

## A77 - Pharyngeal Apparatus, Face, and Neck Development

- Pass 1 - rewatch lecture
- Pass 2 - complete LO breakdown
- Pass 3 - make Quizlet
- Pass 4 - once through Quizlet
- Pass 5 - practice questions

### Learning Objectives

- Summarize the adult derivatives of the pharyngeal arches, pouches, and grooves
- Describe the embryological primordia, development, and morphogenesis of the thyroid gland and tongue
- Identify the critical developmental processes and structures involved in developing the face and palate

A 25-year-old patient presents with congenital deafness in her left ear. Exploratory surgery reveals that the malleus is lacking. Normally, this bone is formed from which of the following pharyngeal arch cartilages?

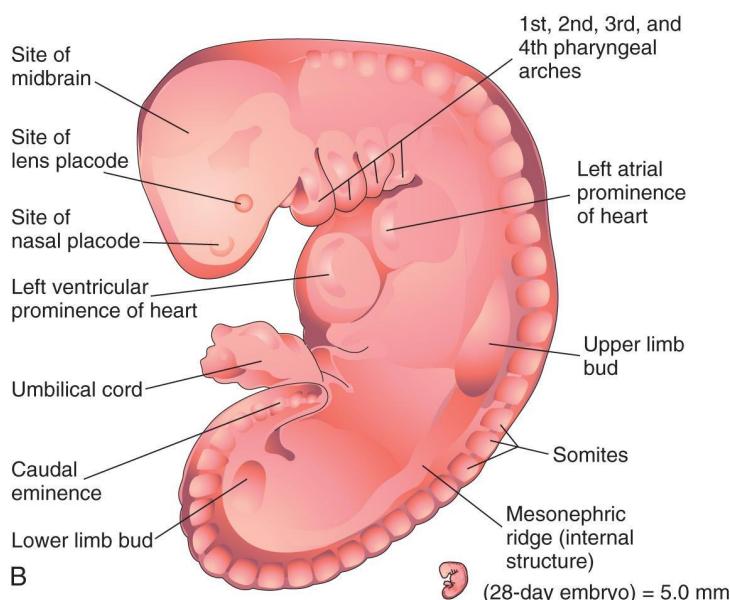
- a. First
- b. Second
- c. Third
- d. Fourth
- e. Fifth

### Discussion

The first pharyngeal arch gives rise to the following bones: maxilla, mandible, malleus and incus, zygomatic, part of temporal.

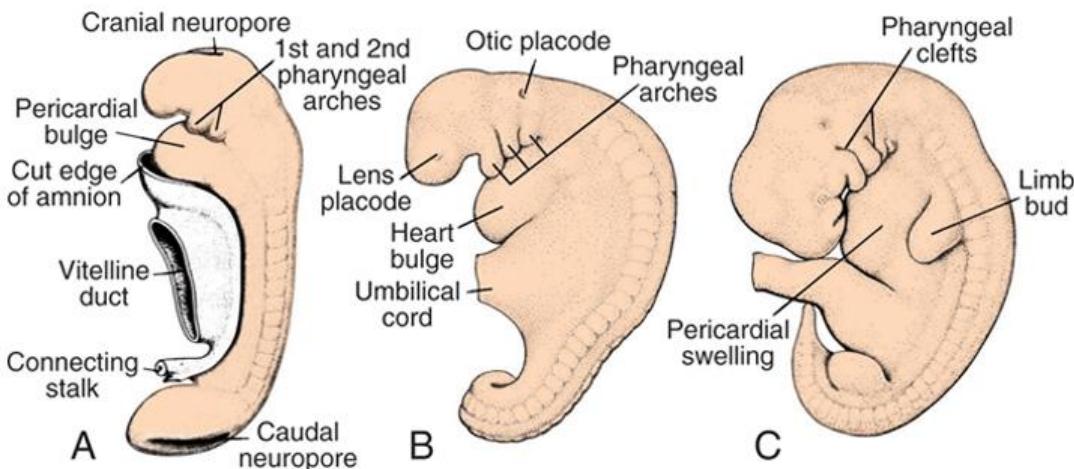
### Pharyngeal Arch Derivatives

- Embryologically, there is an overlap of several structures
  - Pharyngeal or branchial apparatus
    - Occipital bones
    - Muscles of tongue
    - Hypoglossal nerve
  - Cervical somites
    - Cervical vertebra
    - Muscles of neck
    - Cervical spinal nerves
  - Neural crest cells

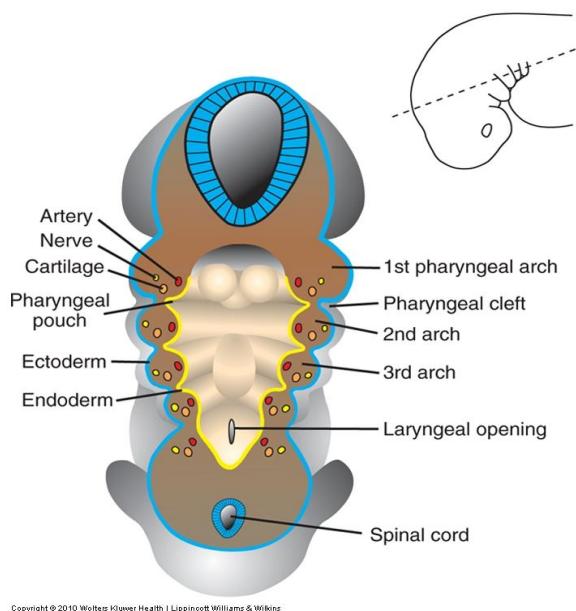


### ● Pharyngeal (Branchial) Apparatus

- Evolutionary history
  - Related to gill system of fishes
- Pharyngeal (branchial) arches
  - 4th to 5th week
  - Derived from all 3 germ layers
    - Consists of core of mesenchyme
    - Outer ectoderm
    - Inner endodermal epithelium
  - Five pharyngeal arches
    - Artery
    - Cartilaginous part
    - Muscle component
    - Cranial nerve



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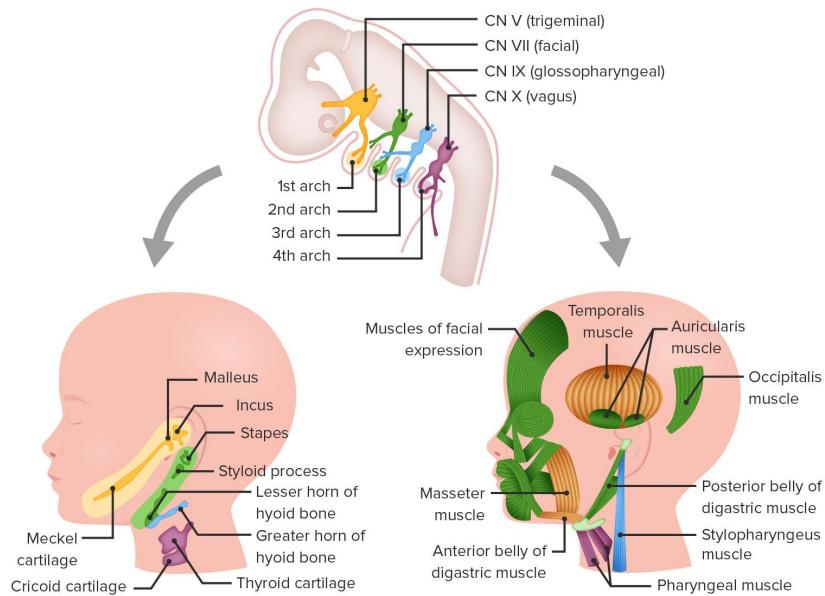


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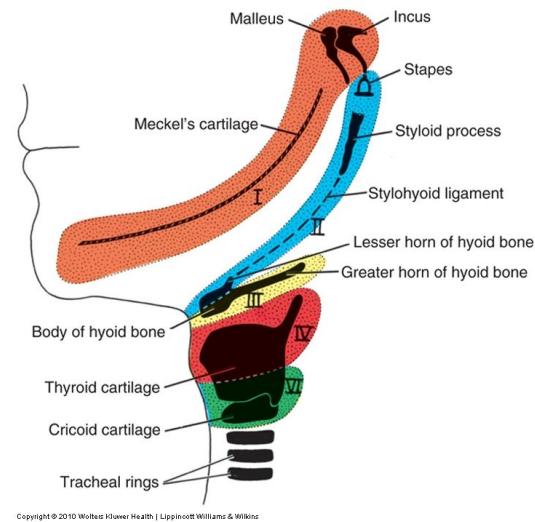
- First Arch

- Dorsal maxillary process and ventral mandibular process
- Muscles
  - Muscles of mastication
  - Mylohyoid
  - Anterior belly of digastric
  - Tensor tympani
  - Tensor veli palatini
- Bones
  - Maxilla
  - Mandible
  - Malleus and incus
  - Zygomatic

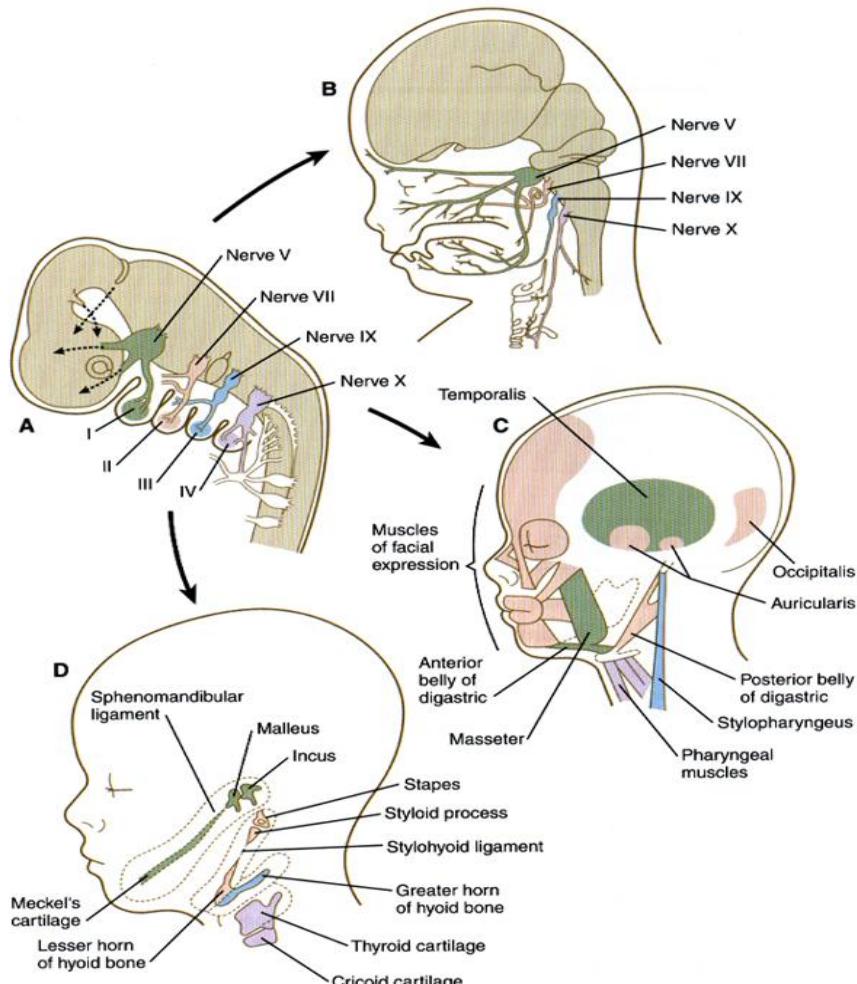
- Part of temporal
- Nerves
  - V2 - maxillary
  - V3 - mandibular



- Second Arch
  - Muscles
    - Muscles of facial expression
    - Stylohyoid
    - Posterior belly of digastric
    - Stapedius
  - Bones
    - Stapes
    - Styloid process
    - Lesser cornu
    - Upper hyoid
  - Nerves
    - Facial nerve
- Third Arch
  - Muscle
    - Stylopharyngeus
  - Bones
    - Greater cornu
    - Lower hyoid
  - Nerve
    - Glossopharyngeal nerve



- Fourth Arch
  - Muscles
    - Cricothyroid
    - Levator palatini
    - Constrictors of pharynx
  - Fuses cartilage with 6th arch to form cartilages of larynx
  - Nerves
    - Superior laryngeal branch of vagus
- Fifth Arch - exists only for transient period
- Sixth Arch
  - Muscles
    - Intrinsic muscles of larynx
  - Fuses cartilage with 4th arch to form cartilages of larynx
  - Nerves
    - Recurrent laryngeal branch of vagus



**FIGURE 14-22** Pharyngeal arch system (**A**) and adult derivatives of the neural (**B**), muscular (**C**), and skeletal (**D**) components of the arches. *Human Embryology and Developmental Biology*, Carlson, p340

- Pharyngeal pouches

- First Pouch

- Diverticulum → tubotympanic recess
  - External auditory meatus
- Proximal
  - Auditory tube
- Distal
  - Middle ear tympanic cavity

- Second Pouch

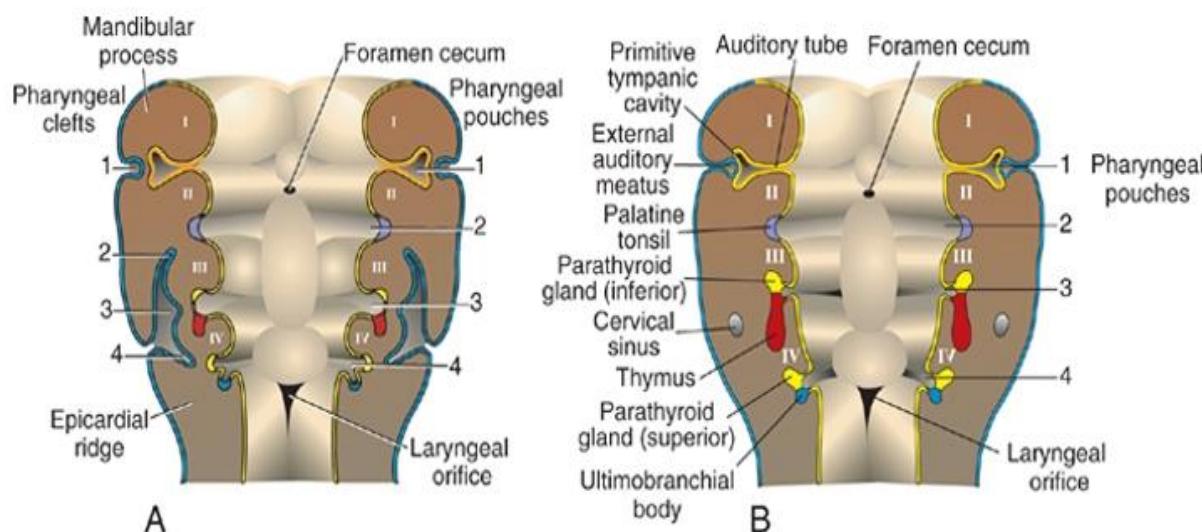
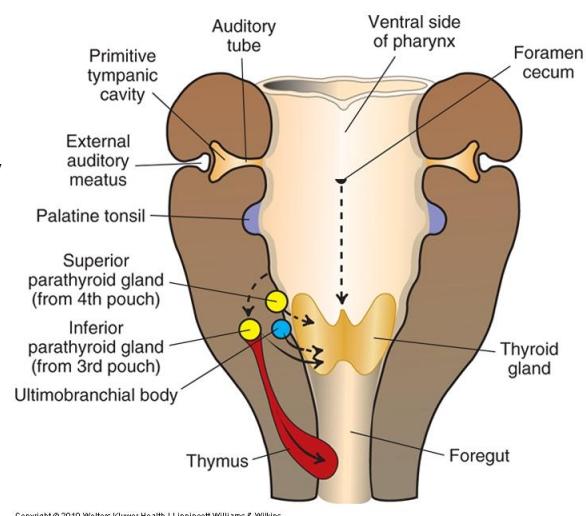
- Palatine tonsils and fossa
- Lymphatic tissue: 3-5 months

- Third Pouch

- Dorsal wing
  - Inferior parathyroid glands
- Ventral wing
  - Thymus

- Fourth Pouch

- Dorsal wing
  - Superior parathyroid gland
- Ventral wing
  - Ultimobranchial body



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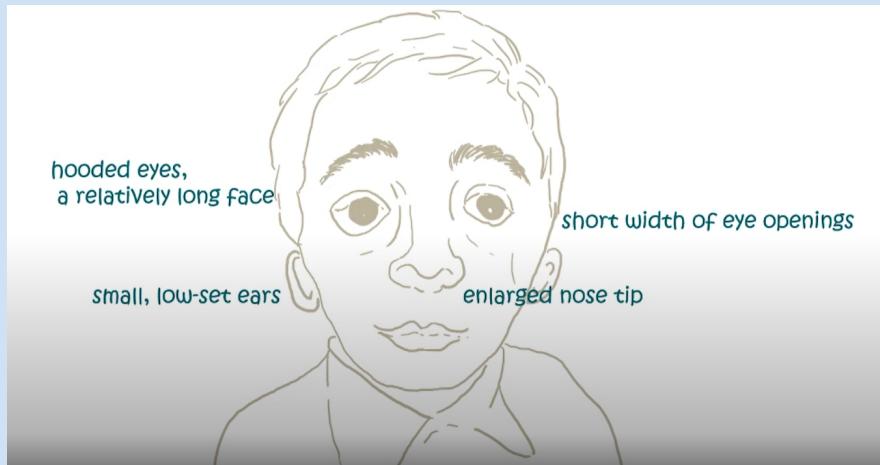
### Clinical Correlates: DiGeorge Syndrome

#### Cause

- Failure of differentiation of 3rd and 4th pouches
  - Microdeletion in q11.2 region of chromosome 22

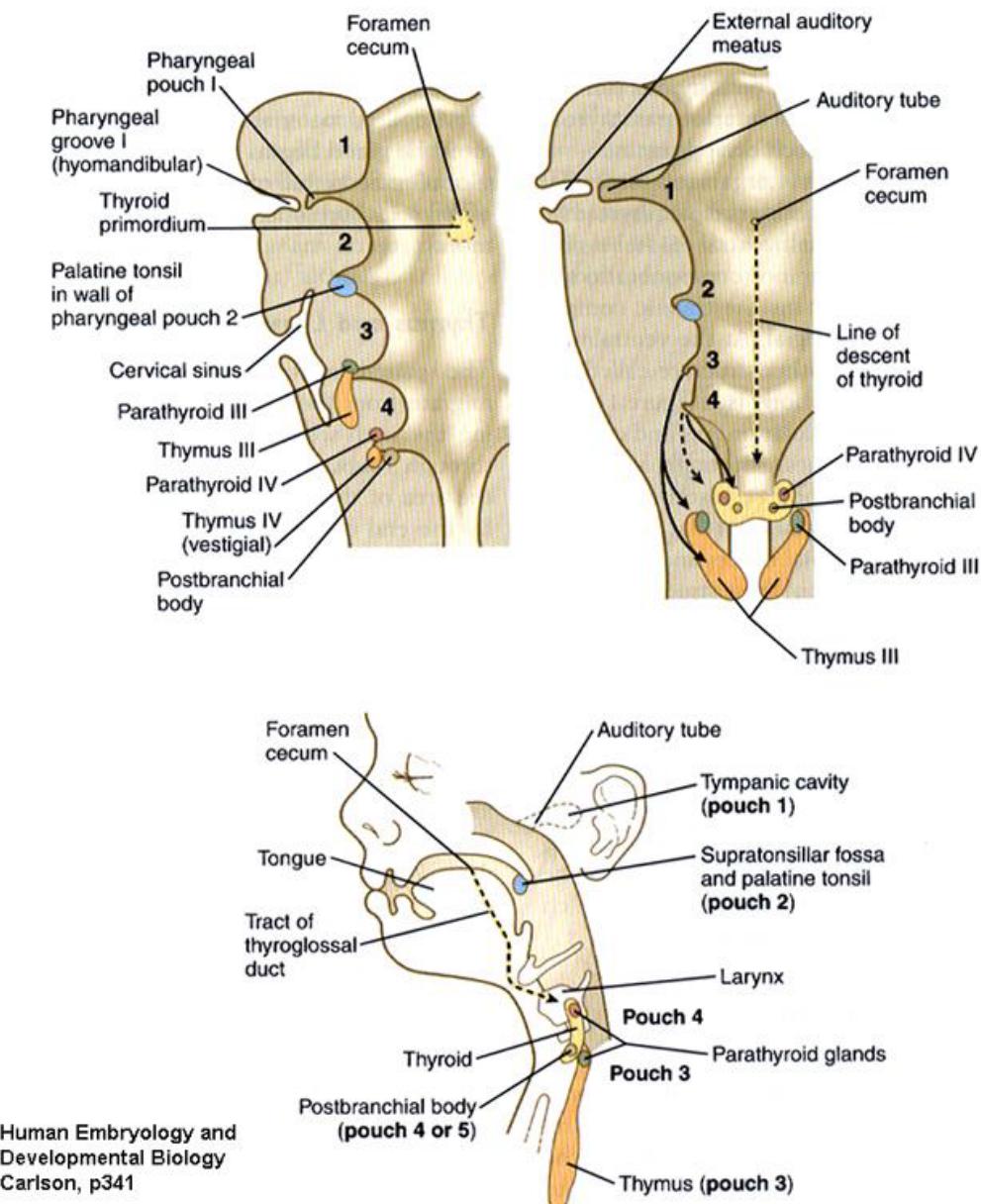
Infants born without thymus and parathyroid gland

- Incurs facial anomalies, thyroid hypoplasia, congenital hypoparathyroidism, and cardiac abnormalities



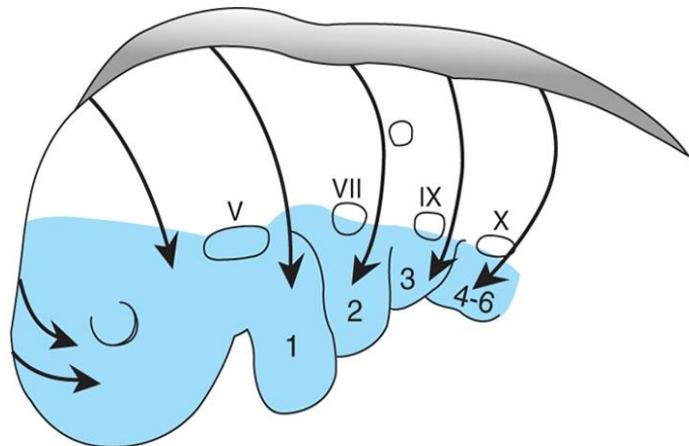
Schoenwolf et al; Larsen's Human Embryology, 4th Edition.  
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- Pharyngeal clefts
  - Four Total
  - @ five weeks, only dorsal part of first cleft remains
    - Becomes external auditory meatus
  - As second arch grows
    - It overlaps with third and fourth arch as well as clefts 2, 3, and 4
    - Fused inferior clefts eventually close and form cervical sinus

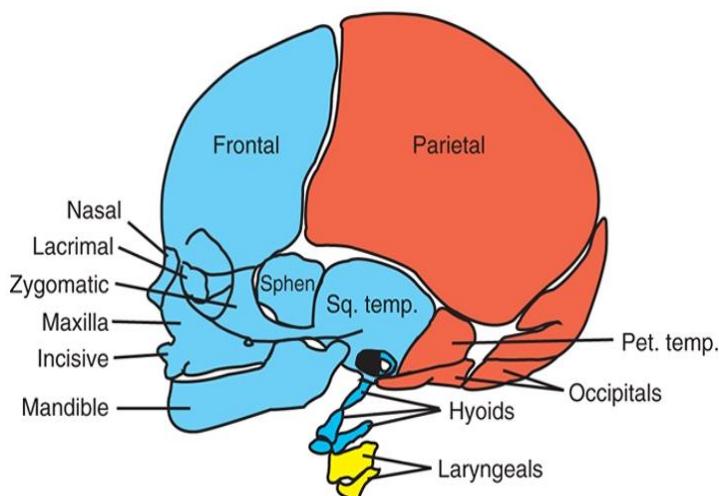


**FIGURE 14-23** Embryonic origins and pathways of primordia of glands derived from the pharyngeal pouches and the floor of the pharynx.

- Neural Crest Cells
  - Migrate into arches
    - Forms skeletal elements of face and nervous tissues
  - Together with cells from ectodermal placodes form cranial nerves
    - 5 - trigeminal
    - 7 - facial
    - 9 - glossopharyngeal
    - 10 - accessory
  - Forms dermis and hypodermis of face and neck



- Skeletal Elements of Face and Head
  - Neural crest cells
    - Skeletal structures of face
  - Paraxial mesoderm
    - Skeletal structures of head
      - All voluntary muscles of head
  - Lateral plate mesoderm
    - Cartilages of larynx



- Differentiation of Facial Components

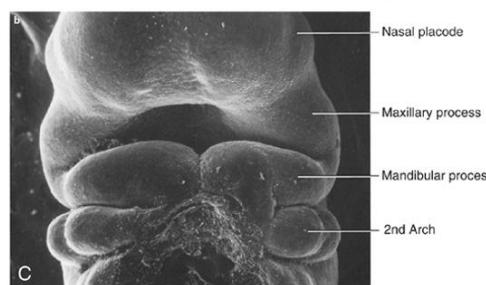
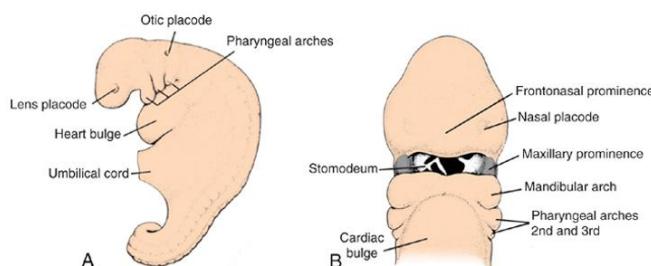
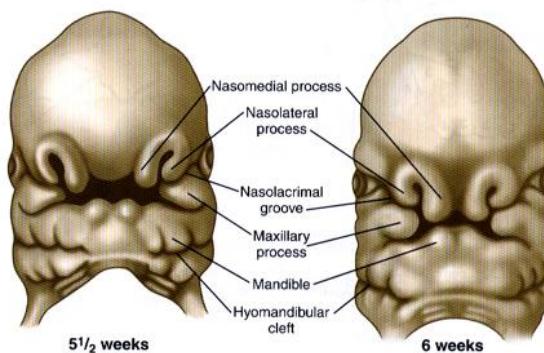
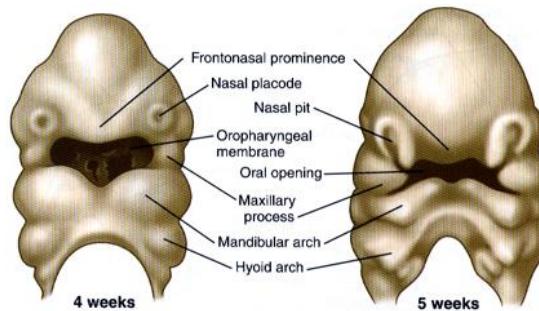
- Mouth and lip

- 4th week

- Stomodeum
- Five facial prominences
- Nasal placodes

- 5th week

- Nasal placodes invaginate
- Maxillary prominences grow
- Forms upper lip



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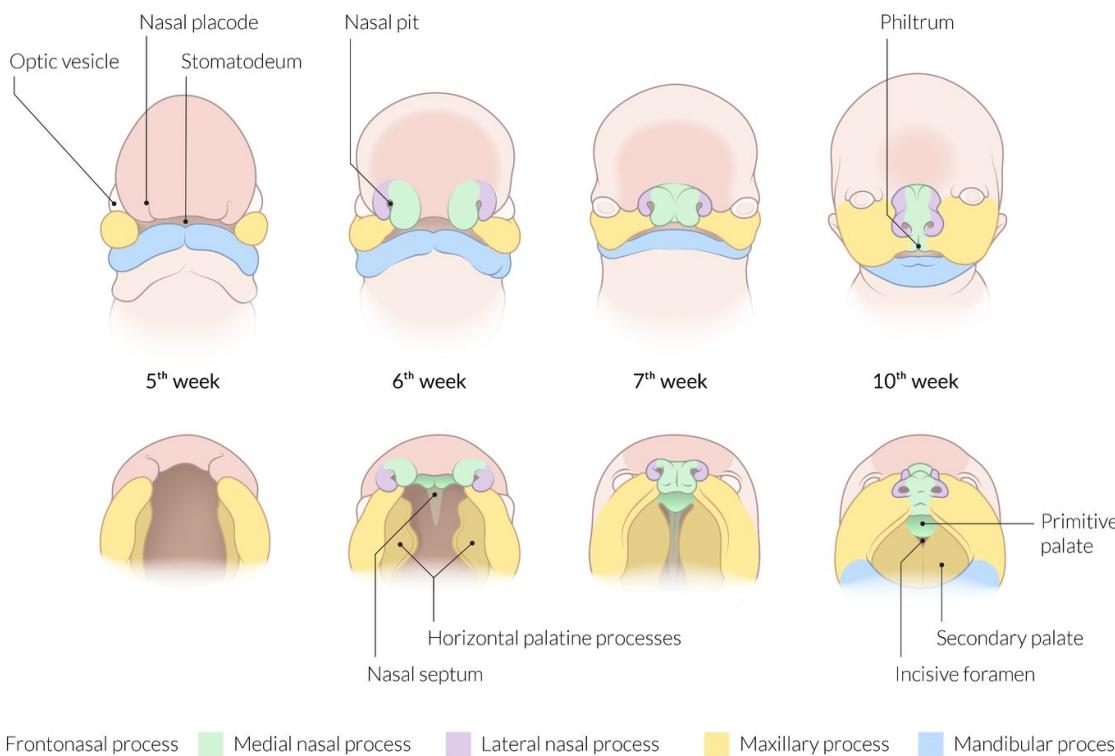
### Clinical Correlates: Lateral Cleft Lip

#### Types

- Unilateral
- Bilateral

#### Cause

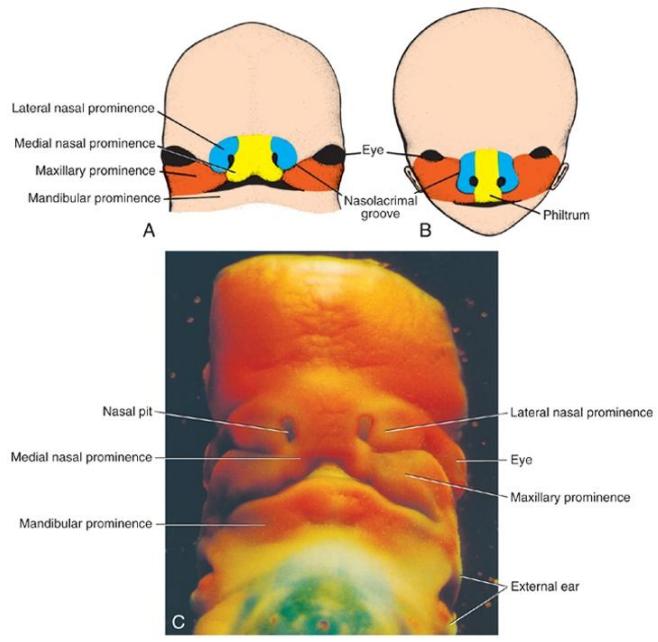
- Partial or complete lack of fusion of maxillary prominences with one or both medial nasal prominences



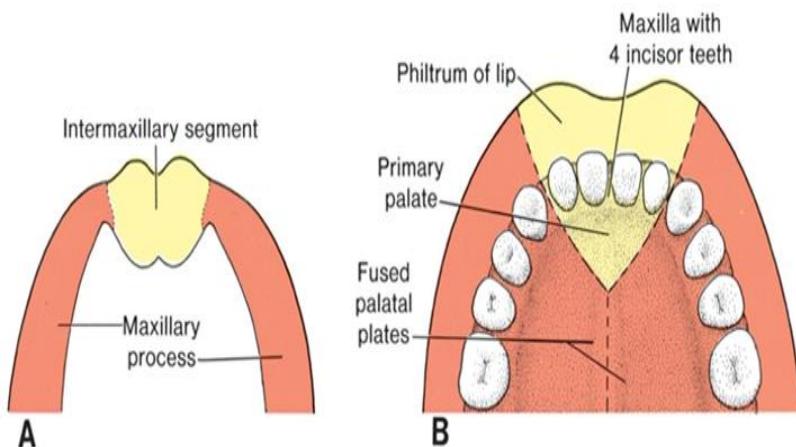
- Nose

- Maxillary prominences fuse with lateral nasal prominences
  - Upper cheek regions and upper lip
  - Before fusion = nasolacrimal groove
    - Later becomes the duct
- Nose Components
  - Bridge
  - Crest and tip
  - Sides (ala)
- Mandibular prominence

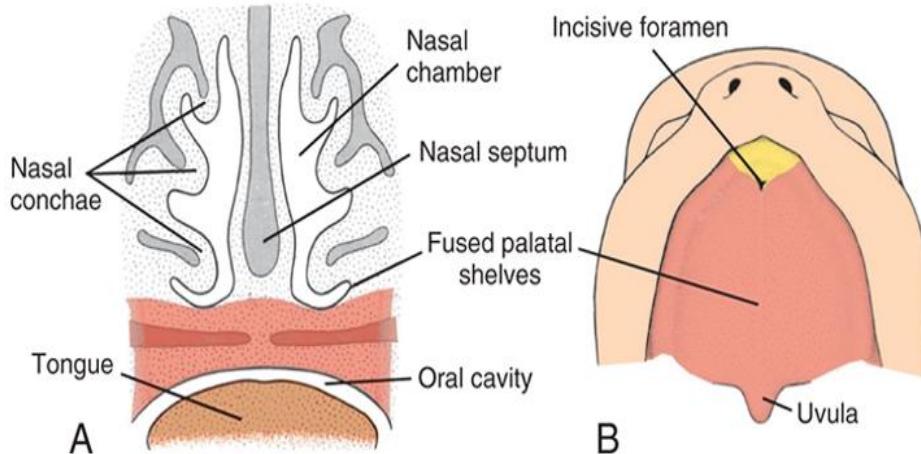
- Chin
- Lower cheek
- Lower lip



- Primary Palate - formation of intermaxillary segment
  - Fused medial prominences
  - Three components
    - Labial component
      - Philtrum of upper lip
    - Upper jaw component
      - Upper for incisors
    - Palatal component
      - Primary palate



- Secondary Palate
  - Outgrowths of two maxillary prominences - palatine shelves
    - Fuse to form secondary palate
  - Incisive foramen
    - Fusion site of primary and secondary palate
  - Nasal septum grows downward and fuses with newly formed palate



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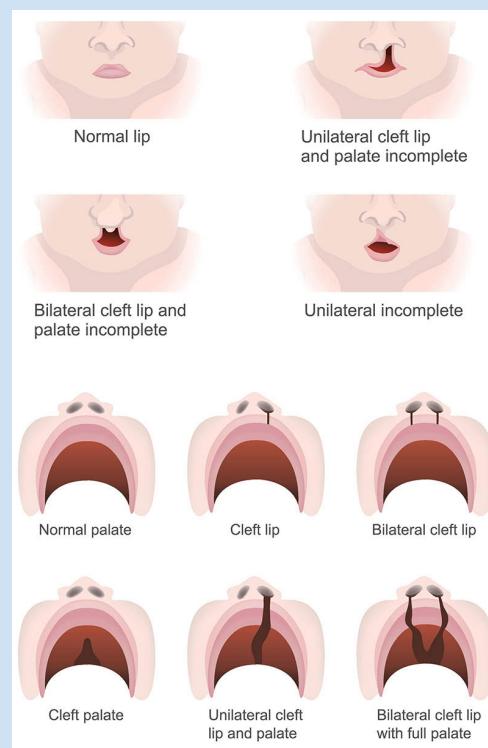
### Clinical Correlates: Abnormal Development of Palate

#### Anterior Deformities

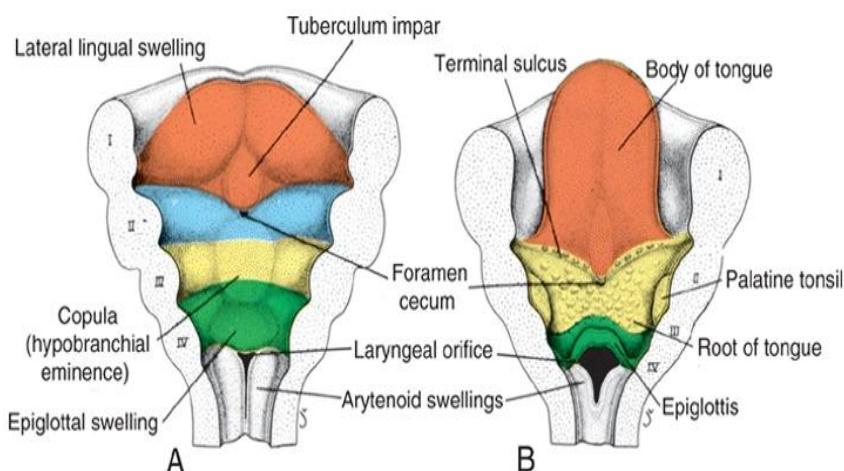
- Lateral cleft lip
- Primary cleft lip
- Median cleft lip

#### Posterior Deformities

- Secondary cleft palate
- Cleft uvula



- Formation of Tongue
  - Two lateral and medial swellings
    - 1st pharyngeal arch
      - Two lateral lingual, tuberculum impar (body of tongue)
    - 2nd, 3rd, and part of 4th arch
      - Copula of hypobranchial eminence (root of tongue)
    - Posterior part of 4th arch
      - Epiglottis
    - Occipital somites
      - Tongue muscles
      - Hypoglossal nerve



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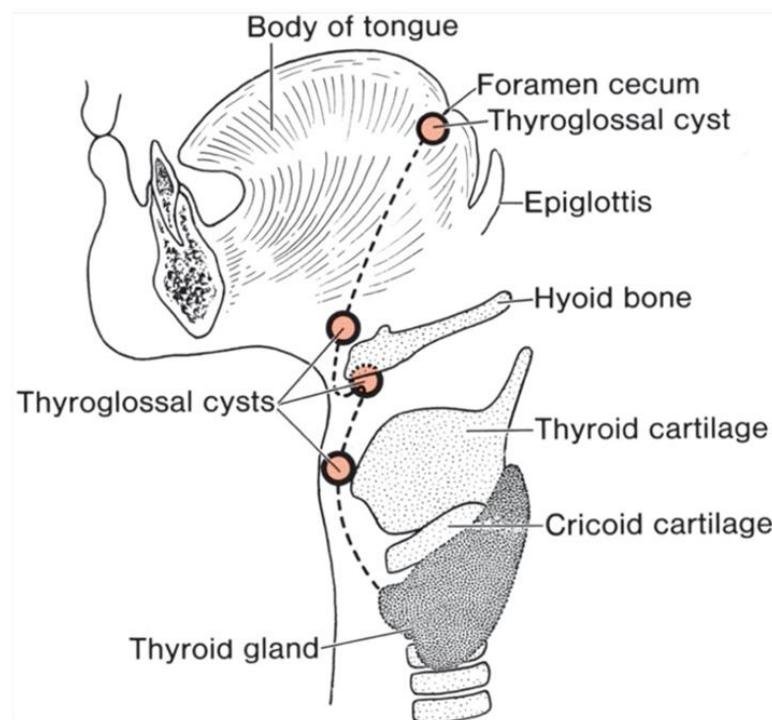
### Clinical Correlates: Ankyloglossia (tongue tied)

Tongue not free from mouth

- Frenulum anchors tongue
  - Most common form: frenulum extends to tip of tongue



- Formation of Thyroid Gland
  - In foramen cecum
    - Epithelial proliferation between tuberculum impar and copula
  - Thyroid descends along thyroglossal duct
  - @ week 7, thyroid is positioned anterior to trachea
  - @ 3 months, thyroid gland begins functioning



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