Normal anatomy of the skull (cranial) bones.

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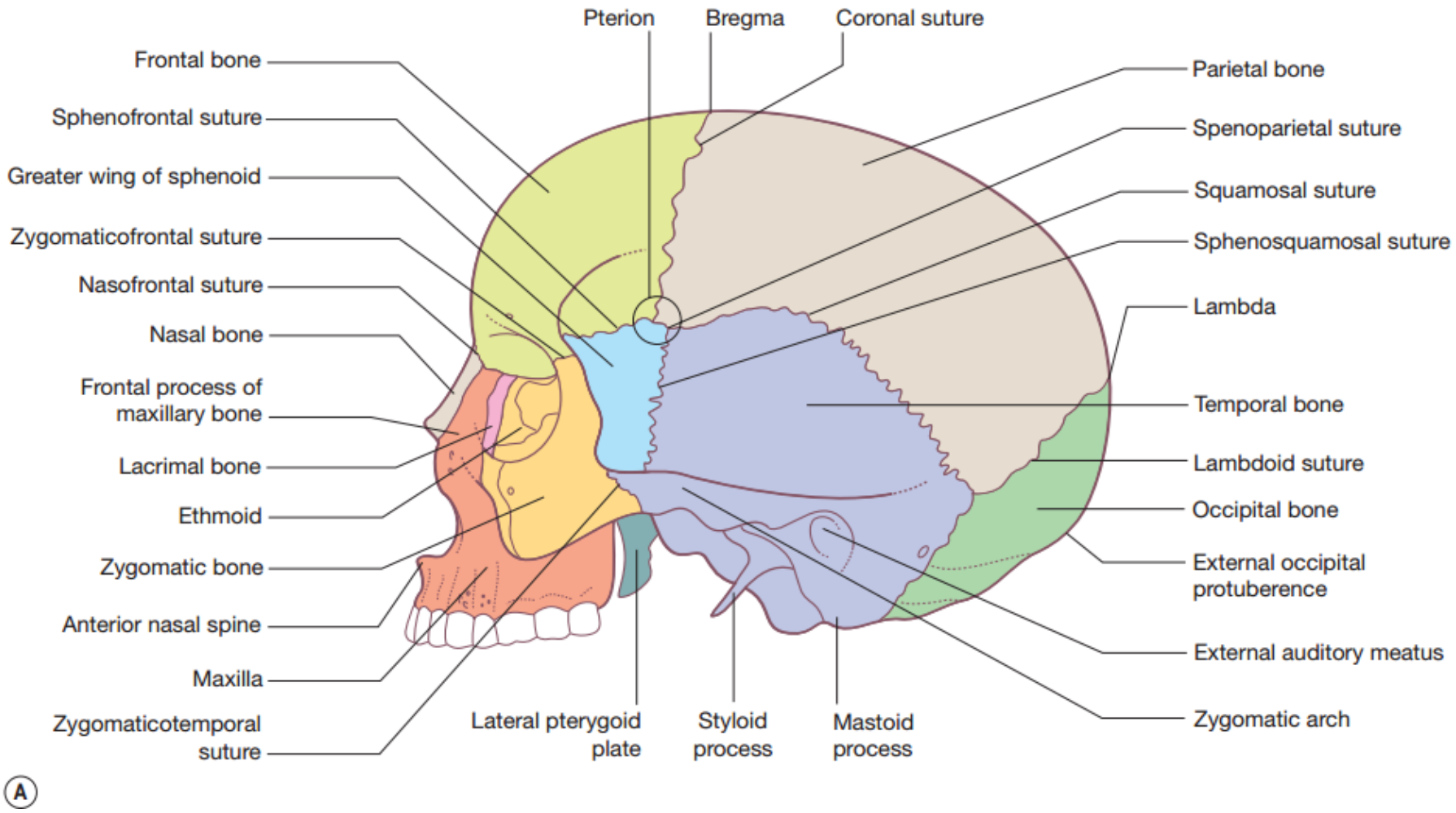
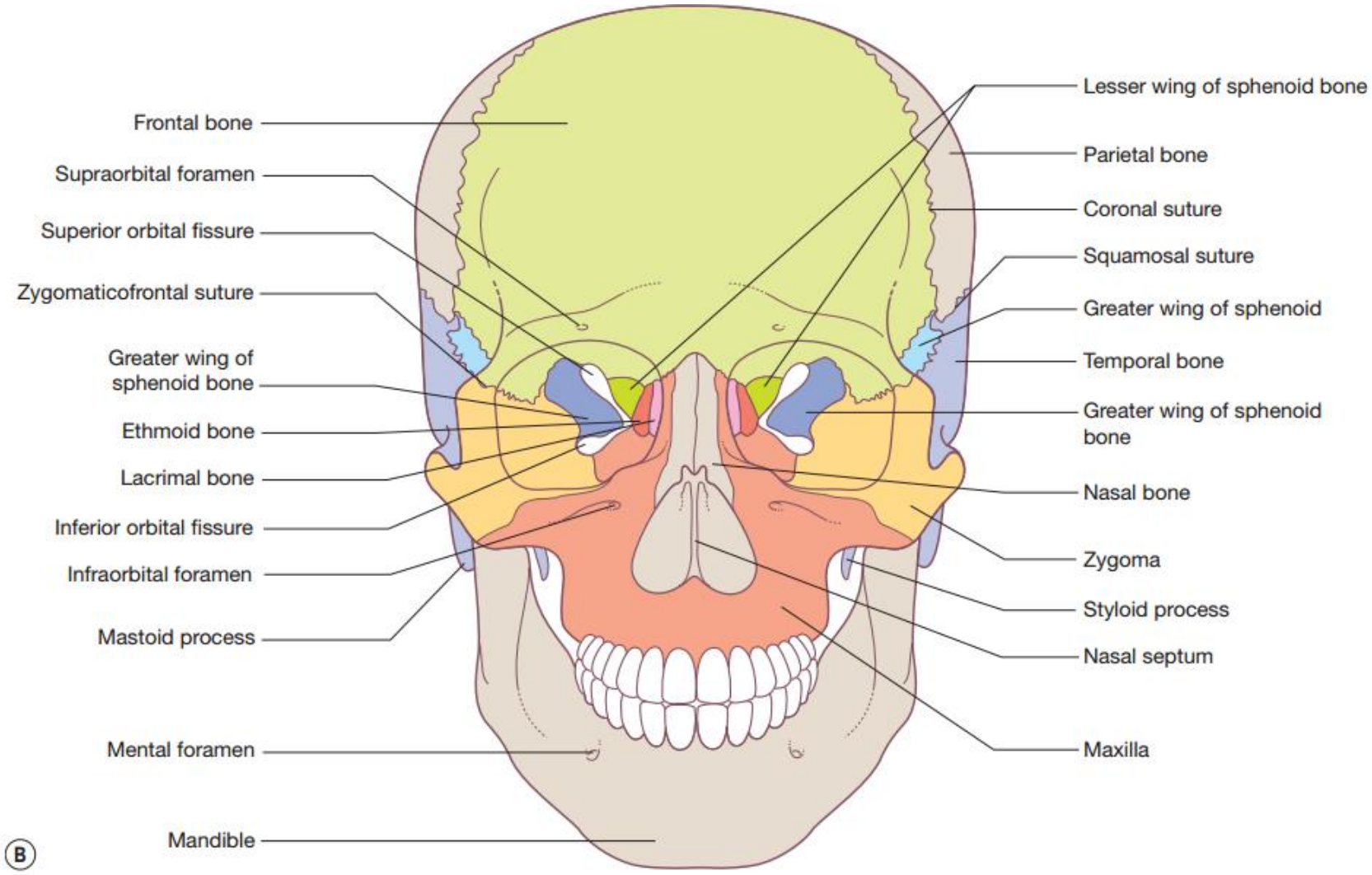
The skull vault

The skull vault is made up of several flat bones, joined at sutures, which can be recognized on skull radiographs.

The bones consist of the **diploic space** (a cancellous layer containing vascular spaces) – sandwiched between the inner and outer tables of cortical bone


Pterion
Bregma
Coronal suture
Frontal bone
Sphenofrontal suture
Greater wing of sphenoid
Zygomaticofrontal suture
Nasofrontal suture
Nasal bone
Frontal process of maxillary bone
Lacrimal bone
Ethmoid
Zygomatic bone
Anterior nasal spine
Maxilla
Zygomaticotemporal suture
Parietal bone
Spenoparietal suture
Squamosal suture
Sphenosquamosal suture
Lambda
Temporal bone
Lambdoid suture
Occipital bone
External occipital protuberence
External auditory meatus
Zygomatic arch
Lateral pterygoid plate
Styloid process
Mastoid process
A

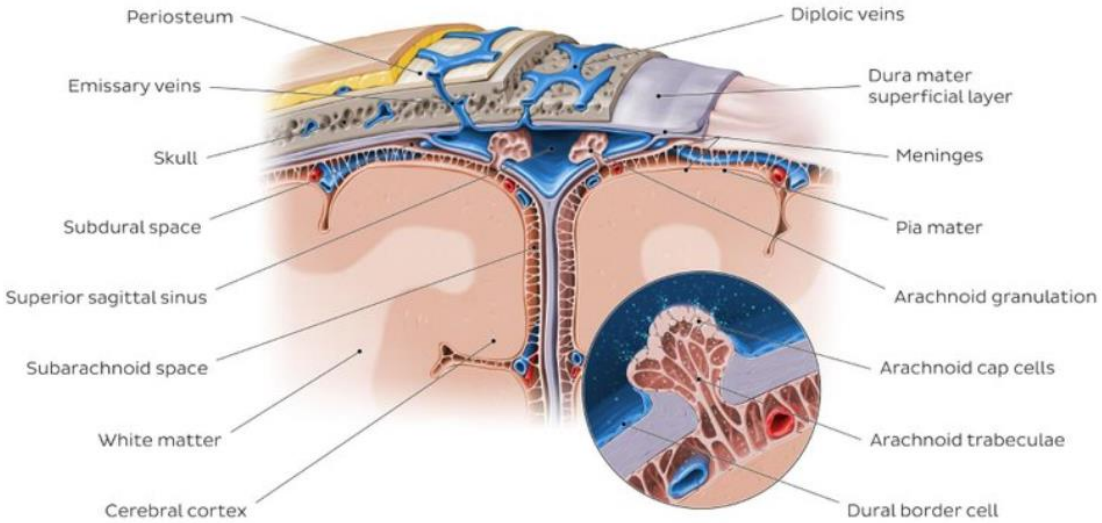

Frontal bone
Supraorbital foramen
Superior orbital fissure
Zygomaticofrontal suture
Greater wing of sphenoid bone
Ethmoid bone
Lacrimal bone
Inferior orbital fissure
Infraorbital foramen
Mastoid process
Mental foramen
Mandible
Lesser wing of sphenoid bone
Parietal bone
Coronal suture
Squamosal suture
Greater wing of sphenoid
Temporal bone
Greater wing of sphenoid bone
Nasal bone
Zygoma
Styloid process
Nasal septum
Maxilla
B

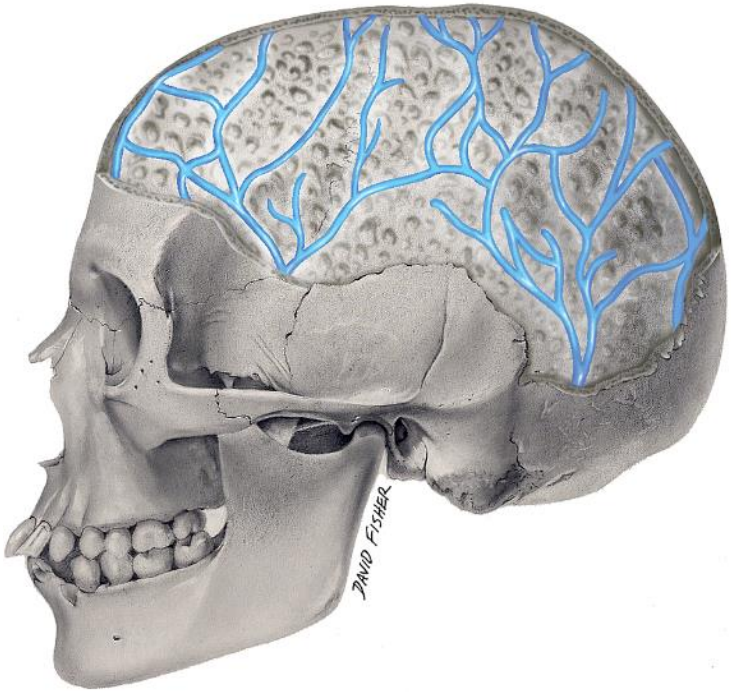
The skull is covered by **periosteum**, which is continuous with the fibrous tissue in the sutures.

The periosteum is called the **pericranium** externally and on the deep surface of the skull is called **endosteum.**

The endosteum **is the outer layer of the dura.**

The diploic veins within the skull are large, valveless vessels withthin walls. They communicate with the meningeal veins, the dural sinuses and the scalp veins.

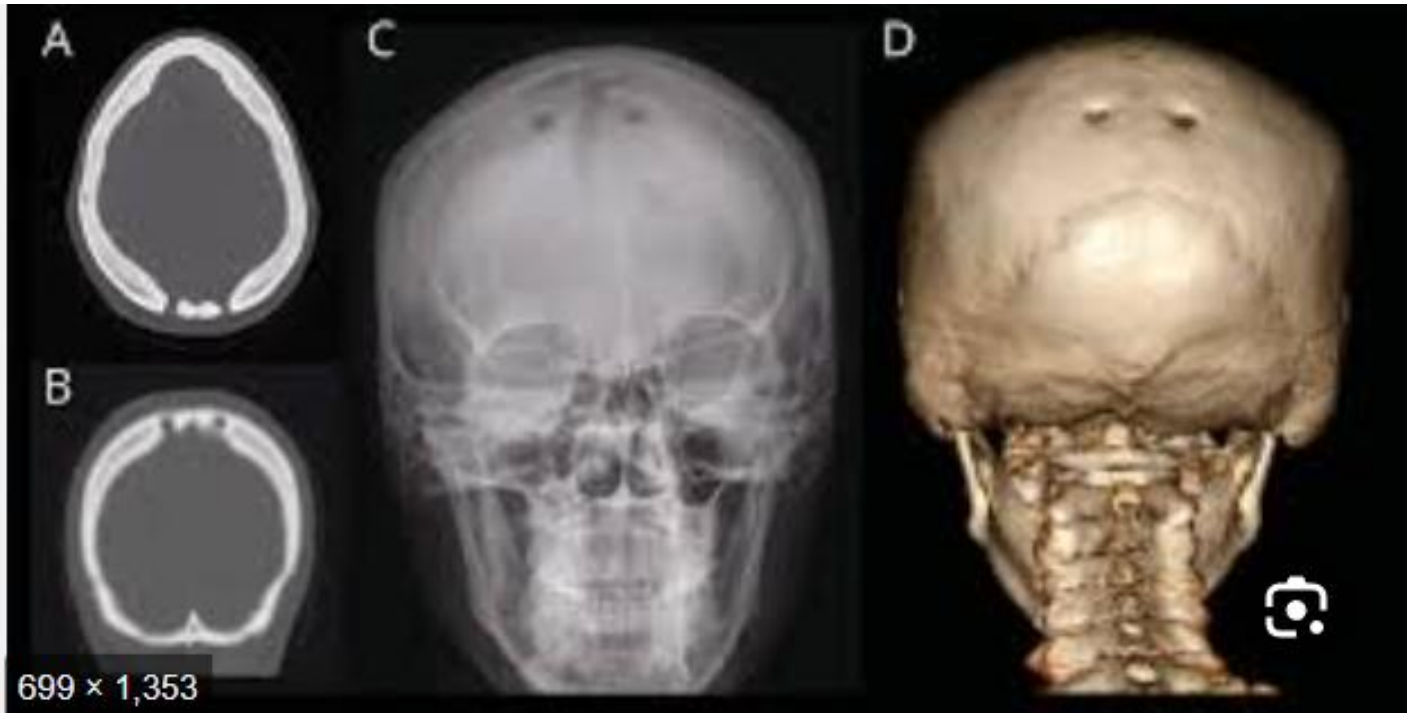

Periosteum
Emissary veins
Skull
Subdural space
Superior sagittal sinus
Subarachnoid space
White matter
Cerebral cortex
Diploic veins
Dura mater
superficial layer
Meninges
Pia mater
Arachnoid granulation
Arachnoid cap cells
Arachnoid trabeculae
Dural border cell


DAVID FISHER

The Cranial bones

The parietal bones form much of the side and the roof of the skull and are joined in the midline at the **sagittal suture.**

Parietal foramina are paired foramina or areas of thin bone close to the midline in the parietal bones. They are often visible on a radiograph, may be big and may even be palpable. They may transmit emissary veins from the sagittal sinus.


A
B
C
D
699 × 1,353

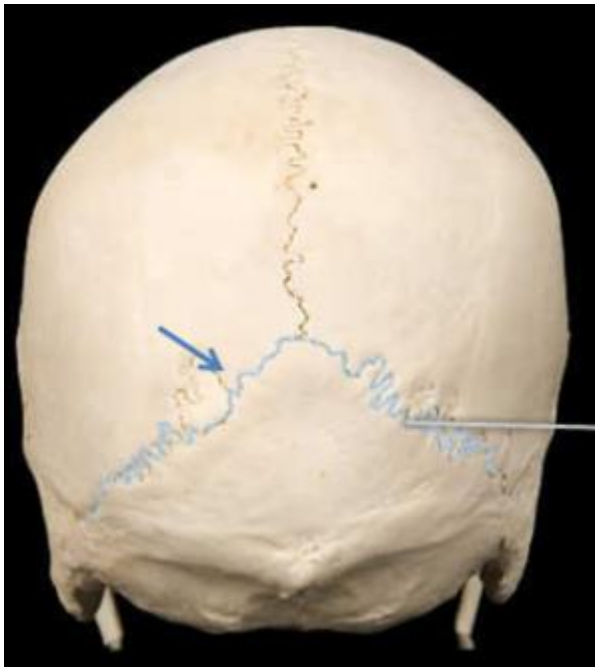
The frontal bone forms the front of the skull vault.

It is formed by two frontal bones that unite at **the metopic suture**.

The frontal bones join the parietal bones at the **coronal suture**. The junction of coronal and sagittal sutures is known as the **bregma**.

The occipital bone forms the back of the skull vault and is joined to the parietal bones at the **lambdoid suture**.

The lambdoid and sagittal sutures join at a point known as the **lambda**



The greater wing of sphenoid and the squamous part of

the temporal bone form the side of the skull vault below the frontal and parietal bones.

The sutures formed here are:

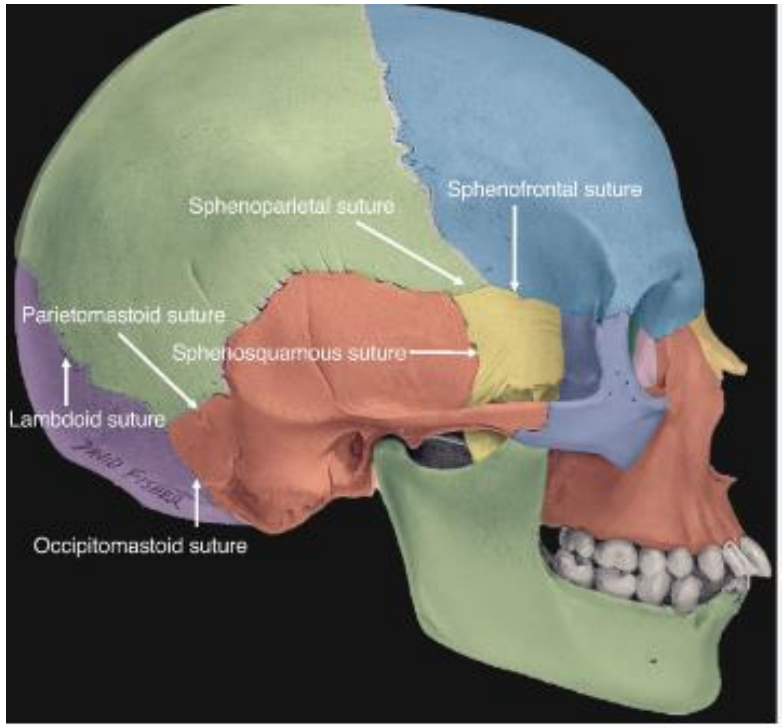
(i)the sphenosquamosal suture **(i)** between the sphenoid and temporal bones;

(ii) the sphenofrontal and **(ii) sphenoparietal sutures**

between greater wing of sphenoid and frontal and parietal

bones; and

(iii) the squamosal suture between temporal and parietal bones.



The intersection of the sutures between the frontal, sphenoidal, parietal and temporal bones is termed the **pterion**

It provides a surface marking for the anterior branch of the middle meningeal artery on the lateral skull radiograph.

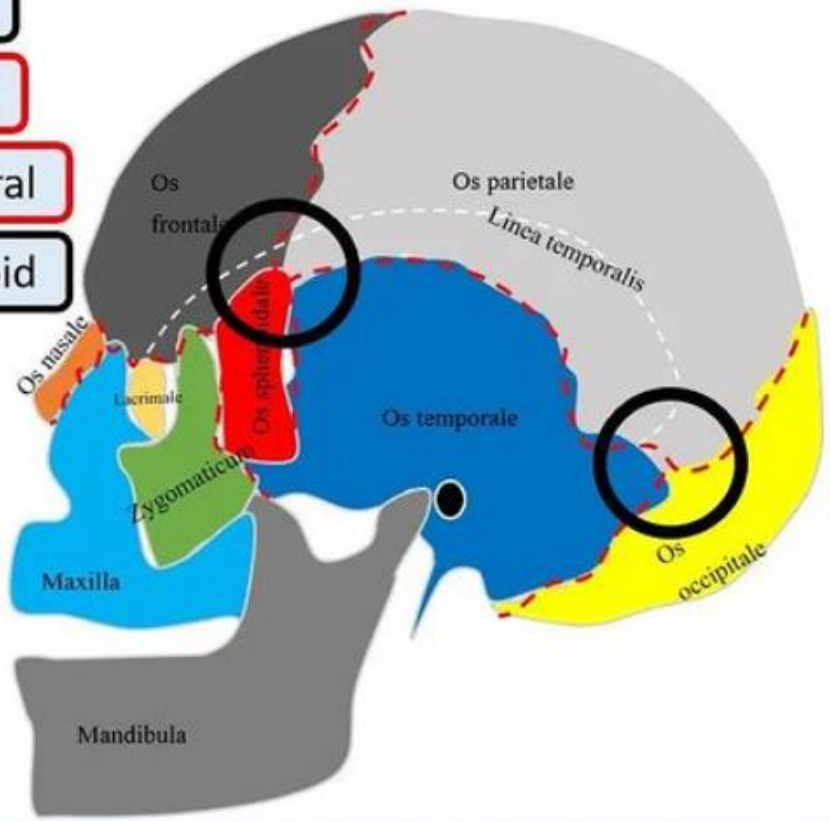
The asterion is the point where the squamosal suture meets the lambdoid suture

Frontal

Parietal

Temporal

Sphenoid



Parietal

Temporal

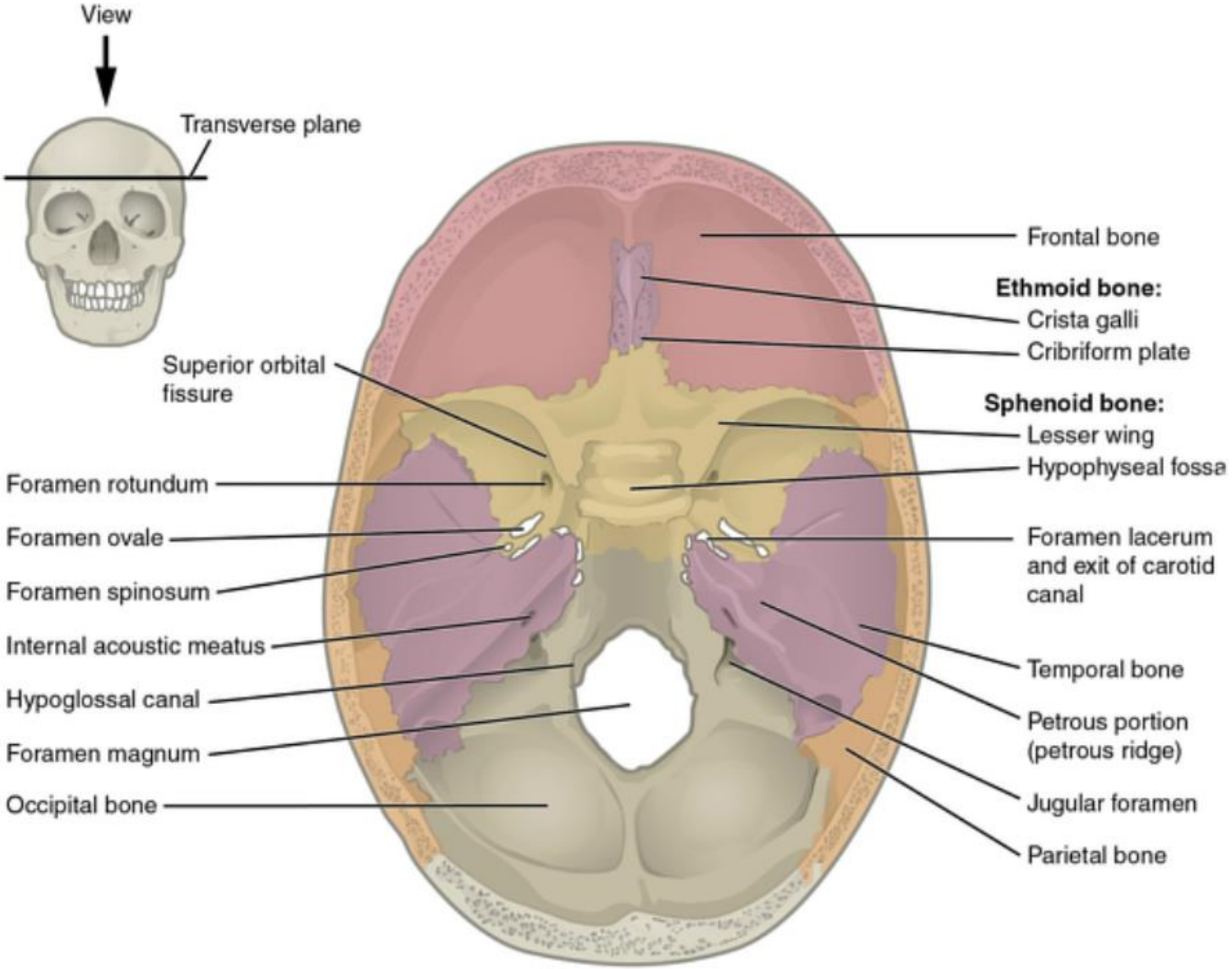
Occipital

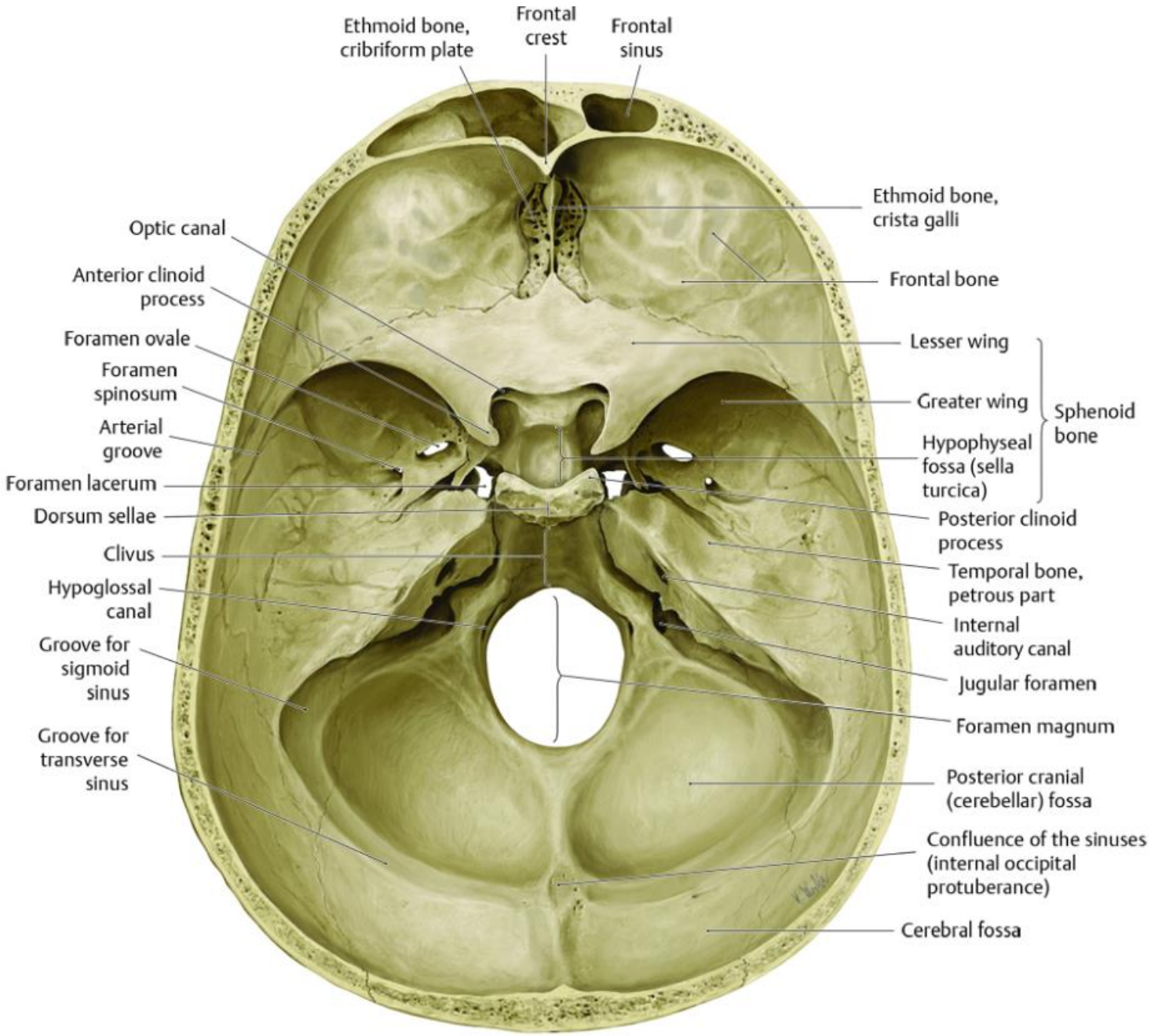
Pterion	**Parietal – Temporal** **Sphenoid – Frontal**
Asterion	**Parietal – Temporal** **Occipital**

The skull base

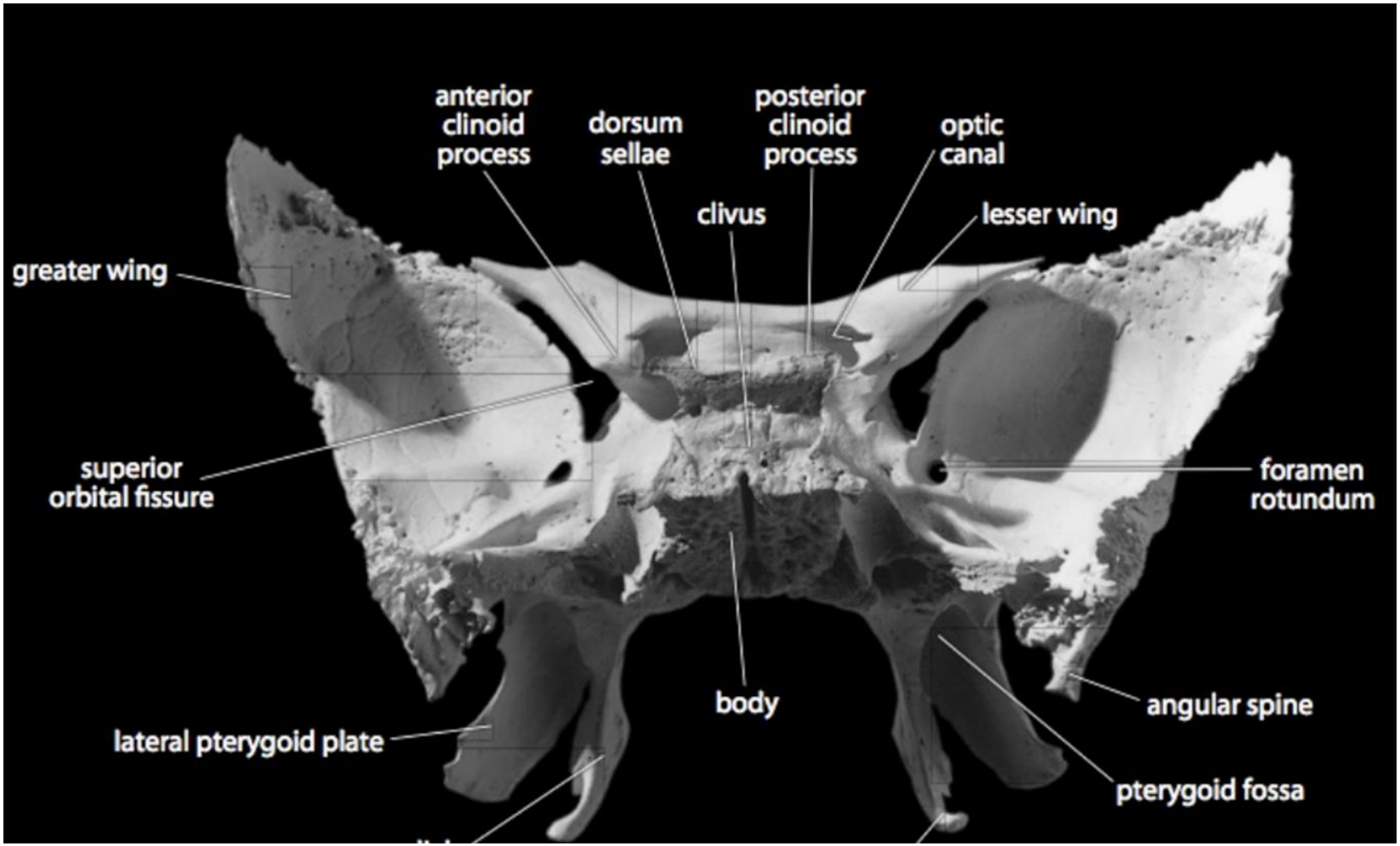
The inner aspect of the skull base is made up of the following bones from anterior to posterior:

- the orbital plates of the frontal bone, with the cribriform plate of the ethmoid bone and crista galli in the midline;
- the sphenoid bone with its lesser wings anteriorly, the greater wings posteriorly, and body with the elevated sella turcica in the midline;
- part of the squamous temporal bone and the petrous temporal bone; and
- the occipital bone


View
Transverse plane
Frontal bone
Ethmoid bone:
Crista galli
Cribriform plate
Superior orbital fissure
Sphenoid bone:
Lesser wing
Hypophyseal fossa
Foramen rotundum
Foramen ovale
Foramen spinosum
Foramen lacerum and exit of carotid canal
Internal acoustic meatus
Temporal bone
Hypoglossal canal
Petrous portion (petrous ridge)
Foramen magnum
Jugular foramen
Occipital bone
Parietal bone

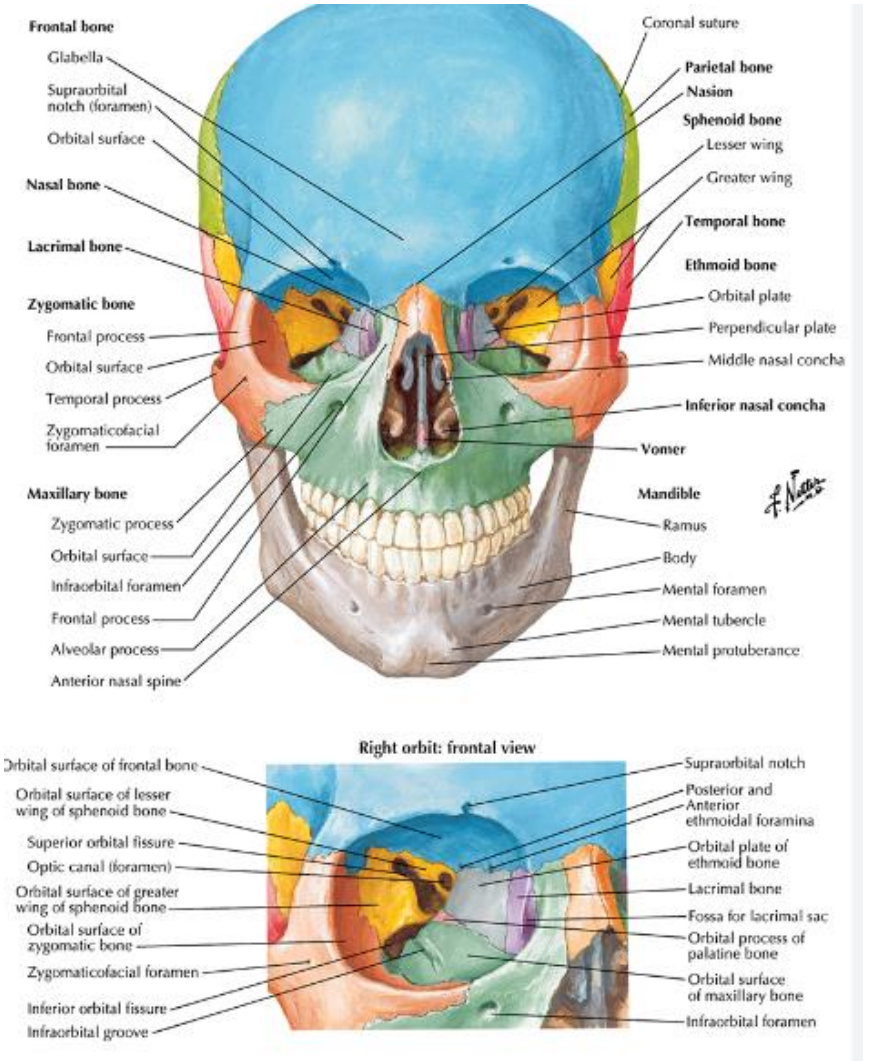

Ethmoid bone, cribriform plate
Frontal crest
Frontal sinus
Ethmoid bone, crista galli
Optic canal
Anterior clinoid process
Frontal bone
Foramen ovale
Lesser wing
Foramen spinosum
Greater wing
Sphenoid bone
Arterial groove
Hypophyseal fossa (sella turcica)
Foramen lacerum
Dorsum sellae
Posterior clinoid process
Clivus
Temporal bone, petrous part
Hypoglossal canal
Internal auditory canal
Groove for sigmoid sinus
Jugular foramen
Foramen magnum
Groove for transverse sinus
Posterior cranial (cerebellar) fossa
Confluence of the sinuses (internal occipital protuberance)
Cerebral fossa

Posterior view of Sphenoid bone



Individual bones of the skull base

The orbital plates of the frontal bones are thin and irregular and separate the anterior cranial fossa from the orbital cavity



The cribriform plate of the ethmoid bone is a thin, depressed bone separating the anterior cranial fossa from the nasal cavity

It has a superior perpendicular projection, the **crista galli,** which is continuous below with the nasal septum on the frontal skull radiograph

The sphenoid body has a deep fossa superiorly known as the **sella turcica** or **pituitary fossa** , which houses the pituitary gland

On the **anterior part** of the sella is a prominence known as the tuberculum sellae ; anterior to this is a groove called the sulcus chiasmaticus , which leads to the optic canal on each side

The **posterior part** of the sella is called the dorsum sellae, and this is continuous posteriorly with the **clivus**

The **floor** of the sella is formed by a thin bone known as the lamina dura

The temporal bone consists of four parts:

- a flat squamous part, which forms part of the vault and part of the skull base;
- a pyramidal petrous part, which houses the middle and inner ears and forms part of the skull base;
- an aerated mastoid part; and
- an inferior projection known as the **styloid process**

The **zygomatic process** projects from the outer side of the squamous temporal bone and is continuous with the zygomatic arch process of the zygoma to form the zygomatic arch

The curved occipital bone forms part of the skull vault and posterior part of the skull base

It has the **foramen magnum** in the midline, through which the cranial cavity is continuous

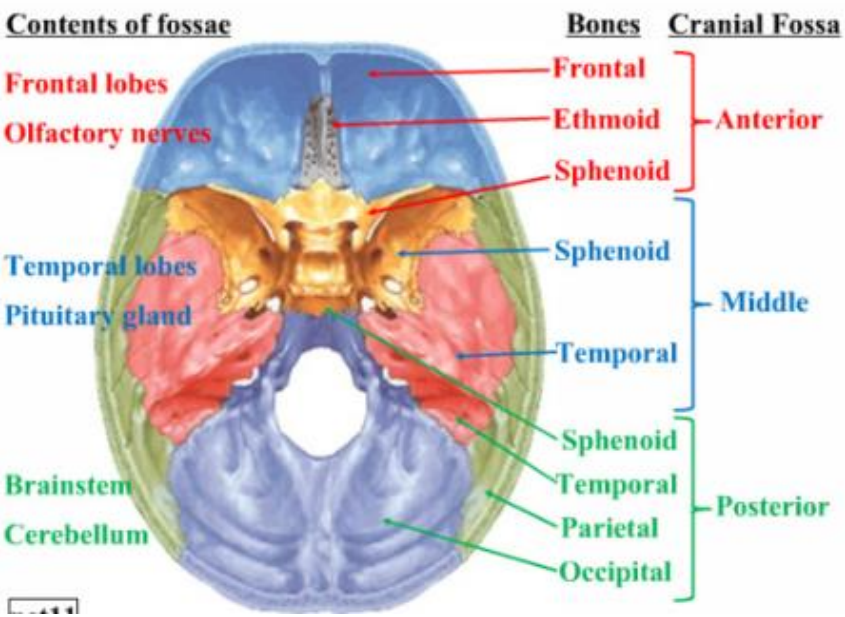
with the spinal canal

Cranial fossae

The anterior cranial fossa supports the frontal lobes of the brain

The middle cranial fossa It contains the temporal lobes of the brain, the pituitary gland, and most of the foramina of the skull base

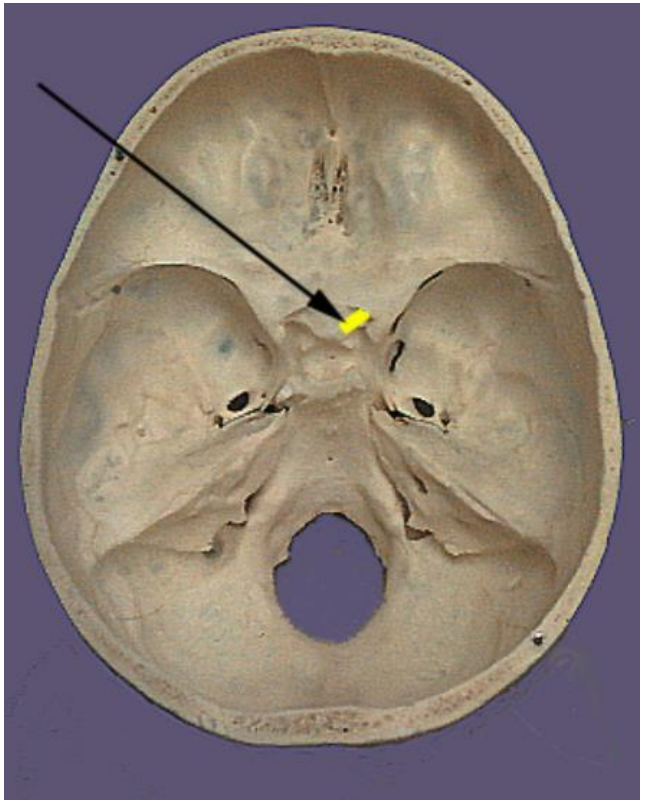
The posterior cranial fossa It contains the cerebellum posteriorly, and anteriorly the pons and medulla lie on the clivus and are continuous, through the foramen magnum, with the spinal cord

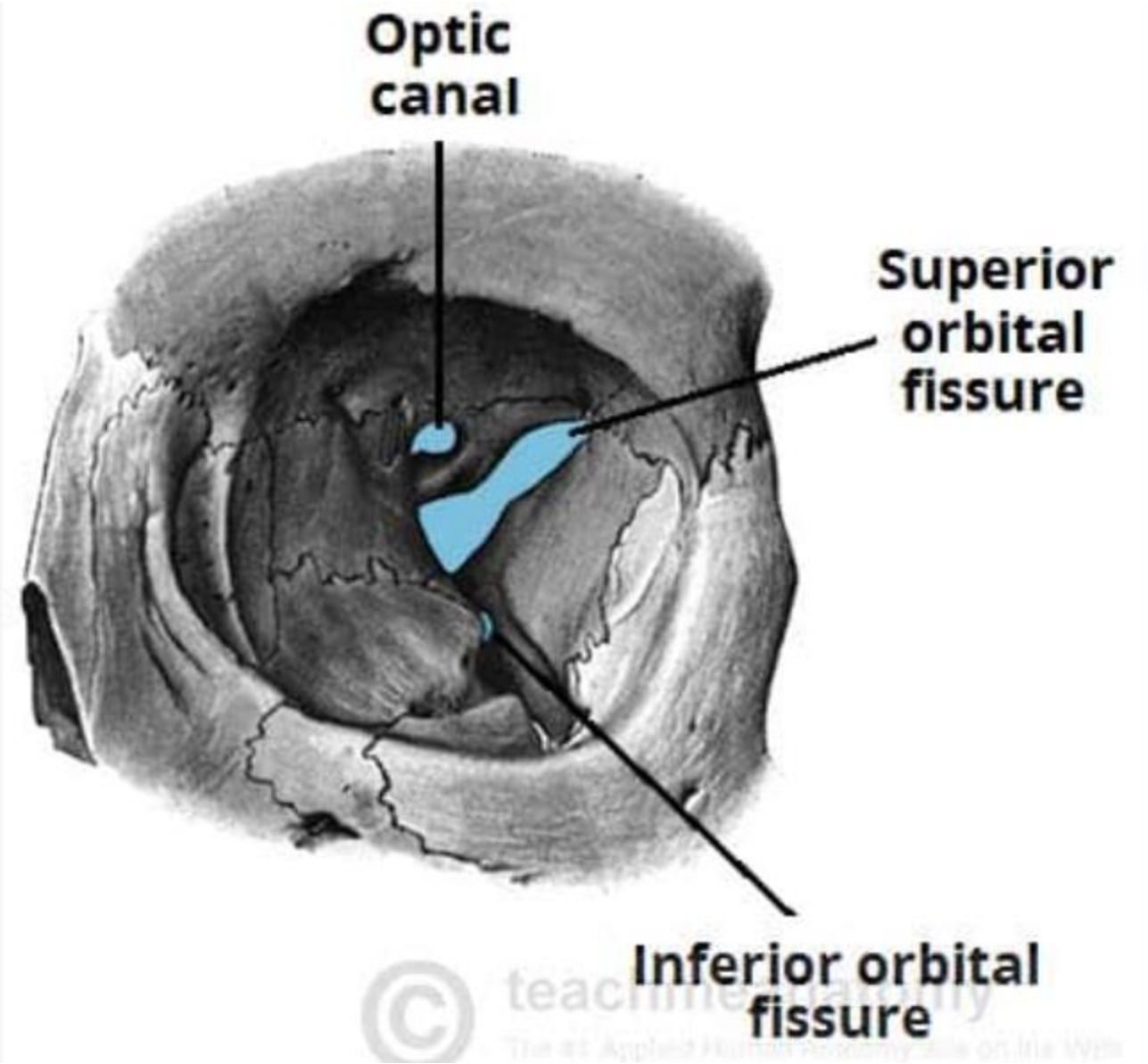


Foramina of the skull base

The optic canals run from the sulcus chiasmaticus anterior to the tuberculum sellae, anteroinferolaterally to the orbital apex

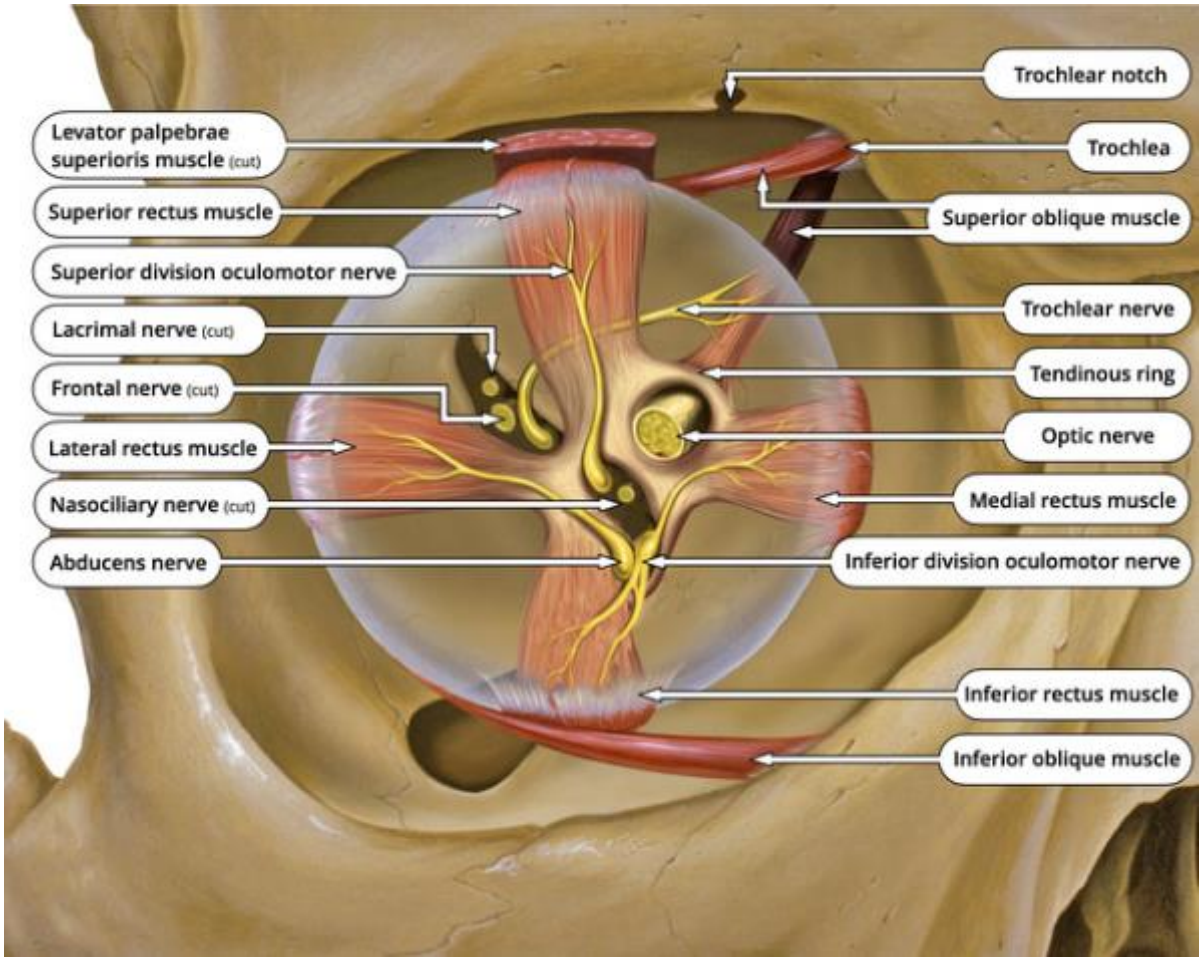
They transmit the optic nerves and ophthalmic arteries




Optic canal
Superior orbital fissure
Inferior orbital fissure

The **superior orbital fissure** is a triangular defect between the greater and lesser wings of sphenoid

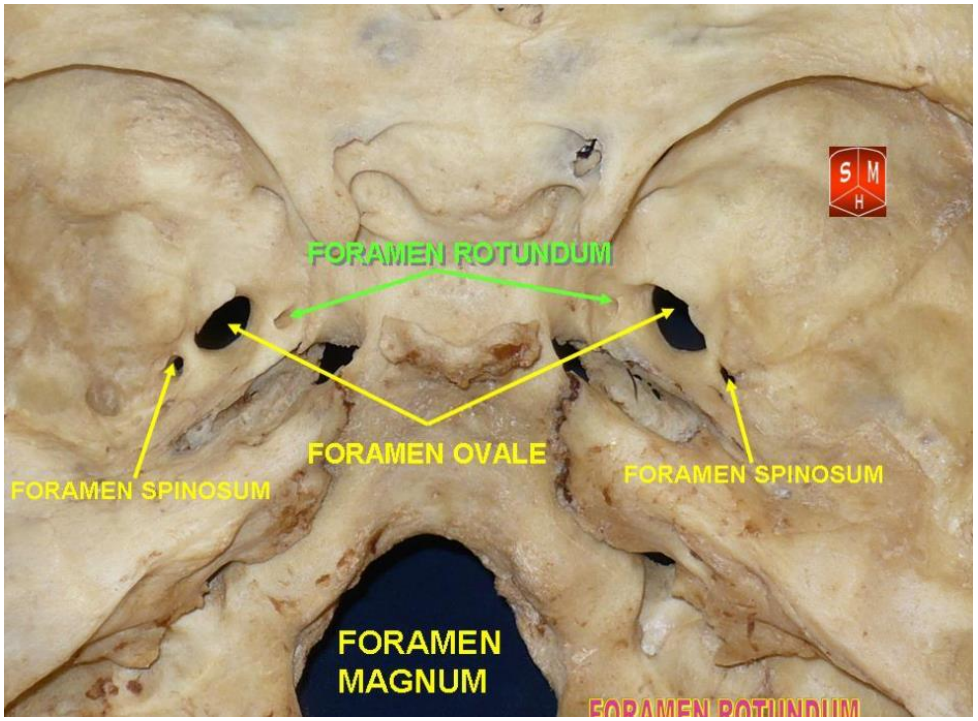
It transmits **the first (orbital) division of the fifth, and the third, fourth and sixth cranial nerves**, along with the **superior orbital vein** and **a branch of the middle meningeal artery** from the middle cranial fossa to the orbital apex

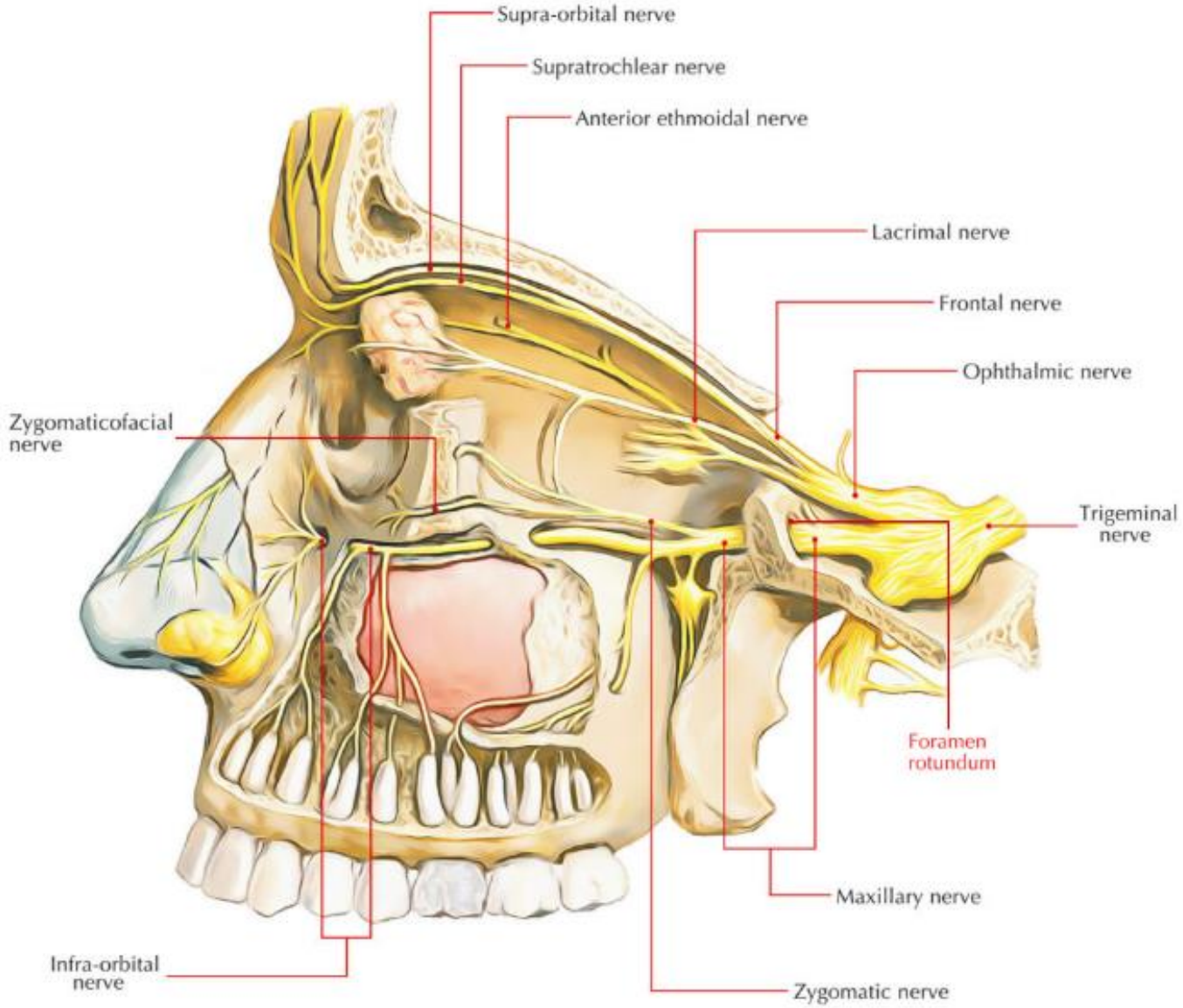

Trochlear notch
Levator palpebrae superioris muscle (cut)
Trochlea
Superior rectus muscle
Superior oblique muscle
Superior division oculomotor nerve
Trochlear nerve
Lacrimal nerve (cut)
Tendinous ring
Frontal nerve (cut)
Optic nerve
Lateral rectus muscle
Medial rectus muscle
Nasociliary nerve (cut)
Abducens nerve
Inferior division oculomotor nerve
Inferior rectus muscle
Inferior oblique muscle

The foramen rotundum is posterior to the superior orbital fissure in the greater wing of sphenoid

It runs from the middle cranial fossa to the pterygopalatine fossa

It transmits the second (maxillary) division of the fifth cranial nerve

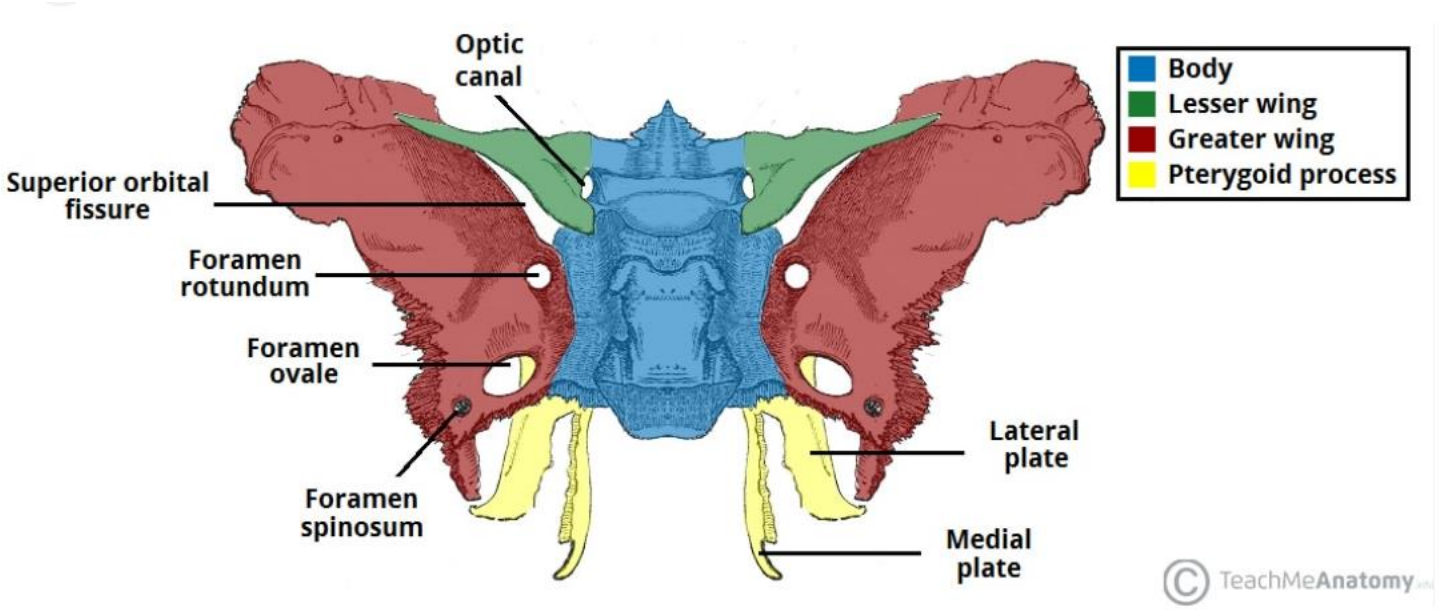



Supra-orbital nerve
Supratrochlear nerve
Anterior ethmoidal nerve
Lacrimal nerve
Frontal nerve
Ophthalmic nerve
Zygomaticofacial nerve
Trigeminal nerve
Foramen rotundum
Maxillary nerve
Infra-orbital nerve
Zygomatic nerve

The foramen ovale is posterolateral to the foramen rotundum in the greater wing of sphenoid

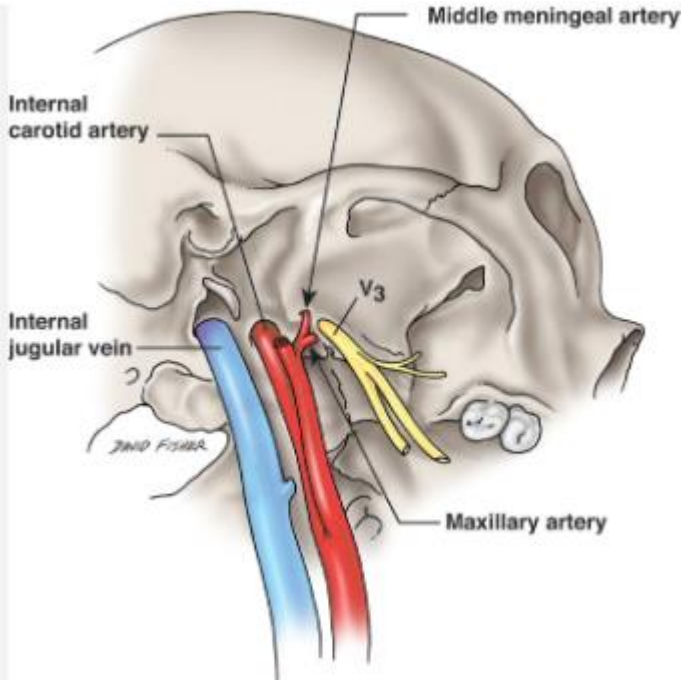
It runs from the middle cranial fossa to the infratemporal fossa

It transmits the third (mandibular) division of the fifth cranial nerve and the accessory meningeal artery



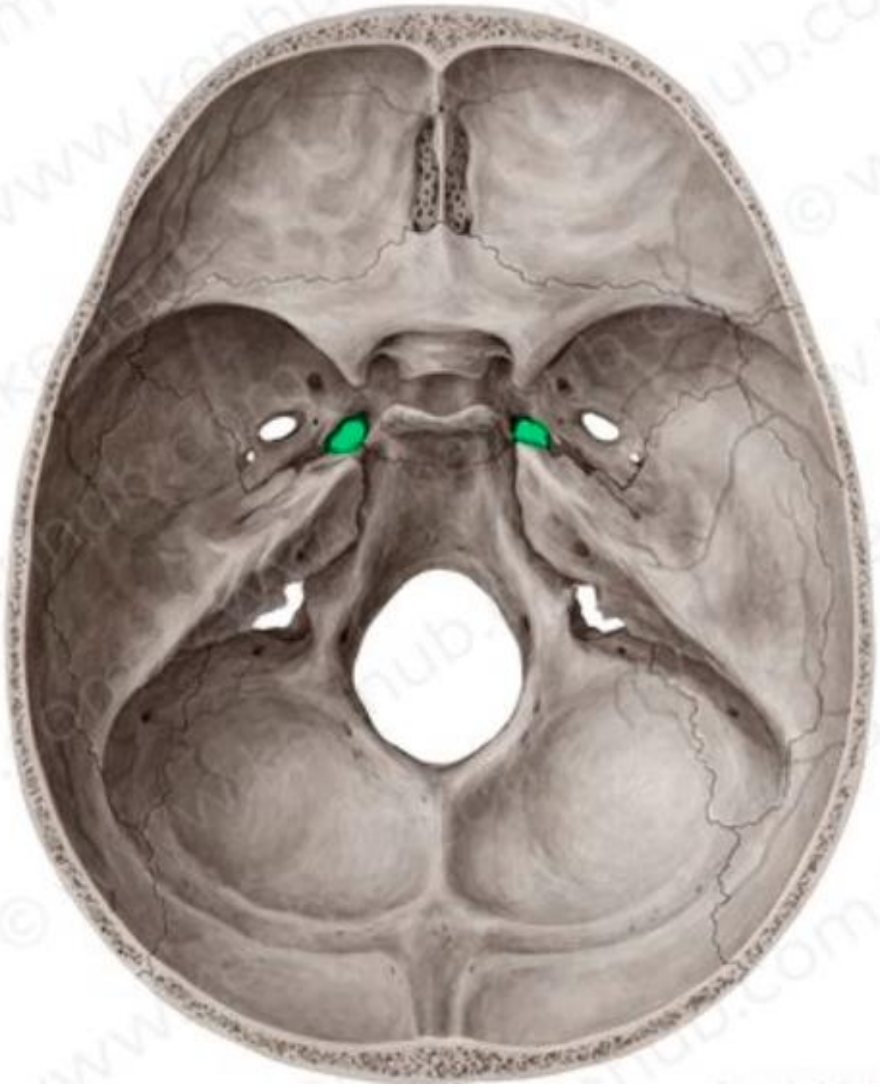
The foramen spinosum , posterolateral to the foramen rotundum, is a small foramen

It transmits the middle meningeal artery from the infratemporal to the middle cranial fossa



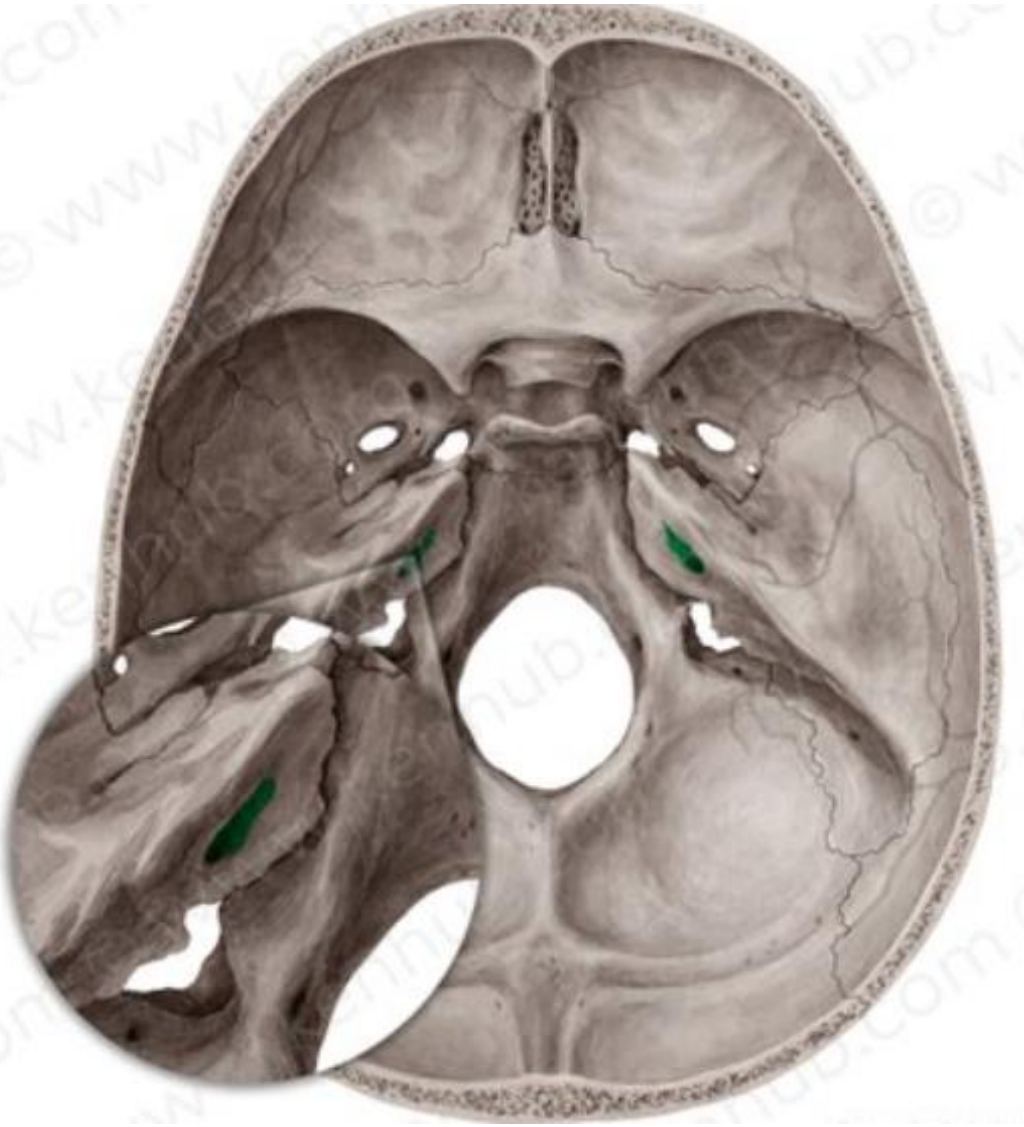
The foramen lacerum is a ragged bony canal posteromedial to the foramen ovale at the apex of the petrous bone

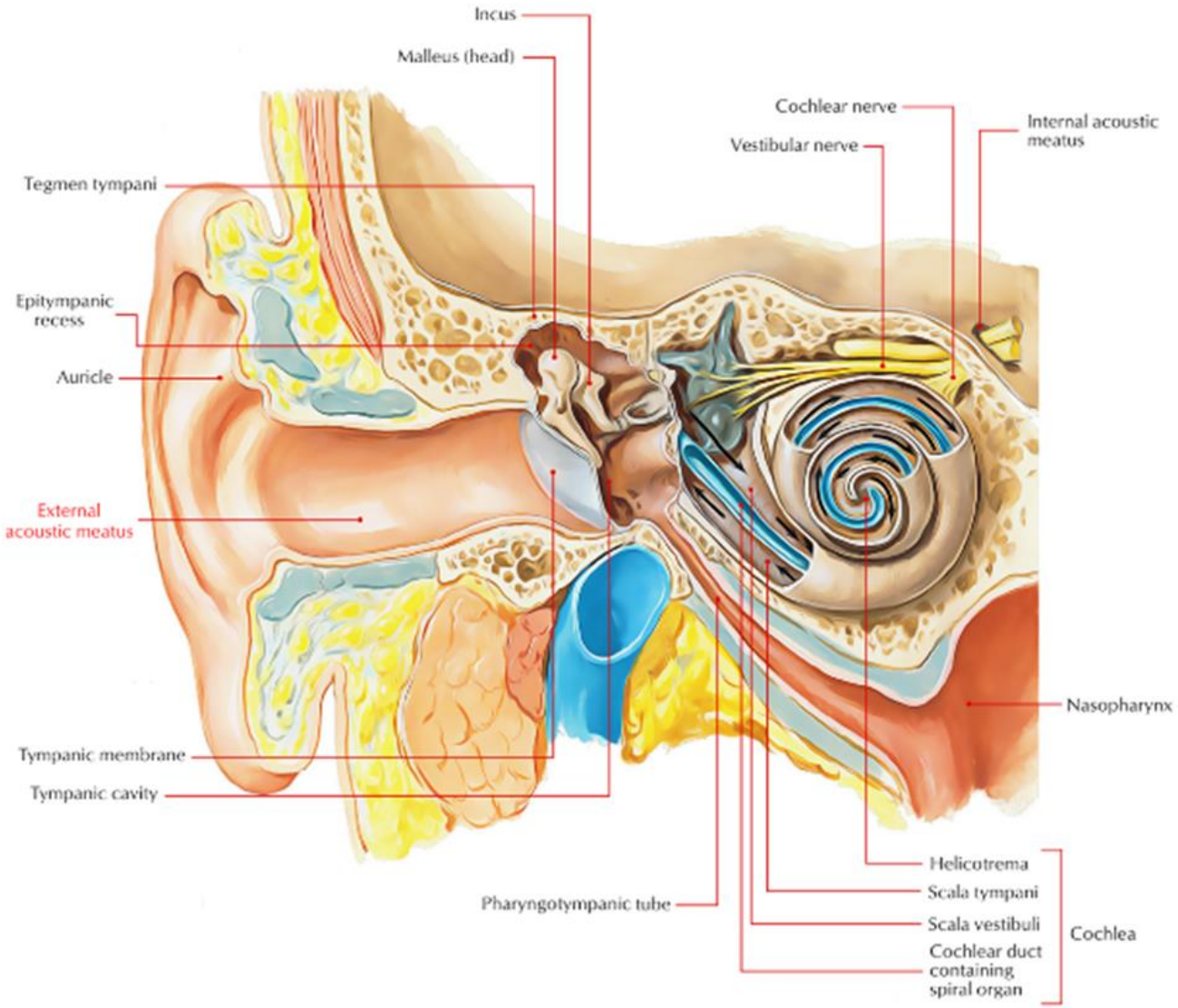
The internal carotid artery passes through its posterior wall, having emerged from the carotid canal (which runs in the petrous bone), before turning upwards to run in the carotid sulcus



The internal auditory meatus and canal run from the posterior cranial fossa through the posterior wall of the petrous bone into the inner ear;

they transmit the seventh and eighth cranial nerves and the internal auditory artery

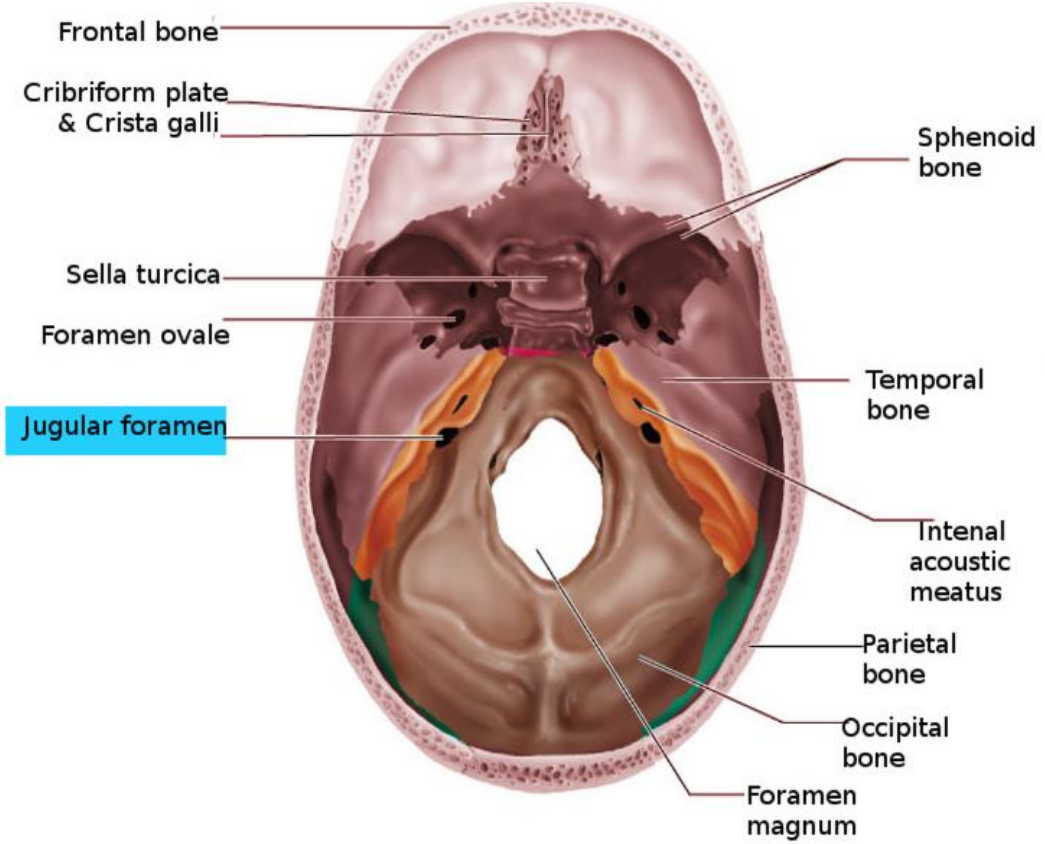


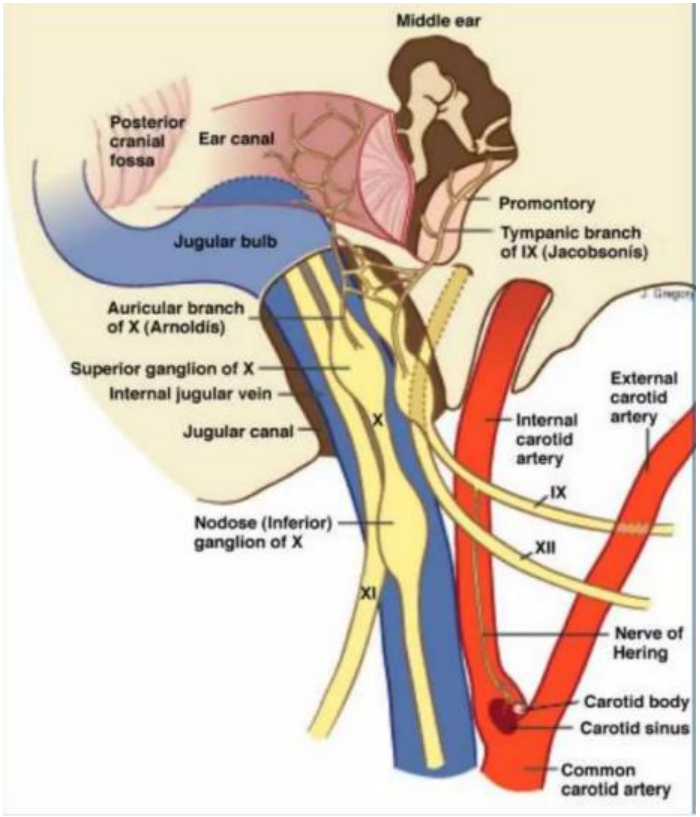

Incus
Malleus (head)
Cochlear nerve
Internal acoustic meatus
Vestibular nerve
Tegmen tympani
Epitympanic recess
Auricle
External acoustic meatus
Nasopharynx
Tympanic membrane
Tympanic cavity
Helicotrema
Scala tympani
Pharyngotympanic tube
Scala vestibuli
Cochlear duct containing spiral organ
Cochlea

The jugular foramen is an irregular opening situated at the posterior end of the junction of the occipital and petrous bones

It runs downward and medially from the posterior cranial fossa

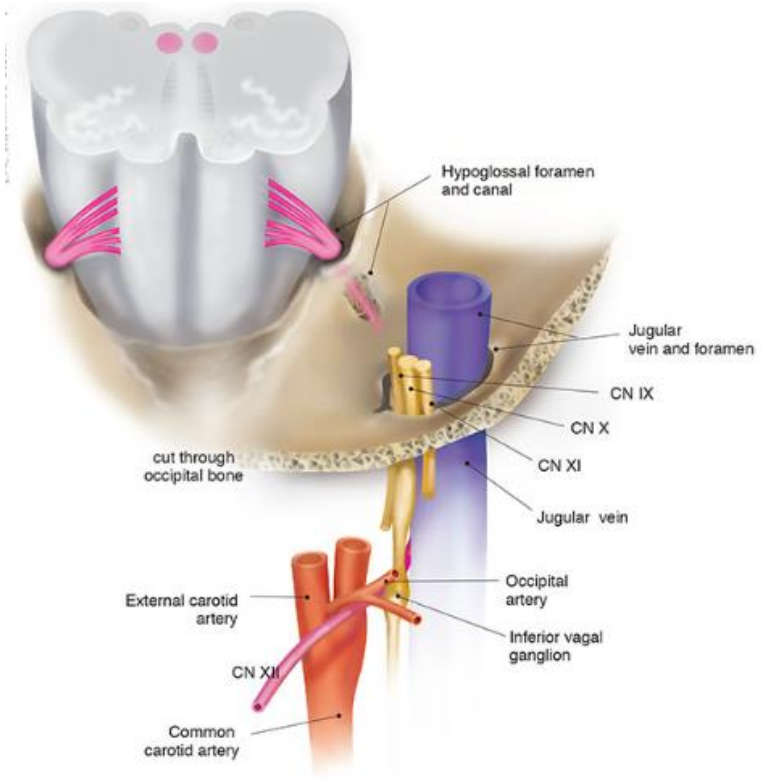
It transmits the internal jugular vein lateral to the ninth, tenth and eleventh cranial nerves

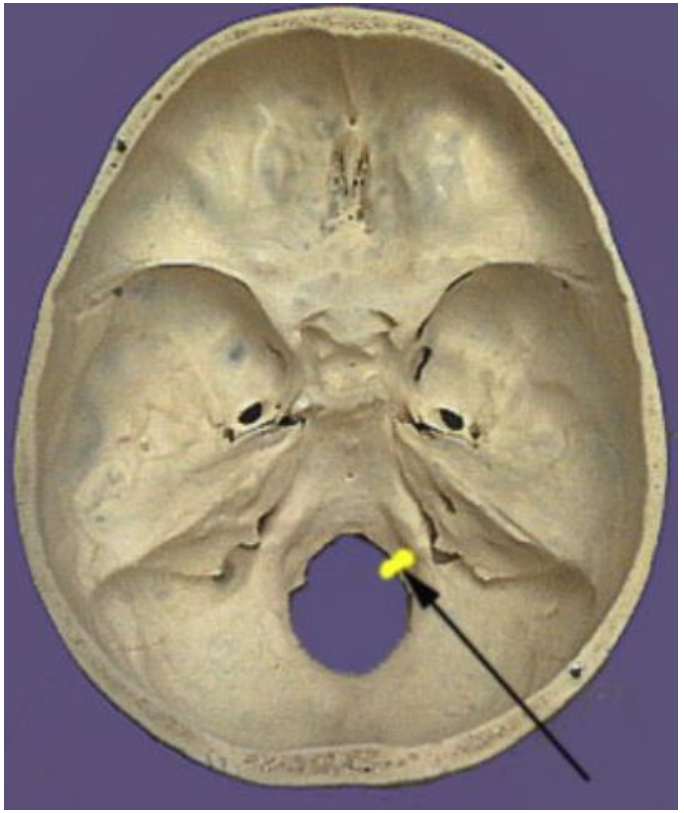

Frontal bone
Cribriform plate & Crista galli
Sphenoid bone
Sella turcica
Foramen ovale
Temporal bone
Jugular foramen
Intenal acoustic meatus
Parietal bone
Occipital bone
Foramen magnum


Middle ear
Posterior cranial fossa
Ear canal
Promontory
Tympanic branch of IX (Jacobsonís)
Jugular bulb
Auricular branch of X (Arnoldís)
Superior ganglion of X
Internal jugular vein
Jugular canal
X
Internal carotid artery
External carotid artery
IX
Nodose (Inferior) ganglion of X
XII
XI
Nerve of Hering
Carotid body
Carotid sinus
Common carotid artery

The hypoglossal canal is anterior to the foramen magnum and medial to the jugular fossa

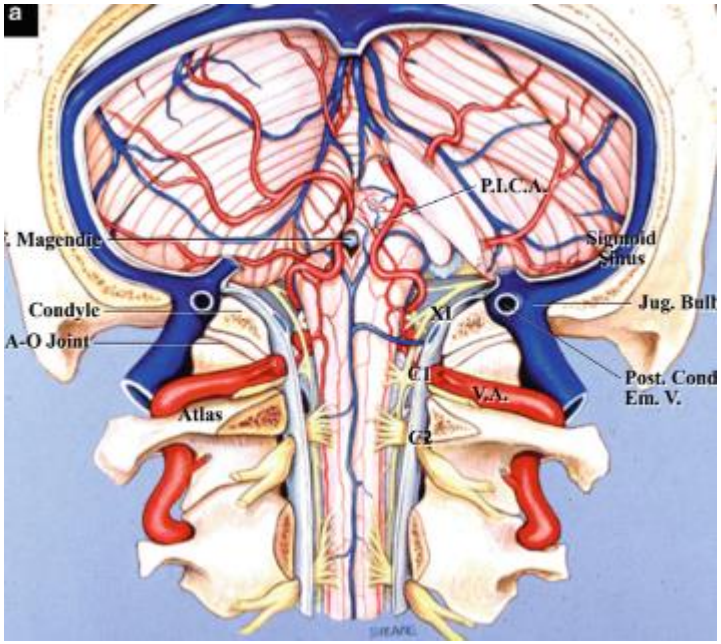
It transmits the twelfth (hypoglossal) cranial nerve

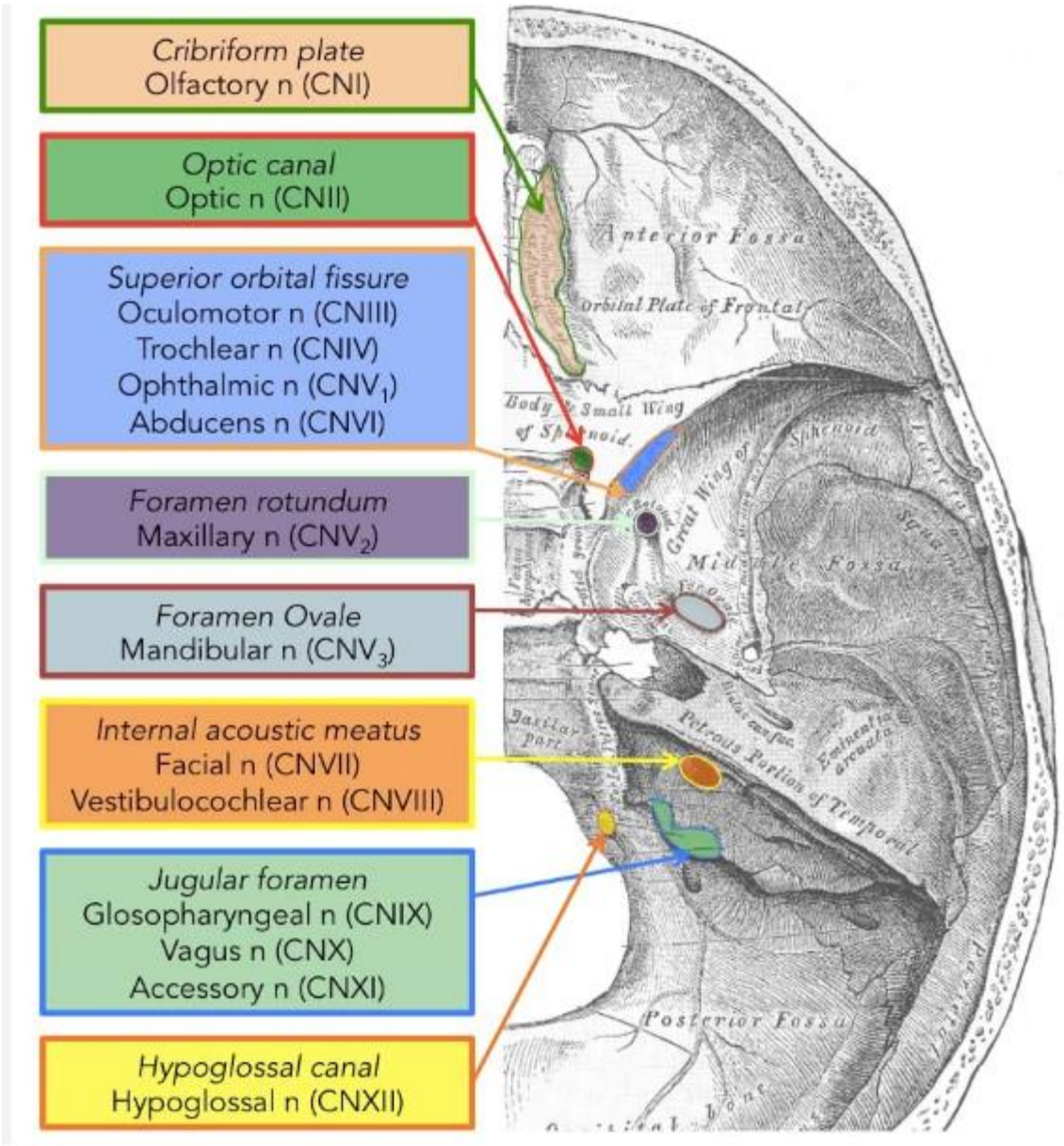




The foramen magnum runs from the posterior cranial fossa to the spinal canal

It transmits the medulla oblongata, which is continuous with the spinal cord, along with the vertebral and spinal arteries and veins and the spinal root of the eleventh cranial nerve




Cribriform plate
Olfactory n (CNI)
Optic canal
Optic n (CNII)
Superior orbital fissure
Oculomotor n (CNIII)
Trochlear n (CNIV)
Ophthalmic n (CNV1)
Abducens n (CNVI)
Foramen rotundum
Maxillary n (CNV2)
Foramen Ovale
Mandibular n (CNV3)
Internal acoustic meatus
Facial n (CNVII)
Vestibulocochlear n (CNVIII)
Jugular foramen
Glosopharyngeal n (CNIX)
Vagus n (CNX)
Accessory n (CNXI)
Hypoglossal canal
Hypoglossal n (CNXII)
Anterior Fossa
Orbital Plate of Frontal
Middle Fossa
Petrous Portion of Temporal
Posterior Fossa