Lecture - Head Development

Embryology (/embryology/index.php/Main_Page) - 5 Sep 2016 (/embryology/index.php/File:Facebook_16x16.png) [Expand]
(/embryology/index.php/File:Pinterest_16x16.png) (/embryology/index.php/File:Twitter_16x16.png) Expand to Translate

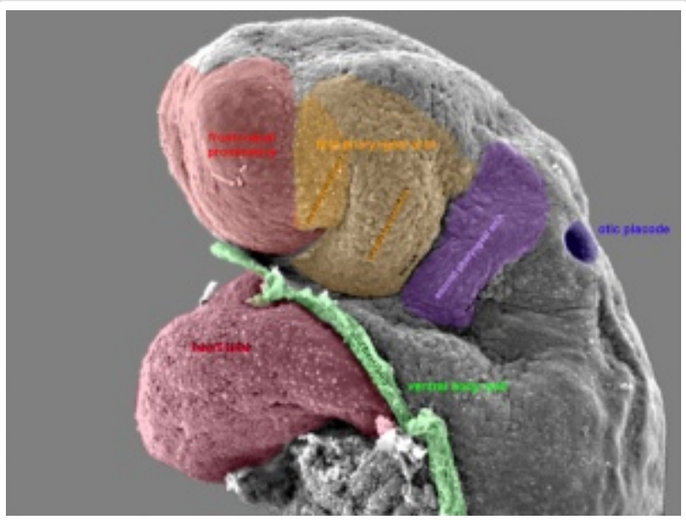
Contents

Head Development

Introduction

The face is the anatomical feature which is truly unique to each human, though the basis of its general development is identical for all humans and similar to that seem for other species. The face has a complex origin arising from a number of head structures and sensitive to a number of teratogens during critical periods of its development. The related structures of upper lip and palate significantly contribute to the majority of face abnormalities.

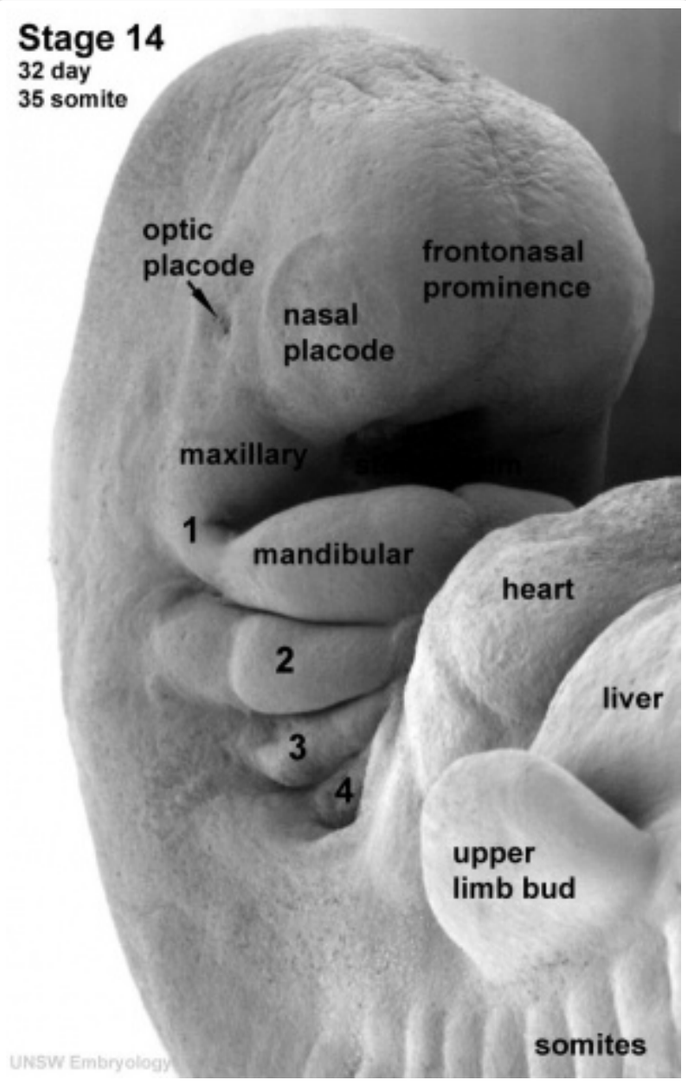
The head and neck structures are more than just the face, and are derived from pharyngeal arches 1 - 6 with the face forming from arch 1 and 2 and the frontonasal prominence. Each arch contains similar Arch components derived from endoderm, mesoderm, neural crest and ectoderm. These components though will form different structures depending on their arch origin. Because the head contains many different structures also review notes on Special Senses (/embryology/index.php/Sensory_System_Development)), Respiratory (/embryology/index.php/Respiratory_System_Development), Integumentary (Teeth), Endocrine (/embryology/index.php/Endocrine_System_Development) (thyroid, parathyroid, pituitary, thymus) and Ultrasound (/embryology/index.php/Ultrasound)- Cleft lip/palate.



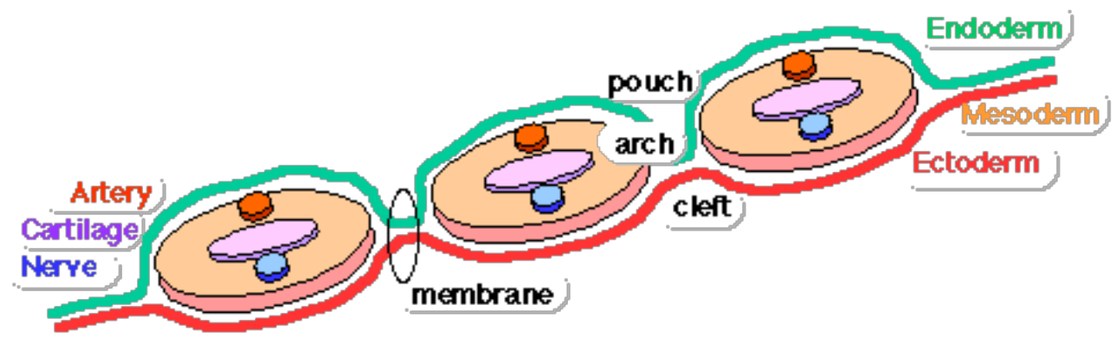
(/embryology/index.php/File:Stage11_sem81.jp
Human face development (Week 4)

Lecture Objectives

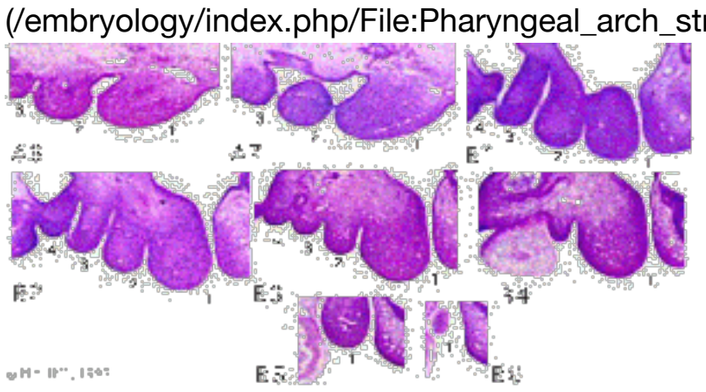
- Understand the main structures derived from the pharyngeal arches, pouches and clefts.
- Understand the stages and structures involved in the development of the face.
- Understand the development of palate and tongue.
- Briefly understand special sensory early development.
- Briefly understand the abnormal development of the face and palate.



(/embryology/index.php/File:Stage14_sem2l.jpg
Human face development (Week 5)



(/embryology/index.php/File:Pharyngeal_arch_structure_cartoon.gif)



(/embryology/index.php/File:Stage13_pharyngeal_arch_excerpts.gif)

Lecture Resources

Movies[Expand]

(/embryology/index.php/File:Stage16-18_face.jpg)
Human face development (Week 6 to 7)

References **[Collapse]**

Head Links (/embryology/index.php/Head_Developmen
(/embryology/index.php/Head_Development) | Medicine
(/embryology/index.php/BGD_Lecture_-_Face_and_Ear

(/embryology/index.php/File:Logo.png) Hill, M.A. (2016). *UNSW Embryology* (16th ed.) Retrieved September 5, 2016, from https://embryology.med.unsw.edu.au (https://embryology.med.unsw.edu.au)

 (/embryology/index.php/Embryology_Textbooks#The_Developing_Human:_Clinically_Oriented_Embryology) Moore, K.L., Persaud, T.V.N. & Torchia, M.G. (2011). *The developing human: clinically oriented embryology* (9th ed.). Philadelphia: Saunders.	The following chapter links only work with a UNSW connec • Pharyngeal Apparatus, Face, and Neck (http://www.unsw.eblib.com.wwwproxy0.library.unsw.e p=1430154&pg=181) • Development of Eyes and Ears (http://www.unsw.eblib.com.wwwproxy0.library.unsw.e p=1430154&pg=451)
 (/embryology/index.php/Embryology_Textbooks#Embryology_Textbooks.23Larsen.27s_Human_Embryology) Schoenwolf, G.C., Bleyl, S.B., Brauer, P.R. & Francis-West, P.H. (2009). *Larsen's human embryology* (4th ed.). New York; Edinburgh: Churchill Livingstone.	The following chapter links only work with the UNSW Libra (http://er.library.unsw.edu.au/er/cgi-bin/eraccess.cgi?url=http://www.unsw.eblib.com.wwwproxy0.library.unsw.ec p=2074524) • Chapter 16 - Development of the Pharyngeal Apparatus • Chapter 17 - Development of the Ears and Eyes

ECHO360 Recording[Expand]

Animation of Face Development

Development of the Face

This animation shows a ventral view of development of the human face from approximately week 5 through to neonate.

The separate embryonic components that contribute to the face have been colour coded.

- **Frontonasal Prominence (white)**
- **Frontonasal Prominence - Lateral nasal** (purple)
- **Frontonasal Prominence - Medial nasal** (green)
- **Pharyngeal Arch 1 - Maxillary prominence** (yellow)
- **Pharyngeal Arch 1 - Mandibular prominence** (orange)
- **Stomodeum (black)**

The stomodeum (/embryology/index.php/S#stomodeum) is the primordial mouth region and a surface central depression lying between the forebrain bulge and the heart bulge. At the floor of the stomodeum indentation is the buccopharyngeal membrane (/embryology/index.php/B#buccopharyngeal_membrane) (oral membrane).

Note the complex origin of the maxillary region (upper jaw) requiring the fusion of several embryonic elements, abnormalities of this process lead to cleft lip (/embryology/index.php/C#cleft_lip) and cleft palate (/embryology/index.php/C#cleft_palate).

See also the movie showing a similar view of human embryo faces between Carnegie stage 16 (/embryology/index.php/Carnegie_stage_16) to 18 (/embryology/index.php/Carnegie_stage_18).

Click Here to play on mobile device (/embryology/images/d/dd/Face_001.mp4)

Week 3

Buccopharyngeal Membrane

These images of the Stage 11 embryo show the breakdown of the buccopharyngeal membrane.

(/embryology/index.php/BGDB_Practical_-_Face_and_E
Lecture | Science Lab (/embryology/index.php/ANAT23
Seminar (/embryology/index.php/AACP_Meeting_2013_
(/embryology/index.php/Gastrointestinal_Tract_-_Mouth
(/embryology/index.php/Palate_Development) | Tongue
(/embryology/index.php/Tongue_Development) | Placod
(/embryology/index.php/Placodes) | Skull Development
(/embryology/index.php/Musculoskeletal_System_-_Sku
Face Movies (/embryology/index.php/Movies#Head_an
(/embryology/index.php/Head_Development_-_Abnorm
(/embryology/index.php/Category:Head)

Historic Embryology (/embryology/index.php/Embryolo

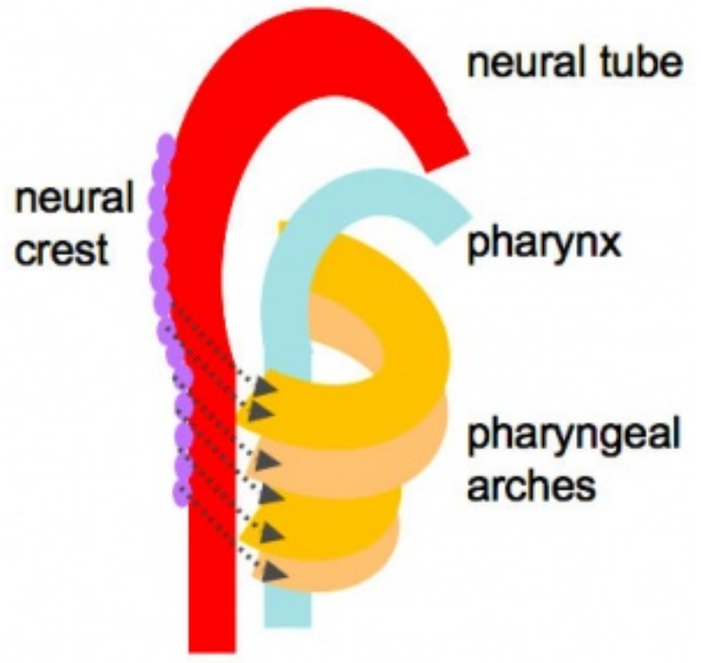
- Lecture Archive: 2015 (https://embryology.med.unsw.ec title=Lecture_-_Head_Development&oldid=197375) | 20 (/embryology/images/f/f4/2015ANAT2341_Lecture_11_ 2014 (https://embryology.med.unsw.edu.au/embryolog _Head_Development&oldid=143731) | 2014 PDF (/embryology/images/5/51/ANAT2341_Lecture_11_-_20

Low power ventral view of the Buccopharyngeal Membrane

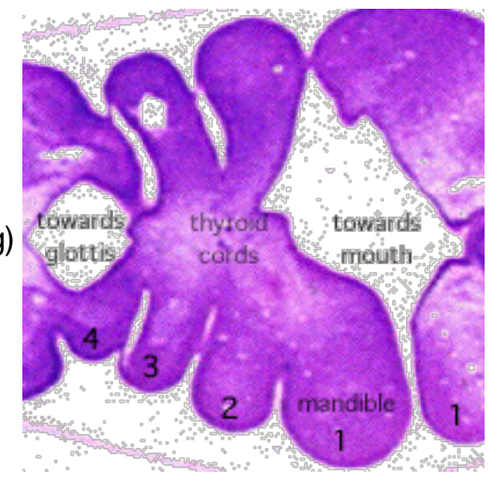
Higher power ventrolateral view of the Buccopharyngeal Membrane

Close up view of the degenerating Buccopharyngeal Membrane

The Pharynx



(/embryology/index.php/File:Head_arches_cartoon.jpg)



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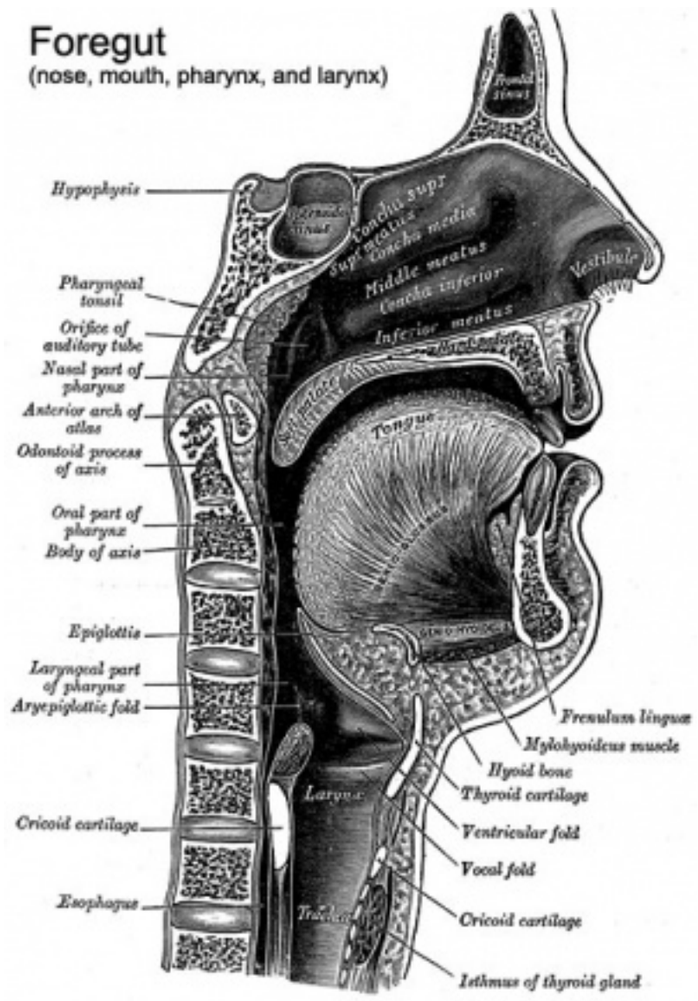


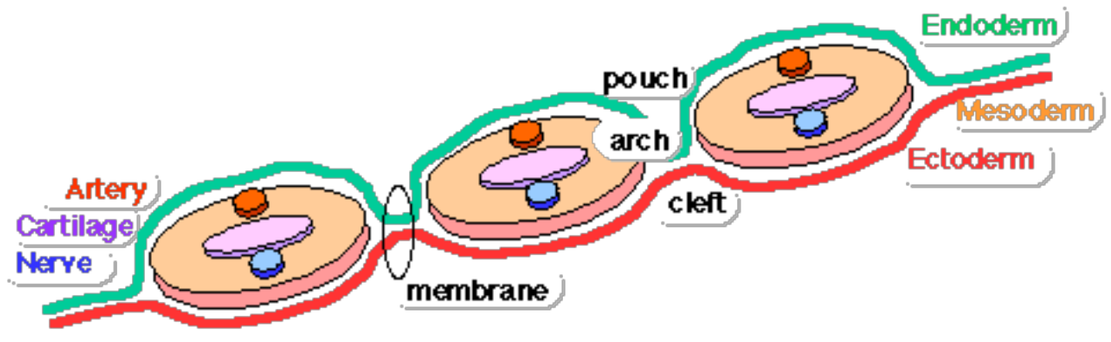
(/embryology/index.php/File:Pharynx_cartoon.jpg)

The cavity within the pharyngeal arches forms the pharynx.

- begins at the buccopharyngeal membrane (oral membrane), apposition of ectoderm with endoderm (no mesoderm between)
- expands behind pharyngeal arches
- narrows at glottis and bifurcation of gastrointestinal (oesophagus) and respiratory (trachea) systems
- regions on roof, walls and floor have important contributions to endocrine in oral and neck regions
- also contributes to tongue development

Week 4

Pharyngeal Arch Components



(/embryology/index.php/File:Pharyngeal_arch_structure_cartoon.gif)

Major features to identify for each: **arch**, **pouch**, **groove** and **membrane**. Contribute to the formation of head and neck and in the human appear at the 4th week. The first arch contributes the majority of upper and lower jaw structures.

Pharyngeal Arch Development

- branchial arch (Greek. *branchia* = gill)
- arch consists of all 3 trilaminar embryo layers
- ectoderm- outside
- mesoderm- core of mesenchyme
- endoderm- inside

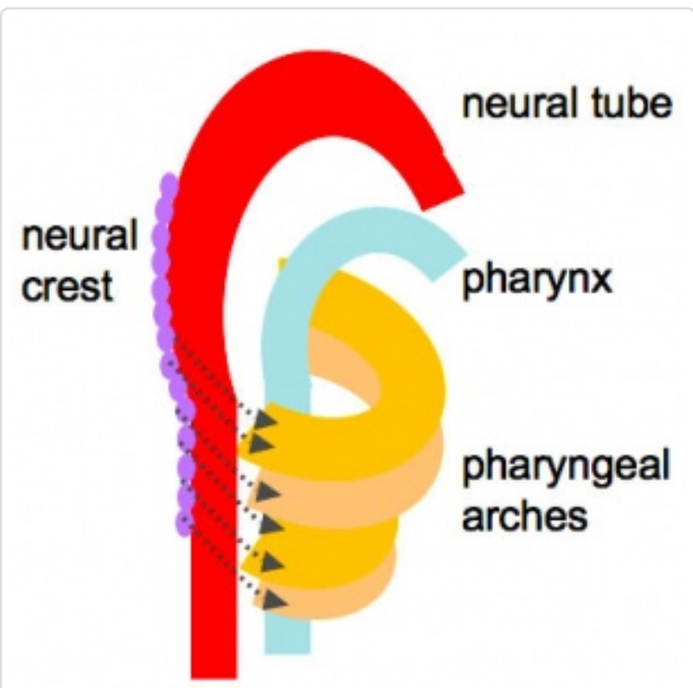
Neural Crest

- Mesenchyme invaded by neural crest generating connective tissue components
- cartilage, bone, ligaments
- arises from midbrain and hindbrain region

Neural Crest Origins[Expand]

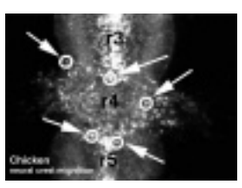
(/embryology/index.php/File:Stage12_sem1.jpg

Week 4 (stage 12 (/embryology/index.php/Carnegie_stage_12))



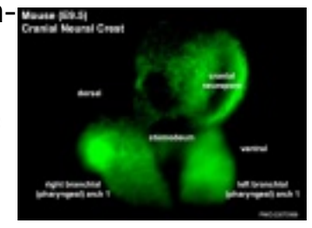
(/embryology/index.php/File:Head_arches_carto

neural crest migration



(/embryology/index.php/File:Chicken-neural-crest-migration-01.jpg)

Chicken embryo sequence shows the migration of DiI-labeled neural crest cells towards the branchial arches as the embryo. White rings indicate migration of individual cells. Each image represents 10 confocal sections separated by 10 microns.



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Cranial Neural Crest

Page (/embryology/index.php/Mouse_Cranial_Neural_Crest_Migration_M

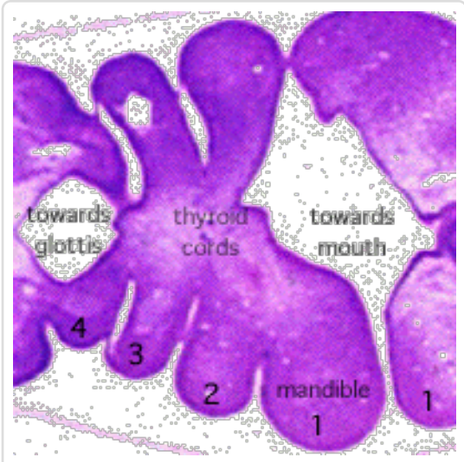
Play (/embryology/images/5/56/Mouse_cranial_neural_crest_migration_0

Arch Features

Each arch contains: artery, cartilage, nerve, muscular component

Arches and Phanynx Form the face, tongue, lips, jaws, palate, pharynx and neck cranial nerves, sense organ components, glands

- Humans have 5 arches - 1, 2, 3, 4, 6 (Arch 5 does not form or regresses rapidly)
- form in rostro-caudal sequence, Arch 1 to 6 (from week 4 onwards)
- arch 1 and 2 appear at time of closure of cranial neuropore
- Face - mainly arch 1 and 2
- Neck components - arch 3 and 4 (arch 4 and 6 fuse)



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- **arch** - the entire structure
- **groove** - (cleft) externally separates each arch (only first pair persist as external auditory meatus)
- **pouch** - internally separates each arch (pockets out from the pharynx)
- **membrane** - ectoderm and endoderm contact regions (only first pair persist as tympanic membrane)

'**Pharyngeal Arch 1** (Mandibular Arch) has 2 prominences

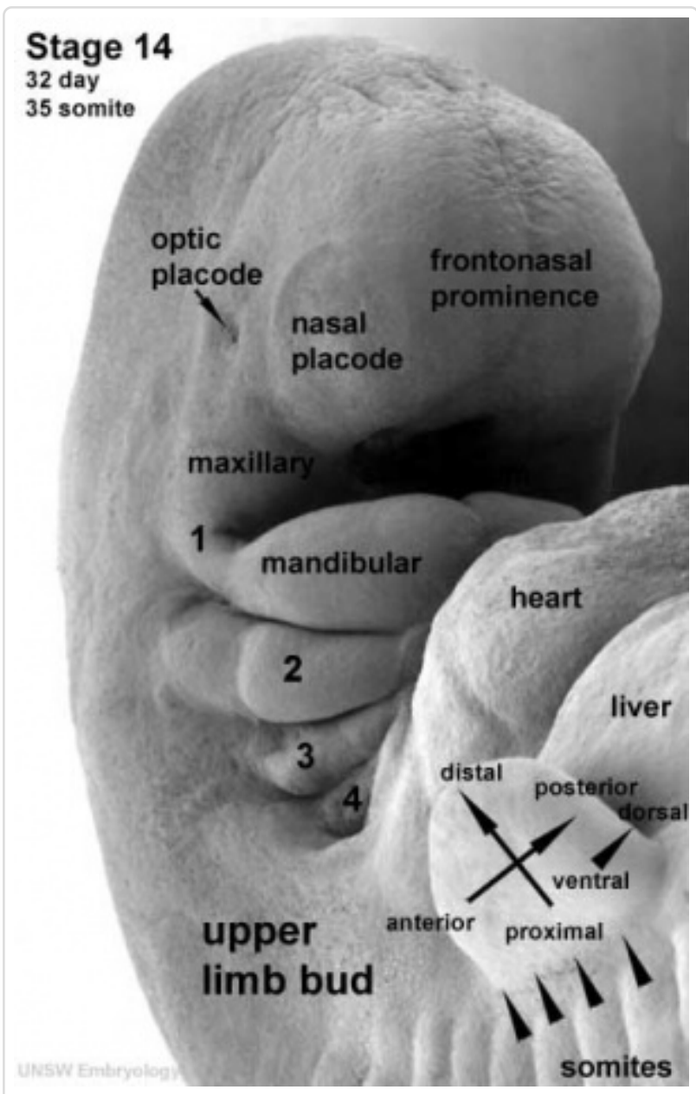
- smaller upper- maxillary forms maxilla, zygomatic bone and squamous part of temporal
- larger lower- mandibular, forms mandible

Pharyngeal Arch 2 (Hyoid Arch)

- forms most of hyoid bone

Arch 3 and 4

- neck structures

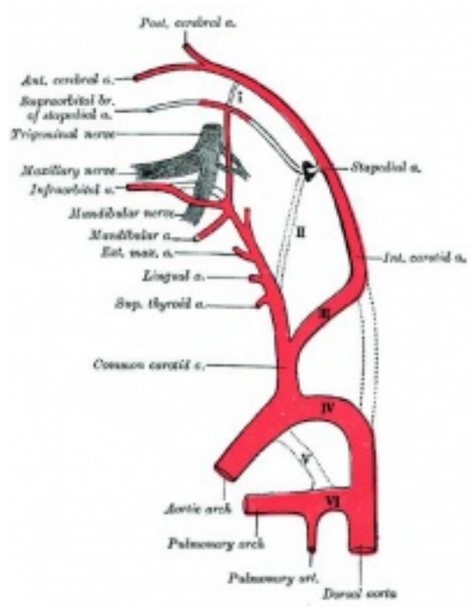


(/embryology/index.php/File:Stage14_sem2b-limb.jpg)
Pharyngeal arches Week 5 (Stage 14 sensory)

Arch Arteries

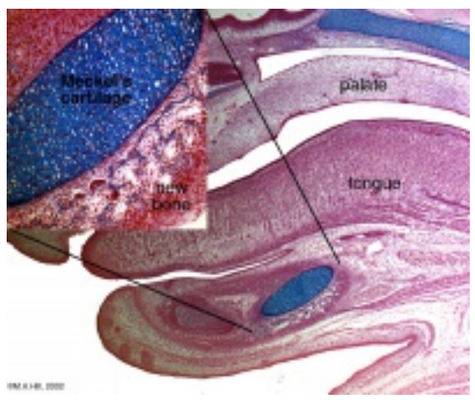
- Arch 1 - mainly lost, form part of maxillary artery
- Arch 2 - stapedial arteries
- Arch 3 - common carotid arteries, internal carotid arteries
- Arch 4 - left forms part of aortic arch, right forms part right subclavian artery
- Arch 6 - left forms part of left pulmonary artery , right forms part of right pulmonary artery

placental vein -> liver -> heart -> truncus arteriosus -> aortic sac -> **arch arteries** -> dorsal aorta -> placental artery



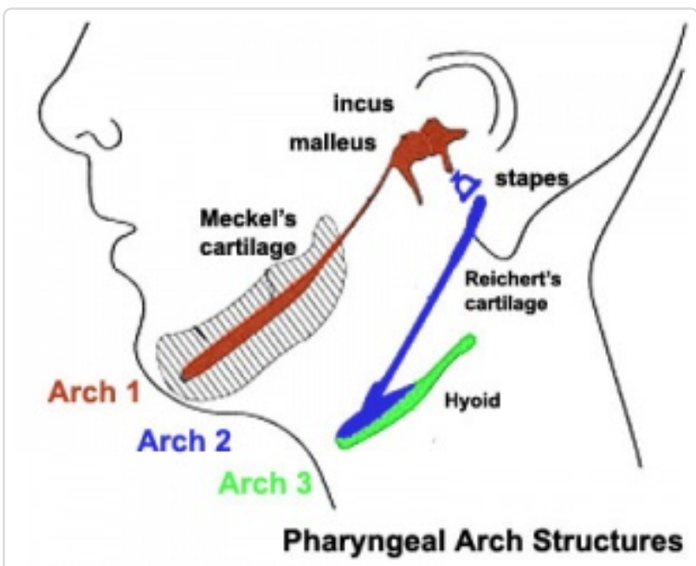
(/embryology/index.php/File:Gray0474.jpg)
Arch artery fates

Arch Cartilage



(/embryology/index.php/File:Meckel.jpg)
Meckel's cartilage, first pharyngeal arch

- Arch 1 - Meckel's cartilage, horseshoe shaped
  - dorsal ends form malleus and incus
  - midpart forms ligaments (ant. malleus, sphenomandibular)
  - ventral part forms mandible template
- Arch 2 - Reichert's cartilage
  - dorsal ends form stapes and Temporal bone styloid process
  - ventral part ossifies to form hyoid bone components
  - lesser cornu and superior body
- Arch 3- forms greater cornu and inferior part of hyoid
- Arch 4&6- form laryngeal cartilages, except epiglottis (from hypobranchial eminence)



(/embryology/index.php/File:Pharyngeal_arch_c
Pharyngeal arch cartilages

Arch Muscle

- Arch 1 - muscles of mastication, mylohyoid, tensor tympanic, ant. belly digastric
- Arch 2 - muscles of facial expression, stapedius, stylohyoid, post. belly digastric
- Arch 3 - stylopharyngeus
- Arch 4&6 - crycothyroid, pharynx constrictors, larynx muscles, oesophagus (st. muscle)

Arch Nerve

- Arch 1 - CN V trigeminal, caudal 2/3 maxillary and mandibular, cranial 1/3 sensory nerve of heaad and neck, mastication motor
- Arch 2 - CN VII facial
- Arch 3 - CN IX glossopharyngeal
- Arch 4&6 - CN X vagus, arch 4- superior laryngeal, arch 6- recurrent laryngeal

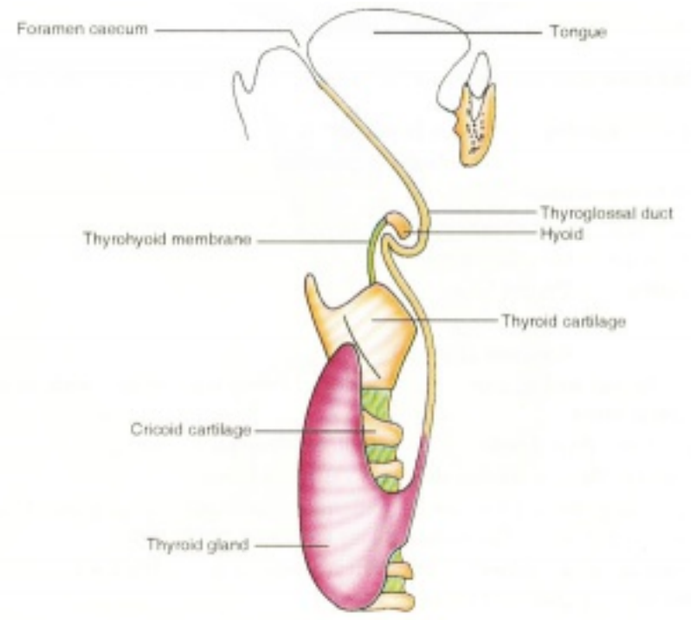
Arch Pouches

- Arch 1 - elongates to form **tubotympanic recess**, tympanic cavity, mastoid antrum, eustachian tube
- Arch 2 - forms **tonsillar sinus**, mostly oblierated by palatine tonsil
- Arch 3 - forms **inferior parathyroid** and **thymus**
- Arch 4 - forms **superior parathyroid**, parafollicular cells of thyroid

Endocrine

Note endocrine development will be covered in detail in a later lecture.

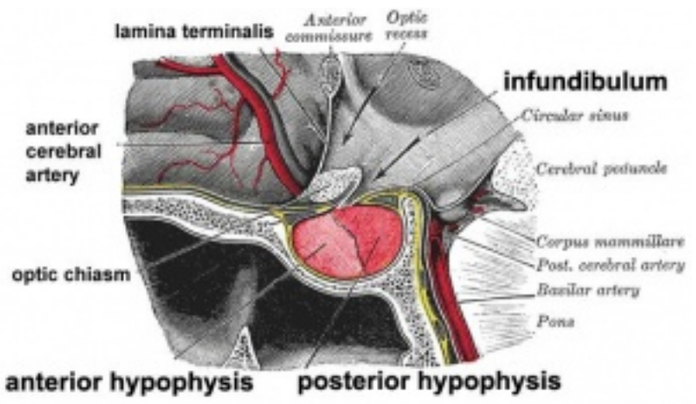
Thyroid Gland



(/embryology/index.php/File:Thyroid-development-cartoon.jpg)

- not a pouch structure
- first endocrine organ to develop day 24
- from floor of pharynx
- descends thyroglossal duct (which closes)
- upper end at foramen cecum

Anterior Pituitary



(/embryology/index.php/File:Historic-pituitary.jpg)

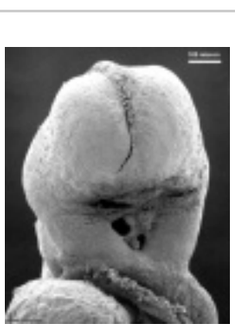
- not a pouch structure
- boundary epitheilal ectoderm in the roof of the pharynx
- forms a pocket (Rathke's pouch) that comes into contact with the ectoderm of developing brain.
  - Rathke's pouch is named after German embryologist and anatomist Martin Heinrich Rathke (1793 — 1860).

Face Development

Begins week 4 centered around stomodeum, external depression at oral membrane

5 initial primordia from neural crest mesenchyme (week 4)

- **single frontonasal prominence** (FNP) - forms forehead, nose dorsum and apex
  - nasal placodes develop later bilateral, pushed medially
- **paired maxillary prominences** - form upper cheek and upper lip
- **paired mandibular prominences** - lower cheek, chin and lower lip

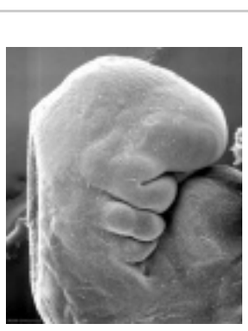


(/embryology/index.php/File:Stage11_sem1.jpg)

Stage 11 (25 days)

(/embryology/index.php/File:Stage12_sem2.jpg)

Stage 12 (26 days)



(/embryology/index.php/File:Stage13_sem2a.jpg)

Stage 13 (28 days)

(/embryology/index.php/File:Stage14_sem2.jpg)

Stage 14 (32 days)

Week 4 onward (/embryology/index.php/File:Face_animation.gif) | Week 6-7 (/embryology/index.php/File:Stage16-18_face_animation.gif)

Head/Skull

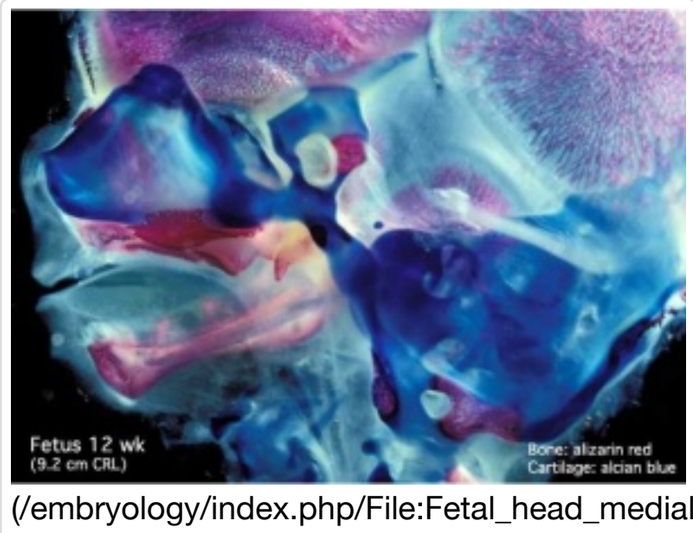
- Cranium (Neurocranium) surrounds brain.
  - dermatocranium (membranous) - skull calvarial vault develops from **intramembranous ossification**
  - chondrocranium (cartilaginous) - skull base develops from **endochondral ossification**
  - 8 bones - occipital, 2 parietals, frontal, 2 temporals, sphenoidal, ethmoidal.
- Face (Viscerocranium) development of the facial bones
  - 14 bones - 2 nasals, 2 maxillæ, 2 lacrimals, 2 zygomatics, 2 palatines, 2 inferior nasal conchæ, vomer, mandible.

Calveria - bone has no cartilage (direct ossification of mesenchyme)

- bones do not fuse, fibrous sutures

1. allow distortion to pass through birth canal
2. allow growth of the brain

- 6 fontanelles - posterior closes at 3 months, anterior closes at 18 months



(/embryology/index.php/File:Fetal_head_medial

Fetal skull (week 12)

(/embryology/index.php/File:Skull_anterior.gif)

Skull anterior (anterior fontenelle, sutures, mandible)

(/embryology/index.php/File:Skull_superior.gif)

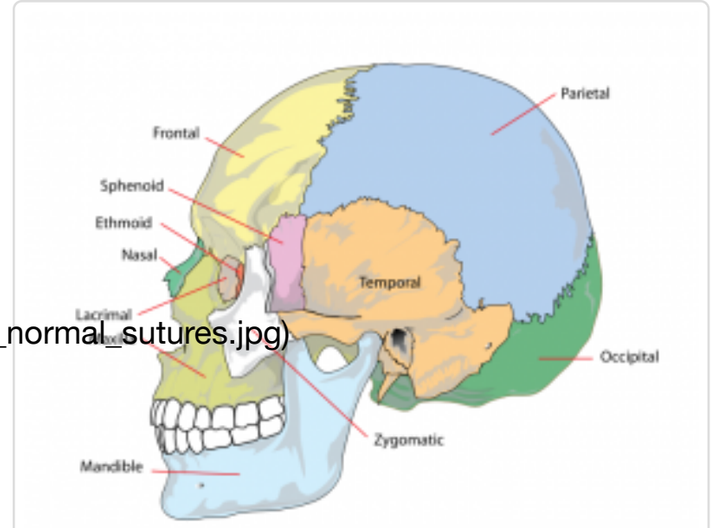
Skull_superior (anterior fontenelle, sutures)

(/embryology/index.php/File:Skull_lateral_view.gif)

Skull lateral view (suture, mandible)

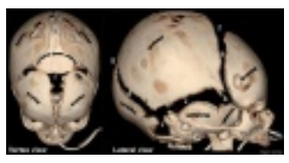
(/embryology/index.php/File:Skull_CT_normal_sutures.jpg)

Developing overview CT (/embryology/index.php/Computed_Tomography)



(/embryology/index.php/File:Human_skull_latera

Adult skull

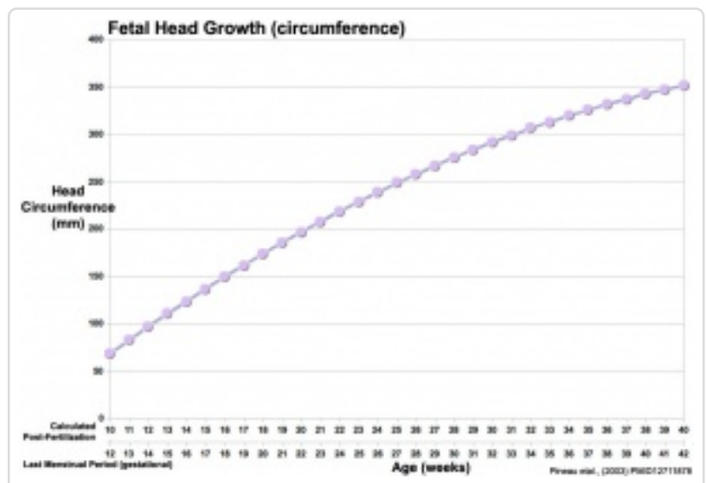


(/embryology/index.php/File:Skull_CT_normal_sutures_01.jpg)

Developing vertex and lateral CT (/embryology/index.php/Computed_Tomography)

(/embryology/index.php/File:Skull_CT_normal_sutures_02.jpg)

Developing endocranial and vertex CT (/embryology/index.php/Computed_Tomography)



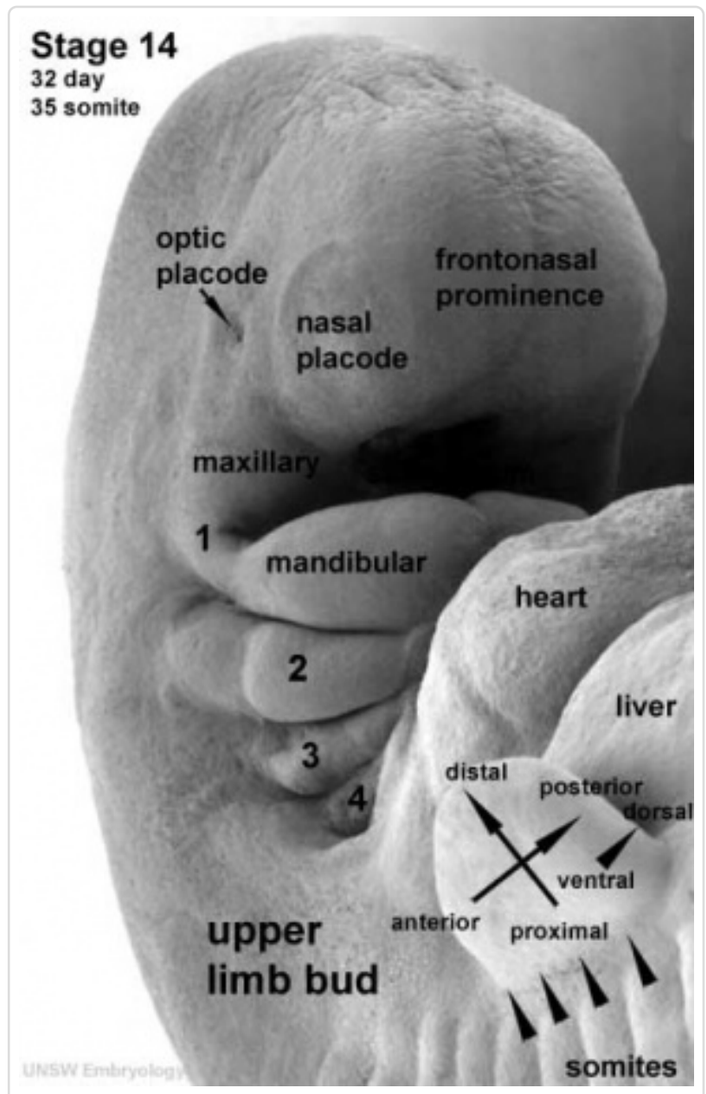
(/embryology/index.php/File:Fetal_head_growth

Fetal head growth circumference

Links: Skull Development (/embryology/index.php/Musculoskeletal_System_-_Skull_Development)

Sensory Placodes

- Sensory development will be covered in detail in a later lecture.
- During week 4 a series of thickened surface ectodermal patches form in pairs rostro-caudally in the head region.
- Recent research suggests that all sensory placodes may arise from common panplacodal primordium origin around the neural plate, and then differentiate to eventually have different developmental fates.
- These sensory placodes will later contribute key components of each of our special senses (vision, hearing and smell). Other species have a number of additional placodes which form other sensory structures (fish, lateral line receptor). Note that their initial postion on the developing head is significantly different to their final position in the future sensory system

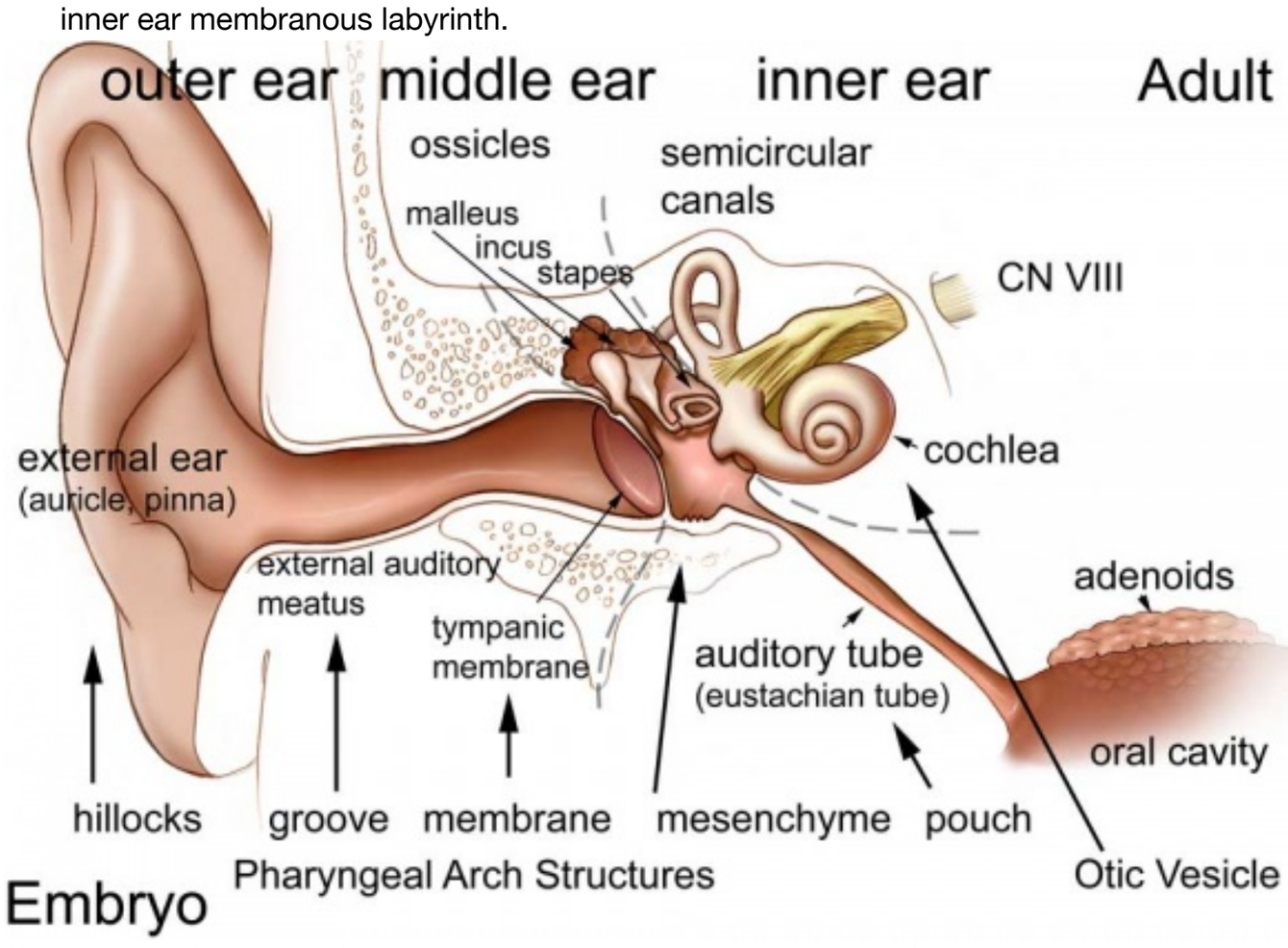


(/embryology/index.php/File:Stage14_sem2b-limb.jpg)

Stage 14 sensory placodes

Otic Placode

- Carnegie stage 12 (/embryology/index.php/Carnegie_stage_12) still visible on embryo surface.
- Carnegie stage 13/14 embryo (shown below) the otic placode has sunk from the surface ectoderm to form a hollow epithelial ball, the otocyst, which now lies beneath the surface surrounded by mesenchyme (mesoderm). The epithelia of this ball varies in thickness and has begun to distort, it will eventually form the inner ear membranous labyrinth.



(/embryology/index.php/File:Adult_hearing_embryonic_origins.jpg)

Lens Placode

- (optic placode) lies on the surface, adjacent to the outpocketing of the nervous system (which will for the retina) and will form the lens.

Nasal Placode

- Has 2 components (medial and lateral) and will form the nose olefactory epithelium.

Head Growth

- continues postnatally - fontanelle allow head distortion on birth and early growth
- bone plates remain unfused to allow growth, puberty growth of face

(/embryology/index.php/File:Fetal_head_lateral.

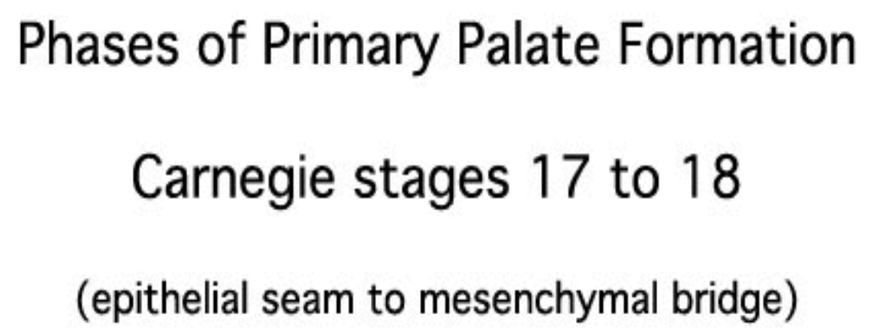
Fetal Head (12 weeks) showing bone and cartilage

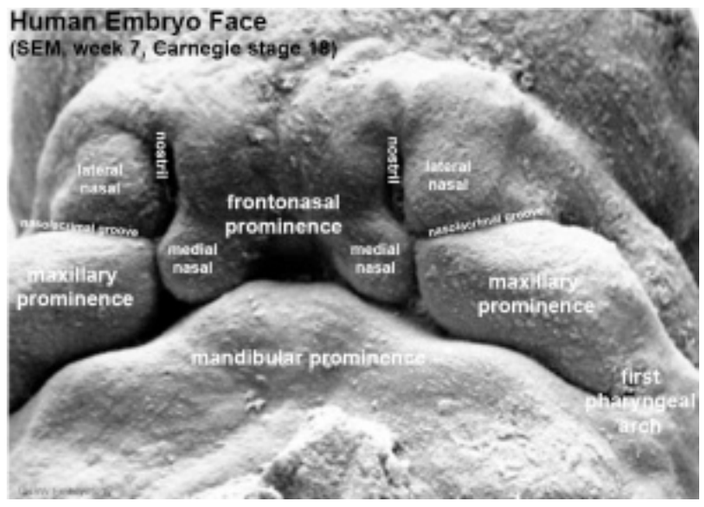
Palate

The palate has both an embryonic and fetal developmental component.

Embryonic

Primary palate, fusion in the human embryo between week 6-7 (stage 17 and 18, GA Week 8-9), from an epithelial seam to the mesenchymal bridge.



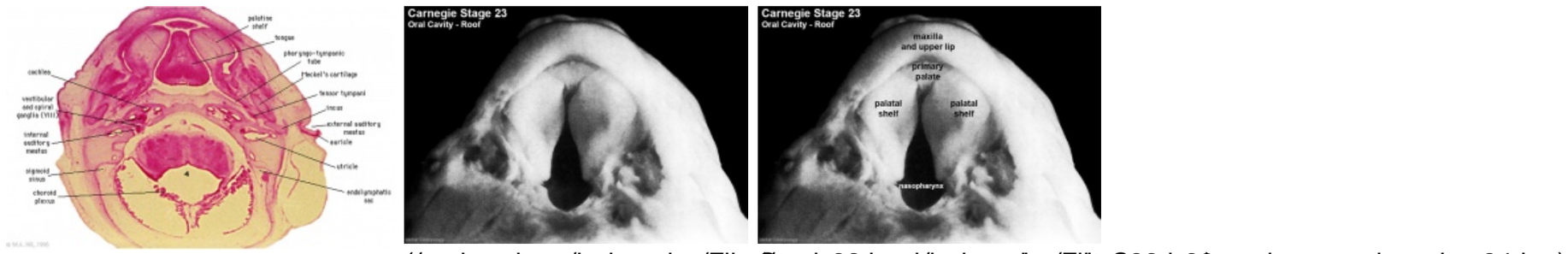


(/embryology/index.php/File:Stage18_em11.jpg)

(/embryology/index.php/File:Stage17-18_Primary_palate.gif)

Embryonic Palate

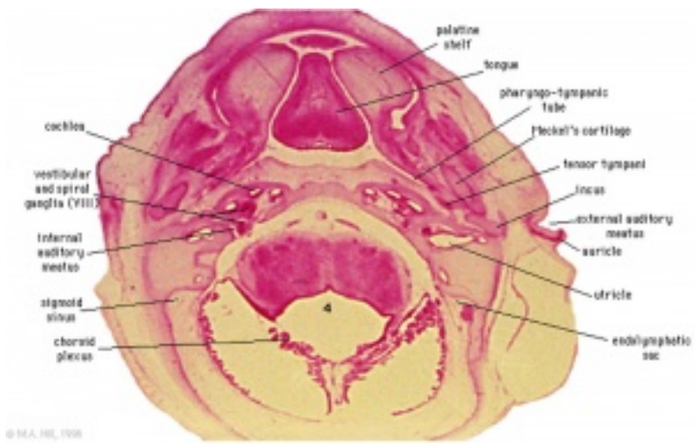

(/embryology/index.php/File:Stage16_em01.jpg) (/embryology/index.php/File:Stage17_em01.jpg) (/embryology/index.php/File:Stage18_em01.jpg) (/embryology/index.php/File:Stage19_em01.jpg)



(/embryology/index.php/File:Stage_22_image_061.jpg) (/embryology/index.php/File:Stage23_embryo_oral_cavity_03.jpg) (/embryology/index.php/File:Stage23_embryo_oral_cavity_04.jpg)

Fetal

Secondary palate, fusion in the human embryo in week 9 (GA week 11). This requires the early palatal shelves growth, elevation and fusion during the early embryonic period. The fusion event is to both each other and the primary palate. palatal shelf elevation (/embryology/index.php/File:Palatal_shelves_animation.gif) | secondary palate (/embryology/index.php/File:Palate.gif)



(/embryology/index.php/File:Stage_22_image_061.jpg)
Week 8 palatal shelves

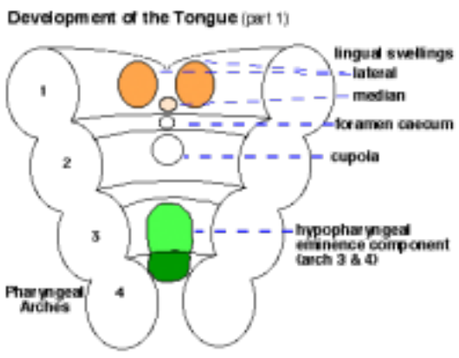

(/embryology/index.php/Palate_Development_1_Movie)

Palate (oral view)
Page (/embryology/index.php/Palate_Development_1_Movie) | Play (/embryology/images/8/8f/Palate_001.mp4)

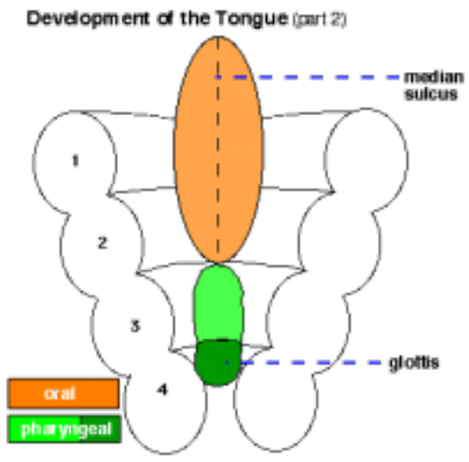

(/embryology/index.php/Palate_Development_2_Movie)

Palate (front view)
Page (/embryology/index.php/Palate_Development_2_Movie) | Play (/embryology/images/7/78/Palate_002.mp4)

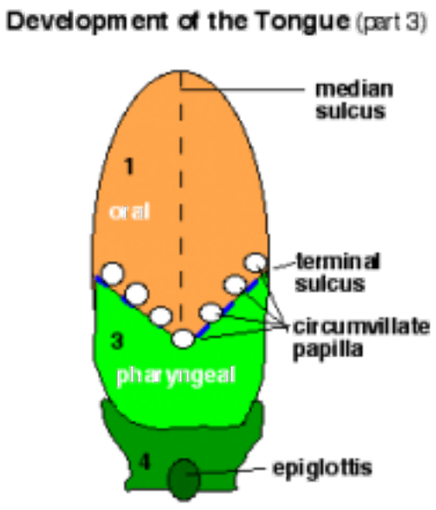
Tongue Development



(/embryology/index.php/File:Tongue1.png)



(/embryology/index.php/File:Tongue2.png)



(/embryology/index.php/File:Tongue3.png)

- Ectoderm of the first arch surrounding the stomodeum forms the epithelium lining the buccal cavity.
- Also the salivary glands, enamel of the teeth, epithelium of the body of the tongue.
  - As the tongue develops "inside" the floor of the oral cavity, it is not readily visible in the external views of the embryonic (Carnegie) stages of development.

Contributions from all arches, which changes with time, begins as swelling rostral to foramen cecum, **median tongue bud**

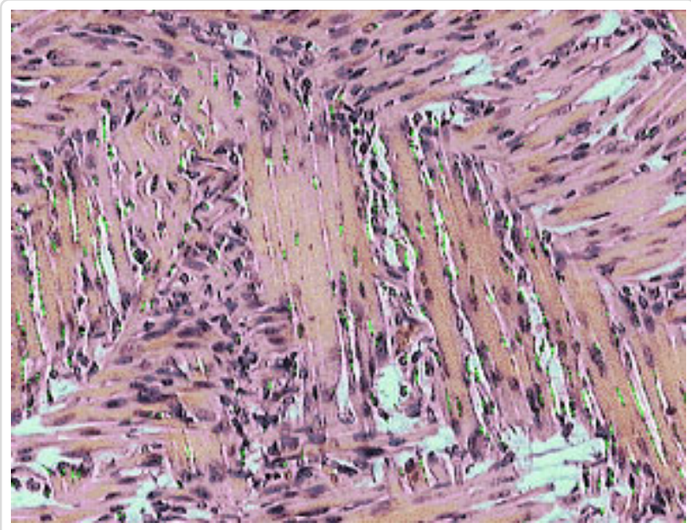
- Arch 1 - oral part of tongue (ant 3/2)
- Arch 2 - initial contribution to surface is lost
- Arch 3 - pharyngeal part of tongue (post 1/3)
- Arch 4 - epiglottis and adjacent regions

(/embryology/index.php/Tongue_Development_Movie)

Tongue
Page (/embryology/index.php/Tongue_Development_Movie) | Play (/embryology/images/5/57/Tongue_001.mp4)
tongue development animation (/embryology/index.php/File:Tongue.gif)

Tongue Muscle

- Tongue muscles originate from the somites. Tongue muscles develop before masticatory muscles and is completed by birth.
- Masticatory muscles originate from the somitomeres. These muscles develop late and are not complete even at birth.



(/embryology/index.php/File:Tongue-muscle.jpg)
tongue muscle

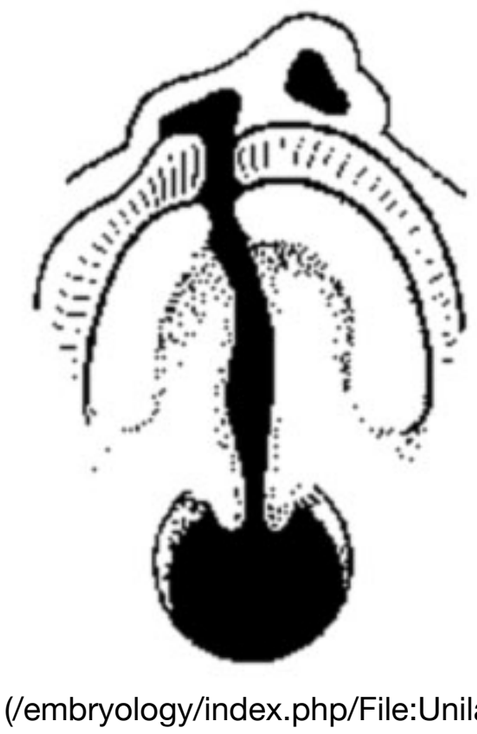
Salivary Glands

- epithelial buds in oral cavity (wk 6-7) extend into mesenchyme
- parotid, submandibular, sublingual

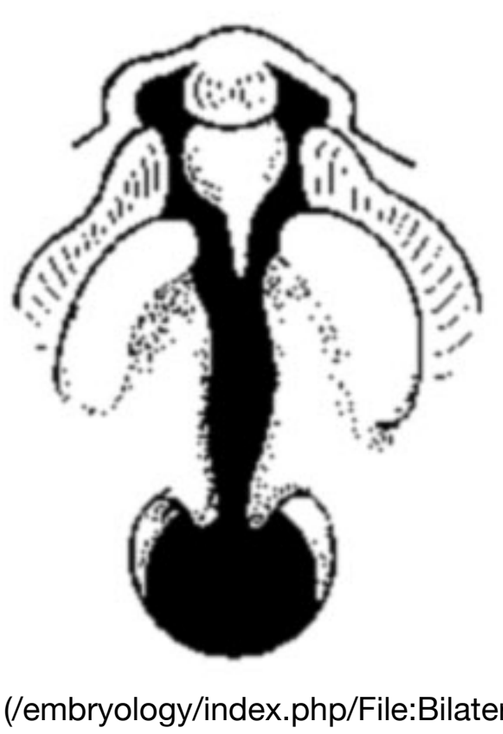
Abnormalities

Cleft Lip and Palate

(/embryology/index.php/File:Cleft_palate.jpg)
cleft palate



(/embryology/index.php/File:Unilateral_cleft_palate.jpg)
unilateral cleft lip and palate



(/embryology/index.php/File:Bilateral_cleft_palate.jpg)
bilateral cleft lip and palate

- 300+ different abnormalities, different cleft forms and extent, upper lip and ant. maxilla, hard and soft palate

Victoria

The ten most frequently reported birth defects in Victoria between 2003-2004.

1. Hypospadias (/embryology/index.php/Genital_Abnormality_-_Hypospadia)
2. Obstructive Defects of the Renal Pelvis (/embryology/index.php/Renal_System_-_Abnormalities#Obstructive_Renal_Pelvis_Defect) or Obstructive Genitourinary Defects (/embryology/index.php/Renal_System_-_Abnormalities)
3. Ventricular Septal Defect (/embryology/index.php/Cardiovascular_System_-_Ventricular_Septal_Defects)
4. Congenital Dislocated Hip (/embryology/index.php/Musculoskeletal_System_-_Abnormalities#Developmental_Dysplasia_of_the_Hip)
5. Trisomy 21 (/embryology/index.php/Trisomy_21) or Down syndrome
6. Hydrocephalus (/embryology/index.php/Abnormal_Development_-_Congenital_Hydrocephalus)
7. Cleft Palate (/embryology/index.php/Palate_Development)
8. Trisomy 18 (/embryology/index.php/Trisomy_18) or Edward Syndrome - multiple abnormalities of the heart, diaphragm, lungs, kidneys, ureters and palate 86% discontinued.
9. Renal Agenesis/Dysgenesis (/embryology/index.php/Renal_System_-_Abnormalities#Renal_Agenesis_or_Dysgenesis) - reduction in neonatal death and stillbirth since 1993 may be due to the more severe cases being identified in utero and being represented amongst the increased proportion of terminations (approximately 31%).
10. Cleft Lip (/embryology/index.php/Palate_Development) and Palate - occur with another defect in 33.7% of cases.

Statistics[Expand]

Cleft Palate

- Cleft palate has the International Classification of Diseases code 749.0.
- In Australia the national rate (1982-1992) for this abnormalitity in births was 4.8 - 6/10,000 births, which represented 1,530 infants 5.5% were stillborn and 11.5% liveborn died during neonatal period and slightly more common in twin births than singleton.

Cleft Lip

- The International Classification of Diseases code 749.1 for isolated cleft lip and 749.2 for cleft lip with cleft palate.
- In Australia the national rate (1982-1992) for this abnormalitity was 8.1 - 9.9 /10,000 births. Of 2,465 infants 6.2% were stillborn and 7.8% liveborn died during neonatal period and the rate was similar in singleton and twin births.

Links: Palate Development (/embryology/index.php/Palate_Development)

First Arch Syndrome

There are 2 major types of associated first arch syndromes, Treacher Collins (Mandibulofacial dysostosis) and Pierre Robin (Pierre Robin complex or sequence), both result in extensive facial, sensory and palate abnormalites.

DiGeorge Syndrome

- absence of thymus and parathyroid glands, 3rd and 4th pouch do not form
- disturbance of cervical neural crest migration

Cysts

- Many different types

Facial Clefts

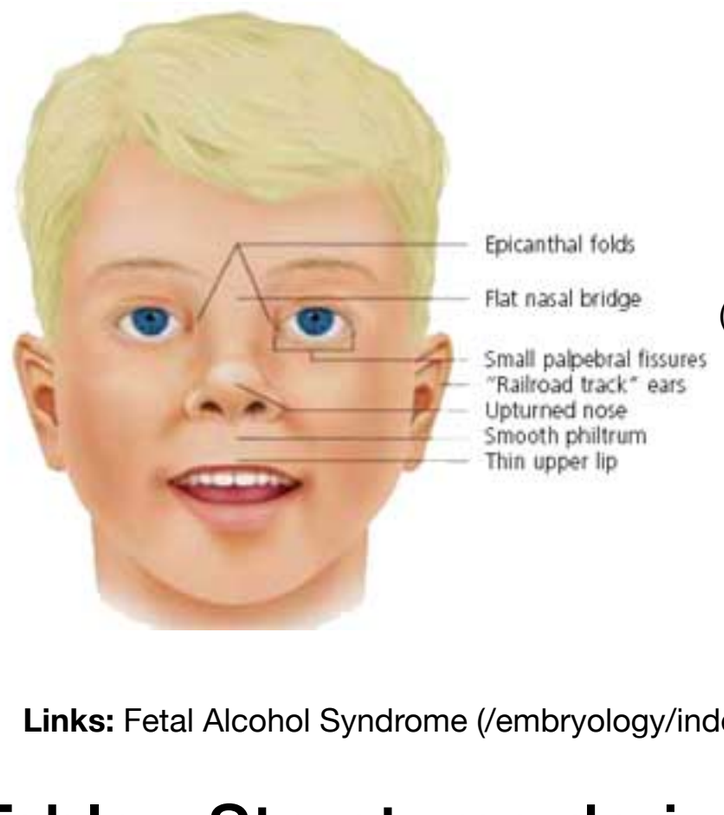
extremely rare

- Holoprosencephaly - shh abnormality

Maternal Effects

- Retinoic Acid - present in skin ointments
- 1988 associated with facial developmental abnormalities

Fetal Alcohol Syndrome



(/embryology/index.php/File:FASface.jpg)

Due to alcohol in early development (week 3+) leading to both facial and neurological abnormalities

- lowered ears, small face, mild+ retardation
- Microcephaly - leads to small head circumference
- Short Palpebral fissure - opening of eye
- Epicanthal folds - fold of skin at inside of corner of eye
- Flat midface
- Low nasal bridge
- Indistinct Philtrum - vertical grooves between nose and mouth
- Thin upper lip
- Micrognathia - small jaw

  Exposure of embryos in vitro to ethanol simulates premature differentiation of prechondrogenic mesenchyme of the facial primordia (1999)

Links: Fetal Alcohol Syndrome (/embryology/index.php/Abnormal_Development_-_Fetal_Alcohol_Syndrome)

Table - Structures derived from Arches

Pharyngeal Arch	Nerve	Artery	Neural Crest (Skeletal Structures)	Muscles	Ligaments
1		maxillary artery (terminal		muscles of mastication,	ant lig of malleus,

(maxillary/mandibular)	trigeminal (V)	branches)	mandible, maxilla, malleus, incus	mylohyoid, tensor tympanic, ant. belly digastric	sphenomandibular ligament
2 (hyoid)	facial (VII)	stapedial (embryonic) corticotympanic (adult)	stapes, styloid process, lesser cornu of hyoid, upper part of body of hyoid bone	muscles of facial expression, stapedius, stylohyoid, post. belly digastric	stylohyoid ligament
3	glossopharyngeal (IX)	common carotid, internal carotid arteries	greater cornu of hyoid, lower part of body of hyoid bone	stylopharyngeus	
4	vagus (X) superior laryngeal branch	part of aortic arch (left), part right subclavian artery (right)	thyroid, cricoid, arytenoid, corniculate and cuneform cartilages	crycothyroid, soft palate levator veli palatini (not tensor veli palatini)	
6	vagus (X) recurrent laryngeal branch	part of left pulmonary artery (left), part of right pulmonary artery (right)	thyroid, cricoid, arytenoid, corniculate and cuneform cartilages	larynx intrinsic muscles (not cricothyroid muscle)	

Structures derived from Pouches

Each pouch is lined with endoderm and generates specific structures.

POUCH	Overall Structure	Specific Structures
1	tubotympanic recess	tympanic membrane, tympanic cavity, mastoid antrum, auditory tube
2	intratonsillar cleft	crypts of palatine tonsil, lymphatic nodules of palatine tonsil
3	inferior parathyroid gland, thymus gland	
4	superior parathyroid gland, ultimobranchial body	
5	becomes part of 4th pouch	

Structures derived from Grooves

Only the **first groove** differentiates into an adult structure and forms part of the external acoustic meatus.

Structures derived from Membranes

At the bottom of each groove lies the membrane which is formed from the contact region of ectodermal groove and endodermal pouch. Only the **first membrane** differentiates into an adult structure and forms the tympanic membrane.

Terms

- palate - The roof of the mouth (oral cavity) a structure which separates the oral from the nasal cavity. Develops as two lateral palatal shelves which grow and fuse in the midline. Initally a primary palate forms with fusion of the maxillary processes with the nasal processes in early face formation. Later the secondary palate forms the anterior hard palate (/embryology/index.php/H#hard_palate) which will ossify and separate the oral and nasal cavities. The posterior part of the palate is called the soft palate (velum, muscular palate) and contains no bone. Abnormalities of palatal shelf fusion can lead to cleft palate (/embryology/index.php/C#cleft_palate). (More? Palate Development (/embryology/index.php/Palate_Development) | Head (/embryology/index.php/Head_Development) | Head Abnormalities (/embryology/index.php/Head_Development_-_Abnormalities))
- palatogenesis - The process of palate formation, divided into primary and secondary palate development. (More? Palate Development (/embryology/index.php/Palate_Development) | Head (/embryology/index.php/Head_Development) | Head Abnormalities (/embryology/index.php/Head_Development_-_Abnormalities))
- pharyngeal arch - (branchial arch (/embryology/index.php/B#branchial_arch), Greek, *branchial* = gill) These are a series of externally visible anterior tissue bands lying under the early brain that give rise to the structures of the head and neck. In humans, five arches form (1,2,3,4 and 6) but only four are externally visible on the embryo (/embryology/index.php/E#embryo). Each arch has initially identical structures: an internal endodermal pouch, a mesenchymal (mesoderm (/embryology/index.php/M#mesoderm) and neural crest (/embryology/index.php/N#neural_crest)) core, a membrane (endoderm (/embryology/index.php/E#endoderm) and ectoderm (/embryology/index.php/E#ectoderm)) and external cleft (ectoderm (/embryology/index.php/E#ectoderm)). Each arch mesenchymal core also contains similar components: blood vessel, nerve, muscular, cartilage. Each arch though initially formed from similar components will differentiate to form different head and neck structures. (More? | Head Development (/embryology/index.php/Head_Development) | Endocrine (/embryology/index.php/Endocrine_System_Development) | Neural Crest (/embryology/index.php/Neural_Crest_Development))
- pharyngeal arch artery - Each early developing pharyngeal arch contains a lateral pair of arteries arising from the aortic sac, above the heart, and running into the dorsal aorta. later in development these arch arteries are extensively remodelled to form specific components of the vascular system. Pharyngeal Arch 1 arteries are mainly lost and forms part of maxillary artery. Pharyngeal Arch 2 arteries remains to form the stapedial arteries. Pharyngeal Arch 3 arteries forms the common carotid arteries, internal carotid arteries in the neck. Pharyngeal Arch 4 arteries will form part of aortic arch (left arch artery) and part right subclavian artery (right arch artery) Pharyngeal Arch 6 arteries form part of left pulmonary artery (left arch artery) and part of right pulmonary artery (right arch artery). (More? | Head Development (/embryology/index.php/Head_Development) | Cardiovascular (/embryology/index.php/Cardiovascular_System_Development))
- pharyngeal arch cartilage - Each early developing pharyngeal arch contains a horseshoe shaped band of cartilage that acts as a template and contributes to the development of head and neck bony and cartilagenous features, including the middle ear bones. Pharyngeal Arch 1 cartilage (Meckel,Äôs cartilage) dorsal ends form malleus and incus midpart forms ligaments (ant. malleus, sphenomandibular) ventral part forms mandible template. Pharyngeal Arch 2 cartilage (Reichert,Äôs cartilage) dorsal ends form stapes and Temporal bone styloid process, ventral part ossifies to form hyoid bone components, lesser cornu and superior body. Pharyngeal Arch 3 cartilage forms hyoid components, greater cornu and inferior part of hyoid. Pharyngeal Arch 4 and 6 cartilage forms laryngeal cartilages except epiglottis (from hypobranchial eminence). (More? Head Development (/embryology/index.php/Head_Development) | Middle Ear (/embryology/index.php/Hearing_-_Middle_Ear_Development))
- pharyngeal arch nerve - Each early developing pharyngeal arch contains the developing cranial nerves, as a pair, within the arch mesenchyme. Each cranial nerve is numbered (roman numeral) in rostrocaudal sequence and also has a specific name. The cranial nerve within each arch often relates to the other structures formed from taht arch. Pharyngeal Arch 1 contains the trigeminal nerve (CN V, cranial nerve 5). Pharyngeal Arch 2 contains the facial nerve (CN VII, cranial nerve 7). Pharyngeal Arch 3 contains the glossopharyngeal nerve (CN IX, cranial nerve 9) Pharyngeal Arch 4 and 6 contains the Vagus (CN X cranial nerve 10), forming the adult superior laryngeal and recurrent laryngeal branches. (More? | Head Development (/embryology/index.php/Head_Development) | Neural (/embryology/index.php/Neural_System_Development) | Neural Crest (/embryology/index.php/Neural_Crest_Development))
- pharyngeal arch pouch - An out-pocketing of the endoderm (/embryology/index.php/E#endoderm) lined pharynx occurring between each developing pharyngeal arch. Each of the pharyngeal arch pouches contributes different components of the head and neck, either cavities or endocrine tissues. Pharyngeal Arch 1 pouch elongates to form tubotympanic recess tympanic cavity, mastoid antrum and auditory tube (Eustachian tube). Pharyngeal Arch 2 pouch forms the tonsillar sinus and is later mostly oblierated by palatine tonsil. Pharyngeal Arch 3 pouch forms the inferior parathyroid and thymus. Pharyngeal Arch 4 pouch forms the superior parathyroid, parafollicular cells of Thyroid. (More? Middle Ear (/embryology/index.php/Hearing_-_Middle_Ear_Development) | Thyroid

(/embryology/index.php/Endocrine_-_Thyroid_Development) | Parathyroid (/embryology/index.php/Endocrine_-_Parathyroid_Development) | Thymus (/embryology/index.php/Endocrine_-_Thymus_Development) | Endocrine (/embryology/index.php/Endocrine_System_Development) | Head Development (/embryology/index.php/Head_Development)

- pharyngotympanic tube - (auditory tube (/embryology/index.php/A#auditory_tube), eustachian tube (/embryology/index.php/E#eustachian_tube), otopharyngeal tube (/embryology/index.php/O#otopharyngeal_tube)) A narrow canal connecting the middle ear (/embryology/index.php/M#middle_ear) space to the back of the oral cavity. The tube allows ventilation, protection and clearance for the middle ear cavity. Ventilation is the pressure equalization in the middle ear. Clearance is to allow fluid drainage from the middle ear. Embryonic origin is from the first pharyngeal pouch. In development, the canal is initially both horizontal, short and very narrow leading to poor drainage and easy blockage. (More? Middle Ear (/embryology/index.php/Hearing_-_Middle_Ear_Development) | Hearing (/embryology/index.php/Sensory_-_Hearing_and_Balance_Development) | Hearing Abnormalities (/embryology/index.php/Sensory_-_Hearing_Abnormalities))
- pharynx - (throat) Forms the initial segment of the upper respiratory tract divided anatomically into three regions: nasopharynx, oropharynx, and laryngopharynx (hypopharynx). Anatomically extends from the base of the skull to the level of the sixth cervical vertebra. (More? Respiratory System Development (/embryology/index.php/Respiratory_System_Development))

ANAT2341 Course Timetable (/embryology/index.php/ANAT2341_Course_Timetable_2016) **[Expand]**

Glossary Links

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