

# SKELETAL SYSTEM

There are two main forms of skeleton

**(a) Exo skeleton**

**(b) Endo skeleton**

**Exoskeleton :-** This is developed from epidermis. Example Hair, Nails, Claws, Hoof & Horns feathers, etc.

Exoskeleton is Ectodermal in origin & Non living. Mesodermal exoskeleton occur in fishes scales , crocodiles, Turtles, etc.

**Endoskeleton :-** It is present inside the body & mesodermal in origin. In vertebrate endoskeleton is formed of bone and cartilage. These are living in nature.

## Human skeleton

Endo skeleton is divided into two parts.

- (A) Axial skeleton
- (B) Appendicular skeleton

**(A) Axial skeleton :-**

It lies along the longitudinal axis of body . It includes –

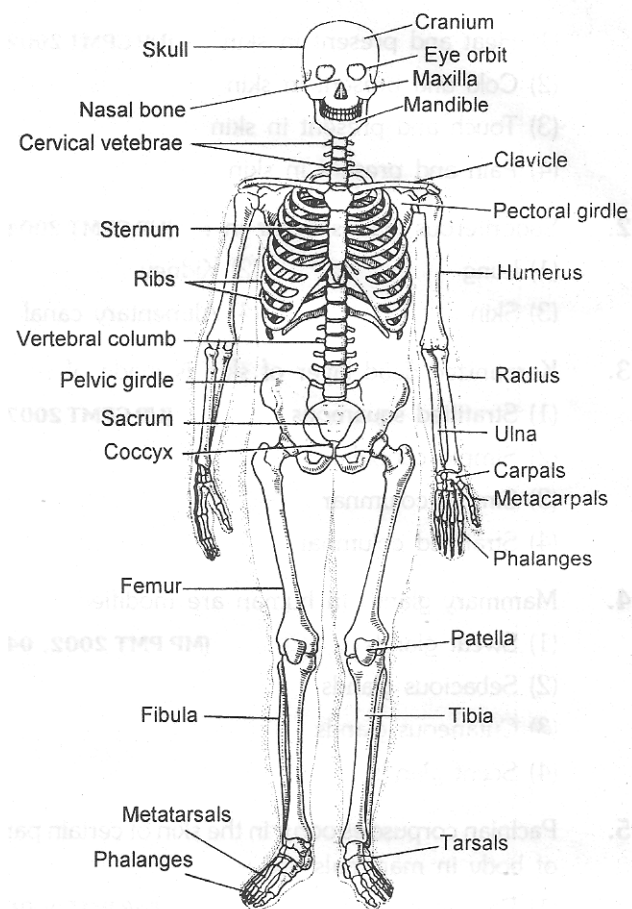
- (1) skull
- (2) vertebral column
- (3) Ribs & sternum. **In rabbit : 132 and in Human : 80** Bones are present in Axial skeleton

**(B) Appendicular Skeleton :**

It includes bones of the limbs.

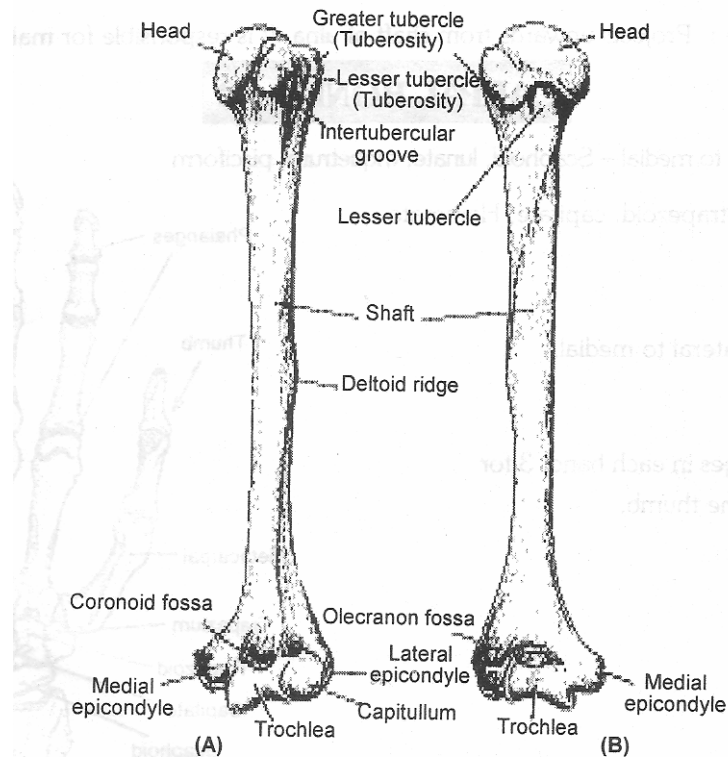
It is made of : 126 bones in **Man** and 128 bones in **Rabbit**

<b>Man</b>	late foetal age	-	306
	at birth	-	270
	after birth	-	206 in adult stage
<b>Rabbit</b>	128	+	132 = 260
	Ap.		Ax.



**Endoskeleton Framework of man**

## THE HUMERUS



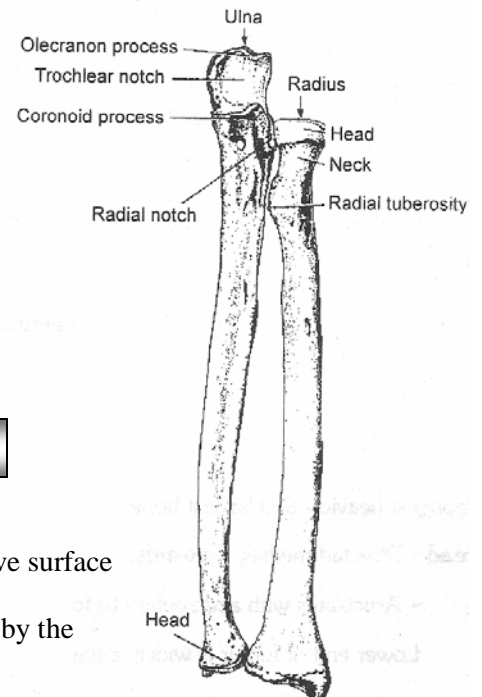
**Left humerus from anterior (A) and posterior (B) aspects**

- Head : It articulates with the glenoid cavity of scapula to form shoulder joint.
- Deltoid ridge : Elevated rough part on the shaft where deltoid muscle is attached.
- Lower end : Articulates laterally with radius & medially with ulna
- Coronoid fossa : depression just above the anterior aspect of trochlea. It accommodates the Coronoid process of ulna when elbow is flexed.
- Olecranon fossa : It accommodates the olecranon process when Elbow is extended.

## THE RADIUS & ULNA

**Head :**

Disc shaped, covered with hyaline cartilage. It's superior concave surface articulates with the Capitulum of humerus at the elbow joint. Circumference of head is also articular, it fits into socket formed by the radial notch of the ulna to form radioulnar joint.



**Bones of left forearm (anterior aspect)**

**Inferior surface** : bears an articular area for the scaphoid bone & lunate bone.

**Olecranon process** : Projects upwards from shaft of ulna. It is responsible for making elbow joint hinge.

## CARPAL BONES - 8

Proximal row : From lateral to medial – Scaphoid, lunate, triquetrum, pisiform

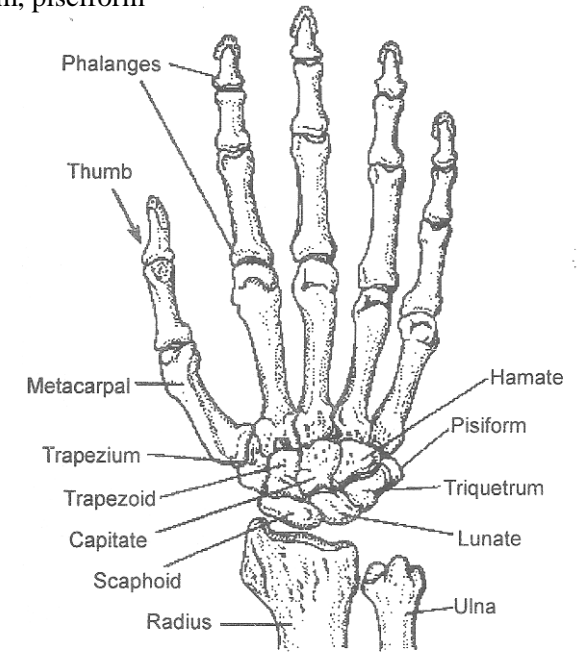
Distal Row : Trapezium, trapezoid, capitate, Hamate.

### Metacarpal bones

5 bones, numbered lateral to medial.

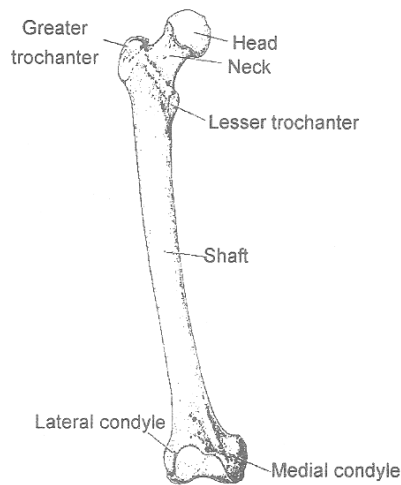
### Phalanges.

There are 14 phalanges in each hand. 3 for each finger & 2 for the thumb.



**Bones of right hand and wrist**

## FEMUR



**Right femur from anterior aspect**

Strongest heaviest and largest bone

**Head** : Directed medially, upwards.

-- Articulates with acetabulum to form the hip joint.

Lower end of femur is widely expanded to form two large condyles, one medial & one lateral.

**Greater and lesser trochanter** are rough projections to provide attachment to muscles.

## TIBIA

- Medial & larger bone of the leg.

### Upper end :

Expanded from side to side to form two large condyles.

**Medial condyle :** Its superior surface articulates with medial condyle of femur.

**Lateral condyle :** Superior surface of condyle articulates with lateral condyle of

## FIBULA

- Lateral & smaller bone of the leg.  
Its upper end articulates with the lateral condyle of tibia.

## TARSUS

- Tarsus is made of seven tarsal bones arranged in two rows.

**Proximal row :** Talus above, Navicular in between and Calcaneum below.

Tarsal bones are much larger & stronger than carpal bones because they have to support & distribute body weight.

Talus is second largest tarsal bone, lies between tibia above & calcaneum below.

**Calcaneum :** Largest tarsal bone, forms the prominence of heel.

**Distal row :-** Four tarsal bones lying side by side (three cuneiform and one cuboid)

## Meta tarsus

Made of 5 meta tarsal bones which are **numbered medial to lateral**.

## Phalanges

- 14 Phalanges, 2 for great toe & 3 each for each other four toes.
- As compared to Phalanges of hand these are small in size.

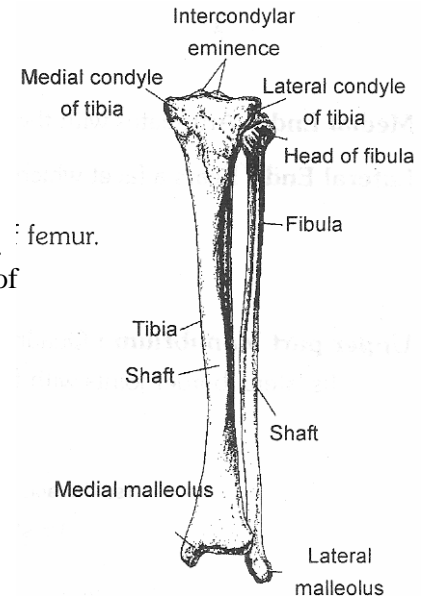
## SCAPULA

**Pectoral girdle :** Each pectoral girdle consists of two bones i.e. Scapula + Clavicle

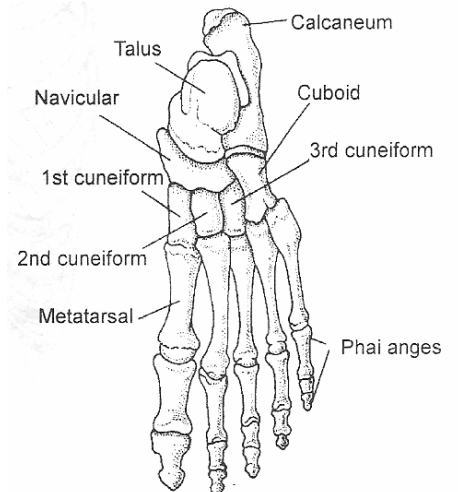
It has 3 process which provide attachment to muscles

- Spinous process
- Acromion process
- Coracoid process

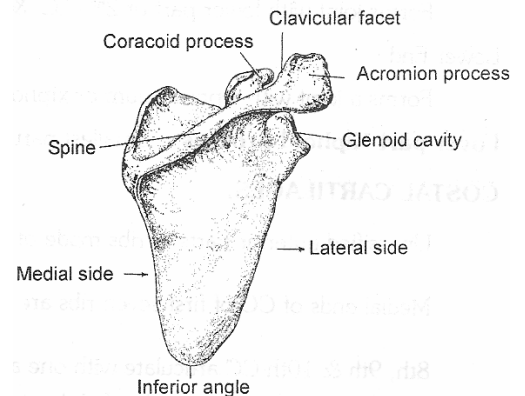
It also has a glenoid cavity to accommodate head of Humerus.



**Left tibia and fibula (anterior aspect)**



**Bones of left foot (Upper aspect)**



**Right scapula from dorsal aspect**

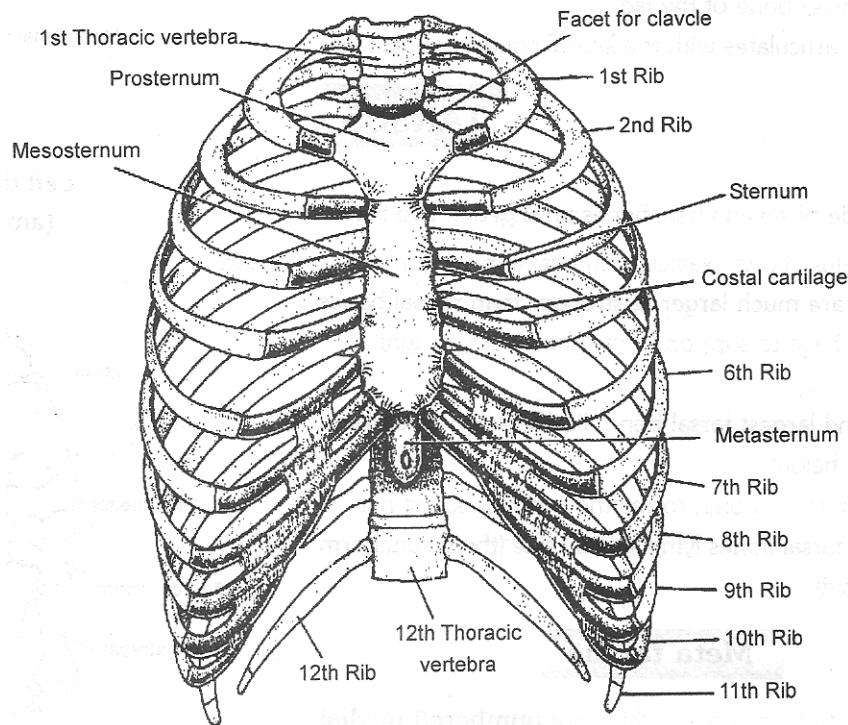
## Clavicle (Collar Bone)

**Medial End :** Articulates with the clavicular notch of manubrium.

**Lateral End :** Bears a facet which articulates with acromion process of scapula.

## STERNUM (15 cm long)

**Upper part Manubrium :** Quadrilateral shaped. inferior border of Manubrium forms a joint with body of sternum. Its lateral border joints with first rib pair.



**Bones of thorax (front view)**

### Body (Middle part)

Lateral border :

Forms joint with lower part of 2<sup>nd</sup> C.C. & 3<sup>rd</sup> to 6<sup>th</sup> CC & upper half of 7<sup>th</sup> CC.

Lower End :

Forms a joint with xiphisternum of xiphoid process.

**Lower part Xiphoid process :** Smallest part

### COSTAL CARTILAGES.

Unossified anterior parts of ribs made of hyaline cartilage. These contribute to the elasticity of thoracic wall.

Medial ends of CC of first seven ribs are directly attached to sternum.

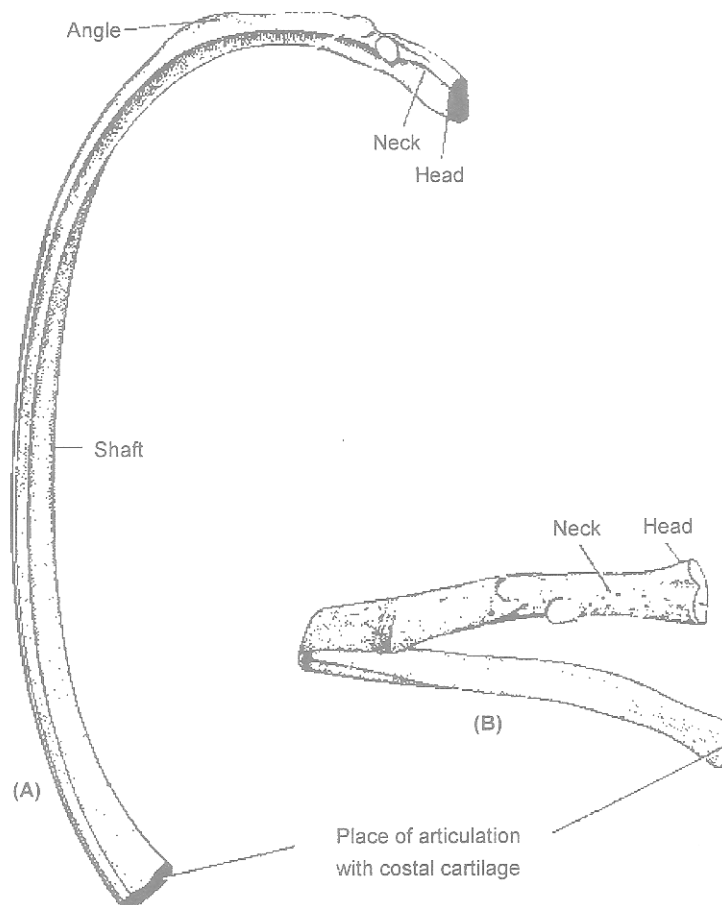
8<sup>th</sup>, 9<sup>th</sup> & 10<sup>th</sup> CC articulate with one another. The cartilage of 11<sup>th</sup> & 12<sup>th</sup> ribs are small. Their ventral ends are free and lie in the muscle of abdominal wall.

## THE RIBS

- 12 ribs on each side
- First 7 ribs which are connected through cartilage to the sternum are called **True Ribs**. (Vertebrosteral ribs)
- Remaining 5 are **False Ribs**, out of these the cartilage of the 8<sup>th</sup>, 9<sup>th</sup> & 10<sup>th</sup> ribs are joined to the next higher cartilage, 8<sup>th</sup>, 9<sup>th</sup>, 10<sup>th</sup> are called **Vertebrochondral** ribs. The anterior ends of 11<sup>th</sup> & 12<sup>th</sup> ribs are free & are called **floating ribs**.

**Head** – Has two parts. Lower part articulates with numerically corresponding vertebrae

Upper part articulates with higher vertebrae.



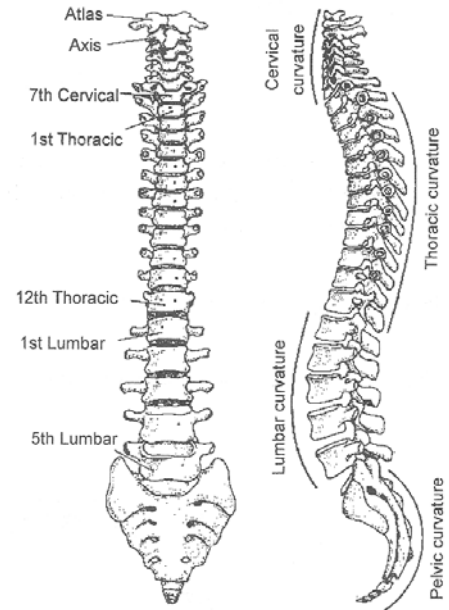
**A typical rib of left side**

**A - inferior aspect ; B – Posterior aspect**

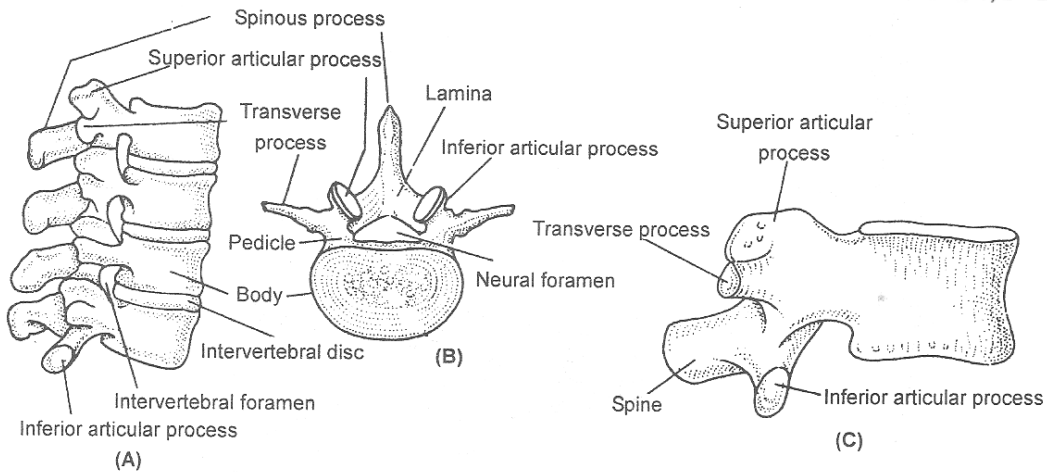
# THE VERTEBRAL COLUMN

Mede of 33 vertebrae or 26 bones

$C_7 T_{12} L_5 S_{(5)} C_{(4)}$  - ∴ 24 movable or true vertebrae  
 and (5) + (4) = 9 fused or false vertebrae  
 ∴ False vertebrae – Sacrum & coccyx.



**Vertebral column of man :**  
**A– Ventral view; B - Left later view**



**(A) Thoracic vertebra viewed from right side**  
**(B) A typical vertebra (third lumbar) and**  
**(C) From right side**

### Parts of a typical vertebrae

**Body :** Lies anteriorly; shaped like a short cylinder; with Flat upper & lower surfaces attached with adjoining intervertebral disc. (= centrum Amphiplatyn)

Vertebral arch or Neural Arch → Carries vertebral foramen or Spinal foramen.

All vertebral foramen aligned one over each other make a vertebral canal which carries the spinal cord.

**Spinous process or spine :**

Projecting backwards & down wards.

**Transverse Processes :**

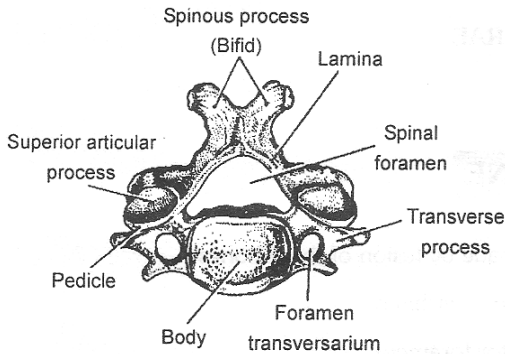
Projects laterally on both sides.

**Articular process :** (Prezygapophysis and Postzygapophysis)

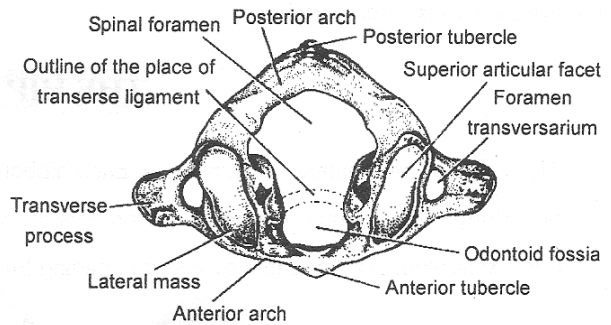
Projecting upwards and downwards, on either Articular side a superior and inferior articular processes are present.

Two adjoining vertebrae therefore articulate at 3 joints.

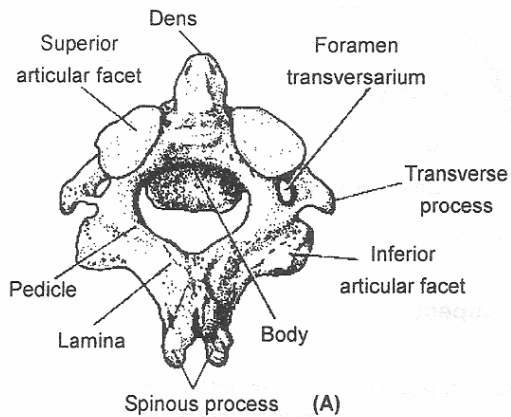
Two between Left & Right articular processes, one between the bodies of vertebrae (through inter vertebral disc.)



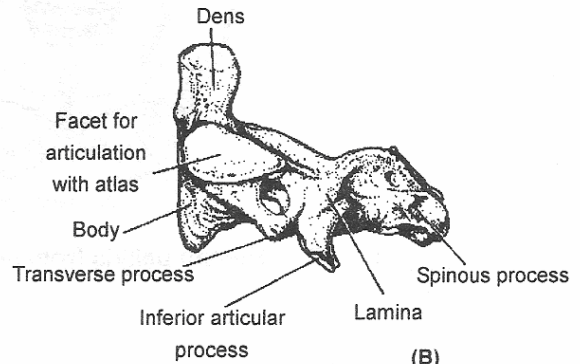
**A typical cervical vertebra (superior aspect)**



**ATLAS**



**Axis**



**Axis**

**Second cervical vertebra (Axis or Epistropheos) ;**

**(A) superior aspect; (B) left side view**

**CERVICAL VERTEBRAE**

All cervical vertebrae have apertures in their transverse process (**Foramina transversalis** which form vertebrarterial canal on either side for vertebral artery to pass through to supply brain & spinal cord).

$C_1$  &  $C_2$  = Atypical ,  $C_3$  to  $C_7$  = typical

**Atlas :-**  $C_1$ , transverse process are wing like, centrum is absent, Ring like.



Neural arch of this vertebrae is divided in 2 parts with a ligament. In the upper part of this ligament, Spinal cord is present. In lower part odontoid fossa is present in which odontoid process of axis is fitted to make

pivot joint. (Also called as **median atlanto axial joint**)

On each surface of atlas a pair of articular facet are present. Upper pair articular with condyle of skull.

lower pair articulates with condyle of axis to make **Lateral atlanto axial joint**.

**Axis : C<sub>2</sub>** – Centrum is present. At anterior surface of centrum a long odontoid process is present which fits into odontoid fossa of atlas vertebrae.

Only C<sub>7</sub> has demifacets where upper part of head of 1st Rib articulates.

## THORACIC VERTEBRAE

**Identified by :** Presence of costal Demi facets.

## LUMBAR VERTEBRAE

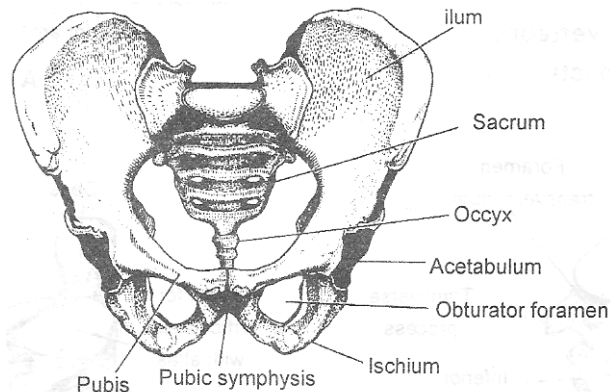
These are the largest sized vertebrae

## THE HIP BONE

Also called as innominate or coxal bone. Each hipbone is made by fusion of three bone

Superiorly – Ilium, Anteroinferiorly – Pubis. Postero inferiorly – ischium.

Pubis & ischium are separated by a large opening (= obturator foramen)

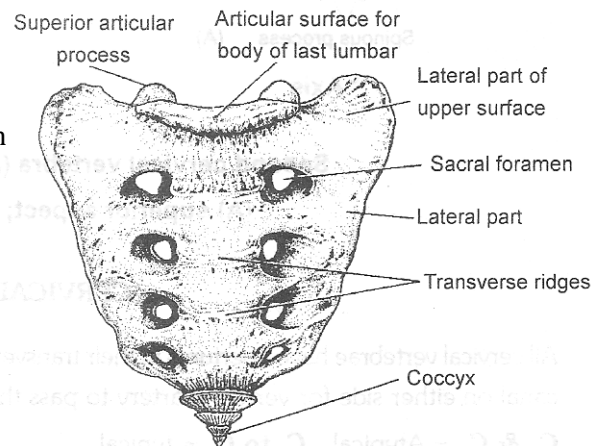


Human pelvis from anterior aspect

## SACRUM

Large flattened triangular bone formed by fusion of five sacral vertebrae.

In females : Pelvic diameter is larger & more circular to accommodate the during pregnancy.



Human sacrum and coccyx (anterior view)