Support in Living organisms

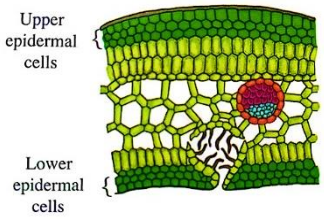
Support in plant

- The plants have different methods and systems for support to maintain its shape and for its protection. The most important method is: **Structural support**

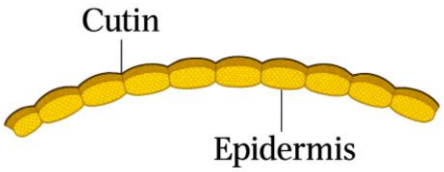
Structural Support (Permanent support)

- It concerns (affect) the cell wall of plant cell by deposition of **hard substances** such as: **Cellulose**, **lignin**, **cutin** and **suberin** **in** or **on** the cell wall.
- **Examples:**

1. **Increasing the thickness of epidermal cells**, especially the outer one



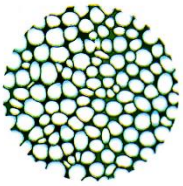
2. Deposition of **impermeable cutin** on the external walls of epidermal cell, **to:**
   - Protect the inner tissues
   - Prevent water loss

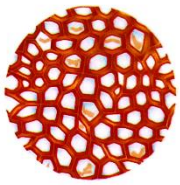


3. Surrounding the **woody stems** with a layer of **cork cells** **water-impermeable** containing deposited **suberin**, **to:**
   - Protect the inner tissues
   - Prevent water loss

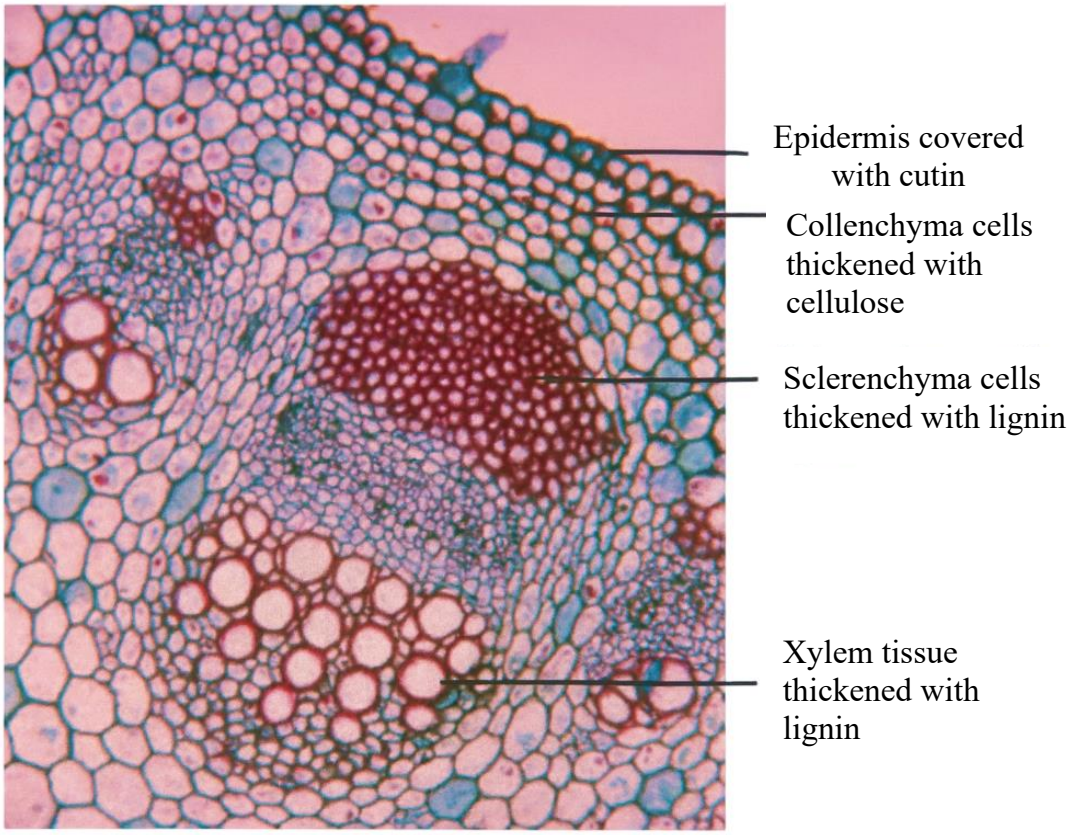
4. Deposition of **cellulose** or **lignin** in the cell walls of some parts of the cell wall, to **provide these cells rigidity** and **strength to support the plant**

   Examples:
   - **Collenchyma** (walls are thickened with **cellulose**)
   - **Sclerenchyma** "**Stone** and **fiber cells**" (walls are thickened with **lignin**)


Collenchyma

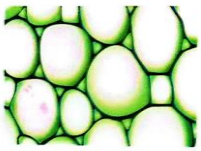
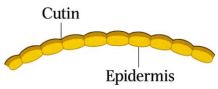
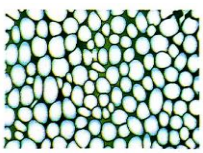
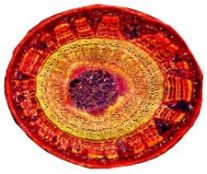
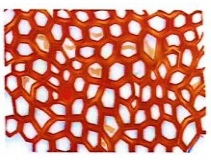

Sclerenchyma

The location of these cells and its distribution in the plant:

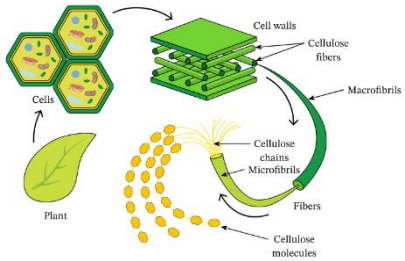


T.S in young dicot stem

- **The structural support is permanent. Why?**
  Because it depends on the deposition of some substances, such as cellulose, lignin, suberin and cutin in the cell walls or in some parts of them, which supplies them with the hardness and strength, protect the internal plant tissues and prevent the loss of water through them.

Figure					
Type of cells	Parenchyma cells	Cells of the leaf epidermis	Collenchyma	Cork cell	Sclerenchyma cells (fiber – stone cells)
Nature of cell	Living cell	Living cell	Living cell	Non-living cell	Non- living cells
Deposited substance		Cutin	Cellulose	Suberin	Lignin

Key points



- Plant cell walls are made of **carbohydrate polymer** called **cellulose**; made up of **thousands of glucose** molecules bonded together.
- **Cutin** is deposited on the epidermis of **stems**, **leaves**, and **some fruits**, while it is **absent** in the root epidermis because it is an **impermeable substance**.
  Therefore, its deposition on **root cells** leads to the **stop** of water absorption from the soil, causing the plant to die.
- Both **suberin** (in **cork cells**) and **lignin** (in **sclerenchyma cells**) are completely deposited. These substances are **impermeable to water**, and thus the transport of water to these cells **stops**, vital processes **stop**, and the protoplasm is **absent**, making these cells **non-living**.
- When thickness of the cutin layer on the outer epidermal cells **increases**, the rate of water loss **decreases** (**Reverse proportional**).
  This is clearly shown in **desert plants** such as **cactus**.
- The presence of **sclerenchyma tissue** increases in the **external coat of seeds**, such as **bean seeds** and the **hard coat of nuts**, as **hazelnuts** and **almonds**, in addition to it is present in the tissues of **some fruits**, as **pears**.
- The surface of some fruits such as **apple** and **plum** is covered by a layer of **cutin** that is covered by a **waxy substance**.

The earlier you start working on something, the earlier you will see results

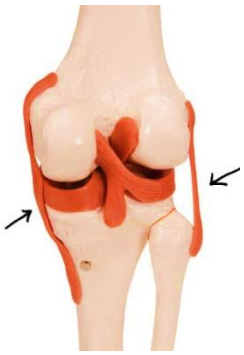
Support in Human

- The skeletal system represents **the main part of support** in human.
- The skeletal system in man works on :
  Supporting the body, protecting some of its organ and participating in movement, in addition to providing the human with a characteristic shape.
- **It consists of:**


Skeleton


Cartilages

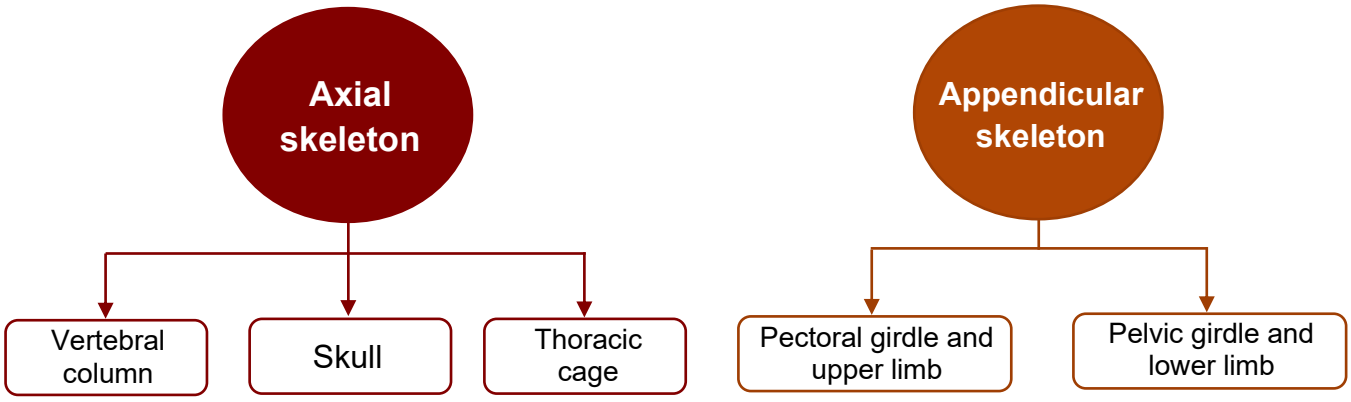

Joints

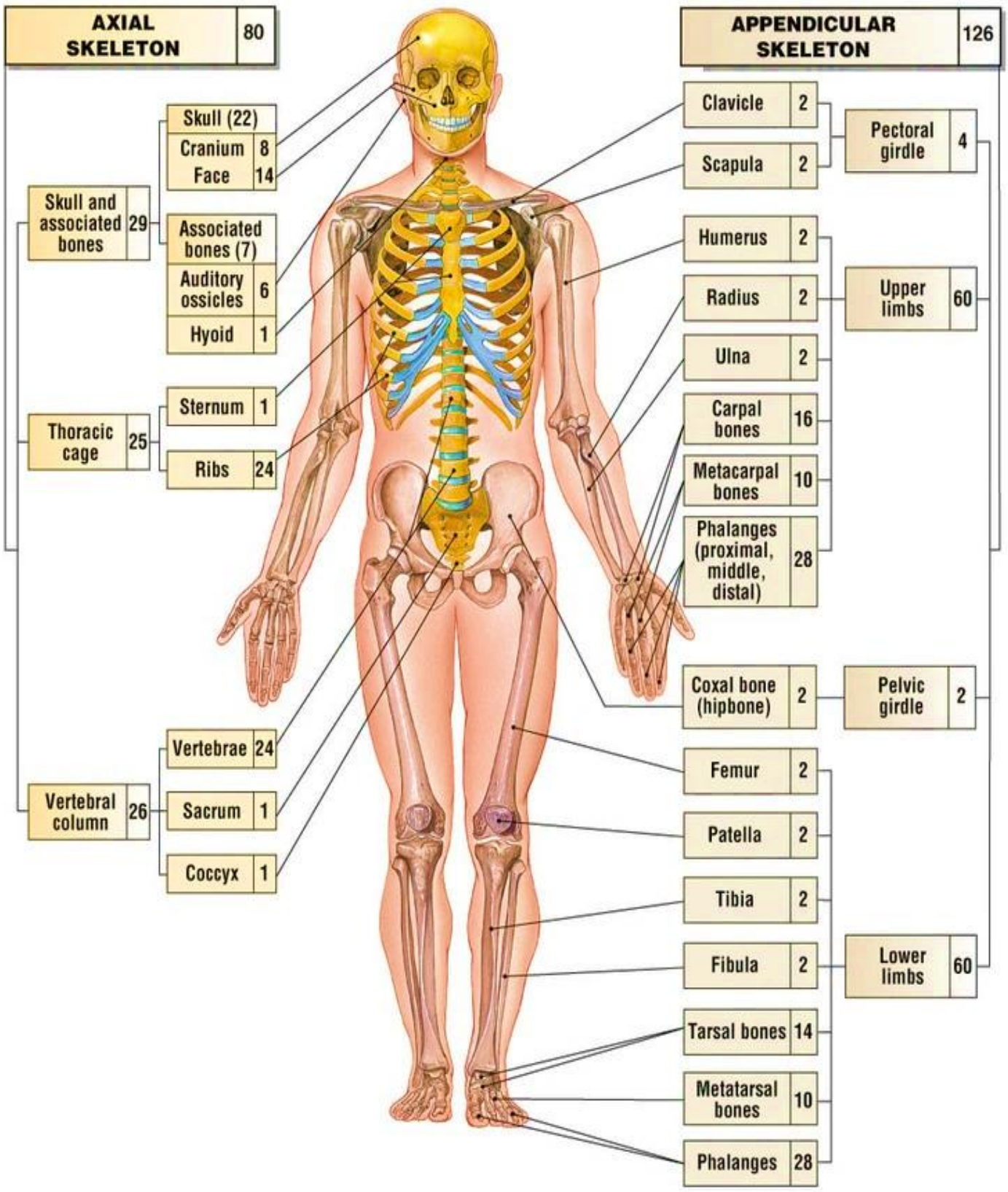

Ligaments


Tendons

First: Skeleton

- The human skeleton consists of **206 bones**
- Each bone has **its shape** and **size** ⟶ to suitable its **function**
- Function of the skeletal system :
  Support, **Protection**, **Movement**, **Immunity** and **Shape determination**
- The human skeleton consists of: **Axial skeleton** and **Appendicular skeleton**




AXIAL SKELETON 80
Skull and associated bones 29
Skull (22)
Cranium 8
Face 14
Associated bones (7)
Auditory ossicles 6
Hyoid 1
Thoracic cage 25
Sternum 1
Ribs 24
Vertebral column 26
Vertebrae 24
Sacrum 1
Coccyx 1
APPENDICULAR SKELETON 126
Pectoral girdle 4
Clavicle 2
Scapula 2
Upper limbs 60
Humerus 2
Radius 2
Ulna 2
Carpal bones 16
Metacarpal bones 10
Phalanges (proximal, middle, distal) 28
Pelvic girdle 2
Coxal bone (hipbone) 2
Lower limbs 60
Femur 2
Patella 2
Tibia 2
Fibula 2
Tarsal bones 14
Metatarsal bones 10
Phalanges 28

Axial skeleton

Consists of:

(1) Vertebral column

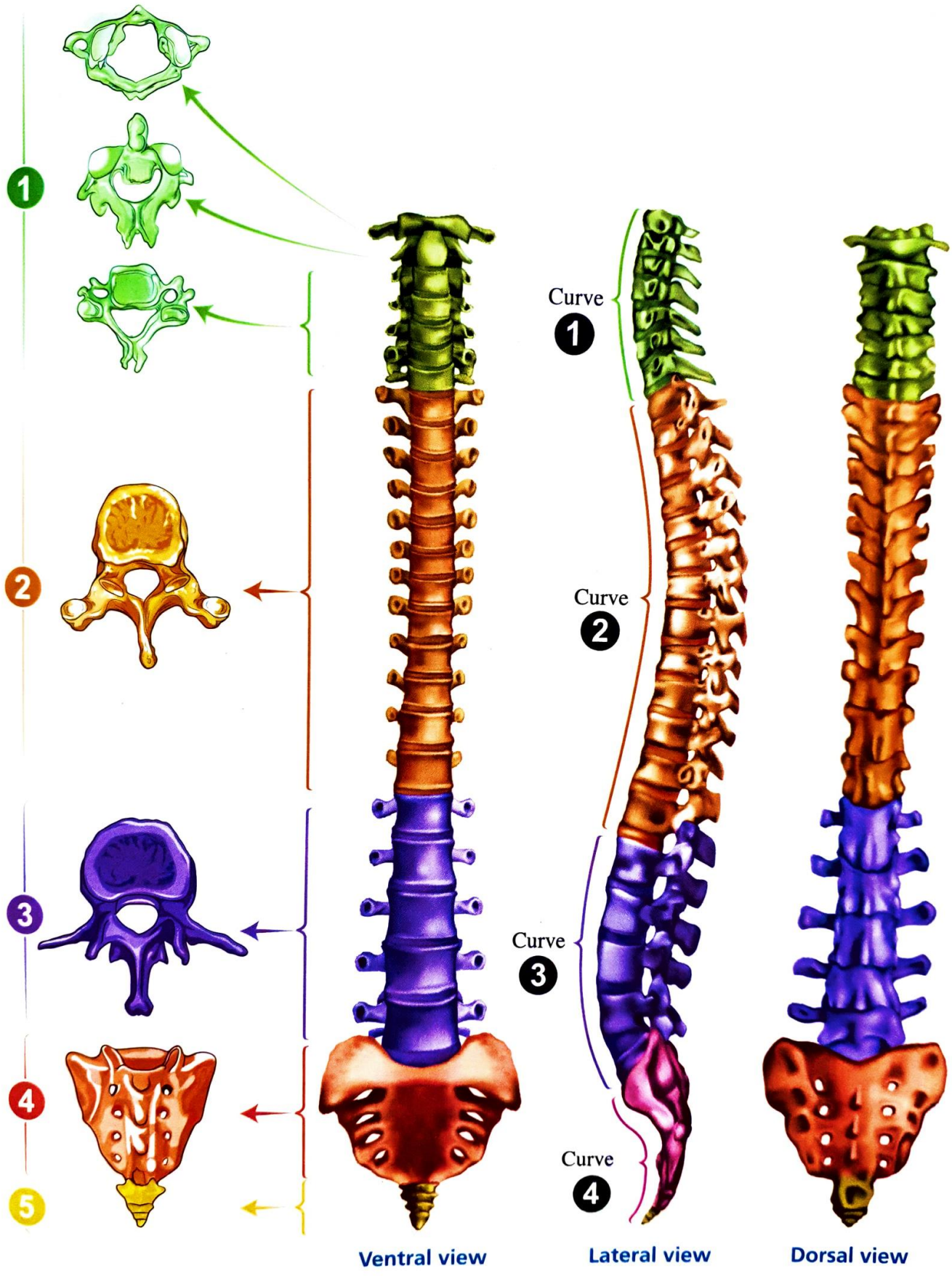
- It represents **the axis** of the human skeleton.
- Vertebral column attachments, as :
  - Its **upper part** attached with the **skull**
  - At **the thoracic region**, it is attached with **the thoracic cage** and **two upper limbs** by **the shoulder bones (pectoral girdle).**
  - Its **lower part** is attached with the **two lower limbs** by **the pelvic girdle.**
- It consists of **33 vertebrae** that are divided into five groups and **differ in shape** according to **their sites of presence**

	Cervical vertebrae	Thoracic vertebrae	Lumbar vertebrae	Sacral vertebrae	Coccygeal vertebrae
Number	7	12	5	5	4
Arrangement	1 : 7	8 : 19	20 : 24	25 : 29	30 : 33
Site of their presence	Neck	Thorax	Abdominal region	In the pelvic region	At the end of vertebral column
Size	Moderate	Larger than the cervical	The Largest vertebrae	Broad and flat	Small in size
Articulation	Articulating	Articulating	Articulating	Fused	Fused

- **Function of vertebral column:**
  - It acts as **the main support** of the **body.**
  - It **protects** the **spinal cord.**
  - It helps in the **movement** of the **head** and **upper part of the body.**

Key points

- The number of bones of the vertebral column in human is about **26 bones** (due to the fusion of the five sacral vertebrae together as one bone, and the four coccygeal vertebrae together as one bone).
- Number of the **articulated vertebrae** are **24**, and the **fused vertebrae** are **9.**
- The vertebral column in human contains **four curves**.


1
2
3
4
5
Curve 1
Curve 2
Curve 3
Curve 4
Ventral view
Lateral view
Dorsal view

- **The structure of bony Vertebra:**

The vertebrae consist of:

1) **Centrum (vertebrae body):**
   It is an anterior thick part attaches to the two transverse processes
2) **Two transverse processes**
3) **Spinal ring (neural ring):**
   it is a bony ring that attaches posteriorly to the centrum and the spinal cord extends inside it to be protected
4) **Processes that attach to spinal ring:**
   - **Two anterior articulating process**
   - **Two posterior articulating process**
   - **Neural spine (spinal process):** a dorsal spine incline downward

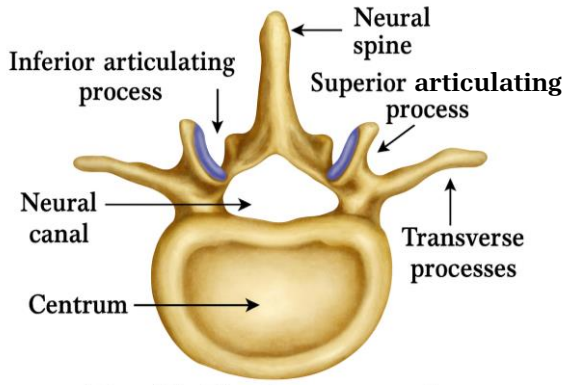
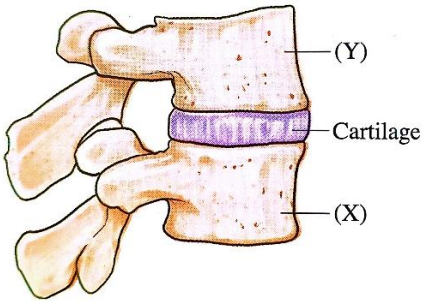


Fig. (2) The bony vertebra

- **Functional adaptation of the vertebrae:**
  - **Vertebrae** are **strong** and **hard** structure to **protect the spinal cord.**
  - **Vertebrae** have **neural canal** to **allow the passage of spinal cord.**
  - **Vertebrae** have **transverse processes** to **join with ribs** to **support the thoracic cage.**
  - **Vertebrae** contain **bone marrow** which produces **all types of blood cells.**

Key points

- The number of **processes** in the typical (lumbar) vertebra is **7 processes**.
- The number of **paired processes** in the typical vertebra = **3 pairs**.
- The vertebrae articulate with each other through the **articulating processes**.
- Vertebra (X) articulates through its **two superior articulating processes** with the **two inferior articulating processes** of the vertebra (Y).



- The trunk is the region that mediates the human body and consists of the **thorax**, **abdomen** and **pelvis**, in which the number of articulating vertebrae = **17** vertebrae (**12 thoracic** + **5 lumbar**).
- The vertebra that bisects the neck is the **4th vertebra**, while the vertebra that bisects the vertebral column is the **vertebra no. (17)**