

GROSS ANATOMY OF A SKULL

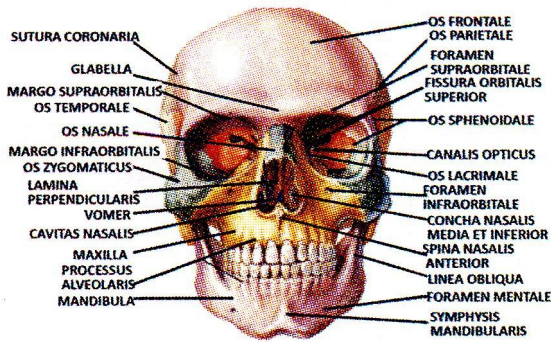


Fig. 101. Skull (ant. view)

The head consists of the skull, face, scalp, teeth, brain, cranial nerves, meninges, special sense organs, and other structures such as blood vessels, lymphatics, and fat. It is also the site where food is ingested and air is inspired and expired (Fig. 101; Fig. 102). Diseases of important structures in the head form the bases of many medical, dental, and surgical specialties - dentistry, maxillofacial surgery, neurology, neuroradiology, neurosurgery, neuropsychiatry, oral surgery, maxillofacial surgery, ophthalmology, oral surgery, otology, psychiatry, and rhinology. The skull is the skeleton of the head; a series of bones form its two parts, the **neurocranium** and **facial skull**. The neuro-cranium ('brain box' or cranial vault) provides a case for the brain and cranial meninges (membranes covering the brain), proximal parts of the cranial nerves, and blood vessels. The term **cranium** (means skull) is sometimes restricted to a skull without the mandible. The cranium has a domelike roof-the calvaria - skullcap (Fig. 103) - and a floor or cranial base (**basicranium**) consisting of the ethmoid bone and parts of the occipital and temporal bones (Fig. 104). The facial skeleton consists of the bones surrounding the mouth and nose and contributing to the orbits (eye sockets, orbital cavities). In the anatomical position, the skull is oriented so that the inferior margin of the orbit

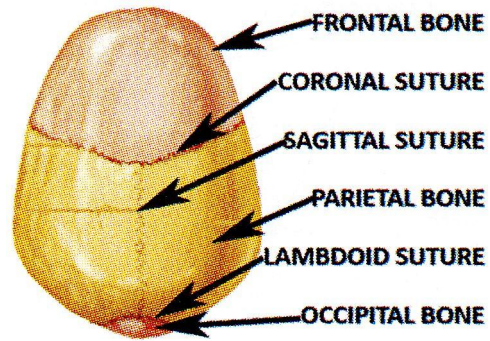


Fig. 103. Skull (superior view)

(eye socket) and the superior margin of the external acoustic meatus (auditory canal) are horizontal. This is called the **orbitomeatal plane (Frankfurt plane)**.

THE NEUROCRANIUM in adults is formed by eight bones:

1. A frontal bone (*os frontale*),
2. Paired parietal bones (*os parietale*),
3. Paired temporal bones (*os temporale*),
4. An occipital bone (*os occipitale*),
5. A sphenoid bone (*os sphenoidale*),
6. An ethmoid bone (*os ethmoidale*).

Most of these bones are largely flat, curved, and united by fibrous interlocking sutures. During childhood, some bones are united by hyaline cartilage (synchondroses) - between the occipital and sphenoid bones. A number of irregular bones form the framework of the face and cranial base.

1. **THE FRONTAL BONE** - specifically its squamous (flat) part - forms the skeleton of the forehead, articulating inferiorly with the nasal and zygomatic bones (Fig. 105). In the fetal skull, the frontal suture separates the two halves of the frontal bone, and they remain separate until approximately 6 years of age. The smooth, broad, convex plate of bone called the frontal squama. The frontal articulates with twelve bones: the sphenoid, the ethmoid, the two

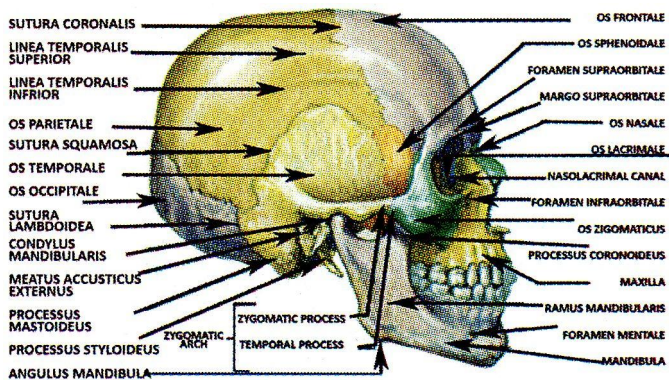


Fig. 102. Skull (lat. view)

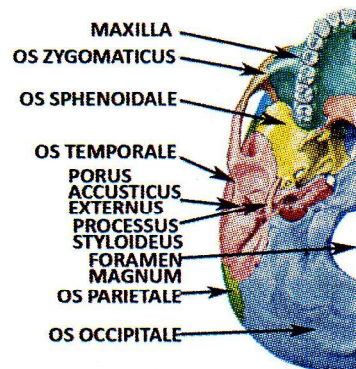


Fig. 104. Skull (inferior view)

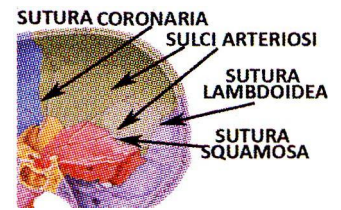
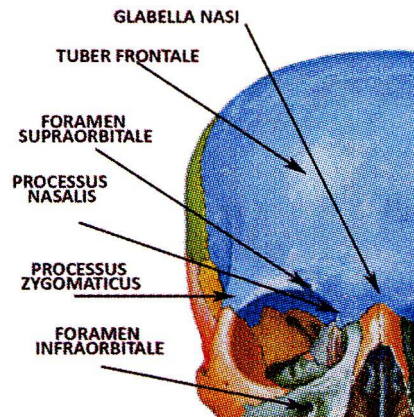
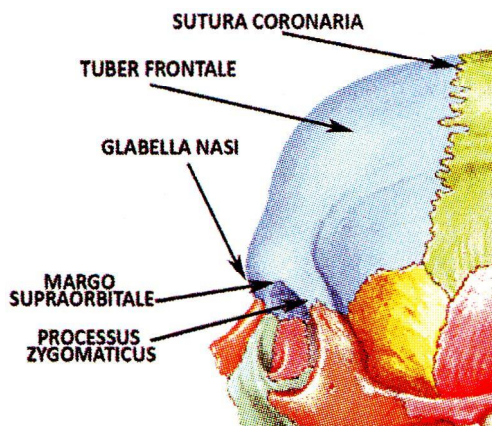


Fig. 105. Frontal bone (lat. view)

Fig. 106. Frontal bone (ant. view)

Fig. 107. Parietal bone (internal view)

parietals, the two nasals, the two maxillæ, the two lacrimals, and the two zygomatics. In fetal skulls, a **metopic suture** divides the halves of the frontal squama. In most people the halves of the frontal bone begin to fuse during infancy and the suture between them is usually not visible after 6 years of age. The frontal bone forms the thin roof of the orbits (eye sockets). Just superior to and parallel with each supraorbital margin is a bony ridge, the **superciliary arch**, which overlies the **frontal sinus (Haimori)**. This arch is more pronounced in males. Between these arches there is a gently, rounded, median elevation called the **glabella**. In most people the skin over the glabella is hairless. The slight prominences of the forehead on each side, superior to the superciliary arches, are called **frontal eminences** (tubers). The **supraorbital foramen** (occasionally a notch), which transmits the supraorbital vessels and nerve, is located in the medial part of the supraorbital margin. The frontal bone articulates with the two parietal bones at the **coronal suture**. It also articulates with the nasal bones at the **frontonasal suture**. At the point where this suture crosses the **internasal suture** in the median plane, there is an anthropological landmark called the **nasion**. This depression is located at the root of the nose, where it joins the cranium (Fig. 106). The frontal bone also articulates with the zygomatic, lacrimal, ethmoid, and sphenoid bones. Bruising of the skin over a superciliary arch causes tissue fluid and blood to accumulate in the surrounding connective tissue, which gravitates into the upper eyelid and around the eye. This results in swelling and a 'black eye.' In some adults the separation line persists as the metopic suture in the midline of the **glabella**, the smooth, slightly depressed area between the superciliary arches. The nasion

in most people is related to a distinctly depressed area («bridge of the nose»). The frontal bone also articulates with the lacrimal, ethmoid, and sphenoid bones, and a horizontal portion of bone (the orbital part [plate] of the frontal bone) forms both the roof of the orbit and part of the floor of the cranial cavity. The frontal bone consists of two portions - a **vertical portion, the squama**, corresponding with the region of the forehead; and **an orbital or horizontal portion**, which enters into the formation of the roofs of the orbital and nasal cavities.

SQUAMA (SQUAMA FRONTALIS) contents of **the external surface**, which is convex and usually exhibits, in the lower part of the middle line, the remains of **the frontal or metopic suture**. In infancy this suture divides the bone into two, a condition which may persist throughout life. The border of the squama is thick, strongly serrated, bevelled at the expense of the inner table above, where it rests upon the parietal bones, and at the expense of the outer table on either side, where it receives the lateral pressure of those bones; this border is continued below into a triangular, rough surface, which articulates with the great wing of the sphenoid. On either side of this suture, about 3 cm. above the supraorbital margin, is a rounded elevation, **the frontal eminence (tuber frontale)**. These eminences vary in size in different individuals, are occasionally unsymmetrical, and are especially prominent in young skulls. The surface of the bone above them is smooth, and covered by the galea aponeurotica. Below the frontal eminences, and separated from them by a shallow groove, are two arched elevations, **the superciliary arches**. They are prominent medially, and are joined to one another by a smooth elevation named **the glabella**. They are larger in the male than in the

female, and their degree of prominence depends to some extent on the size of the frontal air sinuses; prominent ridges are, however, occasionally associated with small air sinuses. The squama and the zygomatic processes are very thick, consisting of diploic tissue contained between two compact laminae. The diploic tissue is absent in the regions occupied by the frontal air sinuses. Beneath each superciliary arch is a curved and prominent margin, **the supraorbital margin**, which forms the upper boundary of the base of the orbit, and separates the squama from the orbital portion of the bone. The lateral part of this margin is sharp and prominent,affording to the eye, in that situation, considerable protection from injury; the medial part is rounded. At the junction of its medial and intermediate thirds is a notch, sometimes converted into a foramen, **the supraorbital notch or foramen**, which transmits the supra-orbital vessels and CN V-1. A small aperture in the upper part of the notch transmits a vein from the diploë to join the supraorbital vein. The supraorbital margin ends laterally in **the zygomatic process**, which is strong and prominent, and articulates with the zygomatic bone. Running upward and backward from this process is a well-marked line, **the temporal line**, which divides into **the upper and lower temporal lines**,continuous, in the articulated skull, with the corresponding lines on the parietal bone. The area below and behind the temporal line forms the anterior part of the temporal fossa, and gives origin to the temporalis muscle. Between the supraorbital margins the squama projects inferiorly to a level inferior that of the zygomatic processes. This portion is known as **the nasal part** and presents a rough, uneven interval, **the nasal notch**, which articulates on either side of the middle line with the nasal bone, and laterally with the frontal process of the maxilla and with the lacrimal. The term **nasion** is applied to the middle of the frontonasal suture. From the center of the notch the **nasal process** projects downward and forward beneath the nasal bones and frontal processes of the maxillæ, and supports the bridge of the nose. The nasal process ends below in a sharp **spine**, and on either side of this is a small grooved surface which enters into the formation of the roof of the corresponding nasal cavity. The spine forms part of the septum of the nose, articulating in front with the crest of the nasal bones and behind with the perpendicular plate of the ethmoid. **The**

internal surface of the squama is concave and presents in the upper part of the middle line a vertical groove, **the sagittal sulcus**, the edges of which unite below to form a ridge, **the frontal crest**. This sulcus lodges the superior sagittal sinus, while its margins and the crest afford attachment to the falx cerebri. The crest ends below in a small notch which is converted into a foramen, **the foramen cecum**. This foramen varies in size in different subjects, and is frequently impervious. When open, it transmits a vein from the nose to the superior sagittal sinus. On either side of the middle line the bone presents depressions for the convolutions of the brain, and numerous small furrows for the anterior branches of the middle meningeal vessels. Several small, irregular fossæ may also be seen on either side of the sagittal sulcus, for the reception of the arachnoid granulations.**ORBITAL OR HORIZONTAL PART (PARS ORBITALIS)**. This portion consists of two thin triangular plates, **the orbital plates**, which form the vaults of the orbits, and are separated from one another by a median gap, **the ethmoidal notch**. The posterior borders of the orbital plates are thin and serrated, and articulate with the small wings of the sphenoid. The orbital portion is thin, translucent, and composed entirely of compact bone; hence the facility with which instruments can penetrate the cranium through this part of the orbit; when the frontal sinuses are exceptionally large they may extend backward for a considerable distance into the orbital portion, which in such cases also consists of only two tables. The inferior surface of each orbital plate is smooth and concave, and presents, laterally, under cover of the zygomatic process, a shallow depression, **the lacrimal fossa**, for the lacrimal gland. Near the nasal part is a depression, **the fovea trochlearis**,or occasionally a small **trochlear spine**, for the attachment of the cartilaginous pulley of the obliquus oculi superior muscle. **The superior surface** is convex, and marked by depressions for the convolutions of the frontal lobes of the brain, and faint grooves for the meningeal branches of the ethmoidal vessels. **The ethmoidal notch** separates the two orbital plates. It is quadrilateral, and filled, in the articulated skull, by the cribriform plate of the ethmoid. The margins of the notch present several half-cells which, when united with corresponding half-cells on the upper surface of

the ethmoid, complete the ethmoidal air cells. Two grooves cross these edges transversely; they are converted into **the anterior and posterior ethmoidal canals** by the ethmoid, and open on the medial wall of the orbit. The anterior canal transmits the nasociliary nerve and anterior ethmoidal vessels, the posterior, the posterior ethmoidal nerve and vessels. In front of the ethmoidal notch, on either side of the frontal spine, are the openings of **the frontal air sinuses**. These are two irregular cavities, which extend posterosuperiorly, and laterally for a variable distance between the two tables of the skull. They are separated from one another by a thin bony septum, which often deviates to one or other side, with the result that the sinuses are rarely symmetrical. Absent at birth, they are usually fairly well-developed between the seventh and eighth years, but only reach their full size after puberty. They vary in size in different persons, and are larger in men than in women. They are lined by mucous membrane, and each communicates with the corresponding nasal cavity by means of a passage called **the frontonasal duct**. The frontal bone is ossified in membrane from **two primary centers**: one for each half, which appear toward the end of the second month of fetal life, and one superiorly each supraorbital margin. From each of these centers ossification extends superiorly to form the corresponding half of the squama, and backward to form the orbital plate. The spine is ossified from a **pair of secondary centers**, on either side of the middle line; similar centers appear in the nasal part and zygomatic processes. At birth the bone consists of two pieces, separated by the frontal suture, which is usually obliterated, except at its lower part, by the eighth year, but occasionally persists throughout life. It is generally maintained that the development of the frontal sinuses begins at the end of the first or beginning of the second year, but Onodi's researches indicate that development begins at birth. The sinuses are of considerable size by the 7 or 8 year, but do not attain their full proportions until after puberty.

2. THE PARIETAL BONES

The two parietal bones form large parts of the walls of the calvaria (Fig. 107). On the outside of these smooth convex bones, there are slight elevations near the center called **parietal eminencies**. Two curved lines, the superior and

inferior temporal lines, cross the middle of the lateral surfaces of the parietal bones. The superior temporal line indicates an attachment of **temporal fascia**, the inferior temporal line marks the superior limit of **temporal muscle**. The parietal bones articulate with each other in the median plane at **sagittal suture**. The median plane of the body passes through the sagittal suture. The inverted V-shaped suture between the parietal bones and the occipital bone is called **lambdoid suture**. The parietal bones articulate with each other in the median plane at **sagittal suture**. The median plane of the body passes through the sagittal suture. The point where the parietal and occipital bones join is a useful reference point called the lambda. It can be felt as a depression in some people. In addition to articulating with each other and the frontal and occipital bones, the parietal bones articulate with the temporal bones and the greater wings of sphenoid bone. The parietal articulates with five bones: the opposite parietal, the occipital, frontal, temporal, and sphenoid. The parietal bones form, by their union, the sides and roof of the cranium. Each bone is irregularly quadrilateral in form, and has two surfaces, four borders, and four angles. The parietal bone is divided into two parts, upper and lower, by an anteroposterior suture.

THE EXTERNAL SURFACE is convex, smooth, and marked near the center by **the parietal eminence (tuber parietale)**, which indicates the point where ossification commenced. Crossing the middle of the bone in an arched direction are two curved lines, **the superior and inferior temporal lines**. The former gives attachment to the temporal fascia, and the latter indicates the upper limit of the muscular origin of the temporalis muscle. Superiorly these lines the bone is covered by the galea aponeurotica. Inferiorly them it forms part of the temporal fossa, and affords attachment to the temporalis muscle. At the back part and close to the upper or sagittal border is **the parietal foramen**, which transmits a vein to the superior sagittal sinus, and sometimes a small branch of the occipital artery. It is not constantly present, and its size varies.

THE INTERNAL SURFACE is concave. It presents depressions corresponding to the cerebral convolutions, and numerous furrows for the ramifications of the middle meningeal vessel. They run superoposteriorly from the sphenoidal angle, and from the central and posterior part of the squamous border. Along the upper margin is