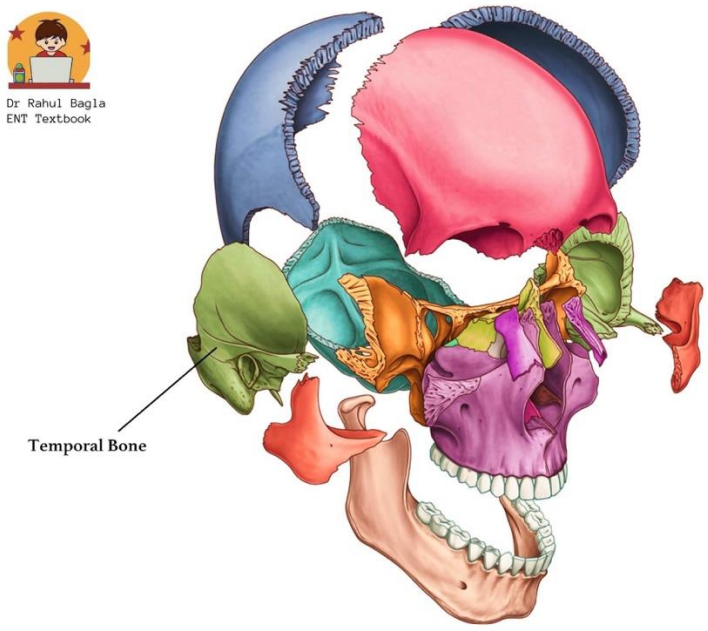
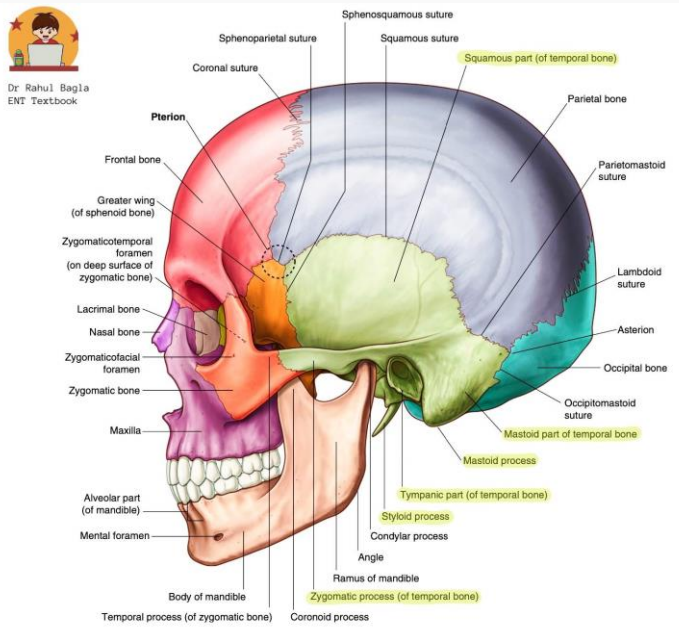
Dr. Rahul Bagla ENT Textbook

Ultimate Guide – Makes You Best

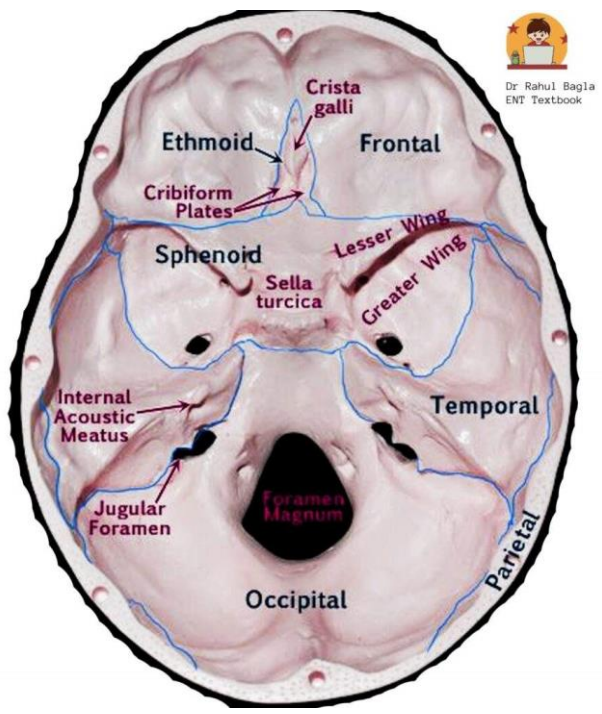
# Anatomy of Temporal Bone




Lateral view of skull showing parts of temporal bone

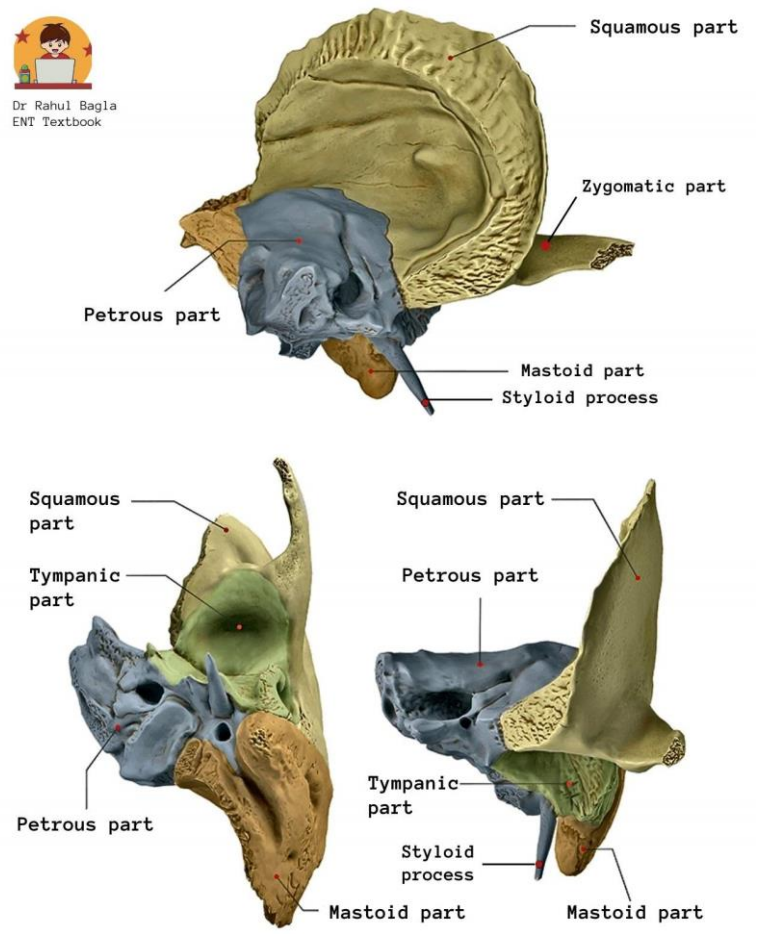
**Anatomy of Temporal Bone.** The temporal bone is a paired, symmetrical bone forming the lower lateral walls of the human skull. The temporal bone houses critical structures of the vestibulocochlear apparatus, including the external auditory canal, the middle ear and the inner ear. These components play essential roles in hearing and balance. The temporal bone also contributes to the middle cranial fossae, posterior cranial fossae and the base of the skull. The sphenoid bone lies between the right and left temporal bones. The temporal bone lies anteriorly between the sphenoid bone (its greater wing) and the occipital bone posteriorly. Inferiorly, the temporal bone articulates with the mandible, forming the temporomandibular joint, a synovial joint that facilitates jaw movement.




The greater wing of sphenoid, parietal and frontal bones together with squamous part of temporal bone form the **pterion**, which is the weakest part of the skull.

**Parts of temporal bone.** It is a composite structure consisting of five parts, each ossifying independently and later fuses with each other.

i. Squamous
ii. Petrous
iii. Mastoid
iv. Tympanic
v. Styloid.




**Squamous part of the temporal bone.**

**(i) Squamous part (Squama).** It is the largest and superior most part of the temporal bone. It forms the lateral wall of the middle cranial fossa. It is a thin, translucent, shell-like plate of bone. It interfaces with the parietal bone superiorly and the mastoid part of the temporal bone posteriorly. It interfaces

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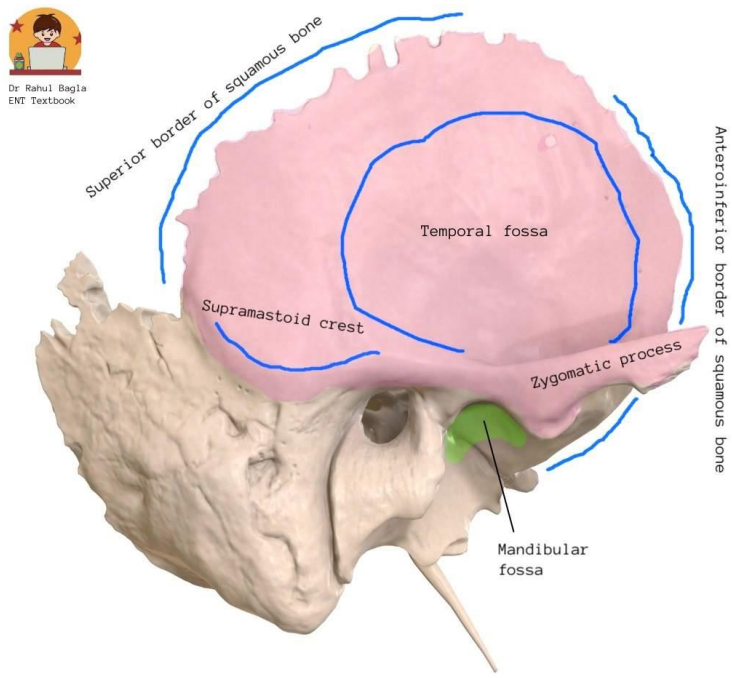
with the greater wing of the sphenoid bone anteriorly and also with the zygomatic process it articulates with the zygomatic bone anteriorly. The squamous part forms the roof and very small parts anterior and posterior walls of the external auditory canal (EAC). The tympanic part of the temporal bone forms the rest of the EAC (a major part of the anterior and posterior walls along with the inferior wall (floor) of the EAC). The squamous part of the temporal bone has two surfaces (lateral & medial), two borders (superior & anteroinferior), a zygomatic process and mandibular fossa.




Lateral surface of squamous part of temporal bone

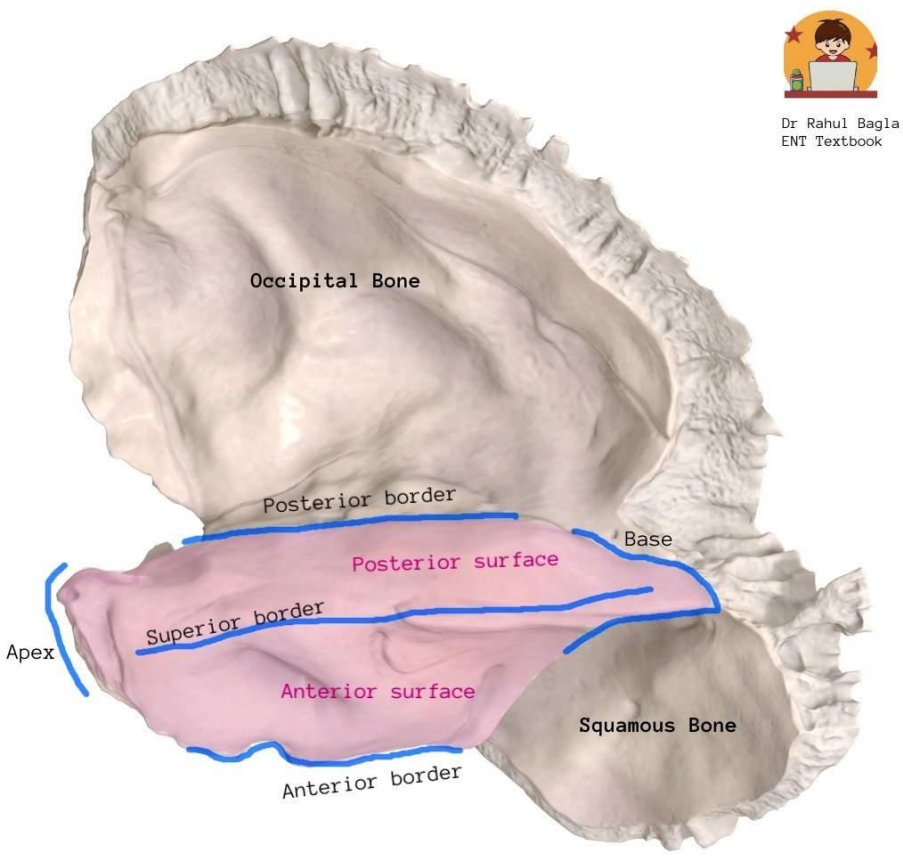

Medial surface of squamous part of temporal bone

**Relations of the squamous temporal bone:**

- *Lateral surface (outer surface/ norma lateralis)* – It is convex in shape and forms the temporal fossa. The temporalis muscle originates from here. The lateral surface is limited posteriorly by the supramastoid crest which provides attachment to the temporalis fascia. The squamous part is separated from the mastoid part by an imaginary suture line which gets fused about 1.5 cm posterior to the supramastoid crest. On the lateral surface, the middle temporal artery runs in a groove.
- *Medial surface (inner/ cerebral surface)*– It is related to the temporal lobe of the brain. Anterior and posterior branches of the middle meningeal artery run over it.
- *Superior border* – It articulates with the inferior border of the parietal skull bone.
- *Anteroinferior border* – It articulates with the greater wing of the sphenoid bone. It forms the posterolateral aspect of the infratemporal fossa.
- *Zygomatic process* – The zygomatic process projects from the lateral surface of the squamous part of the temporal surface and articulates with the temporal process of the zygomatic bone to form a zygomatic arch (palpable as 'cheekbones').
- The mandibular *fossa* is a depression that houses the synovial temporomandibular joint and it lies below the zygomatic process.

**(ii) Petrous part of the temporal bone.**

**Petrous (rock-like) part**: It is located in the base of the skull between the greater wing of the sphenoid bone anteriorly and the occipital bone posteriorly. It separates the middle cranial fossa from the posterior cranial fossa and it also forms a part of the cranial floor. It houses the middle ear, internal ear and mastoid antrum, which it safely shields due to its high bone density.




Petrous part of temporal bone

**Relations of the petrous part.** It is a pyramid-shaped structure, having a base, an apex, three surfaces (anterior, posterior, inferior) and three edges or margins (superior, anterior, posterior).

- *Base* – It is fused with the medial surface of the squamous part of the temporal bone and medial surface of the mastoid part of the temporal bone.
- *Apex* – It is directed forwards, upwards, medially towards the greater wing and the body of the sphenoid bone. At the apex of the petrous bone is the trigeminal nerve running into Meckel's cave with the abducent nerve (within Dorello's canal) passing close to its roof. Gradenigo's syndrome occurs due to infection at the petrous apex and comprises retroorbital pain (Vth nerve involvement), lateral rectus palsy, diplopia (VIth nerve involvement), and discharging ear. Apex forms the posterolateral margin of foramen lacerum. Apex also presents an internal opening of the carotid canal which carries the petrous part of the internal carotid artery. The apex and the sphenoid bone together with the basilar part of the occipital bone make a lacerated foramen at the meeting point known as *foramen lacerum*.

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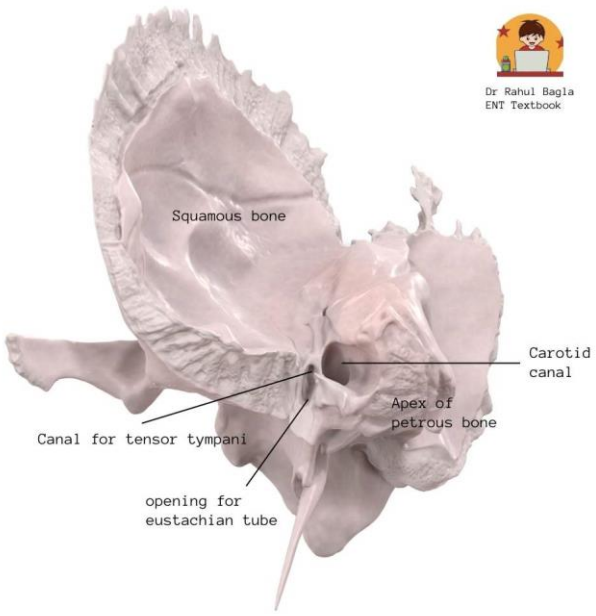
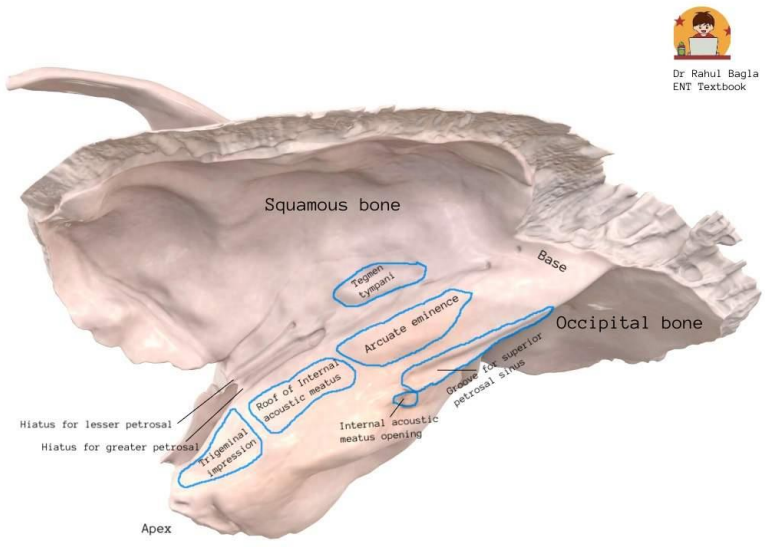



Anterior surface of petrous part of temporal bone




Important landmarks on anterior and posterior surfaces of petrous bone.

- *Anterior surface* – It forms the posterior wall of the middle cranial fossa. It presents four important structures (medial to lateral), the trigeminal impression (lodges trigeminal ganglion), the roof of internal acoustic meatus, arcuate eminence and the roof of the middle ear (tegmen tympani). The depressed area, just lateral to the trigeminal impression is the *roof of the internal acoustic meatus*. The elevated area, just lateral to the roof of the internal acoustic meatus is the *arcuate eminence*, which is formed by the underlying superior semicircular canal. The rest of the area lateral to the arcuate eminence towards the squamous part of the temporal bone is the roof of the middle ear (tegmen tympani). The area of the roof of the middle ear cavity presents two hiatus for greater and lesser petrosal nerves. It also presents two openings, the canal for tensor tympani (upper one) and the opening of the bony part of the eustachian tube (lower one), both of which open in the middle ear cavity.
- *Posterior surface* – It forms the anterior wall of the posterior cranial fossa. It presents an important structure, the opening of the *internal acoustic meatus*. The internal acoustic meatus is one cm is length and it is in line with the external auditory canal. The vestibulocochlear nerve, facial nerve and labyrinthine artery enter from the medial opening of the internal acoustic meatus (also known as porus) and pass through it. At the lateral opening of the internal acoustic meatus (also known as fundus), the meatus is divided into upper and lower compartments by a bony plate, the '*horizontal crest'*.
- On the anterior aspect of the *upper compartment,* there is a facial canal through which the facial nerve passes and on the posterior aspect, there is the superior vestibular area through which the superior division of the vestibular nerve passes.

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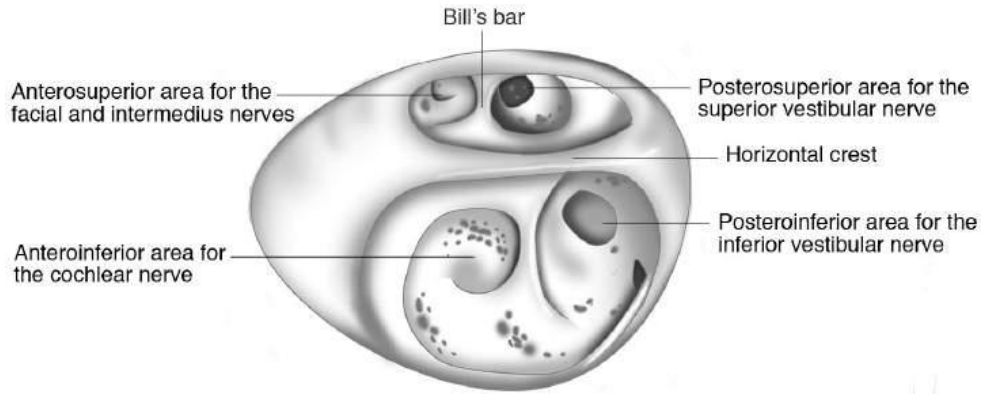
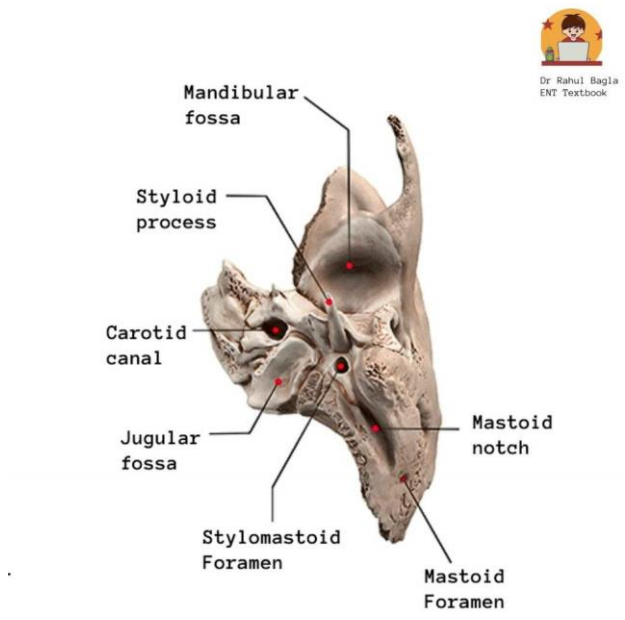
- On the anterior aspect of *lower compartment* there are spiral-shaped multiple foramina (known as tractor spiralis foraminosus) through which the cochlear nerve passes and on the posterior aspect there is inferior vestibular area through which the inferior division of vestibular nerve passes. On the most posterior aspect of lower compartment there is also a foramen singulare through which the branch of vestibular nerve passes which supply the ampulla of posterior semicircular canal.




**Lateral end of Internal acoustic meatus (Fundus)**




**Inferior surface of the petrous part of the temporal bone**

- *Inferior surface* – It is a quadrangular area viewed in the base of the skull. It is located between the occipital bone posteriorly and greater wing of sphenoid & squamous part anteriorly. Inferior surface presents the outer opening of the carotid canal. Lateral to the carotid canal lies the jugular fossa. Stylomastoid foramen is also present on the inferior surface through which facial nerve exit from the middle ear.
- *Superior border* – It is a long sharp crest which intervenes between middle and posterior cranial fossae. It provide attachment to tentorium cerebelli and it encloses the superior petrosal sinus.
- *Anterior border* – It can be divided into two parts. Medial part articulates with greater wing of sphenoid while the lateral part joins with the squamous part of temporal bone with a suture – petrosquamosal suture.
- *Posterior border* – It presents groove which lodges the inferior petrosal sinus. Its lateral part creates the superolateral boundary of the jugular foramen.

### (iii) Mastoid part of temporal bone.

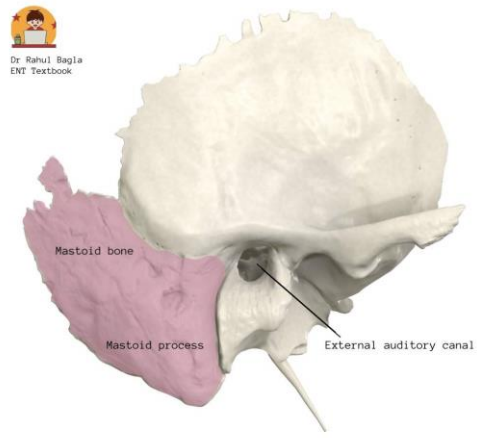
Mastoid part: It is situated posterior to the squamous part of temporal bone and separates from it by an imaginary suture line which gets fused about 1.5 cm posterior to the supra-mastoid crest. Mastoid part of temporal bone includes mastoid antrum and its air cells, which communicate with the middle ear cavity.

It is formed by squamous part of temporal bone (laterally) and a petrous part of temporal bone (medially) separated by Korner's (petrosquamous) septum.

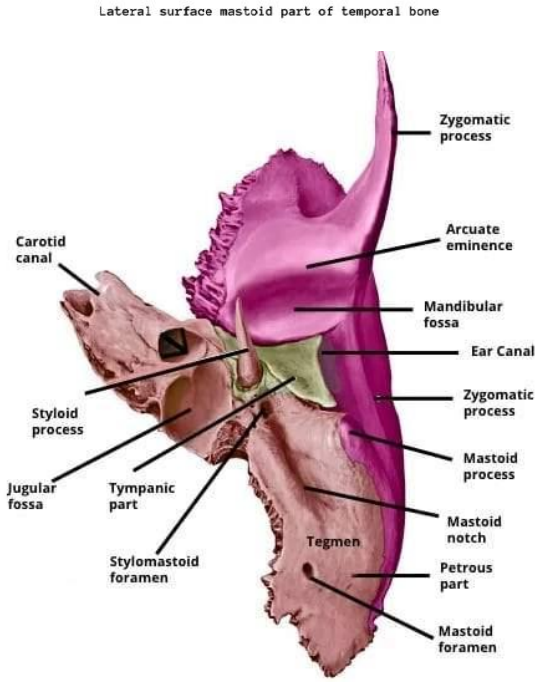
### Relations of the mastoid part of temporal bone:

It has two surfaces and two borders:

- *Lateral surface* is continuous with mastoid process which provide attachment of sternocleidomastoid, splenius capitis and longissimus capitis muscles. Mastoid process is present just posterior to the external auditory canal opening and it is not fully developed in children. A more horizontal postauricular incision should be given to prevent injury to the facial nerve.
- *Medial/ inner surface* of the mastoid part of temporal bone forms the sigmoid sulcus which lodges sigmoid sinus. Medial surface is further continuous with posterior surface of petrous part of temporal bone. Whereas the medial surface of the mastoid process which is present inferior to the mastoid part of temporal bone, presents a digastric notch which presents attachment to the posterior belly of digastric muscle. Groove for occipital artery lies medial to digastric notch. The mastoid foramen, is also present on the medial surface of mastoid process, which is passed by the mastoid emissary vein for venous drainage and one or two mastoid arteries.
- *Superior border* articulates with the inferior border of parietal bone forming parietomastoid suture.
- *Posterior border* articulates with the occipital bone forming occipitomastoid suture.




Lateral surface mastoid part of temporal bone




**Medial and Inferior surface of mastoid part of temporal bone**

The mastoid part of temporal bone, parietal and occipital bones meet at a point to form **asterion**.

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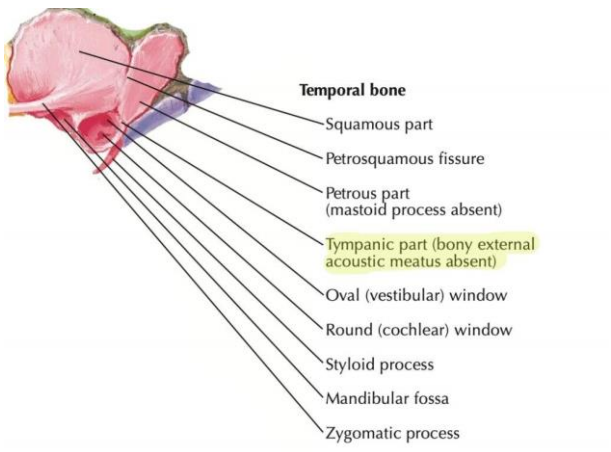
### (iv) Tympanic part of temporal bone.

**Tympanic part** is situated lateral to the petrous part of temporal bone, inferiorly to the squamous part of temporal bone, and anteriorly to the mastoid part of temporal bone. Tympanic part is attached to squamous part and mastoid part forming the tympanosquamous anteriorly and tympanomastoid sutures posteriorly. It is a triangular bony plate. It has three borders (superior, inferior & lateral) and two surfaces (anterior & posterior):

### Relations of tympanic part of temporal bone:

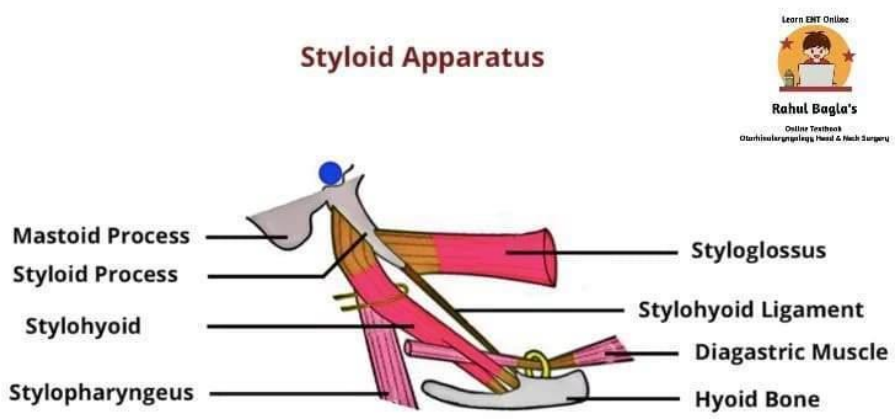
- *Superior border* is related to mandibular fossa.
- *Inferior border* is related to styloid process and inferior aspect of petrous part of temporal bone.
- *Lateral border* along with the *posterior surface* forms anterior wall, the floor and lower part of the posterior wall of the bony ear canal. Tympanic bone boundary ends at the cartilaginous EAC.
- *Anterior surface* is related to parotid gland & mandibular fossa.
- *Posterior surface,* it bears a circular groove tympanic sulcus (annular sulcus) for the attachment of the tympanic membrane.




Chorda tympani, anterior tympanic artery and anterior process of malleus traverses the petrotympanic fissure. Arnold's nerve traverses tympanomastoid suture. The inferior aspect of the tympanomastoid suture line is an important operative landmark for identifying the facial nerve as it exits the stylomastoid foramen.

### (v) Styloid part of temporal bone.

Styloid process is a long, slender, pointed piece of bone originating from the inferior aspect of the fusion of the tympanic and petrous bones and located in front of the jugular fossa. Its normal length is approximately 2.5 cm. It projects downwards, forwards and medially, giving attachment to several muscles and ligaments.




- *Ligaments* – Stylohyoid, stylomandibular

- *Muscles* – Styloglossus, stylohyoid, stylopharyngeus.

Styloglossus is supplied by hypoglossal nerve, stylohyoid is supplied by facial nerve, stylopharyngeus is supplied by glossopharangeal nerve. Stylomandibular ligament extends from anterior surface of apex of styloid process to the posterior surface of the angle of mandible. This ligament separates parotid gland from submandibular gland & medial pterygoid muscle.

The stylomastoid foramen is a round opening situated between the styloid and the mastoid processes. It transmits the facial nerve (CN VII) and the stylomastoid artery.

**——– End of the chapter ——–**