

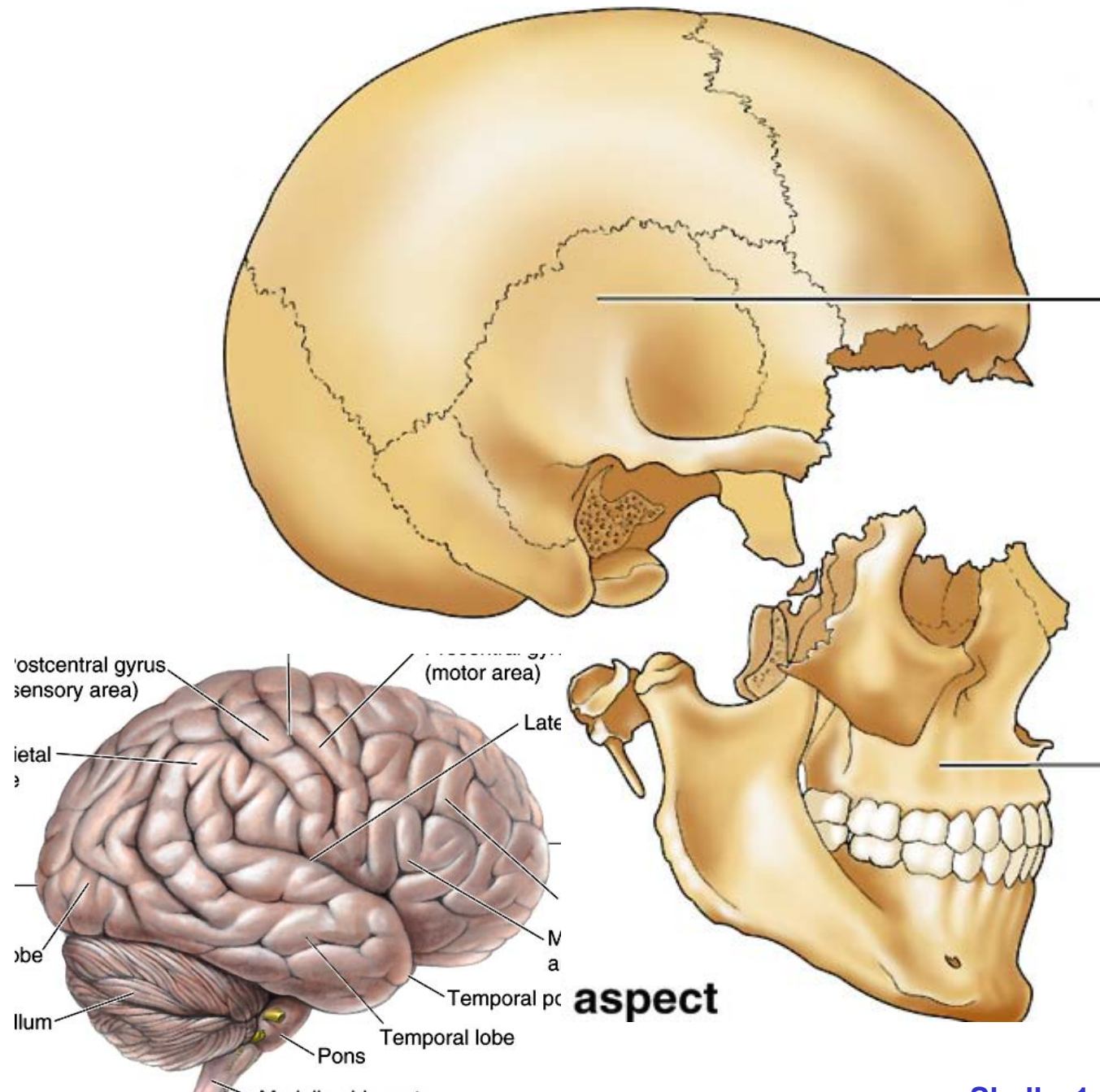
Skull

- **Cranial skeleton (Neurocranium)**

- Calarvia
 - Frontal, Temporal, Parietal, Occipital

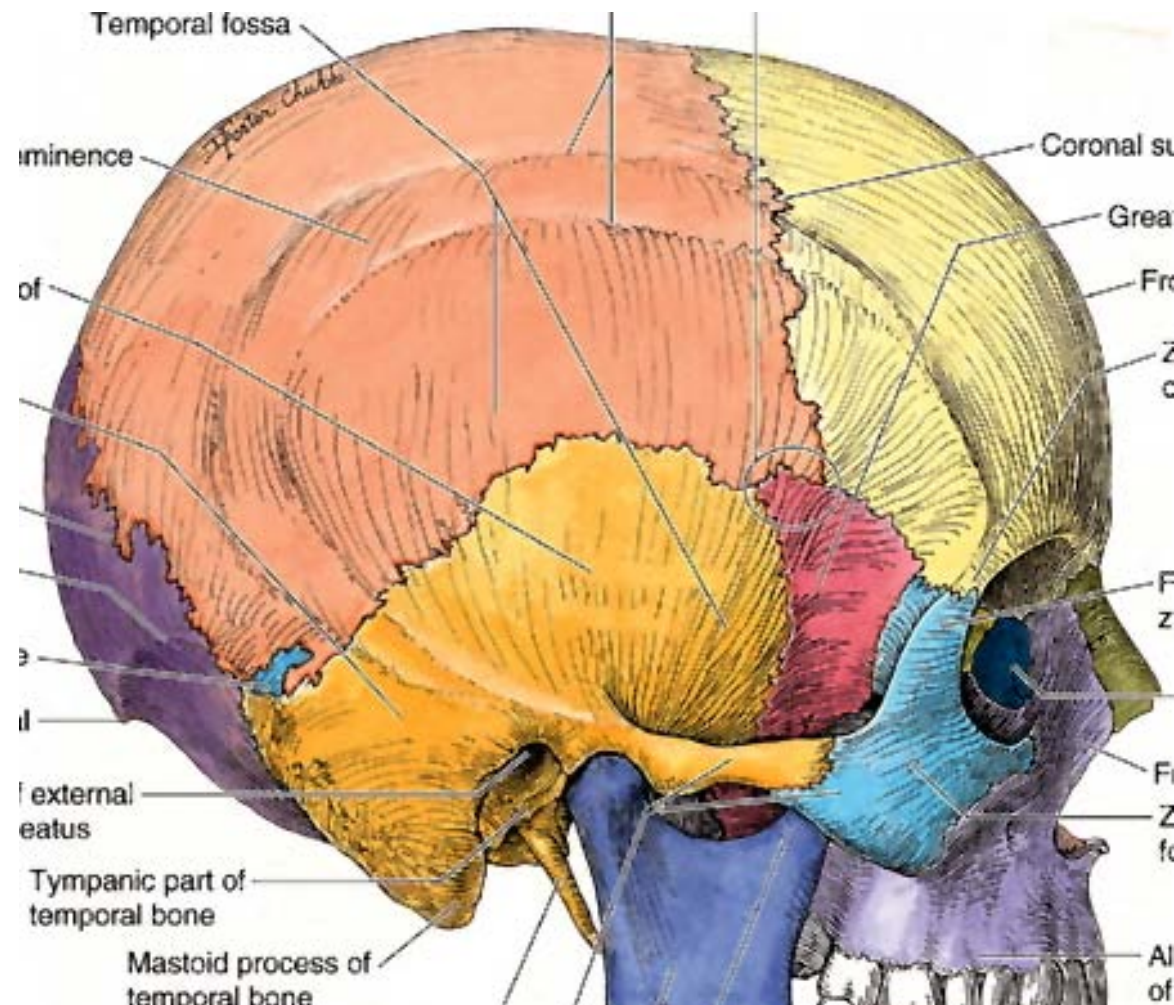
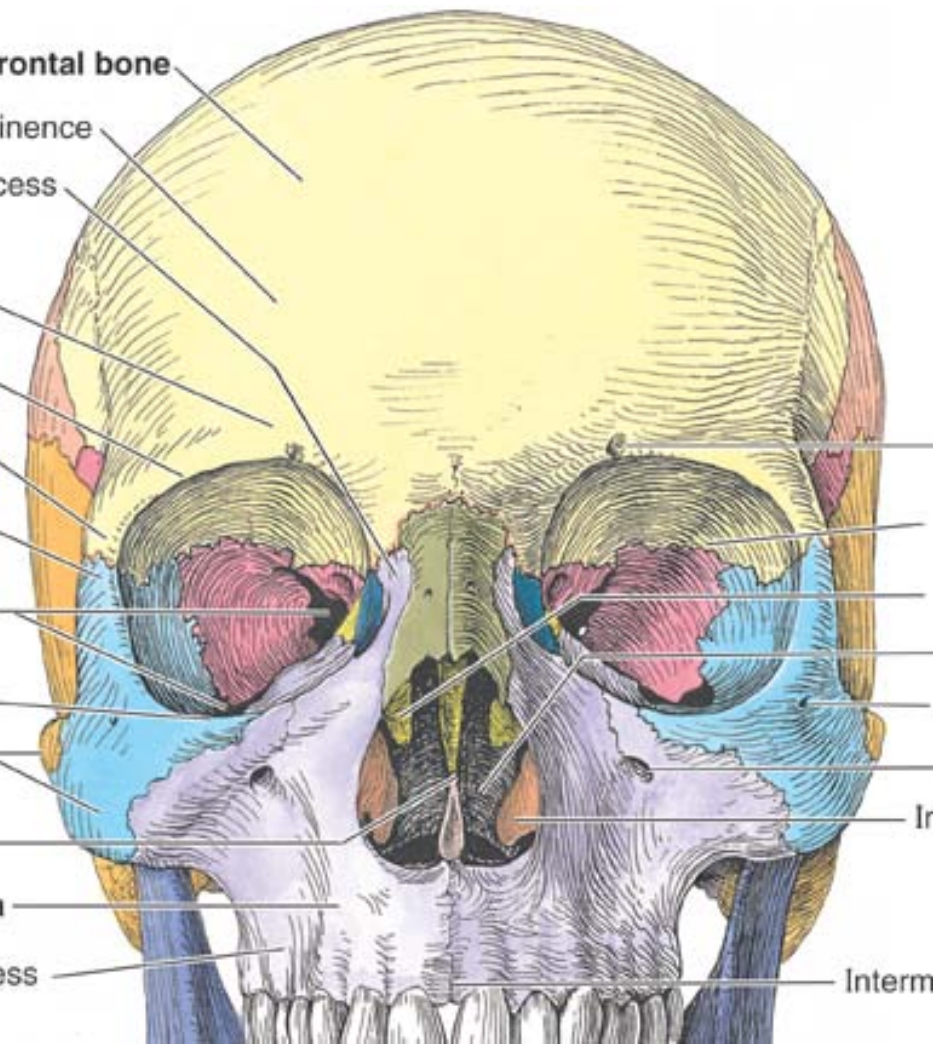
- Cranial base

- **Facial skeleton (Viscerocranium)**



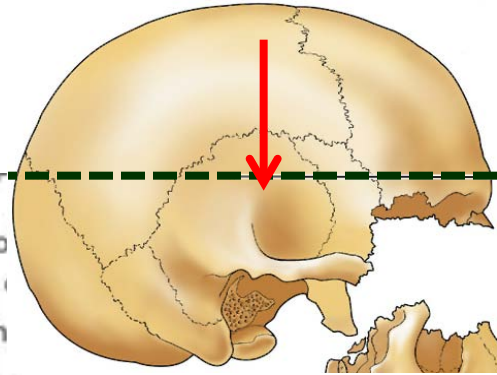
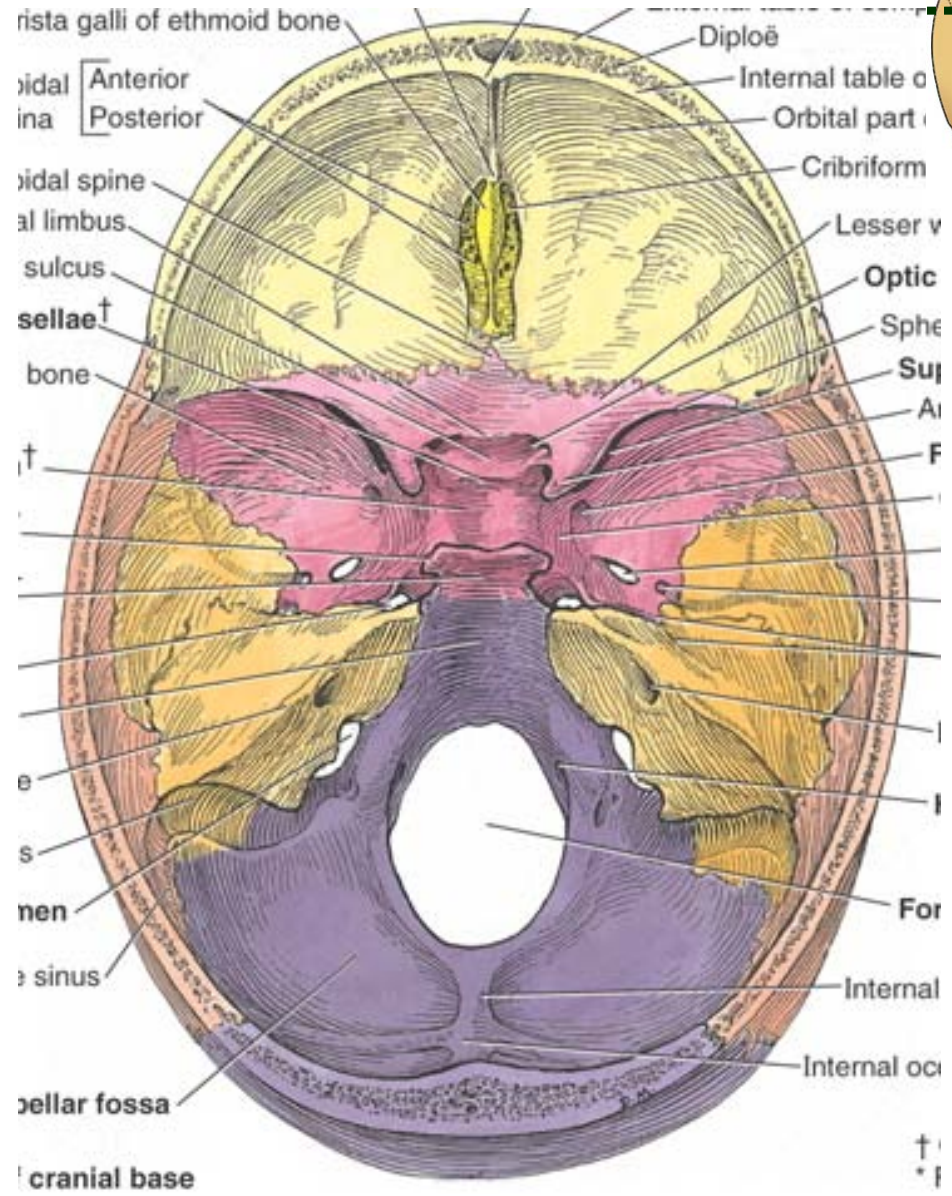
Neurocranium: cranial vault

- Frontal, Parietal, Temporal
- Mainly membranous bone formation



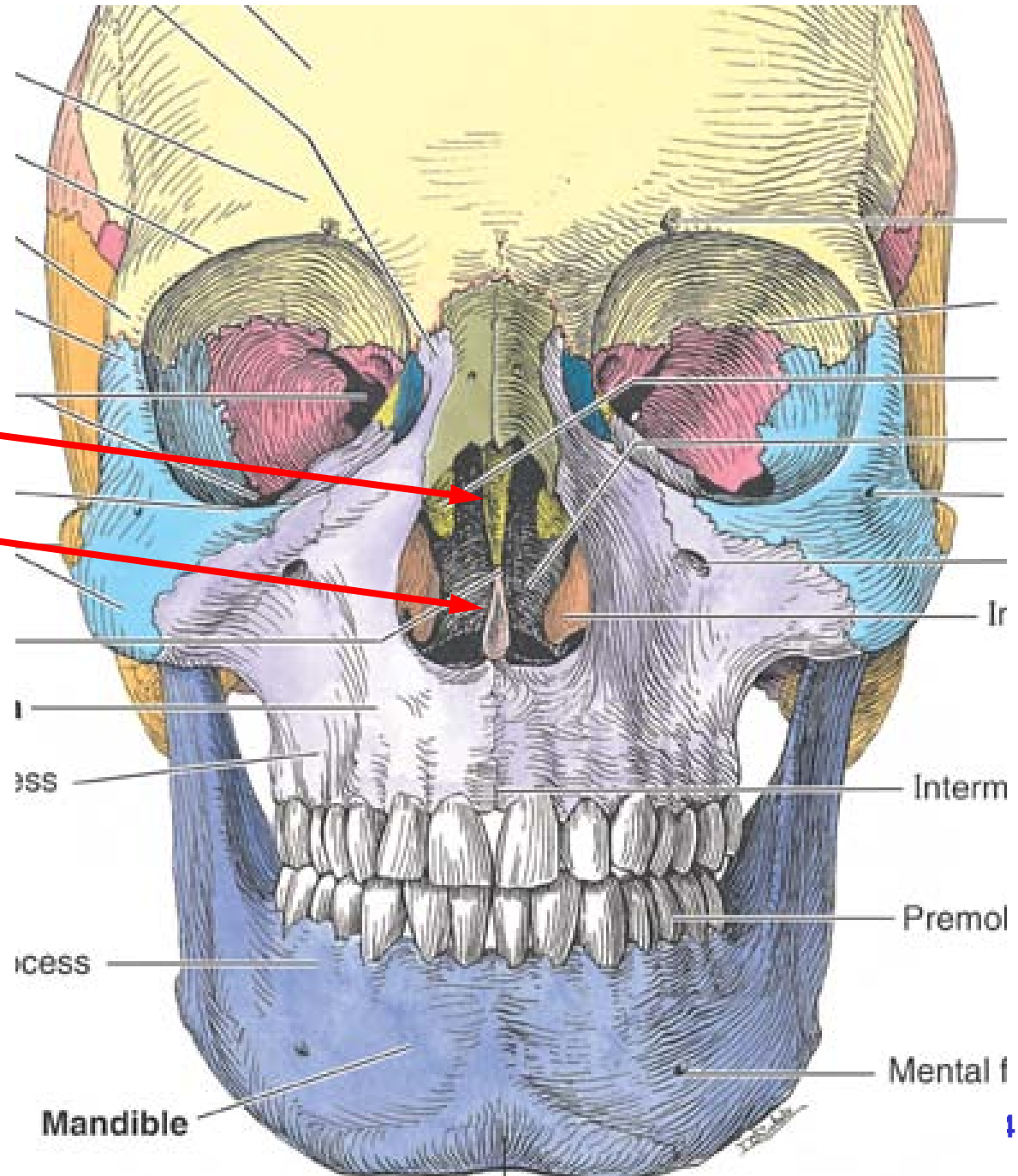
Neurocranium: cranial base

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



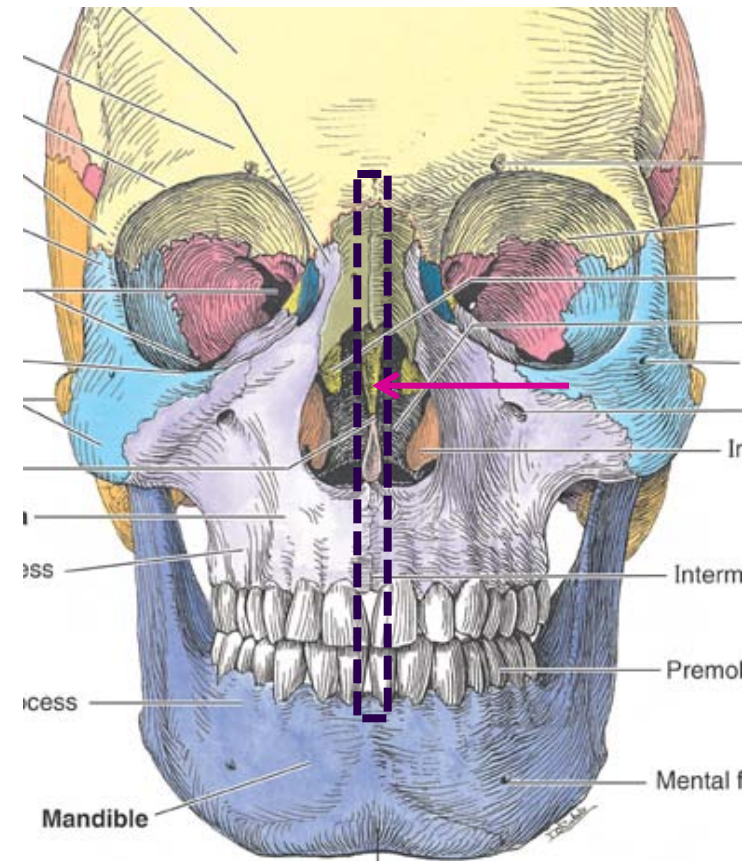
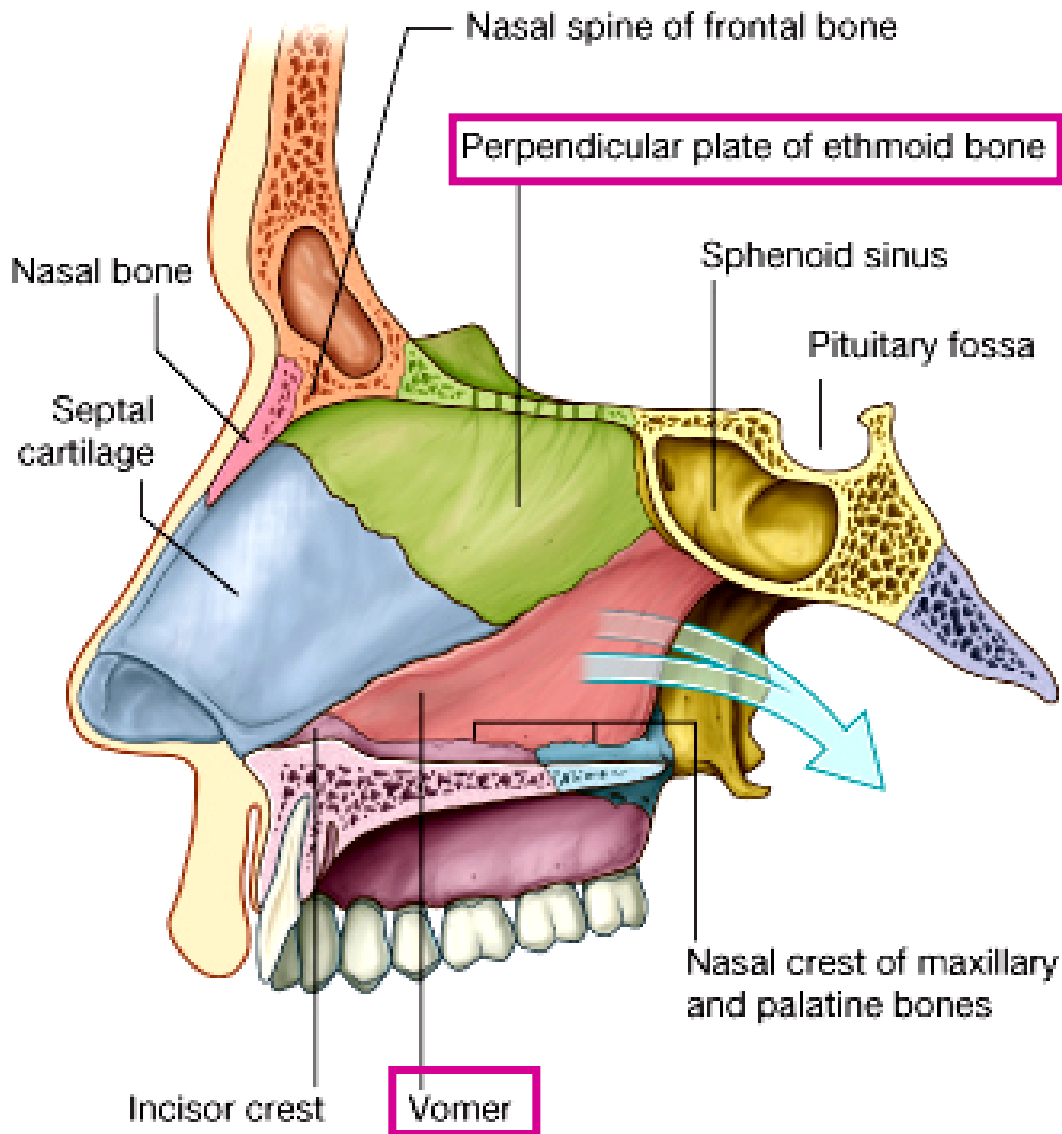
Viscerocranium: anterior view

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



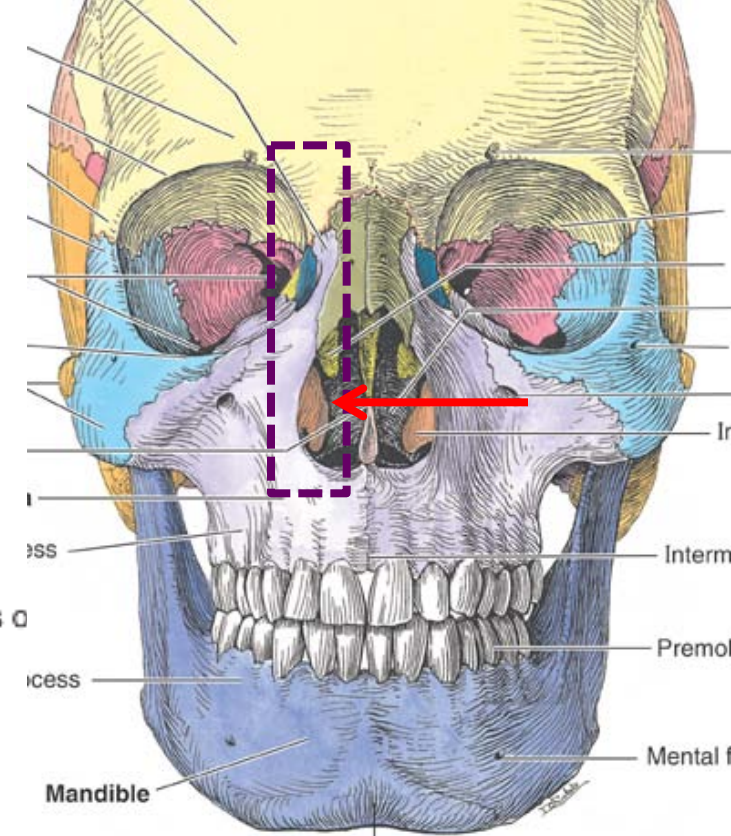
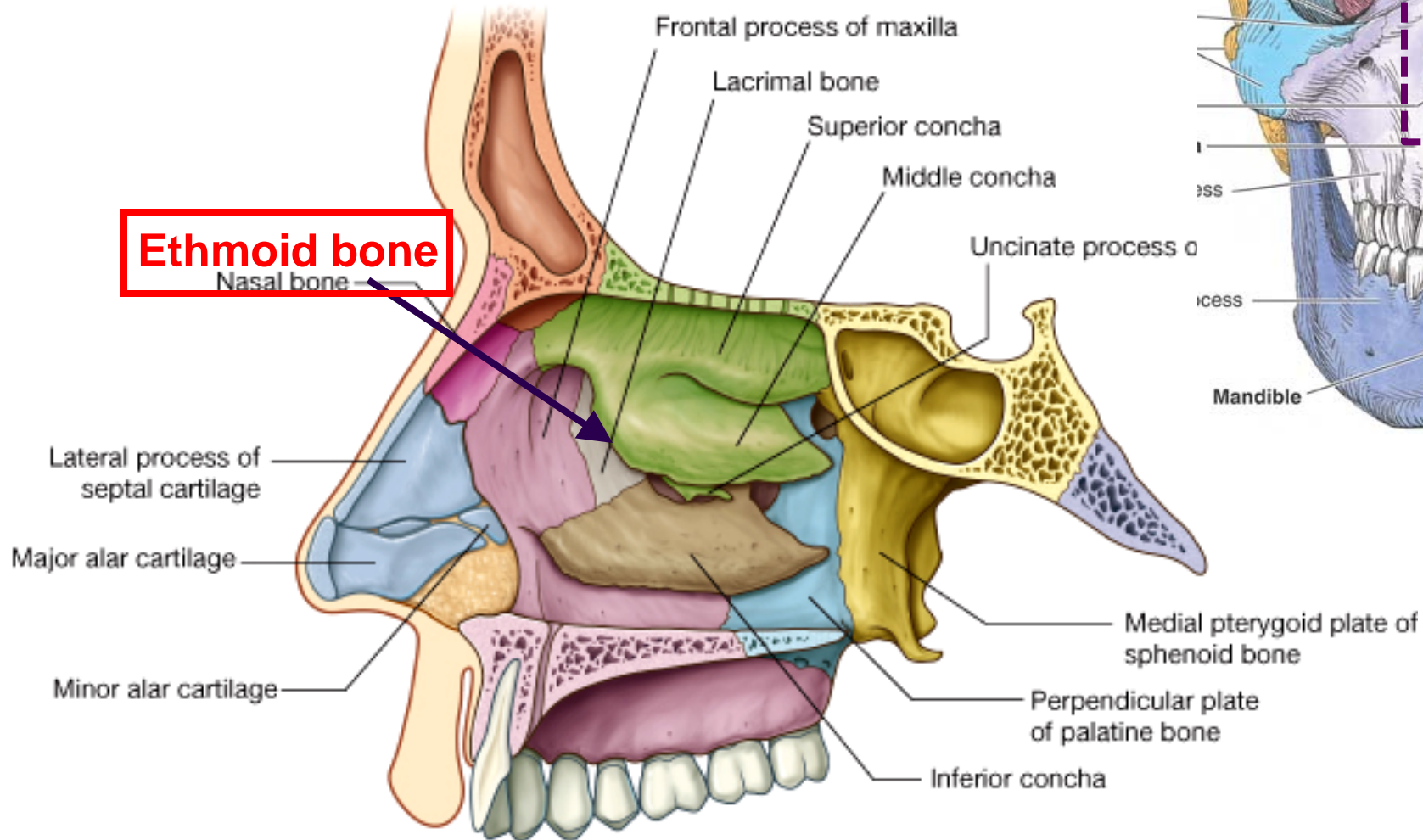
nasal cavities: septum

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



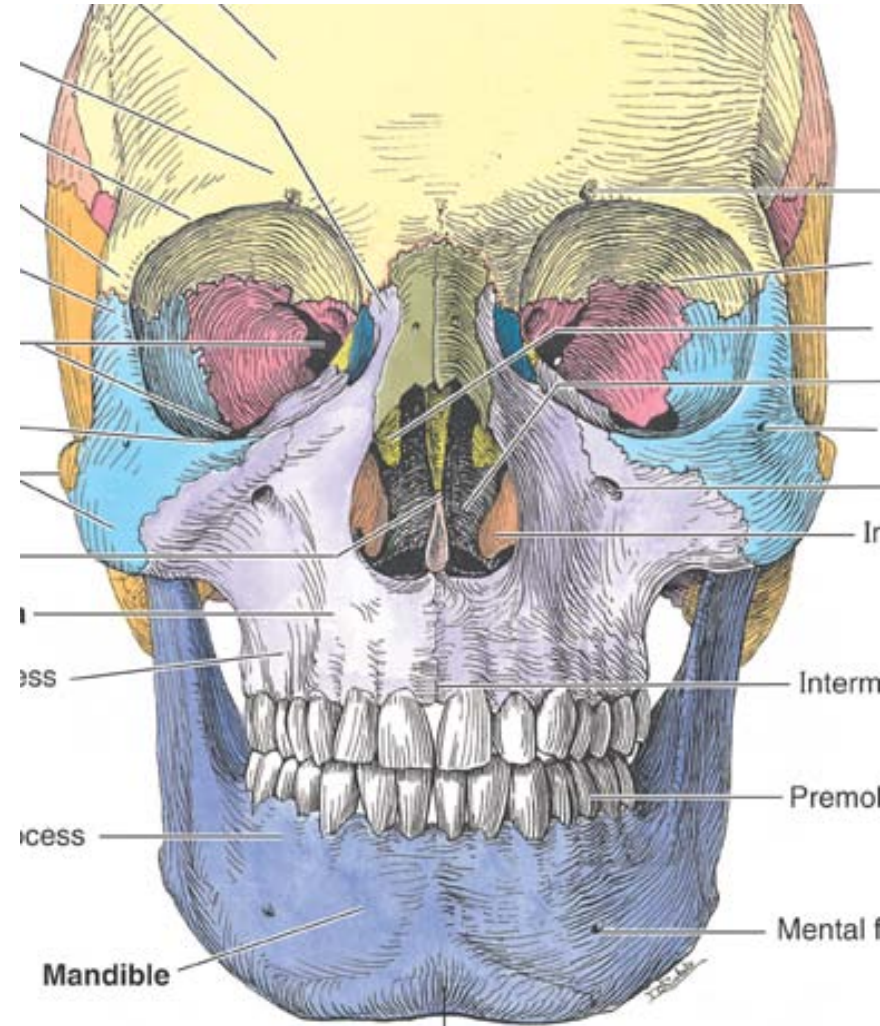
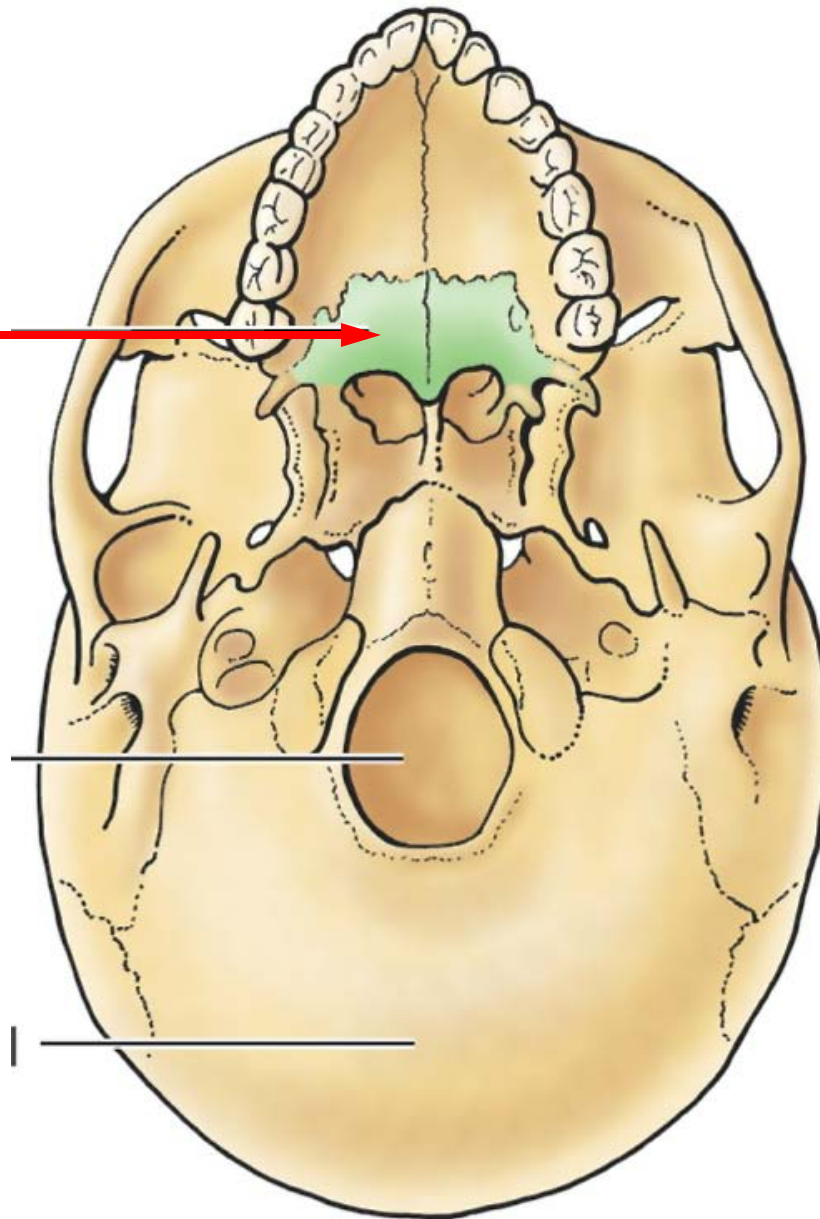
Lateral wall of nasal cavity

- Inferior nasal concha



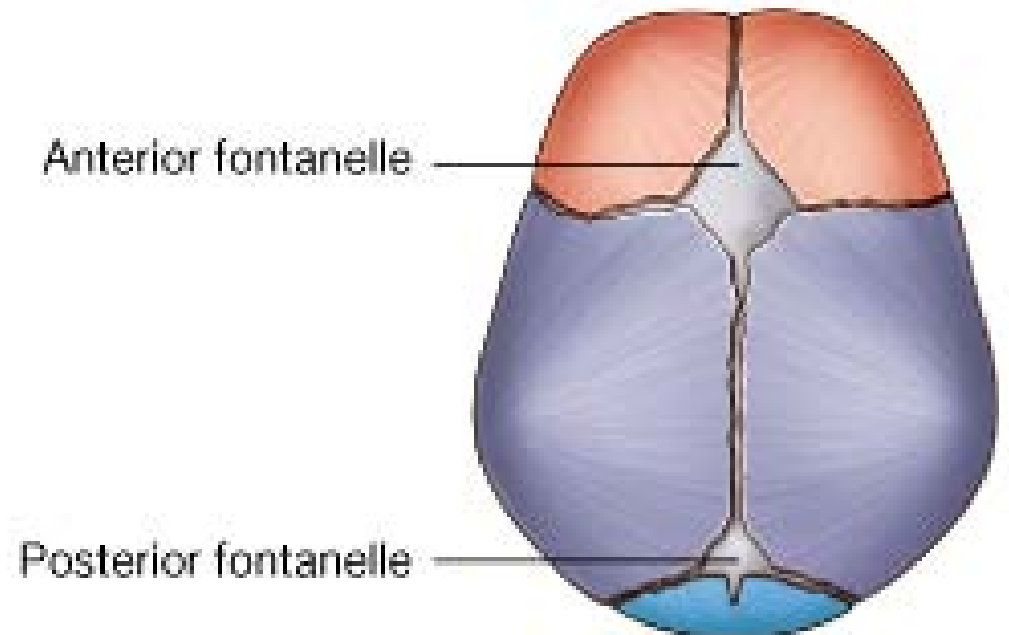
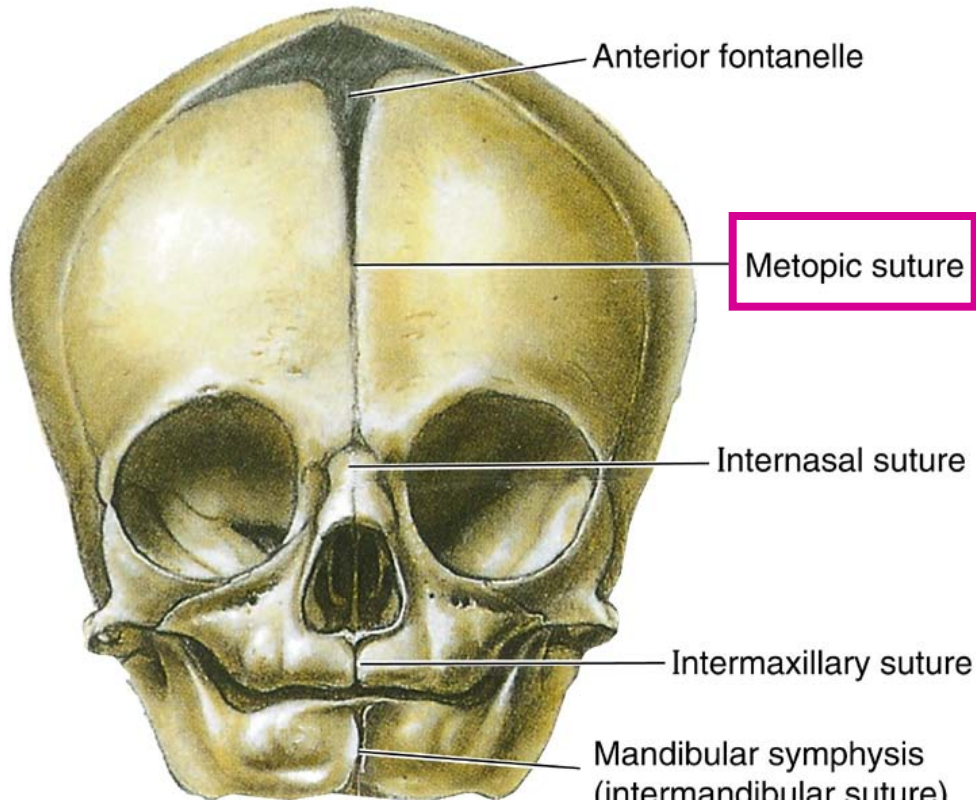
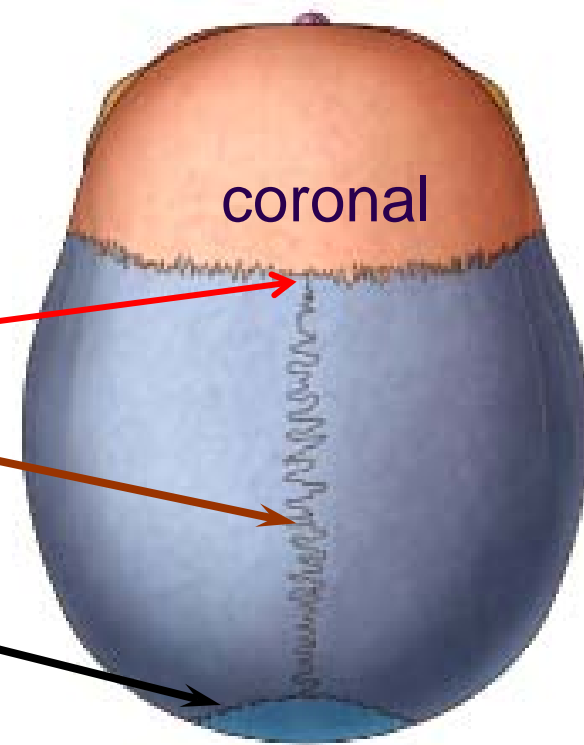
Viscerocranium: inferior view

- Palatine
- Maxilla
- Zygoma



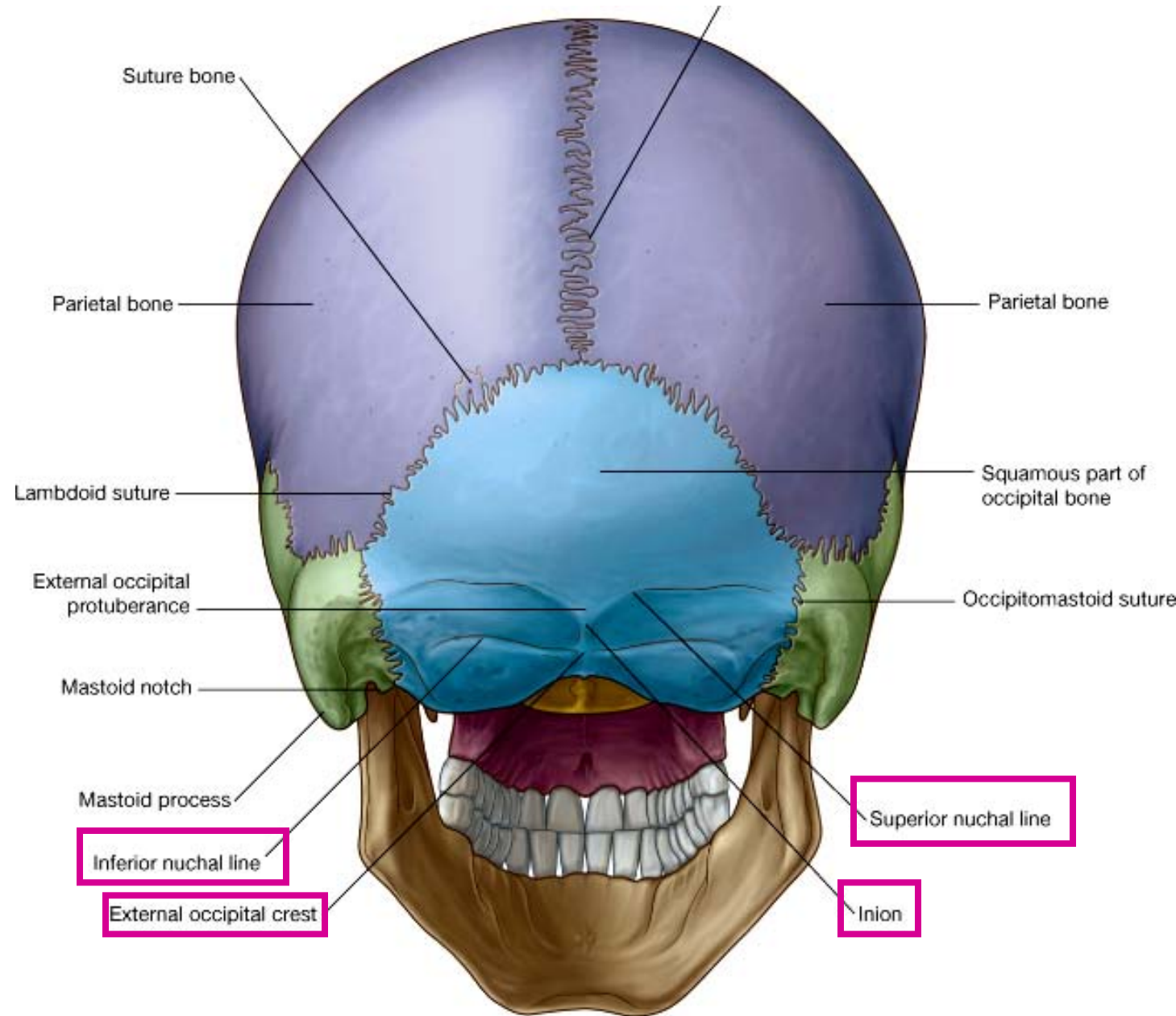
Sutures and Fontanelles

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



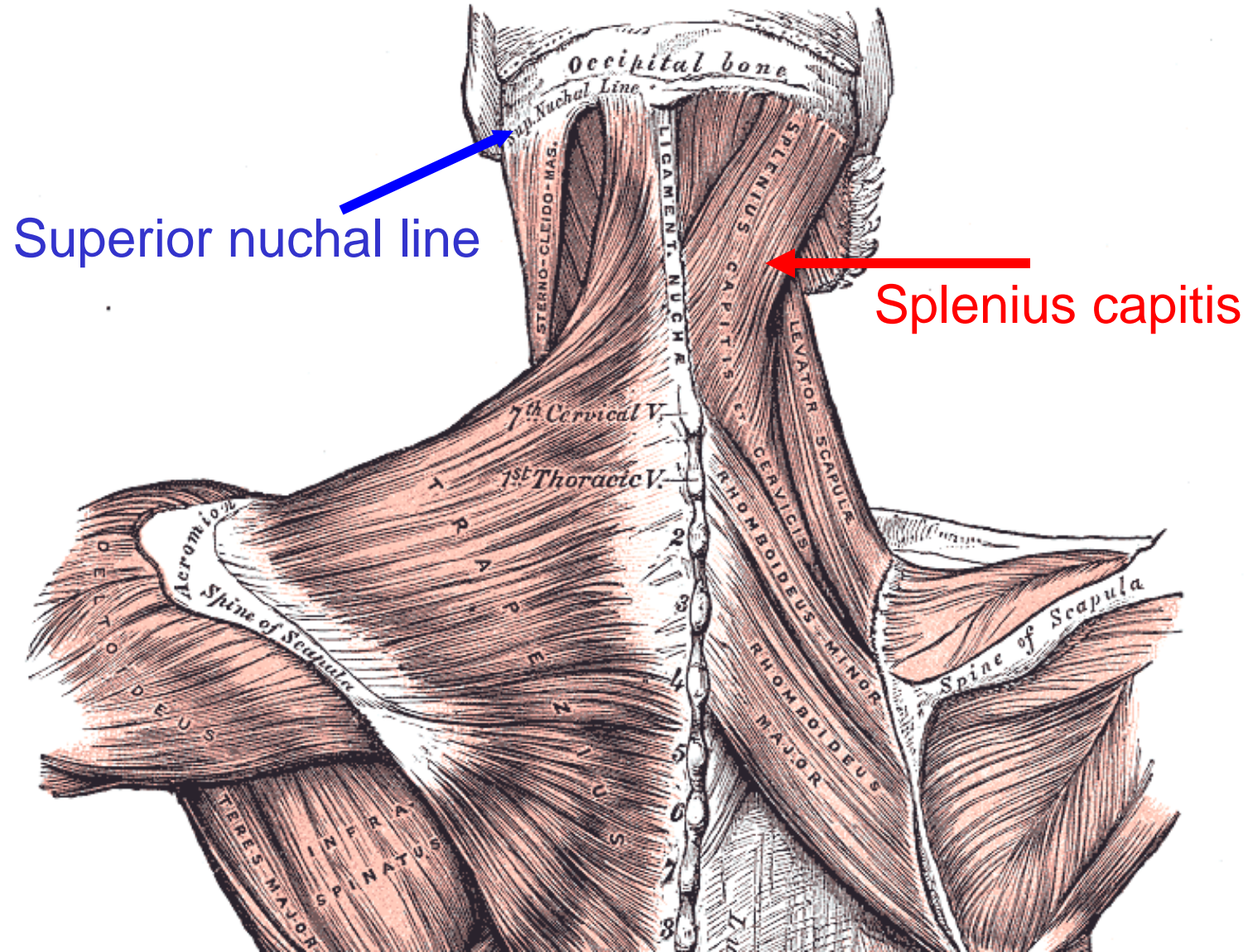
Skull: posterior view

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



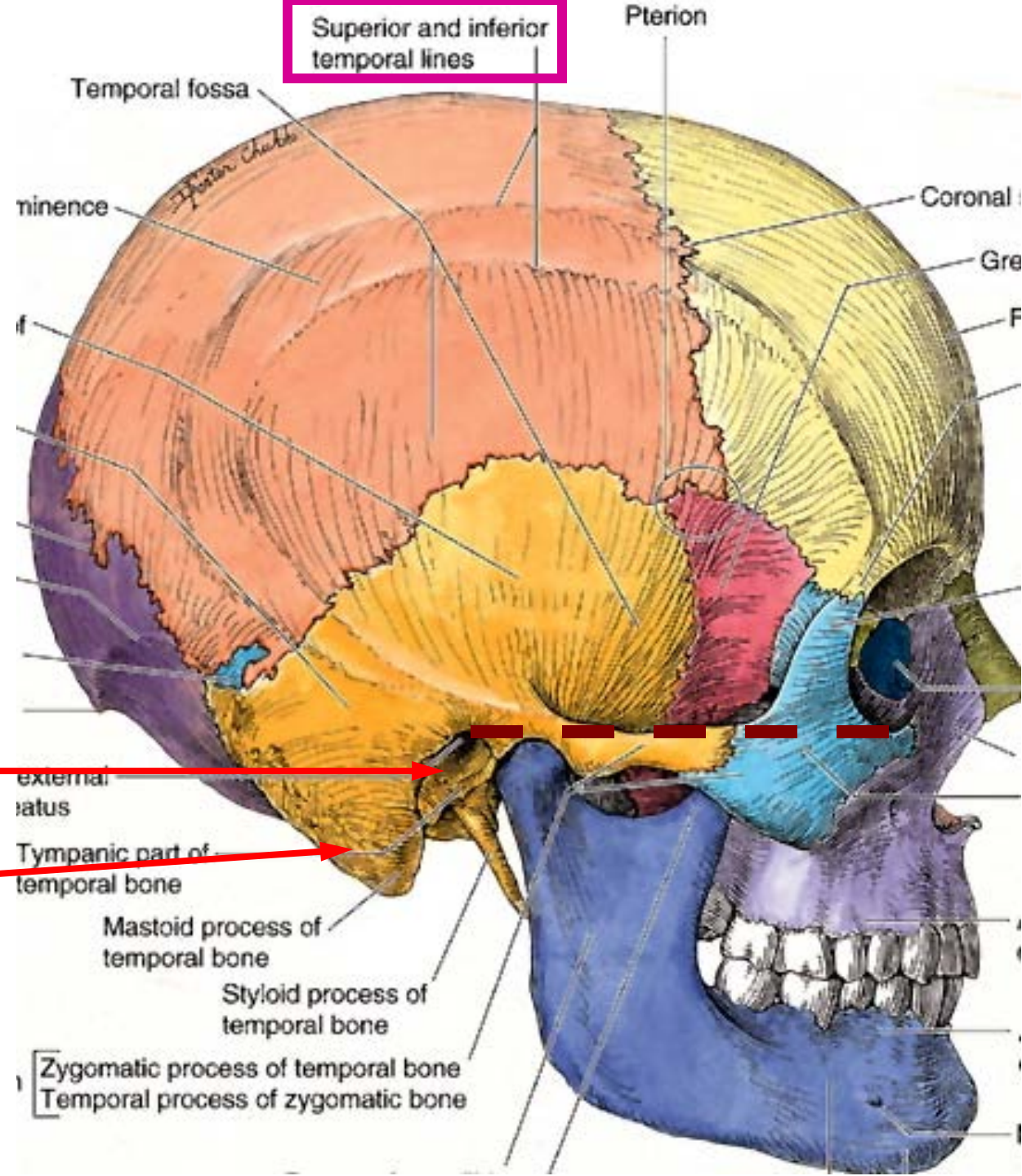
Superior nuchal line

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



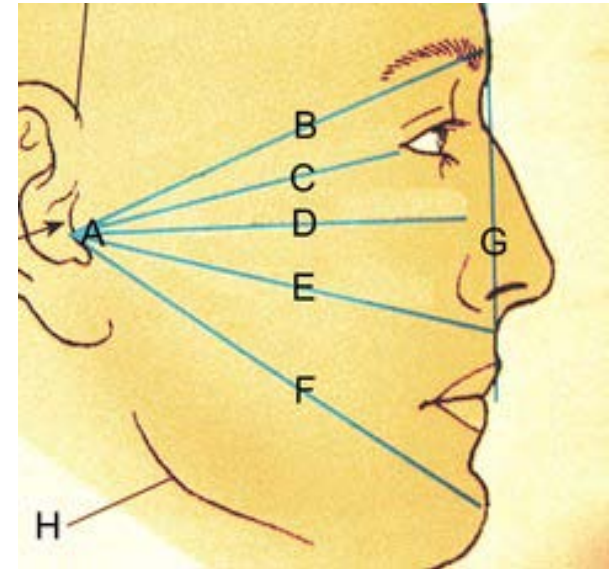
Skull: lateral view

- 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

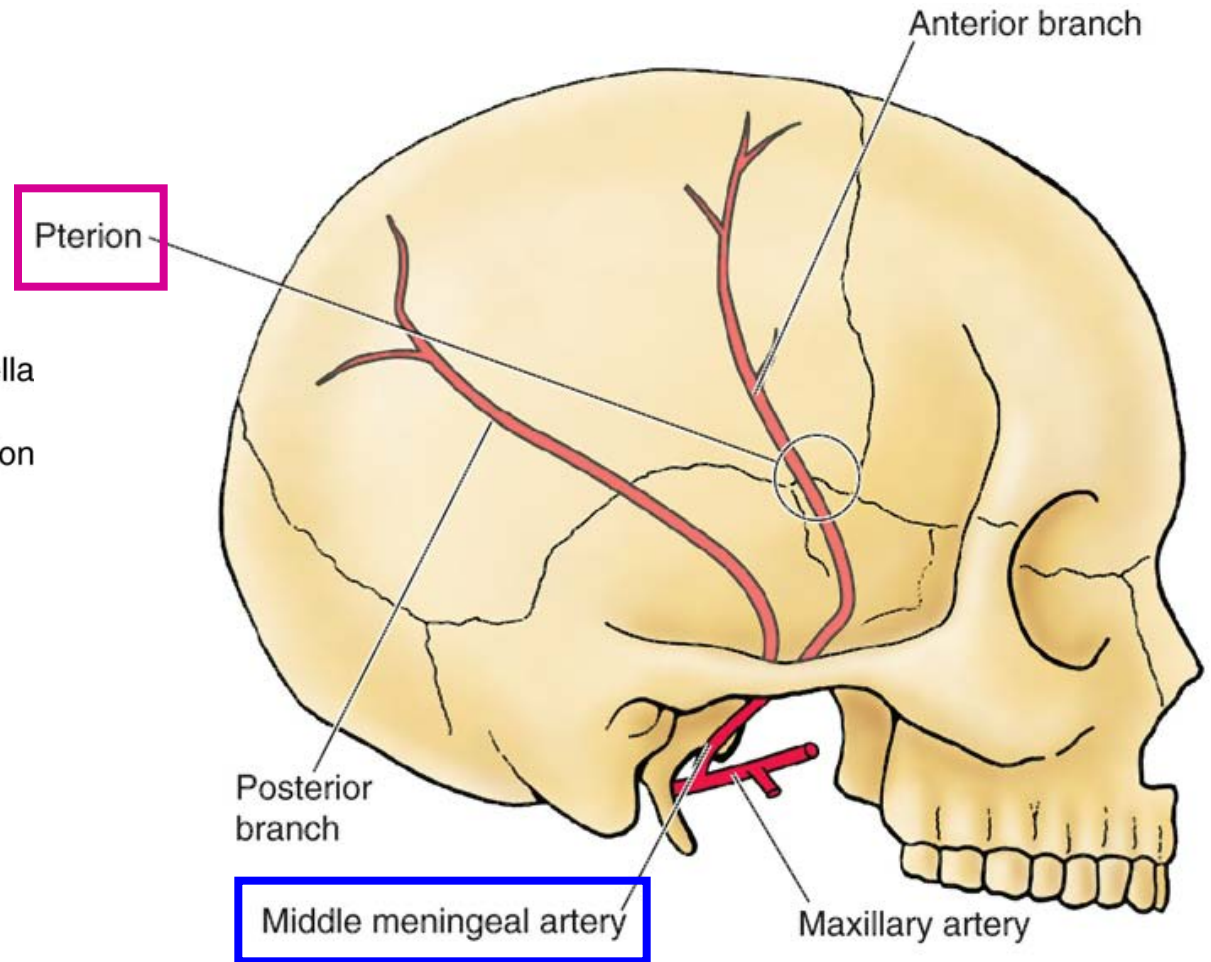
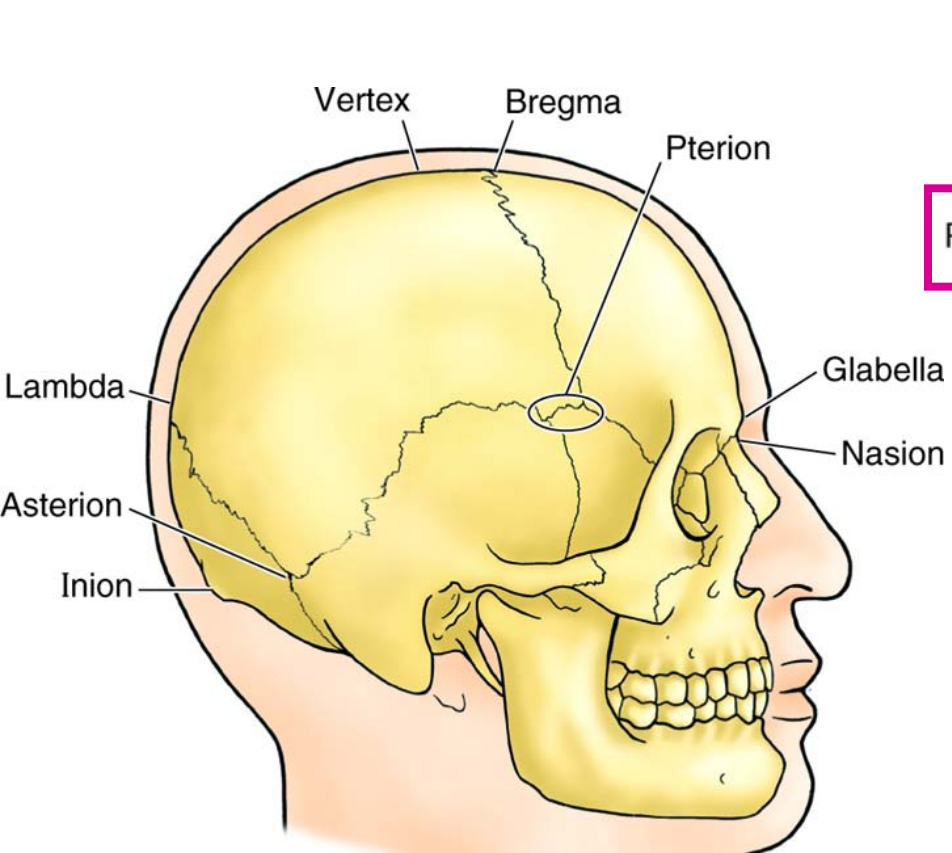


OrbitoMeatal line (OM line) in radiology

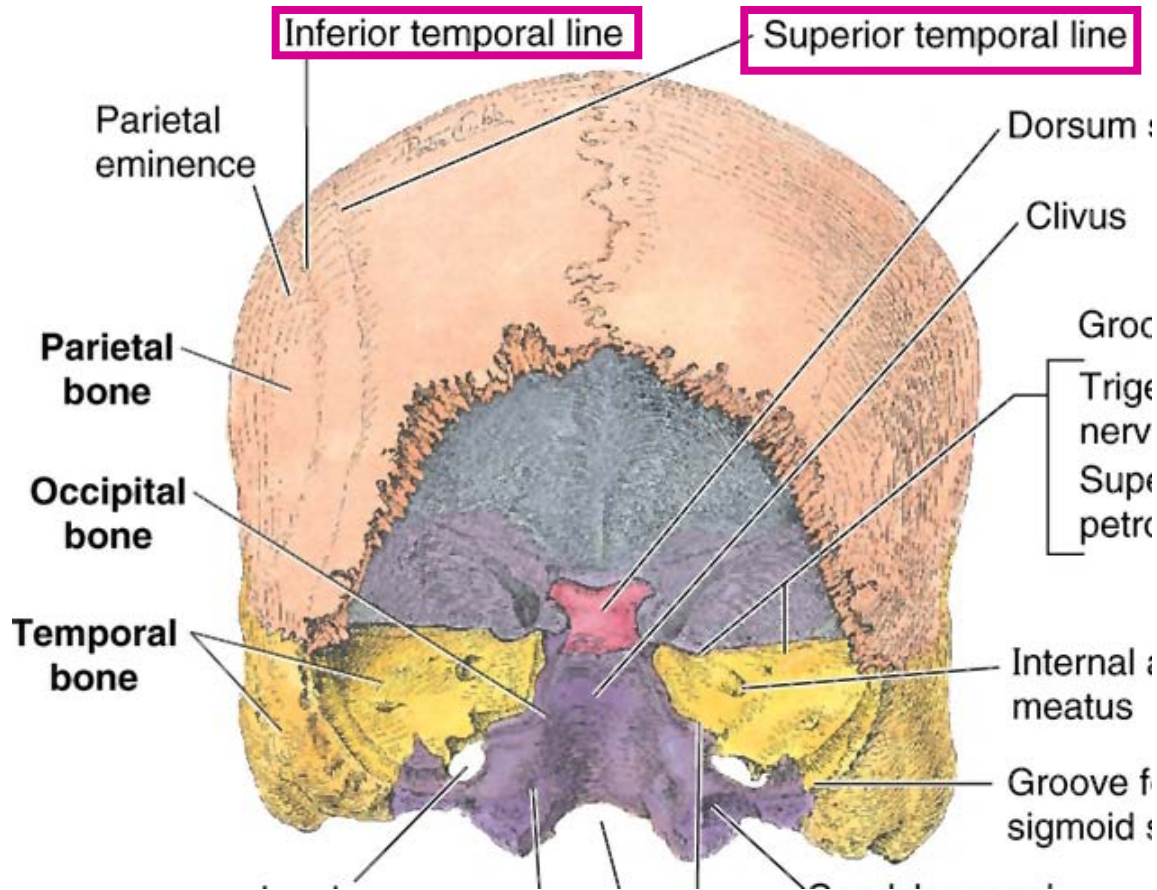
- from lateral canthus to external acoustic meatus



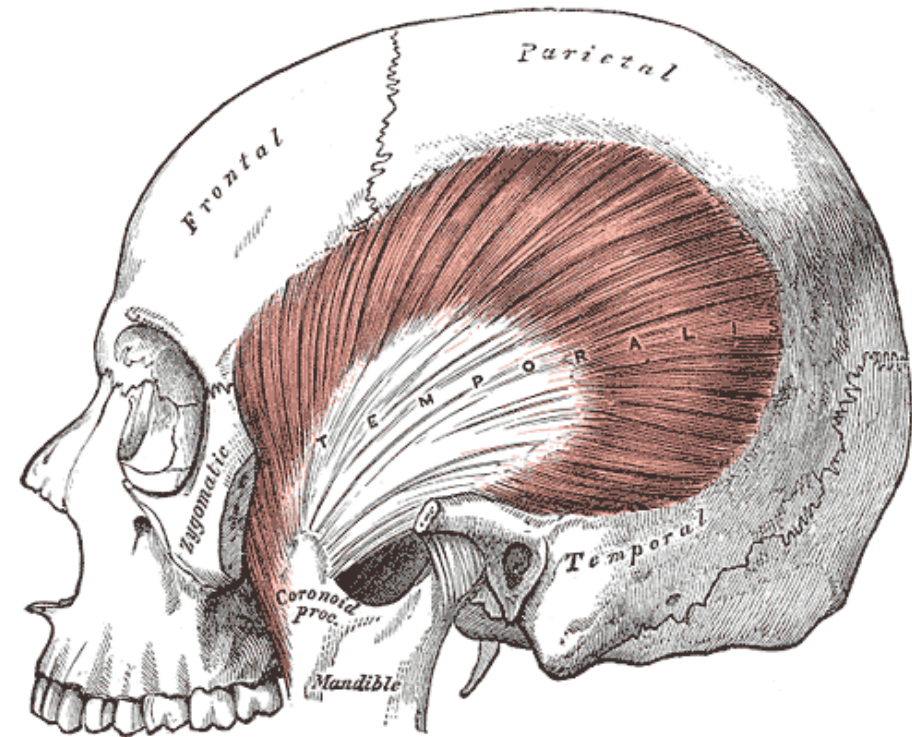
Pterion



Superior temporal line and Temporalis muscle

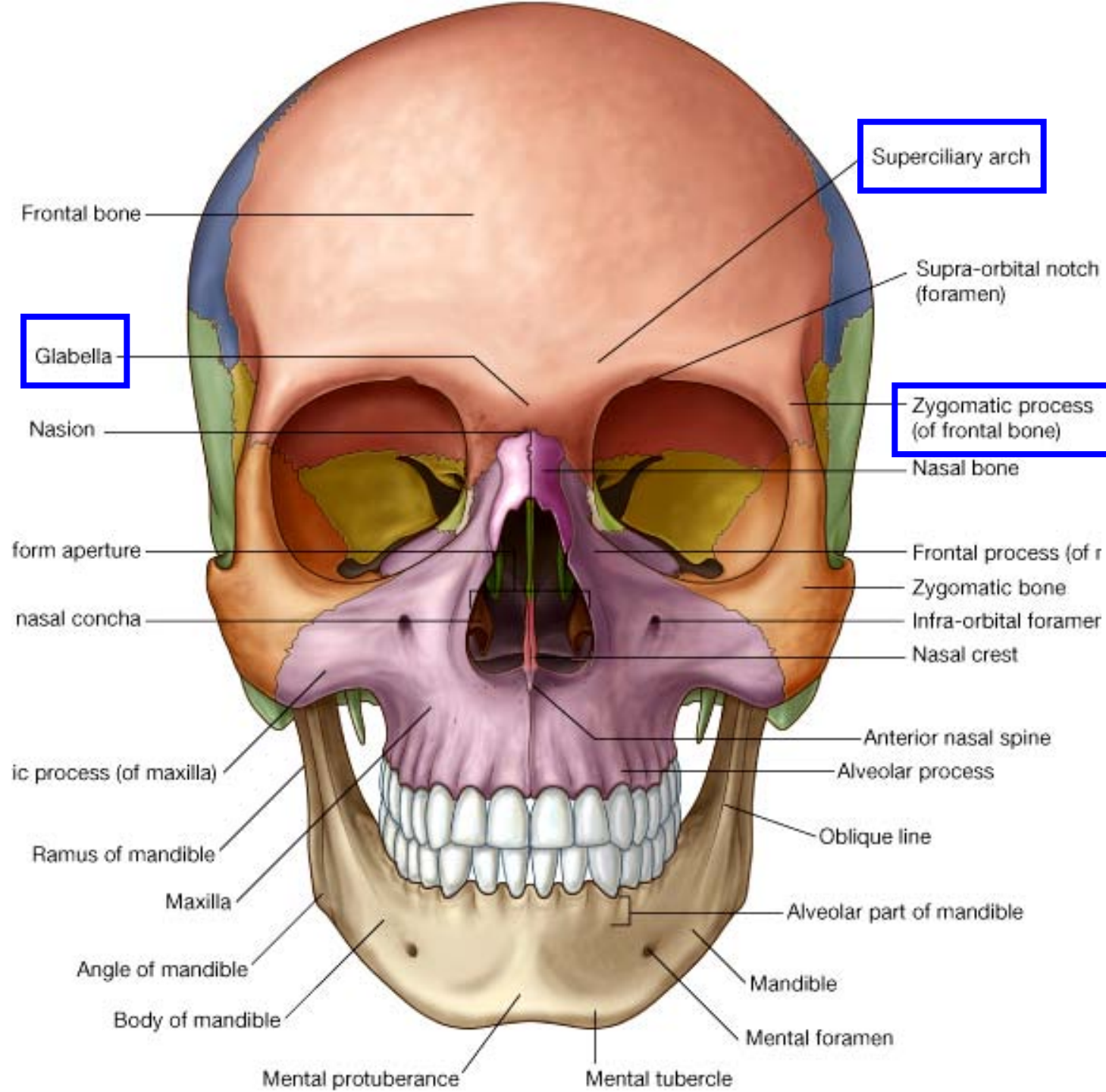


Posterior view



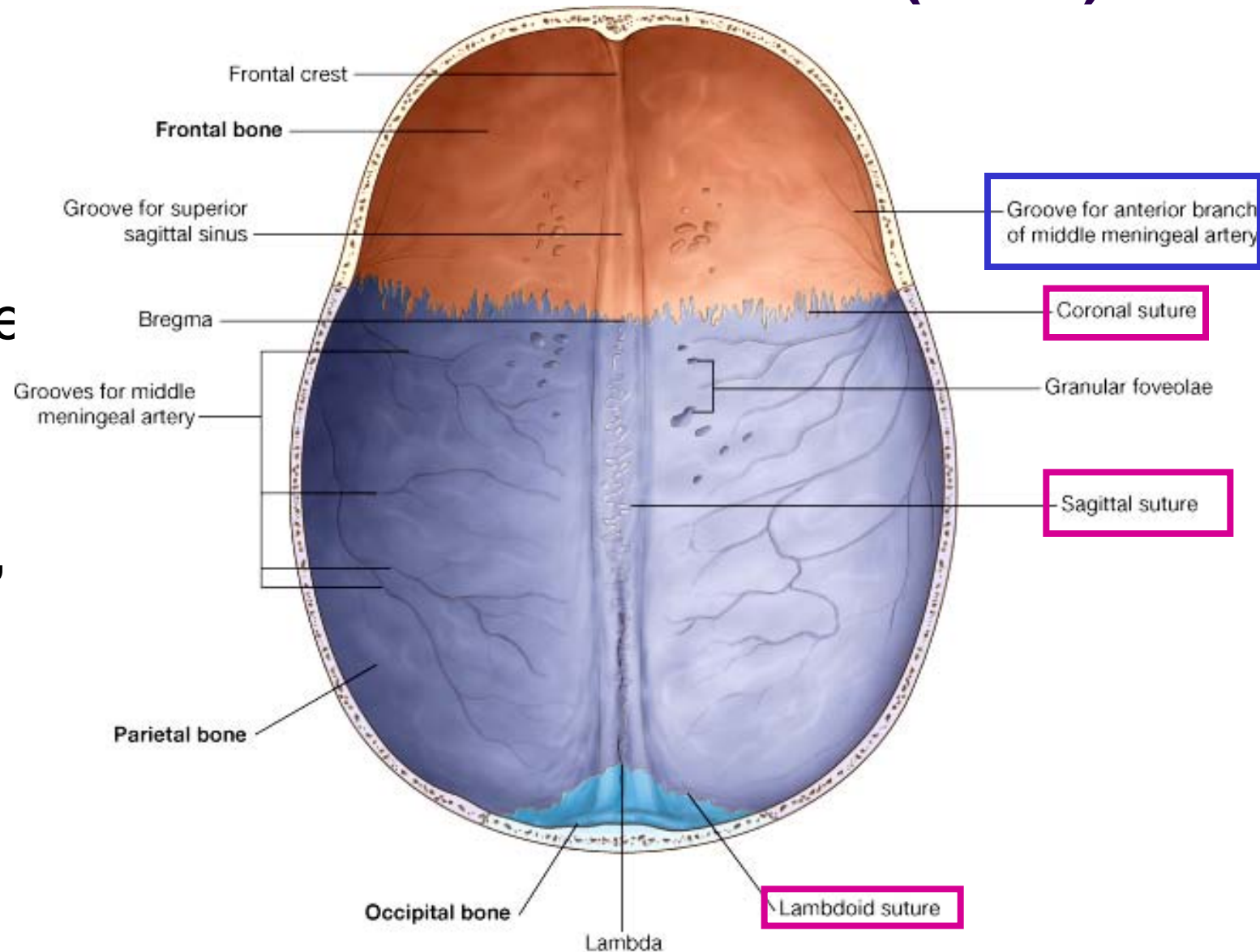
Skull from front

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



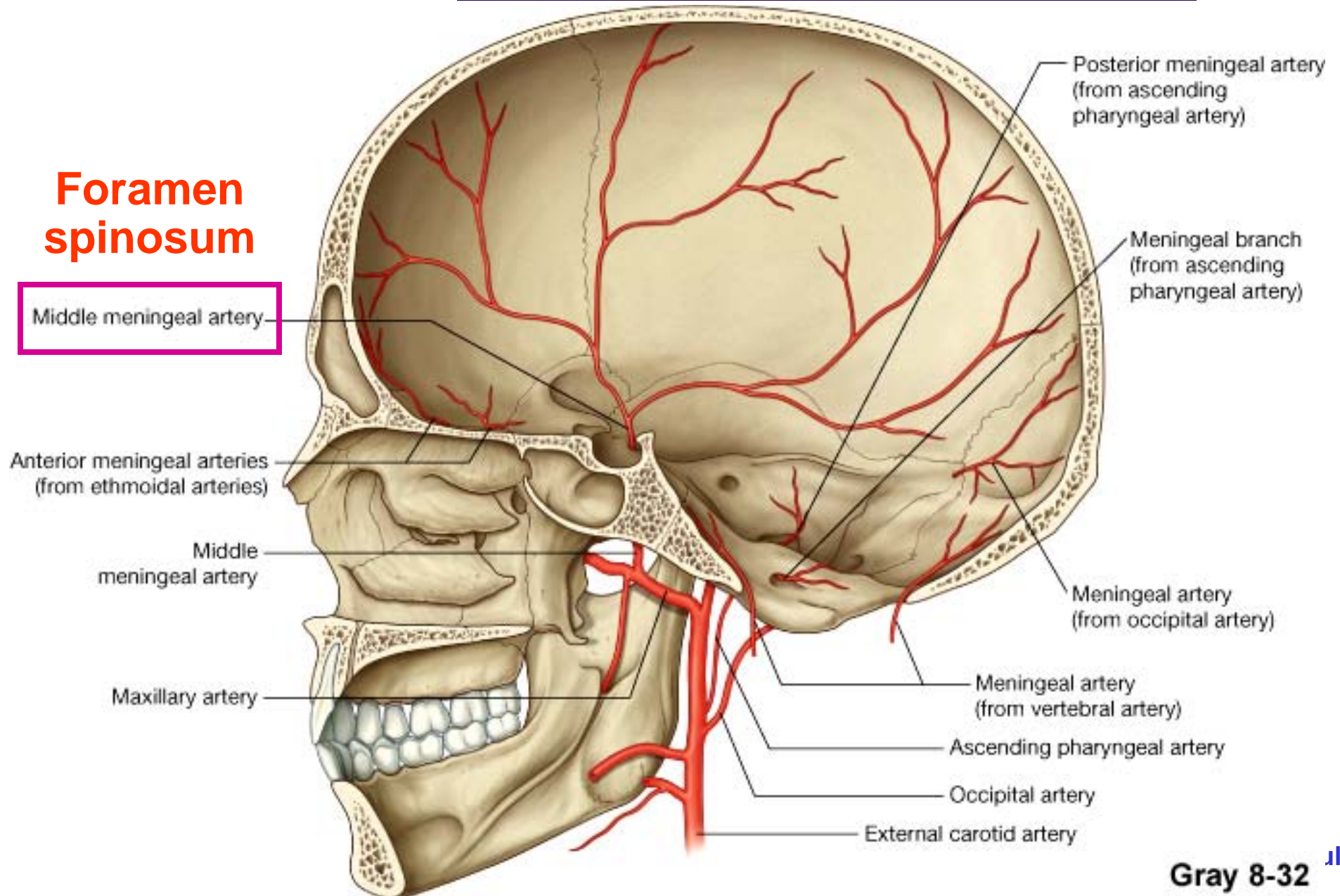
Internal surface of the skull: The roof (vault)

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



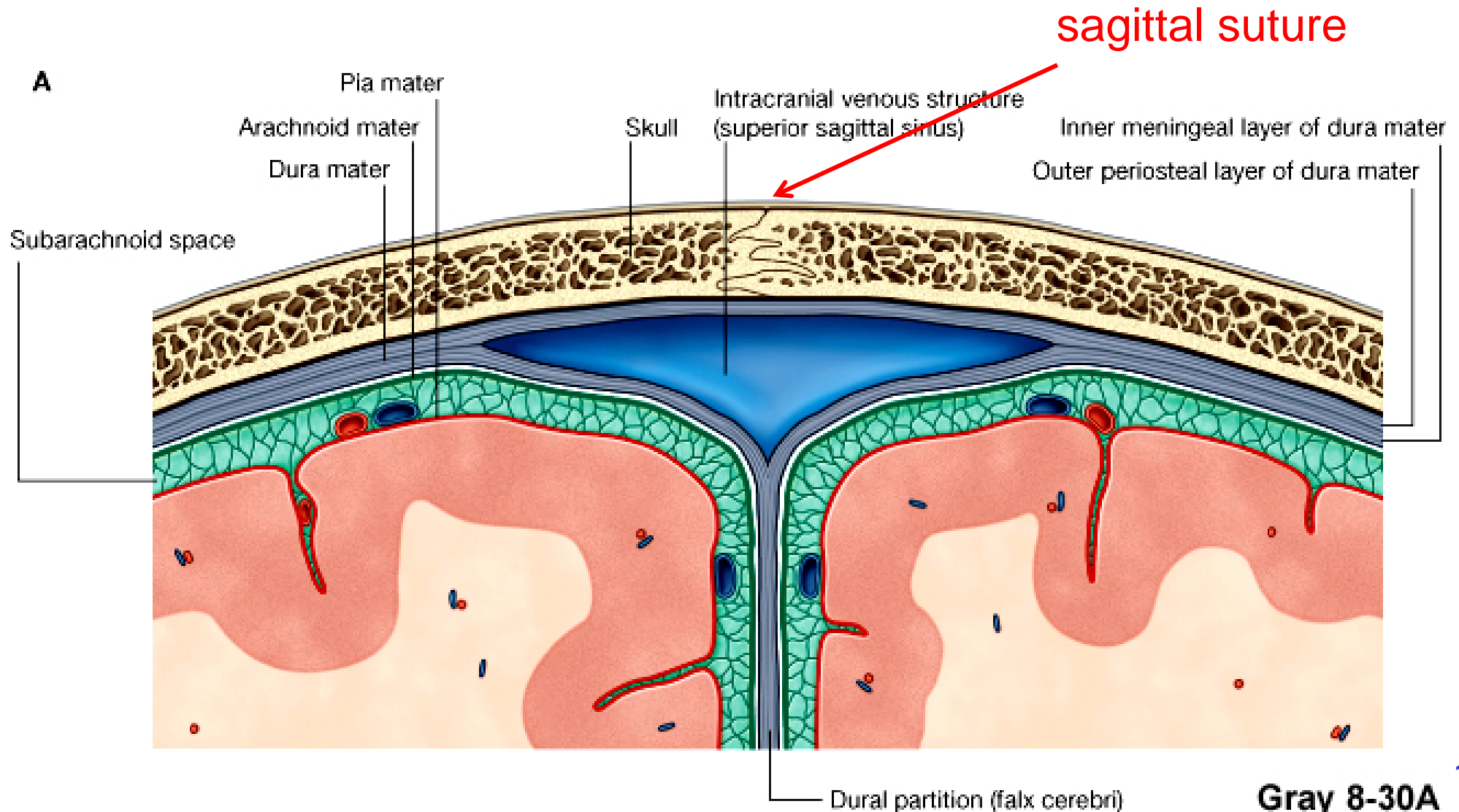
Grooves for middle meningeal arteries

Foramen spinosum



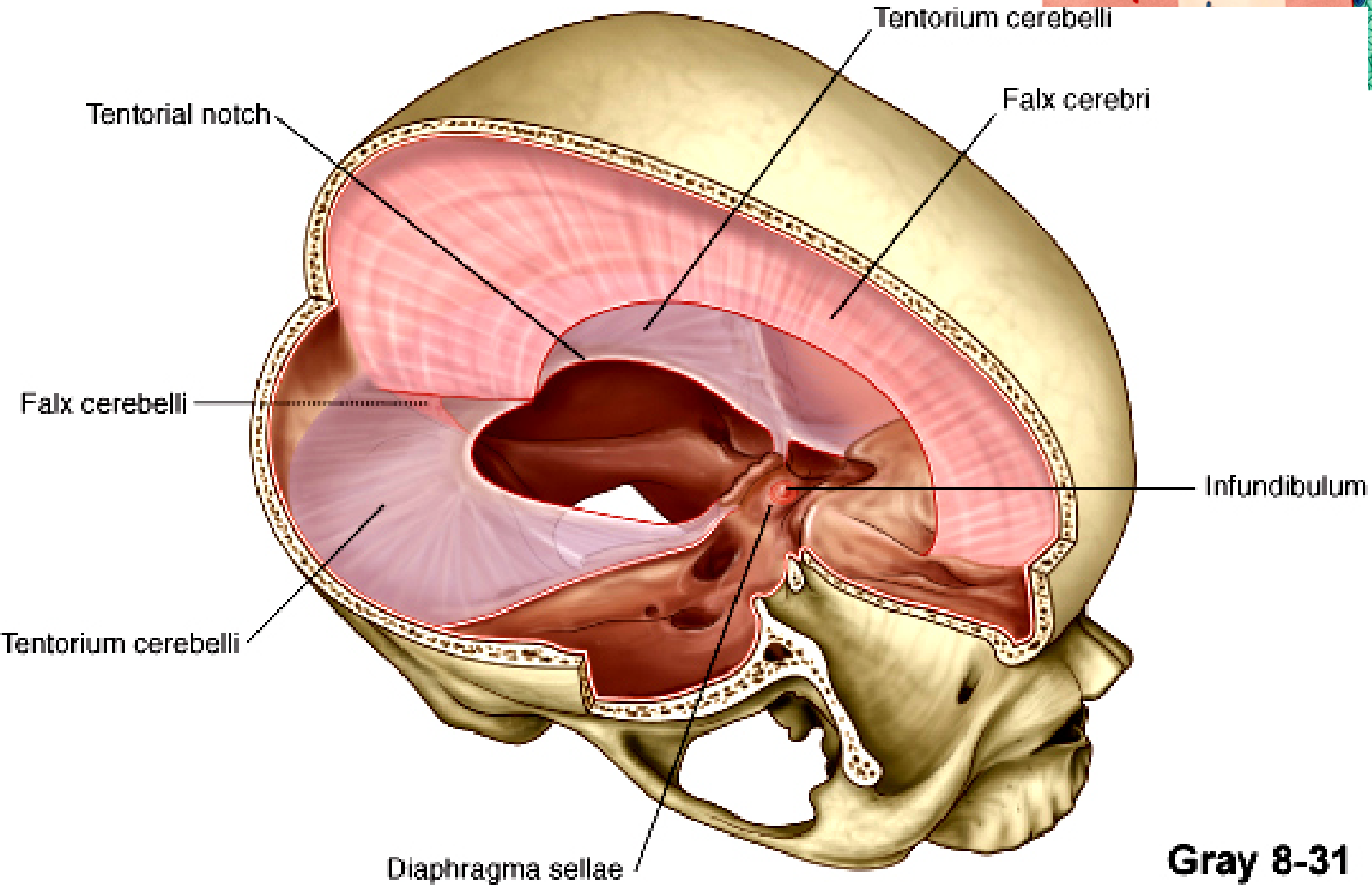
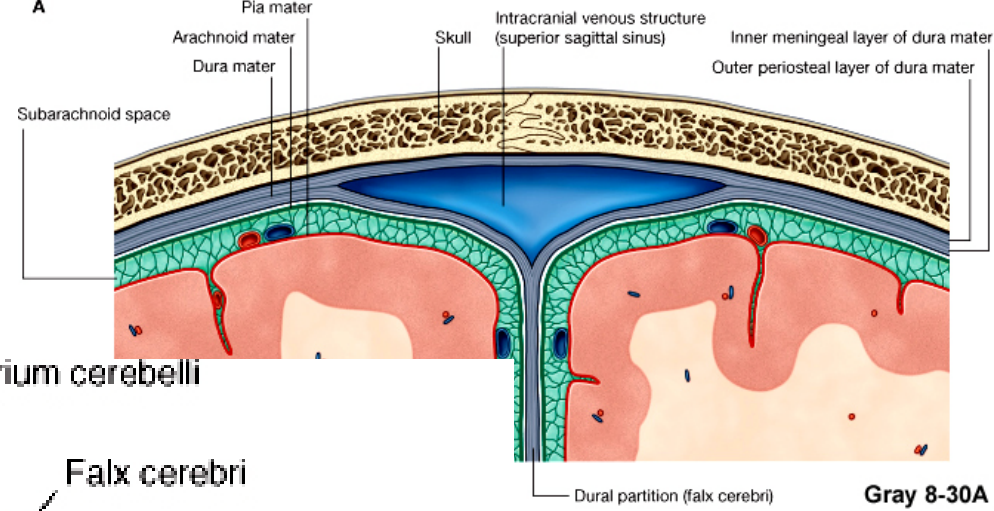
Sagittal fissure: superior sagittal sinus

- sup. sagittal sinus (SSS)



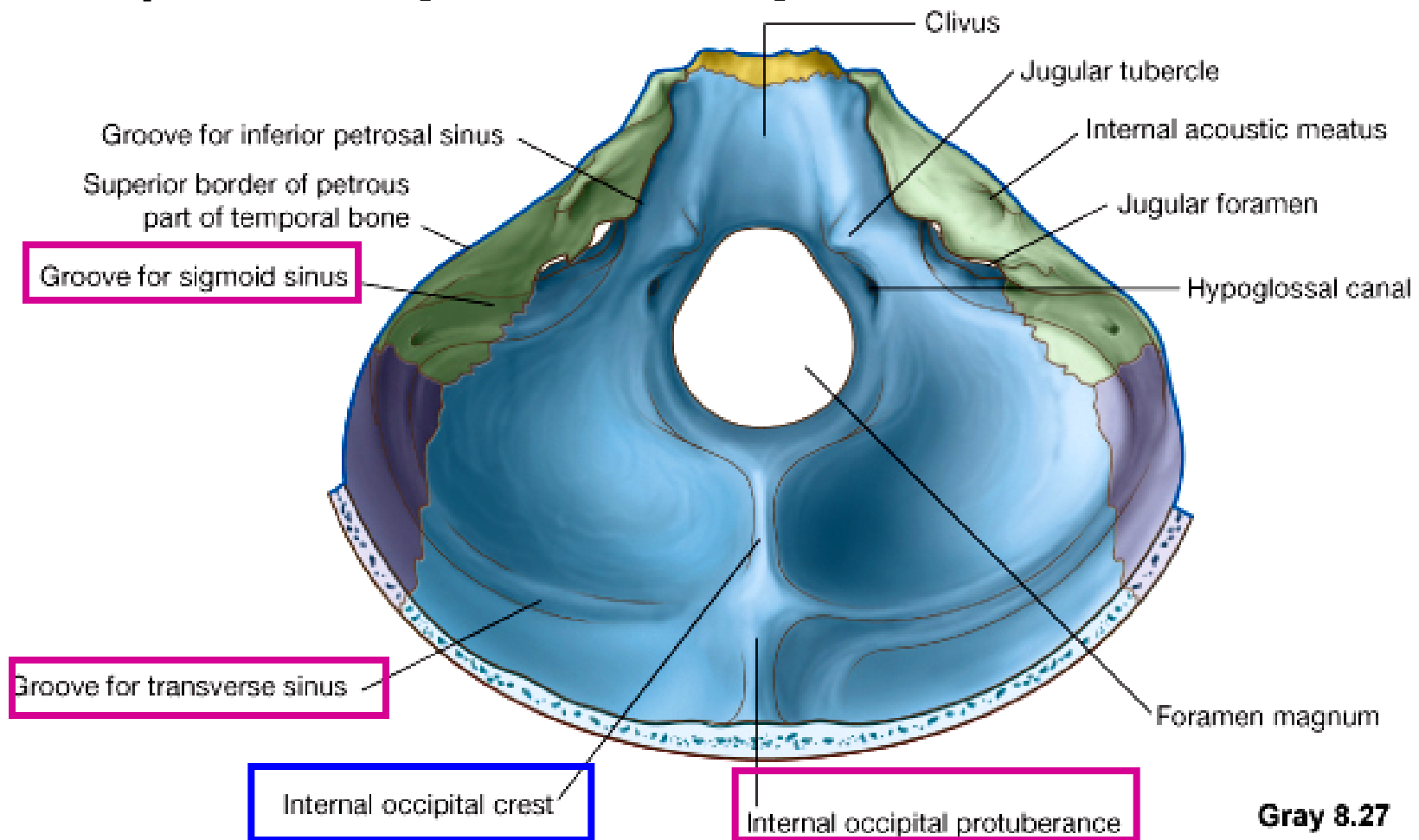
Sagittal fissure: falx cerebri

- Dura extending from skull



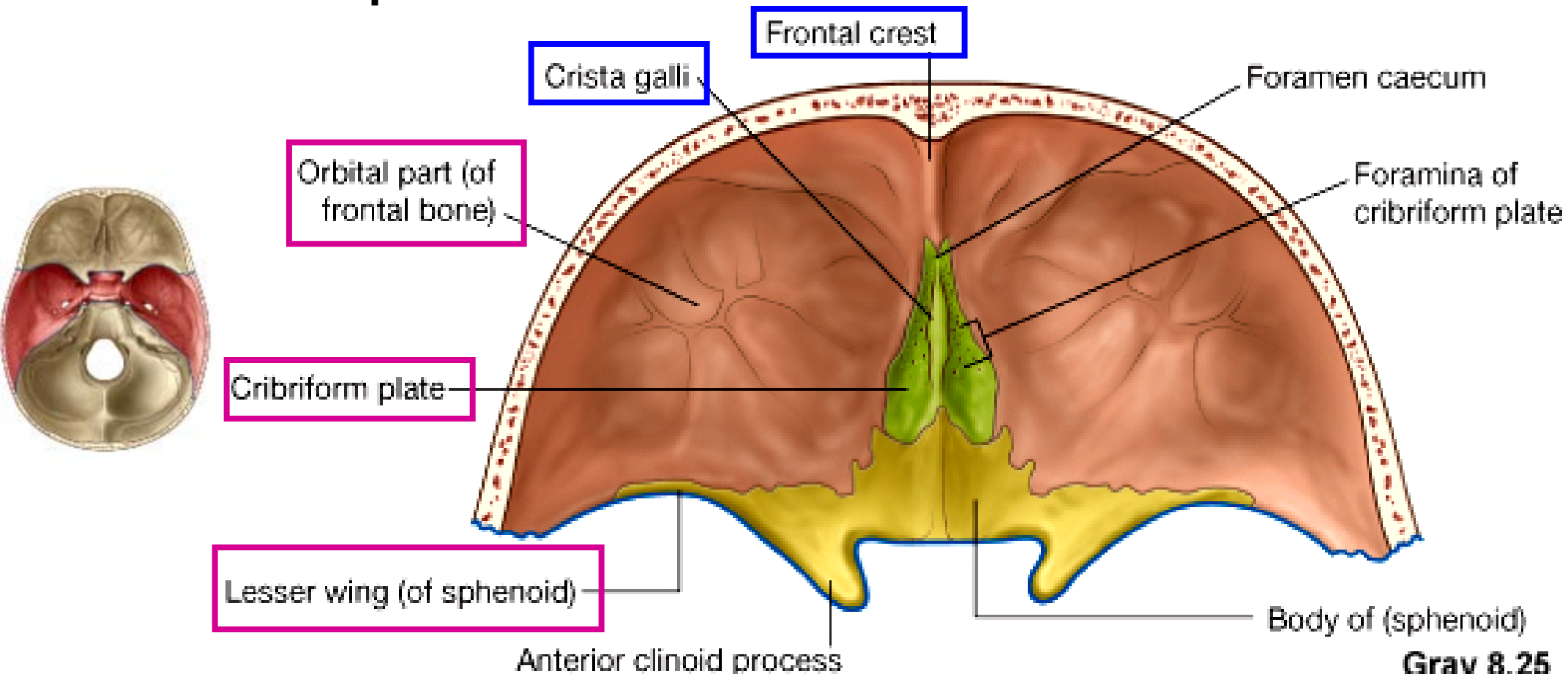
Dural sinuses in Posterior cranial fossa

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



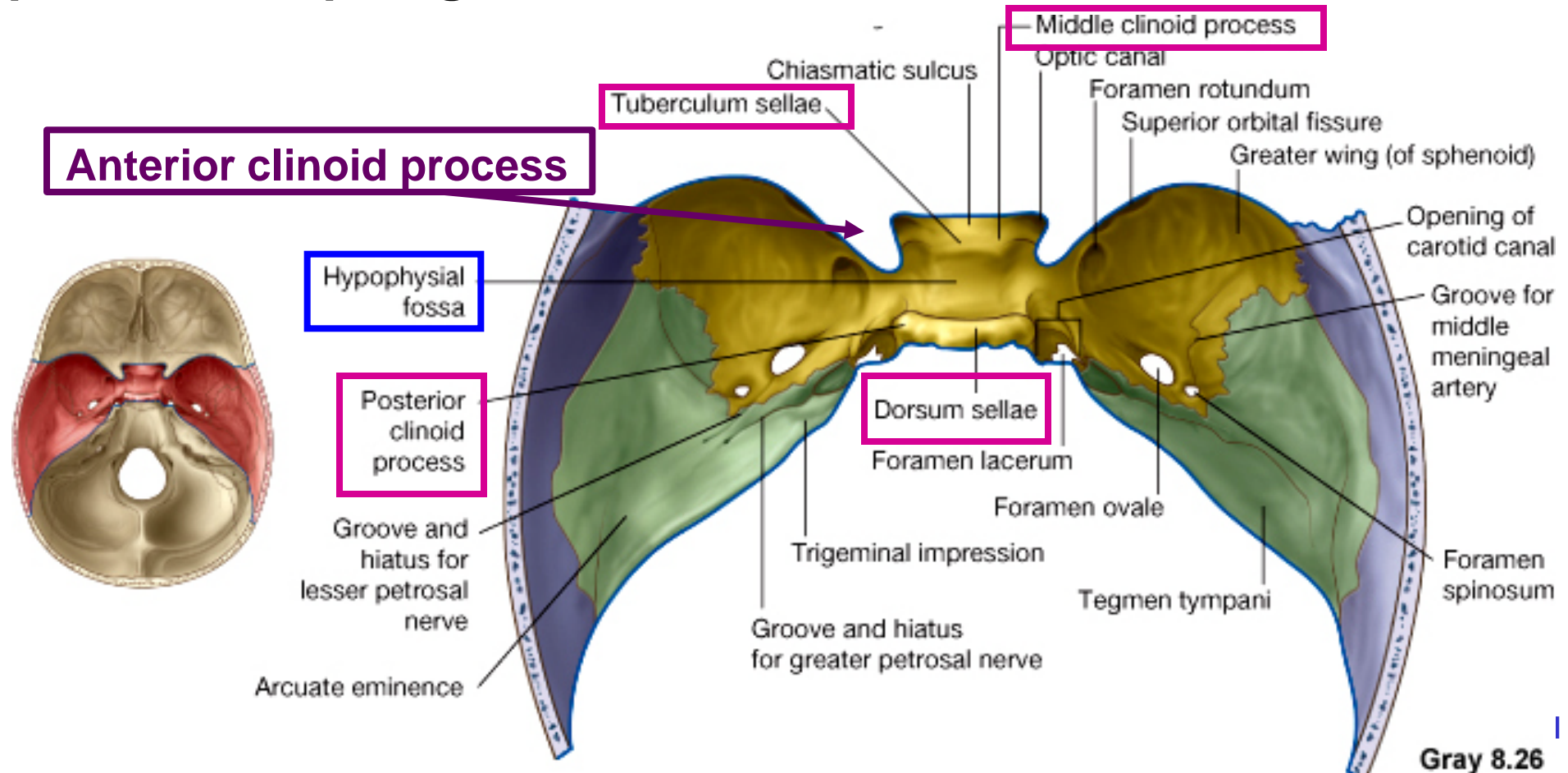
Inner surface of Anterior cranial fossa

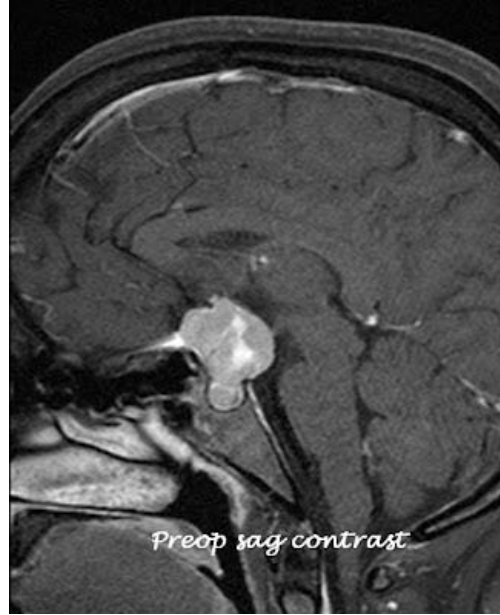
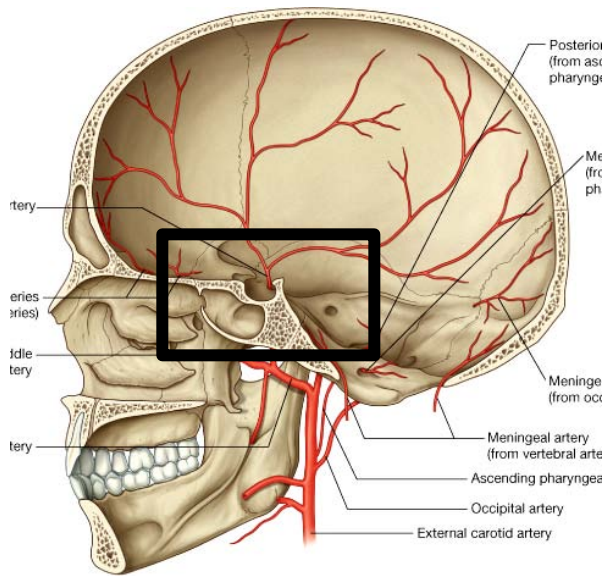
- Frontal bone: Orbital plate: thin except near superciliary arch; frontal air sinus
- **Lesser wing of sphenoid:** ant. clinoid processes
- **Ethmoid bone: crista galli** (*attachment of falx cerebri*)
- **Cribriform plate**



Inner surface of Middle cranial fossa (1/2)

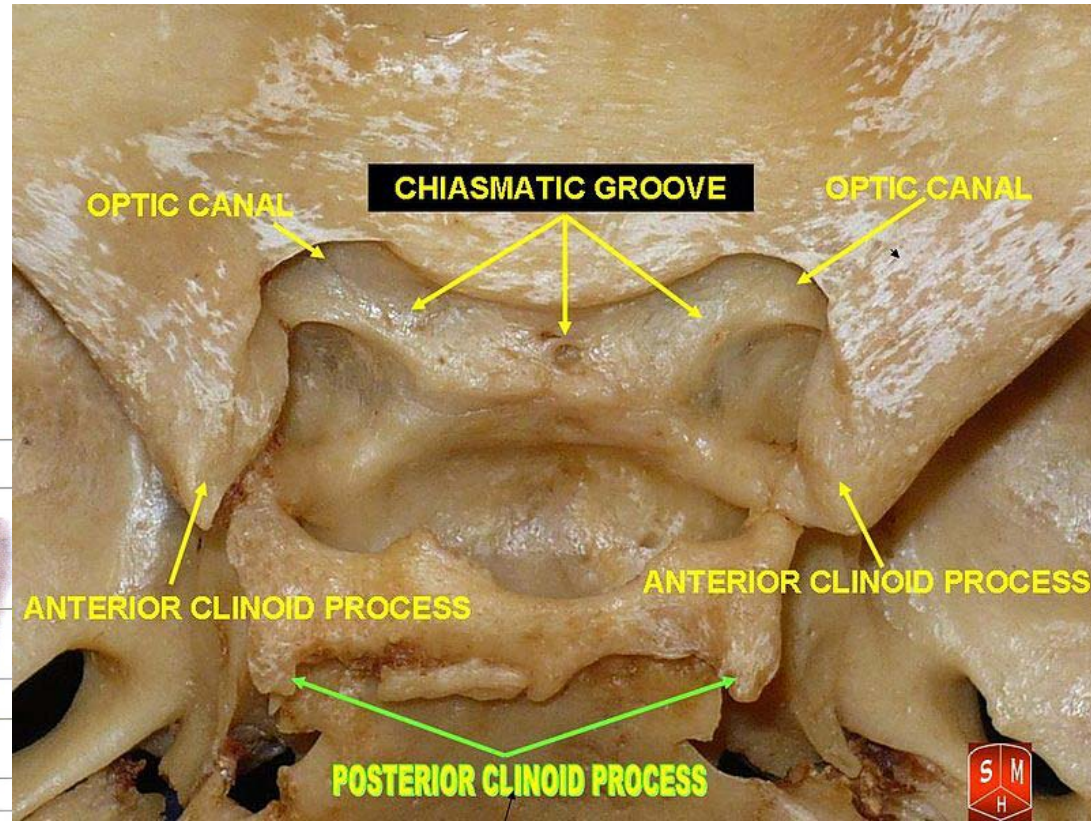
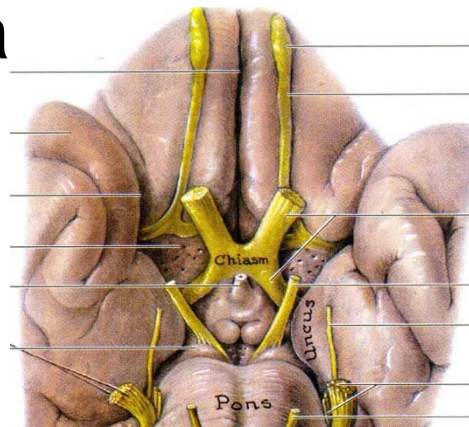
- **Temporal bone: petrous part:** thick, contains inner ear
- **Hypophyseal fossa** = sella turcica (Turk's saddle); tuberculum sellae, dorsum sellae
- **Ant. clinoid process** (clinoid in Latin: bed-side); **Post. clinoid process**; **Diaphragma sellae**



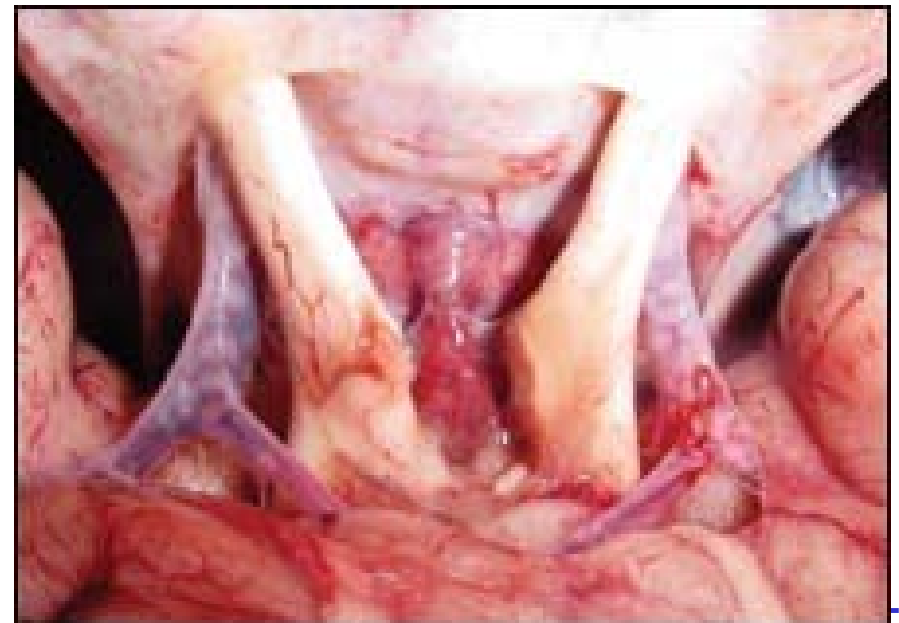
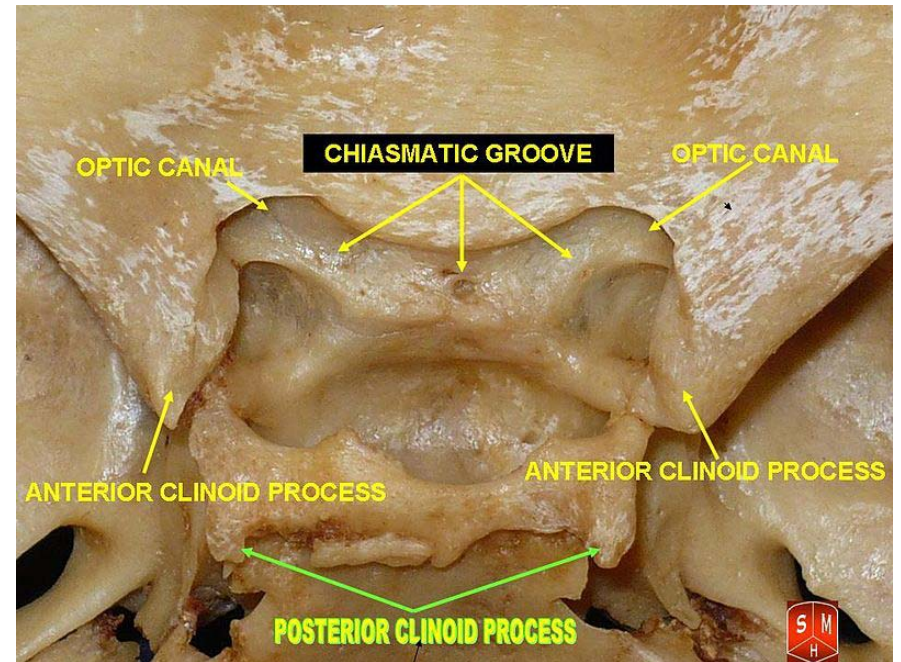
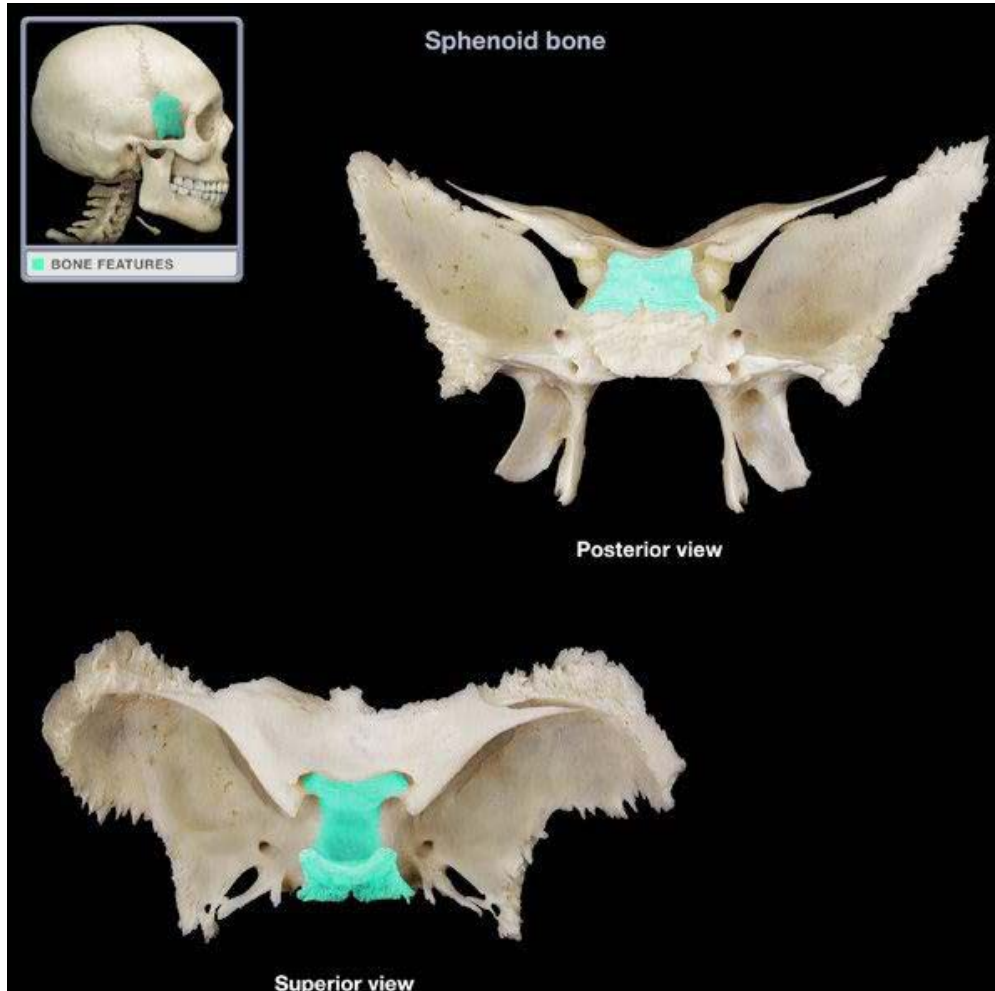


Sella turcica

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

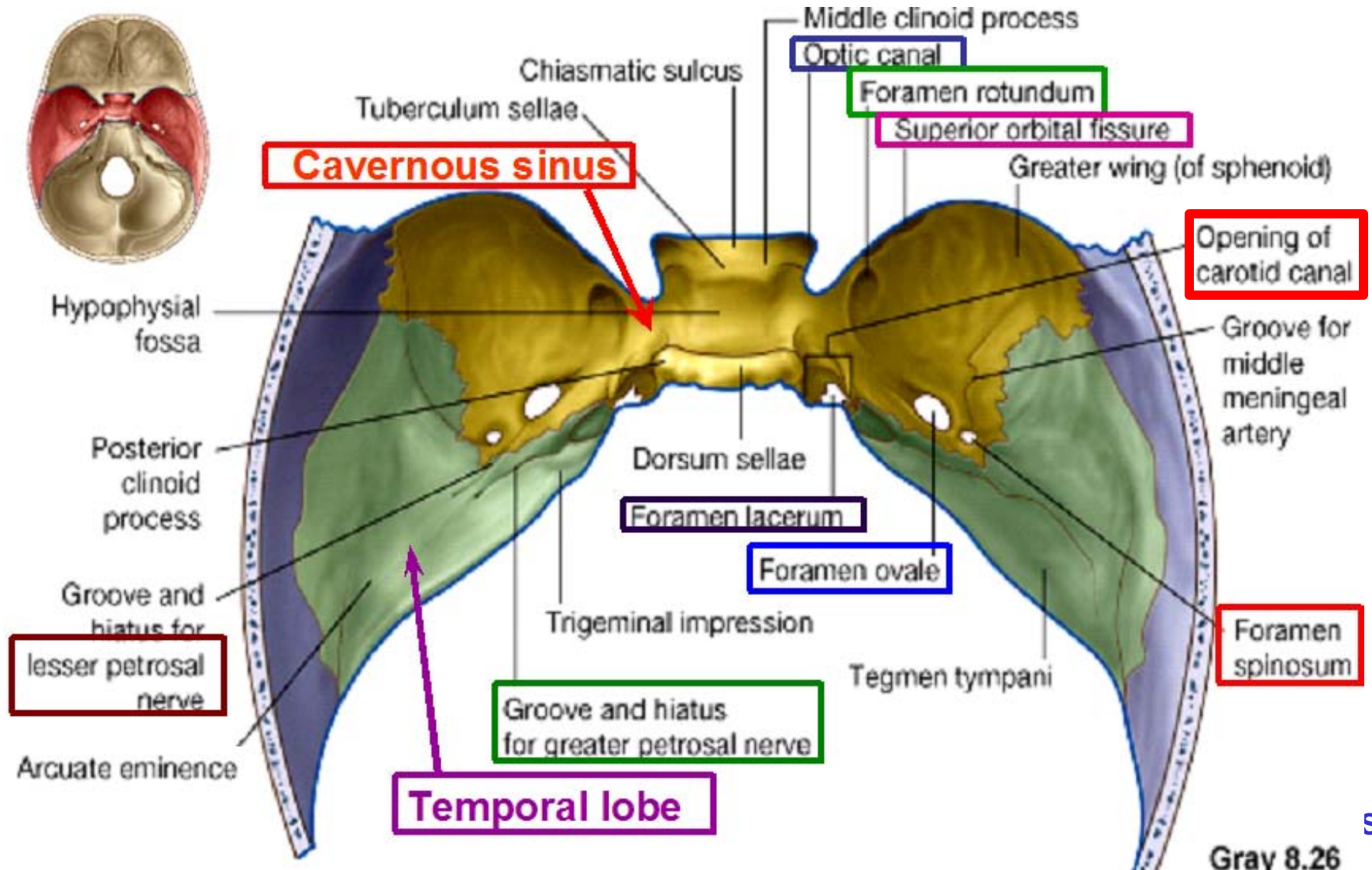


Sella turcica in sphenoid bone



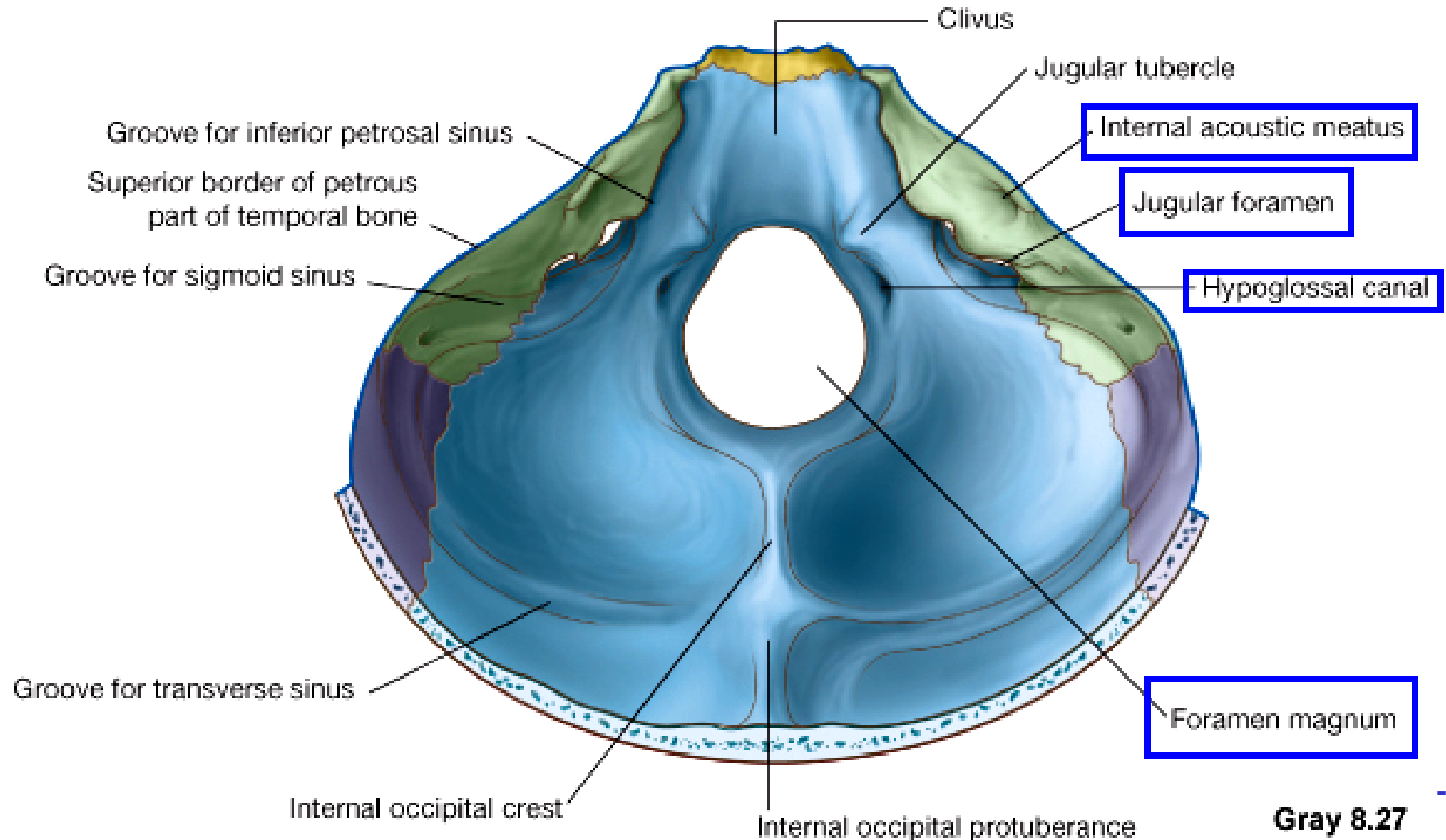
Inner surface of Middle cranial fossa (2/2)

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



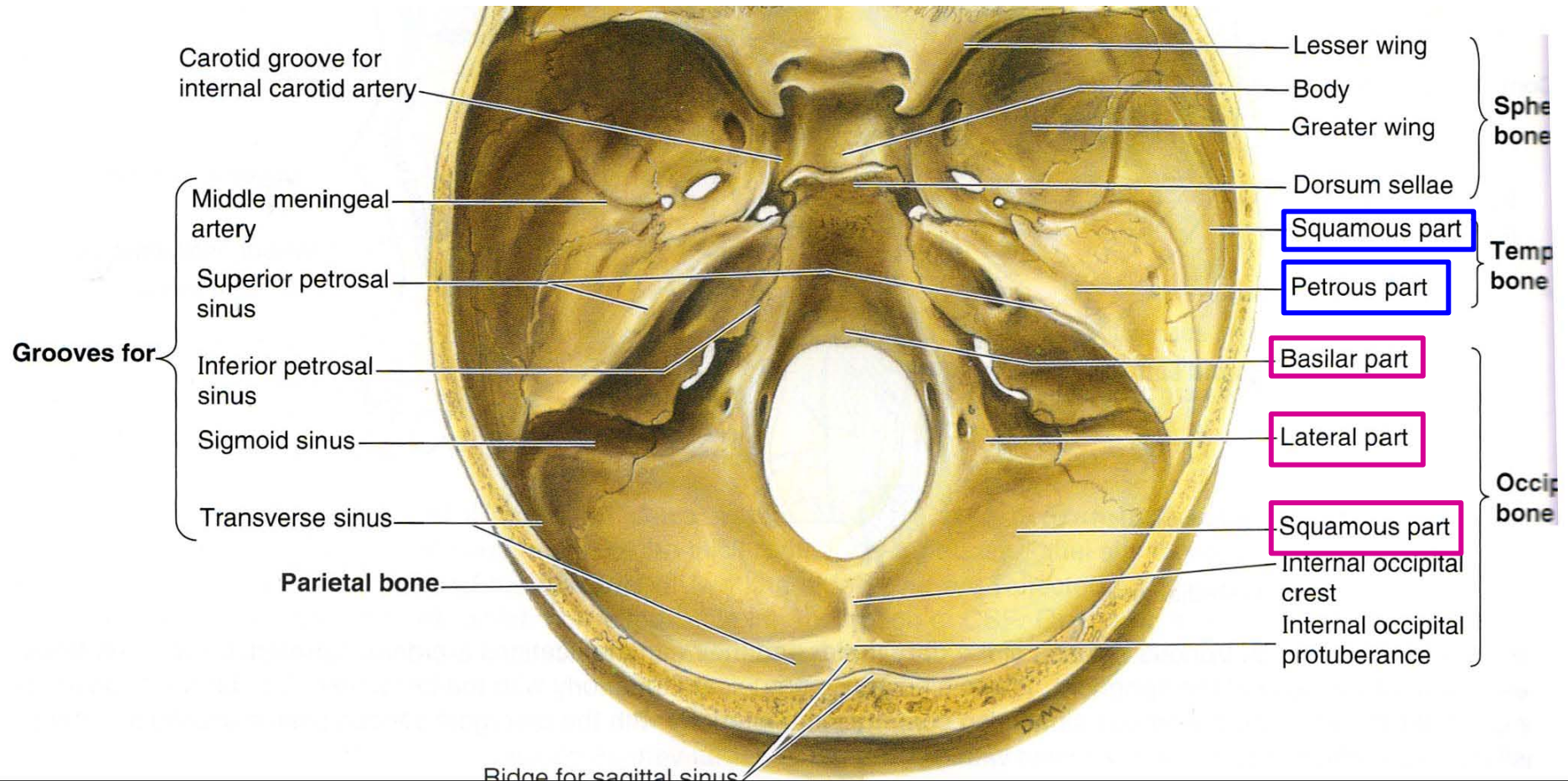
Inner surface of Posterior fossa

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



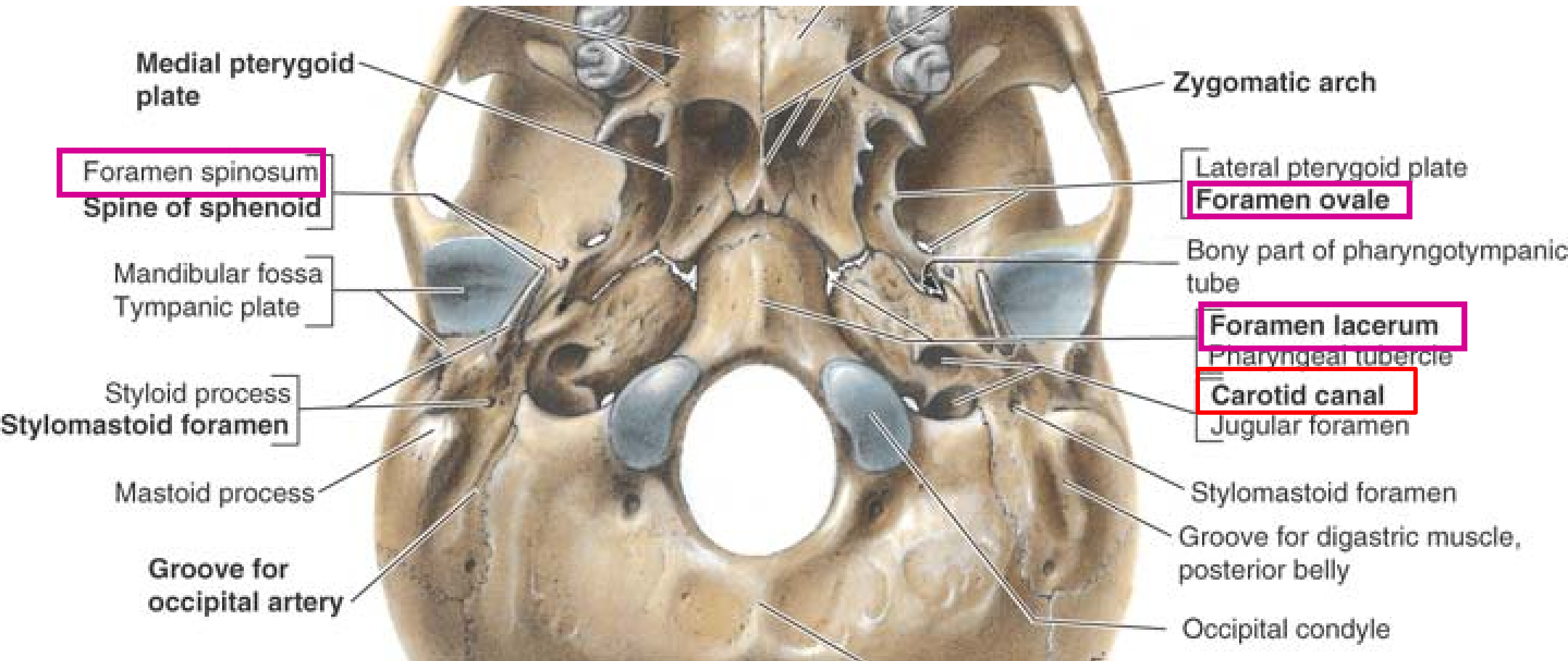
Inner surface of Occipital bone, Temporal bone

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



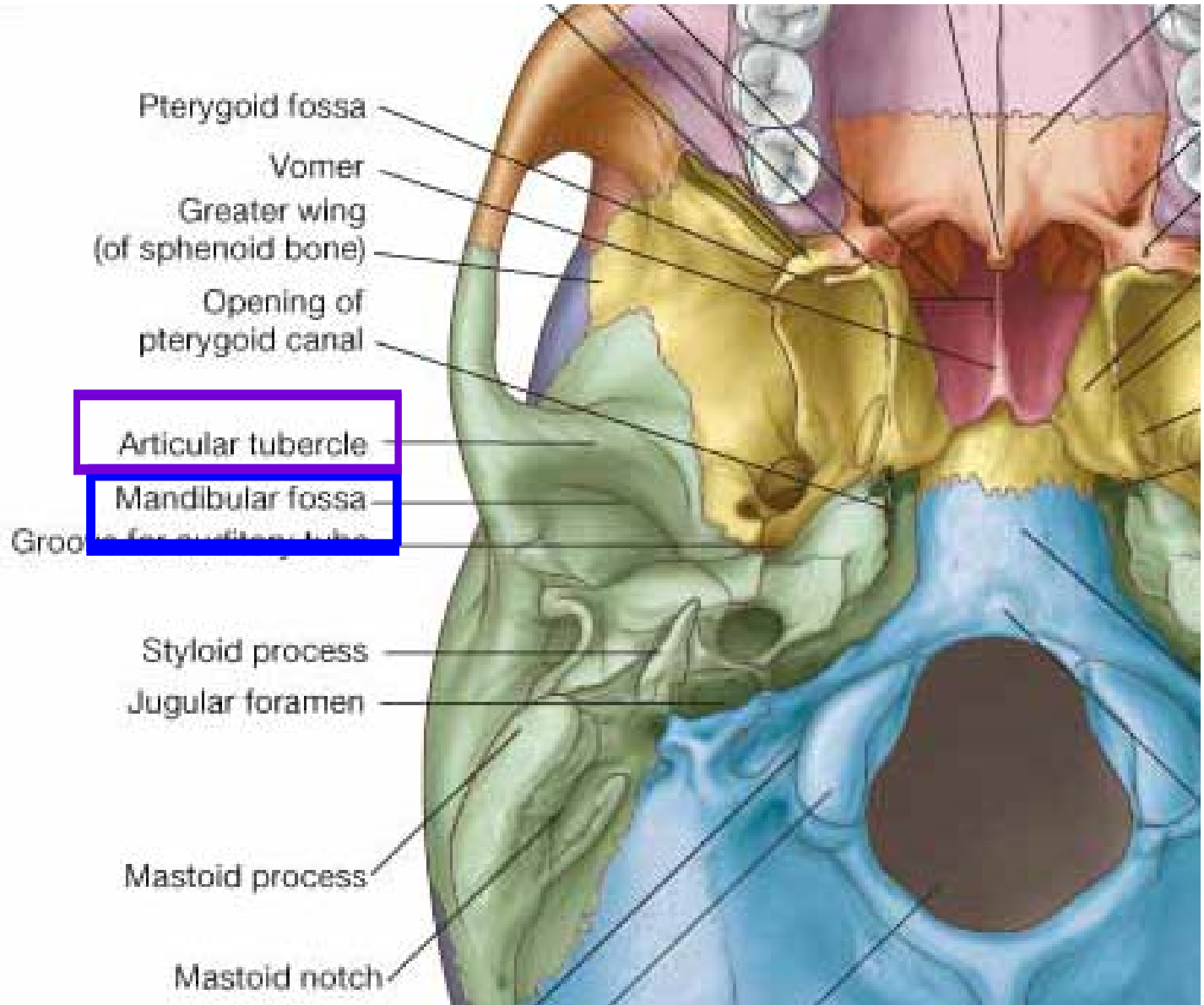
Floor (Outer surface) of middle cranial fossa-1

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



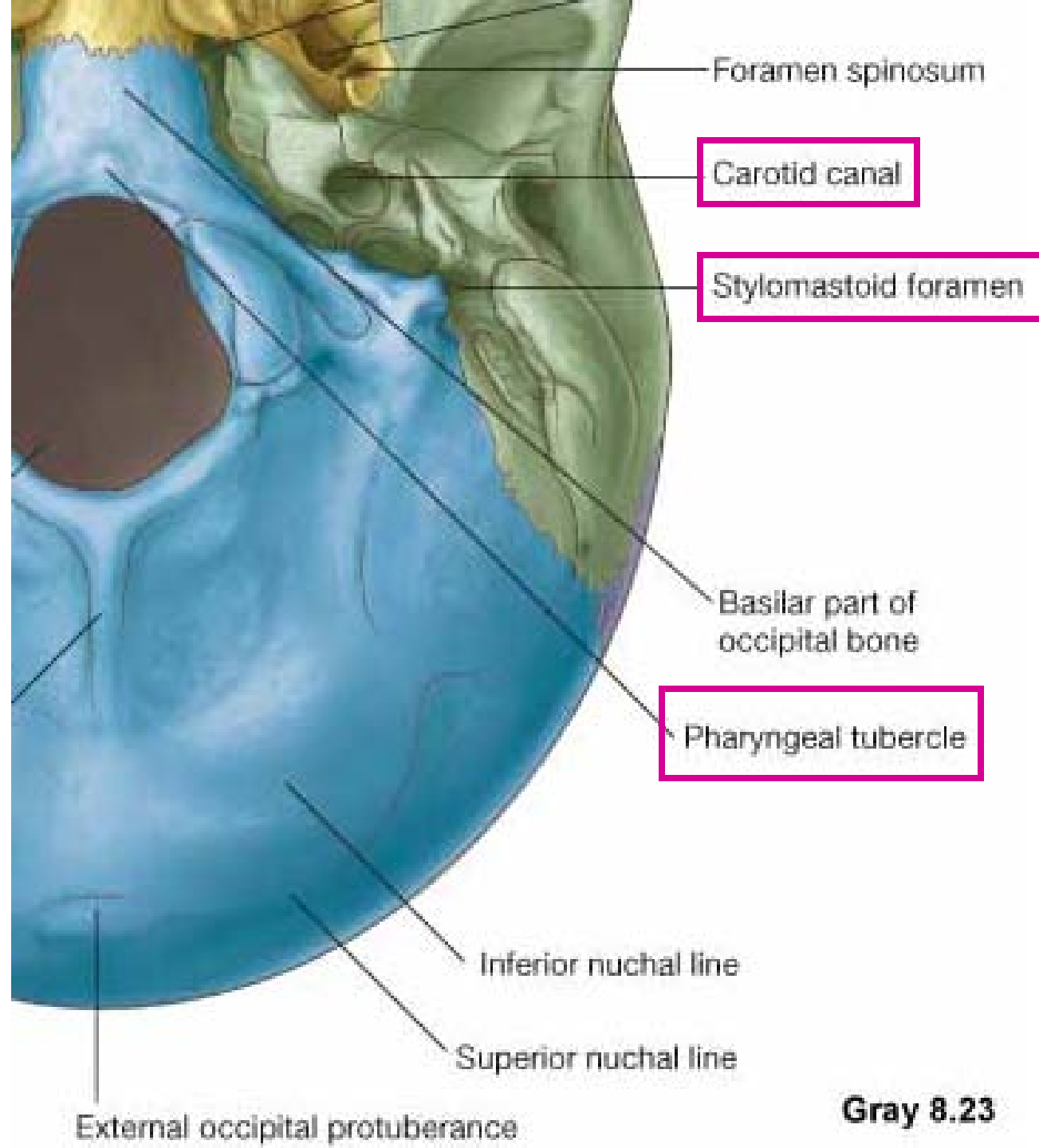
Floor (Outer surface) of middle cranial fossa-2

- mandibular fossa, articular tubercle

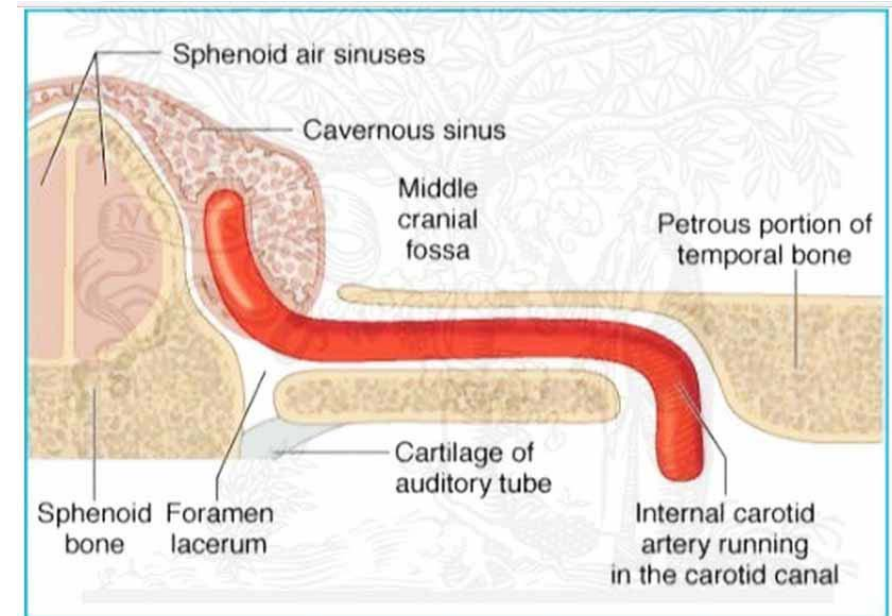
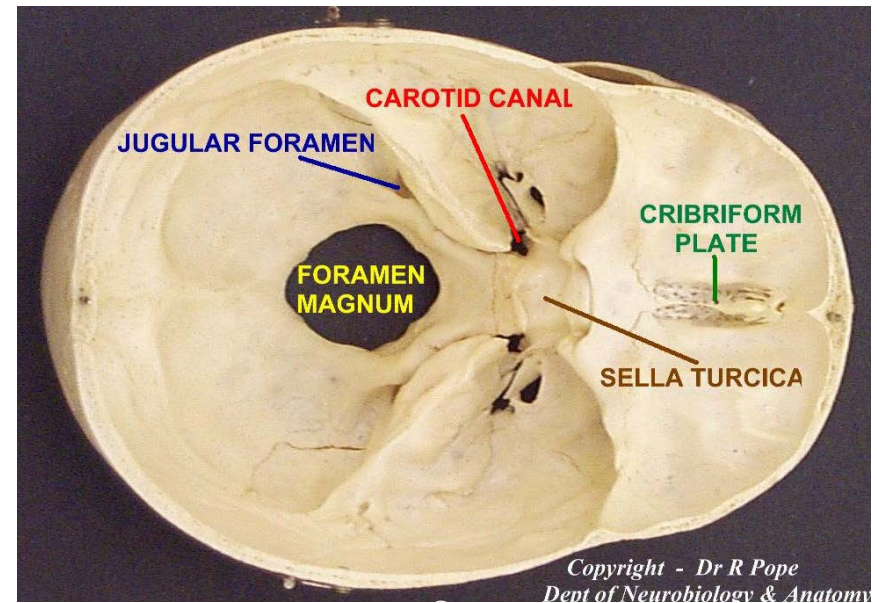
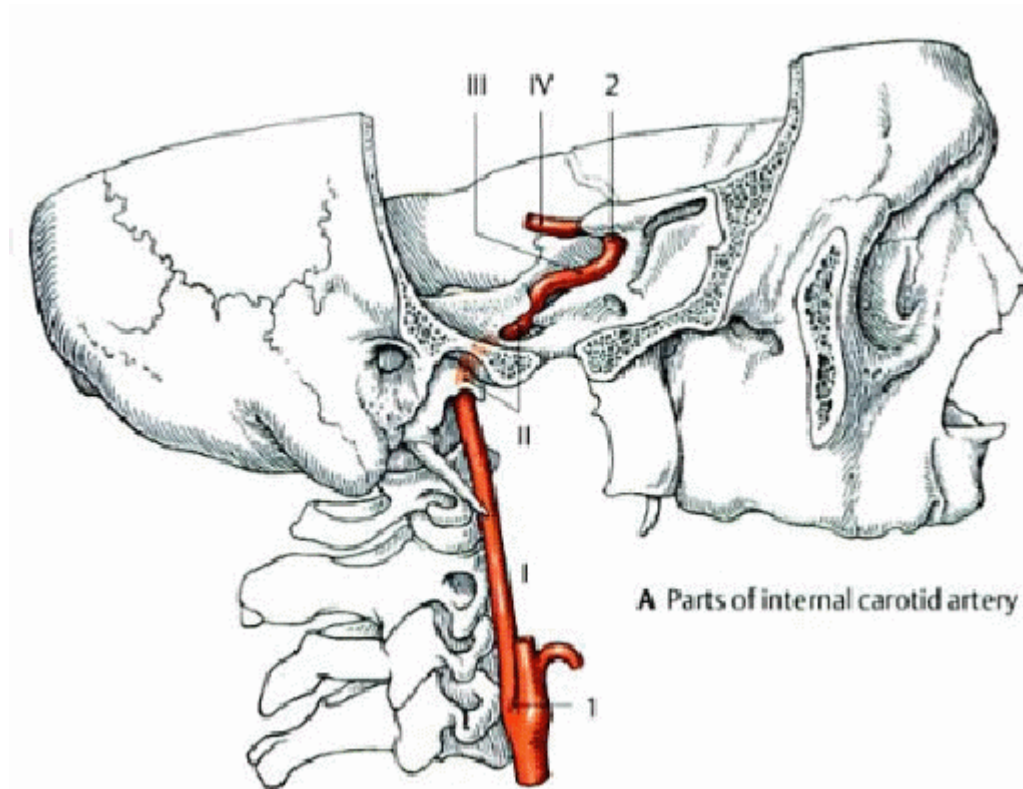


Outer surface of Post. cranial fossa

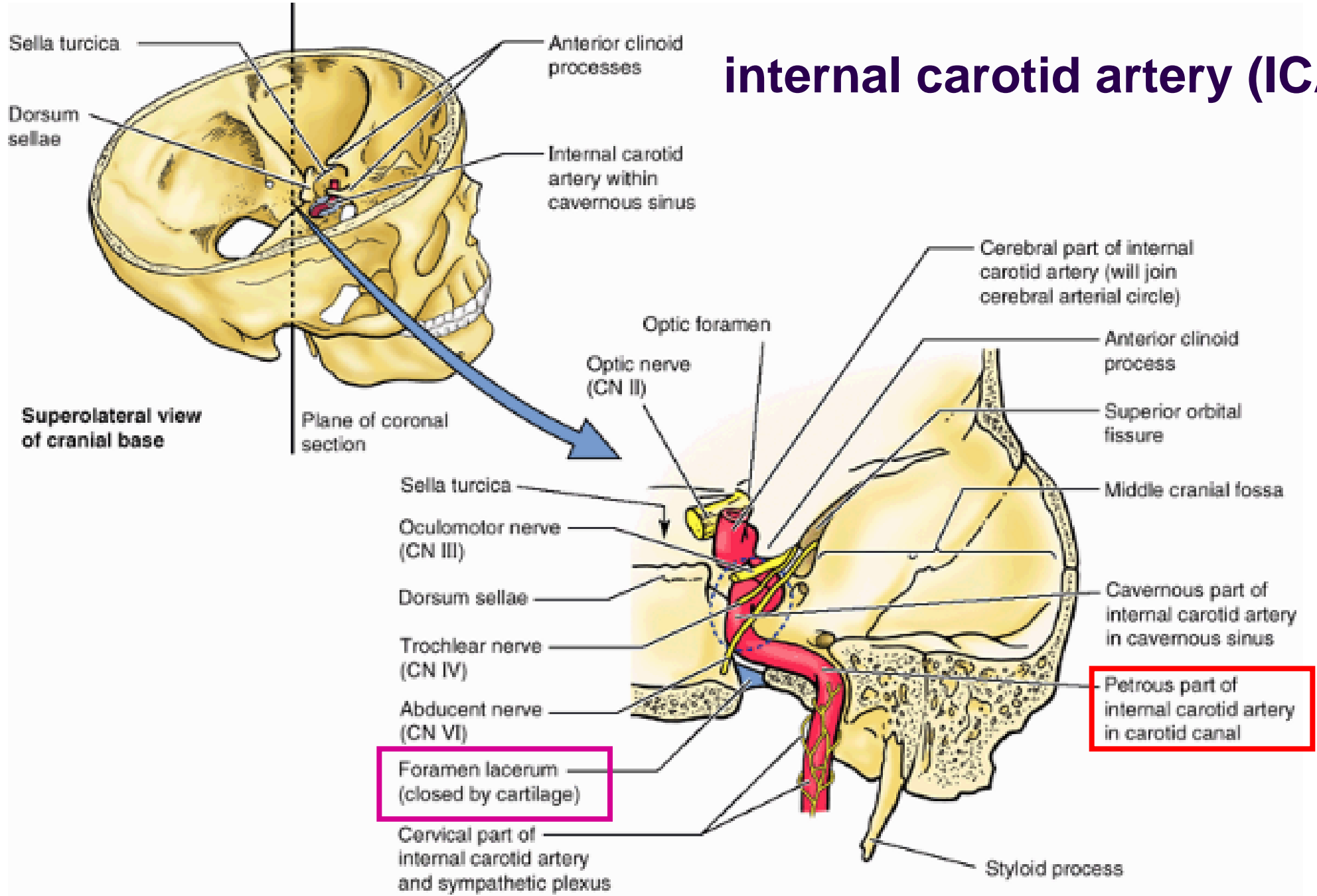
- sphenoid and occipital fused in the midline
- opening of carotid canal (ICA)
- **stylomastoid foramen** (CN VII)
- **pharyngeal tubercle**



carotid canal for internal carotid artery

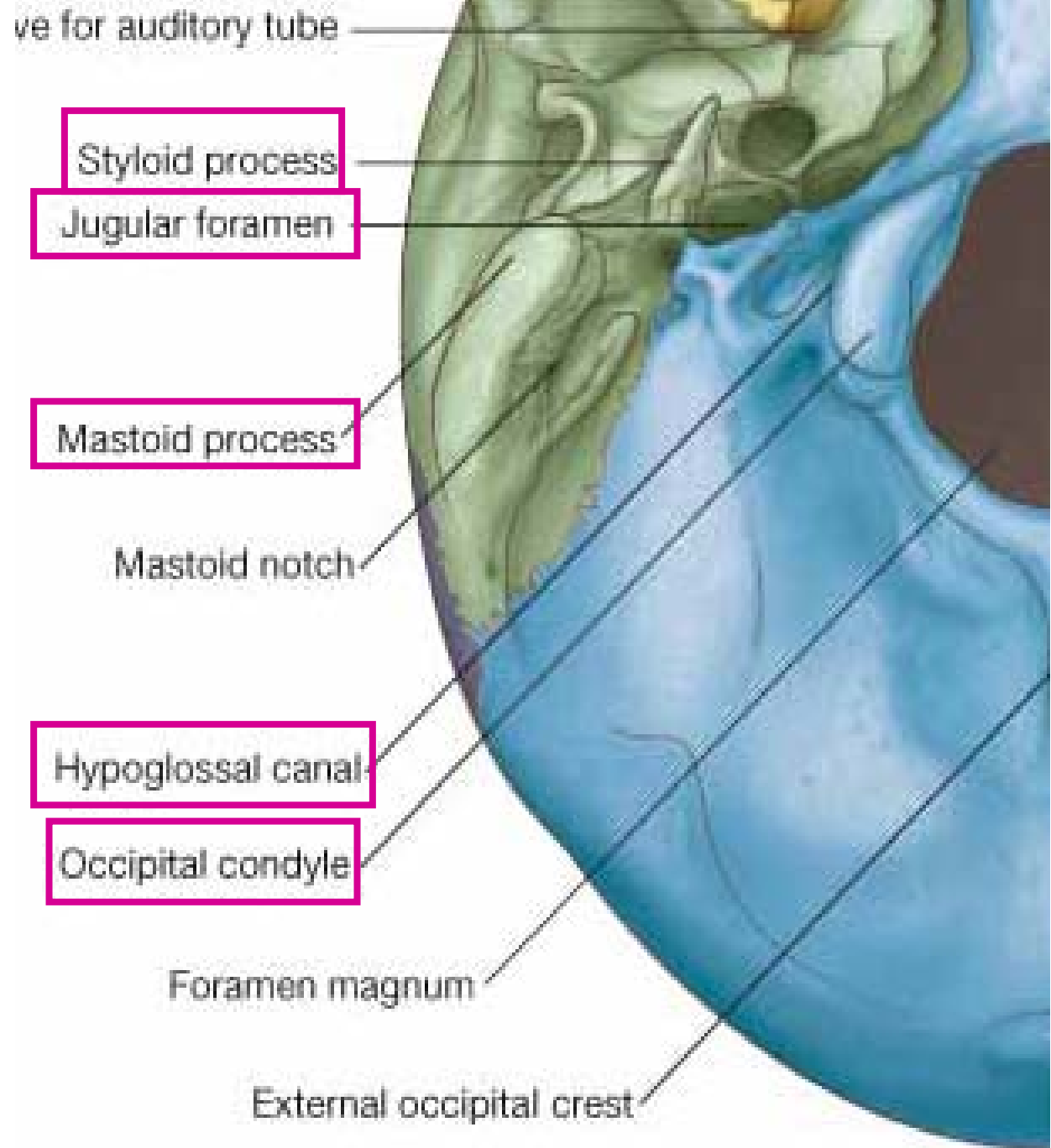


internal carotid artery (ICA)



Outer surface of Post. cranial fossa

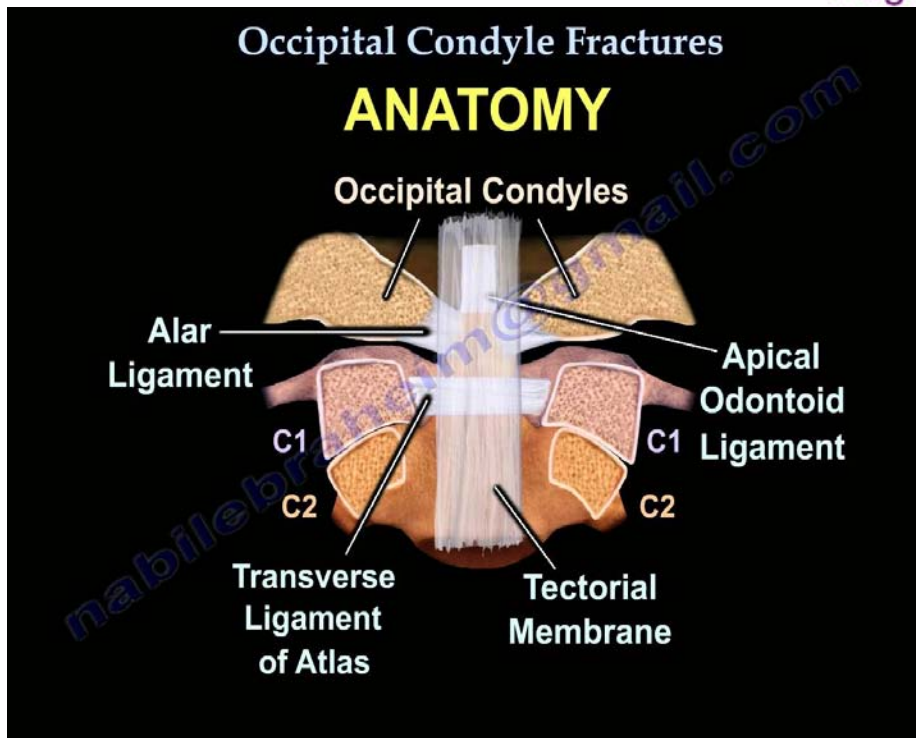
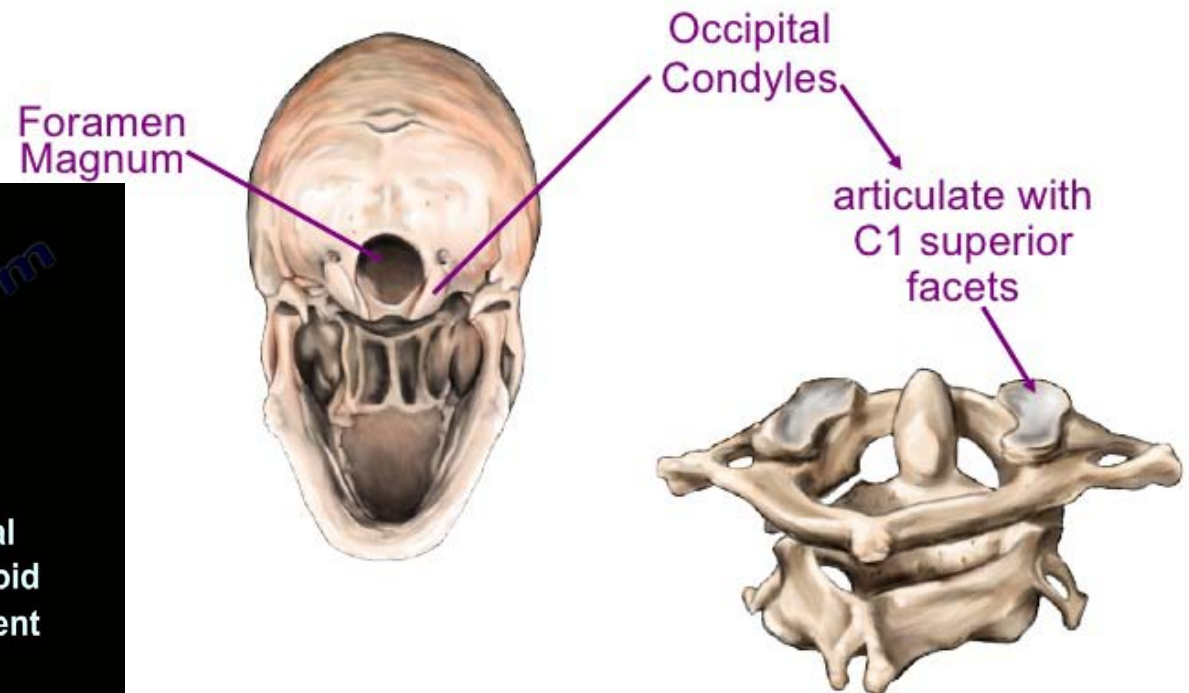
- jugular foramen
- occipital condyle
- hypoglossal canal (medial opening hidden under condyle)
- **styloid process:** stylohyoid lig.
- **mastoid process:** air cell ↔ middle ear
 - sternocleidomastoid



Occoital-Atas joint

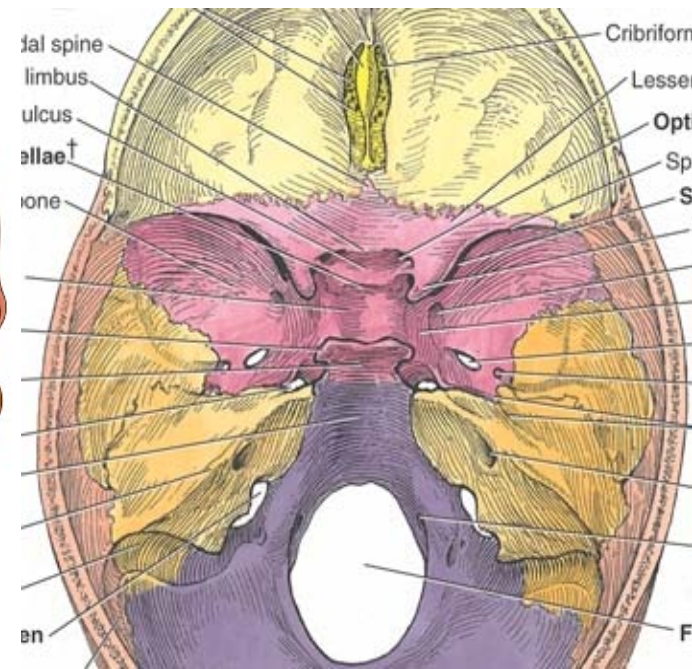
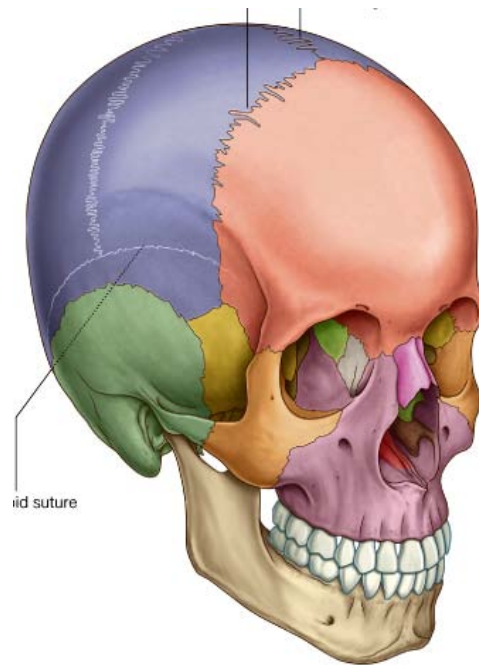
- Occipital bone:
(condyle)
- C1 Atlas: sup. facet

Occipitocervical Joint



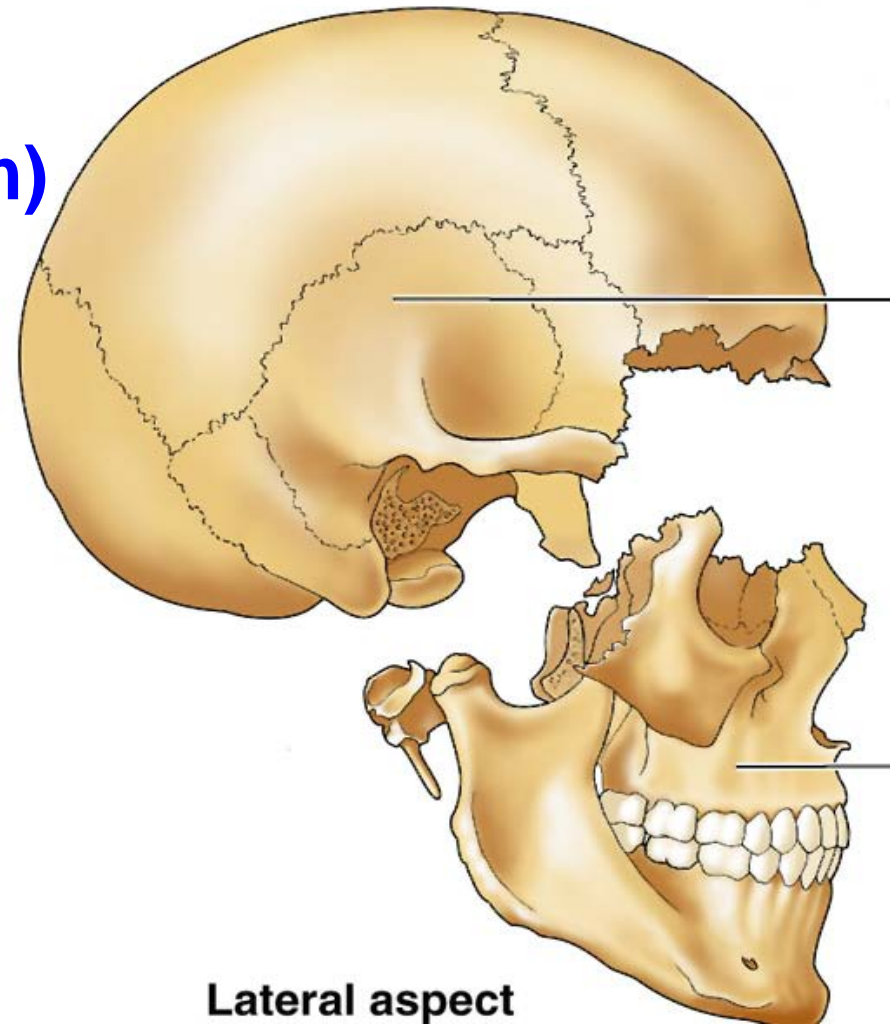
Skull (cranial skeleton): review

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

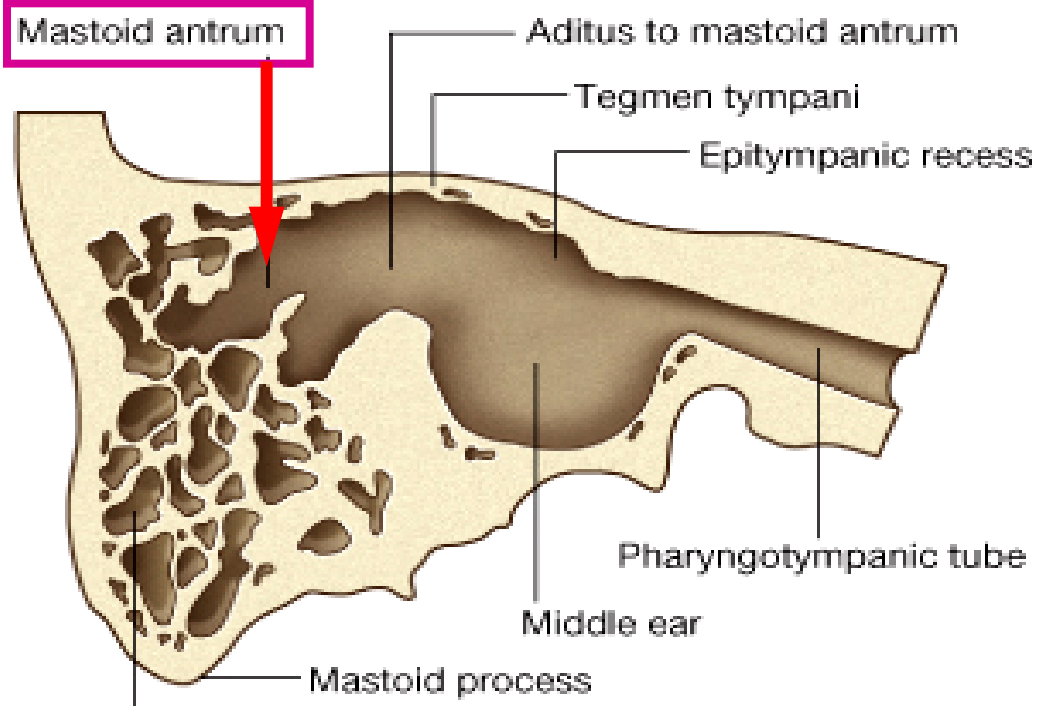
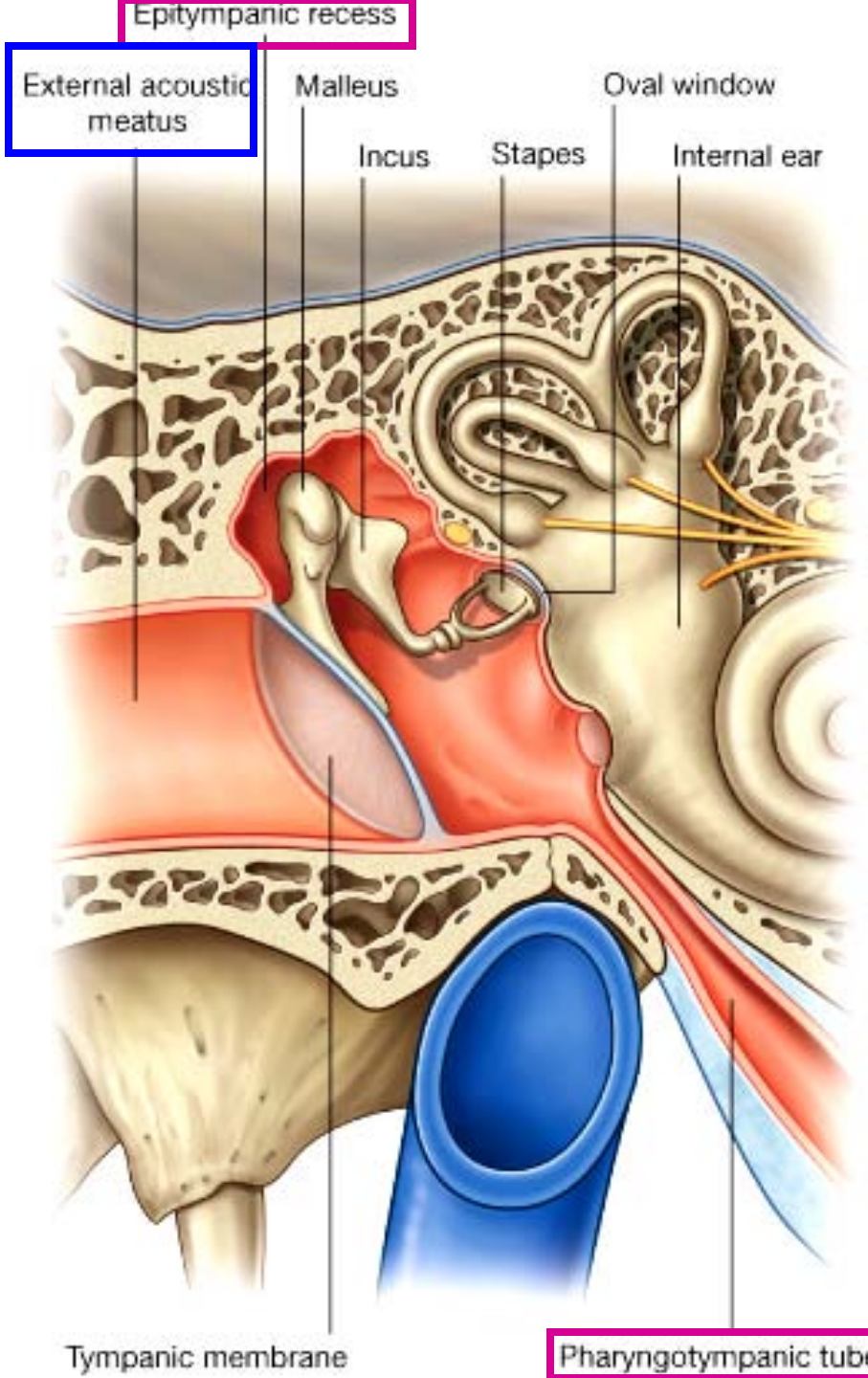


Facial skeleton

- 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)

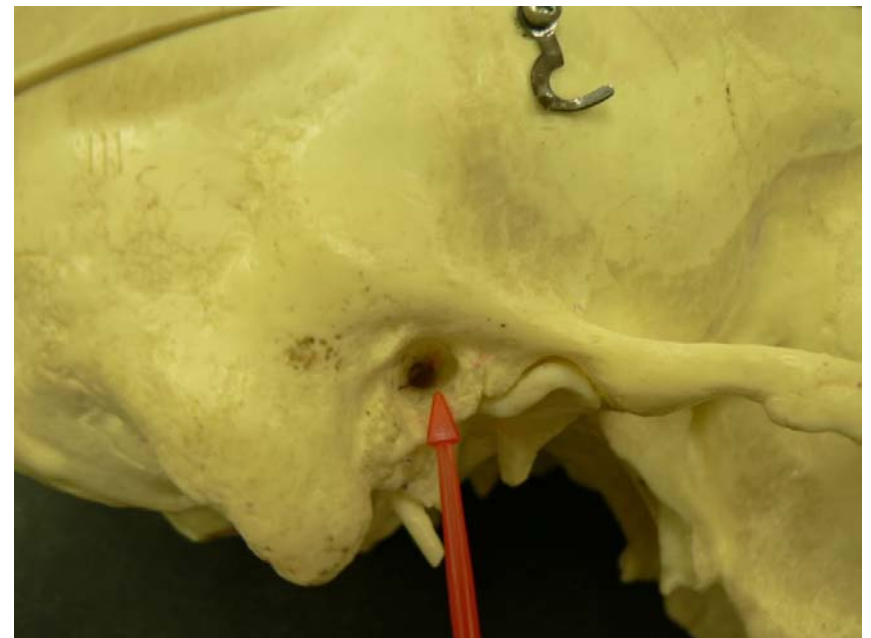
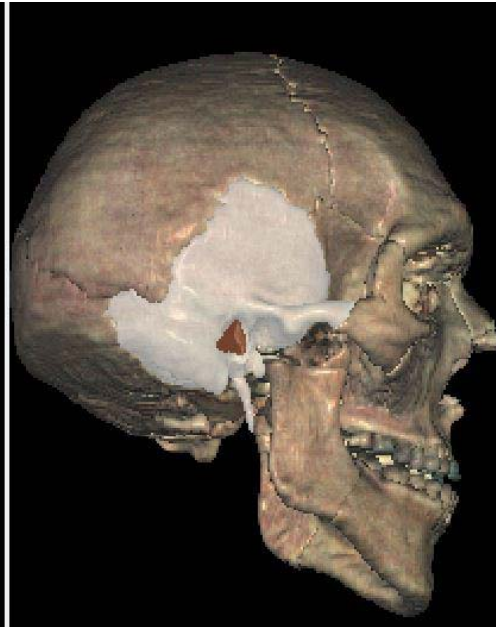
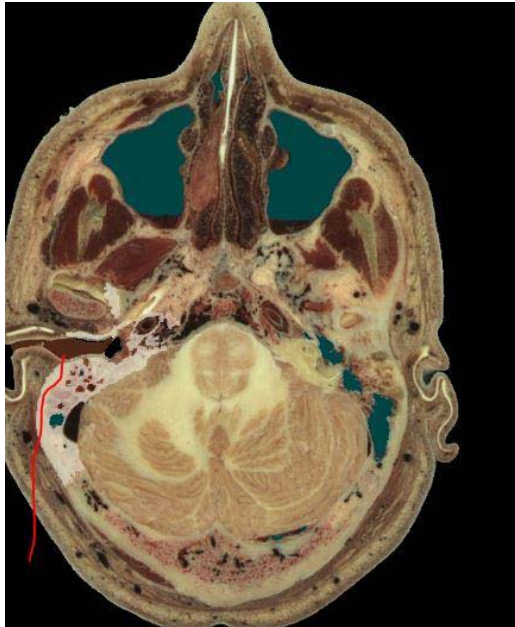
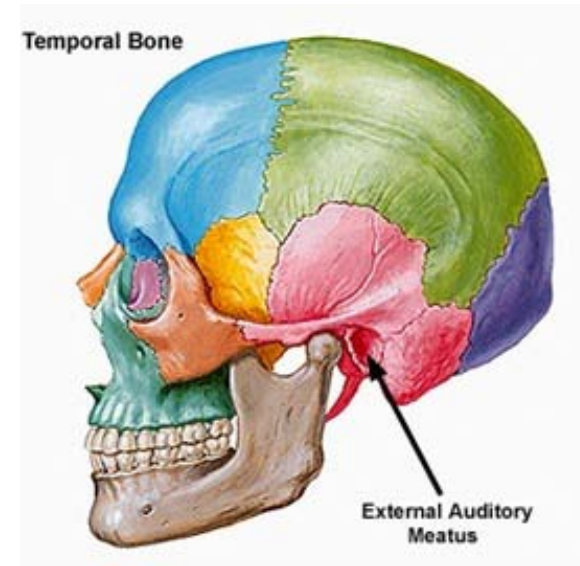
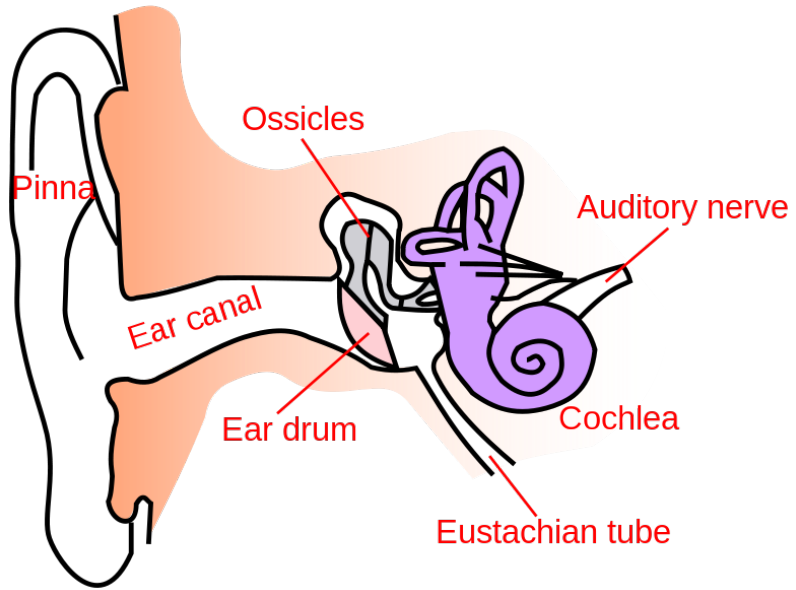


Mastoid air cells

Tympanic membrane

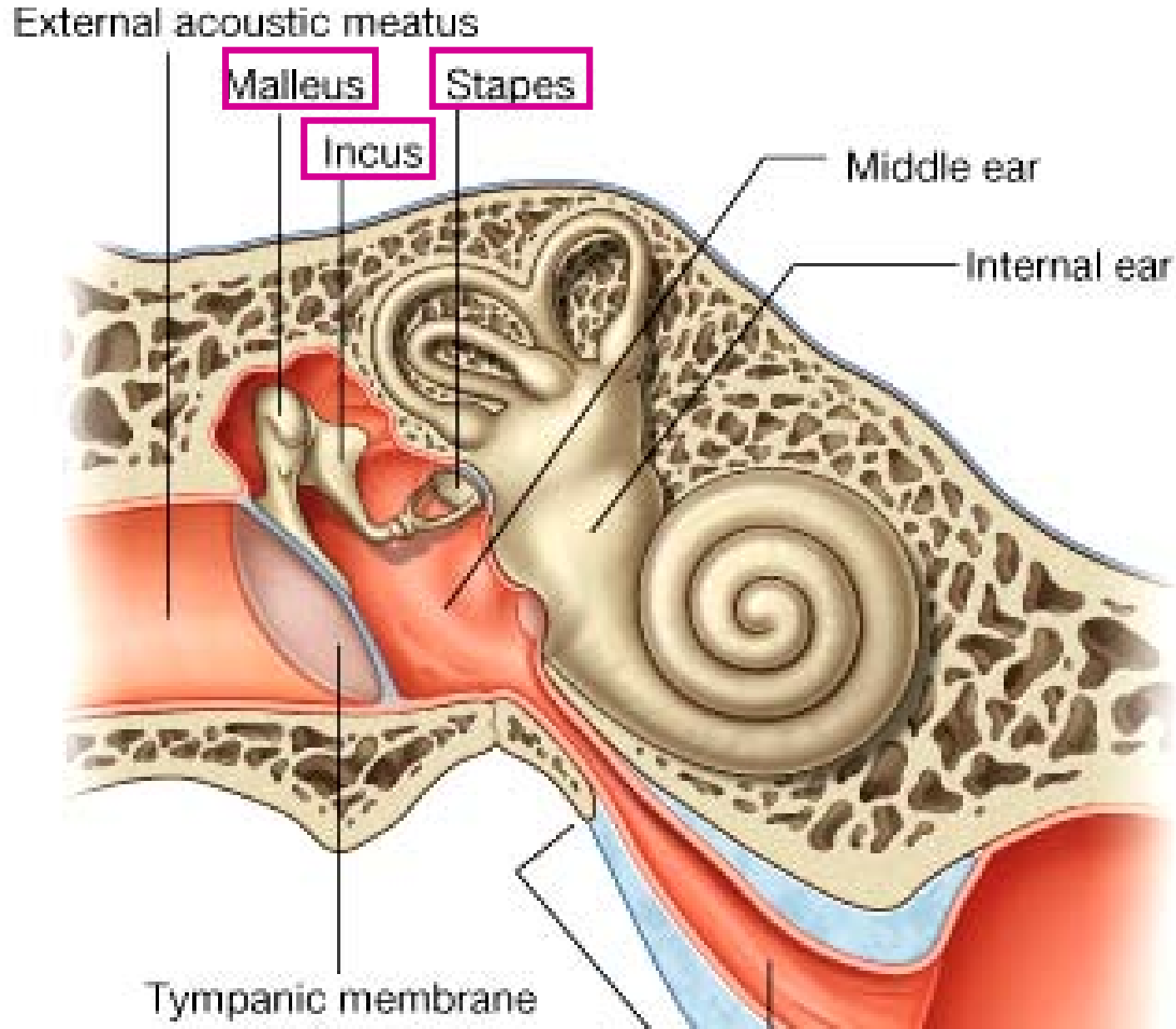
Pharyngotympanic tube

external auditory meatus



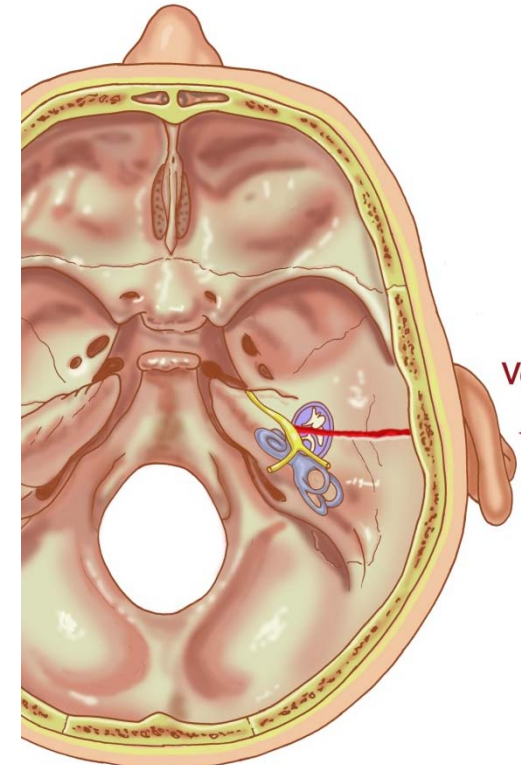
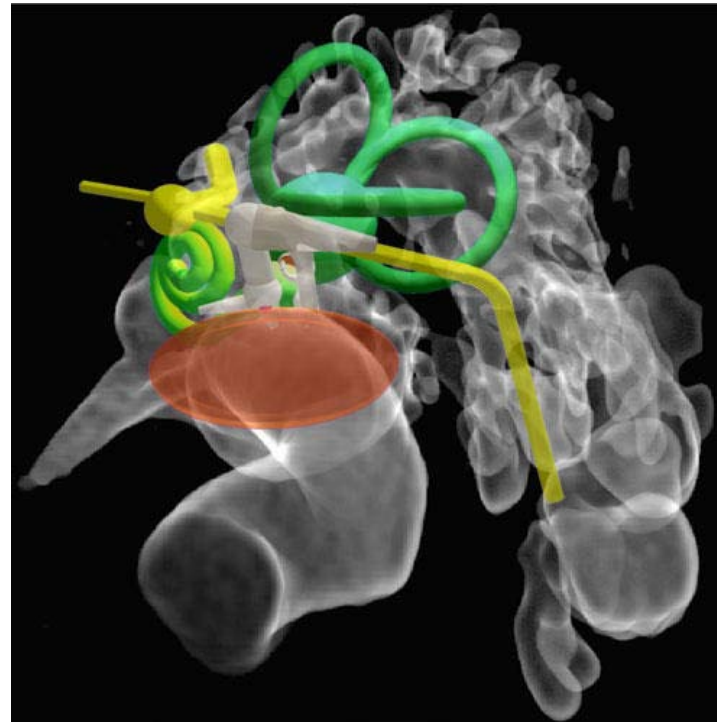
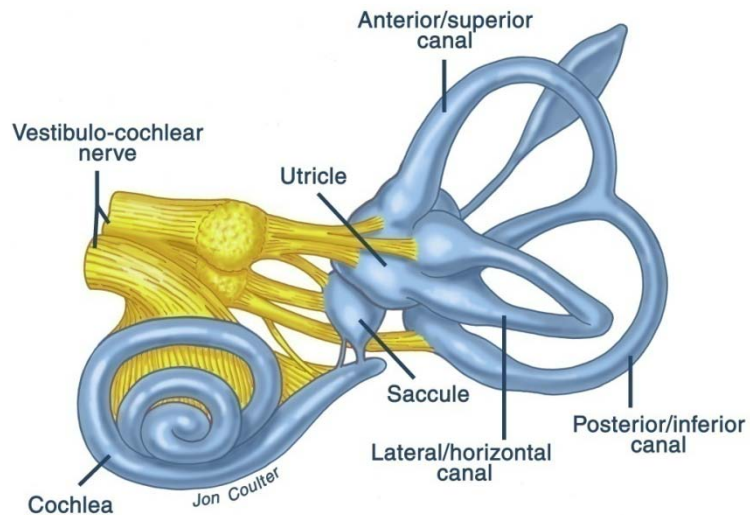
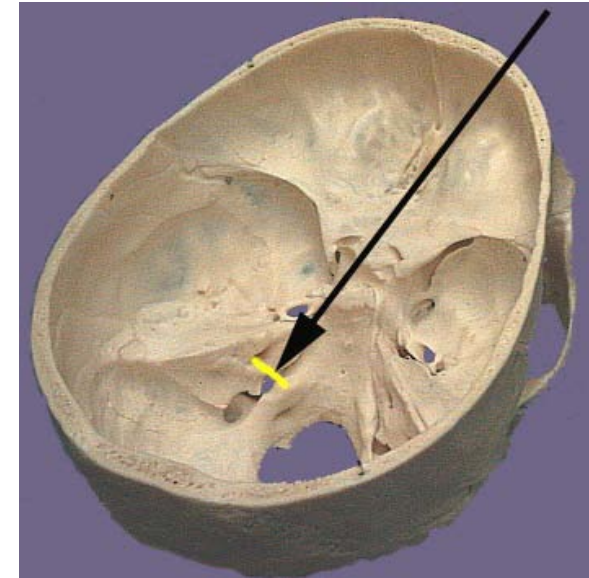
3 ossicles

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

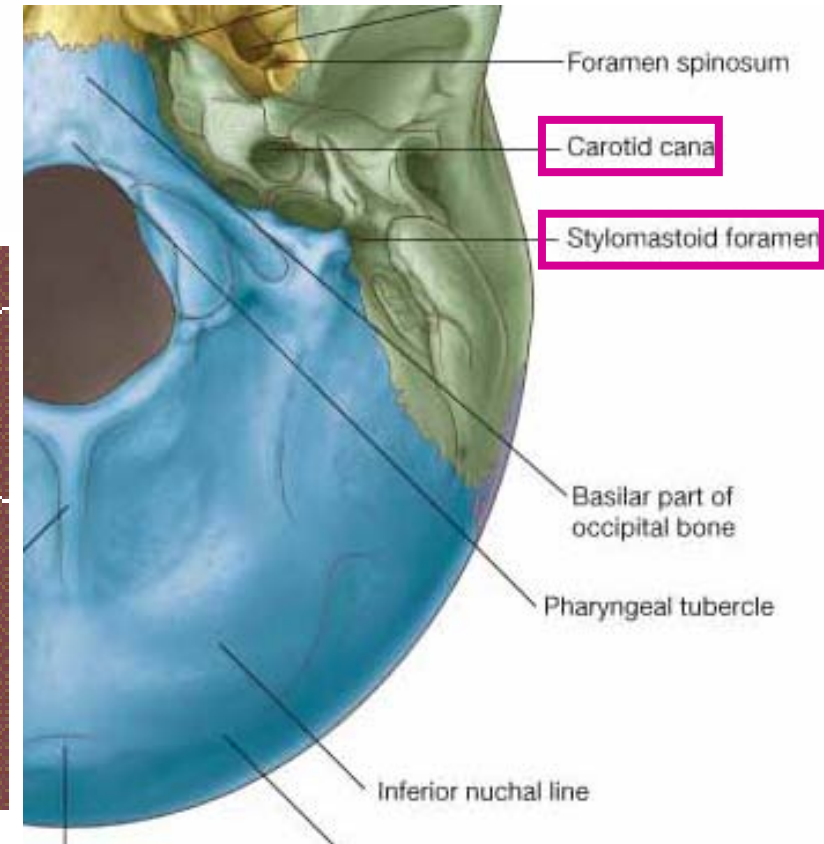
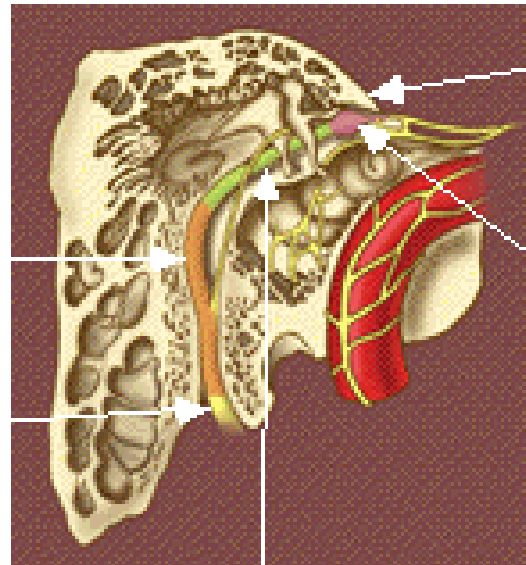
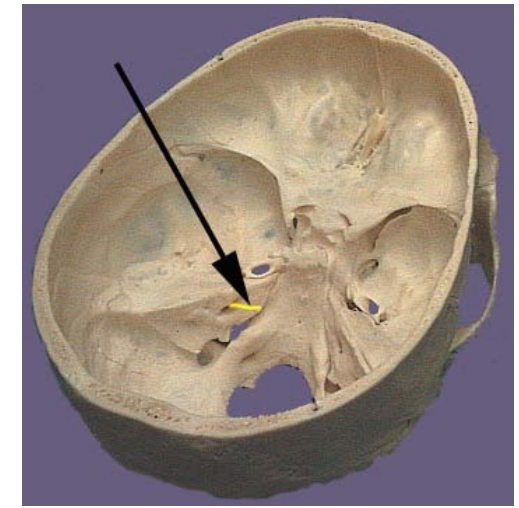
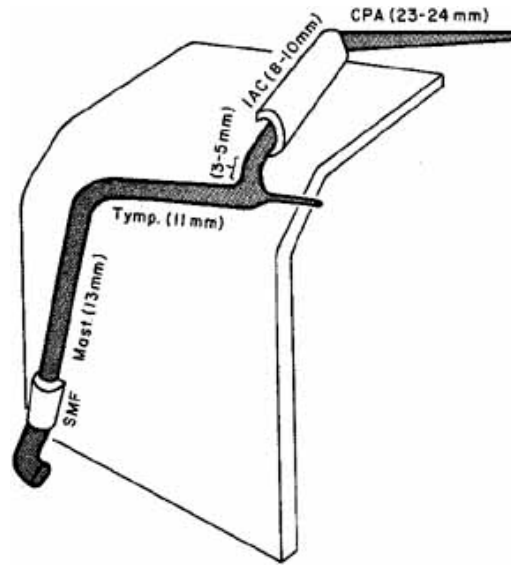
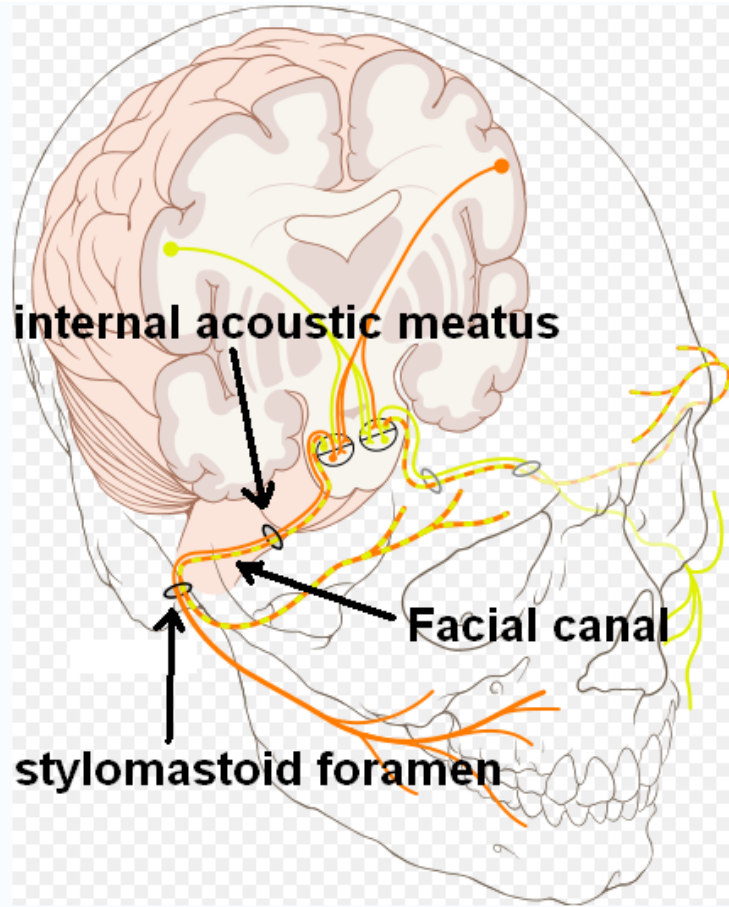


Inner ear: petrous part of temporal bone

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

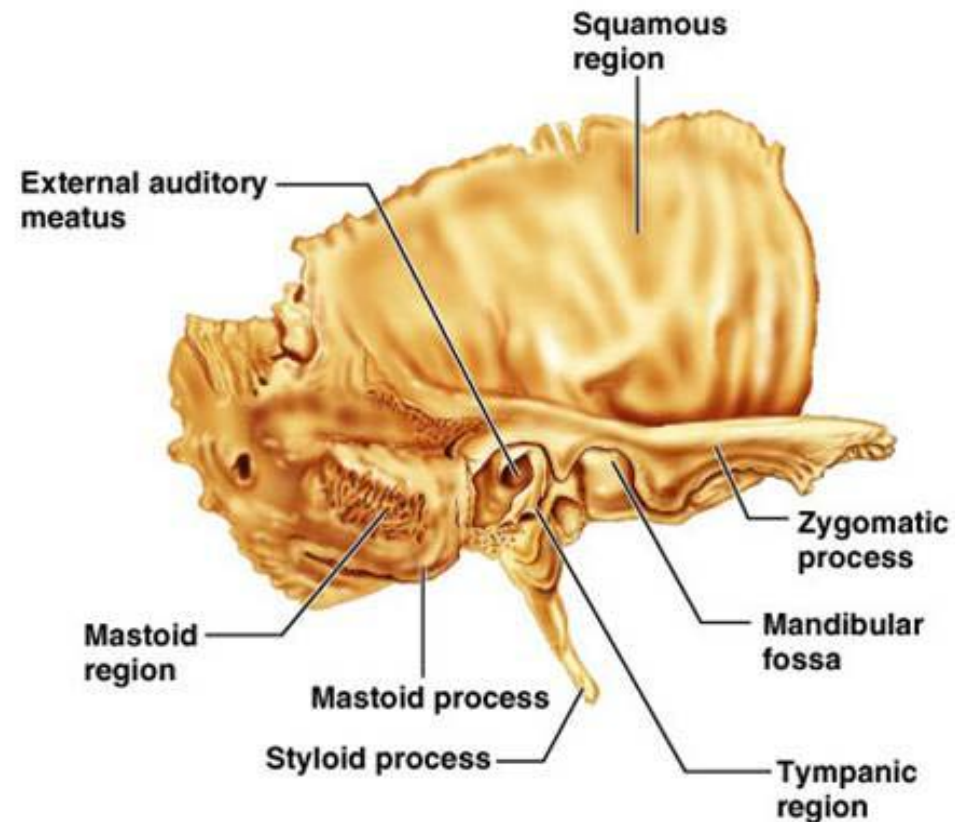
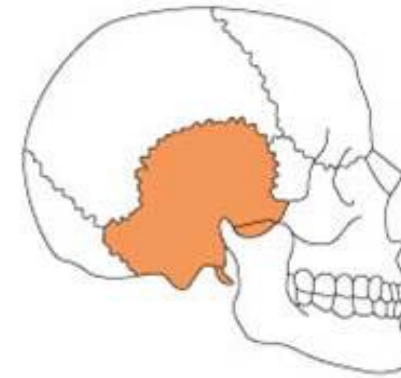
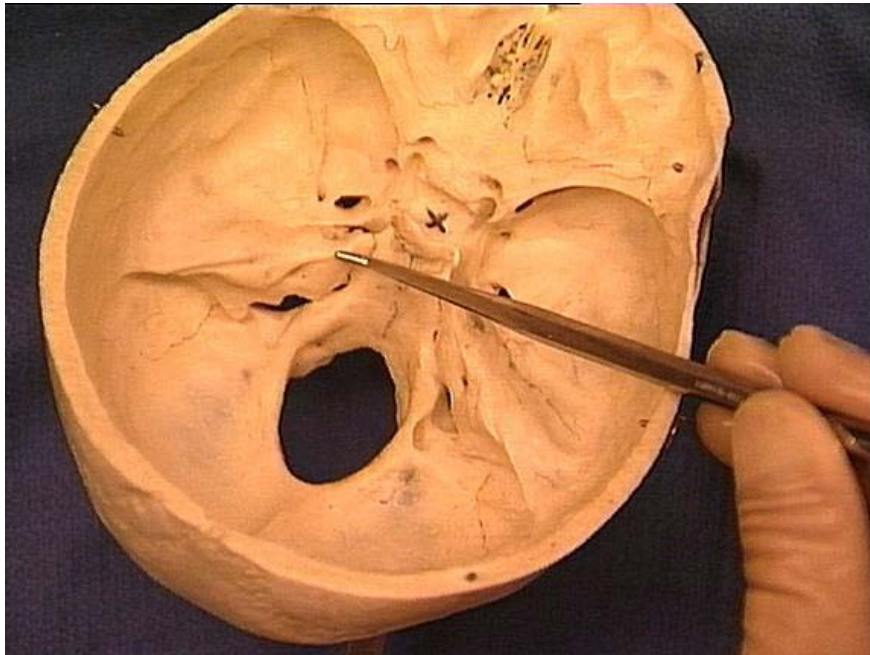


Facial canal: internal acoustic meatus; stylomastoid foramen



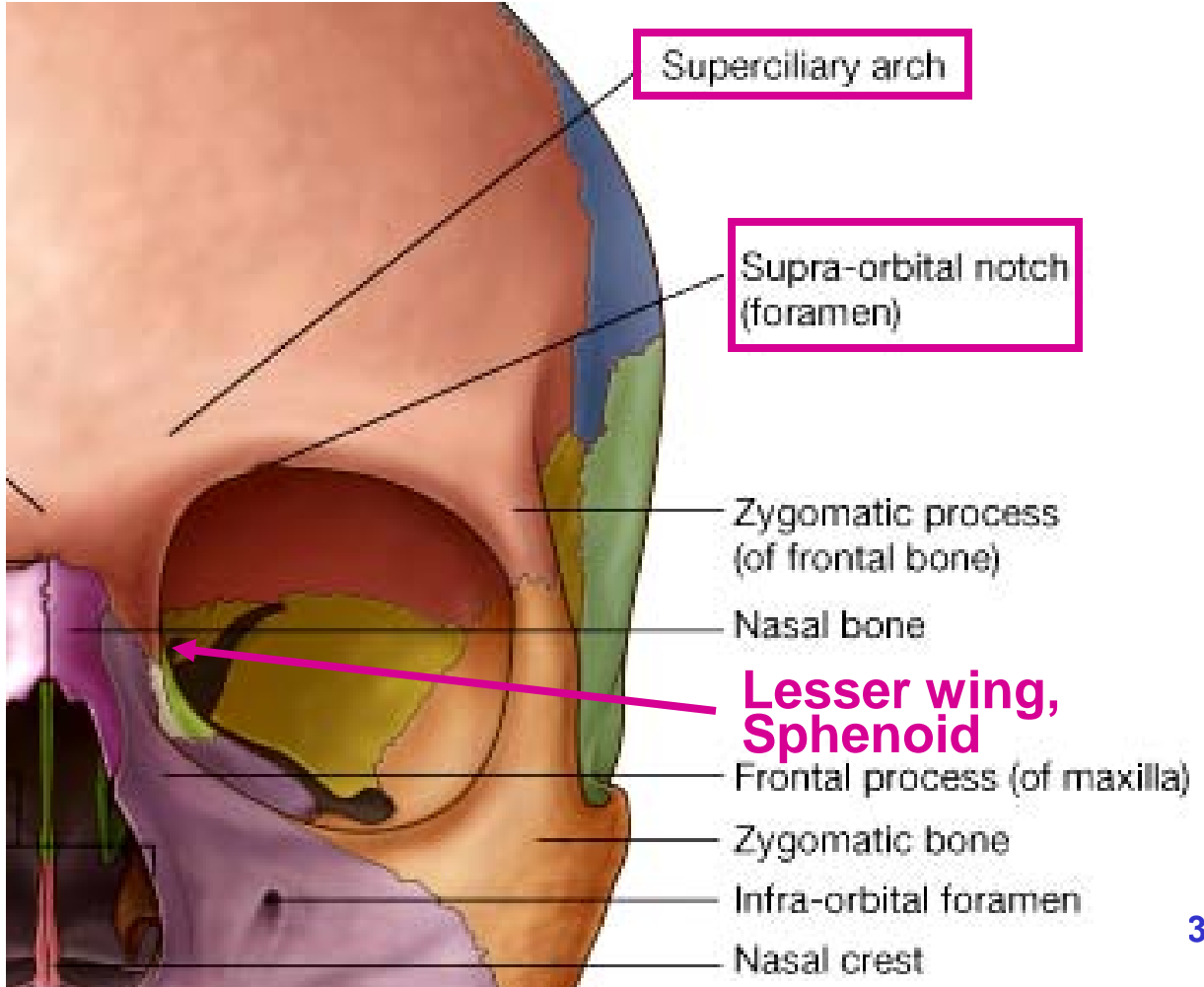
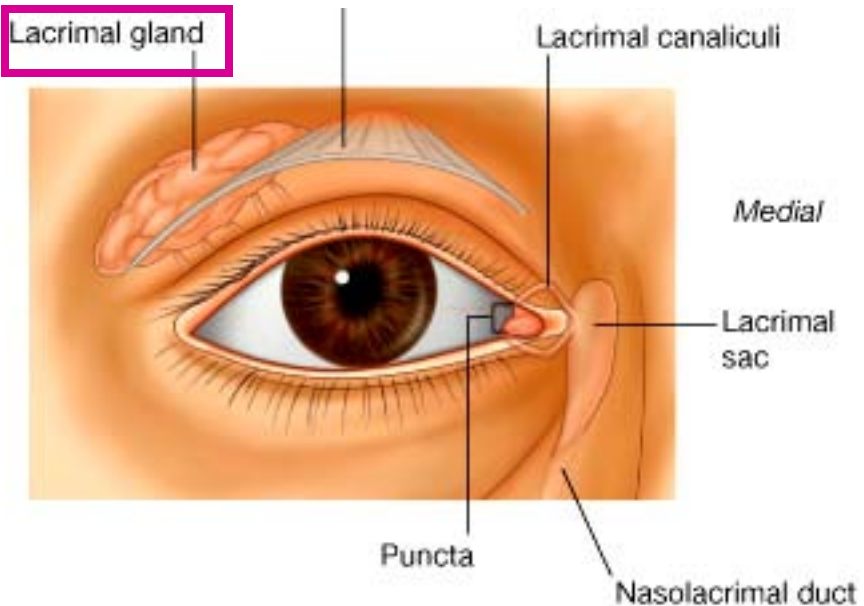
Temporal bone

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

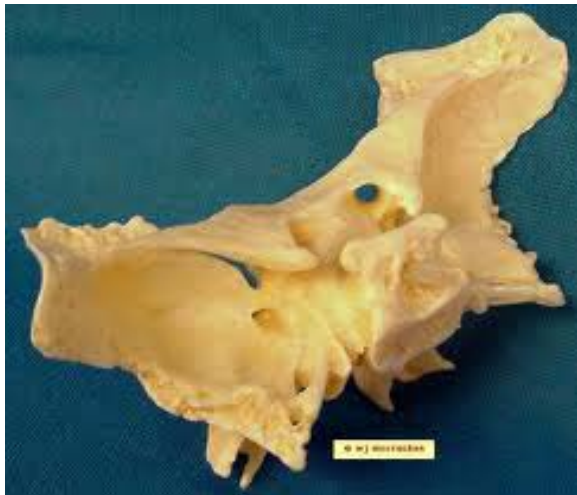


Bony orbits: roof

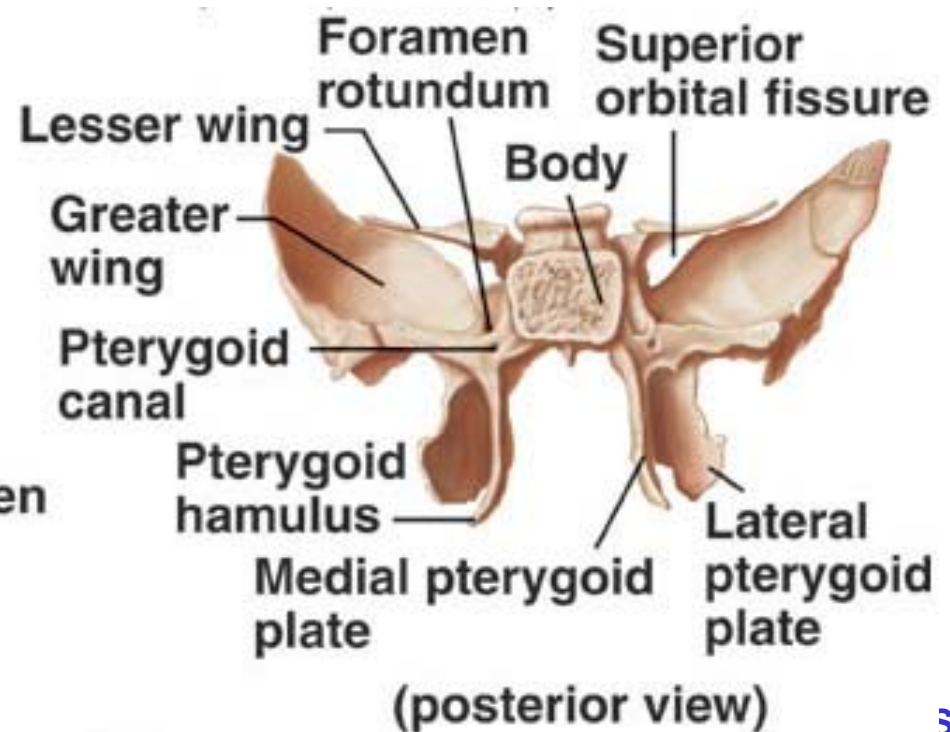
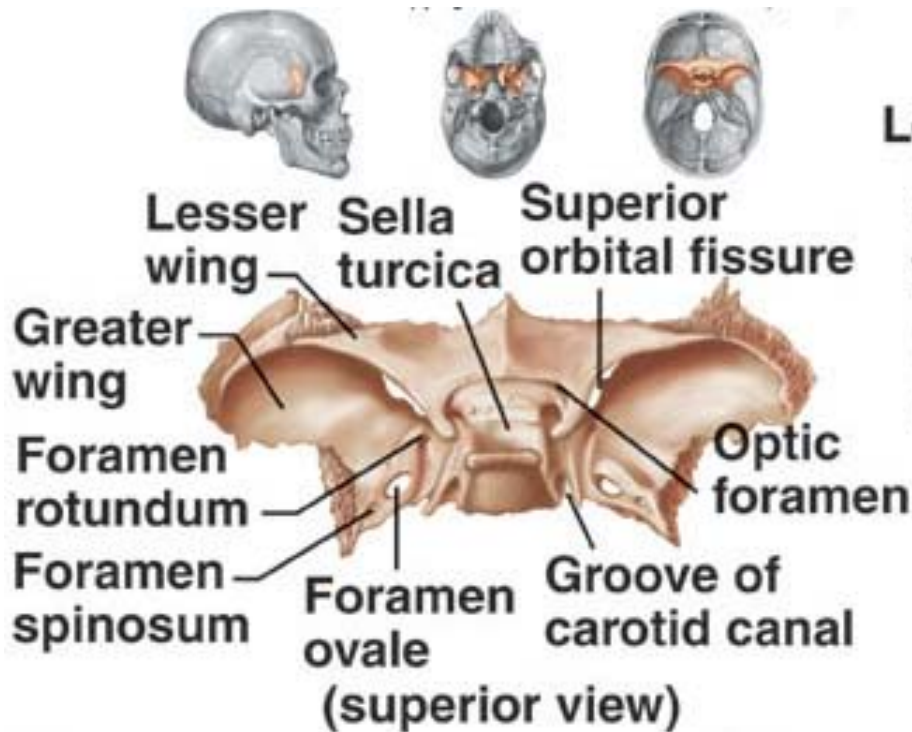
- superciliary arch of frontal bone: thickened
- **supraorbital notch (foramen):** supraorbital n. (V_1), vessels
- floor of ant. cranial fossa: thin
- lesser wing of sphenoid
- Lacrimal gland



Sphenoid bone

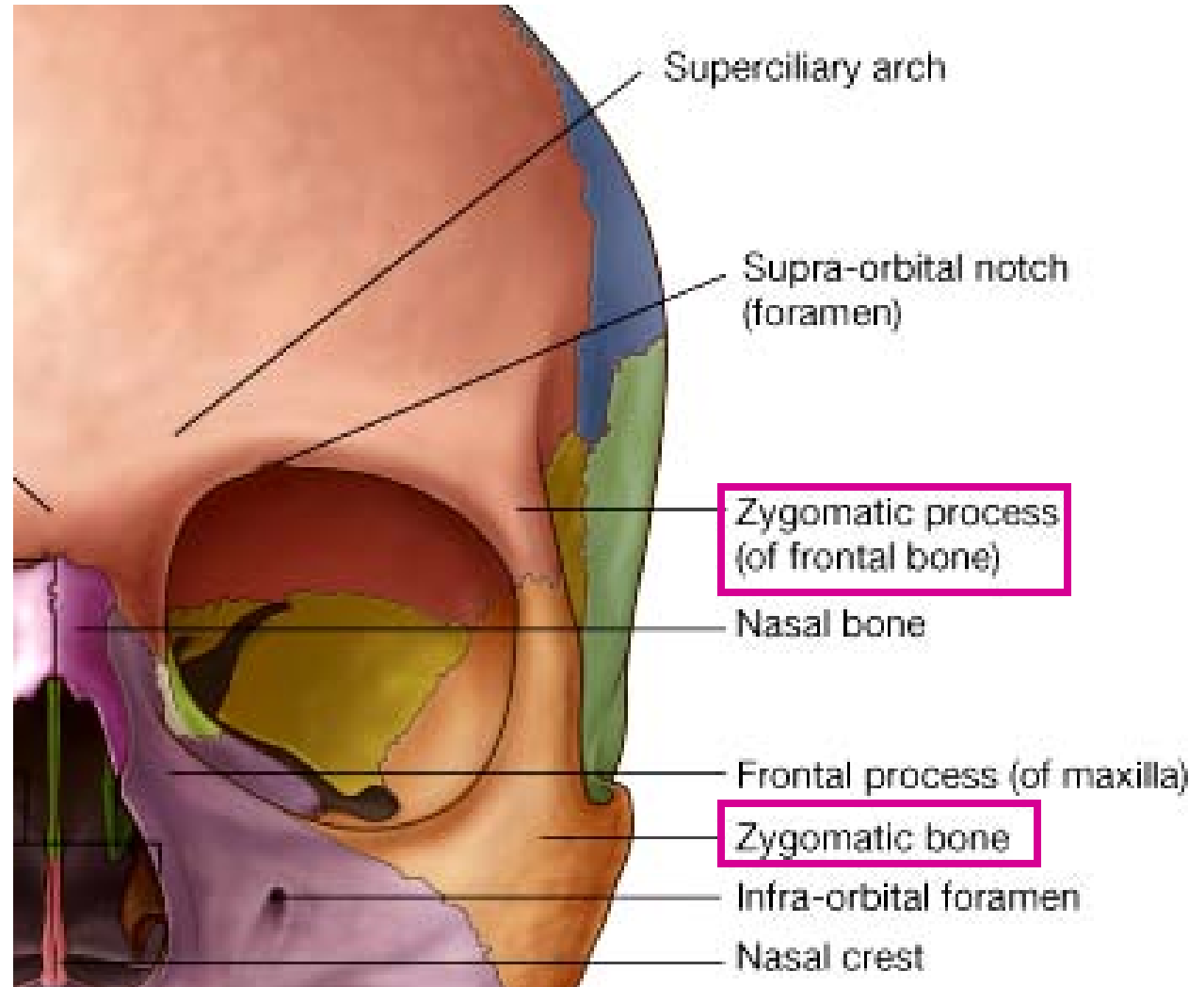


- Greater wing
- Lesser wing
- Sphenoid body
- Medial pterygoid plate
- Lateral pterygoid plate
- Superior orbital fissure



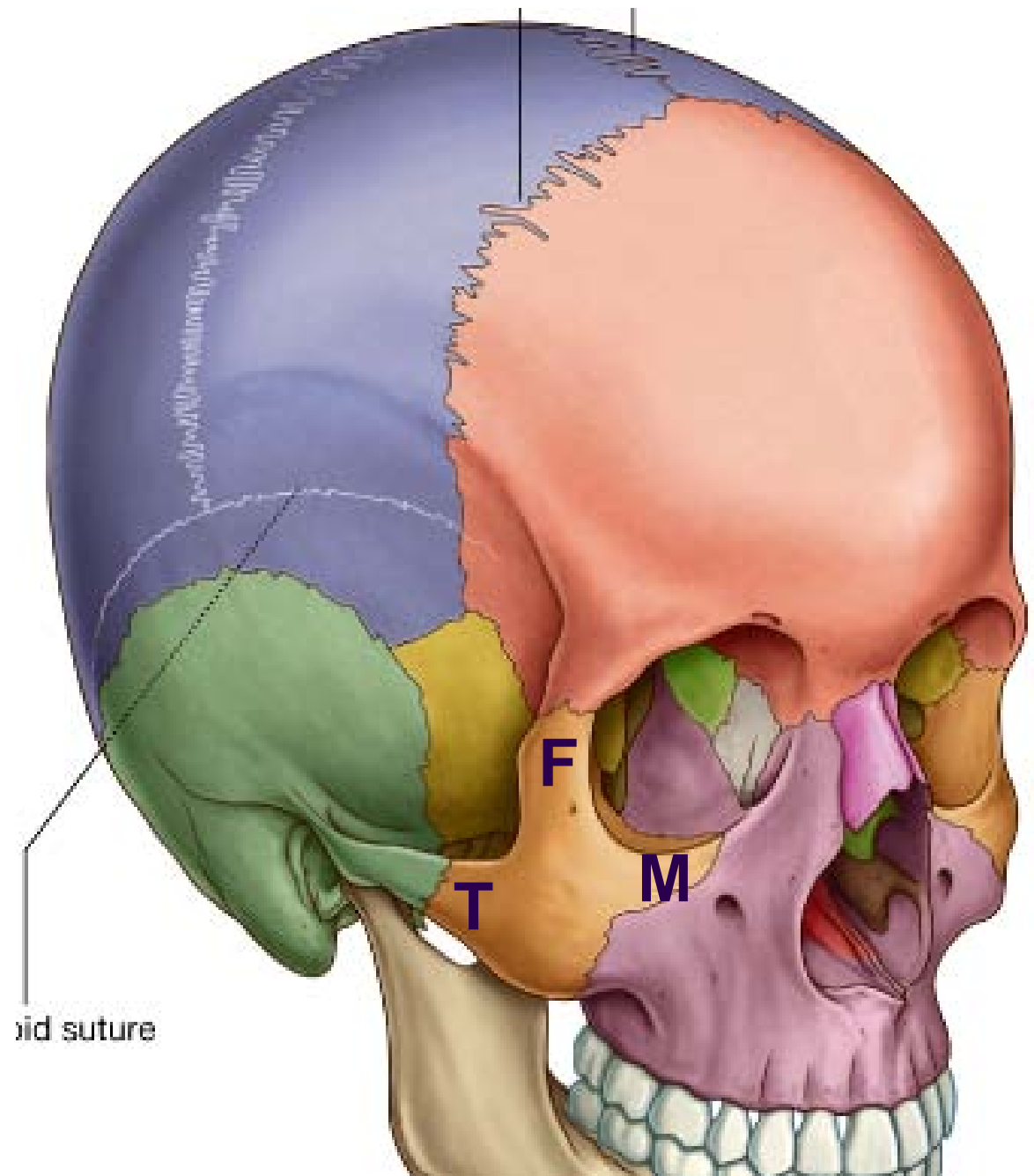
Bony orbits: lateral wall-1

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



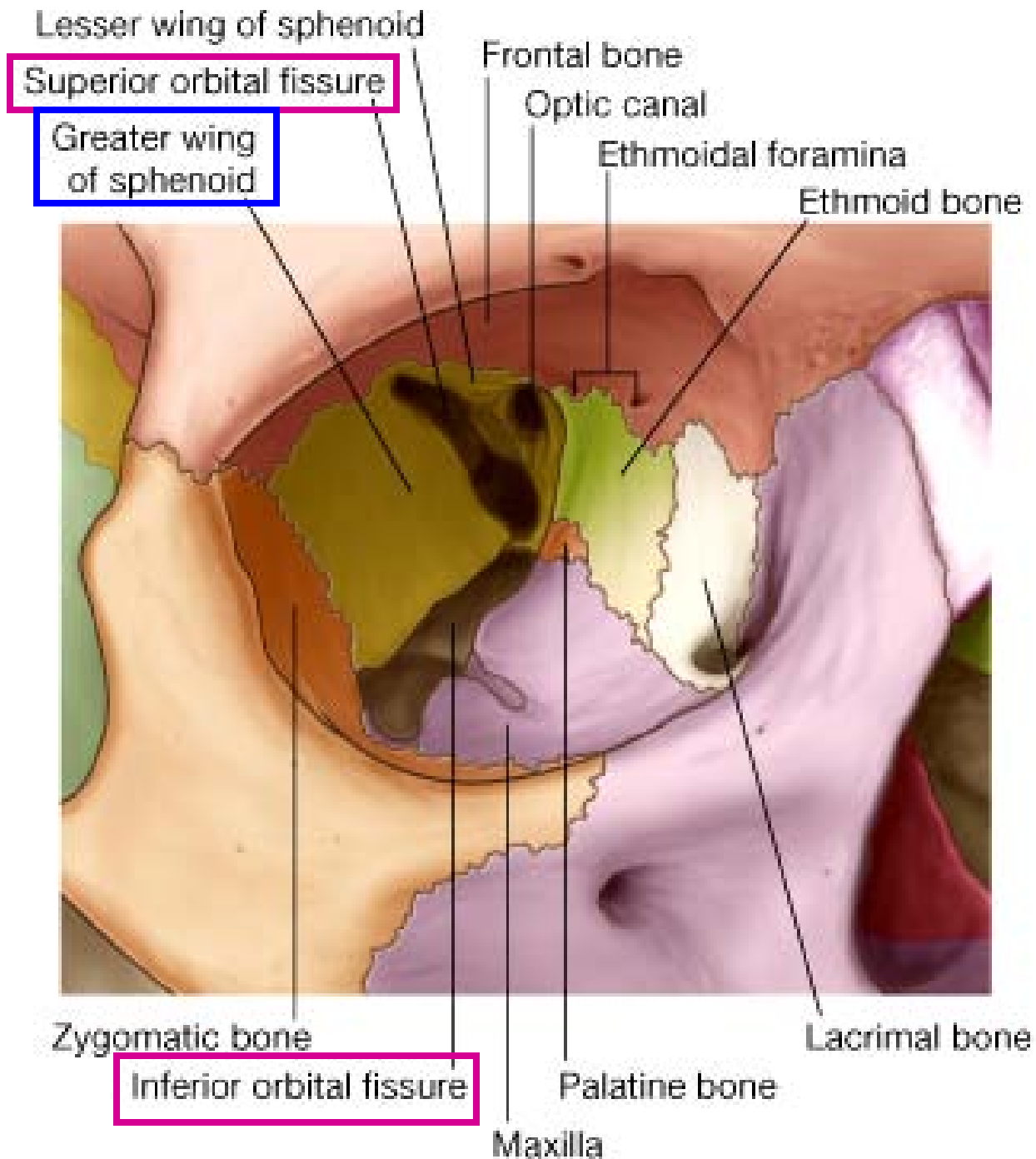
Zygomatic bone

- Frontal process
- Maxillary process
- Temporal process



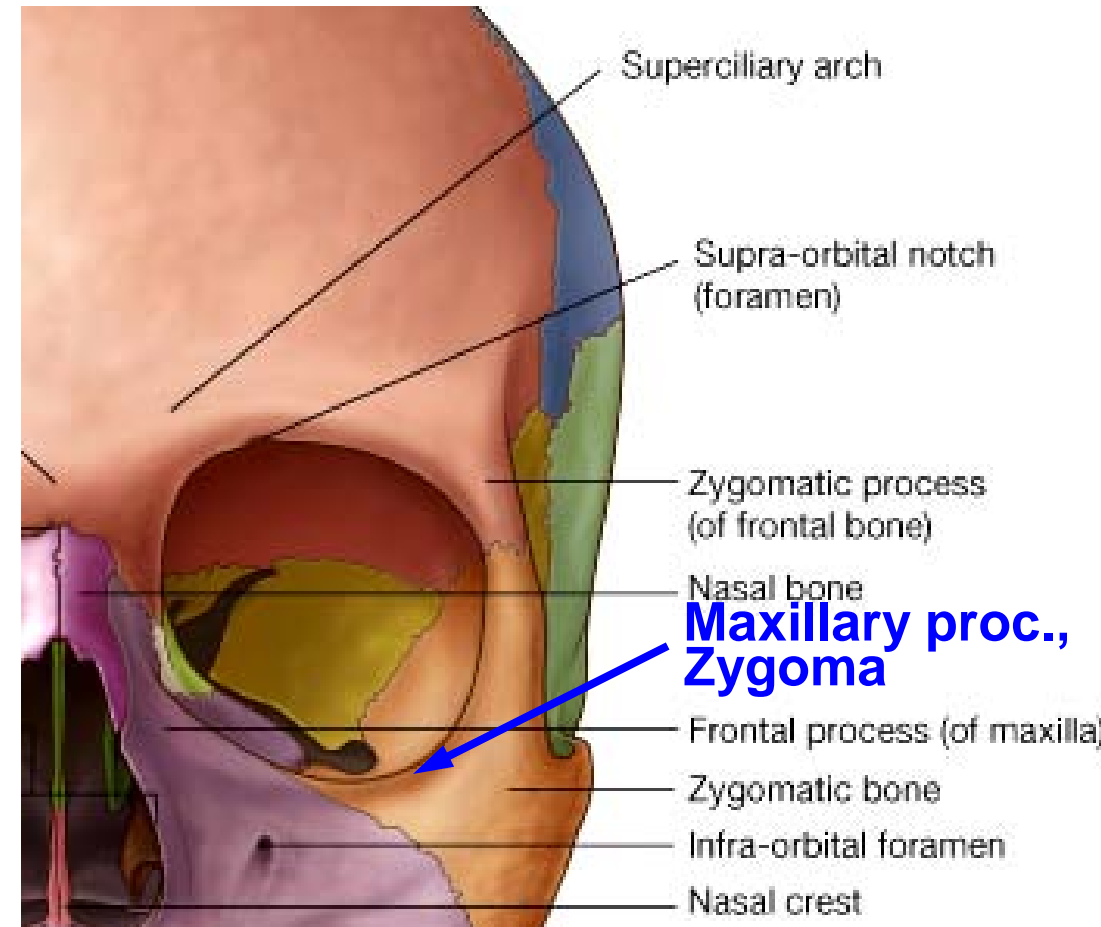
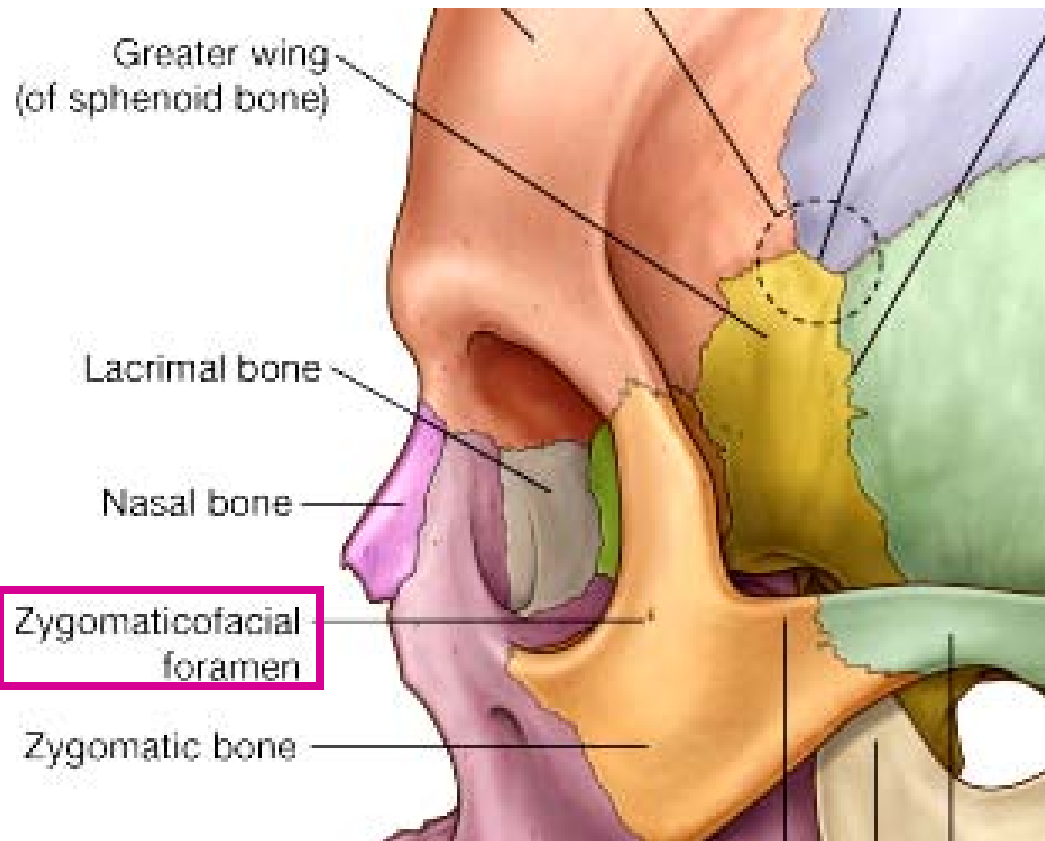
Bony orbits: lateral wall-2

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



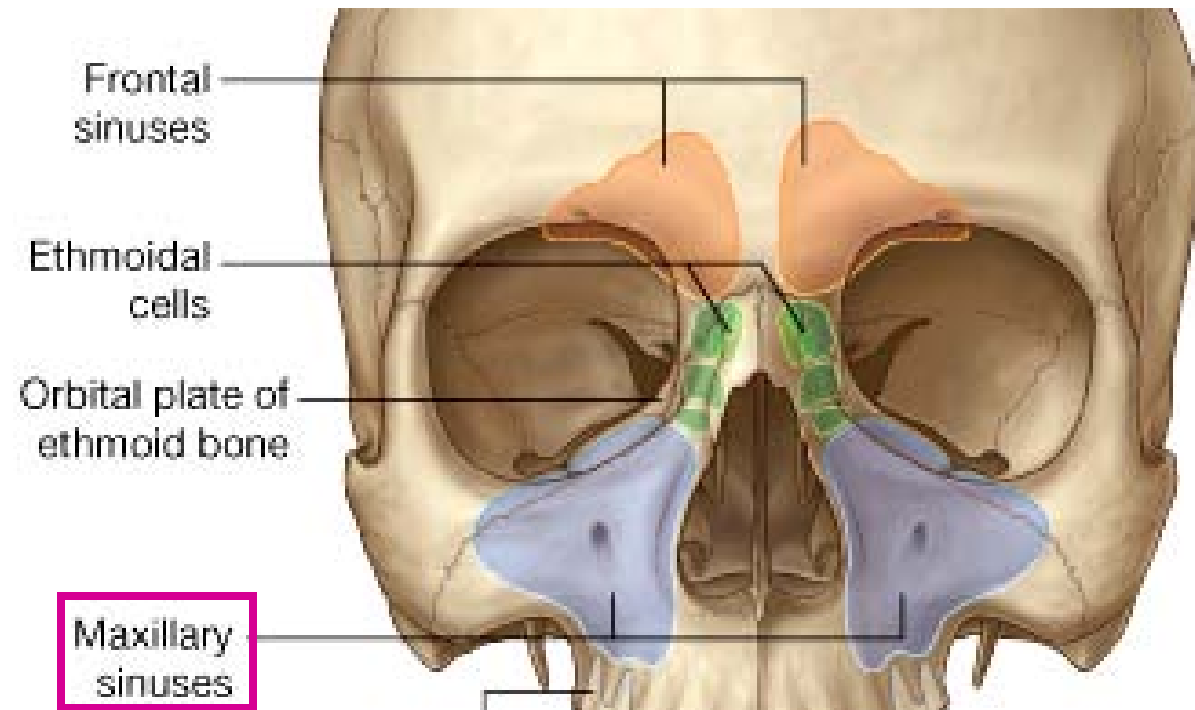
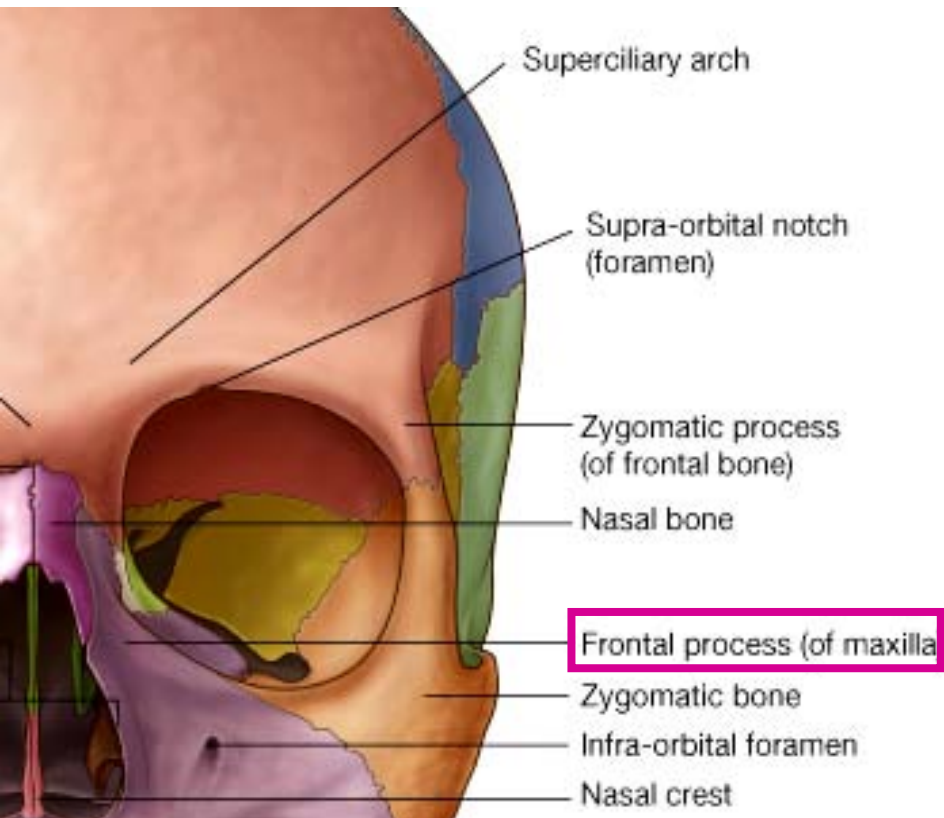
Bony orbits: floor-1

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



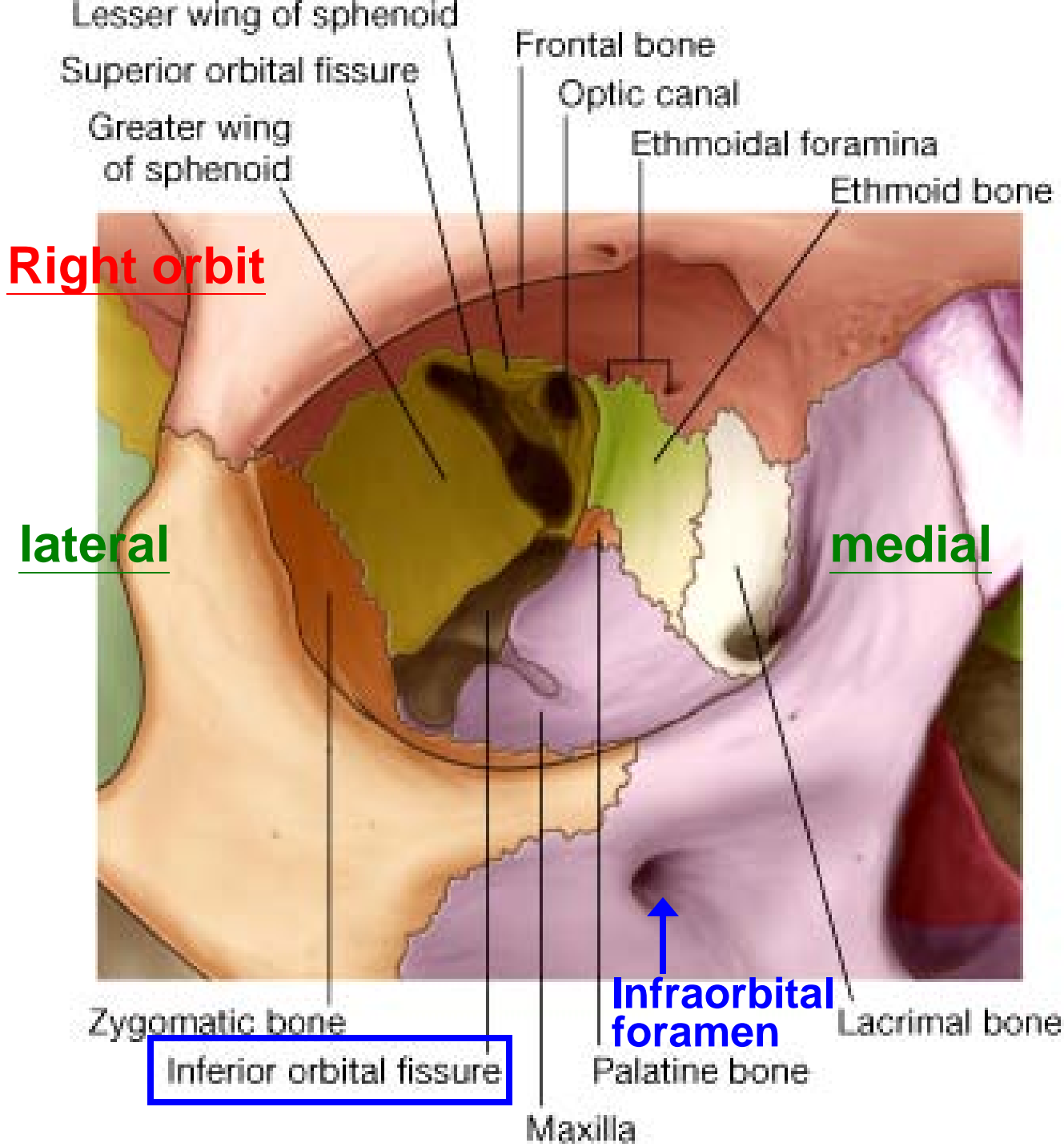
Bony orbits: floor-2

- Maxilla
 - maxillary sinus



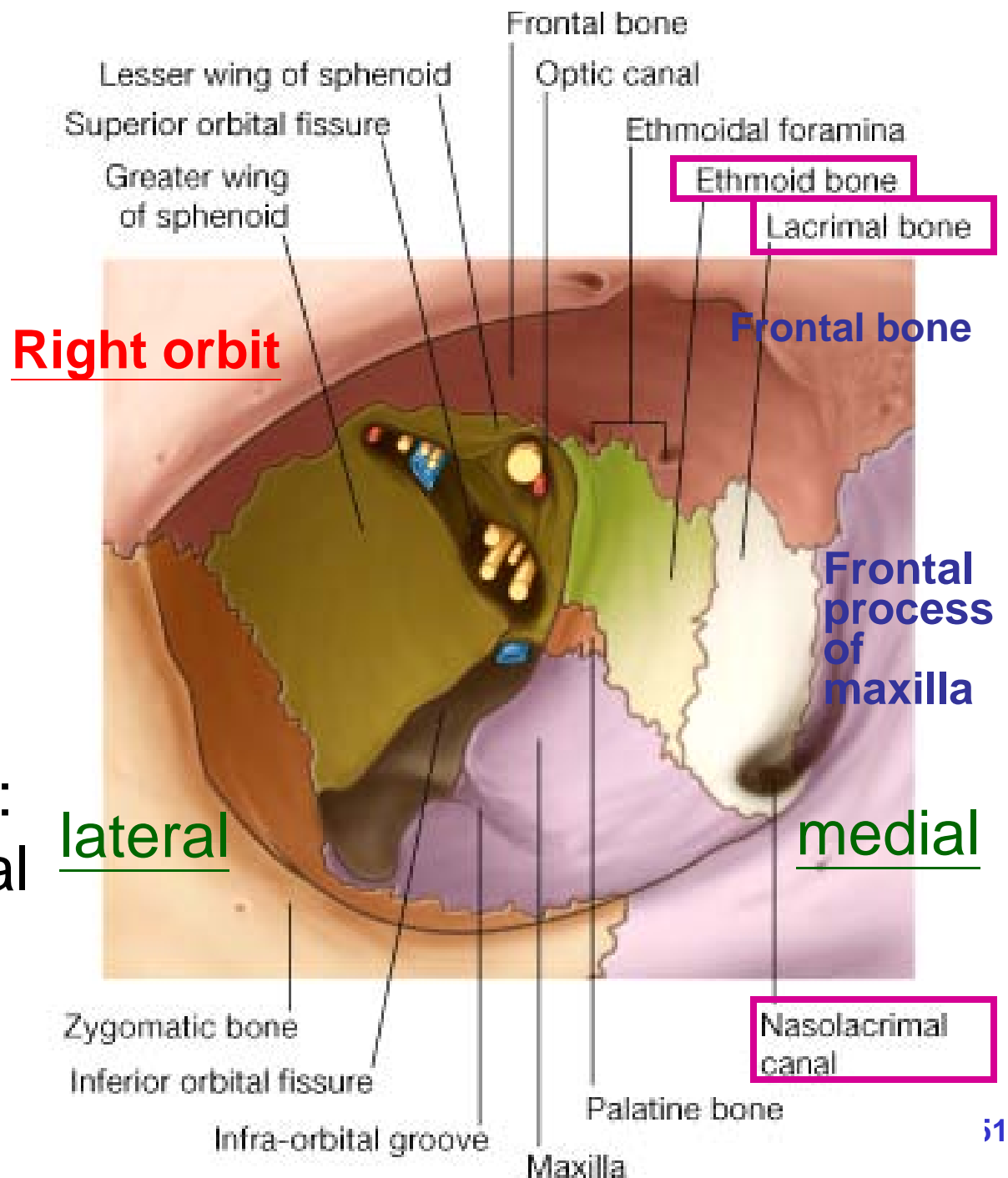
Bony orbits: floor-3

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



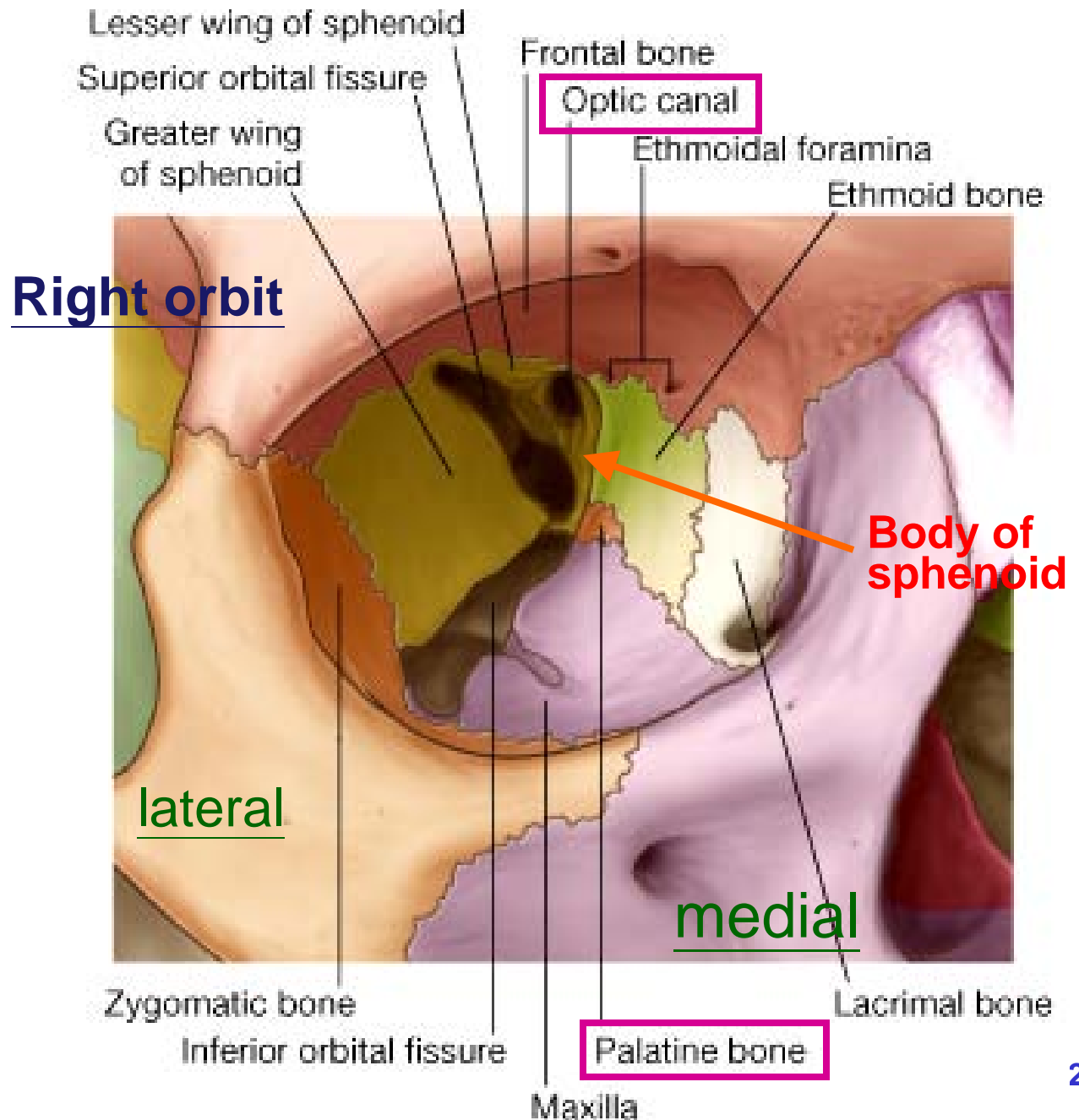
Bony orbits: medial wall-1

- 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)



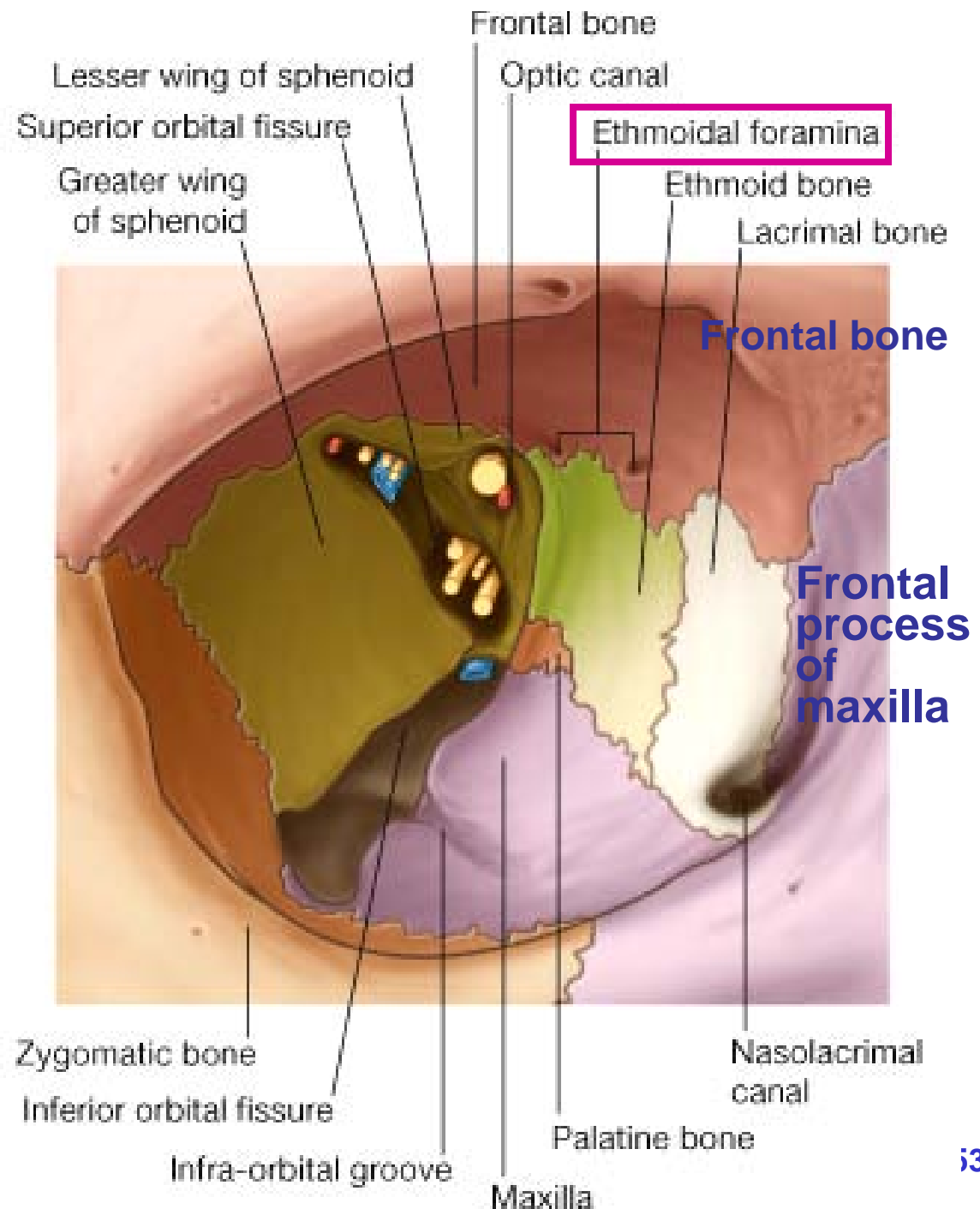
Bony orbits: medial wall-2

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



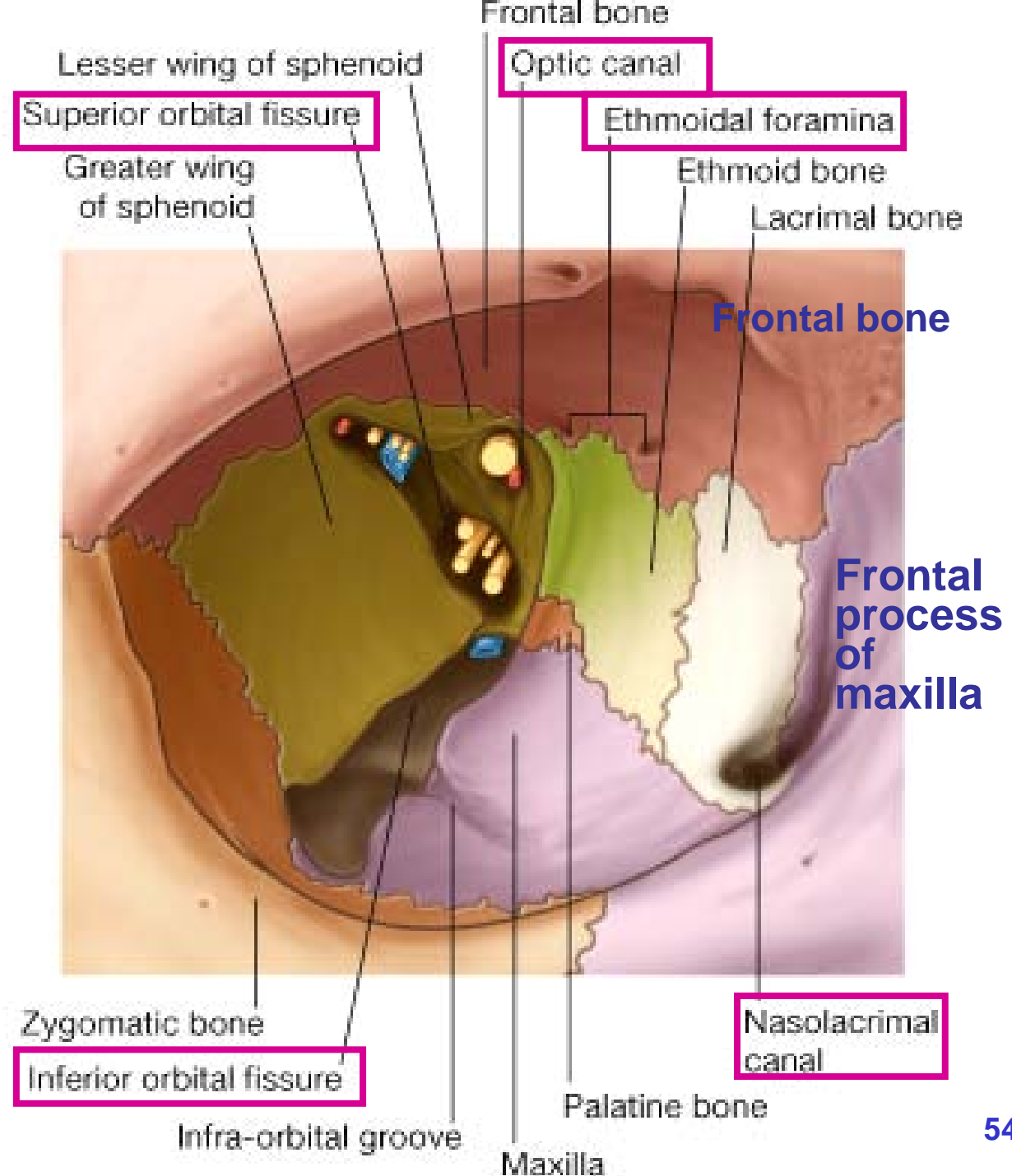
Bony orbits: medial wall-3

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

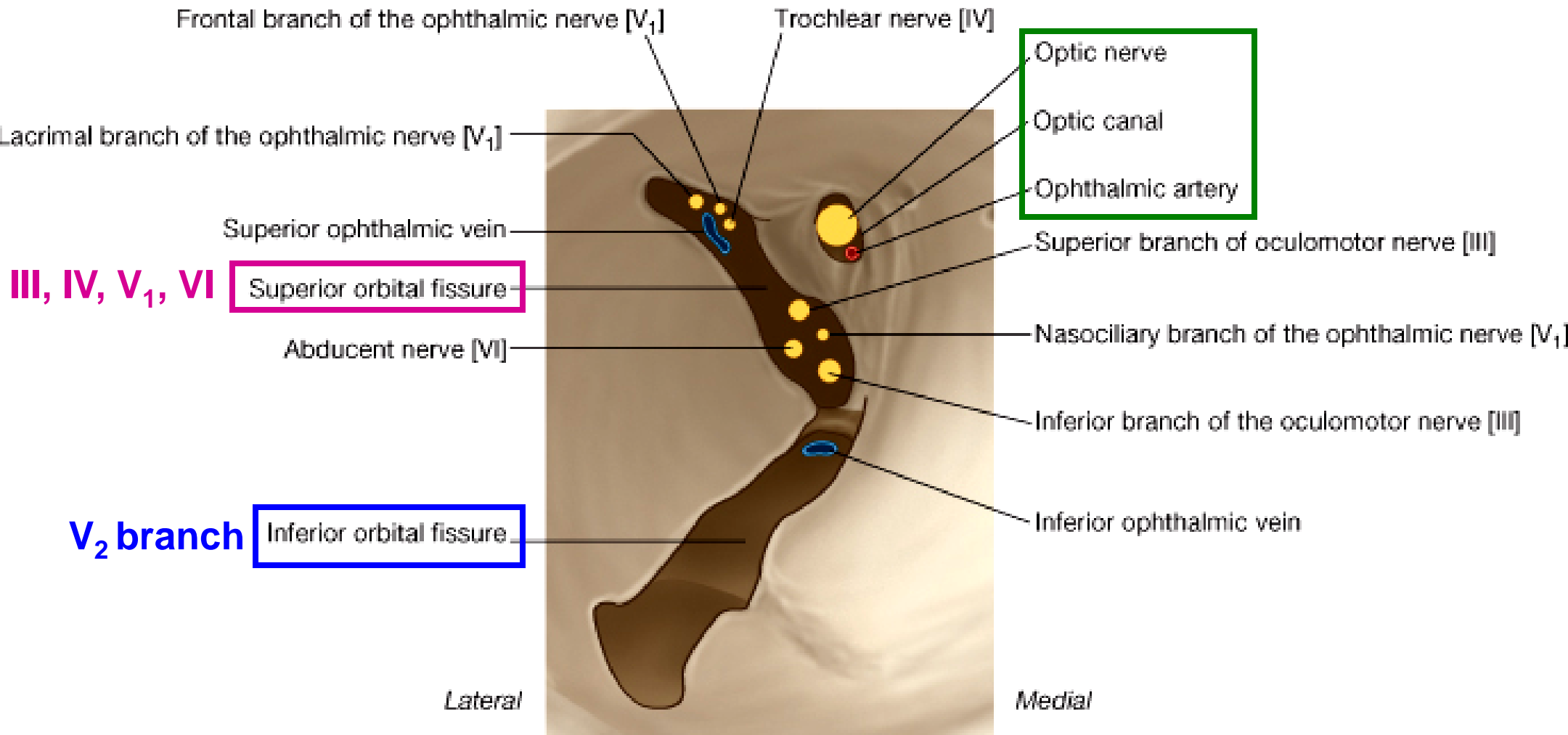


Openings of orbit

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

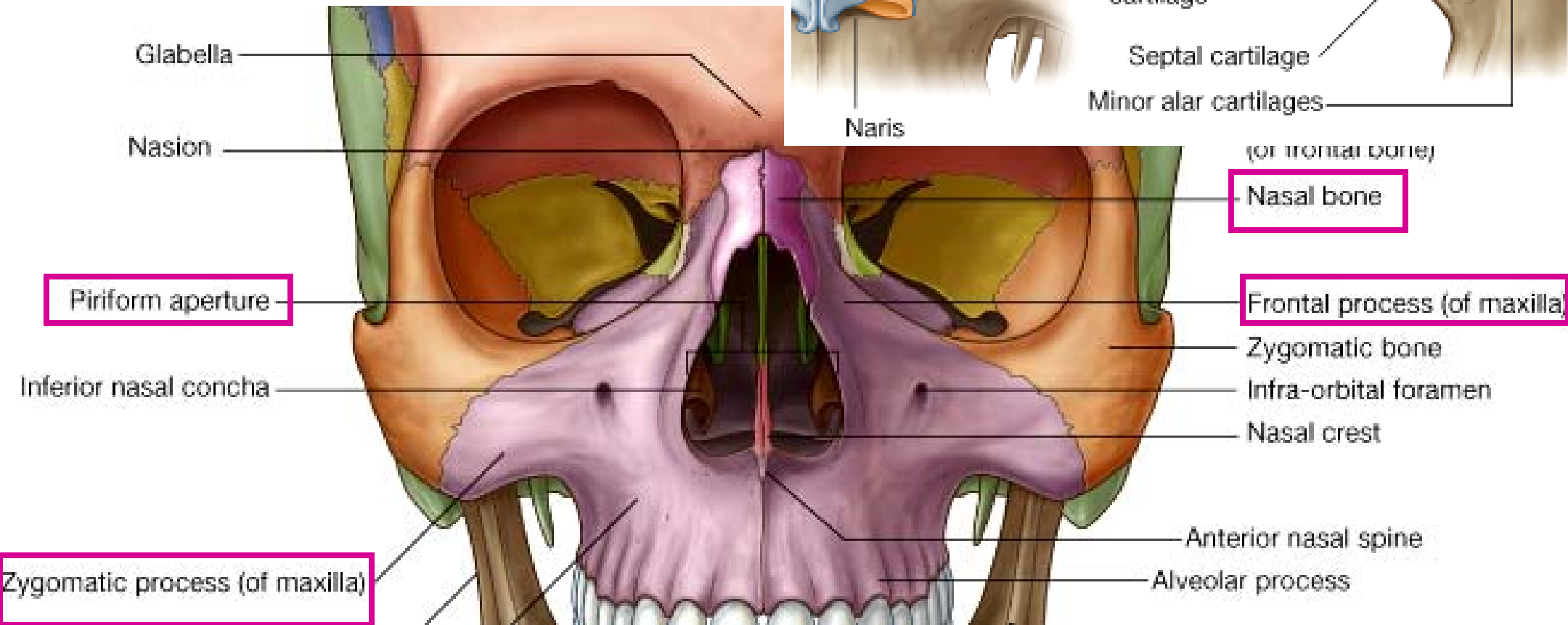
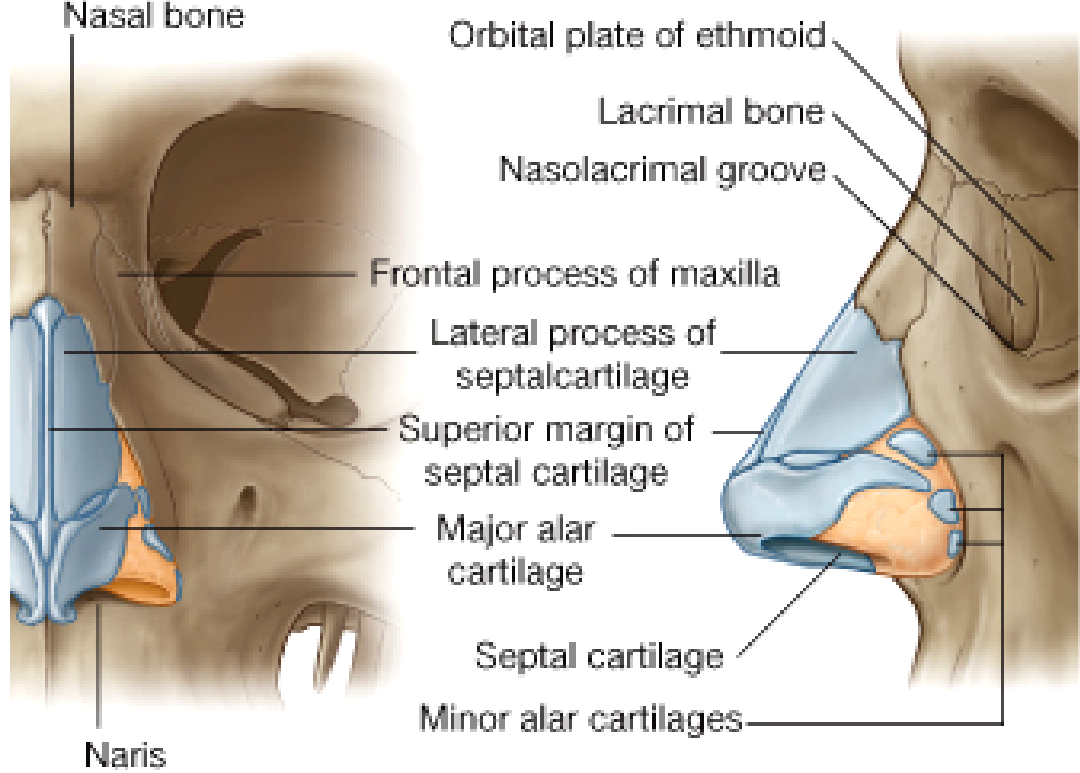


Contents of orbital openings



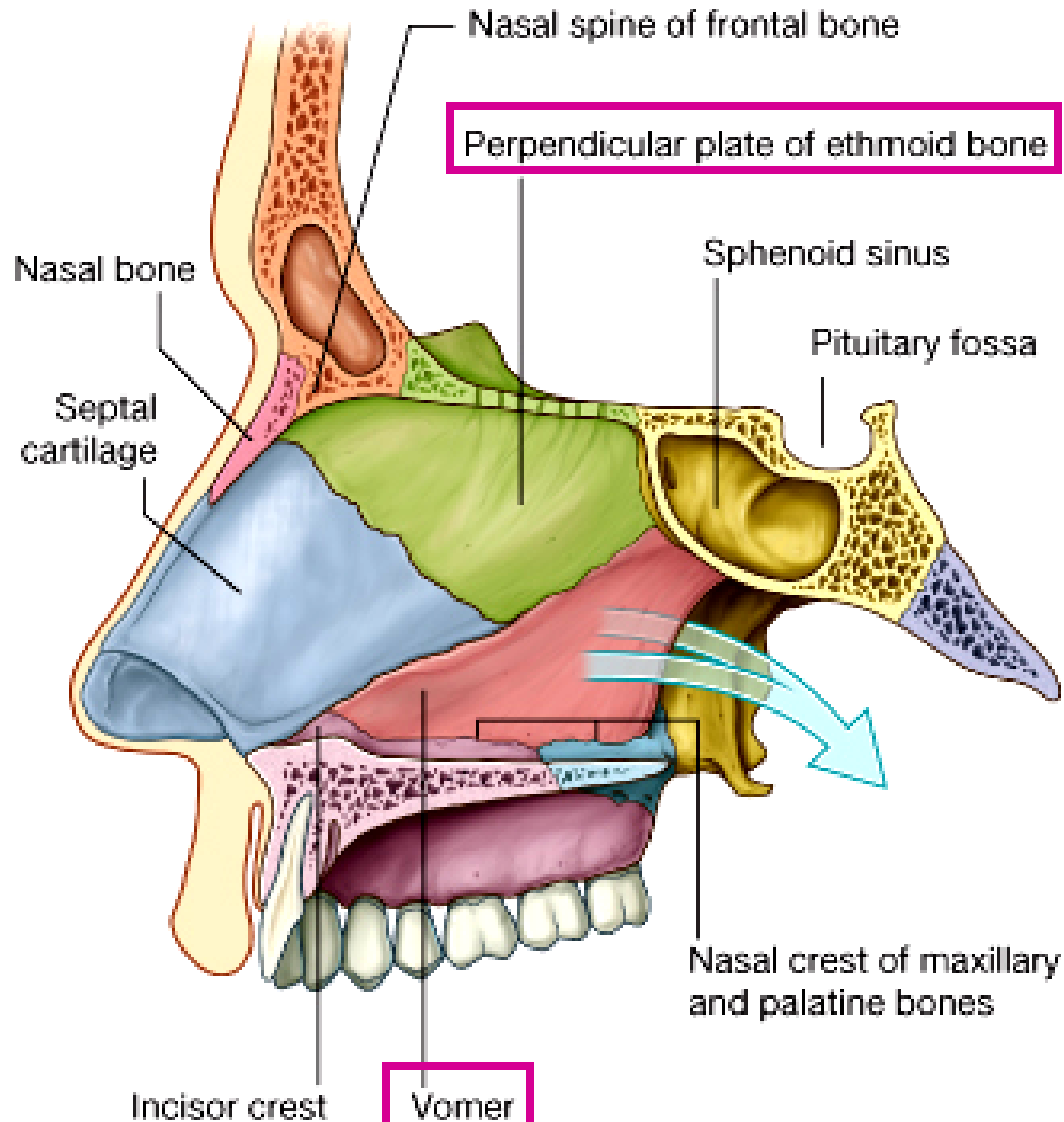
Nasal cavity-1

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



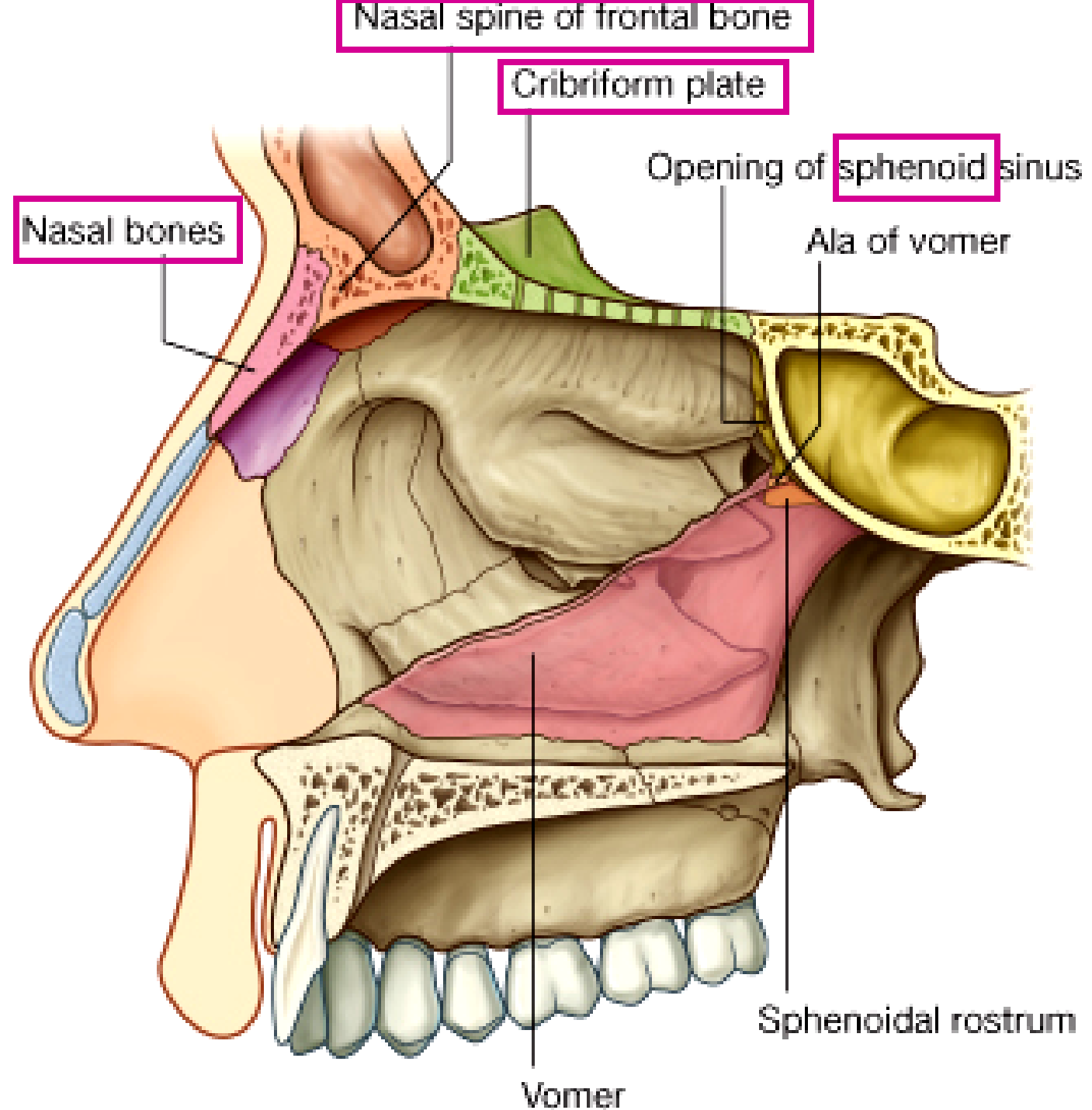
nasal cavities and nasopharynx-2

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



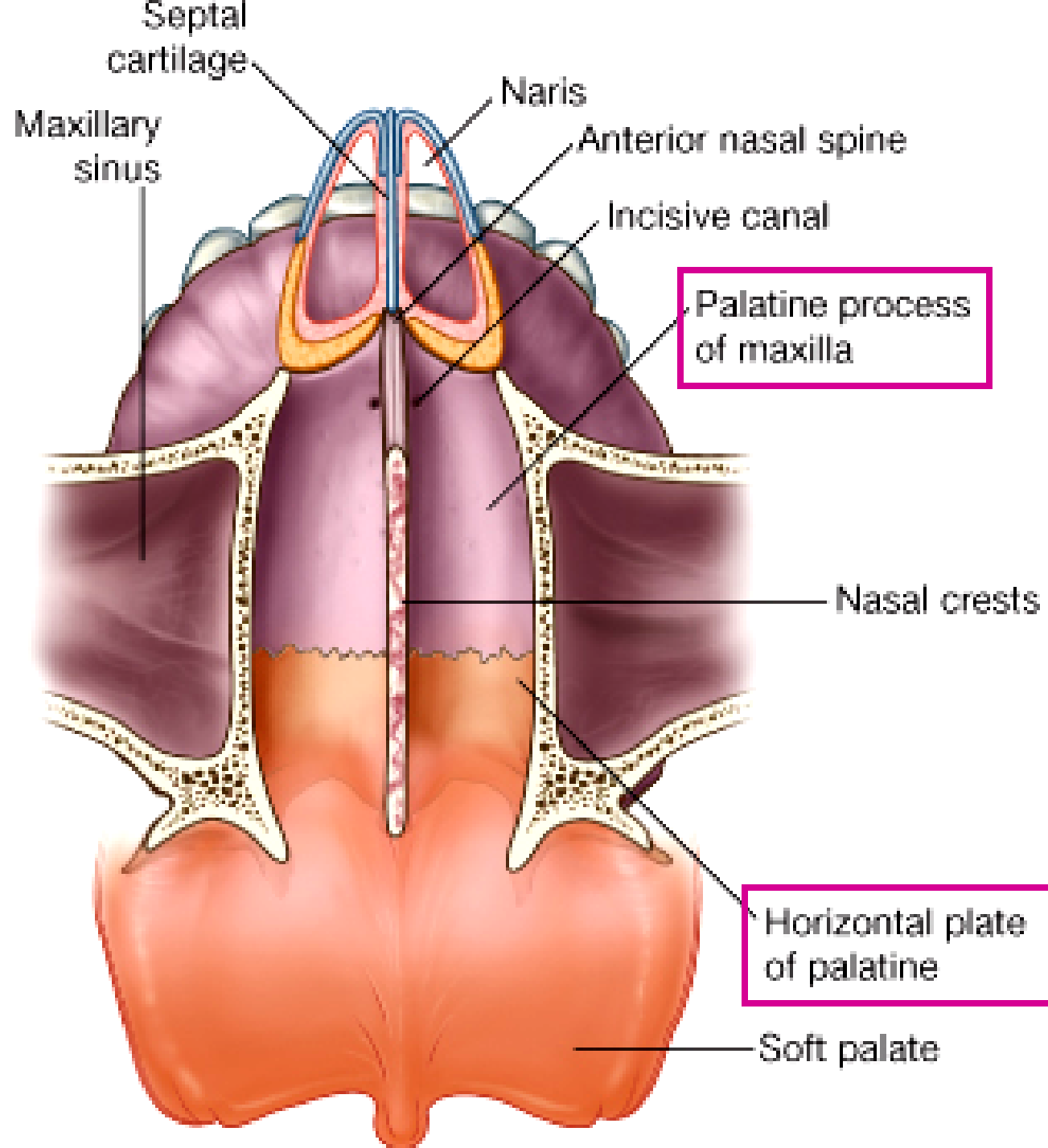
Roof of nasal cavity

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



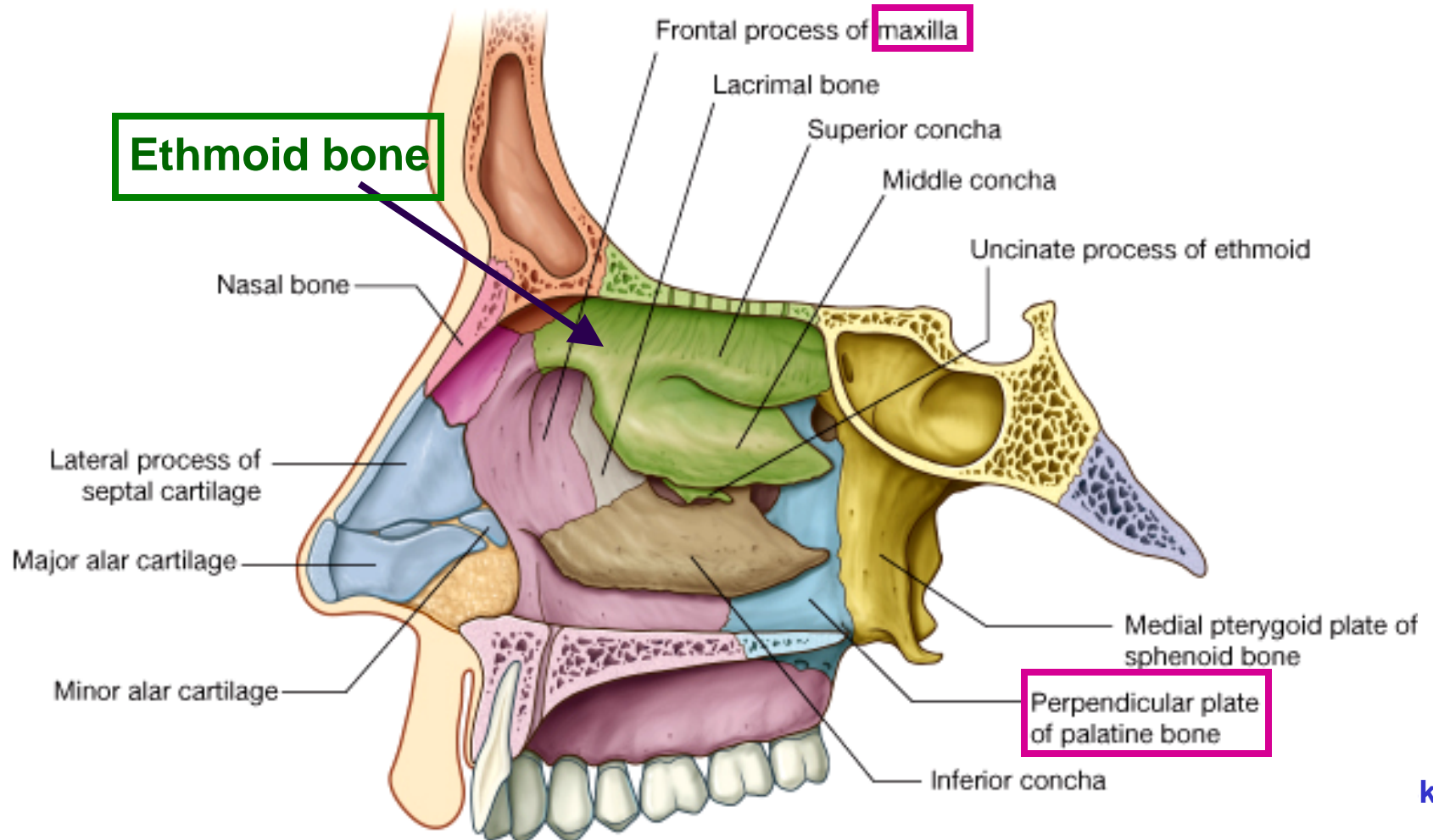
Floor of nasal cavity

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

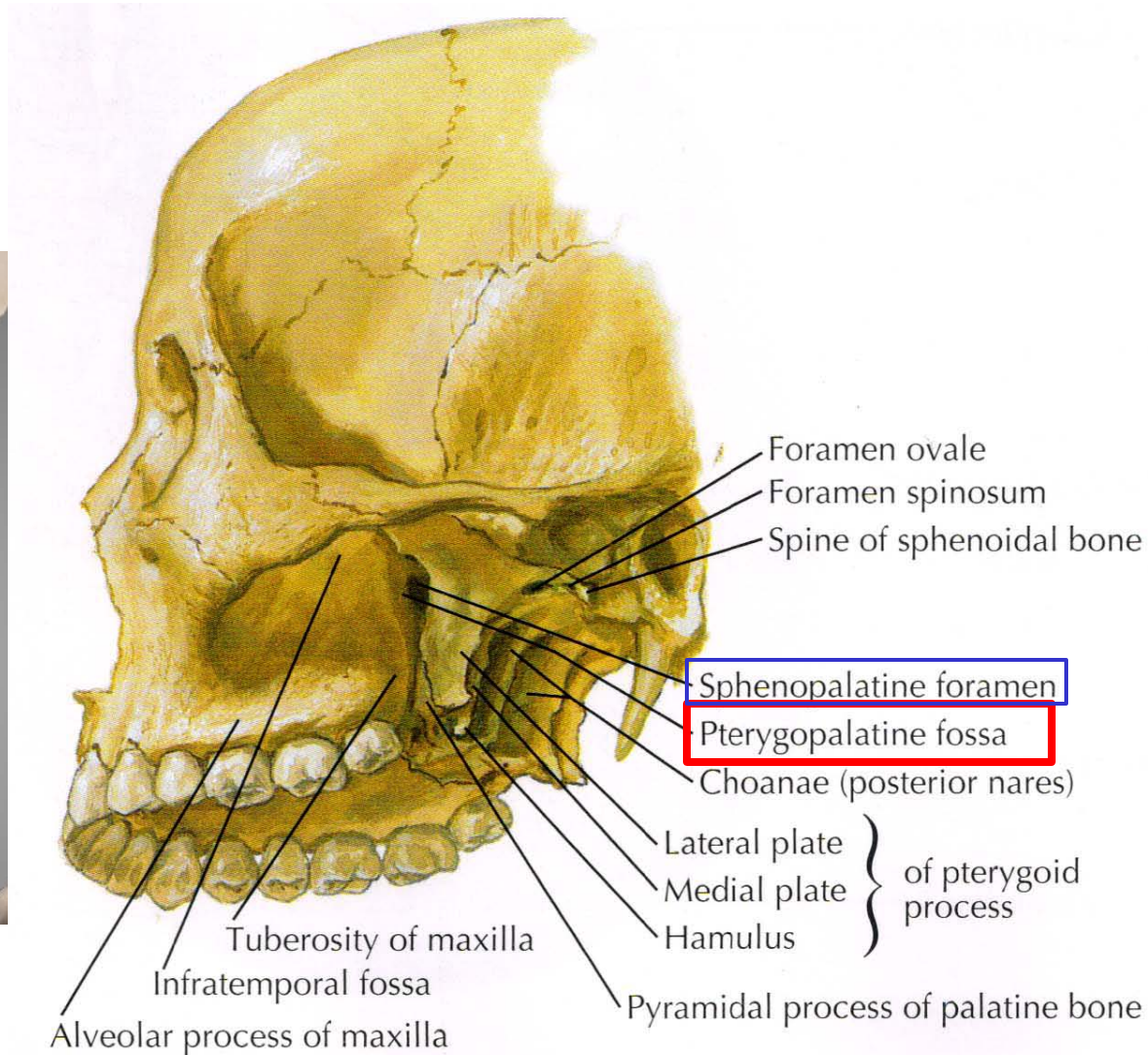
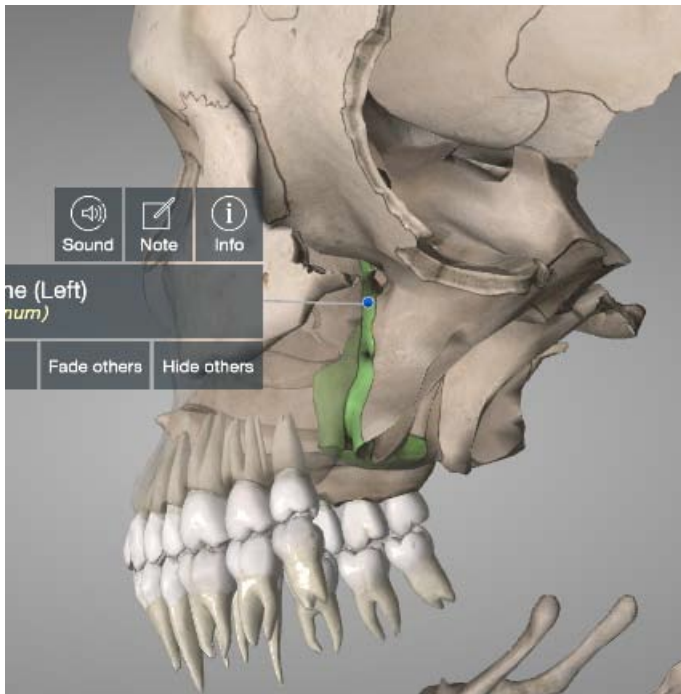


Lateral wall of nasal cavity-1

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



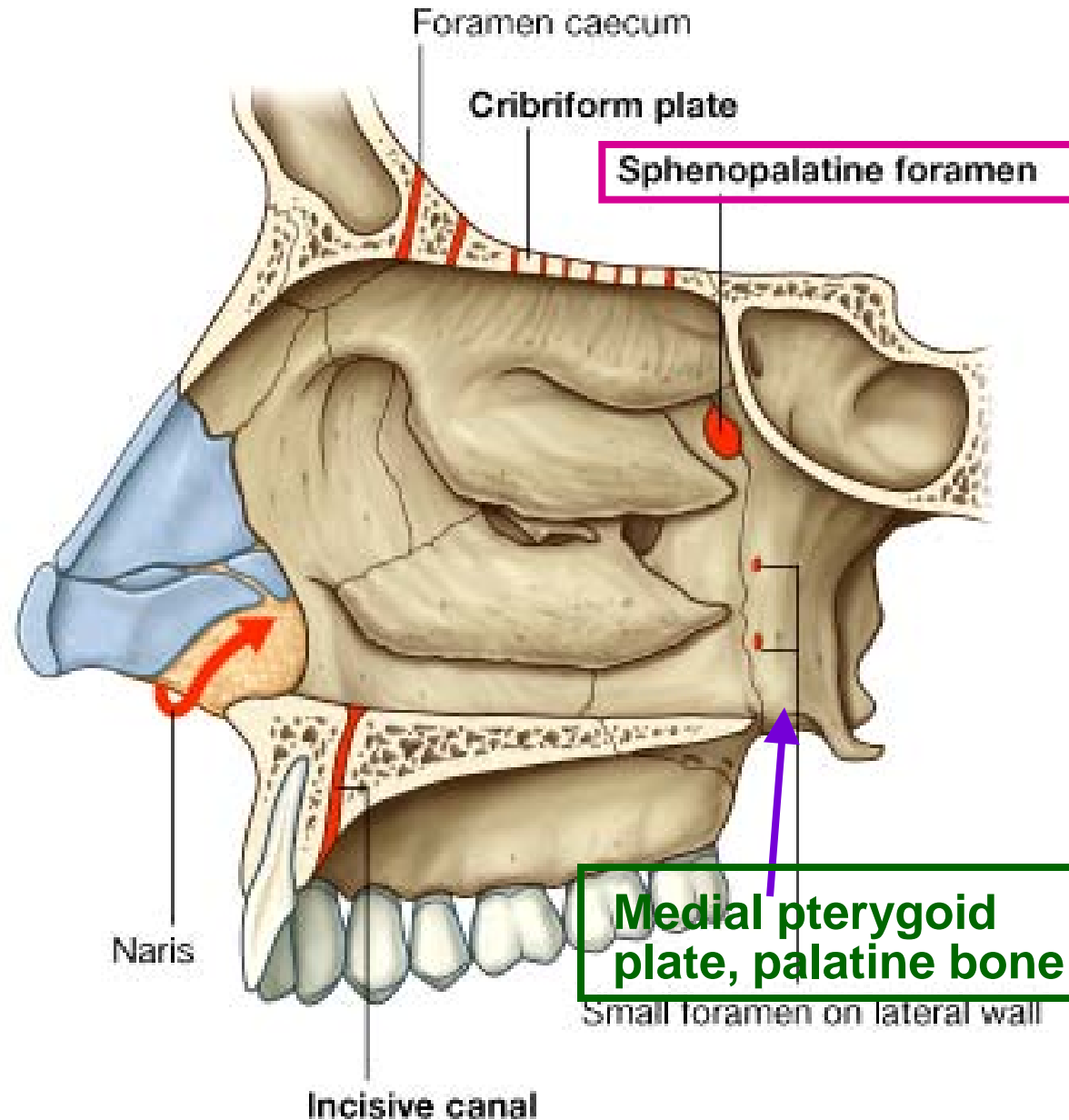
Pterygopalatine fossa



F. Netter M.D.

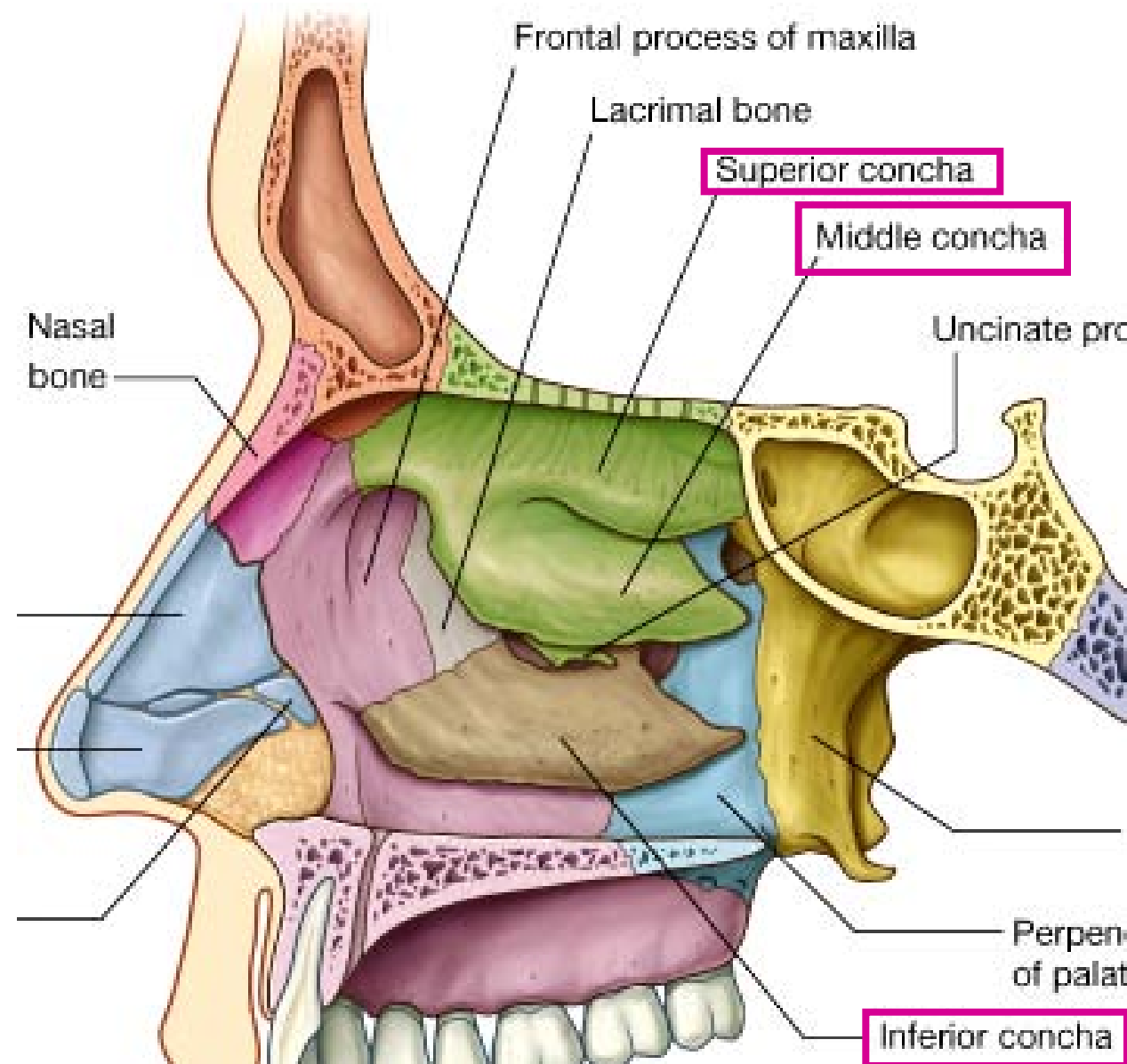
Lateral wall of nasal cavity-2

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



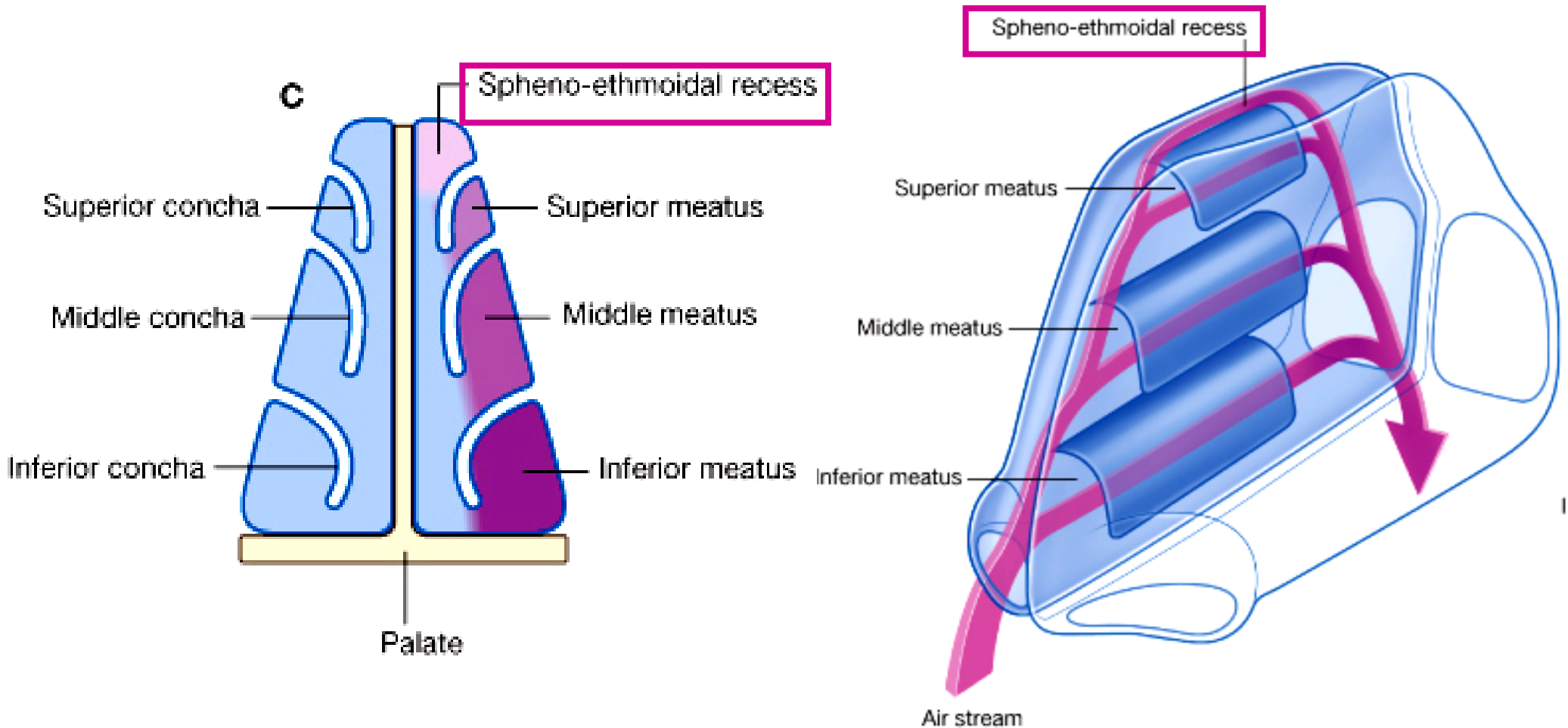
Extension of bones into Nasal cavity-1

- 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



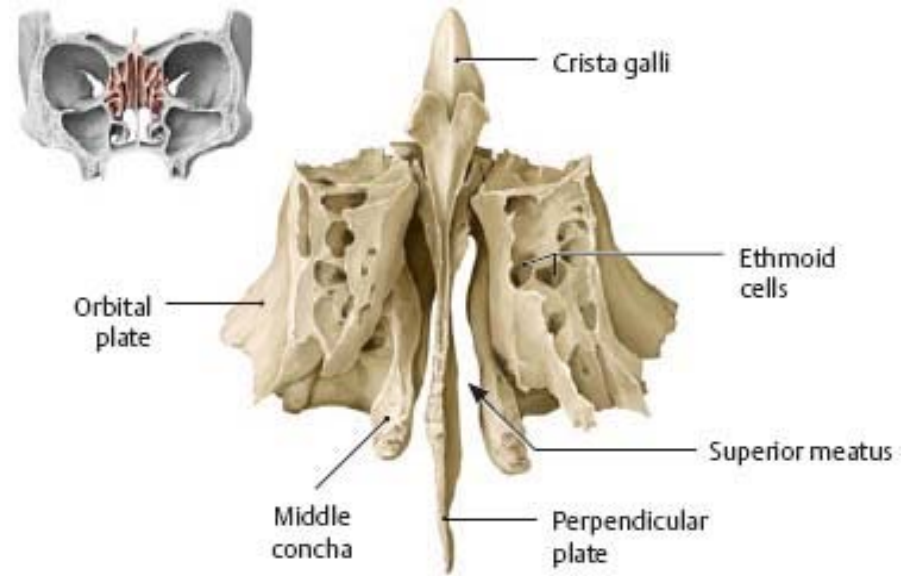
Extension of bones into Nasal cavity-2

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

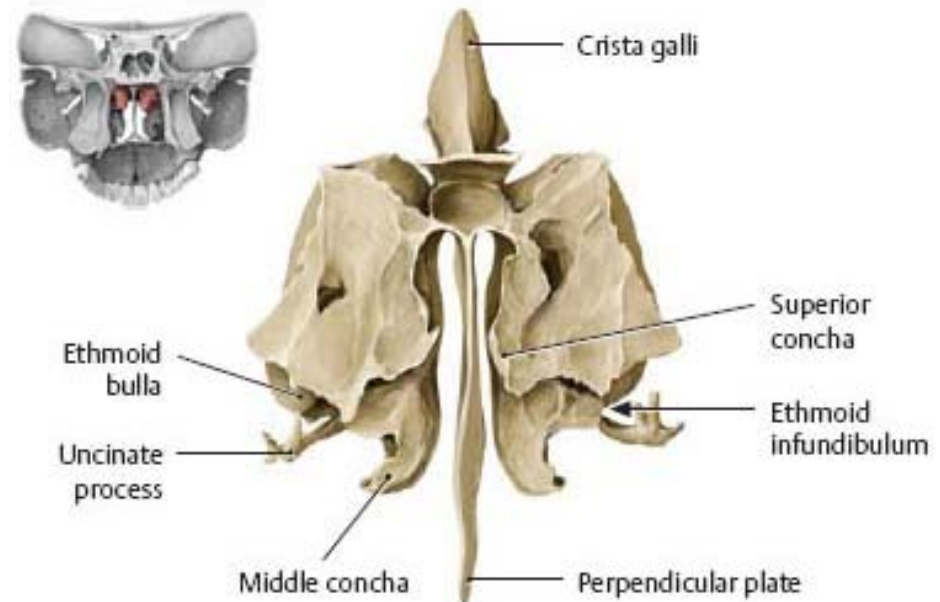


Ethmoid bone

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



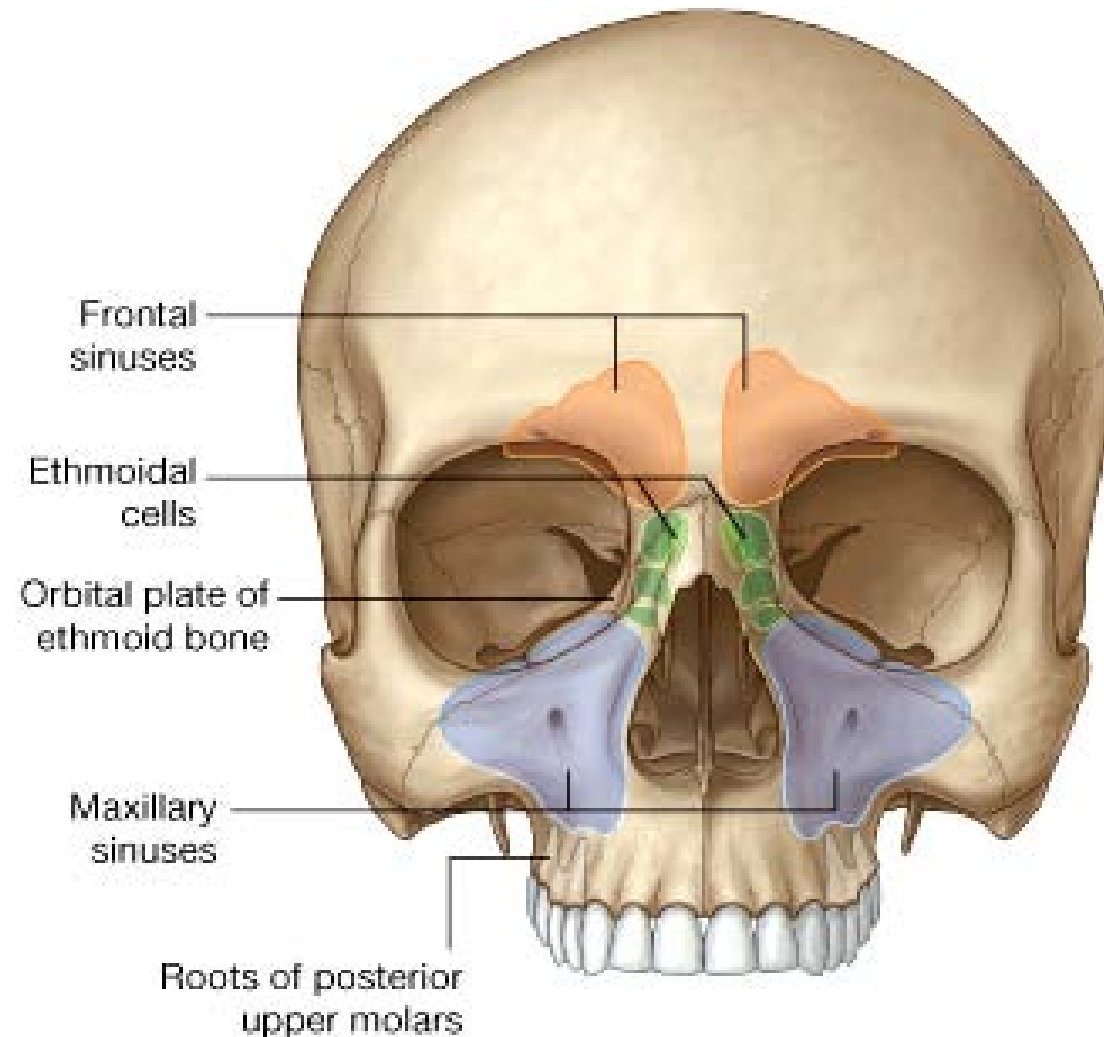
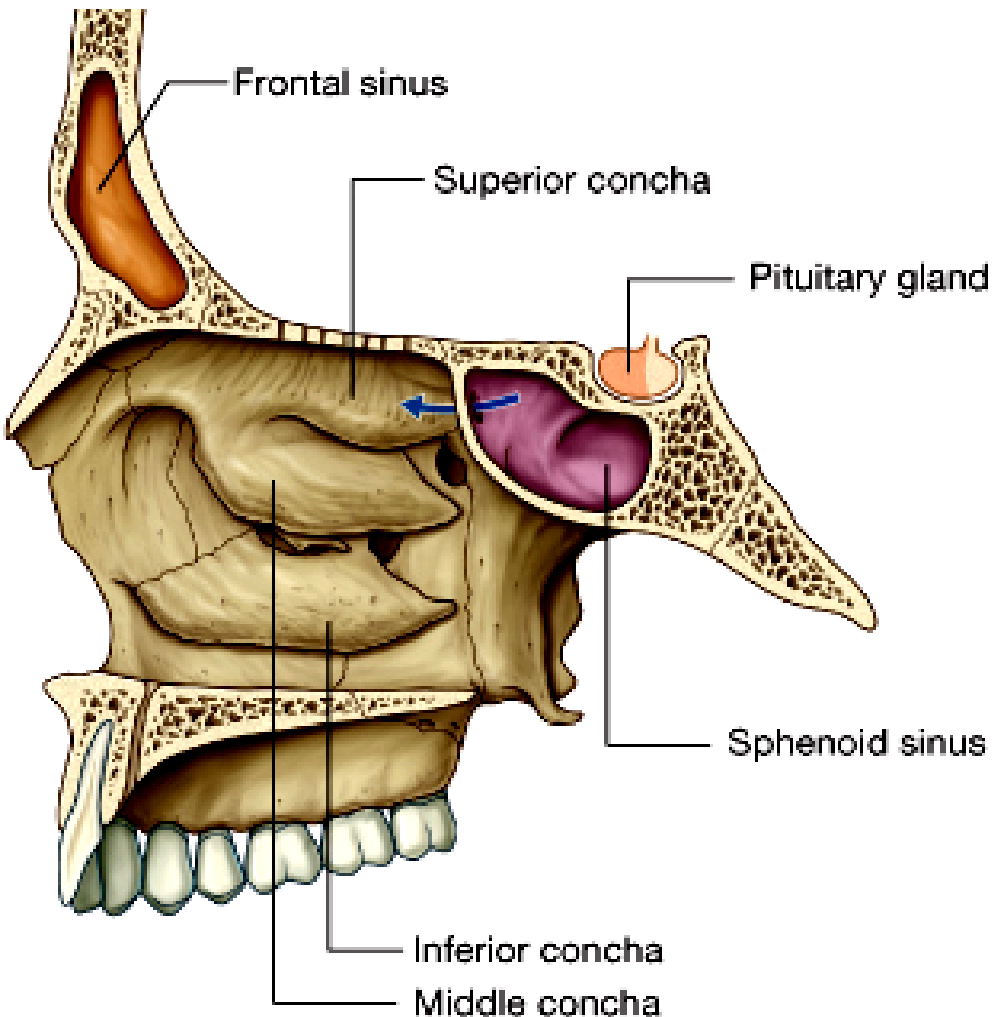
A Anterior view.



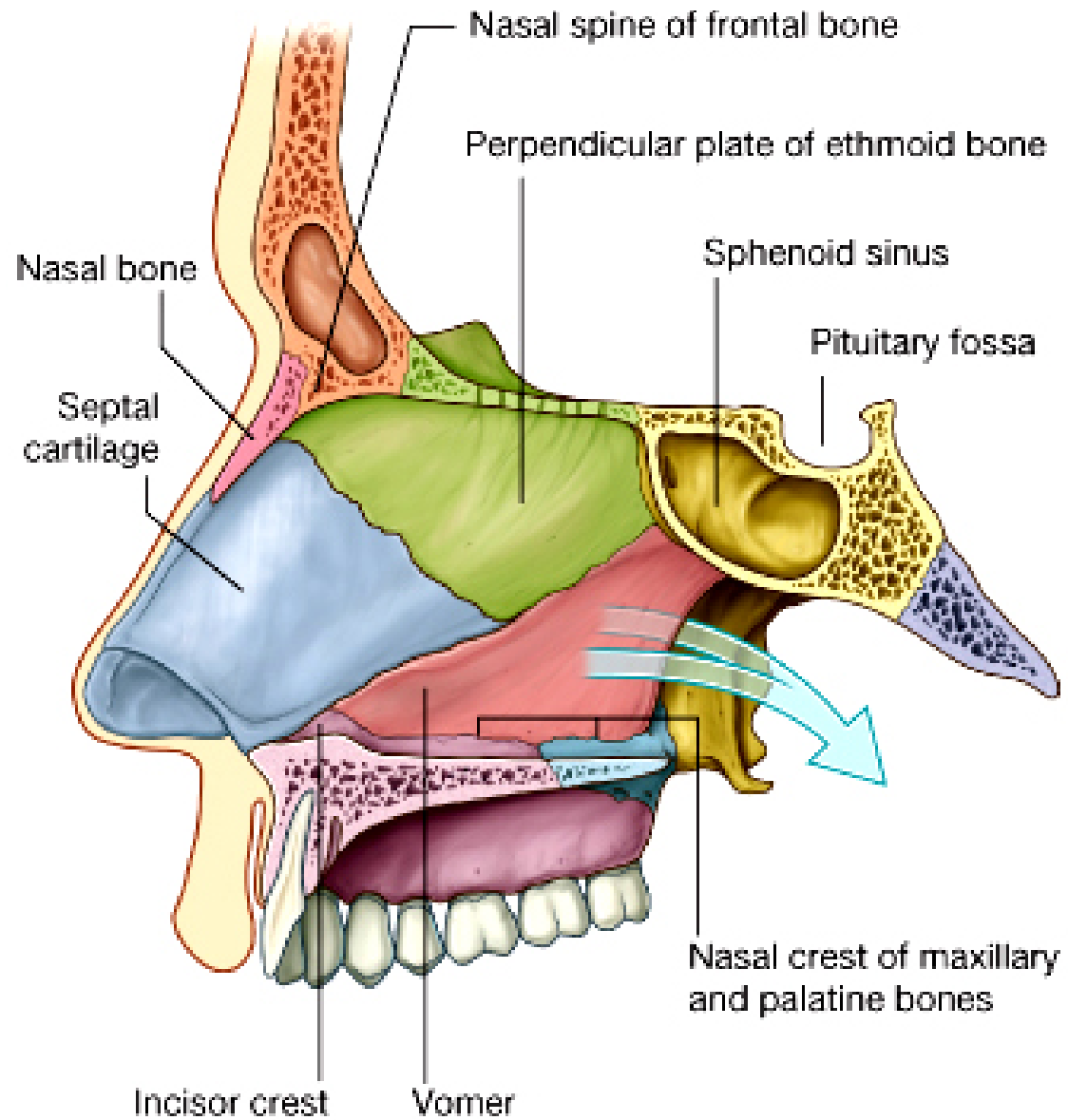
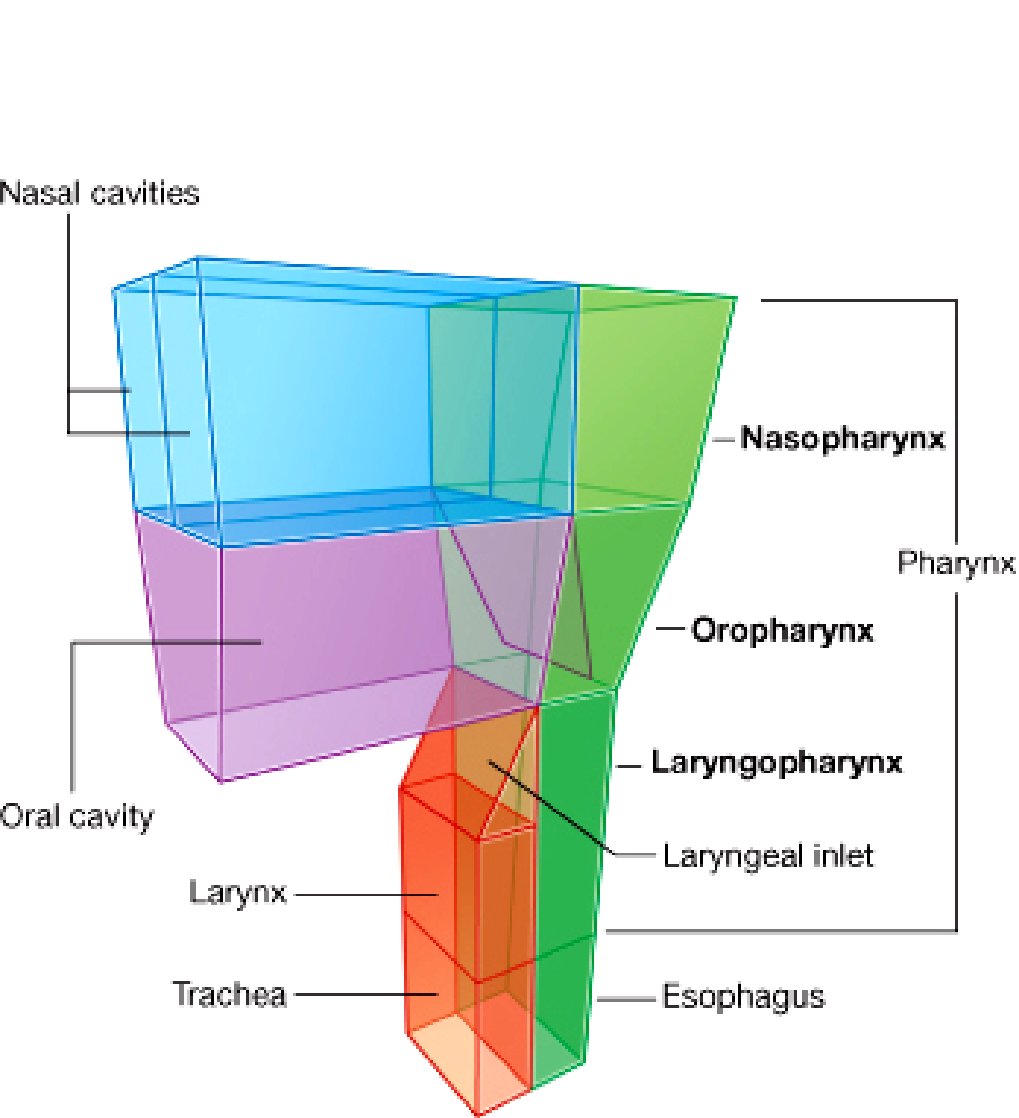
C Posterior view.

Paranasal sinuses

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

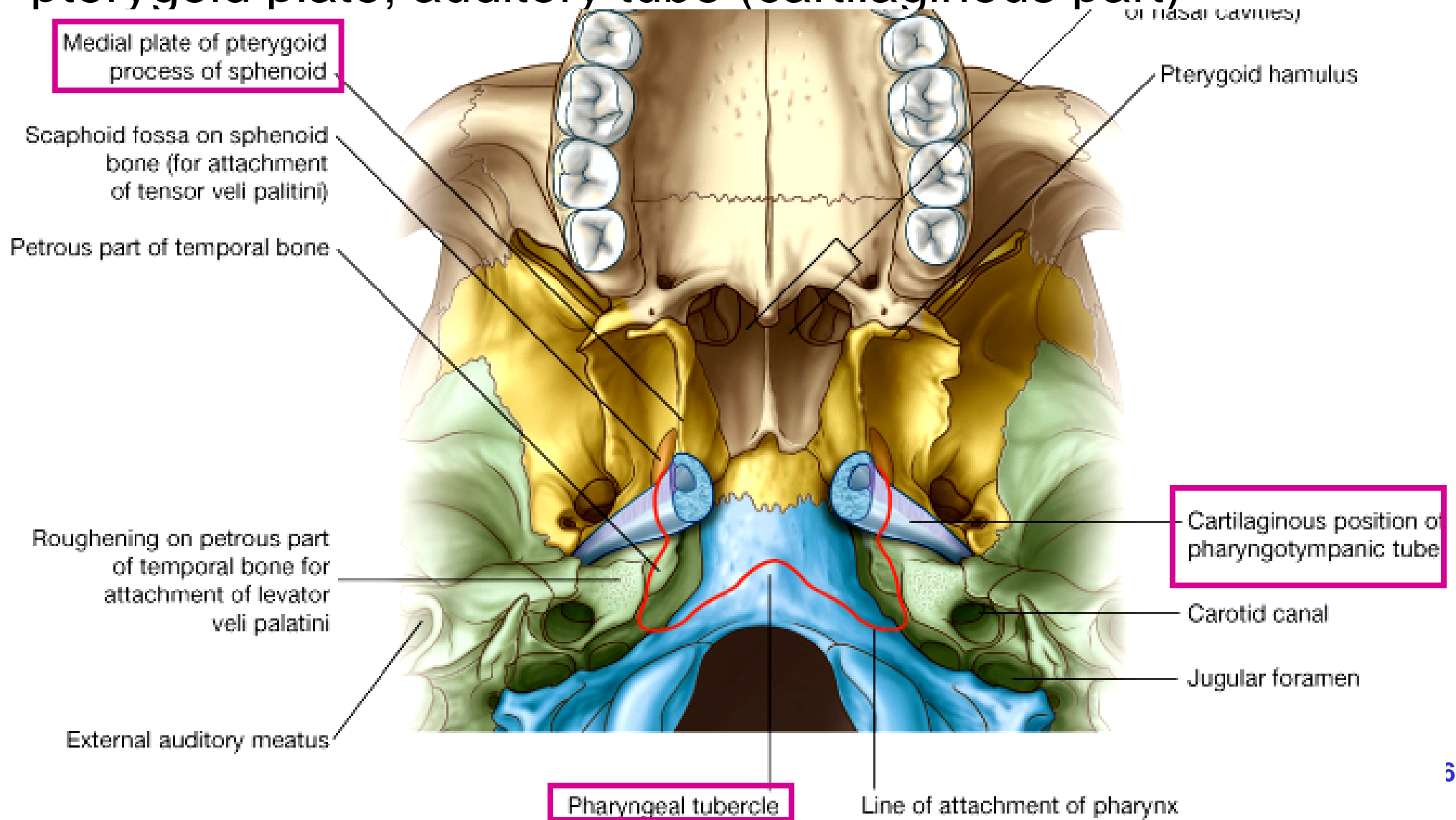


Nasopharynx



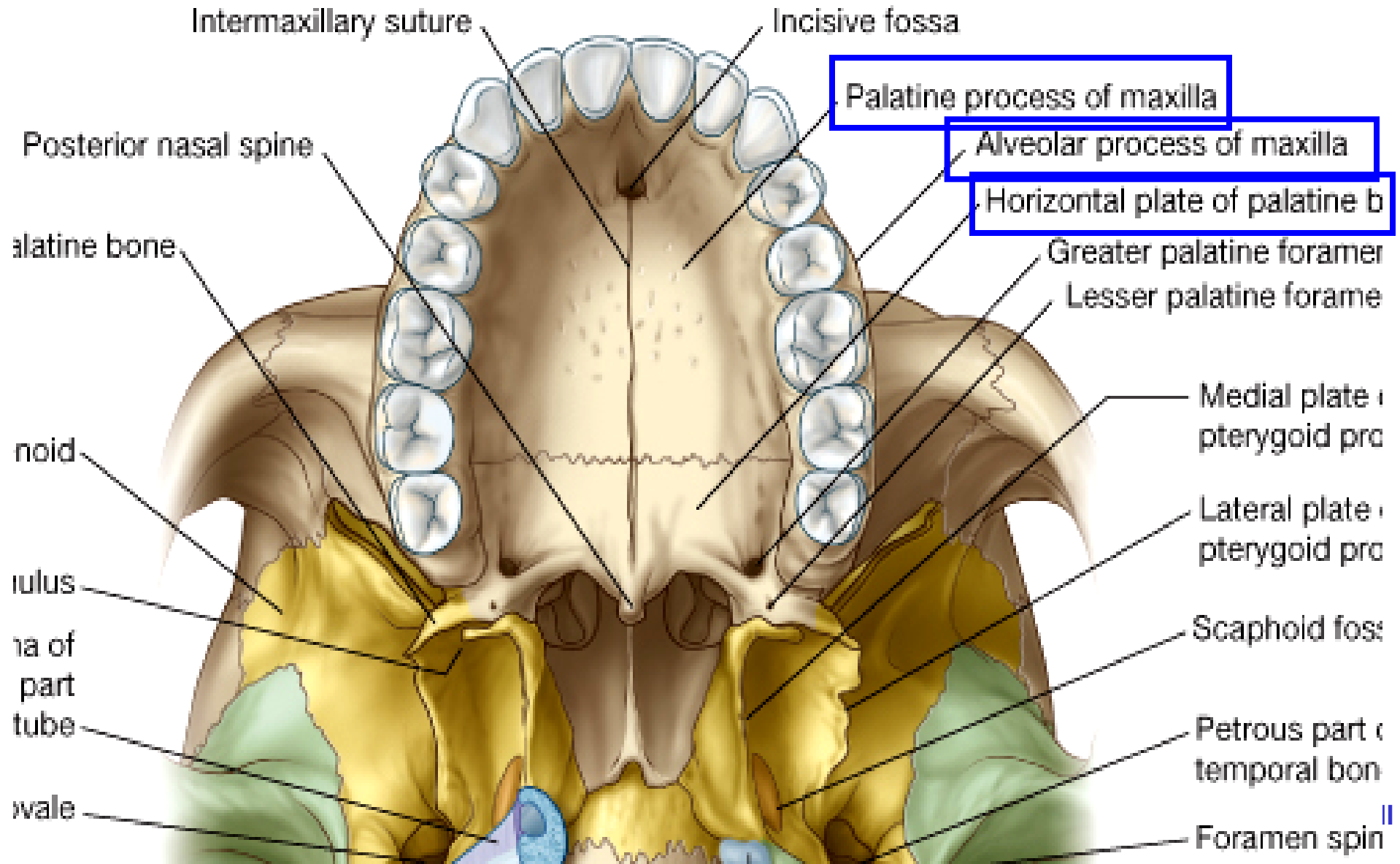
Bony walls of nasopharynx

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



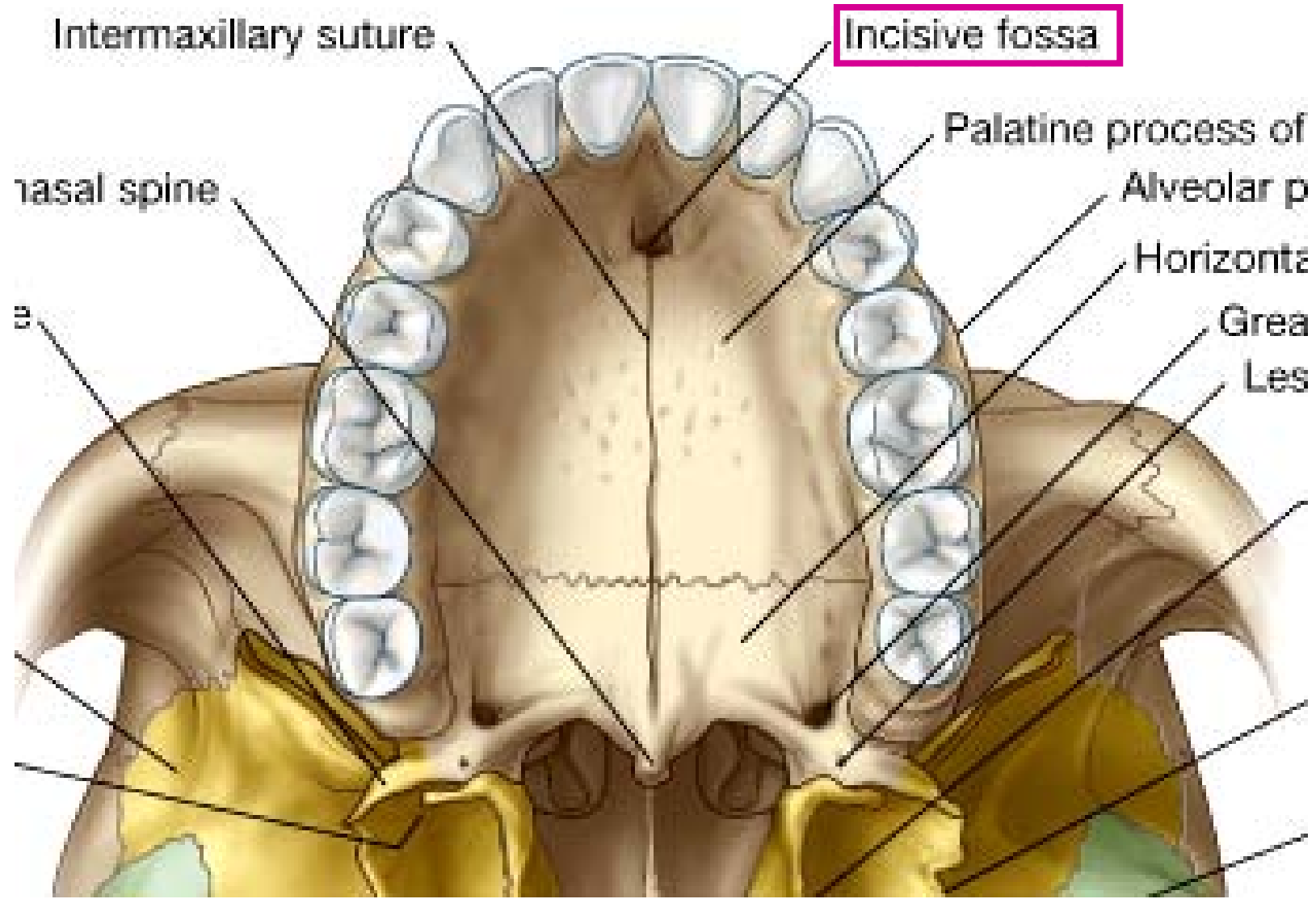
Oral cavity: upper jaw

- maxilla; hard palate; alveolar process



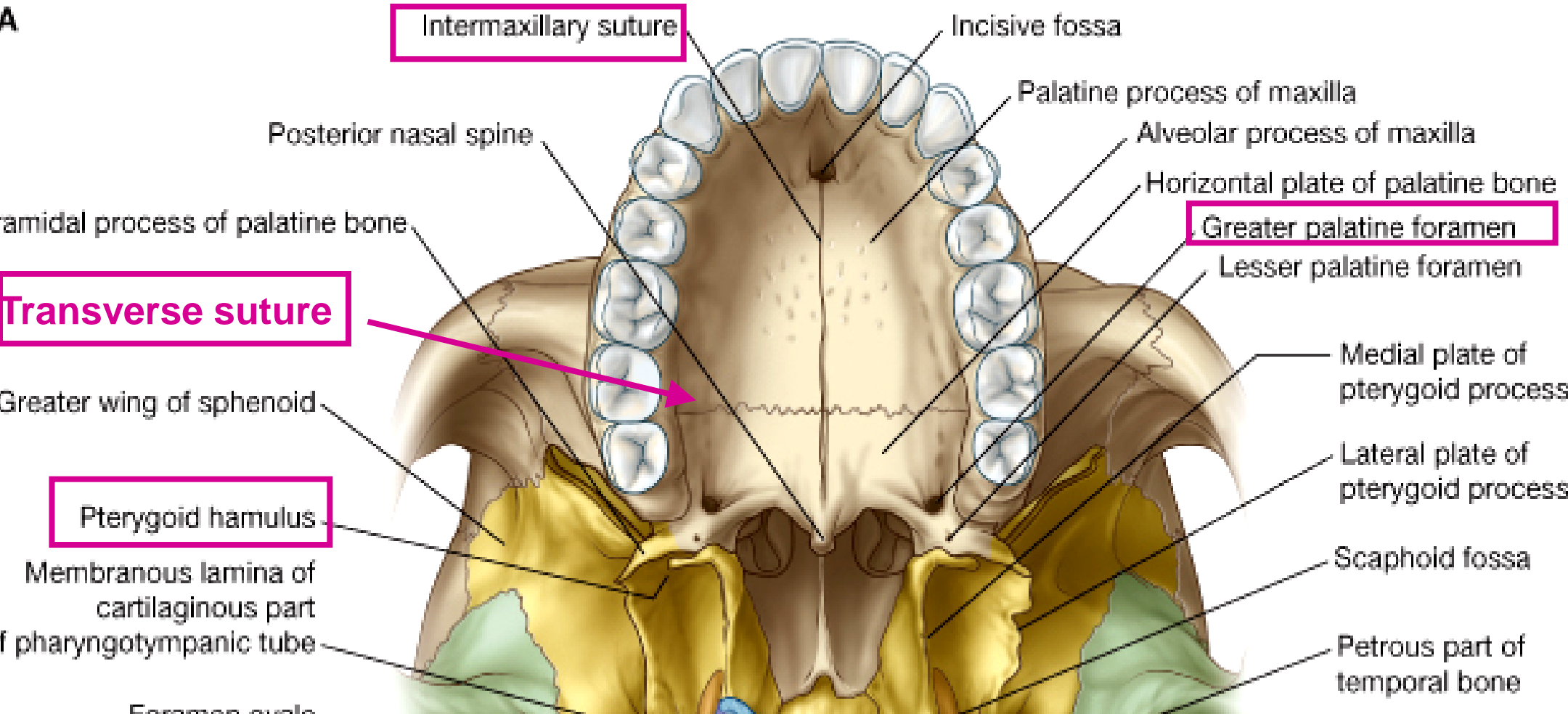
Bony palate-1

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



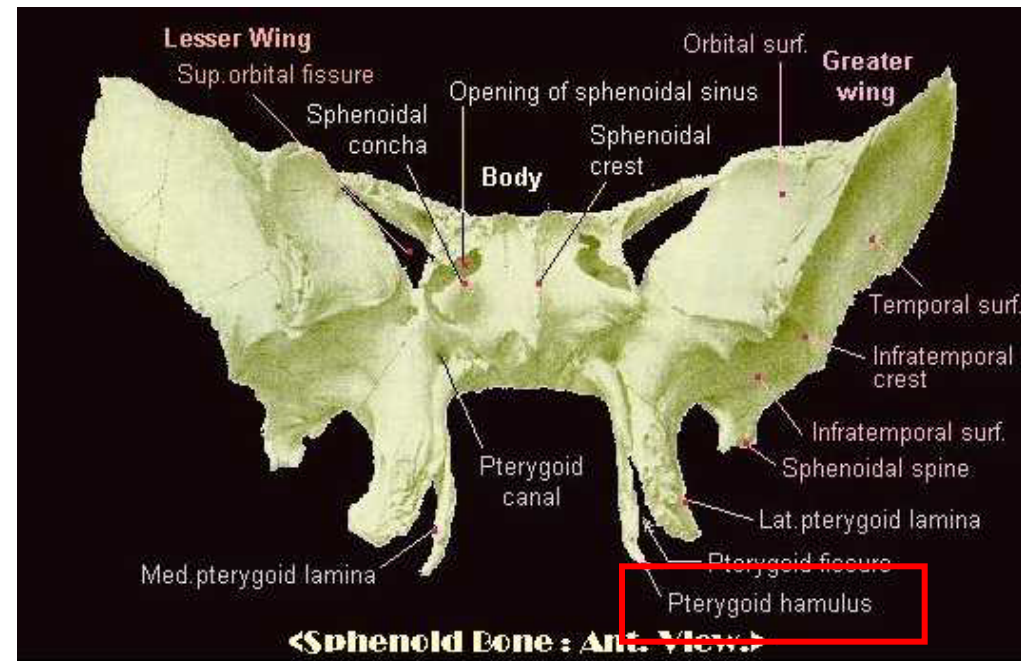
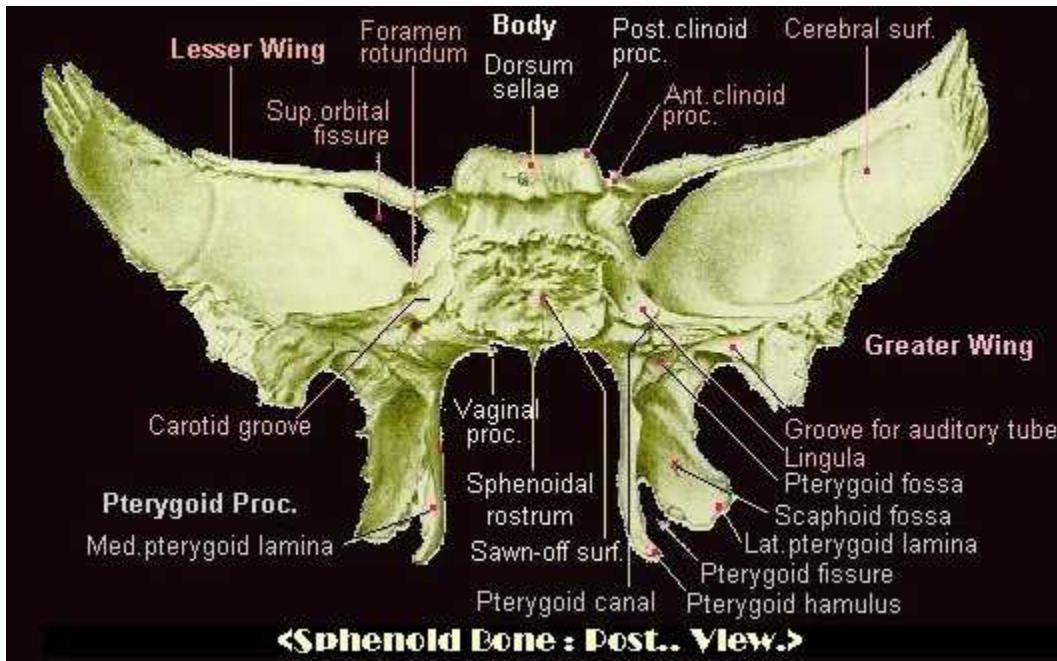
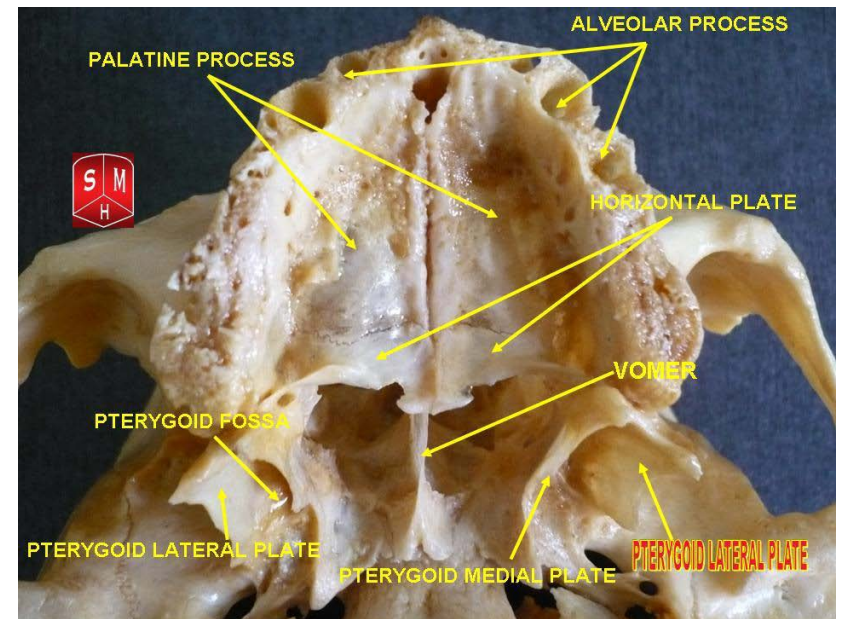
Bony palate-2

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



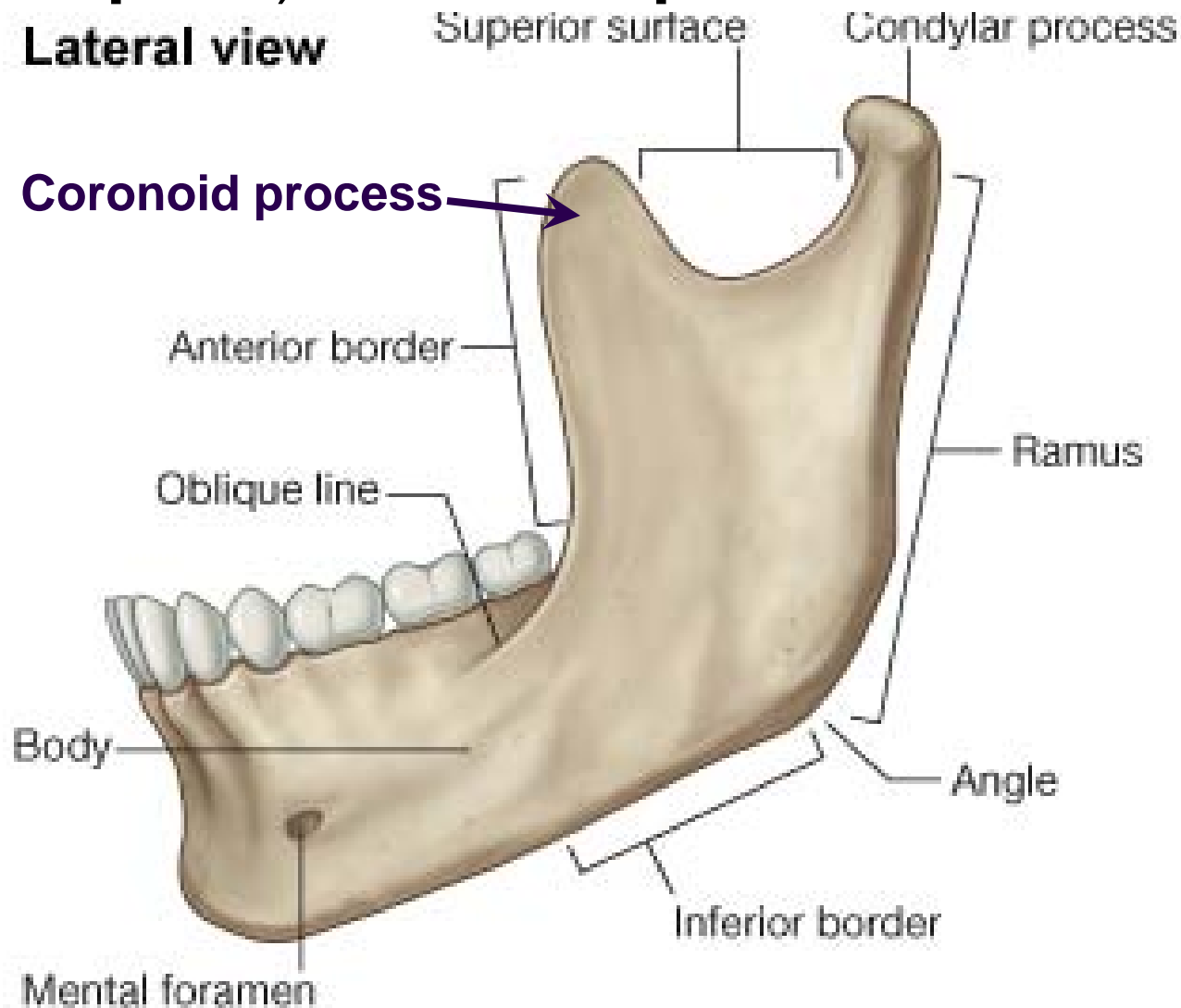
Pterygoid of sphenoid bone

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



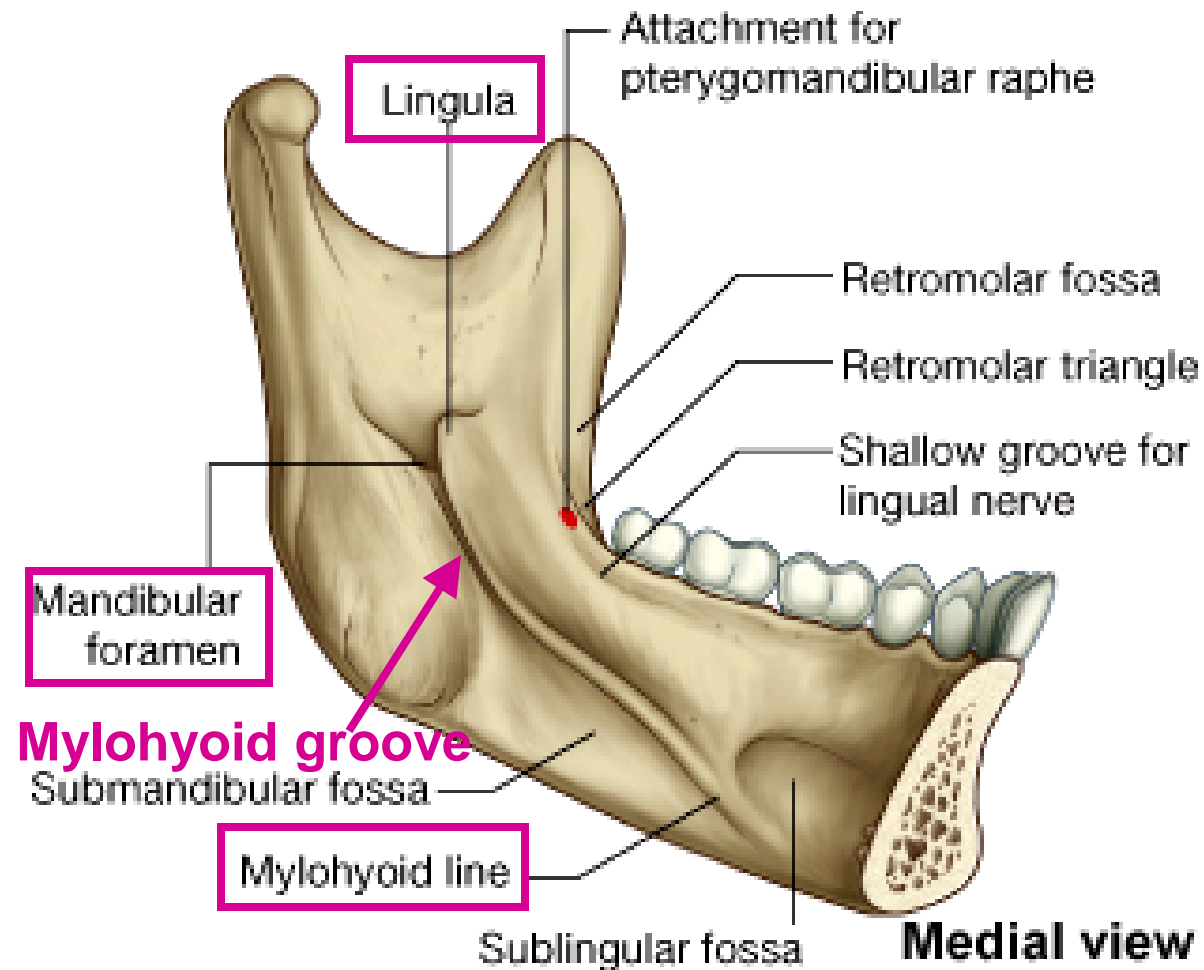
lower jaw (mandible)

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



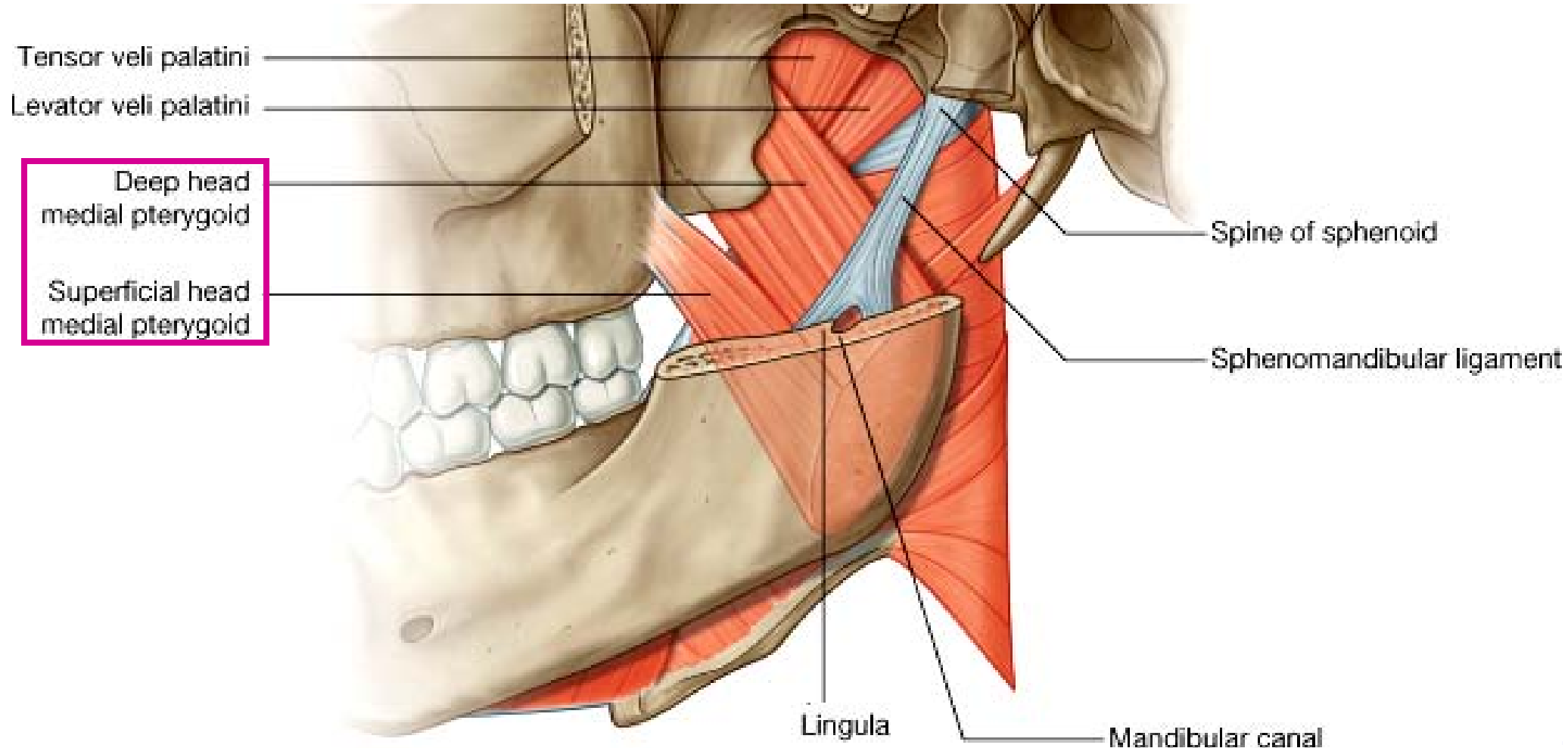
Medial surface of mandible-1

- 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



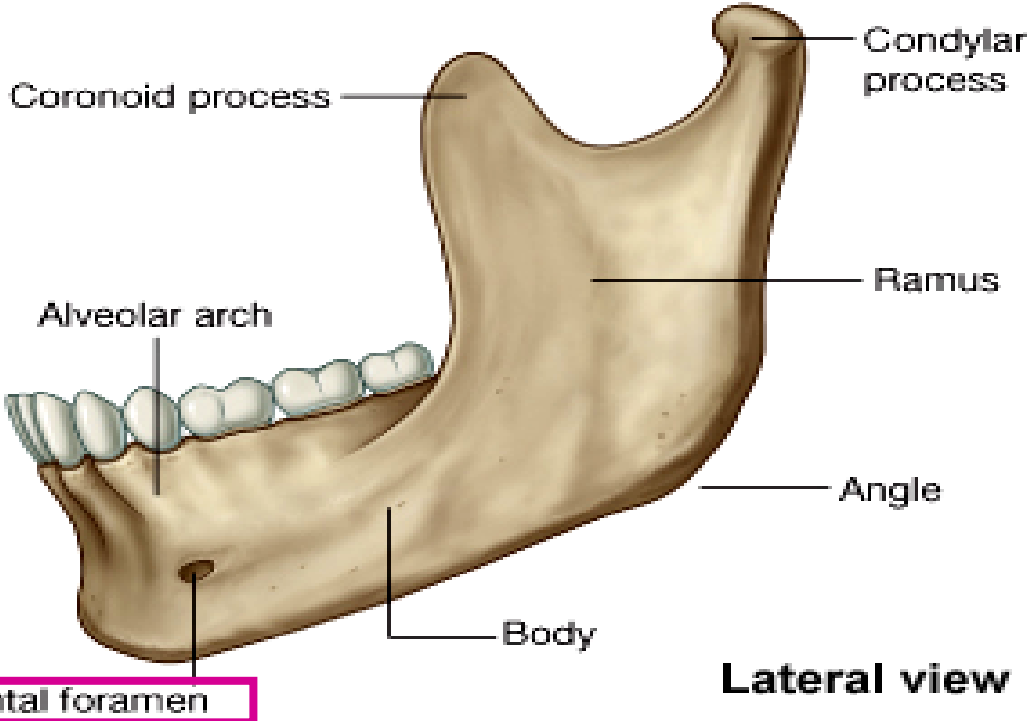
Medial surface of mandible-2

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

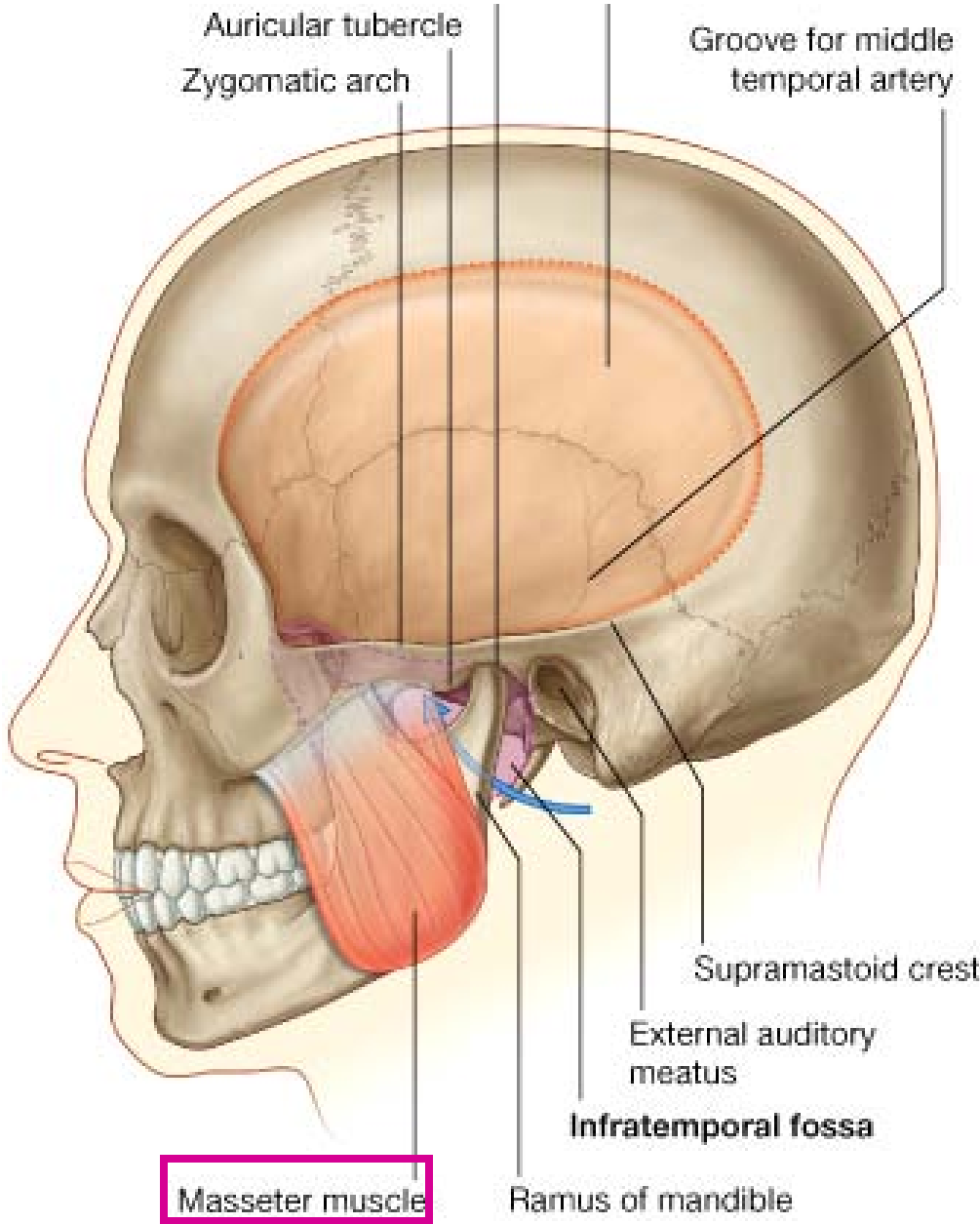


Lateral surface of mandible

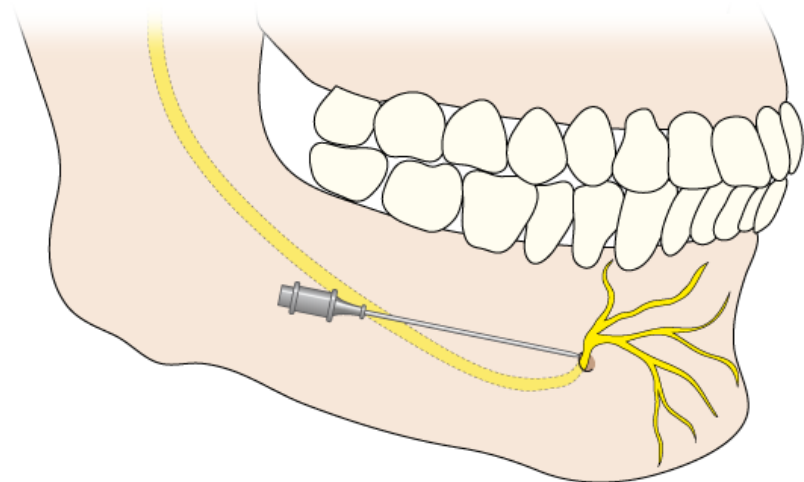
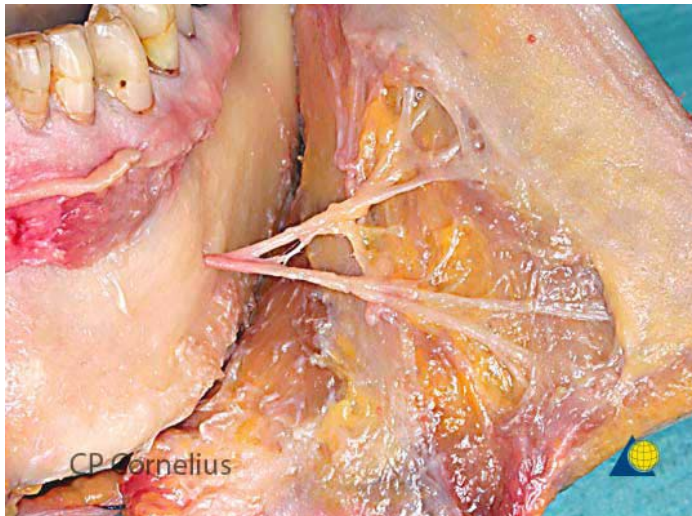
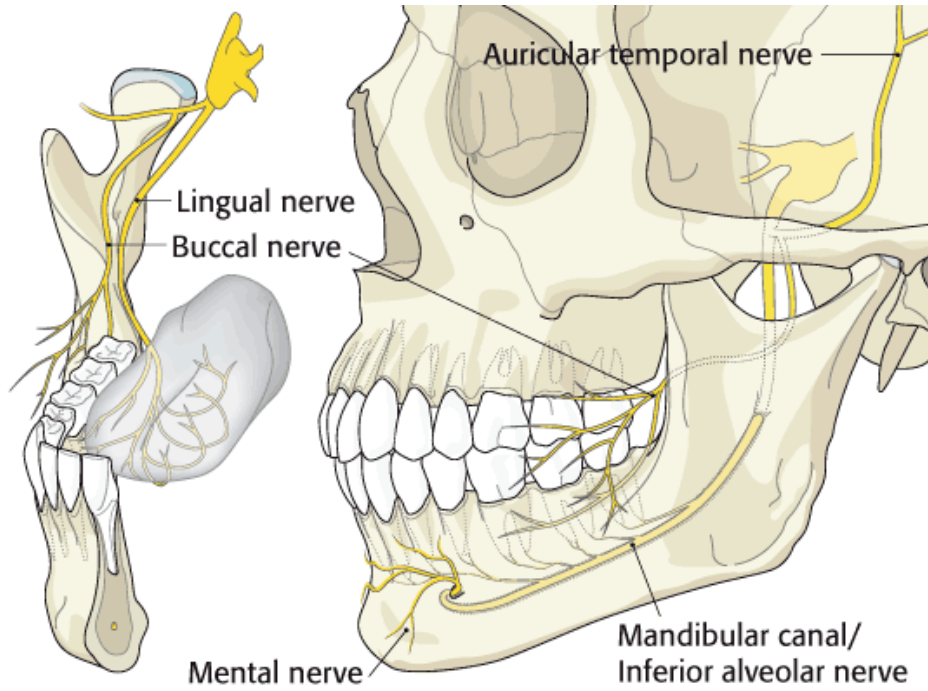
- masseter muscle attachment;
mental foramen



Lateral view

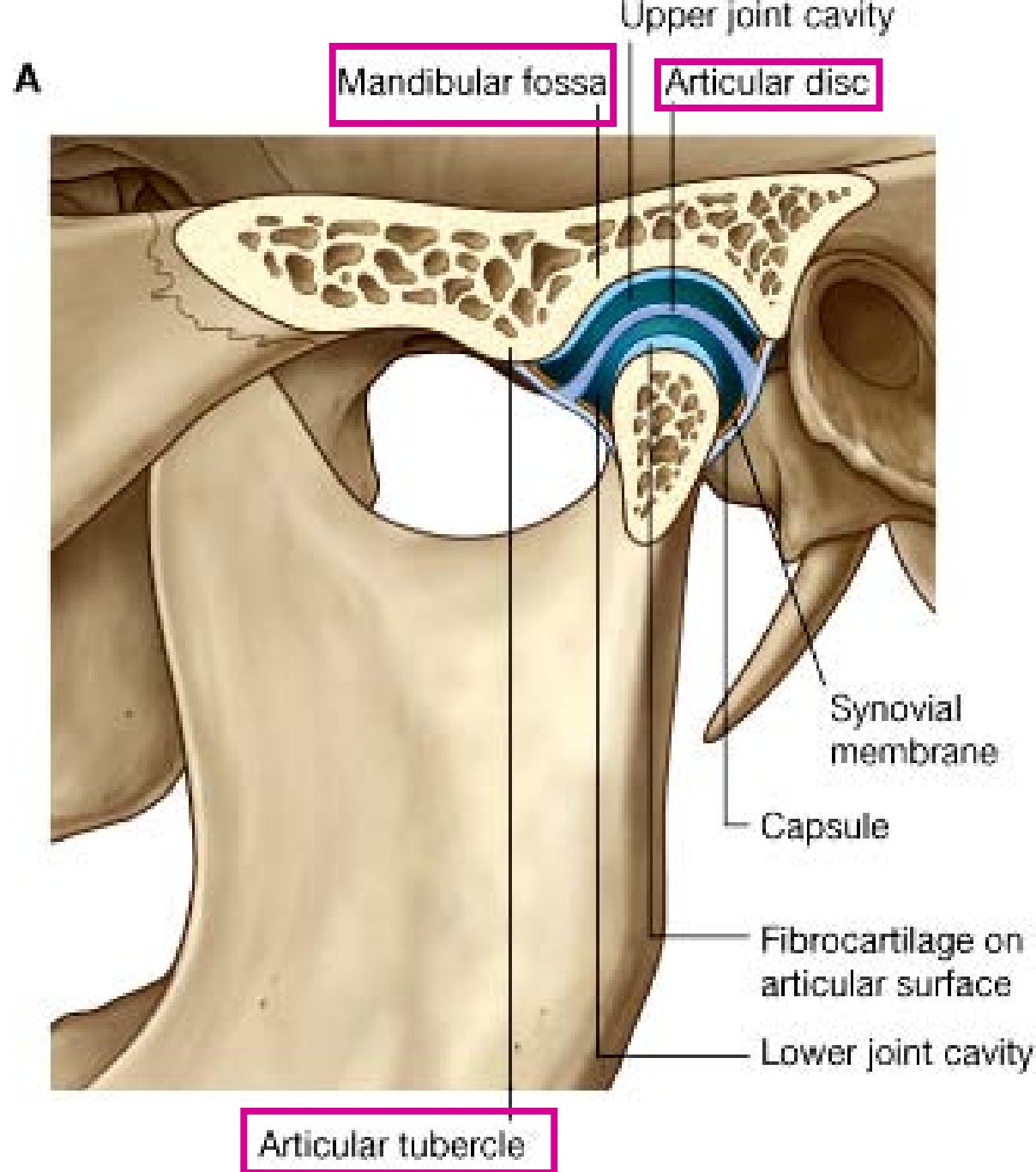


Mandibular foramen; Mental foramen



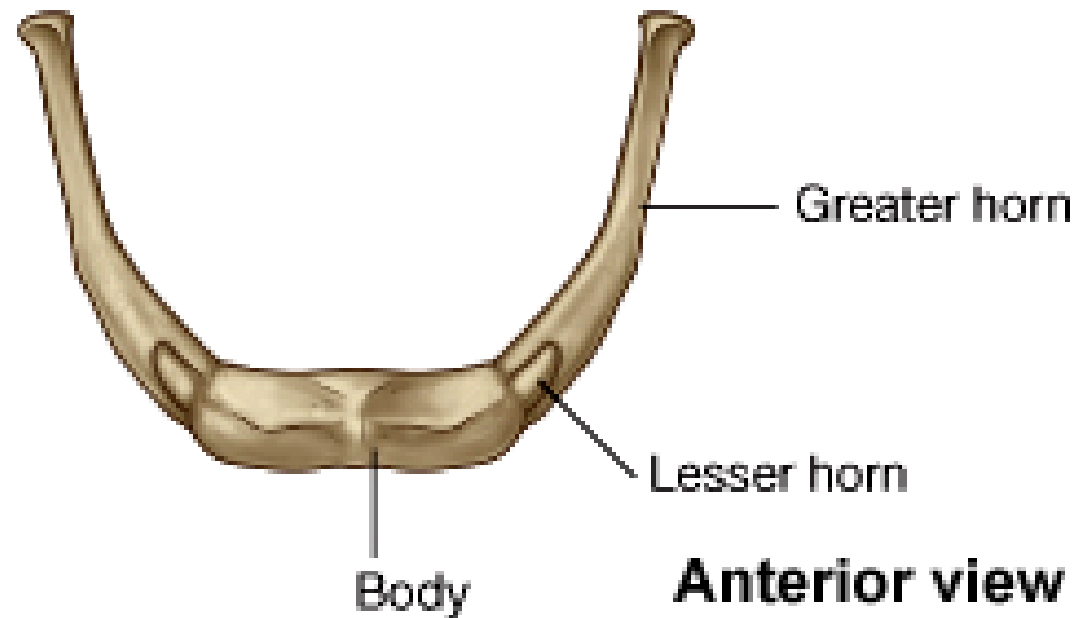
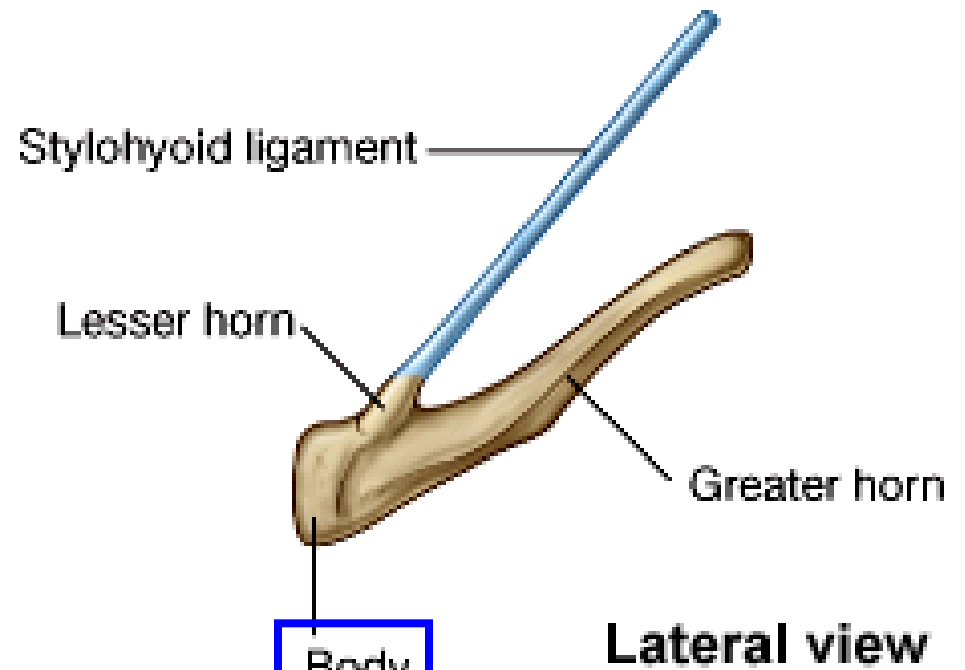
Temporomandibular joint (TM joint, TMJ)

- 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

