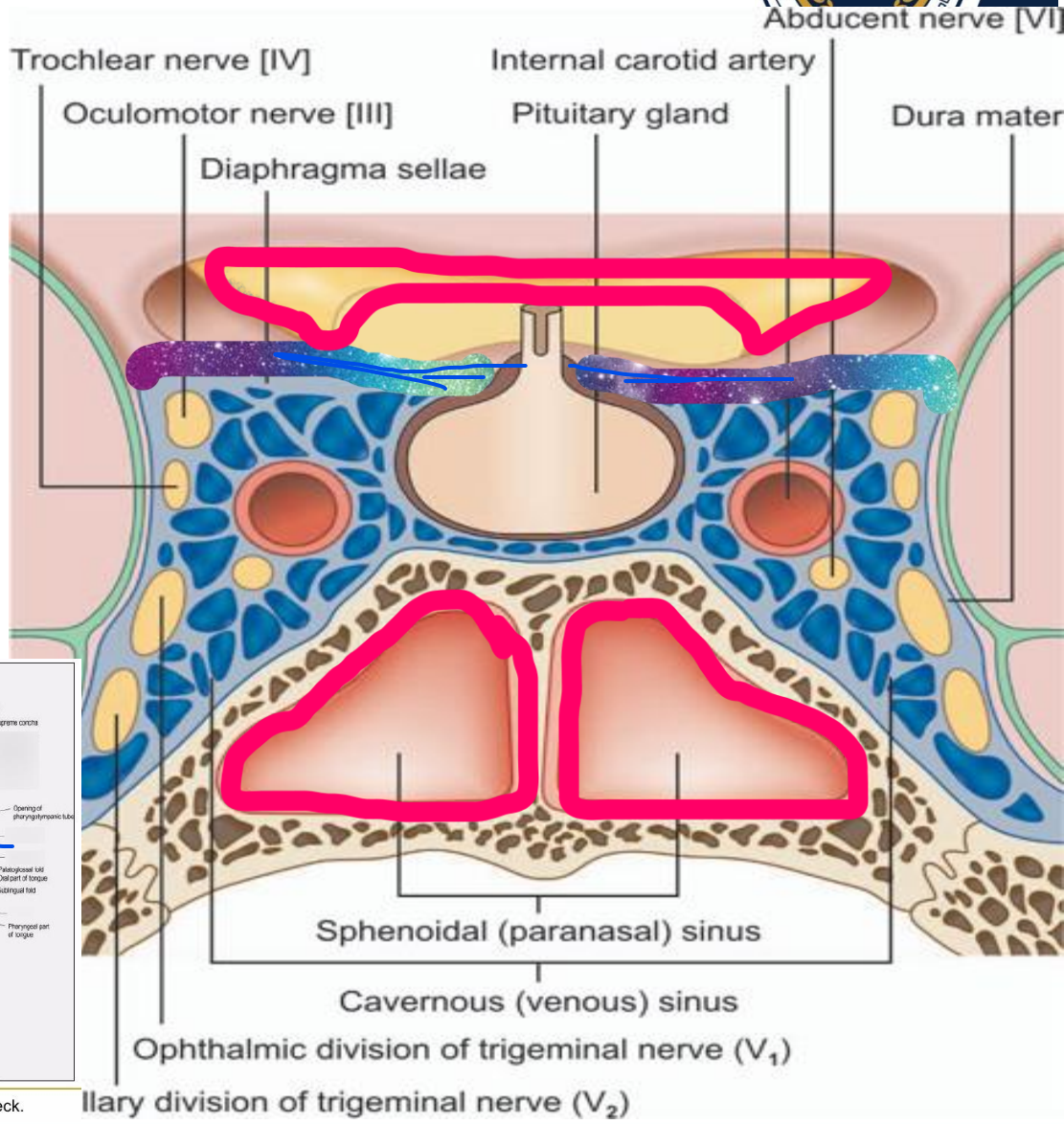
Relations

WHICH DURAL FOLF COVERS THE PIT GLAND?

- **Superiorly:** Diaphragma sellae separating it from the Optic chiasma
- **Inferiorly:** body of the sphenoid & sphenoidal air sinuses. (separating it from the nasopharynx)



Median sagittal section through the head and neck.



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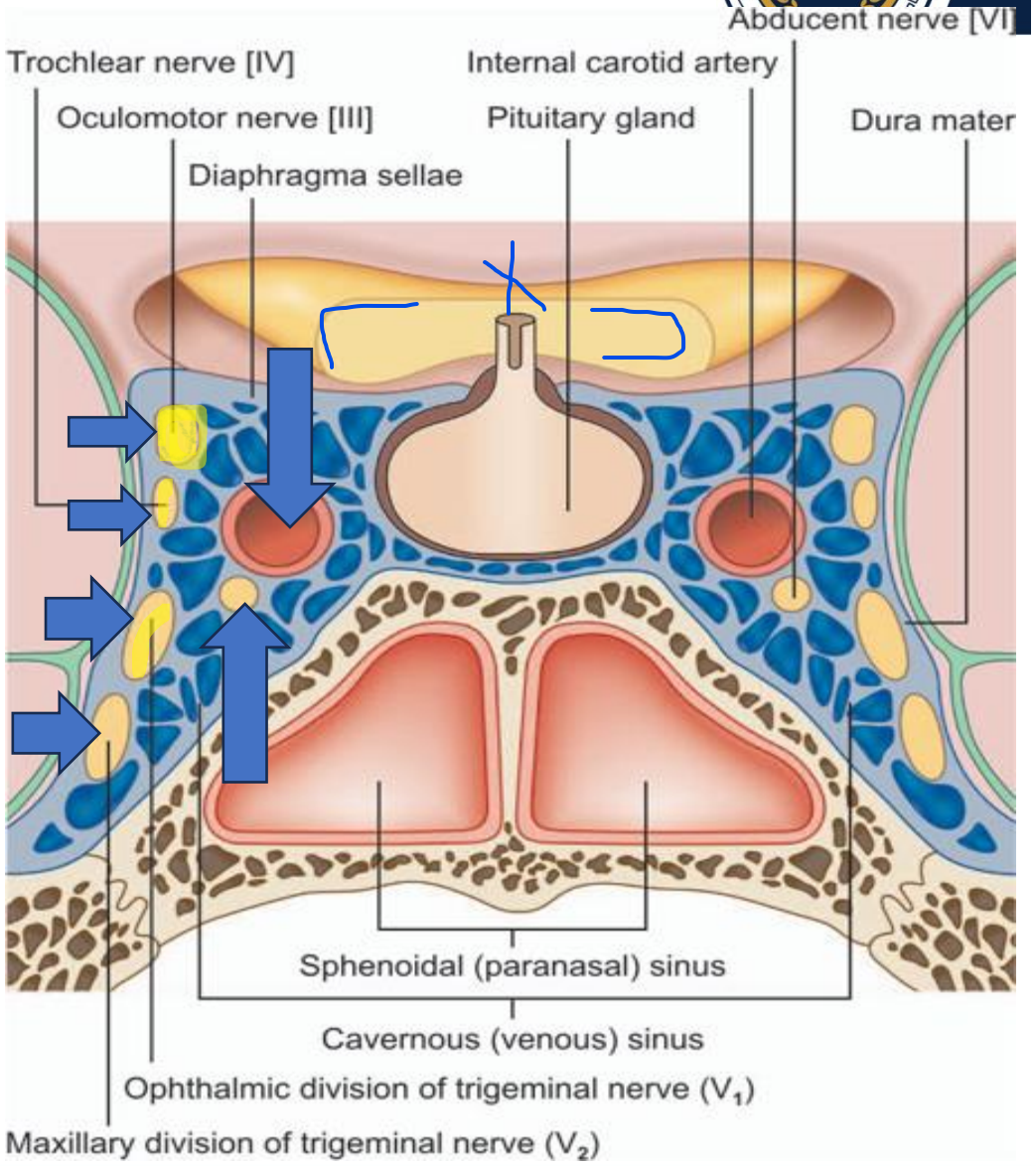
Relations

- **On each side:** the **cavernous sinus** and its contents. MCQ

1. In its lateral wall (Nerves): oculomotor, trochlear, ophthalmic (V1) and maxillary (V2).

2. In the floor (Artery & nerve): internal carotid artery and abducent nerve. MCQ



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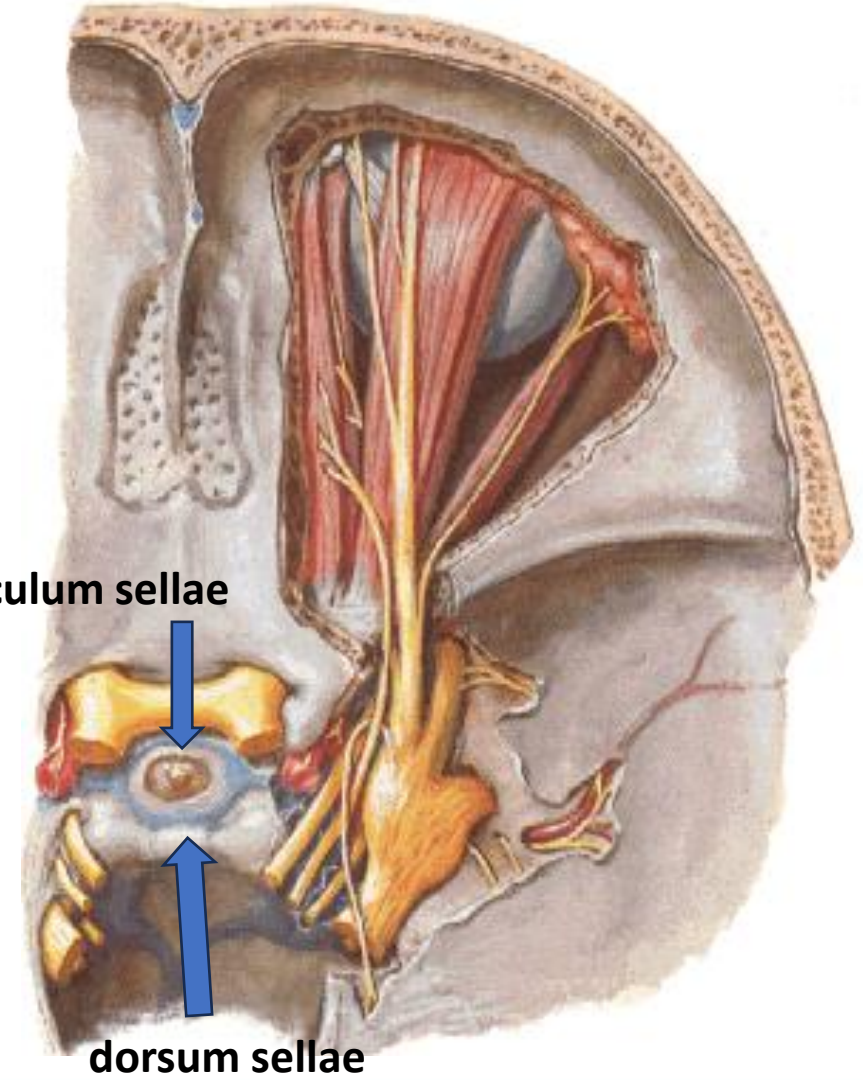
Relations

- **Anteriorly:** the tuberculum sellae (separating it from the optic chiasma)
- **Posteriorly:** the dorsum sellae (separating it from the pons)



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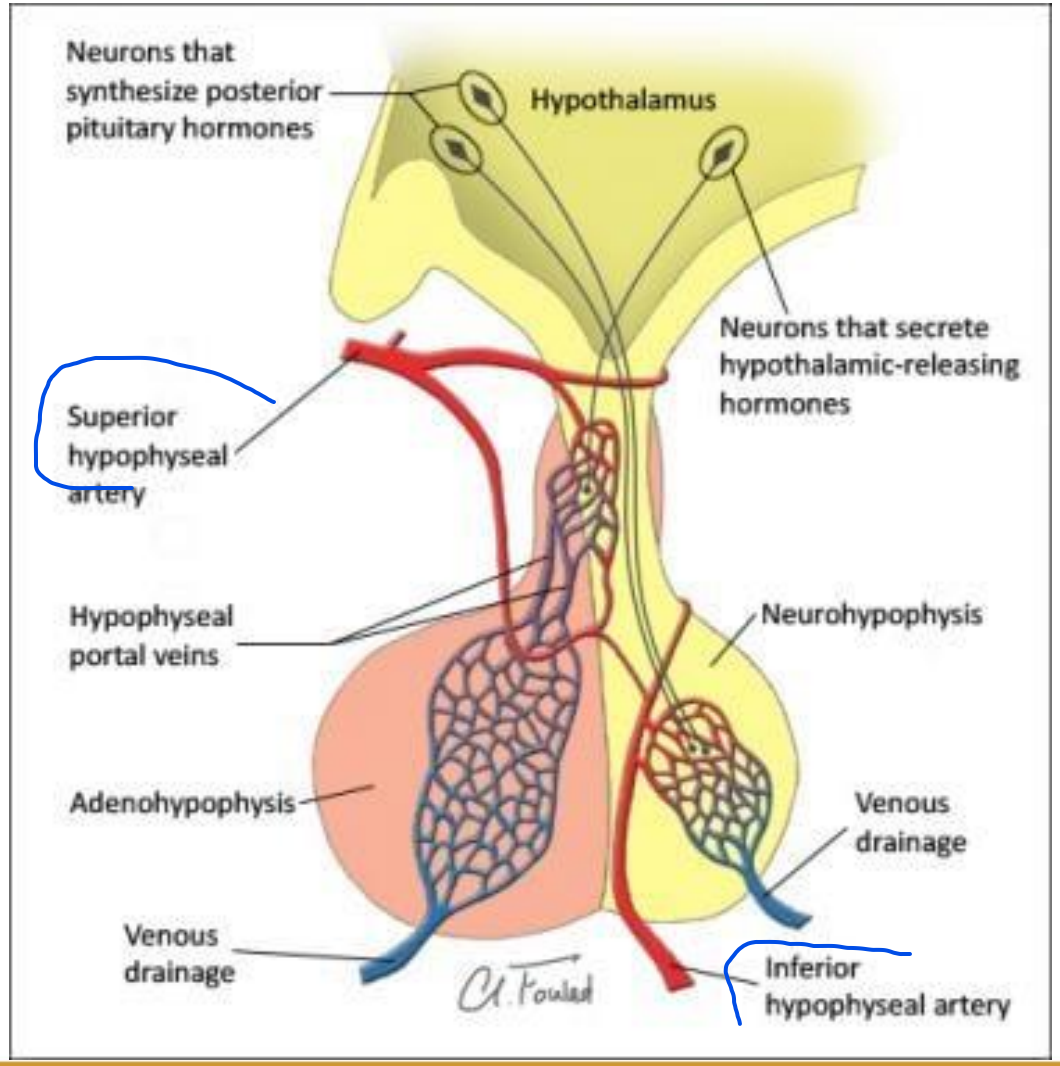
SAQ

Arterial supply

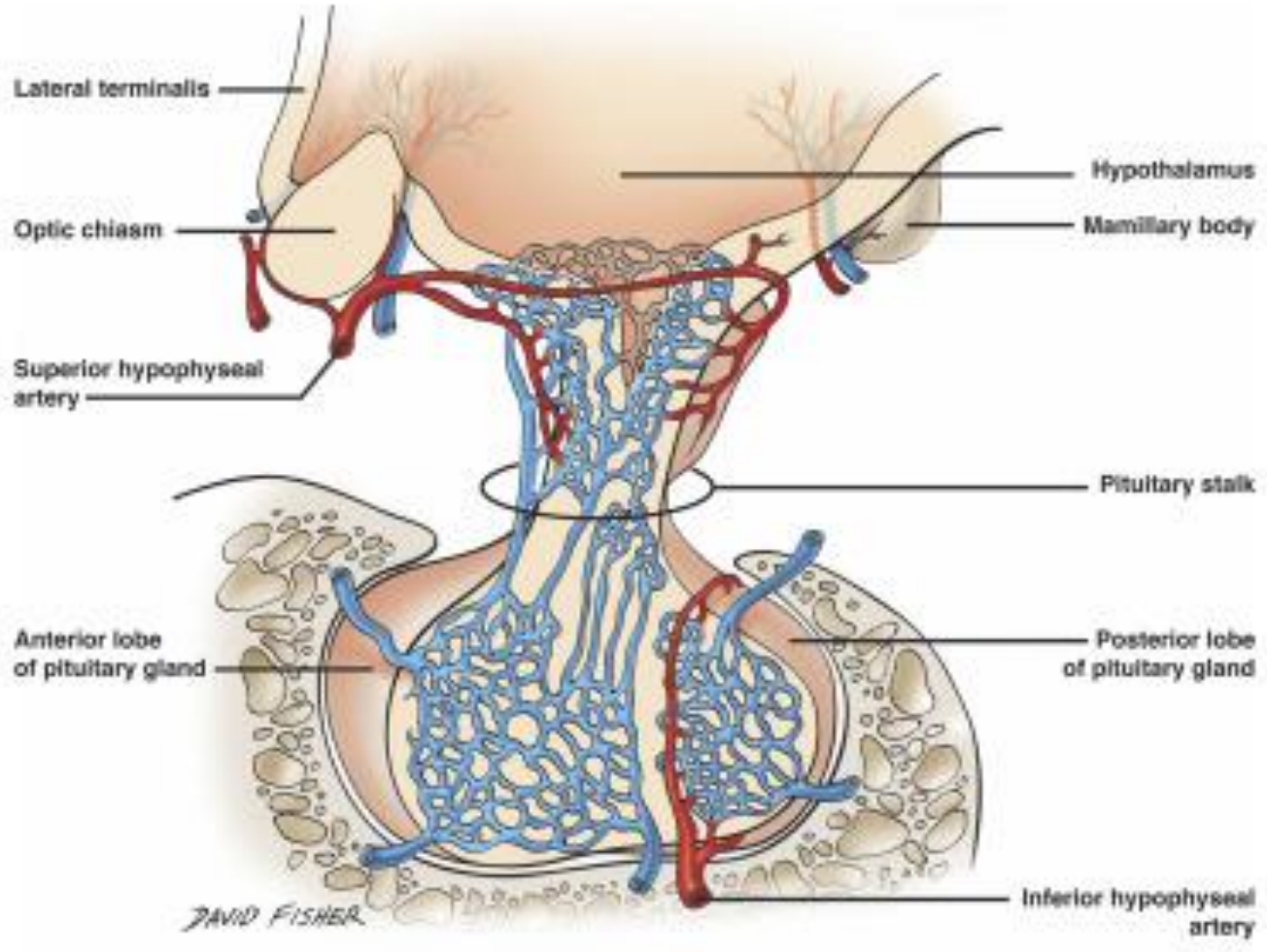
1. Superior hypophyseal artery: branches from the **internal carotid artery,** supplies the **anterior lobe**

2. Inferior hypophyseal artery: branches from the **internal carotid artery,** supplies the **posterior lobe**.



Venous drainage:

Short veins drain in the surrounding venous sinuses (**cavernous and intercavernous sinuses**).



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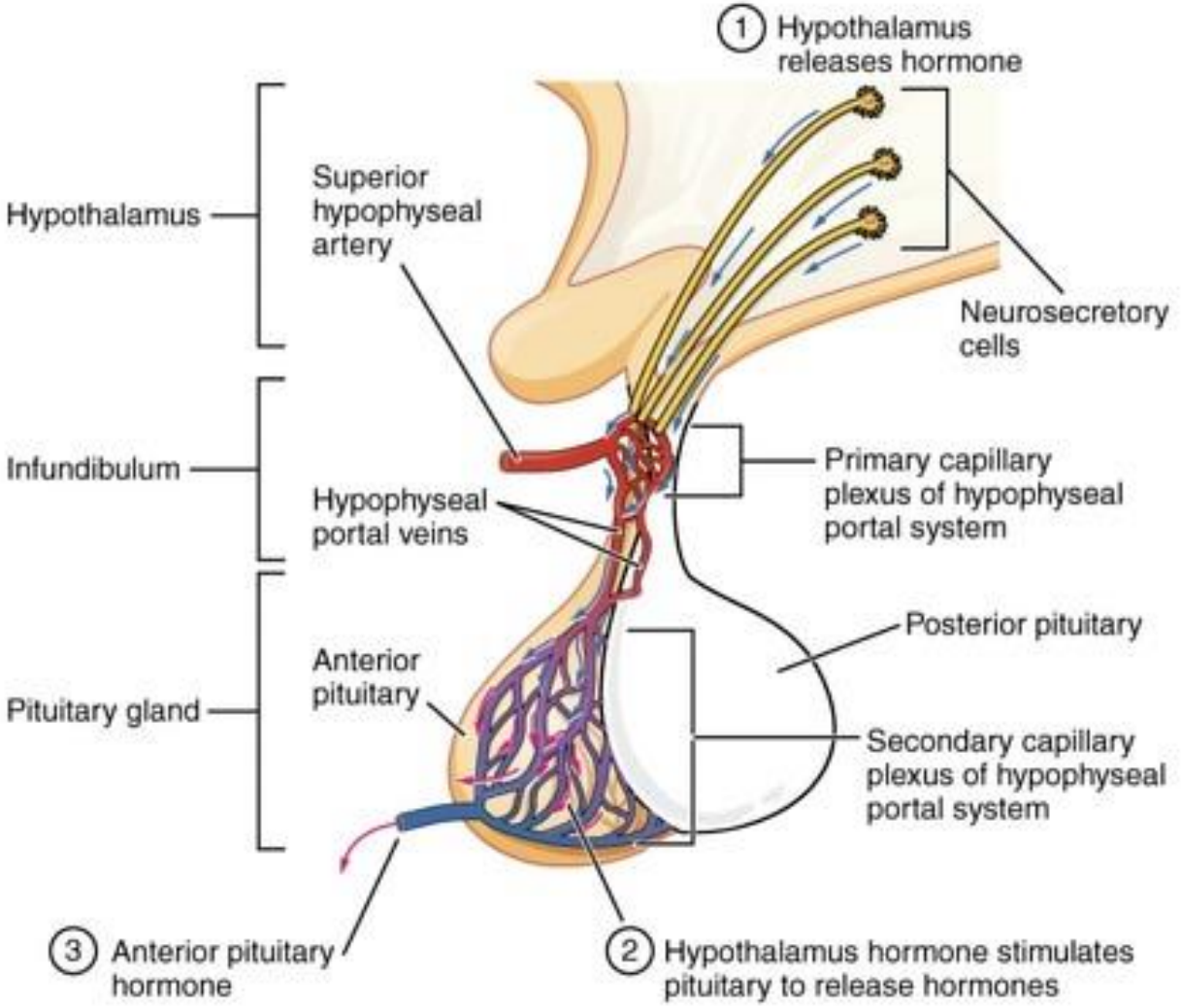
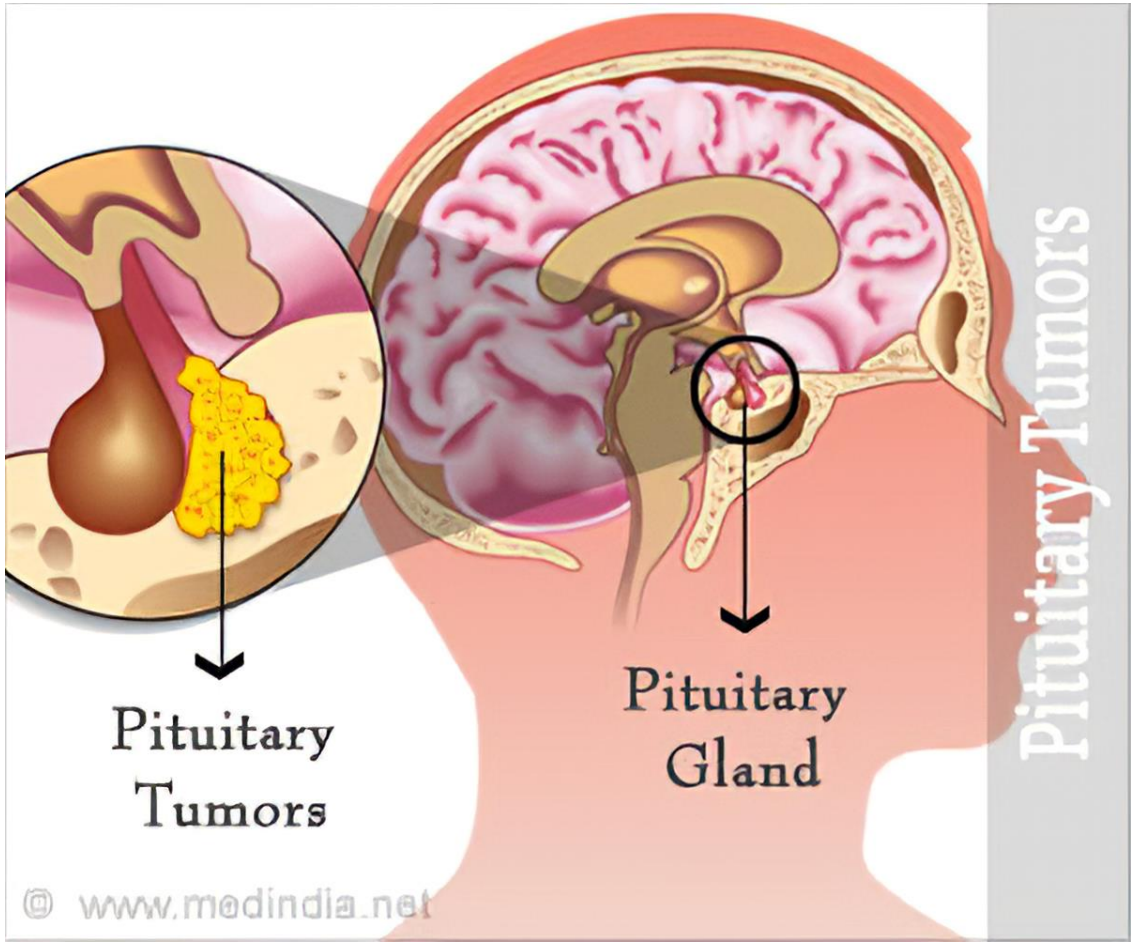

1 Hypothalamus releases hormone
Hypothalamus
Superior hypophyseal artery
Neurosecretory cells
Infundibulum
Primary capillary plexus of hypophyseal portal system
Hypophyseal portal veins
Posterior pituitary
Anterior pituitary
Pituitary gland
Secondary capillary plexus of hypophyseal portal system
3 Anterior pituitary hormone
2 Hypothalamus hormone stimulates pituitary to release hormones

Clinical Note

Tumors of the pituitary gland tend to occlude the **internal carotid artery** and press the **abducent nerve** before affecting the other cranial nerves in the sinus.

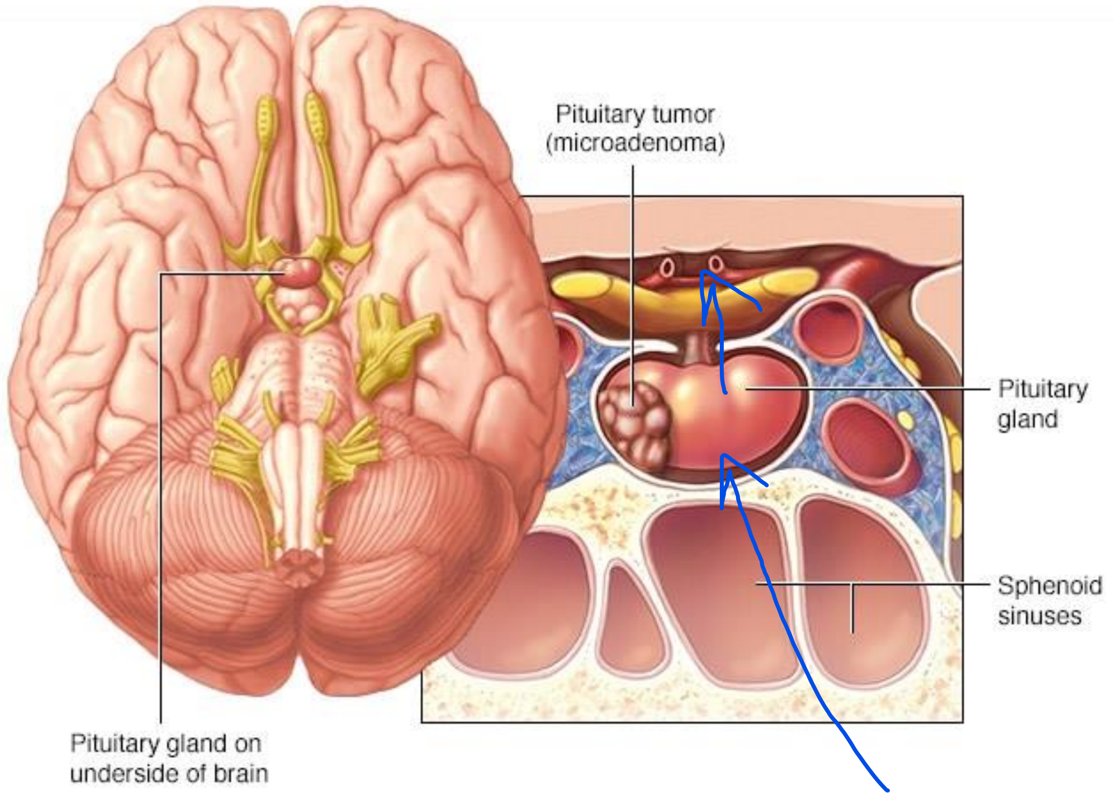


Surgical Considerations

- A nonfunctioning adenoma only gets surgically resected when the tumor causes compression or mass effect to the adjacent structures like the **optic chiasm** causing **bitemporal hemianopsia** field defect.

MCQ

- **Transsphenoidal surgery** is a commonly chosen procedure for resection,



Development of Pituitary Gland

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Development of Pituitary Gland

Time: at the middle of the **4th week**

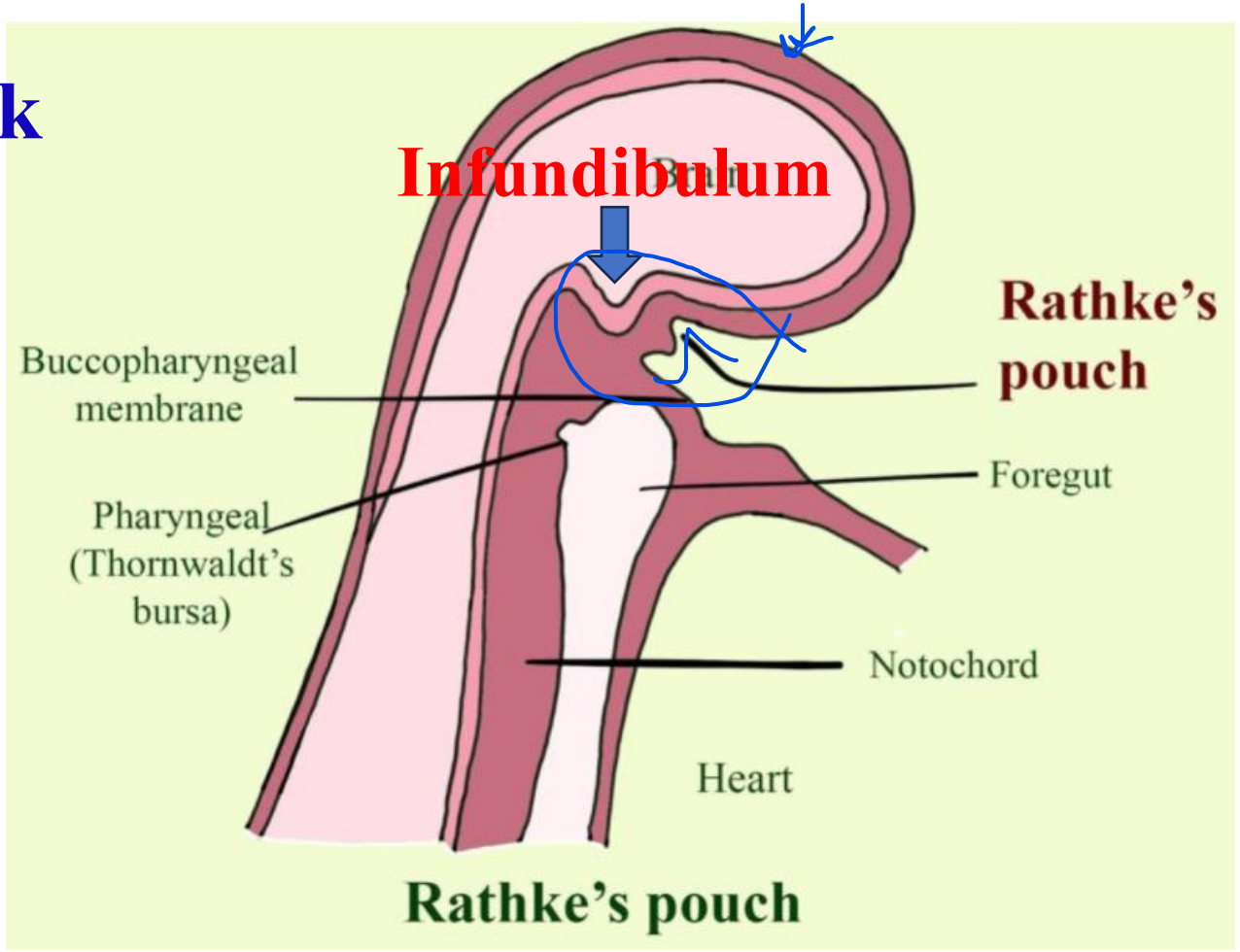
Sources: hypophysis cerebri develops from **two ectodermal sources:** MCQ

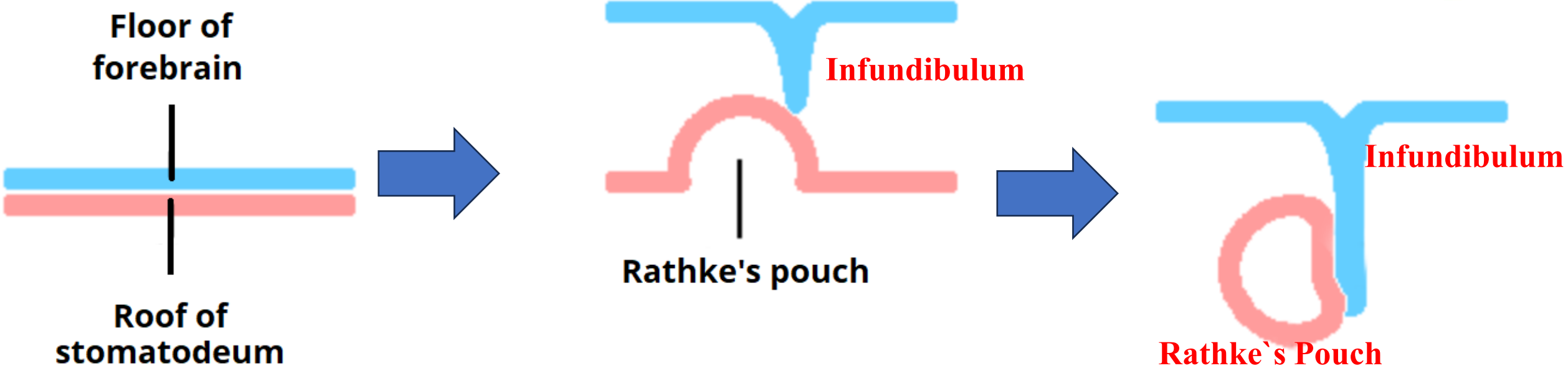
I. Adenohypophysis

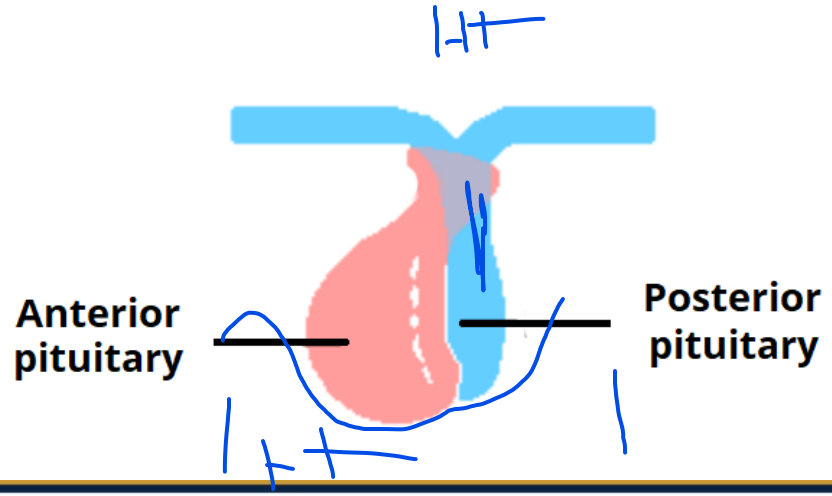
(Rathke`s pouch)

II. Neurohypophysis

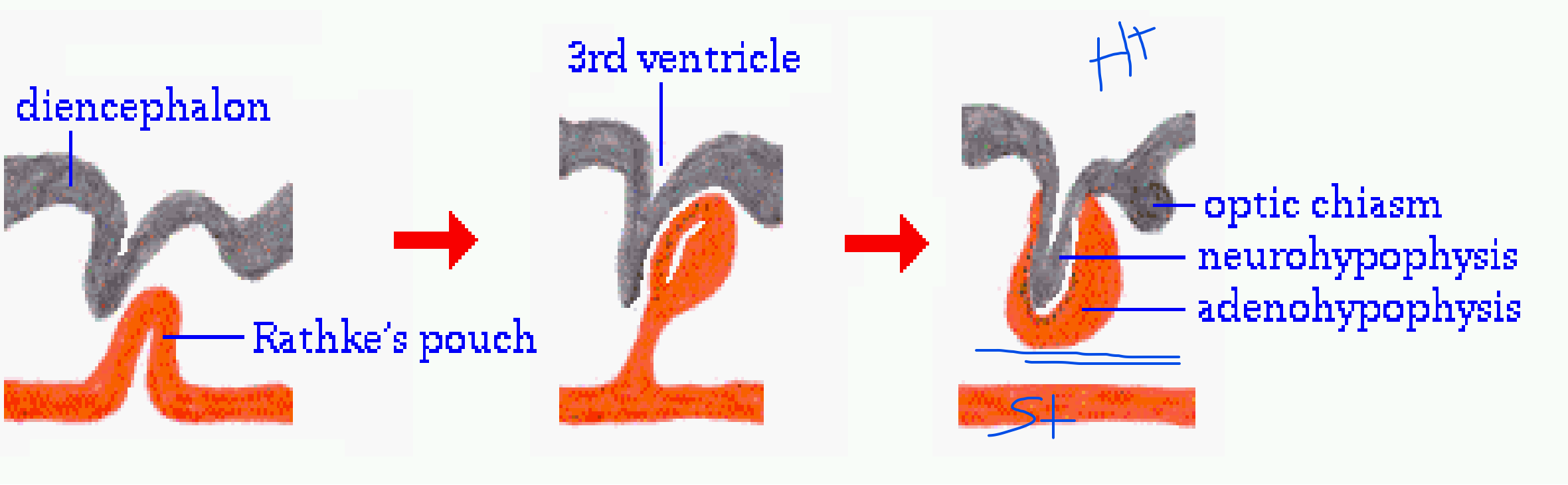
(Infundibulum)



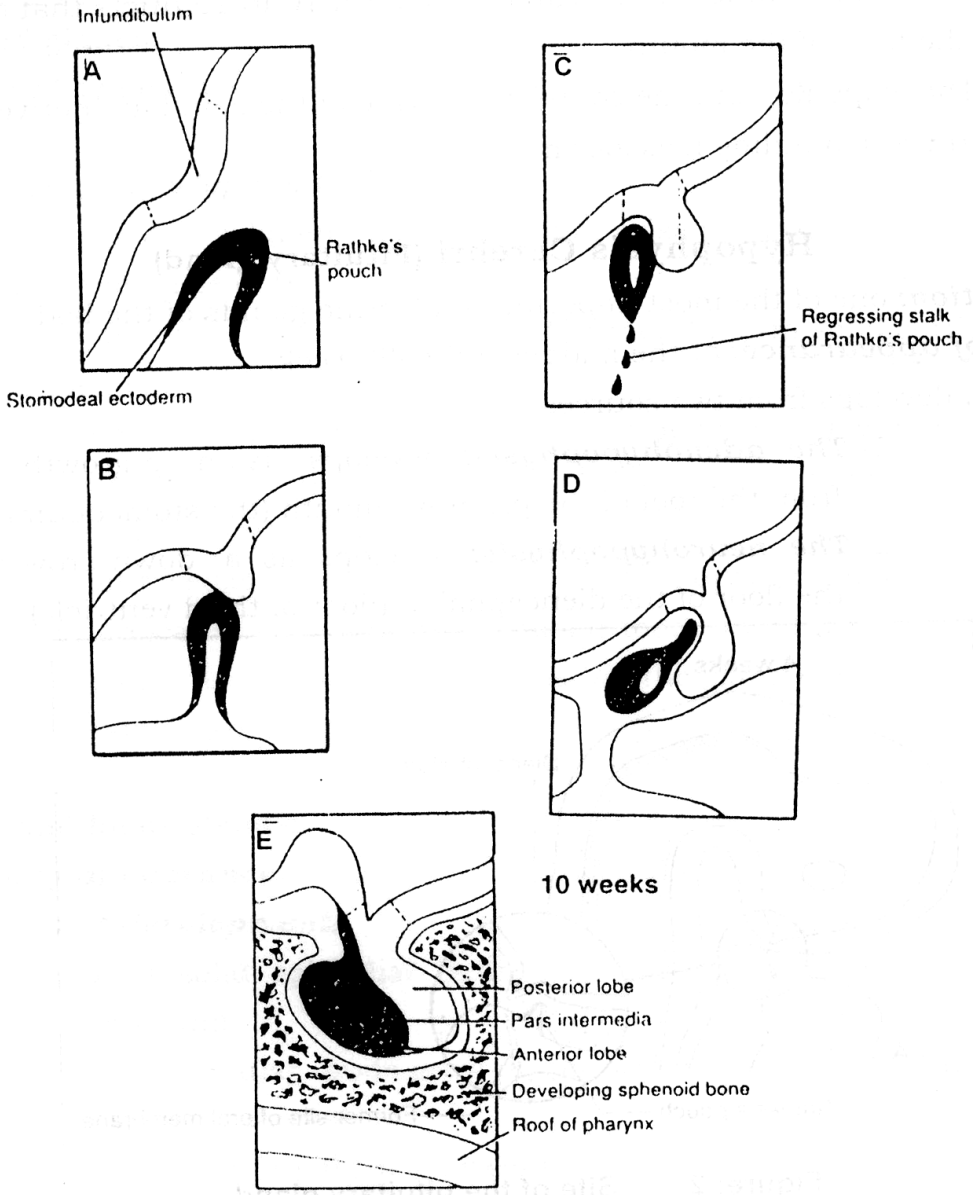

Floor of forebrain
Roof of stomatodeum
Infundibulum
Rathke's pouch
Infundibulum
Rathke`s Pouch


Anterior pituitary
Posterior pituitary

Stages of development of pituitary gland



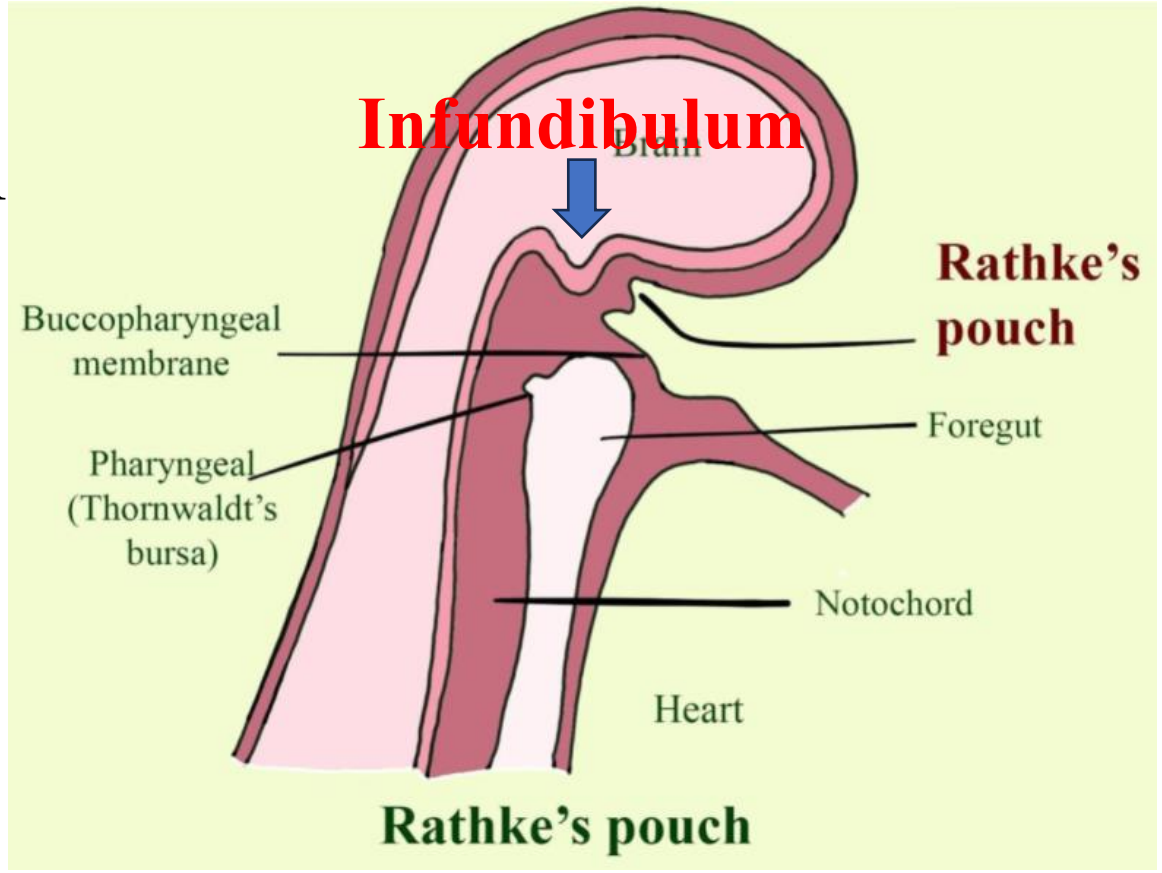
Stages of development of pituitary gland



Development of pituitary gland

I. Adenohypophysis :

- It is an **ectodermal** diverticulum (**upgrowth**), arises from the **roof of the stomodeum.**
- It **ascends towards the floor of the diencephalon** where it swells to form a vesicle.

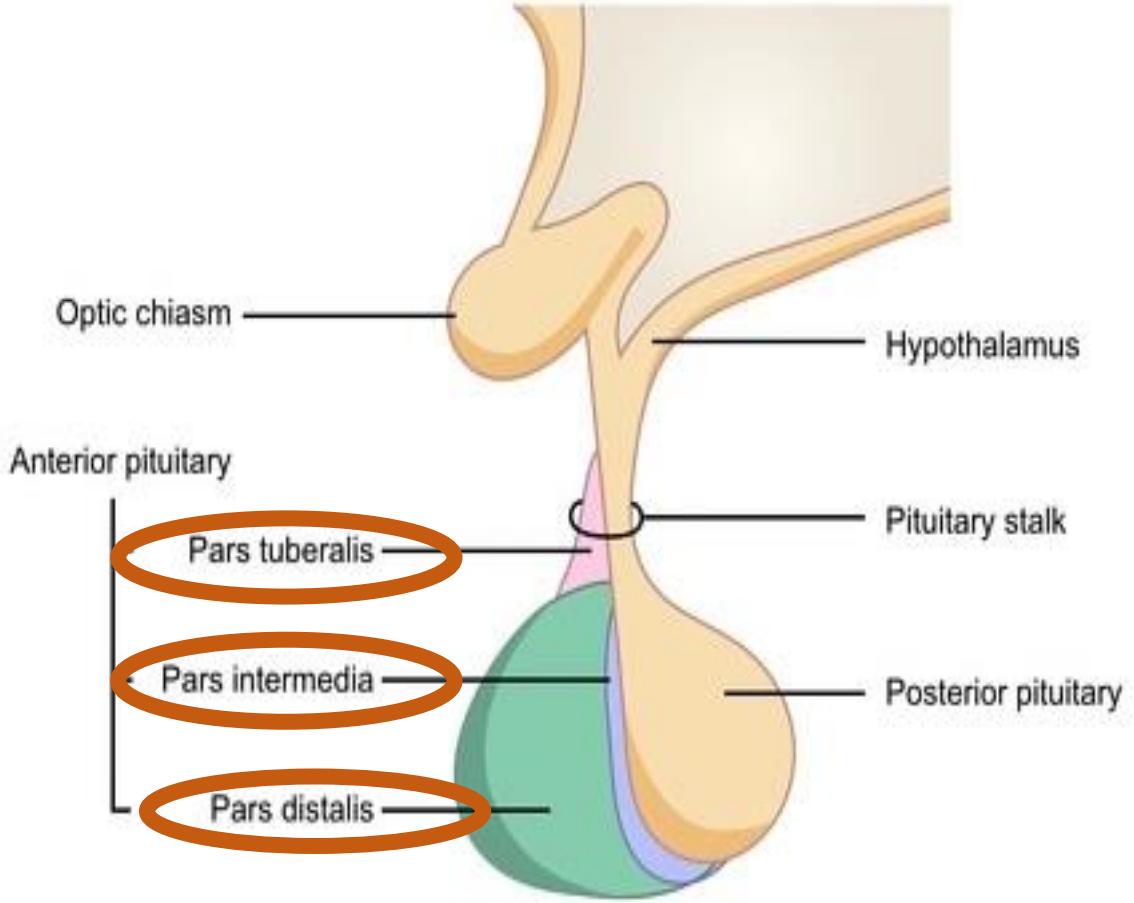


The stem connecting this vesicle to the roof of the stomodeum degenerates

The vesicle differentiate to form the anterior lobe of pituitary gland (adenohypophysis), as follows:

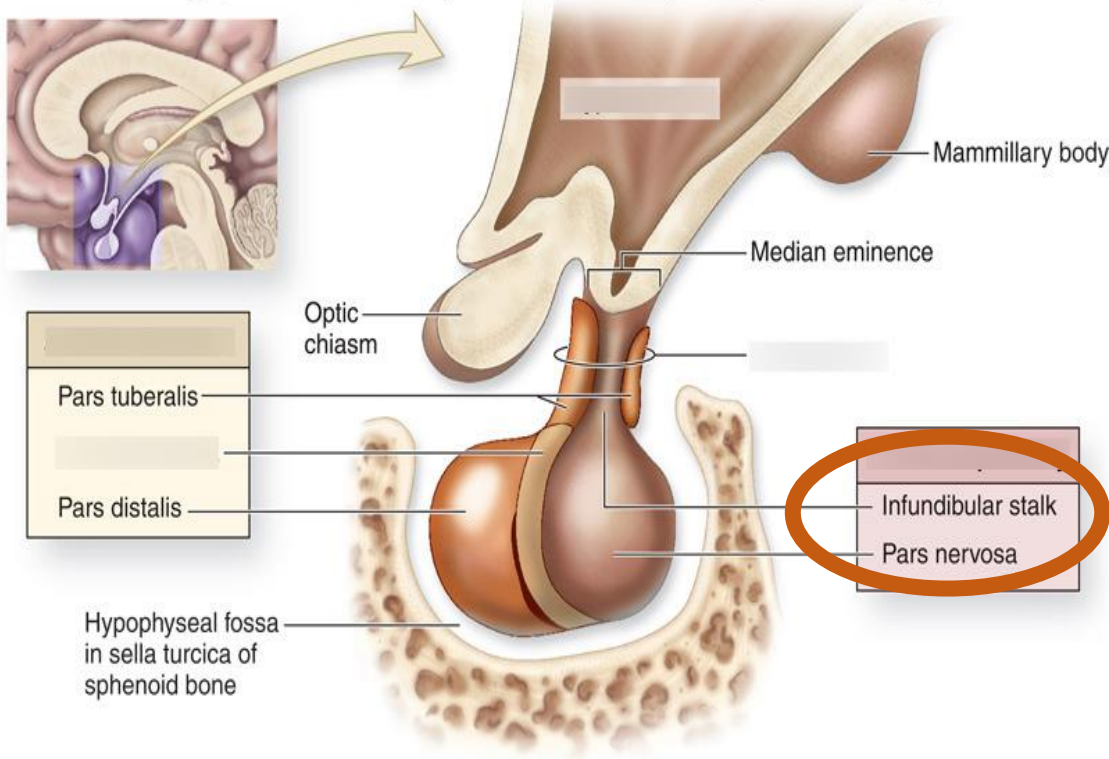
SAQ

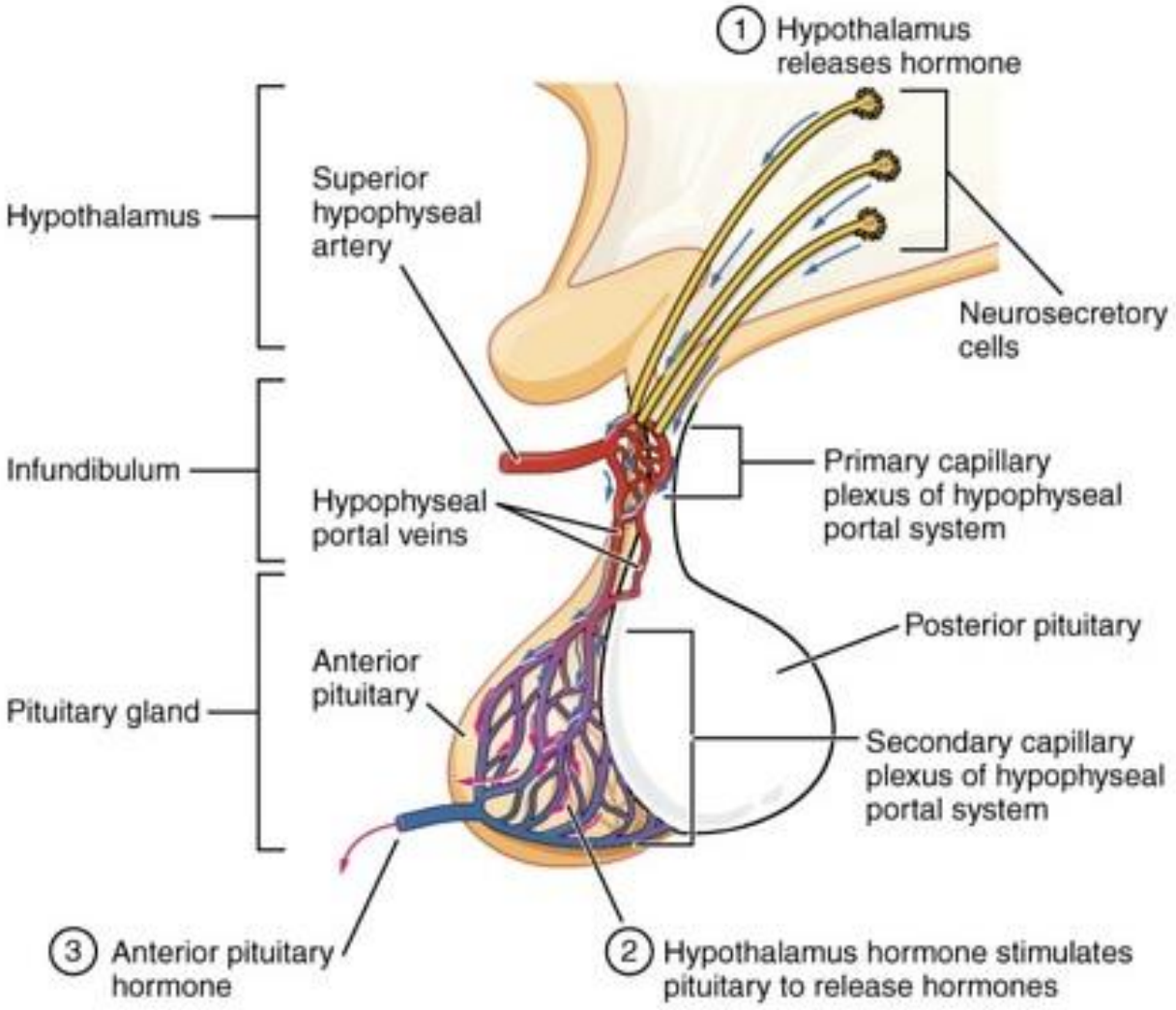
a. **Pars anterior (pars distalis)**: is derived from the **anterior wall** of the vesicle
b. **Pars intermedia**: is derived from the **posterior wall** of the vesicle
c. **Pars tuberalis**: is an **upward extension** of the wall of the vesicle to surround the stalk of the infundibulum which descends from the diencephalon.

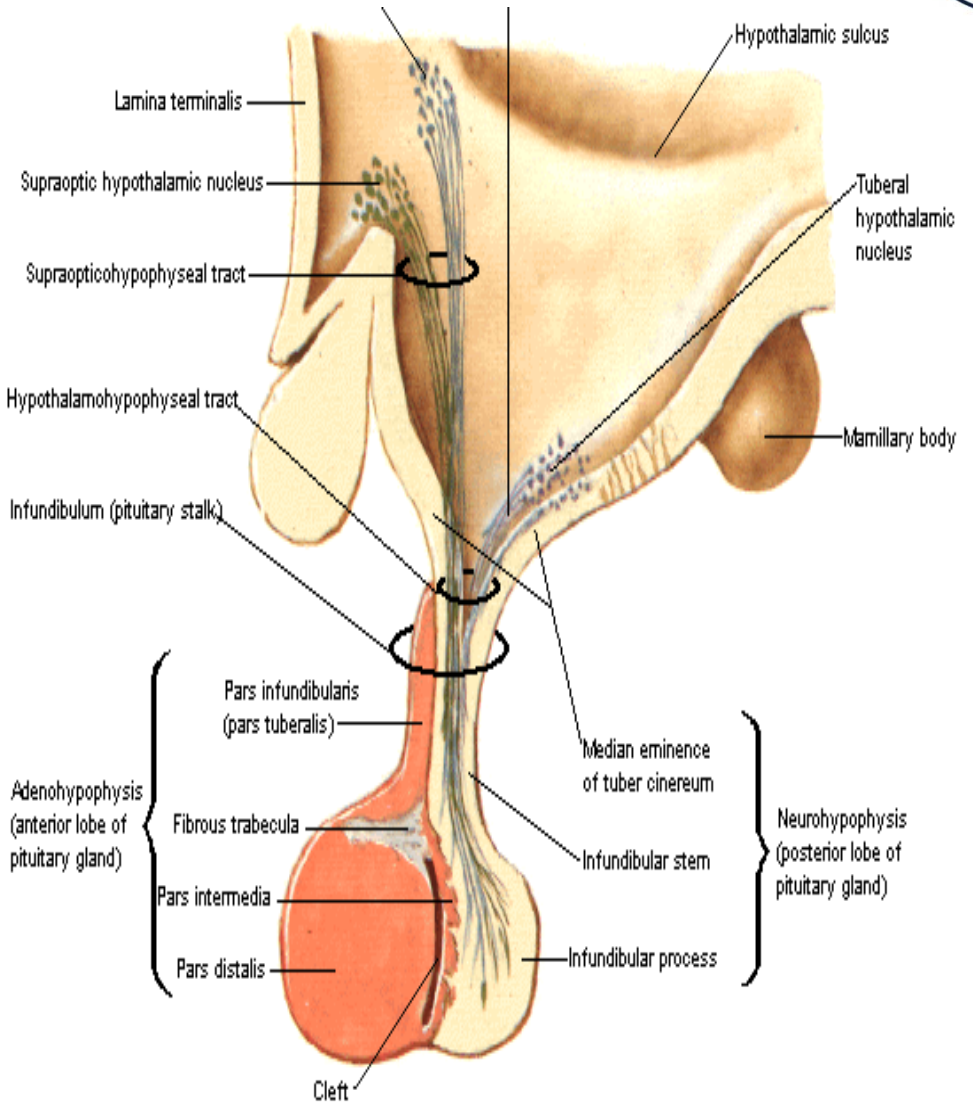


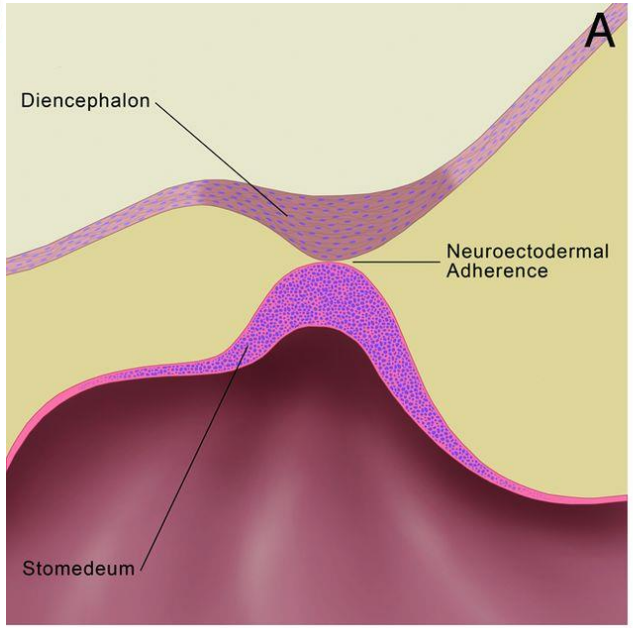
II. Neurohypophysis:

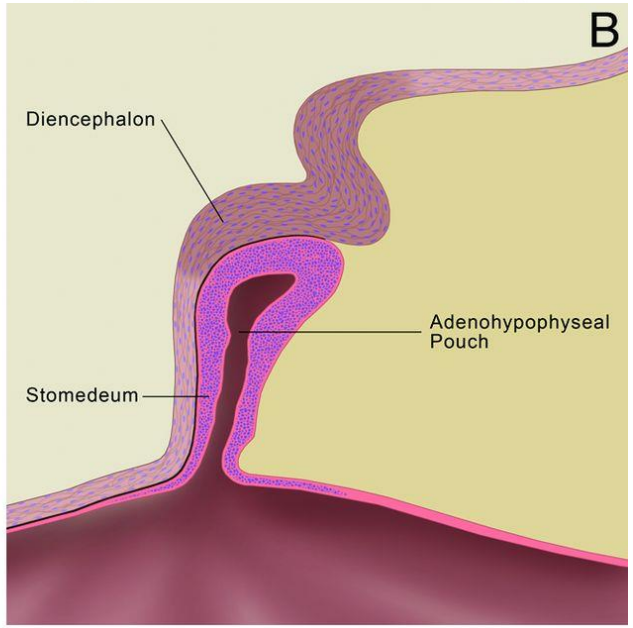
- It is an **ectodermal diverticulum (downgrowth)** which arises from the **floor of the diencephalon (future hypothalamus)**
- It descends caudal to the **Rathke`s** pouch and forms:
  a. **Infundibulum (**the infundibular recess of the 3rd ventricle**)**
  b. **Posterior lobe** of the pituitary gland (**pars nervosa**)
- Contains the nerve cells and nerve fibers which belong to the nuclei of the hypothalamus

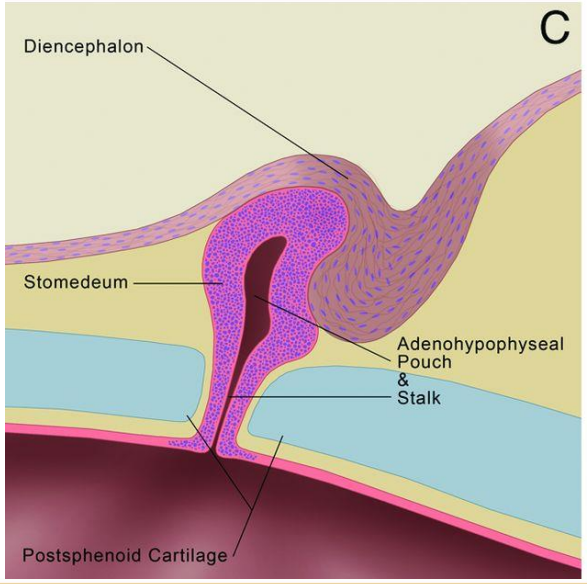


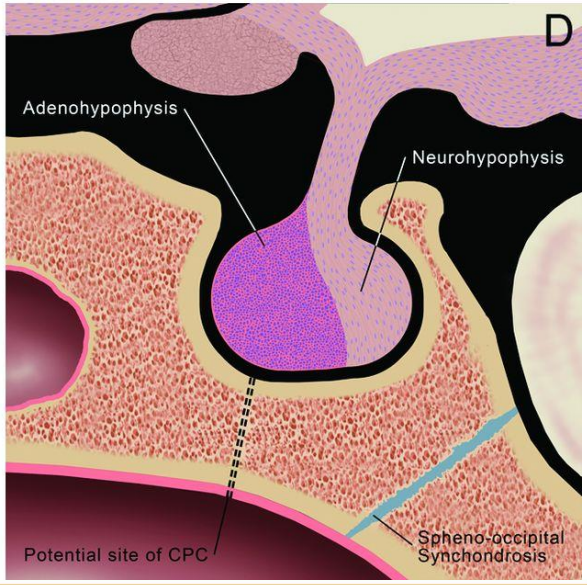

1 Hypothalamus releases hormone
Hypothalamus
Infundibulum
Pituitary gland
Superior hypophyseal artery
Neurosecretory cells
Primary capillary plexus of hypophyseal portal system
Hypophyseal portal veins
Posterior pituitary
Anterior pituitary
Secondary capillary plexus of hypophyseal portal system
3 Anterior pituitary hormone
2 Hypothalamus hormone stimulates pituitary to release hormones


Hypothalamic sulcus
Lamina terminalis
Supraoptic hypothalamic nucleus
Tuberal hypothalamic nucleus
Supraopticohypophyseal tract
Hypothalamohypophyseal tract
Mamillary body
Infundibulum (pituitary stalk)
Pars infundibularis (pars tuberalis)
Median eminence of tuber cinereum
Adenohypophysis (anterior lobe of pituitary gland)
Fibrous trabecula
Infundibular stem
Neurohypophysis (posterior lobe of pituitary gland)
Pars intermedia
Pars distalis
Infundibular process
Cleft


A
Diencephalon
Neuroectodermal Adherence
Stomedeum


B
Diencephalon
Adenohypophyseal Pouch
Stomedeum


C
Diencephalon
Stomedeum
Adenohypophyseal Pouch & Stalk
Postsphenoid Cartilage


D
Adenohypophysis
Neurohypophysis
Potential site of CPC
Spheno-occipital Synchondrosis

Congenital anomalies of pituitary gland

SAQ

1-Pharyngeal pituitary gland:

Due to: persistence of a remnant of the stalk of Rathke`s pouch.

Features: accessory masses of the anterior lobe of the pituitary gland in the roof of oropharynx.

Congenital anomalies of pituitary gland

2-Aplasia & hypoplasia of pituitary gland:

Due to: Failure or incomplete development of the anterior wall of Rathke`s pouch.

Features: Hypofunction of pituitary gland.

Anatomy & DEVELOPMENT of Thyroid & Parathyroid GLANDS

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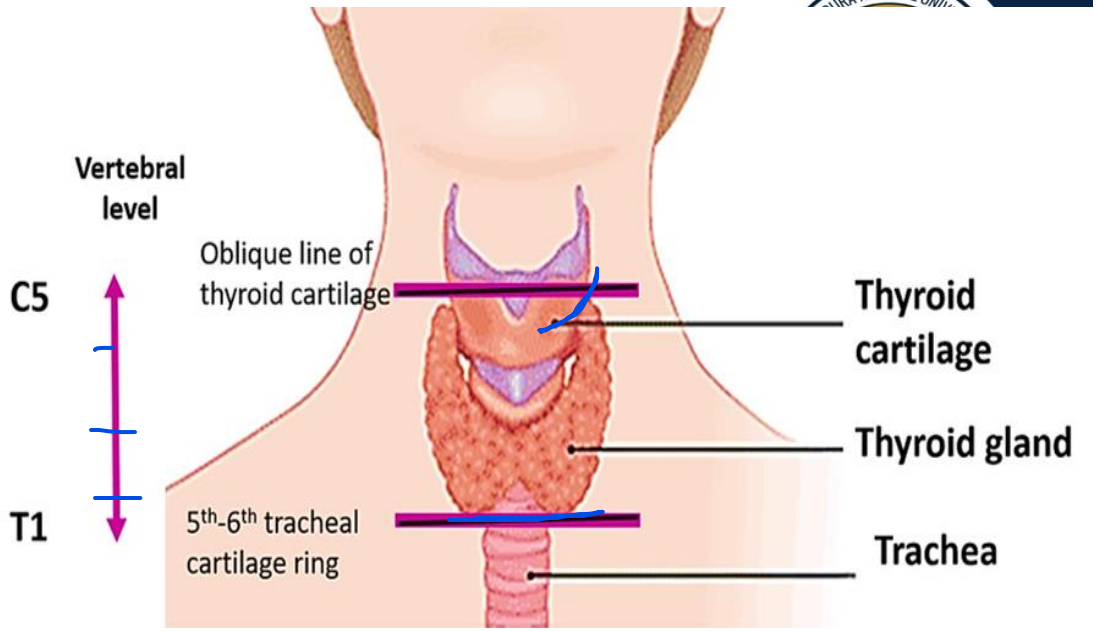
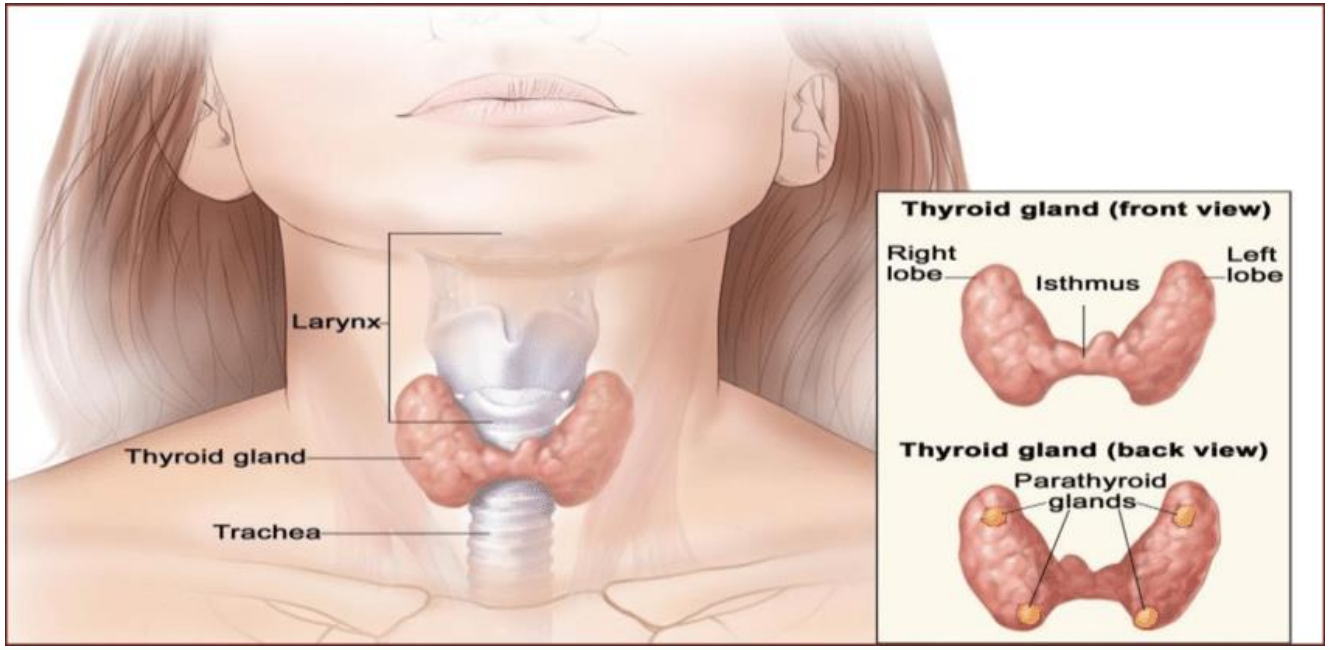
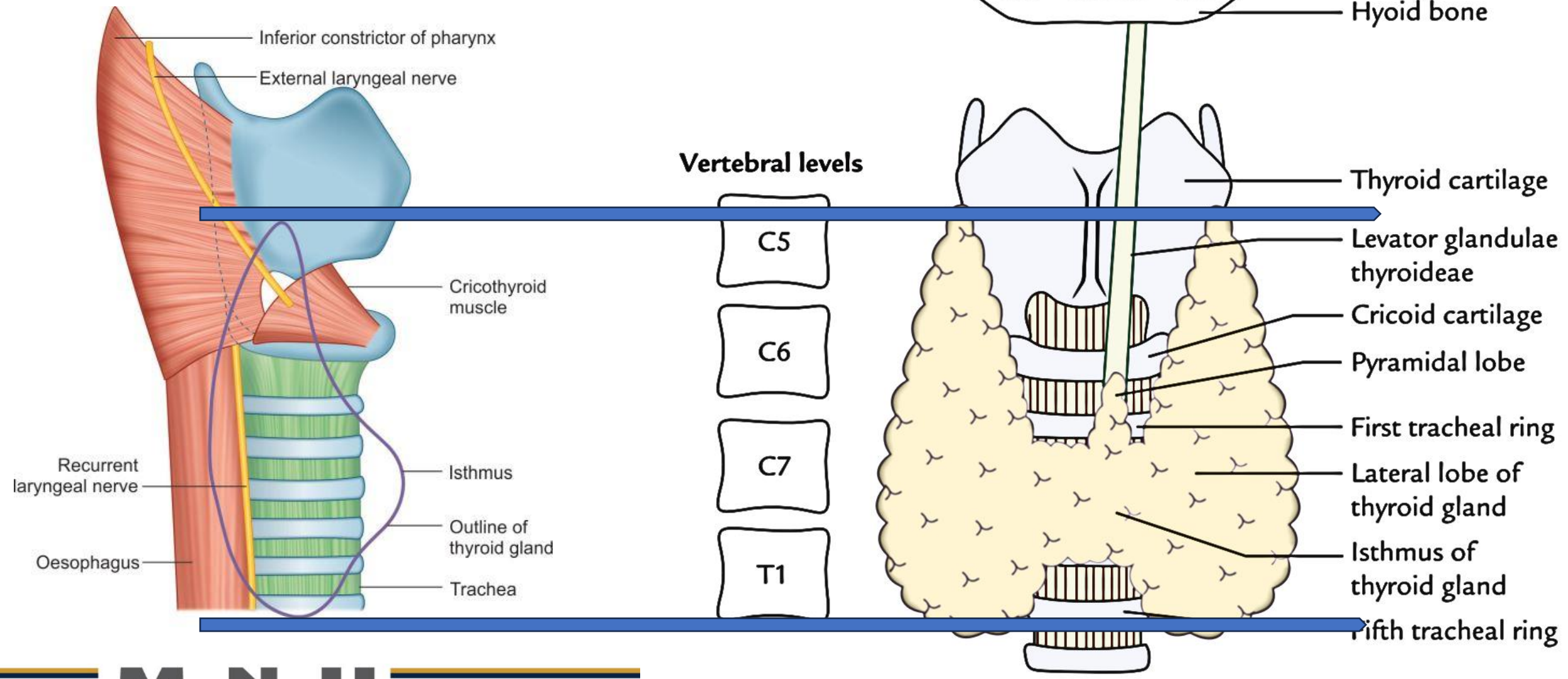
Extent

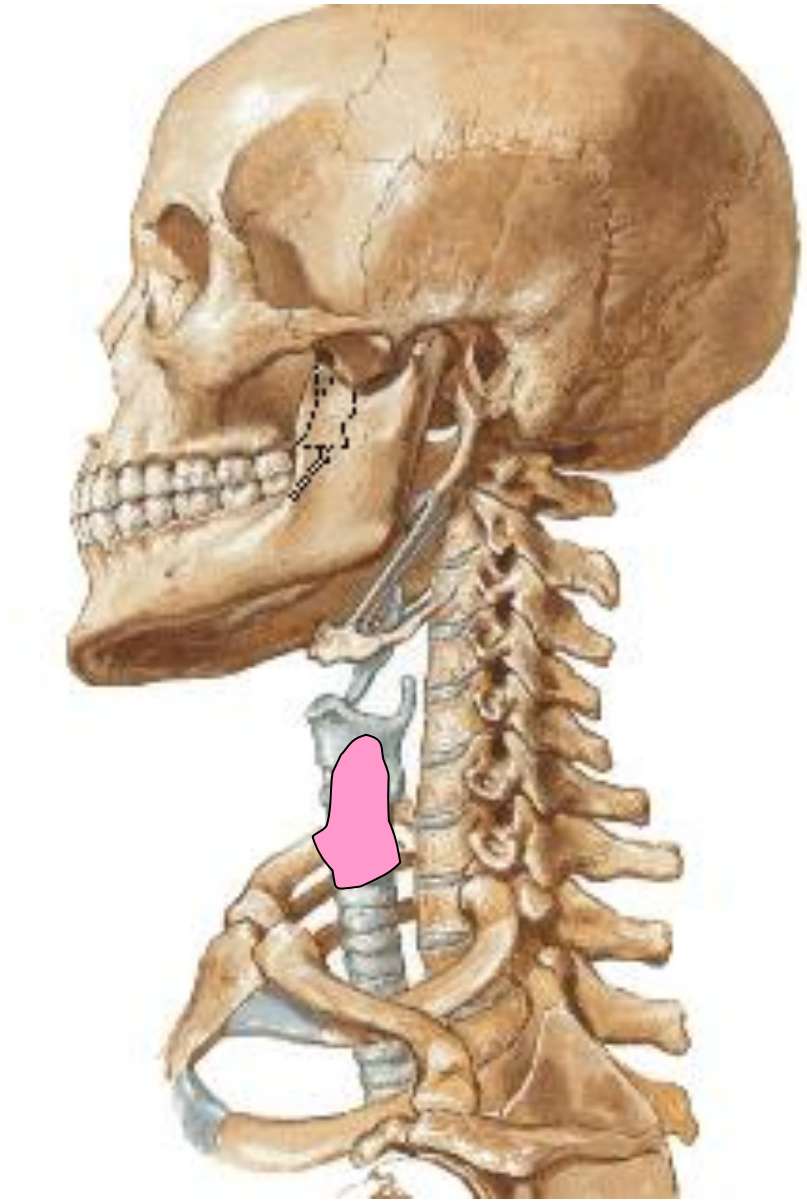
MCQ

- in the lower part of front of neck
- extending from **middle of thyroid cartilage to 5th tracheal ring (Infront)**
- opposite **5th, 6th, 7th cervical vertebrae & 1st thoracic vertebra (Behind)**



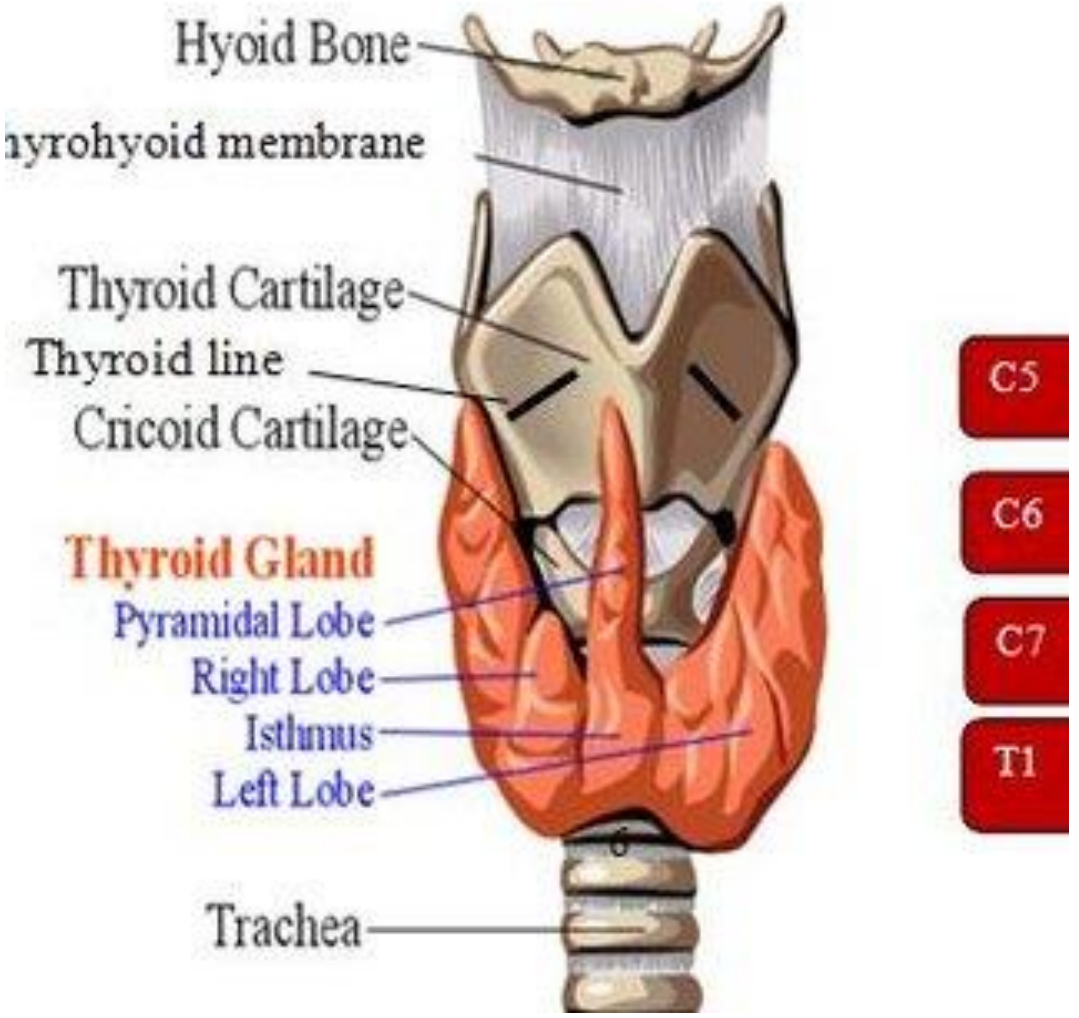



Inferior constrictor of pharynx
External laryngeal nerve
Cricothyroid muscle
Recurrent laryngeal nerve
Isthmus
Outline of thyroid gland
Oesophagus
Trachea
Vertebral levels
C5
C6
C7
T1
Hyoid bone
Thyroid cartilage
Levator glandulae thyroideae
Cricoid cartilage
Pyramidal lobe
First tracheal ring
Lateral lobe of thyroid gland
Isthmus of thyroid gland
Fifth tracheal ring



Shape

- **Butterfly** in shape.
- Formed of
  1. Right & left **lobes**.
  2. **Isthmus** connecting the 2 lobes.
  3. **Pyramidal** lobe MCQ

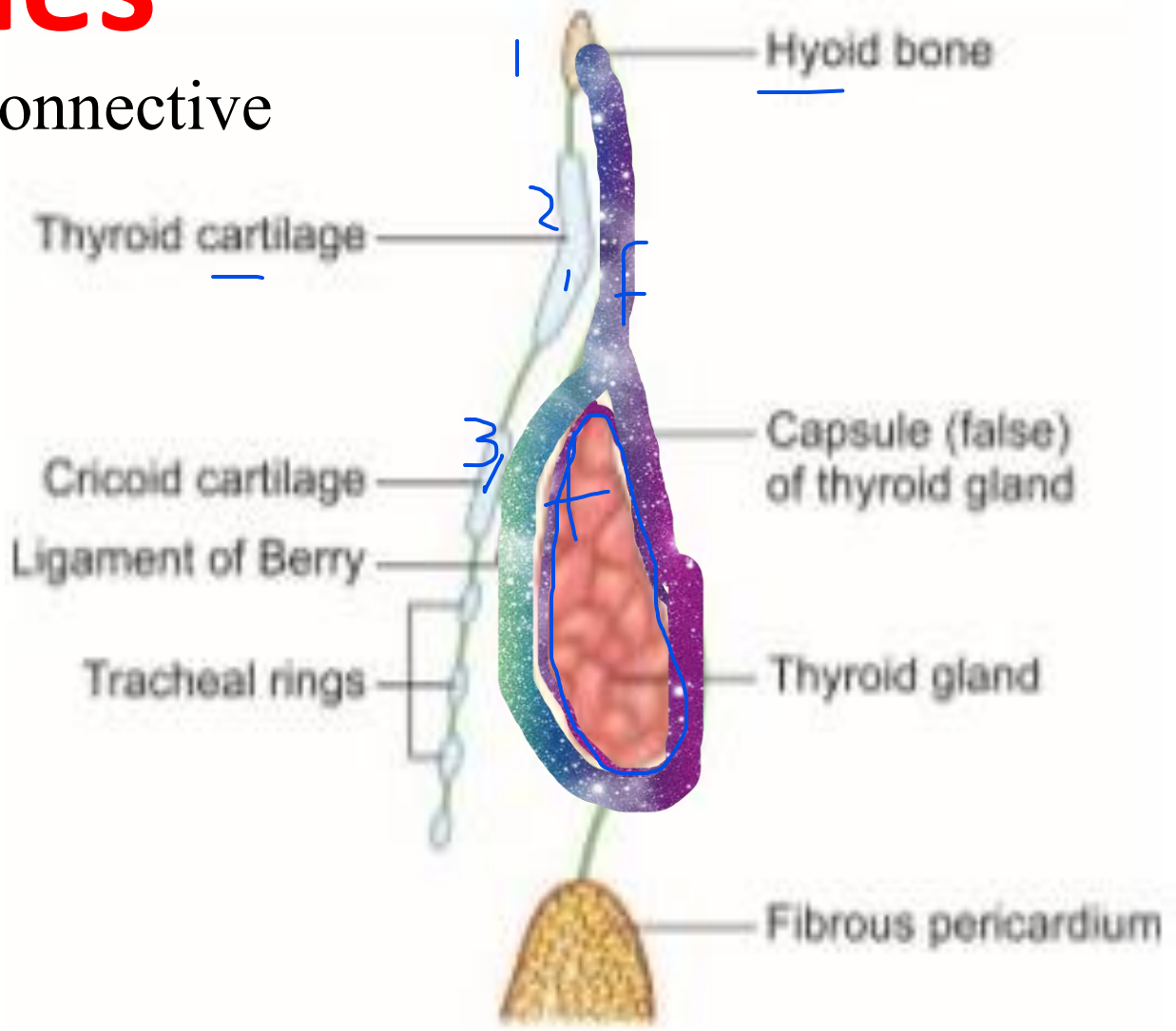


Capsules

A. True capsule: condensation of connective tissue of the gland.

B. False capsule: a sheath of pretracheal fascia, which fixes the gland to hyoid bone, thyroid & cricoid cartilage. (the gland moves up and down with swallowing)

MCQ



Surfaces & Relations

Lateral surface

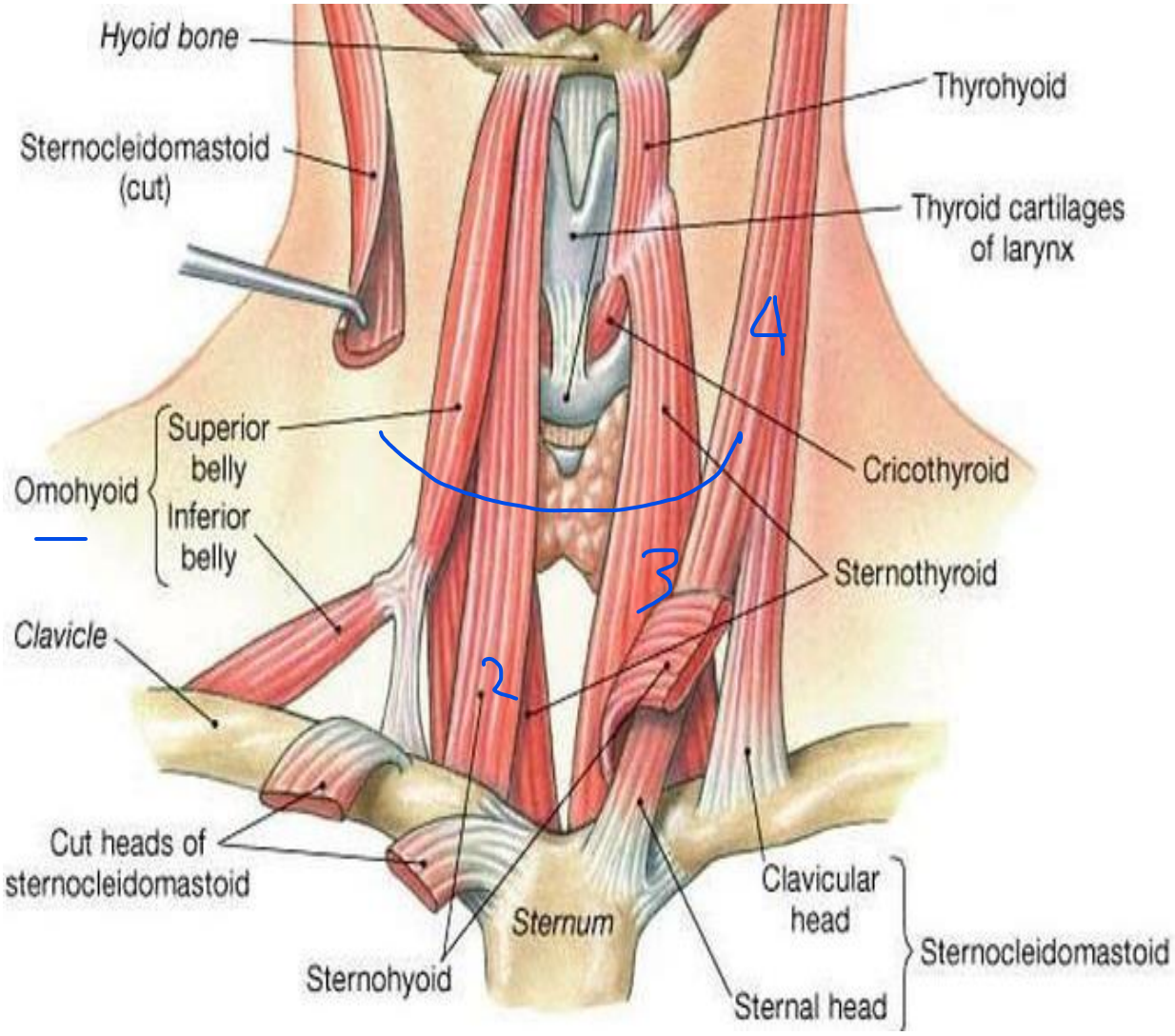
SAQ

Superficial (lateral) surface, is full & rounded & is Covered by:

i. Superior belly of omohyoid, at its upper part.

ii. Sternomastoid, at its lower part.

iii. Sternohyoid & sternothyroid, at middle

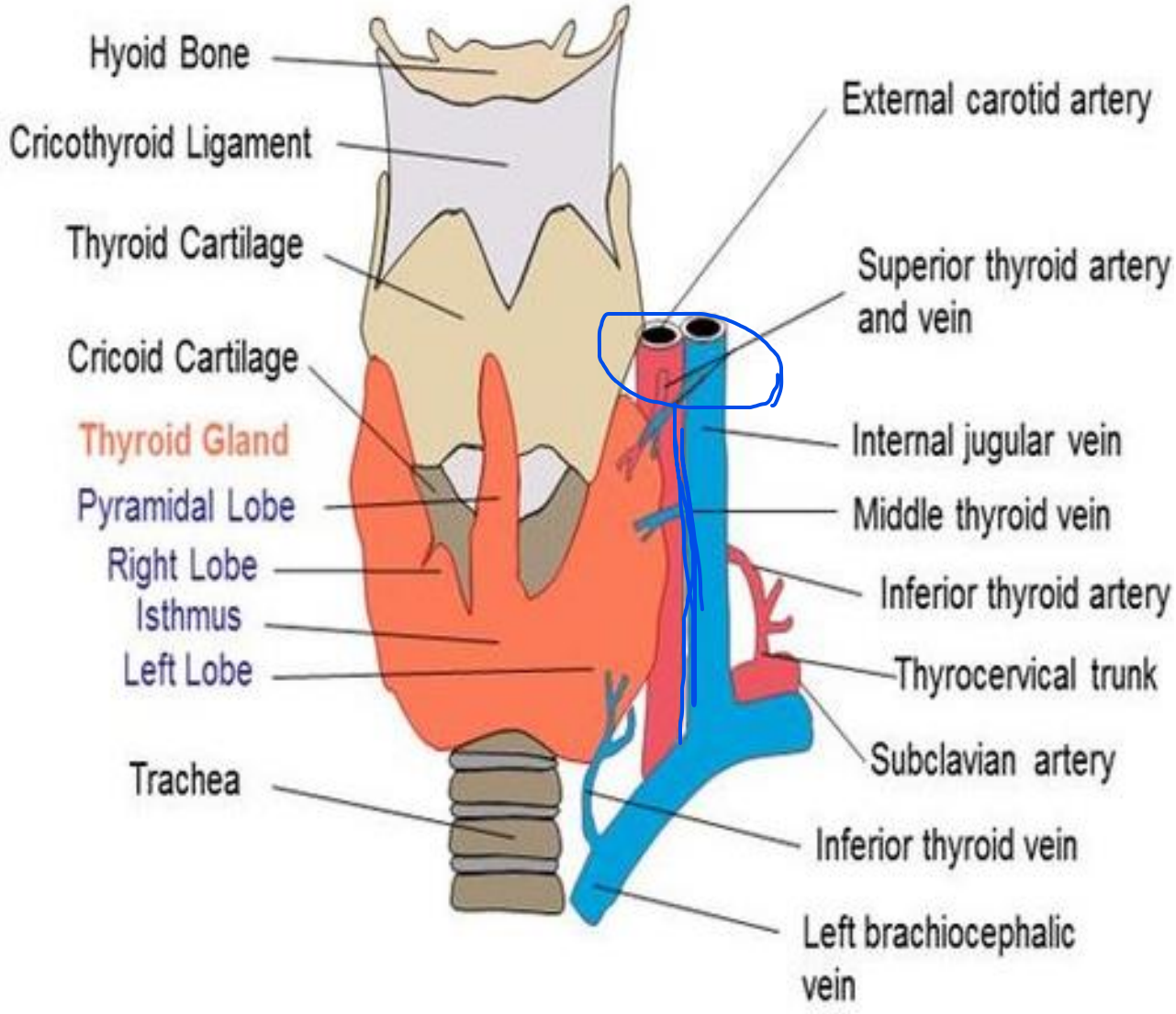


Posterior surface

SAQ

Carotid sheath:

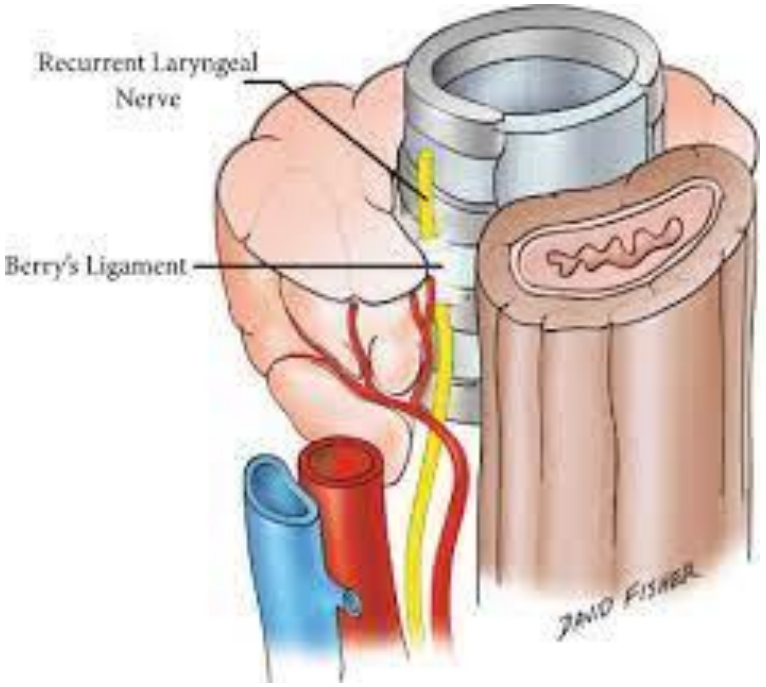
A. Common carotid artery
B. Internal jugular vein
C. Vagus in between



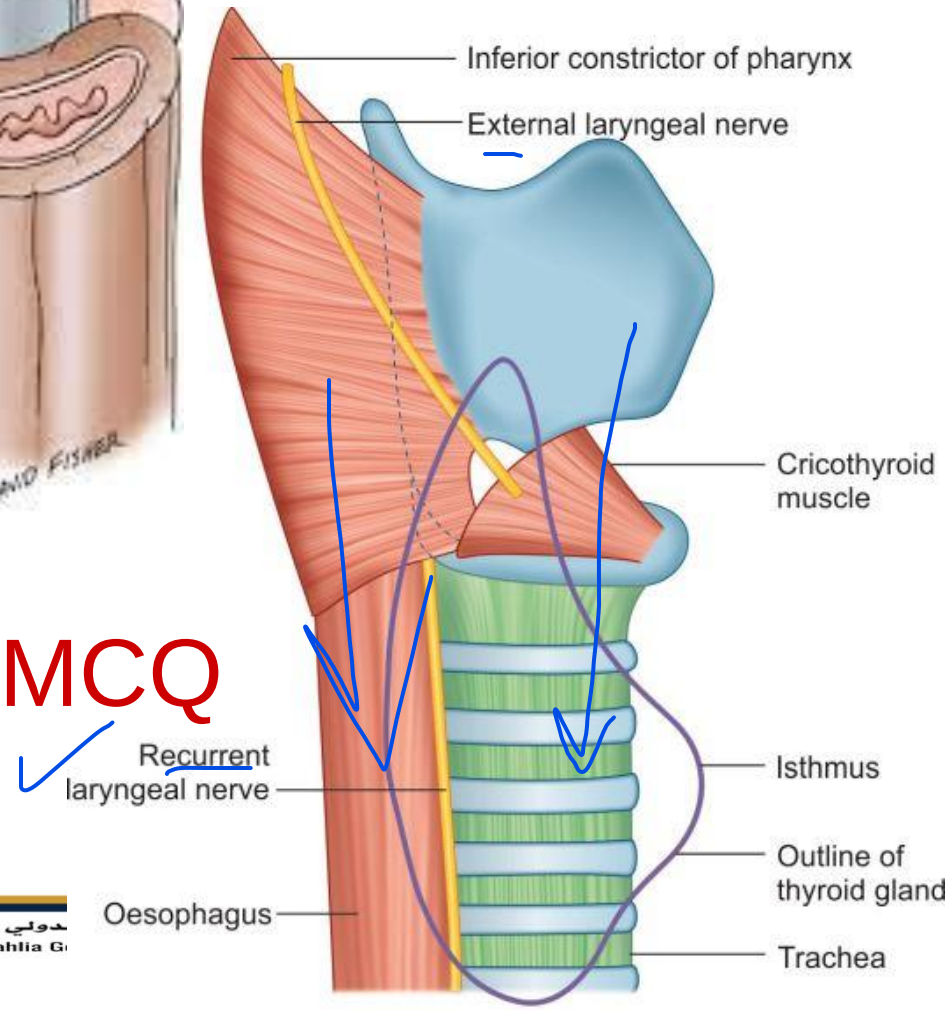
Medial surface

SAQ

1. Upper part:
   A. Larynx
   B. Pharynx
   C. External laryngeal nerve in between
2. Lower part:
   A. Trachea
   B. Esophagus
   C. Recurrent laryngeal n. in between



MCQ



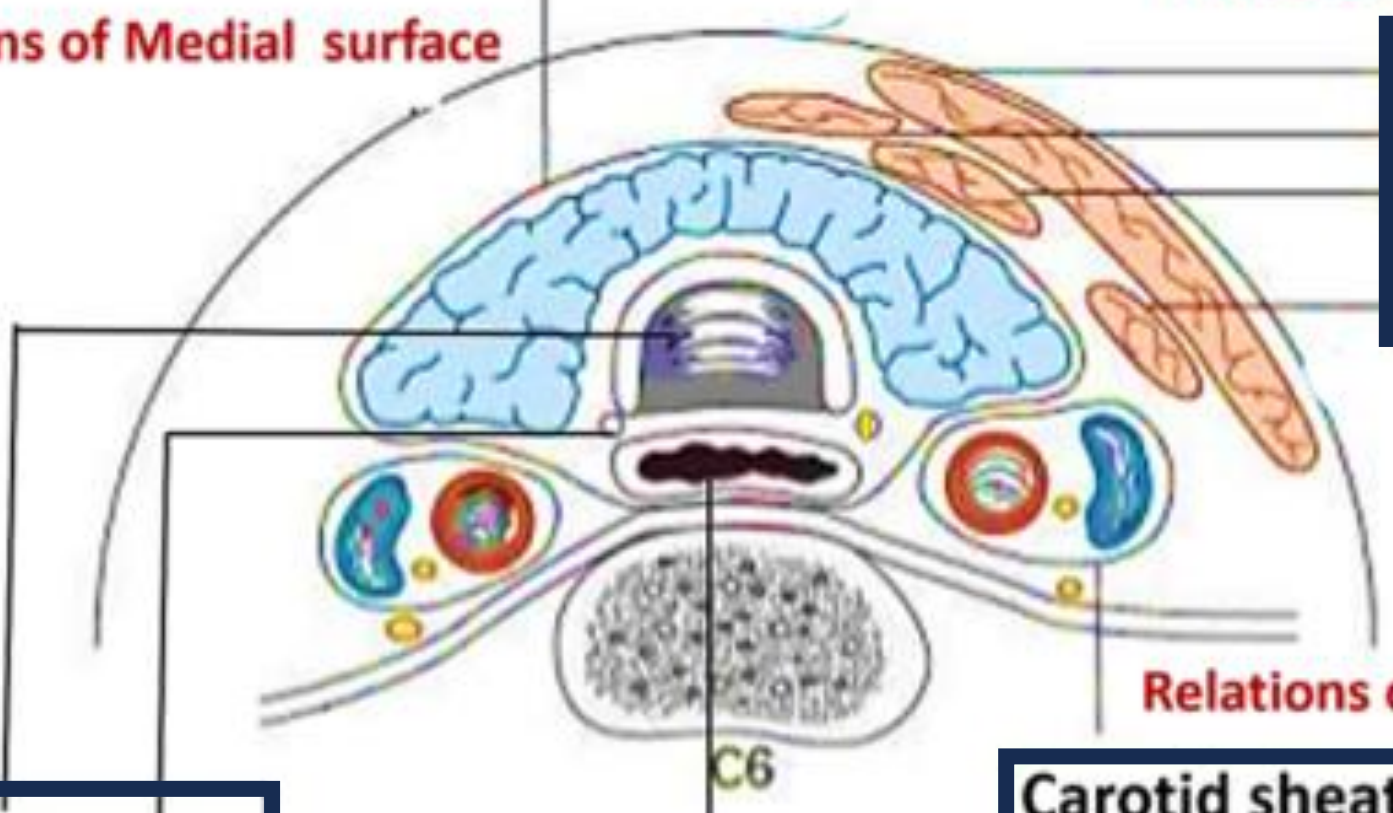
Pre- tracheal fascia

Relations of Medial surface

Relations of lateral surface

Sternocleidomastoid
Sternohyoid
Sternothyroid

Omohyoid



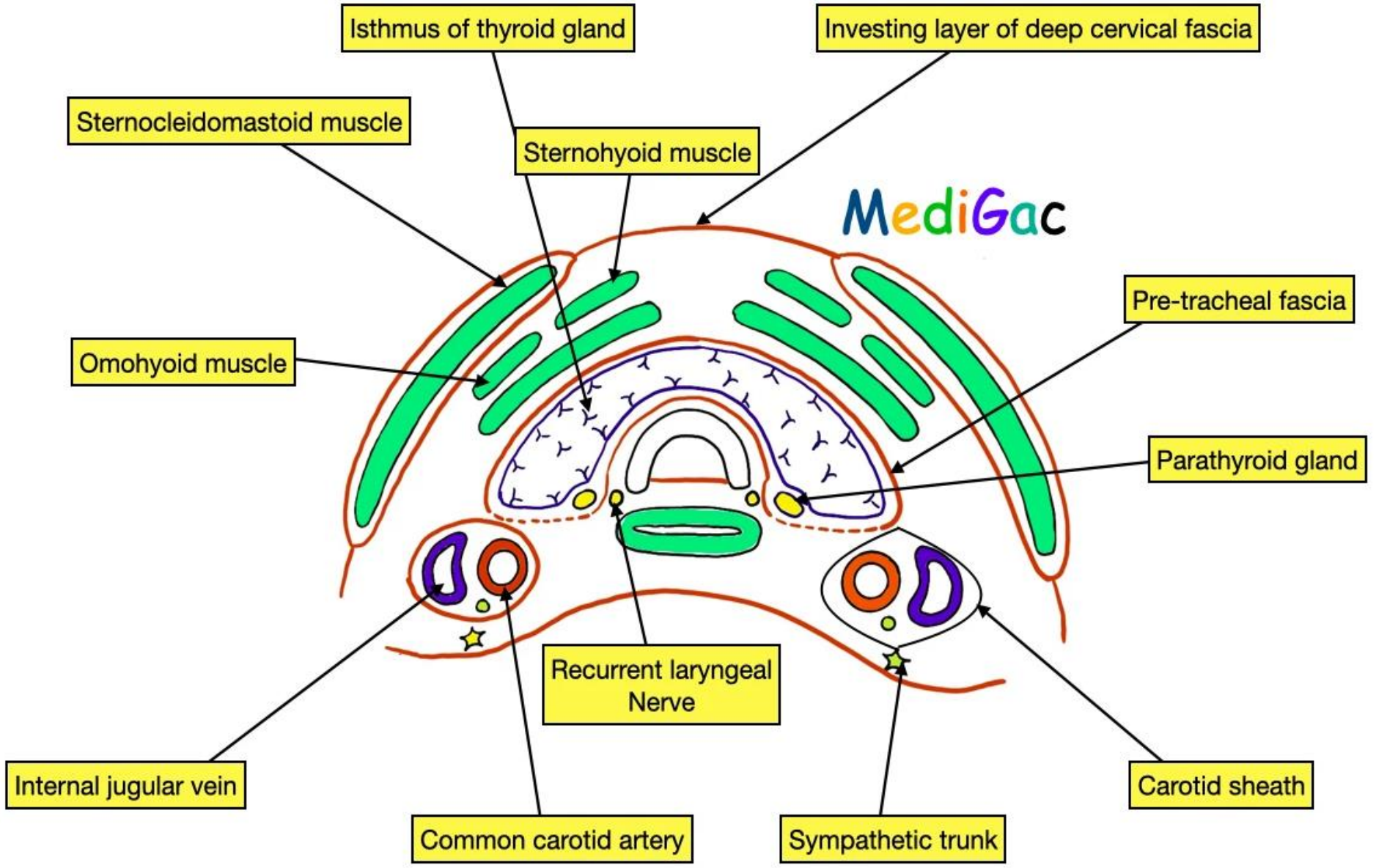
Relations of Posterolateral surface

Trachea

Recurrent laryngeal nerve

Oesophagus

Carotid sheath containing common carotid artery, internal jugular vein and vagus nerve


Isthmus of thyroid gland
Investing layer of deep cervical fascia
Sternocleidomastoid muscle
Sternohyoid muscle
MediGac
Pre-tracheal fascia
Omohyoid muscle
Parathyroid gland
Recurrent laryngeal Nerve
Internal jugular vein
Carotid sheath
Common carotid artery
Sympathetic trunk

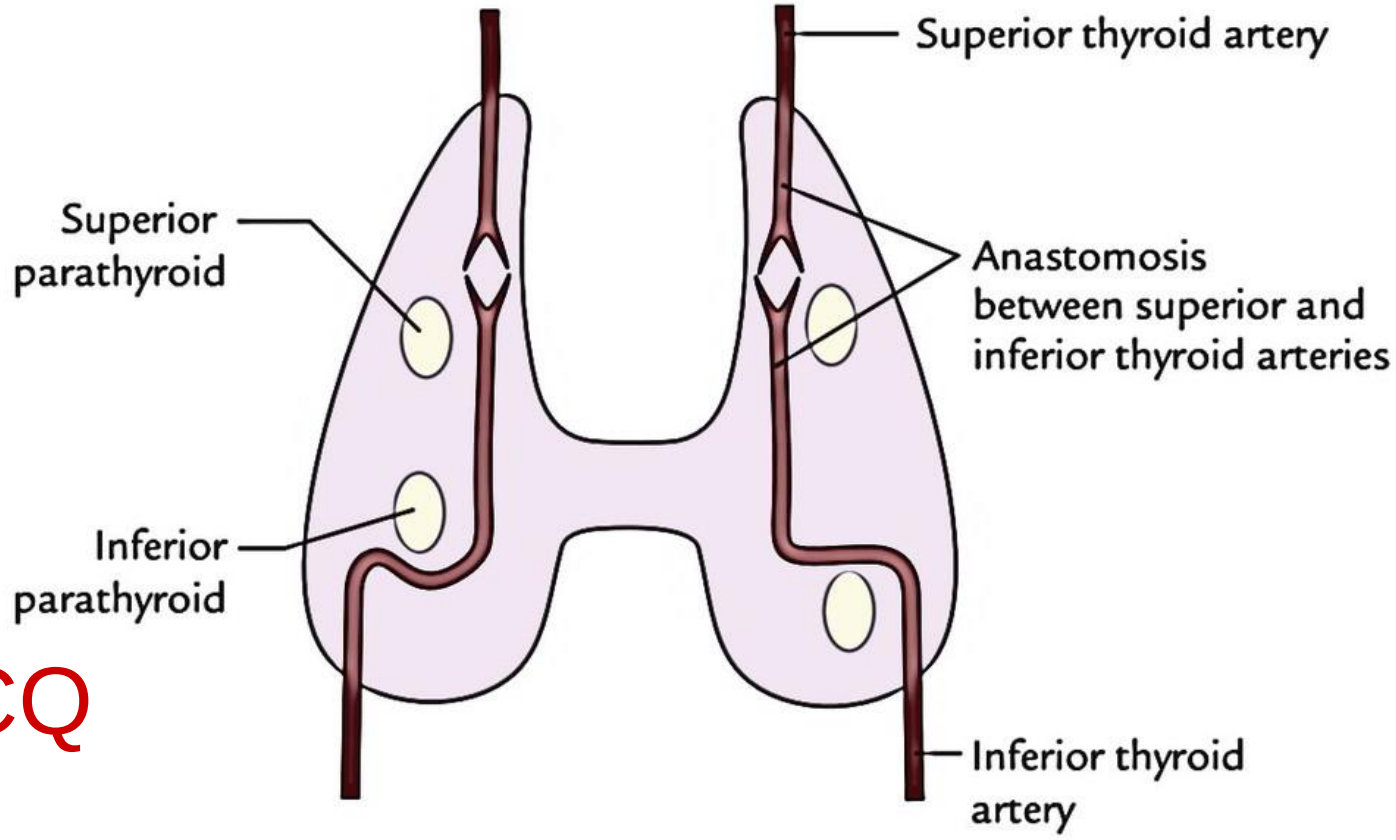
Borders

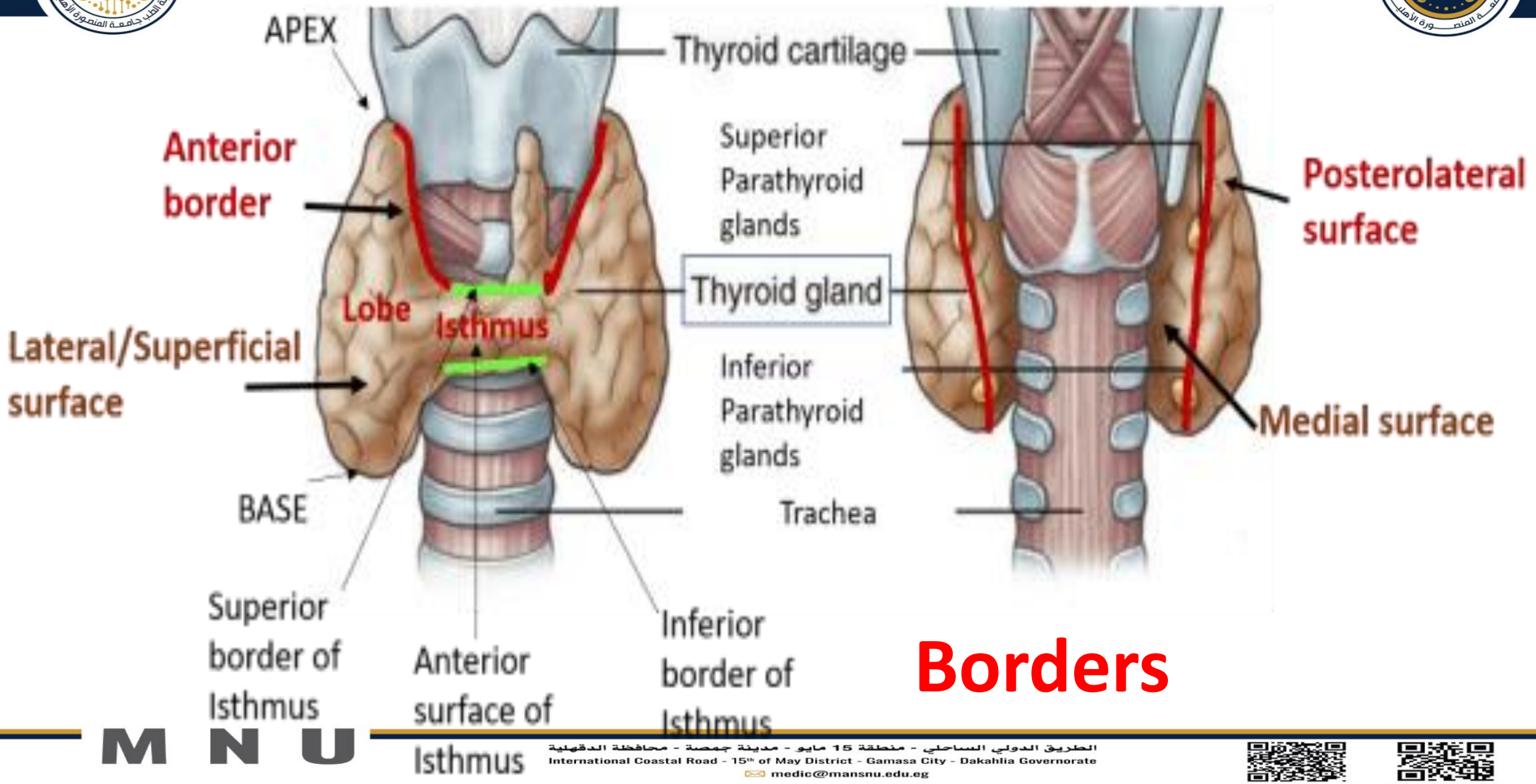
Anterior border:

Related to anterior branch of superior thyroid artery. MCQ

Posterior border:

Related to parathyroid glands, inferior thyroid artery & anastomosis between superior & inferior thyroid arteries MCQ




Anterior
Posterior
APEX
Thyroid cartilage
Anterior border
Superior Parathyroid glands
Posterolateral surface
Thyroid gland
Lobe
Isthmus
Lateral/Superficial surface
Inferior Parathyroid glands
Medial surface
BASE
Trachea
Superior border of Isthmus
Anterior surface of Isthmus
Inferior border of Isthmus

Borders

Isthmus of thyroid gland

It connects the two lobes.

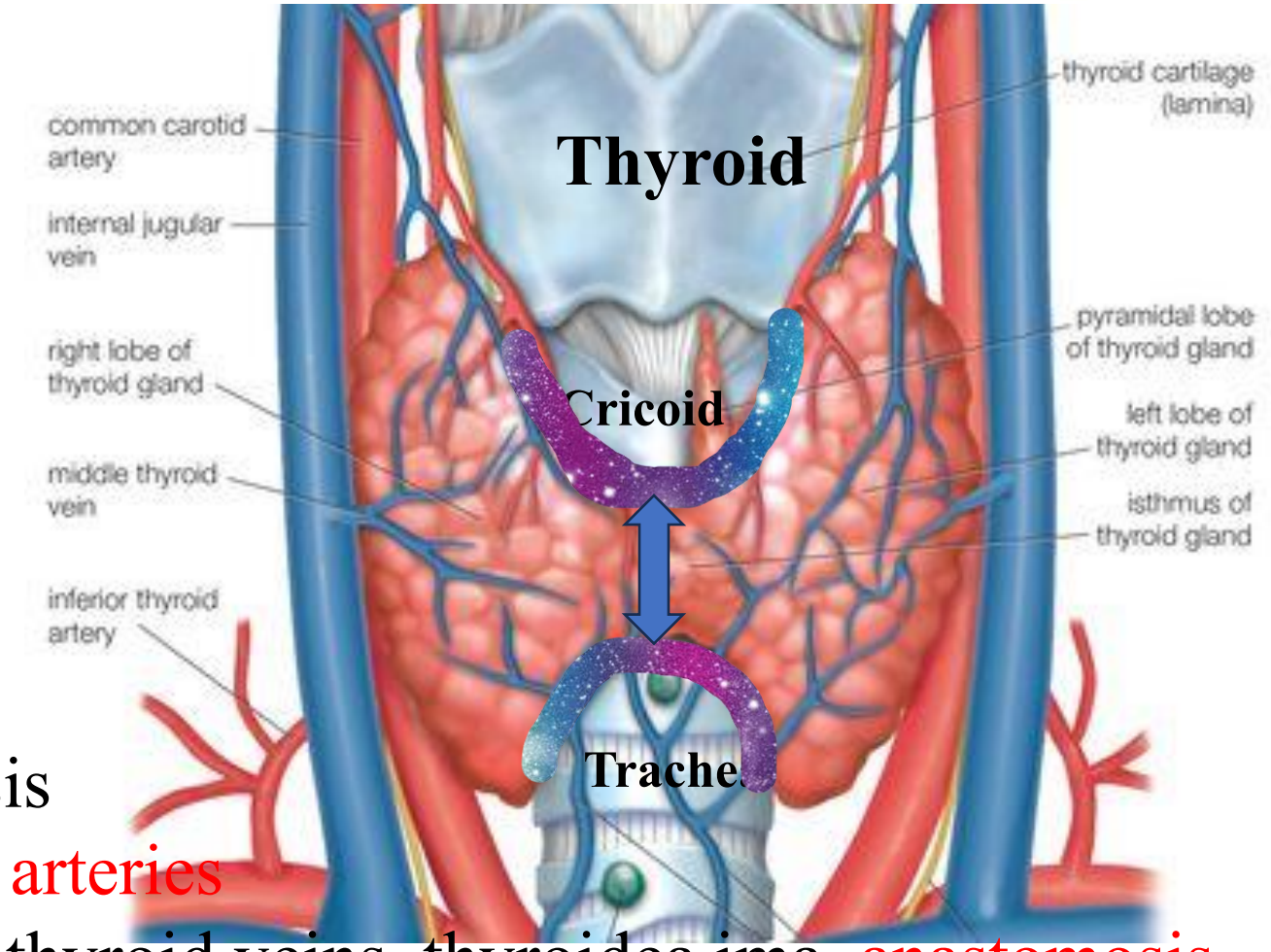
- **Surfaces:**

A. Anterior surface: is covered by:

- Sternohyoid
- Anterior jugular veins.
- Sternothyroid MCQ

B. Posterior surface: related to

2nd, 3rd & 4th tracheal rings



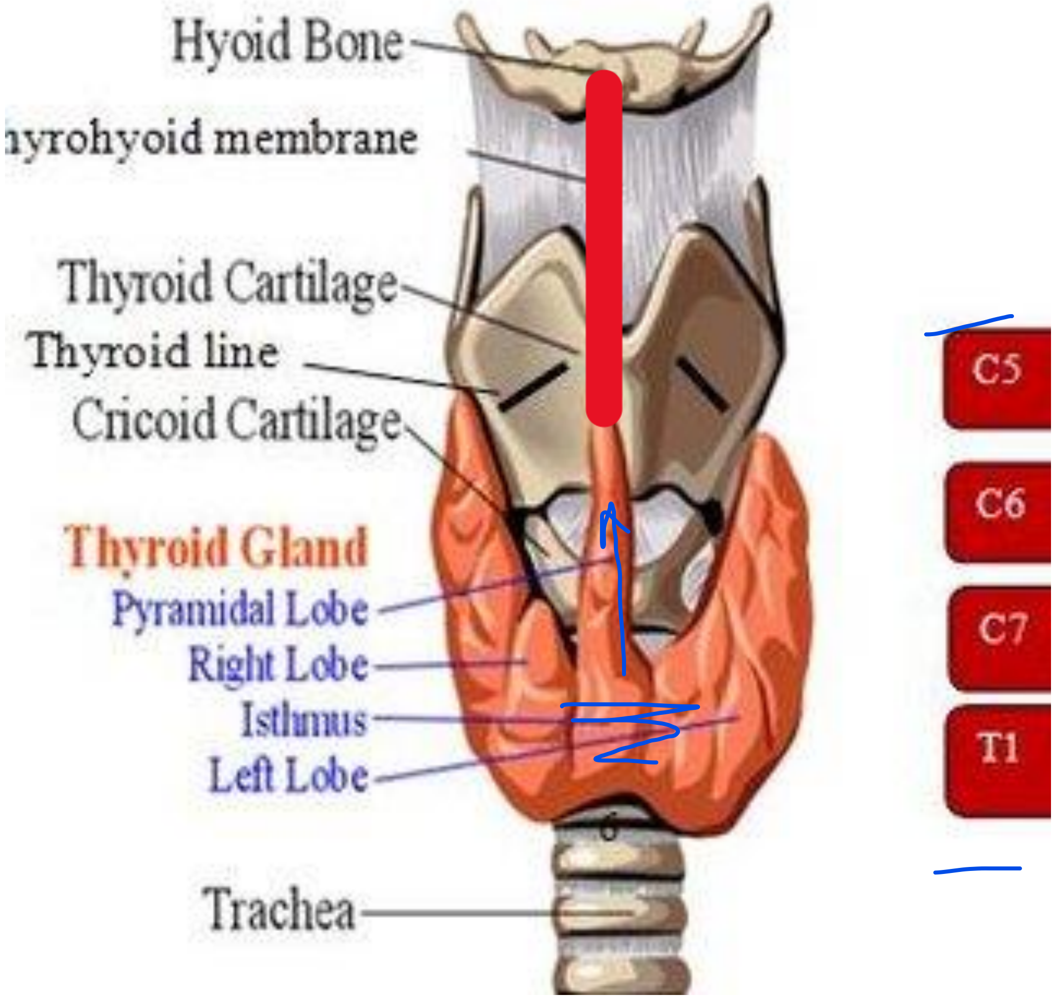
- **Borders:**

A. **Upper border:** shows anastomosis between the two superior thyroid arteries

B. Lower border: related to inferior thyroid veins, thyroidea ima, anastomosis between inferior thyroid arteries

Relations of the pyramidal lobe

- It is a small conical process that extends from the upper border of the isthmus.
- It connected to the hyoid bone by a fibromuscular band, the levator glandulae thyroidae.



Blood supply of thyroid gland

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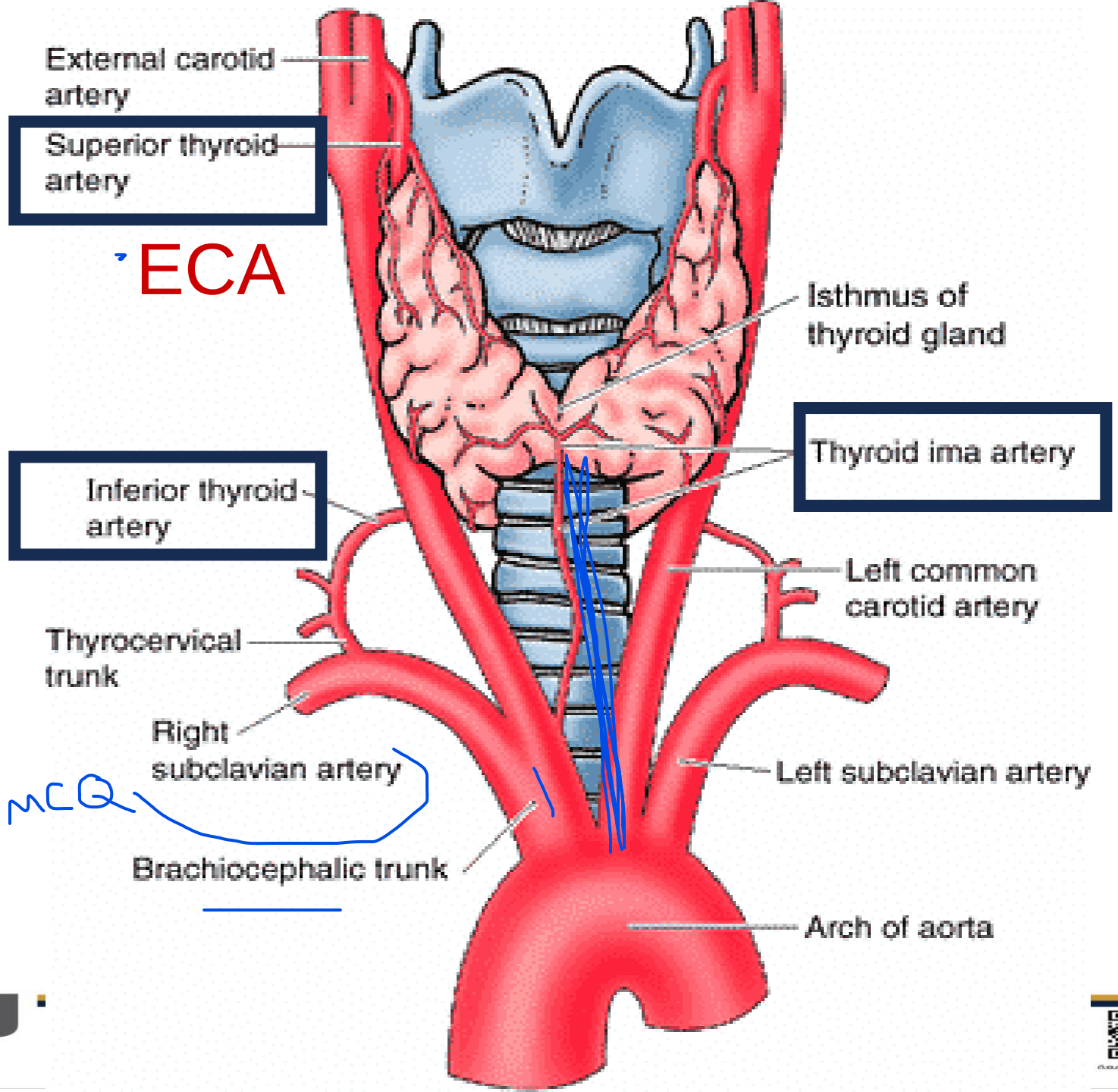
SAQ

ECA


External carotid artery
Superior thyroid artery
Isthmus of thyroid gland
Thyroid ima artery
Inferior thyroid artery
Left common carotid artery
Thyrocervical trunk
Right subclavian artery
Left subclavian artery
Brachiocephalic trunk
Arch of aorta

MCQ

1. Superior thyroid artery

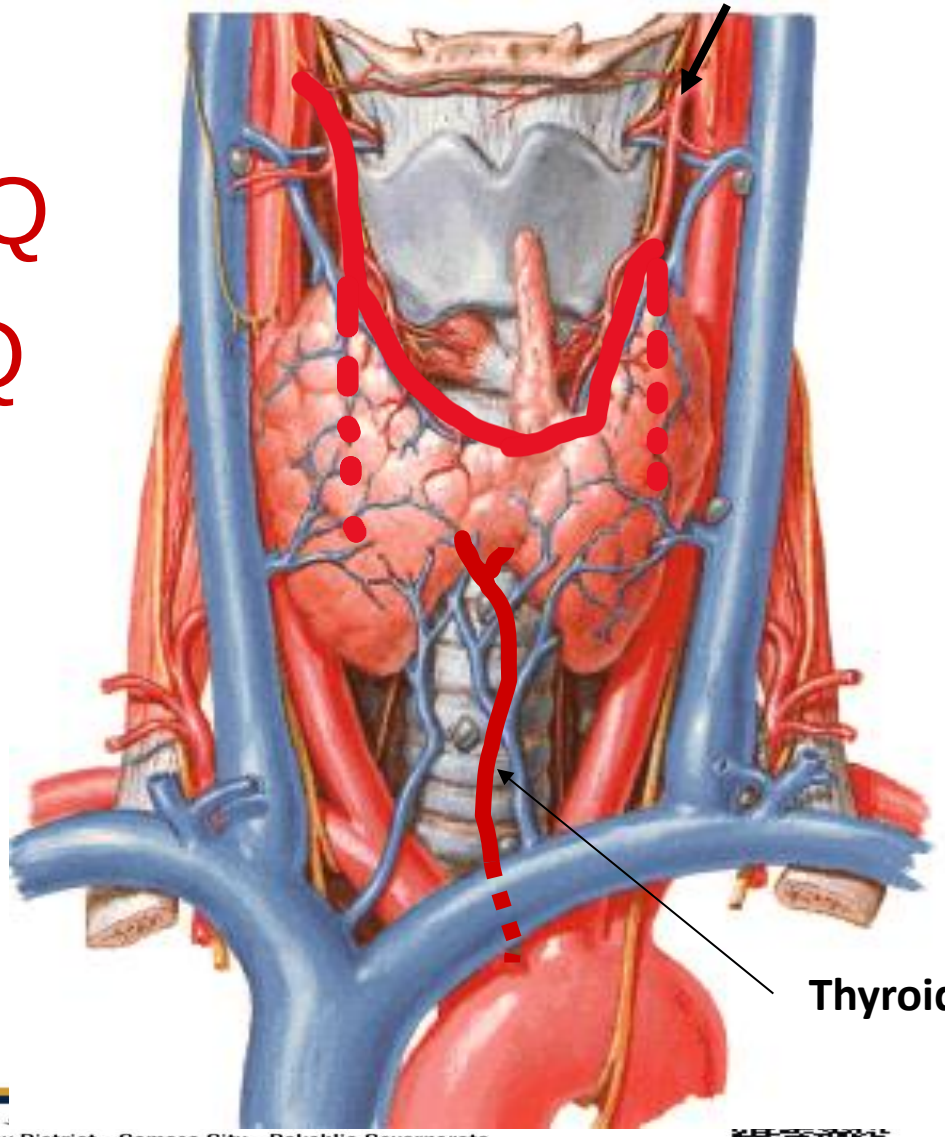
Origin: external carotid artery. MCQ

Course: accompanied with external laryngeal nerve MCQ

Termination: it ends in the apex by dividing into:

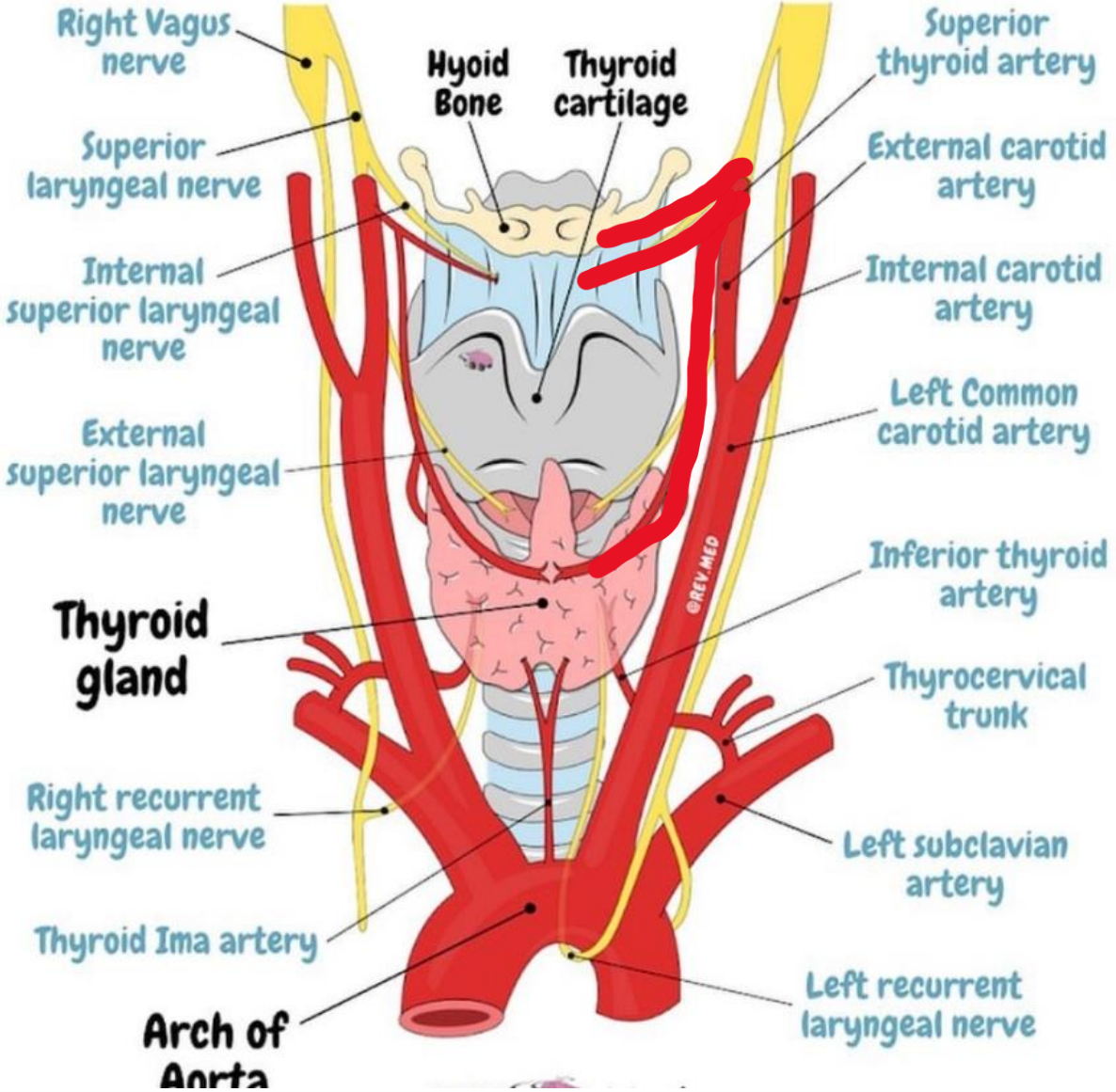
Anterior branch that anastomoses with its fellow of the opposite side.

Posterior branch that anastomoses with inferior thyroid artery.



Branches of thyroid artery:

1. Glandular branches: to the apex & upper 1/3 of the thyroid lobe and upper 1/2 of the isthmus.
2. Superior laryngeal artery: pierces the thyrohyoid membrane.
3. Infrahyoid artery.
4. Artery to sternomastoid muscle.
5. Artery to cricothyroid muscle.



2. Inferior thyroid artery

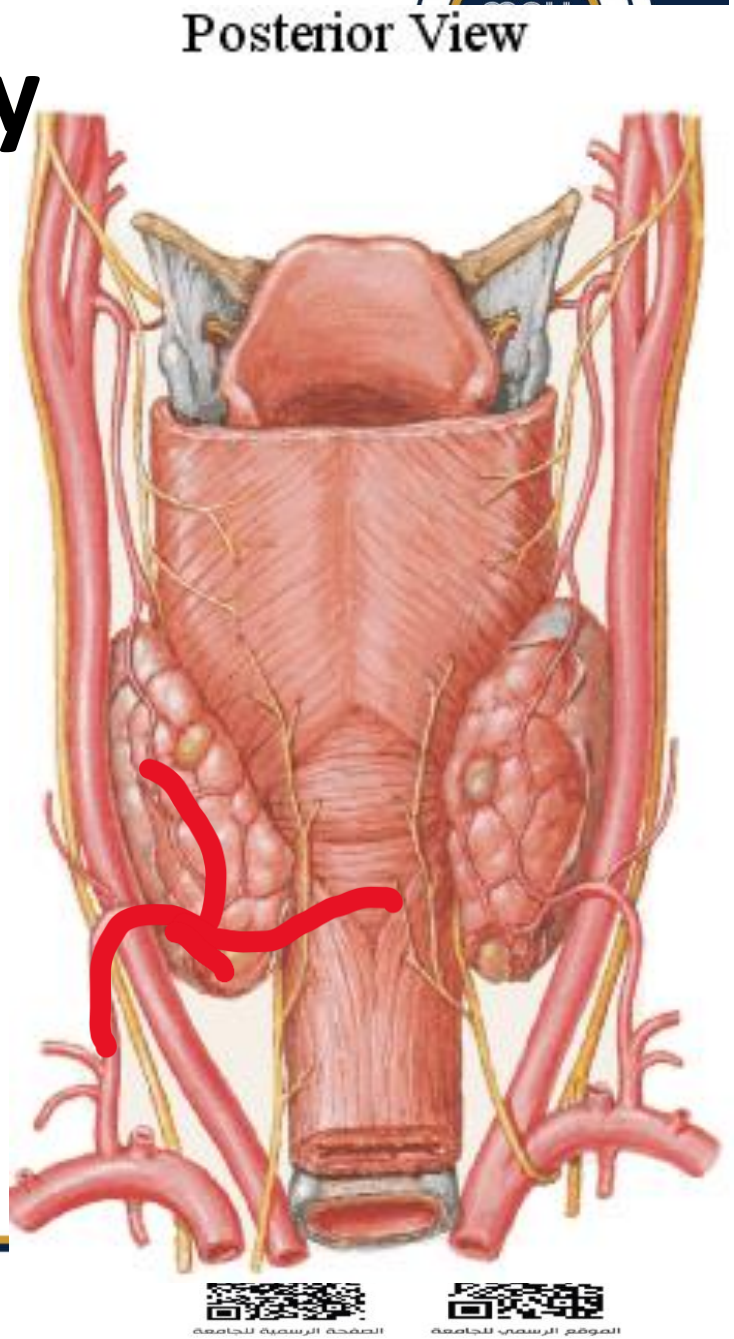
Origin: thyrocervical trunk from 1st part of subclavian artery.

MCQ

Course: accompanied with recurrent laryngeal nerve is related to it close to the gland.

Branches:

1. Glandular branches: to the base & lower 2/3 of the thyroid lobe and lower 1/2 of the isthmus.
2. Parathyroid glands
3. Inferior laryngeal artery.
4. Tracheal and esophageal branches.
5. Ascending cervical artery: anterior to scalenus anterior.



3. Thyroid ima artery:

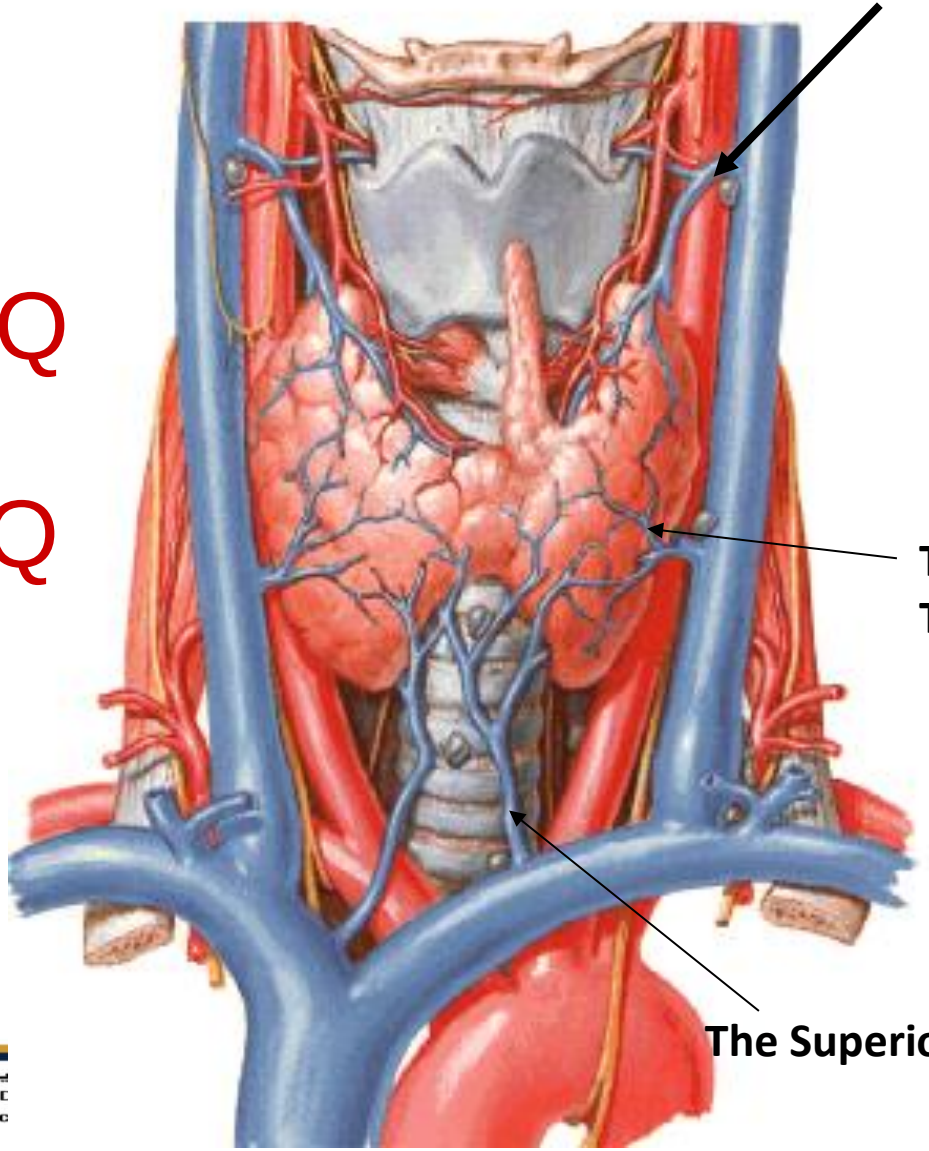
- ❑ It may be present.
- ❑ **Origin:** it arises either from the arch of aorta or from the brachiocephalic artery. MCQ
- ❑ Ascends in front of the trachea to supply the isthmus.
- ❑ It is a potential source of bleeding when performing procedures in the midline of the neck inferior to the isthmus.

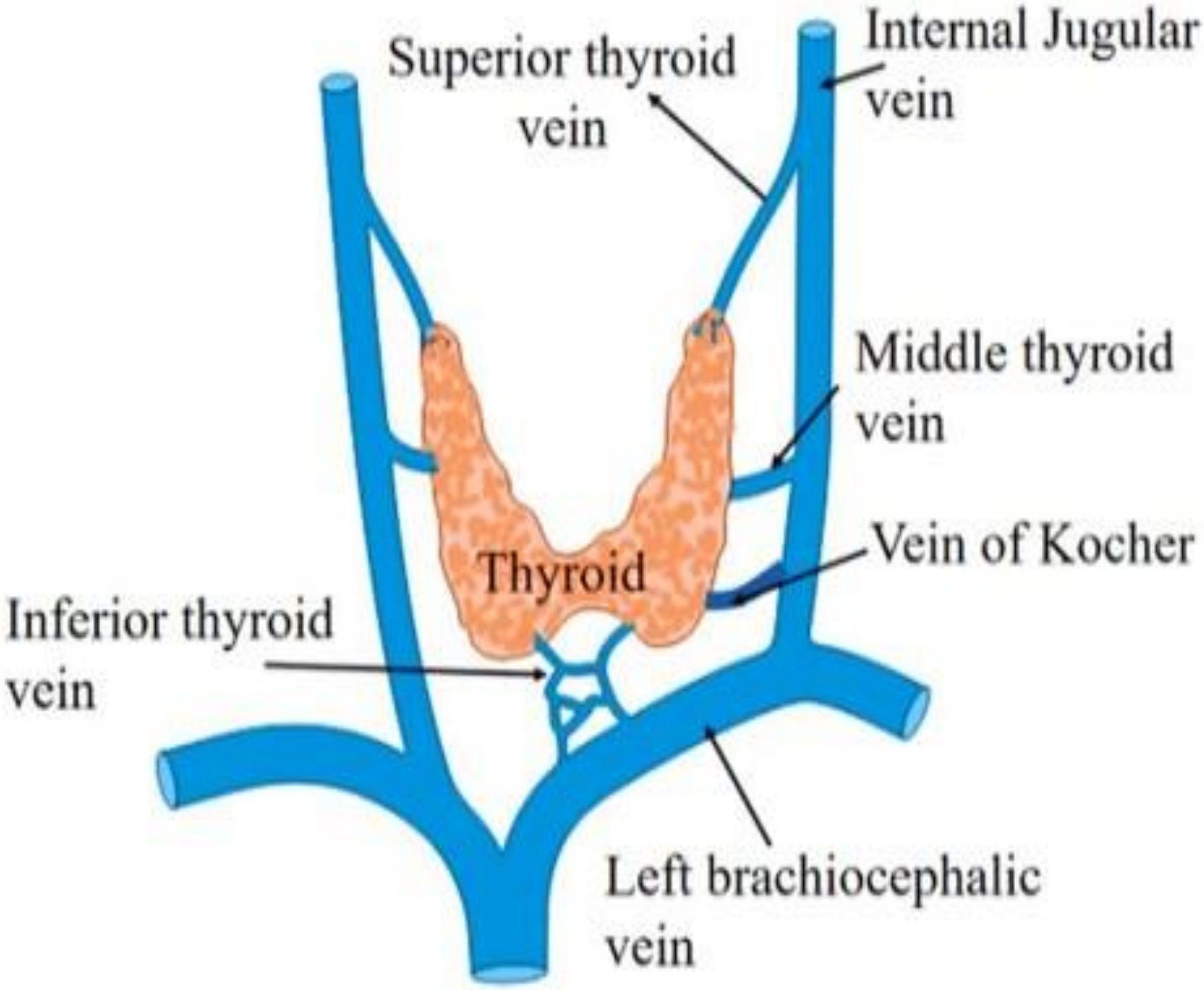
NB: Accessory thyroid arteries: From the esophageal and tracheal branches.

Venous Drainage:

SAQ

1. **Superior thyroid vein:** it ends in internal jugular vein. MCQ
2. **Middle thyroid vein:** it ends also in internal jugular vein. MCQ
3. **Inferior thyroid vein:** it ends in brachiocephalic vein. MCQ




Superior thyroid vein
Internal Jugular vein
Middle thyroid vein
Vein of Kocher
Thyroid
Inferior thyroid vein
Left brachiocephalic vein

Lymphatic drainage of thyroid gland

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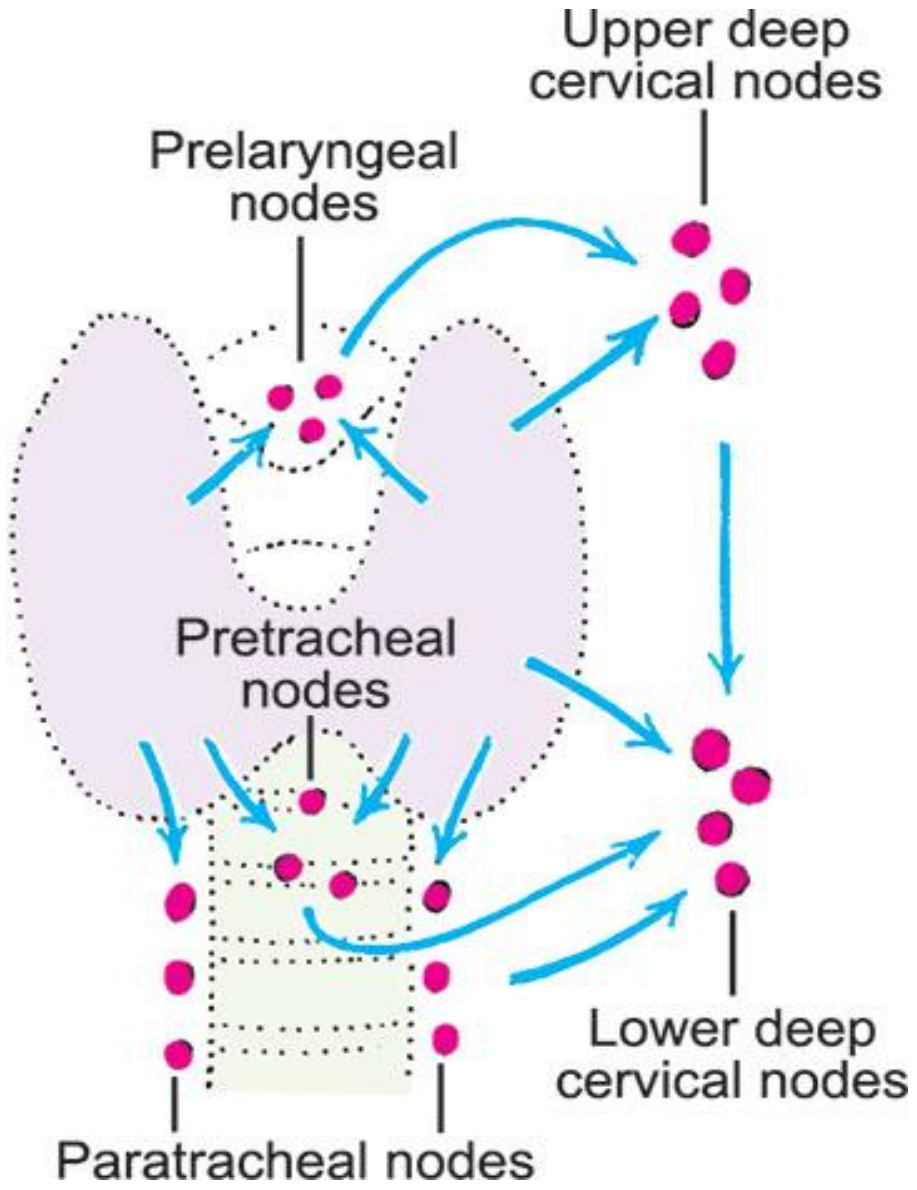
- **Upper parts:** upper and deep cervical lymph nodes.
- **Lower parts:** lower deep cervical lymph nodes.
- **Isthmus:** pretracheal lymph nodes.



Clinical applied of thyroid gland

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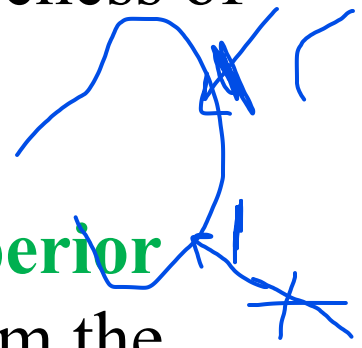
Applied anatomy for thyroid gland

Injury of laryngeal nerves during thyroidectomy may cause hoarseness of voice



1) **Try to avoid injury of external laryngeal n** while **ligating superior thyroid artery by ligating it near to the gland** (as it lies away from the nerve at that position). MCQ

2) **Try to avoid injury of recurrent laryngeal n** while **ligating inferior thyroid artery by ligating it away from the gland** (as it lies away from the nerve at that position). MCQ

Case study

- 54 years old patient suffering from palpation, alertness and irritability. Lab examination and U/S was performed indicating **goiter**. **Thyroidectomy** was done but the patient suffered from post-operative hoarseness of voice.

Explain?!!!

NB:

1. **Unilateral or partial injury of recurrent laryngeal nerve** may result in transient hoarseness of voice.
2. **Bilateral nerve injury of recurrent laryngeal nerve** may present with severe respiratory distress and stridor requiring immediate airway management and potential tracheostomy.

Massive Thyroid Enlargement

Parathyroid glands

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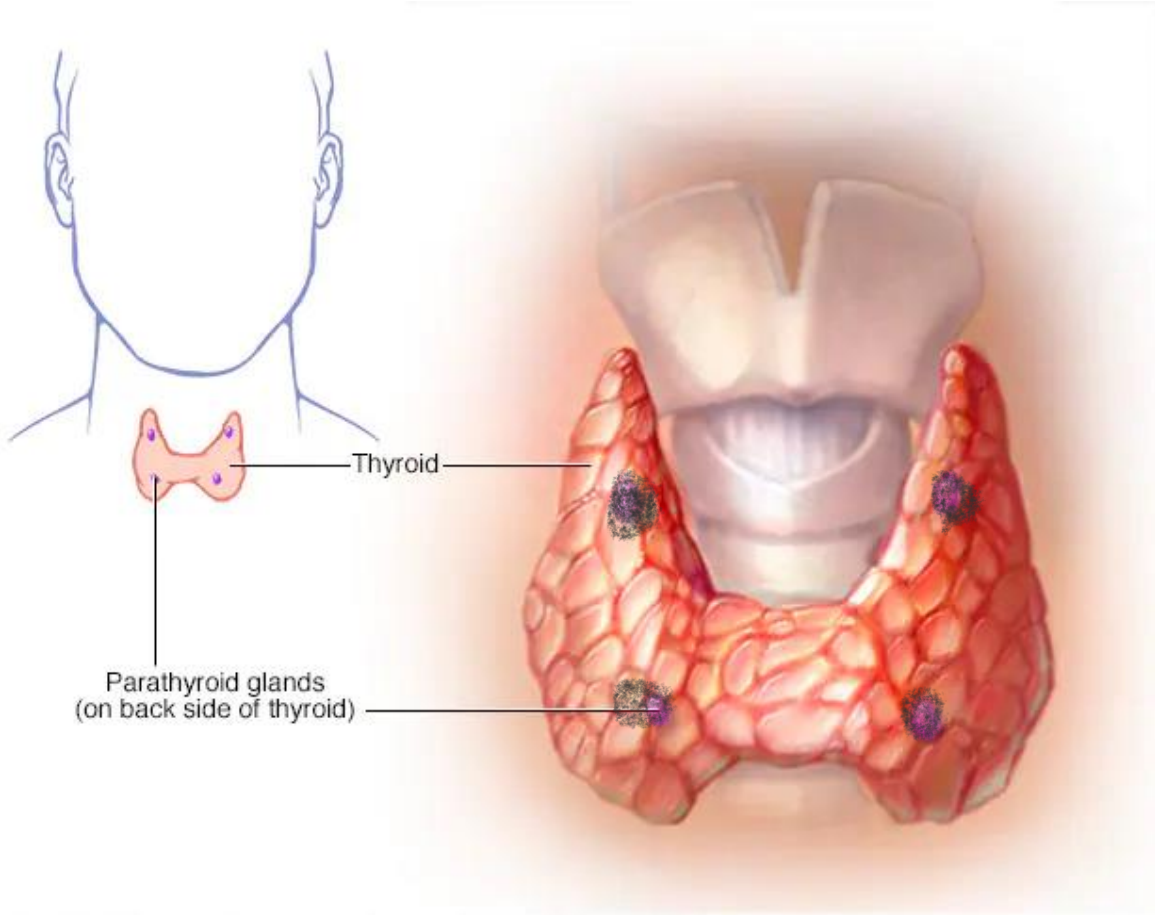
الصفحة الرسمية للجامعة

الموقع الرسمي للجامعة

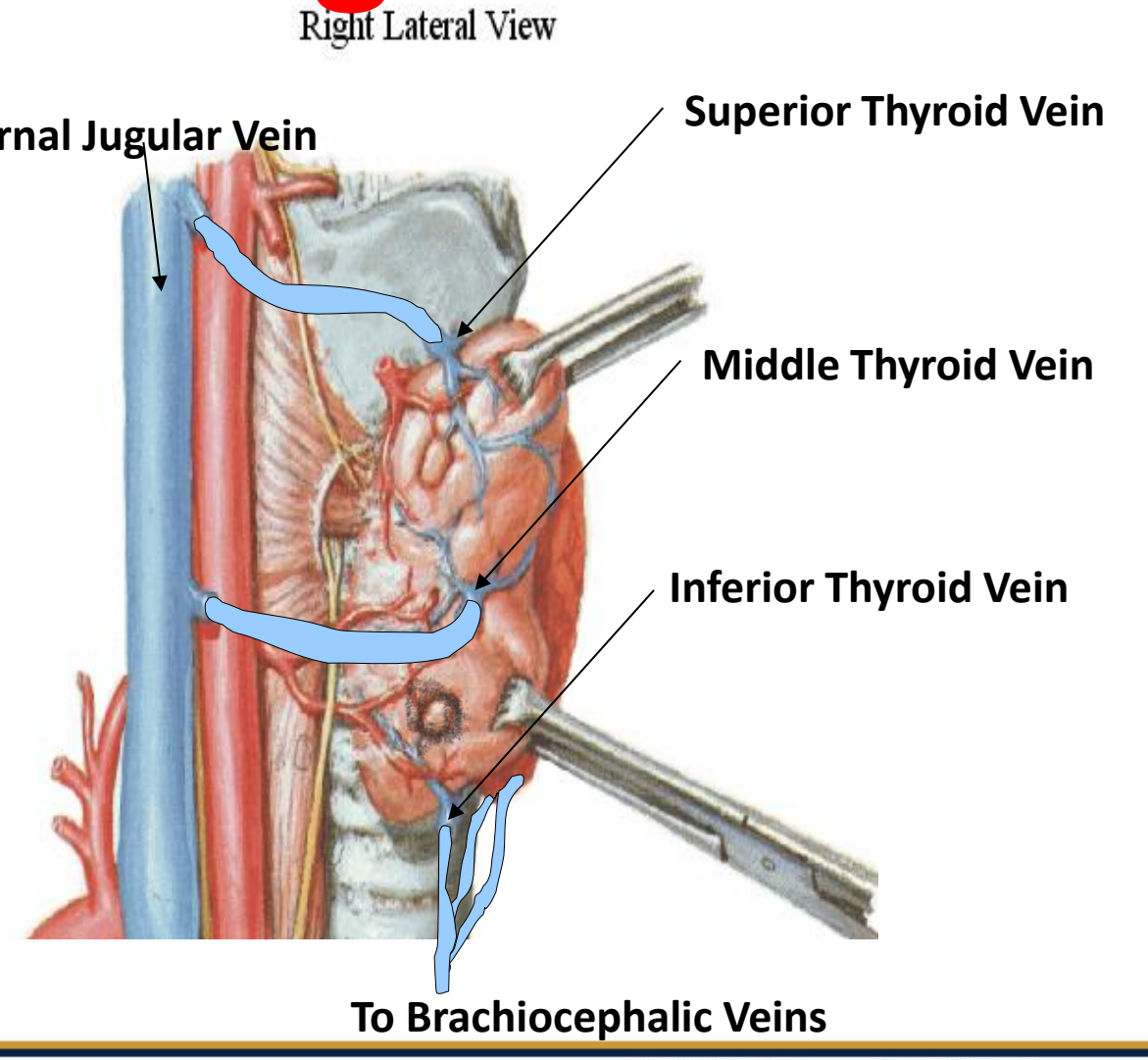
Site of parathyroid glands

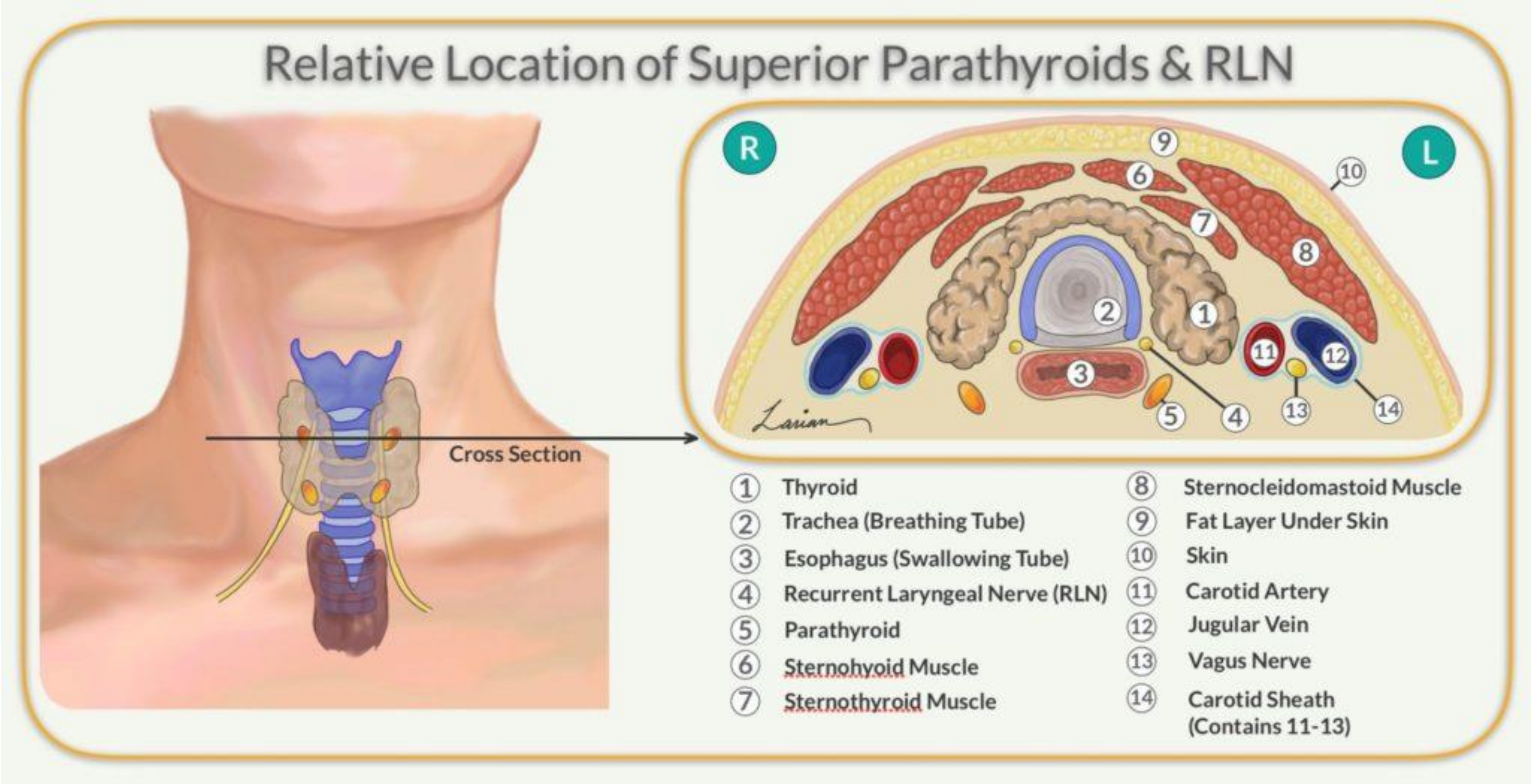
The **two superior parathyroid glands** are the more constant in position and lie at the level of the middle of the posterior border of the thyroid gland, usually at the level of the inferior border of the cricoid cartilage.



Site of parathyroid glands

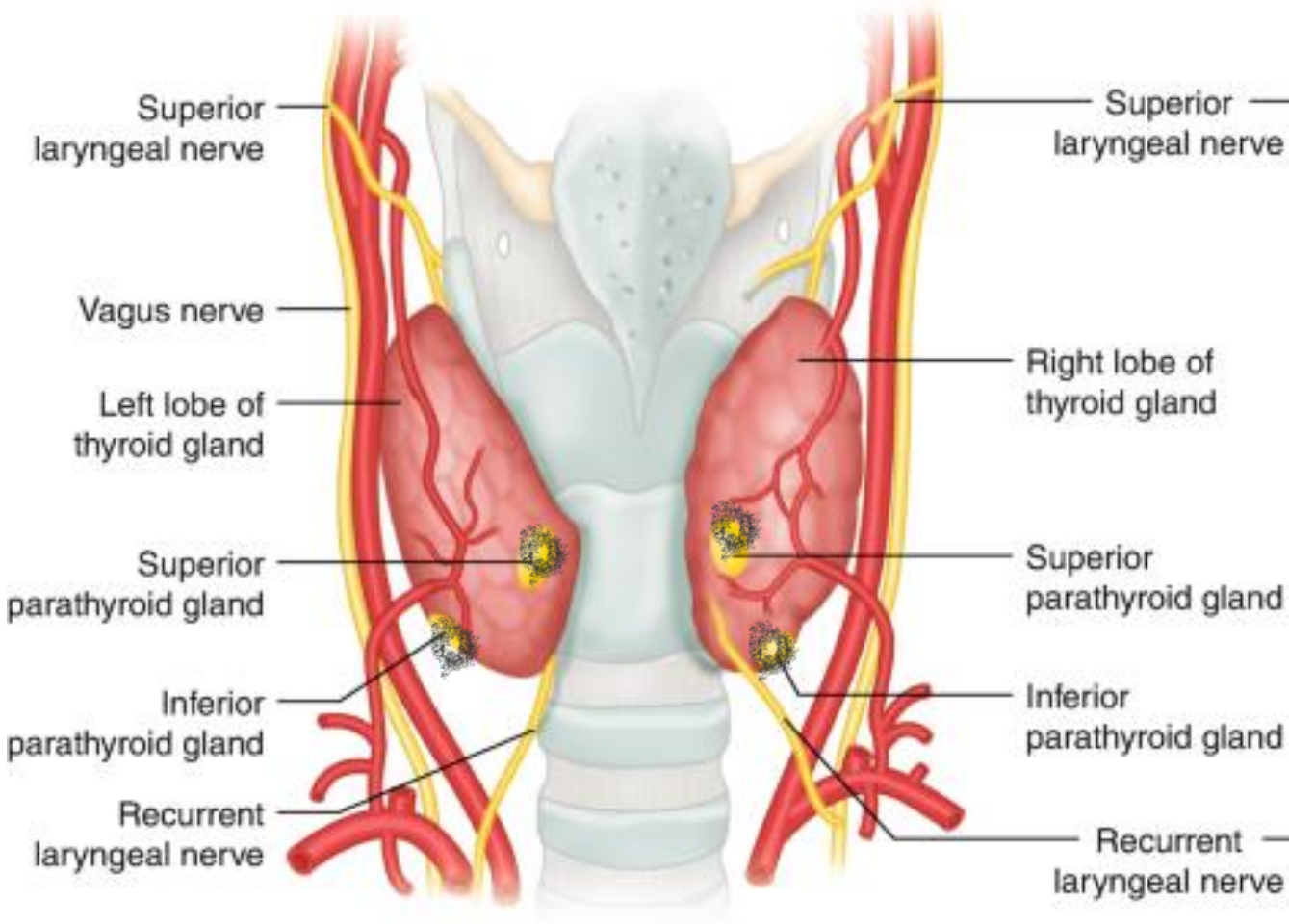
- The **two inferior parathyroid glands** usually lie close to the inferior poles of the thyroid gland.
- They may lie within the fascial sheath, embedded in the thyroid substance, or outside the fascial sheath.
- They may be found some distance caudal to the thyroid gland, in **association with the inferior thyroid veins,** or they may in the superior mediastinum in the thorax.




Relative Location of Superior Parathyroids & RLN
Cross Section
R
L
1 Thyroid
2 Trachea (Breathing Tube)
3 Esophagus (Swallowing Tube)
4 Recurrent Laryngeal Nerve (RLN)
5 Parathyroid
6 Sternohyoid Muscle
7 Sternothyroid Muscle
8 Sternocleidomastoid Muscle
9 Fat Layer Under Skin
10 Skin
11 Carotid Artery
12 Jugular Vein
13 Vagus Nerve
14 Carotid Sheath
(Contains 11-13)

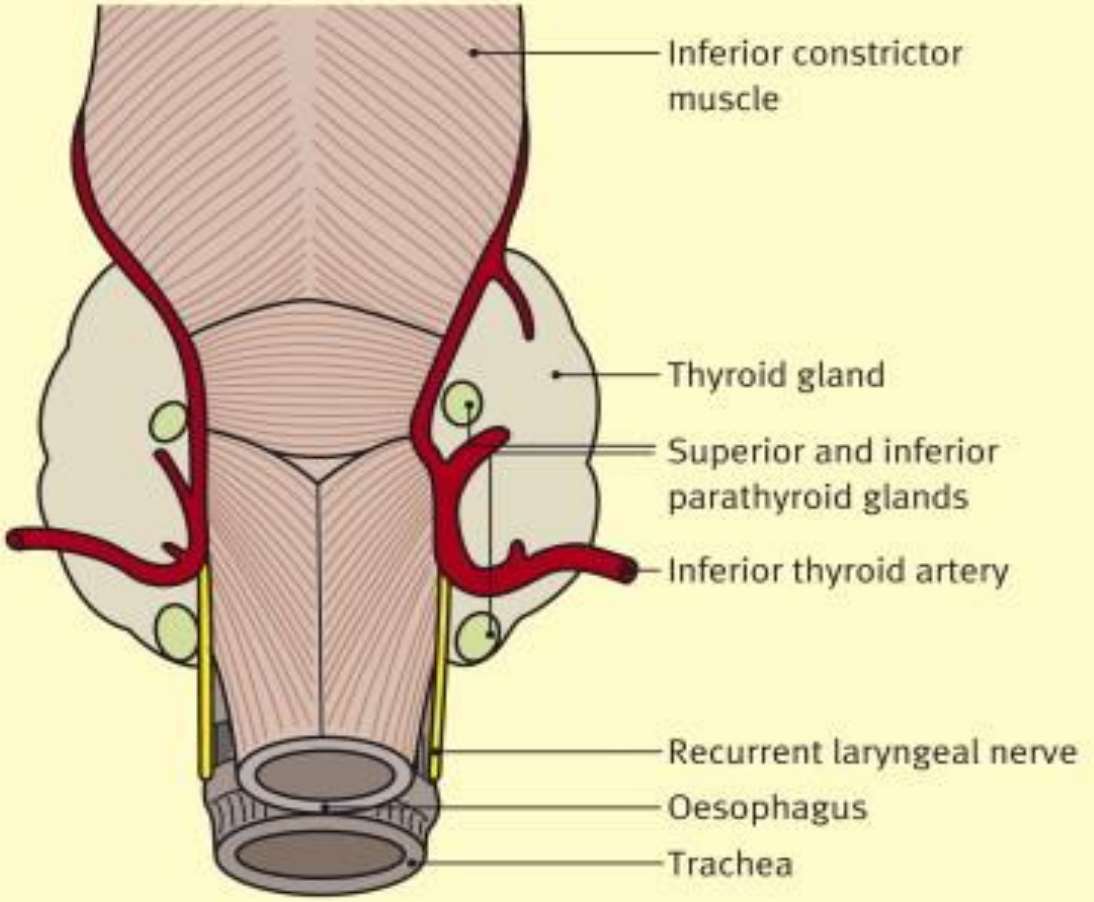
Features of parathyroid Glands

- The parathyroid glands are **ovoid bodies** measuring about **6 mm** in their greatest diameter.
- They are four in number and are closely related to the posterior border of the thyroid gland, lying within its fascial capsule.



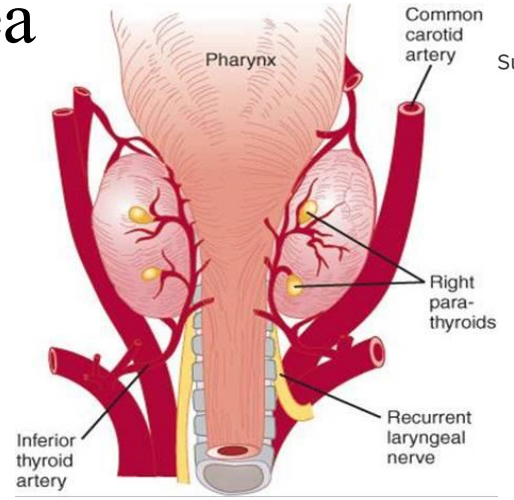
Posterior

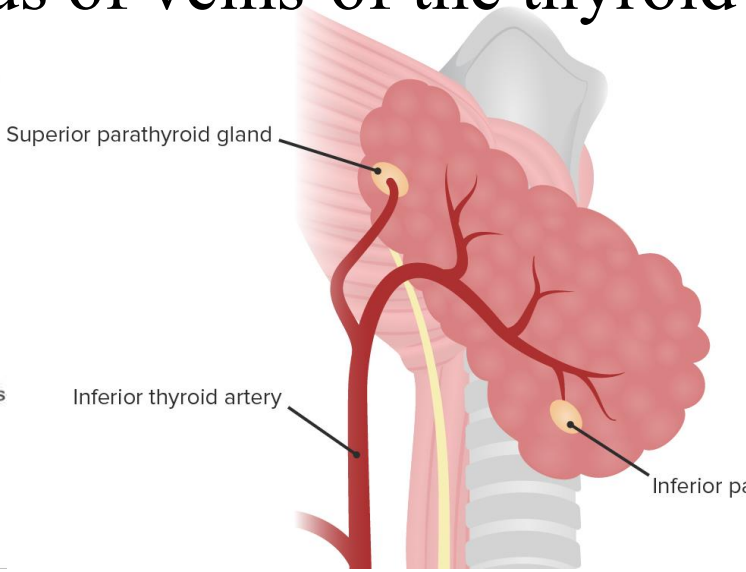
Posterior aspect of the thyroid gland

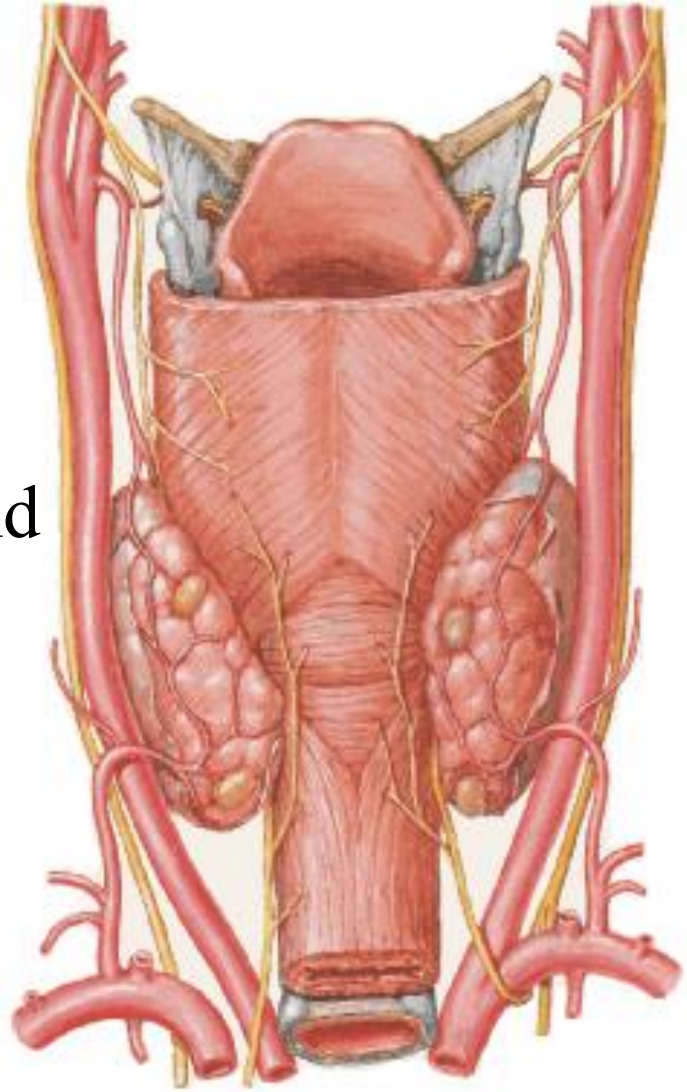


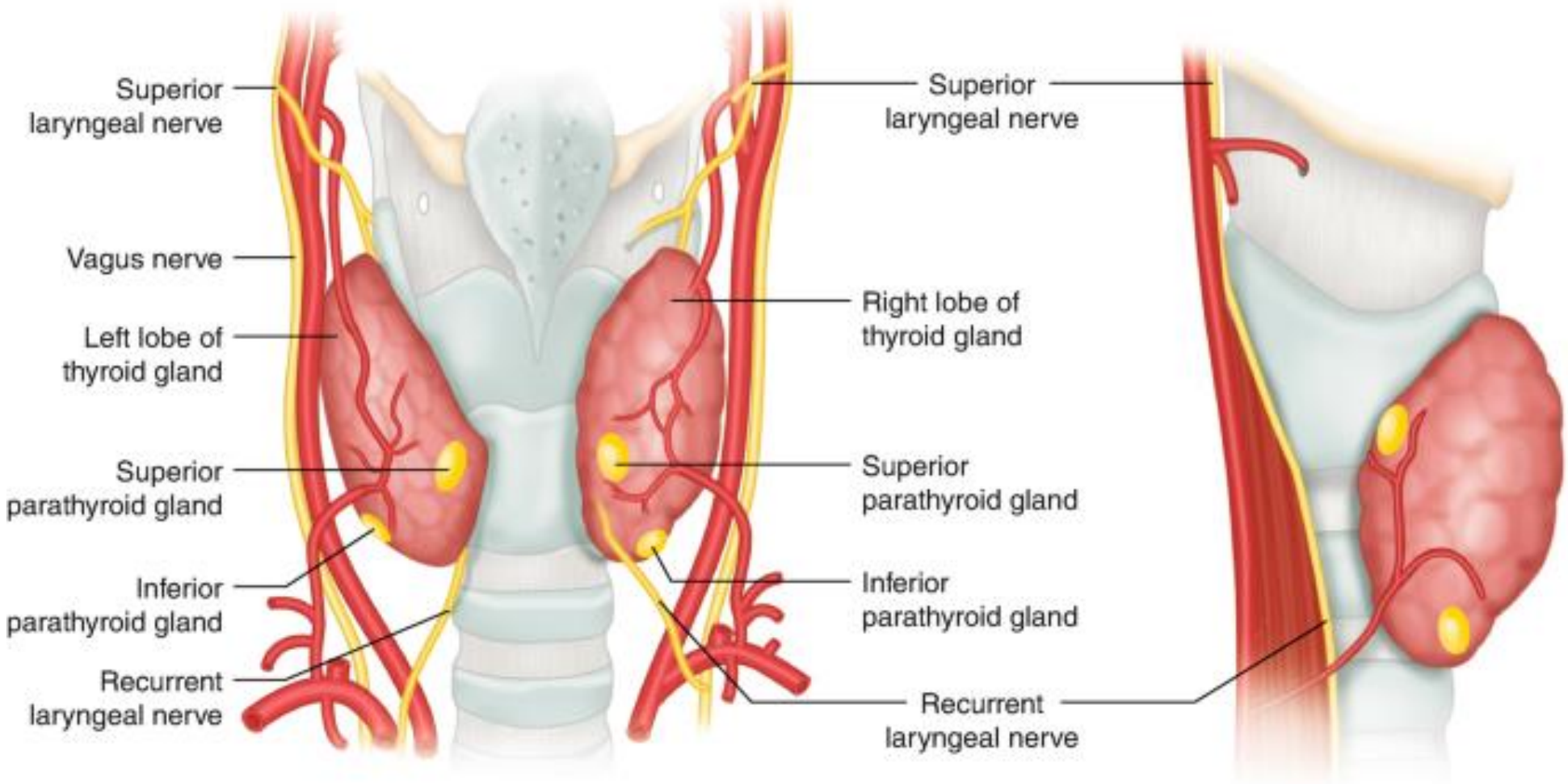
Blood Supply

- **The arterial supply** to the parathyroid glands is from superior and inferior thyroid arteries **mainly inferior thyroid arteries.** MCQ
- **The venous drainage** is into the parathyroid veins drain into the thyroid plexus of veins of the thyroid gland and trachea








Superior laryngeal nerve
Vagus nerve
Left lobe of thyroid gland
Superior parathyroid gland
Inferior parathyroid gland
Recurrent laryngeal nerve
Superior laryngeal nerve
Right lobe of thyroid gland
Superior parathyroid gland
Inferior parathyroid gland
Recurrent laryngeal nerve

Development of thyroid gland

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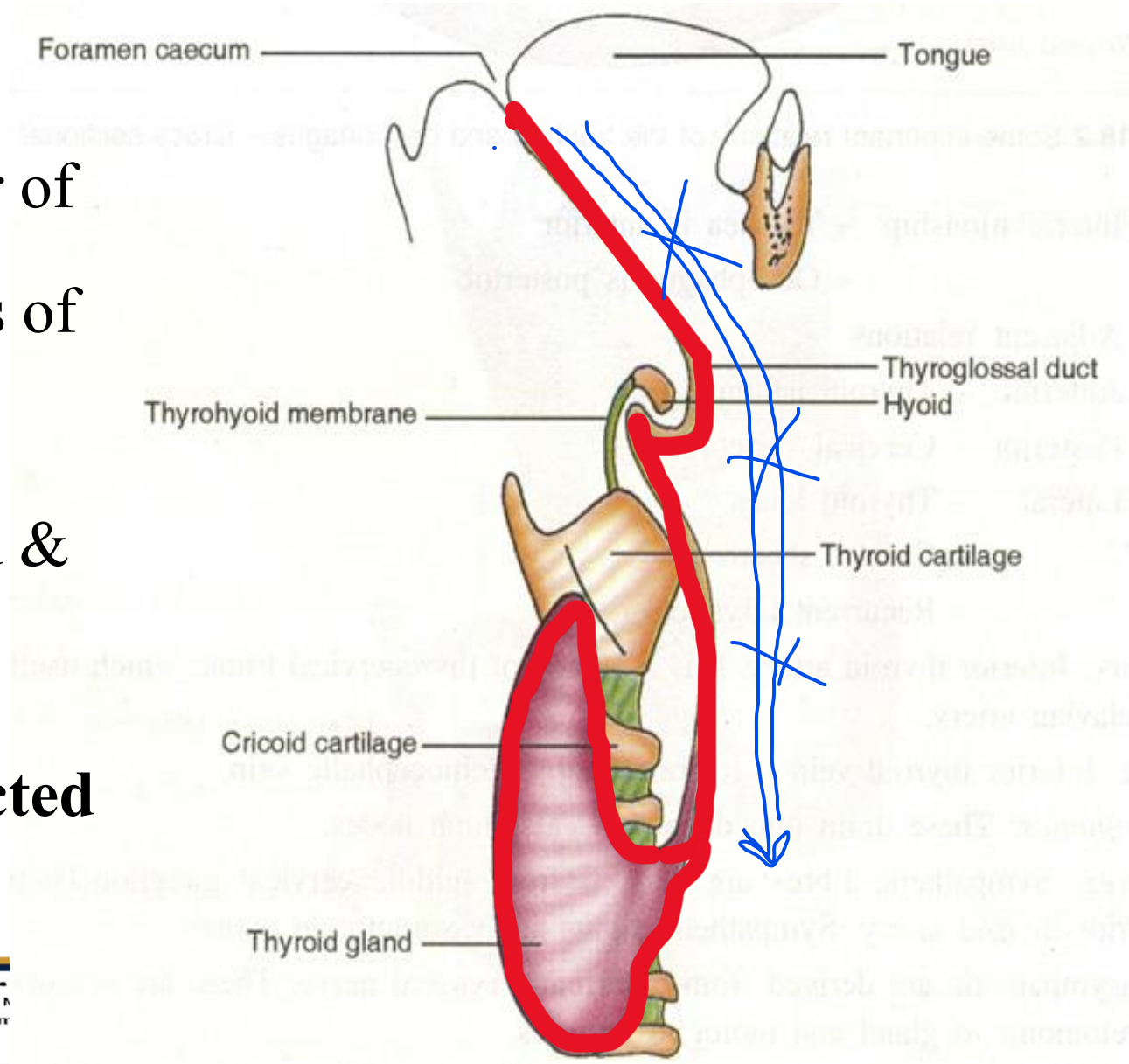
Time of development: 4th week

Steps:

1) Median **bilobed diverticulum** in floor of primitive pharynx between the processes of tongue

2) It **descends** ventral to pharynx, hyoid & thyroid cartilage

3) During its migration, it is still **connected** to tongue with thyroglossal duct



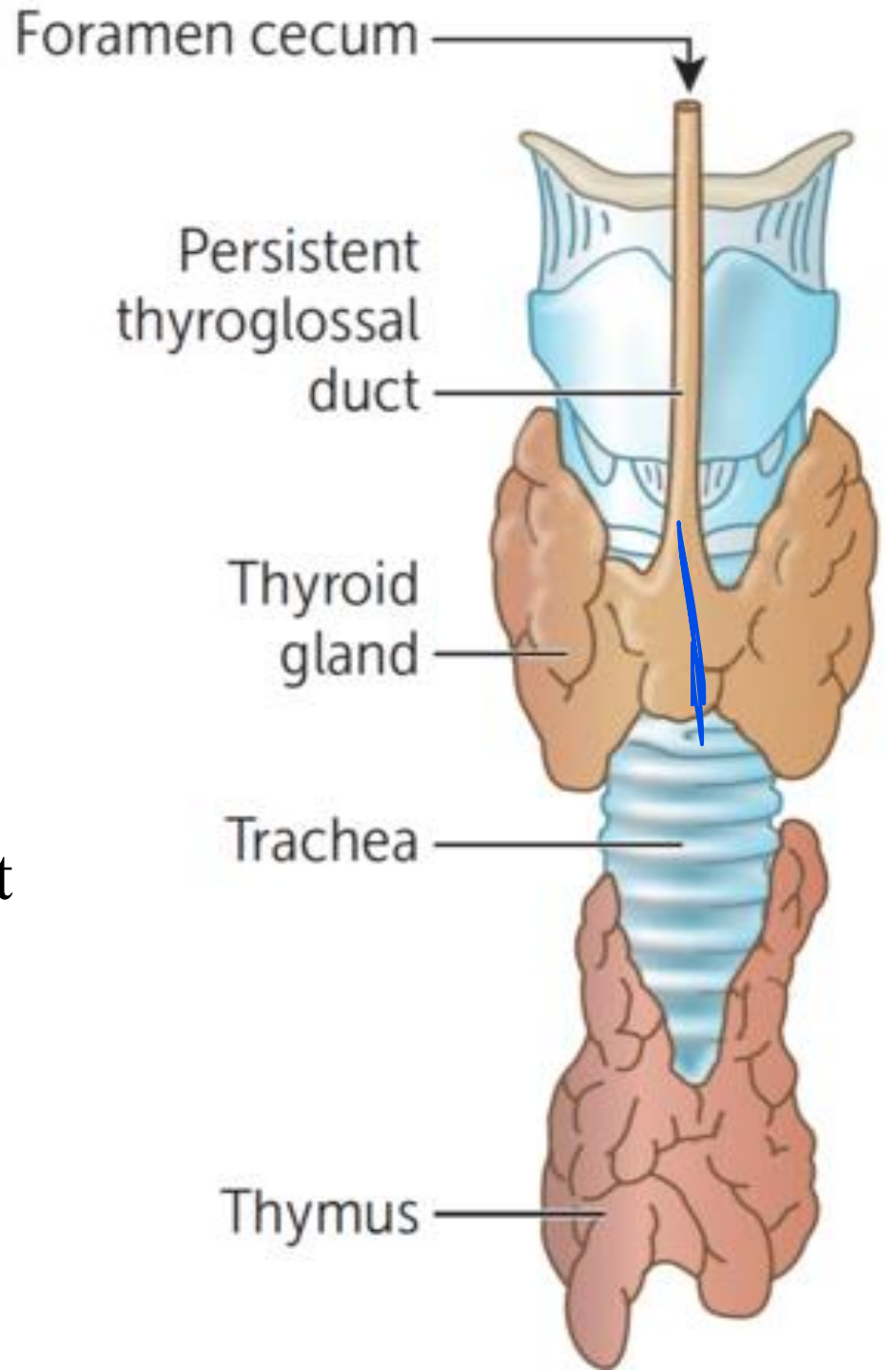
4) It reaches its **final position** in front of trachea **in 7th week** MCQ

5) It that time, it is formed of 2 lobes with a narrow isthmus

6) **Thyroglossal duct:** disappears except

   a) Foramen cecum of tongue at its proximal part

   b) Pyramidal lobe & levator glandulae thyroidae at its distal part

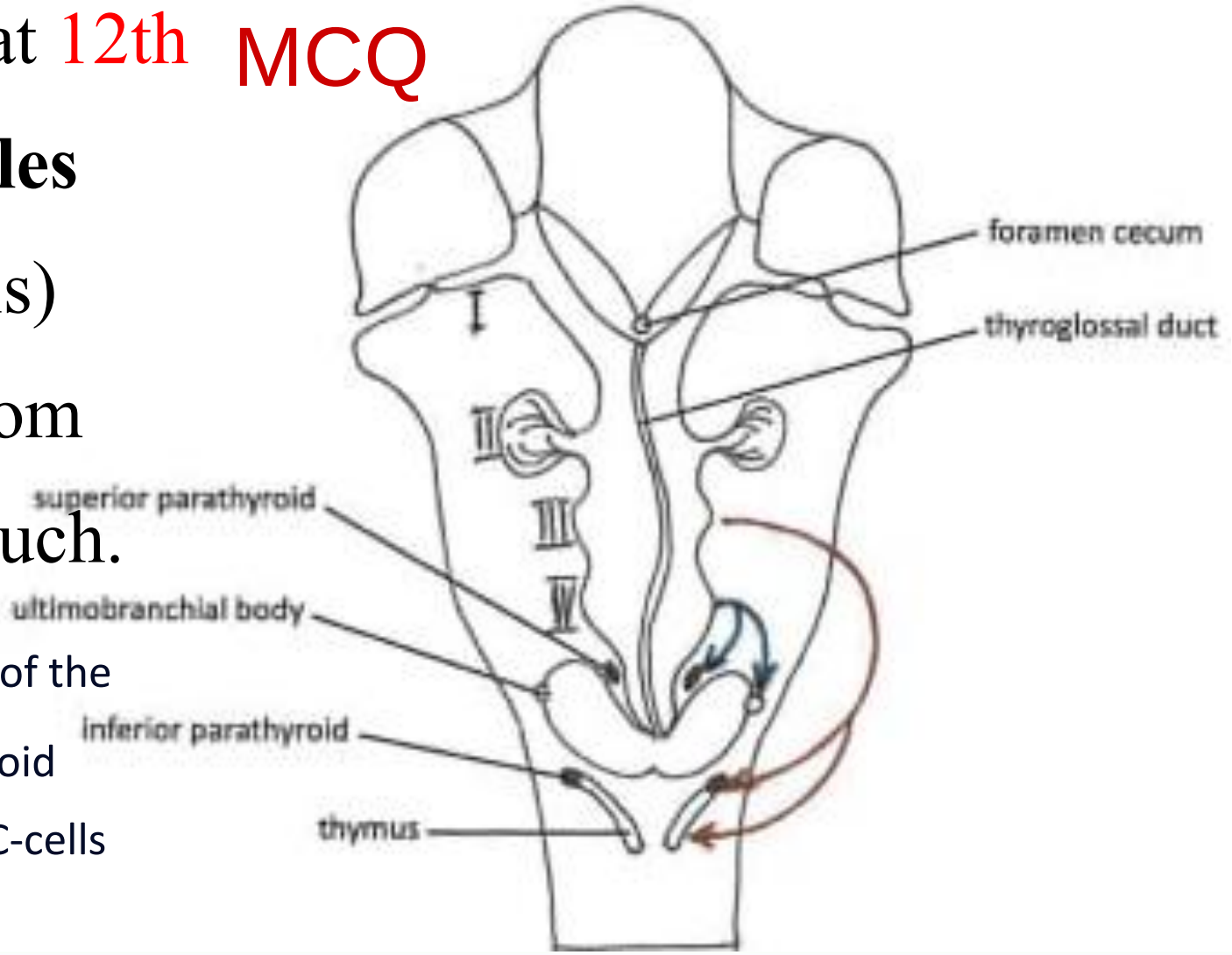


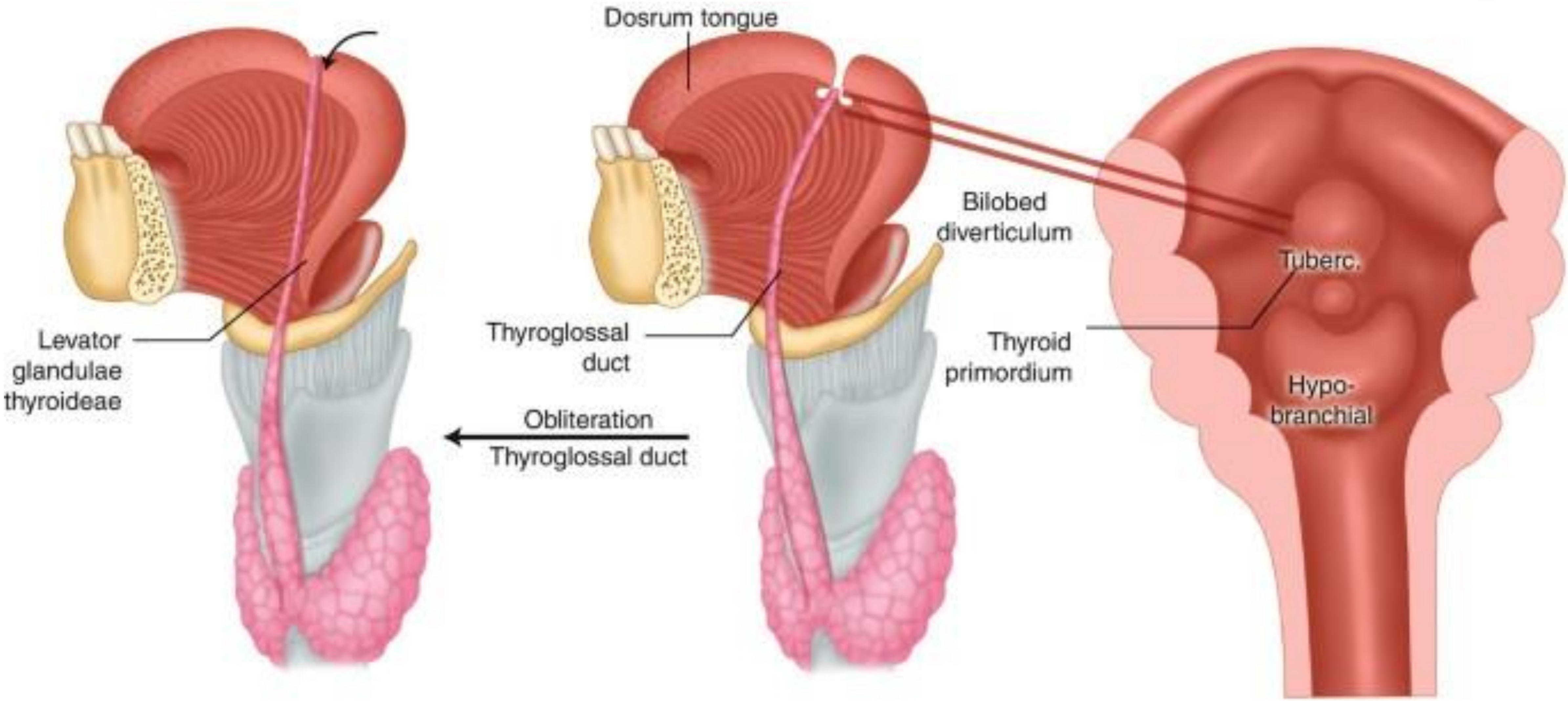
7) gland becomes functioning at 12th week with **colloid- filled follicles**

MCQ

8) Parafollicular cells, (C cells) secreting calcitonin, derived from ultimobranchial body at 5th pouch.

NB: ultimobranchial body is an out pocketing of the fourth pharyngeal pouch that fuses with the thyroid diverticulum, giving rise to calcitonin-producing C-cells




Dosrum tongue
Bilobed diverticulum
Tuberc.
Thyroid primordium
Hypo-branchial
Thyroglossal duct
Obliteration
Thyroglossal duct
Levator glandulae thyroideae

Anomalies of thyroid

SAQ

1) Aplasia or hypoplasia

2) Aberrant thyroid gland: found along path of thyroid descent

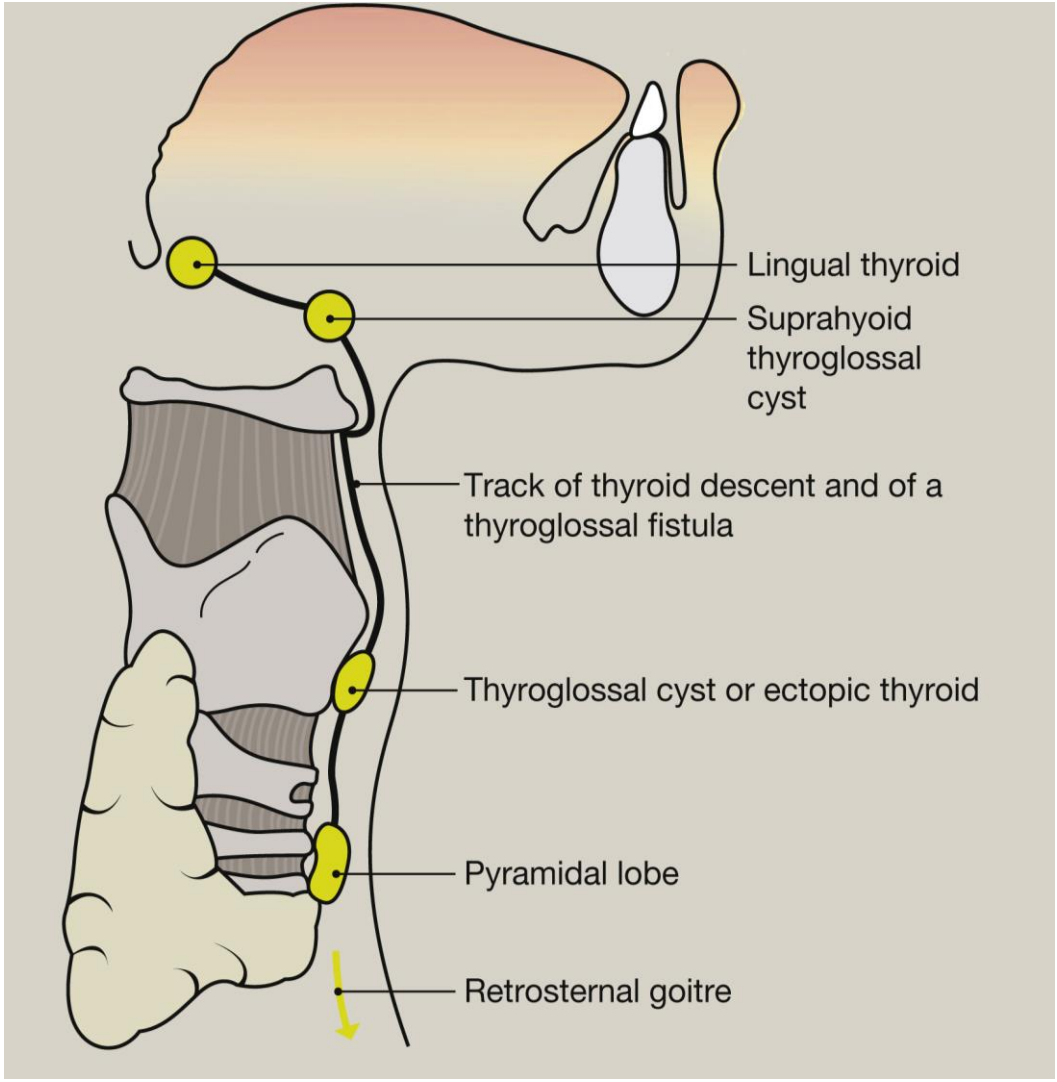
a) **Lingual thyroid:** found at base of tongue due to failure of descent

b) **Retrosternal thyroid:** due to excessive descent

3) Anomalies of thyroglossal duct:

a) **Thyroglossal cyst:** found along path of thyroid descent at midline

b) **Thyroglossal fistula:** opening at midline of neck



Anomalies of the thyroid gland

Agenesis

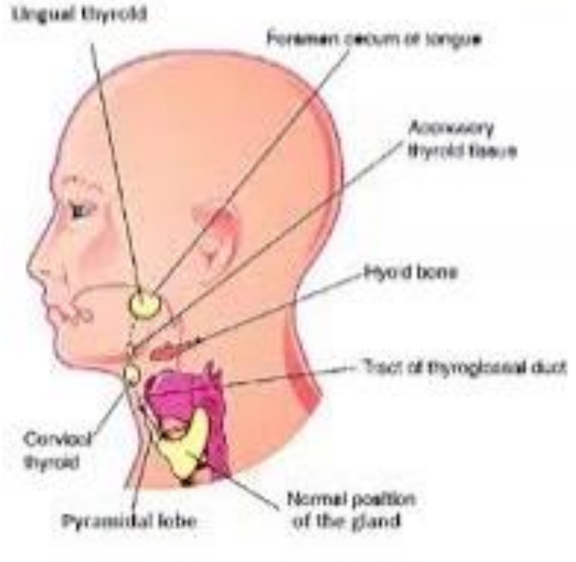
- It means congenital absence of thyroid gland, causing congenital cretinism.

Aberrant thyroid

- It means ectopic thyroid tissue along the course of the thyro-glossal duct (lingual, supra-hyoid, retro-hyoid, or infra-hyoid thyroid).

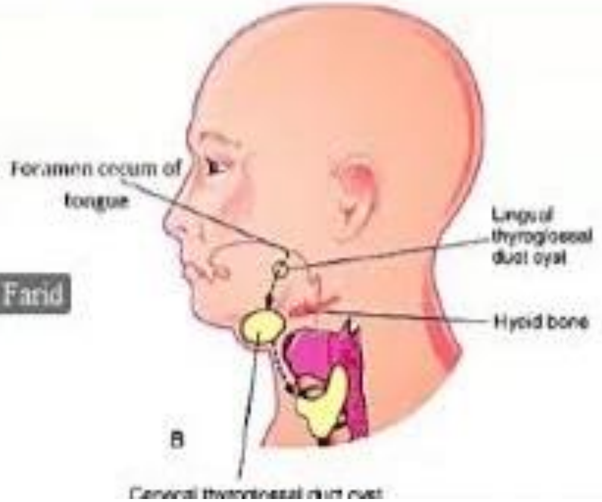
Thyro-glossal cyst

- It is located close to the middle line, and moves with deglutition (compare with branchial cyst).



Aberrant thyroid

Thyro-glossal cyst



Development of Parathyroid glands

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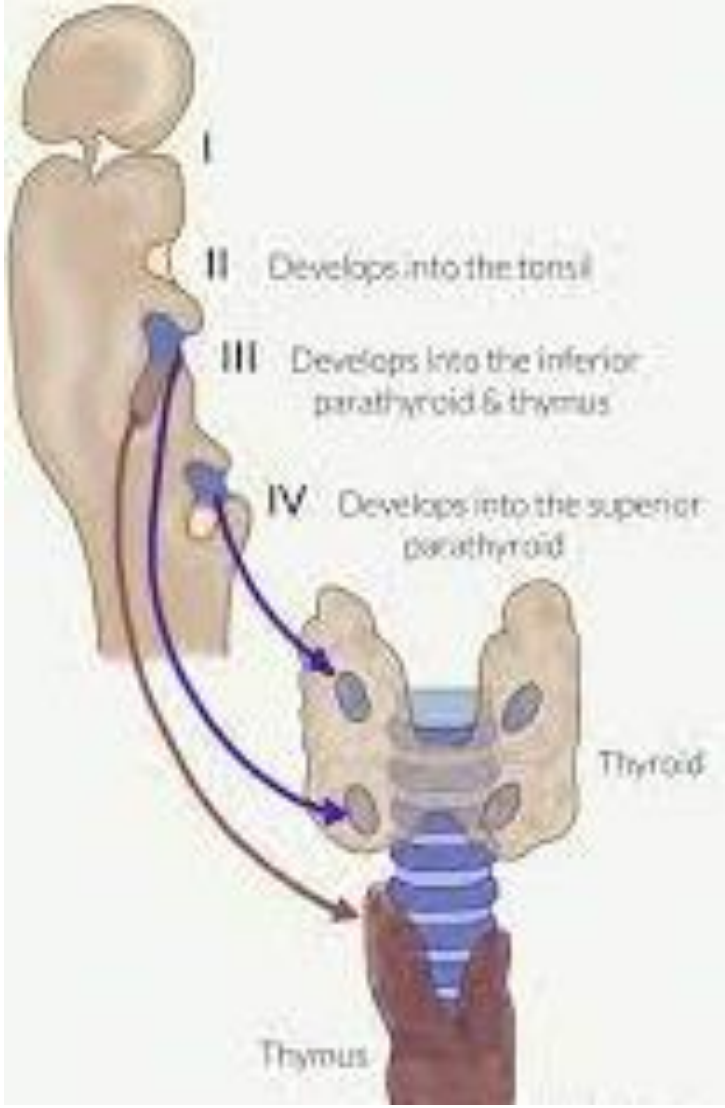
Development of parathyroid glands

- Embryologically, the parathyroid glands derive from the endoderm of the third and fourth pharyngeal pouches. MCQ
- The third pharyngeal pouch gives rise to the inferior parathyroid glands.
- the fourth pharyngeal pouch gives rise to the superior parathyroids.



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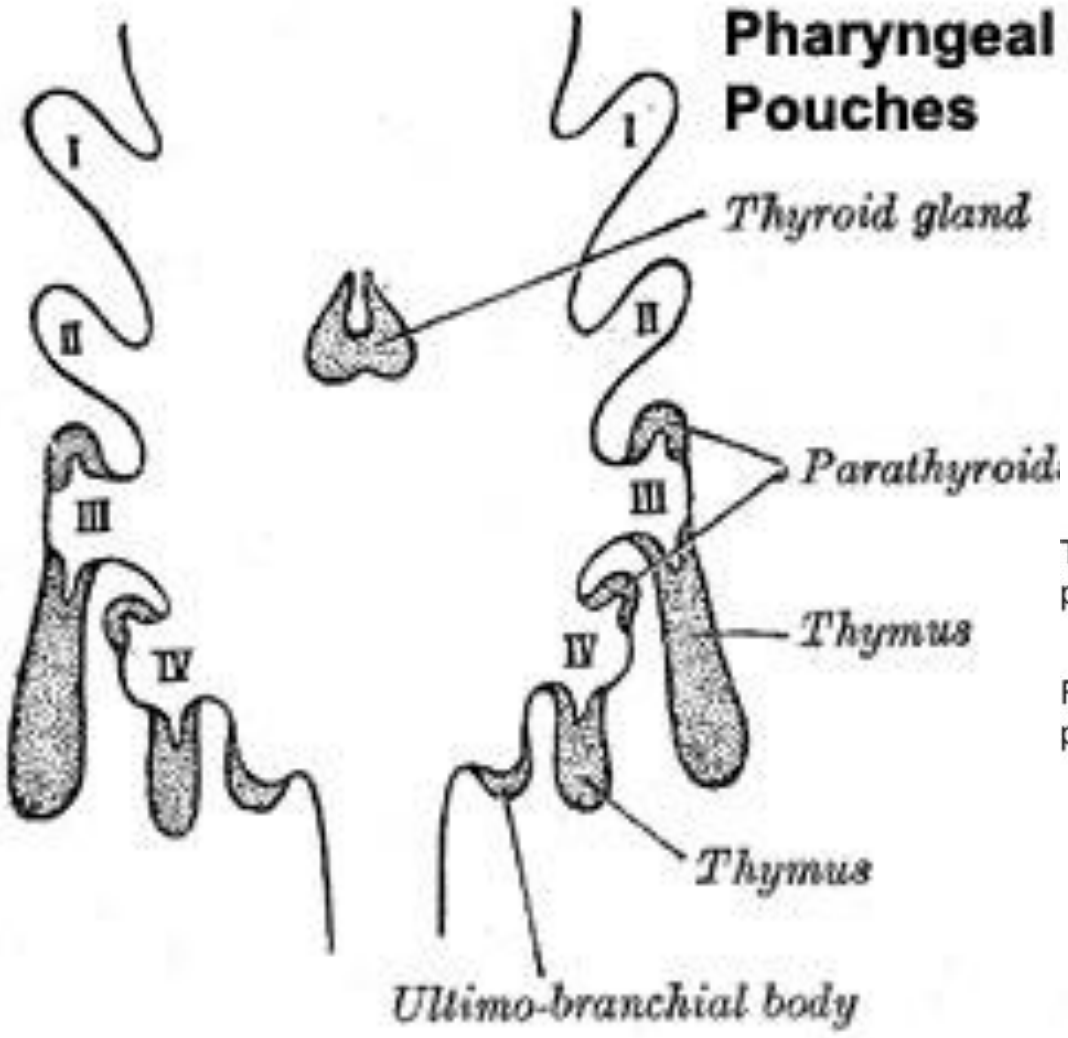

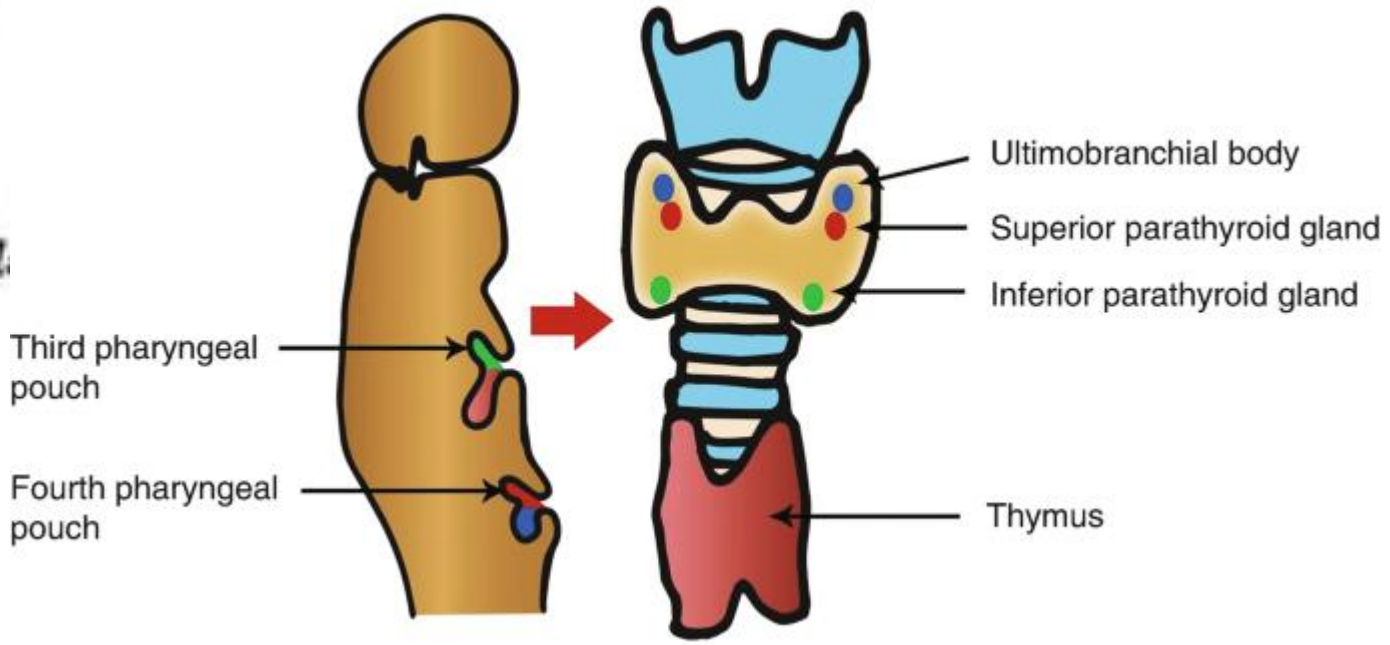

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International Coastal Road - 15th of May District - Gamasa City - Dakahlia Governorate
medic@mansnu.edu.eg

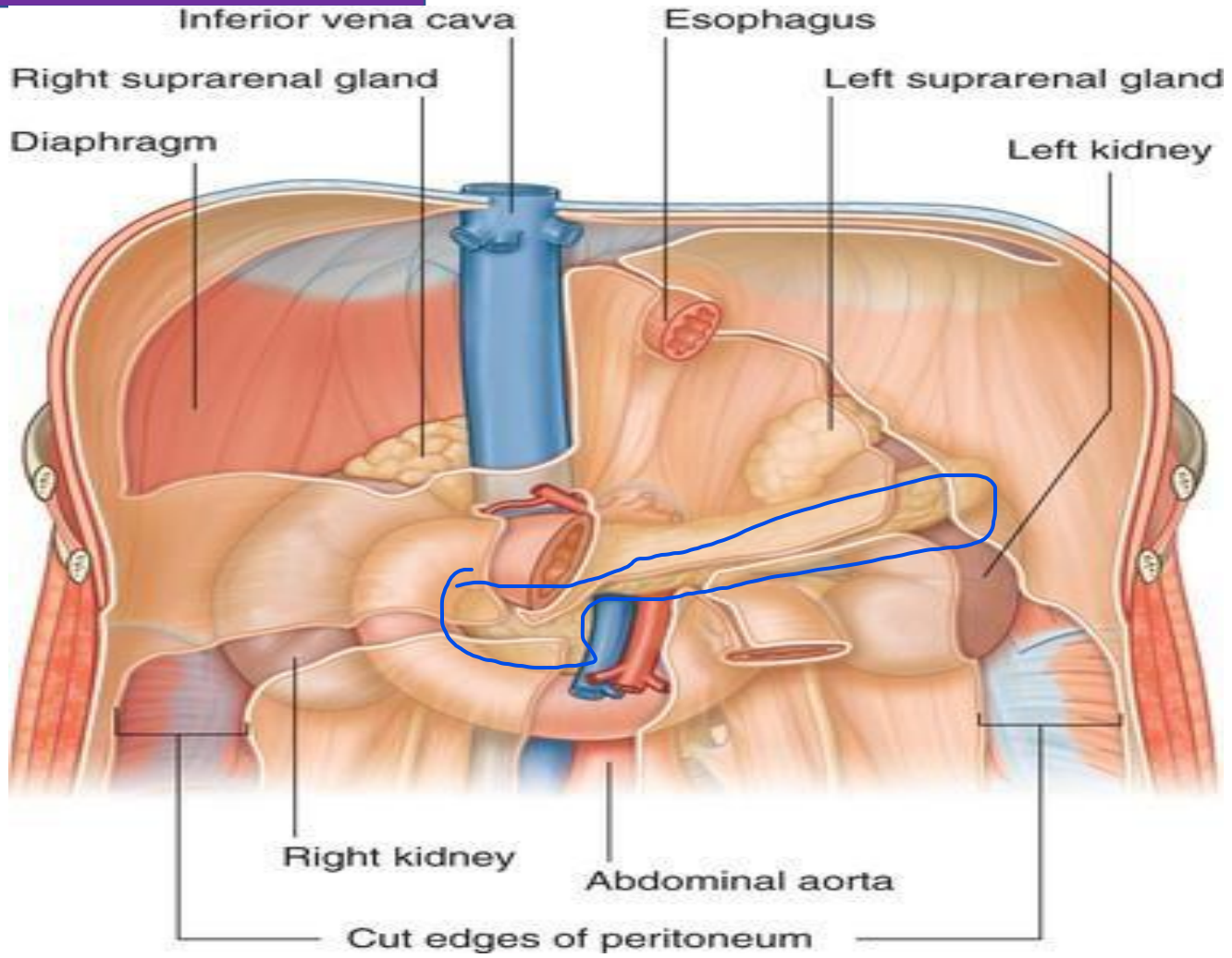
Anatomy and Development of Pancreas and Adrenal Glands

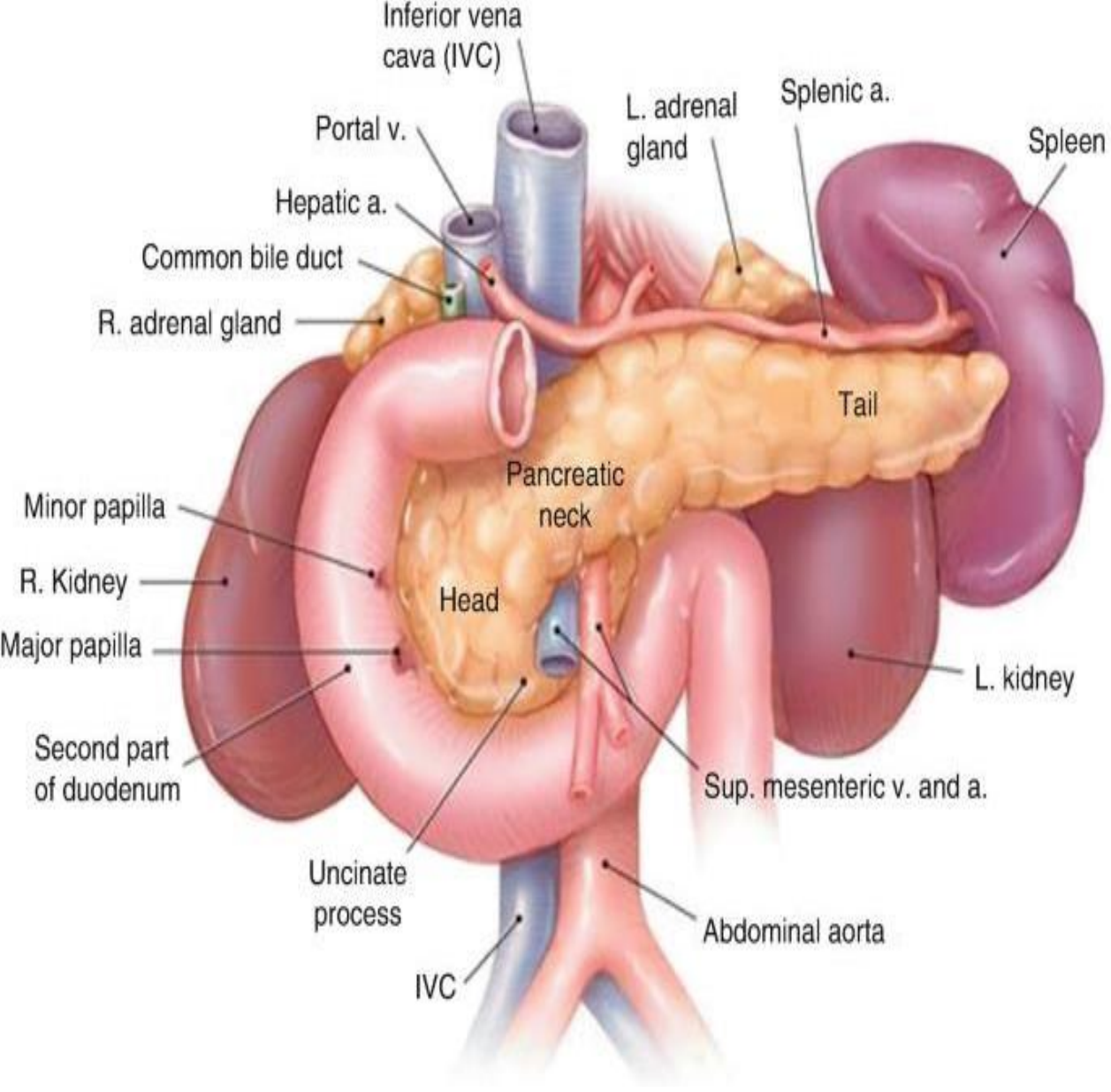
Department of human Anatomy and Embryology
Faculty of Medicine
Mansoura National University, Egypt

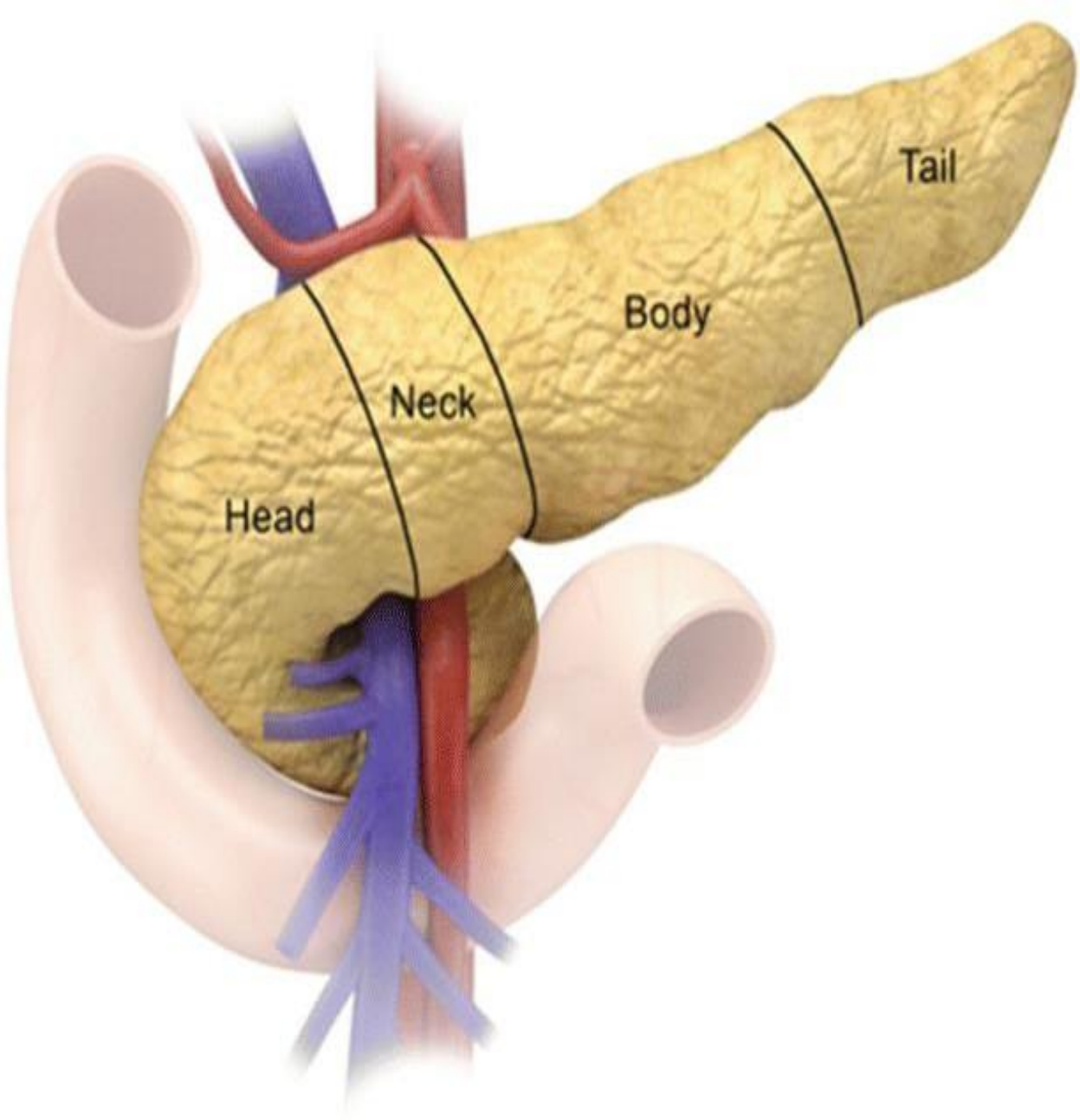
Anatomy of the Pancreas

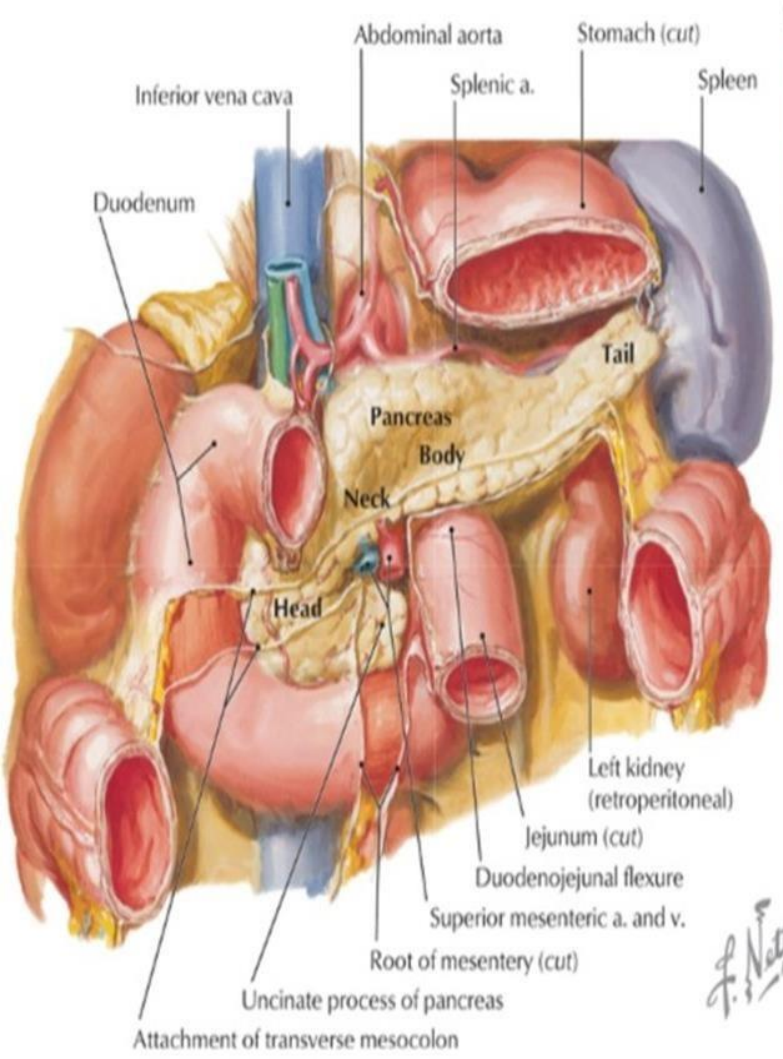
PANCREAS :

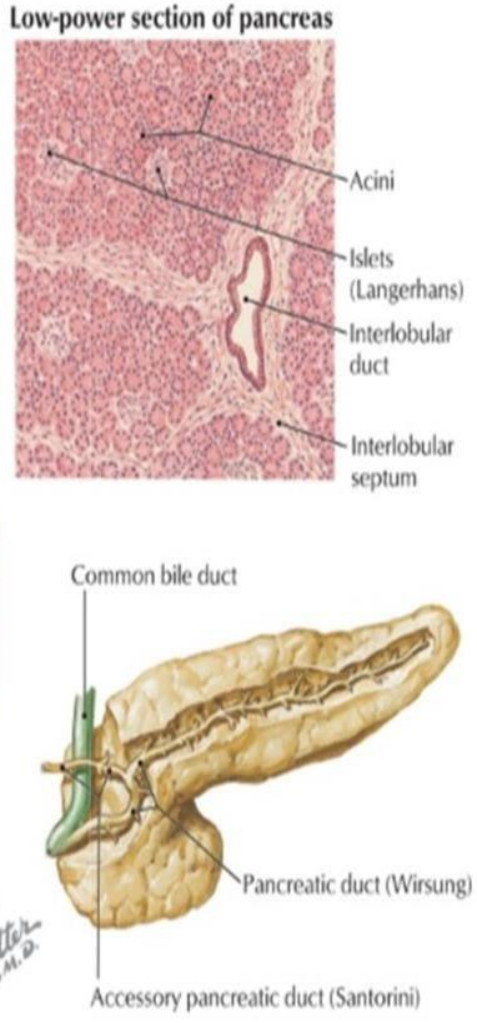
- **SITE:** lies across the upper part of the posterior abdominal wall behind the peritoneum of the lesser sac.
- **It crosses** from the **concavity** of the **DUODENUM** to the **hilum** of the spleen.

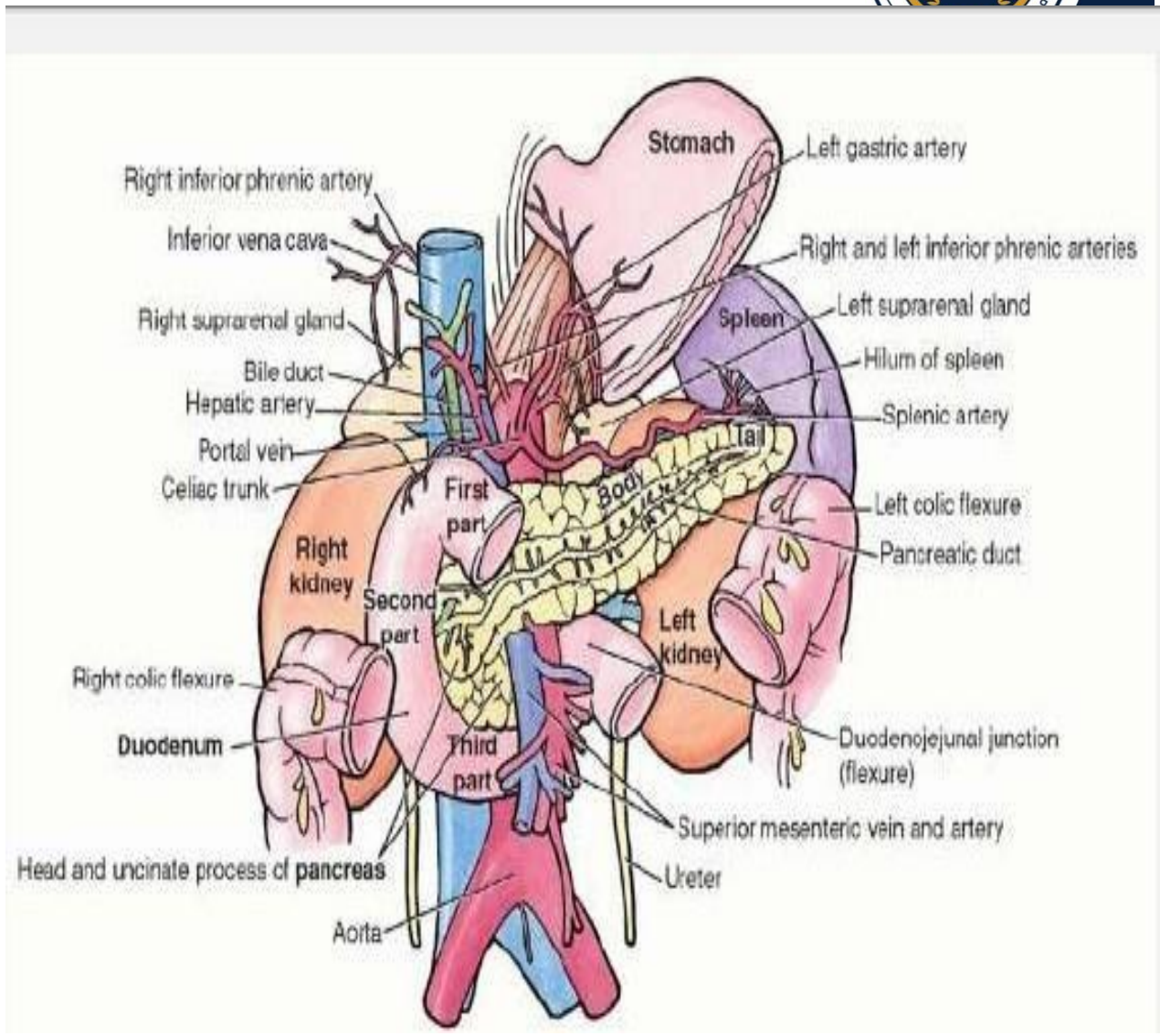



Inferior vena cava (IVC)
Portal v.
Hepatic a.
Common bile duct
R. adrenal gland
L. adrenal gland
Splenic a.
Spleen
Tail
Pancreatic neck
Minor papilla
R. Kidney
Head
Major papilla
L. kidney
Second part of duodenum
Sup. mesenteric v. and a.
Uncinate process
Abdominal aorta
IVC


Tail
Body
Neck
Head


Abdominal aorta
Stomach (cut)
Inferior vena cava
Splenic a.
Spleen
Duodenum
Tail
Pancreas
Body
Neck
Head
Left kidney
(retroperitoneal)
Jejunum (cut)
Duodenojejunal flexure
Superior mesenteric a. and v.
Root of mesentery (cut)
Uncinate process of pancreas
Attachment of transverse mesocolon


Low-power section of pancreas
Acini
Islets
(Langerhans)
Interlobular
duct
Interlobular
septum
Common bile duct
Pancreatic duct (Wirsung)
Accessory pancreatic duct (Santorini)


Stomach
Left gastric artery
Right inferior phrenic artery
Inferior vena cava
Right and left inferior phrenic arteries
Right suprarenal gland
Spleen
Left suprarenal gland
Bile duct
Hilum of spleen
Hepatic artery
Splenic artery
Portal vein
Tail
Celiac trunk
First
part
Body
Left colic flexure
Right
kidney
Pancreatic duct
Second
part
Left
kidney
Right colic flexure
Duodenum
Third
part
Duodenojejunal junction
(flexure)
Superior mesenteric vein and artery
Head and uncinate process of pancreas
Ureter
Aorta

Parts and Relations of pancreas:

it is divided into four parts:

1 Head of the Pancreas:

❑ **Lies in the concavity of the duodenum, separated from it by groove containing the pancreaticoduodenal vessels.**

❑ **Uncinate process: projects upwards and to the left.**

❑ Anterior relations:

1. The transverse colon. 2. The coils of the jejunum

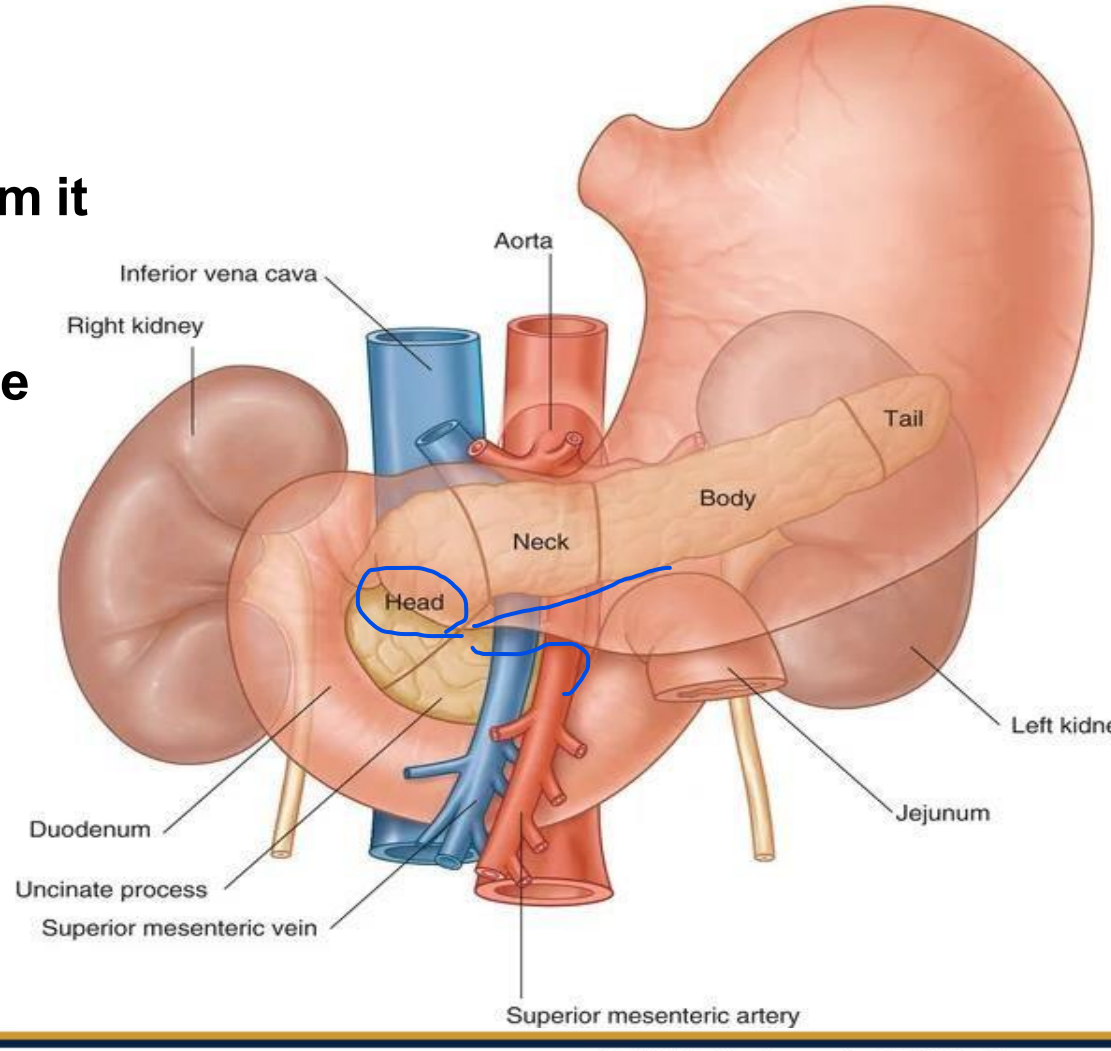
3. The superior mesenteric vessels: in front of the uncinate process.

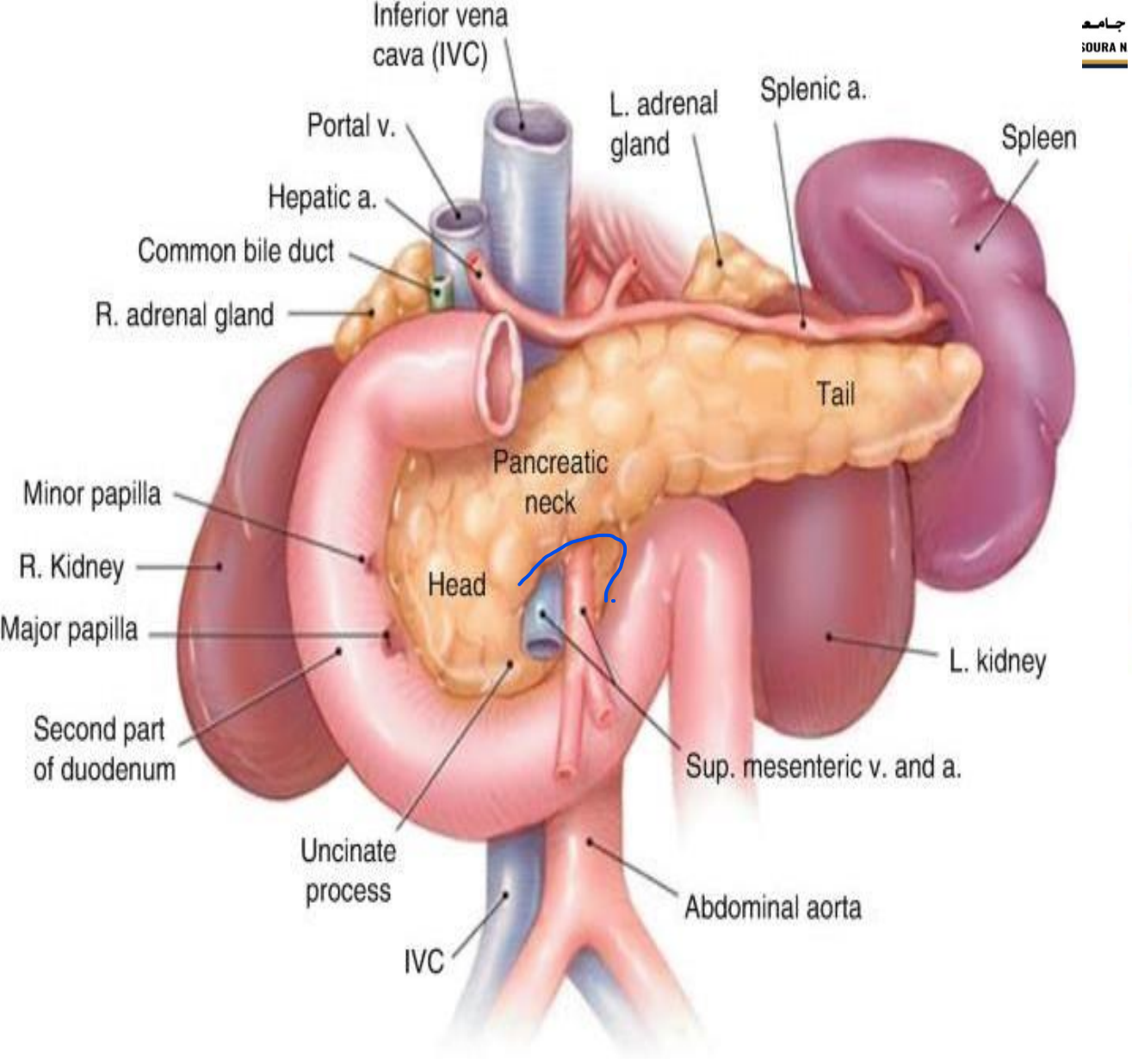
MCQ

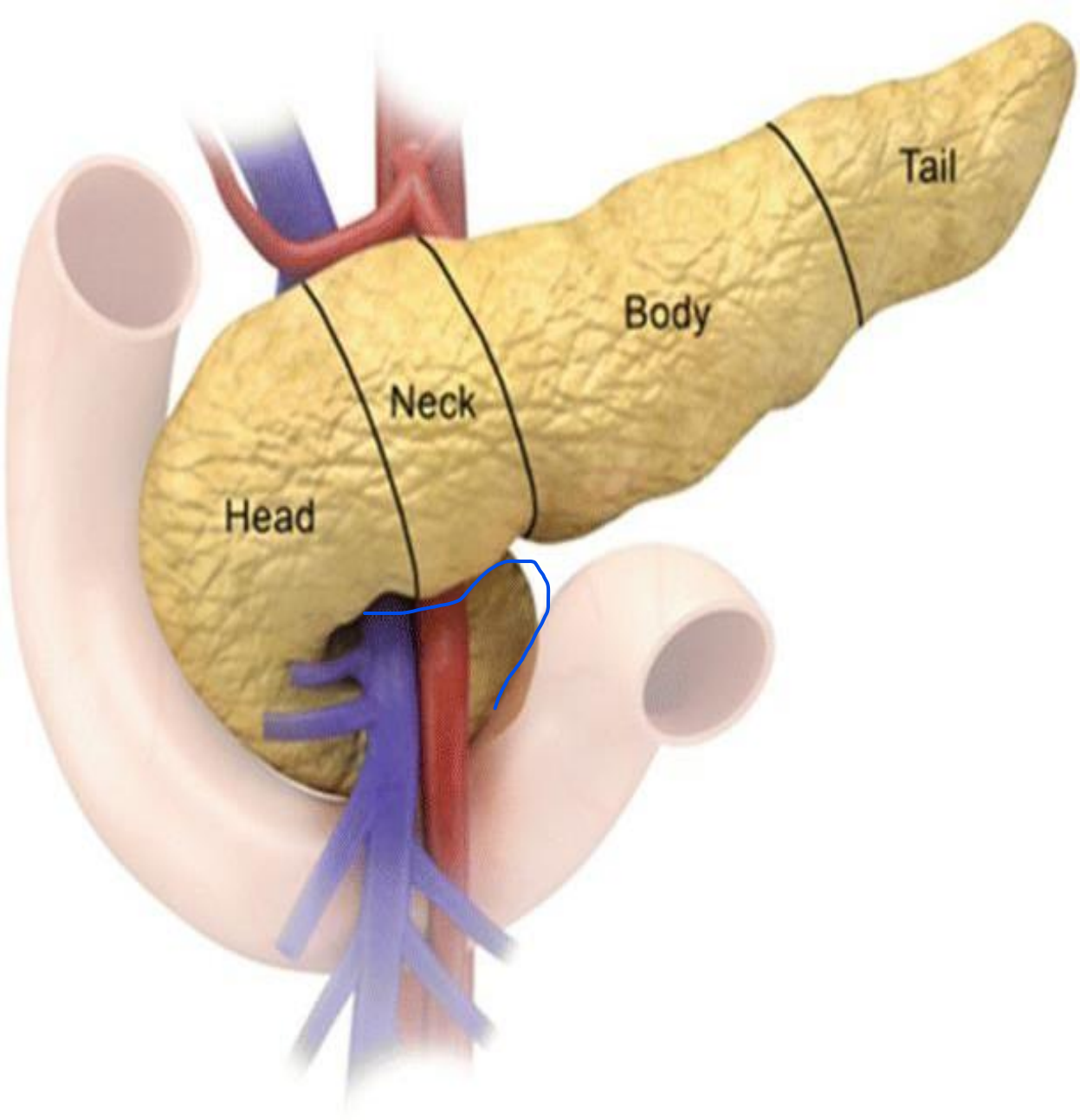
❑ Posterior relations:

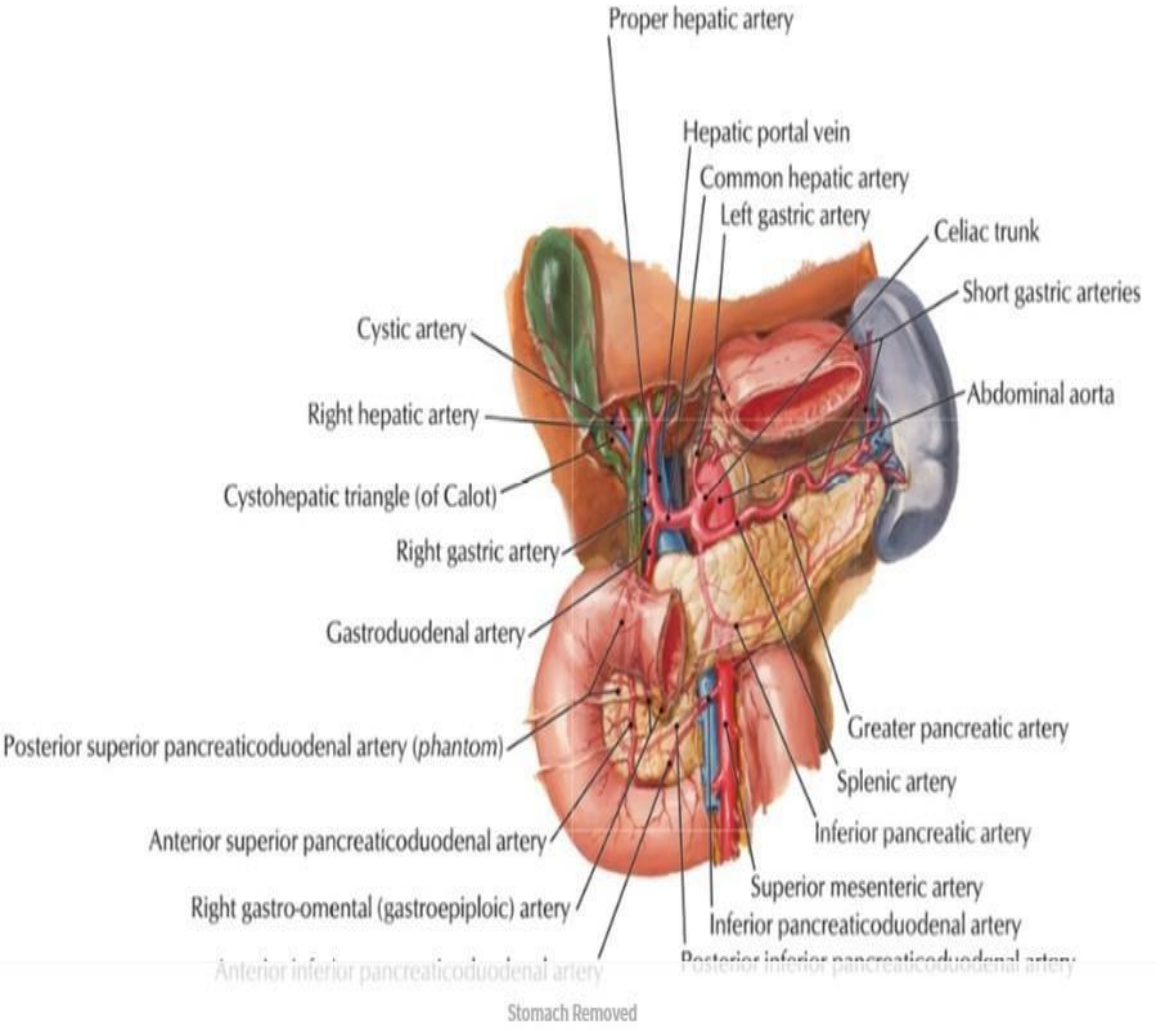
1. The I.V.C. 2. The common bile duct.

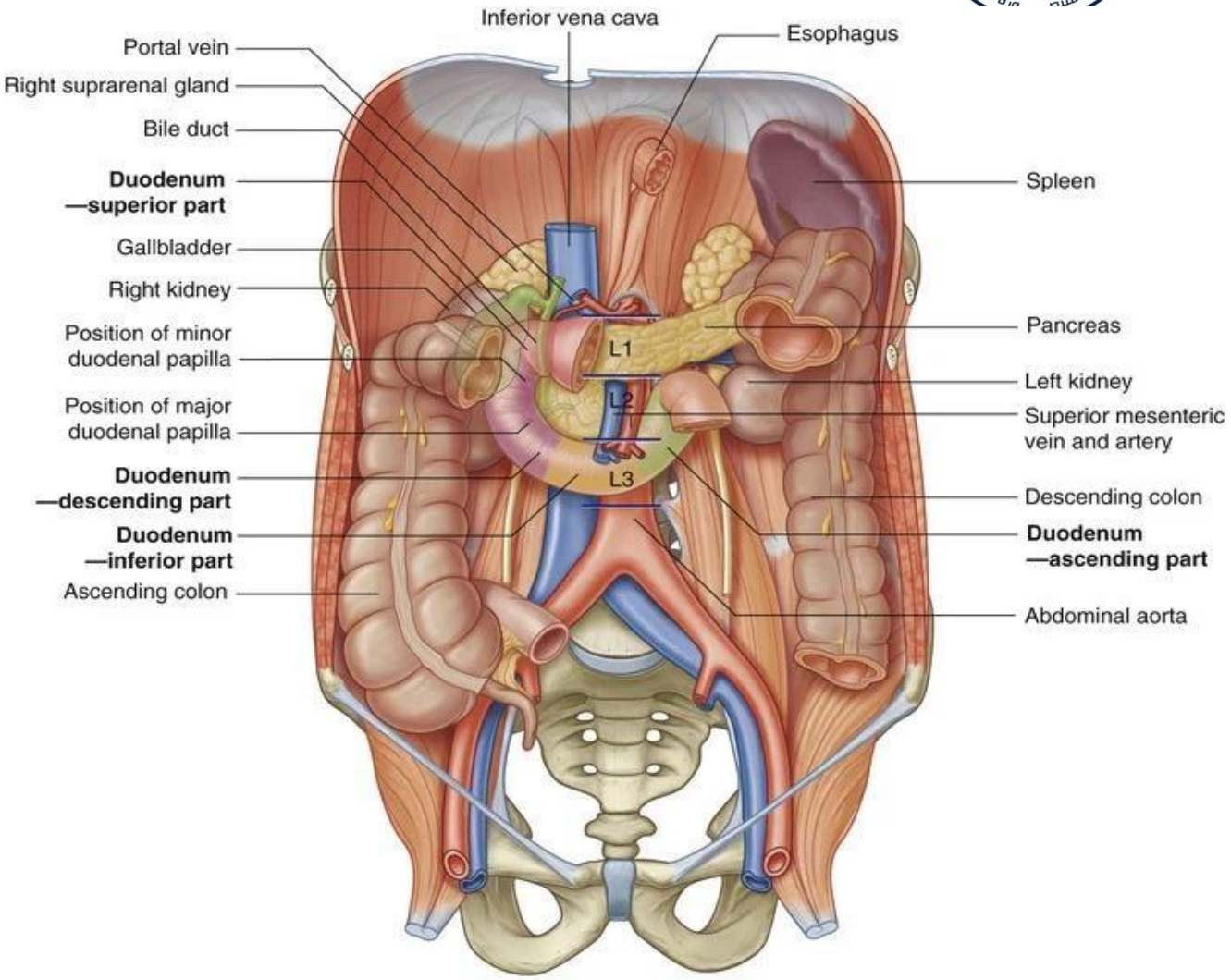
3. The aorta: behind the uncinate process.




Inferior vena cava (IVC)
Portal v.
Hepatic a.
Common bile duct
R. adrenal gland
L. adrenal gland
Splenic a.
Spleen
Tail
Pancreatic neck
Minor papilla
R. Kidney
Head
Major papilla
L. kidney
Second part of duodenum
Sup. mesenteric v. and a.
Uncinate process
Abdominal aorta
IVC


Tail
Body
Neck
Head


Proper hepatic artery
Hepatic portal vein
Common hepatic artery
Left gastric artery
Celiac trunk
Short gastric arteries
Cystic artery
Abdominal aorta
Right hepatic artery
Cystohepatic triangle (of Calot)
Right gastric artery
Gastroduodenal artery
Posterior superior pancreaticoduodenal artery (phantom)
Greater pancreatic artery
Splenic artery
Anterior superior pancreaticoduodenal artery
Inferior pancreatic artery
Superior mesenteric artery
Right gastro-omental (gastroepiploic) artery
Inferior pancreaticoduodenal artery
Anterior inferior pancreaticoduodenal artery
Stomach Removed


Inferior vena cava
Esophagus
Portal vein
Right suprarenal gland
Bile duct
Duodenum —superior part
Spleen
Gallbladder
Right kidney
Pancreas
Position of minor duodenal papilla
L1
Left kidney
L2
Position of major duodenal papilla
Superior mesenteric vein and artery
L3
Duodenum —descending part
Descending colon
Duodenum —inferior part
Duodenum —ascending part
Ascending colon
Abdominal aorta

Neck of the Pancreas:

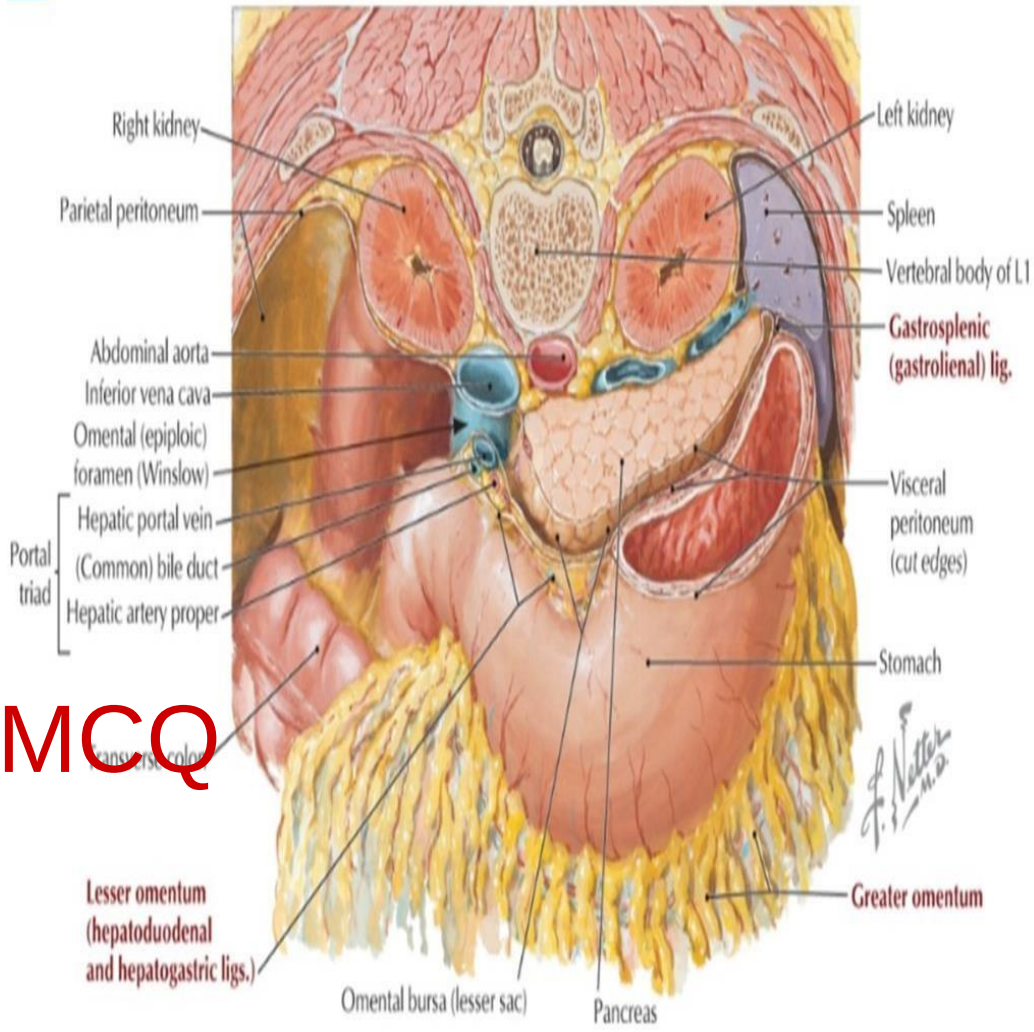
❑ Anterior relations:

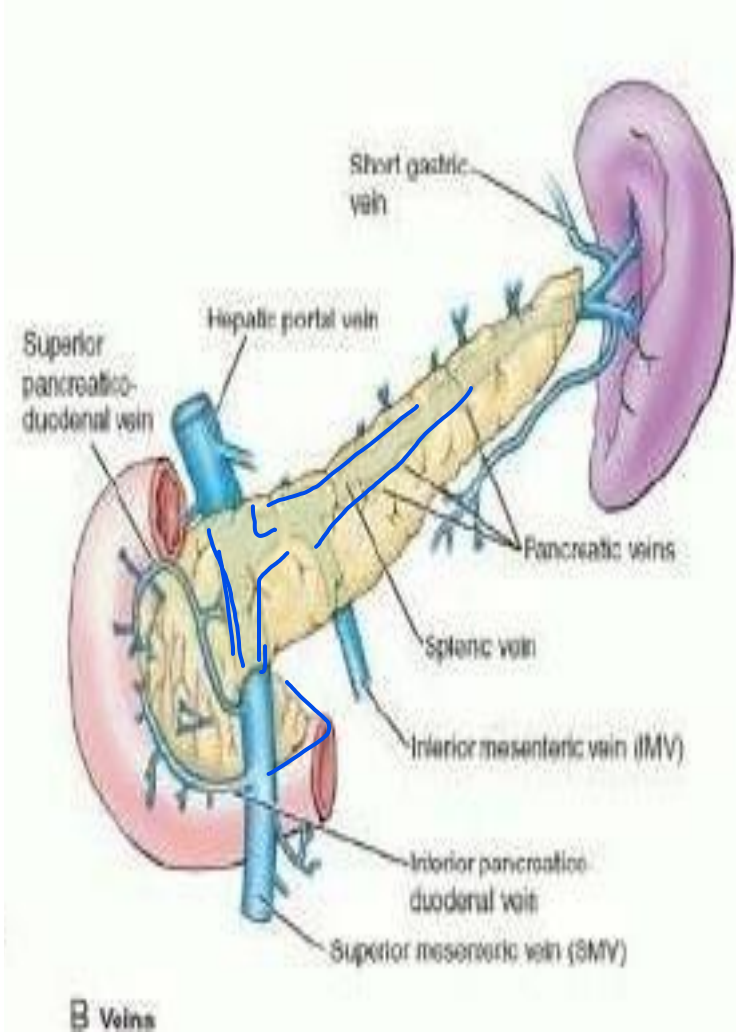
1. The pylorus and the first part of the duodenum.
2. The peritoneum of the lesser sac.

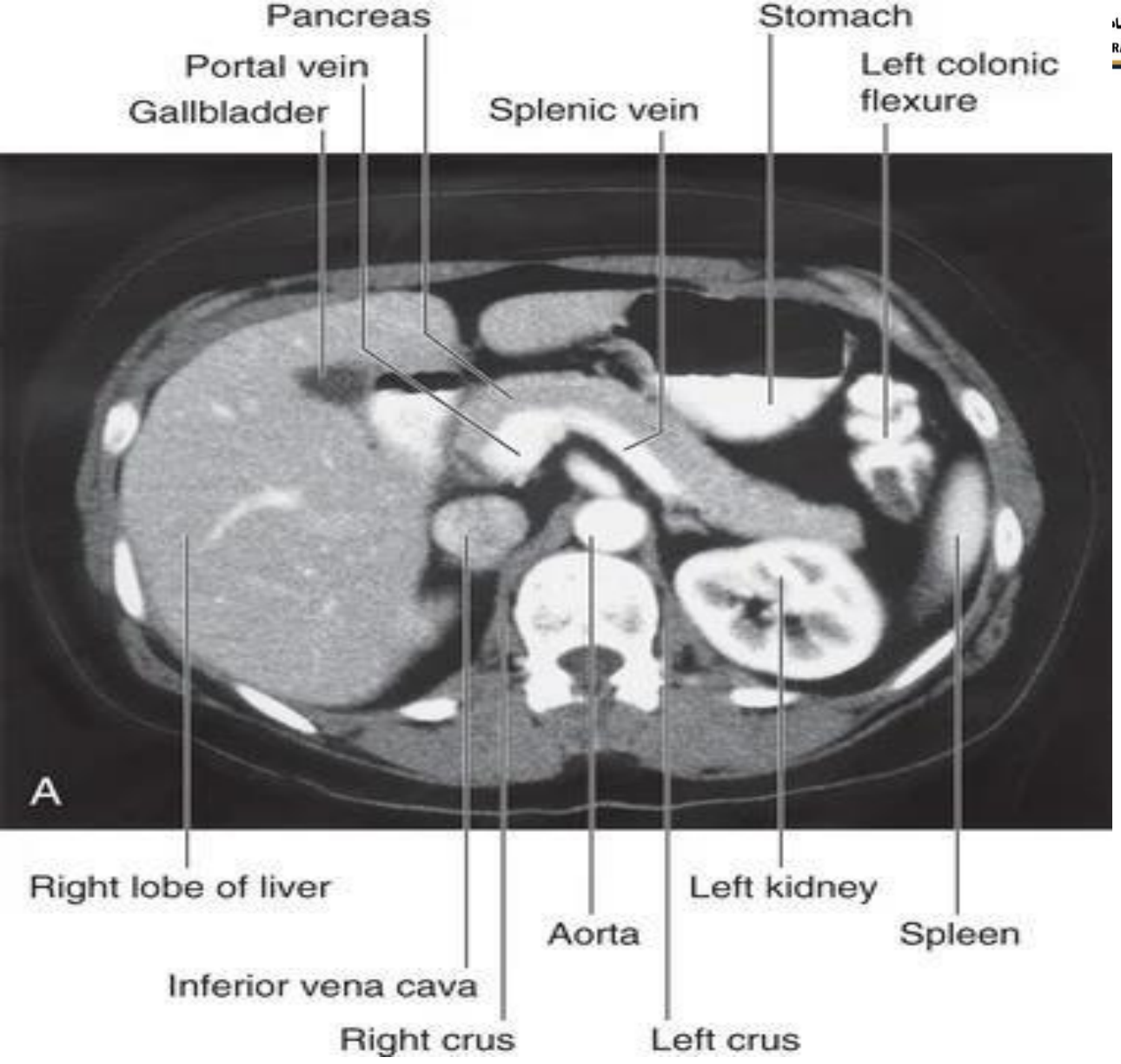
❑Posteriorly:

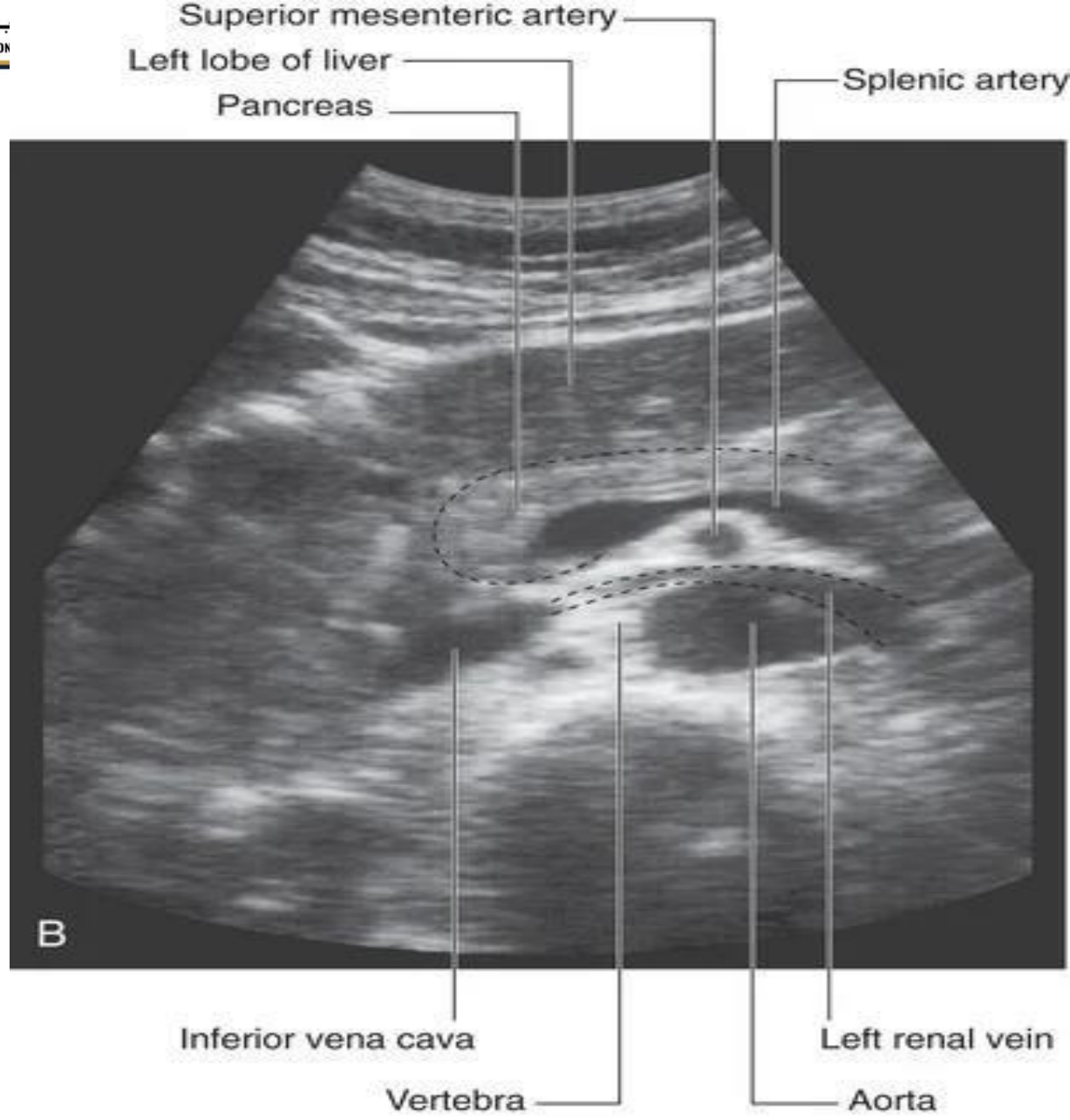
It is related to the **beginning of the portal vein** and the **termination** of the superior mesenteric and splenic veins.

MCQ






Pancreas
Portal vein
Gallbladder
Splenic vein
Stomach
Left colonic flexure
A
Right lobe of liver
Inferior vena cava
Right crus
Aorta
Left crus
Left kidney
Spleen


Superior mesenteric artery
Left lobe of liver
Pancreas
Splenic artery
B
Inferior vena cava
Vertebra
Left renal vein
Aorta

Body of the Pancreas:

- It extends to the left behind the lesser sac.
- It is triangular in cross section.

It has three surfaces and three borders.

- 3 Surfaces:

1. The anterior surface:

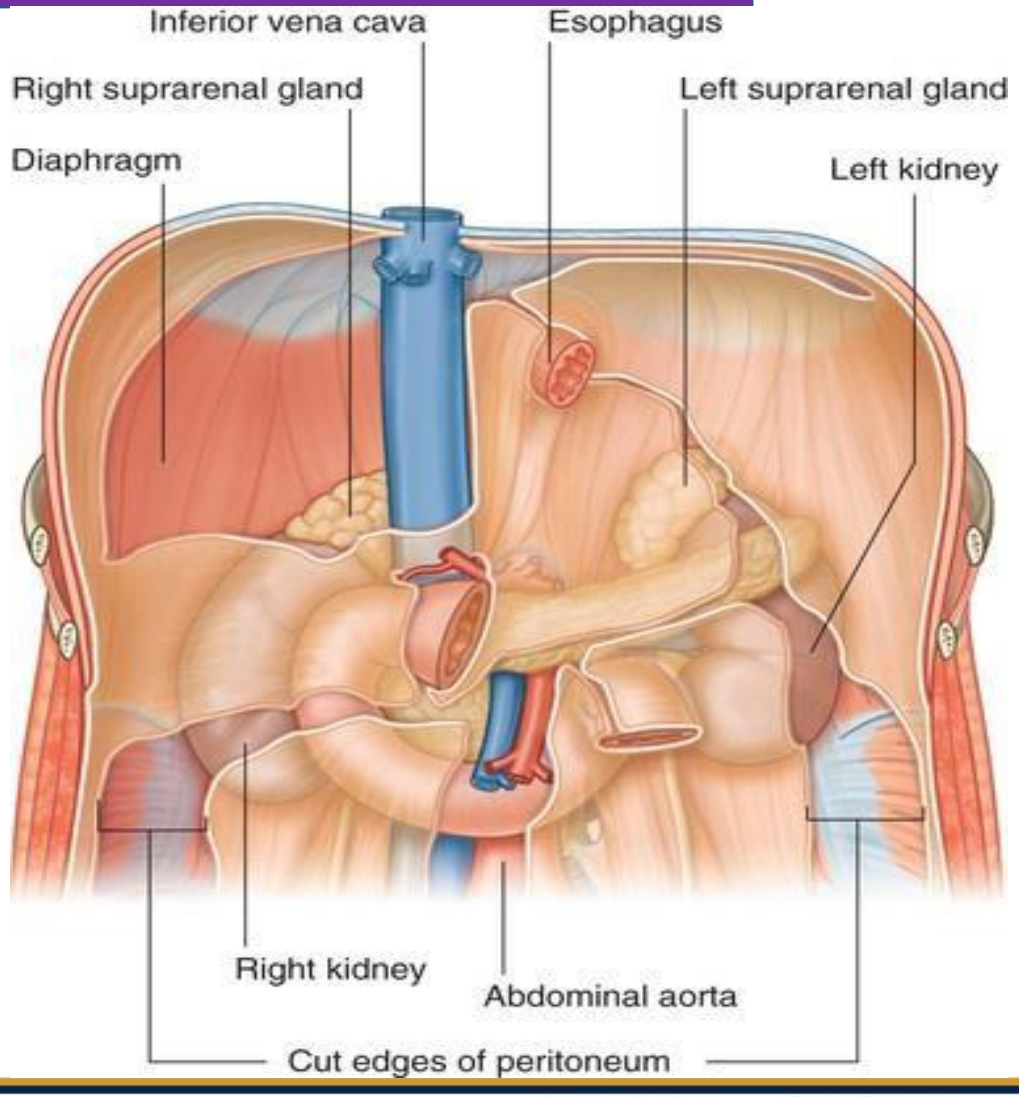
➢ Is covered by the peritoneum of the lesser sac.

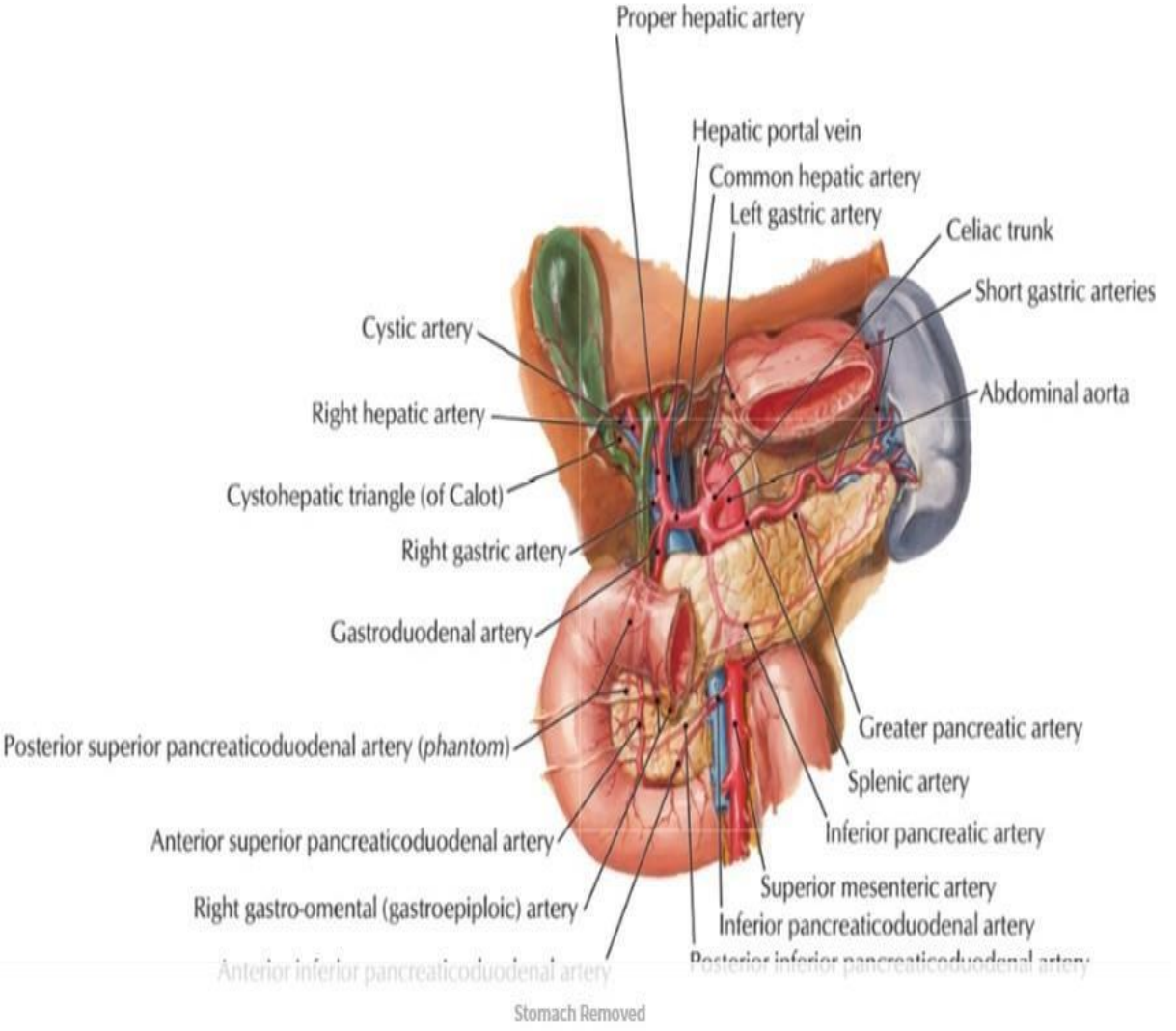
➢ Is separated from the posterior surface of the stomach by the cavity of the lesser sac.

2. The inferior surface:

➢ Is covered by the peritoneum of the greater sac.

➢ It is related to: The duodenojejunal flexure and left colic flexure.




Proper hepatic artery
Hepatic portal vein
Common hepatic artery
Left gastric artery
Celiac trunk
Short gastric arteries
Cystic artery
Abdominal aorta
Right hepatic artery
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Greater pancreatic artery
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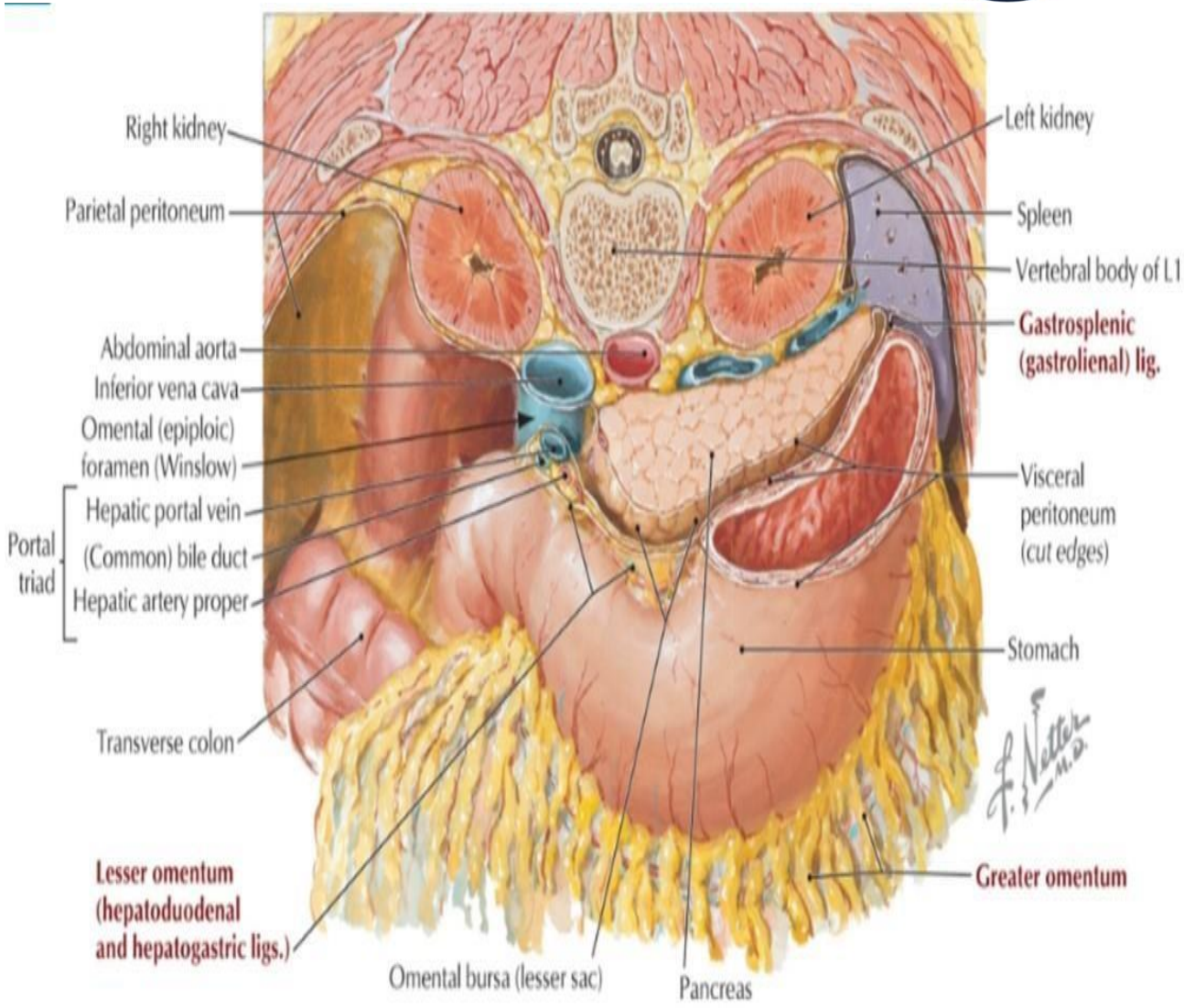
Anterior superior pancreaticoduodenal artery
Inferior pancreatic artery
Superior mesenteric artery
Right gastro-omental (gastroepiploic) artery
Inferior pancreaticoduodenal artery
Anterior inferior pancreaticoduodenal artery
Posterior inferior pancreaticoduodenal artery
Stomach Removed


Right kidney
Left kidney
Parietal peritoneum
Spleen
Vertebral body of L1
Abdominal aorta
Gastrosplenic (gastrolienal) lig.
Inferior vena cava
Omental (epiploic) foramen (Winslow)
Portal triad
Hepatic portal vein
(Common) bile duct
Hepatic artery proper
Visceral peritoneum (cut edges)
Stomach
Transverse colon
Lesser omentum (hepatoduodenal and hepatogastric ligs.)
Greater omentum
Omental bursa (lesser sac)
Pancreas

Body of the Pancreas:

3. The Posterior Surface:

o It is **not covered by** peritoneum, and it is related directly to:

1. The abdominal aorta.
2. The splenic vein: above the superior mesenteric artery.
3. The left renal vein: below the superior mesenteric artery.

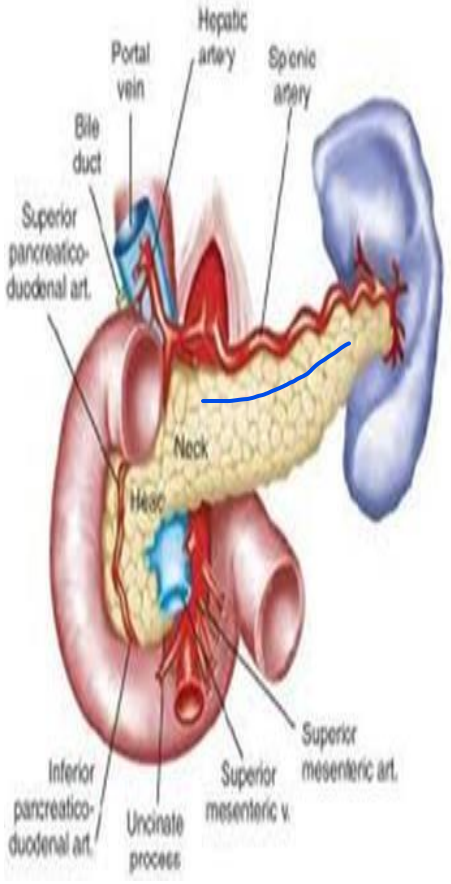
MCQ

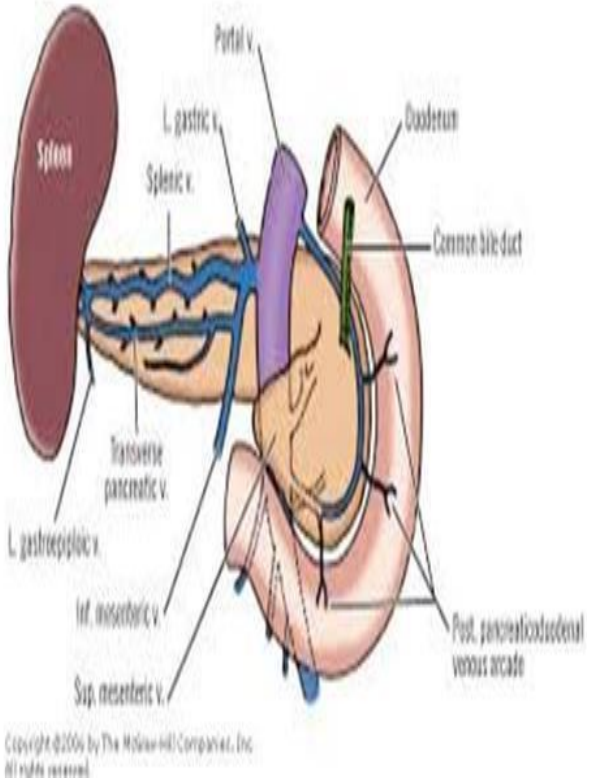
❑ **3 Borders:**

A. The upper border: Related to the splenic artery.

B. The anterior border: Gives attachment to transverse mesocolon.

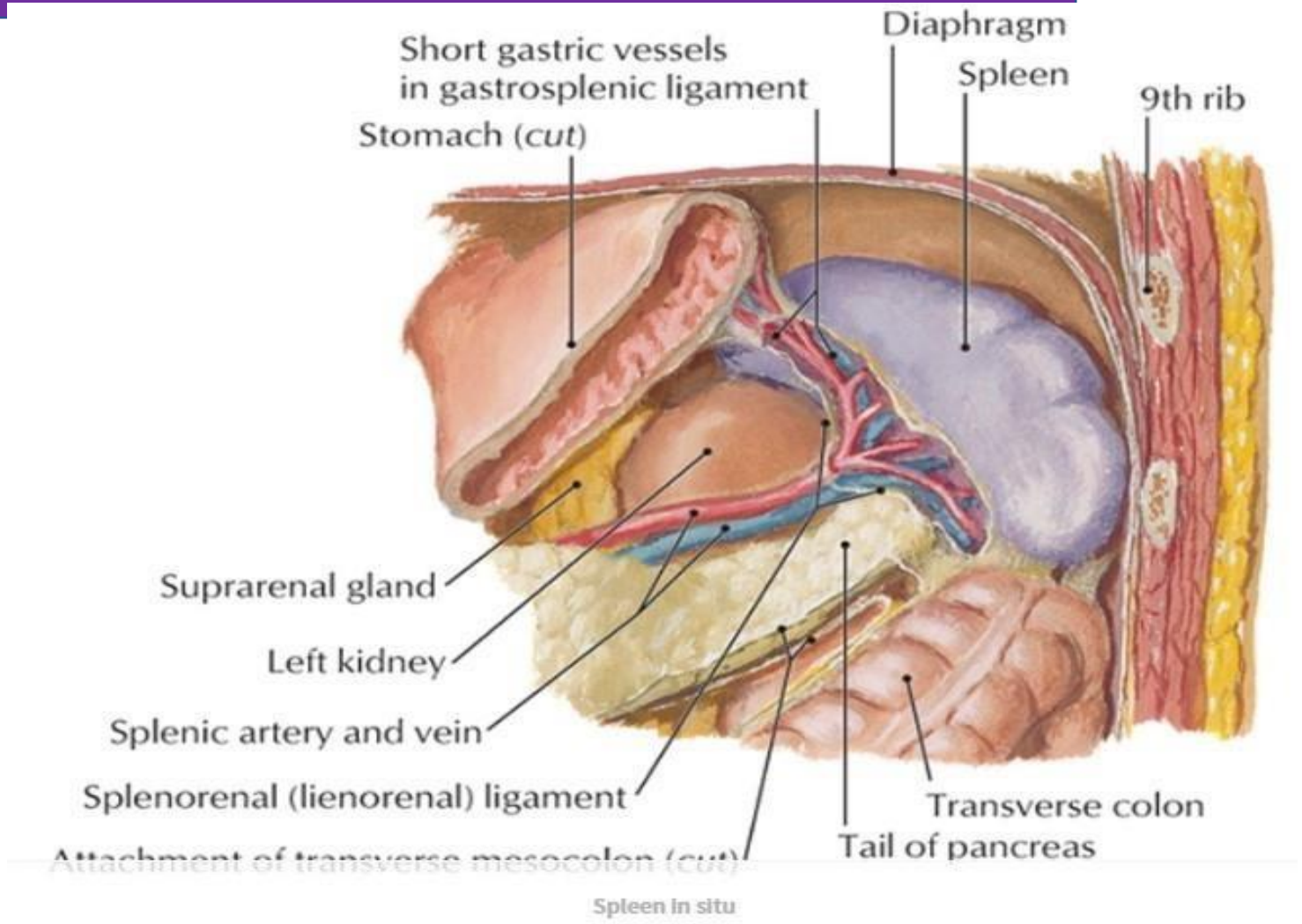
C. The posterior border: the same relations as posterior surface.





Tail of the Pancreas:

- ❑ **Is thick and blunt.**
- ❑ **It lies between the two layers of the lienorenal ligament.**
- ❑ **It is related to the terminal parts of the splenic vessels.**
- ❑ **It comes into direct relation with visceral surface of spleen close to its hilum.**



Spleen in situ

Pancreatic ducts:

1. The main pancreatic duct:

It passes through tail, body and lower part of head.

❑ In the lower part of the head of pancreas, the pancreatic duct joins the bile duct.

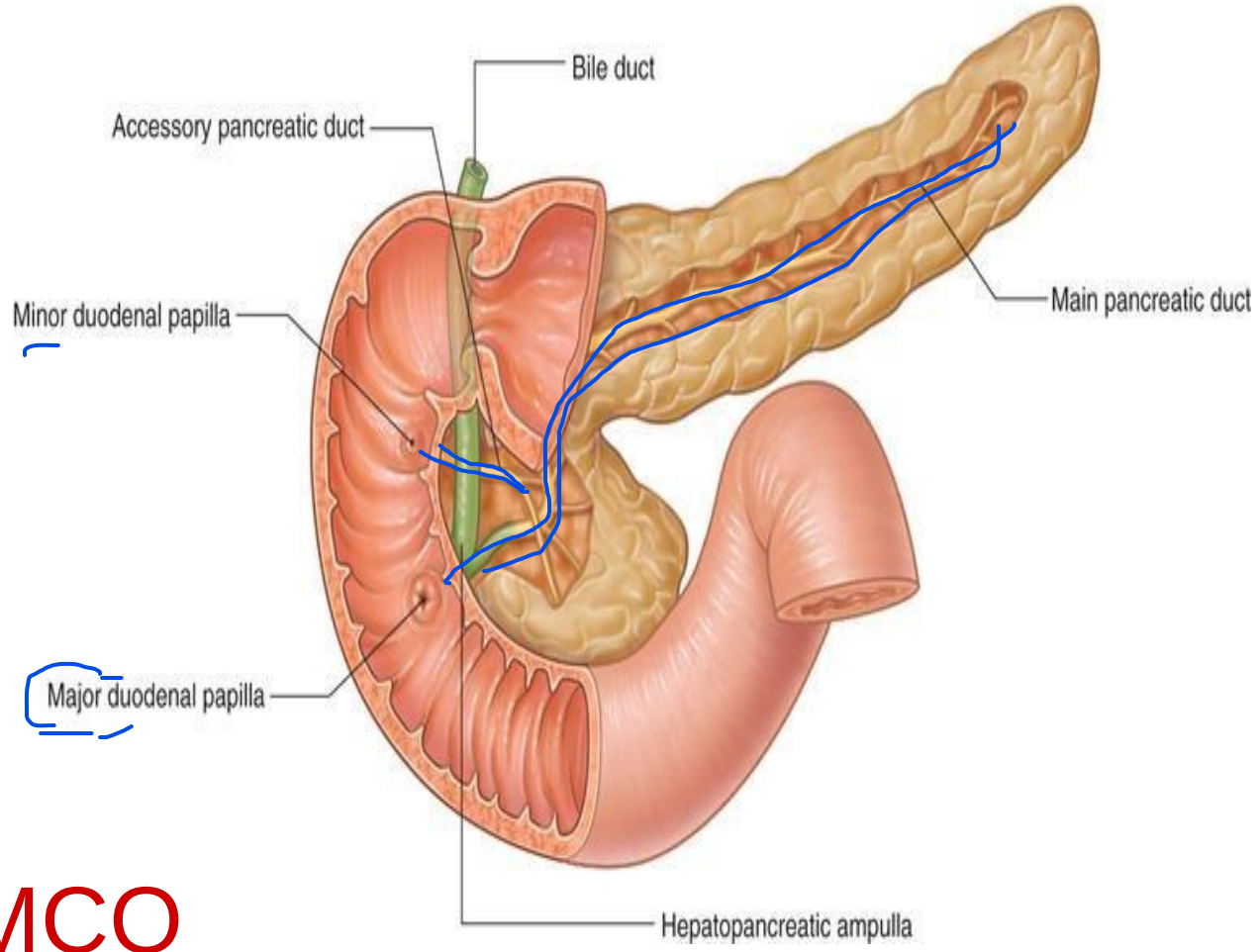
The joining of these two structures forms the hepatopancreatic ampulla (ampulla of Vater), which enters the 2nd part of the duodenum at the major duodenal papilla. MCQ

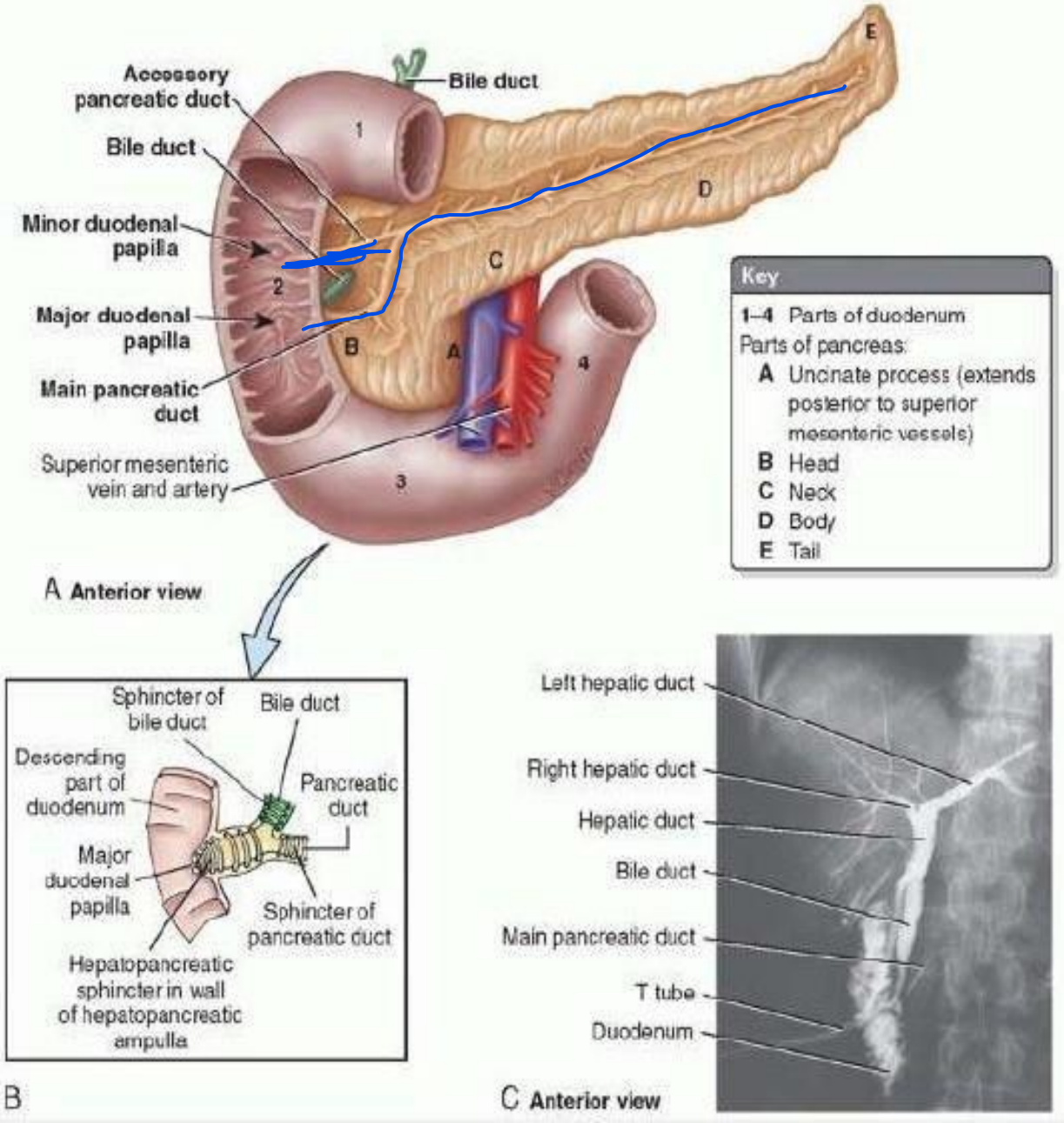
❑ Surrounding the ampulla is the sphincter of ampulla (sphincter of Oddi), which is a collection of smooth muscle

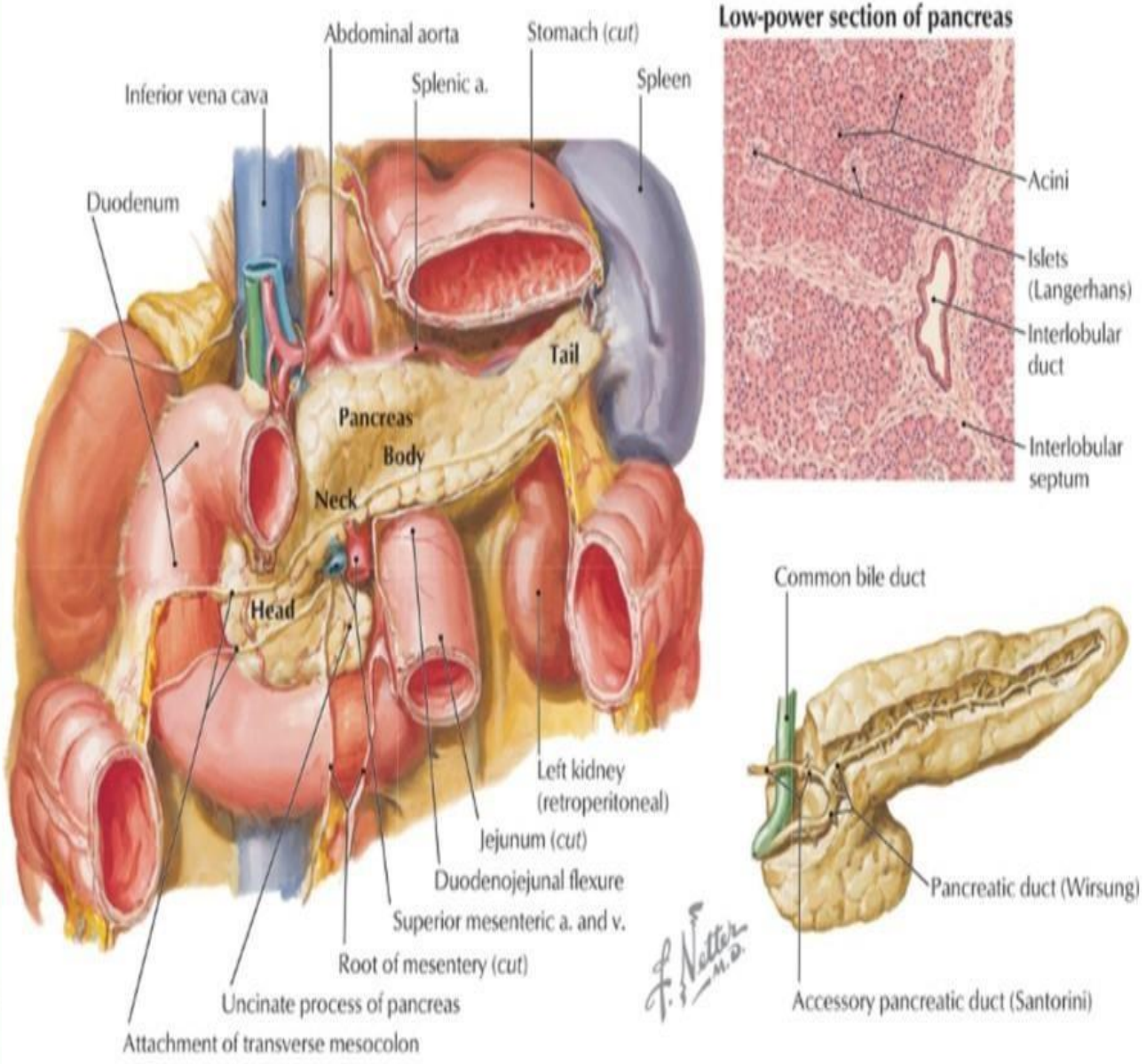
2. The accessory pancreatic duct:

❑ It is small duct, which begins in the upper part of the head. ❑ It opens into the second part of the duodenum on the summit of the minor duodenal papilla, one inch ABOVE the major duodenal papilla.

MCQ




Accessory pancreatic duct
Bile duct
Minor duodenal papilla
Major duodenal papilla
Main pancreatic duct
Superior mesenteric vein and artery
1
2
3
4
A
B
C
D
E
Key
1–4 Parts of duodenum
Parts of pancreas:
A Uncinate process (extends posterior to superior mesenteric vessels)
B Head
C Neck
D Body
E Tail
A Anterior view
Sphincter of bile duct
Bile duct
Descending part of duodenum
Pancreatic duct
Major duodenal papilla
Sphincter of pancreatic duct
Hepatopancreatic sphincter in wall of hepatopancreatic ampulla
B
Left hepatic duct
Right hepatic duct
Hepatic duct
Bile duct
Main pancreatic duct
T tube
Duodenum
C Anterior view


Abdominal aorta
Stomach (cut)
Inferior vena cava
Splenic a.
Spleen
Duodenum
Tail
Pancreas
Body
Neck
Head
Left kidney (retroperitoneal)
Jejunum (cut)
Duodenojejunal flexure
Superior mesenteric a. and v.
Root of mesentery (cut)
Uncinate process of pancreas
Attachment of transverse mesocolon
F. Netter M.D.

Low-power section of pancreas
Acini
Islets (Langerhans)
Interlobular duct
Interlobular septum
Common bile duct
Pancreatic duct (Wirsung)
Accessory pancreatic duct (Santorini)

Development of the pancreas

SAQ

- **Development:** The pancreas develops from the duodenum by **2 buds:**
- **Dorsal pancreatic bud:** arises from the **dorsal wall** of the duodenum slightly **above** the hepatic bud. It extends dorsally and upwards in the **mesoduodenum.**
- **Ventral pancreatic bud:** arises from the **ventral wall** of the duodenum in conjunction with the **hepatic bud.**
- **The ventral pancreas** comes to lie **below & behind** the dorsal pancreas as a result of:

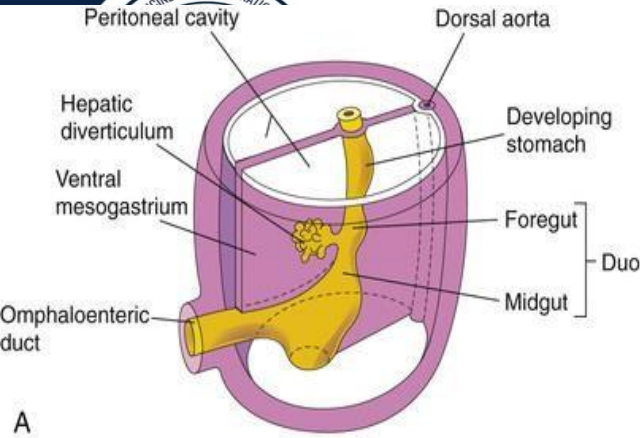
1. **Differential growth** of the duodenal wall.
2. **Axial rotation** of the duodenum to **right** side.

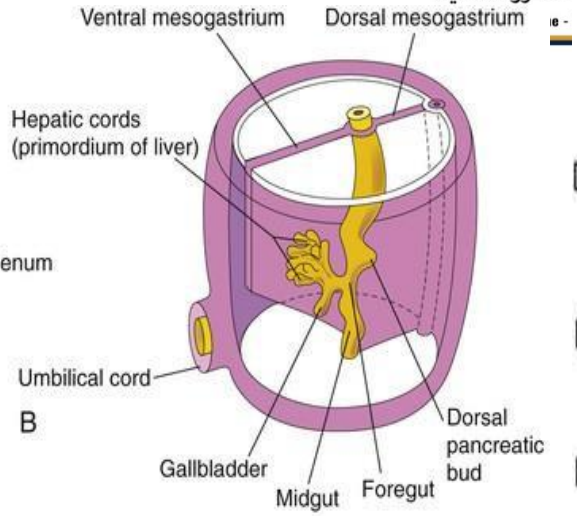
o Later **the parenchyma** as well as the **duct systems** of the two buds **fuse** together so that:

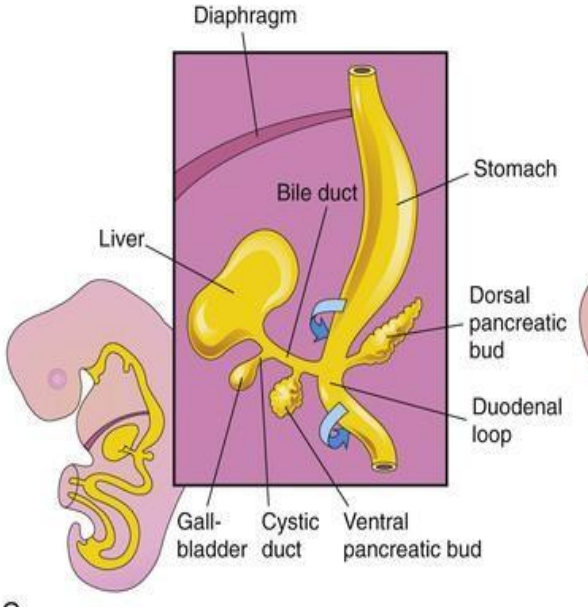
✓ **The ventral bud** forms the **uncinate process & the inferior part of the head** of the pancreas.

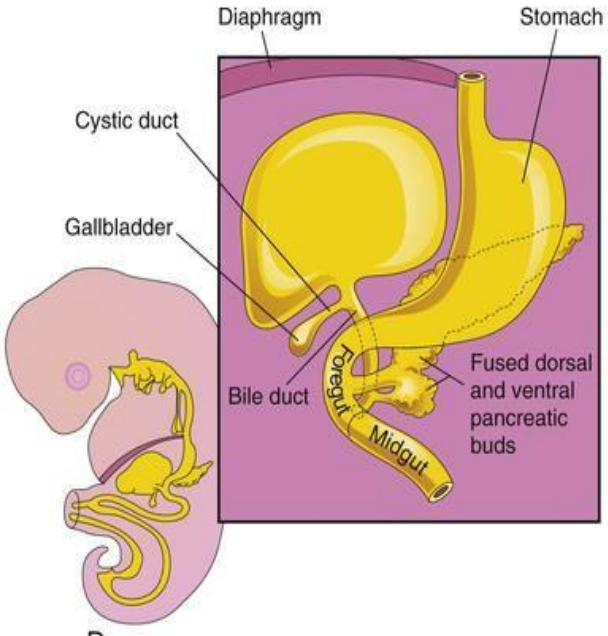
✓ **The remaining part** of pancreas is derived from **the dorsal bud.**

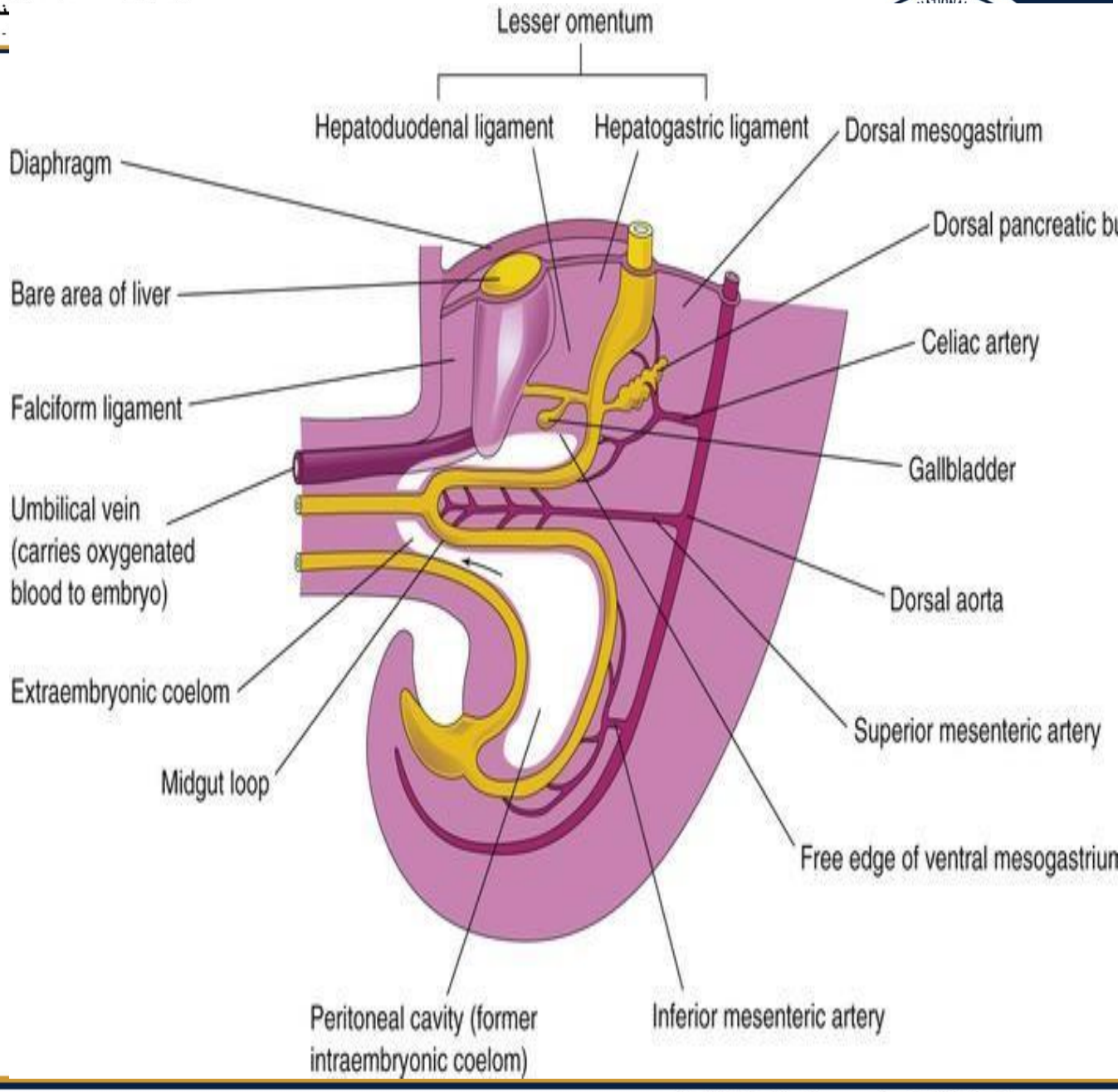
MCQ


Peritoneal cavity
Dorsal aorta
Hepatic diverticulum
Developing stomach
Ventral mesogastrium
Foregut
Duodenum
Midgut
Omphaloenteric duct
A


Ventral mesogastrium
Dorsal mesogastrium
Hepatic cords (primordium of liver)
Umbilical cord
Dorsal pancreatic bud
Gallbladder
Midgut
Foregut
B


Diaphragm
Stomach
Bile duct
Liver
Dorsal pancreatic bud
Duodenal loop
Gall-bladder
Cystic duct
Ventral pancreatic bud
C


Diaphragm
Stomach
Cystic duct
Gallbladder
Bile duct
Foregut
Midgut
Fused dorsal and ventral pancreatic buds
D

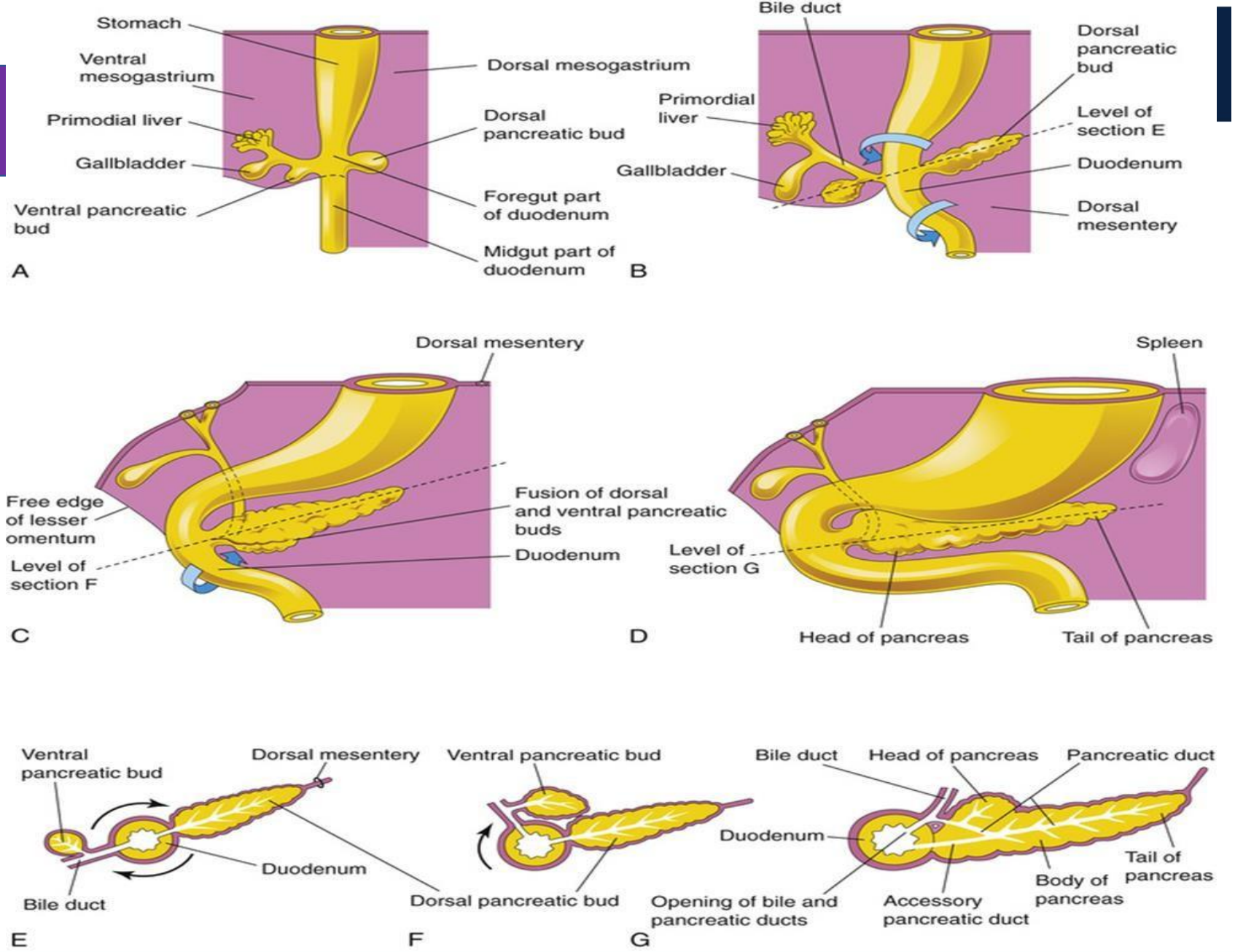

Lesser omentum
Hepatoduodenal ligament
Hepatogastric ligament
Dorsal mesogastrium
Diaphragm
Dorsal pancreatic bu
Bare area of liver
Celiac artery
Falciform ligament
Gallbladder
Umbilical vein (carries oxygenated blood to embryo)
Dorsal aorta
Extraembryonic coelom
Superior mesenteric artery
Midgut loop
Free edge of ventral mesogastrium
Peritoneal cavity (former intraembryonic coelom)
Inferior mesenteric artery

Development of Pancreas

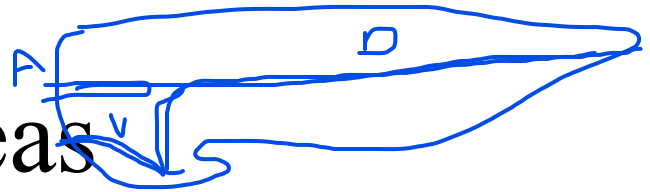
- The pancreas develops between the layers of the mesenteries from dorsal and ventral pancreatic buds, which arise from the caudal part of the foregut .
- Most of the pancreas is derived from the larger dorsal pancreatic bud, which appears first.
- The smaller ventral pancreatic bud develops near the entry of the bile duct into the duodenum .
- As the duodenum rotates to the right and becomes C-shaped, the ventral bud is carried dorsally with the bile duct .
- It soon lies posterior to the dorsal pancreatic bud and later fuses with it .
- As the pancreatic buds fuse, their ducts anastomose (link).
- The ventral pancreatic bud forms the uncinate process and part of the head of the pancreas.
- As the stomach, duodenum, and ventral mesentery rotate, the pancreas comes to lie along the dorsal abdominal wall (retroperitoneal)

A to D, Successive stages in the development of the pancreas from the fifth to the eighth weeks.

E to G, Transverse sections through the duodenum and developing pancreas. Growth and rotation (arrows) of the duodenum bring the ventral pancreatic bud toward the dorsal bud, where the two buds subsequently fuse.



Development of The Pancreas

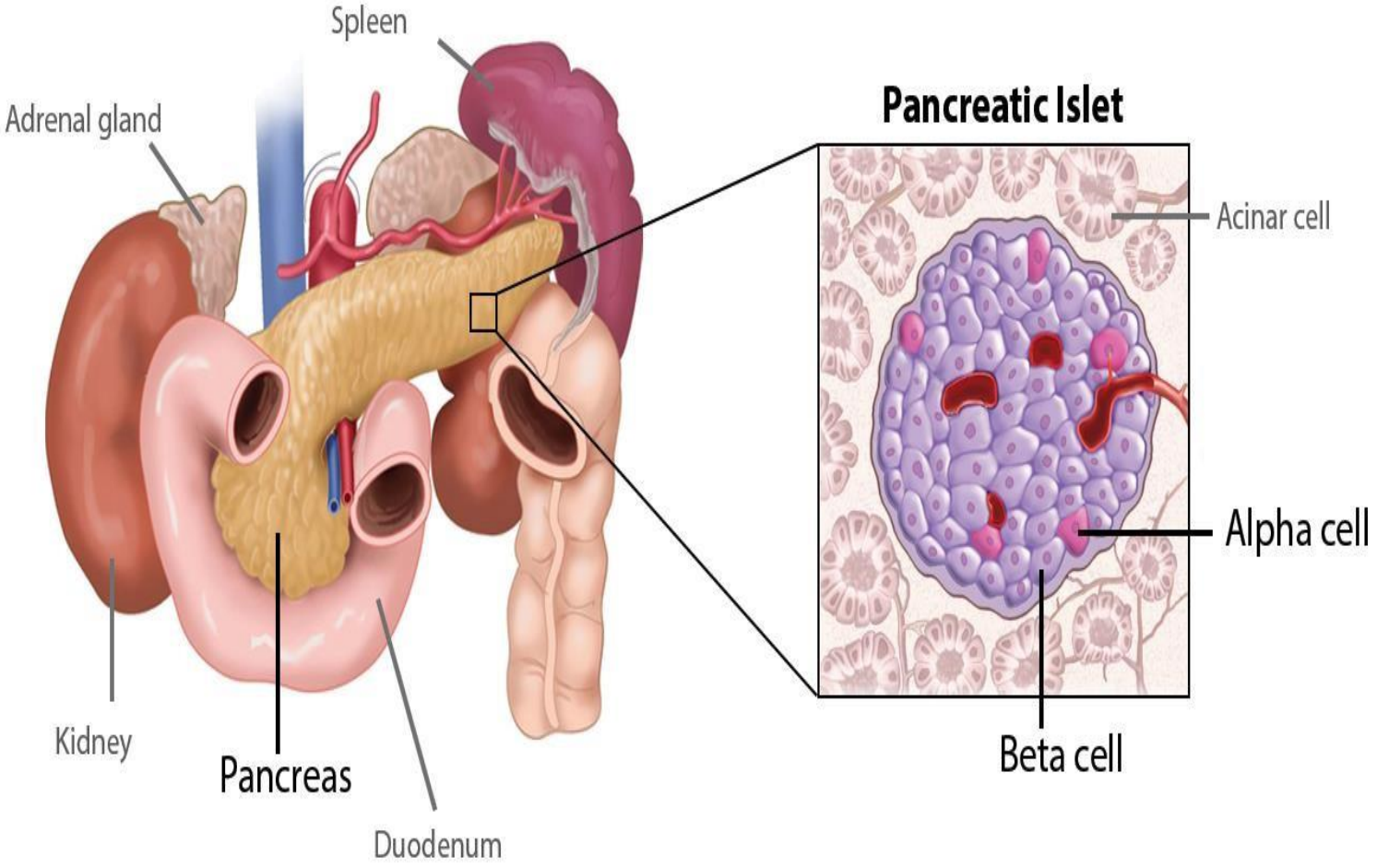


✓ **The main pancreatic duct is formed by the distal part of the dorsal pancreatic duct & the whole ventral pancreatic duct.** MCQ

✓ **The proximal part of the dorsal pancreatic duct is either obliterated or persists as the accessory pancreatic duct.** MCQ ✓ **In 10% of the cases the duct system fails to fuse(Pancreatic divisum) .**

✓ **The connective tissue sheath and interlobular septa of the pancreas develop from the surrounding splanchnic mesenchyme. Isolated clumps of endodermal cells bud from the tubules and accumulate within the mesoderm to form islet cells (i.e., endocrine pancreas).**

✓ **The glucagon- and somatostatin-containing cells develop before differentiation of the insulin-secreting cells occurs. With increasing fetal age, total pancreatic insulin and glucagon content also increases. The islets of Langerhans: develop from the parenchymatous tissue in the 3rd month, but they start insulin secretion during the 5th month.**


Spleen
Adrenal gland
Kidney
Pancreas
Duodenum
Pancreatic Islet
Acinar cell
Alpha cell
Beta cell

Congenital anomalies of Pancreas

SAQ

1-Annular pancreas is an uncommon birth defect, but it warrants attention because it may cause duodenal obstruction .

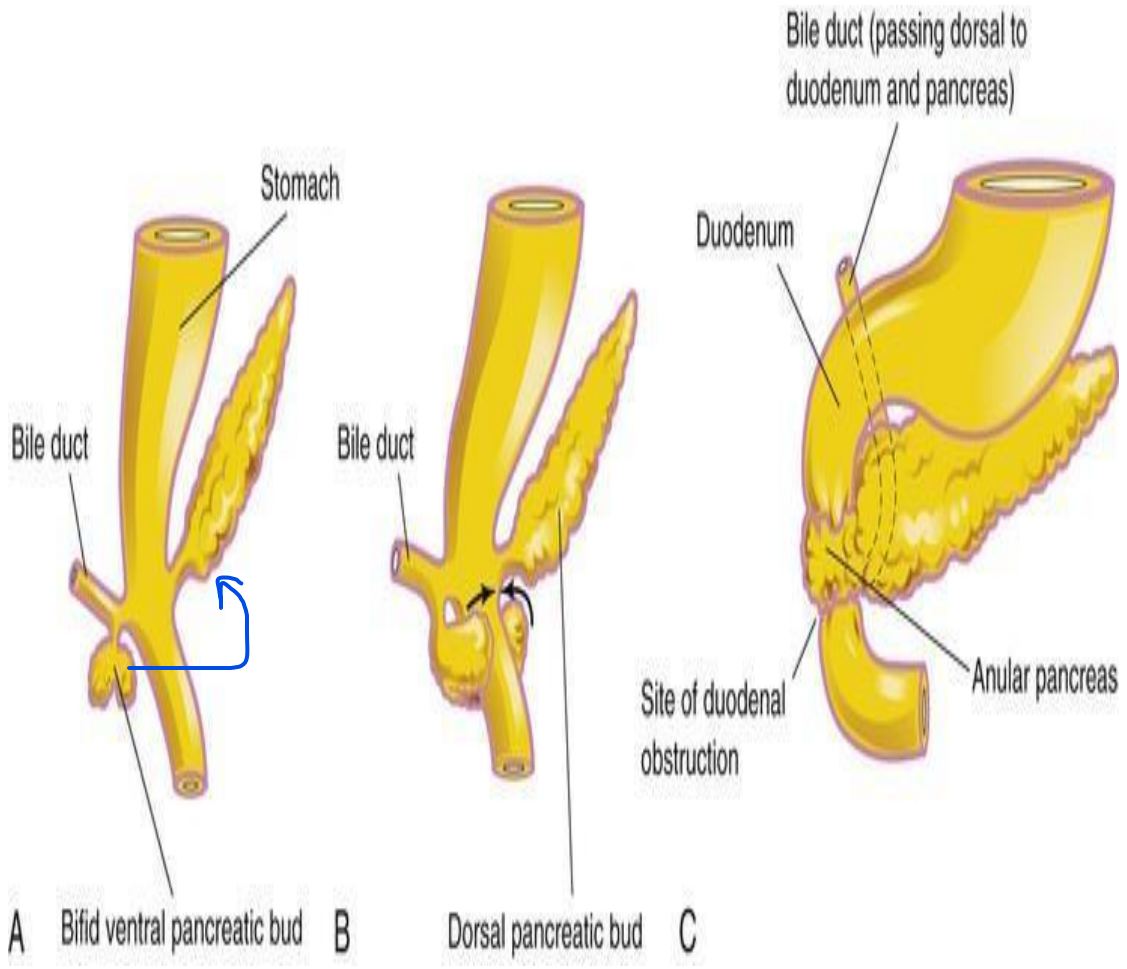
This defect probably results from the growth of a bifid ventral pancreatic bud around the duodenum .

The parts of the bifid ventral bud then fuse with the dorsal bud, forming a pancreatic ring.

The ring-like, annular part of the pancreas consists of a thin, flat band of pancreatic tissue surrounding the descending or second part of the duodenum.

An annular pancreas may cause obstruction of the duodenum shortly after birth, but many cases are not diagnosed until adulthood.

Newborns and infants are intolerant of oral feeding and often have bilious vomiting.



Congenital anomalies of Pancreas:

2. Accessory pancreatic tissue: may be found in the wall of stomach or duodenum.

3-Hyperplasia of pancreatic islets occurs when fetal islets are exposed to high blood glucose levels, as frequently happens in infants of diabetic mothers. Glucose freely crosses the placenta and stimulates fetal islet hyperplasia and insulin secretion, which causes increased fat and glycogen deposition in fetal tissues.
This results in increased birth weight of infants at term (i.e., macrosomia) and serious episodes of hypoglycemia in the postnatal period.

THE SUPRARENAL (ADRENAL) GLANDS

❖ **STRUCTURE** consists of an **outer cortex** and an **inner medulla**

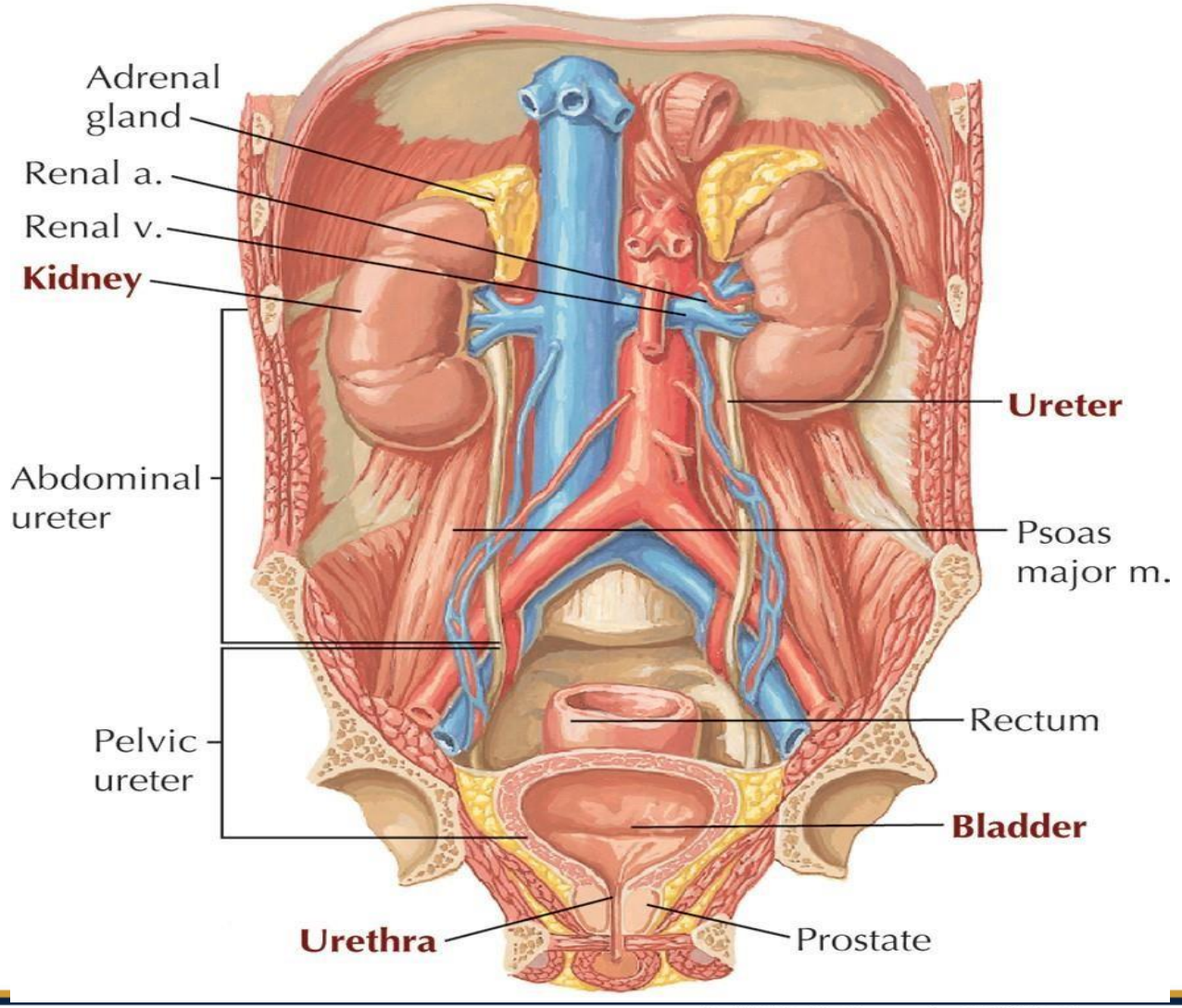
❖ **POSITION:** over the **upper pole** of the kidney one on each side of the midline.

❖ **COVERINGS:** enclosed together with the kidney in the **renal fascia and perirenal fat**, separated from the kidney by a septum of **fibro-areolar tissue.**

❖ **NERVES:**

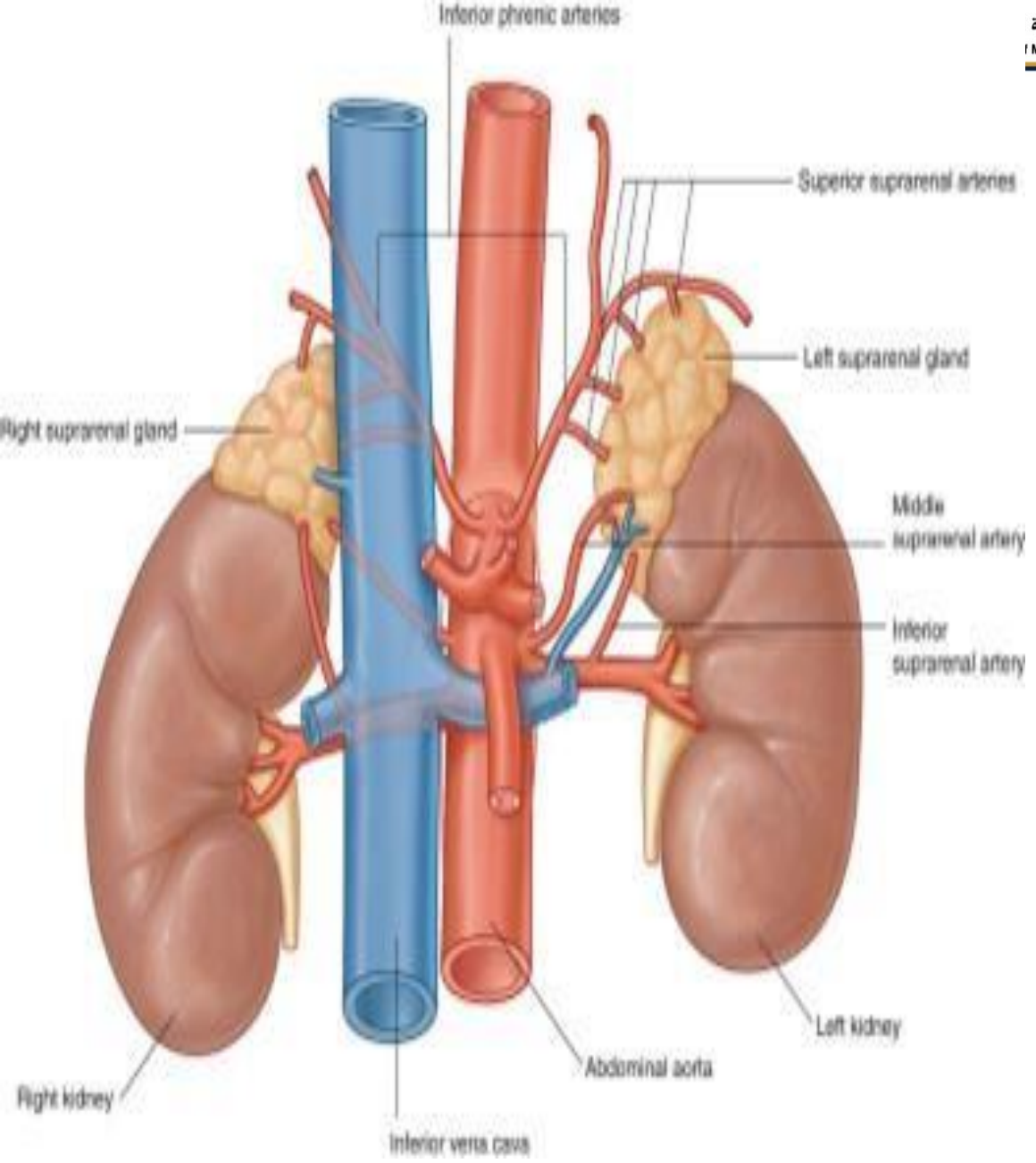
The Medulla: supplied by **preganglionic sympathetic fibers** which end on the chromaffin cells of the medulla.

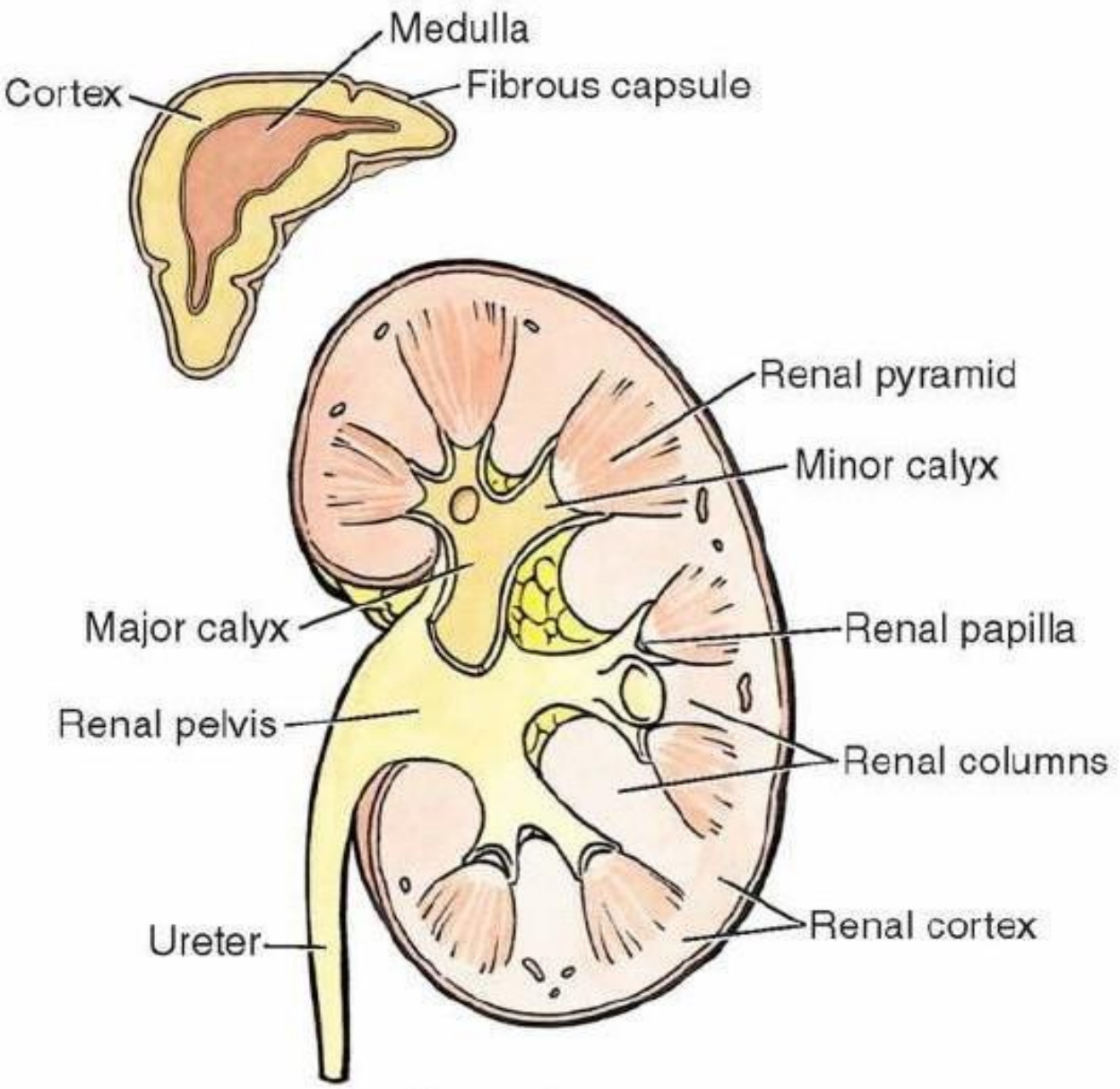
• **The cortex:** under hormonal control of **ACTH.**

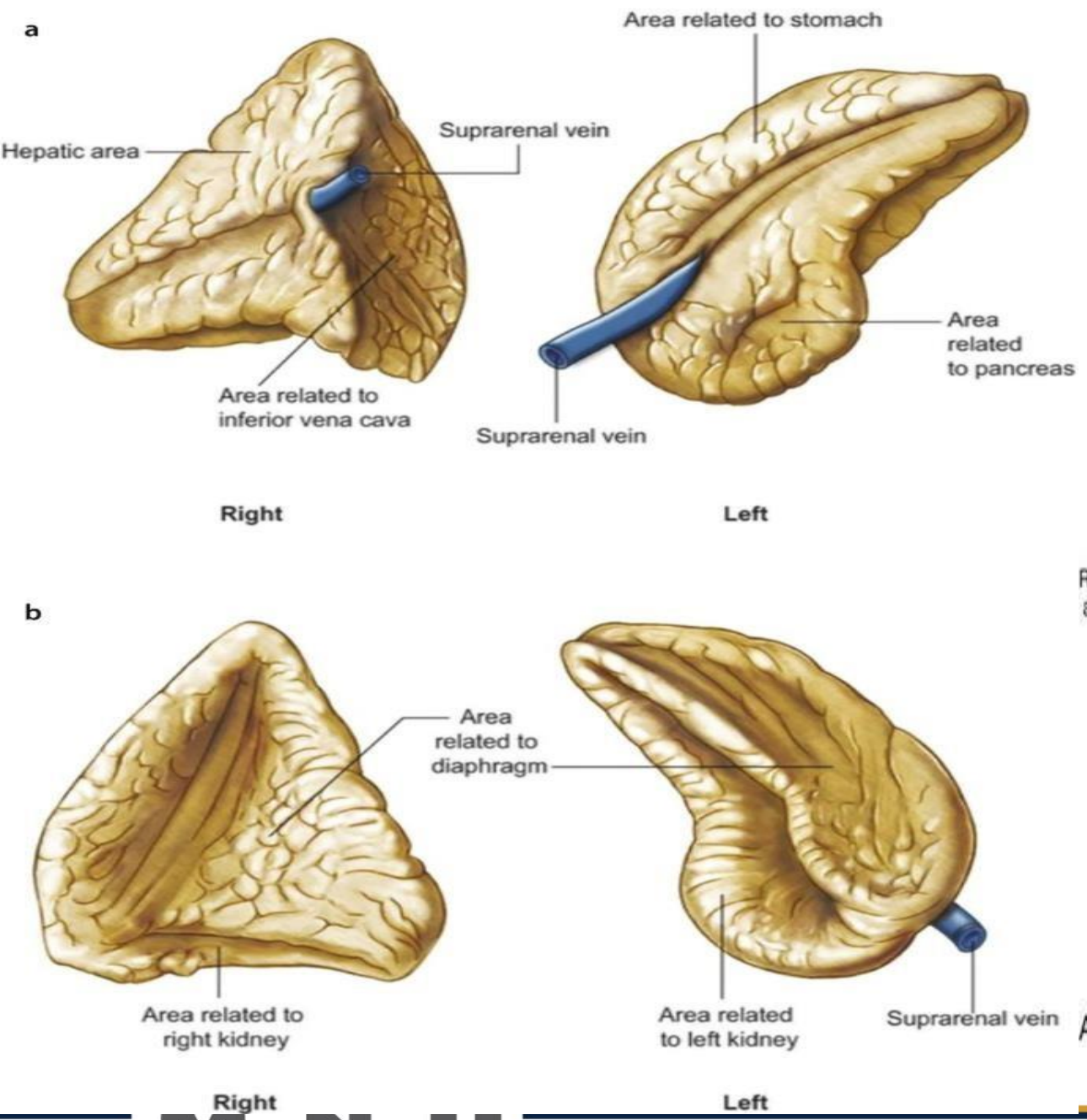


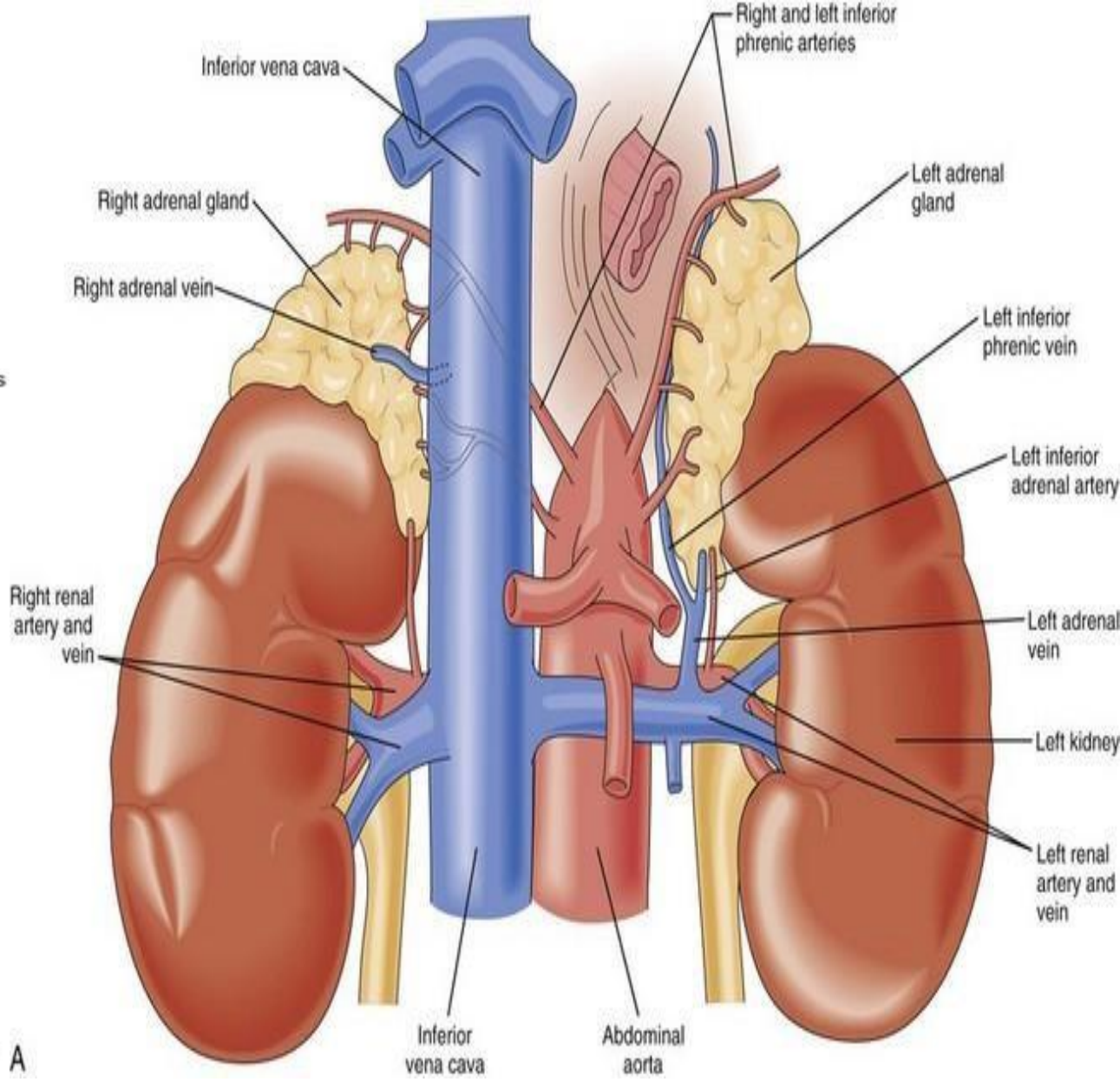
SAQ

	Right Suprarenal Gland	Left Suprarenal Gland
Shape	Pyramidal	semilunar
Anterior relations	➢ IVC. ➢ Bare area of the liver.	➢ lesser sac (stomach bed) ➢ stomach.
Posterior relations	➢ Right crus of diaphragm ➢ Right kidney.	➢ Left crus of diaphragm ➢ Left kidney.
Hilum	Directed **upwards**	Directed **downwards**
Supra-renal arteries	**1. Superior suprarenal artery:** from inferior phrenic artery. **2. Middle suprarenal artery:** from abdominal aorta **3. Inferior suprarenal artery:** from the renal artery.	
Supra-renal veins	ends in **the inferior vena cava.**	ends in **the left renal vein**.


Inferior phrenic arteries
Superior suprarenal arteries
Left suprarenal gland
Right suprarenal gland
Middle suprarenal artery
Inferior suprarenal artery
Left kidney
Abdominal aorta
Right kidney
Inferior vena cava


Medulla
Cortex
Fibrous capsule
Renal pyramid
Minor calyx
Major calyx
Renal papilla
Renal pelvis
Renal columns
Ureter
Renal cortex


a
Hepatic area
Suprarenal vein
Area related to stomach
Area related to inferior vena cava
Suprarenal vein
Area related to pancreas
Right
Left
b
Area related to diaphragm
Area related to right kidney
Area related to left kidney
Suprarenal vein
Right
Left


Right and left inferior phrenic arteries
Inferior vena cava
Right adrenal gland
Left adrenal gland
Right adrenal vein
Left inferior phrenic vein
Left inferior adrenal artery
Right renal artery and vein
Left adrenal vein
Left kidney
Left renal artery and vein
Inferior vena cava
Abdominal aorta
A

Quiz

Which of the following related to pancreas?

A. lies across the lower part of the posterior abdominal wall behind the peritoneum of the greater sac.

B. The neck related posteriorly to pylorus and the first part of the duodenum and peritoneum of the lesser sac.

C. The neck related anteriorly to pylorus and the first part of the duodenum and peritoneum of the lesser sac

D. The uncinate process of its head projects downwards and to the left

E. The cross sections of its body has 3 borders and 2 surfaces

Answer:

Quiz

- Which of the following related to adrenal glands?

A. It consists of an outer medulla and an inner cortex

B. The left suprarenal vein ends in the inferior vena cava.

C. The right adrenal gland related anteriorly Left crus of diaphragm Left kidney.

D. The left adrenal gland related anteriorly to IVC and Bare area of the liver.

E. The right adrenal gland related anteriorly to IVC and Bare area of the liver.

- Answer:

Quiz 1

1- Which of the following NOT share in the development of pituitary gland

A- Rathke`s pouch

B- Infundibulum

C- Roof of the stomodeum

D- Buccopharyngeal membrane

ANSWER: D

Quiz 2

2- Which of the following NOT part of Rathke's pouch

A- Pars anterior

B- Pars intermedia

C- Pars tuberalis

D- Infundibulum

ANSWER: D

Quiz 1

1- Superior thyroid artery arises from which artery

A- Internal carotid

B- External carotid

C- Subclavian

D- Vertebral

ANSWER: B

Quiz 2

2- Thyroid gland reaches its final position in front of trachea in which week

A- 4^{th}

B- 5^{th}

C- 6^{th}

D- 7^{th}

ANSWER: D

- Regarding cavernous sinus which is correct

A. Internal carotid artery lies in its lateral wall

B. Maxillary nerve lies in its floor

C. Lies on each side of Sella turcica

D. Related anteriorly to pituitary gland

E. Connected posteriorly with ophthalmic veins

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- Is the source of adenohypophysis

A. Rathke`s pouch
B. Floor of stomodeum
C. Floor of diencephalon
D. Floor of third ventricle
E. Infundibulum

- Regarding development of pituitary gland which is correct

A. Pars distalis develops from the floor of diencephalon

B. Pars nervosa develops from the roof of stomodeum

C. Pharyngeal pituitary is caused by persistence of a remnant of infundibulum in the roof of stomodeum

D. hypoplasia of pituitary gland is caused by failure or incomplete development of the anterior wall of Rathke`s pouch

E. pars intermedia is part of neurohypophysis

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- Is the source of the neurohypophysis

A. Rathke`s pouch
B. Roof of stomodeum
C. Lateral wall of diencephalon
D. Roof of third ventricle
E. Infundibulum

Which is correct regarding thyroid gland

A. Recurrent laryngeal nerve lies close to superior thyroid artery near the gland
B. External laryngeal nerve lies close to superior thyroid artery near the gland
C. during thyroidectomy we ligate superior thyroid artery away from the gland to avoid injury of external laryngeal nerve
D. during thyroidectomy we ligate inferior thyroid artery away from the gland to avoid injury of recurrent laryngeal nerve
E. External laryngeal nerve lies close to inferior thyroid artery near the gland

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Which nerve accompanies superior thyroid artery

A. Internal laryngeal
B. External laryngeal
C. Recurrent laryngeal
D. Glossopharyngeal
E. Vagus

Parathyroid glands are derived from

A. **the endoderm of the 2nd & 3rd pharyngeal pouches**
B. **the endoderm of the 3rd & 4th pharyngeal pouches**
C. **the ectoderm of the 2nd & 3rd pharyngeal clefts**
D. **the ectoderm of the 3rd & 4th pharyngeal clefts**
E. **the mesoderm of the 3rd & 4th pharyngeal arches**

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Which nerve accompanies inferior thyroid artery

A. Internal laryngeal
B. External laryngeal
C. Recurrent laryngeal
D. Glossopharyngeal
E. Vagus

Which is correct regarding blood supply of thyroid gland

A. Superior thyroid artery arises from first part of subclavian artery
B. Inferior thyroid artery arises from external carotid artery
C. Middle thyroid vein terminates in brachiocephalic vein
D. Superior thyroid vein terminates in internal jugular vein
E. Vein of Kocher terminates in subclavian vein

SAQ

Summarize congenital anomalies of pituitary gland and mention the features and causes of each anomaly:

1-Pharyngeal pituitary gland:

Due to: persistence of a remnant of the stalk of Rathke`s pouch.

Features: accessory masses of the anterior lobe of the pituitary gland in the roof of oropharynx.

2-Aplasia & hypoplasia of pituitary gland:

Due to: Failure or incomplete development of the anterior wall of Rathke`s pouch.

Features: Hypofunction of pituitary gland.

SAQ

- **Mention nerves in relation to the medial surface of thyroid lobes**

1. **Upper part is related to External laryngeal nerve**
2. **Lower part is related to Recurrent laryngeal nerve**

SAQ

Compare between right and left suprarenal vein regarding the points listed in the table

	Right Suprarenal Gland	Left Suprarenal Gland
Shape	Pyramidal	semilunar
Hilum	Directed upwards	Directed downwards
Supra-renal arteries	1. Superior suprarenal artery: from inferior phrenic artery. 2. Middle suprarenal artery: from abdominal aorta 3. Inferior suprarenal artery: from the renal artery.	
Supra-renal veins	ends in the inferior vena cava.	ends in the left renal vein.


الحمد لله
Thank You
Thank You