General Anatomy

Lecture 2: Axial Skeleton: The Skull

Dr. Mohamed Fathi Elrefai

Ass. Professor of Anatomy & Embryology

mohamed@hu.edu.jo

THE SKELETON

* It comprises cartilages, bones, ligaments & joints.
* The bones are rigid and heavier than cartilages.
* Cartilages are more flexible and lighter.
* The younger the age, the greater is the contribution of cartilage to the skeleton.

* **Divisions of the skeleton:**

1. Exoskeleton: rudimentary in man.

It is represented by: nails & enamel of teeth .

2. Endoskeleton: about 206 bones & is formed of:

a. The axial skeleton.

b. The appendicular skeleton.

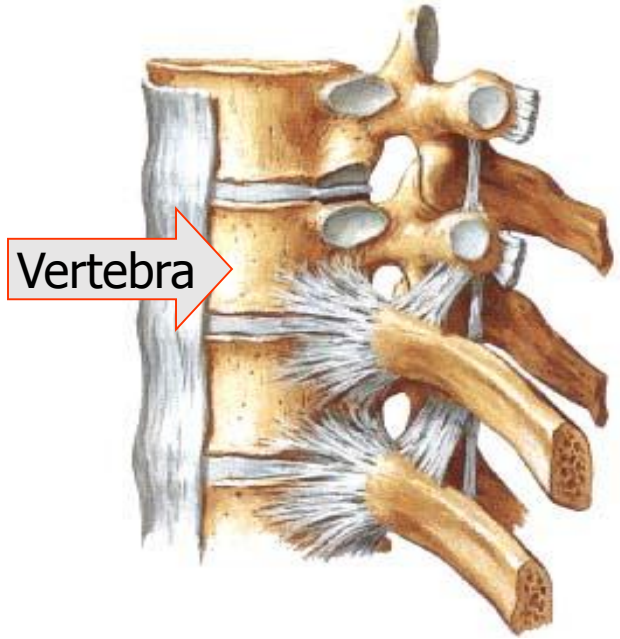
Regional classification of bones

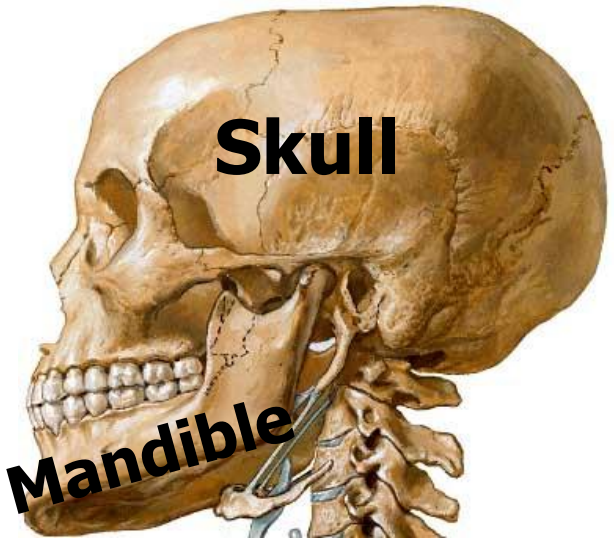
*** The human skeleton is divided into:**

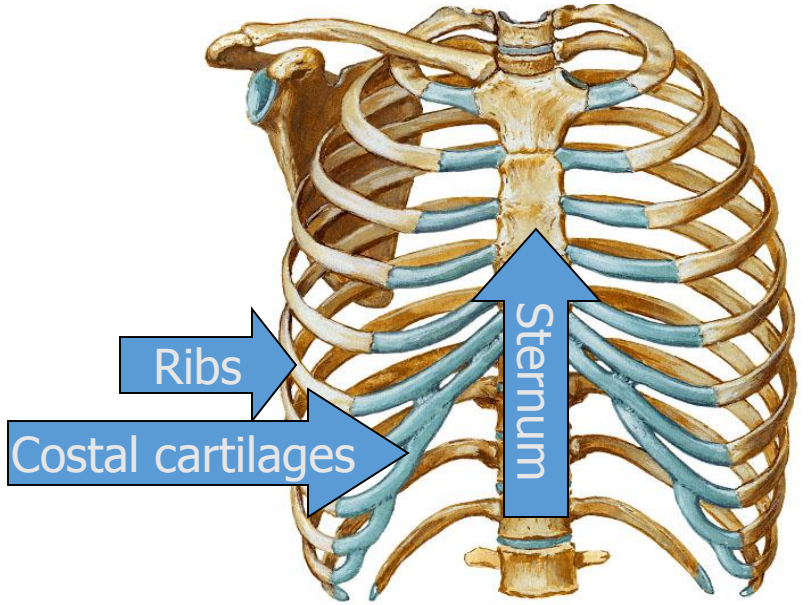
1. **Axial skeleton: which includes skull, vertebral column, ribs & sternum.**
2. **Appendicular skeleton: which includes the bones of the appendages (upper & lower limbs) & their girdles (shoulder & pelvic).**

Axial skeleton

1. Skull & mandible.
2. Ribs.
3. Sternum.
4. Vertebral column.







* **The skull (cranium)** (which contains the brain + its meninges) + **the mandible** (part of facial bones) → form the skeleton of the head.

The skull

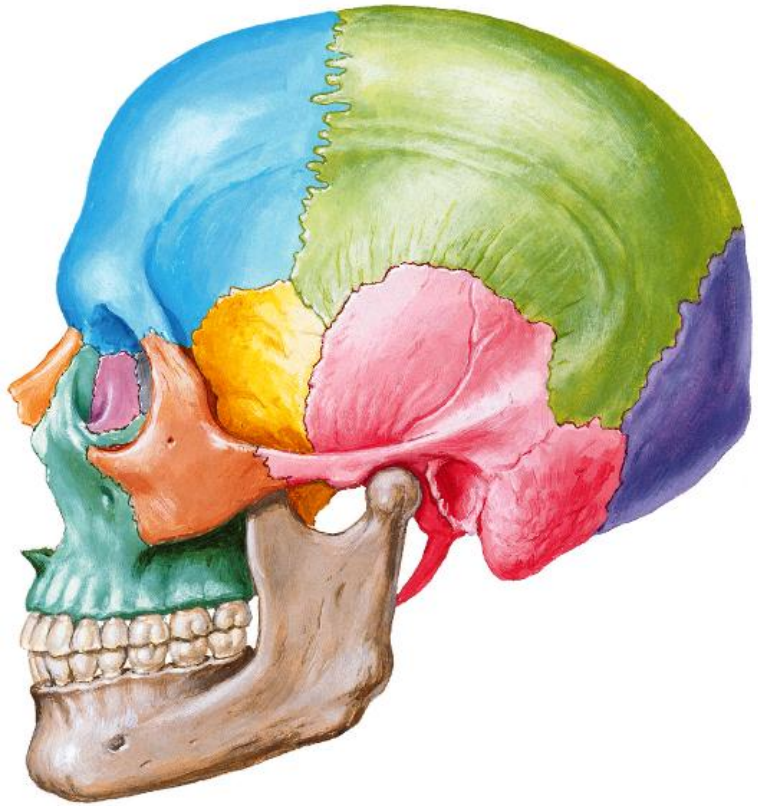
Is formed of 22 separate bones

One movable bone

The mandible

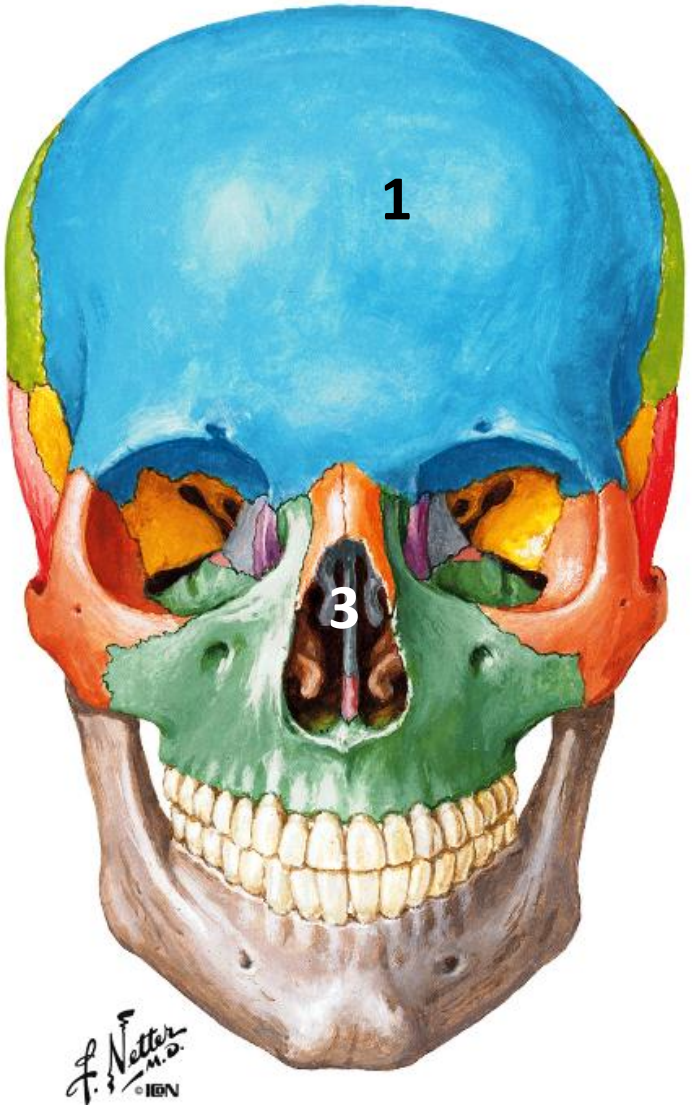
21 immovable bones

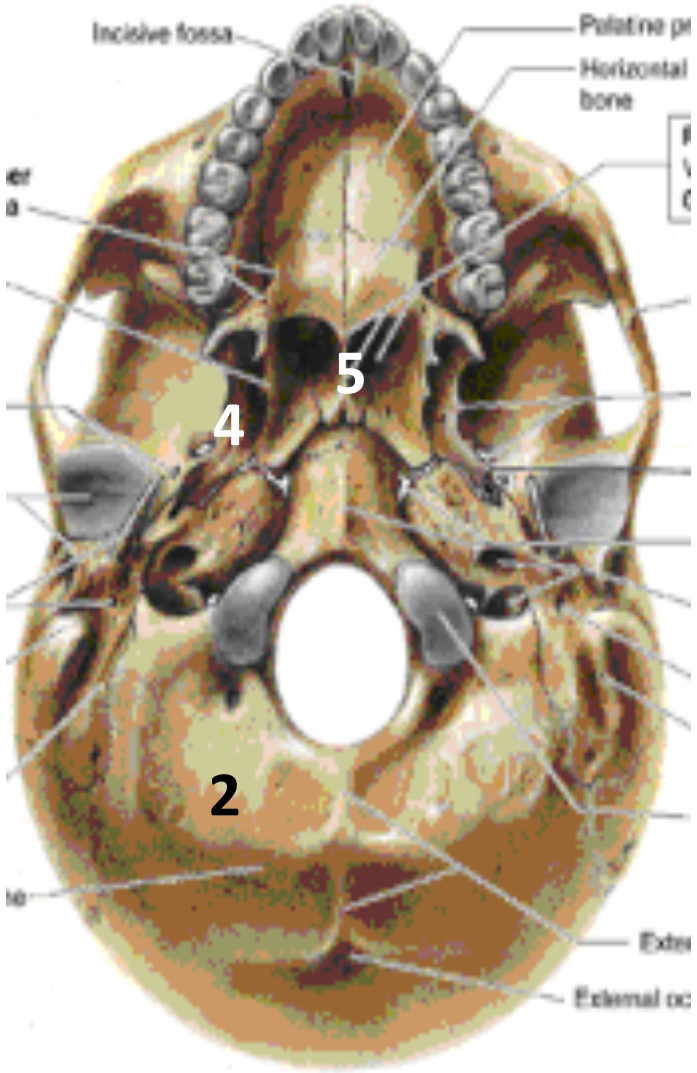
Articulating together by **sutures** (which are fibrous joints)

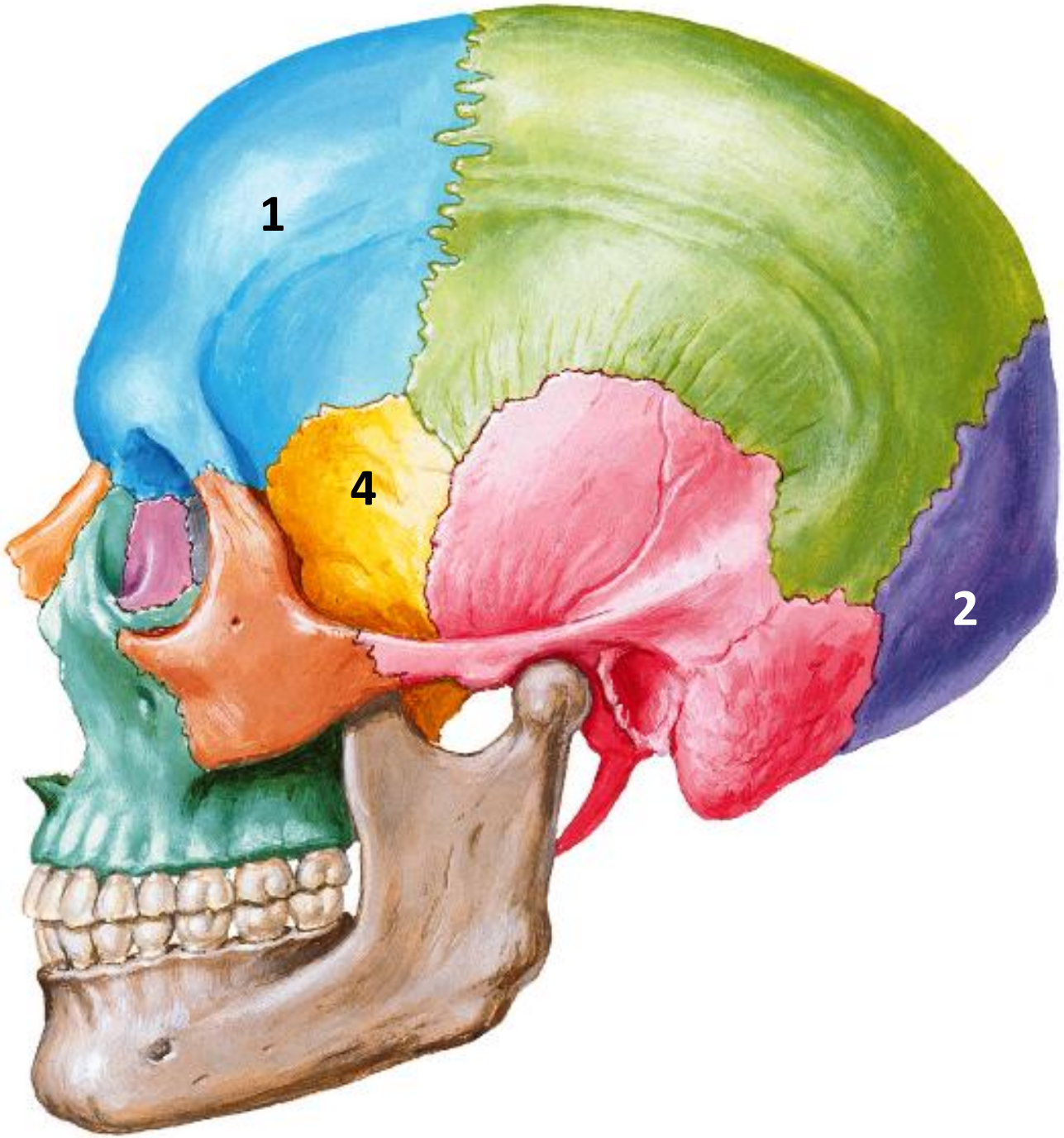


5 Unpaired bones

1. Frontal
2. Occipital
3. Ethmoid
4. Sphenoid
5. Vomer

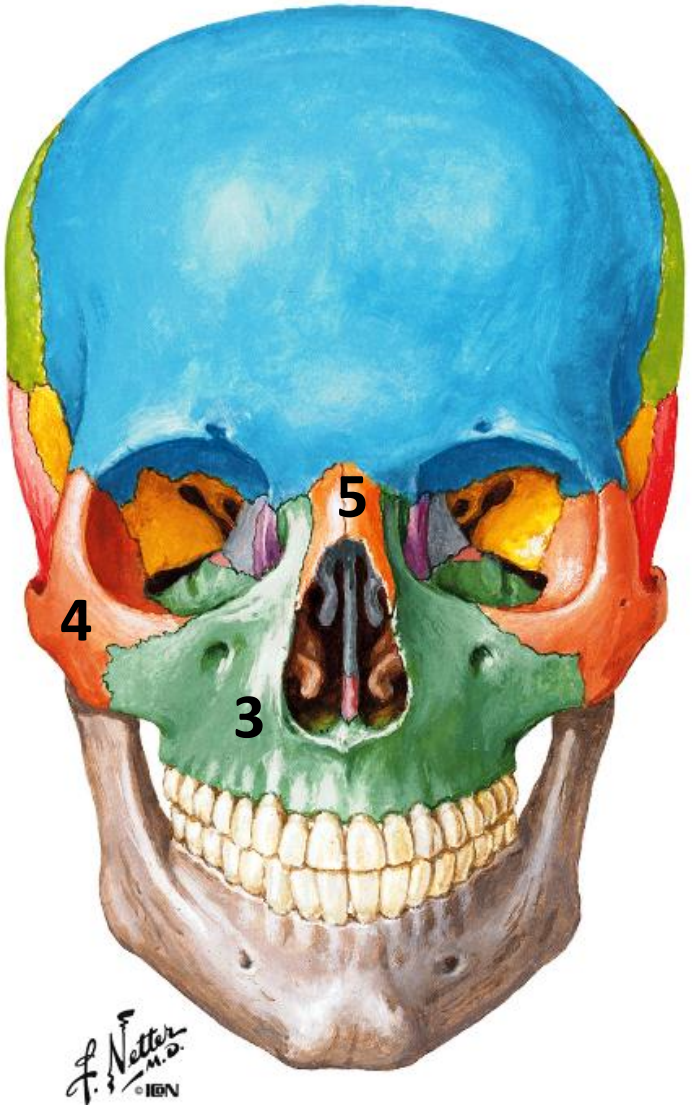


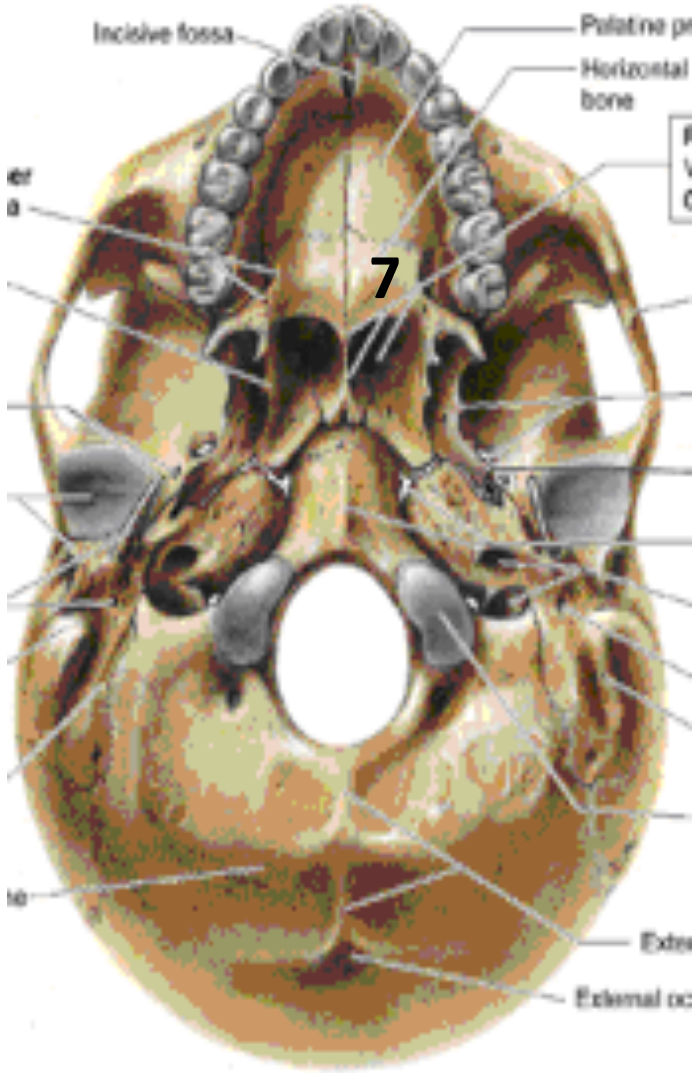


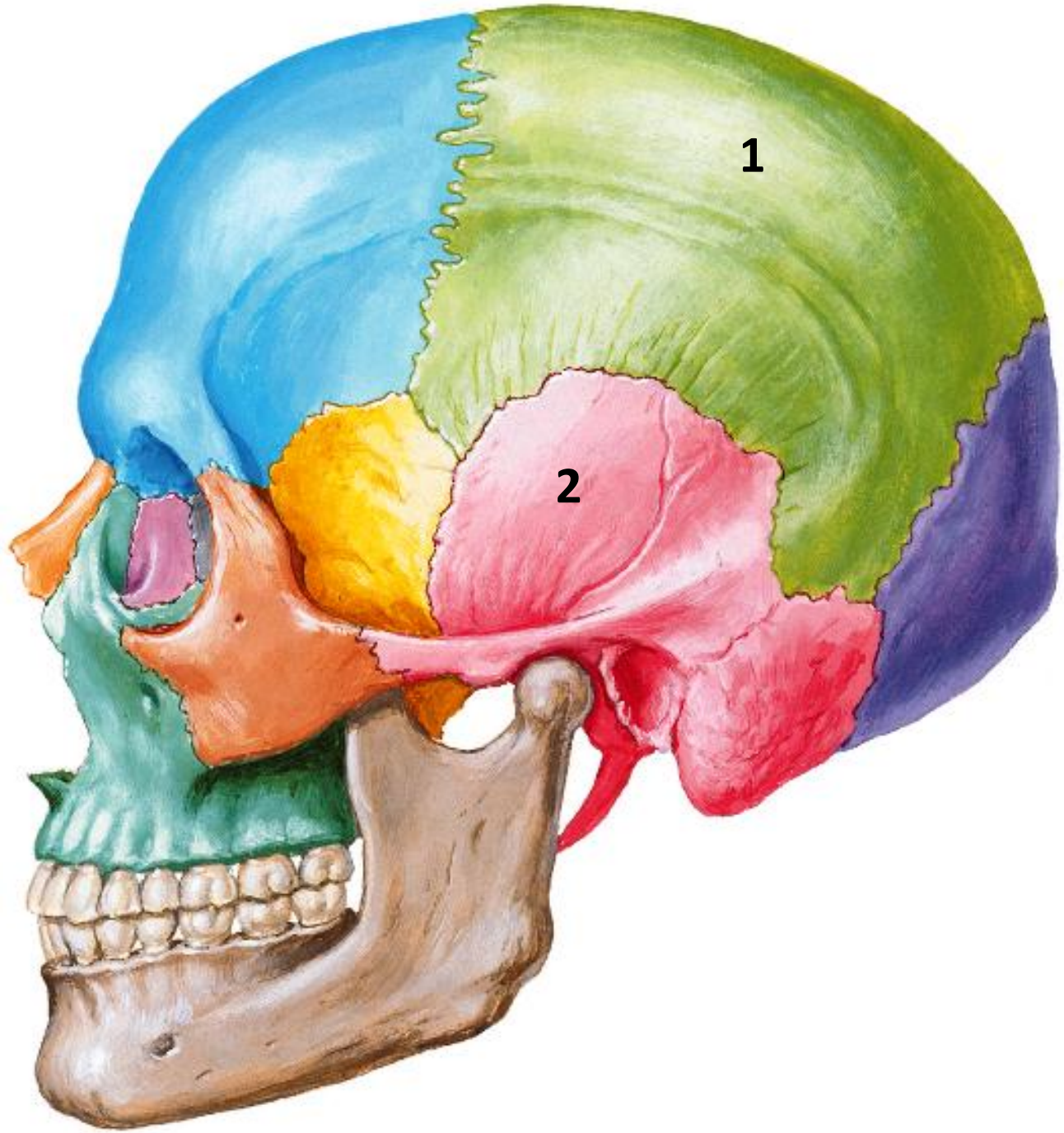

1
4
2

8 Paired bones

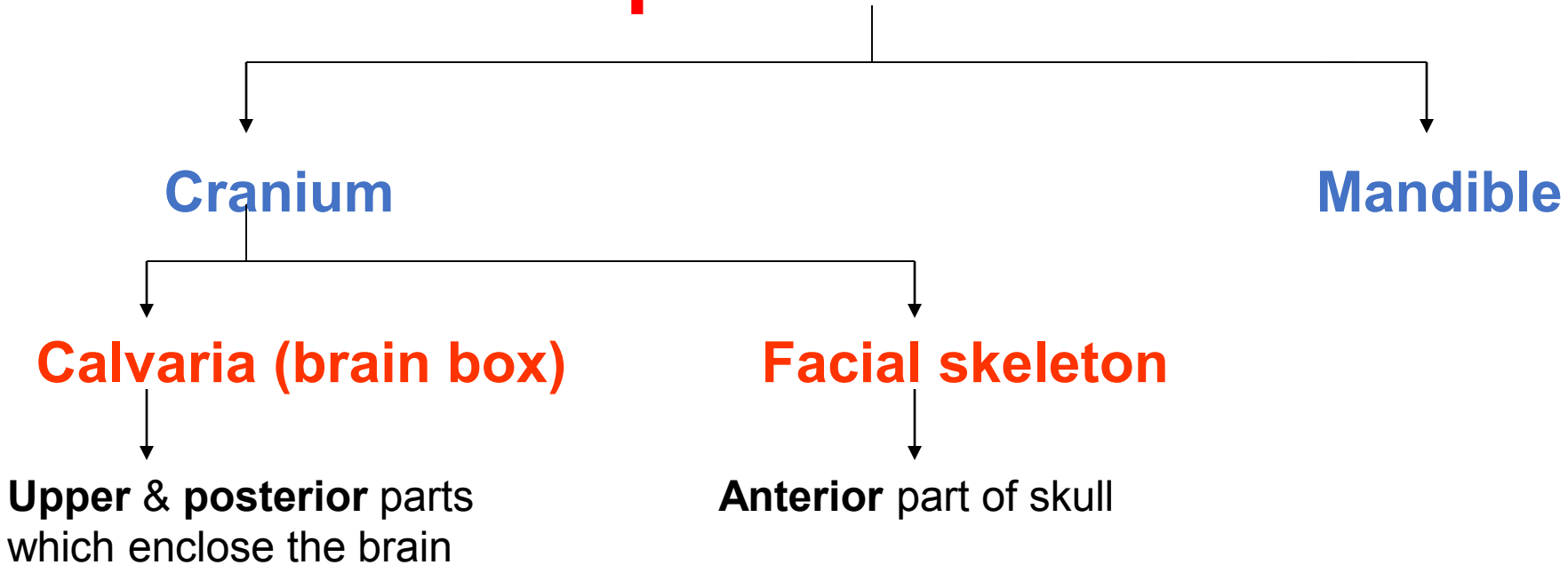
1. Parietal
2. Temporal
3. Maxillary
4. Zygomatic
5. Nasal
6. Lacrimal
7. Palatine
8. Inferior concha






1
2

The parts of the skull



Norma verticalis

* It is the **upper** aspect (**vault**) of the skull.

* It presents 4 bones:

1. The frontal bone in its anterior part.

2. The 2 parietal bones behind the frontal bones.

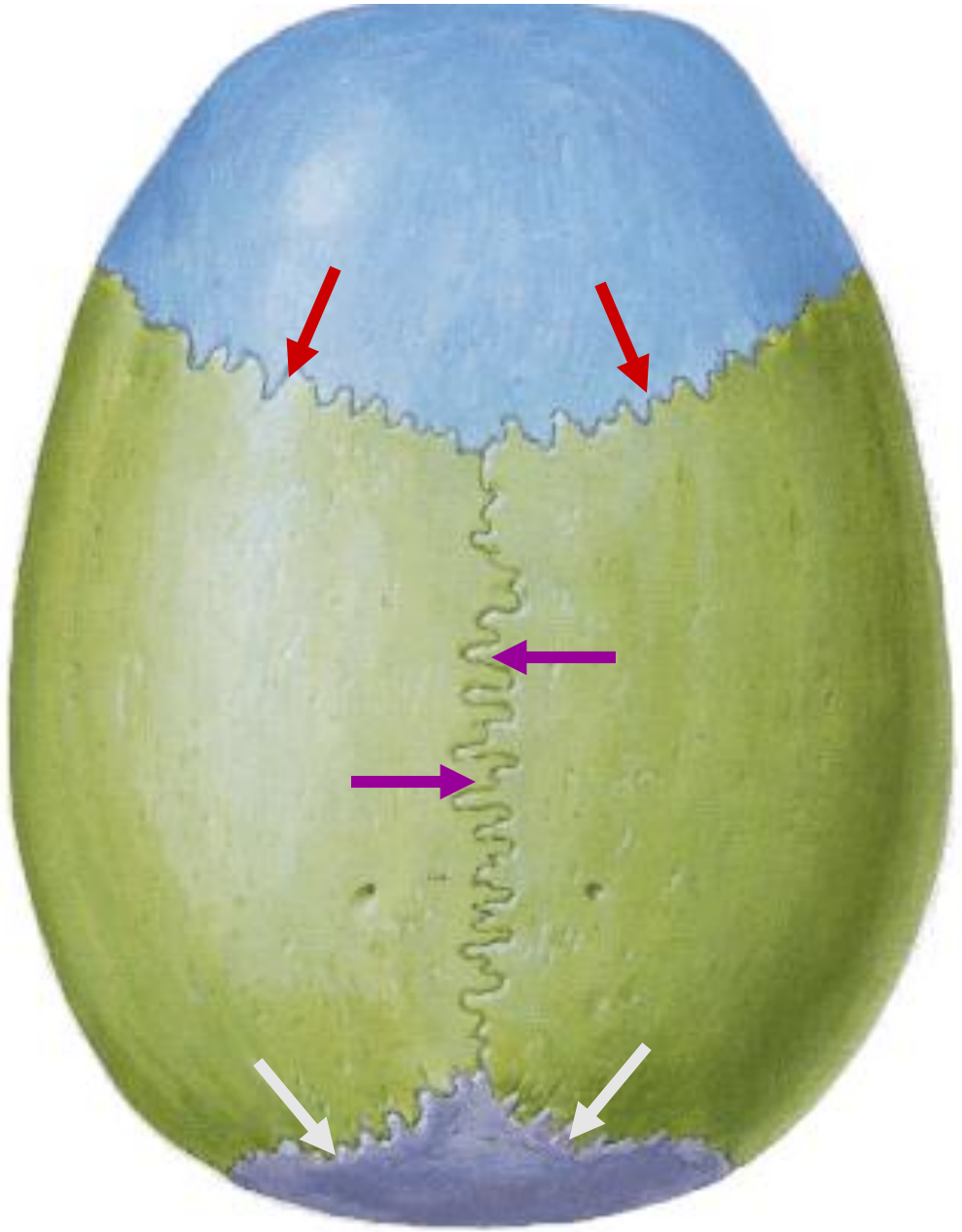
3. The occipital bone in its posterior part.

* It presents 3 sutures:

1. The **coronal suture:** between the frontal bone and the 2 parietal bones.

2. The **sagittal suture:** between the 2 parietal bones.

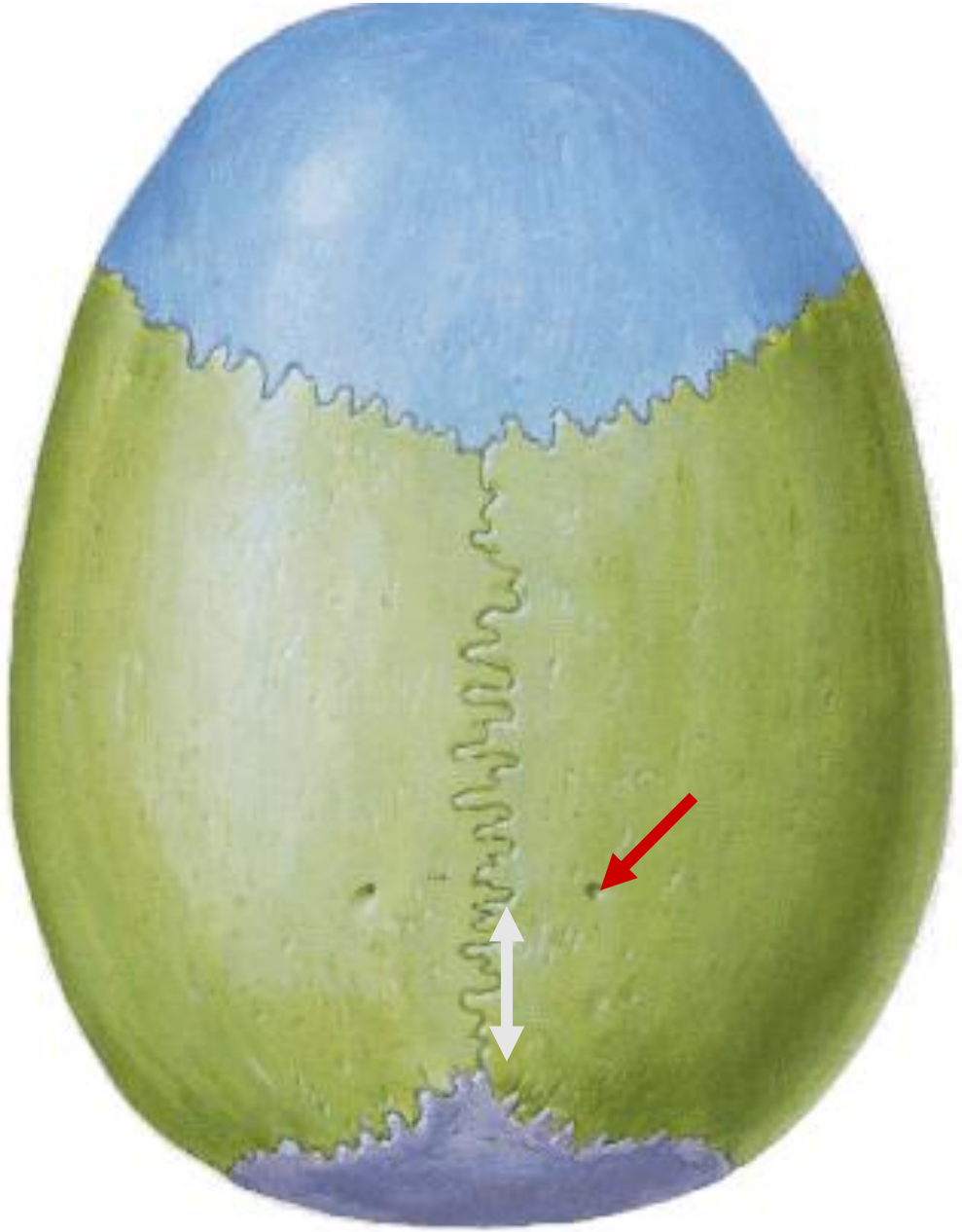
3. The **lambdoid suture:** between the occipital bone and the 2 parietal bones.



* **It presents 2 parietal emissary foramina:**

* One on each side of the sagittal suture, **4 cm anterior** to the **lambda**.

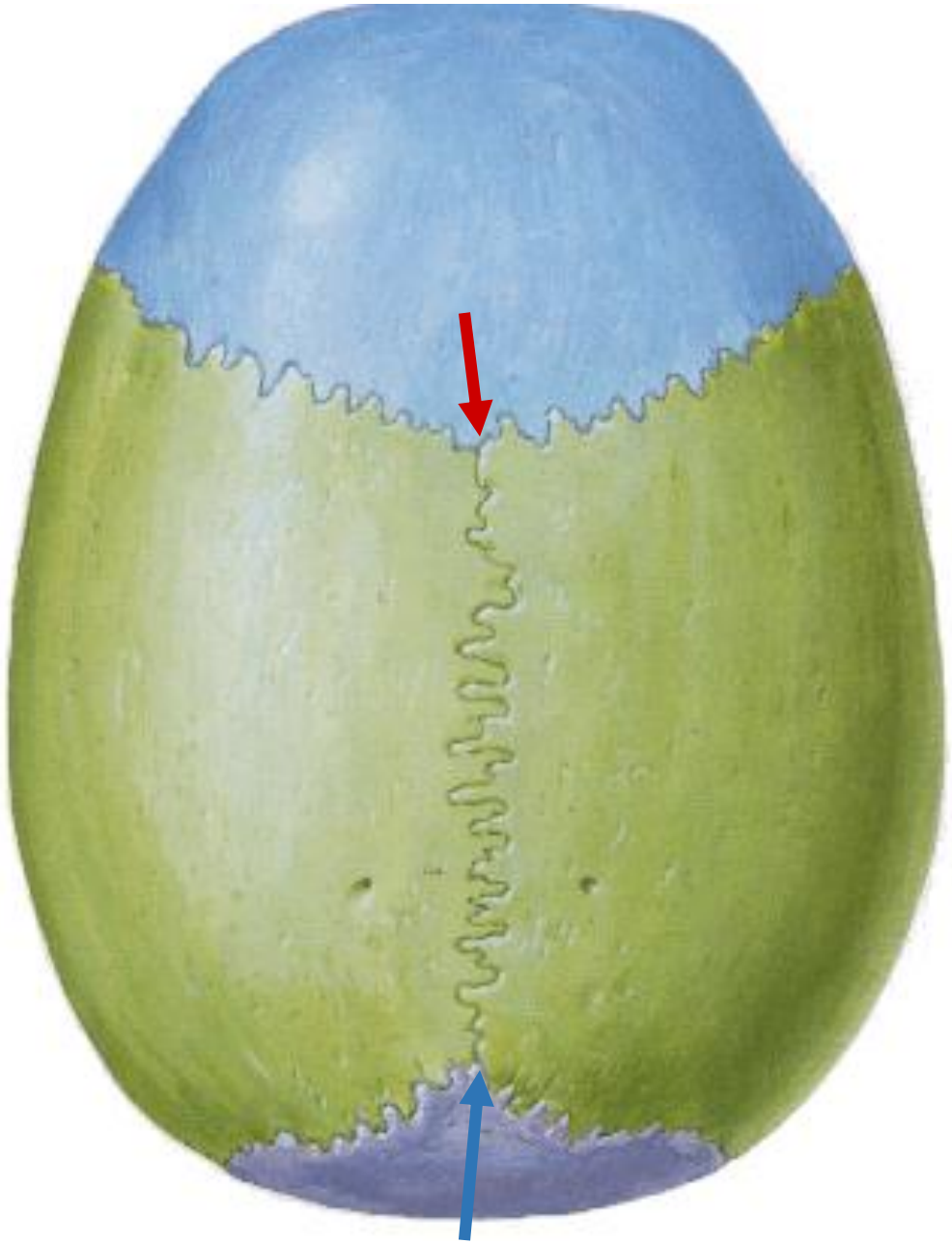
* It transmits an emissary vein.



* It presents 2 meeting points:

1. The bregma: is the meeting of coronal and sagittal sutures.

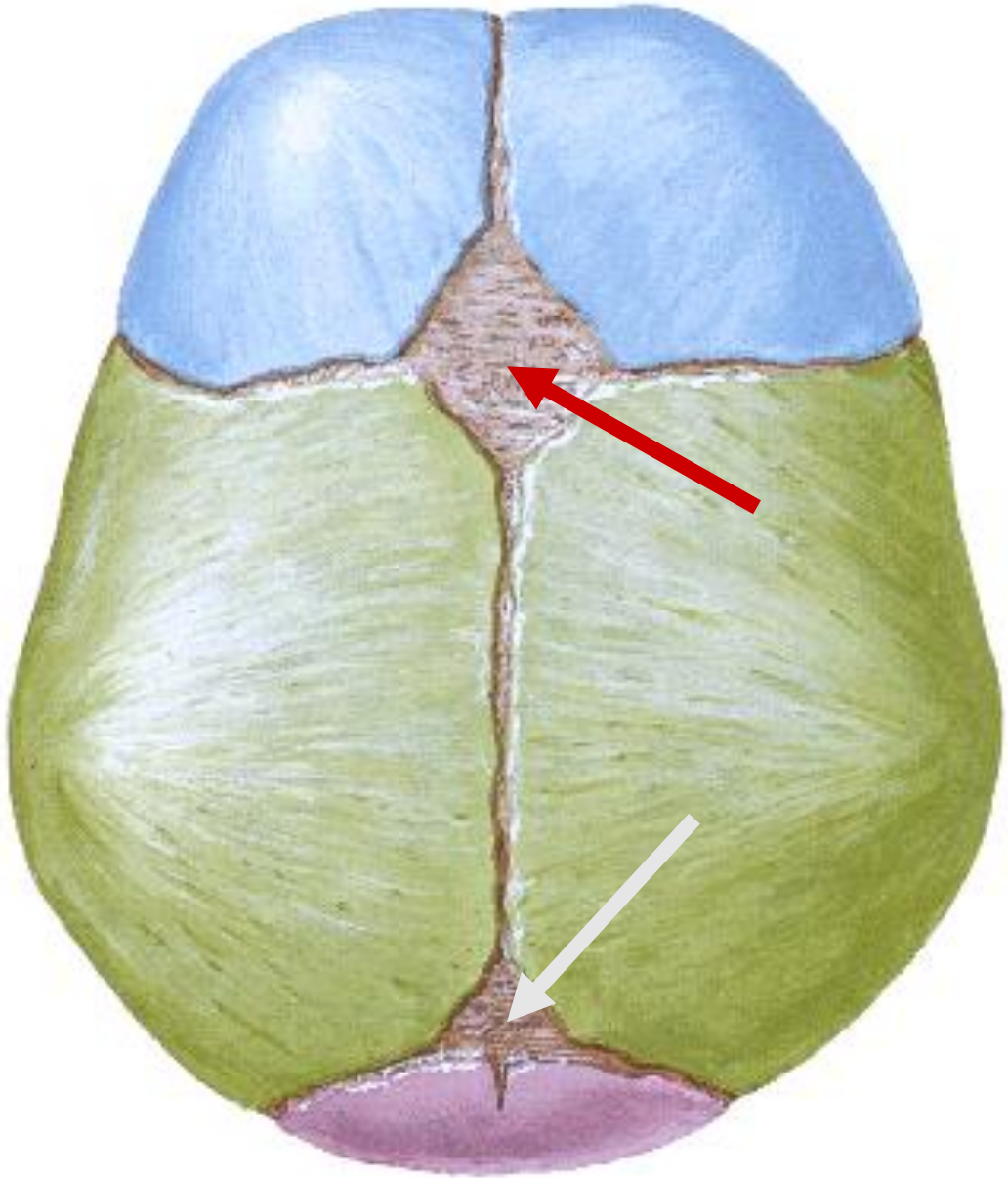
2. The lambda: is the meeting of the lambdoid and sagittal sutures.



* During foetal life:

1. The bregma is the site of membrane – filled rhomboidal area called **anterior fontanelle.** It usually closes 1.5 – 2 years after birth.

2. The lambda is the site of a membrane – filled triangular area, called the **posterior fontanelle.**. It usually closes **6 months** after birth.



* Clinical importance of fontanelles:

1. They are present at birth to allow overlap of skull bones during delivery.

2. They give an idea about the intra cranial pressure:

- If the pressure ↑ it bulges.
- If the pressure ↓ it sinks (dehydration).

3. They help in diagnosis of some diseases:

- Premature closure causes craniostenosis → microcephaly.
- Delayed closure diagnoses rickets.

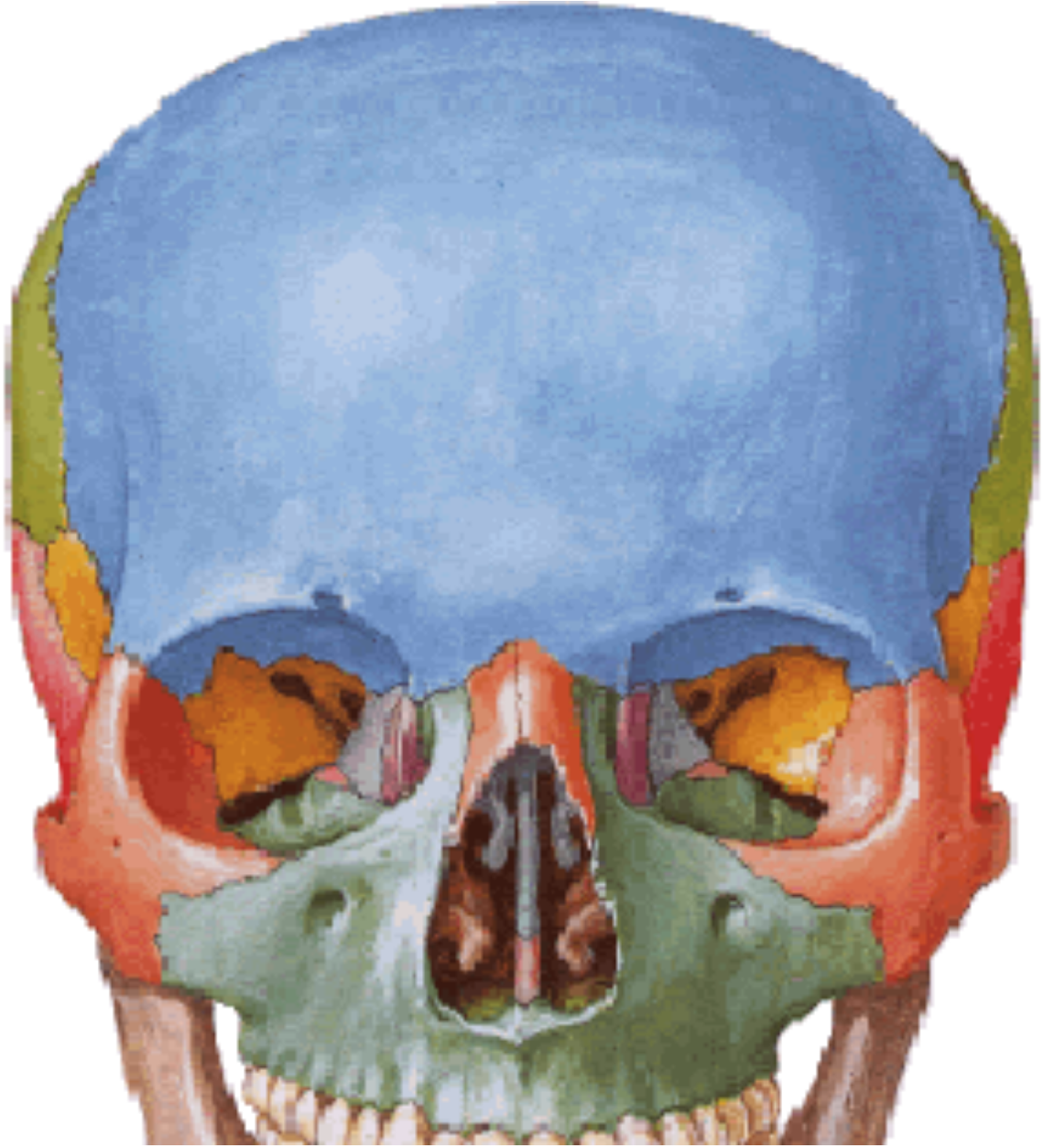
4. They can be used as a site for IV injection (superior Sagittal sinus).

Norma Frontalis

* **It presents:**

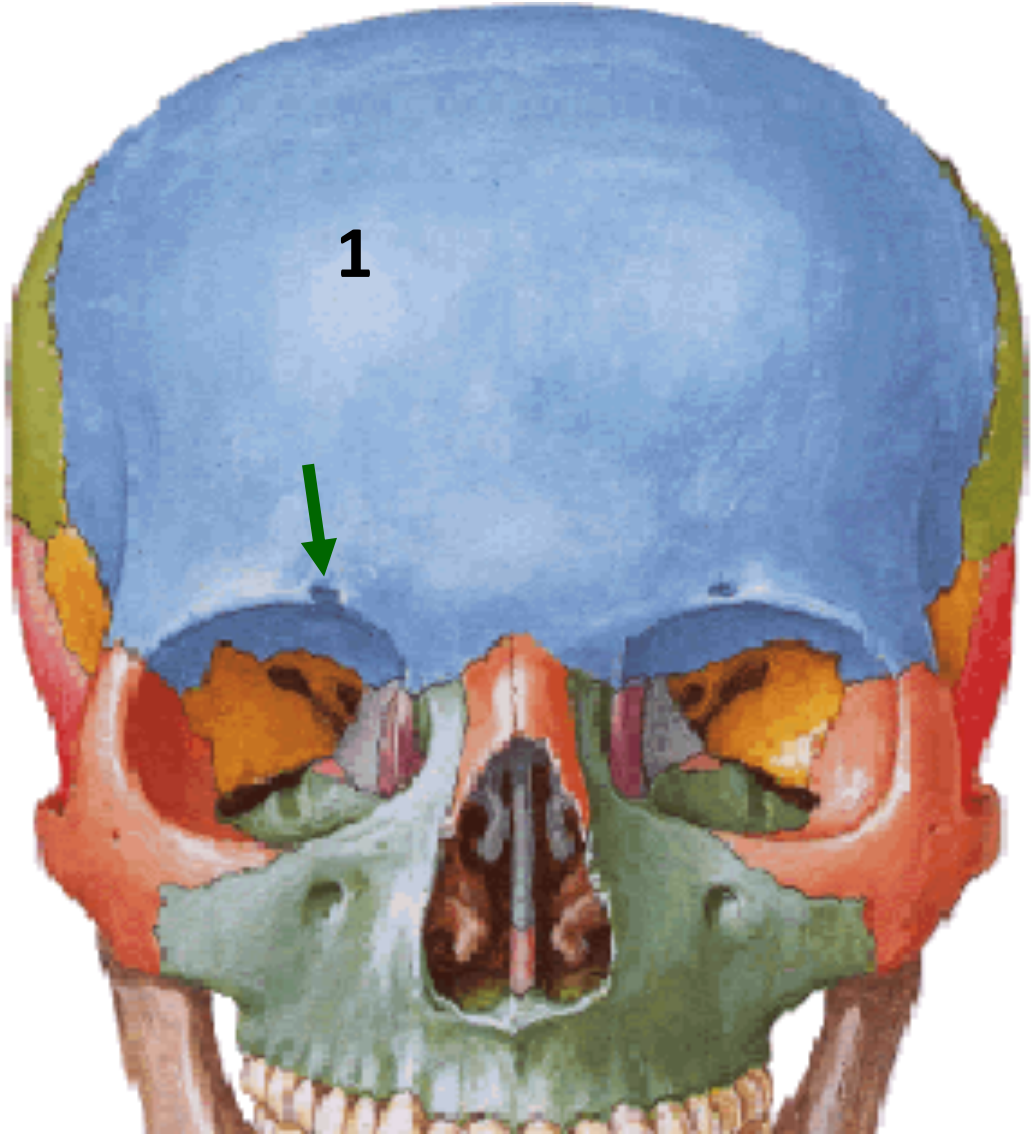
* 4 bones.

* 3 apretures (surrounding 3 cavities; 2 orbital & 1 nasal).



1. The frontal bone:

* Before the age of 8 years, the frontal bone is formed of two halves separated by **metopic suture** which is completely ossified by 8 years.
* It persists in black race & in 8% of population.
* It is pierced by the **supraorbital foramen** (which gives passage to supraorbital nerve & vessels).

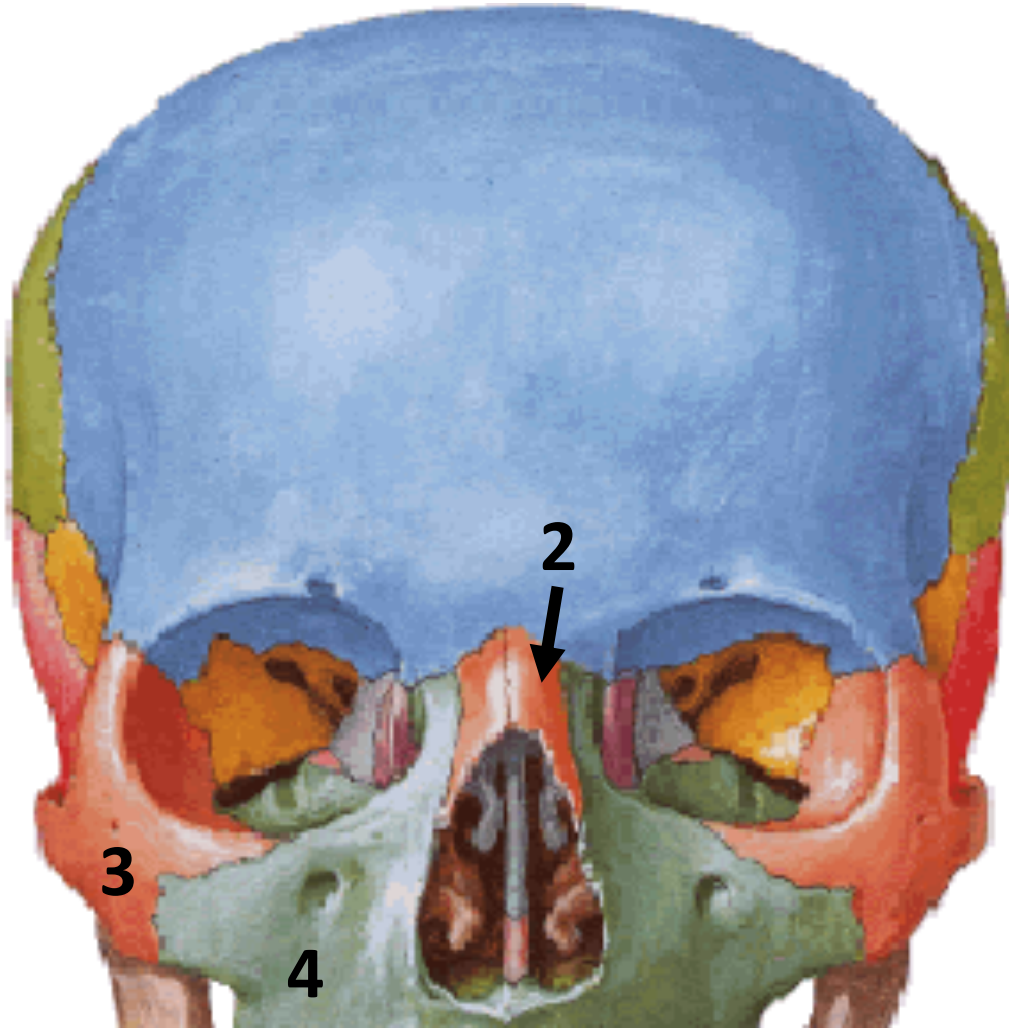


2. **The 2 nasal bones:** form the bridge of the nose.

3. **Zygomatic bone:**

4. **The maxillary bone:**

- Is has a **body** which contains the maxillary air sinus.
- It is pierced by the **infra-orbital foramen** (which gives passage to infra-orbital nerve & vessels).

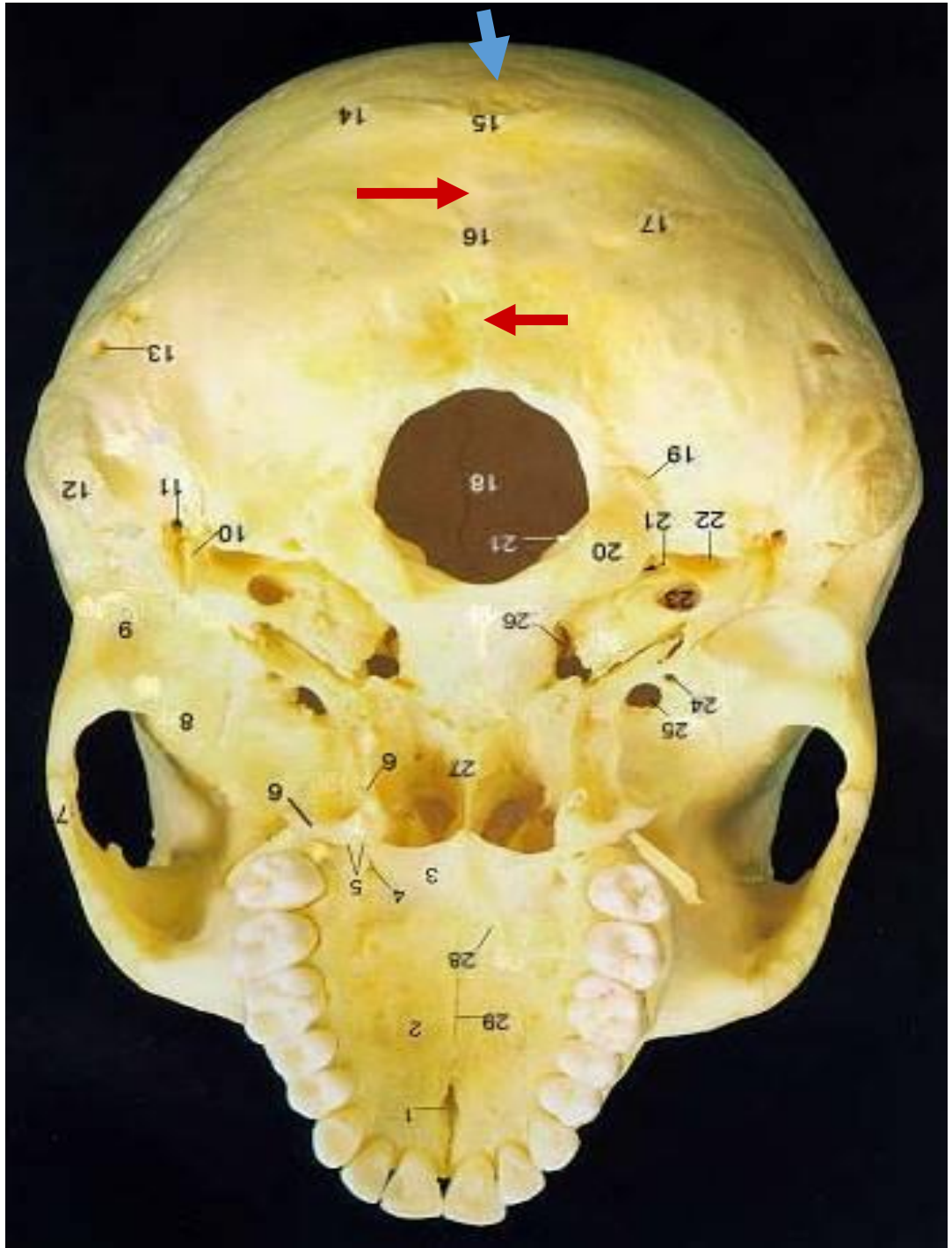


Norma Occipitalis

* The occipital bone presents:

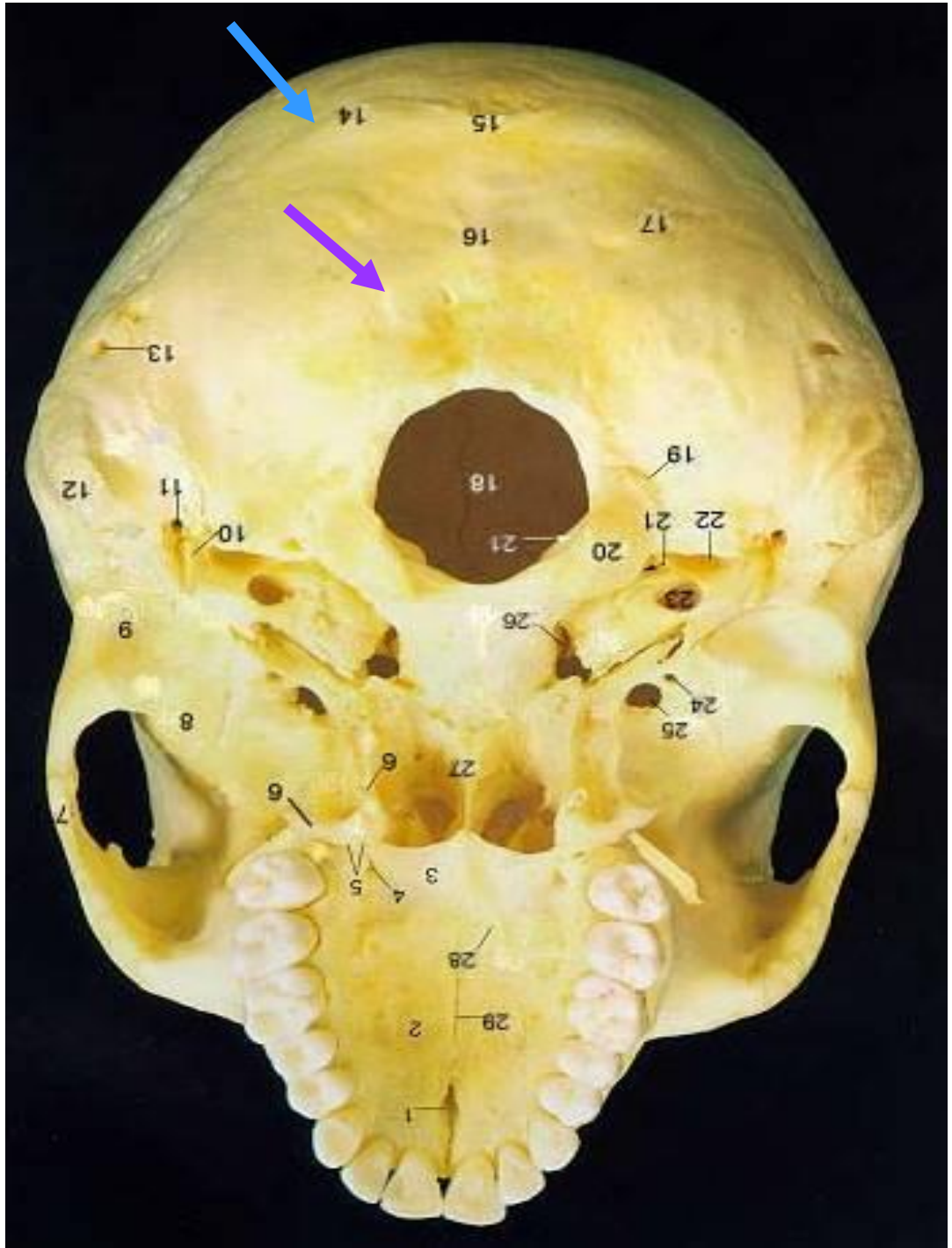
1. External occipital protuberance: it is a median elevation on the occipital bone. Its most projecting point is called **inion.**

2. External occipital crest: extends from the protuberance to the foramen magnum.



3. The superior nuchal lines: extends laterally from the protuberance.

4. The inferior nuchal lines: extends laterally from the crest & run parallel to and below the superior nuchal lines.

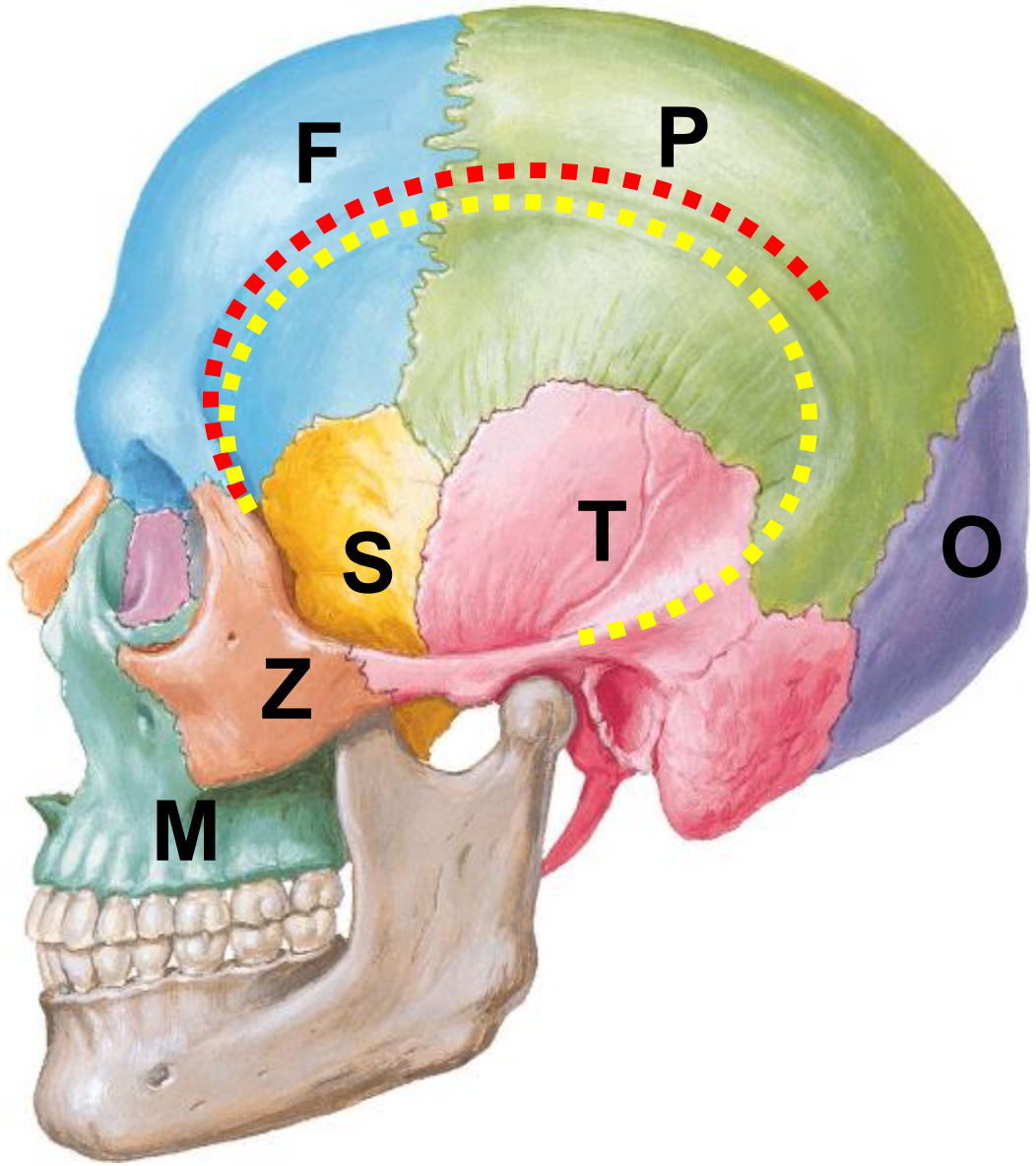


Norma Lateralis

*It is formed of: frontal, parietal, occipital, temporal, greater wing of sphenoid bone, maxilla and zygomatic bones.

***The superior temporal line:**
extends from zygomatic bone and passes backwards.

***The inferior temporal line:**
with **the temporal fossa** lies below it.

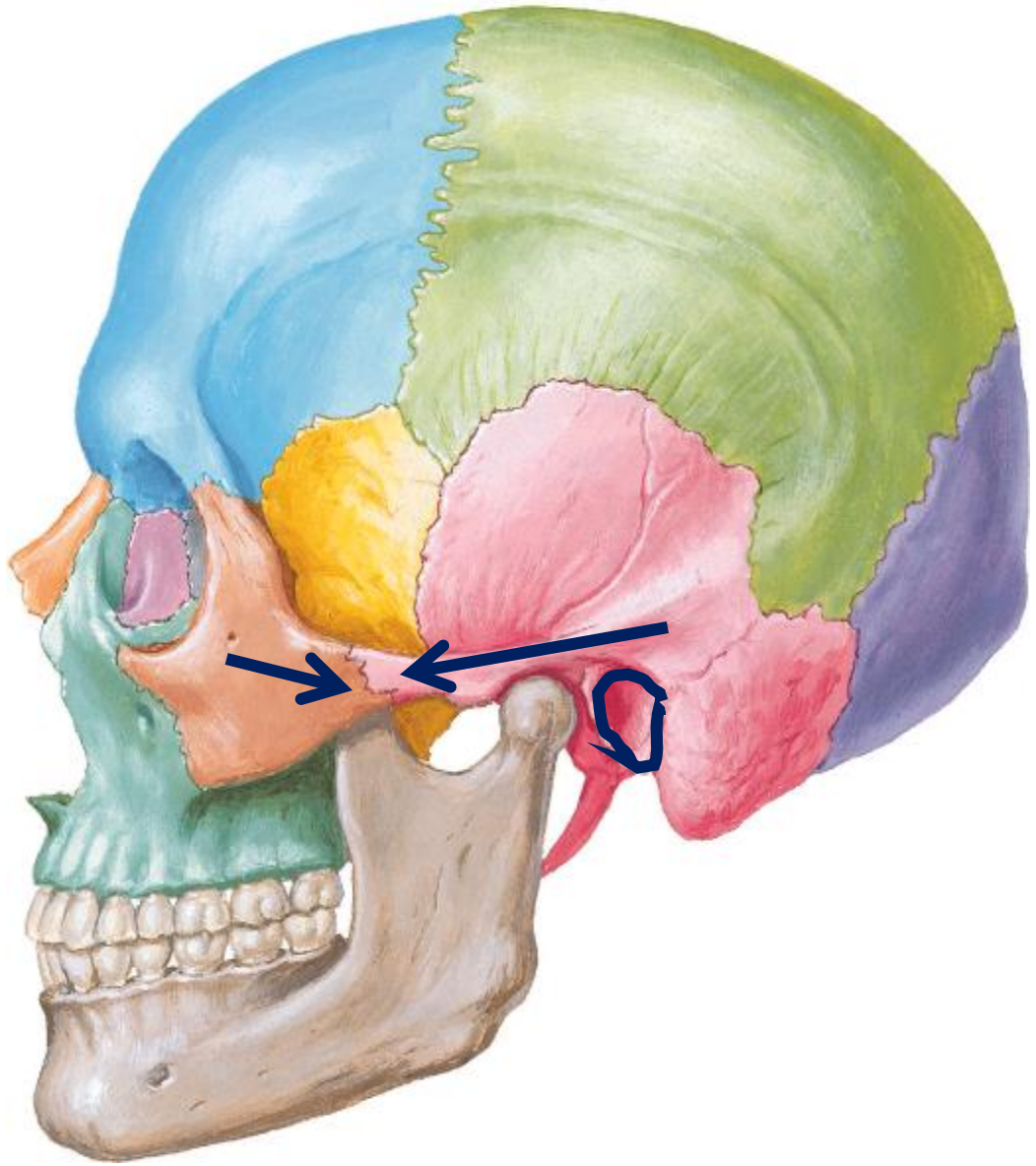


* The zygomatic arch:

* Is formed by the temporal process of zygomatic bone and zygomatic process of temporal bone.

* The external auditory meatus:

* lies below the posterior part of the zygomatic process of the temporal bone.



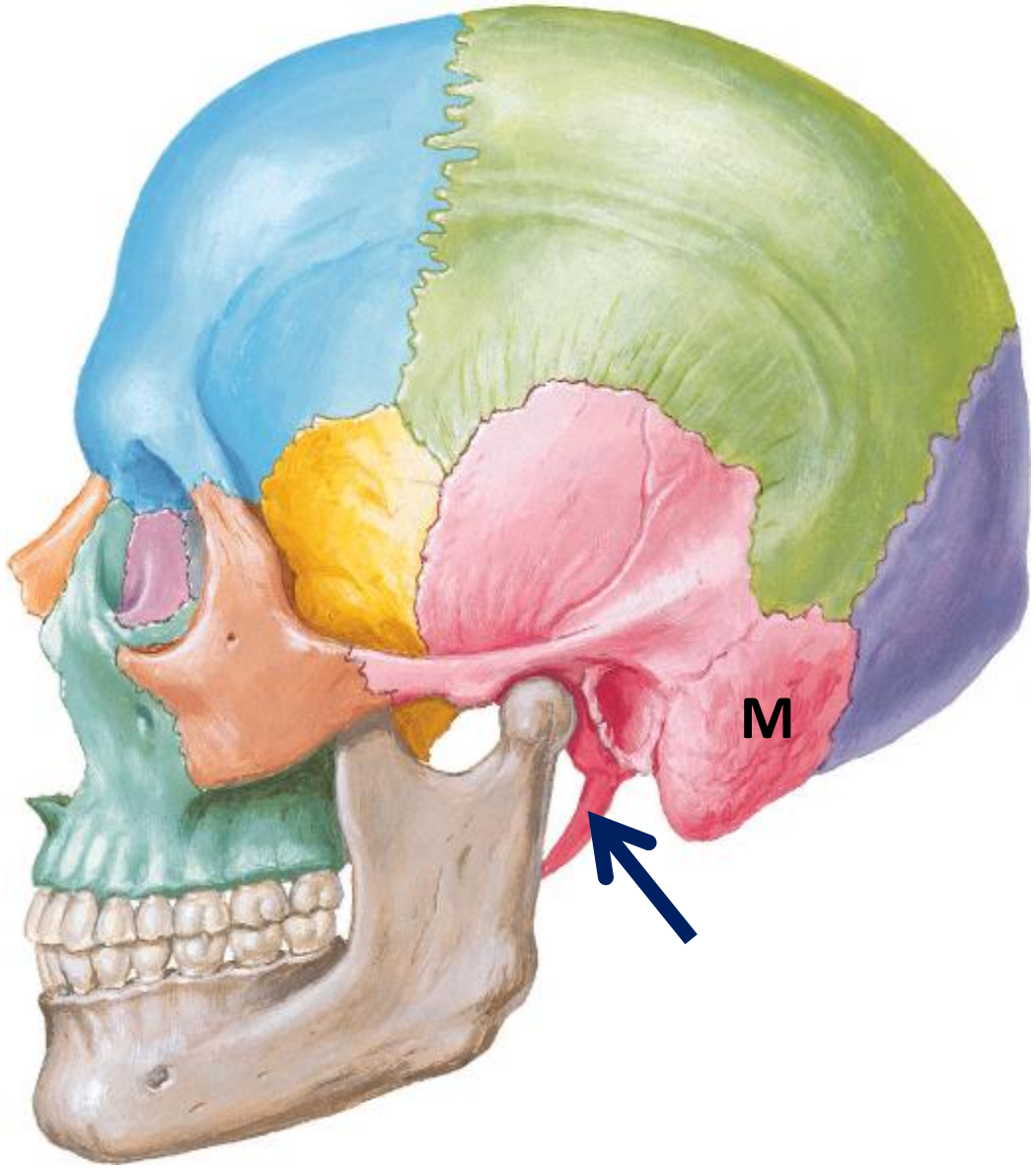
*** The mastoid process (M):**

* It is a part of the temporal bone.

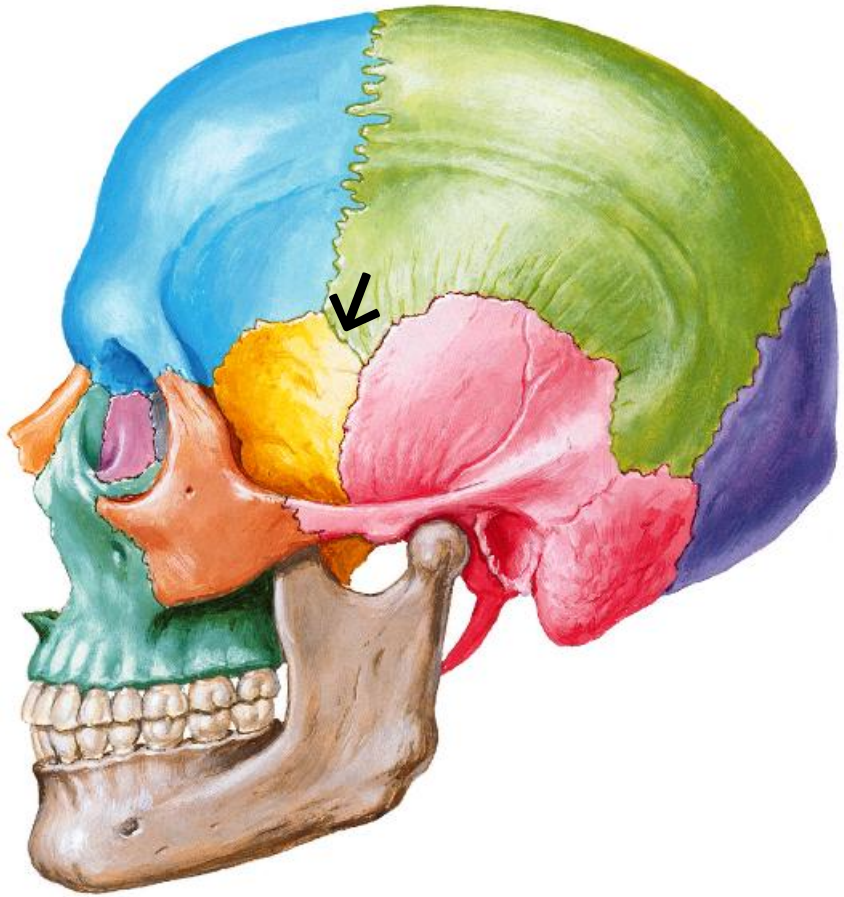
* It lies behind the external auditory meatus.

*** The Styloid process (↑):**

* It is a slender projection of the temporal bone.

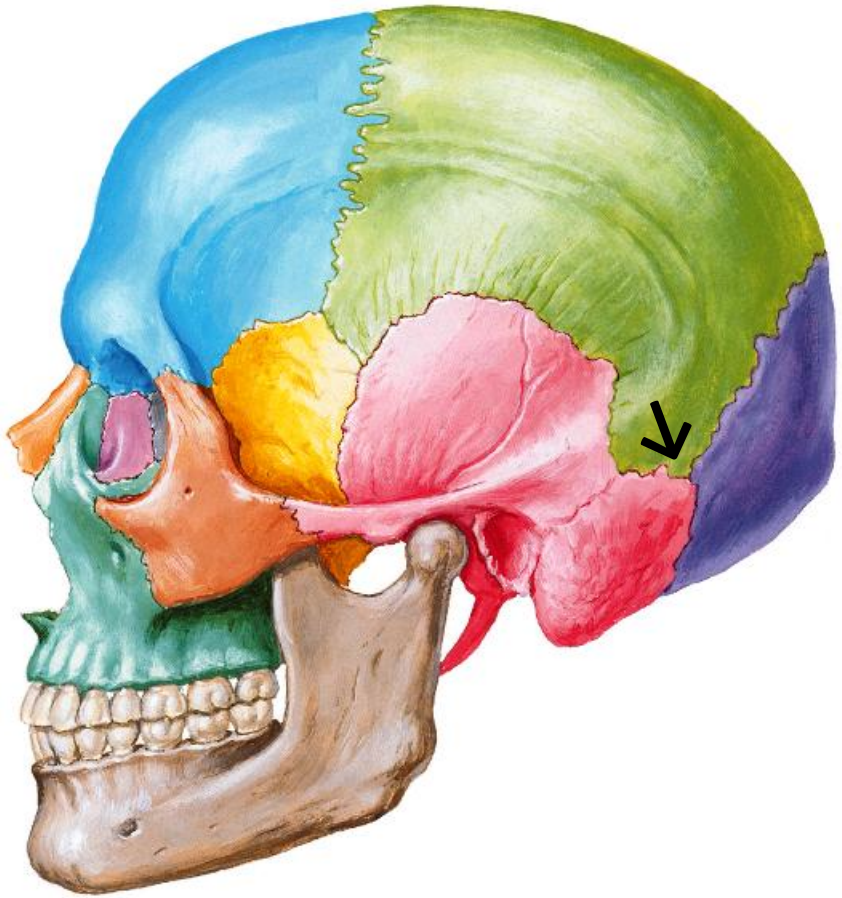


* **Pterion (↓):**
* It is the meeting point of 4 bones, the frontal, parietal, temporal and greater wing of sphenoid.
* It is an H-shaped suture.
* It is the ossified anterolateral fontanelle at the age of 3 months.
* The center of the pterion lies 4 cm above the mid-point of the zygomatic arch & 3.5 cm behind frontozygomatic suture.
* It is related to the middle meningeal A.
* Since it is very thin, the pterion is the most frequently fractured part of skull in car accidents leading to hemorrhage (extradural hematoma) which compresses the motor area of the brain.



* Asterion (↓):

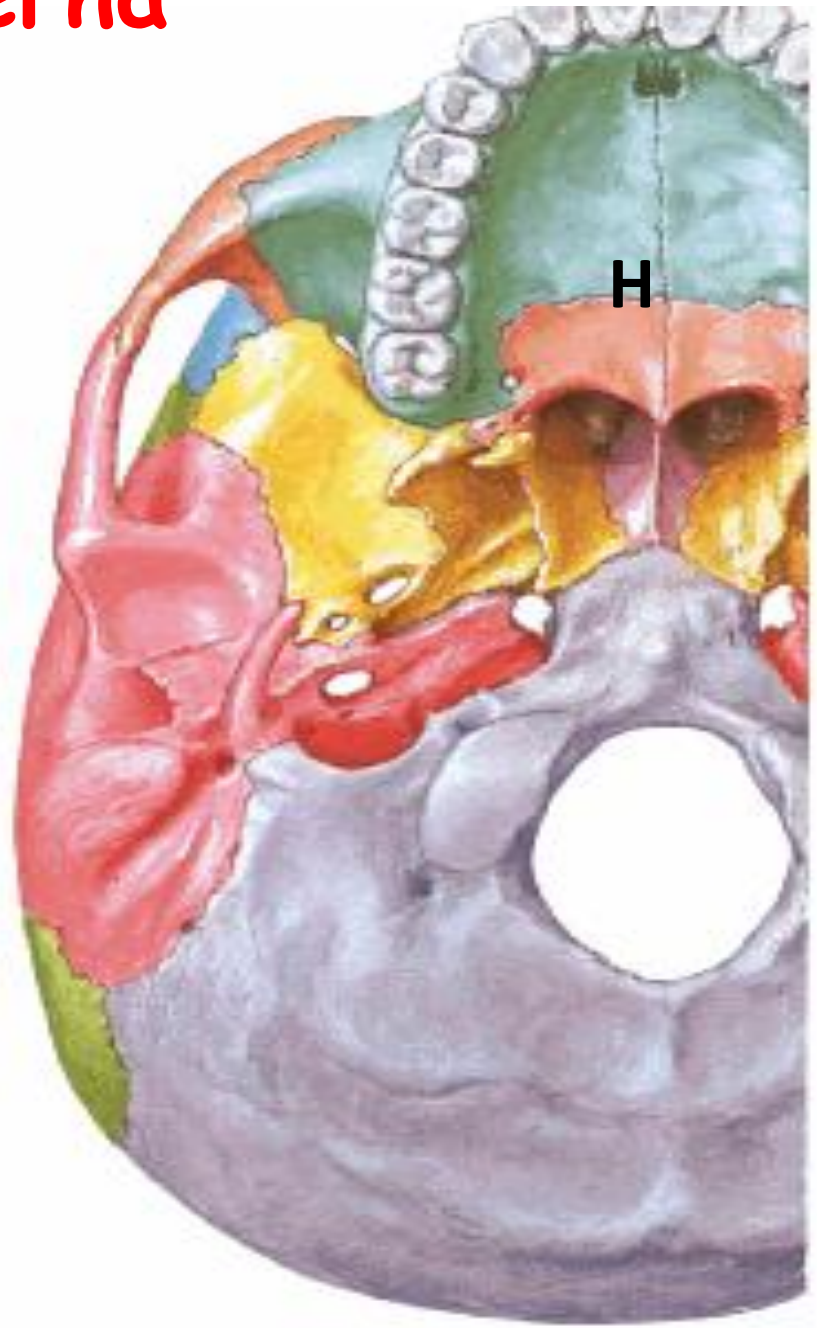
* It is the meeting point of the parietal, occipital & mastoid part of temporal bones.
* It is the site of posterolateral fontanelle which ossifies at the age of 3 months.



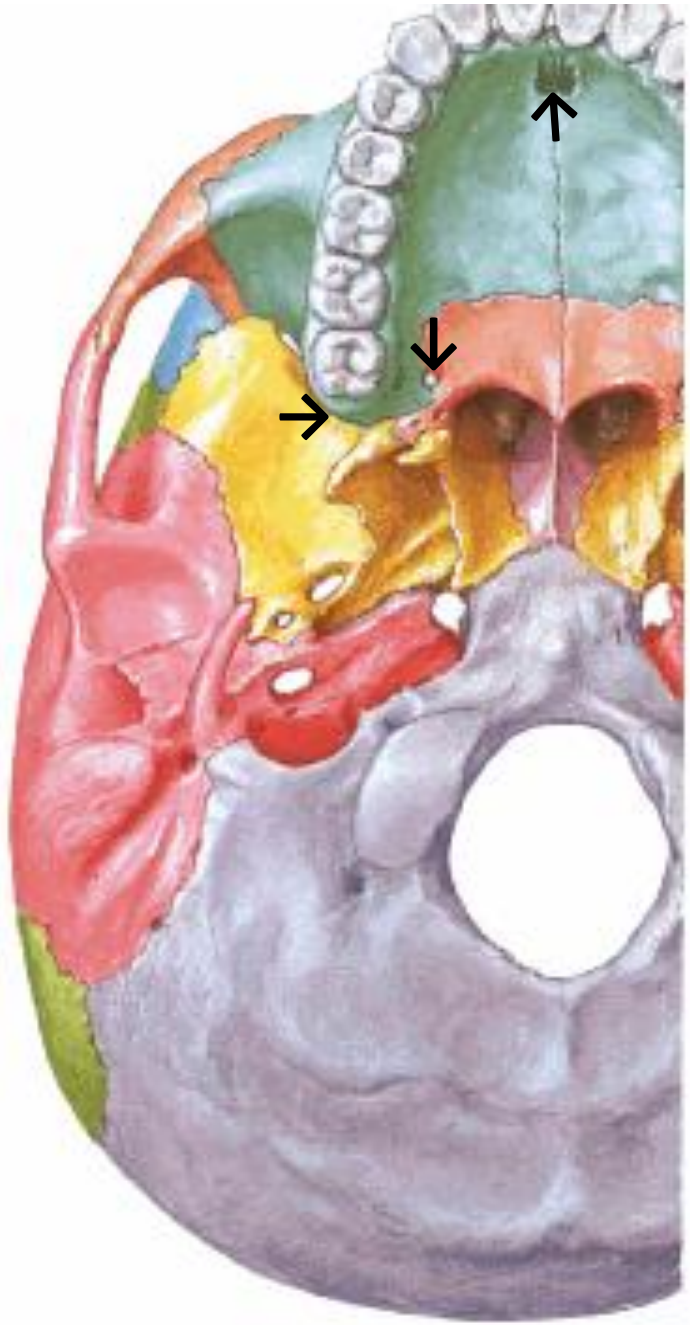
Norma Basalis Externa

A. Anterior part:

* It is formed by the hard palate (H).
* The hard palate is bounded anteriorly by the alveolar arch, which has 16 sockets for the roots of the upper teeth.



* **The greater palatine foramen (↓) lies in the posterior part of the hard palate. It gives passage to greater palatine nerve & vessels.**
* **The lesser palatine foramina, usually two, lie behind the greater palatine foramen. They give passage to lesser palatine nerve & vessels.**
* **The maxillary tuberosity (→) is present at the posterior end of the alveolar arch.**
* **The incisive fossa (↑) lies posterior to the central incisor teeth. It contains foramina which serve as a connection between palate & nose.**



B. Middle part:

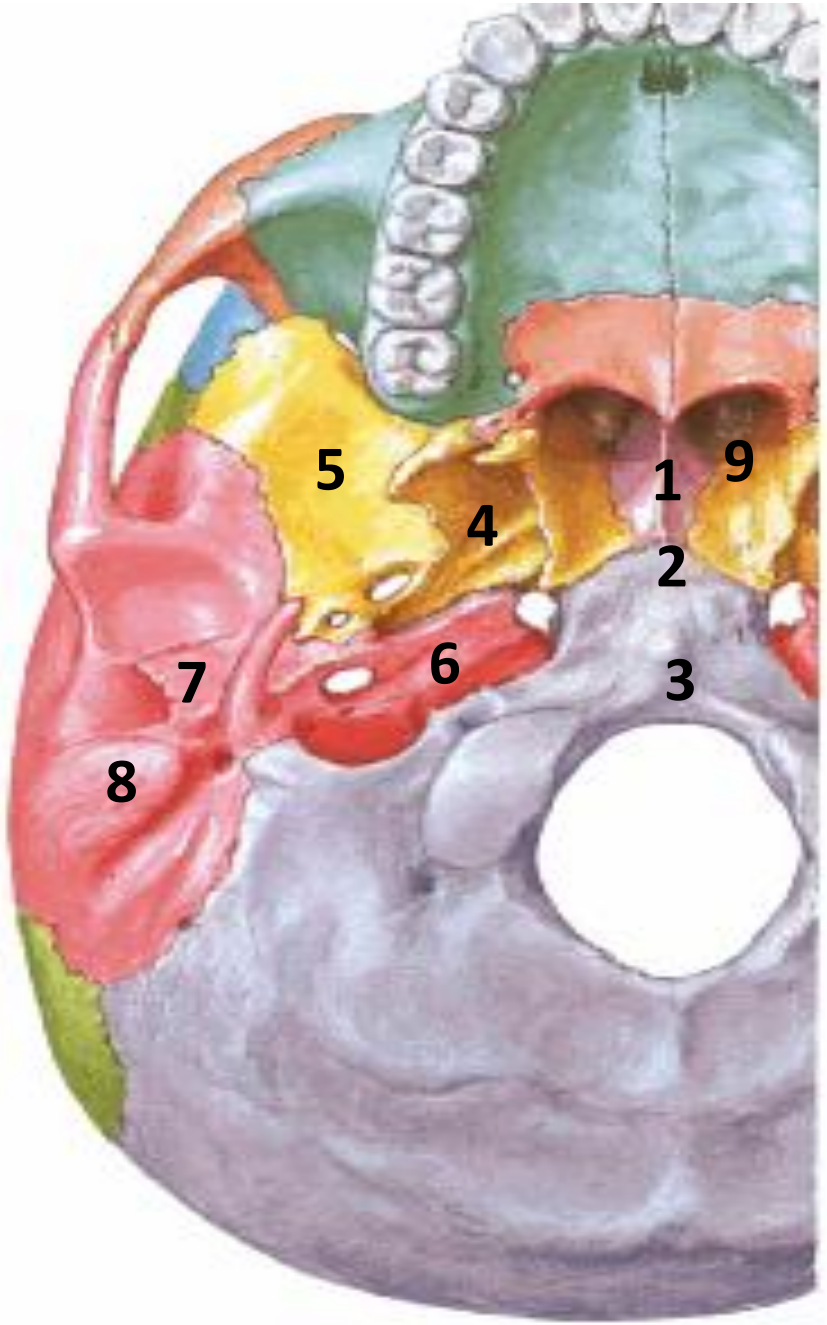
*** In the middle, it shows:**

1. Vomer.
2. Body of sphenoid.
3. Basilar part of occipital bone.

*** Laterally, it shows:**

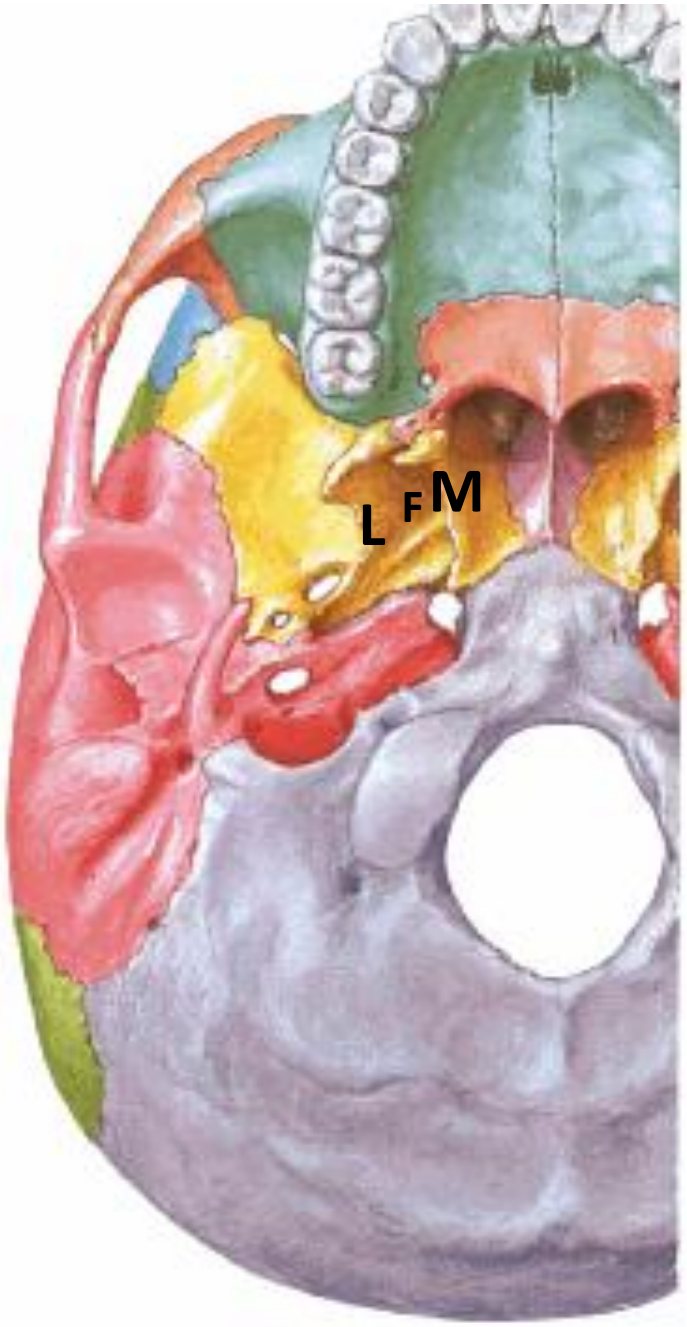
4. Pterygoid process.
5. Greater wing of sphenoid.
6. Petrous part of temporal bone.
7. tympanic parts of temporal bone.
8. Mastoid process.

* It contains: Posterior nasal openings (9) (choanae) which are separated by vomer (part of nasal septum).



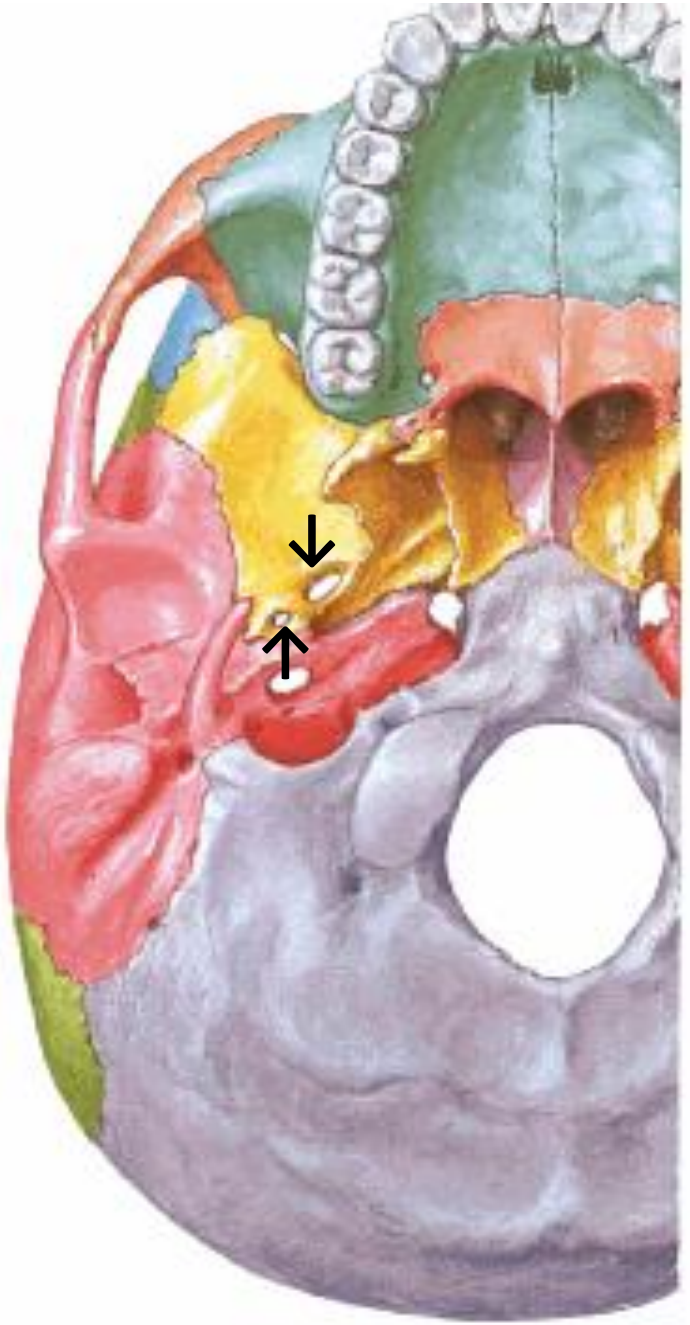
** The pterygoid process of the sphenoid bone:

* It is formed of lateral pterygoid plate (L) and medial pterygoid plate (M) with the pterygoid fossa (F) in between.



** The greater wing of sphenoid bone shows:

1. Foramen ovale (↓):
   * Gives passage to:
      a. Mandibular nerve.
      b. Lesser petrosal nerve.
      c. Accessory meningeal artery.
2. Foramen spinosum (↑):
   * Gives passage to:
      a. Nervus spinosus.
      b. Middle meningeal artery.

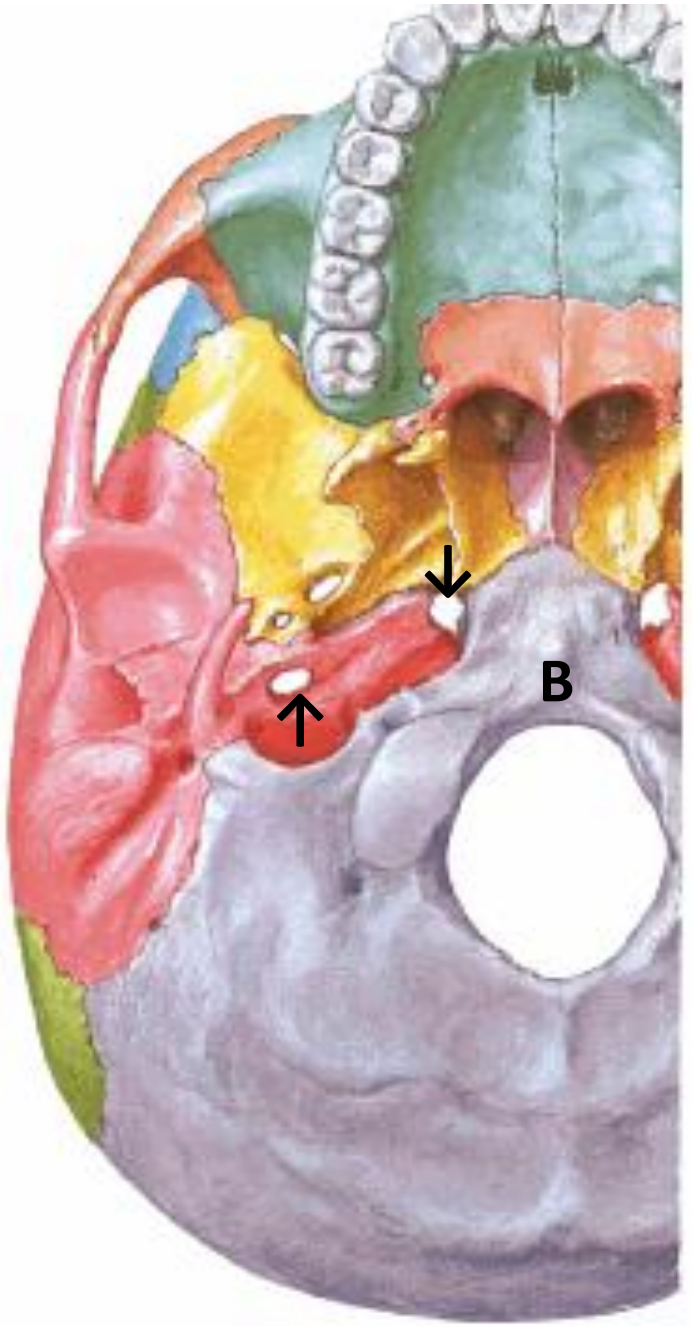


C. Posterior part:

** **The basilar part of occipital bone (B)** articulates anteriorly with the body of the sphenoid bone.

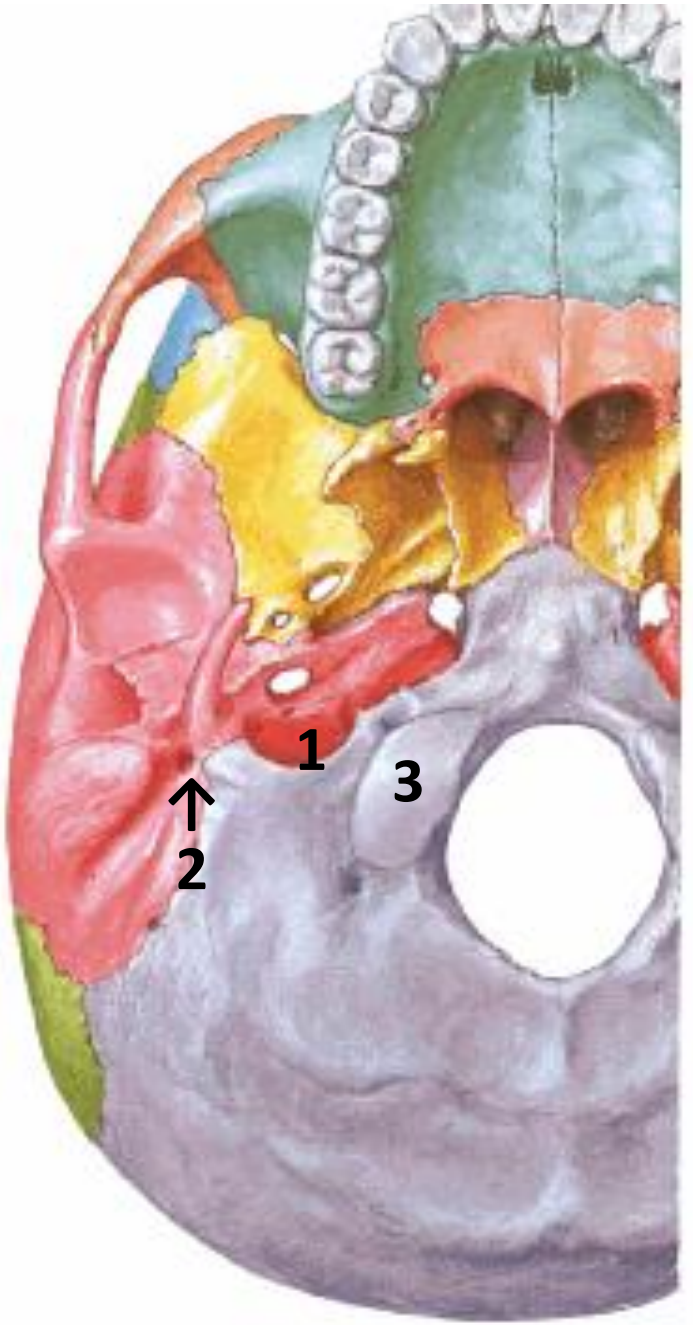
** **Foramen lacerum (↓)** lies between petrous part of temporal bone, basilar part of occipital and the pterygoid process. In life it is closed by cartilage plate.

** **The carotid canal (↑):** lies posterolateral to foramen lacerum. Gives passage to internal carotid artery.



** Notice the following:

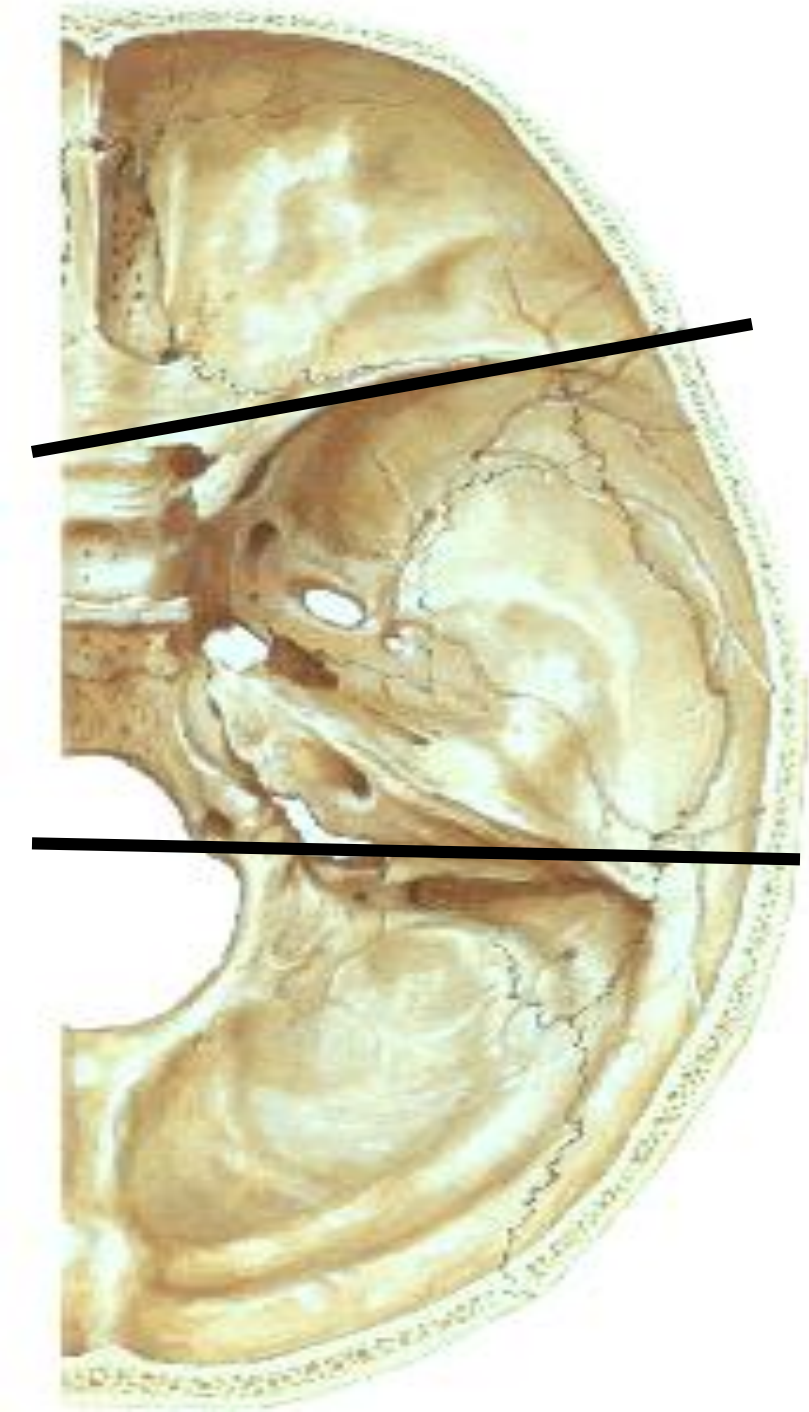
1. **The jugular foramen:** lies lateral to the occipital condyle. Gives passage to internal jugular vein.
2. **The stylomastoid foramen:** lies between styloid and mastoid processes. Gives passage to facial nerve.
3. **The occipital condyles:** articulate with the atlas to form atlanto-occipital joint.
4. **The anterior condylar (hypoglossal) foramen.** Gives passage to hypoglossal nerve.
5. **The posterior condylar foramen.**
6. **The foramen magnum:** communicates the cranial cavity with the vertebral canal. Gives passage to brain stem which continues as spinal cord.



Cranial Cavity

* **It is divided into:**

1. Anterior cranial fossa.
2. Middle cranial fossa.
3. Posterior cranial fossa.



Ant. Cranial Fossa

* It is formed by the following bones:

* In the midline:

1- Frontal bone.

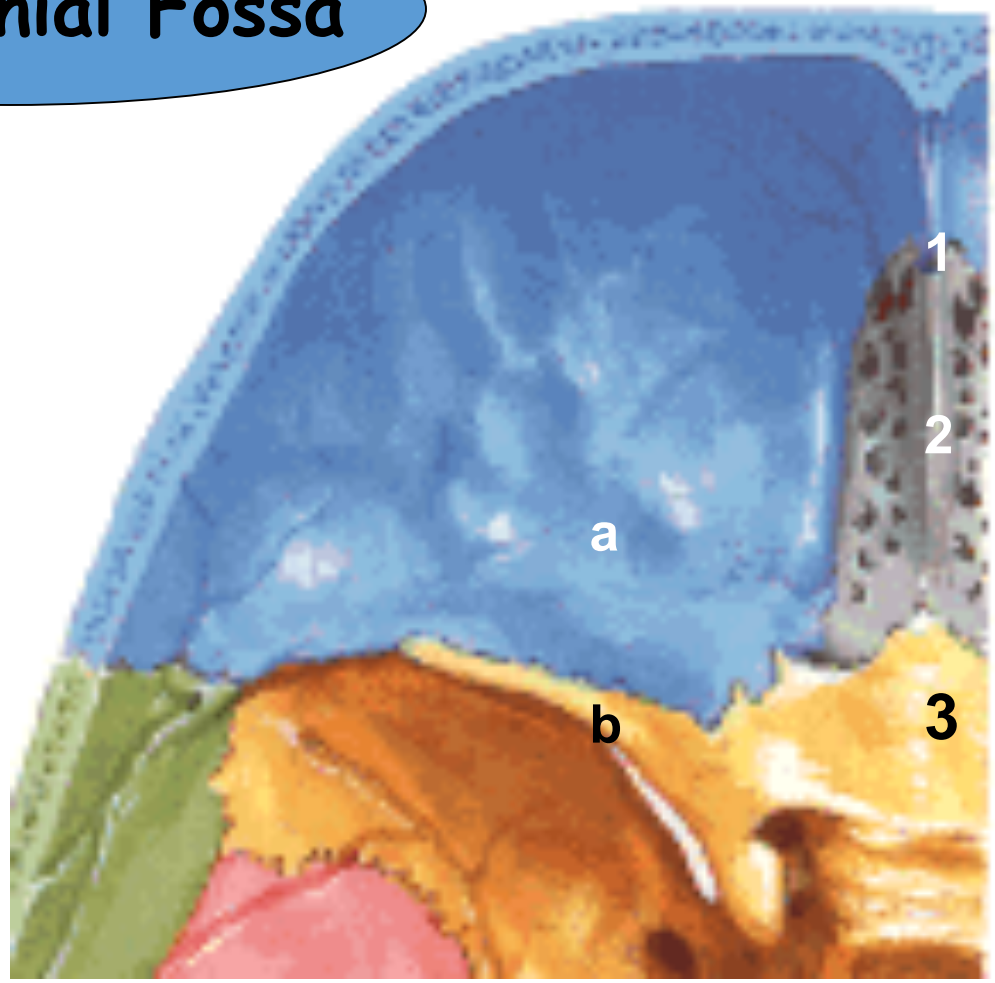
2- Ethmoid.

3- Sphenoid.

* On each side:

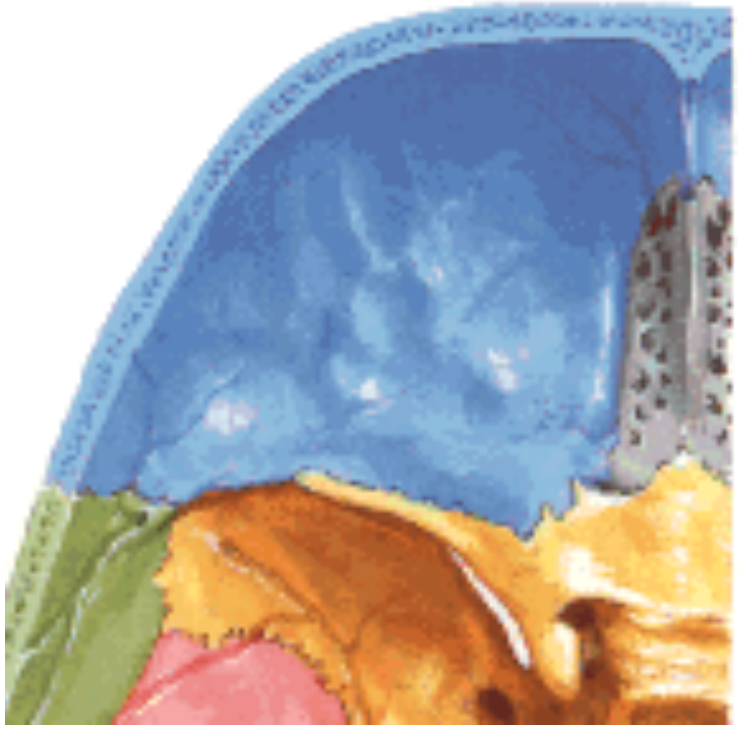
a. Frontal bone.

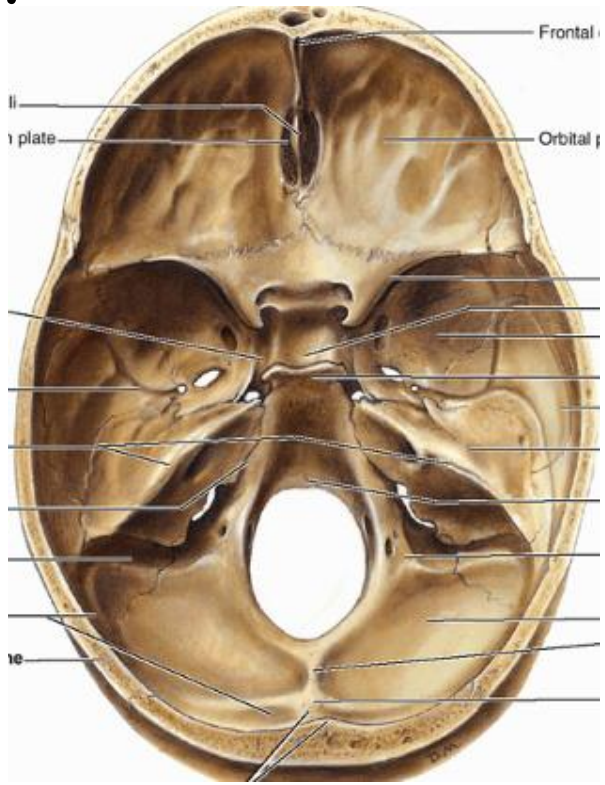
b. Sphenoid (lesser wing).



* Midline structures of the anterior cranial fossa:

1. Frontal crest.
2. Foramen caecum.
3. Crista galli.
4. Cribriform plate of ethmoid (gives passage to olfactory nerve).





Middle Cranial Fossa

* Formed by the following bones:

* In the midline:

Sphenoid (body).

* On each side:

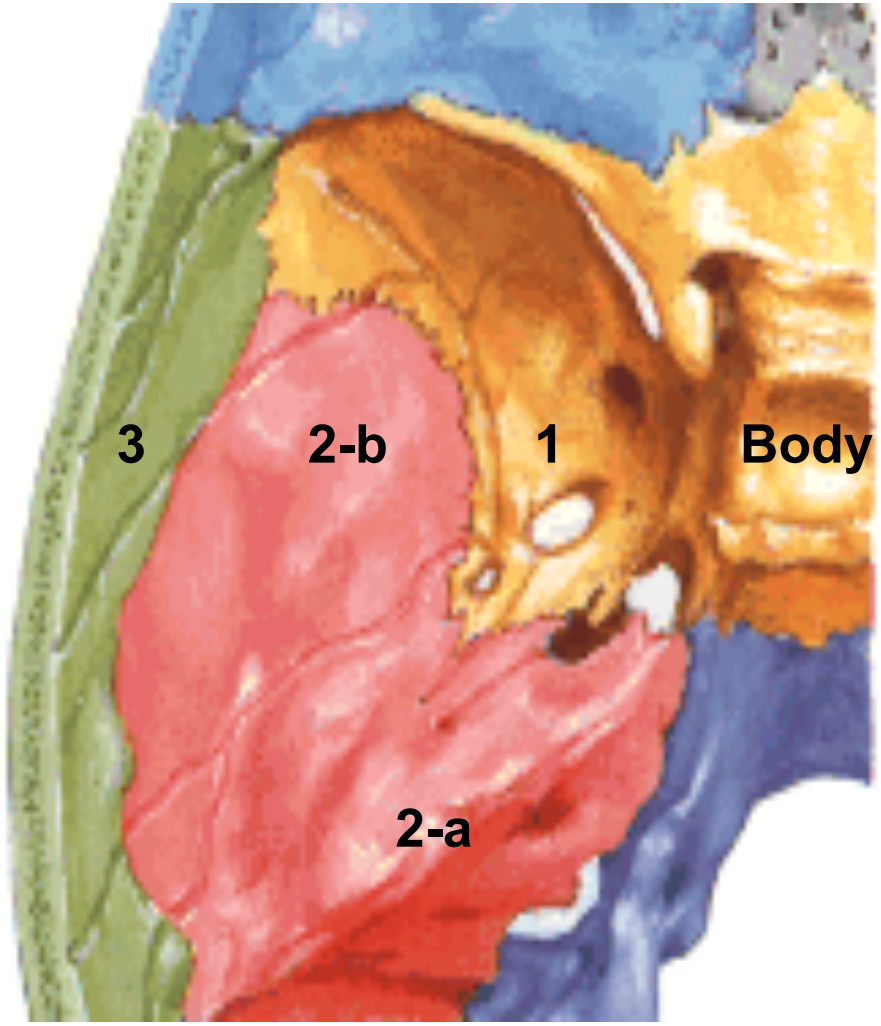
1- Sphenoid (greater wing).

2- Temporal bone:

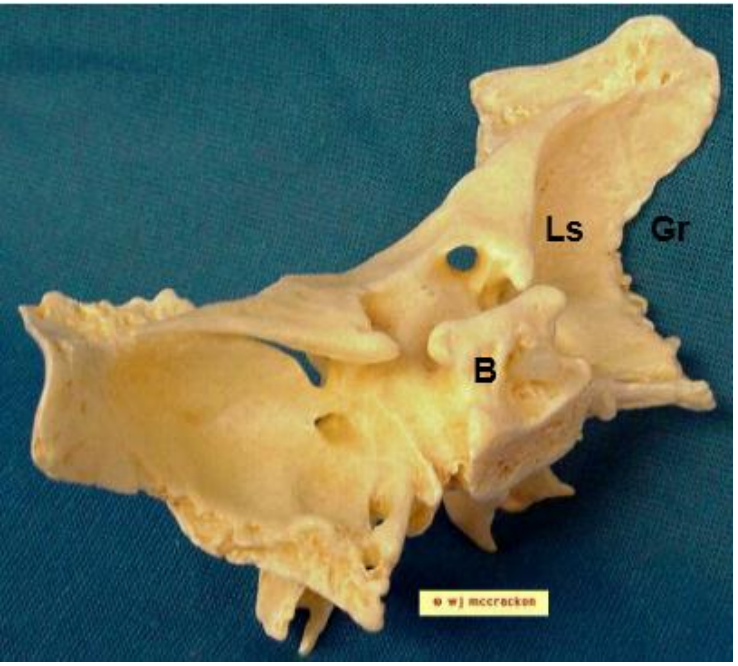
   a. Petrous part.

   b. Squamous part.

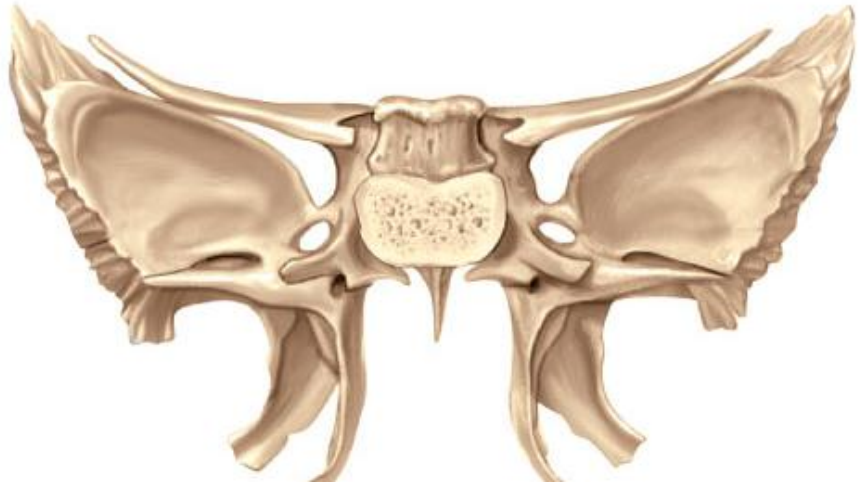
3- Parietal bone.



sphenoid bone is like a butterfly



(a) Superior view



* Middle cranial fossa shows:

Greater wing of sphenoid which contains:

1. **Sup. Orbital Fissure** → gives passage to nerves & vessels of orbit.
2. F. Rotundum → gives passage to maxillary nerve
3. F. Ovale.
4. F. Spinosum.

Post. Cranial Fossa

* **Formed by the following bones:**

* **In the midline:**

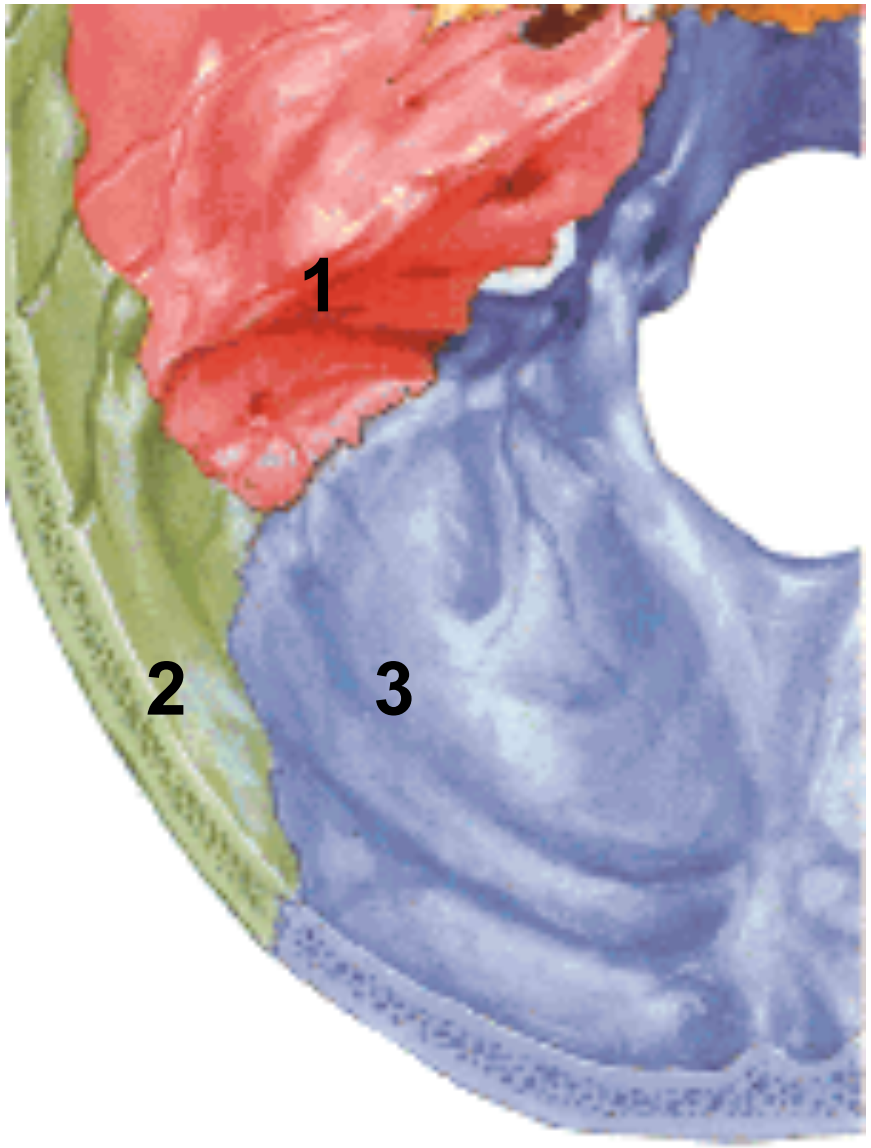
Occipital bone.

* **Laterally-placed:**

1- Petrous part of temporal bone.

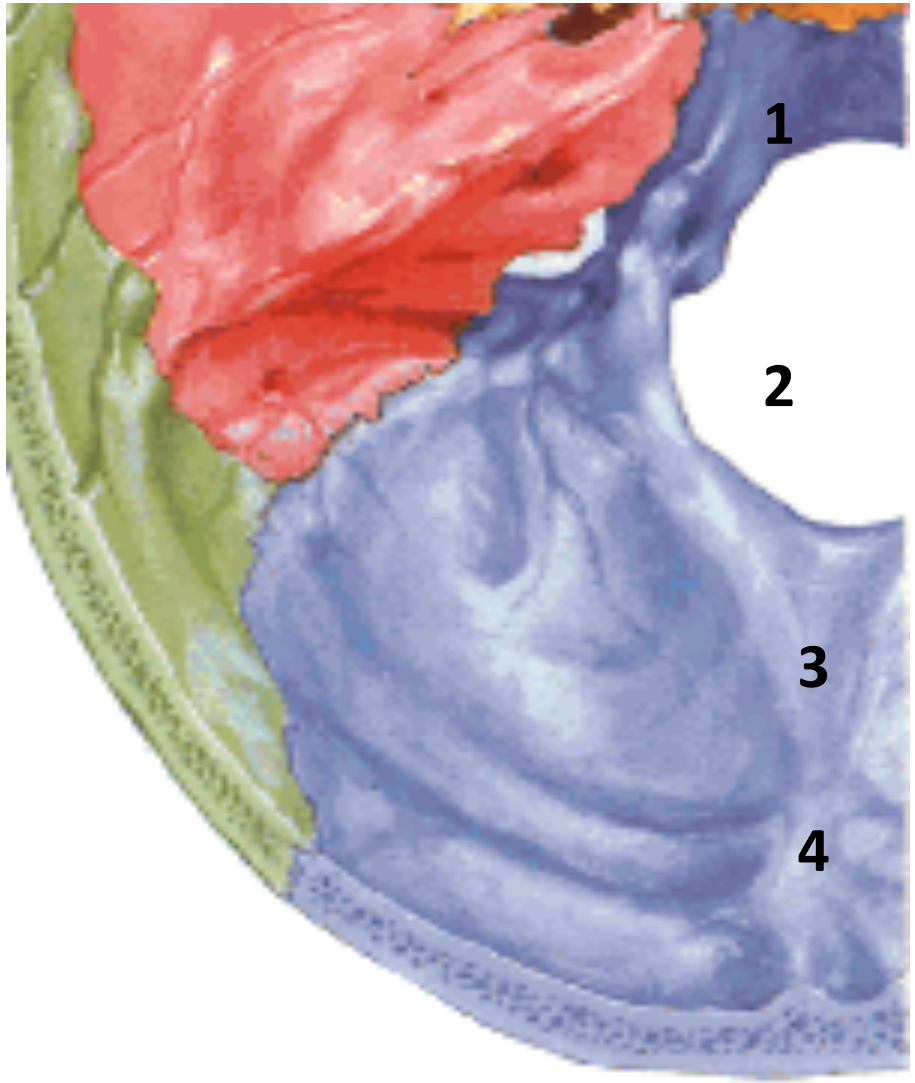
2- Parietal bone.

3- Occipital bone.



* Midline structures in the posterior cranial fossa :

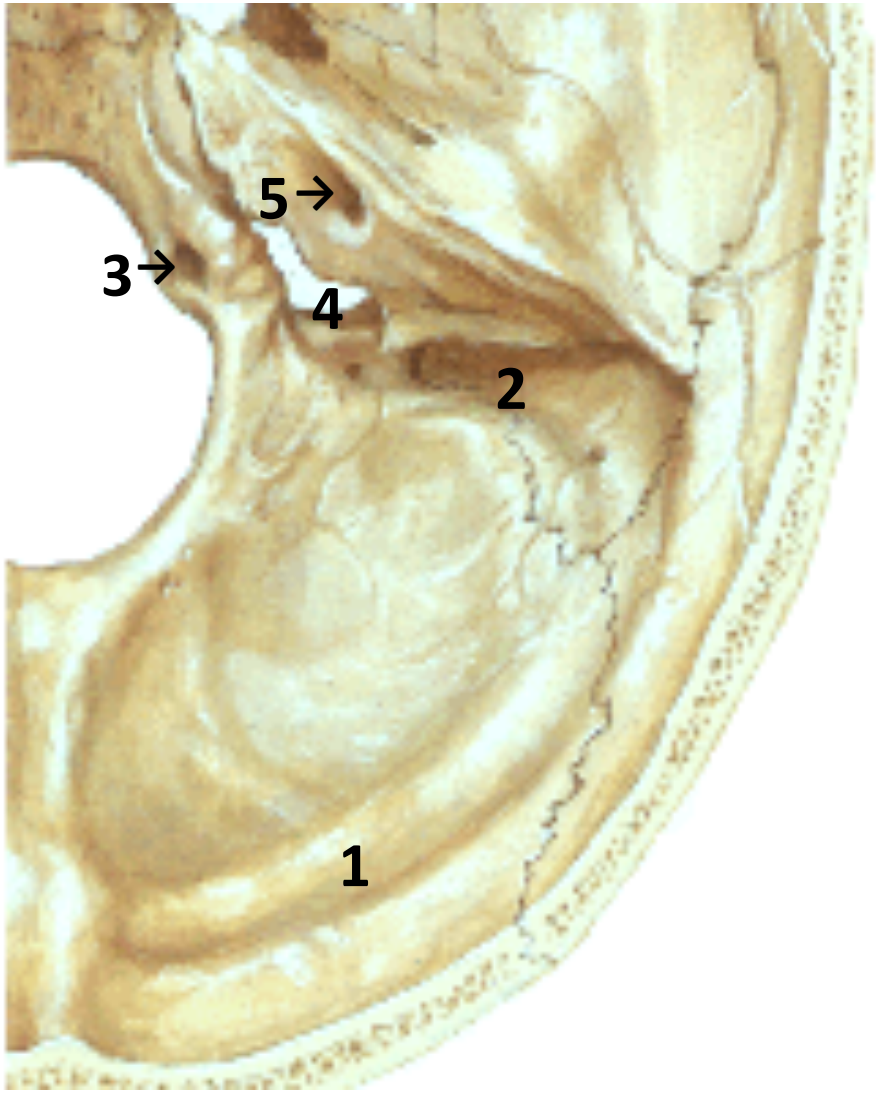
1. Clivus (formed by: body of sphenoid + basilar part of occipital bone).
2. Foramen magnum.
3. Internal occipital crest.
4. Internal occipital protuberance.



* Laterally-placed structures in the post. cranial fossa:

* Two sulci & 3 foramina:

1. Transverse sulcus (contains transverse sinus).
2. Sigmoid sulcus (contains sigmoid sinus).
3. Hypoglossal canal (gives passage to hypoglossal nerve).
4. Jugular foramen (gives passage to internal jugular vein).
5. internal auditory meatus → gives passage to 7th & 8th cranial nerves).




Thank You
Thank You
Thank You!!!!