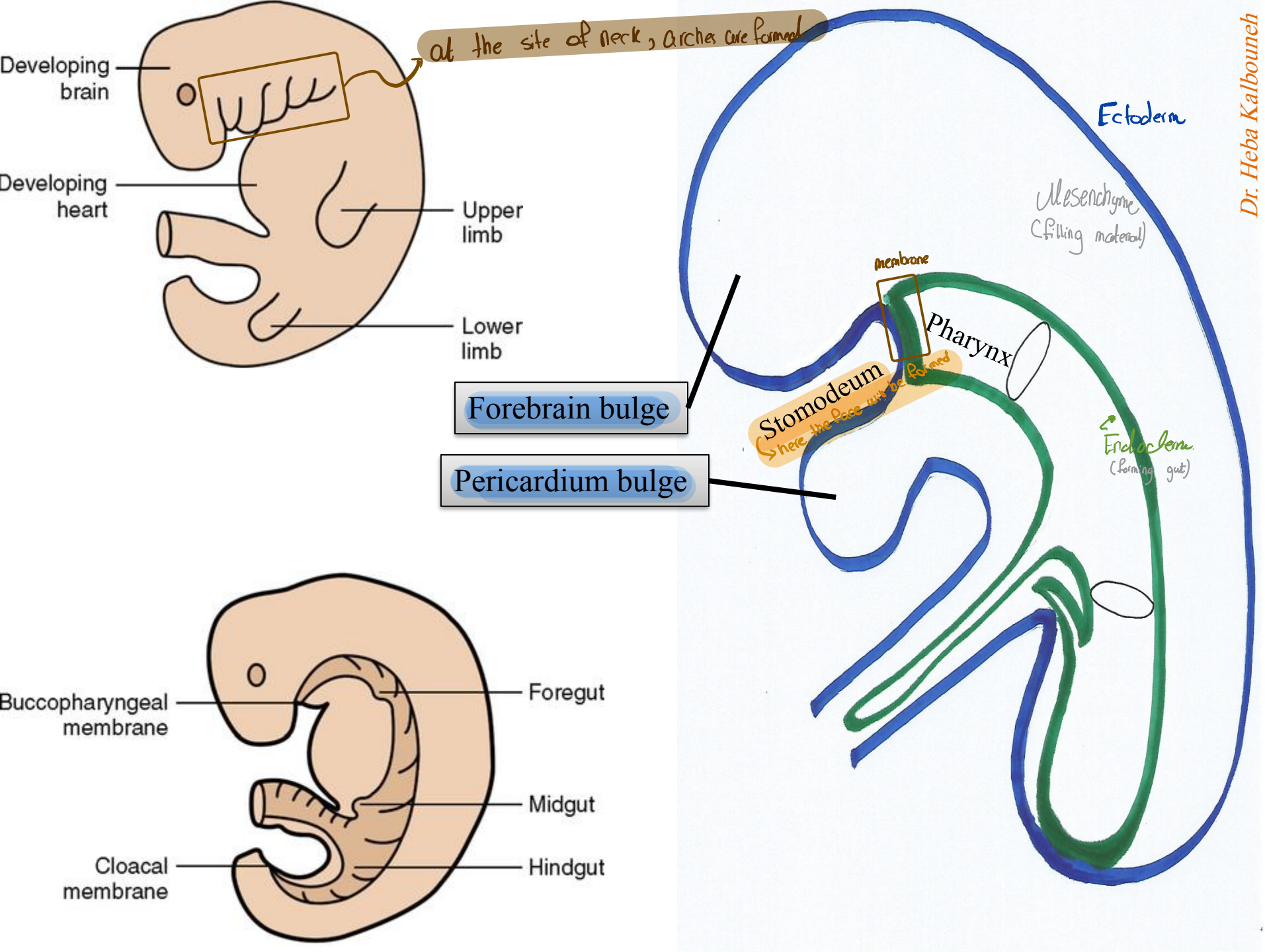
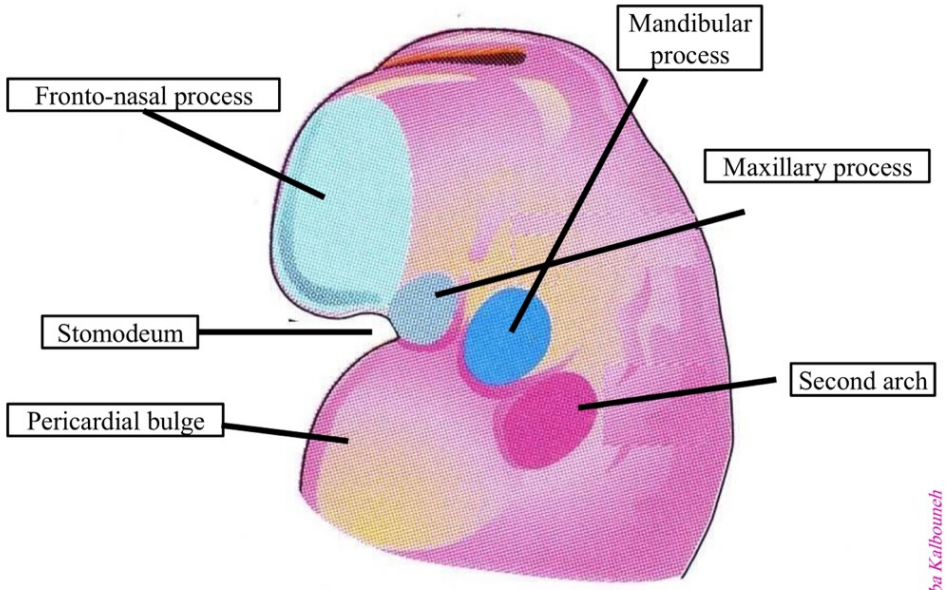
Development of Face and Palate

كان النبي عليه افضل الصلاة والسلام يقول
اللهم أنت أحقُ من ذُكر،وأحقُّ من عُبد واكرم من ابتُغي وأرأف من مَلَك،واجودُ من سُئل واوسع من اعطى، انت الملك لا شريك لك
والفرد لا نِدَّ لك، كل شيء هالك إلا وجهك،كل شيء هالك إلا وجهك، لن تُطاع إلا بإذنك ولن تُعصى إلا بعلمك، اقرب شهيدٍ وأدنى حفيظ ، اقرب شهيد وأدنى حفيظ، القلوب لك مَفضية والسرُ عندك علانية، الحلال ما احللت والحرام ما حرمت ، والدين ما شرعت والأمر ما قضيت والخلق خلقك والعبد عبدك وأنت الله الرؤوف الرحيم
اسألك بكل حق هو لك وبحق السائلين عليك أن تقبلني في هذه الغداه وأن تجيرني من النار بقدرتك.
اللهُمَّ اجعَل ما يُلاقيه أهل غزّة في سبيلك، وعوّضهم بصبرهِم جنّةَ الفردوس، وأقرّ عُيونهم بالفرج، اللهُمَّ أطفئ نارَ الحرب بعِزِّ المُسلِمين..
اللهُمَّ إنَّهم لا يُعجزونَك، وأنتَ المَلك القويّ المتكبّر، اللهُمَّ أرِنا فيهم آية، اللهُمَّ إنّا نلوذُ بك، ونعتصِمُ بك، ونتوكّل عليك، وليس لنا غيرك، ولا يُعيننا على عدوّنا سِواك
لا إله إلّا أنت سبحانك ، ولا حولَ لنا ولا قوّة إلّا بك

Dr. Heba Kalbouneh
Professor of Anatomy and Histology

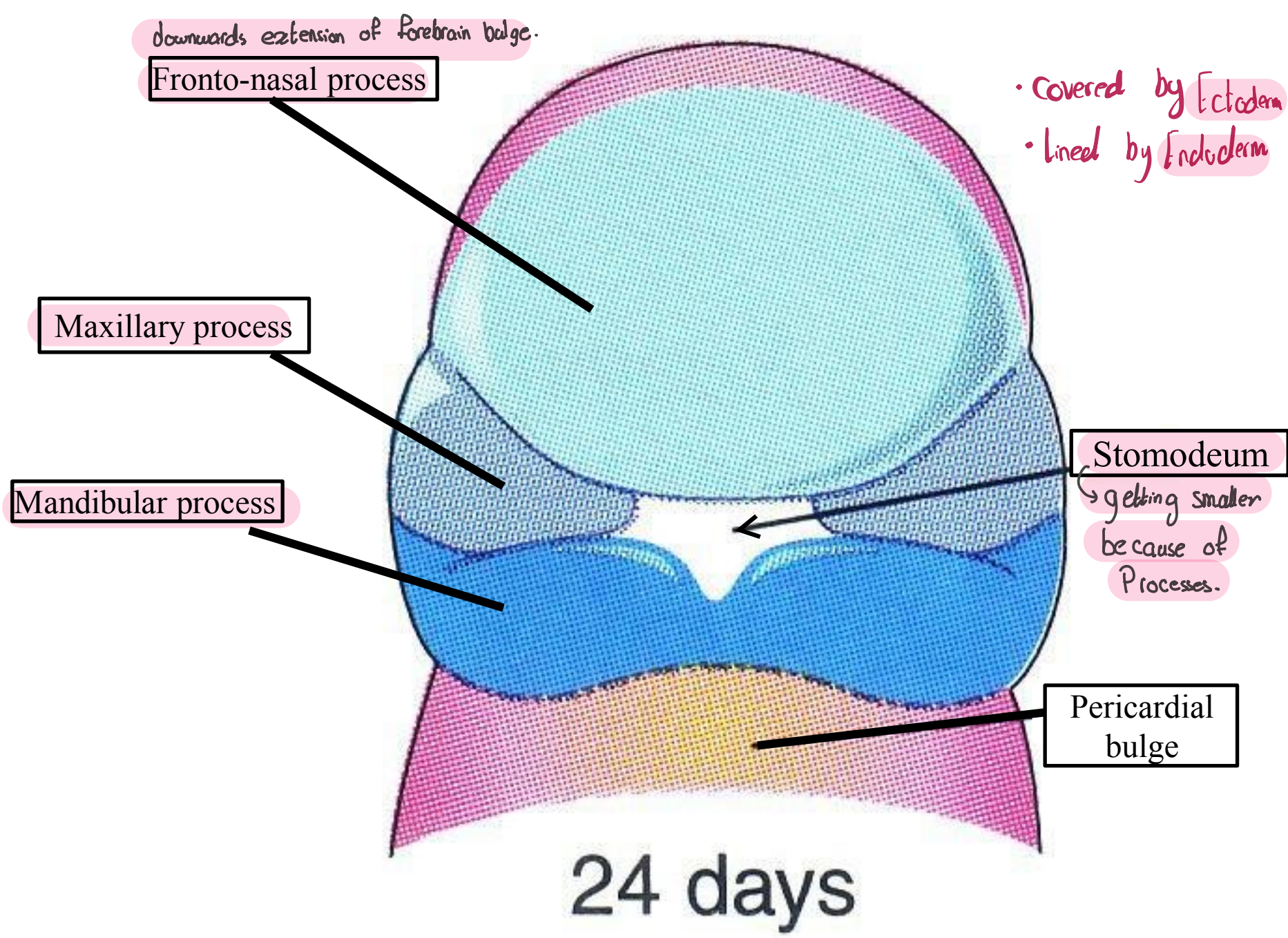




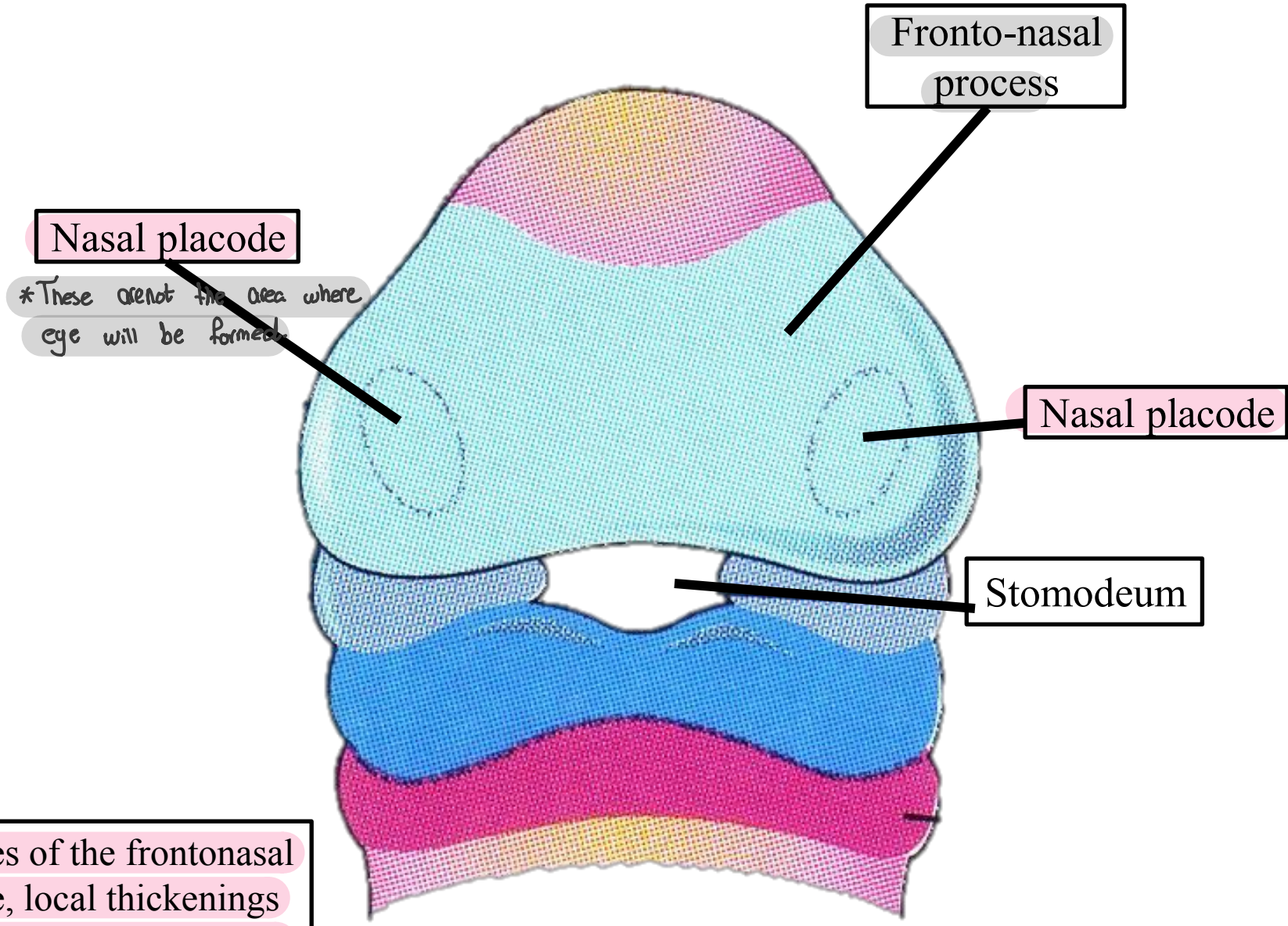
The formation of the face in the stomodeum (the precursor to the oral cavity) occurs through the growth and fusion of several processes derived from the first pharyngeal arch and the forebrain.

The stomodeum area is initially open, but it will be closed by the two processes of the first pharyngeal arch. These processes, known as the maxillary and mandibular processes, grow forward and toward each other to close the stomodeum from the sides of the face.
At the same time, the forebrain bulges extends downward, forming the frontonasal process. This process contributes to the formation of the nose and the upper part of the face.
Thus, the face is formed by a total of five processes:

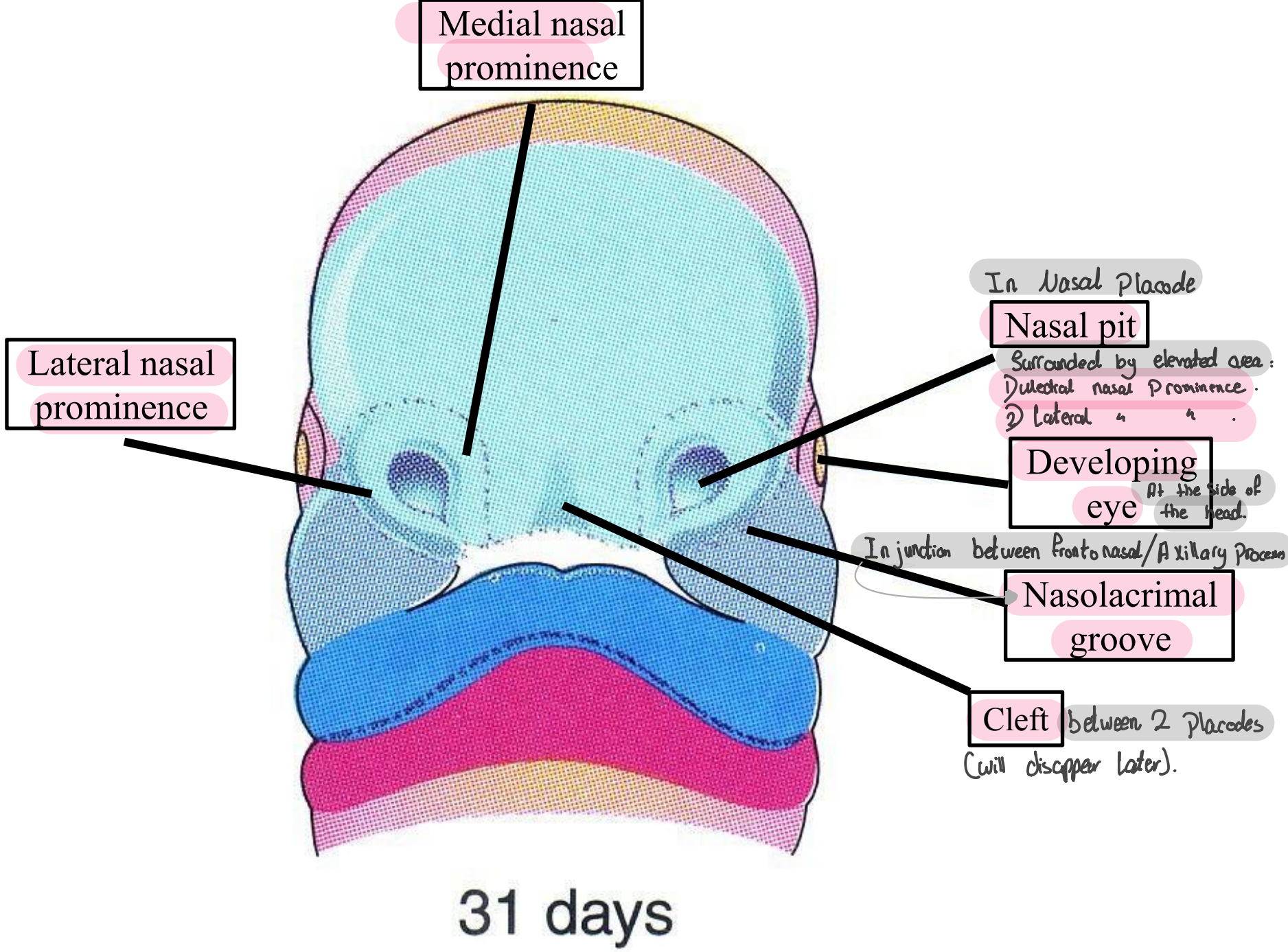
Two maxillary processes (from the first pharyngeal arch)
Two mandibular processes (from the first pharyngeal arch)
One frontonasal process (from the forebrain)

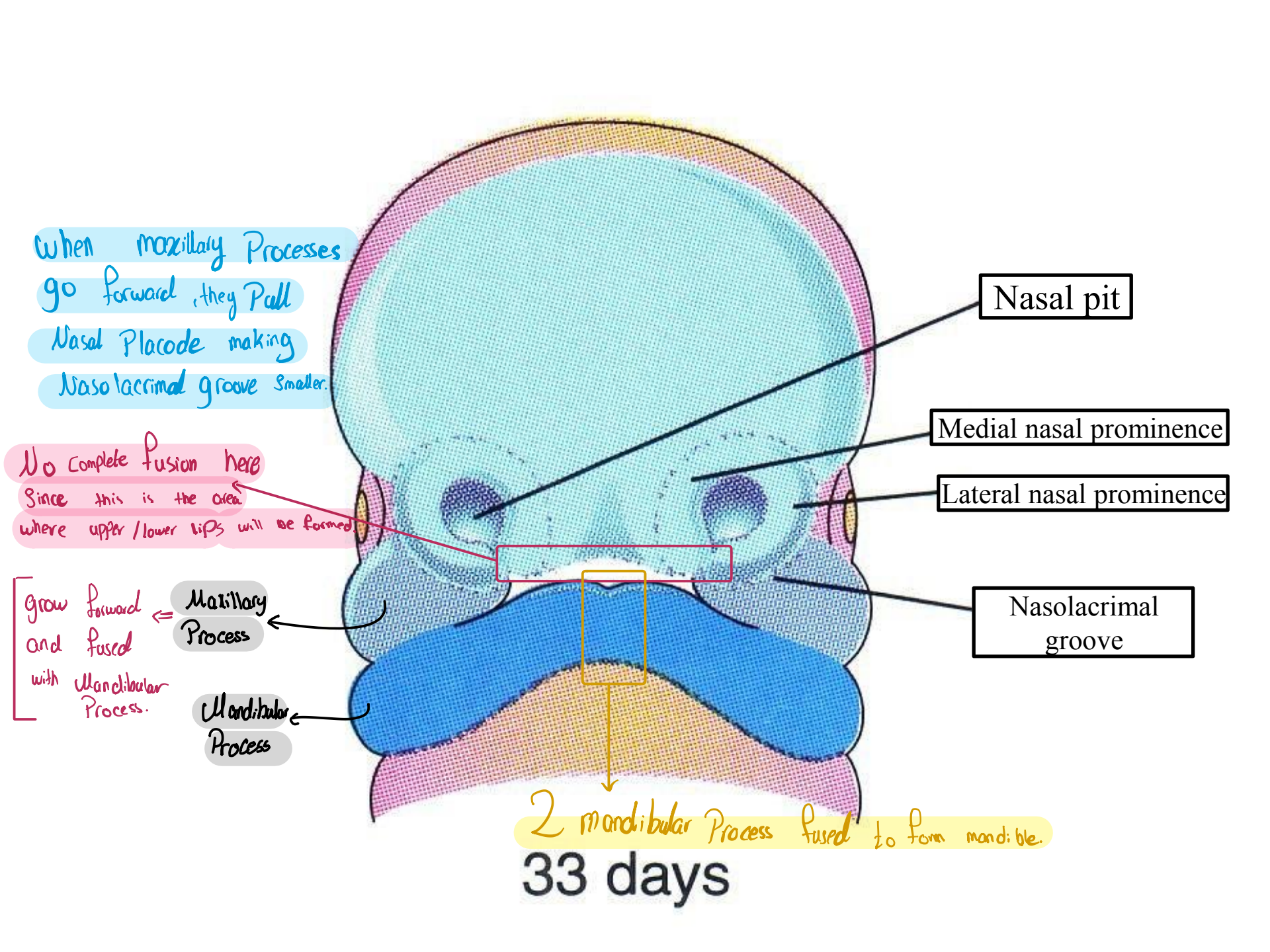


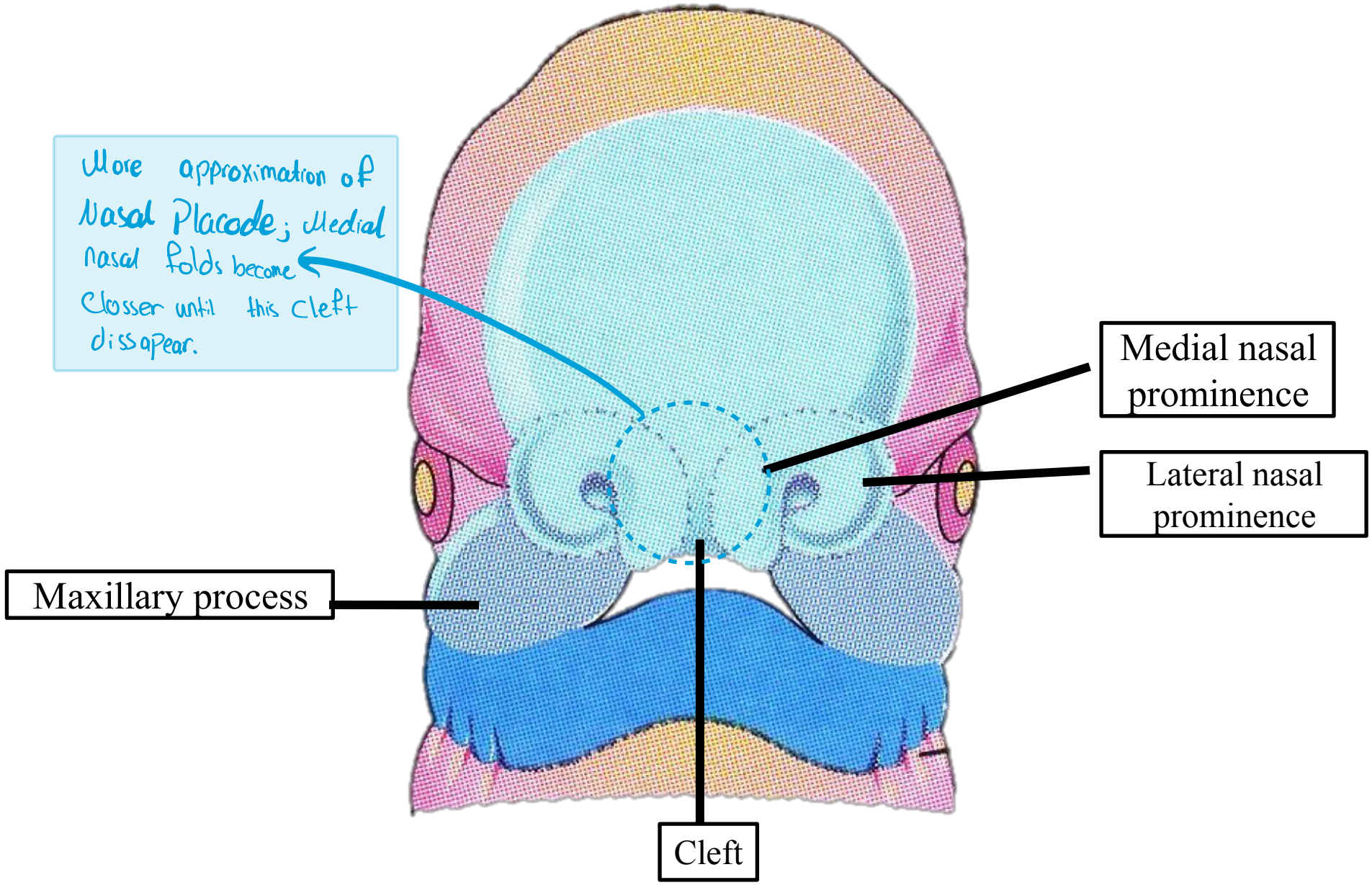
- Covered by Ectoderm
- Lined by Endoderm

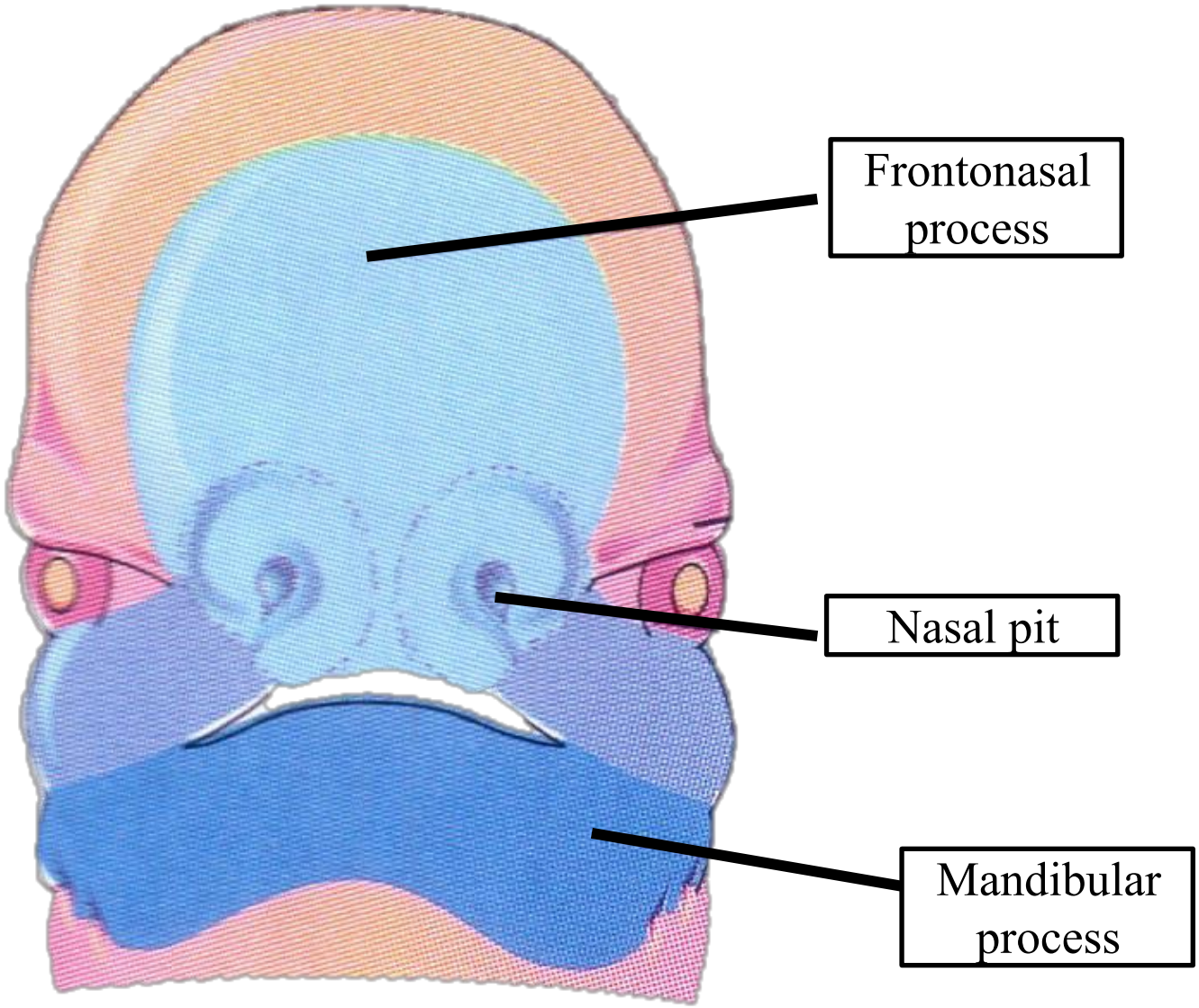


On both sides of the frontonasal prominence, local thickenings of the surface ectoderm will be formed, the **nasal placodes**


Medial nasal prominence
Lateral nasal prominence
In Nasal Placode
Nasal pit
Surrounded by elevated area:
1) Medial nasal Prominence.
2) Lateral " "
Developing eye
At the side of the head.
In junction between Fronto nasal/Axillary Process
Nasolacrimal groove
Cleft
between 2 Placodes
(will disappear later).
31 days


When maxillary Processes go forward, they Pull Nasal Placode making Nasolacrimal groove smaller.
No complete fusion here
Since this is the area where upper / lower lips will be formed.
grow forward and fused with Mandibular Process.
Maxillary Process
Mandibular Process
Nasal pit
Medial nasal prominence
Lateral nasal prominence
Nasolacrimal groove
2 mandibular Process fused to form mandible.
33 days


More approximation of Nasal Placode; Medial nasal folds become closer until this cleft dissapear.
Medial nasal prominence
Lateral nasal prominence
Maxillary process
Cleft

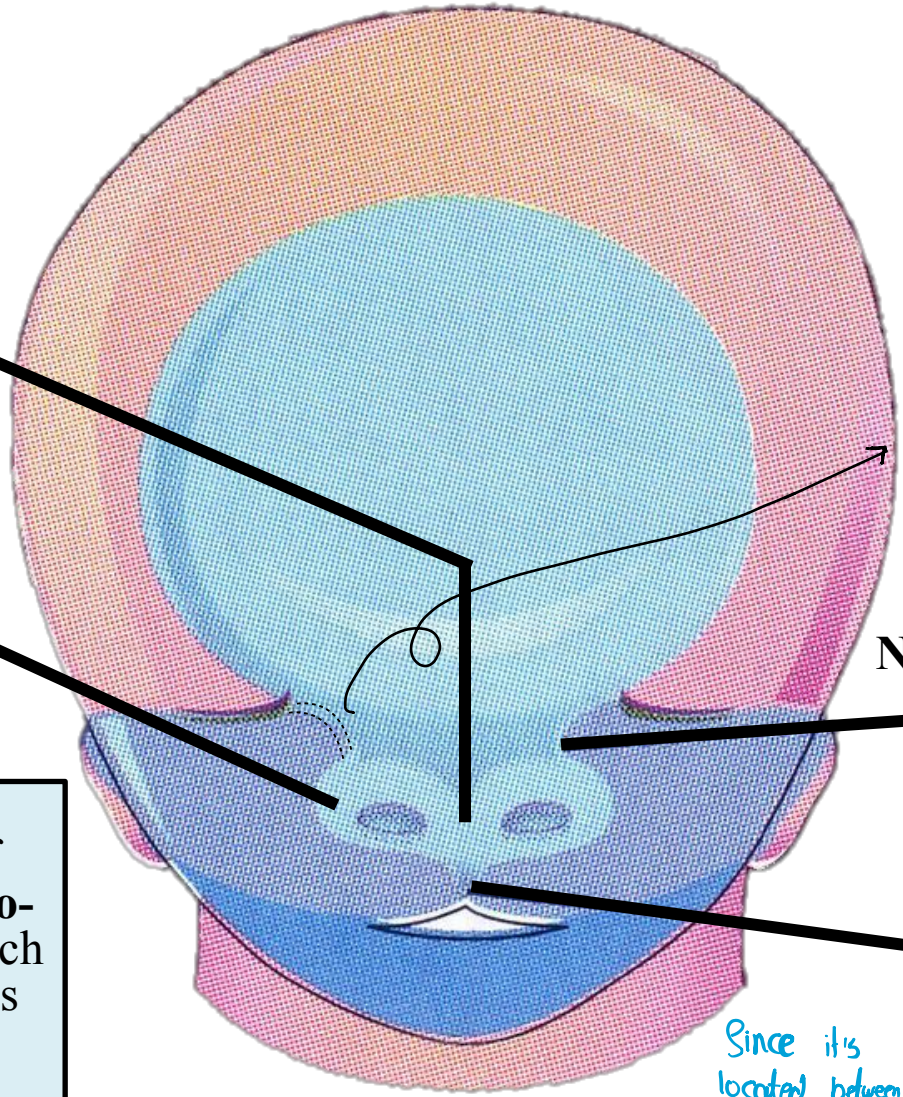

Frontonasal process
Nasal pit
Mandibular process

Medial nasal prominences fuse and form the middle part of the nose

- No Cleft.

Lateral nasal prominence forms the ala of the nose

The maxillary process is separated from the side of fronto-nasal process by **naso-lacrimal groove**, inside which a cord of ectodermal cells is formed then becomes canalized to form naso-lacrimal duct. Its upper end forms lacrimal sac.

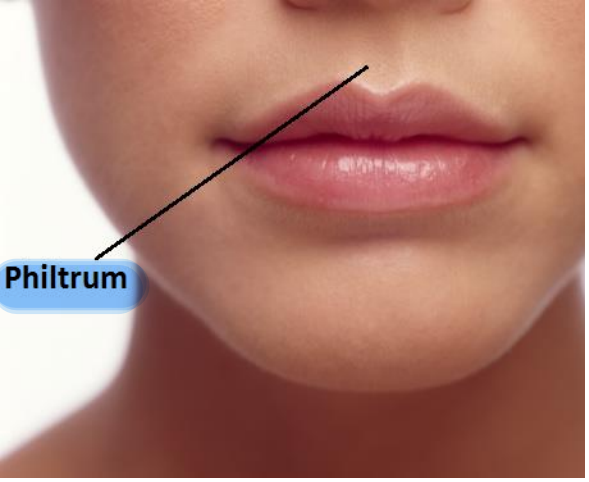


At naso-lacrimal groove ectodermal cells will form a cord (forming naso-lacrimal duct) widenes to form lacrimal sac

Naso-lacrimal groove

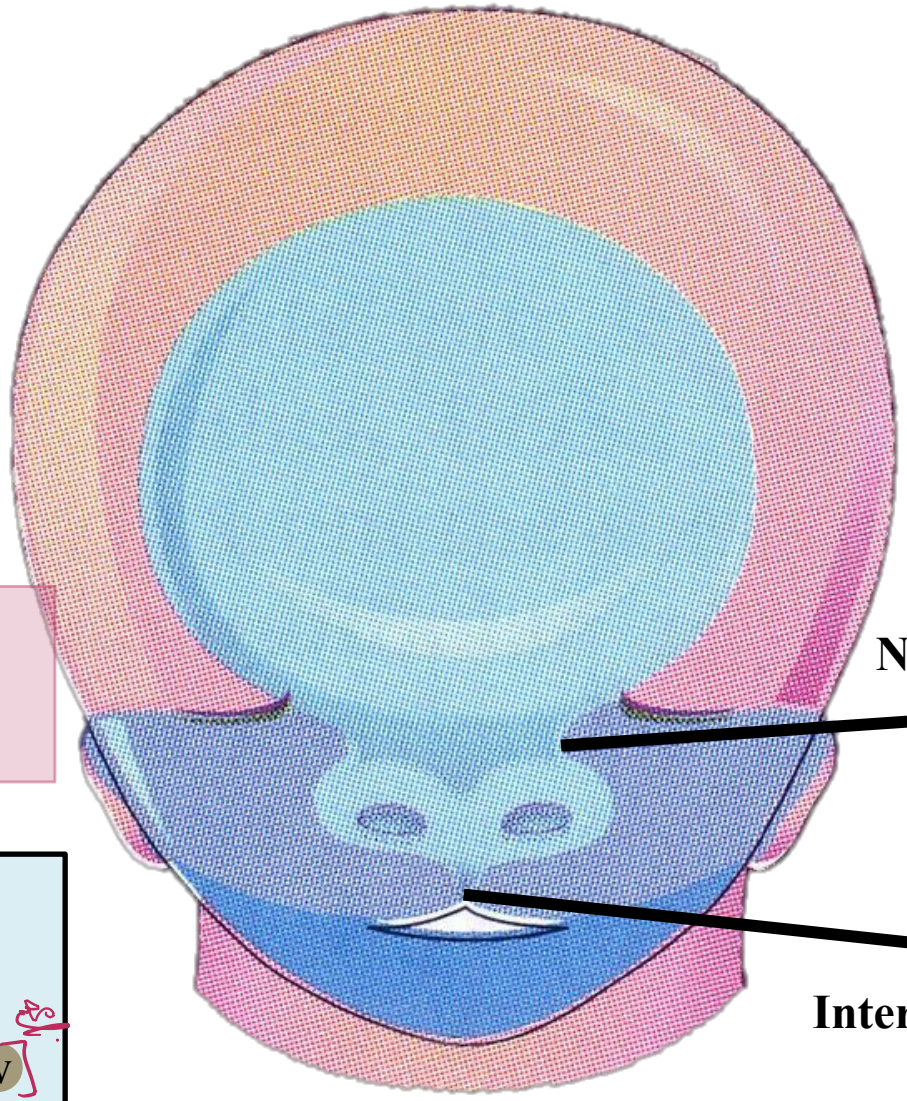
The two medial nasal folds fuse to form the **Intermaxillary segment**

Since it's located between 2 maxillary processes Prevent fusion of them in this area.



Macrostomia is a condition where the mouth is abnormally large.
Microstomia refers to an abnormally small mouth opening

Intermaxillary segment: from fused medial nasal prominences. It forms philtrum, part of upper jaw that carries upper 4 incisors and primary palate

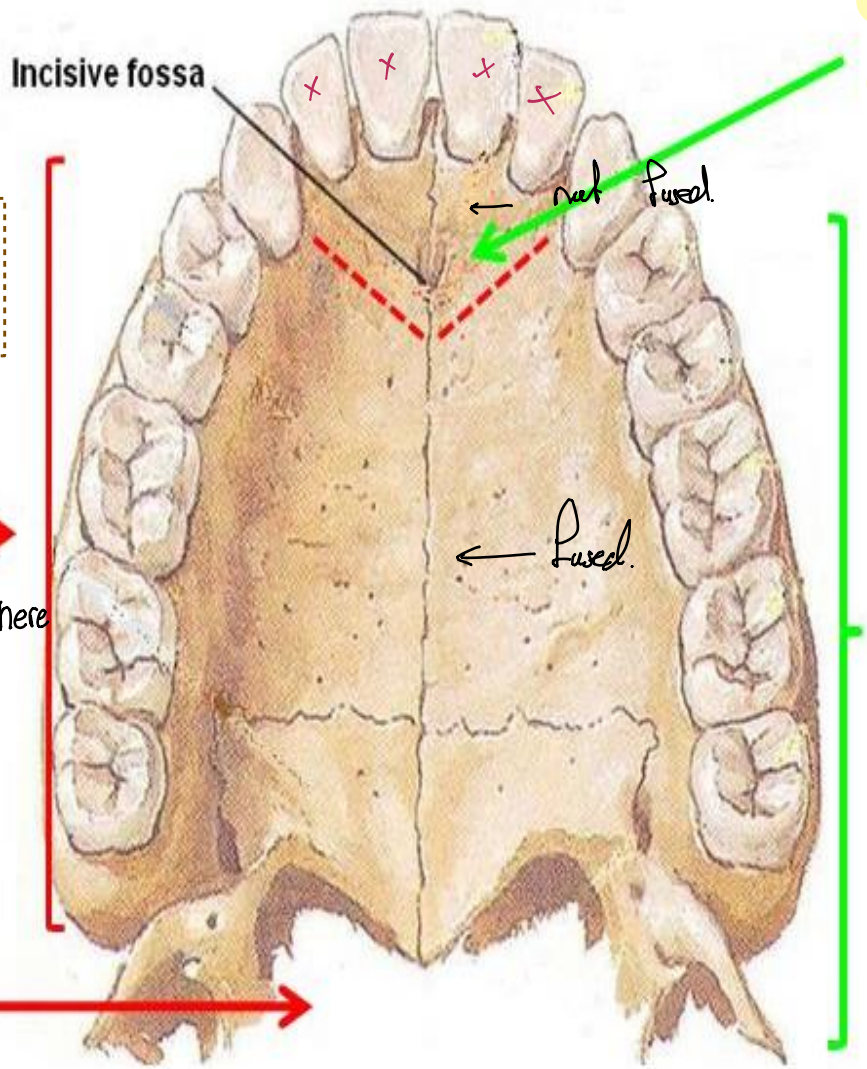


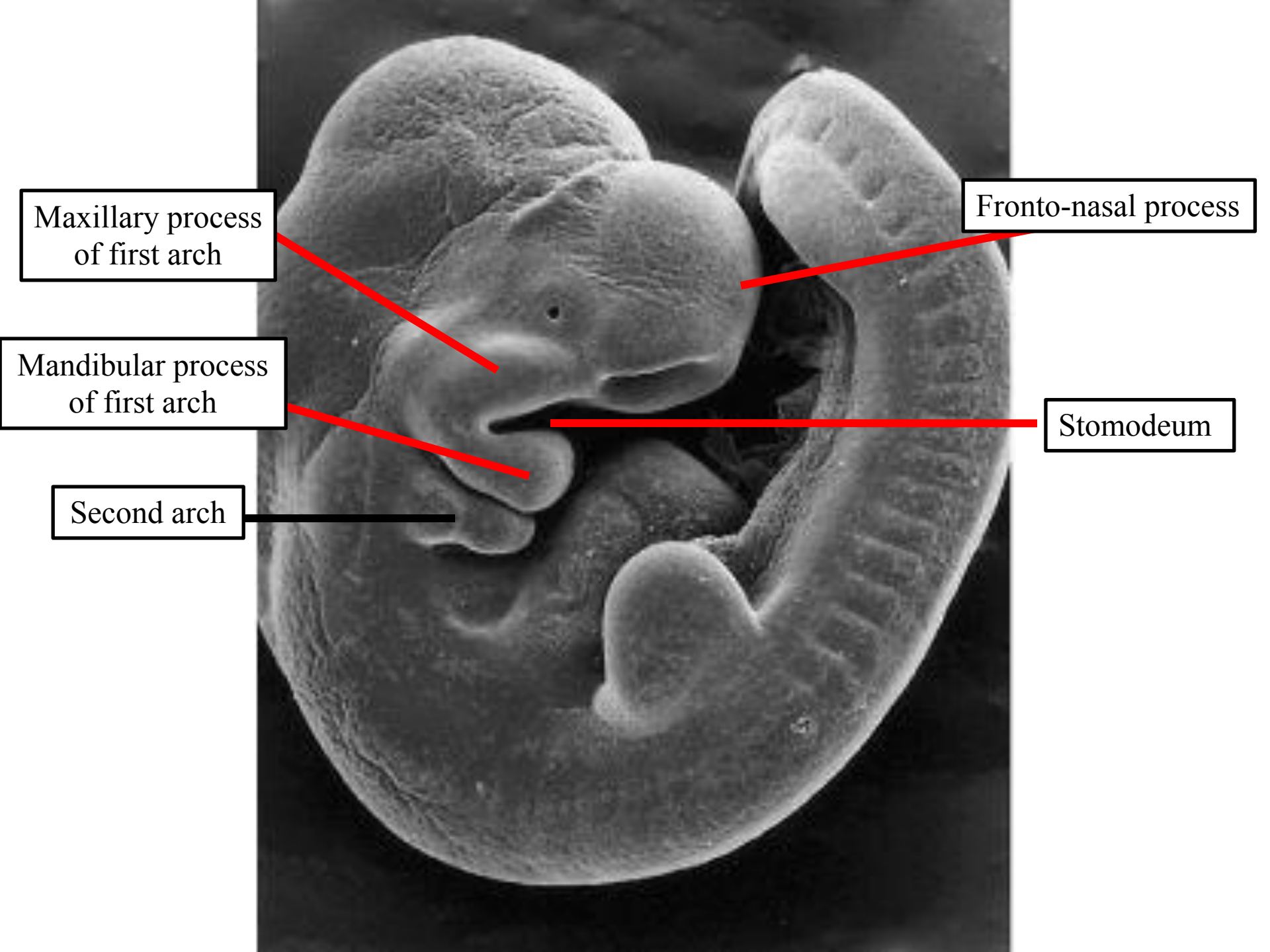
Intermaxillary segment: Primary palate

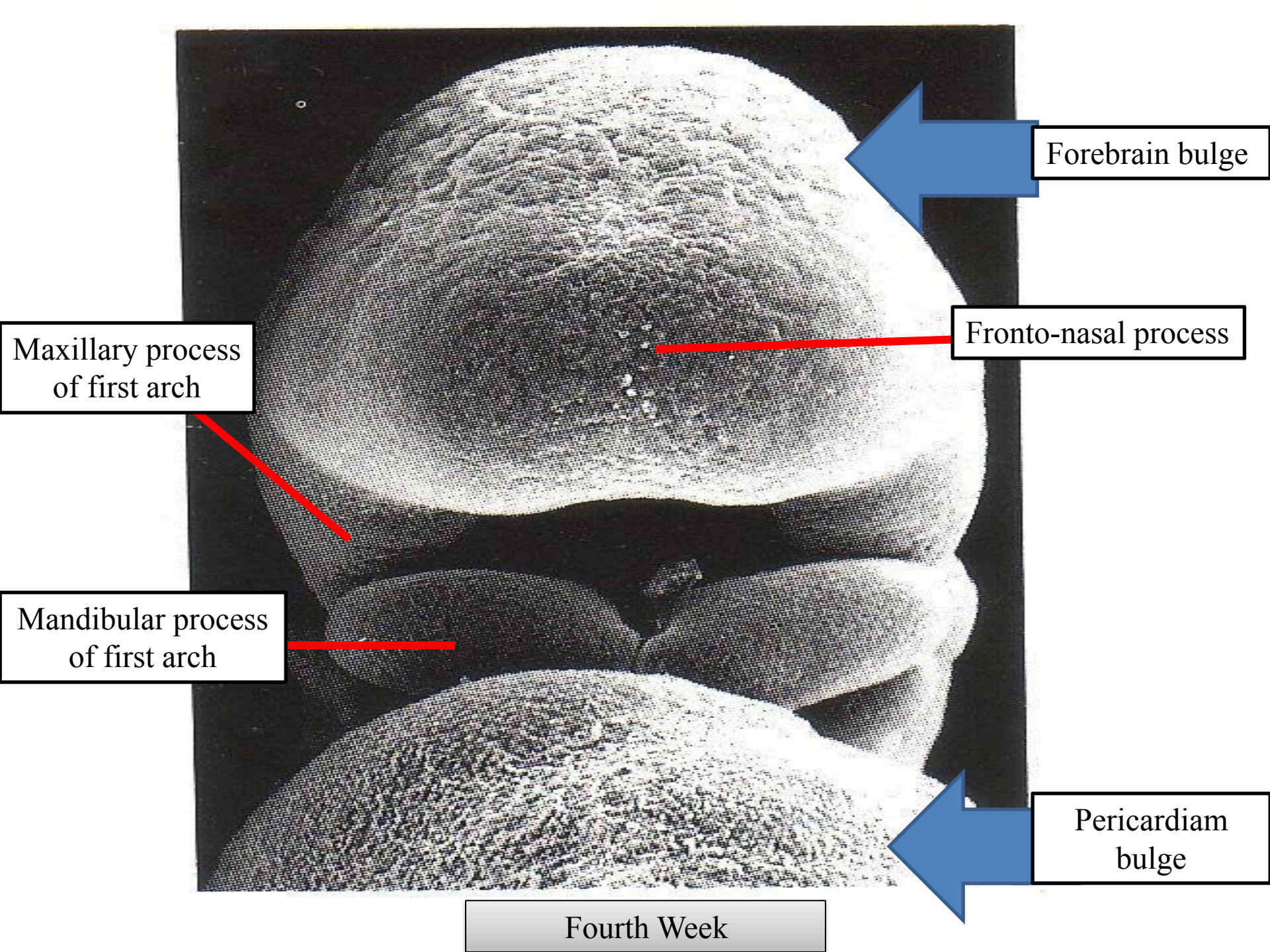
Palatine shelves of the maxillary processes: Secondary palate

Note
secondary palate refers to palatine processes of maxilla, horizontal processes of palatine bone and soft palate

The maxillary processes send out horizontal extensions called palatal shelves, which form the secondary (palatine) palate.



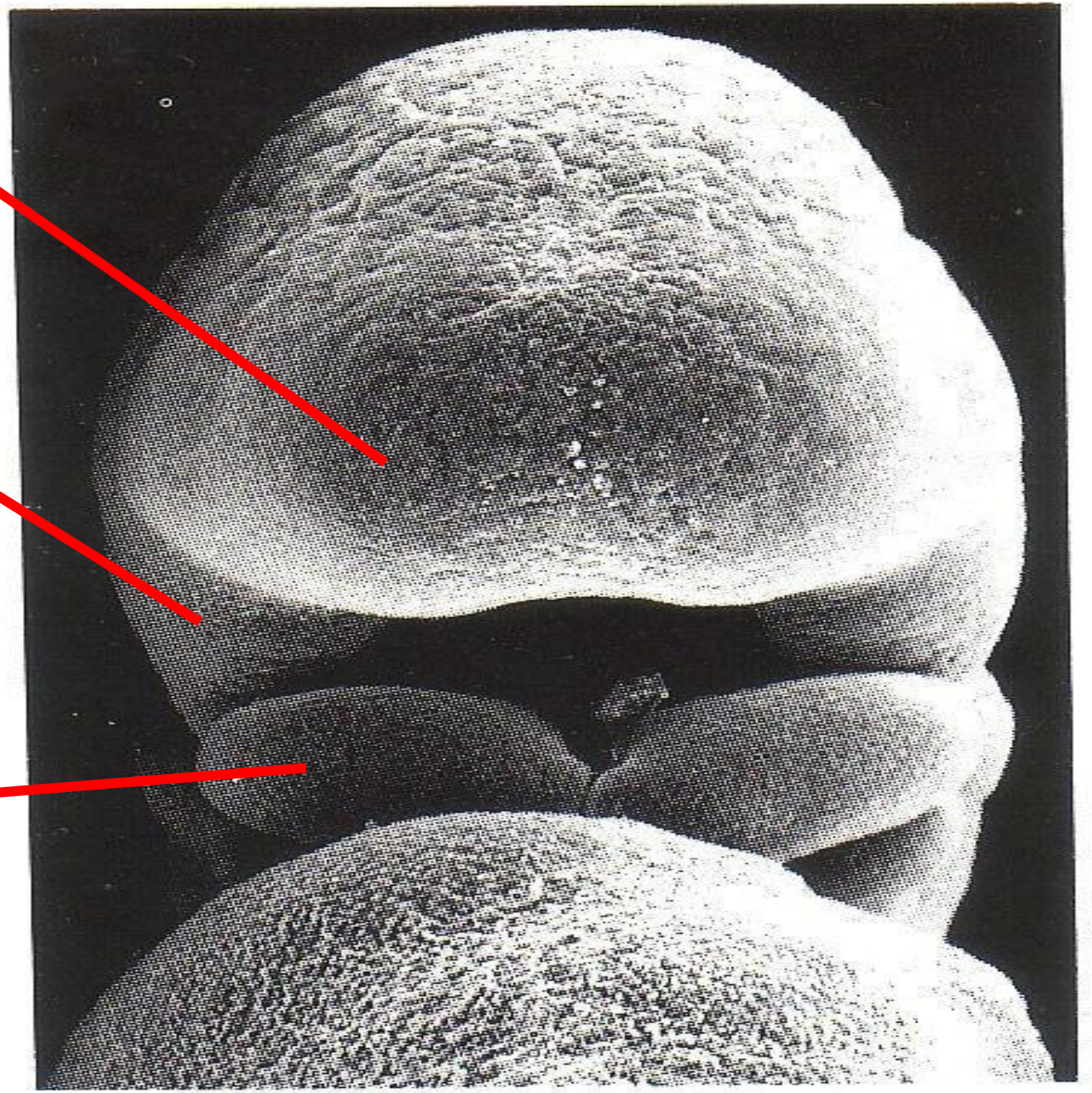

Maxillary process of first arch
Fronto-nasal process
Mandibular process of first arch
Stomodeum
Second arch


Forebrain bulge
Fronto-nasal process
Maxillary process of first arch
Mandibular process of first arch
Pericardiam bulge
Fourth Week

The **frontonasal process** grows downward toward the stomodeum

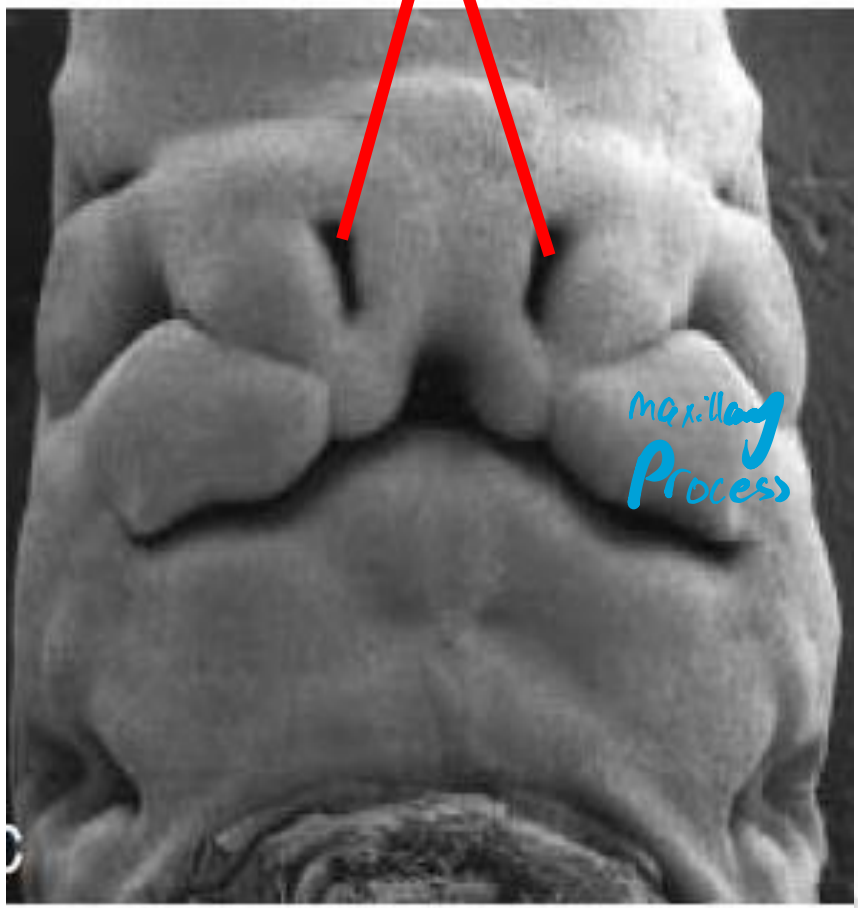
The **maxillary process** grows medially

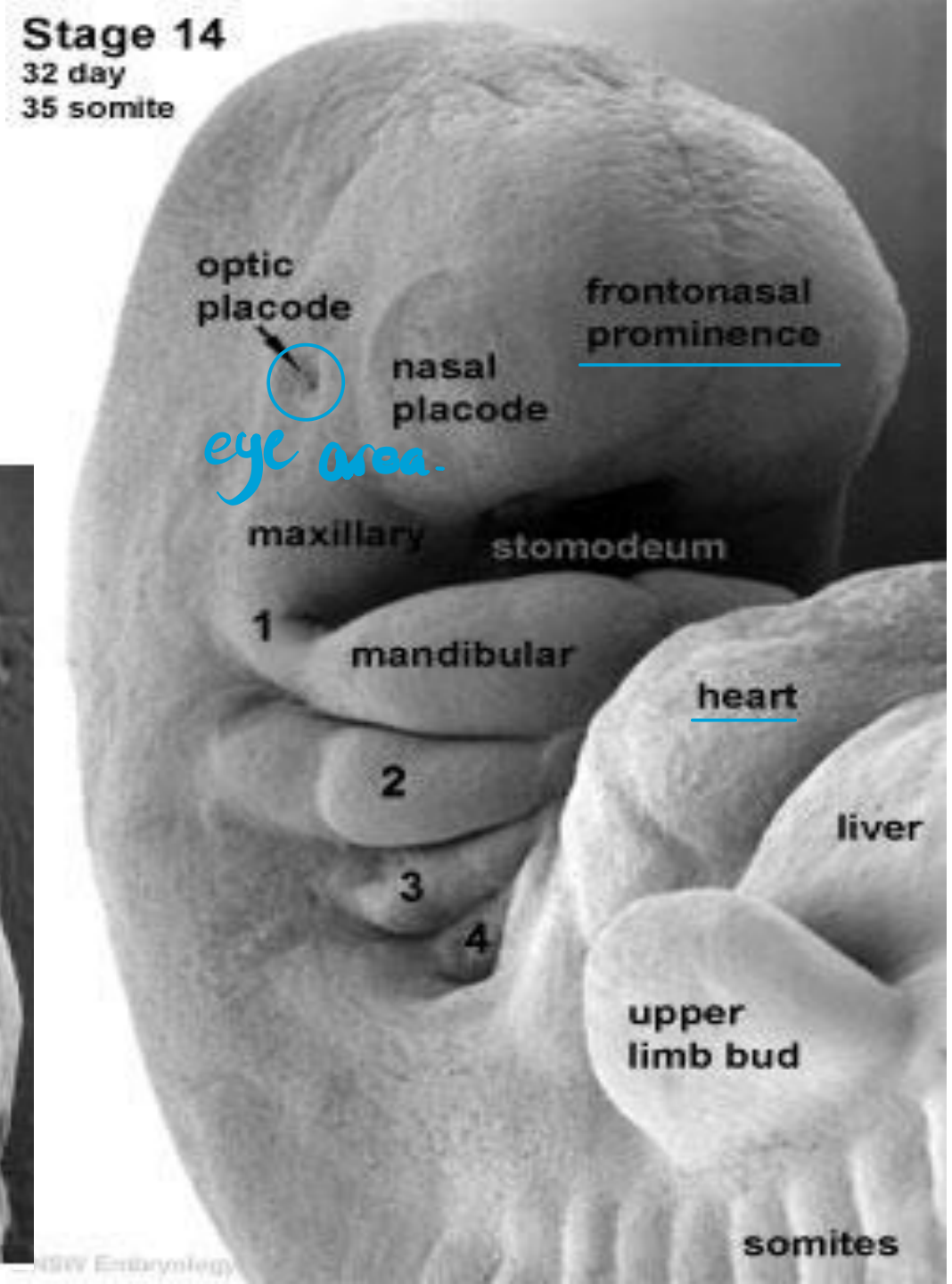
The **mandibular processes** approach one another in the midline below the stomodeum and fuse to form the lower jaw and lower lip

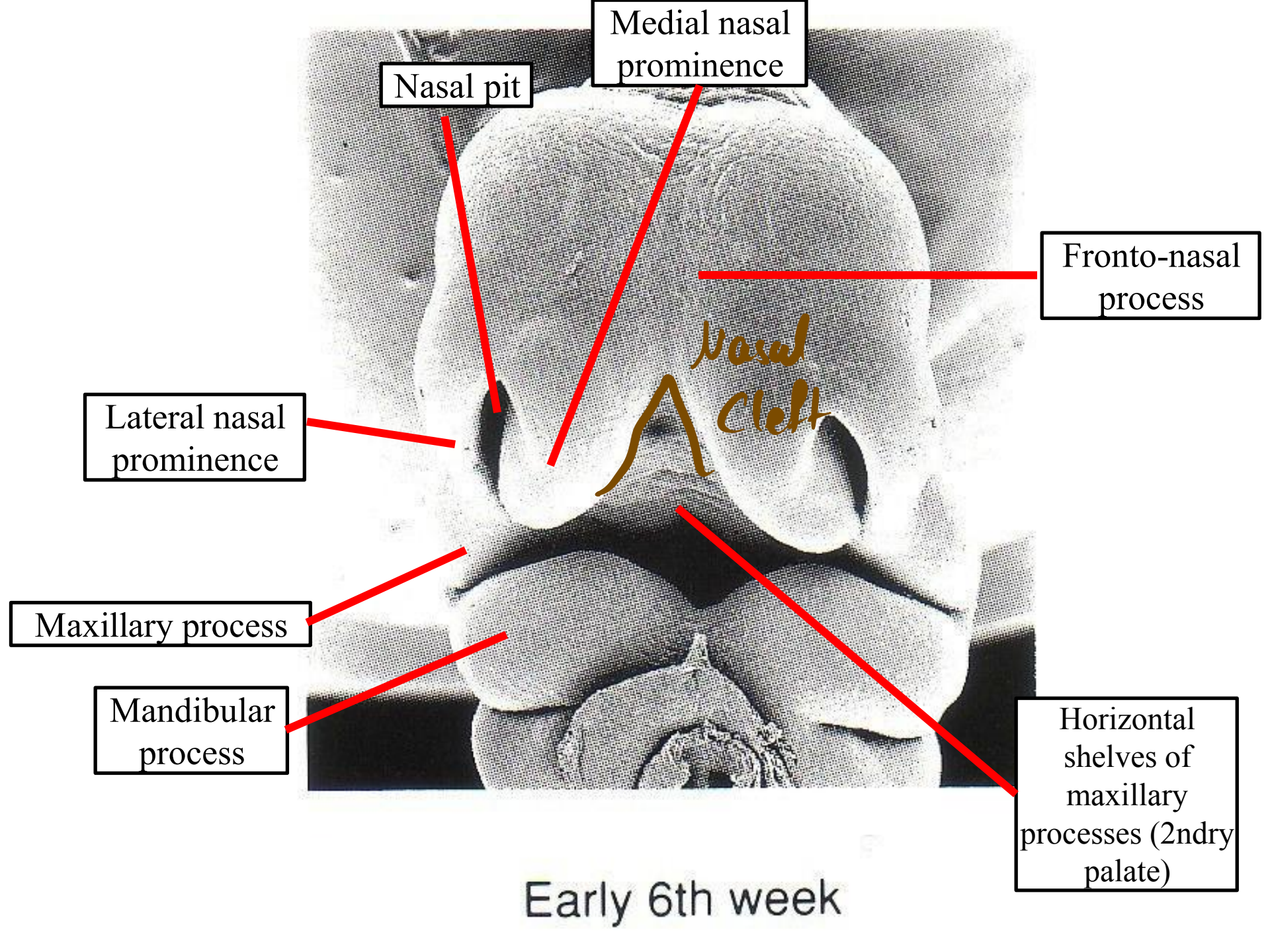


Fourth Week

NASAL PITS


maxillary
Process


Stage 14
32 day
35 somite
optic placode
nasal placode
frontonasal prominence
eye area
maxillary
stomodeum
1
mandibular
heart
2
liver
3
4
upper limb bud
somites


Medial nasal prominence
Nasal pit
Fronto-nasal process
Nasal Cleft
Lateral nasal prominence
Maxillary process
Mandibular process
Horizontal shelves of maxillary processes (2ndry palate)
Early 6th week

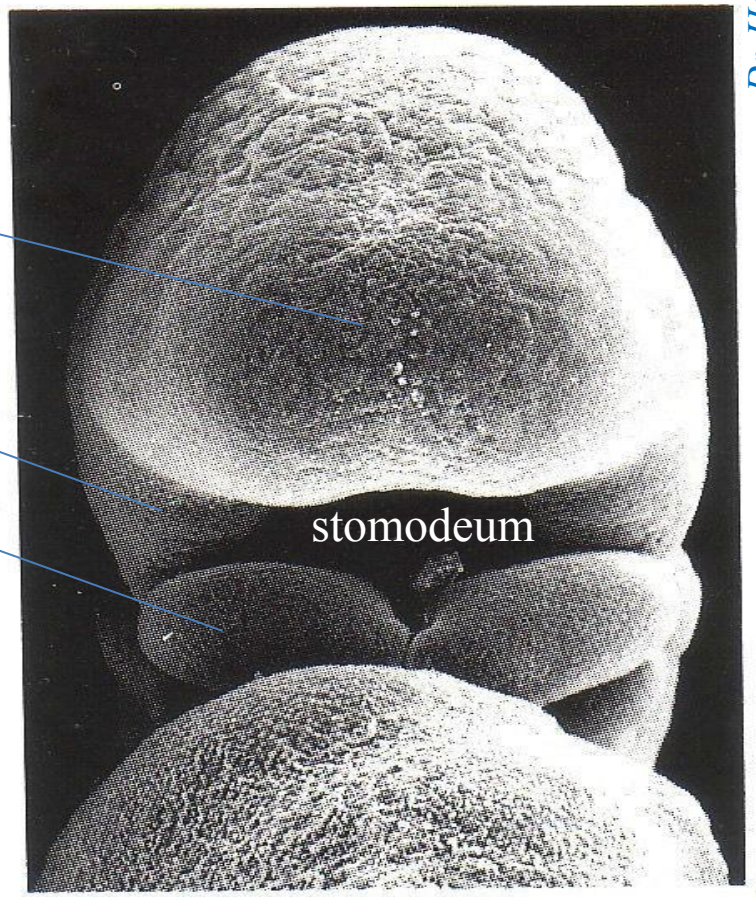
Development of face

Face is developed from 5 processes (prominences):

One fronto-nasal process

2 maxillary processes

2 mandibular processes



- ✓ **Maxillary process** is a forward growth of **dorsal end of 1st pharyngeal arch.**
- ✓ **Mandibular process** is a forward growth of **ventral end of 1st pharyngeal arch.**

These processes surround stomodeum (primitive nasal and oral cavities). Bucco-pharyngeal membrane will rupture to allow continuity between oro-nasal and pharyngeal cavities.

Fronto-nasal process

- **Nasal placodes:** rounded thickenings of the surface ectoderm in the lower lateral parts of the fronto-nasal process.
- **Nasal pits & prominences:** invagination of placode will form nasal pits which are surrounded by medial & lateral nasal prominences (folds).
- **Intermaxillary segment:** from fused medial nasal prominences. It forms philtrum, part of upper jaw that carries upper 4 incisors and primary palate.

Maxillary process

- ✓ It is separated from other maxillary process by intermaxillary segment.
- ✓ It fuses partially with mandibular process to form the cheek.
- ✓ Palatine process is formed as inward projection of maxillary process to form secondary palate which divides stomodeum into upper nasal and lower oral cavities.

So maxillary process forms lower eyelid, upper part of cheek, upper lip except philtrum, upper jaw except part that carries upper incisors and most of hard palate.

Mandibular process

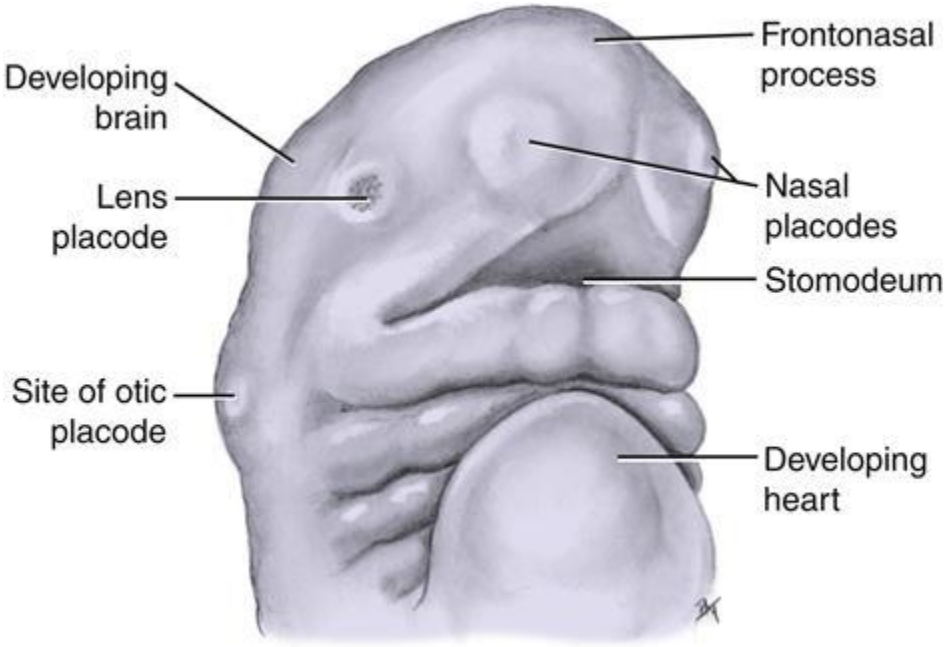
It forms the lower part of cheek, whole lower lip and lower jaw and floor of mouth.

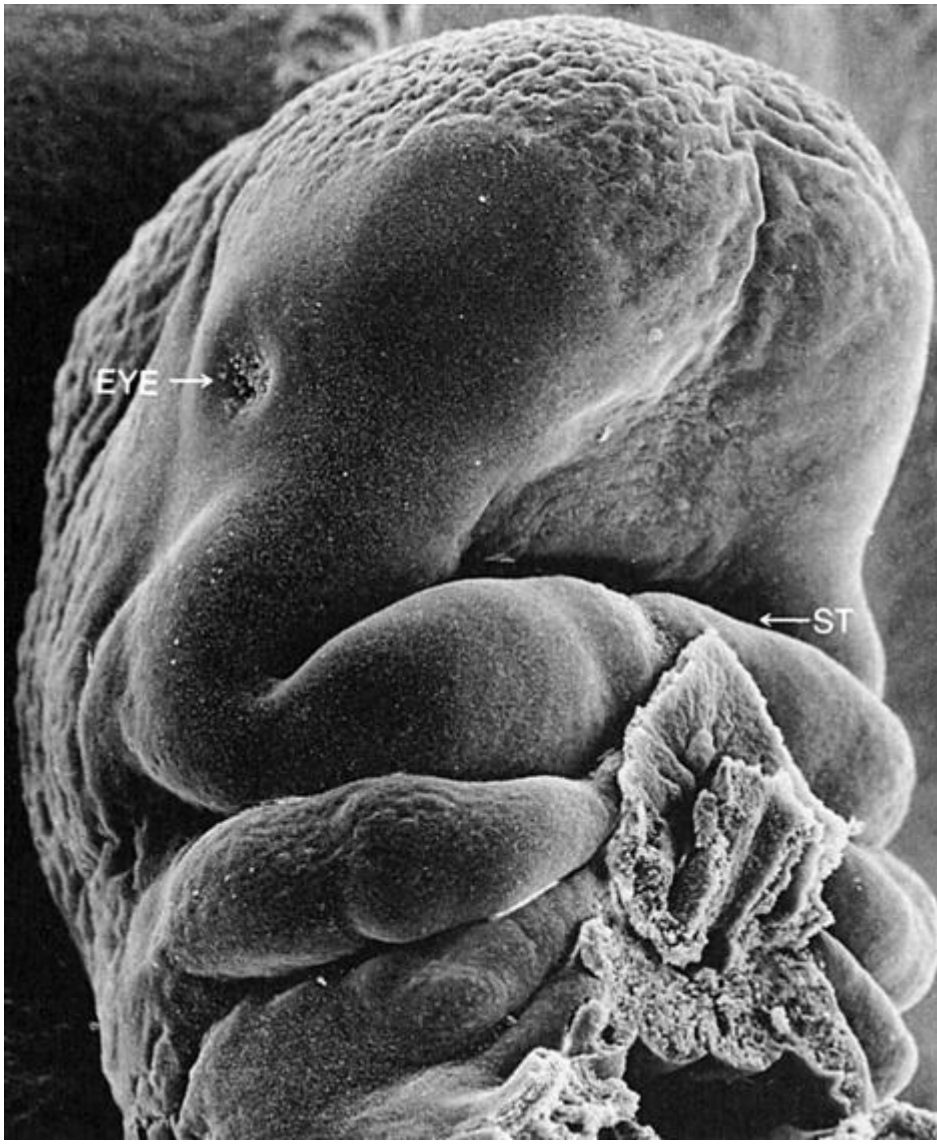
Development of palate:

1- Primary palate: from intermaxillary segment of fronto-nasal process.

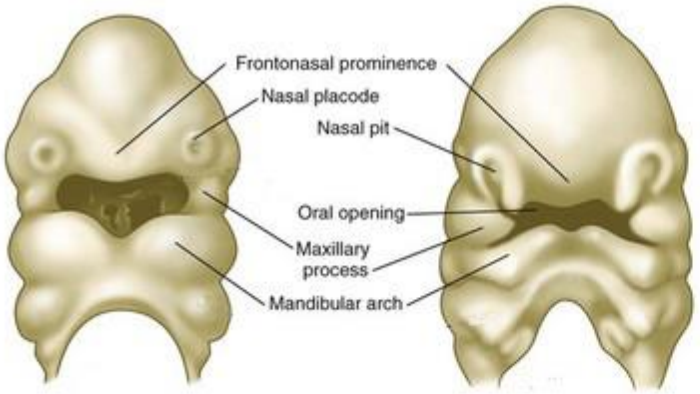
2- Secondary palate: from palatine shelves of maxillary processes that form most of hard palate and soft palate.

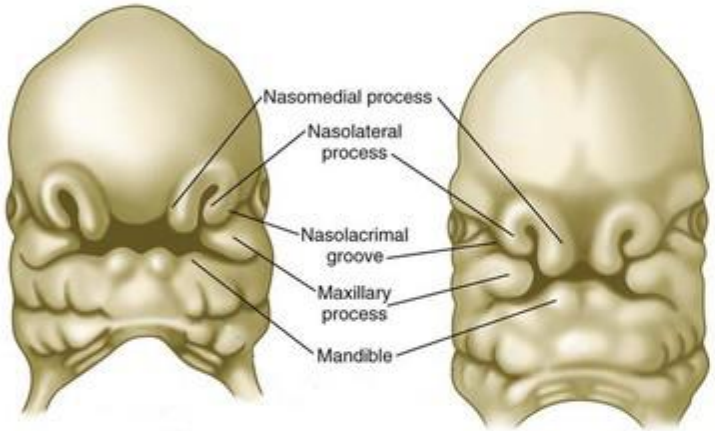
Hard palate receives downward growth of nasal septum

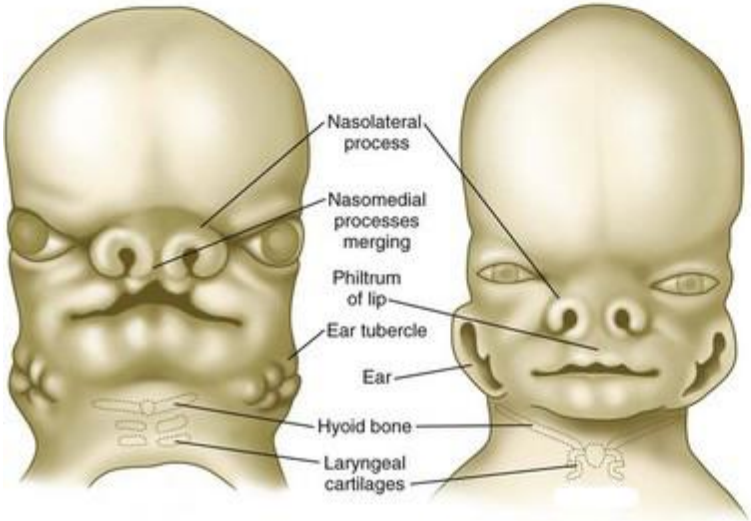

Developing brain
Frontonasal process
Lens placode
Nasal placodes
Stomodeum
Site of otic placode
Developing heart

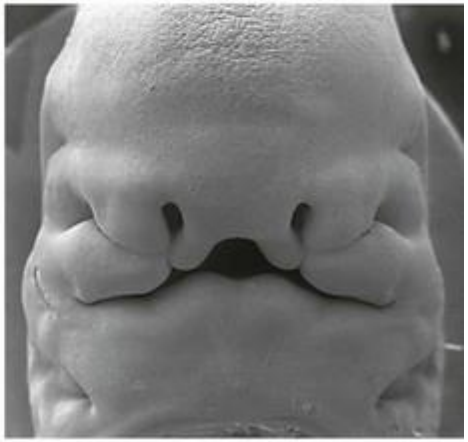

EYE
ST

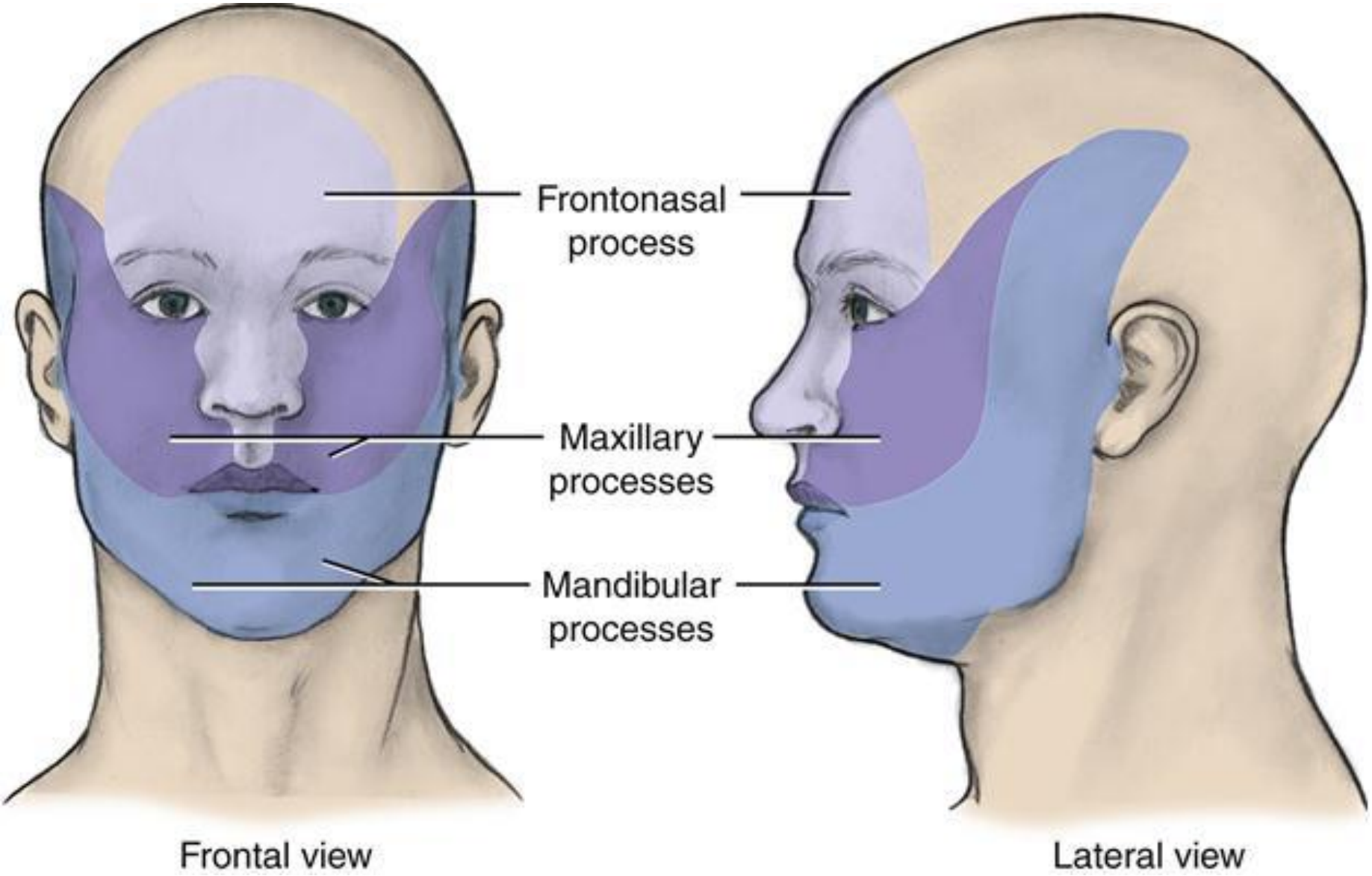
Ectodermal tubercles forming the auricle


Frontonasal prominence
Nasal placode
Nasal pit
Oral opening
Maxillary process
Mandibular arch


Nasomedial process
Nasolateral process
Nasolacrimal groove
Maxillary process
Mandible


Nasolateral process
Nasomedial processes merging
Philtrum of lip
Ear tubercle
Ear
Hyoid bone
Laryngeal cartilages




Frontonasal process
Maxillary processes
Mandibular processes
Frontal view
Lateral view

Congenital anomalies

Dermoid cyst: cystic swelling at a line of fusion between processes of the face

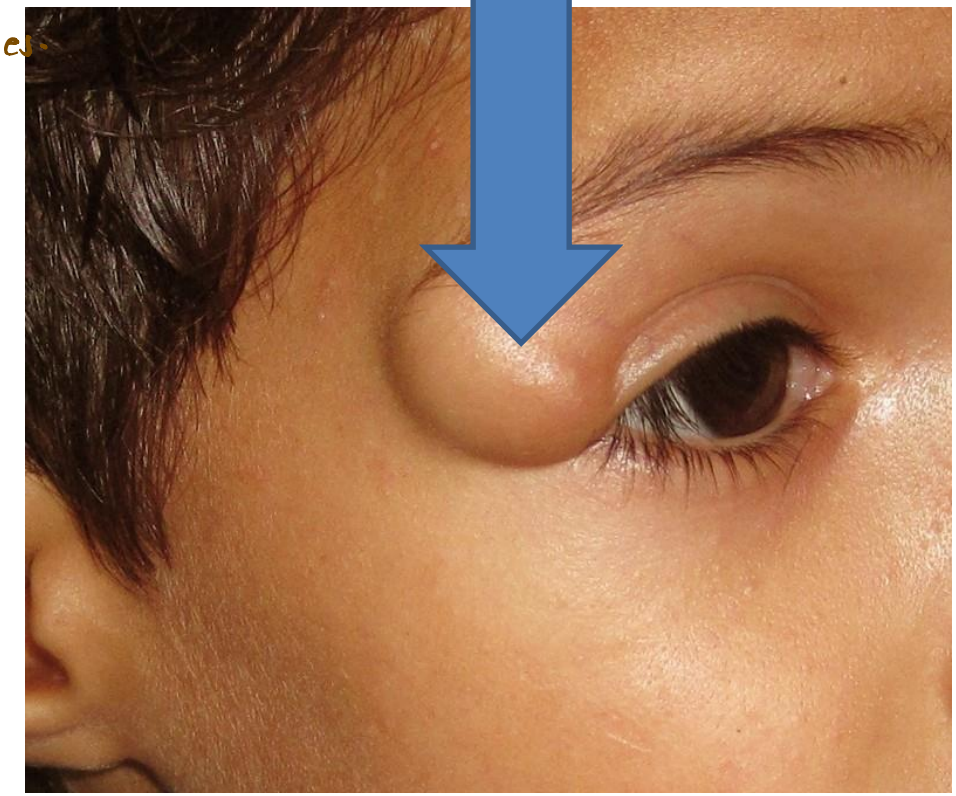
cyst at the line of fusion between frontonasal and Maxillary Processes.

Dermoid cyst

سببه انتشر الـectoderm بهاي المنطقة بعدها تتمايز

lateral side of eye.

Inside this cyst: skin appendages.

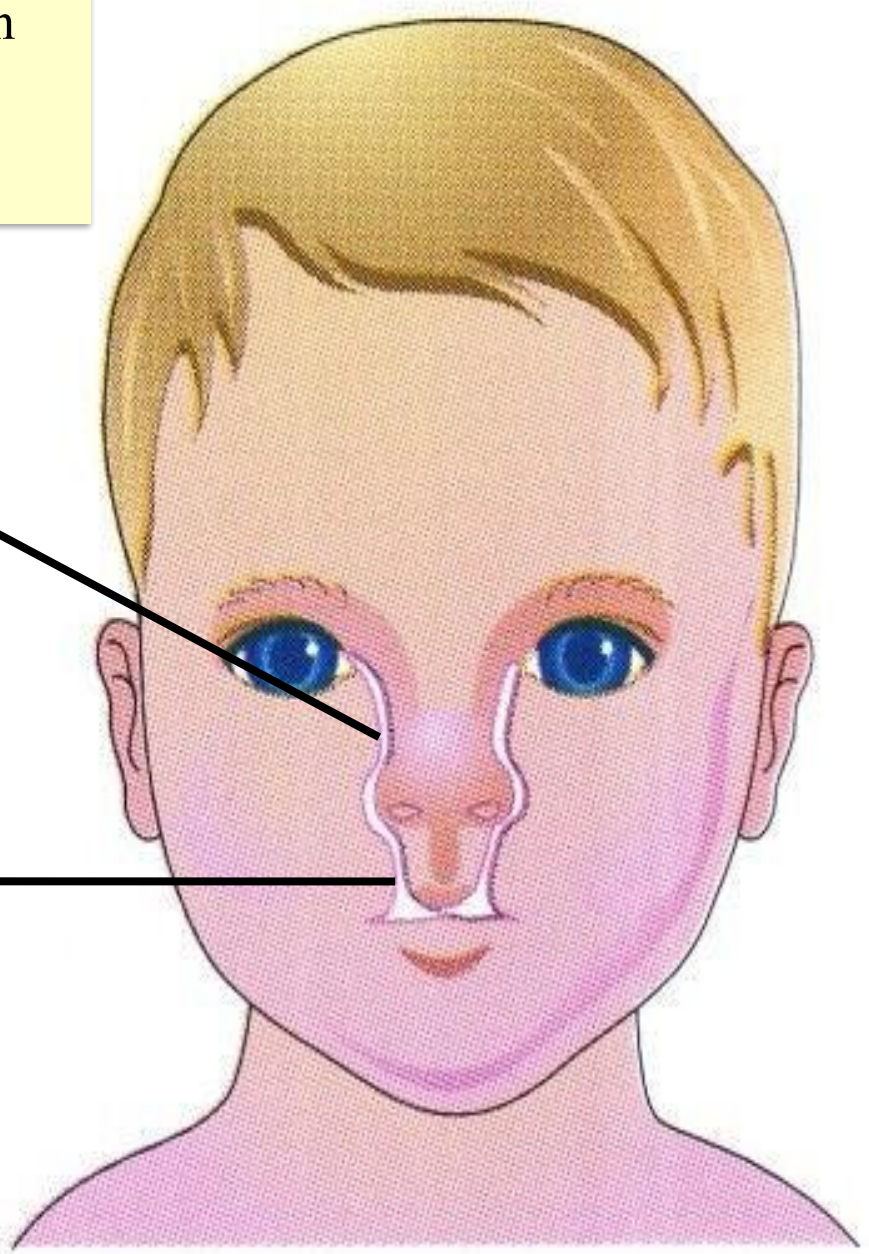


Usually congenital anomalies of the face and palate are caused by failure of fusion between the different processes/ prominences forming them

Oblique facial cleft: failure of fusion between maxillary and fronto-nasal processes.

Oblique facial cleft

Cleft lip



Macrostomia or Microstomia: defective or marked fusion between maxillary and mandibular processes

- Could be uni / bi lateral.

b

Macrostomia

c

Microstomia

excessive fusion

Unilateral Cleft lip

Cleft (hare) lip: cleft lip due to failure of fusion between maxillary process and intermaxillary segment.

Bilateral Cleft lip

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Median cleft lip:
Results from malfusion of the medial nasal prominences

Incomplete fusion in lower part.

Cleft Lower Lip
The cleft is exactly central and is caused by incomplete fusion of the mandibular processes

Dr. Heba Kalbouneh

Cleft palate

Cleft palate: failure of fusion between different parts that form palate

The incisive foramen is considered the dividing landmark between the anterior and posterior cleft deformities

Cleft of the primary palate

✓Results from failure of the maxillary process to fuse with the intermaxillary segment

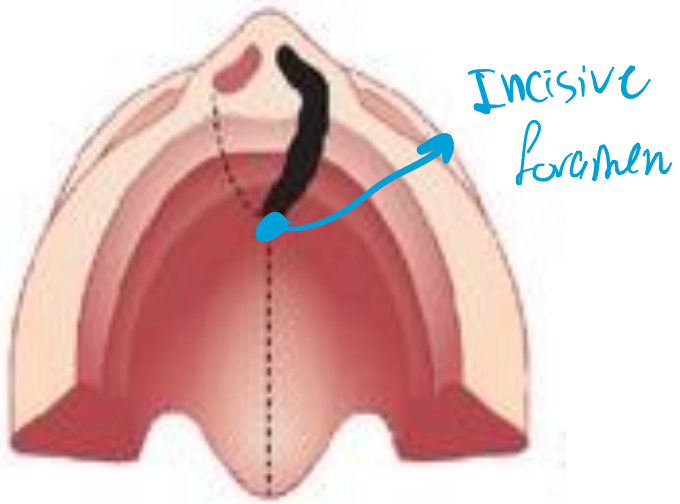
✓Takes place **anterior to the incisive foramen,** therefore this type is Anterior cleft palate

✓Note: that cleft of the primary palate is always **anterior**

✓Can be unilateral and bilateral

Primary Bilateral Cleft Palate
(combined with bilateral cleft lip)

Primary Unilateral Cleft Palate
(combined with unilateral cleft lip)



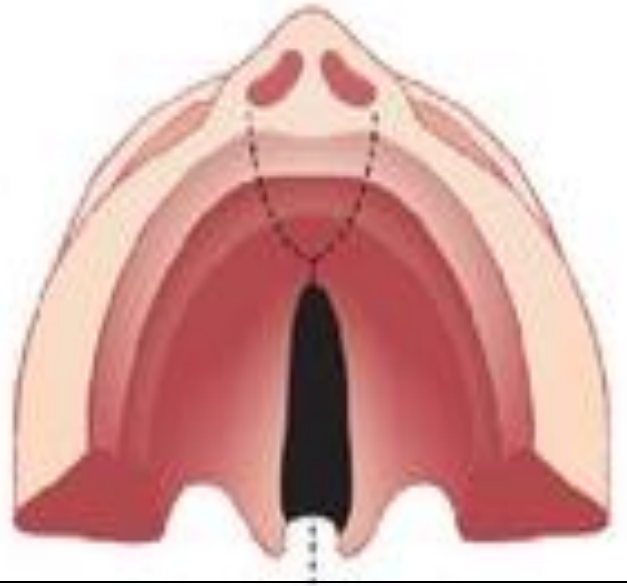
Cleft of the secondary palate

✓ Results from failure of the maxillary processes to fuse with each other

✓ Takes place **posterior to the incisive foramen,** therefore this type is Posterior cleft palate

✓Note that cleft of the secondary palate is always **posterior**

Secondary cleft palate

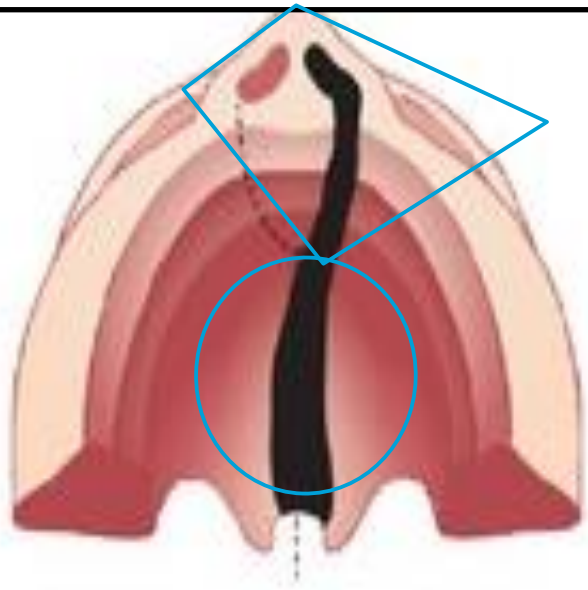


Cleft of the primary and secondary palate

✓Results from failure of the maxillary processes to fuse with each other and with the intermaxillary segment

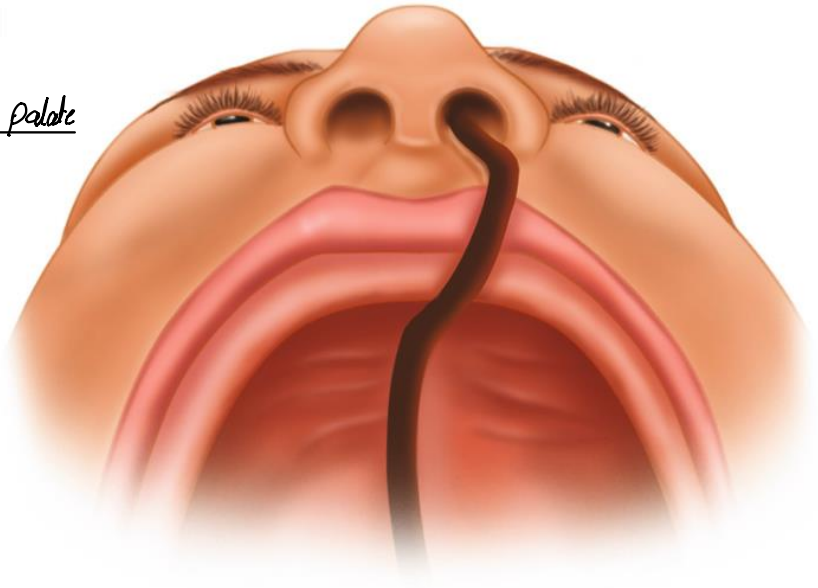
✓ Takes place **anterior and posterior to the incisive foramen,** therefore this type is mixed anterior and posterior cleft palates

Primary and secondary Cleft palates
(combined with unilateral cleft lip)



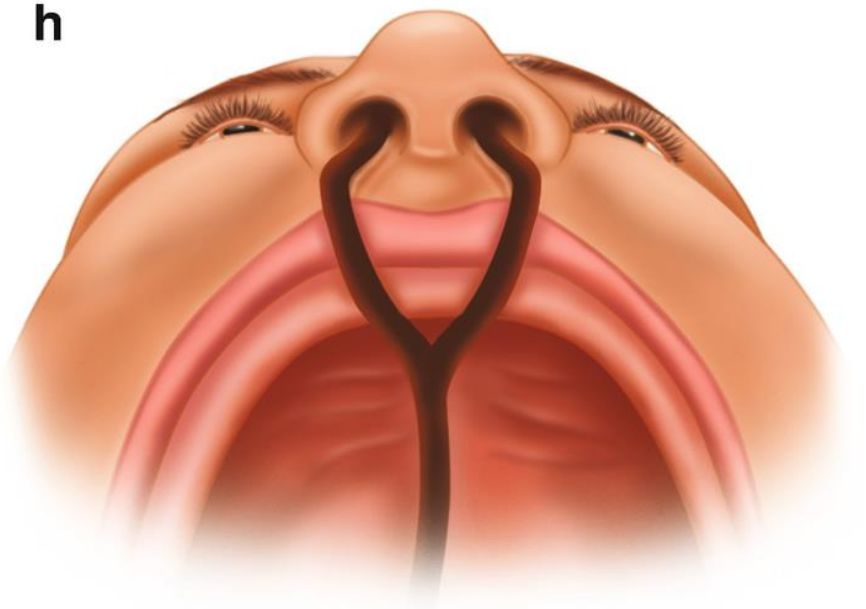
If you have a new born with cleft lip, you should examine cleft palate

g



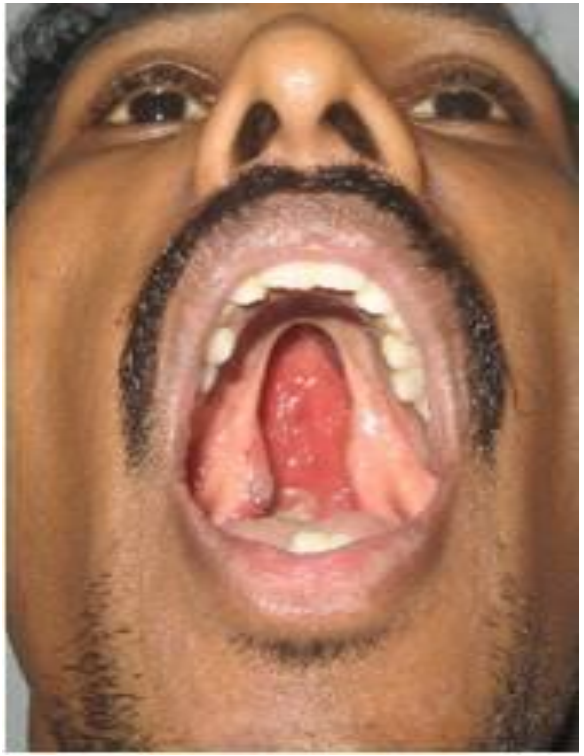
Unilateral complete cleft lip and palate

h

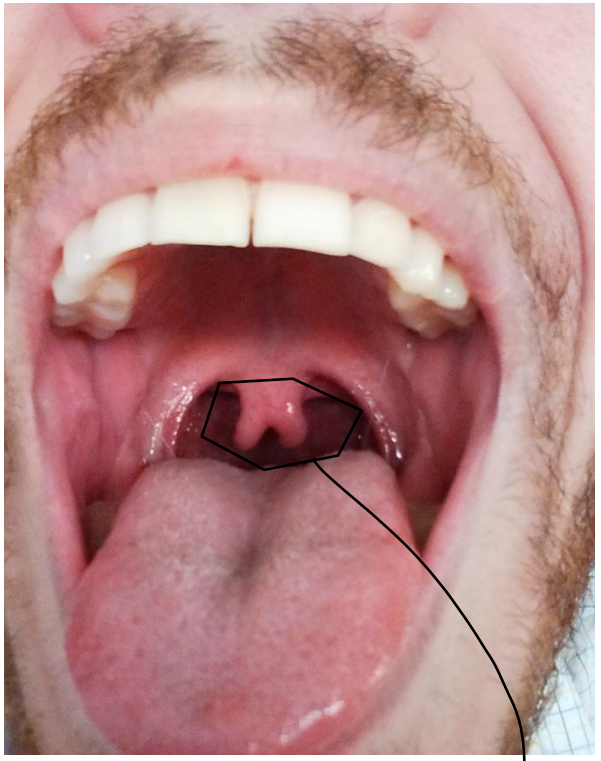


Bilateral Cleft Lip & Palate

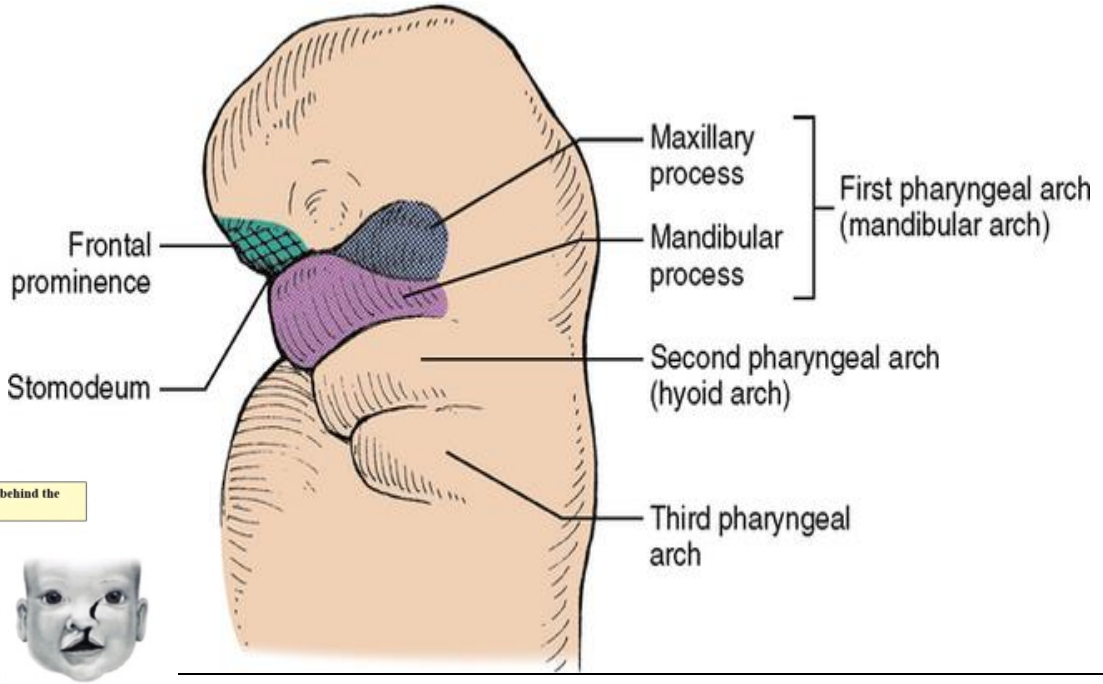
Primary and secondary Cleft palates
(combined with unilateral cleft lip)



Secondary cleft palate

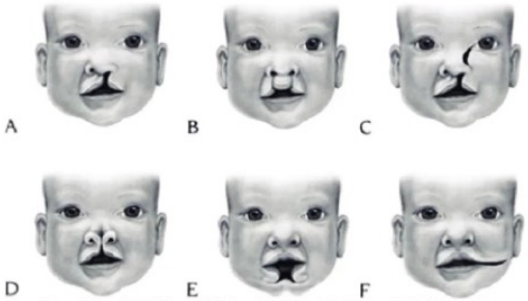


Cleft uvula

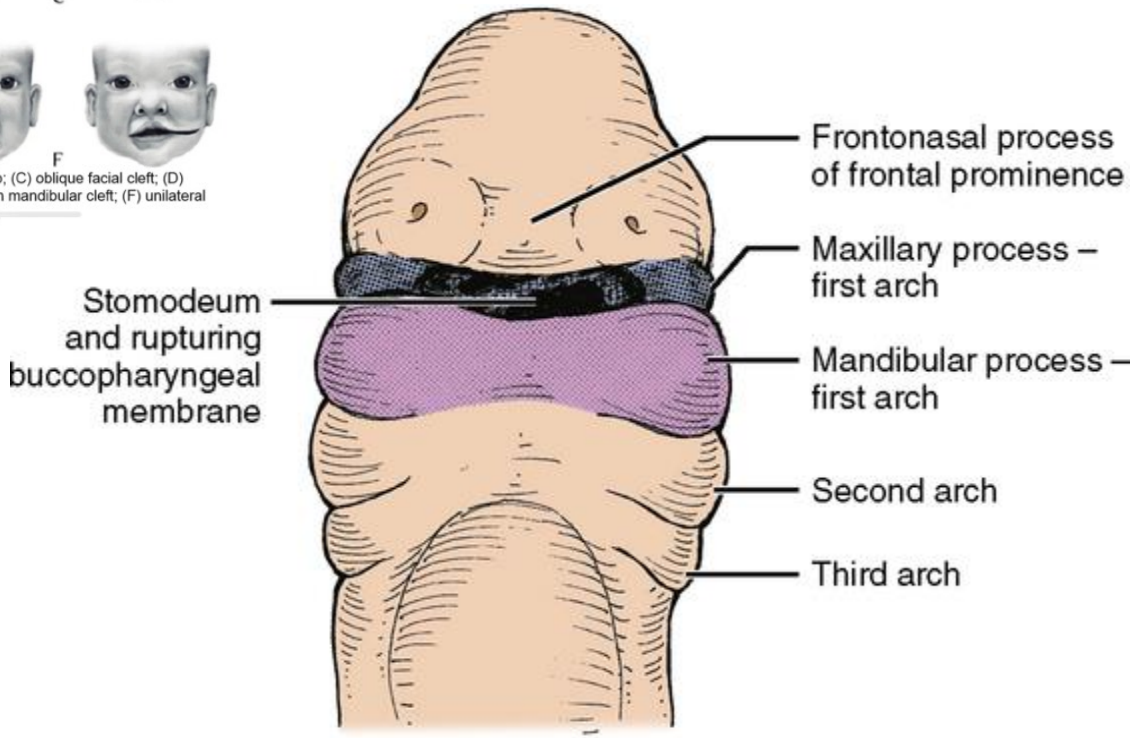


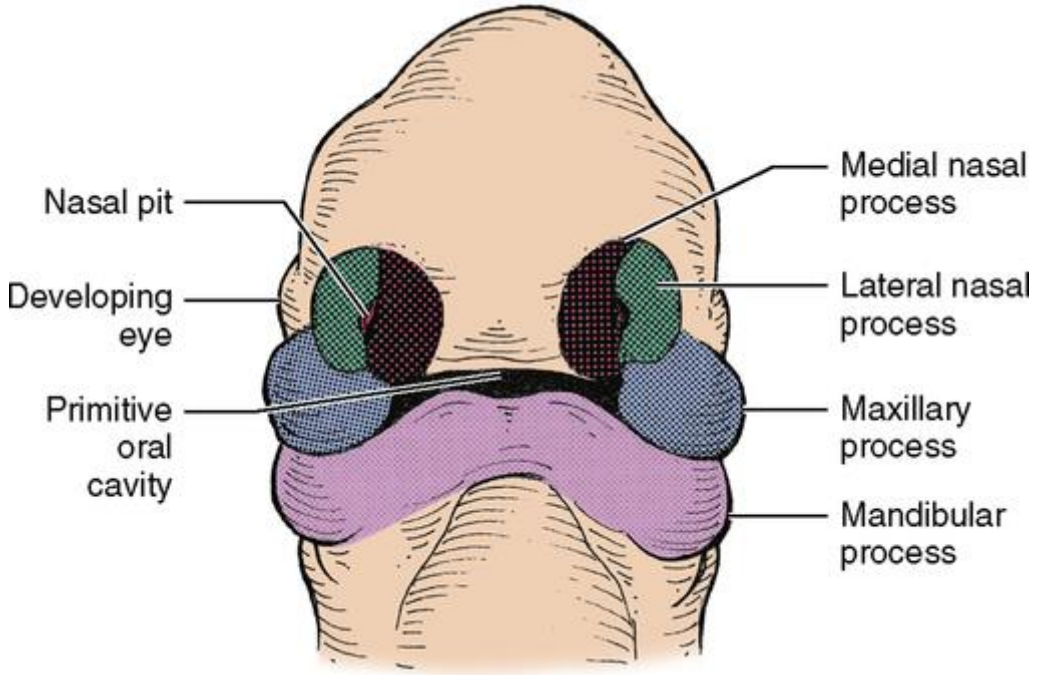
I last slide.

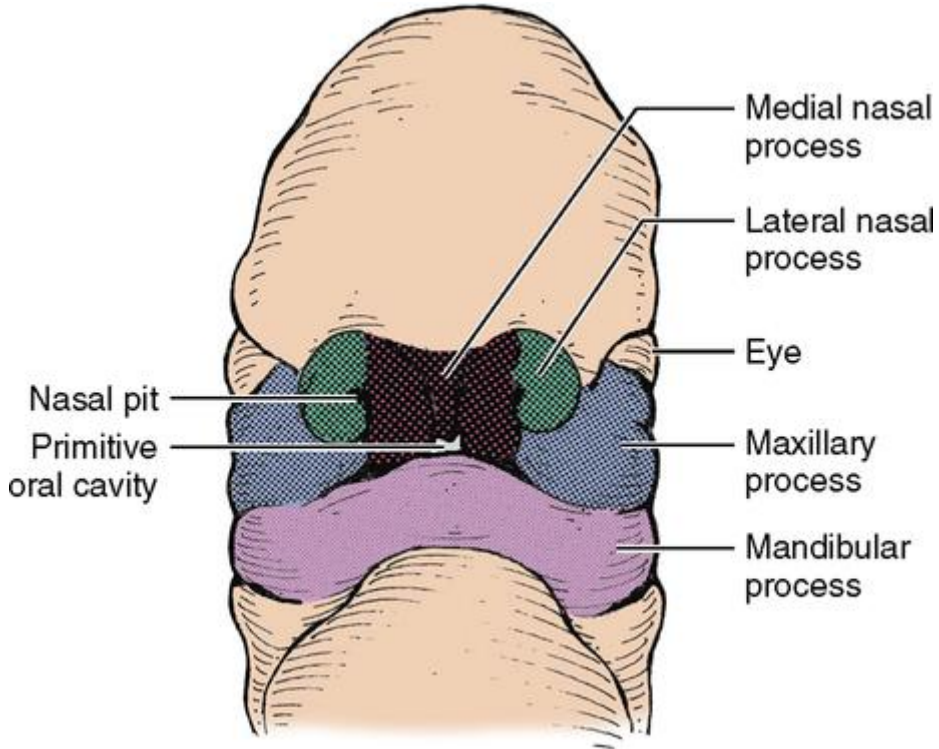
Try to figure out the embryonic rationale behind the following orofacial anomalies

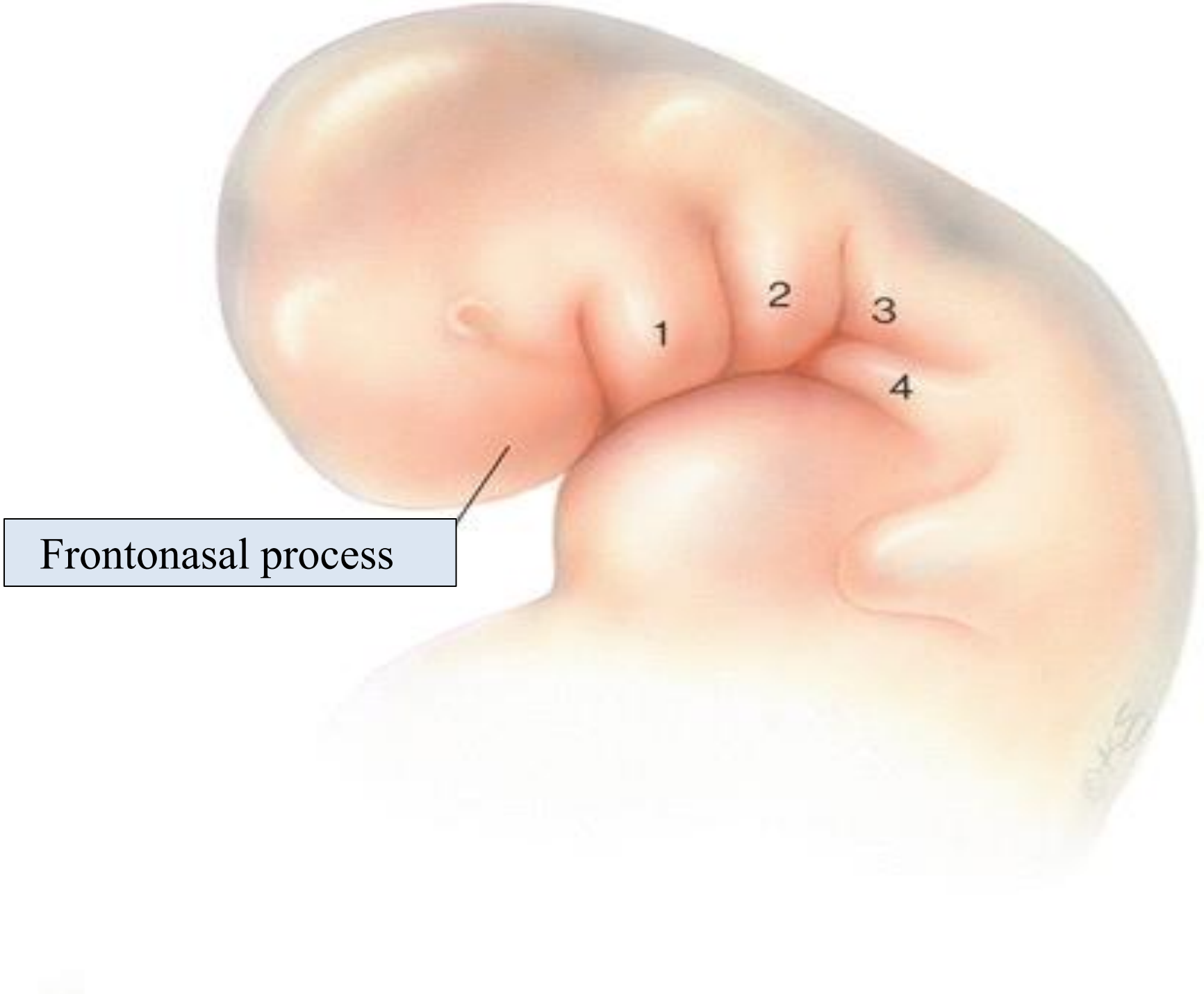


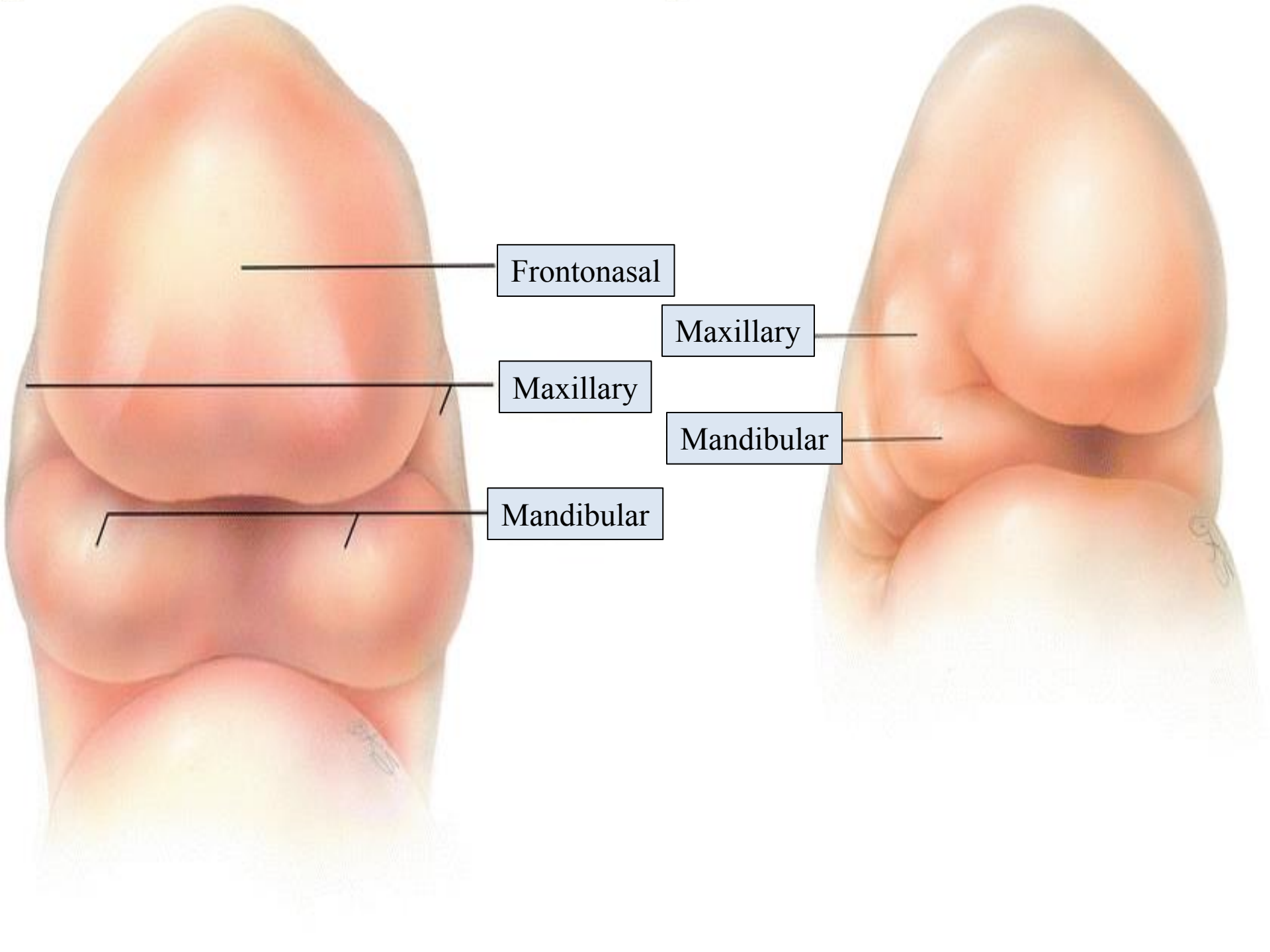
(A) unilateral cleft lip; (B) bilateral cleft lip; (C) oblique facial cleft; (D) median cleft lip and nasal defect; (E) median mandibular cleft; (F) unilateral macrostomia.

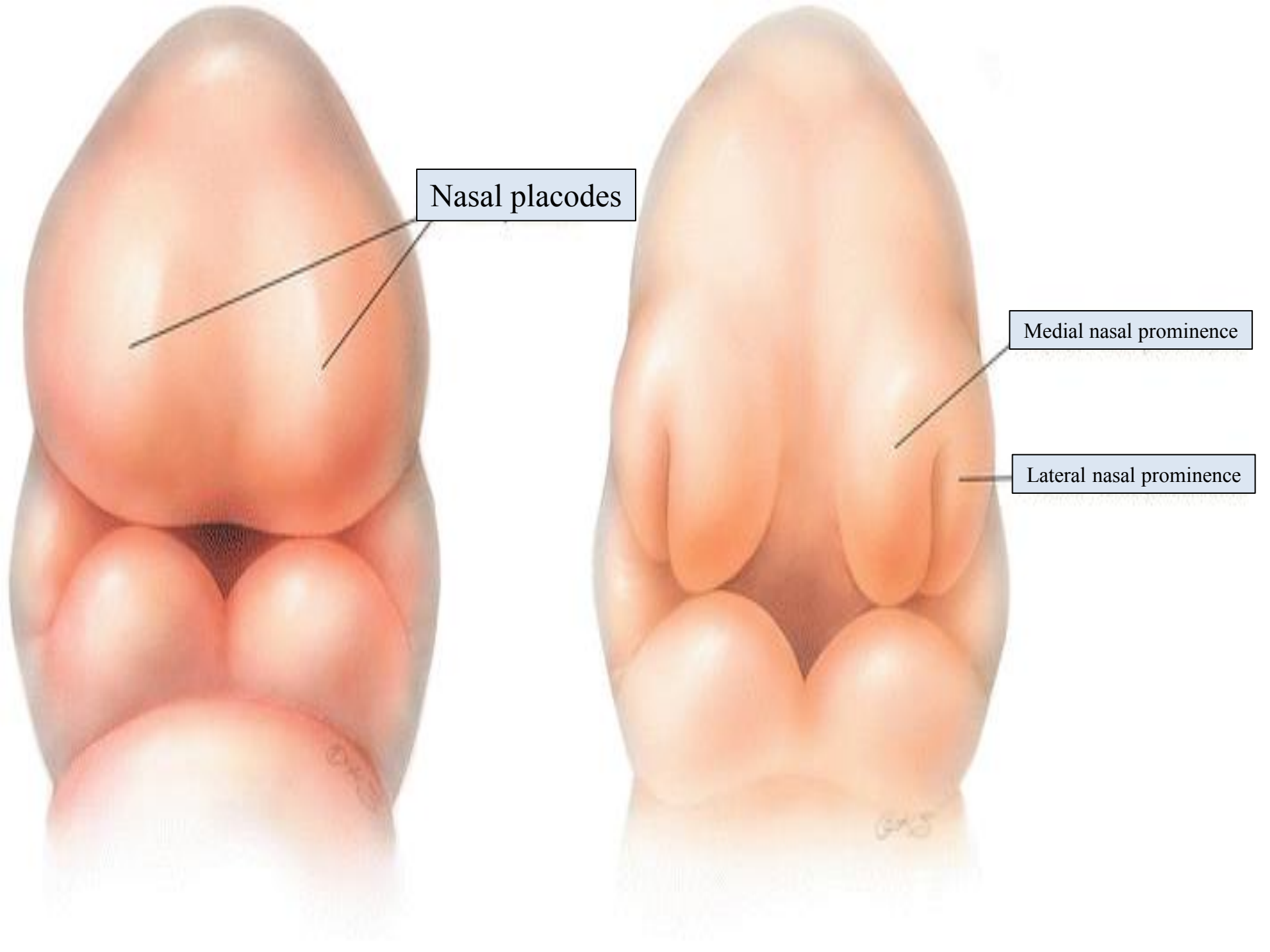


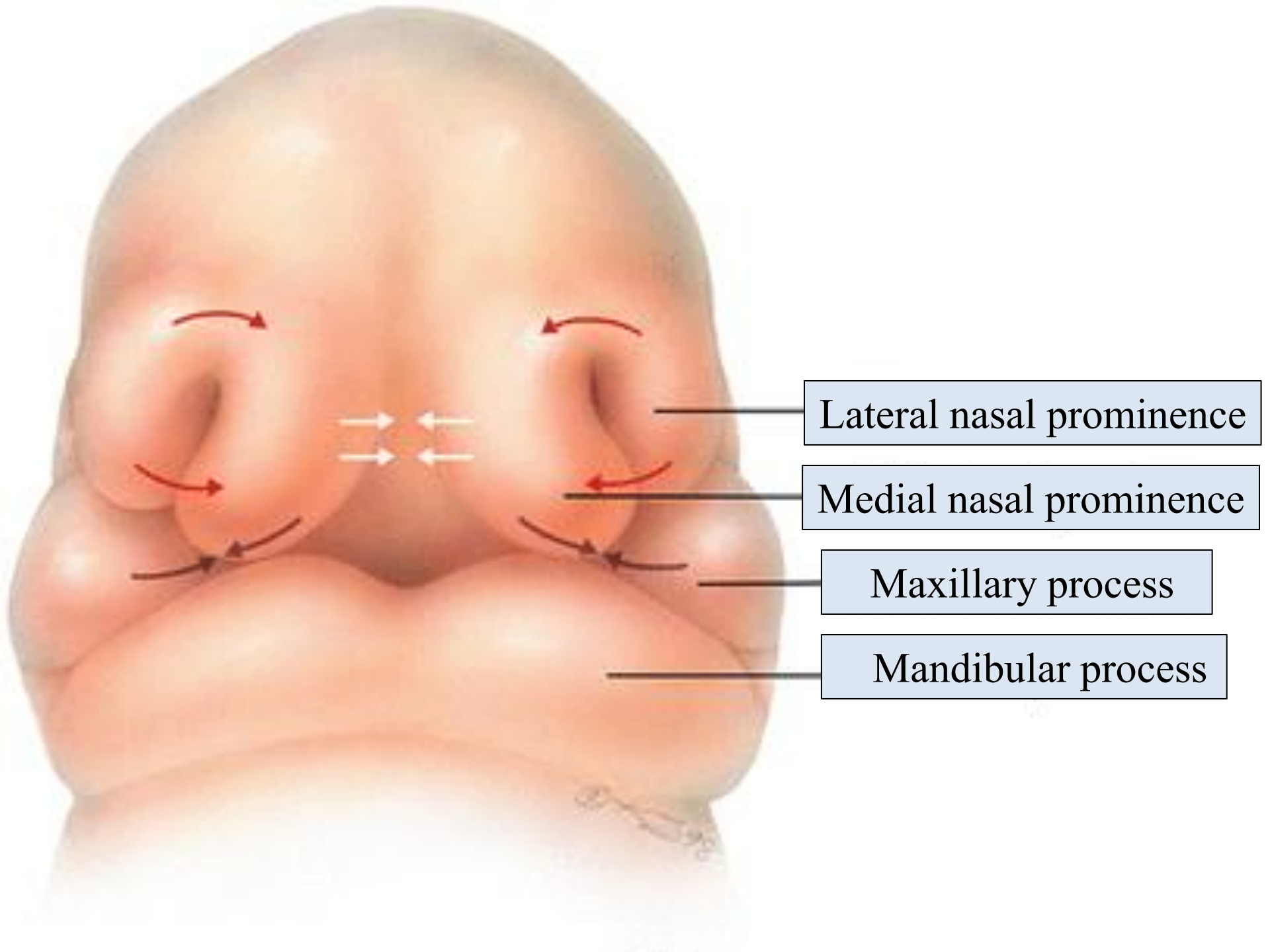

Nasal pit
Developing eye
Primitive oral cavity
Medial nasal process
Lateral nasal process
Maxillary process
Mandibular process

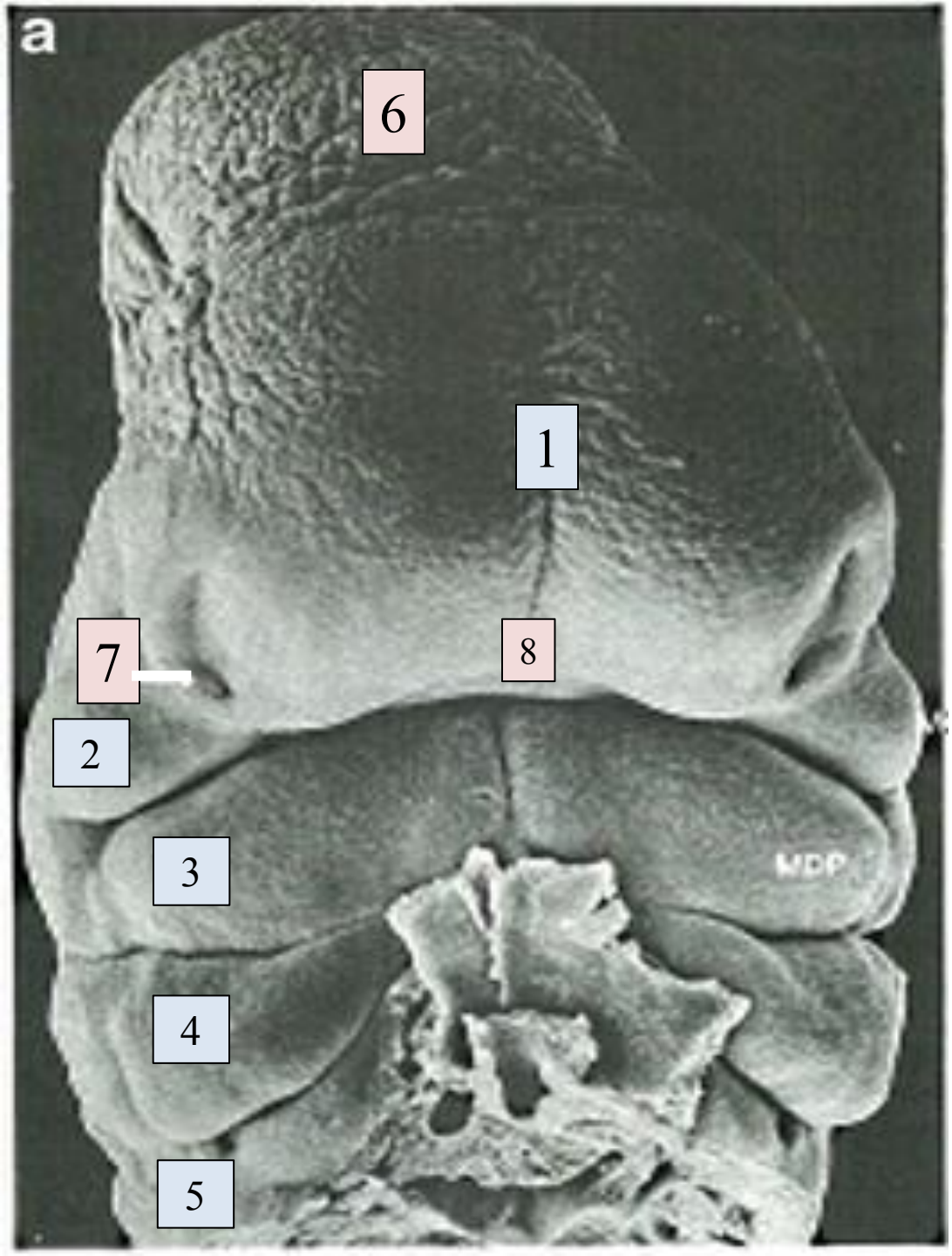

Nasal pit
Primitive oral cavity
Medial nasal process
Lateral nasal process
Eye
Maxillary process
Mandibular process


1
2
3
4
Frontonasal process


Frontonasal
Maxillary
Maxillary
Mandibular
Mandibular

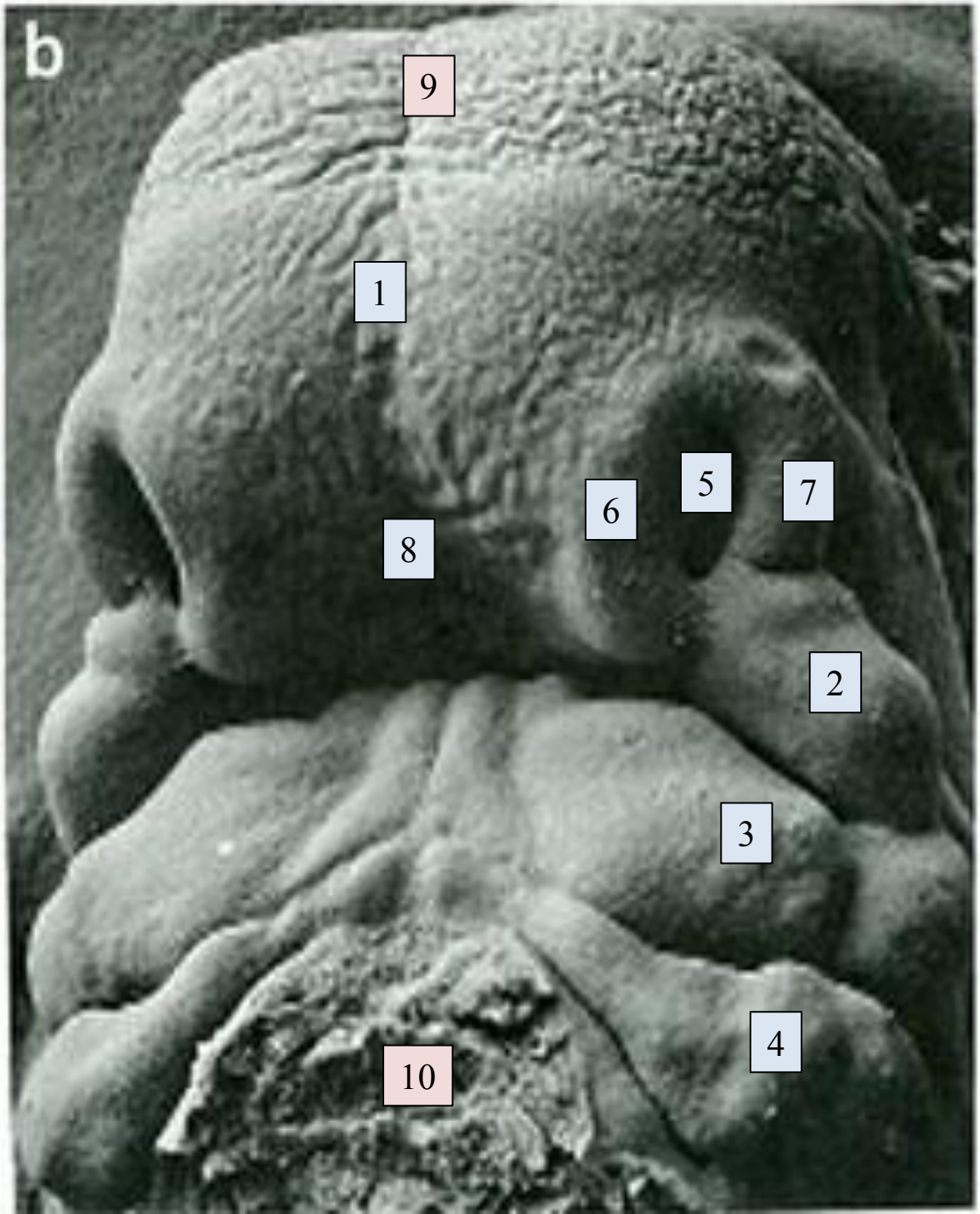

Nasal placodes
Medial nasal prominence
Lateral nasal prominence


Lateral nasal prominence
Medial nasal prominence
Maxillary process
Mandibular process



1: Frontonasal process
2: Maxillary process
3: Mandibular process
4: Second arch
5: Third arch

6: Forebrain bulge
7: Nasal placode
8: Nasal cleft



1: Frontonasal process
2: Maxillary process
3: Mandibular process
4: Second arch

5: Nasal pit
6: Medial nasal prominence
7: Lateral nasal prominence
8: Nasal cleft

9: Forebrain bulge
10: Pericardial bulge

Refer to

http://www.indiana.edu/~anat550/hnanim/face/face.swf

https://www.youtube.com/watch?v=oz1kJexvEFE