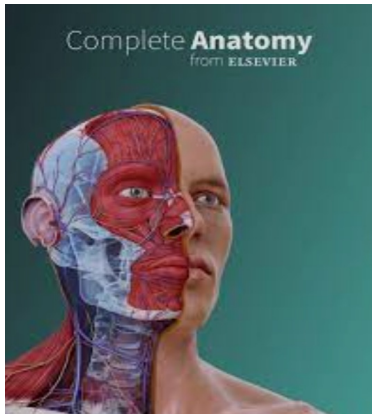
Neurocranium
Splanchnocranium

Omid Moztarzadeh

Literature:



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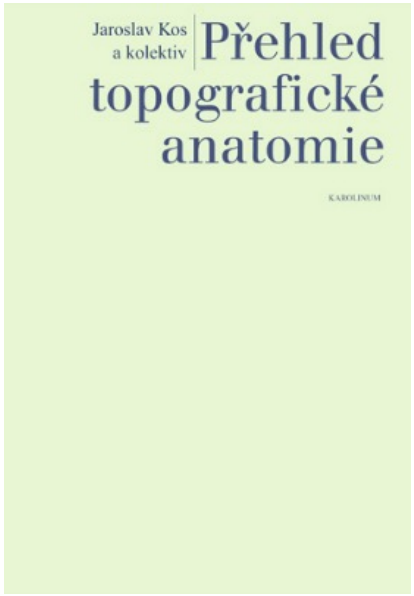
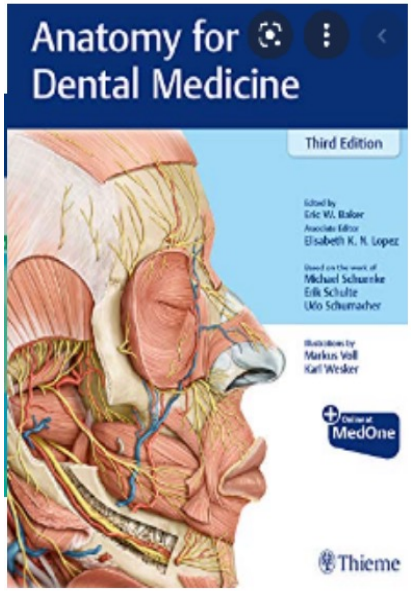
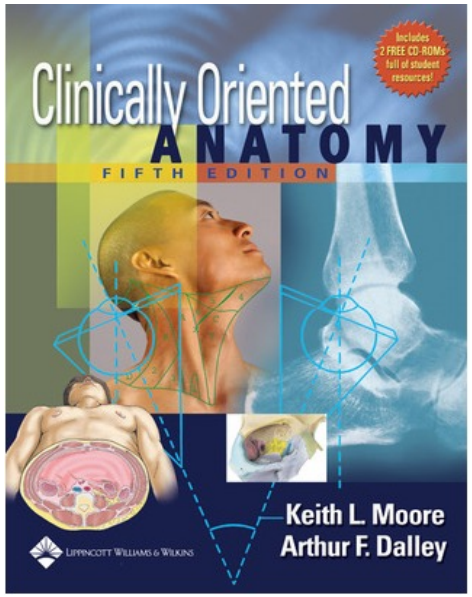
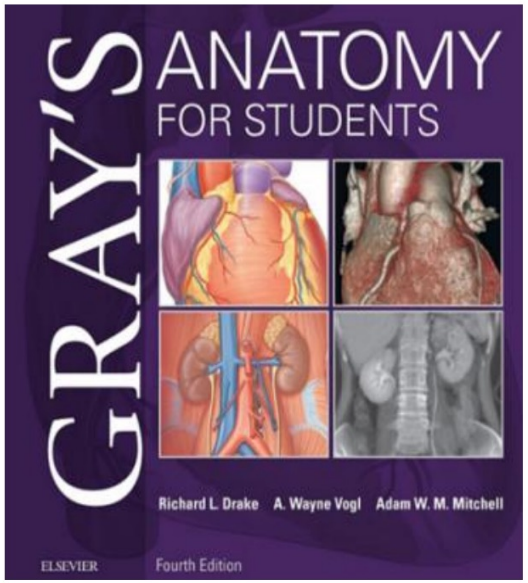








The adult human skull is comprised of 22 bones (excluding the ossicles of the ear) which are divided into two parts of differing embryological origin:
The neurocranium and the viscerocranium (splanchnocranium).

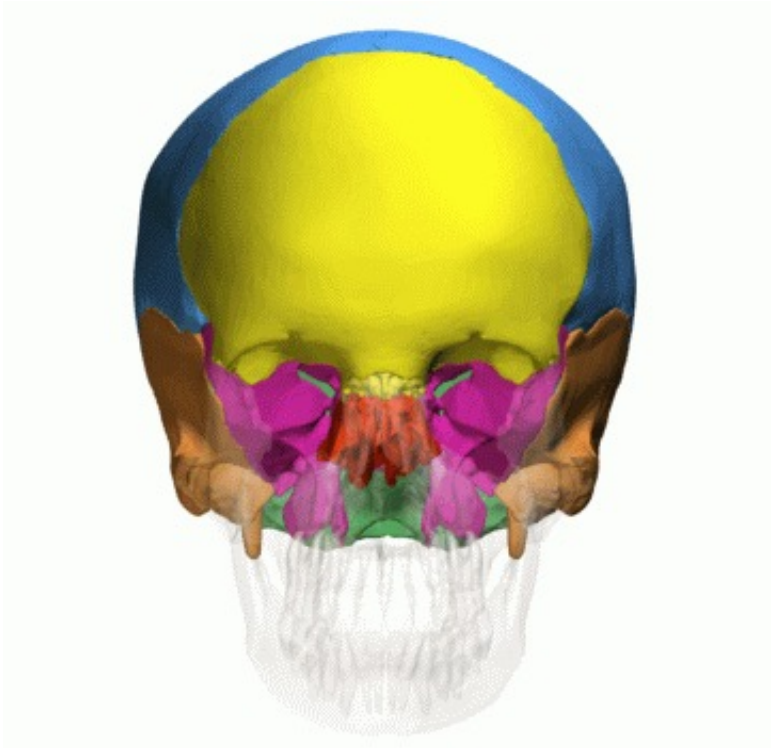
The neurocranium is the upper and back part of the skull and as a bony capsule enclosing the brain.
The viscerocranium (or splanchnocranium) is situated anteriorly and forms the skeleton of the face as well as parts of the jaw

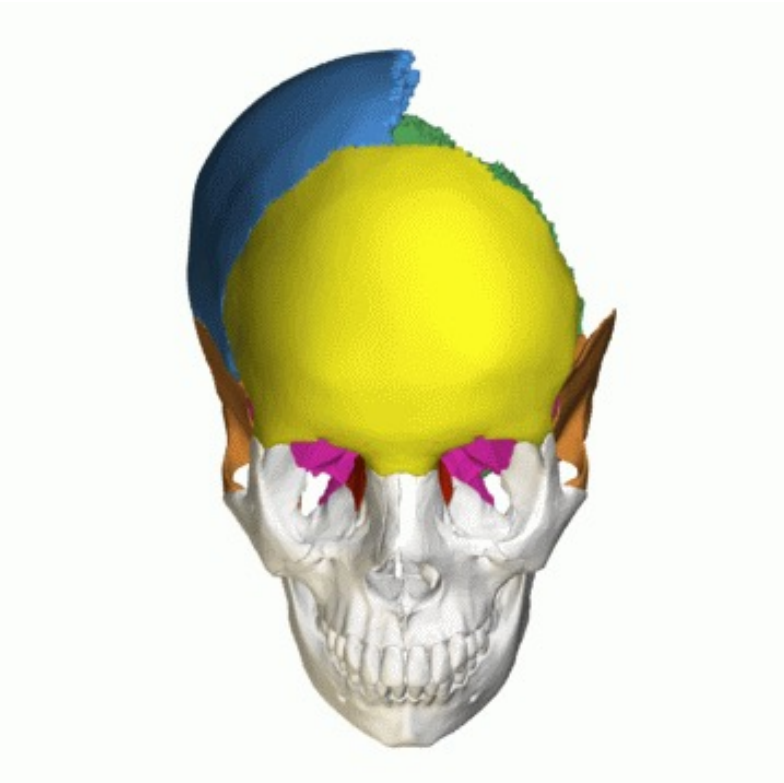
Neurocranium consists of a
Calvaria (vault) and
Cranial base.

The neurocranium is divided into two parts based on ossification:

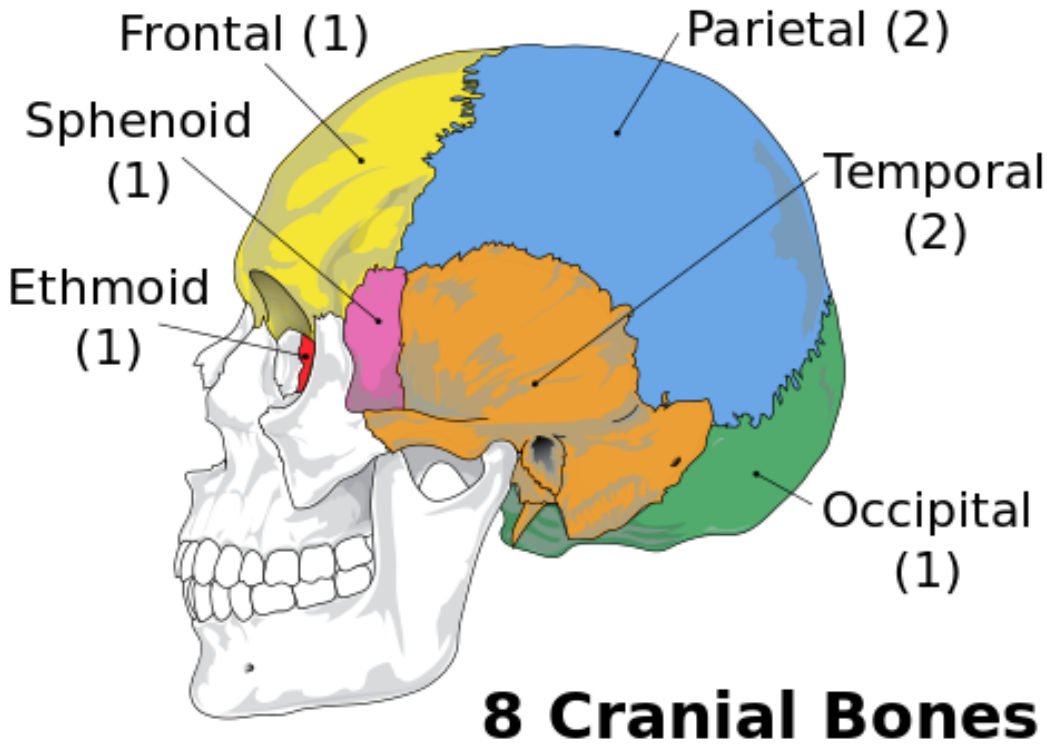
- cartilaginous neurocranium undergoes endochondral ossification to form the base of the skull.
- membranous neurocranium undergoes intramembranous ossification – calva and most of the bones of splanchnocranium

Contains proximal parts of the cranial nerves and vasculature of the brain.





8 bones contribute to the formation of the neurocranium: Frontal bone, Parietal bone, Sphenoid bone, Temporal bone, Occipital bone, Ethmoid bone (cribriform plate)

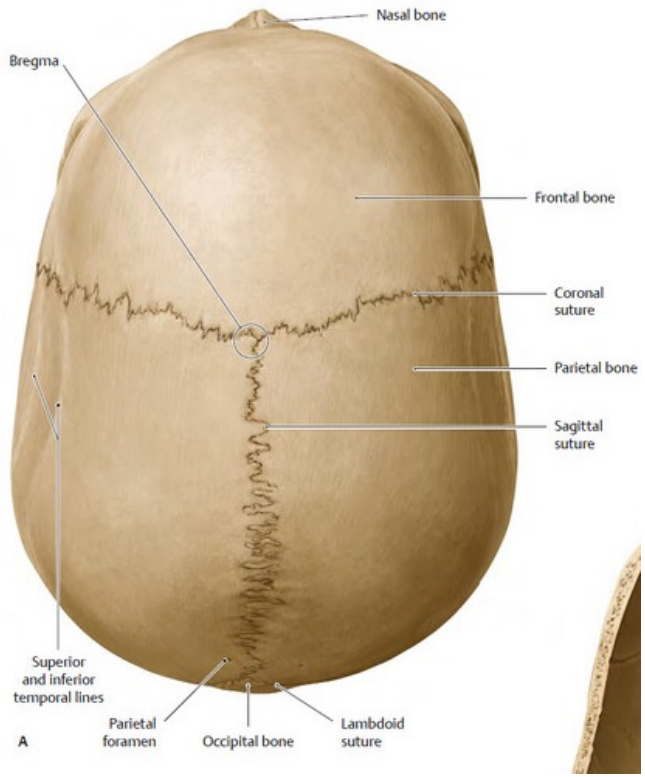


Neurocranium consists of a vault (calvaria) and cranial base.

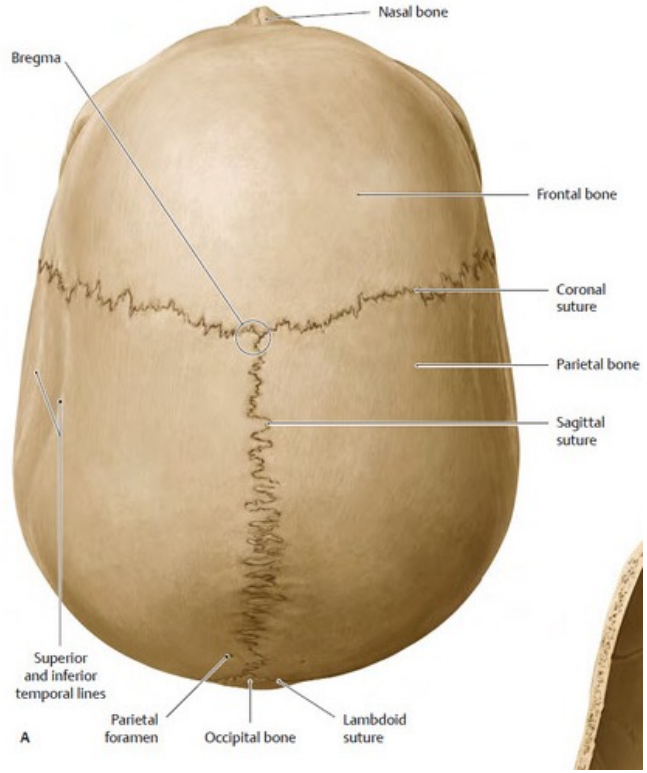
Calvaria

- The calvaria is the upper part of the neurocranium and covers the cranial cavity containing the brain.
- It is drived from membranous neurocranium and made up of the parietal, squamus part of frontal,occipital and temporal bones, and greater wings of sphenoid bone.
- These bones are primarily connected by the fibrous sutures joints.

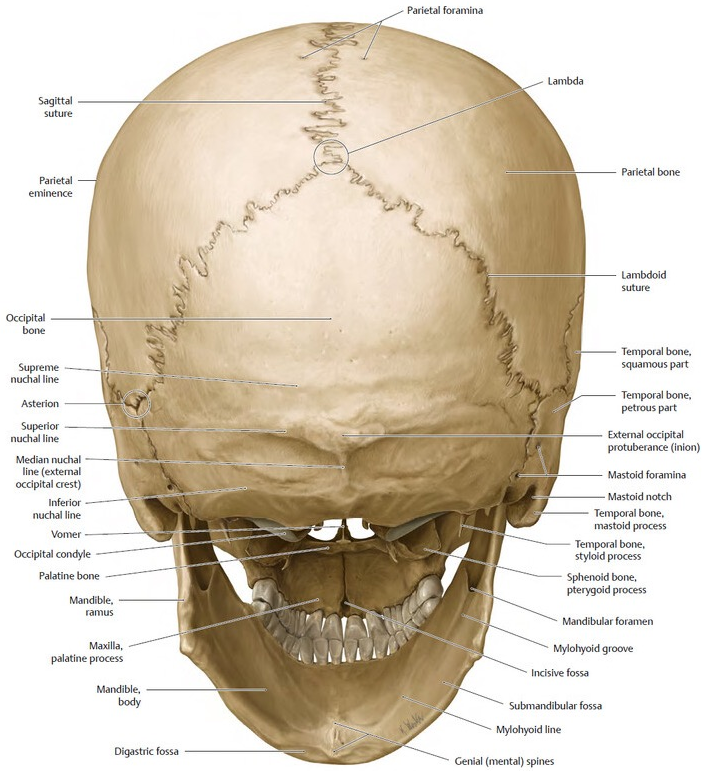
The coronal suture lies between the frontal bone and paired parietal bones of the skull.
The junction between coronal and sagittal sutures called Bregma.

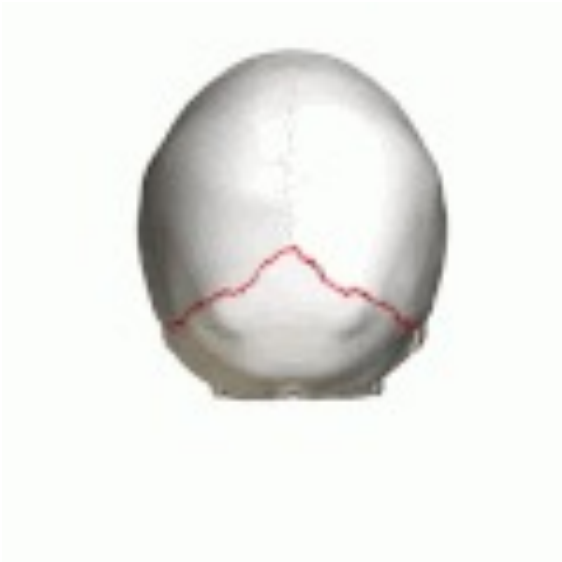


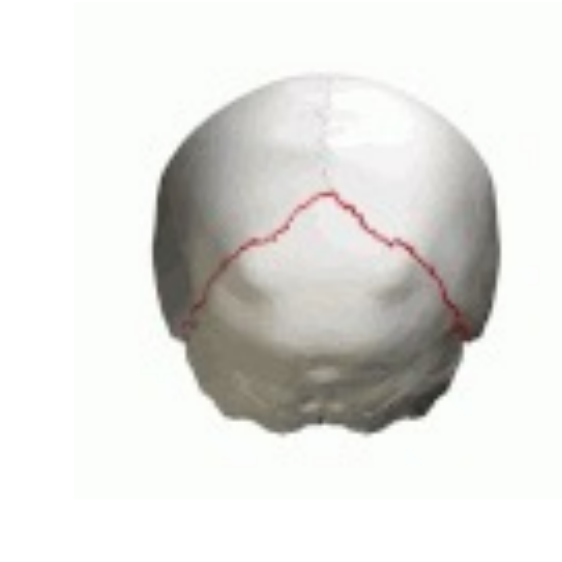
The sagittal suture, also known as the **interparietal suture** and is a dense, fibrous connective tissue joint between the two parietal bones.The term is derived from the Latin word *sagitta*, meaning arrow. The vertex is the highest point on the skull and is often near the midpoint of the sagittal suture.



Lambdoidal suture is on the posterior aspect of the skull that connects the parietal bones with the occipital bone.
The junction between sagittal and lambdoidal sutures called Lambda.

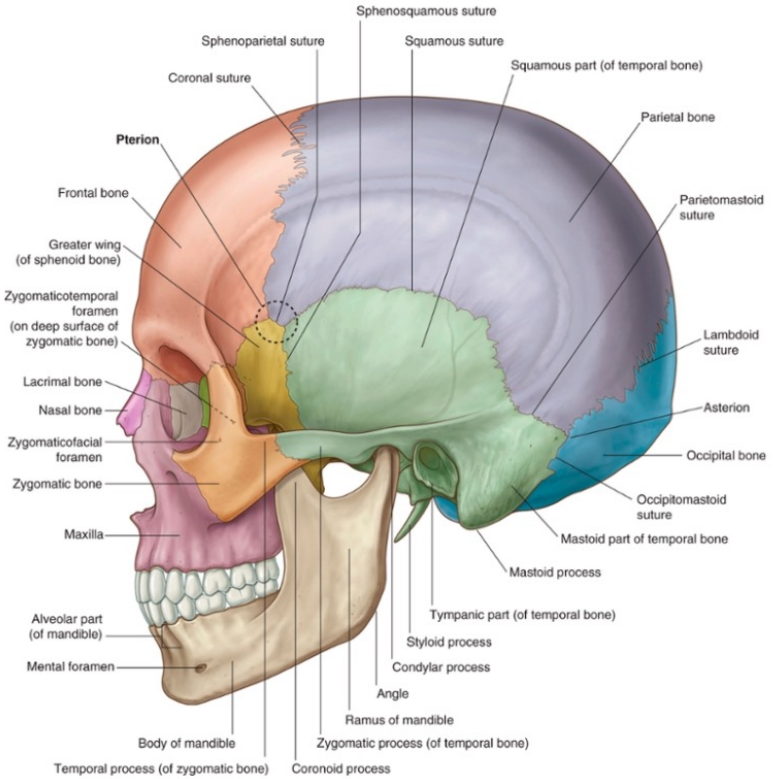






Squamous suture, arches backward from the pterion and connects the temporal squama with the lower border of the parietal bone.

Pterion: is the region where the frontal, parietal, temporal, and sphenoid bones (greater wing) join together. The anterior division of the middle meningeal artery runs underneath the pterion. a traumatic blow to the pterion may rupture the middle meningeal artery causing an epidural haematoma



Calvaria

The external surface of the calvaria is relatively smooth, unlike its internal surface.

The smooth external surface is interrupted by the parietal foramina, which gives passage to the parietal emissary veins.(**spread of infection** through calvaria into the cranial cavity and reach to the intracranial structures such as meninges)

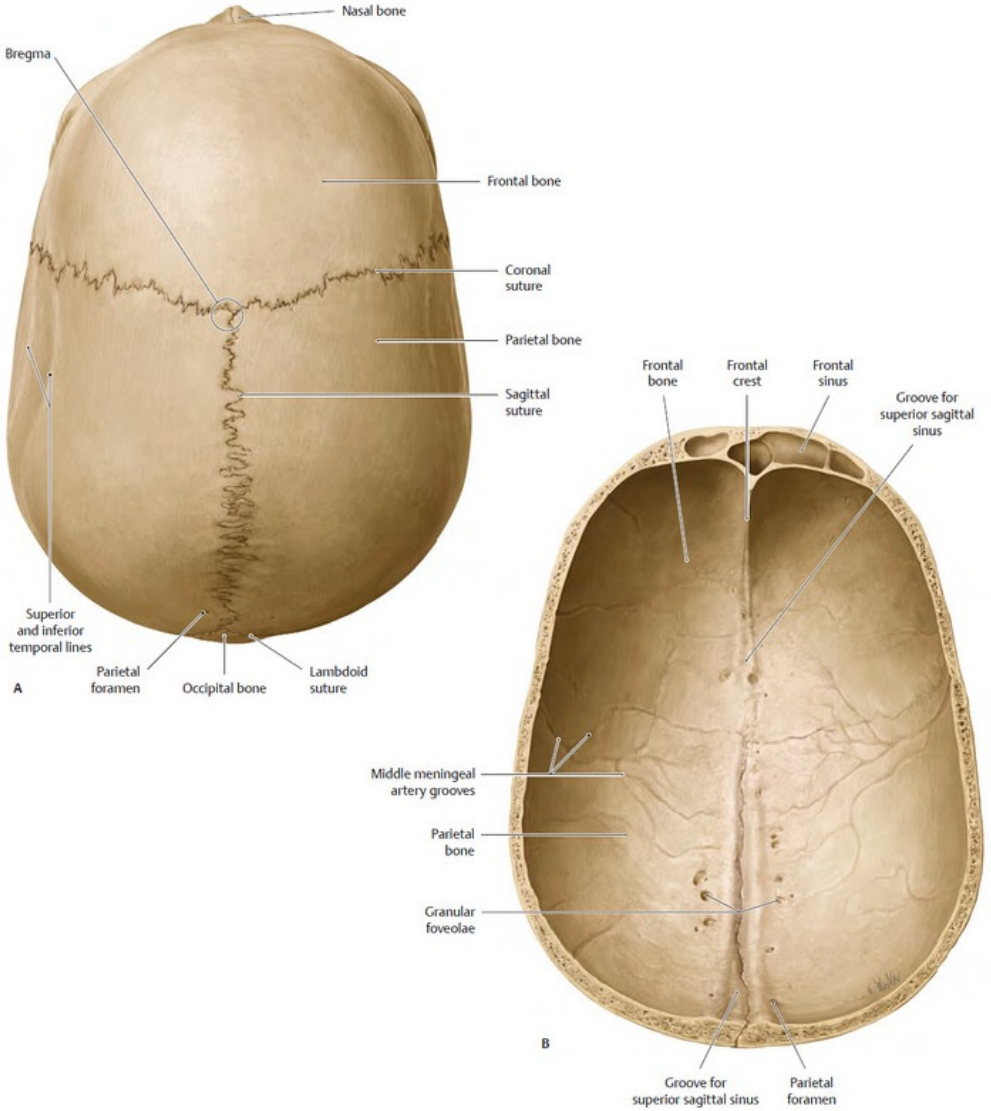
The internal surface of the calvaria bears a number of pits and grooves:

Granular foveolae (small pits in the inner surface of the skull caused by saccular protrusions of the arachnoid membrane [arachnoid granulations] covering the brain)

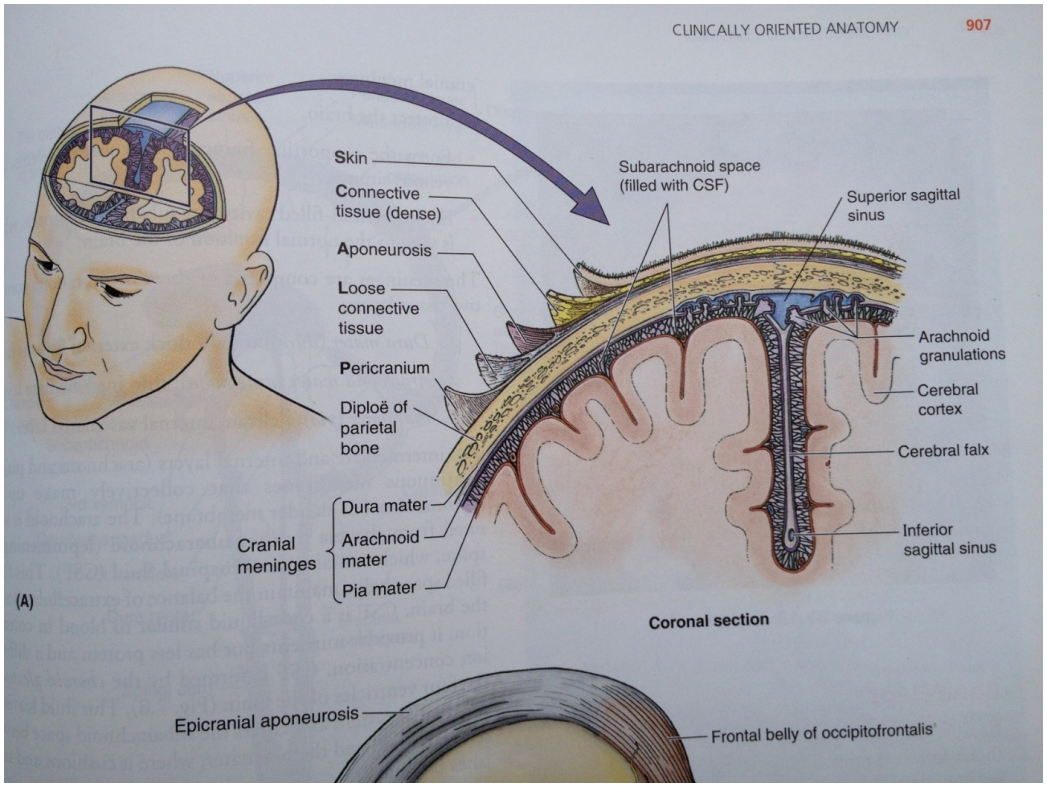
Groove for the superior sagittal sinus (a dural venous sinus of the brain

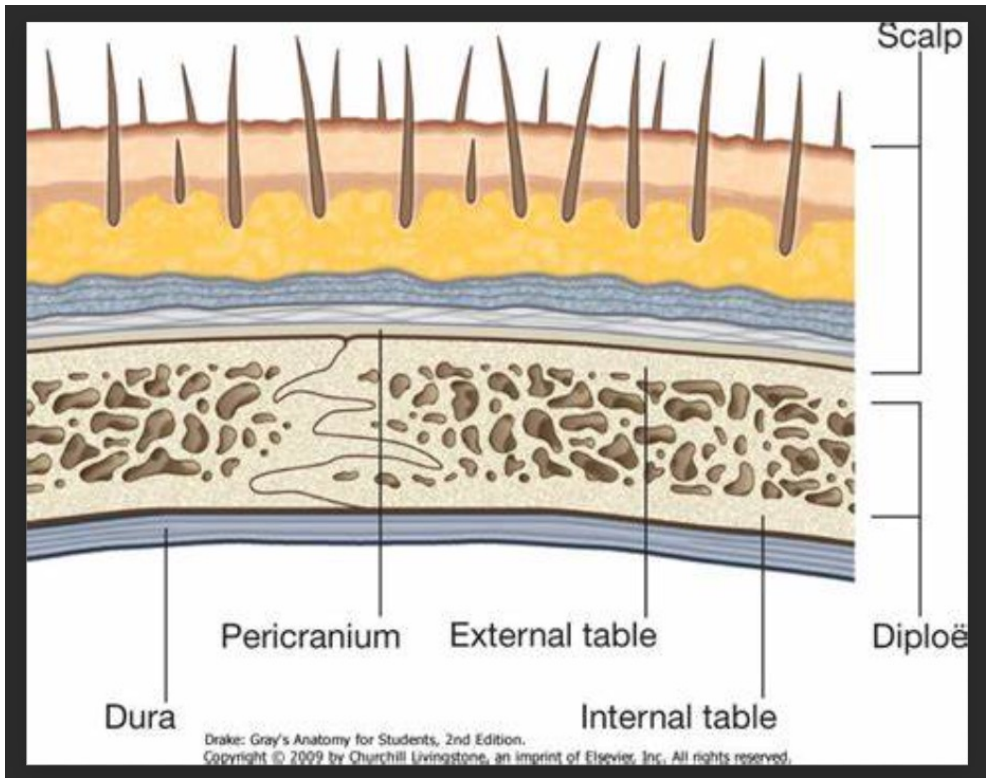
Arterial grooves (which mark the positions of the arterial vessels of the dura mater, such as the middle meningeal artery, which supplies most of the dura mater and overlying bone). (Most **epidural** hematomas result from arterial **bleeding** from a branch of the middle meningeal artery).

Frontal crest (which gives attachment to the falx cerebri, a sickle-shaped fold of dura mater between the cerebral hemispheres).



The skull bones are made up of external and internal tables of the compact bone separated by a layer of spongy bone called diploe.



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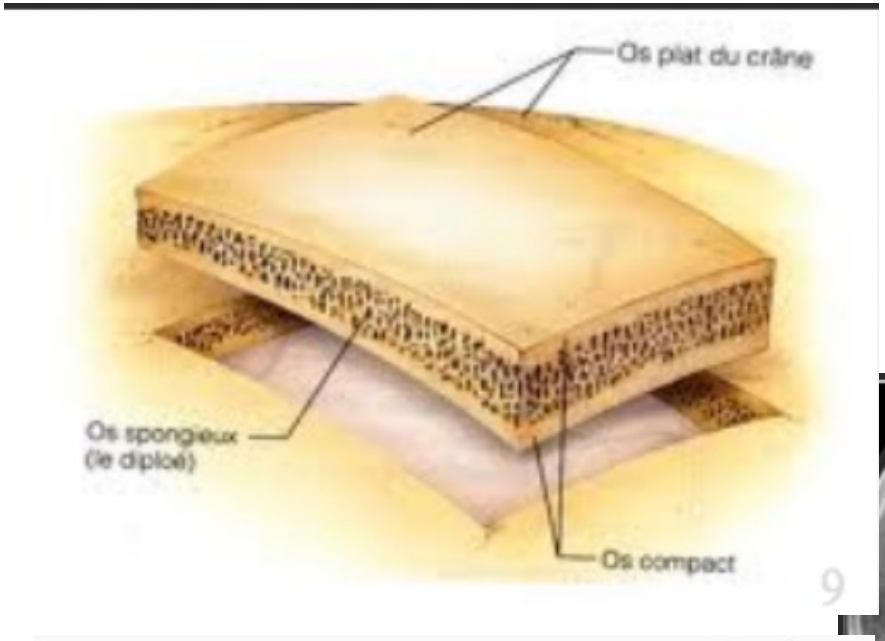

Os plat du crâne
Os spongieux
(le diploé)
Os compact

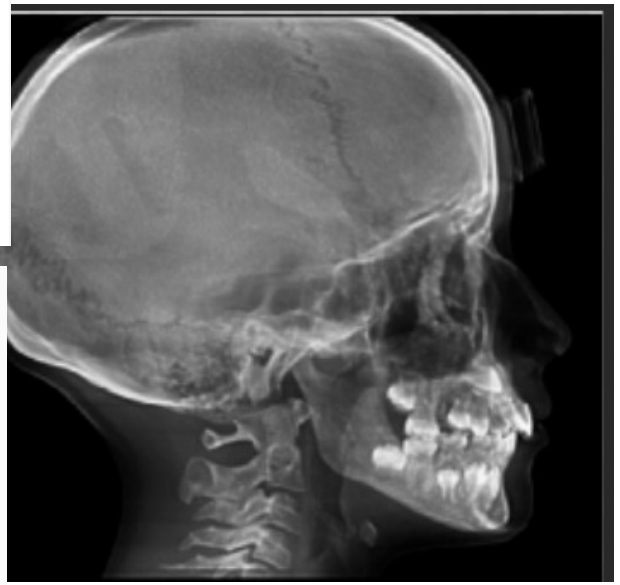
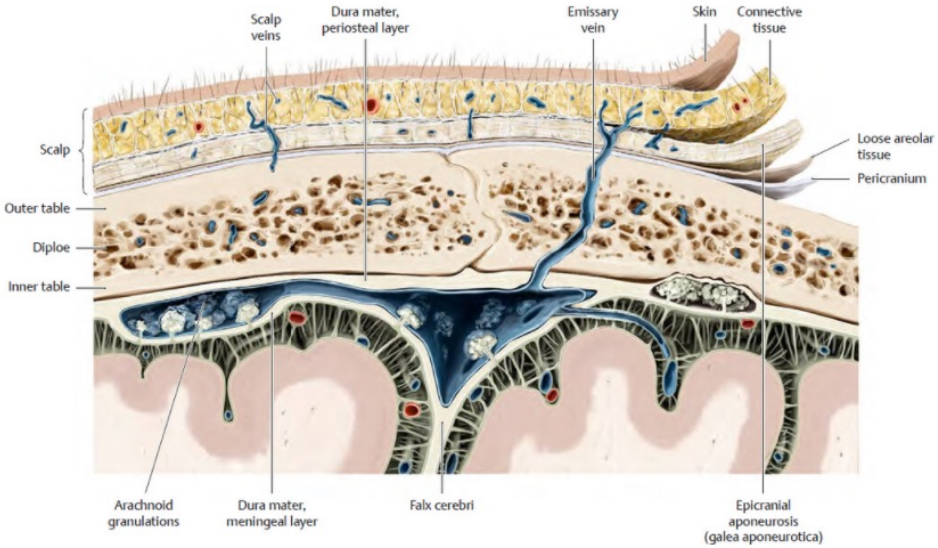
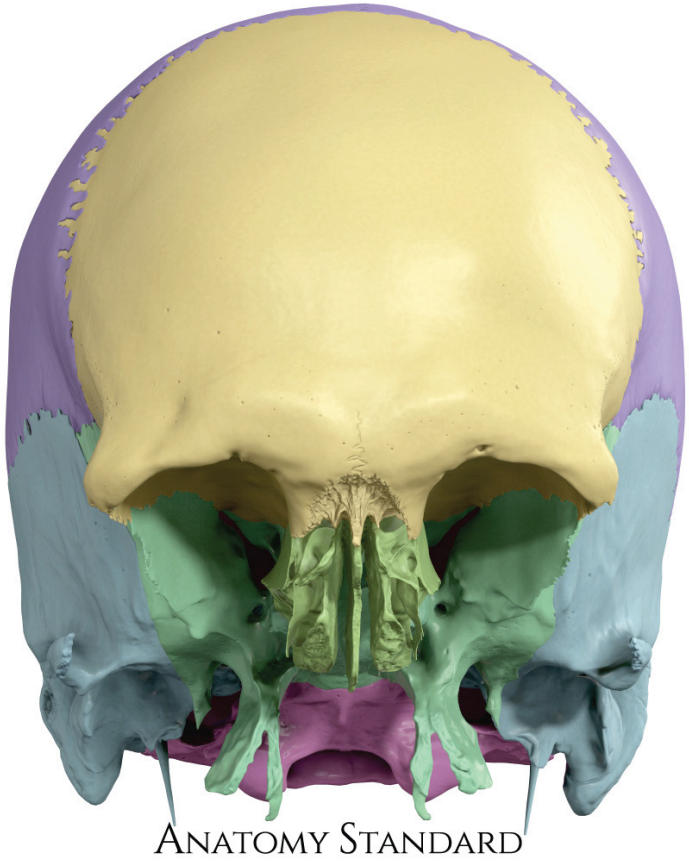


Fig. 1.20 **Diploic veins in the calvaria**
The diploic veins are located in the cancellous or spongy tissue of the cranial bones (the diploë) and are visible when the outer table is removed. The diploic veins communicate with the dural venous sinuses and scalp veins by way of the *emissary veins*, which create a potential route for the spread of infection.



Frontal bone: articulates with parietal, ethmoidal, lacrimal, zygomatic, sphenoid, nasal bones and maxilla

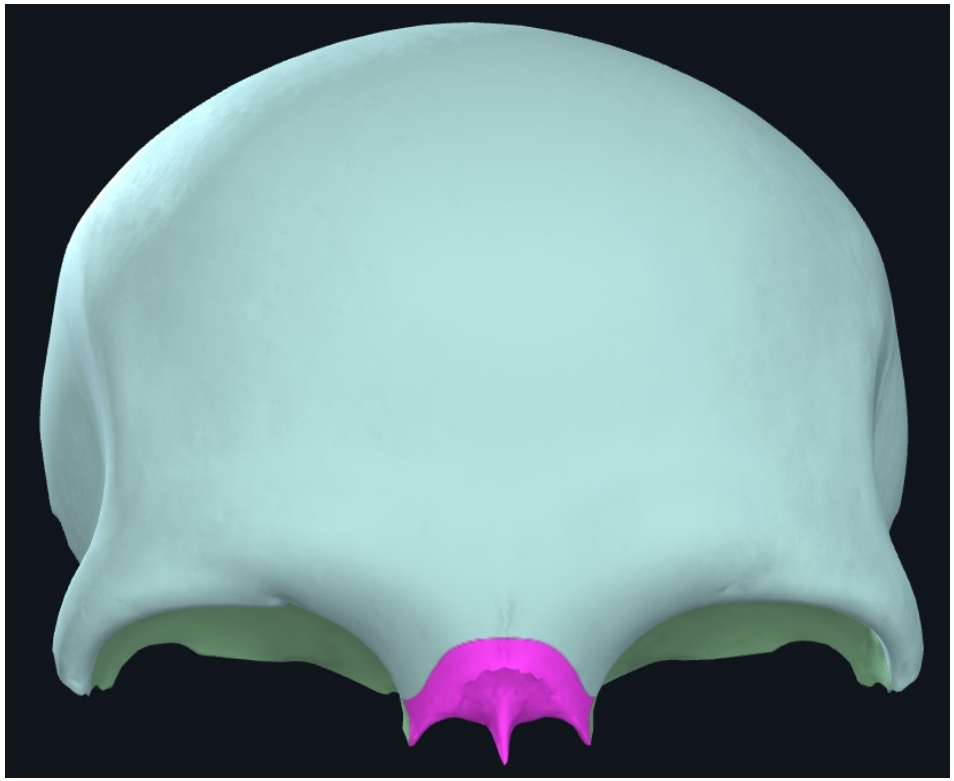


Parts:

Squamus part- mainly forms the skeleton of forehead.

Orbital part- forms roof of the orbit and part of the floor of the anterior cranial fossa.

Nasal part-articulates with the nasal bone at the frontonasal suture.



Frontal bone

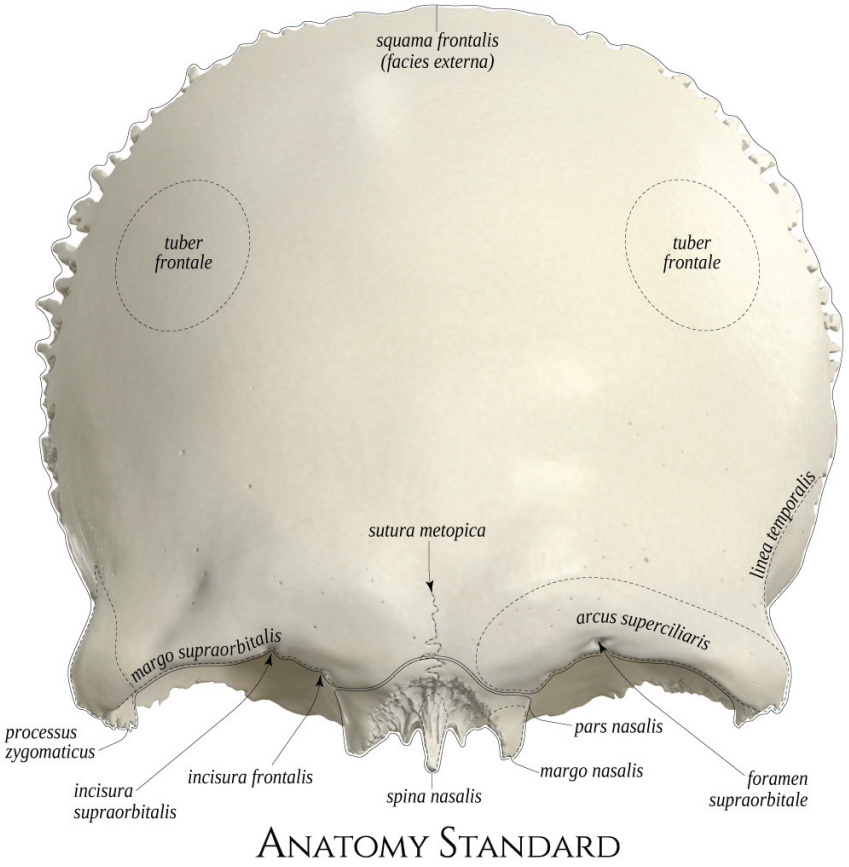
Is a flat bone of neurocranium.

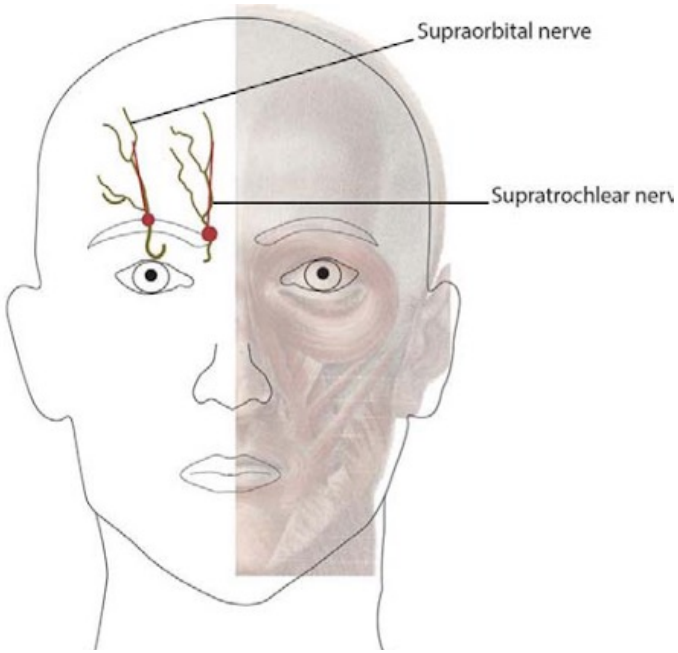
At birth, it is usually paired but before the first age of life, the suture separating them (***sutura frontalis, s. metopica***) usually ossifies.

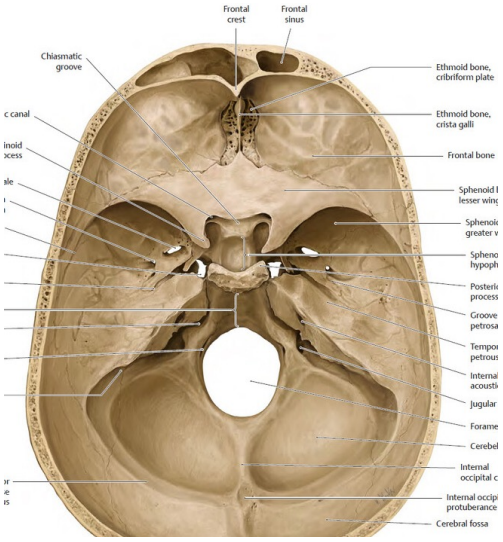
Supraorbital foramen or notch between the squamous and orbital parts for passage of the supraorbital nerve and vessels – (pressure point for examination of the 1st branch of the trigeminal nerve).

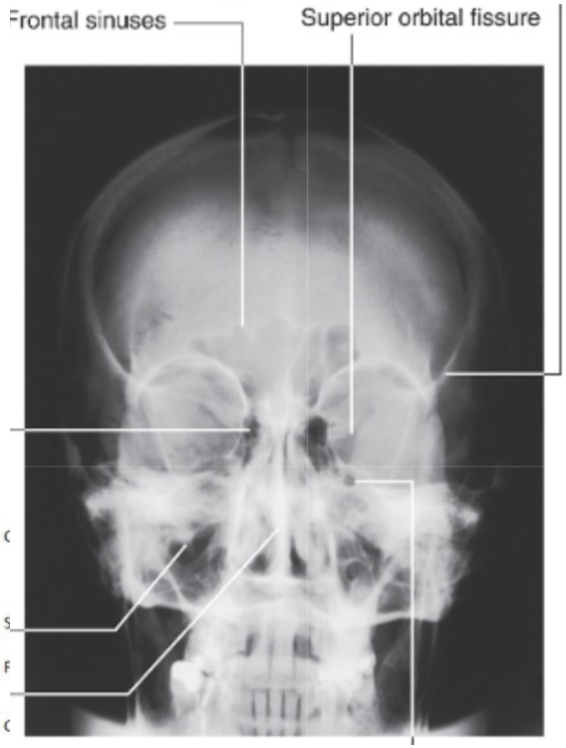
Frontal foramen or notch

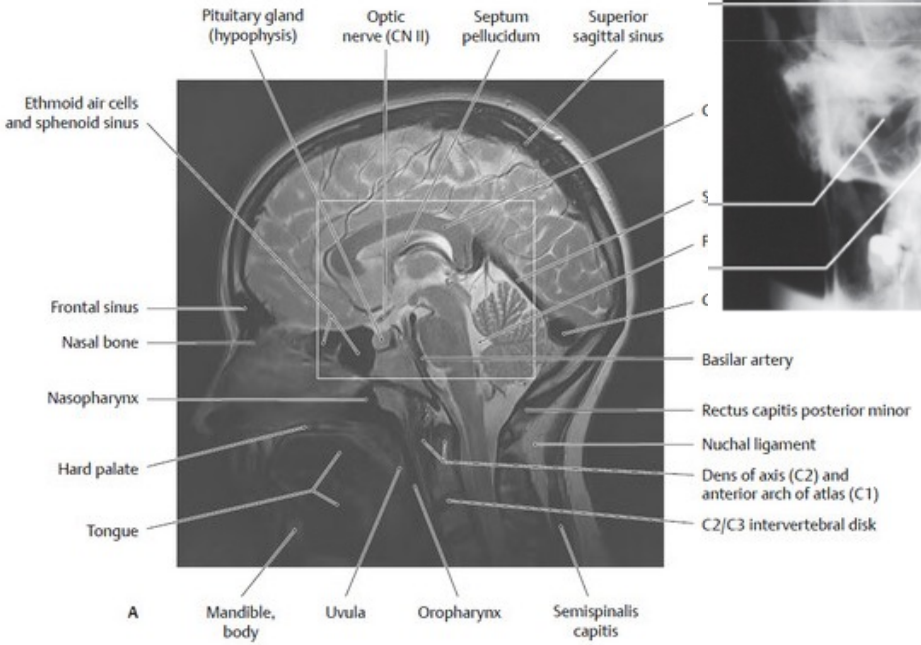
The paired frontal sinuses located between two compact layer of the squamus part of frontal bone and separated by septum. They are rarely symmetrical.



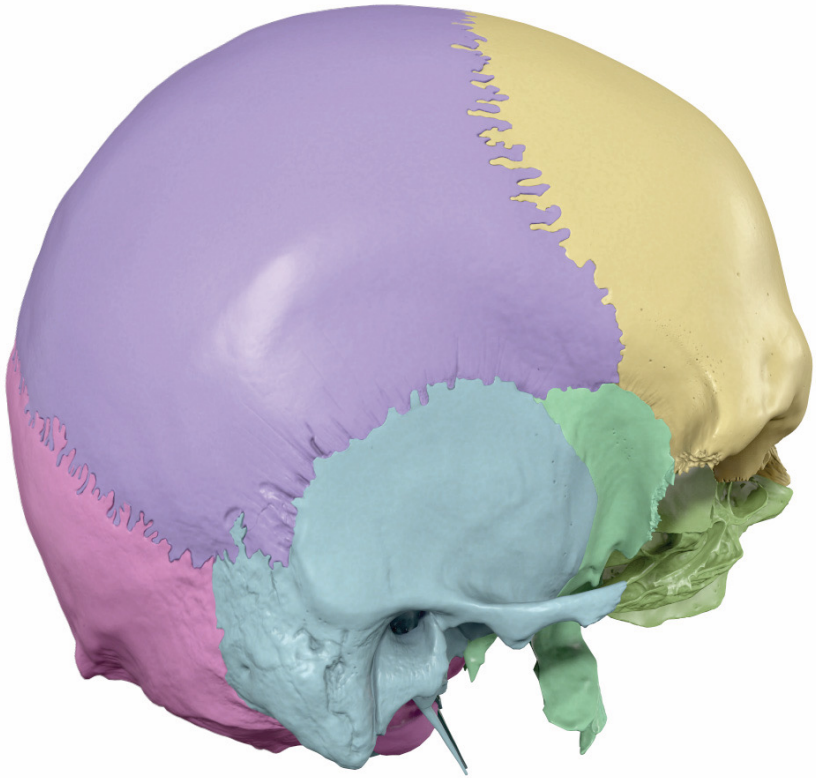

Supraorbital nerve
Supratrochlear nerv


Frontal crest
Frontal sinus
Chiasmatic groove
Ethmoid bone, cribriform plate
Ethmoid bone, crista galli
Frontal bone
Jugular
Cerebral fossa


Frontal sinuses
Superior orbital fissure


Pituitary gland (hypophysis)
Optic nerve (CN II)
Septum pellucidum
Superior sagittal sinus
Ethmoid air cells and sphenoid sinus
Frontal sinus
Nasal bone
Nasopharynx
Hard palate
Tongue
Basilar artery
Rectus capitis posterior minor
Nuchal ligament
Dens of axis (C2) and anterior arch of atlas (C1)
C2/C3 intervertebral disk
A
Mandible, body
Uvula
Oropharynx
Semispinalis capitis

Parietal bone: articulates with opposite parietal bone, frontal, occipital, temporal and sphenoid bone.



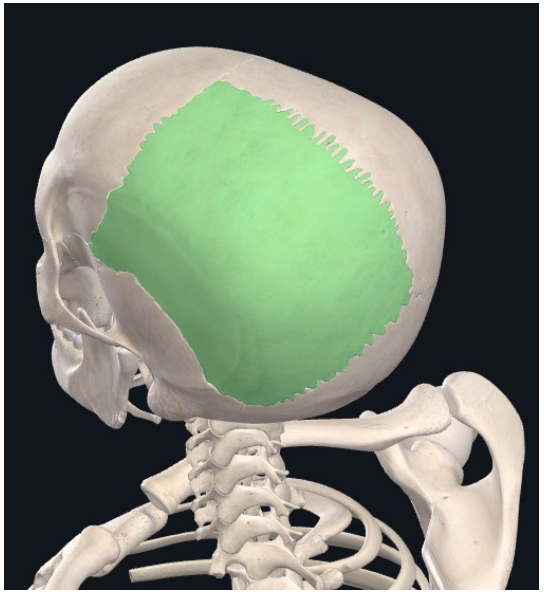
Parietal bone

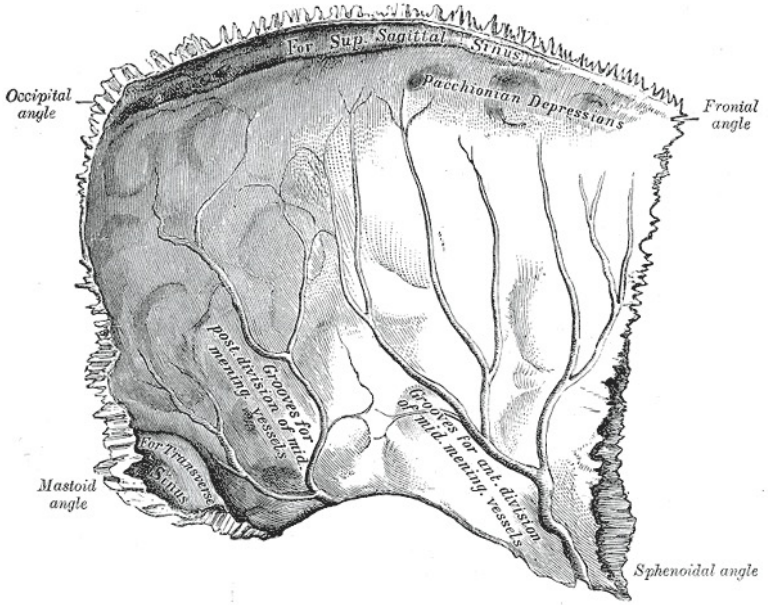
Is a flat bone of neurocranium.

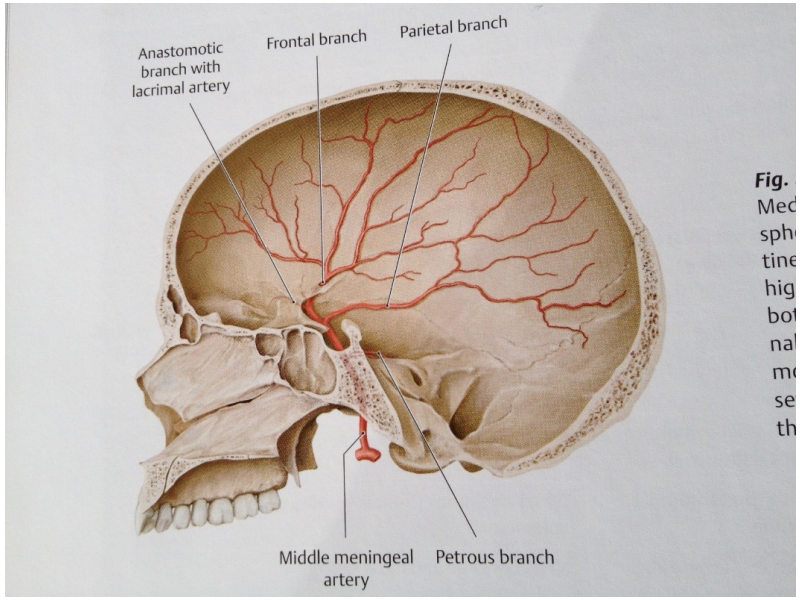
Quadrangular shape.

Frontal, occipital, sphenoid and mastoid angles.

Groove for middle meningeal artery. (fracture cause epidural bleeding- Between 15 and 20% of epidural hematomas are fatal).







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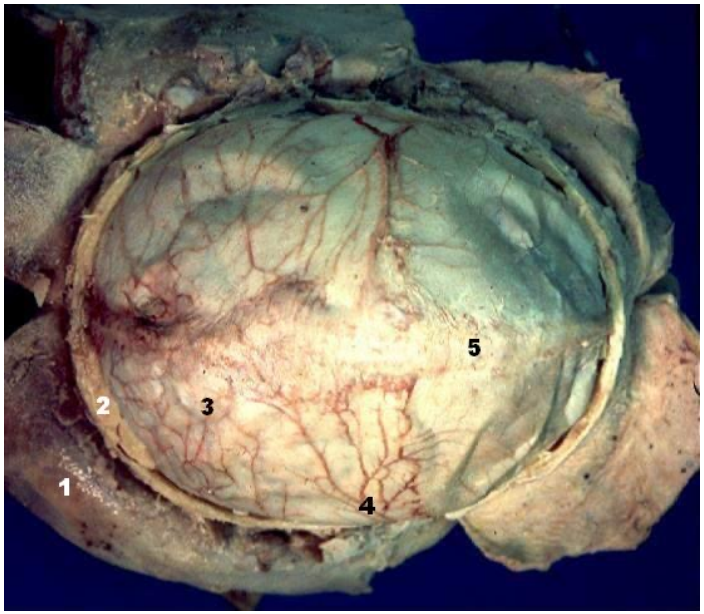
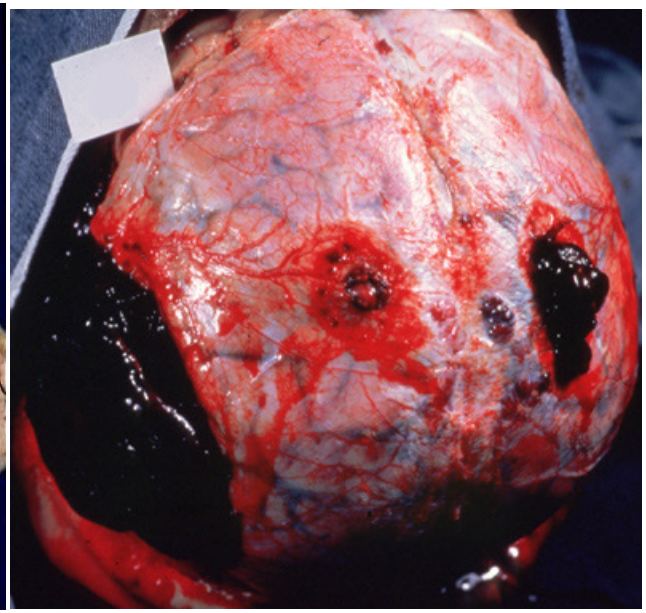
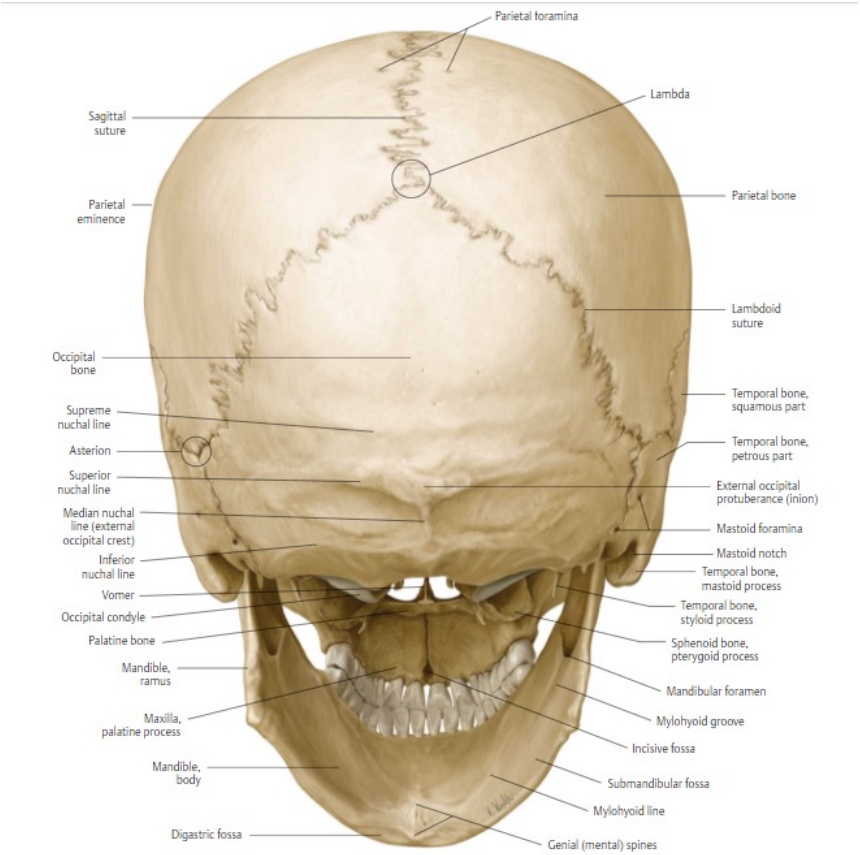
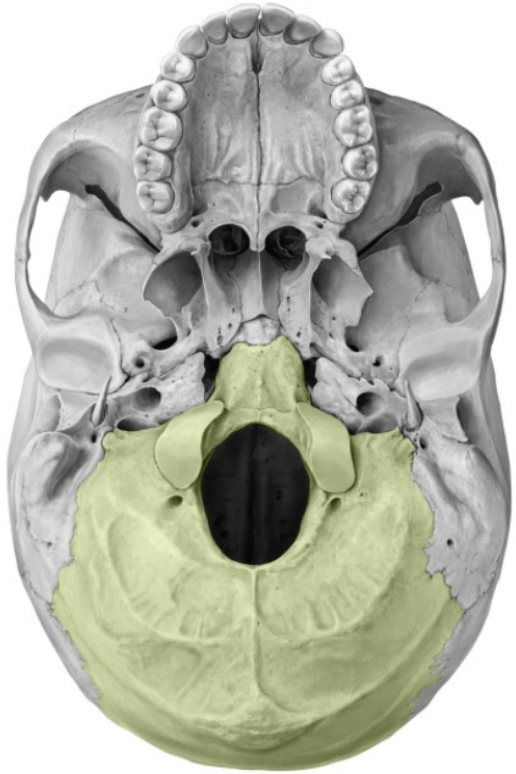


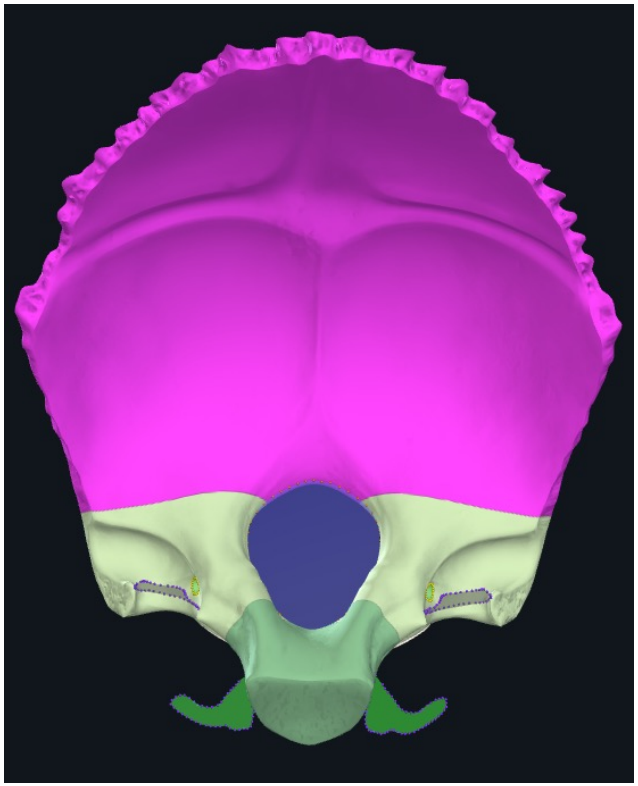


Occipital bone: articulates with parietal, temporal, and sphenoid bones and atlas.





Parts: squamus, basilar and lateral parts



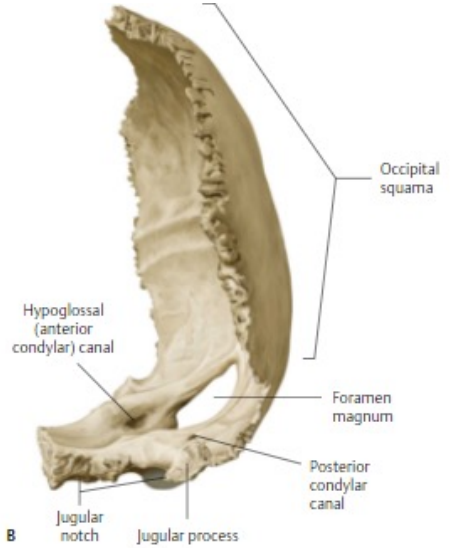
Occipital bone

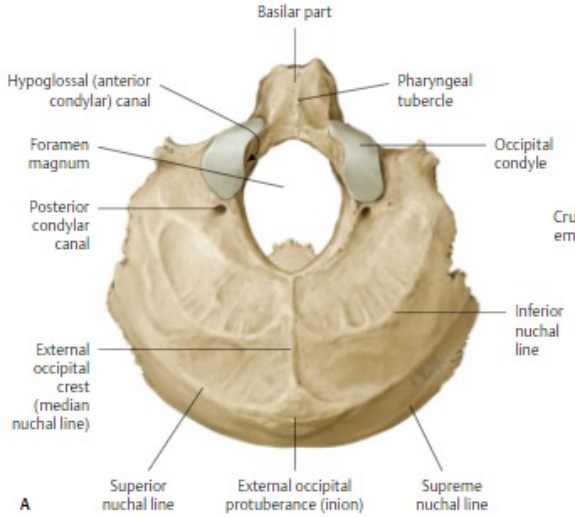
Is a flat bone of neurocranium.

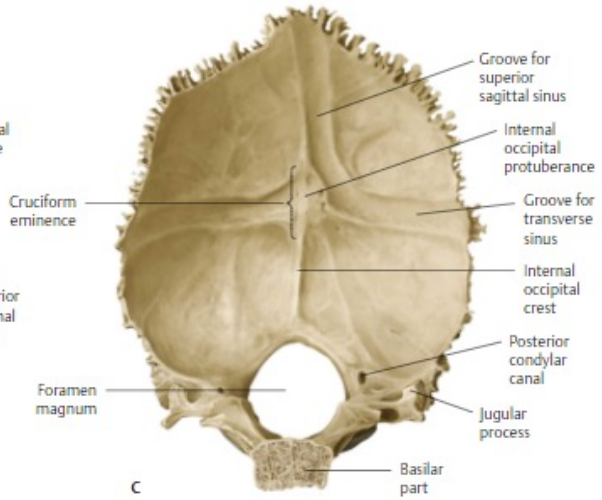
external occipital protuberance provides a palpable bony landmark on the occiput.

Foramen magnum

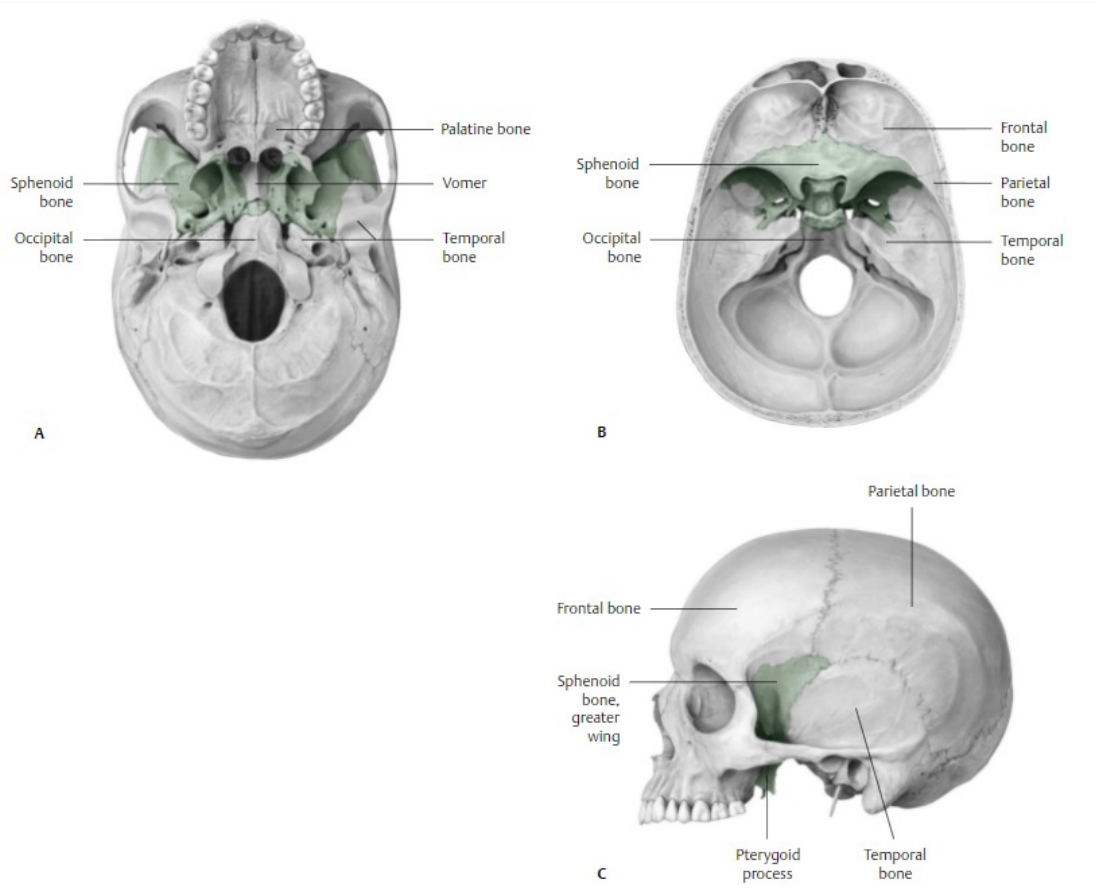
Hypoglossal canal



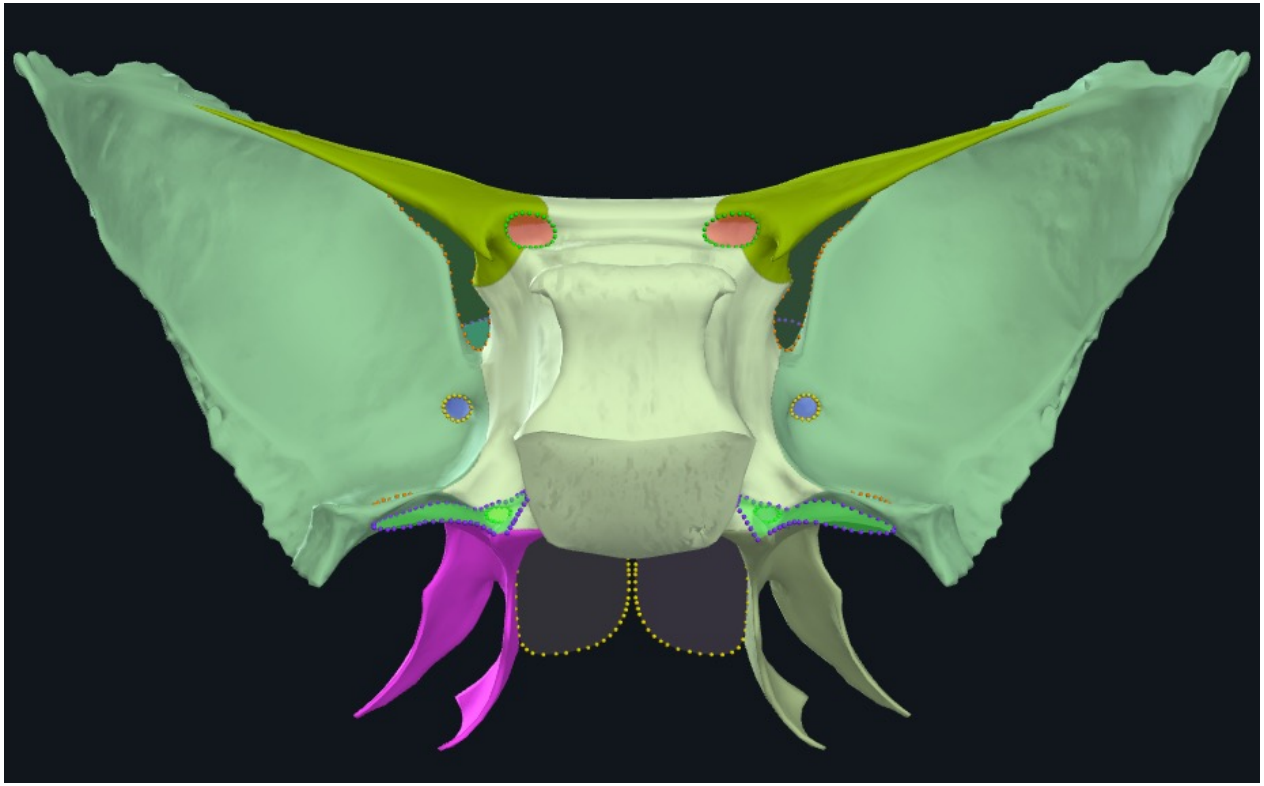




Sphenoid bone: articulates with frontal, parietal, occipital, zygomatic, ethmoidal and palatine bones and vomer.



Parts: body- median portion, greater wing- lateral side, lesser wing- anterior side (forms the boundary between the anterior and middle cranial fossae) and pterygoid processes- directed downwards



Sphenoid bone

Is a irregular bone of neurocranium

Its shape looks like butterfly

assists with the formation of the base and the sides of the skull, and the floors and walls of the orbits

It is the site of attachment for some muscles of mastication

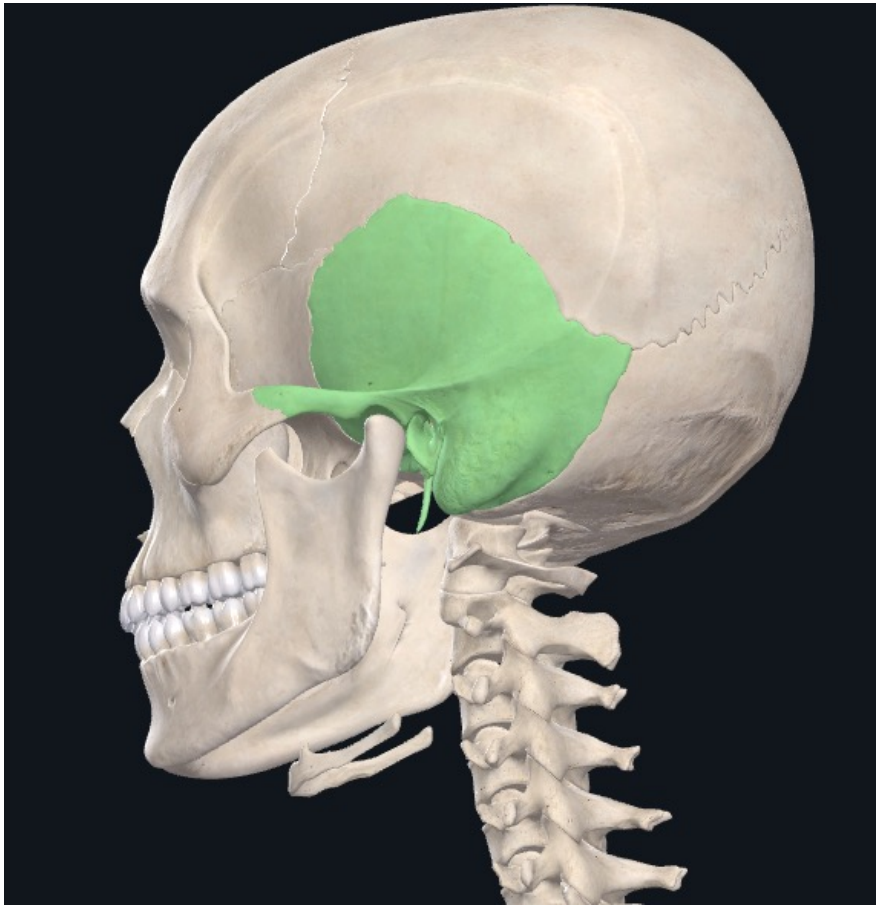
Foramen rotundum! Maxillary nerve

Foramen ovale! Mandibular nerve

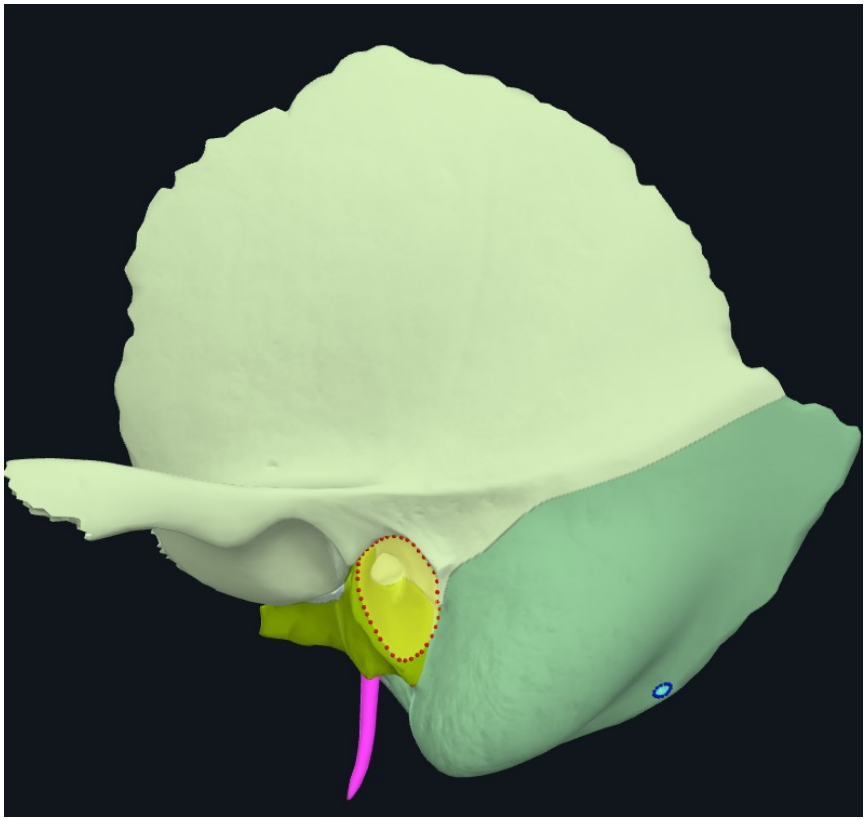
Foramen spinosum! Middle meningeal artery

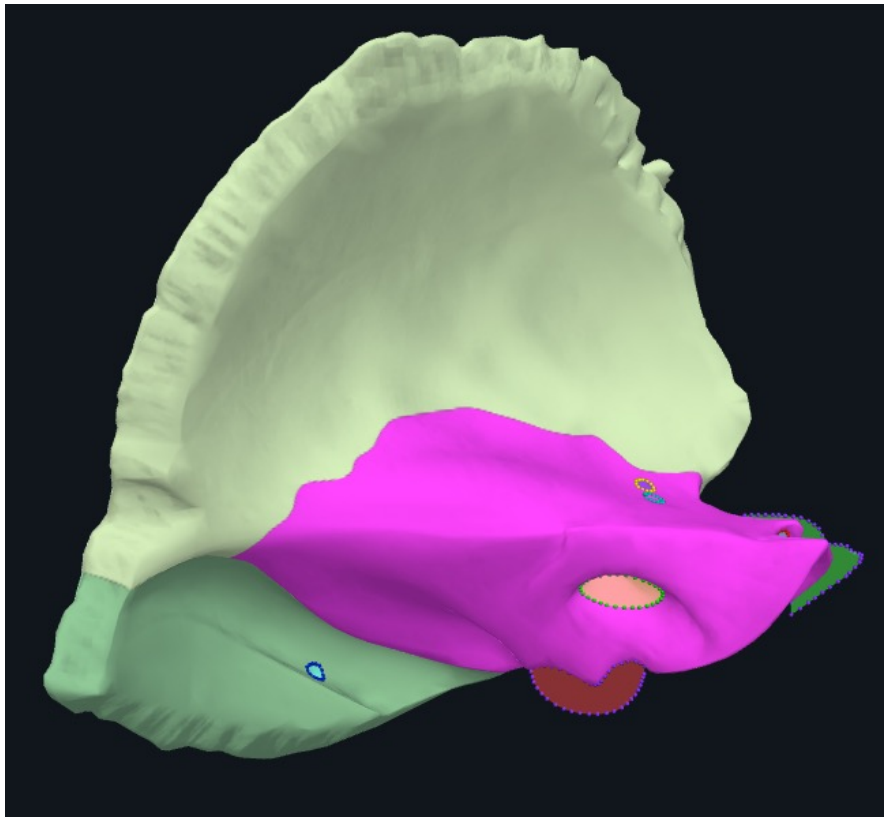
Contain sphenoid sinuses

Temporal bone: articulates with parietal, occipita, sphenoid and zygomatic bones



Parts: squamous – mandibular fossa TMJ, petrous - contains the auditory and vestibular apparatus, tympanic - forms large portions of the external auditory canal, mastoid process and styloid process





Temporal bone

Is a irregular bone of neurocranium

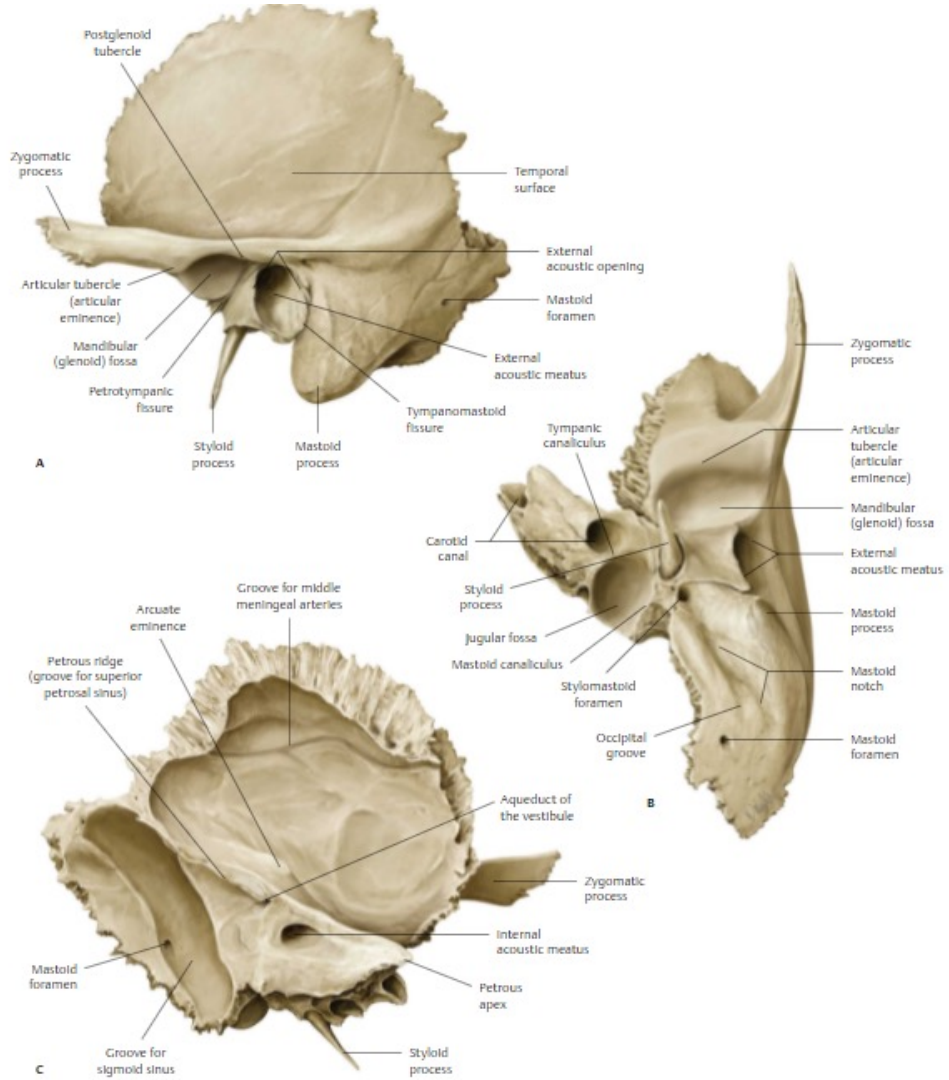
The mandibular (glenoid) fossa is articular fossa of the temporomandibular joint.(*squamous part*)

The facial nerve emerges from the base of the skull through the stylomastoid foramen.

Internal carotid artery passes through the carotid canal to enter the skull.

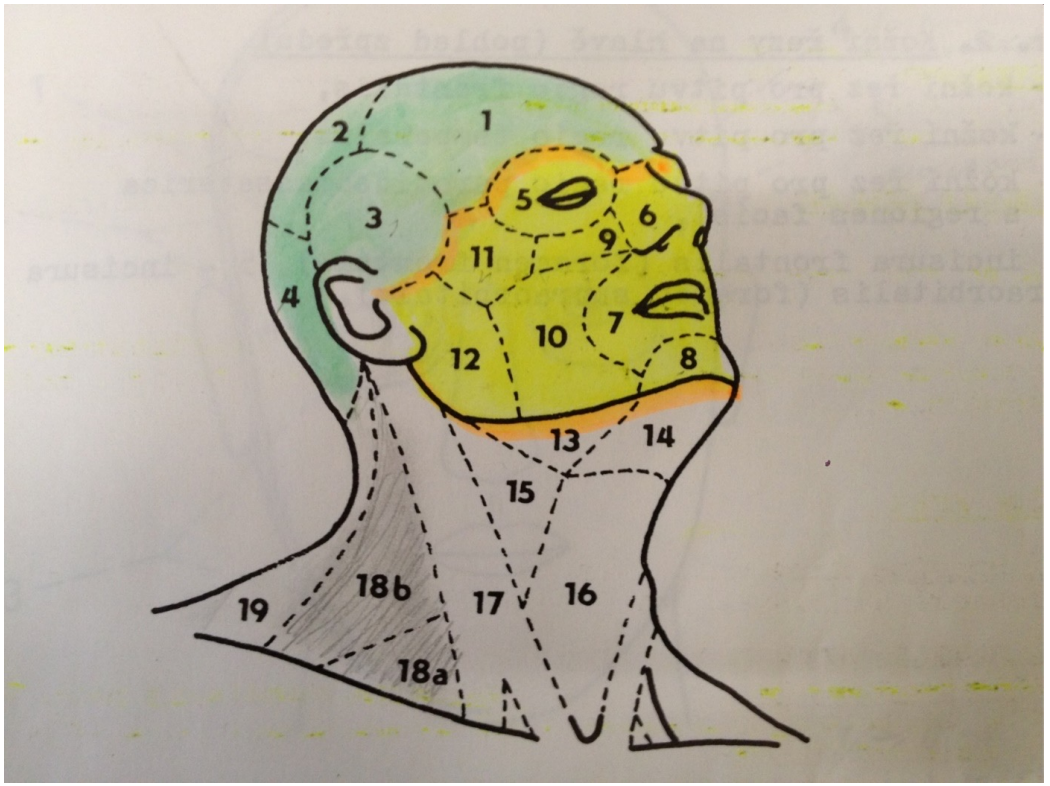
Contain middle ear and internal ear

Contain vestibular apparatus



Border between neurocranium and viscerocranium:

Line going from the external acoustic meatus alongside the zygomatic arch and the supraorbital margin to the root of the nose



• Borders between head and neck :

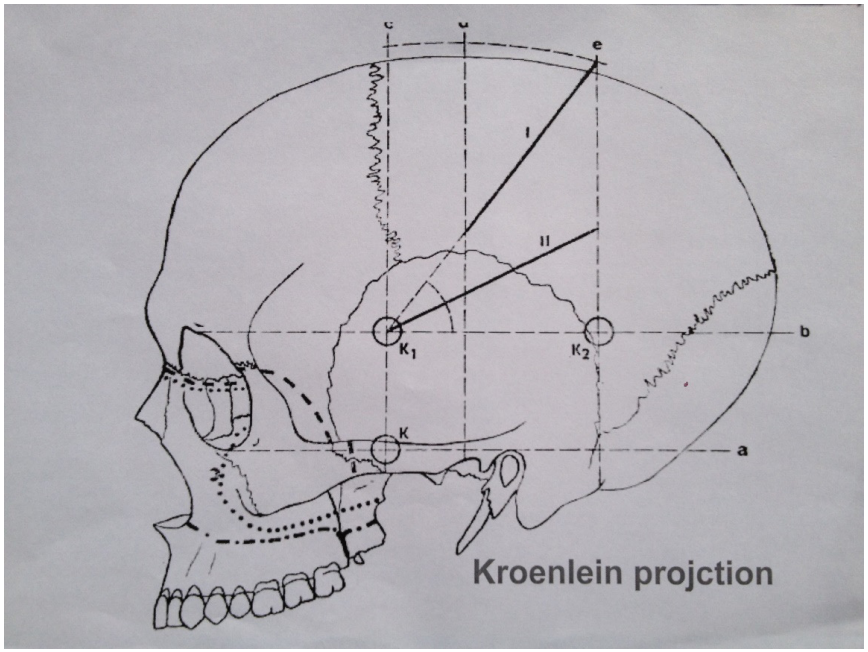
Superficial border: represents the line running from the external occipital protuberance along the superior nuchal line to the external acoustic pore (mastoid process), along the posterior margin of the ramus and angle of mandible,inferior margin of the body of the mandible to the chin

Deep border: does not correspond to the superficial border in the dorsal part, where it consists of the external cranial base and styloid septum, body of the mandible and the floor of the oral cavity

Border between neurocranium and viscerocranium:

- Line going from the external acoustic meatus alongside the zygomatic arch and the supraorbital margin to the root of the nose

In the anatomical position, the skull is oriented so that the inferior margin of the orbit and the superior margin of the external acoustic opening of both sides lie in the same horizontal plane.(Auriculoorbitalis plane or Frankfort horizontal plane).
It serves for basic orientation of head or skull in space through e.g. X-ray examination

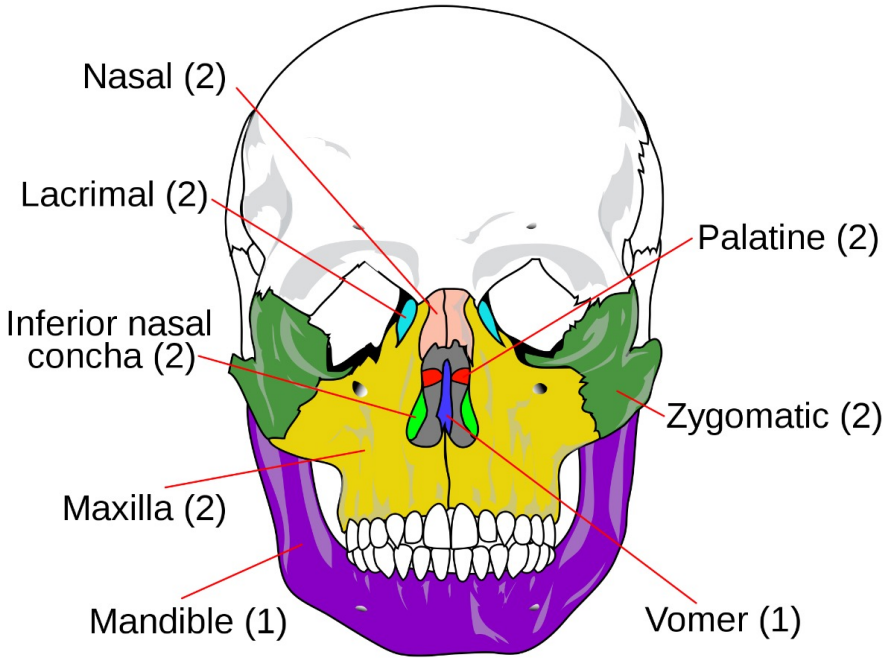


The imagination plane which connected an inferior border of nasal wing and a superior border of external auditory meatus.(Camper line) - is thought to be parallel more in the occlusal plane.
Camper line is Important for adjusting the position of the head during X-ray examination of upper teeth. During X-ray examining of the teeth in the lower jaw, the head is tilted so that the connection between the corner of the mouth and the tragus runs horizontally.

Between auriculoorbital line and Camper prosthetic line there is 10°až 15°angle.

The viscerocranium (or splanchnocranium) is situated anteriorly and forms the skeleton of the face as well as parts of the jaw

The viscerocranium (face) consists of 14 (15) bones : vomer, 2 inferior nasal conchae, 2 nasals, 2 maxilla, mandible, 2 palatine, 2 zygomatics, and 2 lacrimals, Ethmoid bone (except cribriform plate)

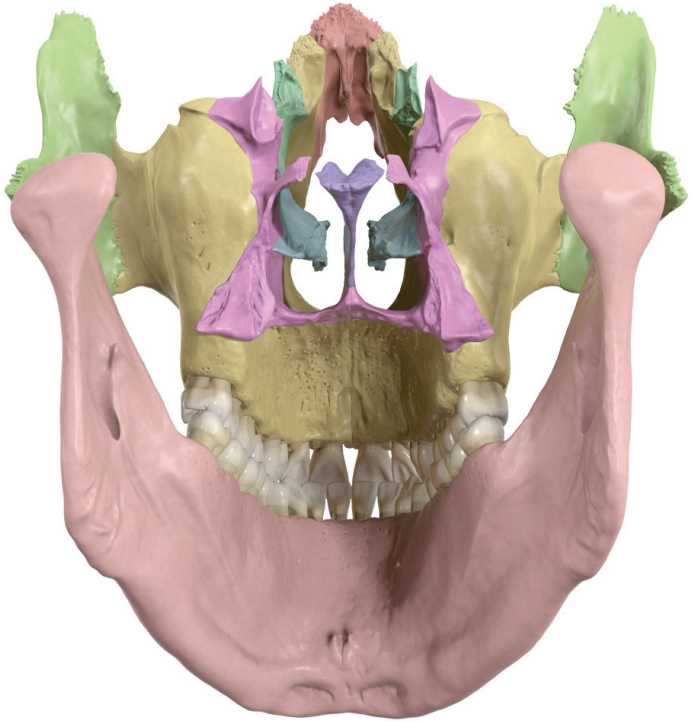


14 facial bones

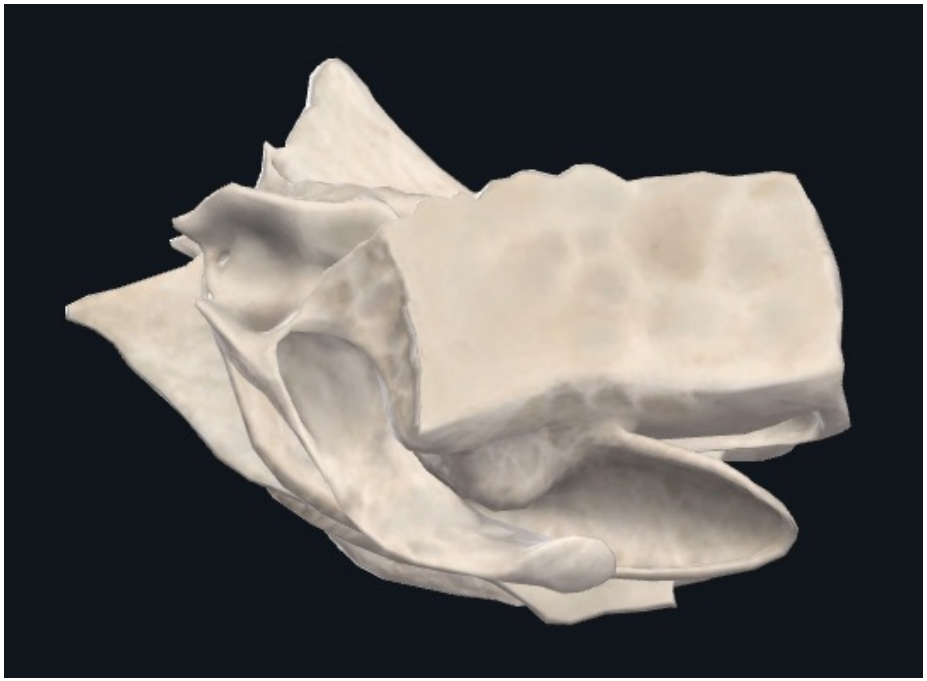
The viscerocranium (face) consists of 14 (15) bones : vomer, 2 inferior nasal conchae, 2 nasals, 2 maxilla, mandible, 2 palatine, 2 zygomatics, and 2 lacrimals, Ethmoid bone (except cribriform plate)

Bones of viscerocranium fuse to house the orbits of the eyes, the nasal and oral cavities.
Provides attachment sites to muscles of the head.

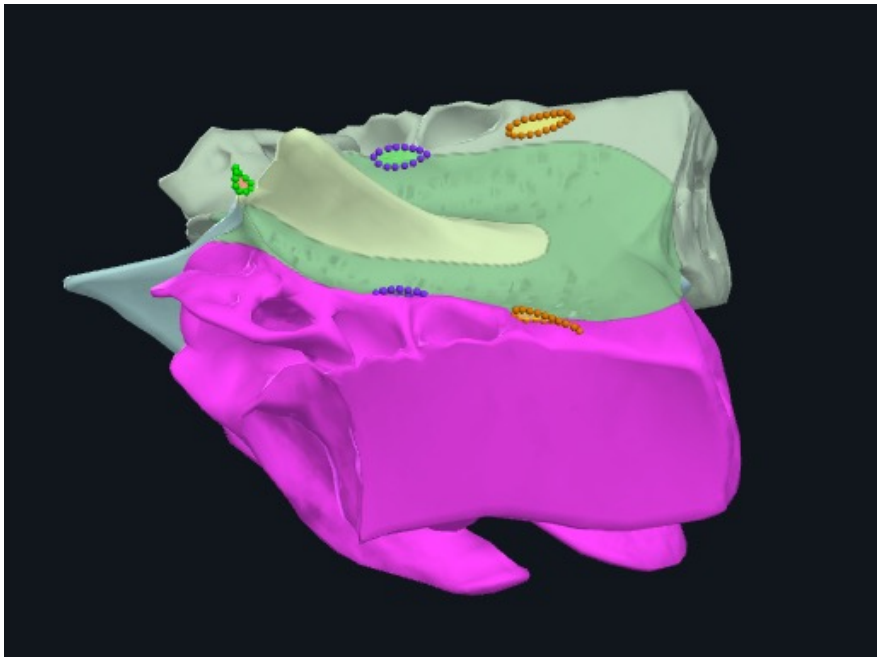
Accommodates the teeth and sensory structures for vision,hearing, smell and taste.



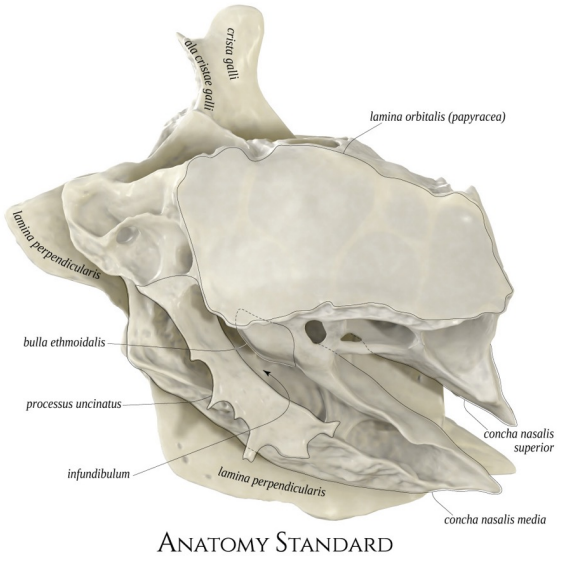
Ethmoid bone: articulates with frontal, sphenoid, palatine, lacrimal, nasal bones and maxillae, inferior nasal conchae and vomer

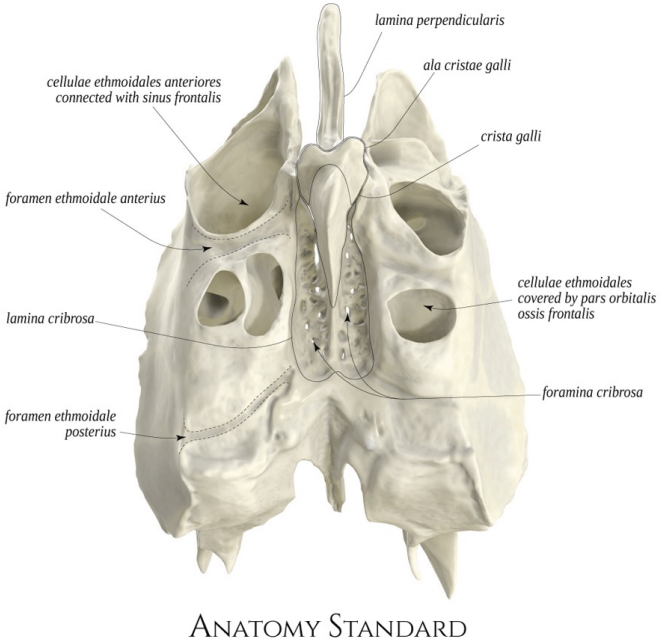


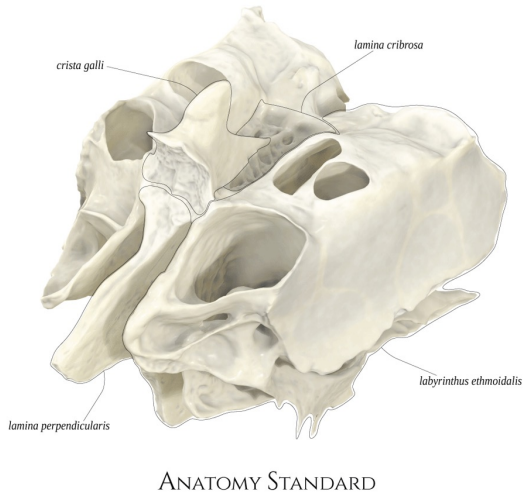
Parts: cribriform plate, perpendicular plate, Ethmoidal labyrinths



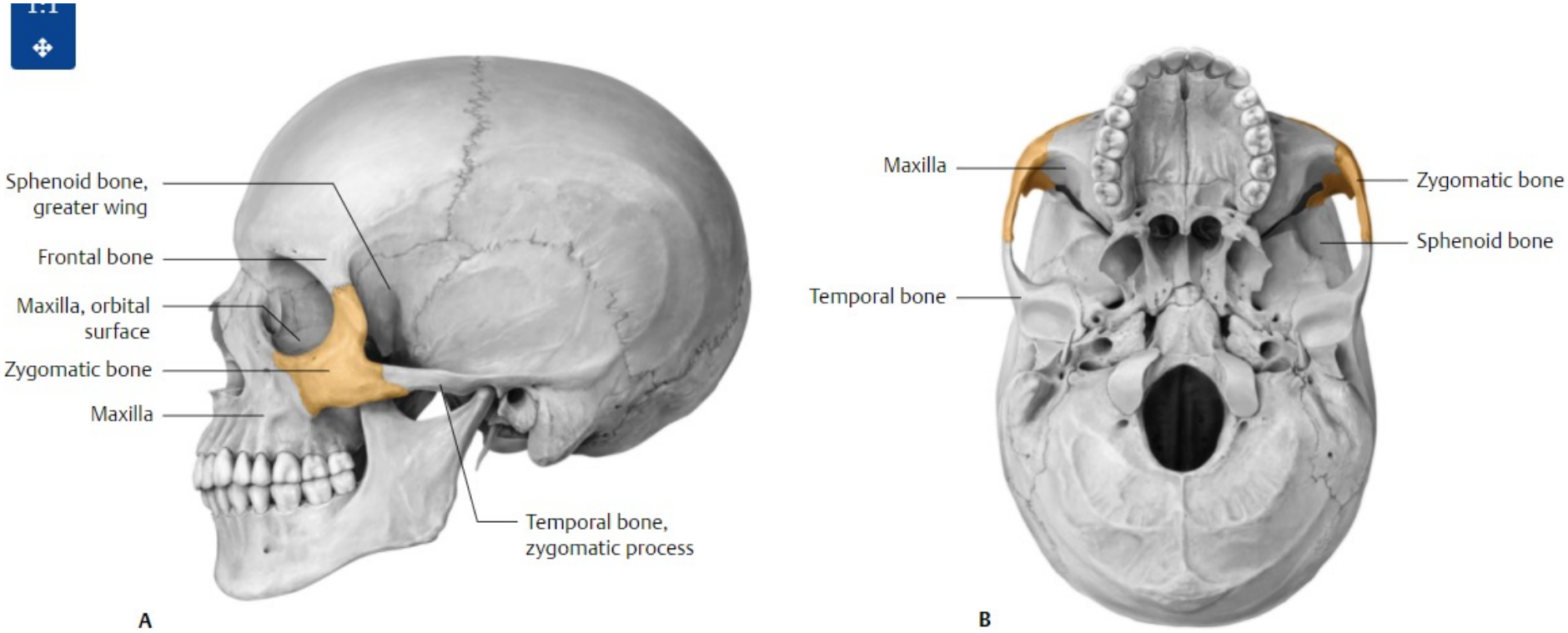
Irregular bone of neurocranium (cribriform plate) and viscerocranium (the rest).
Very fragile bone
contributes to the nasal cavity, superior and anterior part of nasal septum and medial wall of the orbit (Fracture of the lamina papyracea permits communication between the nasal cavity and the orbit).
Contains anterior, middle and posterior air-filled sinuses (cells).
located at the roof of the nose and between the orbits and separates the nasal cavity from the brain(trauma can lead to a leak of cerebrospinal fluid into the nasal cavity).
Contain superior and middle nasal concha







Zygomatic bone: articulates with frontal, temporal and sphenoid bones and maxilla



Zygomatic bone (malar or cheek bone)

Irregular bone of viscerocranium

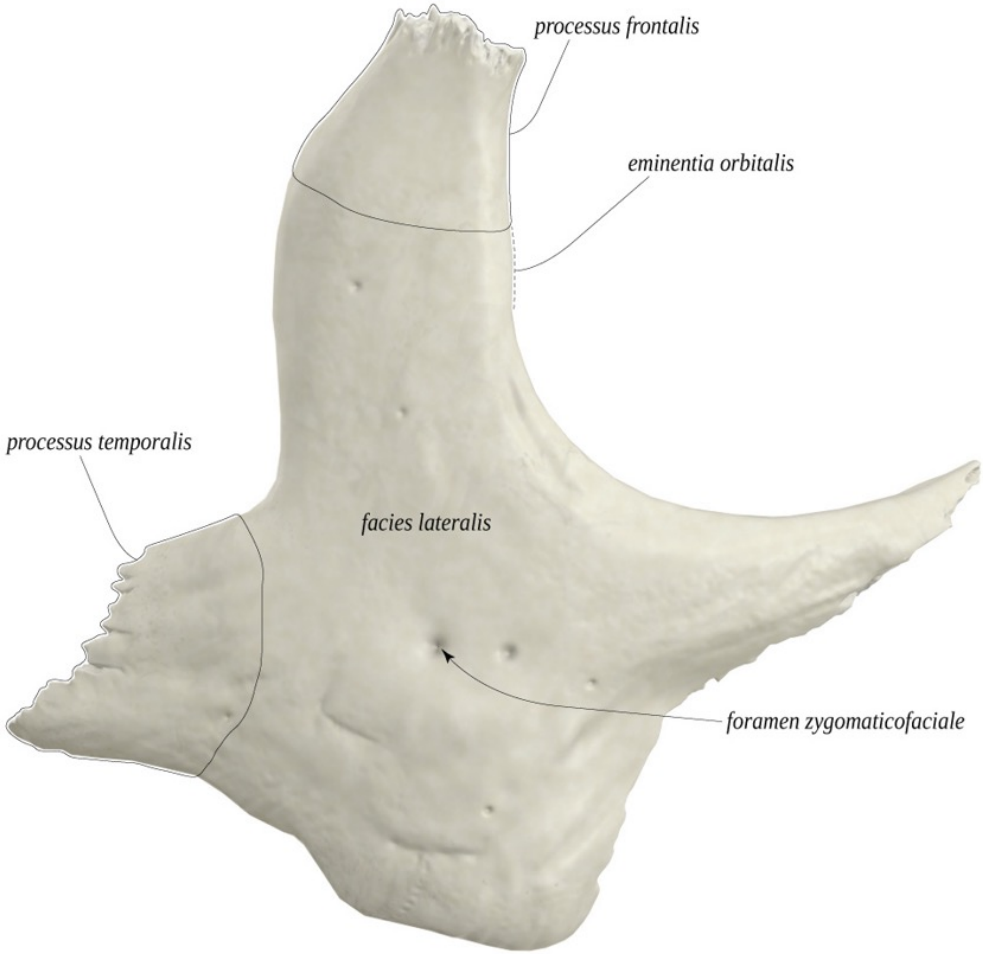
Connects neurocranium with viscerocranium

Form the prominence of the cheeks, a portion of the lateral wall and floor of orbit, and some portions of the temporal fossa and infratemporal fossa

Place for attachment of masseter muscle

3 processes, 3 surfaces, 3 foramens

Prominent position on the face leaves it vulnerable to fracture following trauma.



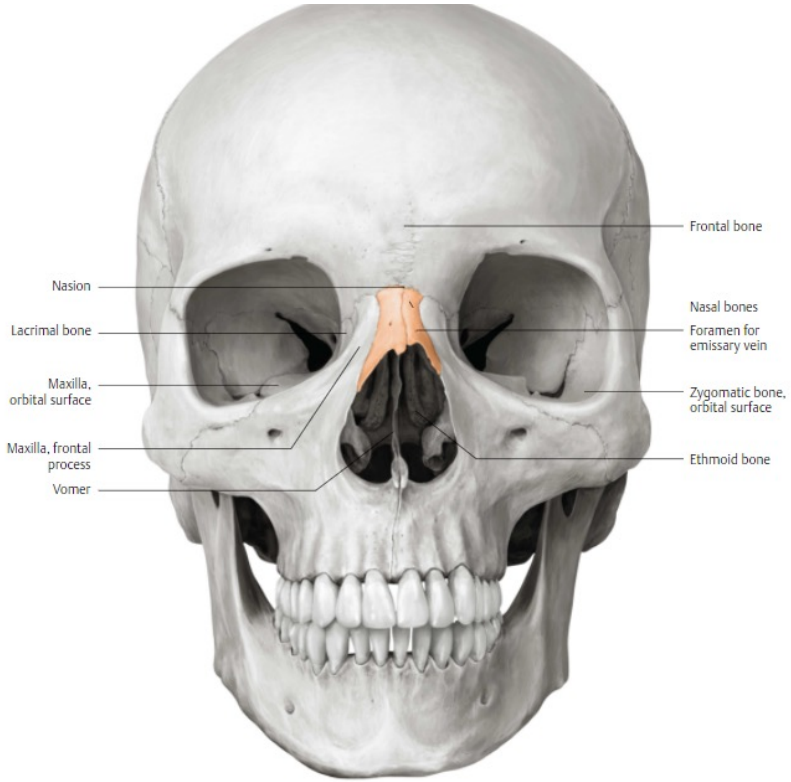
Os zygomaticum ex situ

ANATOMY STANDARD

Nasal bone: Articulates with frontal, ethmoidal, opposit nasal bone and maxila.

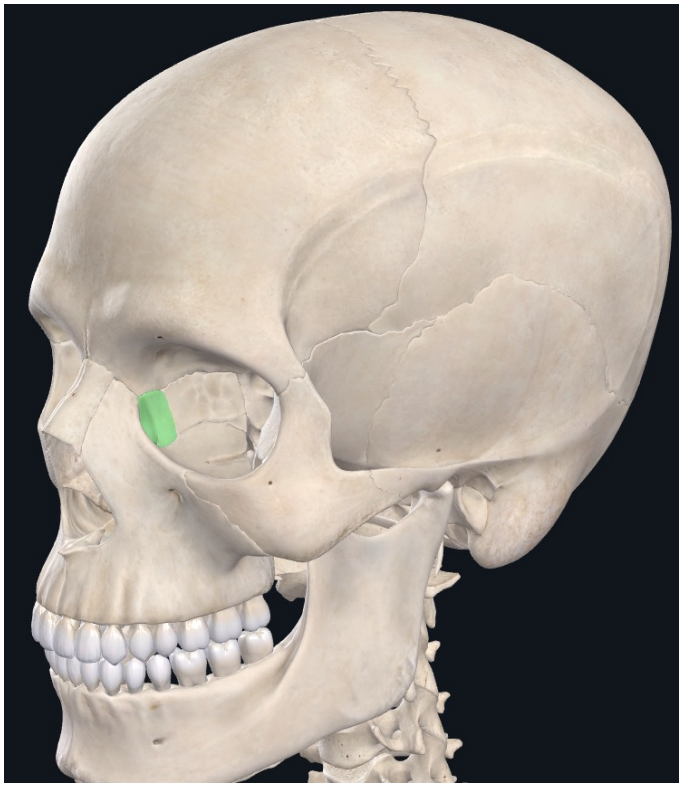
Flat bone of viscerocranium.

Fractures of the nasal bones are common following facial trauma.



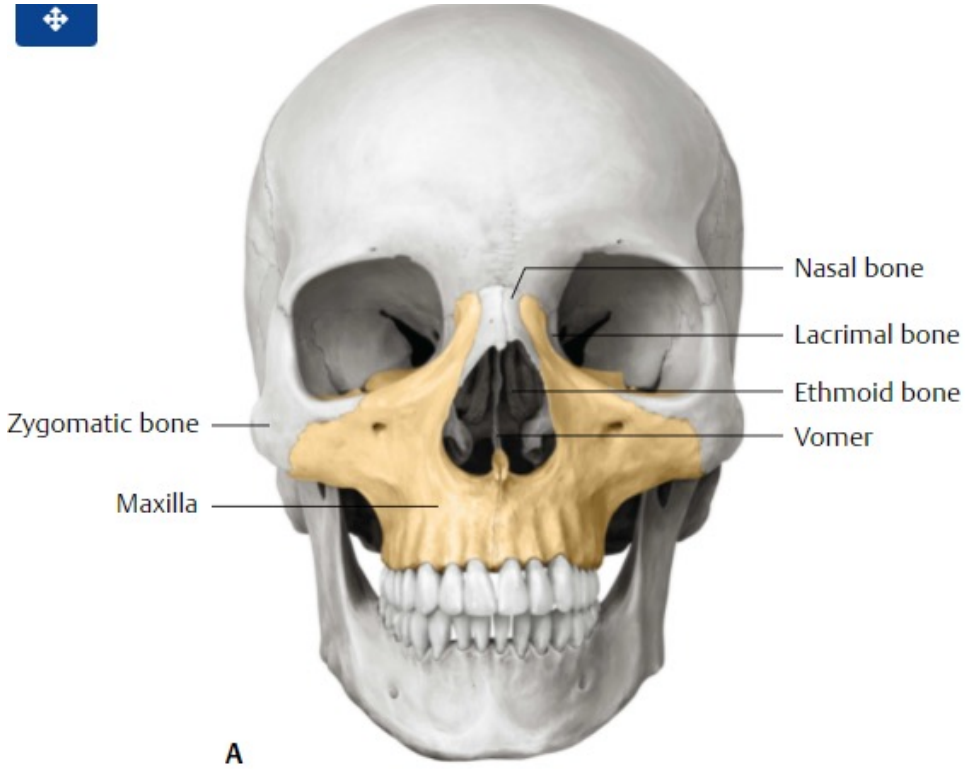
Vomer: articulates with sphenoid, ethmoid, palatine bones and maxila.
Flat bone of viscerocranium.
Forms the inferior and posterior part of the nasal septum

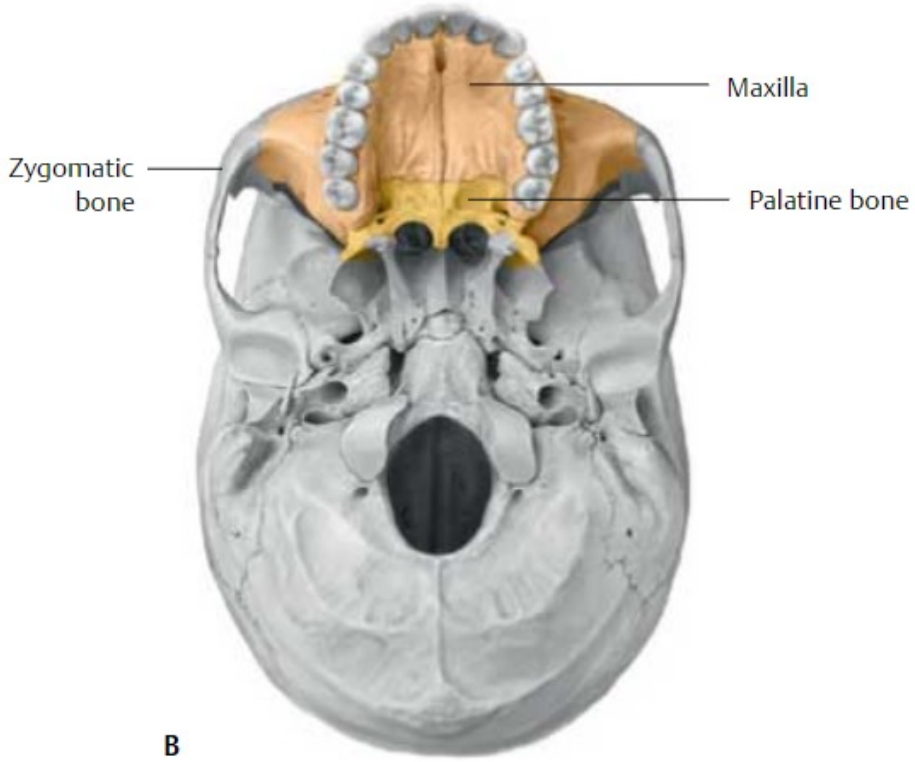
Lacrimal bone: Articulate with frontal and ethmoid bones, inf. Nasal concha and maxila.
Irregular fragile bone of viscerocranium.
Forms part of the medial wall of the orbit.
Helps form the nasolacrimal canal necessary for tear translocation



Inferior nasal concha bone: Articulates with palatine, ethmoid, lacrimal and maxilla.
Irregular bone of viscerocranium.

Maxilla (upper jaw): articulates with opposite maxila, frontal, ethmoid, lacrimal, nasal, palatine, zygomatic vomer, inferior nasal





Maxilla

Irregular bone of viscerocranium

4 processes, 4 surfaces

The alveolar process of the maxillae holds the upper teeth, and is referred to as the maxillary arch.

Forms the roof of the oral cavity, the floor and lateral wall of the nasal cavity, floor and medial wall of the orbit.

Forms anterior border of the infratemporal and pterygopalanie fossae

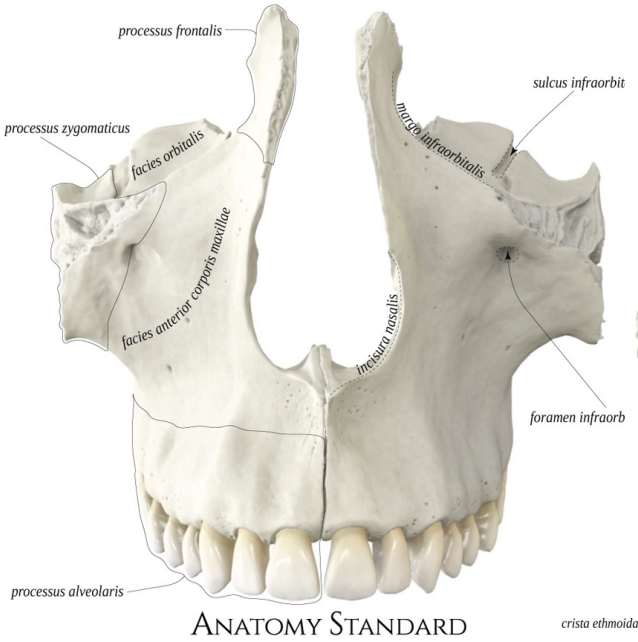
Consists of maxillary sinus **(antrum of Highmore)**

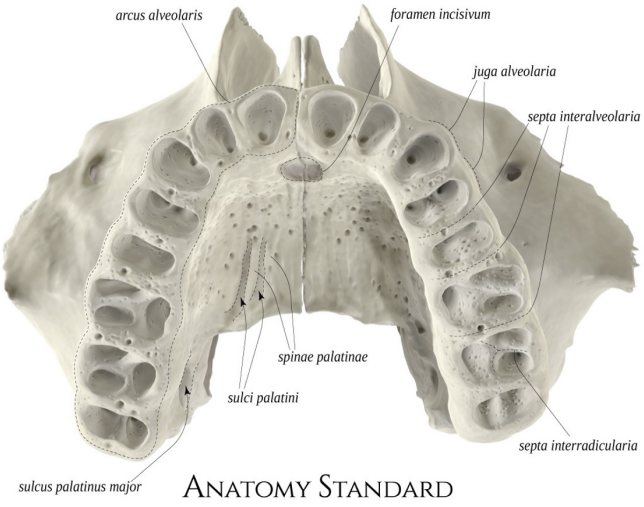
Infraorbital foramen- passage of the infraorbital nerve and vessels – (pressure point for examination of the 2nd branch of the trigeminal nerve).(place for application of block anesthesia).

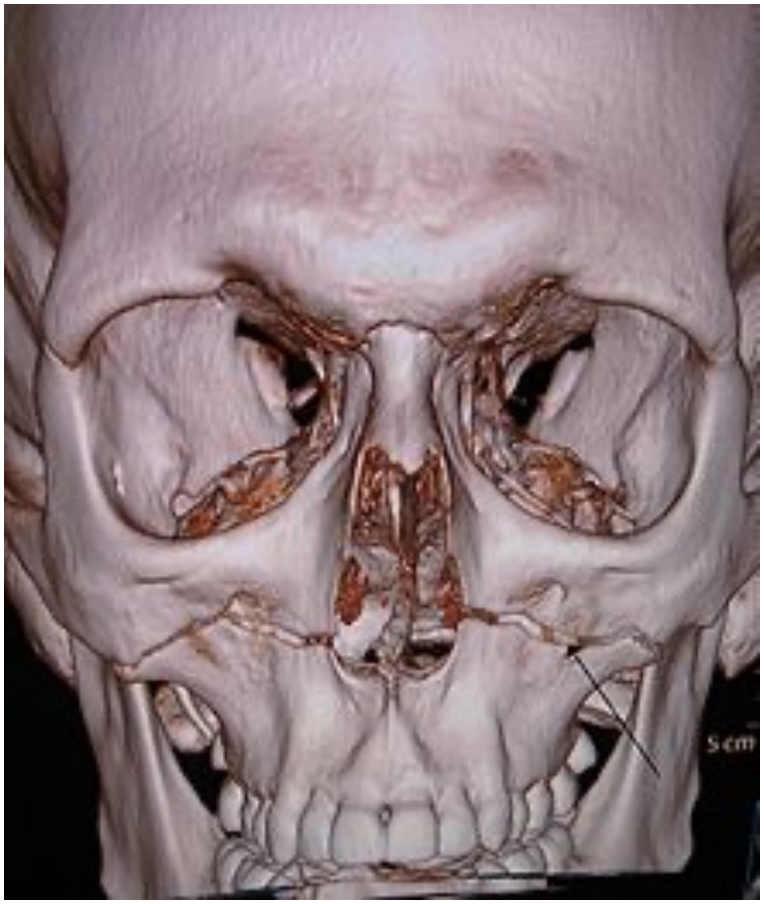
Posterior superior alveolar foramens and canals at the **maxillary tuberosity** passage of posterior superior alveolar nerves and vessels (place for application of block anesthesia).

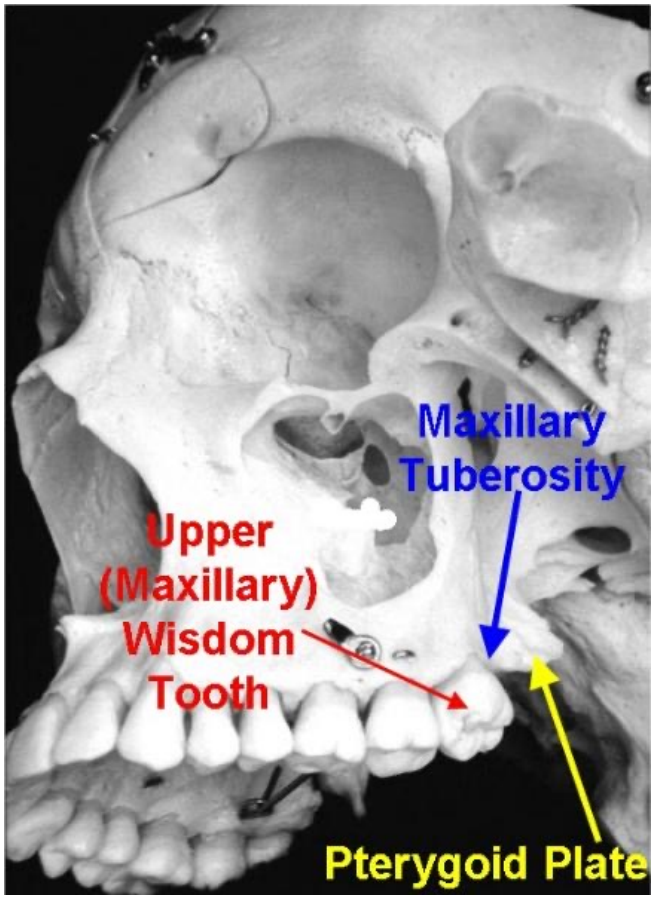
Incisive foramen- Passage of nasopalatine nerve and vessels (place for application of block anesthesia).

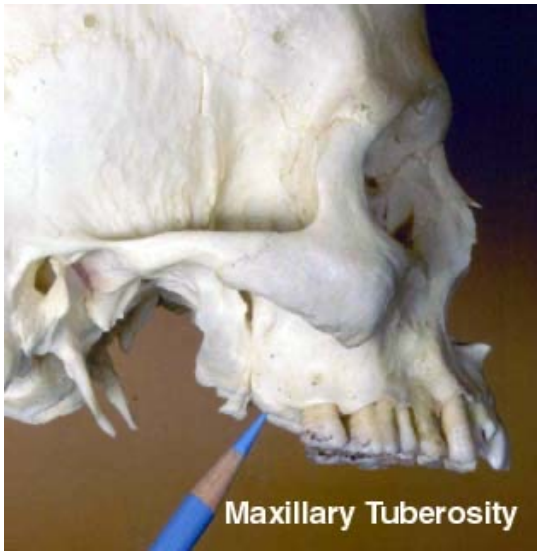
Maxilla fractures are classified according to the Le Fort classification





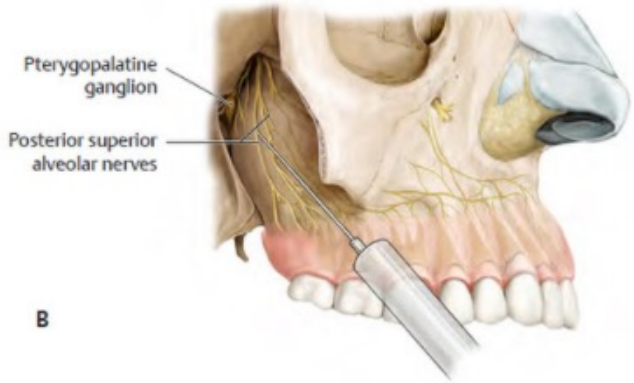



Maxillary
Tuberosity
Upper
(Maxillary)
Wisdom
Tooth
Pterygoid Plate


Maxillary Tuberosity

Posterior superior alveolar nerve block at the maxillary tuberosity

A



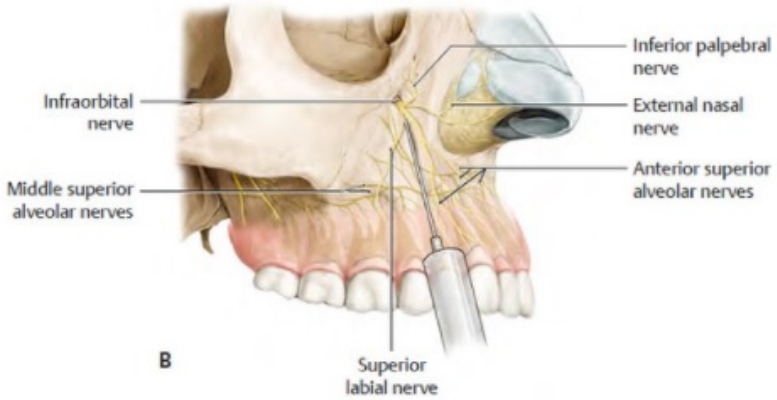
B

C

D

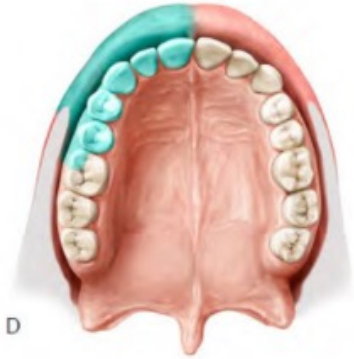
Infraorbital nerve block

A



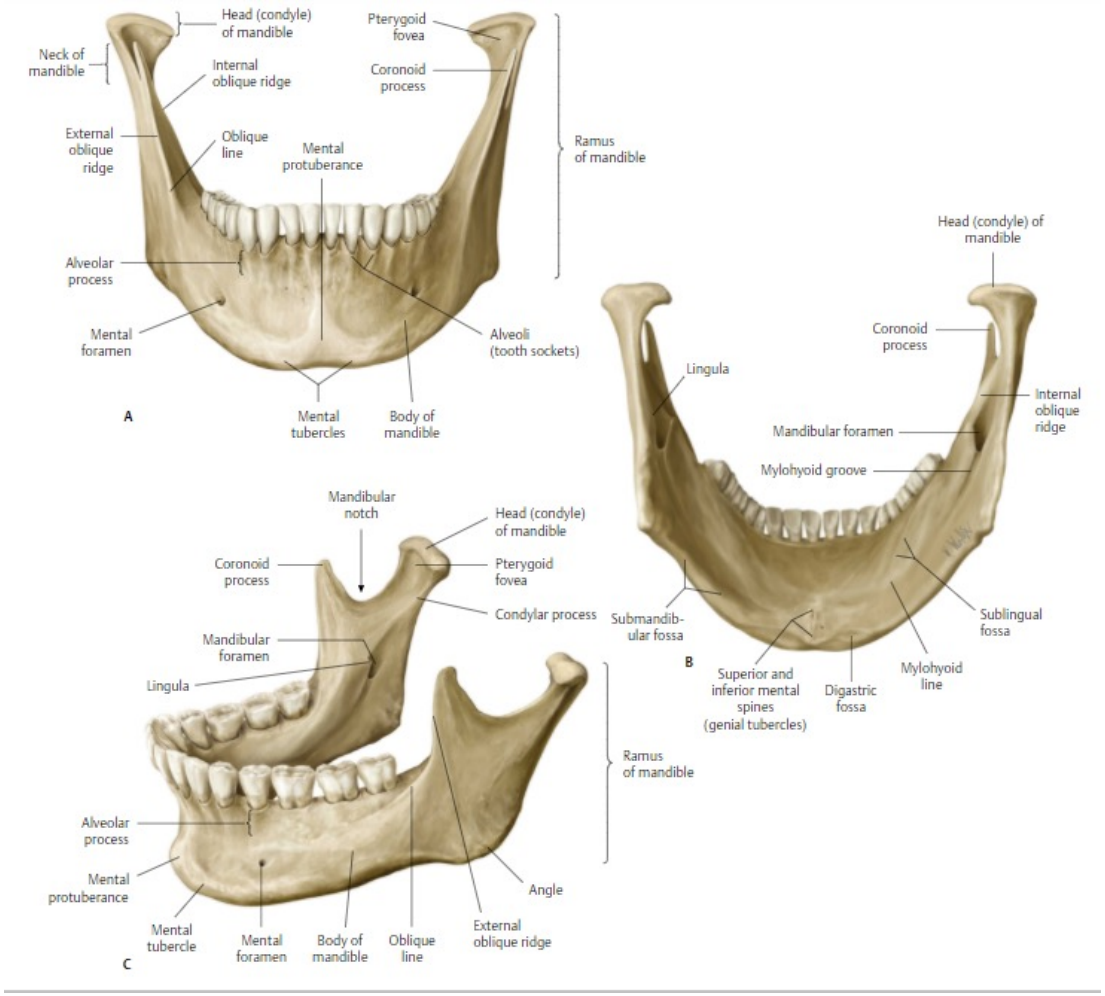
B

C

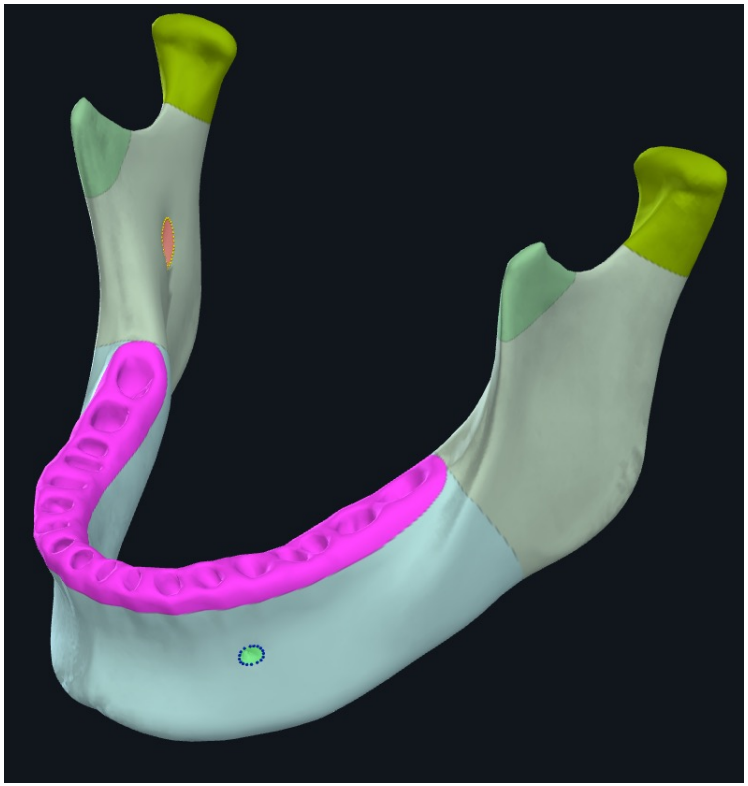


D

Mandible (lower jaw): Articulates with temporal bone at the temporomandibular joints



Parts: body, angle, ramus, condylar and coronoid (muscular) processes.



Mandible

Irregular bone of viscerocranium.

largest, strongest and lowest bone in the human facial skeleton,

holds the lower teeth in place.

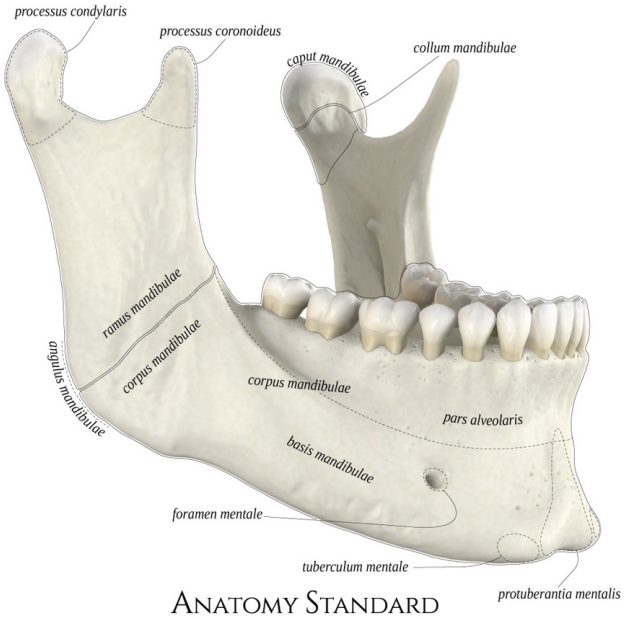
It is the only movable bone of the skull.

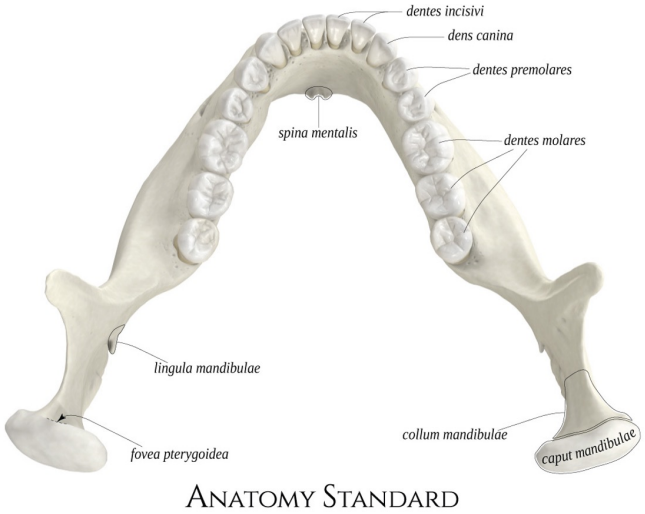
The front part gives structure to the chin – **mental protuberance**

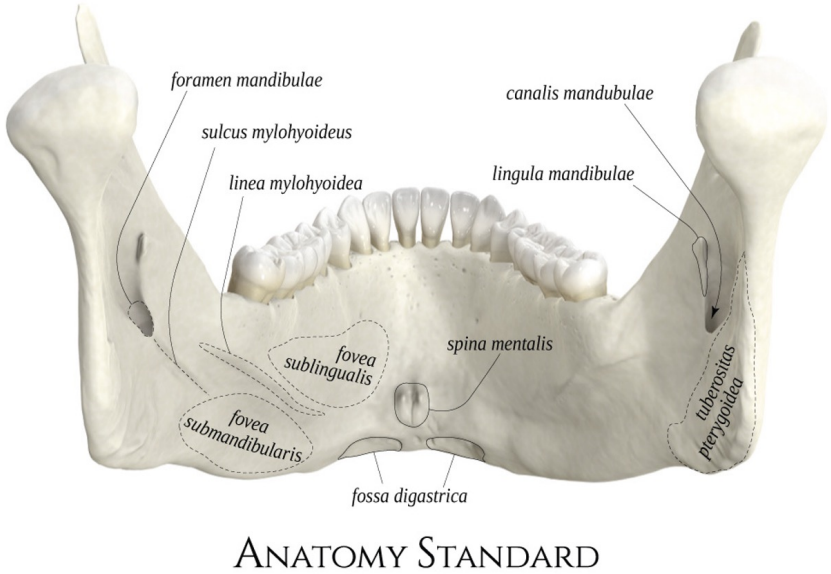
Mental foramen: passage of the mental nerve and vessels – (pressure point for examination of the 3rd branch of the trigeminal nerve).(Place for application of the block anesthesia)

Mandibular foramen: place for application of block anesthesia of inferior alveolar nerve.

One fifth of facial injuries involve a mandibular fracture.



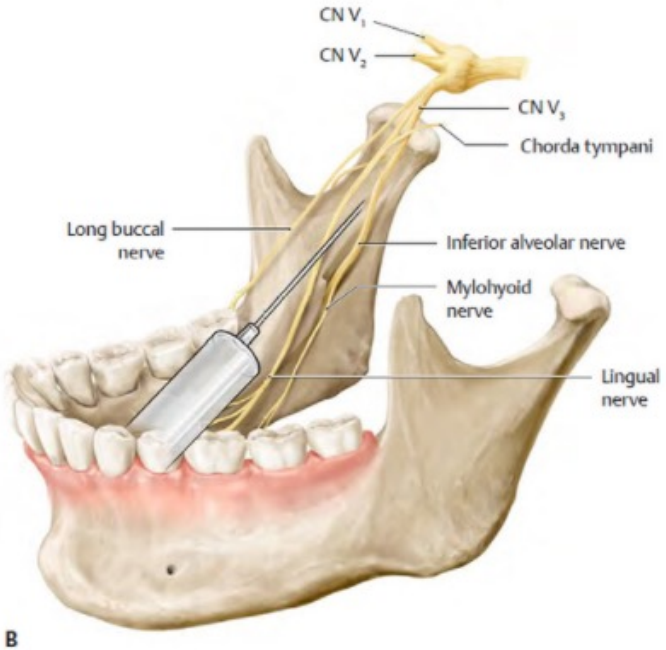




Inferior alveolar nerve block and mental nerve block

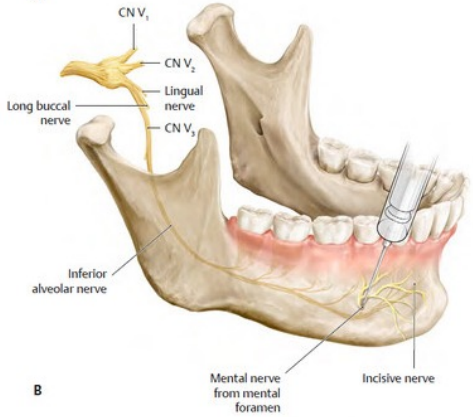
A

C

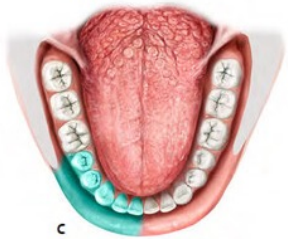


B

A



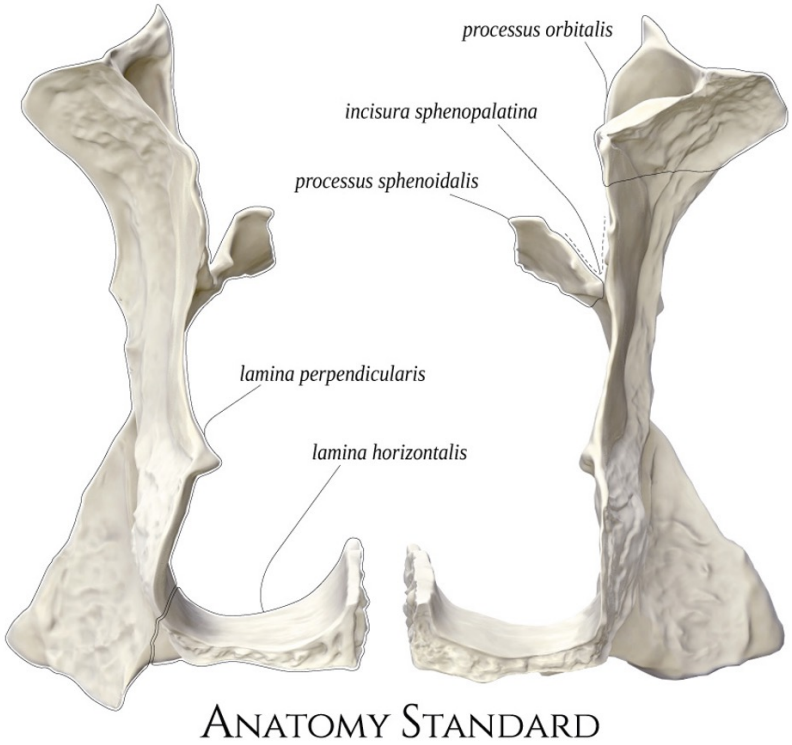
B

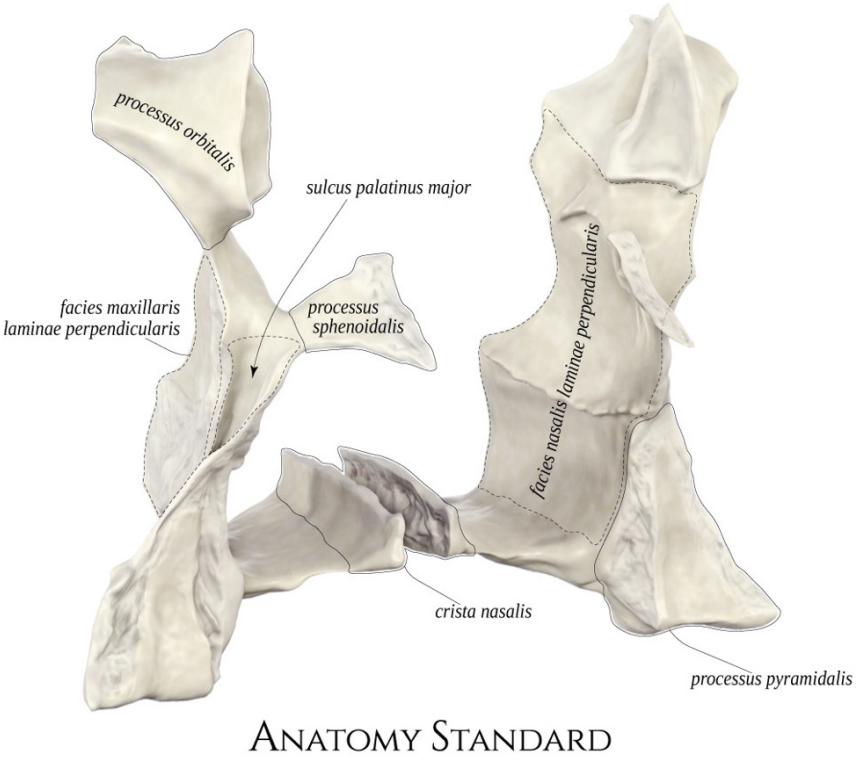


C

Palatine bone: articulates with opposite palatine bone,sphenoid and ethmoid bones and maxila, vomer and inferior nasal concha.

Parts: perpendicular plate, horizontal plate, orbital, sphenoidal and pyramidal processes





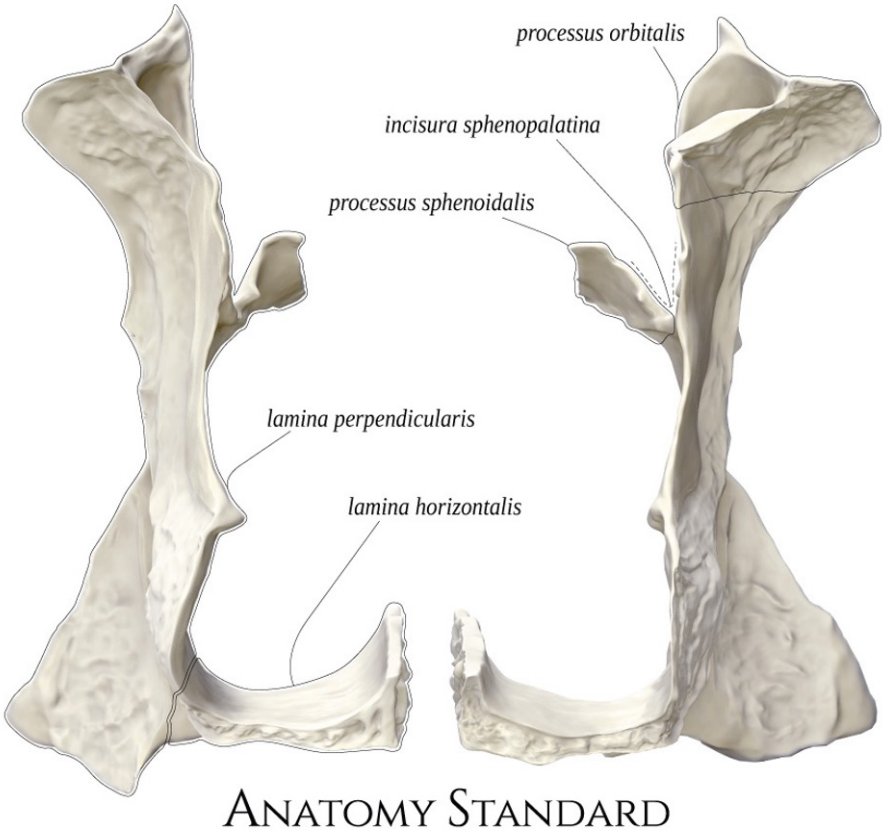
Palatine bone

Irregular bone of viscerocranium.

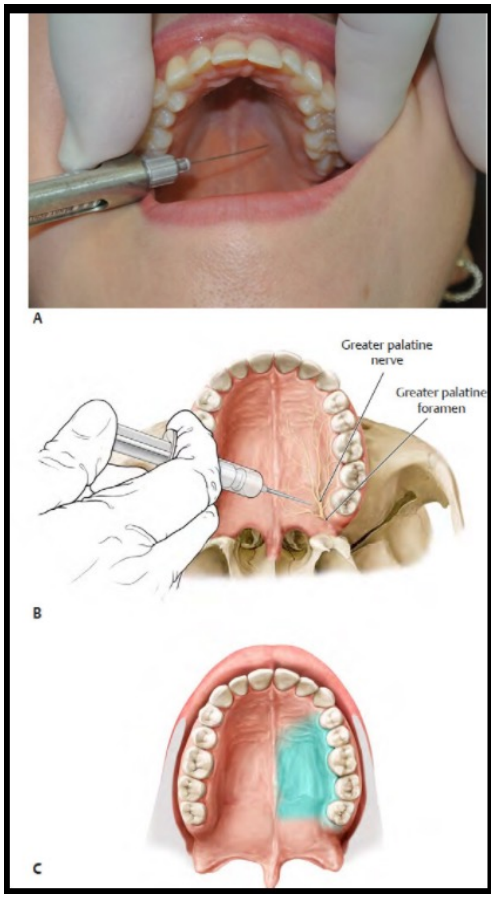
Contribute to the formation of the posterior 1/3 of bony hard palate and floor and lateral walls of the nasal cavity, roof of the oral cavity, floor of the orbit.

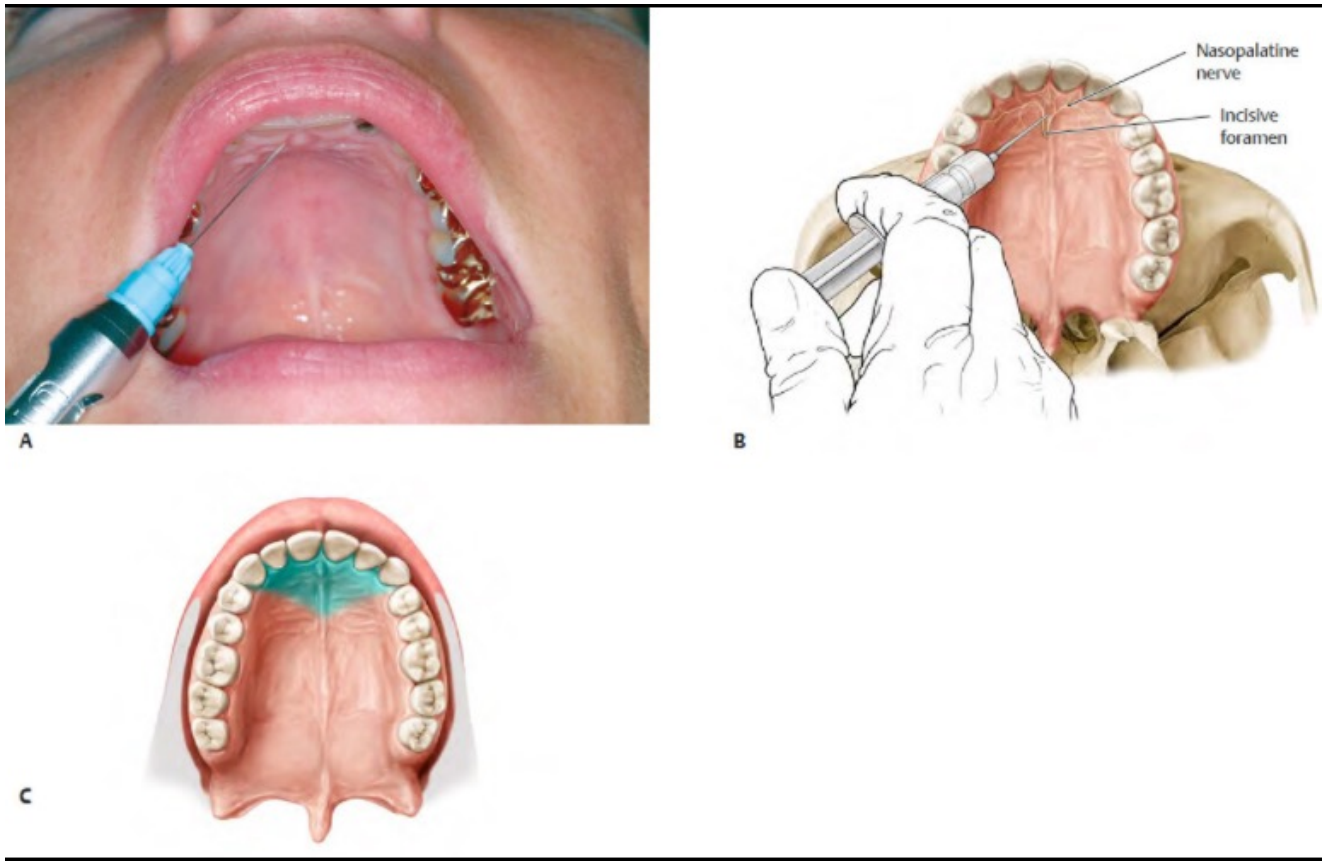
Forms medial wall of the pterygopalatine fossa

The greater palatine foramen lies ~0.5 to 1.0 cm mesial to the margin of the gingiva at the distal border of the maxillary second molar (place for application of the block anesthesia).



Greater palatine nerve block and nasopalatine nerve block





Thank you for your attention