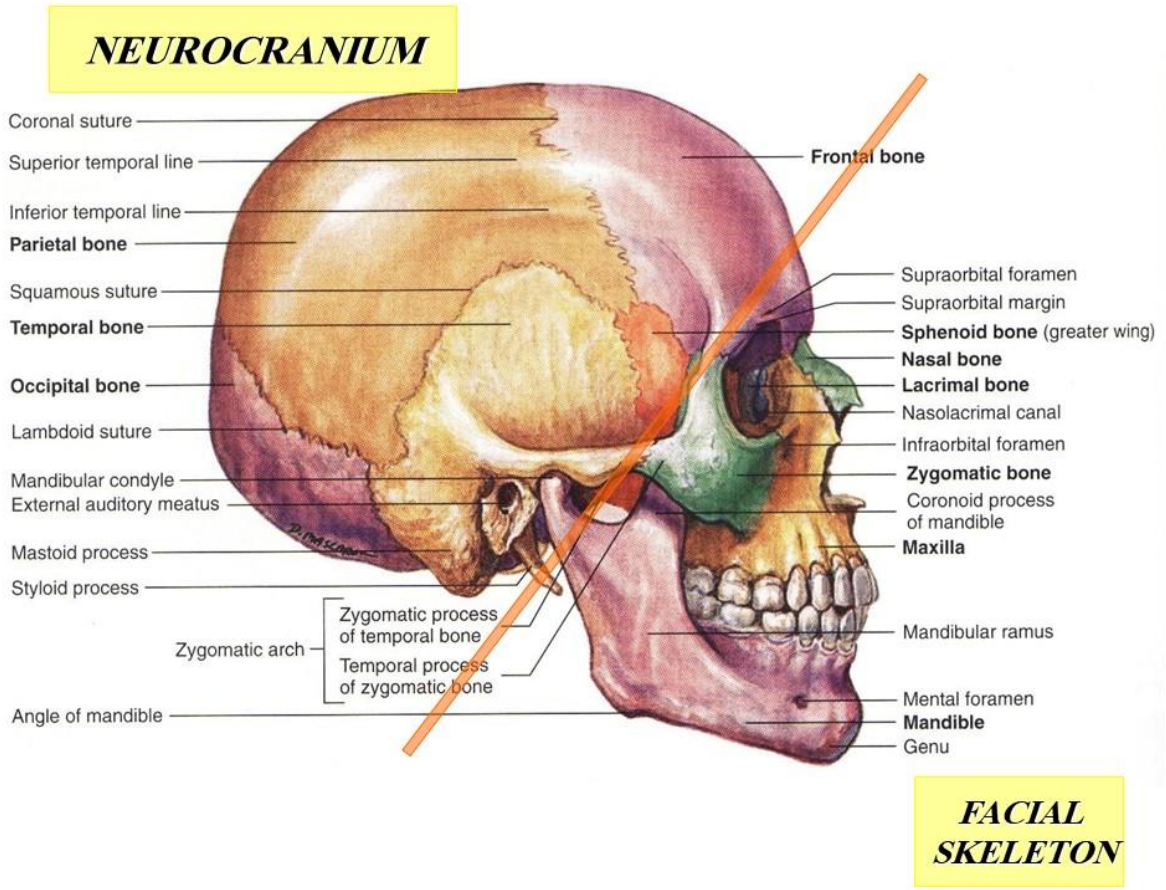
The Skull (Cranium)

- Parts, names, articulations:

a. The calvaria (=brain box=neurocranium) is the upper part of the cranium which encloses the brain. It consists of a skull cap/vault (upper part) and a base (lower part).

b. The facial skeleton (viscerocranium) constitutes the rest of the skull and includes the mandible.



Bones of the skull may be paired (right & left) or single. Single bones are found at or near the midline. All bones of the skull articulate by fibrous joints called sutures except at three areas which are made up of synovial joints:

1. The temporomandibular joint
2. & 3. Two joints between the three auditory ossicles (incus, malleus, stapes).

Names of the skull bones according to region

a. The calvaria or brain case is composed of 14 bones including three paired ear ossicles.

Paired	Unpaired
1. Parietal (2)	1. Frontal (1)
2. Temporal (2)	2. Occipital (1)
3. Malleus (2)	3. Sphenoid (1)
4. Incus (2)	4. Ethmoid (1)
5. Stapes (2)	

b. The *facial skeleton* is composed of 14 bones.

Paired	Unpaired
1. Maxilla (2)	1. Mandible (1)
2. Zygomatic (2)	2. Vomer (1)
3. Nasal (2)	
4. Lacrimal (2)	
5. Palatine (2)	
6. Inferior nasal concha (2)	

- How to study the skull

The skull is best studied as a whole.

1. The whole skull can be studied from the outside or externally in different views:

a. Anterior view (norma frontalis)
b. Superior view (norma verticalis)
c. Posterior view (norma occipitalis)
d. Lateral view (norma lateralis)
e. Inferior view or norma basalis

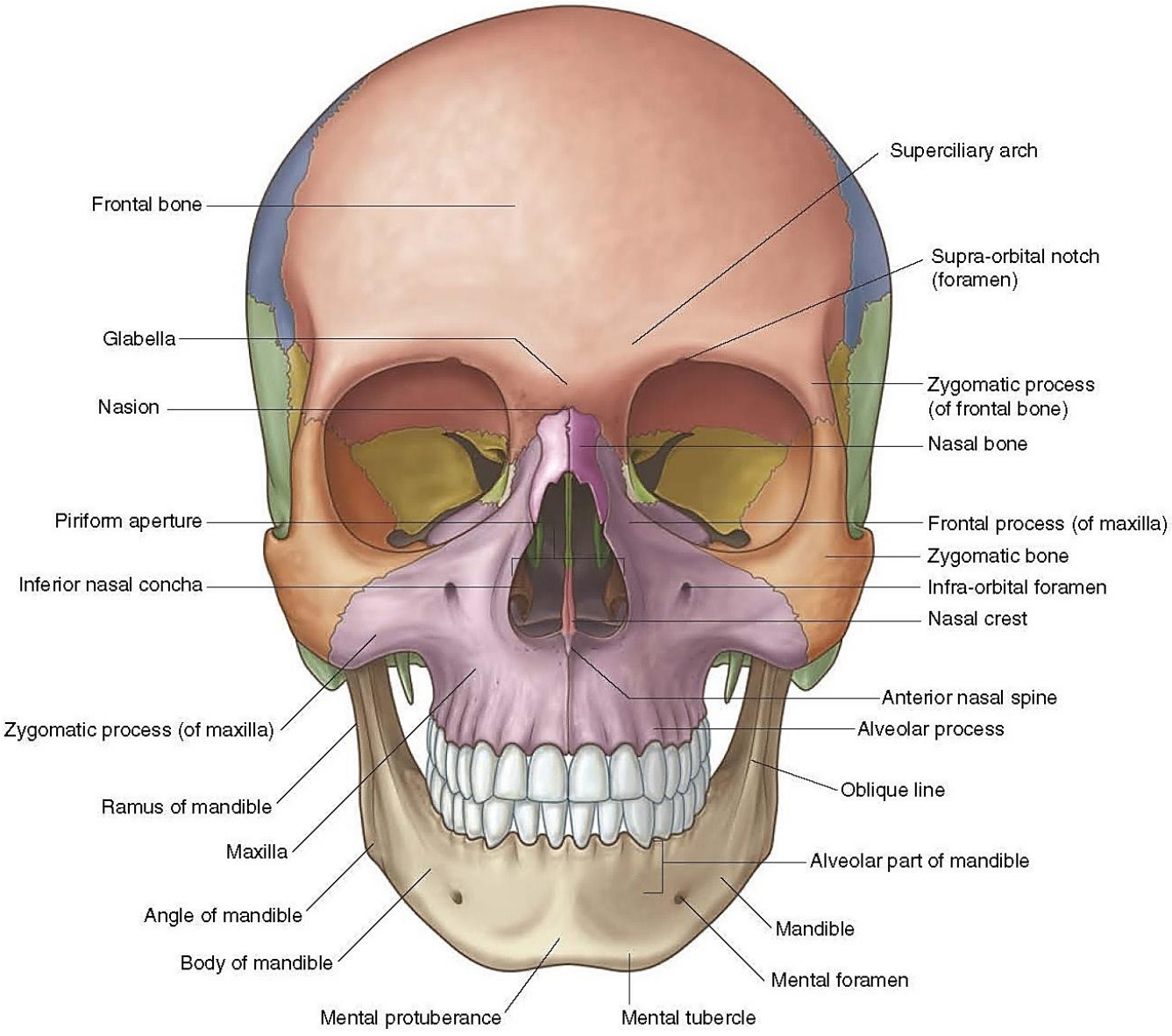
2. The whole skull is also studied from the inside (cranial cavity) after removing the roof of the calvaria or skull cap by studying the:

a. Internal surface of the cranial vault.

b. Internal surface of the cranial base which shows a natural subdivision into anterior, middle & posterior cranial fossae.

In each view, you should be able to identify the individual bones and how they articulate. Foramina or fissures I each view lead from one area of the skull to another and transmit certain structures as shown in the illustrations below.

Anterior view (norma frontalis)



The norma frontalis is roughly oval in outline, being wider above than below.

Bones, Sutures & Regions

1. Frontal bone forms the forehead.

2. The right and left maxillae form the upper jaw.

3. The right and left nasal bones form the bridge of the nose.

4. The zygomatic bones form the bony prominence of the superolateral part of the cheeks.

5. The mandible forms the lower jaw.

- These bones meet at the following sutures:

- Internasal
- Frontonasal
- Nasomaxillary
- Lacrimomaxillary
- Frontomaxillary
- Intermaxillary
- Zygomaticomaxillary
- Zygomaticofrontal

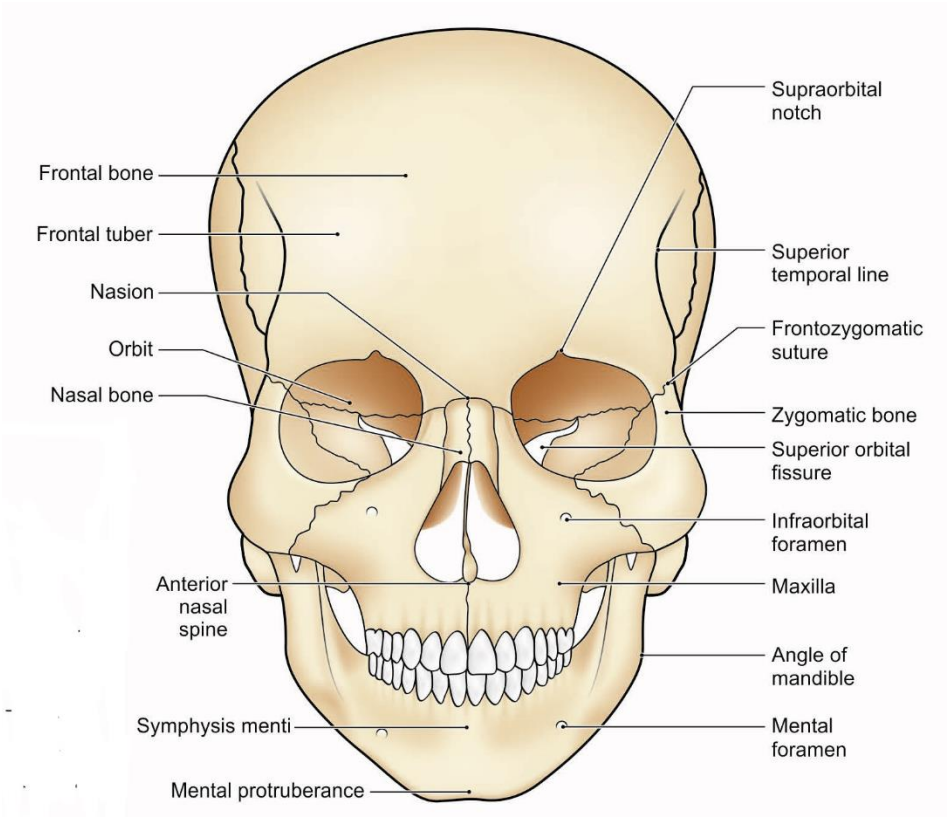
The norma frontalis can be studied in these parts:

a. Frontal region

b. Orbital openings

c. Anterior bony aperture of the nose

d. Lower part of the face



Frontal Region features

1. The superciliary arch is a rounded, curved elevation situated just above the medial part of each orbit. It overlies the frontal sinus and is better formed in males than in females.

2. The frontal tuber or eminence is a low rounded elevation above the superciliary arch—one on each side. It is more prominent in females and in children.

3. The glabella is a median elevation connecting the two superciliary arches. Below the glabella, the skull recedes to frontonasal suture at root of the nose.

4. The nasion is a median point at the root of the nose where the internasal suture meets with the frontonasal suture.

Orbital Openings features

Each orbital opening is quadrangular in shape and is bounded by the following four margins:

1. The supraorbital margin is formed by the frontal bone. At the junction of its lateral 2/3 & its medial 1/3 the supraorbital notch or foramen is present. The supratrochlear notch lies medial to it.

2. The lateral orbital margin is formed mostly by the frontal process of zygomatic bone, which is met above by the zygomatic process of frontal bone.at the frontozygomatic suture.

3. The infraorbital margin is formed by the zygomatic bone laterally, and maxilla medially.

4. The medial orbital margin is ill-defined & is formed by the frontal bone above, and by the lacrimal crest of the frontal process of the maxilla below.

Anterior Bony (Piriform) Aperture of the Nose Features

The anterior bony aperture is pear-shaped, being wide below and narrow above.

Boundaries

Above: By the lower border of the nasal bones. The *Rhinion* is the lowermost point of the internasal suture.

Below: By the nasal notch of the body of maxilla on each side. The anterior nasal spine is a sharp projection in the median plane in the lower boundary of the piriform aperture.

Lower Part of the Face Features

1. Maxilla (upper jaw bone)

The anterior surface of the body of the maxilla presents:

a. The nasal notch medially; b. The anterior nasal spine;

c. The infraorbital foramen, 1 cm below the infraorbital margin;

In addition, three processes of the maxilla are also seen in this view.

a. The frontal process of the maxilla is directed upwards. It articulates anteriorly with the nasal bone, posteriorly with the lacrimal bone, and superiorly with the frontal bone.

b. The zygomatic process of the maxilla articulates with the zygomatic bone.

c. The alveolar process of the maxilla bears sockets for the upper teeth.

2. Zygomatic Bone (Malar Bone)

Zygomatic bone forms the prominence of the cheek. The zygomaticofacial foramen is seen on its surface.

3. Mandible (lower jaw bone)

- The upper border or alveolar arch lodges the lower teeth.
- The lower border or base is rounded.
- The middle point of the base is called the mental point or gnathion.
- The point on the angle of mandible is called gonion.
- The anterior surface of the body of the mandible shows:

a. The symphysis menti, the mental protuberance and the mental tubercles, anteriorly.

b. The mental foramen below the interval between the two premolar teeth.

c. The oblique line runs upwards and backwards from the mental tubercle to the anterior border of the ramus of the mandible.

Structures Passing through Foramina in the Frontal view

1. The supraorbital notch or foramen transmits the supraorbital nerves and vessels & the supratrochlear notch transmits the supratrochlear nerve & vessels from the orbit to the face & scalp.

2. The external nasal nerve emerges between the nasal bone and upper nasal cartilage.

3. The infraorbital foramen transmits the infraorbital nerve and vessels from the orbital floor to the face.

4. The zygomaticofacial foramen transmits the nerve of the same name from the orbit to the face.

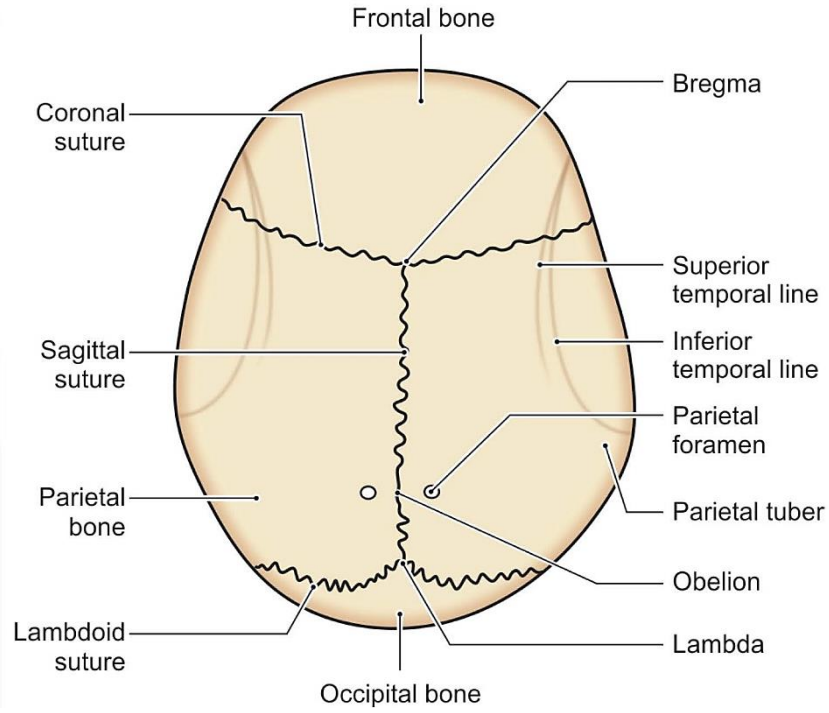
5. The mental foramen on the mandible transmits the mental nerve and vessels from the mandibular canal to the face.

Clinical notes

The nasal bone is one of the most commonly fractured bones of the face. Mandible and parietal eminence are the next bones to be fractured

Superior view (norma verticalis)

When viewed from above, the skull is usually oval in shape. It is wider posteriorly than anteriorly. The shape may be more nearly circular.



Bones

1. Upper part of frontal bone anteriorly.
2. Uppermost part of occipital bone posteriorly.
3. A parietal bone on each side.

Sutures

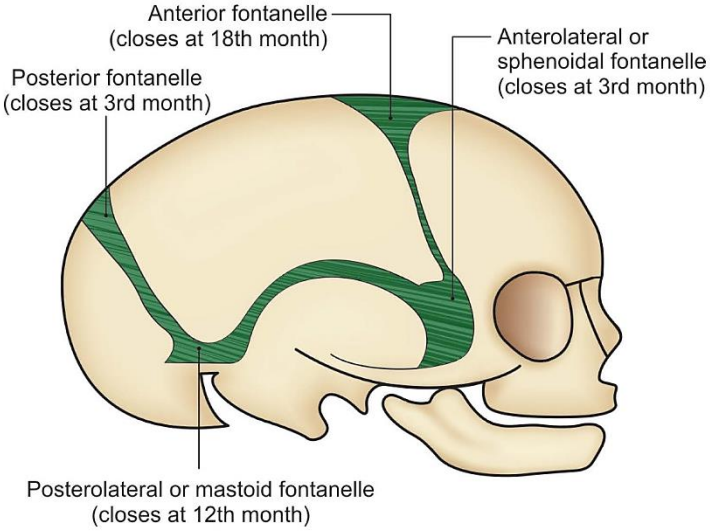
1. *Coronal suture*: is placed anteriorly between the frontal and the two parietal bones.
2. *Sagittal suture*: is placed in the median plane between the two parietal bones.
3. *Lambdoid suture*: lies posteriorly between the occipital and the two parietal bones. Sutural or Wormian bones are common along this suture.
4. Metopic suture: is occasionally present in about 3-8% individuals. It lies in the median plane and separates the two halves of the frontal bone. Normally, it fuses at 6 years of age.

Some other Named Features

1. *Vertex* is the highest point on sagittal suture.
2. *Vault* of skull is the arched roof for the dome of skull.
3. *Bregma* is the meeting point between the coronal and sagittal sutures. In the fetal skull, this is the site of a membranous gap, called the *anterior fontanelle* which closes at 18 to 24 months of age.
4. The *lambda* is the meeting point between the sagittal and lambdoid sutures. In the fetal skull, this is the site of the posterior fontanelle which closes at birth or up to 2 to 3 months of age.
5. The *parietal tuber (eminence)* is the area of maximum convexity of the parietal bone. This is a common site of fracture of the skull.
6. The *parietal foramen*, one on each side, pierces the parietal bone near its upper border, 2.5 to 4 cm in front of the lambda. It transmits an emissary vein from the veins of scalp to superior sagittal sinus.
7. The *obelion* is the point on the sagittal suture between the two parietal foramina.

Clinical notes

Fontanelles are sites of growth of skull, permitting growth of brain and help to determine age. If fontanelles fuse early, brain growth is stunted; such children are less intelligent. If anterior fontanelle is bulging, there is raised intracranial pressure. If anterior fontanelle is depressed, it shows decreased intracranial pressure, mostly due to dehydration. Bones override at the fontanelle helping to decrease size of head during vaginal delivery.



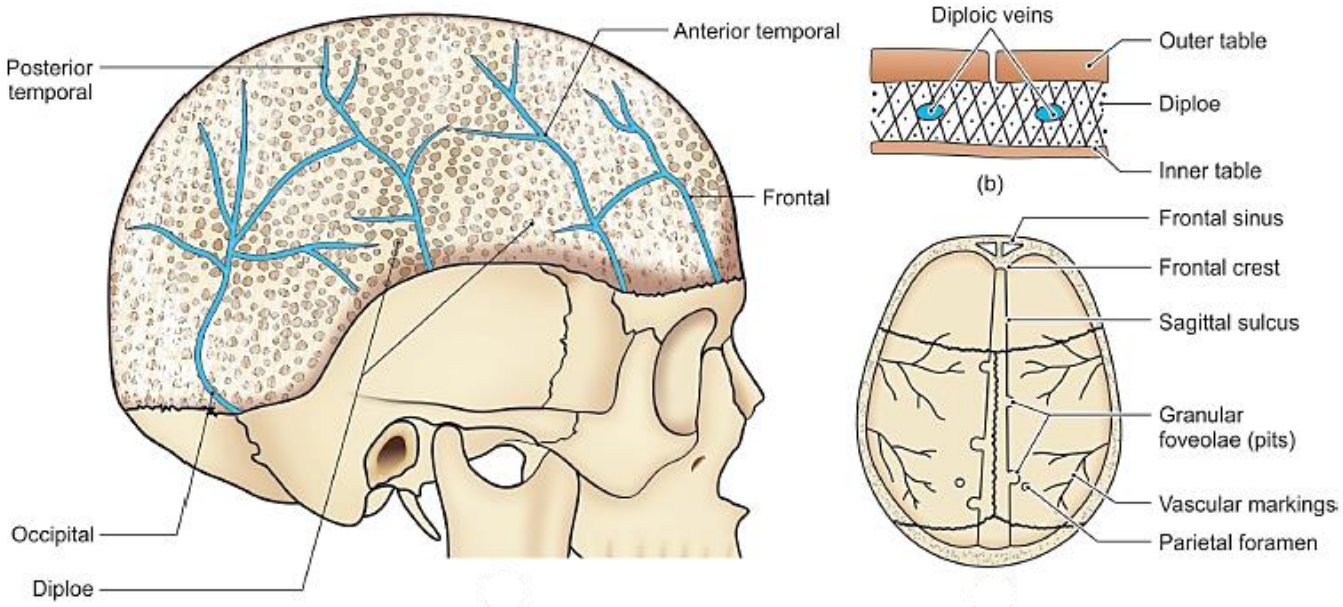
Internal aspect of the cranial vault

Main features

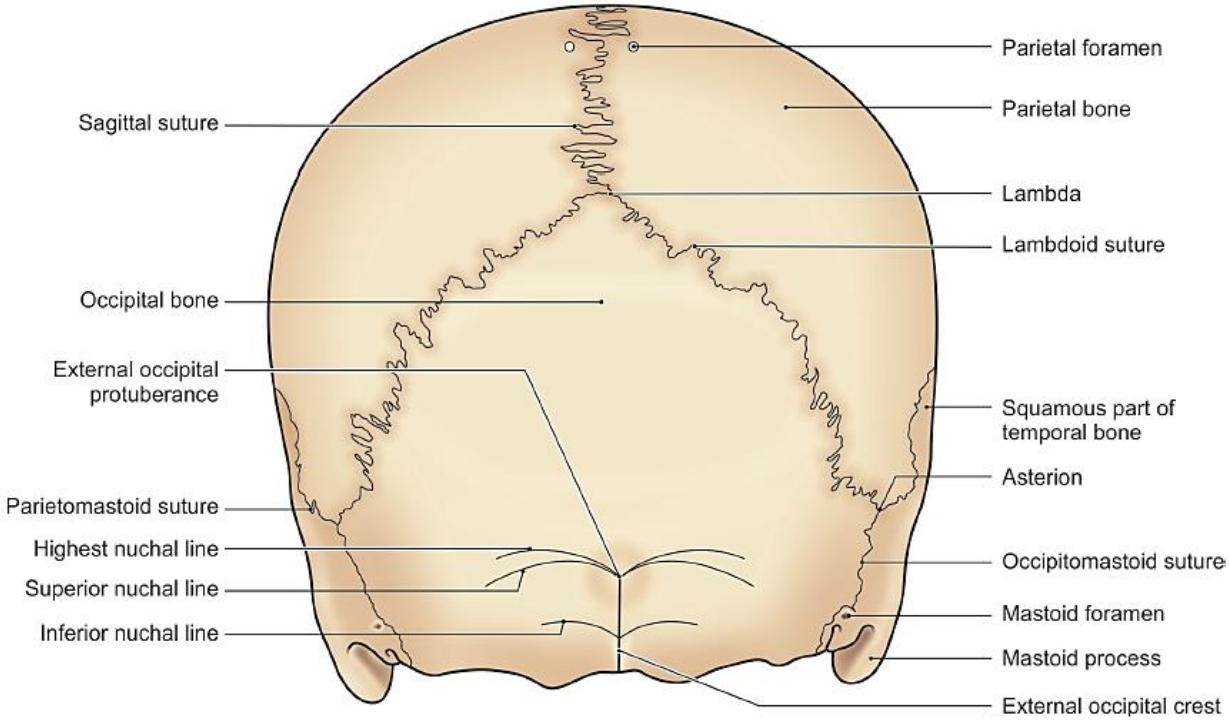
- The sutures are similar as seen in the superior view.
- The frontal sinuses appear as cavities in the frontal bone anteriorly.
- The *frontal crest* lies anteriorly in the median plane & projects backwards.
- The *sagittal sulcus* runs from before backwards in the median plane becoming progressively wider posteriorly. It lodges the superior sagittal sinus.
- The *granular foveolae* are deep, irregular, large, pits situated on each side of the sagittal sulcus. They are formed by arachnoid granulations. They are larger and more numerous in aged persons.
- The groove for the anterior branch of the middle meningeal artery runs upwards 1 cm behind the coronal suture. Smaller grooves for the branches from the anterior and posterior branches of the middle meningeal vessels run upwards and backwards over the parietal bone.
- The *parietal foramina* open near the sagittal sulcus 2.5 to 3.75 cm in front of the lambdoid suture.

Clinical notes

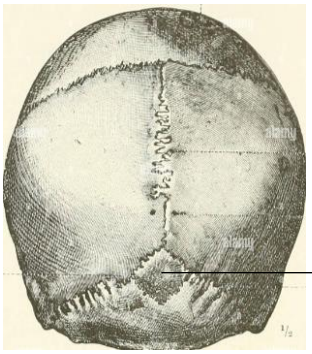
The cranium is lined internally by *endocranium* which is continuous with the pericranium through the foramina and sutures. The *thickness* of the cranial vault is variable. The bones covered with muscles, i.e. temporal & posterior cranial fossae, are thinner than those covered with scalp. Further, the bones are thinner in females than in males, and in children than in adults. Most of the cranial bones consist of an *outer table* of compact bone (thick & tough), an *inner table* of compact bone (thin & brittle) and the *diploe in between* which consists of spongy bone filled with red marrow.
The skull bones derive their blood supply mostly from the meningeal arteries from inside and very little from the arteries of the scalp. The blood from the diploes is drained by four diploic veins on each side draining into venous sinuses.



Posterior view (norma occipitalis)



Norma occipitalis is convex upwards and on each side &is flattened below.



Bones

1. Posterior parts of the parietal bones, above.

2. Upper part of the squamous part of the occipital bone, below.

3. Mastoid part of the temporal bone, on each side.

Sutures

1. The *lambdoid suture*.

2. The *occipitomastoid suture* lies between the occipital bone and mastoid part of the temporal bone.

3. The *parietomastoid suture* lies between the parietal bone and mastoid part of the temporal bone.

4. The posterior part of the *sagittal suture* is also seen.

Other Features

1. *Lambda, parietal foramina* and *obelion* as seen in the norma verticalis.

2. The *external occipital protuberance* is a median prominence in the lower part of this view & marks the junction of the head and the neck. The most prominent point on this protuberance is called the *inion*.

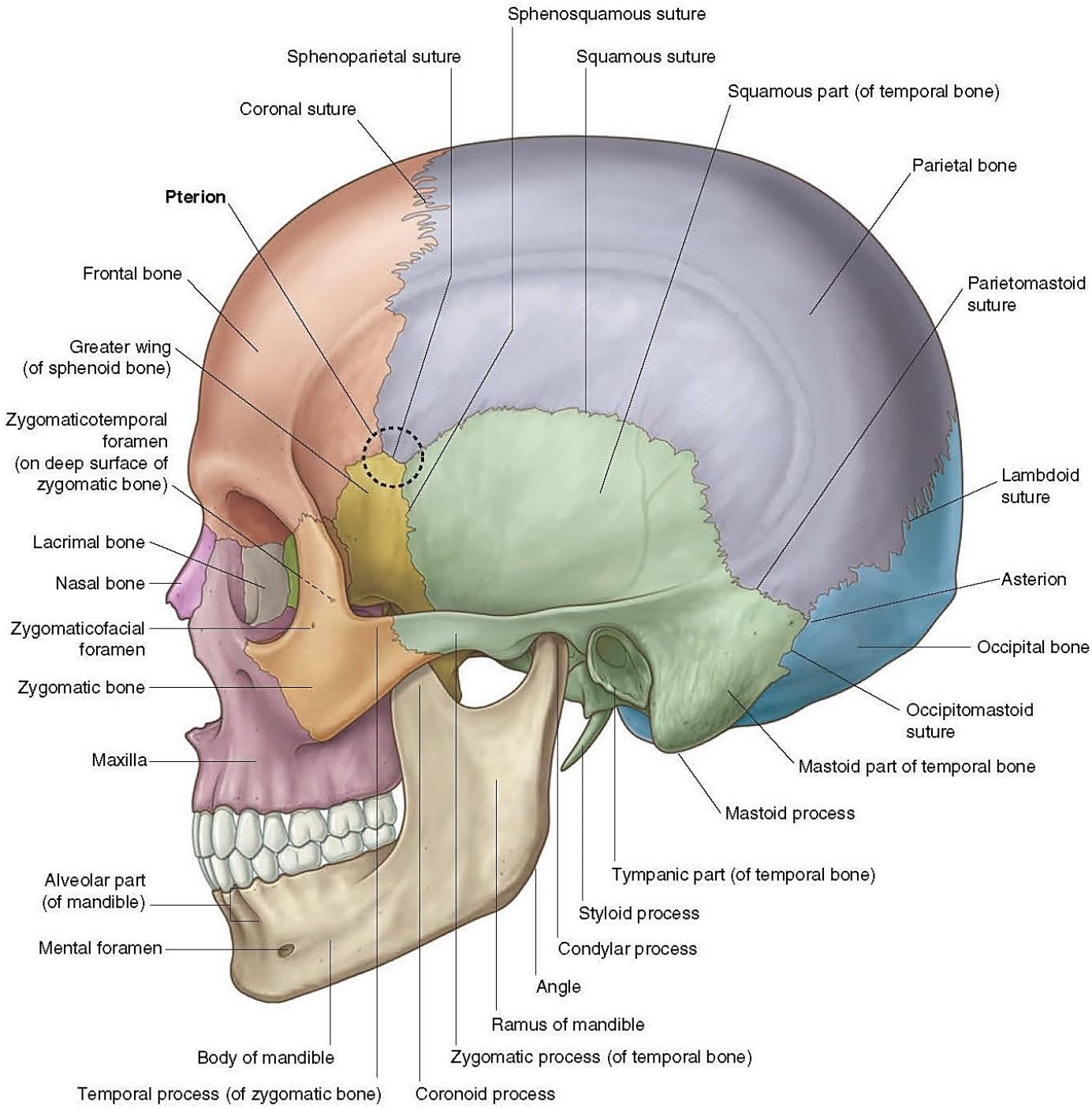
3. The *superior nuchal lines* are curved bony ridges passing laterally from the protuberance. The area below the superior nuchal lines is the basal part of the occipital bone.

4. The *highest nuchal lines* are not always present. They are curved bony ridges situated about 1 cm above the superior nuchal lines.

5. The *mastoid foramen* is located on the mastoid part of the temporal bone at or near the occipitomastoid suture. Internally, it opens at the sigmoid sulcus & transmits an emissary vein and the meningeal branch of the occipital artery.

6. The *interparietal bone (inca bone)* is occasionally present. It is a large triangular bone located at lambda. It represents the membranous part of the occipital bone which has failed to fuse with the rest of the bone.

Lateral view (norma lateralis)



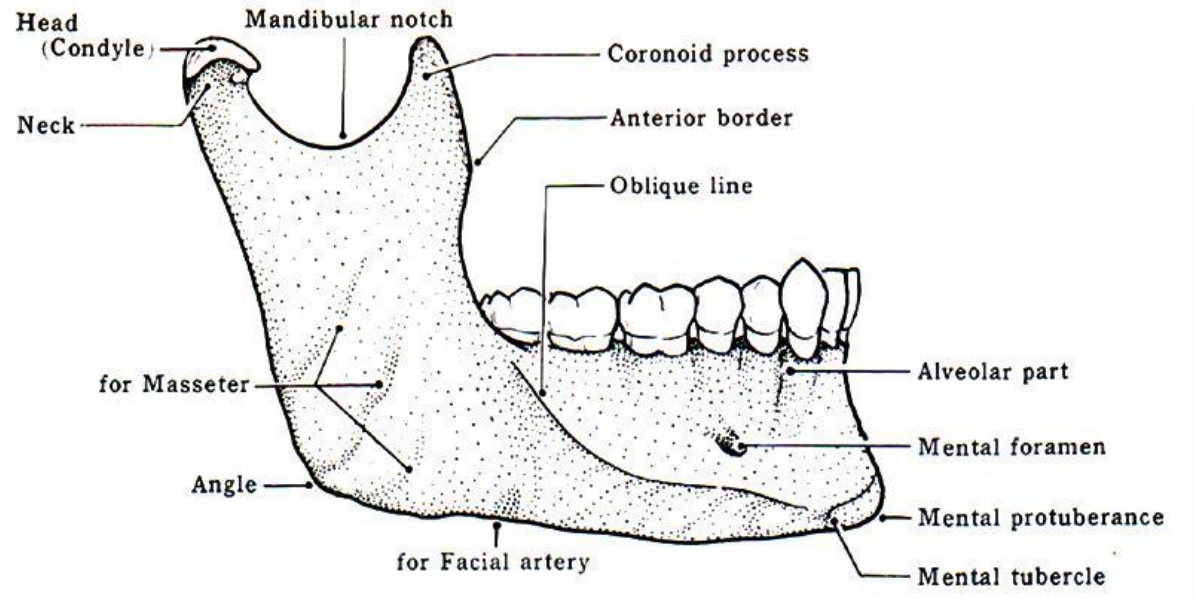
Bones

Frontal, nasal, maxilla, mandible, greater wing of the sphenoid, parietal, temporal & occipital.

Features

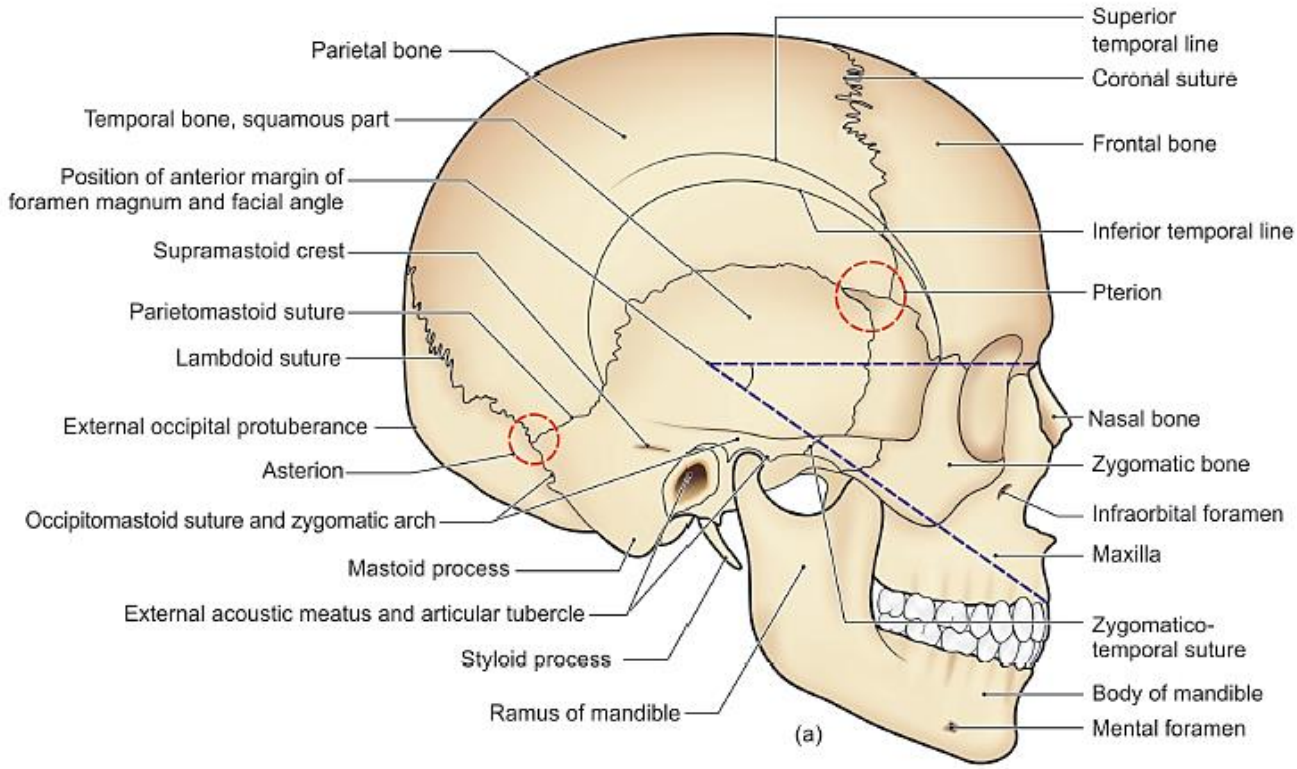
External surface of the mandible

The horizontal body of the mandible curves upwards posteriorly on each side into a flattened ramus. The point of the curve is the mandibular angle. The sharp anterior border of the ramus is continuous with the oblique line externally and ends superiorly at the coronoid process. The thicker posterior border of the ramus constricts superiorly at the neck before expanding into the head or condylar process that articulates with the temporal bone at the temporomandibular joint (TMJ).



Zygomatic Arch or Zygoma

The zygomatic arch is a horizontal bar on the side of the head, in front of the ear. It is formed by the junction of the temporal process of the zygomatic bone & the zygomatic process of the temporal bone which meet at the zygomaticotemporal suture. The lateral surface of the arch is subcutaneous while the medial surface is separated from the skull by a gap. Above the zygomatic arch is temporal fossa. On the lower border of the zygomatic arch posteriorly is the articular (glenoid) fossa that houses the mandibular head. This fossa is limited anteriorly by the articular tubercle & posteriorly by the external acoustic meatus.



External Acoustic Meatus

The *external acoustic (auditory) meatus* opens just below the posterior part of the posterior root of zygoma. Its anterior and inferior margins and the lower part of the posterior margin are formed by the tympanic part of the temporal bone, while the posterosuperior margin is formed by the squamous temporal bone. The margins are roughened for the attachment of auricular cartilage. The *suprameatal triangle (of McEwen)* is a small depression posterosuperior to the meatus.

Mastoid Part of the Temporal Bone & Styloid process

This is a breast-like projection from the lower part temporal bone, posteroinferior to the external acoustic meatus which it joins at the tympanomastoid fissure. It appears during the second year of life. It articulates with the parietal bone at the *parietomastoid suture,* and with the squamous occipital bone at the *occipitomastoid suture.* These two sutures meet at the lateral end of the lambdoid suture at a point called the *asterion.* In infants, the asterion is the site of the *posterolateral* or *mastoid fontanelle,* which closes by 12 months.

The styloid process is a needle-like thin, long projection from the temporal bone just anteromedial to the mastoid process. It is directed downwards, forwards and slightly medially. Its base is partly ensheathed by the tympanic plate, while the apex or tip is hidden from view by the posterior border of the ramus of the mandible.

Temporal lines, Temporal Fossa & Pterion

The temporal lines begin at the zygomatic process of the frontal bone, arch backwards and upwards, and cross the frontal bone, the coronal suture and the parietal bone. Over the parietal bone, there are two lines: superior and inferior. Traced anteriorly, they fuse to form a single line. Traced posteriorly, the superior line fades out over the posterior part of the parietal bone, but the inferior temporal line continues downwards and forwards & becomes continuous with the *supramastoid crest* on the squamous temporal bone near its junction with the mastoid temporal. This crest is continuous anteriorly with the posterior root of the zygomatic arch.

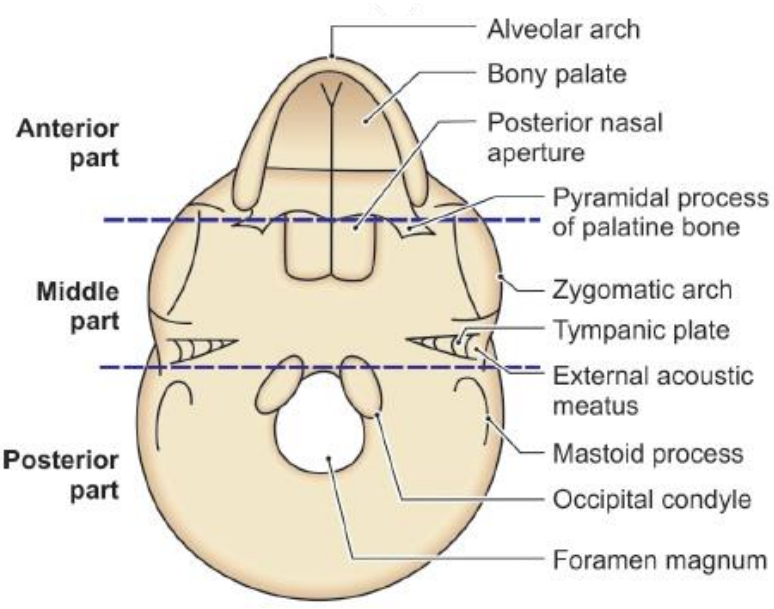
The *pterion* is the area in the temporal fossa where four bones (frontal, parietal, temporal and sphenoid) articulate at an H-shaped suture. The center of the pterion is marked by a point 4 cm above the midpoint of the zygomatic arch, falling 3.5 cm behind the frontozygomatic suture. Deep to the pterion lie the anterior branch of the middle meningeal artery, the middle meningeal vein, and the lateral sulcus of the cerebral hemisphere.

Clinical notes

The skull bones are thinnest at the pterion, making it a common site for trephining (making a hole in the skull) during. Because of its deep relations, in roadside accidents, the anterior division of middle meningeal artery at pterion may be ruptured, leading to clot formation between the skull bone and dura mater (extradural haemorrhage). The clot compresses the motor area of brain, leading to paralysis of the opposite side. The clot must be sucked out at the earliest by trephining operation

Inferior view (norma basalis)

For ease of study, the norma basalis is divided into anterior, middle and posterior parts. The *anterior part* is formed by the hard palate and the alveolar arches. The *middle and posterior parts* are separated by an imaginary transverse line passing through the anterior margin of the foramen magnum. Each of the middle & posterior parts consist of median & lateral areas.



Anterior part of norma basalis

The alveolar arch bears sockets for the roots of the upper teeth. The arch limits the domed hard palate. The hard palate is formed by two bones:

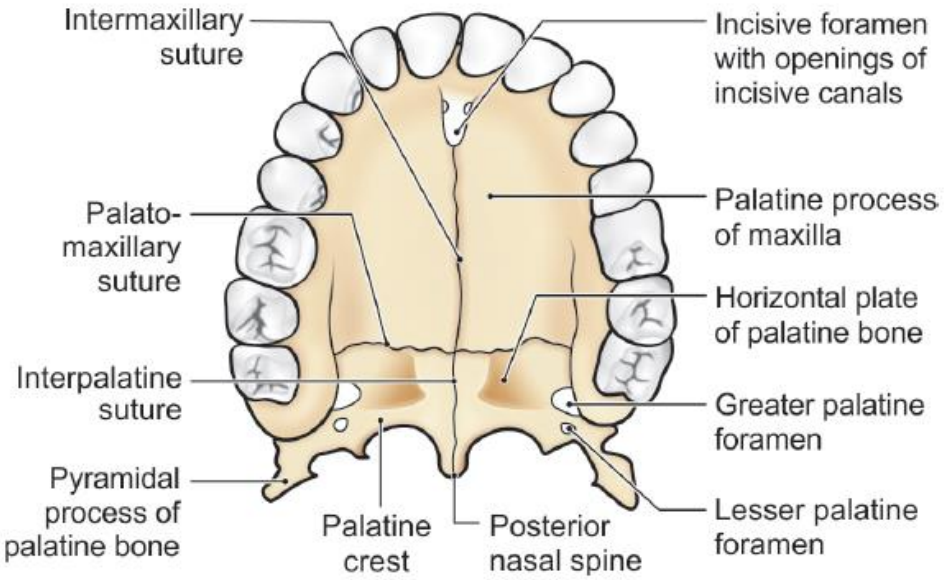
a. Anterior 2/3 by the palatine processes of the maxillae.

b. Posterior 1/3 by the horizontal plates of the palatine bones.

- The palatine processes of the maxillae are joined at the intermaxillary suture. The horizontal plates of the palatine bones are joined at the interpalatine suture. The palatine & maxillary processes are joined on each side at the palatomaxillary suture.

- The *posterior border* of the hard palate is free and presents the *posterior nasal spine* in the median plane. The *palatine crest* is a curved ridge near the posterior

Border that runs from the posterior nasal spine to behind the greater palatine foramen.



- Foramina:

1. The *incisive foramen* is a deep fossa situated anteriorly in the median plane. Two *incisive* canals, right and left, pierce the walls of the incisive foramen & transmit the nasopalatine nerve & sphenopalatine vessels.

2. The greater palatine foramen, one on each side, is just behind the lateral part of the palatomaxillary suture & transmits the greater palatine nerve & vessels.

3. The 2-3 *lesser palatine foramina* on each side, lie behind the greater palatine foramen, perforate the pyramidal process of the palatine bone & transmit the lesser palatine nerves & vessels.

Middle part of norma basalis

- ***Median Area***

The median area shows:

a. The posterior border of the *vomer which* separates the two posterior nasal apertures (choanae).

b. A *broad bar of bone* formed by fusion of the posterior part of the body of sphenoid and the basilar part

of occipital bone (*basiocciput)*. This is marked in the median plane by the *pharyngeal tubercle*, just in front of the foramen magnum.

- ***Lateral Area***

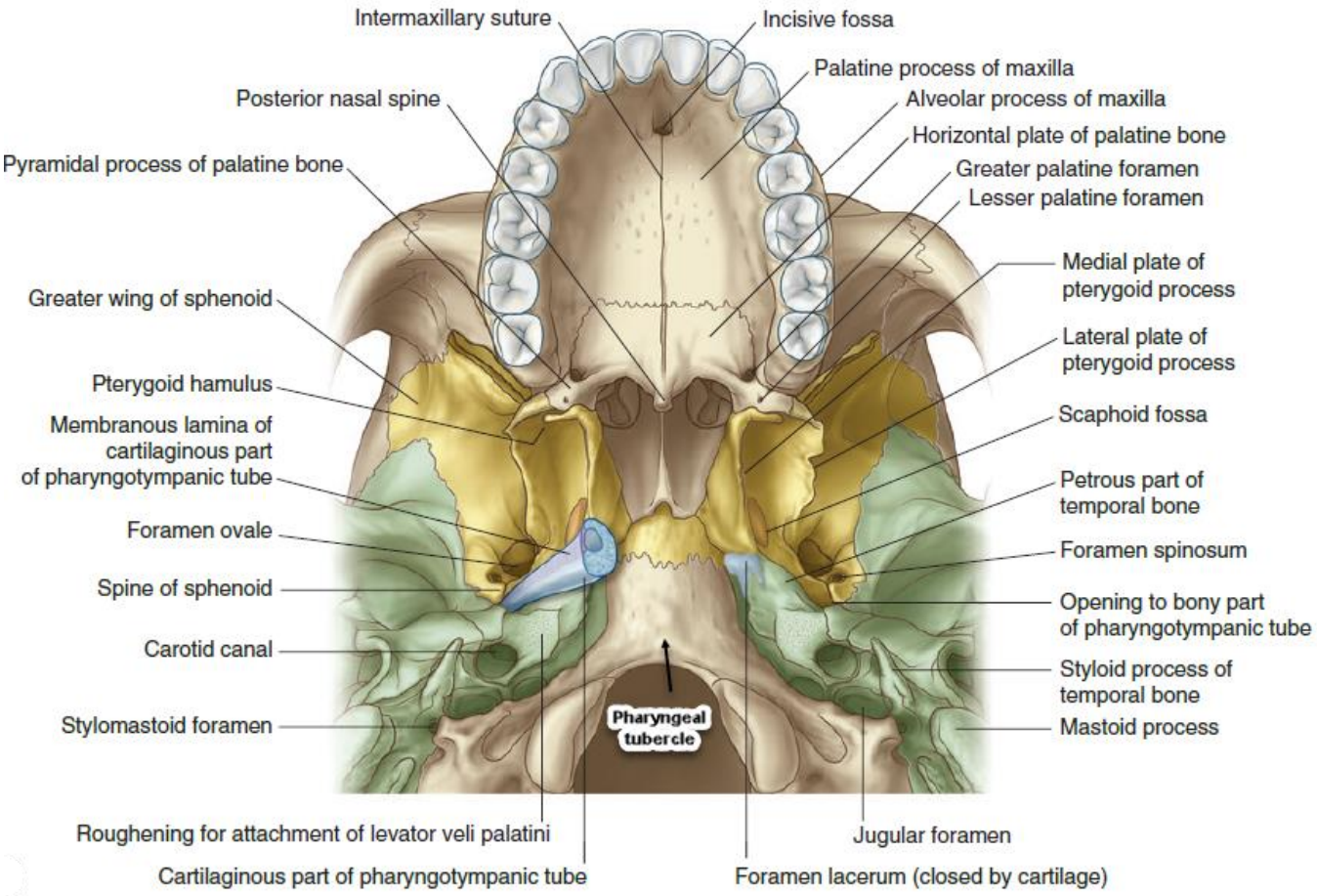
The lateral area shows <u>two parts</u> of the <u>sphenoid bone</u>: 1. <u>pterygoid process (&plates)</u> and 2. <u>greater wing</u> + <u>three parts</u> of the <u>temporal bone</u>: 3. <u>petrous part, 4. tympanic plate</u> and 5. <u>squamous part.</u>

1. The *pterygoid process* projects downwards from the junction of greater wing & the body of sphenoid behind the 3rd molar tooth. Inferiorly, it divides into the *medial and lateral pterygoid plates (laminae)* which are separated posteriorly by the V-shaped *pterygoid fossa. The medial pterygoid plate has a free posterior border, the upper end of which divides to enclose a triangular depression called the scaphoid fossa. The opening of the pterygoid canal lies just medial to thr scaphoid fossa. The lower end of the posterior border of the medial pterygoid plate is prolonged downwards and laterally to form the hook-shaped pterygoid hamulus.*

2. The greater wing of the sphenoid is perforated by three foramina. From behind forward they are: *foramen spinosum, foramen ovale & foramen rotundum*. Only the first two are visible at the base of the skull. The *spine of the sphenoid* is seen posterolateral to the foramen spinosum. The *tubal sulcus* is the groove between the posteromedial margin of the greater wing of the sphenoid & the petrous temporal bone. It lodges the *cartilaginous part of the auditory tube*.

3. The inferior surface of the *petrous* part of the temporal bone is triangular in shape with its apex directed anteromedially between the greater wing of the sphenoid and the basiocciput. Its *apex* is perforated by the upper end of the carotid canal, and is separated from the sphenoid by the foramen lacerum. The 2 openings are continuous with each other via a bony tunnel in the petrous bone that lodges the internal carotid artery. In the living, the foramen

lacerum is sealed inferiorly by a fibrous tissue & leads into the cranial cavity, while the carotid canal has a bony roof and leads to the petrous bony tunnel so that the internal carotid artery runs a short distance within the petrous bone.



4. *the tympanic plate,* is a triangular curved plate which lies in the angle between the petrous and squamous temporal parts. Its apex is directed medially and lies close to the spine of the sphenoid. Behind it lies the carotid canal medially & the base of the styloid process laterally.

5. The squamous temporal bone shows the articular tubercle anteriorly & the articular mandibular fossa behind the tubercle.

Posterior part of norma basalis

- ***Median Area***

The median area shows from before backwards:

1. The *foramen magnum* is the largest foramen of the skull. It is oval in shape, being wider behind than in front where it is overlapped on each side by the occipital condyles.

2. The *external occipital crest* begins at the posterior margin of the foramen magnum and ends posterosuperiorly at the external occipital protuberance.

3. The *external occipital protuberance*.

4&5. Superior & inferior *Nuchal lines*.

- ***Lateral Area***

The lateral area shows:

1. The condylar part of the occipital bone: represented by the occipital condyles which are oval in shape and are situated on each side of the anterior part of the foramen magnum. The *hypoglossal* or *anterior condylar canal* pierces the bone anterosuperior to the occipital condyle. The *condylar* or *posterior condylar canal* is occasionally present behind the occipital condyle.

2. The squamous part of the occipital bone is the flattened part marked by the superior and inferior nuchal lines.

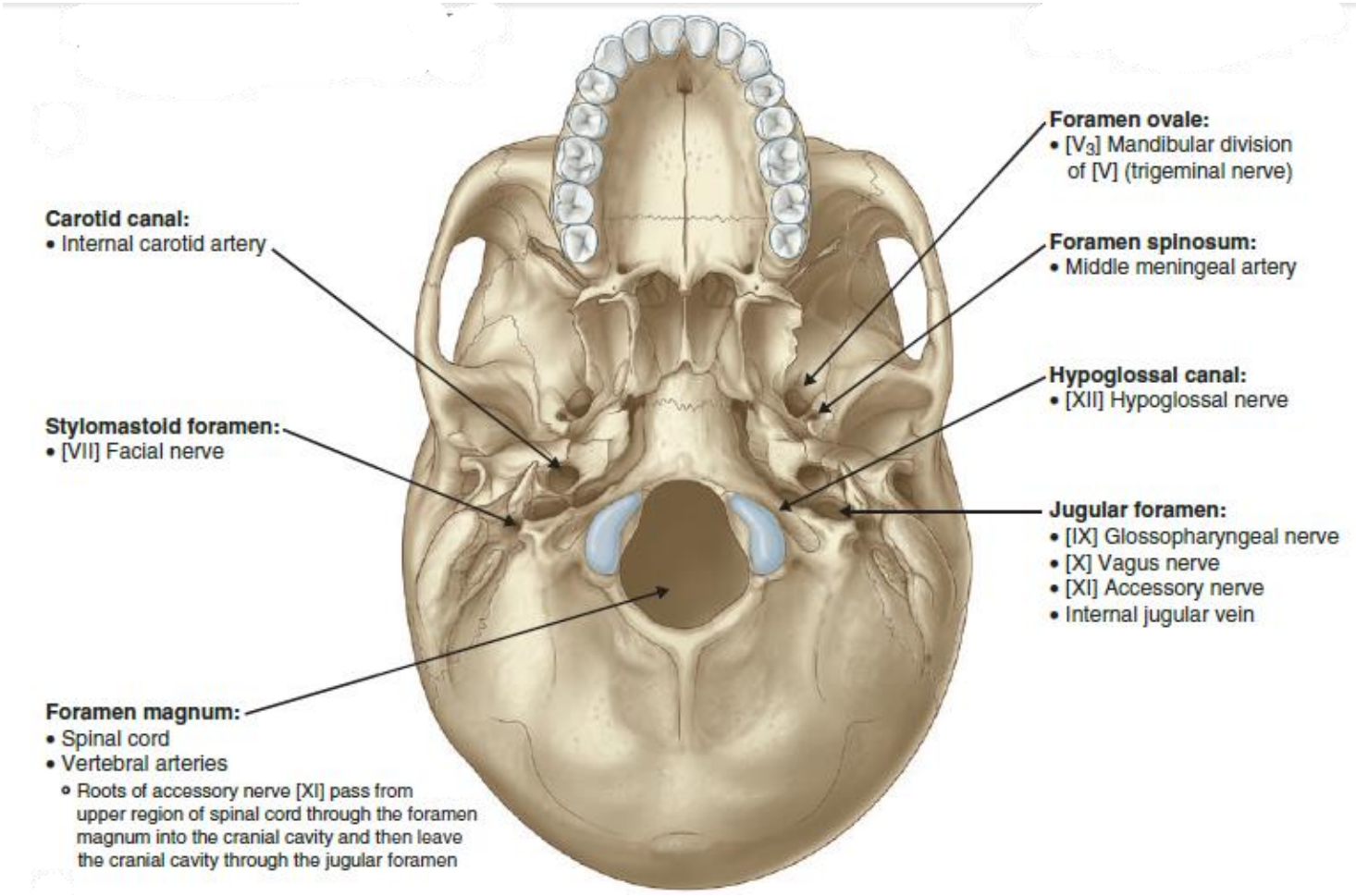
3. The jugular foramen between the occipital and petrous temporal bones with its long axis directed anteromedially.

4. The styloid process of the temporal bone. The *stylomastoid foramen* is lies posterior to the

root of the styloid process, at the anterior end of the mastoid notch.

5. Mastoid part of the temporal bone.

The following diagram summarizes the major foramina of the middle & posterior parts of the base of the skull & the structures that pass through them



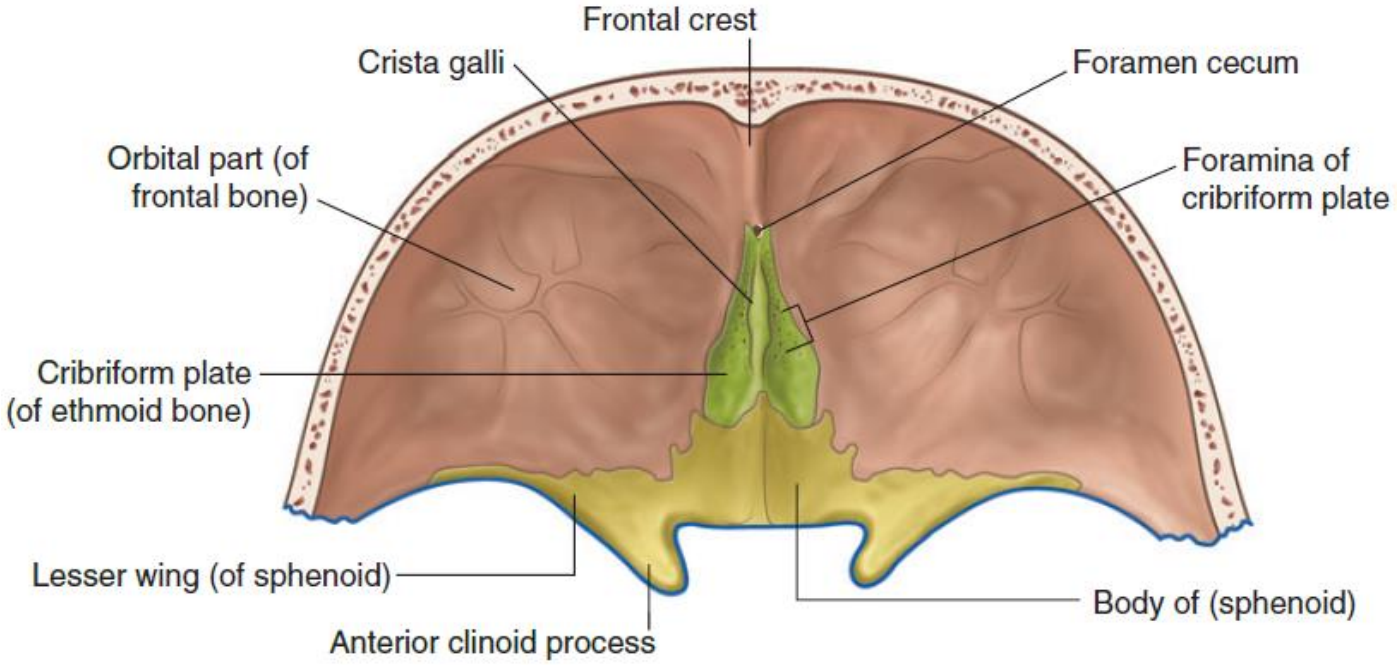
Internal aspect of the cranial base (Cranial Fossae)

The interior of the base of skull presents natural subdivisions into the anterior, middle and posterior cranial fossae. The dura mater is firmly adherent to the floor of fossae and is continuous with pericranium through the foramina and fissures. Because of the shape of the brain, the cranial fossae increase in depth & size from anterior to posterior. Each fossa has boundaries, floor & distinct features, foramina & communications.

Anterior Cranial Fossa

Boundaries

Anteriorly and on the sides, by the frontal bone with the frontal crest in the median plane. *Posteriorly,* it is separated from the middle cranial fossa by the free *posterior border* of the *lesser wing of the sphenoid*, the *anterior clinoid process*, and the *anterior margin of the sulcus chiasmaticus*.



Floor

In the median plane, it is formed anteriorly by the *cribriform plate of the ethmoid bone*, and posteriorly by the superior surface of the anterior part of the body of the sphenoid (*jugum sphenoidale). On each side,* the floor is formed mostly by the *orbital plate of the frontal bone*, and is completed posteriorly by the lesser wing of the sphenoid.

Main Features

1. The *cribriform plate of the ethmoid bone* separates the anterior cranial fossa from the nasal cavity. *Its Anterior* margin articulates with the frontal bone at the *frontoethmoidal suture* which is marked in the median plane by the blind *foramen caecum*. Its *Posterior margin* articulates with the jugum sphenoidale. Anteriorly, the cribriform plate has a midline projection called the *crista galli*. On each side of the crista galli, the cribriform plate is perforated by *numerous foramina* for the passage of olfactory nerve rootlets.

2. The *jugum sphenoidale* separates the anterior cranial fossa from the sphenoidal sinuses.

3. The *orbital plate of the frontal bone* separates the anterior cranial fossa from the orbit.

4. The *lesser wing of the sphenoid* is broad medially where it is continuous with the jugum sphenoidale and tapers laterally. It ends medially as the *anterior clinoid process.* Inferiorly, the posterior border forms the upper boundary of the *superior orbital fissure*. Medially, the lesser wing is connected to the body of the sphenoid & enclose the *optic canal*.

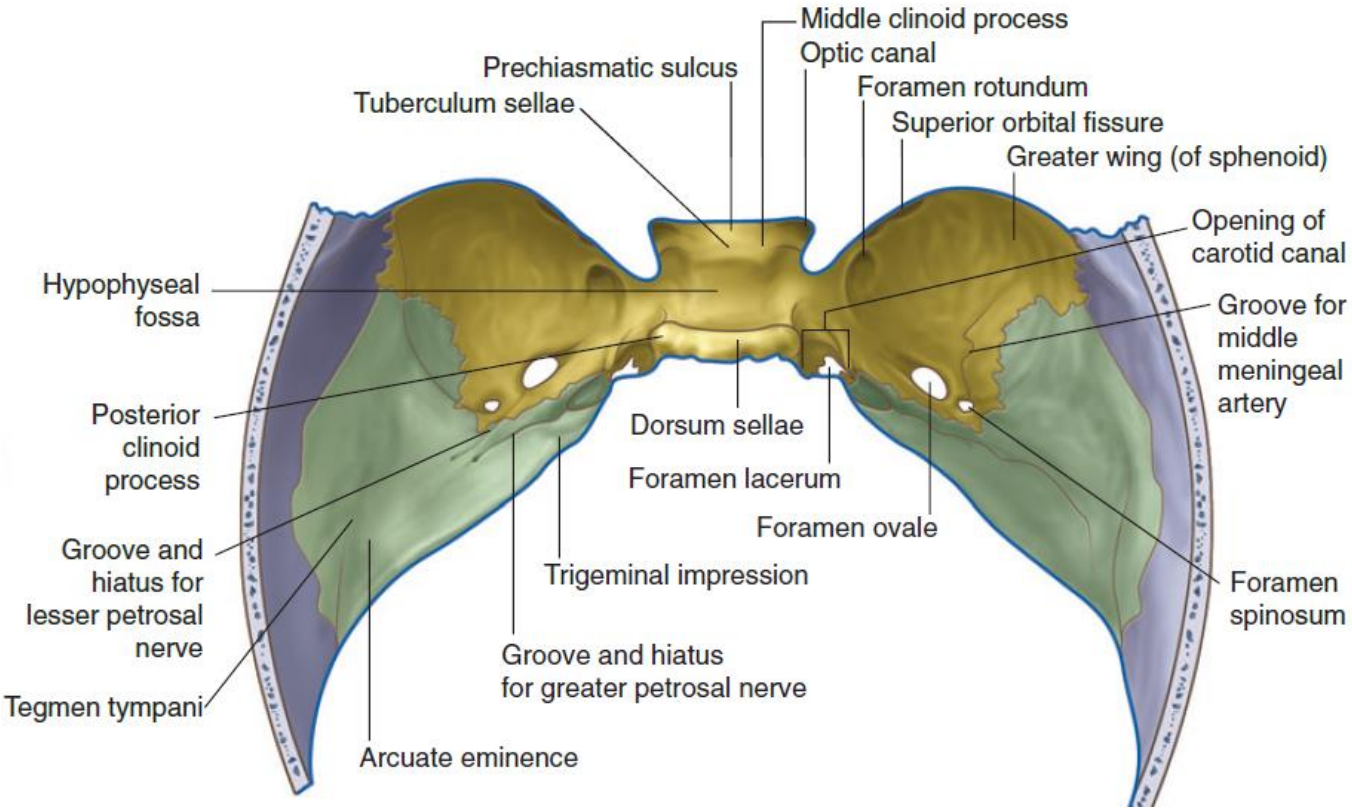
<u>Middle Cranial Fossa</u>

Boundaries

Anteriorly is the posterior border of the anterior cranial fossa as mentioned above. *Posteriorly:* superior border of the petrous temporal bone & the dorsum sellae of the sphenoid. *Laterally:* Greater wing of the sphenoid, anteroinferior angle of the parietal bone & the squamous temporal bone

Floor

Floor is formed by body of sphenoid in the median region and by greater wing of sphenoid, squamous temporal and anterior surface of petrous temporal on each side.



Main Features

- The body of the sphenoid presents the following features in the median area:

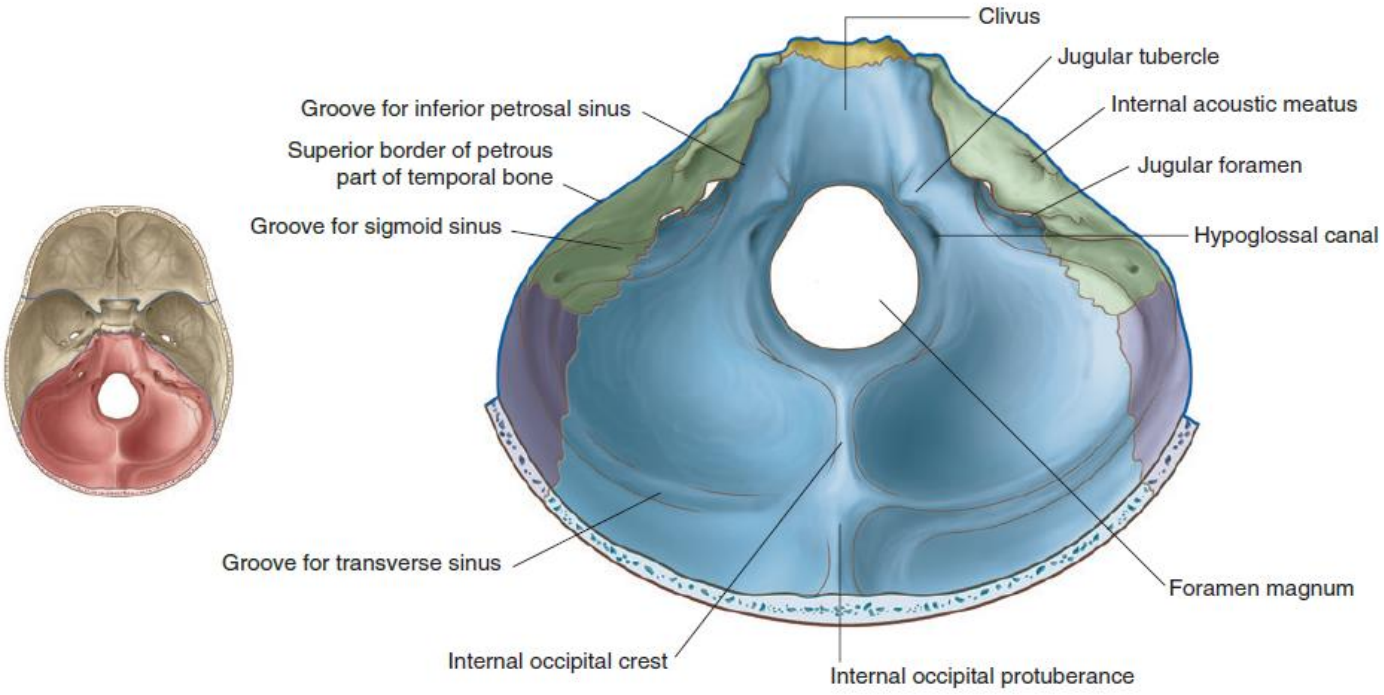
1. The *sulcus perichiasmaticus* or *optic groove* leads, on each side, to the optic canal which leads to the orbit. The optic chiasma does not occupy the sulcus, it lies at a higher level well behind the sulcus.

2. *Sella turcica*: is a hollow on the upper surface of the body of the sphenoid. It consists of the *tuberculum sellae* in front, the *hypophyseal (pituitary) fossa* in the middle and the *dorsum sellae* behind. The *tuberculum sellae* separates the optic groove from the *hypophyseal fossa*. The *hypophyseal fossa* lodges the hypophysis cerebri = pituitary gland. Beneath the floor of fossa lie the sphenoidal air sinuses. The *dorsum* forms the back of the saddle & its superolateral angles form the *posterior clinoid processes.*

- The lateral area:

is deep and lodges the temporal lobe of the brain. The *superior orbital fissure* opens anteriorly into the orbit. It is *bounded* above by the lesser wing, below by the greater wing, and medially by the body of the sphenoid. The *greater wing of the sphenoid* has 3 openings: *foramen rotundum* leads anteriorly to the pterygopalatine fossa, *foramen ovale* leads to the infratemporal fossa & *foramen spinosum* most posterolaterally also leads to the infratemporal fossa. The *foramen lacerum* lies at the posterior end of the carotid groove, posteromedial to the foramen ovale.

The *anterior surface of the petrous temporal bone* shows the *trigeminal impression (fossa)* near the apex, behind the foramen lacerum. It lodges the trigeminal ganglion. The *arcuate eminence* lies more laterally & is produced by the superior semicircular canal. The *cerebral surface of the squamous temporal bone* is concave. It shows impressions for the temporal lobe and grooves for branches of the middle meningeal vessels.



Posterior Cranial Fossa

Boundaries

Anteriorly: The superior border of the petrous temporal bone & dorsum sellae of the sphenoid bone.

Posteriorly: Squamous part of the occipital bone.

On each side: Mastoid part of the temporal bone *&* mastoid angle of the parietal bone

Floor

Median area: Sloping area behind the dorsum sellae called the clivus in front, The foramen magnum in the middle & the squamous occipital behind

Lateral area: Posterior surface of the petrous temporal bone, Condylar part of occipital bone*,* Mastoid temporal bone & Mastoid angle of the parietal bone

Main Features

- The *internal occipital protuberance* lies opposite the external occipital protuberance. It is grooved on each side by the beginning of transverse sinuses.

- The *internal occipital crest* runs in the median plane from the internal occipital protuberance to the foramen magnum. where it forms a shallowdepression, the *vermian fossa.*

- On each side of the internal occipital crest, there are *deep fossae* which lodge the cerebellar hemispheres.

- The *jugular tubercle* lies over the occipital condyle.

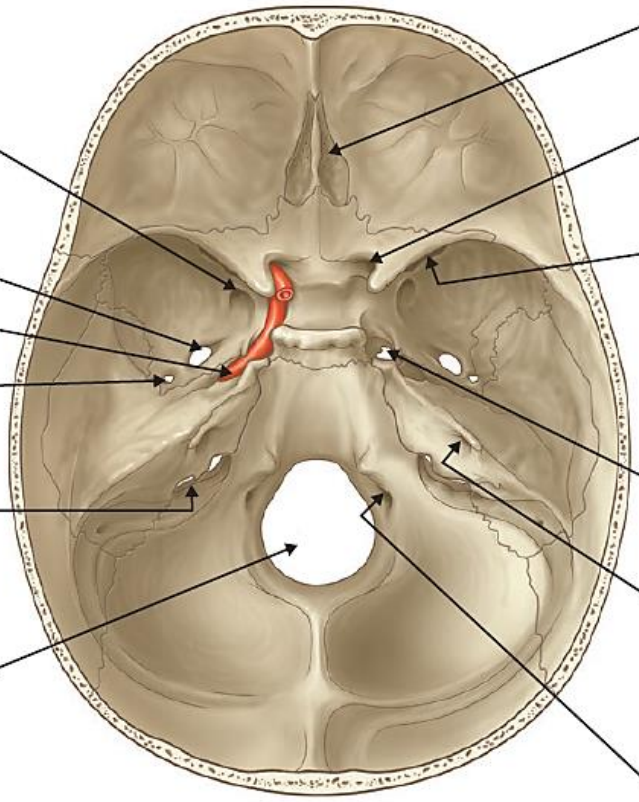
- The *hypoglossal canal* lies posteroanterior to the jugular tubercle.

- The *jugular foramen* lies at the posterior end of the petro-occipital fissure. The upper margin is sharp and irregular, and shows the *glossopharyngeal notch*.

-The *internal acoustic meatus* opens above the anterior part of the jugular foramen.

- Anterior to the mastoid part of the temporal bone is the groove for the sigmoid sinus.

The following diagram summarizes the major foramina of the cranial fossae, their communications & the structures that pass through them



Foramen rotundum:
(*middle cranial fossa/ pterygopalatine fossa*)
- [V_2] Maxillary division of [V] (trigeminal nerve)

Foramen ovale:
(*middle cranial fossa/ infratemporal fossa*)
- [V_3] Mandibular division of [V] (trigeminal nerve)

Carotid canal:
(*middle cranial fossa/neck*)
- Internal carotid artery

Foramen spinosum:
(*middle cranial fossa/ infratemporal fossa*)
- Middle meningeal artery

Jugular foramen:
(*posterior cranial fossa/neck*)
- [IX] Glossopharyngeal nerve
- [X] Vagus nerve
- [XI] Accessory nerve
- Internal jugular vein

Foramen magnum:
(*posterior cranial fossa/neck*)
- Spinal cord
- Vertebral arteries
  - Roots of accessory nerve [XI] pass from upper region of spinal cord through the foramen magnum into the cranial cavity

Cribriform plate:
(*anterior cranial fossa/nasal cavity*)
- [I] Olfactory nerves

Optic canal:
(*middle cranial fossa/orbit*)
- [II] Optic nerve
- Ophthalmic artery

Superior orbital fissure:
(*middle cranial fossa/orbit*)
- [V_1] Ophthalmic division of [V] (trigeminal nerve)
- [III] Oculomotor nerve
- [IV] Trochlear nerve
- [VI] Abducent nerve
- Superior ophthalmic vein

Foramen lacerum
(filled with cartilage in life)

Internal acoustic meatus:
(*posterior cranial fossa/ear, and neck via stylomastoid foramen*)
- [VII] Facial nerve
- [VIII] Vestibulocochlear nerve
  - Labyrnthine artery and vein

Hypoglossal canal:
(*posterior cranial fossa/neck*)
- [XII] Hypoglossal nerve