

Skeletal and muscular systems



UNTAMED
EDUCATION

1.1 Anatomy and physiology

Joints

Antagonistic Pairs

Skeletal System

Isotonic Contractions

Skeletal and Muscular System

Range of movement

Synergists

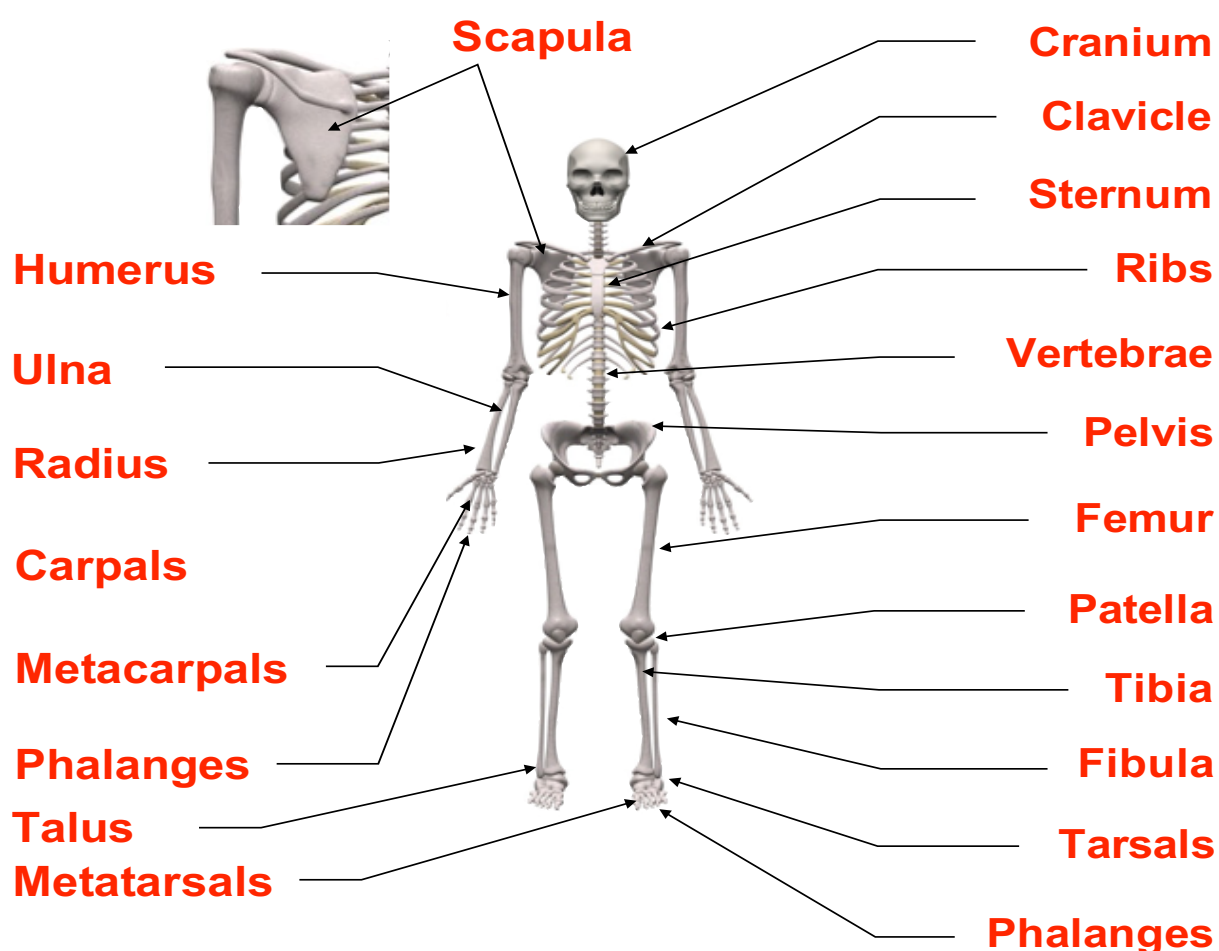
Muscular System

Isometric Contractions



The Skeletal and Muscular System

1. Skeletal system



2. Joints

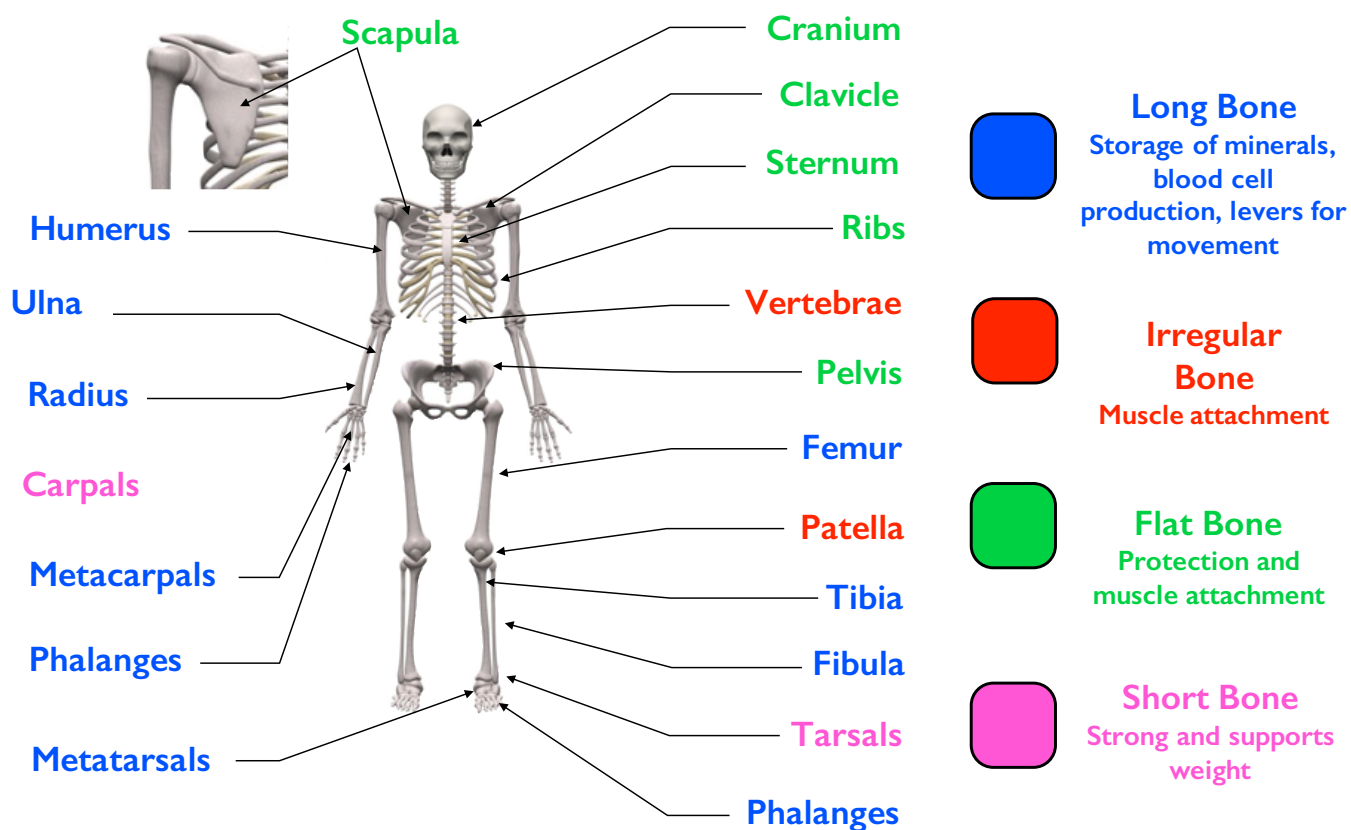
a. The human body has **joints** where bones meet and **articulate** to create **movement**.

- ▶ **Shoulder** - scapula, clavicle, humerus.
- ▶ **Elbow** - humerus, radius, ulna.
- ▶ **Hip** - pelvis, femur
- ▶ **Knee** - femur, patella, fibula, talus
- ▶ **Ankle** - tibia, fibula, talus



The Skeletal and Muscular System

3. Types of bones



4. Functions of the skeletal system

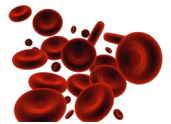
- Support** - Bones are strong and are able to bear our weight. For example carpals support and weight bear in a handstand.
- Protection** - Bones protect our vital organs. For example the flat bones of the cranium protect the brain when heading the ball.
- Structural shape and points for attachment** - Muscles attach to bones so when they contract our bone becomes a lever which generates force and allows us to reach. For example when the bicep contracts it moves our radius and ulna when throwing a ball.





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4. **Storage of minerals** - Our bones store calcium and phosphorus and release it when needed. This keeps the correct balance of minerals in our body for optimum sports performance.
5. **Production of blood cells** - The marrow in our bones (i.e. femur) produce vital blood cells. Red blood cells for oxygen carriage, white blood cells for fighting disease and platelets for clotting blood when we cut ourselves whilst performing.



5. Joints

1. Fibrous/Fixed/Immovable

- ▶ These joints prevent movement, act as a shock absorber and protect vital organs.
- ▶ They are held together by tough fibre.
- ▶ This type of joint is very strong.
- ▶ Examples are joints in your cranium, pelvic girdle and sacrum.



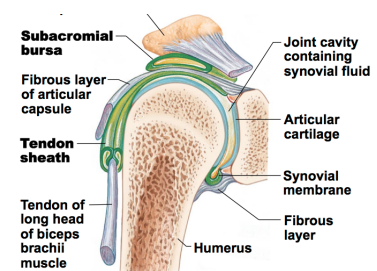
2. Slightly movable or Cartilaginous

- ▶ These joints can only move a little.
- ▶ They are joined together by a cushion material called cartilage.
- ▶ These keep the bones from rubbing together as well as acting as a shock absorber and limiting movement.
- ▶ Ligaments keep the joint in place.
- ▶ Examples are joints of the vertebrae and between your ribs and sternum



3. Freely Movable or Synovial Joints

- ▶ These joints move freely.
- ▶ There are many parts to the synovial joint that work together to allow smooth movement:
 - ▶ Joint capsule holds the joint together
 - ▶ Joint cavity is the space between the two bones





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- ▶ Synovial fluid fills the joint cavity and acts as a lubricant preventing friction/pain and wear and tear.

6. Cartilage and Ligaments

Synovial joints also have two other important components: cartilage and ligaments.

1. Hyaline cartilage is at the ends of the bones.

- ▶ It stops the bones from touching
- ▶ The smooth material reduces friction preventing wear and tear of the bone.
- ▶ The cartilage also acts as a shock absorber.

2. Ligaments join bone to bone and stabilise the joint.

- ▶ Prevents unwanted movement.
- ▶ Prevents dislocation of the joint.

7. Types of joints

Ball and Socket

- ▶ Allows the largest amount of movements and are found at the **shoulder** and the **hip**.

Range of Movement
Flexion
Extension
Abduction
Adduction
Rotation

Hinge

- ▶ Allows two types of movement and are found at the **elbow** and the **knee**.

Range of Movement
Flexion
Extension

Pivot

- ▶ Allows only one type of movement and can be found at the **neck** as well as the **radio-ulna joint**.

Range of Movement
Rotation

Saddle

- ▶ Also allows a **full range of movement** and can be found at the **thumb**.

Range of Movement
Flexion
Extension
Abduction
Adduction
Limited Rotation



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Gliding

- Allows **a full range of movement** and are found between the joints in your **hand**.

Range of Movement
Small gliding movements

Condyloid

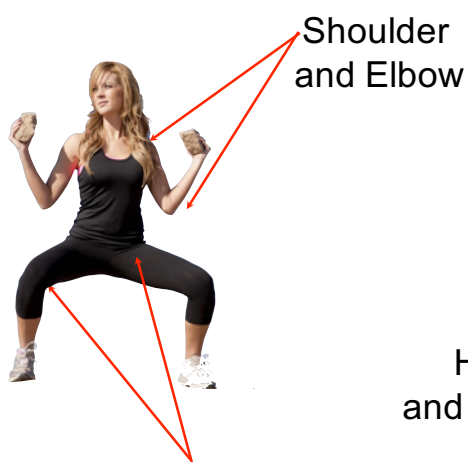
- Allows **a full range of movement** and are found in the **wrist**.

Range of Movement
Flexion
Extension
Abduction
Adduction
Limited Rotation

8. Range of movement

Flexion

Decrease the angle at the joint



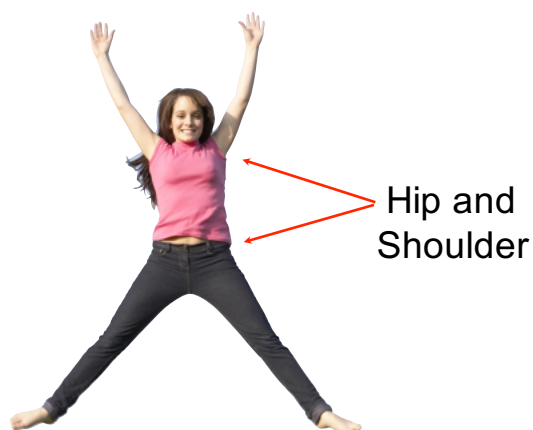
Extension

Increase the angle at the joint



Abduction

Move the limb away from the central axis



Adduction

Move the limb towards the central axis





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Rotation

Movement around an axis/rotational movement



Neck



Shoulder



Hip

Plantar flexion

Movement at the ankle joint that points the toes



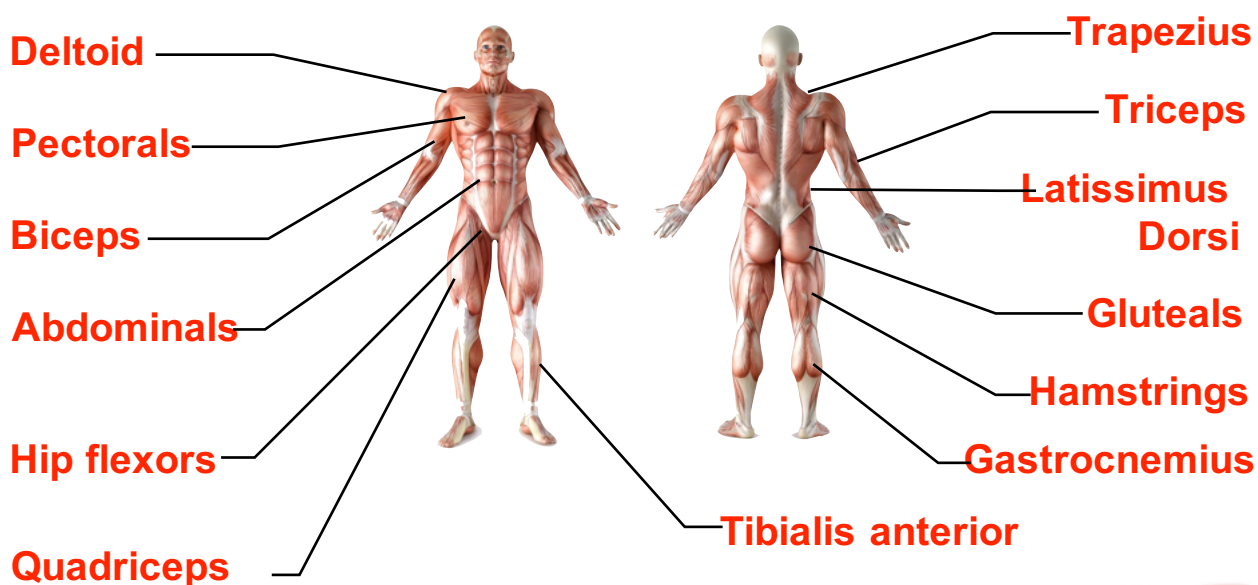
Dorsiflexion

Movement at the ankle joint that flexes the foot upwards



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9. Muscular system



10. Muscle action

Muscle	Main Action
Deltoid	Flexion, extension, adduction and abduction at the shoulder
Trapezius	Rotation at the shoulder
Pectorals	Rotation and adduction at the shoulder
Biceps	Flexion at the elbow
Triceps	Extension at the elbow
Latissimus Dorsi	Adduction, extension and rotation at the shoulder
Abdominals	Flexion at the trunk
Gluteals	Rotation and extension at the hip
Quadriceps	Extension at the knee
Hamstrings	Flexion at the knee
Gastrocnemius	Extension (plantar flexion) at the ankle joint



11. Tendons

The functions of **tendons** are:

- ▶ Attaches **muscle** to **bone**.
- ▶ **Strong** and able to withstand **large forces**.
- ▶ Stores **energy**.
- ▶ Allows **movement**.

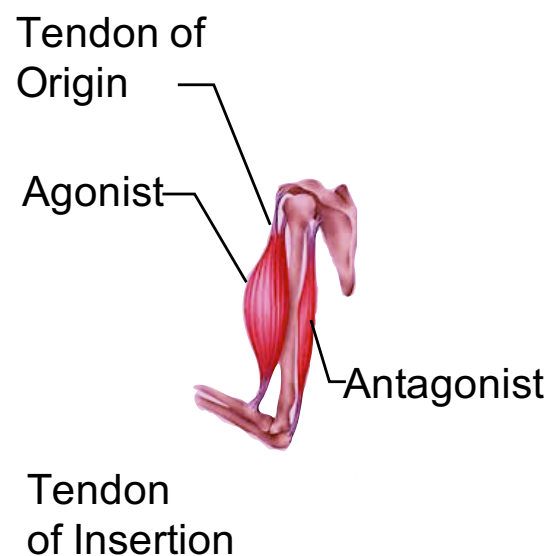
12. Antagonistic Pairs

Two good examples of **antagonistic pairs** are:

- ▶ **Hamstrings and Quadriceps**
- ▶ **Biceps and Triceps**

Muscles can **only pull** so they have to work in pairs to create movement.

- ▶ When the muscle contracts it **pulls on the moveable bone** attached by the **tendon of insertion**.
- ▶ It pulls **towards the tendon of origin** on the **fixed bone**.
- ▶ The **contracting muscle** is called the **prime mover** or **agonist**.
- ▶ The other muscle in the pair **relaxes** and this is called the **antagonist**.
- ▶ During movement other muscles called **synergists** contract to **support the contraction**.



13. Types of muscle contractions

1. **Isotonic Contraction** - Muscle contraction that results in **limb movement**.

- ▶ This is the most frequent muscle contraction during **sports play**.



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- ▶ When the **muscle contracts** it causes a **concentric movement**.
- ▶ When the **muscle relaxes** it causes an **eccentric movement**.
- ▶ **Training** your muscles **isotonically** improves dynamic (moving) strength, power and endurance.

2. **Isometric Contraction** - Muscle contraction with **no** limb movement.

- ▶ Despite contracting the muscle length stays the **same**.
- ▶ One muscle may contract isometrically to **stabilise a movement** so others can contract isotonically.
- ▶ Less sports require this muscle contraction but examples are **gymnastic handstand** or **rugby scrum**.
- ▶ Training isometrically provides **little improvements**.



14. Fast Twitch and Slow Twitch Muscles

- ▶ There are three different types of muscle fibre.



Slow Twitch (Type I)	Fast Twitch (Type IIa)	Fast Twitch (Type IIx)
Contracts slowly	Contracts quickly	Contracts quickly
Low force production	Intermediate force production	High force production
Uses aerobic energy	Uses anaerobic energy	Uses anaerobic energy
Fatigues slowly	Fatigues quickly	Fatigue very quickly
Suited to long distance sports	Suited to middle distance sports	Suited to explosive sports

