



◉ Presented by:

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DERIVATIVES OF BRANCHIAL APPARATUS

Normal Development

The branchial apparatus, which contributes to formation of the head and neck, consists of paired

- ◉ branchial arches
- ◉ pharyngeal pouches
- ◉ branchial grooves and
- ◉ branchial membranes.
- ◉ The branchial arches form along the lateral primitive pharynx.
- ◉ Each arch consists of a mesenchymal core (containing **neural crest cells** and arterial, nerve, cartilage, and muscular elements)

- ◉ Each arch is separated by branchial membranes and covered externally by surface ectoderm (branchial grooves) and internally by endoderm (pharyngeal pouches).
- ◉ The primitive mouth (stomodeum) arises from the surface ectoderm in contact with the amniotic cavity externally and the primitive gut internally via the esophagus (after rupture of the primitive buccopharyngeal membrane).

- ◉ The tongue buds are mesenchymal proliferations derived from the first pair of branchial arches.
- ◉ The salivary glands begin as solid proliferations from epithelial buds.
- ◉ The developing thyroid gland is a diverticulum connected by the thyroglossal duct ventral to the hyoid to the tongue base at the foramen cecum.

- ◉ The thyroglossal duct normally involutes.
- ◉ The thymus and inferior parathyroid originate from the third pharyngeal pouch.
- ◉ The superior parathyroid glands arise from the fourth pharyngeal pouch.
- ◉ The laryngotracheal groove and tracheoesophageal folds form to become the ventral laryngotracheal tube and dorsal esophagus.

- ◉ The neck is divided by the hyoid bone into the suprahyoid and infrahyoid regions.
- ◉ Three layers of deep cervical fascia divide the suprahyoid neck into eight compartments (parapharyngeal space, pharyngeal mucosal space, masticator space, parotid space, retropharyngeal space, perivertebral space, and posterior cervical space).

- ◉ The adenoids become conspicuous within the nasopharynx by 2 to 3 years of age and regress during adolescence.
- ◉ If no adenoidal tissue is seen in a young child, and in the absence of prior adenoidectomy, the possibility of immunodeficiency should be considered.

Branchial arches

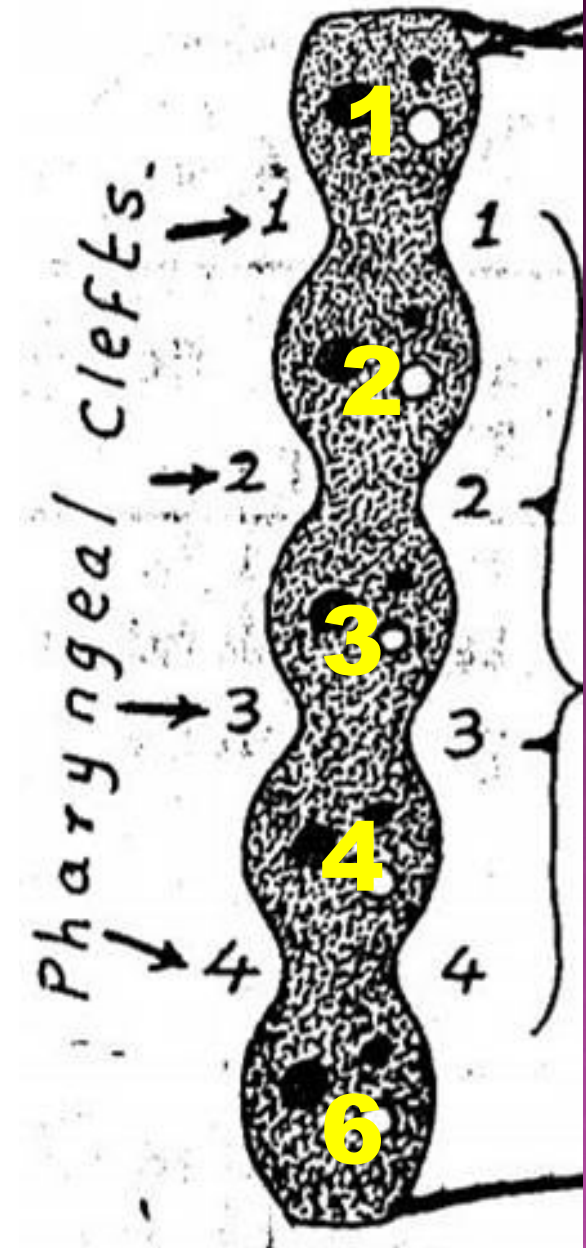
- ◉ The branchial apparatus consists of four branchial arches visible on the surface of the embryo, as well as fifth and sixth arches that cannot be seen on the surface.
- ◉ Branchial pouches and clefts are likewise numbered craniocaudally .

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Pharyngeal arches

The pharyngeal (branchial) apparatus

- ❖ It is formed of the arches, clefts and pouches.
- ❖ The **mesoderm in the region of the future neck** between the surface ectoderm and endoderm of the wall of the primitive pharynx condenses and form **6 C-shaped masses called pharyngeal arches** (in front and on each side of the pharynx). The fifth is degenerated.
- ** **These mesodermal arches are separated from each other by 4 grooves:**
 - * **External ectodermal grooves: pharyngeal clefts.**
 - * **Internal endodermal grooves: pharyngeal pouches.**



Pharyngeal pouches

First pharyngeal arch

A) Cranial nerve: Mandibular nerve of trigeminal nerve (V)

B) Blood vessels: maxillary artery

C) Skeletal structures:

1. **Maxillary process** gives rise to (**MZIP**) **M**axilla, **Z**ygomatic, **P**alatine bones and **I**ncus of the middle ear.

2. **Mandibular process** (Mackle's cartilage) gives rise to (**3M**) **M**andible, **M**astoid process and **M**alleus of the middle ear.

D) Muscles: supplied by mandibular nerve

1) **Muscles of mastication** (temporalis, masseter, lateral and medial pterygoids),

2) **Tensor** palate and **tensor** tympani.

3) **Mylohyoid** and **anterior** belly of the digastric.

E) Joints: Temporomandibular joint.

F) Ligaments: **SAT**, Sphenomandibular ligament, Anterior ligament of malleus, Tempromandibular ligament.

Second pharyngeal arch

A) Cranial nerve: Facial nerve (VII)

B) Blood vessels: Stapedial artery (embryonic), Caroticotympanic(adult).

C) Skeletal structures: 3S

1- **Stapes** of the middle ear.

2- **Styloid** process.

3- **Lesser** horn and upper 1/2 of hyoid bone.

D) Muscles: supplied by the facial nerve

1- Muscles of the **facial** expression.

2- **Large muscles of the face** (orbicularis oculi, orbicularis oris, buccinator).

3- Muscles of the **auricle**.

4- **Platysma**.

5- Occipitofrontalis muscle of the **scalp**.

6- **Posterior** belly of digastric and **stylohyoid**.

7- **Stapedius**.

E) Ligaments: 2S Stylohyoid ligament and stylomandibular ligament.

Third pharyngeal arch

- A) Cranial nerve:** Glossopharyngeal nerve (IX)
- B) Blood vessels:** Common **carotid**, internal **carotid** and external **carotid** arteries.
- C) Skeletal structures:** Lower 1/2 of the hyoid bone and greater horn.
- D) Muscles:** Stylopharyngeus muscle.

Fourth pharyngeal arch

- A) Cranial nerve:** Superior laryngeal nerve of vagus (X)
- B) Blood vessels:** 1- **Left** side, **Arch of aorta**.
2- **Right** side, **right subclavian artery**
- C) Skeletal structures:** Laryngeal cartilages,
1- **Epiglottis**.
2- Upper 2/3 of the **thyroid** cartilage.
3- **Cuneiform** cartilage.
- D) Muscles:** Cricothyroid muscle supplied by external laryngeal nerve.

Single

Paired

Epiglottis

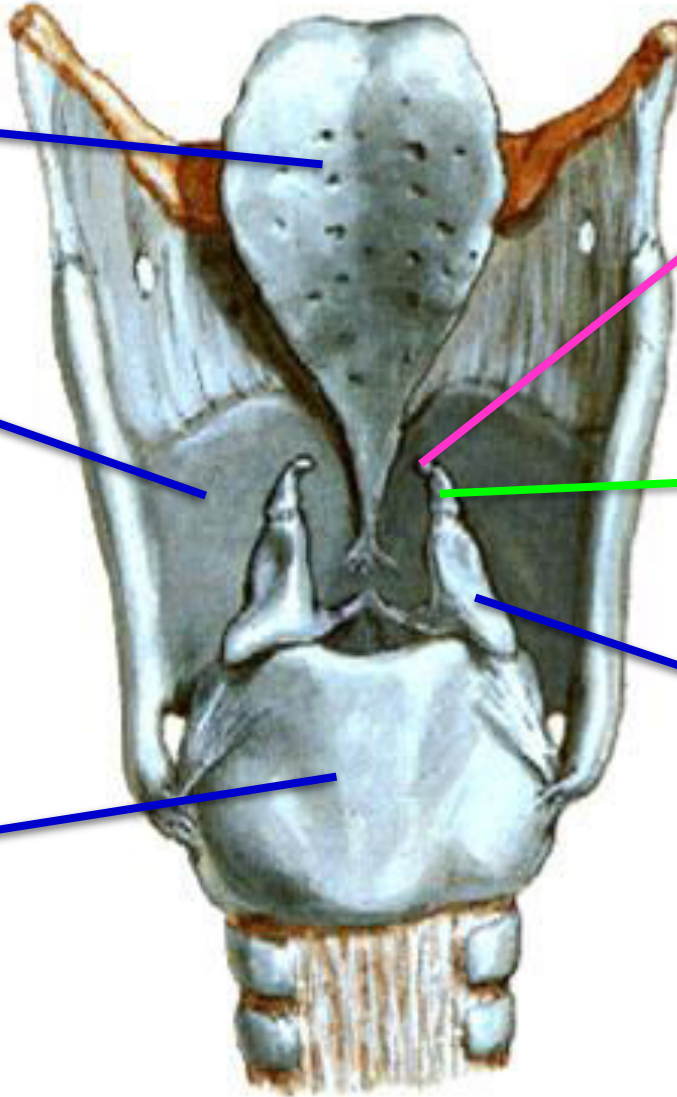
**Cuneiform
cartilage**

Thyroid

**Corniculate
cartilage**

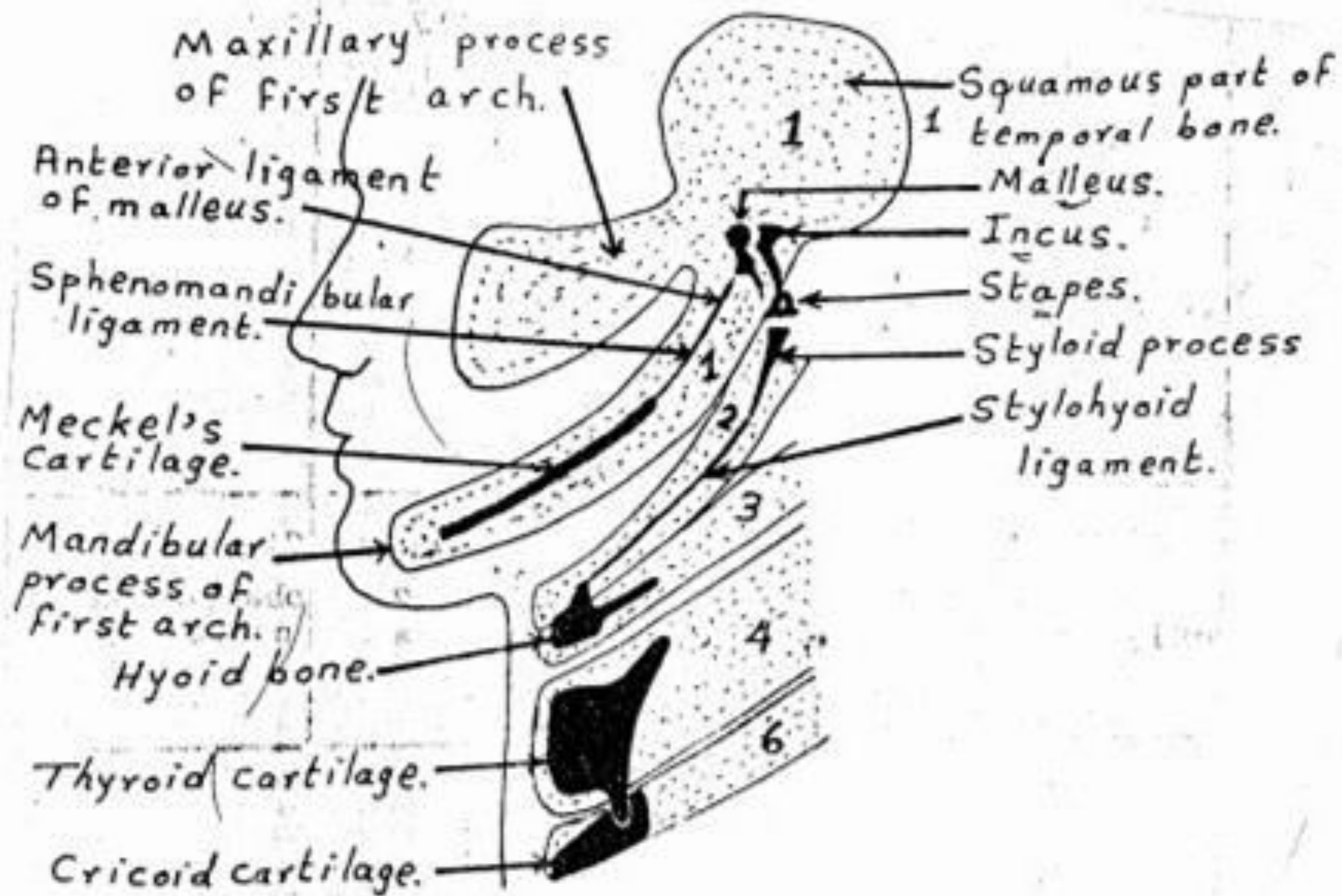
Cricoid

Arytenoid



Sixth pharyngeal arch

- a- Cranial nerve:** Recurrent laryngeal nerve of vagus (X)
- b- Blood vessels:** 1- **Pulmonary arteries** on **both sides**.
2- **Ductus arteriosus** on **left** side.
- c- Skeletal structures:** Lower 1 /3 of the thyroid cartilage, cricoid, **arytenoid** and corniculate cartilages.
- d- Muscles:** All intrinsic muscles of larynx except cricothyroid.
- e- Joints:** cricothyroid and cricoarytenoid joints.



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Pharyngeal Pouches

Derivatives of the pharyngeal pouches

- **1st pouch gives tubotympanic** recess that forms the mucous membrane of the **Eustachian tube, tympanic cavity, and tympanic membrane.**
 - This explains the connection of the tympanic cavity with the nasopharynx.
- **2nd pouch,** it develops the **palatine tonsils.**
- **3rd pouch** gives rise to
 - 1) Most of the **thymus** gland. 2) **Inferior** parathyroid gland.
- **4th pouch** gives rise to
 - 1) Small part of the **thymus** gland
 - 2) **Superior** parathyroid gland.
 - 3) **Parafollicular cells of the thyroid gland**
which are the source of calcitonin that responsible for regulation of the calcium level in the blood.

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Pharyngeal Clefts

Derivatives the pharyngeal clefts

❖ The 1st pharyngeal cleft:

- It forms the **skin** of the **external auditory canal** and **outer layer of the tympanic membrane**.

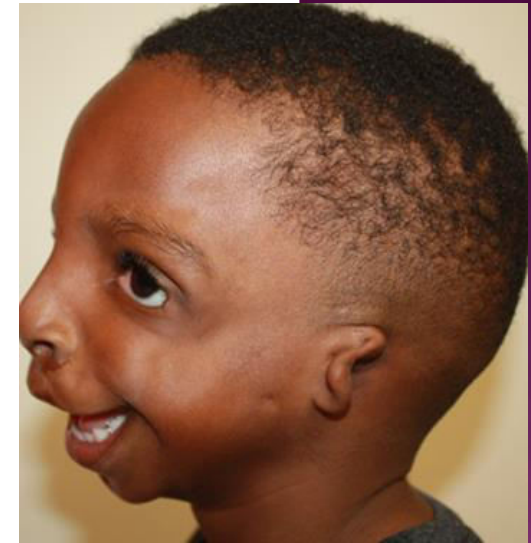
❖ The remaining clefts

are covered externally by the **downward growth of the 2nd pharyngeal arch (platysma)** to form the smooth neck.

**** Congenital anomalies of the first pharyngeal arch:**

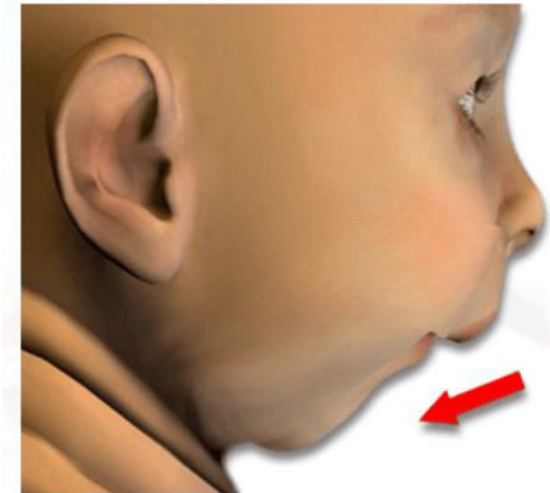
- **Treacher-Collins syndrome**

- Abnormalities of the ear.
- Hypoplasia of the mandible.
- Defect of the lower eye lid.



- **Pierre Robin syndrome**

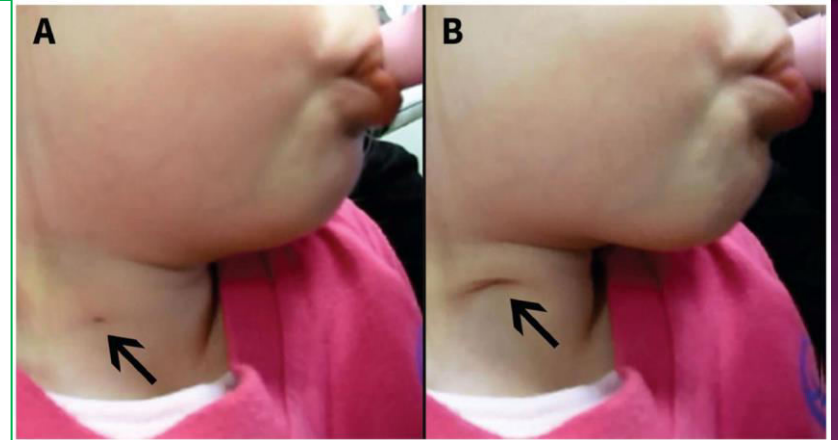
- Abnormalities of the ear and eye.
- Hypoplasia of the mandible.
- Cleft palate.
- a tongue that falls back in the throat, and difficulty breathing



**** Congenital anomalies of the pharyngeal clefts**

- **Branchial sinus;**

- It develops when the 2nd pharyngeal arch fails to cover all the pharyngeal clefts. Its opening is found at the anterior border of sternomastoid muscle.



- **Branchial cyst**



- **Branchial fistula:**

- The cyst opens on the external surface.



THANK YOU