Movement and Support

Matthew Williams • Biology • May 9, 2026

Movement and Support

Movement is one of the characteristics of living organisms, but it takes different forms in animals and plants. Animals move their whole body from place to place — this is **locomotion**. Plants respond to stimuli by growing in a particular direction — **tropisms** — covered in the coordination topic. This page focuses on how the human body achieves locomotion through the skeleton and muscles.

Functions of the Skeleton

The skeleton has five main roles:

Function	How the skeleton achieves it
Support	provides a rigid framework that holds the body upright against gravity
Protection	encloses and shields vital organs (skull protects brain; ribcage protects heart and lungs; vertebral column protects spinal cord)
Movement	acts as a system of levers; bones move at joints when pulled by muscles
Blood cell production	red bone marrow in long bones produces red blood cells, white blood cells, and platelets
Mineral storage	calcium and phosphorus are stored in bone and released when needed

Bone and Cartilage

Bone is a hard, living tissue made of calcium salts (mainly calcium phosphate) deposited on a protein (collagen) framework. It is strong, slightly flexible, and can be repaired.

Cartilage is a softer, more flexible connective tissue. It is found at the ends of bones (reduces friction in joints), in the ear and nose (shape without rigidity), and between vertebrae (absorbs shock).

Feature	Bone	Cartilage
Hardness	hard and rigid	firm but flexible
Mineral content	high (calcium salts)	low
Blood supply	well supplied	poorly supplied (slow to heal)
Role in joints	forms the joint	covers the articulating surface

Types of Joints

A **joint** is where two or more bones meet. Different joints allow different amounts of movement.

Joint type	Movement	Example
Fixed (fibrous)	none	skull sutures
Slightly movable (cartilaginous)	limited	vertebrae of the spine (cartilage pads between)
Freely movable (synovial)	wide range	hip, knee, elbow, shoulder

Synovial Joint Structure

Freely movable joints share a common plan:

- **Cartilage** on the ends of each bone — smooth surface; reduces friction
- **Synovial membrane** — produces synovial fluid
- **Synovial fluid** — lubricates the joint; acts as a shock absorber
- **Joint capsule** — tough fibrous covering; holds joint together
- **Ligaments** — strong bands of fibrous tissue connecting bone to bone; stabilise the joint

Labelled diagram of a synovial joint showing cartilage, synovial membrane, synovial fluid, capsule, and ligaments

Antagonistic Muscles

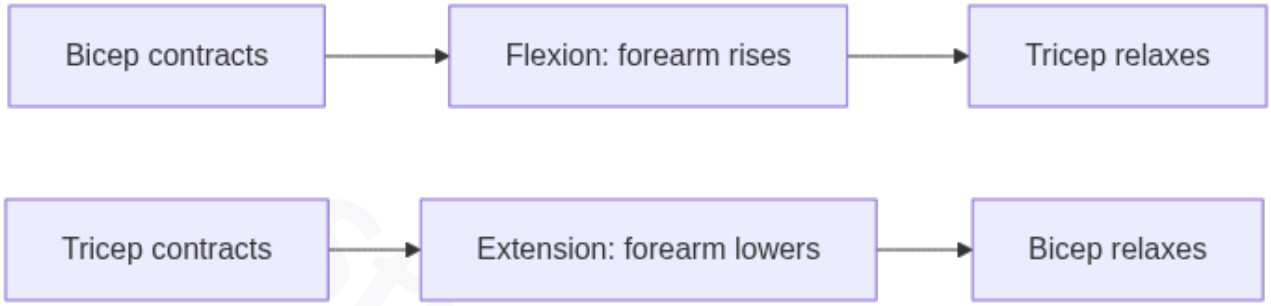
Muscles can only pull, not push. Movement at a joint therefore requires at least two muscles that work in opposite directions — an **antagonistic pair**.

The classic example is the upper arm:

Muscle	Action when contracting	Effect on forearm

Bicep (flexor)	contracts	forearm moves up (flexion) — arm bends
Tricep (extensor)	contracts	forearm moves down (extension) — arm straightens

When the bicep contracts, the tricep relaxes, and vice versa. Tendons (which connect muscle to bone) transmit the pulling force across the joint.



Antagonistic muscle action in the arm

Tendons connect muscle to bone and are made of inelastic collagen — they transmit force efficiently without stretching. **Ligaments** connect bone to bone and are slightly elastic, preventing dislocation while allowing movement.

Why Locomotion is Important

The ability to move from place to place gives animals major survival advantages:

- finding food (hunting, foraging, migrating to new food sources)
- escaping predators
- finding mates for reproduction
- moving away from harmful conditions (extreme temperature, pollutants)
- caring for offspring
- dispersing to new habitats

Plants, being rooted, achieve similar outcomes passively through growth tropisms, seed dispersal, and pollen transfer.

> 🧠 **Remember**
> Muscles pull on bones by contracting. A single muscle can flex or extend a joint, but only one direction — a paired muscle provides the opposite movement. This is why antagonistic pairs are essential.

PRACTICE — MOVEMENT AND SUPPORT

Skeleton
The rigid internal framework of the body; provides support, protection, and a system for movement.

Cartilage
Smooth, flexible connective tissue found at bone ends and between vertebrae; reduces friction and absorbs shock.

Synovial joint
A freely movable joint with cartilage, synovial fluid, a capsule, and ligaments (e.g. hip, knee).

Ligament
Strong fibrous tissue connecting bone to bone; stabilises joints.

Tendon
Inelastic fibrous tissue connecting muscle to bone; transmits the force of muscle contraction.

Antagonistic muscles
A pair of muscles that produce opposite movements at a joint; when one contracts the other relaxes.

Flexion
Bending a joint; caused by a flexor muscle (e.g. bicep) contracting.

Extension
Straightening a joint; caused by an extensor muscle (e.g. tricep) contracting.

Locomotion
Movement of the whole body from one place to another; an advantage for finding food, mates, and escaping danger.