MUSCULOSKELETAL SYSTEM II

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Human Skeleton

- 206 Bones
- Axial skeleton: (80 bones) in skull, vertebrae, ribs, sternum, hyoid bone
- Appendicular Skeleton: (126 bones)- upper & lower extremities plus two girdles

Axial Skeleton

- Skull
- Ossicles of the middle ear
- Hyoid bone
- Thorax or chest
- Vertebral column

Appendicular Skeleton

- **Upper Extremity (64)**
  - Shoulder Girdle
  - Arms
  - Forearm
  - Hands
- **Lower Extremity (62)**
  - Pelvic Girdle
  - Thigh
  - Legs
  - Feet

Appendicular Skeleton

- The primary function is **movement**
- It includes bones of the **upper** and **lower limbs**
- **Girdles** attach the limbs to the axial skeleton; these bones allow the limb to have **exceptionally free movement**

Upper Limb

- The ***pectoral girdle*** consists of two bones, the **scapula shoulder blade** and the **clavicle (collarbone);**
- The *free part* has 30 bones
- 1 **humerus** (arm)
- 1 **ulna** (forearm)
- 1 **radius** (forearm)
- 8 **carpals** (wrist)
- 19 **metacarpal** and **phalanges** (hand)

Pectoral Girdle - Clavicle

- The clavicle is “S” shaped
- The clavicle is convex in shape anteriorly near the sternal junction and concave anteriorly on its lateral edge near the acromion

- The medial end articulates with the manubrium of the sternum forming the **sternoclavicular joint**

- The lateral end articulates with the acromion forming the **acromioclavicular joint**

Pectoral Girdle - Scapula

- Also called the shoulder blade
- Triangular in shape
- Most notable features include the **spine, acromion, coracoid process** and the **glenoid cavity**

Scapulae

- **Spine** - a large process on the posterior of the scapula that ends laterally as the acromion
- **Acromion** - the flattened lateral portion of the spine of the scapula, articulate with clavicle
- **Coracoid process** - a protruding projection on the anterior surface just inferior to the lateral aspect of the clavicle
- **Glenoid cavity** - shallow concavity that articulates with the head of the humerus, **shoulder joint**

(a) (b) (c)

Upper Limb

- Humerus
- Radius
- Ulna

(Interosseous membrane)

- Carpals
- Metacarpals
- Phalanges

Skeleton of the Arm
Humerus

- The arm is formed by a **single bone**!
- **Longest and largest bone of the free part of the upper limb**
- The proximal ball-shaped end **articulates with the glenoid cavity of the scapula *and form shoulder joint***
- The distal end **articulates at the elbow with the radius and ulna *and form elbow joint***

Humerus
Surface Features

- Just distal to the head is the ***anatomical neck***
- The ***surgical neck*** is where the tubular shaft begins and is a common area of fracture
- **Capitulum** - a round knob-like process on the lateral distal humerus
- **Trochlea** - medial to the capitulum, is a spool-shaped projection on the distal humerus

Humerus
Surface Features

- ***Coronoid fossa*** - anterior depression that receives the coronoid process of the ulna during forearm flexion

- ***Olecranon fossa*** - posterior depression that receives the olecranon of the ulna during forearm extension

Skeleton of the Forearm
Ulna

- The **longer** of the two forearm bones
- Located **medial** to the radius
- ***Olecranon*** - the large, prominent proximal end, the “tip of your elbow”
- ***Coronoid process*** - the anterior “lip” of the proximal ulna
- ***Trochlear notch*** - the deep fossa that receives the trochlea of the humerus during elbow flexion
- ***Styloid process*** - the thin cylindrical projection on the posterior side of the distal of ulna

Skeleton of the Forearm

Radius

- Lies **lateral** to the ulna (**thumb side** of the forearm)
- The head (disc-shaped) and neck are at the proximal end
- The **head articulates with the capitulum of the humerus and the radial notch of the ulna**
- **Styloid process** - large distal projection on lateral side of radius

Ulna and Radius

- The shaft of these bones are connected by an **interosseus membrane**
- There is a **proximal radioulnar joint** and a **distal radioulnar joint**
- Proximally, the head of the radius articulates with the radial notch of the ulna
- Distally, the head of the ulna articulates with the ulnar notch of the radius

Skeleton of the hand

- The hand
  - Carpals – wrist
  - Metacarpals – palm
  - Phalanges – fingers

Skeleton of the Hand

- The carpus (wrist) consists of **8 small bones (carpals)**
- Two rows of carpal bones
  - **Proximal row - scaphoid, lunate, triquetrum, pisiform**
  - **Distal row - trapezium, trapezoid, capitate, hamate**
- **Scaphoid** - most commonly fractured
- **Carpal tunnel** - space between carpal bones and flexor retinaculum

Metacarpals and Phalanges

- Five metacarpals - numbered I-V, lateral to medial
- 14 phalanges - two in the thumb and three in each of the other fingers
- Each phalanx has a base, shaft, and head
- Joints - carpometacarpal, metacarpophalangeal, interphalangeal

Joints of Upper Extremity

- **Sternoclavicular**
  - Synovial-saddle
  - Diarthrosis
- **Acromioclavicular**
  - Synovial-plane
  - Diarthrosis

- **Glenohumeral joint**
  - **Synovial-ball&socket**
  - Diarthrosis
  - Muscle reinforcement
  - Great Mobility

Joints of the Upper Extremity

- Elbow Joint
  - Synovial – hinge
    - Diarthrosis
- Articulations
  - Humerus & Ulna
  - Humerus & Radius
- Many Ligaments

Joints of Upper Extremity

- Proximal Radioulnar joint
  - Synovial - pivot
  - Diarthrosis
- Distal Radioulnar joint
  - Synovial – pivot
  - Diarthrosis
- !Allows pronation and supination of forearm

Joints of the Upper Extremity

- **Radiocarpal joint**
  - Synovial-condyloid
  - Distal radius with proximal row of carpals
- **Intercarpal joints**
  - Synovial-plane
- **Carpal-metacarpal (2-5)**
  - Synovial-plane
- **Trapezium-metacarpal 1**
  - Synovial-saddle
- **Metacarpal-phalangeal**
  - Synovial-condyloid
- **Interphalangeal**
  - Synovial-hinge

The Muscles of Upper Limb

- **Muscles of shoulder**
- **Deltoid**
- **Rotator cuff;** Four deep shoulder muscles strengthen and stabilize the shallow shoulder joint, and act to join the scapula to the humerus. They form the **rotator cuff**, a nearly complete circle of tendons around the shoulder joint, like the cuff on a shirtsleeve.
  - **Supraspinatus**
  - **Infraspinatus**
  - **Teres minor**
  - **Subscapularis**
- **Teres major**

Major muscles of shoulder

- **Deltoid**
  - **Origin**: lateral third of clavicle, acromion, and spine of scapula
  - **Insertion**: deltoid tuberosity of humerus
  - **Action**: abduction, flexion and extension, medial and lateral rotation of arm

Arm Muscles That Move the Elbow Joint/Forearm

- **Anterior compartment (flexor) ;**
  - primarily contains elbow flexors
    - the principal flexors
      - biceps brachii, brachialis, and coracobrachialis
- **Posterior compartment contains elbow extensors**
  - muscles that extend the elbow joint
    - triceps brachii

Muscles of arm

- **Anterior group**
  - Biceps brachii
  - Coracobrachialis
  - Brachialis
- **Posterior group**
  - Triceps brachii

Forearm Muscles

Move the Wrist Joint, Hand, and Fingers

- The muscles of the wrist and hand originate on the forearm, not the wrist or hand.
- Tendons of forearm muscles typically are surrounded by tendon (synovial) sheaths and held adjacent to the skeletal elements by strong fascial structures.

Supinate and Pronate

- Supinator muscle supinates the forearm.
- Biceps brachii supinates the forearm.
- Pronator teres and pronator quadratus pronate the forearm.

Muscles of forearm

- **Superficial layer**
  - Pronator teres
  - Flexor carpi radialis
  - Palmaris longus
  - Flexor carpi ulnaris
- **Second layer** Flexor digitorum superficialis
- **Third layer**
  - Flexor digitorum profundus
  - Flexor pollicis longus
  - Pronator quadratus
- **Action:** flex radiocarpal joint and fingers, pronate forearm

Posterior group

- Superficial layer
  - Brachioradialis
  - Extensor carpi radialis longus
  - Extensor carpi radialis brevis
    - Extensor digitorum
    - Extensor digiti minimi
    - Extensor carpi ulnaris
    - Action: extension at wrist joint

- Deep layer
- Supinator
- Abductor pollicis longus
- Extensor pollicis brevis
- Extensor pollicis longus
- Extensor indicis
- Action: extend at wrist joint and fingers, and supinate forearm

Action: extend radiocarpal joint and fingers, supinate forearm

Muscles of the Palm that Move the Digits: Muscles of the Hand

- Hand muscles are split into 3 groups: **thenar, hypothenar, & intermediate.**
- Movements of the thumb are defined in different planes compared to other digits because the thumb is positioned at a right angle to the other digits (Opposition-Reposition…)

Skeleton of the Lower Limb

- Two separate regions
- 1. A single ***pelvic girdle*** (2 bones)
- 2. The ***free part*** *(30 bones)*

Functions of the Lower Limb

Support the body weight

The ligaments at the hip and knee joints facilitate locking of these joints therefore reducing the amount of muscular energy required to maintain a standing position.

Locomotion

To move the body through space. This involves integration of movements at all joints of the lower limb to place the foot on the ground and move the body over it.

Pelvic (Hip) Girdle

- Each **coxal (hip) bone (also called innominate bone)** consists of three bones that fuse together: **ilium, pubis,** and **ischium**
- The two coxal bones are joined anteriorly by the **pubic symphysis** (fibrocartilage)
- Joined posteriorly by the sacrum forming the **sacroiliac joints**

The Ilium, Ischium and Pubis

- **Ilium** is the superior part of the hip bone, largest of the three hip bones
- **Ischium** - inferior and posterior part of the hip bone
- Most prominent feature is the ischial tuberosity, it is the part that meets the chair when you are sitting
- **Pubis** - inferior and anterior part of the hip bone
- Acetabulum!!!

False and True Pelves

- **Pelvic brim** - a line from the sacral promontory to the upper part of the pubic symphysis
- **False pelvis** - lies above this line Contains no pelvic organs except urinary bladder (when full) and uterus during pregnancy
- **True pelvis** - the bony pelvis inferior to the pelvic brim, has an inlet, an outlet and a cavity
- Pelvic axis - path of baby during birth

Bones of the Lower Limb

- Thigh
  - Femur
- Knee
  - Patella
- Leg
  - Tibia (medial)
  - Fibula (lateral)
- Foot
  - Tarsals (7)
  - Metatarsals (5)
  - Phalanges (14)

Thigh

- **Femur**
  - **Largest, longest, strongest bone in the body!!**

Head- Articulates with acetabulum proximally, hip joint

- **Neck** - distal to head, common site of fracture
- **Distally,** the medial and lateral condyles articulate with the condyles of the tibia forming the knee joint.
- Also **articulates with patella, patellofemoral joint**

Knee

- **Patella**
  - Triangular **sesamoid bone**
  - **Protects** knee joint
  - Improves leverage of thigh muscles acting across the knee
  - Contained **within patellar ligament**
  - Articulates with femur; **patellofemoral joint**

(Patellofemoral stress syndrome - “runner’s knee”)

Leg

- **Tibia**
  - **Receives the weight of body from femur and transmits to foot**
  - Second to femur in size and weight
  - **Articulates with fibula proximally and distally**
    - Interosseous membrane
- **Fibula**
  - **Does NOT bear weight**
  - **Muscle attachment**
  - **Not part of knee joint**
  - **Stabilize ankle joint**

Tibia (shin bone)

- **The larger, medial weight-bearing bone of the leg**
- **The lateral and medial condyles** at the proximal end articulate with the femur
- **It articulates distally with the talus(one of the foot bones-tarsal bone) and fibula**
- **Tibial tuberosity** - attachment site for the patellar ligament
- **Medial malleolus** - medial surface of distal end, articulates with the talus at the ankle **(medial surface of ankle joint)**

Fibula

- The smaller, laterally placed bone of the leg
- Non-weight bearing
- The head forms the **proximal tibiofibular joint,** distal part forms **distal tibiofibular joint**
- **Lateral malleolus** - distal end, articulates with the talus at the ankle

Foot

- Function:
  - Supports the weight of the body
  - Act as a lever to propel the body forward

- Parts:
  - **Tarsals (7)**
    - Talus = ankle
      - Between tibia and fibula
      - Articulates with both
    - Calcaneus = the heel bone, the largest and strongest
      - Attachment for Calcaneal tendon
      - Carries talus
    - Navicular
    - Cuboid
    - Cuneiforms (Medial, lateral and intermediate)

  - **Metatarsals (I-V)**

  - **Phalanges (14) (big toe is the hallux)**

Foot

- 3 arches
  - Medial
  - Lateral
  - Transverse
    - Has tendons that run inferior to foot bones
      - Help support arches of foot
- Function
  - Recoil after stepping
- **Flatfoot** - the arches decrease or “fall”

Longitudinal

Joints of Lower Limb

- Hip (femur + acetabulum)
  - Ball + socket
  - Multiaxial
  - Synovial
- Knee (femur + tibia)
  - Hinge (modified)
  - Biaxial
  - Synovial
  - Contains menisci, bursa, many ligaments
- Knee (femur + patella)
  - Plane
  - Gliding of patella
  - Synovial

Joints of Lower Limb

- Proximal Tibia + Fibula
  - Plane, Gliding
  - Synovial
- Distal Tibia + Fibula
  - Slight “give” (synarthrosis)
  - Fibrous (syndesmosis)
- Ankle (Tibia/Fibula + Talus)
  - Hinge, Uniaxial
  - Synovial
- Intertarsal & Tarsal-metatarsal
  - Plane, synovial
- Metatarsal-phalanges
  - Condyloid, synovial
- Interphalangeal
  - Hinge, uniaxial

Joints

Joint	Bones	Type	Movements
Hip joint	Pelvis and femur	Ball and socket	Flexion, extension, abduction, adduction and circumduction
Knee joint	Femur, tibia and patella	Hinge	Flexion and extension
Ankle joint	Tibia, fibula and talus (a tarsal bone)	Hinge	Plantarflexion and dorsiflexion

Ankle joint

Muscles

Muscle Compartment	Actions
Gluteal region	Extend, abduct and rotate the thigh at the hip joint.
Thigh	
• Anterior compartment	Extend the leg at the knee joint.
• Posterior compartment (hamstrings)	Extend the thigh at the hip joint and flex the leg at the knee joint.
• Medial compartment	Adduct the thigh at the hip joint.
Leg	
• Anterior compartment	Dorsiflex the foot and extend the digits.
• Posterior compartment	Plantarflex the foot and flex the digits.
• Lateral compartment	Evert the foot.
Foot	Support the arches of the foot.

Muscles of the Thigh

- Deep fascia separate muscles that act on the femur, and tibia and fibula into medial, anterior, and posterior compartments.
  - **Medial (adductor) compartment** of the thigh adduct the femur at the hip joint.
  - **Anterior (extensor) compartment** of the thigh extend the leg (and flex the thigh).
  - **Posterior (flexor) compartment** of the thigh flex the leg (and extend the thigh).

Muscles of Hip and Thigh

- Gluteals
  - Posterior pelvis
  - Extend- Rotate- Abducts thigh
- Anterior Compartment Thigh
  - Flexes thigh at hip
  - Extends leg at knee
- Medial/Adductor Compartment
  - Adducts thigh
  - Medially rotates thigh
- Posterior Compartment Thigh
  - Extends thigh
  - Flexes leg

Muscles of the Gluteal Region that Move the Femur

- Gluteus maximus
  - Origin - Ilium, sacrum and coccyx
  - Insertion - Gluteal tuberosity of femur, iliotibial tract
  - Action - Extends thigh, some lateral rotation and abduction
- Gluteus medius
  - Origin - Ilium
  - Insertion - Greater trochanter of femur
  - Action - Abduction, medial rotation
- Gluteus minimus
- **Lesser Gluteals help stabilize hip to allow fluent bipedal walking**

Posterior Pelvis

- Tensor fasciae latae
  - Origin – iliac crest and anterior inferior iliac spine of ilium
  - Insertion – iliotibial tract
  - Action - Flex thigh, abduct thigh, medial rotation of thigh

Anterior Compartment Thigh

- **Quadriceps femoris**
  - Rectus femoris
  - Vastus lateralis
  - Vastus medialis
  - Vastus intermedius
- **Iliopsoas**
  - **Action – flexor of thigh**
- **Sartorius**
  - Origin - anterior superior iliac spine of ilium
  - Insertion – medial side of tibia
  - Action - flex, abduct, lat rotate thigh; weak knee flexor

Adductors

- Adductor longus
- Adductor brevis
- Adductor magnus
  - Origin – inferior pelvis
  - Insertion - femur
  - Action – **adducts**
- Pectineus
  - Origin - pubis
  - Insertion – femur
  - Action – **adducts**
- Gracilis
  - Origin - pubis
  - Insertion – medial tibia
  - Action – **adducts** thigh, flex, medial, rotates leg

Posterior Compartment - Hamstring

- Biceps femoris (2 heads)
  - Origin – ischial tuberosity of ischium, distal femur
  - Insertion - lateral tibia, head fibula
  - Action - thigh extension, knee flexion, lateral rotation
- Semitendinosus
- Semimembranosus
  - Origin - ischial tuberosity of ischium
  - Insertion - medial tibia
  - Action - thigh extension, knee flexion, medial rotation

Muscles of the Leg that Move the Foot and Toes

- Leg muscles, like those of the thigh, are divided by deep fascia into three compartments: anterior, lateral, and posterior.
  - **Anterior compartment** muscles dorsiflex the foot.
  - **Lateral compartment** muscles plantar flex & evert the foot.
  - **Posterior compartment** muscles are split between superficial (e.g., gastrocnemius) and deep (e.g., tibialis posterior) groups. Superficial muscles share a common tendon of insertion, the **calcaneal tendon.**

Anterior Compartment

- Tibialis anterior
  - Action - dorsiflexion, foot inversion
- Extensor digitorum longus
  - Action – dorsiflex foot
- Extensor hallucis longus
  - Action - extend big toe, dorsiflex foot

Lateral Compartment

- **Fibularis (peroneus) longus**
  - Action - plantarflex, evert foot
- **Fibularis (peroneus) brevis**
  - Action – same as above!!

Superficial Posterior Compartment

- Triceps surae
  - Gastrocnemius (2 heads)
  - Soleus
    - Insertion – (both)posterior calcaneus via Achilles tendon
  - Action of both – plantarflex foot
- Plantaris (variable)
  - Action – plantarflex foot, week knee flexion

Deep Posterior Compartment

- Popliteus
  - Action – flex and medially rotate leg
- Flexor digitorum longus
  - Action – plantarflex and invert foot, flex toe
- Flexor hallucis longus
  - Action - plantarflex and invert foot, flex toe
- Tibialis posterior
  - Action - plantarflex and invert foot

Muscles of the Foot

- These muscles are termed **intrinsic** because they originate & insert *within* the foot.
- These muscles are limited designed for support and locomotion, and are split into **dorsal** and **plantar groups.**
- There is only one dorsal muscle which extends toes 2–5 at the MTP joints.
- Plantar muscles are arranged in four layers with the most superficial of these called the first layer, etc.

The Axial Skeleton

- Forms the longitudinal part of the body
- Divided into three parts
  - Skull
  - Vertebral column
  - Bony thorax

The Skull (28 bones)

- Protects brain, eyes, ears, nasal cavity, and oral cavity
- Attachment for muscles of chewing and turning the head
- Sits on top of the vertebral column
- Two sets of bones
  - **Neurocranium-Cranium (8 bones)**
  - **Viscerocranium-Facial bones (14 bones)**
- **Only the mandible is attached by a freely movable joint**

The Cranium

- Bony structure that encases and protects the brain.
- 8 bones
  - **Frontal Bone** ~ forehead/upper part of the bony structure surrounding the eyes.
  - Parietal Bone (2) ~ upper sides of the head and the roof of the cranial cavity (top of the head)

The Cranium

- **Temporal Bones** (2) ~ sides of the head, close to ears.
  - Commonly called the temples
  - Includes the external auditory meatus
    - Opening for the ear
  - Includes the zygomatic process
    - Part of the cheekbone

- Occipital Bone ~ back and base of the cranium
  - Includes the foramen magnum
    - Foramen magnum, large hole for the brainstem/spinal cord

The Cranium

- **Sphenoid Bone** ~ forms sides of cranium and parts of orbits of the eyes
- Butterfly shaped
  - Includes Sella Turcica (Turk's Saddle)
    - Where pituitary gland sits
- Ethmoid Bone ~ irregularly shaped bone located between the eye orbits
  - Major supporting bone of the nasal cavity

Facial Bones

- 14 bones
- Most of these bones come in pairs
- Only the mandible and vomer are single bones

Facial Bones

- **Mandible** ~ the lower jaw bone
  - Carries the lower teeth
  - The anterior portion forms the chin
  - Only freely movable joint in the skull

- **Maxilla** (2) ~ Upper jaw
  - Two bones fused together
  - Roof of the mouth
  - Also form parts of the nasal cavity and eye orbits

Facial Bones

- **Palantine Bones (2)** ~ form the posterior part of the hard palate and the floor of the nasal cavity.
  - Failure of the palatine and/or maxillary bones to fuse causes a cleft palate.

- **Zygomatic Bones** (2) ~ the cheekbones
  - Also forms a part of the orbits of the eyes

Other Facial Bones

Lacrimal Bones (2) ~ inner wall of eye sockets

Nasal Bones (2) ~ bridge of nose

Vomer ~ nasal septum

Inferior Nasal Conchae (2)

Paranasal Sinuses

- Functions of paranasal sinuses
- Air filled cavities
- Lighten the skull
- Give resonance and amplification to voice
- **Frontal, Ethmoid, Sphenoid, Maxilla**

The Fetal Skull

- The fetal skull is large compared to the infants total body length
- **Fontanelles** – fibrous membranes connecting the cranial bones
  - Allow the brain to grow
  - Convert to bone within 24 months after birth

Muscles of facial expression

- Muscles of facial expression
  - lie within the subcutaneous layer
  - usually originate in the fascia or skull bones & insert into the skin.
- Because of their insertions, the muscles of facial expression move the skin rather than a joint when they contract.

Muscles that move the mandible

- Four pairs of muscles move the mandible, and are known as ‘muscles of mastication’.
- The **masseter**, **temporalis**, and **medial pterygoid** account for the strength of the bite.
- The medial and **lateral pterygoid** muscles help to chew by moving the mandible from side to side. Additionally, these muscles protract (protrude) the mandible.

The Hyoid Bone

- U shaped
- Found in the upper neck, between mandible and larynx
- **The only bone that does not articulate with another bone**
- Serves as a moveable base for the tongue
- In neck Attachment point for swallowing and speech muscles

Muscles of the anterior neck that help in swallowing and speech

- There are two main muscle groups in the anterior neck:
  - **suprahyoid muscles**, are superior to the hyoid
  - **infrahyoid muscles**, are inferior to the hyoid.
- Both groups of muscles stabilize the hyoid bone, allowing it to serve as a firm base on which the tongue can move.

Middle Ear

- 3 Tiny bones ~ transmit vibrations
- All derived from Latin words
- Malleus (hammer)
- Incus (anvil)
- Stapes (stirrup)
  - Smallest bone in the body

The Trunk

- Vertebral column
- Ribs
- Sternum

The Vertebral Column

- The **backbone or spine**
- Vertebrae separated by **intervertebral discs** (act as shock absorbers)
- The spine has a normal curvature
- Each vertebrae is given a name according to its location

Vertebral column

- C1-C7 ~ in the neck region
  - 7 cervical vertebrae
- T1-T12 ~ located in the chest region
  - 12 thoracic vertebrae
- L1-L5 ~ located in the lower back
  - 5 lumbar vertebrae

Vertebral column

- Sacrum ~ curved bone of the lower back (posterior wall of the pelvis)
- fused sacral vertebrae
  - 5 vertebrae at birth
- Coccyx ~ the tailbone
  - 4 vertebrae at birth

Vertebral Column

- The vertebrae become larger as the vertebral column descends
- Vertebral foramen ~ opening for spinal cord.
- What is the opening for the spinal cord in the skull called?

Vertebra

- Parts
  - Body
  - Vertebral foramen
  - Vertebral arch
  - Superior and inferior articular processes
  - Transverse process
  - Articular facets for rib
  - Spinous process

Cervical Vertebrae

- Atlas
  - **First vertebra**
  - ‘yes’ motion
- Axis
  - **Second vertebra**
  - Dens or odontoid process
  - ‘no’ motion

The Bony Thorax (Thoracic Cage)

- The **chest region**
- Forms a cage to protect major organs
- Composed of **sternum, ribs** and **thoracic vertebrae**.

Thoracic Cage

- Sternum ~ breastbone.
- Dagger-shaped bone located along the midline of the anterior chest.

Thoracic Cage

- Ribs ~ 12 pairs of ribs attach posteriorly to the thoracic vertebrae
- True ribs ~ first 7 pair
- False ribs ~ last 5 pairs
  - **Floating ribs**
    - Inferior 2 pairs
    - No attachment in front

The muscles of back

- **Trapezius**
- **Latissimus dorsi**
- Levator scapulae
- Rhomboideus major/minor
- Erector spinae
- Serratus posterior sup/inf

Muscles of the Thorax that Assist in Breathing

- Respiratory muscles alter the size of the thoracic cavity which affects the pressure in the lungs, and that determines whether we inhale or exhale.
- The **diaphragm** is the most important respiratory muscle.
- Other important respiratory muscles include the **external** and **internal intercostal muscles.**
- There are also a number of accessory muscles useful in forced breathing.

The muscles of thorax

- **Pectoralis major**
- Pectoralis minor
- Serratus anterior

- **Intercostales externi**
- **Intercostales interni**
- Intercostales intimi

Muscles of the abdomen that protect the viscera and move the vertebral column

- The anterolateral abdominal wall includes the **external oblique, internal oblique, and transversus abdominis muscles** which form three protective layers around the abdomen.

- The aponeuroses of these 3 muscles form the **rectus sheaths** which enclose the **rectus abdominis muscles.**
  - The sheaths form the **linea alba**, a connective tissue band extending from the xiphoid process to the pubic symphysis.

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