The skull

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THE SKULL

- = 22 BONES [actually 29]
- ALL FUSED EXCEPT ONE.:HYOID BONE
- JOINTS = SUTURES
- CRANIAL CAVITY 8 BONES=CRANIAL BONES
- 14 LEFT = FACIAL BONES
- 3 MORE IN THE EARS

Neurocranium: This forms the protective casing around the brain. It includes the following bones:

- Frontal bone (forehead)
- Two parietal bones (top and sides)
- Two temporal bones (sides and base)
- Occipital bone (back of skull)

These bones are joined by fibrous joints called sutures.

Viscerocranium:

- This comprises the facial bones and provides structure for
    - the eyes,
    - nose,
    - mouth, and other facial features.
- It includes bones like
    - the maxilla,
    - zygomatic,
    - nasal,
    - mandible (jawbone).

- The Skull cranial vault (which encloses the brain) bones are formed by **intramembranous ossification.**
- While the **bones that form the base of the skull are formed by endochondrial ossification.**

- The bones enclosing the brain have large flexible fibrous joints (sutures) which allow firstly the head to pass through the birth canal and secondly postnatal brain growth.
- Ossification continues postnatally, through puberty until mid 20s.

- Note that in old age the sutures are in some cases completely ossified.

- In the entire skeleton, early ossification occurs in the jaw and at the ends of long bones

Cranium – protects the brain and is the site of attachment for head and neck muscles

Facial bones

Supply the framework of the face, the sense organs, and the teeth

Provide openings for the passage of air and food

Anchor the facial muscles of expression

Eight bones form the *neurocranium* (braincase), a protective vault surrounding the brain and medulla oblongata.

Fourteen bones form the *splanchnocranium*, the bones supporting the face.

Encased within the temporal bones are the six *ear ossicles* of the middle ear.

The hyoid bone, supporting the larynx, is usually not considered as part of the skull, as it does not articulate with any other bones.

Functions of the Skull:

- **Protection:** The primary function of the skull is to protect the brain from injury.

- **Support:** Provides structure and support for the face.

- **Attachment:** Serves as an attachment site for muscles of the head and neck.

- **Sensory Input:** Houses and protects the organs of sight, hearing, taste, and smell.

- **Passage for Nerves and Vessels:** Contains foramina (holes) that allow the passage of nerves and blood vessels to and from the brain.

Paired Cranial Bones:

- Parietals
- Temporals

Unpaired Cranial Bones:

- Frontal
- Occipital
- Sphenoid
- Ethmoid

Paired Facial Bones:

- Lacrimals
- Nasals
- Zygomatics
- Maxillae
- Palatines
- Inferior Nasal Conchae

Unpaired Facial Bones:

- Vomer
- Mandible
- Hyoid

***In the skull (22)*:**

Cranial bones:

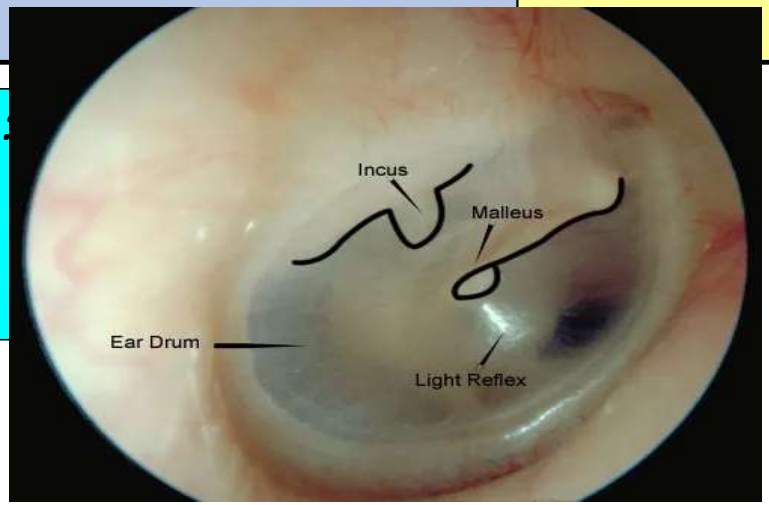
1. frontal bone
2. parietal bone X(2)
3. temporal bone X(2)
4. occipital bone
5.sphenoid bone
6.ethmoid bone

Facial bones:

1. zygomatic bone (2)
2. superior and inferior maxilla
3. nasal bone (2)
4. mandible
5.palatine bone (2)
6.lacrimal bone (2)
7.vomer bone
8.inferior nasal conchae (2)

***In the middle ears** (6):*

- malleus (2)
- incus (2)
- stapes (2)



***In the throat** (1):*

- hyoid bone

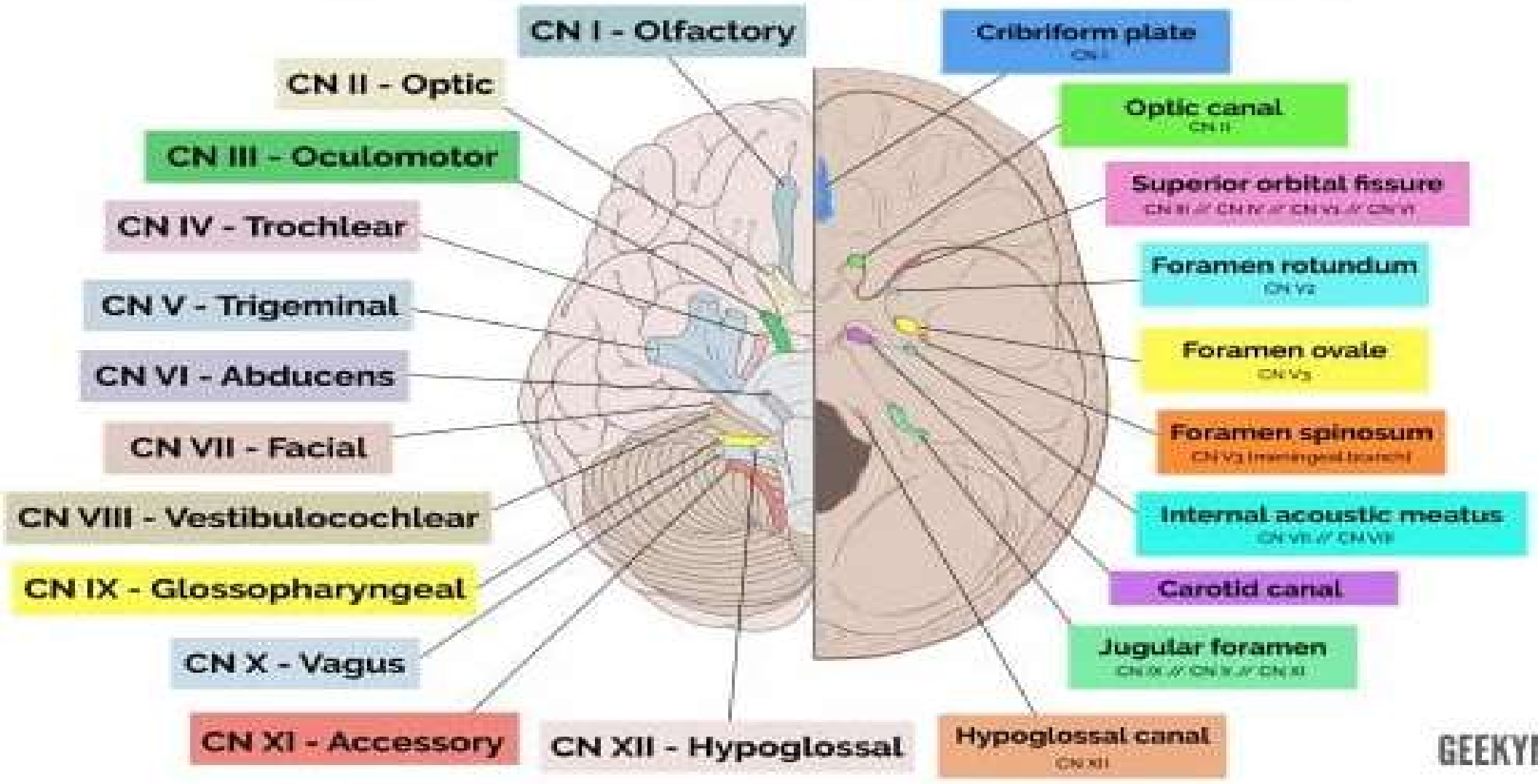
Key Features of the Skull:

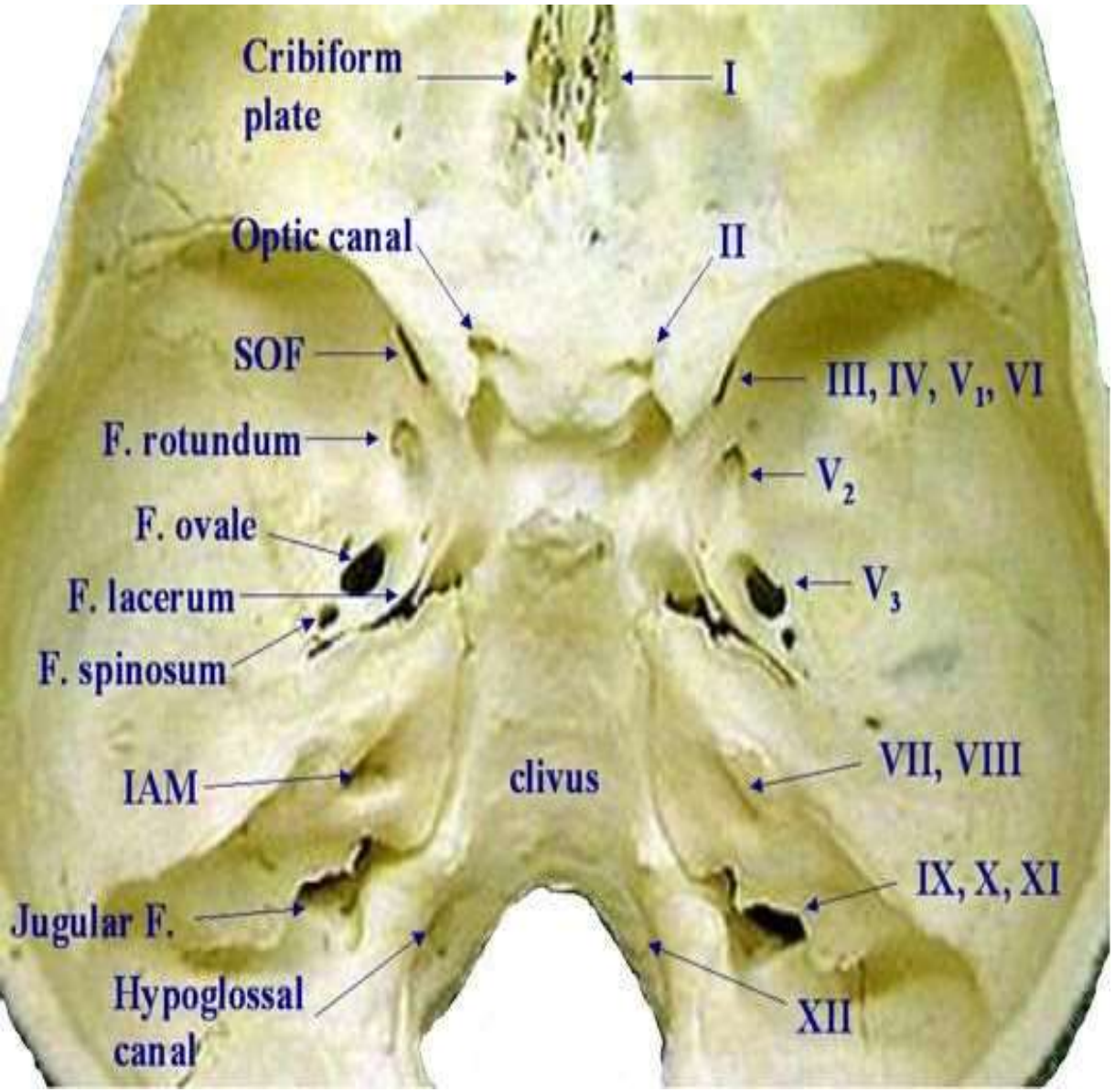
•**Sutures:** Immovable joints where the bones of the skull are connected. Major sutures include the coronal, sagittal, lambdoid, and squamous sutures.

•**Foramina:** Openings in the skull that allow the passage of nerves and blood vessels. Important foramina include the foramen magnum, optic foramina, and jugular foramen.

•**Sinuses:** Air-filled cavities that lighten the skull and enhance the resonance of the voice. Major sinuses include the frontal, ethmoid, sphenoid, and maxillary sinuses.

CRANIAL NERVES AND SKULL FORAMINA





Cribriform plate
Olfactory n (CNI)

Optic canal
Optic n (CNII)

Superior orbital fissure
Oculomotor n (CNIII)
Trochlear n (CNIV)
Ophthalmic n (CNV_1)
Abducens n (CNVI)

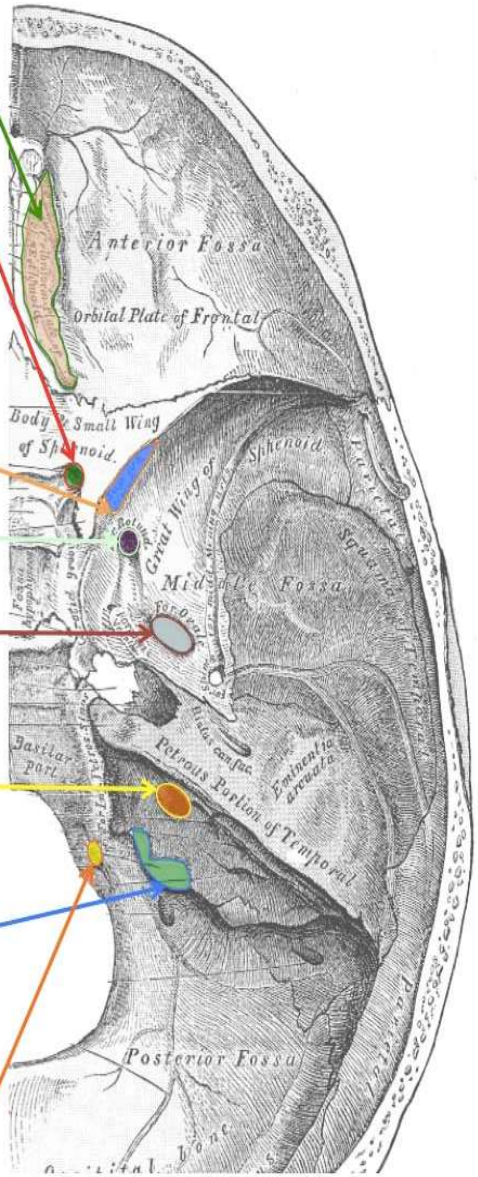
Foramen rotundum
Maxillary n (CNV_2)

Foramen Ovale
Mandibular n (CNV_3)

Internal acoustic meatus
Facial n (CNVII)
Vestibulocochlear n (CNVIII)

Jugular foramen
Glosopharyngeal n (CNIX)
Vagus n (CNX)
Accessory n (CNXI)

Hypoglossal canal
Hypoglossal n (CNXII)



Major Skull Foramina

1.Foramen Magnum

1. **Location**: Occipital bone
2. **Structures Passing Through**: Spinal cord, vertebral arteries, accessory nerve (cranial nerve XI)

2.Optic Canal

1. **Location**: Sphenoid bone
2. **Structures Passing Through**: Optic nerve (cranial nerve II), ophthalmic artery

3.Superior Orbital Fissure

1. **Location**: Sphenoid bone
2. **Structures Passing Through**: Oculomotor nerve (cranial nerve III), trochlear nerve (cranial nerve IV), ophthalmic branch of the trigeminal nerve (cranial nerve V1), abducens nerve (cranial nerve VI), superior ophthalmic vein

4.Foramen Rotundum

1. **Location**: Sphenoid bone
2. **Structures Passing Through**: Maxillary branch of the trigeminal nerve (cranial nerve V2)

5.Foramen Ovale

1. **Location**: Sphenoid bone
2. **Structures Passing Through**: Mandibular branch of the trigeminal nerve (cranial nerve V3), accessory meningeal artery

6. Foramen Spinosum

1. **Location**: Sphenoid bone
2. **Structures Passing Through**: Middle meningeal artery, meningeal branch of the mandibular nerve (cranial nerve V3)

7.Internal Acoustic Meatus

1. **Location**: Temporal bone
2. **Structures Passing Through**: Facial nerve (cranial nerve VII), vestibulocochlear nerve (cranial nerve VIII), labyrinthine artery

8.Jugular Foramen

1. **Location**: Between the temporal and occipital bones
2. **Structures Passing Through**: Glossopharyngeal nerve (cranial nerve IX), vagus nerve (cranial nerve X), accessory nerve (cranial nerve XI), internal jugular vein

9.Hypoglossal Canal

1. **Location**: Occipital bone
2. **Structures Passing Through**: Hypoglossal nerve (cranial nerve XII)

10. Foramen Lacerum

1. **Location**: Junction of the sphenoid, temporal, and occipital bones
2. **Structures Passing Through**: Generally no major structures pass through directly; it is filled with cartilage in life. The internal carotid artery passes over it after leaving the carotid canal.

11.Carotid Canal

1. **Location**: Temporal bone
2. **Structures Passing Through**: Internal carotid artery, sympathetic plexus

12.Stylomastoid Foramen

1. **Location**: Temporal bone
2. **Structures Passing Through**: Facial nerve (cranial nerve VII)

13. Infraorbital Foramen

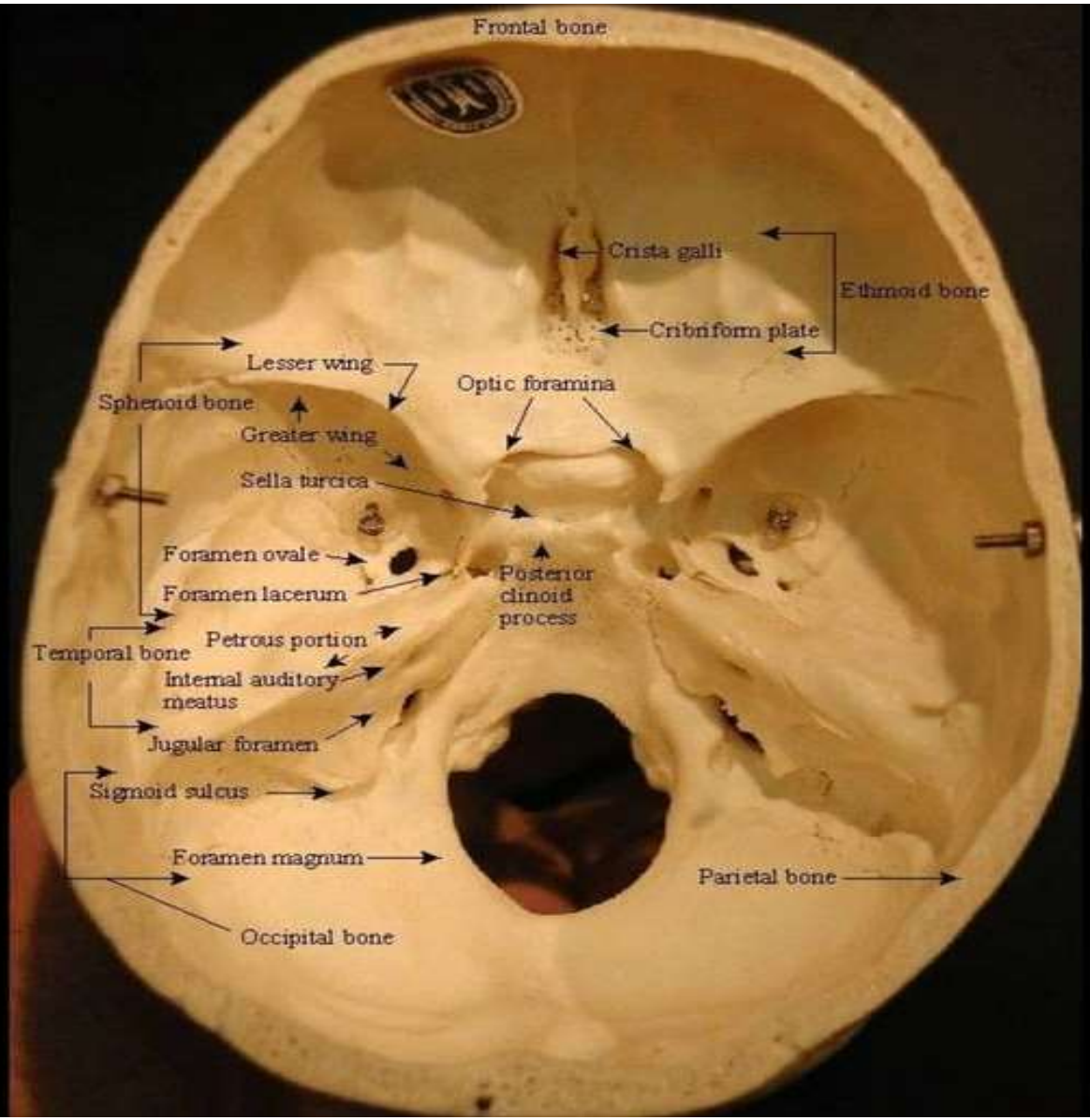
1. **Location**: Maxillary bone
2. **Structures Passing Through**: Infraorbital nerve, artery, and vein

14.Mental Foramen

1. **Location**: Mandible
2. **Structures Passing Through**: Mental nerve, artery, and vein

15.Supraorbital Foramen (or Notch)

1. **Location**: Frontal bone
2. **Structures Passing Through**: Supraorbital nerve, artery, and vein


Frontal bone
Crista galli
Ethmoid bone
Cribriform plate
Lesser wing
Optic foramina
Sphenoid bone
Greater wing
Sella turcica
Foramen ovale
Posterior clinoid process
Foramen lacerum
Petrous portion
Temporal bone
Internal auditory meatus
Jugular foramen
Sigmoid sulcus
Foramen magnum
Parietal bone
Occipital bone

Functions and Importance of skull sutures

•**Growth and Development**: Sutures allow the skull to expand with the growing brain during infancy and childhood.

•**Flexibility During Birth**: Sutures provide flexibility to the skull during childbirth, allowing the bones to overlap slightly as the baby passes through the birth canal.

•**Protection**: The sutures help protect the brain by distributing mechanical forces across the skull.

•**Clinical Significance**: Abnormalities in sutures, such as premature fusion (craniosynostosis), can lead to developmental issues and require medical intervention.

Major Sutures of the Skull to know

1.Coronal Suture

1. **Location**: Between the frontal bone and the two parietal bones.
2. **Description**: Runs across the top of the skull, from ear to ear.

2.Sagittal Suture

1. **Location**: Between the two parietal bones.
2. **Description**: Runs along the midline of the skull, from the front to the back.

3.Lambdoid Suture

1. **Location**: Between the occipital bone and the two parietal bones.
2. **Description**: Forms an inverted "V" shape on the back of the skull.

4.Squamous Suture

1. **Location**: Between the parietal bone and the temporal bone on each side of the skull.
2. **Description**: Runs along the side of the skull.

1.Metopic (Frontal) Suture

1. **Location**: Between the two halves of the frontal bone.
2. **Description**: Present in infants and young children, typically fuses by age 6-8.

2.Parietomastoid Suture

1. **Location**: Between the parietal bone and the mastoid portion of the temporal bone.
2. **Description**: Part of the suture complex at the side of the skull.

3.Occipitomastoid Suture

1. **Location**: Between the occipital bone and the mastoid portion of the temporal bone.
2. **Description**: Runs near the base of the skull.

4.Sphenoparietal Suture

1. **Location**: Between the sphenoid and parietal bones.
2. **Description**: Located near the temples.

5.Sphenosquamosal Suture

1. **Location**: Between the sphenoid and squamous part of the temporal bone.
2. **Description**: Runs along the side of the skull near the temporal region.

6.Frontonasal Suture

1. **Location**: Between the frontal bone and the nasal bones.
2. **Description**: Located near the bridge of the nose.

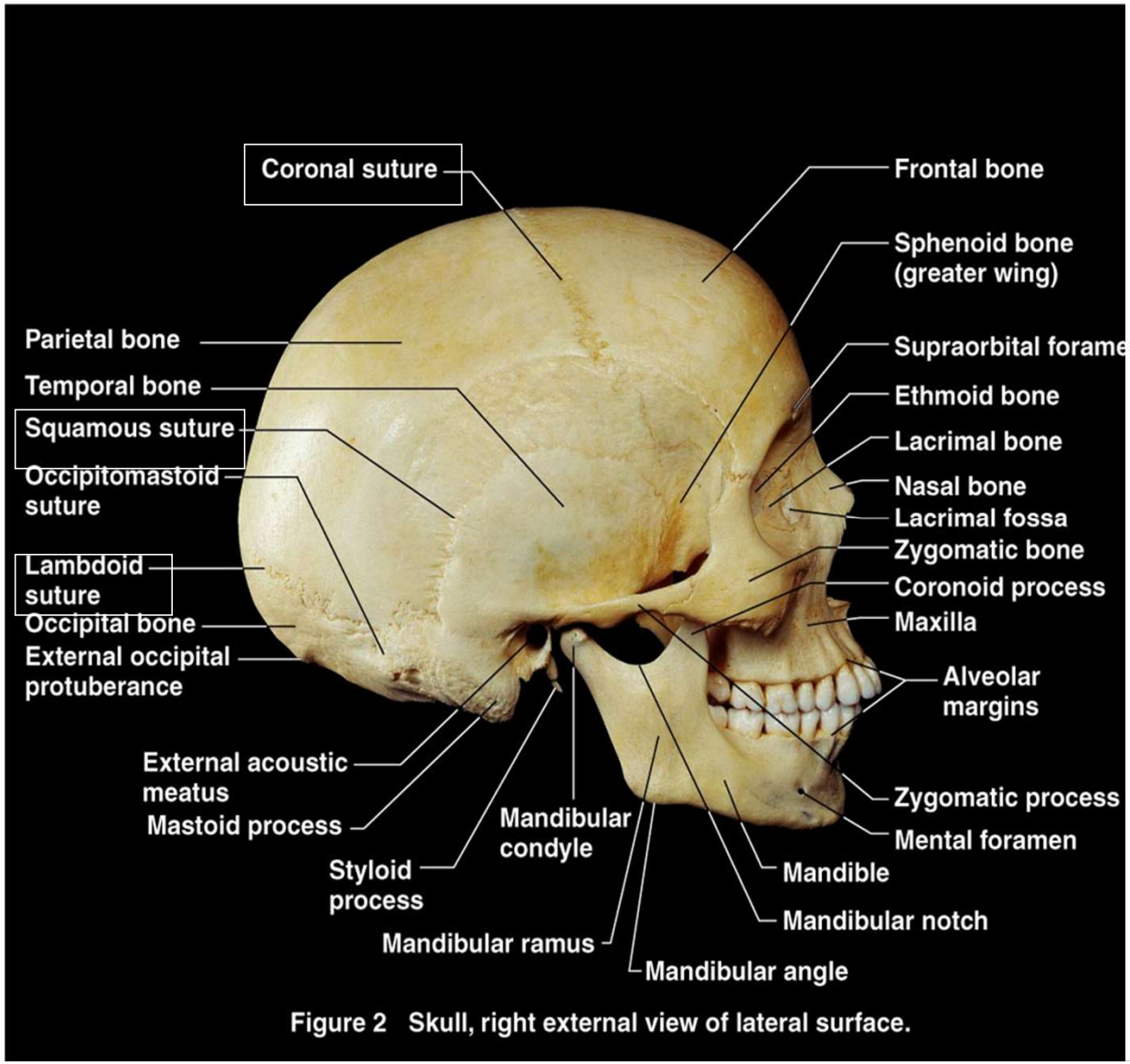
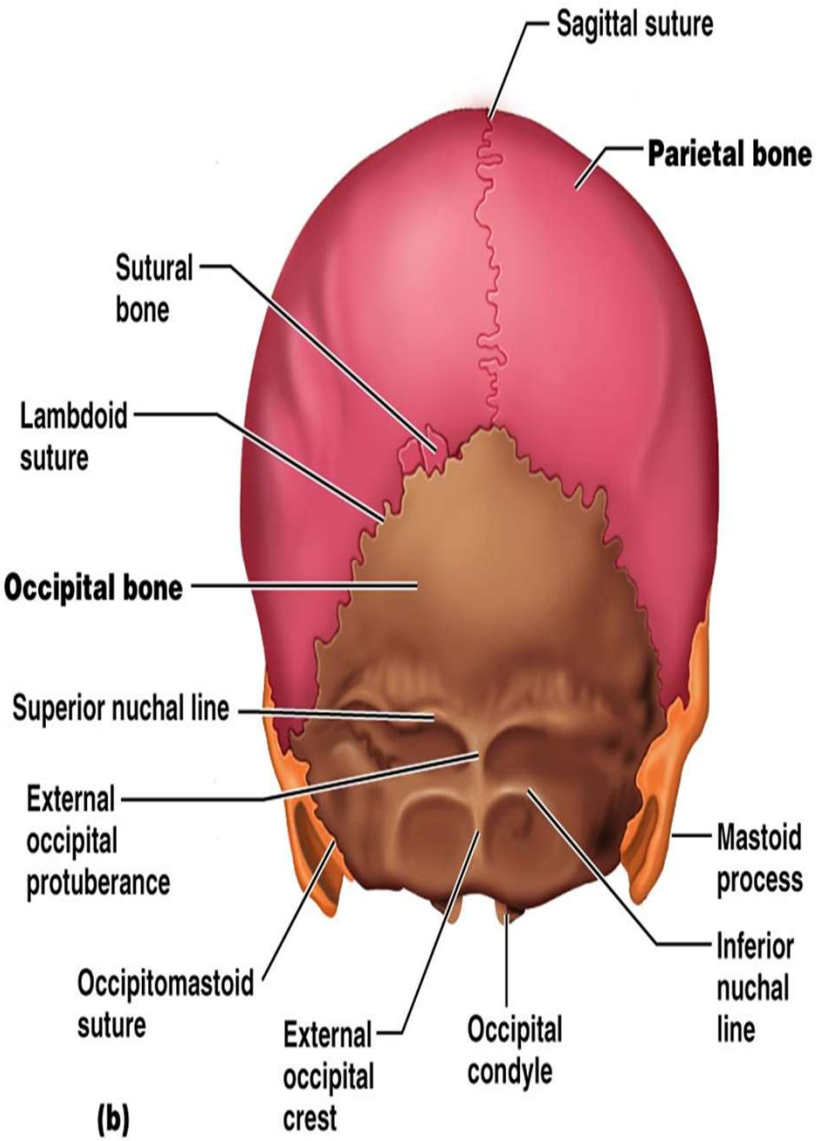
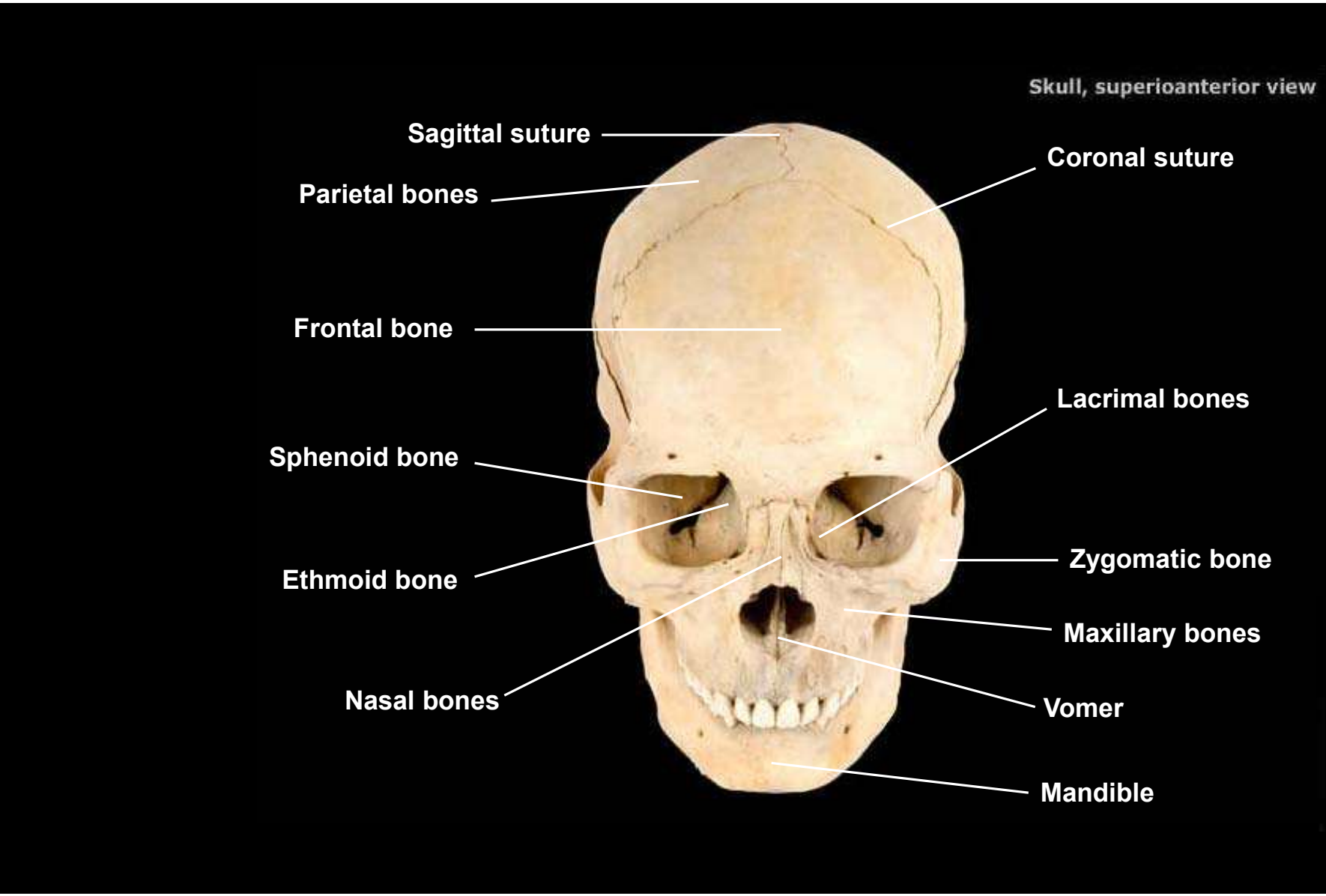
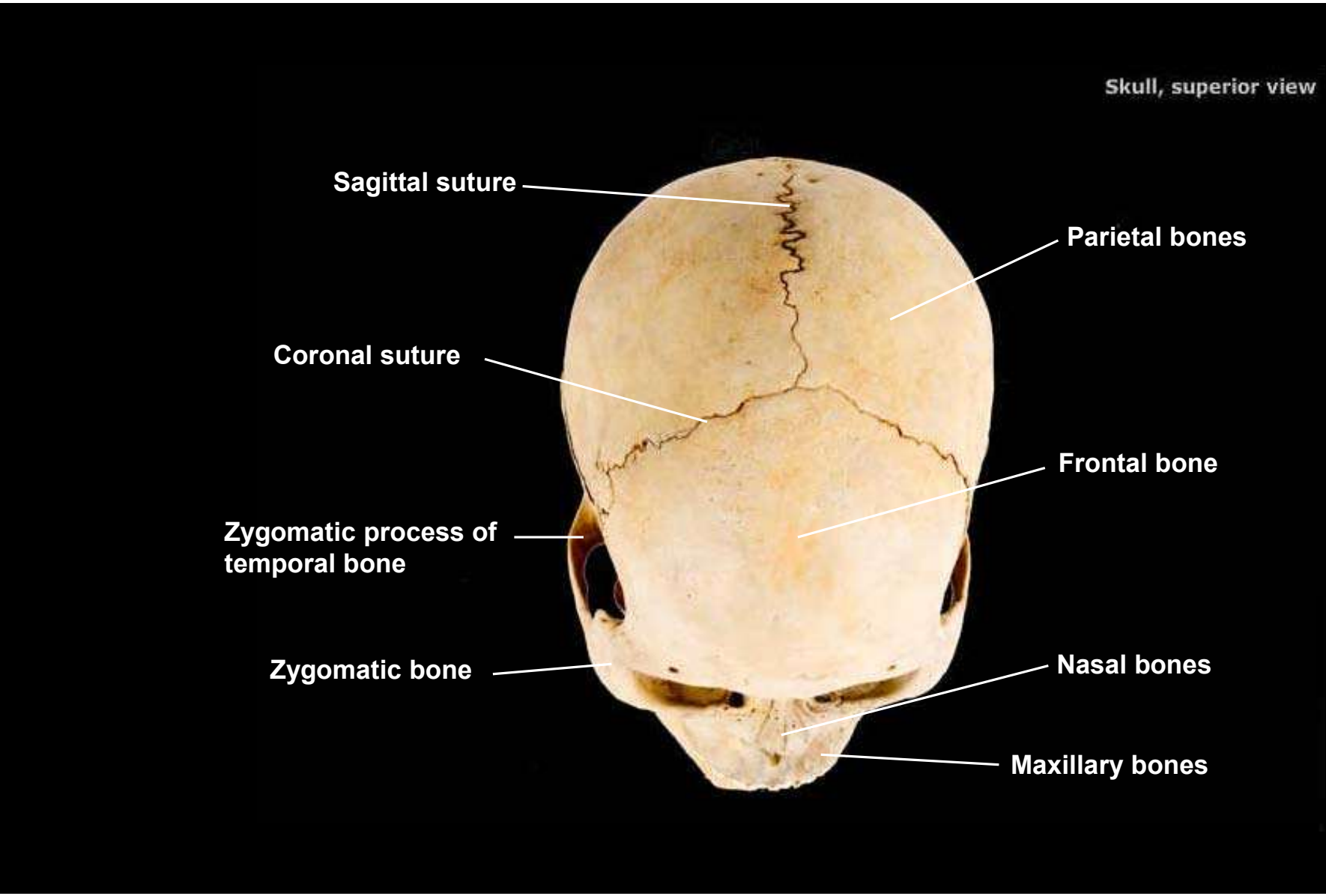
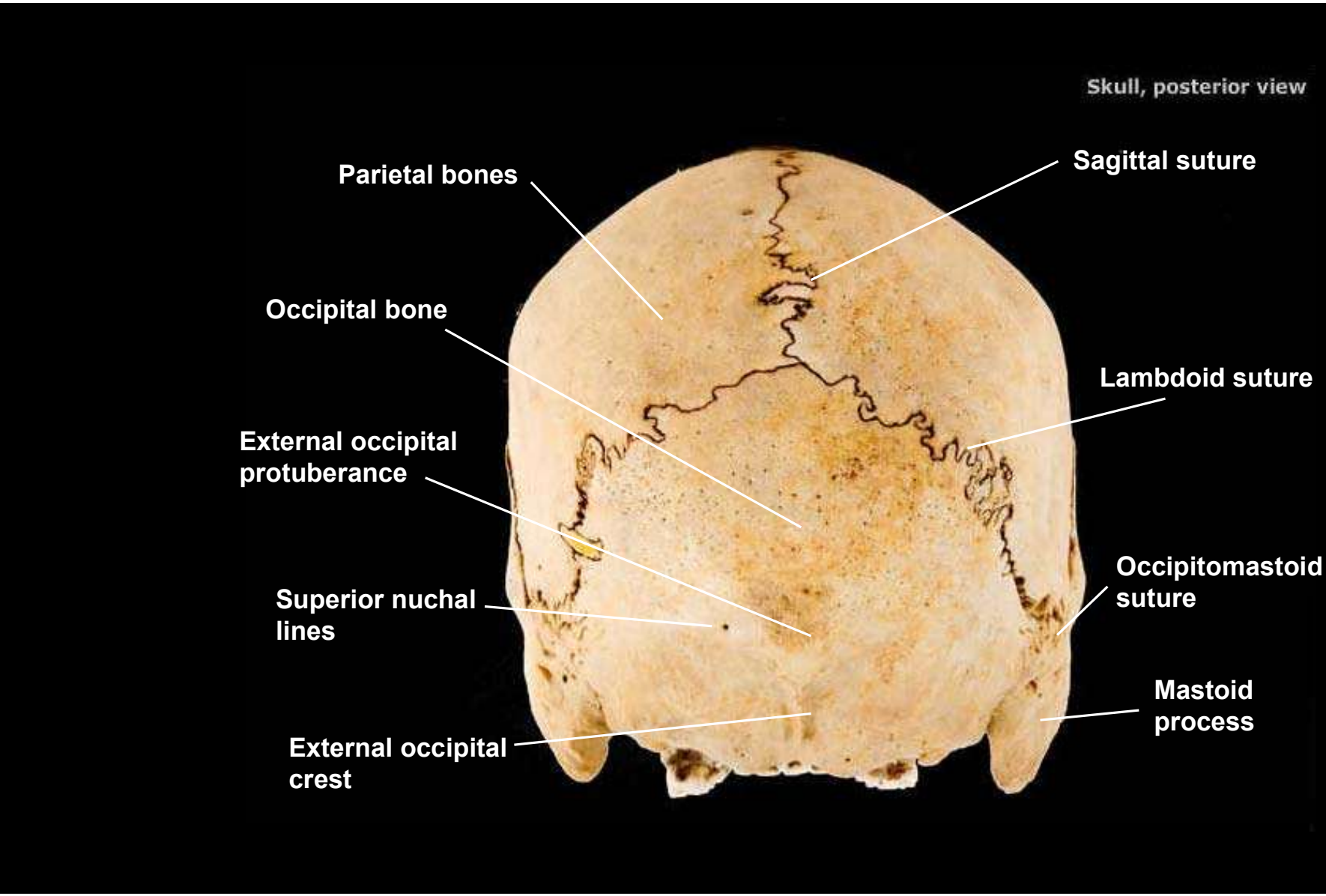


Figure 2 Skull, right external view of lateral surface.




Skull, superioanterior view
Sagittal suture
Parietal bones
Frontal bone
Sphenoid bone
Ethmoid bone
Nasal bones
Coronal suture
Lacrimal bones
Zygomatic bone
Maxillary bones
Vomer
Mandible


Skull, superior view
Sagittal suture
Parietal bones
Coronal suture
Frontal bone
Zygomatic process of temporal bone
Zygomatic bone
Nasal bones
Maxillary bones


Skull, posterior view
Parietal bones
Sagittal suture
Occipital bone
Lambdoid suture
External occipital protuberance
Occipitomastoid suture
Superior nuchal lines
Mastoid process
External occipital crest

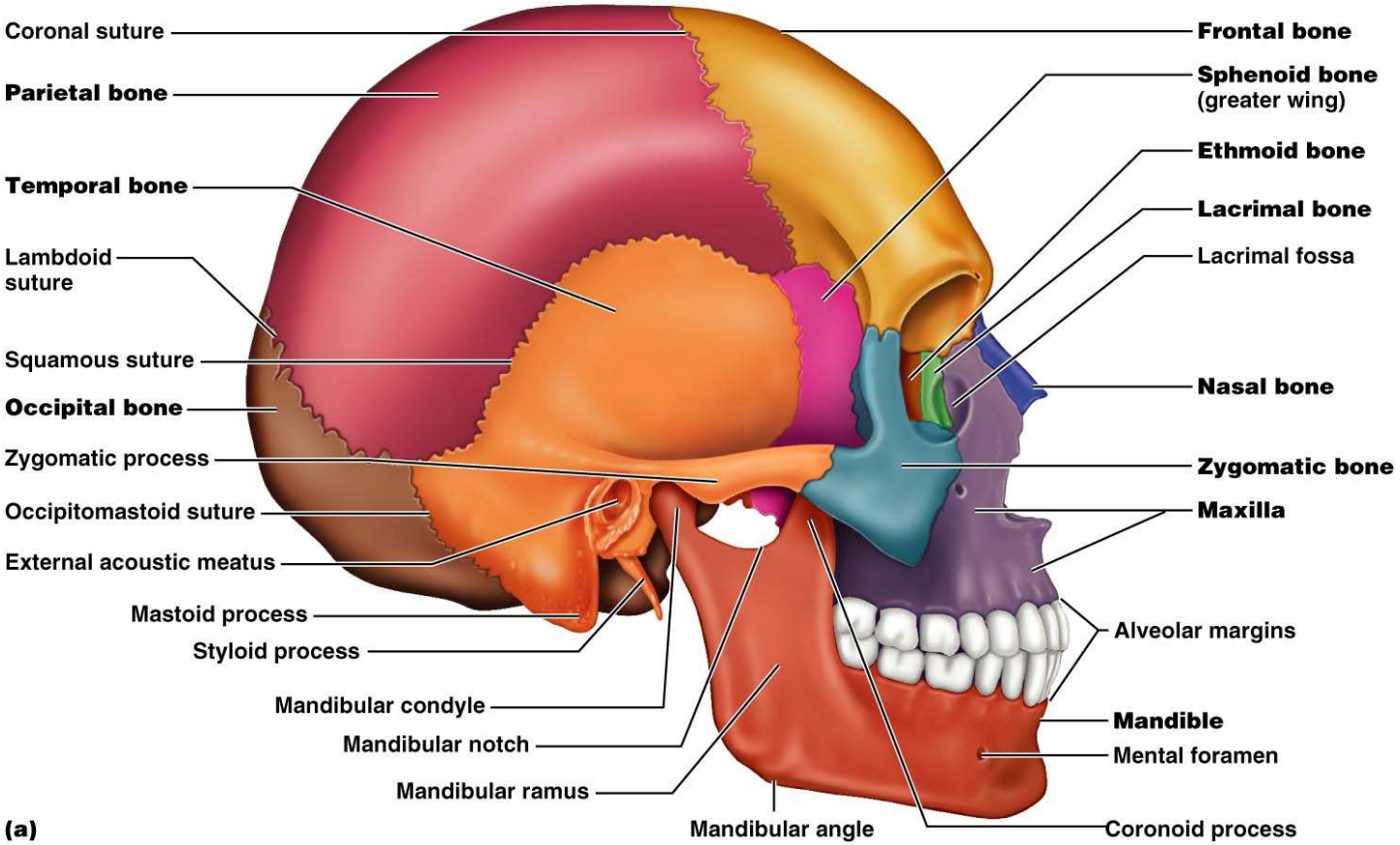
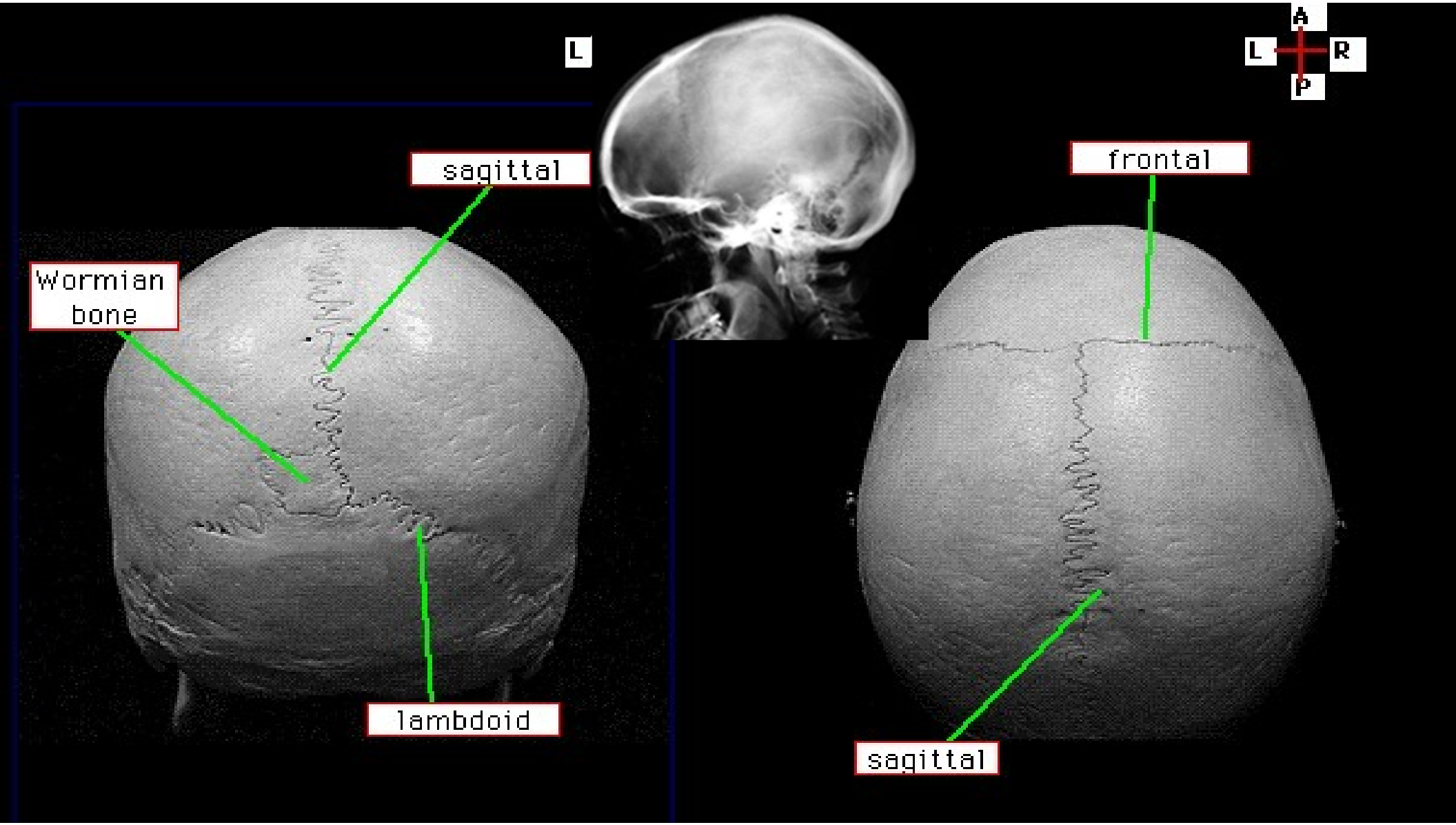


Figure 7.3a


L
A
L
R
P
sagittal
Wormian bone
lambdoid
frontal
sagittal

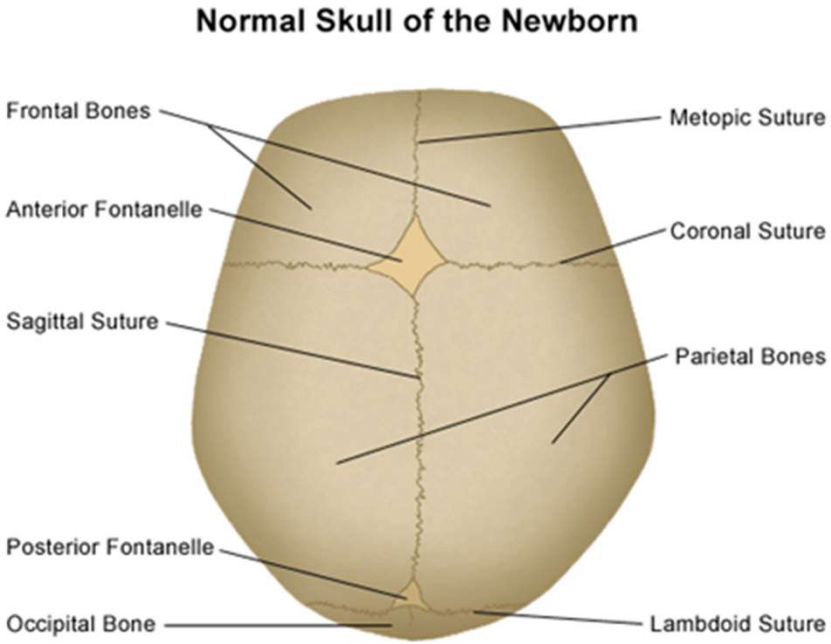
Coronal Suture Articulation between the parietal bones and the frontal bone.

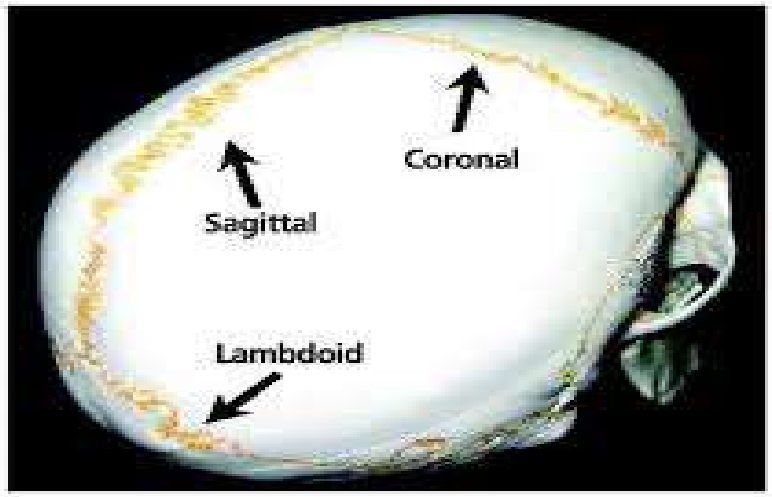
Squamous Suture: Articulation between the temporal bones with the parietal bones.

Lambdoid Suture: Articulation of the parietal bones and the occipital bone.

Occipitomastoid Suture: Articulation between the occipital bone and the mastoid process of the temporal bone.

Sagittal Suture: You can't really see this one, but it is on the very top of the cranium. The articulation between the parietal bones.





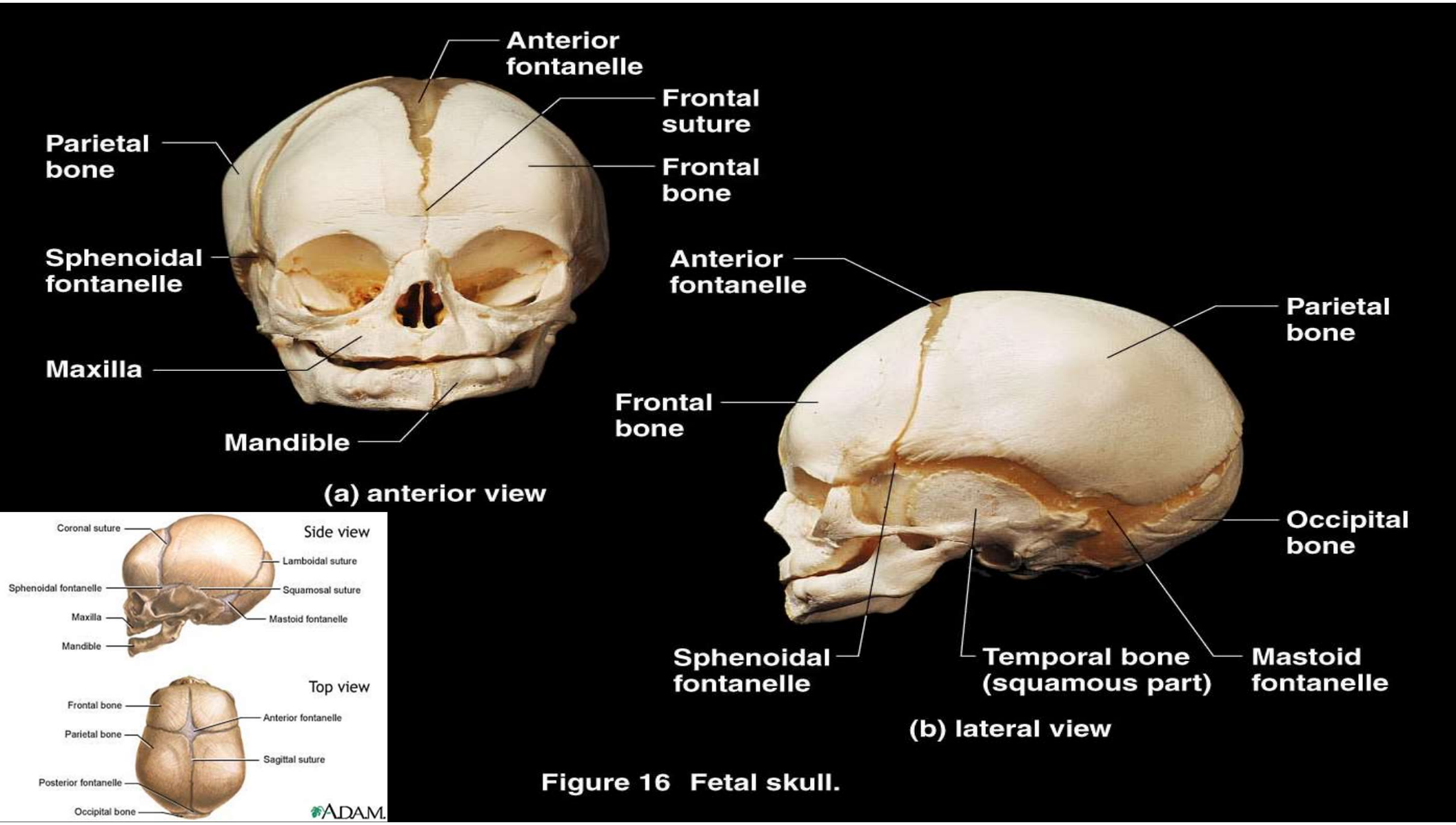
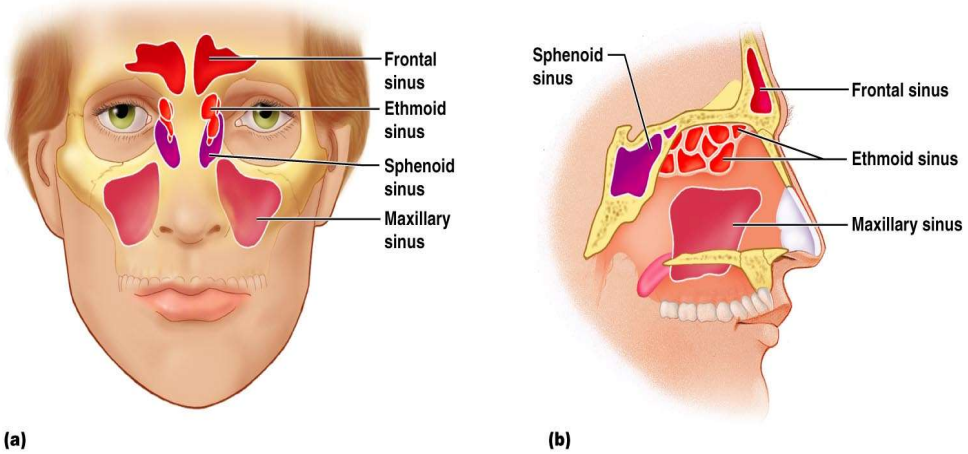


Figure 16 Fetal skull.

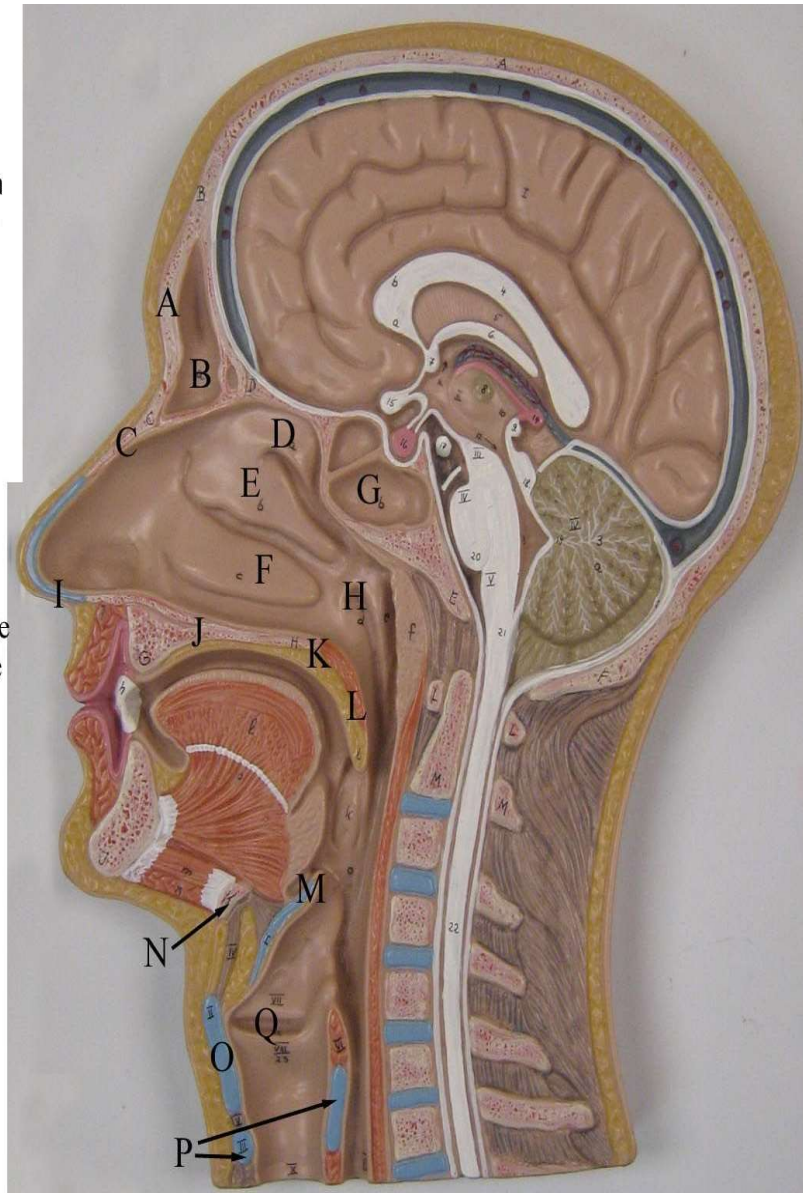


- The sinuses, also known as paranasal sinuses, are air-filled spaces located within the bones of the skull and face.
- They are connected to the nasal cavity and play a role in various functions**, including reducing the weight of the skull, producing mucus, and aiding in voice resonance.**

- **lined with respiratory epithelium, which also lines the large airways.**

- **The exact functions of the sinuses are unclear; they may contribute to lessening the weight of the skull with a minimal reduction in strength,or they may be important in improving the resonance of the voice.**

A = frontal bone
B = frontal sinus
C = nasal bone
D = superior concha
E = middle concha
F = inferior concha
G = sphenoid sinus
H = internal nares
I = external nares
J = hard palate
K = soft palate
L = uvula
M = epiglottis
N = hyoid bone
O = thyroid cartilage
P = cricoid cartilage
Q = vocal cords



Paranasal sinuses are air-filled spaces, communicating with the nasal cavity, within the bones of the skull and face.

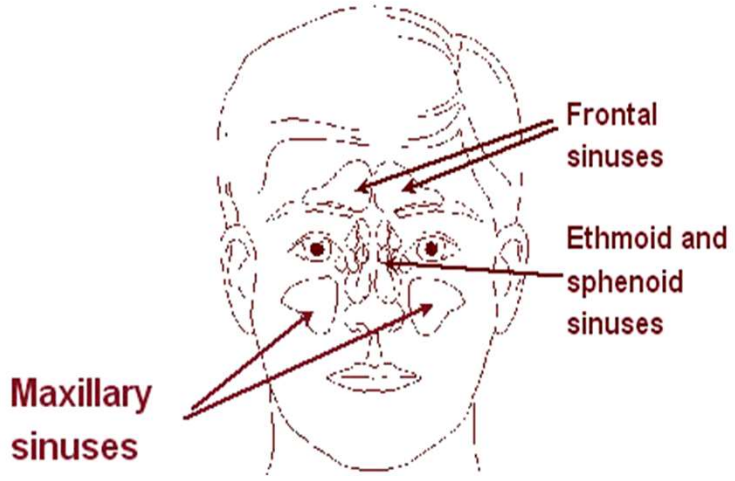
Humans possess a number of paranasal sinuses, divided into subgroups that are named according to the bones within which the sinuses lie:

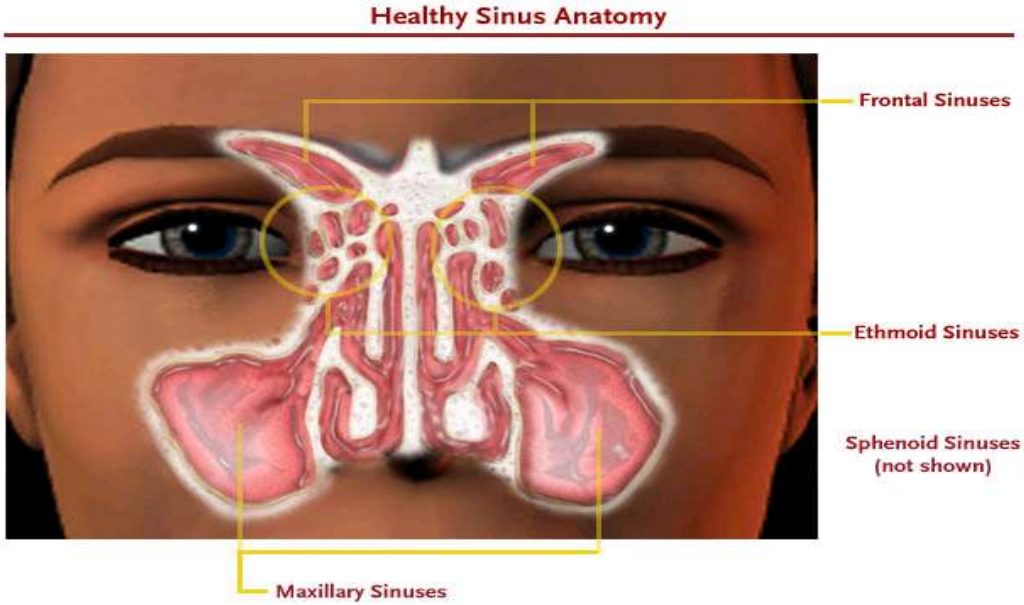
The maxillary sinuses, also called the maxillary antra and the largest of the paranasal sinuses, are under the eyes, in the maxillary bones (cheek bones).

The frontal sinuses, over the eyes, in the frontal bone, which forms the hard part of the forehead.

The ethmoid sinuses, which are formed from several discrete air cells within the ethmoid bone between the nose and the eyes.

The sphenoid sinuses, in the sphenoid bone at the center of the skull base under the pituitary gland.





1. Frontal Sinuses

•**Location**: Situated in the frontal bone, just above the eyebrows.

•**Function**: They are involved in producing mucus that helps moisten the nasal cavity and improve voice resonance.

2. Maxillary Sinuses

•**Location**: Located in the maxillary bones (cheekbones) on either side of the nose.

•**Function**: The largest of the paranasal sinuses, they also produce mucus that drains into the nasal cavity.

3. Ethmoid Sinuses

•**Location**: Positioned between the nose and the eyes, within the ethmoid bone.

•**Function**: These small, interconnected air cells help filter and clean the air inhaled through the nasal cavity.

4. Sphenoid Sinuses

•**Location**: Found deep within the skull behind the ethmoid sinuses, in the sphenoid bone.

•**Function**: These sinuses also produce mucus and play a role in the overall function of the nasal cavity.

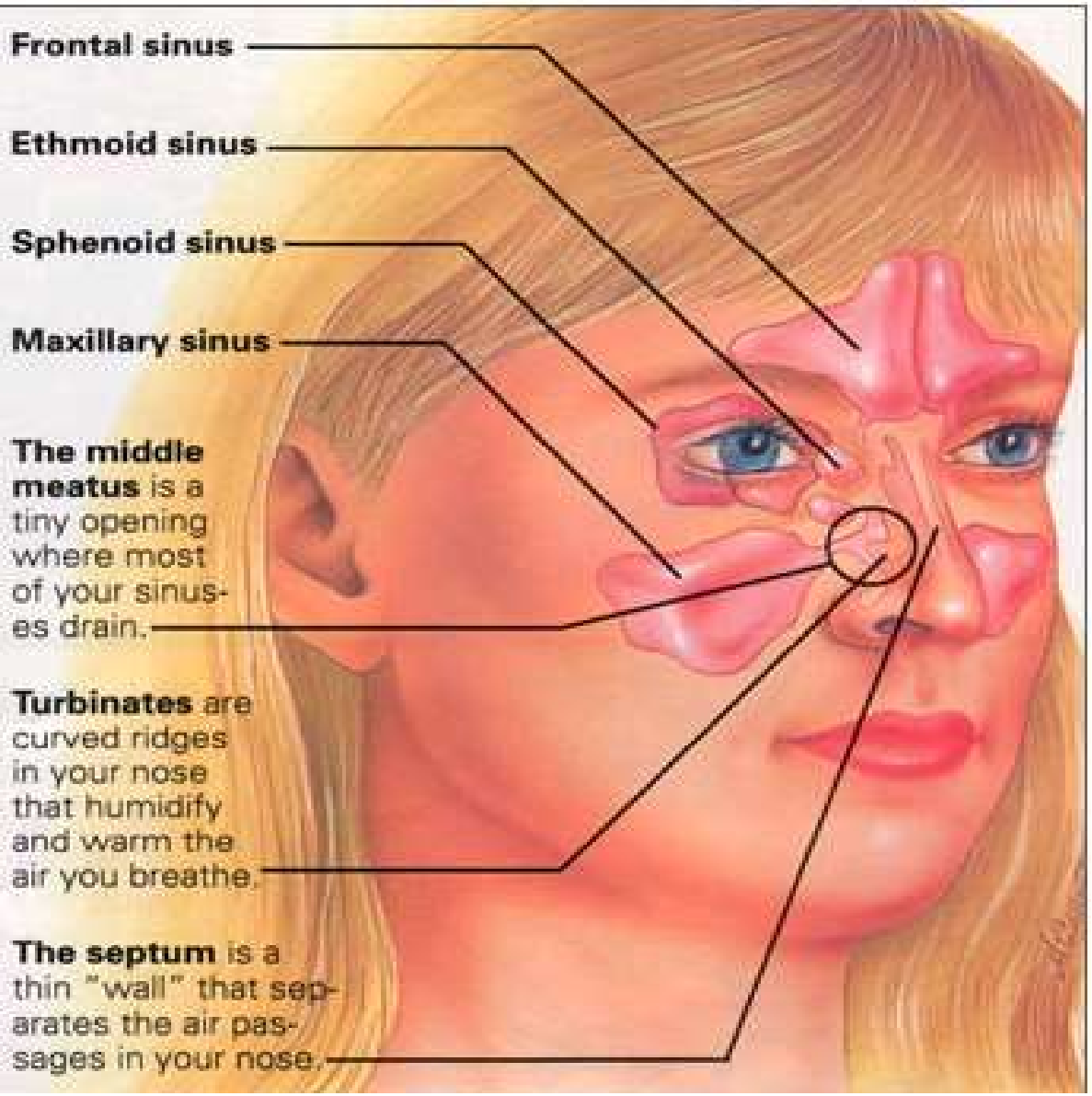
Functions of the Sinuses

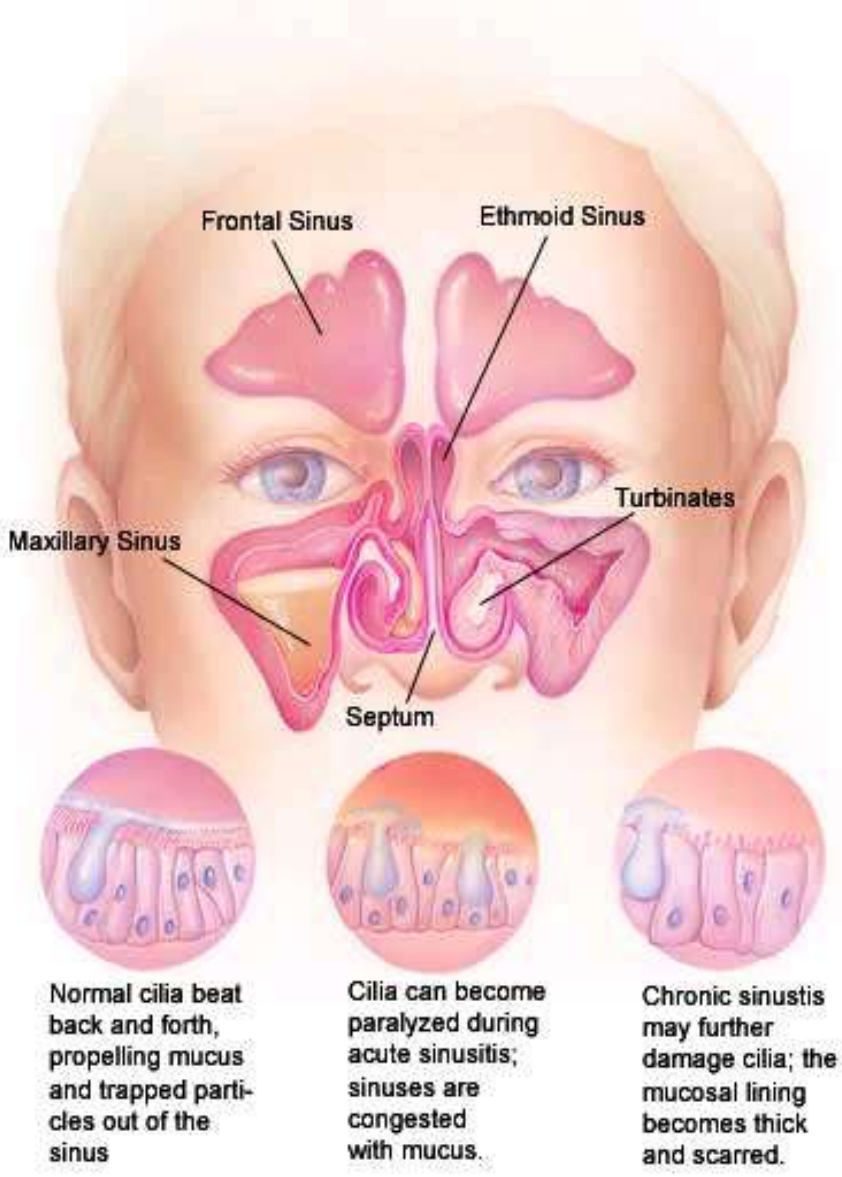
1.Mucus Production: The sinuses produce mucus that helps trap dust, pollutants, and microorganisms, preventing them from entering the respiratory system.

2.Air Humidification and Filtration: The mucus and cilia within the sinuses help humidify and filter the air we breathe.

3.Voice Resonance: The sinuses contribute to the quality of our voice by acting as resonating chambers.

4.Lightening the Skull: The air-filled spaces reduce the weight of the skull, making it easier for the head to be held upright.

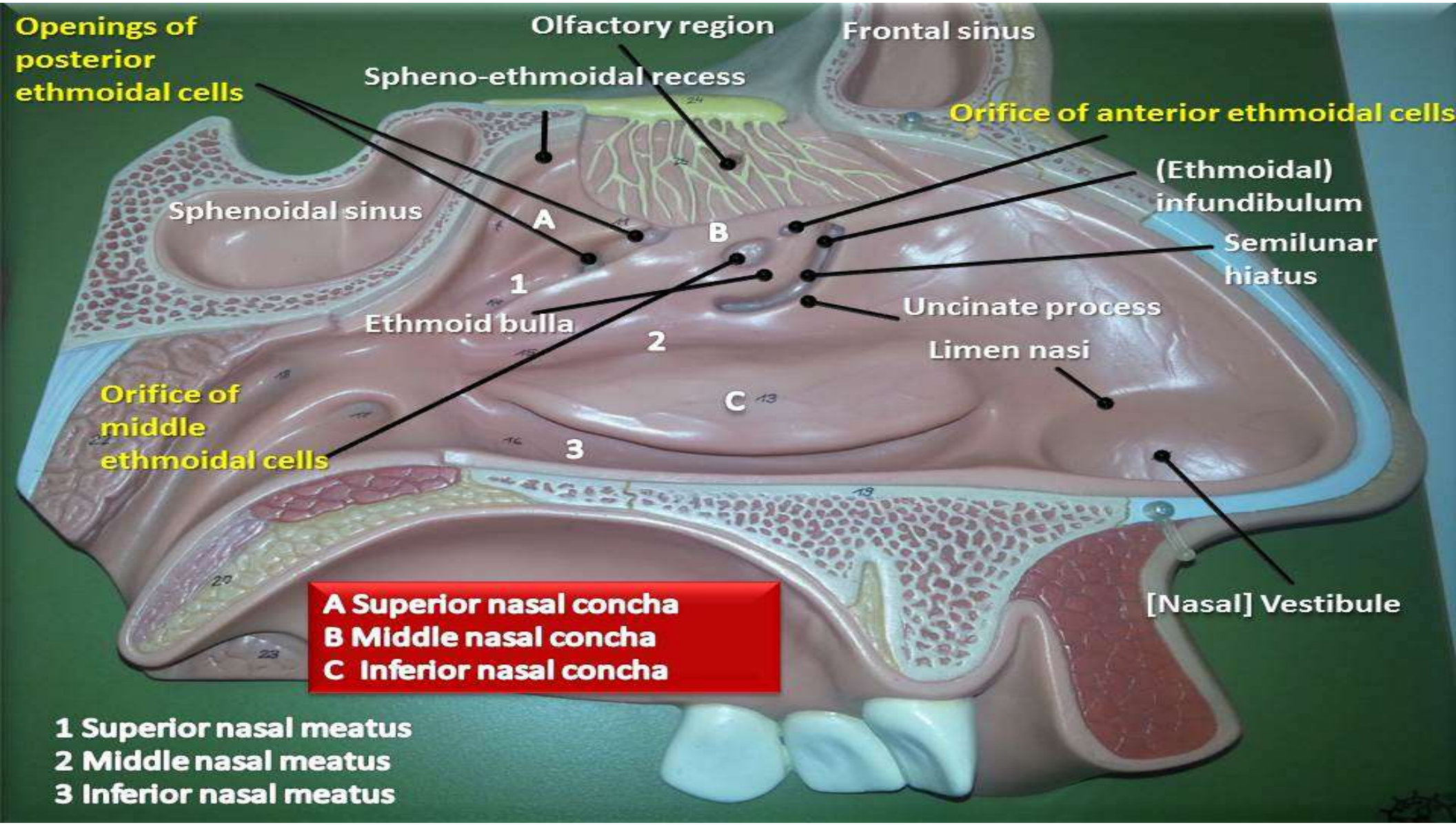

Frontal sinus
Ethmoid sinus
Sphenoid sinus
Maxillary sinus
The middle meatus is a tiny opening where most of your sinuses drain.
Turbinates are curved ridges in your nose that humidify and warm the air you breathe.
The septum is a thin "wall" that separates the air passages in your nose.

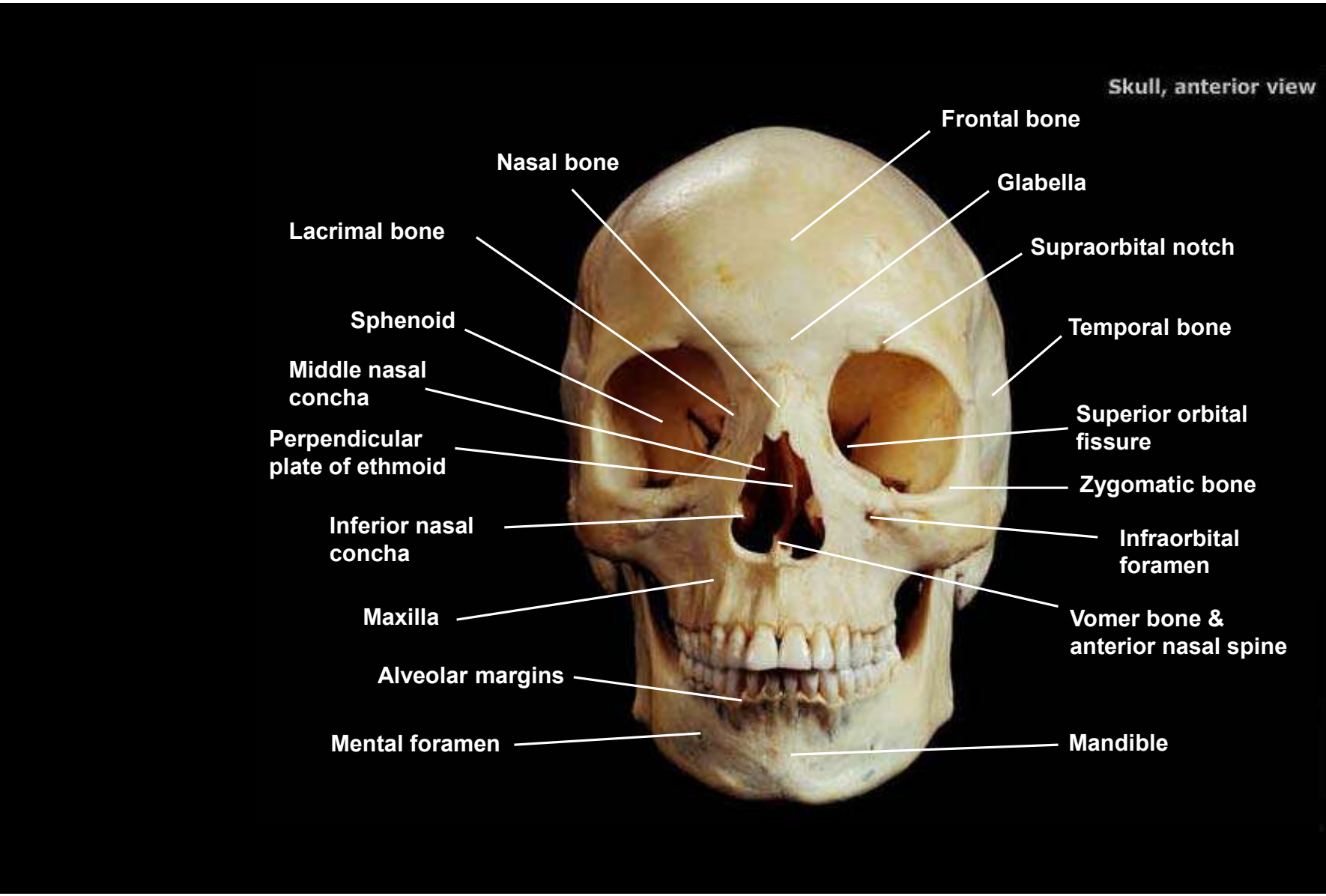

Frontal Sinus
Ethmoid Sinus
Turbinates
Maxillary Sinus
Septum
Normal cilia beat back and forth, propelling mucus and trapped particles out of the sinus
Cilia can become paralyzed during acute sinusitis; sinuses are congested with mucus.
Chronic sinustis may further damage cilia; the mucosal lining becomes thick and scarred.

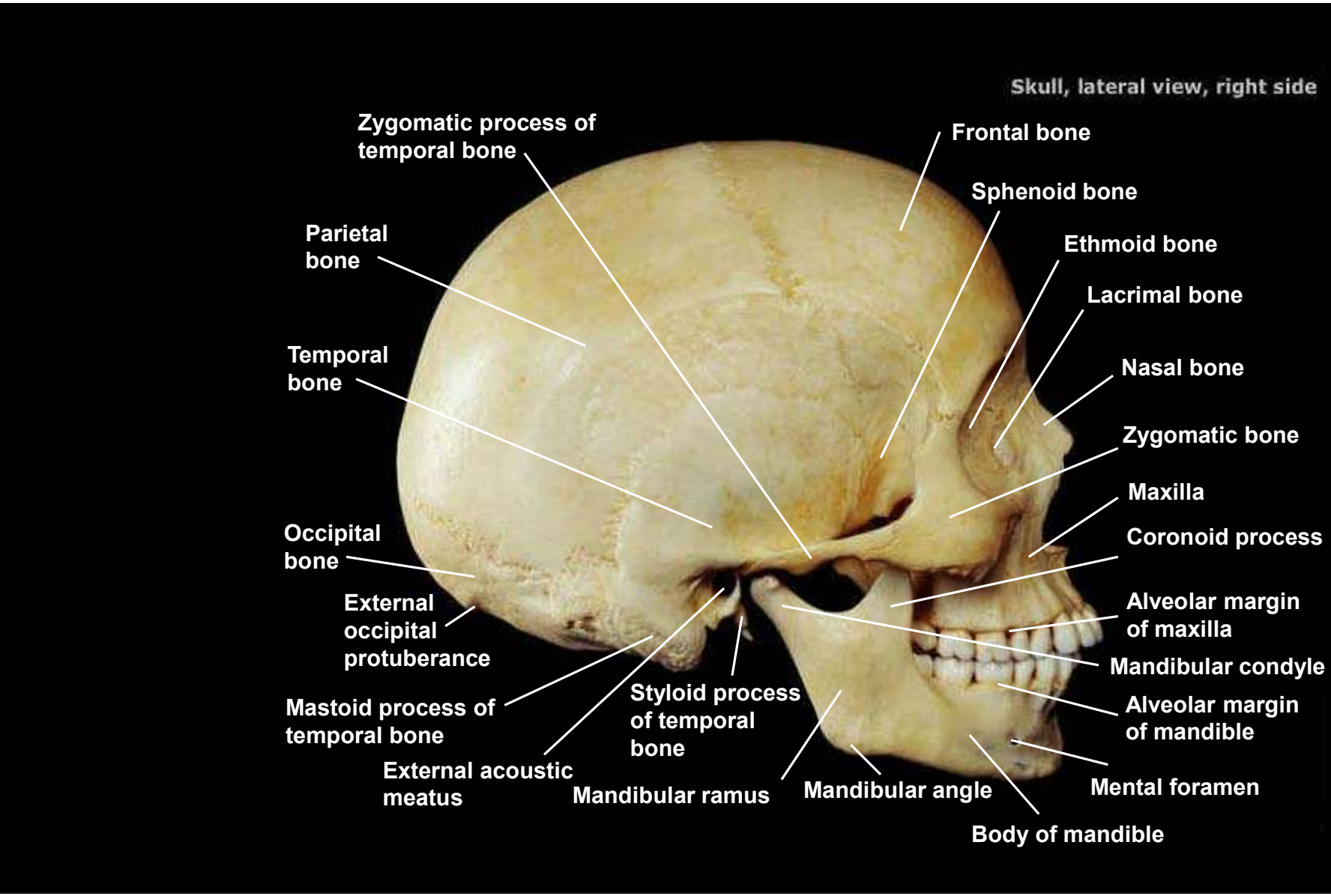
Anatomical Connections

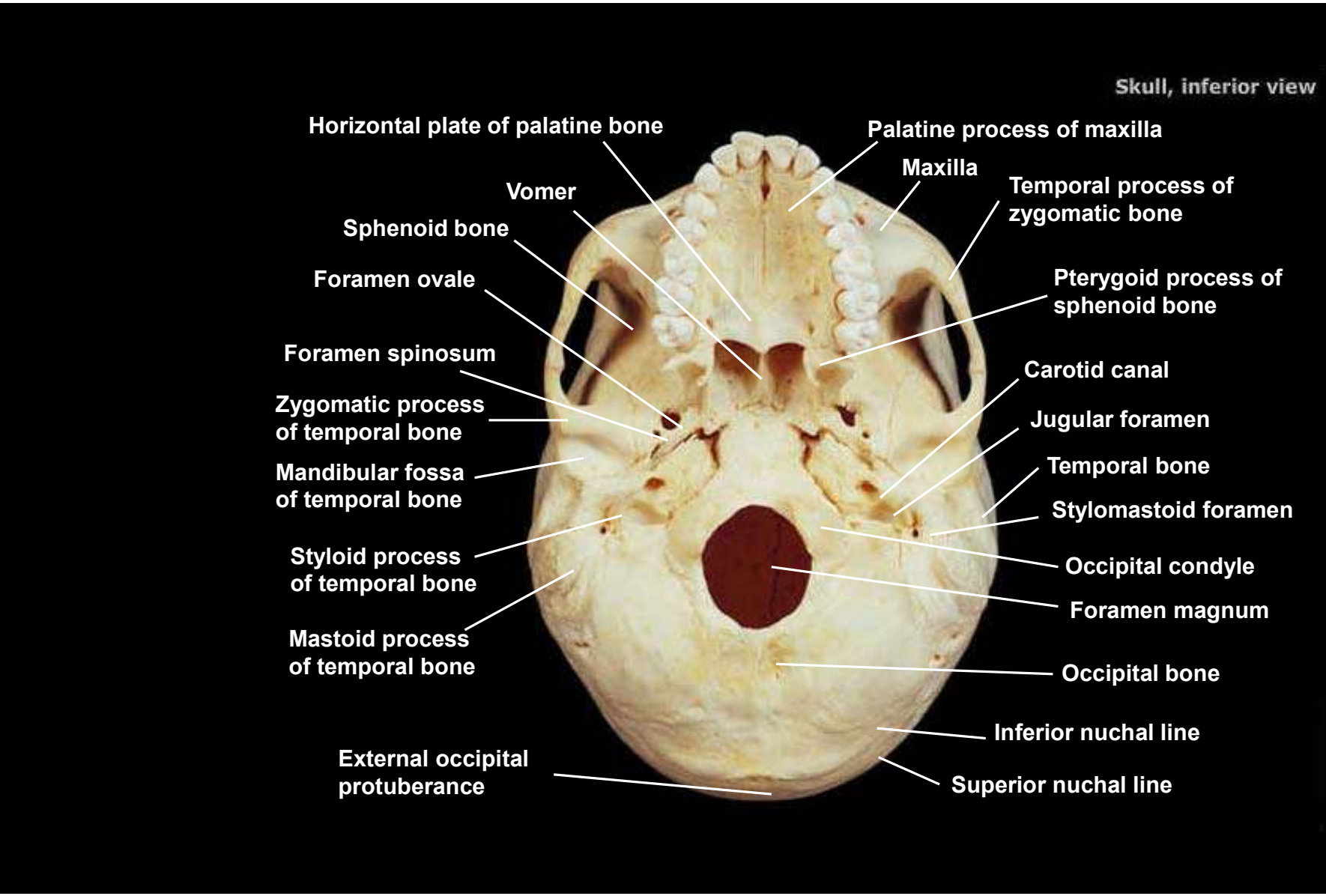
•**Ostia**: Each sinus has an opening (ostium) that allows mucus to drain into the nasal cavity.

•**Nasal Cavity**: The sinuses are connected to the nasal cavity, facilitating the movement of mucus and air between these structures.

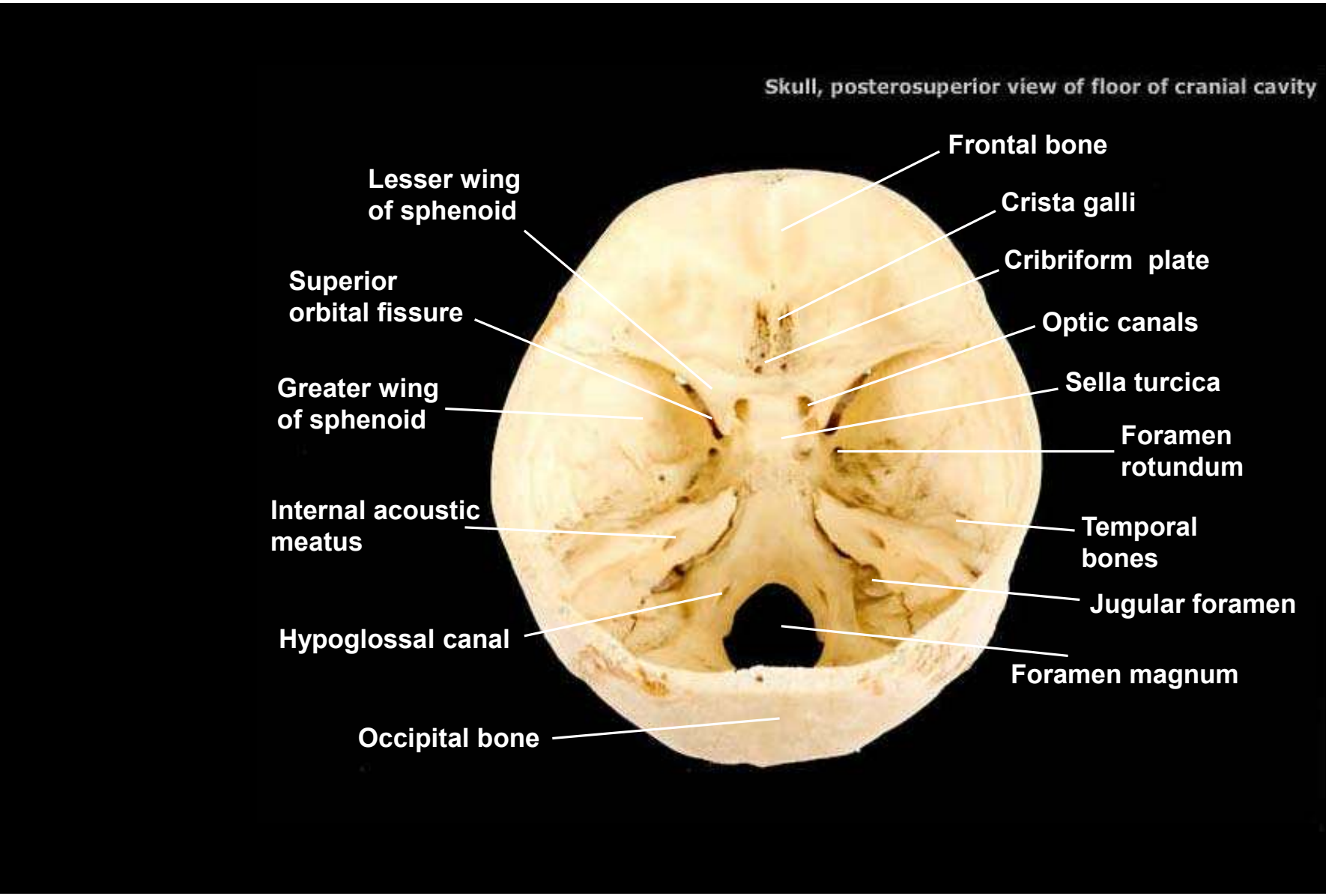

Openings of posterior ethmoidal cells
Olfactory region
Frontal sinus
Spheno-ethmoidal recess
Orifice of anterior ethmoidal cells
(Ethmoidal) infundibulum
Sphenoidal sinus
A
B
Semilunar hiatus
1
Uncinate process
Ethmoid bulla
2
Limen nasi
Orifice of middle ethmoidal cells
C
3
[Nasal] Vestibule
A Superior nasal concha
B Middle nasal concha
C Inferior nasal concha
1 Superior nasal meatus
2 Middle nasal meatus
3 Inferior nasal meatus


Skull, anterior view
Frontal bone
Nasal bone
Glabella
Lacrimal bone
Supraorbital notch
Sphenoid
Temporal bone
Middle nasal concha
Superior orbital fissure
Perpendicular plate of ethmoid
Zygomatic bone
Inferior nasal concha
Infraorbital foramen
Maxilla
Vomer bone & anterior nasal spine
Alveolar margins
Mental foramen
Mandible


Skull, lateral view, right side
Zygomatic process of temporal bone
Frontal bone
Sphenoid bone
Parietal bone
Ethmoid bone
Lacrimal bone
Temporal bone
Nasal bone
Zygomatic bone
Maxilla
Occipital bone
Coronoid process
External occipital protuberance
Alveolar margin of maxilla
Mandibular condyle
Styloid process of temporal bone
Alveolar margin of mandible
Mastoid process of temporal bone
External acoustic meatus
Mandibular ramus
Mandibular angle
Mental foramen
Body of mandible


Skull, inferior view
Horizontal plate of palatine bone
Palatine process of maxilla
Maxilla
Vomer
Temporal process of zygomatic bone
Sphenoid bone
Foramen ovale
Pterygoid process of sphenoid bone
Foramen spinosum
Carotid canal
Zygomatic process of temporal bone
Jugular foramen
Mandibular fossa of temporal bone
Temporal bone
Stylomastoid foramen
Styloid process of temporal bone
Occipital condyle
Foramen magnum
Mastoid process of temporal bone
Occipital bone
Inferior nuchal line
External occipital protuberance
Superior nuchal line

Skull, posterosuperior view of floor of cranial cavity



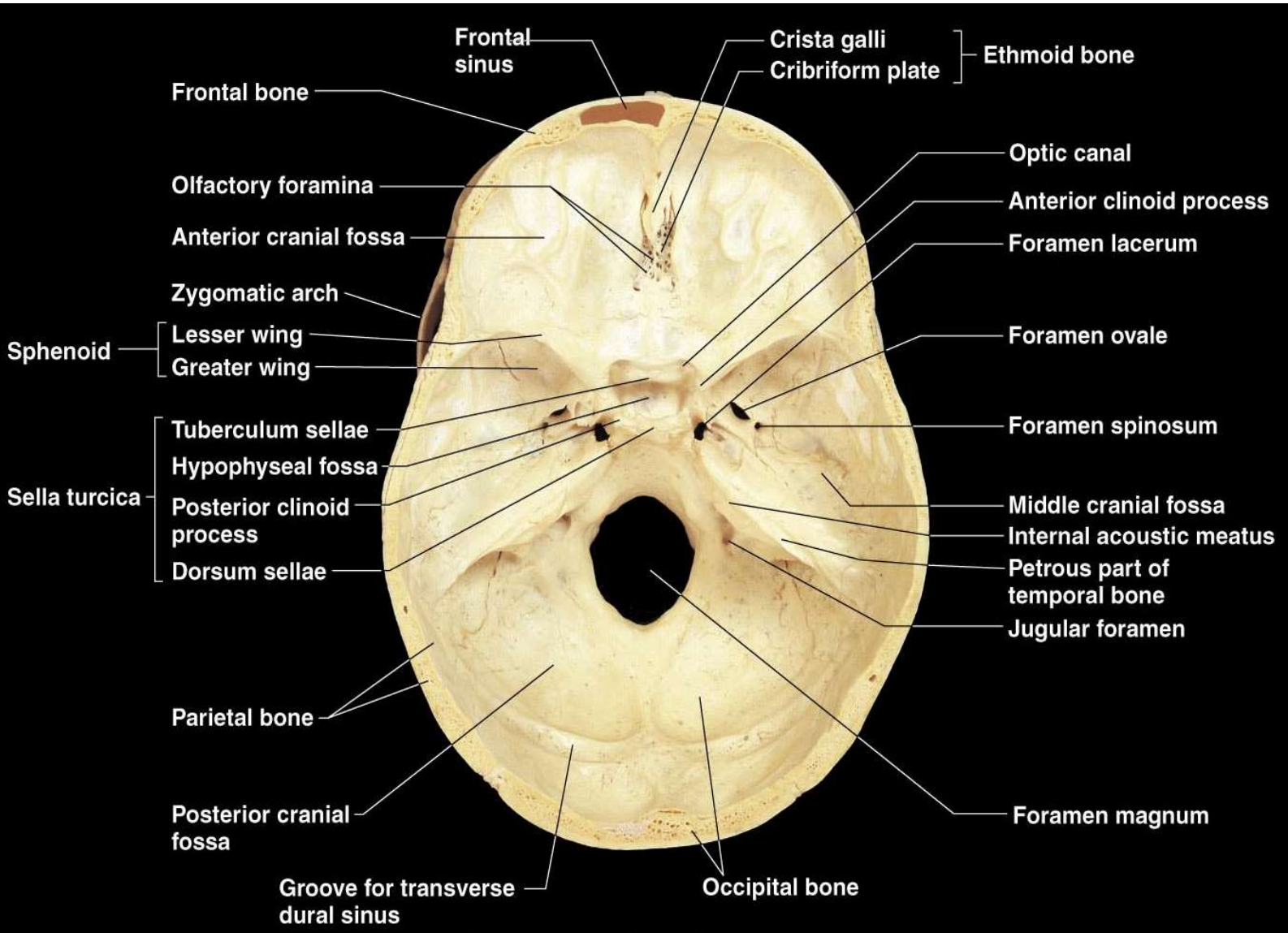
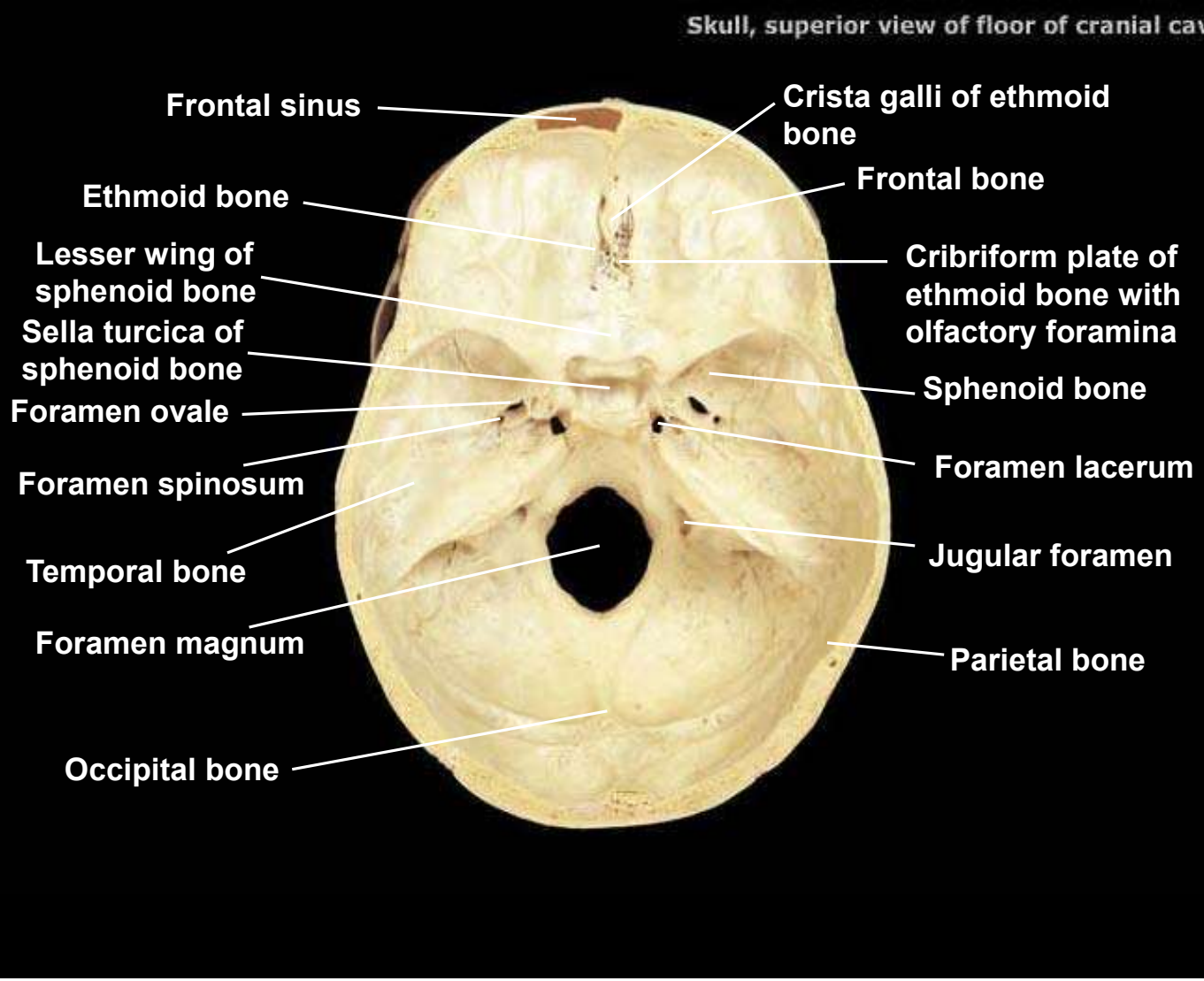
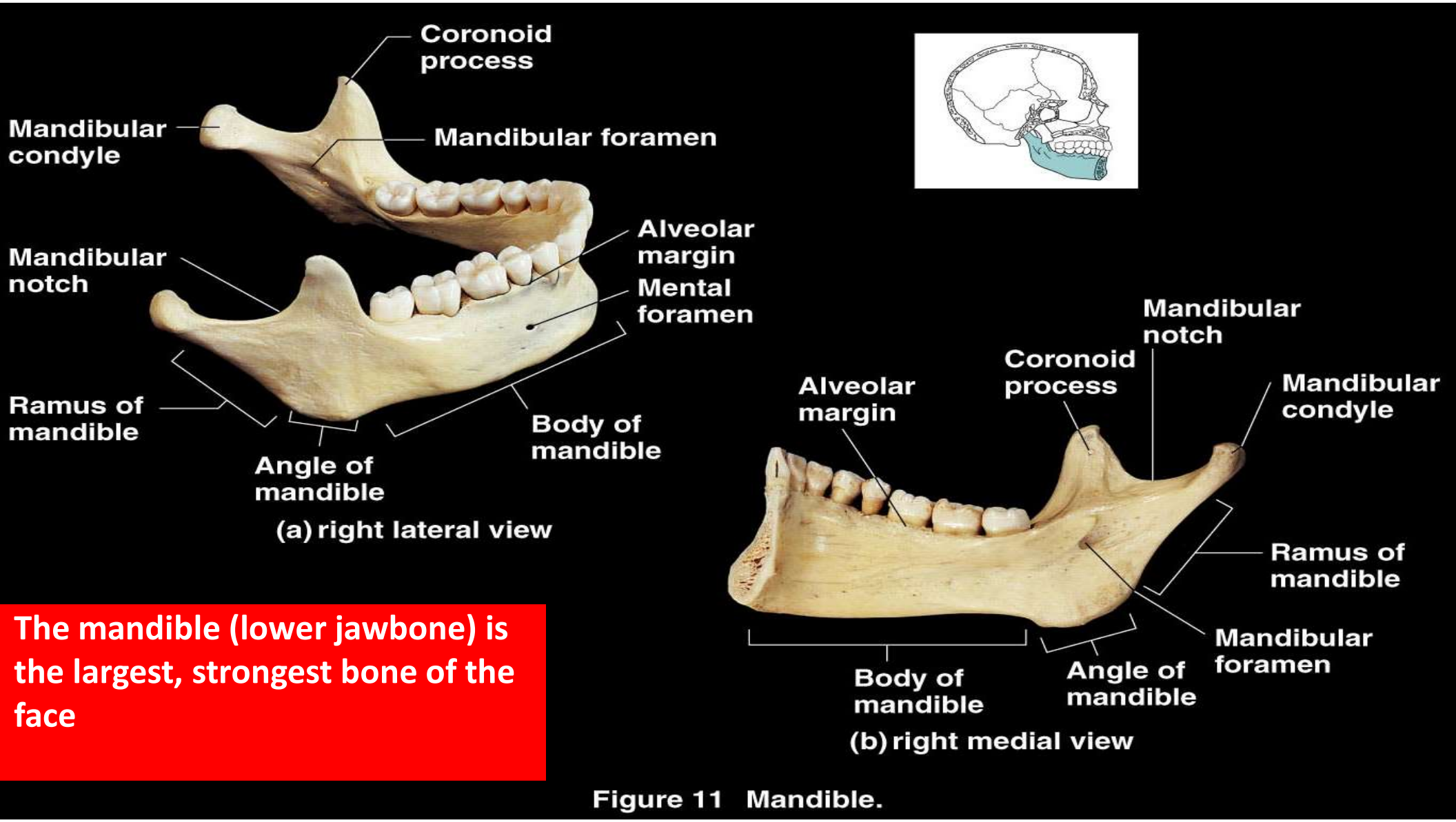


Figure 5 Skull, internal view of base.

Skull, superior view of floor of cranial cavity





The mandible (lower jawbone) is the largest, strongest bone of the face

Figure 11 Mandible.

The palatine articulates with six bones: the sphenoid, ethmoid, maxilla, inferior nasal concha, vomer and opposite palatine

Hard Palate
Maxillae (palatine processes)
Palatines
Transverse palatine suture
Anterior Palatine Foramen (incisive fossa)

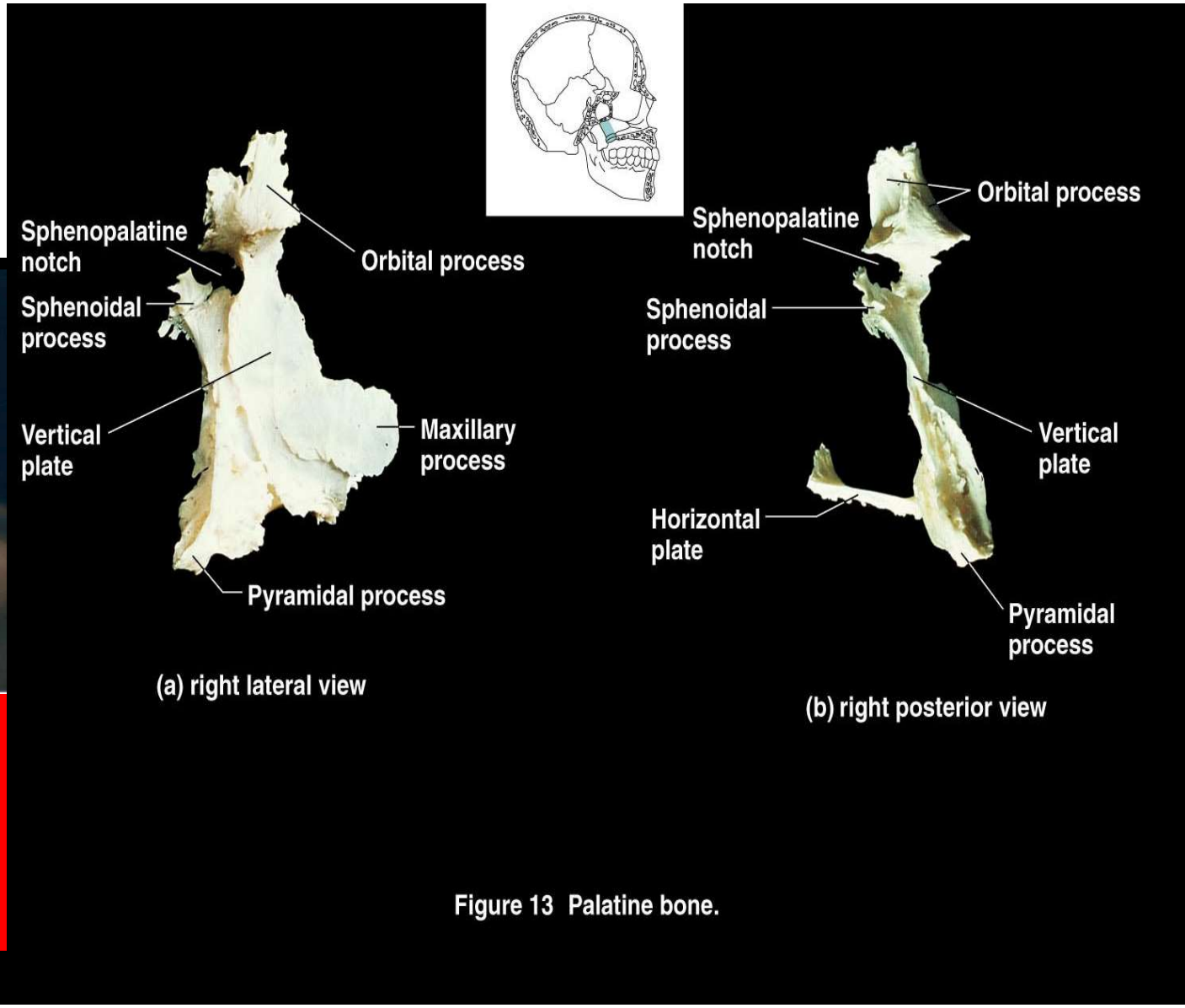
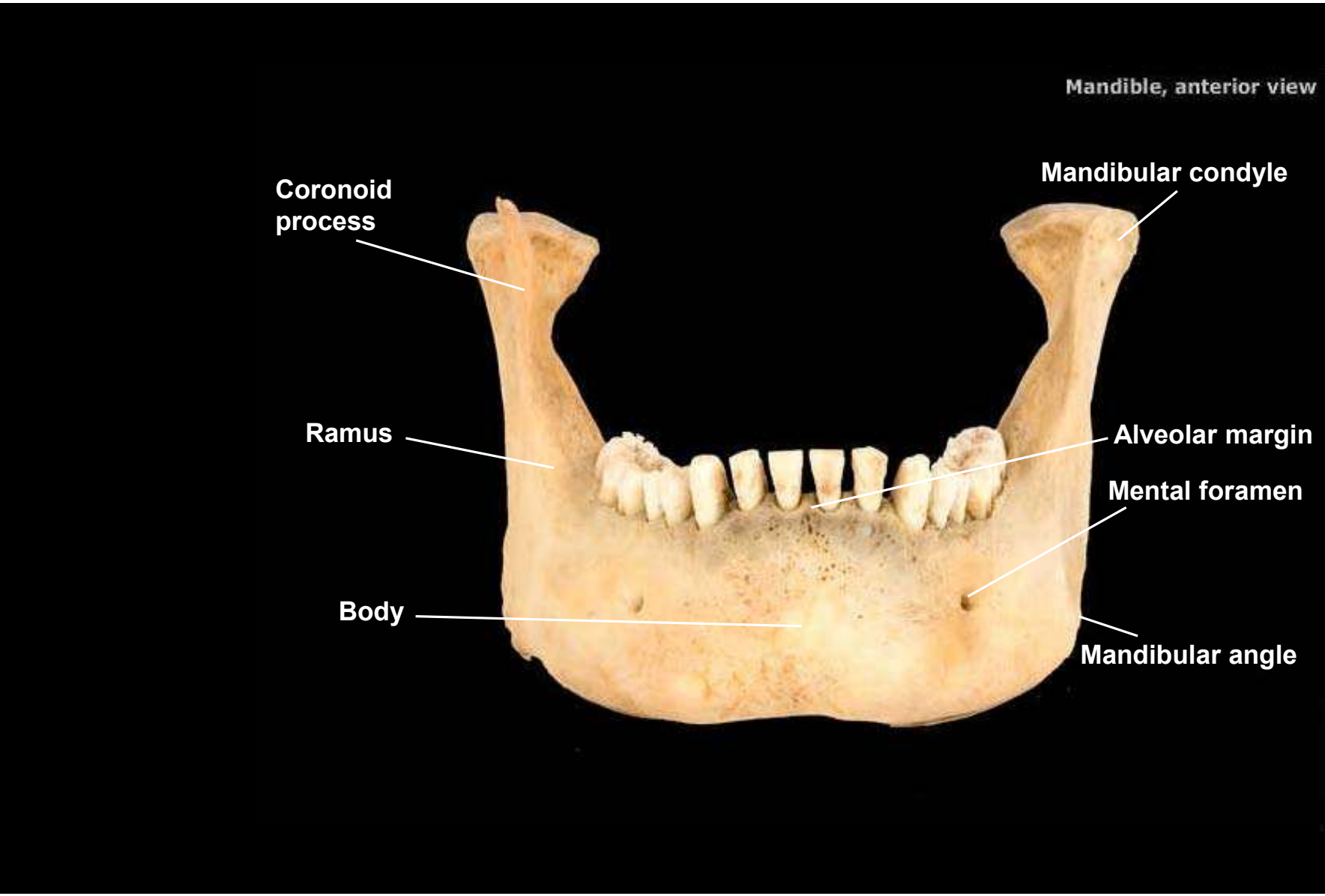
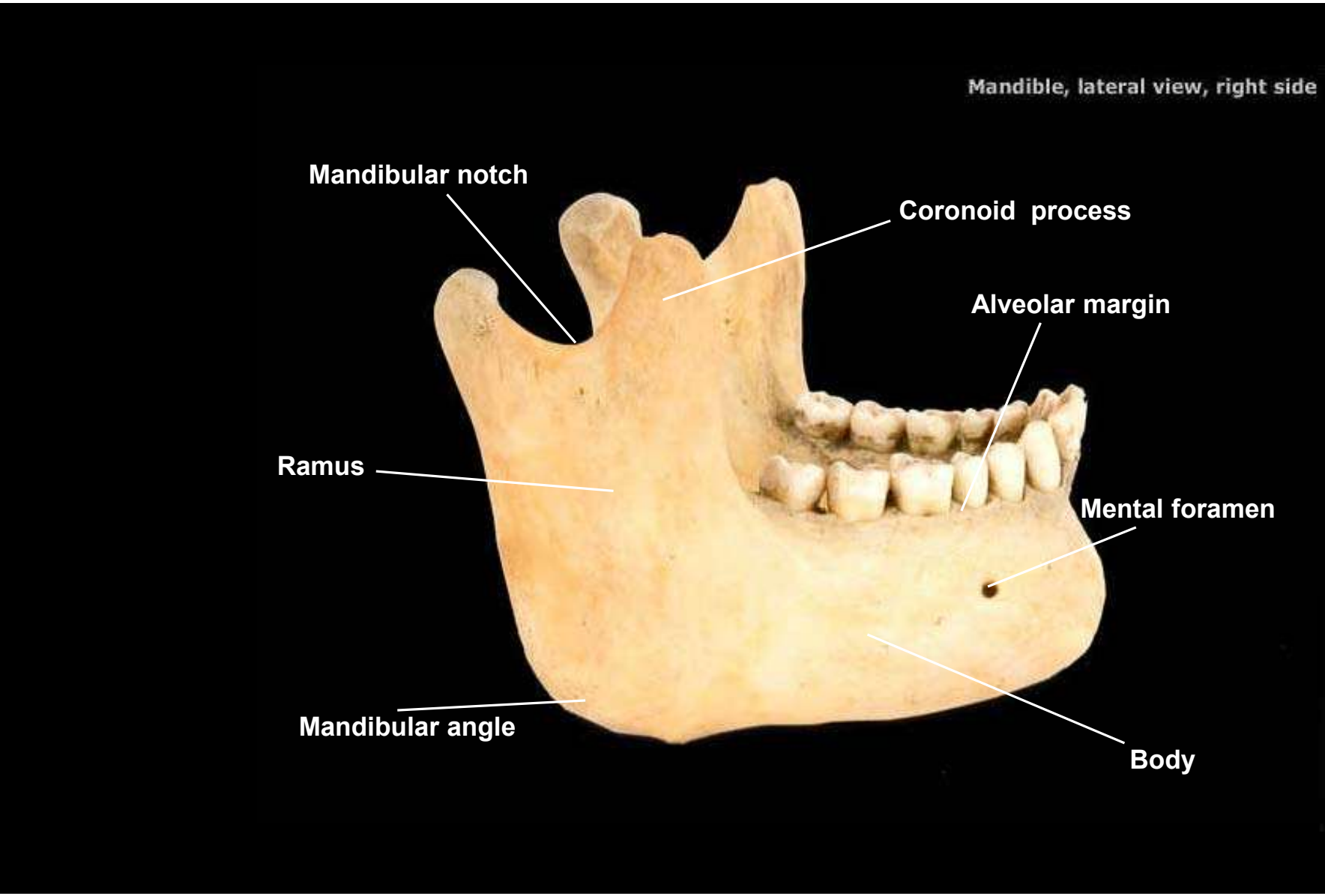
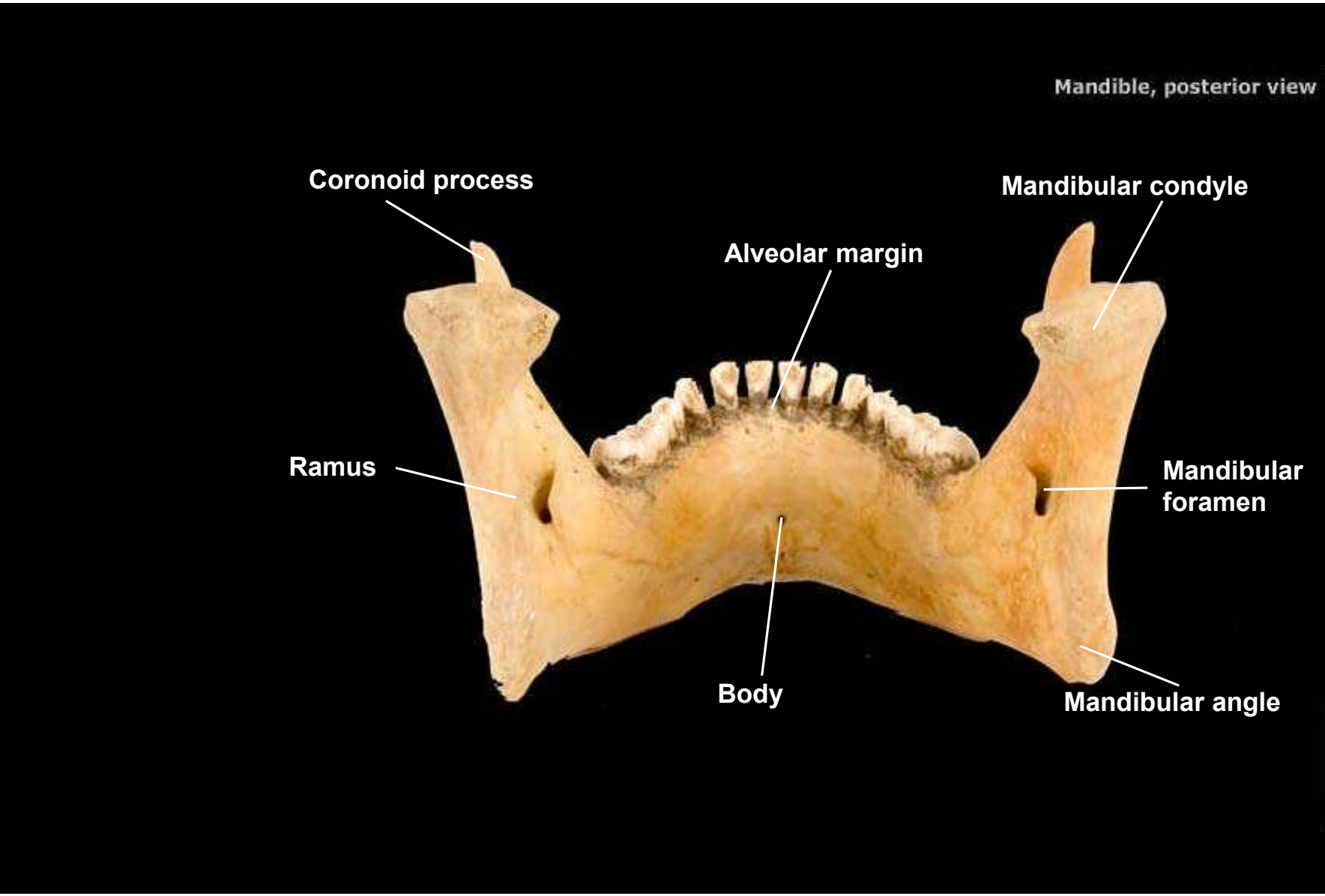


Figure 13 Palatine bone.


Mandible, anterior view
Coronoid process
Mandibular condyle
Ramus
Alveolar margin
Mental foramen
Body
Mandibular angle


Mandible, lateral view, right side
Mandibular notch
Coronoid process
Alveolar margin
Ramus
Mental foramen
Mandibular angle
Body


Mandible, posterior view
Coronoid process
Mandibular condyle
Alveolar margin
Ramus
Mandibular foramen
Body
Mandibular angle

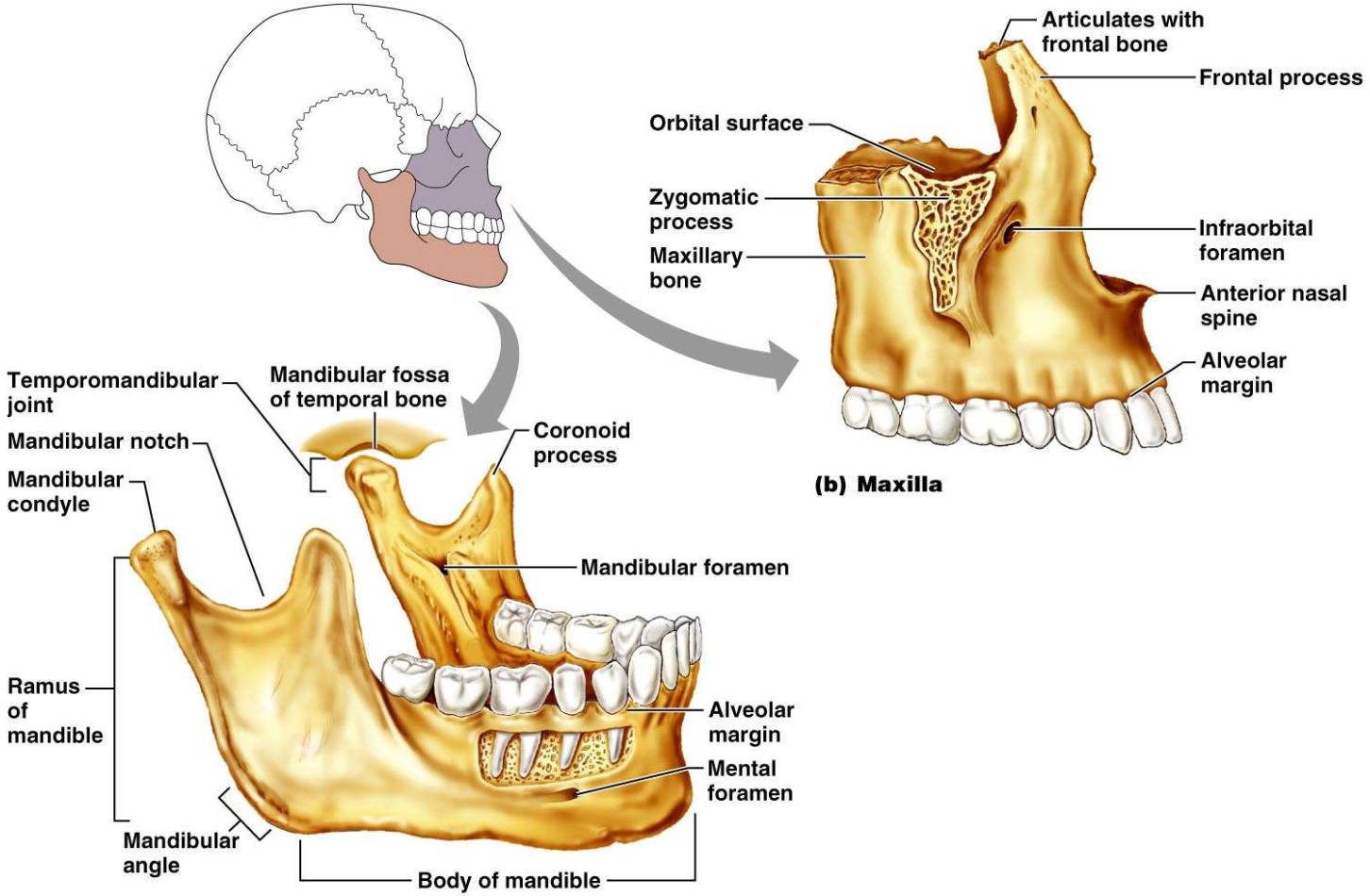
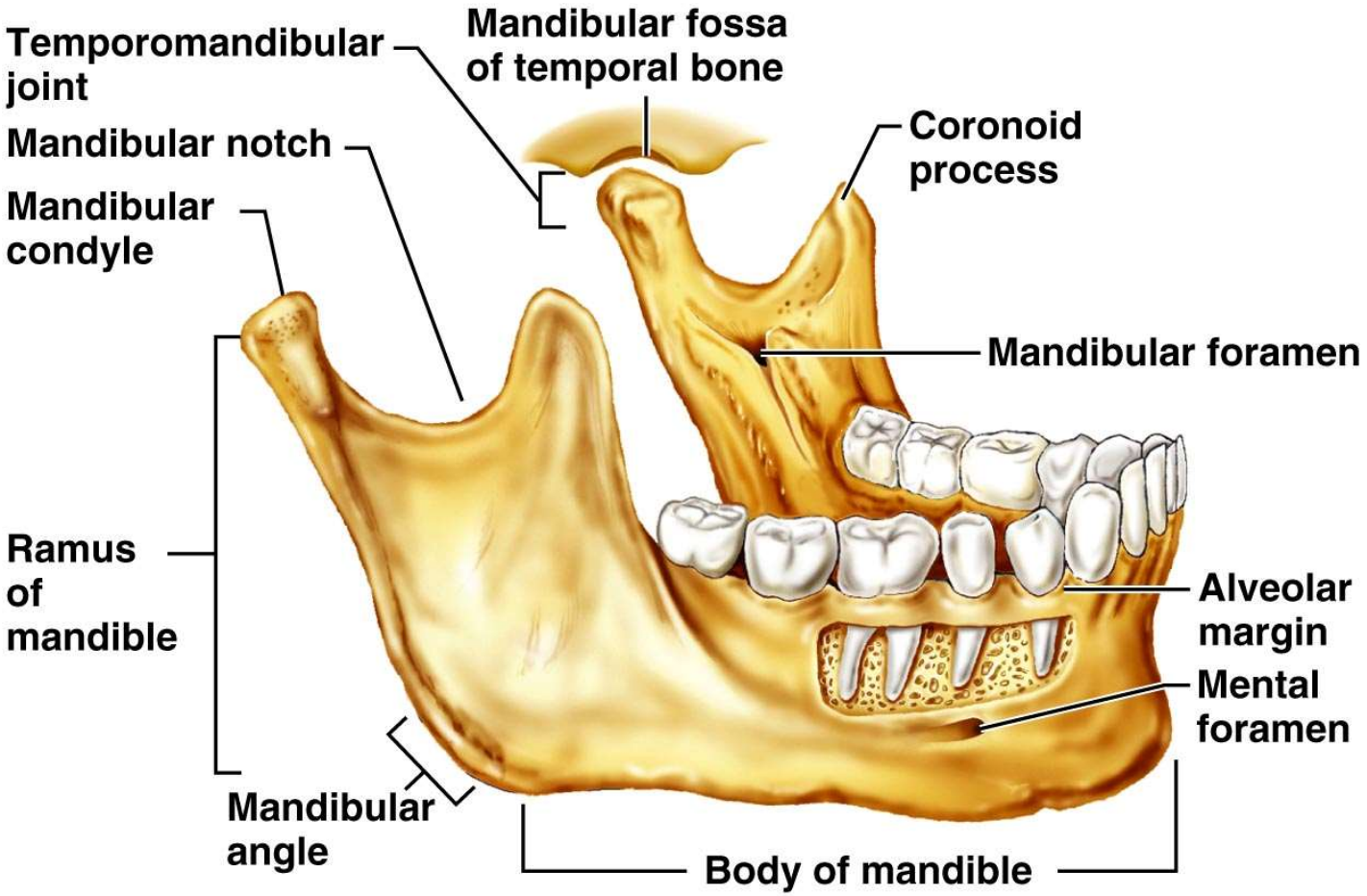
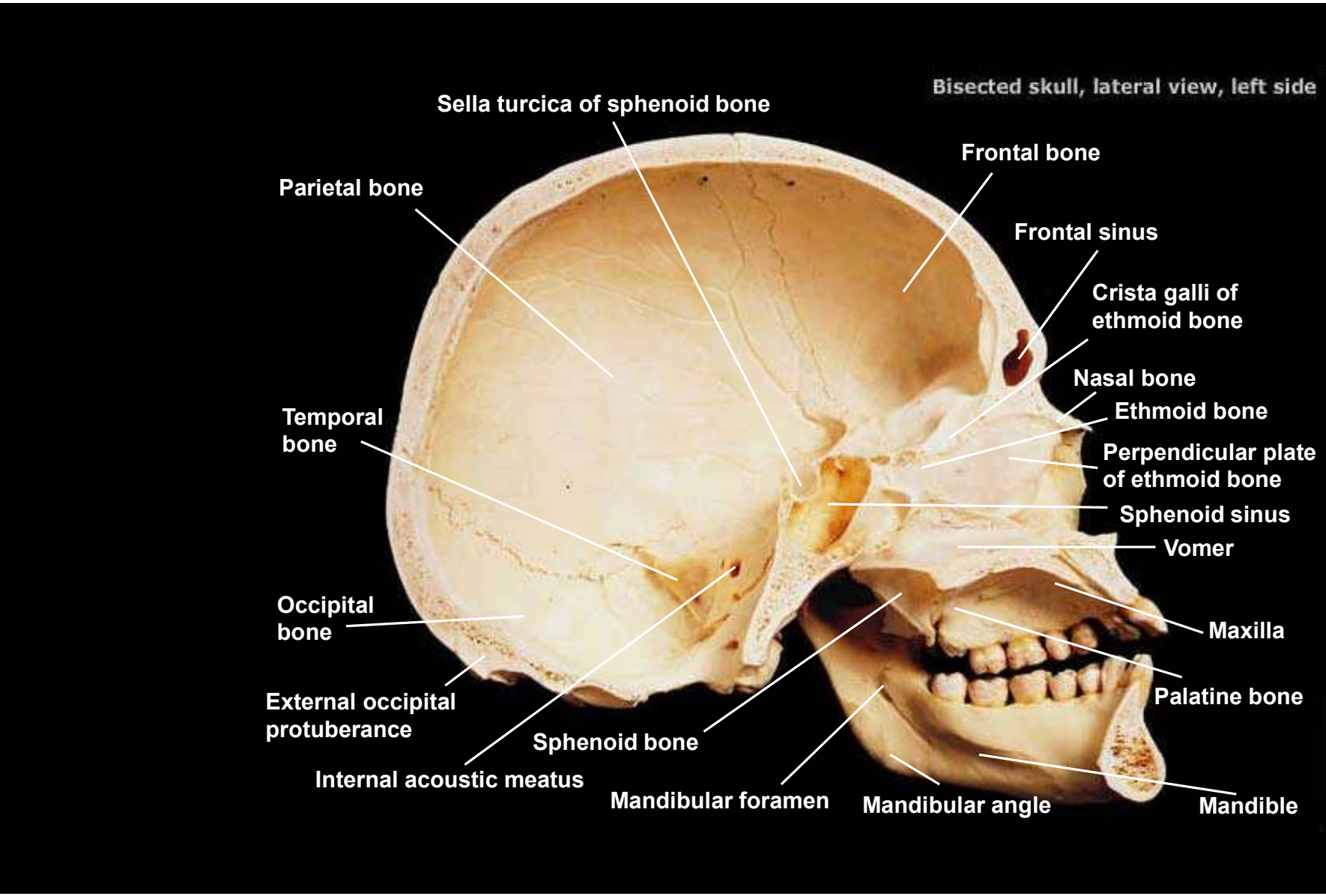


Figure 7.8



(a) Mandible

Figure 7.8a


Bisected skull, lateral view, left side
Sella turcica of sphenoid bone
Frontal bone
Parietal bone
Frontal sinus
Crista galli of ethmoid bone
Nasal bone
Ethmoid bone
Temporal bone
Perpendicular plate of ethmoid bone
Sphenoid sinus
Vomer
Occipital bone
Maxilla
Palatine bone
External occipital protuberance
Sphenoid bone
Internal acoustic meatus
Mandibular foramen
Mandibular angle
Mandible

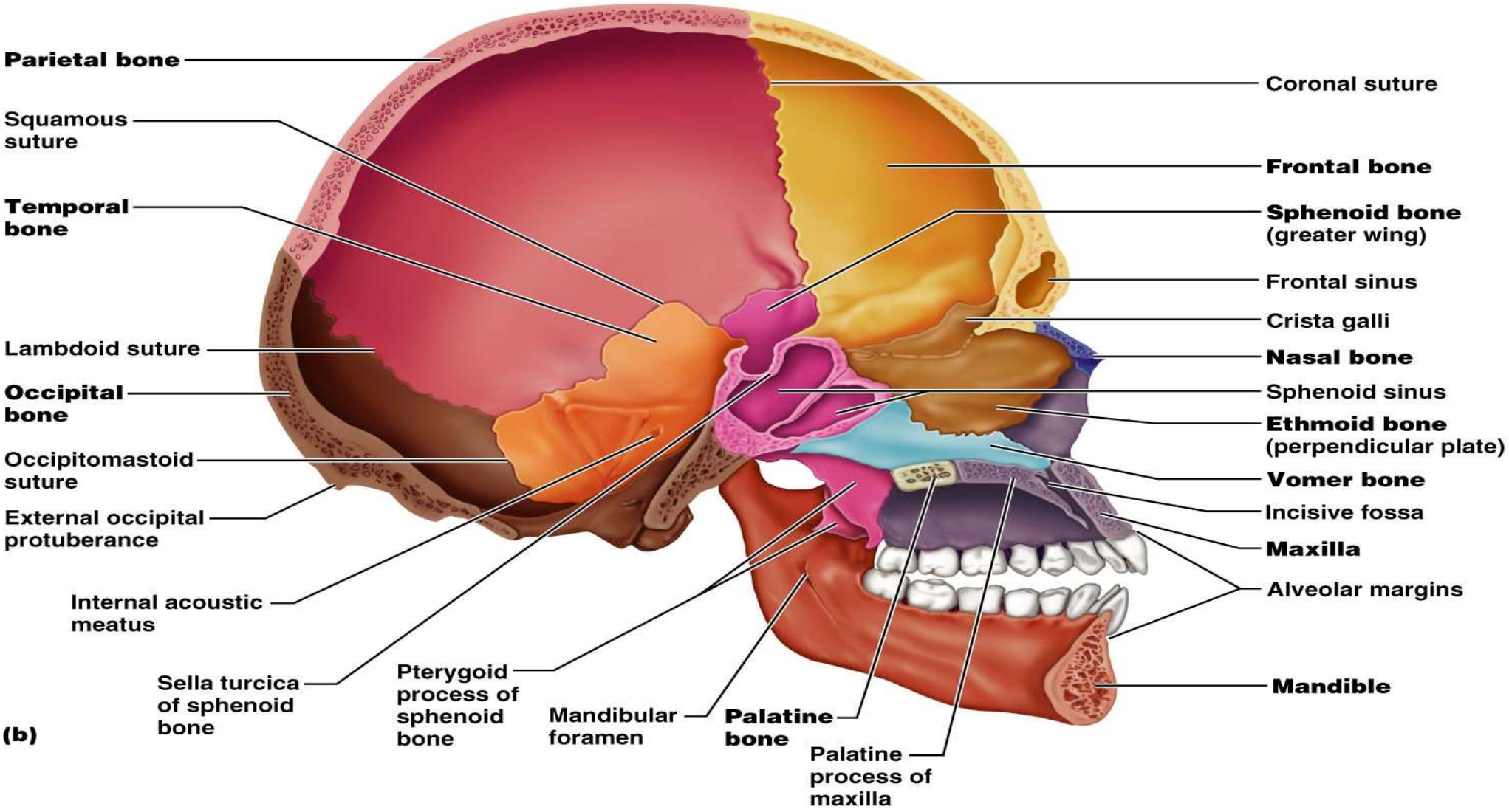
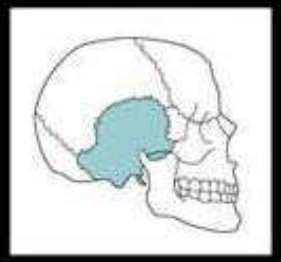
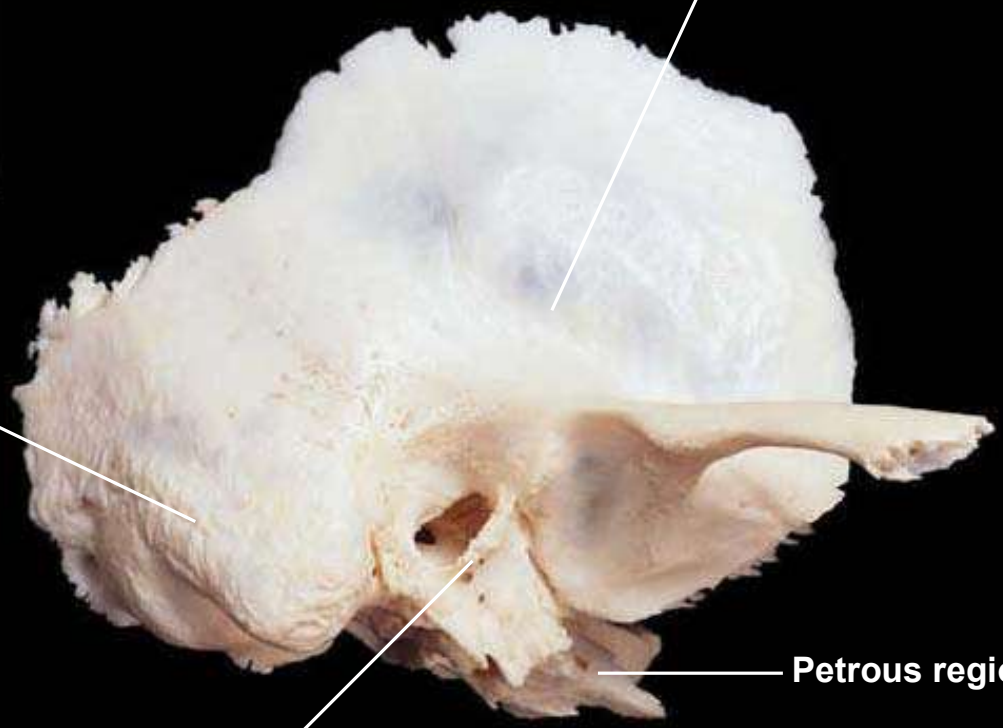


Figure 7.3b

Temporal, lateral view, right side



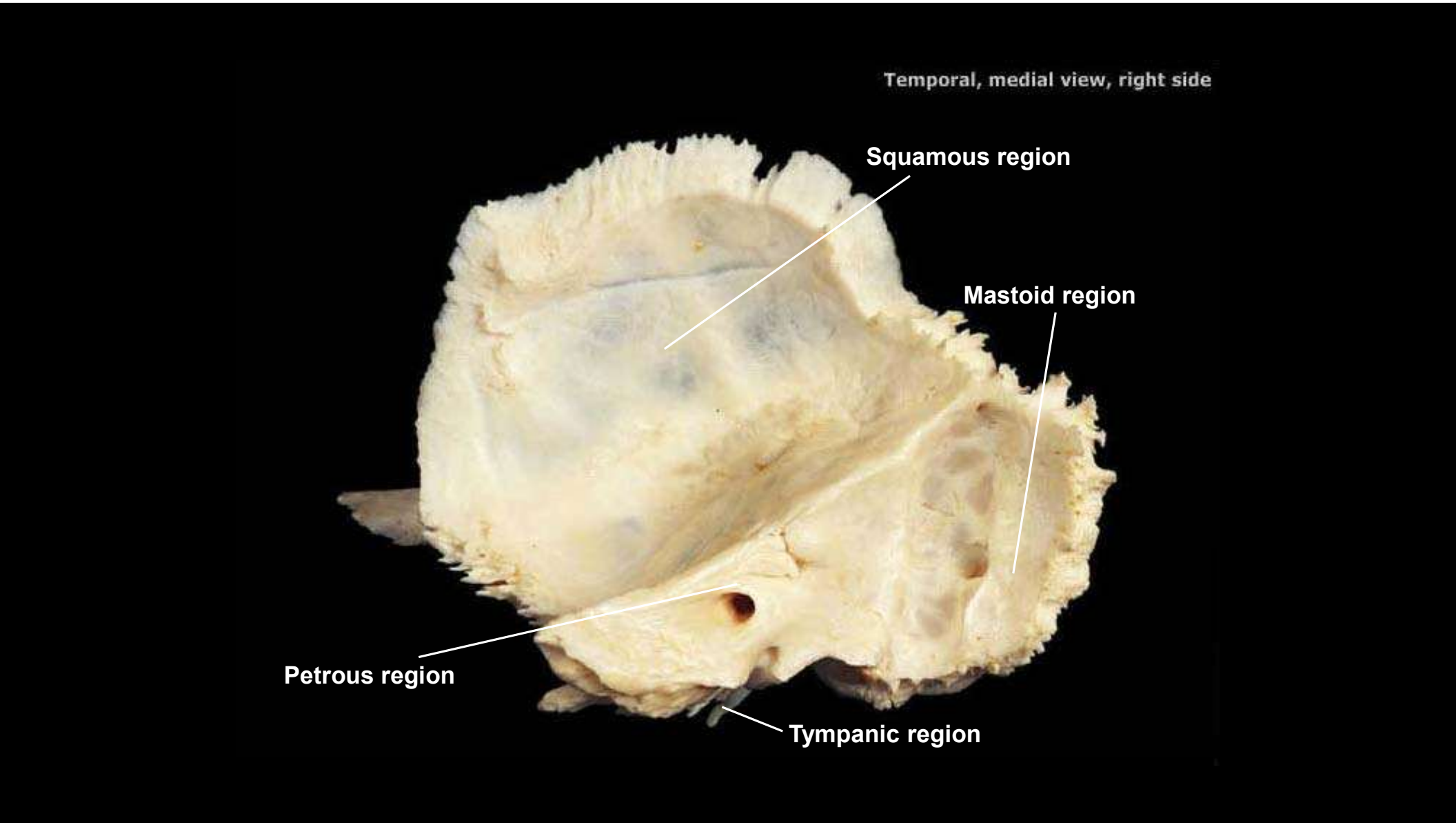


Squamous region

Mastoid region

Petrous region

Tympanic region


Temporal, medial view, right side
Squamous region
Mastoid region
Petrous region
Tympanic region

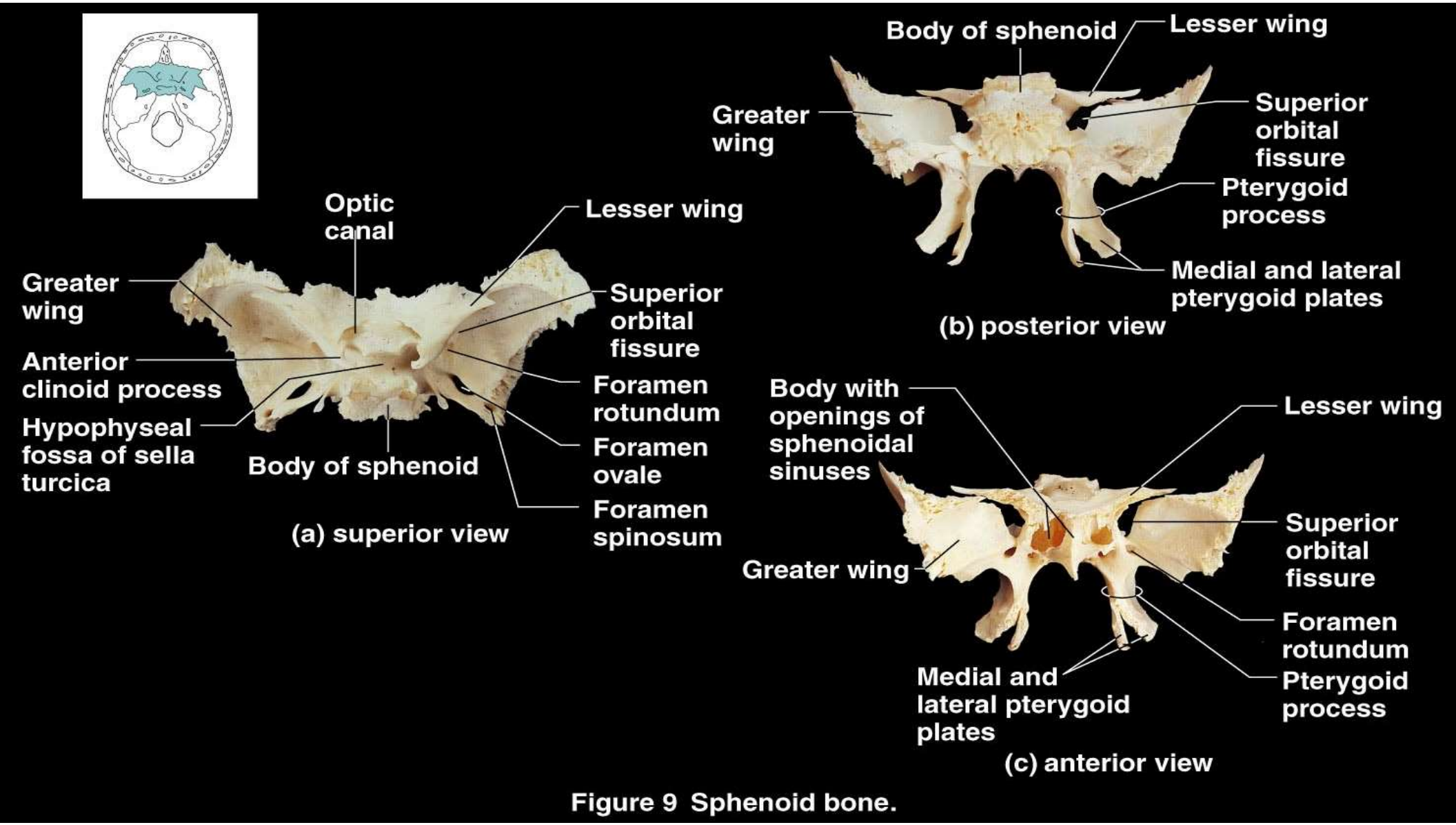
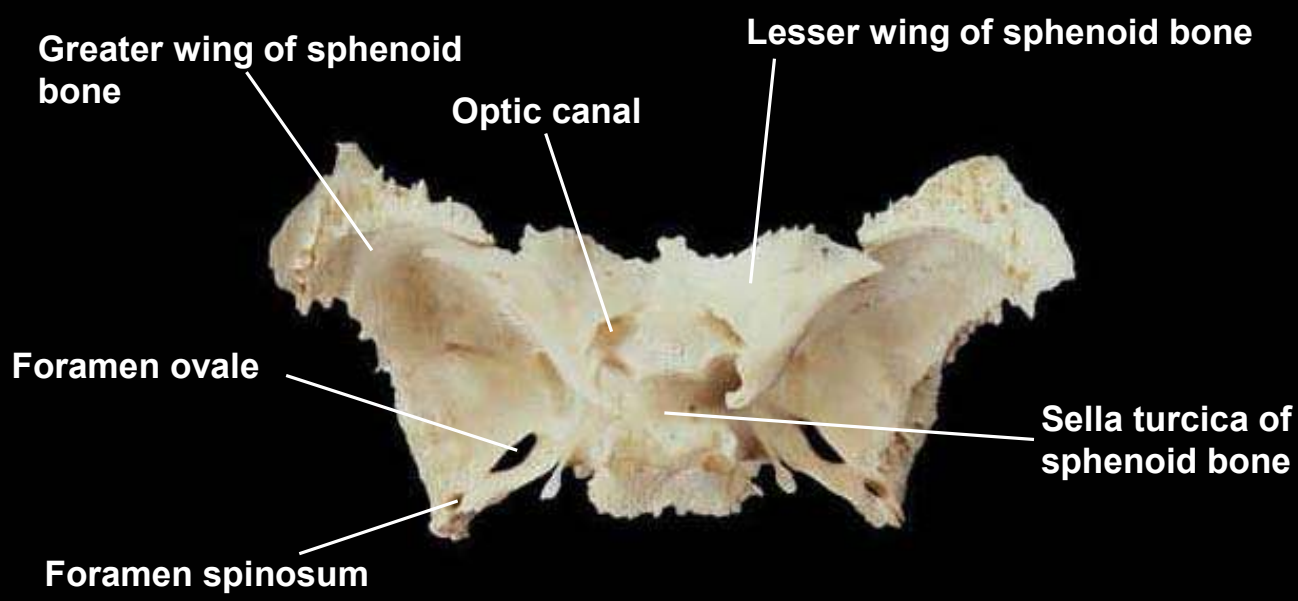
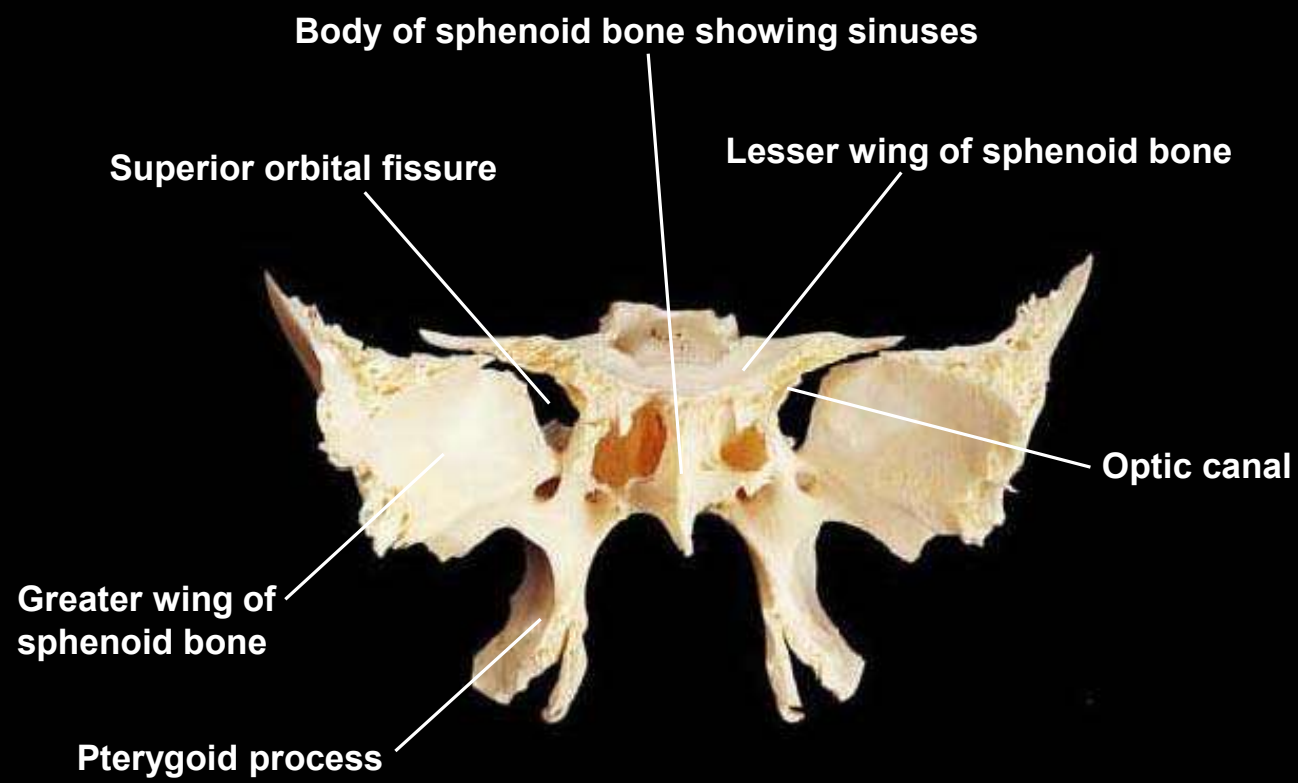


Figure 9 Sphenoid bone.

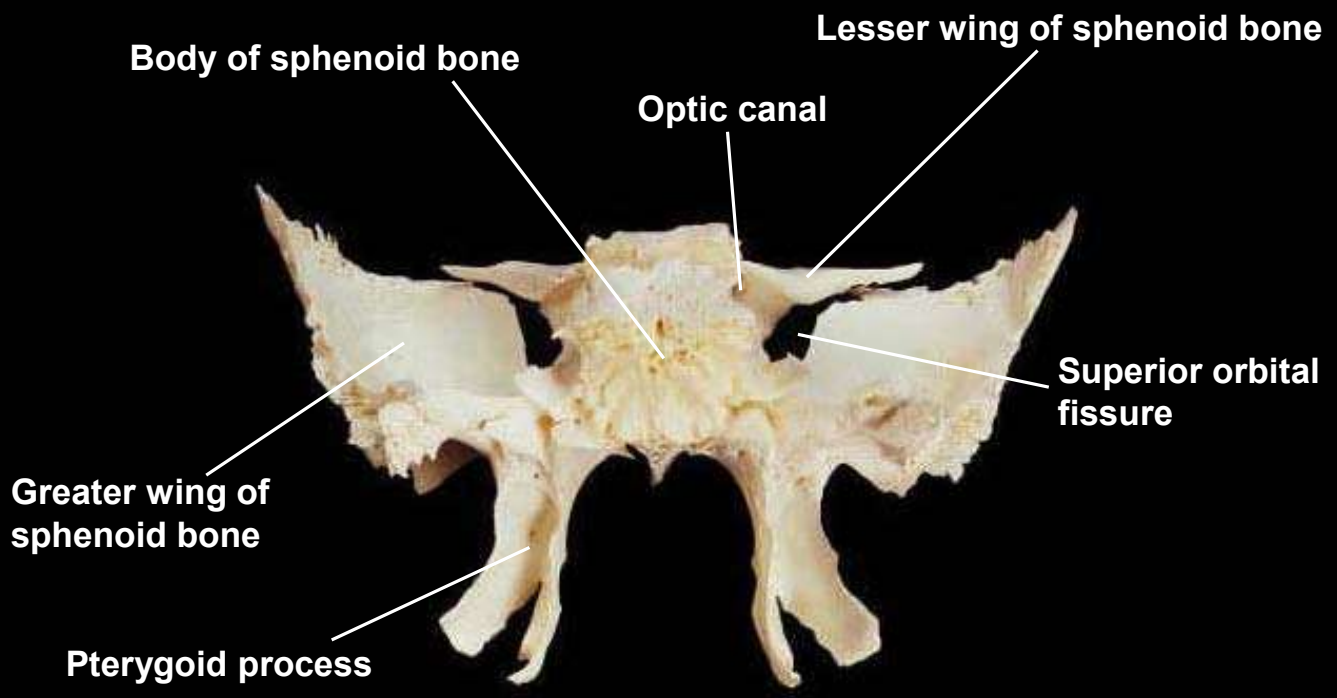
Sphenoid, superior view

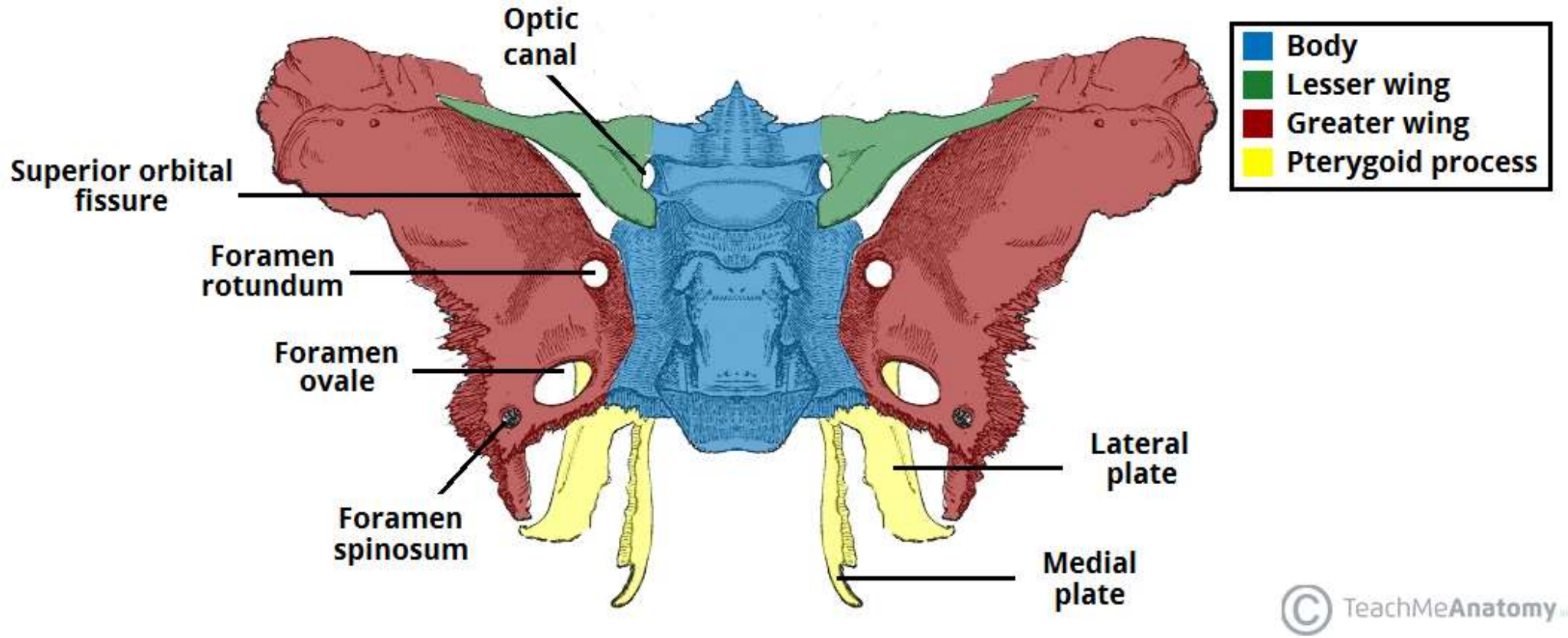


Sphenoid, anterior view

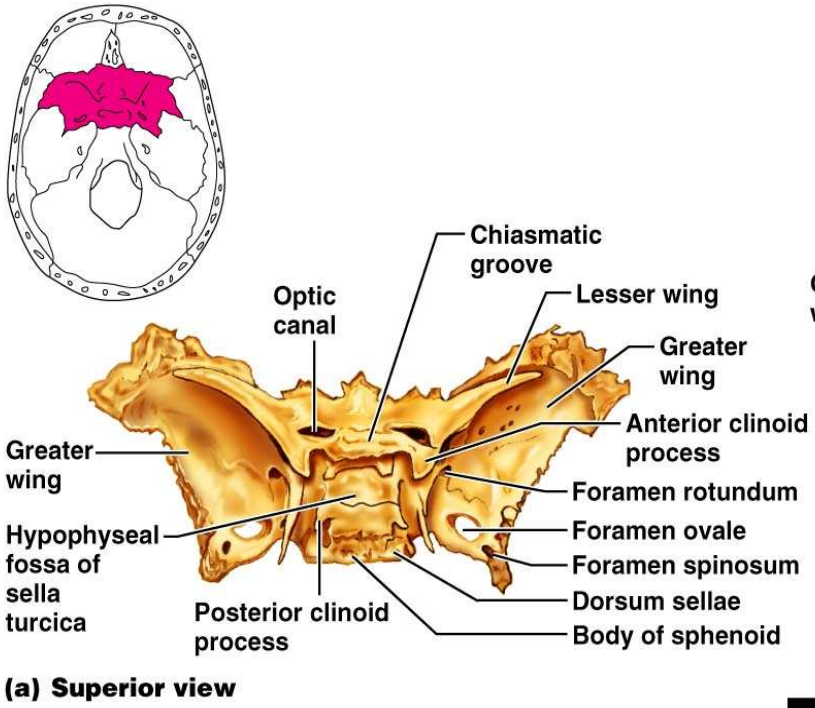


Sphenoid, posterior view

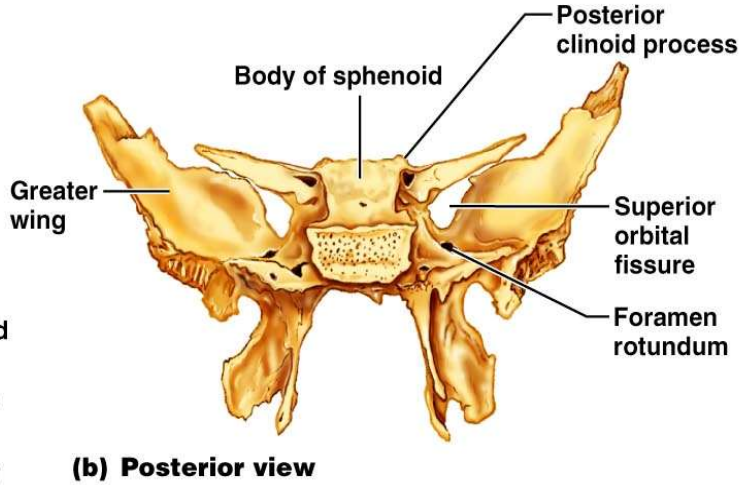




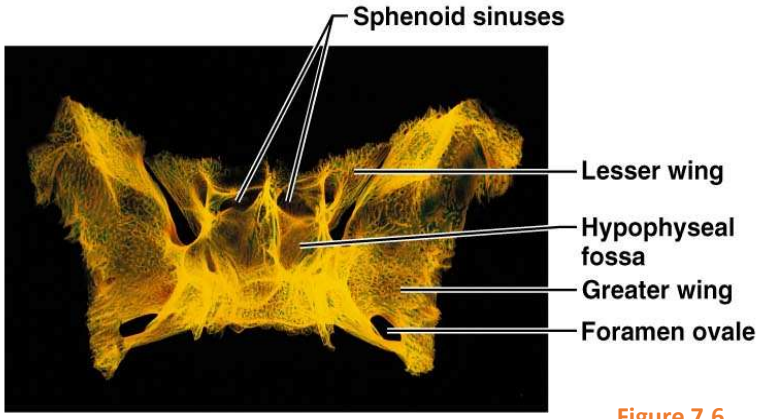
The sphenoid forms part of the eye orbit and helps to form the floor of the cranium.



(a) Superior view

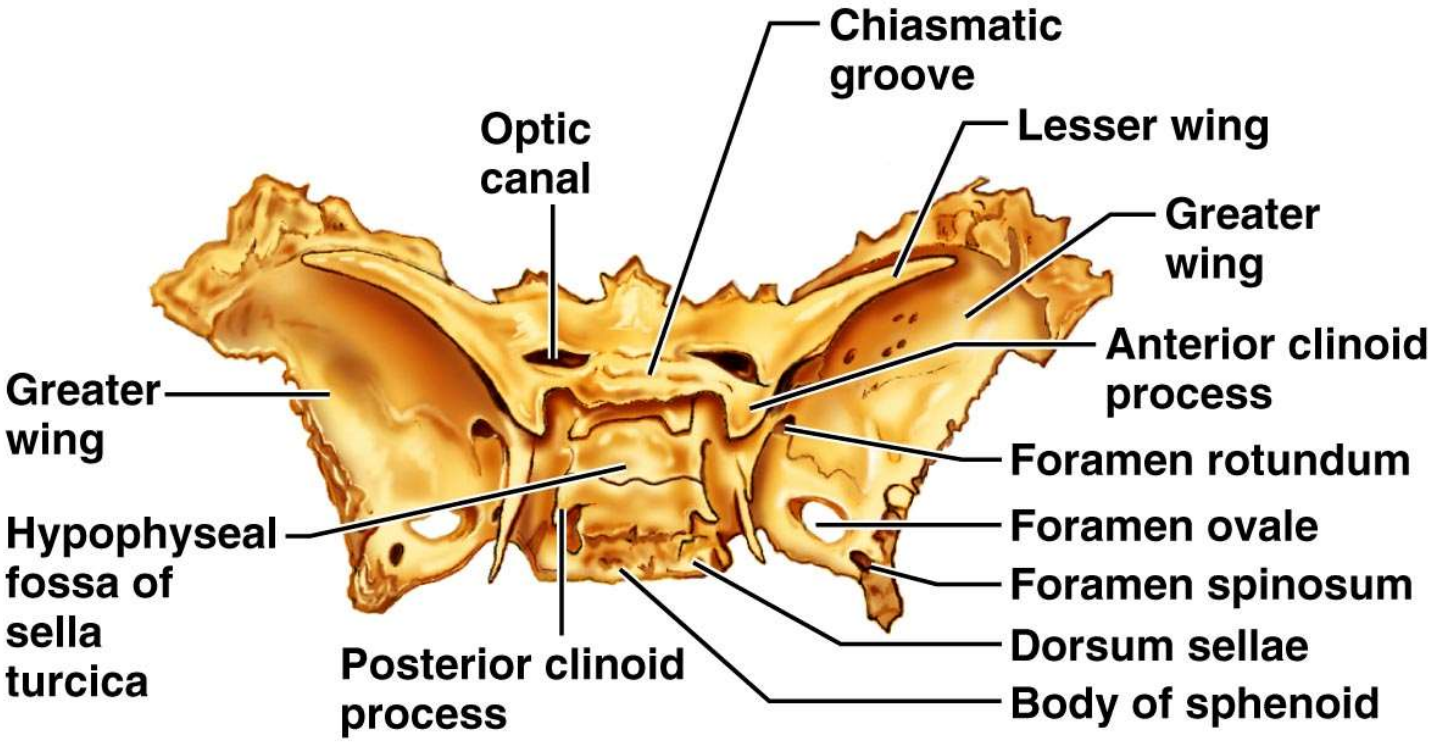


(b) Posterior view



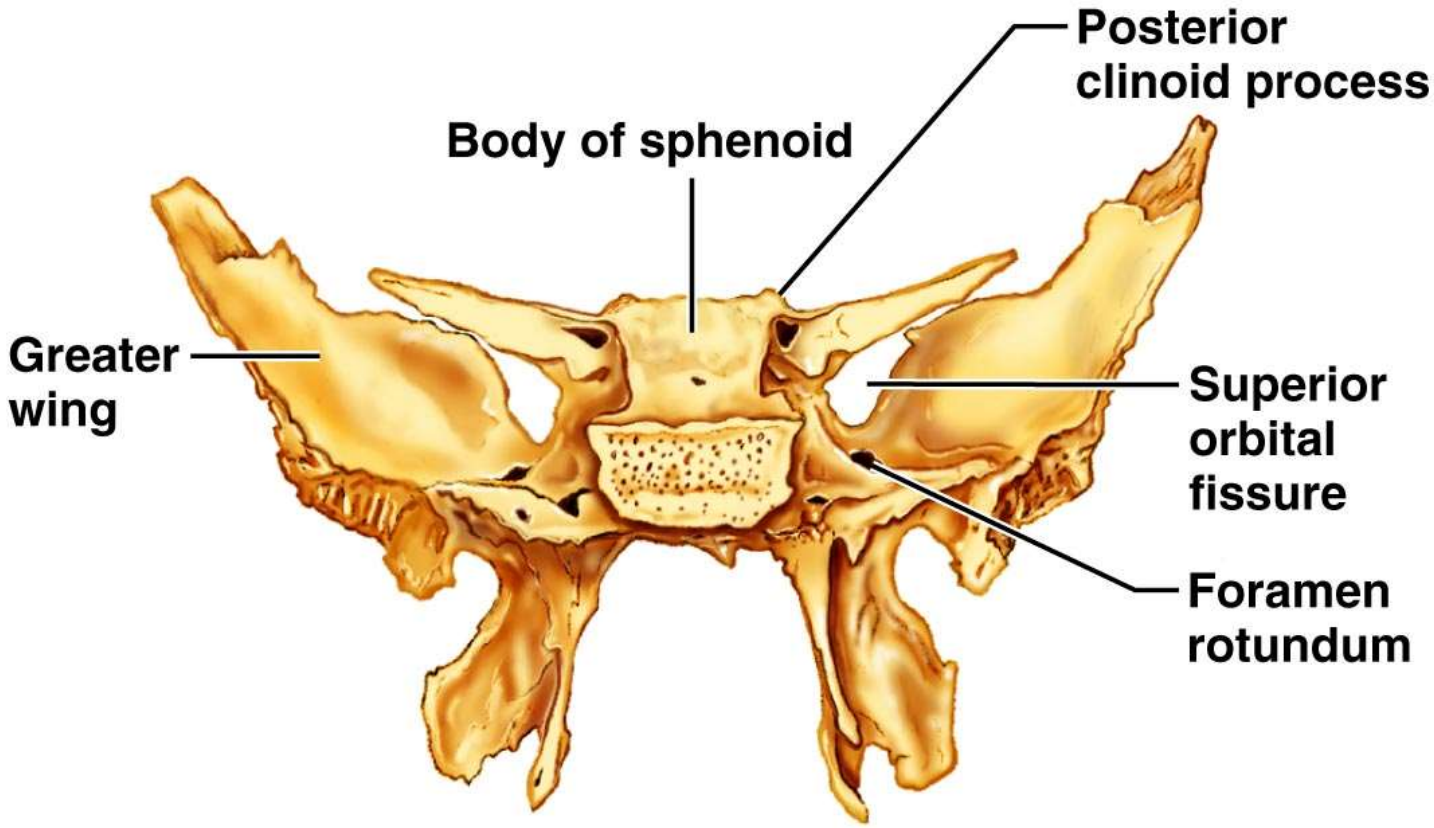
(c)

Figure 7.6



(a) Superior view

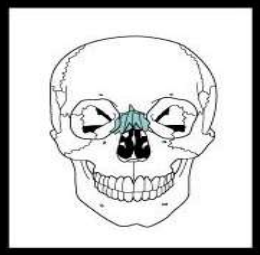
Figure 7.6a

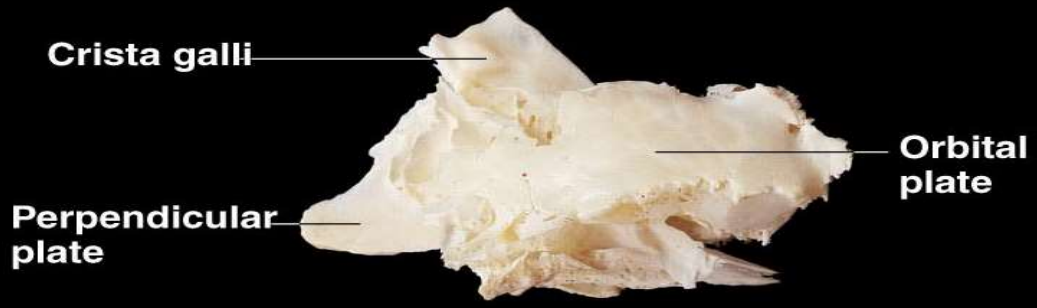


(b) Posterior view

Figure 7.6b

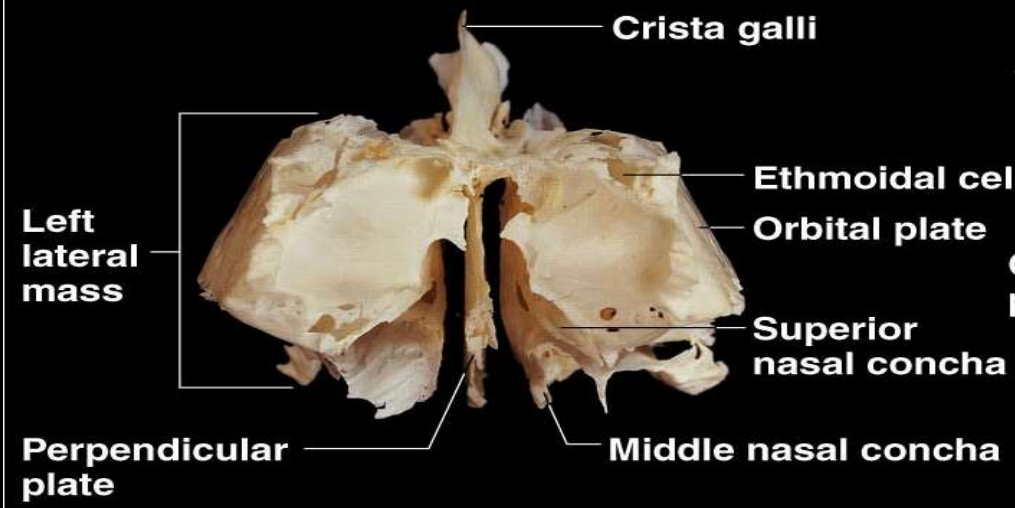
The ethmoid forms the medial portions of the orbits and the roof of the nasal cavity.



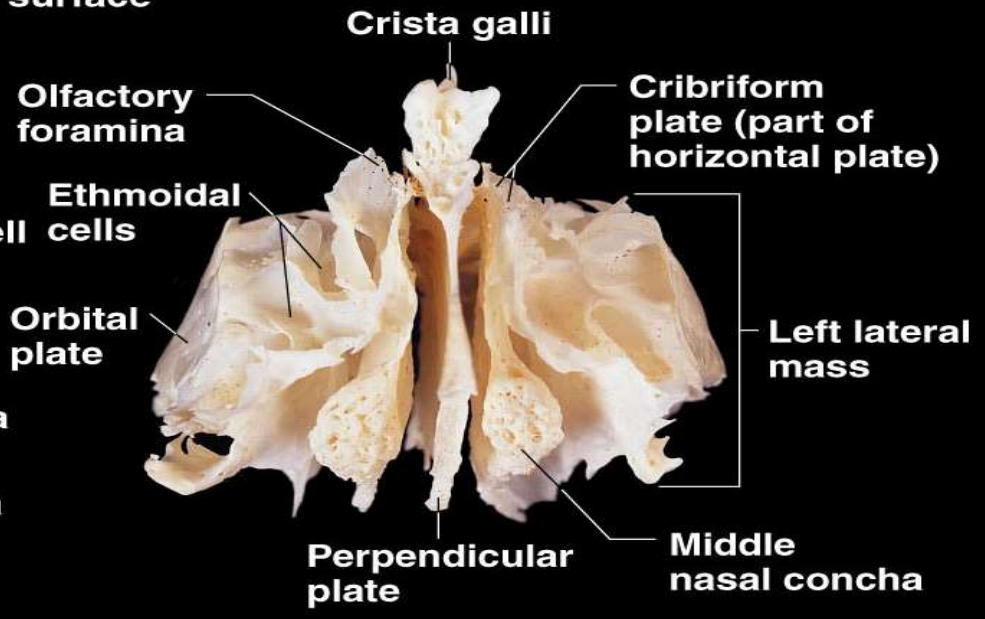


(a) left lateral surface

Major markings include the cribriform plate, crista galli, perpendicular plate, nasal conchae, and the ethmoid sinuses



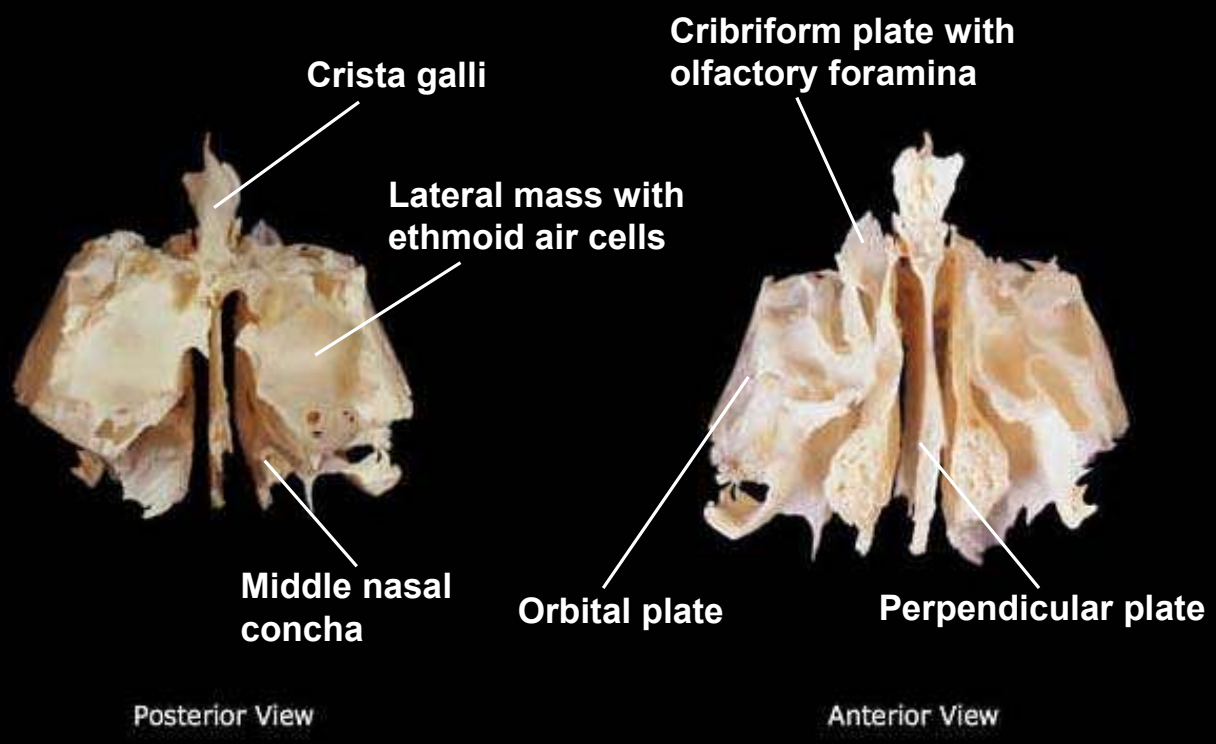
(b) posterior view



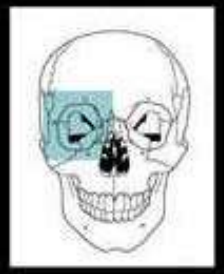
(c) anterior view

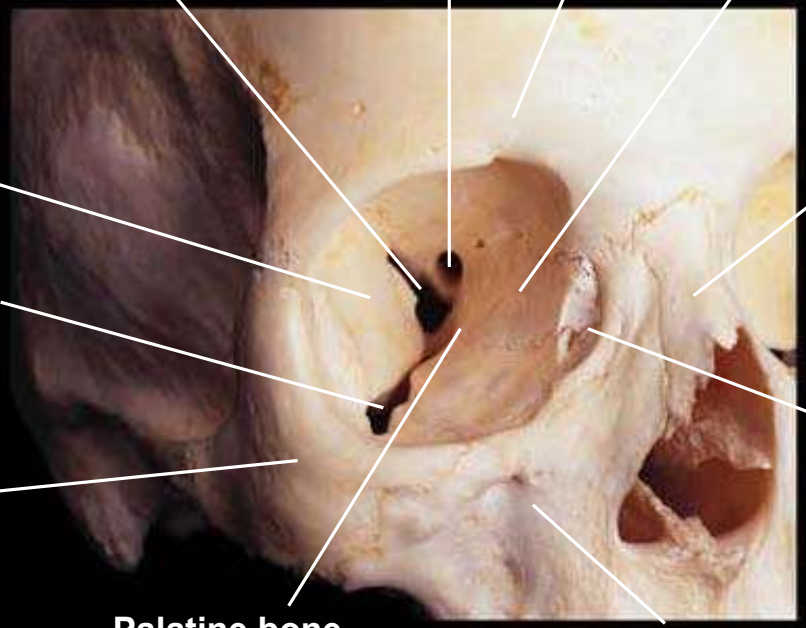
Figure 10 Ethmoid bone.

Ethmoid, posterior and anterior views



Bones of the orbit





Optic canal

Frontal bone

Superior orbital fissure

Ethmoid bone

Sphenoid bone

Nasal bone

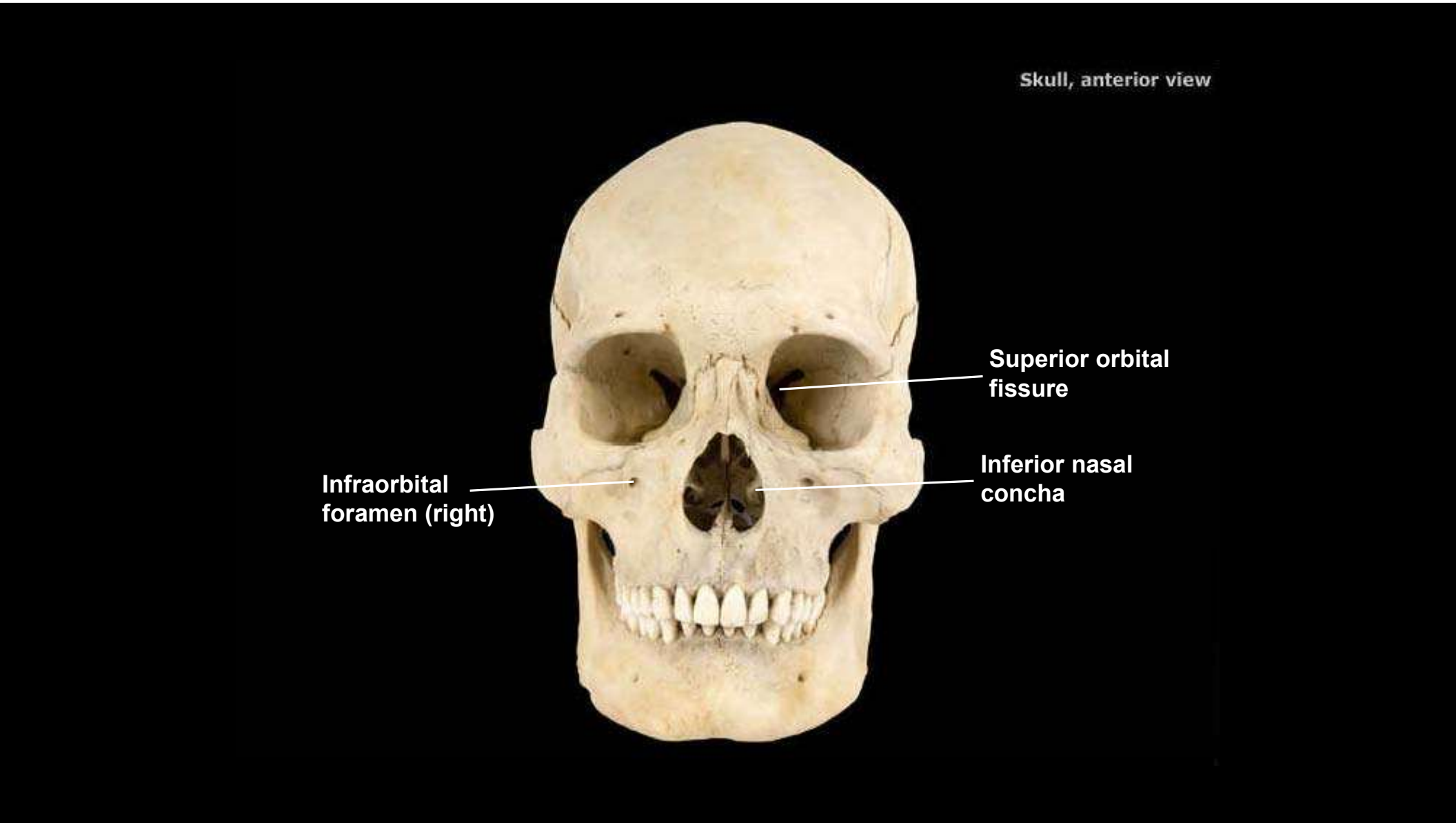
Inferior orbital fissure

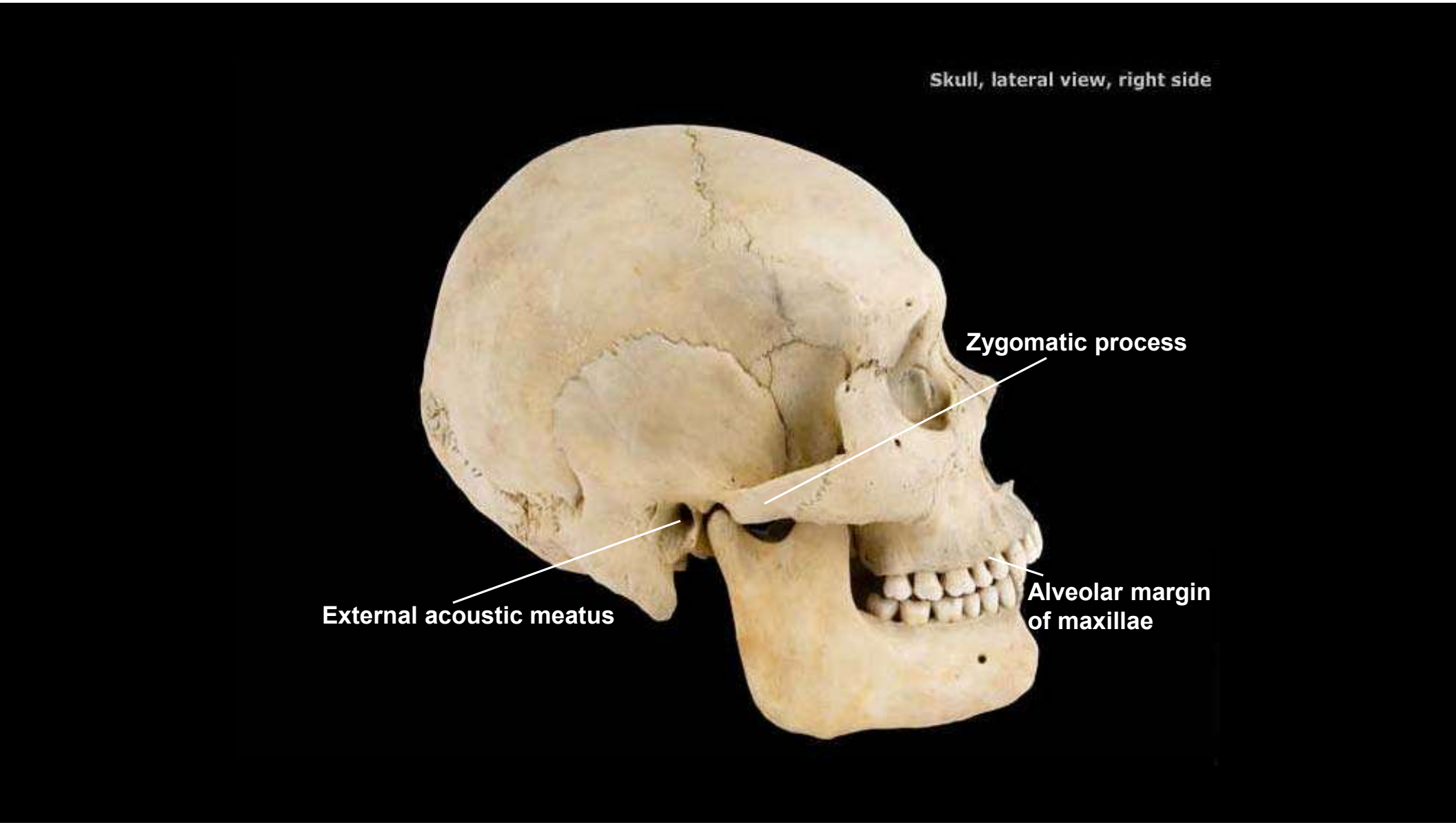
Lacrimal bone

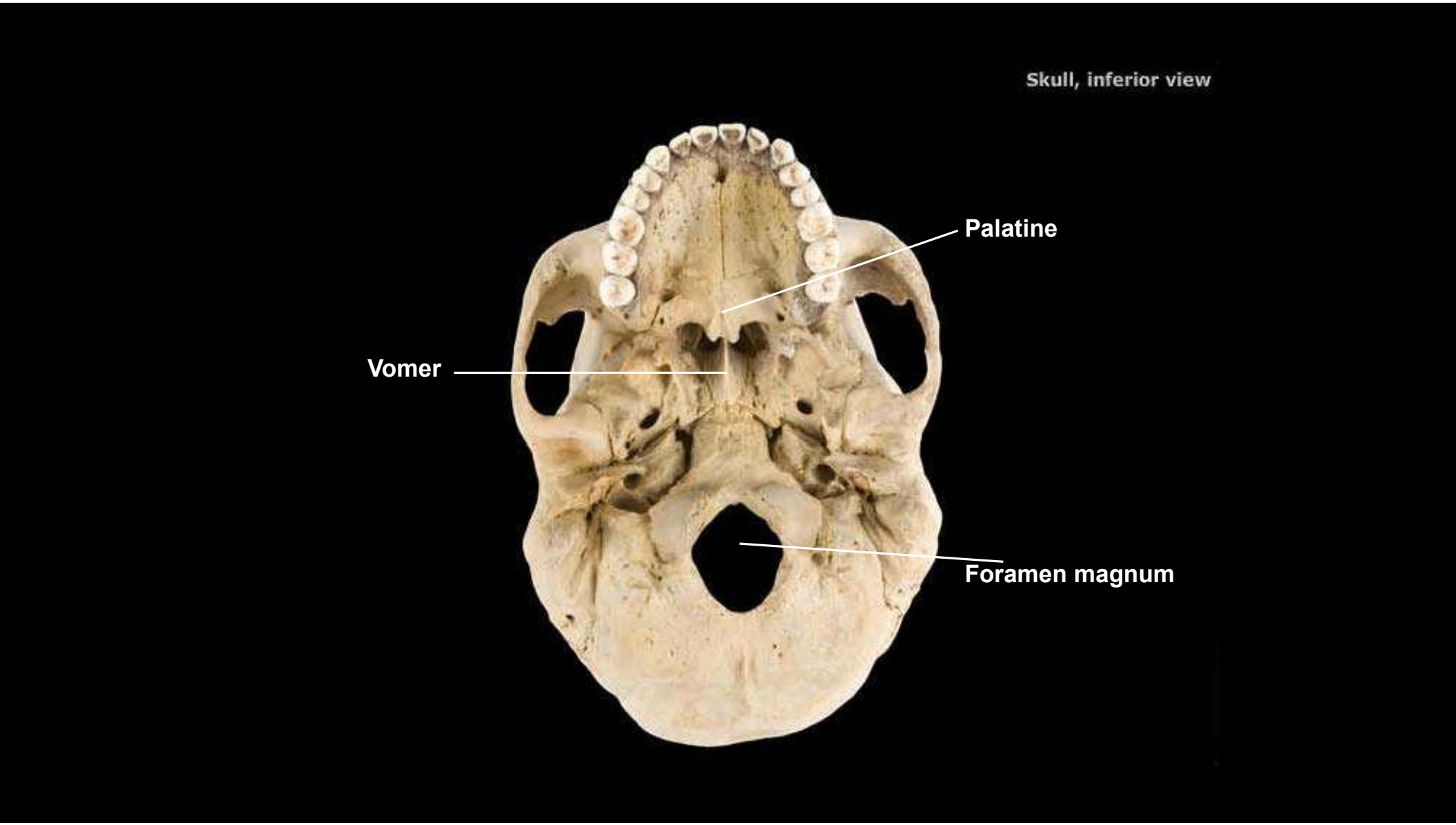
Zygomatic bone

Palatine bone

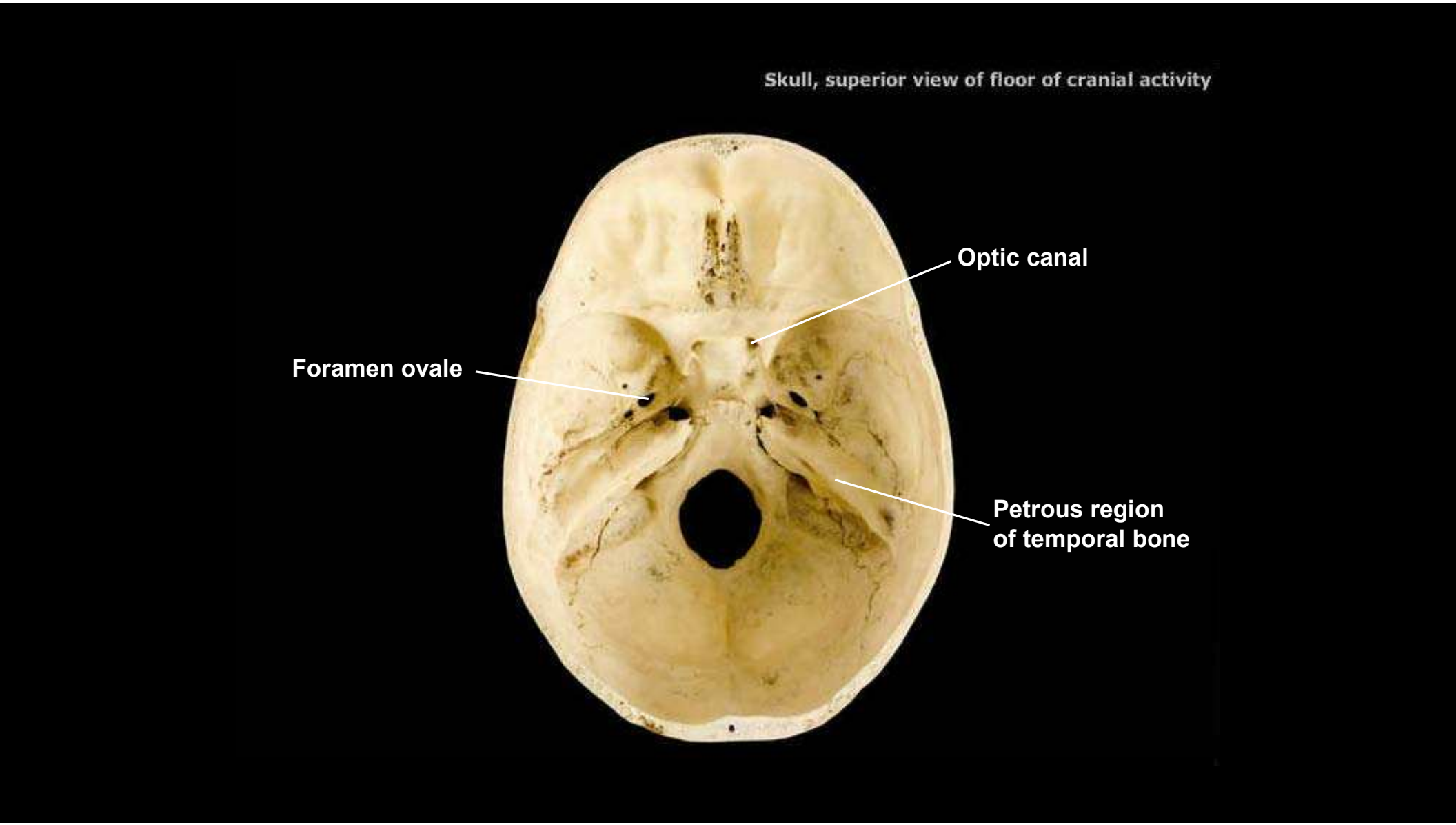
Maxilla

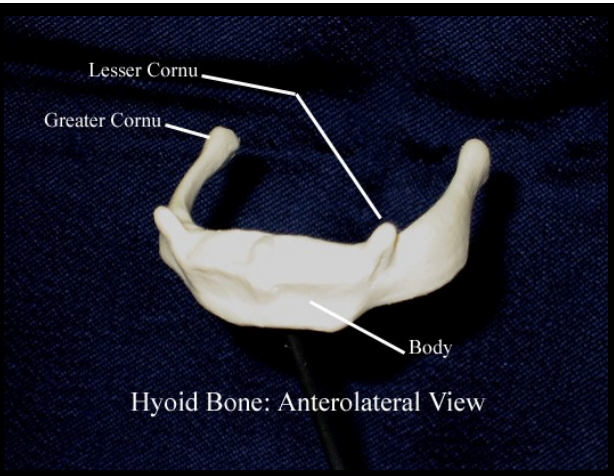

Skull, anterior view
Superior orbital fissure
Inferior nasal concha
Infraorbital foramen (right)

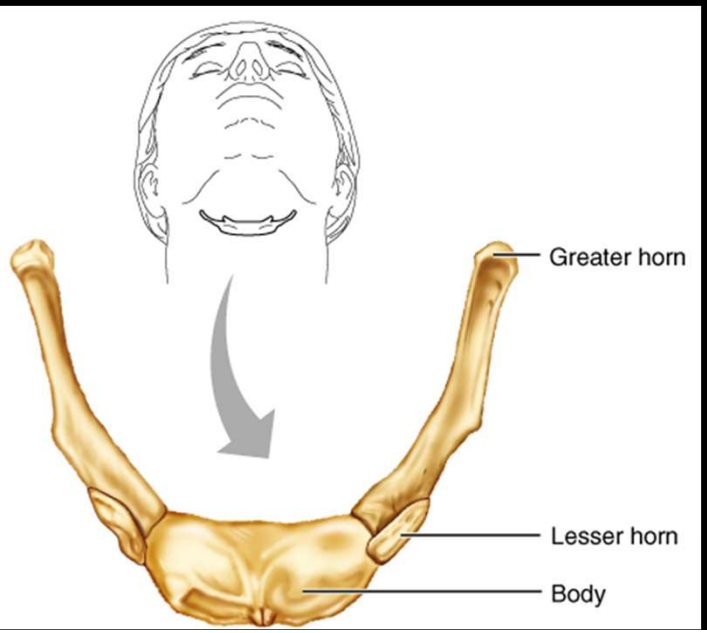

Skull, lateral view, right side
Zygomatic process
External acoustic meatus
Alveolar margin
of maxillae


Skull, inferior view
Palatine
Vomer
Foramen magnum

Skull, superior view of floor of cranial activity







Hyoid, superior view

Greater horn

Body

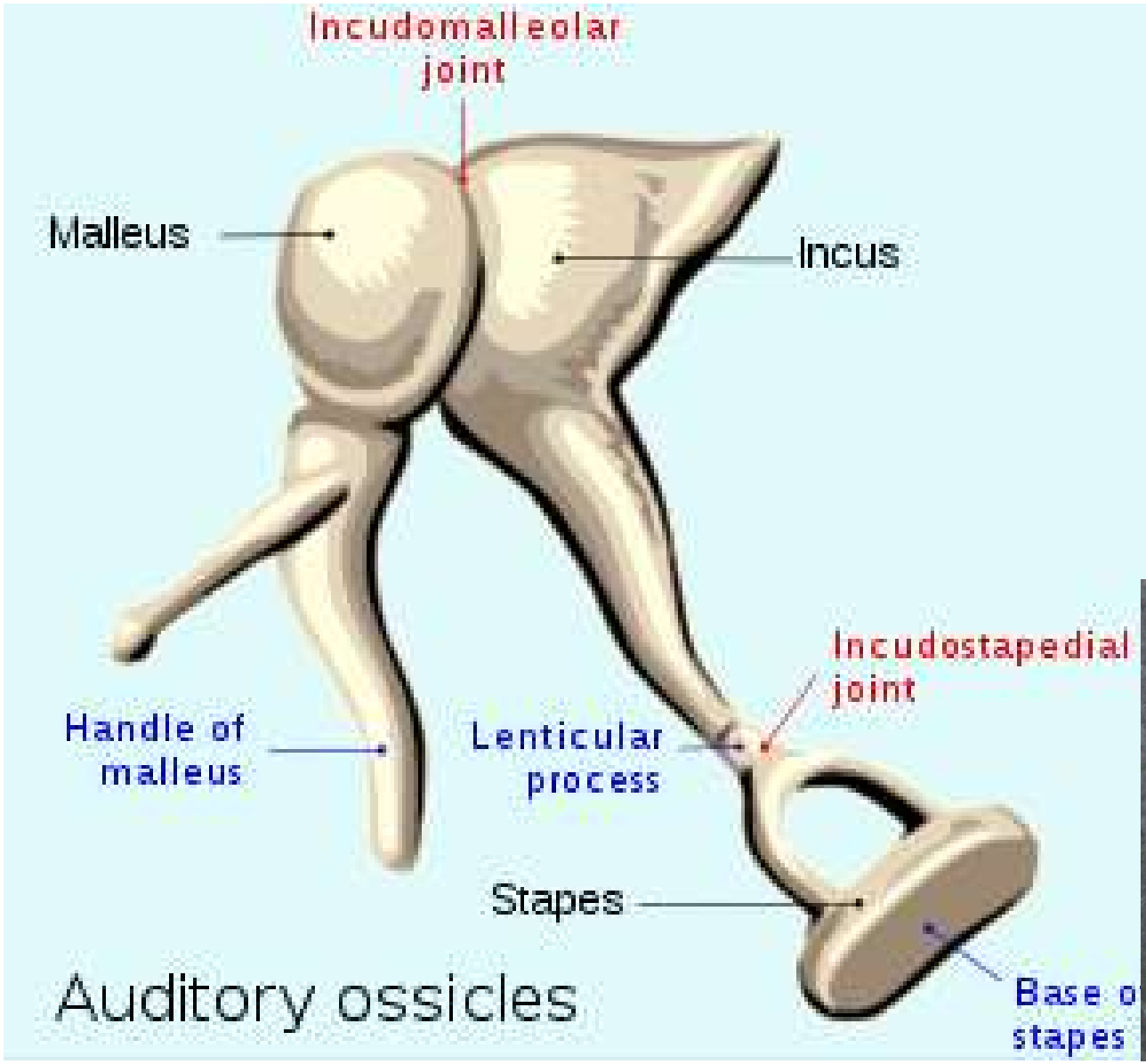
Lesser horn

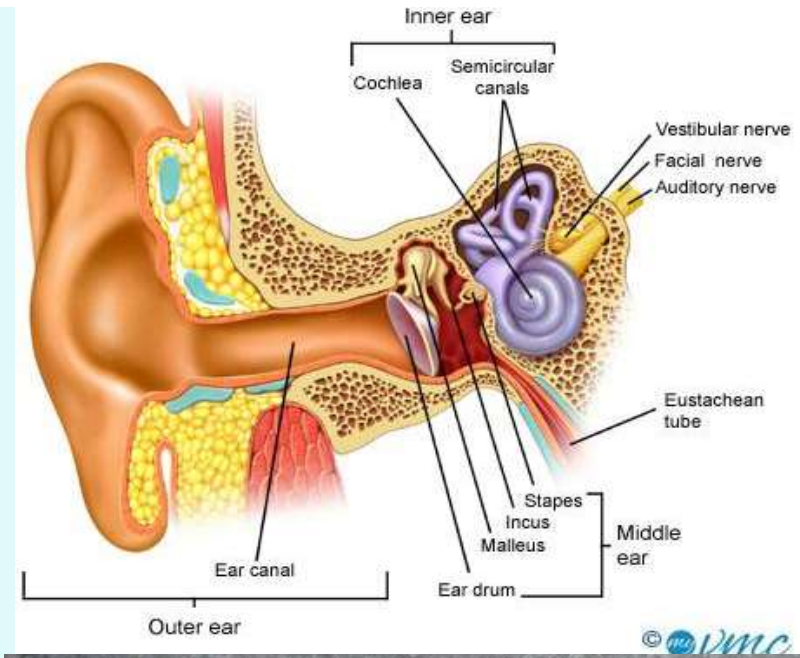
Anatomy of the Middle Ear:

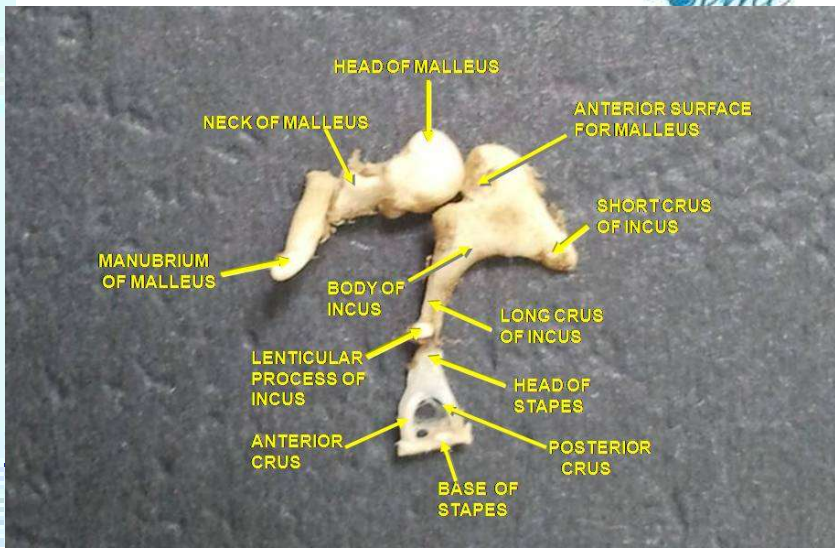
1.Tympanic Membrane (Eardrum): Separates the outer ear from the middle ear and vibrates in response to sound waves.

2.Ossicles: Three tiny bones called the malleus (hammer), incus (anvil), and stapes (stirrup) that amplify and transmit vibrations from the eardrum to the inner ear.

3.Eustachian Tube: Connects the middle ear to the nasopharynx and helps equalize pressure on both sides of the eardrum.


Incudomalleolar joint
Malleus
Incus
Handle of malleus
Lenticular process
Incudostapedial joint
Stapes
Base o
stapes
Auditory ossicles


Inner ear
Cochlea
Semicircular canals
Vestibular nerve
Facial nerve
Auditory nerve
Eustachean tube
Stapes
Incus
Malleus
Middle ear
Ear canal
Ear drum
Outer ear

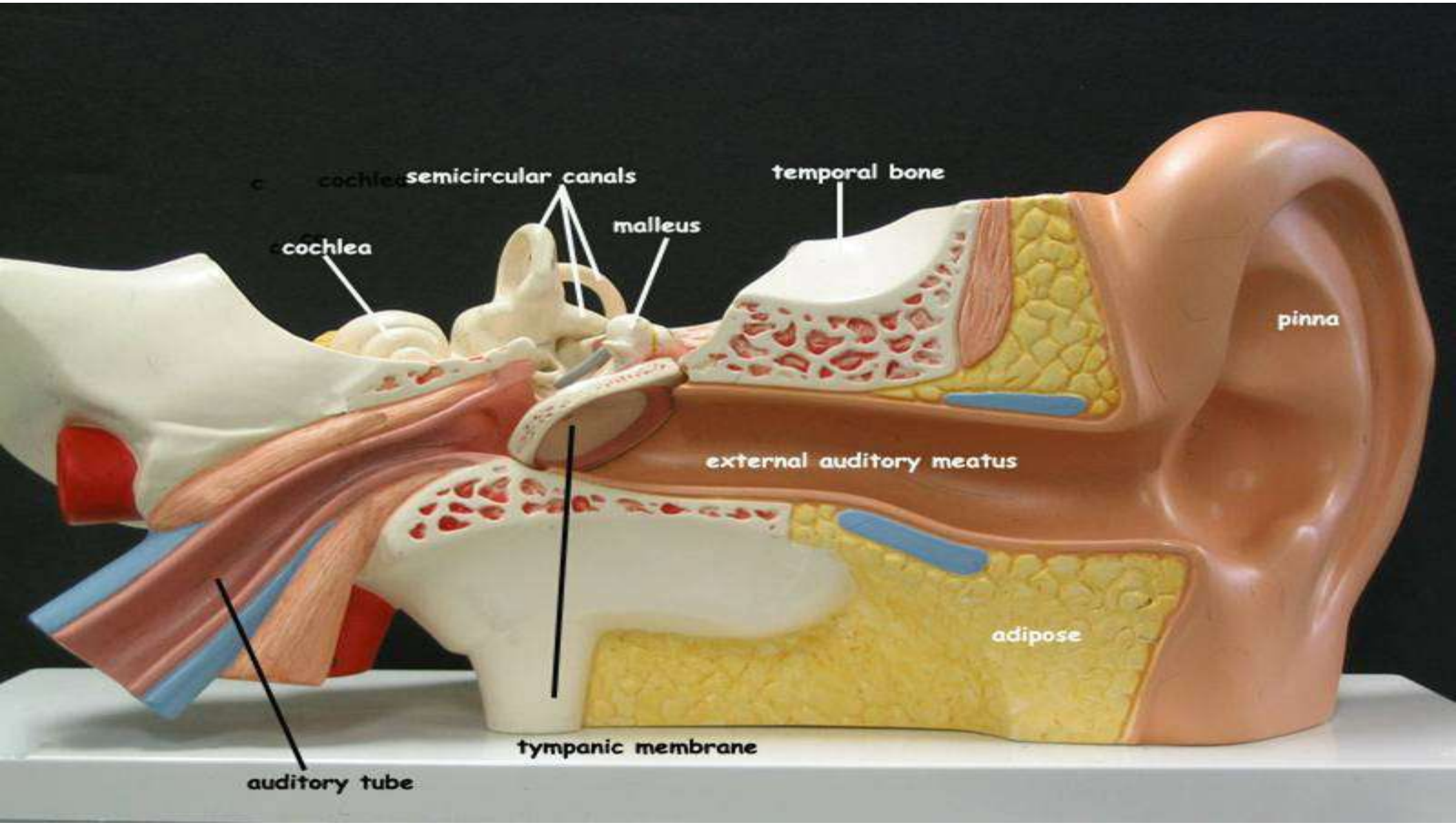

HEAD OF MALLEUS
NECK OF MALLEUS
ANTERIOR SURFACE FOR MALLEUS
SHORT CRUS OF INCUS
MANUBRIUM OF MALLEUS
BODY OF INCUS
LONG CRUS OF INCUS
LENTICULAR PROCESS OF INCUS
HEAD OF STAPES
ANTERIOR CRUS
POSTERIOR CRUS
BASE OF STAPES

Functions of the Middle Ear:

1.Amplification of Sound: The ossicles amplify the vibrations from the tympanic membrane before transmitting them to the oval window of the cochlea in the inner ear.

2.Pressure Equalization: **The Eustachian tube** maintains equal air pressure on both sides of the eardrum, which is crucial for proper hearing and balance.

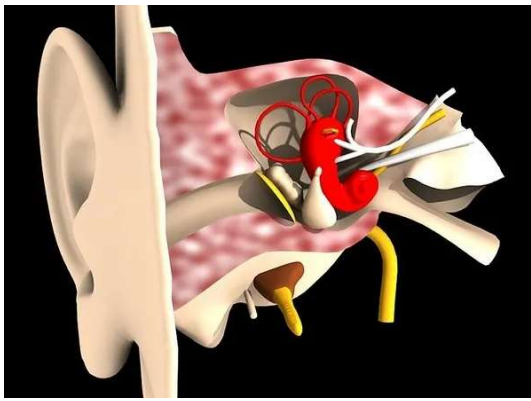
3.Protection: The middle ear muscles (tensor tympani and stapedius) can contract to protect the inner ear from loud sounds by reducing the transmission of vibrations through the ossicles.


semicircular canals
temporal bone
malleus
cochlea
pinna
external auditory meatus
adipose
tympanic membrane
auditory tube

Functions of the Ossicles:

1.Transmission of Sound Vibrations:

1. **Malleus**:
   - The malleus is attached to the tympanic membrane (eardrum).
   - When sound waves strike the eardrum, it vibrates, and these vibrations are transferred to the malleus.
2. **Incus**:
   - The malleus is connected to the incus.
   - The incus receives vibrations from the malleus and passes them on to the stapes.
3. **Stapes**:
   - The stapes is connected to the oval window, a membrane-covered opening to the inner ear.
   - The stapes transmits the vibrations from the incus to the oval window.

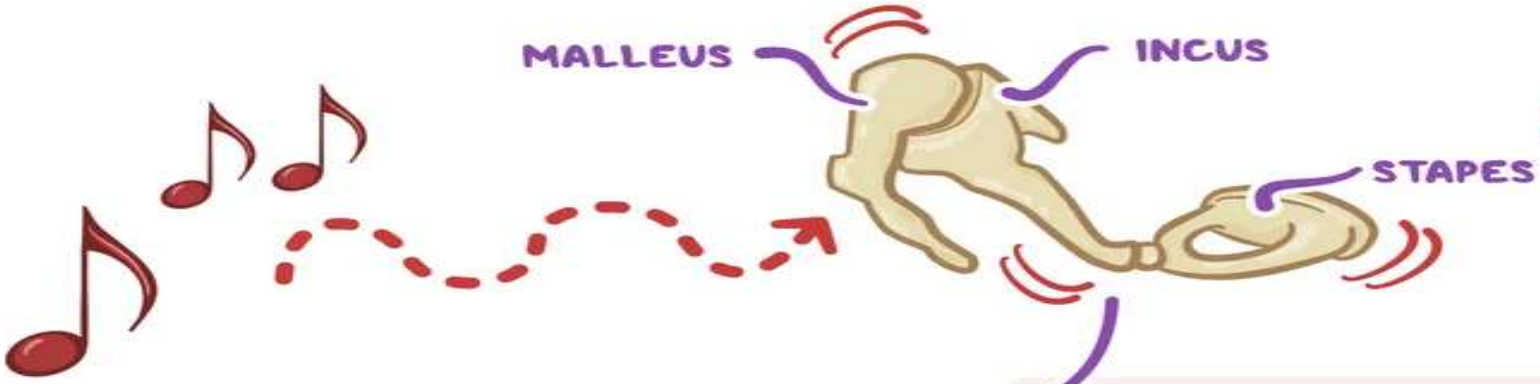


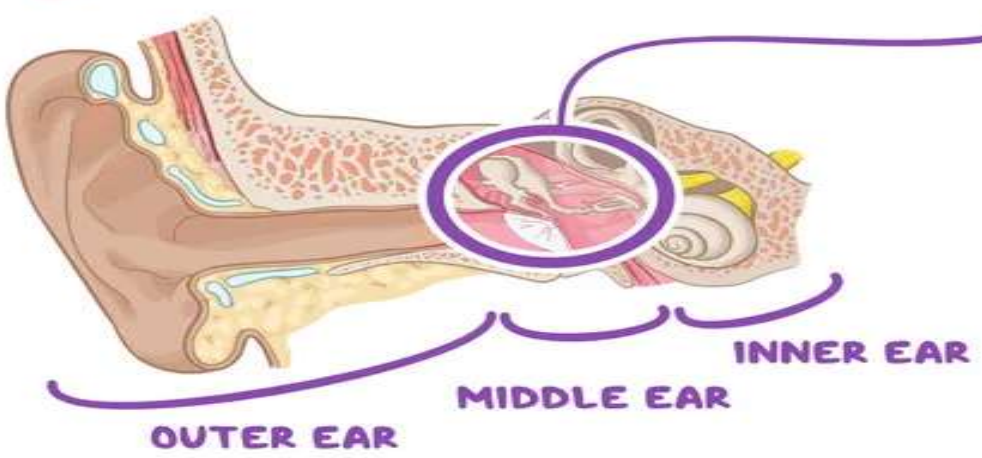
2.Amplification of Sound:

1. The ossicles amplify the sound vibrations. The surface area of the tympanic membrane is larger than that of the oval window, and the leverage action of the ossicles increases the force of the vibrations. This amplification is necessary to transfer sound waves efficiently from the air (in the ear canal) to the fluid-filled inner ear.

BACKGROUND

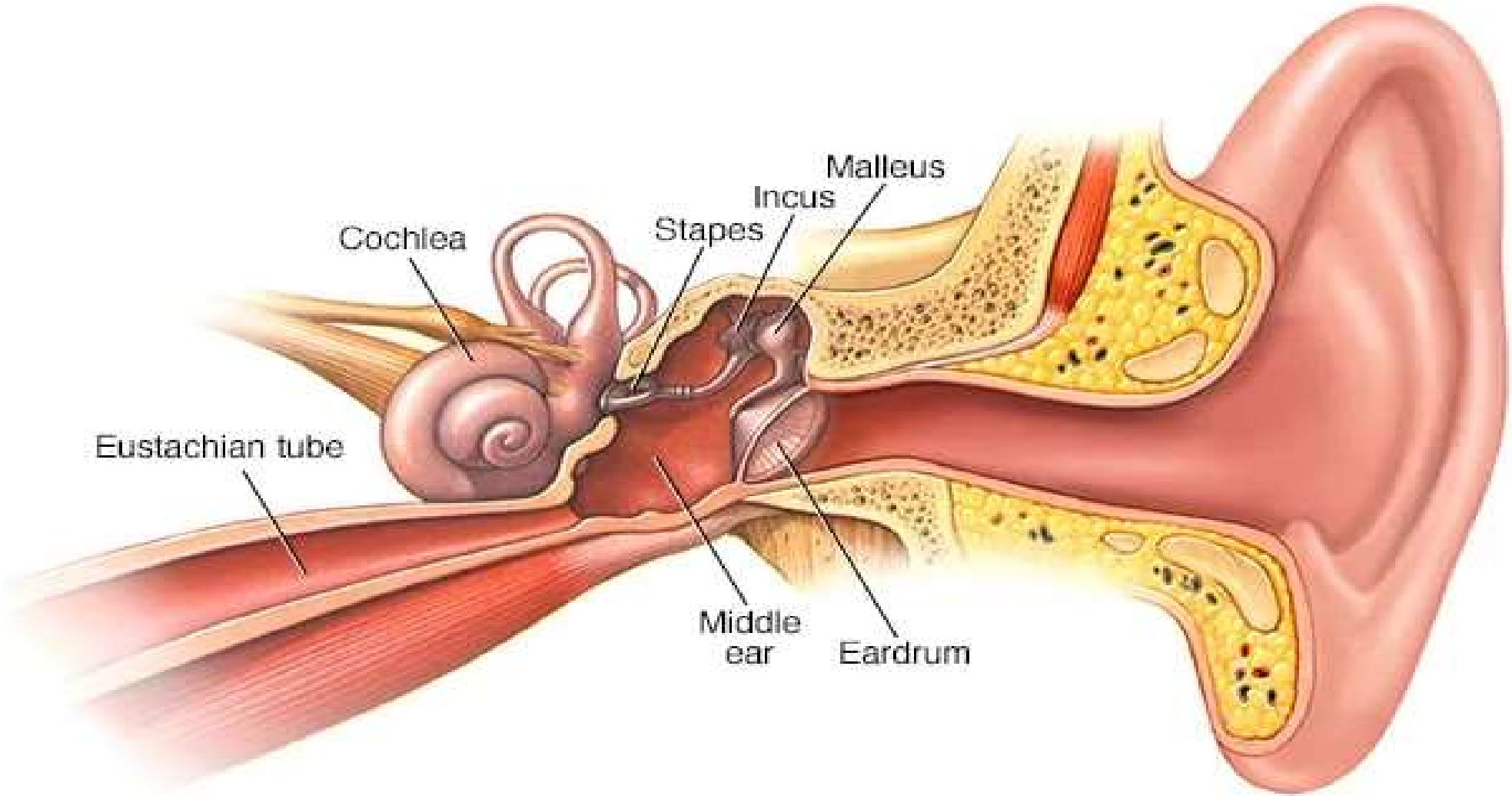
* THREE SMALL BONES in MIDDLE EAR that TRANSMIT AIR VIBRATIONS from OUTER EAR to INNER EAR to be PROCESSED as SOUND





INJURIES

* SEVERE HEAD INJURIES
* BLAST INJURIES
* BAROTRAUMA
* TYMPANIC PERFORATION
* MIDDLE EAR INFECTIONS
* OTOSCLEROSIS
* GENETIC MUTATIONS INTERFERING with FETAL DEVELOPMENT of AUDITORY OSSICLES



Protection of the Inner Ear:

- The middle ear muscles (tensor tympani and stapedius) can contract in response to loud sounds.

- This contraction dampens the movement of the ossicles, thus reducing the transmission of sound vibrations to the inner ear.

- This reflex helps protect the delicate structures of the inner ear from potential damage due to loud noises.