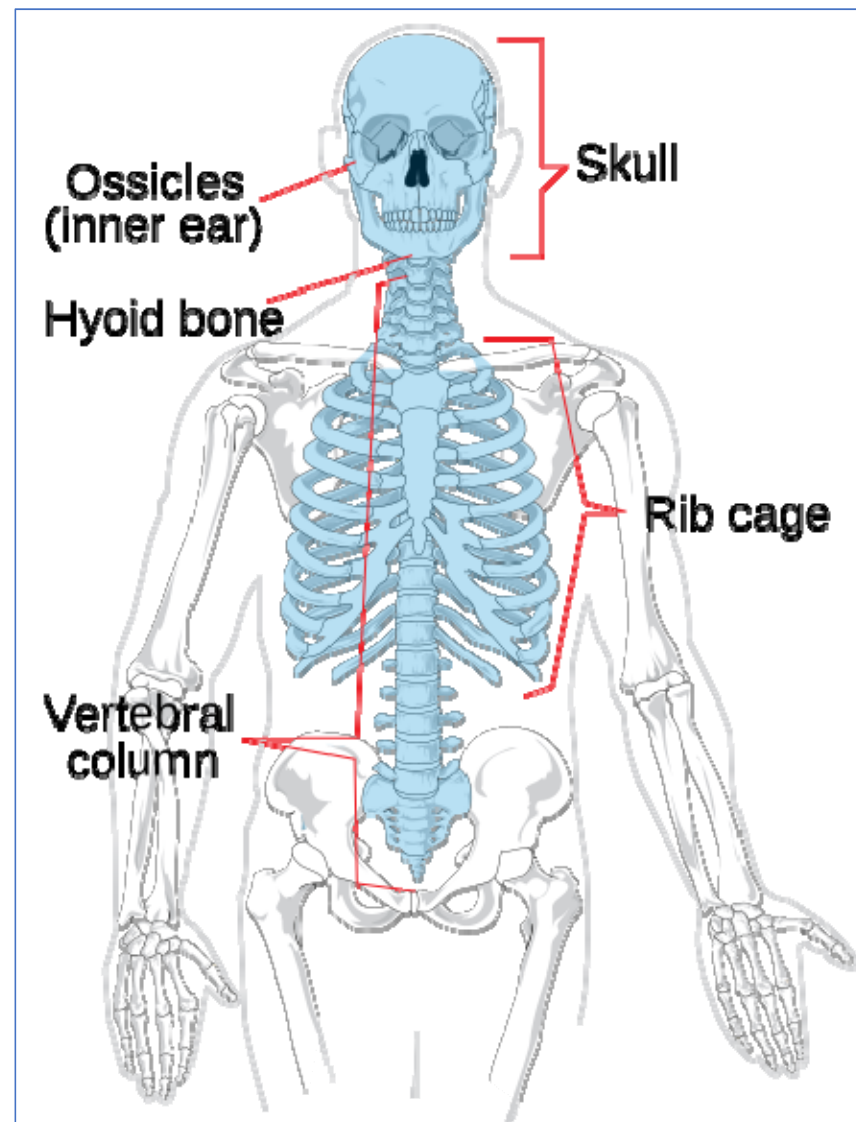


Asst. Lec. Safa Jalil Al-Yassiri

Skeleton anatomy
(skull, vertebral column and thoracic cage)

Department of occupational Therapy
Techniques



Bone:

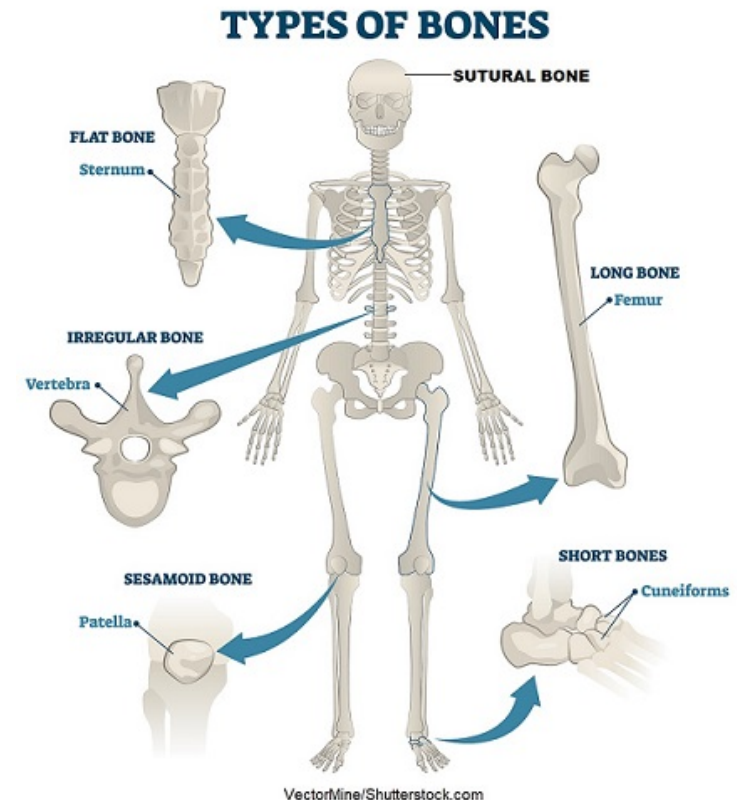
is a strong and specialized type of connective tissue. It consists of:

- water
- organic constituents including osteoid and bone cells
- inorganic constituents, mainly calcium phosphate

Types of bones:

Bones are classified as long, short, irregular, flat and sesamoid.

- ❖ **Long bones:** these consist of a shaft and two extremities. Examples include the femur, humerus, tibia and fibula.
- ❖ **Short, irregular, flat and sesamoid bones:** these have no shafts or extremities and are diverse in shape and size. Examples include:
 - **short bones:** wrist and ankle bones
 - **irregular bones:** vertebrae and pelvis (pubis, ilium, and ischium)
 - **flat bones:** sternum, ribs and most skull bones (occipital, parietal, frontal, nasal, lacrimal, and vomer)
 - **sesamoid bones:** patella (anterior to the knee joint within the tendon of the quadriceps femoris muscle)

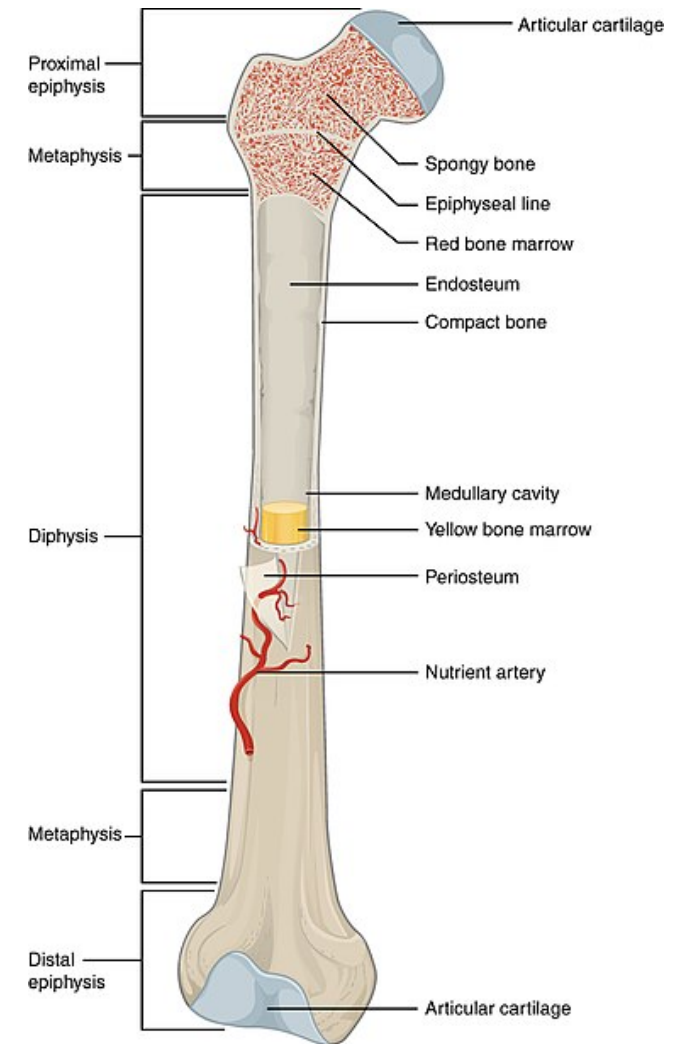


General structure of a long bone:

- ❖ These have a diaphysis or shaft and two epiphyses.
- ❖ The diaphysis is composed of compact bone with a central medullary canal, containing fatty yellow bone marrow.
- ❖ The epiphyses consist of an outer covering of compact bone with cancellous bone inside.
- ❖ The diaphysis and epiphyses are separated by epiphyseal cartilages, which ossify when growth is complete.
- ❖ Long bones are almost completely covered by a vascular membrane, the **periosteum**. The outer layer is fibrous and the inner layer is osteogenic cells, which are involved in maintenance and remodeling of bones.
- ❖ Hyaline cartilage replaces periosteum on the articular surfaces of bones forming synovial joints.

Structure of short, irregular, flat and sesamoid bones:

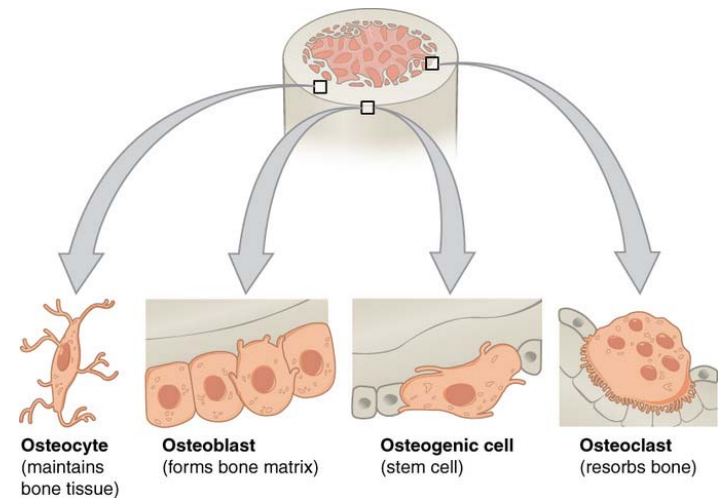
These have a relatively thin outer layer of compact bone with cancellous bone inside containing red bone marrow.



Functions of bones:

1. Supporting the body and helping to move.
 2. Protecting the internal organs. For example, the ribs protect heart and lungs, and skull protects brain.
 3. Producing blood cells (haematopoiesis). Certain types of bones make platelets, red blood cells, and white blood cells.
 4. Storing fat. Certain types of bones store fat and then release it when the body needs energy.
 5. Storing minerals. Bones can also store necessary minerals when their levels are too high in the blood. Examples of these minerals include calcium and phosphorus.
- ❖ There are two types of bone tissue: compact and spongy bone.
 - ❖ Types of cells that contribute to bone homeostasis.

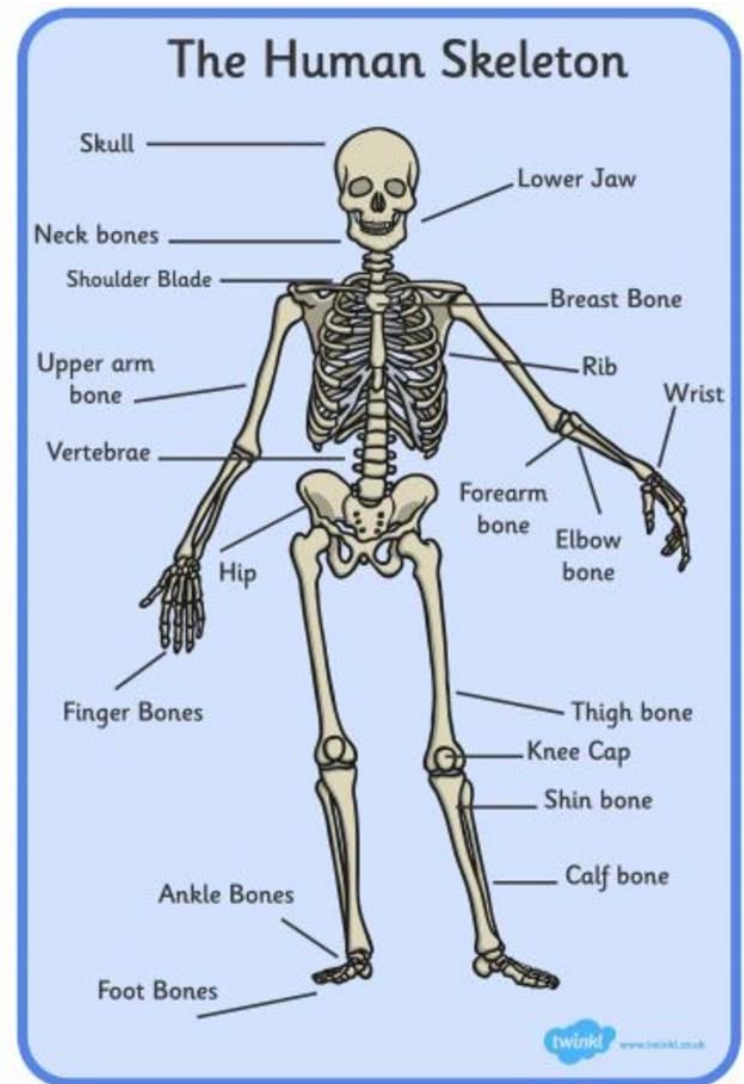
Bone Cells		
Cell type	Function	Location
Osteogenic cells	Develop into osteoblasts	Deep layers of the periosteum and the marrow
Osteoblasts	Bone formation	Growing portions of bone, including periosteum and endosteum
Osteocytes	Maintain mineral concentration of matrix	Entrapped in matrix
Osteoclasts	Bone resorption	Bone surfaces and at sites of old, injured, or unneeded bone



There are 206 bones in the adult human skeleton. include:

80 axial bones: This includes the skull, hyoid, auditory ossicles, vertebral column, ribs and sternum.

126 appendicular bones: This includes of the pectoral (shoulder) girdle, pelvic girdle, arms, wrist, legs, ankle, hands, and feet.



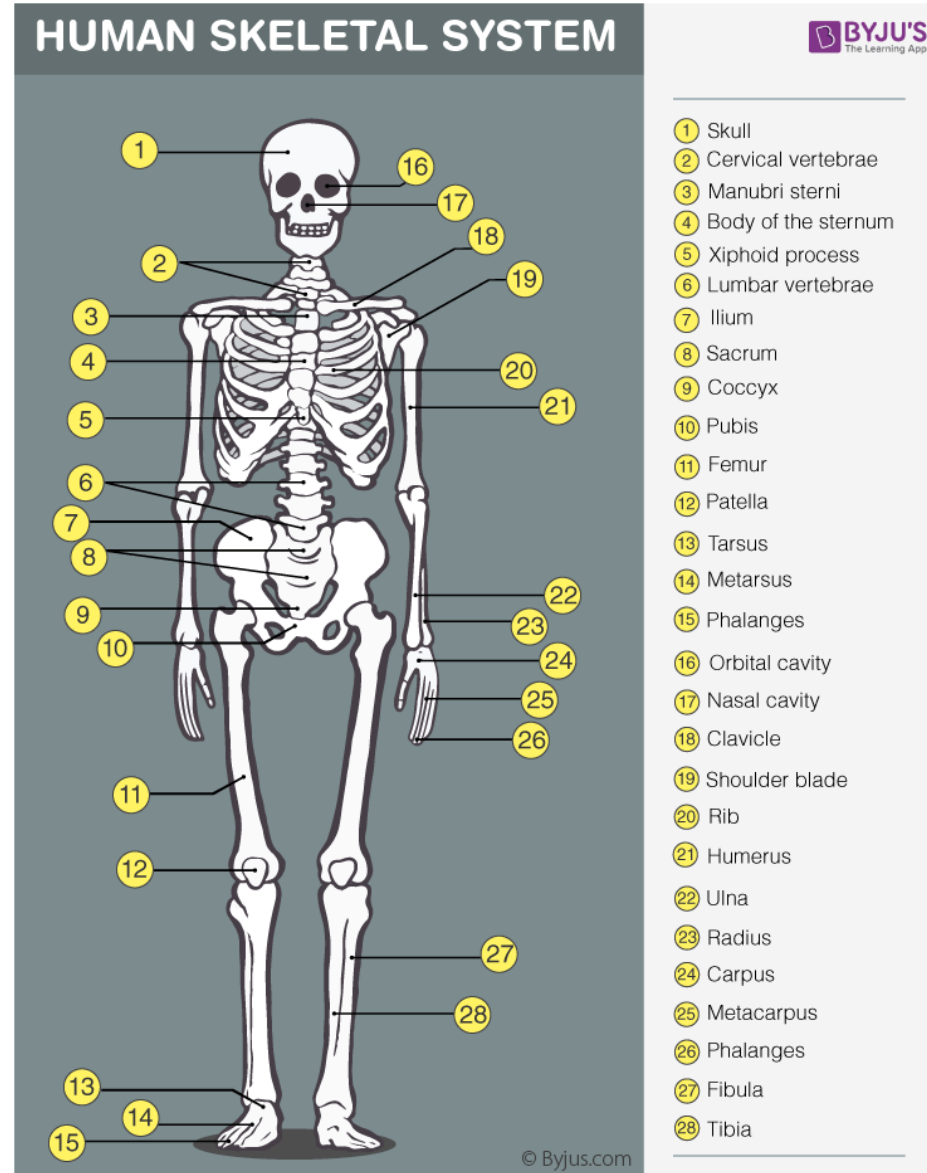
Axial skeleton

Skull:

The skull is the bony framework of the head, the skull rests on the upper end of the vertebral column is divided into two parts:

- ❑ **The cranial bone or (neurocranium):** form the braincase (lined with the meninges) that encloses and protects the brain, eyes, and ears.
- ❑ **Facial bones or (viscerocranium):** underlie the facial structures, form the nasal cavity, enclose the eyeballs, and support the teeth of the upper and lower jaws.

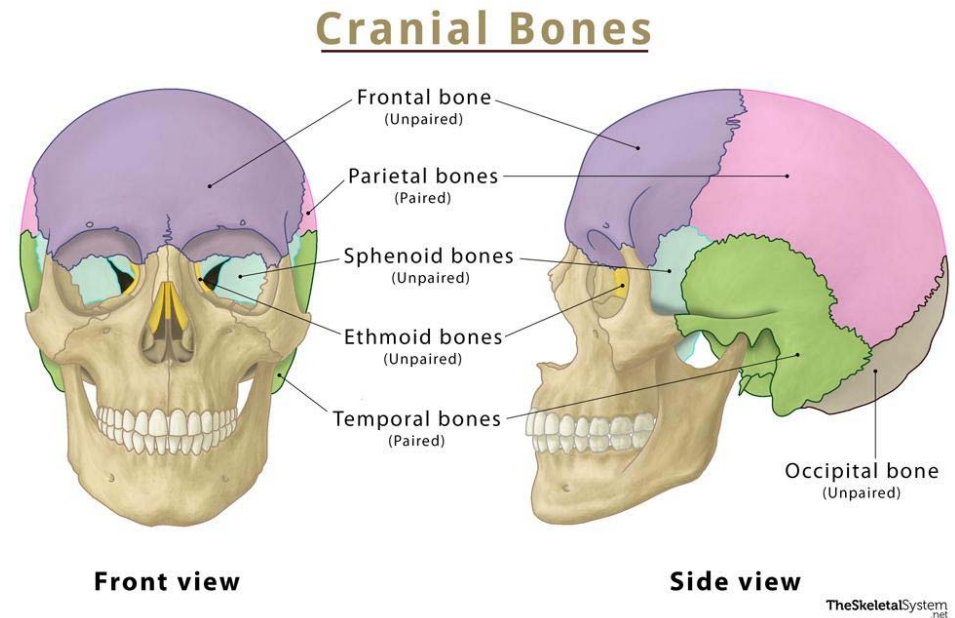
In the adult, the skull consists of 22 individual bones, 21 of which are immovable and only one bone moveable is the mandible (lower jaw).

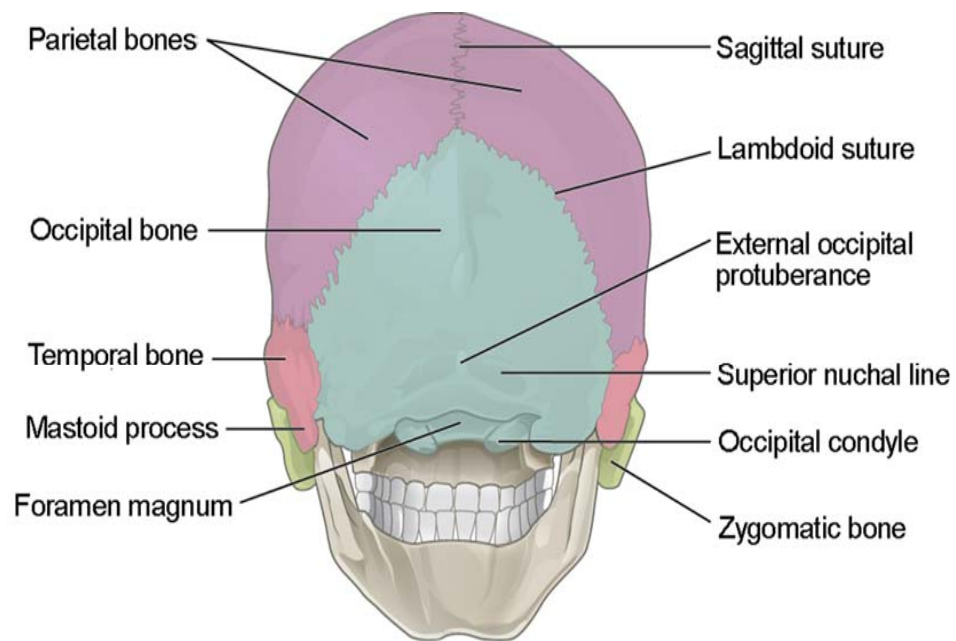


The cranial bones:

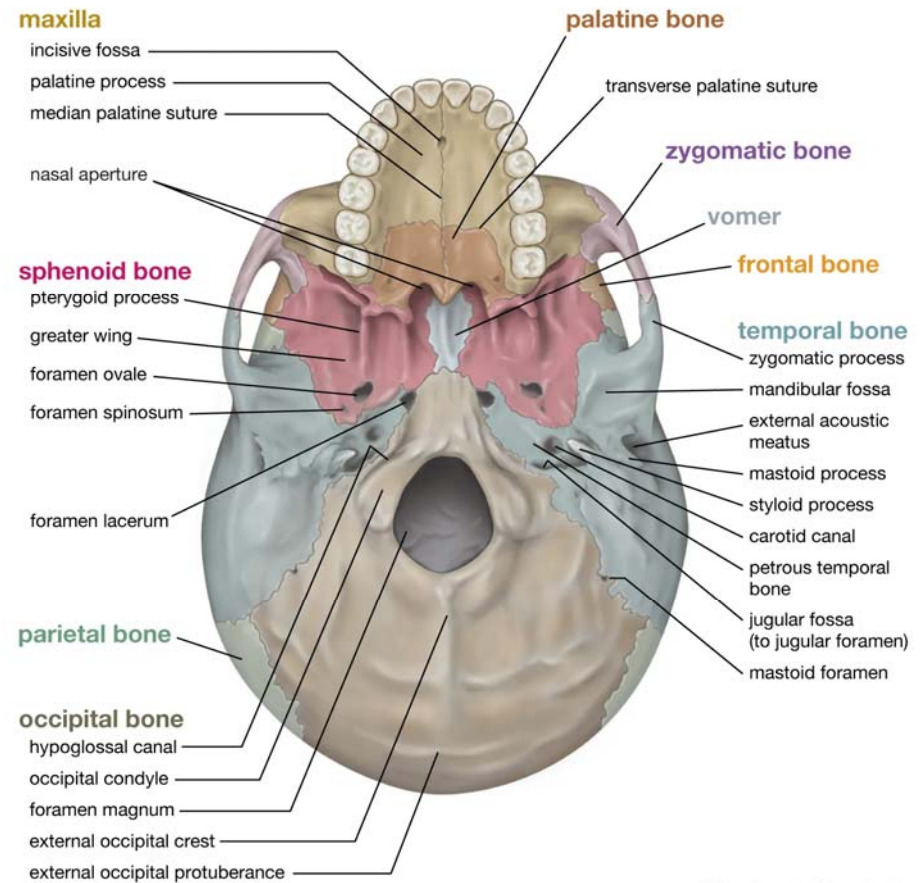
Encloses and protects the brain, eyes, and ears. Its eight (8) bones.

- ☐ Frontal bone (1)
- ☐ Parietal bone (2)
- ☐ Temporal bone (2)
- ☐ Occipital bone (1) which has a central opening (foramen magnum) to admit the spinal cord.
- ☐ Sphenoid bone (1)
- ☐ Ethmoid bone (1)





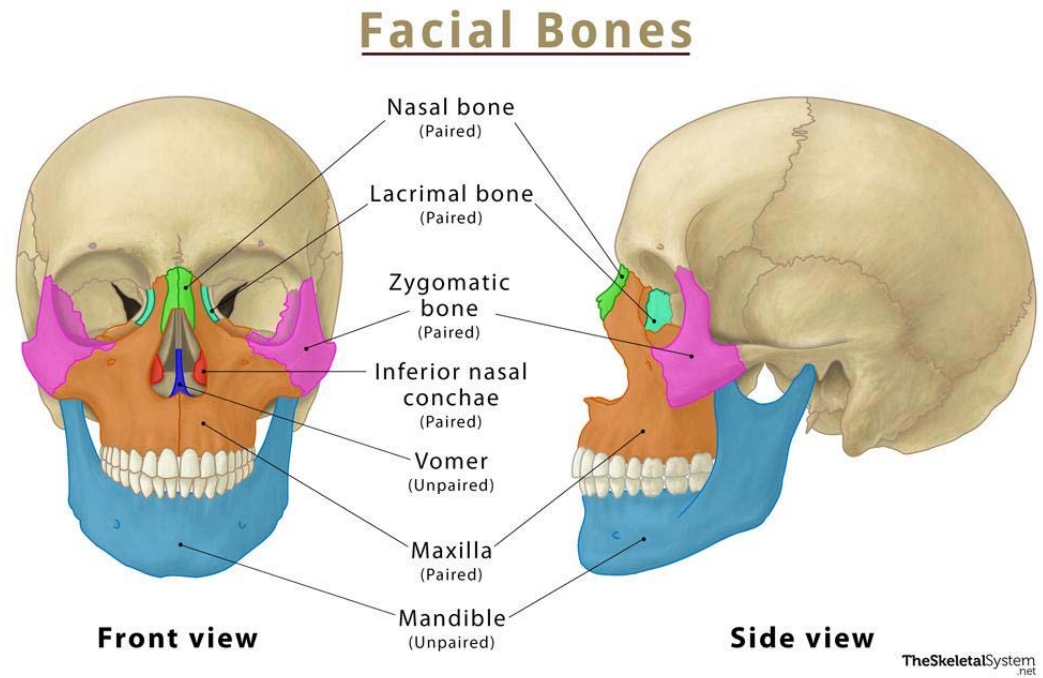
Posterior View



Facial bones:

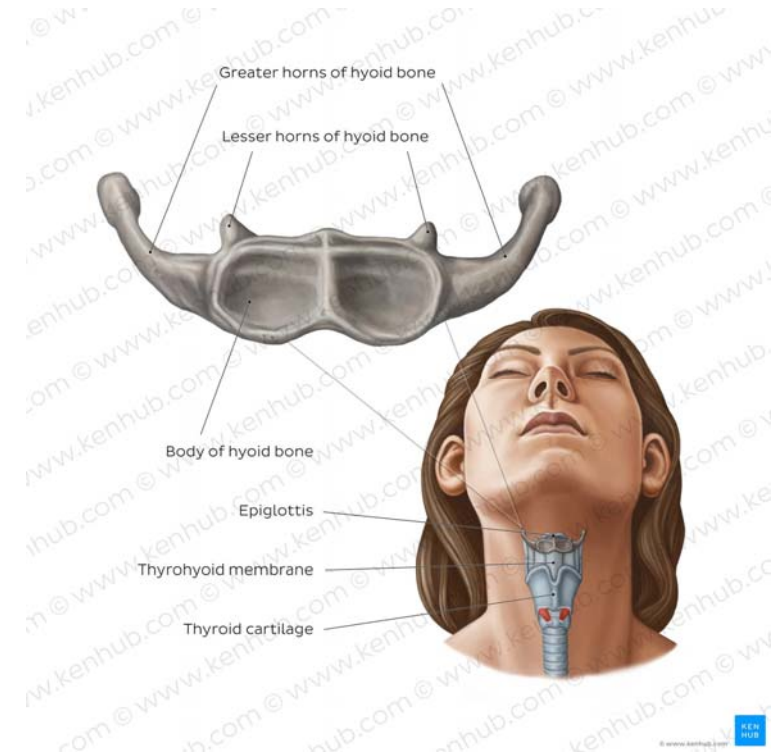
which are fourteen (14) facial bones form the front portion of the skull.

- ☐ Zygomatic bone (2)
- ☐ Lacrimal bone (2)
- ☐ Inferior nasal conchae (2)
- ☐ Nasal bone (2)
- ☐ Palatine bone (2)
- ☐ Maxilla (paired, but fused)
- ☐ Vomer (1)
- ☐ Mandible (1)



Hyoid bone:

is an isolated small U-shaped bone lying in the soft tissues of the neck just above the larynx and below the mandible. It does not articulate with any other bone and is suspended in place by the muscles and ligaments that attach to it. It gives attachment to the base of the tongue. This bone has functions include speech, breathing, tongue movement, mastication, swallowing and prevention of regurgitation.

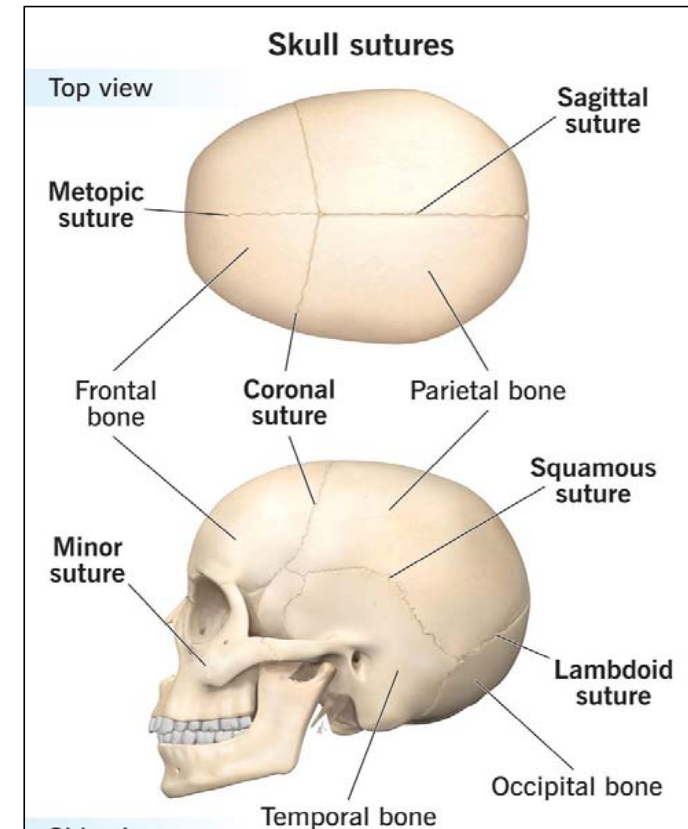
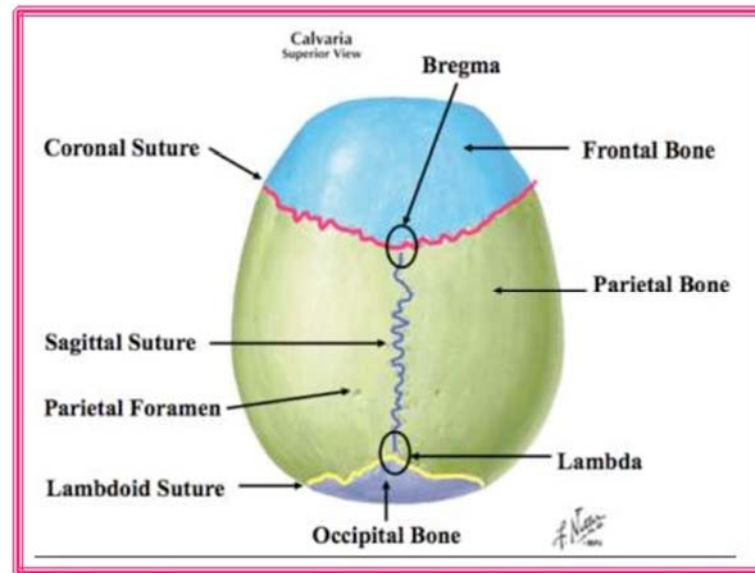


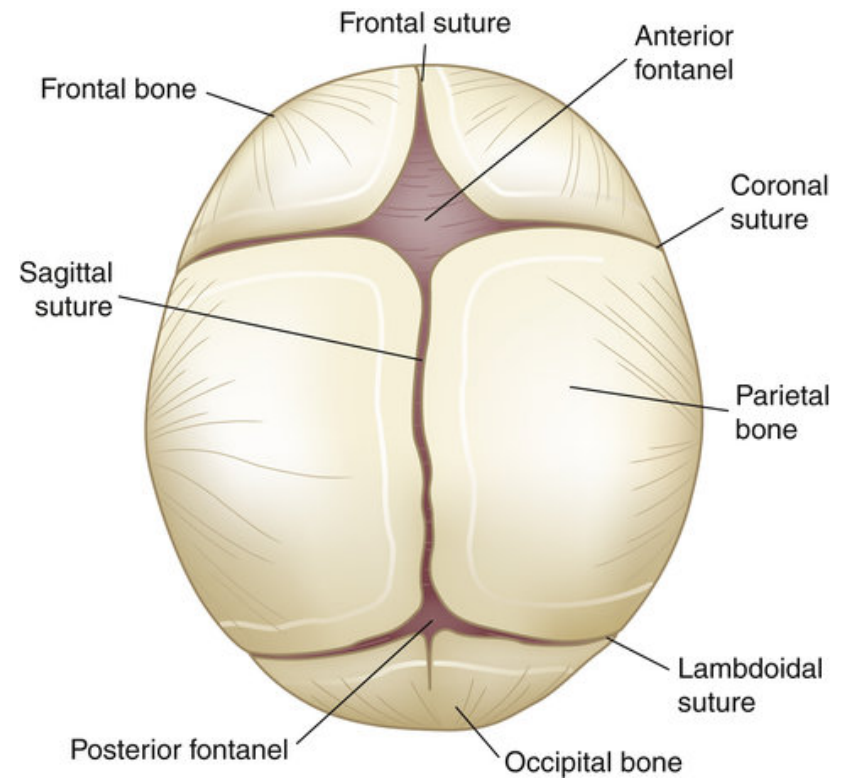
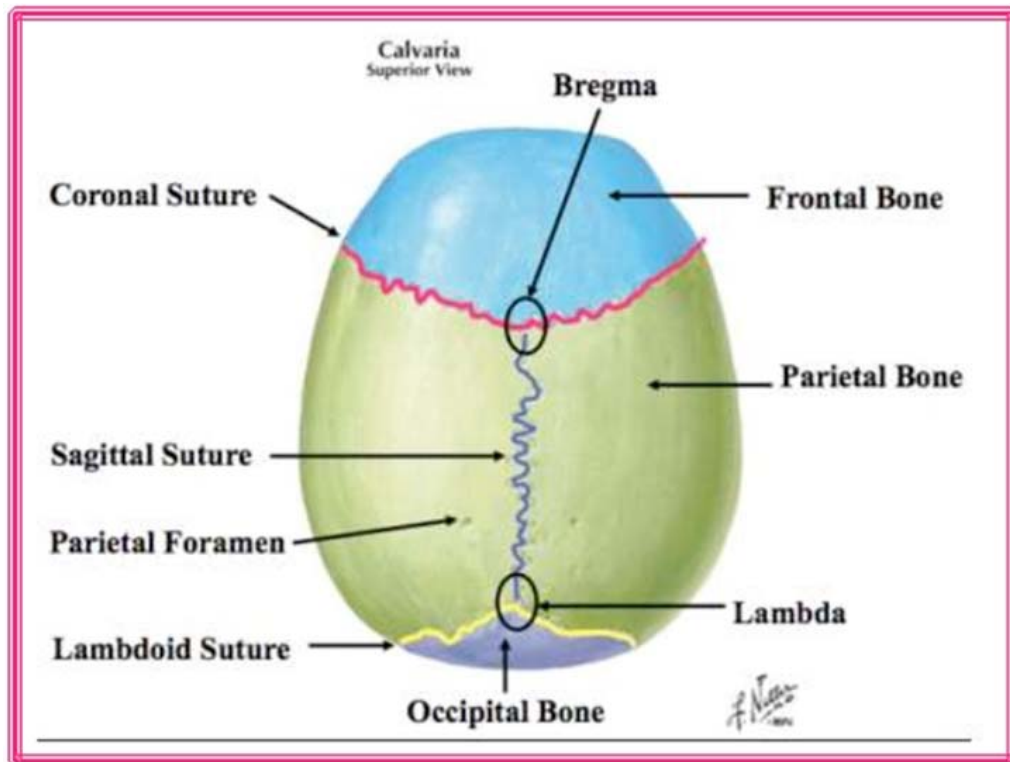
Skull sutures:

The sutures of the skull, also referred to as the cranial sutures, are fibrous joints that connect the bones of the skull. They appear as intricate thin lines that mark the adherence between the bones and the growth and closure of the cranial fontanelles. These joints are fixed, immovable, and they have no cavity. They are also referred to as the **synarthroses**. In fetal skull, which allow movement that facilitates childbirth and brain growth, but later in life they become rigid and fixed.

The main sutures are:

1. The coronal suture (between the frontal and parietal bones).
2. Sagittal suture (between the two parietal bones)
3. Lambdoid suture (between the parietal and occipital bones).
4. Squamosal suture (between the parietal and temporal bones).

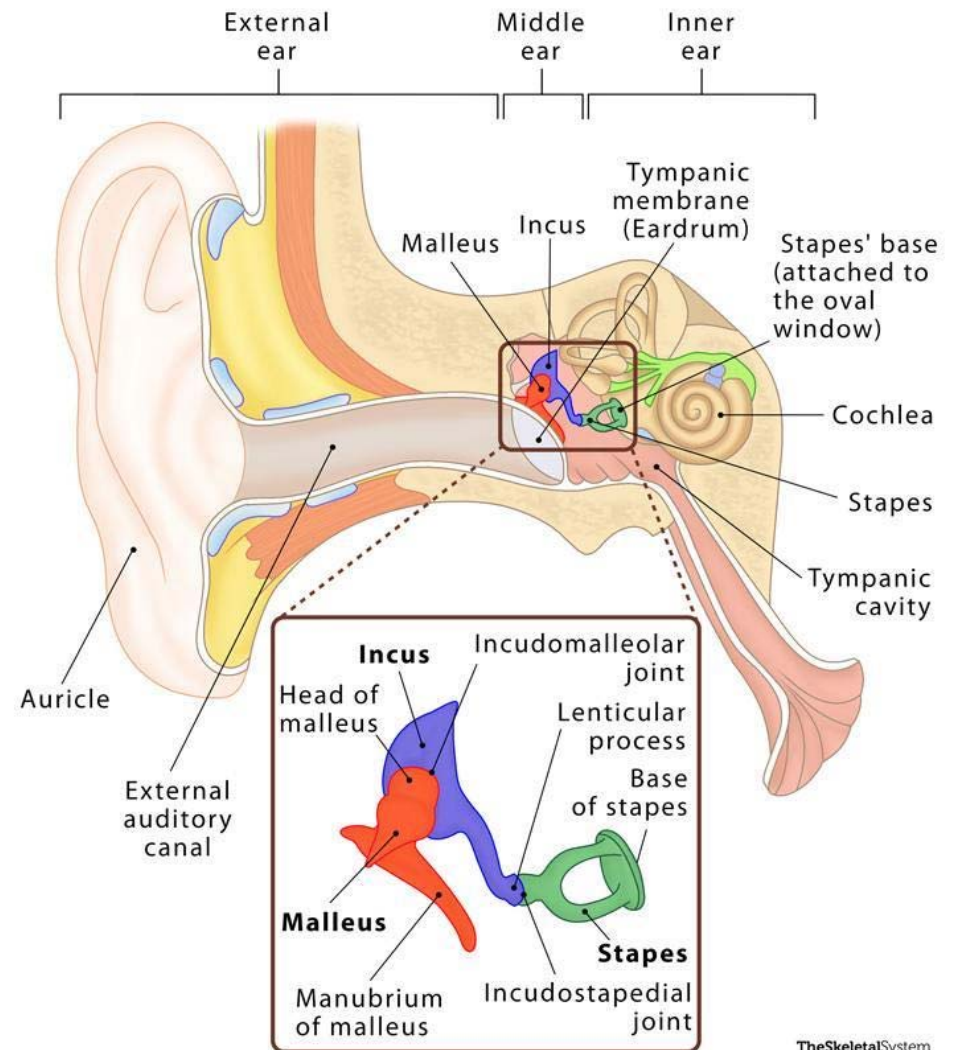




Auditory Ossicles

the auditory ossicles:

- ❖ namely **the malleus, incus, and stapes**.
- ❖ Inside of the middle ear are the smallest bones in the body—the auditory ossicles, or ear bones.
- ❖ By definition, these three bones are named after their shape: malleus (“hammer”), incus (anvil), and stapes (stirrup).
- ❖ During development, the auditory ossicles are the first bones to fully ossify and are mature at the time of birth, where they do not grow afterwards.



Thoracic cage:

The thoracic cage is formed by the vertebral column behind, the ribs and intercostal spaces on either side and the sternum and costal cartilages in front.

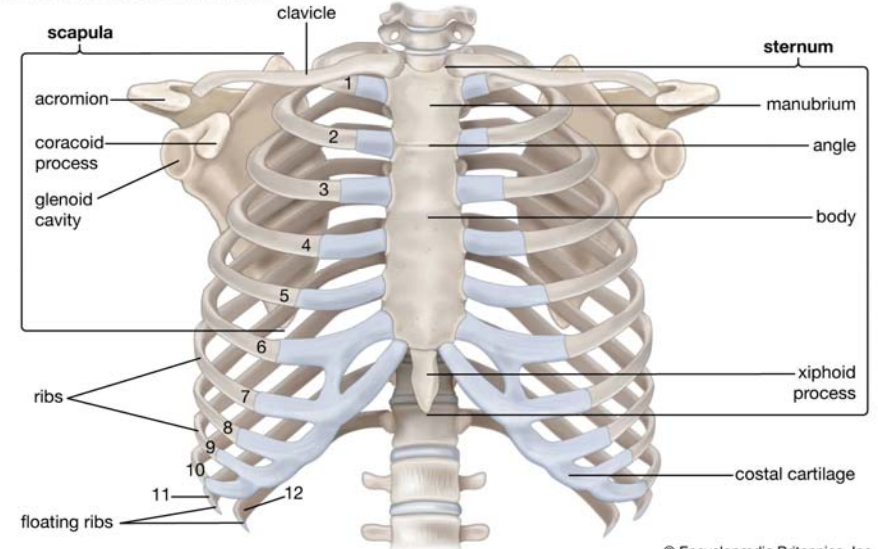
Functions of the thoracic cage:

- ☐ It protects the thoracic organs heart, lungs, large blood vessels and other structures.
- ☐ It forms joints between the upper limbs and the axial skeleton.
- ☐ It gives attachment to the muscles of respiration.

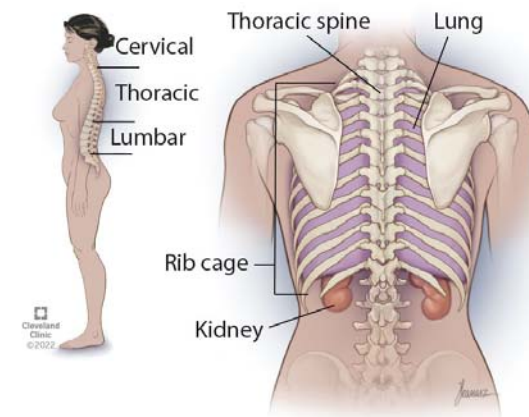
Thoracic cage is formed by:

- sternum or breastbone
- 12 pairs of ribs
- 12 thoracic vertebrae

Bones of the human thorax



Thoracic Spine



Sternum:

commonly called breastbone, is a flat bone located in the midline of the chest, making up the anterior thoracic wall. As it lies superficially, it is easily palpable below the skin of the chest in the midline. **Consist of three parts:**

1. Manubrium:

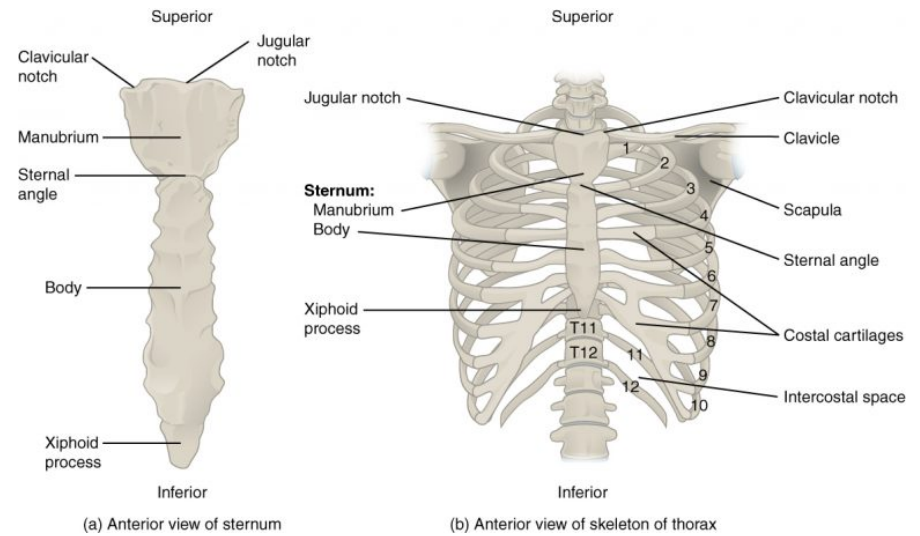
The manubrium is the uppermost section and articulates with the clavicles at the sternoclavicular joints and with the first two pairs of ribs.

2. Body (gladiolus):

It is flat and elongated, articulating with the manubrium superiorly forming manubriosternal joint and the xiphoid process inferiorly, forming the xiphisternal joint. Its lateral borders which articulate with the costal cartilages of the ribs 2nd - 7th.

3. Xiphoid process:

It is the most inferior and smallest part of the sternum. It is usually pointed and largely cartilaginous in structure.



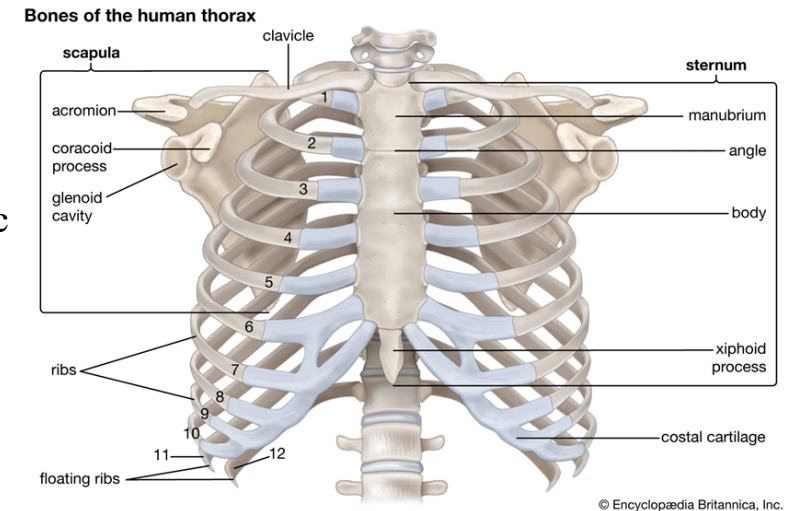
Ribs:

There are 12 pairs of ribs which form the bony lateral walls of the thoracic cage and articulate posteriorly with the thoracic vertebrae.

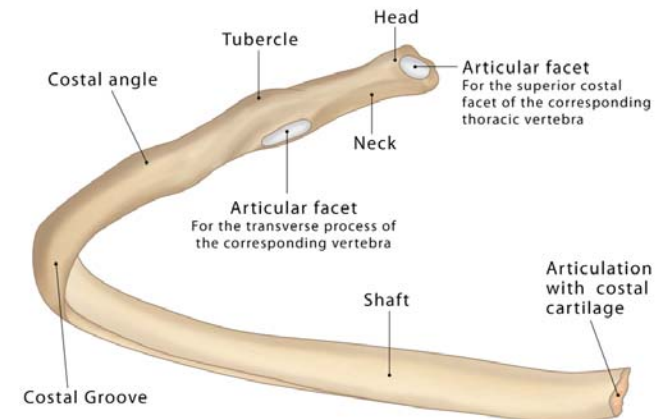
- ❑ **The first seven pairs** are attached directly to the sternum by costal cartilages and are called **true ribs**.
- ❑ **The 8th, 9th, and 10th pairs** do not join the sternum directly but are connected to the 7th rib by cartilage called **false ribs**.
- ❑ **The 11th and 12th pairs** floating ribs.

Anatomy of typical rib: Each typical rib has:

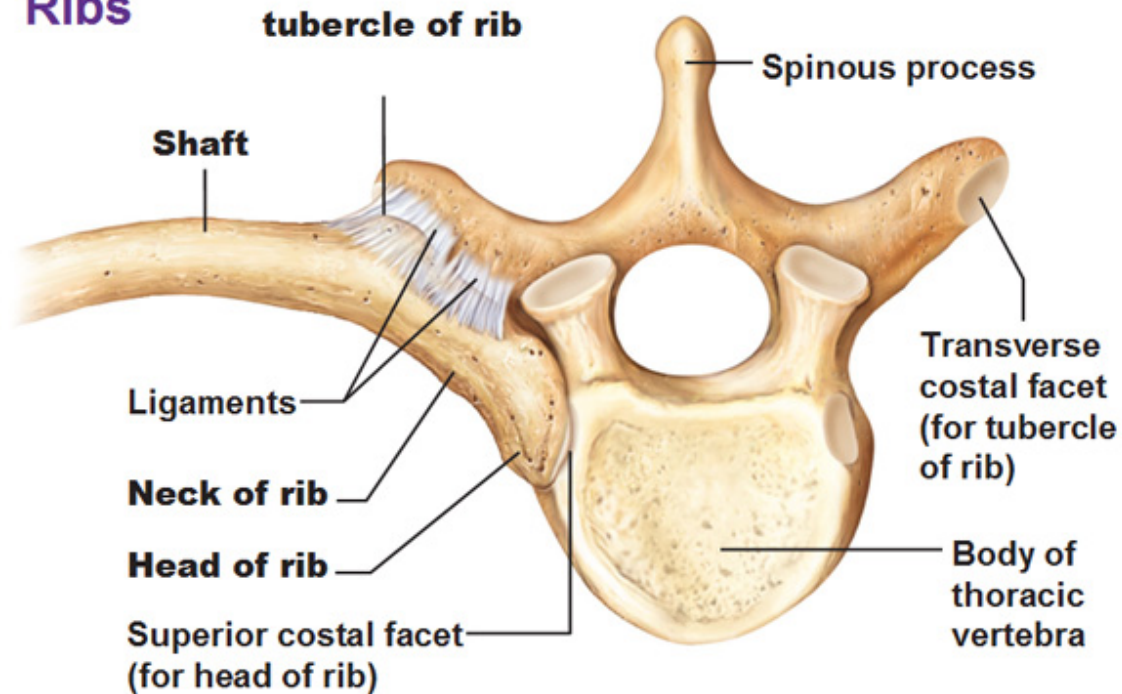
- A head bearing two articular facets.
- A neck
- A tubercle with a rough non-articular portion and a smooth facet, for articulation with the transverse process of the vertebra.
- Angle
- Costal groove



Anatomy of a Typical Rib

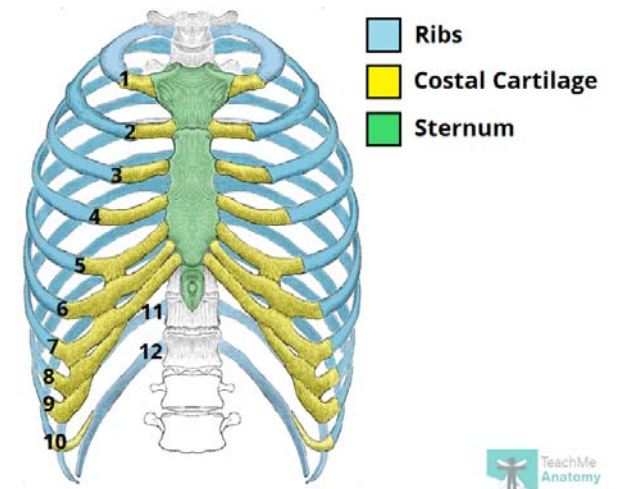


Ribs



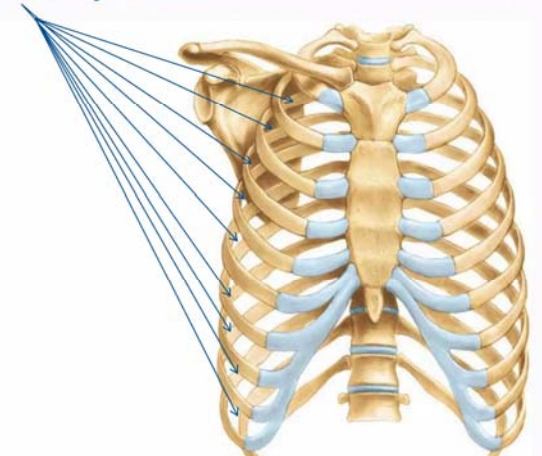
(c) Superior view of the articulation between a rib and a thoracic vertebra

Costal cartilages: These bars of **hyaline cartilage** serve to connect the upper seven ribs directly to the side of the sternum and the 8th, 9th and 10th ribs to the cartilage immediately above. The cartilages of the 11th and 12th ribs merely join the tapered extremities of these ribs and end in the abdominal musculature.



The intercostal space: is the anatomic space between two ribs. Since there are 12 ribs on each side, there are 11 intercostal spaces. There are 3 muscular layers in each intercostal space, consisting of the external intercostal muscle, the internal intercostal muscle, and the thinner innermost intercostal muscle. These muscles help to move the ribs during breathing.

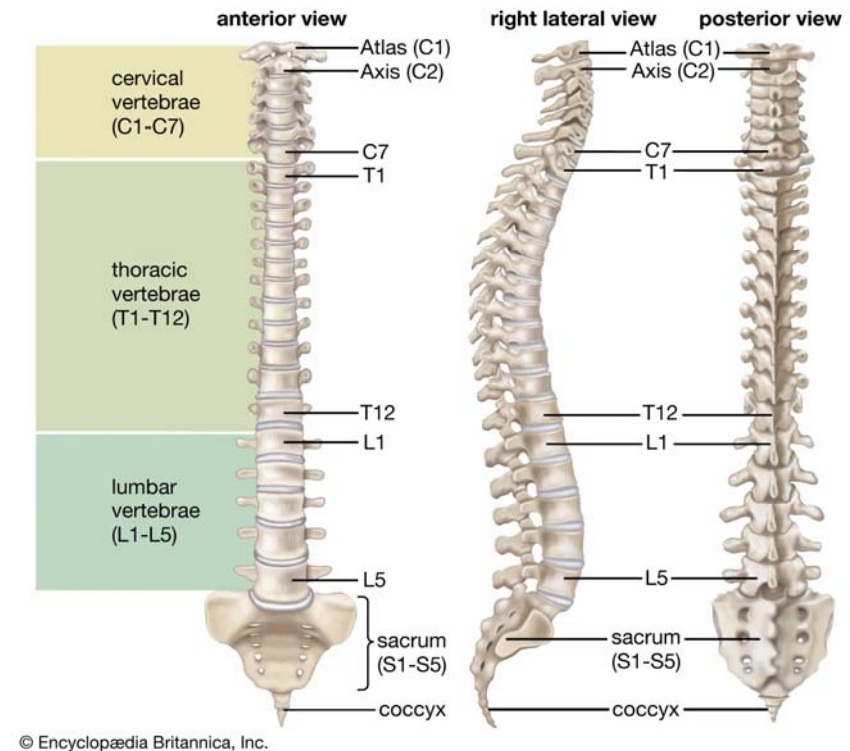
Intercostal spaces



Vertebral column:

The spinal or vertebral column is made up of thirty-three vertebrae, of which twenty-four are discrete vertebrae and nine are fused in the sacrum and coccyx:

- ❑ **7 cervical vertebrae**, are located within the neck. The first vertebra is called the atlas which articulates with the occipital bone to support the skull and then second cervical vertebra called axis. The remaining five cervical vertebrae do not have individual names
- ❑ **12 thoracic vertebrae**, articulate (form joints) with the ribs on the posterior side of the trunk.
- ❑ **5 lumbar vertebrae**, the largest and strongest bones of the spine.
- ❑ **5 sacral fused into 1 sacrum**, permits the articulation of the two hip bones
- ❑ **(3, 4 or 5) small coccygeal into 1 coccyx.**



In adults, its show normal four curves:

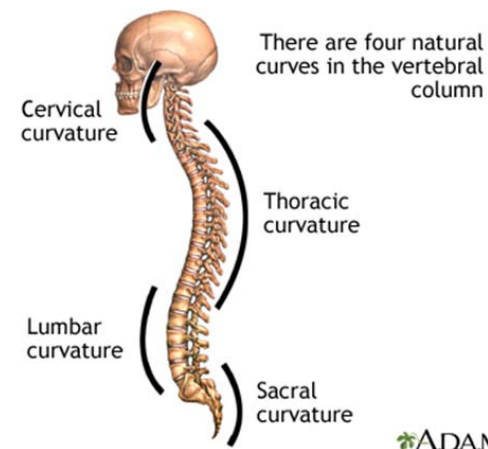
- ❖ Cervical and lumbar curve are convex (lordotic)
- ❖ Thoracic and sacral curve are concave (Kyphotic).

Functions of the Vertebral or Spinal Column:

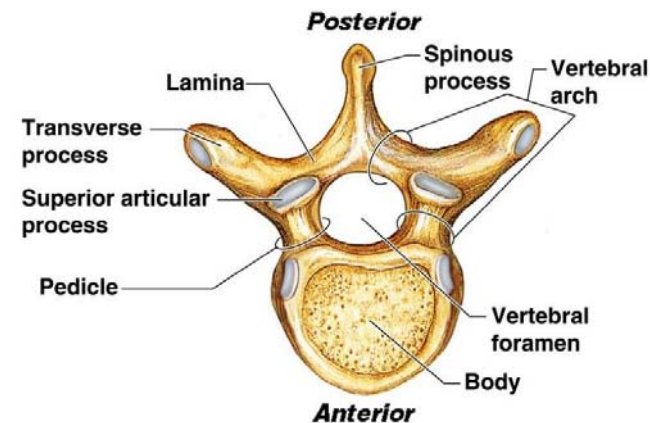
- ❖ Protection of the spinal cord and nerve root.
- ❖ Base for attachment of ligaments, tendons, muscles.
- ❖ In the thoracic region the ribs articulate with the vertebrae forming joints which move during respiration.
- ❖ Structural support for the head, shoulders, chest.
- ❖ Connects upper and lower body for balance and weight distribution.
- ❖ Flexibility.

Typical vertebrae consist of:

- ☐ A body
- ☐ A vertebral arch (pedicles and lamina)
- ☐ vertebral foramen which contains the spinal cord
- ☐ Seven processes (two transverse processes, one spinous process and four articular processes)



Structure of a Typical Vertebrae



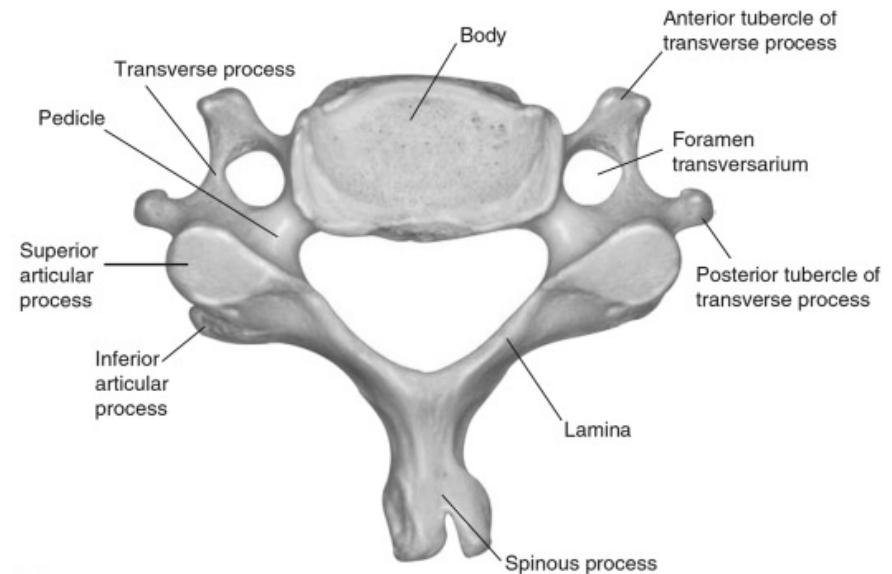
Cervical vertebrae :

These are readily identified by **the foramen transversarium** perforating the transverse processes. This foramen transmits the vertebral artery, the vein, and sympathetic nerve fibers. The spines are small and bifid (except C1 and C7 which are single) and the articular facets are relatively horizontal.

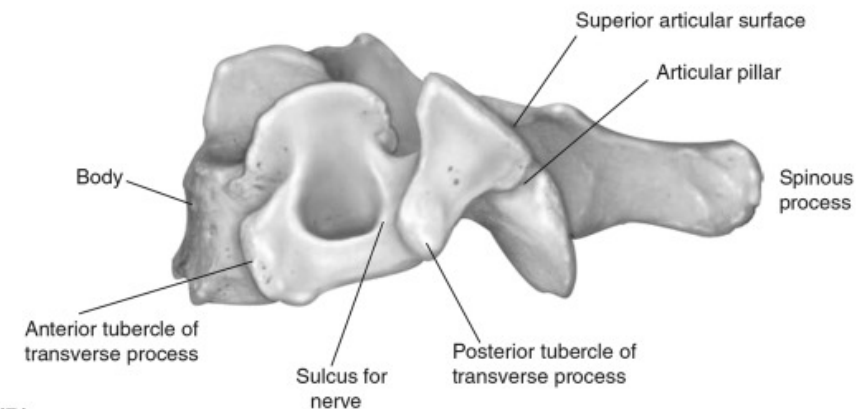
C1, C2 and C7- Atypical vertebrae

C3-C6 – have similarities- typical characterized by:

- Smaller bodies
- Large vertebral arch- larger vertebral foramen
- Transverse process consist of transverse foramina
- Spinous process short and bifid.



(A)

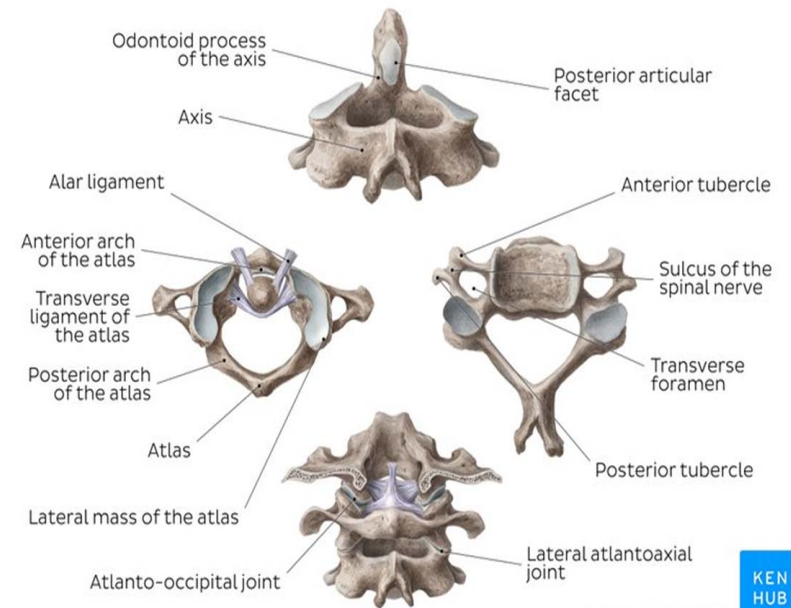
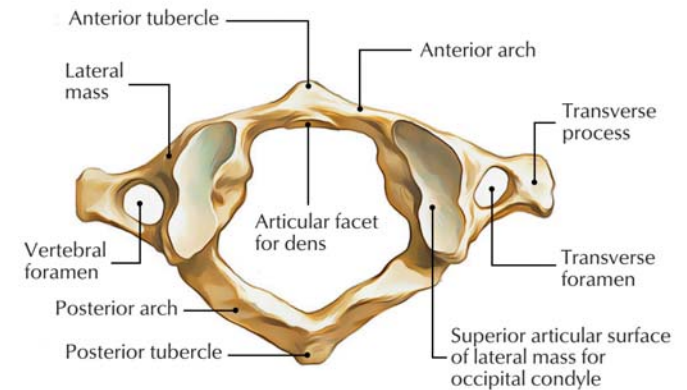


(B)

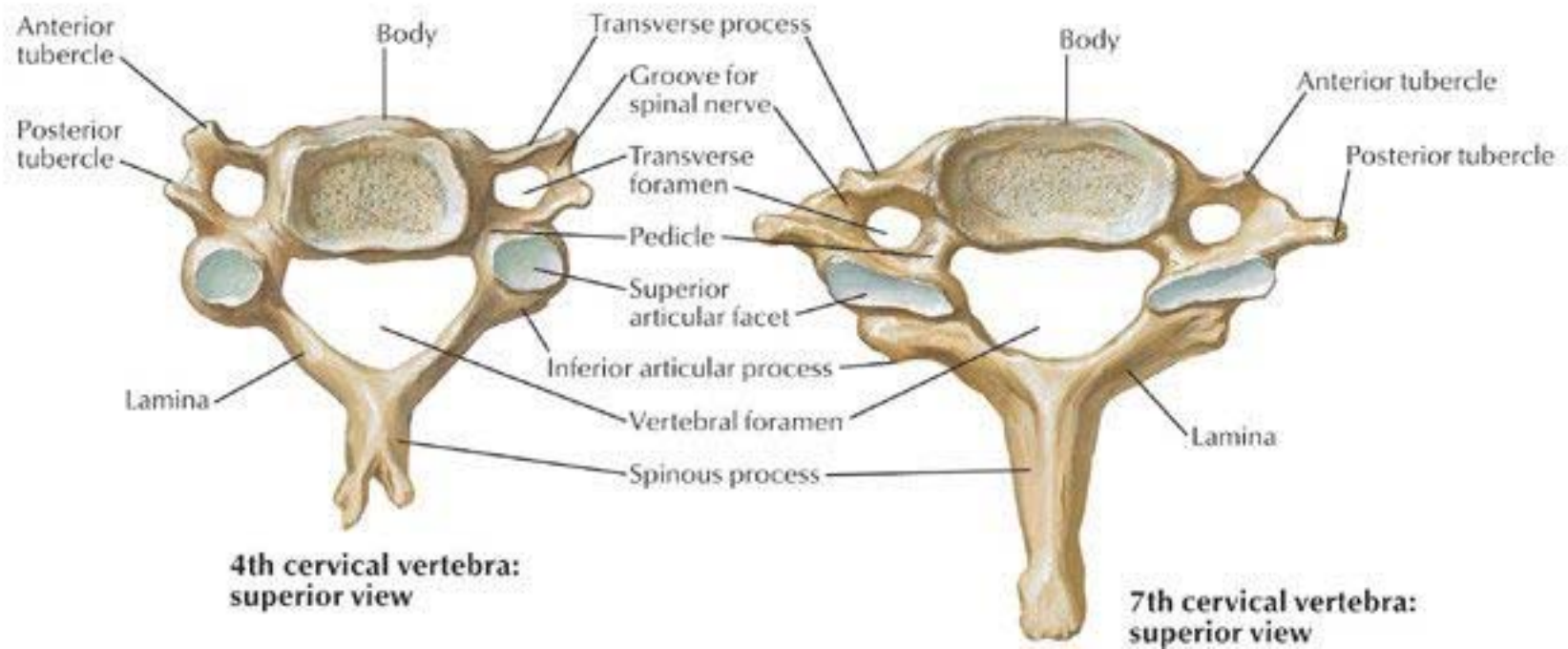
The atlas (C1): lacks a body or spinous process. It has anterior and posterior arches with lateral masses. Its superior articular surfaces articulate with occipital condyles of the skull at the atlanto-occipital joint, this articulation contributes of neck flexion and extension movement. Its inferior articular surfaces articulate with the axis at the atlanto-axial joint.

The axis (C2): Is the 2nd cervical vertebra. The body is small and has the upward projecting odontoid process or (dens) that articulates with the first cervical vertebra, the atlas. The movement at this joint is turning the head from side to side.

The vertebra prominens (C7): has the longest spinous process of all cervical vertebrae. It is also non-bifid. These features give rise to its name. Its transverse foramina are small and do not transmit the vertebral artery like the other cervical vertebrae which transmits only the vein, is small or even sometimes absent.

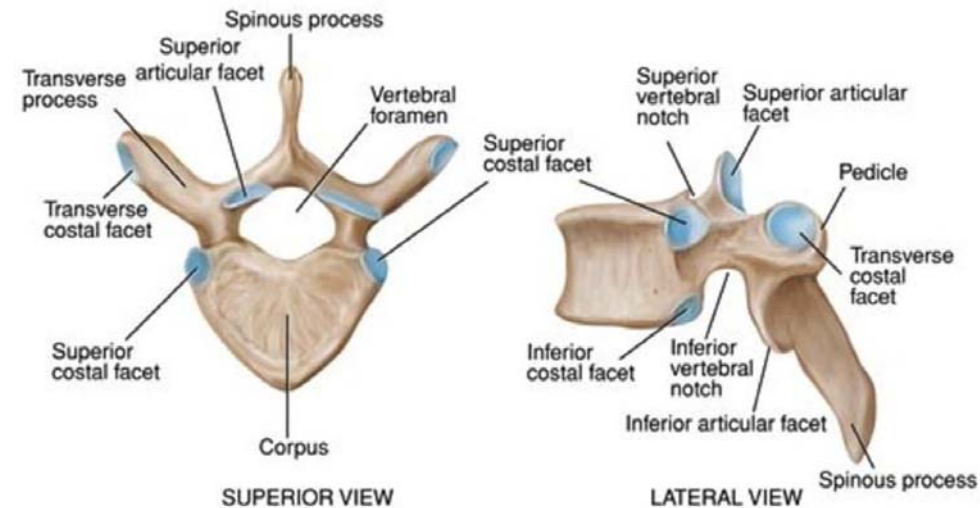
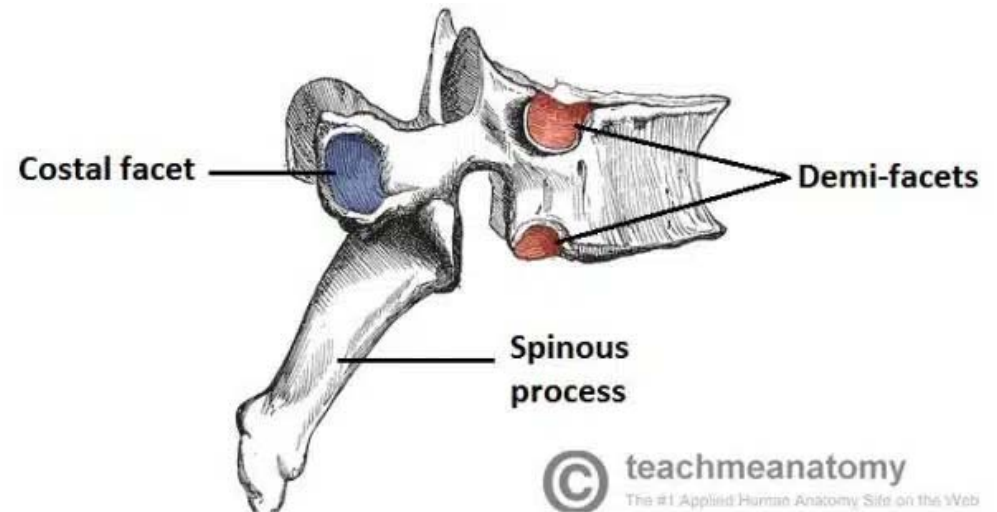


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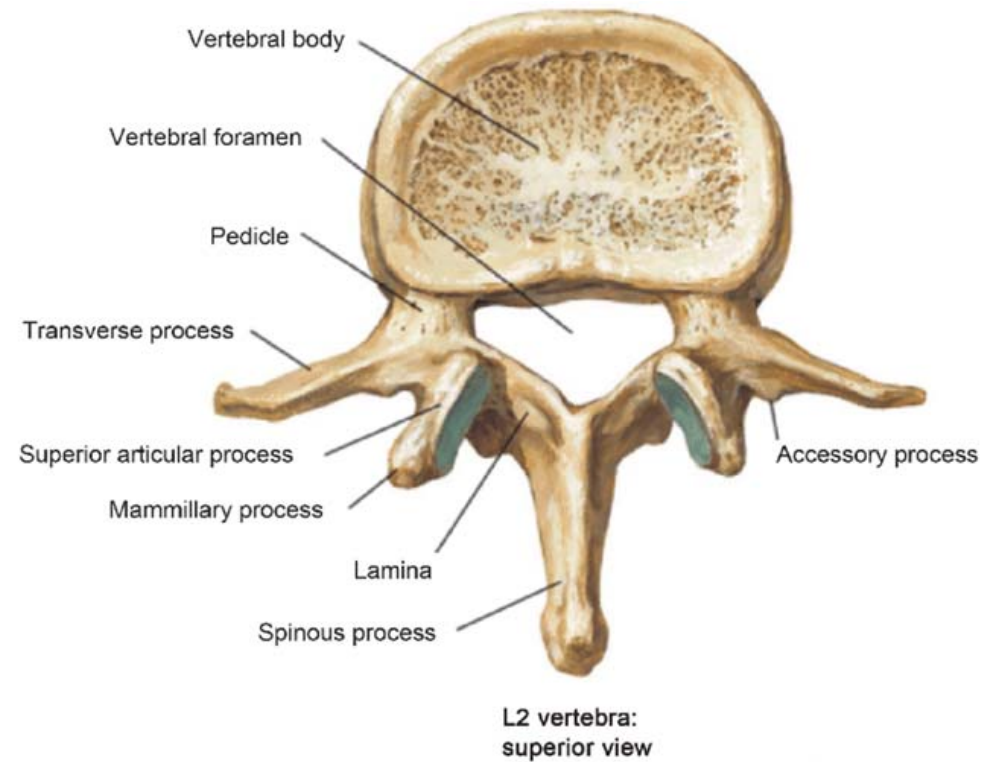
Thoracic vertebrae:

- ❑ A typical thoracic vertebra is distinguished by large body and the spinous process, which is long and projects downward to overlap the next inferior vertebra.
- ❑ These vertebrae are characterized by demifacets on the sides of their bodies for articulation with the heads of the ribs and by facets on their transverse processes (apart from those of the lower two or three vertebrae) for the rib tubercles. In the majority of the vertebrae (T2-T9) these facets are demi-facets.
- ❑ The lowest couple are rather 'lumbar' in appearance, have a single facet on the side of the body and no facet on the transverse process.



Lumbar vertebrae:

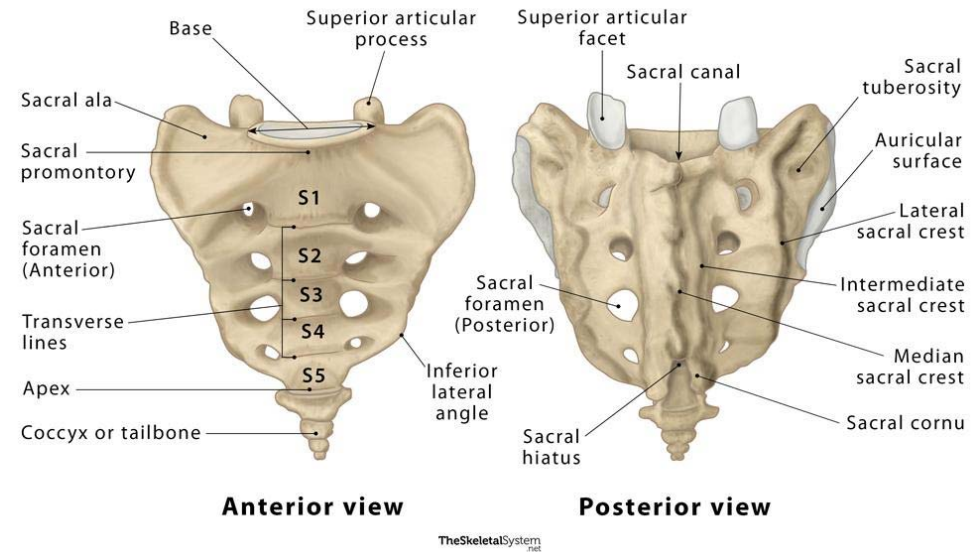
- ☐ Carry the greatest amount of body weight.
- ☐ large size and thickness of the vertebral body.
- ☐ Short transverse processes
- ☐ Short, blunt spinous process.
- ☐ Articular processes are large, with the superior process facing medially and the inferior facing laterally.



The sacrum:

- This consists of five rudimentary vertebrae fused to form a triangular bone. The upper part, or base, articulates with the 5th lumbar vertebra.
- On each side it articulates with the ilium to form a sacroiliac joint, and at its inferior tip it articulates with the coccyx.
- The anterior edge of the base, the promontory, protrudes into the pelvic cavity. On each side of the bone there is a series of foramina for the passage of nerves.

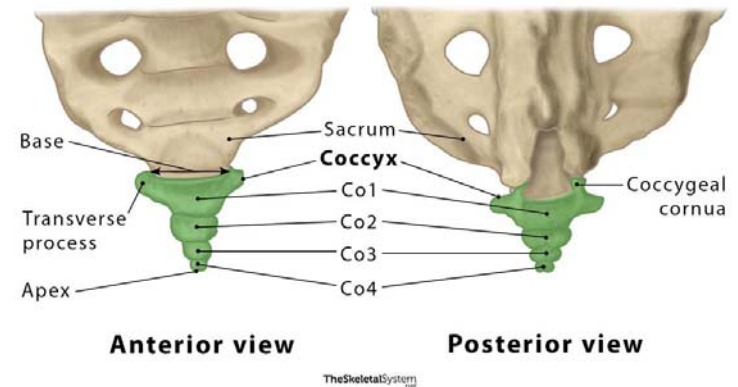
Sacrum



Coccygeal vertebrae

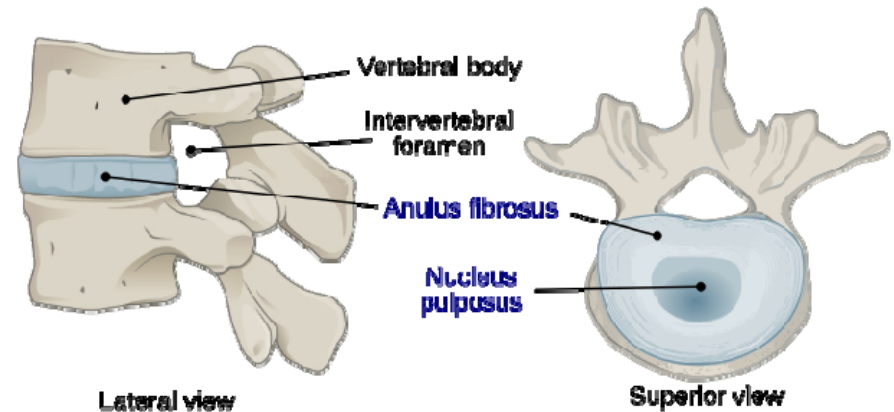
It articulates with the inferior tip of the sacrum. It is not weight bearing in the standing position, but may receive some body weight when sitting.

Coccyx



Intervertebral discs:

- ❑ The bodies of adjacent vertebrae are separated by intervertebral discs, consisting of an outer rim of fibrocartilage (annulus fibrosus) and a central core of soft gelatinous material (nucleus pulposus). They are thinnest in the cervical region and become progressively thicker towards the lumbar region. They have a shock absorbing function and the cartilaginous joints they form contribute to the flexibility of the vertebral column as a whole.
- ❑ Intervertebral discs constitute approximately a quarter of the length of the spine as well as accounting for its secondary curvatures. In old age, the discs atrophy, with resulting shrinkage in height and return of the curvature of the spine to the C shape of the newborn



Movements of the vertebral column:

Flexion (bending forward).

Extension (bending backward)

Lateral flexion (bending to the side)

Rotation.

