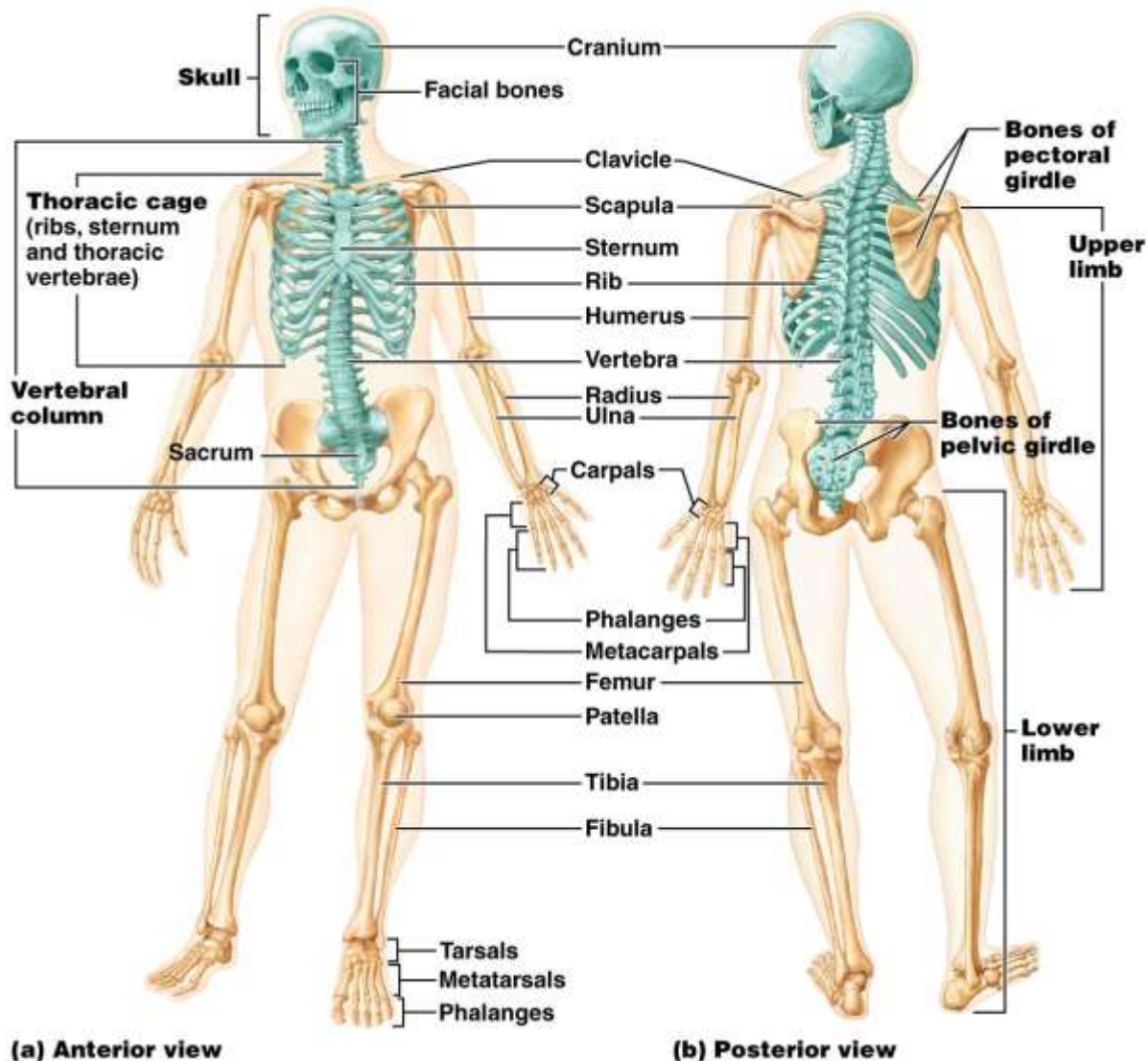
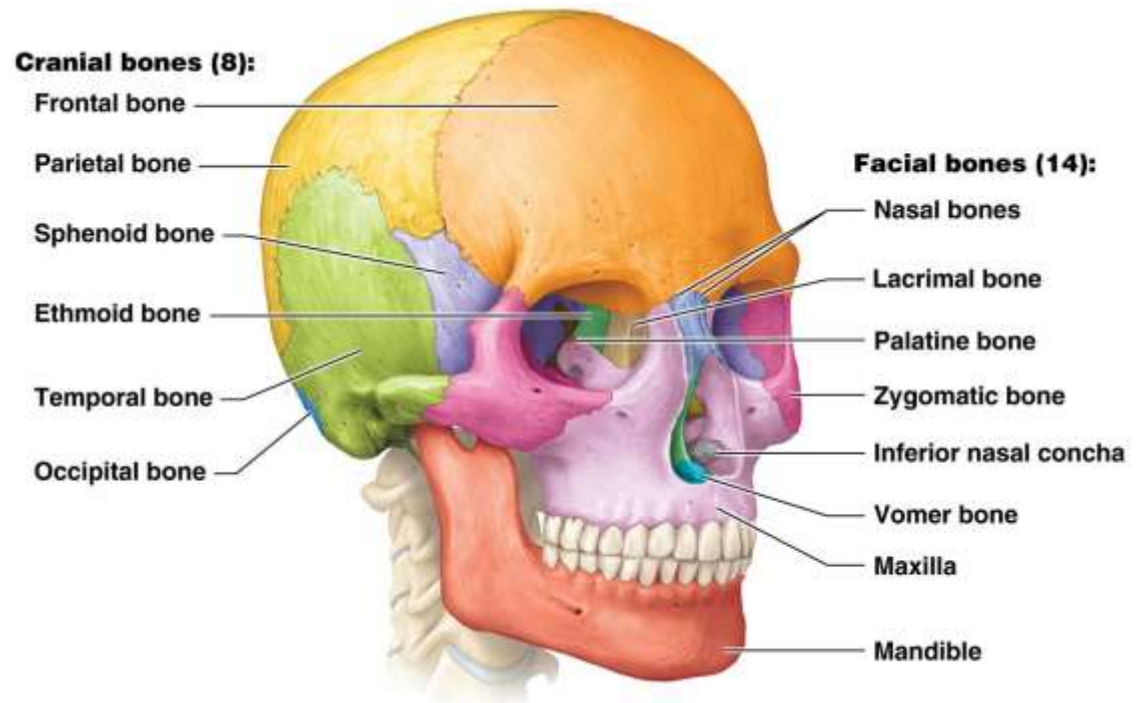


The Axial Skeleton

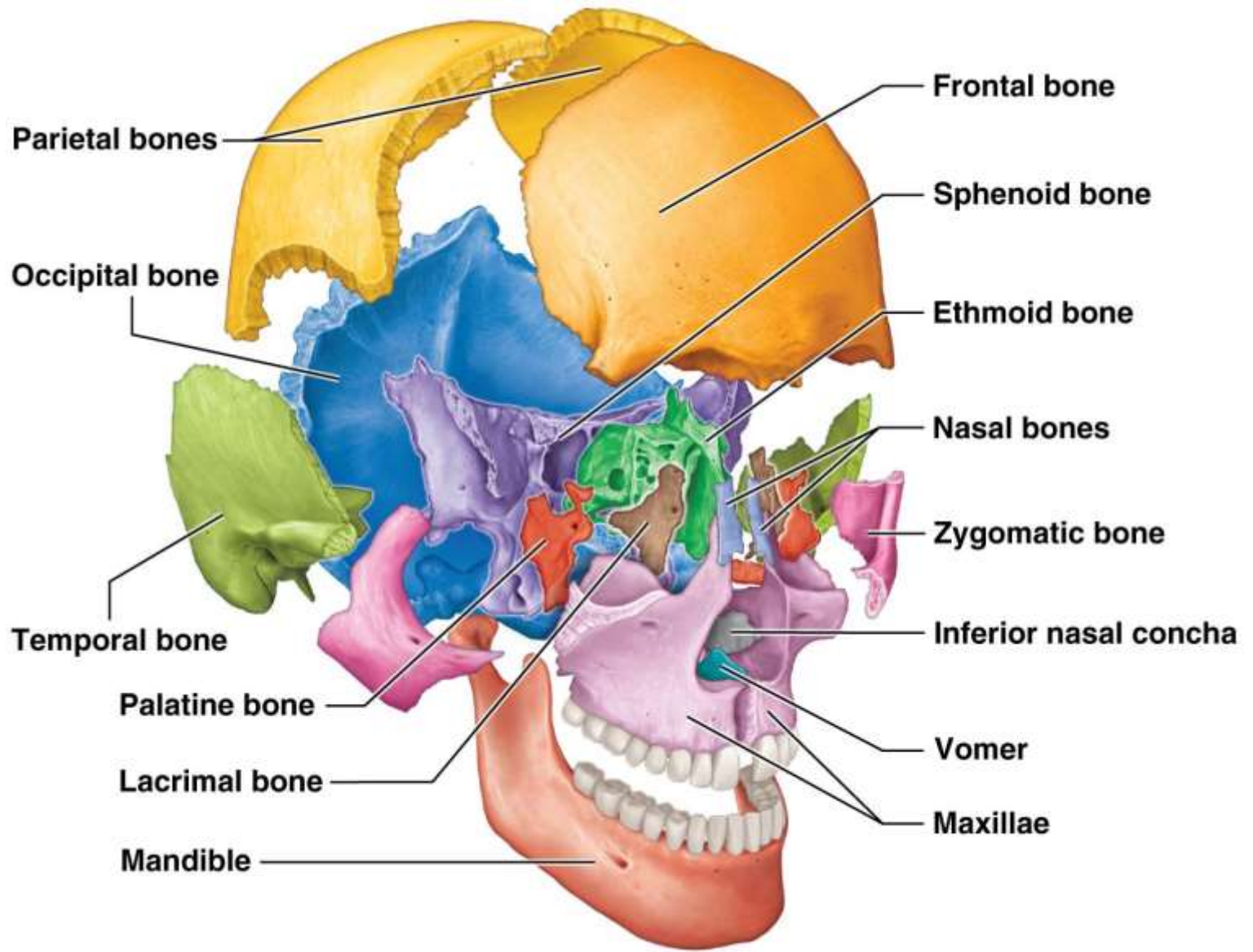


The Adult Skull

- Two sets of bones: cranial and facial bones
- Bones are joined by sutures - fibrous immovable joints
 - What are they made of?
 - Can you explain the anatomy of the skull with respect embryonic development?
- Only the mandible is attached by a freely movable synovial joint

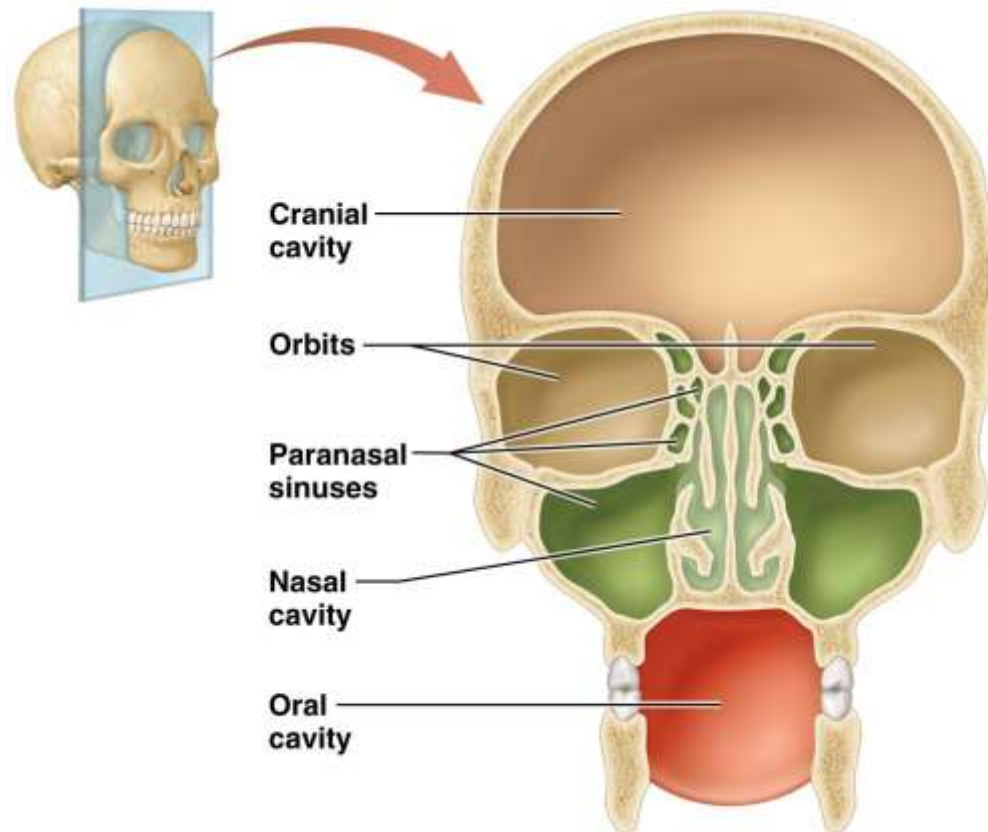


The *disarticulated* Skull



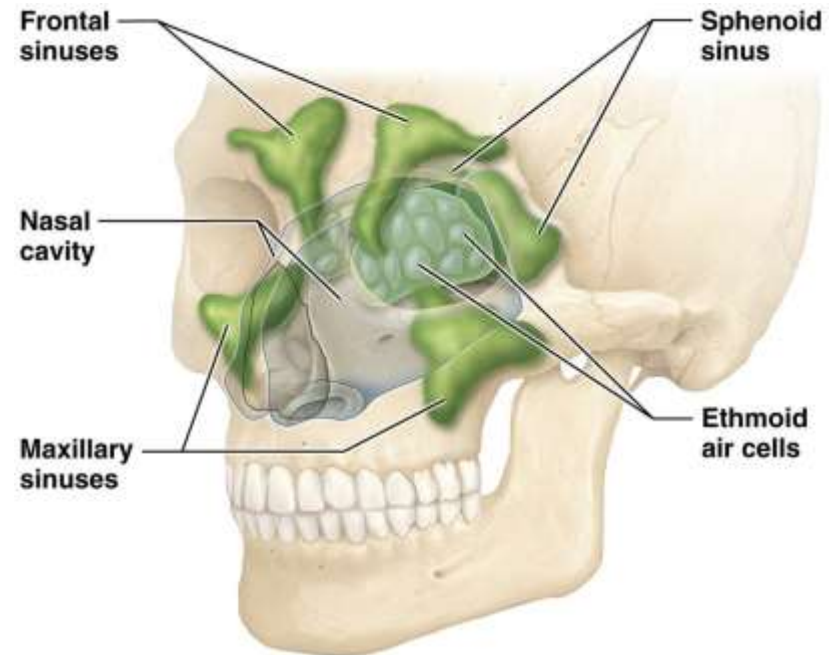
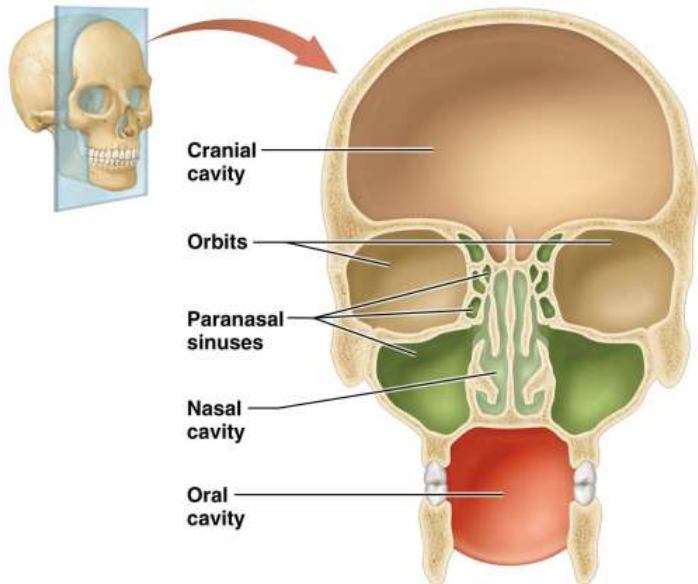
Cavities of the Skull

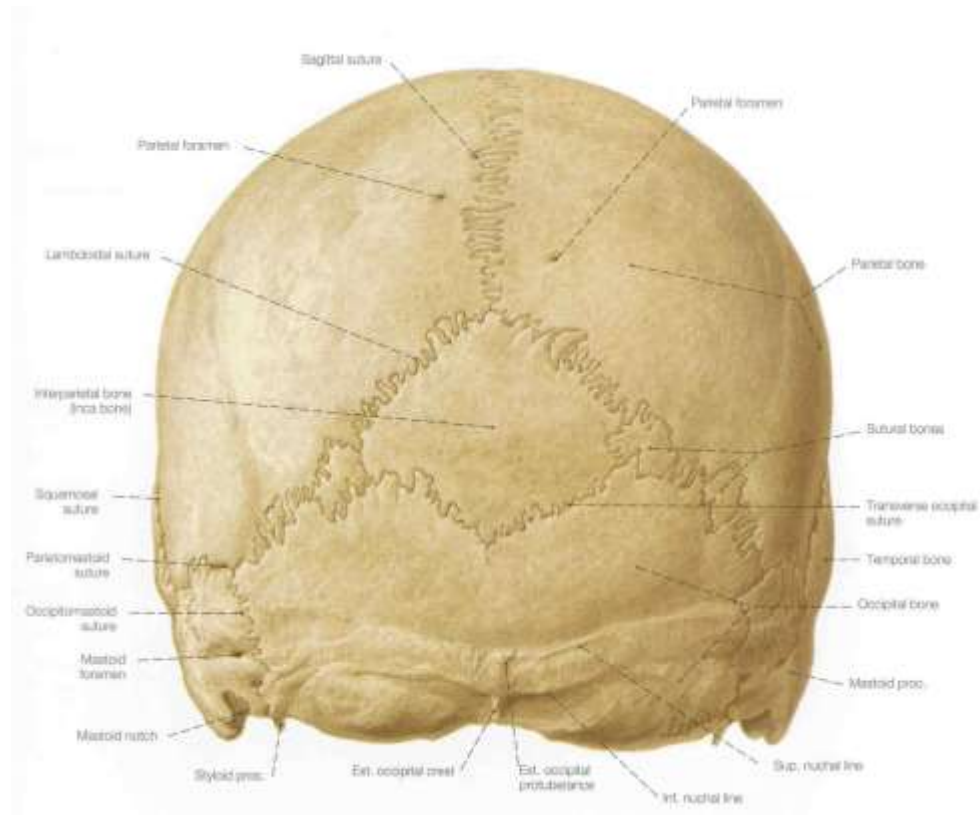
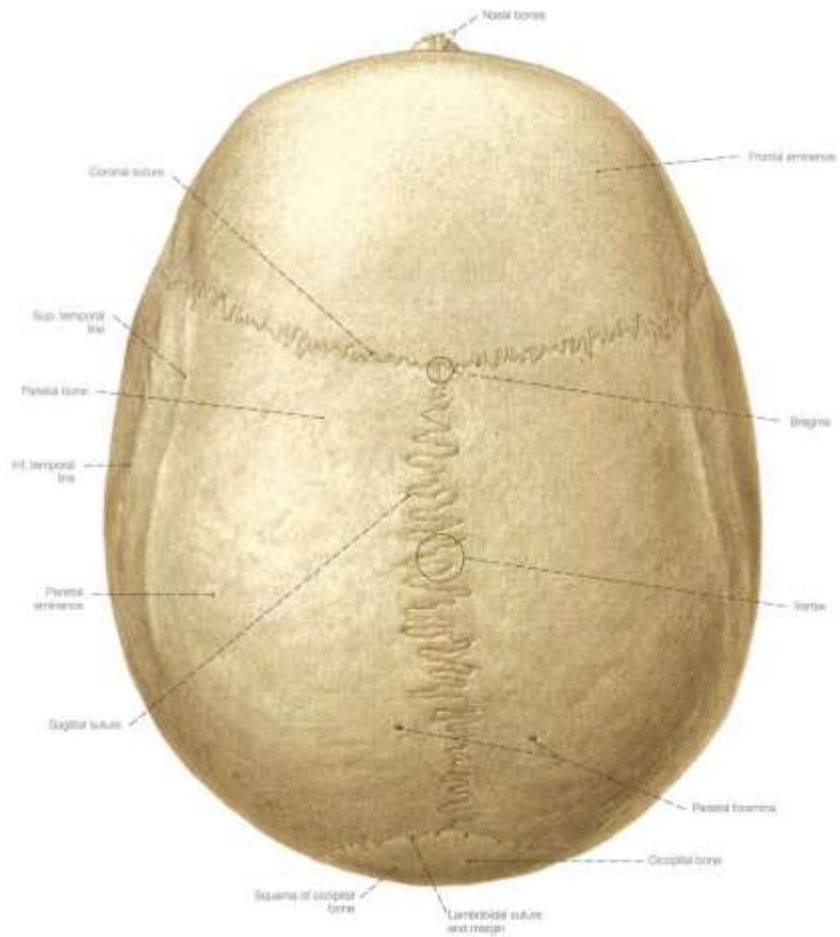
- **Orbits** contain *eyeballs*
- **Nasal cavity** houses sensory receptors for *smell*
- **Oral cavity** surrounds teeth and tongue (receptors for *taste*)
- Other small cavities contain organs for *hearing* and *balance*

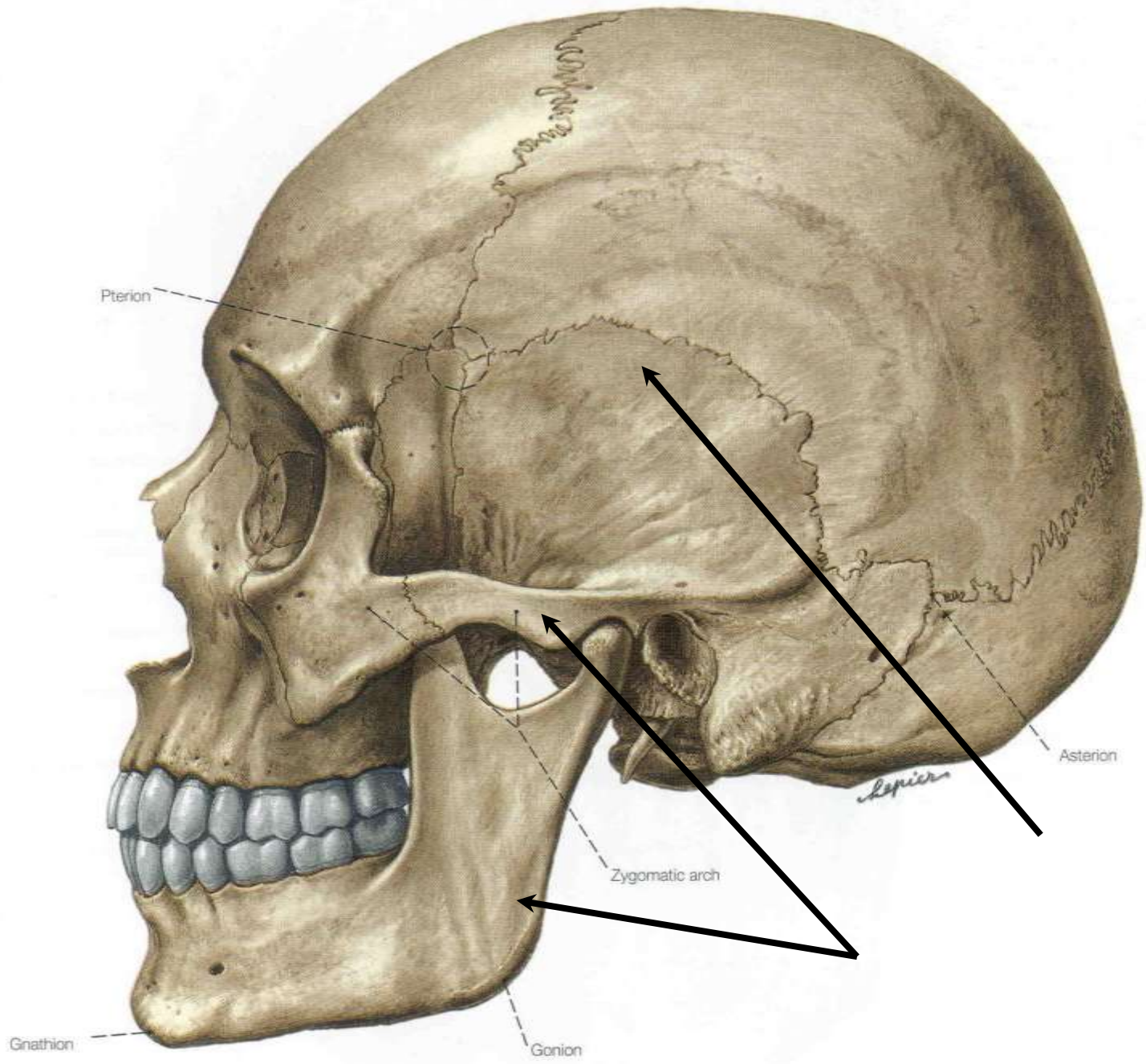


Cavities of the Skull

- Four bones surrounding nasal cavity contain large sinuses, or the **paranasal sinuses**
 - Lined with **Mucous membranes** to *filter, warm, and humidify* inhaled air
 - Cavities also reduce *weight* of skull and enhance voice *resonance*



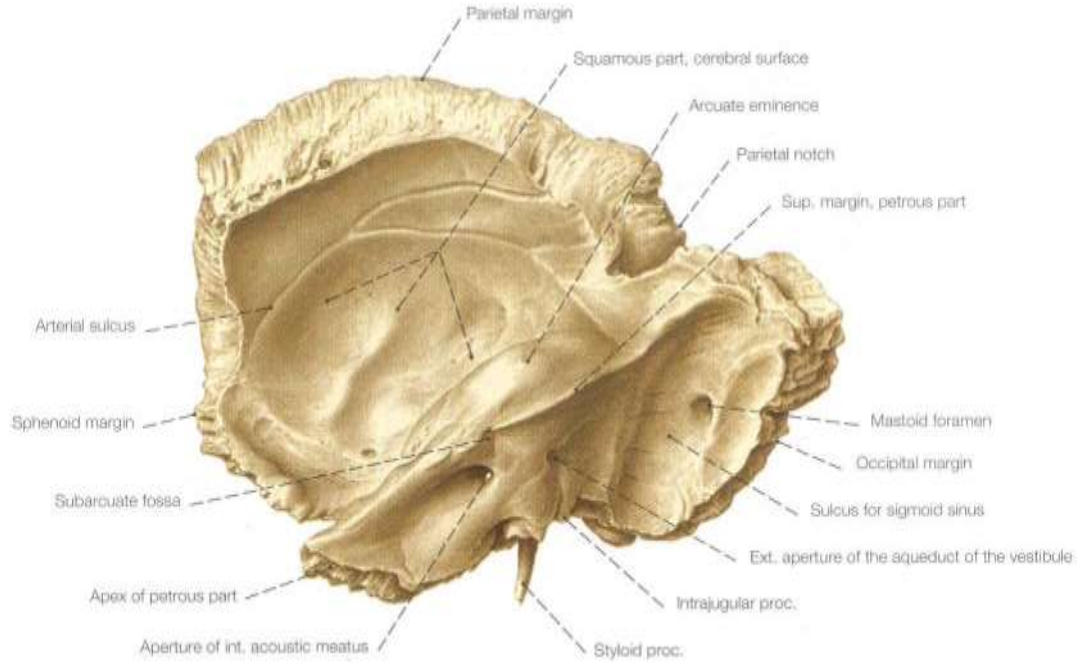
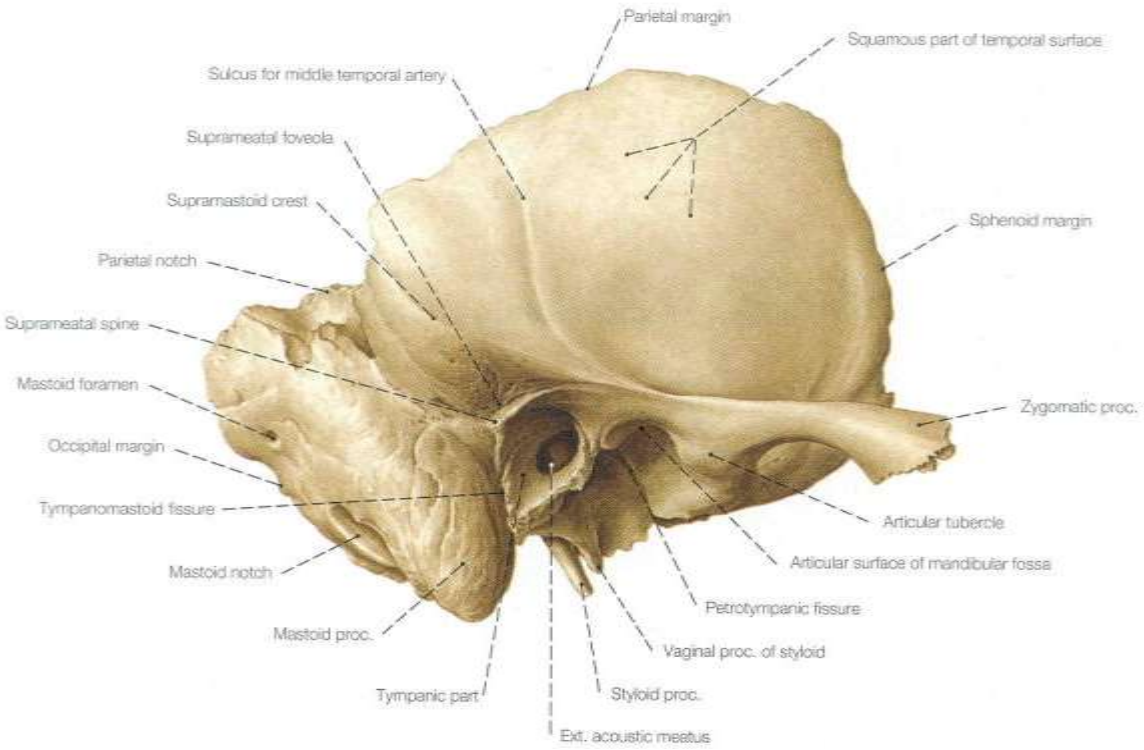


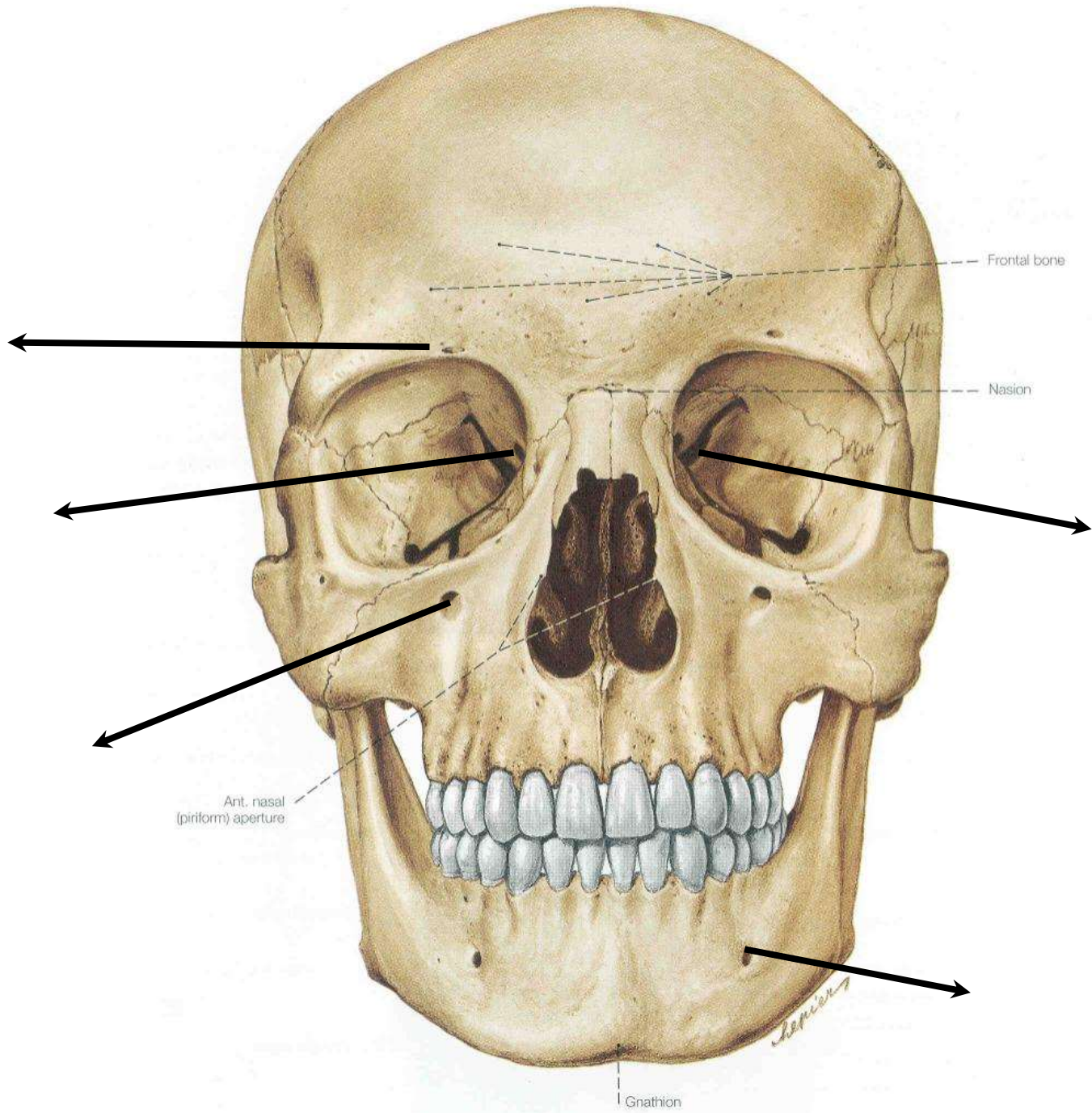


Temporal

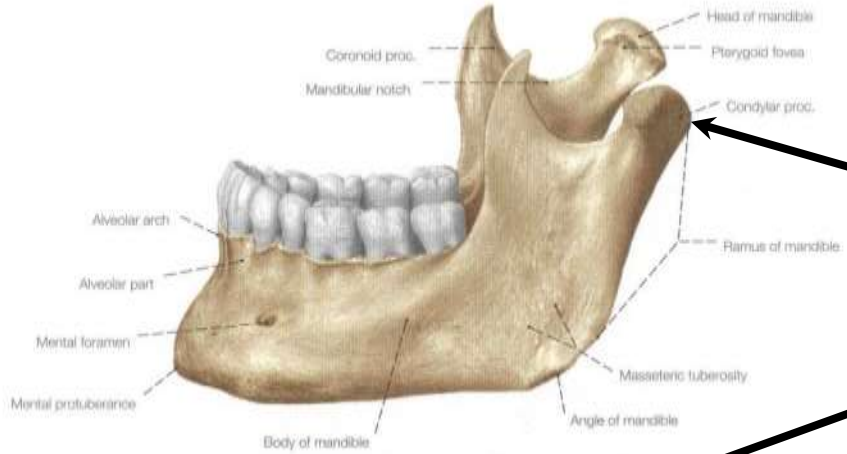
Internal

External



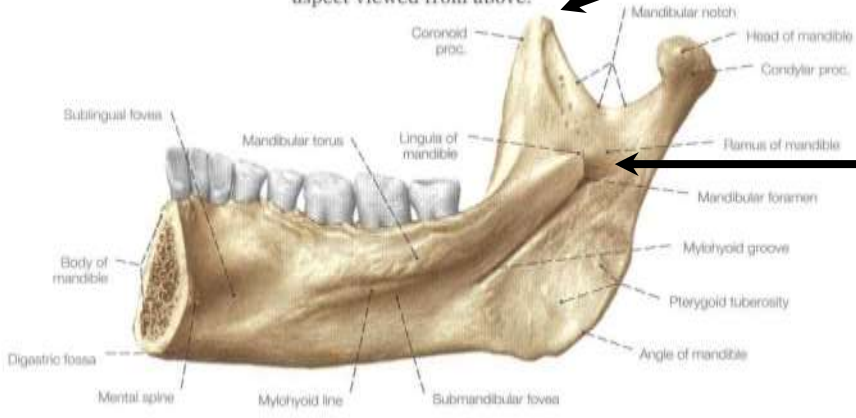


Mandible

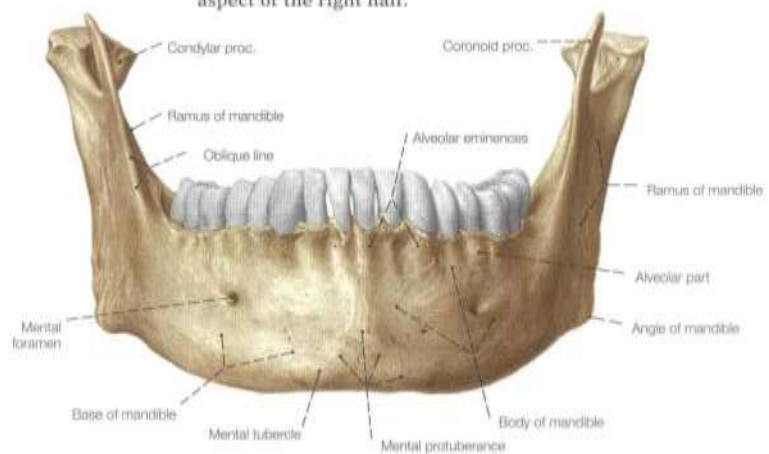


Temporal mandibular joint

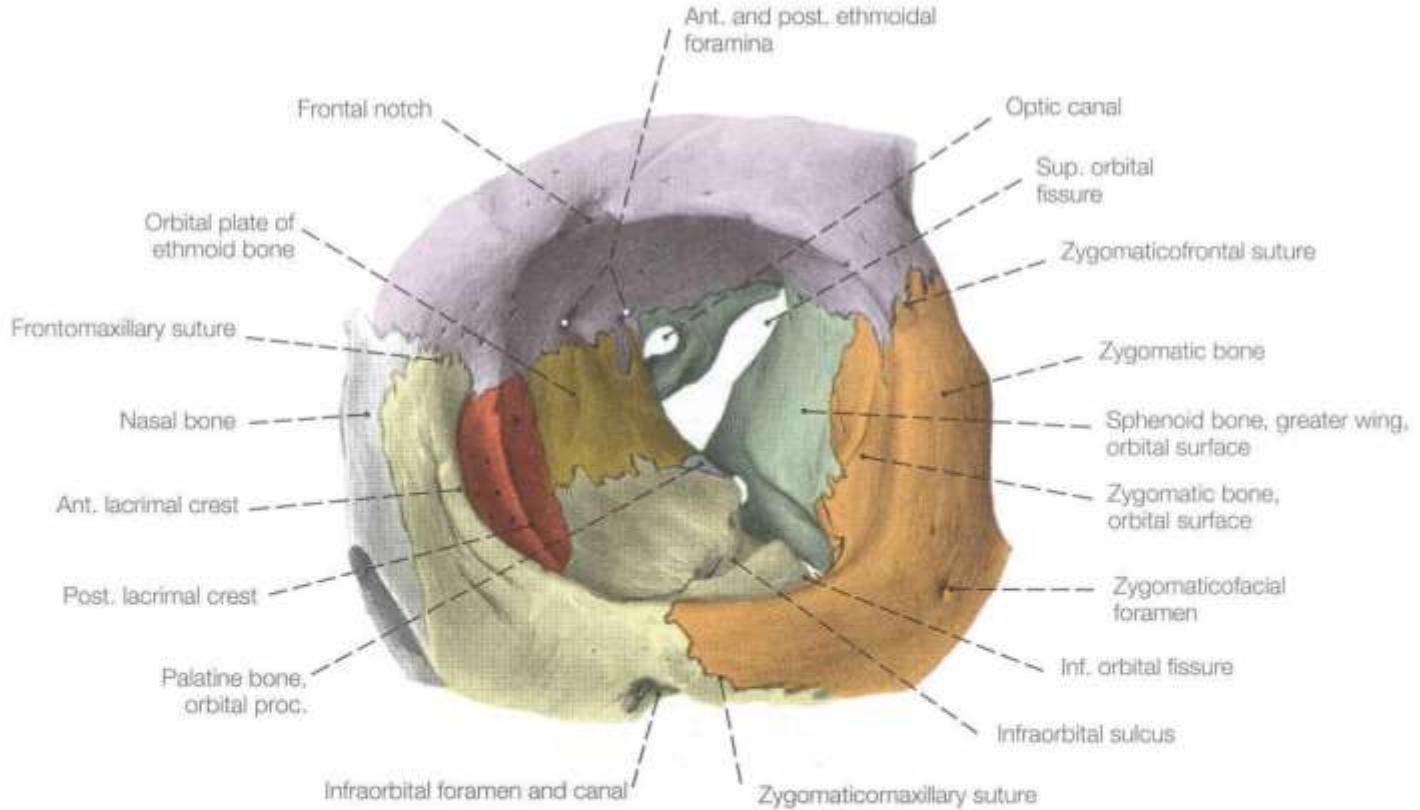
The mandible, lateral aspect viewed from above.



The mandible, medial aspect of the right half.







The Orbit



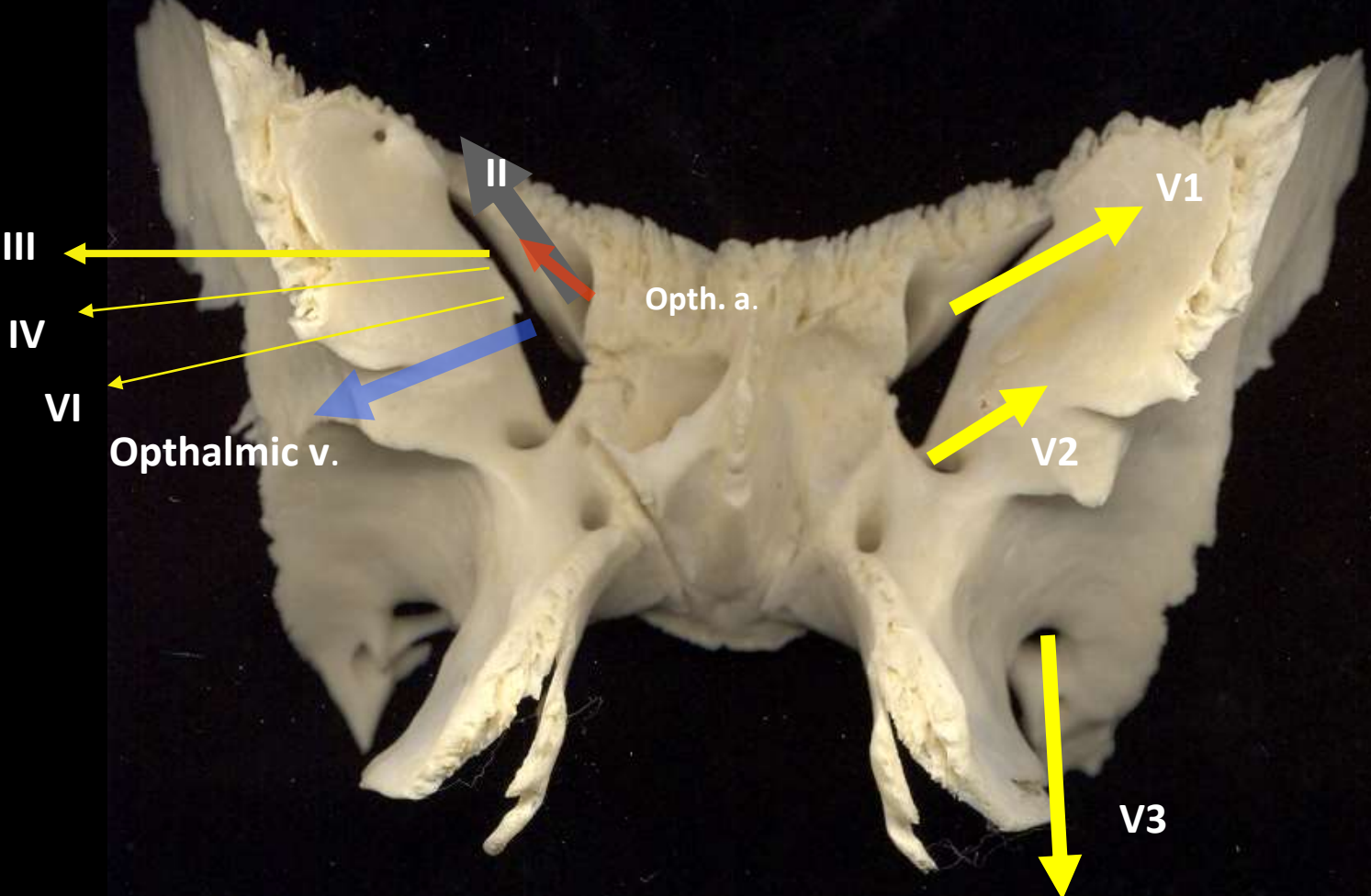
The left orbit, anterolateral view (110%). The probe is in the infraorbital canal.

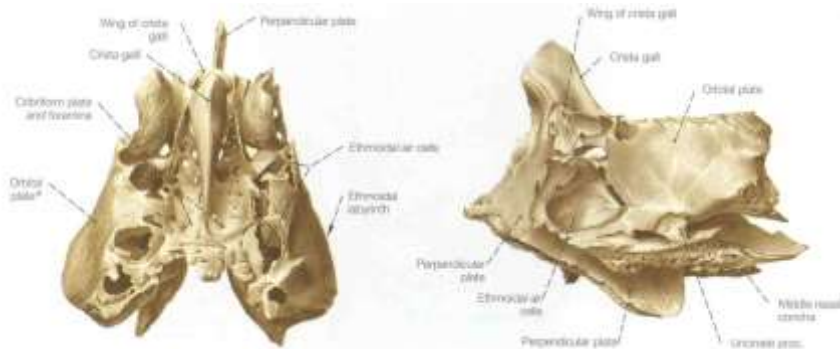
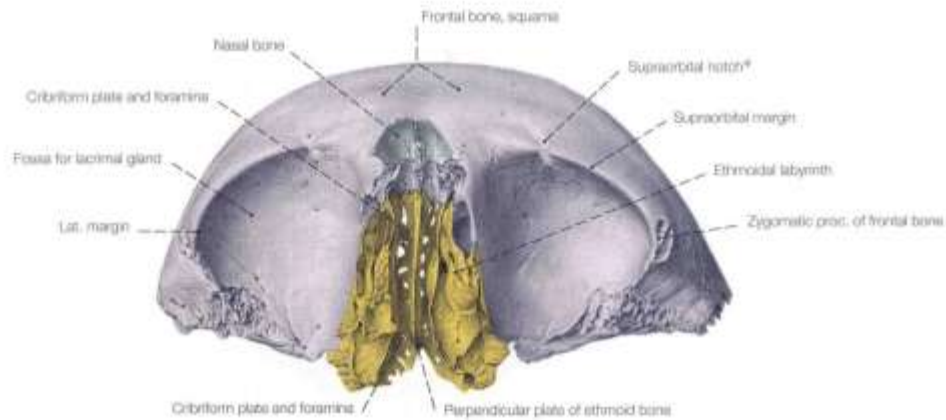
-  Nasal bone
-  Frontal bone
-  Palatine bone
-  Ethmoid bone

-  Vomer
-  Zygomatic bone
-  Maxilla

-  Temporal bone
-  Inf. nasal concha
-  Sphenoid bone
-  Lacrimal bone

Sphenoid/ anterior view of orbital surface and foramina with associated cranial nerves indicated

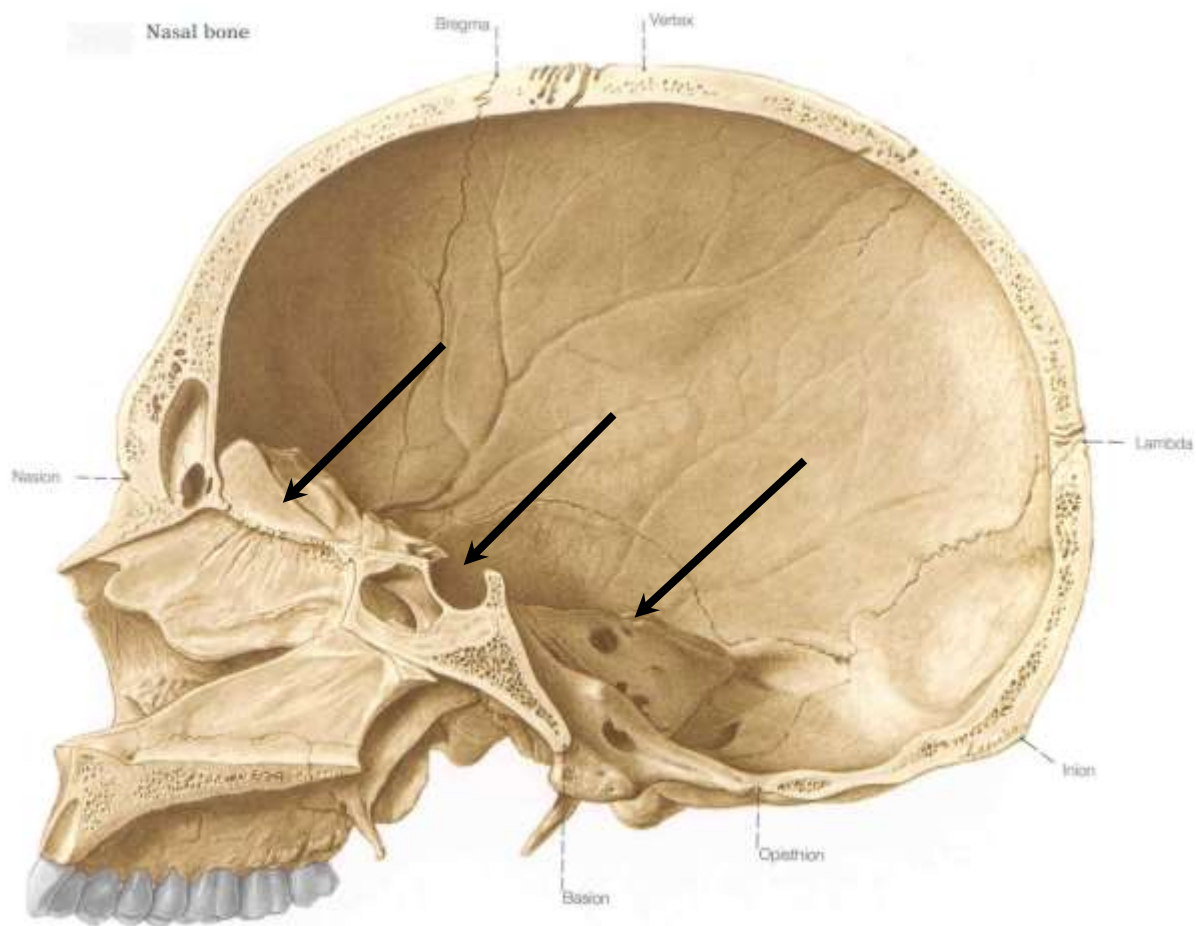


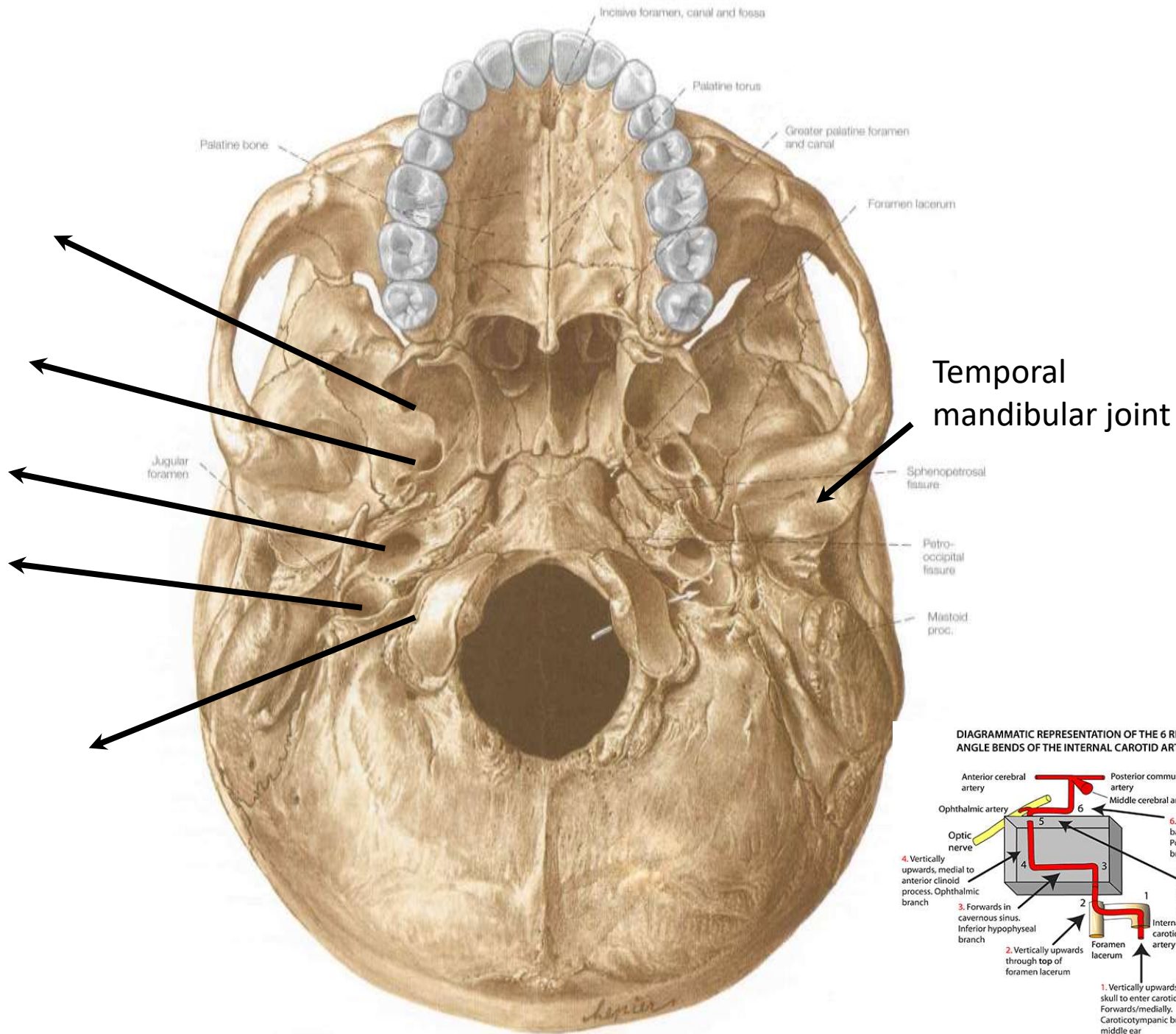


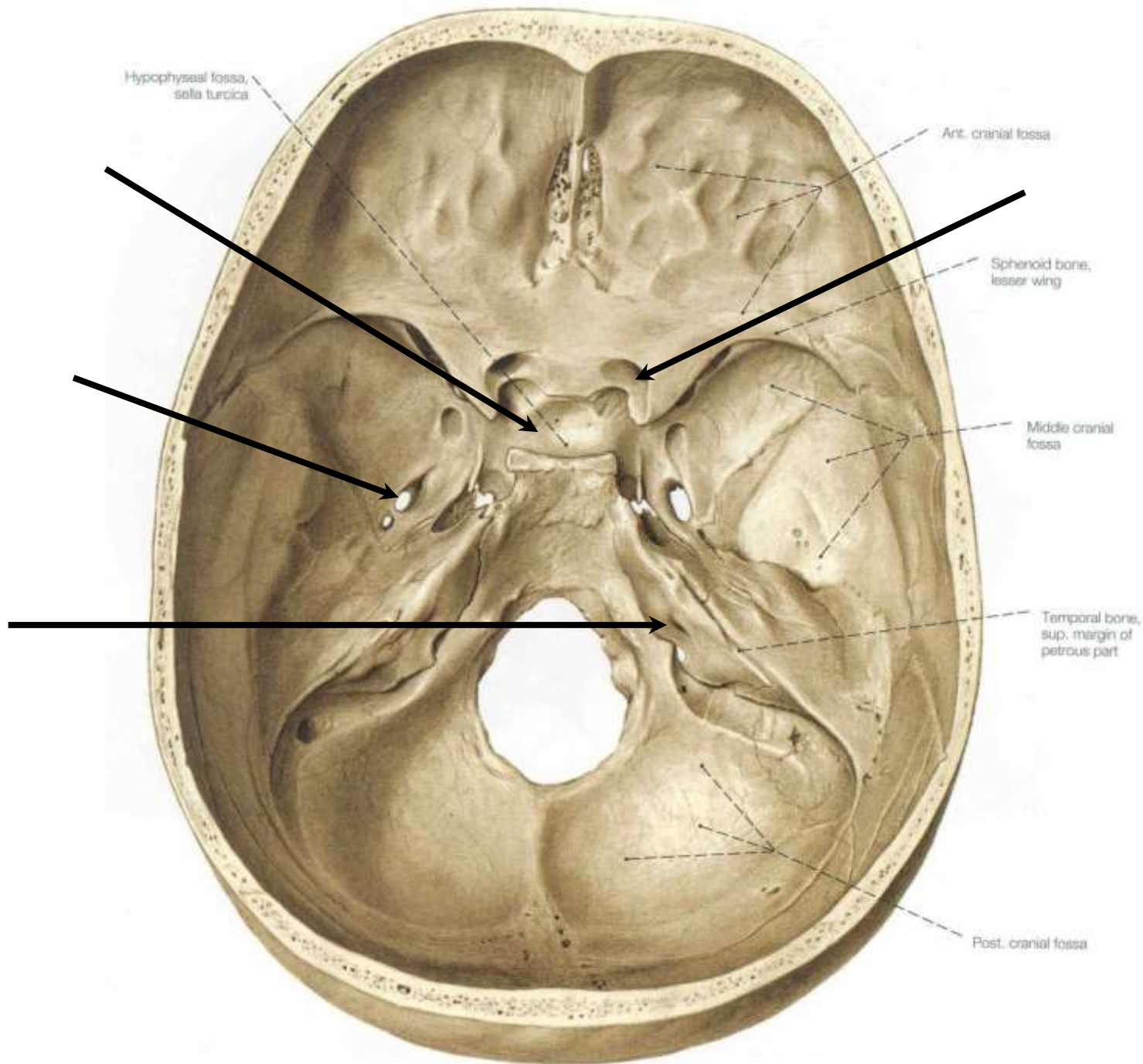
Frontal bone

Ethmoid bone

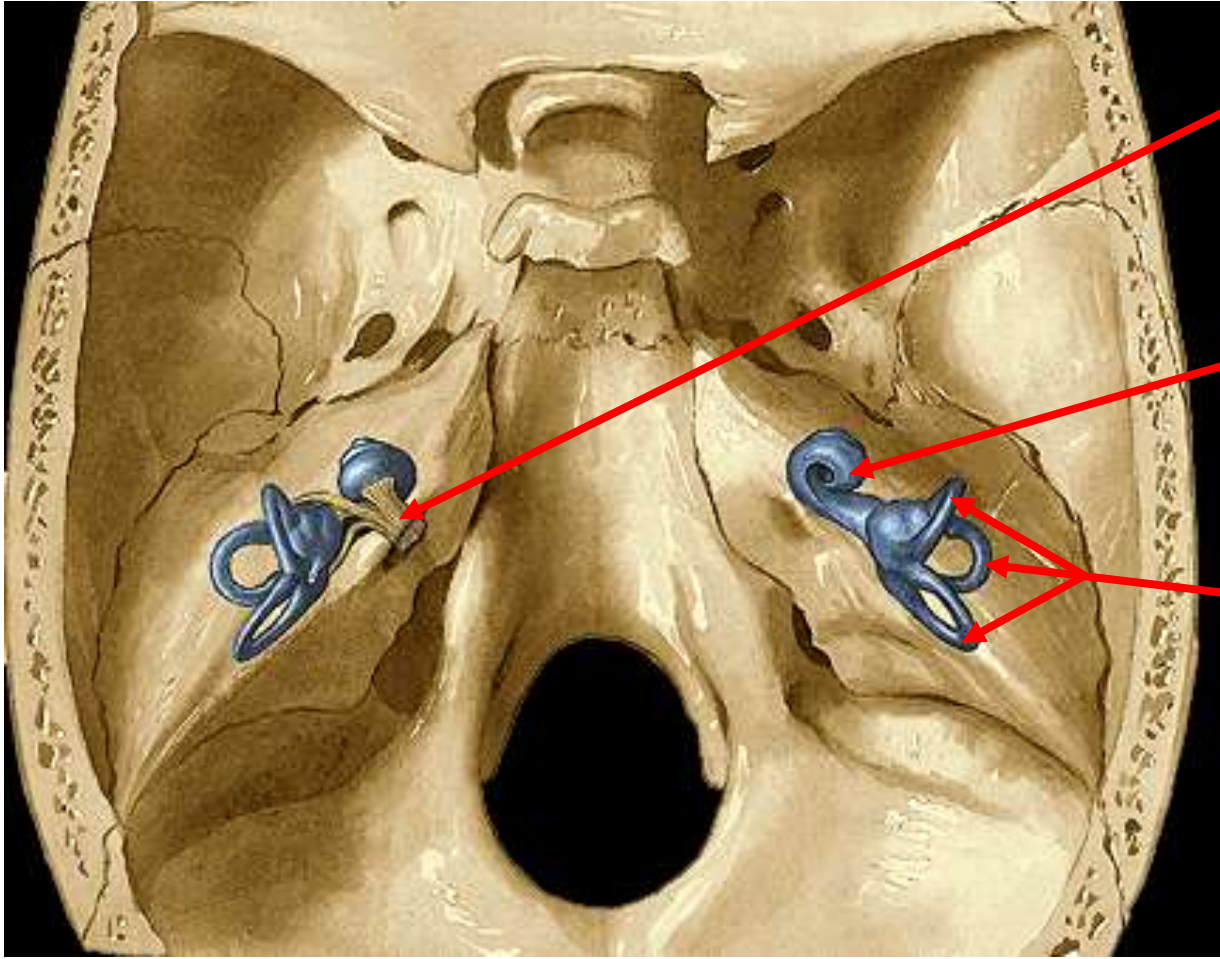
Nasal bone







Inner Ear Structures in Temporal Bone

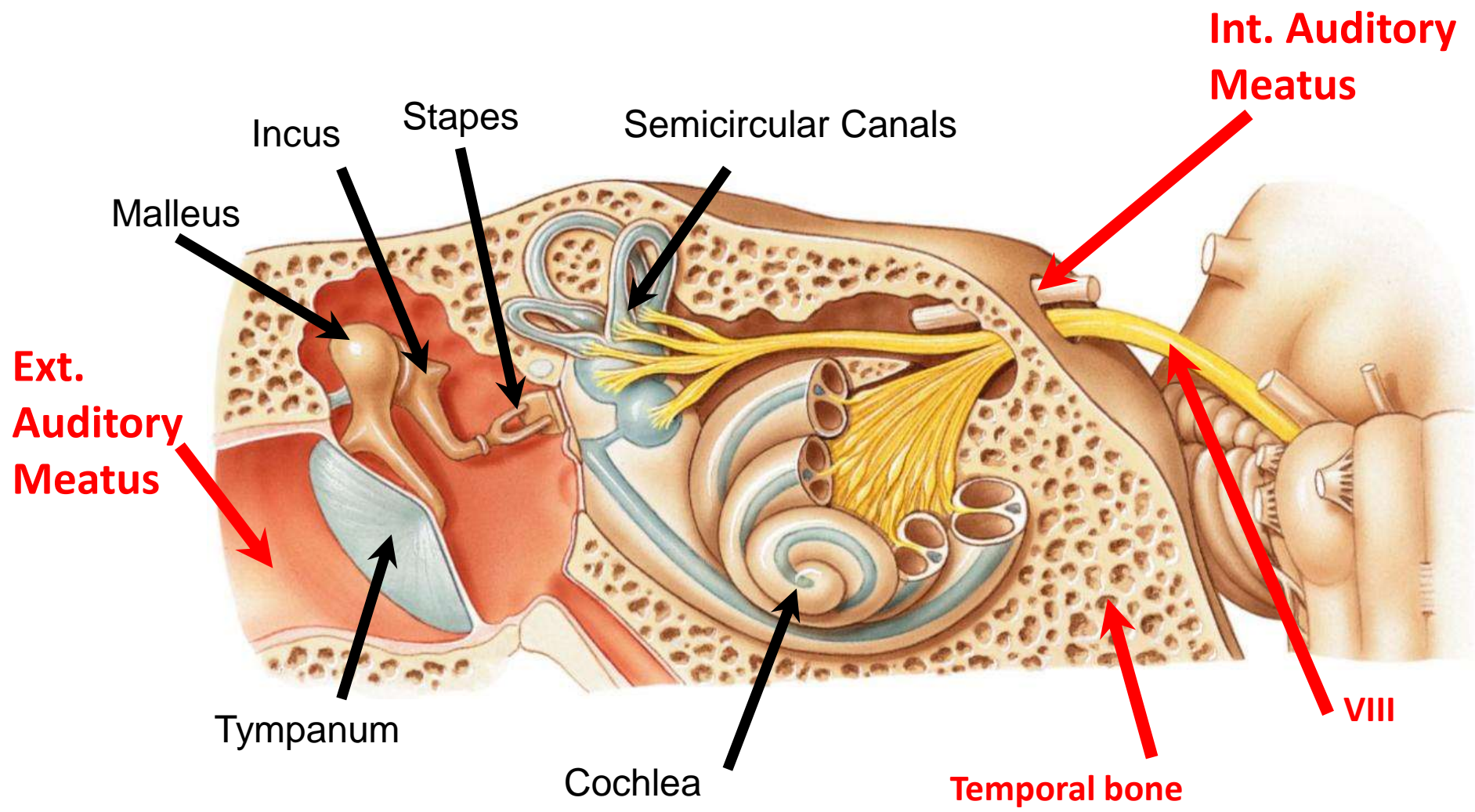


Vestibulocochlear Nerve (VIII) via internal auditory meatus

Cochlea (Inner Ear)

Semicircular Canals (Inner Ear)

Anatomy of the Ear



Opening	Bone of Passage	Contents
Mental foramen		
Cribriform plate		
Foramen rotundum		
Foramen ovale		
Internal acoustic meatus		
External acoustic meatus		
Hypoglossal		
Foramen magnum		
Sella turcica		

Opening	Bone of Passage	Contents
Mandibular foramen		
Supraorbital foramen		
Infraorbital foramen		
Optic canal		
Superior orbital fissure		
Inferior orbital fissure		
Stylomastoid foramen		
Jugular foramen		
Carotid canal		

Male versus Female Skull

- Four obvious differences:
 1. *Forehead* of male skull is sloped and female's is straight
 2. Male's *supraorbital ridge* is more prominent
 3. *Mandibular angle* of male skull is closer to 90 degrees, and that of female skull is generally greater than 90 degrees.
 4. *Mastoid process* of male skull is larger and more prominent



© Bone Clones, www.boneclones.com

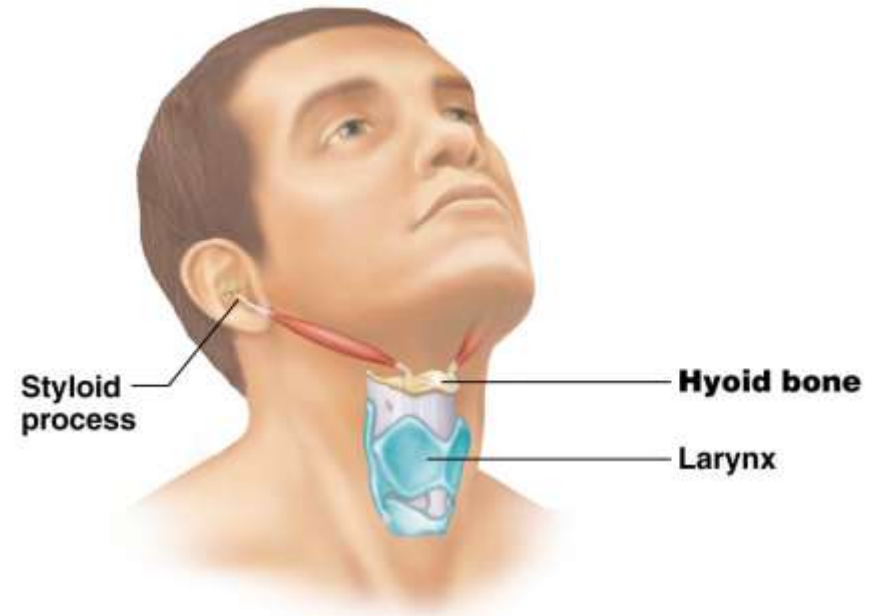
Male skull

Female skull



Hyoid Bone

- C-shaped bone, superior to the larynx
- Doesn't articulate with any skull bones (or any other bones)
 - Provides numerous attachment points for muscles involved in *swallowing* and *speech*



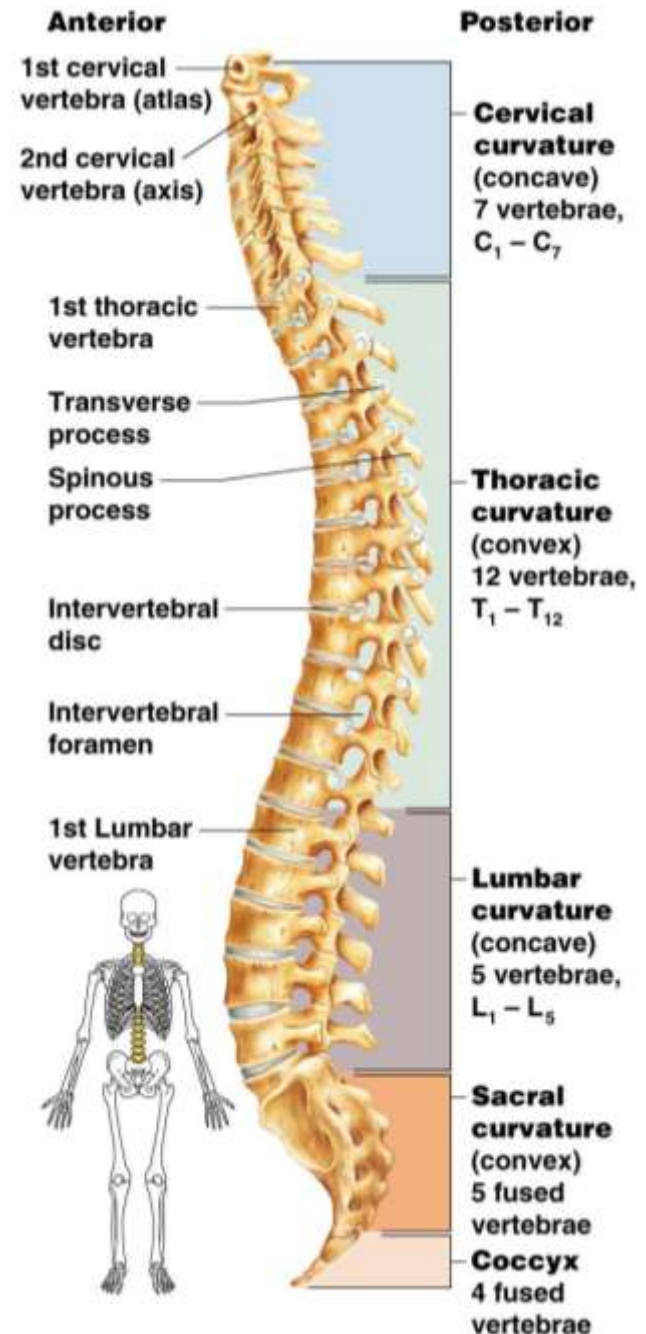
(a) Position of the hyoid bone



(b) Hyoid bone, anterior view

The Vertebral Column

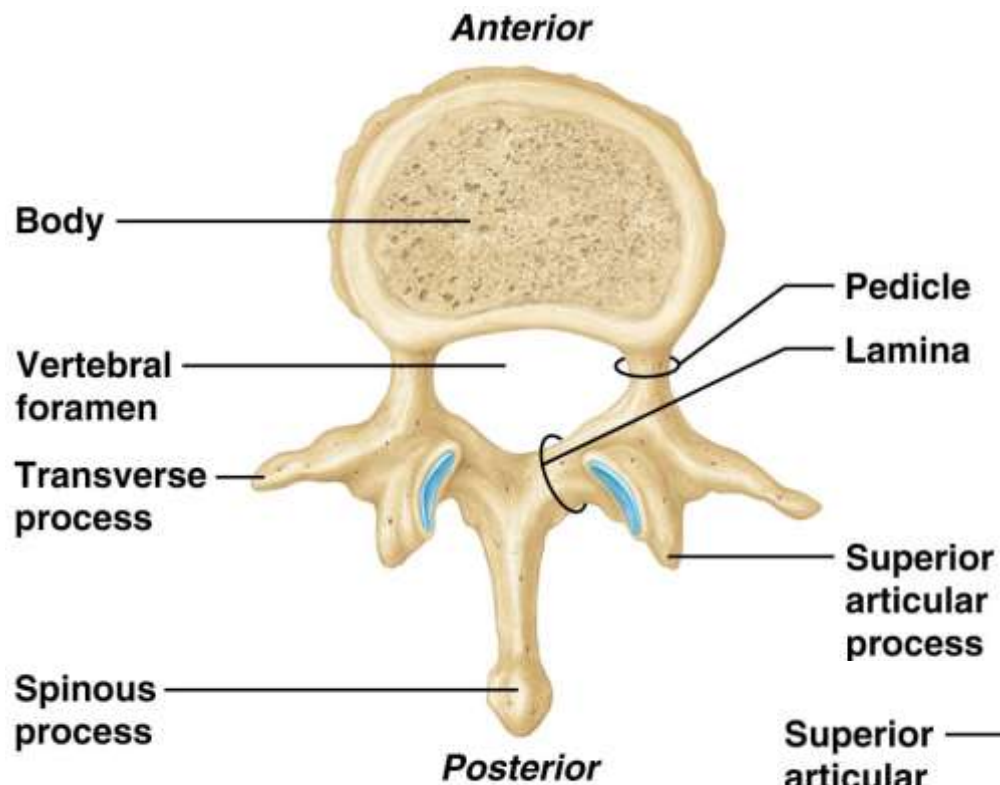
- There are 24 single vertebral bones separated by intervertebral discs
 - Seven (7) cervical vertebrae
 - Twelve (12) thoracic vertebrae
 - Articulate with 12 pairs of ribs
 - Five (5) lumbar vertebrae
- Sacrum
 - Fusion of five (5) vertebrae
- Coccyx
 - Fusion four (4) vertebrae
 - Remnant of a tail



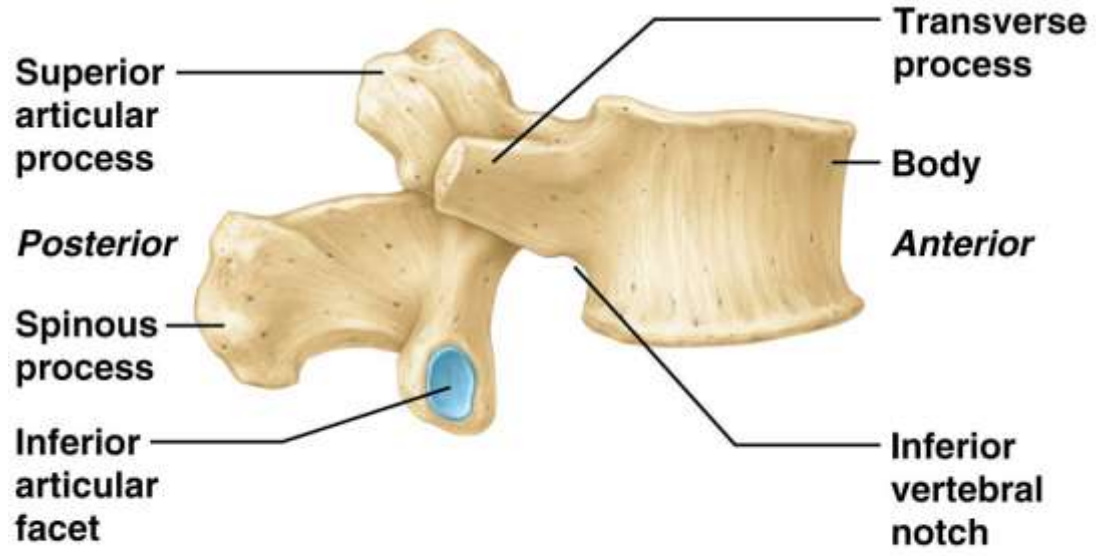
Structure of a Typical Vertebrae

- Functions of spinal cord *protection* and *support* of head and neck
 - **Body** – most anterior aspect of vertebra
 - primary *weight-bearing surface*
 - **Intervertebral discs** are found between adjacent bodies
 - *absorb shock*
 - **Vertebral foramen** – just posterior to body; *large opening* through which spinal cord and associated tissues travel
 - all foraminae together form **vertebral canal**
 - **Superior and inferior articular processes** – form *joints* between successive vertebrae
 - **Transverse processes** – project from lateral sides of vertebral arch; provide *attachment sites* for muscles
 - **Spinous process** – projects from most posterior aspect of vertebral arch; provides *attachment sites* for muscles

A Typical Vertebrae, Superior View



(a) Superior view



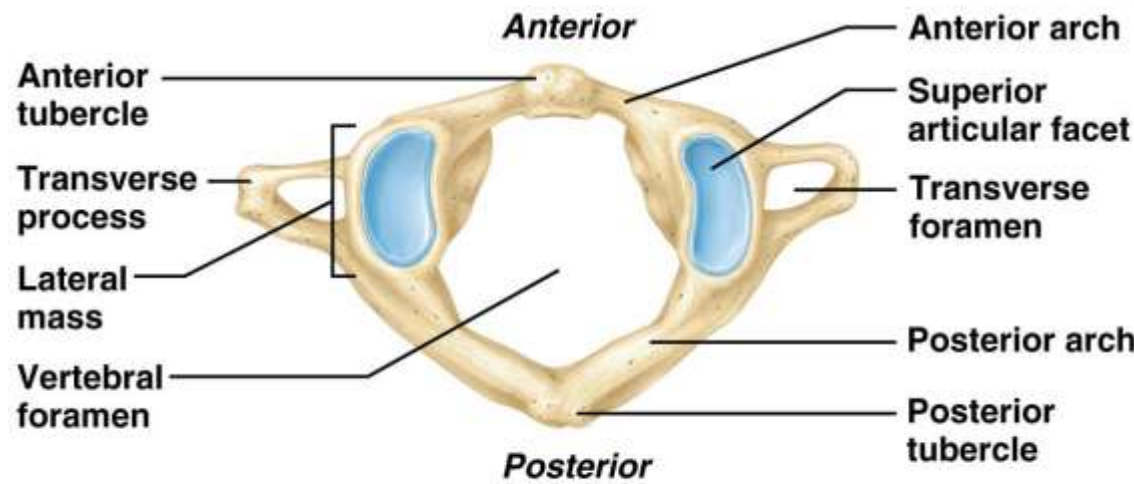
(b) Right lateral view

Structure of the Vertebrae

- Cervical vertebrae
 - Easily identified by **transverse foramina** found in their transverse processes;
 - Allows passage of vertebral arteries and veins
 - **Atlas (C₁)**
 - lacks a **vertebral body**
 - Articulate with *occipital bone* and C₂;
 - Shaking your head to indicate “yes”
 - **Axis (C₂)**
 - **Dens (odontoid process)** - prominent superior tooth-shaped projection
 - Articulates with *atlas*
 - Allows for *rotational movement* of head at neck; shaking your head to indicate “no”



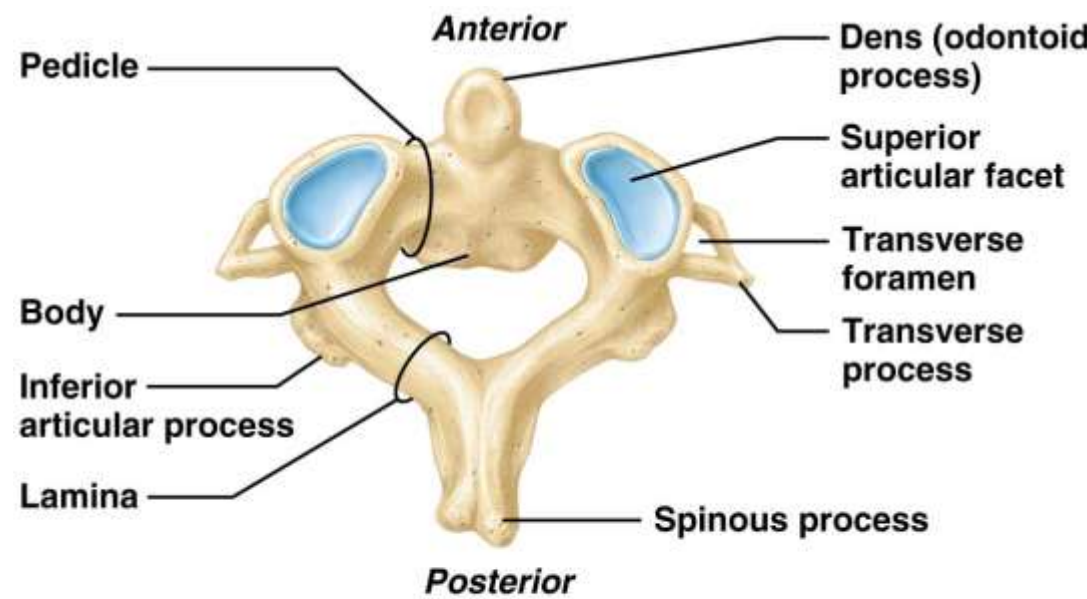
Atlas and Axis



Looks like me, it does

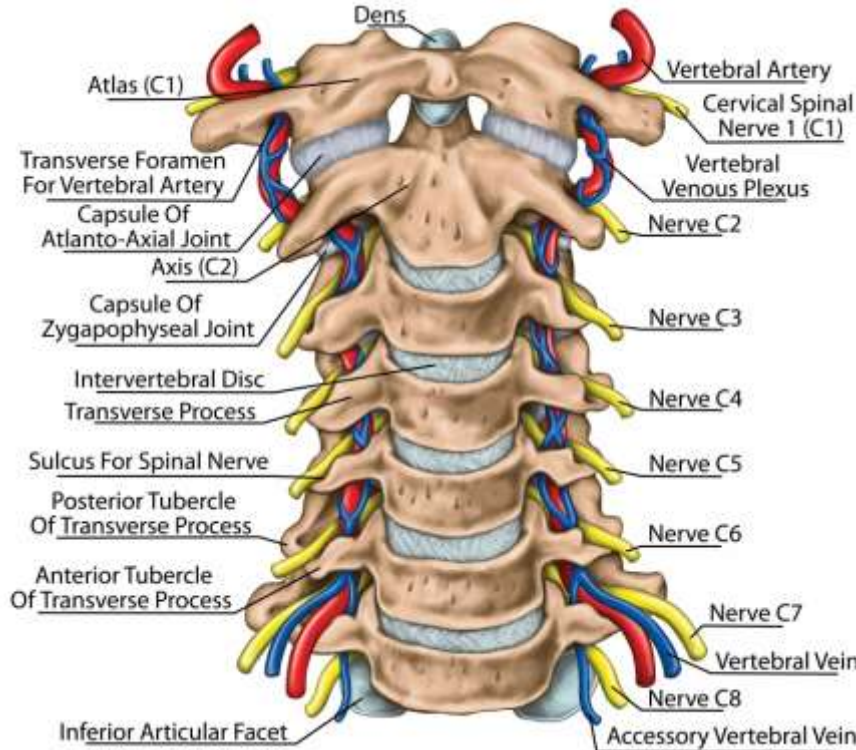
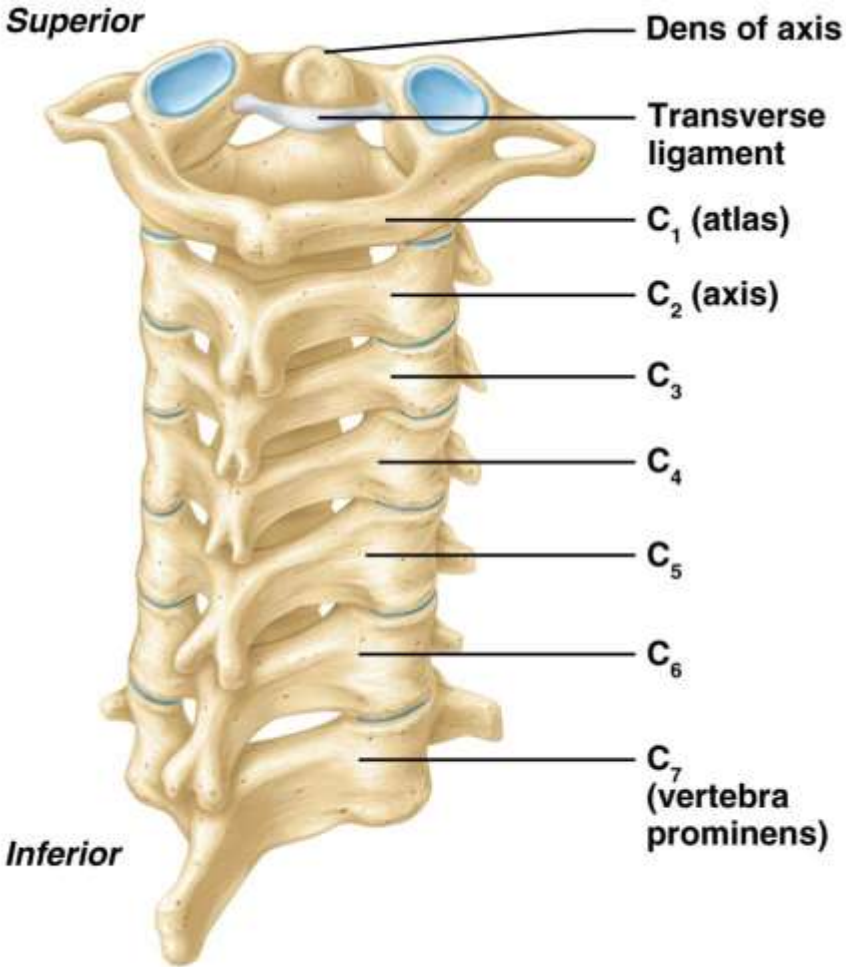


(b) Atlas (C₁), superior view



(c) Axis (C₂), superior view

Regional Characteristics of Cervical Vertebrae



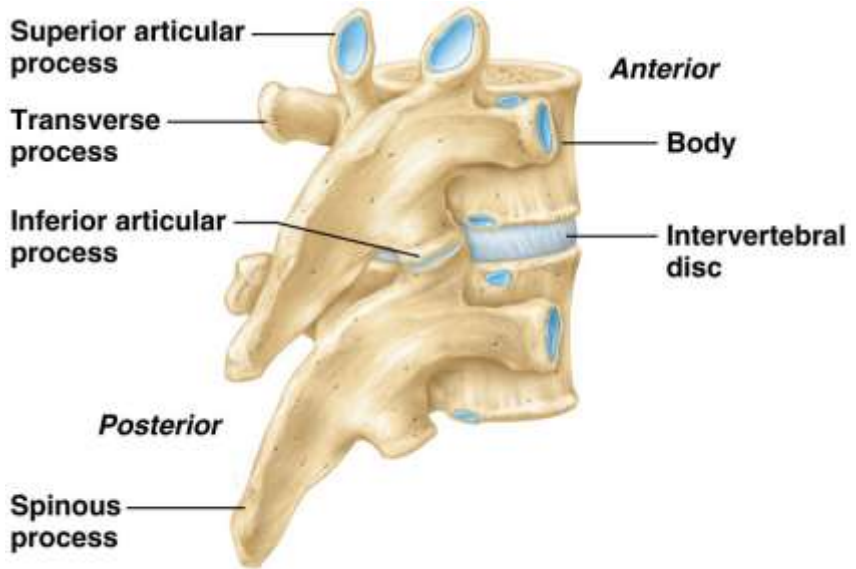
Anterior view

(d) Posterior view of articulated cervical vertebrae

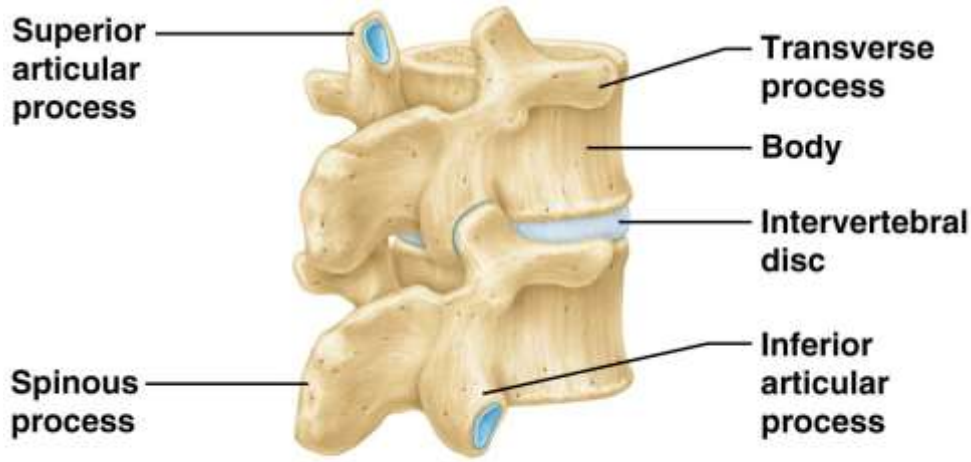
Structure of the Vertebrae

- **Thoracic vertebrae (12)** – *larger* than cervical vertebrae with *heart-shaped* bodies, *circular* vertebral foramina, and long spinous processes that point *inferiorly*
 - **Superior, inferior, and transverse costal facets** are the three points of articulation with the ribs
- **Lumbar vertebrae (5)** – *largest* and *heaviest* of all vertebrae
 - Well-suited for bearing weight of torso
 - Large, *kidney-shaped* bodies and thick spinous processes that point *posteriorly*
 - Vertebral foramina have a flattened *triangle* shape

Regional Characteristics of Thoracic, and Lumbar Vertebrae



(c) Two articulated thoracic vertebrae, superior view



(c) Posterolateral view



Thoracic giraffe



Lumbering moose



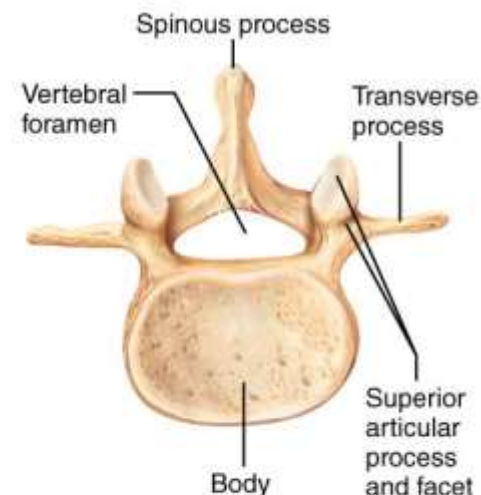
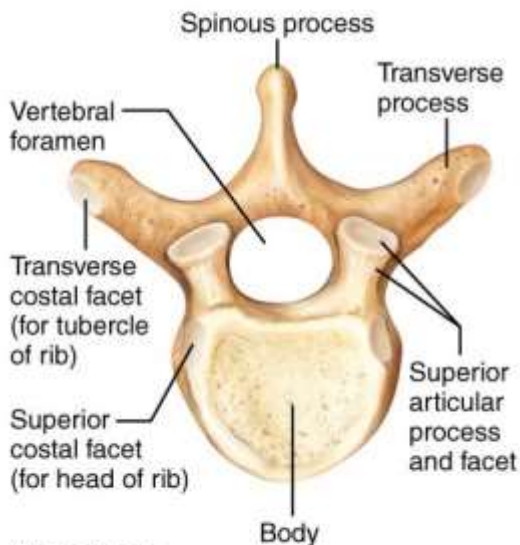
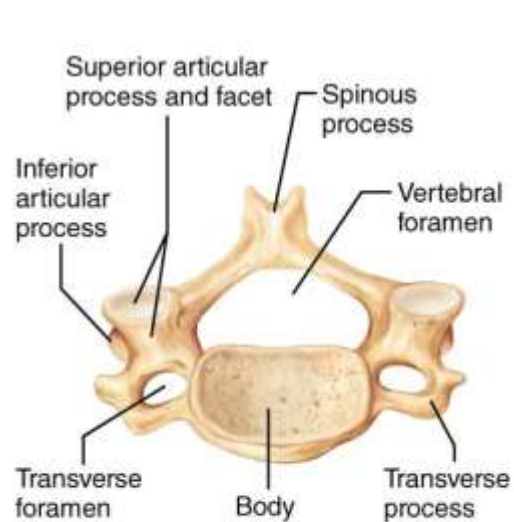
CHARACTERISTIC

CERVICAL (3-7)

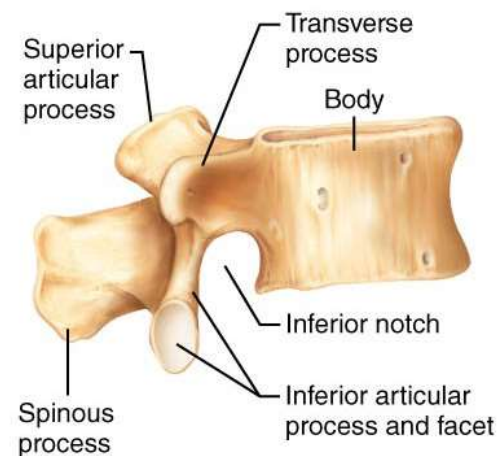
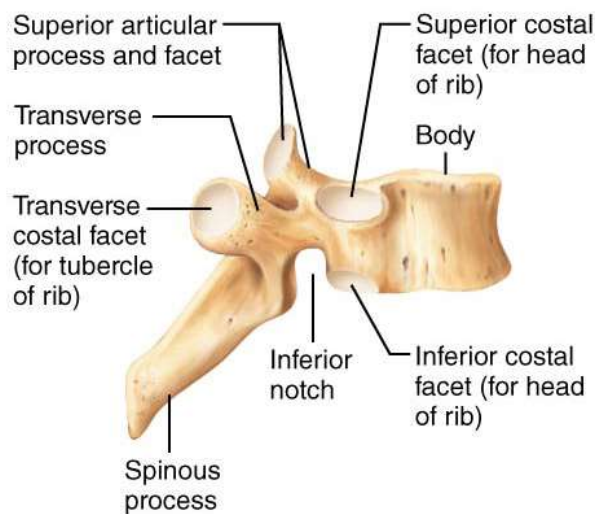
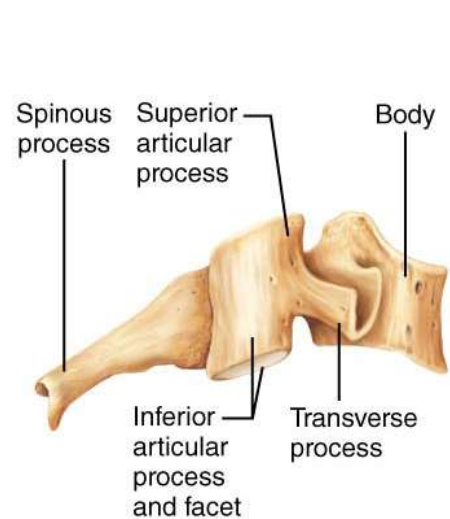
THORACIC

LUMBAR

Superior View



Right Lateral View



(a) Cervical

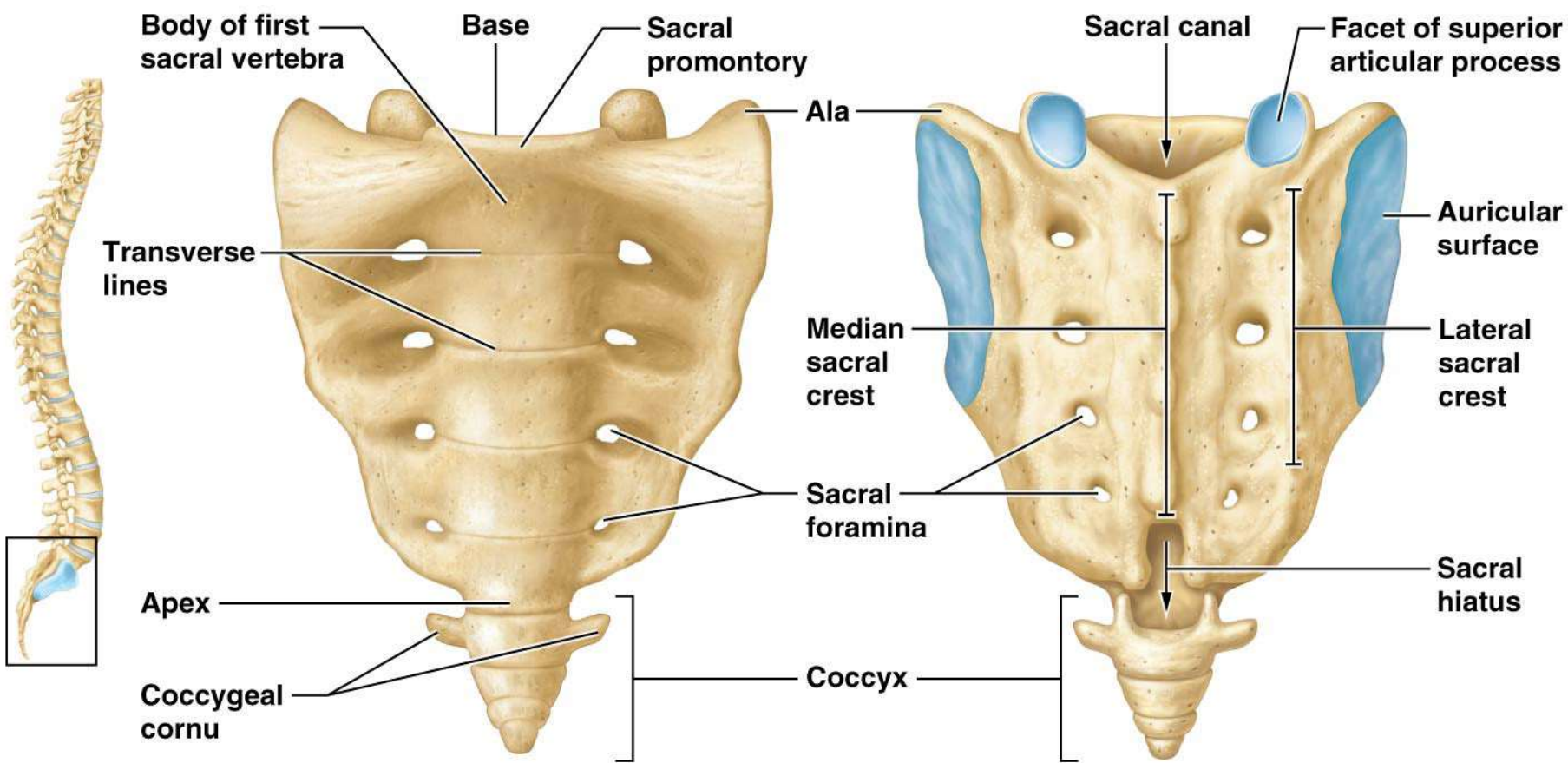
(b) Thoracic

(c) Lumbar

Structures of the Sacrum

- 5 *fused* sacral vertebrae form the curved triangular-shaped *posterior boundary* of pelvic cavity
 - Superior surface (**base**) articulates with L5 vertebra at facets of superior articular processes
 - **Sacral promontory** – bony *projection* at anterior margin of base
 - **Alae** – *two smooth regions* found lateral to sacral promontory
 - **Sacral canal** – *opening* continuous with vertebral canal; on posterior surface; allows for passage of nerve roots
 - **Median sacral crest** – *ridge* of bone formed by fused sacral spinous processes found at posterior boundary of sacral canal
 - **Sacral foramina** – *4 pairs of holes* found on either side of median sacral crest. Passage way for lumbar plexus nerves

Sacrum and coccyx



(a) Anterior view

(b) Posterior view

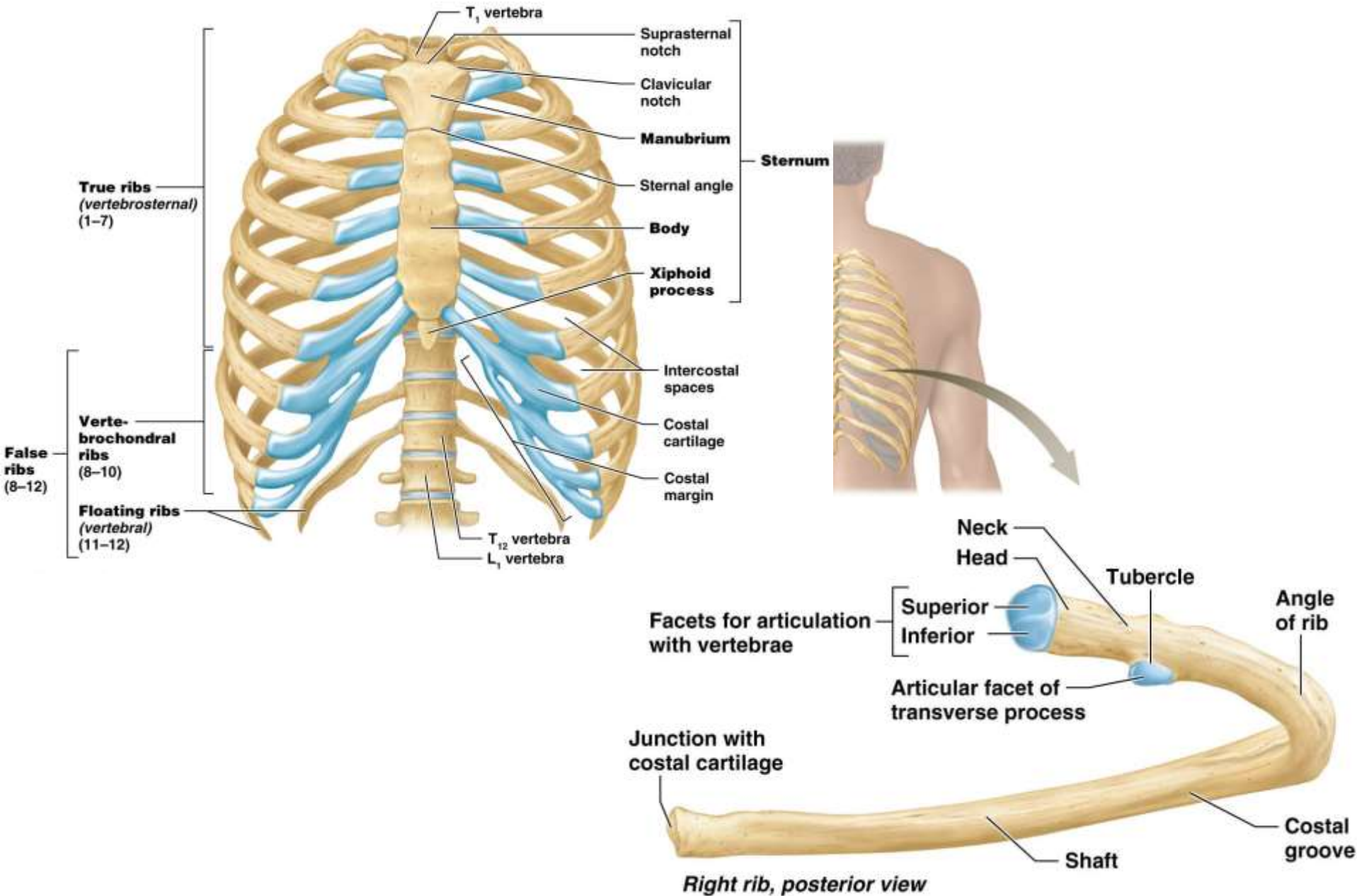
The Thoracic Cage

- Forms a cage to protect major organs
 - Sternum – curved, “T” shaped bone
 - **Manubrium** – superior portion where the clavicle articulates
 - **Suprasternal / Jugular notch** – jugular vein passes posterior toward the cervical region
 - **Body** – middle portion where costal cartilages and pectoral muscles attach
 - **Xiphoid process** – inferior portion and indirectly attaches costal cartilage to the sternum

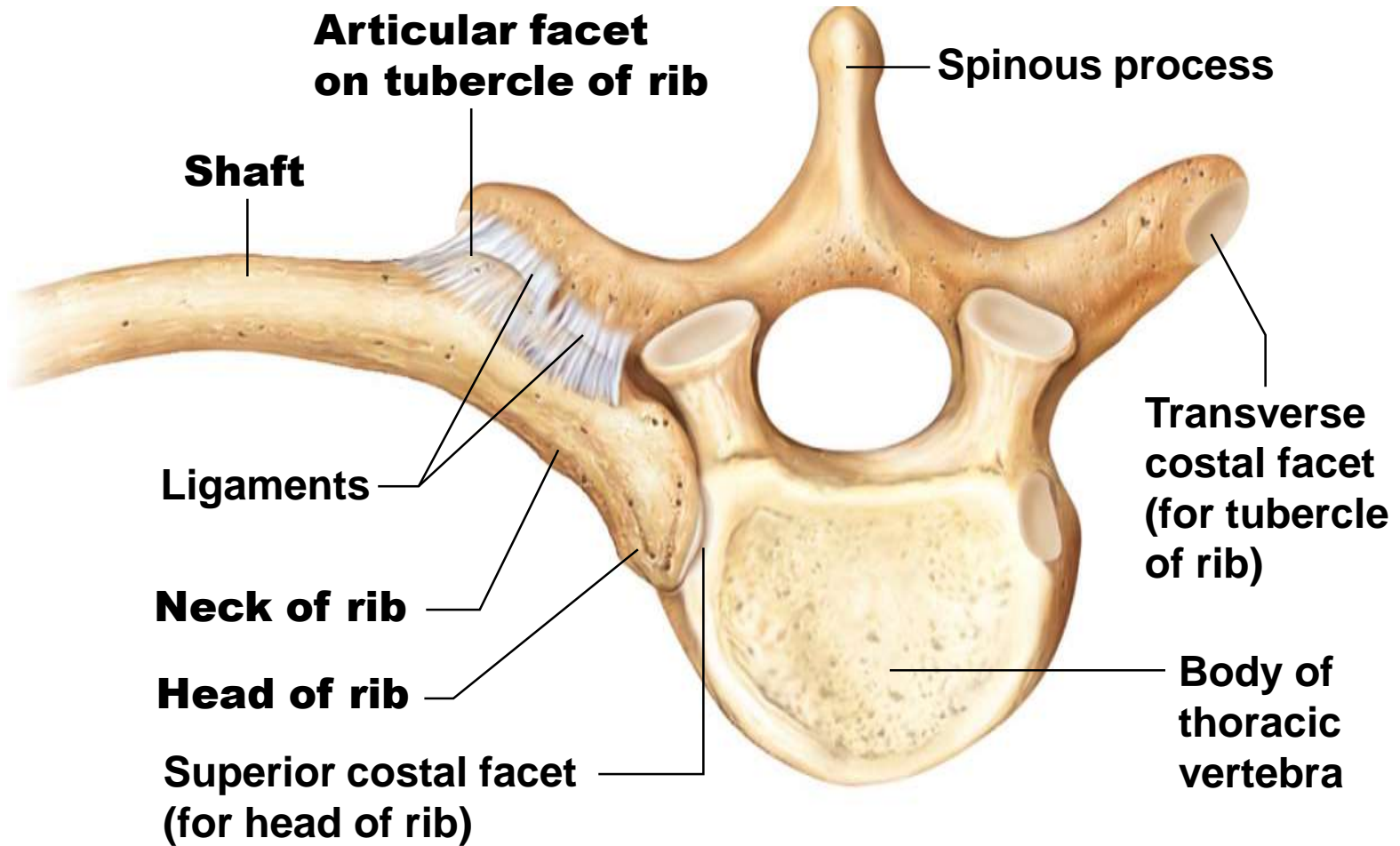
The Thoracic Cage

- Forms a cage to protect major organs
 - Ribs - 12 pairs of ribs and their costal cartilages; curved into a C-shape
 - **True ribs** (pairs 1–7) - attach to sternum via their *costal cartilages*
 - **False ribs** (pairs 8–12) - are not directly attached to sternum
 - **Floating ribs** (pairs 11–12) - not attached to sternum

The Ribs



Rib articulation with the thoracic vertebra.



(b)