

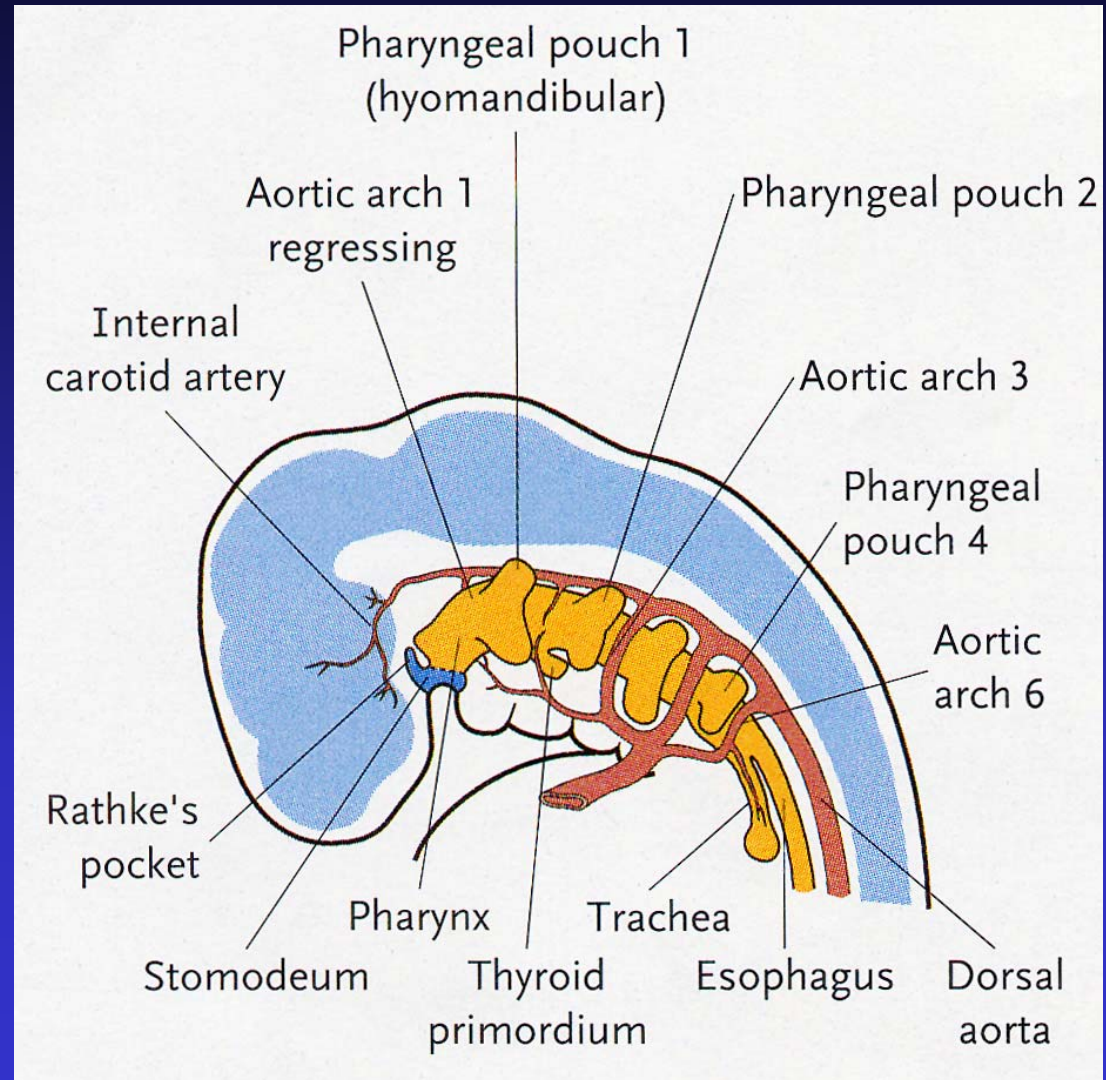
Pharyngeal Apparatus

Pouches – Endoderm

Grooves – Ectoderm

Arch – Neural Crest
Somitomes

Aortic Arch - Vessel



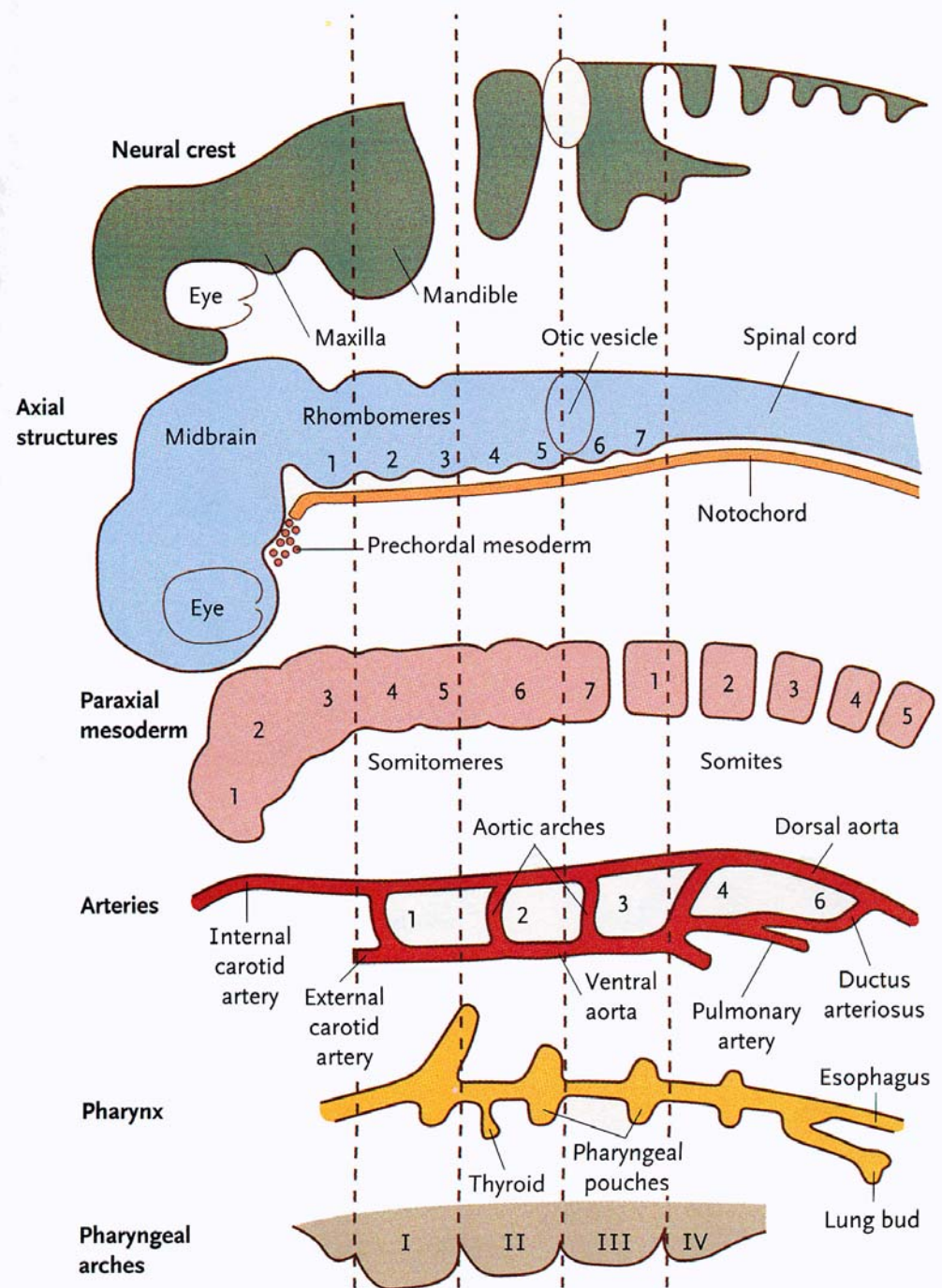
Segmental Organization

Humans:

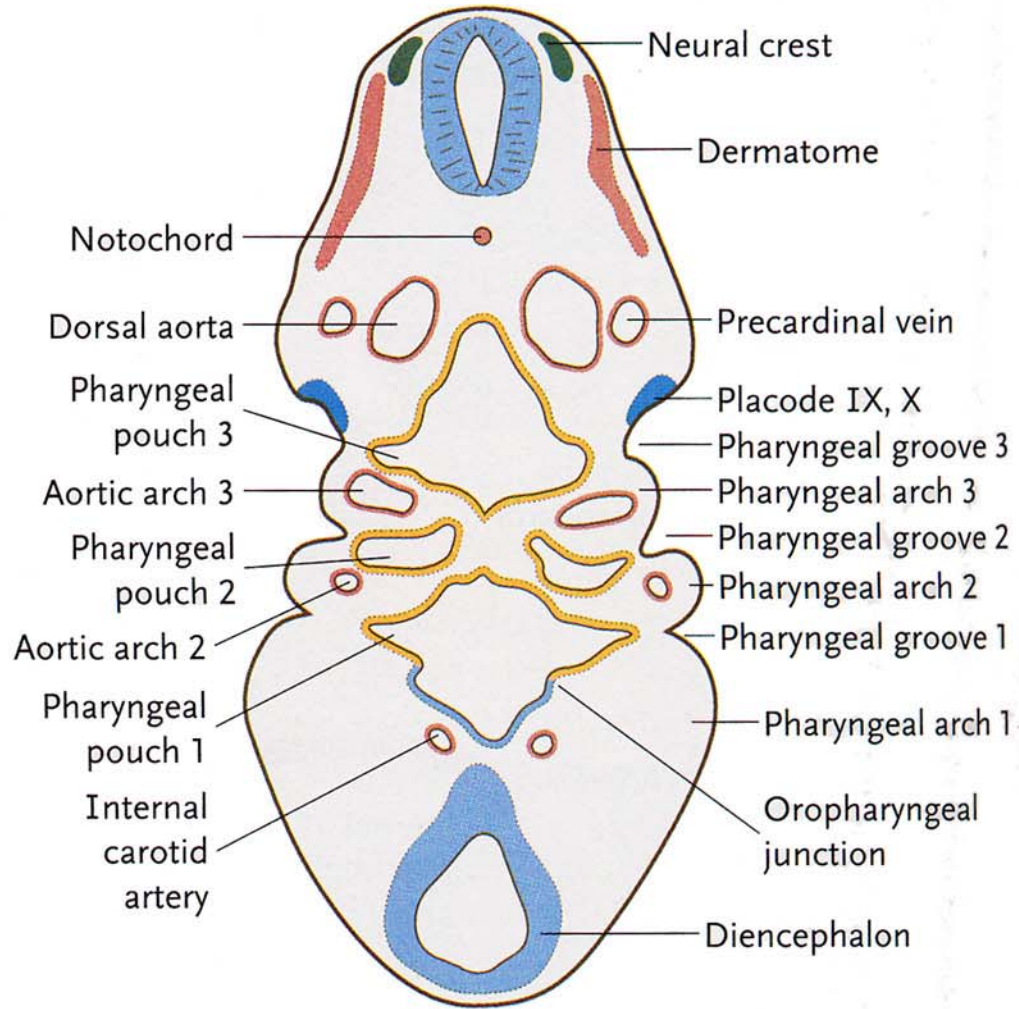
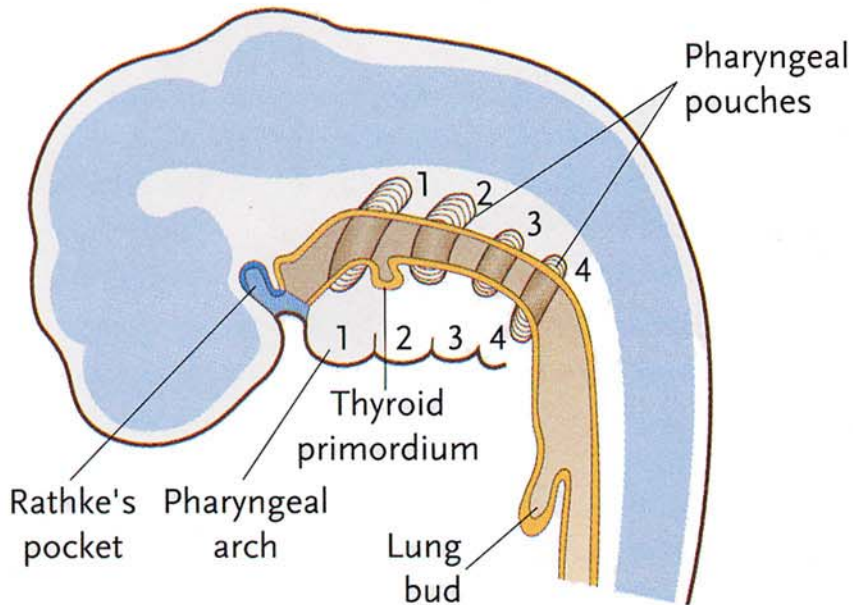
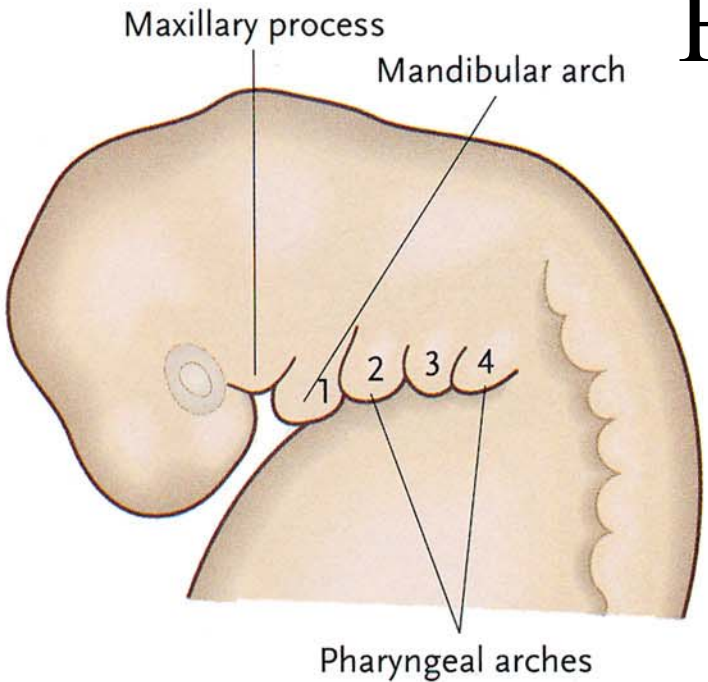
Arch 1-4 – prominent

Arch 5 – absent

Arch 6 - transient



First Arch → Face



#1 = Mandibular Arch

2 prominences: Maxillary and Mandibular

Maxillary Process:

Cranial - upper jaw

Cartilages (endochondrial):

alisphenoid

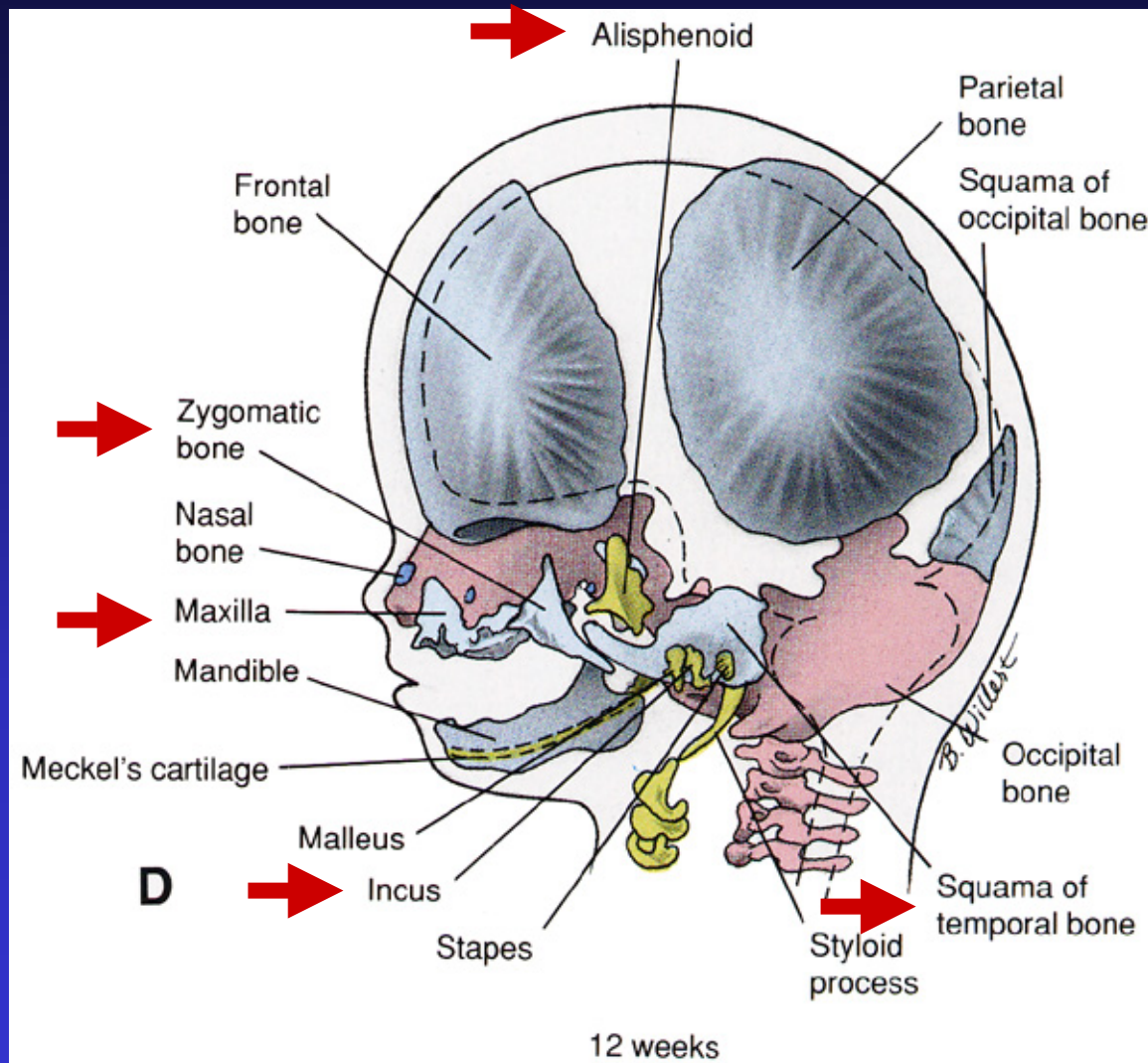
incus

Bone (intramembranous):

maxilla

zygomatic bone

squamous part of the
temporal bone



Manidibular Process

Caudal - lower jaw

Cartilages

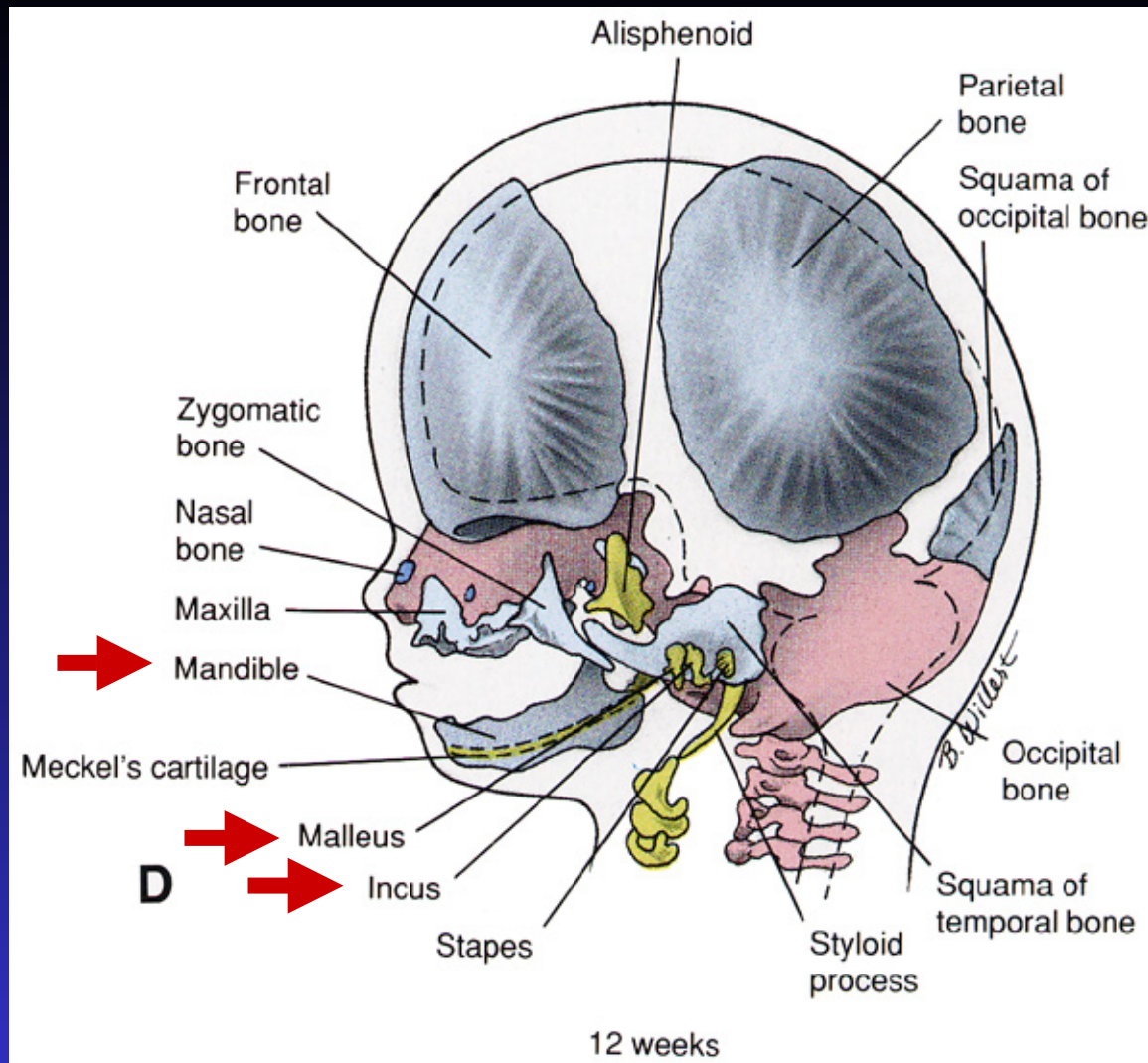
Meckel's cartilage

Malleus

Incus

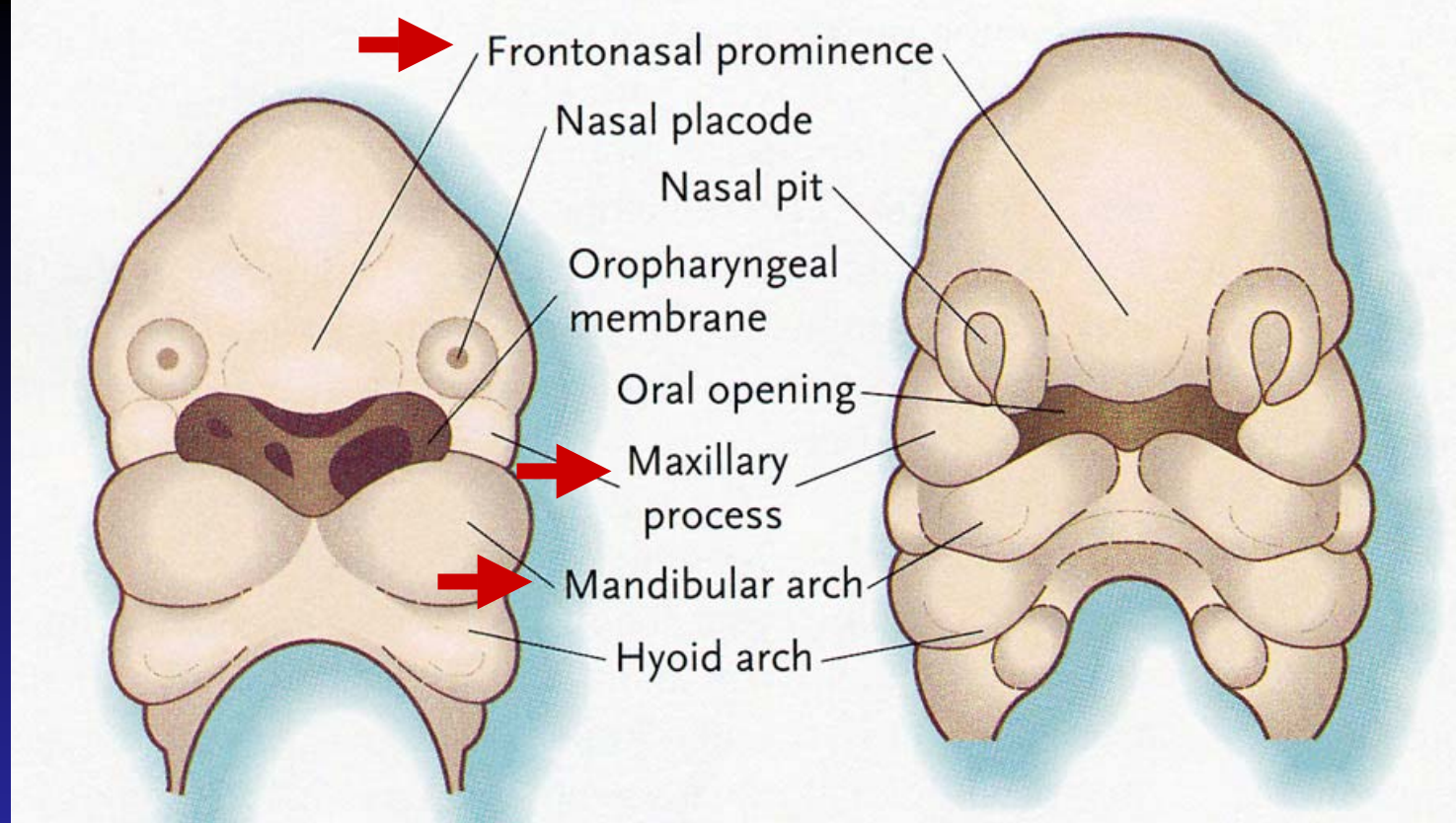
Bone

Mandible



Maxillary and Mandibular processes are important for Face formation

Face



Face is formed from 7 primordia surrounding the stomodeum

- 1 frontonasal prominence - cranial boundary of the stomodeum
- Paired nasomedial process
- Paired maxillary process
- Paired of mandibular process

Frontonasal prominence forms the forehead

Horseshoe-shaped nasal process forms the nasal pit with the nasal placode in the depression.

Nasal prominences fuse medially

Midline fusion of the nasomedial processes forms the intermaxillary segment that later forms:

- 1) philtrum - groove of upper lip
- 2) Bridge and septum of the nose
- 3) Part of the maxilla and gum
- 4) Primary palate

The nasolacrimal groove separates the nasolateral process from the maxillary process – forms the nasolacrimal duct via ectodermal thickening, internalization and canalization

Maxillary process fuses lateral to the nasal process

Maxillary process forms:

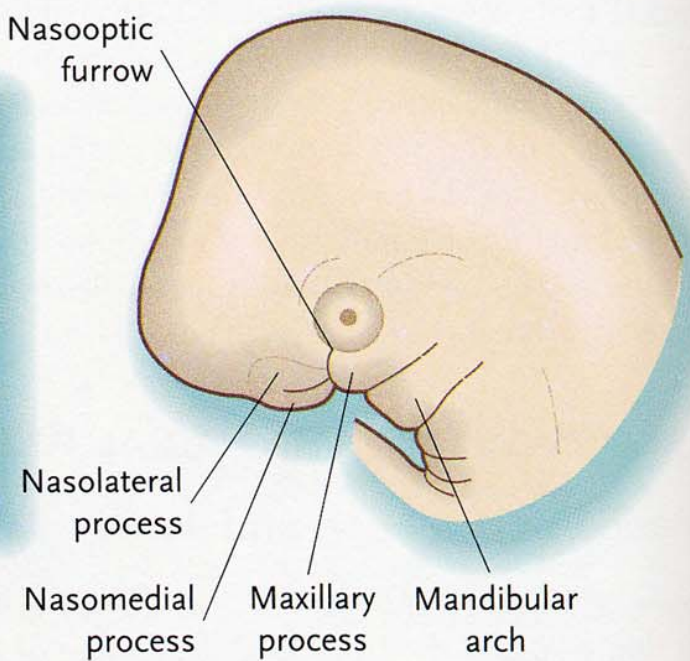
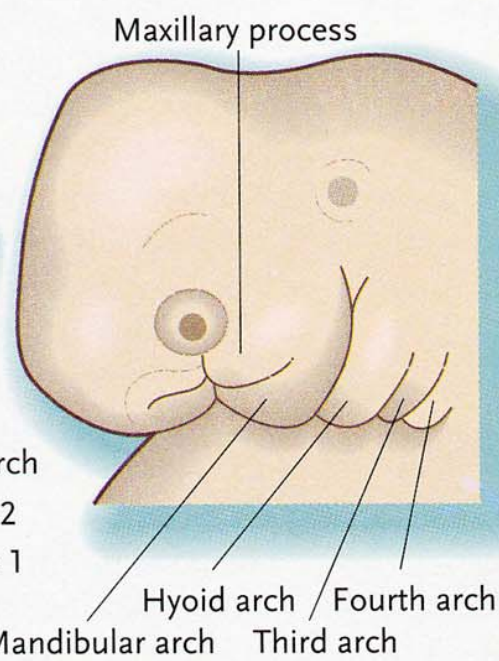
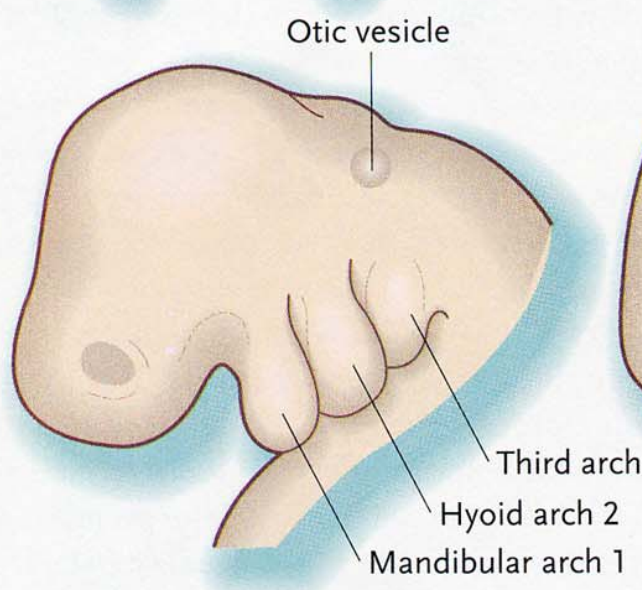
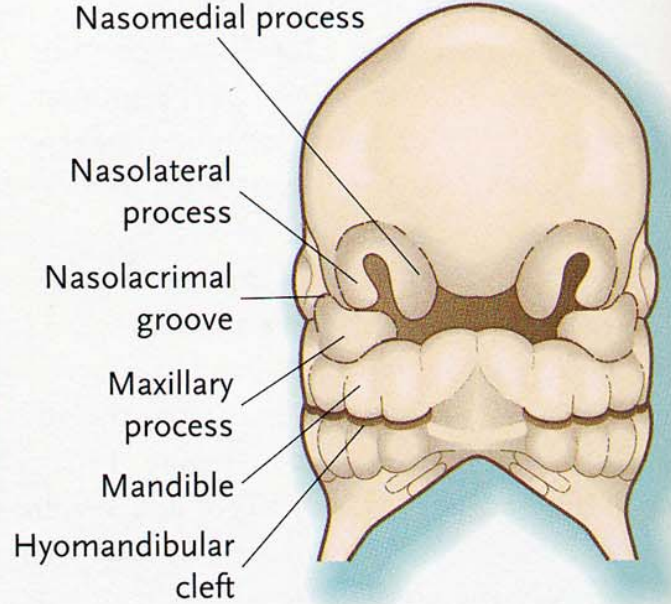
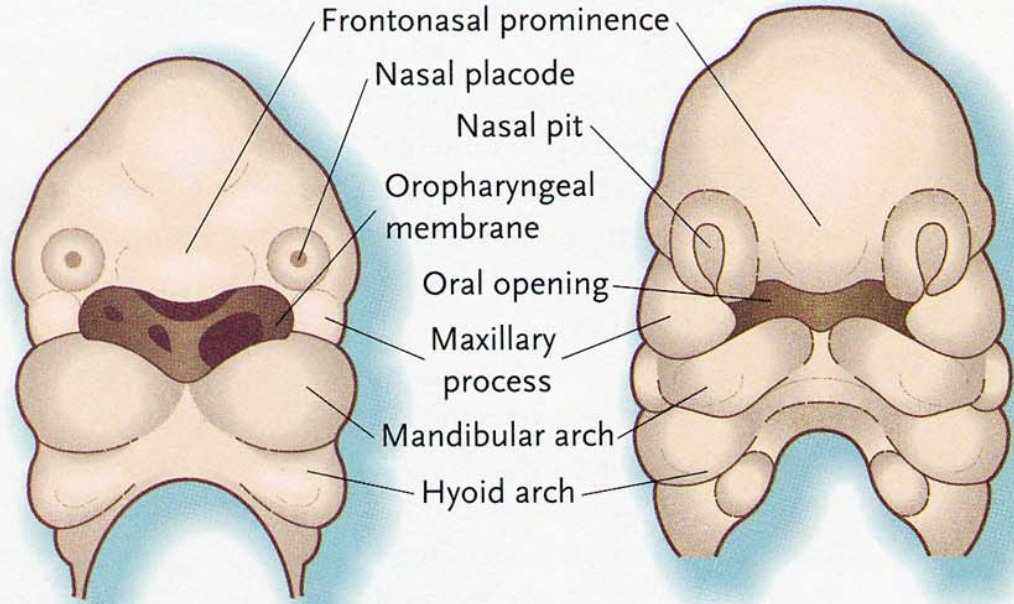
Lateral parts of the upper lip

Maxilla

Secondary palate

Medial fusion of mandibular processes forms the lower jaw

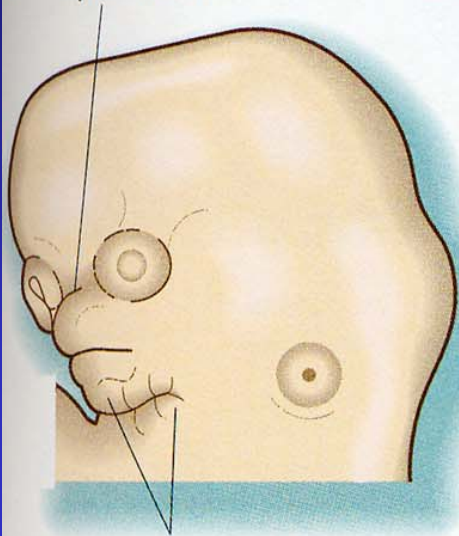
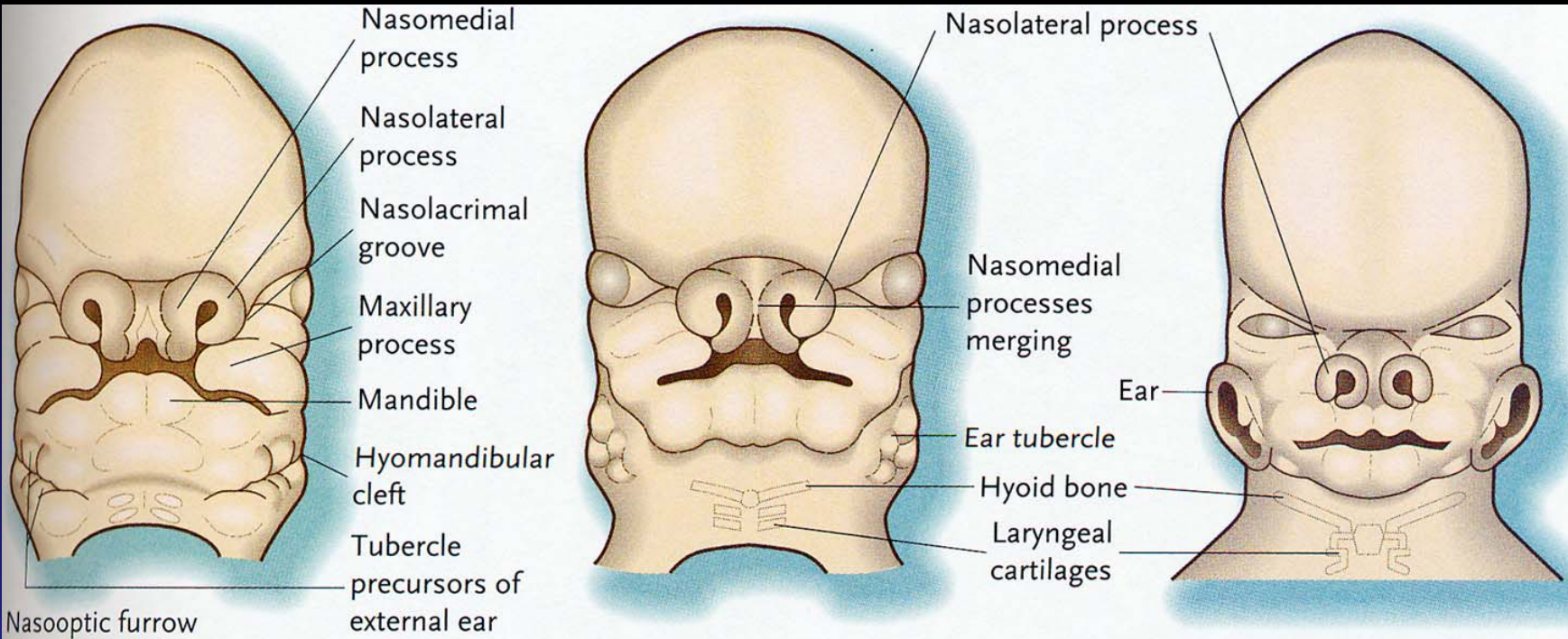
Lateral fusion of maxillary and mandibular processes



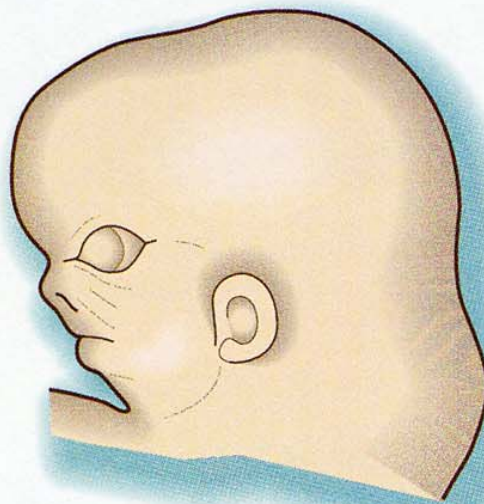
4 weeks

5 weeks

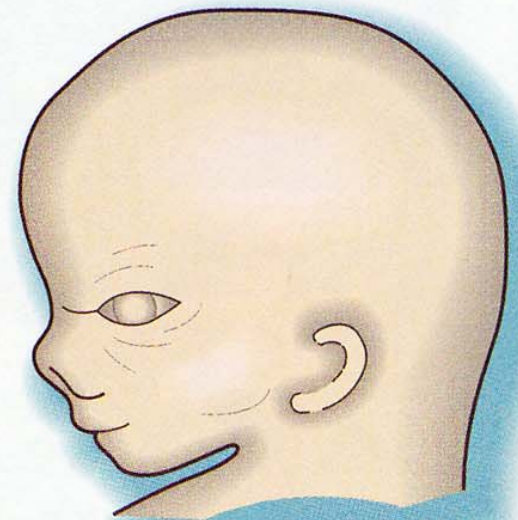
5 1/2 weeks



6 weeks



7 weeks



8 weeks

Palate

Three primordia

Primary palate = median palatine process

Secondary palate = fuses lateral palatine processes

Primary palate - The innermost part of the intermaxillary segment forms a wedge-shaped mesodermal tissue between maxillary processes (median palatine process)

Secondary palate - forms from two projections from the maxillary processes - called lateral palatine processes (palatal shelves)

Palate

Projection of lateral palatine processes fuses:

- Medially with each other

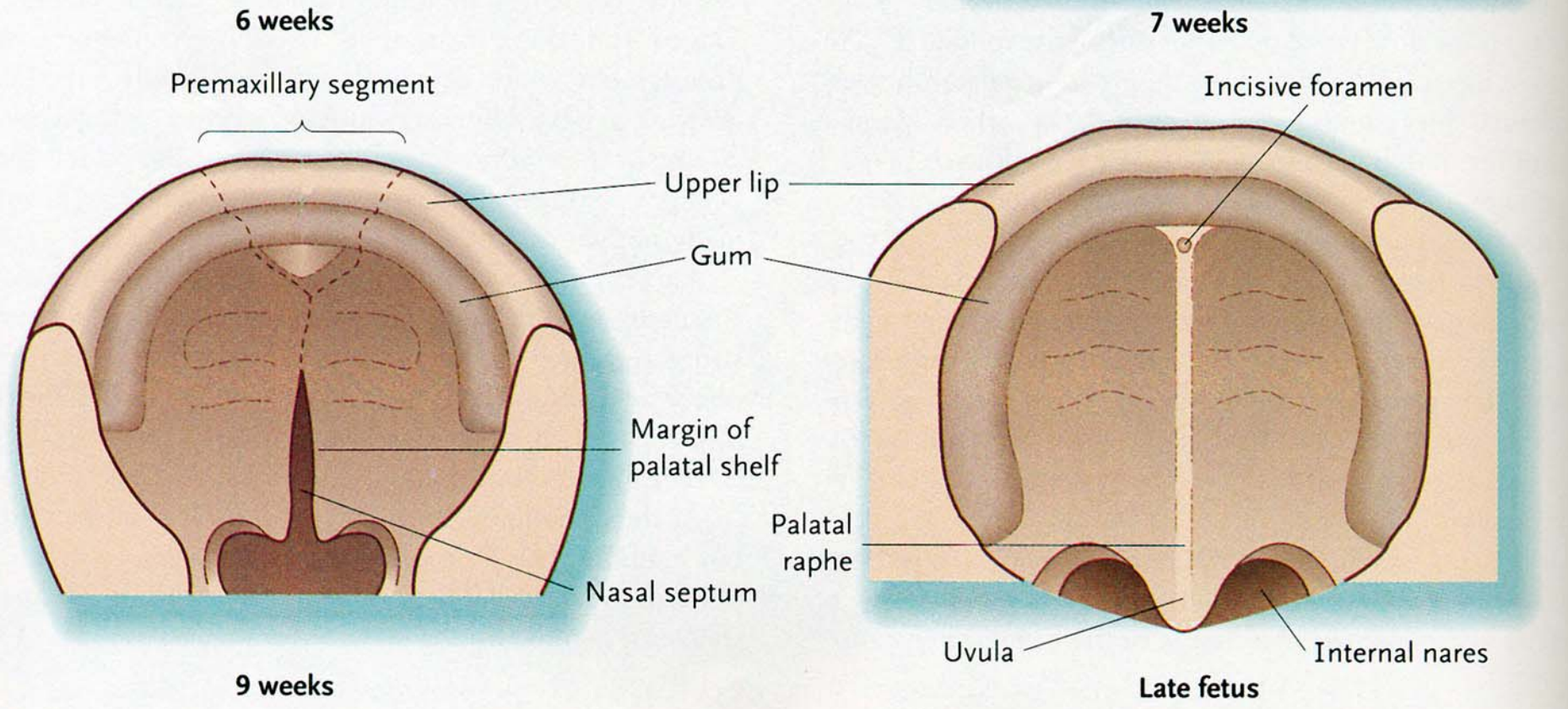
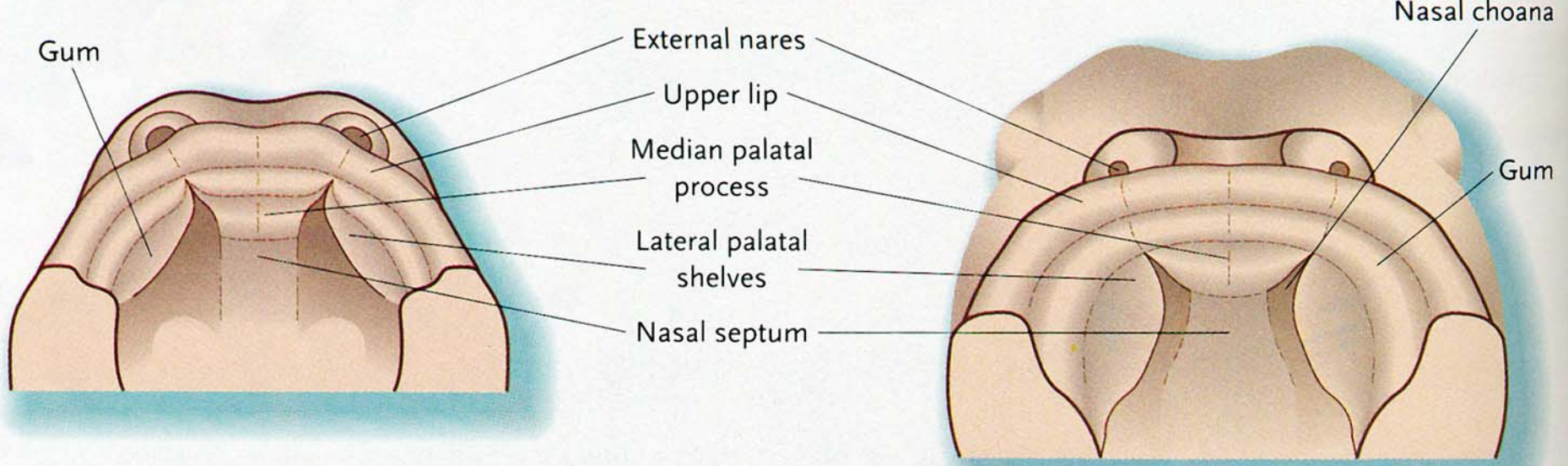
- Medially with nasal septum (from the frontonasal prominence)

- Rostrally with the medial palatine process

Palatal raphe = fusion line of lateral palatine processes

Hard palate – Ossification in the lateral palatine processes

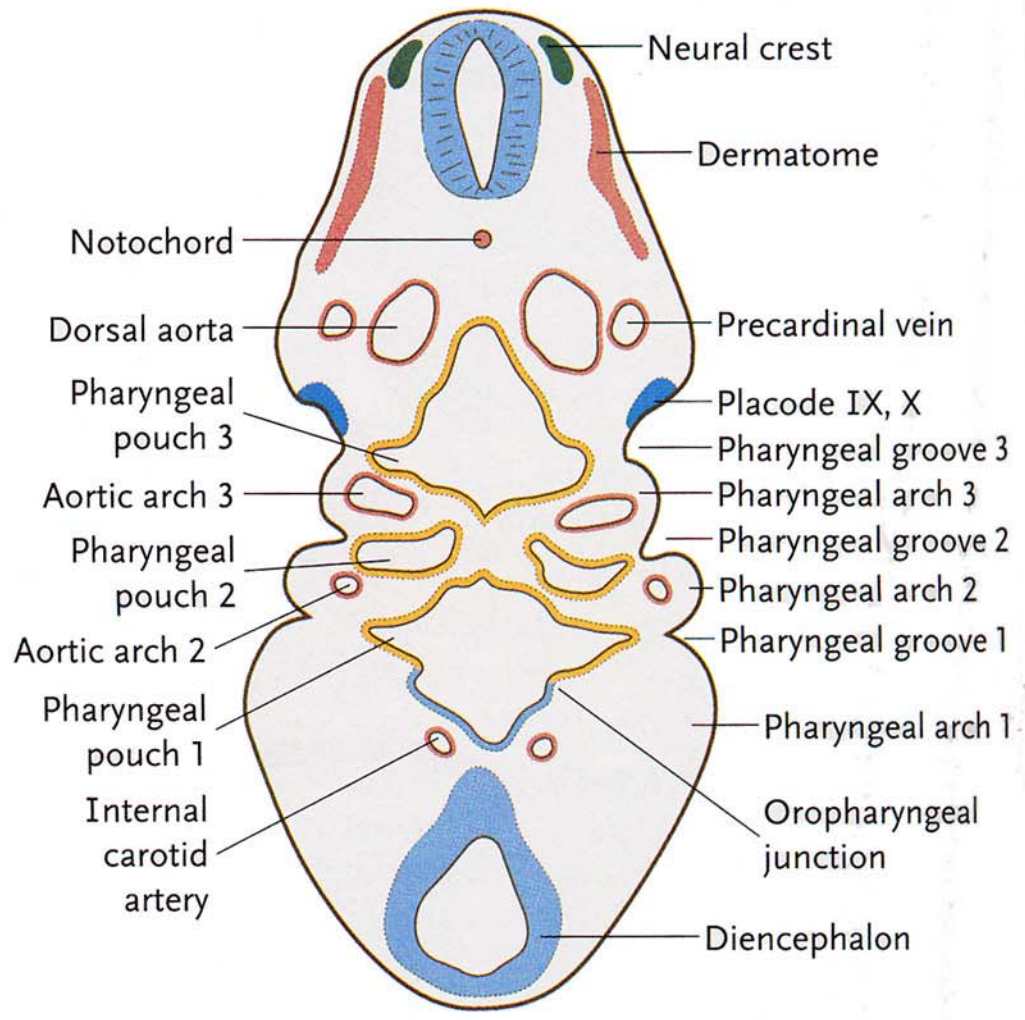
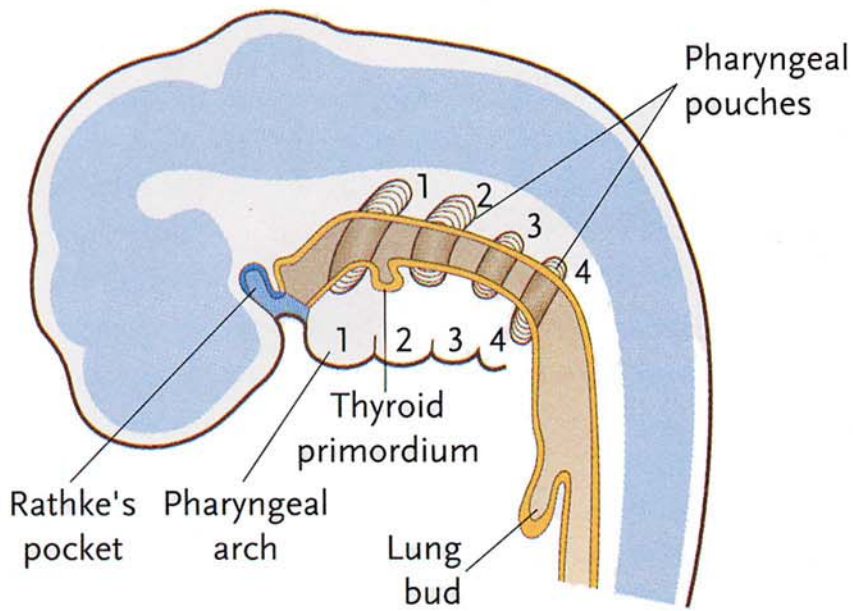
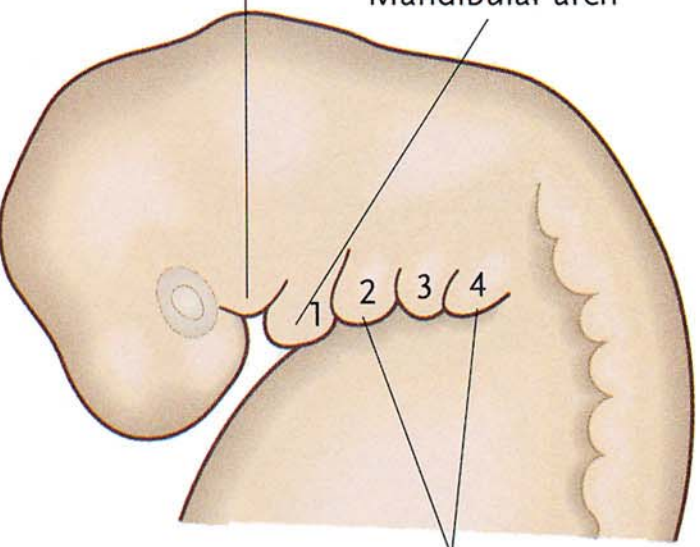
Soft palate - posterior to the hard palate and its projection
= uvula



Maxillary process

Mandibular arch

Pharyngeal arches



Neural crest

Dermatome

Notochord

Dorsal aorta

Pharyngeal pouch 3

Aortic arch 3

Pharyngeal pouch 2

Aortic arch 2

Pharyngeal pouch 1

Internal carotid artery

Precardinal vein

Placode IX, X

Pharyngeal groove 3

Pharyngeal arch 3

Pharyngeal groove 2

Pharyngeal arch 2

Pharyngeal groove 1

Pharyngeal arch 1

Oropharyngeal junction

Diencephalon

#1 - Mandibular Arch

Muscles – from 4th Somitomere

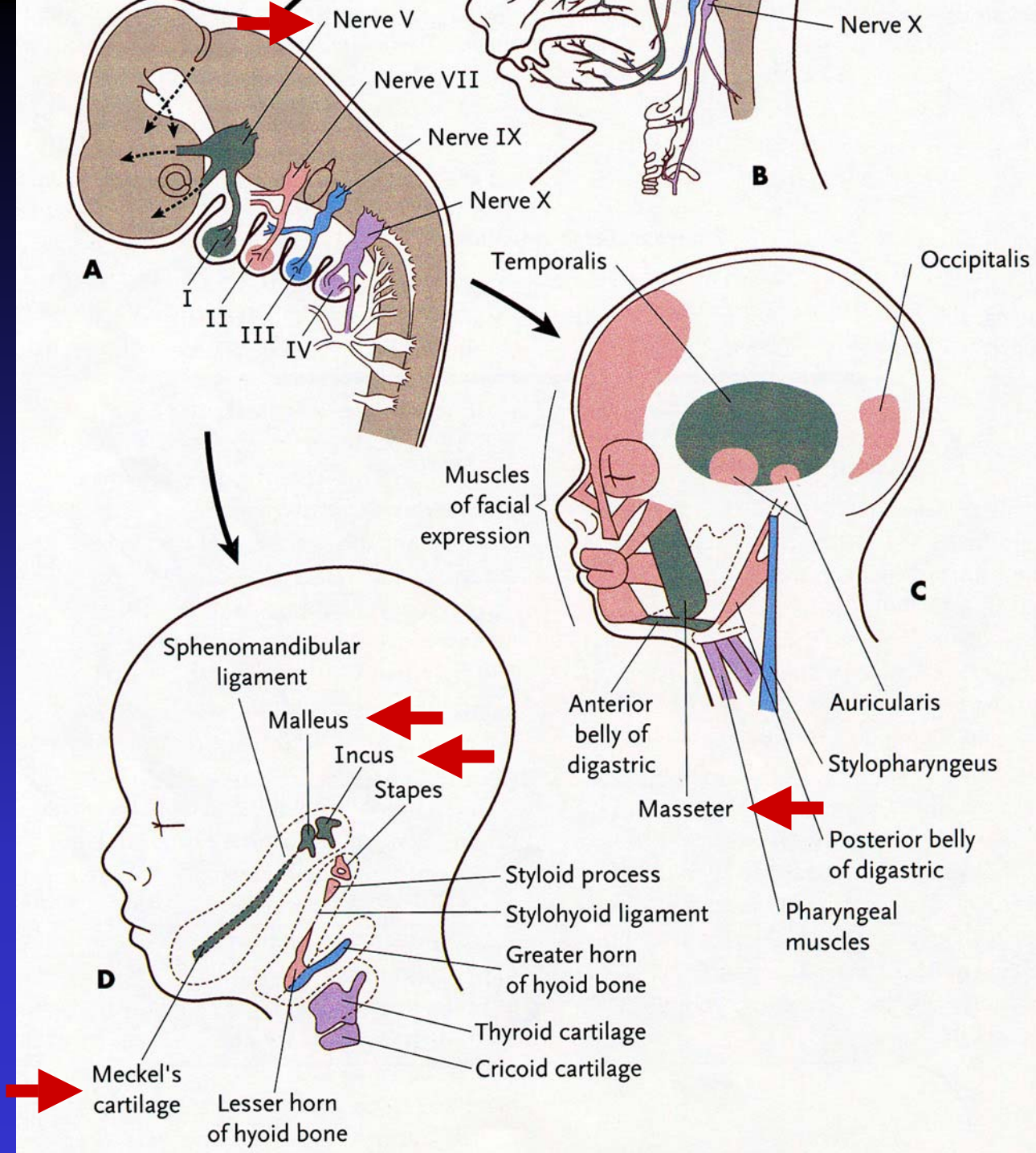
Muscles of mastication (e.g. masseter)

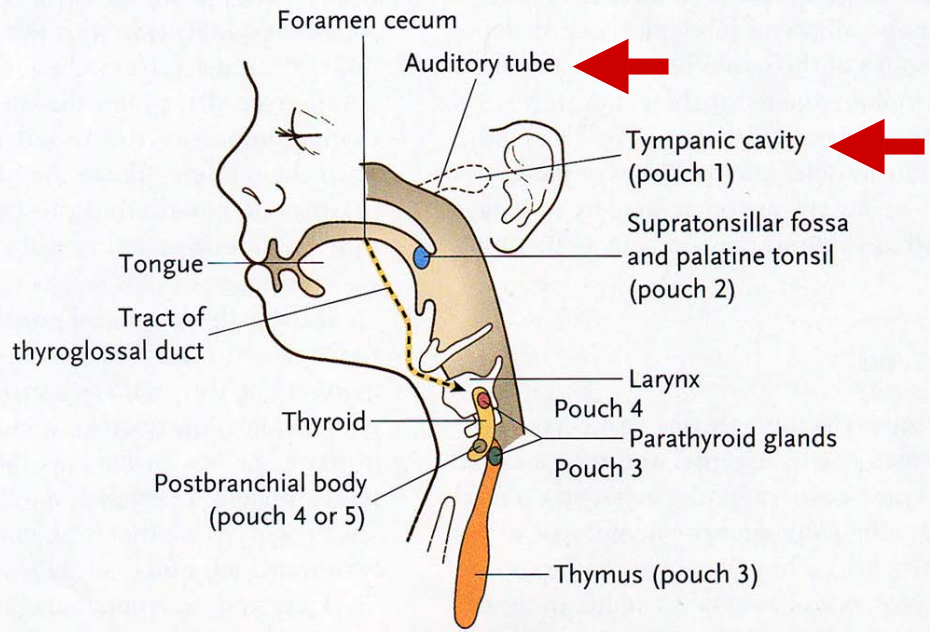
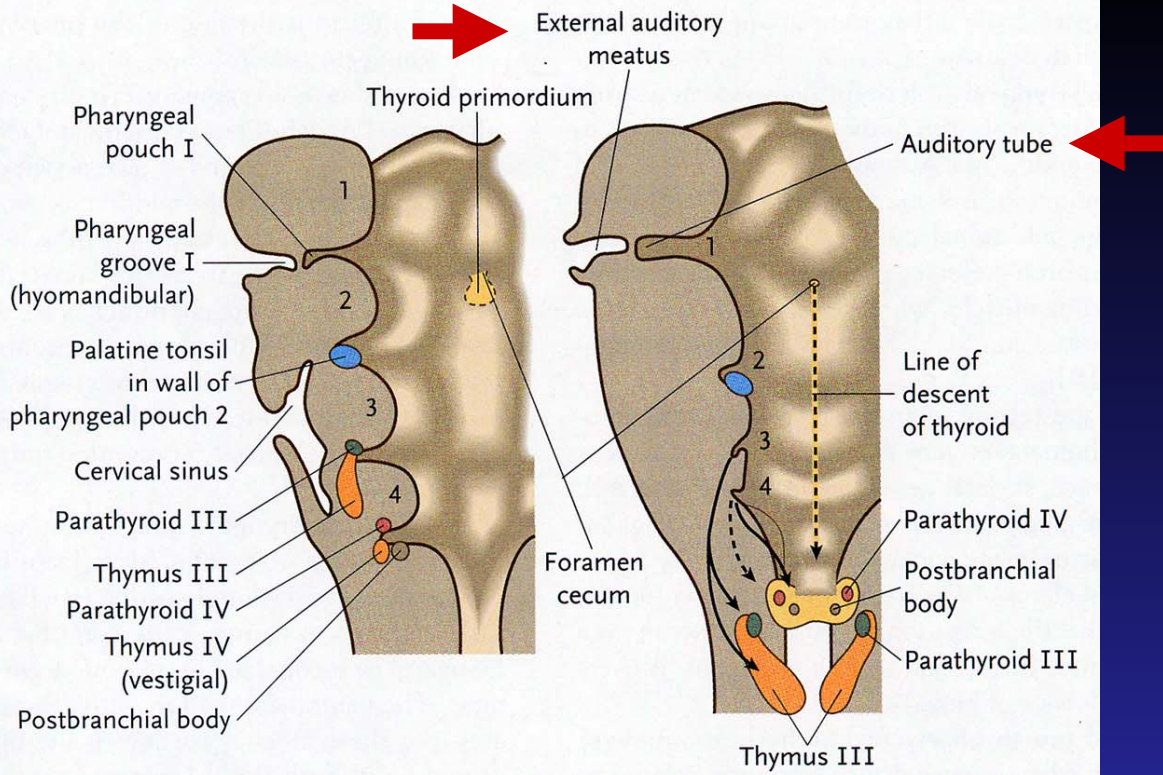
Nerve – Trigeminal (V)

Aortic Arch - Maxillary Artery

1st Pharyngeal Pouch – Auditory tube (eustachian tube) and tympanic cavity (distal end)

1st Pharyngeal Groove – External auditory meatus (exterior ear opening)





#2 – Hyoid Arch

Skeleton

Stapes

Styloid process

Lesser horn of the hyoid bone

Muscles – from 6th Somitomere

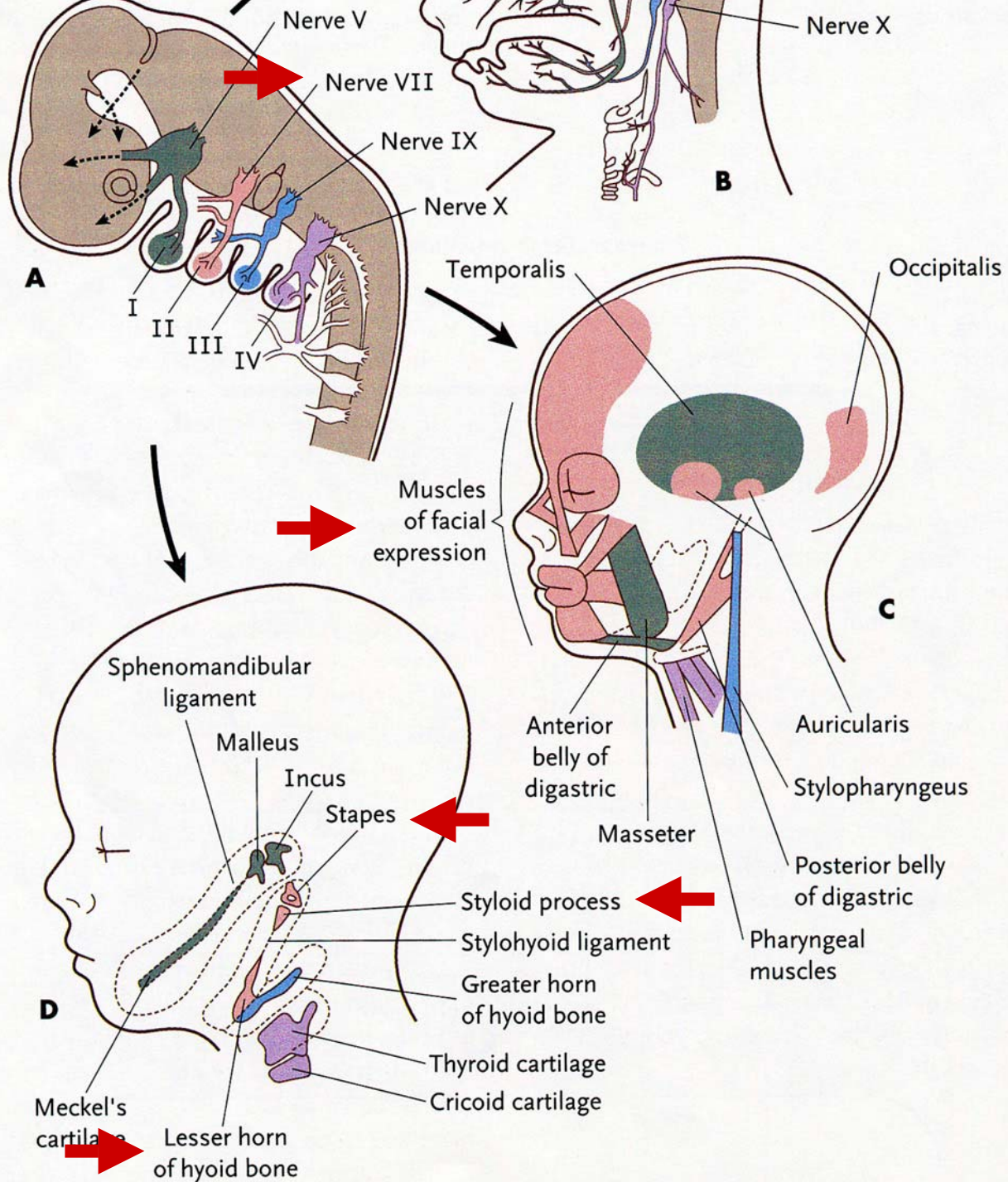
Muscles of facial expression

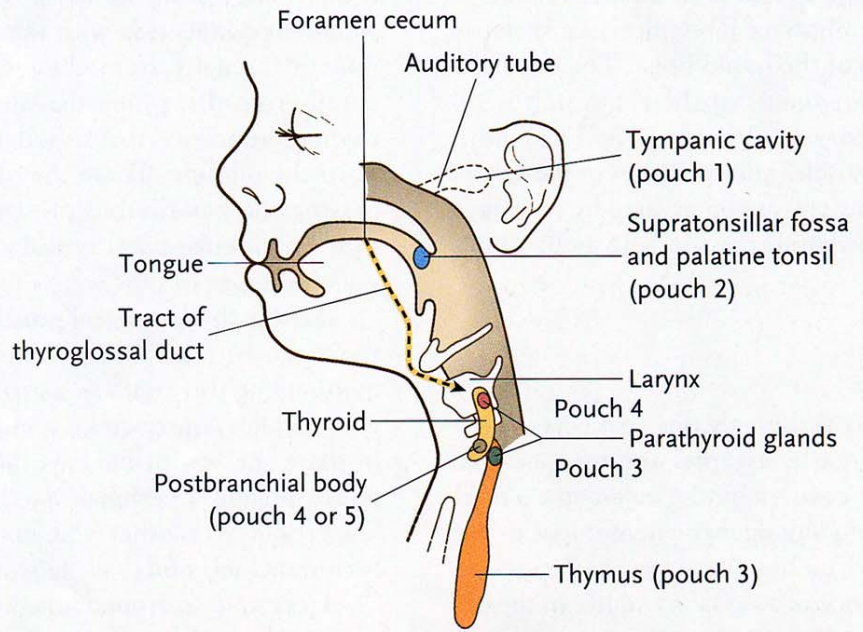
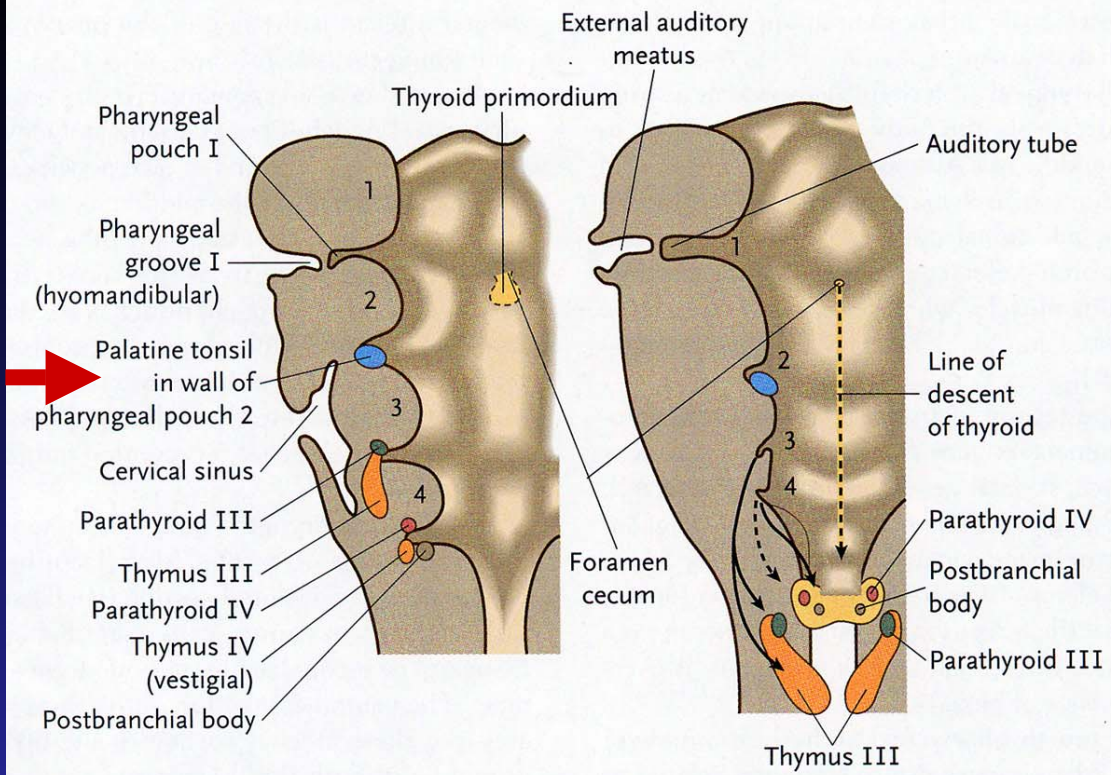
Nerve – Facial (VII)

2nd Aortic Arch - Hyoid artery, Stapedial artery

2nd Pharyngeal Pouch

Supratonsillar fossa –component of the palatine tonsils





3rd Arch

Skeleton

Greater horn of the hyoid bone

Muscles – from 7th Somitomere

Stylopharyngeus (raises the pharynx during vocalization and swallowing)

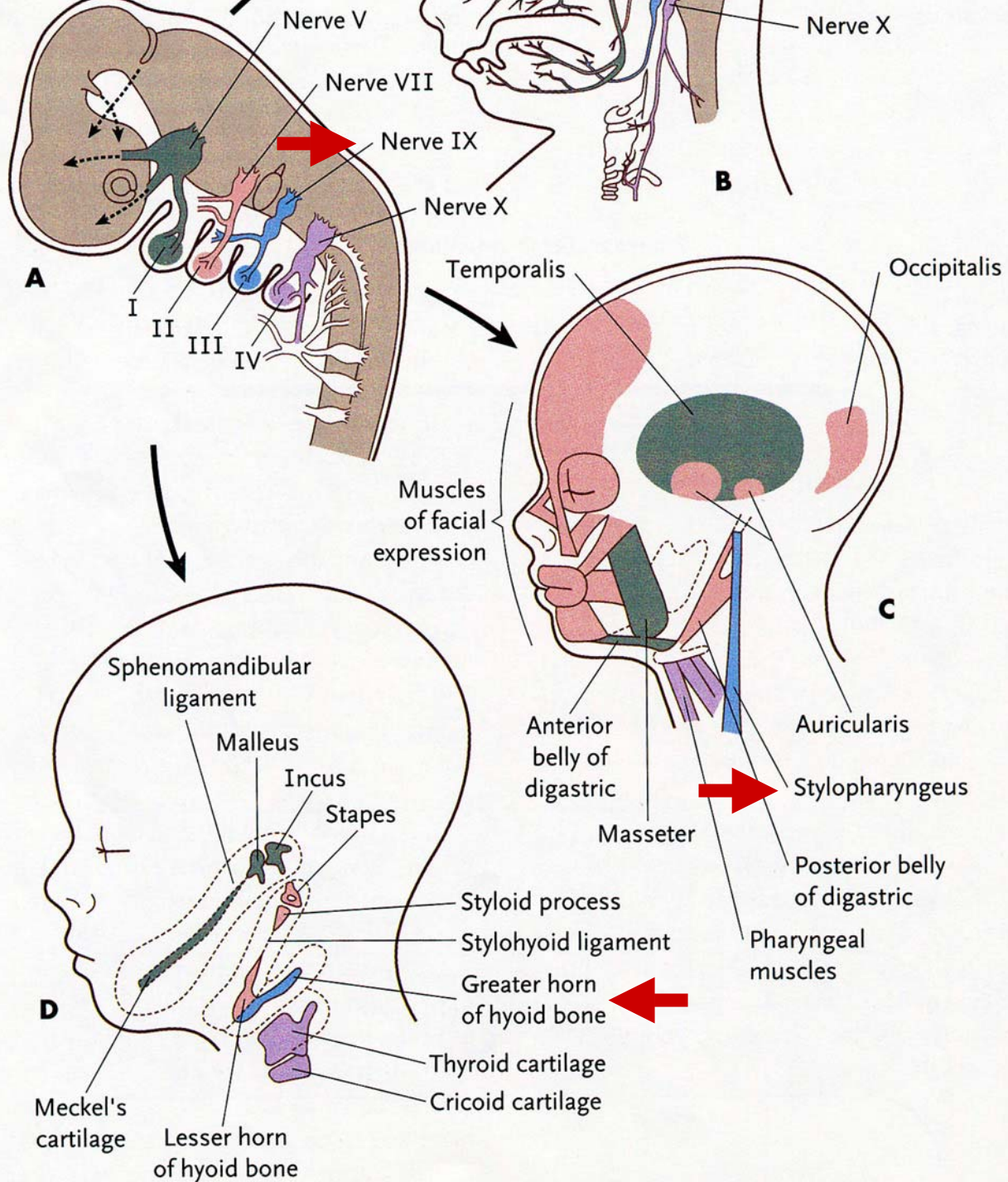
Nerve – Glossopharyngeal (IX)

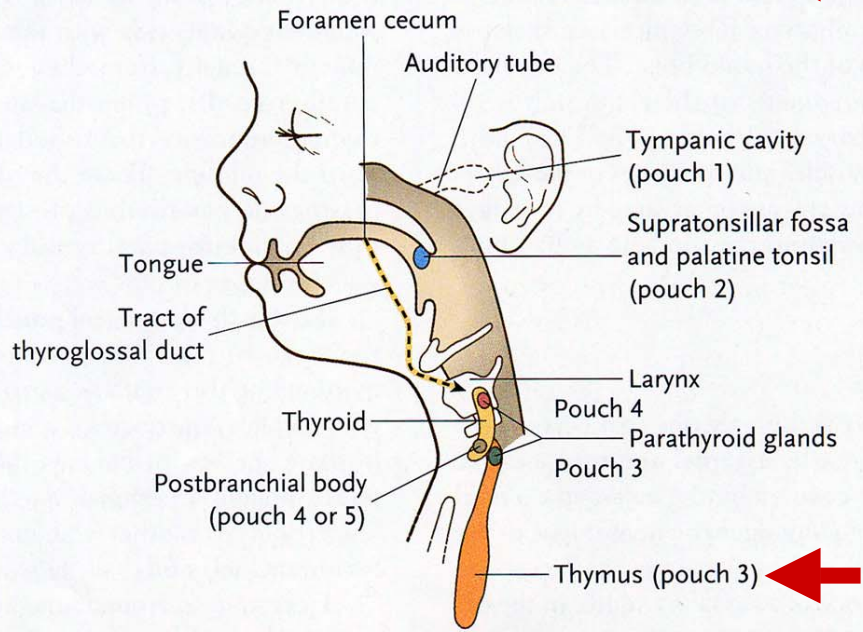
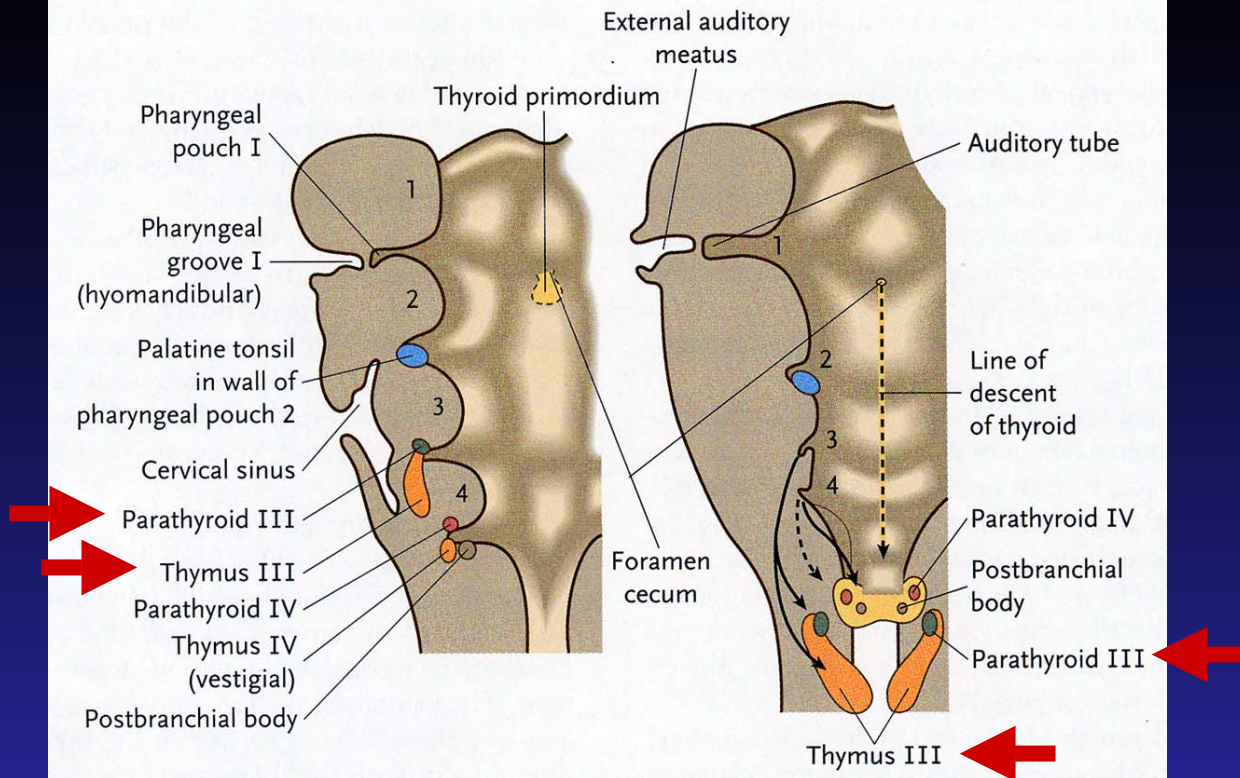
3rd Aortic Arch – Internal Carotid artery

3rd Pharyngeal Pouch

Dorsal - Paired inferior parathyroid, fuses with thyroid gland (parathyroid hormone, Calcium regulation)

Ventral - hollow and elongate - fuses ventro-medially to form the bilobed thymus, secondarily moves posterior to become posterior to the thyroid gland (lymphocyte production, blood-thymic barrier)





4th Arch

Skeleton

Laryngeal cartilages

Muscles – from occipital somites 2-4 and cervical somite 1

Pharyngeal and Laryngeal musculature

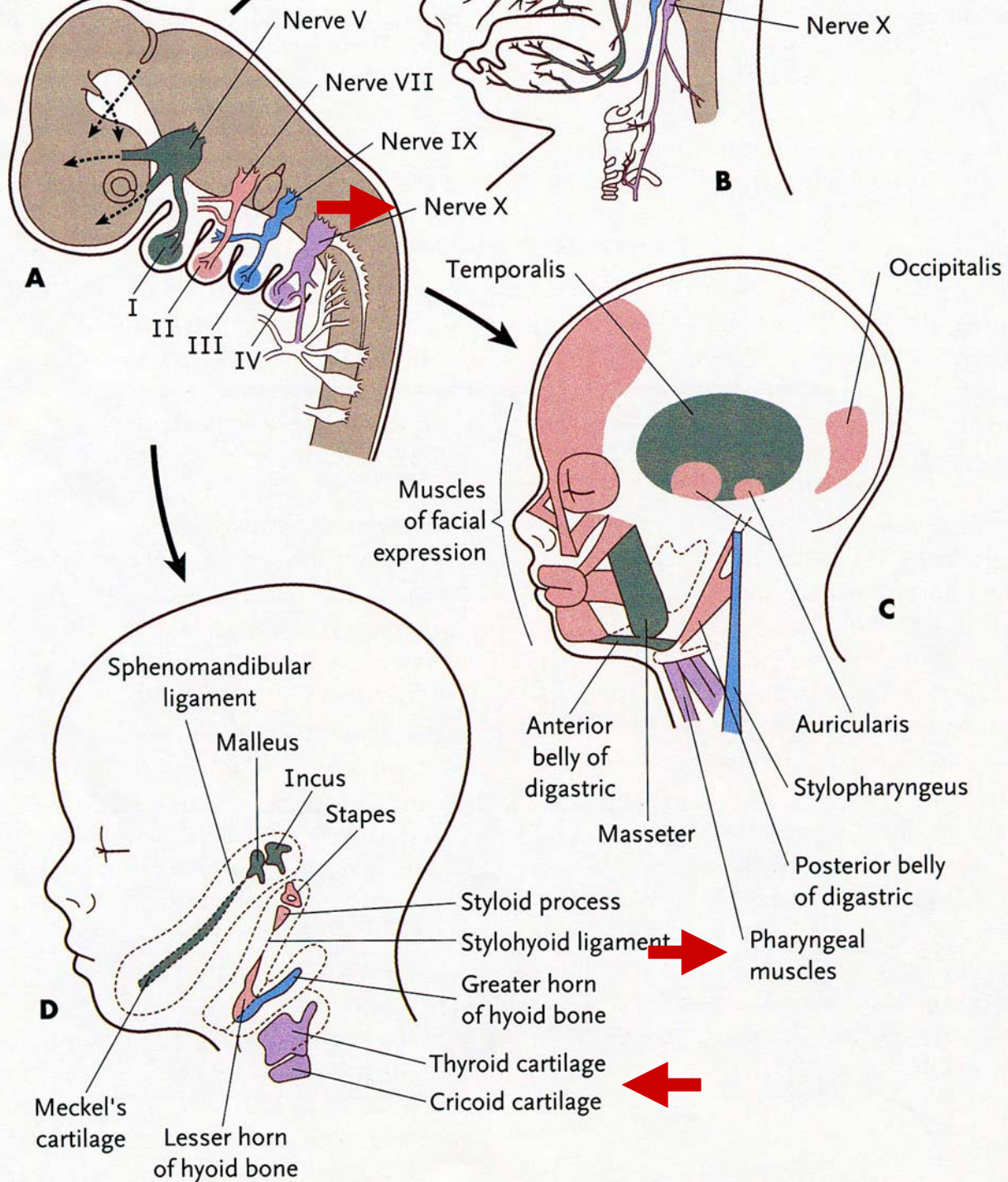
Nerve – Vagus (X)

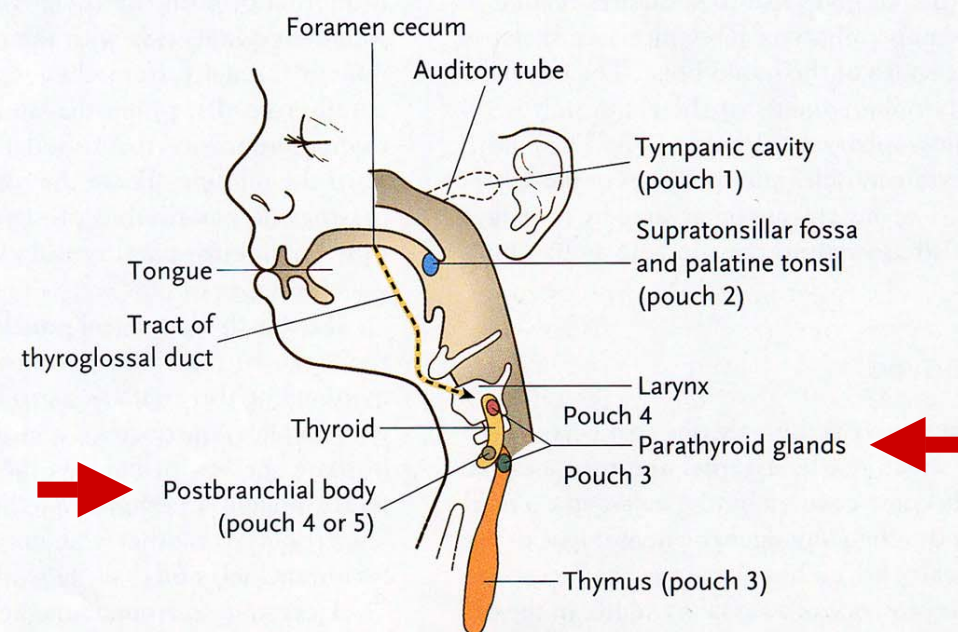
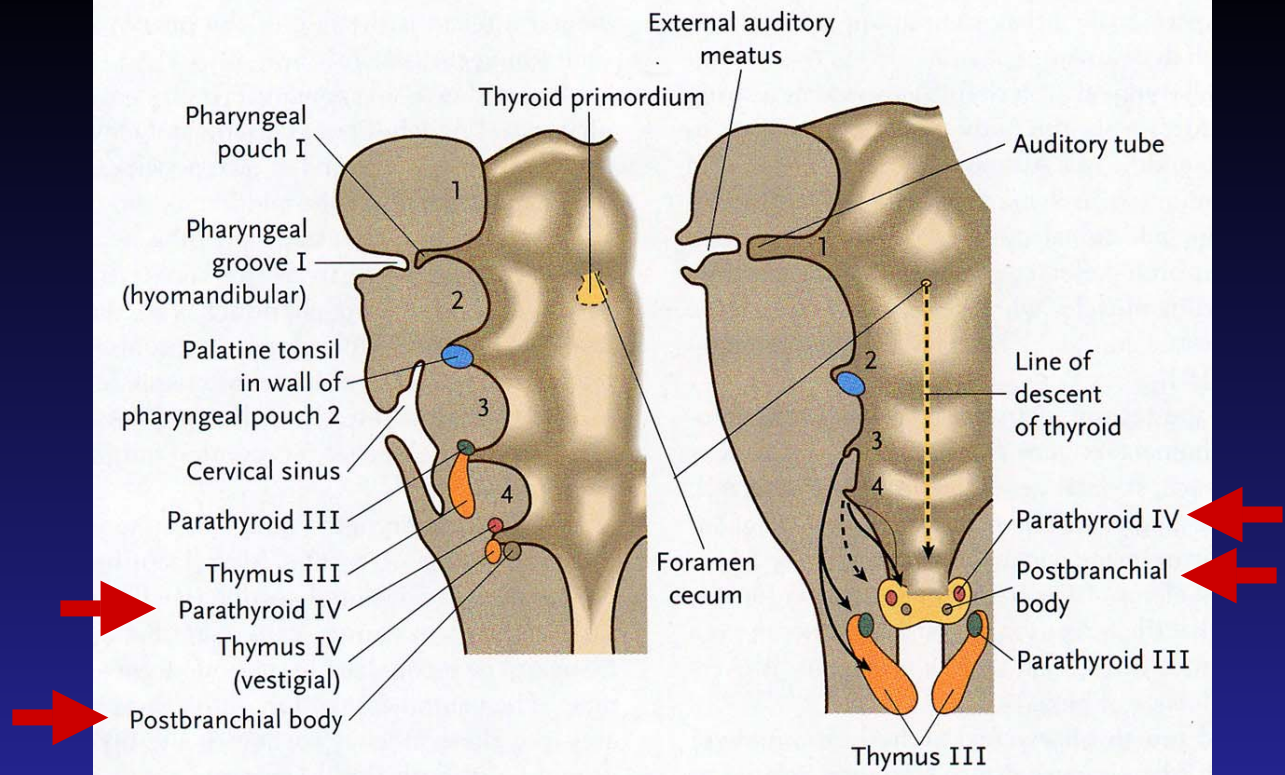
4th Aortic Arch – Right Subclavian artery, Aorta

4th Pharyngeal Pouch

Dorsal - forms paired superior parathyroids

Ventral - Postbranchial Body (ultimobranchial body, calcitonin)





Anomalies

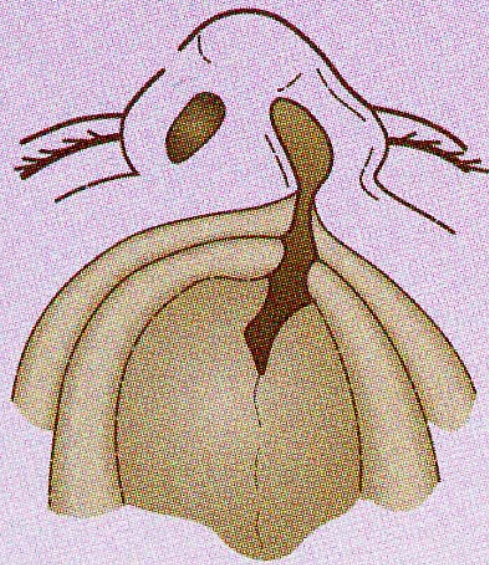
Craniofacial: Mostly defects associated with tissue fusion:

Estimated 1/3 of all congenital defects

Facial Clefts - Anomalies associated with defective fusion of Facial prominences

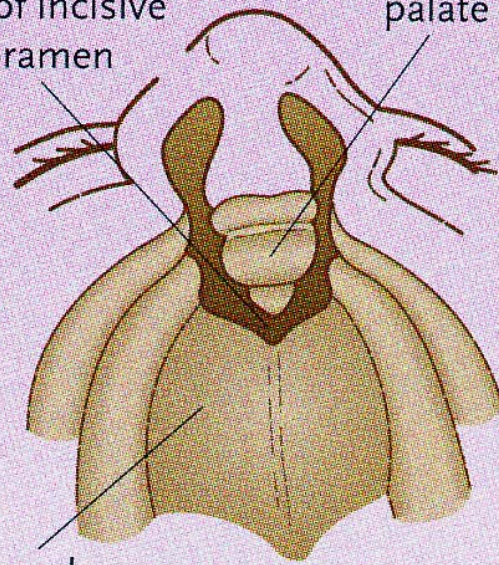
Cleft lip - failure of maxillary prominence to fuse with intermaxillary process

Cleft palate - failure of the lateral palatine processes to fuse

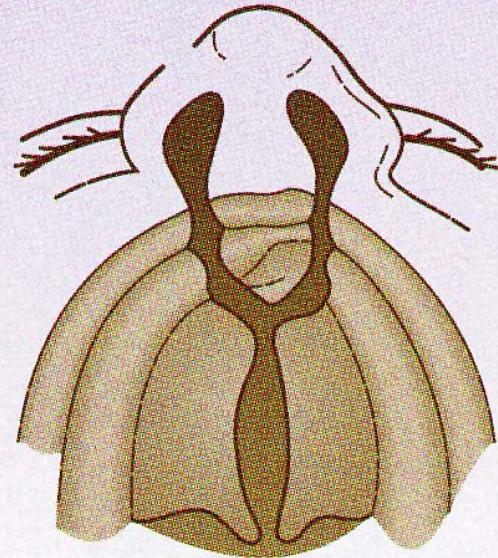
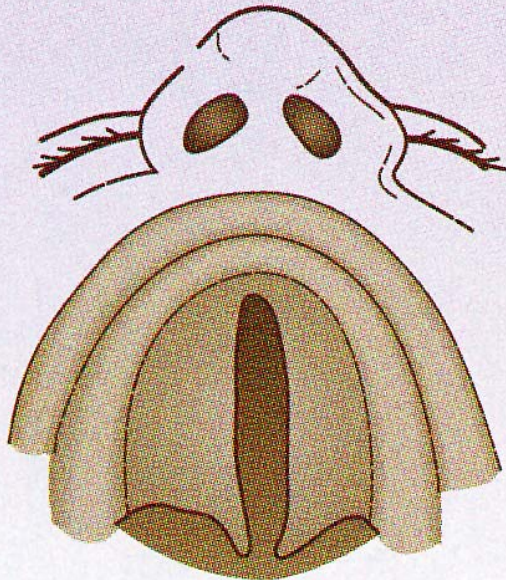


Site of incisive foramen

Primary palate



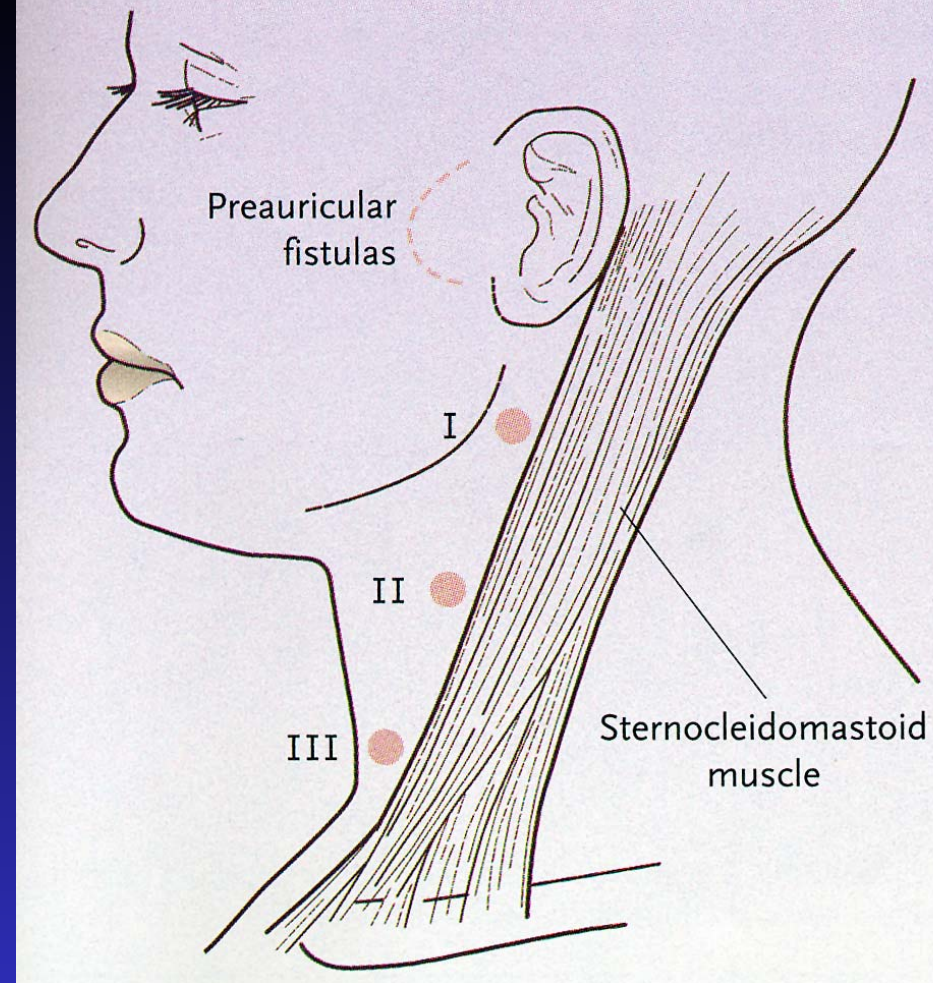
Secondary palate



Anomalies

Pharyngeal:

Branchial cysts, sinus or fistula:
opens on the side of the neck
Persistence of the pharyngeal
groove and/or pouch



Piriform sinus fistula:

canal is persistent that follows the migration of the postbranchial body from the 4th pouch to the thyroid.