

# Skull

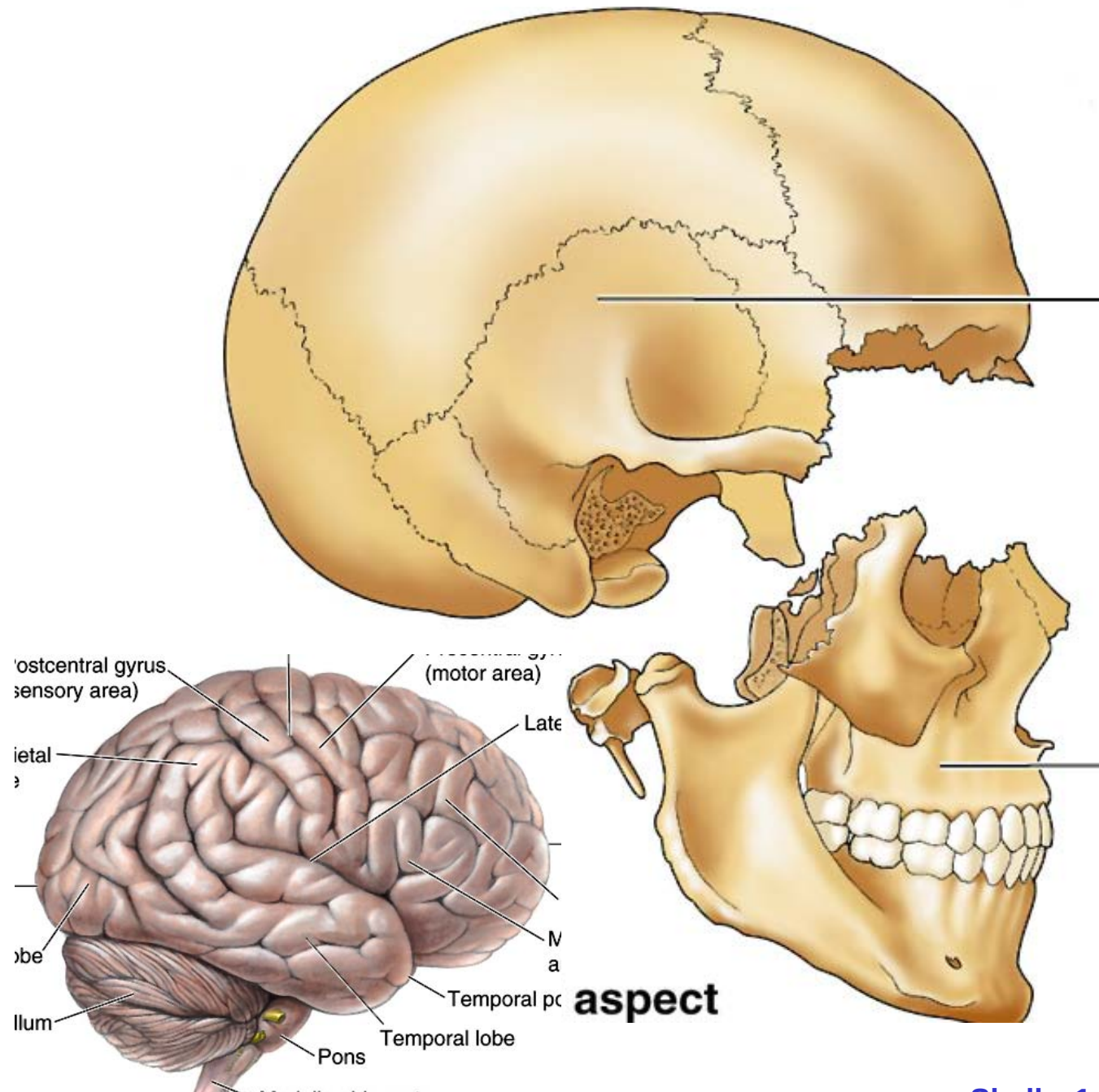
- **Cranial skeleton (Neurocranium)**

- Calvaria

- Frontal, Temporal, Parietal, Occipital

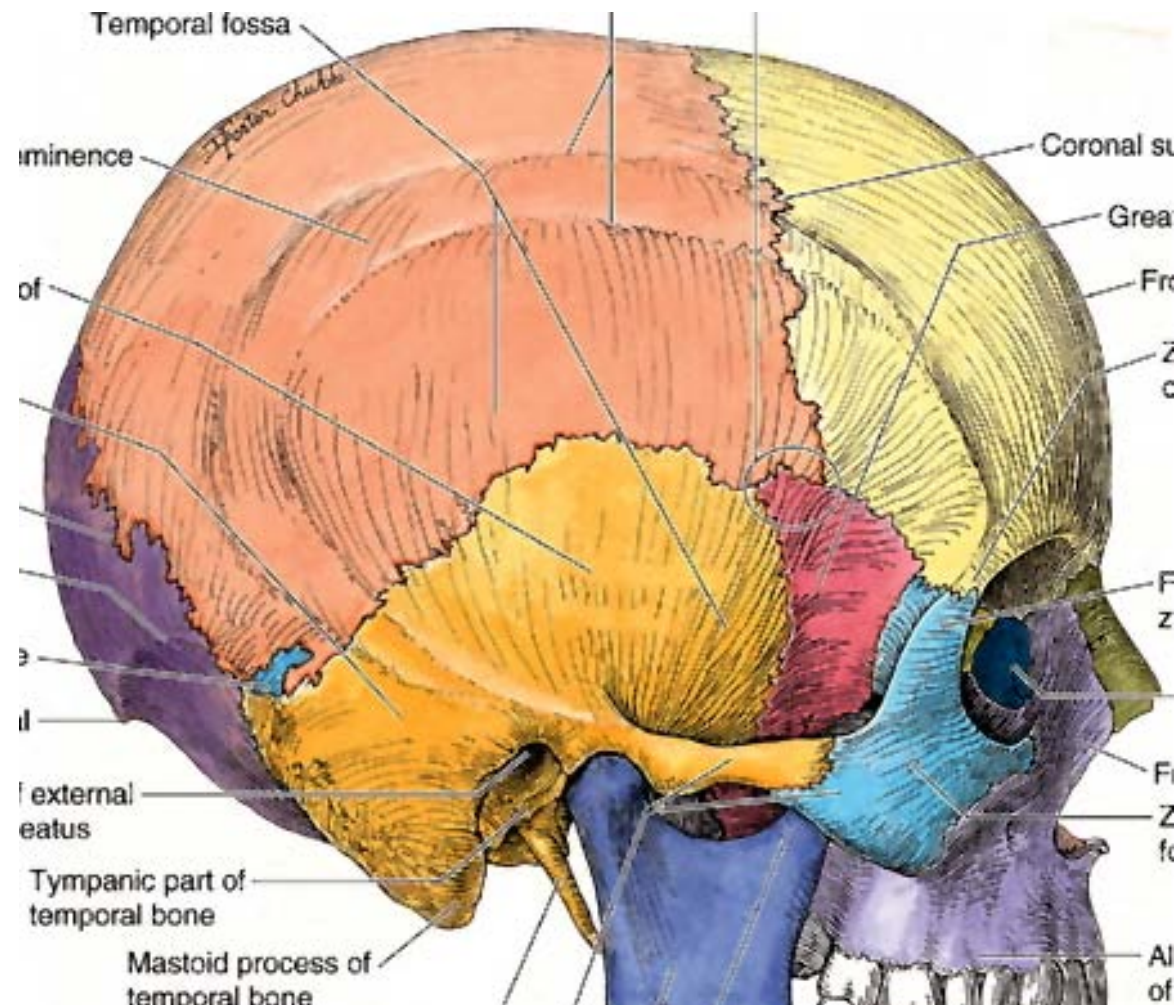
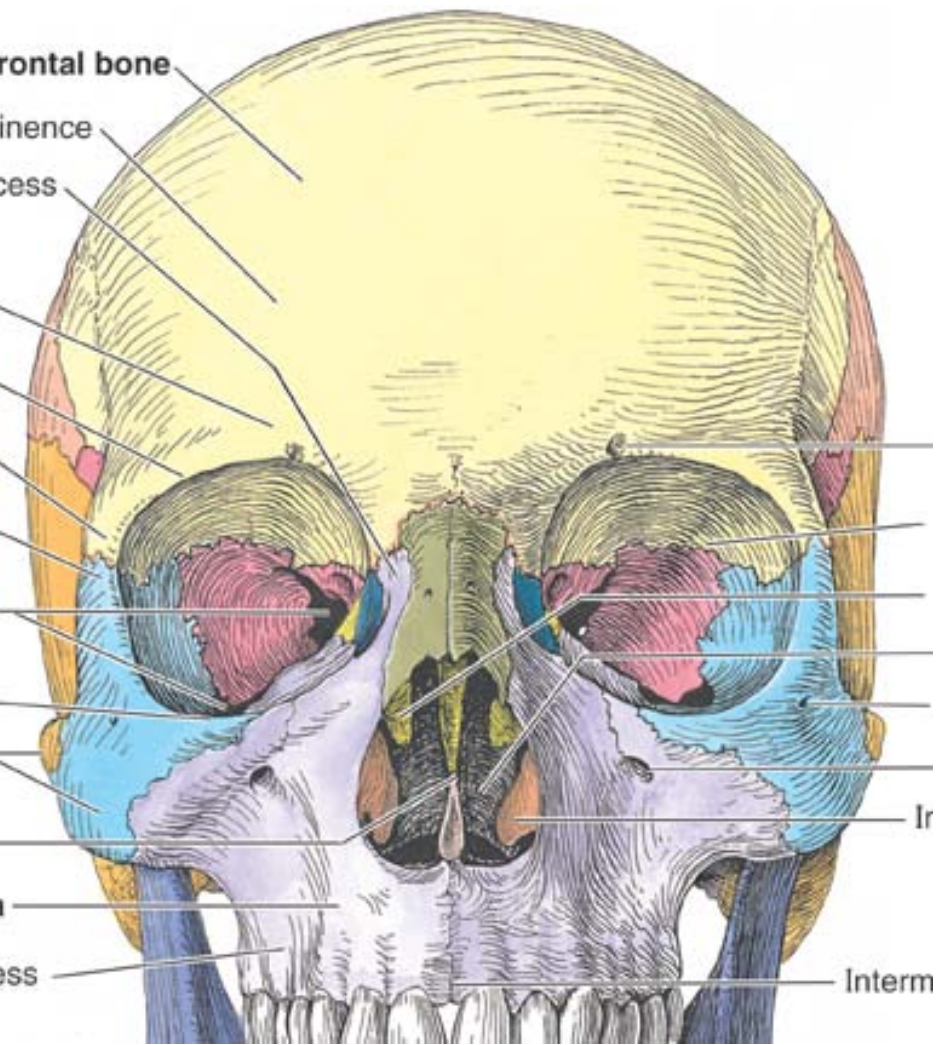
- Cranial base

- **Facial skeleton (Viscerocranium)**



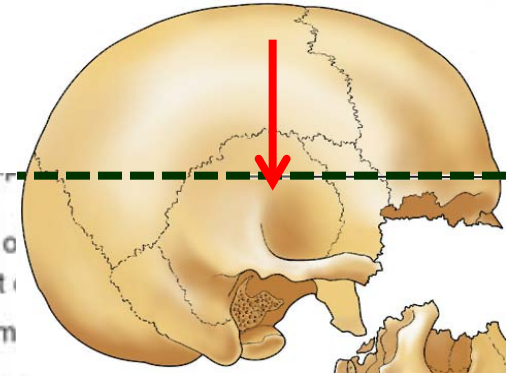
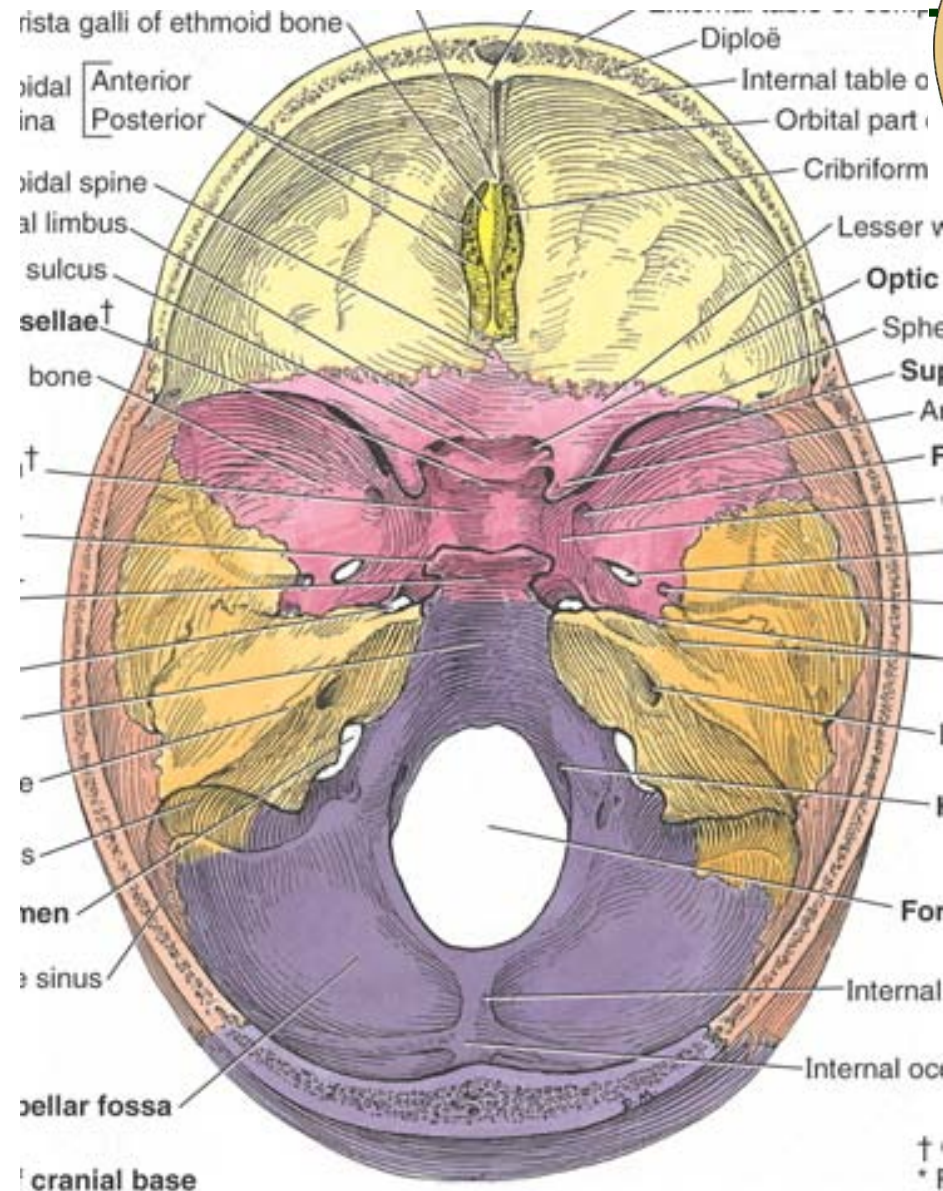
# Neurocranium: cranial vault

- Frontal, Parietal, Temporal
- Mainly membranous bone formation



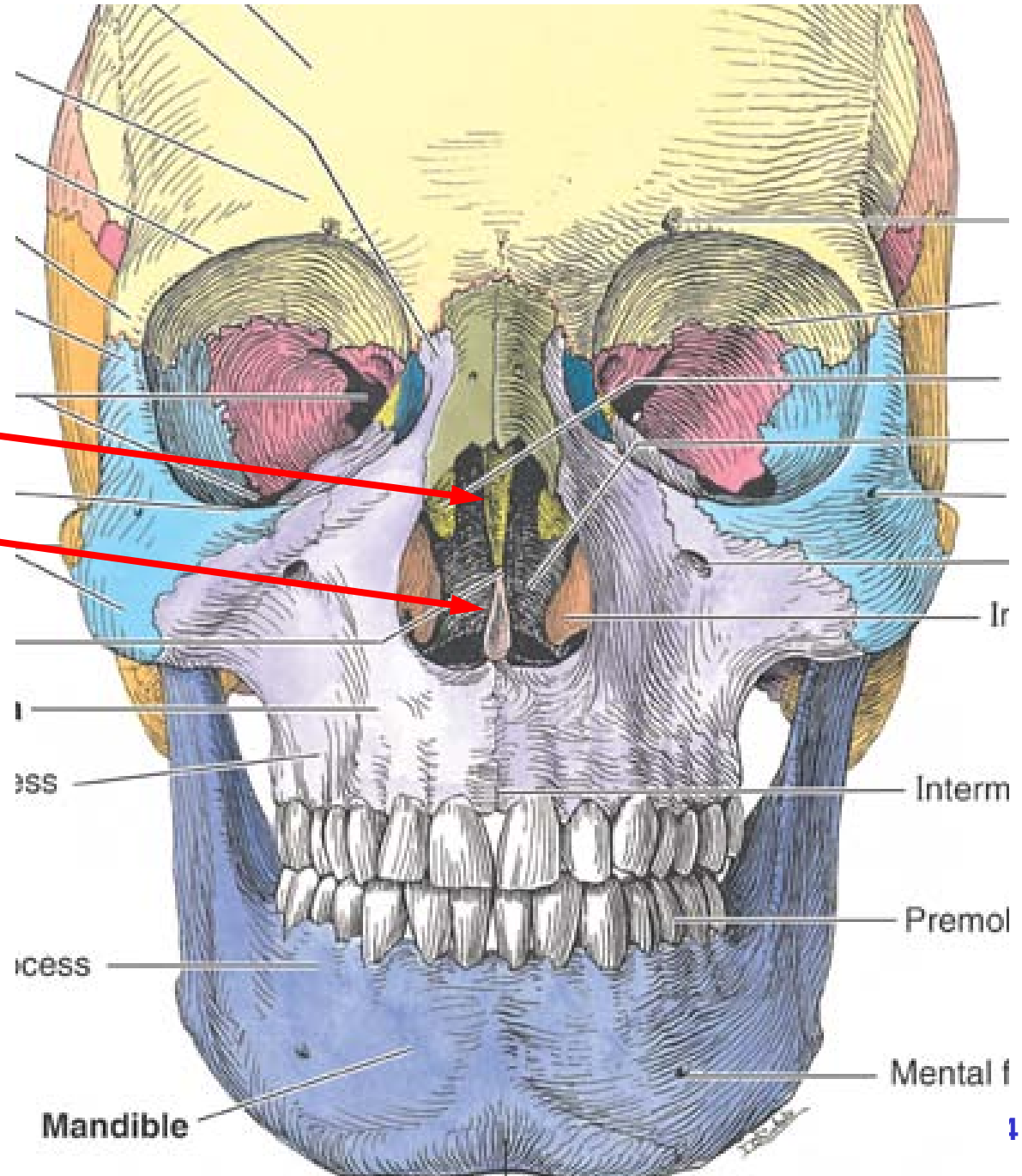
# Neurocranium: cranial base

- Midline
  - Ethmoid
  - Sphenoid
  - Occipital
- Bilateral
  - Temporal
- Foramen magnum



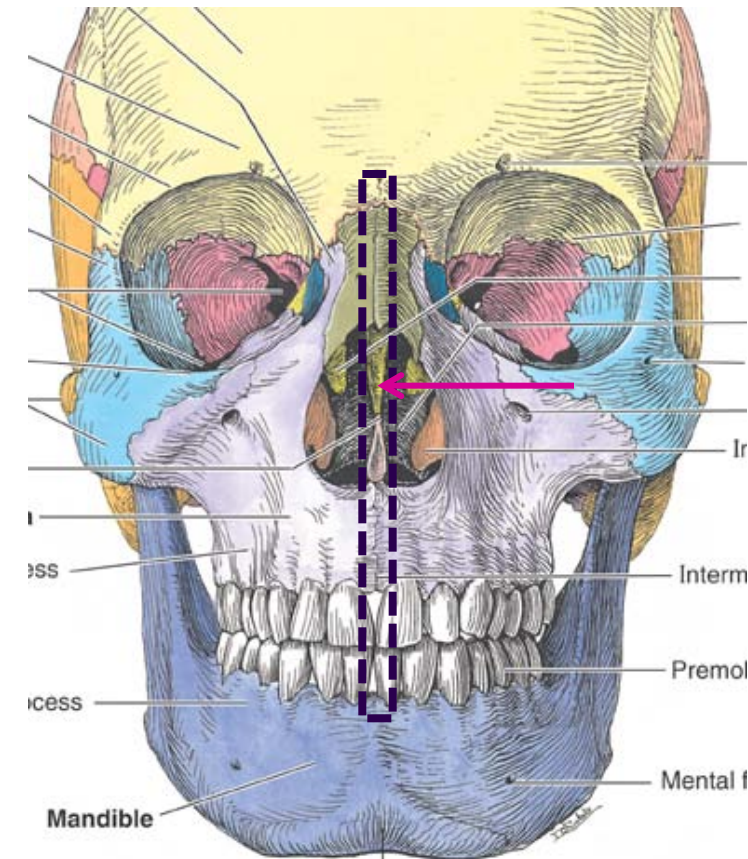
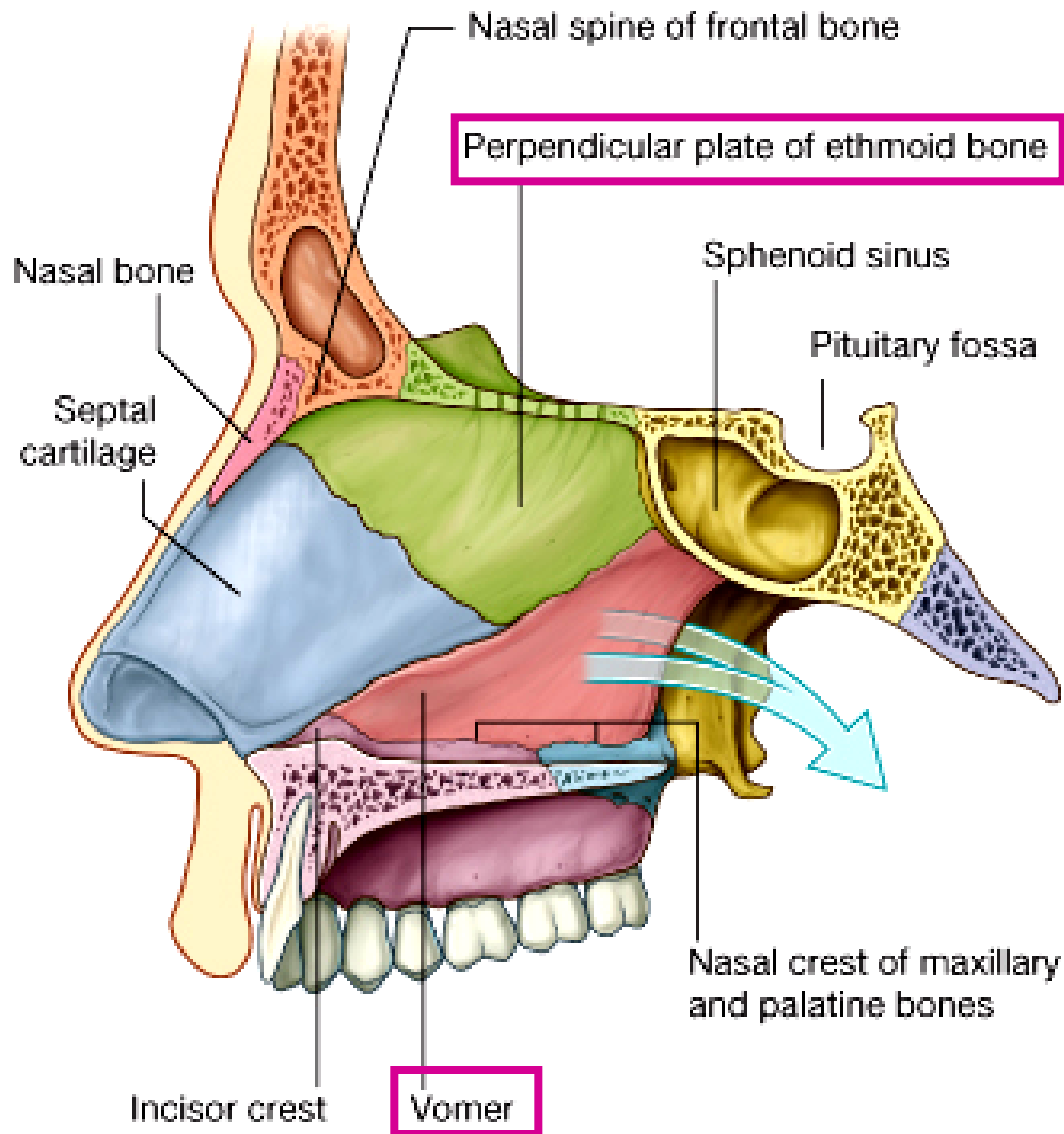
# Viscerocranium: anterior view

- Viscerocranium
  - Ethmoid, Vomer, Mandible
  - Maxilla, Zygoma, Nasal, Lacrimal, Inferior nasal chonae, Palatine



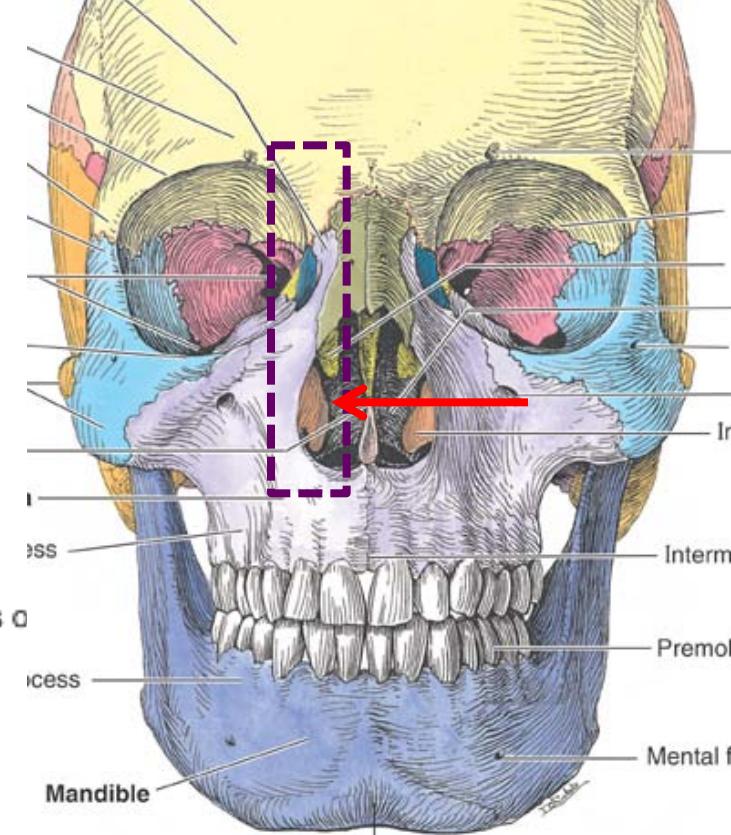
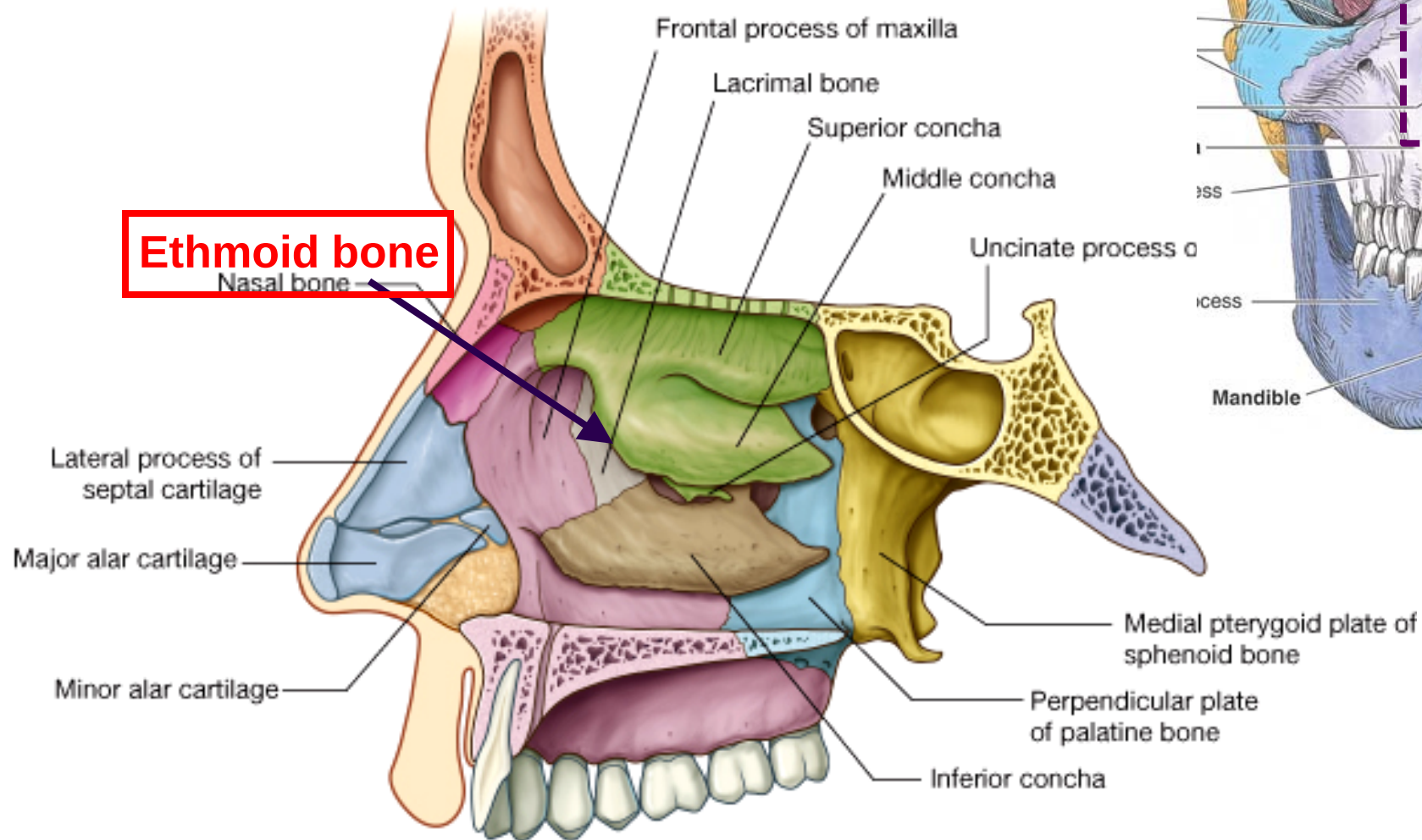
# nasal cavities: septum

- nasal septum: **perpendicular plate of ethmoid + vomer**



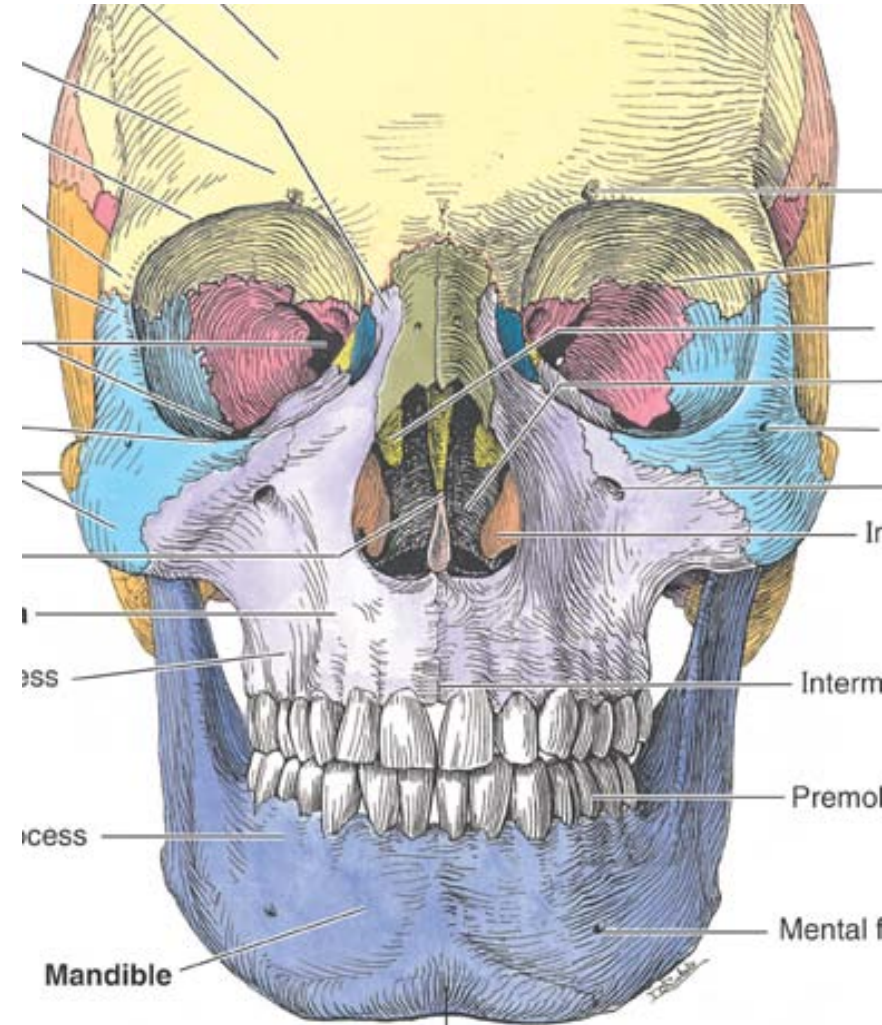
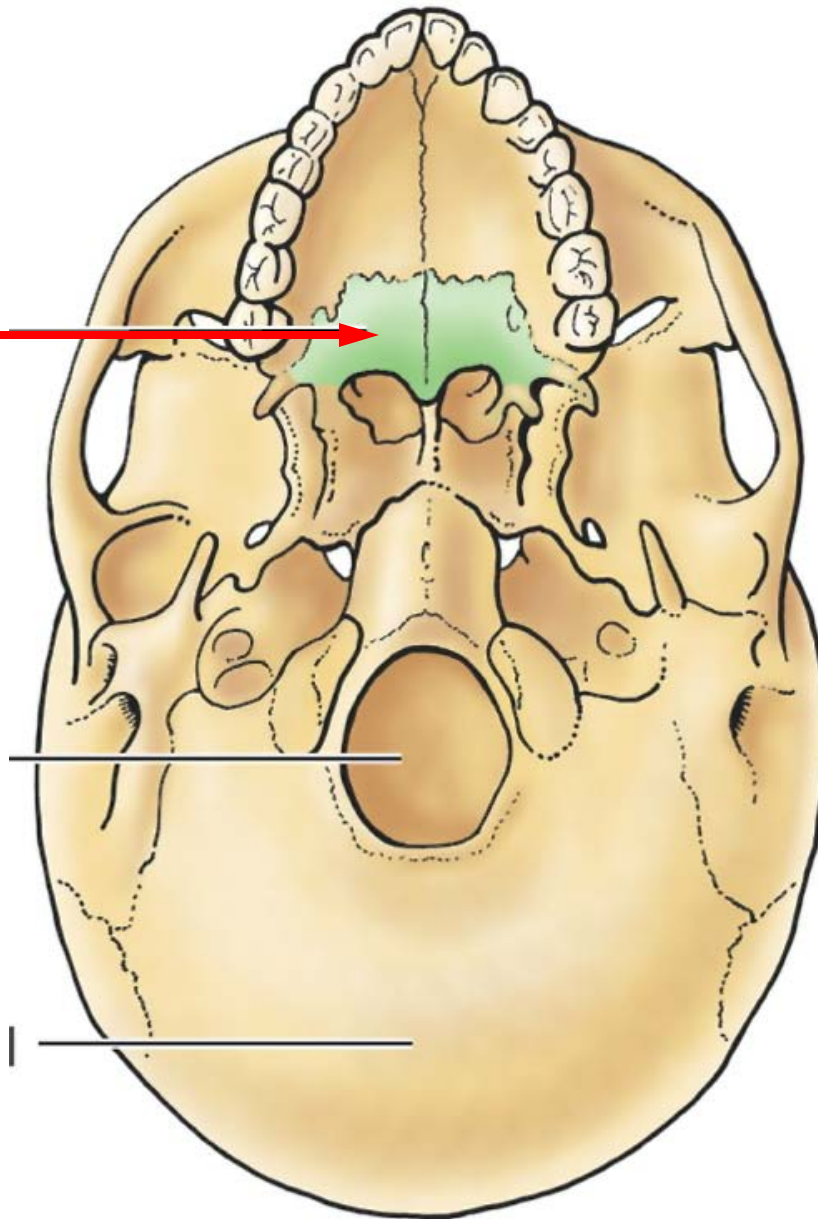
# Lateral wall of nasal cavity

- Inferior nasal concha



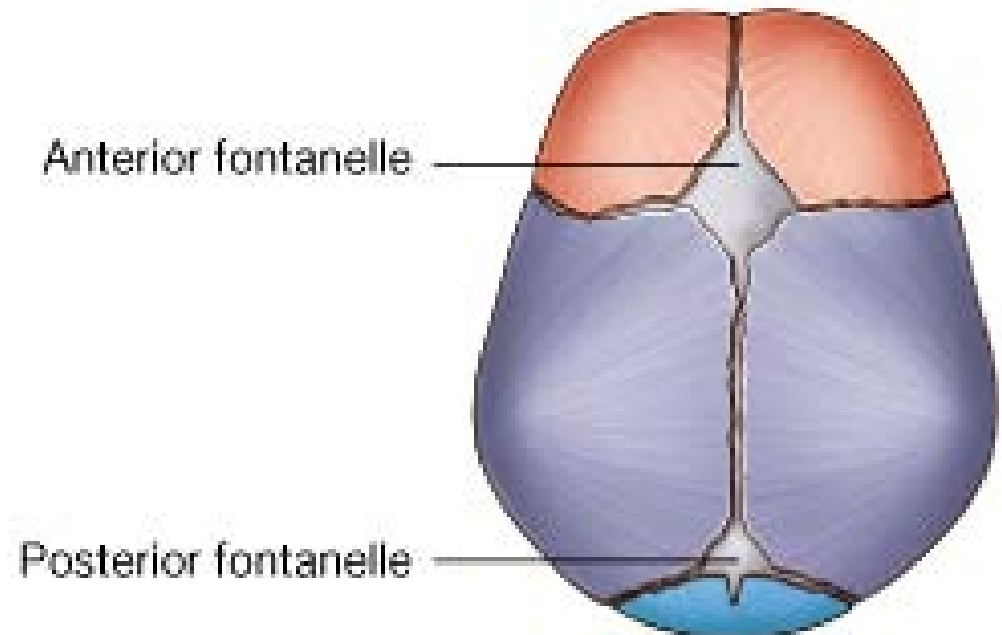
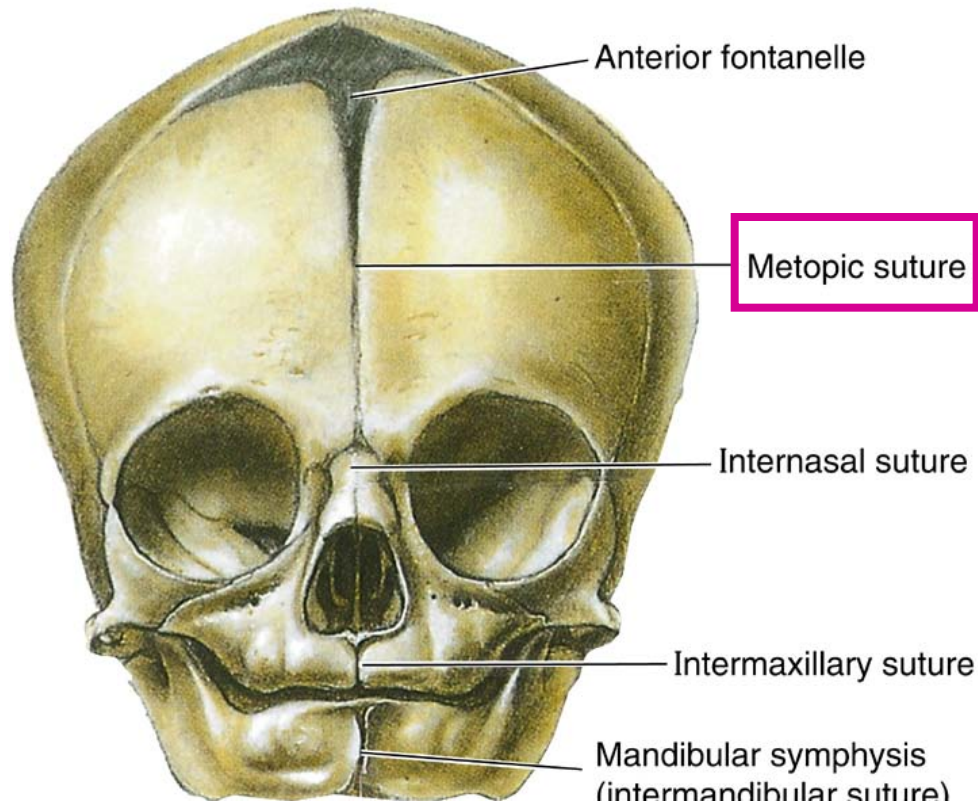
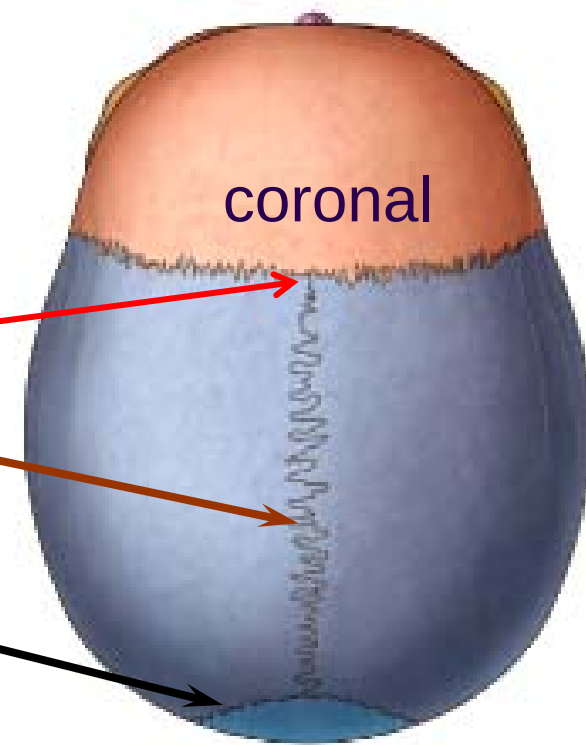
# Viscerocranium: inferior view

- Palatine
- Maxilla
- Zygoma



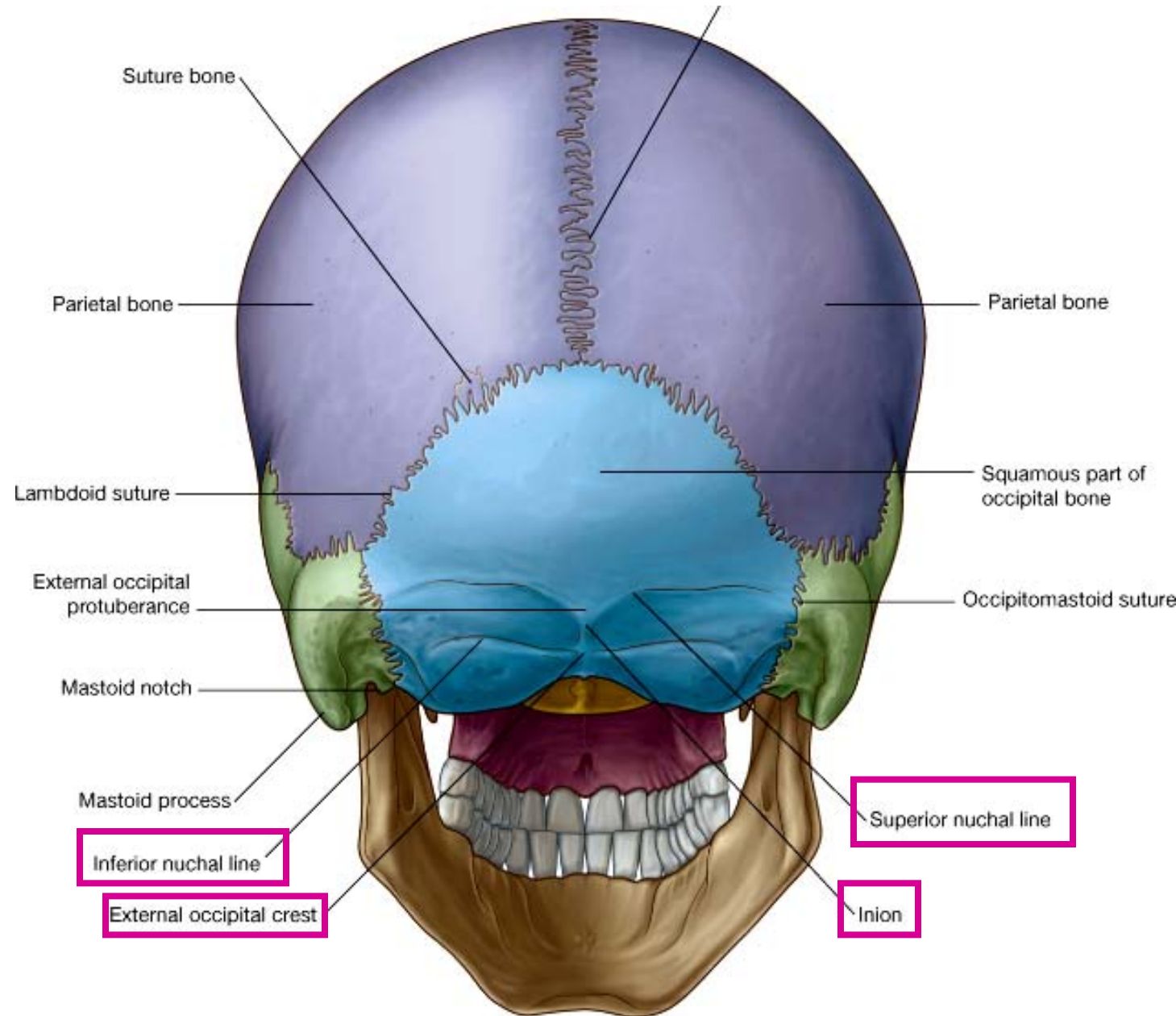
# Sutures and Fontanelles

- Coronal suture
- Sagittal suture
  - Bregma
- Lambdoid suture
- Metopic suture



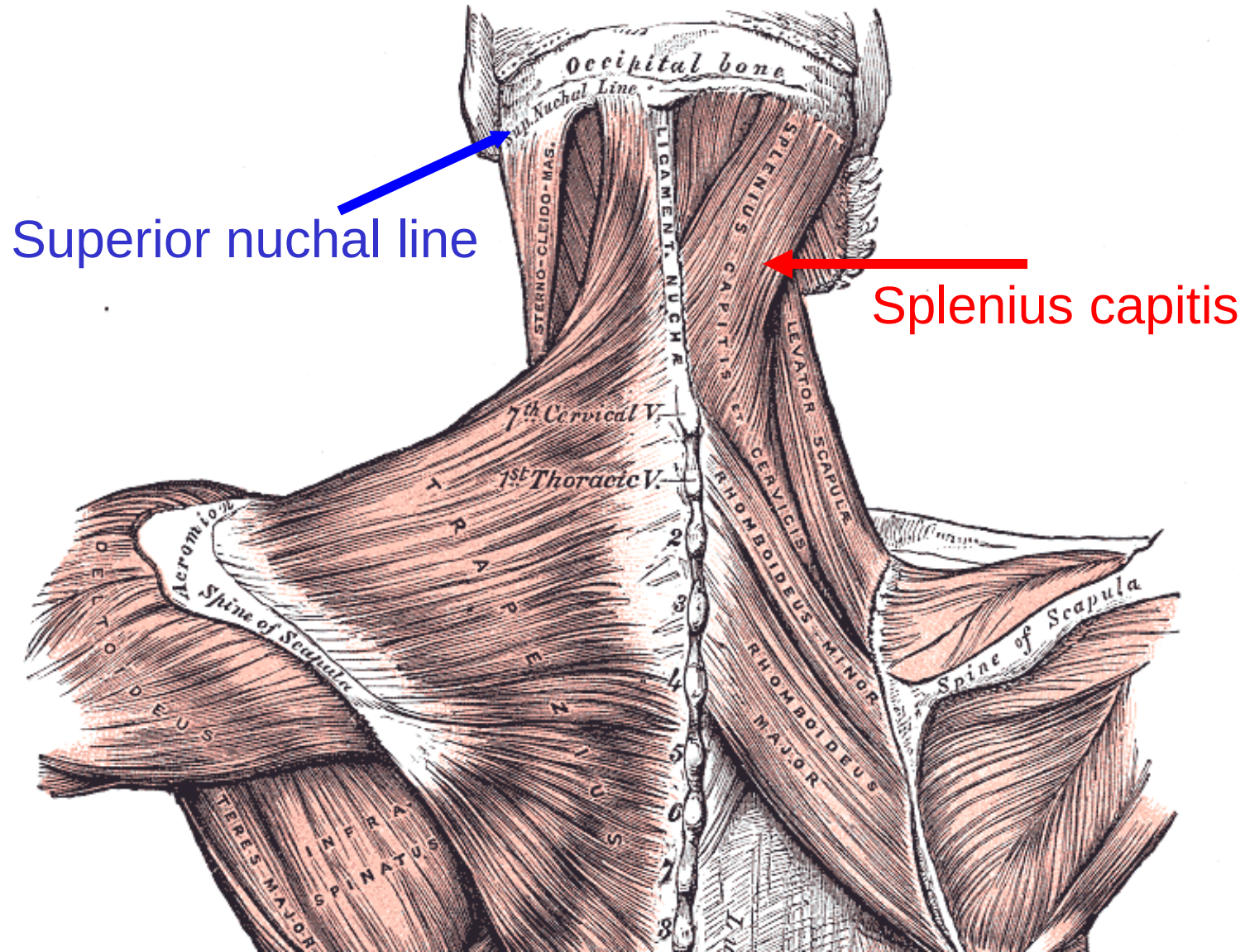
# Skull: posterior view

- external occipital protuberance (inion)
- external occipital crest
- superior nuchal line
- inferior nuchal line



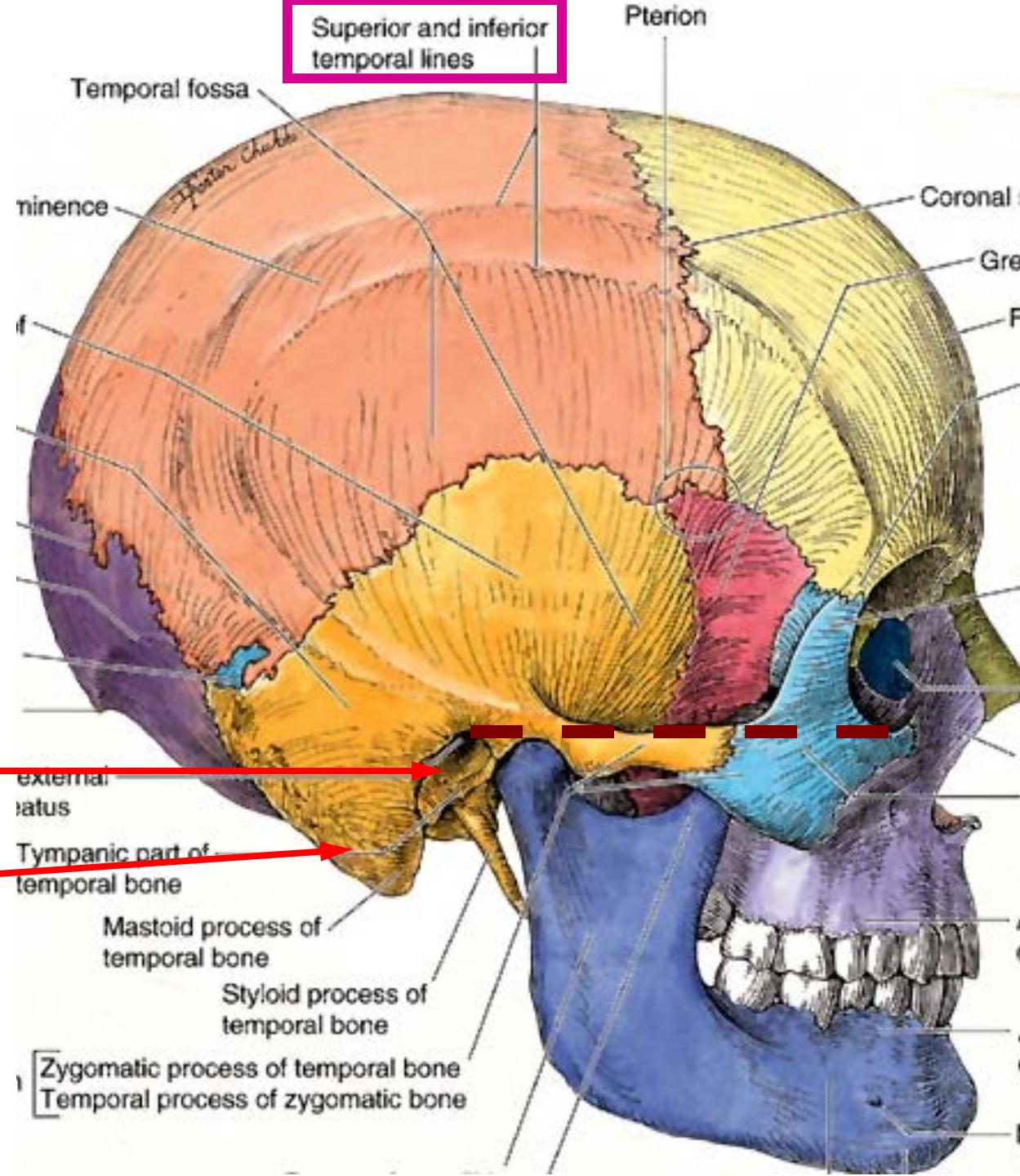
# Superior nuchal line

- Attachment of back muscles; e.g. **Splenius capitis** (“bandage”) from spinous process of C7/T1-3 to superior nuchal line; draw head back



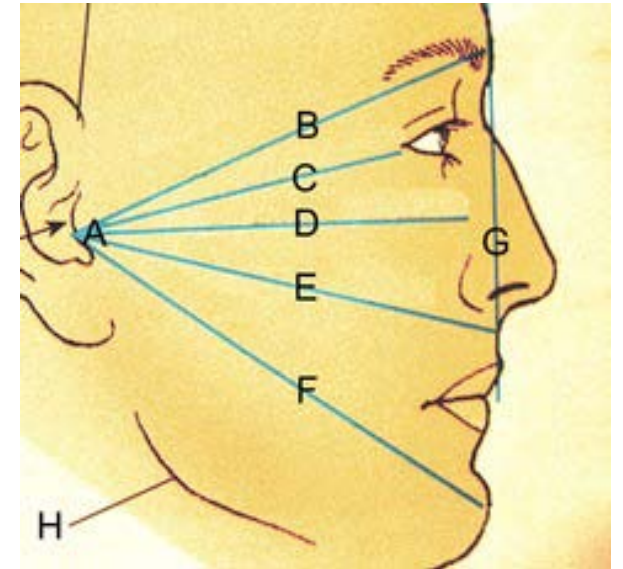
# Skull: lateral view

- Frankfurt plane  
(anatomical position, OrbitoMeatal line):  
upper margin of ext. acoustic meatus - orbit floor → horizontal
- superior temporal line;  
inferior temporal line
- external acoustic meatus; mastoid process
- level of ant., mid., post. cranial fossae

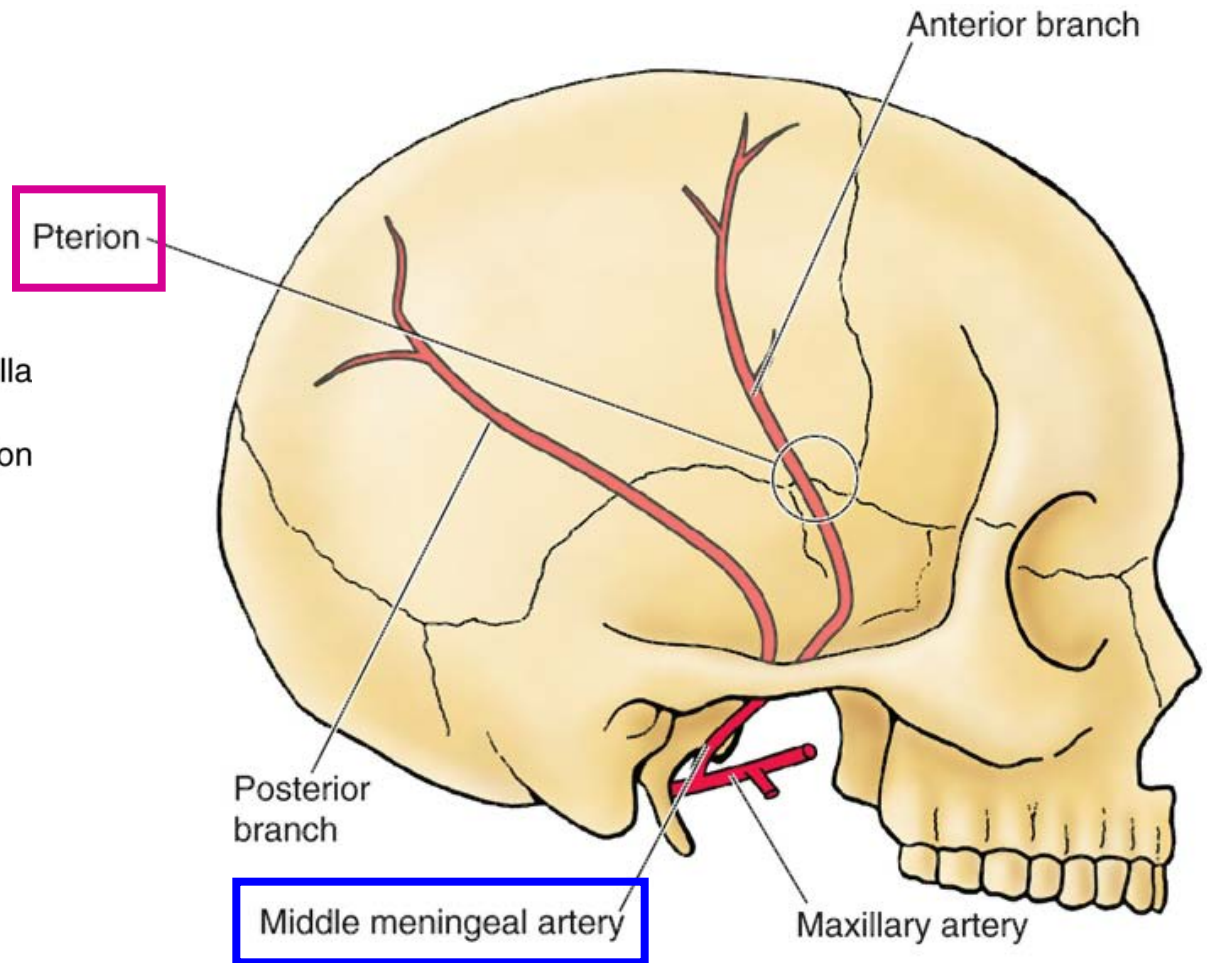
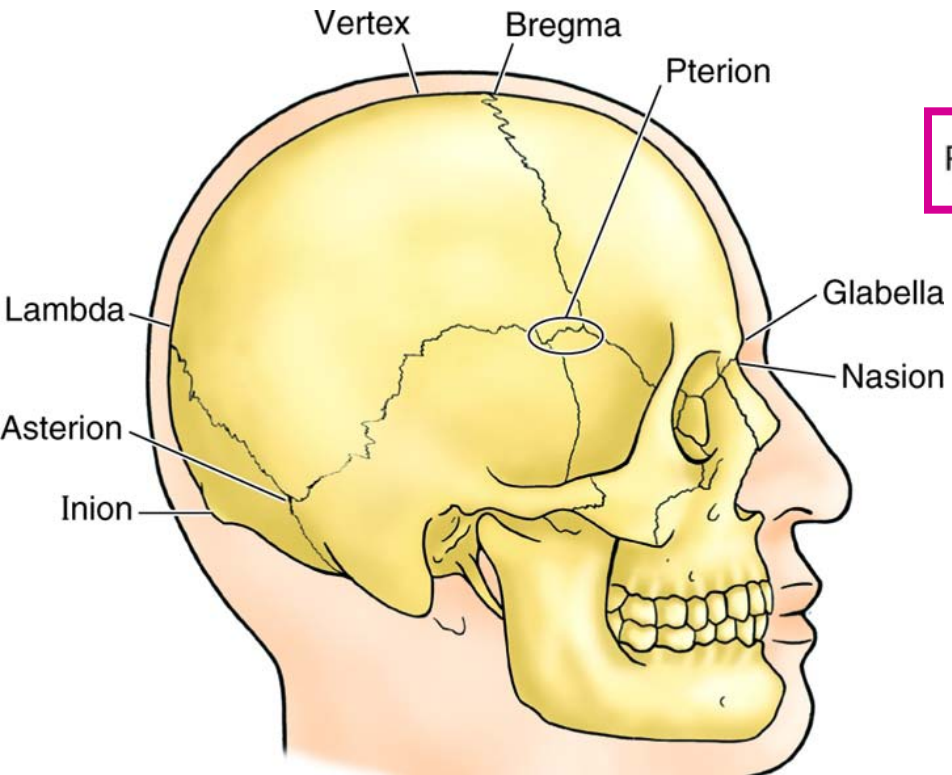


# OrbitoMeatal line (OM line) in radiology

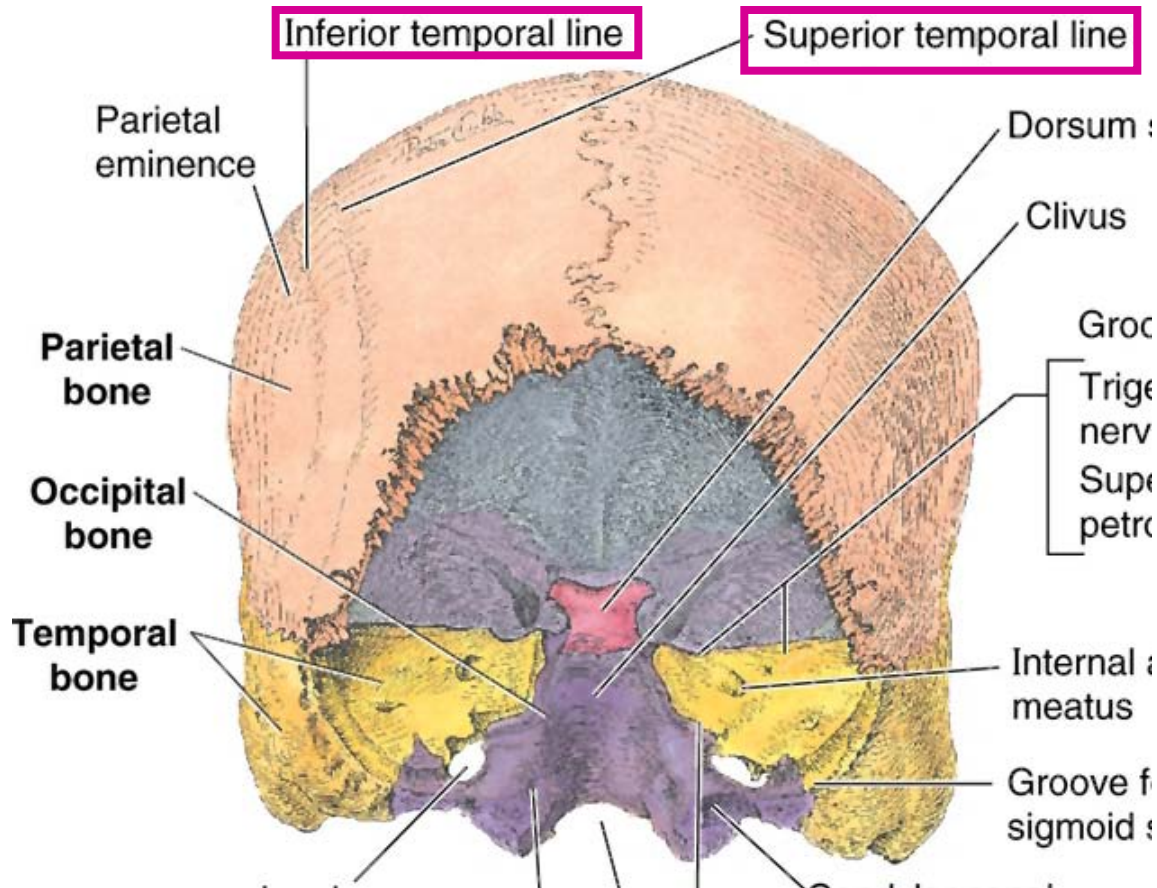
- from lateral canthus to external acoustic meatus



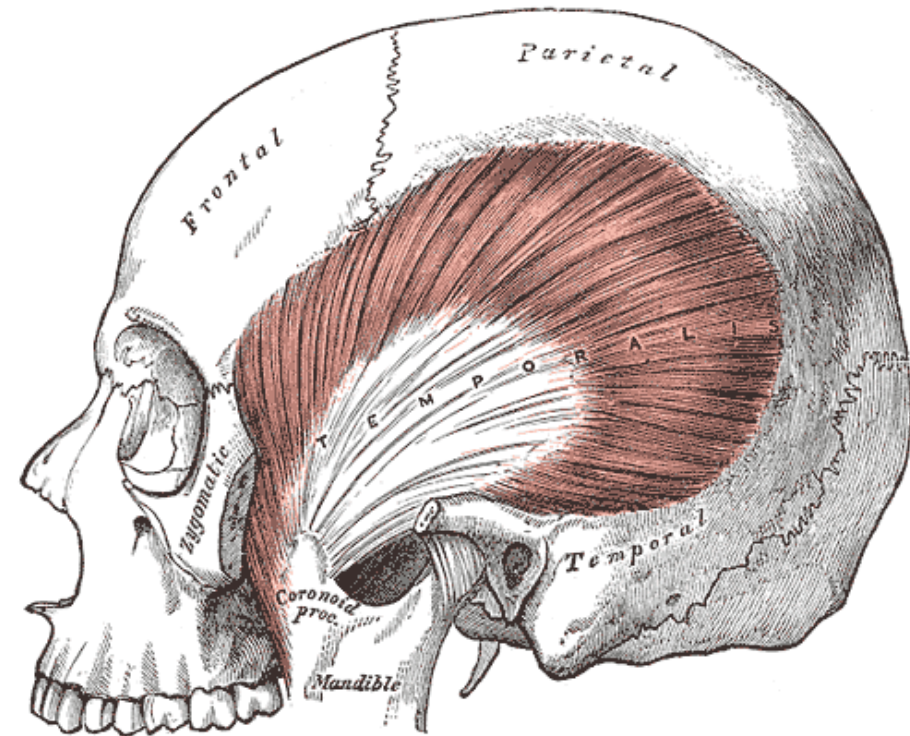
# Pterion



# Superior temporal line and Temporalis muscle

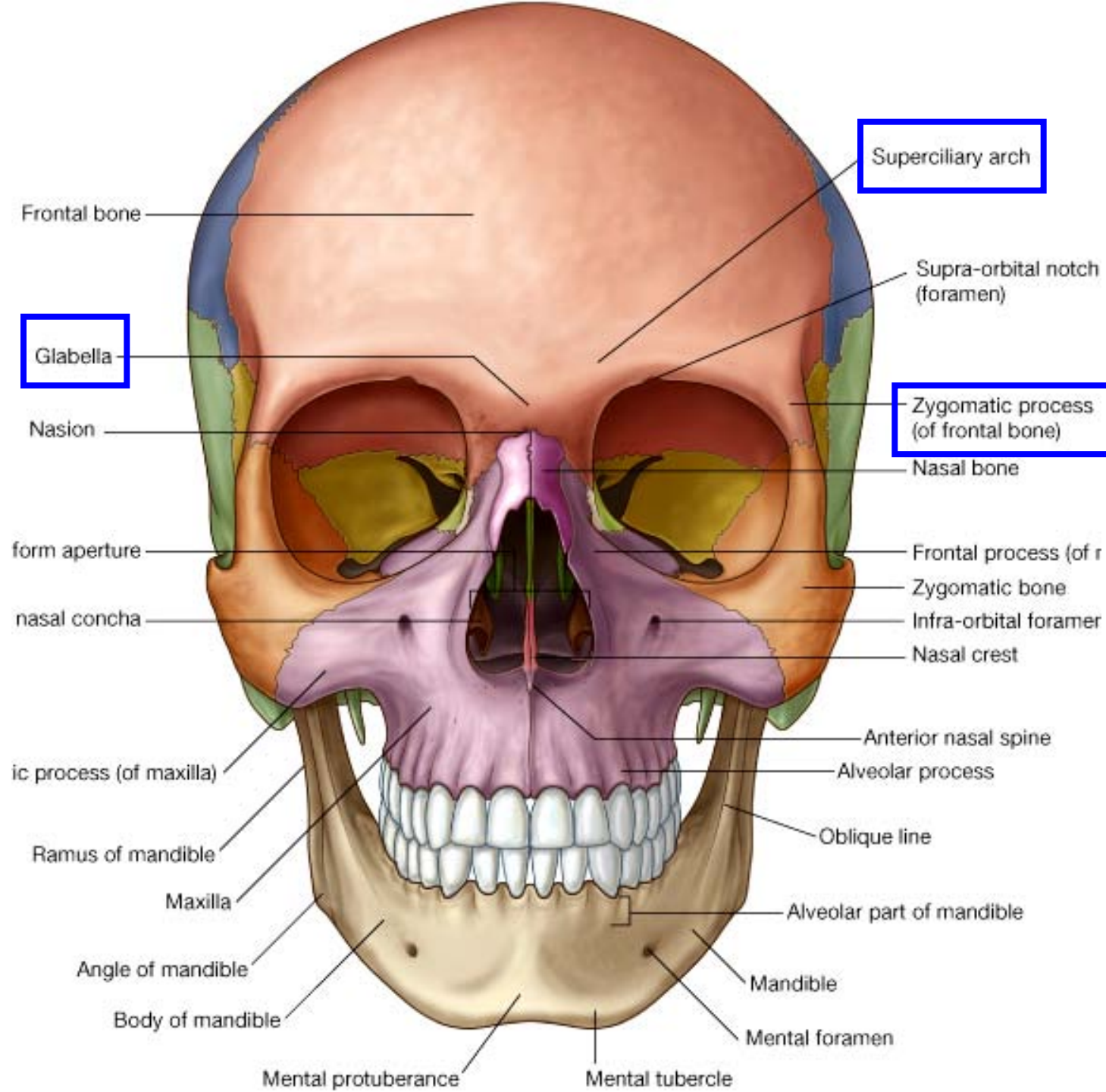


Posterior view



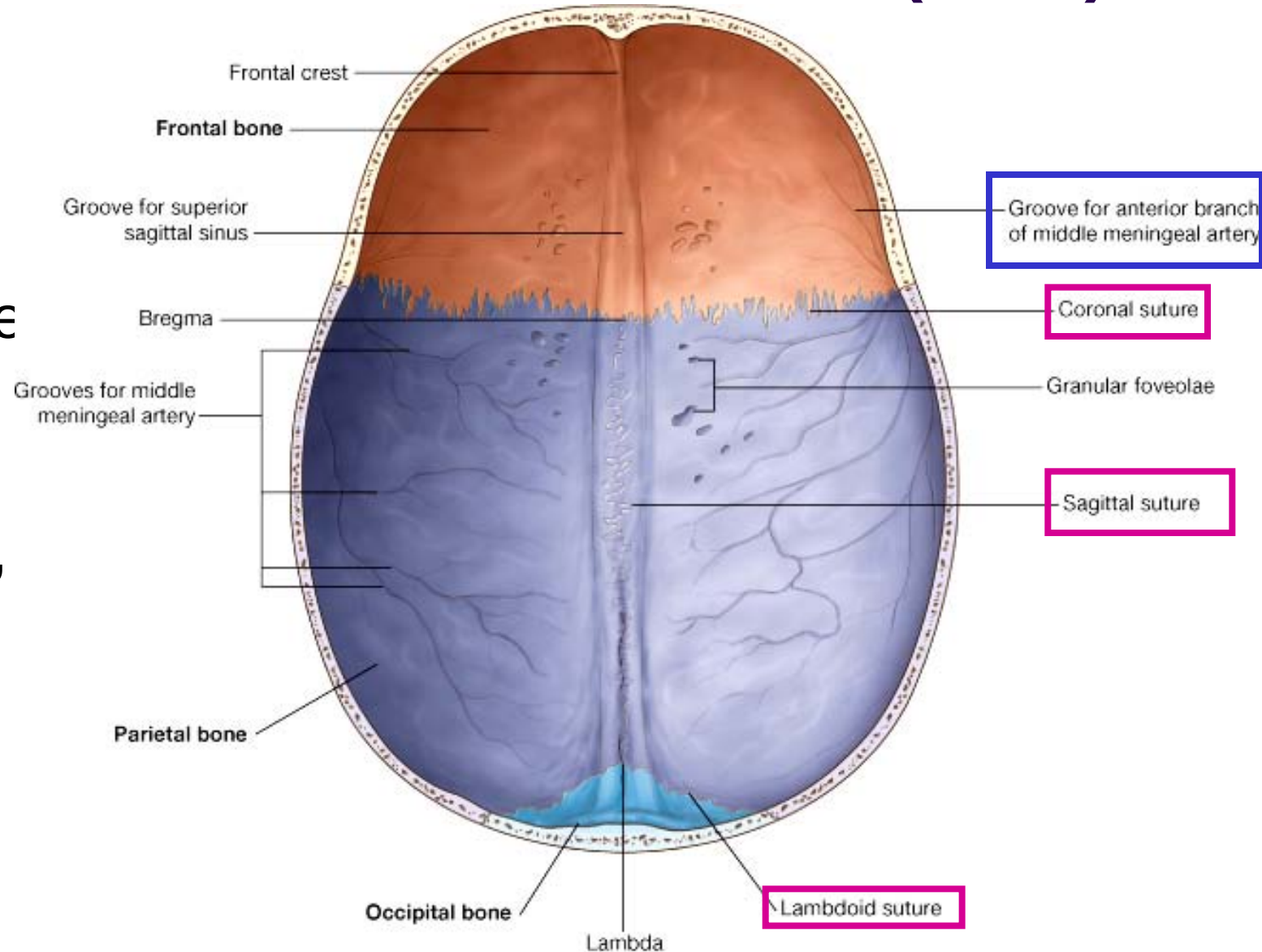
# Skull from front

- Superciliary arch
- Zygomatic proc. of frontal bone
- Glabella
- Zygomatic bone
- Frontal proc. of maxilla
- Frontal proc. of zygoma

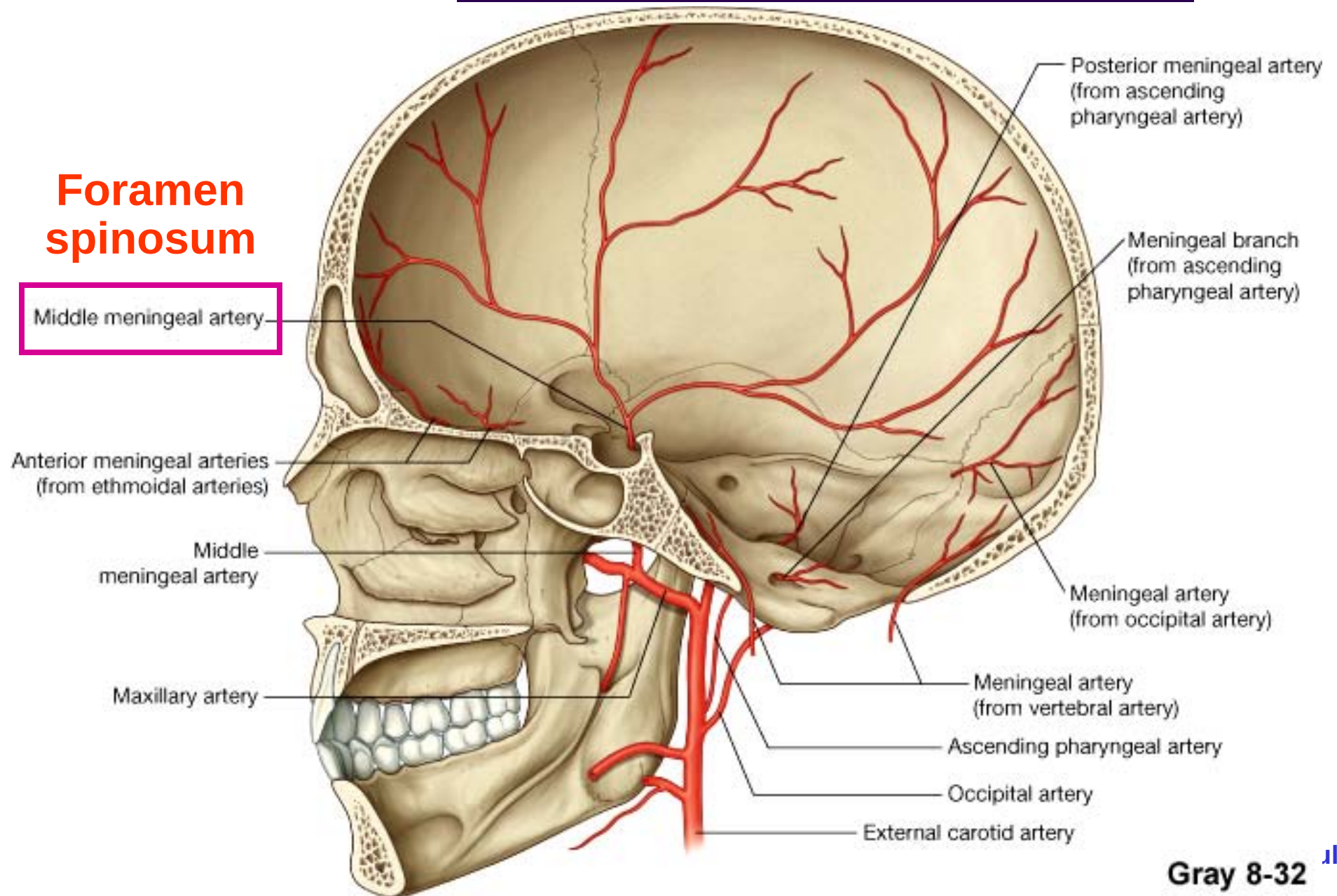


# Internal surface of the skull: The roof (vault)

- sagittal fissure
- coronal fissure
- lambdoid fissure
- grooves for middle meningeal vein, artery

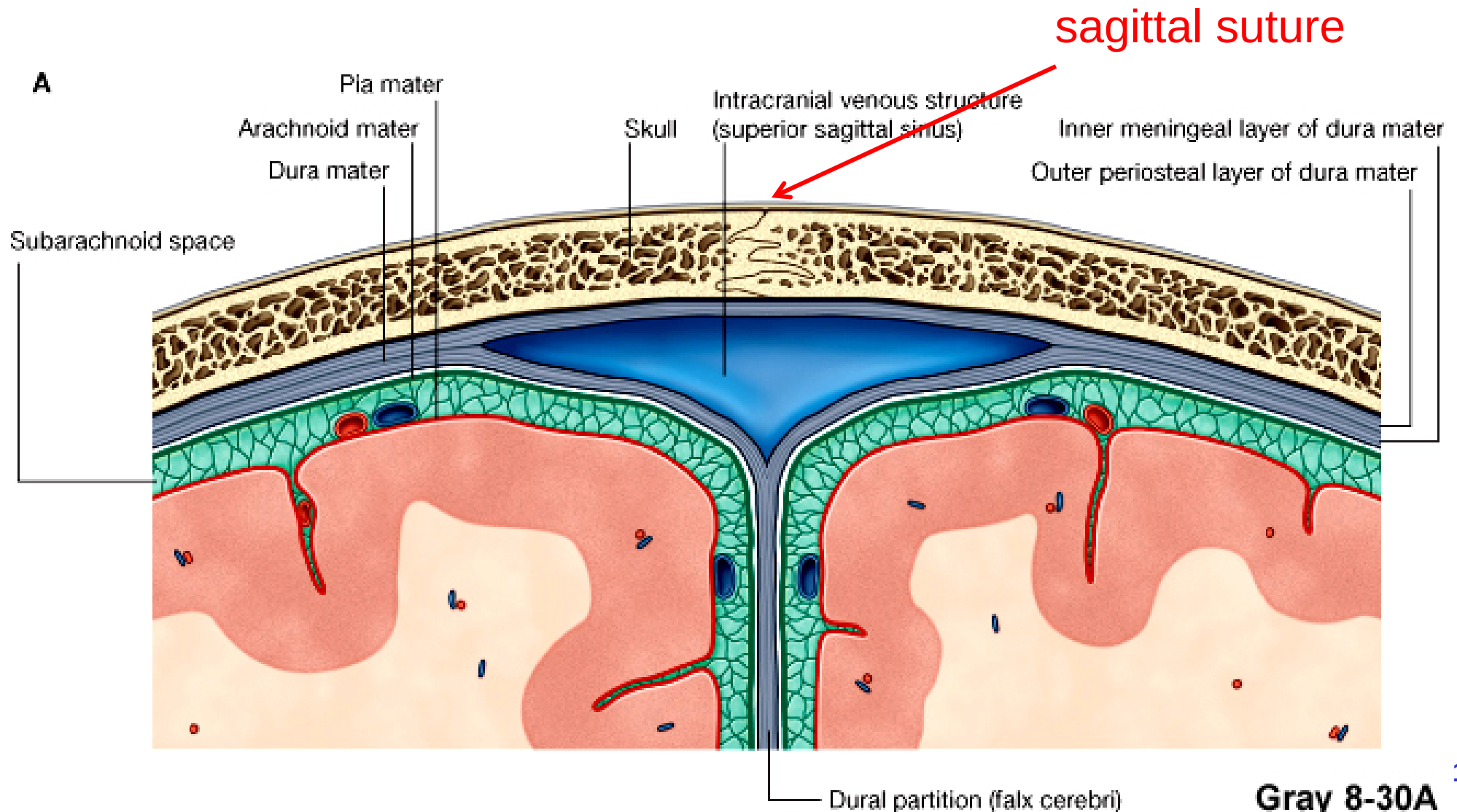


# Grooves for middle meningeal arteries



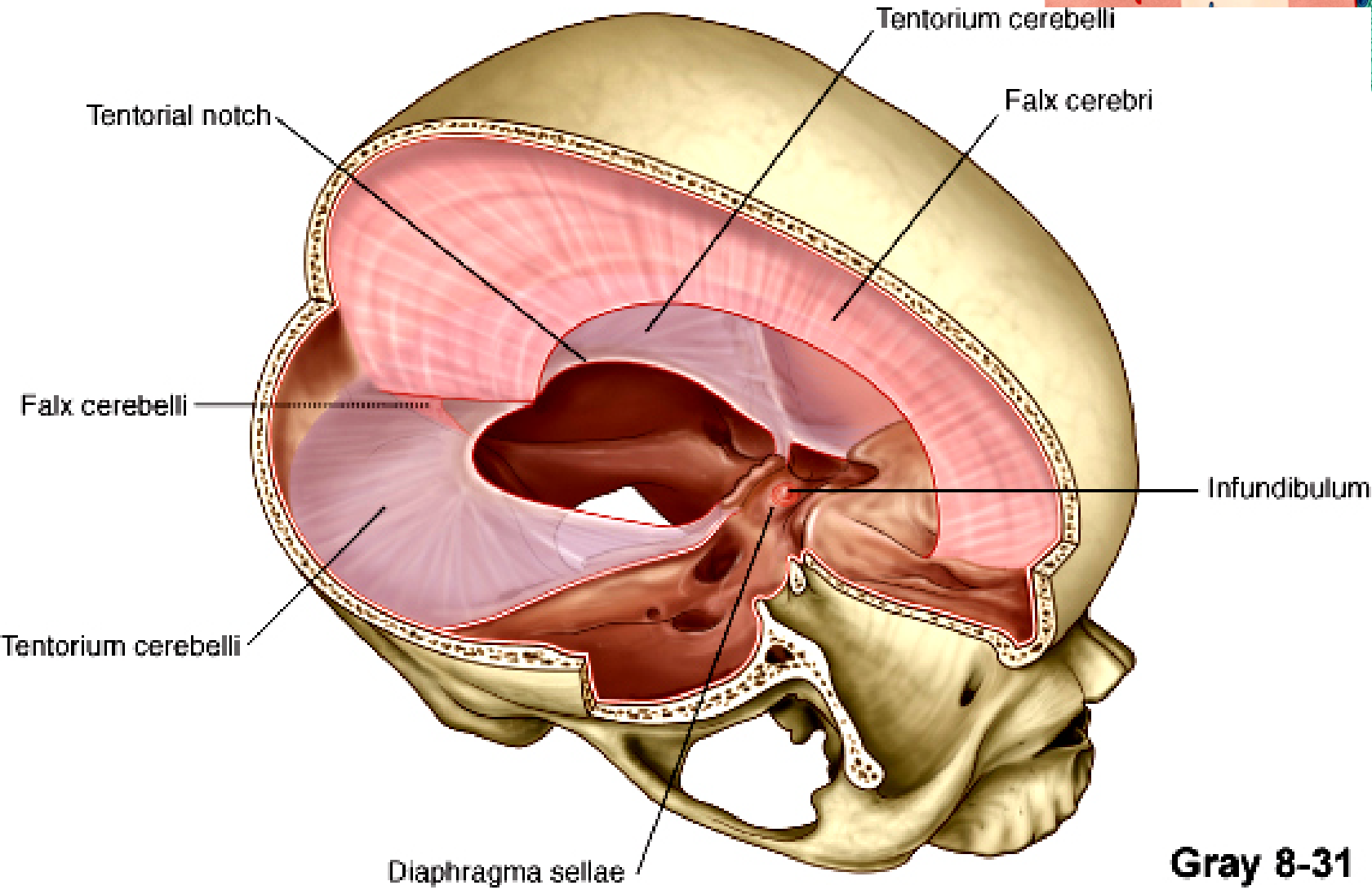
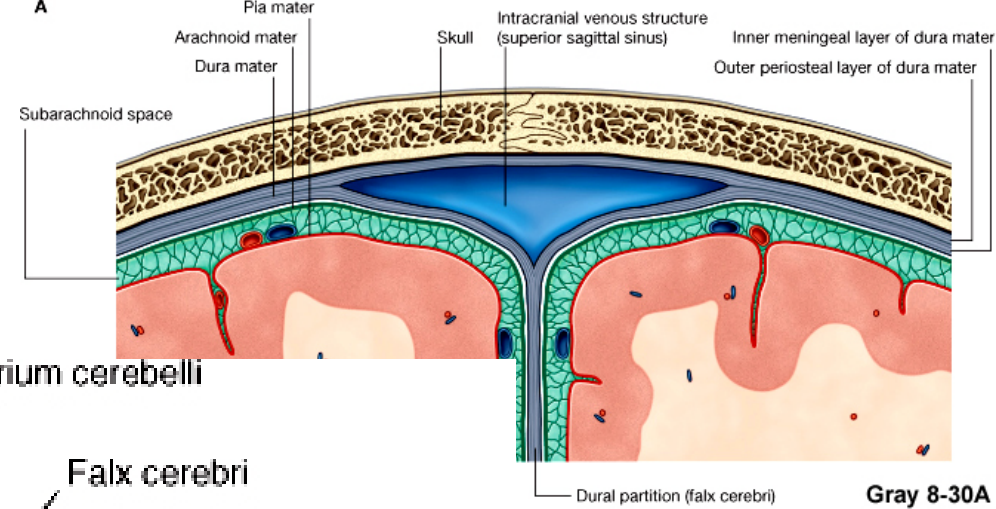
# Sagittal fissure: superior sagittal sinus

- sup. sagittal sinus (SSS)



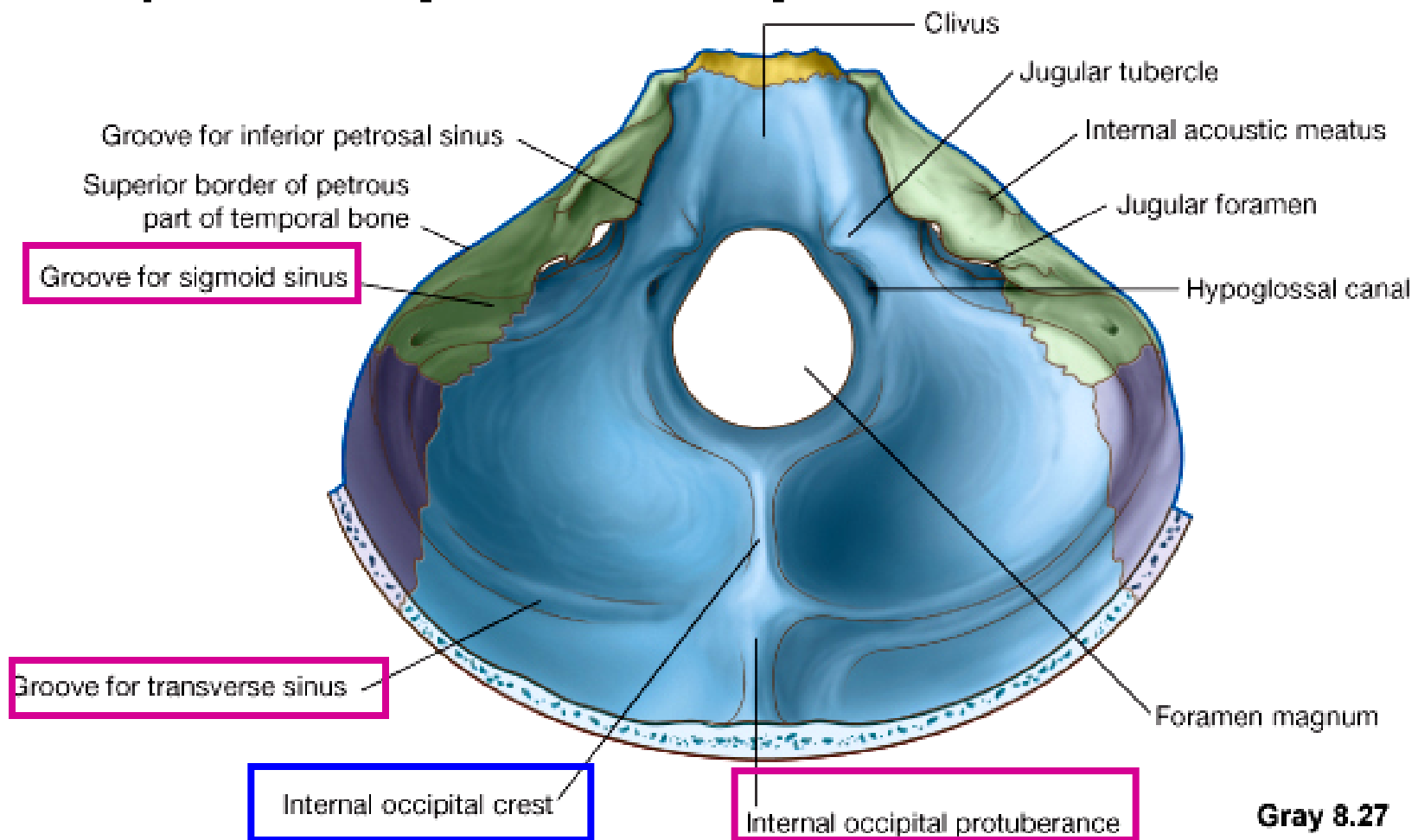
# Sagittal fissure: falx cerebri

- Dura extending from skull



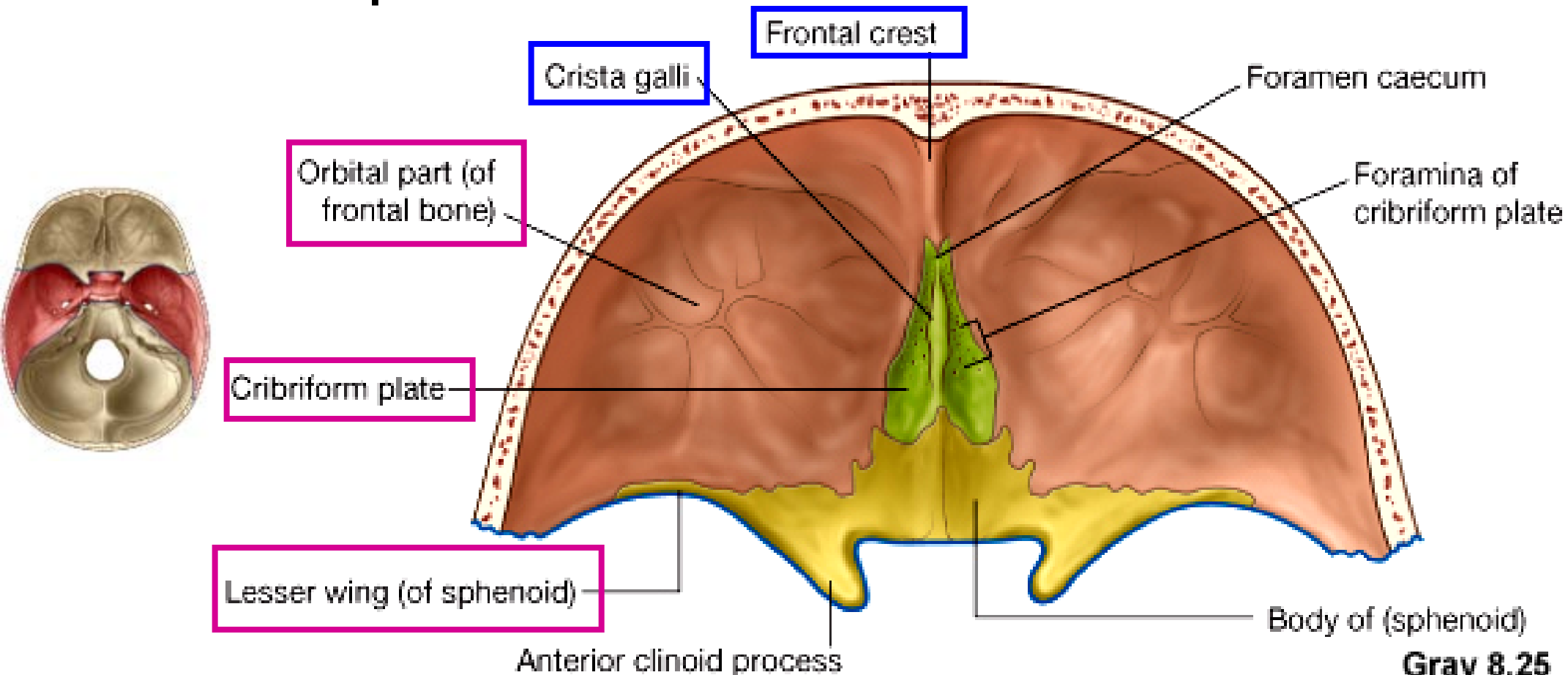
# Dural sinuses in Posterior cranial fossa

- groove for transverse sinus; confluence of the sinus - **internal occipital protuberance**
- tentorium cerebelli: separating occipital lobe from cerebellum
- **internal occipital crest** [- falx cerebelli]



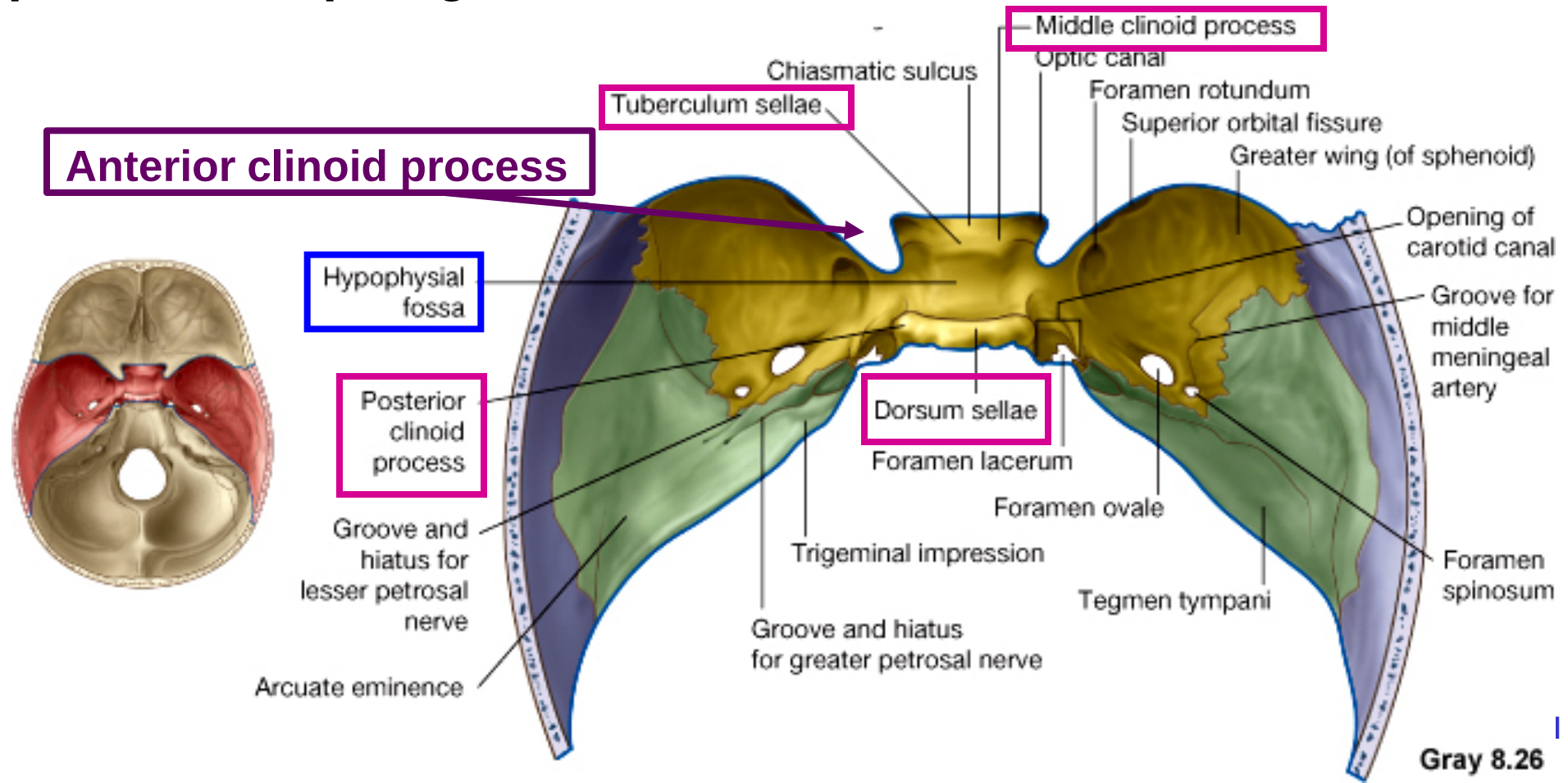
# Inner surface of Anterior cranial fossa

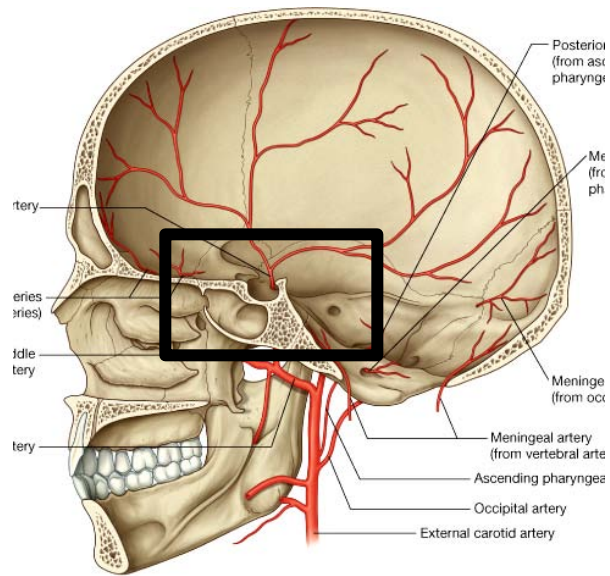
- Frontal bone: Orbital plate: thin except near superciliary arch; frontal air sinus
- **Lesser wing of sphenoid:** ant. clinoid processes
- **Ethmoid bone:** **crista galli** (*attachment of falx cerebri*)
- **Cribriform plate**



# Inner surface of Middle cranial fossa (1/2)

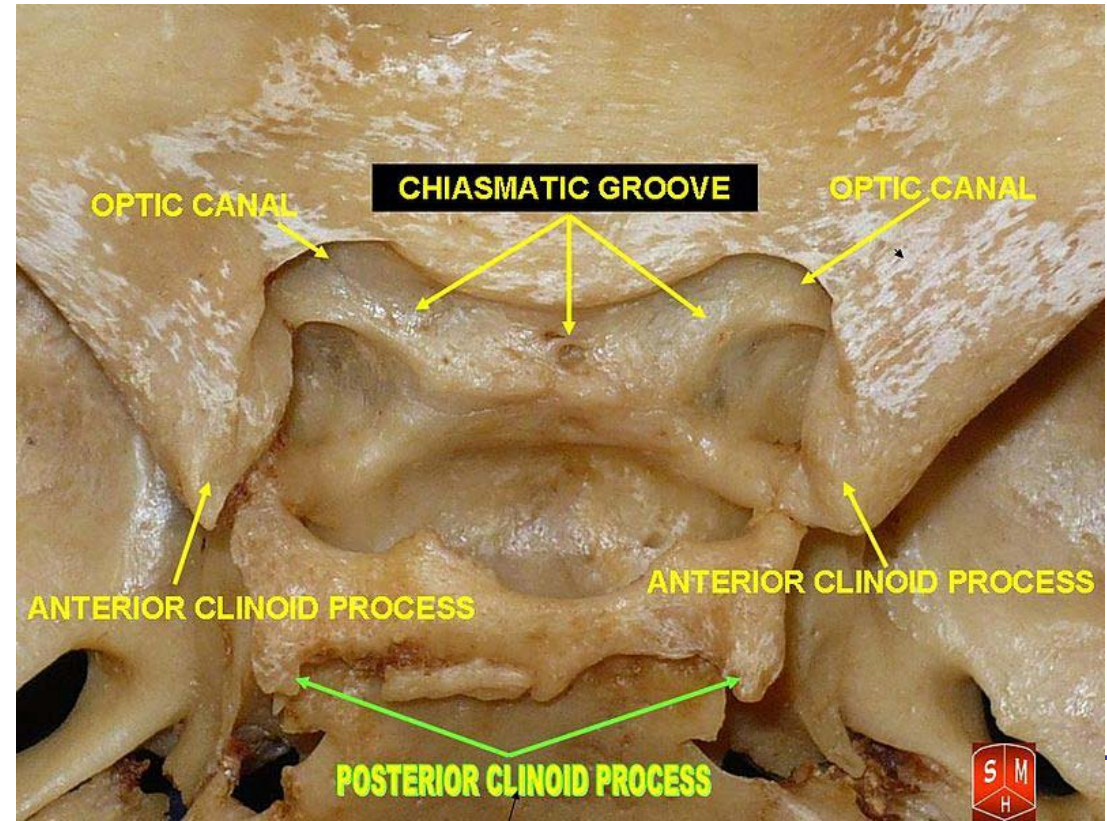
- **Temporal bone: petrous part:** thick, contains inner ear
- **Hypophyseal fossa** = sella turcica (Turk's saddle); tuberculum sellae, dorsum sellae
- **Ant. clinoid process** (clinoid in Latin: bed-side); **Post. clinoid process**; **Diaphragma sellae**



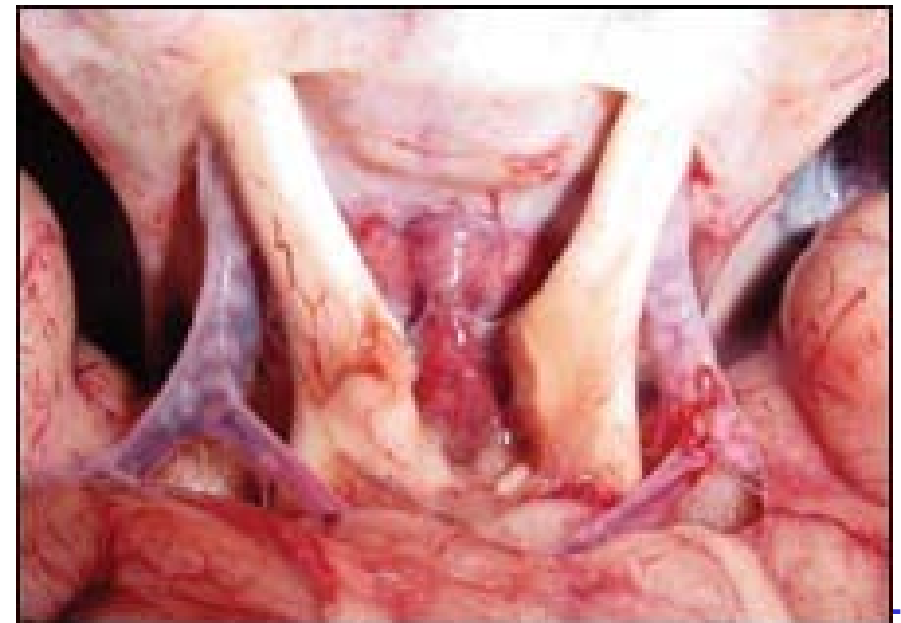
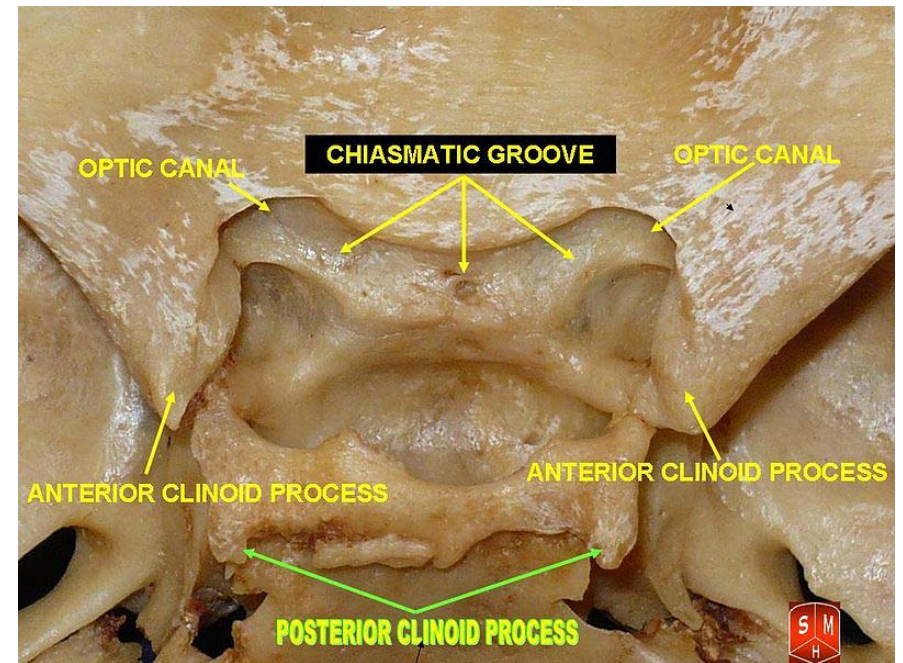
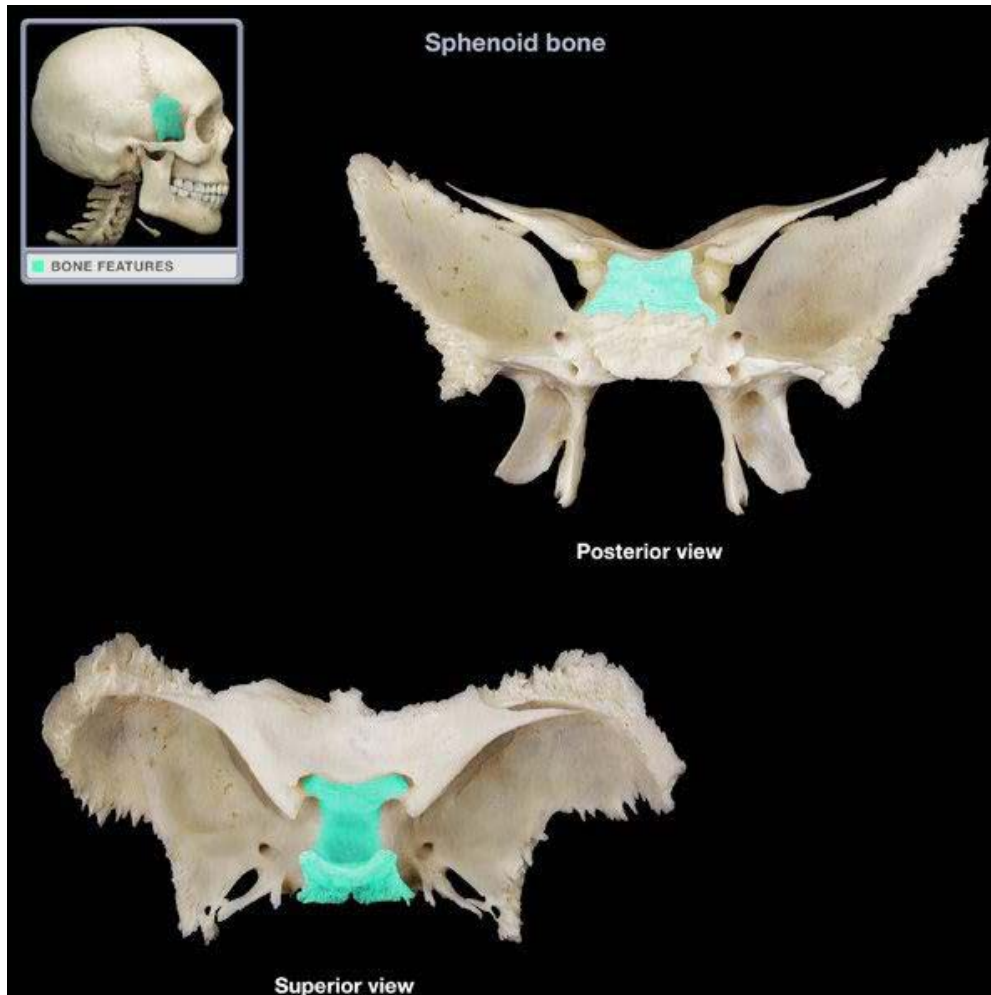


## Sella turcica

- Tuberculum sella
- Hypophyseal fossa: pituitary gland
- Dorsum sella

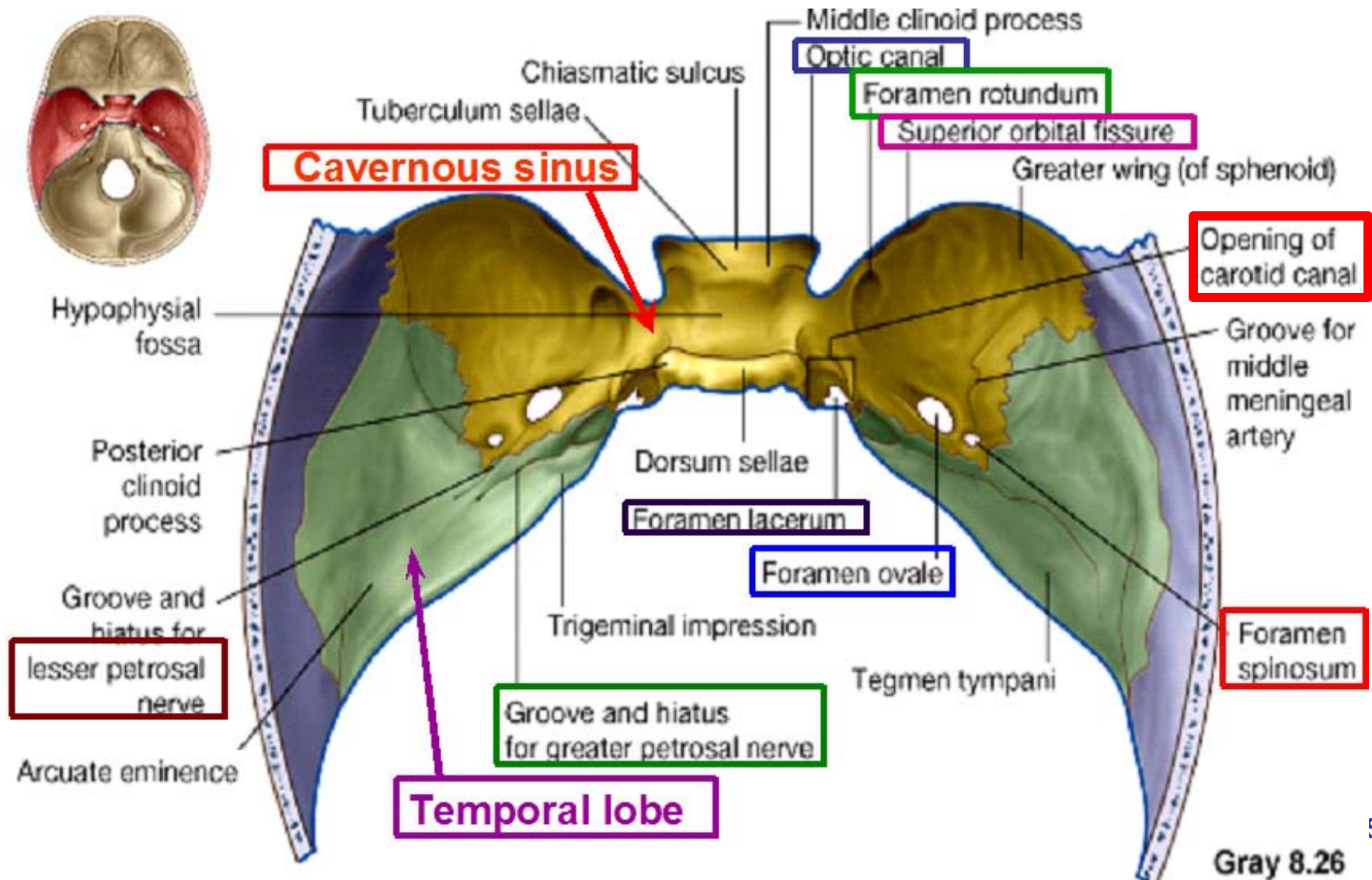


# Sella turcica in sphenoid bone



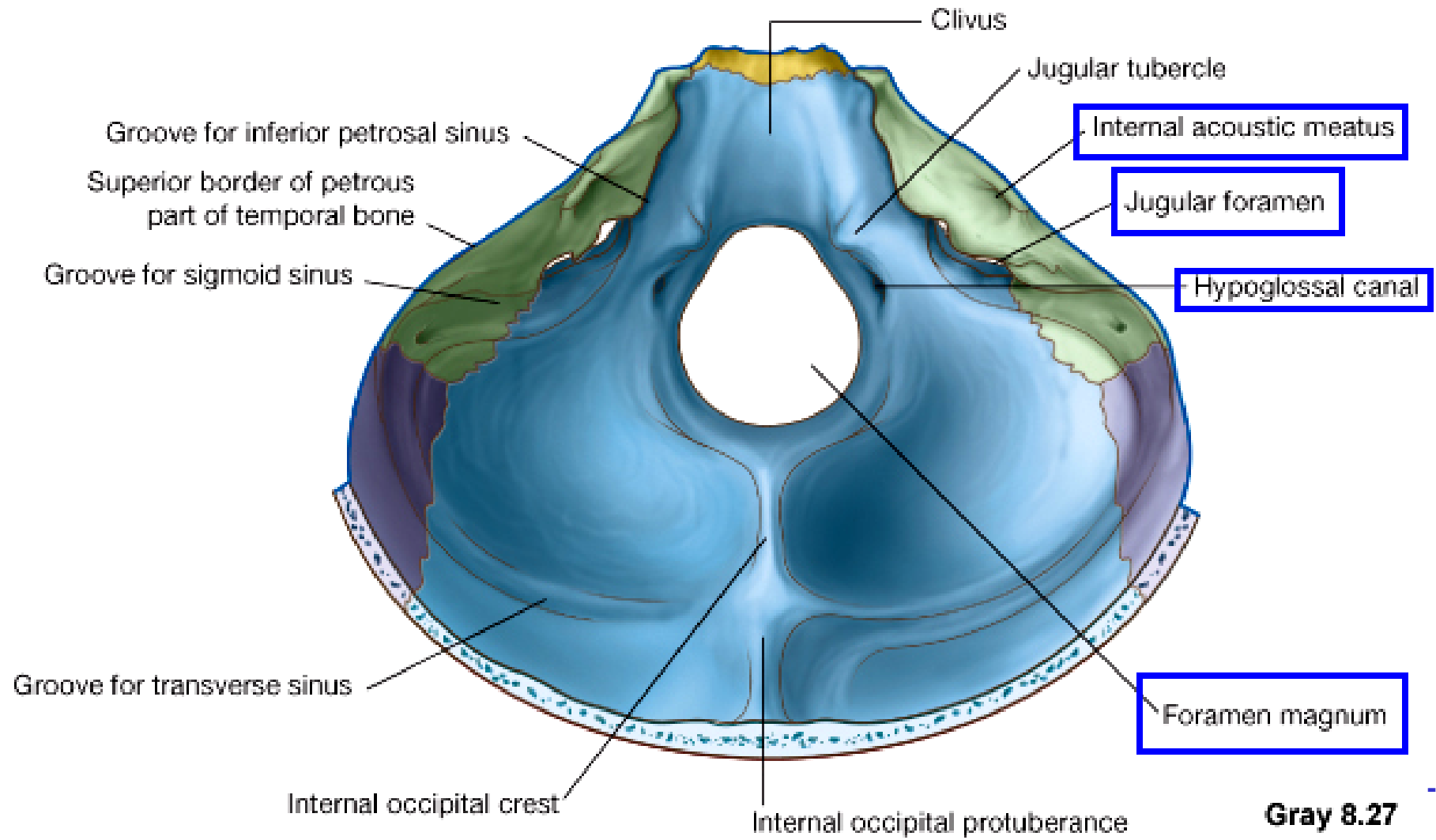
# Inner surface of Middle cranial fossa (2/2)

Superior orbital fissure (V1), foramen Rotundum (V2), foramen Ovale (V3)  
foramen spinosum; opening of Int. Carotid Art – Cavernous sinus



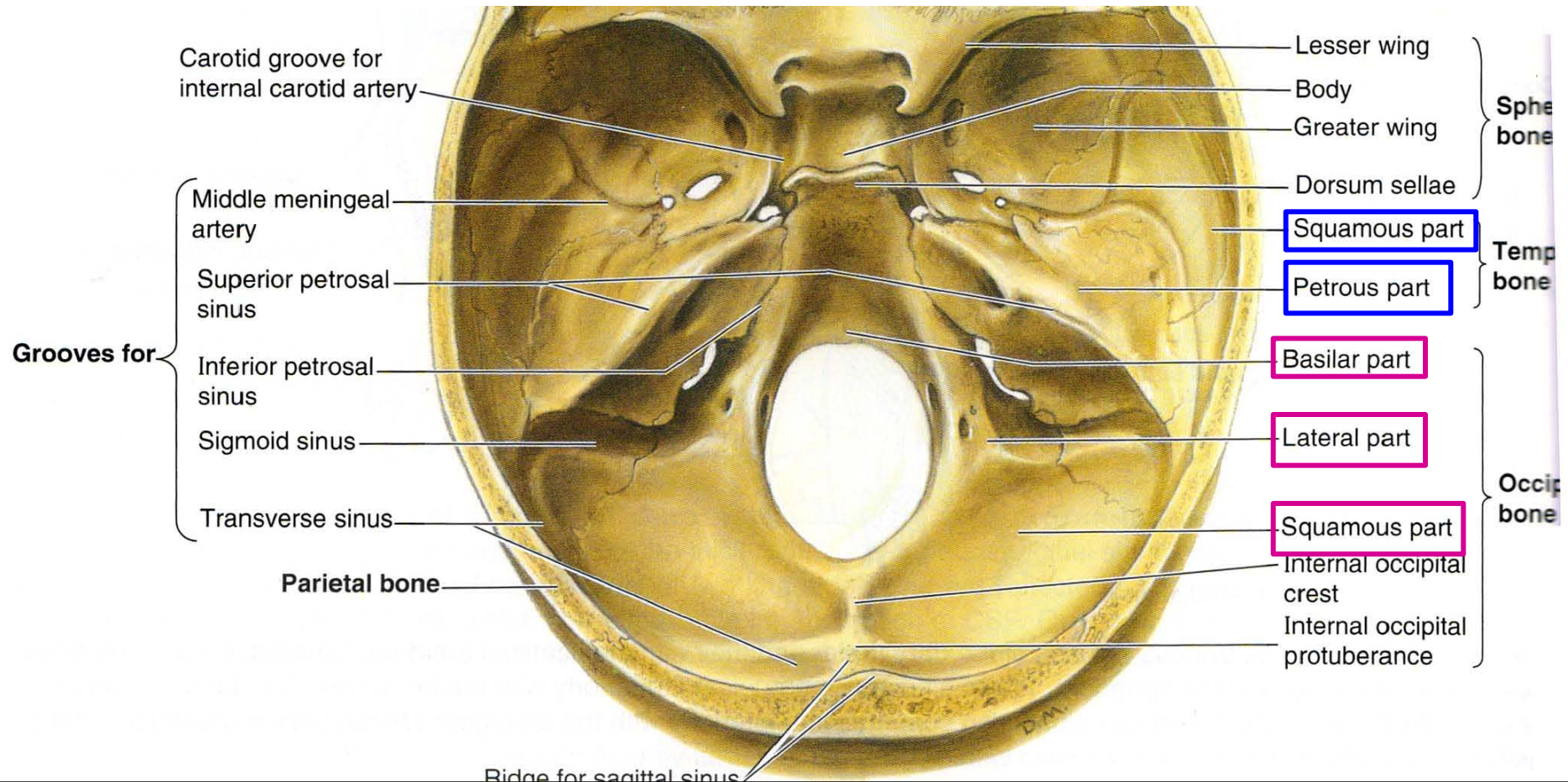
# Inner surface of Posterior fossa

- petrous portion of temporal (inner ear)
  - **int. acoustic meatus** (N. VII and N. VIII.)
- to and from neck: **foramen magnum**; **jugular foramen**; **hypoglossal canal**



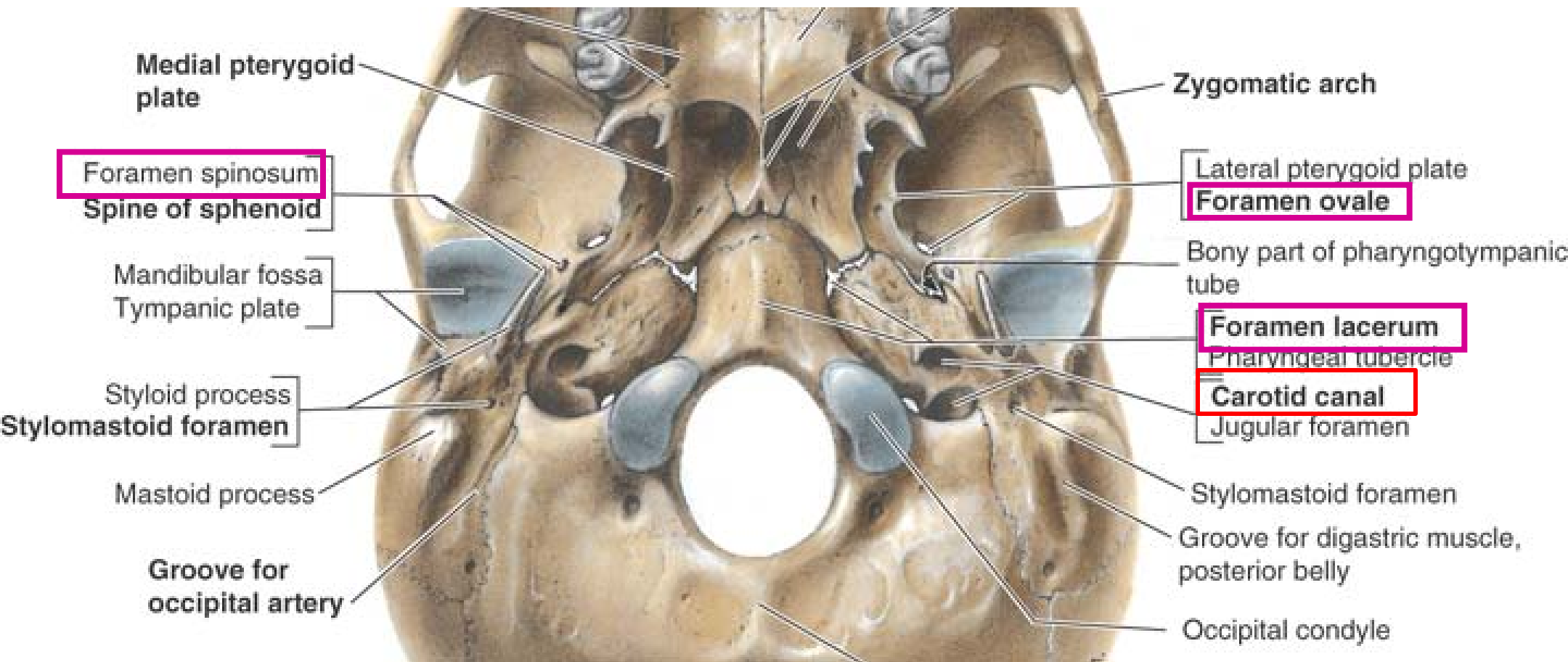
# Inner surface of Occipital bone, Temporal bone

- Occipital bone: Basilar part, [clivus]; Lateral parts; Squamous part (squama occipitalis)
- Temporal bone: Squamous part; Petrous part; (Mastoid part; Styloid process)



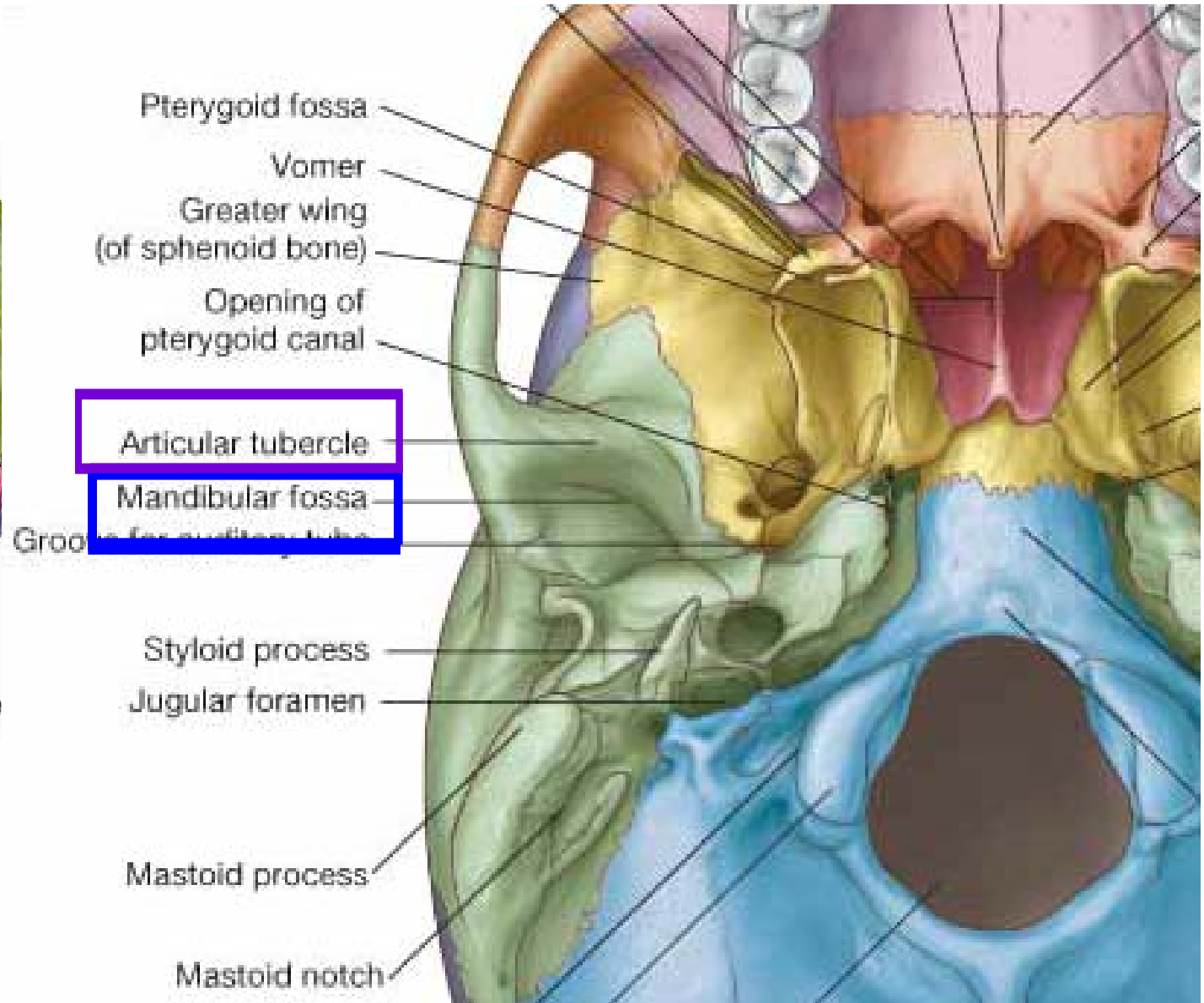
# Floor (Outer surface) of middle cranial fossa-1

- foramen ovale (V3); foramen spinosum: (spine of sphenoid bone close to foramen) for middle meningeal a.
- foramen lacerum: cartilage (internal carotid artery)



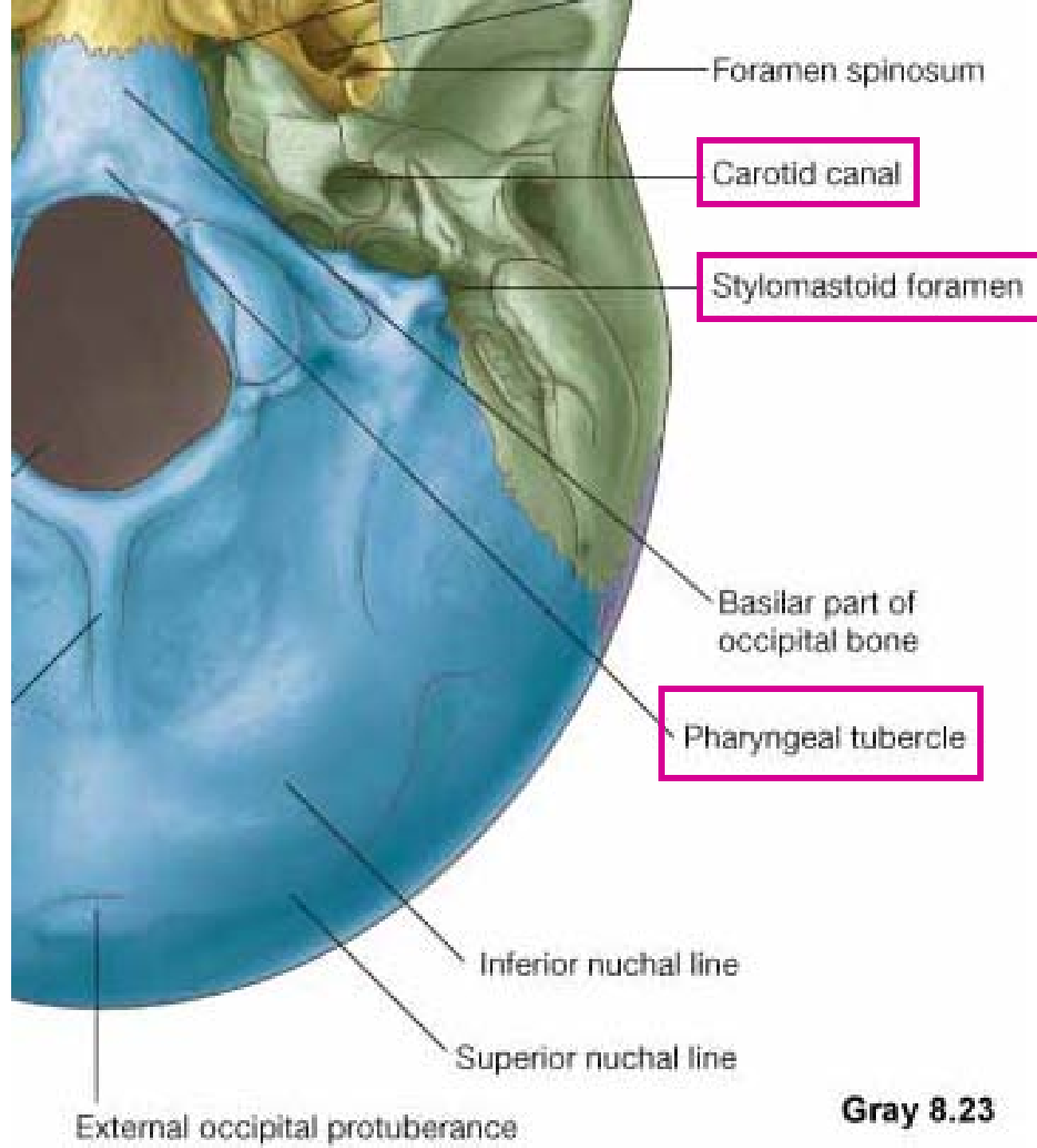
# Floor (Outer surface) of middle cranial fossa-2

- mandibular fossa, articular tubercle

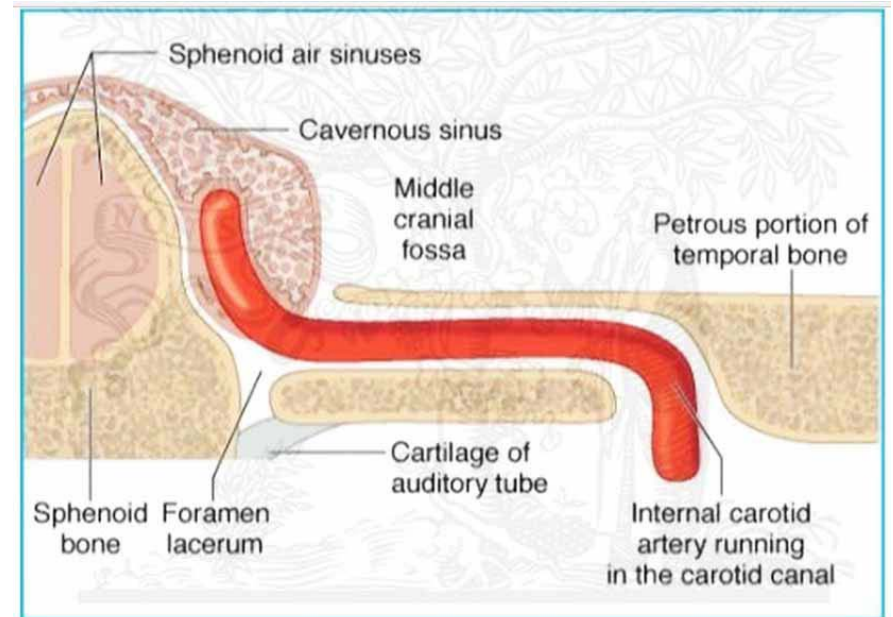
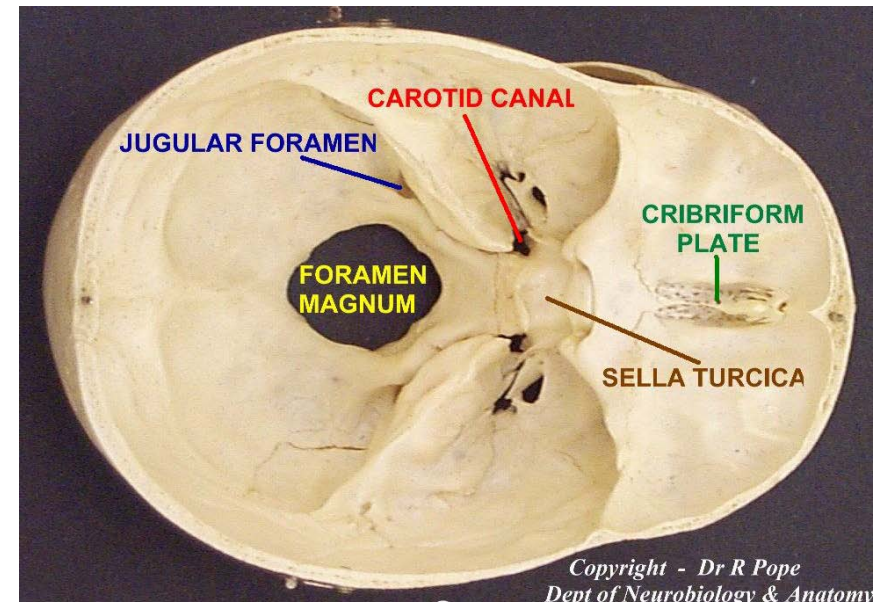
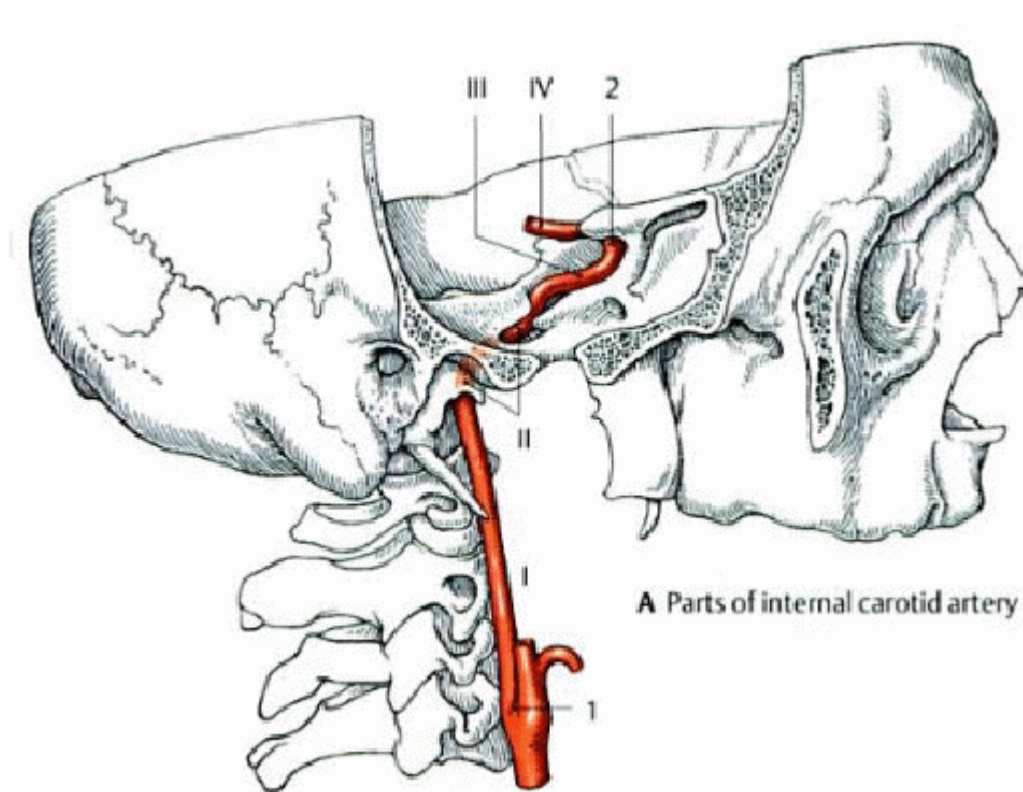


# Outer surface of Post. cranial fossa

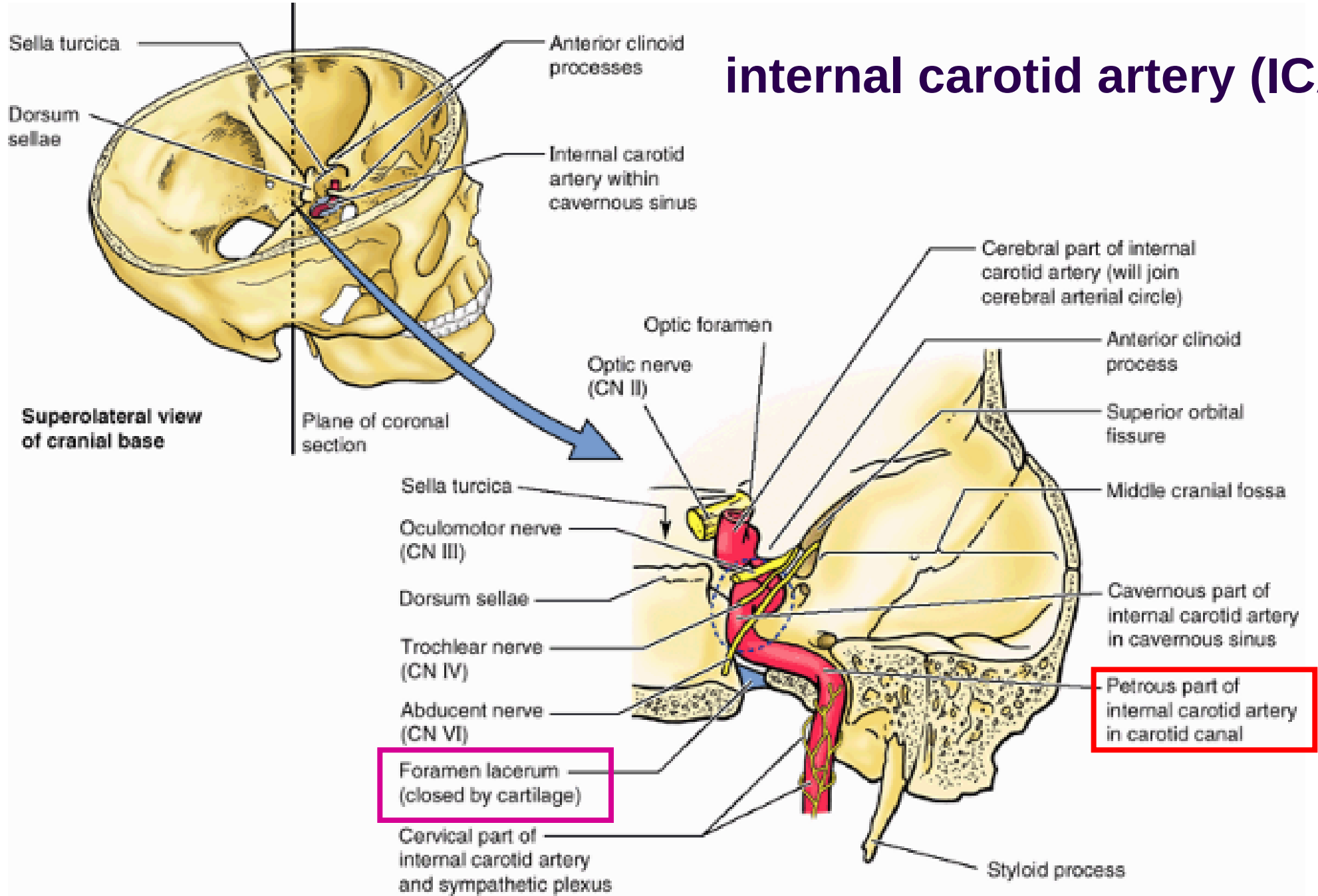
- sphenoid and occipital fused in the midline
- opening of carotid canal (ICA)
- stylomastoid foramen (CN VII)
- pharyngeal tubercle



# carotid canal for internal carotid artery

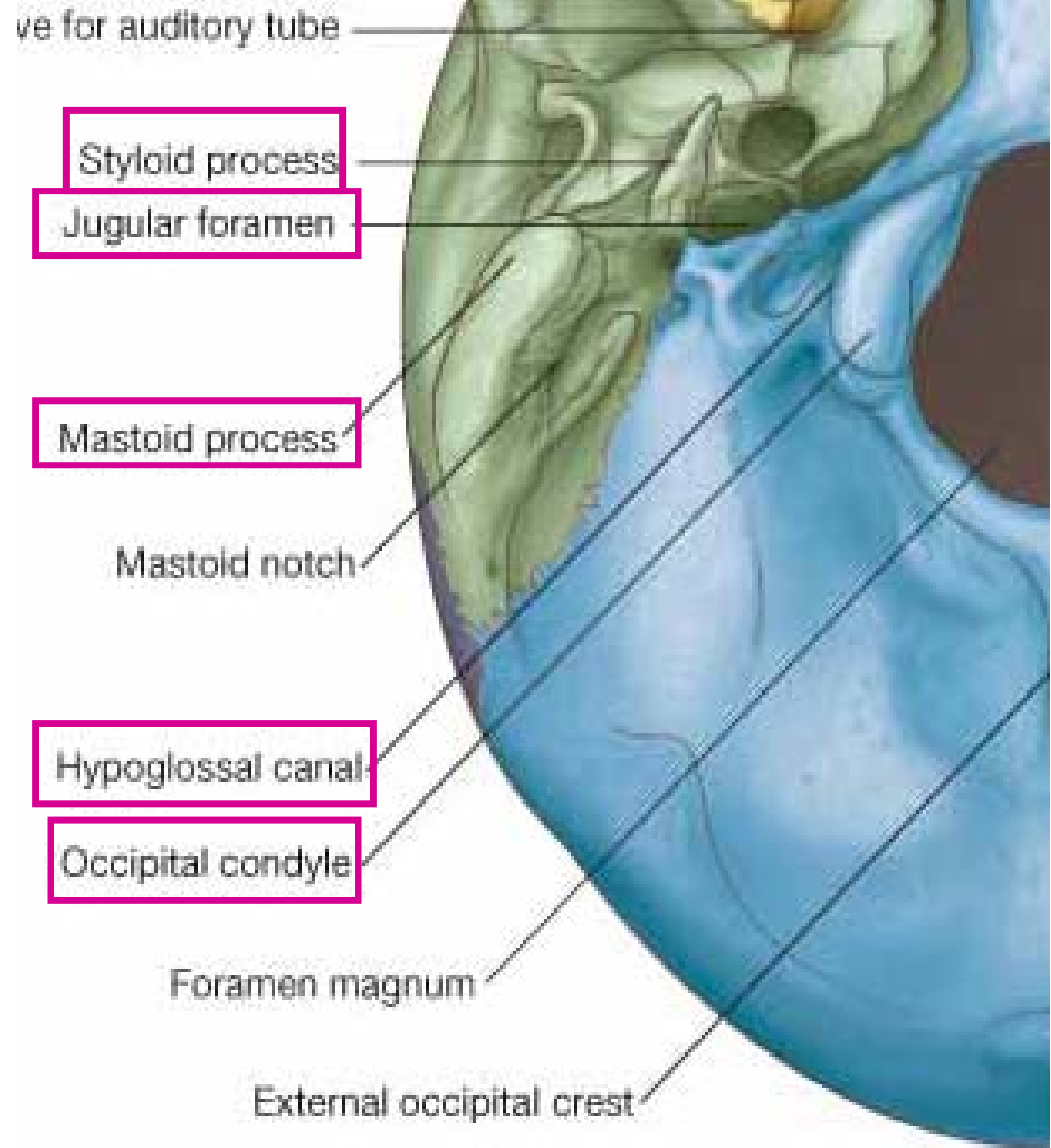


# internal carotid artery (ICA)



# Outer surface of Post. cranial fossa

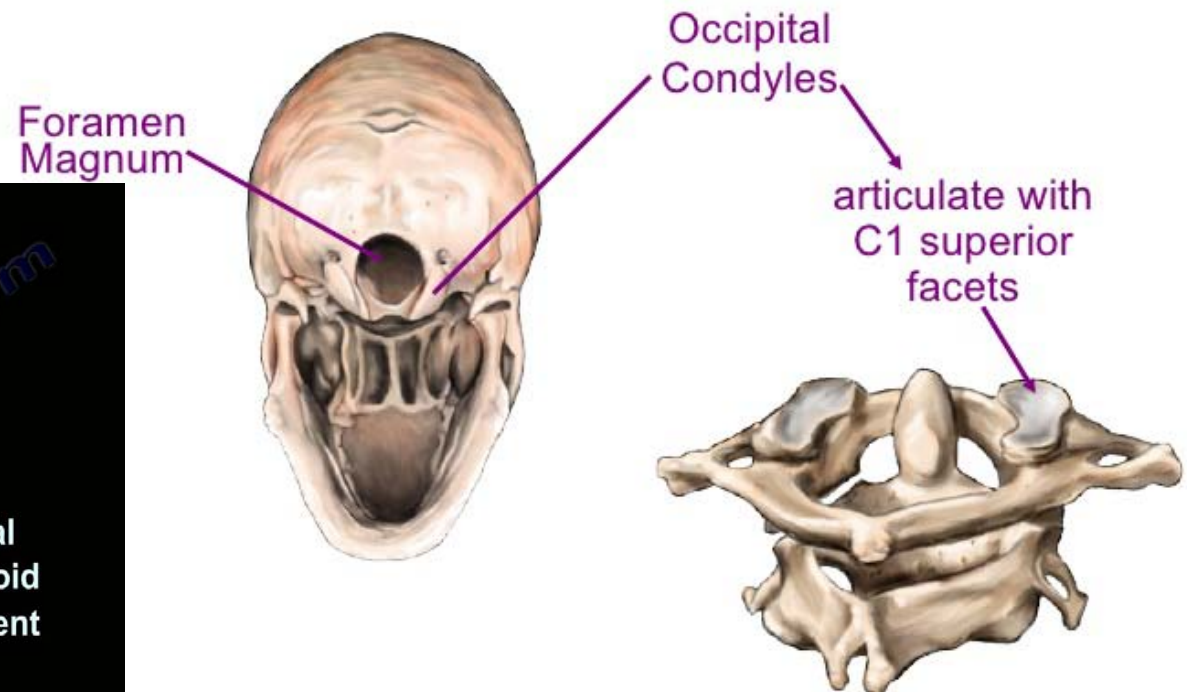
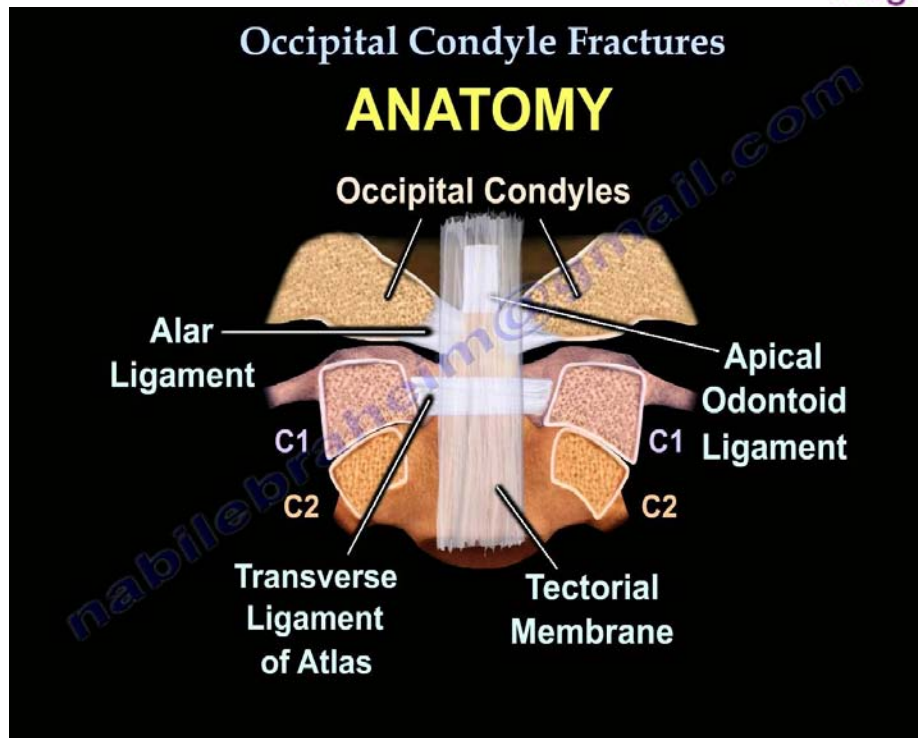
- jugular foramen
- occipital condyle
- hypoglossal canal (medial opening hidden under condyle)
- **styloid process:** stylohyoid lig.
- **mastoid process:** air cell ↔ middle ear
  - sternocleidomastoid



# Occoital-Atas joint

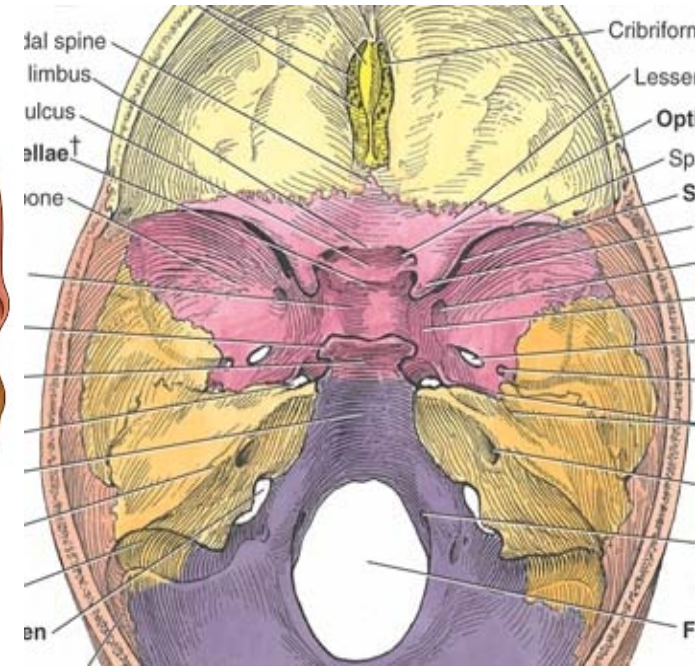
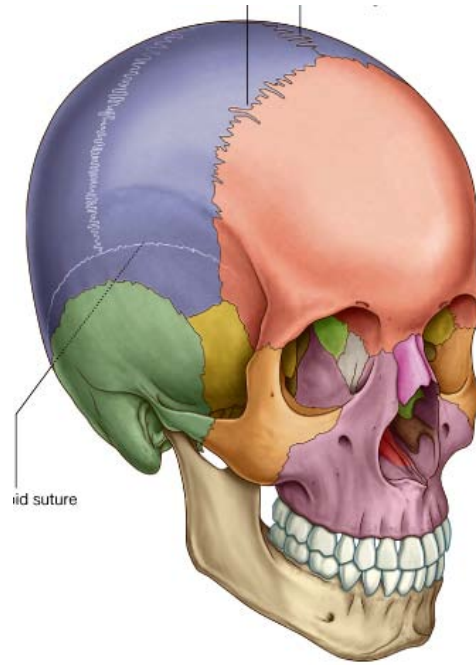
- Occipital bone:  
(condyle)
- C1 Atlas: sup. facet

## Occipitocervical Joint



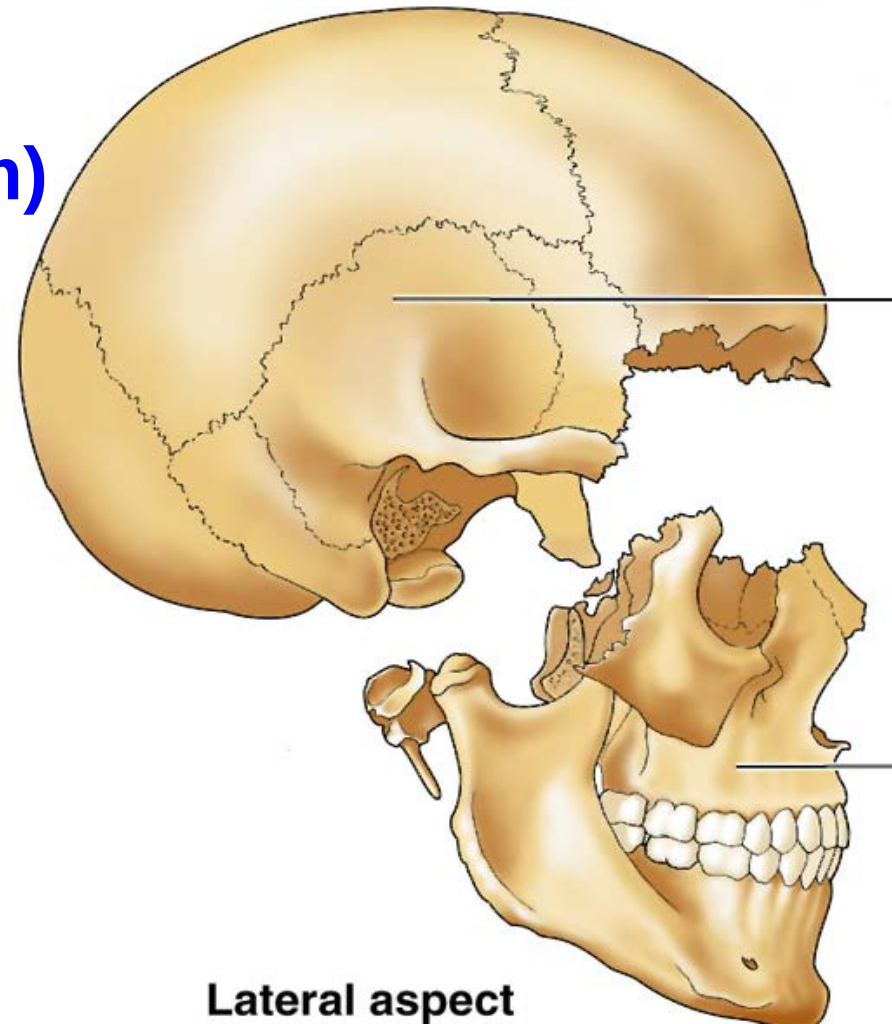
## Skull (cranial skeleton): review

- Neurocranium
  - External surface
  - Interior (cranial fossa)
    - Anterior
    - Middle
    - Posterior
- Openings and contents through them



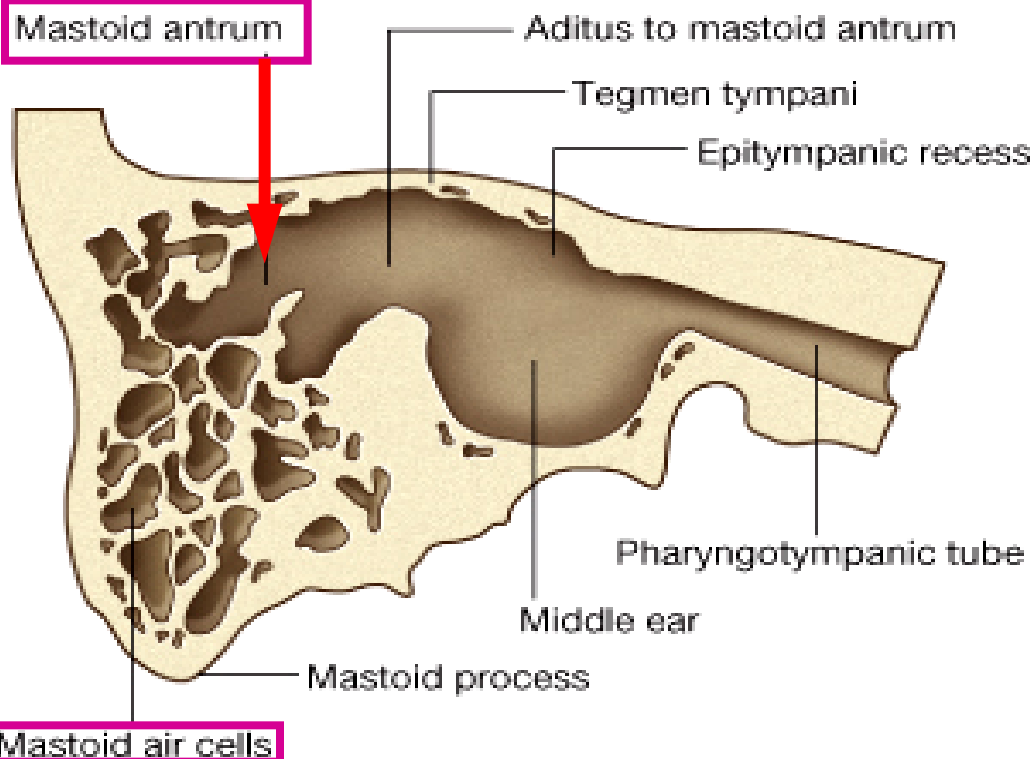
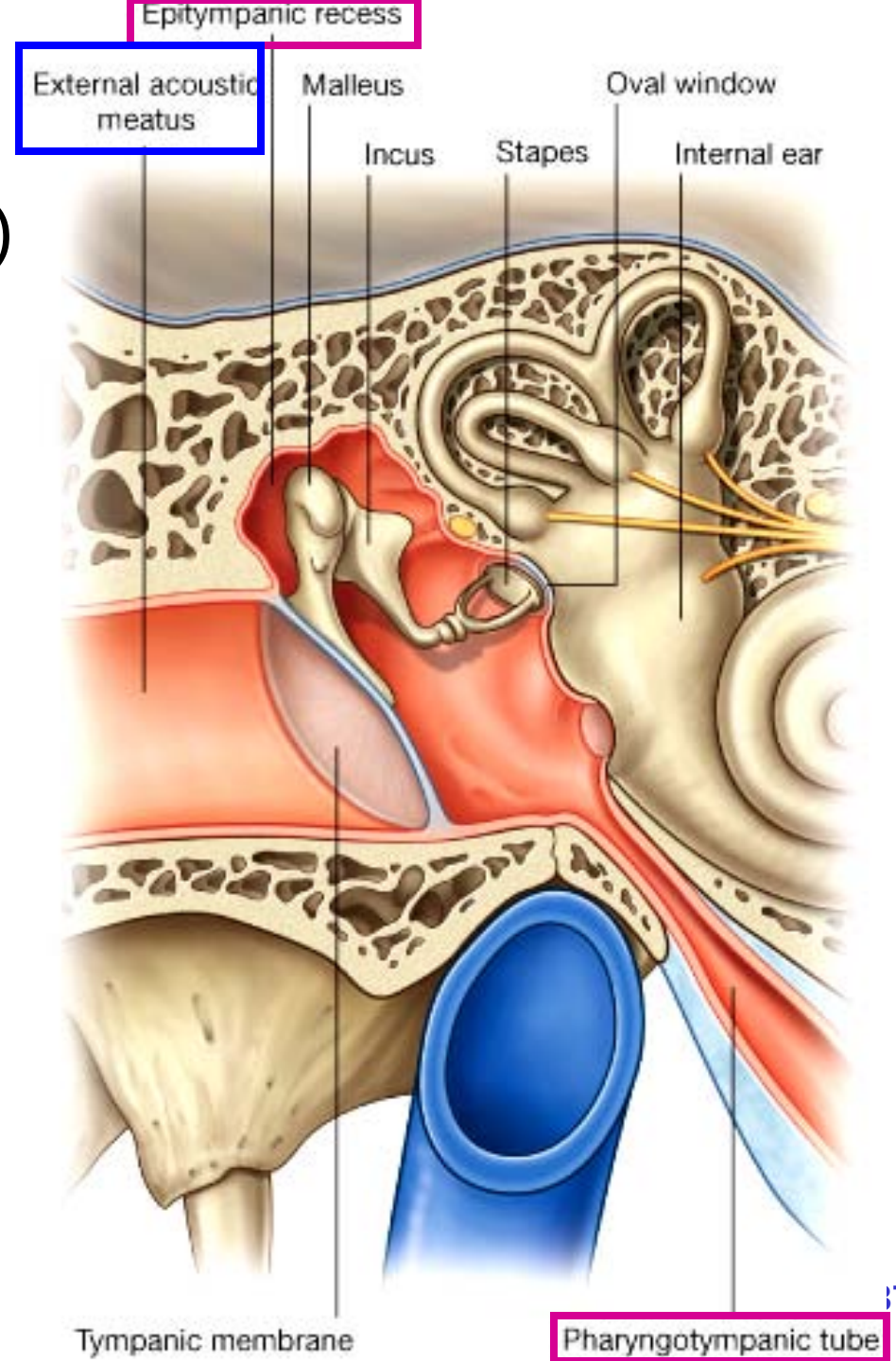
# Facial skeleton

- Cranial skeleton (Neurocranium)
- **Facial skeleton (Viscerocranium)**
  - Ear
  - Orbit
  - Nasal cavity / Nasopharynx
  - Oral cavity / Palate and Jaw
  - Mandible
- **Bones**
  - Temporal bone
  - Sphenoid bone

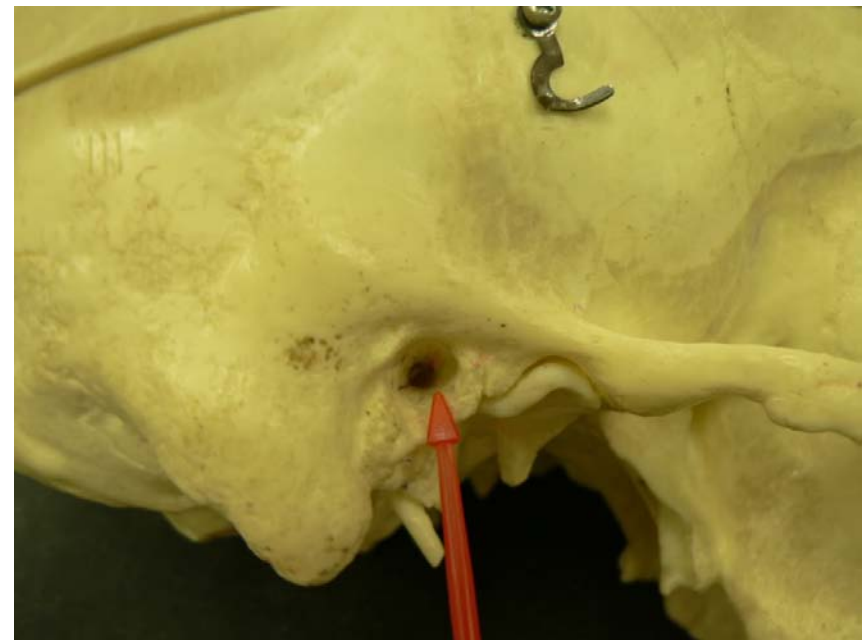
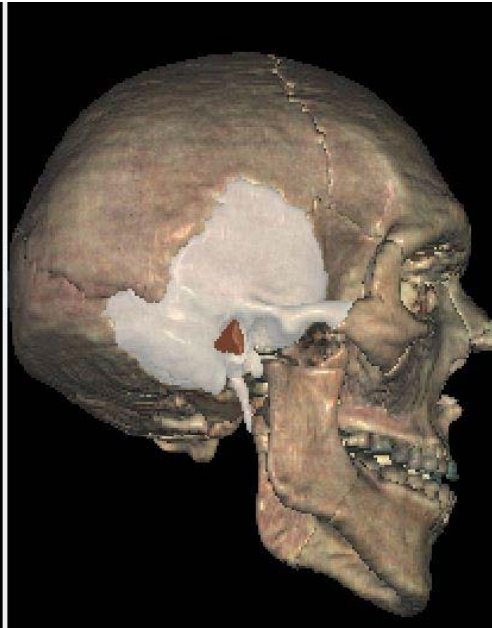
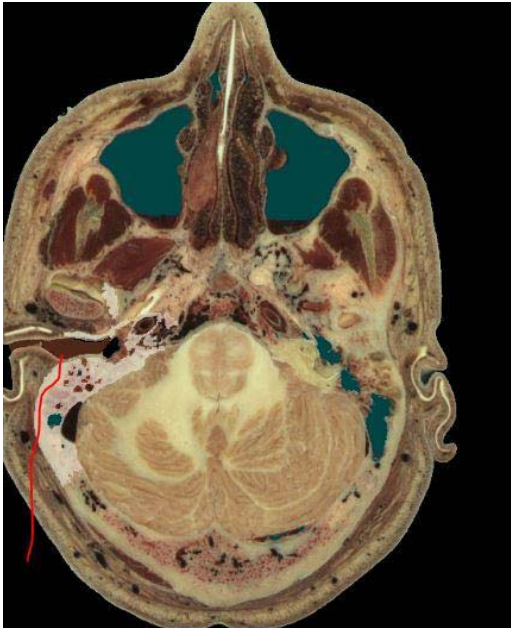
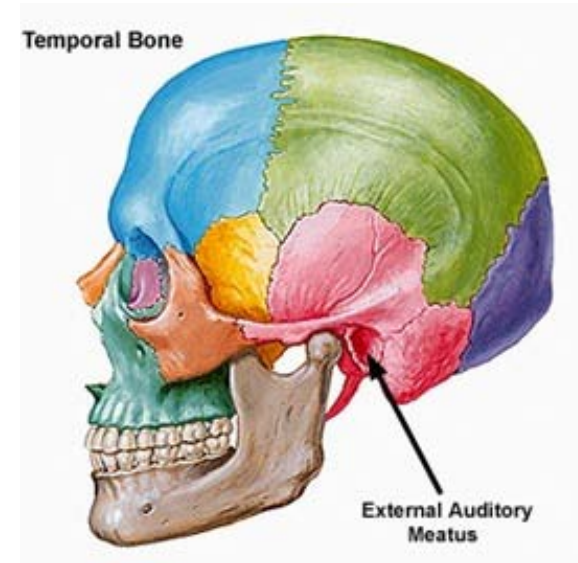
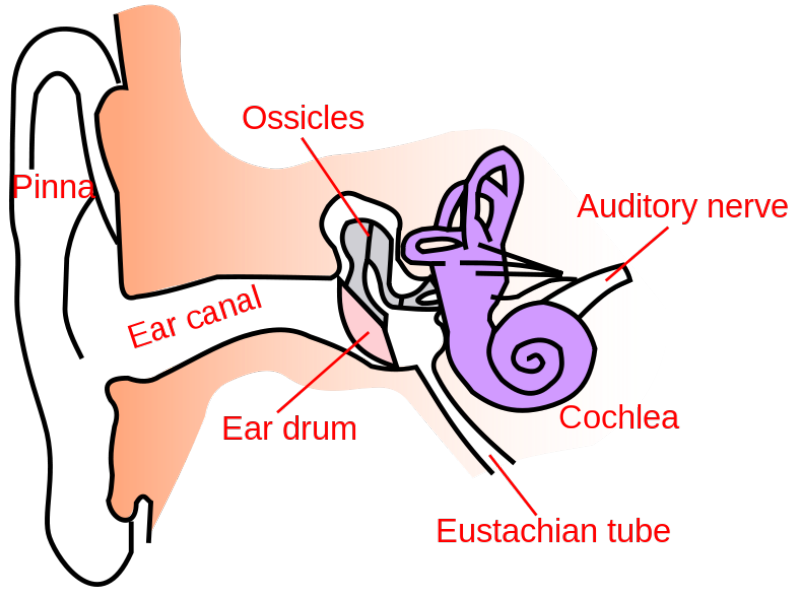


# Ear ● External ear

- External auditory meatus
- Middle ear (tympanic cavity)
  - Mastoid antrum
  - Pharyngotympanic tube
  - Auditroy ossicles
- Inner ear (petrous part)

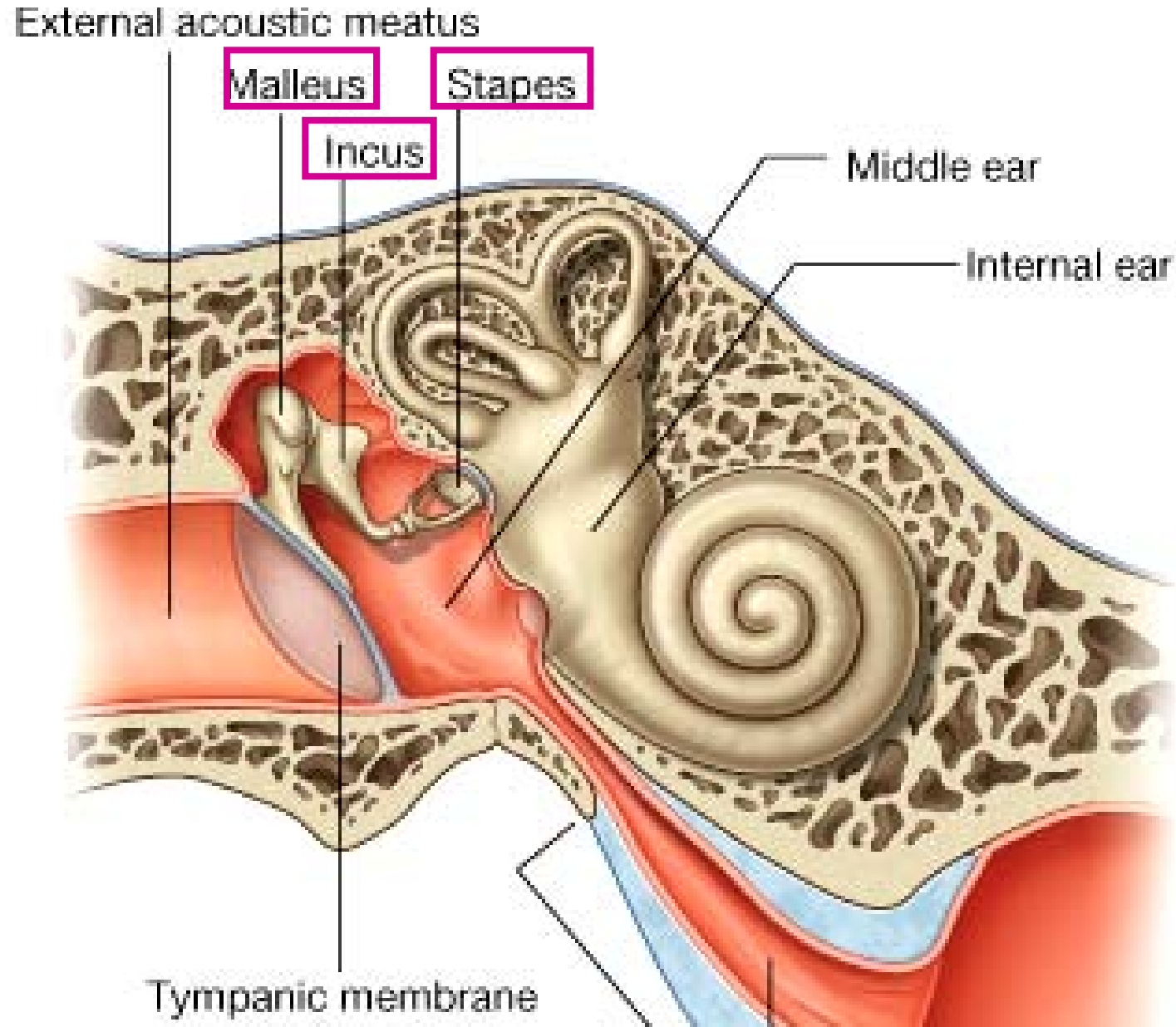


# external auditory meatus



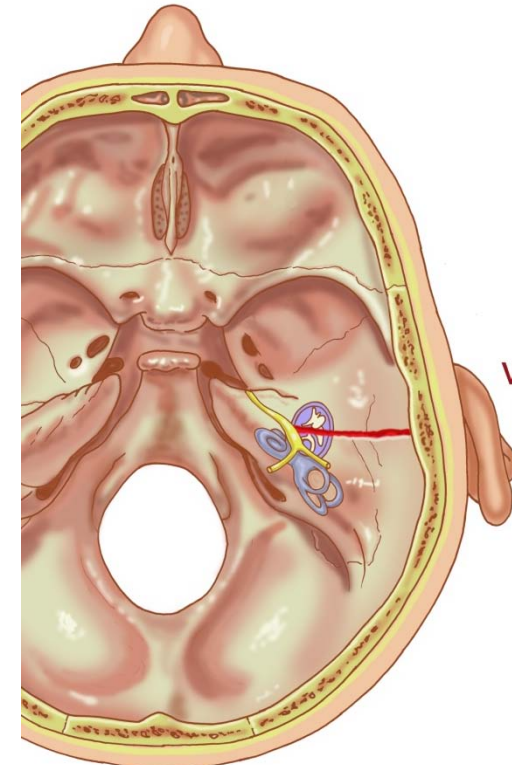
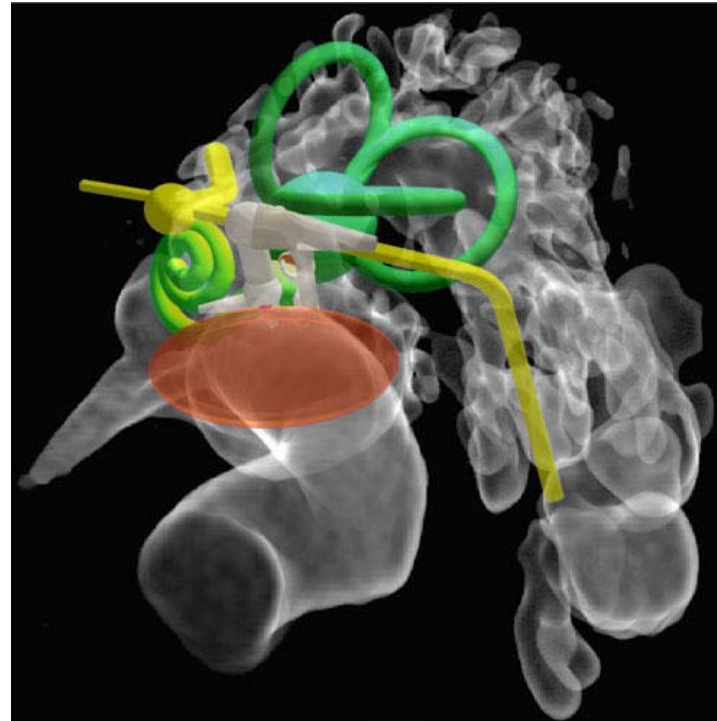
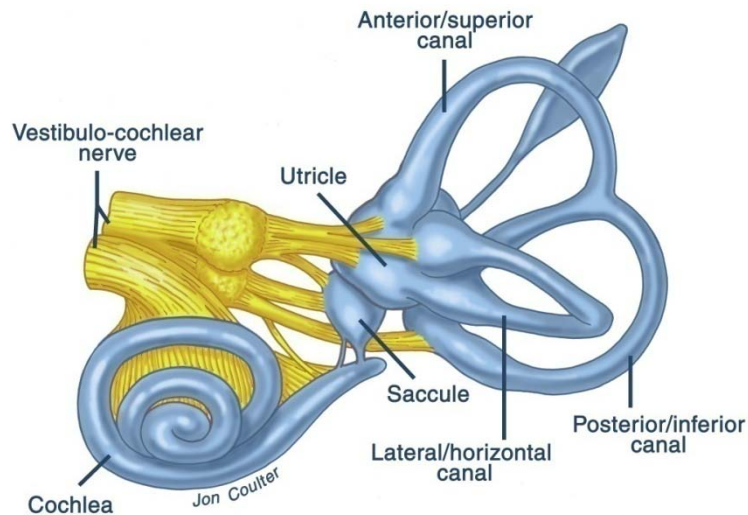
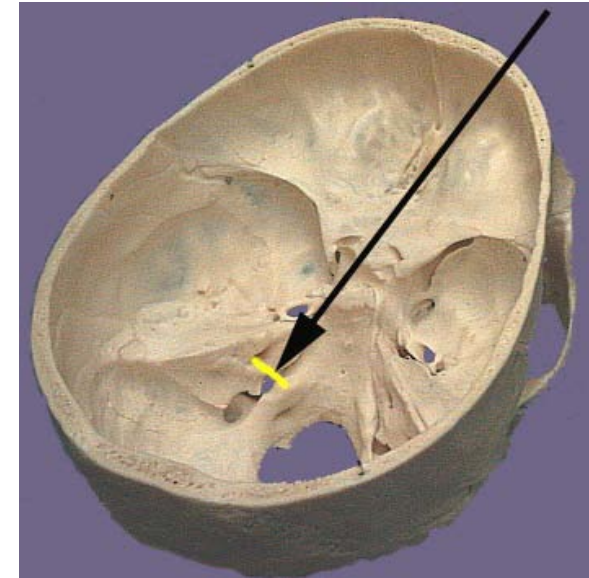
## 3 ossicles

- **malleus** (handle on tympanic membrane)
- **incus**
- **stapes** (rest on fenestra vestibuli)

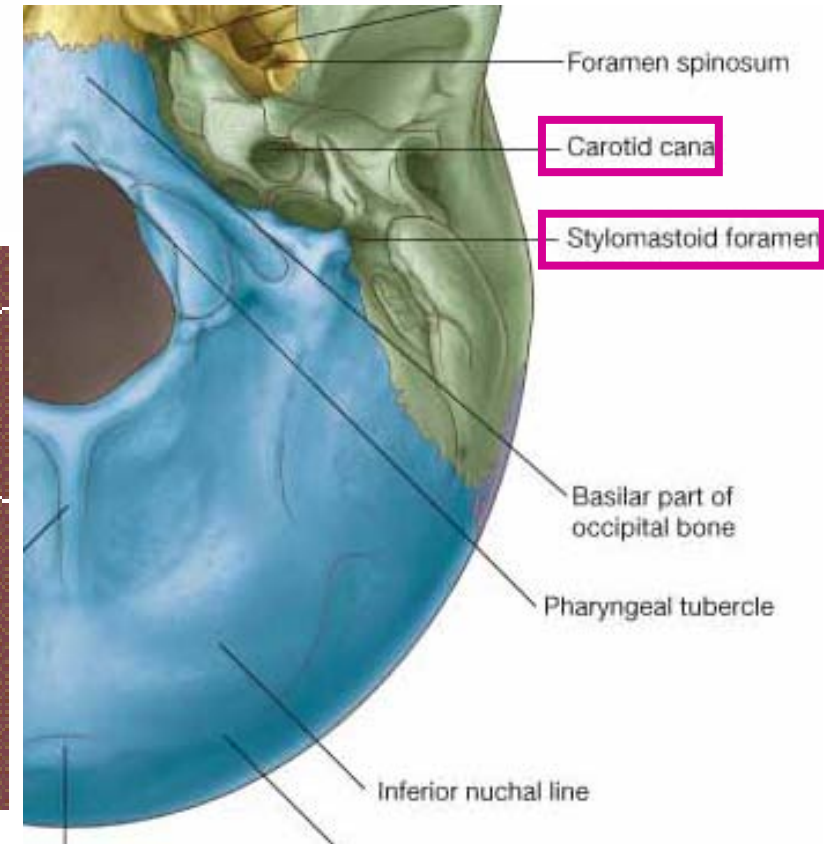
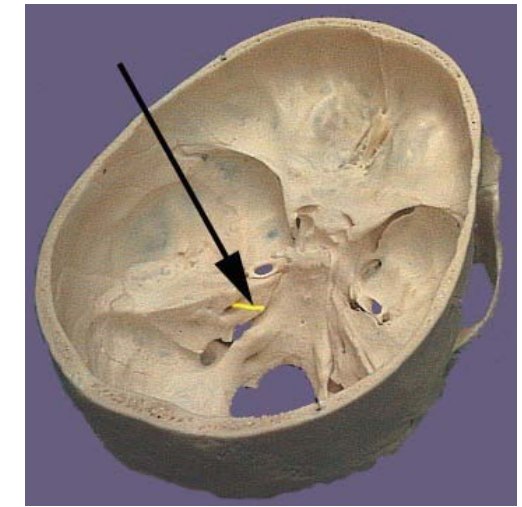
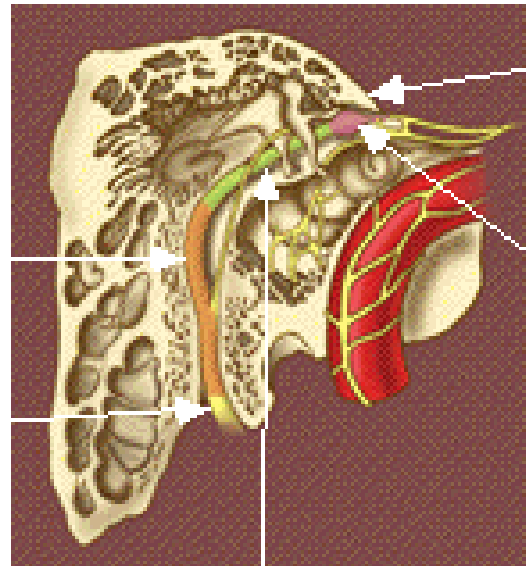
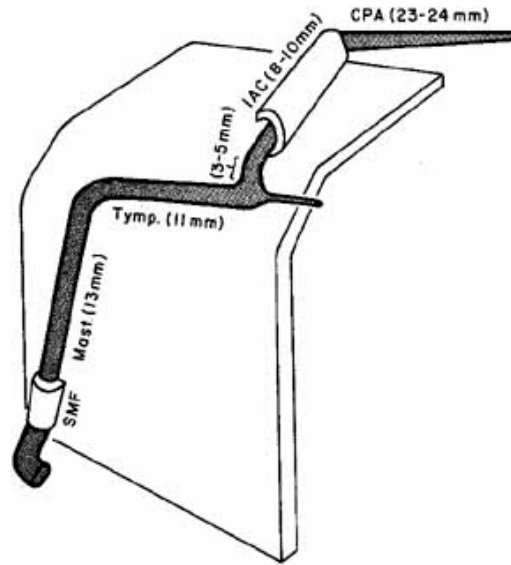
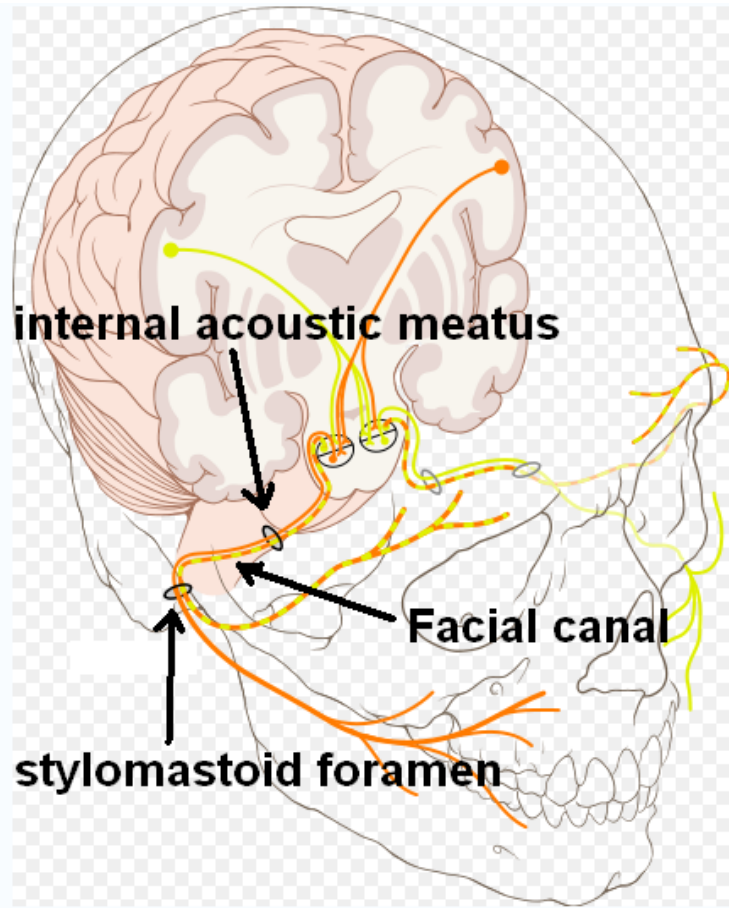


# Inner ear: petrous part of temporal bone

- bony labyrinth
  - Cochlea
  - Vestibula, Semicircular canals
- internal acoustic meatus:  
vestibulocochlear nerve (8<sup>th</sup>)  
and facial nerve (7<sup>th</sup>)

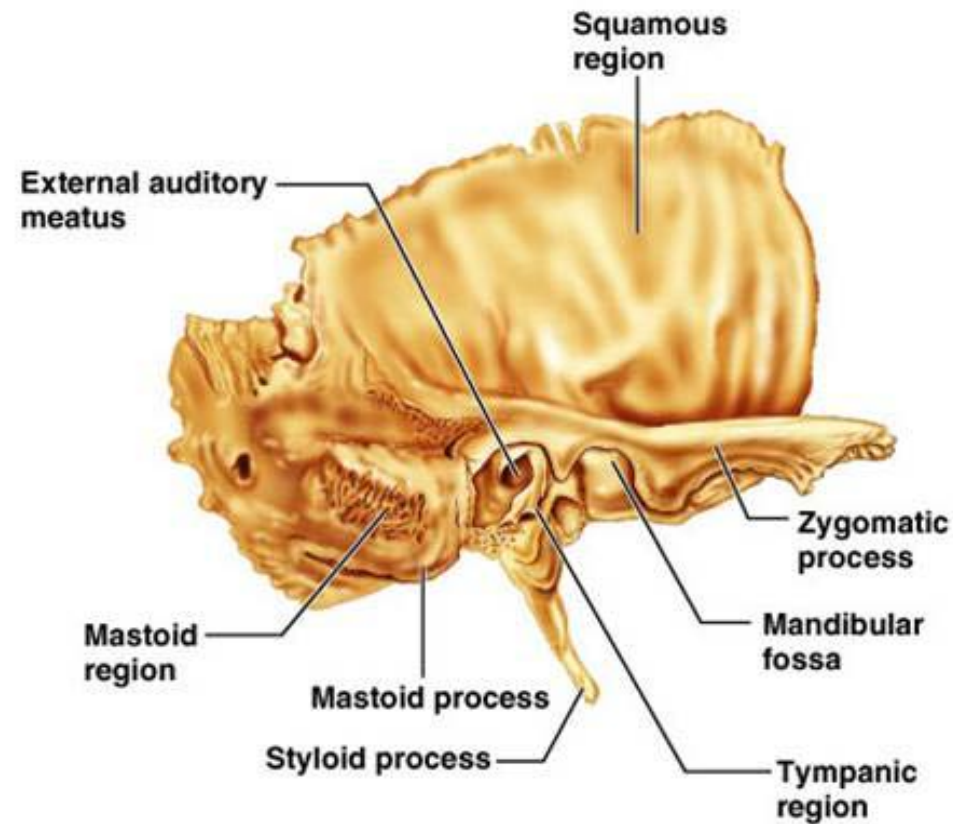
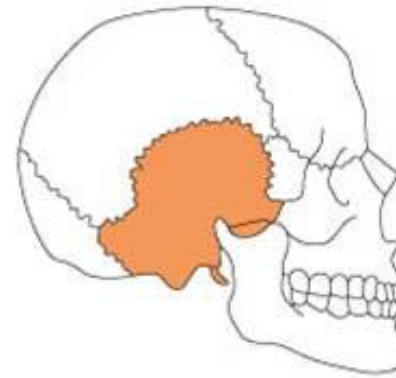
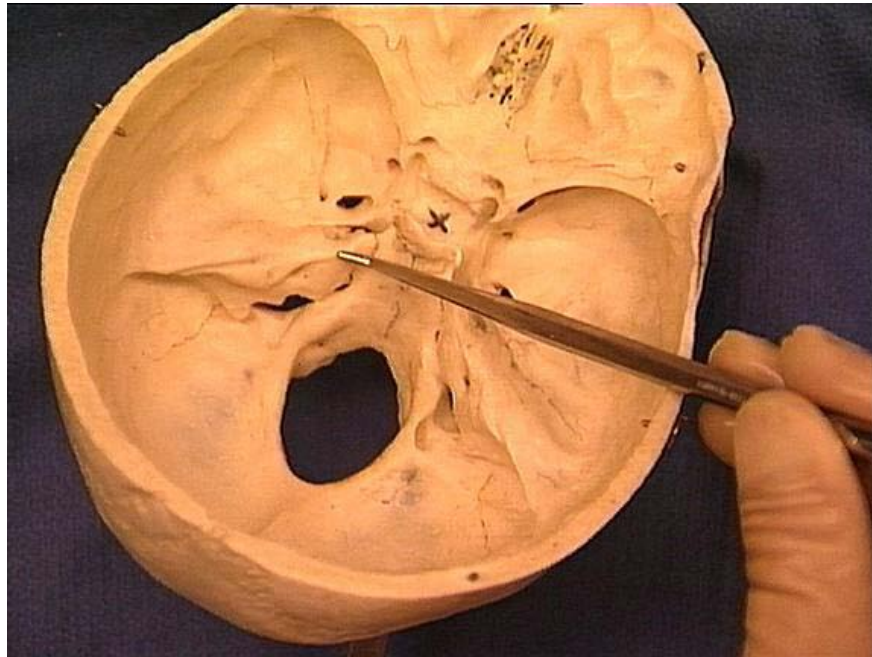


# Facial canal: internal acoustic meatus; stylomastoid foramen



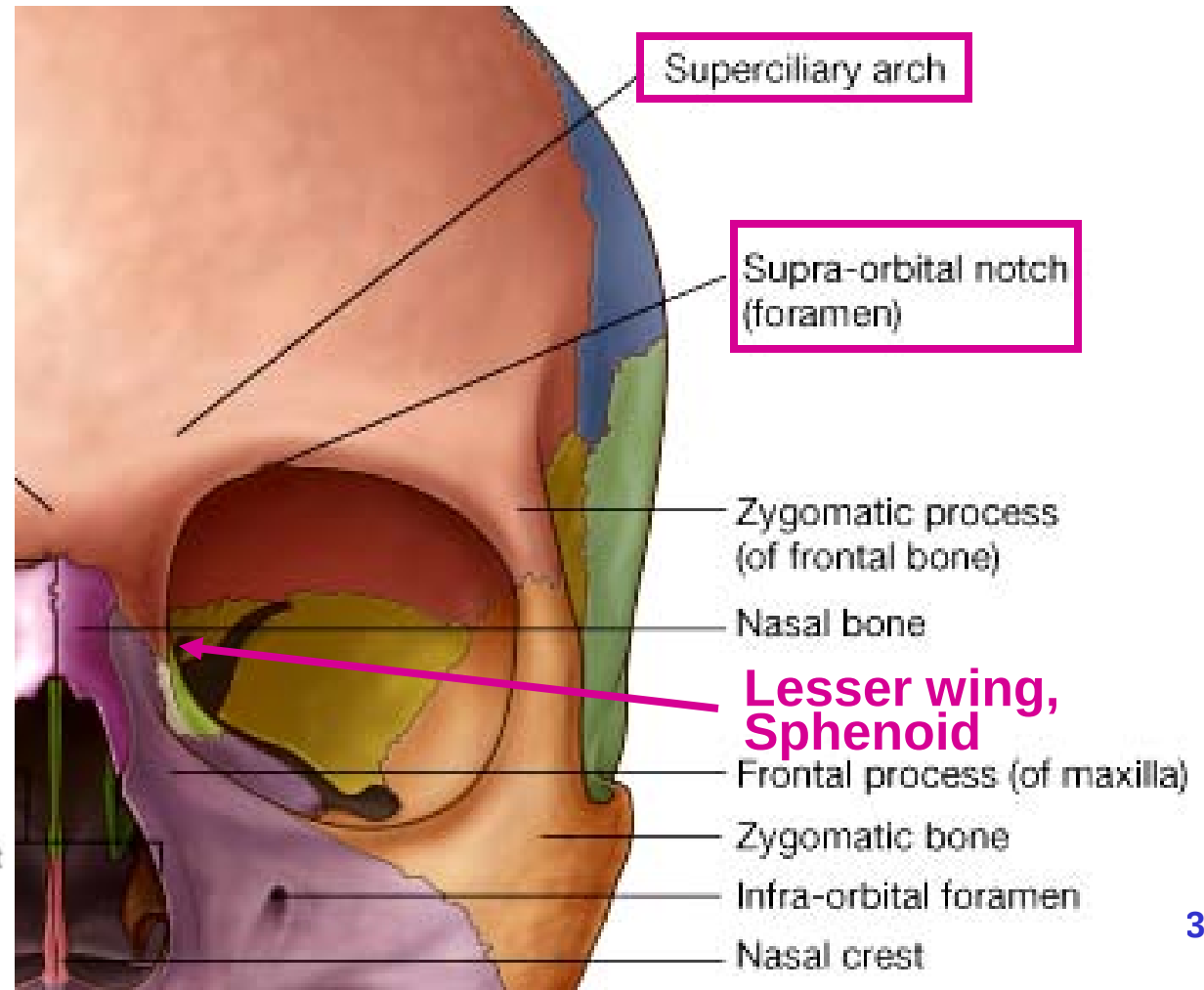
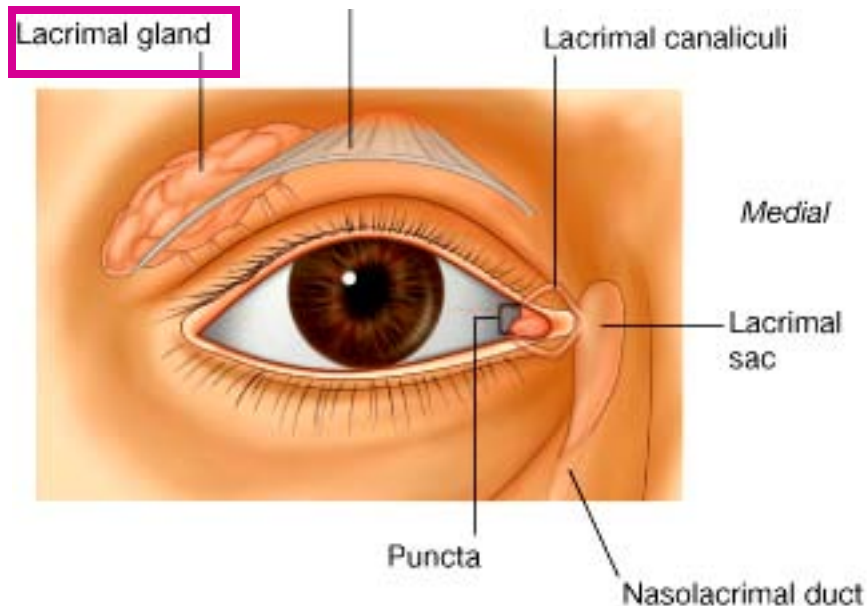
# Temporal bone

- External surface
  - Squamous part
  - Zygomatic process
  - Mastoid part
  - Styloid process
- Internal surface
  - Petrous part

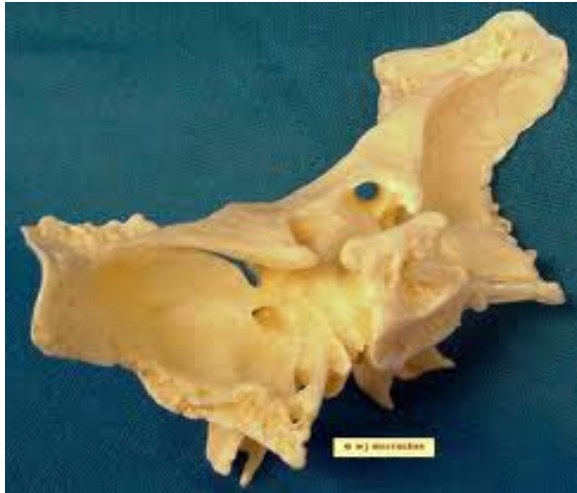


# Bony orbits: roof

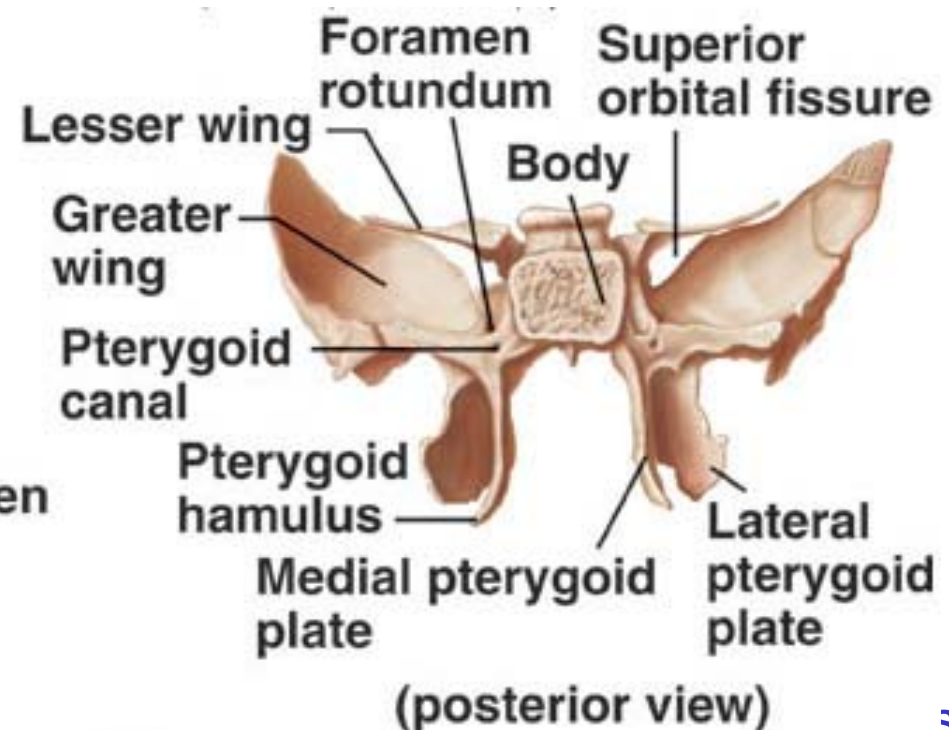
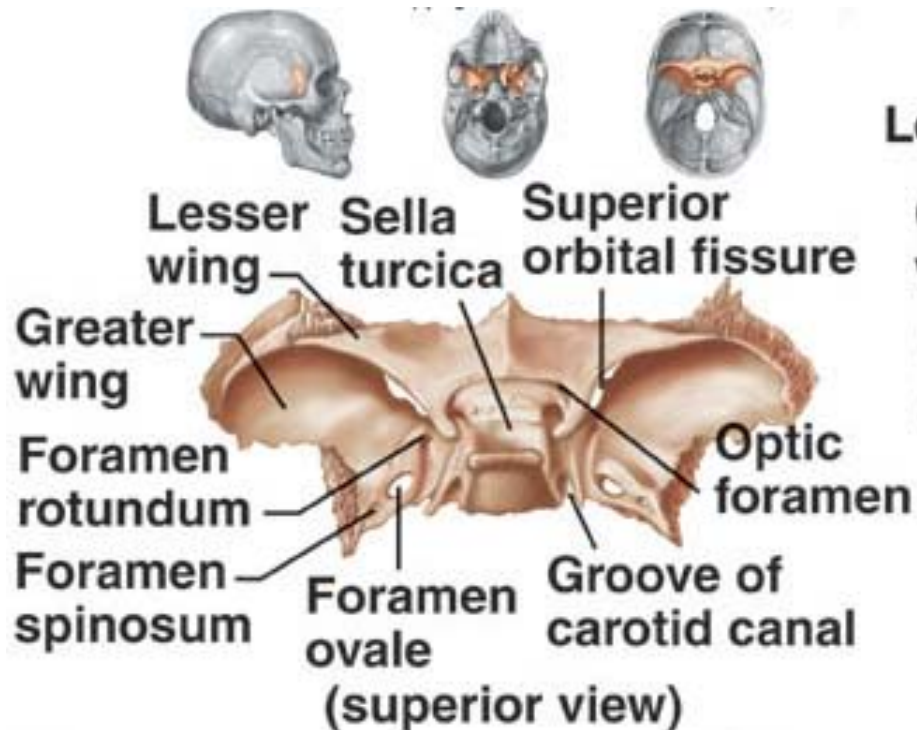
- superciliary arch of frontal bone: thickened
- **supraorbital notch (foramen)**: supraorbital n. ( $V_1$ ), vessels
- floor of ant. cranial fossa: thin
- lesser wing of sphenoid
- Lacrimal gland



# Sphenoid bone

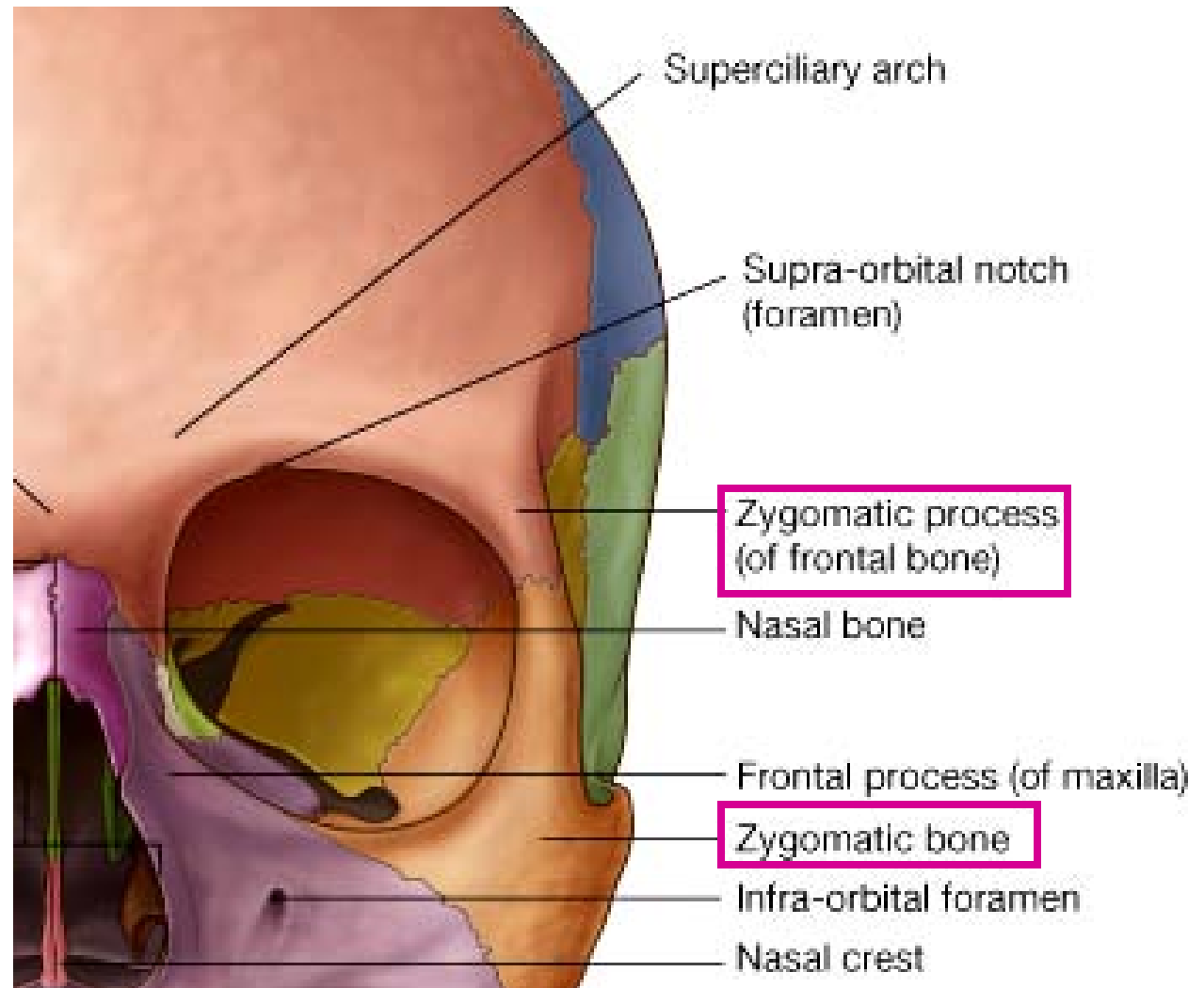


- Greater wing
- Lesser wing
- Sphenoid body
- Medial pterygoid plate
- Lateral pterygoid plate
- Superior orbital fissure



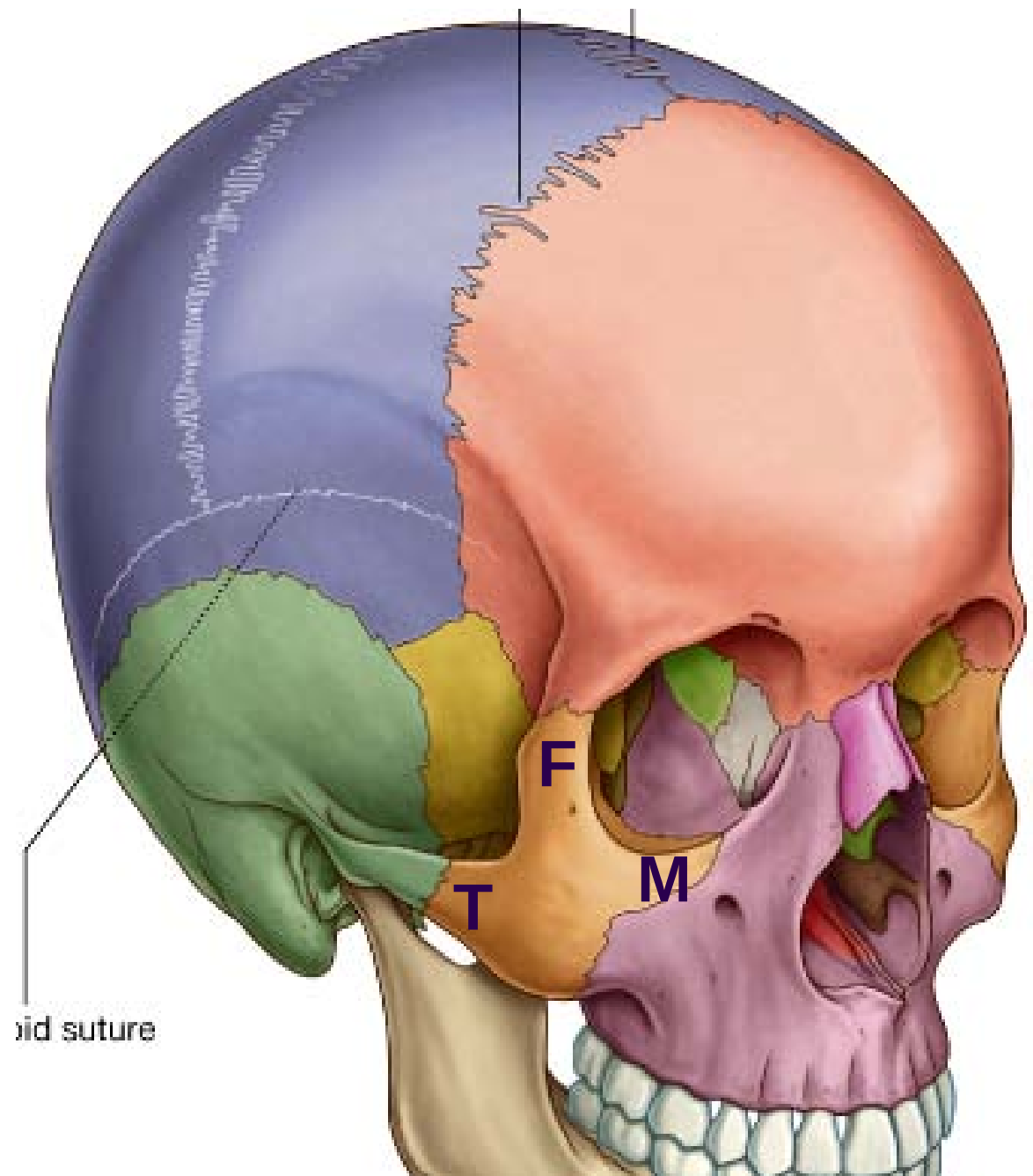
# Bony orbits: lateral wall-1

- frontal proc. of zygomatic bone
- zygomatic proc. of frontal bone



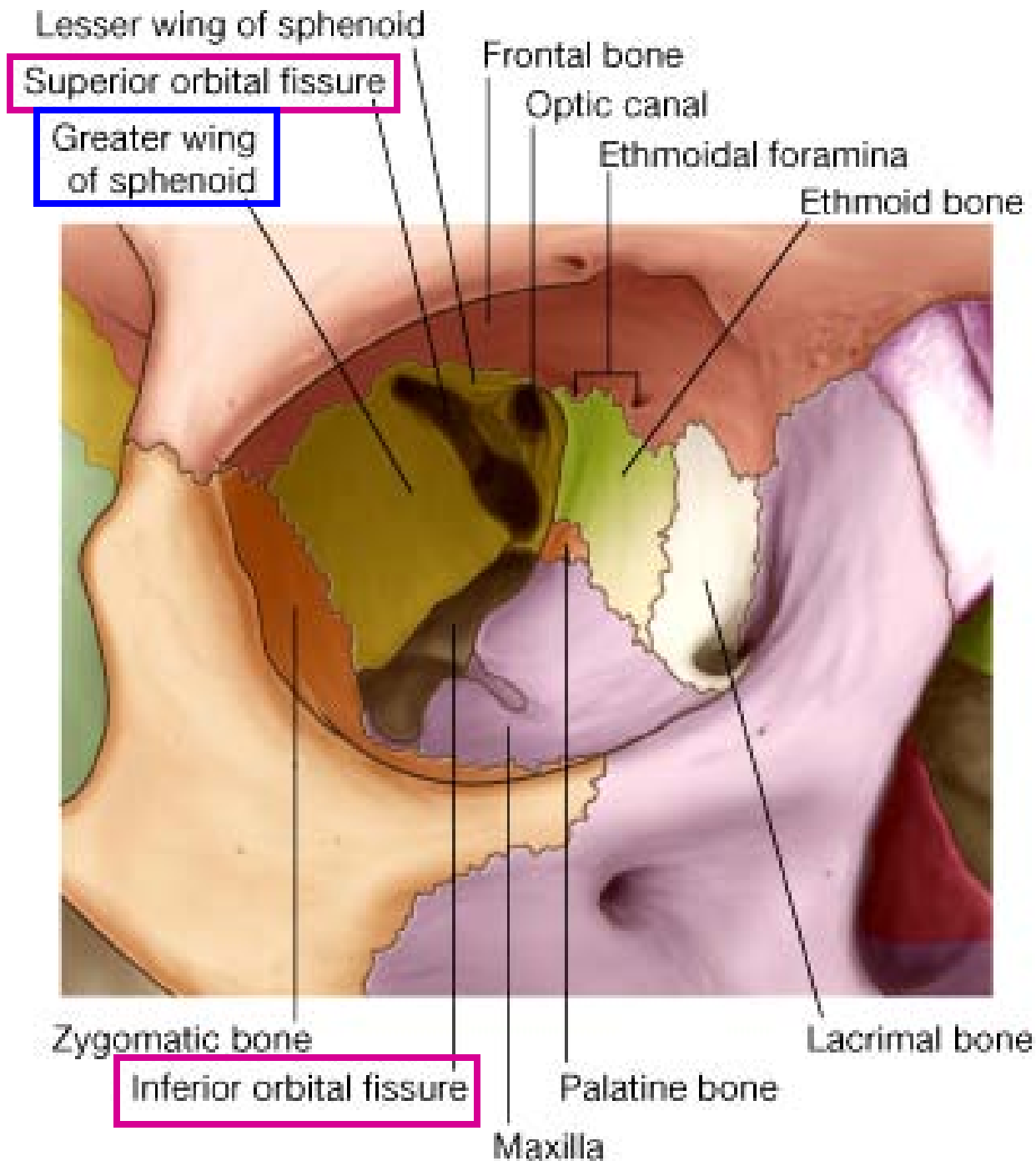
# Zygomatic bone

- Frontal process
- Maxillary process
- Temporal process



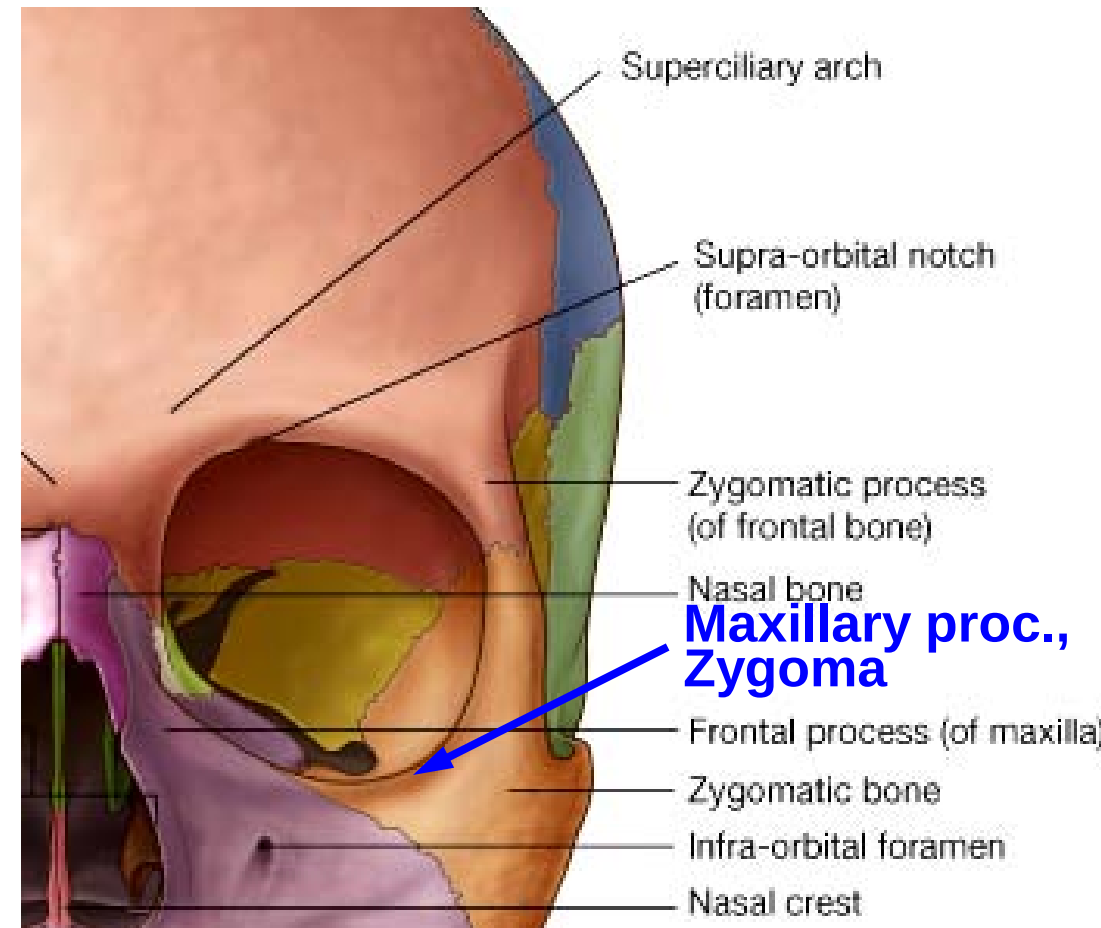
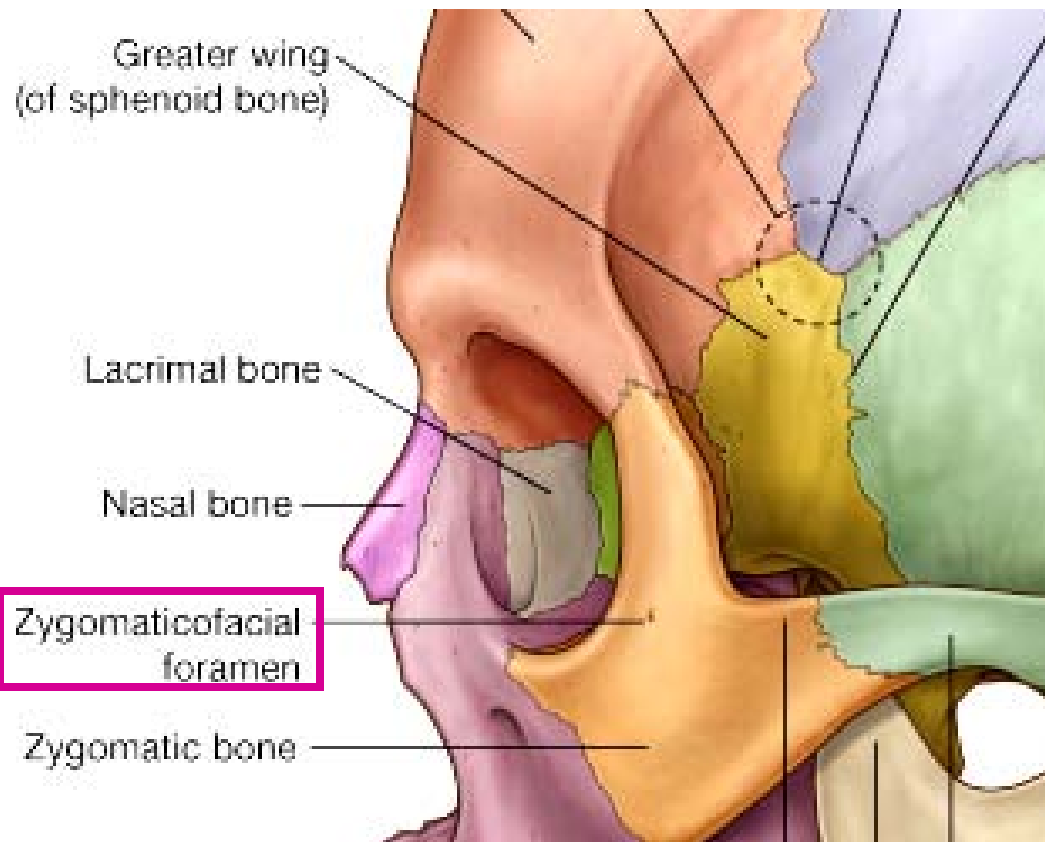
## Bony orbits: lateral wall-2

- **Greater wing of sphenoid**
- **superior orbital fissure** (where roof and lateral wall meet)
- **inferior orbital fissure** (where lateral wall and floor meet)



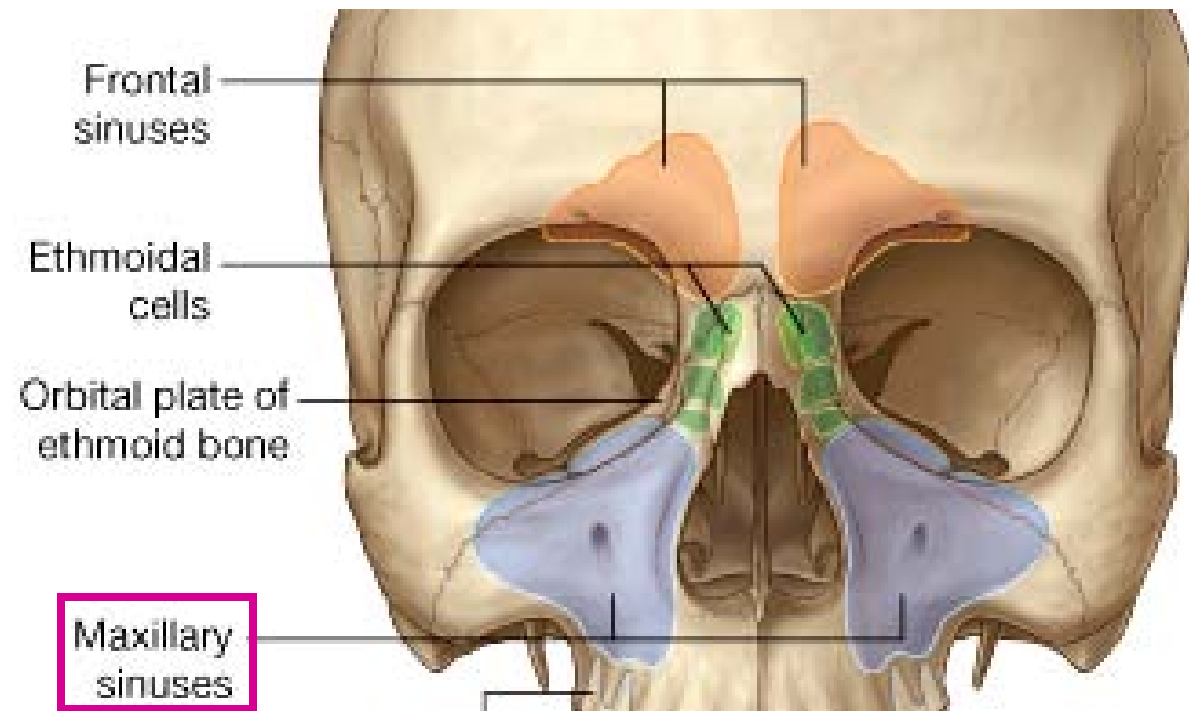
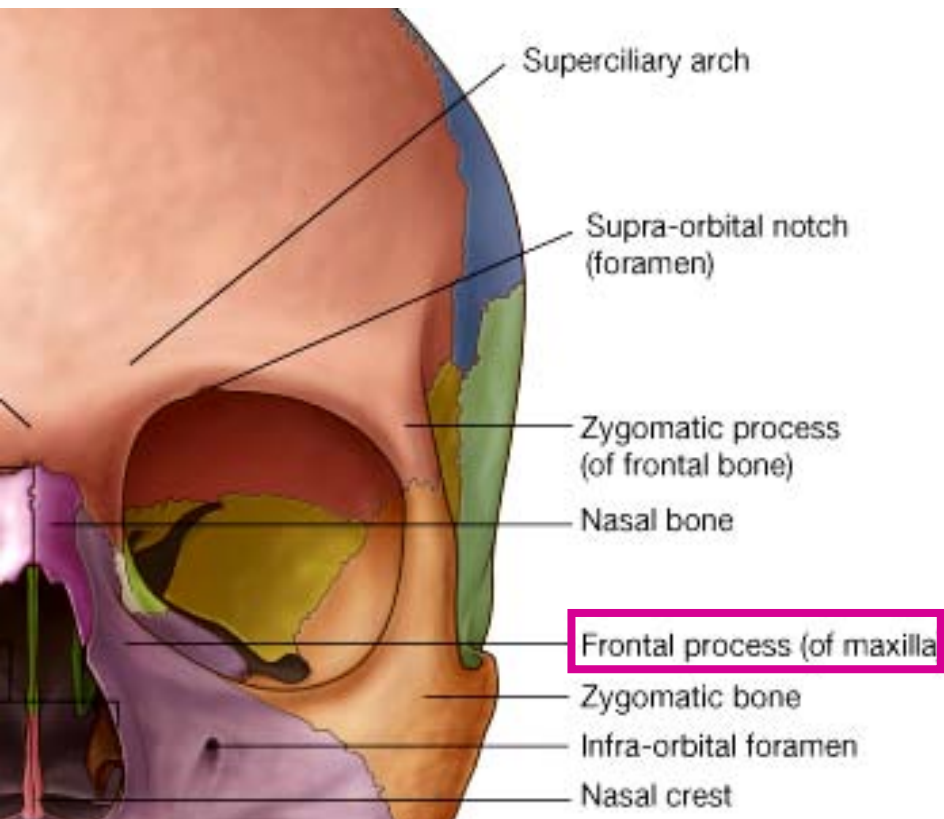
# Bony orbits: floor-1

- thin orbital floor
- maxillary process of zygomatic bone
  - zygomaticofacial foramen on malar surface



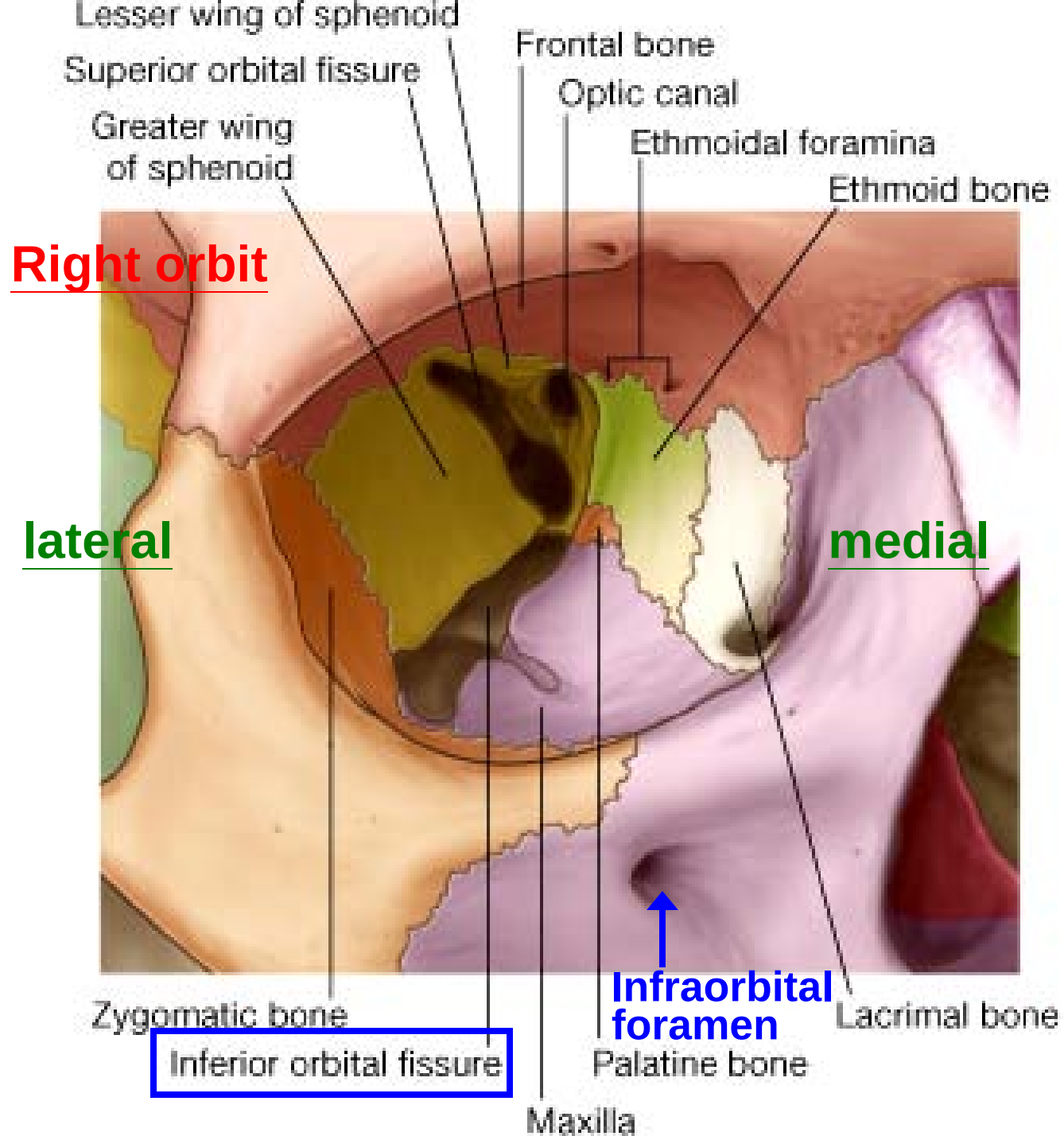
## Bony orbits: floor-2

- Maxilla
- maxillary sinus



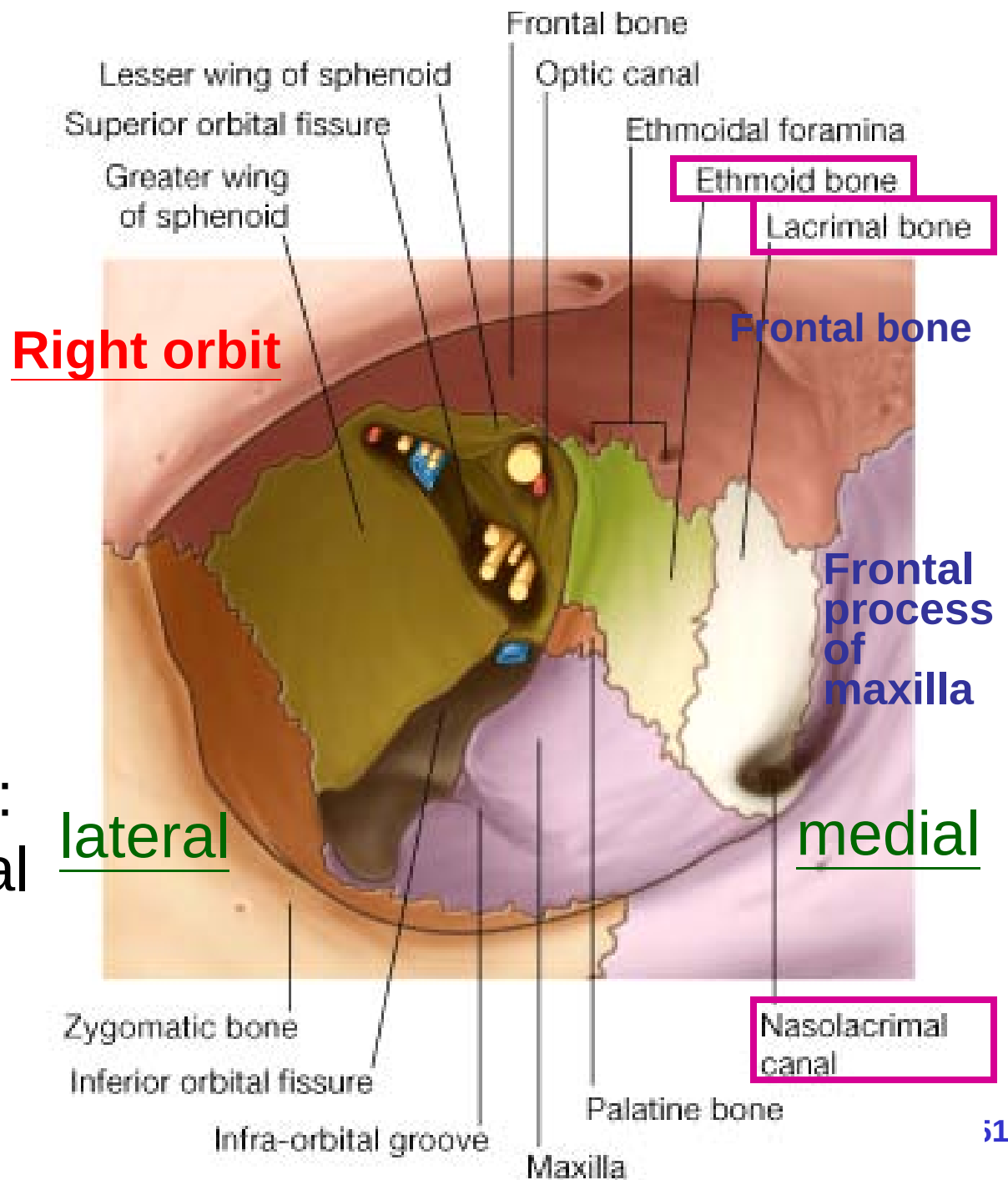
## Bony orbits: floor-3

- infraorbital n.: enters from pterygopalatine fossa through inf. orbital fissure → infraorbital groove → infraorbital canal → infraorbital foramen



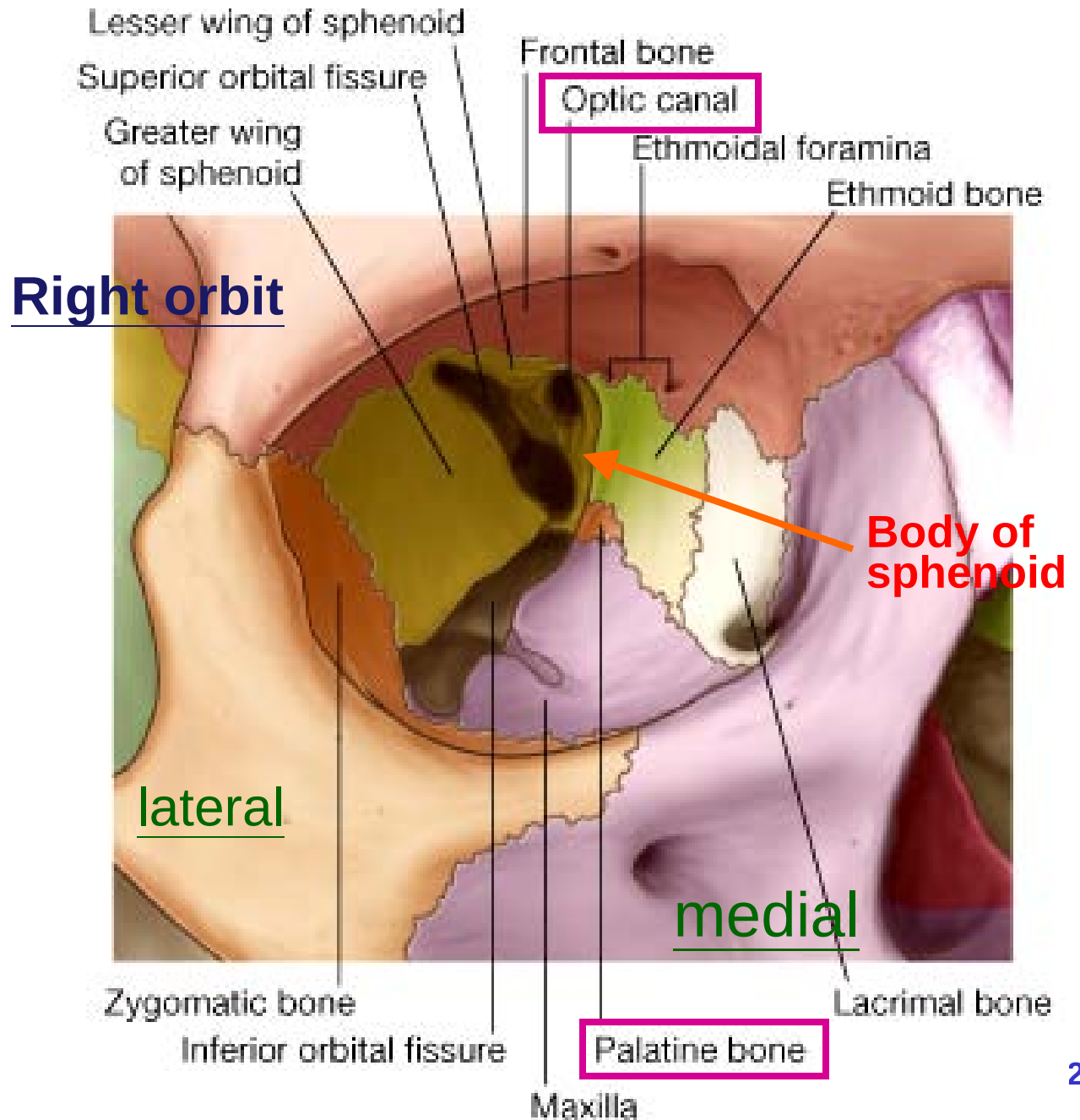
# Bony orbits: medial wall-1

- frontal process of maxilla
- frontal bone
- **lacrimal bone**
- fossa for lacrimal sac → **nasolacrimal canal** → inferior nasal meatus
- **orbital plate of ethmoid:** (ethmoidal air cells medial to this)



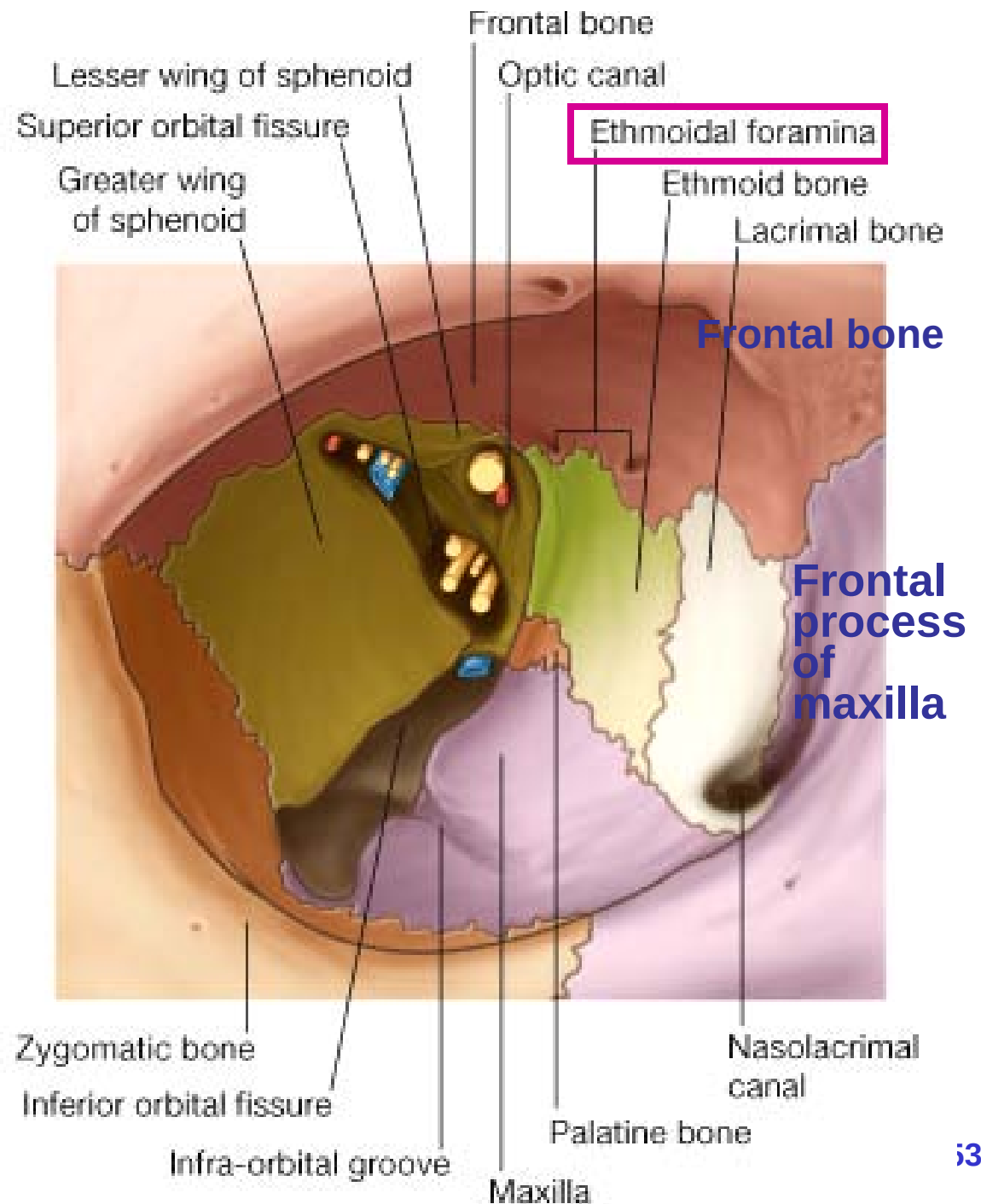
## Bony orbits: medial wall-2

- **orbital plate of palatine bone**
- **body of sphenoid:**  
completes the lower part of optic canal
- **optic canal (where roof and medial wall meet)**



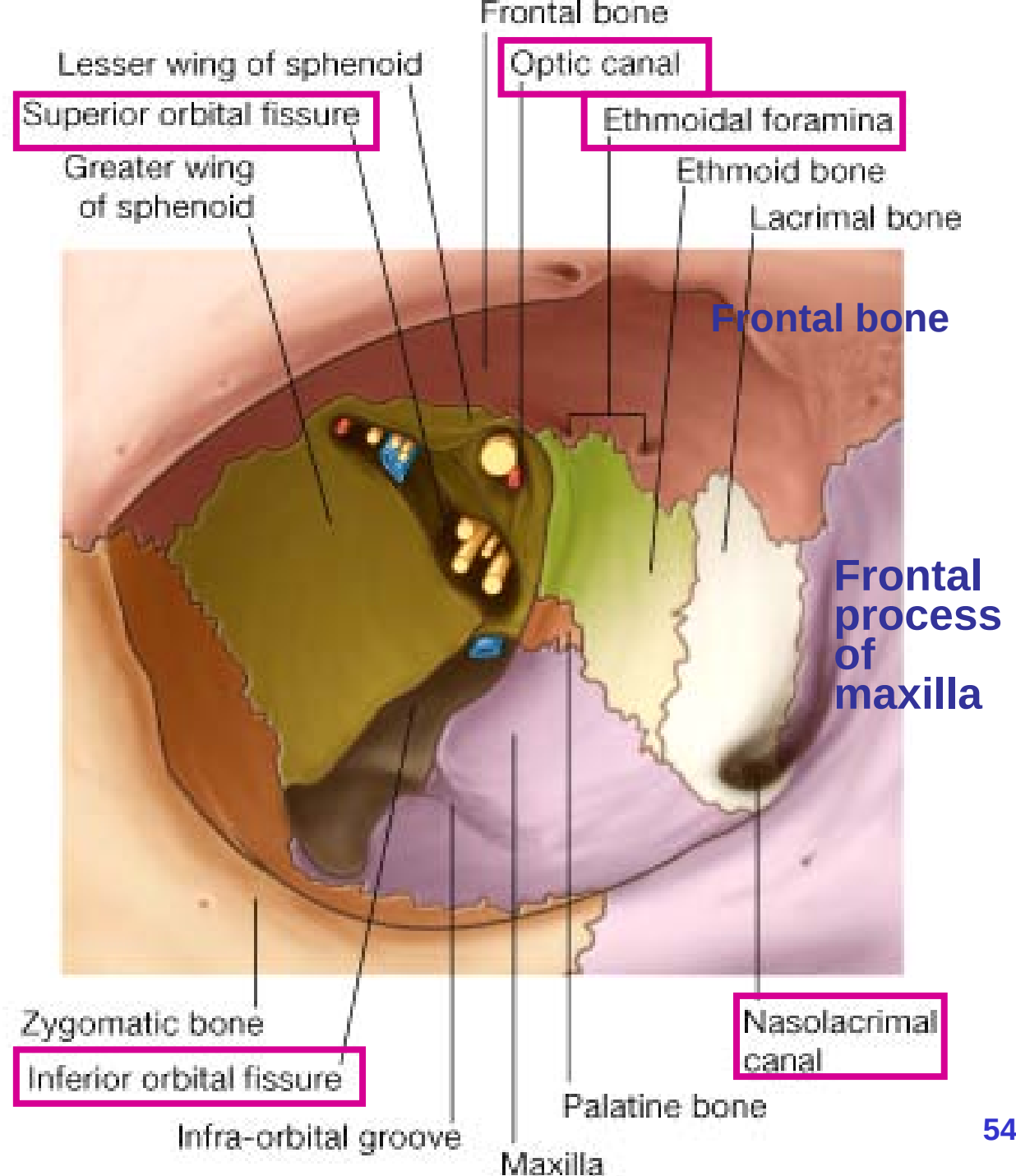
# Bony orbits: medial wall-3

- ant. & post. ethmoidal foramina
- transmitting corresponding vessels (br. of ophthalmic a.) to supply nasal cavity and ethmoidal air cells

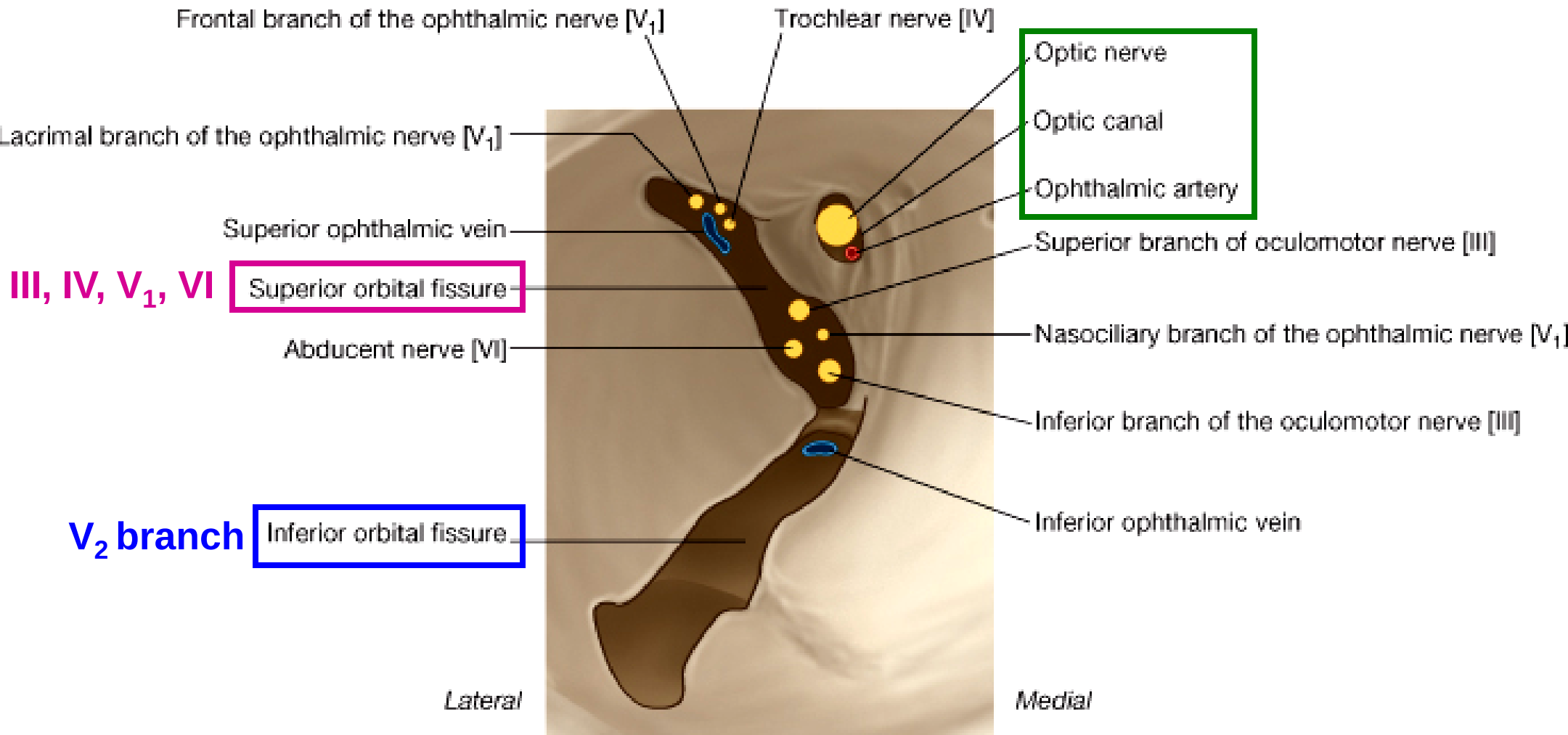


# Openings of orbit

- 1. optic foramen (canal)
- 2. sup. orbital fissure
- 3. inf. orbital fissure
- 4. nasolacrimal canal
- 5. ant. & post. ethmoidal foramina

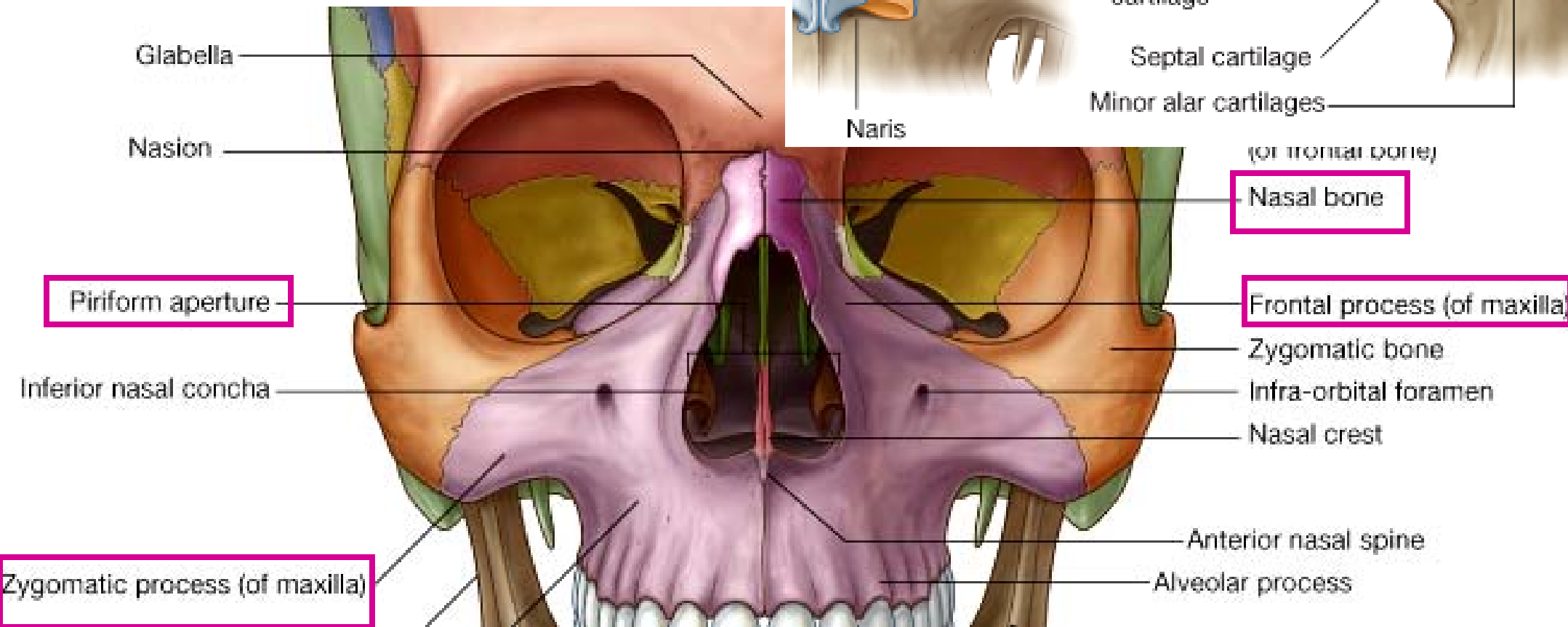
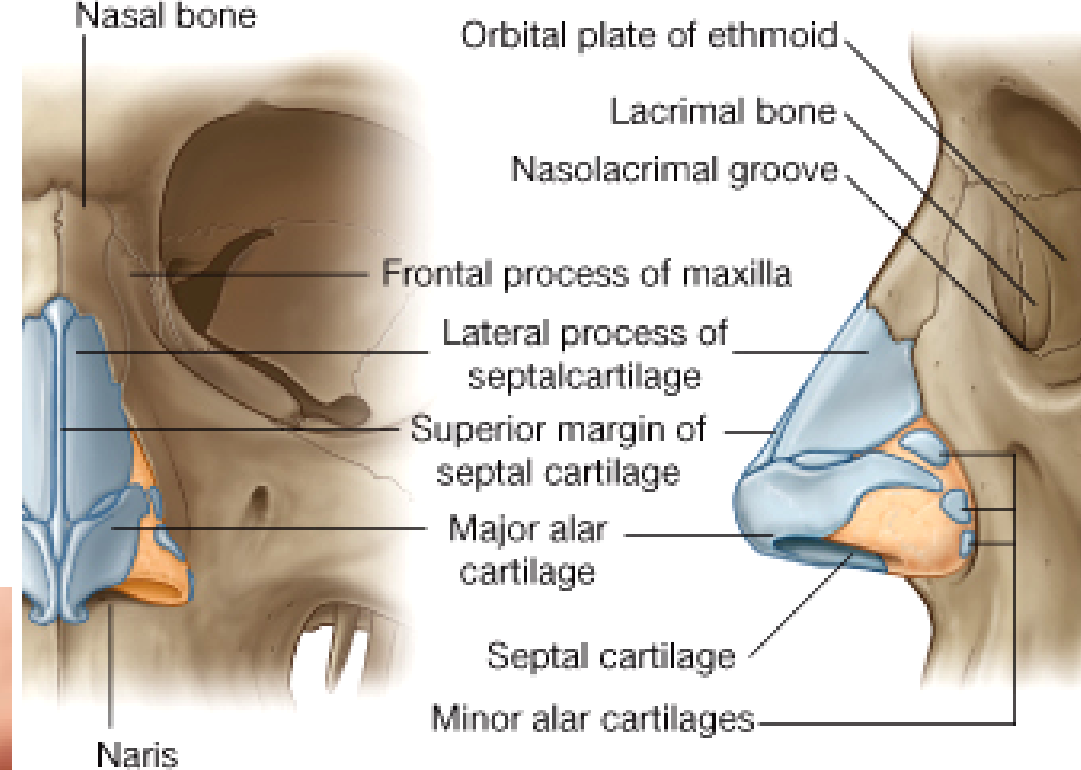


# Contents of orbital openings



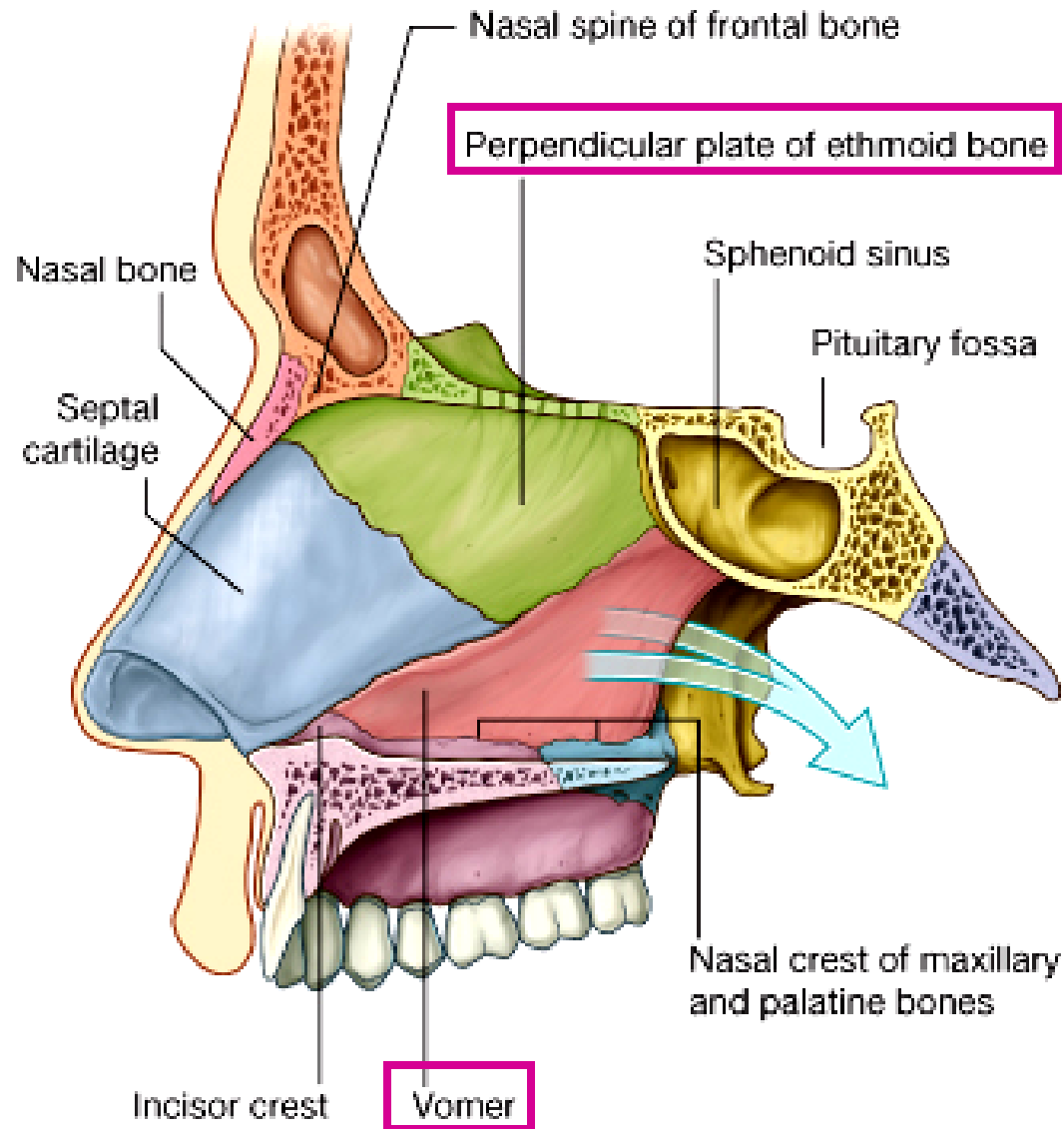
# Nasal cavity-1

- piriform aperture; cartilage plates; maxilla; **nasal bone**



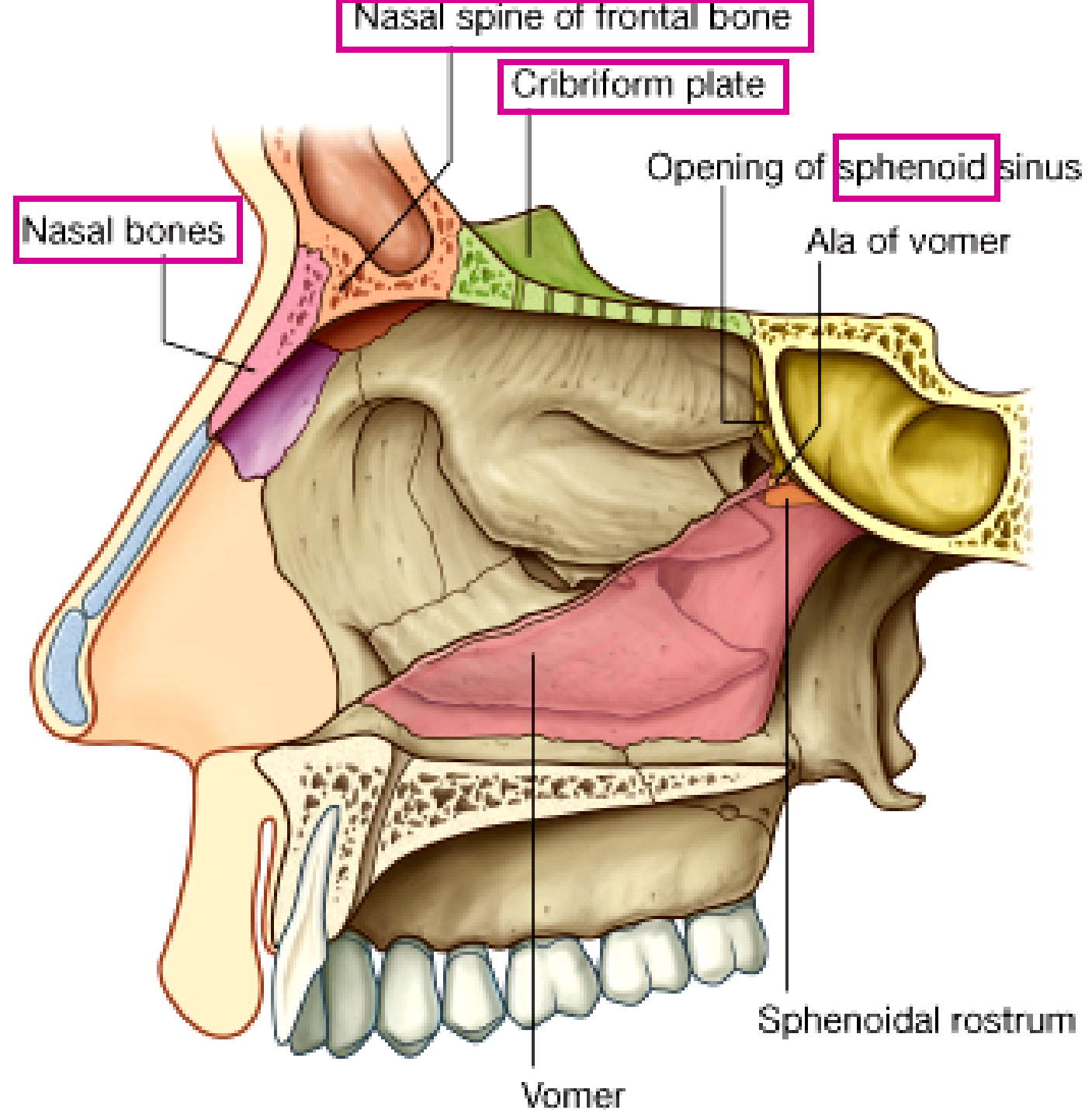
## nasal cavities and nasopharynx-2

- nasal septum: **perpendicular plate of ethmoid + vomer**



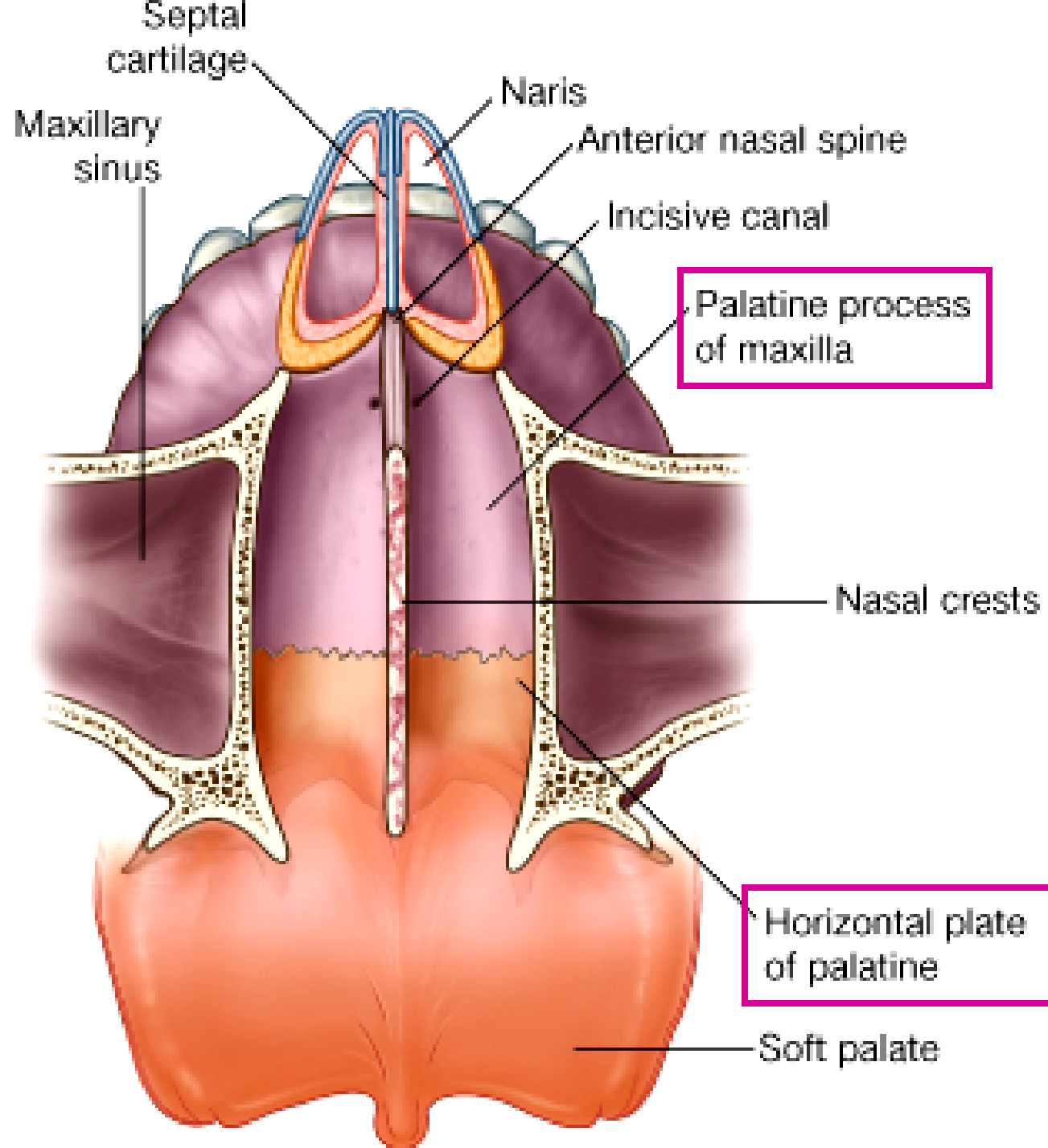
# Roof of nasal cavity

- **cribriform plate of ethmoid;**  
frontal & nasal  
bone anteriorly;  
sphenoid  
posteriorly



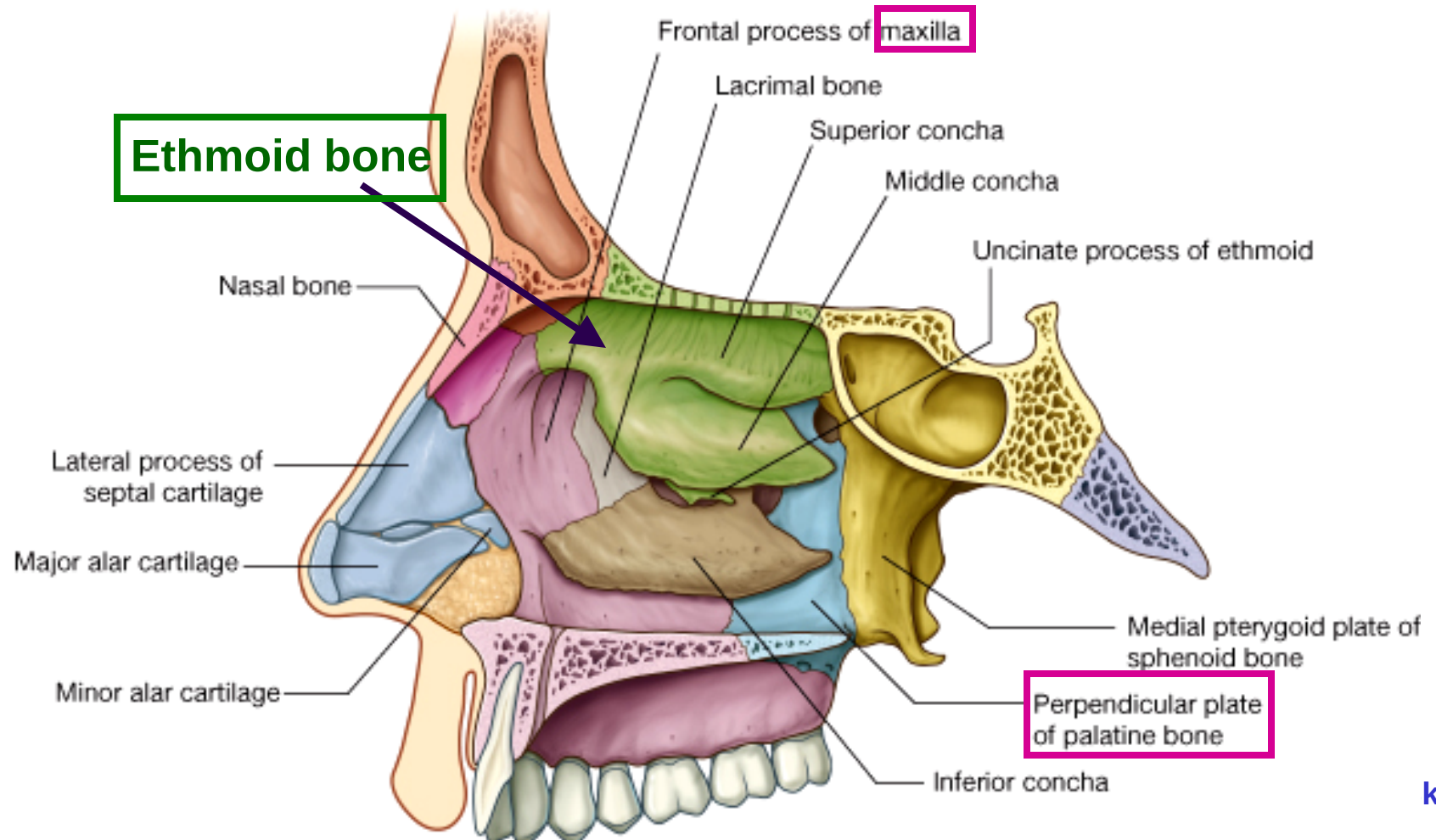
# Floor of nasal cavity

- ant. 2/3: **palatine process of maxilla**
- post. 1/3: **horizontal plate of palatine**

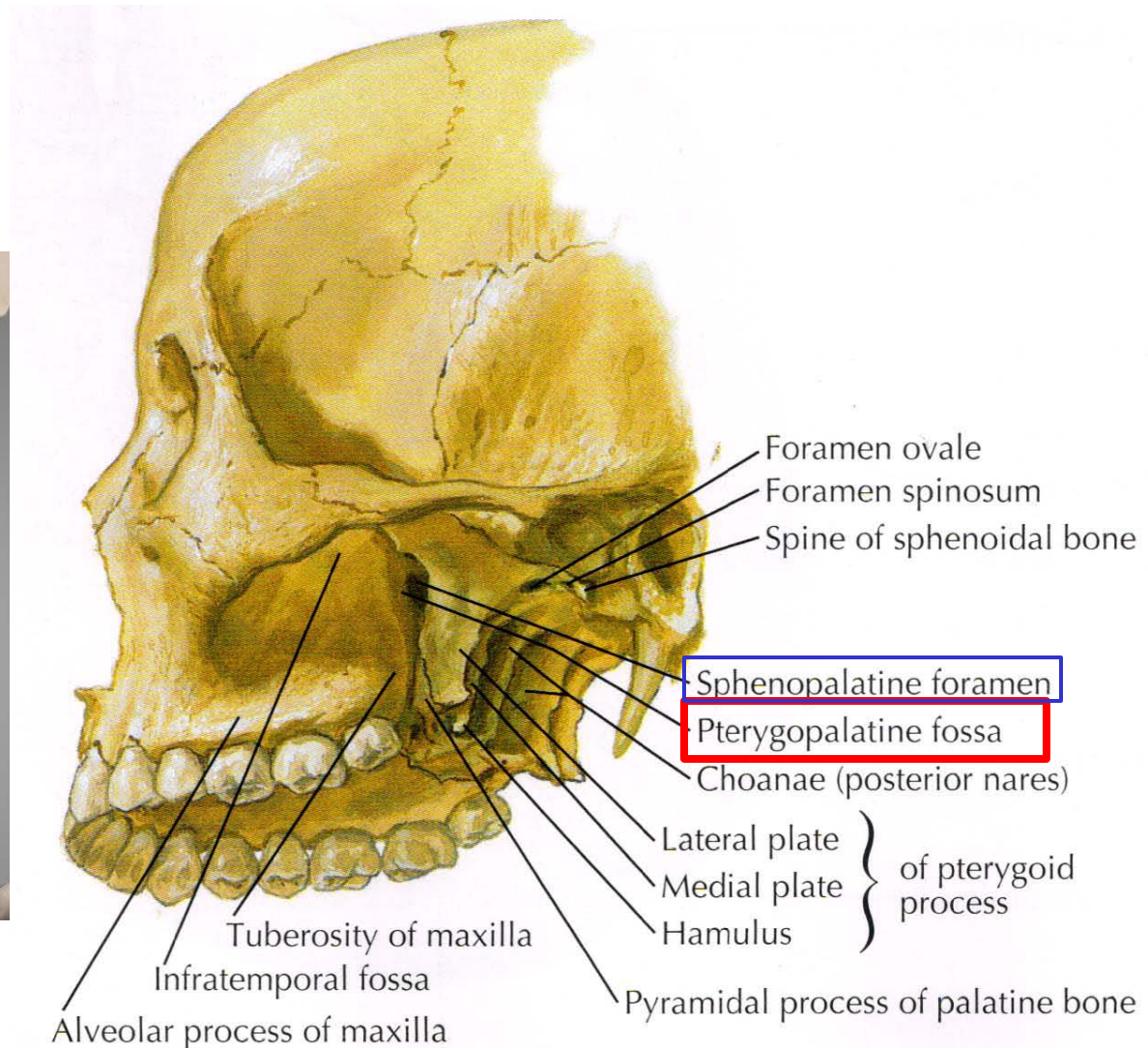
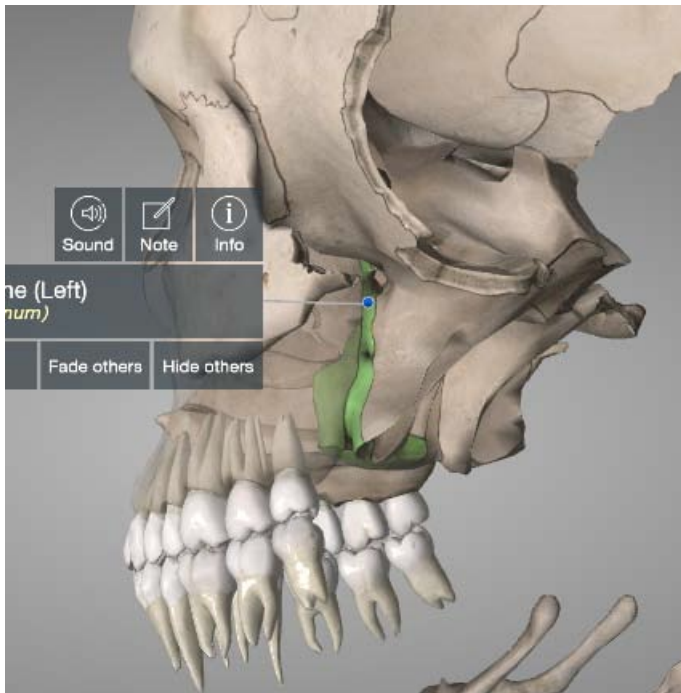


# Lateral wall of nasal cavity-1

- Superior: ethmoid (ethmoidal air cells); inferior: maxilla (maxillary sinus); posterior: perpendicular plate of palatine
- perpendicular plate separates the nasal cavity from pterygopalatine fossa



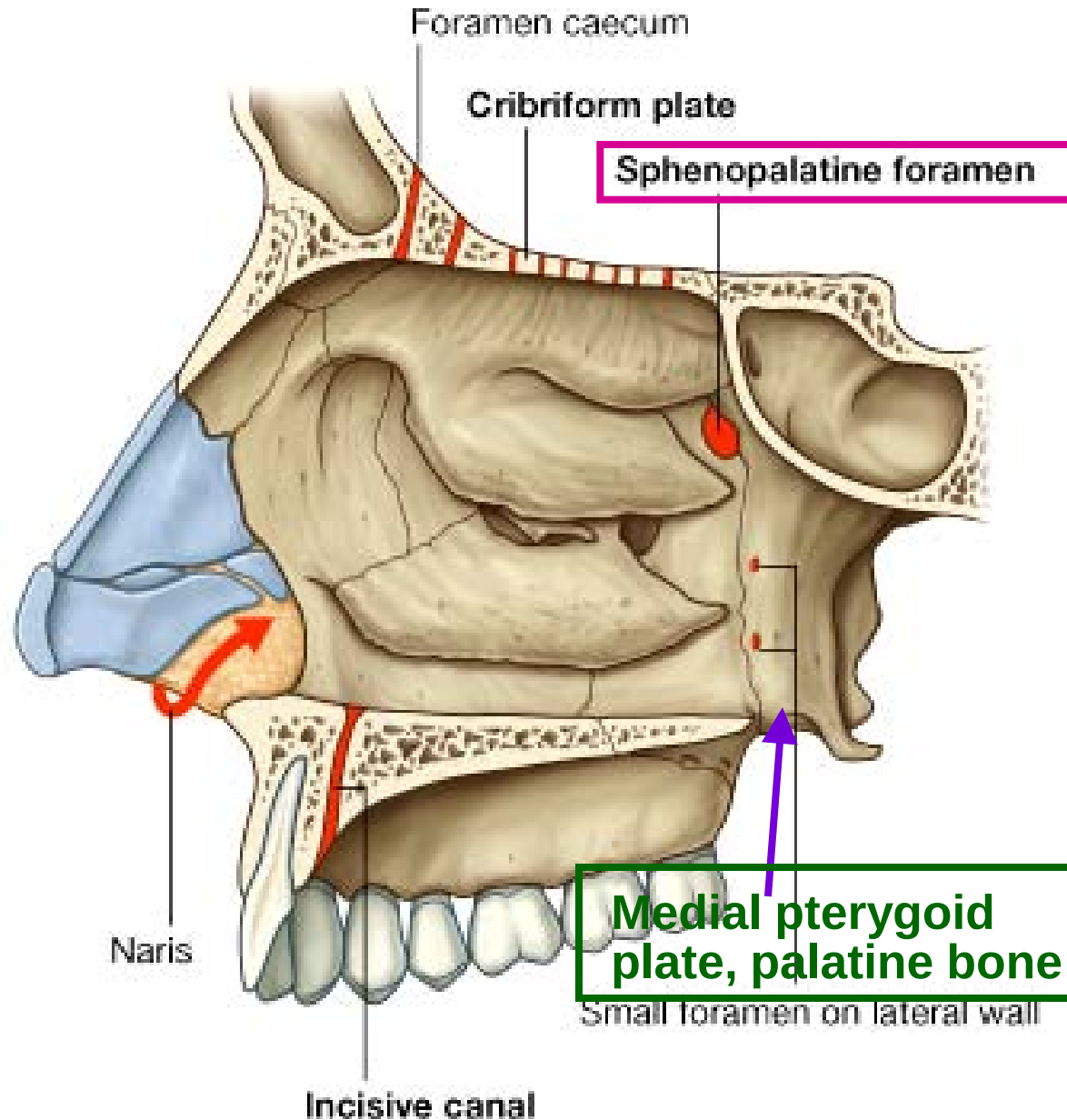
# Pterygopalatine fossa



*F. Netter M.D.*

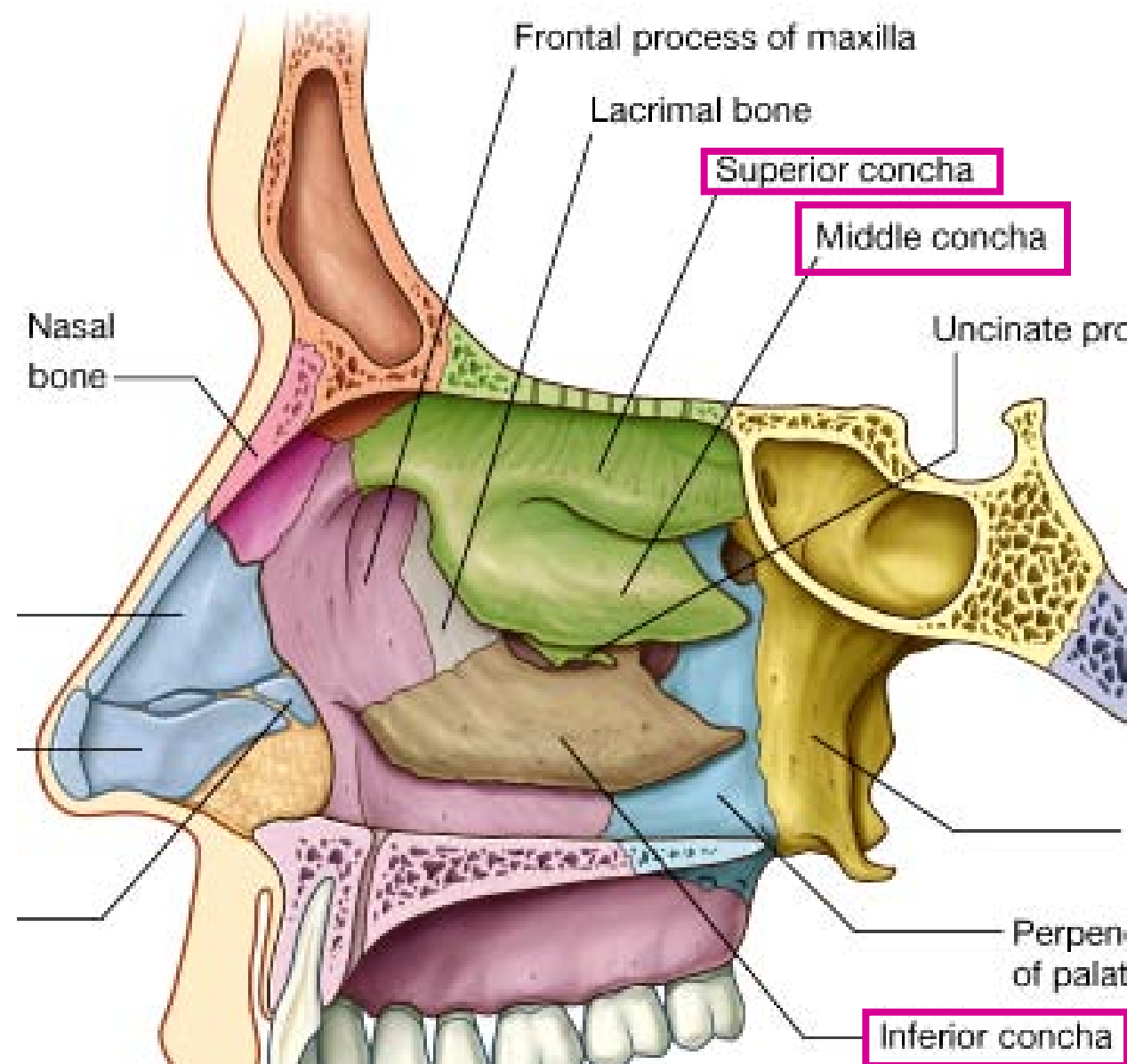
# Lateral wall of nasal cavity-2

- **sphenopalatine foramen** opens from nasal cavity to pterygopalatine fossa.
- further posteriorly, the medial surface of medial pterygoid plate completes the lateral wall



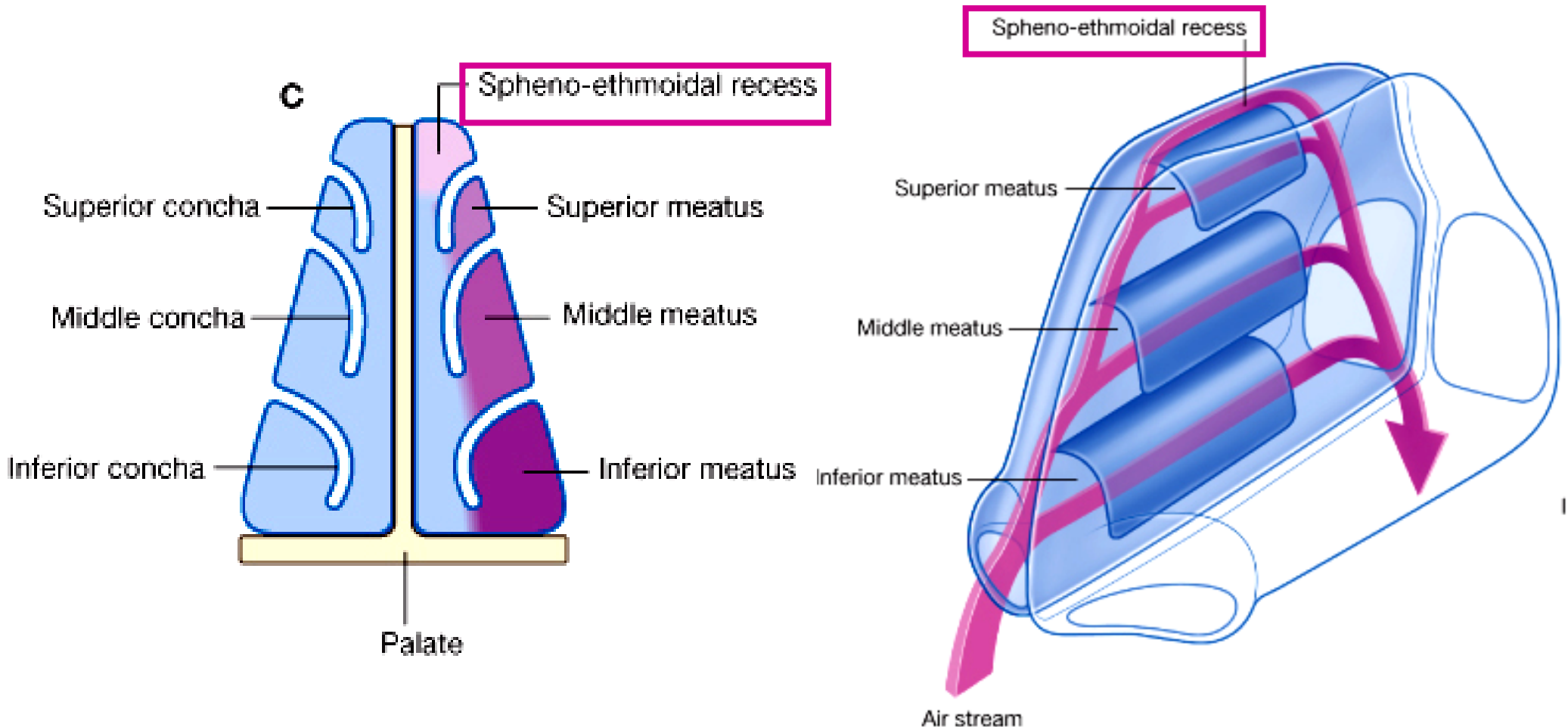
# Extension of bones into Nasal cavity-1

- Shells of bones extending into the nasal cavities:
- 1) **superior concha**: part of ethmoid
- 2) **middle concha**: part of ethmoid
- 3) **inferior concha**: a separate bone



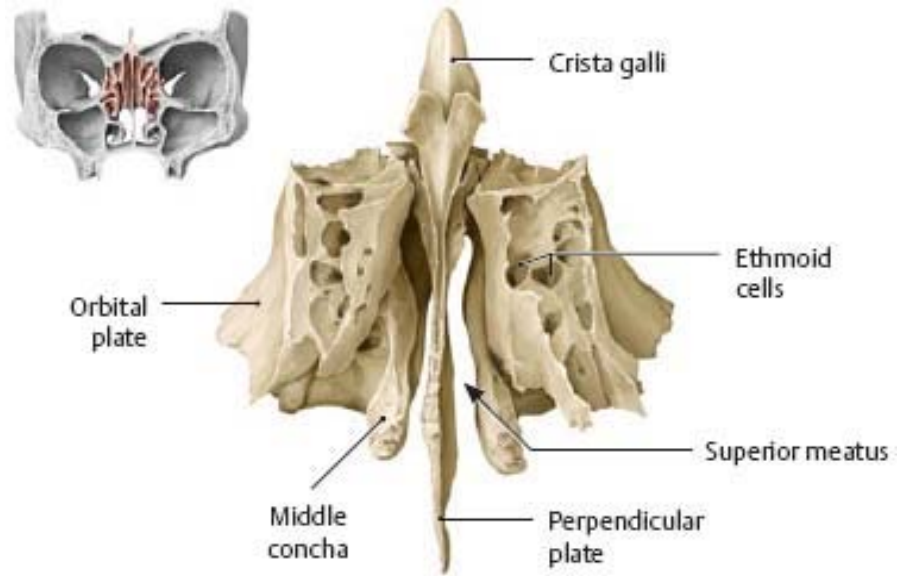
## Extension of bones into Nasal cavity-2

- 4 channels in nasal cavity:
- 1) **sphenoethmoidal recess**: above superior concha, 2) **sup.** 3) **mid.** and 4) **inf. nasal meatus**

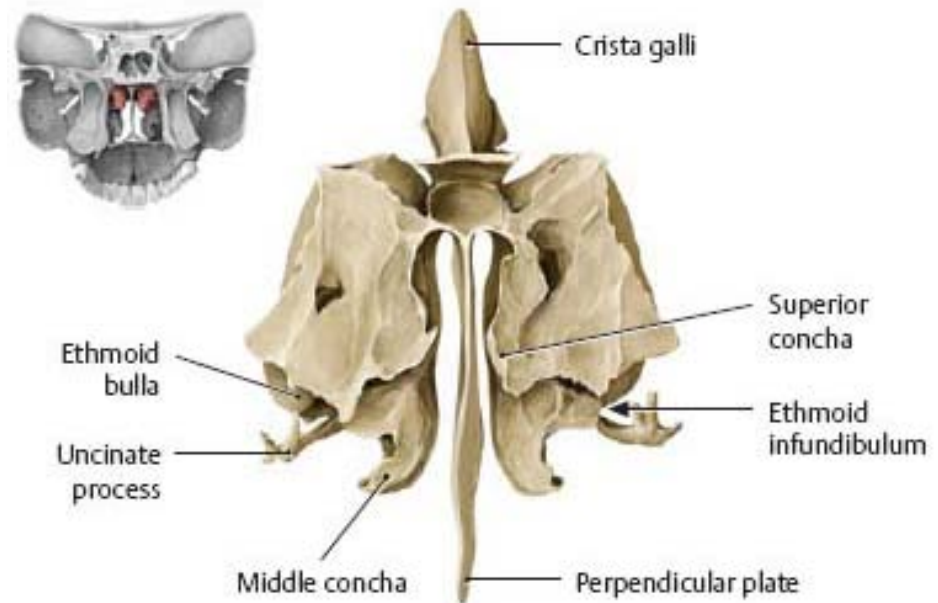


# Ethmoid bone

- Crista galli
- Perpendicular plate
- Cribriform plate
- Lateral and inferior extension
  - Superior concha
  - Middle concha



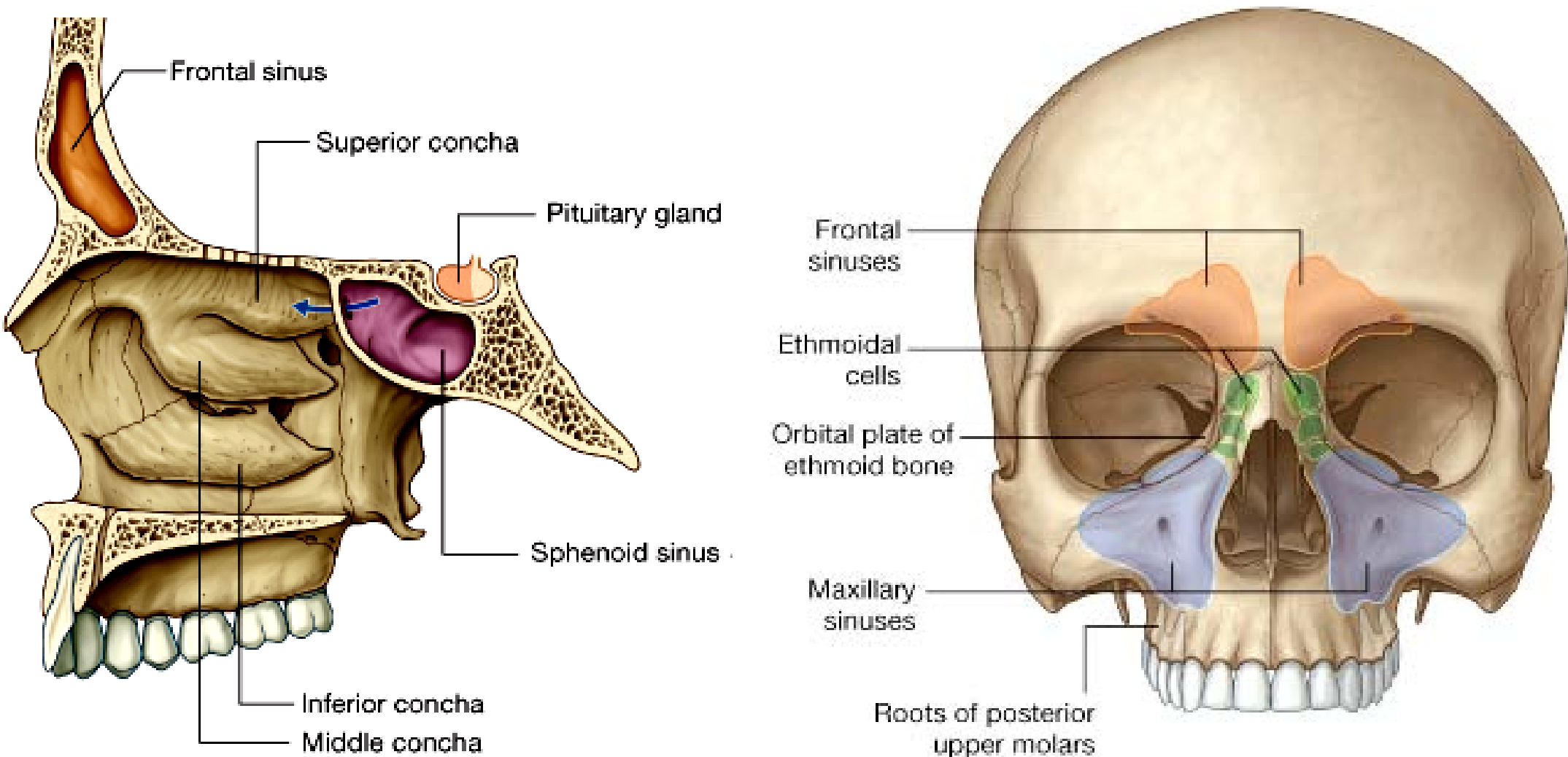
A Anterior view.



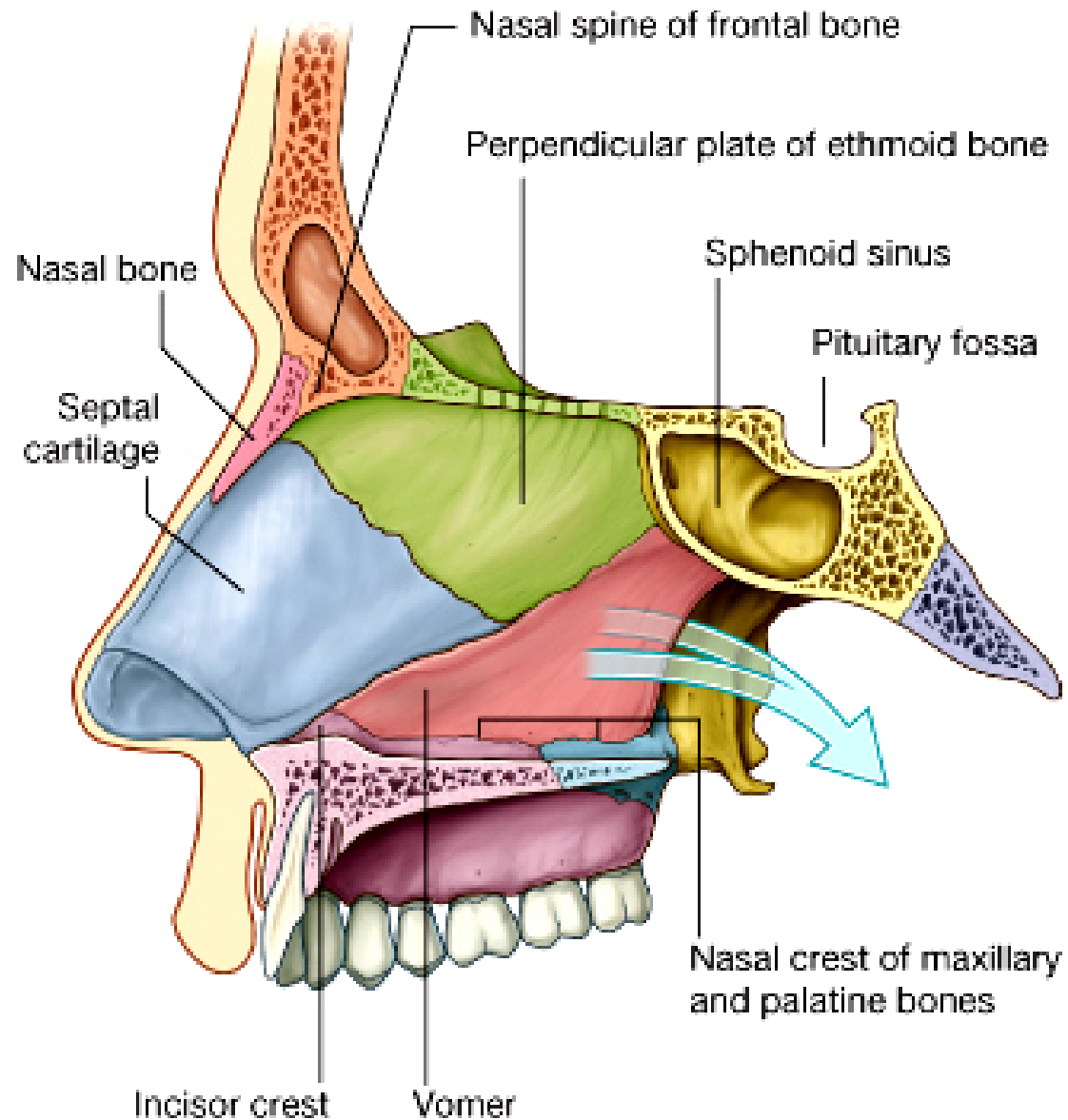
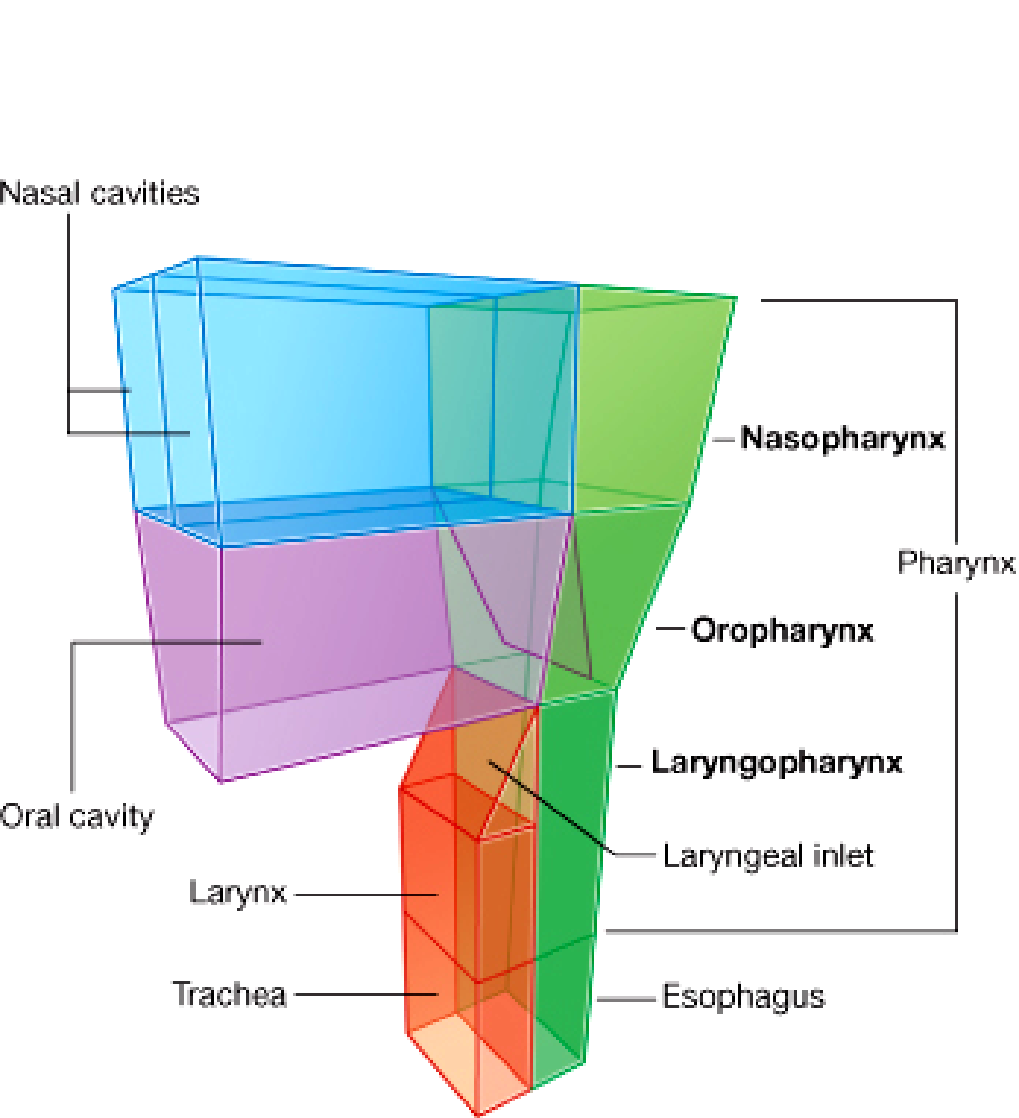
C Posterior view.

# Paranasal sinuses

- communicate with nasal cavities and nasopharynx
- frontal sinus, ethmoidal air cells, maxillary & sphenoidal sinus

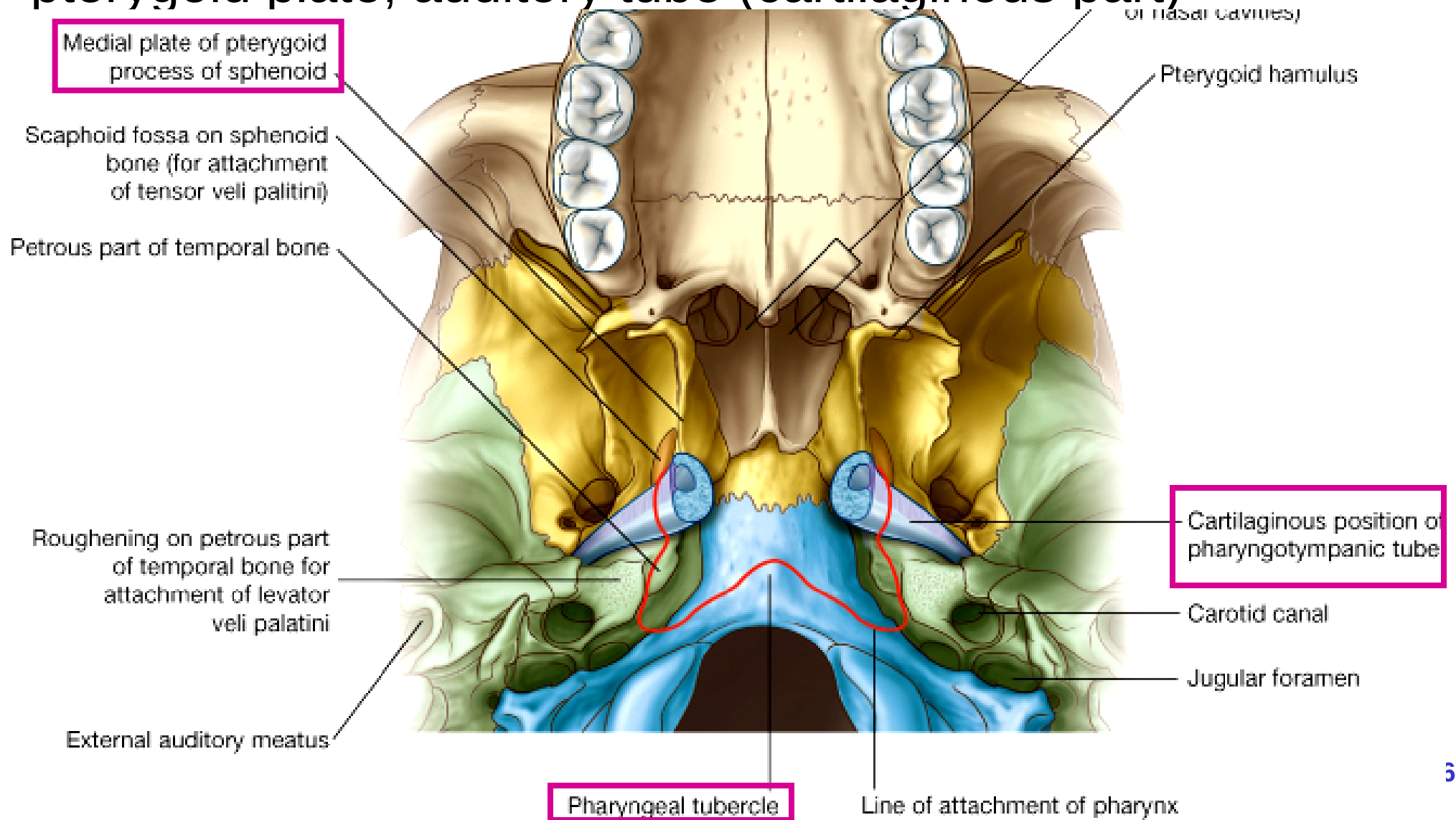


# Nasopharynx



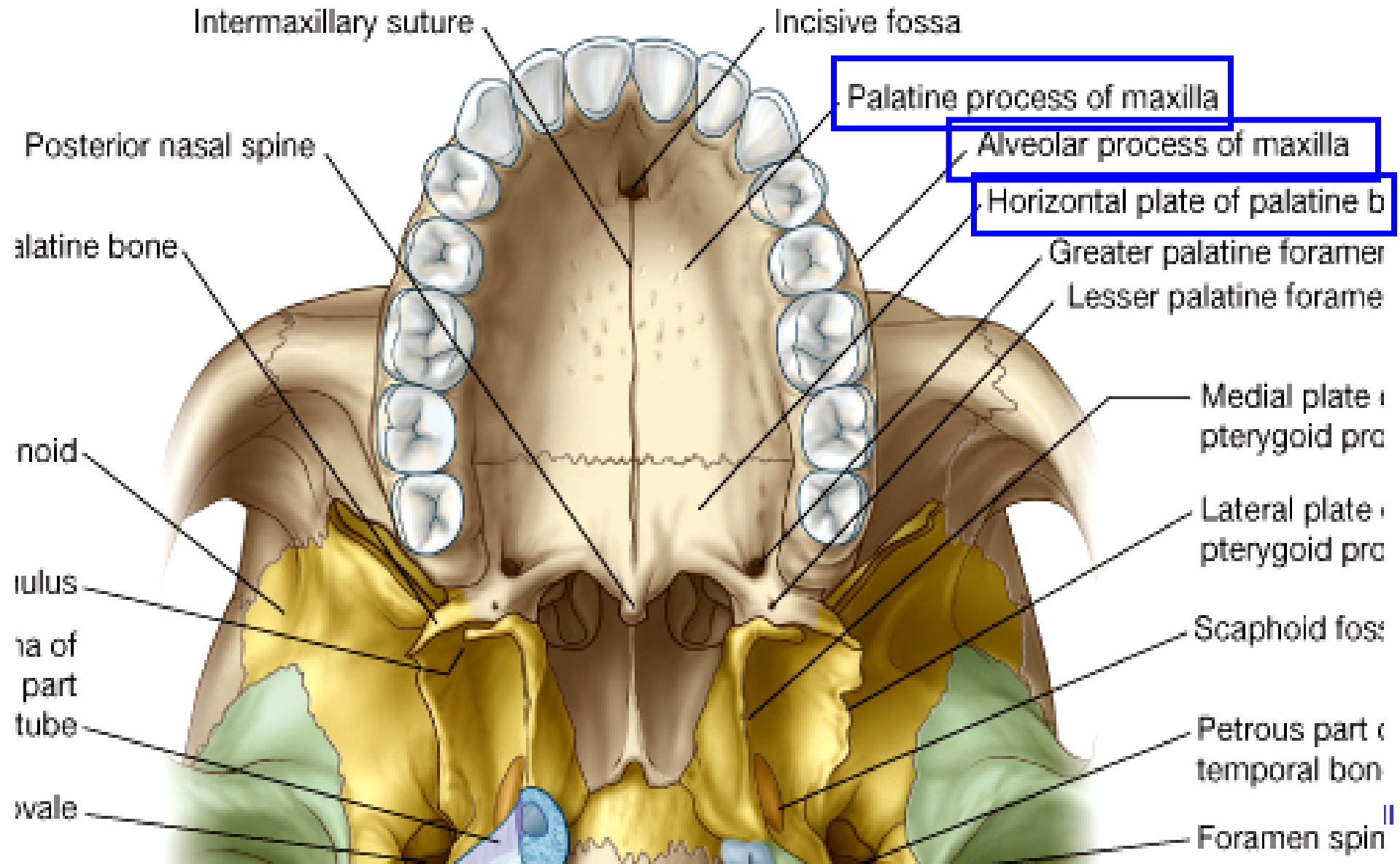
# Bony walls of nasopharynx

- pharynx (raphe) attaches to pharyngeal tubercle; medial pterygoid plate; auditory tube (cartilaginous part)



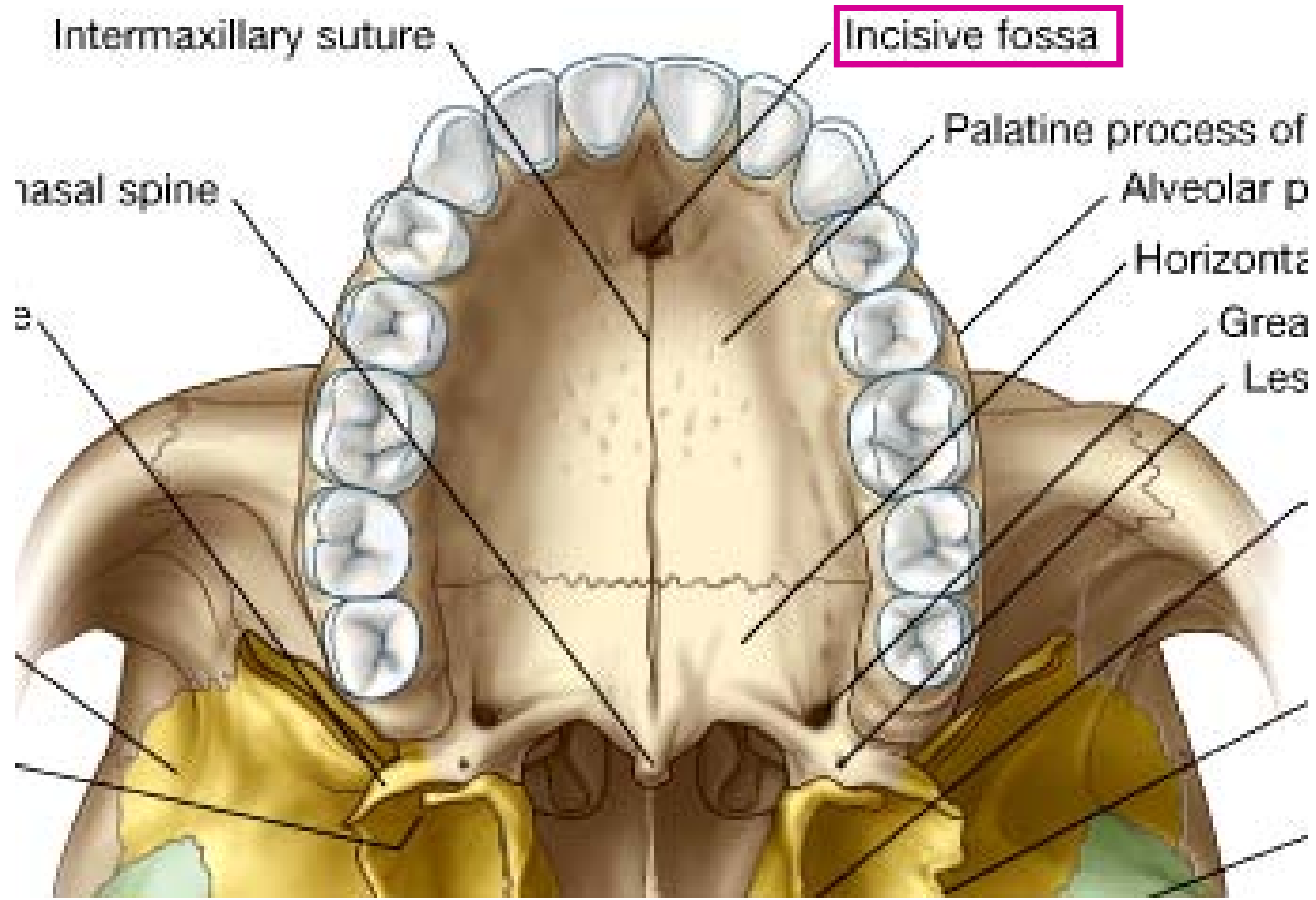
# Oral cavity: upper jaw

- maxilla; hard palate; alveolar process



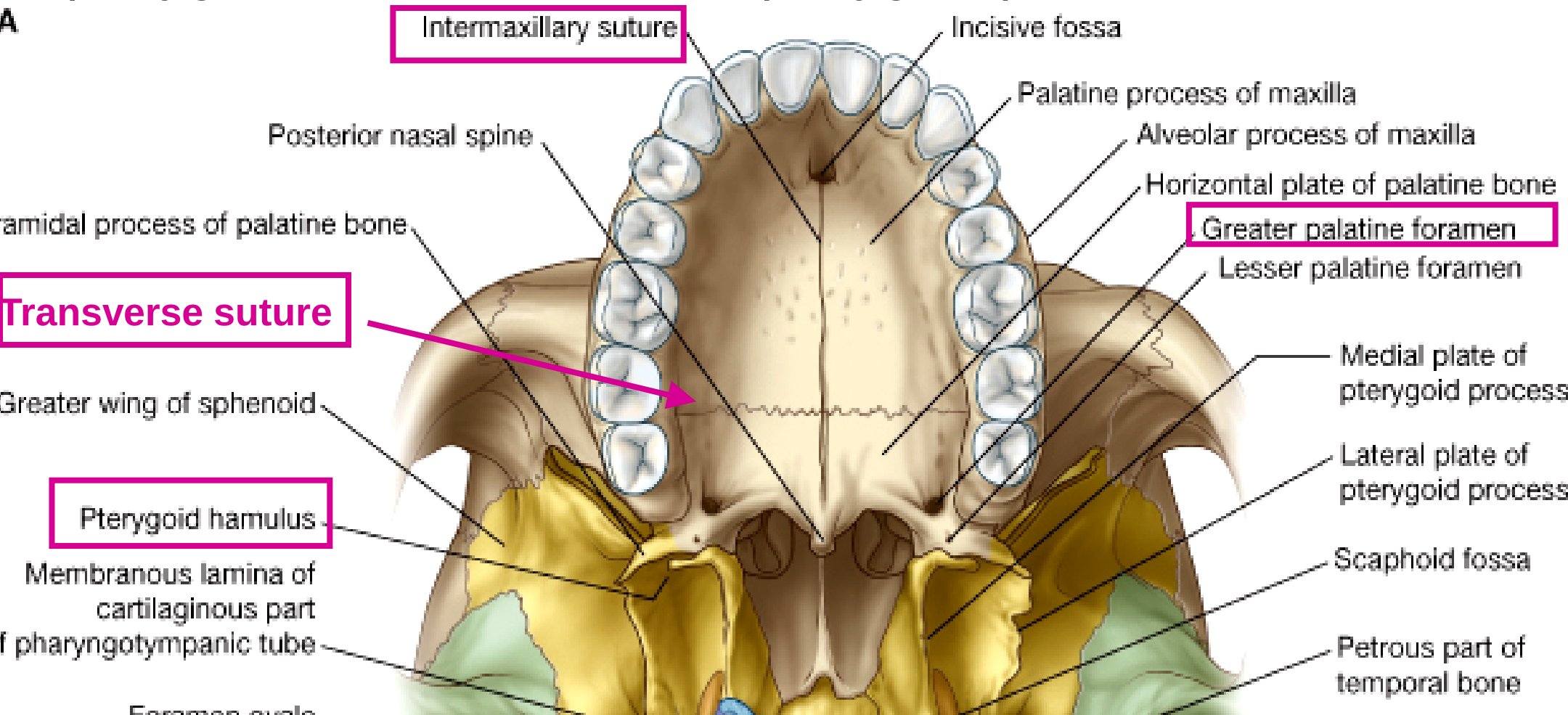
## Bony palate-1

- **incisor fossa/foramen**: septal br. of sphenopalatine a. + nasopalatine n. (connection between oral and nasal cavity)



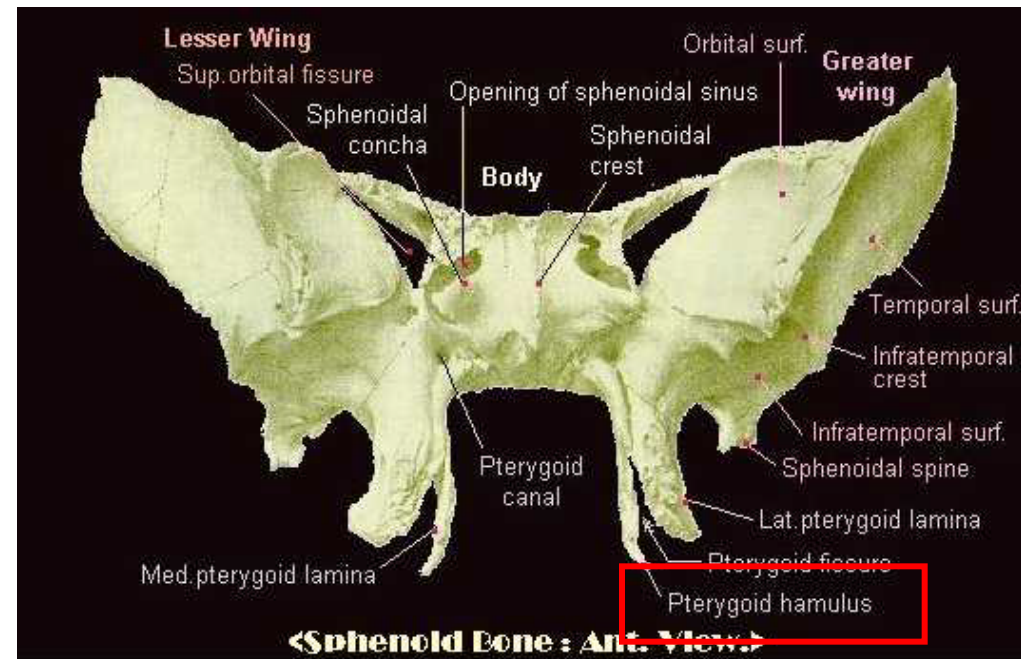
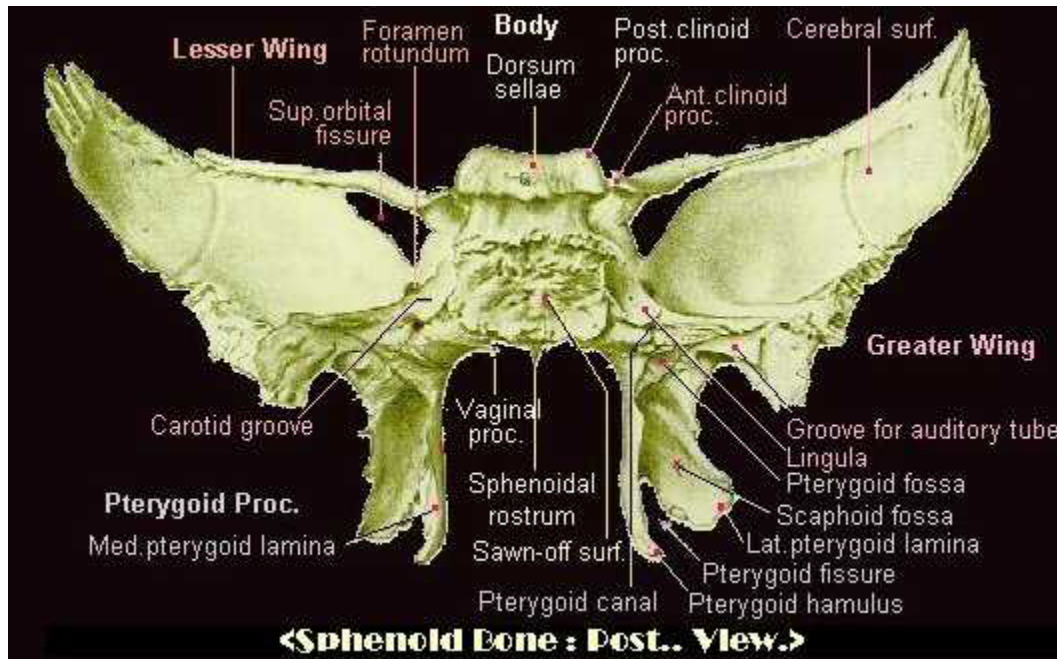
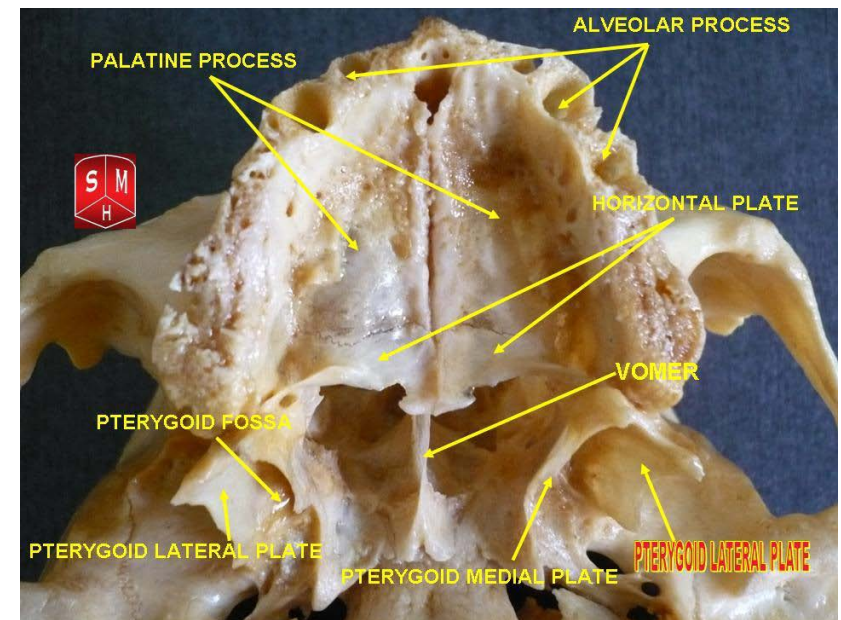
## Bony palate-2

- midline suture; transverse suture: palatine/ maxilla
- **greater palatine foramen**:  $\leftrightarrow$  pterygopalatine fossa
- pterygoid hamulus of medial pterygoid plate



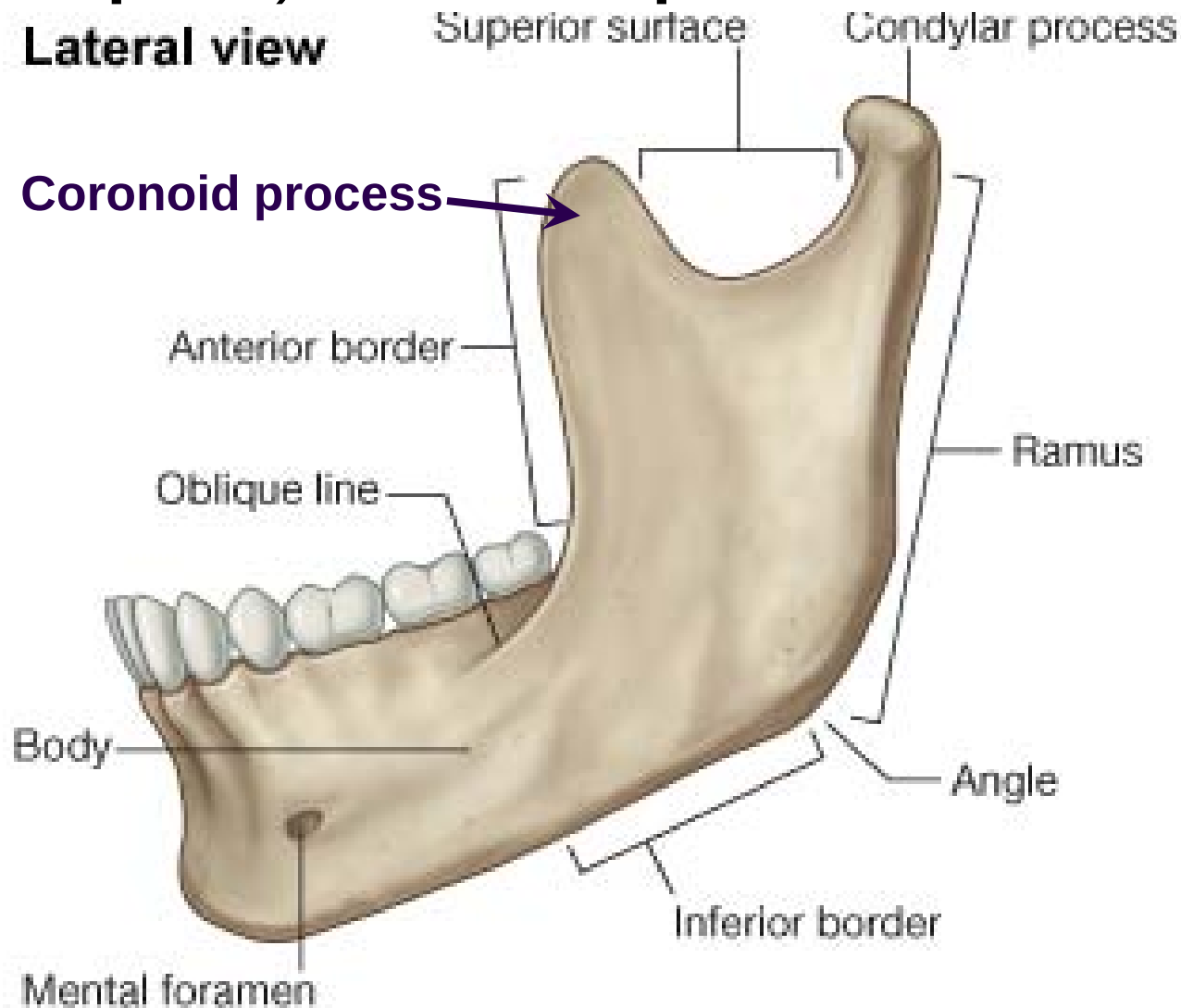
# Pterygoid of sphenoid bone

- Lateral pterygoid plate (lamina)
- Medial pterygoid plate (lamina)
- Pterygoid hamulus



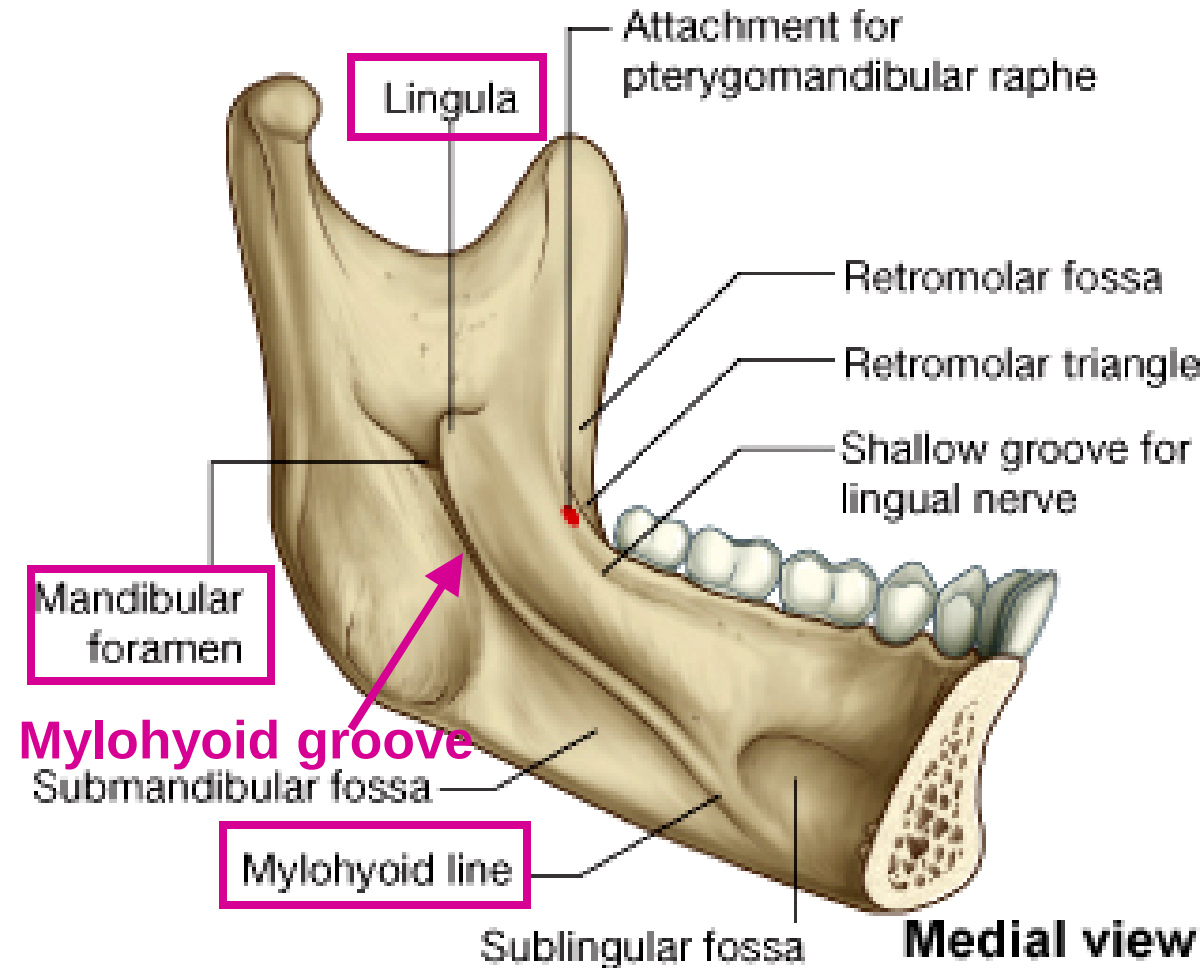
# lower jaw (mandible)

- body; alveolar process; angle; ramus: head of mandible (condylar proc.); coronoid proc.



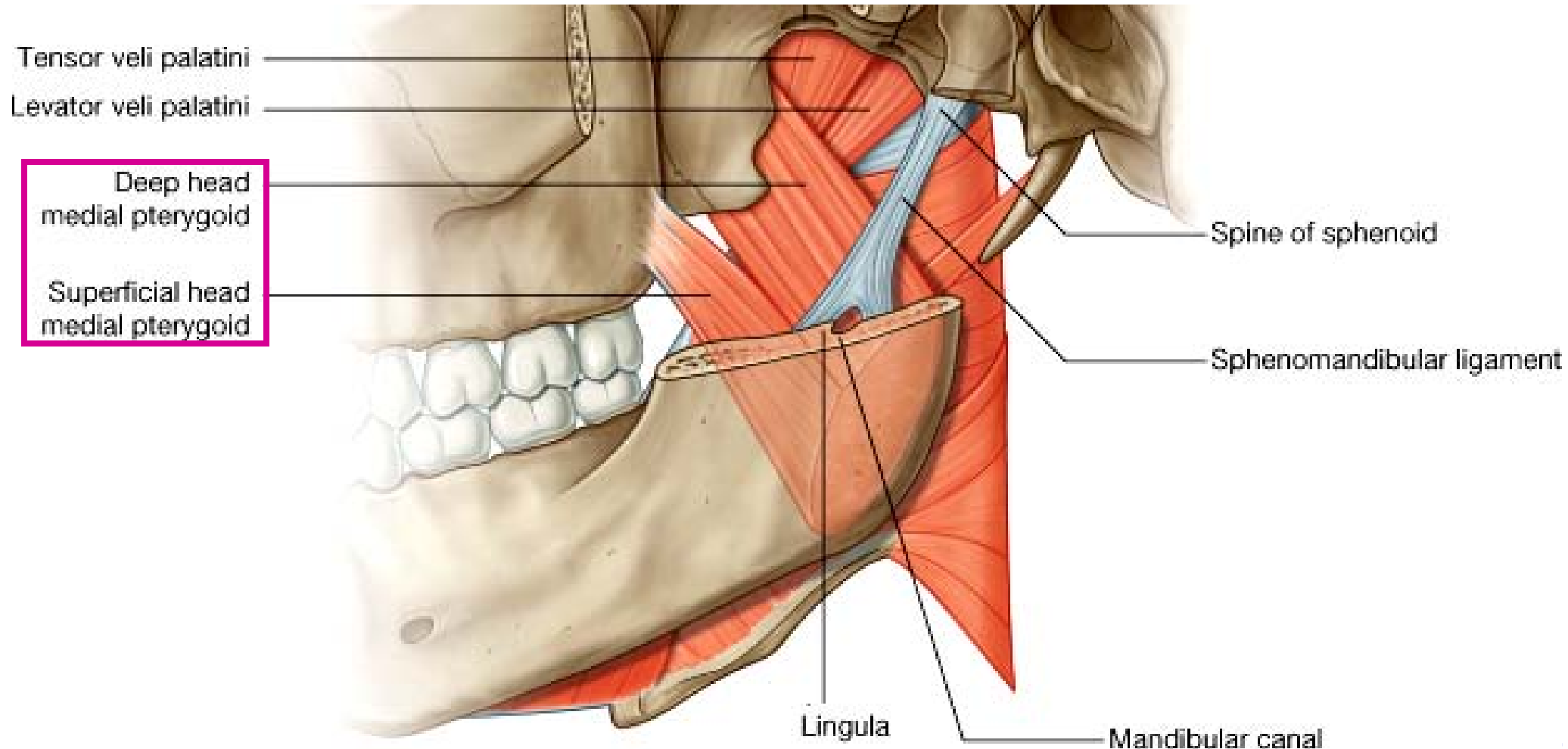
# Medial surface of mandible-1

- mandibular foramen
  - inf. alveolar n. (branch of  $V_3$ ), vessels
  - Entrance into mandibular canal
- Lingula: triangular, for sphenomandibular lig.
- mylohyoid groove: mylohyoid n., vessels
- mylohyoid line: attachment of mylohyoid muscle



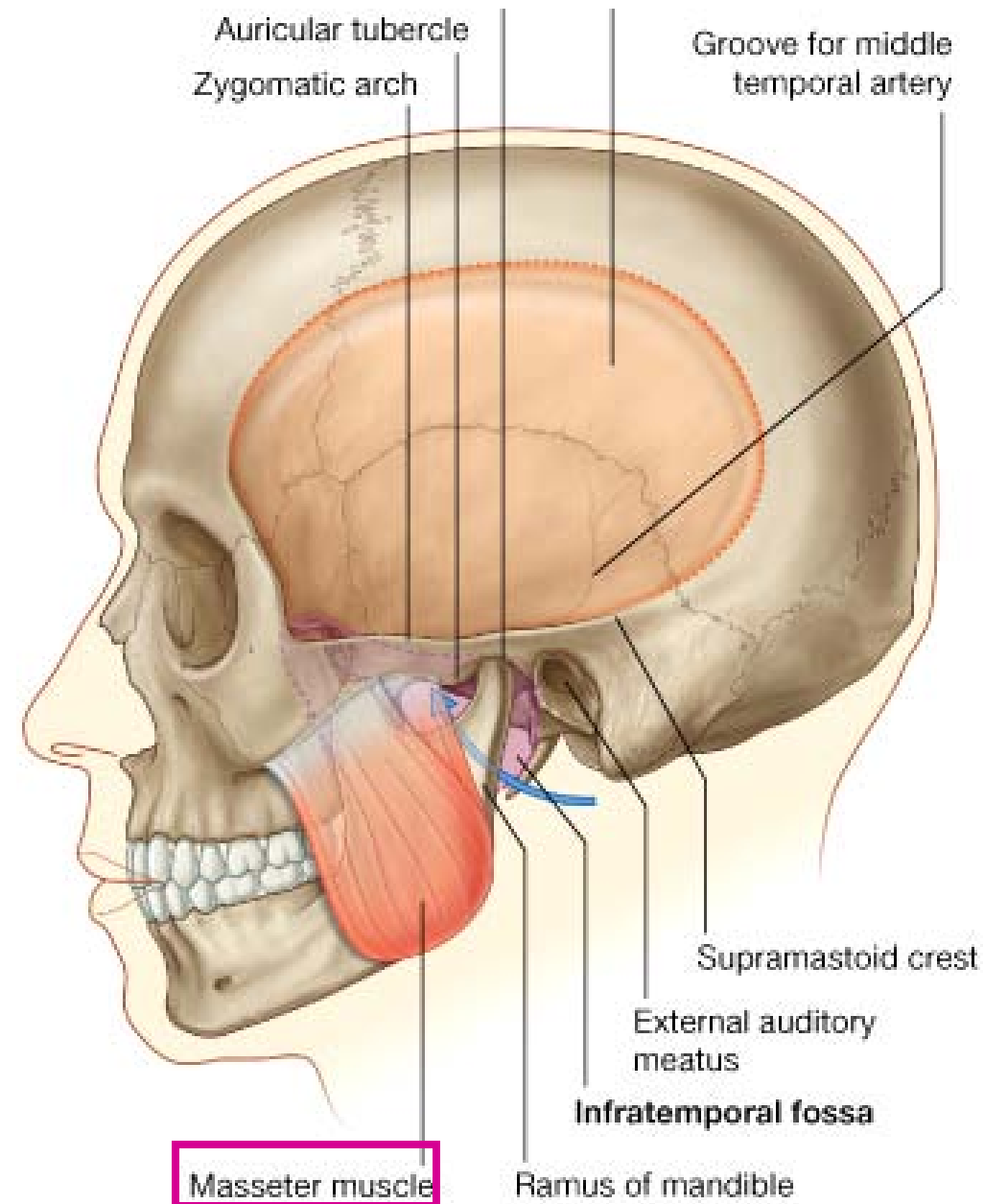
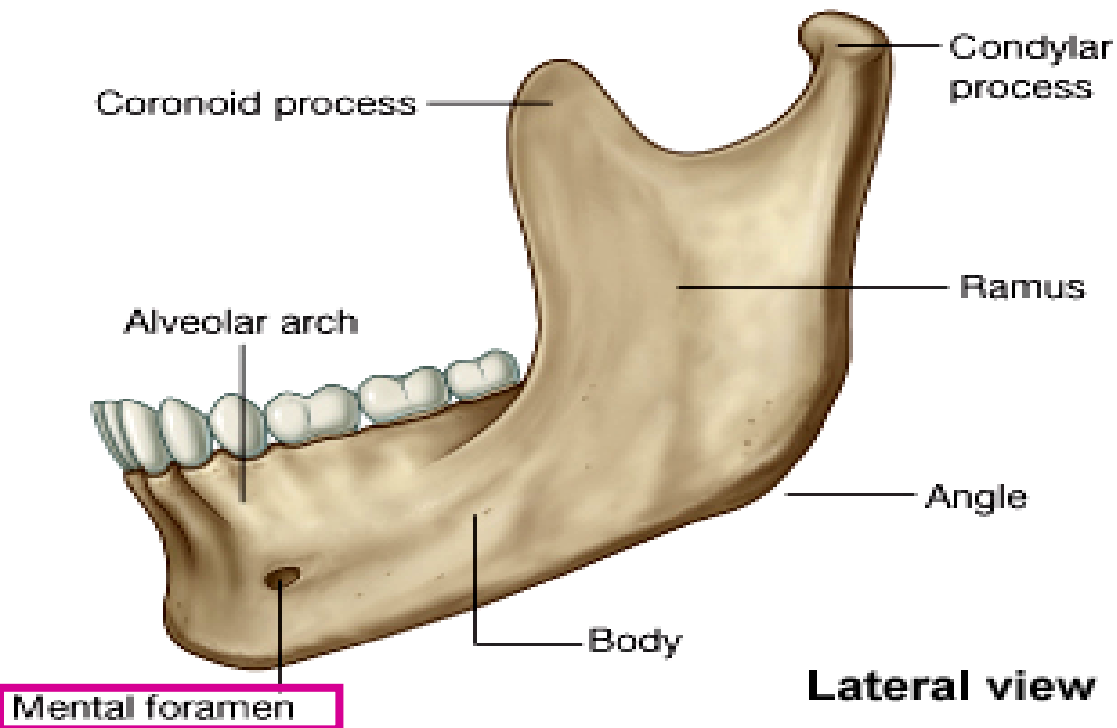
## Medial surface of mandible-2

- rough area at angle and post. margin of ramus:  
med. pterygoid muscle attachment

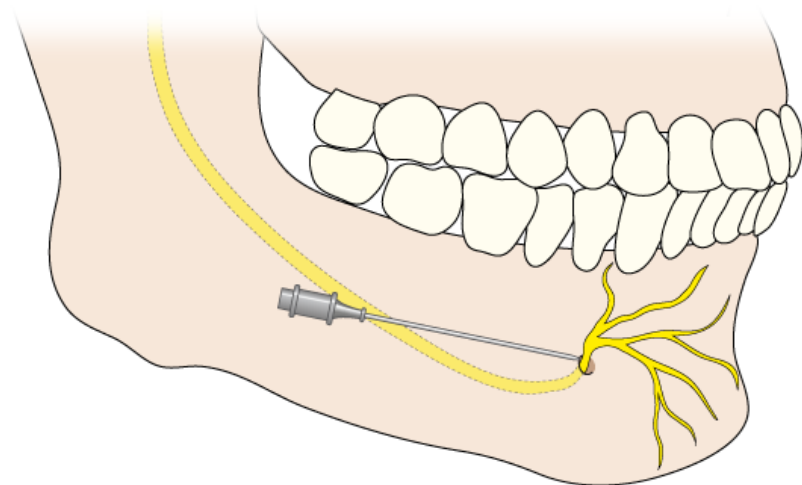
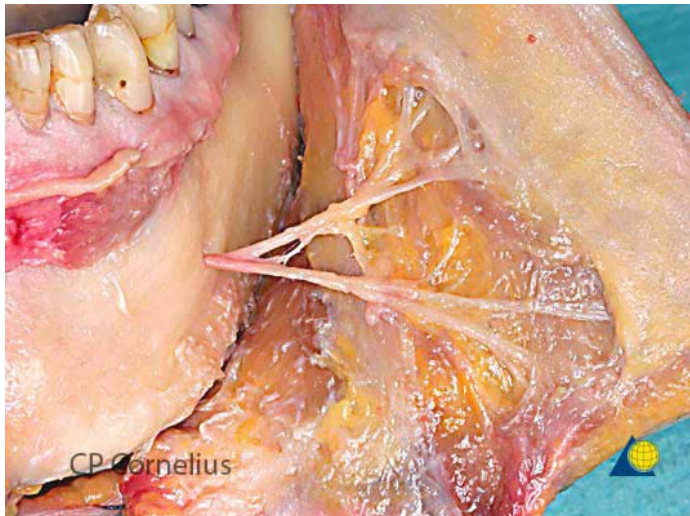
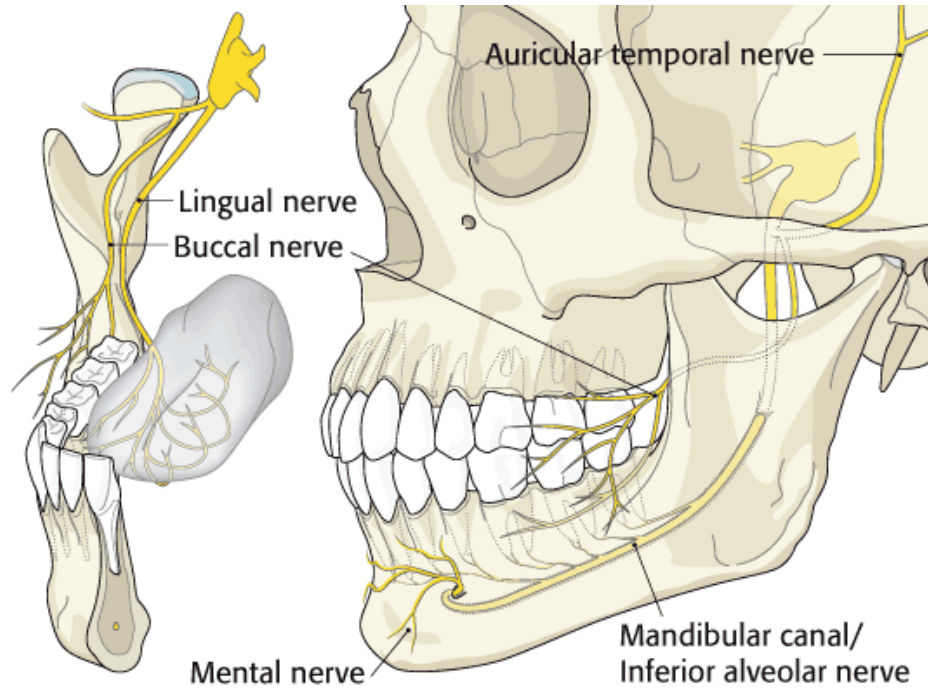


# Lateral surface of mandible

- masseter muscle attachment;  
**mental foramen**

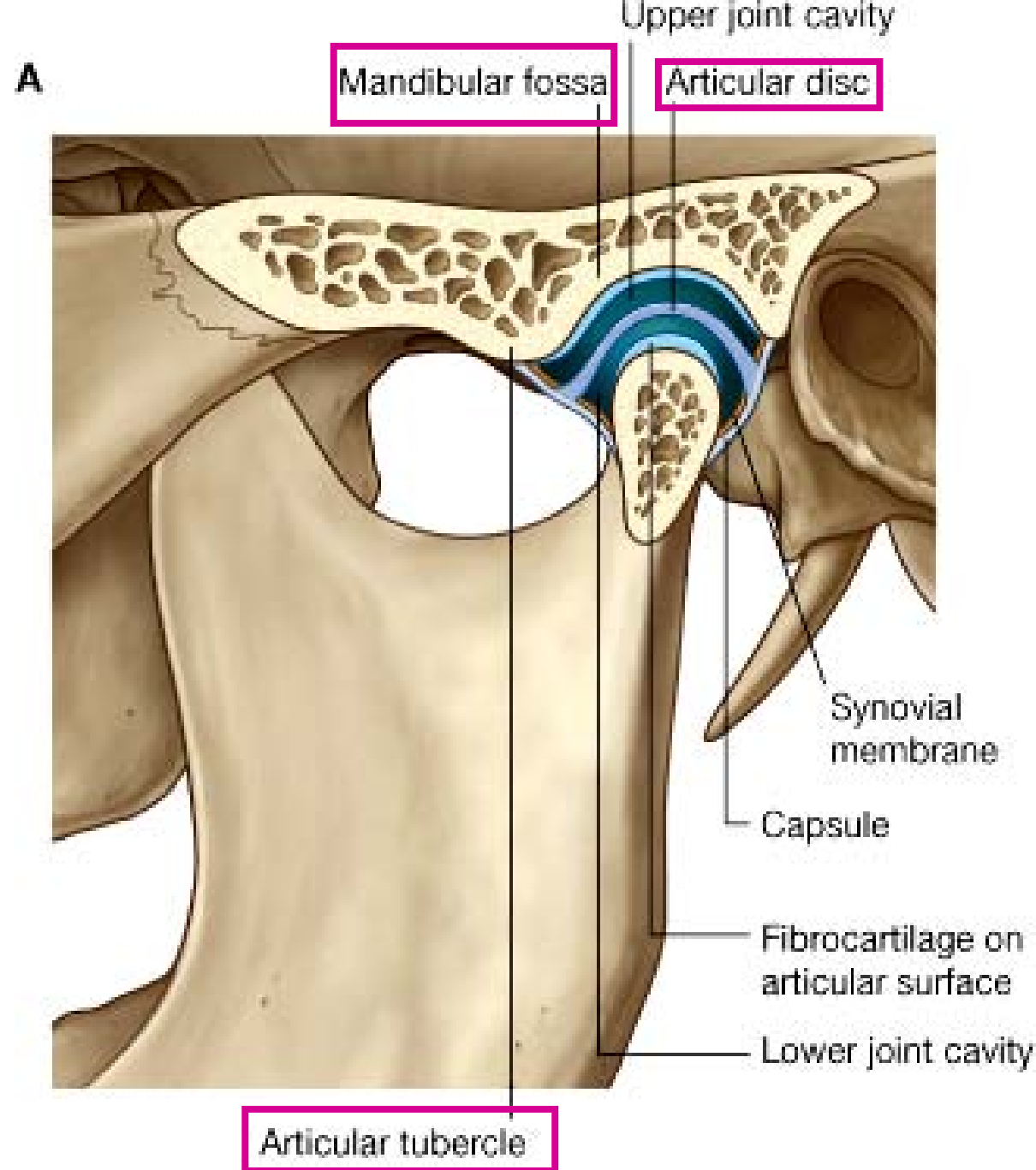


# Mandibular foramen; Mental foramen



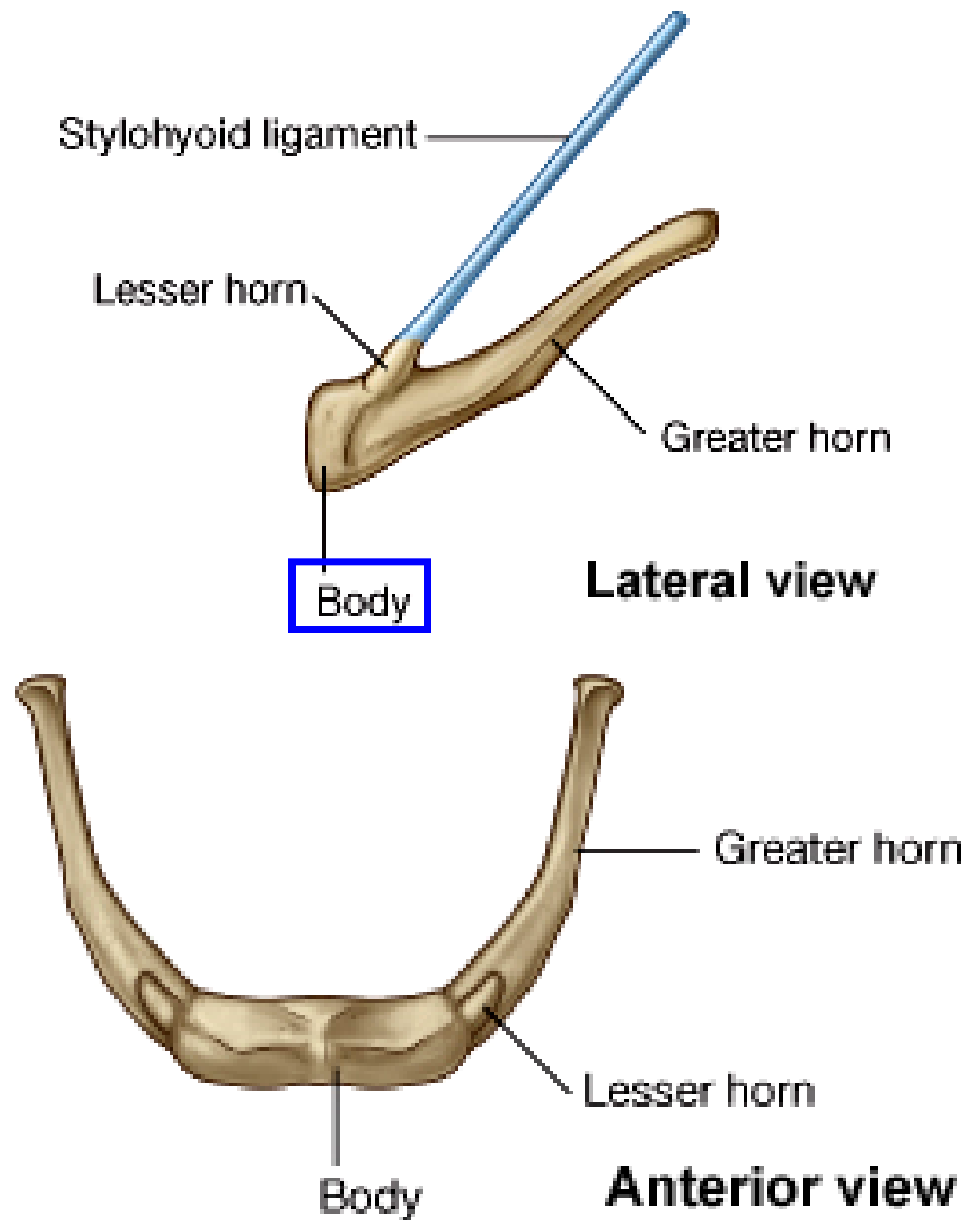
# Temporomandibular joint (TM joint, TMJ)

- head of mandible ↔ mandibular fossa + articular tubercle



# Hyoid bone

- **Body**
- **greater cornu**
- **lesser cornu**  
(stylohyoid lig.)



# Skull: review

- Neurocranium
  - External surface
  - Interior: Anterior, Middle, Posterior cranial fossa
- Facial skeleton
  - Ear, Orbit
  - Nasal and Oral cavities
  - Mandible
- Openings and contents through them

