



*Anatomy  
Passion*



Lecture: 2

Done By: Lina Imar



# 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.

**bones** Vs **Cartilages**  
rigid and heavier flexible and lighter.

\*The younger the age, the greater is the contribution of cartilage to the skeleton.

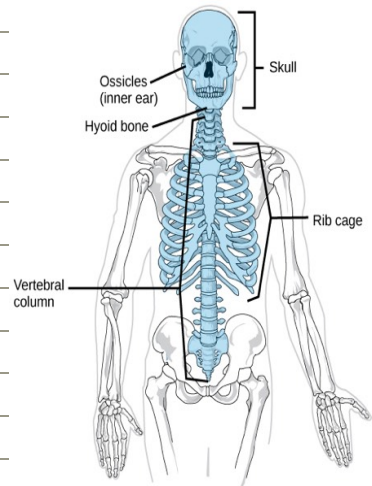
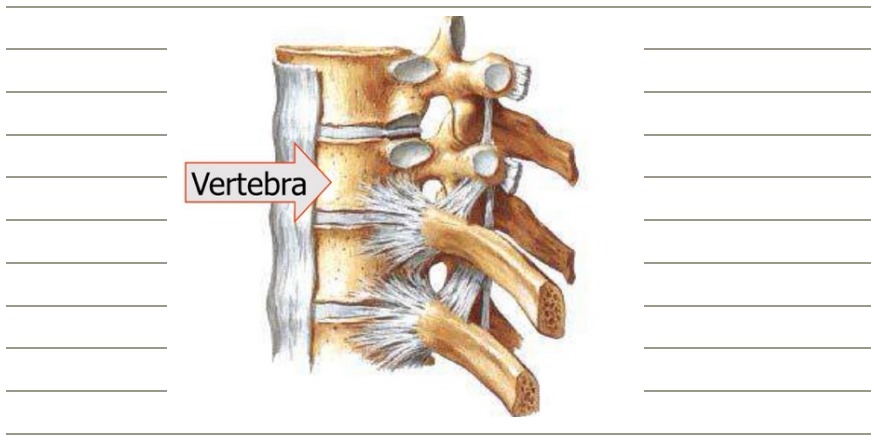
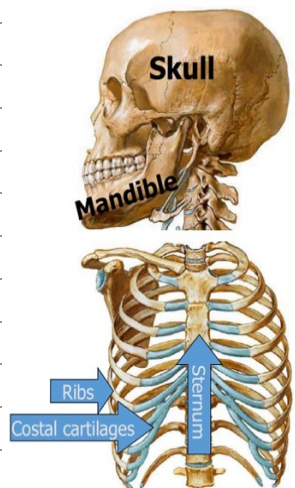
## Divisions of the skeleton:

بدائي

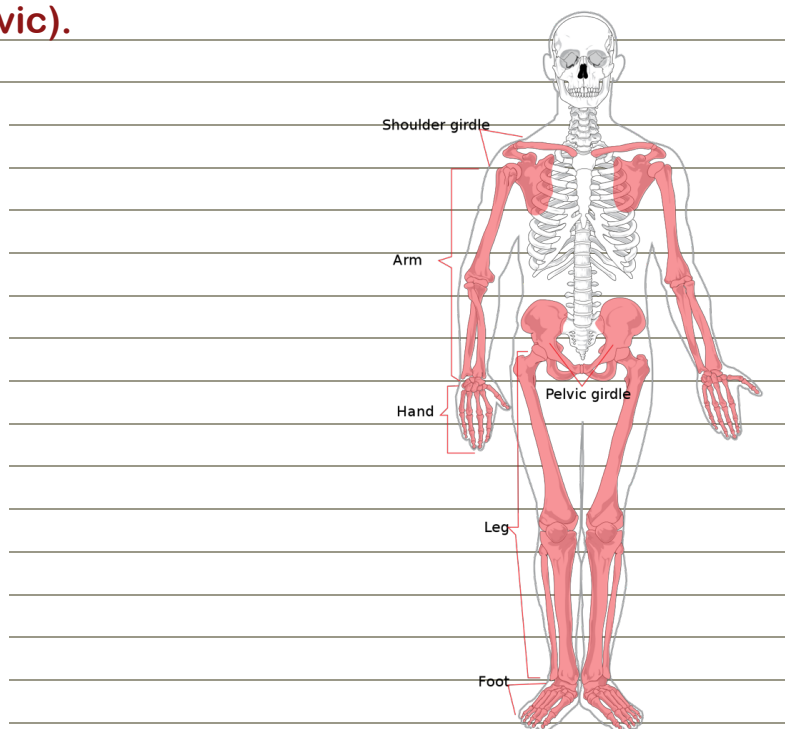
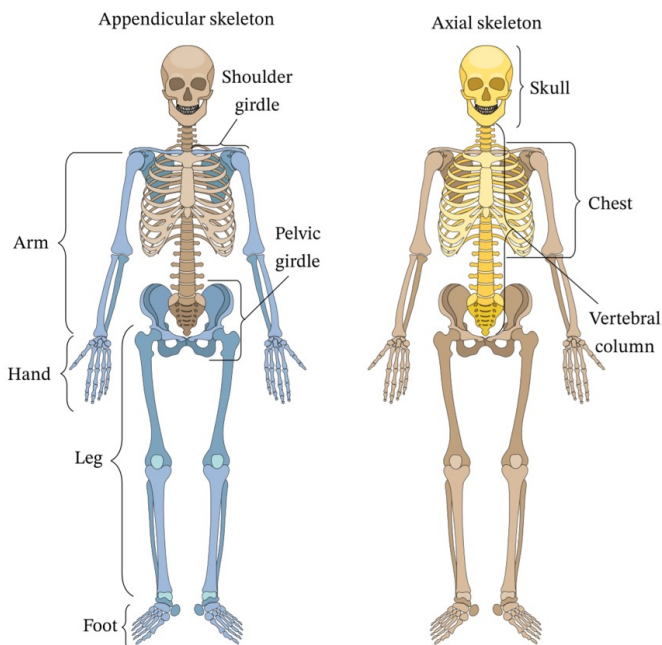
1) Exoskeleton: rudimentary in man. It is represented by: nails & enamel of teeth .

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

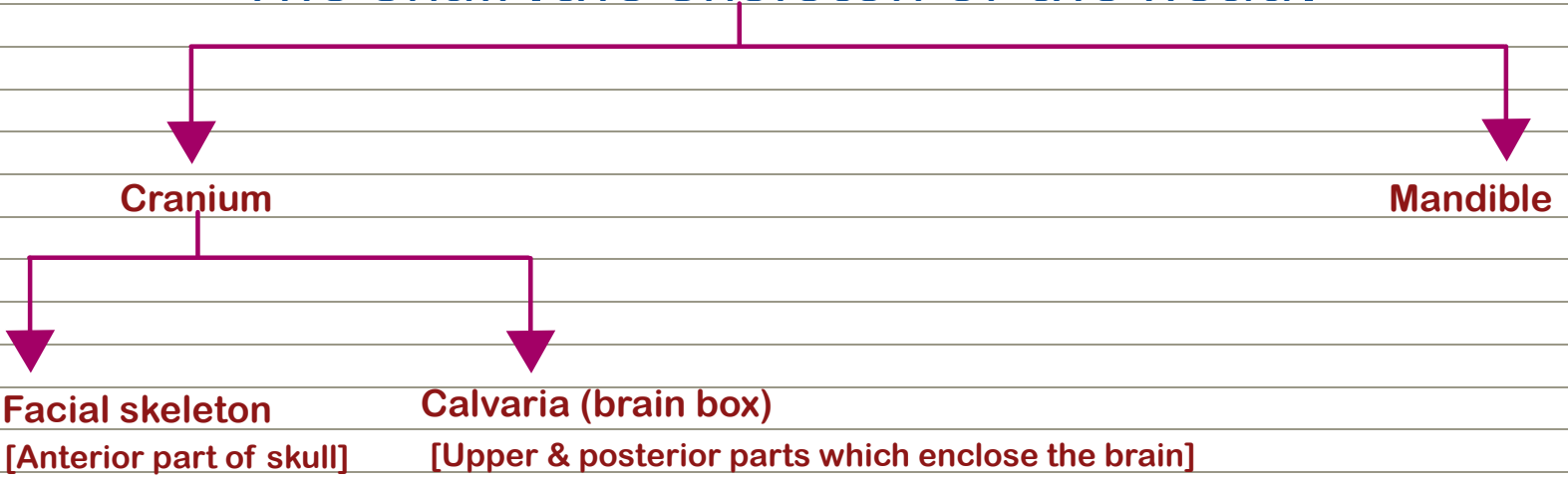
a. The axial skeleton: which includes skull, mandible , vertebral column, ribs & sternum.



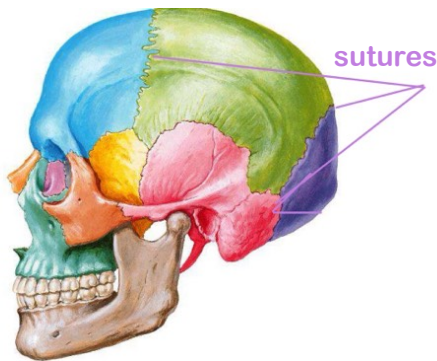
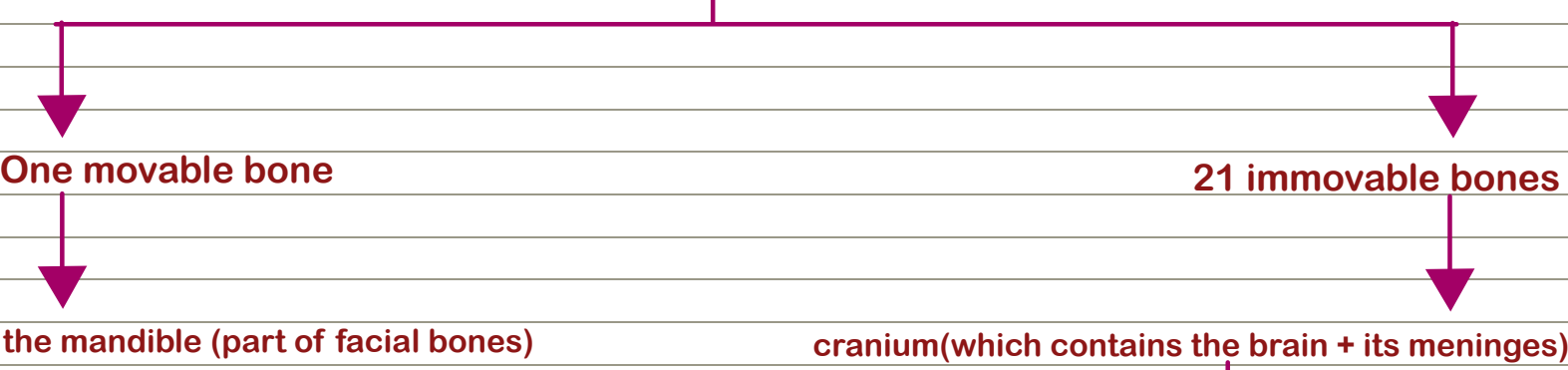
b. The appendicular skeleton: which includes the bones of the appendages (upper & lower limbs) & their girdles (shoulder & pelvic).



# The skull [the skeleton of the head]



Is formed of 22 separate bones

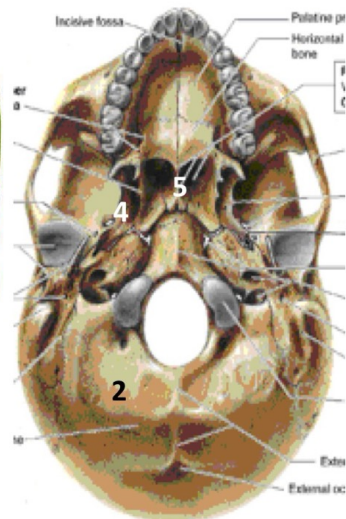
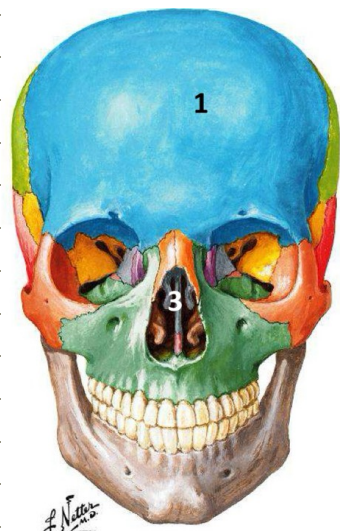


5 Unpaired bones

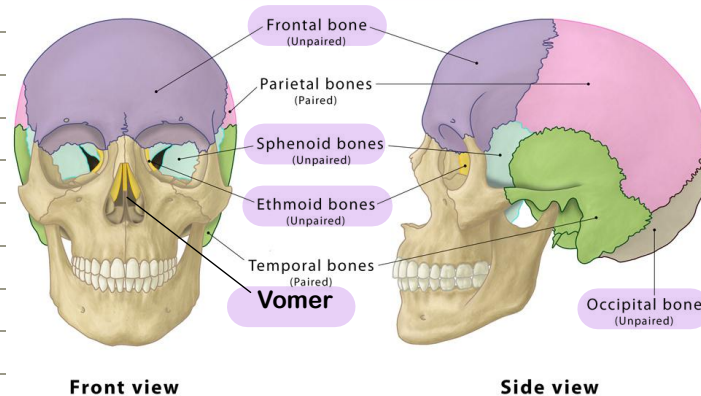
8 Paired bones

Articulating together by sutures (which are fibrous joints)

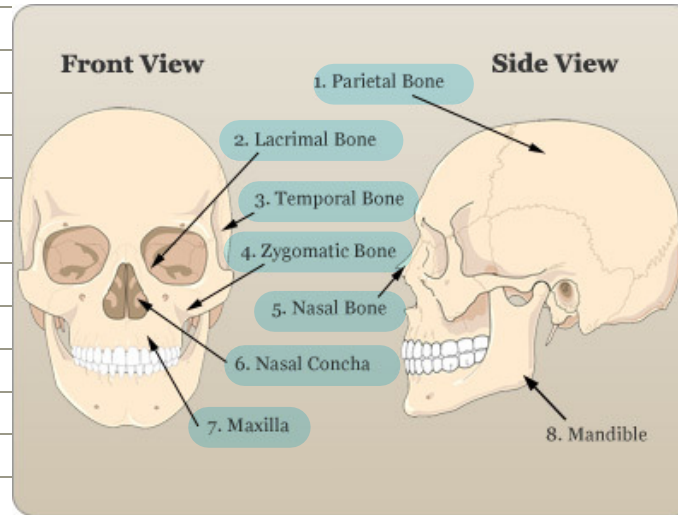
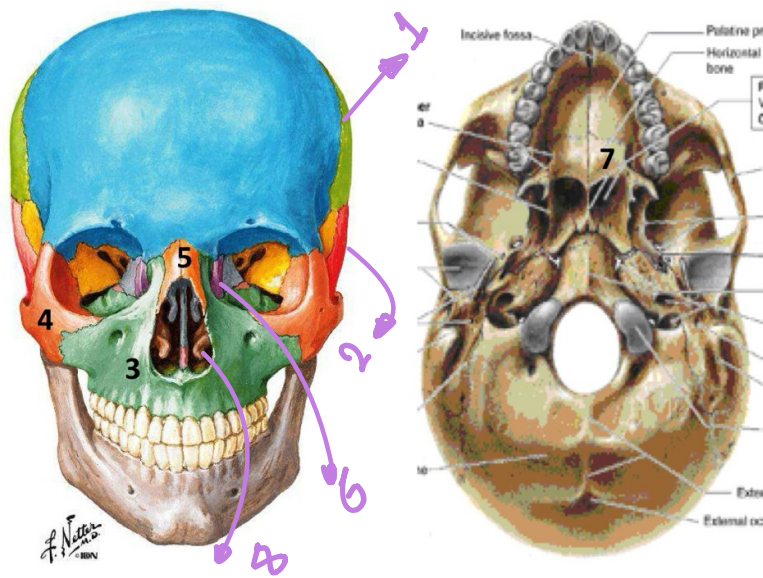
**5 Unpaired bones:** 1. Frontal 2. Occipital 3. Ethmoid 4. Sphenoid 5. Vomer (back of nose)



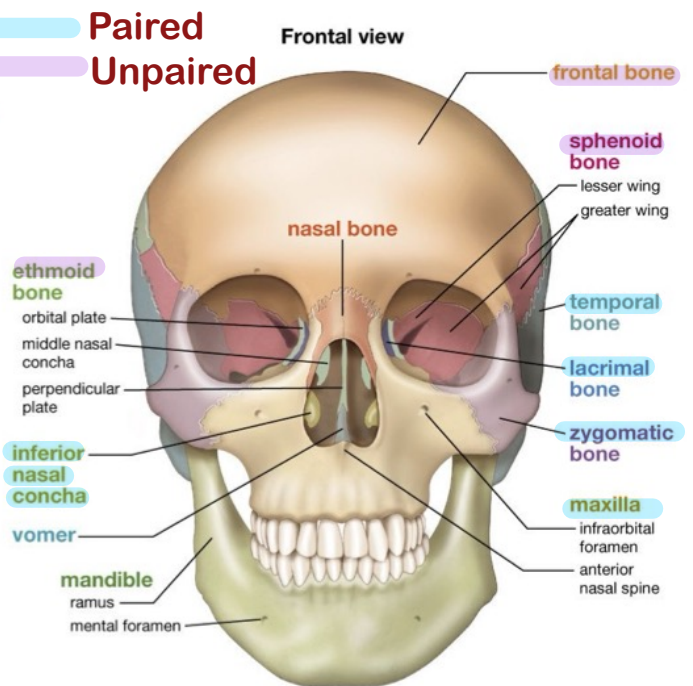
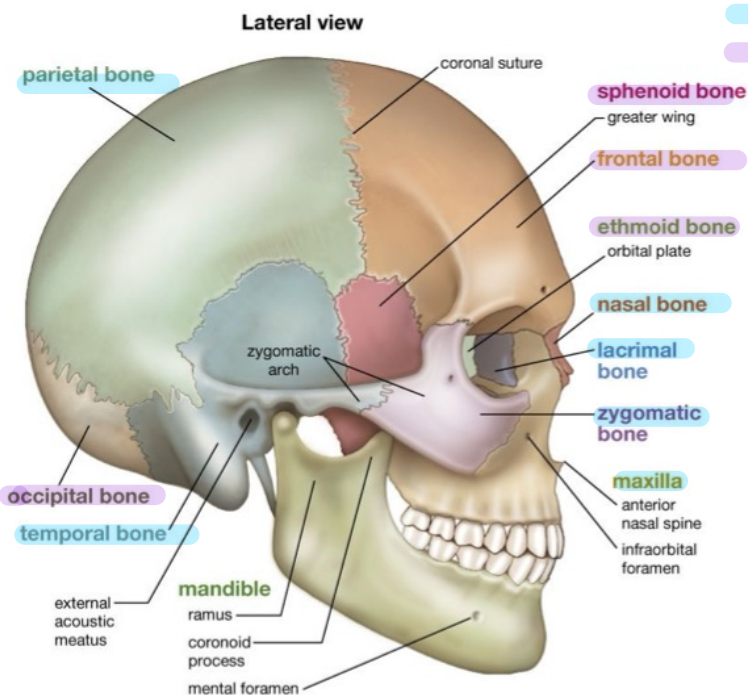
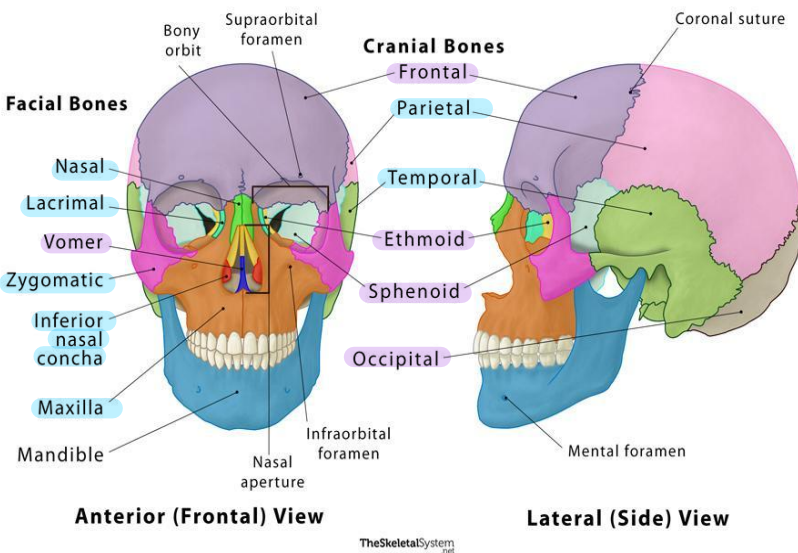
## Cranial Bones



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



**Bones of the Skull**



# Normas of skull = views of skull

- 1) Norma verticalis[ superior view]: 4bones,3 sutures,2(parietal emissary) foramina  
2fontanelles( meeting points)
- 2) Norma Frontalis[ anterior view ]: 4bones,3 apertures (surrounding 3 cavities; 2 orbital  
& 1 nasal),2 foramina( supraorbital, infra orbital)
- 3) Norma Occipitalis[ posterior view ]:1protuberance,1crest,2nuchal lines  
,1 foramen(magnum.)
- 4) Norma Lateralis[ lateral view ]:7bones,2lines,1arch,1meatus,2processes,2 meeting  
points
- 5) Norma Basalis Externa[ inferior view]: 3 parts

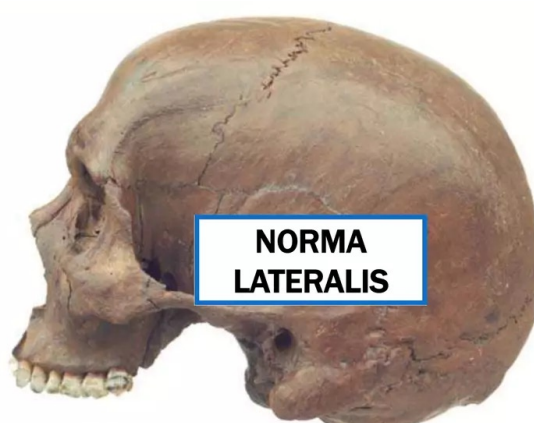
1. Anterior part:hard palate,alveolar arch,The maxillary tuberosity,The incisive fossa  
,3foramina (greater palatine,lesser palatine,incisive )
2. Middle part:  
A)In the middle:Vomer,Body of sphenoid,Basilar part of occipital bone.  
B)Laterally:Pterygoid process,Greater wing of sphenoid,Petrous part of temporalbone.  
tympanic parts of temporal bone,Mastoid process,Posterior nasal openings (choanae),  
2foramina( ovale,spinosum)
3. Posterior part:The basilar part of occipital bone,The carotid canal,The occipital  
condyles,6foramina(lacerum,The jugular ,The stylomastoid ,The anterior condylar  
(hypoglossal),The posterior condylar,magnum)



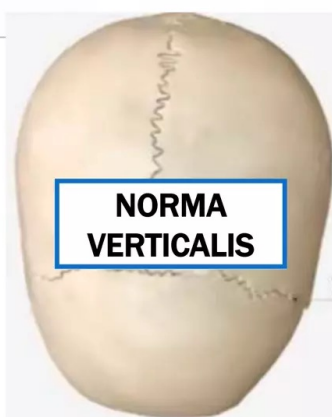
**NORMA  
FRONTALIS**



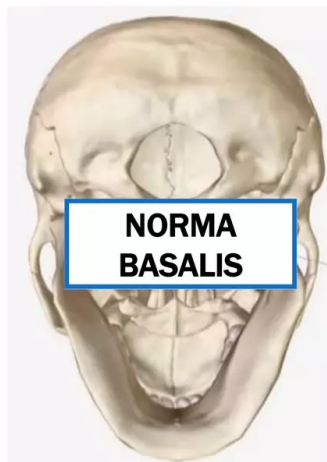
**NORMA  
OCCIPITALIS**



**NORMA  
LATERALIS**



**NORMA  
VERTICALIS**



**NORMA  
BASALIS**

# Norma verticalis

## \*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 which connects blood vessels outside and inside the skull

## \*It presents 2 meeting points(fontanelles):

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 (Larger) is the site of membrane - filled rhomboidal area called anterior fontanelle. It usually closes 1.5 - 2 years after birth.
2. The lambda (smaller) 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. (لتسهيل الولادة)
2. They give an idea about the intra cranial pressure: because there is fluid around the brain ( CSF fluid)  
If the pressure increases it bulges.  
If the pressure decreases it sinks (dehydration).

## 3. They help in diagnosis of some diseases:

Premature closure (الاعلاق المبكر) causes craniostenosis = microcephaly. (small head)

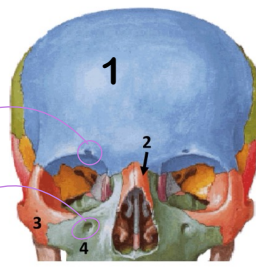
Delayed closure (اغلاق متأخر) diagnoses rickets (لين العظام)

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

(في حالات الجفاف يكونوا الاوردة مو مبيينين ف انا بسوي ادخال للسوائل للمريض عن طريقهم)



# Norma Frontalis



\*It presents 4 bones:

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.

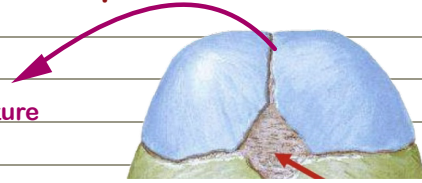
3. Zygomatic bone

4. The maxillary bone:

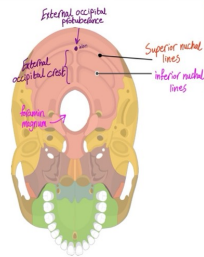
\*Is has a body which contains the maxillary air sinus.(pneumatic bone)

\*It is pierced by the infra-orbital foramen (which gives passage to infra-orbital nerve & vessels).

metopic suture



# Norma Occipitalis



\* it 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.

External occipital protuberance

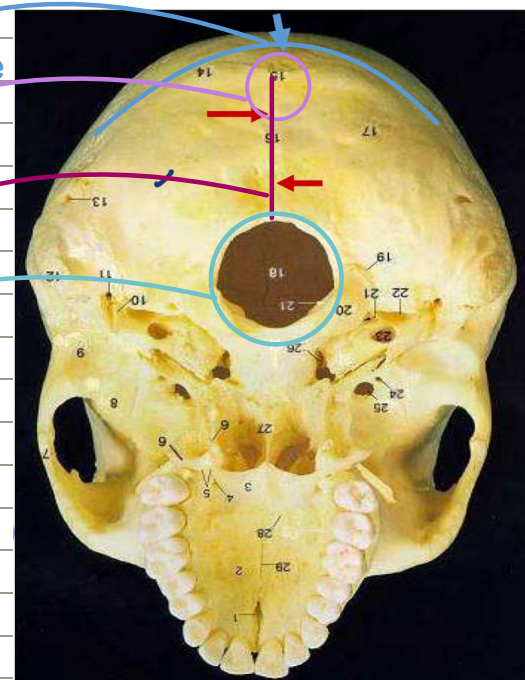
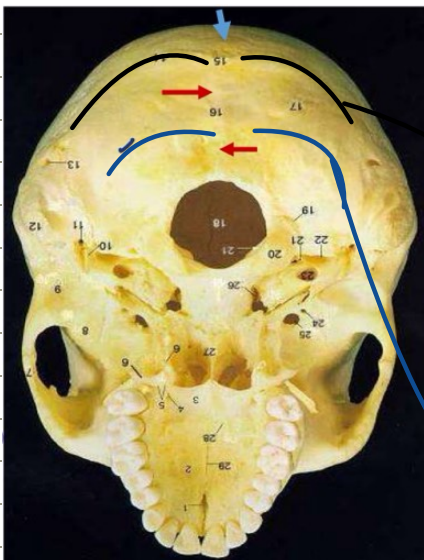
inion

External occipital crest

foramen magnum

The superior nuchal lines

The inferior nuchal lines





# Norma Lateralis

\*It presents 7 bones:frontal, parietal, occipital, temporal, greater wing of sphenoid bone maxilla and zygomatic bones.

\* it presents 2 lines :

1.The superior temporal line(incomplete line): extends from zygomatic bone and passes backwards.

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

\* The zygomatic arch:ls 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.

\* it presents 2 processes:

1.The mastoid process :It is a part of the temporal bone,It lies behind the external auditory meatus

2.The Styloid process :It is a slender projection of the temporal bone.

\* it presents 2 meeting points :

1.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 Artery

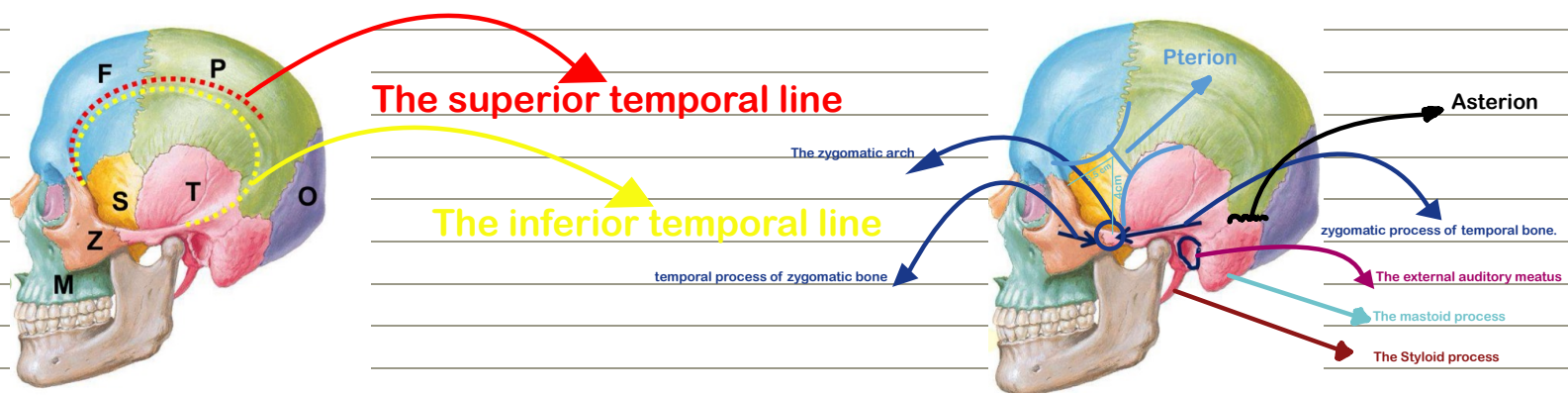
\* Since it is very thin, the pterion is the most frequently fractured part of skull in car accidents leading to hemorrhage (extradural hematoma) which compresses the motor area of the brain

شخص سوا حادث وخبط راسه بالشباك من جنب وبعد فترة حس بصدا ع وراح عالدكتور وسواله صورة اشعاعية للمخ فالدكتور رح يلاقي extradural hematoma لللي بسوي compression للمotor area of the brain ف عن طريق ال pterion بدخلوا على الشريان اللي تضرر وبعالجوه

2.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

\* The hard palate is bounded anteriorly by the alveolar arch, which has 16 sockets for the roots of the upper teeth

\* 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.

\* It presents 2 foramina:

1)The greater palatine foramen :lies in the posterior part of the hard palate. It gives passage to greater palatine nerve & vessels

2)The lesser palatine foramina:usually two, lie behind the greater palatine foramen. They give passage to lesser palatine nerve & vessels

## B. Middle part:

\* In the middle, it shows:

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

\* Laterally, it shows:

1. The pterygoid process of the sphenoid bone:It is formed of lateral pterygoid plate and medial pterygoid plate with the pterygoid fossa in between.

2. Greater wing of sphenoid:shows:

A)Foramen ovale :Gives passage to:a. Mandibular nerve. b. Lesser petrosal nerve. c. Accessory meningeal artery.

B)Foramen spinosum:Gives passage to: a.Nervus spinosus,b. Middle meningeal artery.

3. Petrous part of temporal bone.

4. tympanic parts of temporal bone.

5.Mastoid process.

6.Posterior nasal openings(choanae) which are separated by vomer (part of nasal septum).

## C. Posterior part:

\*It presents:

\* The basilar part of occipital bone ,articulates anteriorly with the body of the sphenoid bone.

\* The carotid canal: lies posterolateral to foramen lacerum. Gives passage to internal carotid artery.

\*The occipital condyles: articulate with the atlas to form atlanto-occipital joint.

\*\*6 foramina

1)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.

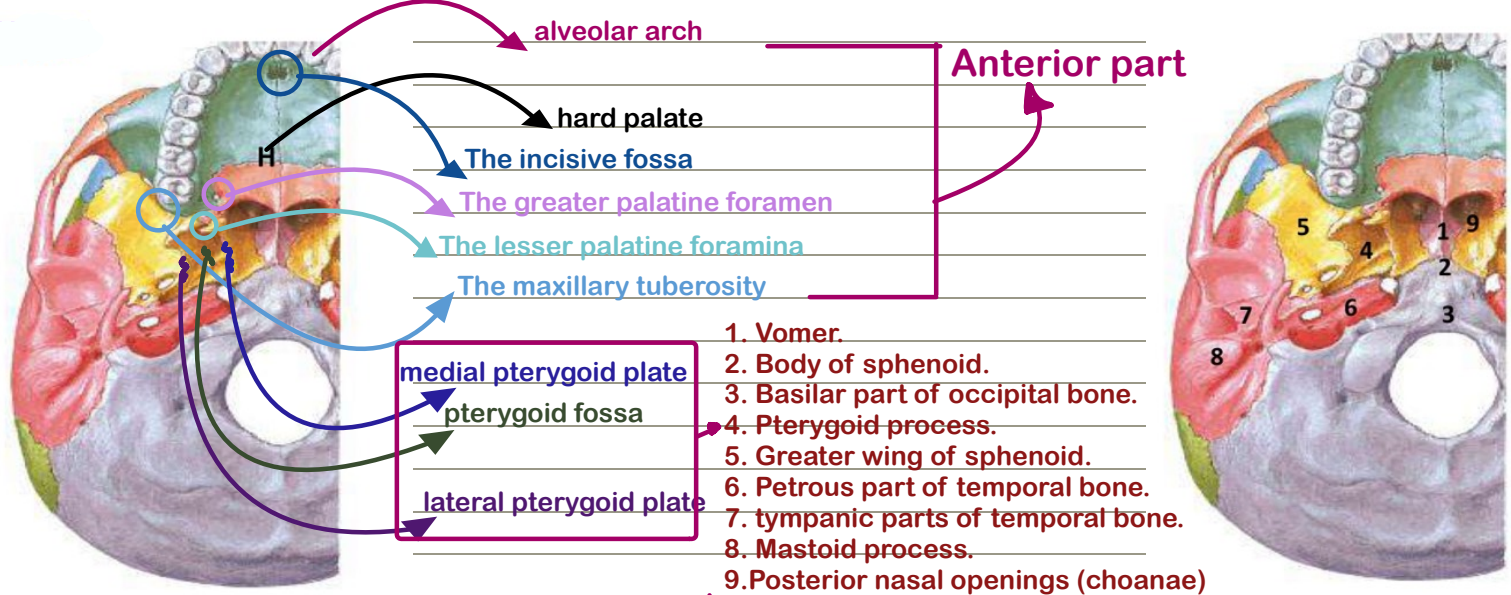
2) The jugular foramen: lies lateral to the occipital condyle. Gives passage to internal jugular vein.

3)The stylomastoid foramen: lies between styloid and mastoid processes. Gives passage to facial nerve.

4)The anterior condylar (hypoglossal) foramen. Gives passage to hypoglossal nerve

5)The posterior condylar foramen.

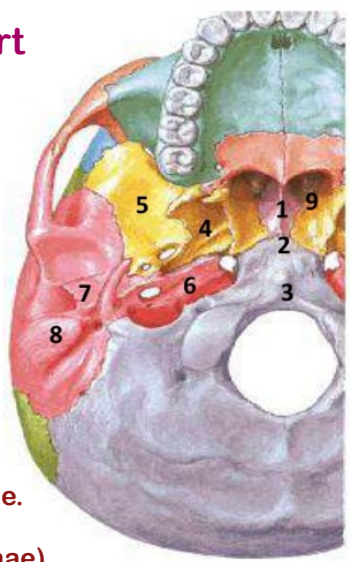
6)The foramen magnum: communicates the cranial cavity with the vertebral canal. Gives passage to brain stem which continues as spinal cord.



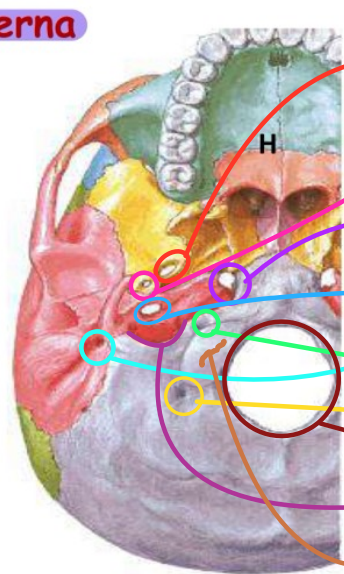
**Anterior part**

medial pterygoid plate  
 pterygoid fossa  
 lateral pterygoid plate

1. Vomer.
2. Body of sphenoid.
3. Basilar part of occipital bone.
4. Pterygoid process.
5. Greater wing of sphenoid.
6. Petrous part of temporal bone.
7. tympanic parts of temporal bone.
8. Mastoid process.
9. Posterior nasal openings (choanae)



**Middle part**



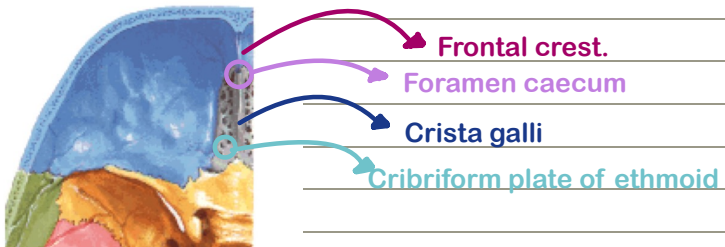
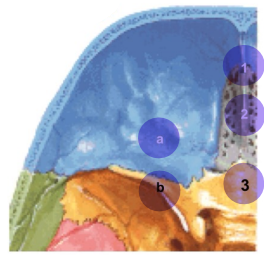
- Foramen ovale
- Foramen spinosum
- Foramen lacerum
- The carotid canal
- The stylomastoid foramen
- The anterior condylar (hypoglossal) foramen
- The posterior condylar foramen
- The foramen magnum
- The jugular foramen
- The occipital condyles

**Posterior part**

## Cranial Cavity

- \* It is divided into:
- 1. Anterior cranial fossa: from: frontal bone, to: lesser wing of Sphenoid
- 2. Middle cranial fossa: from: lesser wing of Sphenoid, to: Petrous part
- 3. Posterior cranial fossa: from: Petrous part, to: occipital bone

- 1. Anterior 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).



## 2. Middle cranial fossa

\* Formed by the following bones:

\* In the midline: Sphenoid (body): sphenoid bone is like a butterfly

\* On each side: 1- Sphenoid (greater wing). 2- Temporal bone: a. Petrous part. b. Squamous part. 3- Parietal bone.

\* Middle cranial fossa shows:

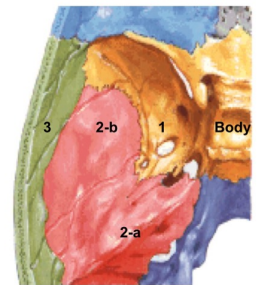
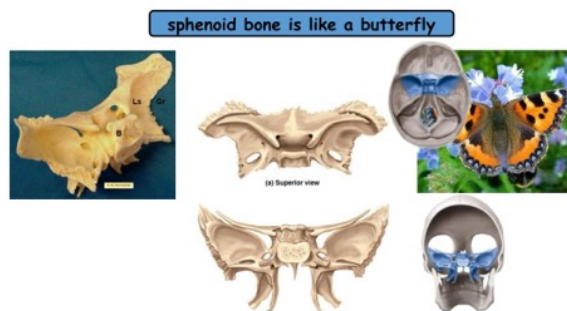
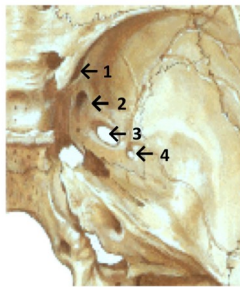
Greater wing of sphenoid which contains:

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.



## 3. Posterior 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.

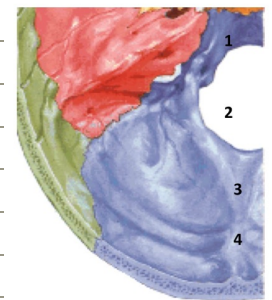
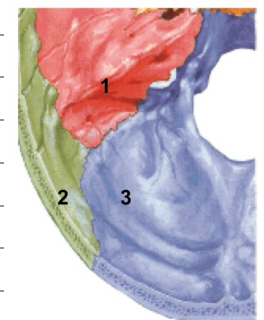
\* Midline structures in the posterior cranial fossa :

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:

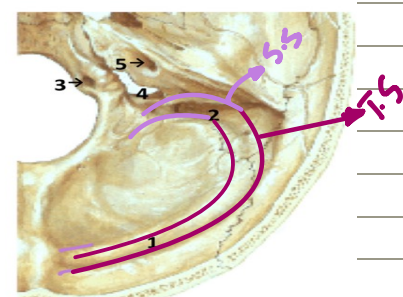
1. Transverse sulcus (contains transverse sinus).

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 (facial nerve)



1) If the child is dehydrated, the fontanelles will be sunken.

• True • False

2) Which part of the human skeleton forms the helmet for the protection of the human brain?

A- Temporal bone. B- Mandible. C- Hyoid. D- Cranium.

3) What is the name of the suture between the parietal and frontal bones?

A- Coronal suture. B- Sagittal suture. C- Lambdoid suture. D- bregma.

4) Which of the following nerves leaves the skull through the stylomastoid foramen?

A- Mandibular nerve. B- Facial nerve. C- Lesser petrosal nerve. D- None of the above.

5) According to the norma basalis externa, the posterior part includes:

A- Foramen lacerum B- pterygoid process C- Mastoid process D- none of the above

6) The occipital condyles articulate with ..... to form a joint:

A- cranial cavity B- carotid canal C- Atlas D- Axis

7) The anterior cranial fossa, on each side, has:

A- Sphenoid (greater wing) B- Sphenoid (lesser wing) C- Sphenoid (body) D- All of the above

8) Which of the following foramina gives passage to the facial nerve?

A- hypoglossal foramen B- posterior condylar foramen C- foramen Rotundum  
D- stylomastoid foramen

9) The joint that is formed by the body of the sphenoid and the basilar part of the occipital bone is:

A- clivus B- atlanto-occipital joint C- ankle joint D- none of the above

10) The squamous part is a part of:

A- parietal bone B- occipital bone C- temporal bone D- Sphenoid bone

Answers:

1) True

2) D

3) A

4) B

5) A

6) C

7) B

8) D

9) A

10) C

Done by: Lina Imar