**The Cranial Cavity**

The cranial cavity contains the brain and its surrounding meninges, portions of the cranial nerves, arteries, veins, and venous sinuses.

Vault of the Skull

The internal surface of the vault shows the coronal, sagittal, and lambdoid sutures. In the midline is a shallow sagittal groove that lodges the **superior sagittal sinus.** On each side of the groove are several small pits, called **granular pits,** which lodge the **lateral lacunae** and **arachnoid granulations**. Several narrow grooves are present for the anterior and posterior divisions of the **middle meningeal vessels** as they pass up the side of the skull to the vault.
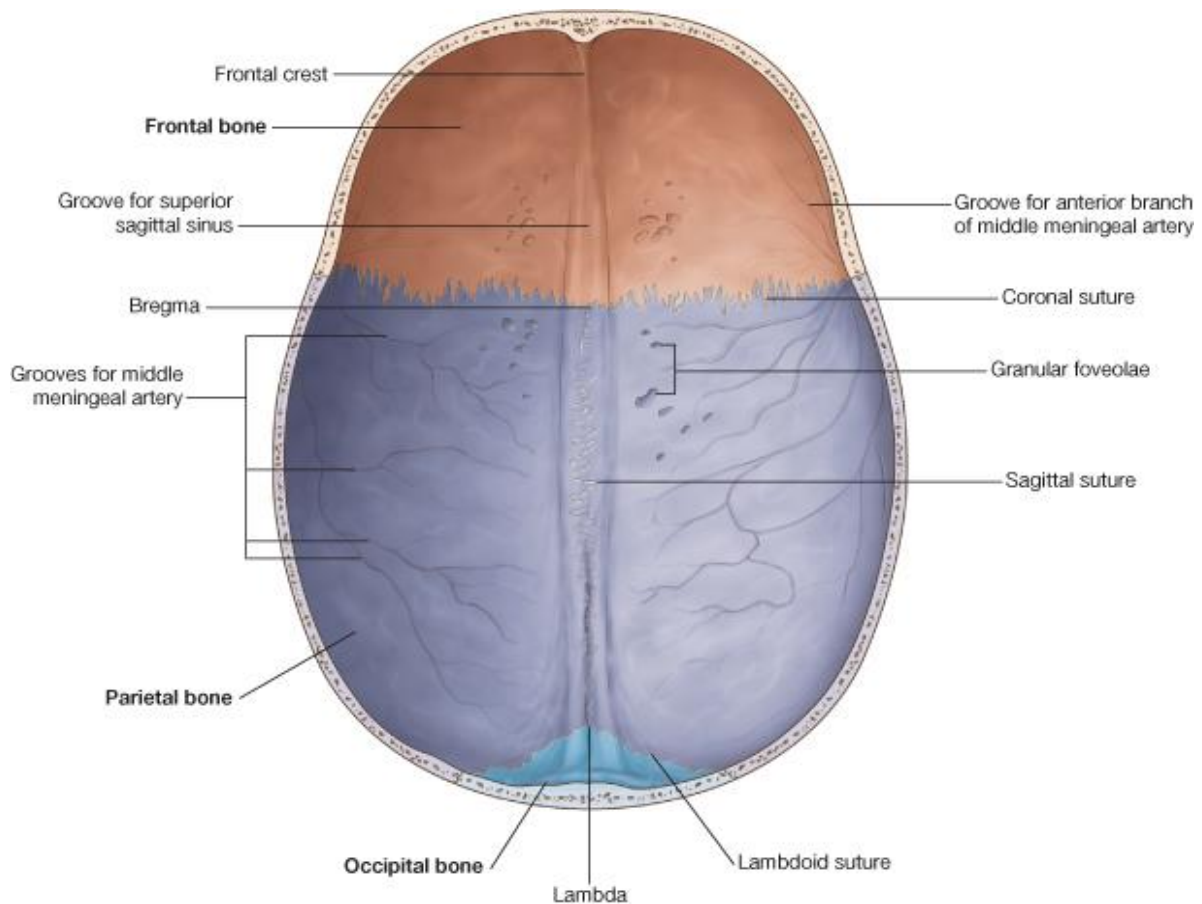
Base of the Skull

The interior of the base of the skull is divided into three cranial fossae: anterior, middle, and posterior. The anterior cranial fossa is separated from the middle cranial fossa by the lesser wing of the sphenoid, and the middle cranial fossa is separated from the posterior cranial fossa by the petrous part of the temporal bone.

Anterior Cranial Fossa

The anterior cranial fossa lodges the frontal lobes of the cerebral hemispheres. It is bounded anteriorly by the inner surface of the frontal bone, and in the midline is a crest for the attachment of the **falx cerebri.** Its posterior boundary is the sharp lesser wing of the sphenoid, which articulates laterally with the frontal bone and meets the anteroinferior angle of the parietal bone, or the pterion. The medial end of the lesser wing of the sphenoid forms the **anterior clinoid process** on each side, which gives attachment to the **tentorium cerebelli.** The median part of the anterior cranial fossa is limited posteriorly by the groove for the optic chiasma. The floor of the fossa is formed by the ridged orbital plates of the frontal bone laterally and by the **cribriform plate** of the ethmoid medially. The **crista galli** is a sharp upward projection of the ethmoid bone in the midline for the attachment of the falx cerebri. Alongside the crista galli is a narrow slit in the cribriform plate for the passage of the **anterior ethmoidal nerve** into the nasal

cavity. The upper surface of the cribriform plate supports the olfactory bulbs, and the small perforations in the cribriform plate are for the **olfactory nerves.**

Middle Cranial Fossa

The middle cranial fossa consists of a small median part and expanded lateral parts. The median raised part is formed by the body of the sphenoid, and the expanded lateral parts form concavities on either side, which lodge the **temporal lobes** of the **cerebral hemispheres.** It is bounded anteriorly by the lesser wings of the sphenoid and posteriorly by the superior borders of the petrous parts of the temporal bones. Laterally lie the squamous parts of the temporal bones, the greater wings of the sphenoid, and the parietal bones. The floor of each lateral part of the middle cranial fossa is formed by the greater wing of the sphenoid and the squamous and petrous parts of the temporal bone.

The sphenoid bone resembles a bat having a centrally placed **body** with **greater** and **lesser wings** that are outstretched on each side. The body of the sphenoid contains the **sphenoid air sinuses,** which are lined with mucous membrane and communicate with the nasal cavity; they serve as voice resonators. Anteriorly, the **optic canal** transmits the optic nerve and the ophthalmic artery, a branch of the internal carotid artery, to the orbit. The **superior orbital fissure,** which is a slitlike opening between the lesser and the greater wings of the sphenoid, transmits the lacrimal, frontal, trochlear, oculomotor,

nasociliary, and abducent nerves, together with the superior ophthalmic vein. The sphenoparietal venous sinus runs medially along the posterior border of the lesser wing of the sphenoid and drains into the cavernous sinus. The **foramen rotundum,** which is situated behind the medial end of the superior orbital fissure, perforates the greater wing of the sphenoid and transmits the maxillary nerve from the trigeminal ganglion to the pterygopalatine fossa. The **foramen ovale** lies posterolateral to the foramen rotundum. It perforates the greater wing of the sphenoid and transmits the large sensory root and small motor root of the mandibular nerve to the infratemporal

fossa; the lesser petrosal nerve also passes through it. The small **foramen spinosum** lies posterolateral to the foramen ovale and also perforates the greater wing of the sphenoid. The foramen transmits the middle meningeal artery from the infratemporal fossa into the cranial cavity. The artery then runs forward and laterally in a groove on the upper surface of the squamous part of the temporal bone and the greater wing of the sphenoid. After a short distance, the artery divides into anterior and posterior branches. The anterior branch passes forward and upward to the anteroinferior angle of the parietal bone. Here, the bone is deeply grooved or tunneled by the artery for a short distance before it runs backward and upward on the parietal bone. It is at this site that the artery may be damaged after a blow to the side of the head. The posterior branch passes backward and upward across the squamous part of the temporal bone to reach the parietal bone. The large and irregularly shaped **foramen lacerum** lies between the apex of the petrous part of the temporal bone and the sphenoid bone. The inferior opening of the foramen lacerum in life is filled by cartilage and fibrous tissue, and only small blood vessels pass through this tissue from the cranial cavity to the neck. The **carotid canal** opens into the side of the foramen lacerum above the closed inferior opening. The internal carotid artery enters the foramen through the carotid canal and immediately turns upward to reach the side of the body of the sphenoid bone. Here, the artery turns forward in the cavernous sinus to reach the region of the anterior clinoid process. At this point, the internal carotid artery turns vertically upward, medial to the anterior clinoid process, and emerges from the cavernous sinus. Lateral to the foramen lacerum is an impression on the apex of the petrous part of the temporal bone for the **trigeminal ganglion.**

On the anterior surface of the petrous bone are two grooves for nerves; the largest medial groove is for the **greater petrosal nerve,** a branch of the facial nerve; the smaller lateral groove is for the **lesser petrosal nerve,** a branch of the tympanic plexus. The greater petrosal nerve enters the foramen lacerum deep to the trigeminal ganglion and joins the **deep petrosal nerve** (sympathetic fibers from around the internal carotid artery), to form the **nerve of the pterygoid canal.** The lesser petrosal nerve passes forward to the foramen ovale. The abducent nerve bends sharply forward across the apex of the petrous bone, medial to the trigeminal ganglion. Here, it leaves the posterior cranial fossa and enters the cavernous sinus. The **arcuate eminence** is a rounded eminence found on the anterior surface of the petrous bone and is caused by the underlying **superior semicircular canal.** The **tegmen tympani,** a thin plate of bone, is a forward extension of the petrous part of the temporal bone and adjoins the squamous part of the bone . From behind forward, it forms the roof of the mastoid antrum, the tympanic cavity, and the auditory tube. This thin plate of bone is the only major barrier that separates infection in the tympanic cavity from the temporal lobe of the cerebral hemisphere.

The median part of the middle cranial fossa is formed by the body of the sphenoid bone. In front is the **sulcus chiasmatis,** which is related to the optic chiasma and leads laterally to the **optic canal** on each side. Posterior to the sulcus is an elevation,

the **tuberculum sellae.** Behind the elevation is a deep depression, the **sella turcica,** which lodges the **pituitary gland.** The sella turcica is bounded posteriorly by a square plate of bone called the **dorsum sellae.** The superior angles of the dorsum sellae have two tubercles, called the **posterior clinoid processes,** which give attachment to the fixed margin of the tentorium cerebelli. The cavernous sinus is directly related to the side of the body of the sphenoid. It carries in its lateral wall the 3rd and 4th cranial nerves and the ophthalmic and maxillary divisions of the 5th cranial nerve. The internal carotid artery and the 6th cranial nerve pass forward through the sinus.

Posterior Cranial Fossa

The posterior cranial fossa is deep and lodges the parts of the hindbrain, namely, the **cerebellum, pons,** and **medulla oblongata.** Anteriorly, the fossa is bounded by the superior border of the petrous part of the temporal bone, and posteriorly it is bounded by the internal surface of the squamous part of the occipital bone. The floor of the posterior fossa is formed by the basilar, condylar, and squamous parts of the occipital bone and the mastoid part of the temporal bone.

The roof of the fossa is formed by a fold of dura, the **tentorium cerebelli,** which intervenes between the cerebellum below and the occipital lobes of the cerebral hemispheres above.

The **foramen magnum** occupies the central area of the floor and transmits the medulla oblongata and its surrounding meninges, the ascending spinal parts of the accessory nerves, and the two vertebral arteries.

The **hypoglossal canal** is situated above the anterolateral boundary of the foramen magnum and transmits the **hypoglossal nerve.** The **jugular foramen** lies between the lower border of the petrous part of the temporal bone and the condylar part of the occipital bone. It transmits the following structures from before backward: the **inferior petrosal sinus;** the **9th, 10th,** and **11th cranial nerves;** and the large **sigmoid**

sinus. The inferior petrosal sinus descends in the groove on the lower border of the petrous part of the temporal bone to reach the foramen. The sigmoid sinus turns down through the foramen to become the **internal jugular vein.** The **internal acoustic meatus** pierces the posterior surface of the petrous part of the temporal bone. It transmits the vestibulocochlear nerve and the motor and sensory roots of the facial nerve.

The **internal occipital crest** runs upward in the midline posteriorly from the foramen magnum to the **internal occipital protuberance;** to it is attached the small **falx cerebella** over the **occipital sinus.**

On each side of the internal occipital protuberance is a wide groove for the **transverse sinus**. This groove sweeps around on either side, on the internal surface of the occipital bone, to reach the posteroinferior angle or corner of the parietal bone. The groove now passes onto the mastoid part of the temporal bone, and here the transverse sinus becomes the **sigmoid sinus.** The **superior petrosal sinus** runs
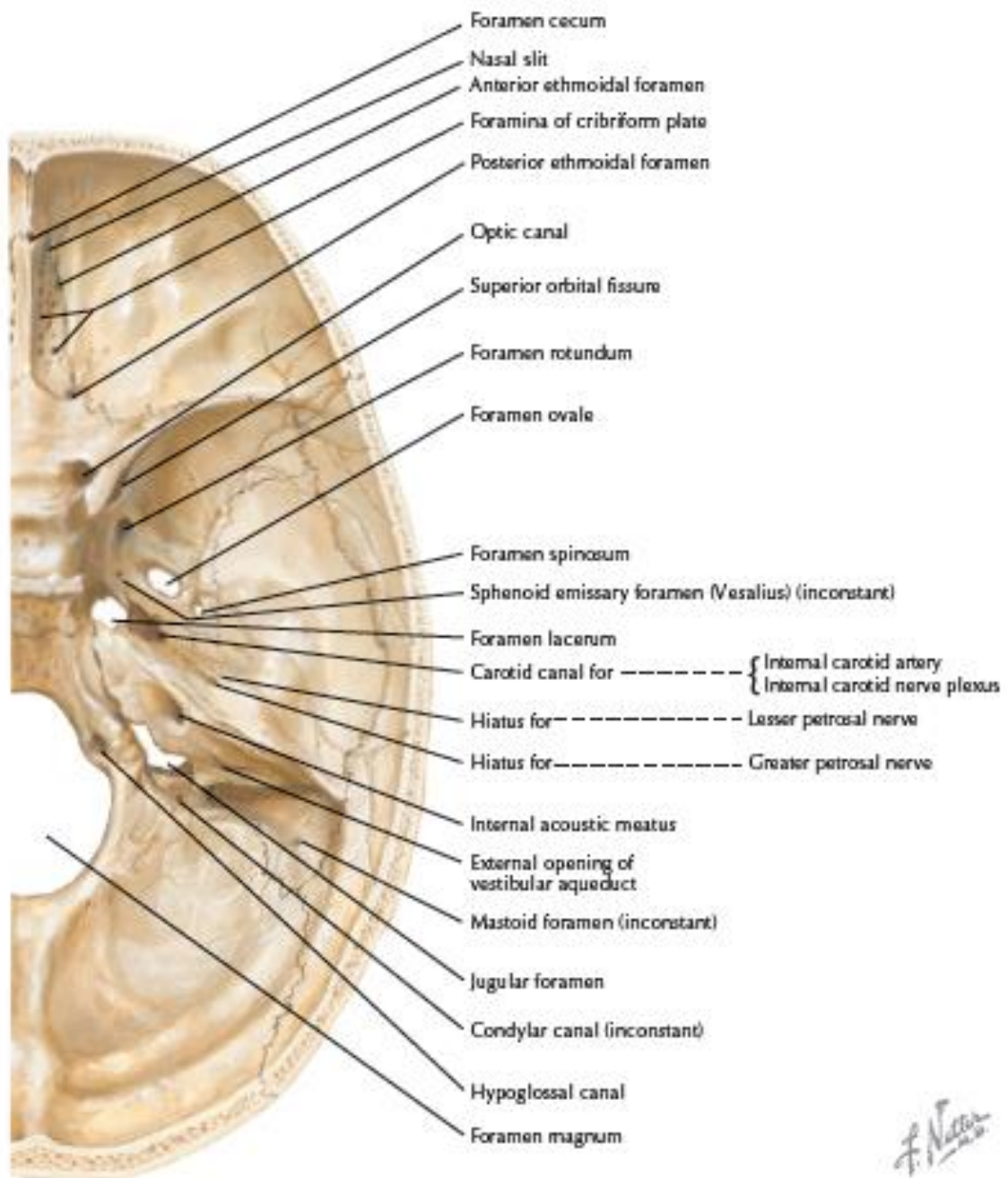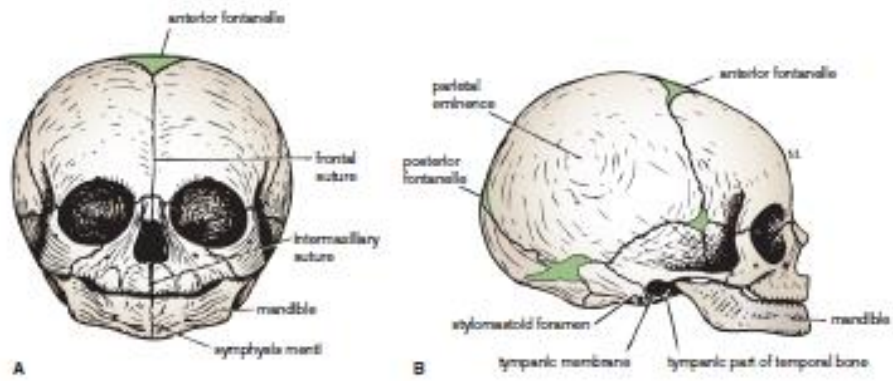
backward along the upper border of the petrous bone in a narrow groove and drains into the sigmoid sinus. As the sigmoid sinus descends to the jugular foramen, it deeply grooves the back of the petrous bone and the mastoid part of the temporal bone. Here, it lies directly posterior to the mastoid antrum.
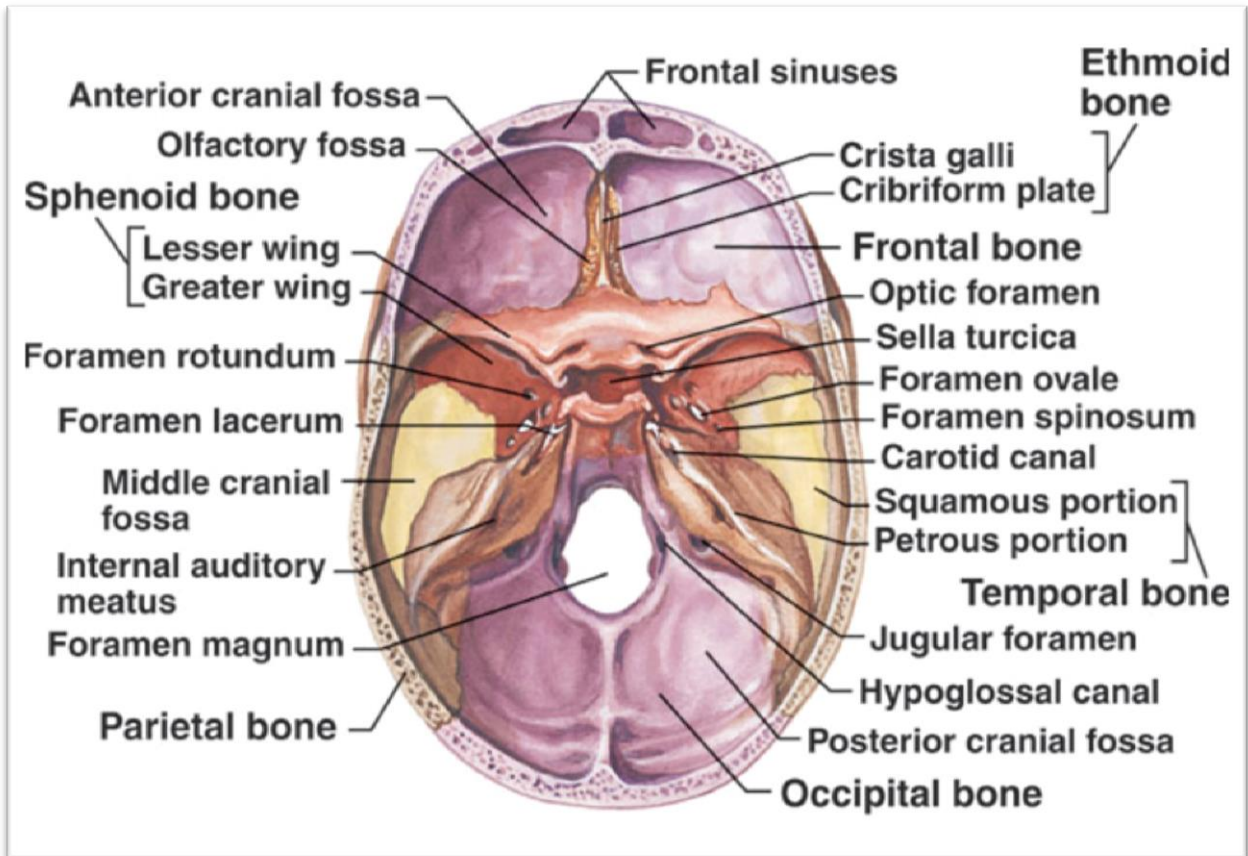
Opening in Skull	Bone of Skull	Structures Transmitted
Anterior Cranial Fossa		
Perforations in cribriform plate	Ethmoid	Olfactory nerves
Middle Cranial Fossa		
Optic canal	Lesser wing of sphenoid	Optic nerve, ophthalmic artery
Superior orbital fissure	Between lesser and greater wings of sphenoid	Lacrimal, frontal, trochlear, oculomotor, nasociliary, and abducent nerves; superior ophthalmic vein
Foramen rotundum	Greater wing of sphenoid	Maxillary division of the trigeminal nerve
Foramen ovale	Greater wing of sphenoid	Mandibular division of the trigeminal nerve, lesser petrosal nerve
Foramen spinosum	Greater wing of sphenoid	Middle meningeal artery
Foramen lacerum	Between petrous part of temporal and sphenoid	Internal carotid artery
Posterior Cranial Fossa		
Foramen magnum	Occipital	Medulla oblongata, spinal part of accessory nerve, and right and left vertebral arteries
Hypoglossal canal	Occipital	Hypoglossal nerve
Jugular foramen	Between petrous part of temporal and condylar part of occipital	Glossopharyngeal, vagus, and accessory nerves; sigmoid sinus becomes internal jugular vein
Internal acoustic m	Petrous part of temporal	Vestibulocochlear and facial nerves

Neonatal Skull

The newborn skull, compared with the adult skull, has a disproportionately large cranium relative to the face. In childhood, the growth of the mandible, the maxillary sinuses, and the alveolar processes of the maxillae results in a great increase in length of the face. The bones of the skull are smooth and unilaminar, there being no diploë present. Most of the skull bones are ossified at birth, but the process is incomplete, and the bones are mobile on each other, being connected by fibrous tissue or cartilage. The bones of the vault are ossified in membrane; the bones of the base are ossified in cartilage. The bones of the vault are not closely knit at sutures, as in the adult, but are separated by unossified membranous intervals called **fontanelles.** Clinically, the anterior and posterior fontanelles are most important and are easily examined in the midline of the vault. The **anterior fontanelle** is diamond shaped and lies between the two halves of the frontal bone in front and the two parietal bones behind. The fibrous membrane forming the floor of the anterior fontanelle is replaced by bone and is closed by 18 months of age. The **posterior fontanelle** is triangular and lies between the two parietal bones in front and the occipital bone behind. By the end of the 1st year, the fontanelle is usually closed and can no longer be palpated. The **tympanic part of the temporal bone** is merely a C-shaped ring at birth, compared with a C-shaped curved plate in the adult. This means that the external auditory meatus is almost entirely cartilaginous in the newborn, and the **tympanic membrane** is nearer the surface. Although the tympanic membrane is nearly as large as in the adult, it faces more inferiorly. During childhood, the tympanic plate grows laterally, forming the bony part of the meatus, and the tympanic membrane comes to face more directly laterally. The **mastoid process** is not present at birth and develops later in response to the pull of the sternocleidomastoid muscle when the child moves his or her head. At birth, the mastoid antrum lies about 3 mm deep to the floor of the **suprameatal triangle.** As growth of the skull continues, the lateral bony wall thickens so that at puberty the antrum may lie as much as 15 mm from the surface. The mandible has right and left halves at birth, united in the midline with fibrous tissue. The two halves fuse at the **symphysis menti** by the end of the 1st year. The **angle of the mandible** at birth is obtuse, the head being placed level with the upper margin of the body and the coronoid process lying at a superior level to the head. It is only after eruption of the permanent teeth that the angle of the mandible assumes the adult shape and the head and neck grow so that the head comes to lie higher than the coronoid process. In old age, the size of the mandible is reduced when the teeth are lost. As the alveolar part of the bone becomes smaller, the ramus becomes oblique in position so that the head is bent posteriorly.

A

anterior fontanelle

frontal suture

intermaxillary suture

mandible

symphysis menti

B

parietal eminence

posterior fontanelle

anterior fontanelle

M.

stylomastoid foramen

tympanic membrane

tympanic part of temporal bone

mandible

Foramen cecum

Nasal slit

Anterior ethmoidal foramen

Foramina of cribriform plate

Posterior ethmoidal foramen

Optic canal

Superior orbital fissure

Foramen rotundum

Foramen ovale

Foramen spinosum

Sphenoid emissary foramen (Vesalius) (inconstant)

Foramen lacerum

Carotid canal for ——————— { Internal carotid artery / Internal carotid nerve plexus

Hiatus for —————————— Lesser petrosal nerve

Hiatus for —————————— Greater petrosal nerve

Internal acoustic meatus

External opening of vestibular aqueduct

Mastoid foramen (inconstant)

Jugular foramen

Condylar canal (inconstant)

Hypoglossal canal

Foramen magnum

F. Netter

References :

1- Snell, Richard S. Clinical anatomy by regions. Lippincott Williams & Wilkins, 2011.

2- Norton, Neil S. Netter's head and neck anatomy for dentistry e-book. Elsevier Health Sciences, 2016.