

# *Chapter 20 Locomotion and Movement*

The term "locomotion" describes the deliberate movement of animals. The approach changes based on the environment and circumstances. The main reasons for moving are usually to find a mate, food, shelter, a good climate, a place to breed, or to flee from predators.

## **Types of Movement**

Numerous modes of movement and locomotion have evolved throughout aeons of time by evolution. Ammonites, extinct marine creatures resembling squids, travelled across the ancient waters by means of jet propulsion. Snails move along a coating of mucus by slowly contracting and relaxing their muscular foot. This is known as sticky locomotion.

Due to their bipedal nature, humans are able to walk on two legs. With the exception of primates, this mode of movement is uncommon in the animal kingdom.

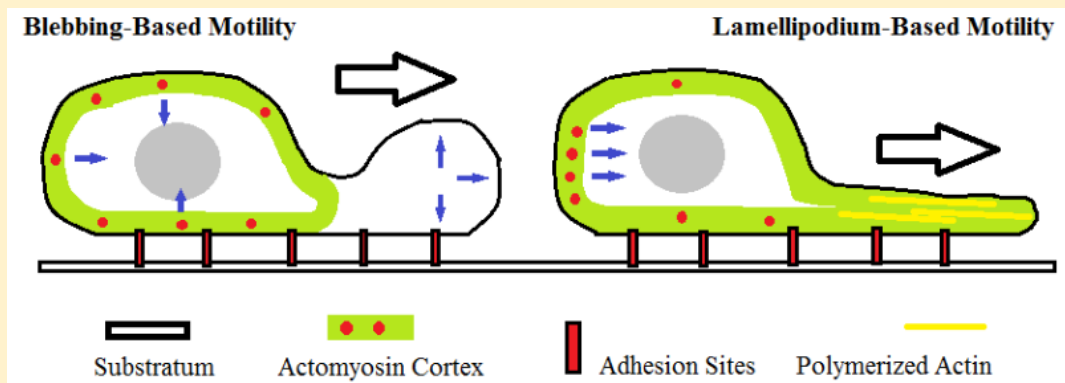
There are three kinds of movement which are ciliary, amoeboid, and muscular.

## **Ciliary Movement**

This kind of movement is seen in organs with ciliated epithelium covering them. It facilitates the passage of the egg from the fallopian tube into the uterus as well as the collection of dust particles ingested when breathing.

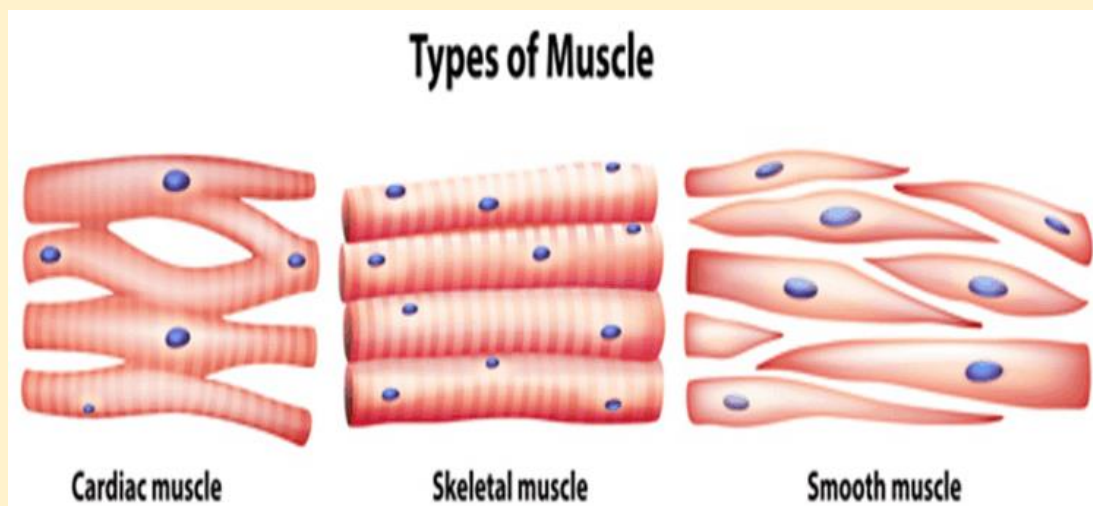
## Amoeboid Movement

Certain immune cells, like white blood cells and macrophages, exhibit this kind of mobility. Additionally, amoeba passing via pseudopods exhibits it.



## Muscle

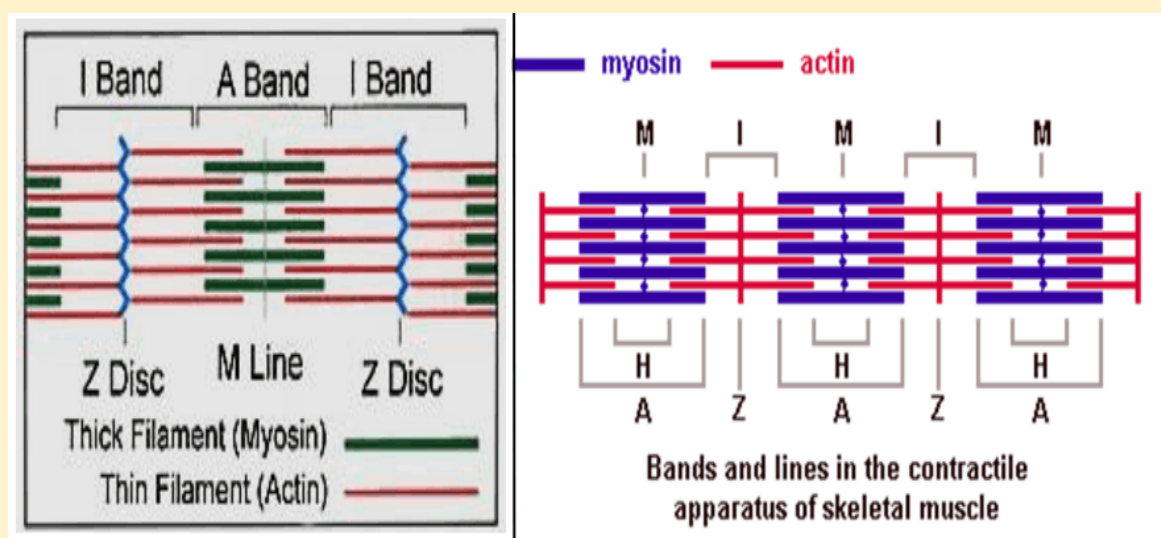
An adult human's body has between 650 and 840 muscles according to anatomy. Three types of muscles can be distinguished from these ones:



## Structure of Muscle

A fascicle is made up of several muscular bundles in skeletal muscle. Multiple muscular fibres make up each muscle bundle. Sarcolemma is the name for the plasma membrane that is placed on the muscle fibres. The sarcoplasm is encircled by the sarcolemma, or muscle membrane. Muscle fibres contain several nuclei referred to as syncytium.

Sarcoplasmic reticulum is the term for the endoplasmic reticulum found in muscle fibres. Muscle contraction is aided by the calcium ions that are kept in the sarcoplasmic reticulum. Myofibrils, or parallel strands of myofilaments, are found inside muscle fibres. The fibrous tissue that envelops the skeletal muscle is called the epimysium.



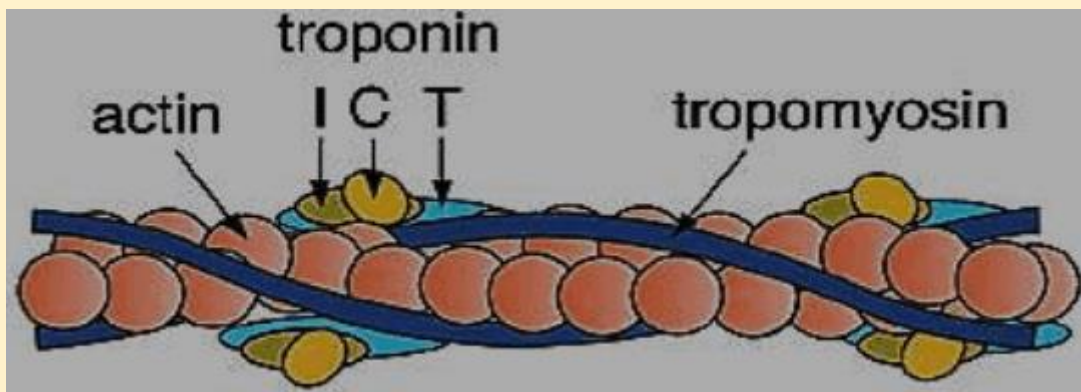
The two types of proteins—myosin and actin—that give skeletal muscle its distinctive stripes are present. The light stripes are active and go by the name isotropic bands. However, the dark stripes are known as myosin protein-containing anisotropic bands. Actin filaments are thin filaments, whereas myosin filaments are dense filaments.

In the middle of every actin stripe is an elastic fibre known as the Z-line. Sarcomeres are the segments of myofibrils that lie between two

successive Z-lines. The functional unit of muscular contraction is known as the sarcomere.

## Structure of Contractile Protein

Actin and myosin are the two primary contractile proteins. *G*-actin, often known as globular actin, is the name of the actin monomer unit. F-actin, or F-filament, is created when *G*-actin polymerizes. To create actin molecules, two F-filaments wind around one another. The F-actin is encircled by the protein tropomyosin. Tropomyosin contains an even distribution of a different protein called troponin.



Meromyosin is the name for the monomeric form of myosin. The two components of every meromyosin are a lengthy tail and a spherical head. Actin-binding sites and ATPase activity are present in the spherical head.

1. Skeletal muscle
2. Visceral muscle
3. Cardiac muscle

## Skeletal muscle

They are also called striated muscles because they are closely related to the skeletal components of the body that, when viewed under a microscope, appear to be striped. These muscles are mostly used for posture adjustments and locomotor activities.

## **Visceral muscle**

They are located in the interior walls of the body's hollow visceral systems, such the alimentary canal, reproductive tract, etc., and they are striation-free.

They are called smooth muscles because of their smooth appearance. Food may pass through the digestive tract and gametes can pass through the vaginal tract thanks to these involuntary muscles.

## **Cardiac muscle**

These are the cardiac muscles, which are made up of cells arranged in a branching manner. They are striated and uncontrollably so.

## **Skeletal System**

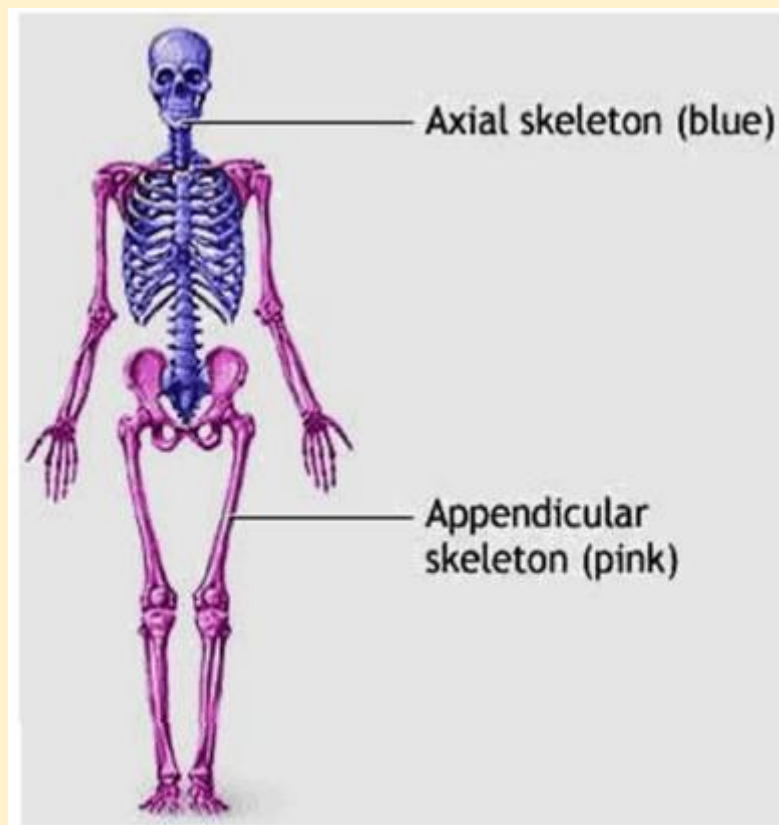
An adult's skeletal system is made up of roughly 206 bones, all of which are joined together by a web of cartilage, tendons, and ligaments. Given that it can sustain forces greater than 4,000 newtons, the femur is a rather amazing bone. These figures, however, can vary depending on the attack's position and angle.

Muscle fibres with smaller units called myofibrils make up skeletal muscle. Each myofibril is composed of three different types of proteins: contractile, regulatory, and structural proteins.

Actin and myosin are two types of contractile proteins. Actin is a thin filament, made up of two helical filamentous actin strands, and each filamentous actin strand is made up of several units of actin helix. Two filaments of regulatory proteins, troponin and tropomyosin, are periodically observed alongside the 'F' actin. Troponin covers myosin binding sites on actin filaments during muscular relaxation.

## **Axial Skeletal System**

There are a total of 80 bones present in the axial skeletal system including the skull, sternum, vertebral column, and ribs.



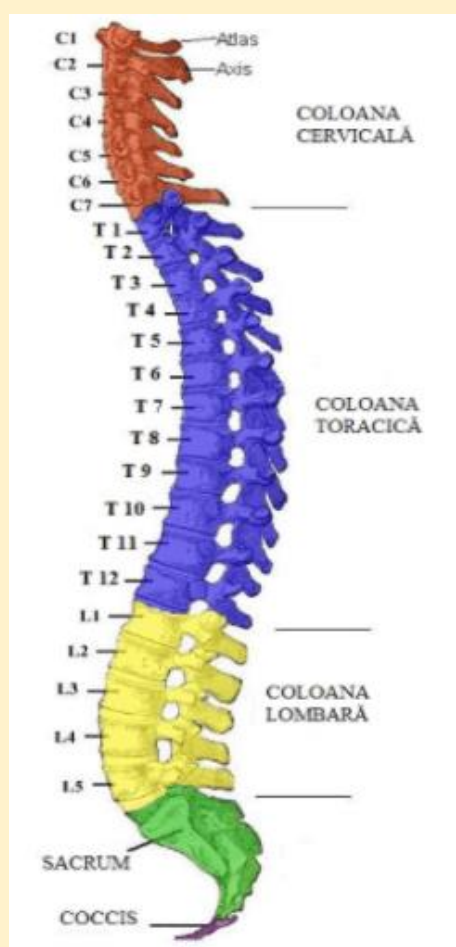
There are twenty-two face and cranial bones in the skull. The brain is shielded by the eight cranial bones in total. The front portion of the skull is made up of 14 bones, which make up the facial region. At the base of the mouth is the U-shaped hyoid bone. The malleus, incus, and



stapes are the three tiny bones that make up each middle ear. All of these are referred to as ear ossicles.

There are thirty-three vertebrae in the vertical column, or spine. The trunk's basic anatomy is made up of the vertebral column, which projects from the base of the skull. The neural tube, a hollow section in the middle of each vertebrae, is where the spinal cord travels through.

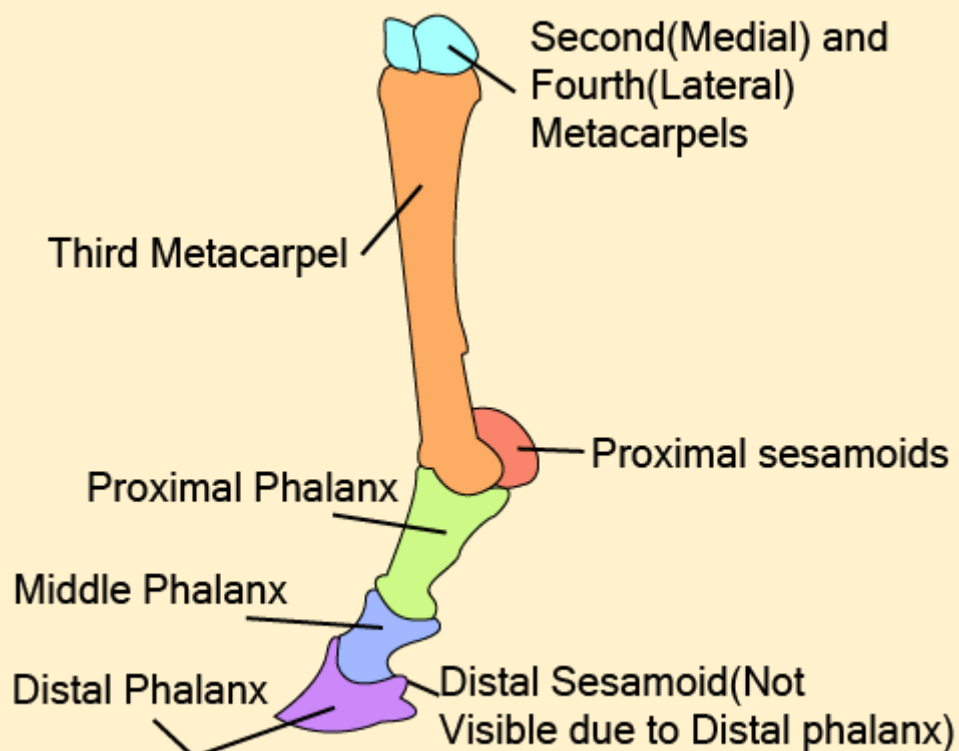
The occipital condyle is joined to the first vertebra, known as the atlas. Starting from the head, the spine, also known as the vertebral column, is separated into 7 cervicals, 12 thoracic, 5 lumbar, 1 sacral, and 1 coccyx. Mammals retain their number of cervical vertebrae.



## Appendicular Skeletal System

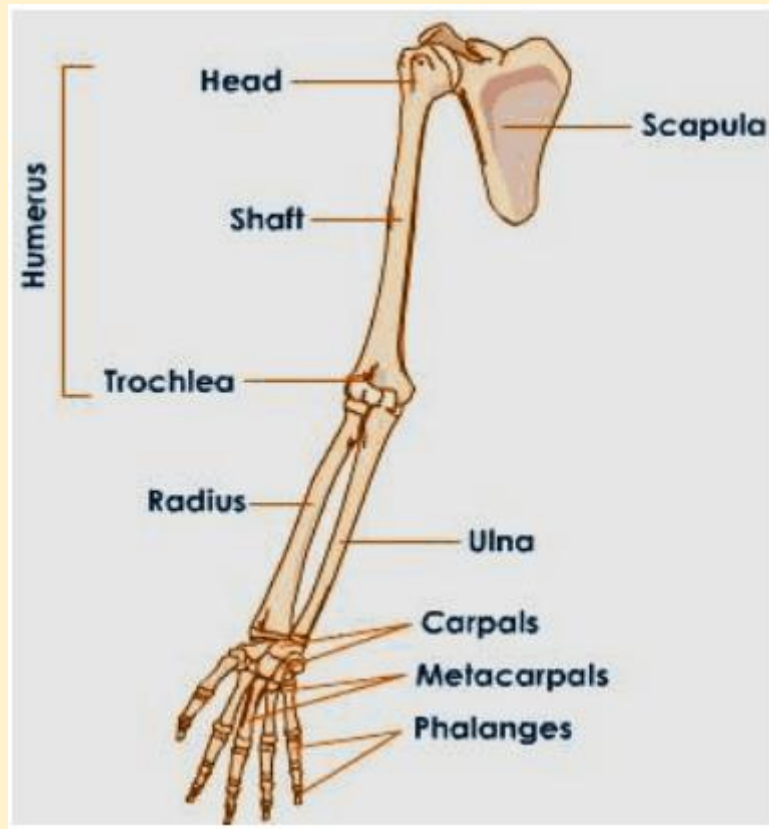
The Appendicular Skeletal System is made up of limb bones and girdles. Each limb has 30 bones.

**Forelimb Bones:** The bones of the front leg or arm or forelimb are the humerus, radius and ulna, wrist (8 carpal bones), and metacarpal bone (5 palm bones), and phalanges (14 digit bones).



**Hindlimb Bones:** There are several bones present in the hind leg or limb which are the femur, the thigh bone (the longest bone), tibia and fibula, and 7 tarsals (the ankle bones), 5 metatarsals, and 14 phalanges. The cup-shaped bones present on the knees are called the patella.





The scapula and the collarbone/clavicle make up the pectoral girdle. The glenoid cavity in the scapula connects to the forelimb bones and creates a hinge with the humerus in the shape of a ball and socket joint.

The acetabulum, a cup-shaped chamber in the pelvic girdle, connects the thigh muscles to the pelvic girdle and forms a spherical ball and socket joint with the femur, which is connected to the bones of the hind leg.

## Joints

Joints, which are necessary for mobility, connect bones and even cartilage. They fall into the following categories:

Fibrous joints: they are immobile. As an illustration, consider flat skull bones that fuse together end to end with the aid of dense, fibrous connective tissues to form sutures and, eventually, a cranium.

Cartilaginous joints: cartilages link the bones in these areas. This kind of joint allows limited movement between neighbouring vertebrae in the vertebral column.

Synovial joints are spaces between the articulating surfaces of two bones that are filled with synovial fluid and allow for some movement. For instance, a ball and socket joint, hinge joint, etc.

## **Disorders of The Muscular and Skeletal System**

Myasthenia Gravis: This illness weakens and paralyses skeletal muscles by affecting neuromuscular nodes. The illness known as myasthenia gravis is autoimmune.

A hereditary condition known as muscular dystrophy gradually destroys skeletal muscle.

Tetany: This causes the body's fluids to contain low amounts of calcium ions, which causes muscular spasms to occur quickly.

Joint inflammation is known as arthritis.

Gout: This disorder is brought on by uric acid crystals building up in the joints, which can lead to joint inflammation.

Osteoporosis: A decrease in bone mass raises the possibility of fractures. It's age-related and typically associated with low oestrogen levels.

