The Axial Skeleton

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The Axial Skeleton

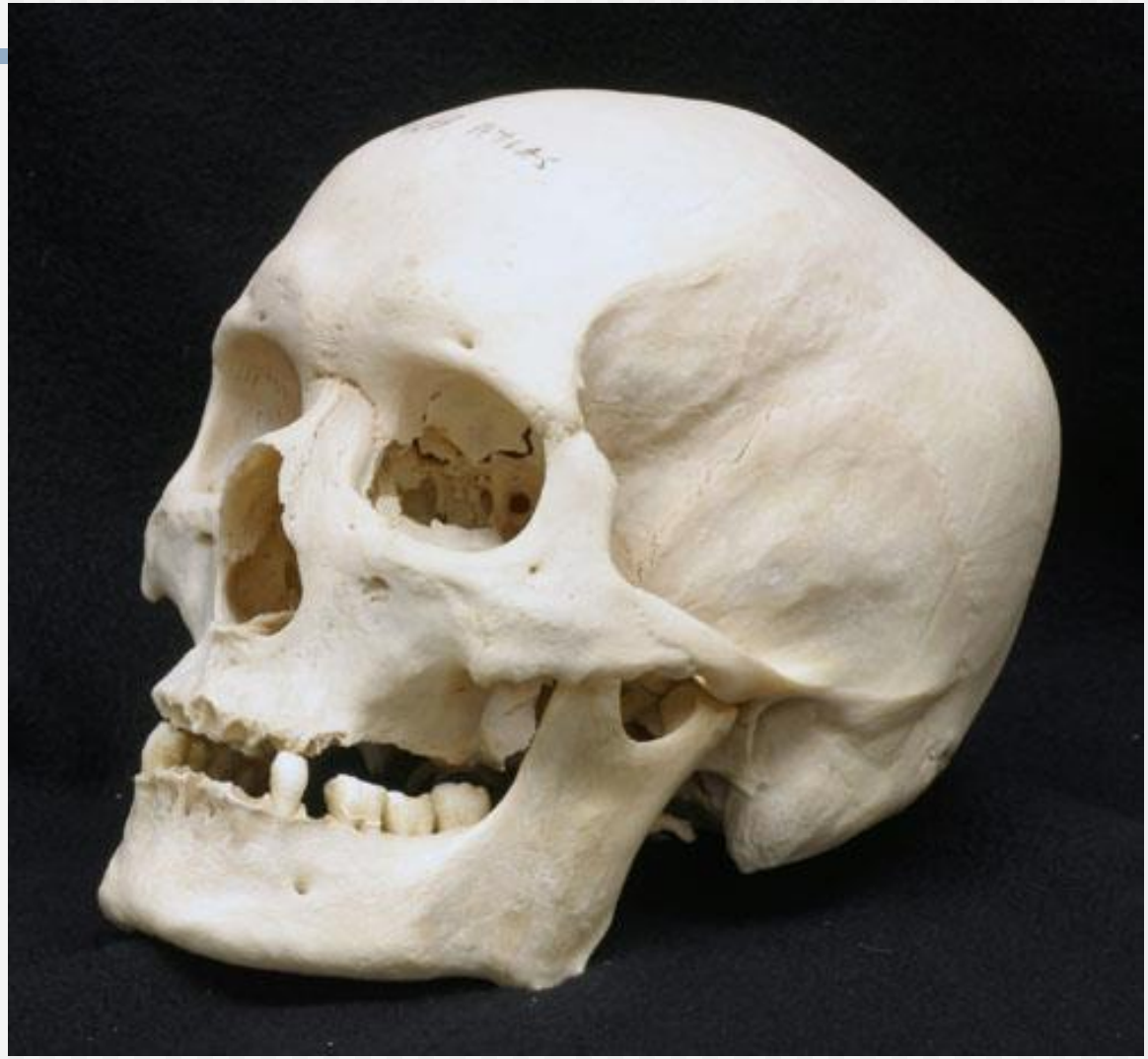
- Includes:
  - Skull
    - Cranium
    - Face
  - Hyoid bone
  - Auditory ossicles
  - Vertebral column
  - Thorax
    - Sternum
    - Ribs

Axial Skeleton: The Skull

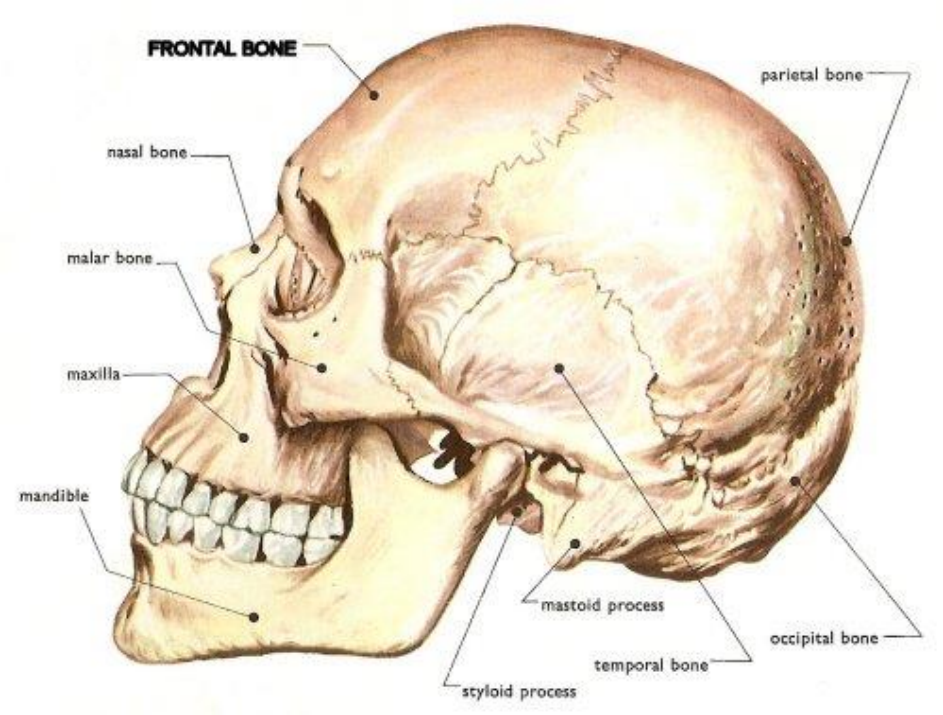
The Skull

- Contains 22 bones
- 8 Cranial Bones that enclose and protect the brain
- 14 Facial Bones that form the face

Cranial Bones



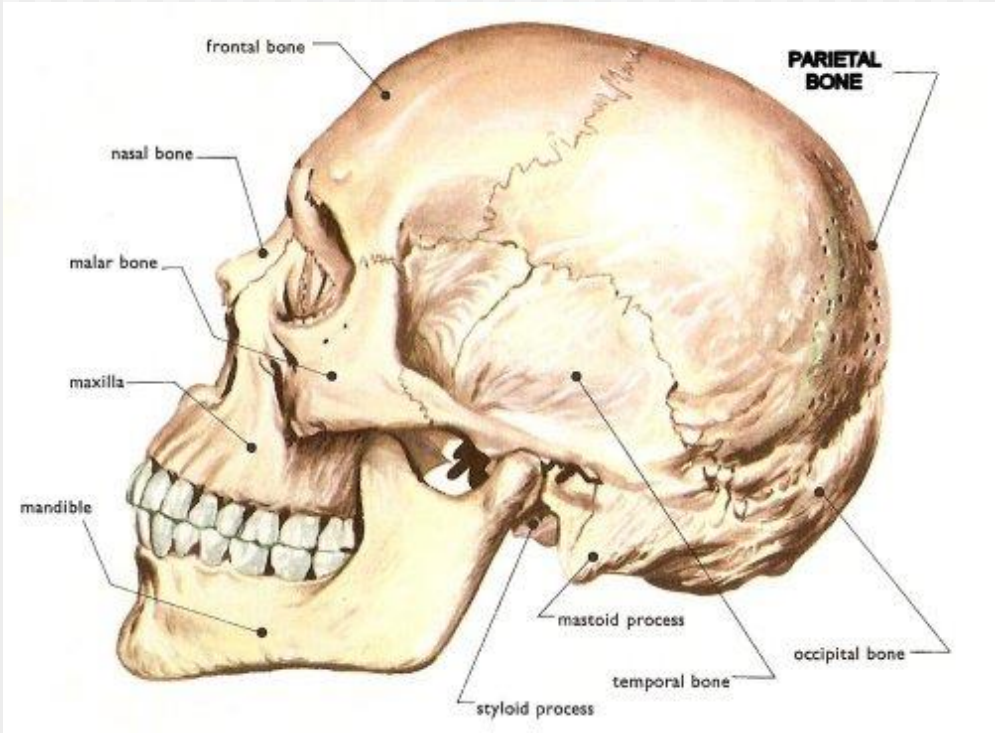
Frontal Bone



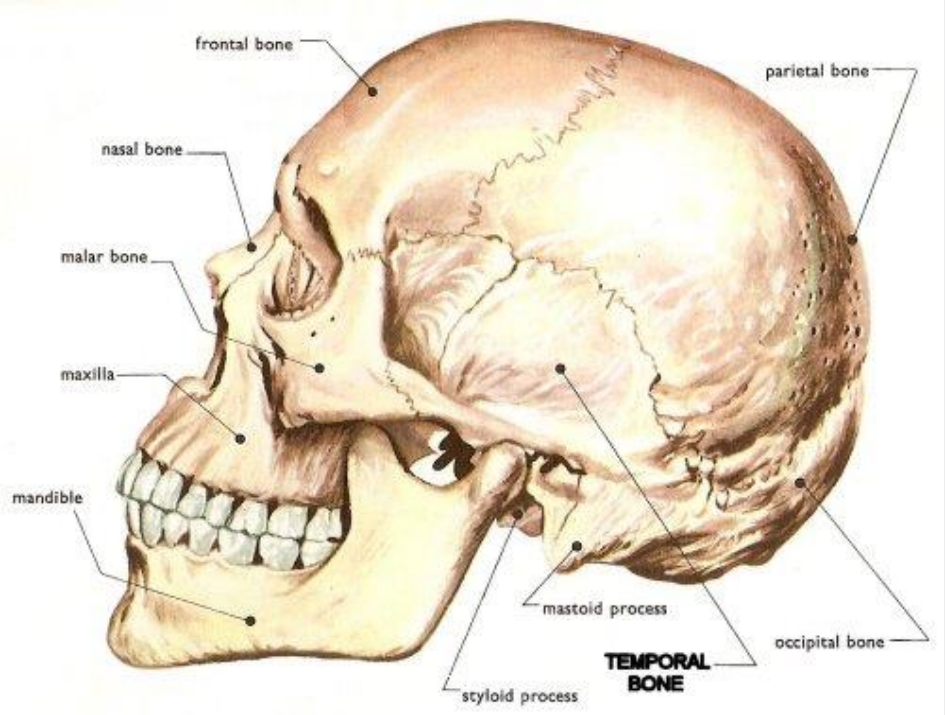
- Forms forehead, roofs of the eye sockets (orbits), and most of the front part of the cranial floor
- Frontal sinuses lie deep within the bone

Parietal Bones

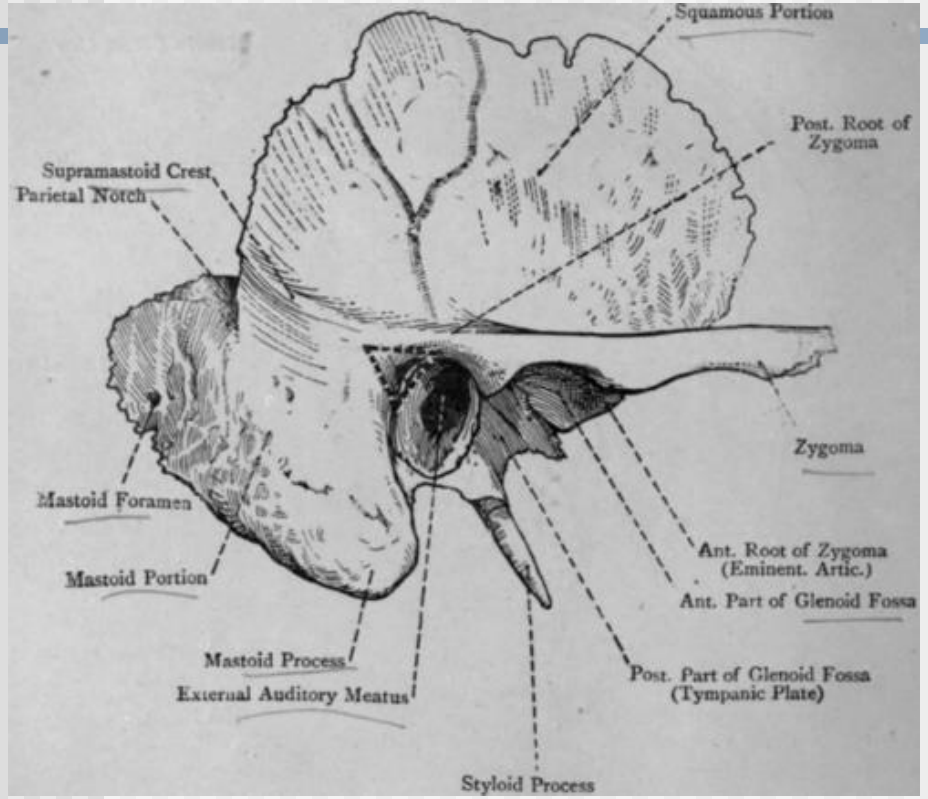
- Form the sides and roof of the cranial cavity
- Separated on top of skull by the sagittal suture



Temporal Bones



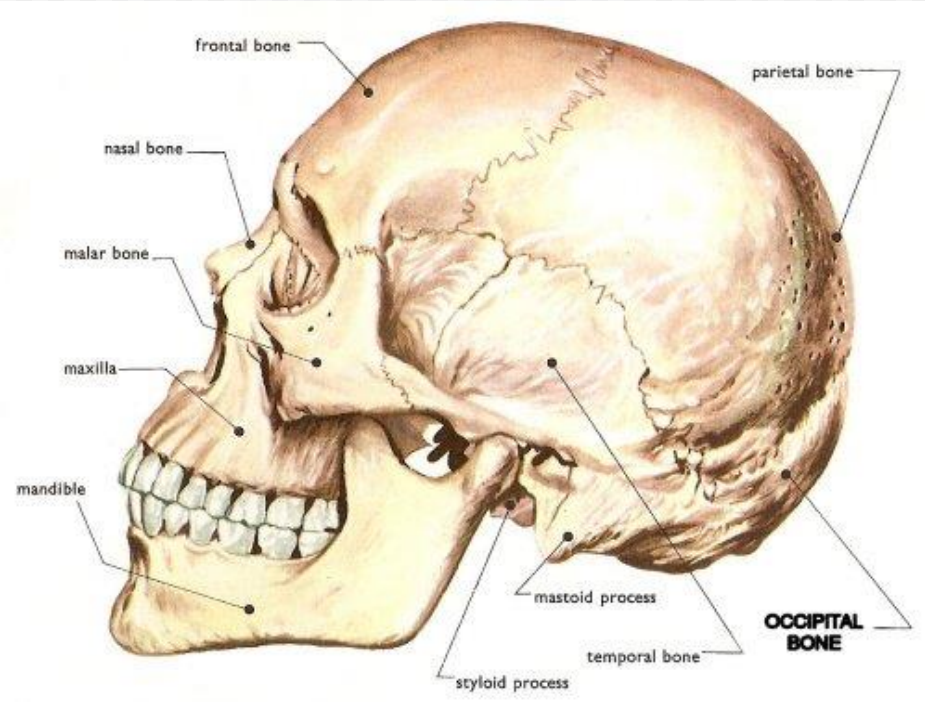
- Form lower sides of the cranium and part of the cranial floor
- External auditory meatus (ear canal) is located within these bones



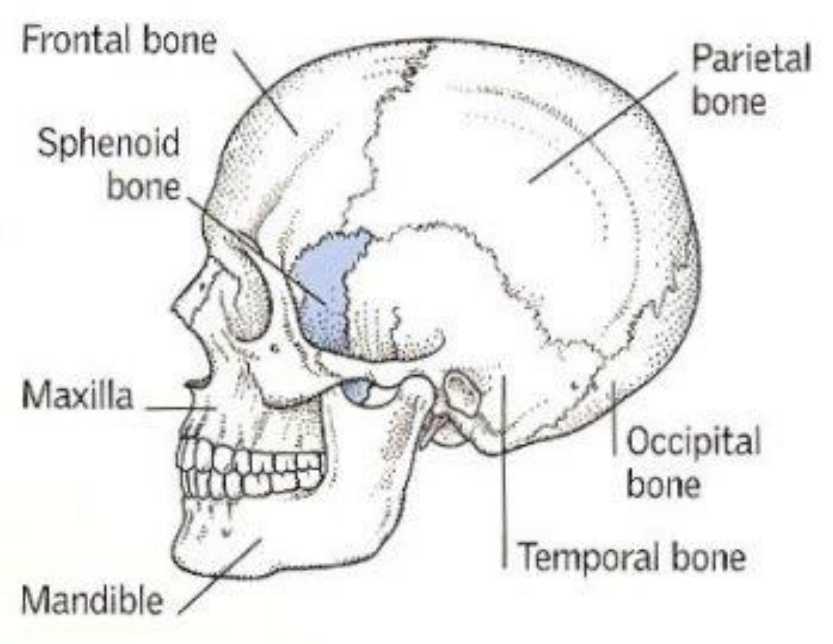
- **Mastoid process** is behind external auditory meatus and is a point of neck muscle attachment
- **Styloid process** is point of neck and tongue muscle and ligament attachment
- **Mandibular fossa** forms half of the temporomandibular joint with the mandible (lower jaw bone)

Occipital Bone

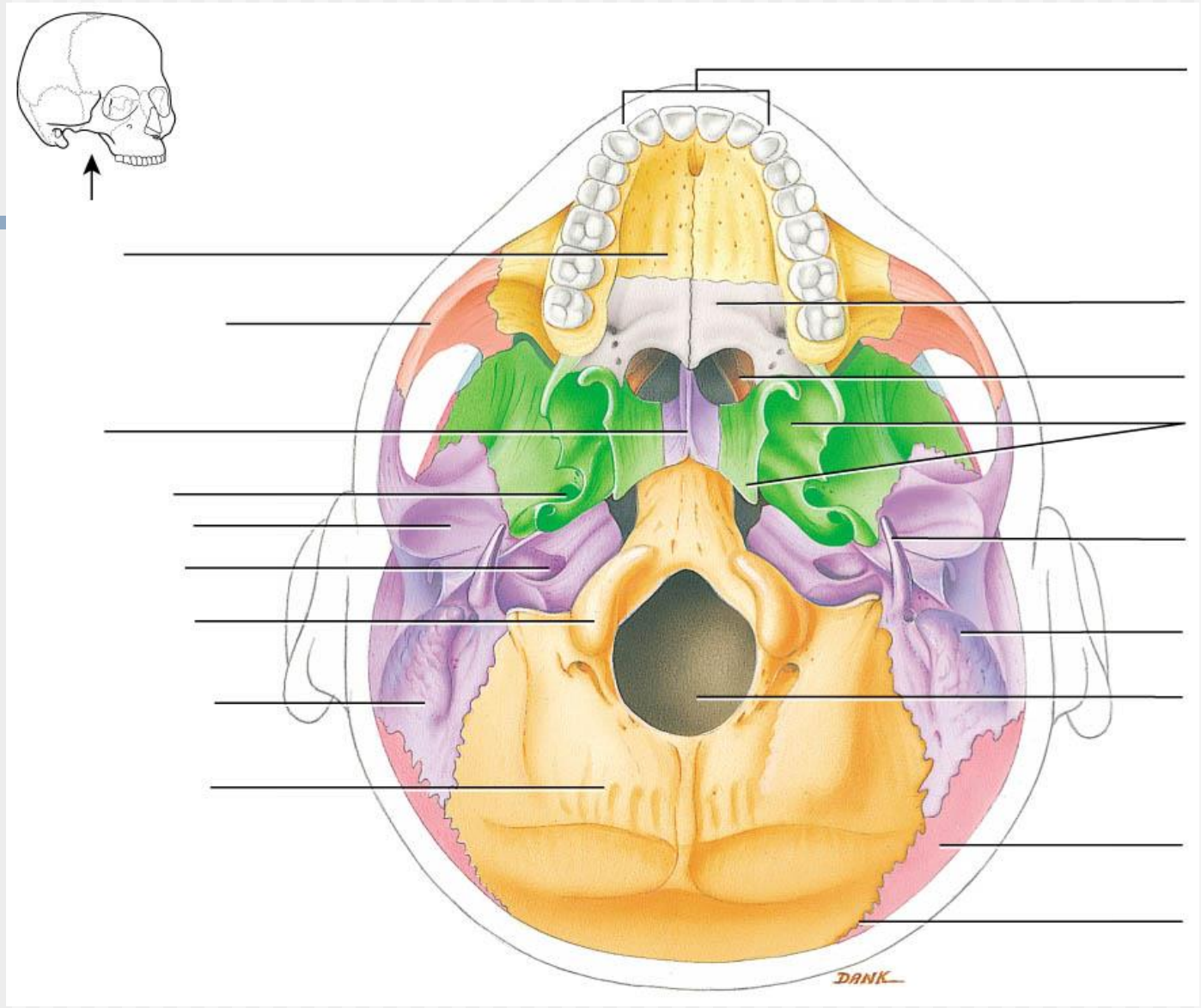
- Forms posterior part and most of the cranial base
- Foramen magnum passes through this bone
- Occipital condyles are on either side of the foramen magnum that connect with the first vertebrae



Sphenoid Bone



- The “keystone” of the cranial floor because it holds together all of the other cranial bones
- The hypophyseal fossa is a depression for the pituitary gland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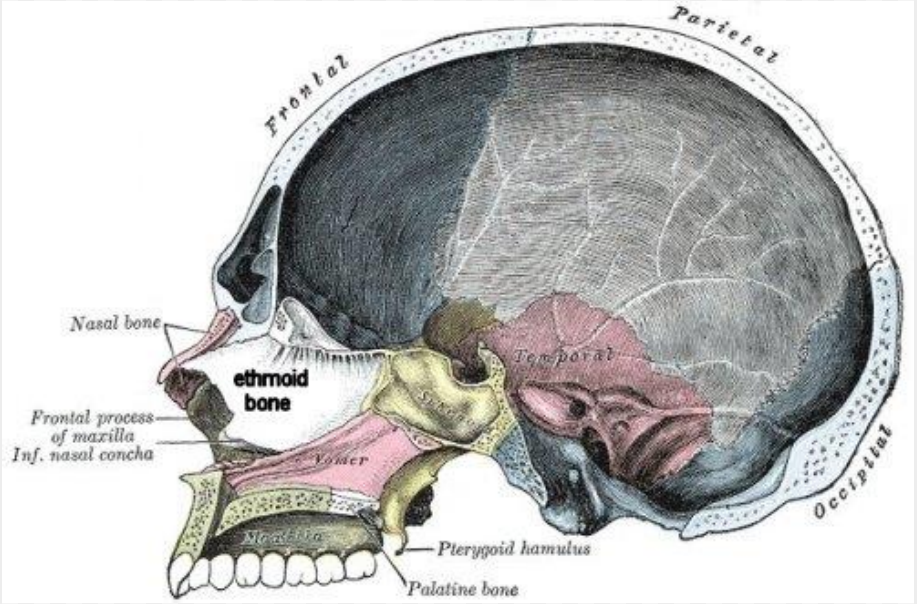
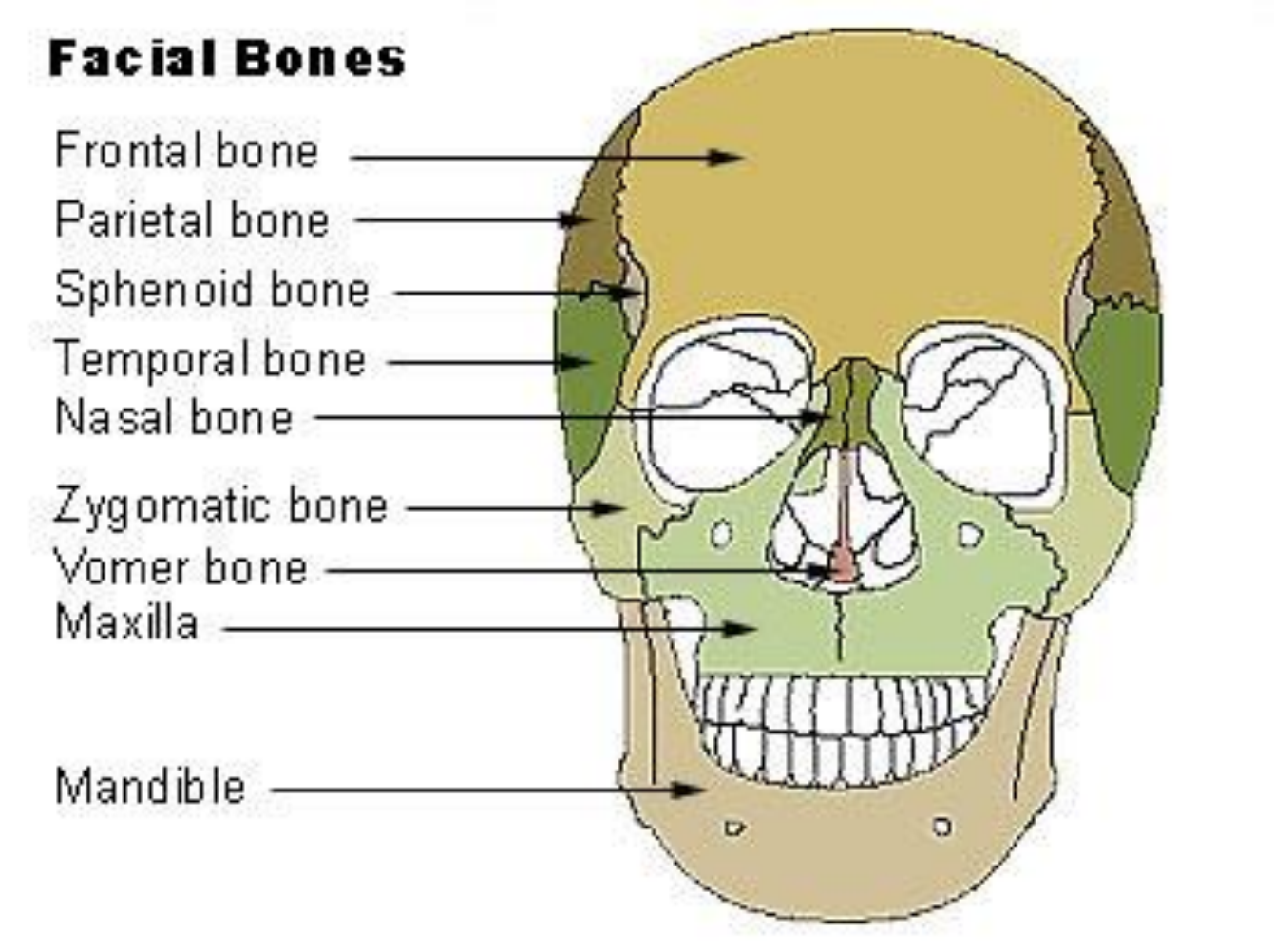
Ethmoid Bone

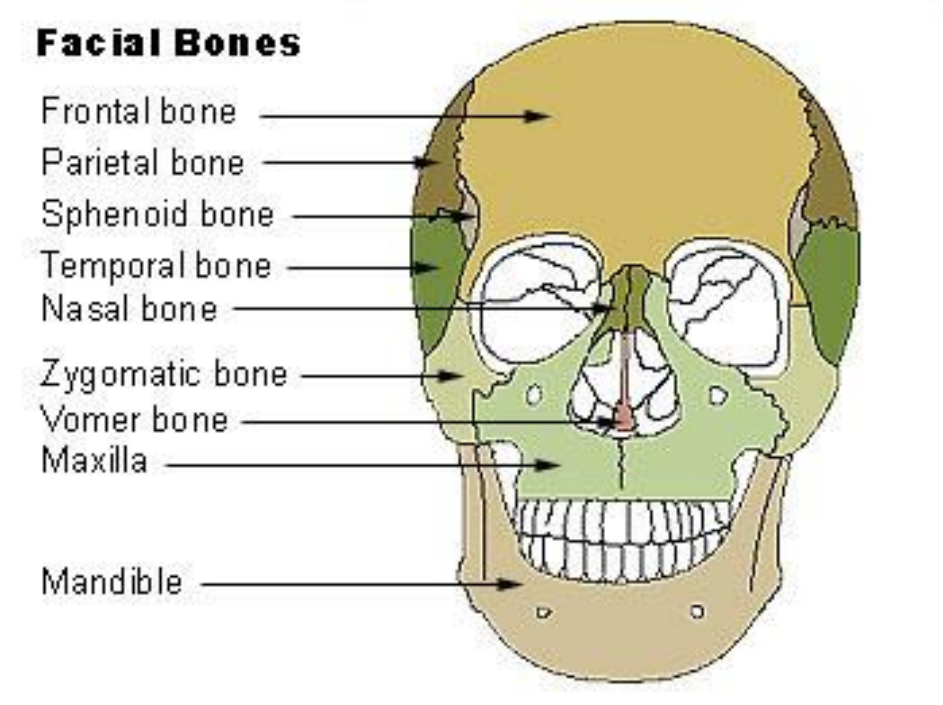
- Light spongy bone in the anterior part of cranial floor between the eye sockets
- Houses the nasal cavity
- Contains the nasal conchae that cause turbulence in inhaled air, cleaning the air before it passes into the rest of the respiratory tract



Facial Bones



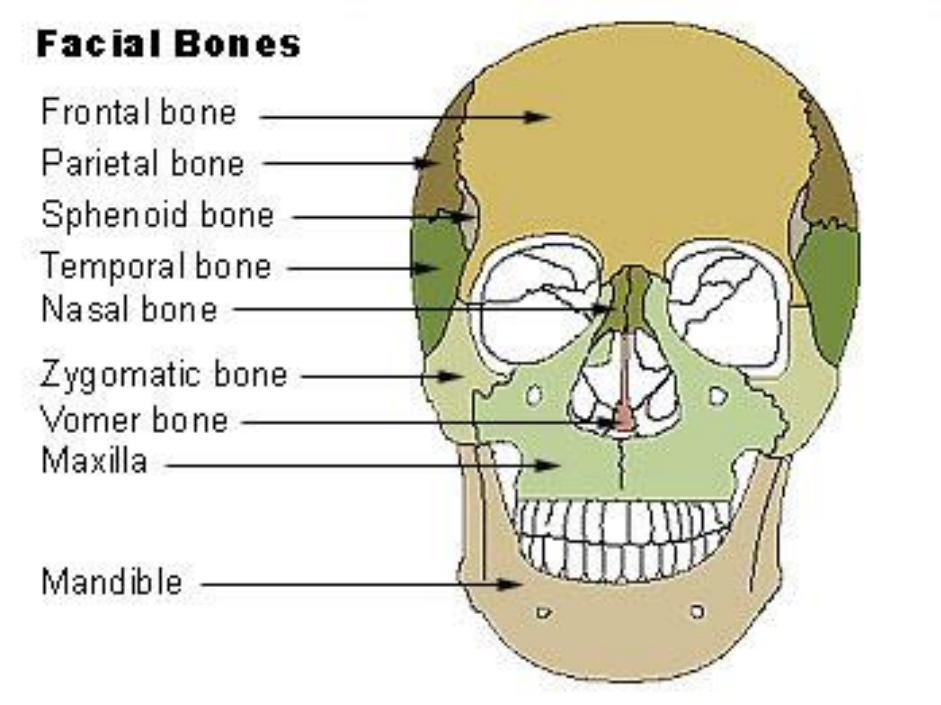
Nasal Bones



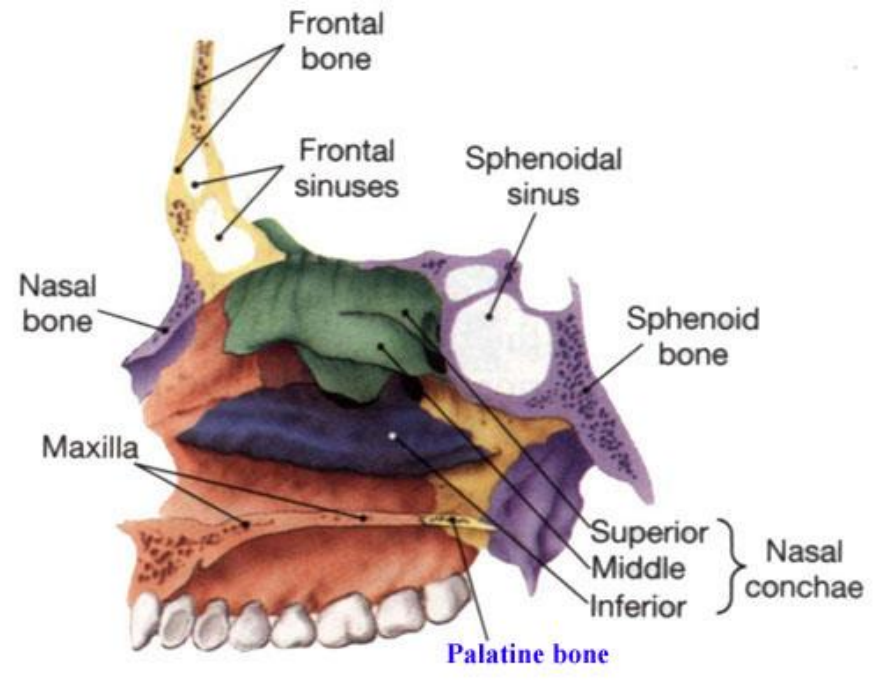
- Paired to form the bridge of the nose
- The rest of the nose consists of cartilage

Maxillae

- Paried to form the upper jawbone
- Articulates with every bone in the face except the mandible
- Forms the anterior 3/4 of the hard palate



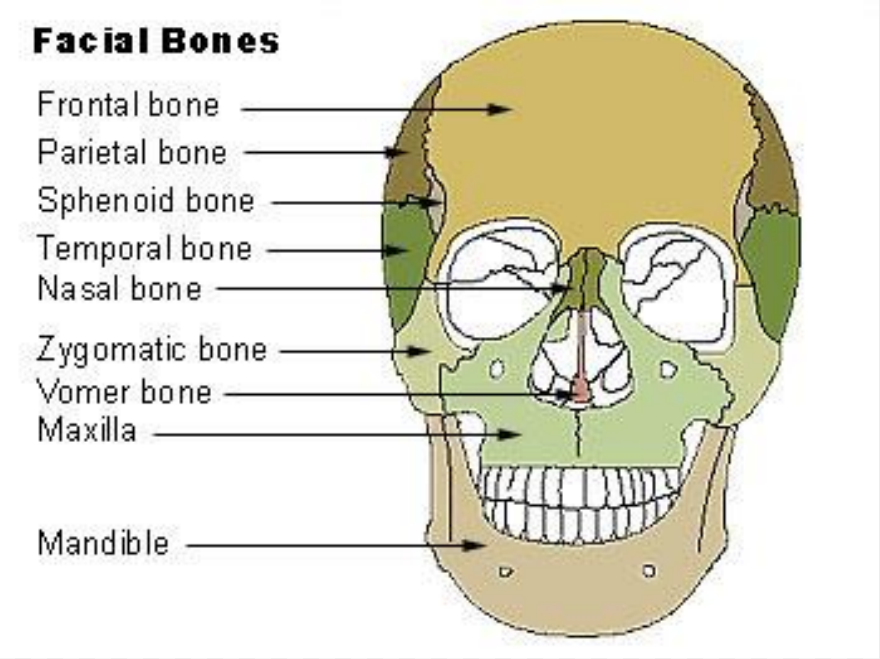
Palatine Bones



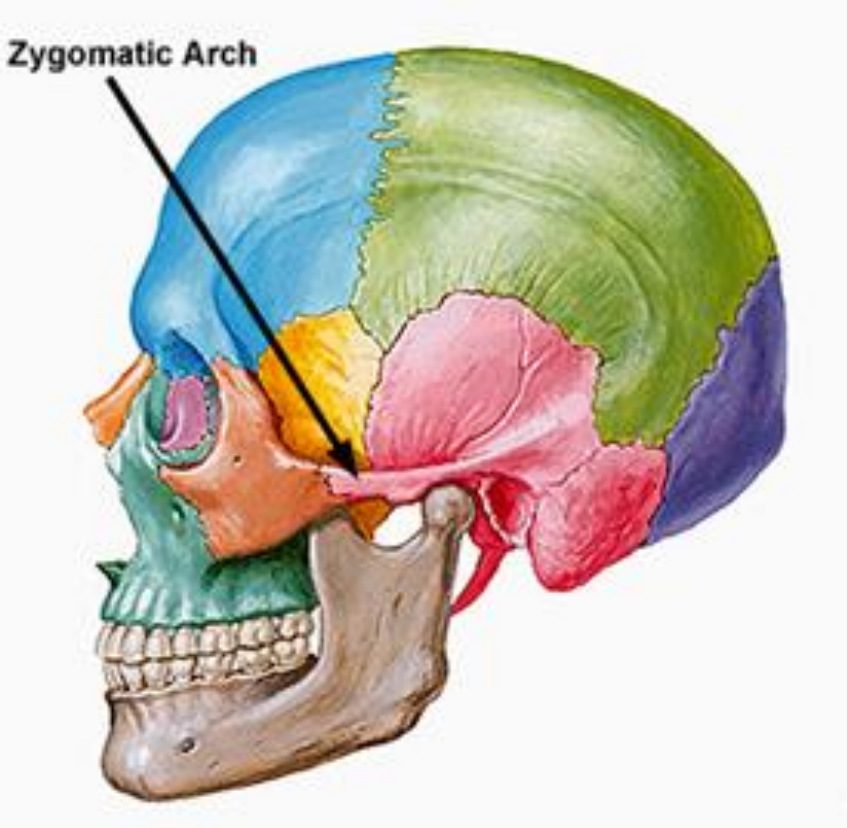
- Paired L-shaped bones
- Form the posterior portion of the hard palate, part of the floor and lateral wall of the nasal cavity, and a small portion of the eye sockets

Mandible

- The lower jawbone
- Largest and strongest facial bone and only movable skull bone
- Condylar process articulates with the mandibular fossa of the temporal bone to form the TMJ



Zygomatic Bones

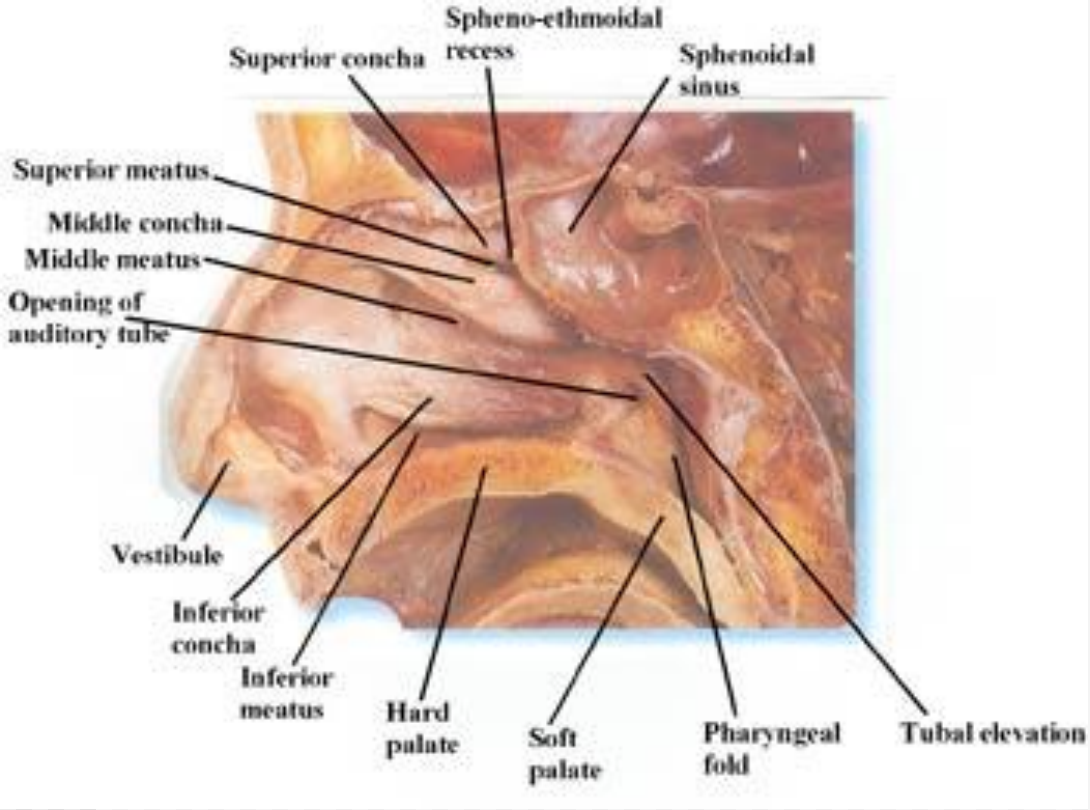


- Two cheekbones
- Form the prominences of the cheeks and part of the lateral wall and floor of the eye sockets

Lacrimal Bones

- Paired smallest bones of the face
- Found near the tear ducts

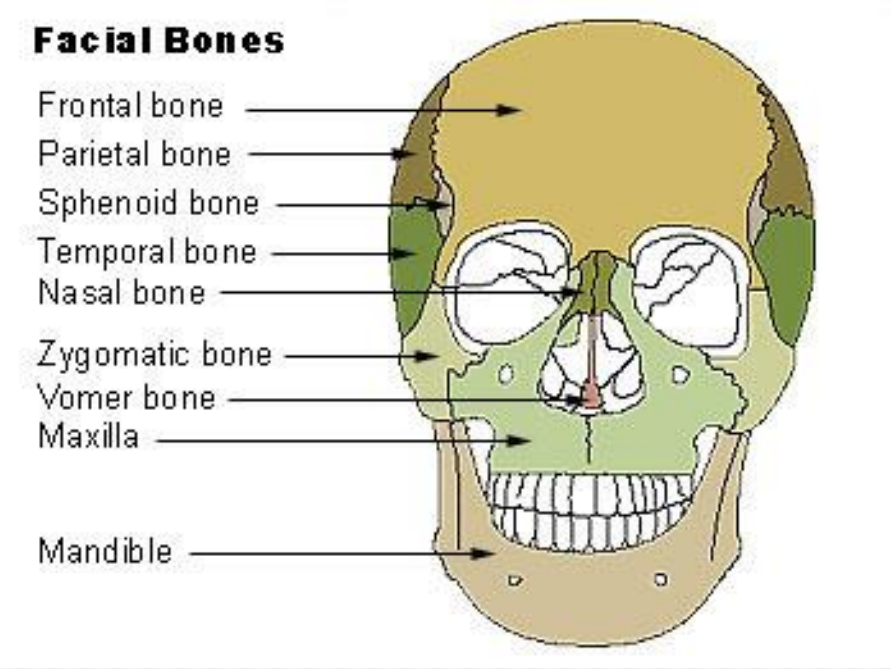
Inferior Nasal Conchae



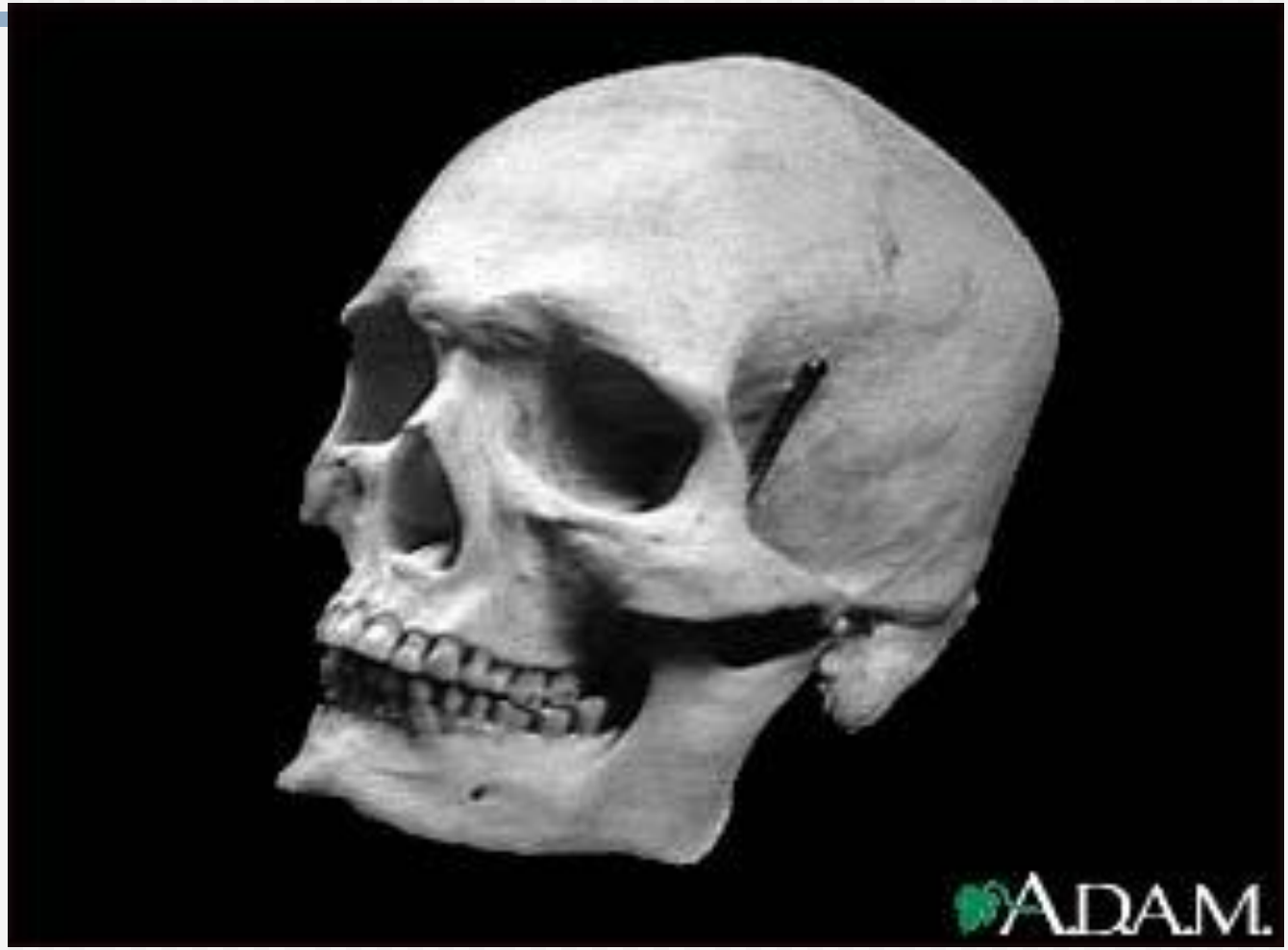
- Scroll-like bones that project into the nasal cavity
- Are below the ethmoid bone and other conchae

Vomer

- Triangular bone on the floor of the nasal cavity
- One of the parts of the nasal septum



Disorders of the Skull



Cleft Palate

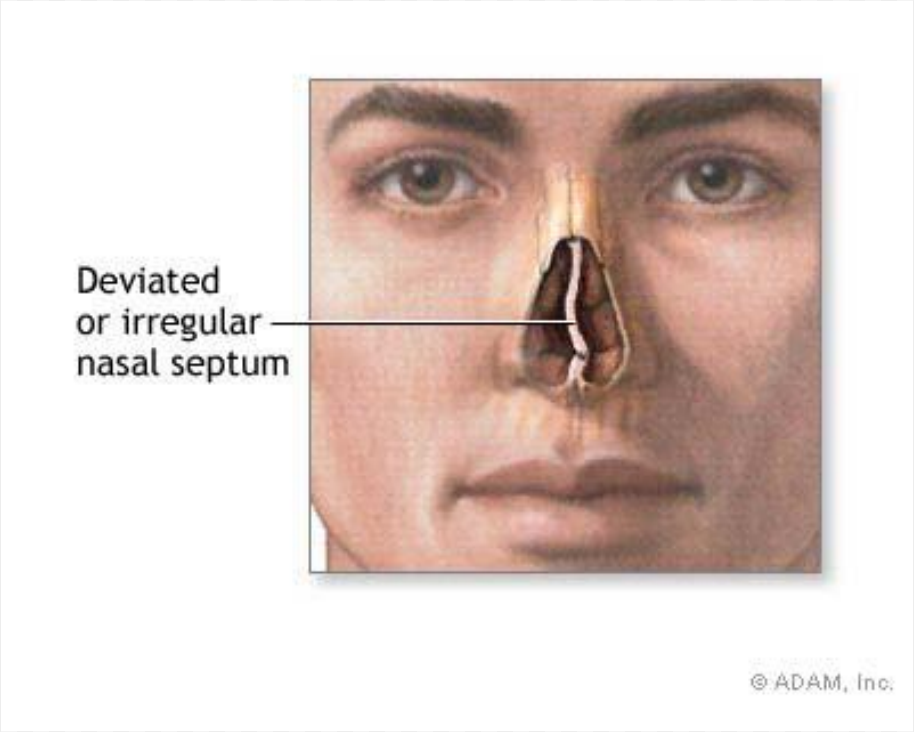
- Occurs when fusion of the left and right maxillary bones is not completed before birth
- Repaired between 12 and 18 months with surgery

TMJ Syndrome

- Caused by improperly aligned teeth, grinding or clenching teeth, trauma, or arthritis
- Generally results in pain around the ear and jaw muscles

Deviated Nasal Septum

- Nasal septum bends sideways from the middle of the nose
- Can entirely block nasal passage in extreme cases



Unique Skull Features

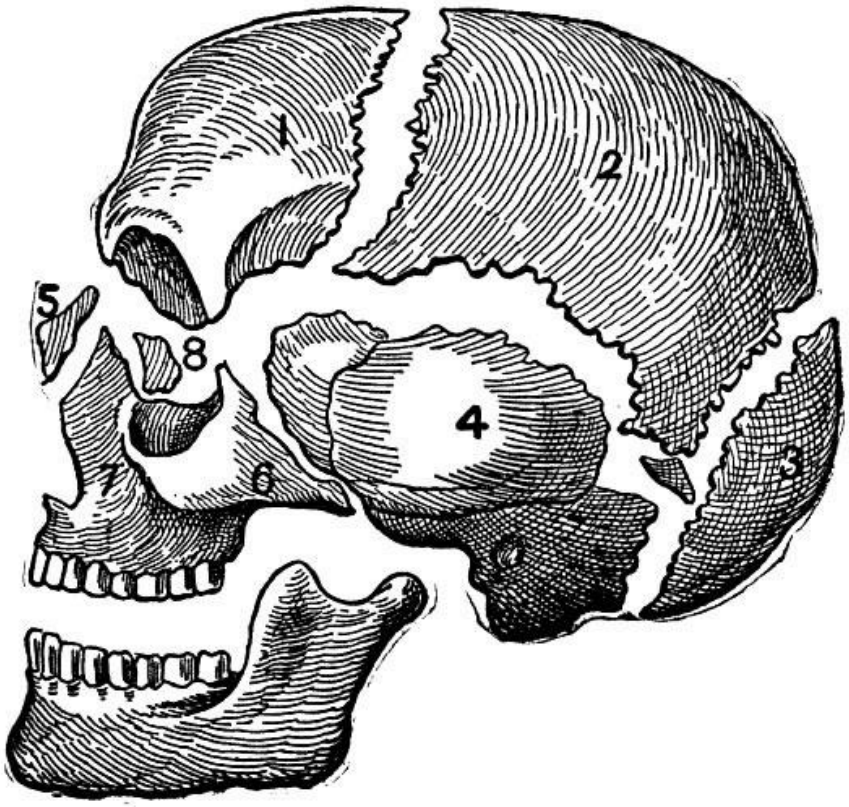
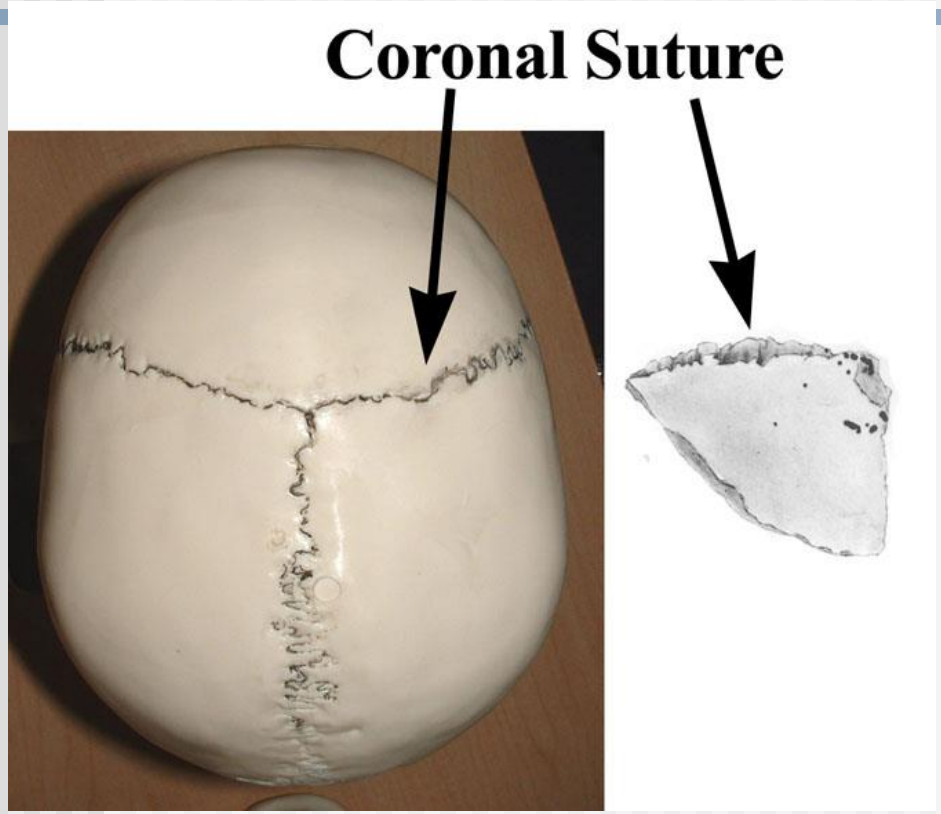


FIG. 5.

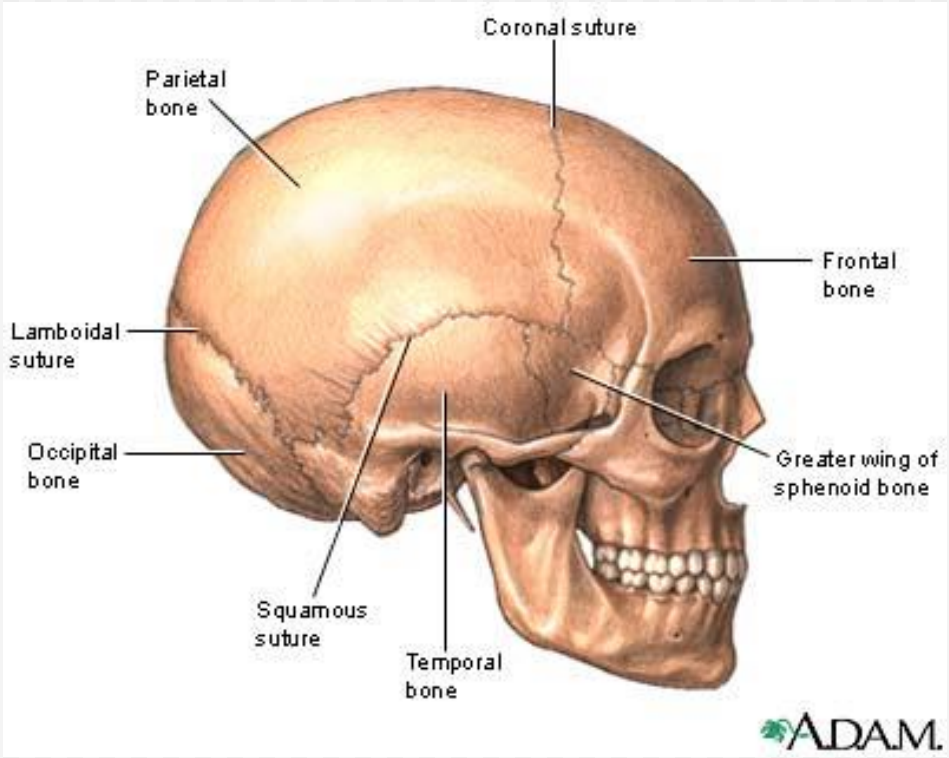
Sutures

- An immovable joint
- Found only between skull bones
- Hold skull bones together

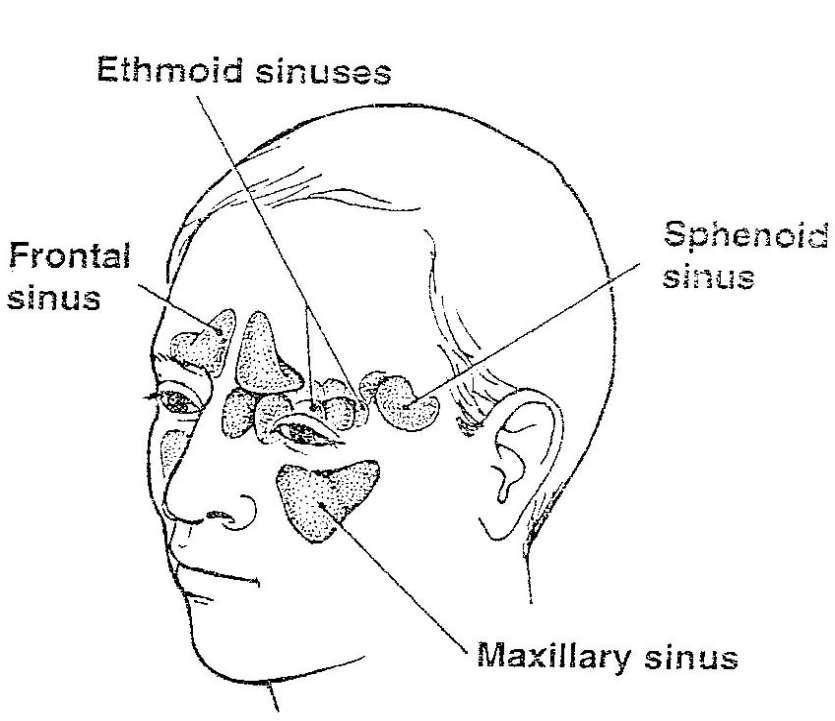


- **Coronal Suture-** Between the frontal bone and two parietal bones
- **Sagittal Suture-** Between the two parietal bones

- **Lambdoid Suture-** between the parietal bones and occipital bone
- **Squamous Suture-** between the parietal bones and temporal bones



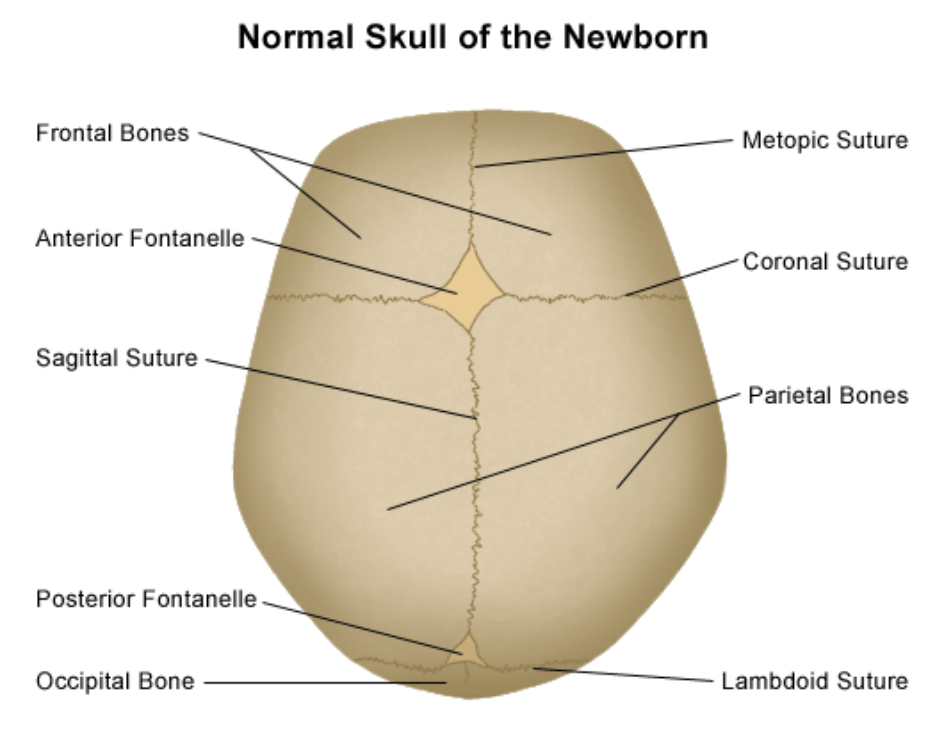
Paranasal Sinuses



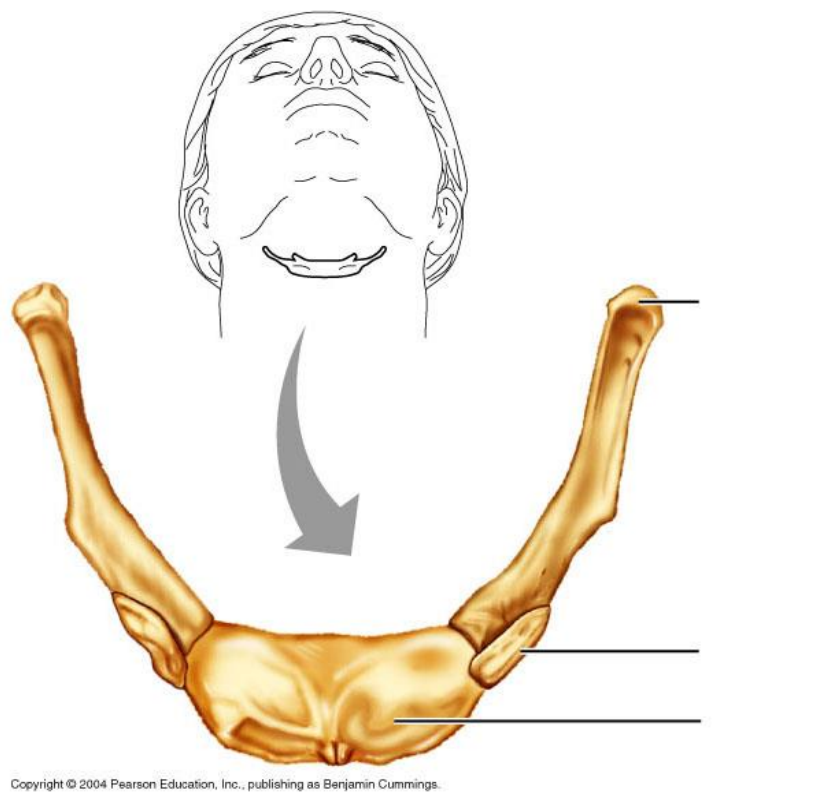
- Paired cavities near nasal cavity
- Located in the frontal bone, sphenoid bone, ethmoid bone, and maxillae
- Lined with mucous membranes

Fontanels

- Membrane-filled spaces found between cranial bones in infants
- Replaced with bone by intramembranous ossification and become sutures
- “Soft Spot” on baby’s head

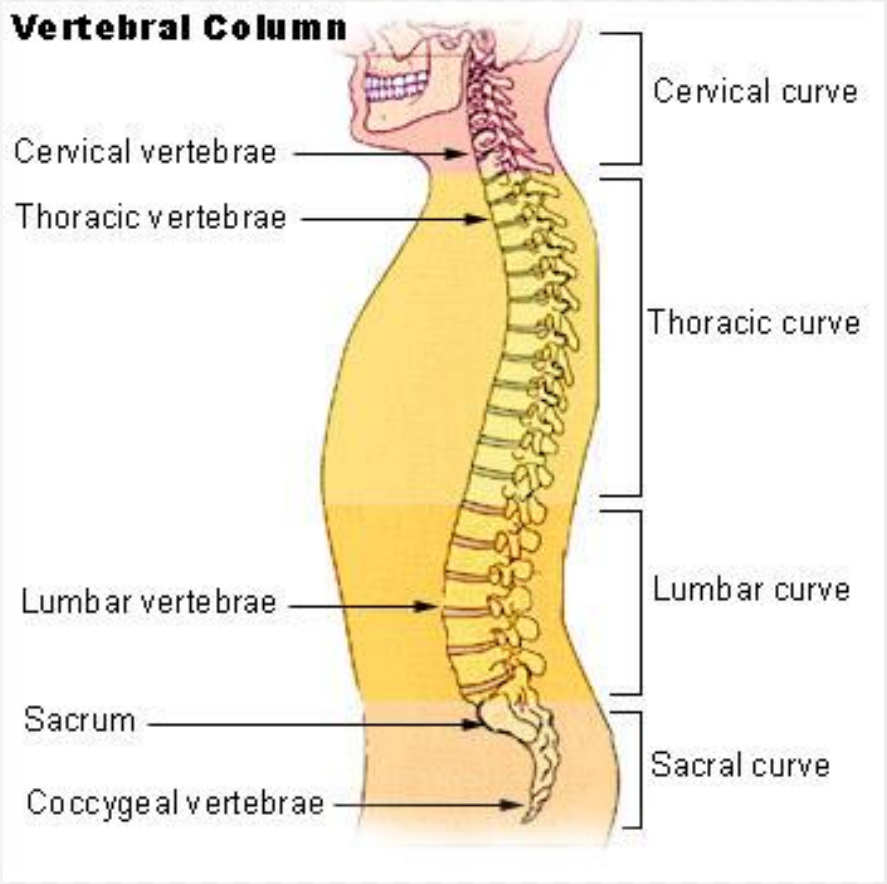


Hyoid Bone



- Does not articulate with or attach to any other bone
- Suspended from the styloid processes by ligaments and muscles
- Located in the neck between the mandible and larynx

Vertebral Column

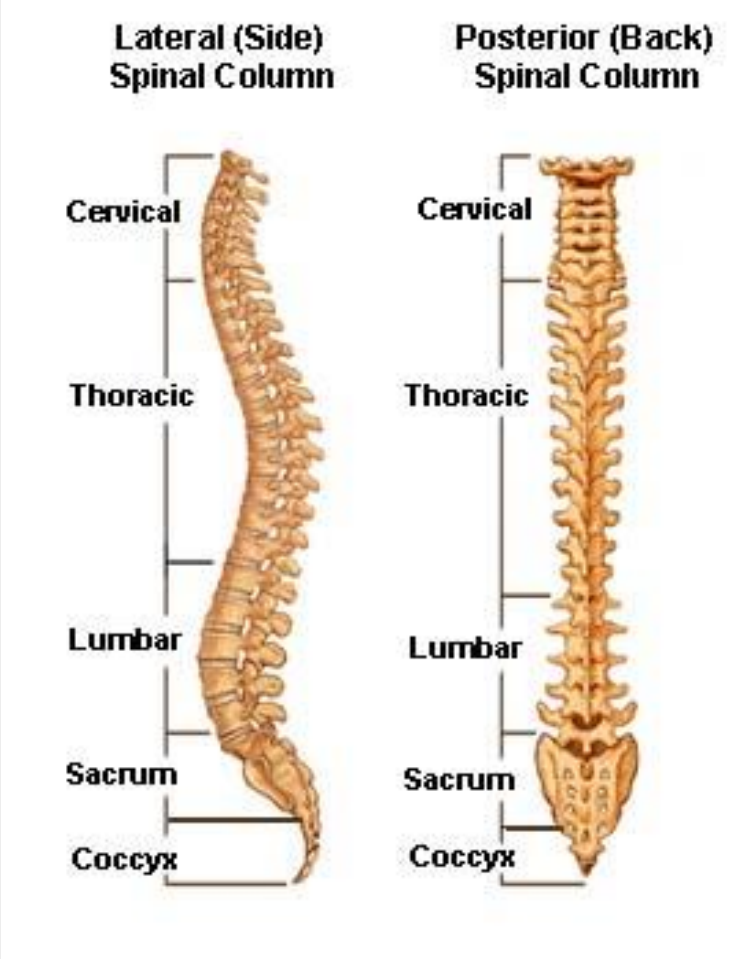


Vertebral Column

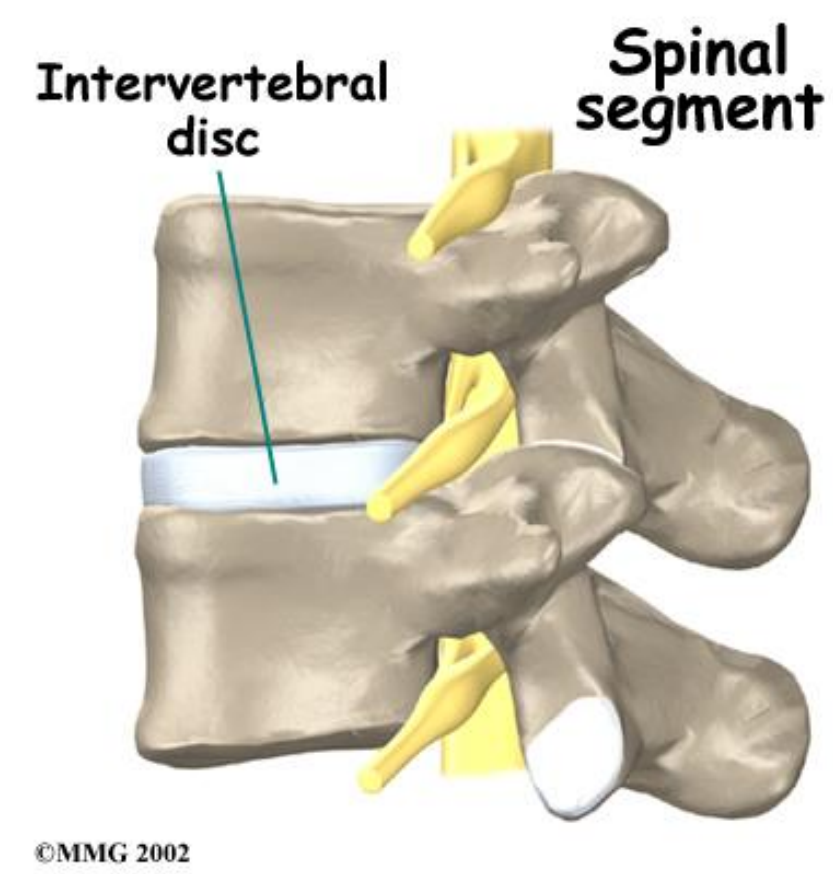
- Also called the spine or backbone
- Composed of vertebrae
- Functions as strong flexible rod that can rotate and move in all directions
- Encloses and protects spinal cord
- Supports the skull
- Point of attachment for ribs, pelvic girdle, and back muscles

Regions of the Vertebrae

- 7 cervical vertebrae in the neck
- 12 thoracic vertebrae
- 5 lumbar vertebrae supporting the lower back
- 1 sacrum (consists of 5 fused sacral vertebrae)
- 1 coccyx (consists of 4 fused coccygeal vertebrae)



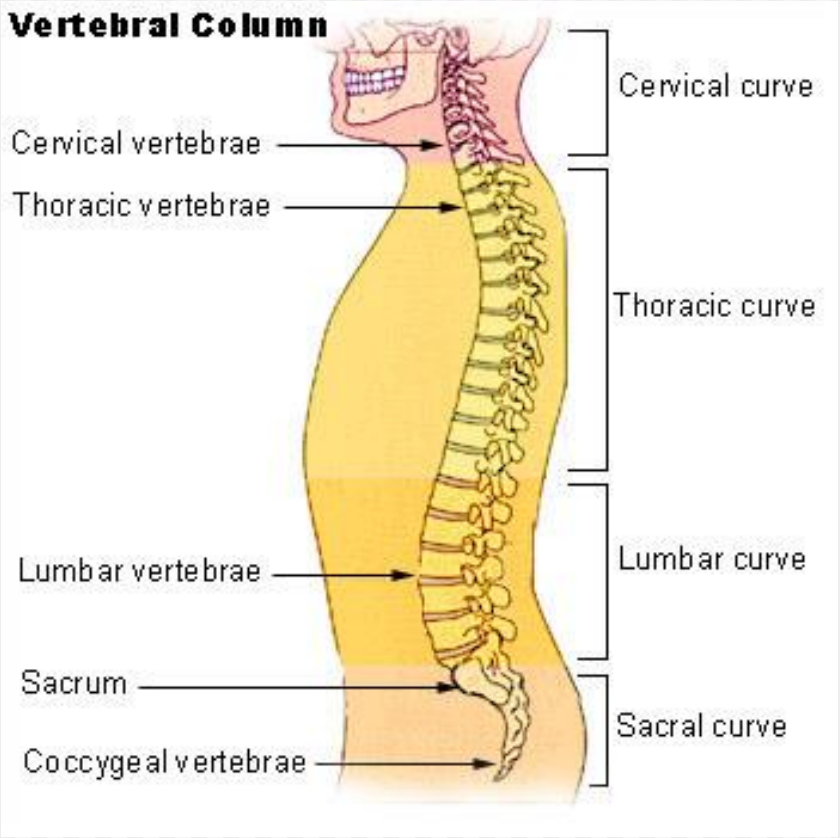
Intervertebral Discs



- Lie in between the vertebrae from the 2nd cervical vertebrae to the sacrum
- Form strong joints, permit movement, and absorb vertical shock

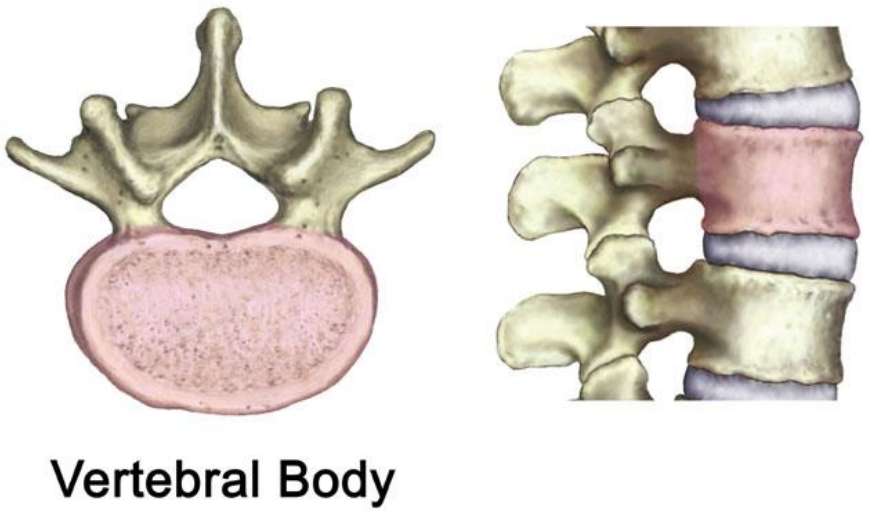
Vertebral Column Curvature

- The spine curves like a snake
- Cervical and lumbar curves are convex (bulging out anteriorly)
- Thoracic and sacral curves are concave (bulge out posteriorly)



Vertebrae

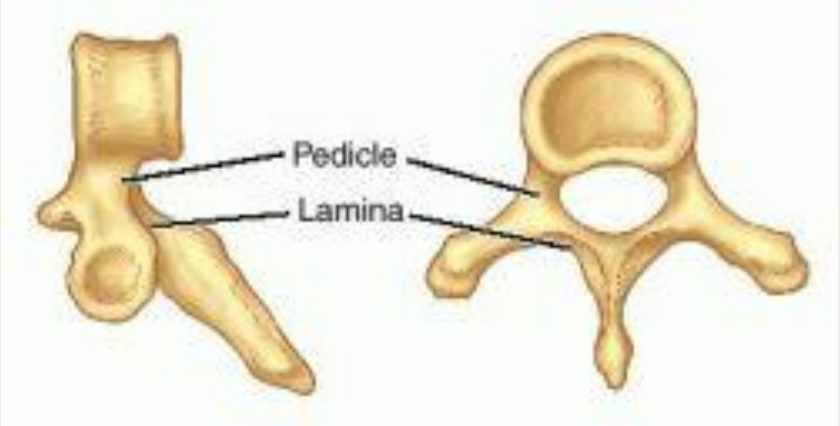
Body



- Thick, disc-shaped front portion
- The weight-bearing part of a vertebra

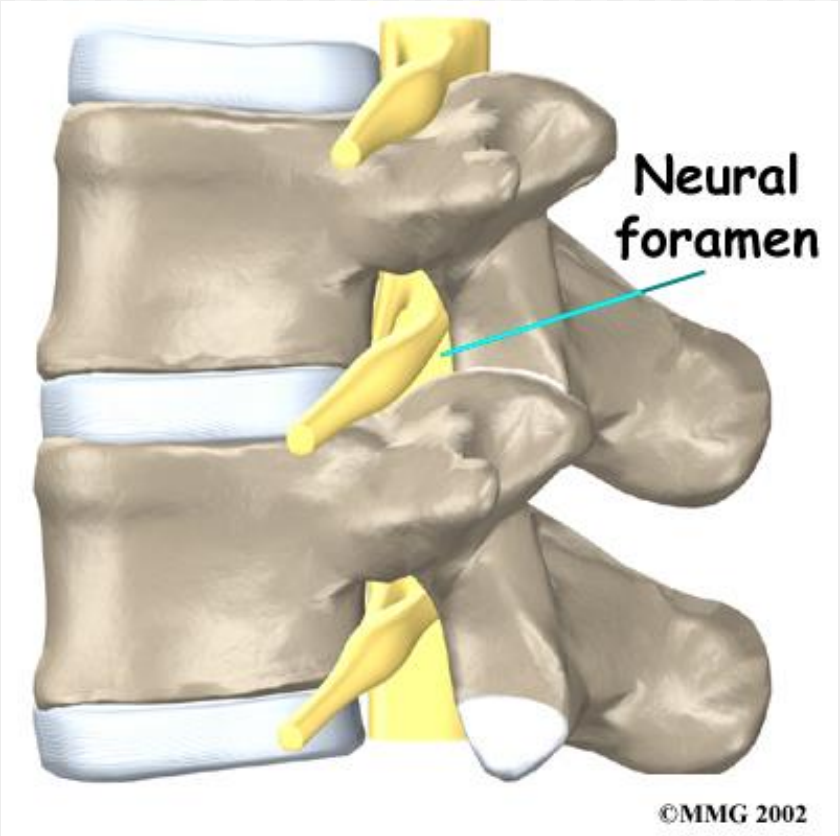
Vertebral Arch

- Extends backwards from the body of the vertebra
- Formed by two short, thick processes (pedicles) that unite with the flat parts of the arch (laminae), ending with a single sharp, slender projection (spinous process)

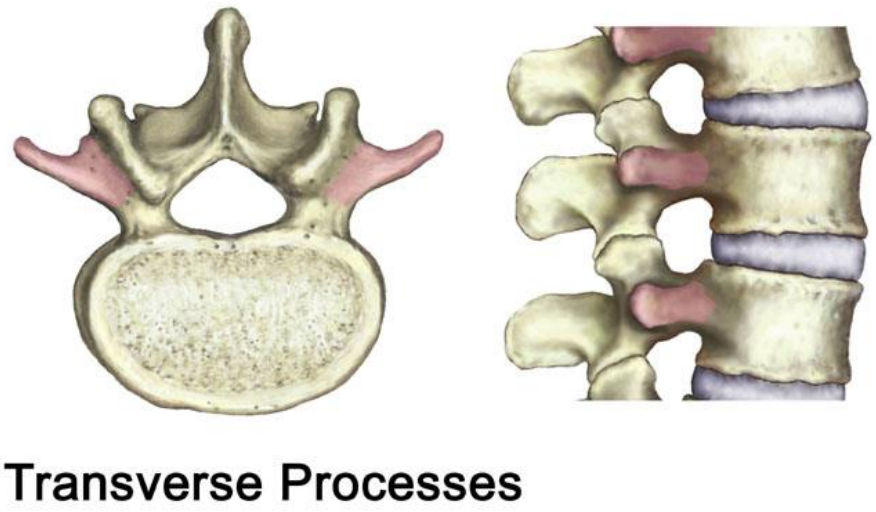


Spinal Cord Openings

- The vertebral foramen is the space between the vertebral arch and body that contains the spinal cord
- All of the vertebral foramen combined forms the vertebral canal
- The intervertebral foramen is the opening between adjoining vertebrae on both sides of the column contains a single spinal nerve



Transverse Processes

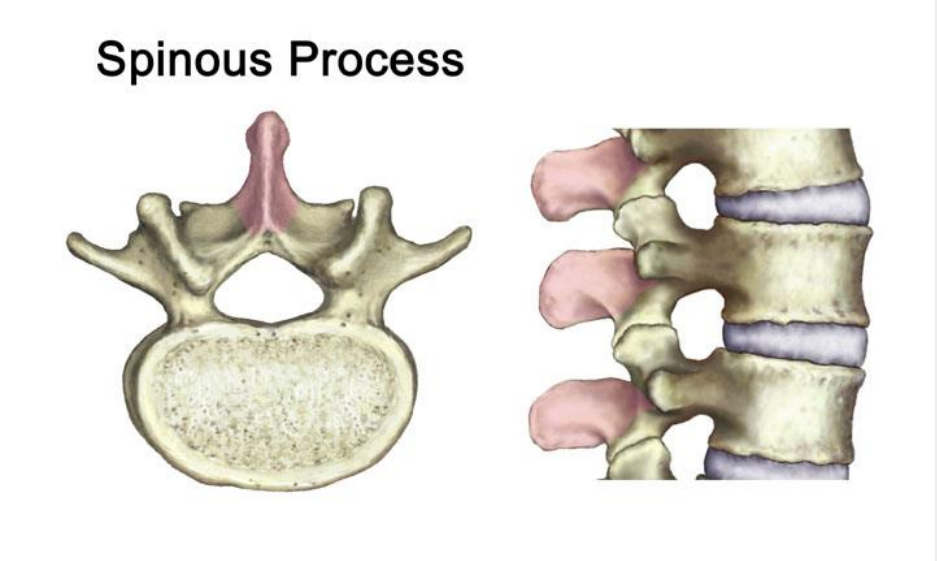


Transverse Processes

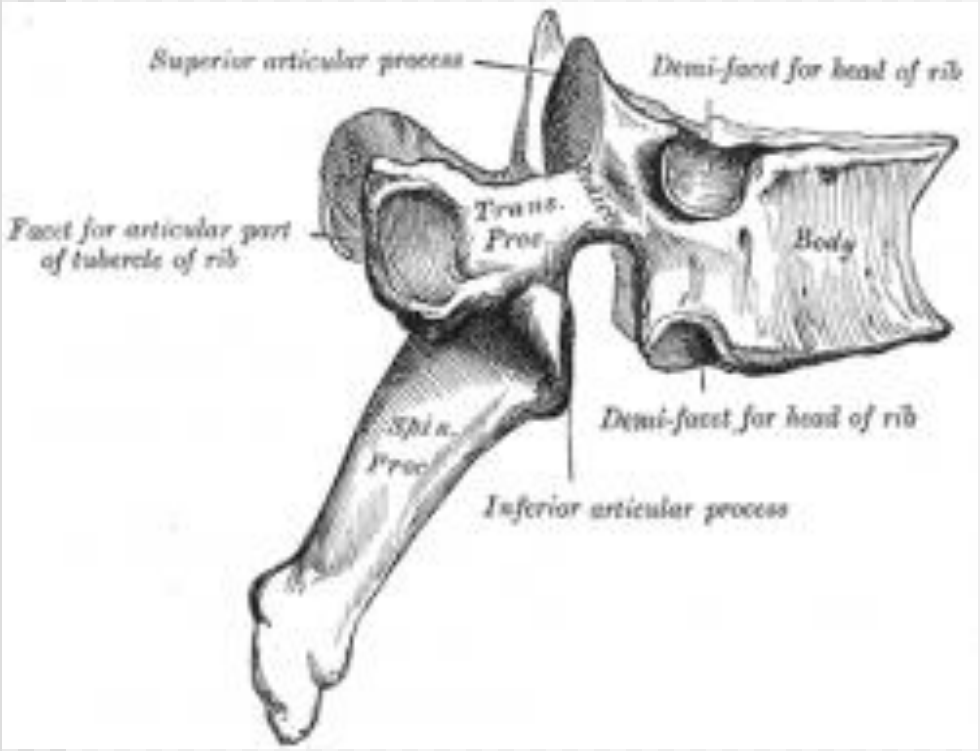
- Extend laterally on each side where the lamina and pedicle join

Spinous Process

- Projects from the junction of the laminae
- Combined with the two transverse processes, these three are points of attachment for muscles to the vertebral column



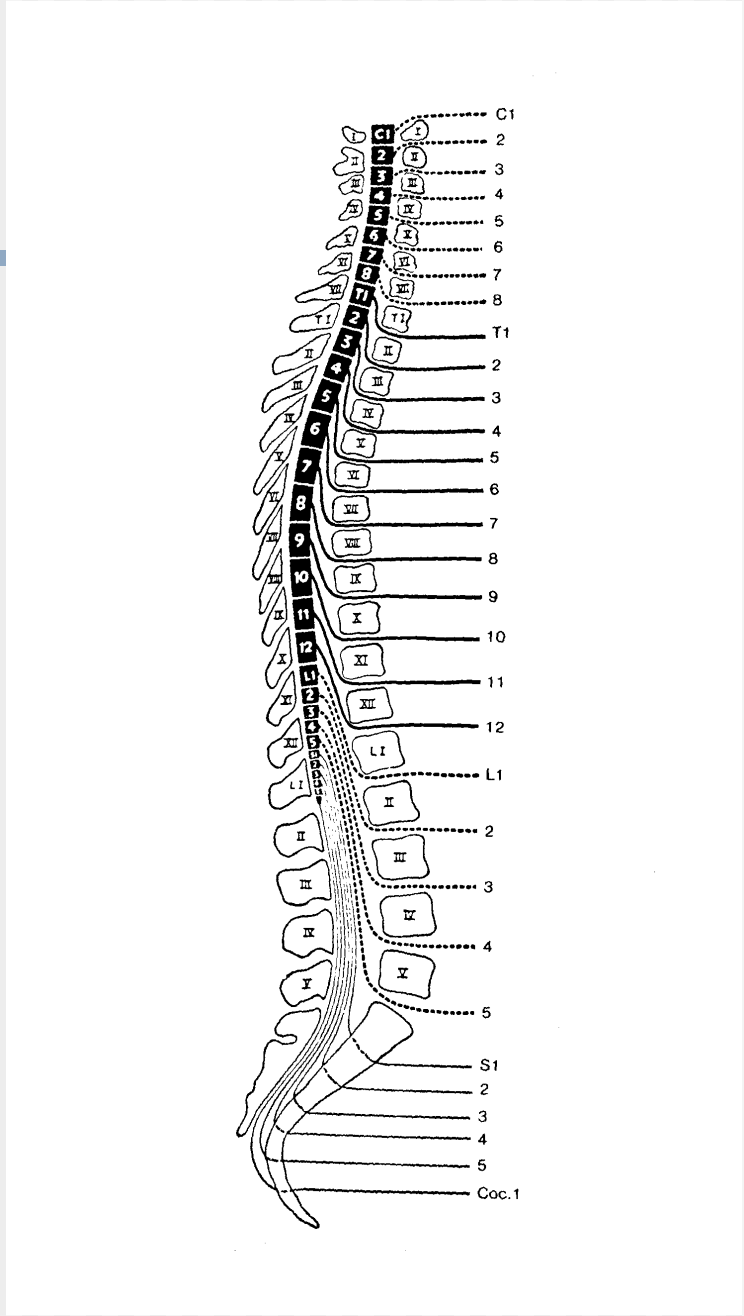
Articular Processes



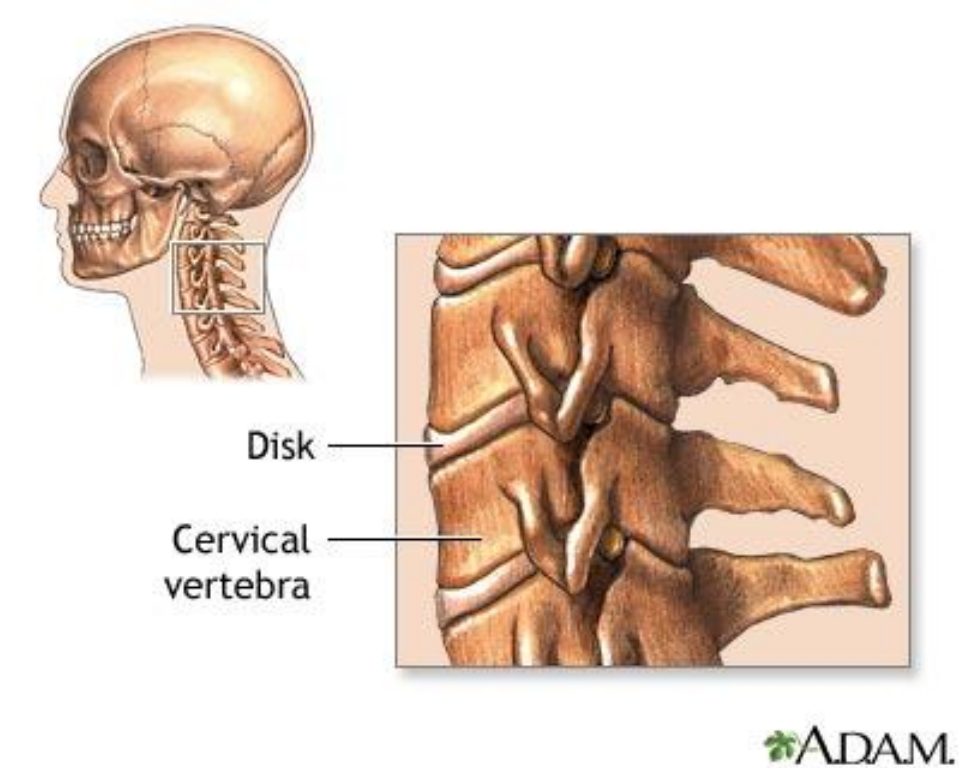
- Superior Articular Processes join with the vertebra right above them
- Inferior Articular Processes join with the vertebra right below them
- The articulating surfaces are called facets and are lined with hyaline cartilage

Vertebrae

- Numbered in sequence from top to bottom in each region



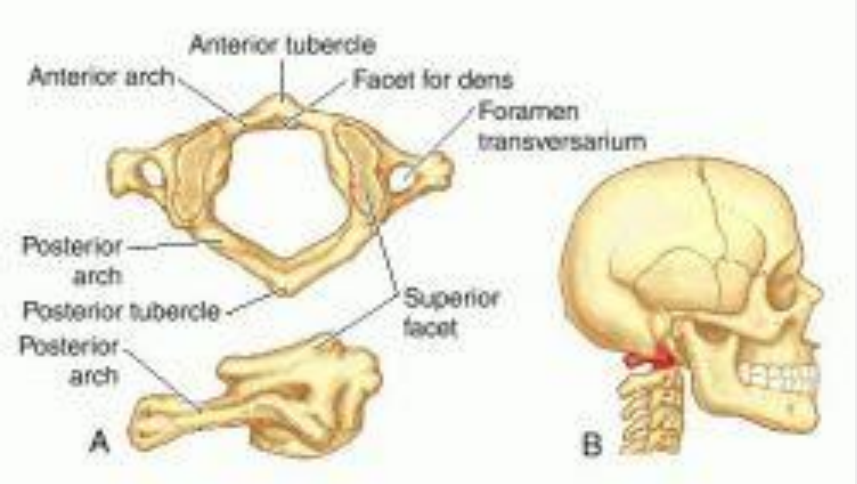
Cervical Vertebrae



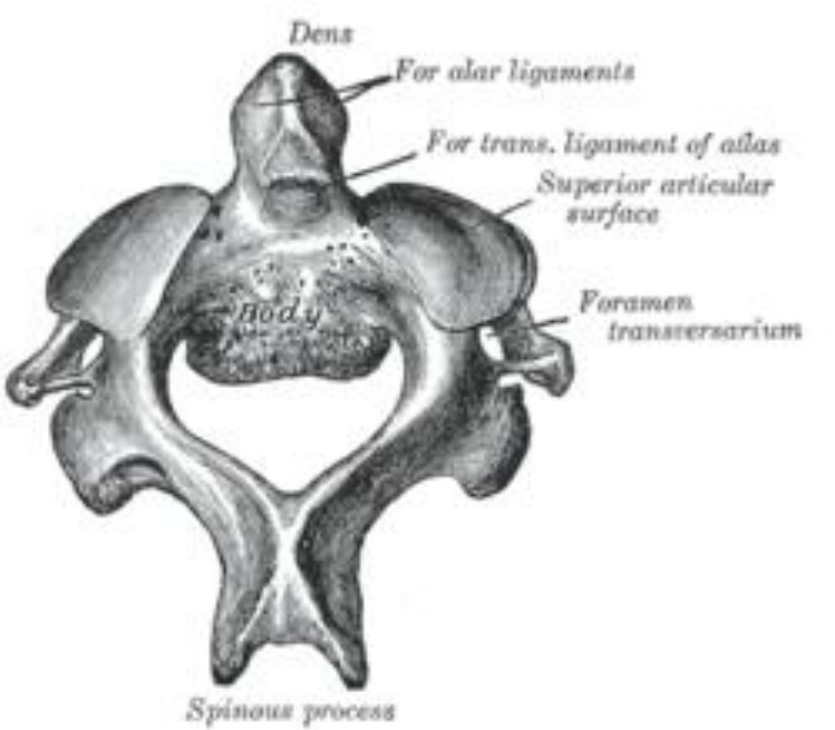
- All have three foramina: one verteral foramen and two transverse foramina

Atlas (C1 Vertebra)

- Supports the head
- Does not have a body or spinous process
- Upper surface contains the superior articular facets that articulate with the occipital bone (allows you to nod “yes”)



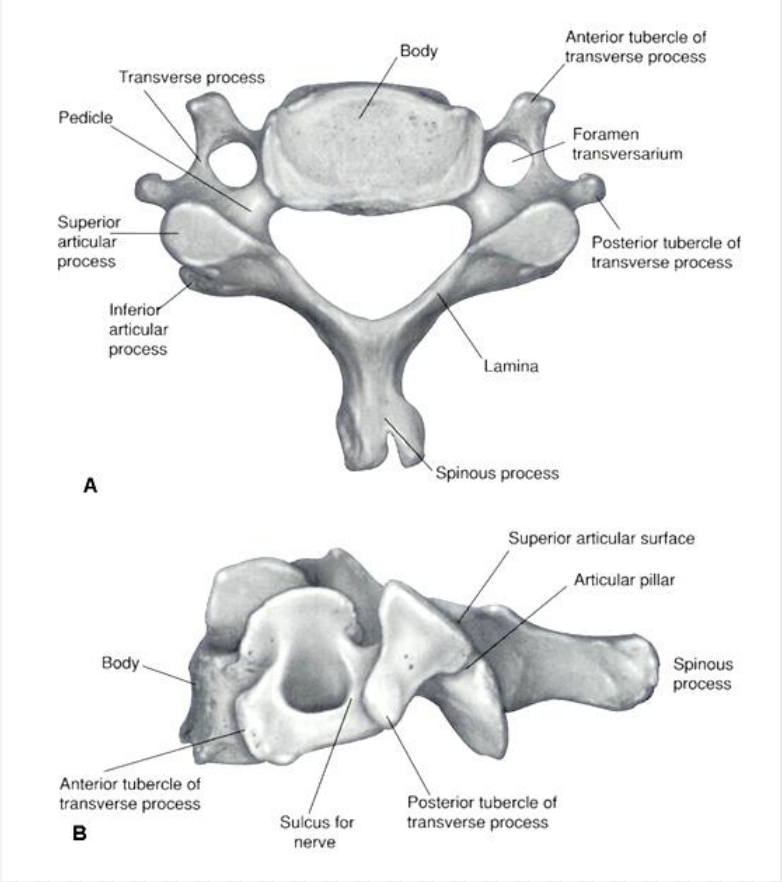
Axis (C2 Vertebra)



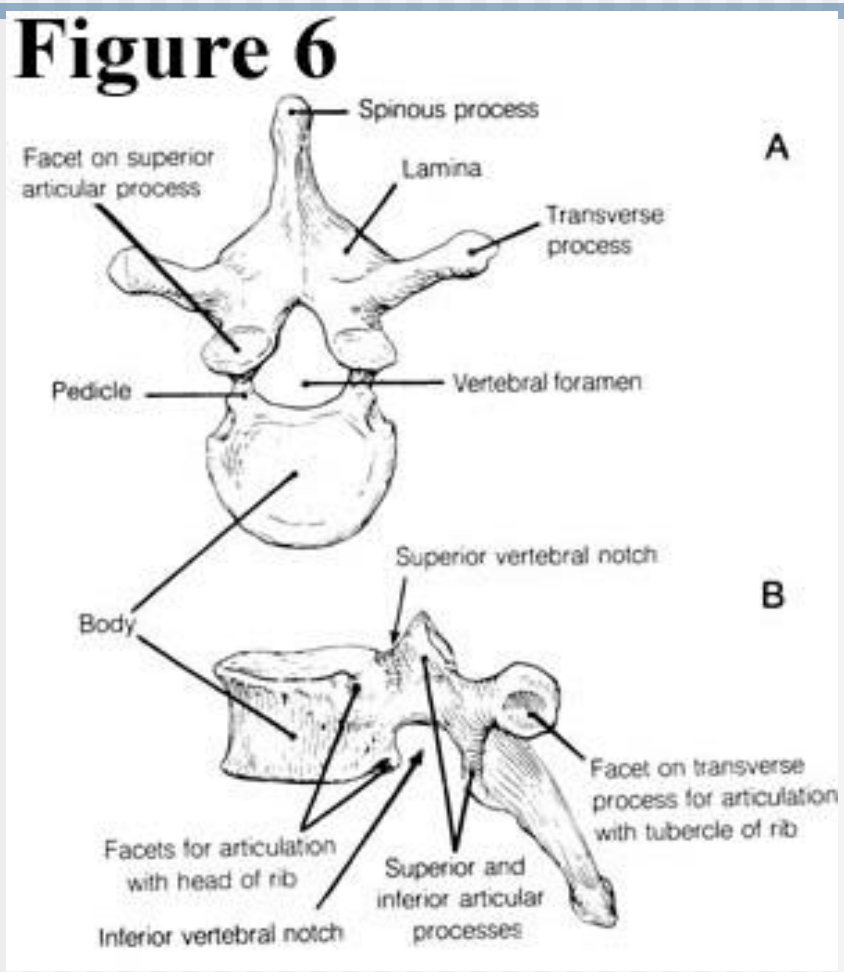
- Does have a body and spinous process
- The dens, a tooth-shaped process, projects up through the vertebral foramen of the atlas and serves as a pivot to allow you to shake your head “no”

Remaining Cervical Vertebrae

- C3 - C6 all follow the normal anatomy of the typical vertebra
- C7 is also called the vertebra prominens; it has a single, large spinous process that can be felt at the base of the neck



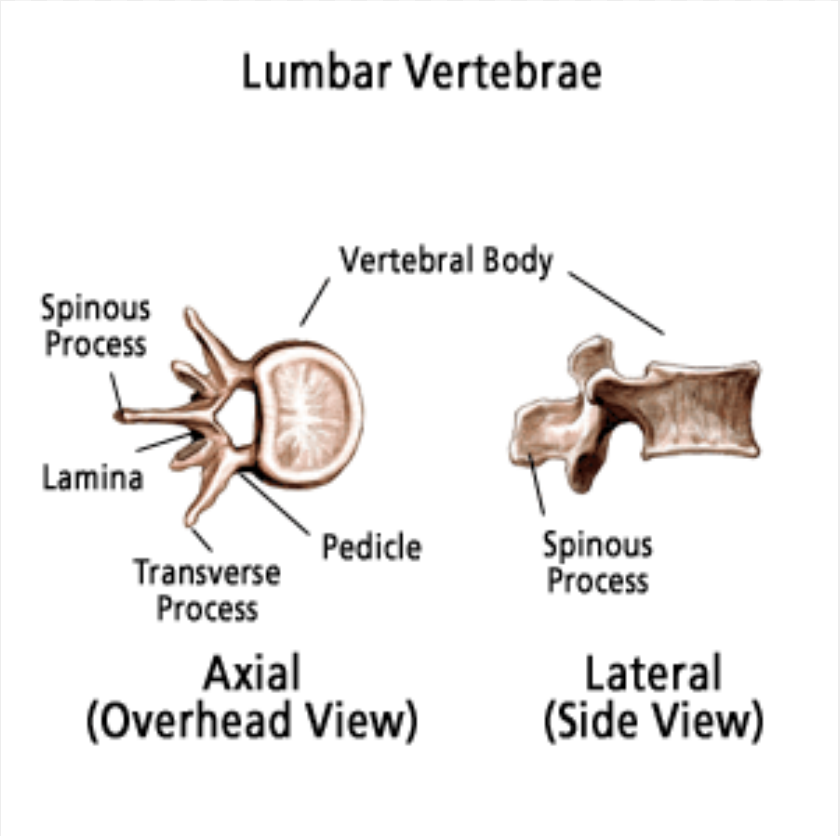
Thoracic Vertebrae (T1 - T12)



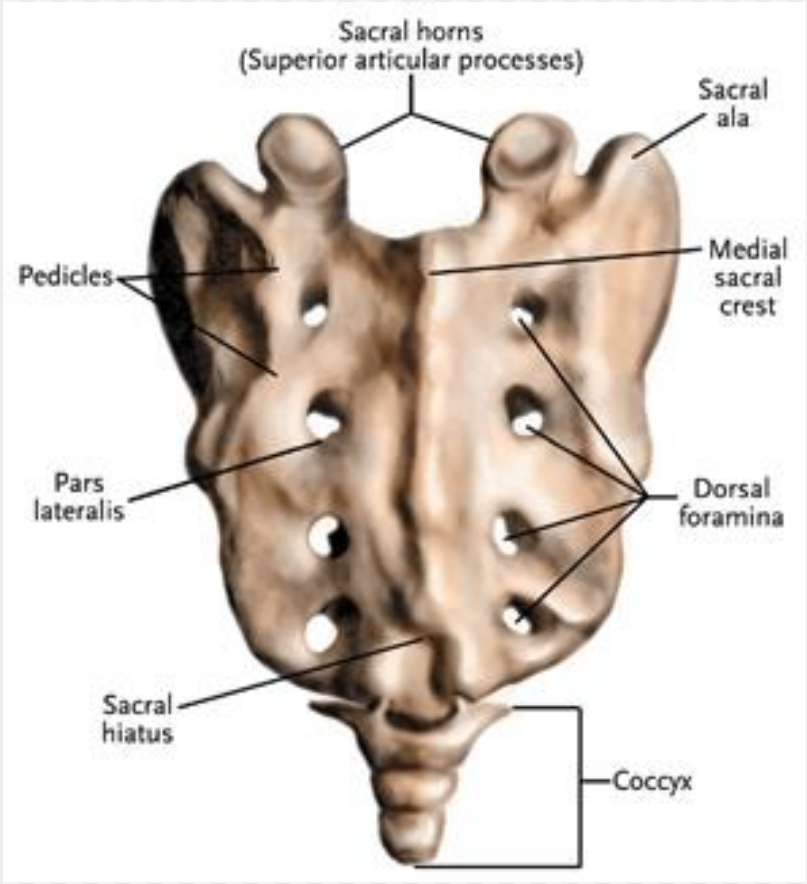
- Much larger and stronger than cervical vertebrae
- Have facets for articulating with the ribs, which limits movement of the vertebrae

Lumbar Vertebrae (L1 - L5)

- Largest and strongest of the column
- Projections are short and thick
- Spinous processes are well adapted for the attachment of large back muscles

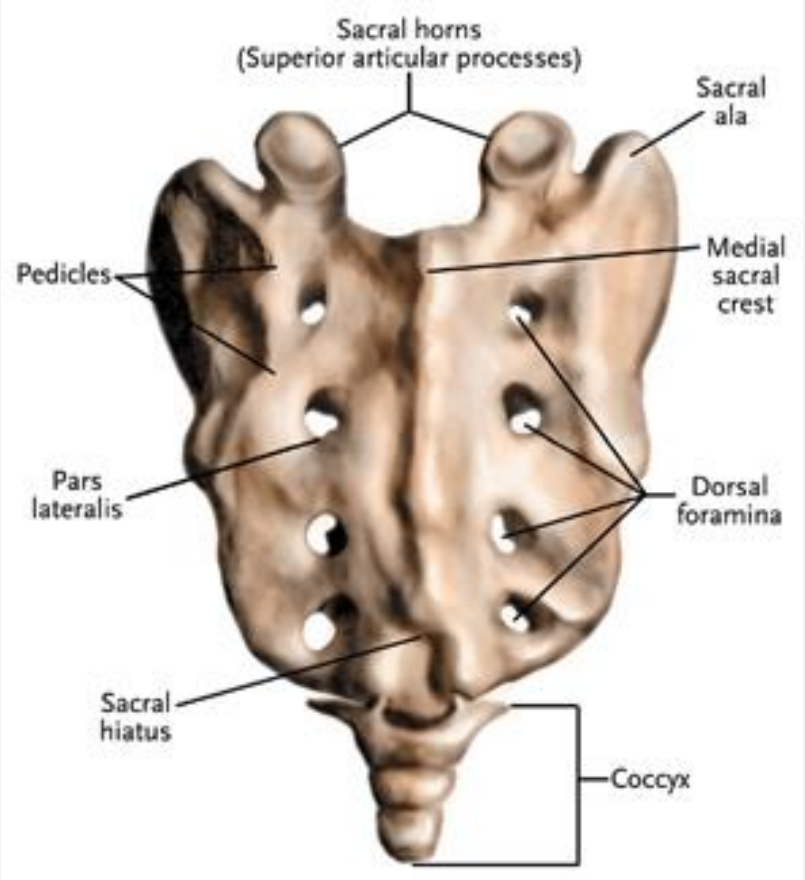


Sacrum

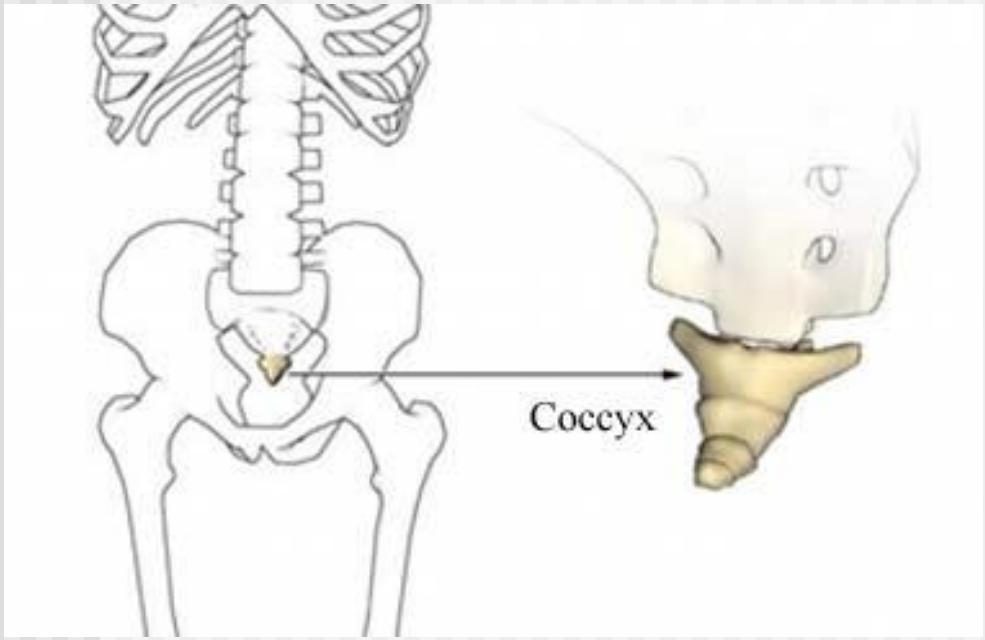


- Triangular bone formed by the fusion of 5 sacral vertebrae that occurs between 16-30 years old
- Serves as strong foundation for the pelvic girdle

- Four sacral foramina on the anterior and posterior sides where nerves and blood vessels pass
- Sacral canal is a continuation of the vertebral canal
- The lower entrance of the canal is the sacral hiatus
- The sacral promontory is a projection on the top border

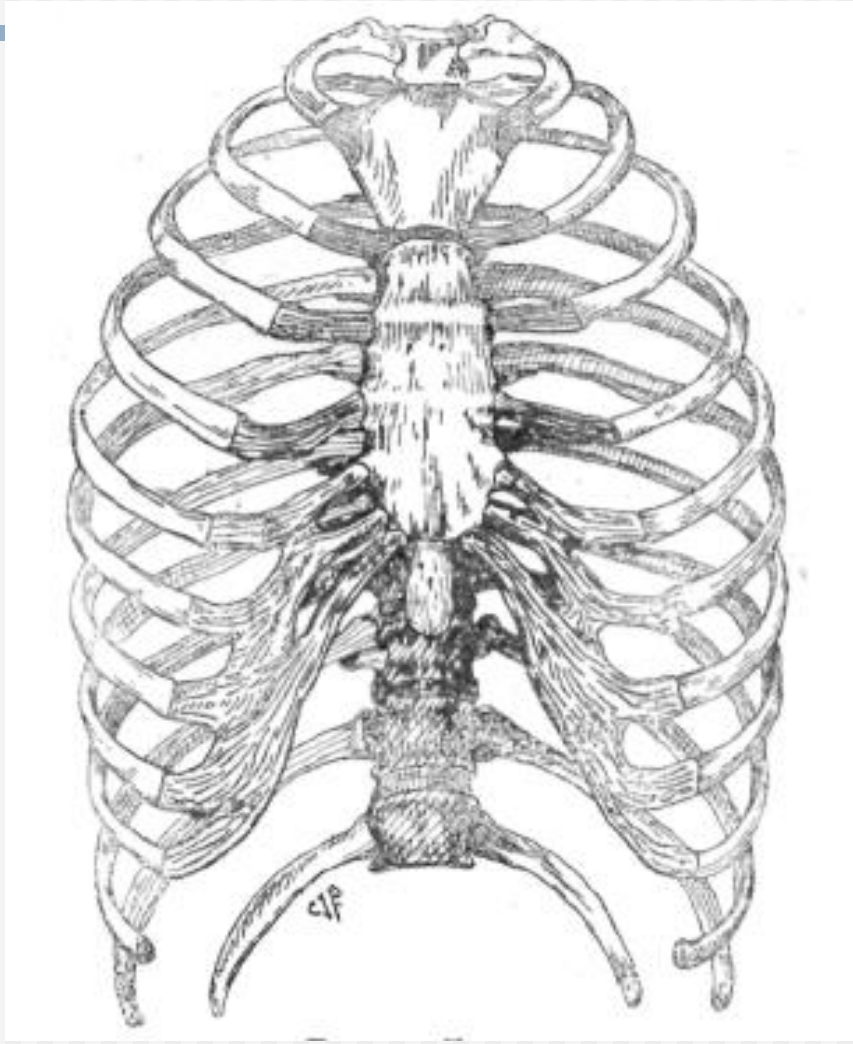


Coccyx



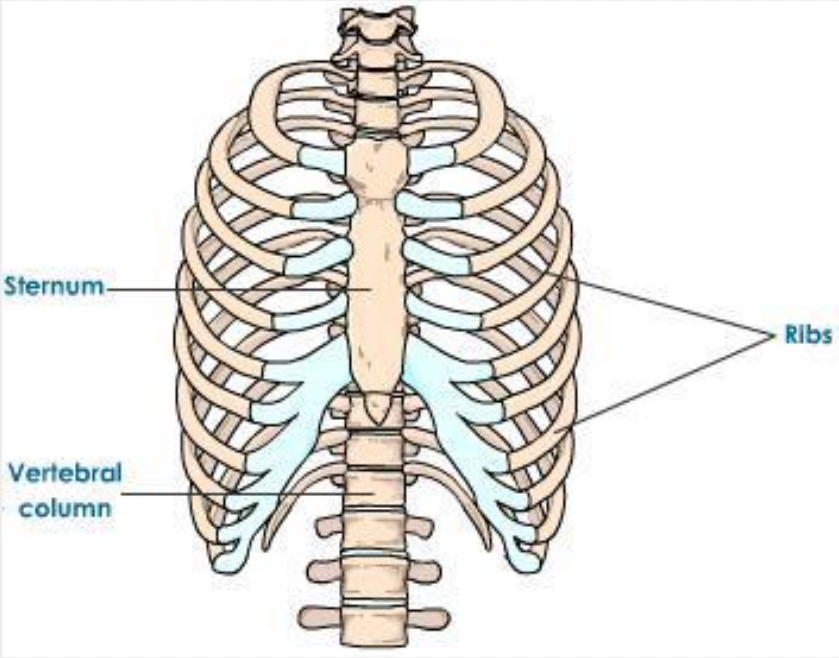
- Triangular shape formed by the fusion of 4 coccygeal vertebrae
- The top articulates with the sacrum

Thorax

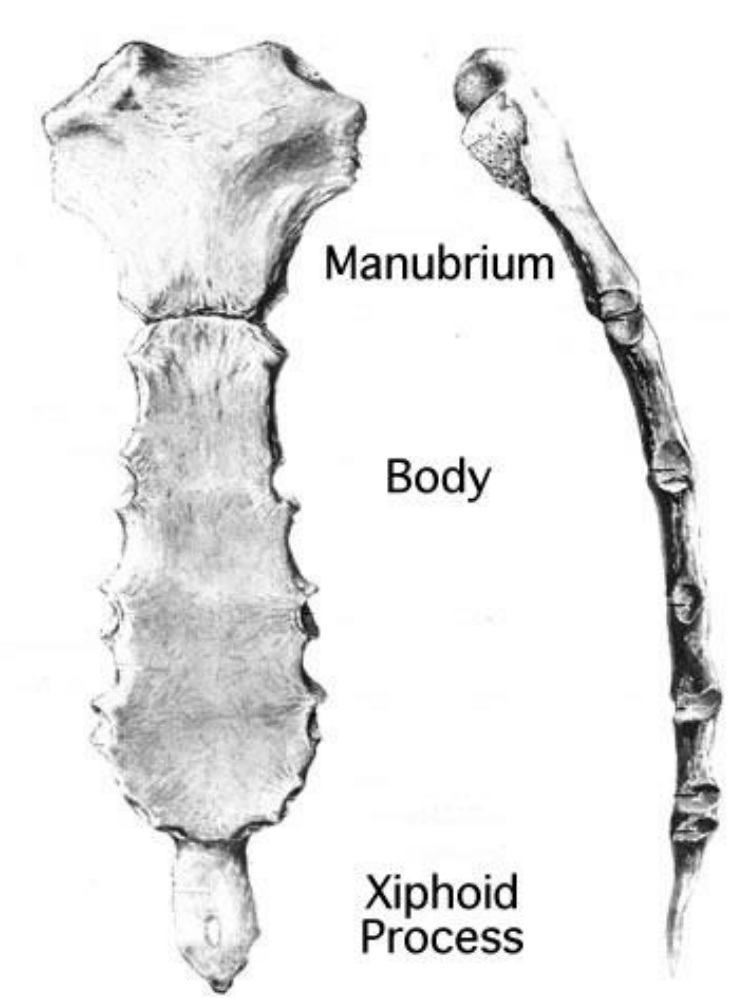


Thoracic Cage

- Bony cage formed by the sternum, costal cartilages, ribs, and bodies of the thoracic vertebrae
- Encloses and protects the organs of the thoracic cavity and upper abdominal cavity
- Provides support for the bones of the shoulder and upper limbs



Sternum



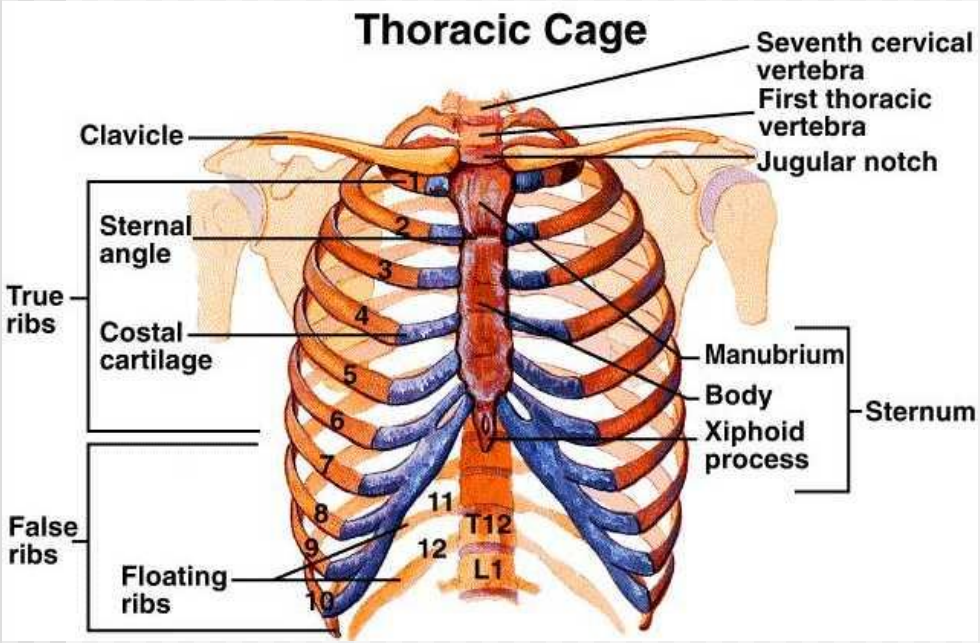
- Flat, narrow bone located in the center of the anterior thoracic wall
- Also known as the breastbone
- Consists of three parts

- The manubrium is the upper part, articulating with the clavicles and first and second ribs.
- The body is the largest and middle part, articulating directly or indirectly with the 2nd-10th ribs.
- The xiphoid process is the lowest and smallest part that has some abdominal muscles attached to it.

Ribs

- Twelve pairs make up the sides of the thoracic cavity
- Each rib articulates posteriorly with its corresponding thoracic vertebra

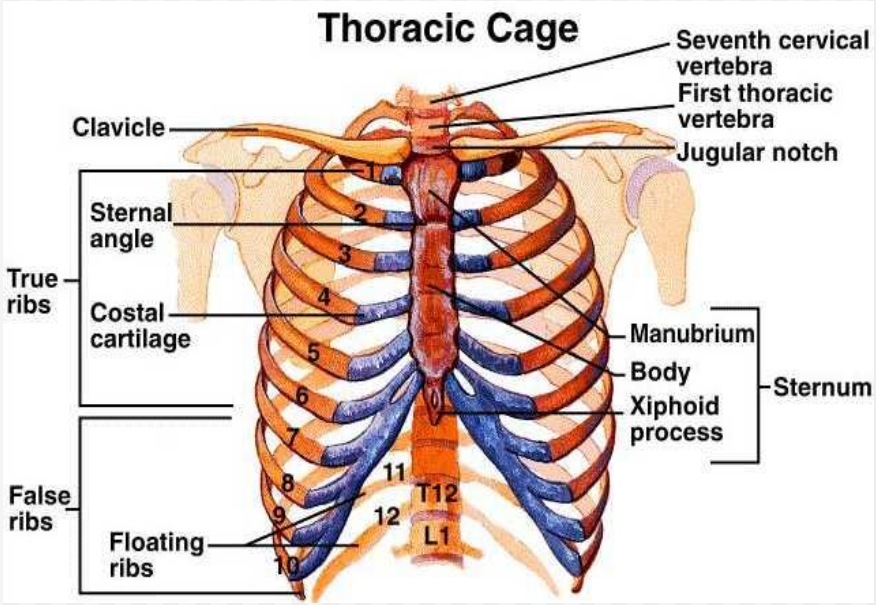
True Ribs



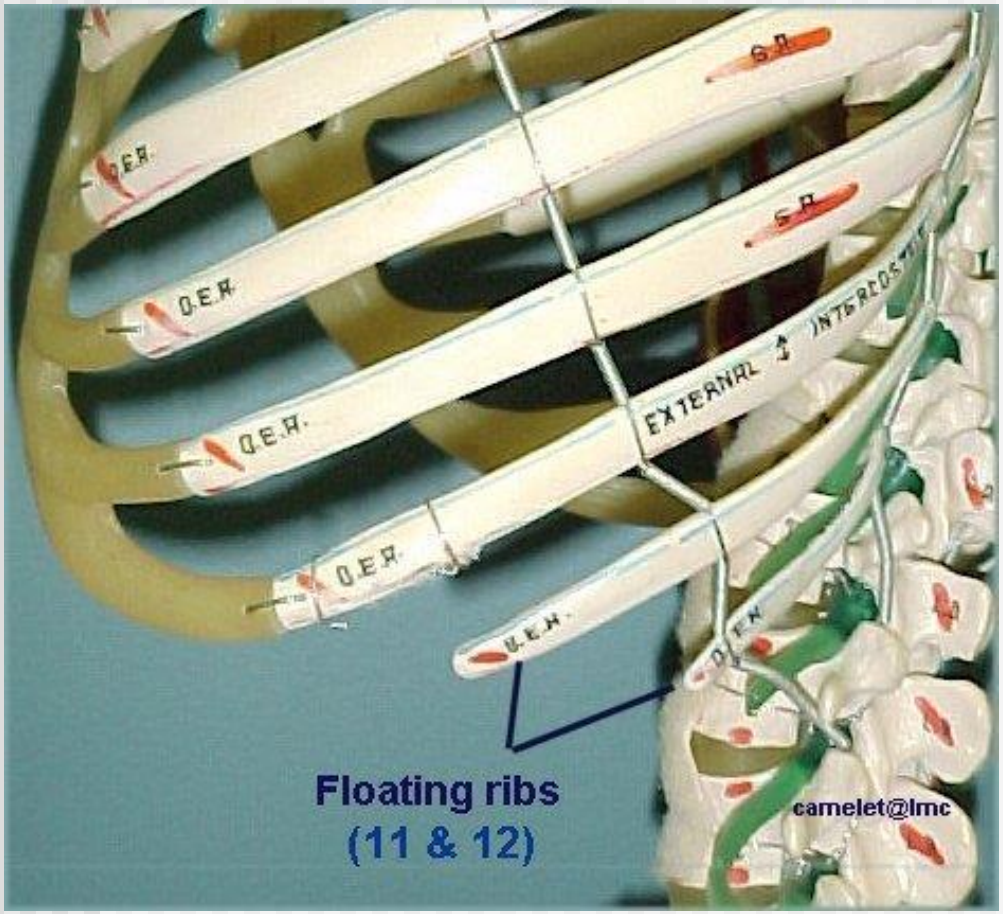
- 1st through 7th pairs of ribs
- Have a direct anterior attachment to the sternum by costal cartilage

False Ribs

- 8th through 12th pairs of ribs
- Costal cartilages either attach indirectly to the sternum or not at all
- Cartilages of ribs pairs 8-10 attach to each other and the cartilages of the 7th pair of ribs

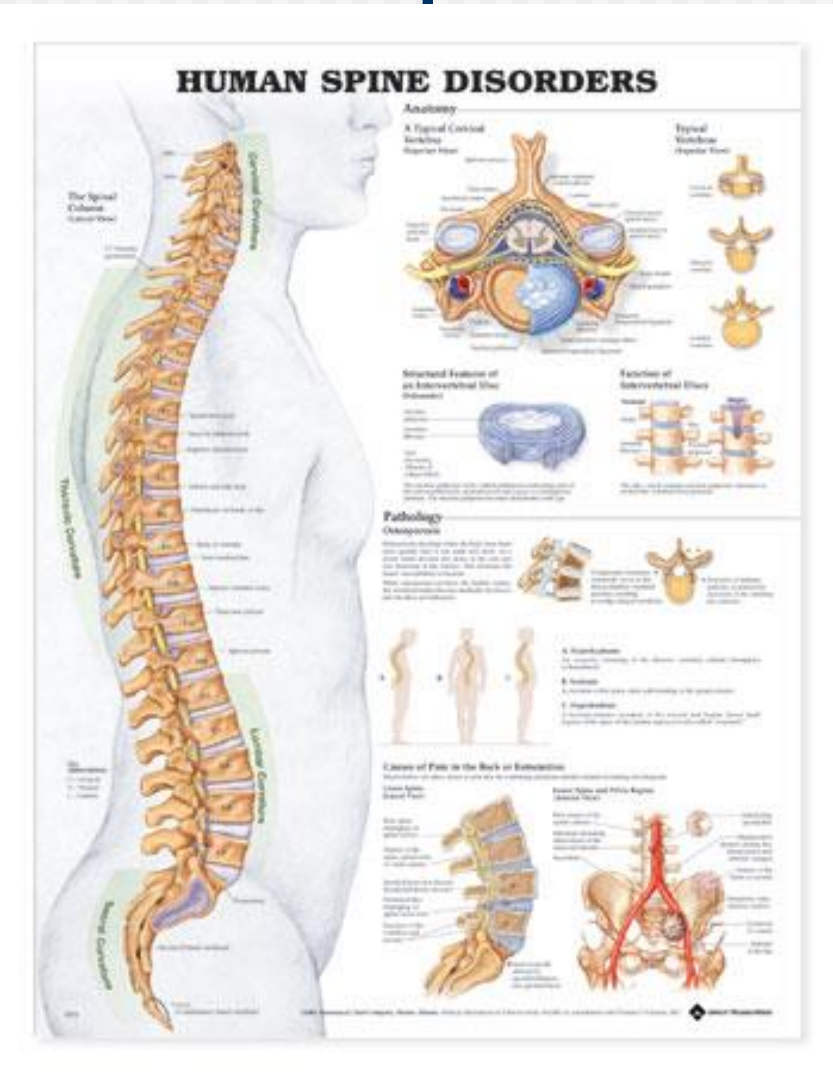


Floating Ribs

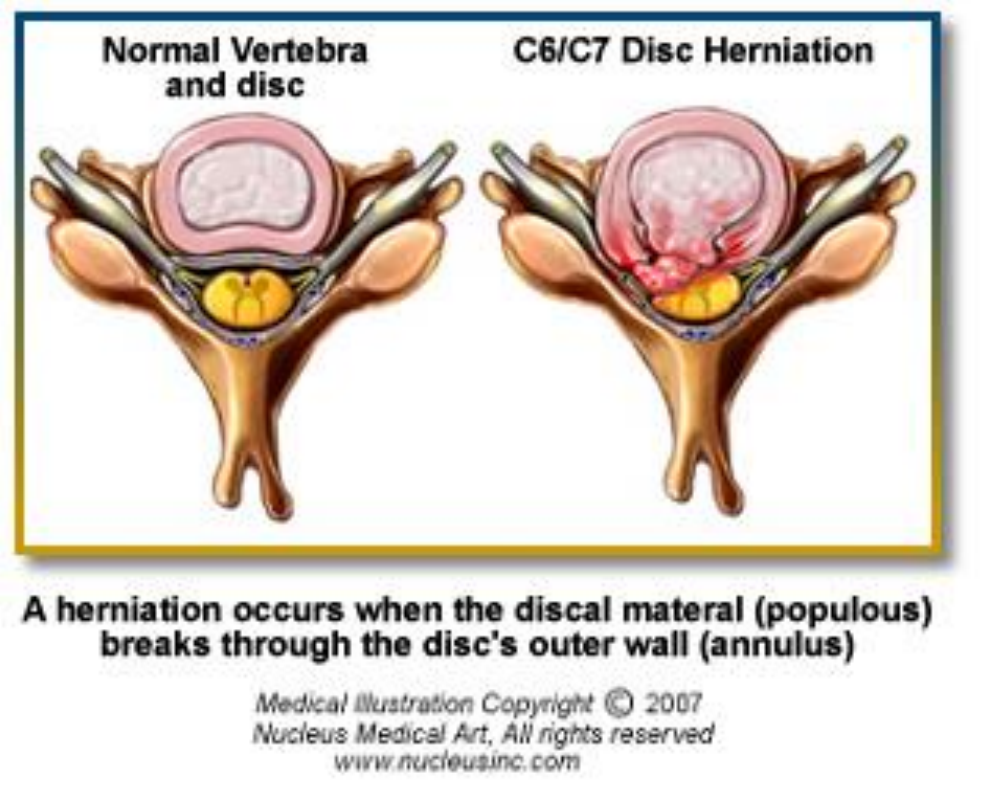


- 11th and 12th pair of ribs are also called floating ribs
- The costal cartilage at their anterior ends does not attach to the sternum at all
- Attach only posteriorly to the thoracic vertebrae

Disorders of the Spine and Thorax



Herniated (Slipped) Disc

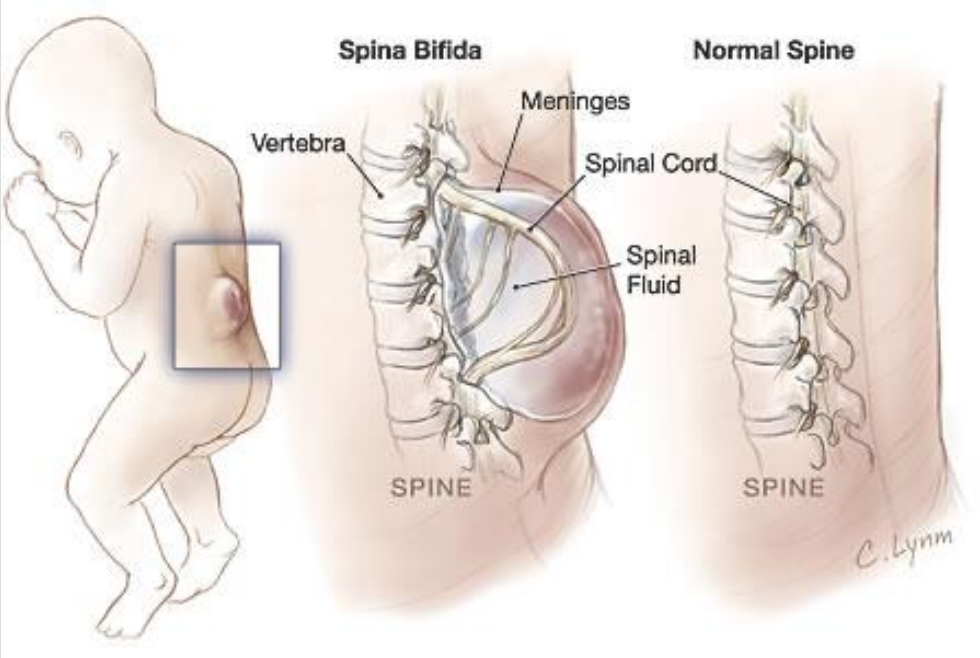


- Caused by ligaments of the intervertebral discs being weakened or injured, resulting in an increase in pressure in the nucleus pulposus rupturing the surrounding fibrocartilage

Scoliosis

- Lateral bending of the vertebral column, usually in the thoracic region
- Can be treated with braces, surgery, or electrical stimulation

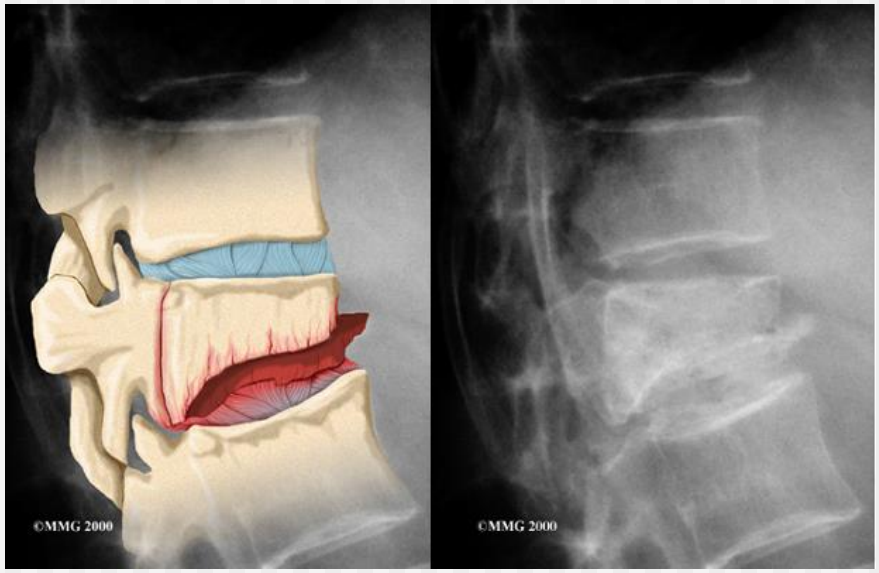
Spinal Bifida



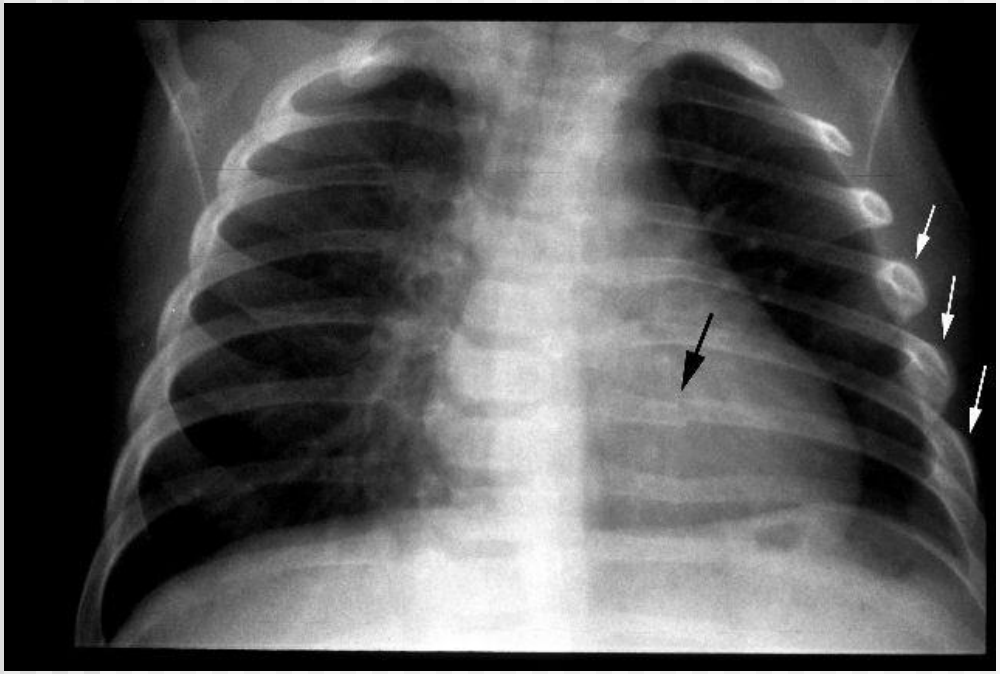
- Congenital defect where the laminae don’t unite at the midline
- Can be mild or severe, and is treated depending on how serious the effects on the patient are

Vertebral Column Fractures

- Thoracic fractures usually result from a compression injury
- Cervical fractures can be fractured or dislocated by extreme whiplash
- Spinal nerve damage may occur



Rib Fractures



- Most common chest injuries
- Break at the point where the greatest force is applied or at the weakest point on the rib
- Middle ribs are most commonly broken

Checkpoint Questions

- Describe the general features of the skull.
- Define the following: suture, foramen, nasal septum, paranasal sinus, and fontanel.
- What are the functions of the vertebral column?
- What are the main distinguishing characteristics of the bones of the various regions of the vertebral column?
- What are the functions of the bones of the thorax?
- What are the parts of the sternum?