

Functional Anatomy

Structure, Function, and Performance

- Structure
 - the arrangement of the parts of the whole
- Function
 - normal characteristic or action
- Performance
 - functional effectiveness

The Calculator

- | | | |
|--------------|------------|---------------|
| • Structure | • Function | • Performance |
| – LCD | – Add | – speed |
| – Number Pad | – Subtract | – accuracy |
| – Battery | – Divide | – digits |
| – Wiring | – Multiply | – ... |
| – ... | – ... | |

The Running Shoe

- | | | |
|-------------|-------------|----------------|
| • Structure | • Function | • Performance |
| – Primary | – Primary | – Measurements |
| – Secondary | – Secondary | |

Structure of the Human Body

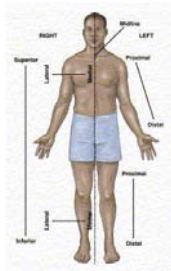
Reference systems
 Directional terminology
 Planes of the human body
 Basic skeletal terminology
 Types of bones and joints

Reference Positions

- Anatomical Position
 - subject standing with an upright posture, feet parallel and close, and palms facing forward.
- Fundamental Position
 - same as Anatomical Position *except* palms are facing the body.

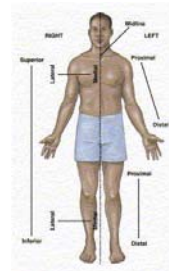
Directional Terminology

- **Proximal**
 - Nearest the trunk or midline
 - the elbow is proximal to the wrist
- **Distal**
 - Further away from the trunk or midline
 - the distal aspect of the tibia is near the ankle
- **Anterior**
 - in front, or front part
 - the quadriceps is located in the anterior aspect of the thigh
- **Posterior**
 - Behind, or back part



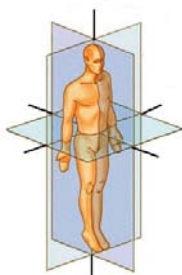
Directional Terminology

- **Superior**
 - Above, higher
 - the head is superior to the shoulders
- **Inferior**
 - Below, lower
- **Lateral**
 - Farther from the midline, outside
 - the fibula is lateral to the tibia
- **Medial**
 - Closer to the midline, inside
 - the hip adductors are located medially



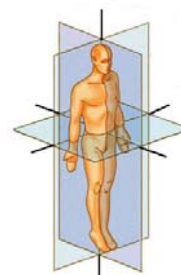
Planes of the Human Body

- **Sagittal or Anteriorposterior Plane**
 - Divides the body into left and right halves
- **Frontal, Lateral or Coronal Plane**
 - Divides the body into front and back halves
- **Transverse or Horizontal Plane**
 - Divides the body into top and bottom halves



Axes of Rotation

- **Anteroposterior or Sagittal Axis**
 - Runs from front to back
 - at right angle to the frontal plane
- **Medial-Lateral, Lateral, or Frontal Axis**
 - runs from side to side
 - at right angle to sagittal plane
- **Longitudinal, Long or Vertical Axis**
 - runs straight down
 - at right angle to the transverse plane



Planes and Axes

Plane	Axis
Sagittal	Medial-Lateral
Frontal	Anterior-Posterior
Transverse	Longitudinal

Identify Plane of Movement

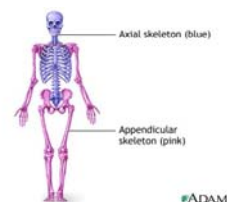
Nodding yes & no	sagittal	ML
cartwheel	frontal	AP
Looking left and right	transverse	Longitudinal
Swing the arm forward as during bowling	sagittal	ML
Swinging the arms during a baseball swing	transverse	L

Skeletal System

- Axial Skeleton
- Appendicular Skeleton

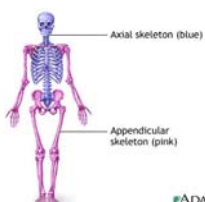
Axial Skeleton

- Forms the axis of the body and support and protect the organs of the head, neck, and trunk.
 - Skull
 - Vertebral column
 - ribs
 - sternum
 - Auditory ossicles 'ear bones'



Appendicular Skeleton

- Composed of the bones of the upper and lower extremities and the bony girdles that anchor the appendages to the axial skeleton.
 - the appendages (upper/lower extremities)
 - shoulder and pelvic girdles
- Types of Bones
 - long, short, flat, irregular, sesamoid

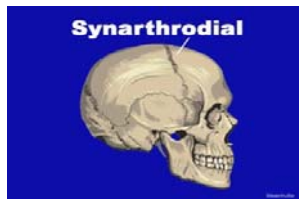


Types of Joints

- Joint: An articulation; the point of juncture between two bones.
- Joints are classified based on the structure of the joint (specifically, what fills the joint cavity) and the amount of movement allowed.

Types of Joints

- Synarthrodial
 - immovable
 - cranial bones
 - teeth



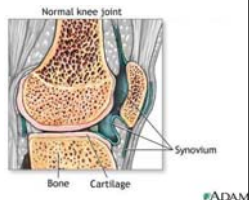
Types of Joints

- Amphiarthrodial: slightly moveable
 - syndesmosis: bones are united by ligamentous tissue. E.g. tibiofibular joint
 - Synchondrosis: bones united by cartilage. E.g. costochondral joints of the ribs.



Types of Joints

- Diarthrodial: Freely moveable
 - aka synovial joint
 - classifications
 - Arthrodial (gliding)
 - Condylodial
 - Enarthrodial (ball and socket)
 - Ginglymus (hinge)
 - Sellar (saddle)
 - Trochoidal (pivot)



Movements

- Defined relative to anatomical starting position
- Abduction: movement away from midline (frontal plane)
- Adduction
- Flexion: decreasing joint angle (sagittal)
- Extension
- Circumduction: movement describes cone
 - combination of flexion, extension, abd + adduction

Movements

- External rotation: anterior aspect of segment rotates away from midline
- Internal rotation
- Eversion: distal aspect of calcaneus rotates away from midline
- Inversion
- Dorsal Flexion: dorsal aspect moves superiorly
- Plantar Flexion

Movements

- Pronation (radioulnar joint): Internal rotation of forearm (anatomical starting position)
- Supination: External rotation of the forearm
- Radial flexion: Abduction at wrist (thumb side)
- Ulnar flexion

Muscle Terminology

- Origin: proximal attachment
- Insertion: distal attachment

Muscle Contraction

- Isometric: No change in muscle length
- Isotonic: Change in length
 - Concentric: muscle length shortens during contraction
 - Eccentric: muscle length increases during contraction
- Isokinetic: Angular speed is constant during contraction
 - Concentric
 - Eccentric

Role of Muscle

- **Agonist:** (prime mover) functions to cause a movement
- **Antagonist:** functions to resist movement
- **Stabilizer:** functions to fixate an area so another movement can occur
 - e.g., stabilizing the scapula so arm extension can occur.
- **Synergist:** assist another muscle
- **Neutralizer:** functions to prevent undesired movement
 - e.g., the biceps causes elbow flexion and forearm supination; if supination is not desired, pronators need to be recruited.

Summary

- **Skeletal System**
 - Axial
 - Appendicular
- **Bones**
 - long, short, flat, irregular, sesamoid
- **Joints**
 - synarthrodial, amphiarthrodial, diarthrodial
- **Movements**
- **Muscle terminology**
 - origin, insertion
- **Types of muscle contraction**
 - isometric, isotonic, concentric, eccentric, isokinetic
- **Role of muscle**
 - agonist, antagonist, stabilizer, synergist, neutralizer