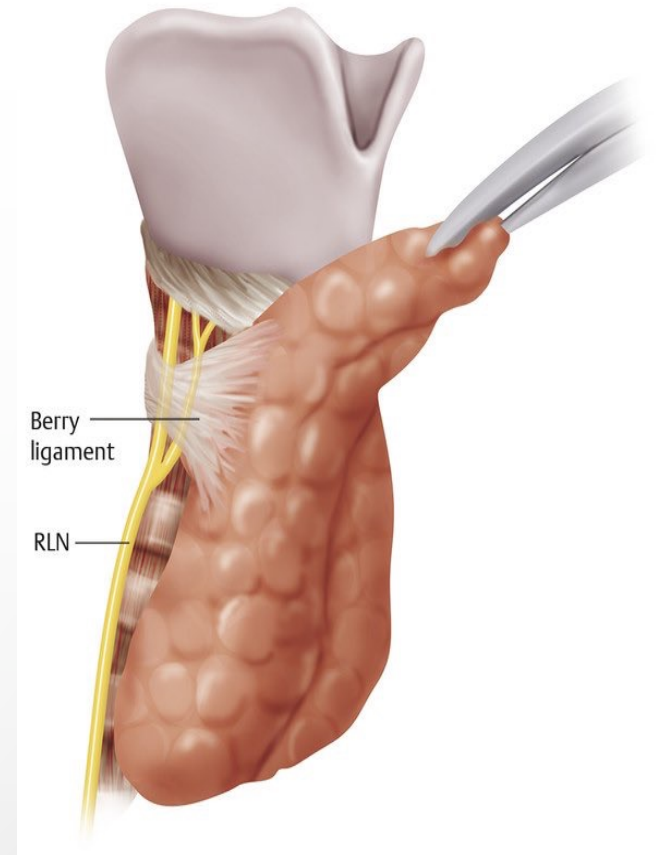
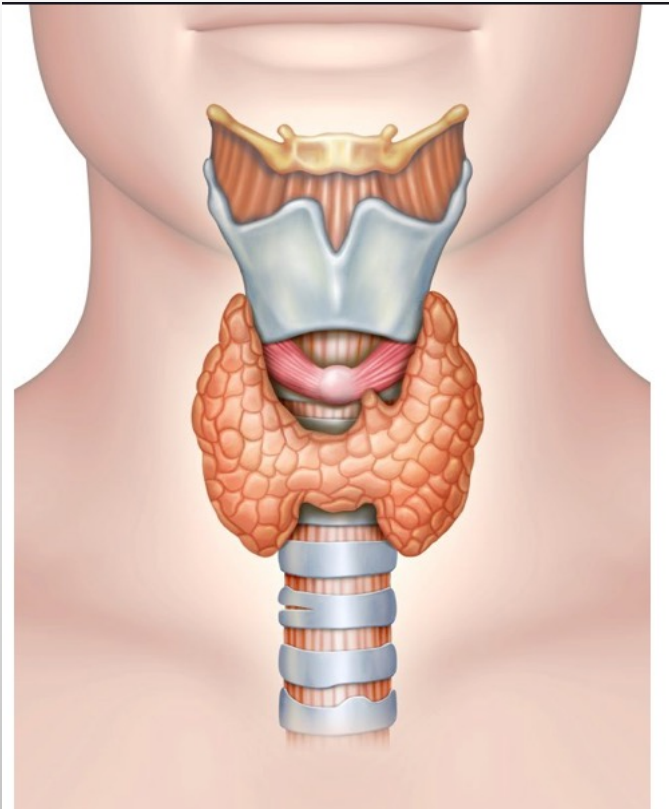


The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance. They are located in the top-left, bottom-left, and bottom-right areas of the frame.

Thyroid Gland

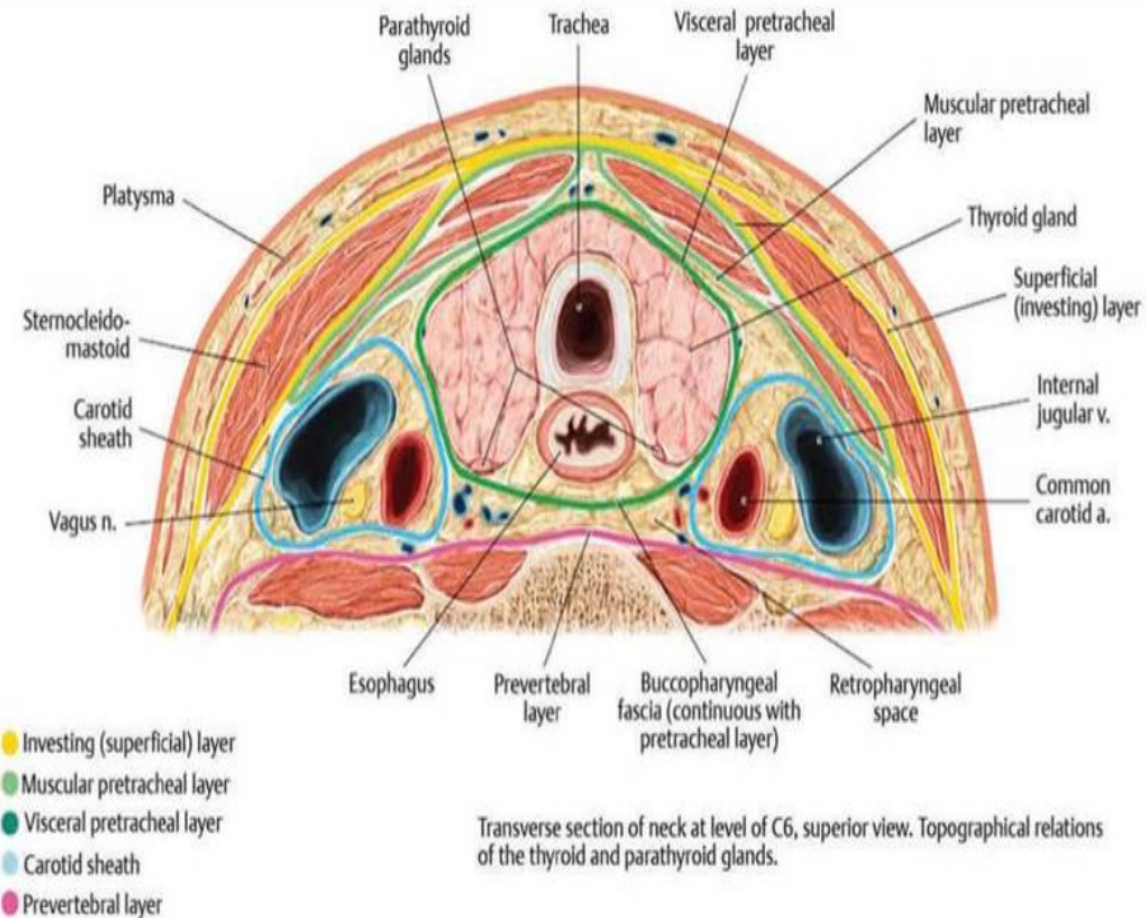
ANATOMY

- Highly vascular, butterfly-shaped gland surrounding the anterior surface of the trachea just below the larynx
- located in the anterior neck and spans C5-T1 vertebrae
- Consists of right and left lobes connected by a narrow isthmus.
- Surrounded by a sheath derived from the visceral pretracheal layer of the deep fascia (attachment to larynx/trachea).
- Berry ligament!!



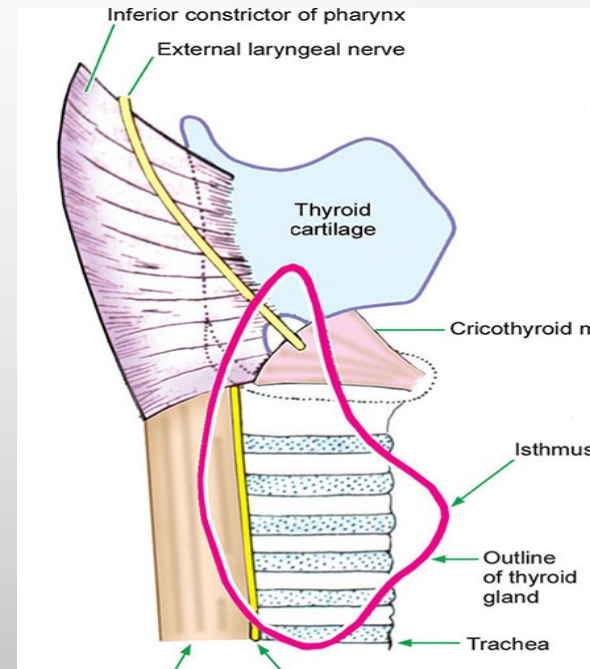
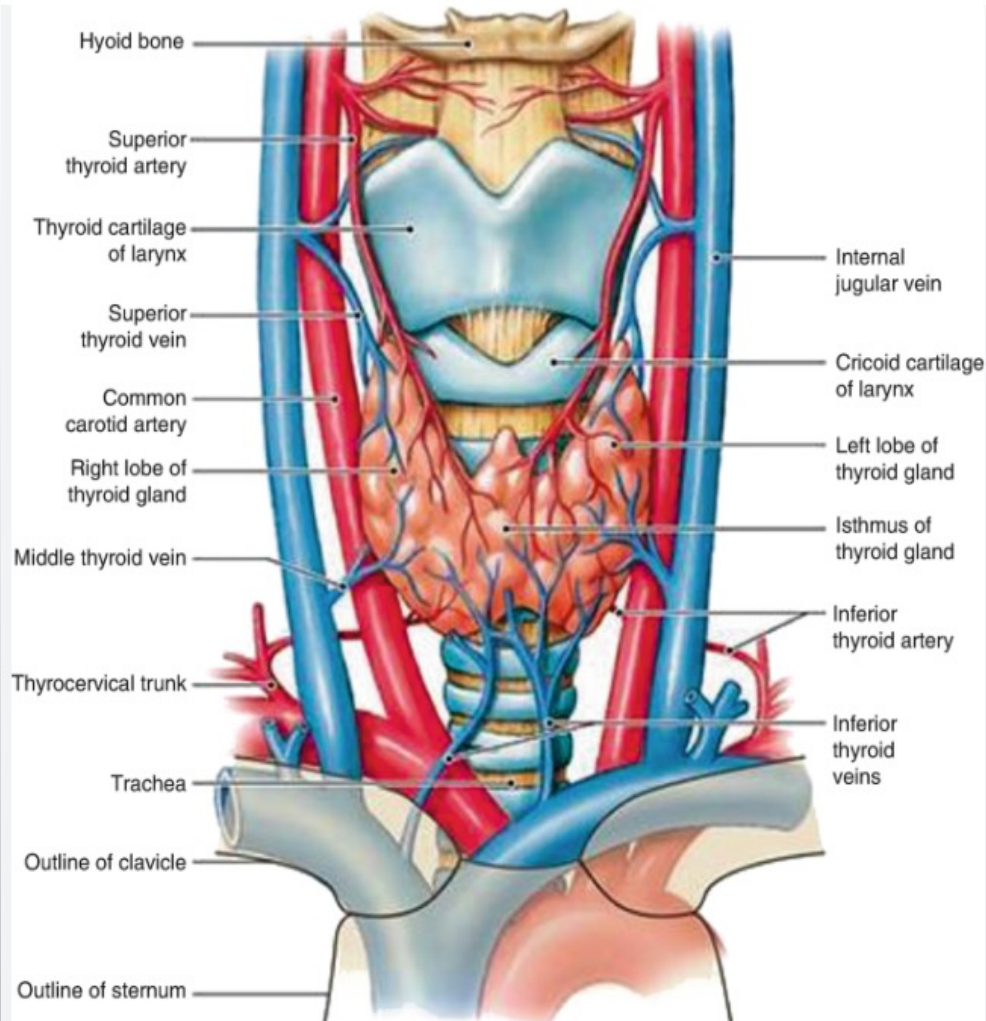
ANATOMY

- Each **lobe** is pear shaped--- apex being directed upward----- oblique line on the lamina of the thyroid cartilage.
- Base lies below at the level of the 4th or 5th tracheal ring.
- The **isthmus** extends across the midline in front of the 2nd-4th tracheal rings.
- A **pyramidal lobe (40%)**: Is often present, and it projects upward from the isthmus (band connects it to the HB --- **levator glandulae thyroideae**)

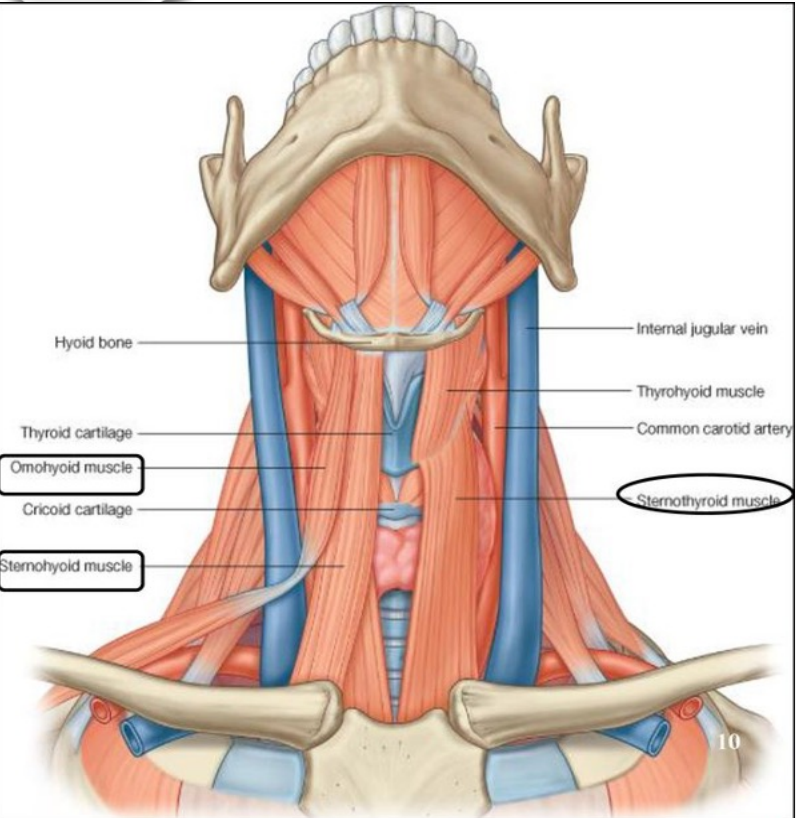


RELATIONS OF LOBES

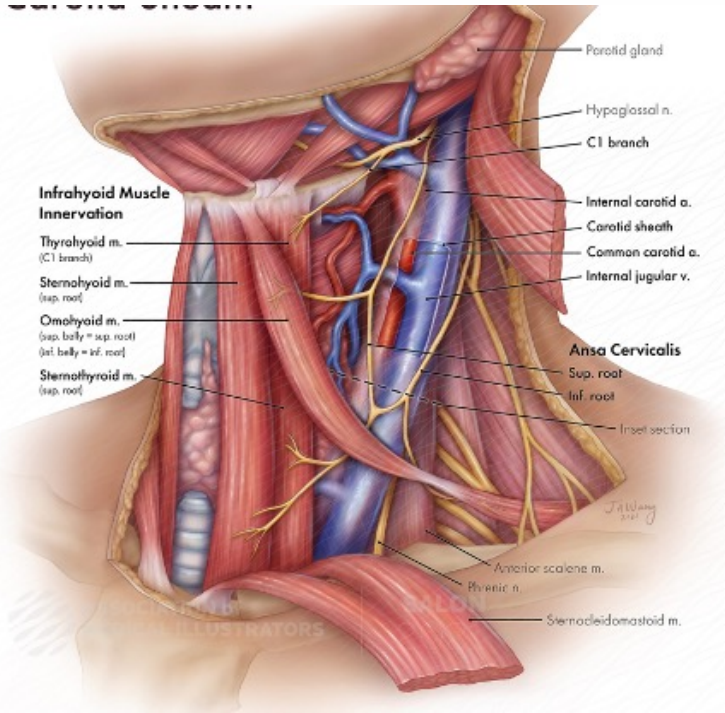
- **Medial:** the larynx, the trachea, the pharynx, and the esophagus (cricothyroid muscle and its nerve supply, the external laryngeal nerve. The recurrent laryngeal nerve is in the groove between the esophagus and the trachea.)



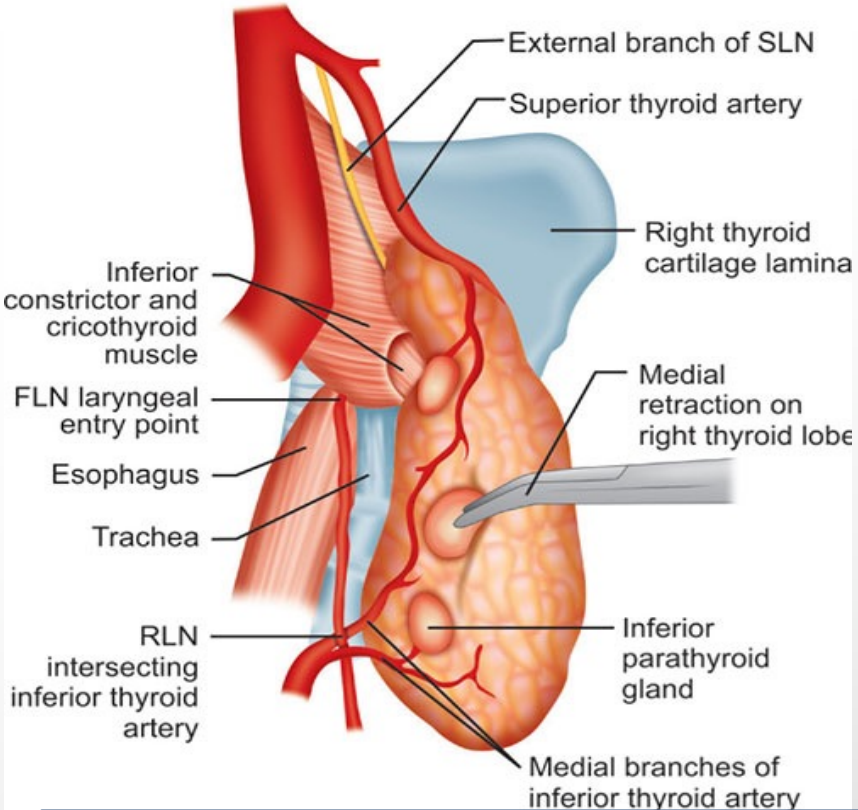
Relations Of Lobes



• **Anterolateral:** sternothyroid, the superior belly of the omohyoid, the sternohyoid, and the anterior border of the sternocleidomastoid



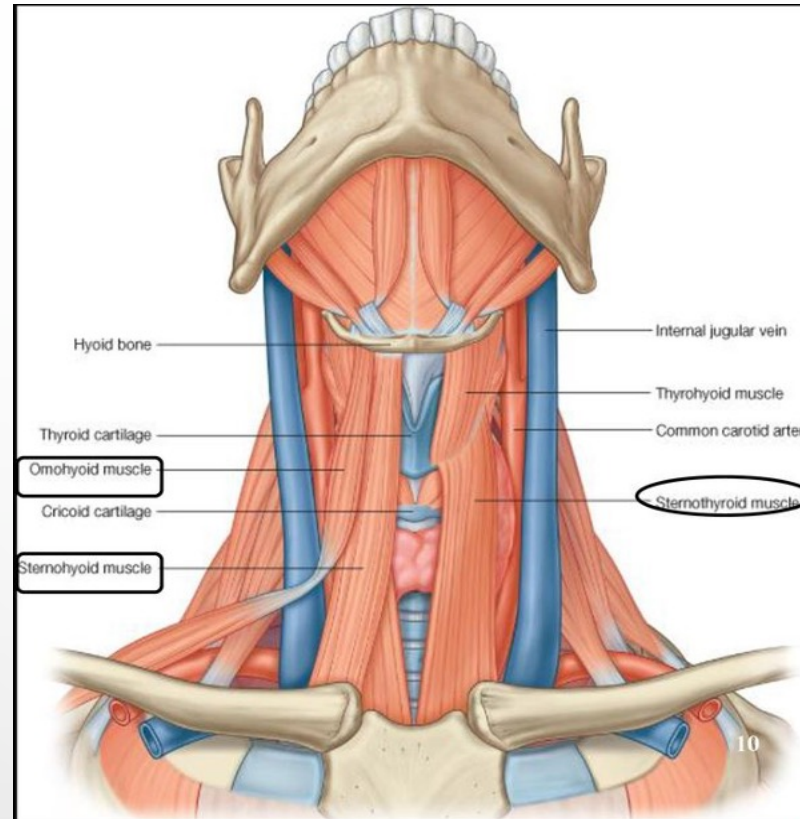
• **Posterolateral:** carotid sheath with the common carotid artery, the internal jugular vein, and the Vagus nerve



• **Posterior:** superior and inferior parathyroid glands and the anastomosis between the superior and inferior thyroid arteries

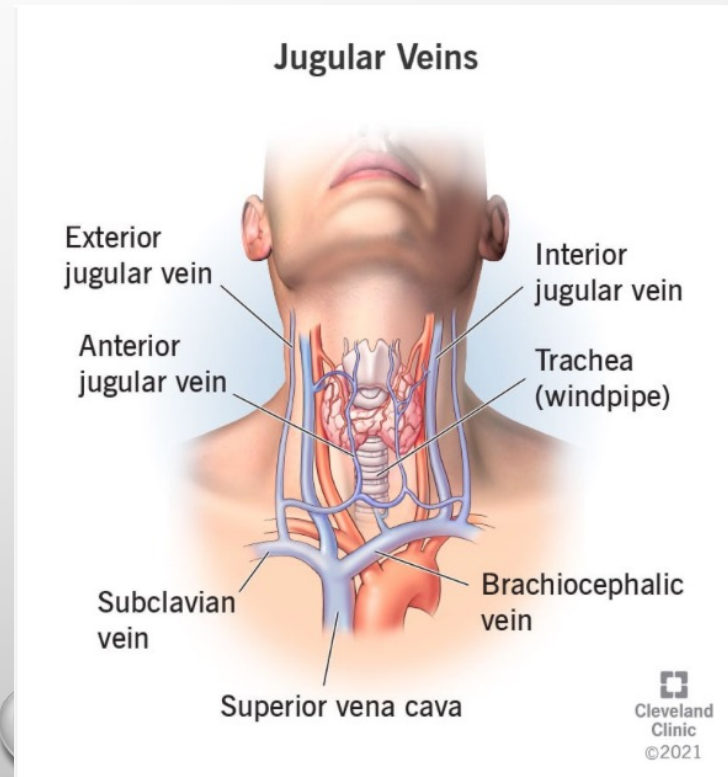
Isthmus Relations

- **Superior:** terminal branches of the superior thyroid arteries (+anastomosis).

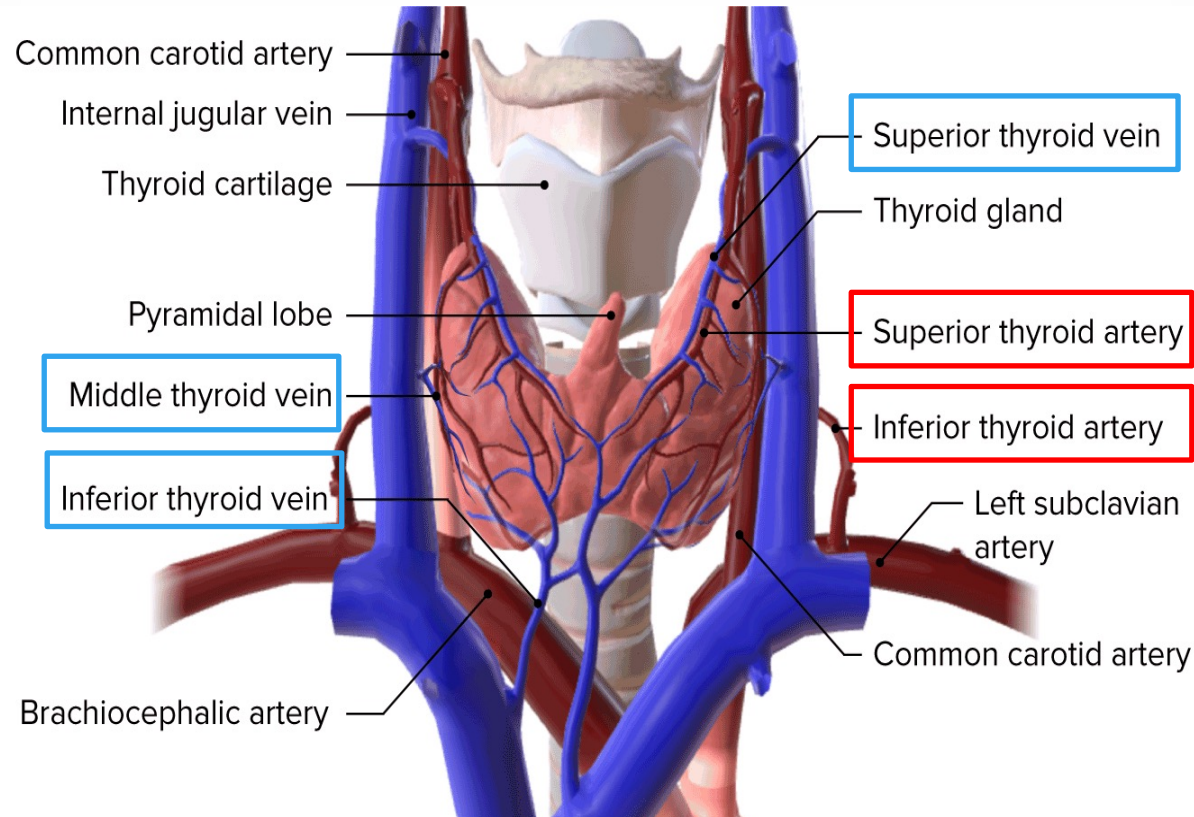


- **Posterior:** 2-4 tracheal rings.

- **Anterior:** sternothyroid, the sternohyoid, anterior jugular veins, fascia, and skin



Blood Supply/Venous D.



1. The **superior thyroid artery (ECA)**: divides into ant., post., and lateral branches. Accompanied by the external laryngeal nerve.

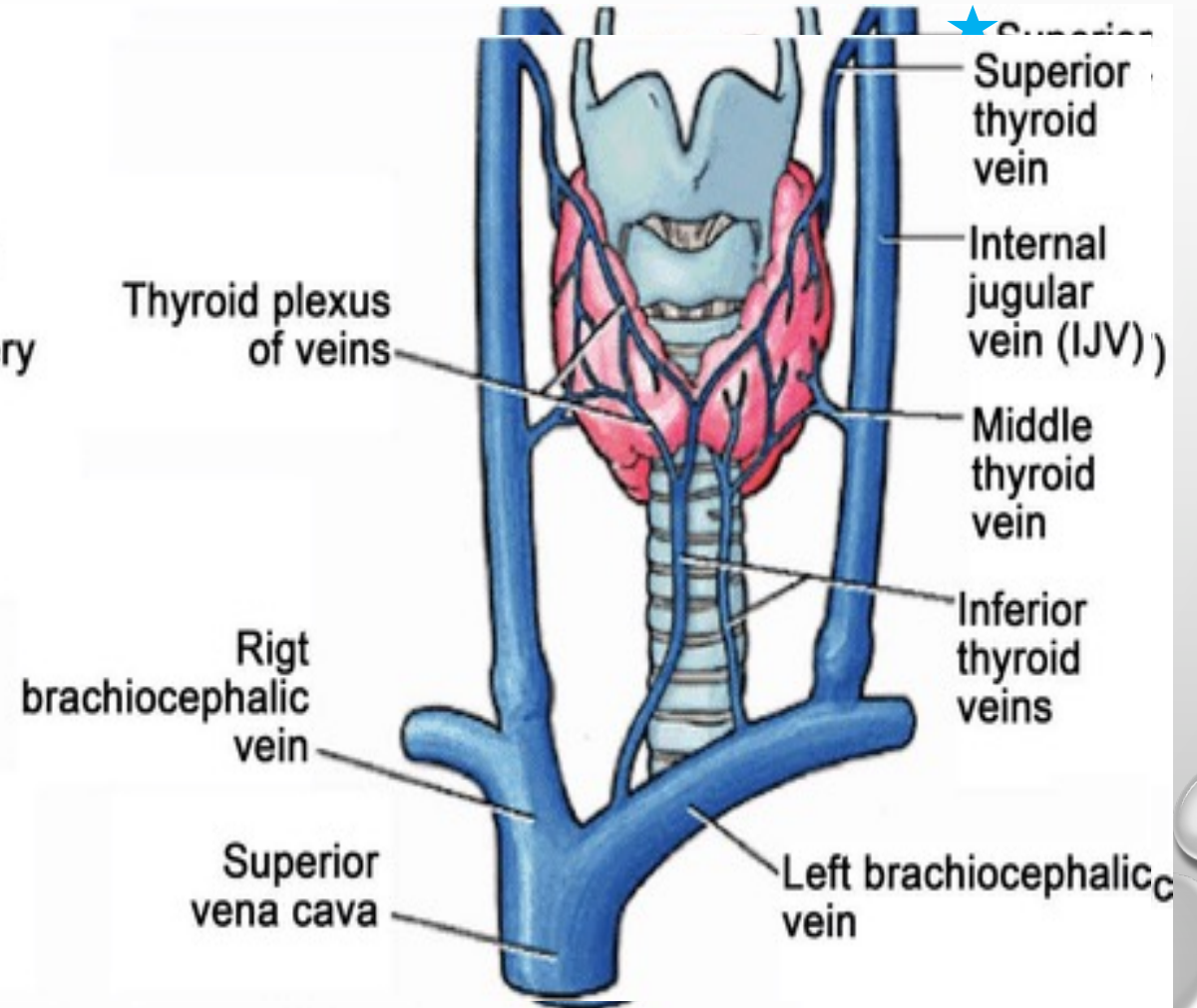
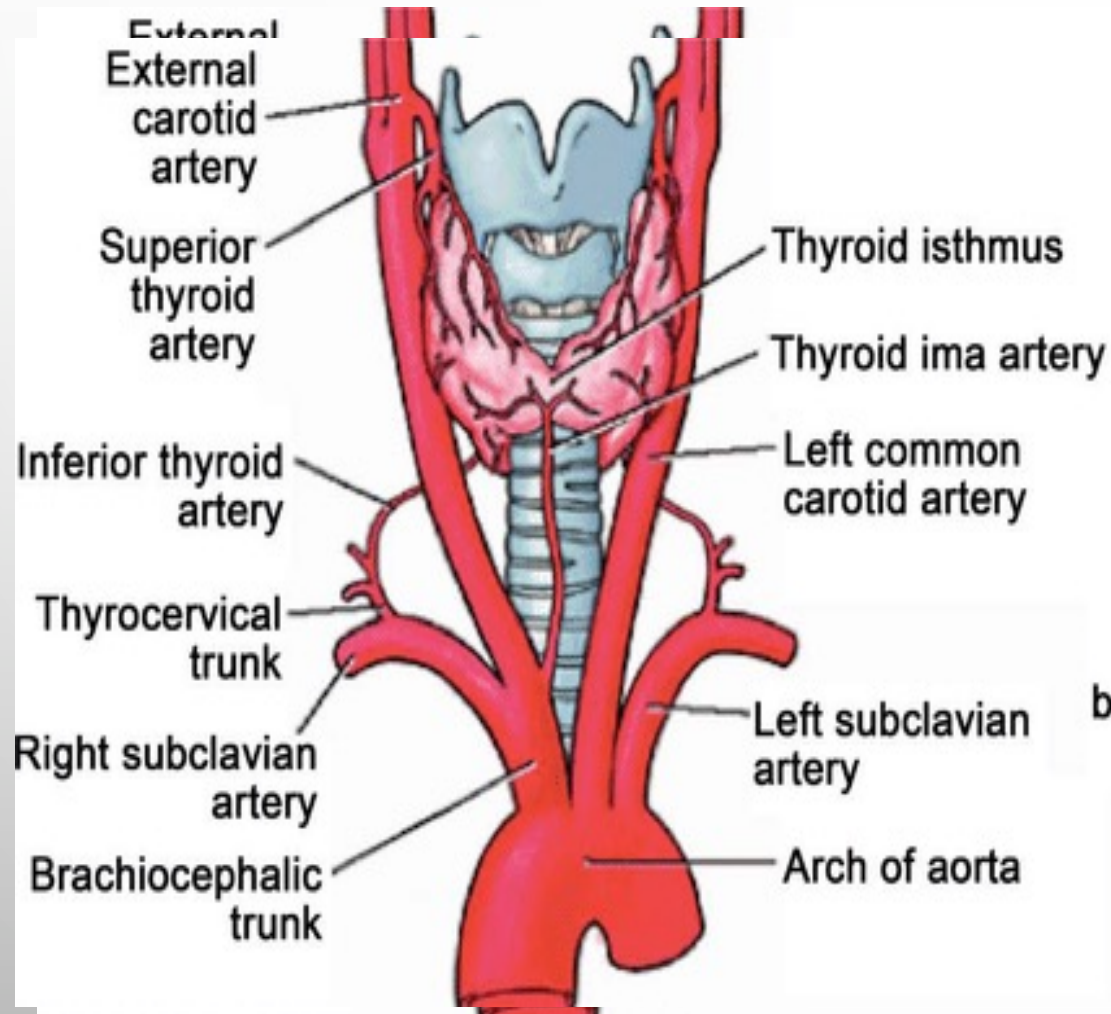
Anastomosis

3. The **thyroidea ima (BCA, arch of aorta, rtCCA)**, if present (10%), It ascends in front of the trachea to the isthmus.

2. The **inferior thyroid artery (TCT; subclavian a.)**: divides into sup. and inf. branches. reaches the posterior border of the gland. The recurrent laryngeal nerve crosses either in front of or behind the artery, or it may pass between its branches.

Superior and middle thyroid Vs ----- IJV.
Inferior thyroid --- 1) left—LBCV, rt---- RBCV/SVC
 2) trunk (2 Vs)---- LBCV, RBCV, or SVC

Blood Supply/Venous D.



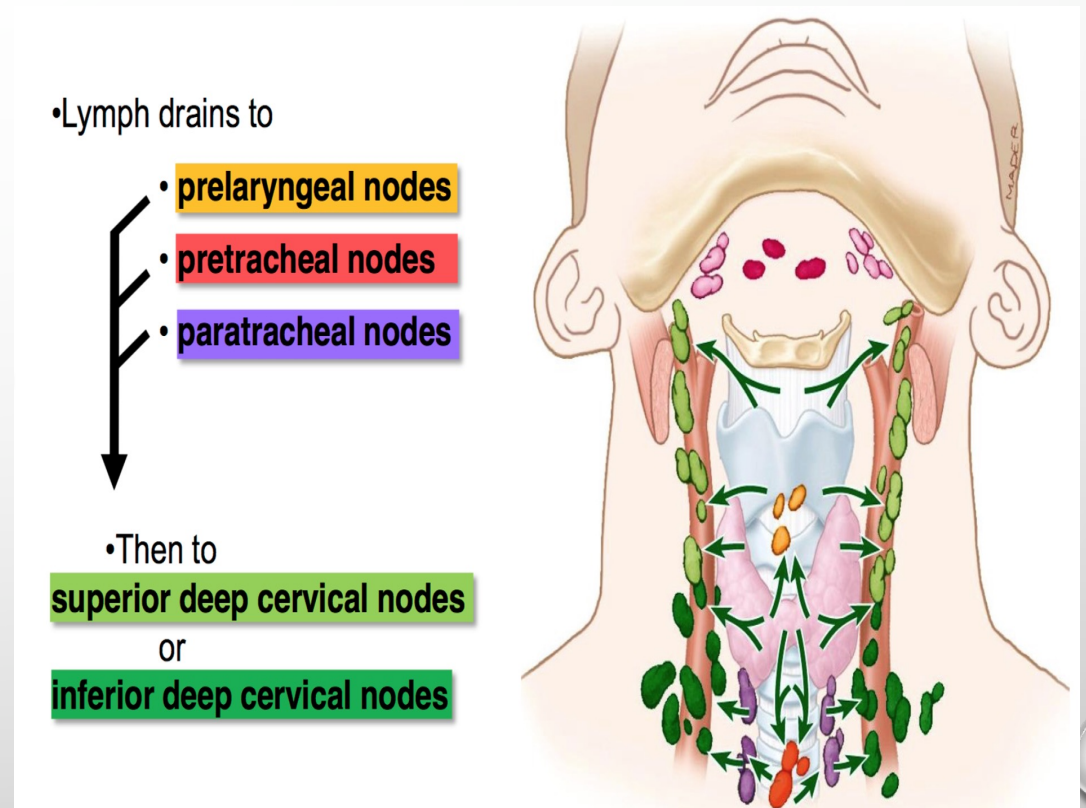
Lymph D./ Nerve Supply

Lymph drainage

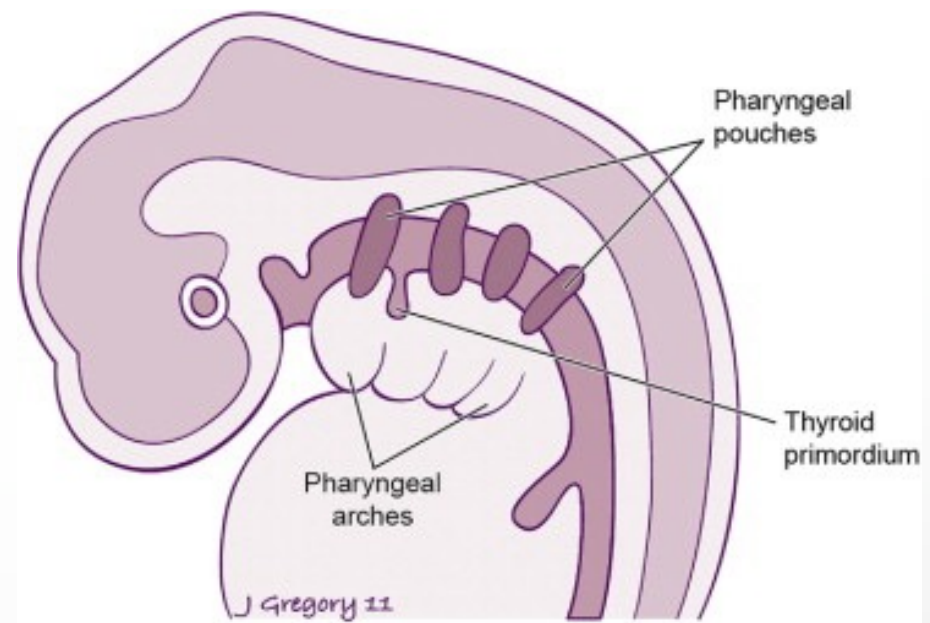
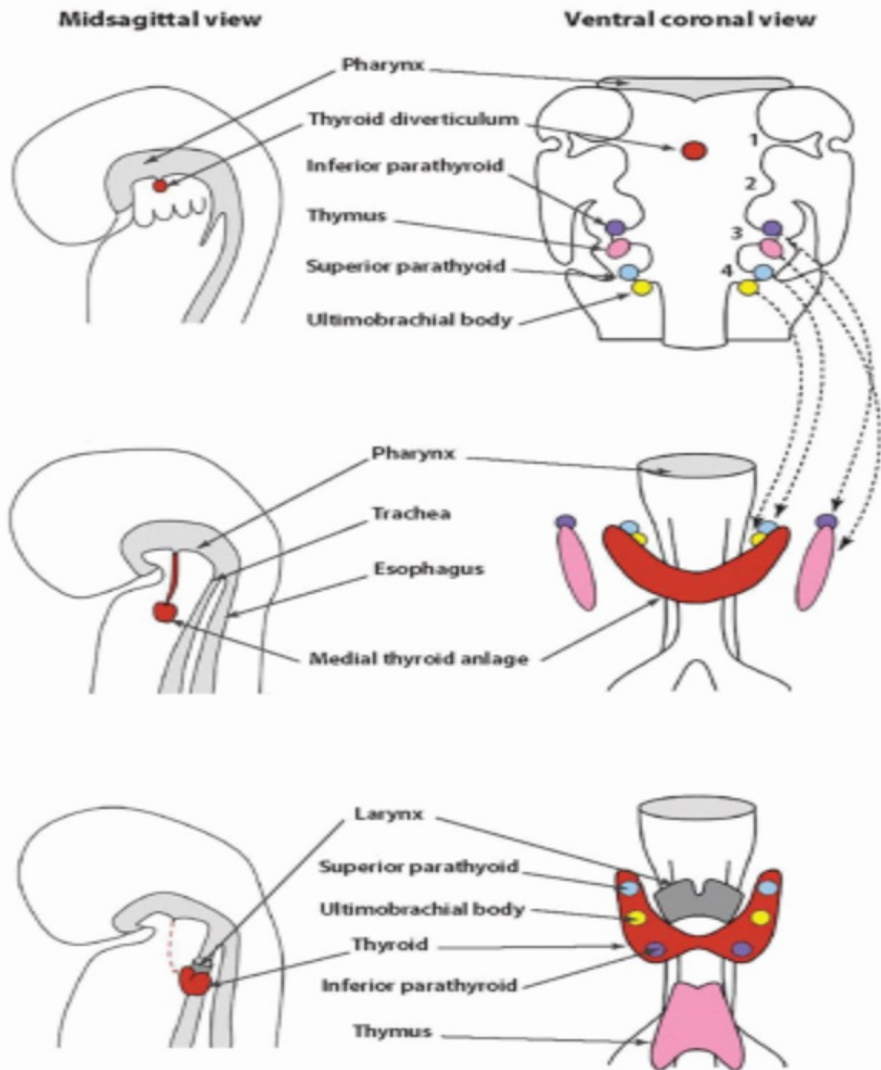
- Drains mainly laterally into the **deep cervical lymph nodes**. A few lymph vessels to the paratracheal nodes (prelaryngeal, pretracheal!!).

Nerve supply

- Superior, middle, and inferior cervical sympathetic ganglia. The Vagus nerve provides the main parasympathetic fibers



Embryology



Development begins as a diverticular outgrowth from the primitive pharynx.

The diverticulum then descends inferiorly to reach its final destination in the neck.

During its descent, the thyroid connects to the tongue by the thyroglossal duct

Embryology

- Originates from endoderm between the 1st /2nd pharyngeal pouches near the base of the tongue.
- Around day 20-24, endodermal cells of the primitive pharynx proliferate--- thyroid diverticulum—**earliest endocrine gland to develop**.

In the fifth week :

- The diverticulum migrates caudally (midline)---- attached to the tongue via thyroglossal duct (TGD)
- In early descent, the thyroid is hollow but then solidifies during migration---- follicular elements of the thyroid.
- Division of the thyroid into right and left lobes.
- Ultimobranchial bodies arise from the 4th/5th pharyngeal pouches ---parafollicular c-cells.

Embryology

By the seventh week:

- TG reach its final destination in the neck

By the tenth week :

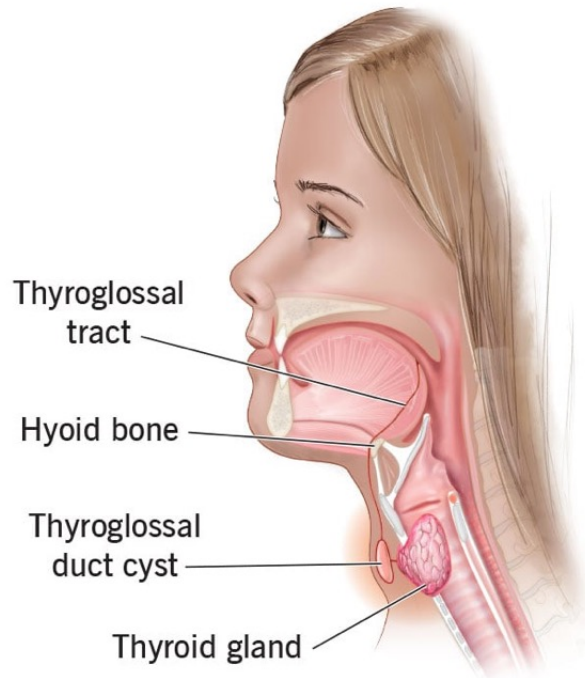
- TGD degenerates ---**incomplete** obliteration of the duct can lead to abnormalities, including thyroglossal duct cysts, or a pyramidal lobe.

By the twelfth week

- Functionally mature
- Incomplete descent of the thyroid could lead to **lingual thyroid**.

Incomplete Degenration Of Thyroglossal Duct

Thyroglossal Duct Cysts



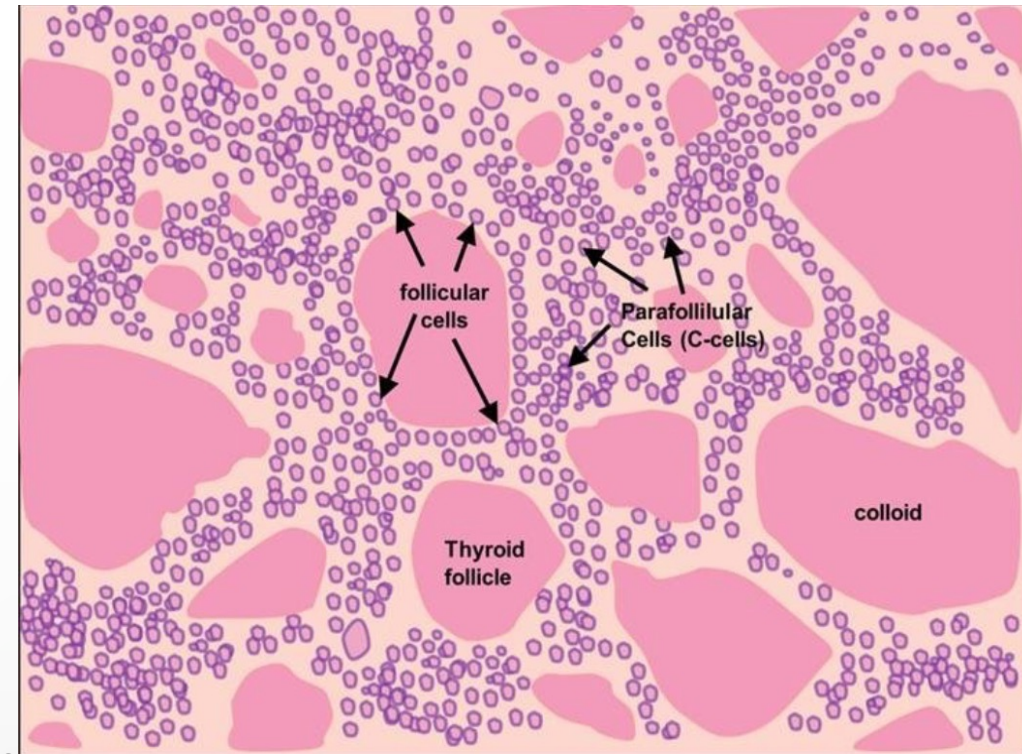
Incomplete descent of thyroid



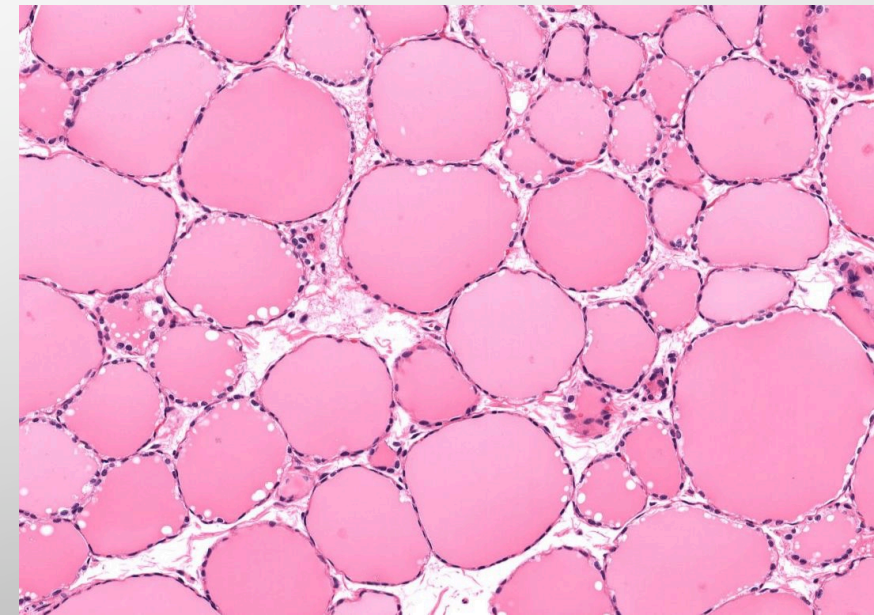
- LINGUAL THYROID

HISTOLOGY

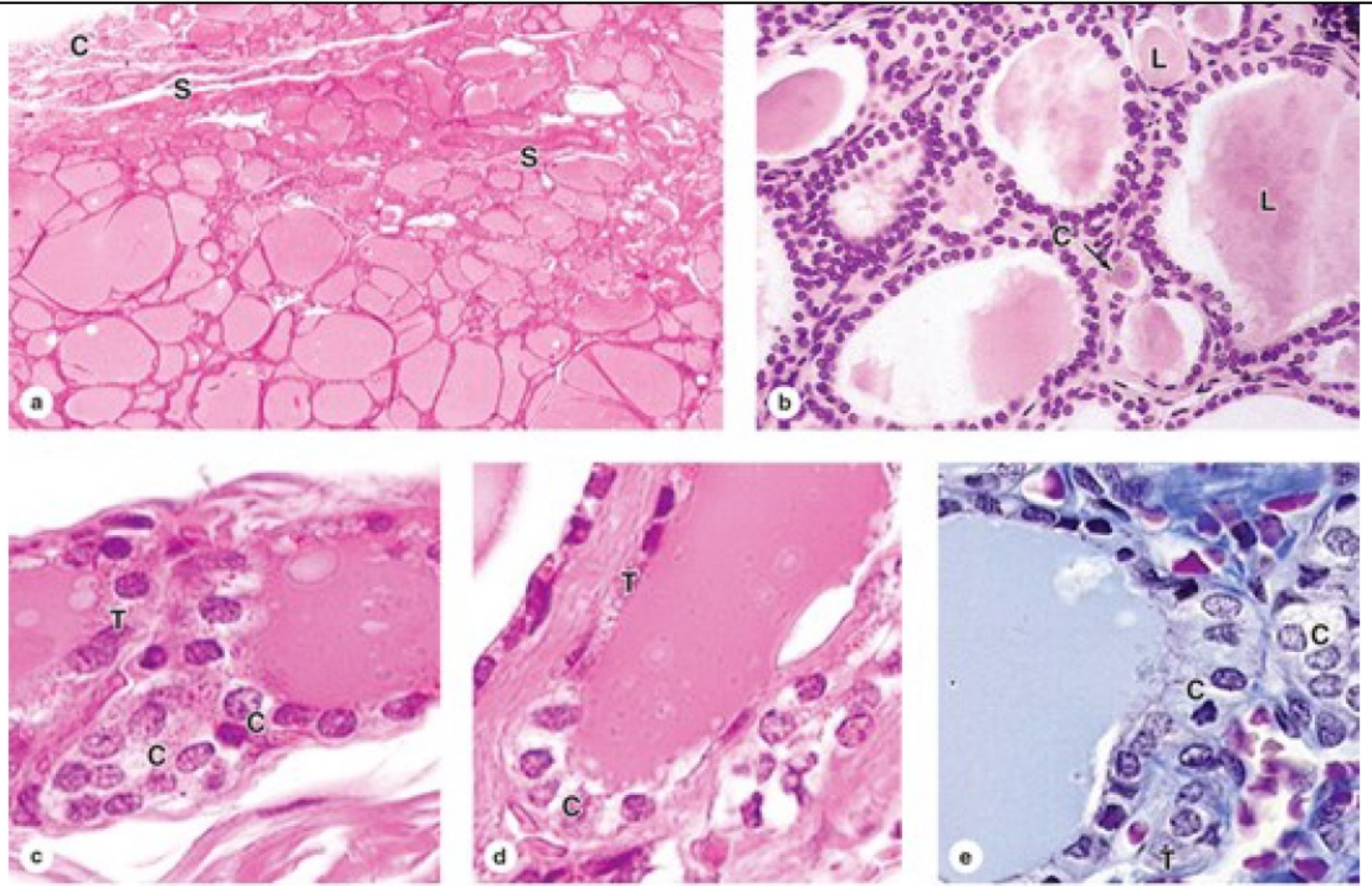
The **parenchyma** is composed of millions of rounded epithelial thyroid **follicles** of variable diameter, each with simple **epithelium** and a central lumen densely filled with gelatinous acidophilic **colloid**.



- Only endocrine gland in which a large quantity of secretory product is stored.
- Storage is outside the cells--- in the colloid of the follicle lumen.
- There is sufficient hormone in follicles to supply the body for up to 3 months.
- Thyroid colloid contains the large glycoprotein **thyroglobulin**---the precursor for the active thyroid hormones.



Thyroid Histology



(a) thin capsule (C), septa (S).

(b) The lumen (L), present are large pale-staining parafollicular or C cells (C).

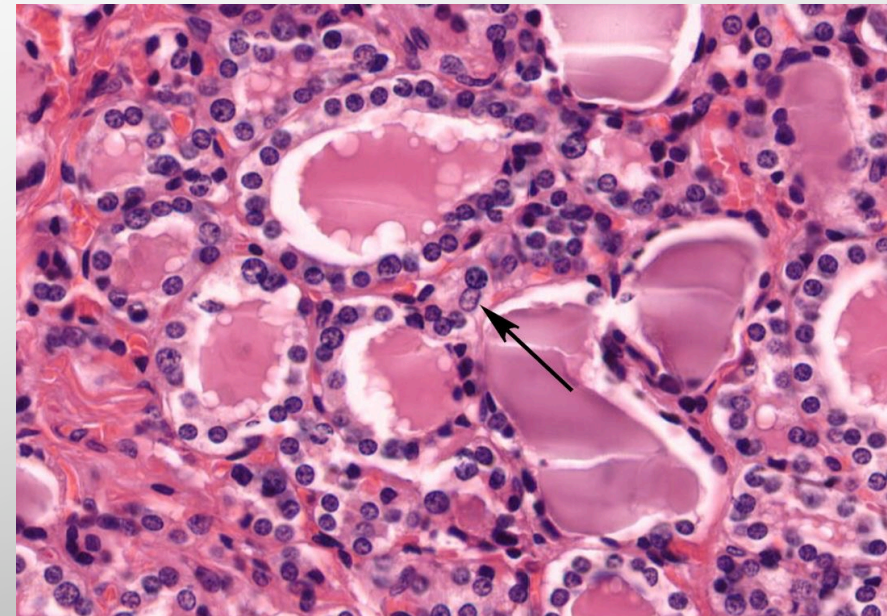
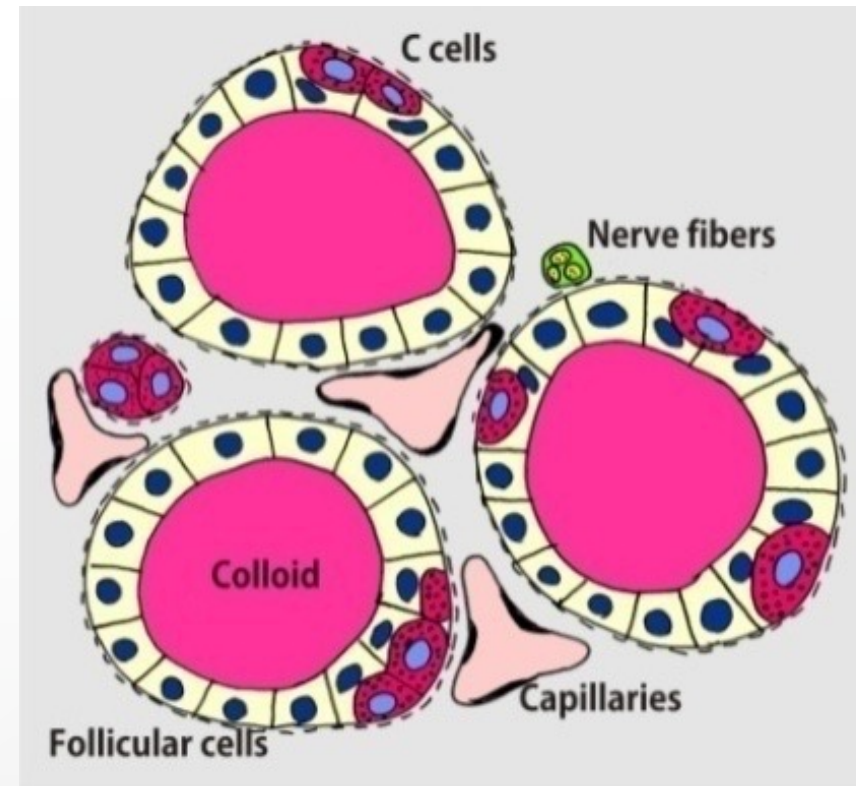
(c-e) Thyrocytes (T) from parafollicular C cells (C) by their smaller size and darker staining properties

Thyroid Follicular Cells And Parafollicular Cells.

- Is covered by a fibrous capsule--- septa.
- Follicles are densely packed together--- sparse reticular connective tissue.
- Stroma is very well vascularized with fenestrated capillaries.
- The follicular cells, or thyrocytes, range in shape from squamous to low columnar (activity related—TSH).
- The cells exhibit organelles indicating active protein synthesis
- The nucleus is generally round and central.
- rER are basally.
- Apically: Golgi, granules, and other organles.

Parafollicular Cells.

- Parafollicular cell (C cell), is also found inside the basal lamina of the follicular cells or as isolated clusters between follicles
- Derived from the neural crest or endoderm!!!!
- Somewhat larger than follicular cells and stain less intense.
- Smaller amount of rER, large Golgi complexes, numerous small granules containing **calcitonin**.
- Secretion of calcitonin is triggered by **elevated blood Ca^{+2}** levels, and it inhibits osteoclast activity.

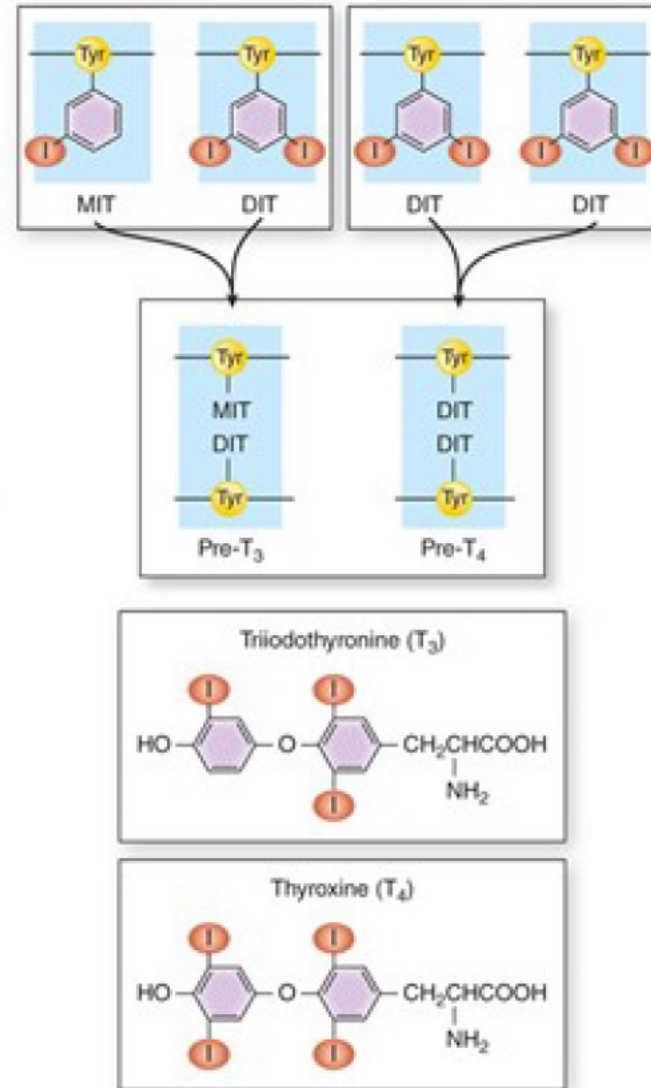
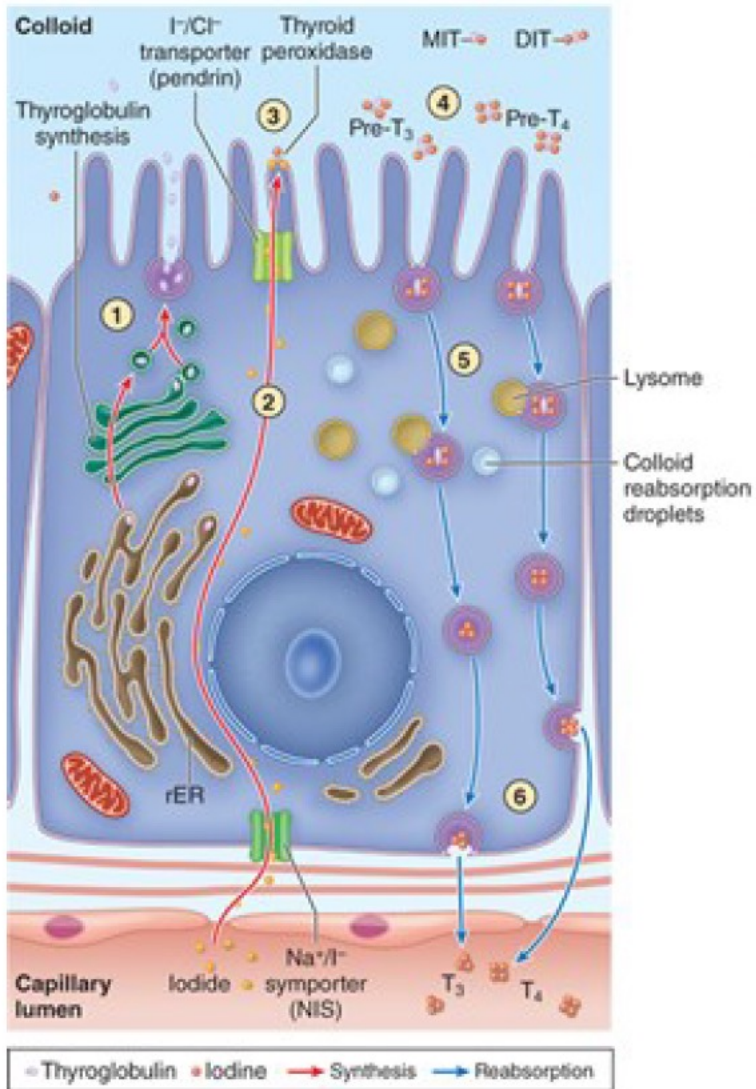


Production of thyroid hormone & its control

The major activities of this process

- The production of **thyroglobulin** (140 tyrosyl residues)
- The uptake of iodide (30-fold concentration)
- Iodination of tyrosyl residues (oxidation of iodide)
- Formation of T3 and T4
- Endocytosis of iodinated thyroglobulin (lysosomal proteases)
- Secretion of T4 and T3

Production Of Thyroid Hormones



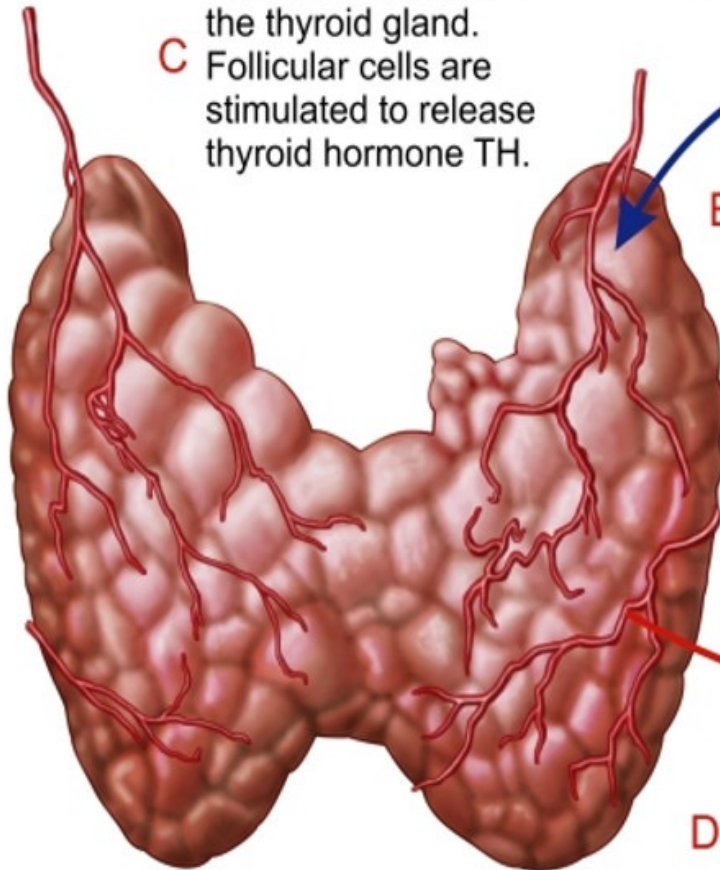
Involve an unusual, multistage process in the thyrocytes---with both an exocrine/ endocrine phases promoted by TSH. and occur in the same cell.

- The diagram shows the multistep process by which thyroid hormones are produced via the stored thyroglobulin intermediate. In an exocrine phase of
- The process, (1) the glycoprotein thyroglobulin is made and secreted into the follicular lumen and (2) iodide is pumped across the cells into the lumen.
- In the lumen (3) iodide is converted to iodine by membrane-bound thyroid peroxidase and added to tyrosine residues of thyroglobulin (4) to form monoiodotyrosine (MIT) or diiodotyrosine (DIT), which are then covalently coupled to form t3 and t4 still within the glycoprotein. The iodinated
- Thyroglobulin is then (5) endocytosed by the thyrocytes and degraded by lysosomes, (6) releasing free active T3 and T4 to the adjacent capillaries in
- An endocrine manner. Detailed steps are given in the text. Both phases are promoted by TSH and may occur simultaneously in the same cell.

Negative Feedback Loops Affecting Anterior Pituitary Secretion

Relation of Thyroid & Pituitary

→ Stimulatory
→ Inhibitory



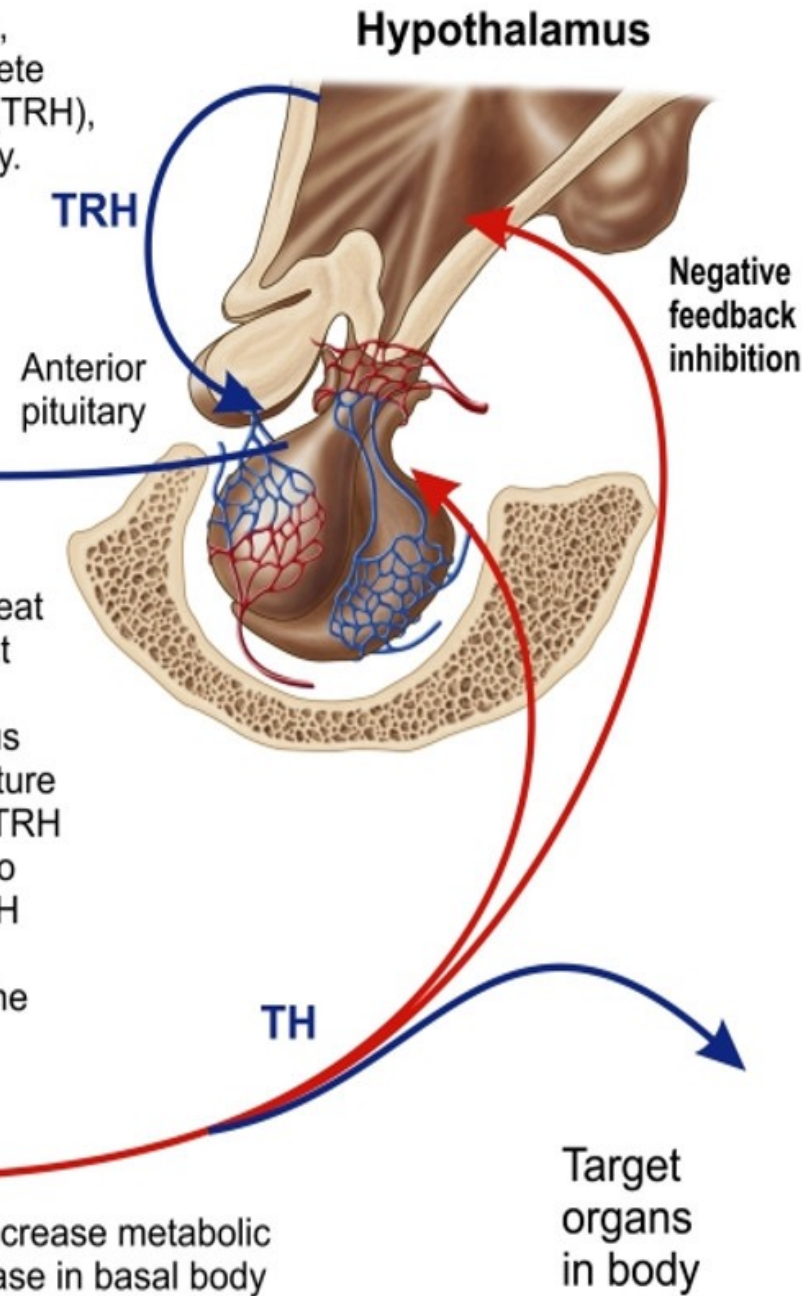
A A stimulus, low body temperature, causes the hypothalamus to secrete Thyrotropin Releasing Hormone (TRH), which acts on the anterior pituitary.

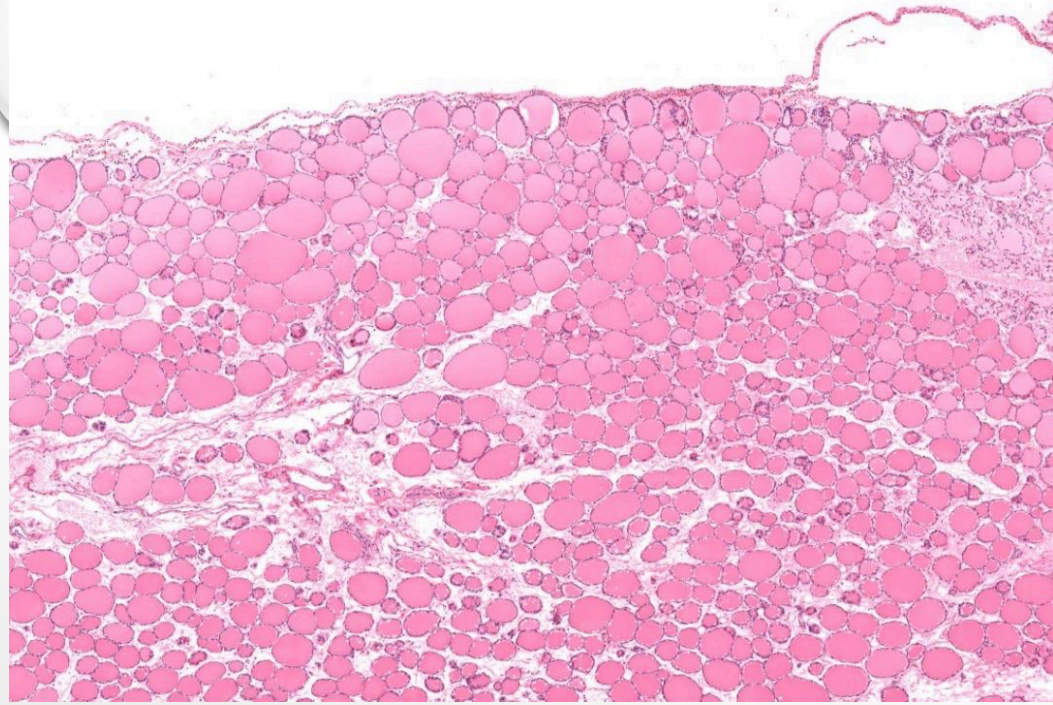
B Thyrotropic cells in the anterior pituitary are stimulated to release thyroid-stimulating hormone TSH

C TSH acts on cells of the thyroid gland. Follicular cells are stimulated to release thyroid hormone TH.

E Increased TH levels cause heat production in target cells, that increase in temperature is detected by the hypothalamus as it monitors blood temperature and inhibits the secretion of TRH by the hypothalamus. TH also blocks the interactions of TRH from the hypothalamus and anterior pituitary to prevent the formation of TSH.

D TH stimulates target cells to increase metabolic activities, resulting in an increase in basal body temperature.





THYROID: ACTIVE OR INACTIVE?

