



## Embryology of Head, Face and Oral Cavity

### Face development ( 4<sup>th</sup> – 7<sup>th</sup> week of intra uterus life )

#### Branchial ( pharyngeal ) Arches :

- During 4<sup>th</sup> week of embryonic development branchial or pharyngeal arches are formed as **bilateral swellings inferior to stomodeum** ( primitive oral cavity ) .
- In humans the 5<sup>th</sup> & 6<sup>th</sup> branchial arches are primitive and may fuse with 4<sup>th</sup> arches.
- Separated **externally by branchial grooves** and **pharyngeal pouches from internally** .  
Covered **externally by ectoderm** and **internally by endoderm**. Between the pharyngeal arches we have pharyngeal clefts .

Branchial arches give rise to important structures of the face and neck & support the lateral walls of primitive pharynx .

Where are the arches located ? at the sides of the stomodeum

#### What is the structure / component / anatomy of each arch ?

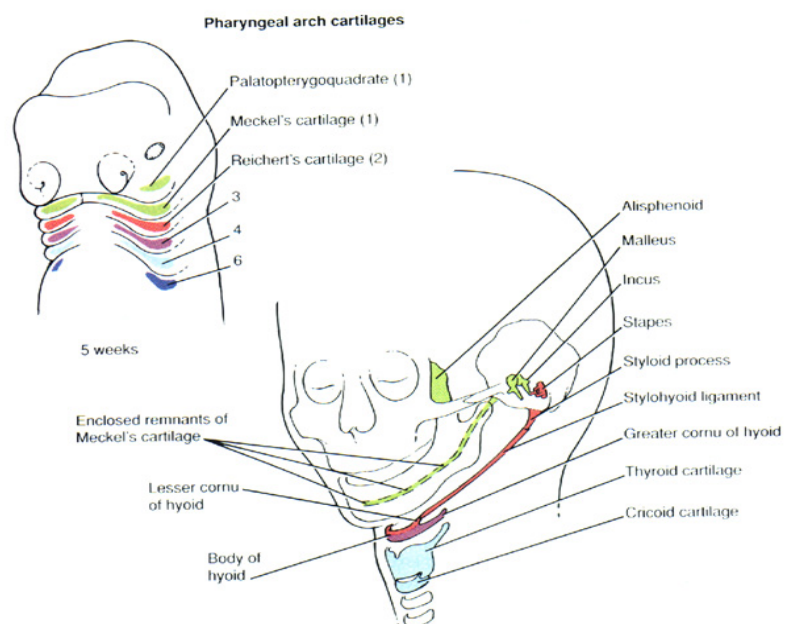
Each arch contains similar components derived from ectoderm, endoderm and ecto-mesoderm.

#### The Ecto-mesoderm contains:

- a. Cartilage rod
- b. Muscular component
- c. Vascular component
- d. Neural component (Nerve)

The ectomesenchymal cells in the middle layer in a branchial arch will differentiate into nerve , artery , bone .

The first branchial arch forms on both sides of the stomodeum, and the rest of the branchial arches form underneath it .( bilaterally )





Number of arch	1 <sup>st</sup> branchial arch (mandibular arch)	2 <sup>nd</sup> branchial arch (hyoid arch)	3 <sup>rd</sup> Branchial arch	4 <sup>th</sup> Branchial arch	5 <sup>th</sup> + 6 <sup>th</sup> branchial arches fuse with the 4 <sup>th</sup> branchial arch
Type of cartilage + what it will give rise to	contains <b>Meckel's cartilage</b> - Gives rise to the maxilla and the mandible, lower face and the mandible with mandibular teeth. (most Meckel's cartilage disappears only 2 bones in the ear stay <b>Malleus and Incus</b> )	Contains Reichert's Cartilage – gives rise to: the stapes bone in the ear styloid process of temporal bone superior hyoid bone	Forms the lower aspect of the hyoid bone	forms the <b>thyroid cartilage and cartilages of the larynx.</b>	
Muscle it will give rise to	Gives origin to muscles of mastication	Muscles of facial expression			
Artery it will give rise to	contributes to maxillary artery and part of the external carotid artery				
Nerve it will give rise to -Innervated by:	Gives the trigeminal nerve (V cranial nerve).	Gives the facial nerve (VII cranial nerve)	Glossopharyngeal (cranial nerve IX)	Vagus nerve (cranial nerve X)	

- We have 3 bones in the ear :  
(incus and malleus) come from the 1<sup>st</sup> branchial arch (Meckel's cartilage) and stapes from 2<sup>nd</sup> branchial arch (Reichert's cartilage)
- **The 1<sup>st</sup>, 3<sup>rd</sup> and 4<sup>th</sup> branchial arches are involved in the formation of the tongue.**
- **In the 3<sup>rd</sup> week you can't see any branchial arches.**
- the tenth cranial nerve is called vagus because when they first discovered it they didn't know what it was so they called it vagus (unknown)

Q: what is the origin of the muscles of mastication?

A: the ectomesoderm of the 1<sup>st</sup> branchial arch



#### Week 4 :

1. The frontal process ( which will later become the frontal part of the face ) covers most of the facial area
2. Underneath the frontal process are two process at the sides of the stomodeum are the **maxillary processes** , underneath them lies the **2 process of the mandible** .

The maxillary process → gives :

1. maxilla + maxillary teeth from canine to last tooth
2. zygomatic bone
3. squamous part of the temporal bone

the mandibular process → gives : the mandible + the lower lip + lower teeth

In between the mandibular and the maxillary processes lies the stomodeum ( primitive oral pit ) – separated from the foregut by the Buccopharyngeal membrane

Q: what is the origin of the buccopharyngeal membrane?

A: it develops from 2 layers the ectoderm and the endoderm . the layer of the membrane facing the foregut comes from endoderm and the layer of the membrane that faces the oral cavity comes from the ectoderm

#### Week 5 :

1. Buccopharyngeal membrane ruptures and the oral cavity is opened to the foregut
2. Formation of a bulge area ( due to the development of the brain )
3. the frontal process is called now the **front nasal process** ( because it will give the nose ) – it will diminish causing the face to become wider
4. The eyes become clearly visible on the sides of the head
5. Development of the nasal placodes : thickening of epithelium located on the upper border of the lip
6. The nasal cavity opens to the oral pit by 2 slits –( called nostrils formed by the nasal placodes )
7. Lateral to the nostrils are the **lateral nasal process** – medial to the nostrils is the **medial nasal process**

**Front nasal process: The bulge area + the frontal process**

<i>Origin</i>	<i>Structure</i>
<i>nasal placodes</i>	Nose
<i>Optic placodes</i>	Eye
<i>Otic placodes</i>	Ear



**Week 6 : ( most important week of embryonic development – because we start to get the odontogenic epithelium which will later gives us teeth )**

1. The eyes move from the side of the face to a more central position ( due to the broadening of the face )
2. Stomodeum widens and attaches laterally to each of the mandibular and maxillary arches
3. The maxilla and the lateral processes fuse together from the **naso lacrimal groove ( later it will become the nasolacrimal duct which lies on both sides of the face )**
4. The 2 medial nasal processes fuse to form the intermaxillary segment which will give : 9 the middle portion of the face )
  - A. Philtrum of the upper lip
  - B. Anterior part of maxilla
  - C. Primary palate
  - D. Part of the nose
  - E. Maxillary Central incisors
5. The lateral nasal process forms the **alae of the nose**
6. Mandibular processes fuse together to form the lower jaw
7. Odontogenic epithelium appears around 38 days

Development of the external ear :

The first branchial groove → gives the external auditory canal ( external acoustic meatus )

The external ear is formed from by fusion of 6 hillocks ( **3 originate from the mandibular arch and 3 originate from the hyoid arch** ) they form around the external auditory canal .

NOTE : The external ear → comes form the branchial grooves 7 the internal ear → comes form the branchial pouches

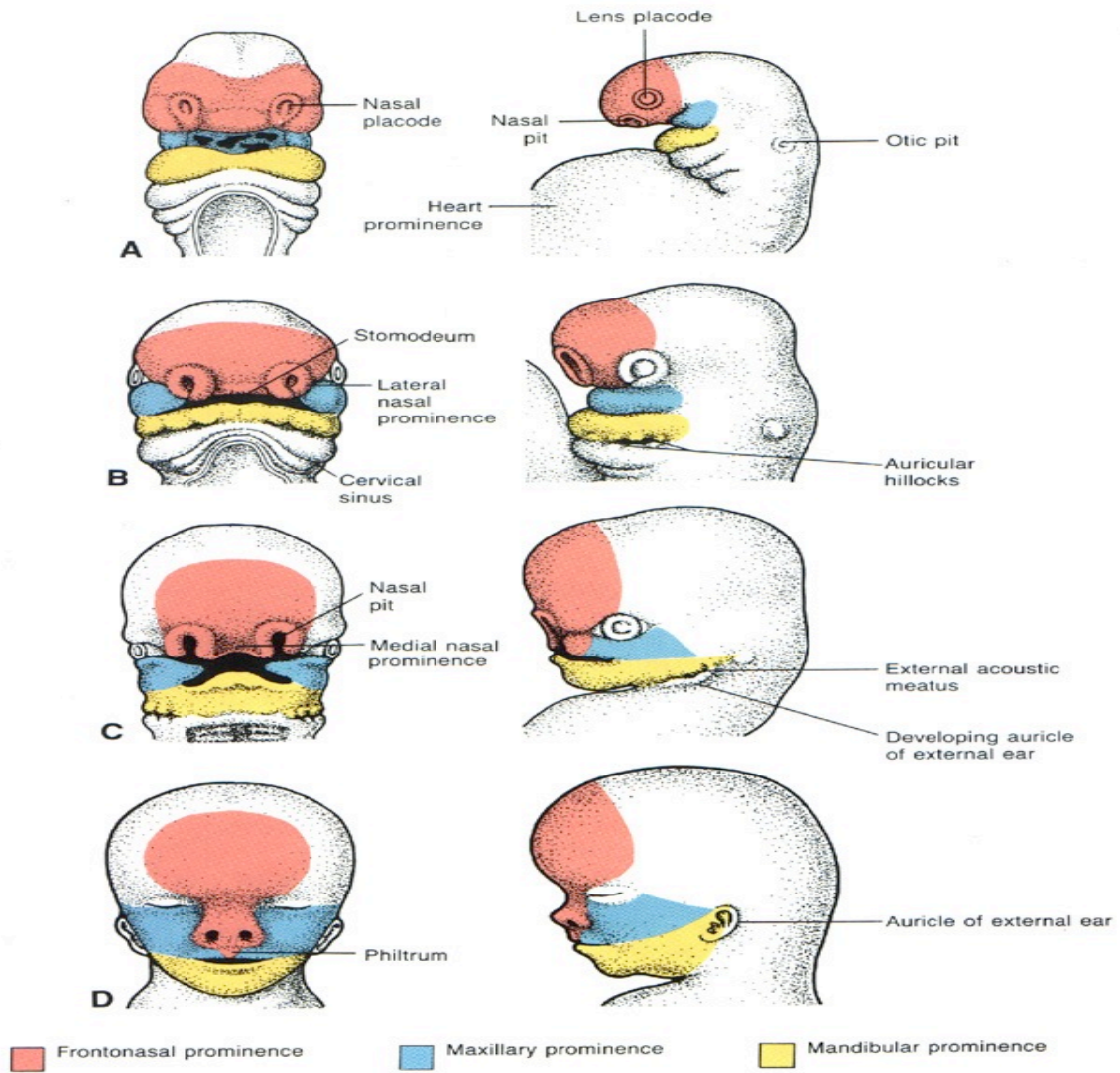
**Week 7:**

The face takes a more human appearance:

- the eyes are in the middle
- the upper lip is fused
- external ear is developed

fusions that occur in the 7<sup>th</sup> week are :

- A. lateral + median nasal processes
- B. median + median nasal processes
- C. median nasal process + maxillary process
- D. lateral nasal process + maxillary process





**FACE CLEFTS** :Failure in the fusion of the different facial processes cause different types of face clefts (Malformations due to **environmental or genetic** mutations )

**A. Bilateral lip cleft** :\_maxillary process fails to fuse with the median nasal process **on both sides**  
( the 2 maxillary processes fail to fuse with the 2 median nasal processes or the intermaxillary segment )



**B. Unilateral lip cleft** : maxillary process fails to fuse with the median nasal process **on one side** .



**C. Median lip cleft** : caused by the **partial failure of the fusion** between the 2 median nasal processes .



**D. Median face cleft** : caused by the **complete failure of the fusion** between the 2 median nasal processes



**E. Oblique facial cleft** : caused by the failure of the fusion between the lateral nasal process and the maxillary process



**F. Lateral facial cleft** : caused by the failure of fusion between the mandibular and the maxillary processes .



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**G. Median mandibular cleft :** caused by the failure of the fusion between the 2 mandibular processes .  
**( some people have a depression on the chin not a complete cleft )**



NOTE : Lip clefts are more common the facial cleft because facial clefts are mostly very severe and they cause the embryo to die .

**Median face cleft = ( Frontonasal dysplasia ) – or median cleft syndrome**

- Caused by complete inability of fusion between the 2 median nasal processes
- Rare disorder affecting face and head
- Unknown cause ( might be genetic ) because some cases were genetically inherited but most cases appear randomly ( sporadically )

Sporadically : when a disease occurs suddenly in a family with no previous family members having this disease

PROCESS	DERIVATIVES
<b>MAXILLARY PROCESS</b>	Maxilla Zygomatic bone Squamous part of temporal bone Upper teeth ( form canine to last tooth ) The sides of the upper lip
<b>MANDIBLE</b>	Mandible Lower teeth Lower lip
<b>MEDIAL NASAL PROCESS</b>	Fuse to give the intermaxillary segment They will give rise to the : philtrum Primary palate The anterior part of the upper lip Part of the nose Maxillary central incisors
<b>LATERAL NASAL PROCESS</b>	Alae of the nose Fuses with the maxillary process to form the nasolacrimal groove which will become the nasolacrimal duct later



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