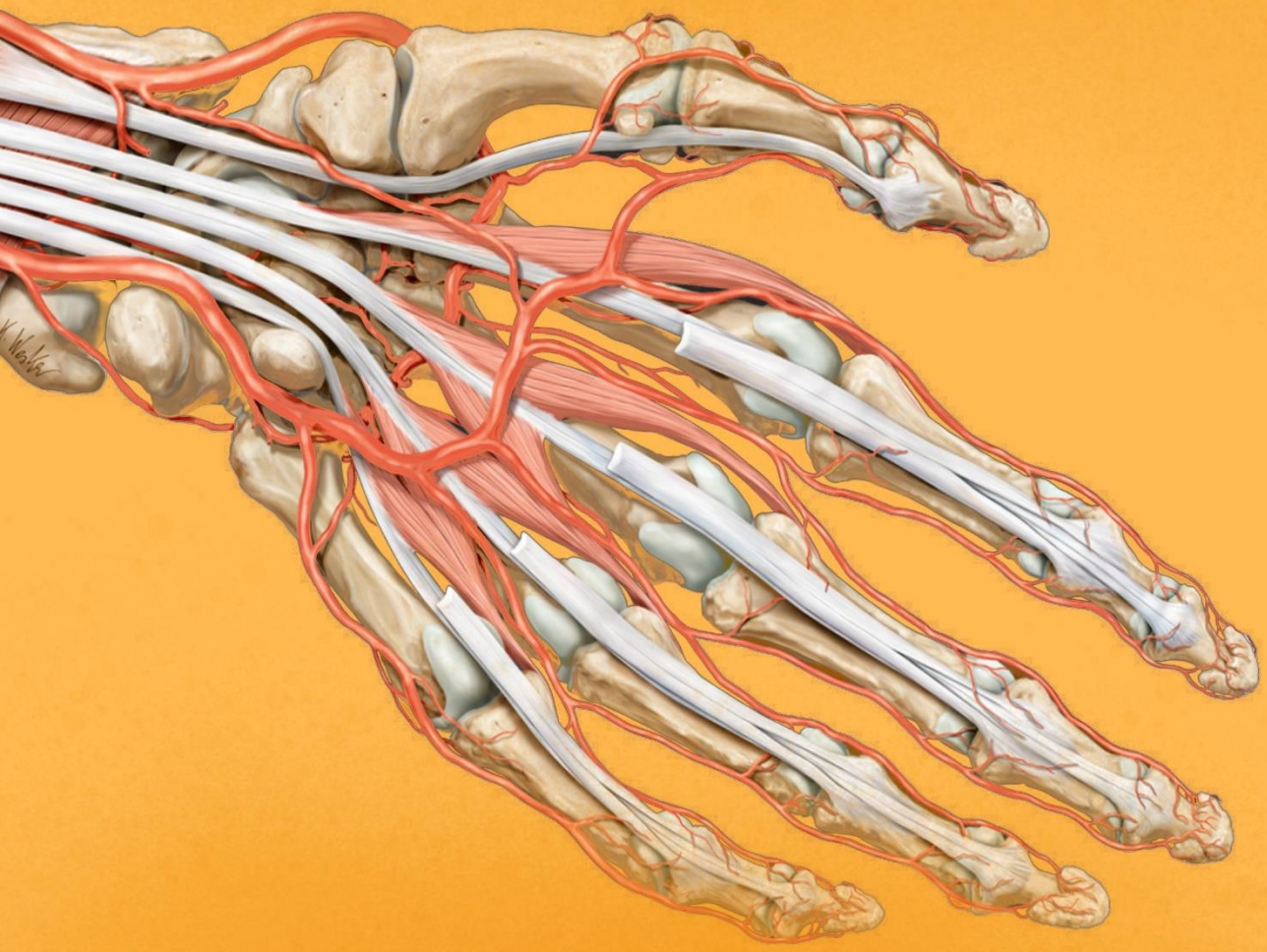
HATAHET ANATOMY



Axial skeleton (Skull)

Lecture: 4

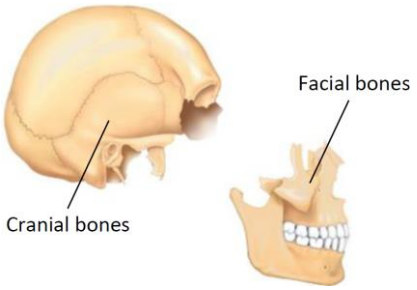
Pages: 11

Lecture 3: The skull

The bones of the skull are immovable bones and have a special type of joints between them called (Sutures), the skull bones make 33% of all axial skeleton bones, classified into 2 types of bones:

1) *Facial bones*: the bones of the skull that have no relation with covering the brain, and they are considered irregular bones

2) *Cranial bones (Brain box)*: the bones of the skull that houses the brain inside the skull, in addition to the special senses, and most are considered flat bones



Anatomical views of the skull

❶ Anterior view (Norma Frontalis)

❷ Posterior view (Norma occipitalis)

❸ Superior view (Norma verticalis)

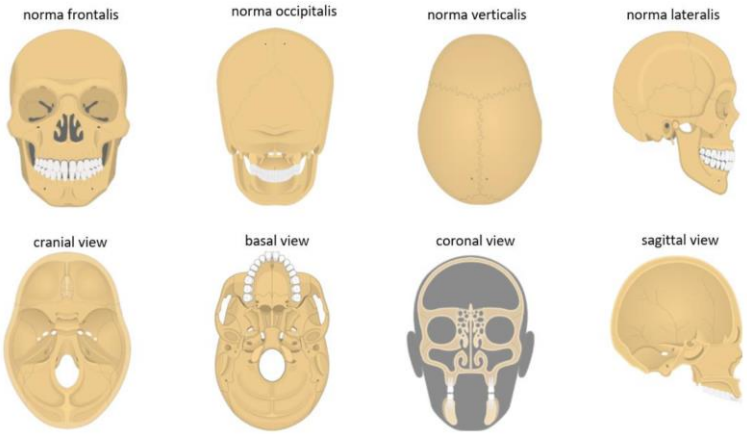
❹ Lateral view (Norma lateralis), divides the skull into cranial and facial bones

❺ Cranial view (Transverse view)

❻ Basal view (Inferior view)

❼ Coronal view

❽ Sagittal view



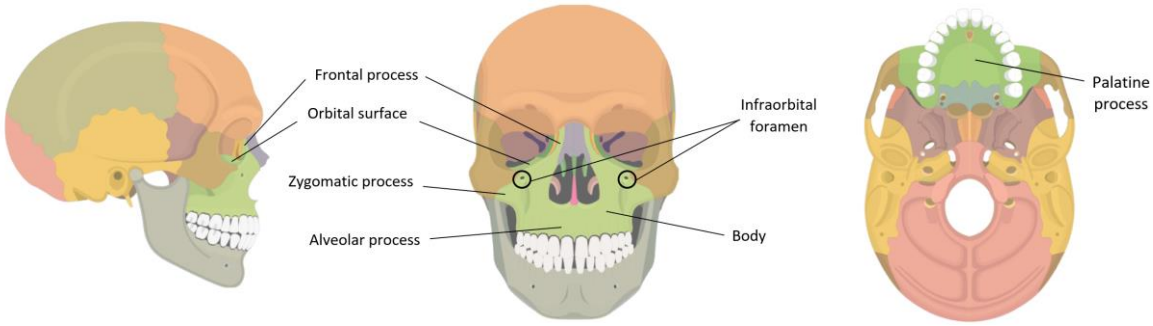
Bones of the skull

Facial bones (Viscerocranium)

The skull contains **14 facial bones**, which are:

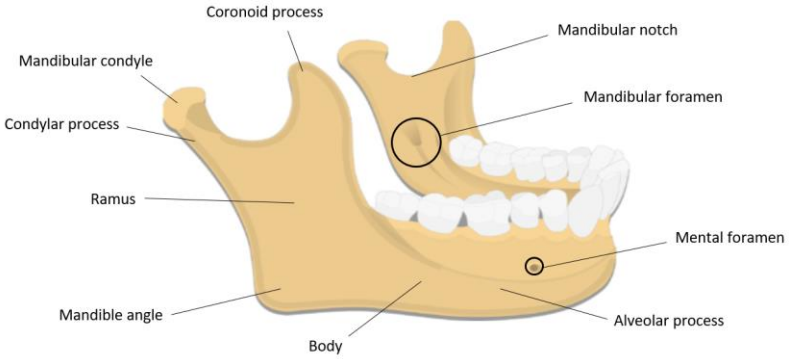
[1] ***Maxillary bone*** **(*Maxilla*)**, the major facial bone; because it articulate with most of the facial bones and doesn't articulate with the mandible

- **Body**, thick and has an air sinus (**Maxillary sinus**)
- **Alveolar process** **(Upper jaw)**, the part that holds the sockets (alveoli) for upper teeth to sit in
- **Zygomatic process**, articulates with zygomatic bone
- **Frontal process**, articulates with frontal bone and nasal bones
- **Infraorbital foramen**, a small foramen below the orbit (eye socket)
- **Orbital surface**, the roof of the orbit (eye socket)
- **Palatine process**, the process that makes the $^{3}/_{4}$ anterior of the hard palate



[2] ***Mandible***, the largest and the strongest bone of the face, it is the only movable bone in the skull

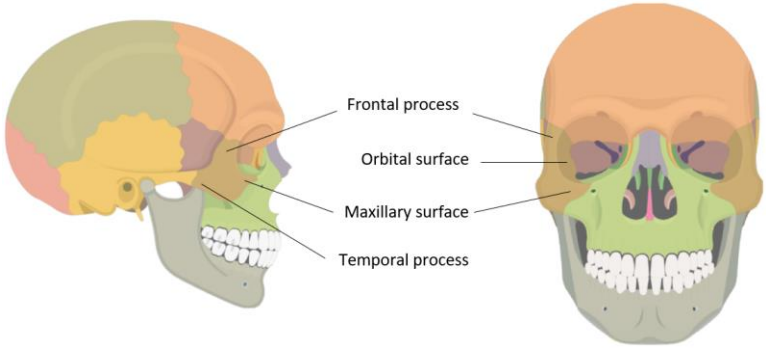
- **Body**, the thick part of the mandible
- **Ramus**, the part of the mandible that goes up and articulate with the skull, one on each side
- **Mandibular angle**, the curved point where each ramus of the mandible meet with the body
- **Condylar process**, the posterior protrusion of the ramus that articulates with the mandibular fossa of the temporal bone to form the (**TemporoMandibular Joint - TMJ**)
- **Coronoid process**, the anterior protrusion of the ramus, serves as an attachment point for the muscles of mastication
- **Mandibular notch**, a notch between the 2 processes of the ramus of the mandible
- **Alveolar process**, the part of the body that holds the sockets for lower teeth to sit in



***Note**: The mandible is the only movable bone in the skull, and the only skull bone that doesn't articulate with other skull bones by sutures, but instead it articulates with the temporal bone via hyaline cartilage at the TMJ

[3] ***Zygomatic bone***, the bone that makes the sides of the face

- **Temporal process**, the process that makes the anterior half of the (Zygomatic arch)
- **Orbital process**, the part of the zygomatic bone that contributes in forming the orbits
- **Maxillary process**, articulates with maxillary bone
- **Frontal process**, articulates with frontal bone

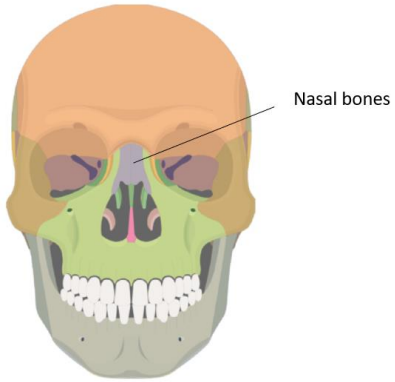


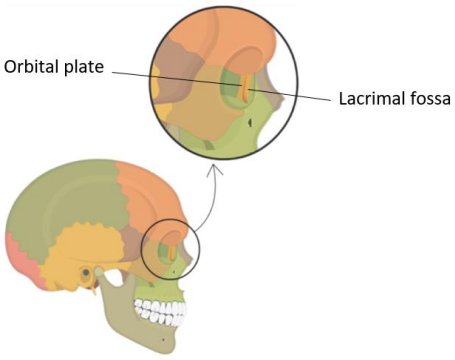
[4] ***Nasal bones***, 2 bones joined together at the midline by a suture, they articulate:

- medially together
- superiorly with the frontal bone
- laterally with the maxilla

[5] ***Lacrimal bone***, the smallest facial bone (and the whole skull), found in the medial wall of the orbit

- **Lacrimal fossa**, a depression in the junction between lacrimal and maxillary bones, it houses the lacrimal sac, where tears are transmitted into the nasal cavity
- **Orbital plate**, posterior to lacrimal fossa, it forms a portion of the medial wall of the orbit

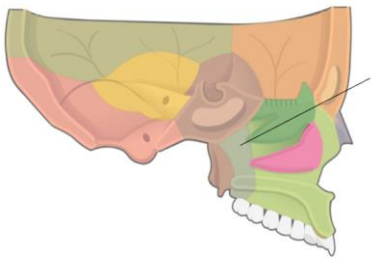


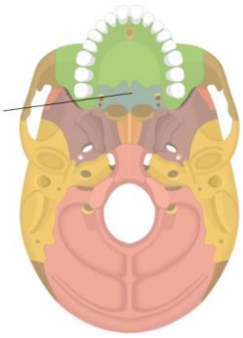


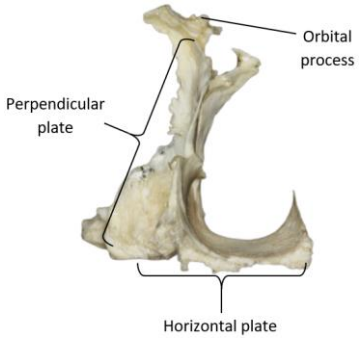
[6] ***Palatine bones***, 2 L-shaped bones joined together at the midline, they form the posterior $^{1}/_{3}$ of the hard palate

- **Horizontal plate**, contributes in forming the $^{1}/_{4}$ posterior part of the hard palate
- **Perpendicular plate**, contributes in forming the walls of the nasal cavity
- **Orbital process**, contributes in forming a very very very small portion of the orbit

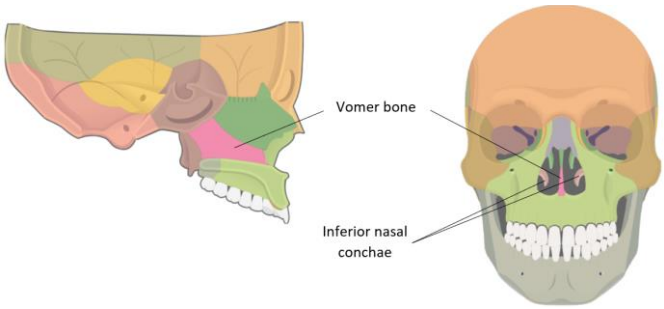
▪ **Hard palate**: the hard bony roof of the mouth that separates the oral cavity from the nasal cavity







[7] ***Vomer bone***, contributes in forming the lower part of the nasal septum



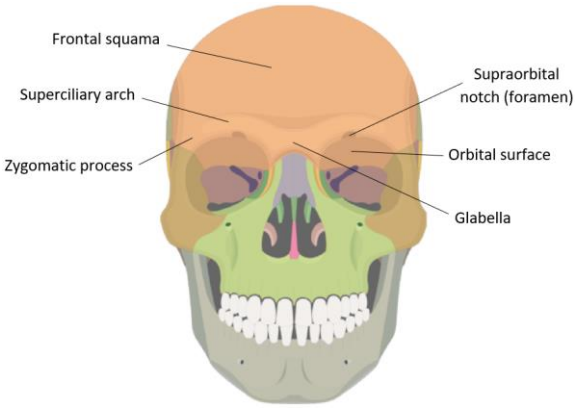
[8] ***Inferior nasal concha***

Cranial bones (Neurocranium)

The skull contains **8 cranial bones**, which are:

[1] ***Frontal bone***, forms the forehead, it starts as 2 bones but they fuse together very early into 1 bone.

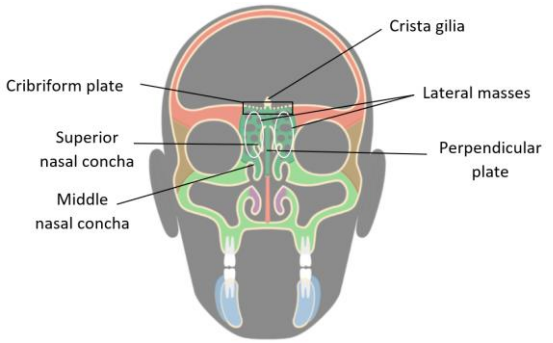
- **Frontal squama**, the thick part of the bone, forms the forehead
- **Superciliary arch** (**Supraorbital arch**), an elevation above each orbit
- **Supraorbital foramen**, a foramen medial to the midpoint of the superciliary arch through which the supraorbital nerve and supraorbital vessels pass. Sometimes this foramen is incomplete and is called **Supraorbital notch**
- **Orbital surface**, contributes to a part of the orbit
- **Zygomatic process**, articulates with zygomatic bone
- **Glabella**, a smooth elevation above the nasal bones between the two superciliary arches



[2] ***Parietal bone***, a paired bone that forms the greater portions of the side of the cranial roof (Calvaria)

[3] ***Ethmoid bone***, the bone that makes up the largest portion of the nasal cavity

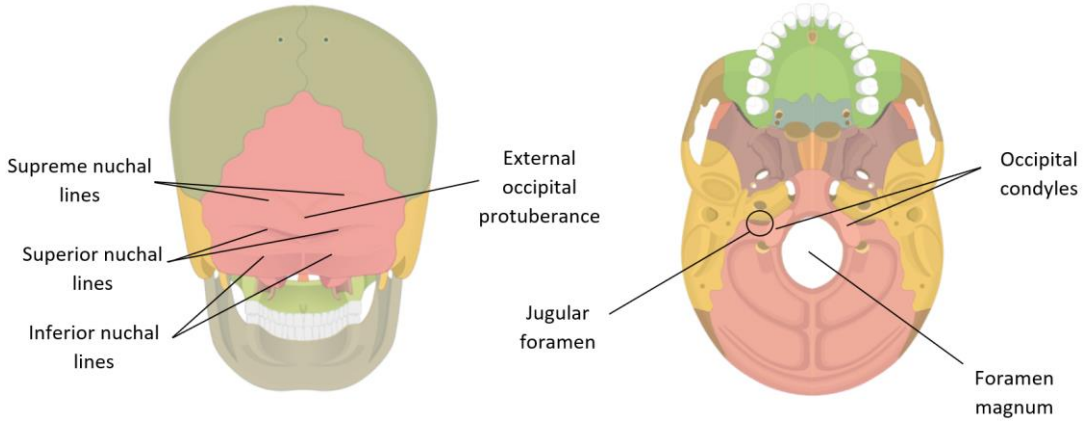
- **Cribriform plate**, appear in the anterior cranial fossa and forms the roof of the nasal cavity, it consists of numerous small holes to pass the olfactory nerve to the nasal cavity
- **Crista galli**, a superior projection from the cribriform plate that serves as an attachment point for the membrane that separates the two hemispheres of the brain
- **Orbital plate**, the part that contributes in forming the orbits
- **Perpendicular plate**, the plate that forms the upper part of the nasal septum
- **Lateral masses**, 2 bony masses lateral to the perpendicular line that contain the ethmoid cells
- **Superior nasal concha**
- **Inferior nasal concha**



[4] ***Occipital bone***, the largest cranial bone.

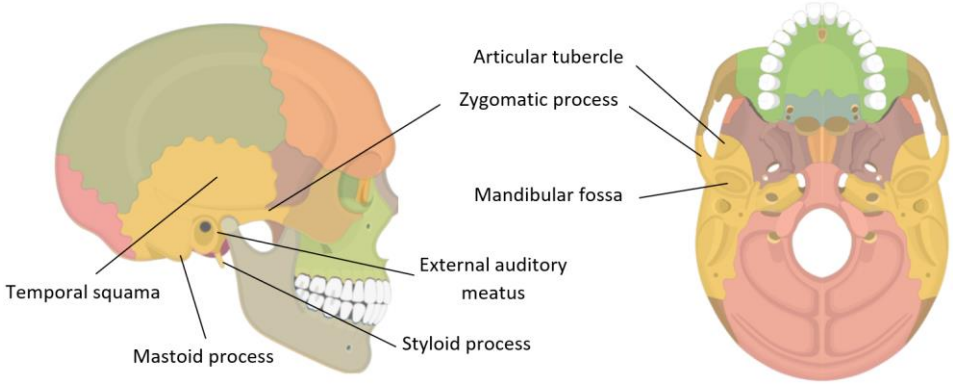
- **External occipital protuberance**, a subcutaneous elevation in the middle of the external posterior surface and it is the most prominent structure in the posterior skull, it is the attachment point for the (Nuchal ligament) a large ligament of the neck that extends to the 7th cervical vertebra
- **Internal occipital crest**, the inner elevation that forms an attachment point for (**Flax cerebelli** – تدوروش شو هاظ)
- **Clivus**, wide depression anterior to foramen magnum
- **Occipital condyles**, 2 oval-shaped processes in both sides of the foramen magnum that articulate with the Atlas vertebra (C1), this attachment is the articulation between the skull and the vertebral column, forming the (**Atlanto occipital joint**)
- **Jugular foramen**, a foramen in the base of the skull, it's for the jugular nerve to pass through
- **Foramen magnum**, the largest foramen of the skull where the spinal cord exits the skull to the vertebral canal
- **Hypoglossal canal**, a canal where the hypoglossal nerve XII and a branch of the ascending pharyngeal artery pass
- **Nuchal lines**, located at the posterior wall of the occipital bone and serve as attachment points for muscles, those are:

❶ Supreme nuchal lines (x2) ❷ Superior nuchal lines (x2) ❸ Inferior nuchal lines (x2)



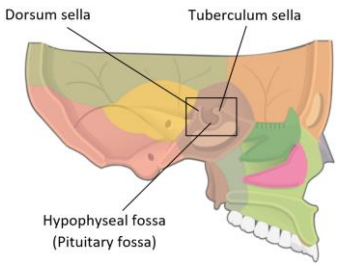
[5] ***Temporal bone***, a paired bone, each one is inferior to the parietal bone of the same side.

- **Temporal squama**, the thick flat part of the bone
- **Zygomatic process**, the process that makes the posterior half of the (Zygomatic arch)
- **Mastoid process**, a subcutaneous process posterior to the ear that makes an attachment point for neck muscles
- **Styloid process**, a projection in the inferior surface of the temporal bone that makes an attachment point for some neck and tongue muscles
- **Petrous Portion**, the inner surface of temporal bone, contains the Internal auditory (acoustic) meatus.
- **Mandibular fossa**, an infero-posterior fossa where the mandible articulates with the temporal bone to form the TMJ.
- **Articular tubercle**, rounded elevation anterior to the mandibular fossa where the mandible articulates.
- **External auditory (acoustic) meatus**, contains the 3 ossicle bones.

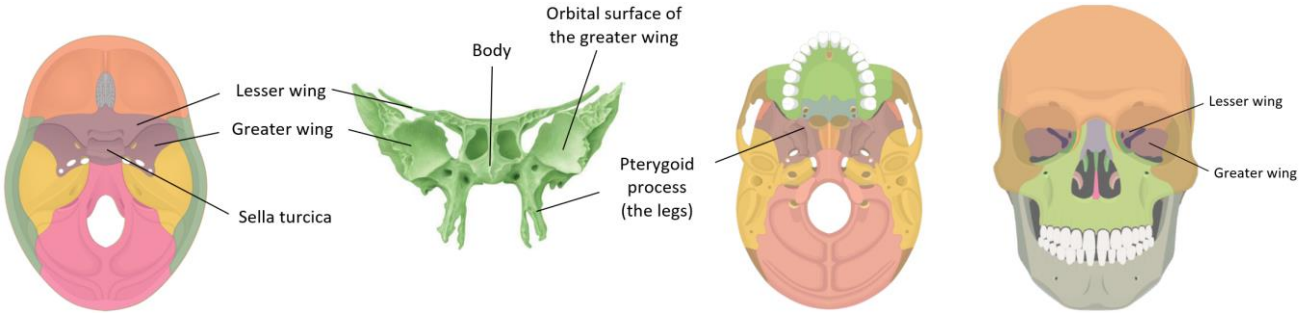


[6] ***Sphenoid bone***, the key bone (keystone) of the cranium; because it articulates with all of the cranial bones, holding them together. This bone looks like a butterfly with a body, 2 wings and 4 legs

- **Body**, contains the sphenoidal sinuses
- **Greater wings**, make a portion of the middle cranial fossa, and contain an orbital surface
- **Lesser wings**, make a portion of the anterior cranial fossa & the posterior part of the orbit of the eye
- **Pterygoid processes (Legs of the butterfly)**, attachment points for some of the muscles that move the mandible, each one has 2 pterygoid plates:
  - Medial pterygoid plate
  - Lateral pterygoid plate



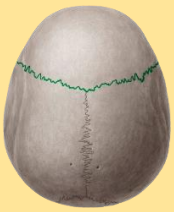
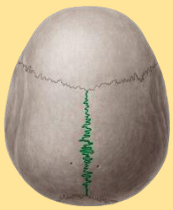
- **Sella turcica**, a bony saddle-shaped structure that houses the pituitary gland, it consists of:
  - Tuberculum sellae, the anterior ridge of the saddle
  - Dorsum sellae, the posterior ridge of the saddle, has 2 extensions called (**Posterior clinoid processes**)
  - Pituitary fossa, the depression between both ridges, contains the pituitary gland



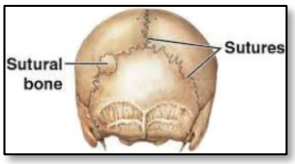
Special structures in the skull

Sutures

▪ **Sutures**: immovable fibrous joints made of dense fibrous connective tissue that connect the bones of the skull in adults together and make them immobile. We have 4 main sutures in the skull:

Suture / Difference	Coronal suture	Squamous suture	Sagittal suture	Lambdoidal suture
Located between	**Frontal & 2 Parietals**	**Temporal & Parietal**	**2 Parietals**	**Occipital & 2 Parietals**
Illustration				

▪ **Sutural bones** (**Wormian bones**): small and several bones between sutures, found in the area where a periphery of a bone meets the periphery of another bone during their ossification process

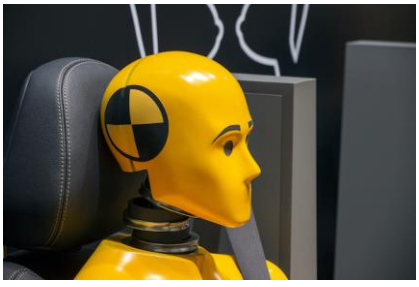


Cranial junctions

✪ **Bregma** → the intersection between both Sagittal & Coronal sutures

✪ **Vertex** → the most superior point in the calvaria

✪ **Lambda** → the intersection between both Sagittal & Lambdoidal sutures



✪ **Pterion** → H-shaped junction between the thin parts of (Frontal / Parietal / Temporal / Sphenoid) bones. An artery called (**Middle meningeal artery**) goes underneath this point and any injury in this area will cause it to bleed, resulting in collection of blood that exert pressure on the brain (**Epidural Hemorrhage**)

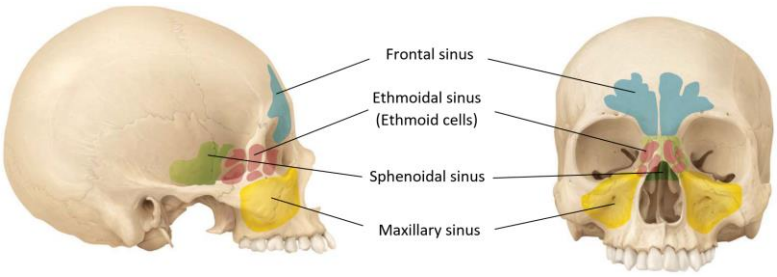
✪ **Nasion** → the intersection between the Frontal & 2 Nasal bones

Paranasal sinuses (Air sinuses)

- **Paranasal sinuses**: extensions of the nasal cavity into the thick parts of the skull bones.

➢ Functions of air sinuses:

❶ decrease the weight of the skull
❷ enhance the quality of the voice



➢ We have **4 main air sinuses**:

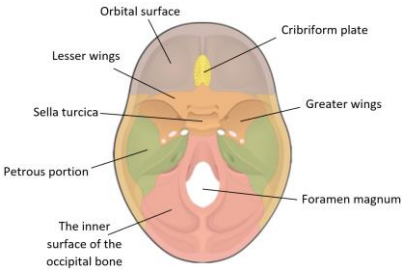
① Maxillary sinuses (x2), the largest
② Frontal sinuses (x2)
③ Sphenoidal sinuses (x2)
④ Ethmoidal sinuses (x18 ethmoidal cells)

***Note**: Sinuses are absent or under-developed at birth, and increase in size during face development (teeth eruption).

Cranial fossae

- **Cranial fossae**: levels in the cranial floor that contain depressions for brain lobes, grooves for blood vessels, and number of foramina
- **Calvaria**: the outer bony cover of the brain

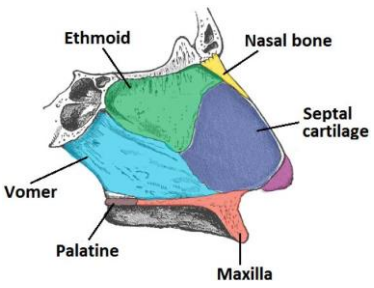
➢ The floor of the skull consists of **3 cranial fossae**:

Cranial fossa	Bones contributing to that fossa	Cranial view
Anterior cranial fossa (Cerebrum '**Frontal lobe**')	• Frontal bone → Orbital surface • Ethmoid bone → Cribriform plate • Sphenoid bone → Lesser wing	
Middle cranial fossa (Cerebrum '**Temporal lobe**')	• Sphenoid bone → Greater wing & Sella turcica • Temporal bone → Petrous portion	
Posterior cranial fossa (Cerebellum & Brainstem)	• Occipital bone → Foramen magnum	

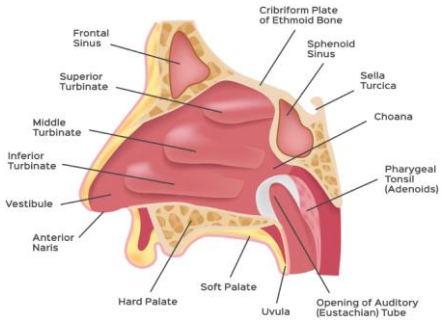
Nasal cavity

- **Nasal septum**: the septum that divides the nasal cavity into 2 (right & left) halves "rarely medial, usually deviates", it consists of 2 parts:

◆ the bony part → superior is (Ethmoid bone) and inferior is (Vomer bone)
◆ the cartilage part → the septal cartilage

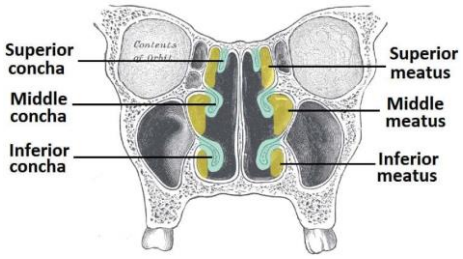


➢ Bones that make up the nasal cavity:

Parts of the nasal cavity	Bones of the nasal cavity	Illustration
Roof	• Ethmoid bone → Cribriform plate • Nasal bones	
Floor	• Palatine bone → Horizontal plate • Maxillary bone → Palatine process	
Medial wall	• Nasal septum	
Lateral walls	• Palatine bone → Perpendicular plate • Maxillary bone • Ethmoid bone → Superior & Middle nasal conchae • Inferior nasal concha	

Conchae of the nasal cavity are:

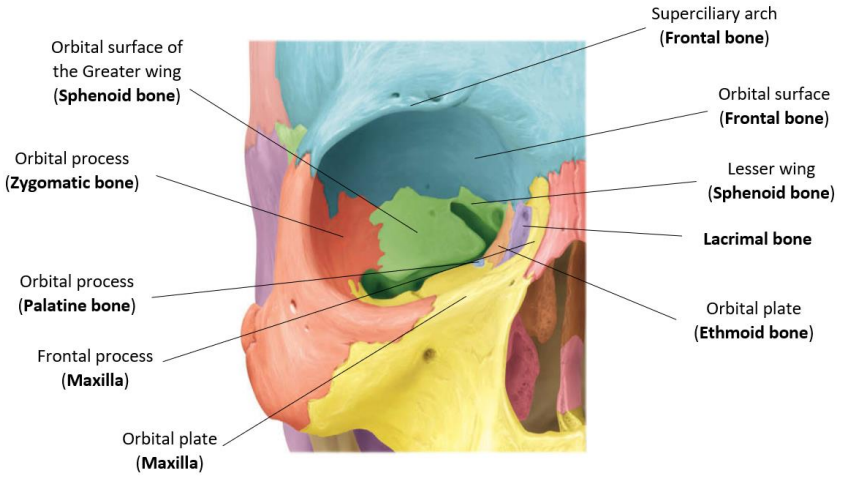
❶ **Superior nasal concha**, two protrusions of the ethmoid bone but can't be seen from the anterior view (only from the coronal view)
❷ **Middle nasal concha**, two protrusions of the ethmoid bone into the nasal cavity.
❸ **Inferior nasal concha**, two separated facial bones attached to the maxilla that give rise to two protrusions into the nasal cavity



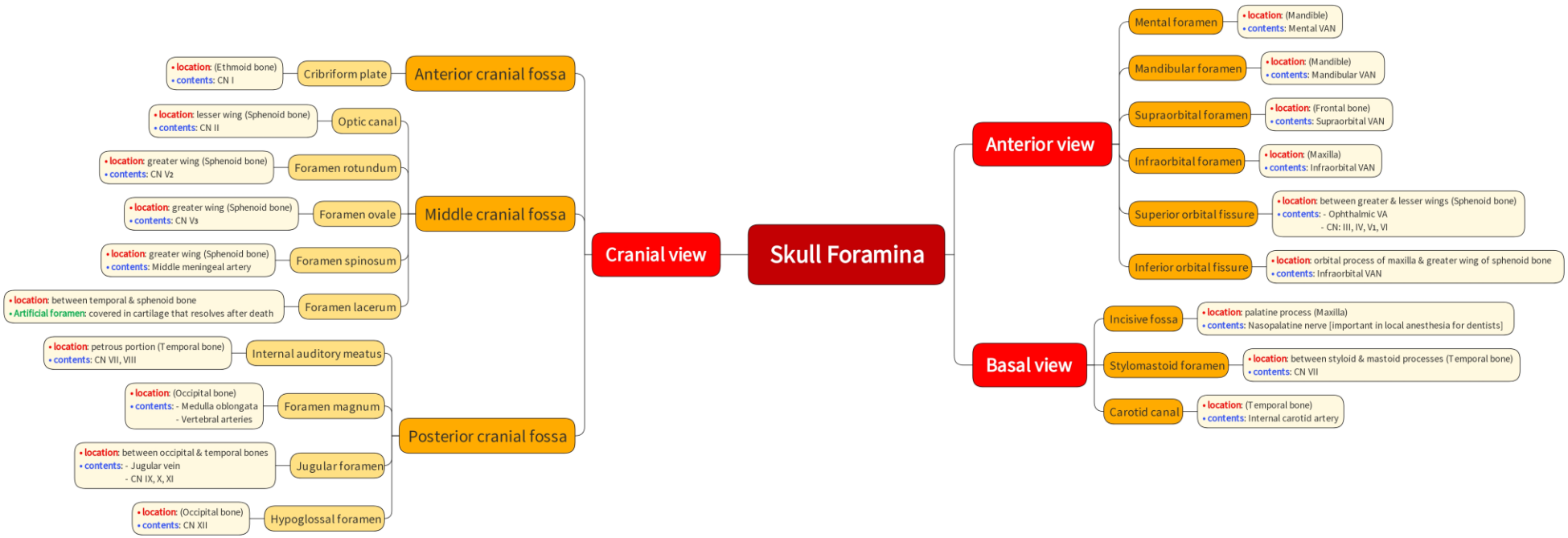
The orbit (Eye socket)

The skull has 2 orbits which house the eyes and lacrimal accessories, each orbit consists of **7 facial & cranial bones**:

Skull bones	Parts of the bone contributing
Facial bones	• Maxillary bone → Frontal process Orbital process • Zygomatic bone → Orbital process • Lacrimal bone → The whole bone • Palatine bone → Orbital process
Cranial bones	• Frontal bone → Superciliary arch • Sphenoid bone → Greater wing & Lesser wing • Ethmoid bone → Orbital plate

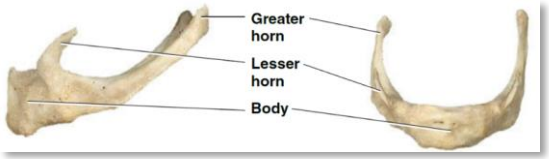


Foramina of the skull



The Hyoid bone

- Hyoid bone is a U-shaped unique bone of the axial skeleton, what makes it a unique bone is that it doesn't articulate with any other bones of the whole skeleton
- It is located in the upper anterior neck between the mandible and the larynx, and it is suspended from the styloid process of the temporal bone by the Stylohyoid ligament
- Hyoid bone is held in place by a ligament called (Thyrohyoid ligament) and ALOT of muscles
- This bone supports the tongue and is an attachment point for several muscles of the neck, tongue and pharynx
- composed of the following structures: (**Body**, **Greater horns**, **Lesser horns**)



Questions

1) All of the following are TRUE regarding the human skeleton, EXCEPT:

A. It is composed of axial skeleton located in the midline & appendicular skeleton located in the periphery
B. Both upper limb & lower limbs are composed of 30 bones each
C. A set of bones that attach the appendicular skeleton to the axial skeleton is the definition of Girdles
D. Pectoral girdle is made up of the two hip bones (Coxal bones)

2) The last fontanel to ossify in a normal child is the:

A. Anterior fontanel
B. Posterior fontanel
C. Sphenoid fontanel
D. Mastoid fontanel

3) All of the following are considered facial bones, EXCEPT:

A. Maxillary bone
B. Vomer bone
C. Inferior nasal concha
D. Ethmoid bone

4) The Olfactory nerve (Cranial nerve I) exits the skull to the upper part of nasal cavity through the:

A. Foramen spinosum
B. Optic canal
C. Cribriform plate
D. Jugular foramen

5) The correct combination of bones that make up the associated structure of the following is:

A. Zygomatic arch is made up of 1 facial bone and 1 cranial bone
B. Nasal septum is made up of 2 bones: Vomer bone superiorly & ethmoid bone inferiorly
C. The $^{3}/_{4}$ anterior of the hard palate is made up of the horizontal palatine bone
D. All of the above are correct

6) The hyoid bone does NOT articulate with ay bones in the skeleton, another true statement about it is:

A. It is a part of the axial skeleton
B. All of the choices are correct
C. It is mainly composed of a central body, greater horns, lesser wings
D. forms attachments points for several muscles of the tongue and neck

7) One of the following is mismatched regarding the anatomy of the nasal cavity:

A. Medial wall → Nasal septum
B. Lateral wall → Superior, Middle, and Inferior nasal conchae
C. Floor → Hard palate
D. All of the above are correctly matched

8) A 42-year-old patient presents with difficulty speaking and swallowing. On physical examination, you notice tongue deviation to the left side due to the 12th cranial nerve (CN XII) abnormality. Which anatomical structure is likely implicated in this patient's symptoms? (يعني هيك سؤال ممكن يكون أصعب صيغة بالامتحان على الفورامينا)

A. Jugular foramen
B. Foramen ovale
C. Hypoglossal foramen
D. Foramen magnum

9) The bone that is considered the Keystone of the cranium (and the correct reason) is:

A. Maxilla; because it articulate with most of the facial bones
B. Sphenoid bone; because it articulates with all of the cranial bones, holding them together
C. Mandible; because it is the only movable bone in the whole skull
D. Maxilla; because it doesn't articulate with the mandible

10) The largest paranasal sinus in the skull is known to be the:

A. Maxillary sinus
B. Frontal sinus
C. Ethmoidal cells
D. Sphenoidal sinus

11) All of the following are TRUE according to the skull sutures, EXCEPT:

A. Lambdoidal suture is located between 3 bones: 2 parietals & 1 frontal
B. Squamous suture is located in both sides of the skull: right & left
C. Squamous suture is best seen and observed from the lateral view of the skull
D. All of the listed statements are false

12) The part that makes up a part of the middle cranial fossa is:

A. Foramen magnum of the occipital bone
B. Lesser wing of the sphenoid bone
C. Cribriform plate of the ethmoid bone
D. Petrous portion of the temporal bone

13) One of the following parts does NOT contribute to the eye socket:

A. Zygomatic bone
B. Frontal bone
C. Ethmoid bone
D. Temporal bone

Answers

1	2	3	4	5	6	7	8	9	10
D	A	D	C	A	B	D	C	B	A
11	12	13							
A	D	D							