

# Growth and Development



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**Development** • It is refer to an increase in complexity and specialization ,is qualitative measure .



## Difference between Growth + Development

- **Growth** – changes in size
- **Development** – increase in physical, emotional, social, or intellectual skills.



# Growth

- According to KROGMAN , growth is an “Increase in size, change in proportion and progressive complexity” is quantitatively measured





# GROWTH

**PRENATAL**

Before birth

**POSTNATAL**

After birth

## Mechanisms Of Bone Growth are:

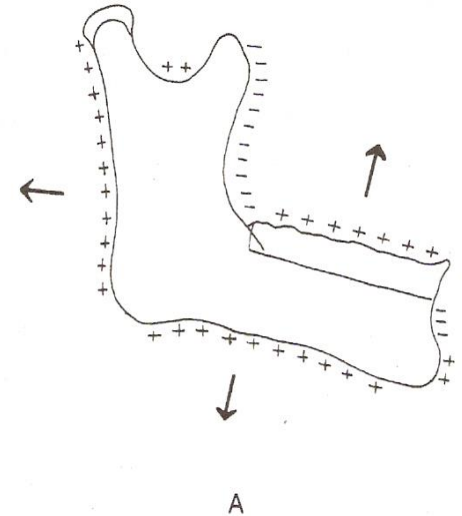
- Remodeling
- Cortical drift
- Displacement



# REMODELING

## BONE DEPOSITION & RESORPTION:

- Bone changes in shape & size by two basic mechanisms, bone deposition & bone resorption. The bone deposition & resorption together is called “ BONE REMODELING”.The changes that bone deposition & resorption can produce are:
  - Change in size
  - Change in shape
  - Change in proportion
  - Change in relationship of the bone with adjacent structures



# CRITICAL DRIFT

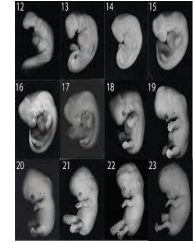
- Most bones grow by interplay of bone deposition & resorption .A combination of bone deposition & resorption resulting in a growth movement towards the deposition surface is called “Cortical Drift”.
- If bone deposition & resorption on either side of a bone are equal, the thickness of the bone remains constant.
- If in case more bone is deposited on one side & less bone resorbed on the opposite side The thickness of the bone increases.



# DISPLACEMENT

- Displacement: Growth which causes the mass of a bone to be moved relative to its neighbours. Displacement can be of two types.
- Primary displacement: If a bone gets displaced as a result of its own growth, it is called “Primary displacement”. e.g.. Growth of the maxilla at the tuberosity region results in pushing of the maxilla against the cranial base in a forward & downward direction.





Secondary displacement: If the bone gets displaced as a result of growth & enlargement of an adjacent bone, it is called “Secondary displacement.” e.g., The growth of the cranial base causes the forward & downward displacement of the maxilla

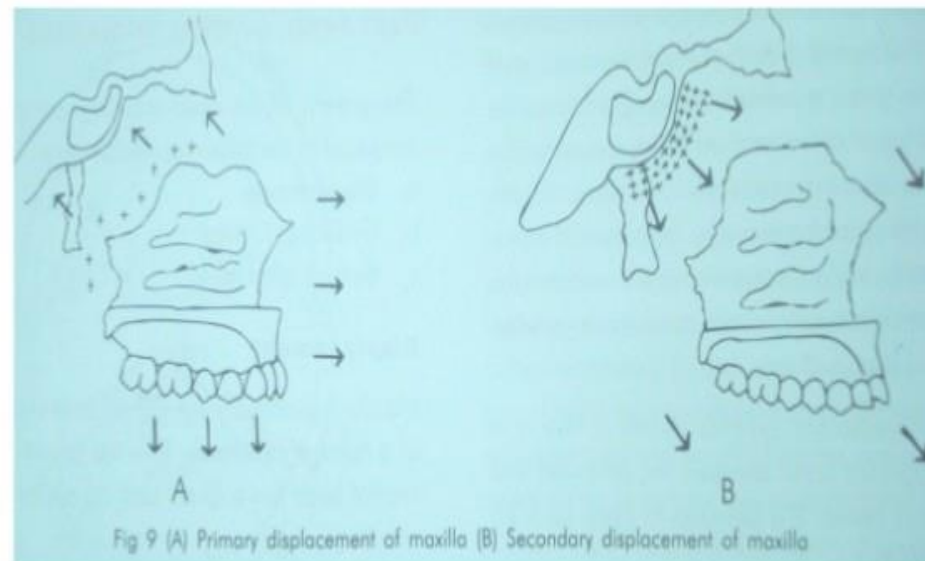


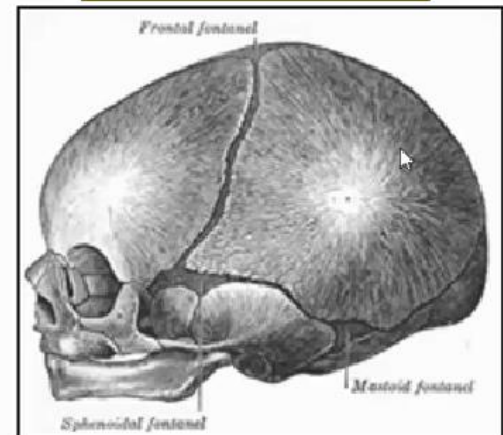
Fig 9 (A) Primary displacement of maxilla (B) Secondary displacement of maxilla

Bone formation occurs by 2 methods of differentiation of mesenchymal tissues. Accordingly 2 types of bone growth is normally seen.

- 1) Intra-membranous ossification : The transformation of mesenchymal connective tissue usually in membranous sheets, into osseous tissues. E.g. Cranial vault, face (Mx & body of Md) and the clavicles

## INTRAMEMBRANOUS

### FLAT BONES



2. Endochondral ossification: The conversion of hyaline cartilage into bone. E.g. Cranial base, condyle and Epiphyseal plate Proliferating cartilage.



# GROWTH SPURTS

Growth doesn't take place uniformly at all times. There seem periods when a sudden acceleration of growth occurs. This sudden increase in growth is called growth spurt.

- The physiologic alteration in hormonal secretion is believed to be the cause for such accentuated growth. The timing of growth spurt differs in boys and girls.



"Wow! That's some growth spurt!"



• The following are the timings of growth spurt

a. Just before the birth

b. 1 year after the birth

c. Mixed dentition growth spurt

Boys 8- 11


Girls 7-9

d. Pubertal growth spurt

Boys 14-16

Girls 11-13



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- Growth modification by the means of functional and orthodontic appliances elicit better response during growth spurt . surgical corrections of maxilla and mandible should be carried out only after cessation of growth spurt

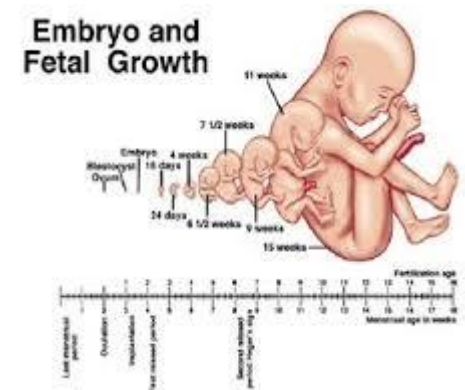
## Growth patterns

- Different tissues have different growth patterns (curves) in terms of rate and timing, and four main types are recognized: neural, somatic, genital, and lymphoid. The first two are the most relevant in terms of craniofacial growth.



## Neural grow

- this essentially that which is determined by growth of the brain, with the calvarium following this pattern. There is rapid growth in the early years of life, but this slows until by about the age of 7 years growth is almost complete. The orbits also follow a neural growth pattern.





# Somatic growth

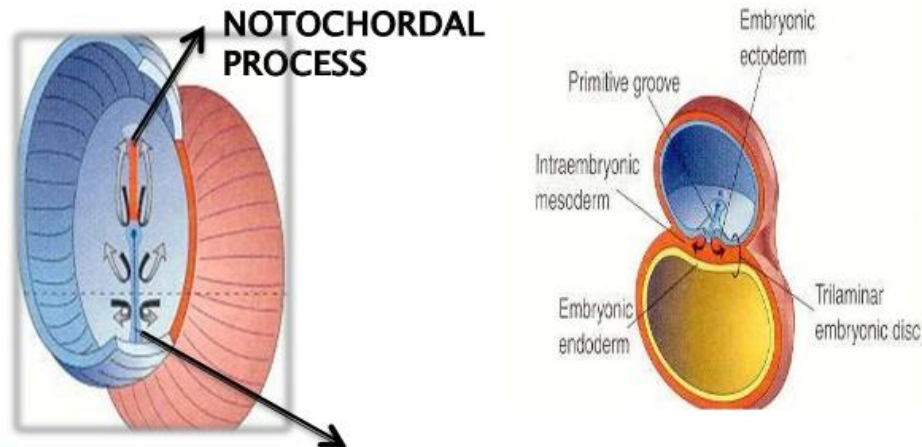
- Is that which is followed by most structures. It is seen in the long bones, amongst others, and is the pattern followed by increase in body height. Growth is fairly rapid in the early years, but slows in the prepubertal period. The pubertal growth spurt is a time of very rapid growth, which is followed by further slower growth.
- Traditionally, the pubertal growth spurt has been reported to occur on average at 12 years in girls, but there is evidence that the age of puberty is decreasing in girls. In boys the age of puberty is later at about 14 years.

## □ PRIMARY GERM LAYERS

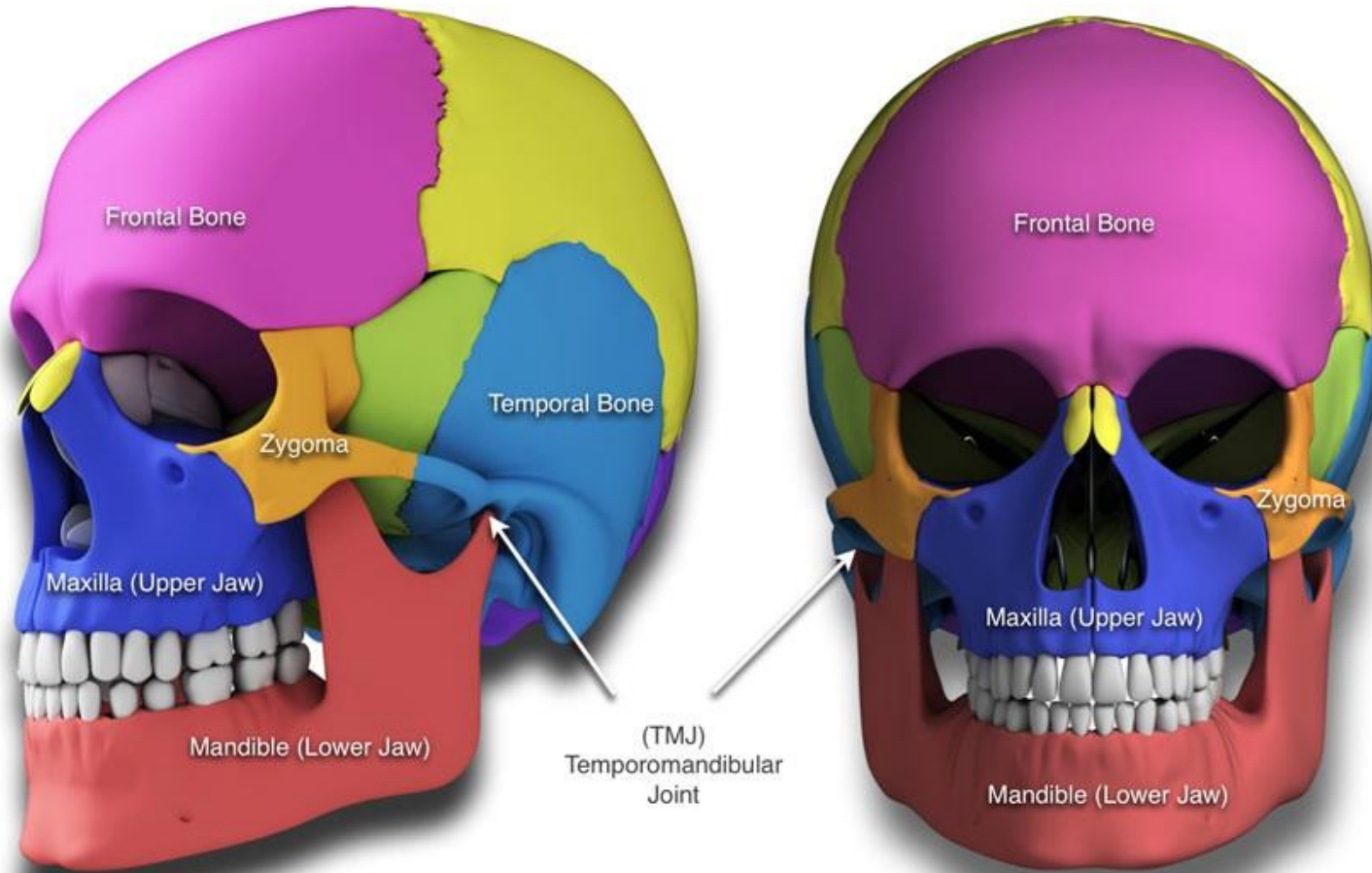
- **ECTODERM** → epithelium covering the outside of the body
  - epithelial lining of oral cavity, nasal cavity & sinuses.
  
- **MESODERM** → Skeletal system ,
  - muscles,
  - blood,
  - lymph cells,
  - vessels,
  - kidneys
  - internal organs

- || **ENDODERM** Epithelial lining of the
  - pharynx,
  - stomach,
  - lungs,

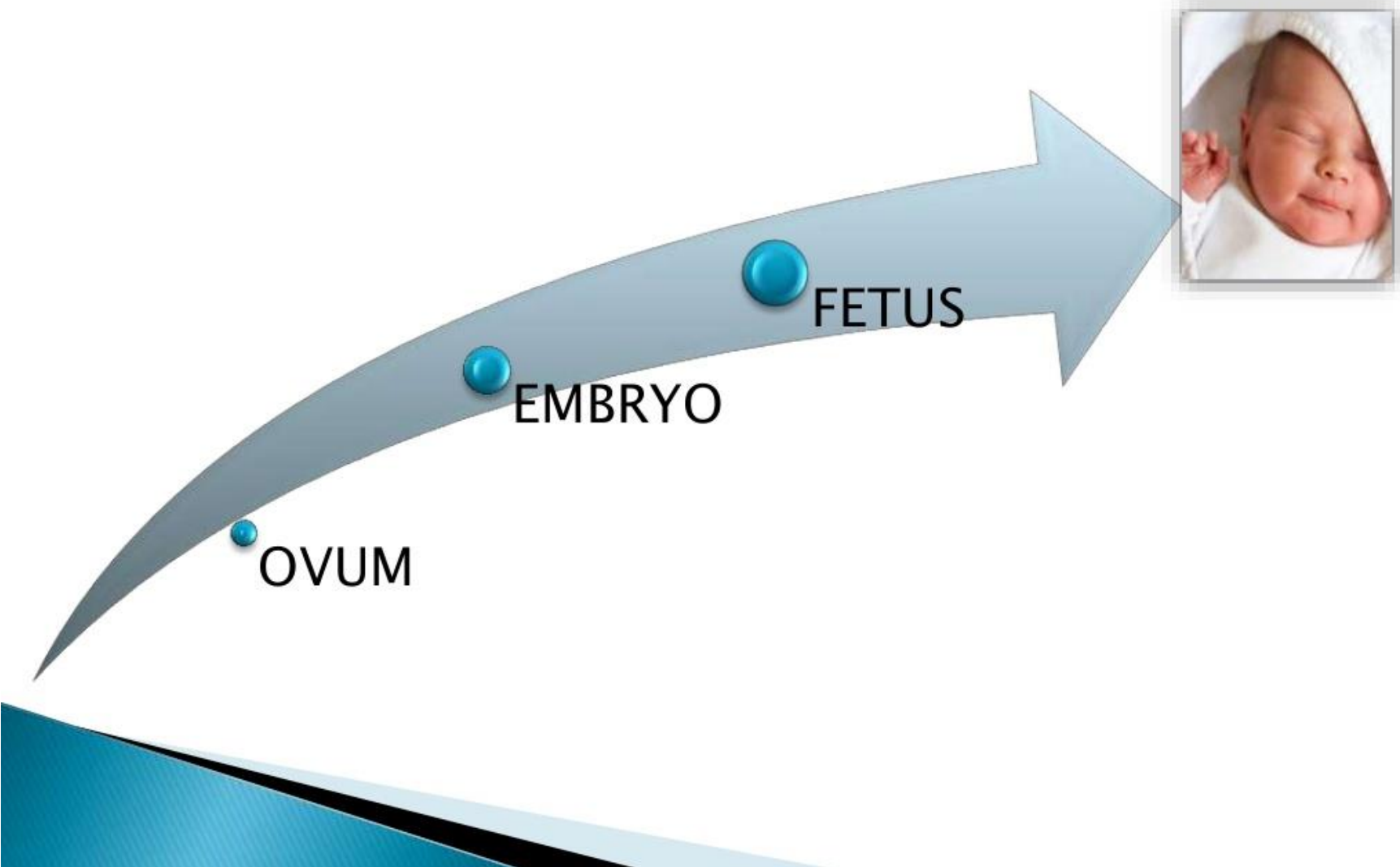
## FORMATION OF THREE LAYERED EMBRYO: GASTRULATION (3<sup>RD</sup> WEEK)



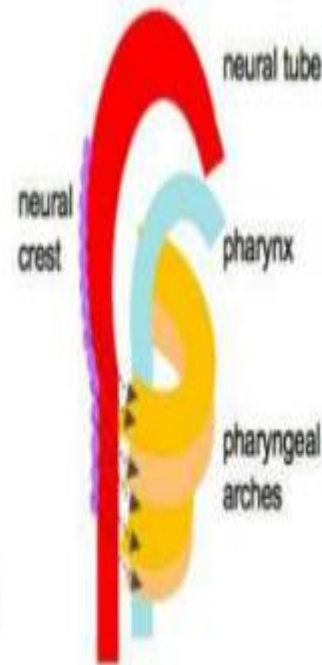
# Development and growth of the jaws



# PRENATAL GROWTH



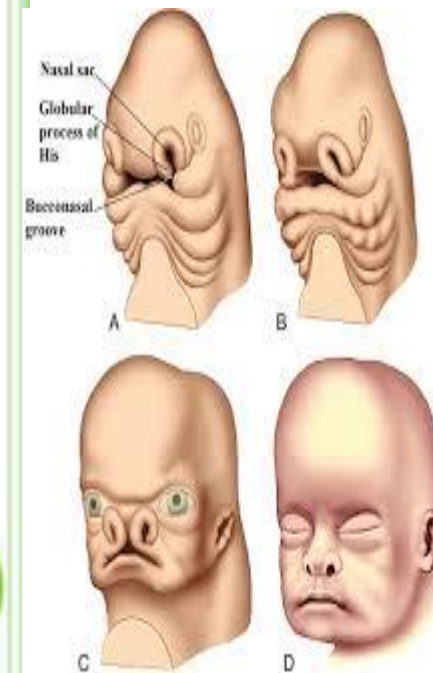
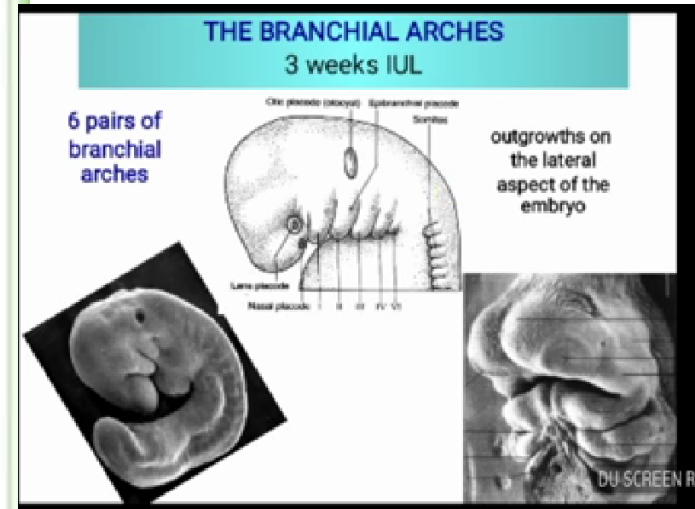
- Initially, there are 6 pharyngeal arches, but the 5<sup>th</sup> one usually disappears as soon as it is formed leaving only five.



- They are separated by 4 branchial grooves.



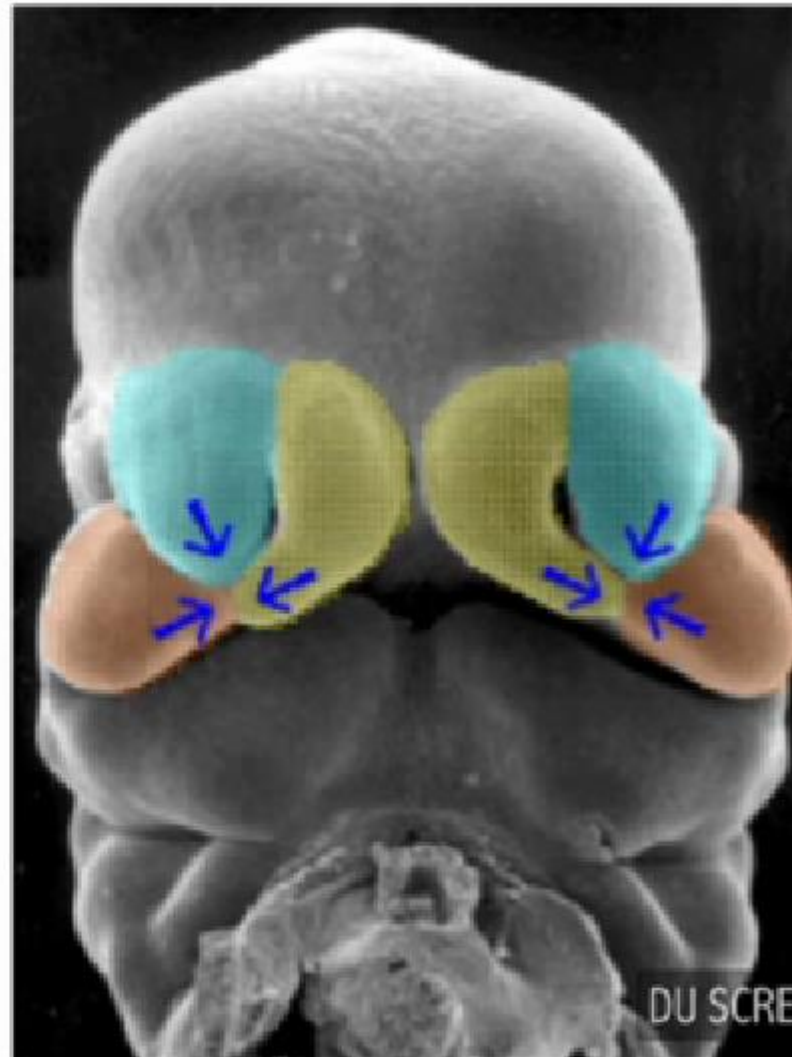
- The first arch is called **MANDIBULAR ARCH** and second arch is called **HYOID ARCH**.



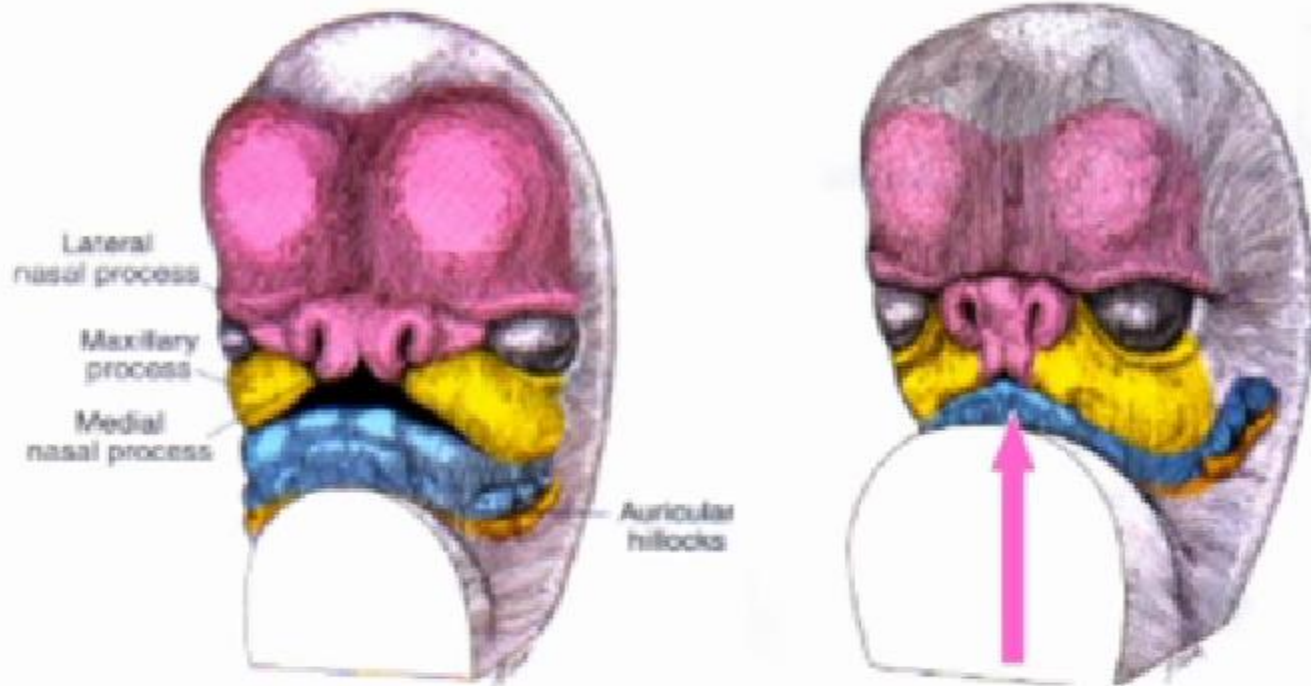
## Derivatives of the first arch:

- 1-The mandible and maxilla
- 2-The lower lip, part of the upper lip and cheek
- 3-All the teeth
- 4-All salivary glands
- 5-All muscles of mastication
- 6-The anterior two thirds of the tongue

- Medial N. P.
- Lateral N.P.
- Maxillary P.
- Mandibular P.





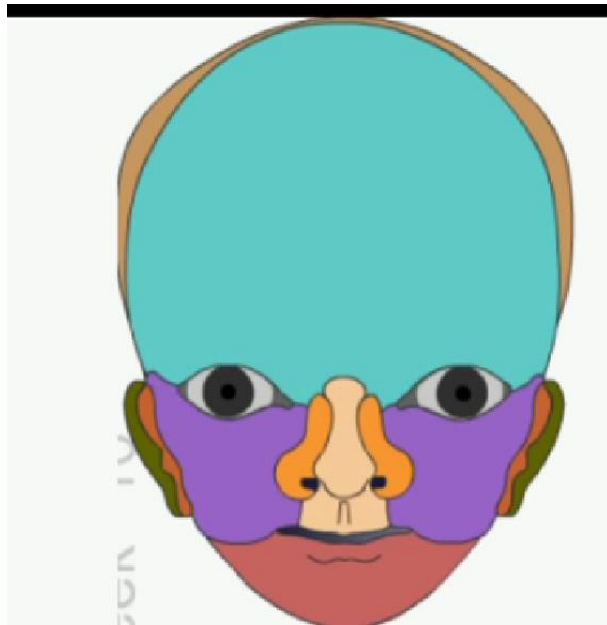
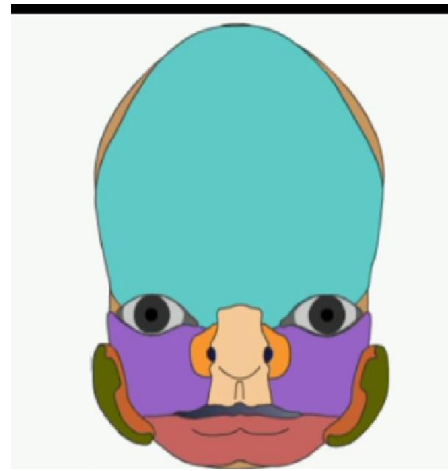


**Fusion of medial nasal processes at the midline**

↓  
filtrum of upper lip

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PALATE  
DEVELOPMENT



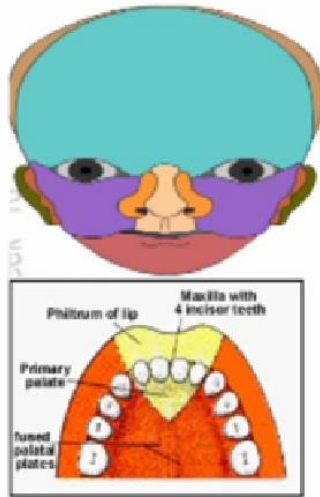
## So the Face is developed from 7 processes

<u>7</u> processes	Origin	structure formed
<u>Two</u> mandibular processes	Mandibular arch.	lower lip
<u>Two</u> Maxillary processes	Mandibular arch.	cheek and lateral parts of the upper lip.
<u>Two</u> lateral nasal processes	Frontonasal process.	lateral part of the nose (Ala of nose )
<u>One</u> medial nasal process	Frontonasal process.	middle portion of nose & filtrum of the upper lip and <u>1 ry</u> <b>palate</b>

**Primary Palate:**

5 - 6 wiu

Inward extension  
of the  
medial nasal  
process

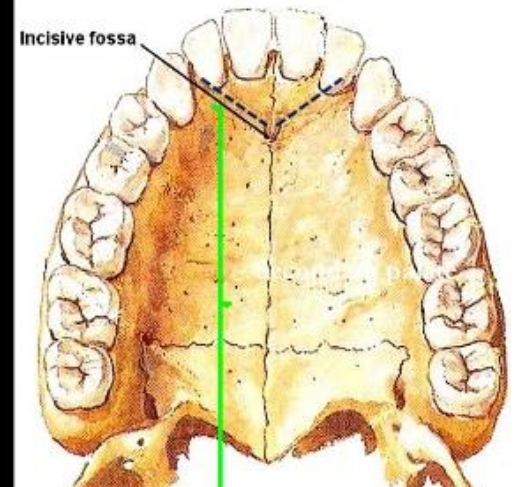


The primary palate represents only a small part lying anterior to the incisive fossa, of the adult hard palate

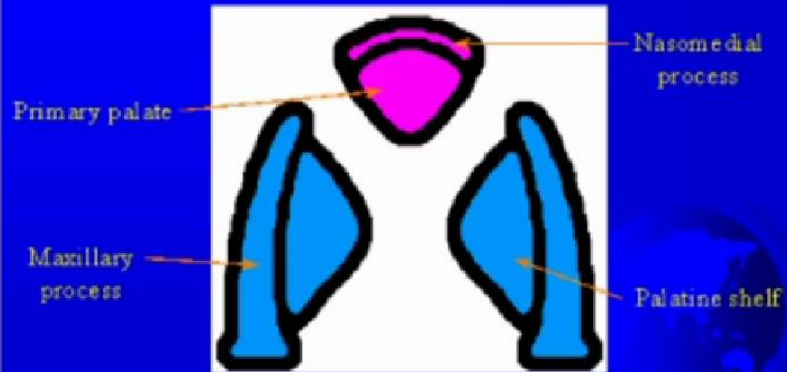
Hard palate



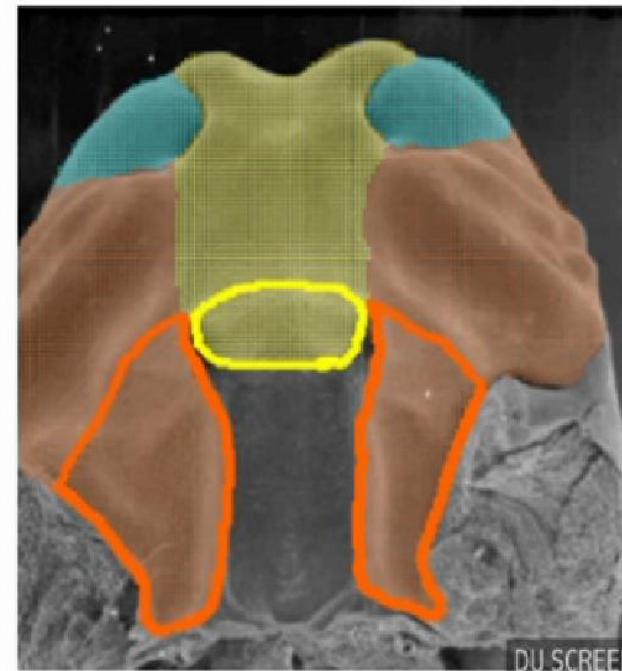
Soft palate



## Intermaxillary Segment



- Medial n.p.
- Lateral n.p.
- Maxillary p
- Primary palate
- Palatin process (shelvs)



# Cleft lip and cleft Palate



Unilateral incomplete



Unilateral complete



Bilateral complete



Incomplete cleft palate



Unilateral complete lip and palate



Bilateral complete lip and palate

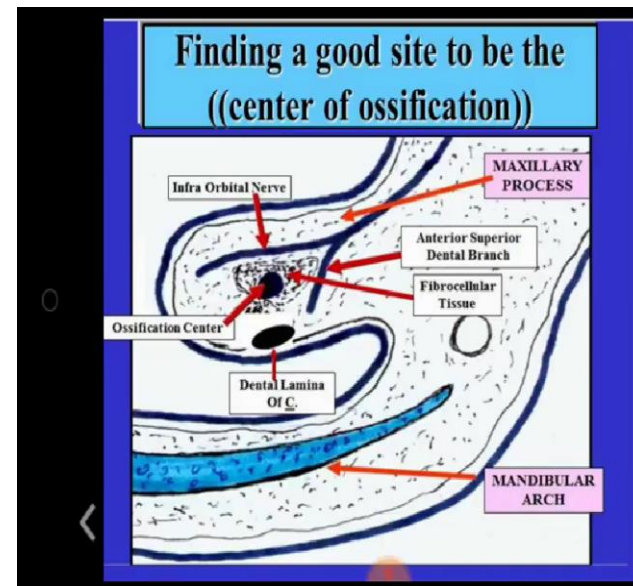
# MAXILLA



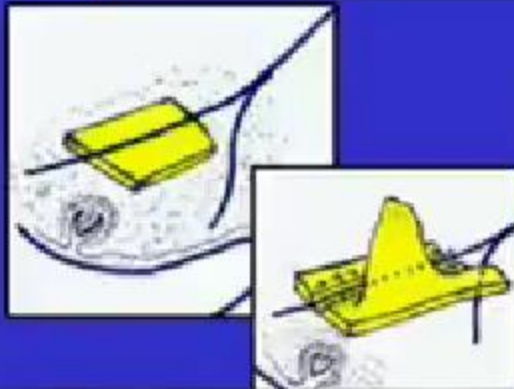


## Nasomaxillary complex

- The maxilla derives from the first pharyngeal arch and ossification of the maxillary complex is intramembranous, beginning in the 6th week i.u.
- The maxilla is the third bone to ossify after the clavicle and the mandible.
- The main ossification centres appear bilaterally above the future deciduous canine close to where the infraorbital nerve gives off the anterior superior alveolar nerve. Ossification proceeds in several directions to produce the various maxillary processes

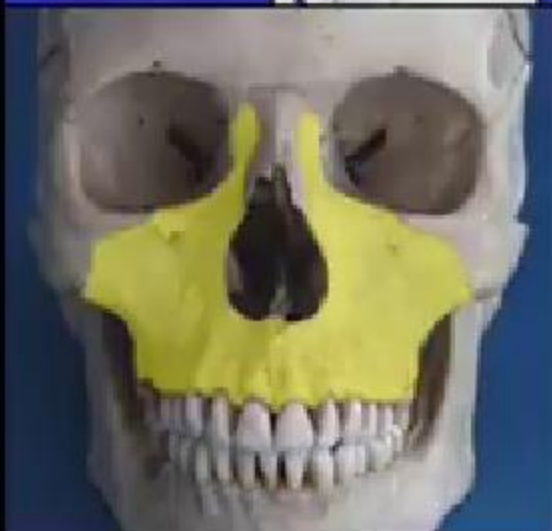


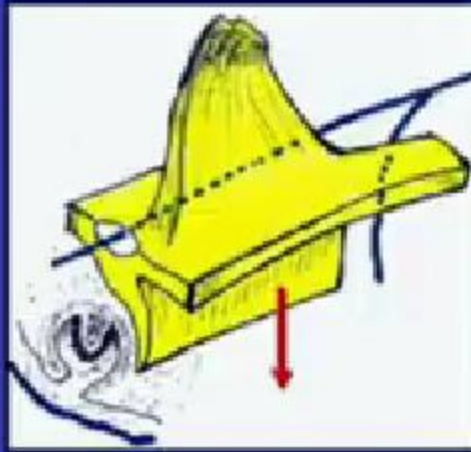
# SPREAD OF OSSIFICATION



At first, ossification occurs below and around the infra orbital nerve, then From the center of ossification, bone formation spreads:

- 1- Backwards below the orbit to form the zygomatic bone,
- 2- Forward towards the incisor region.
- 3- Upwards to form the frontal process.



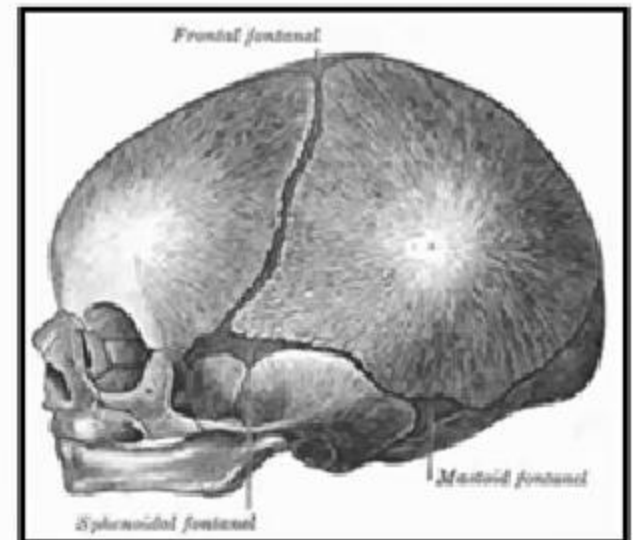
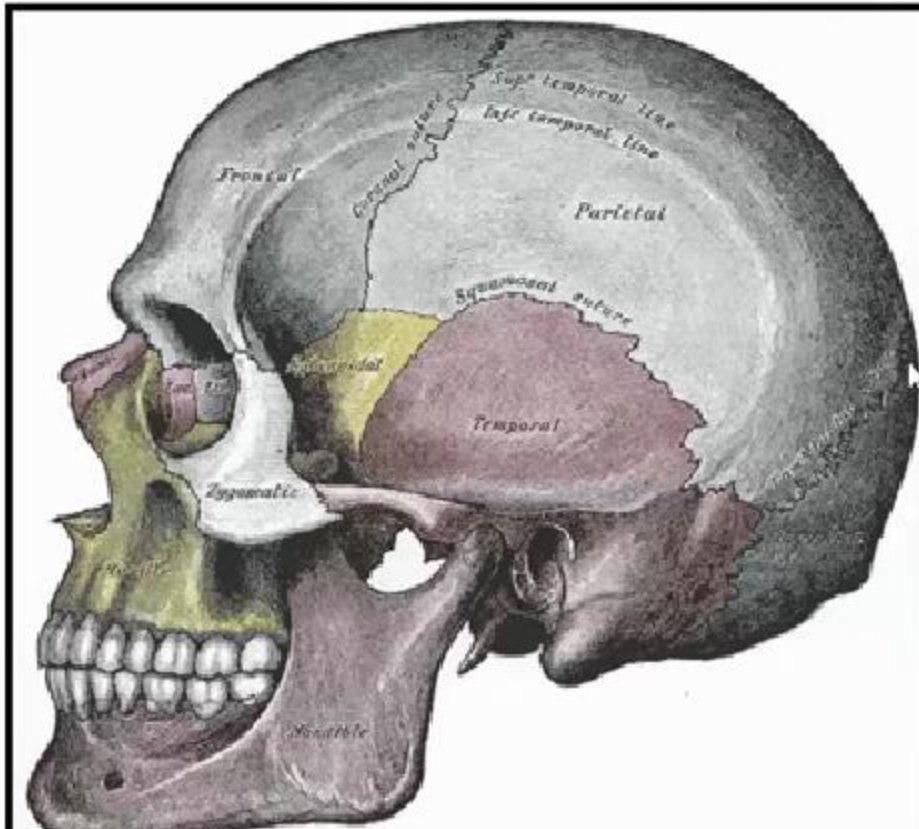


4- Downwards to form the outer alveolar bone ( crypt )



5- Inwards into the palatine process to form the hard palate.

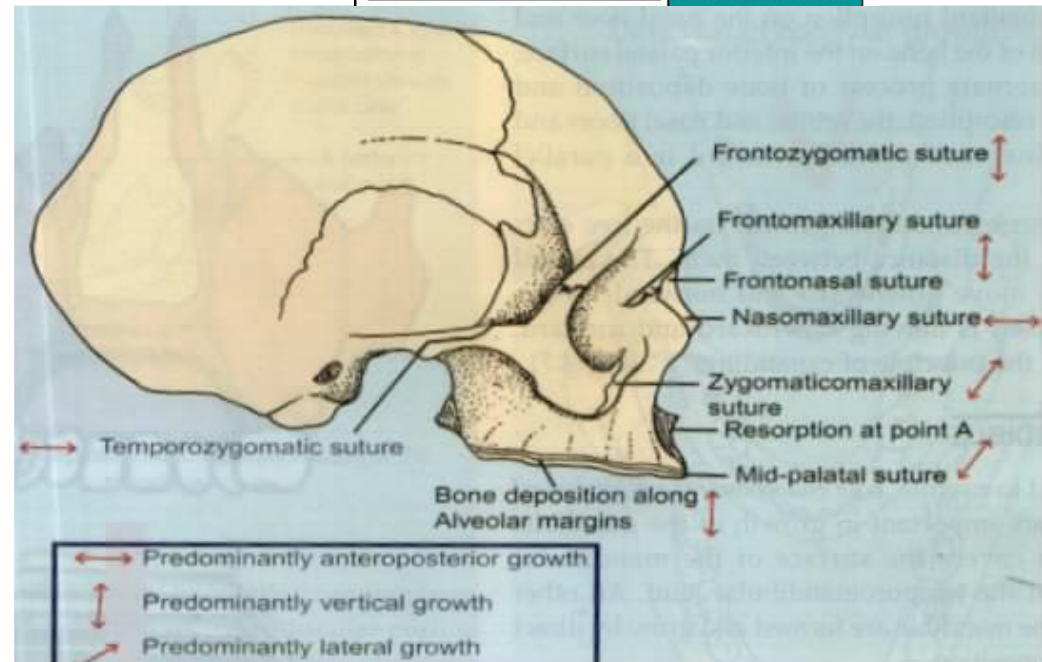
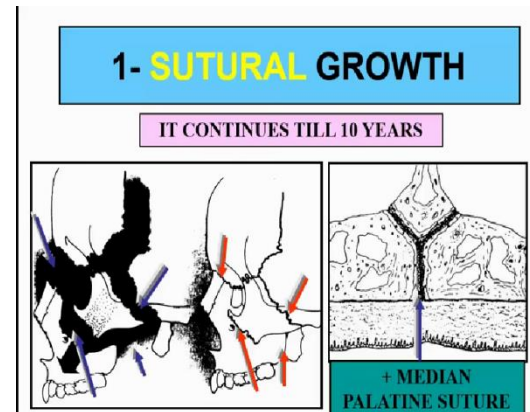
# GROWTH OF THE MAXILLA

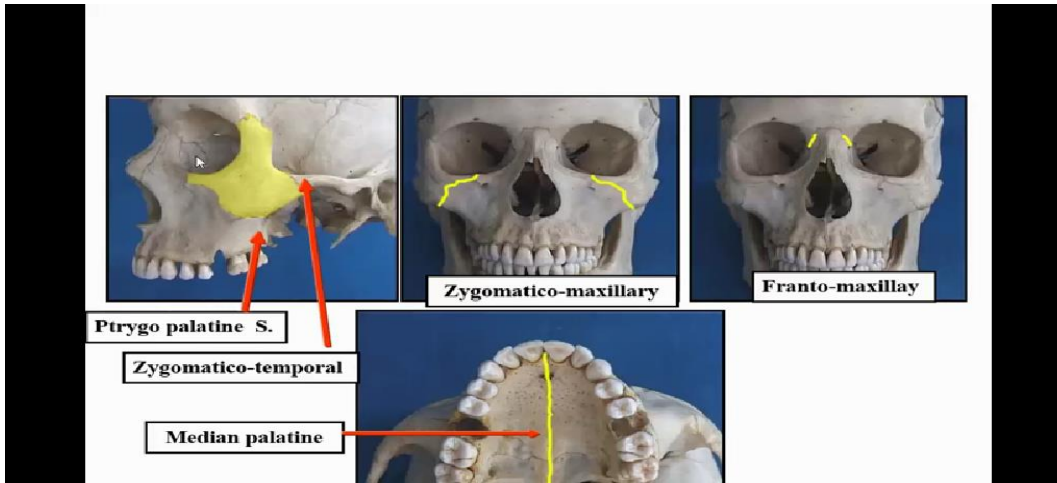


# GROWTH AT SUTURES

Maxilla is attached to the cranium by

- 1- Fronto-nasal suture
- 2- frontomaxillary,
- 3- zygomaticomaxillary
- 4- zygomaticotemporal
- 5- pterygopalatine suture





Sutures are oblique and parallel to each other. This allows the downward and forward repositioning of maxilla as growth occurs at these sutures. As growth of surrounding soft tissue occurs, the maxilla is carried downwards and forward. This leads to opening up of space at the sutural attachments. New bone is formed on either side of the suture. Thus the overall size of the bones on either side increases.

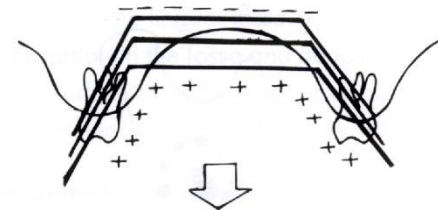
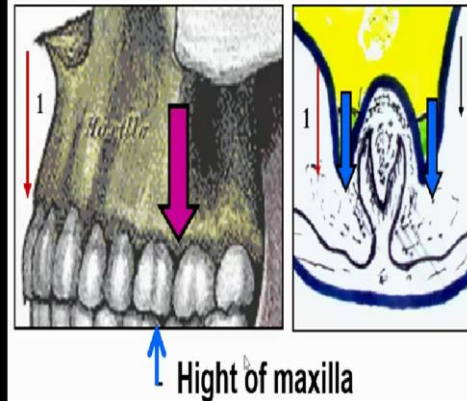
• Downward growth occurs by

1- vertical development of the alveolar process and eruption of the teeth.

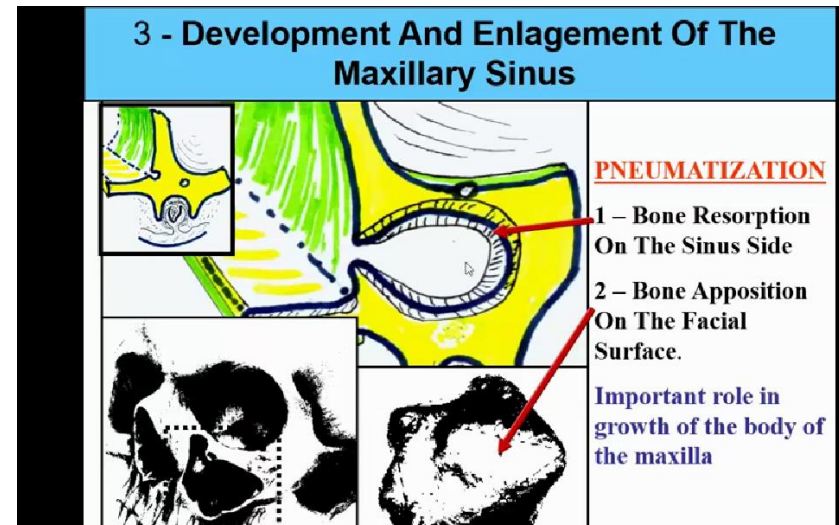
2- also by inferior drift of the hard palate, i.e. the palate remodels downwards by deposition of bone on its inferior surface (the palatal vault) and resorption on its superior surface (the floor of the nose and maxillary sinuses).

3- These changes are also associated with some downward displacement of the bones as they enlarge.

## 2 - Development And Growth Of The Alveolar Process



- Lateral growth in the mid-face occurs by displacement of the two halves of the maxilla, with deposition of bone at the midline suture.
- Internal remodelling leads to enlargement of the air sinuses and nasal cavity as the bones of the mid-face increase in size.





# AGE CHANGES IN MAXILLA

## AT BIRTH:

- The transverse and anteroposterior diameters are more than the vertical diameter.
- Frontal process is well marked
- Body consists of a little more than the alveolar process
- The tooth sockets reaching to the floor of orbit
- Maxillary sinus is a mere furrow on the lateral wall of the nose.



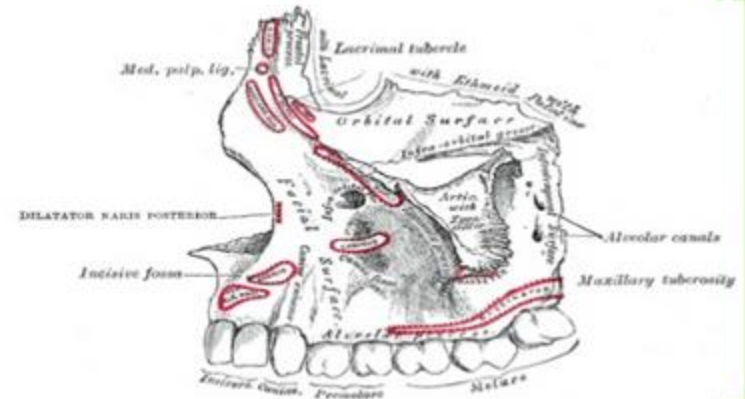
Inferior surface of maxilla at birth



Anterior surface of maxilla at birth

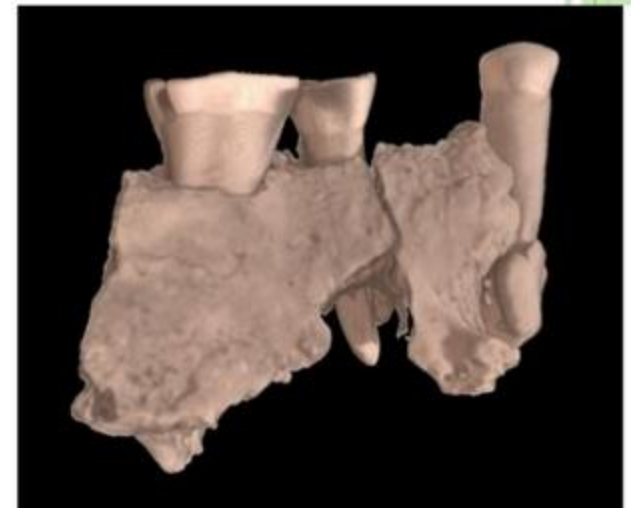
## IN ADULT:

- Vertical diameter is greatest due to the development of the alveolar process and increase in the size of the sinus.



## IN THE OLD:

- The bone reverts to infantile condition.
- Its height is a result of absorption of the alveolar process.



- Maxillary growth slows to adult levels on average at about 15 years in girls and rather later, at about 17 years, in boys.

