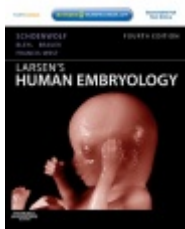
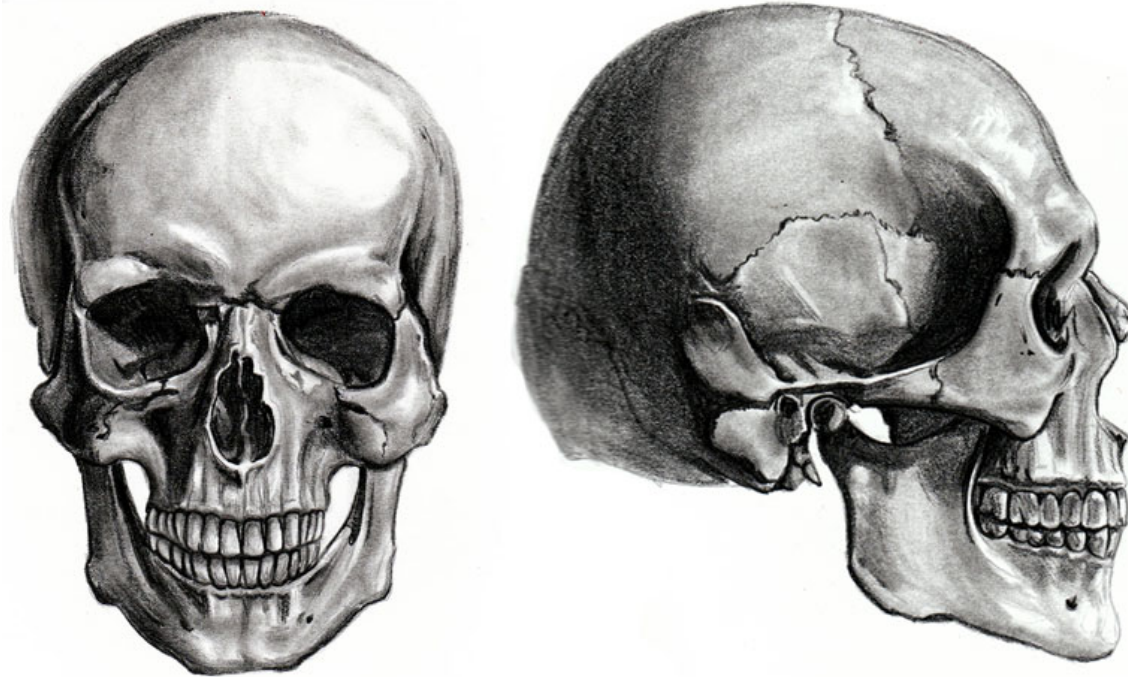
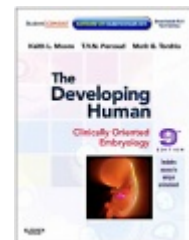


Head and Face Development



Resources:
<http://php.med.unsw.edu.au/embryology/>
Larsen's Human Embryology
The Developing Human: Clinically Oriented Embryology



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Lecture overview

Head and Face Development

Anatomy of the Head

Embryonic tissues contributing to cranial development

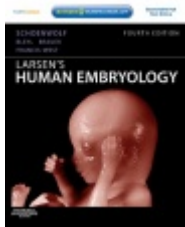
Craniofacial Development

Branchial/Pharyngeal Arch Components

Development of the Pituitary

Development of the Tongue

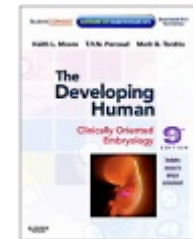
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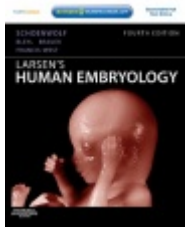
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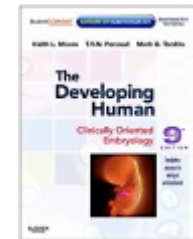
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Head Anatomy

Skull bones

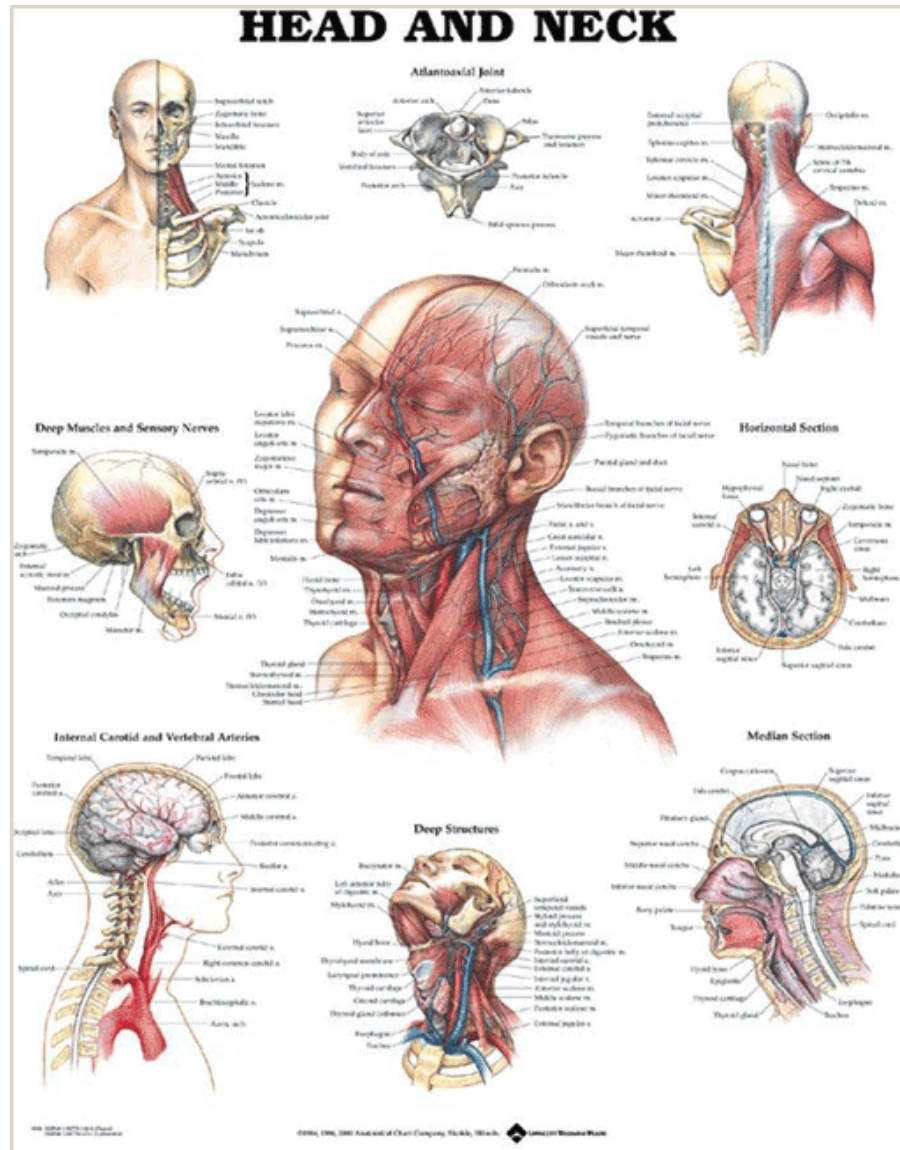
Face

Cranial Nerves

Muscles

Vasculature

Brain



Lecture overview

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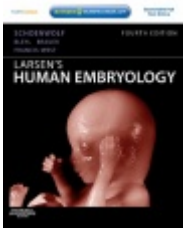
Craniofacial Development

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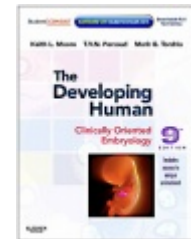
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Trilaminar embryo

Ectoderm (Neural crest)

brain, spinal cord, eyes, *peripheral nervous system*
epidermis of skin and associated structures,
melanocytes, cranial connective tissues (dermis)

Mesoderm

musculo-skeletal system, limbs,
connective tissue of skin, organs and cranium,
urogenital system, heart, blood cells

Endoderm

epithelial linings of gastrointestinal, liver, pancreas,
thyroid and respiratory tracts

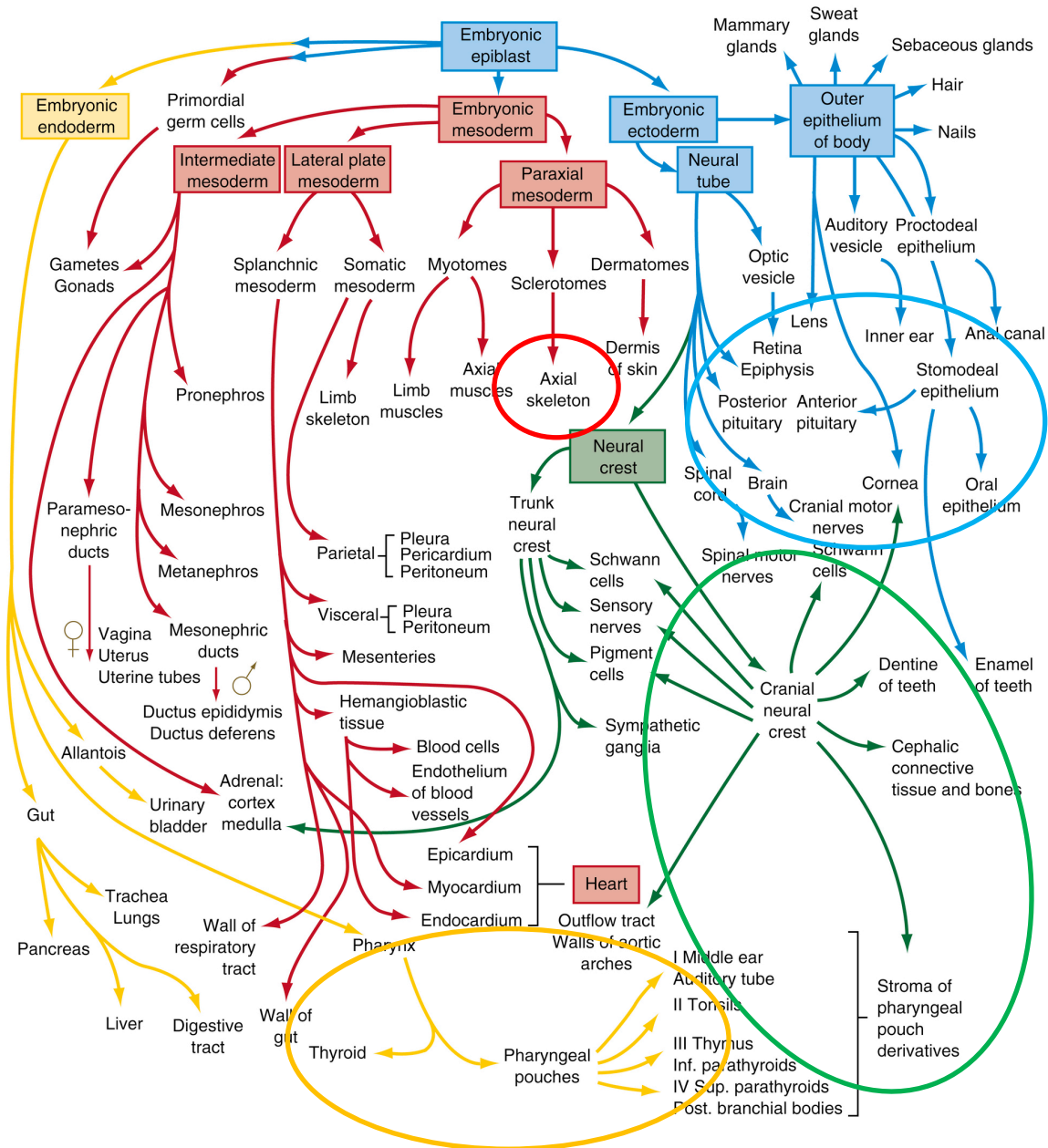
Embryonic tissues contributing to cranial development

Ectoderm and Neural Crest
Paraxial Mesoderm
Endoderm



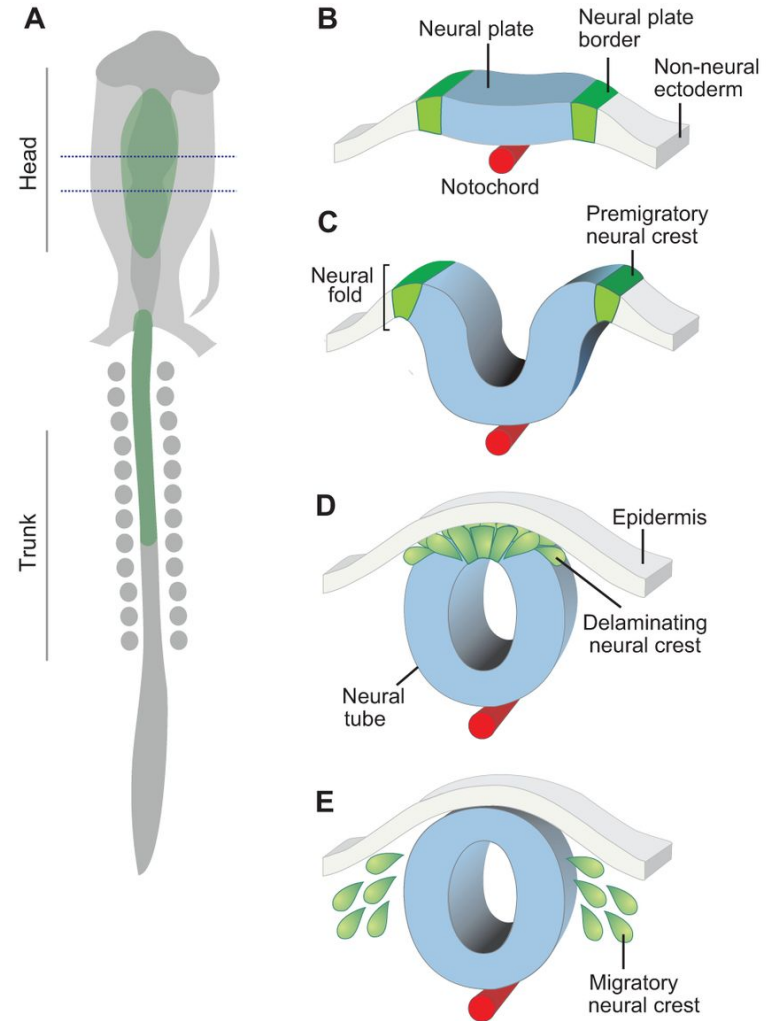
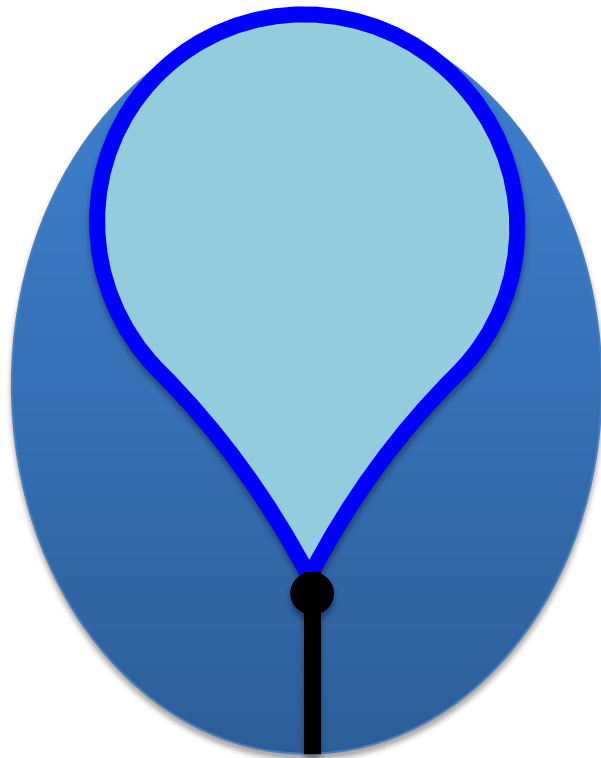
Week 4 embryo

Embryonic tissues contributing to cranial development



Embryonic tissues contributing to cranial development

Cranial Ectoderm and Cranial/Cardiac Neural Crest

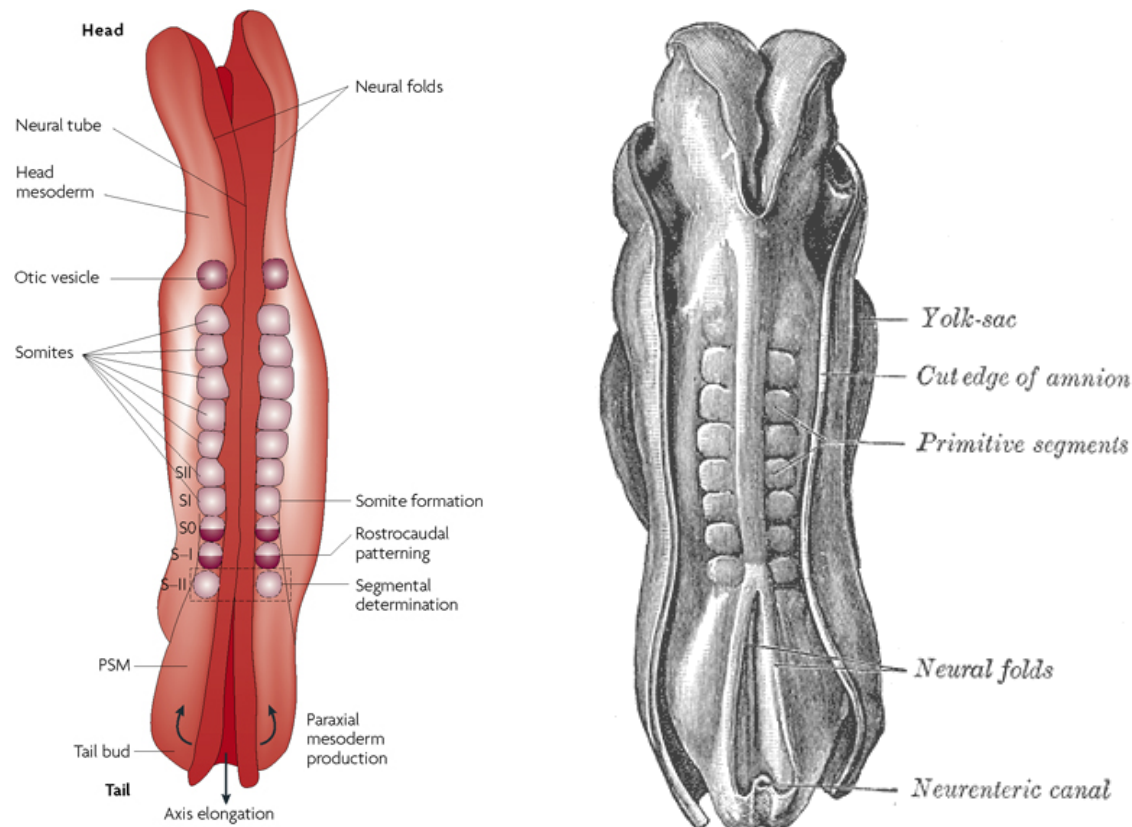


Embryonic tissues contributing to cranial development

Paraxial Mesoderm

Cranial: Unsegmented paraxial mesoderm: head mesenchyme

Trunk: Segmented paraxial mesoderm: somites

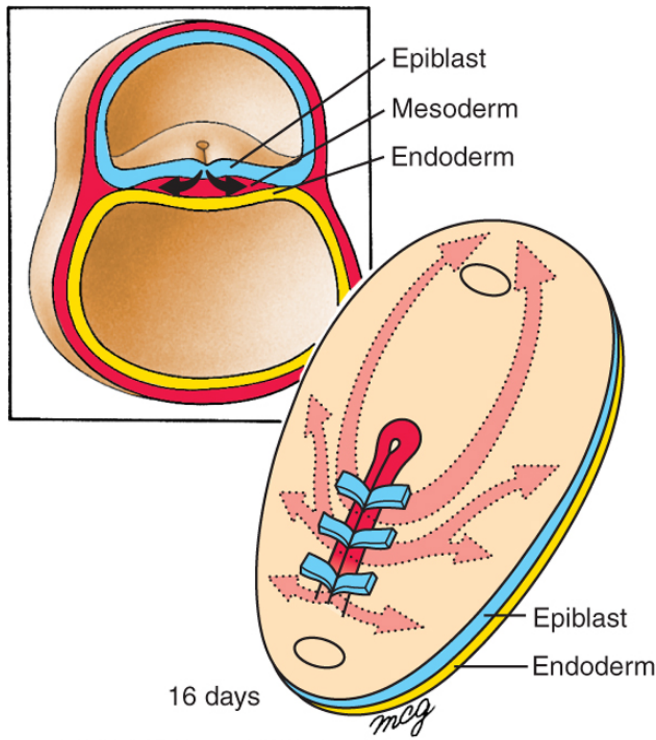


Embryonic tissues contributing to cranial development

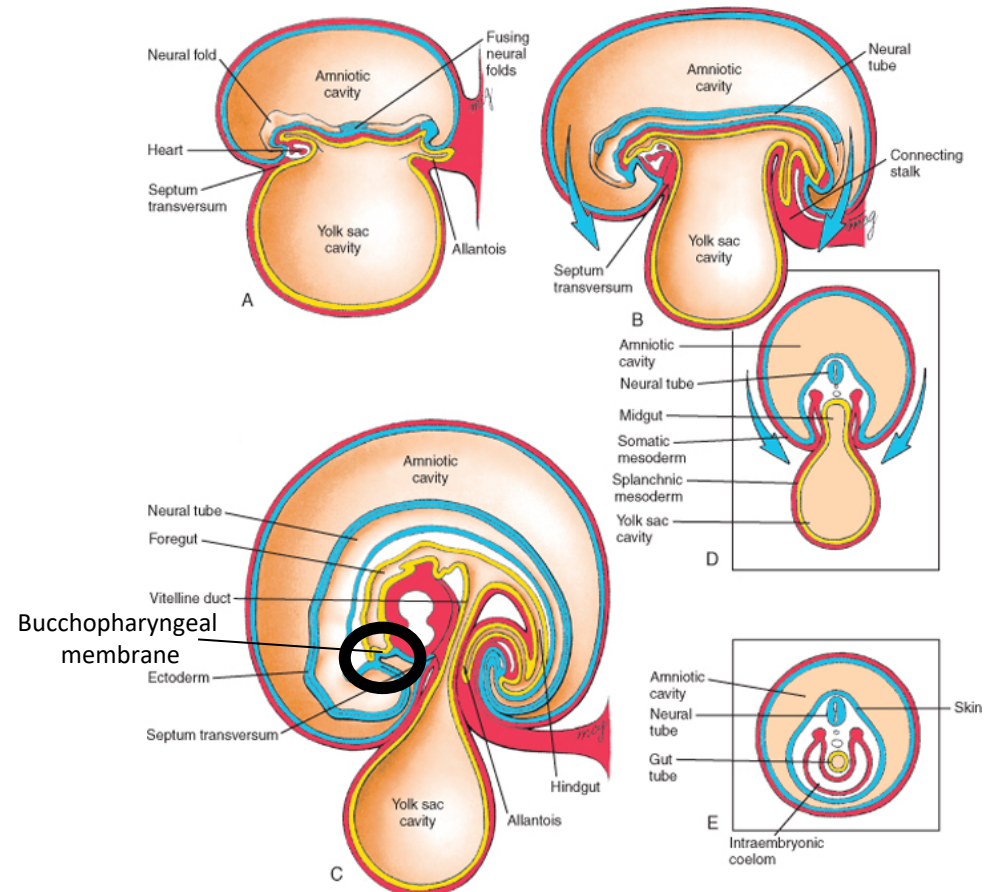
Endoderm

Bucchopharyngeal membrane

Lining of the laryngeal cavity



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Lecture overview

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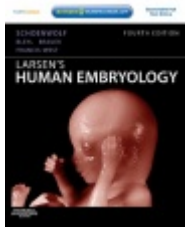
Craniofacial Development

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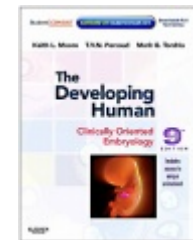
Craniofacial Abnormalities



Resources:

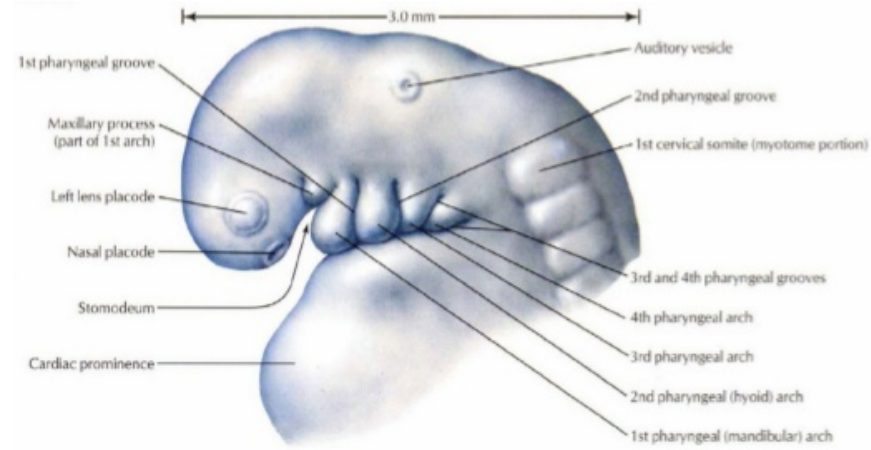
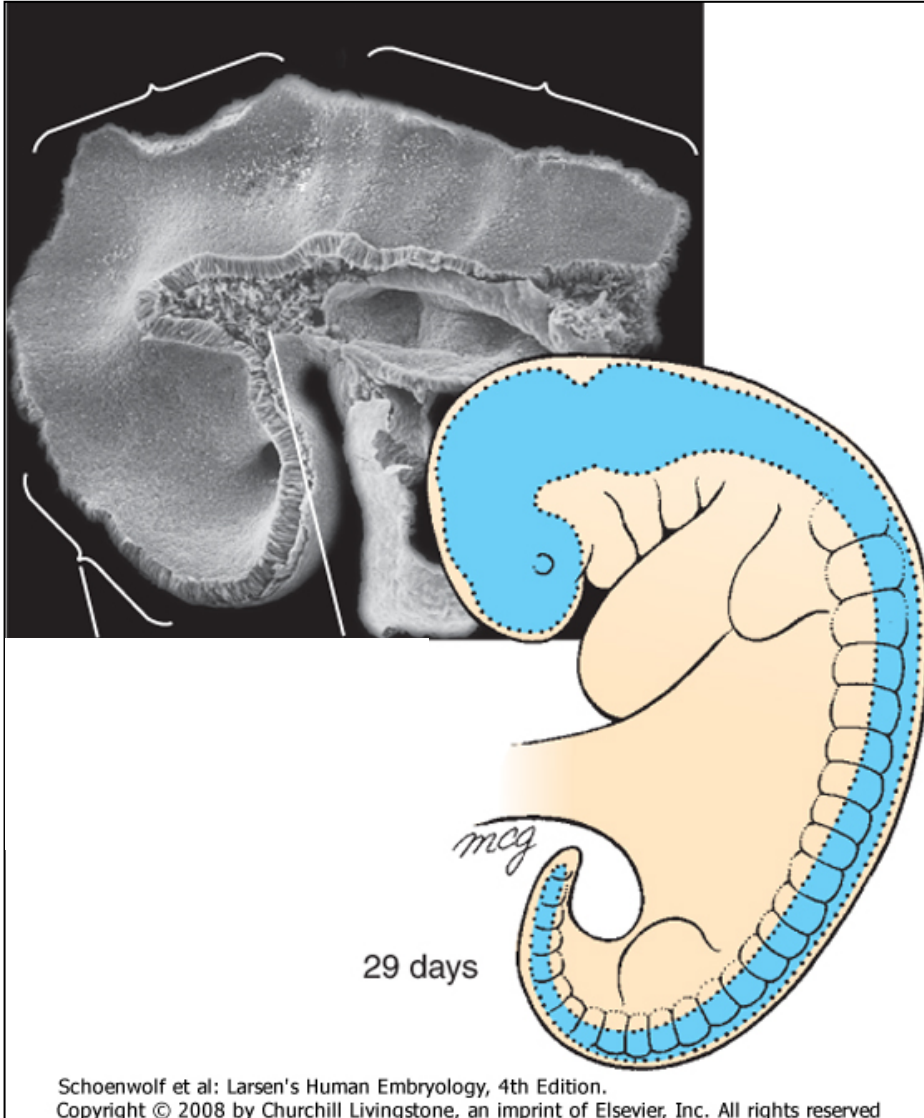
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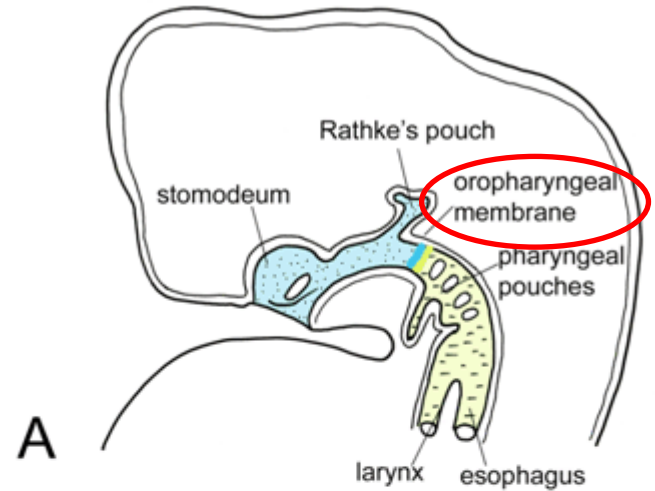


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Craniofacial Development



Embryo at 4 - 5 weeks (Lateral view)



Craniofacial Development

Humans develop 6 pharyngeal or branchial arches (BA)

Form from rostrally to caudally

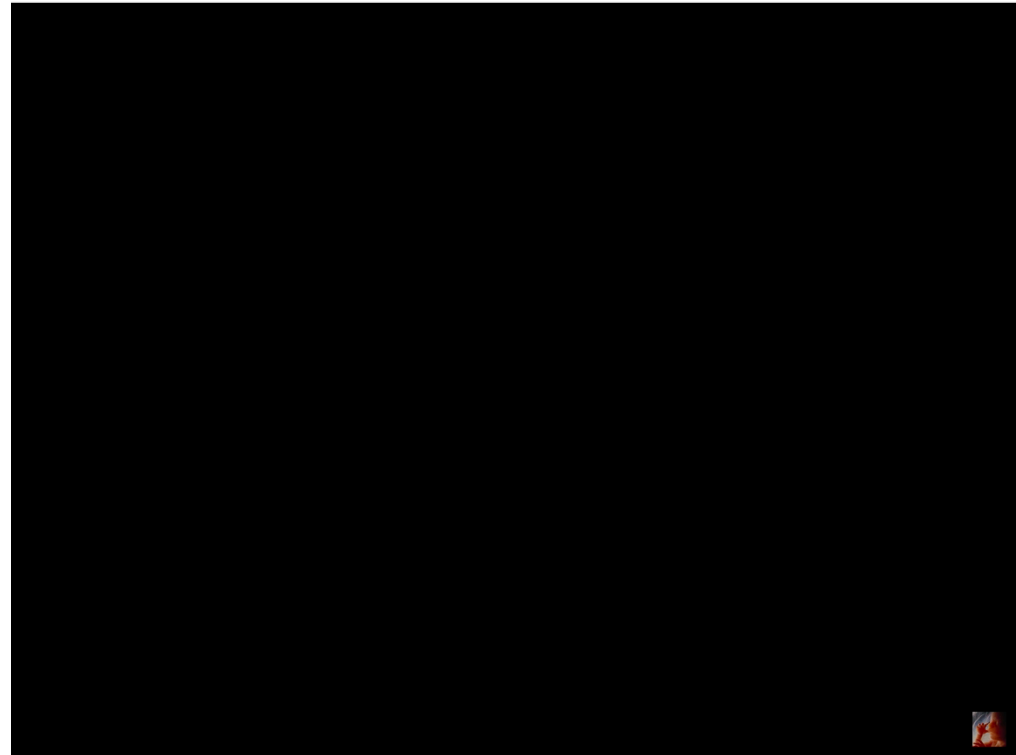
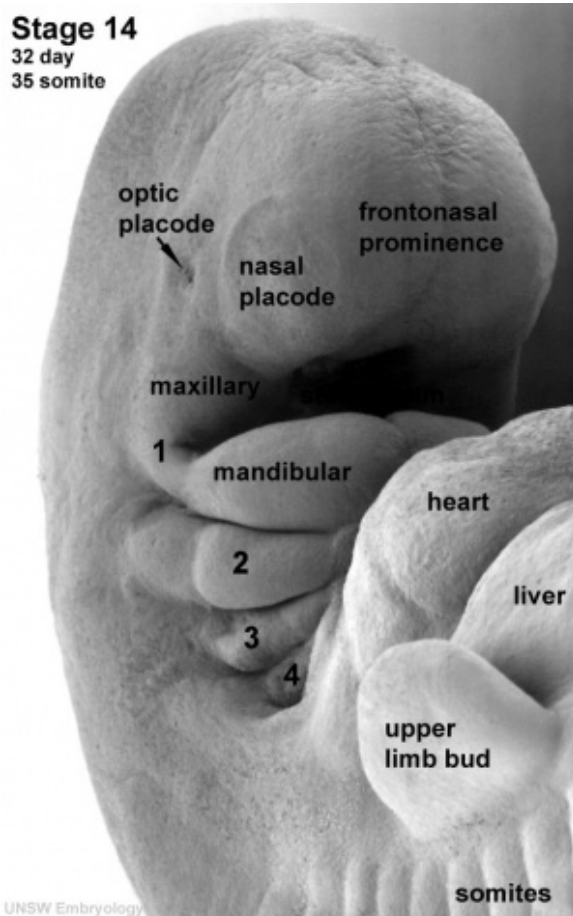
BA1 gives rise to maxillary and mandibular process

BA5 disappears

Frontonasal process/prominence

Stage 14

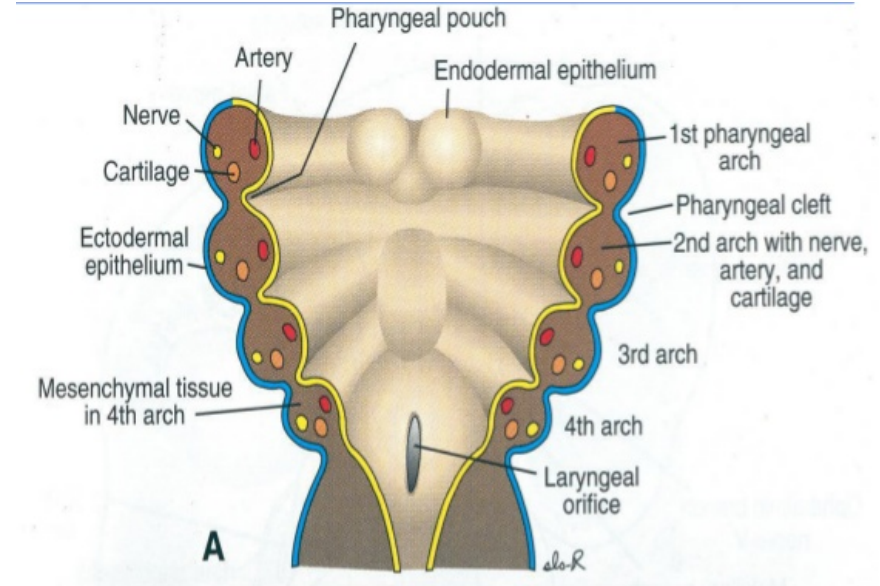
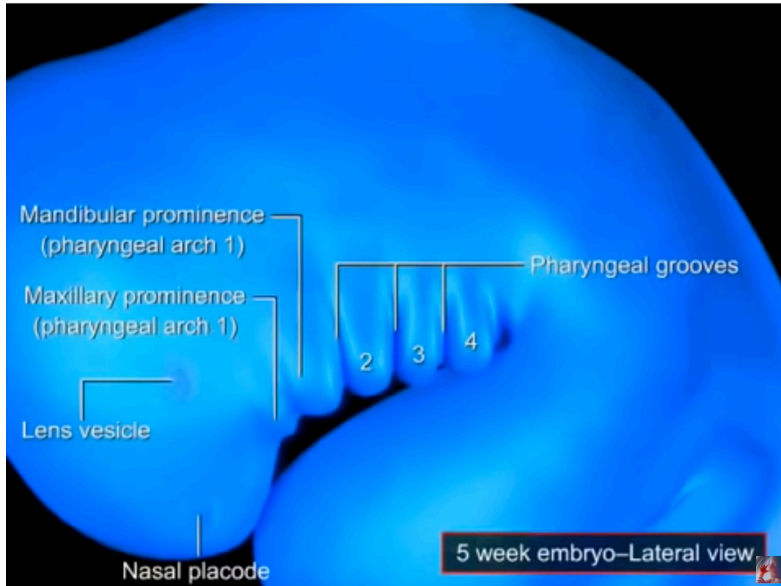
32 day
35 somite



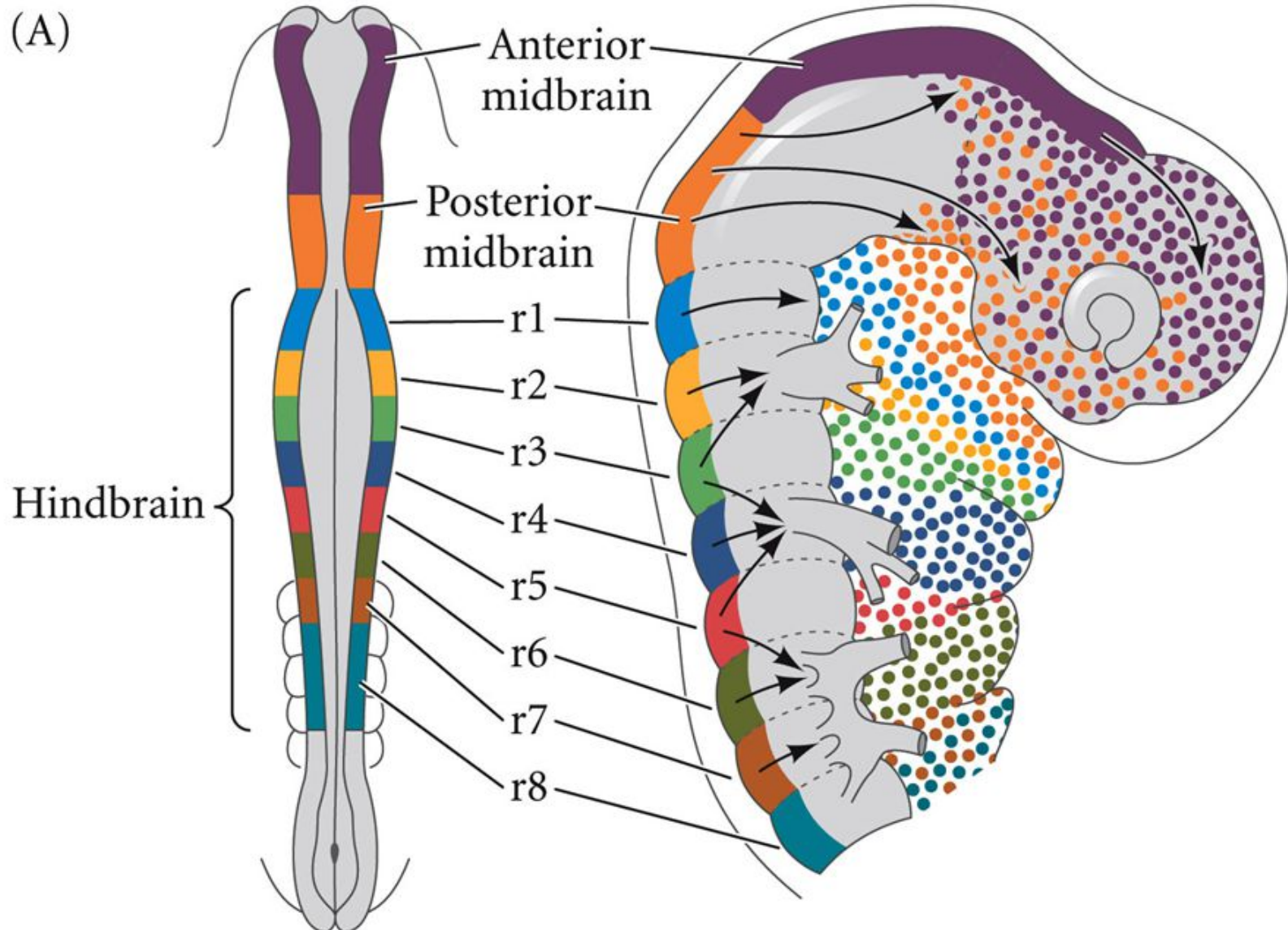
Craniofacial Development

Each branchial arch initially consists of:
 Ectoderm, endoderm and mesoderm
 Pharyngeal pouch (endoderm)
 Pharyngeal groove/cleft (ectoderm)

Each arch will contain: Skeletal element, Artery, Muscle, Cranial Nerve



Craniofacial Development



Craniofacial Development

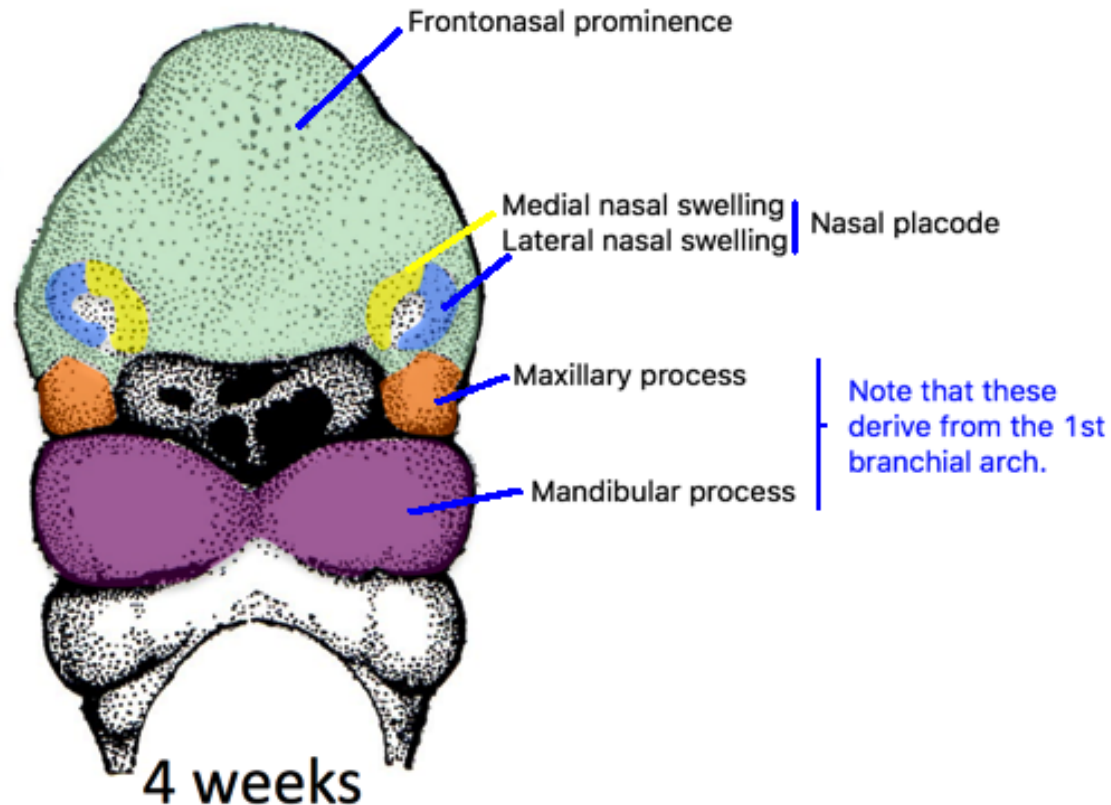
Facial Development

Facial primordia appear in week 4

Frontonasal process and nasal placodes

1st branchial arch: mandibular and maxillary processes

Stomodeum



Craniofacial Development

Facial development

Contributes to the forehead, nose, philtrum of the upper lip, and to the primary palate.

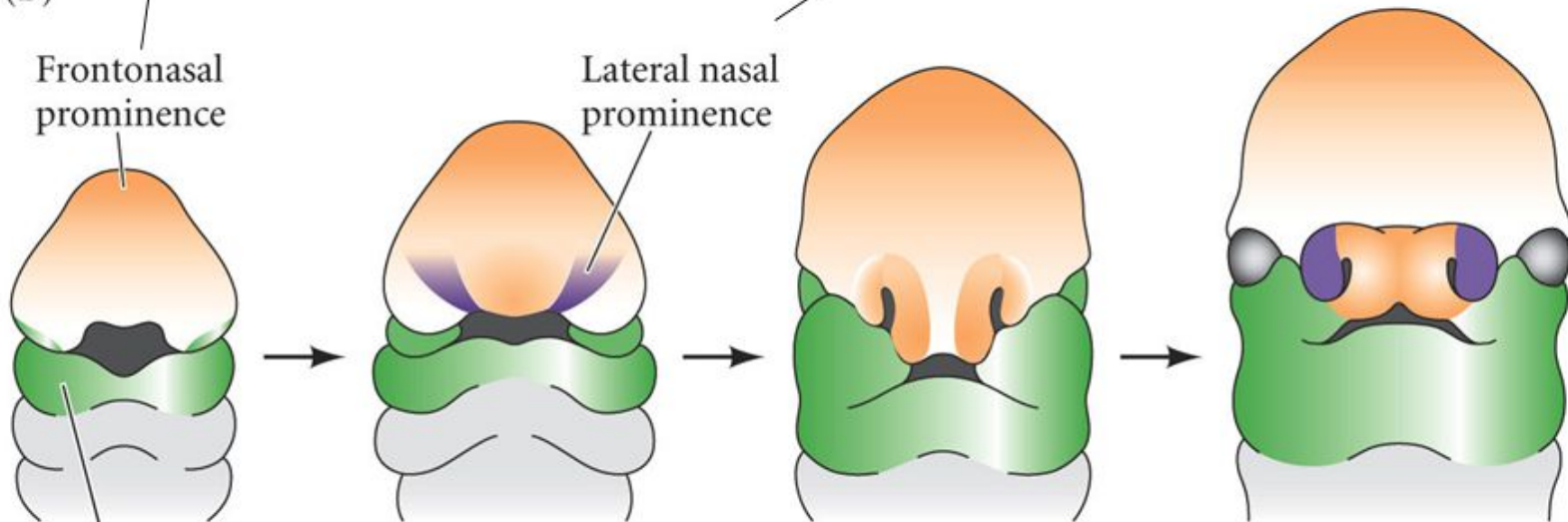
Generates the sides of the nose.

(B)

Frontonasal prominence

Lateral nasal prominence

Maxillomandibular prominence



Lower and upper jaw, and to the sides of the middle and lower regions of the face.

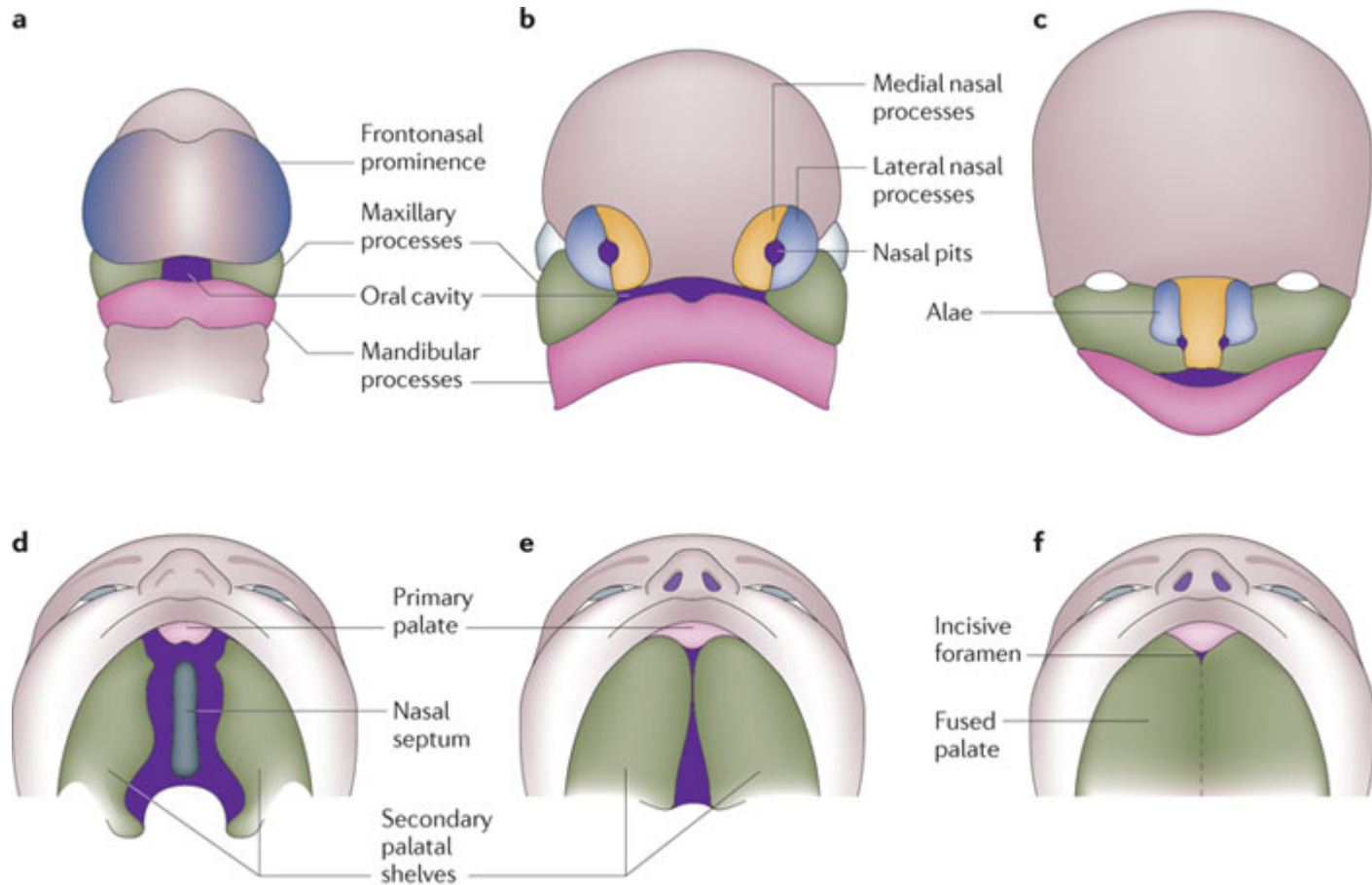
Craniofacial Development

Facial development



Craniofacial Development

Palate and nasal cavities



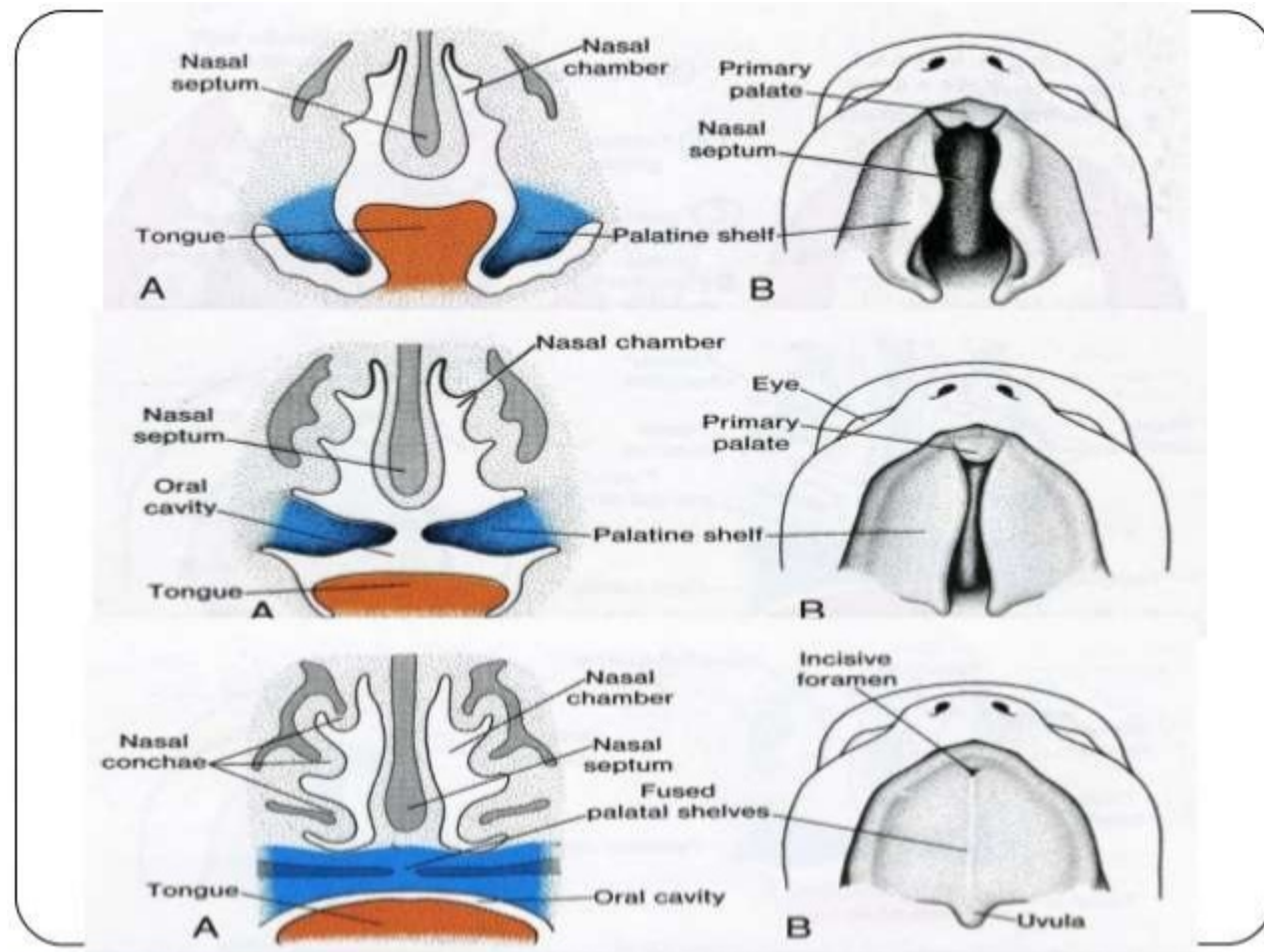
Nature Reviews | **Genetics**

https://embryology.med.unsw.edu.au/embryology/images/8/8f/Palate_001.mp4

https://embryology.med.unsw.edu.au/embryology/images/7/78/Palate_002.mp4

Craniofacial Development

Palate and nasal cavities



Lecture overview

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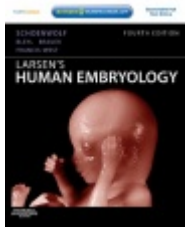
Craniofacial Development

Branchial/Pharyngeal Arch Components

Development of the Pituitary

Development of the Tongue

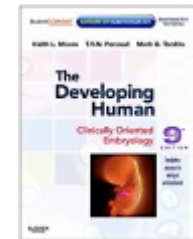
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Pharyngeal/Branchial Arch Components:

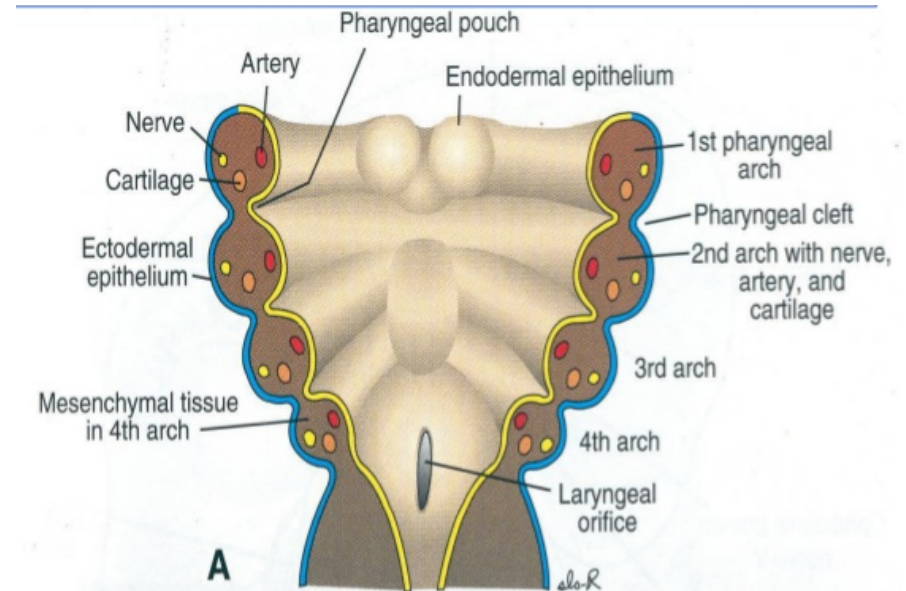
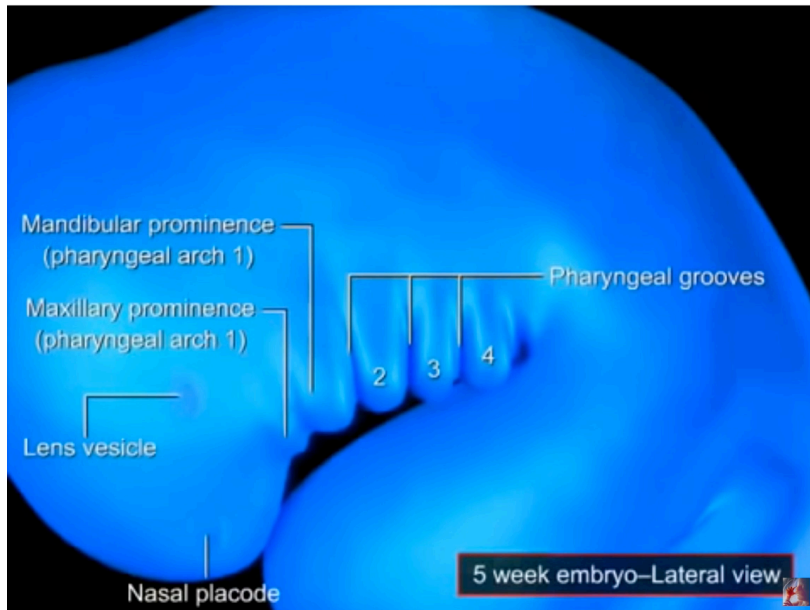
Skeletal derivatives

Arteries

Cranial Nerve

Muscle

Cleft/Pouches



Pharyngeal/Branchial Arch Components

Skeletal derivatives

Frontonasal process: frontal bone, nasal bones and septum, lacrimal bones, nasal labyrinths

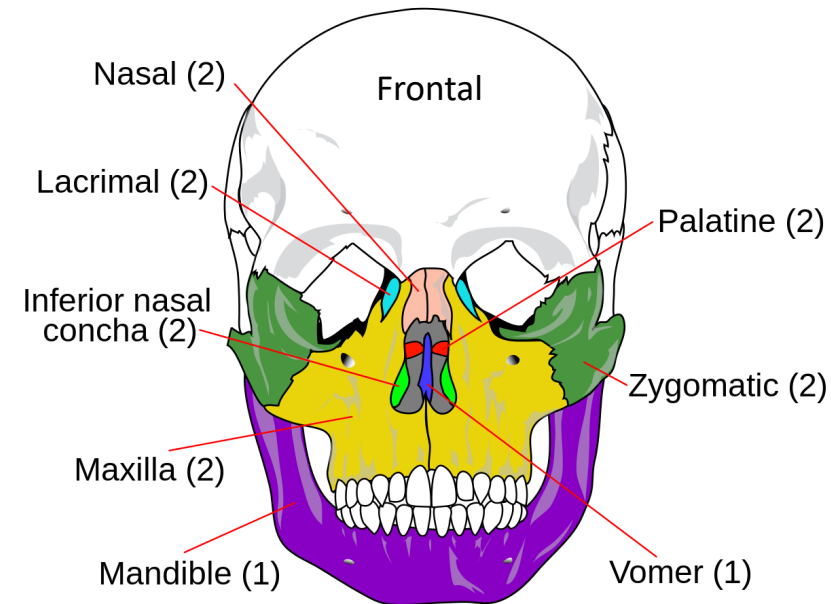
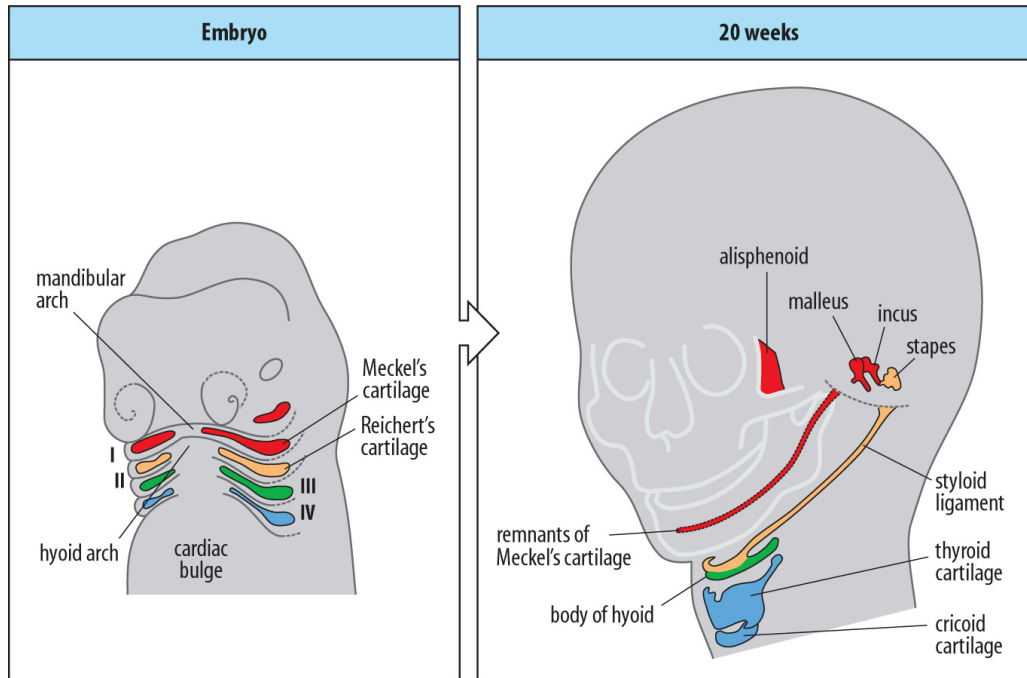
BA1 Maxillary process: maxilla, palatine, vomer, zygomatic bone, part temporal bone

BA1 Mandibular process: Meckel's cartilage and mandible, malleus and incus

BA2: Reichert's cartilage and hyoid (superior part), and stapes

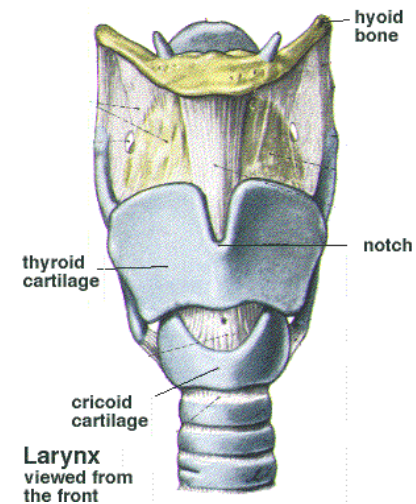
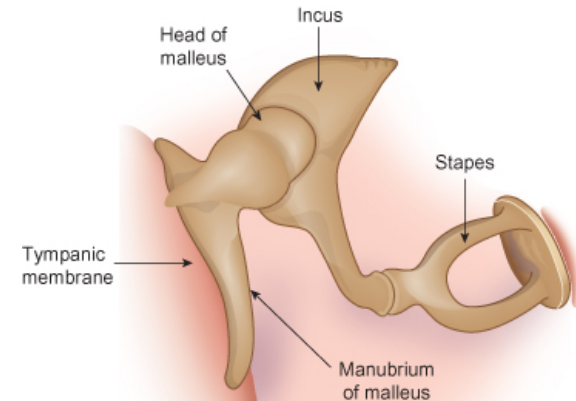
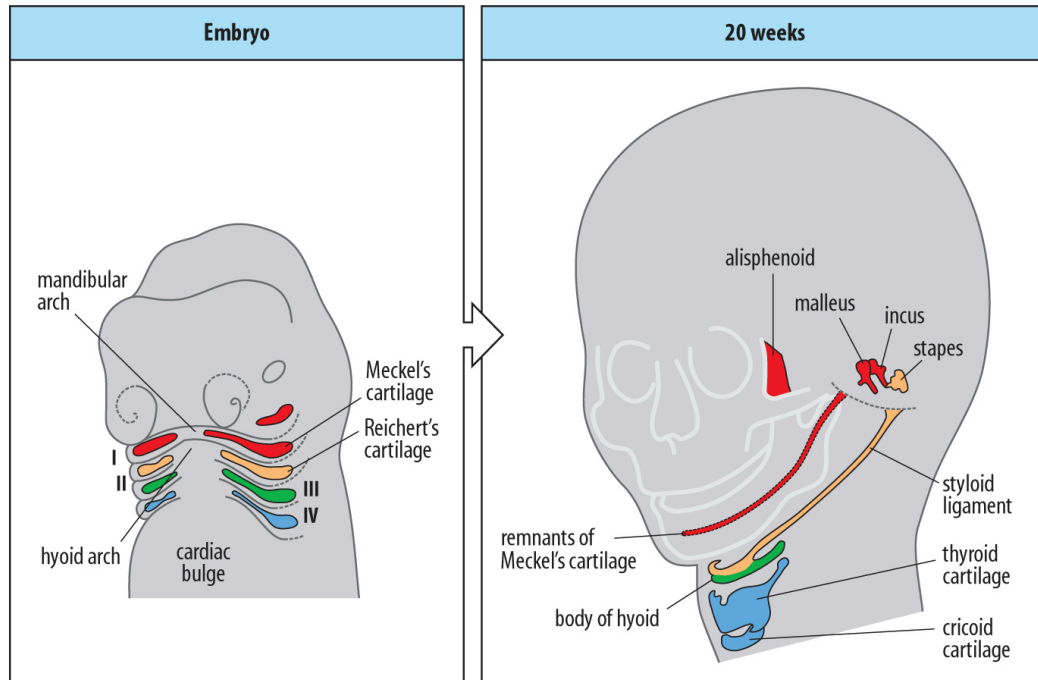
BA3: Hyoid (inferior part)

BA4: laryngeal cartilages: thyroid and cricoid cartilage



Pharyngeal/Branchial Arch Components

Middle ear ossicles and laryngeal cartilages



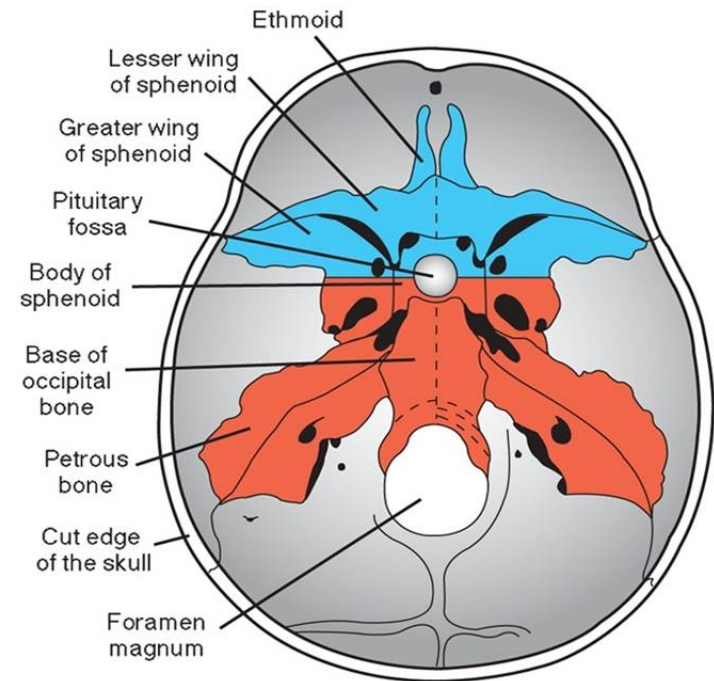
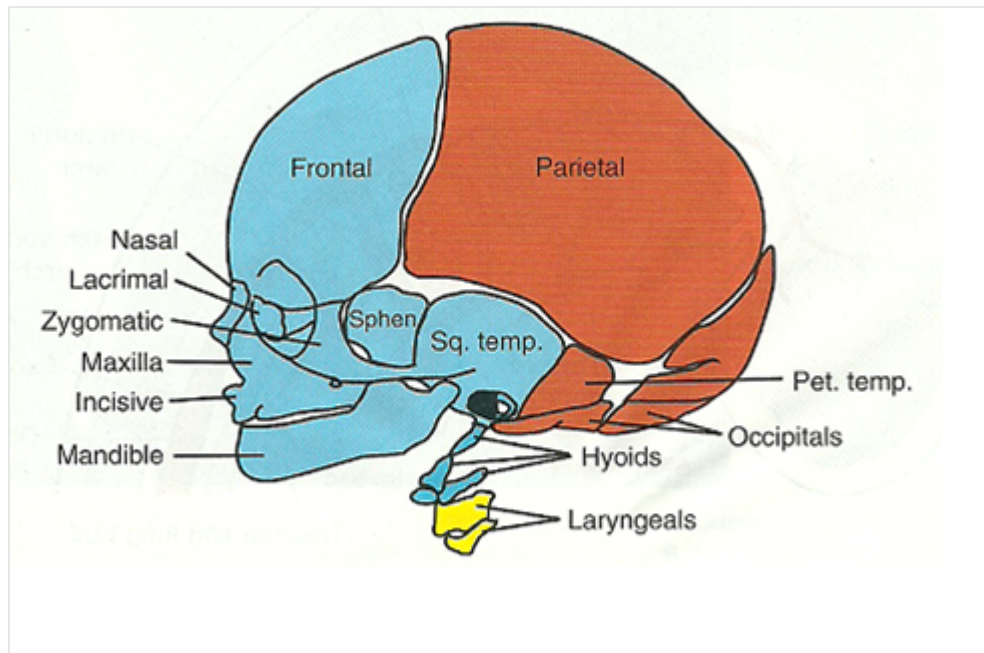
Pharyngeal/Branchial Arch Components

Skeletal derivatives

Blue: Cranial neural crest-derived bones (FNP, BA1 and BA2): most of viscerocranium

Red: Paraxial mesoderm derived bones: most of neurocranium

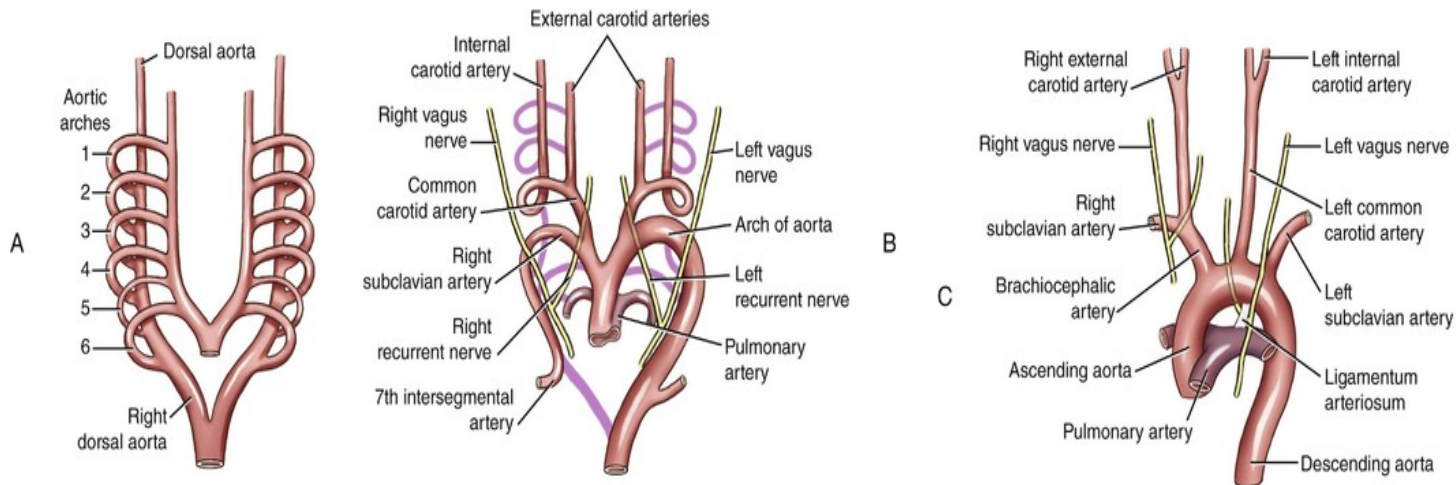
Yellow: BA2-derived



Pharyngeal/Branchial Arch Components Arteries

Aortic arches/arteries initially formed in each of the branchial arches

<https://www.youtube.com/watch?v=YI3A08x2zVo>



BA1 - mainly lost, form part of maxillary artery

BA2 – mainly lost, stapedial arteries

BA3 - common carotid arteries, internal carotid arteries

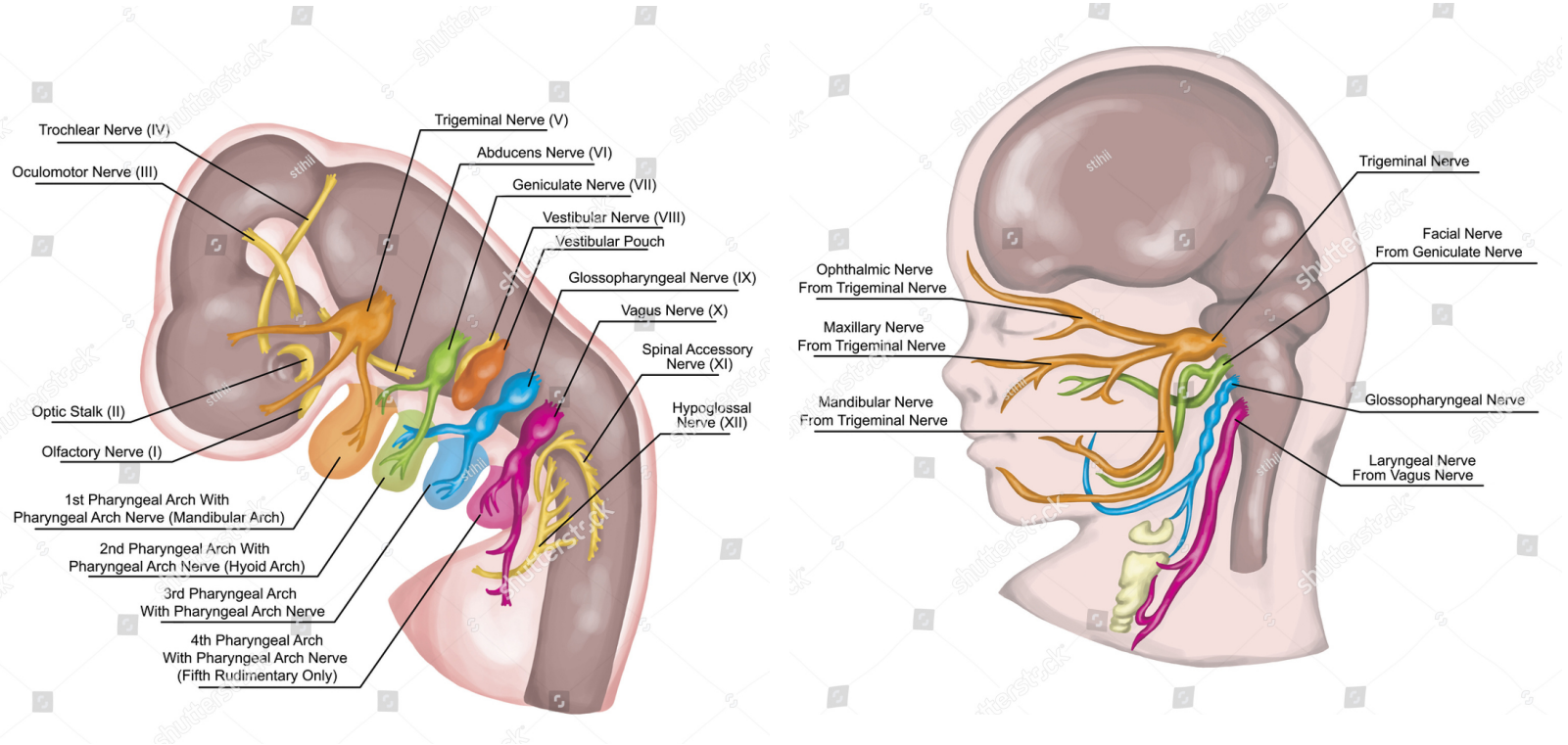
BA4 - left forms part of aortic arch, right forms part right subclavian artery

BA5 - mainly lost

BA6 - left forms part of left pulmonary artery , right forms part of right pulmonary artery

Pharyngeal/Branchial Arch Components

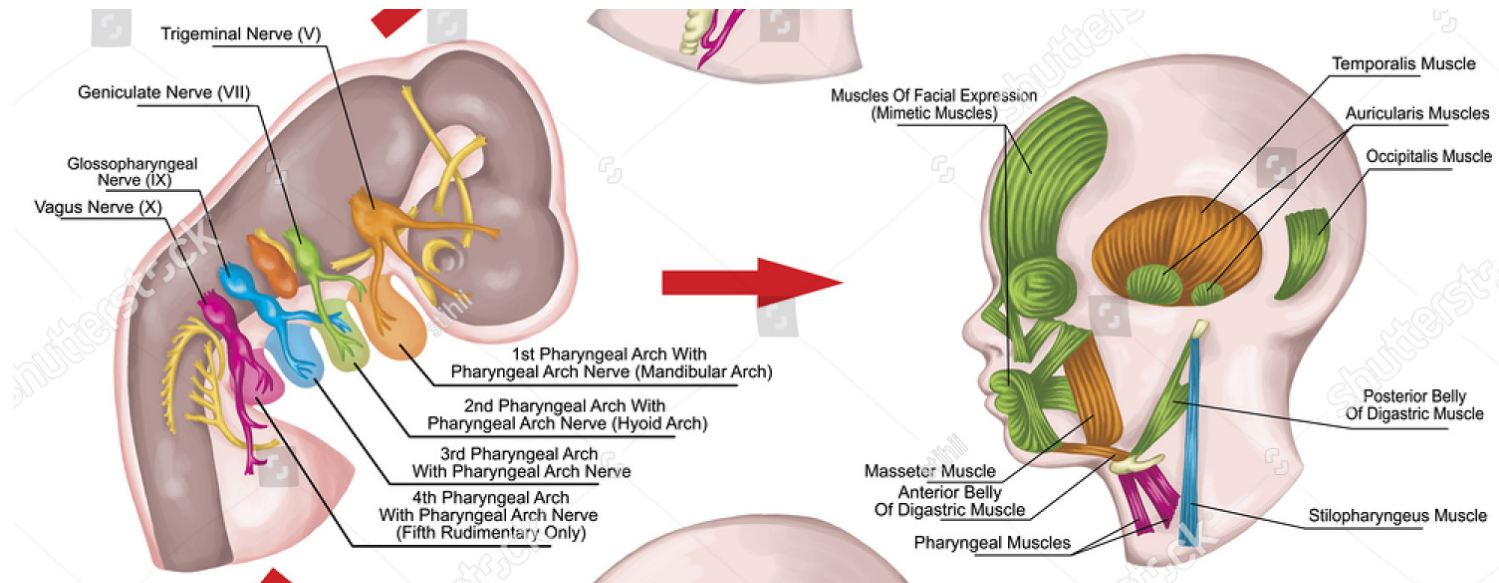
Cranial nerves



- BA1 - Cranial Nerve V: trigeminal nerve
- BA2 - Cranial Nerve VII: facial nerve
- BA3 - Cranial Nerve IX: glossopharyngeal nerve
- BA4&6 - Cranial Nerve X: vagus nerve

Pharyngeal/Branchial Arch Components

Branchial muscles



BA1 - muscles of mastication, mylohyoid, tensor tympanic, ant. belly digastric

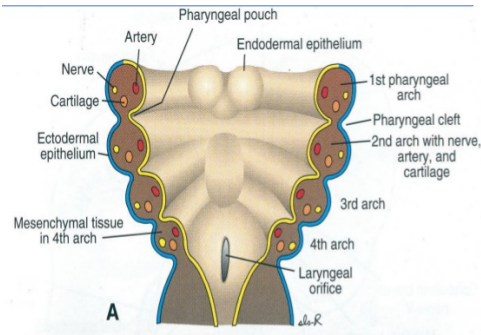
BA2 - muscles of facial expression, stapedius, stylohyoid, post. belly digastric

BA3 - stylopharyngeus

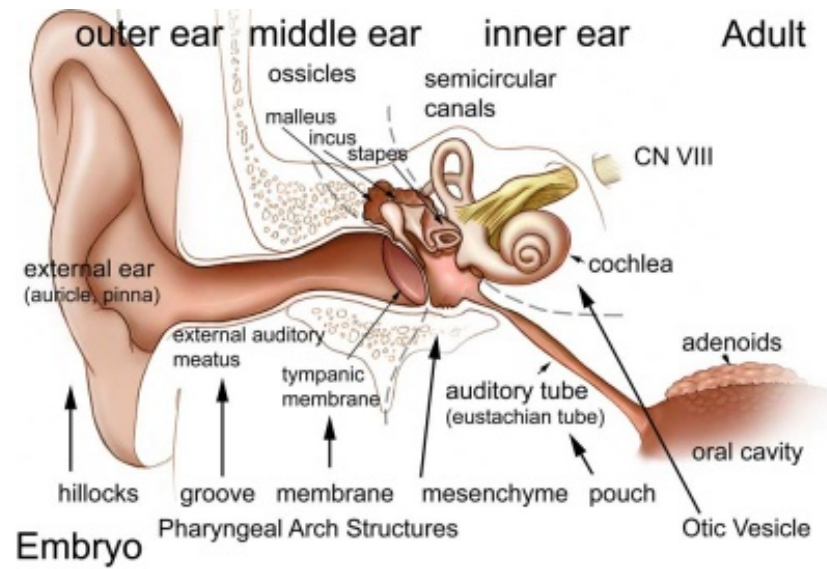
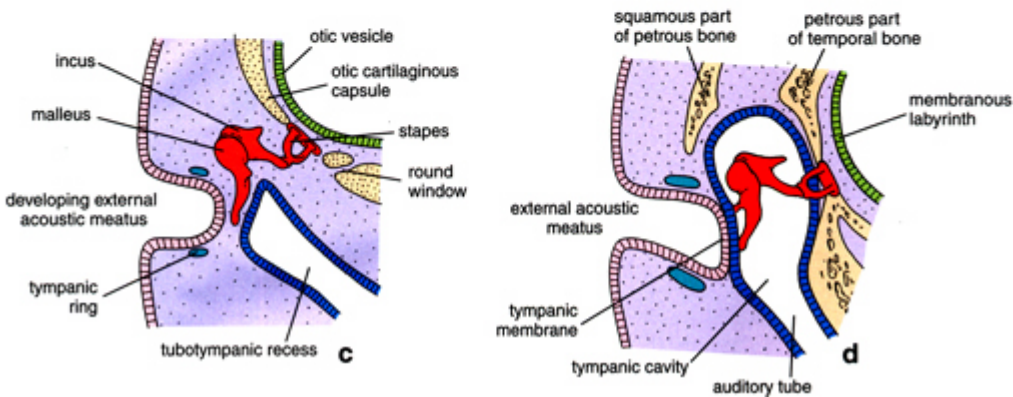
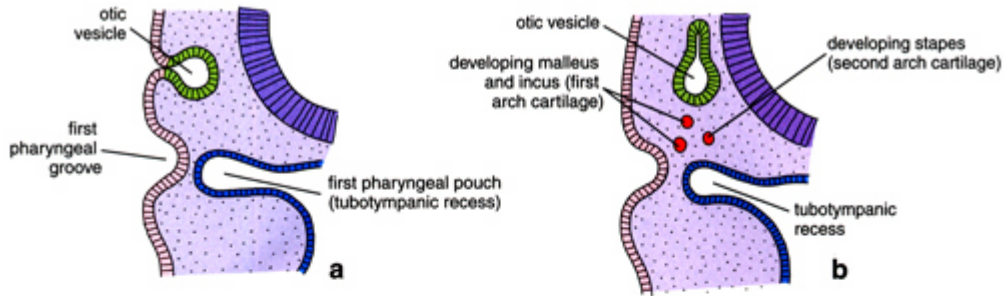
BA4&6 - cryothyroid, pharynx constrictors, larynx muscles, oesophagus (st. muscle)

Pharyngeal/Branchial Arch Components

1st branchial cleft/pouch derivatives



1st pouch: tubotympanic recess: tympanic cavity, auditory tube
 1st cleft: external acoustic meatus



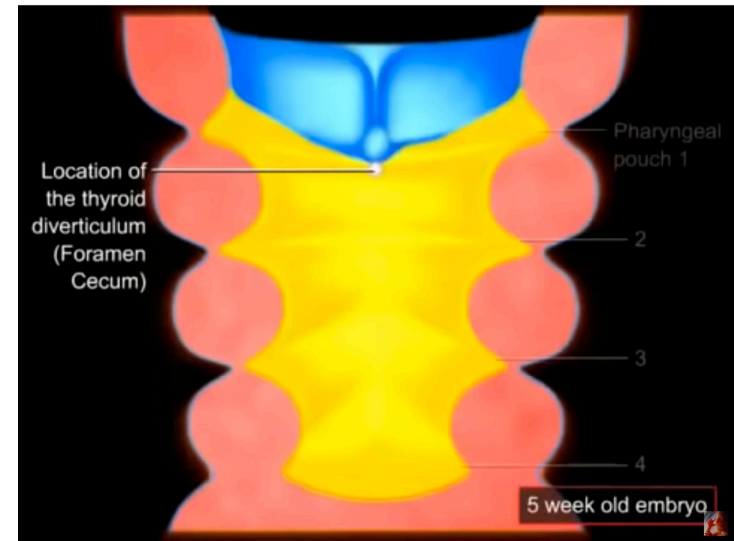
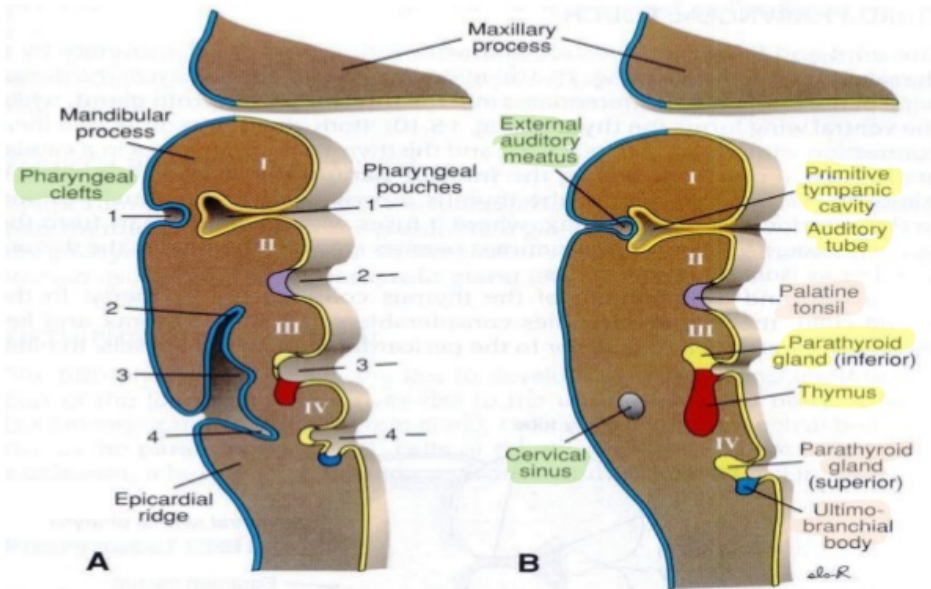
Embryo

Pharyngeal Arch Structures

Otic Vesicle

Pharyngeal/Branchial Arch Components

branchial pouch derivatives



https://www.youtube.com/watch?v=fp3Z_Y--0jo&t=11s

- BA1 - elongates to form **tubotympanic recess**: tympanic cavity, eustachian tube
- BA2 - forms **tonsillar sinus**, mostly obliterated by palatine tonsil
- BA3 - forms **inferior parathyroid** and **thymus**
- BA4 - forms **superior parathyroid**, parafollicular cells of thyroid

Pharyngeal/Branchial Arch Components Summary

Derivates of pharyngeal folds	Arch number	Aortic arch	Cranial nerve	Examples of branchiomeric muscles	Skeletal derivates	Derivates of pharyngeal pouch
external auditory meatus	I mandibular	maxillary artery	V trigeminal	muscles of mastication etc.	malleus, incus spheno- mandibular lig. Meckel cart.	I middle ear auditory tube
	II hyoid	hyoid, stapedial artery	VII facial	muscles of facial expression etc.	stapes, styl. proc., stylohyoid lig., part of hyoid cart.	II supra- tonsillar fossa
neck	III	internal carotid artery	IX glosso- pharyng.	m. stylopha- ryngeus	parts of hyoid cart.	III thymus, parathyr. gland
	IV	right subclavian artery, aorta	X vagus	pharyngeal and laryngeal musculature	laryngeal cart.	IV thymus parathyr. gland ultimobranch. body

Lecture overview

Head and Face Development

Anatomy of the Head

Embryonic tissues contributing to cranial development

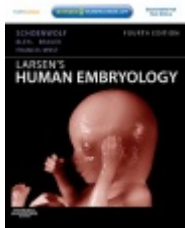
Craniofacial Development

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Development of the Tongue

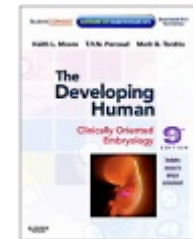
Craniofacial Abnormalities



Resources:

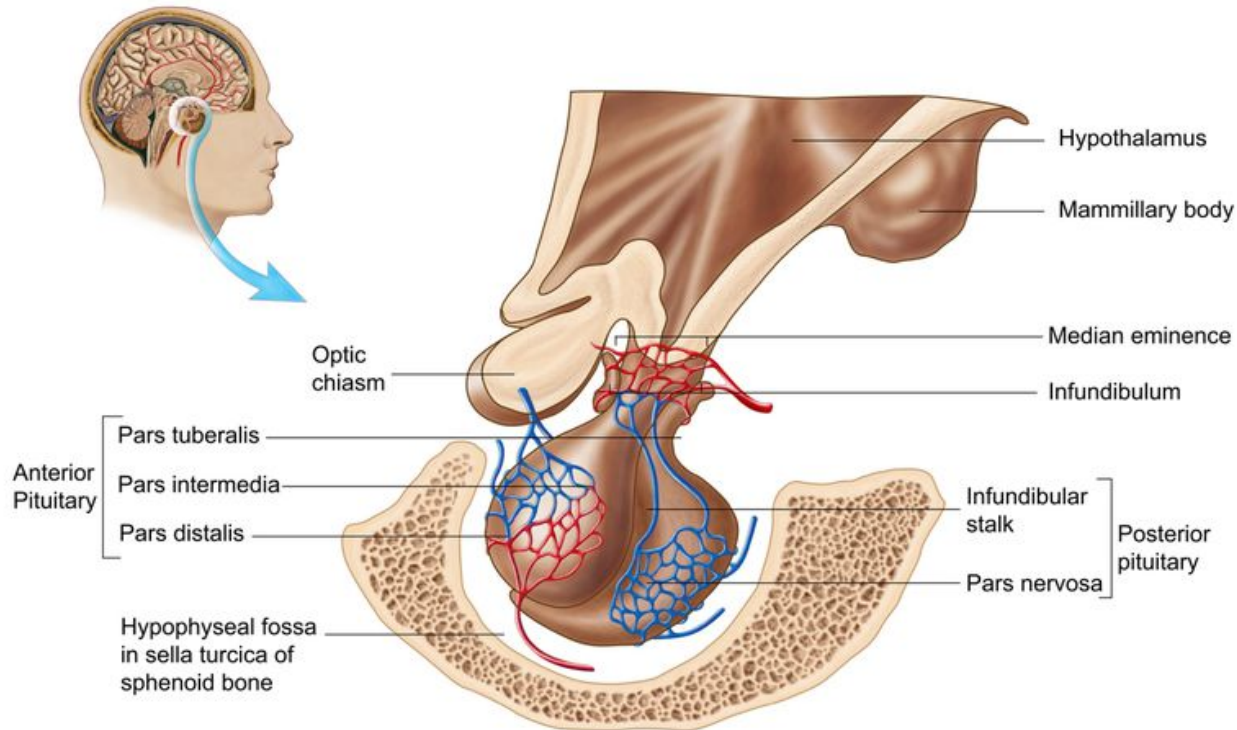
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Development of the Pituitary



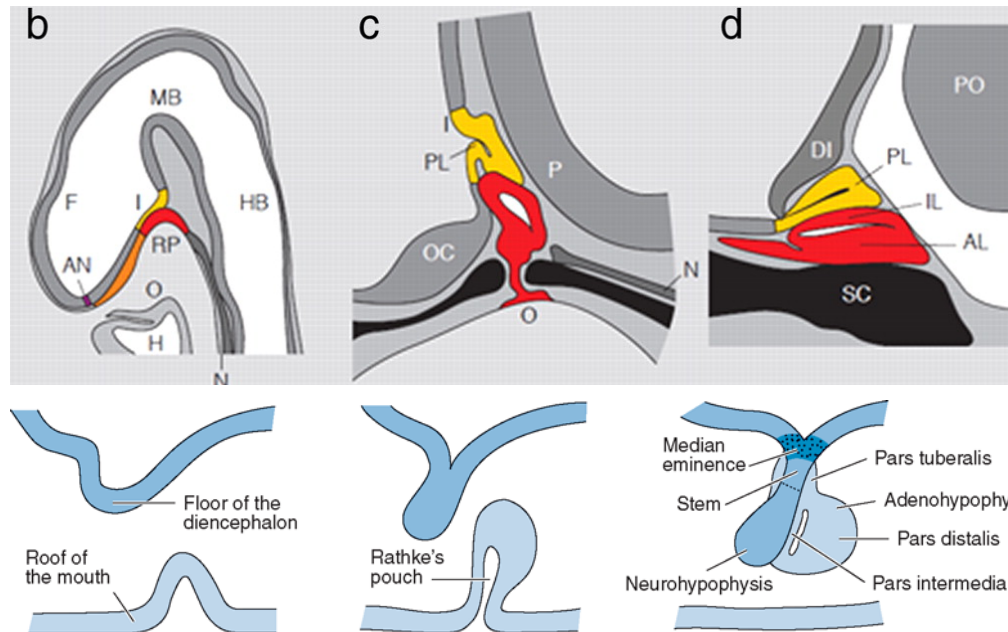
Endocrine organ at base of the brain

Two parts: neurohypophysis (anterior lobe) and adenohypophysis (posterior lobe)

infundibulum

Located in sella turca

Development of the Pituitary



Source: Paulsen DF: *Histology & Cell Biology: Examination & Board Review*, 5th Edition: www.accessmedicine.com

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Two embryonic origins:

1. Ectoderm of oral cavity: Rathke's pouch: adenohypophysis
2. Floor of diencephalon: neurohypophysis

Neurectoderm: Posterior Lobe = Pars nervosa = neurohypophysis

Oral ectoderm: Anterior lobe = Pars distalis = adenohypophysis

Adenohypophysis: TSH, ACTH, LH, FSH, GH, PRL, MSH

Neurohypophysis: oxytocin, arginine vasopressin

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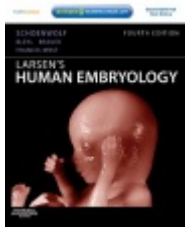
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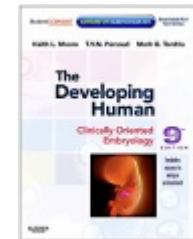
Craniofacial Abnormalities



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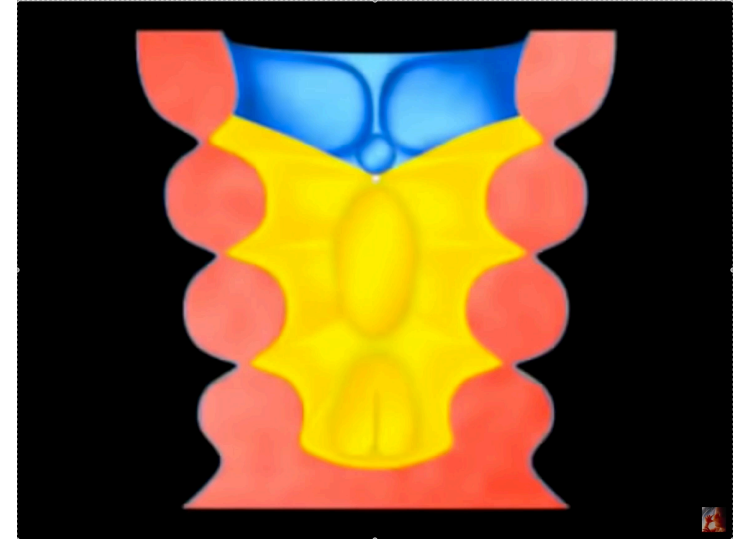
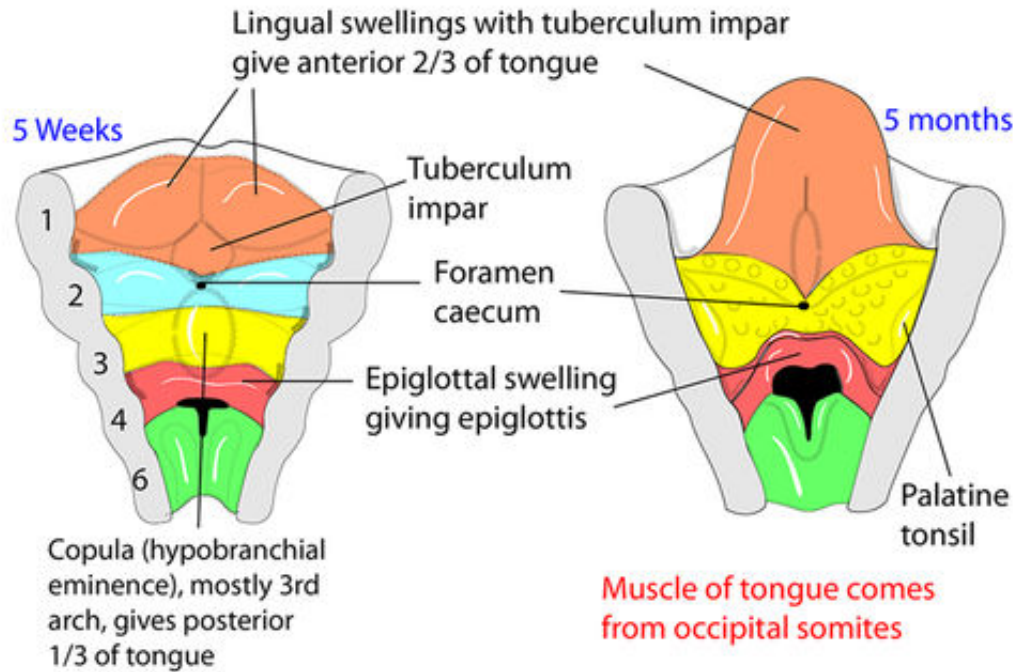
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Larsen's Human Embryology

The Developing Human: Clinically Oriented Embryology



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Development of the Tongue



Contributions initially from all arches:

Arch 1 - oral part of tongue (ant 2/3) (lingual swelling and tuberculum impar)

Arch 2 - initial contribution to surface is lost

Arch 3 - pharyngeal part of tongue (post 1/3)

Arch 4 - epiglottis and adjacent regions

Tongue muscles derived from sclerotomes

Lecture overview

Head and Face Development

Anatomy of the Head

Embryonic tissues contributing to cranial development

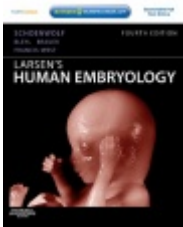
Craniofacial Development

Branchial/Pharyngeal Arch Components

Development of the Pituitary

Development of the Tongue

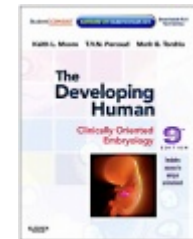
Craniofacial Abnormalities



Resources:

<http://php.med.unsw.edu.au/embryology/>
Larsen's Human Embryology

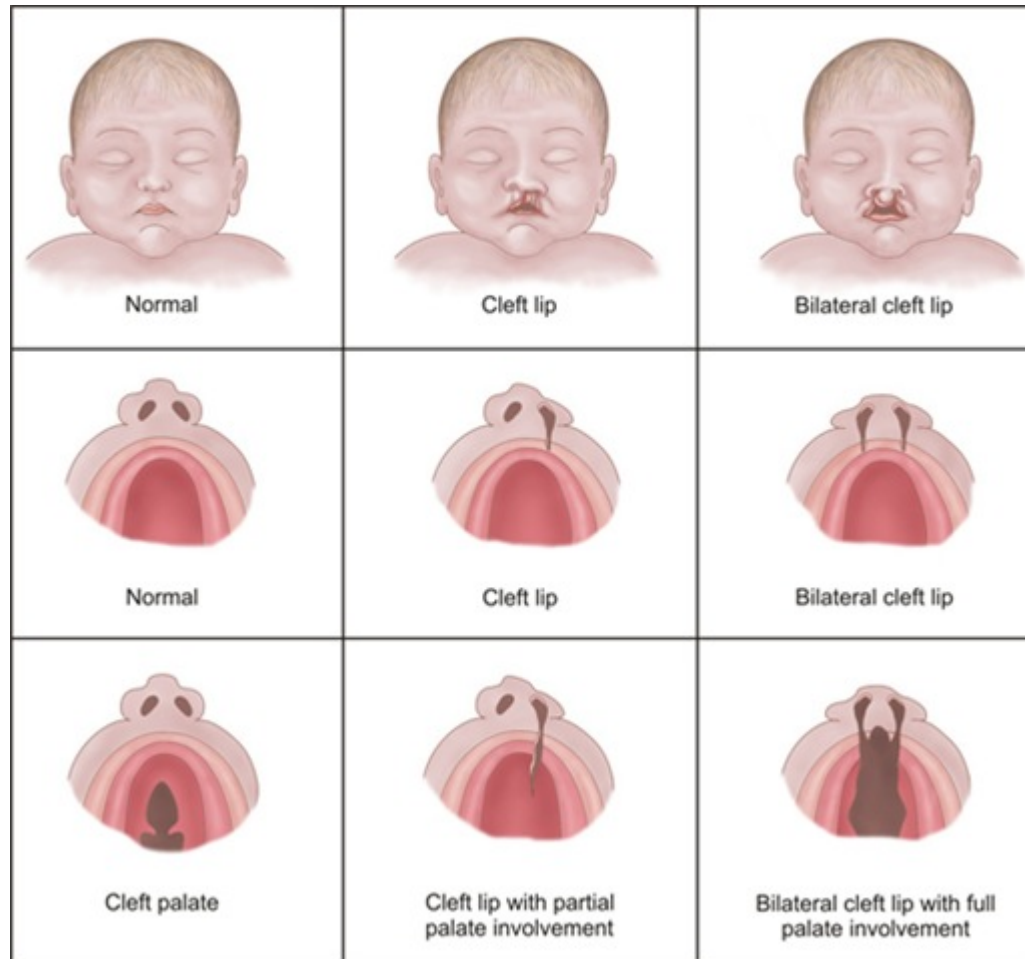
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Craniofacial Abnormalities

Cleft Lip/Palate



Craniofacial Abnormalities

Treacher Collins Syndrome



Autosomal Dominant
Affects Cranial neural crest migration
BA1 hypoplasia
Abnormal development of BA1 structures

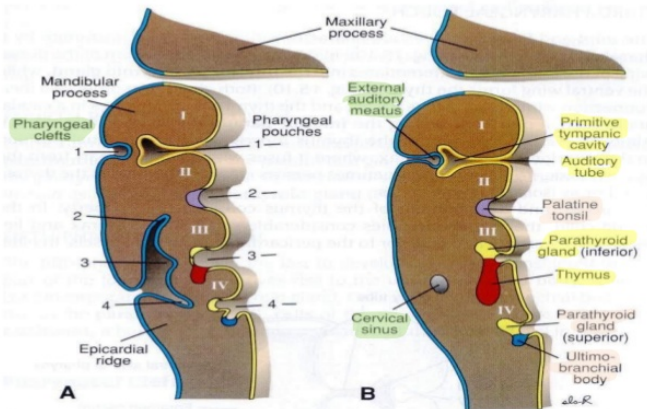
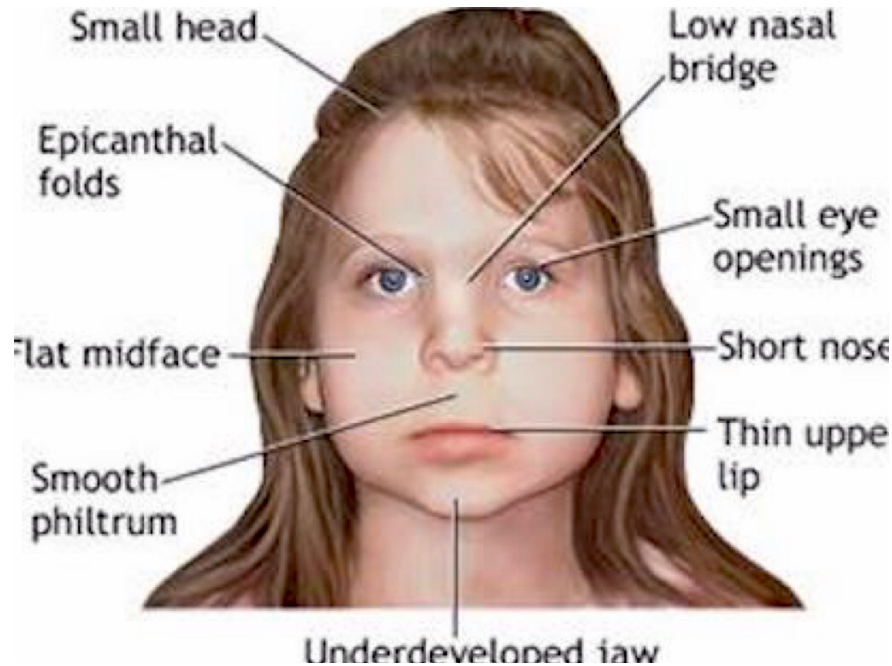
Pierre Robin Syndrome



BA1 syndrome
Cleft Palate
Retrognathia

Craniofacial Abnormalities

DiGeorge Syndrome



Chromosome 22

Disturbance of cervical neural crest migration:

3rd and 4th pouch do not form:

absence of thymus and parathyroid glands

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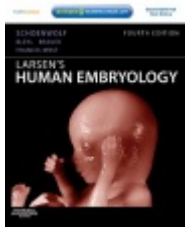
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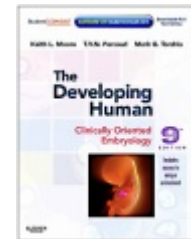
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