Endocrine Block
Embryology Team

Lecture 1: Anatomy & Embryology of Thyroid and Parathyroid glands

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Red: Important
Green: Team Notes

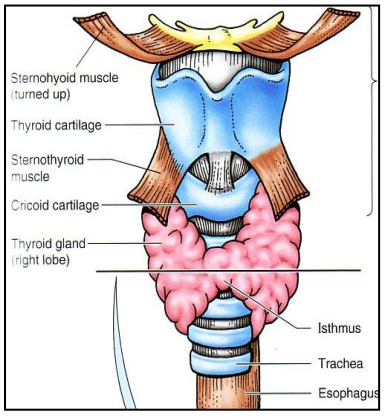
- Parts of the deep fascia or deep cervical fascia of the neck

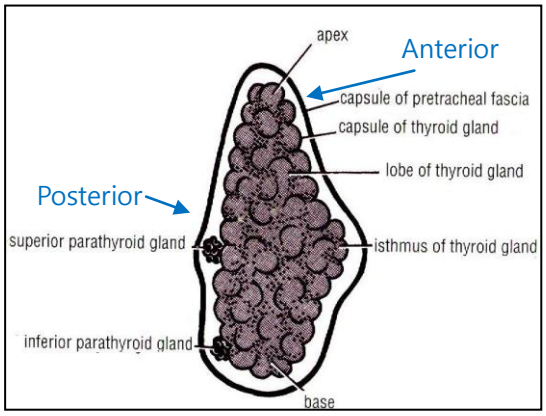
1) Investing layer. 2) Pretracheal layer. 3) Prevertebral layer.

- Pretracheal layer surrounds thyroid gland, trachea, and infrahyoid muscle.
- Prevertbral layer surrounds prevertebral muscles.

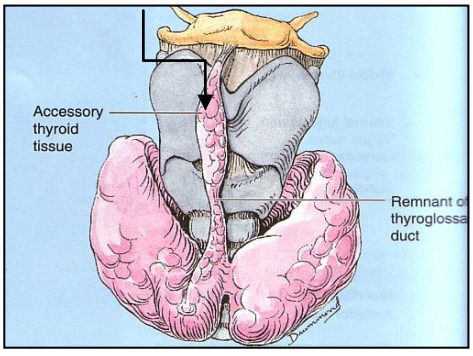
1) Thyroid Gland

- Endocrine, butterfly shaped gland.
- Consists of right & left lobes.
- The 2 lobes are connected to each other by a narrow isthmus, which overlies the 2nd 3rd & 4th tracheal rings.
- It is surrounded by a facial sheath derived from the pretracheal layer of the deep cervical fascia
- Each lobe is pear-shaped, with its apex reaches up to the oblique line of thyroid cartilage.
- Its base lies at the level of 4th or 5th tracheal rings.
- Inside the pretracheal facial capsule, there is another capsule.
- So, it s surrounded by 2 membranes.
- A 3rd small pyramidal lobe is often present which projects from the upper border of the isthmus usually to left of middle line.
- Pyramidal lobe is connected to hyoid bone by a fibrous or muscular band called levator glandulae thyroideae. This represents the fibrosed & obliterated thyroglossal duct.





Levator glandulae thyroideae



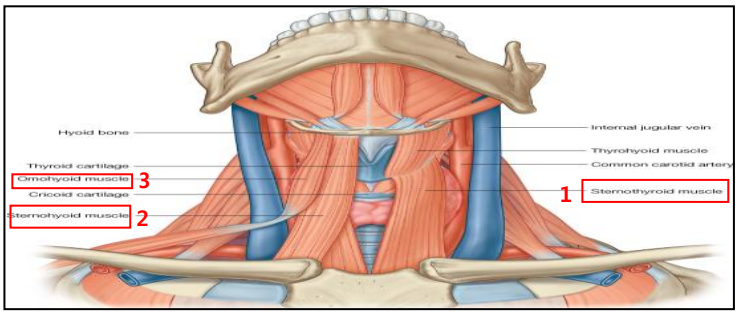
- There are two membranes sheathe:

1) Fascia (outer sheath derived from cervical fascia).
2) C.T (inner sheath surrounds the substance of gland) it is labeled in the picture as capsule of thyroid gland.

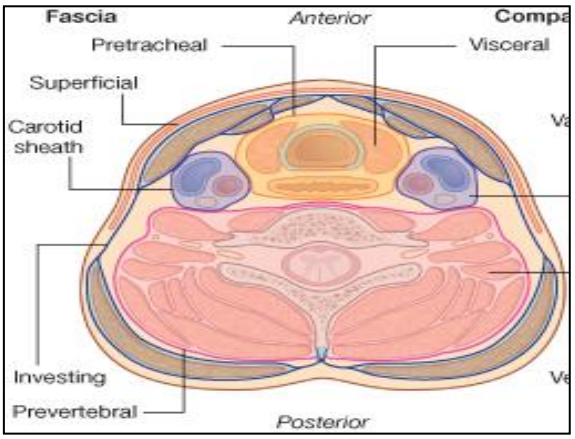
- Pyramidal lobe is present in about 50% of people.

Relations of the Thyroid Gland

1) Anterolaterally: (4 S).	2) Posteriorly:	3) Medially:	4) The rounded posterior border
1) Sternothyroid. (The deepest) 2) Sternohyoid. 3) Superior belly of omohyoid 4) Sternomastoid.	Carotid sheath & its contents	Above: ◆Larynx & pharynx . Below: ◆Trachea & esophagus. ◆ Recurrent laryngeal nerve in between. ◆ Cricothyroid muscle & external laryngeal nerve	◆ Related to the superior & inferior Parathyroid glands. ◆ It is also related to the anastomosis between superior & inferior thyroid arteries.



The carotid sheath contents are common carotid artery, internal carotid artery, internal jugular vein, and vagus



Arterial Supply

1) Superior thyroid

◆ Branch from the external carotid artery

◆ Descends to the upper pole of the lobe, with the external laryngeal nerve.

◆ Runs along the upper border of the isthmus to anastomose with its fellow of the opposite side (& the inferior laryngeal branch of the inferior thyroid artery)

3) Inferior thyroid

◆ From the thyrocervical trunk of 1st part of subclavian artery,

◆ It ascends behind the gland to the level of cricoid cartilage.

◆ Then it curves medially behind the carotid sheath.

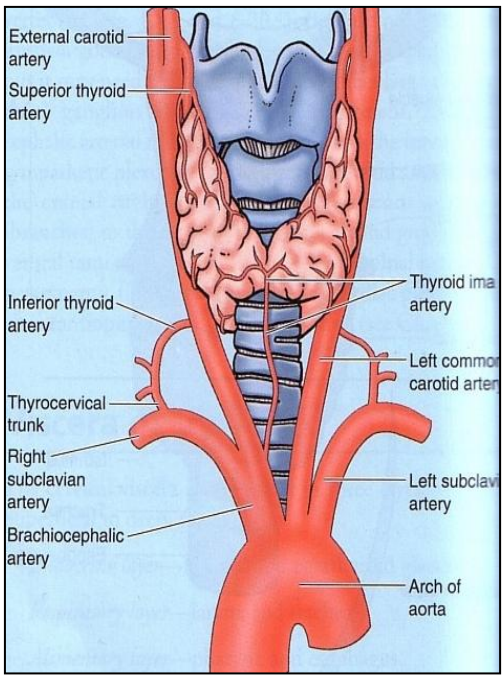
◆ Then it reaches the posterior aspect of the gland & descends downwards.

◆ The recurrent laryngeal nerve crosses either in front or behind it.

2) Thyroidea ima artery

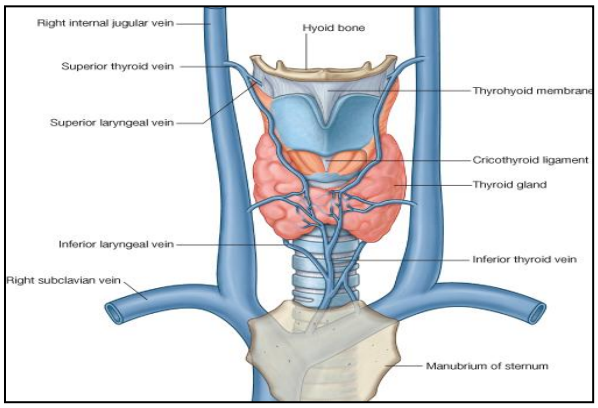
◆ If present, it arises from aortic arch or from brachiocephalic artery.

◆ It ascends in front of the trachea to reach the isthmus.



Veins of the Thyroid Gland

1) Superior thyroid vein → internal jugular vein
2) Middle thyroid vein → internal jugular vein
3) Inferior thyroid vein → left brachiocephalic vein



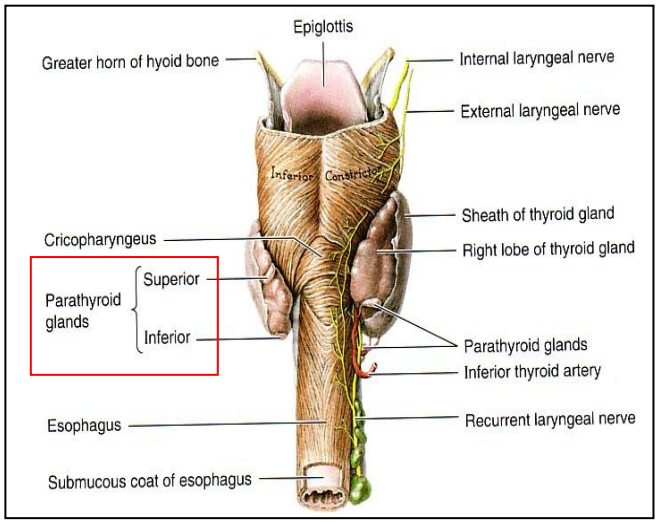
Lymph of the Thyroid Gland

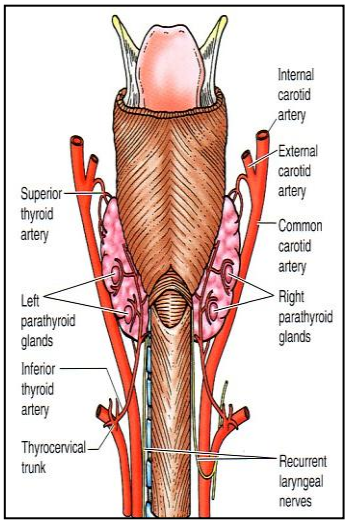
- Deep cervical & paratracheal lymph nodes.

***Deep cervical** lymph nodes found near internal jugular vein.
***Paratracheal** lymph nodes found along the side of trachea

2) Parathyroid Gland

Info	◆ 4 small ovoid bodies, about 6 mm. long. ◆ They lie within the facial capsule of the gland, (between the 2 membranes). ◆ 2 superior parathyroids: has a constant position at the middle of the posterior border of the gland. ◆ 2 inferior parathyroids: usually at the level of the inferior pole. ◆ They lie within the thyroid tissue or sometimes outside the facial capsule.
Arterial Supply	Superior & inferior thyroid arteries.
Veins	Drained to superior, middle and inferior thyroid veins.
Lymph Nodes	Deep cervical & paratracheal lymph nodes
Nerve Supply	Superior & middle cervical sympathetic ganglia.





Development of the Thyroid and Parathyroid Gland

The **head & neck** region develops from Pharyngeal Apparatus, which is formed of

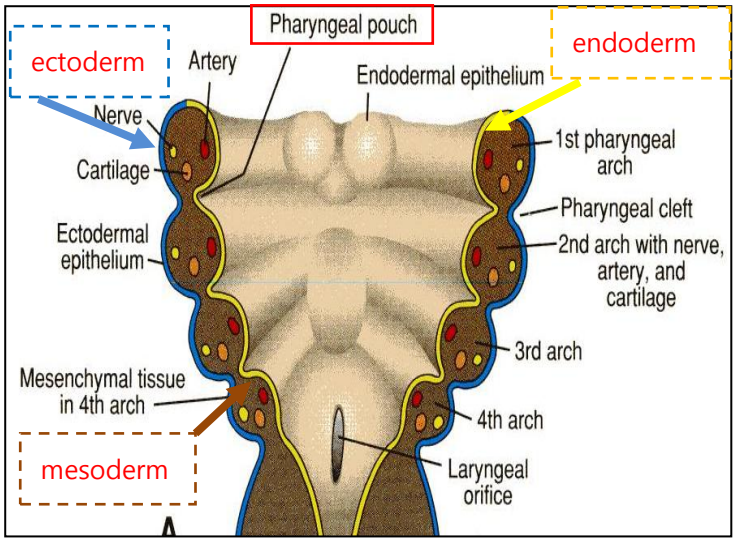
- Pharyngeal arches
- Pharyngeal pouches
- Pharyngeal grooves or clefts
- Pharyngeal membranes

Pharyngeal Apparatus

The mesoderm in the head and neck regions divided into: six cubical masses called the 6 pharyngeal or branchial arches.

Each arch is formed of:

- Core of mesoderm*
- Covered by ectoderm*
- The space between 2 arches from **outside** is called cleft or groove.

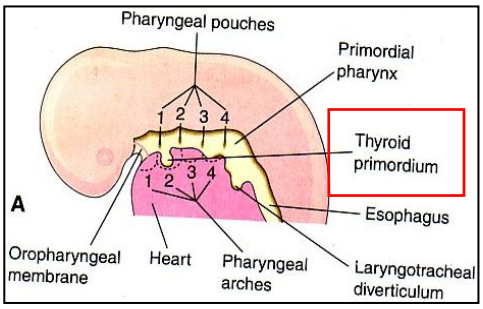


Each arch is lined from inside by

- Endoderm*
- The space between the 2 arches from **inside** is called pouch.

By the **24th day** after fertilization:

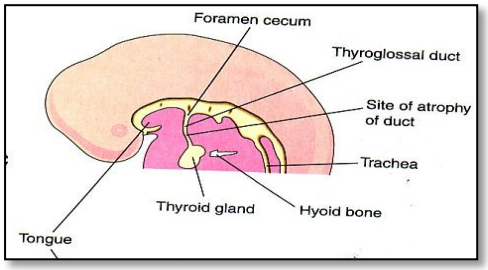
- The thyroid gland begins to develop.
- It is the first endocrine gland to develop.
- It develops from the endoderm of the floor of the primitive pharynx At the junction of: the anterior 2/3rd & posterior 1/3rd of the tongue (foramen cecum).
- It develops from the (Thyroid primordium).

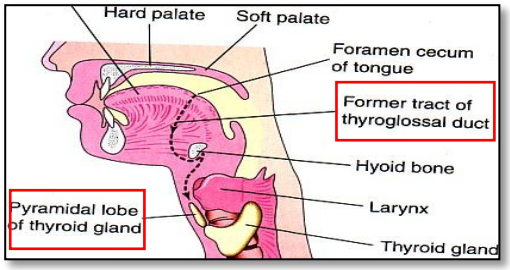


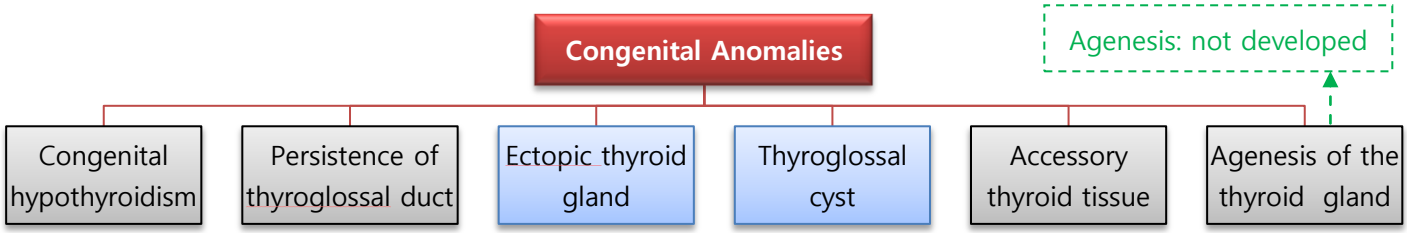
Thyroid primordium will give thyroid gland in future

- As the tongue grows, the developing thyroid gland descends downward in the neck.
- It descends anterior to the developing hyoid bone & laryngeal cartilages.
- The thyroid is connected to the developing tongue by a narrow tube, called the **thyroglossal duct**.
- At first the thyroid primordium is hollow, but soon it becomes solid & divided into 2 lobes & an isthmus.
- **By 7th week (50thday) (after fertilization)** the gland takes its final shape & position, and the thyroglossal duct begins to fibroses and degenerates.

- The upper end of the duct persists in the dorsum of the tongue as the **foramen cecum**.
- The **distal part of the duct may persist in 50**% of people to form **the pyramidal lobe.**
- The pyramidal lobe may be attached to the **hyoid bone** by fibrous or smooth muscle called **Levator glandulae thyroidae.**





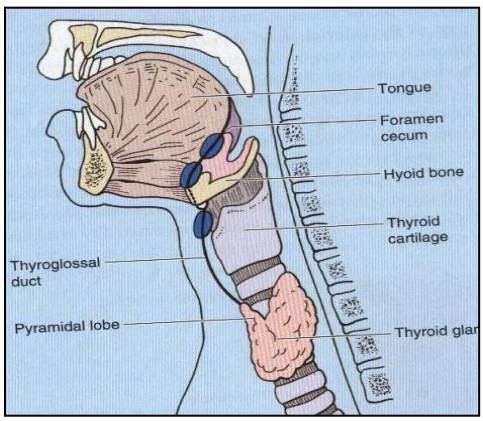


Ectopic Thyroid Gland

- The thyroid gland develops high up close to foramen cecum of the developing tongue.
- Then it descends along the thyroglossal duct to reach its final position by the 7th week.
- Descent of the thyroid could be arrested at any point, or extends down behind the sternum in the thorax

Thyroglossal Cyst

- A) Showing the possible locations of thyroglossal duct cysts at the broken line indicating the course of the duct. A thyroglossal duct sinus is illustrated.
- B) Illustrating lingual & cervical thyroglossal duct cysts.
- Most of thyroglossal duct cysts are located just inferior to hyoid bone.



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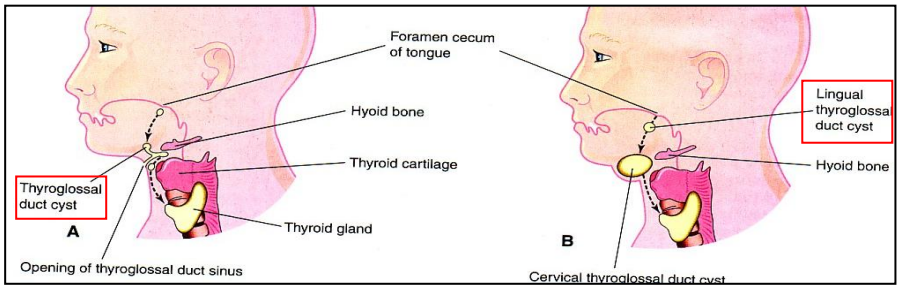
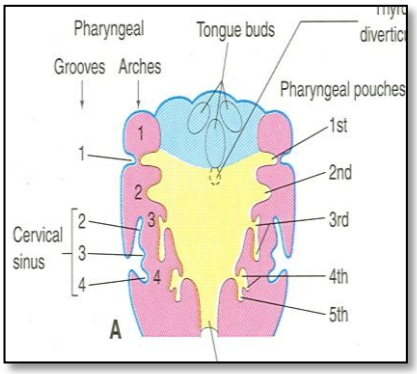


Thyroglossal Cyst

Pharyngeal Pouches



- The pairs of pouches develop in a craniocaudal sequence between the arches.
- The 1st pair of pouches lies between the 1st & 2nd pharyngeal arches.
- There are four pairs of pharyngeal pouches.
- The **fifth pair** of pouches is absent or rudimentary.

Development of the Parathyroids

By the sixth week, each of the 3rd & 4th pharyngeal pouches develop into

1) A dorsal Part

- of the 3rd pouch → inferior parathyroid bud
- of the 4th pouch → superior parathyroid bud

2) A ventral Part

- of the 3rd pouch → thymus gland primordium
- of the 4th pouch → Ultimopharyngeal body

- As the thymus primordium develops, it descends downward to the thorax, behind the sternum in superior mediastinum,
- So, it draws the inferior **parathyroid bud** to a lower level than the superior parathyroid.
- Both parathyroid glands lie behind the thyroid gland.

Clinical Notes

The 2 main arteries supplying the thyroid gland are closely related to important nerves that may be damaged during thyroidectomy operations and dissection

Cricothyroid muscle lies between cricoid & thyroid cartilages. Its function is to tense the vocal folds. So, when it is damaged, it'll cause horsiness of voice.

	Superior Thyroid Artery	Inferior Thyroid Artery (ITA)
Related Nerve	External Laryngeal Nerve	Recurrent laryngeal nerve (RLN)
Supplies	Cricothyroid muscle	-
Results of Damage to nerve (lesion)	Inability to tense the vocal folds and in hoarseness.	Impaired breathing & speech

RLN can be found in a triangle bounded:

- Laterally: by the common carotid artery,
- Medially: by the trachea,
- Superiorly: by the thyroid lobe.

The relationship of the RLN and the ITA is highly variable in that the nerve can:

- Lie deep to the artery
- Superficial to the artery,
- Or between the branches of the artery, and be different on either side of the neck.

Summary

<table>
<tr><th colspan="5">Thyroid Gland</th></tr>
<tr><td>Info</td><td colspan="4">◆ Endocrine, butterfly shaped gland
◆ It is surrounded by a facial sheath derived from the pretracheal layer of the deep cervical fascia.
◆ Inside the pretracheal facial capsule, there is another capsule.</td></tr>
<tr><td>Lobes</td><td colspan="4">◆ Consists of right & left lobes.
◆ Connected to each other by a narrow isthmus, which overlies the 2nd 3rd & 4th tracheal rings
◆ Each lobe is pear-shaped, with its apex reaches up to the oblique line of thyroid cartilage.
◆ Its base lies at the level of 4th or 5th tracheal rings.
◆ A 3rd small pyramidal lobe is often present which projects from the upper border of the isthmus usually to left of middle line.
◆ Pyramidal lobe is connected to hyoid bone by a fibrous or muscular band called levator glandulae thyroideae.
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1) Sternothyroid.
2) Sternohyoid.
3) Superior belly of omohyoid
4) Sternomastoid.</td><td>2) Posteriorly:
Carotid sheath & its contents</td><td>3) Medially:
Above:
◆Larynx & pharynx .
Below:
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◆ Recurrent laryngeal nerve in between.
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◆ Related to the superior & inferior Parathyroid glands.

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<tr><td>ARTERIES</td><td>1) Superior thyroid
◆ branch from the external carotid artery
◆ descends to the upper pole of the lobe, with the external laryngeal nerve.
◆ runs along the upper border of the isthmus to anastomosis with its fellow of the opposite side (& the inferior laryngeal branch of the inferior thyroid artery)</td><td>2) Thyroidea ima artery
◆If present, it arises from aortic arch or from brachiocephalic artery.
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◆From the thyrocervical trunk of 1st part of subclavian artery,
◆It ascends behind the gland to the level of cricoid cartilage.
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</table>

Parathyroid Gland	
Info	◆ 4 small ovoid bodies, about 6 mm. long. ◆ They lie within the facial capsule of the gland, (between the 2 membranes). ◆ 2 superior parathyroids has a constant position at the middle of the posterior border of the gland. ◆ 2 inferior parathyroids usually at the level of the inferior pole. ◆ They lie within the thyroid tissue or sometimes outside the facial capsule.
Arterial Supply	Superior & inferior thyroid arteries.
Veins	Drained to superior, middle and inferior thyroid veins.
Lymph Nodes	Deep cervical & paratracheal lymph nodes
Nerve Supply	Superior & middle cervical sympathetic ganglia.

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Emryology:

◆ The head & neck region develops from the pharyngeal apparatus

◆ They thyroid gland begins its development by the 24th day (3rd week)

◆ The thyroid gland develops from the endoderm of the primitive pharynx

◆ The developing thyroid will descend anterior to the developing hyoid bone.

◆ The gland takes its final shape & position, and the thyroglossal duct fibrosed and degenerates by 7th week (50th day)

◆ Ventral part of 3rd pouch gives the thymus primordium

◆ Dorsal part of the 3rd pouch gives inferior parathyroid bud

◆ Ventral part of the 4th pouch gives ultimobranchial body.

◆ Dorsal part of the 4th pouch develops into the superior parathyroid bud.

Time table for development of the thyroid gland	
Time	Event
24th day after fertilization	thyroid gland begins its development
7th week (50th day)after fertilization	The gland takes its final shape & position, and the thyroglossal duct begins to fibroses and degenerates.

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Dr. Sana'a's Questions

1. The isthmus of the thyroid gland overlies:

a. Thyroid cartilage.
b. 1st & 2nd tracheal ring.
c. 2nd, 3rd, 4th tracheal rings

2. The capsule of the thyroid gland is derived from:

a. Prevertebral cervical fascia.
b. Pretracheal cervical fascia.
c. Investing cervical fascia.

3. The lobe of the thyroid gland is related posteriorly to:

a. Trachea.
b. Carotid sheath.
c. Sternomastoid muscle.

4. Which muscle is related anterolaterally to the thyroid gland?

a. Inferior belly of omohyoid.
b. Superior belly of digastric.
c. Thyrohyoid.
d. Sternothyroid

5. The common site of the developing congenital thyrocervical cyst is:

a. Superior to the hyoid bone.
b. Inferior to hyoid bone.
c. In the thorax.
d. Sublingual.

6. Inferior parathyroid gland develops from:

a. 1st pharyngeal arch.
b. 2nd pharyngeal arch.
c. 3rd pharyngeal pouch.
d. 4th pharyngeal pouch.

7. Superior parathyroid gland develops from:

a. 2nd pharyngeal pouch.
b. 3rd pharyngeal pouch.
c. 4th pharyngeal pouch.
d. 4th pharyngeal arch.

8. During thyroidectomy operation, which nerve is damaged in relation with superior thyroid artery?

a. Internal laryngeal.
b. External laryngeal.
c.. Recurrent laryngeal

Answers: 1)C 2)B 3)B 4)D 5)B 6)C 7)C 8) B

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