

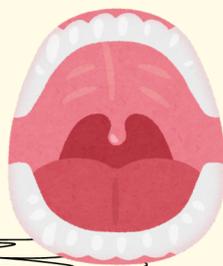
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ONLINE  
DENTAL ACADEMY



Embryology

ORAL  
HISTOLOGY



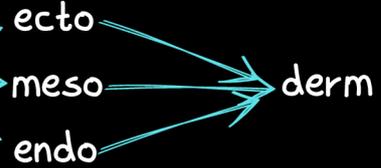
# EMBRYOLOGY

Prenatal development: {1UL}

40 weeks

## 1-Proliferation : Zygotic Phase

- begins → by Fertilization of ovum
- ends → end of 2<sup>nd</sup> week
- Zygote undergoes mitotic divisions
- Zygote implant it self to the Uterine
- Trilaminar embryonic disc develops



## 2-embryonic Phase :

- begins: 3<sup>rd</sup> week
- ends: 8<sup>th</sup> week

### I- Folding of embryonic disc in Two directions

1- cephalocaudally

2- laterally

- Covered externally by ectoderm
- Covered internally by endoderm

### II- development of external features

development of internal features

{العيوب الخلقية تظهر في هذه المرحلة من 5-8 أسابيع}

## 3-Fetal Phase:

- begins: 8<sup>th</sup> week
- ends: birth
- increase overall size and growth of fetus
- notochord development: Pear shaped
- begins: 3<sup>rd</sup> week
- Primitive streak {groove} → Appears at the midline of ectoderm
- Primitive streak have Primitive node

2-Notochord develops from the pit of Primitive Node

3-Ectodermal cells migrate from notochord to buccopharyngeal membrane

4-Notochord forms vertebral column

5-Notochord+ectoderm → neuroectoderm forms neural plate

6-Margins of neural plate grow rapidly to form folds and neural groove

7-At the crest of neural folds → neural crest cells N.C.C

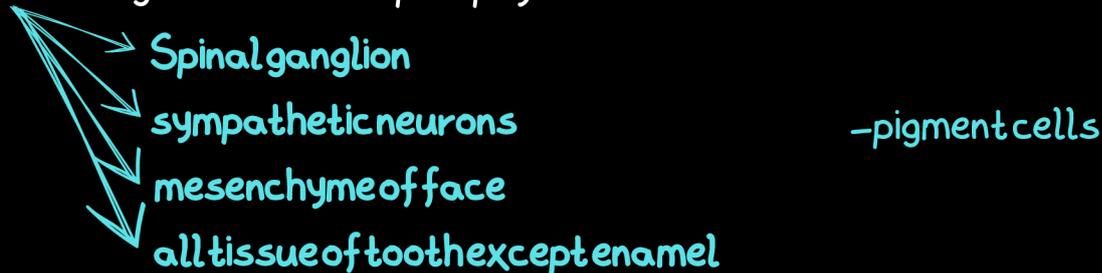
NCC → ectodermal in origin, with mesenchymal characteristics

8-Neural groove grows deeper → neural tube → spinal cord



9-Neural crest cells separate from neuroectoderm

10-N.C.C migrate to develop embryo



\*Failure of migration of N.C.C cause {Treacher syndrome}

-Buccopharyngeal membrane is formed of → ectoderm of stomodium  
→ endoderm of foregut

-Buccopharyngeal membrane breaks down at 4th week

11-From the roof of stomodium: Rathk's pouch develops

-Rathk's pouch → anterior lobe of pituitary gland

# Development of the Face

begins : at 4th Week:

from  $\begin{cases} \rightarrow 1. \text{Frontal prominence} \\ \rightarrow 2. \text{Mandibular arch} \end{cases} \longrightarrow \text{Give 5 swellings}$

one fronto nasal mesoderm covering forebrain push ectoderm

Two mandibular  $\longrightarrow$  From ventral end of mandibular arch

Two Maxillary  $\longrightarrow$  From dorsal end of mandibular arch forming lateral boundaries of stomodium.

- Lower lip, lower part of cheeks and chin  $\longrightarrow$  {Two mandibular}

- at 5th week, nasal placodes develop {thickening}

- give horse shoe shaped  $\begin{cases} \rightarrow \text{lateral} \\ \rightarrow \text{medial} \end{cases} \longrightarrow \text{nasal process}$

- Each maxillary process grow medially till approach L.M nasal process but, remains separated by a grooves

- Tip of maxillary process fuses with L. nasal process then continues below nasal pit to fuse with medial nasal process

- During {6th week} maxillary process push nasal areas to form "globular prominence" inter maxillary segment

- globular prominence fused to maxillary process  $\longrightarrow$  {UPPER LIP}

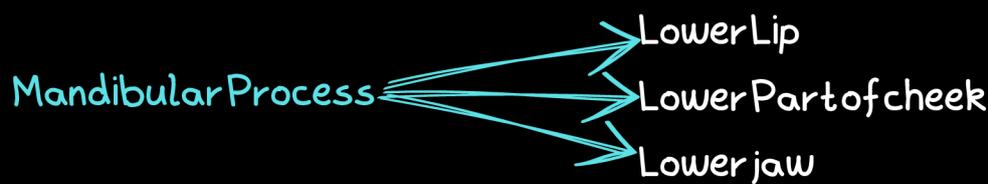
- L. nasal processes don't share information of upper lip they give ala of the nose

- line of fusion of L. nasal process, maxillary process

n.l. duck  $\longleftarrow$  nasolacrimal groove  $\longleftarrow$  groove

- mouth orifice  $\longrightarrow$  degree of fusion between mandibular and maxillary processes

- Muscles of facial expression develop from 2<sup>nd</sup> arch  
supplied by facial nerve
- Muscles of mastication develop from 1<sup>st</sup> arch  
supplied by mandibular nerve
- Final development of the face occurs during 3 months/10 week



### {Congenital anomalies}

1-Cleft {Lip}: is Very rare

- Failure of union of Two mandibular prominences at midline

Upper Lip: may be unilateral or bilateral

- Failure of fusion between Maxillary Process & nasal process
- Median cleft Lip: rare, incomplete merging of Two medial nasal processes in the midline

2-Macrostomia: {Transverse Facial cleft}

- Lack of fusion between mandibular and maxillary processes

3-Microstomia:

- Very rare
- Over Fusion of Maxillary and mandibular processes

4-Oblique facial cleft: Failure of fusion of Maxillary Process with lateral and medial nasal processes

# Development of nasal cavity and Palate

في البداية مش بيكون في اي تمييز للفم عن الانف بيكونوا مفتوحين علي بعض

-Palate formed from:

- 1- Primary Palate from inter maxillary segment
- 2- Secondary Palate from two maxillary processes

## 1-Nasal cavity:

- Oral and nasal cavity separated into oral and two nasal by
  - septum
  - palate
- Defining of nasal pits occurs by growth of their borders
- Nasal sacs separated from stomodeal cavity by double ectodermal membrane → **{nasobuccal membrane}**
- Naso-buccal membrane breaks down → primitive posterior nasal forming

## 2-Primary Palate: Initial separation between oral and nasal pits

### develops from:

- Posterior part of inter maxillary segment

## 3-Secondary Palate: Stomodeum increases in height and nasal septum grows backward

- Tongue is high and reaching free end of nasal septum
- Maxillary process give two shelf like processes forming two palatine shelves growing **vertically!!** downward on each side of the tongue
- Rapid growth of mandible → leave space for tongue
- Tongue withdrawn -Palatine shelves shift horizontally
- Two shelves fuse → secondary palate
- Fusion of palatine shelves, primary palate → **{Y shape}**

-Suggestions which explain Palatine shelves elevation:

- a. Presence of contractile fibroblasts in Palatine shelves
- b. Displacement of the tongue downward helps in elevation
- c. Differential growth
- d. Outer surface of palatine shelves grows more rapidly than nasal surface → Change the position of the shelves

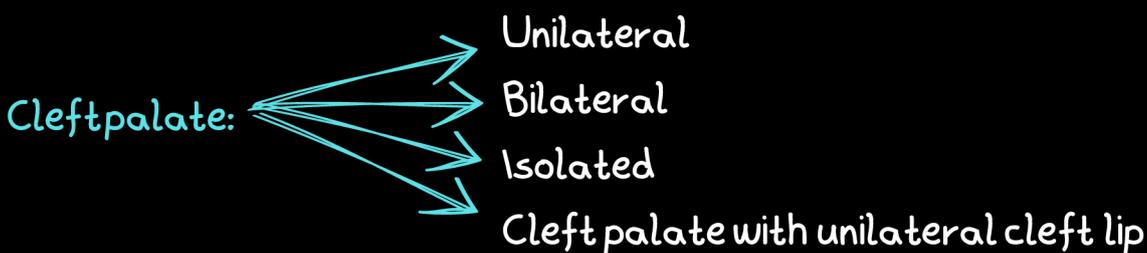
Fusion of embryonic processes

1-Processes separated by grooves: eliminated by tissue proliferation in groove growth more rapid than surrounding tissue

2-Processes separated by space: e.g. palatine processes

- remove their epithelial covering at the line of fusion

### Congenital anomalies of the palate



# {Branchial arches}

begins: 4th week

- Anterior part of the foregut flattens to form pharyngeal cavity
- pharyngeal wall is formed of mesenchymal tissue {mesoderm+N.C.C} 
- First and second arches grow to meet each other
- remaining arches don't meet but separated by median swelling  hypobranchial eminence  
development of the tongue 

1- First arch send process called maxillary process

2- First arch send process called mandibular process

Structure of pharyngeal arches:

1- Pharyngeal arch consists of  core of mesoderm

- covered by ectoderm
- lined by endoderm
- except first arch? both is ectoderm Because first arch is formed front to buccopharyngeal
- mesenchymal tissue of pharyngeal arches develops into straight muscles
- each pharyngeal arch has central bar of cartilage derived from N.C.C
- cartilage of first arch called  Meckel's cartilage

Meckel's cartilage:

1- Anterior end  mental ossicles

2- Posterior end  incus, malleus {bone of middle ear}

3- Middle part  lingula

4- Fibrous capsule  sphenomandibular ligament

مهم اوي

	Vascular	nervous	muscles
1st	External carotid artery internal carotid artery	mandibular nerve Corda tympani	muscles of mastication
2nd	Facial artery	Facial nerve	Facial muscles
3rd	Common carotid artery internal carotid	glossopharyngeal	---
4th	Aortic artery	Vagus nerve	---

### -Grooves and Pouches

- Branchial arches separated externally by grooves {clefts}
- Branchial arches separated internally by pouches

#### 1-Clefts {Grooves}: have limited significance

- Only first cleft has its own derivatives
- Derivatives → external auditory meatus/tympanic membrane
- 2nd, 3rd, 4th are obliterated by large overgrowth of 2nd arch → cause overlap on 3rd+4th
- Fuse with depression called cervical sinus → disappears later
- Cervical sinus → may transform into cyst

#### 2-Pharyngeal Pouches:

- Pouch 1: pharyngotympanic tube, middle ear cavity
- Pouch 2: palatine tonsil, and contribute to pharyngotympanic
- Pouch 3: thymus and inferior para thyroid gland
- Pouch 4: ultimobranchial body + superior para thyroid gland

#### 3-Derivatives of mandibular arch:

- Mandible
- Maxilla
- Lower lip
- Upper lip except philtrum
- All teeth except upper incisors
- Salivary glands
- Muscles of mastication
- Meckel's cartilage

# Development of the tongue

→ muscles

→ mucous

1. Anterior 2/3 → covered by ectoderm contains papillae

2. Posterior 1/3 → covered by endoderm contains lymphoid tissue

- Two parts are separated by → sulcus terminalis

## 1- Development of mucous membrane:

- Anterior 2/3 → develops from two centers:

1. Two lateral lingual swellings {1st}

2. medial swelling tuberculum impar

• mucous membrane originate from 1st arch → innervated by mandibular nerve

• Posterior 1/3 → hypobranchial eminence developed from 2nd and 3rd + 4th arches

• hypobranchial eminence → give mucosa of root of tongue

• innervated by glossopharyngeal → 3rd arch

• Posterior part of tongue is innervated by vagus nerve {4th arch}

• Anterior and posterior part of tongue develop at the same time

• fuse in V shape groove → sulcus terminalis

• At the apex of sulcus → foramen cecum → site of origin of thyroid gland → posterior to tuberculum impar

## 2- Development of muscles: during second month

• intrinsic, extrinsic muscles → innervated by hypoglossal nerve

• both muscle originate from the same origin → occipital myotomes

## innervation of the tongue:

### 1- Sensory innervations of anterior 2/3:

1. mandibular nerve (posttrematic) gives lingual nerve → general sensation
2. facial nerve (pretrematic) → 1,2,3 arch
3. taste by glossopharyngeal → 1,2,3 arch

### 2- innervation of posterior 1/3:

1. glossopharyngeal for general and taste sensation
2. superior laryngeal nerve branch from vagus nerve (3,4 arch)

### 3- Motor innervation:

1. hypoglossal nerve → intrinsic and extrinsic muscles

## Development of tongue papillae:

- Anterior 2/3 → fungiform, circumvallete, foliate → 9 week
- 10 weeks → filliform develops
- circumvallete → near terminal branches of glosseopharyngeal
- fungiform → near chorda tympani
- mesoderm proliferate to form fungiform contains → taste buds
- primitive taste buds disappear and other buds develops

## Development of alveolingual groove:

- The tongue is fused to the floor of the mouth
- a downward growth of epithelium around its periphery occurs
- degeneration of this epithelium forms alveolingual sulcus
- When groove fails to separate → The tongue tip still fused to the floor of the mouth → (tongue tie)

## Development of Mandible:

-Mandible develops from: first arch → Meckl's cartilage

- Meckl's cartilage extend from: otic capsule to: midline
- joined with each other by mesenchyme.
- Meckl's cartilage acts as skeletal support for mandibular nerve
- Mandibular nerve → lingual nerve  
→ inferior dental nerve → mental branch  
→ incisive branch

steps of development:

1-development of body: (intramembranous ossification)

- center of ossification → angle formed by incisive and mental nerve
- 1. Backward → below mental nerve → mental foramen
- 2. Forward → form trough beneath incisive nerve
- 3. Backward → along lateral aspect of meckl's cartilage forming a trough → inferior dental canal

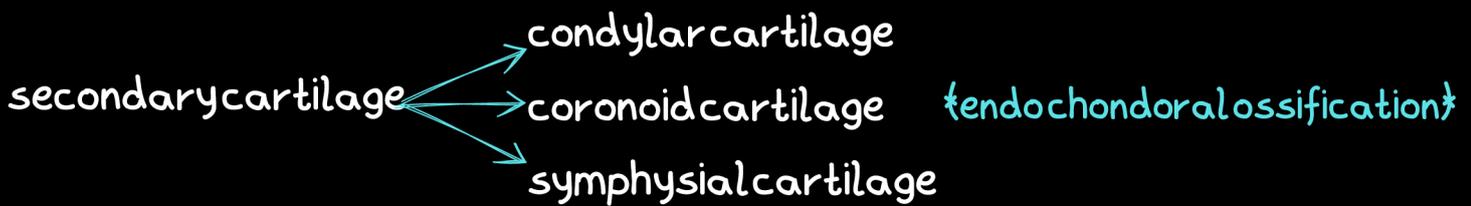
2-development of alveolar process:

- Upward → median and lateral plates of mandibular body grow to contain tooth germs into troughs
- This trough is divided by septa to form separate compartment or alveoli

3-development of ramus:

- Ramus is first mapped out by Fibrocellular condensation
- Thus, mandible is formed by intra membranous ossification with no direct involvement of Meckl's cartilage

-growth of these processes is modified by appearance of secondary cartilages



**Condylar cartilage:** is the first and largest

- This mass is converted to bone by endochondral ossification
- it continues till 20 years
- gives rise to head and neck of condyle and posterior half of ramus above m. foramen

**Coronoid cartilage:** after condylar cartilage

- disappears before birth
- gives rise to coronoid process and anterior half of ramus

**Symphyseal cartilage:** after coronoid cartilage

- separated from each other by connective tissue
- enable mandible in its growth in width
- Union of two halves occur after year of birth
- independent on Meckel's cartilage

**Mental ossicles:**

- 2 or 4 nodules of cartilage → in connective tissue of symphysis they ossify and fuse with each other → mental protuberance

## Growth of mandible

**1-secondary cartilage:** the most important growth

- result in → downward and forward shift of mandible
- increase length of ramus
- increase length of mandible
- increase intercondylar distance {transverse growth}

2-Sub Periosteal bone Formation: on all surfaces increase overall size of the mandible

3-Development of Alveolar Process: increase the height

4-deposition on POS. part of ramus and resorption on anterior:

- increase length of arch
- Provides space for erupting molars

5-deposition: on lower border → increase high

6-deposition: at the angle of mandible with resorption from opposite side.

- increase transverse distance

7-Bone formation: due to development, growth, mastication

8-Development of the Chin: influenced by genetic and sexual properties factors/mental ossicles → mental protuberance

## Development of Maxilla

-Maxilla consists of  Maxilla Proper  
PreMaxilla

1-Maxilla Proper: {intramembranous ossification}

- center of ossification: below infraorbital nerve
- above deciduous canine and spread:

1-Backward: toward Zygomatic bone → Zygomatic process

2-forward: toward Pre Maxilla

- backward and forward → trough → canal → infraorbital foramen

3-Upward: to form Frontal Process of Maxilla

4-downward: outer alveolar plate

- inner alveolar plate develops later from junction of palatal process and body of maxilla

5-inward: toward midline to form hard plate

2-PreMaxilla: 

- Two Frontal processes arise one from PreMaxilla and the other from Maxilla
- The suture remains for one year after birth between U2, U3
- Premaxillary arises the alveolar process carrying 4 incisors

### growth of the maxilla:

1-Sutural growth: Maxilla articulates with bones by 4 sutures

- These sutures are parallel to each other
- direction upward anteriorly to downward posteriorly
- growth shift maxilla anteriorly and downward
- growth continues till 10 years of age

a. FrontoMaxillary suture

b. ZygomaticMaxillary

c. Zygomatic temporal

d. PterygoPalatine suture

2-Sub Periosteal bone: formation throughout life

3-bone apposition: at maxillary tuberosity  $\rightarrow$  increase anterioposterior

4-Development and growth of alveolar process: increase length and height

5-appearance of secondary cartilage:

- secondary cartilage appears in Zygomatic process
- mid line between two palatine process
- along growing margins of alveolar plate

6-Development and growth of maxillary sinus: especially in height

7-Bone resorption at the floor of nasal cavity: enlargement of nasal cavity and increase the height of maxilla

8-Bone deposition: in the floor of the orbit to compensate bone resorption of roof of maxilla  $\rightarrow$  increase height