Lecture 8: Development of Maxilla & Mandible

By

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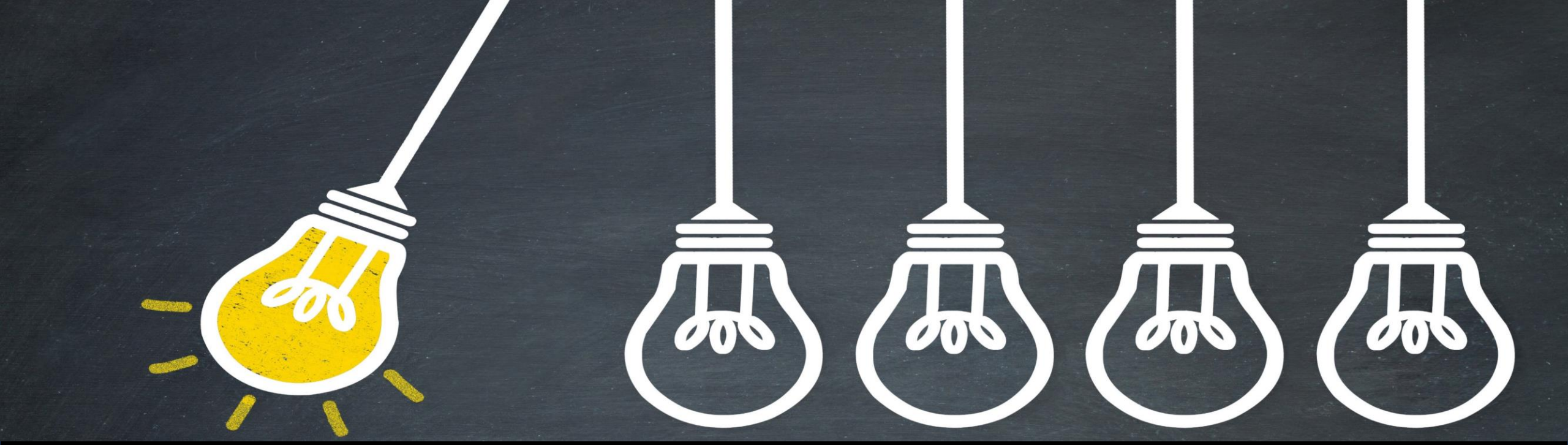


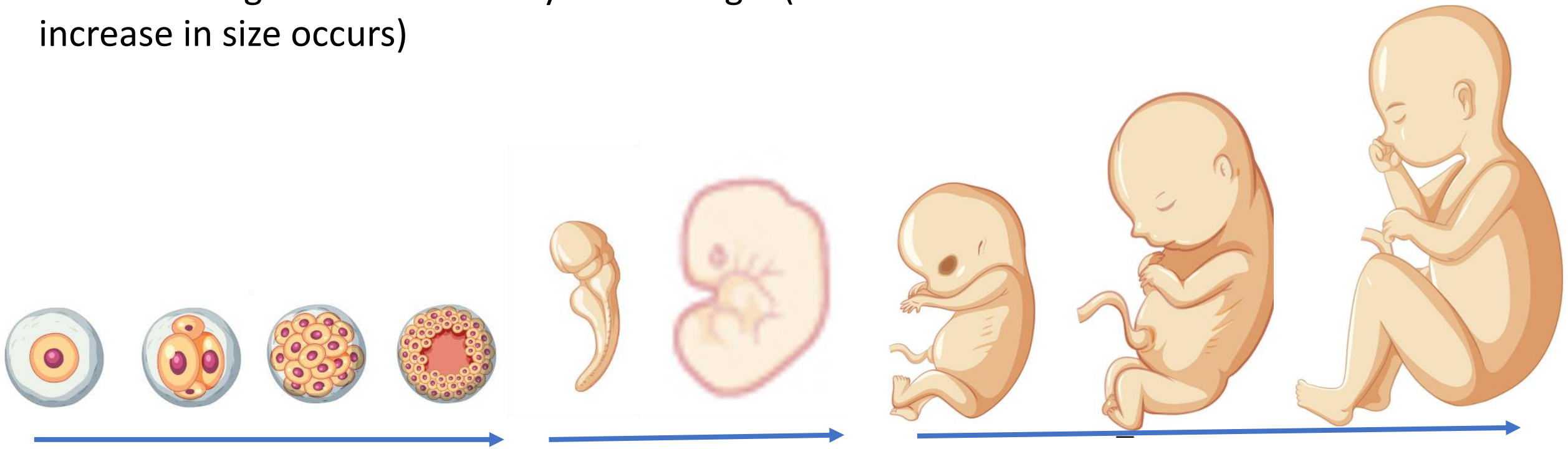
Learning Outcomes

- Define Development and Growth
- Describe Stages of Individual Development
- Describe Developmental Stages of Mandible and Maxilla.
- Define the Intra-membranous and Endochondral Ossification.

Introduction

- Development and Growth of an individual can be divided into **Pre-natal** and **Post-natal periods.**

- **Prenatal** stage is the most dynamic stage (5000 times increase in size occurs)

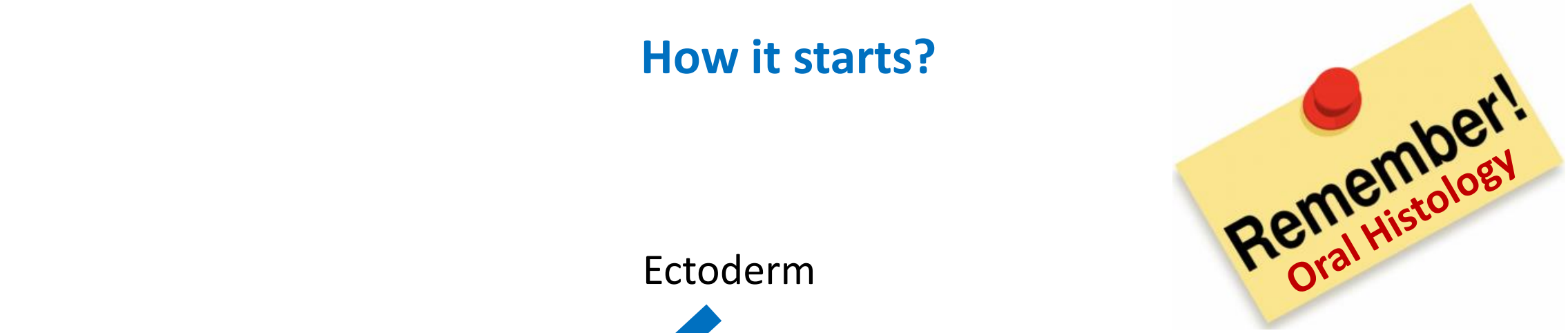


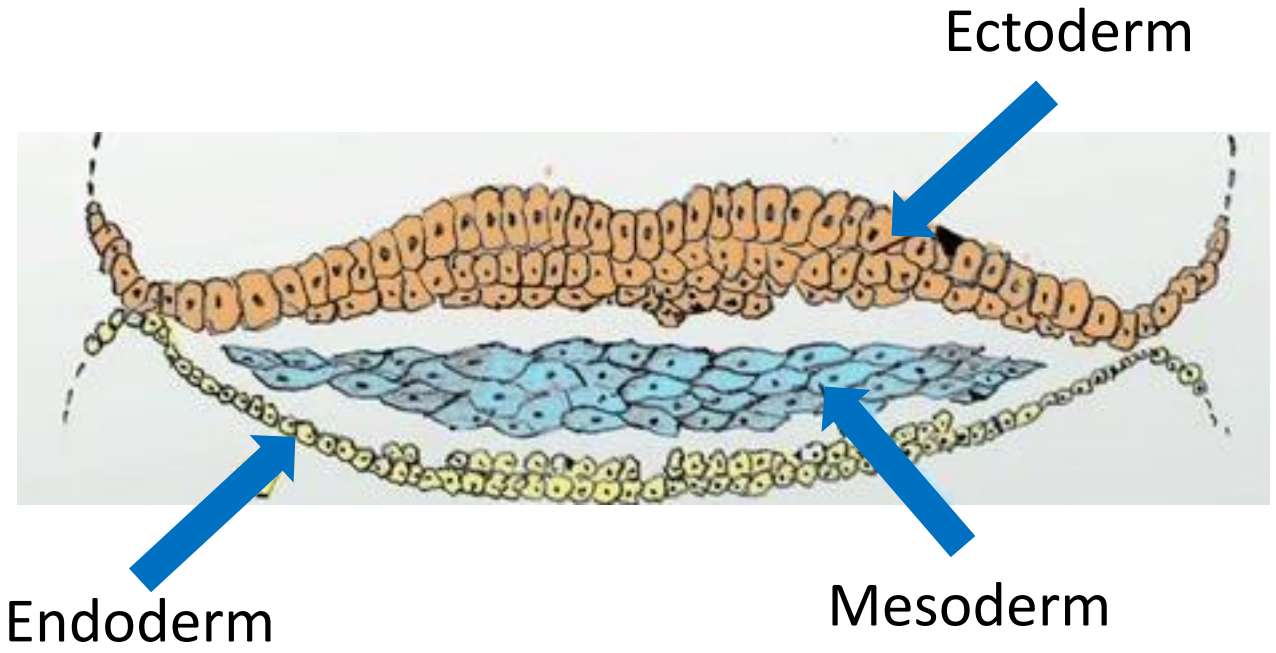
Germinal Period
1 -2 weeks

Embryonic Period (**Embryo**)
3 – 8 Weeks

Fetal Period (**Fetus**)
9 Weeks - birth

How it starts?





in 3rd week

Derivatives

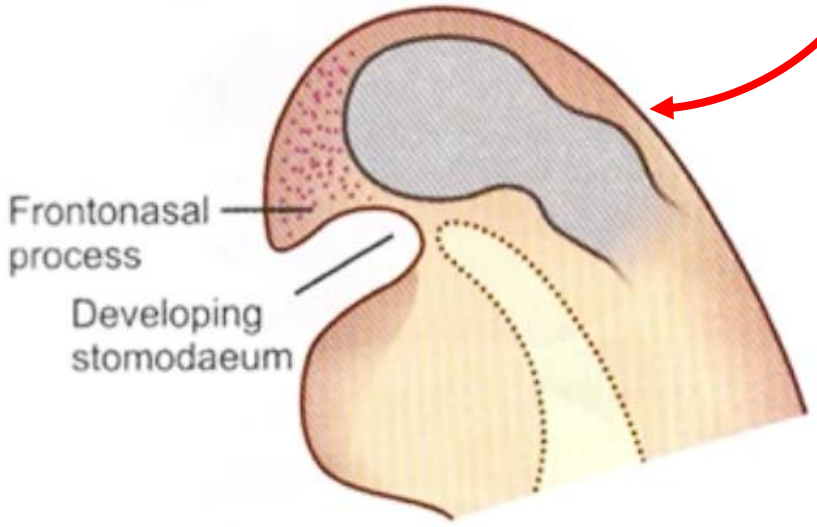
4th Week of Development

Folding

Development of Stomodeum

- Around the **4th week** of intra-uterine life, a prominent **bulge** appears on the ventral aspect of the embryo corresponding to the developing brain.

- Below the bulge a **shallow depression** which corresponds to the primitive mouth appears called " **STOMODEUM**".



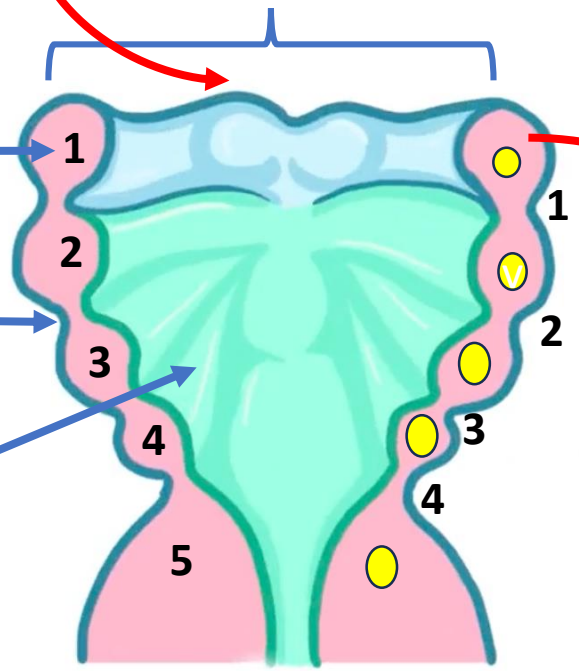
Pharyngeal Arches

Pharyngeal appratus

Arches
Mesoderm

Clefts
Ectoderm

Pouches
Endoderm



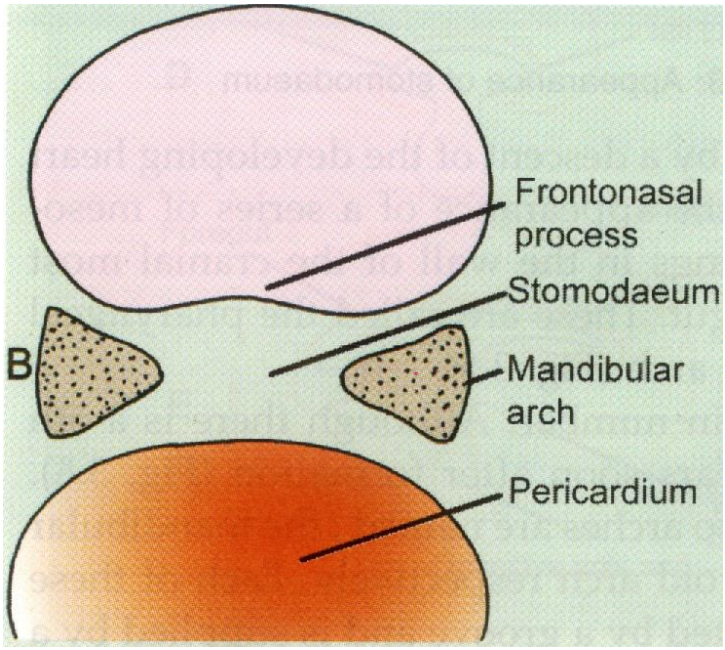
First Pharyngeal Arch

(Mandibular)

Maxilla

Mandible

Top view/ sectioned

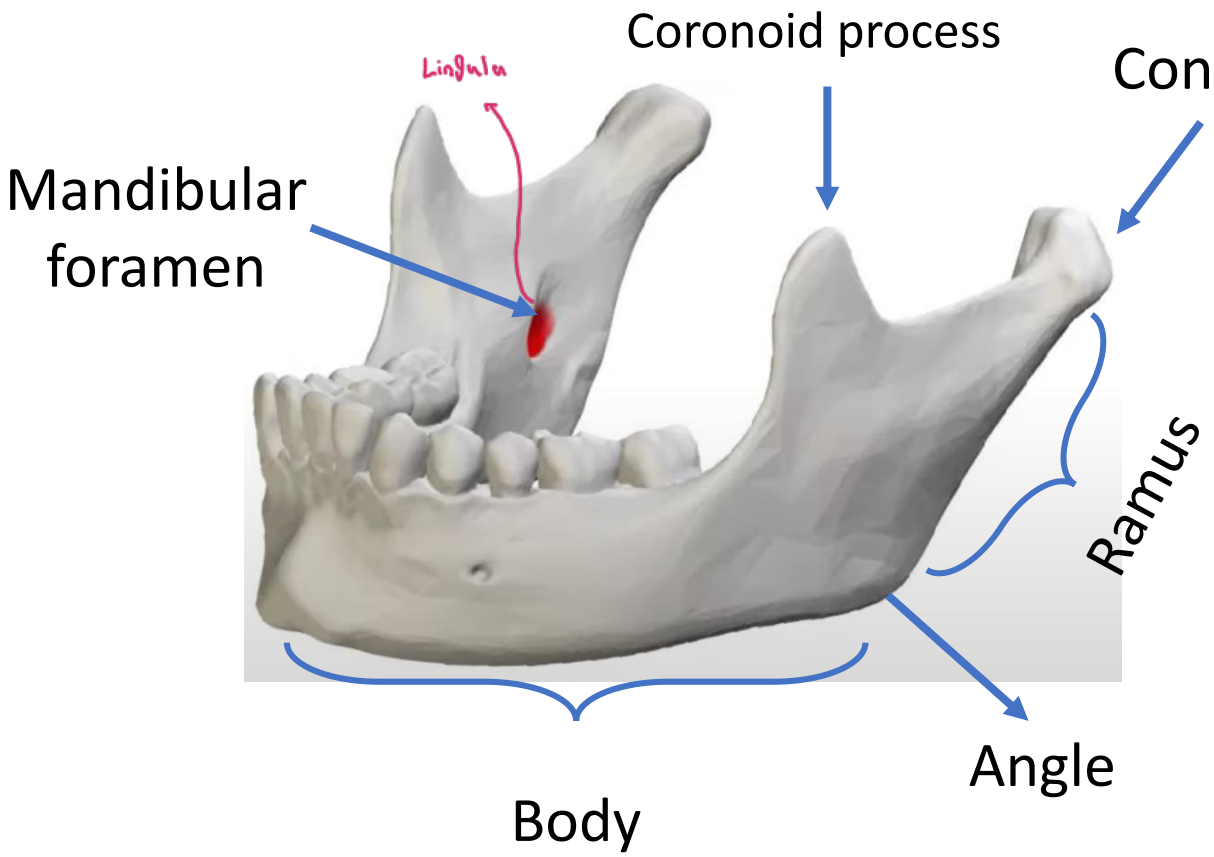


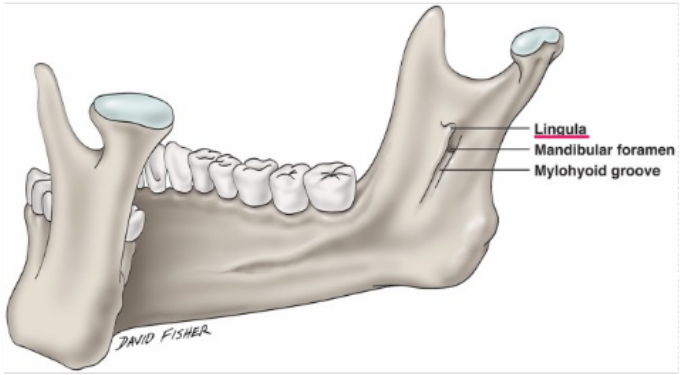
Frontal view

- The mandibular arches of both sides form the **lateral walls of the stomodeum**.

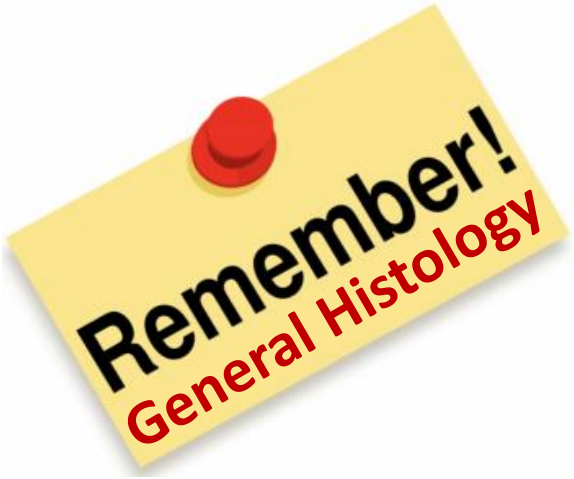
Development of Mandible

Anatomy of Mandible

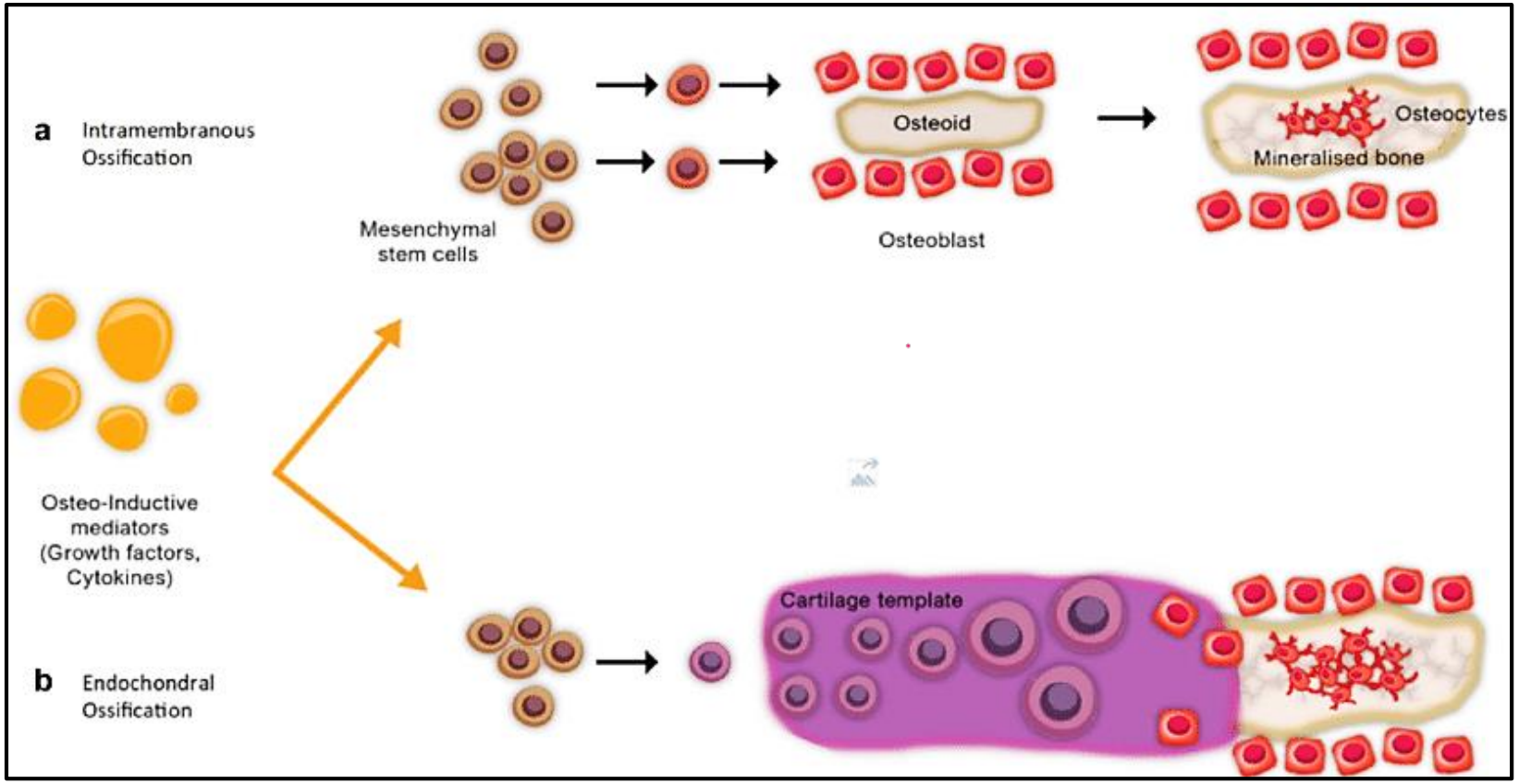




Bone formation (osteogenesis)



- **1) Intramembranous ossification**: The **direct** conversion of mesenchymal tissue into **bone**.
- **2) endochondral ossification:** the mesenchymal cells differentiate into **cartilage**, and this cartilage is later replaced by **bone**.



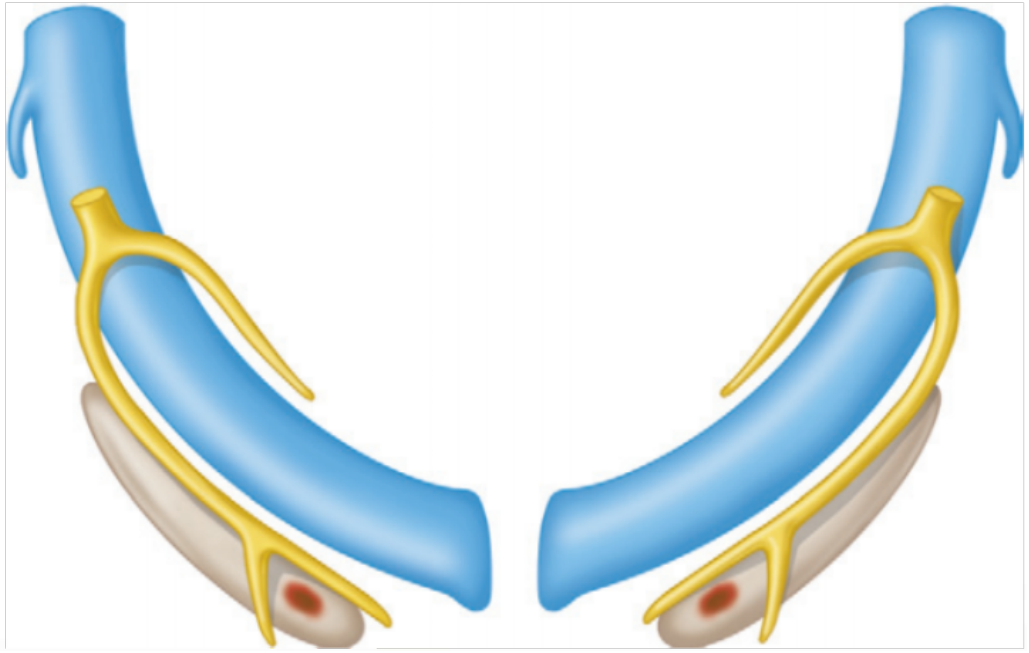
1- Intramembranous Ossification in Mandible

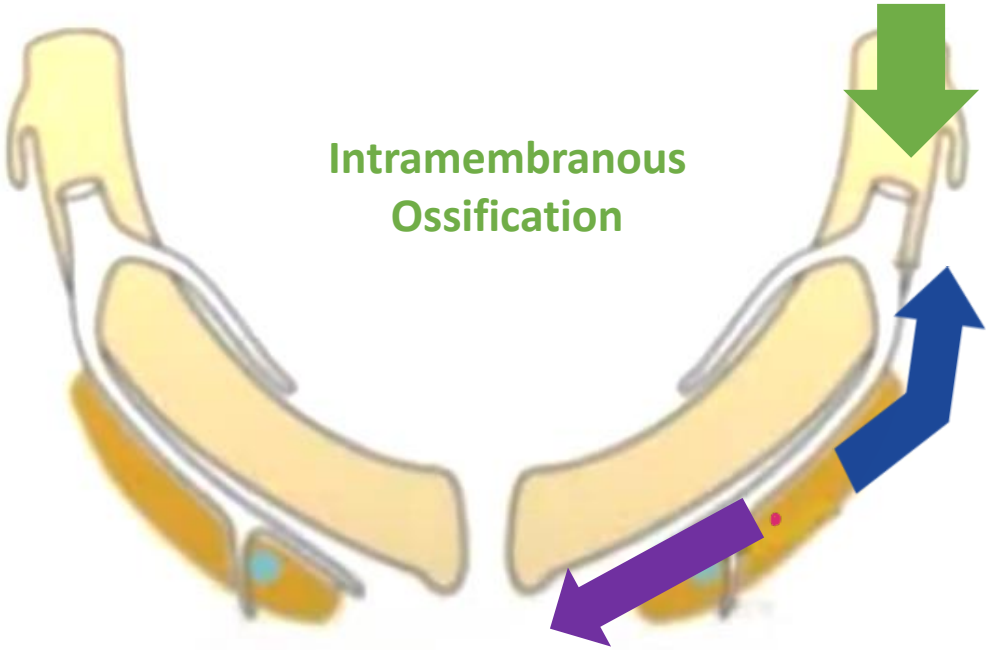
Main type of ossification in the mandible

- At **7th week**
- a **primary ossification centre** appear

Lateral to the Meckle's cartilage

- **Intramembranous Ossification** starts, Proceeds **ventrally** to the body and **dorsally** contributing the mandibular ramus





1ry ossification centre : at the **bifurcation of inferior alveolar nerve and artery**

It's the site where ossification begins.

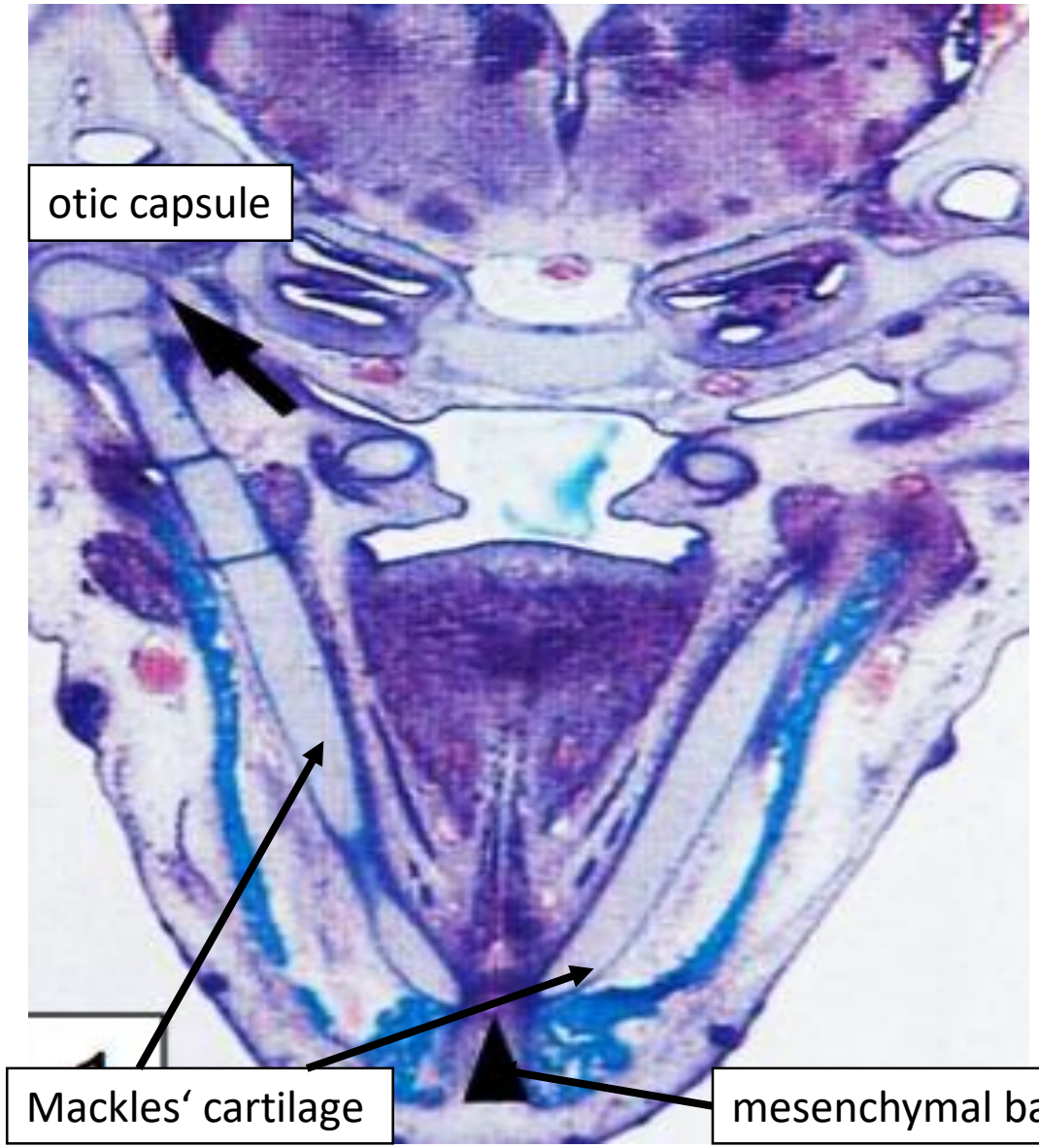
Meckles' cartilage

- During **6 – 7th week** of IU life,
- The 1st pharyngeal arch differentiate into **Meckle's cartilage**

one on the R and one on the L

- Two **solid hyaline cartilaginous rod**, surrounded by a fibrocellular **capsule**, extend from the ear region (otic capsule) to the midline
-
- They are separated at the midline by a thin **mesenchymal band (symphysis)**

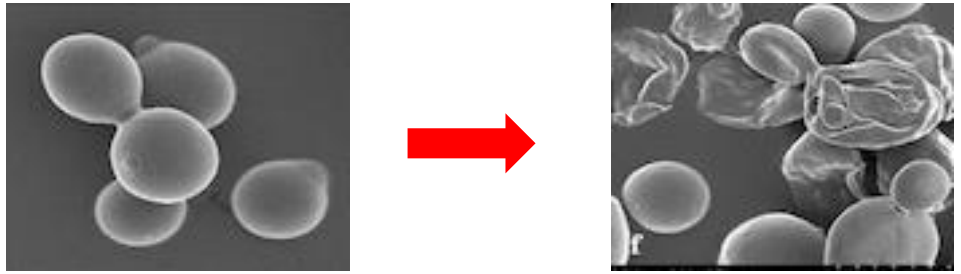
#
- It has a **close positional relationship** to the developing mandible but have **no contribution** to it.



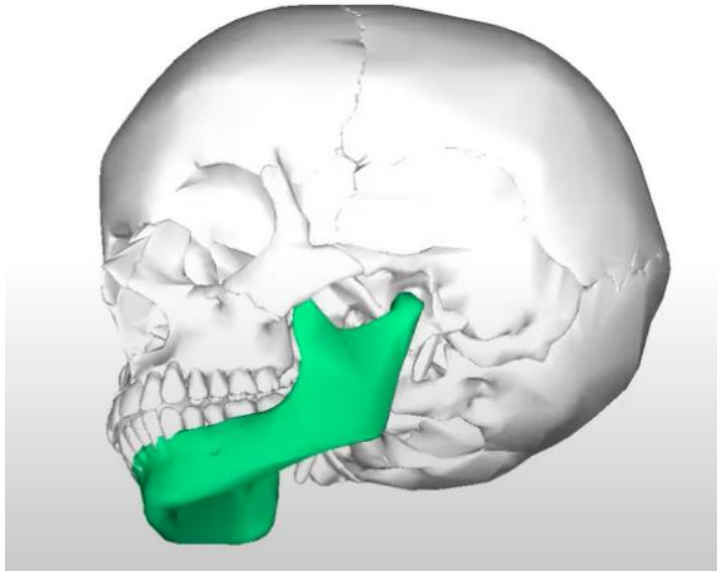
Autolysis of Meckle's cartilage

- At 24 Week, **Autolysis** occurs within the Meckle's cartilage

  Digestion of the cells by its own enzymes

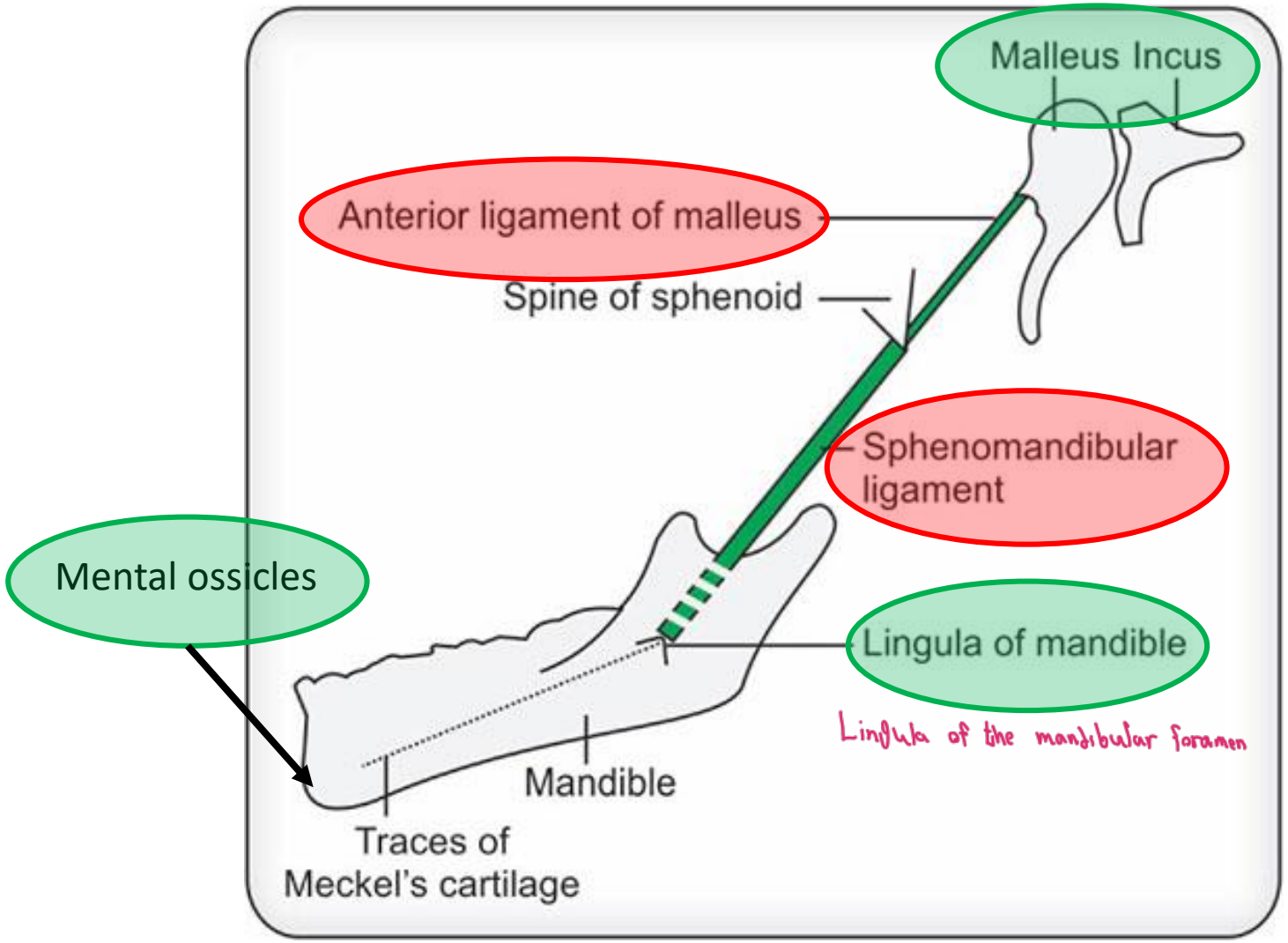


- The cartilage **disappears** & the mandible develop around it

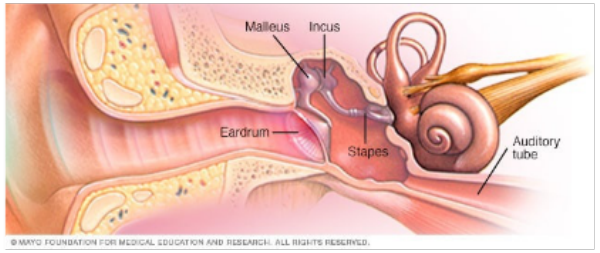


※ Fate and derivatives of Meckle's Cartilage

- By **24th Week**, Meckle's cartilage disappears except the following parts:



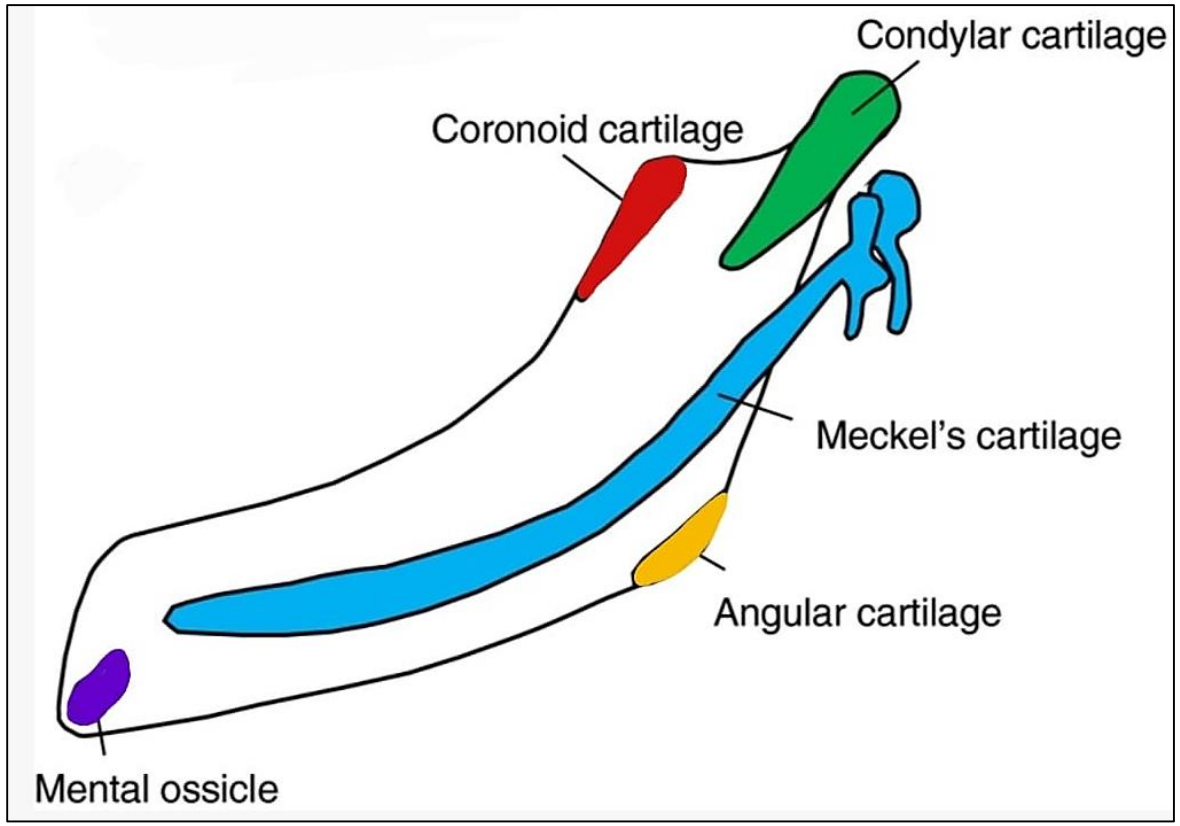
4 Bones



2 Ligaments

2- Endochondrial Ossification in Mandible

- **Secondary cartilages** appears that will eventually give rise to:
- **Condylar cartilage** (12th Week)
- **Angular cartilage** (14th week)
- **Coronoid cartilage** (18th week)
- **Symphysial (mental) cartilage** (20th week)



Why are they called secondary cartilages?

because of:

1) They are **not part** of and have no connection with the **primary cartilaginous skeleton**.

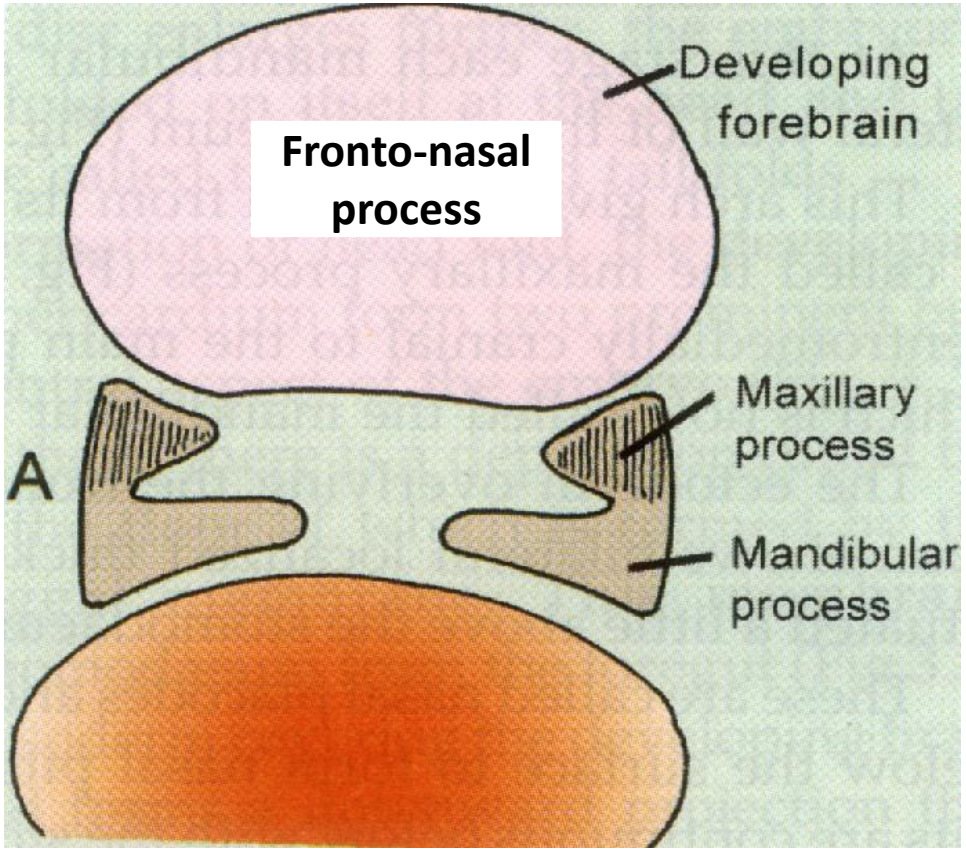
2) They have **different histological structure** from the primary cartilages (less intercellular matrix and larger cells).

3) They **increase in size** by proliferation and transformation of the cells of the perichondrium. (appositional growth)

4) They are **formed according to function** (tension or compression by muscles).

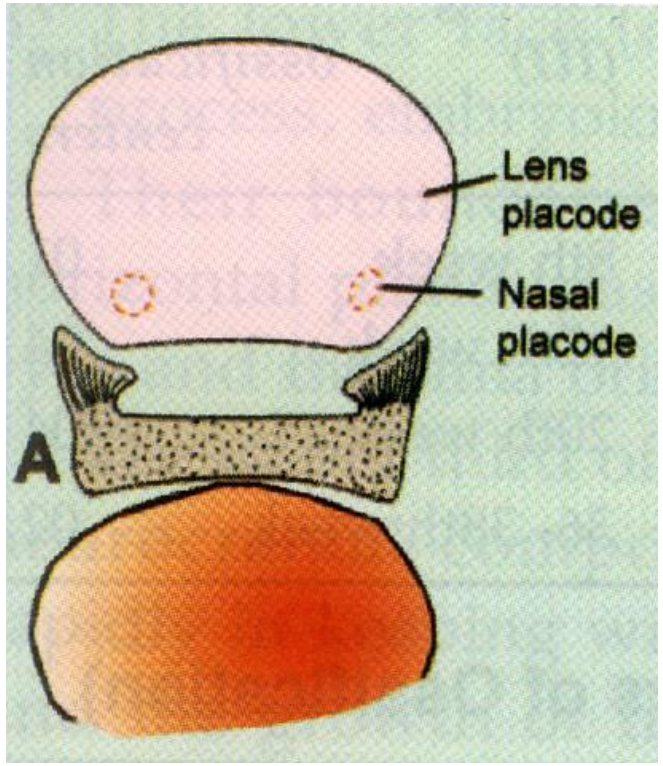
Development of Maxilla

- **At 4.5 weeks**, the stomodeum is thus overlapped superiorly by the fronto-nasal process
- The mandibular arches now called **Mandibular processes** which gives off a **bud** from its **dorsal** end called the **Maxillary process**



Development of Maxilla

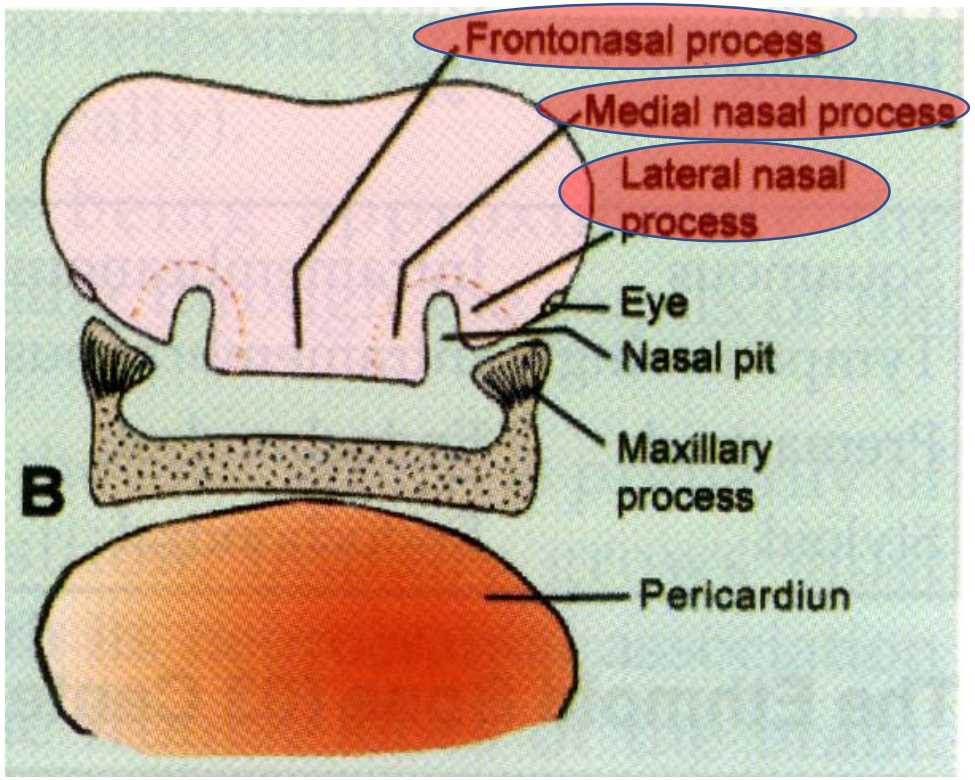
- **At 5th week**
- Appearance of **lens** and **nasal** placodes
- These placodes soon sink and form the **nasal pits**.



- The formation of these nasal pits divides the **fronto-nasal process** into **two** parts

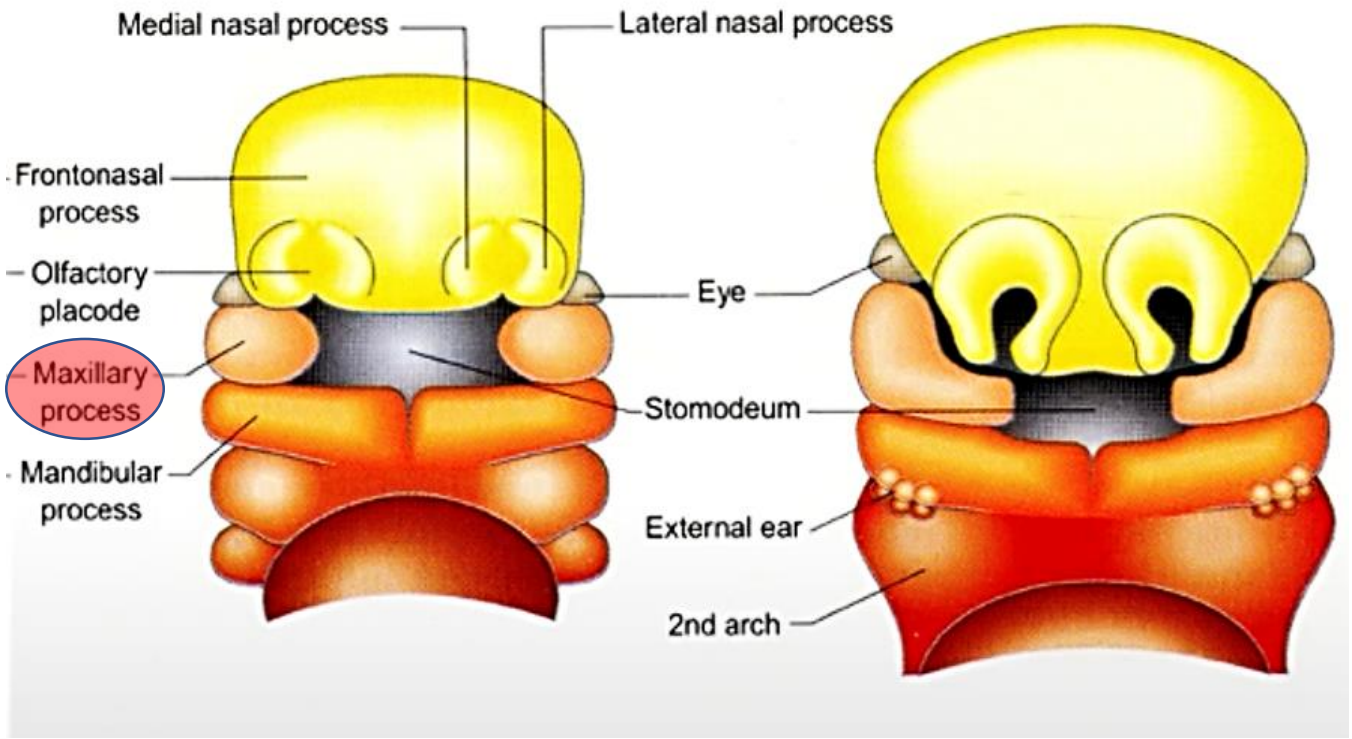
a)The medial nasal process

b)The lateral nasal process

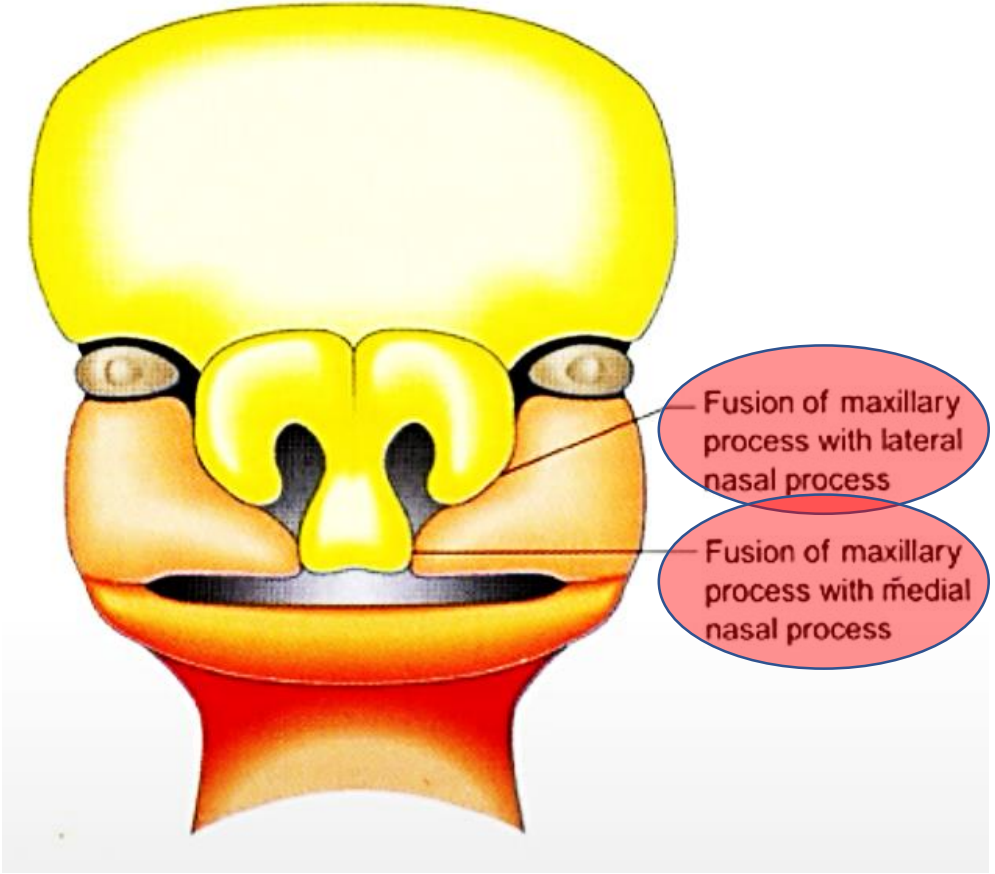


Development of Maxilla

- **At 6th week**
- Maxillary process **approaching** each other



- Maxillary process **fusion** with lateral and mesial nasal process



Development of Maxilla

At 6th week

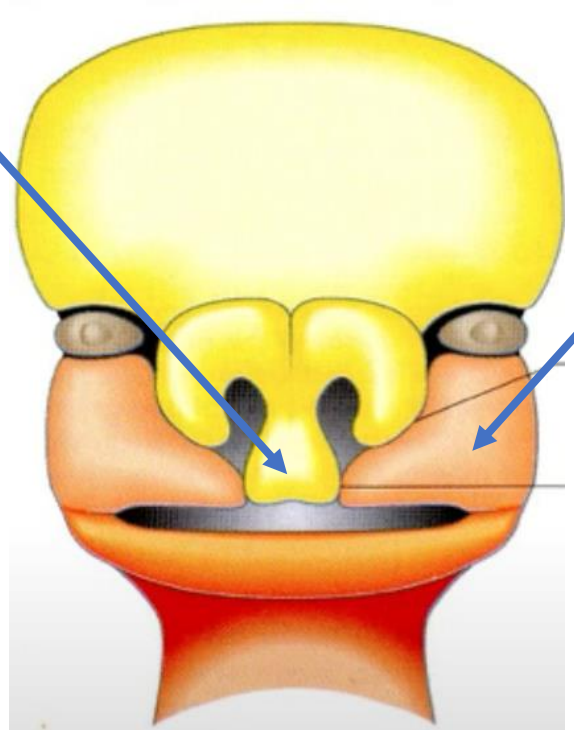
The **Medial Nasal** processes of both sides gives

1- Middle portion and tip of the nose

2- Middle portion of the upper lip "filtrum"

2-Anterior portion of the maxilla that carries anterior teeth **(premaxilla)**

3-Primary palate.



Maxillary processes give:

1 - Lateral major part of the upper lip.

2- **Major part of the maxillary bone**.

3- **Secondary palate (palatine processes of maxillary bone).**

Remember: Development of Palate in Oral Histology course

Intra-membranous ossification is the main type of ossification in the maxilla

Development of Maxilla

- The maxilla proper (excluding the premaxilla) develops also by **intra-membranous ossification** in the maxillary process of the mandibular arch, closely associated with the cartilage of nasal capsule

- **Center of ossification:** appears in the angle between inferior orbital nerve and anterior superior orbital nerve

- **Spread of ossification:**
- **Posteriorly**: below the orbit and developing zygoma (zygomatic process of the maxilla)
- **Anteriorly**: toward the future incisor region.
- **Superiorly**: to form the frontal process.
- And into the **palatine process** to form the hard palate.

- **Secondary cartilage:** (Zygomatic)

Further Readings

-Joci M : Essential of Oral Biology : Anatomy , Histology Physiology and Embryology (2010), 1st edition CBS Publisher New Delhi, Delhi, India

-Nanci A :Ten Cate Oral Histology: Development, Structure and Function (2013) ,8th edition , Mosby , Elsevier Publisher ,USA

Thank You