HUMAN ANATOMY AND PHYSIOLOGY- 1(BP101T)

Unit-2 SKELETAL SYSTEM

Class-3

TOPIC: AXIAL SKELETAL SYSTEM

Human skeletal system can be divided in to two categories.

1. Axial skeletal system.
2. Appendicular skeletal system.

AXIAL SKELETAL SYSTEM(80)

DIVISION OF THE SKELETON	STRUCTURE	NUMBER OF BONES
Axial skeleton	**Skull**	
	Cranium	8
	Face	14
	Hyoid bone	1
	Auditory ossicles (see Figure 7.5)	6
	Vertebral column	26
	Thorax	
	Sternum	1
	Ribs	24
	Number of bones = 80	

- These are those which helps in the formation of body axis. It supports and protects the skull and neck and the trunk region.
- There are 80 bones in adults 87 bones in child.
- The axial skeleton consists of the skull, vertebral column, ribs and sternum.

SKULL: Frontal bone (1), Parietal bones (2), Temporal bones (2), Occipital bone (1), Sphenoid bone (1), Ethmoid bone (1).

- **FRONTAL BONE (1):** This is the bone of the forehead. It forms part of the orbital cavities (eye sockets). The frontal squama, a scalelike plate of bone that forms the forehead of the skull. Just above the supraorbital margins, within the bone, are two air-filled cavities or sinuses lined with ciliated mucous membrane, which open into the nasal cavity.

  Orbital surface – the frontal bone creates the roof of the orbital (eye socket).

  Supraorbital margins – creates the rim of the orbit.

Supraorbital foramen and notch – these are different structures. Foramen is a hole, whereas a notch is a hole that has breached the margin and is no longer a hole, but a notch.

Superciliary arch – a thickening prominence of the forehead just above the eyebrows.

Lacrimal fossa – a shallow depression for lacrimal gland, on orbital surface.

Zygomatic process – portion of this bone meeting the zygomatic bone of the cheek.

Metopic suture - remnant of fusion between the two frontal bones of the fetal skull.

Frontal sinus - the frontal bone is one of 4 skull bones that have a hollow sinus in them.

- **PARIETAL BONES (2):** The two parietal bones form the greater portion of the sides and roof of the cranial cavity. The inner surfaces of the parietal bones in the skull have many **bumps and grooves**. These features make space for blood vessels that supply the dura mater, which is the tough outer layer covering the brain.

- **TEMPORAL BONES (2):** These bones lie one on each side of the head and form sutures with the parietal, occipital, sphenoid and zygomatic bones. The mastoid part contains the mastoid process, a thickened region easily felt behind the ear.
- It contains a large number of very small air sinuses that communicate with the middle ear and are lined with squamous epithelium.

  Squamous portion – the flat thin superior part of this bone, helps make the squamous suture.

  Petrous portion – meaning 'rock' or hard portion (like petroleum or petrified). This is found on the internal aspect of skull and separate the posterior.

  Mastoid process – rounded lump behind ear, 'mastoid' means breast-like.

  Zygomatic process - reaches toward zygomatic bone, contributes to the zygomatic arch.

  Mandibular fossa – the shallow depression that hold the articulation surface with the mandible.

External auditory canal – outer entrance to tympanic membrane (ear drum).

Internal auditory canal – internal passageway within the petrous portion. h) Styloid process -sharp pointy process, stylus means needle.

Carotid canal – passageway for entry of the internal carotid artery to cranium.

Jugular foramen (only seen when temporal bone is joined with occipital). This very large passage way is for the passage of internal jugular vein, in addition to the passage of the glossopharyngeal, vagus, and accessory nerves

- **OCCIPITAL BONE (1):** This bone forms the back of the head and part of the base of the skull. It forms sutures with the parietal, temporal and sphenoid bones. It is deeply concave. This concavity accommodates the occipital lobes of the cerebrum and the cerebellum.

Foramen magnum – means 'hole big', the large passageway is for the spinal cord to exit cranium.

Occipital condyles – these articulate with atlas (c1), responsible for 'yes' gesture.

- **SPHENOID BONE (1):** The sphenoid bone lies at the middle part of the base of the skull. This bone is called the **keystone** of the cranial floor. The space inside the body is the sphenoidal sinus, which drains into the nasal cavity.

Squamous portion – the flat thin superior part of this bone, helps make the squamous suture.

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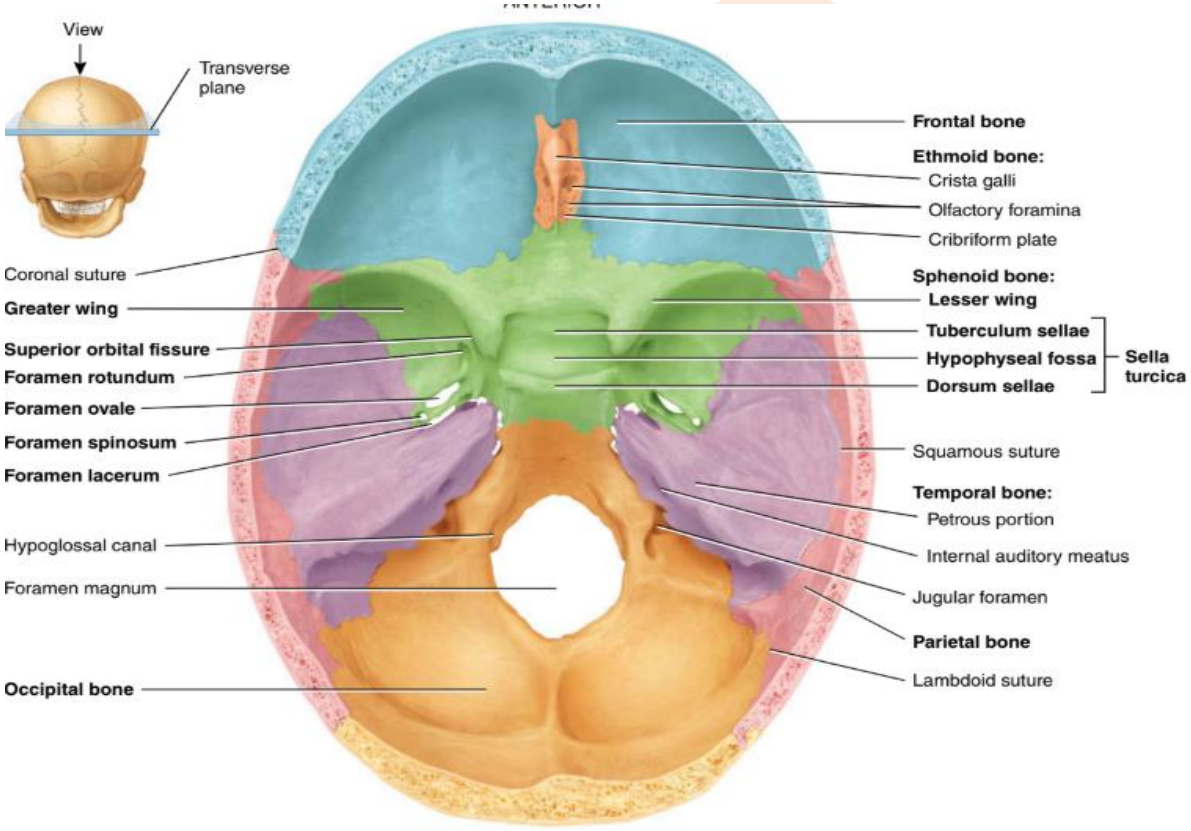
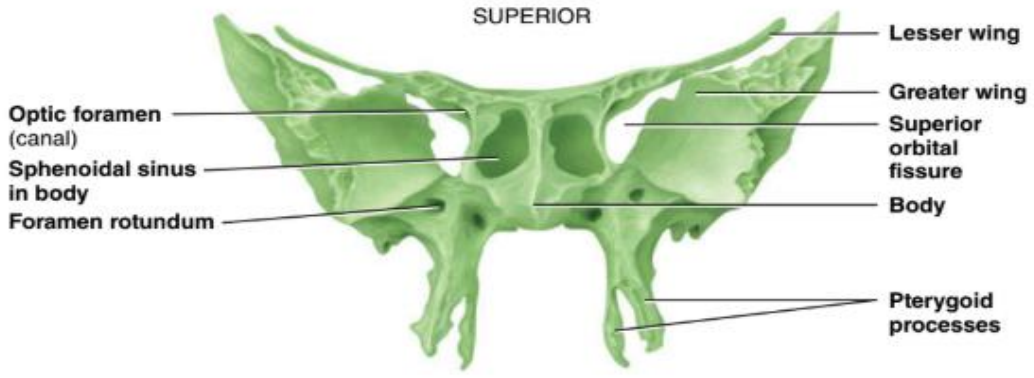


(a) Superior view of sphenoid bone in floor of cranium



(b) Anterior view of sphenoid bone

Carotid canal – passageway for entry of the internal carotid artery to cranium.

Jugular foramen (only seen when temporal bone is joined with occipital). This very large passage way is for the passage of internal jugular vein, in addition to the passage of the glossopharyngeal, vagus, and accessory nerves are for the attachment of the pterygoid muscles which are involved in the lateral movement of the mandible when chewing and grinding food.

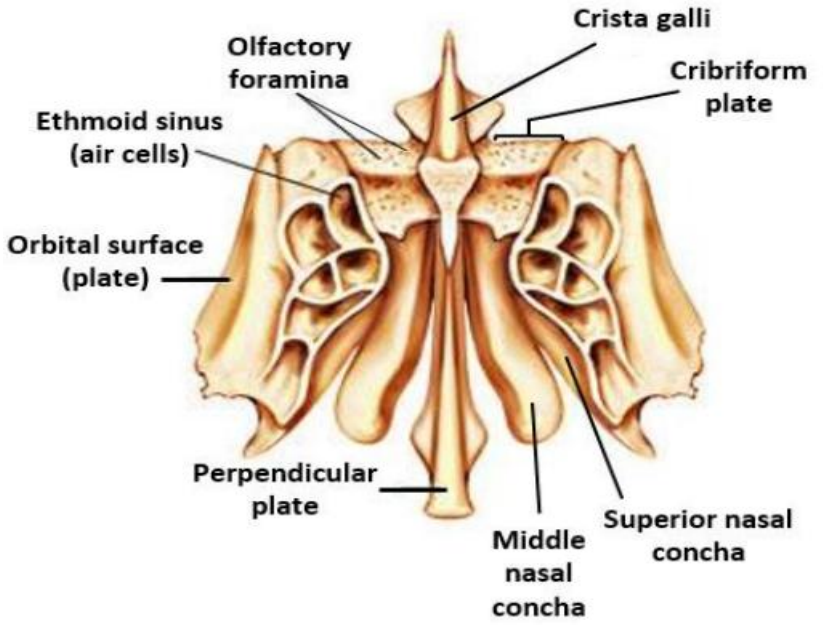
ETHMOID BONE (1): Is present anterior part skull and separates the nasal cavity from the brain. Forms nasal septum and is spongelike in appearance.

Crista galli – site of attachment for the cranial meninges. Means crest of the chicken.

Cribriform plate - opening for passage of the many branches of the olfactory nerve.

Olfactory foramina – these are many holes on the cribriform plate for the olfactory nerve branches.

Perpendicular plate – long structure going down to the vomer to form the bony nasal septum.

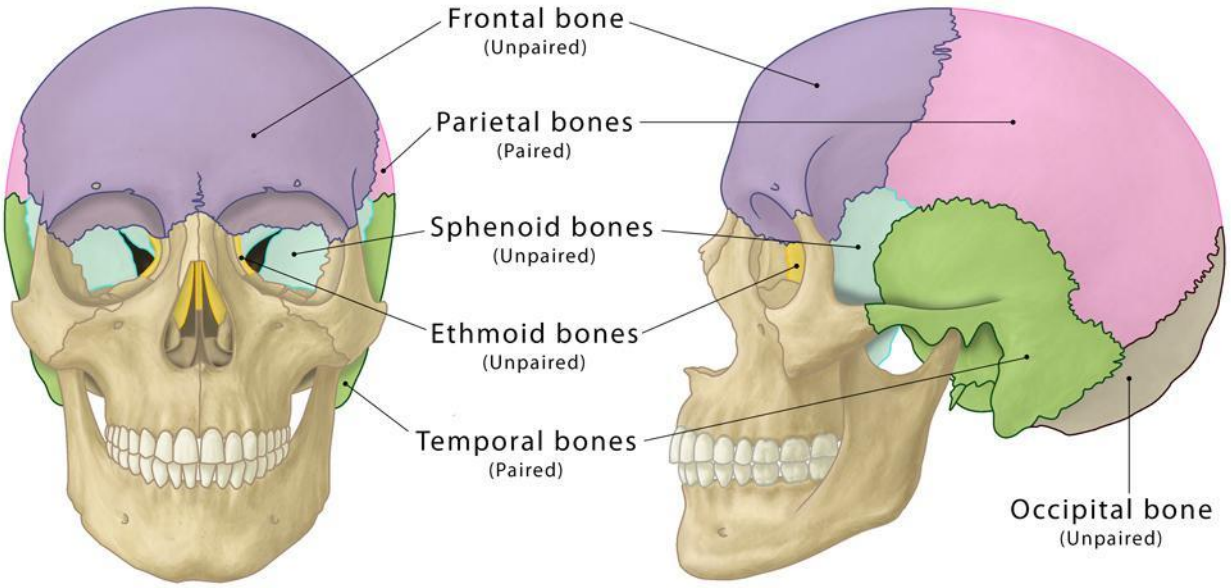


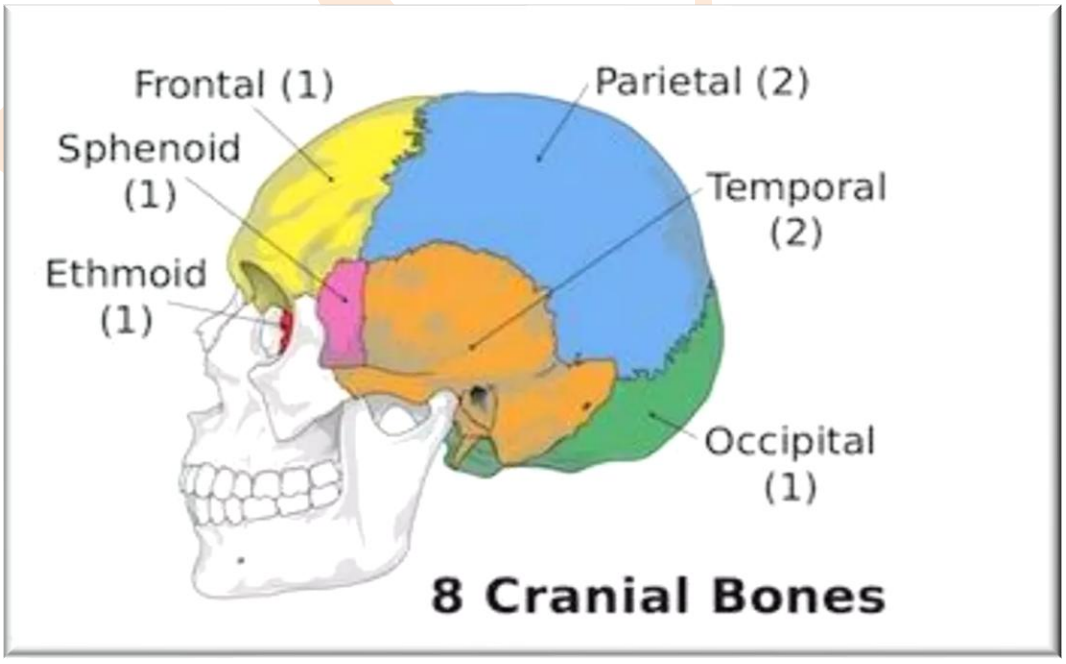
Superior nasal conchae – the top shell structure of ethmoid.

Middle nasal conchae – the bottom shell structure of ethmoid.

Ethmoidal sinuses (air cells) – these are the sinuses of the ethmoid bone.

Cranial Bones





SUTURES: Immoveable joints of the skull.

A. Coronal Suture - between frontal and parietal bones.

B. Lambdoidal Suture - between occipital and parietal bones.

C. Sagittal Suture - between two parietal bones.

D. Squamosal Suture - between temporal and parietal bones.

E. Intermaxillary Suture – between the two halves of the maxillae bones.

FACE (14): It is facial skeleton, also called as **visceral skull which forms frame work for face**. Facial skeleton contains **14 bones** which provide protection to eye, mouth, nose and attached to teeth. The shape of the face changes dramatically during the first two years after birth.

- Nasal bones (2), Maxillae (or maxillas) (2), zygomatic bones (2), lacrimal bones (2), Palatine bones (2), Inferior nasal conchae (2), Mandible (1), Vomer (1).

NASAL BONES (2): The paired nasal bones are small, flattened, rectangular-shaped bones that form the bridge of the nose. These small bones protect the upper entry to

the nasal cavity and provide attachment for a couple of thin muscles of facial expression.

- **LACRIMAL BONES (2):** The paired lacrimal bones are thin and roughly resemble a fingernail in size and shape. These bones, the smallest bones of the face. Support lacrimal ducts responsible for lacrimation.

  A bone that helps to create the orbit of the eye. Within this bone is the lacrimal canal, which drains tears from the eyes into the nasal cavity.

- **MAXILLAE (OR MAXILLAS) (2):** These are the paired bones of the upper jaw. This bone is responsible for holding of upper teeth.

  Frontal process – process that reaches up towards and articulating with the frontal bone.

  Infraorbital foramen – hole just below the orbit.

  Zygomatic process - reaches toward zygomatic bone.

  Palatal process – creates the first 2/3 of the hard pallet (roof) of mouth.

  Horizontal orientation.

Alveolar process - these are the ridges around the sockets for the teeth.

Incisive fossa – immediately posterior to central incisors, leads to the incisive foramen or canal. **Intermaxillary suture -** immovable joint connecting the 2 maxillary bones.

Maxillary sinus – very large, cavernous chamber in this bone, inferior to the eyes.

- **ZYGOMATIC BONES (2):** Zygomatic bones commonly called cheekbones.
- **PALATINE BONES (2):** It is L-shaped bones. It forms the floor of the nasal cavity. Contributes to posterior 1/3 portion of hard palate. A small section of this bone is one of the 7 bones that contributes to the orbit of the eye.
- **INFERIOR NASAL CONCHAE (2):** The inferior nasal concha bone is a curved, spongy bone that forms part of the lateral wall of the nasal cavity. It's also known as the inferior turbinate. All three pairs of nasal conchae (superior, middle, and inferior) increase the surface area of the nasal cavity and help swirl and filter air before it

passes into the lungs. superior nasal conchae of the ethmoid bone are involved in the sense of smell.

- **MANDIBLE BONES (1):** Lower jawbone, is the largest, strongest facial bone. It is the only movable skull bone.

Body – this structure is the bulk of this bone.

Angle – is a term meaning 'corner', it's where it changes direction and goes up from the body.

Ramus – is a term meaning branch. This is the part that goes up to temporal bone after the angle.

Mandibular condyles, or condylar processes – the articulating surface, sitting in the mandibular fossa of the temporal bone creating the temporal mandibular joint, or the TMJ.

Coronoid process – coronoid means 'crown-like', this is the high sharp point opposite the condyles.

Mental foramen – nutrient foramen on the chin region.

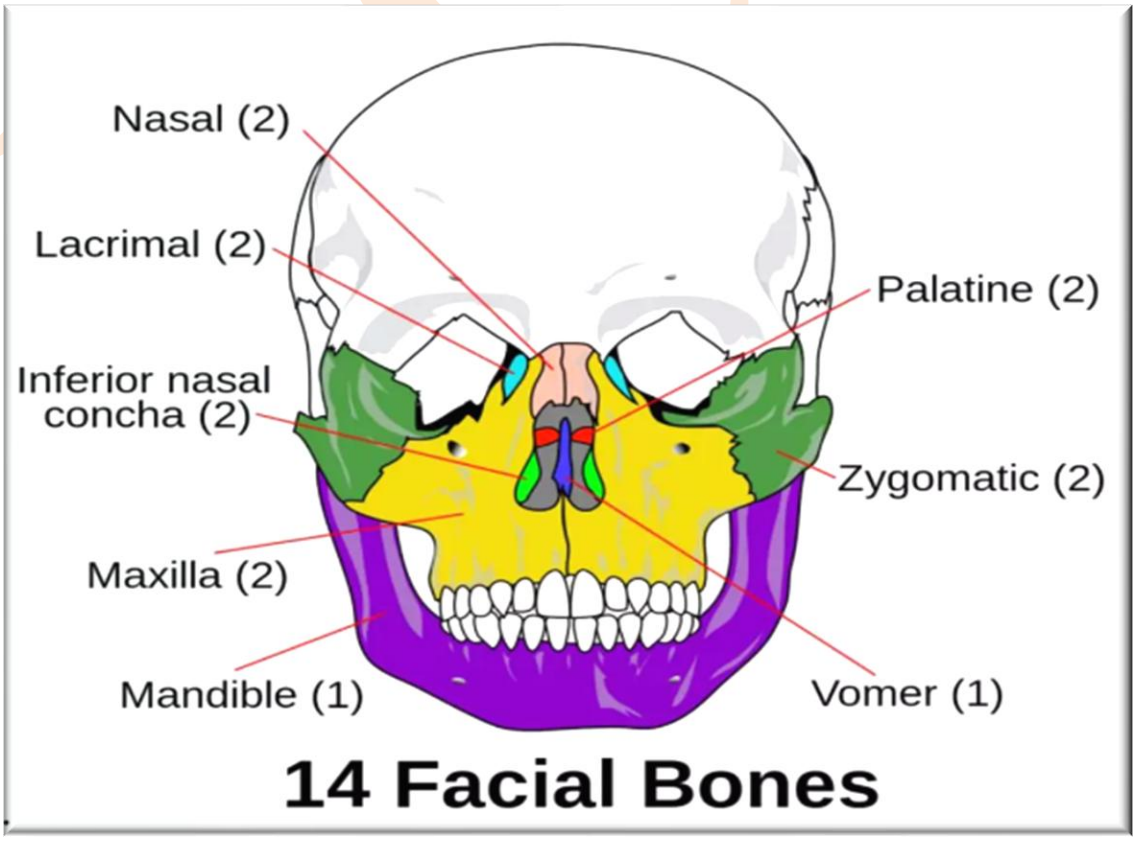
Mental protuberance – bony protrusion of the chin, 'mental' means chin.

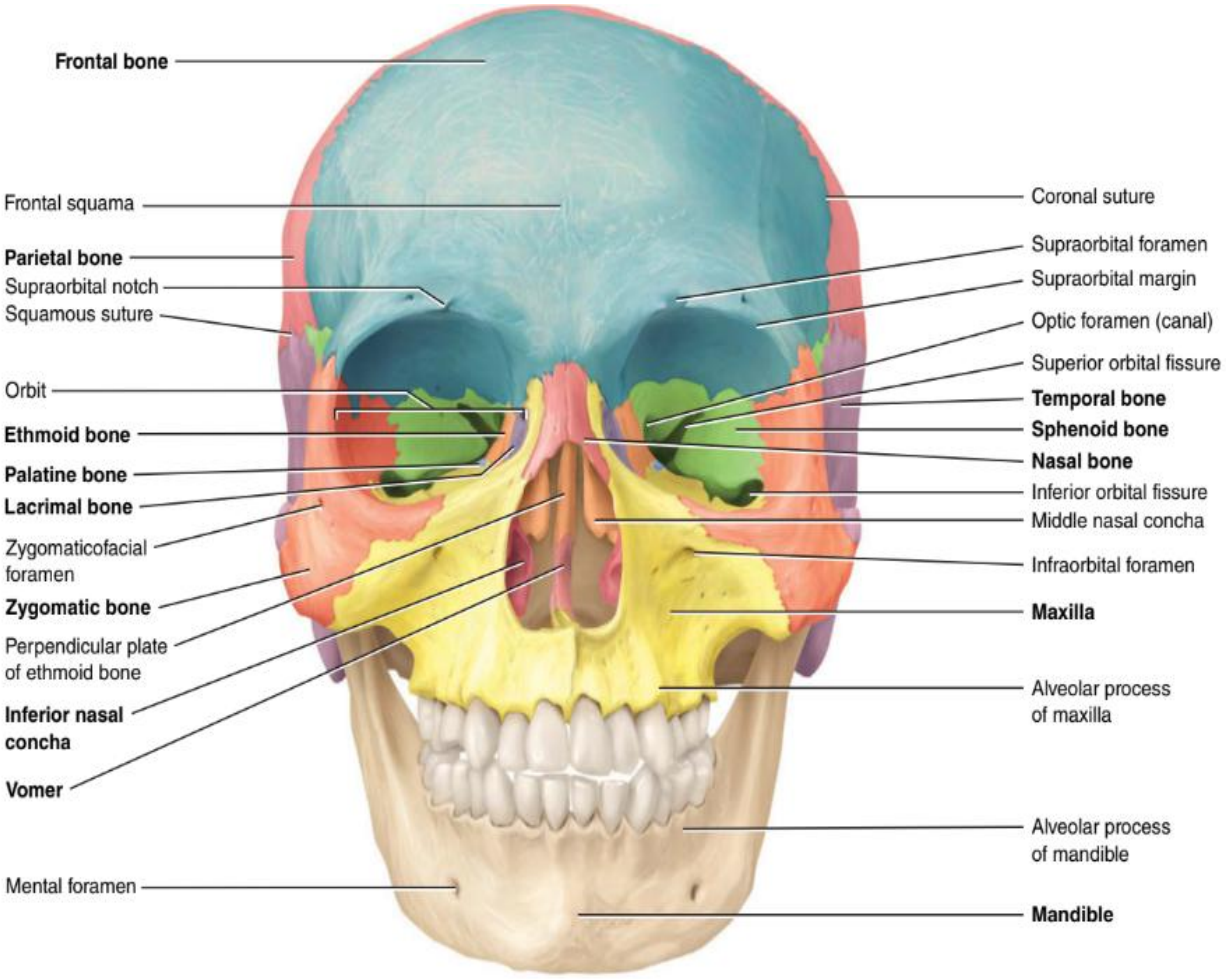
Mandibular notch – that dip or downward arch between condylar and coronoid process.

Mandibular foramen – on the internal aspect of the rami of the mandible.

Alveolar process – these are the ridges around the sockets for the teeth.

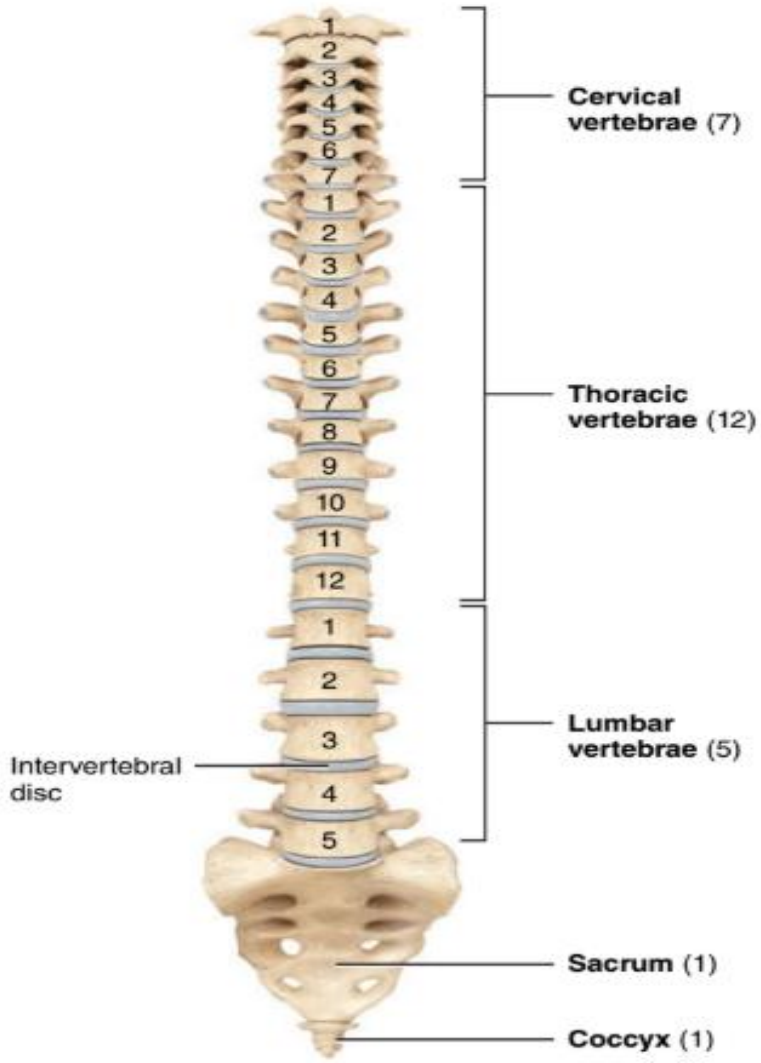
- **VOMER (1):** Vomer is a roughly triangular bone. It is part of nasal cavity and helps in the formation of nasal septum.





Anterior view

- **VERTEBRAE (26):** Vertebral column, also called the **spine, backbone, or spinal column**. Composed of a series of bones called **VERTEBRAE**. The vertebral column consists of bone and connective tissue; the spinal cord that it surrounds and protects consists of nervous and connective tissues.
- At about 71 cm (28 in.) in an average adult male and about 61 cm (24 in.) in an average adult female.
- vertebral column functions as a strong, flexible rod with elements that can move forward, backward, and sideways.
- A baby has 33 vertebrae at birth, but as they grow, some in the sacral and coccygeal regions fuse, leaving adults with 26 vertebrae.



CERVICAL VERTEBRAE (7): There are 7 cervical vertebrae, externally forming the neck region. First vertebrae is named atlas, second vertebrae axis. Joint between atlas and axis called as Atlanto-axial joint.

THORACIC VERTEBRAE: There are larger and stronger than cervical vertebrae. There are 12 thoracic vertebrae which ribs are connected.

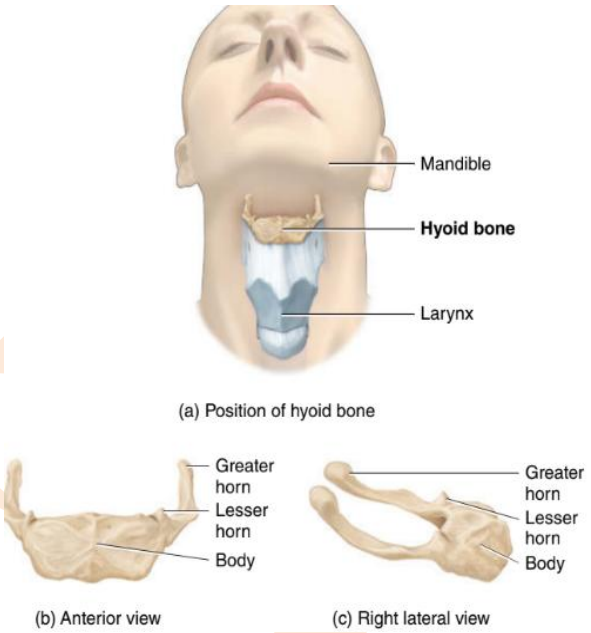
LUMBAR VERTEBRAE: Supporting the lower back. Lumber vertebrae are strongest and longest. There are 5 lumber vertebrae.

SACRUM: It consisting of five fused sacral vertebrae. Present in pelvic region. Female sacrum is larger than male sacrum.

COCCYX: Coccyx usually consisting of four fused coccygeal verte-brae. The cervical, thoracic, and lumbar vertebrae are movable, but the sacrum and coccyx are not.

HYOID BONE:

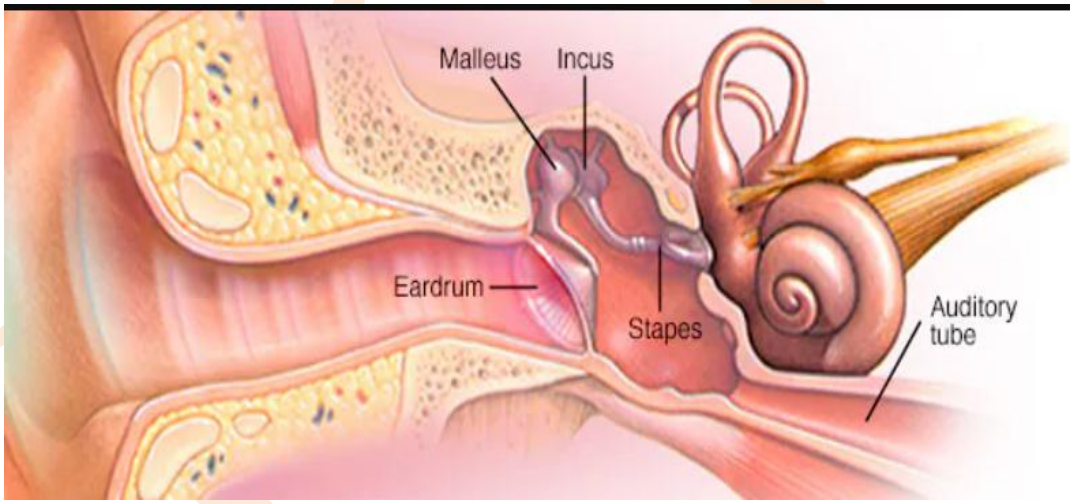
- It is located at the middle of neck in between and forms the floor of the oral cavity. This is a single and U-shaped bone.
- This is the only bone in body that does not directly articulate with any other bone.



- The hyoid bone consists of a horizontal body and paired projections called the lesser horns and the greater horns
- The hyoid bone supports the tongue, providing attachment sites for muscles of the tongue, neck, and pharynx.

❖ AUDITORY OSSICLES (6):

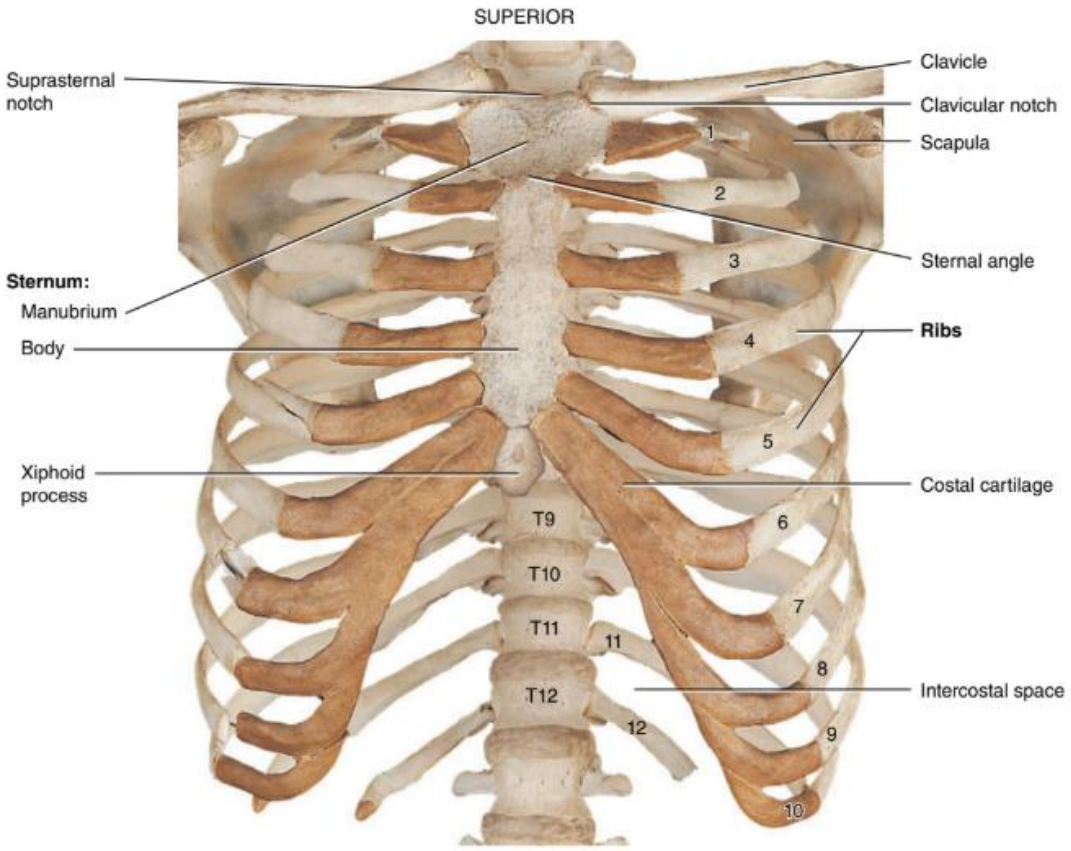
- These are three very small bones only a few millimetres in size that extends across the middle ear.
- They allow the transmission of sound waves.
- Malleus: This is the lateral hammer-shaped bone.
- Incus: This is the middle anvil-shaped bone.
- Stapes: This is the medial stirrup-shaped bone. Smallest bone in the body.



THORACIC CAGE: It is also known as or ribcage. It lies between the head and abdomen excluding upper limib.

- It protects the heart and lungs.
- The thoracic cage expands and contracts when you breathe in and out.
- It includes (Sternum, Ribs, Thoracic vertebrae).

From back side it is attached with vertebrae column and from front it is joint with sternum.



(b) Anterior view of skeleton of thorax

- There are 12 pair of ribs are present. There are three types of ribs present thoracic cage.
- True, Flase, Floating ribs.

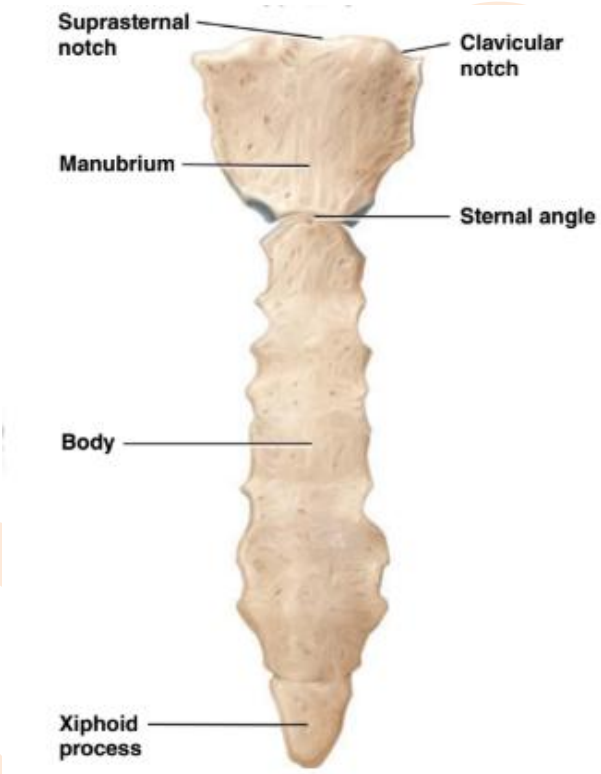
TRUE RIBS: First seven pair of ribs are called true ribs. From front they are attached with sternum and from back they are attached with thoracic vertebrae.

FLASE RIBS: Ribs eight to 10 on each side are called "false" ribs because they don't connect directly to sternum. They are joint with the 7^{th} pair of ribs.

FLOATING RIBS: 11^{th} and 12^{th} pair of ribs are called floating ribs. One end of ribs attached with thoracic vertebrae and other end is free.

All the 12 pairs are attached to Thoracic vertebrae.

Sternum: It is also known as breast bone. Which is flate and give attachment to the ribs. It lies in the midline of the chest and has a 'T' shape. It protects the heart.



(a) Anterior view of sternum

1. **Manubrium** is the most superior portion of the sternum. It is trapezoid in shape.
2. **Body (Middle part)** of the sternum is the longest part of the sternum. It is flat with depressed ridges.

3. Xiphoid process is triangular shaped and forms the distal-most part of the sternum. The size and shape of the xiphoid process are highly variable. It is mostly cartilaginous until the age of 40 and becomes completely calcified by the age of 60.