The Skeletons Role in Movement

Movement is possible due to the way that bones interact at joints.

The structure of the skeleton allows movement to occur by providing points at which muscles can attach via tendons

The movement that is possible at each joint depends on the type of joint

Short bones-allow movement that is more controlled and fine, e.g. throwing a dart.

Long bones allow gross movement, eg throwing a javelin

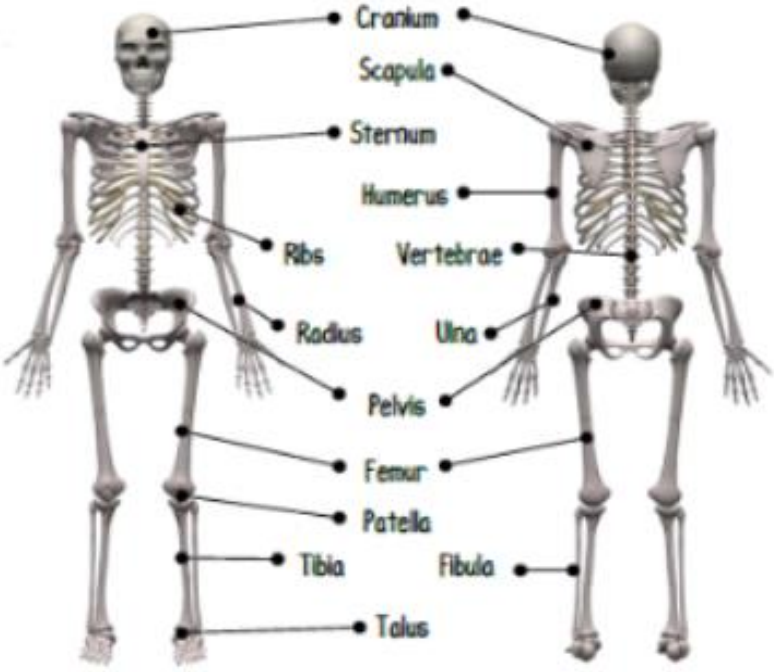
Flat bones provide protection for vital organs

Functions of the skeleton

Support	The skeleton holds your vital organs in place and your vertebrae hold you upright.
Structural shape	A combination of fused and unfused bones allows the body to be stable while also moving at particular joints.
Attachment	Bones provide a surface for muscles to attach via tendons
Movement	The structure and type of different bones determine the movement at point where they meet (a joint)
Protection	Ribs protect internal organs from injury e.g during contact sports
Blood cell production	Bones produce red blood cells which have a function of carrying oxygen to our working muscles
Mineral storage	Bones store minerals, I such as calcium, which I are important for growth and development.

Major Bones of the Skeleton

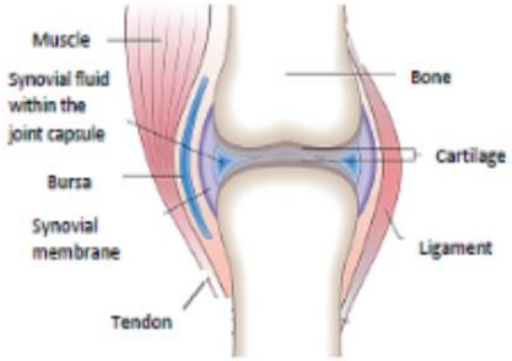
The skeleton has many major articulating bones that work at joints to cause movement.



Joints

Joints are formed where two bones meet. Some joints are fixed and allow no movement, while others are freely moveable, such as a synovial joint.

Structure of a synovial joint



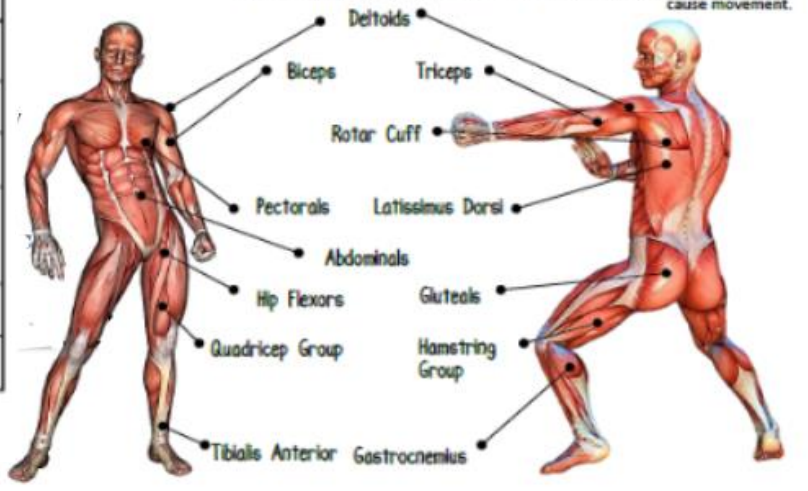
How joint structures help prevent injury

Structure	Prevents injury by...
Synovial membrane	secreting synovial fluid for lubrication
Synovial fluid	lubricating the joint and reducing friction
Joint capsule	sealing joint space to keep in synovial fluid
Bursae	providing a cushion between bones and tendons, and reducing friction
Cartilage	reducing friction and rubbing between two bone ends
Ligament	stabilising the joint and absorbing shock

Synovial joints come in different types: hinge joints (found at the elbow, knee and ankle) and ball-and-socket joints (found at the hip and shoulder). They allow different movements to be performed. To find out more about movements at a joint, go to ❶.

Major Muscles of the Human Body

The skeletal system can't work on its own; it works with these major muscles to cause movement.



Movement at Different Joints

Different joints allow for different movements. The table below outlines the movements possible at different joints and the bones and muscles located at each joint.

Joint	Joint type	Bones of the joint	Movement possible	Main muscles contracting to cause movement
Knee 	Hinge	Femur, tibia, fibula and patella	Flexion	Hamstrings
			Extension	Quadriceps
Elbow 	Hinge	Humerus, radius and ulna	Flexion	Biceps
			Extension	Triceps
Ankle 	Hinge	Tibia, fibula and talus	Plantar flexion	Soleus
			Dorsiflexion	Tibialis anterior
Shoulder 	Ball-and-socket	Clavicle, scapula and humerus	Abduction	Deltoid
			Adduction	Latissimus dorsi, Pectorals
			Rotation	Rotator cuff
			Flexion	Pectorals, Deltoid
			Extension	Latissimus Dorsi, Deltoid
Hip 	Ball-and-socket	Pelvis and femur	Abduction	Gluteals
			Adduction	Hip flexor
			Rotation	Gluteals
			Flexion	Hip flexor
			Extension	Gluteals

Ball-and-socket joint:
- Has the largest range of motion
- Movement can occur in all planes

Hinge joint:
- Has a limited range of motion
- Movement can only occur in one plane

Movement in Sport

The Role of Muscles at the Joint

Muscles connect to bones via tendons

When muscles contract, tendons pull on the bone and cause it to move at the joint.

Muscles work together (in pairs) at joints to cause movement. Each pair of muscles is called an antagonistic pair.

The **agonist (prime mover) contracts**, pulling on the bone to cause movement

The **antagonist relaxes**, so as not to impede the movement.

Muscles contract in two ways

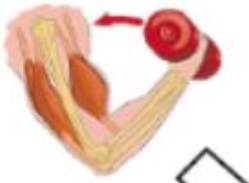
Isotonic contractions: when muscles change length as they contract. These can be either.
- Concentric contractions – muscles shorten as they contract **OR**
- Eccentric contractions – muscles lengthen as they contract

Isometric contractions: when muscles stay the same length as they contract

Lifting the dumbbell

Antagonist = triceps

Agonist = biceps



The biceps contracts and shortens to cause flexion of the elbow. This is isotonic concentric contraction.

Isometric contraction would occur if the dumbbell was held at a midway point. The biceps would be contracting but not changing length.

Lowering the dumbbell

Antagonist = triceps

Agonist = biceps

The biceps is still contracting to lower the weight, but this time is lengthening as it contracts. This is isotonic eccentric contraction.