

AL MUSTAQBAL UNIVERSITY

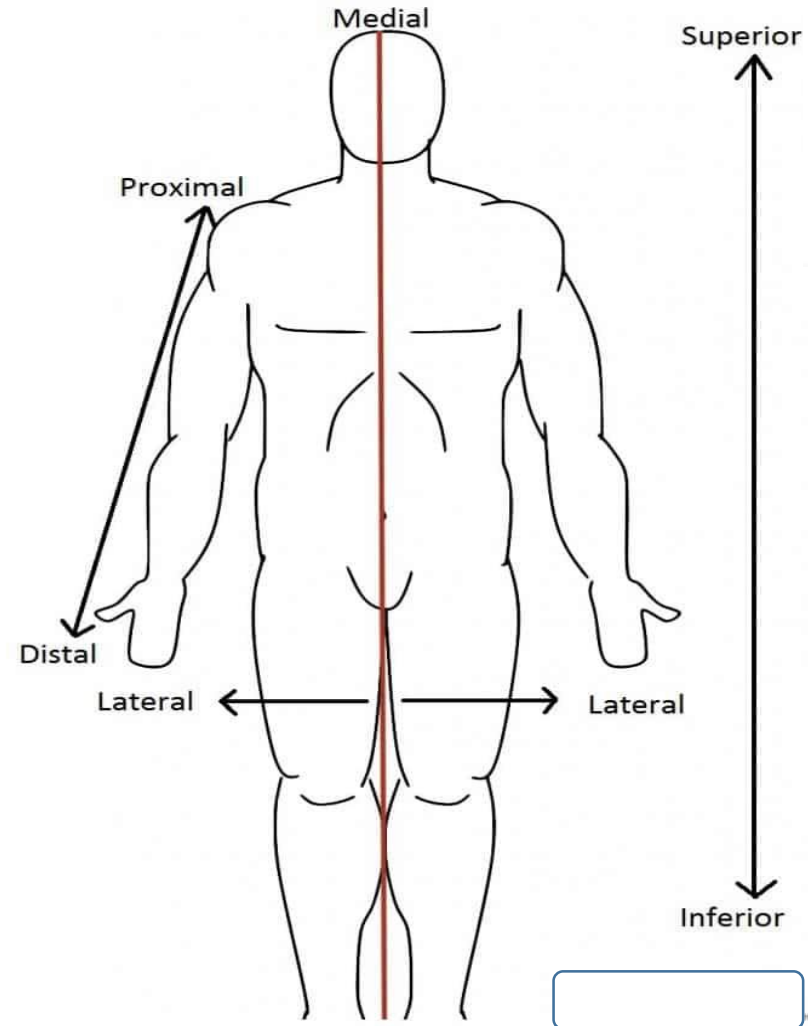
College of Pharmacy / First Stage



ANATOMY

(L1) Basics & Terminology

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Basics and terminology

Anatomy is derived from the Greek *anatomē* "dissection" " cut up, cut open" from *aná* "up", and *tomy*, cut, anatomy is the scientific study of the structure of [organisms](#) including their systems, [organs](#) and [tissues](#). It includes the appearance and position of the various parts, the materials from which they are composed, and their relationships with other parts.

Anatomy is quite distinct from [physiology](#) and [biochemistry](#), which deal respectively with the functions of those parts and the chemical processes involved.

The human body is a complex and intricate piece of engineering in which every structure plays a precise role. There are approximately 200 [bones](#), 650 muscles, 79 [organs](#), and enough [blood vessels](#) to circle the Earth twice!

Ways to explore human anatomy:

Regional anatomy

Organizes the body into defined parts: Upper limb, lower limb, trunk and back, thorax, abdomen and pelvis, head and neck, neuroanatomy

Systemic anatomy

Evaluates the body by defined systems: Integumentary, musculoskeletal, nervous, endocrine, circulatory, respiratory, digestive, urinary, reproductive, lymphatic systems

Microscopic anatomy

Looks at the microscopic structure of tissues and organs

Other methods

Clinical/applied anatomy, cross-section, medical imaging

The **anatomical position** is the standard reference orientation of the human body. It is used to provide a **clear and consistent** mechanism of describing the [location of structures](#).

Description of the Anatomical Position

The standard anatomical position is described as a person in the following orientation:

Standing upright and facing forward.

Mouth closed with neutral facial expression.

Arms straight, hands held by the hips with palms facing forward.

Feet together and parallel, toes pointing forward.

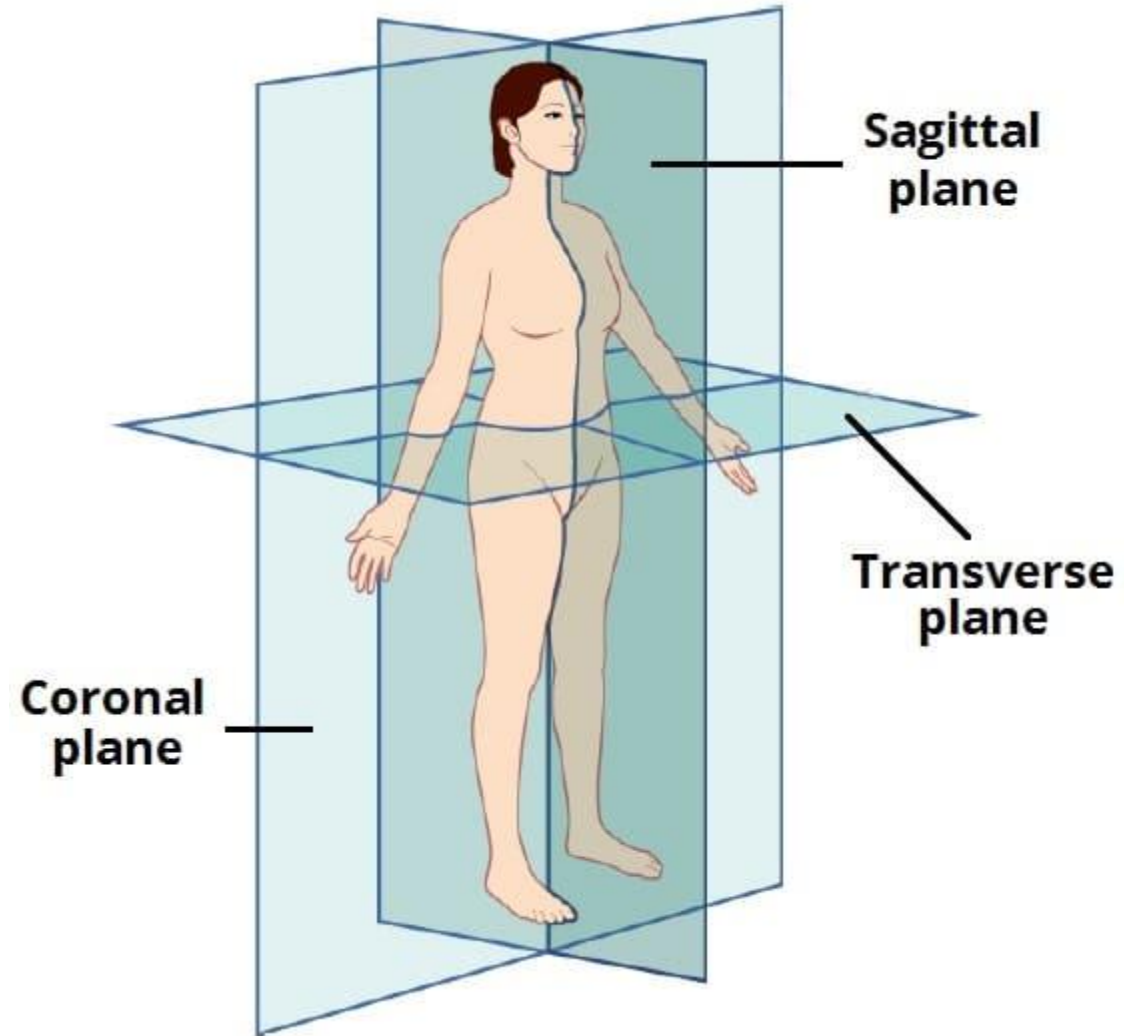


The **Anatomical Planes:**

are hypothetical planes used to describe the location of structures in human anatomy.

They are applied to the human body in the **anatomical position**.

The three most commonly used planes:
sagittal, **coronal** and **transverse**.



Sagittal Plane

The sagittal plane is a vertical plane which passes through the body **longitudinally**. It divides the body into a left section and a right section.

A specific sagittal plane is the **median sagittal plane** – which passes down the midline of the body, separating it into equal halves.

Coronal Plane

The coronal plane is a vertical plane which also passes through the body longitudinally – but **perpendicular** (at a right angle) to the sagittal plane.

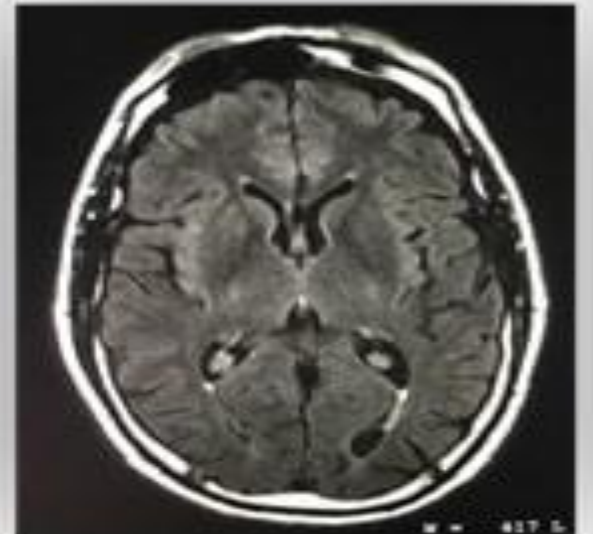
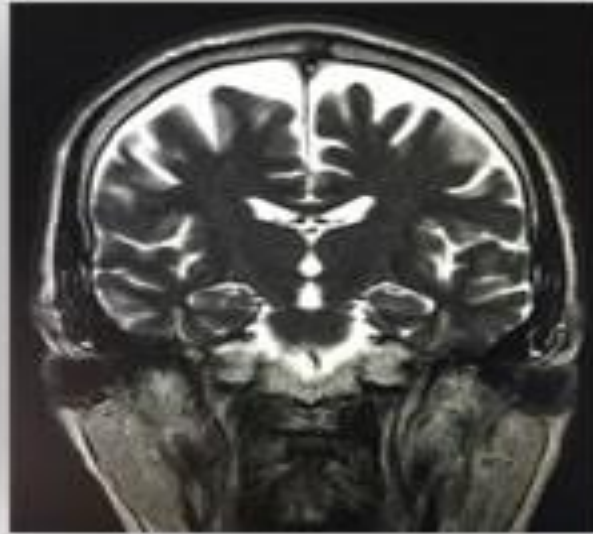
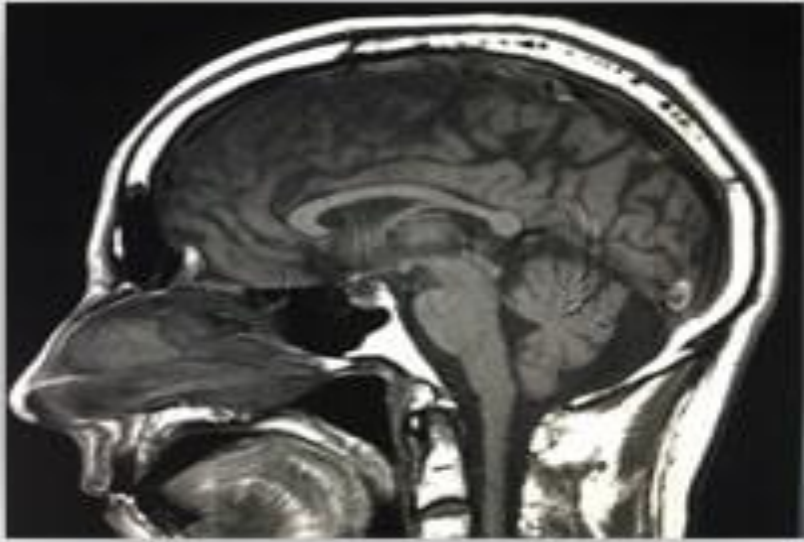
It divides the body into a front (anterior) section and back (posterior) section.

Transverse Plane

The transverse plane is a **horizontal** plane. It is perpendicular to both the sagittal and coronal planes, and parallel to the ground.

It divides the body into an upper (superior) section and a lower (inferior) section.

Transverse planes are also known as **transaxial planes** or axial planes.



MRI scan of the cerebrum, demonstrating the three anatomical planes. Left to right: Sagittal, coronal and transverse

The **anatomical terms of location:**

are vital to understanding and using anatomy. They help to avoid any ambiguity that can arise when describing the location of structures.

Medial and Lateral

Imagine a line in the sagittal plane, splitting the right and left halves evenly. This is the midline. **Medial** means towards the midline, **lateral** means away from the midline.

Examples:

The eye is lateral to the nose.

The nose is medial to the ears.

The brachial artery lies medial to the biceps tendon

Anterior and Posterior

Anterior refers to the 'front', and **posterior** refers to the 'back'. Putting this in context, the heart is posterior to the sternum because it lies behind it. Equally, the sternum is anterior to the heart because it lies in front of it.

Examples

Pectoralis major lies anterior to pectoralis minor.

The triceps are posterior to biceps brachii.

The patella is located anteriorly in the lower limb

Superior and Inferior

Superior means 'higher', **inferior** means 'lower'. The head is superior to the neck; the umbilicus is inferior to the sternum.

Examples

The nose is superior to the mouth.

The lungs are superior to the liver.

The appendix is (usually) inferior to the transverse colon

Proximal and Distal

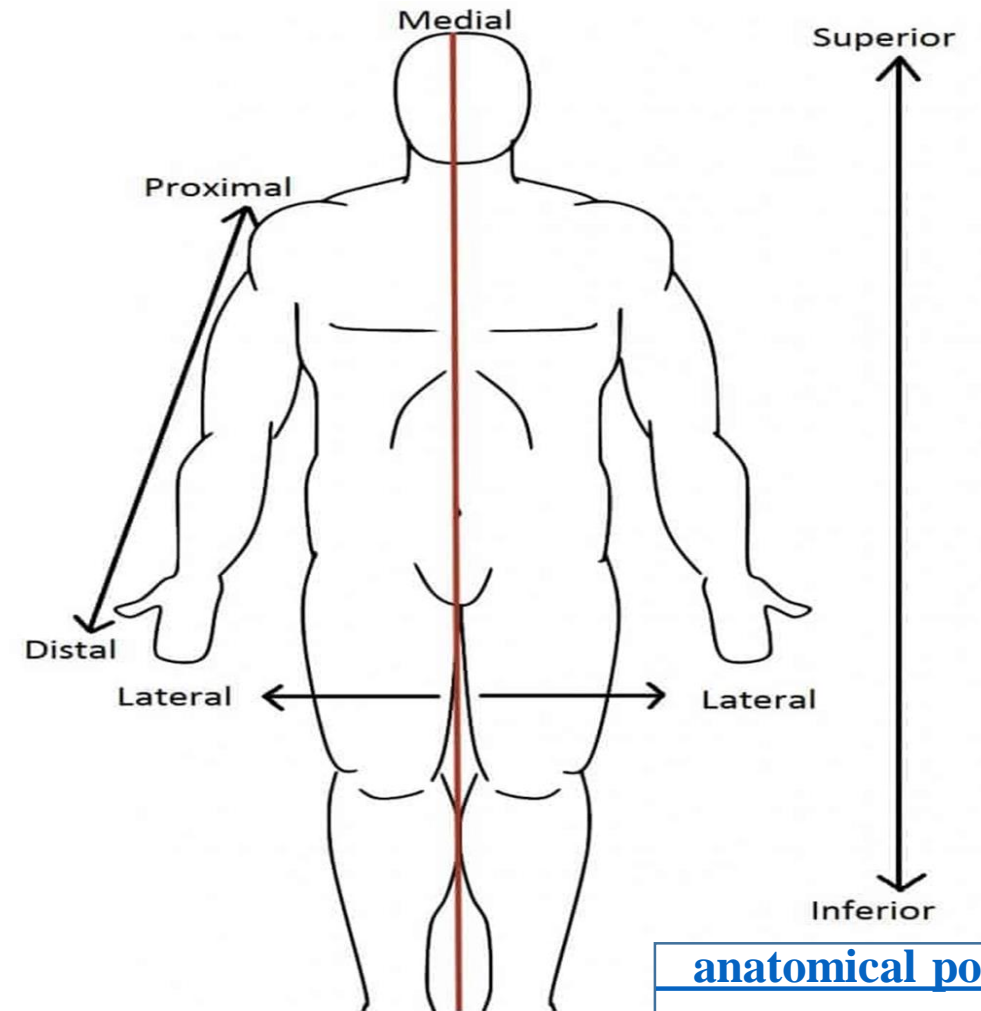
The terms **proximal** and **distal** are used in structures that are considered to have a beginning and an end (such as the upper limb, lower limb and blood vessels). They describe the position of a structure with reference to its origin – proximal means closer to its origin, distal means further away.

Examples:

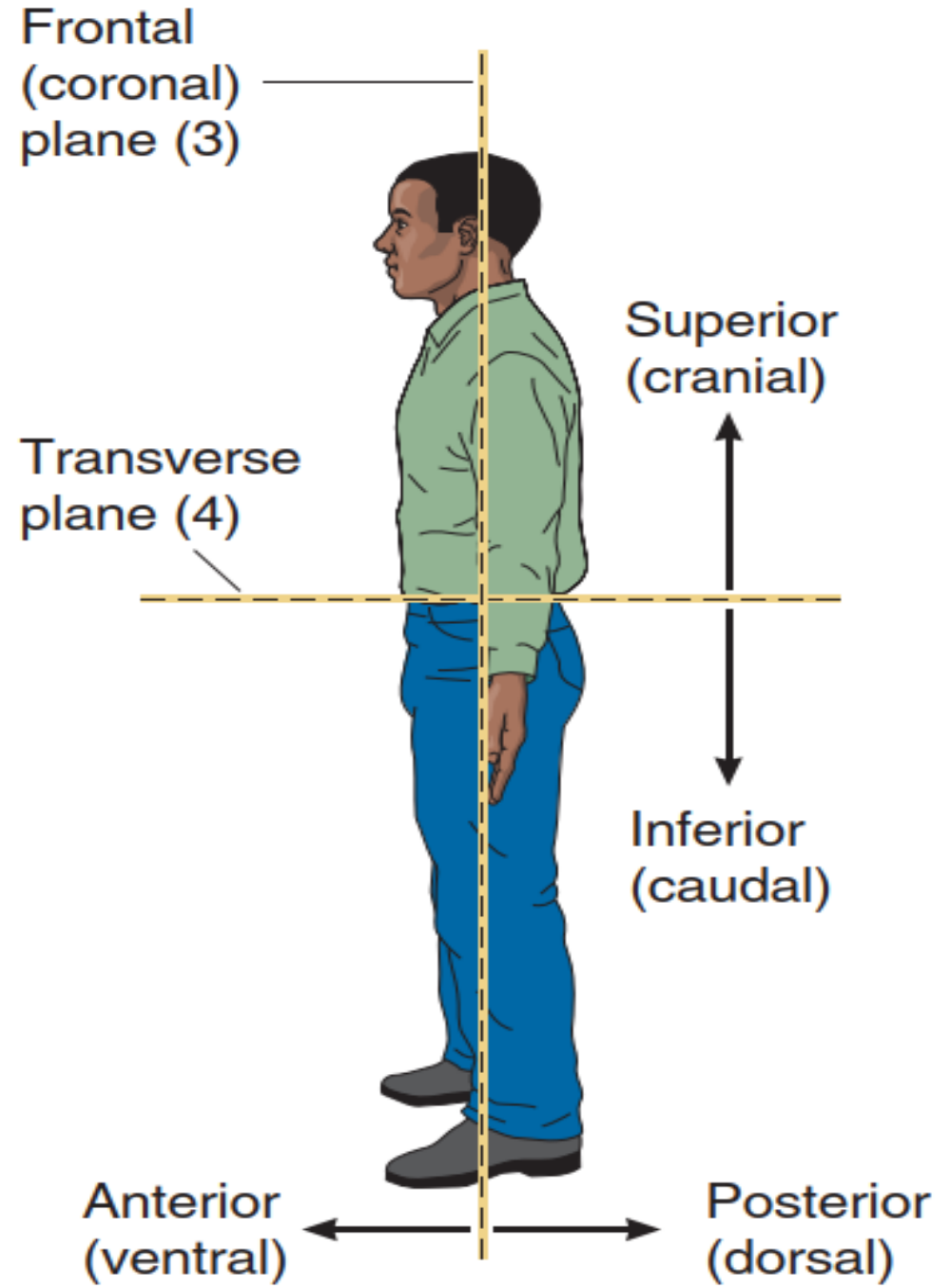
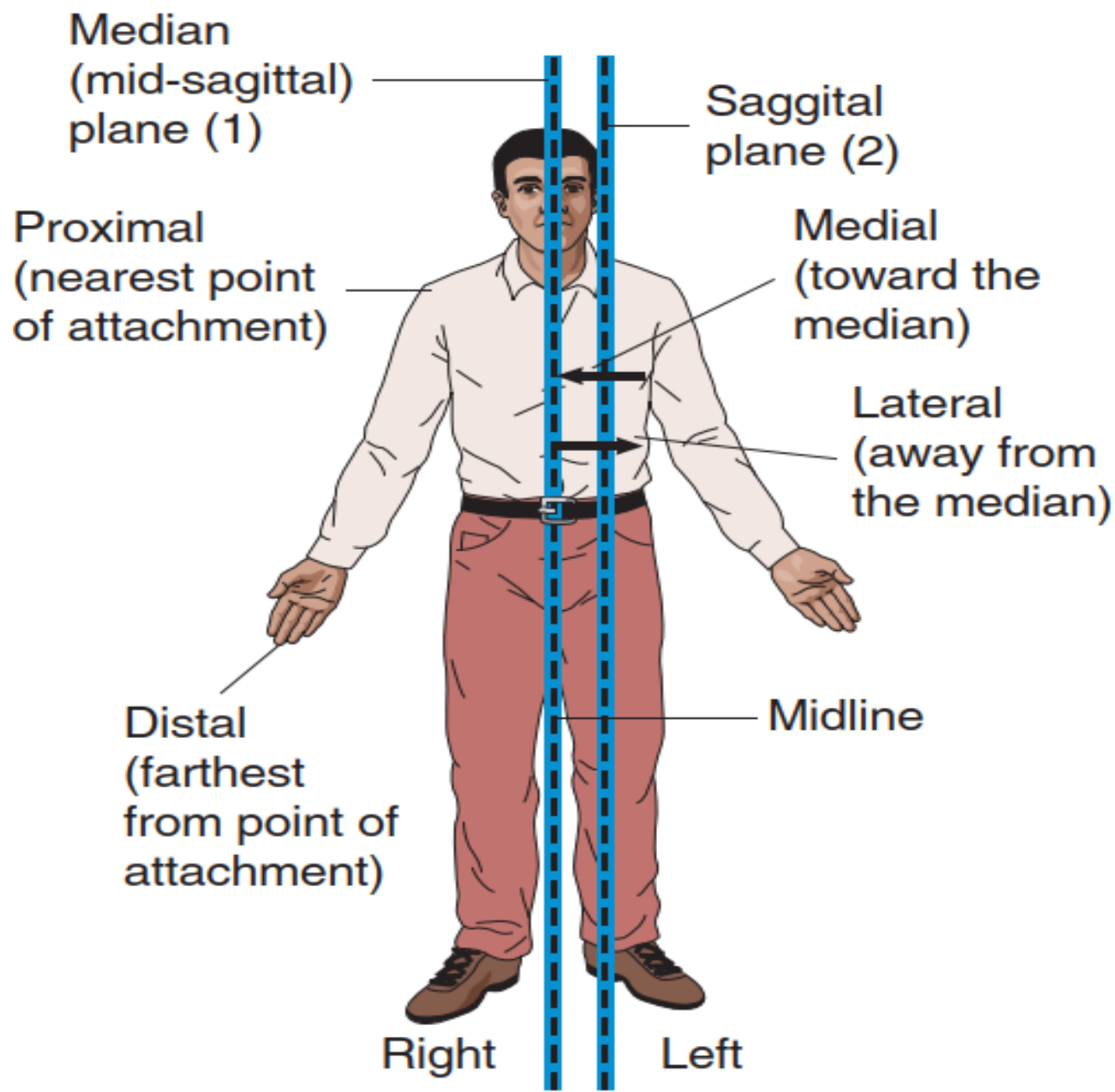
The wrist joint is distal to the elbow joint.

The scaphoid lies in the proximal row of carpal bones.

The knee joint is proximal to the ankle joint



Directional Term	Definition	Example
Superior	Towards the head or upper part of the body.	Pharynx is superior to larynx.
Inferior	Away from the head or lower part of the body.	Small intestine is inferior to stomach
Anterior	Nearer to or at the front of the body	Sternum is anterior to the heart.
Posterior	Nearer to or at the back of the body	Oesophagus is posterior to trachea.
Medial	Nearer to the midline of the body.	Ulna is medial to the radius.
Lateral	Nearer from the midline of the body.	The arms are lateral to the chest.
Intermediate	Between the two structures.	Transverse colon is intermediate to ascending colon and descending colon.
Proximal	situated nearer to the point of attachment.	Humerus is proximal to the radius.
Distal	situated away from the point of attachment.	Phalanges are distal to the carpels.
Superficial	Toward or on the surface of the body.	Ribs are superficial to lungs.
Deep	Away from the surface of the body.	Ribs are deep to the skin.



Terms of Regions

Cranial (cephalic)

Cervical

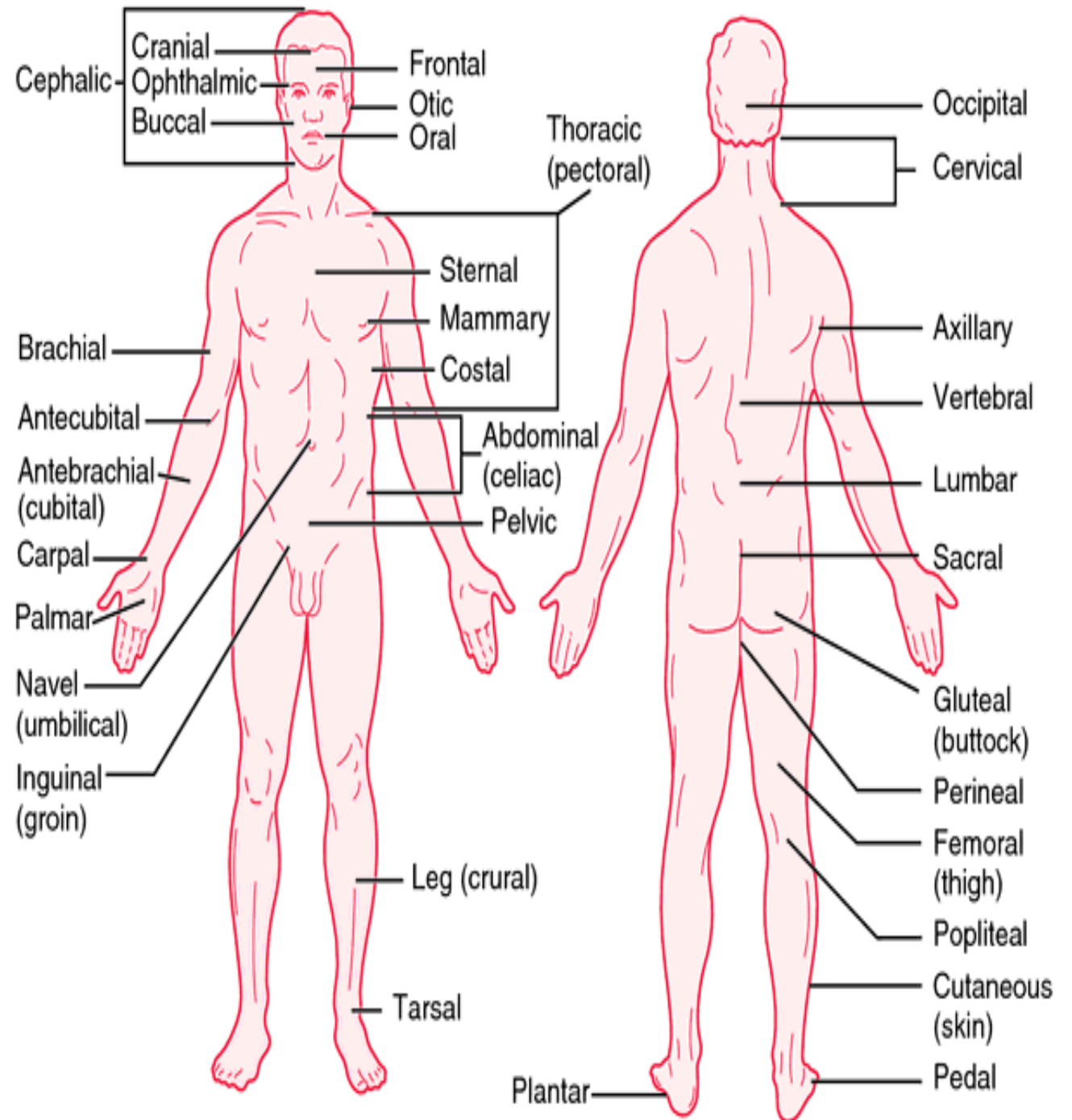
Thoracic

Abdominal

Pelvic

Plantar

Palmar



Body Cavities

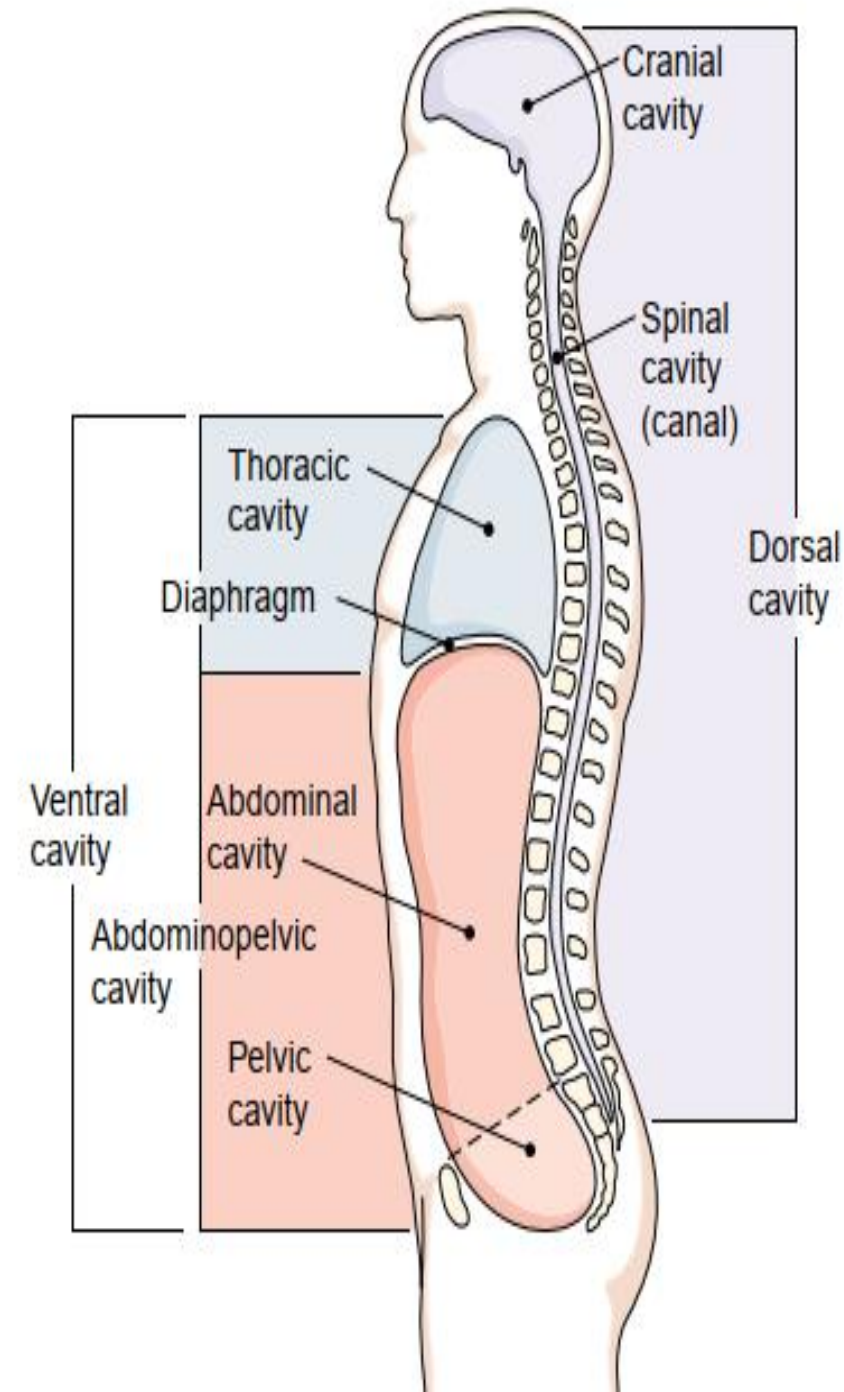
Internal organs are located within dorsal and ventral cavities.

The dorsal cavity contains the brain in the cranial cavity and the spinal cord in the spinal cavity (canal).

The uppermost ventral cavity, **the thoracic cavity**, is separated from the **abdominal cavity** by the diaphragm.

There is no anatomical separation between the **abdominal cavity** and **the pelvic cavity**, which together make up the **abdominopelvic cavity**.

The large membrane that lines the abdominopelvic cavity and covers the organs within it is the peritoneum



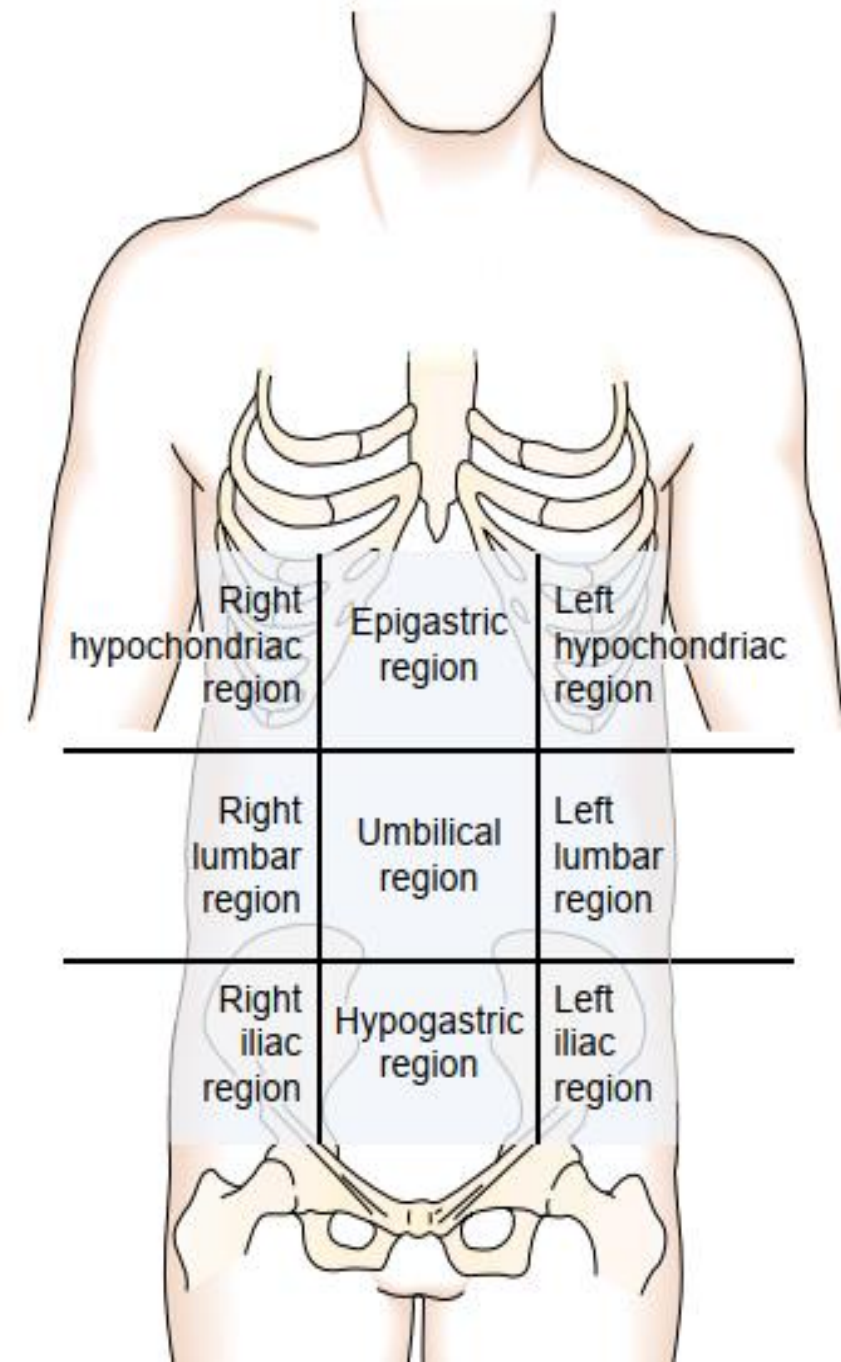
Body Regions

For orientation, the abdomen can be divided by imaginary lines into nine regions. The sections down the midline are the:

- **epigastric region**, located above the stomach
- **umbilical region**, named for the umbilicus, or navel
- **hypogastric region**, located below the stomach

The lateral regions are the:

- right and left **hypochondriac regions**, named for their position near the ribs, near the cartilages (root chondr/o) of the ribs,
- right and left **lumbar regions**, which are located near the small of the back (lumbar region of the spine)
- right and **left iliac regions**, named for the upper bone of the hip, the ilium.

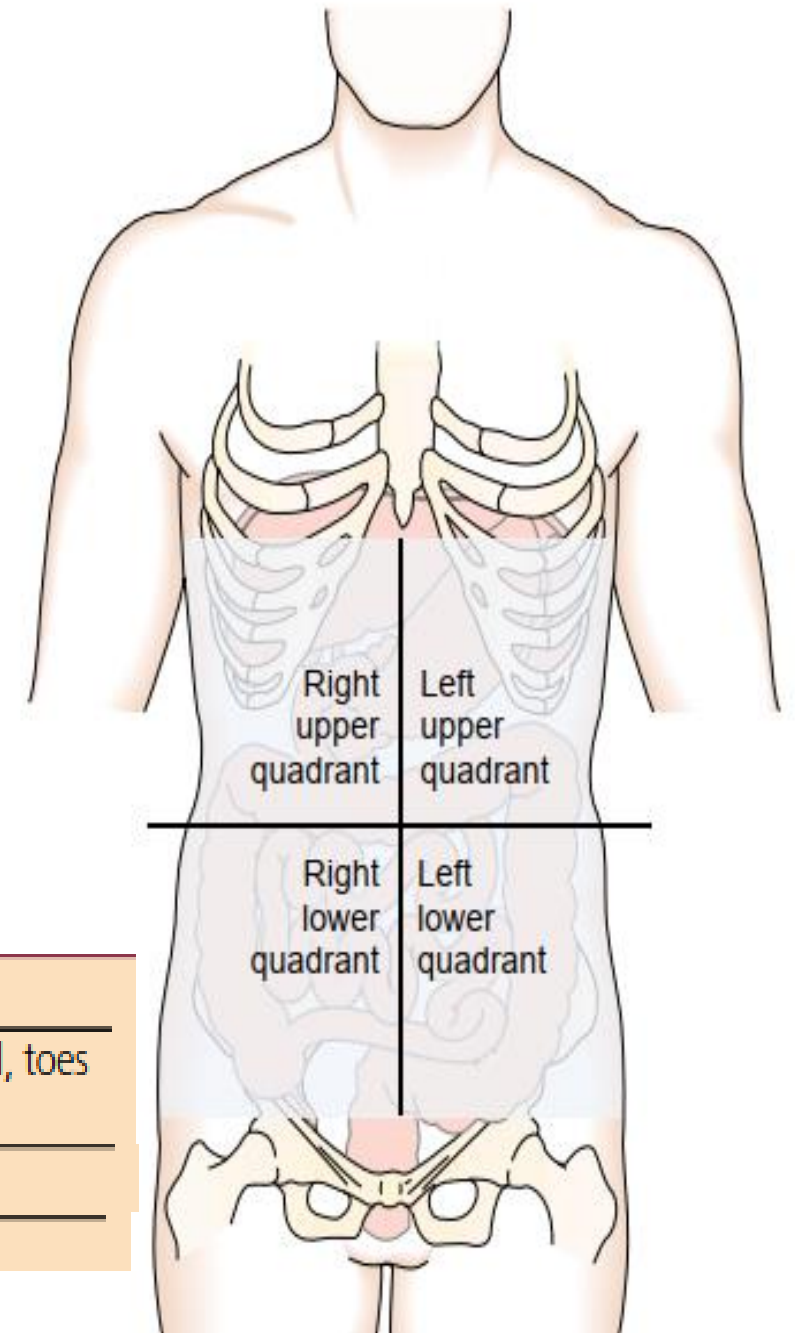


More simply, but less precisely, the abdomen can be divided by a single vertical line and a single horizontal line into four sections, designated:

the right upper quadrant (**RUQ**),
left upper quadrant (**LUQ**),
right lower quadrant (**RLQ**),
and left lower quadrant (**LLQ**).

Positions: In addition to the anatomical position, there are other standard positions in which the body is placed for examination or medical procedures. Like:

POSITION	DESCRIPTION
anatomical position	standing erect, facing forward, arms at sides, palms forward, legs parallel, toes pointed forward
supine*	lying face up
prone	lying face down



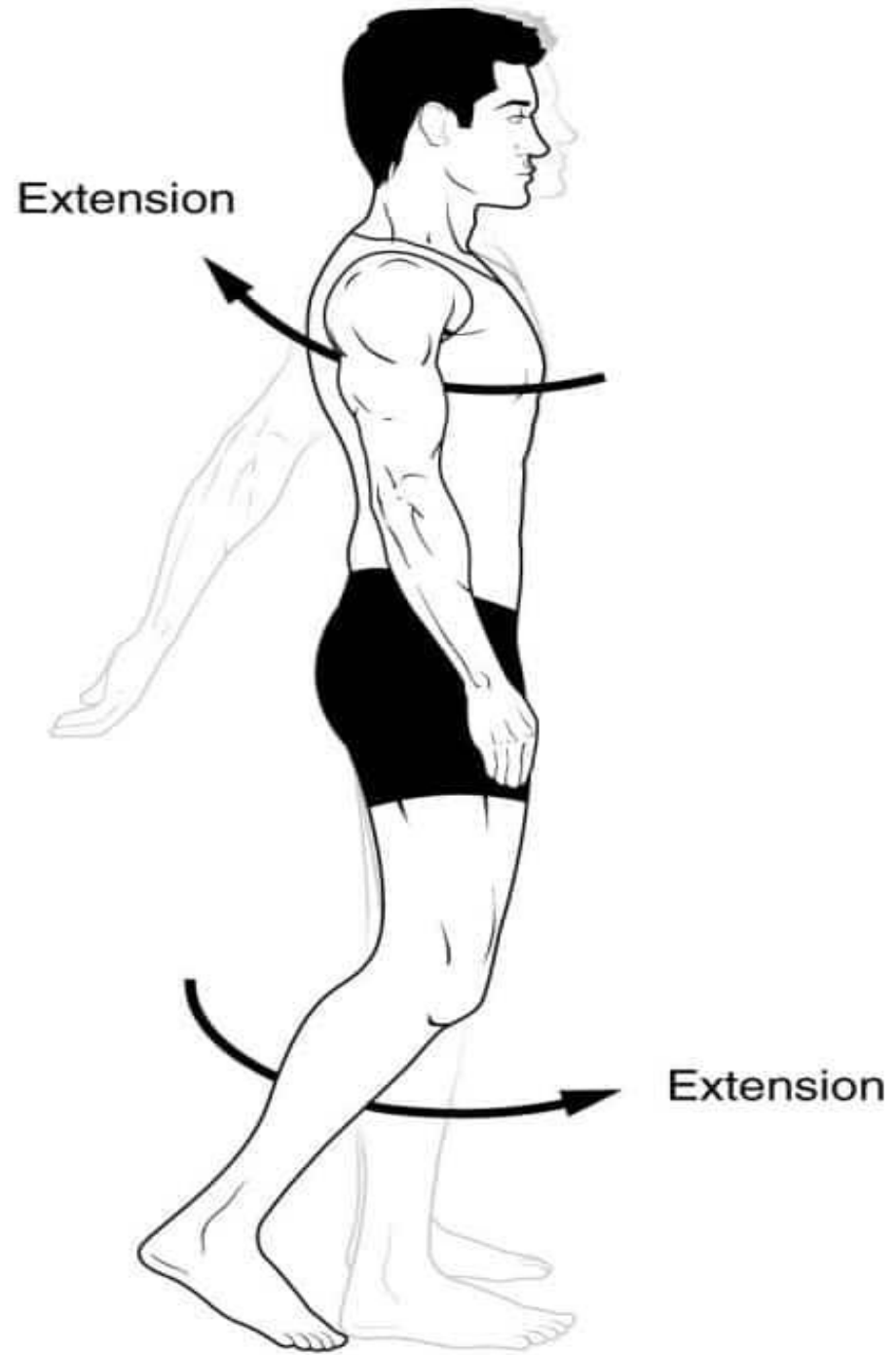
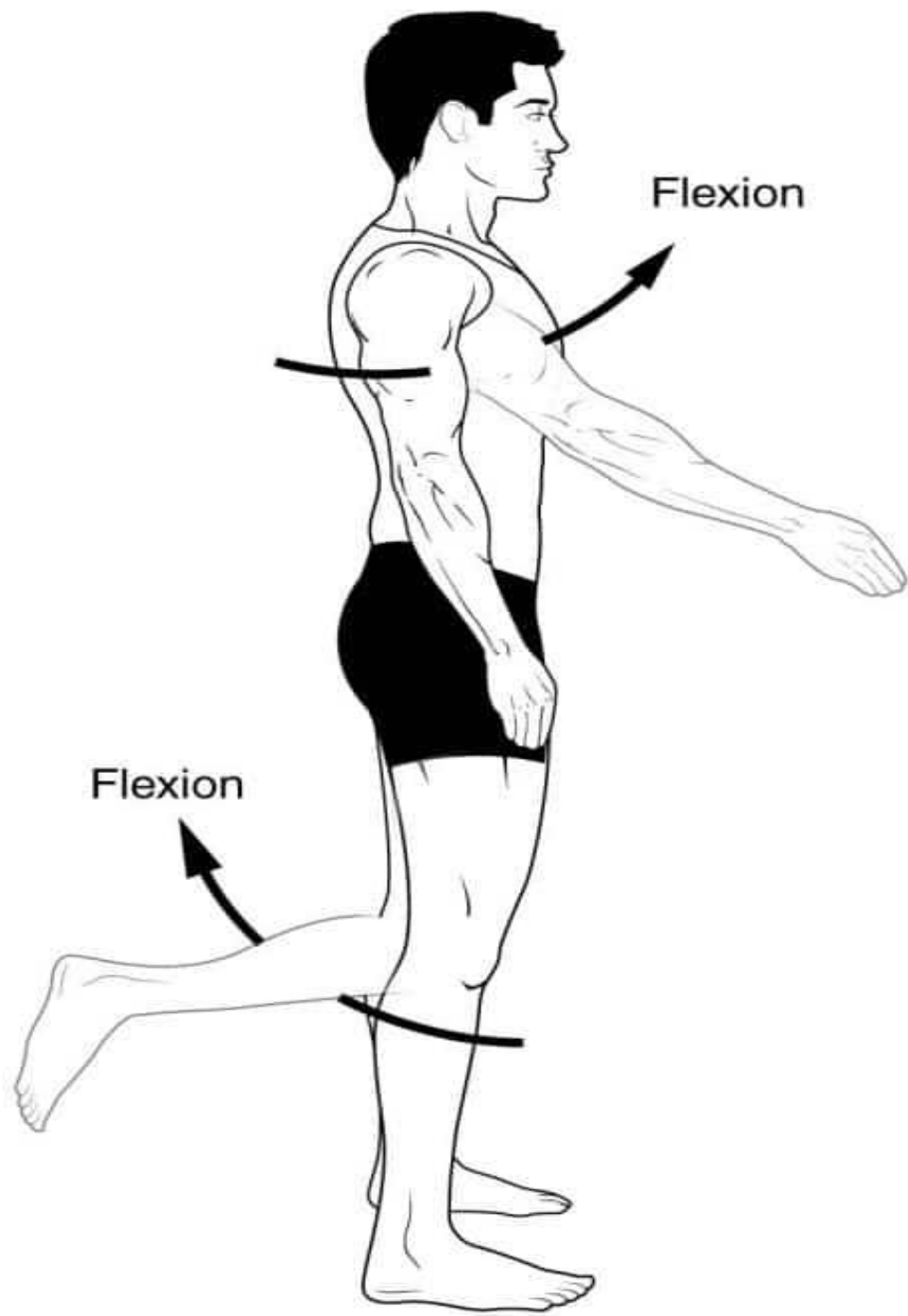
Anatomical terms of movement are used to describe the actions of muscles upon the skeleton. Muscles contract to produce movement at joints, and the subsequent movements can be precisely described using this terminology. Most movements have an opposite movement – also known as an **antagonistic** movement.

Flexion and Extension

Flexion and extension are movements that occur in the sagittal plane. They refer to increasing and decreasing the angle between two body parts:

Flexion refers to a movement that decreases the angle between two body parts. Flexion at the elbow is decreasing the angle between the ulna and the humerus. When the knee flexes, the ankle moves closer to the buttock, and the angle between the femur and tibia gets smaller.

Extension refers to a movement that increases the angle between two body parts. Extension at the elbow is increasing the angle between the ulna and the humerus. Extension of the knee straightens the lower limb.



Abduction and Adduction

Abduction and adduction are two terms that are used to describe movements towards or away from the midline of the body.

Medial and Lateral Rotation

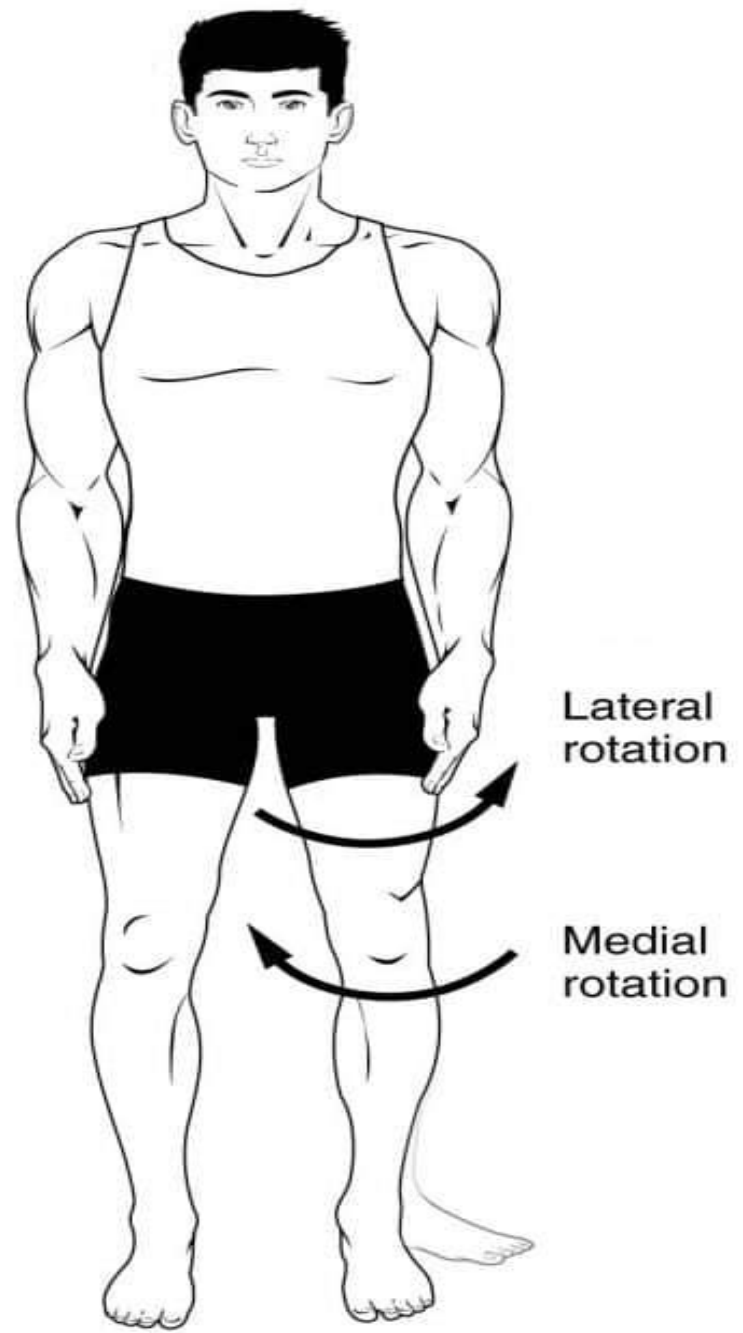
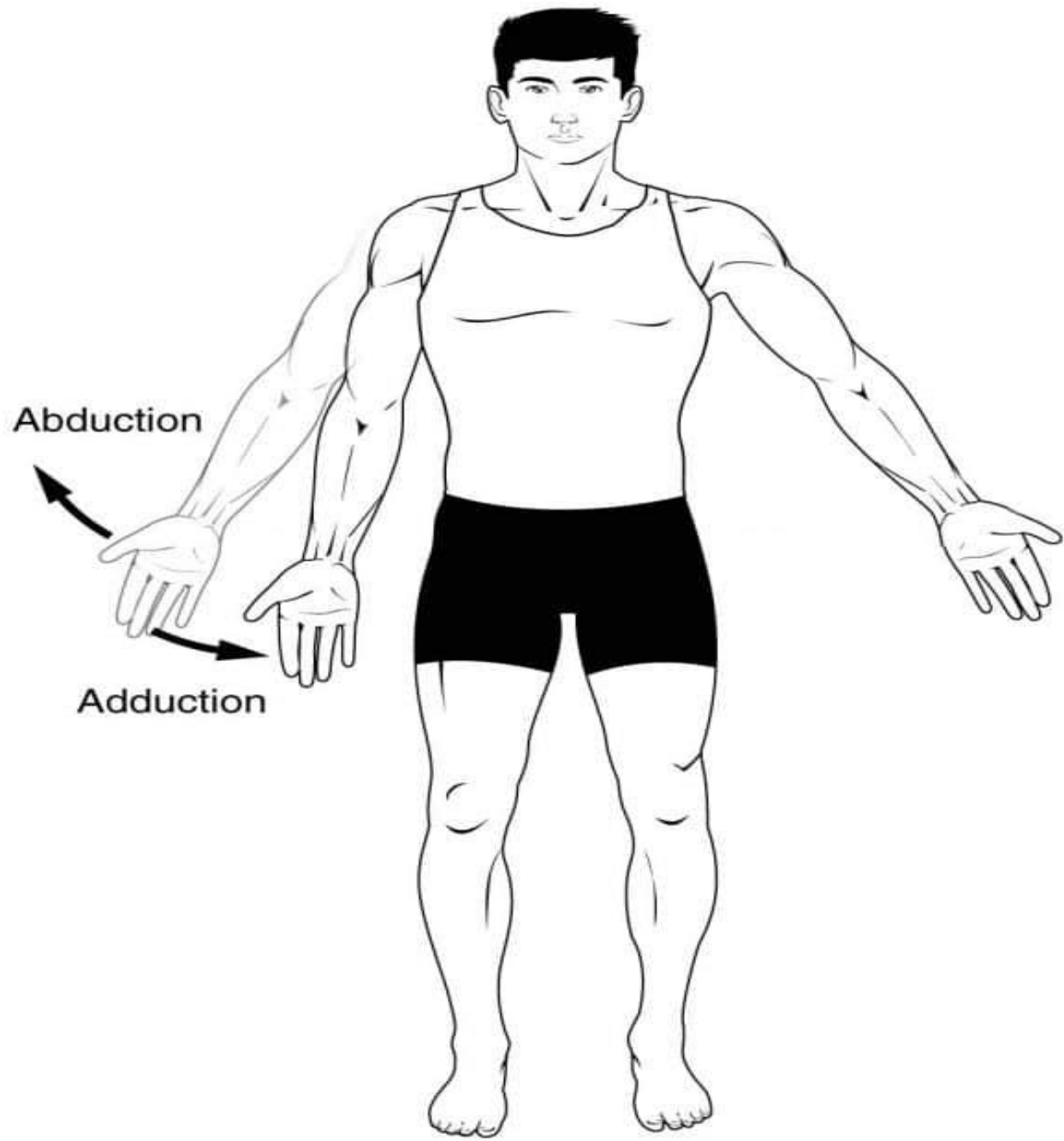
Medial rotation is a rotational movement towards the midline. It is sometimes referred to as internal rotation.

Lateral rotation is a rotating movement away from the midline.

Elevation and Depression

Elevation refers to movement in a superior direction (e.g. shoulder shrug).

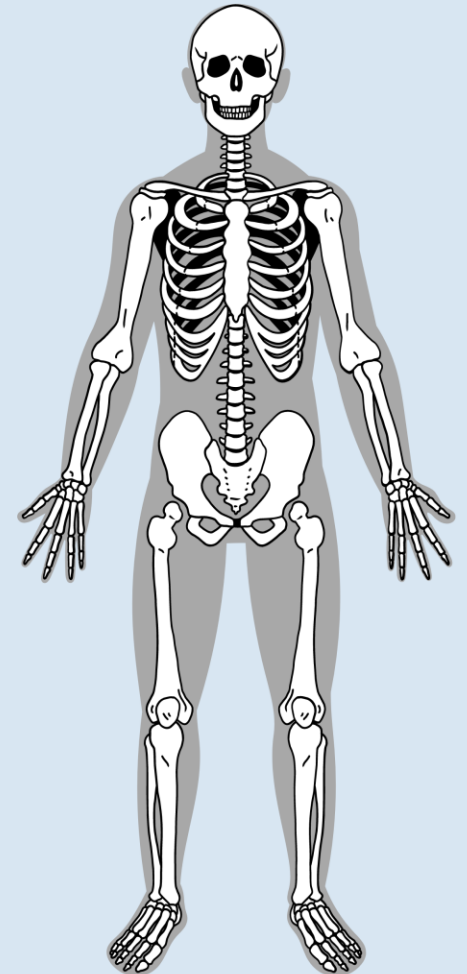
Depression refers to movement in an inferior direction.



Skeletal System

Has five main functions:

- **Provides us with a basic structure/shape**
- **Allows movement**
- **Protects vital organs**
- **Produces blood cells**
- **Storage of fats and minerals**





- 206 BONES
- CARTILAGE
- LIGAMENTS



THE HUMAN SKELETON



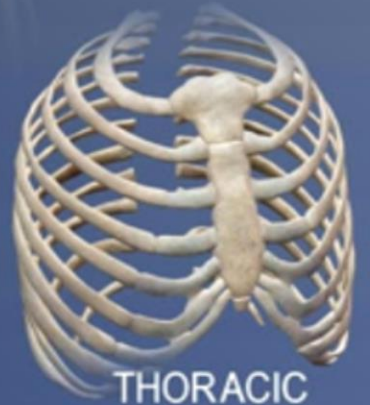
SKULL: 22



SHOULDER GIRDLE and
UPPER LIMBS: 64



VERTEBRAL
COLUMN: 33



THORACIC
CAGE: 25

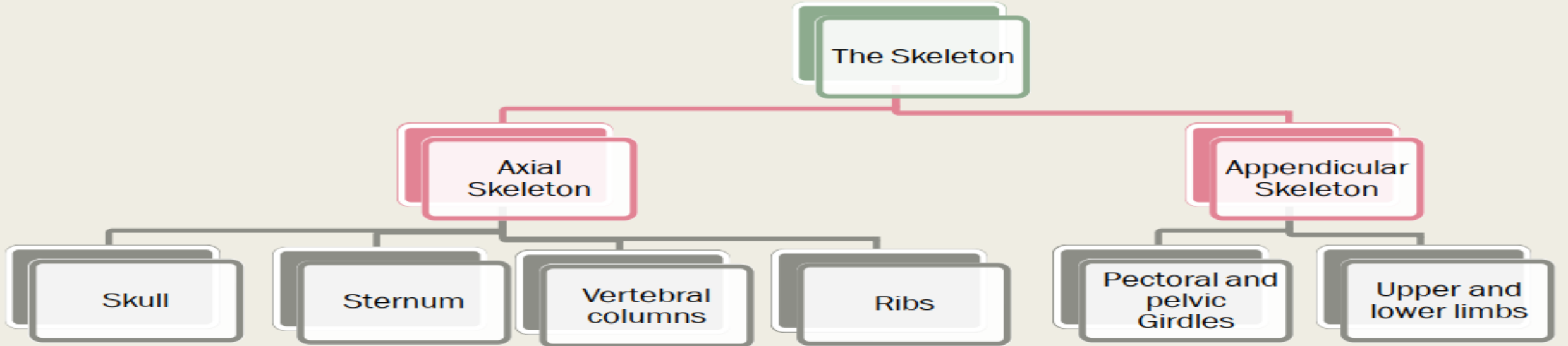


PELVIC GIRDLE and
LOWER LIMBS: 62

206 BONES

The Skeleton

The skeleton is formed from **206** Bones



When you look at the human skeleton the 206 bones and 32 teeth stand out. But look closer and you'll see even more structures. The human skeleton also includes **ligaments and cartilage**. Ligaments are bands of dense and fibrous connective tissue that are key to the function of joints. Cartilage is more flexible than bone but stiffer than muscle. Cartilage helps give structure to the larynx and nose. It is also found between the vertebrae and at the ends of bones like the femur.



APPENDICULAR
SKELETON

AXIAL
SKELETON

THE HUMAN SKELETON

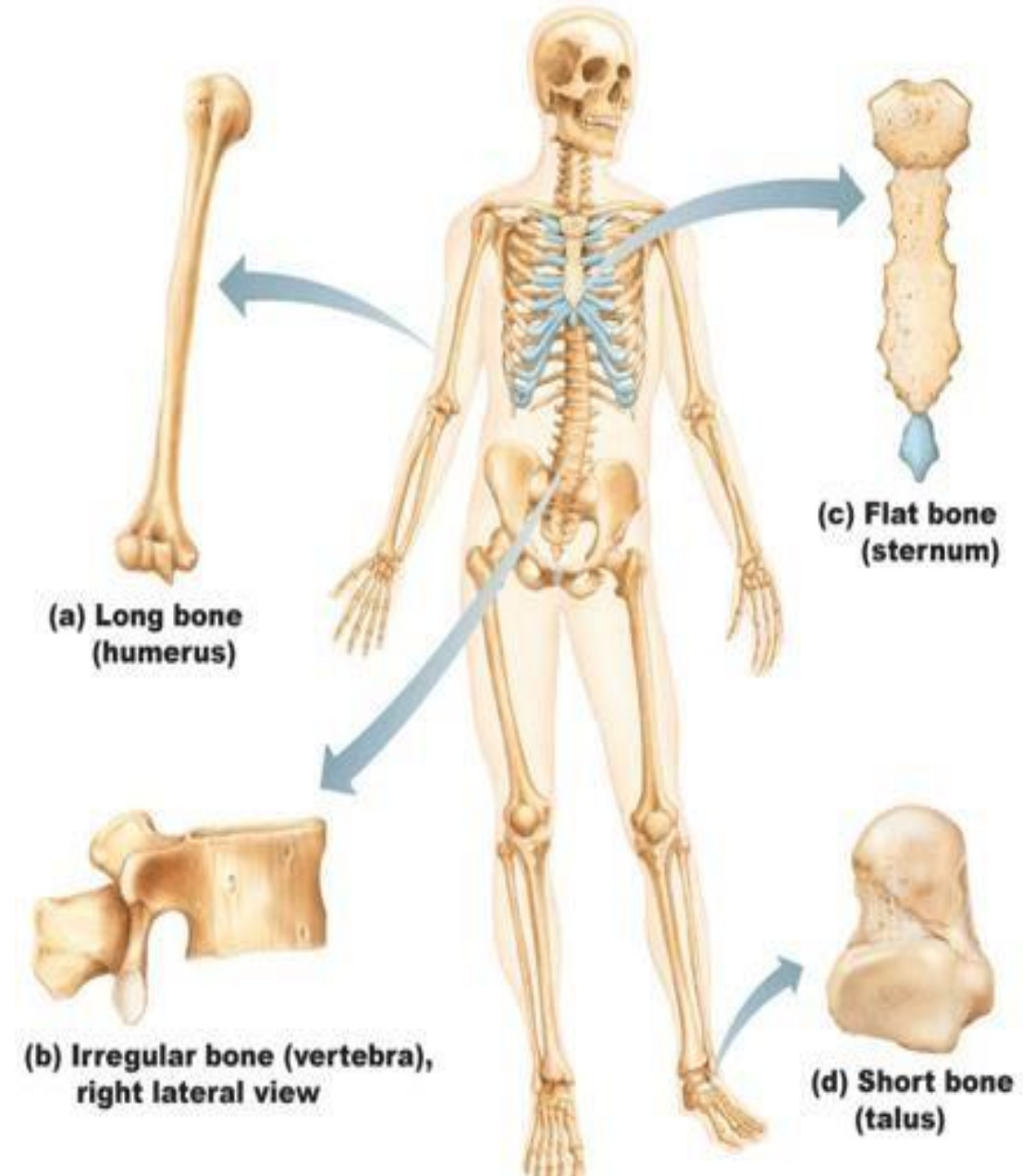
■ *Bones are classified based on three things:*

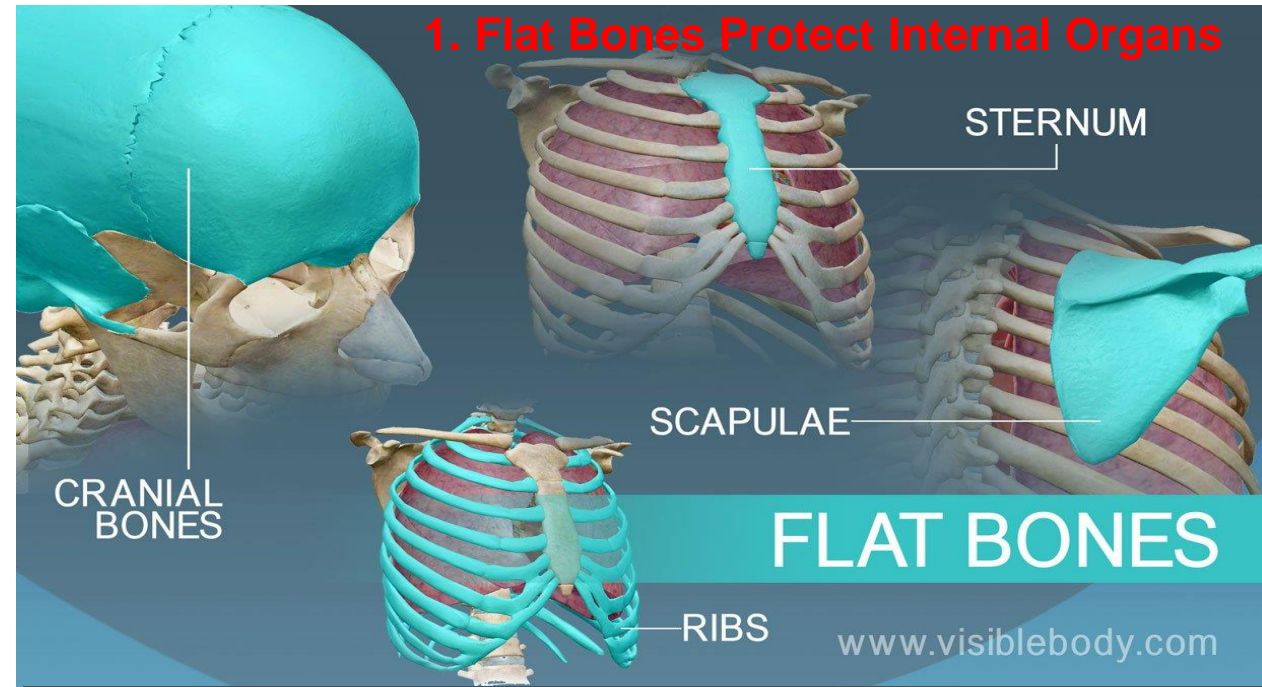
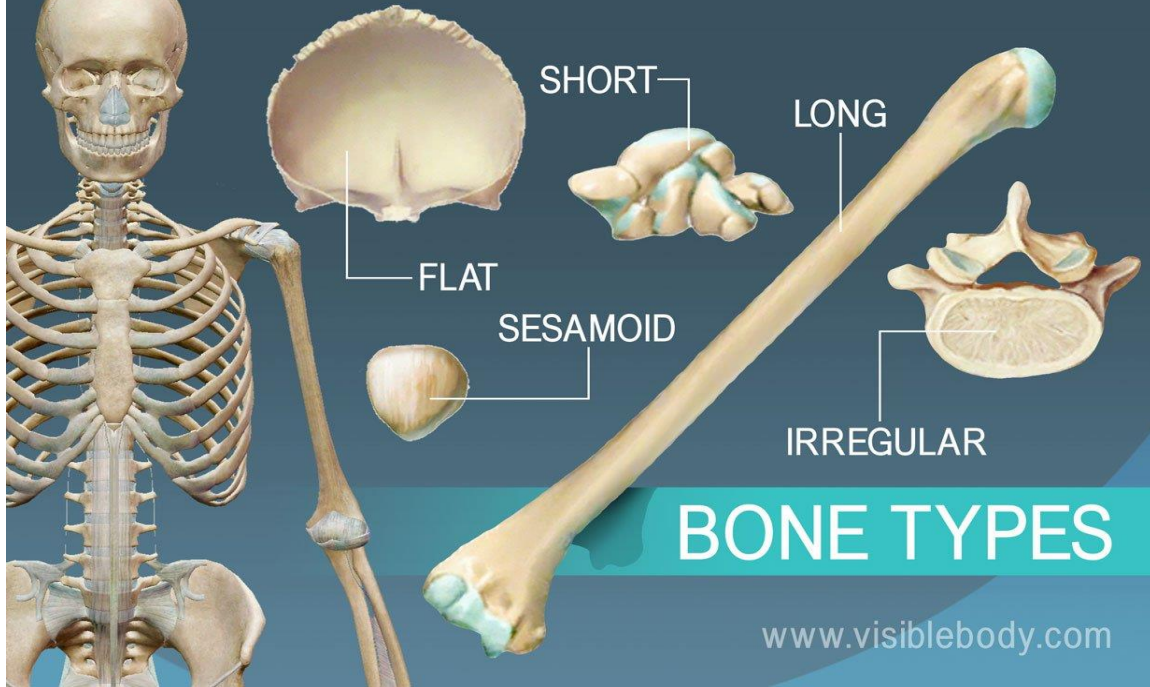
1 Shape: **Long, Short, Irregular, flat**

2 Structure: **Compact, Spongy**

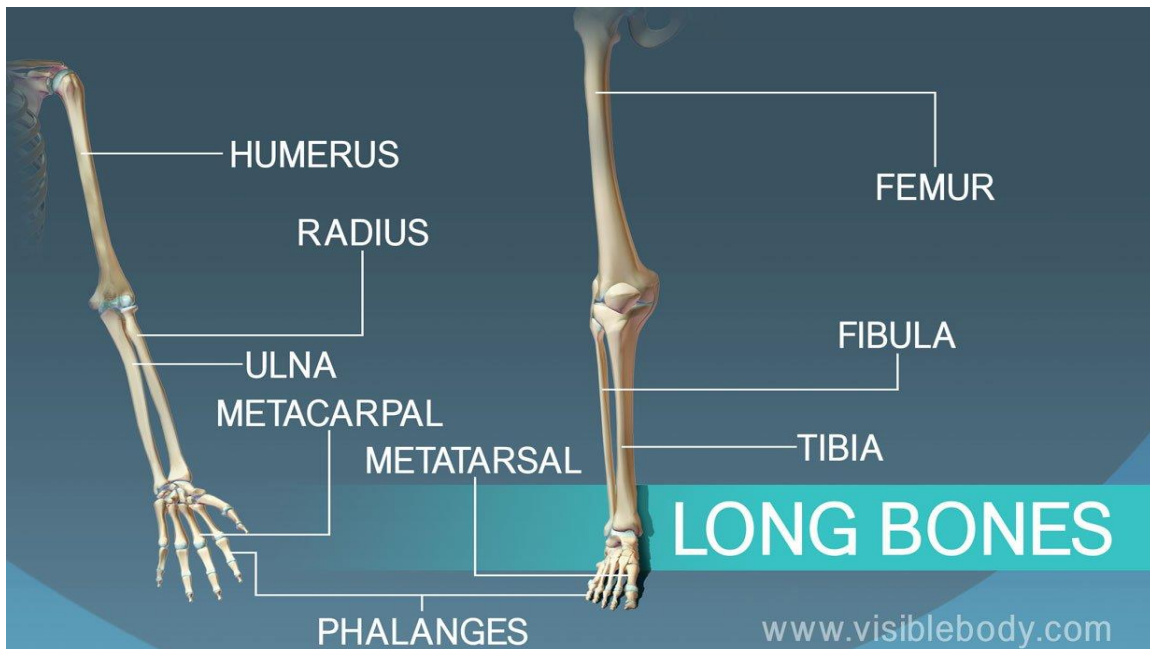
3 Development: **Membrane, Cartilage**

An infant skeleton has almost a hundred more bones than the skeleton of an adult.

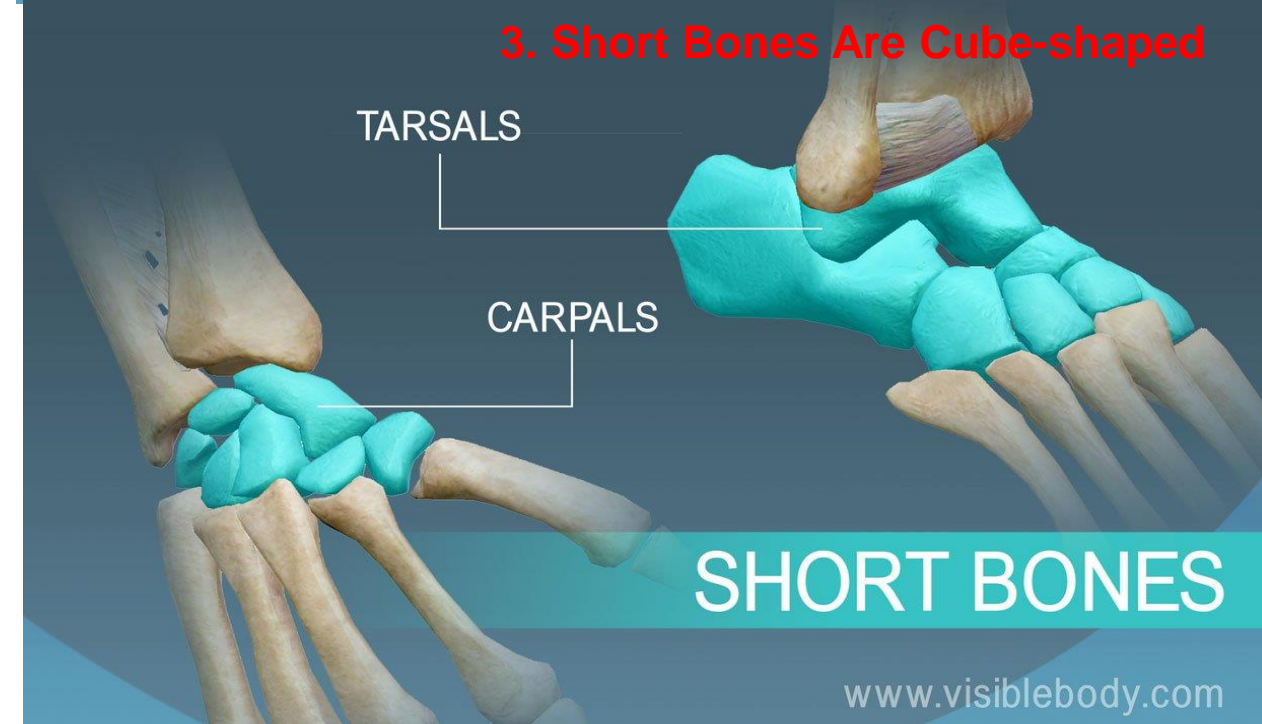




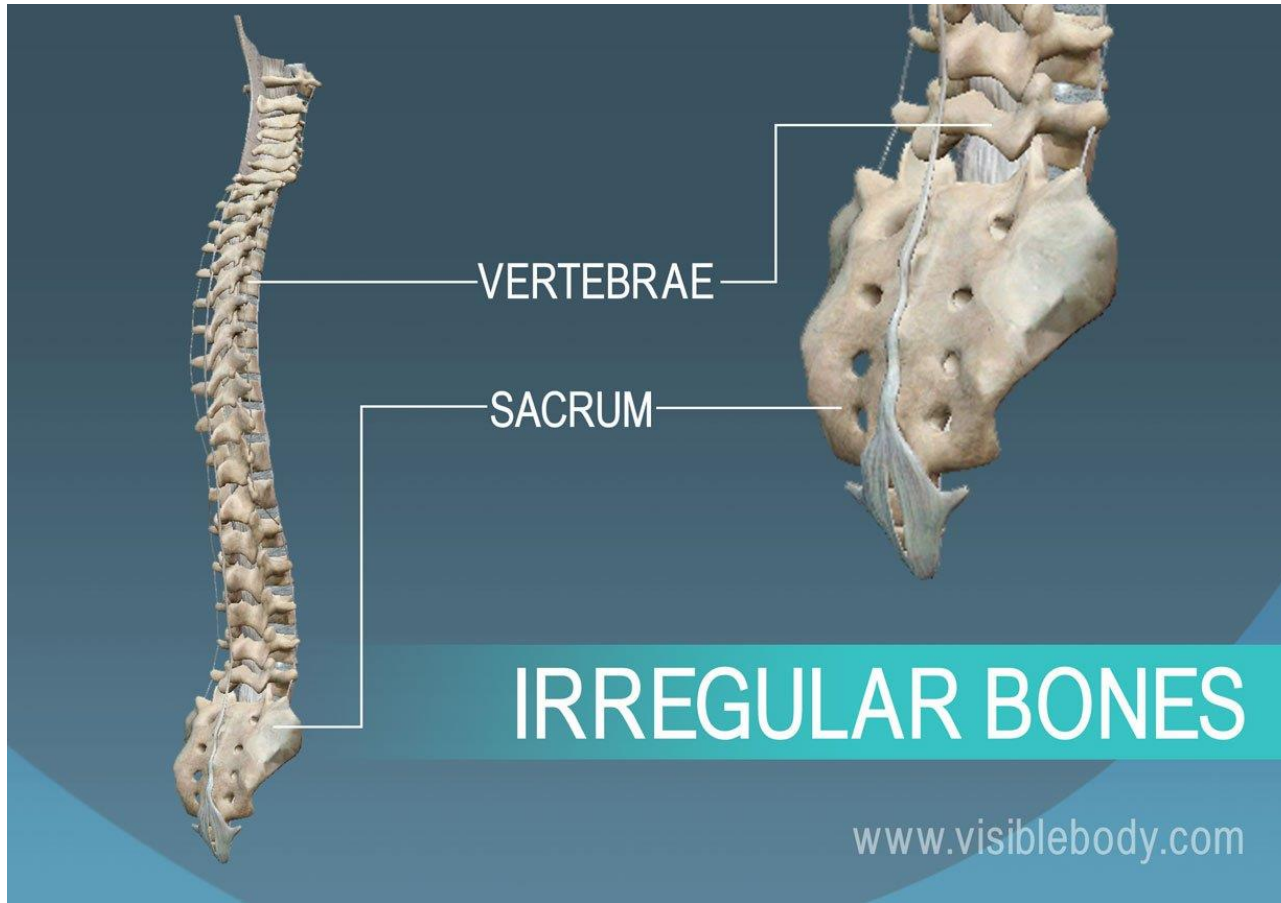
2. Long Bones Support Weight and Facilitate Movement



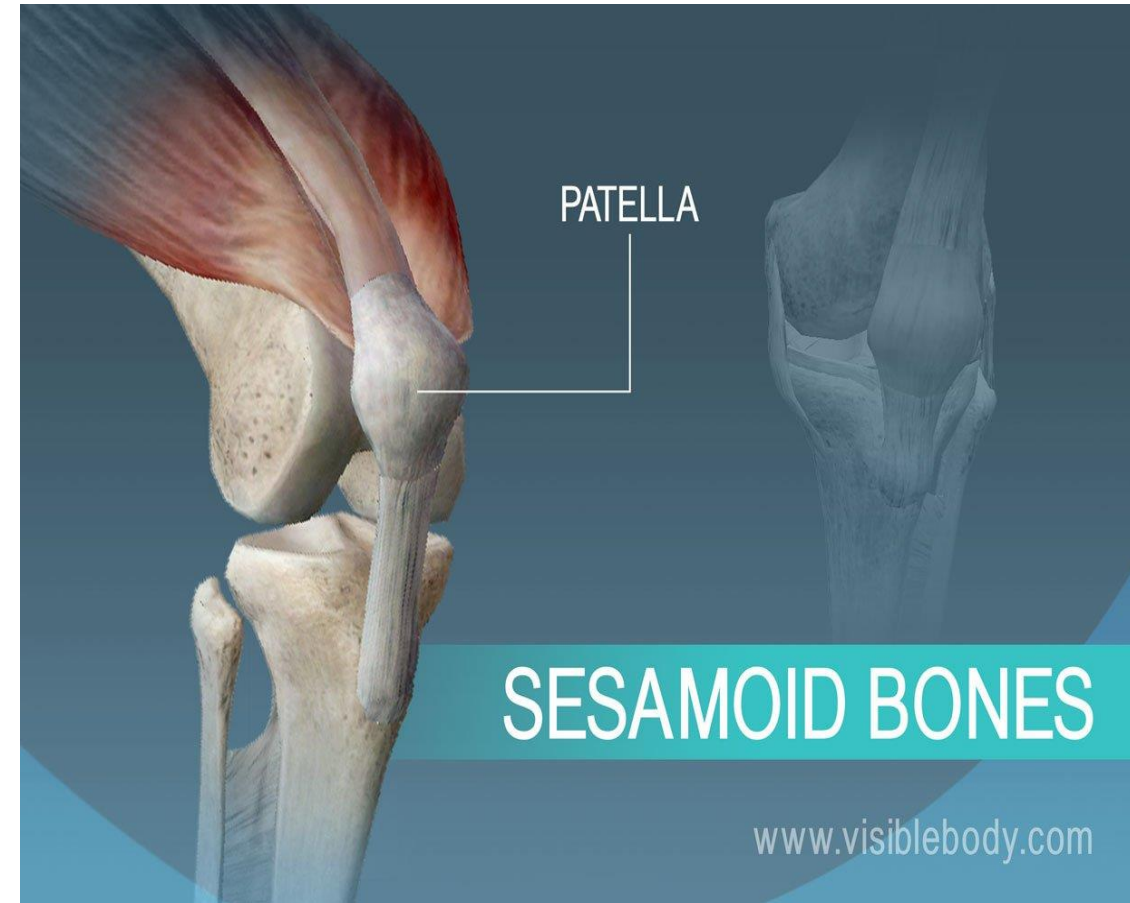
3. Short Bones Are Cube-shaped



4. Irregular Bones Have Complex Shapes



5. Sesamoid Bones Reinforce Tendons



There are **flat bones** in the skull (occipital, parietal, frontal, nasal, lacrimal, and vomer), the thoracic cage (sternum and ribs), and the pelvis (ilium, ischium, and pubis). The function of flat bones is to protect internal organs such as the brain, heart, and pelvic organs.

Sesamoid bones are bones embedded in tendons. These small, round bones are commonly found in the tendons of the hands, knees, and feet. Sesamoid bones function to protect tendons from stress and wear. The patella, commonly referred to as the kneecap, is an example of a sesamoid bone.



The bones of the human skeleton are divided into two groups. The **appendicular skeleton** includes all the bones that form the upper and lower limbs, and the shoulder and pelvic girdles.

The **axial skeleton** includes all the bones along the body's long axis .

The **axial skeleton** includes the bones that form the skull, laryngeal skeleton, vertebral column, and thoracic cage. The bones of the appendicular skeleton (the limbs and girdles) “append” to the axial skeleton.

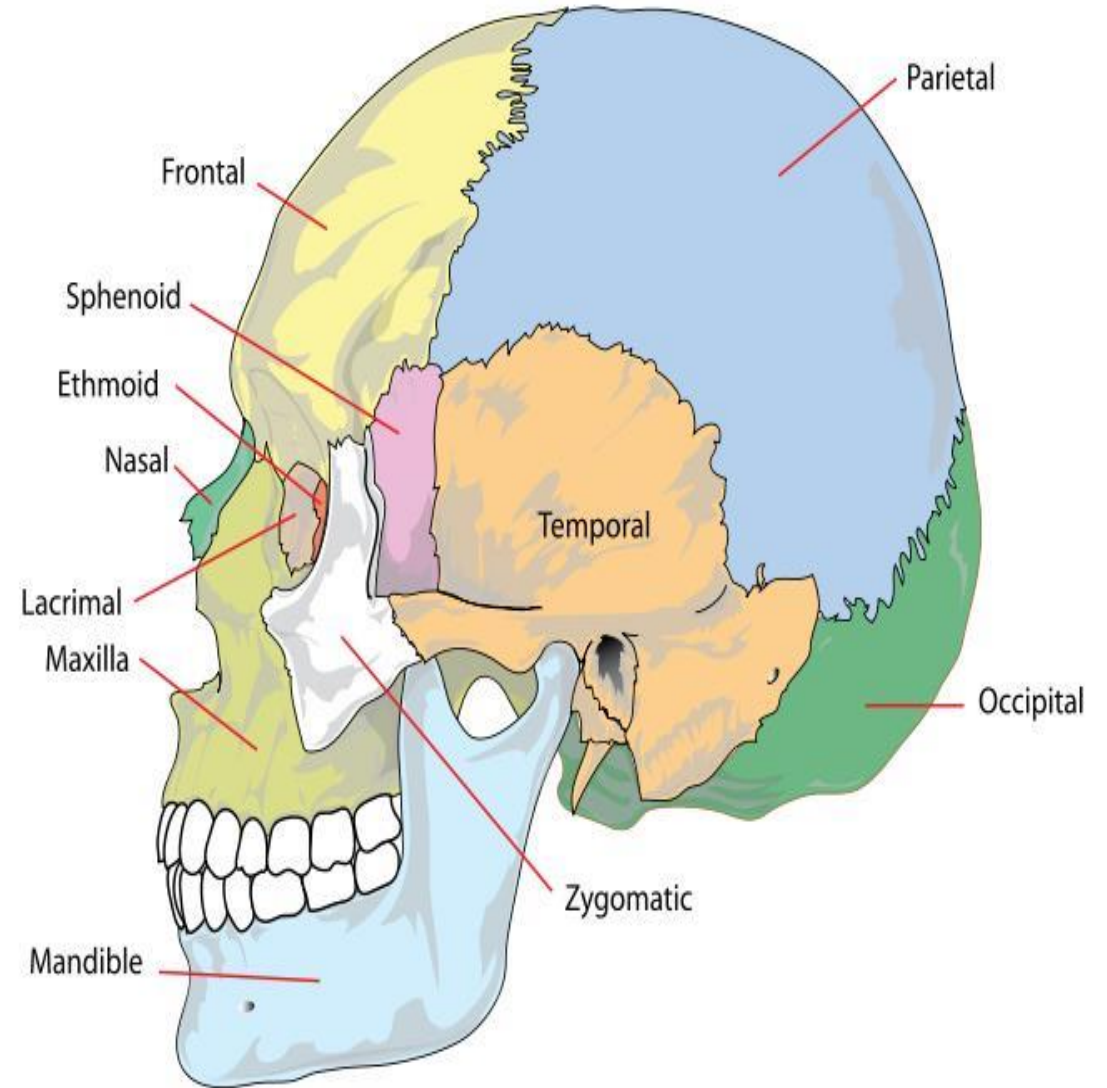
Bones of the axial skeleton

The Skull

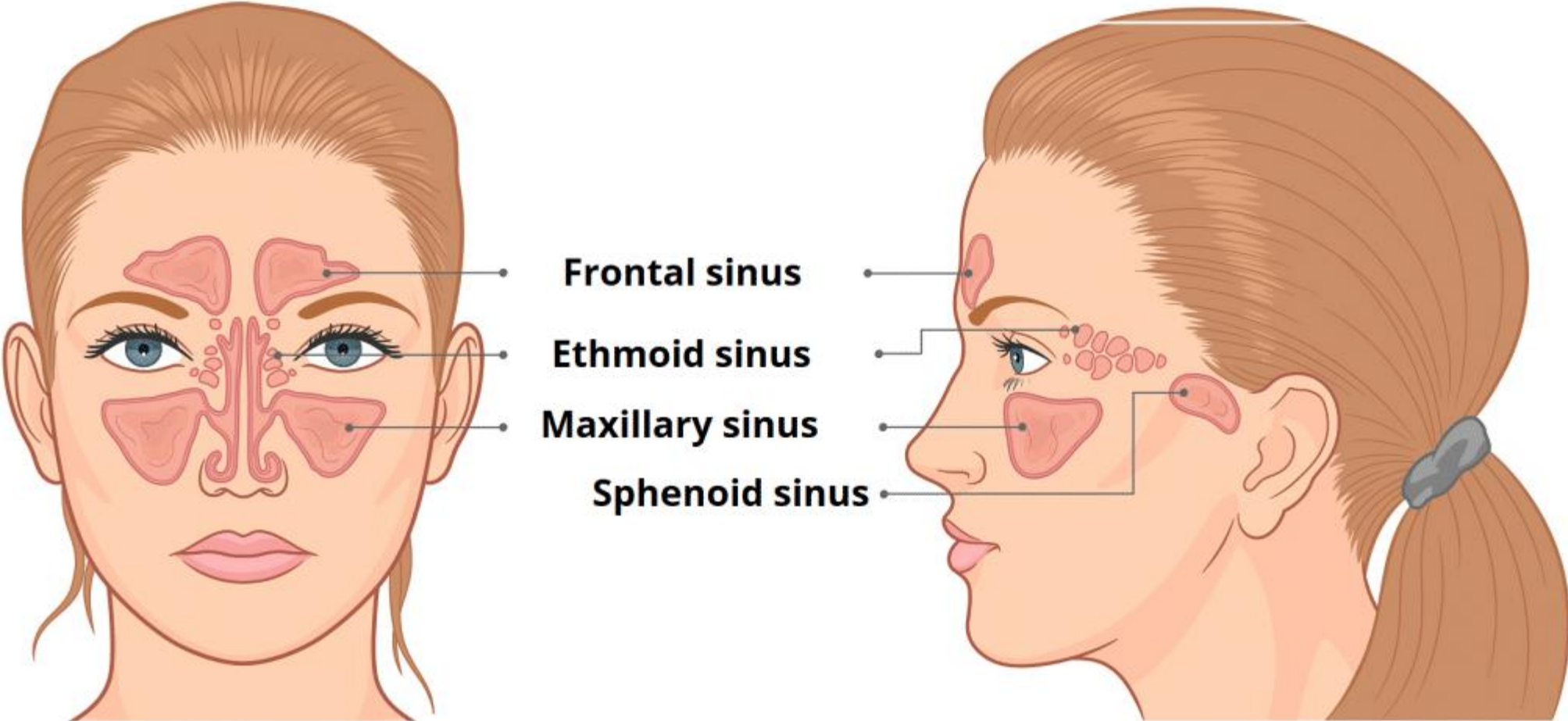
Formed from two sets of bones:

1. **Cranium**(bones enclosing and covering the brain): **Frontal, Temporal, Occipital, Parietal, Sphenoid**

2. **Facial bones** (bones that form the skeleton of the face): **Maxilla, Nasal, Zygomatic, Mandible**



The **paranasal sinuses** are air-filled extensions of the nasal cavity. There are four paired sinuses – named according to the bone in which they are located – maxillary, frontal, sphenoid and ethmoid. Each sinus is lined by a ciliated pseudostratified epithelium, interspersed with mucus-secreting goblet cells.



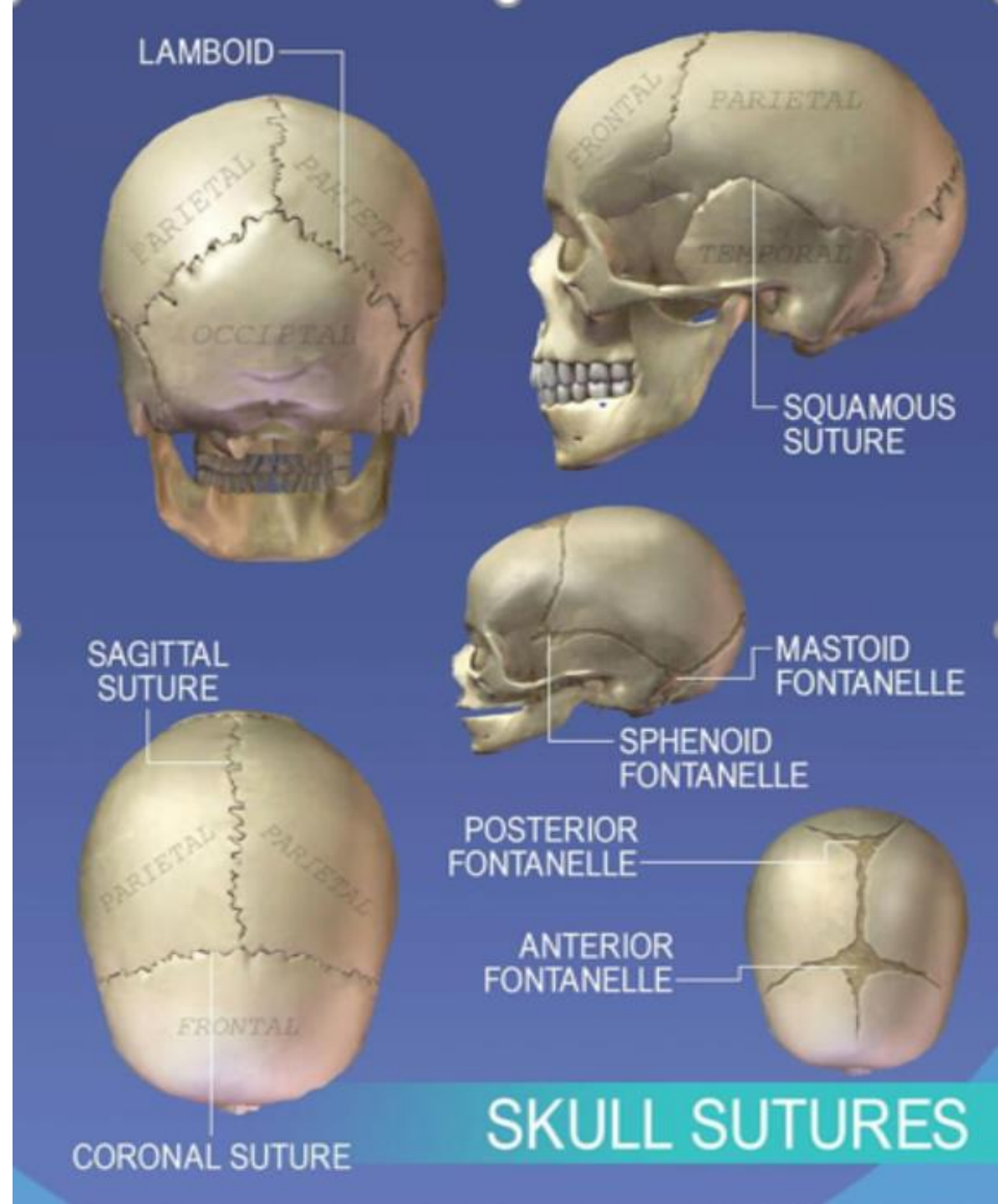
Skull Sutures

In fetuses and newborn infants, cranial bones are connected by flexible fibrous sutures, including large regions of fibrous membranes called **fontanelles**.

These regions allow the skull to enlarge to accommodate the growing brain.

The sphenoidal, mastoid, and **posterior fontanelles** close after two months, while the **anterior fontanelle** may exist for up to two years.

As fontanelles close, sutures develop. Skull sutures are immobile joints where cranial bones are connected with dense fibrous tissue.



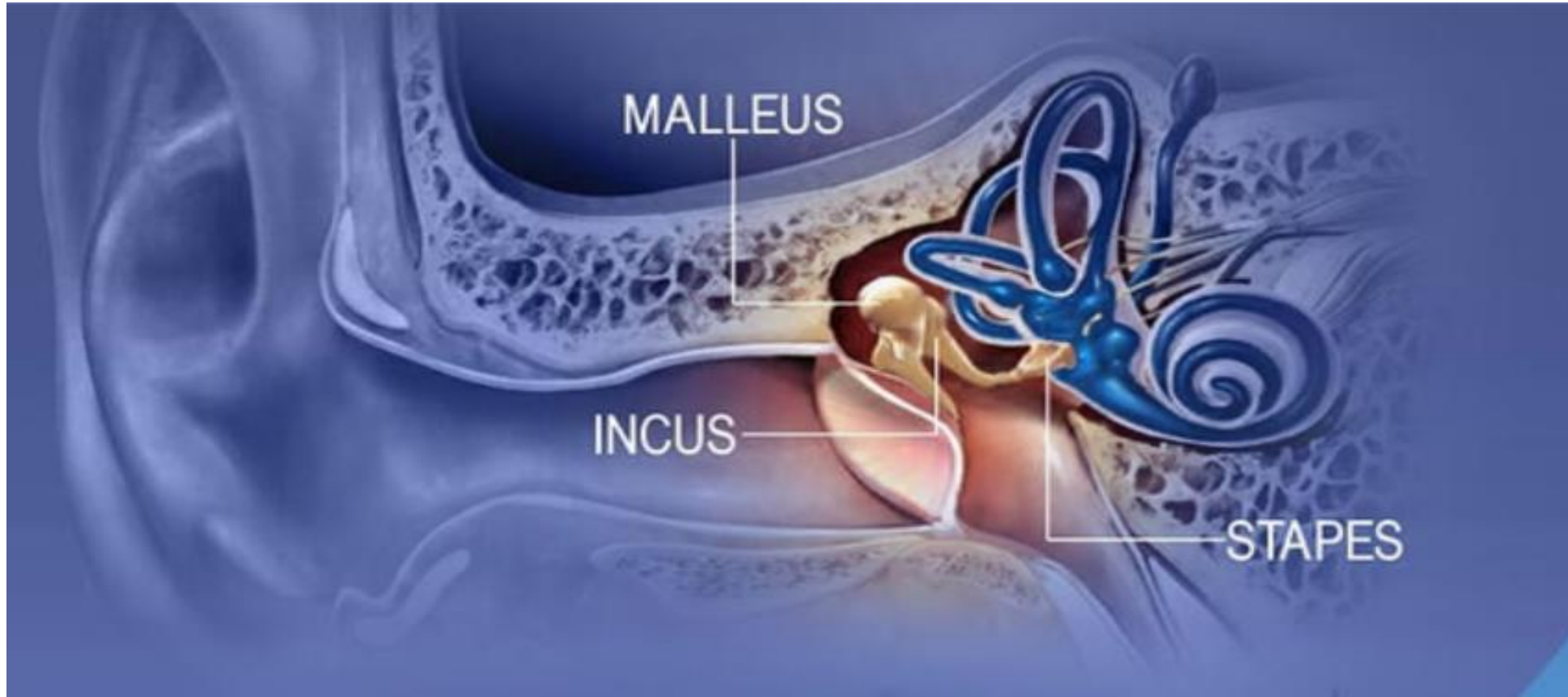
The Hyoid Bone, Laryngeal Skeleton, and Bones of the Middle Ear Are Commonly Categorized with Skull Bones

Laryngeal Skeleton

The **laryngeal skeleton**, also known as the larynx or voice box, is composed of nine cartilages.

It is located between the trachea and the root of the tongue. The hyoid bone provides an anchor point. The movements of the laryngeal skeleton both open and close the glottis and regulate the degree of tension of the vocal folds, which—when air is forced through them—produce vocal sounds.





Bones of the Middle Ear

Inside the petrous part of the temporal bone are the three smallest bones of the body: the malleus, incus, and stapes. These three bones articulate with each other and transfer vibrations from the tympanic membrane to the inner ear.

VERTEBRAL COLUMN

It is a flexible curved structure formed of **33** vertebrae (irregular bones).

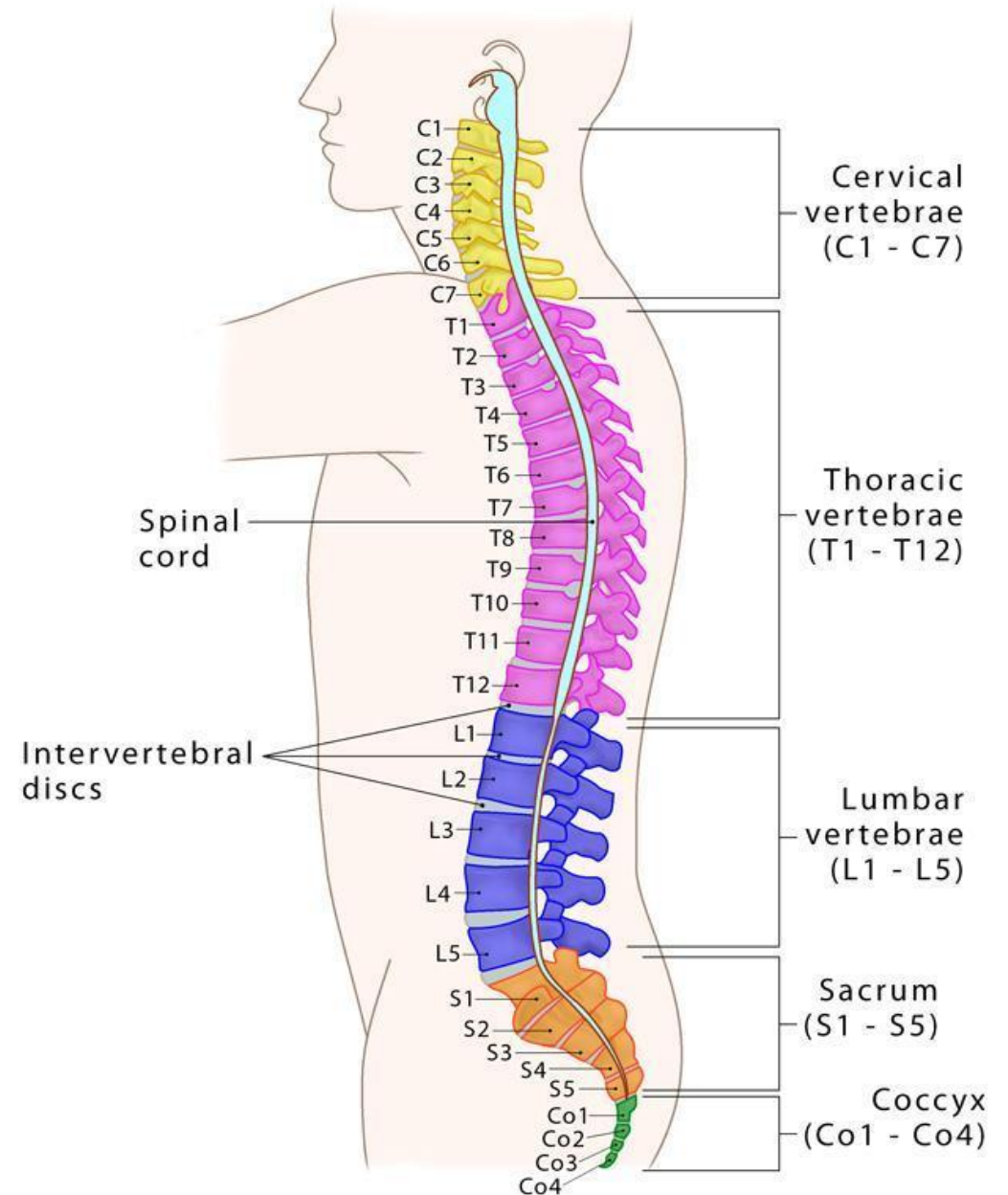
Running through its cavity is the spinal cord

Formed of :

1. **Cervical vertebrae** 7
2. **Thoracic vertebrae** 12
3. **Lumbar vertebrae** 5
4. **Sacral vertebrae fused to form sacrum**
(triangular bone) 5
5. **coccygeal vertebrae fused to form coccyx**
(small bone) 4

Vertebral Column

(Composed of 33 vertebrae)



Sternum (Flat bone) :

Has 3 parts :

1. Manubrium
2. Body
3. Xiphoid process

Ribs :

Number: T vertebrae **12 pairs**

All ribs articulate with T vertebrae

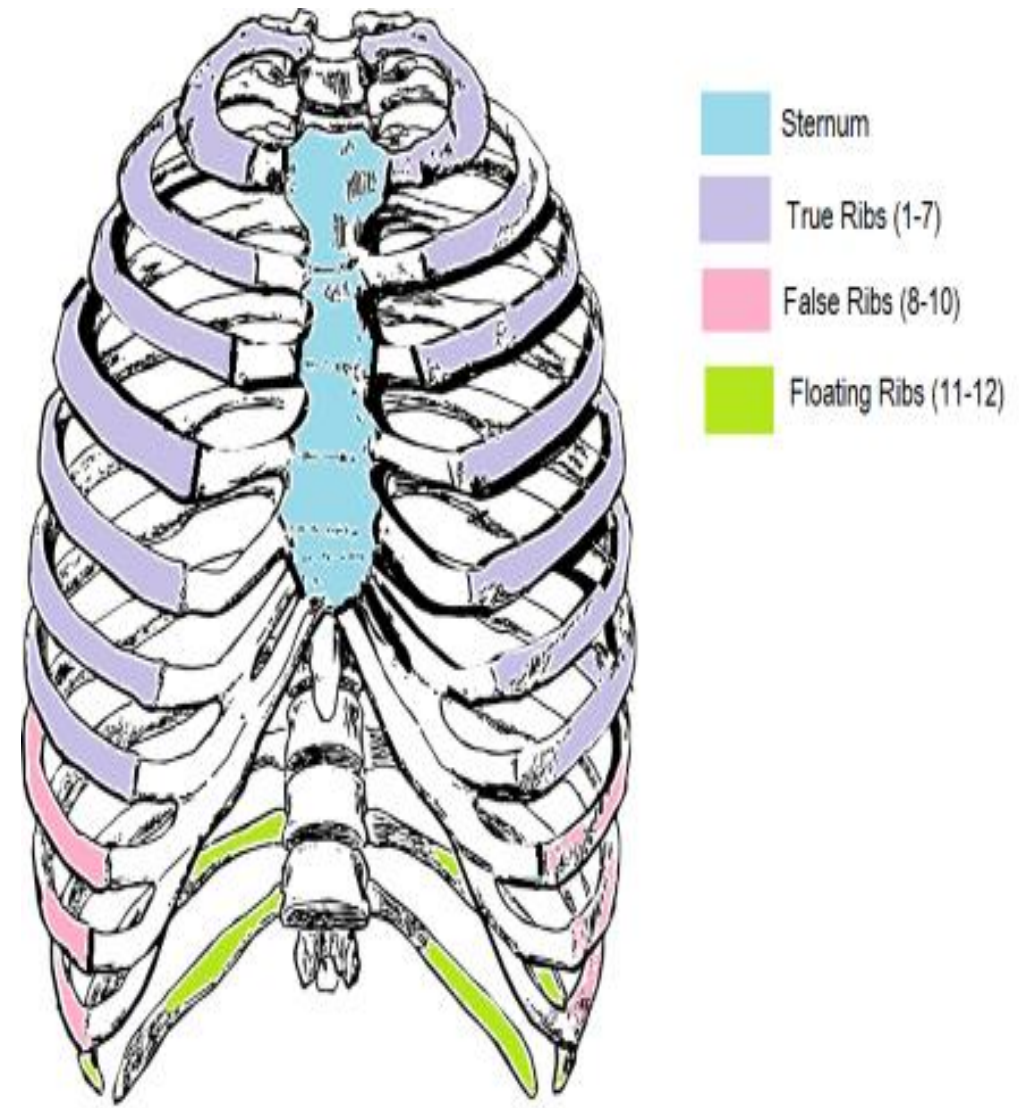
Only upper **7 pairs** articulate with sternum

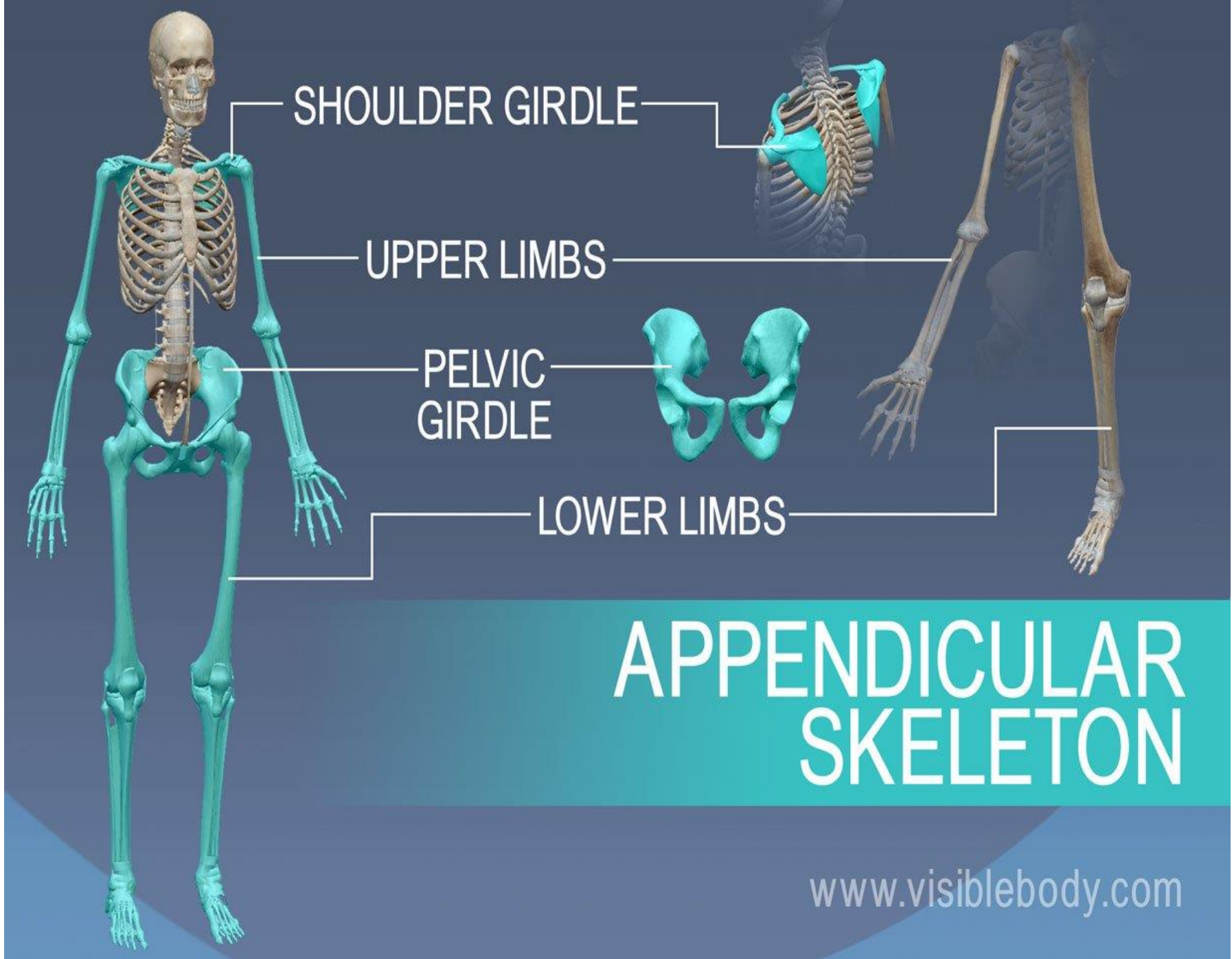
The first **7** are called **true ribs**

The ribs **8,9** and **10** are called **False ribs**

The ribs **11** and **12** are called **Floating ribs**

The **thoracic cage**, formed by **the ribs and sternum**, protects internal organs and gives attachment to muscles involved in respiration and upper limb movement.





SHOULDER GIRDLE

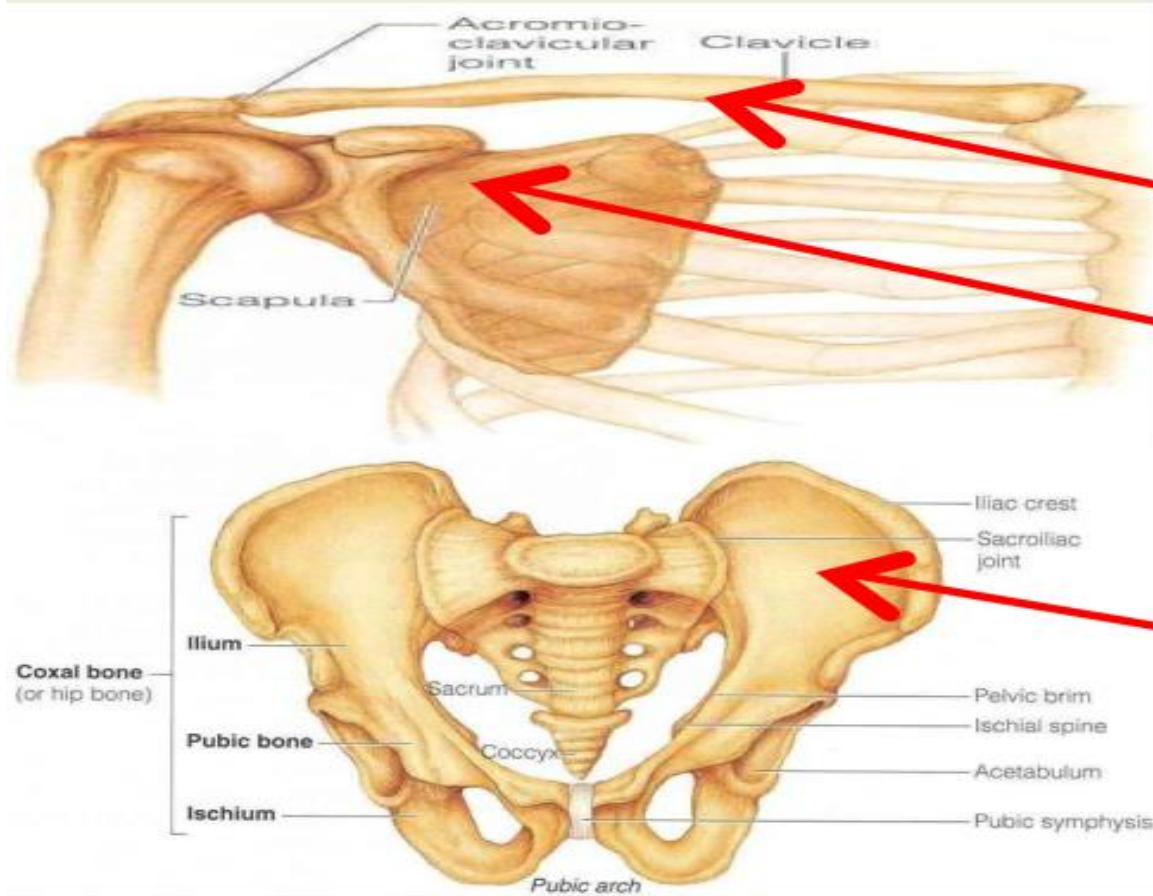
UPPER LIMBS

PELVIC GIRDLE

LOWER LIMBS

APPENDICULAR SKELETON

BONES OF APPENDICULAR SKELETON



PECTORAL GIRDLE

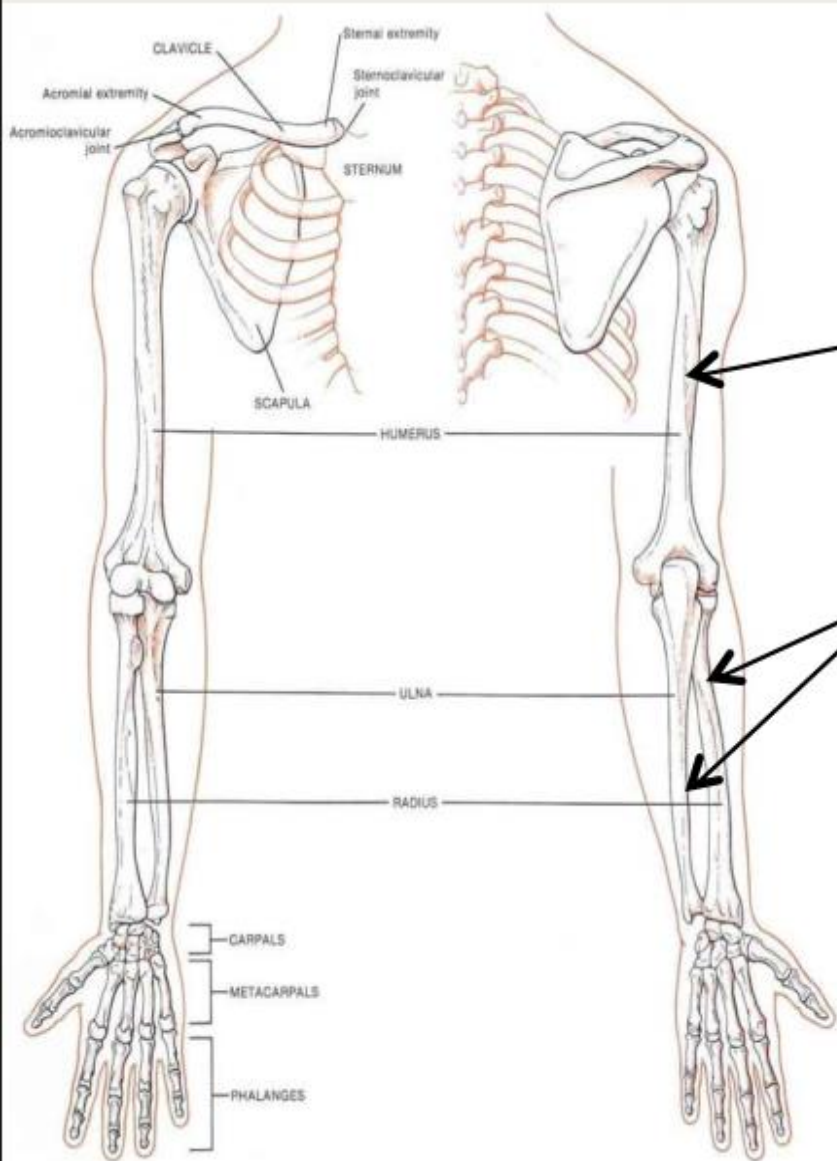
- ❑ Connects upper limb with axial skeleton
- ❑ Formed of: **clavicle & scapula** (2 bones on each side)

PELVIC GIRDLE

- ❑ Connects lower limb with axial skeleton
- ❑ Formed of: **hip bone** (one bone on each side)

Each hip bone is a large, flattened, and irregularly shaped fusion of three bones: the **ilium, ischium, and pubis**.

BONES OF APPENDICULAR SKELETON



UPPER LIMB

- Bone of arm: humerus
- Bones of forearm: radius (lateral) & ulna (medial)
- Bones of hand:
 - 8 carpal bones
 - 5 metacarpal bones
 - 14 phalanges: 2 for the thumb & 3 for each of medial 4 fingers

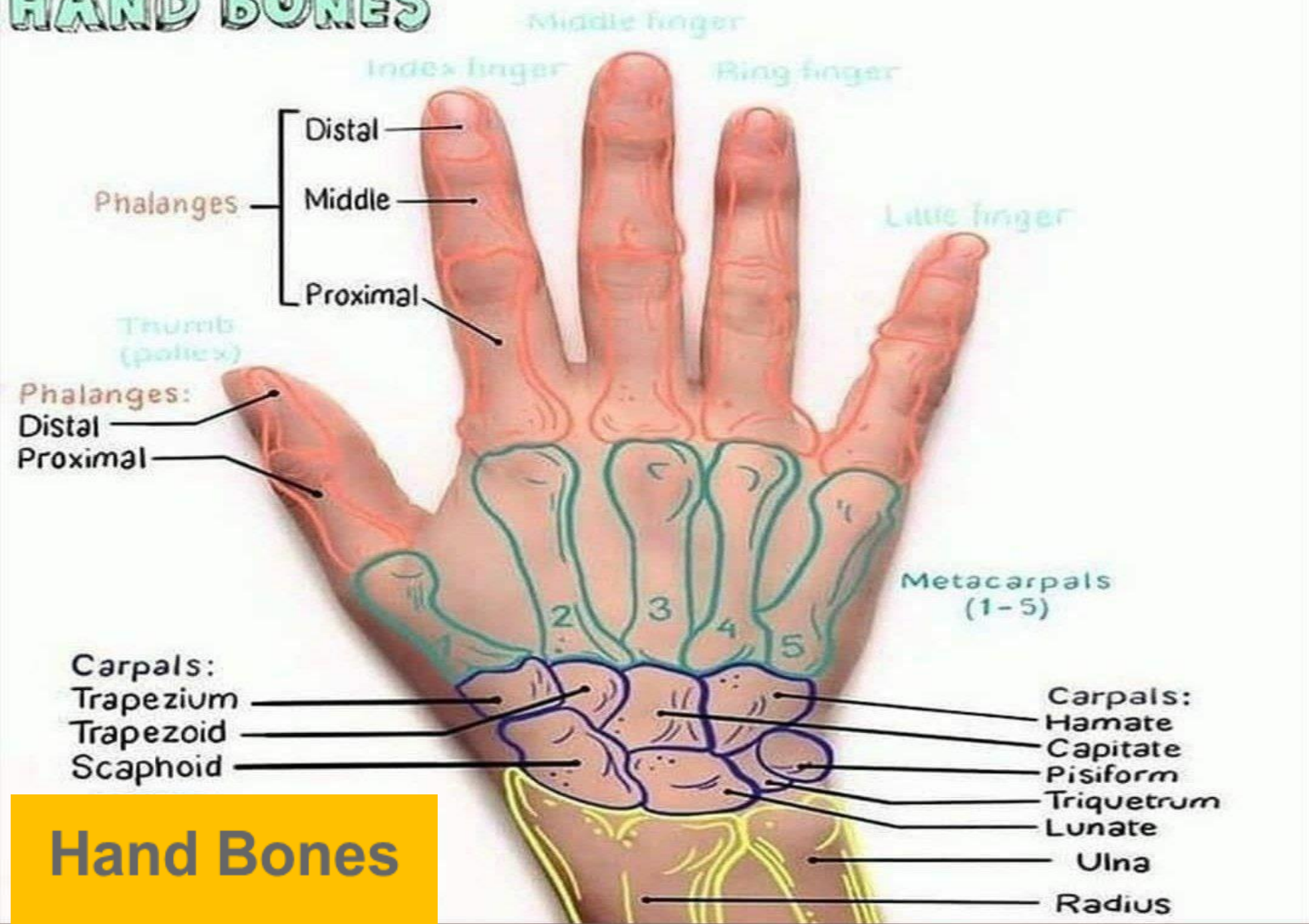
The **upper limbs**:

include the bones of the arm (**humerus**), forearm (**radius and ulna**), wrist, and hand.

The only bone of the arm is the humerus, which articulates with the forearm bones—the radius and ulna—at the elbow joint.

The ulna is the larger of the two forearm bones.

HAND BONES

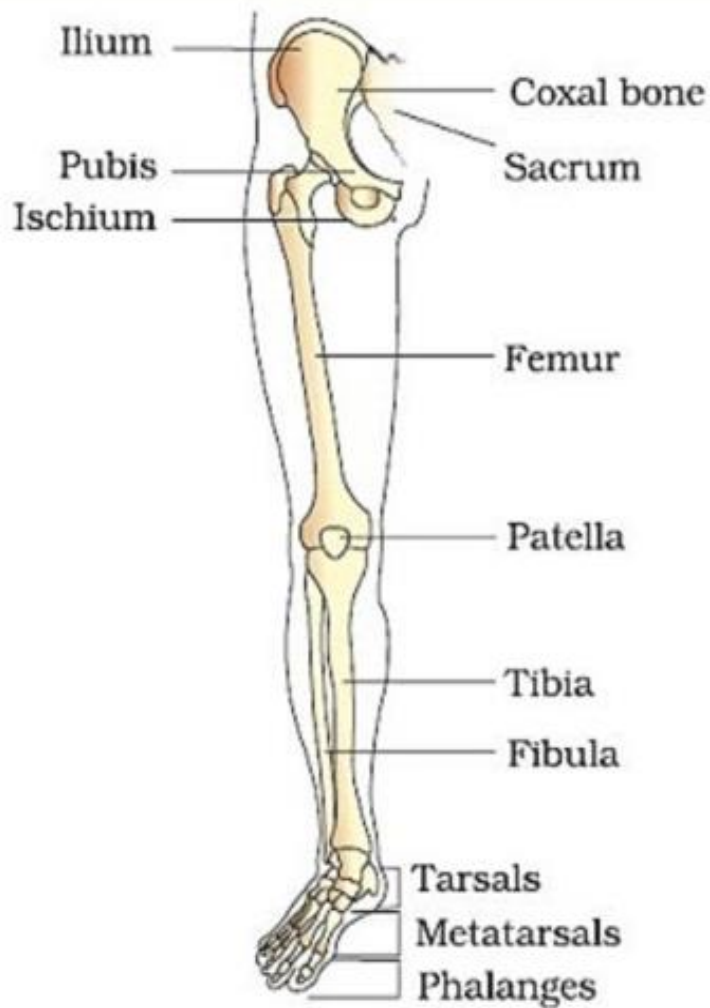


Hand Bones:

The hand includes 8 bones in the wrist, 5 bones that form the palm, and 14 bones that form the fingers and thumb.

The wrist bones are called **carpals**. The bones that form the palm of the hand are called **metacarpals**. The **phalanges** are the bones of the fingers.

Hand Bones



BONES OF APPENDICULAR SKELETON

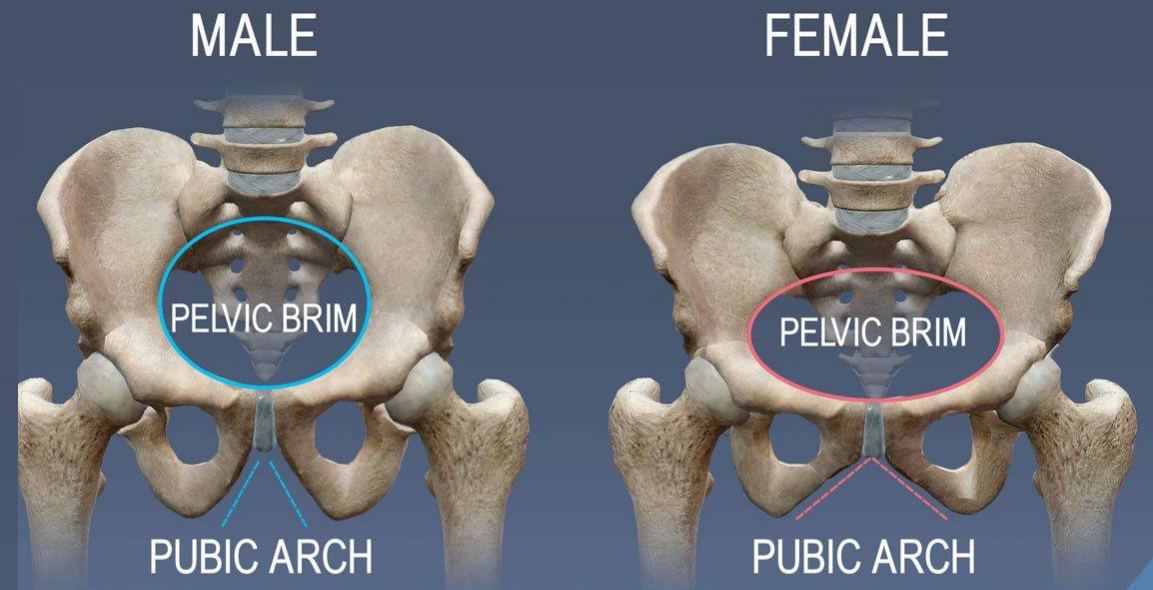
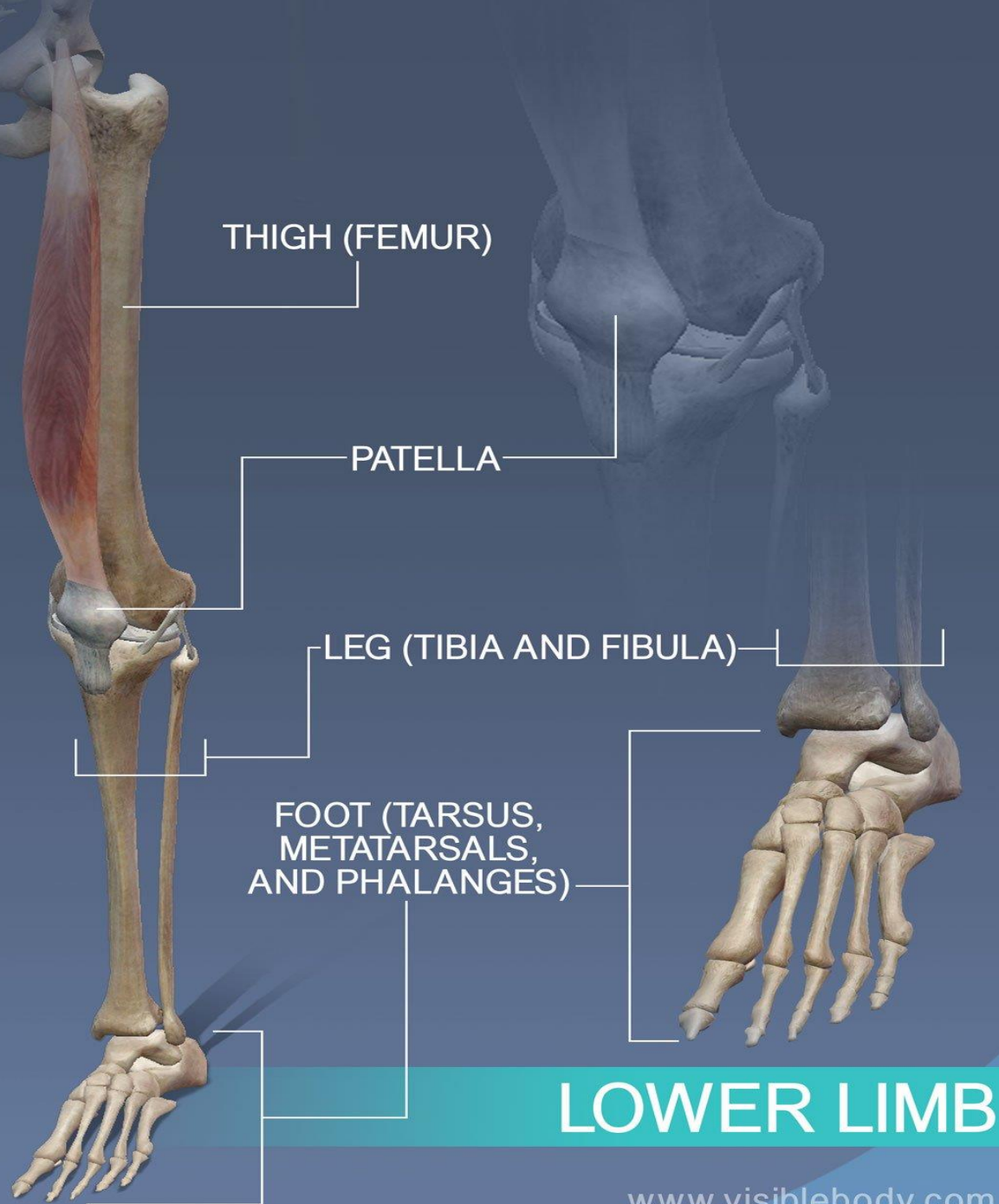
Lower limb

- ❑ Bones of thigh → **Femur** .
- ❑ Bones of leg → **Fibula (lateral) & Tibia (medial)**.
 - ❑ Patella.
 - ❑ Bones of foot :
 - i. **7 tarsal bones** .
 - ii. **5 metatarsal bones**
 - iii. **14 phalanges** 2 for big toe & 3 for each four lateral toes .

The **lower limbs**

include the bones of the thigh, leg, and foot. **The femur** is the only bone of the thigh. It articulates with the two bones of the leg—the larger **tibia** (commonly known as the shin) and smaller **fibula**.

The thigh and leg bones articulate at the knee joint that is protected and enhanced by the patella bone. The bones of the foot include the **tarsus**, **metatarsus**, and **phalanges**.



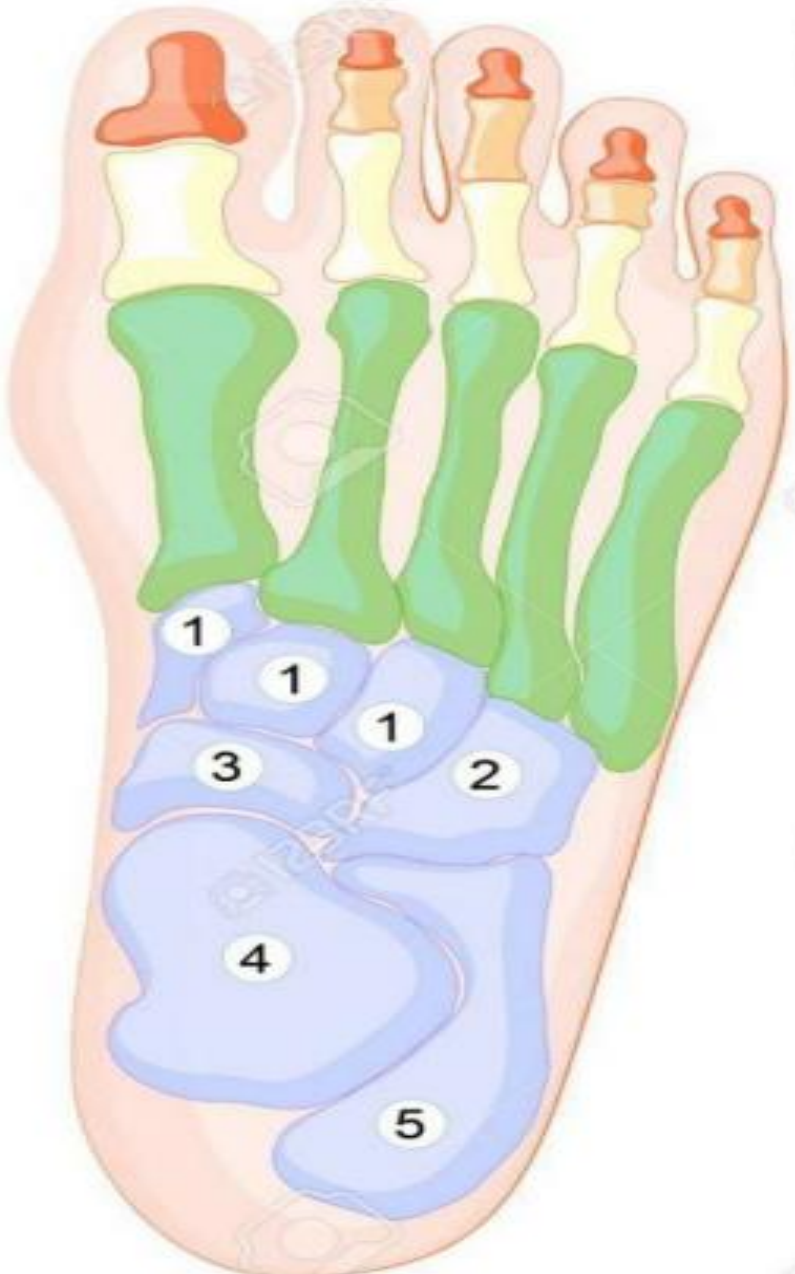
Female and Male Pelvis. The female and male pelvises differ in several ways due to childbearing adaptations in the female.

The female pelvic brim is larger and wider than the male's.

The male pelvis is deeper and has a narrower pelvic outlet than the female's.

BONES OF FOOT

- Distal phalanges
- Middle phalanges
- Proximal phalanges
- Metatarsal bones
- Tarsus:
 - 1. Cuneiform bones
 - 2. Cuboid
 - 3. Navicular
 - 4. Talus
 - 5. Calcaneus



Foot Bones.

The bones of the foot consist of the **tarsal bones** of the ankle, the **phalanges** that form the toes, and the **metatarsals** that give the foot its arch.

As in the hand, the foot has five metatarsals, five proximal phalanges, five distal phalanges, but only four middle phalanges (as the foot's "big toe" has only two phalanges).

LONG BONES

Diaphysis (shaft)

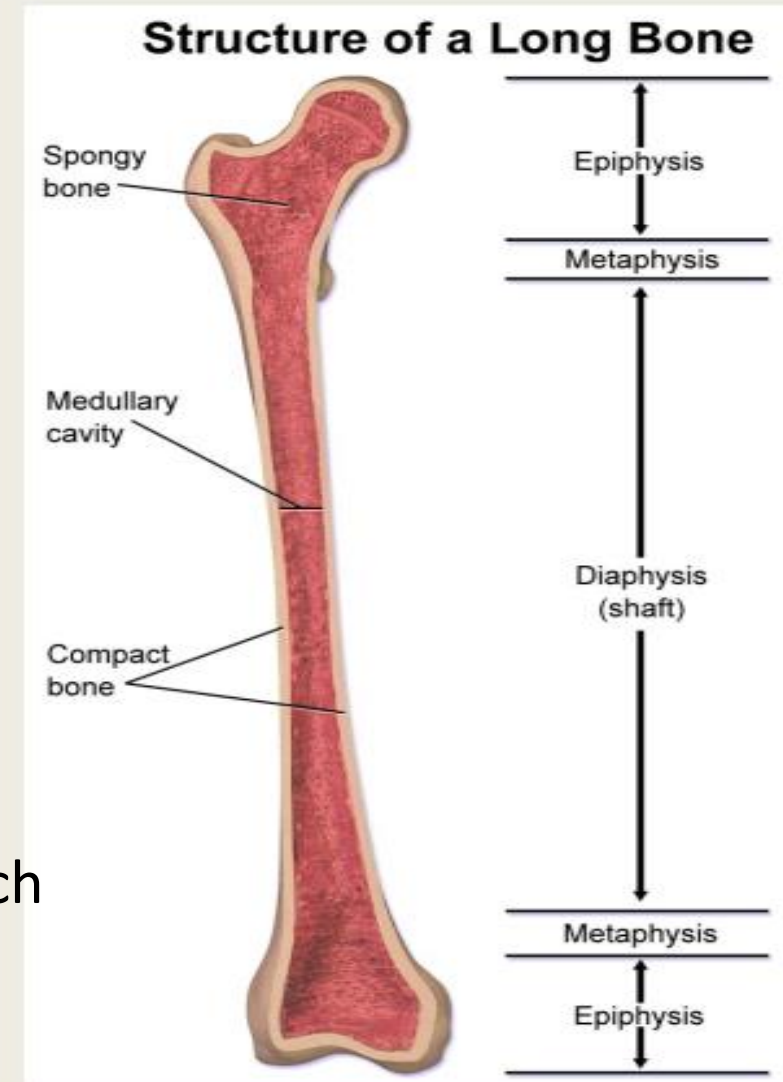
- long & cylindrical
- Compact bone
- Covered on its external surface by a fibrous connective tissue membrane called the **periosteum**.
- Has a cavity called the **marrow cavity** In adults, the marrow cavity is a storage area for **fat** and contains **yellow marrow**. In infants, it contains **red marrow** and is the site of **blood cells formation**

metaphysis (The region between diaphysis and epiphysis)

contains thin plate of cartilage called the **epiphyseal plate** that is responsible for the lengthwise growth of the long bones.

Epiphysis (wide part at each end)

Mostly **spongy bone** (trabecular bone)



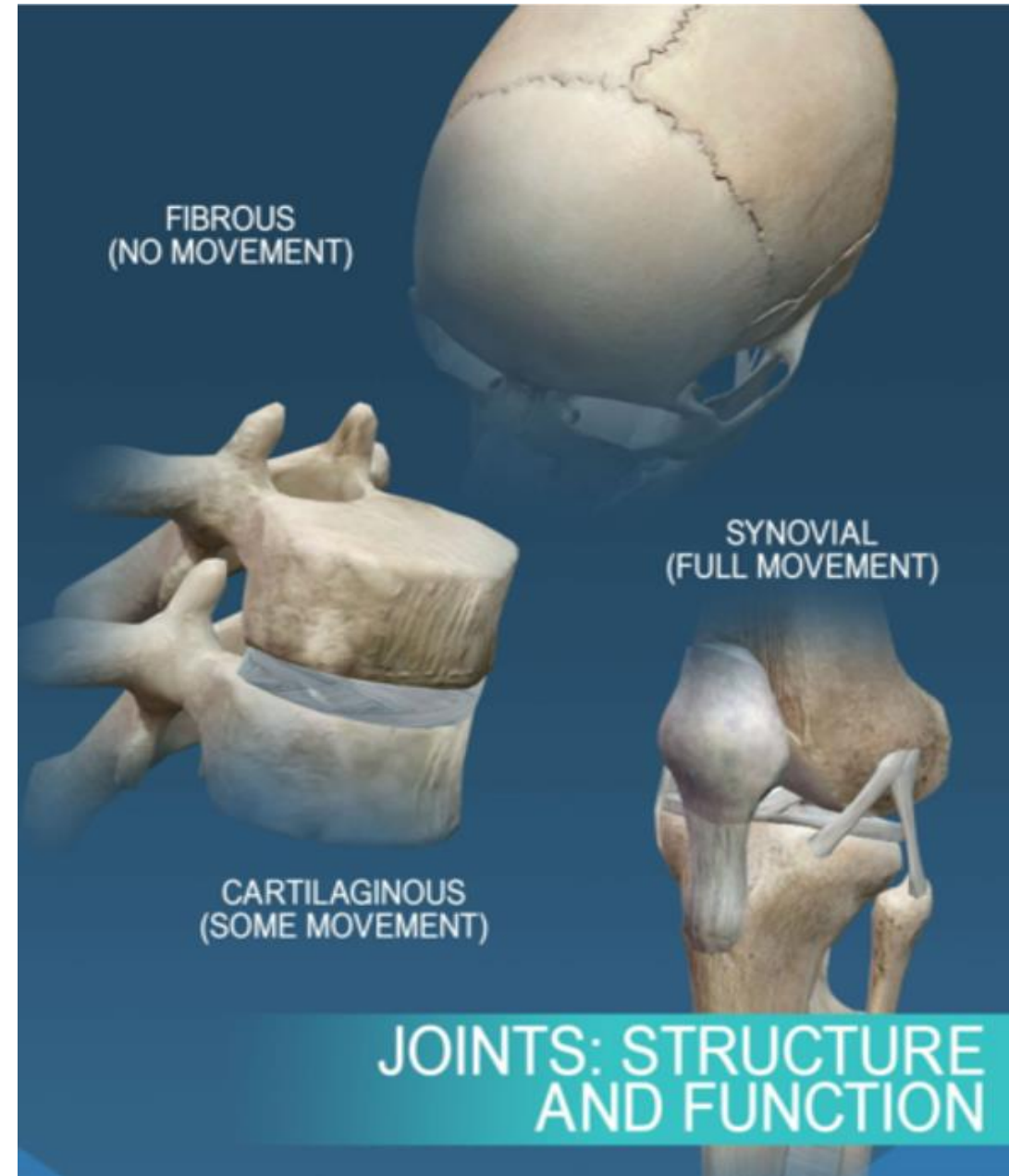
Bones Come Together: Types of Joints in the Human Body

Joints hold the skeleton together and support movement.

There are two ways to categorize joints:

The first is by **joint function**, also referred to as **range of motion**.

The second way to categorize joints is by the material that holds the bones of the joints together; that is an organization of **joints by structure**.

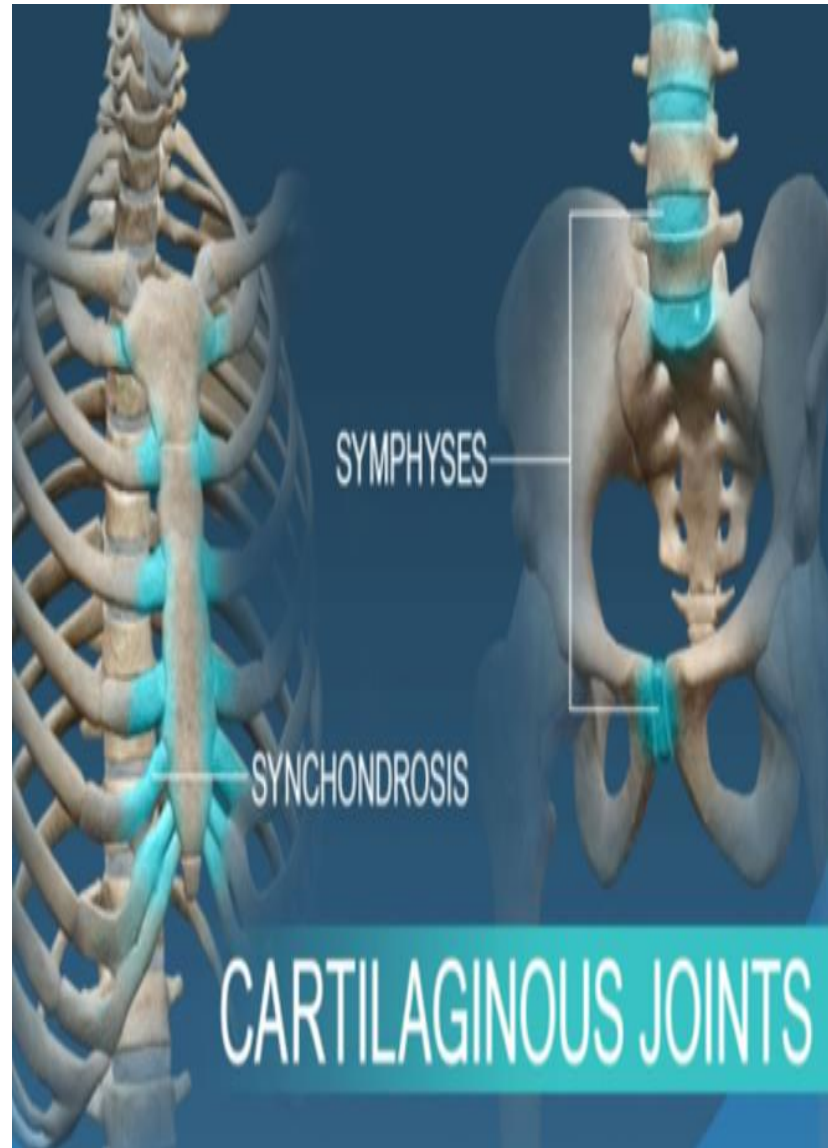


1. Joints Can Be Grouped By Their Function into Three Ranges of Motion

Type of Joint Function	Examples
1. Synarthrosis (range of joint motion: no movement)	Skull Sutures, articulations of bony sockets and teeth in facial skeleton
2. Amphiarthrosis (range of joint motion: little Movement)	distal joint between the tibia and the fibula and the pubic symphysis
3. Diarthrosis (range of joint motion full movement)	Elbow, shoulder, ankle



2. Joints Can Be Grouped By Their Structure into Fibrous, Cartilaginous, and Synovial Joints



Periosteum

The periosteum is a thin layer of tissue that covers the surface of bones and is known as the periosteal membrane. It is made up of two layers, the outermost layer being fibrous and the innermost layer being cellular.

The Role of Periosteum:

- Protects the bone
- Gives attachment to muscles
- Carries blood vessels and nerves to bone
- Deposits new bone on the surface thus increases the girth of bone

MUSCULAR SYSTEM

Muscle Function:

- Stabilizing joints
- Maintaining posture
- Producing movement
- Moving substances within the body
- Stabilizing body position and regulating organ volume
- Producing heat— muscle contraction generates 85% of the body's heat

Characteristics of Muscle Tissue

- Excitability- receive and respond to stimuli
- Contractility- ability to shorten and thicken
- Extensibility- ability to stretch
- Elasticity- ability to return to its original shape after contraction or extension

Types of Muscle

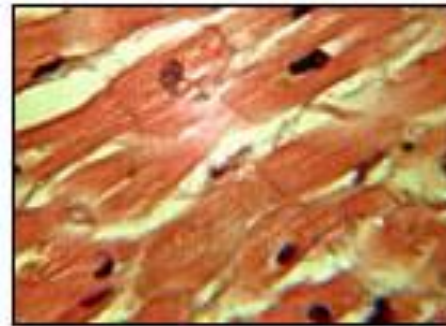
	Skeletal Muscle	Smooth Muscle	Cardiac Muscle
Location	Attached to bone	On hollow organs, glands and blood vessels	Heart



Skeletal muscle

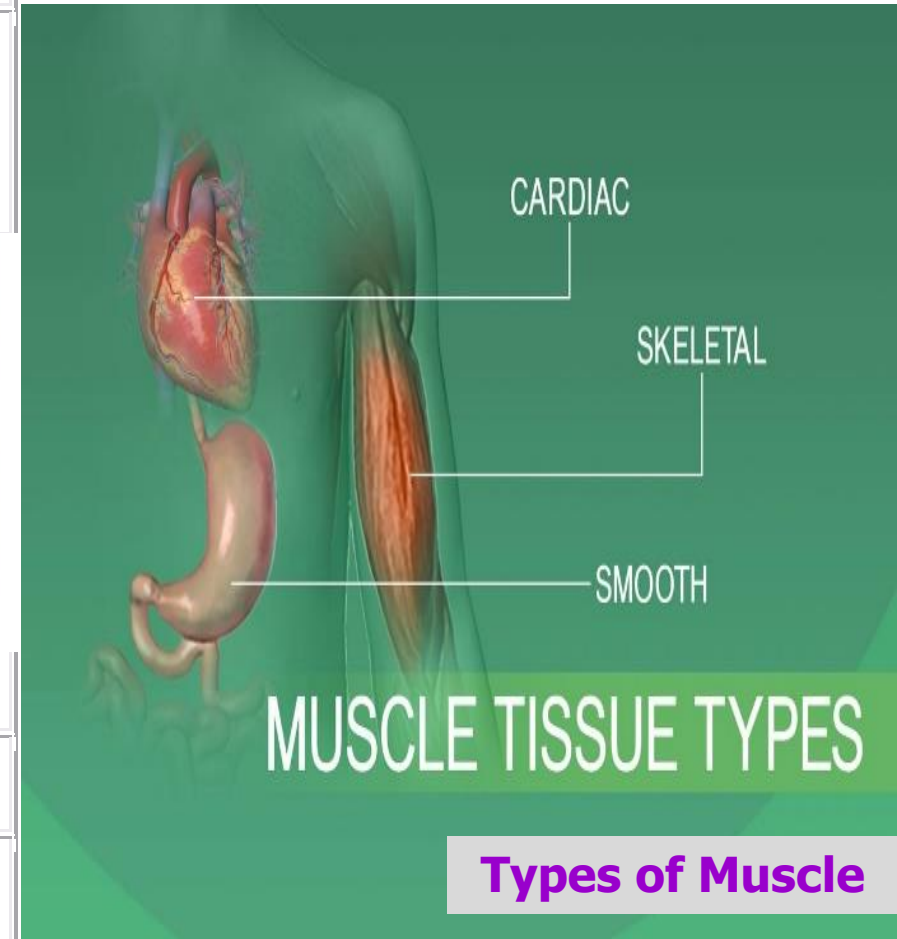


Smooth muscle



Cardiac muscle

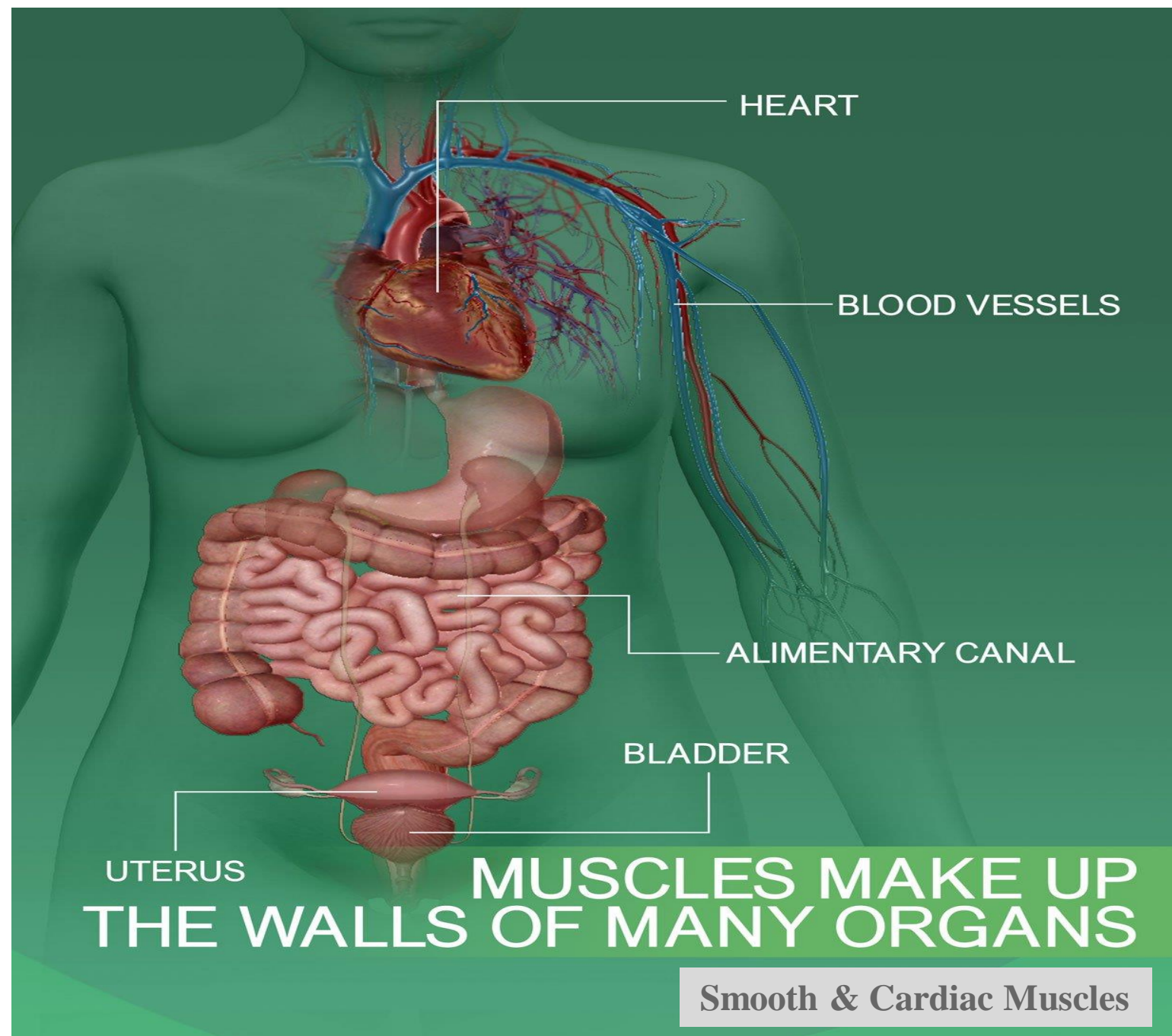
Control	voluntary	involuntary	involuntary
Striations	yes	no	yes
Cell Shape	Cylindrical	Spindle-shaped	Branched



Not all muscle tissue is **skeletal muscle**.

Smooth muscle tissue is in the walls of many human body organs and helps those organs move to facilitate body functions. The alimentary canal (esophagus, stomach, and intestines) includes muscle tissue that contracts and relaxes to move nutrients through the digestion process. The urinary bladder also includes muscle tissue that contracts and relaxes to hold and release urine. Smooth muscles in the walls of arteries help move blood through the body.

Heartbeats are the result of the contraction and relaxation of **cardiac muscle**.



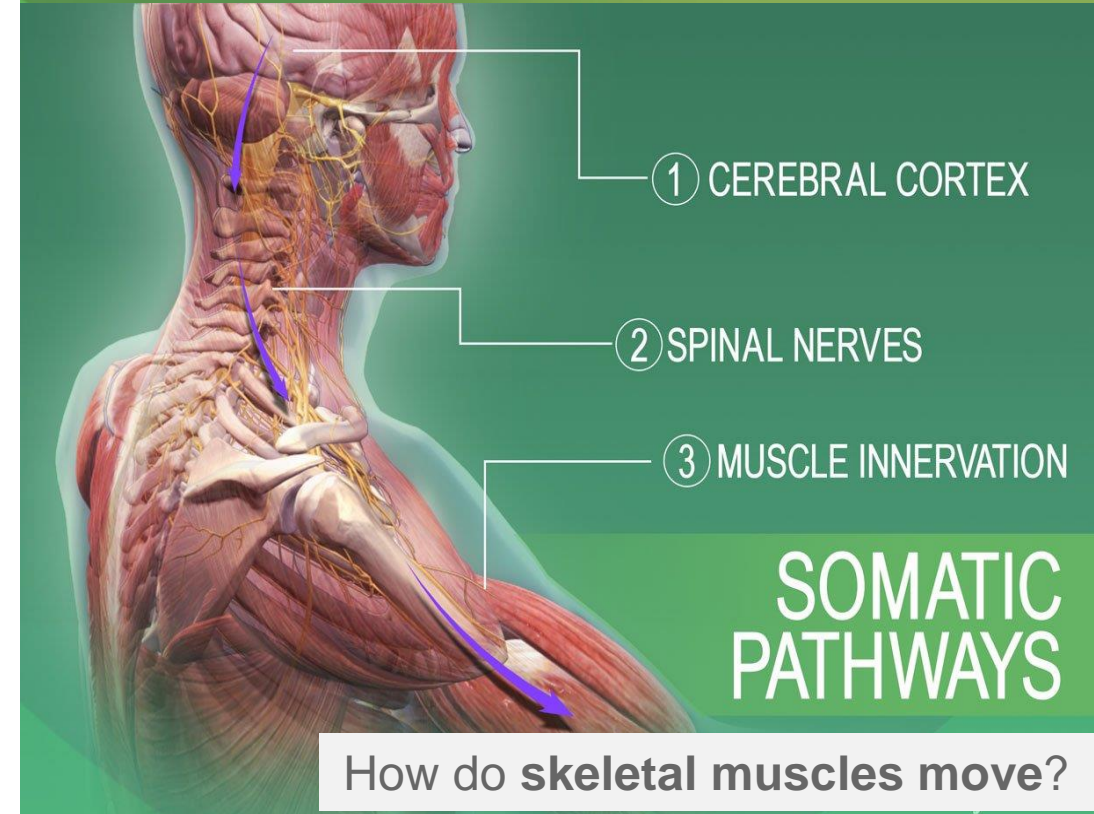
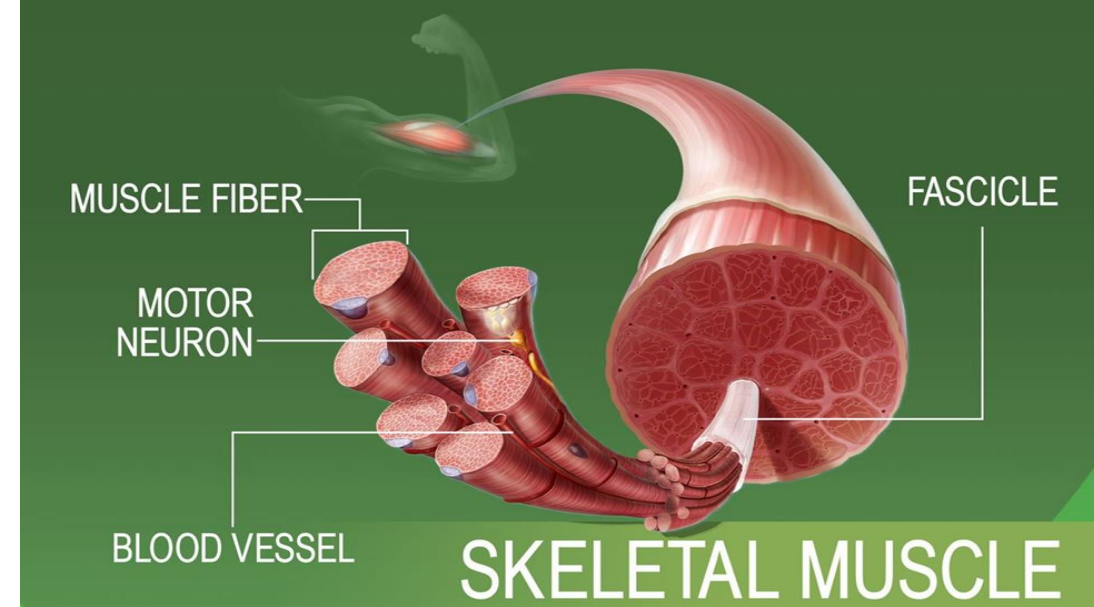
An Introduction to the Muscular System

- The muscular system
 - Consists only of skeletal muscles
 - Muscle organization dramatically affects power, range, and speed of movement.
- Skeletal muscle fibers form bundles called *fascicles*
- How do **skeletal muscles move**?

It happens when the **muscular system** and the **nervous system** work together:

Somatic signals are sent from the cerebral cortex to nerves associated with specific skeletal muscles.

Most signals travel through spinal nerves that connect with nerves that innervate skeletal muscles throughout the body.



Nearly 650 muscles are attached to the skeleton.

Skeletal muscles- work in pairs: one muscle moves the bone in one direction and the other moves it back again.

Most muscles- extend from one bone across a joint to another bone with one bone being more stationary than another in a given movement.

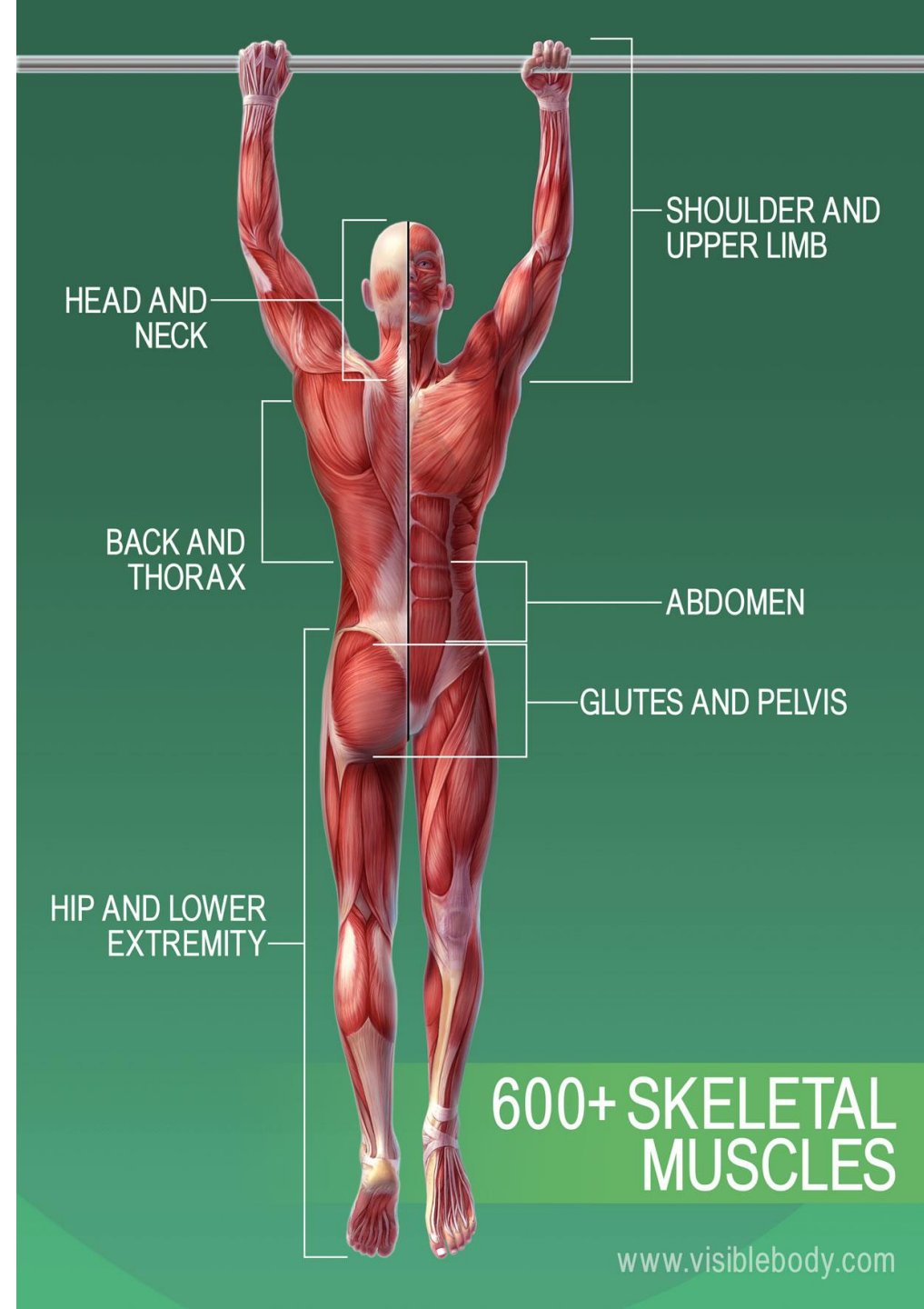
Muscle movement- bends the skeleton at moveable joints.

Tendons: made of dense fibrous connective tissue shaped like heavy cords anchor muscles firmly to bone.

Origin: attachment to the more stationary bone by tendon closest to the body (proximal).

Insertion: attachment to the more moveable bone by tendon at the distal end.

The force producing the bending is always a pull of contraction. Reversing the direction is produced by the contraction of a different set of muscles.



Head and Neck Muscles

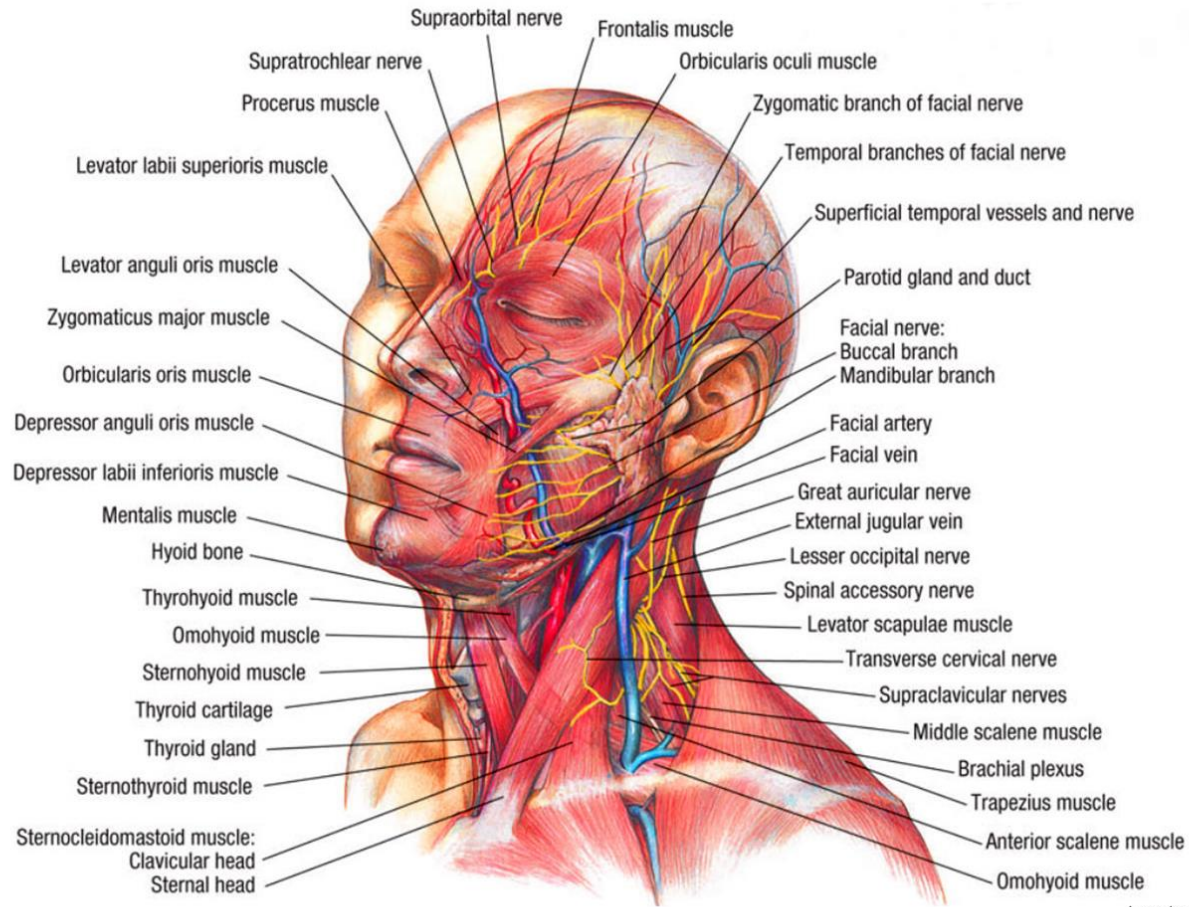


image via: pinterest.com

Trunk Muscles

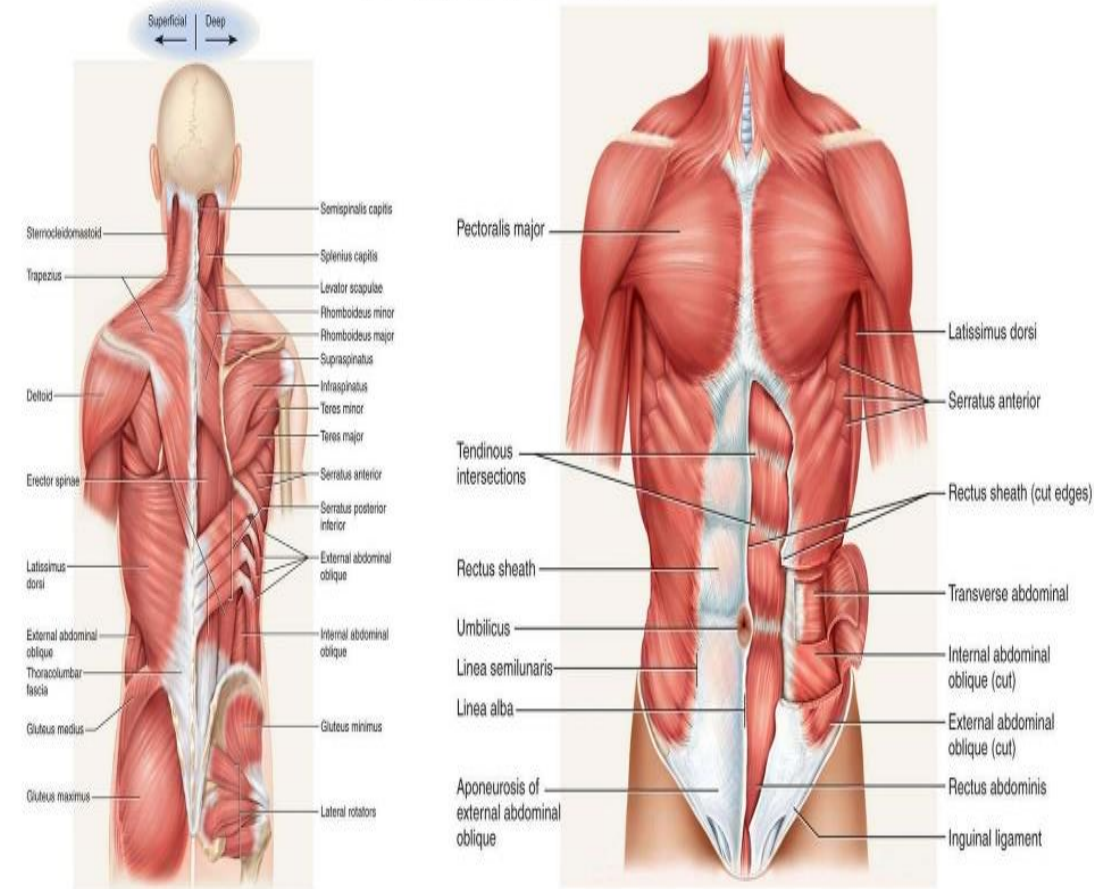


Image: anatomy.com

Action of the muscle. Sometimes muscles are named for their actions, such as flexor, extensor, and adductor appear in their names.

Muscles of the Upper Limb

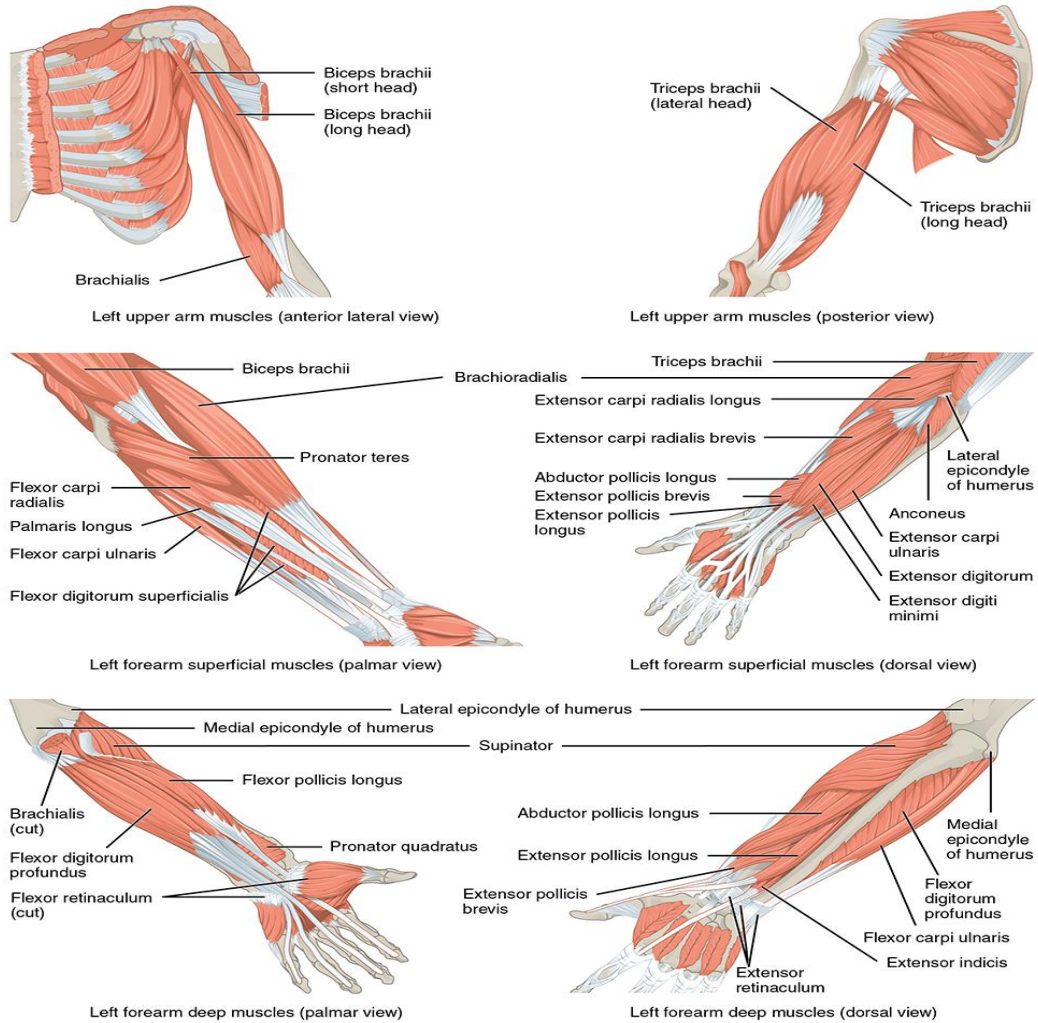


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Leg Muscles

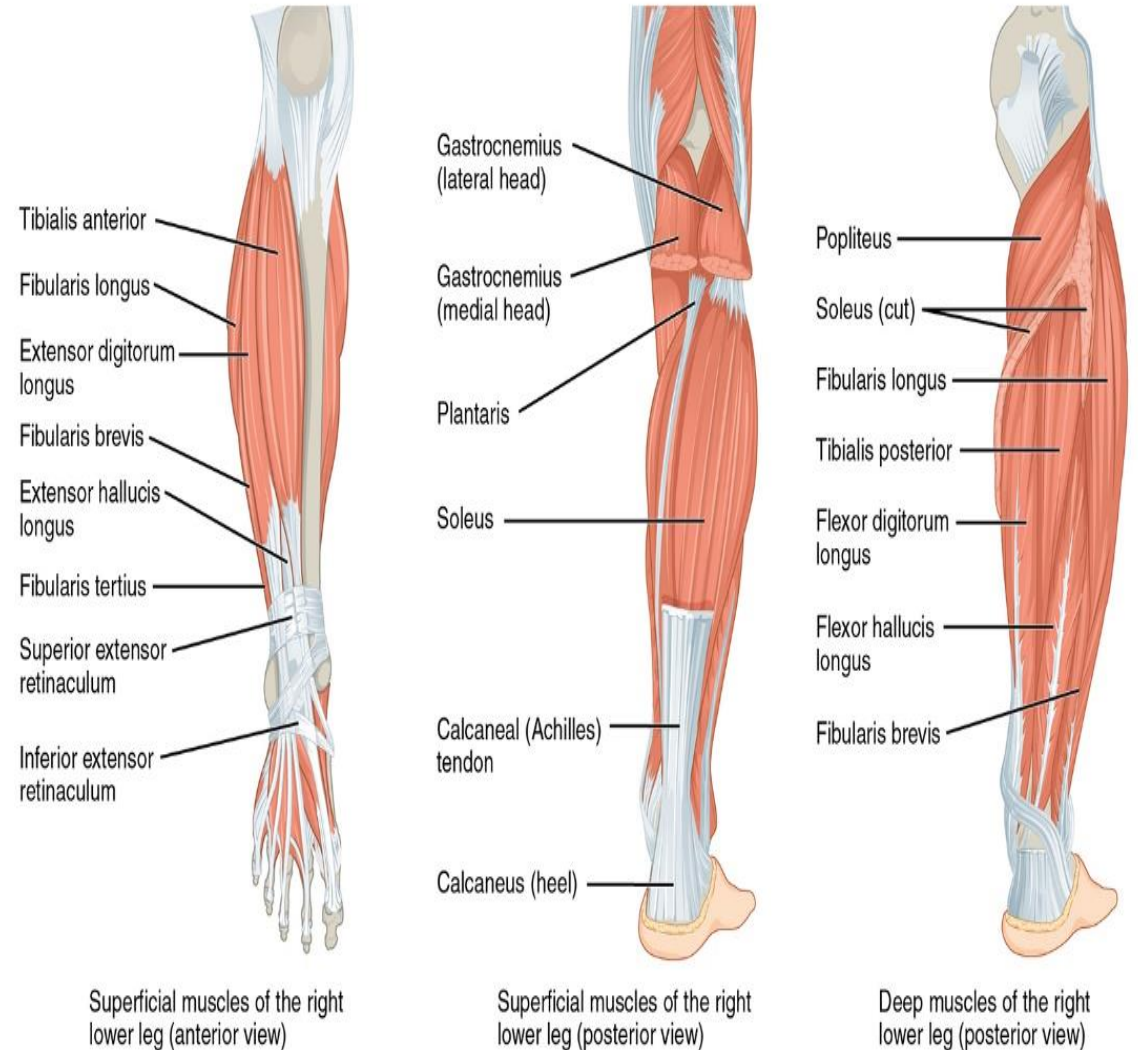


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The **facial muscles**, also called craniofacial muscles, are a group of about 20 flat [skeletal muscles](#) lying underneath the skin of the [face](#) and scalp. Most of them originate from the [bones](#) or fibrous structures of the [skull](#) and radiate to insert on the **skin**.

Contrary to the other skeletal muscles they are not surrounded by a **fascia**, with the exception of the **buccinator** muscle.

The specific location and attachments of the facial muscles enable them to produce movements of the face, such as smiling, grinning and frowning. Thus, these muscles are commonly called **muscles of facial expression**. All of the facial muscles are innervated by the **facial nerve (CN VII)** and vascularized by the **facial artery**.



Muscles
of Facial Expression

Key facts about the muscles of mastication

Definition and function

The muscles of mastication are muscles that attach to the mandible and thereby produce movements of the lower jaw(temporomandibular joint). .

Muscles

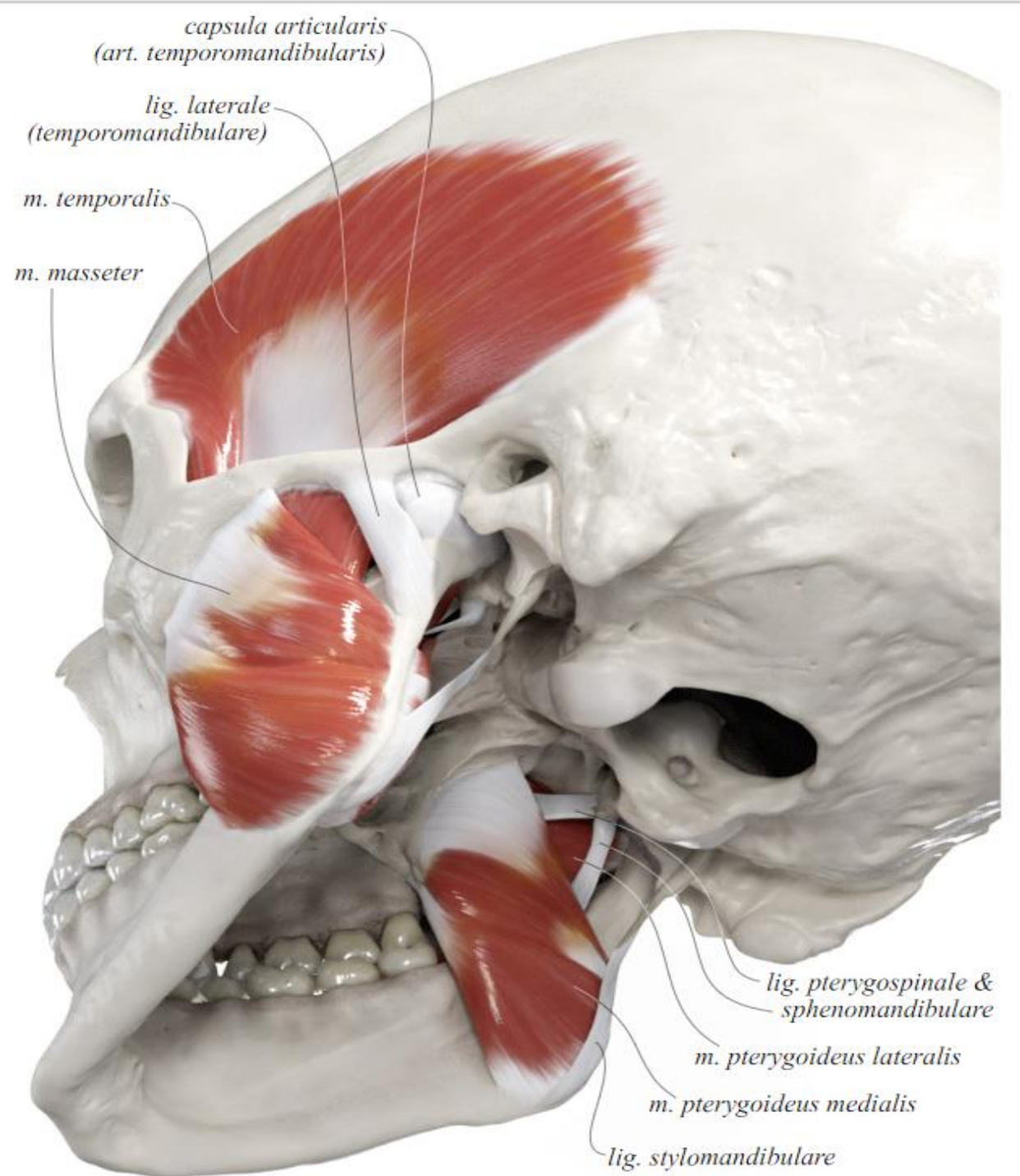
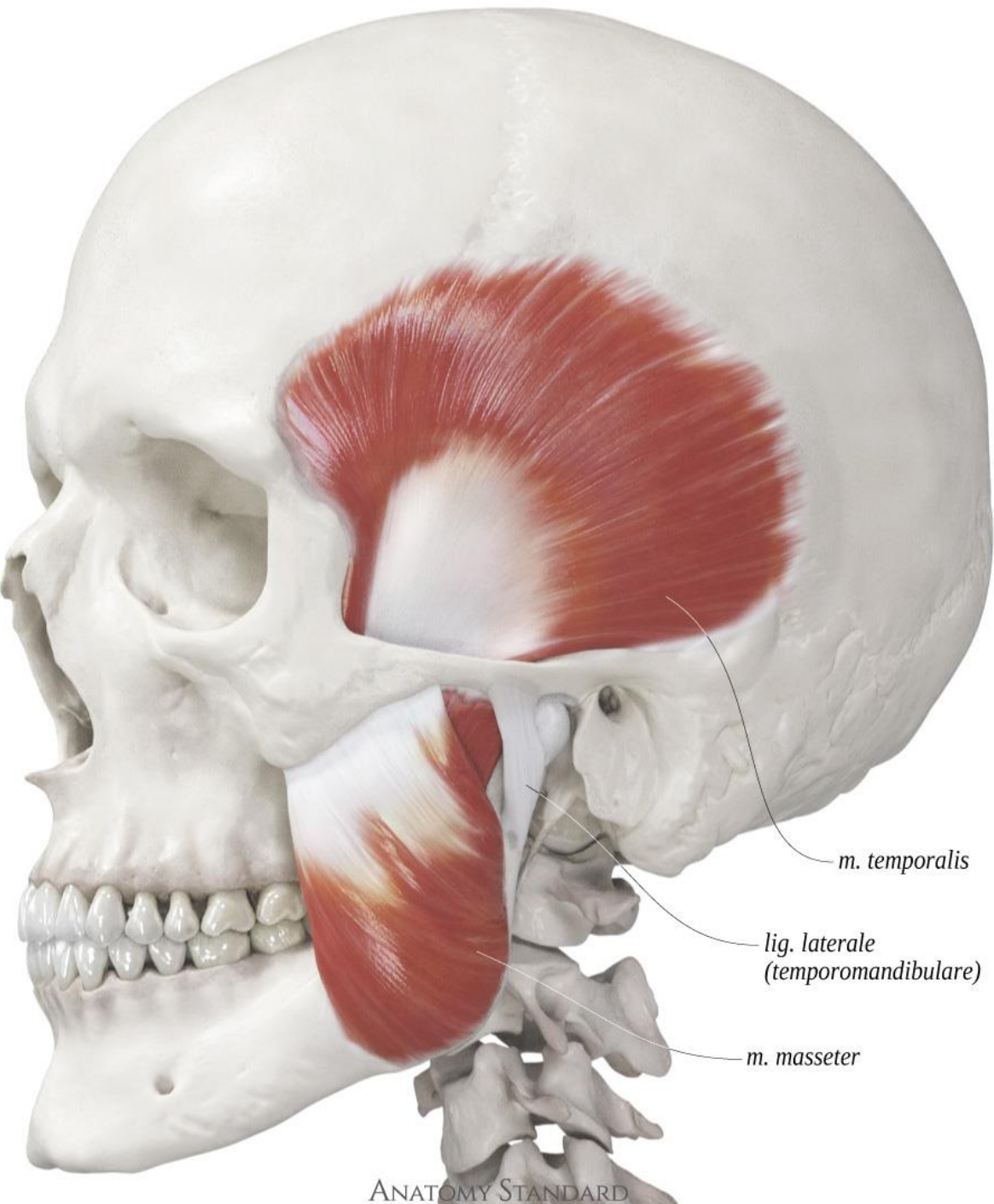
Temporalis, masseter, medial pterygoid and lateral pterygoid

Innervation

Mandibular nerve (CN V3)

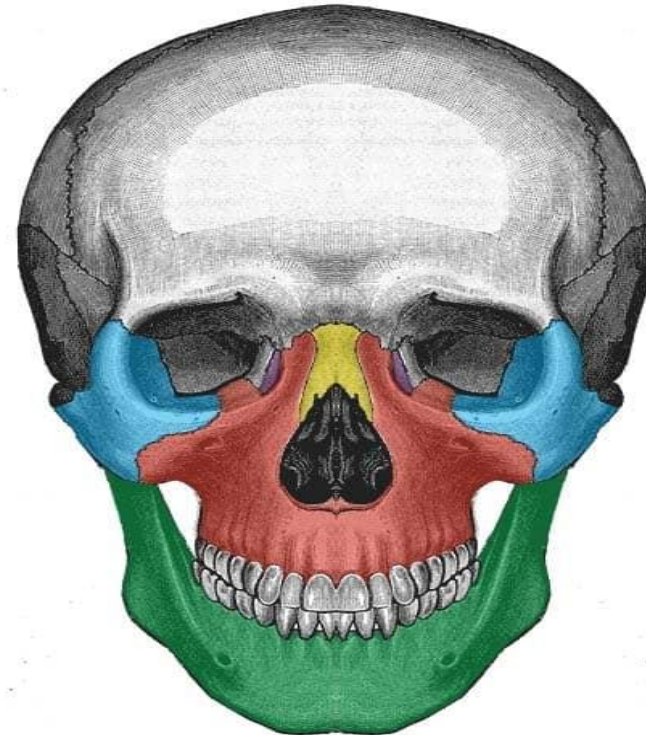
Blood supply

Maxillary artery





THANK YOU!



-  Zygomatic
-  Maxilla
-  Nasal
-  Lacrimal
-  Mandible