WITH NOTES

ANATOMY & DEVELOPMENT OF THYROID & PARATHYROID GLANDS

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By

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Intended Learning Outcomes (ILOs)

1. Describe anatomy of thyroid gland (features, relation & blood supply).
2. Describe anatomy of parathyroid glands (features, relation & blood supply).
3. Describe development of thyroid and parathyroid glands.
4. Summarize congenital anomalies of thyroid and parathyroid glands.

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Agenda

1. Anatomy of thyroid gland (features, relation & blood supply).
2. Anatomy of parathyroid glands (features, relation & blood supply).
3. Development of thyroid and parathyroid glands.
4. Congenital anomalies of thyroid and parathyroid glands.

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Anatomy of Thyroid Gland

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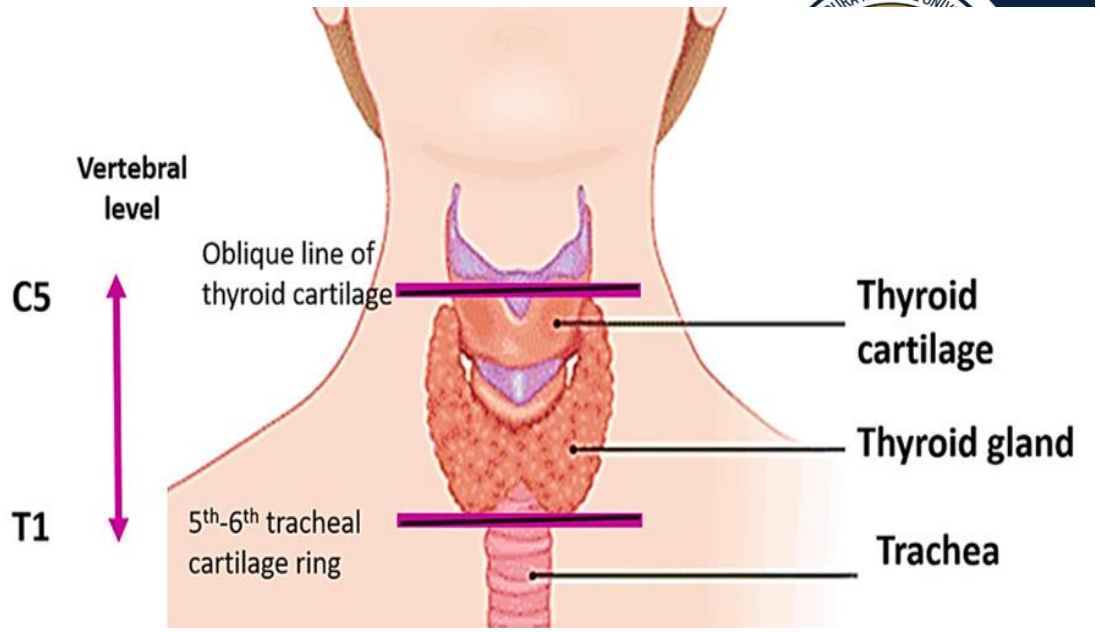
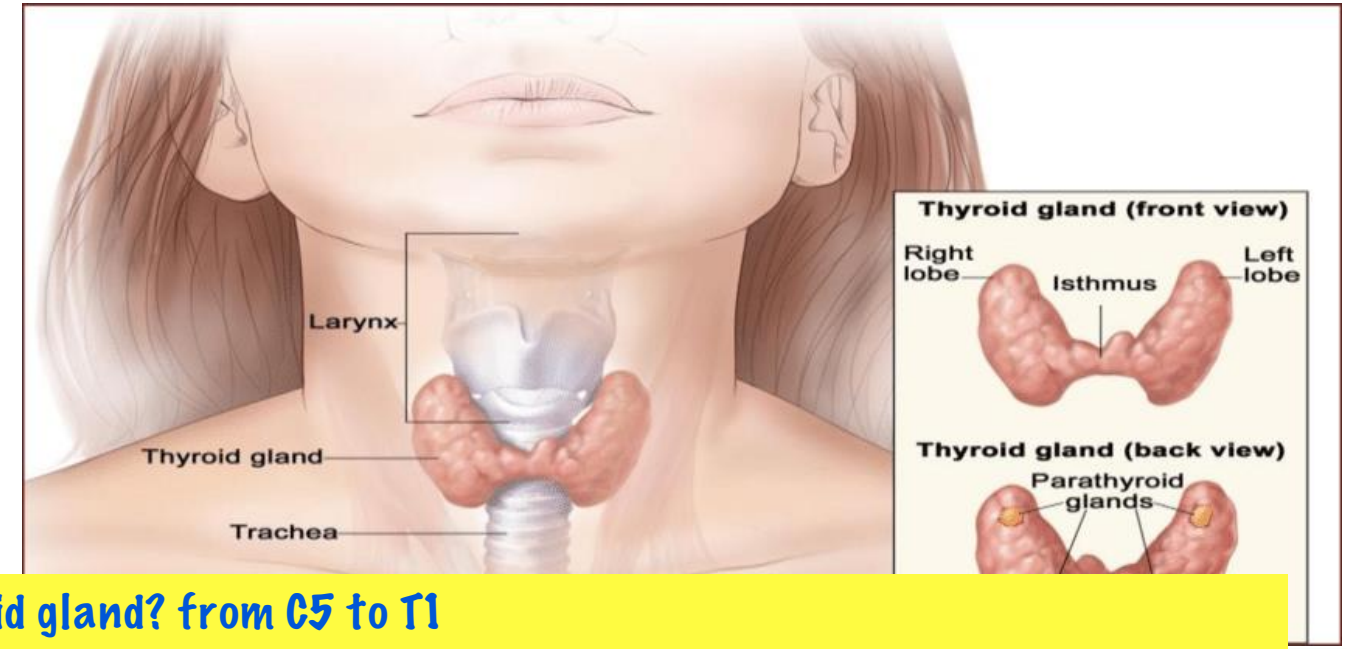
Extent

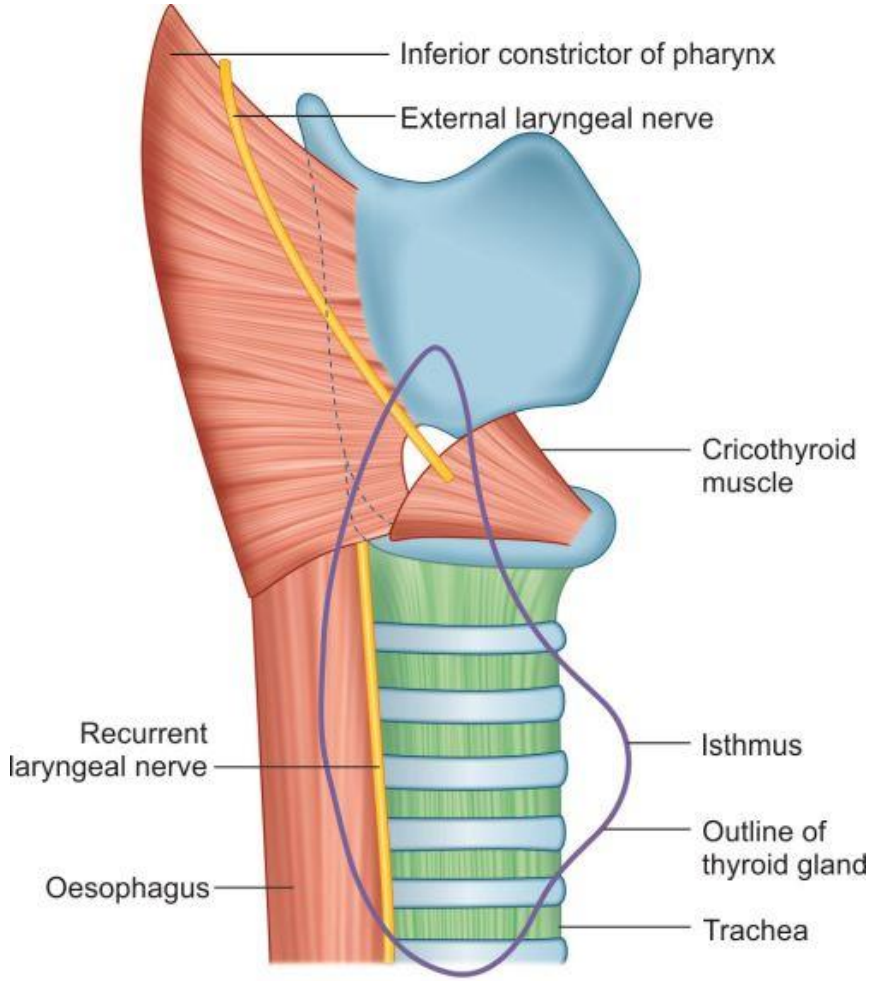
- in the lower part of front of neck
- extending from middle of thyroid cartilage to 5th tracheal ring
- opposite 5th, 6th, 7th cervical vertebrae & 1st thoracic vertebra (behind)





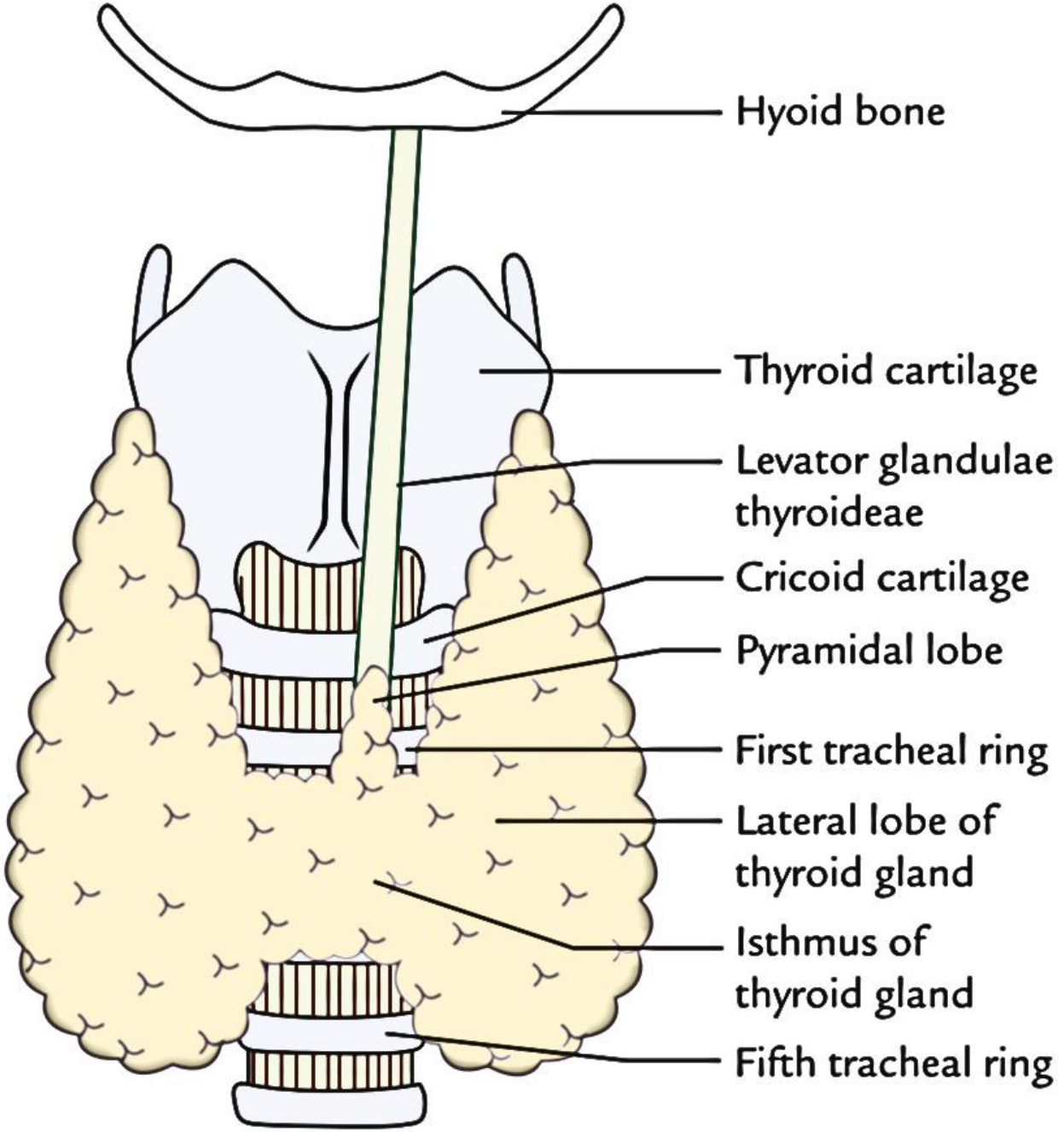
MCQ : What is the vertebral (posterior) level of the thyroid gland? from C5 to T1

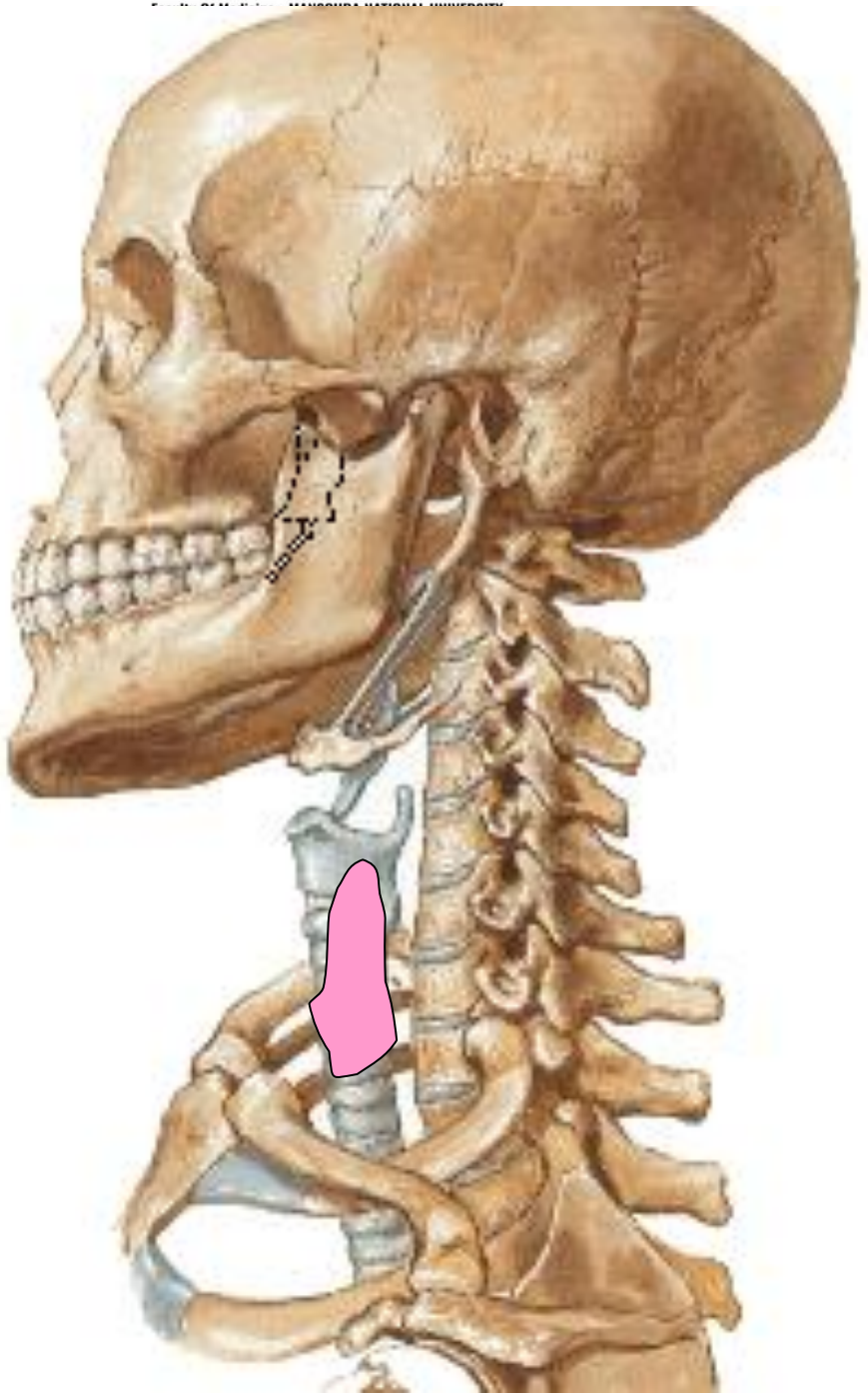
MCQ : At which anterior level does the thyroid gland extend? middle of thyroid cartilage (Oblique line) to 5th tracheal ring



Vertebral levels

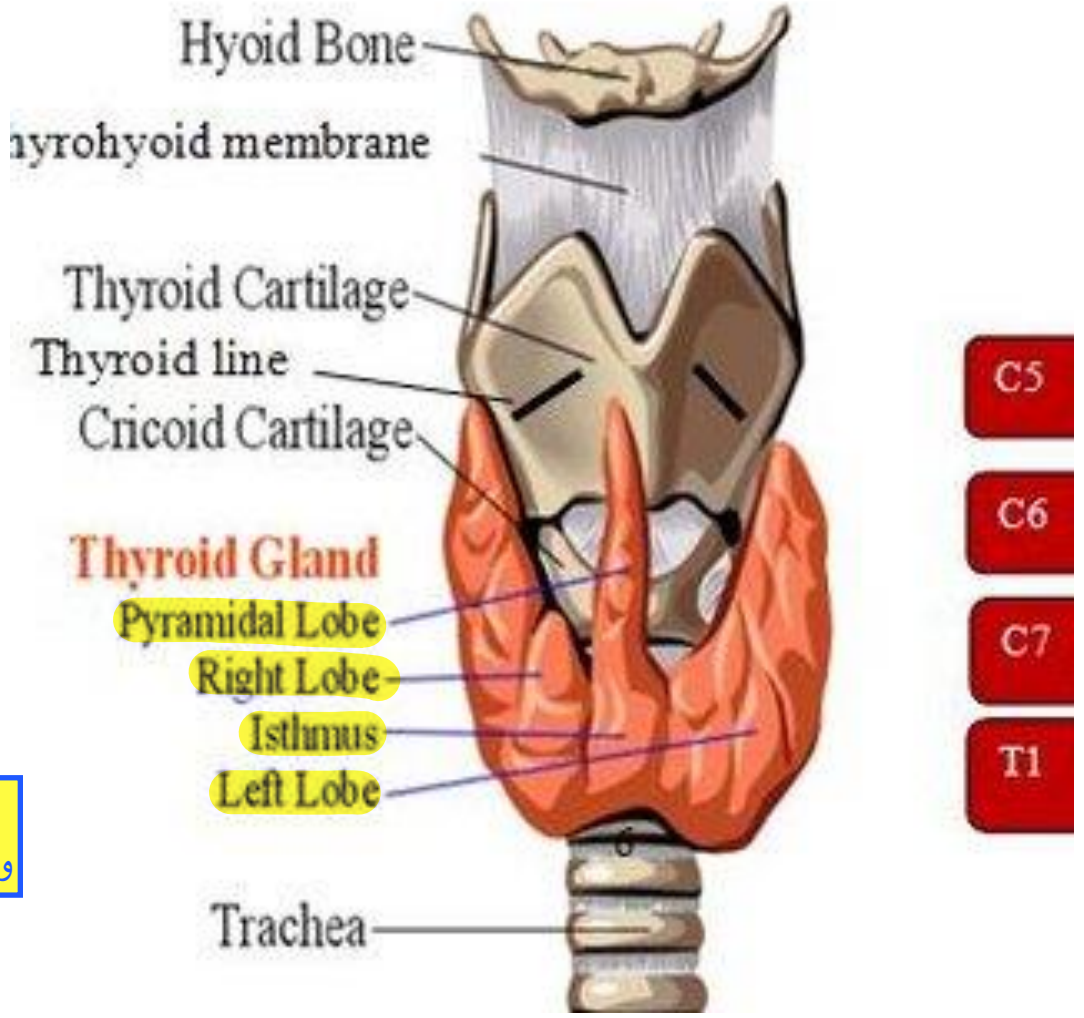
- C5
- C6
- C7
- T1





Shape

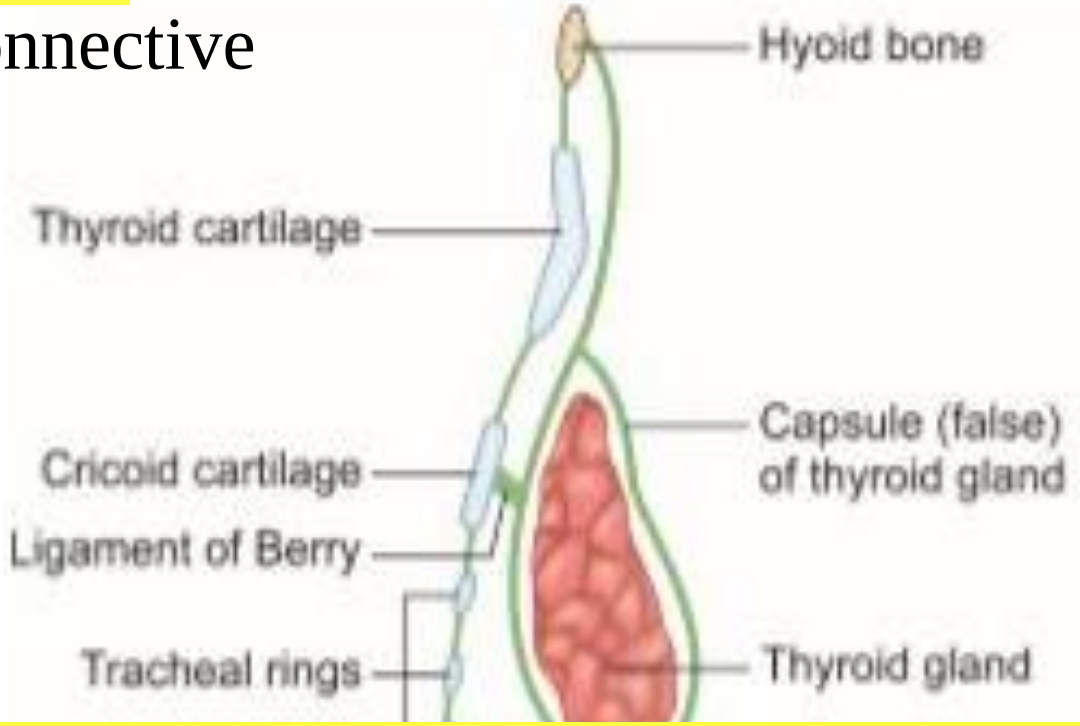
- Butterfly in shape.
- Formed of
  1. Right & left lobes.
  2. Isthmus connecting the 2 lobes.
  3. Pyramidal lobe ← = Middle lobe وطالع من الisthmus



Capsules

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

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



SAQ مهم جدا جدا : Why gland move up & down with swallowing?

A) Due to the false capsule which composed of pretracheal fascia connected to hyoid bone, thyroid cartilage & cricoid cartilage. Levator glandulae thyroideae (Assists in lifting) وممكن نضيف كمان

MCQ : Which capsule of the thyroid gland allows it to move up and down with swallowing? False capsule

Surfaces & Relations

ال**relation** وال **lesion** مهمة جدا جدا جدا !!

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Lateral surface

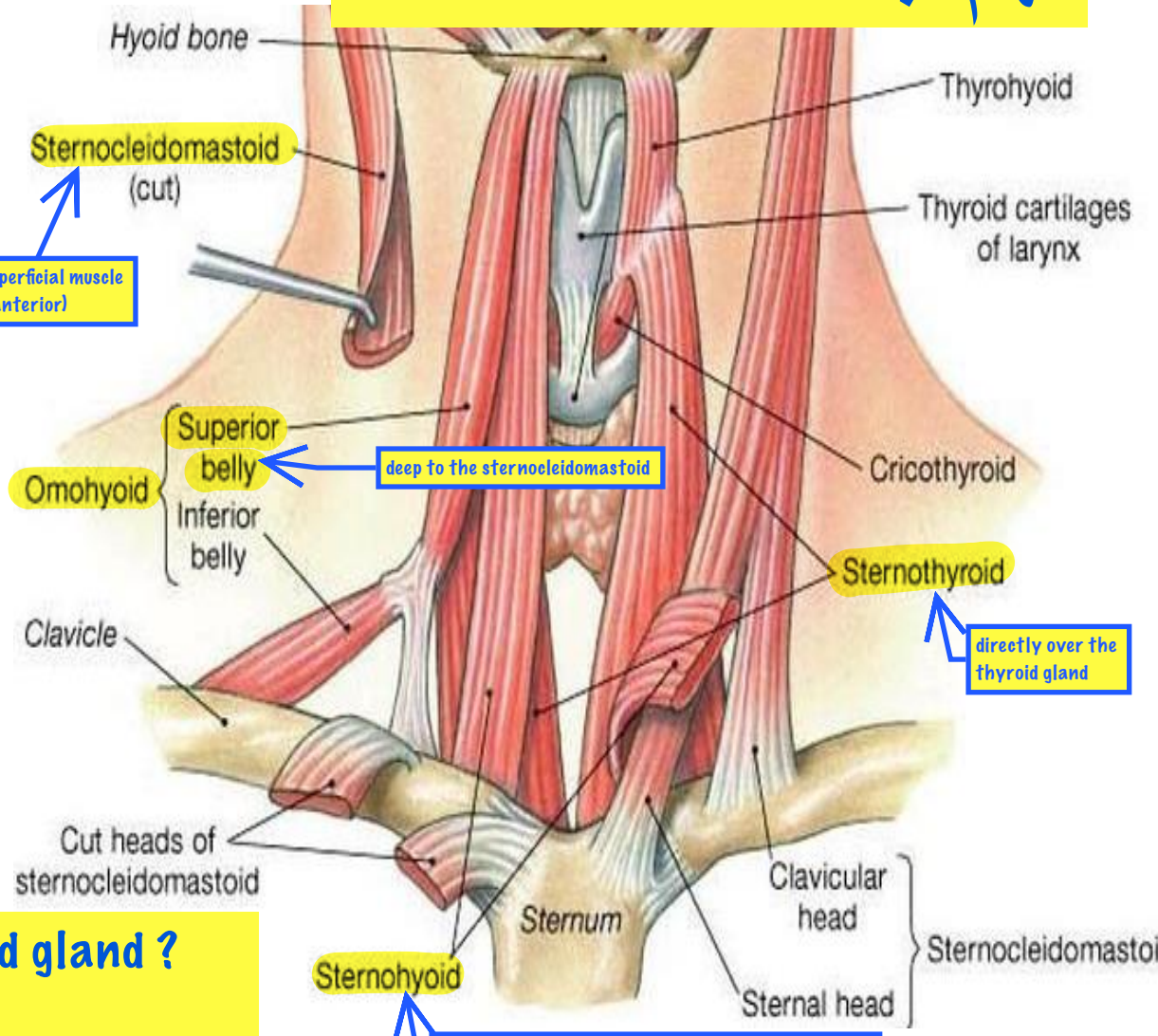
SAQ & MCQ مهم جدا

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



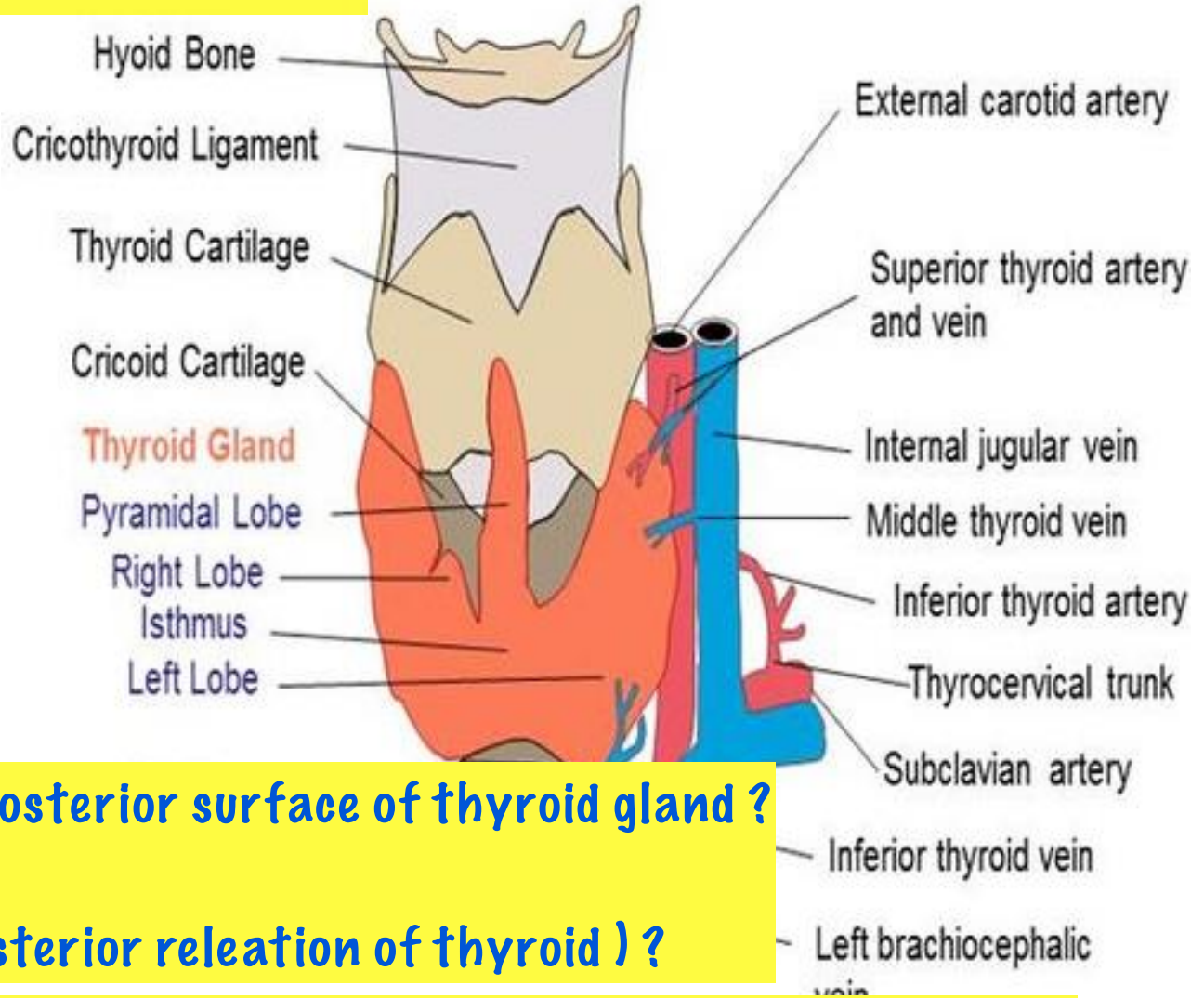
MCQ مهم : Which ms not releated to superficial ms of thyroid gland ? Thyrohyoid

MCQ : Which of the following ms NOT cover thyroid gland ? Thyrohyoid

Posterior surface

Carotid sheath:

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



MCQ : Which of the following NOT releated to posterior surface of thyroid gland ?
Internal carotid artery & External jugular vein
SAQ : Enumerate content of carotid sheath (posterior releation of thyroid) ?

#نوتس على السريع : الinternal carotid artery جوا الcarotid sheath بس مالوش علاقة بالThyroid gland

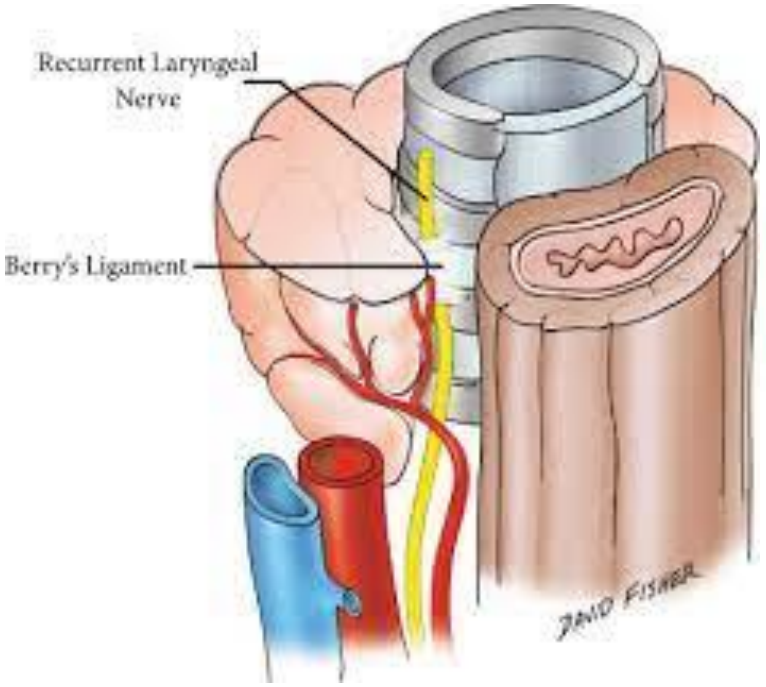
Medial surface = Posterior of isthmus

1. Upper part:

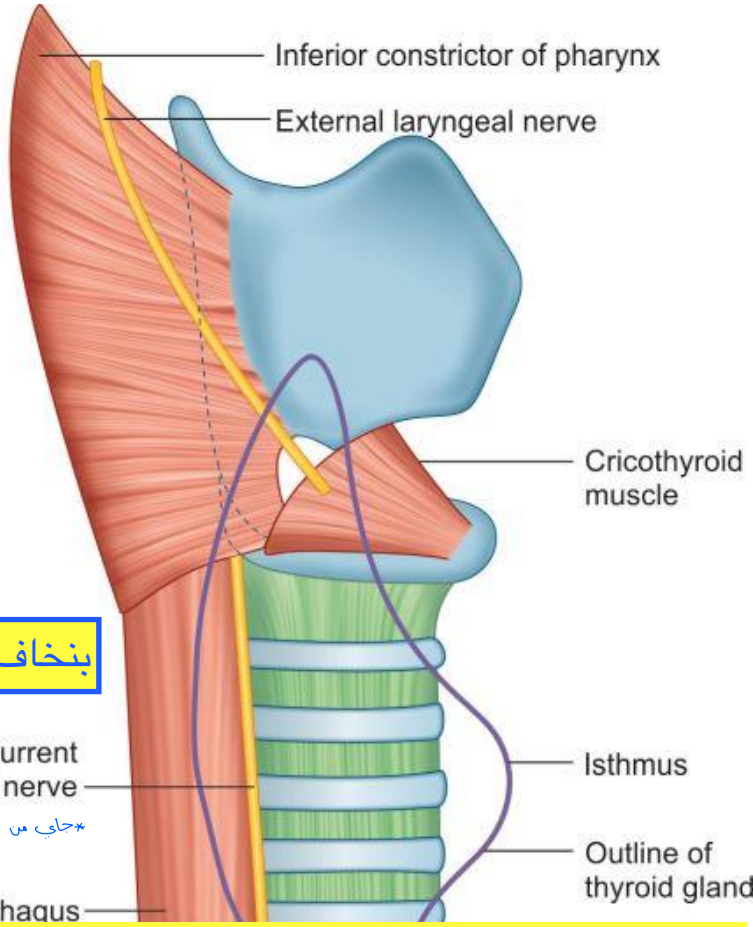
A. Larynx
B. Pharynx
C. External laryngeal nerve in between

2. Lower part:

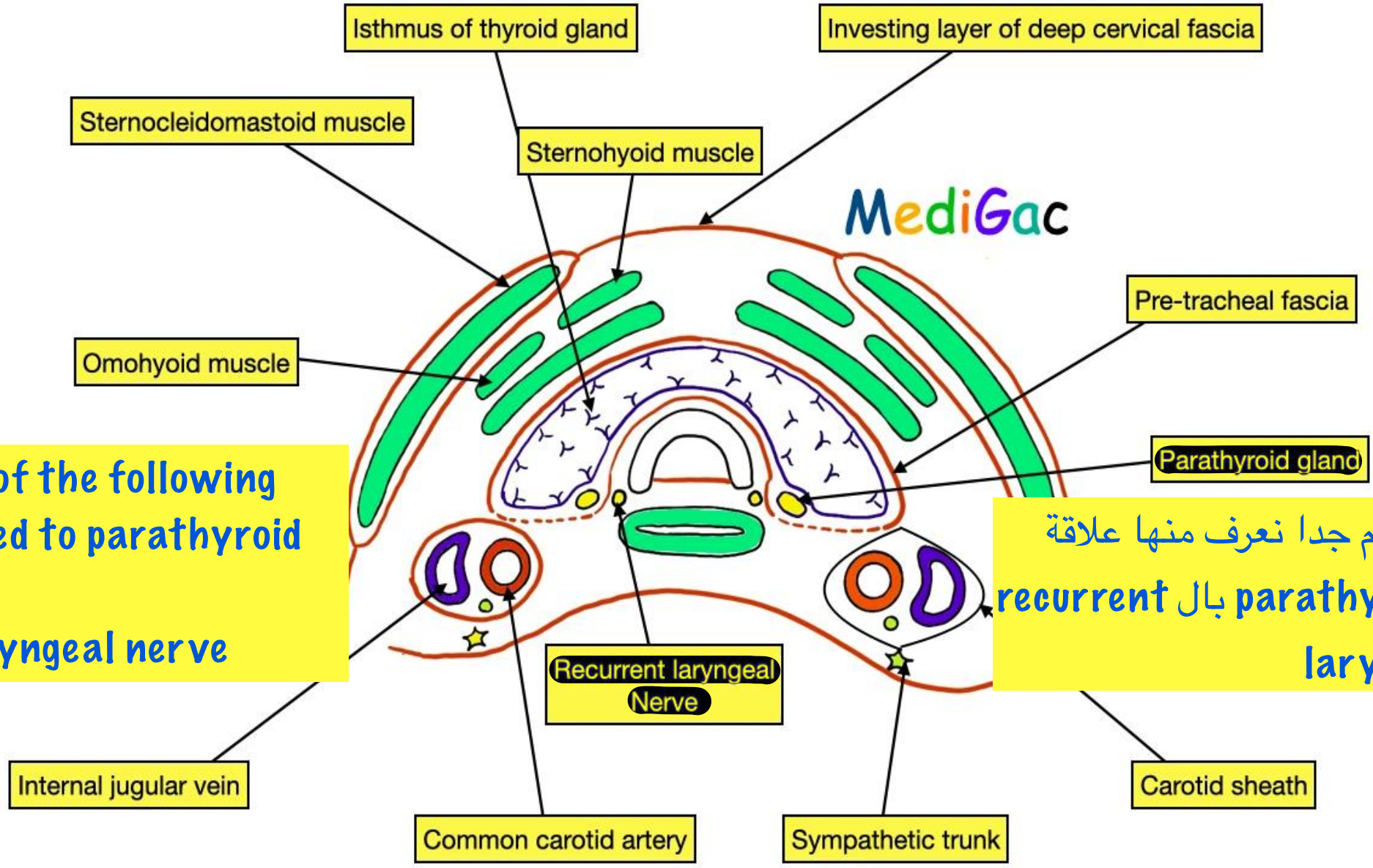
A. Trachea
B. Esophagus
C. Recurrent laryngeal n. in between



بنخاف عليه لأن نسبة قطعه عالية في عمليات الthyroid

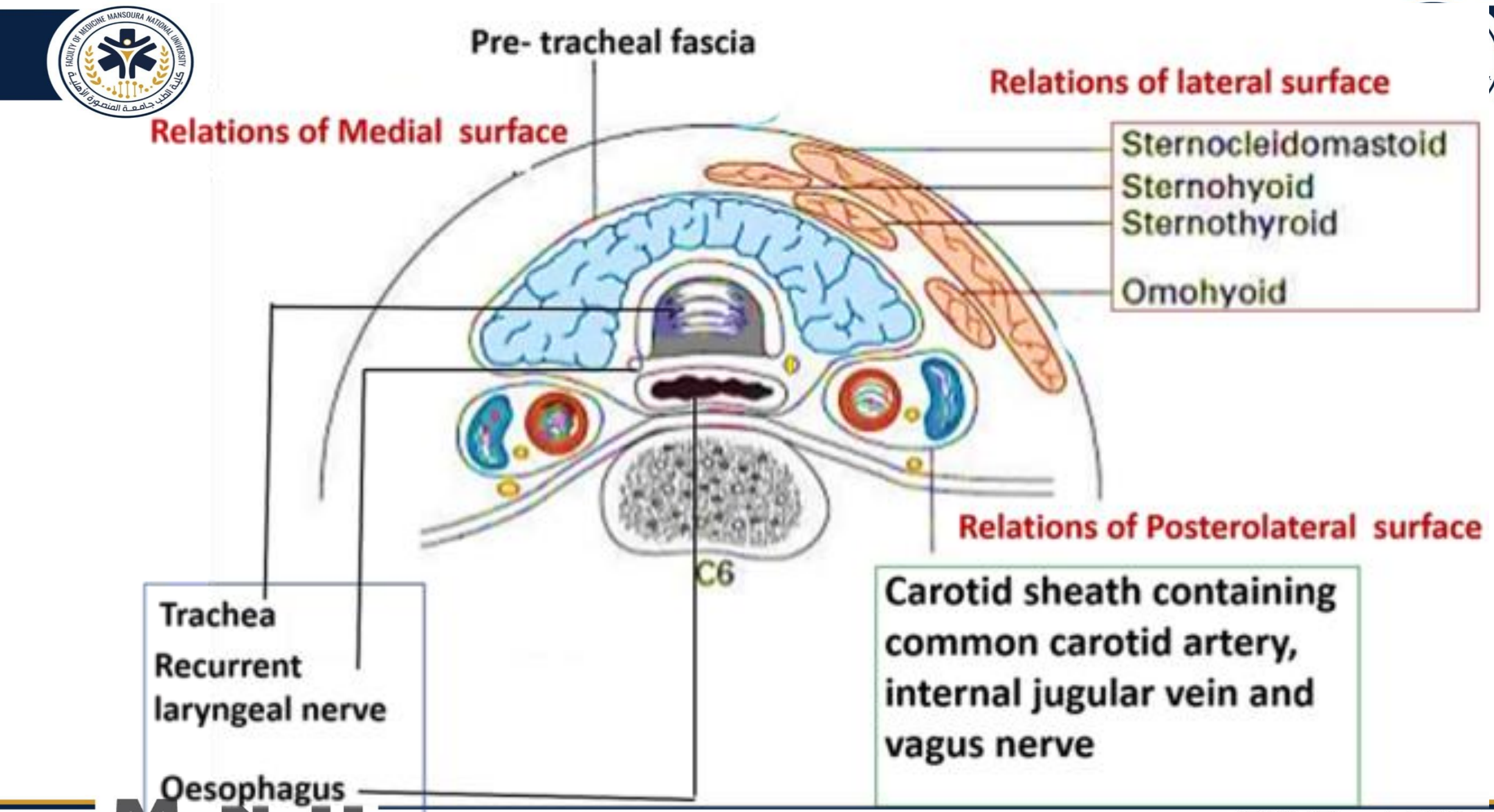


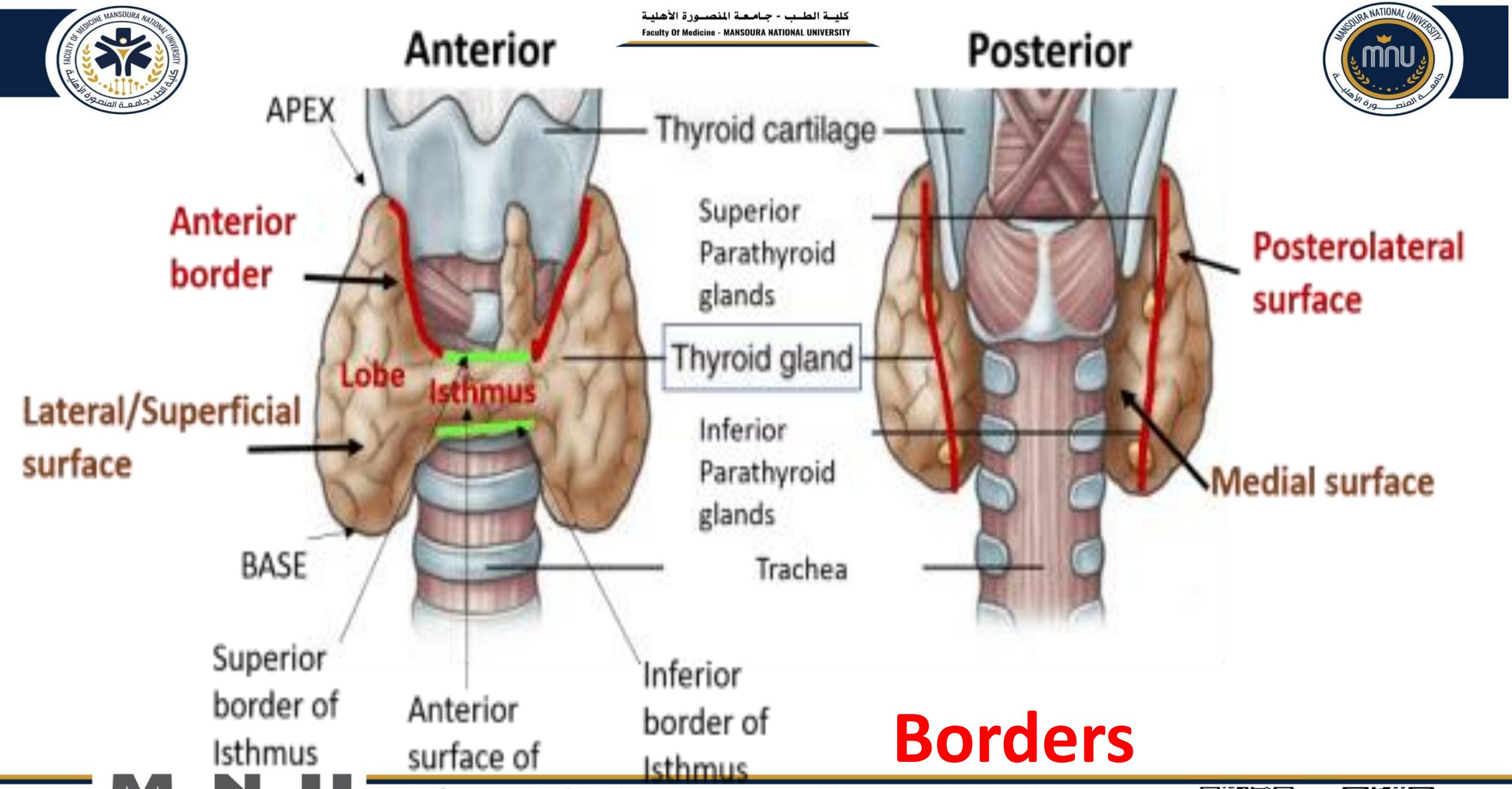
* خلي بالكوا الأعصاب أكتر بوينت بتيجي في الامتحان



MCQ : Which of the following nerves releated to parathyroid gland ?
Recurrent laryngeal nerve

السلايد دي مهم جدا نعرف منها علاقة parathyroid glandال بال recurrent laryngeal nerve


Pre- tracheal fascia
Relations of Medial surface
Relations of lateral surface
Sternocleidomastoid
Sternohyoid
Sternothyroid
Omohyoid
Relations of Posterolateral surface
C6
Trachea
Recurrent laryngeal nerve
Oesophagus
Carotid sheath containing common carotid artery, internal jugular vein and vagus nerve


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

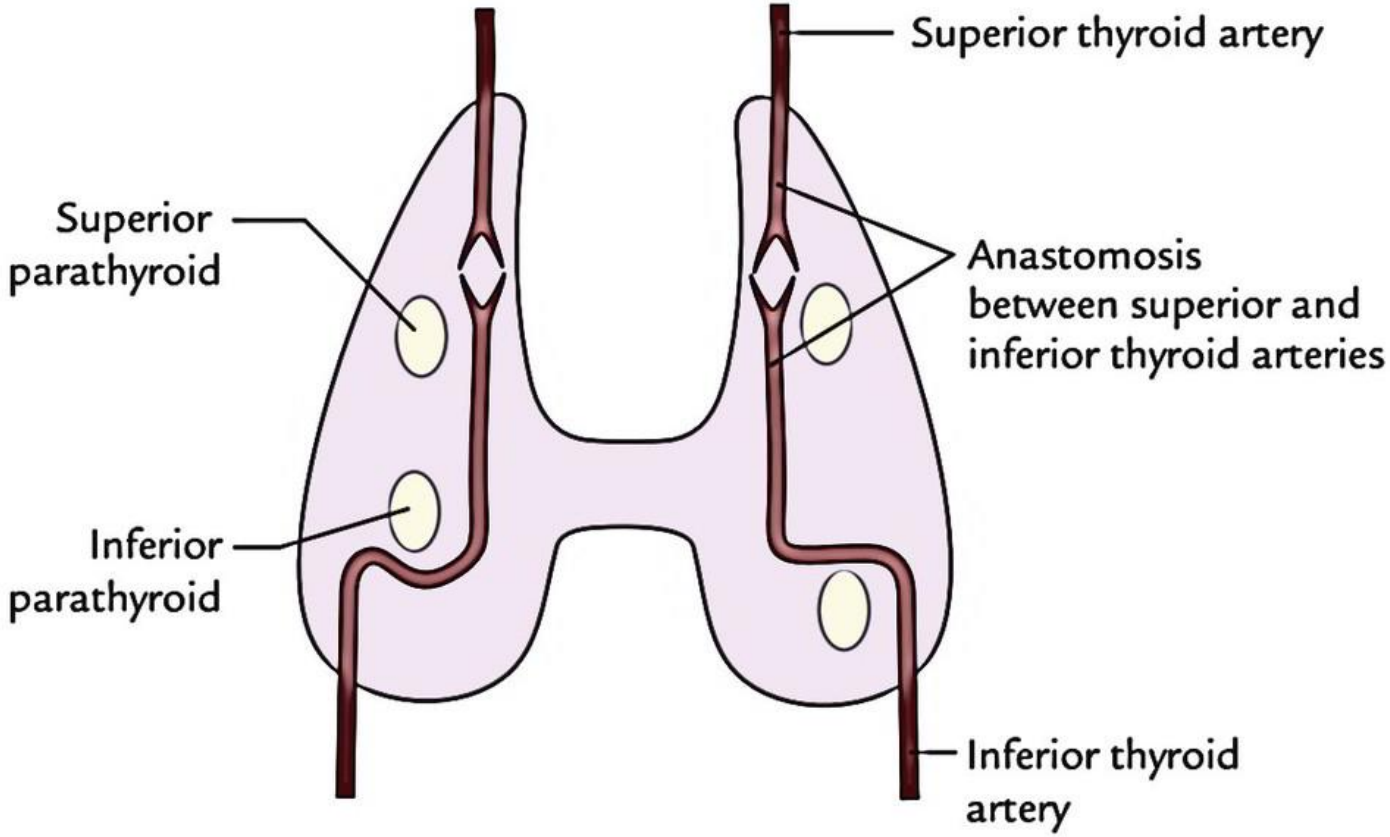
Borders

Anterior border:

Related to anterior branch of superior thyroid artery.

Posterior border:

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



Isthmus of thyroid gland مهمة كمان OSPE

It connects the two lobes.

- **Surfaces:**

A. Anterior surface: is covered by:

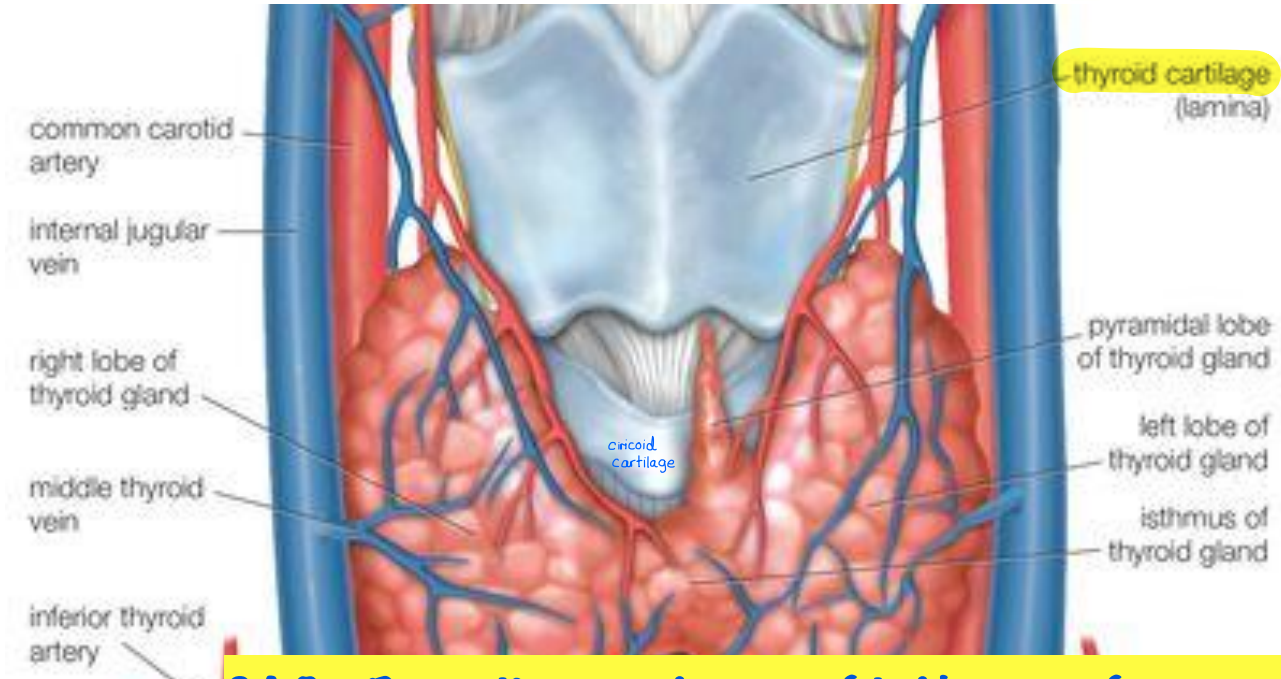
- Sternohyoid
- Anterior jugular veins.
- Sternothyroid

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

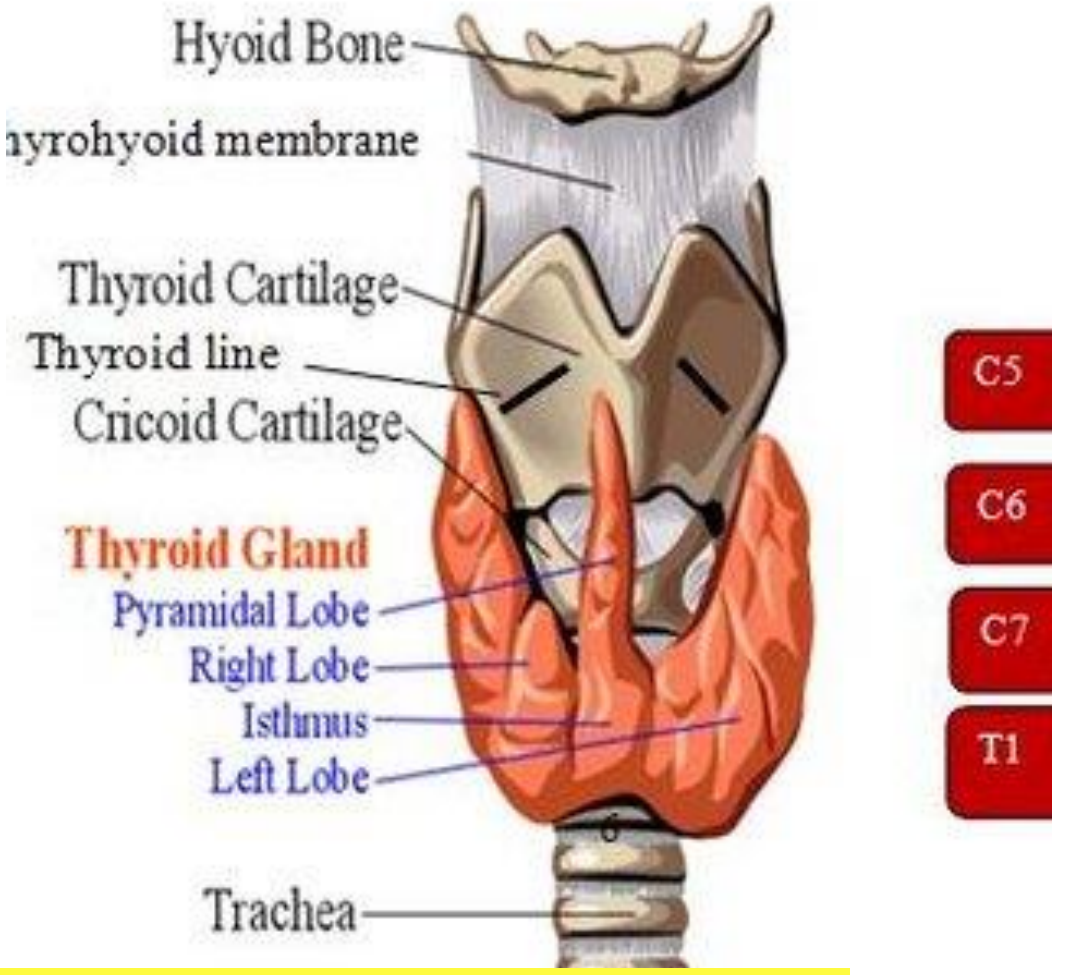


SAQ : Describe anatomy of isthmus of thyroid gland ?

MCQ : Posterior surface of isthmus? 2,3&4 tracheal ring

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. MCQ

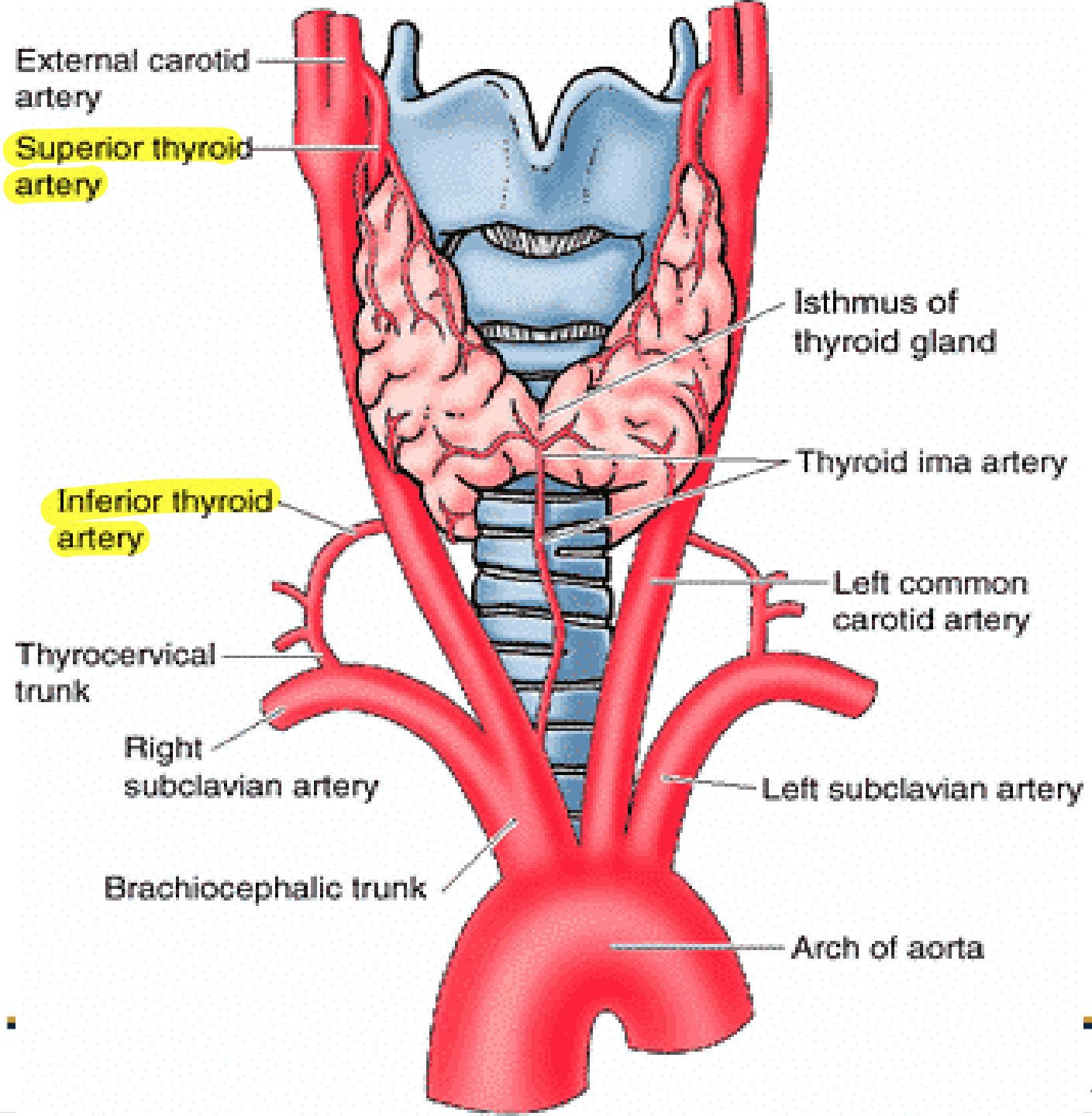


MCQ مهم : Levator glandulae thyroidae connect pyramidal lobe with : Hyoid bone

Blood supply of thyroid gland

مطلوب نعرف الOrigin, Termination& 3branches

- في الـbeaches هنا ممكن تهبد glandular و muscular


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

1. Superior thyroid artery

Origin: external carotid artery. MCQ

Course: accompanied with external laryngeal nerve MCQ

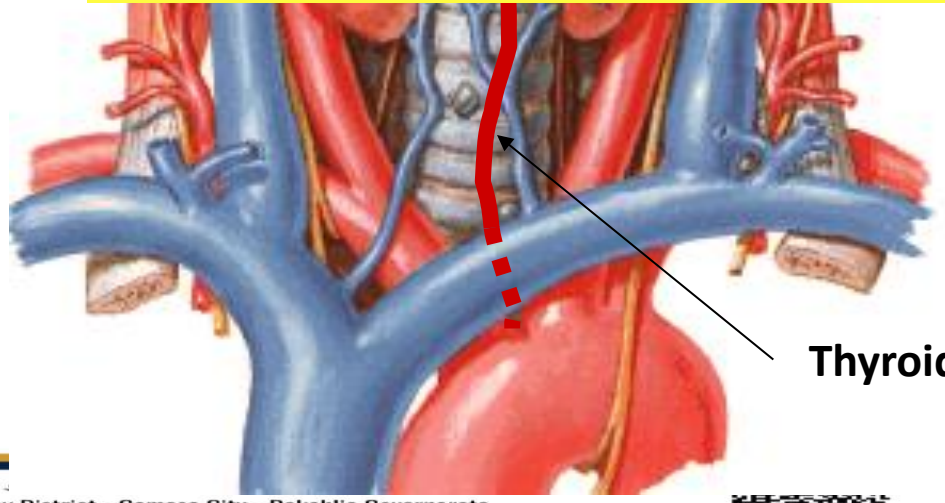
Termination: it ends in the apex by dividing into:

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

Posterior branch that anastomoses with inferior thyroid artery.

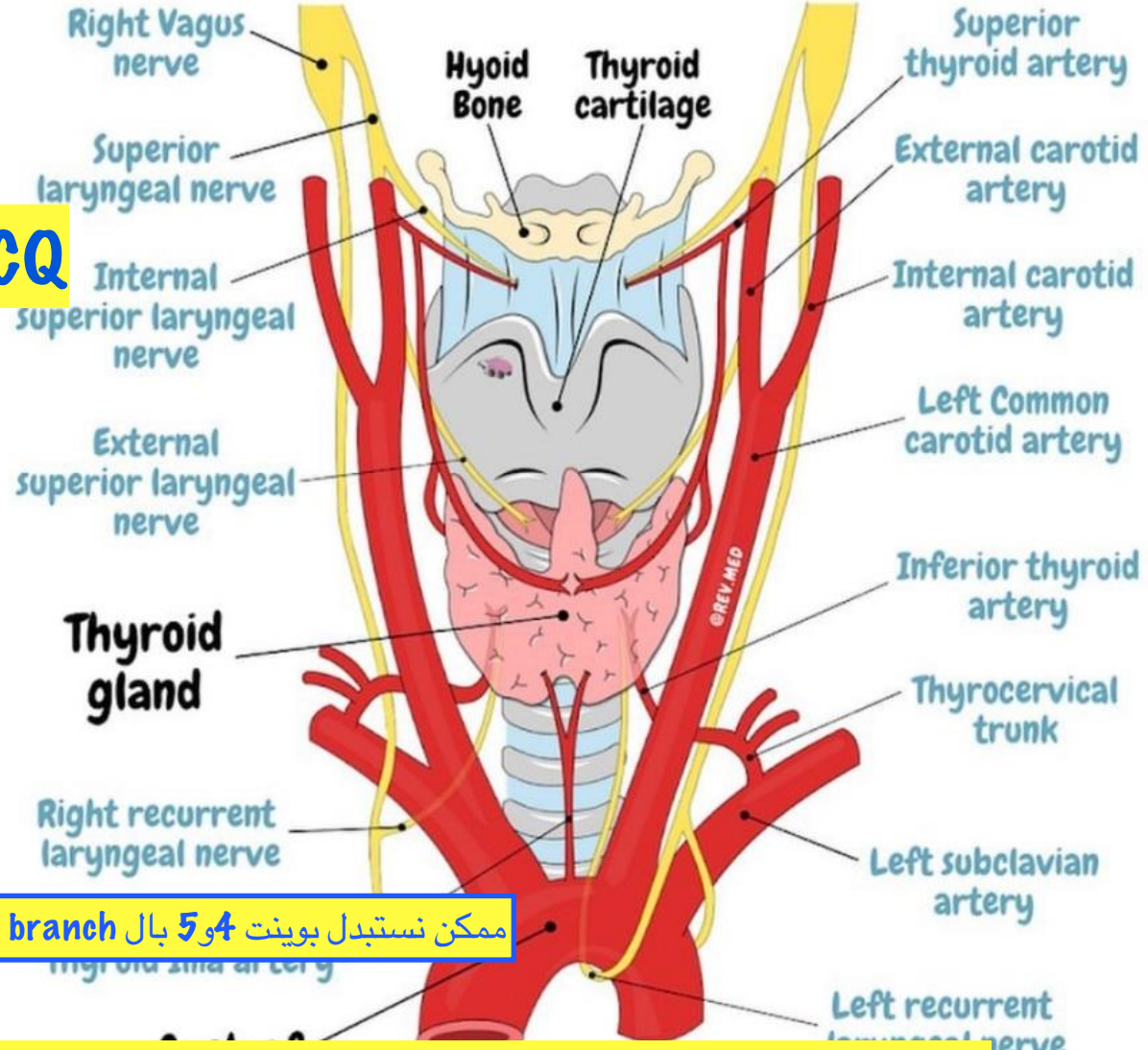
MCQ مهم : Which of the following accompany with external laryngeal nerve ? Superior thyroid artery

MCQ : Origin of superior thyroid artery? External carotid artery



Branches of thyroid artery:

1. Glandular branches: to the apex MCQ & 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.



ممكن نستبدل بوينت 4و5 بال muscular branch

MCQ : The glandular branches of the superior thyroid artery supply which parts of the thyroid gland?
Apex and upper 1/3 of the thyroid lobe and upper 1/2 of the isthmus

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. MCQ

Branches: ← لو حابب تكتب muscular اكتبها عادي

1. Glandular branches: to the base & lower 2/3 of the thyroid lobe and lower 1/2 of the isthmus. MCQ
2. Parathyroid glands ← May be supplied by superior also but mainly inferior
3. Inferior laryngeal artery.
4. Tracheal and esophageal branches.
5. Ascending cervical artery: anterior to scalenus anterior.

MCQ مهم: Which of the following accompany with recurrent laryngeal nerve ? Inferior thyroid artery

MCQ : Origin of inferior thyroid artery ? Subclavian

MCQ : The glandular branches of the inferior thyroid artery supply which parts of the thyroid gland? Base and lower 2/3 of the thyroid lobe and lower 1/2 of the isthmus

MCQ مهم: The main blood supply of thyroid gland is : Inferior thyroid artery

MCQ مهم: The main blood supply of parathyroid gland is : inferior thyroid artery

3. Thyroid ima artery:

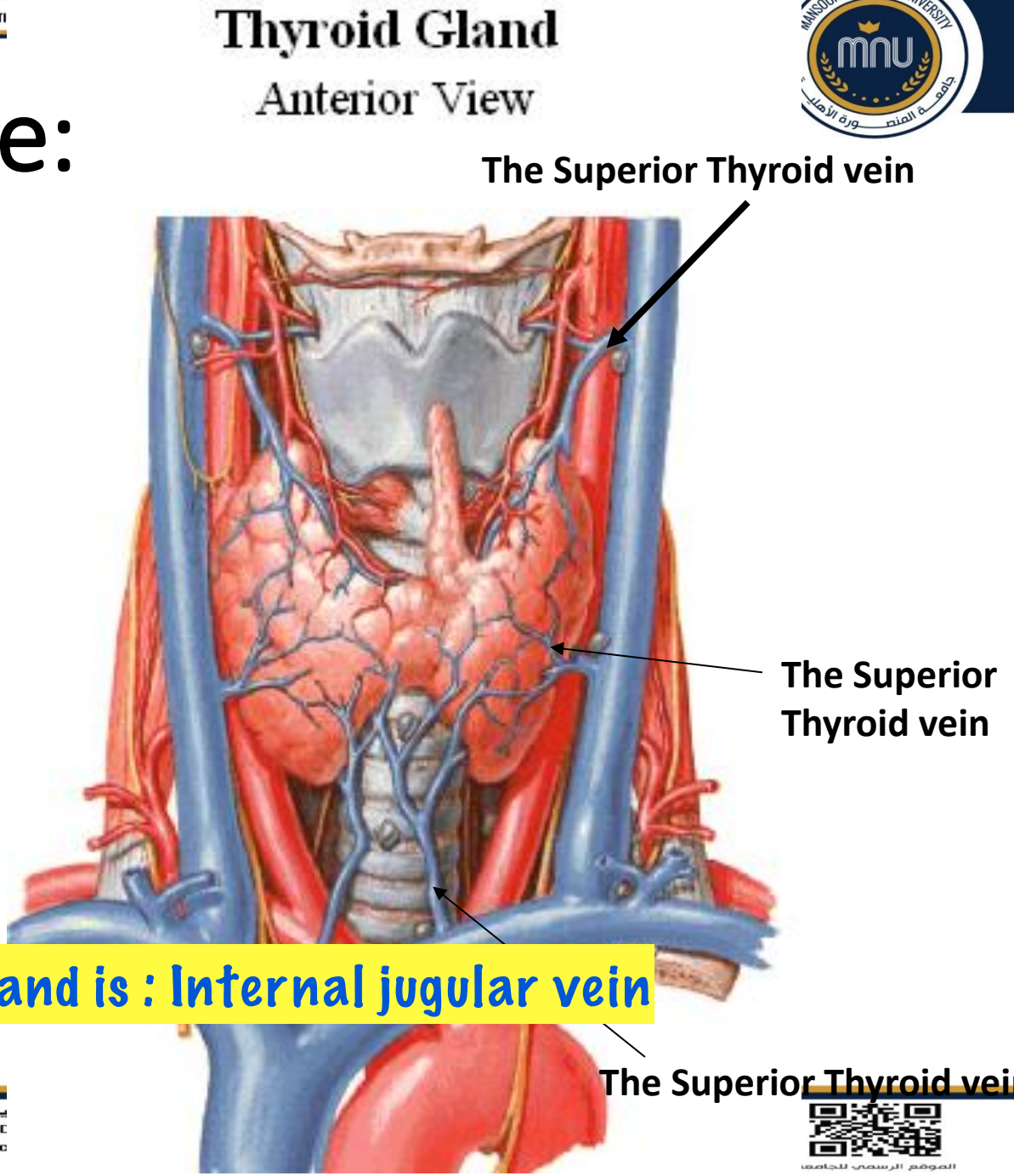
- It may be present.
- **Origin:** it arises either from the arch of aorta or from the brachiocephalic artery. MCQ
- Ascends in front of the trachea to supply the isthmus.
- It is a potential source of bleeding when performing procedures in the midline of the neck inferior to the isthmus.

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

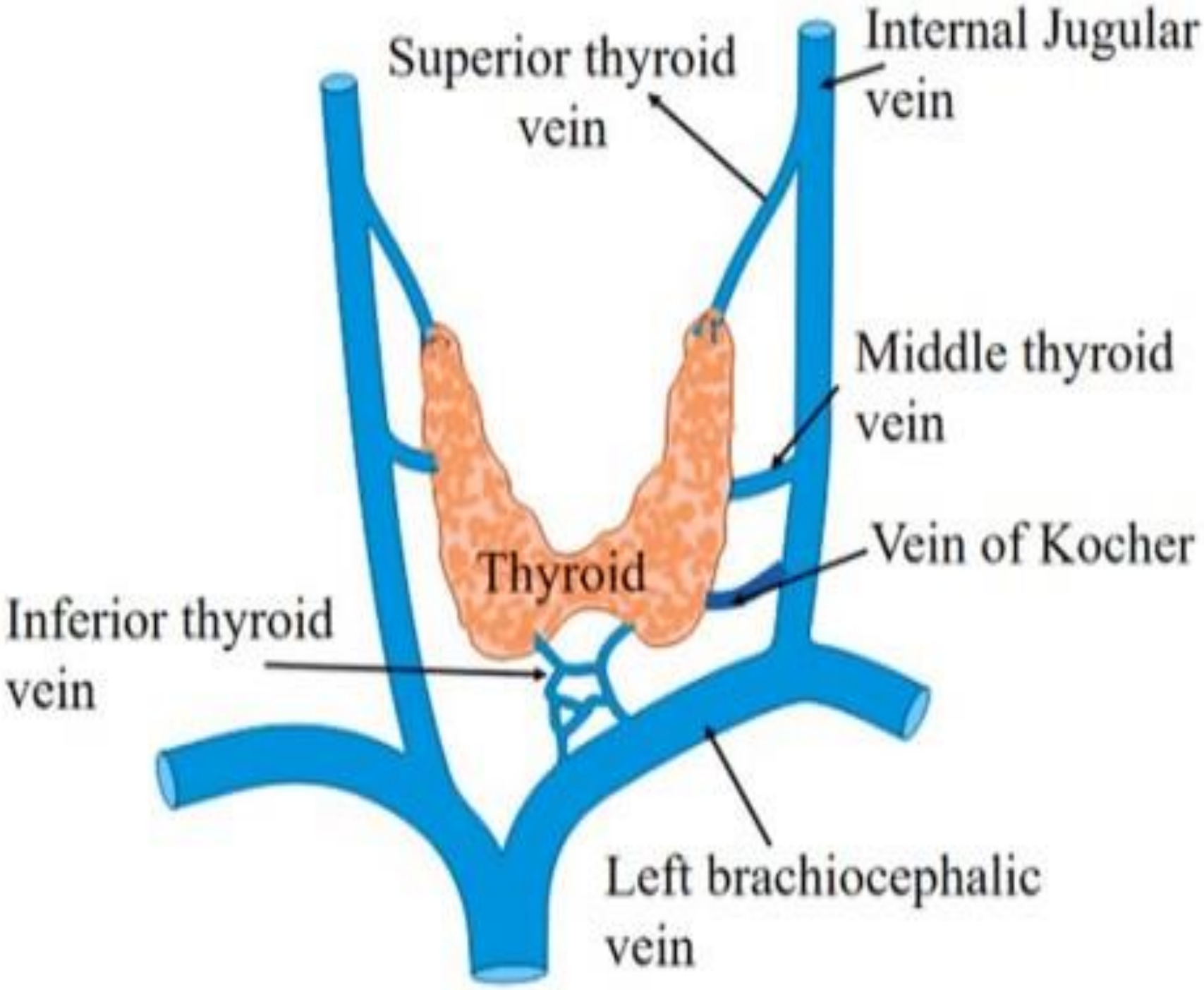
- Isthmus supplied by : Superior thyroid artery, inferior thyroid artery & thyroid ima

Venous Drainage:

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



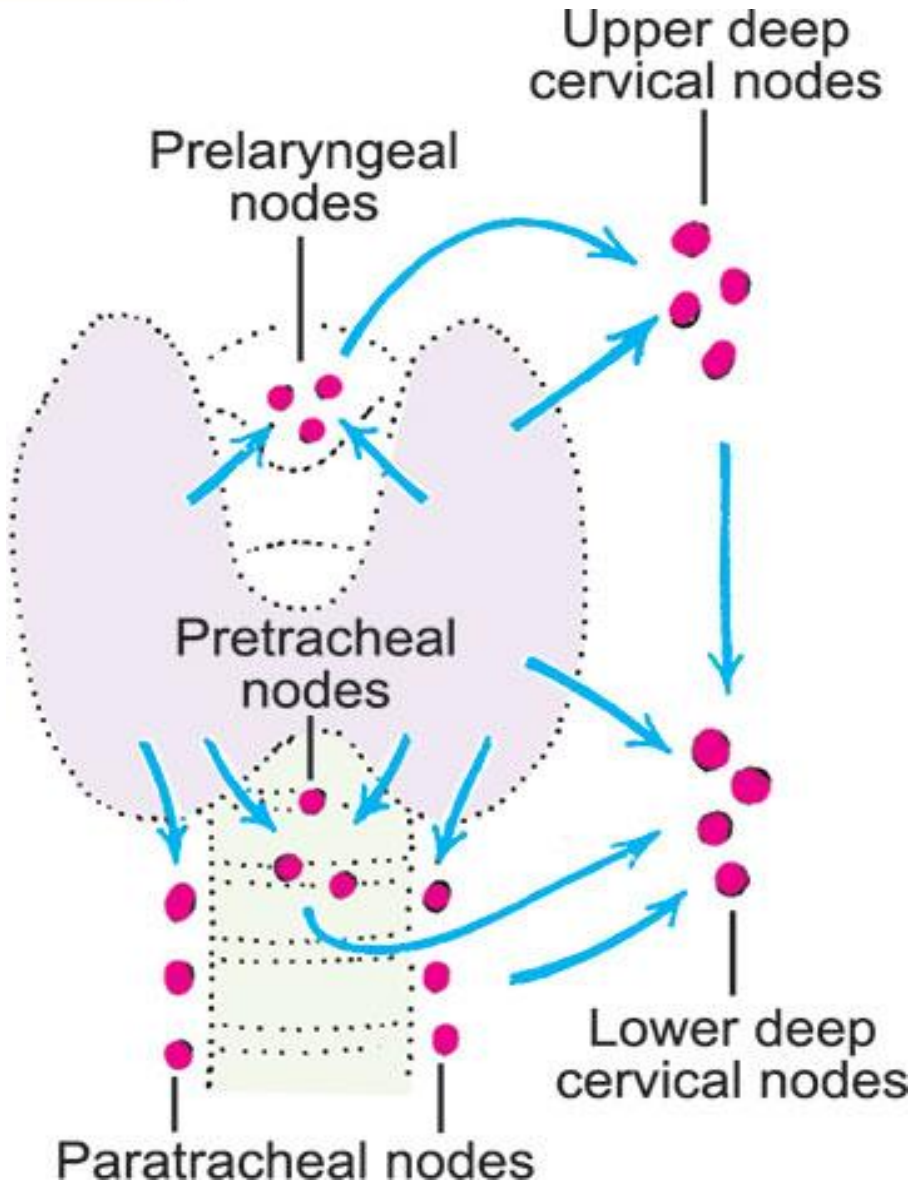
MCQ : The main venous drainage of thyroid gland is : Internal jugular vein


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

Lymphatic drainage of thyroid gland

يدوب نعرف انها **cervical lymph node**

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



أهم حاجة في المحاضرة

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**

MCQ : Superior thyroid artery is ligated Near the gland to avoid external laryngeal nerve injury.
MCQ : Inferior thyroid artery is ligated Away the gland to avoid recurrent laryngeal nerve injury

Clinical applied of thyroid gland

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بتيجي أحيانا Case في الامتحانات

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

* Named artery ligation to prevent hematoma

Parathyroid glands

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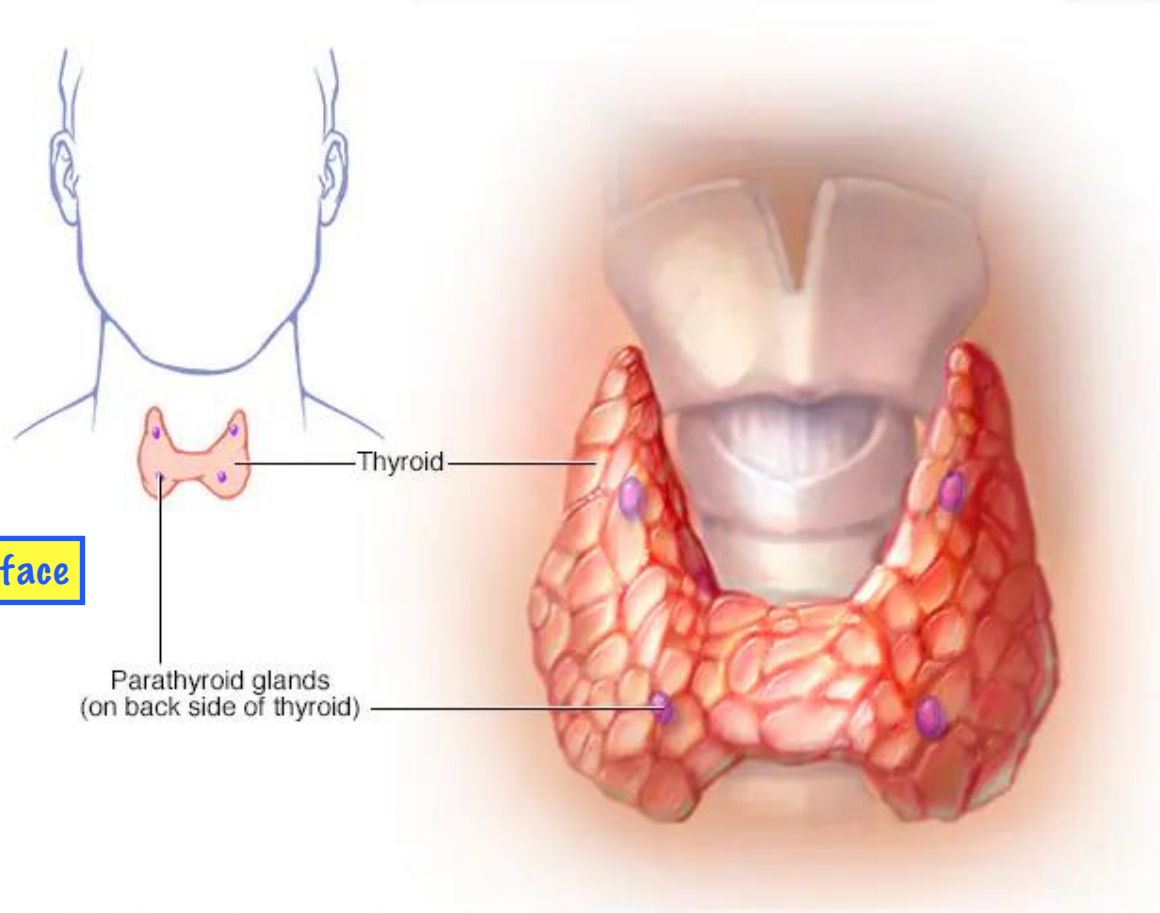
Site of parathyroid glands

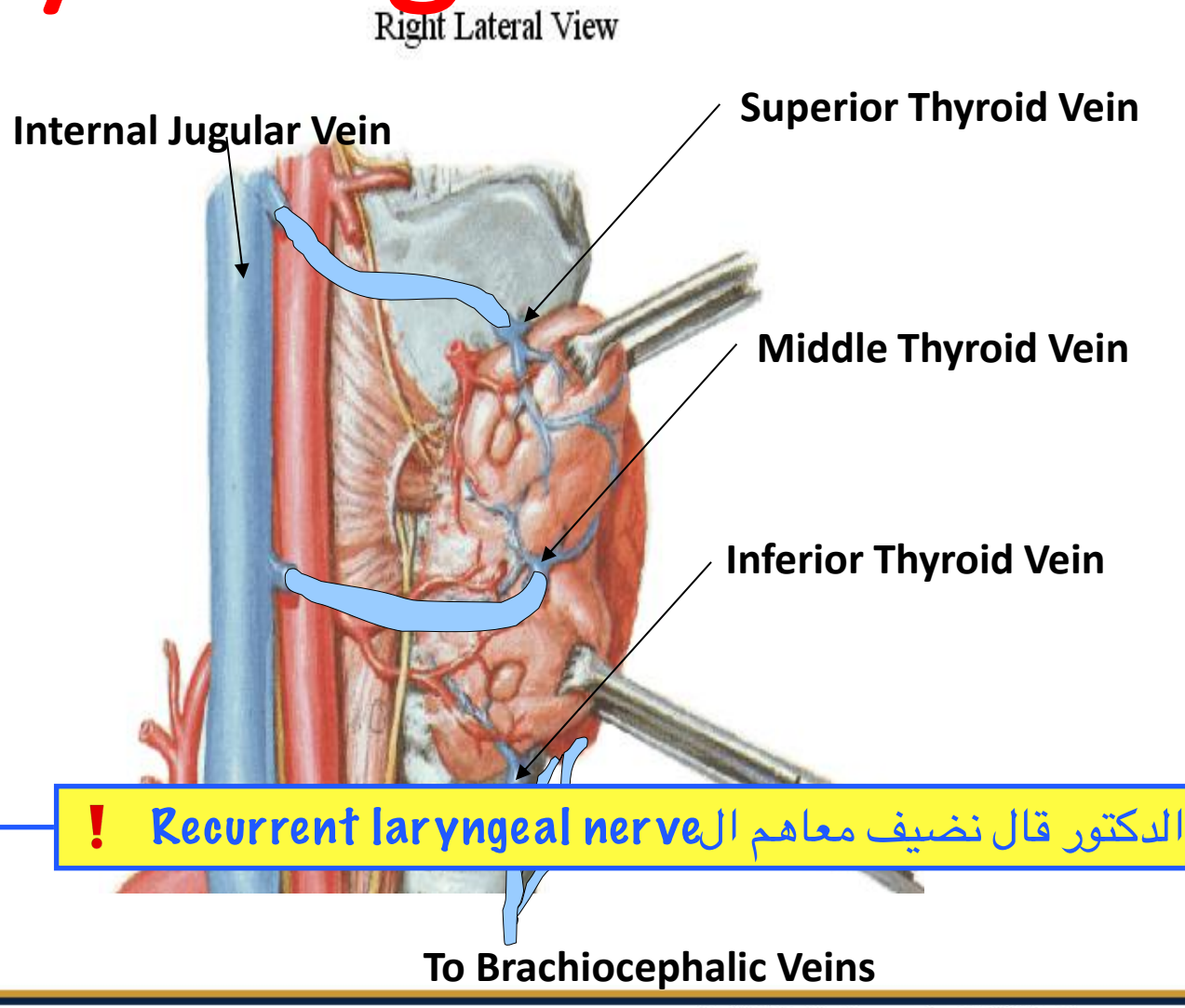
The **two superior parathyroid glands** are the more constant in position and lie at the level of the middle of the posterior border of the thyroid gland, usually at the level of the inferior border of the cricoid cartilage.

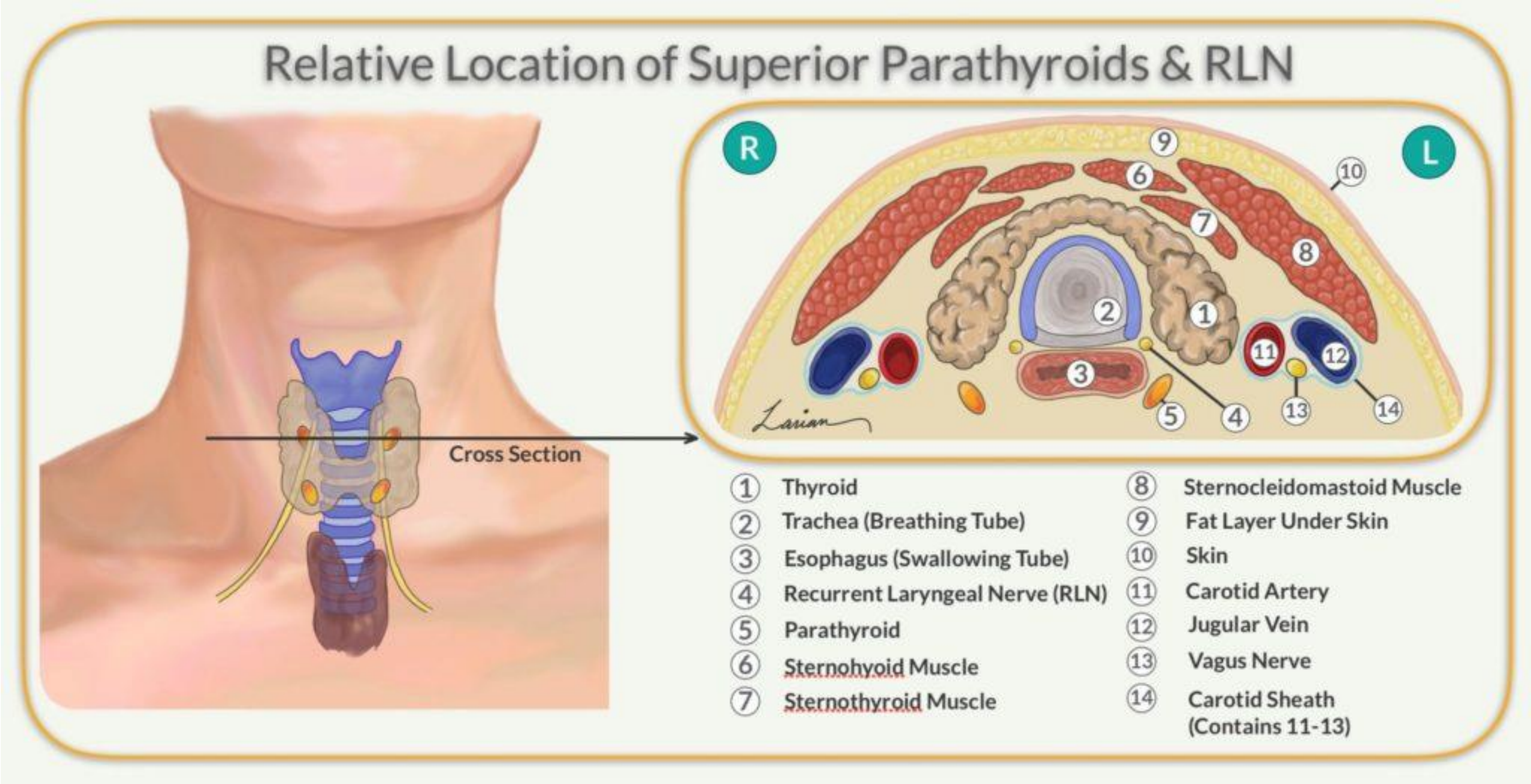
NOT posterior surface



Site of parathyroid glands

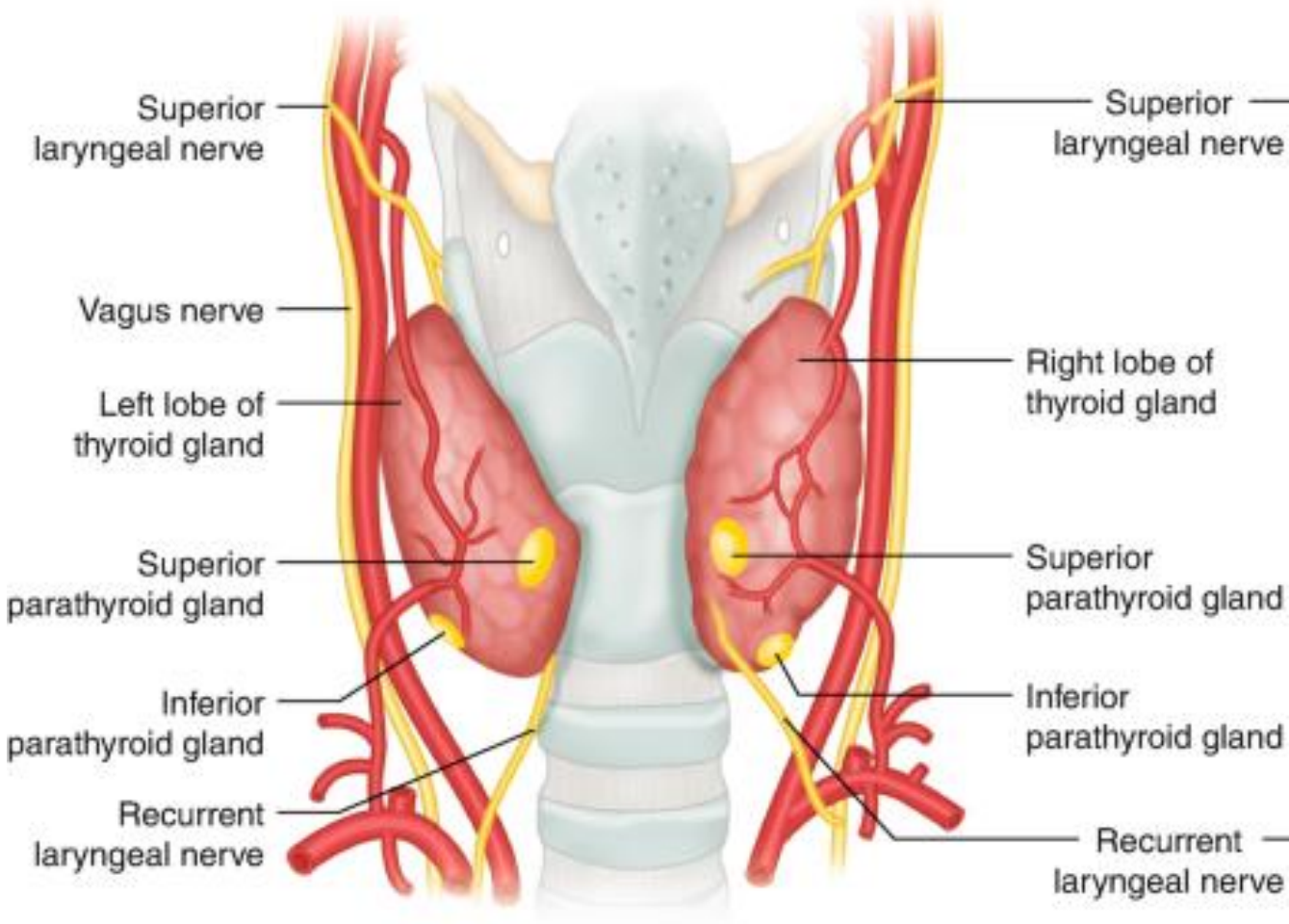
- The **two inferior parathyroid glands** usually lie close to the inferior poles of the thyroid gland.
- They may lie within the fascial sheath, embedded in the thyroid substance, or outside the fascial sheath.
- They may be found some distance caudal to the thyroid gland, in **association with the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

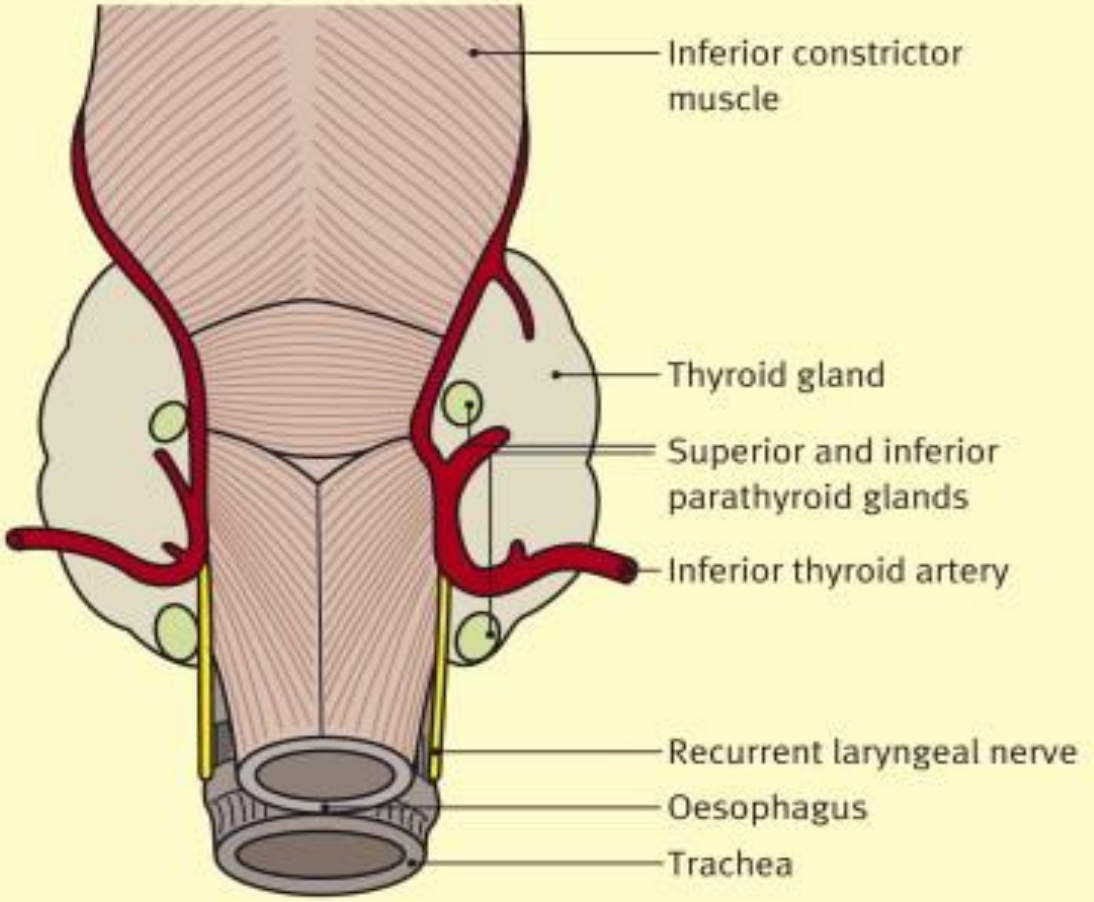
Features of parathyroid Glands

- 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.



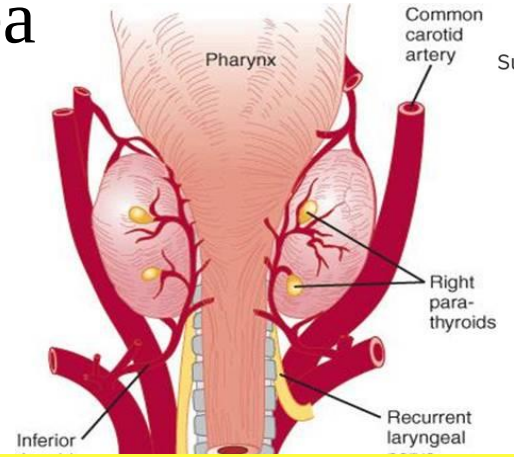
Posterior

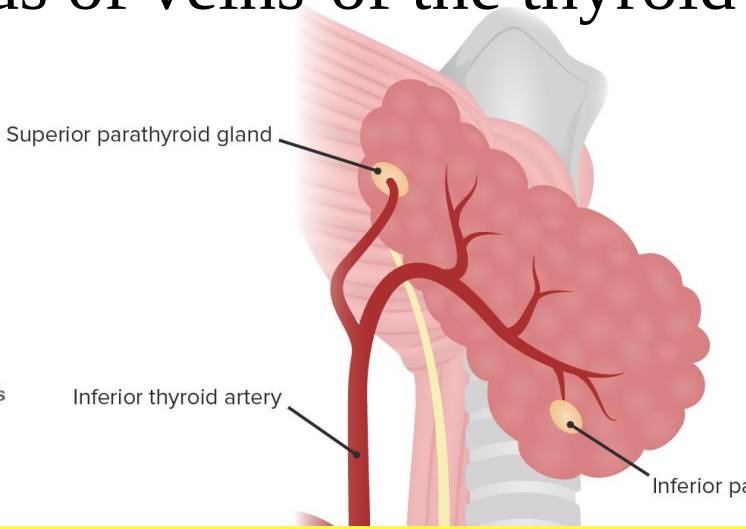
Posterior aspect of the thyroid gland

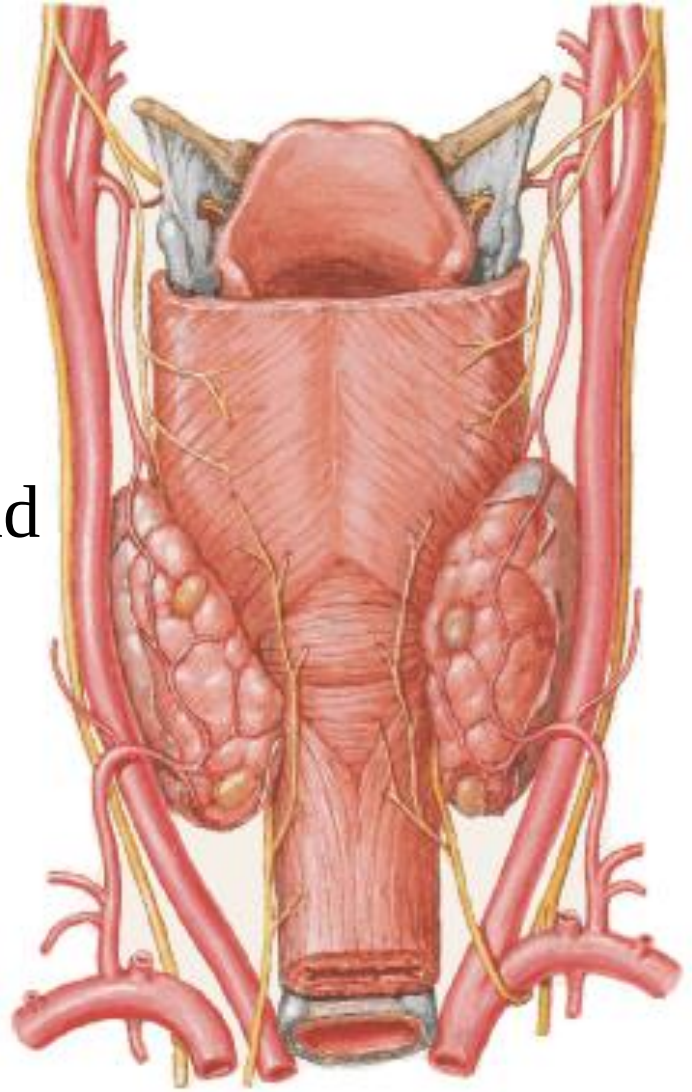


Blood Supply

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

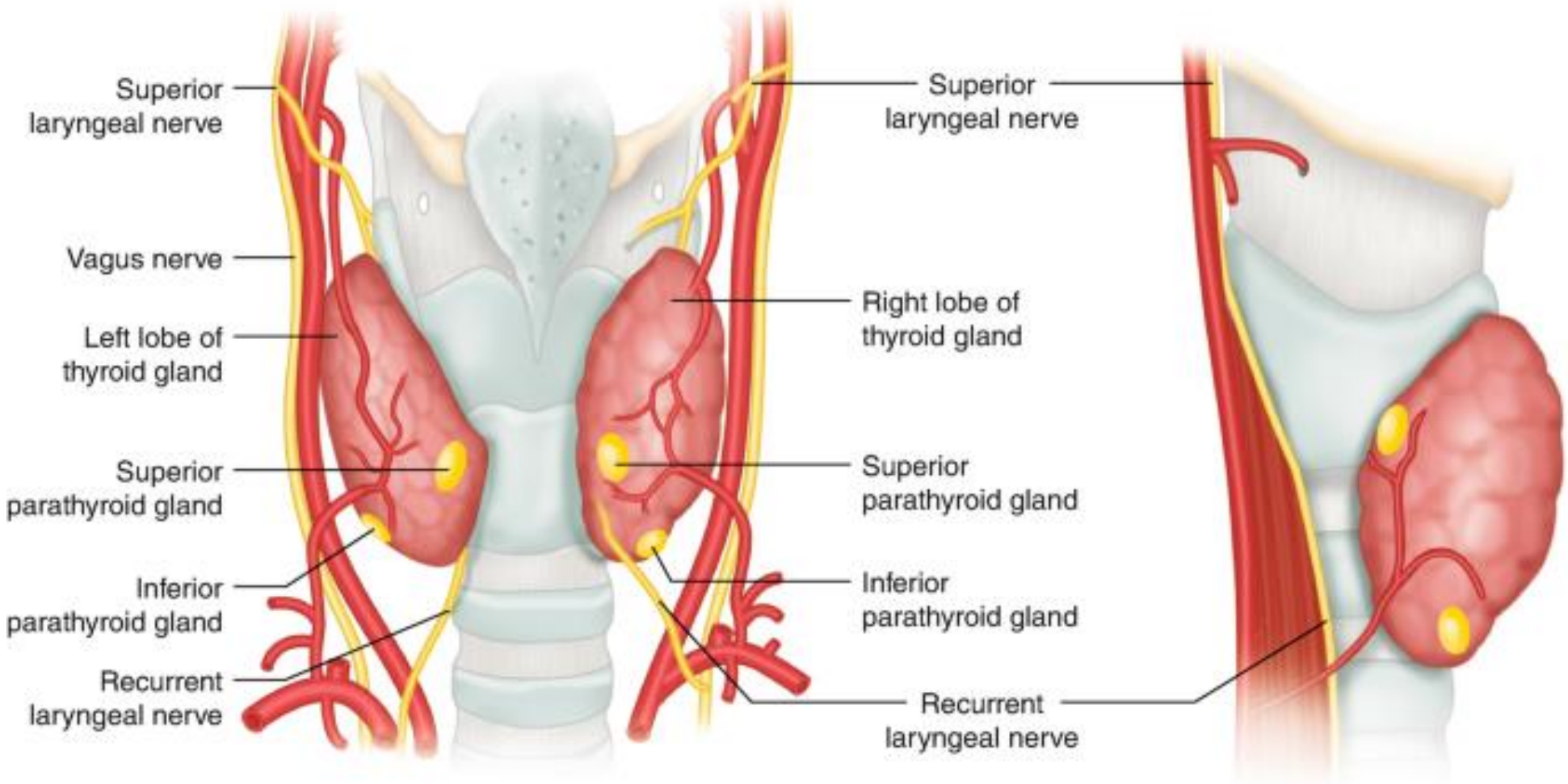






MCQ : Blood supply of parathyroids gland : superior & inferior

MCQ : Parathyroidis supplied mainly by: inferior thyroid artery


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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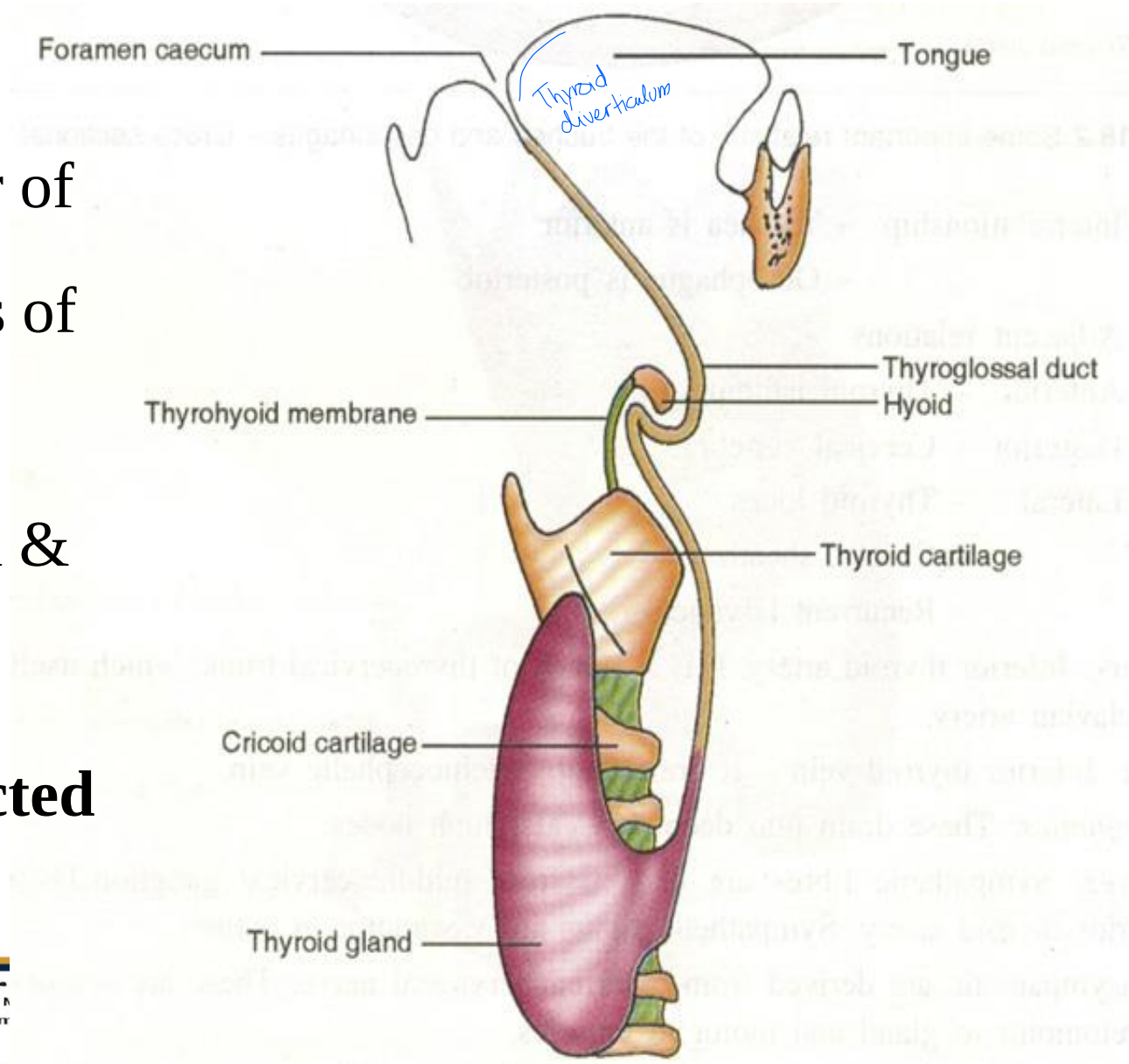
Time of development: 4th week MCQ

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



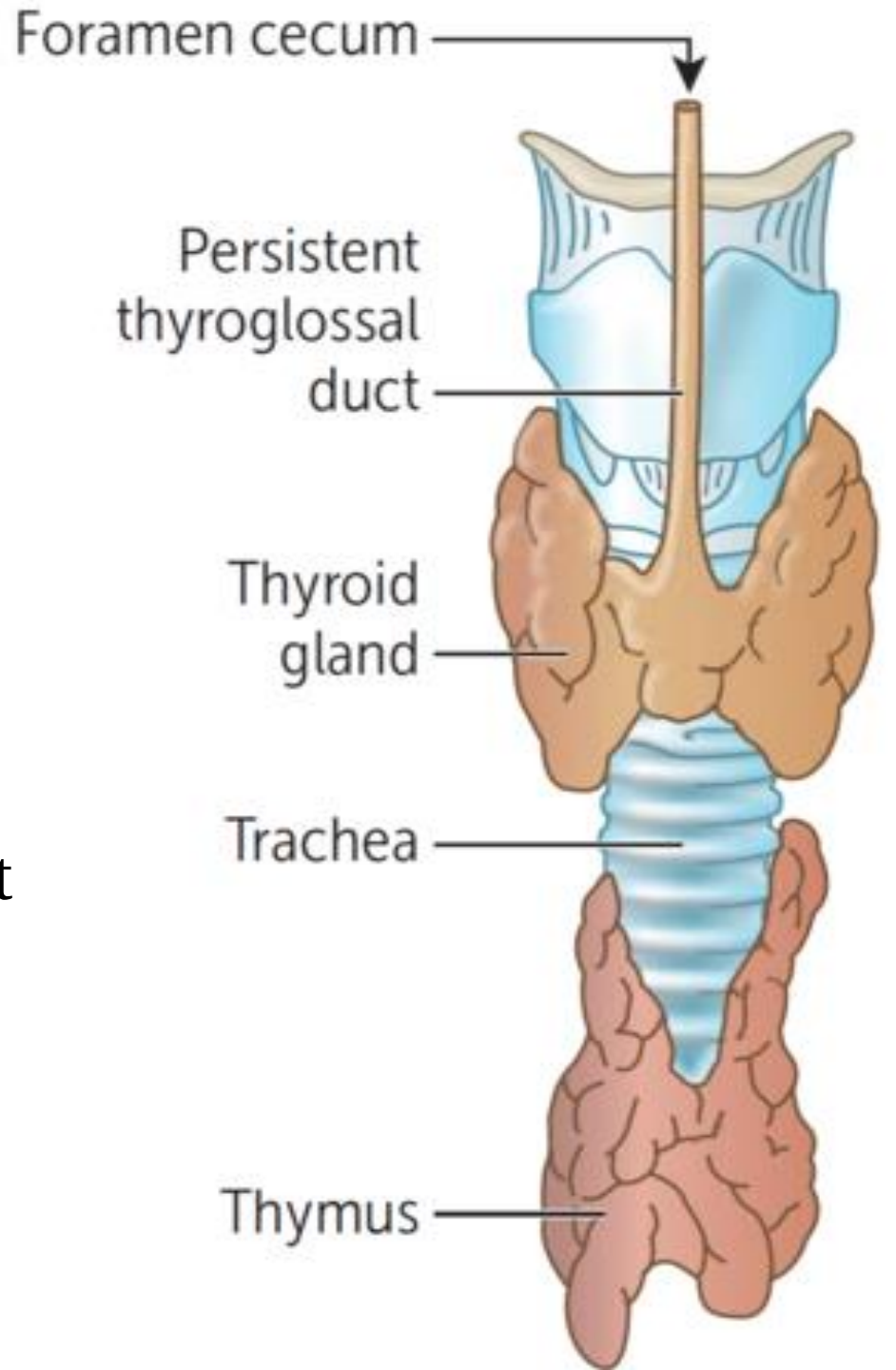
4) It reaches its **final position** in front of trachea **in 7th week** **MCQ مهم جدا**

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

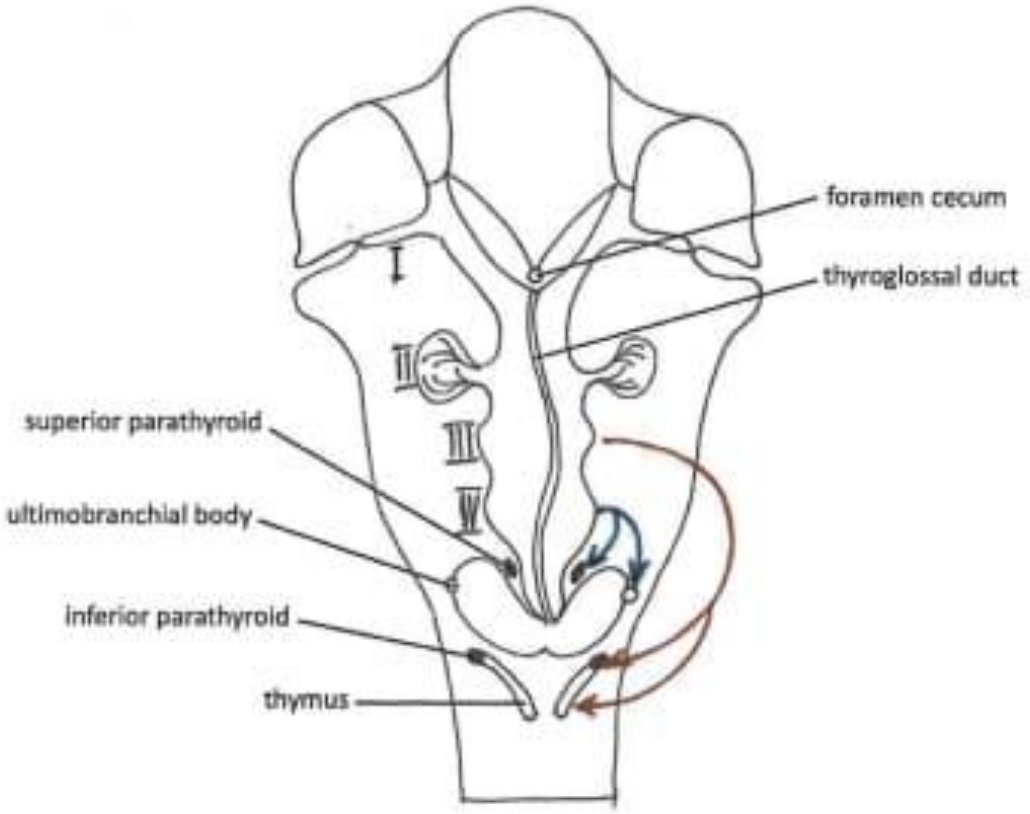


7) gland becomes functioning at 12th week with **colloid- filled follicles**

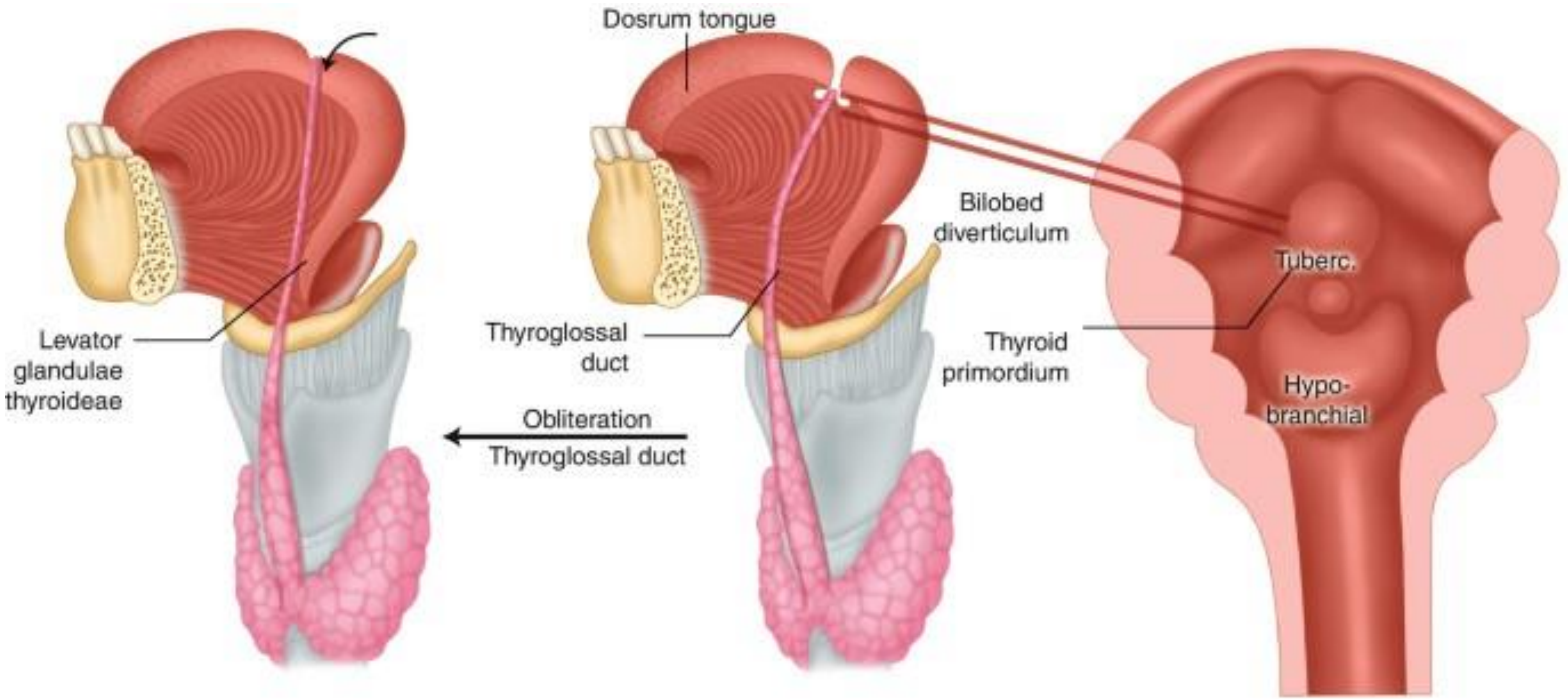
8) Parafollicular cells, (C cells) secreting calcitonin, derived from ultimobranchial body at 5th pouch.

= Hypobranchial eminence

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



- All glands originate from : Endoderm


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

Anomalies of thyroid

1) **Aplasia or hypoplasia** ← Agenesis وممكن نضيف

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

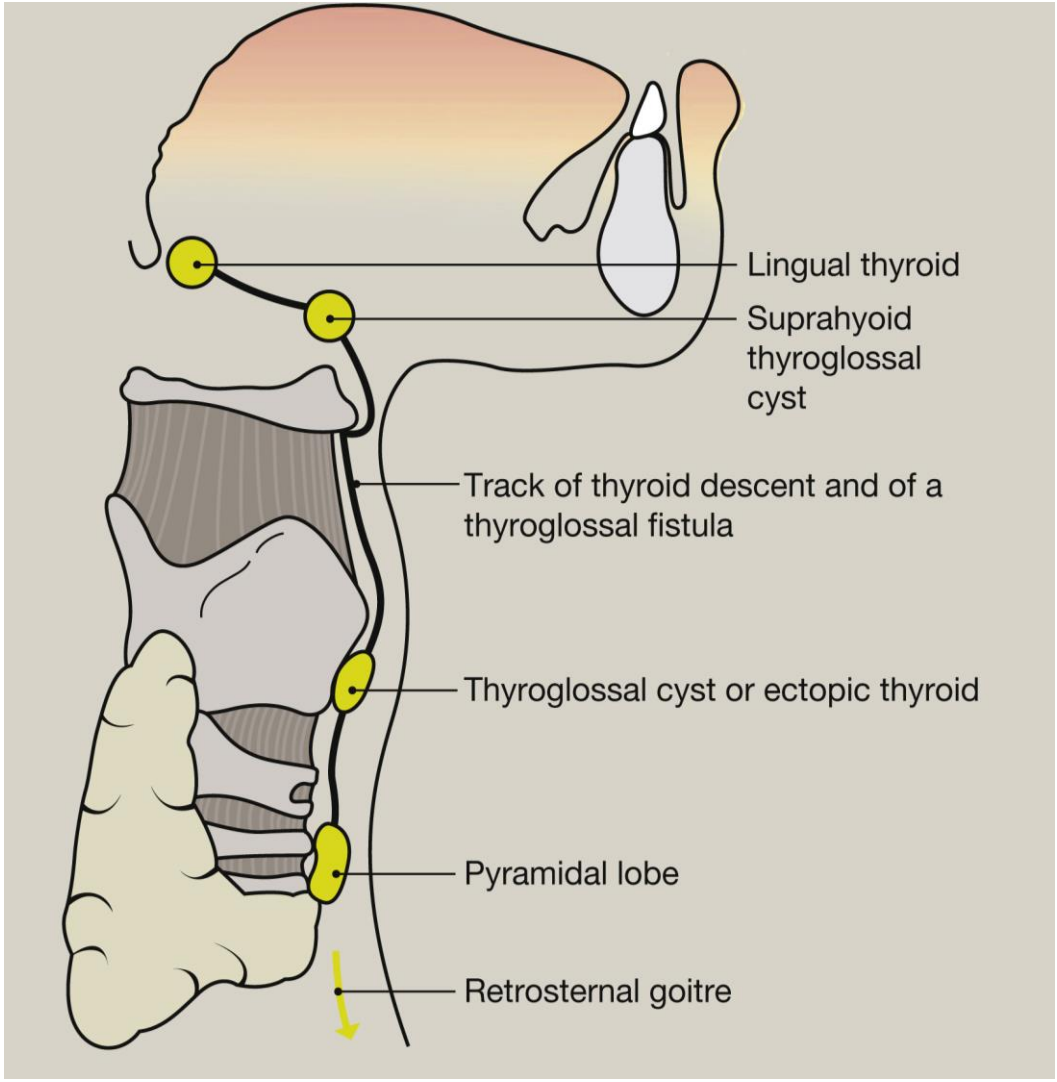
   a) **Lingual thyroid:** found at base of tongue due to failure of descent

   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 ← بتنزل saliva



Anomalies of the thyroid gland

Agenesis

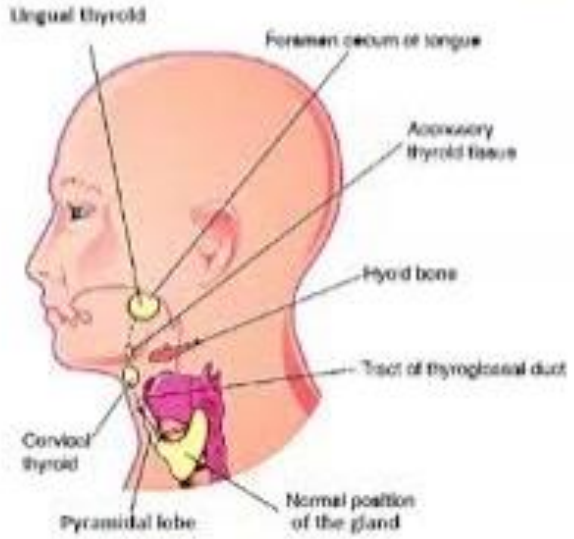
- It means congenital absence of thyroid gland, causing congenital cretinism.

Aberrant thyroid

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

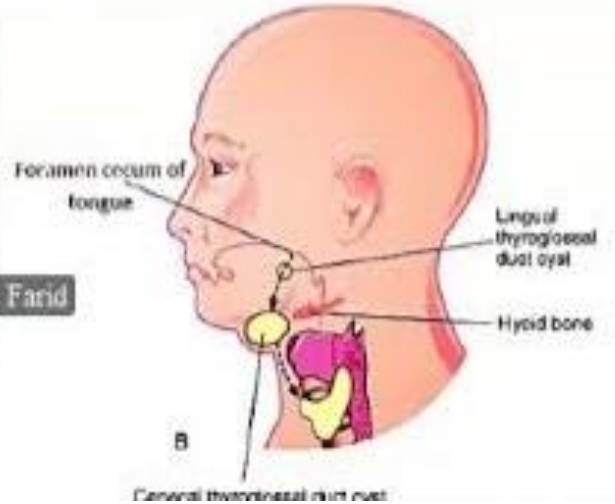
Thyro-glossal cyst

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



Aberrant thyroid

Thyro-glossal cyst



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Development of Parathyroid glands

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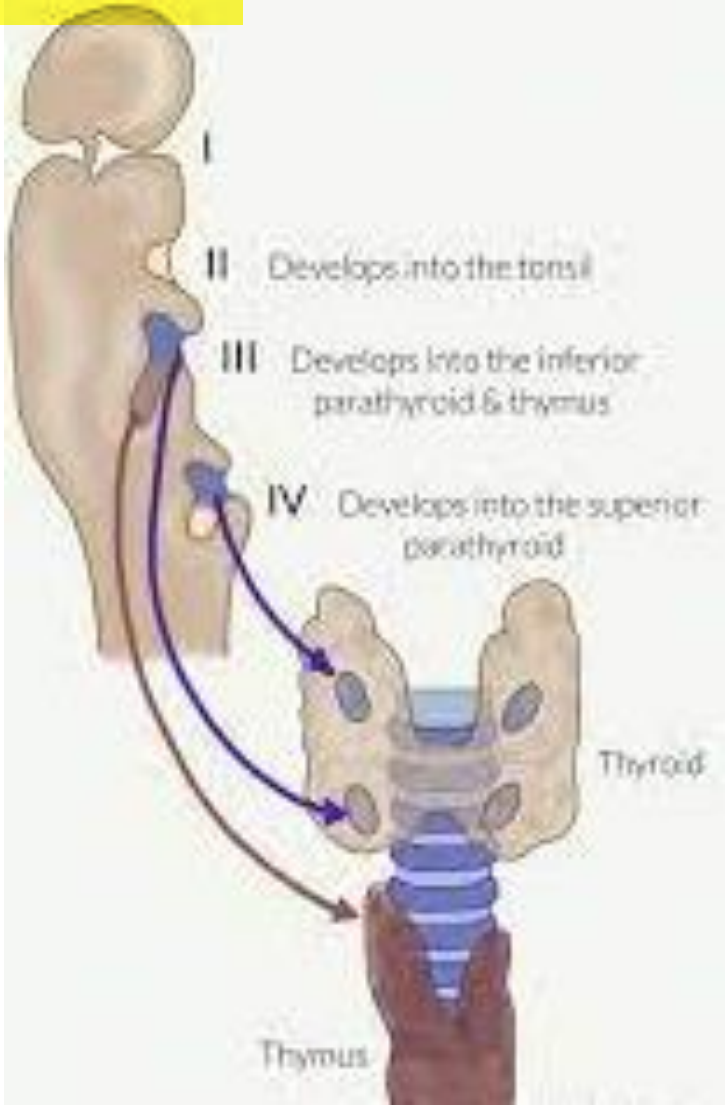
Development of parathyroid glands

- Embryologically, the parathyroid glands derive from the endoderm of the third and fourth pharyngeal pouches.
- 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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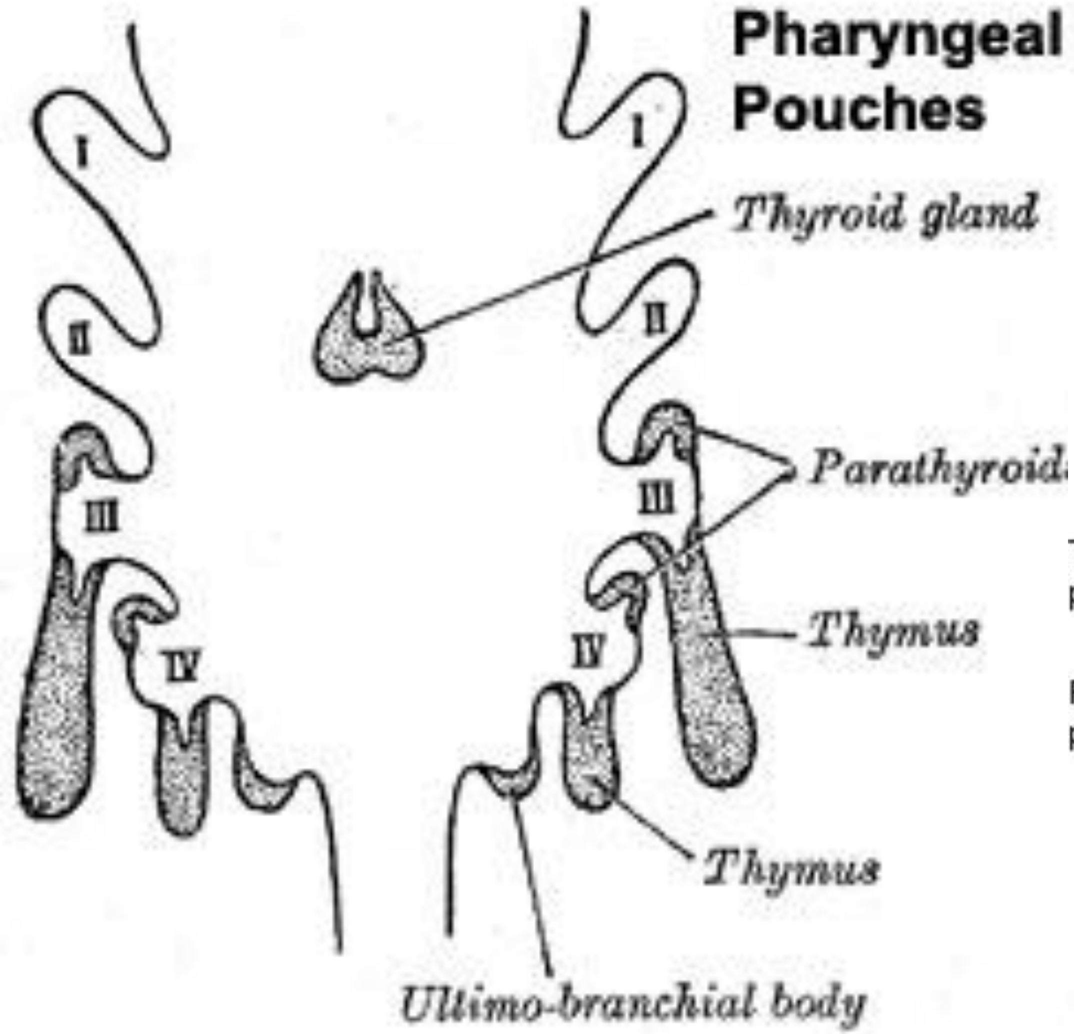
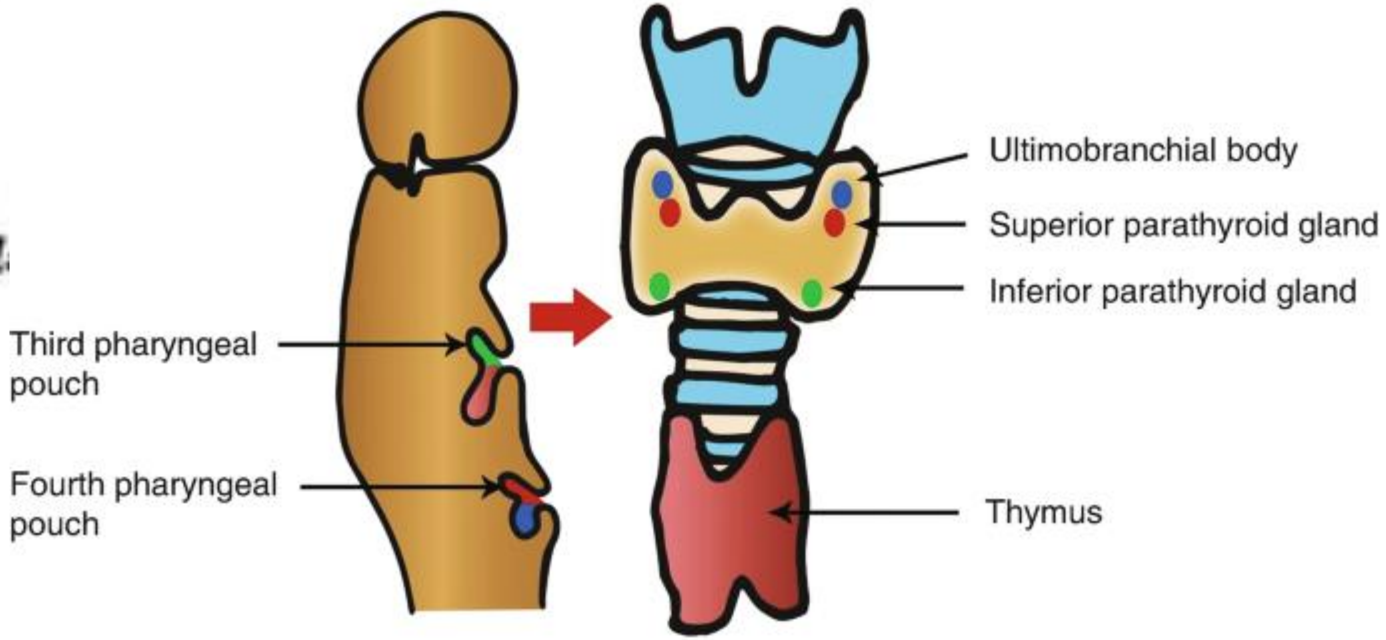

Pharyngeal Pouches
I
II
III
IV
Thyroid gland
Parathyroids
Thymus
Thymus
Ultimo-branchial body


Third pharyngeal pouch
Fourth pharyngeal pouch
Ultimobranchial body
Superior parathyroid gland
Inferior parathyroid gland
Thymus

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

References for further readings

- Oxford Handbook of Clinical Medicine (3rd edition).
- Gray's anatomy for students
- Longman`s medical embryology 10th edition , T.W.Sadler
- Chen CJ (2001) Suprasellar and infrasellar craniopharyngioma with a persistent craniopharyngeal canal: Case report and review of the literature. Neuroradiology 43:760–762
- Chong BW, Newton TH (1993) Hypothalamic and pituitary pathology. Radiol Clin North Am 31:1147–1183


الحمد لله
Thank You
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