SUPPORT AND MOVEMENT IN PLANTS AND ANIMALS

DEFINNITION OF TERMS

- **Support – this is the ability of an organism to bear its own mass/weight and maintain its body form**
- **Movement- this is the process by which an organism displaces parts of its body or the whole of its body from one place to another.**

Types of movement

- **Locomotion**: **this is the process by which an organism displaces the whole of its body from one place to another.**
- **Localized movement**: **this is the process by which an organism displaces parts of its body from one place.**

Levels of movement in plants

- **Cellular level** e.g. swimming of the male gametes in bryophytes and pteridophytes and growth of the pollen tube to bring about fertilization
- **Organ level** e.g. tropic and nastic movements

NECESSITY FOR MOVEMENT IN PLANTS

- **Swimming of the male gametes in bryophytes and pteridophytes and growth of the pollen tube to bring about fertilization**
- **Nastic and tropic responses help plants to obtain resources from the environment such as water, light and nutrients**
- **Movement enables plants to escape harmful stimuli such as high**

NECESSITY FOR SUPPORT IN PLANTS

- Enables plants withstand the forces in the environment
- Enables plants to carry their mass and the mass of the animals that climb on them
- Enables plants to withstand strong wind and storms
- Helps in exposing leaves for photosynthesis
- Enables for efficient gaseous exchange





TRANSVERSE SECTION OF A MONOCOT STEM

- **Draw the internal structure of a monocot stem**

SUPPORT TISSUES IN PLANTS

- Parenchyma
- Collenchyma
- Sclerenchyma
- Xylem vessels and xylem tracheids

PARENCHYMA

- The parenchymatous tissue is a storage tissue which helps in the storage of water and food.
- It is a specialized tissue made of long and cylindrical cells
- Helps in providing support by gaining water and becoming turgid

COLLENCHYMA

- Found beneath the epidermis
- Similar in shape to the parenchyma cells
- Provides support to the plant due to the presence of cellulose

SCLERENCHYMA

- Found in close association with the vascular bundles
- Provide support to the plant due to the deposition of lignin which is tough and rigid

XYLEM VESSELS AND XYLEM TRACHEIDS

- **Xylem tissue helps in the transportation of the absorbed water up the plant. It is therefore a transport tissue**
- **It also helps in providing support to the plant due to presence of lignin i.e. they have thick lignified walls.**
- **The pattern of lignification varies giving rise to various types of lignification**

WILTING

- **This is the process by which a plant loses more water than the absorbed water causing the plant cells to become flaccid.**

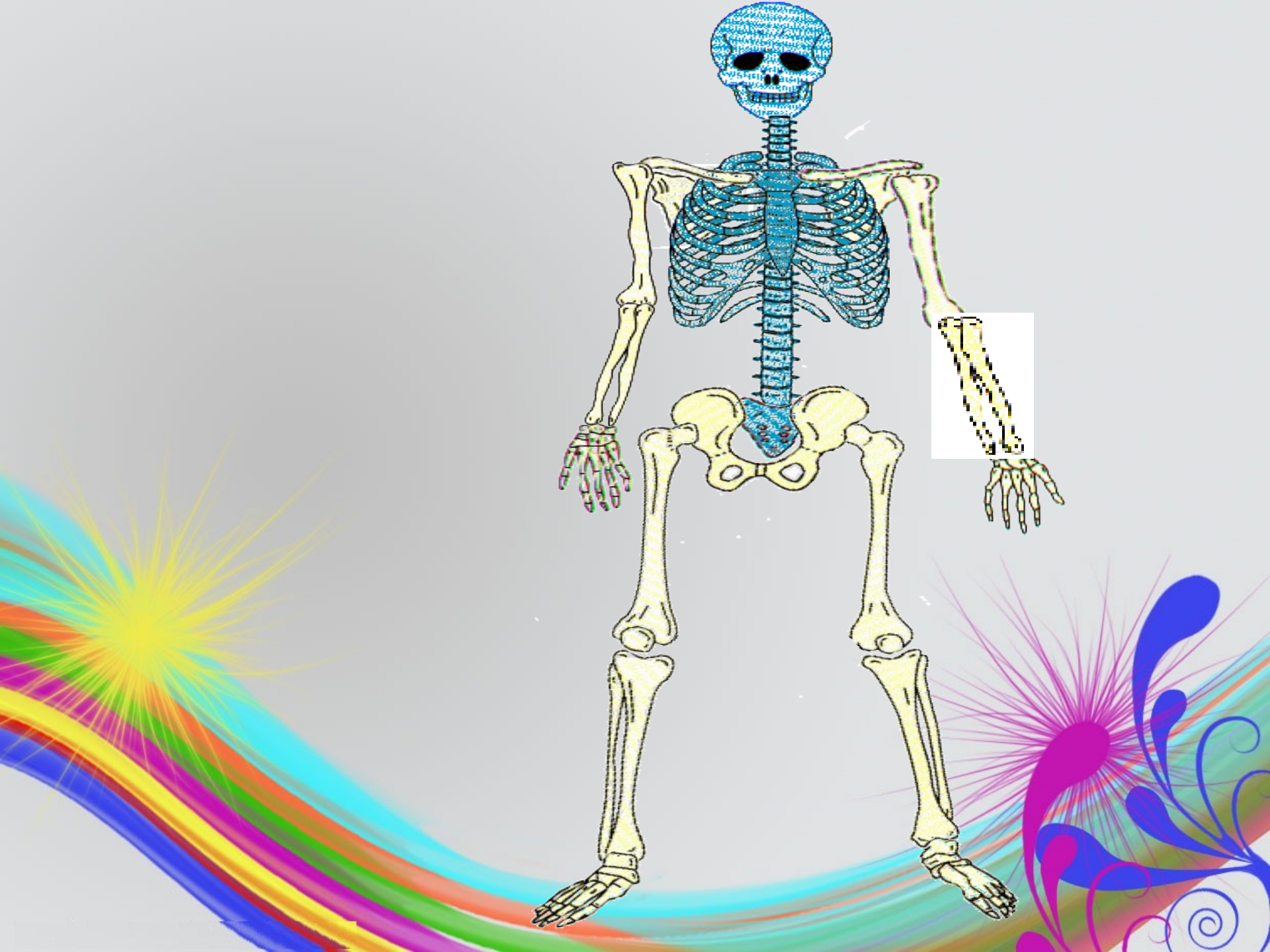
TYPES OF XYLEM VESSELS

- PITTED
- ANNULAR
- SCALARIFORM
- RETICULATE
- SPIRAL

SUPPORT AND MOVEMENT IN ANIMALS

- **Animals need support due to the fluid nature of their protoplasm. Multicellular animals require a rigid framework to support their bodies off the ground and to maintain their shapes. This is performed by the skeleton**





IMPORTANCE OF SUPPORT AND MOVEMENT IN AIMALS

MOVEMENT

- Enables the organisms to obtain food, shelter and mates
- Enables animals to escape predators
- Enables animals to escape harsh/ hostile environmental conditions

SUPPORT

- Helps in the maintainance of the body shape
- Helps in supporting the body off the ground
- Forms a rigid framework for the body against forces such as compression and tension

FUNCTIONS OS THE SKELETON

- **Support**- the skeleton forms a rigid framework for the body against forces such as compression and tension. This helps the body to maintain its body shape and supporting the body off the ground
- **Protection**- offers protection to the delicate internal organs against physical injury. The skull protects the brain; the vertebral column protects the spinal cord while the ribcage protects the lungs and the heart.

Surport cont.

- **Attachment of the skeletal muscles- provides points for the attachment of the skeletal muscles which contract and relax bringing about movement.**
- **Production of white blood cells and red blood cells- the white and the red bone marrow produce the white and the red blood cells respectively.**
- **Act as levers by which the body moves- long bones such as the femur and humerus act as levers by which the body moves.**
- **Storage of calcium and phosphorous**
- **Provides shock absorbing mechanism**

TYPES OF SKELETONS

- **Exoskeleton**
- **Hydroskeleton/ hydrostatic skeleton**
- **Endoskeleton**

HYDROSKELETON

- **This is a type of skeleton consisting of a fluid under pressure. The fluid is surrounded by circular and longitudinal muscles. This type of skeleton is found in soft bodied organisms e.g. earthworms. This enables them to move and burrow into the soil**

EXOSKELETON

- This is a type of skeleton found on the outside of the organism and is made of chitin secreted by the epidermis. It is sclerotized or hardened with proteins. It is found in the phylum arthropoda mainly in the class insecta.

Functions of the exoskeleton

- It is impervious/ impermeable to water and therefore protects the animal from dehydration or desiccation.
- Provides protection against microbial infection
- Provides protection against mechanical injury
- Provides points for muscle attachment hence movement.
- Supports the body off the ground i.e. supports tissues and organs

NB

- **The exoskeleton prevents increase in the size of the organism and therefore it must be shed periodically a process called moulting/ ecdysis.**

ENDOSKELETON

- This is a type of skeleton which is internal to the muscles. It is made up of bones and cartilage. It is found in the vertebrates.
- It is made up of living tissue

Bone	Cartilage
It is rigid	It is flexible
Has calcium and phosphorous deposits which makes it very hard	Lack calcium and phosphorous deposits hence not very hard
Made up of bone cells	Made up of chondroblast

NB

phosphorous confers toughness while calcium confers hardness

MOVEMENT IN AN INSECT

- **Some insects walk, others fly and others jump. Walking is achieved by the coordinated activity of the legs in an insect. An insect's legs consist of hollow tubes whose walls are made up of exoskeleton.**
- **The first part of the leg called the coxa is joined to the body by a ball and socket joint. All the other parts are hinge joints. Movement is brought about by the extensor and flexor muscles which contract and**

- **The flying insects use wings. Flying is controlled by direct and indirect muscles (elevators and depressors)**
- **Draw the structure of an insect’s hind leg and the flight muscles**

FINNED FISH



LOCOMOTION IN A FINNED FISH

- **Locomotion in a fined fish is brought about by side to side movement of the tail. This is due to the relaxation and the contraction of the antagonistic muscles on the right and left sides of the tail. These muscle groups are called myotomes.**

- **Movement of the tail on one side pushes water sideways and backwards. The backward push creates a forward reaction that pushes the fish forward. The sideways push on the water creates a sideways reaction in the opposite direction that tends to push the fish sideways. This reaction is cancelled when the tail moves to the other side hence the tail movement propels**

ADAPTATIONS OF THE FISH TO ITS MOVEMENT

- **Has a streamlined body- this reduces friction between the water and the fish hence reducing resistance to the flow in the water.**
- **Has scales that overlap backwards- this reduces the friction enabling the fish to move in water with little drag**

- **Has a lateral line- act as a sense organ detectaing vibrations in the water and detecting changes in the pressure. This enables the fish to respond suitably hence helps in escaping predators and strangers.**
- **Has an inflexible head- this helps in maintaining a forward thrush**
- **Has a swim bladder- this is an air filled cavity which helps in maintaining buoyancy. This enables the fish to adjust its vertical position in relation to the depth of water.**

- **Has muscle blocks called myotomes - these contract and relax causing the undulating movement (anguiliform movement).**
- **Has a flexible backbone and strong tail muscle- this contract and relax causing the tail to move sideways against water.**
- **Has mucus covering on the body surface- this reduces the friction between the water and the fish. It also reduces evaporation of water and entry of microorganisms**

- **Has paired fins i.e. pelvic and pectoral fins- these fins are used for:**

a. **Maintaining balance**

b. **Braking**

c. **Changing direction**

d. **Controls pitching- this is when the fish plunges head first into the water**

- **Has unpaired fins i.e. anal/ ventral, dorsal and caudal fins- caudal fin is used for the forward propulsion and steering. Dorsal and ventral fins prevent the fish from rolling and yawing.**
- **Rolling- this is the turning of the body of the fish about its own axis**
- **Yawing- this is the lateral deflection of the body of the fish during swimming**

Describe how a finned fish such as tilapia moves in water

Movement of a finned fish in water is by swimming. It involves forward movement and control of body position in water. Mucus, scales overlapping backwards, streamlined body/shape reduces friction to enhance forward movement.

- **Forward/ propulsion is caused by the tail. The tail is long to create enough force for propulsion. Propulsion is achieved when the tail pushes sideways against the water.**
- **Sideways movement is brought about by muscles arranged in segmental blocks called myotomes on both sides of the vertebral column**

The muscles contract alternatively/ antagonistically causing the vertebral column to swing sideways . When the muscles on the right relax, those on the left contract and the body bends to the left. When the muscles on the left relax, those on the right contract and the body bends to the right

The fish uses its fins to control the position of its body in water. During forward movement, the paired fins; pectoral fins and pelvic fins lie flat on the side of the body to reduce friction/ resistance.

To change direction, the fish uses the paired fins. The fish also uses the paired fins to change its level in water/ control pitching/ prevent pitching.

The fish spreads out the pectoral and the pelvic fins at 90 degrees/ right angle to the body to enable it to brake.

The fish can also use its swim bladder to change its level in water. When the bladder fills up with air, the fish becomes lighter/ more buoyant making it to rise in water.

- When the air leaves the swim bladder, the fish becomes heavier/ more dense making it to sink deeper into the water
- Water currents may cause the sideways swaying of the body of the fish/ yawing. The dorsal fin, ventral fin and the anal fin prevent the rolling and yawing of the fish in water

QUOTE OF THE DAY

- **In education it isn't how much you have committed to memory or even how much you know. It's being able to differentiate between what you do know and what you don't. It's knowing where to go to find out what you need to know and it's knowing how to use the information you get.**

William Feather

• SUPPORT AND MOVEMENT IN MAMMALS

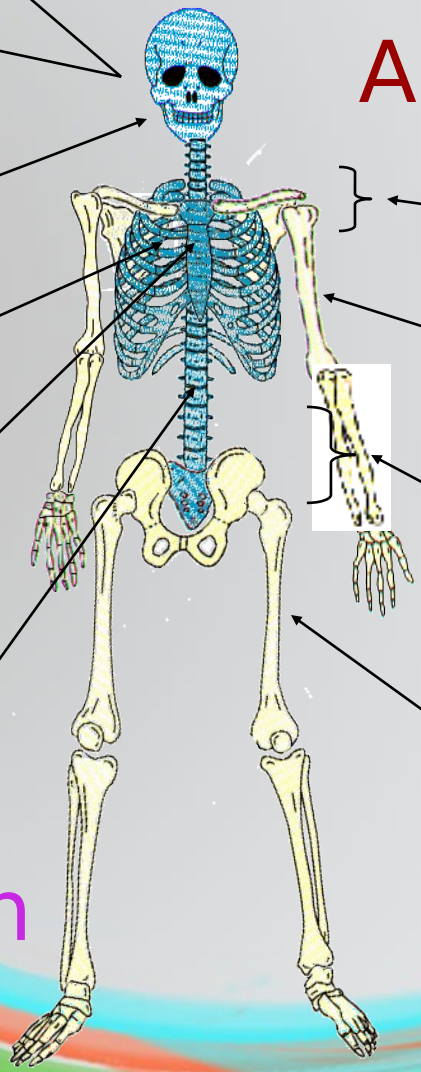
- **This is brought about by muscles and bones. The mammalian skeleton comprises of:**
  - **Axial skeleton**
  - **Appendicular skeleton**

THE AXIAL SKELETON

Consists of:

- **The skull**
- **The sternum**
- **RibS**
- **Vertebral column**

Two parts of Skeleton



Axial skeleton

skull

ribs

sternum

vertebral column

Appendicular skeleton

pectoral girdle

pectoral limb (arm)

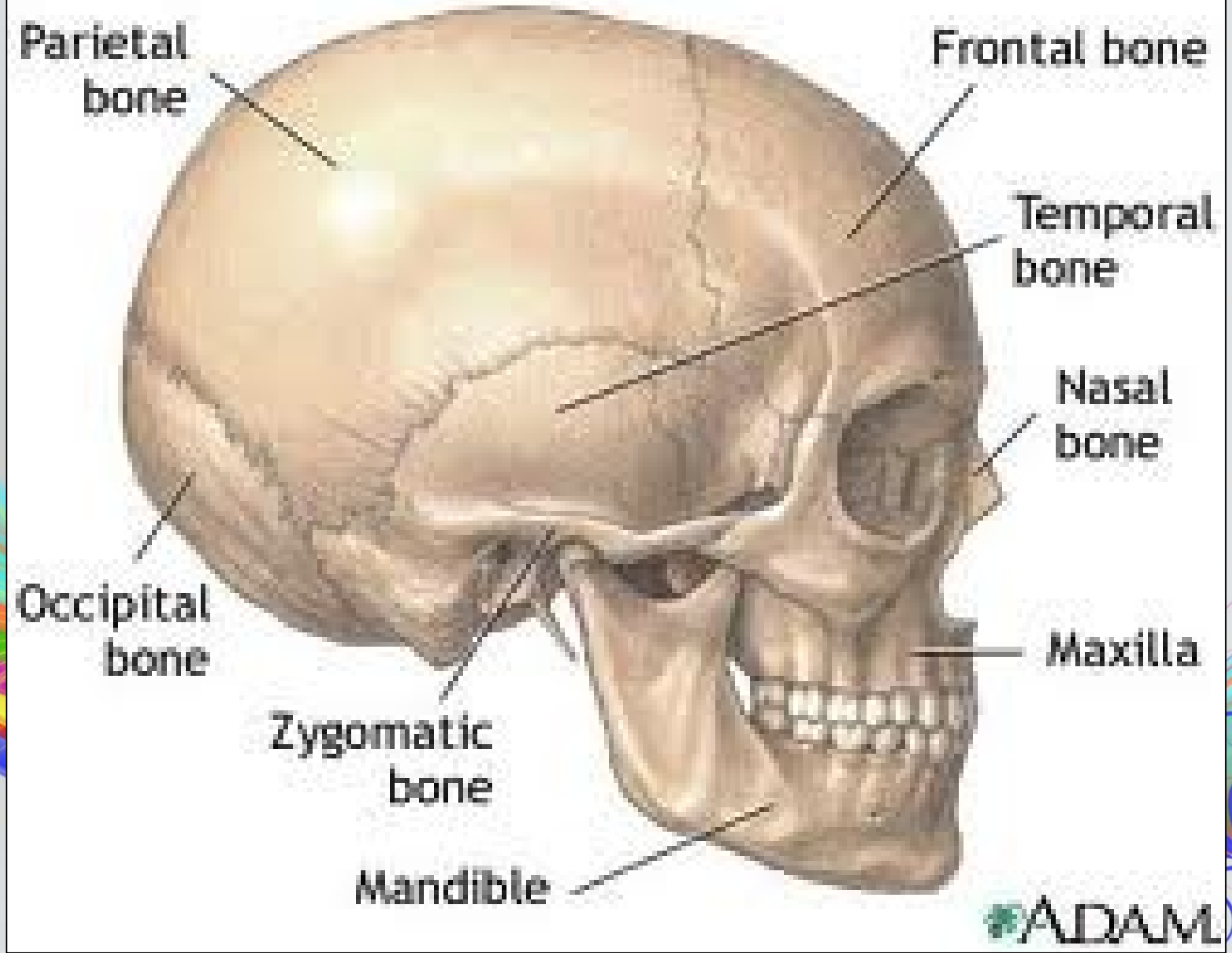
pelvic girdle

pelvic limb (leg)

THE SKULL

- **Also called the cranium**
- **It is made up of many small bones joined together to form immovable joints called sutures.**
- **It also comprises of the upper jaw /maxilla and the lower jaw/ mandibles.**
- **The maxilla is fused to the cranium while the lower jaw articulates with the cranium forming a hinge joint which is movable.**

- **There are perforations on the cranium such as the foramina and fissures to allow nerves, blood vessels and the lymph vessels to pass through to and from the brain.**
- **At the posterior of the cranium are two smooth projections called occipital condyles which articulate with the first bone of the vertebral column called atlas to form a hinge joint. This allows for the nodding of the head.**


Parietal bone
Frontal bone
Temporal bone
Nasal bone
Occipital bone
Maxilla
Zygomatic bone
Mandible
ADAM

FUNCTIONS OF THE SKULL

- Encloses and protects the brain
- protects the olfactory organs, eyes and the inner and middle ear

THE VERTEBRAL COLUMN

THE VERTEBRAL COLUMN

- It consists of bones called the vertebrae.
- The number of the vertebrae varies from species to species
- There are 33 vertebrae in the human skeleton

- The vertebrae are placed end to end and therefore run from the base of the skull to the pelvis
- The bones are separated from each other by cartilage called intervetebral disc

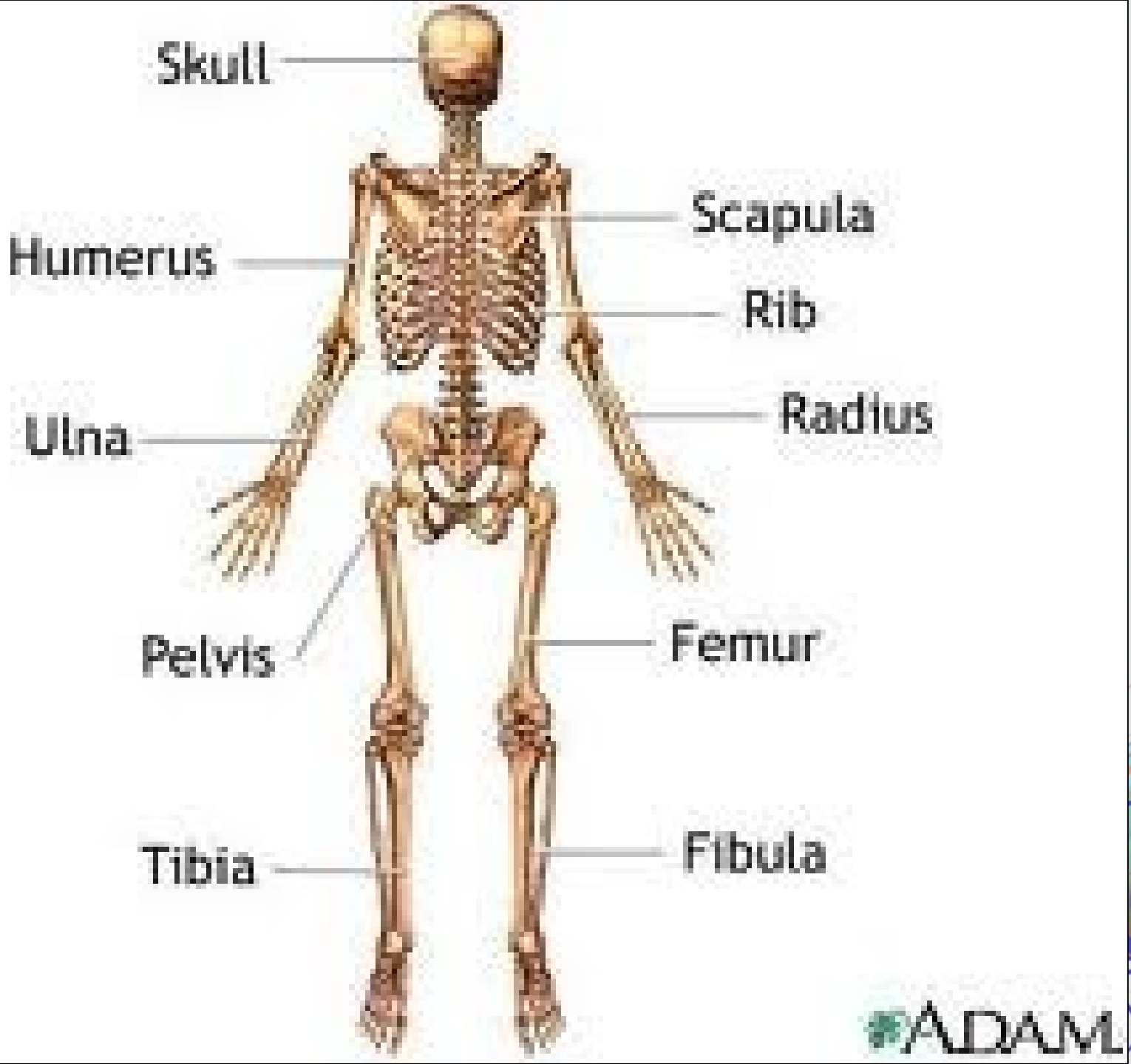
GET READY FOR BIOLOGY



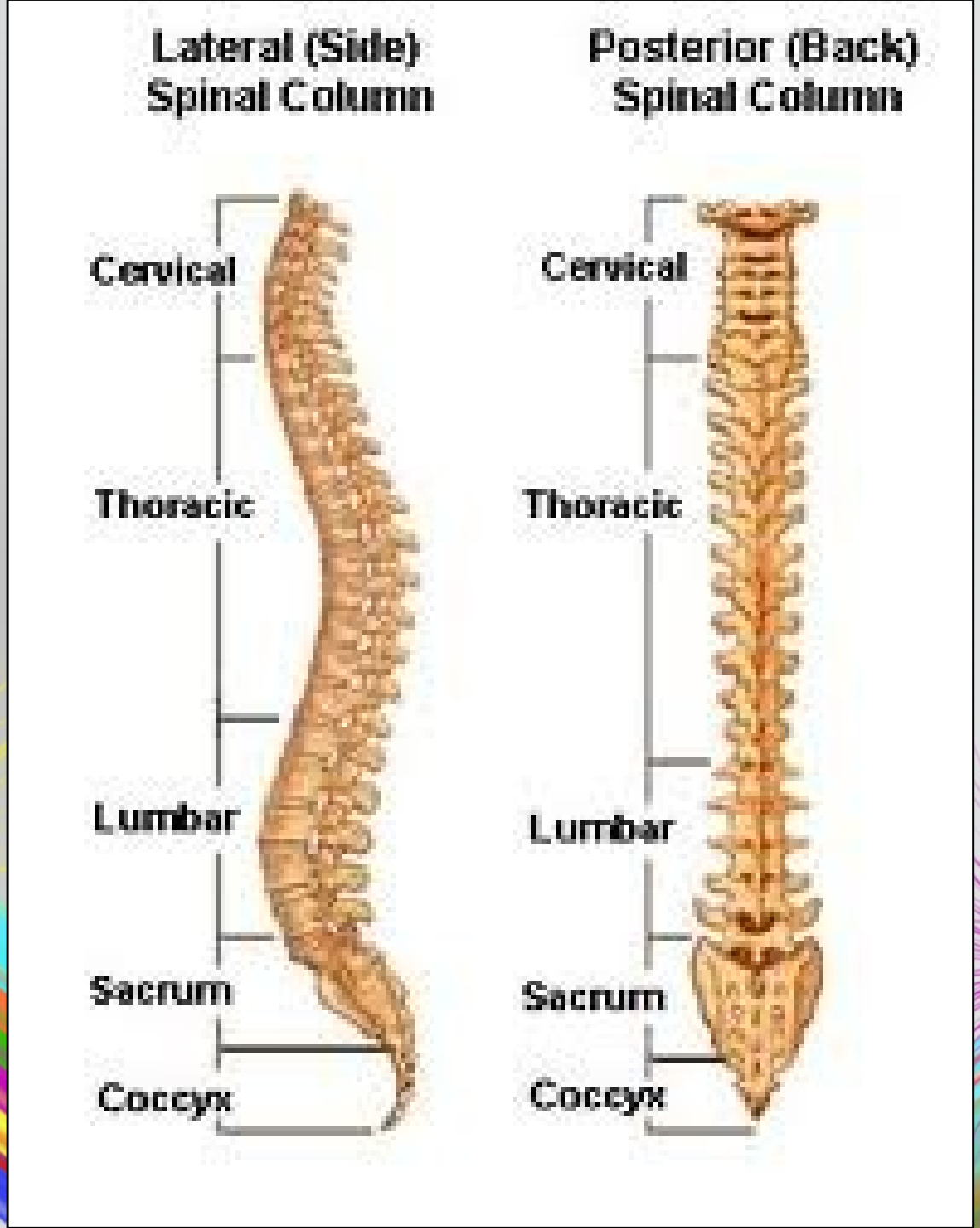
IT IS TIME FOR THE BONES

FUNCTIONS OF THE VERTEBRAL COLUMN

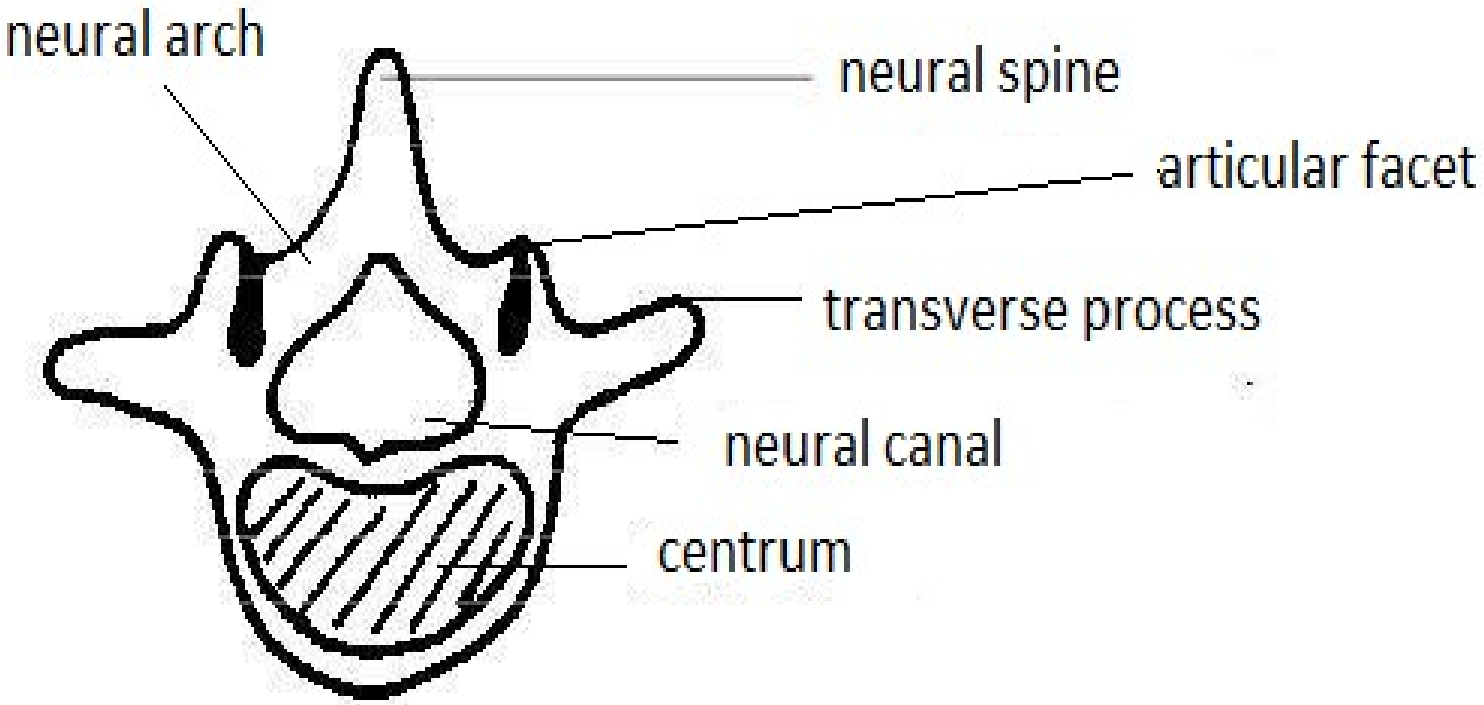
- **Support the trunk**
- **Protects the spinal cord**


Skull
Scapula
Humerus
Rib
Radius
Ulna
Pelvis
Femur
Tibia
Fibula
A.D.A.M.




Lateral (Side)
Spinal Column
Cervical
Thoracic
Lumbar
Sacrum
Coccyx
Posterior (Back)
Spinal Column
Cervical
Thoracic
Lumbar
Sacrum
Coccyx

The basic structure of a vertebra



FUNCTIONS OF PARTS OF VERTEBRA

- **Centrum- supports the weight of the vertebra and the entire vertebral column**
- **Neural arch- encloses the neural canal**
- **Transverse process- provides the surface area for the attachment of the skeletal muscles and ligaments**
- **Neural canal- allows for the**

Neural spine- provides the surface area for the attachment of the skeletal muscles and ligaments

Articular facets- they are four in number. Two are found in the anterior and are known as **prezygapophyses** while two are found at the posterior and are known as the **post-zygapophyses.** The **articular**

GET READY FOR BIOLOGY



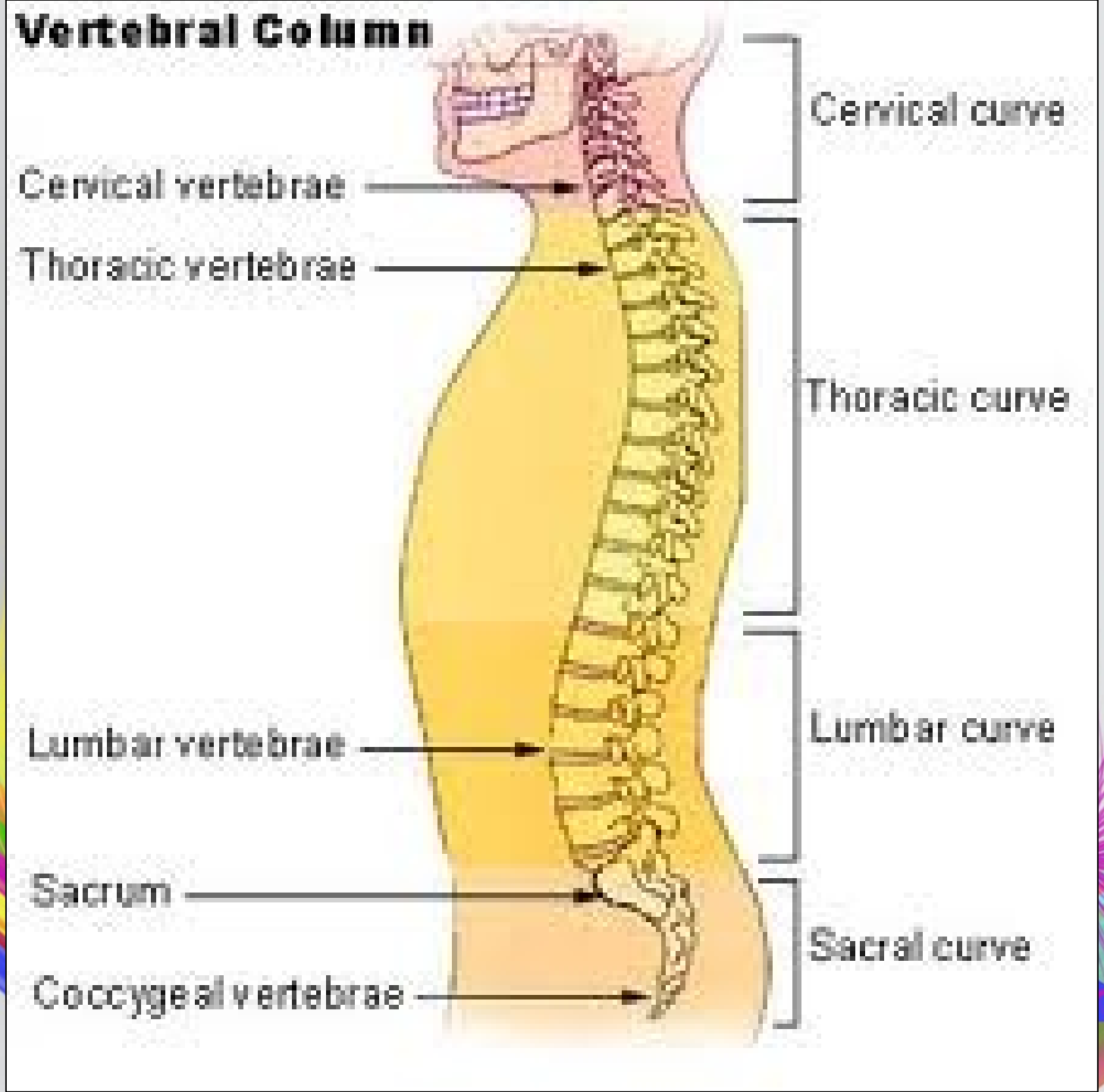
SUPPORT AND MOVEMENT

FUNCTIONS OF INTERVETEBRAL DISC

- Acts as a cushion that absorbs shock
- Reduces friction between bones
- Makes the vertebral column flexible by allowing for certain degree of movement between the

TYPES OF VETEBRAE

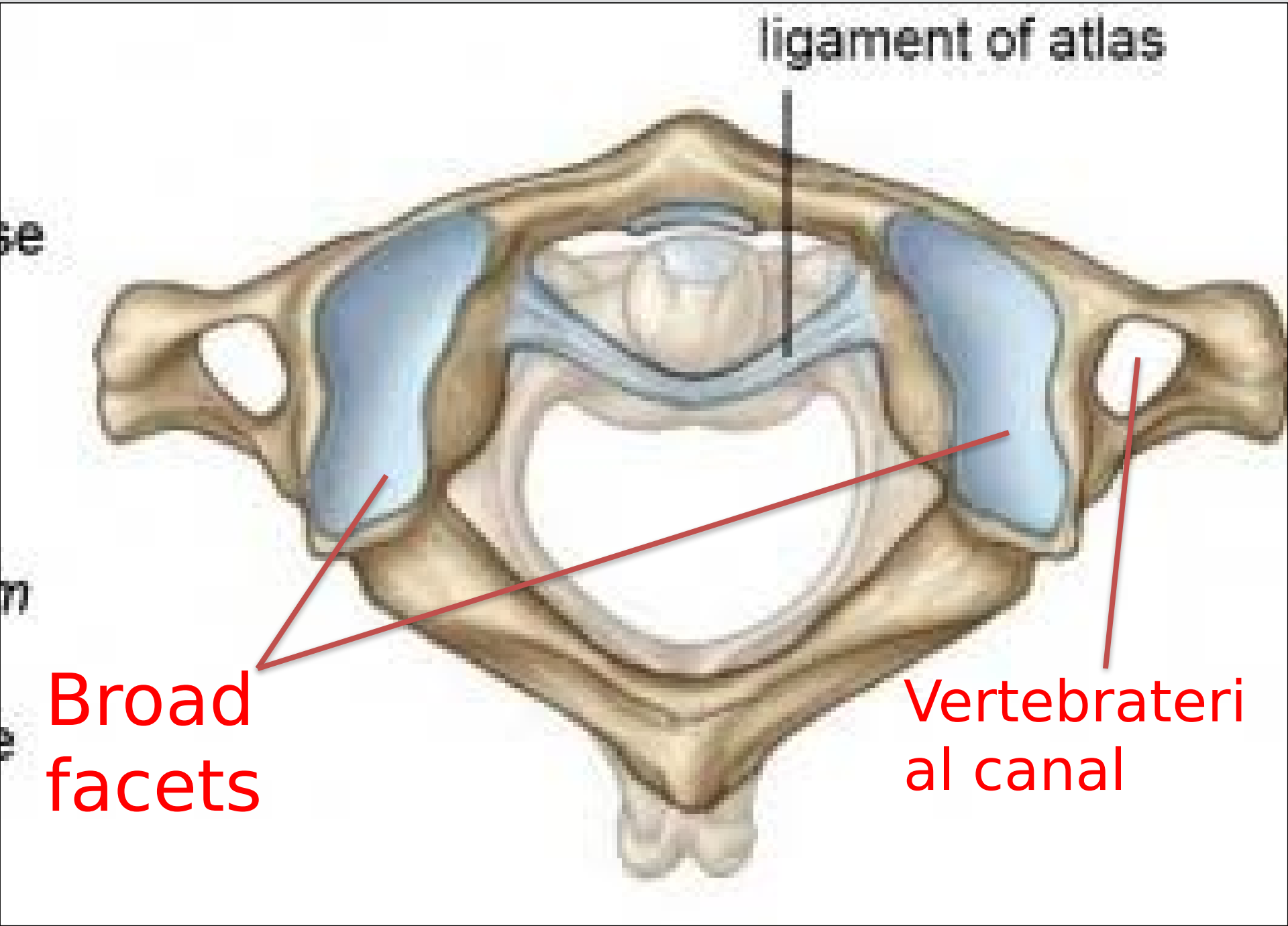
- **Cervical vertebrae**
- **Thoracic vertebrae**
- **Lumbar vertebrae**
- **Sacral vertebrae**
- **Coccyx/ coccygeal vertebrae**

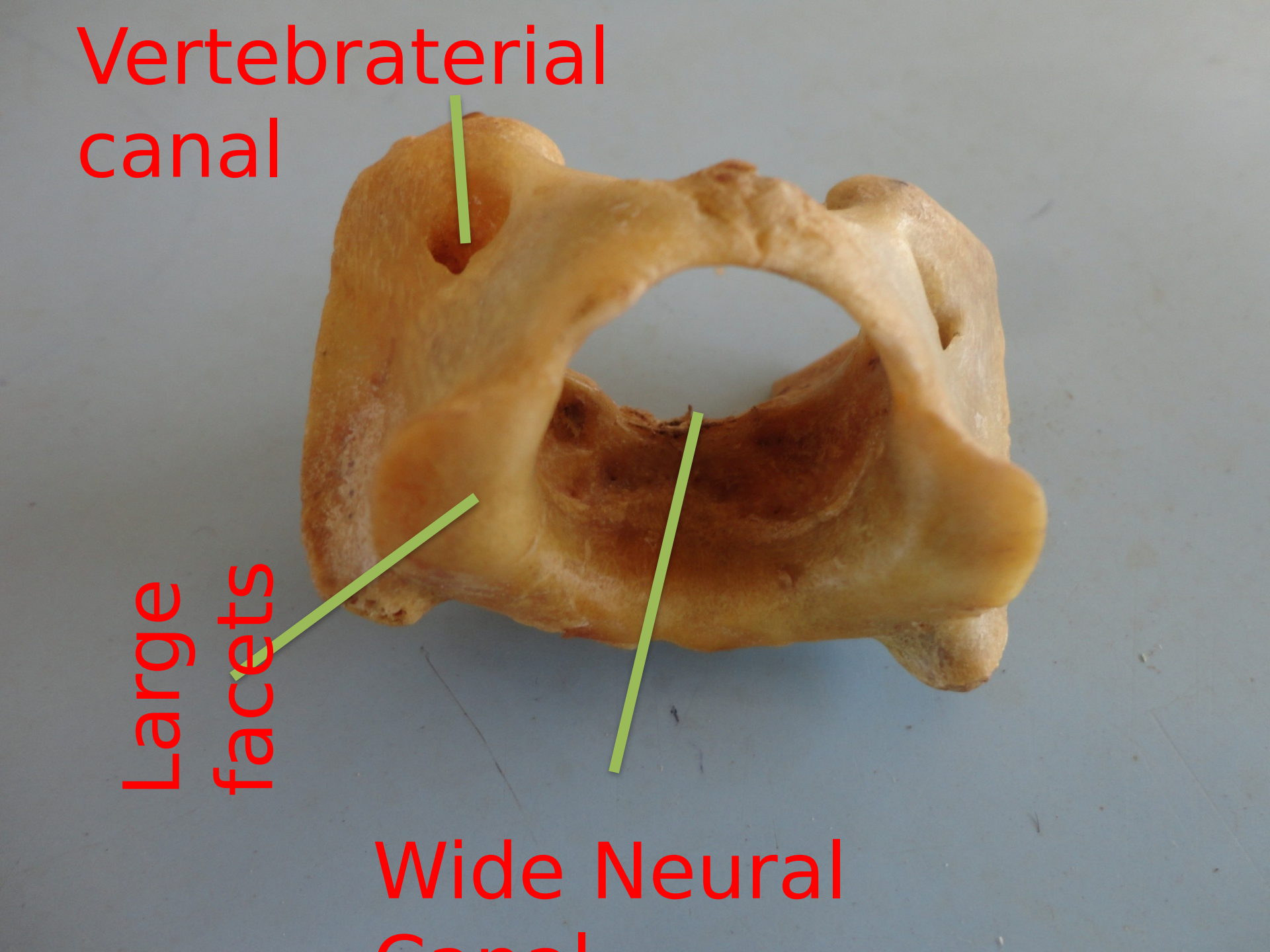

Vertebral Column
Cervical curve
Cervical vertebrae
Thoracic vertebrae
Thoracic curve
Lumbar vertebrae
Lumbar curve
Sacrum
Sacral curve
Coccygeal vertebrae

THE CERVICAL VERTEBRAE

- These are the bones/ vertebrae found at the neck region.
- They are 7 in number in human beings.
- The first bone of the cervical vertebrae is called the atlas
- The second one is called

THE ATLAS


ligament of atlas
Broad facets
Vertebrateri al canal


Vertebraterial canal
Large facets
Wide Neural

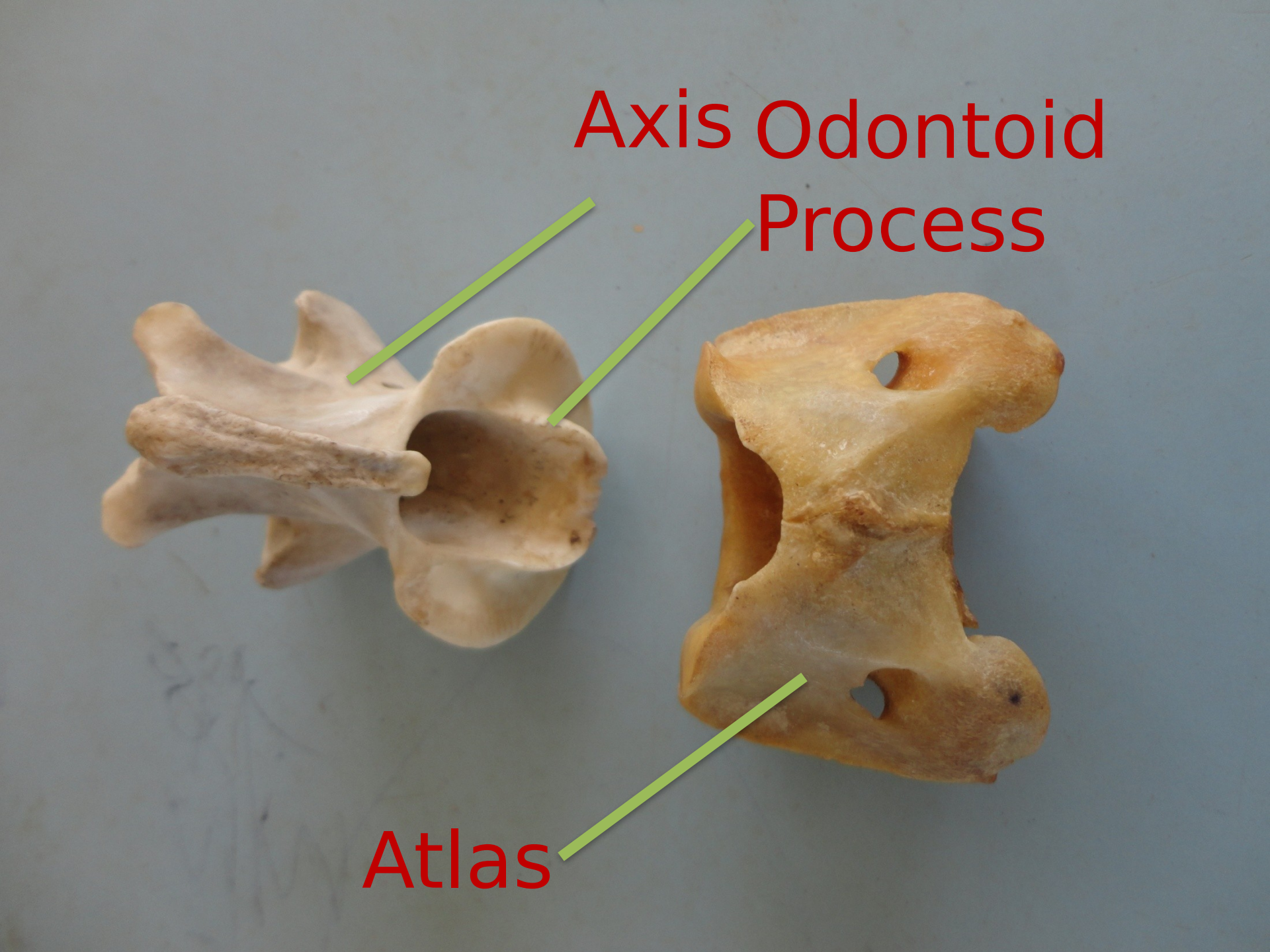

transverse

1. Has a broad (facets)surface for the articulation with the condyles of the skull to form a hinge joint which allows for nodding of the head.
2. Has a small neural spine
3. Has no centrum
4. lacks prezygapophyses

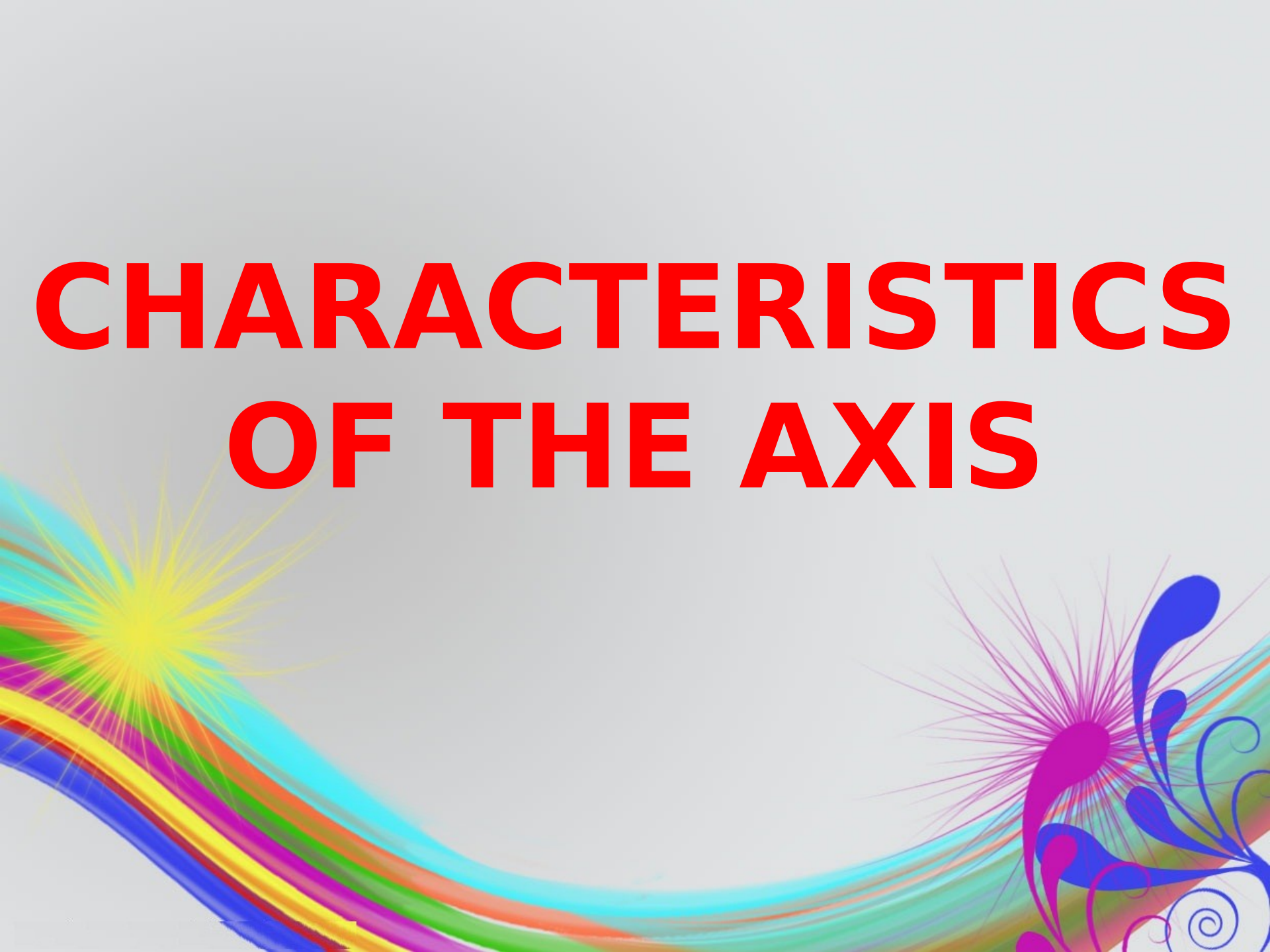
5. Has broad and wing like transverse processes to offer a large surface area for the attachment of the neck muscles.
6. Has a wide neural canal for the passage of the large spinal cord of the neck
7. Has vertebrateral canals

NB

- The wide neural canal of the atlas also fits into the odontoid process of the axis to form pivotal joint


Axis
Odontoid Process
Atlas

CHARACTERISTICS OF THE AXIS



- ✓Has a broad neural spine
- ✓Has a wide neural canal
- ✓Has wing like transverse process
- ✓Has a broad centrum which projects in front to form an odontoid process. The odontoid process forms a peg which fits into the neural canal of the atlas forming a joint which allows the turning/

Axis Cont.

- **Lacks prezygapophyses**
- Has vertebraterial canal

Neural spine
Odontoid Process
Vertebrateral canal
postzygapophysis

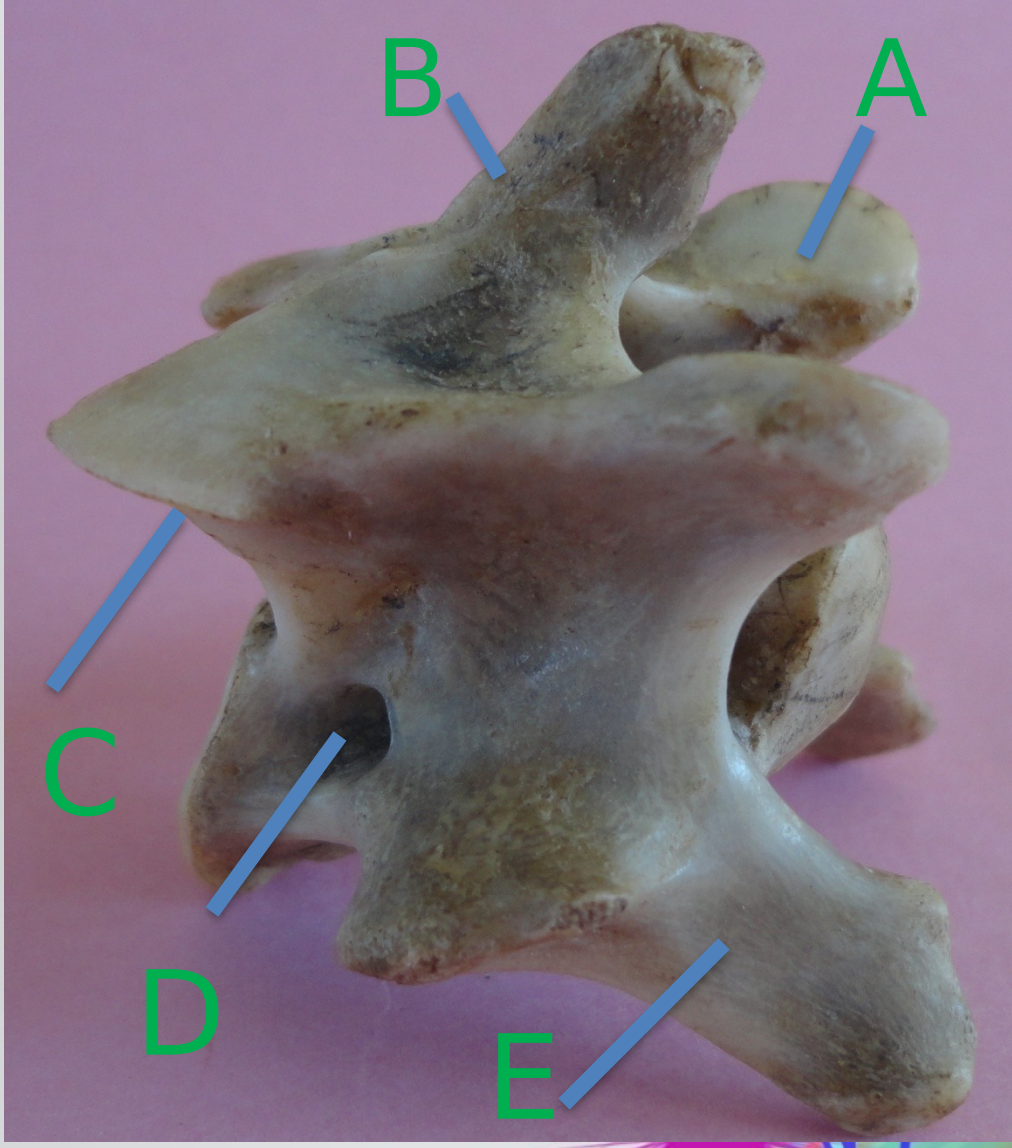
CHARACTERISTICS OF CERVICAL VERTEBRAE

- Have a short neural spine
- Has a small but wide centrum
- Has a wide neural canal
- Has vertebraterial canals for the passage of blood vessels/ vertebral artery

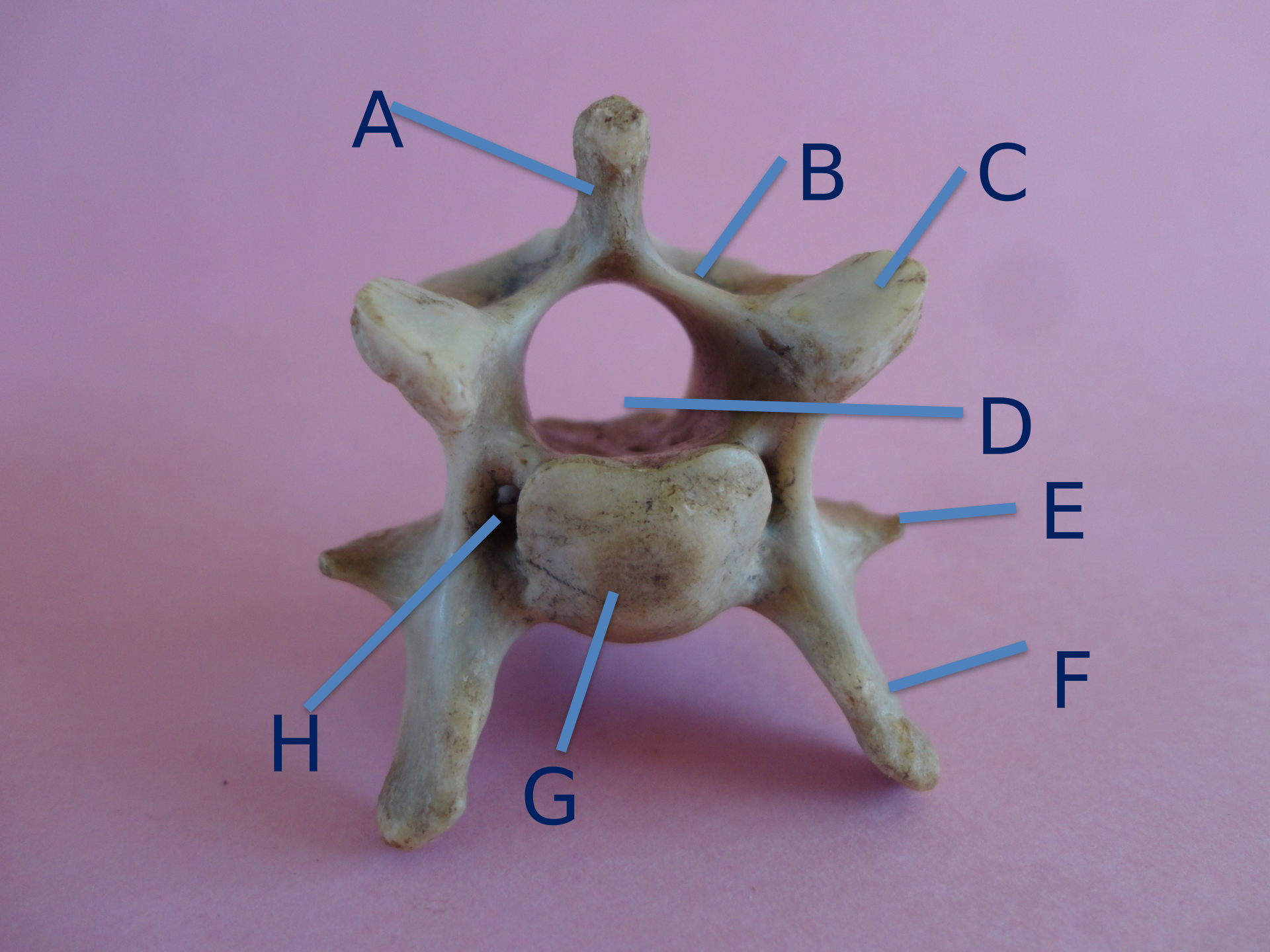
- Have broad and branched transverse process
- Has the prezygapophyses and the post-post-zygapophyses

Anterior view





Side view


A
B
C
D
E
F
G
H



THE THORACIC VERTEBRAE

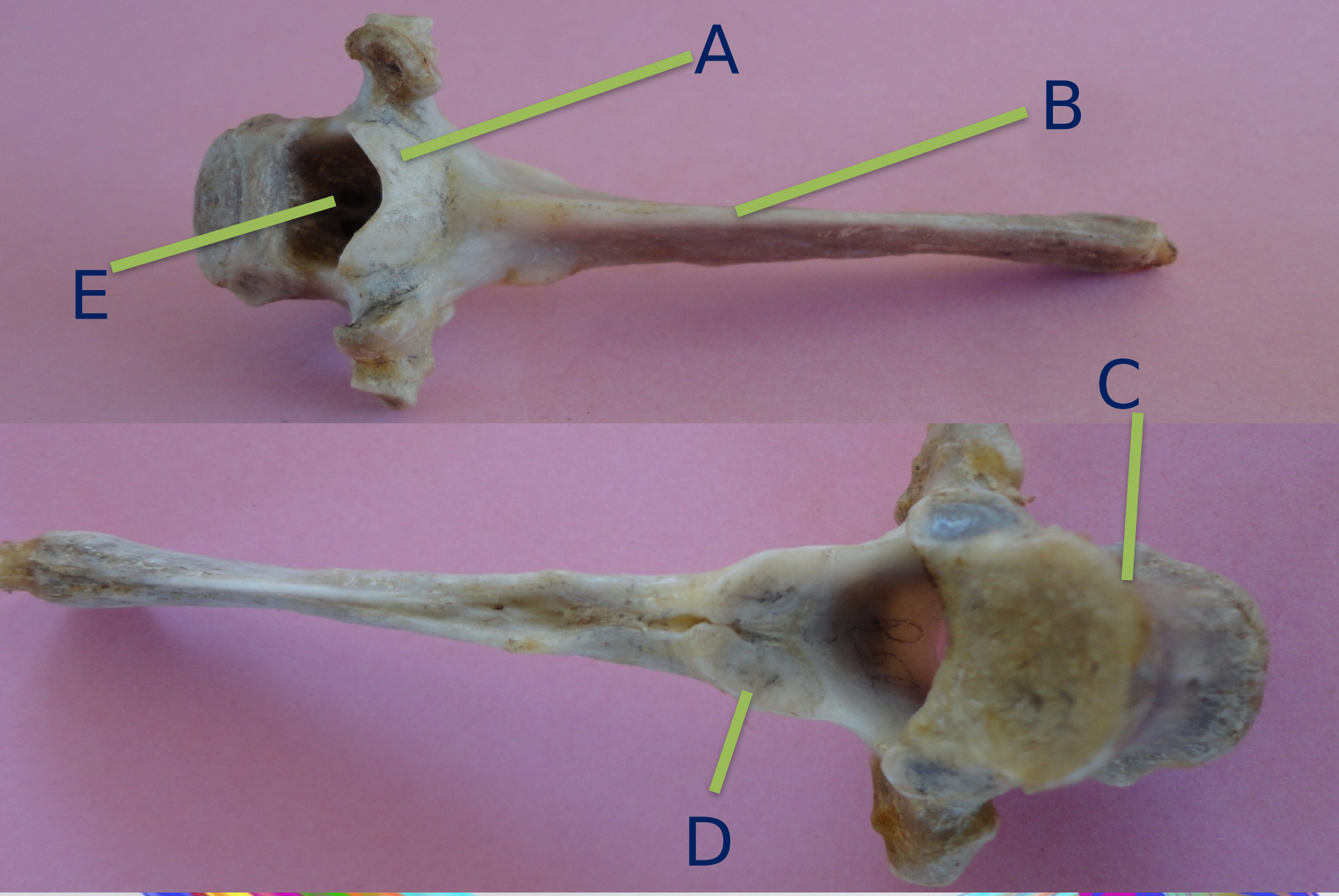
- **Found in the thoracic region articulating with the ribs.**
- **They are 12 in number in human beings.**

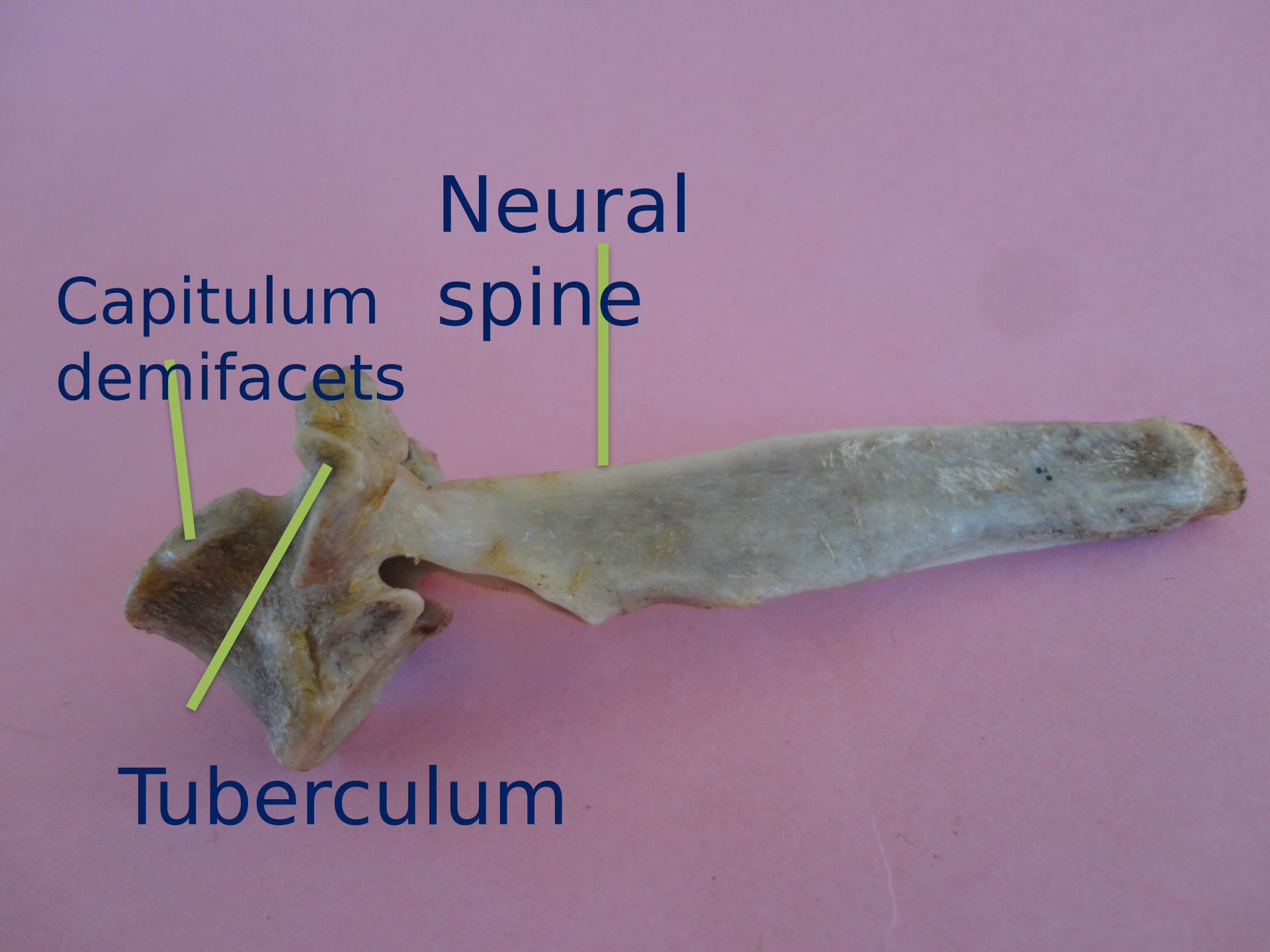
CHARACTERISTICS

- Has a long neural spine which offers a large surface area for the attachment of back muscles.
- Has a large centrum and on its side are capitulum demifacet
- Has short transverse

NB

- **Tubercular facet on each transverse process which articulates with the tuberculum of the rib and a capitular demifacet on the centrum which articulates with the capitulum of the rib**


A
B
E
C
D


Neural spine
Capitulum demifacets
Tuberculum

LUMBAR VERTEBRAE



- ✓They are five in number in human beings
- ✓It is found in the lumbar region of the body

CHARACTERISTICS

- Has a large and broad centrum to offer support
- Has a broad neural spine
- Has long and broad transverse process to provide a large surface area for the attachment of the abdominal muscles

❖Have **metapophyses** on either sides of the neural spine, **anapophyses** near the transverse process and hypapophyses which offers additional surface area for the attachment of the abdominal muscles.

FUNCTIONS OF THE LUMBAR VERTEBRAE

- To bear stress due to the effect of locomotion and the force of gravity
- Provides support and allows the body to bend sideways and rotate
- Provides surface for the attachment of abdominal muscles

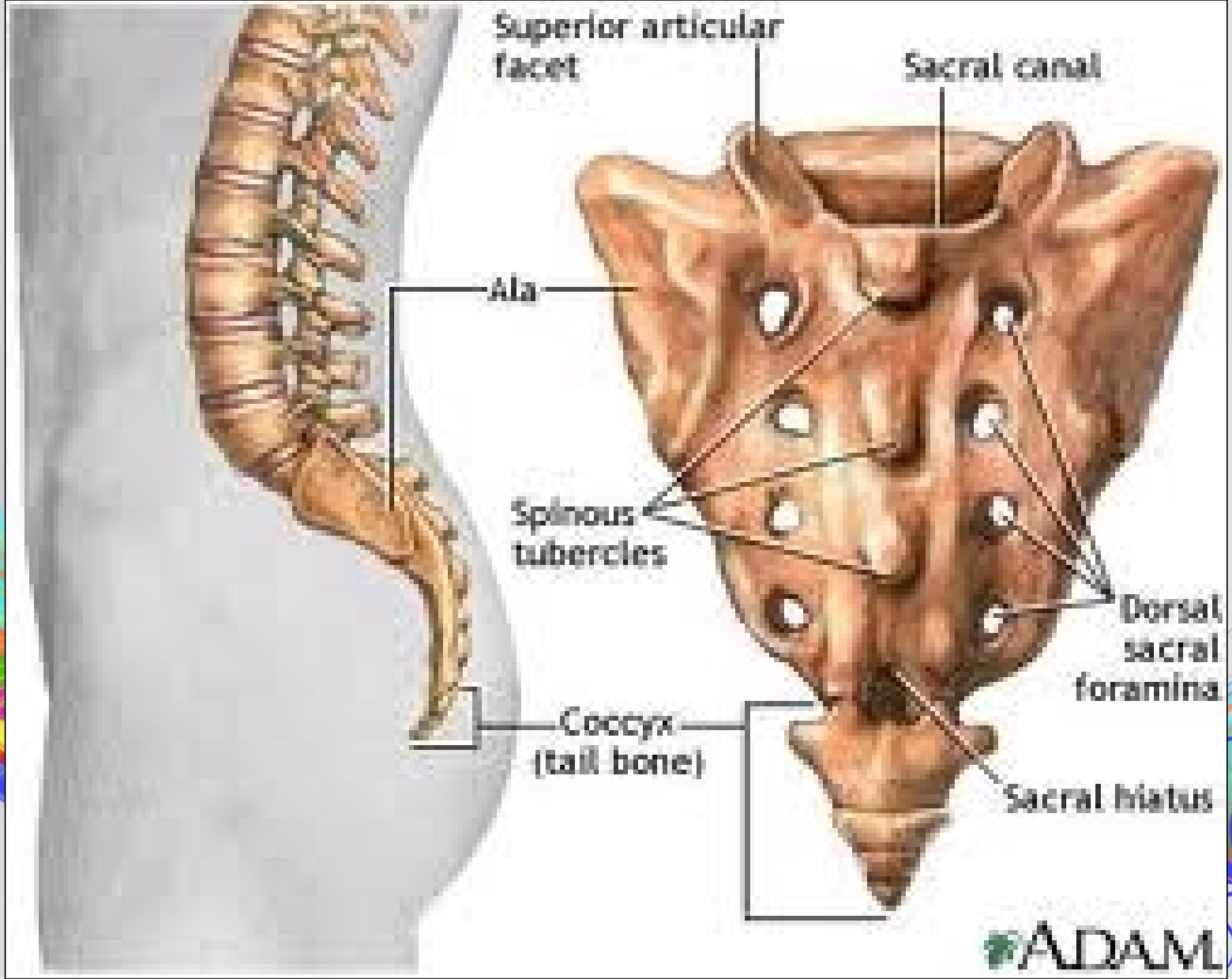
SACRAL VERTEBRAE

- **Found in the sacral region of the body**
- **They are five in number in human beings**

CHARACTERISTICS

- Have large and broad centrum to offer support
- Have narrow neural canal
- Have reduced neural spine
- The first anterior sacral vertebra is large with wing like transverse process which articulates with the

- **The vertebrae are fused to form a rigid structure called sacrum. This makes the sacrum firm and firm to bear the body weight and spread it to the legs through the pelvic girdle.**


Superior articular facet
Sacral canal
Ala
Spinous tubercles
Dorsal sacral foramina
Coccyx (tail bone)
Sacral hiatus
ADAM.

CAUDAL VERTEBRAE / COCCYGEAL VERTEBRAE

- ✓ Found in the tail region
- ✓ The number differs from one animal to another depending on the size of the tail.
- ✓ In human beings there are four caudal vertebrae which are fused to form a

CHARACTERISTICS

- Have reduced neural spine
- Have reduced zygapophyses
- Neural canal is absent
- Neural arch is absent
- The centrum is very large i.e. makes the entire bone