

## Anatomy and Physiology - An Overview

The muscular system is the body's network of tissues that controls movement. The muscles of the body are divided into three main types: skeletal, smooth, and cardiac. Skeletal muscles produce human movement and are attached to the skeleton and produce movement by shortening through a contraction and pulling on a bone via its tendon. The tendon pulls on the bone and movement is produced, allowing movement to occur in a coordinated manner. To allow this movement opposing muscles will need to lengthen. When we stretch in Hatha Yoga, we are focusing mainly on muscles that lengthen as a result of another muscle shortening.

### Skeletal Muscle contraction

Through the process of muscle contraction, tension is developed within the muscle tissue. However this does not always lead to movement, as this largely depends on what kind of muscle contraction is happening. Muscle contractions can be divided into three main types – Isotonic, Isometric and Isokinetic.

When a muscle contracts to create movement, it is called an 'isotonic contraction'. An isotonic contraction can be either 'concentric' or 'eccentric'. A concentric muscle contraction is when the muscle shortens as it contracts. An example of this is bending the knee joint from straight to flexed, as in Shoulder Bridge Pose, which causes a concentric muscle contraction of the hamstring muscles. A concentric muscle is also known as an 'antagonist'. An eccentric muscle contraction is where the fibres contract as the muscle lengthens. To allow the knee to bend, the quadriceps would need to lengthen via an eccentric muscle contraction. An eccentric muscle is also known as an 'agonist'. This grouped action is known as reciprocal innovation.

Isometric contractions occur when there is no change in the length of the contracting muscle and the muscle fixates the body in to position. For example, in Boat Pose, the rectus abdominis muscle group does not lengthen or shorten, but it still contracts to hold or 'fixate' the spine in place once the body has been moved in to it correct position by muscles that are working as agonists (eccentric) and antagonists (concentric).

The third type of muscle contraction is known as Isokinetic (meaning 'same speed'). This type of muscle contraction is rare in human movement and is similar to isotonic in that the muscle changes length during the contraction, but Isokinetic contractions produce movements of a constant speed against resistance.

To create stable coordinated movement often other muscles contract or provide assistance to the antagonist. These muscles are known to as synergists. For example, if the knee joint bends, the gastrocnemius muscle contracts to assist the hamstring muscle group with the movement of knee flexion. The gastrocnemius has now become synergist.

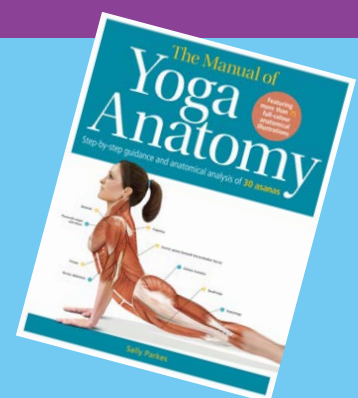


## Anatomy Module Overview



### In summary:

- Prime movers produce the movement of a joint. These are also known as Agonists and produce a concentric contraction.
- Antagonists relax to allow the contraction of the prime mover to occur. These produce an eccentric contraction.
- Synergists contract to assist the prime mover.
- Fixators contract statically to stabilise the position adopted once movement has occurred.



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## Major terms and actions

### Flexion

To bend a limb thus reducing the angle of a joint. Examples include; shortening the elbow and knee joints (bending the elbow and knee).

### Extension

The opposite of flexion, thus returning the joint to a straightened position, or increasing the angle of a joint. Examples include; straightening the elbow and knee joint from a bent position.

### Hyperextension

To move a joint past the anatomical position; An example includes; leaning backwards when standing in a tall position. This action would hyperextend the spinal column.

### Adduction

The action of adduction returns a limb back towards the midline of the body or across the midline of the body from an extended position. Examples include; drawing a leg towards the midline of the body or an arm laterally across the midline.

### Abduction

The opposite of adduction, thus the action of abduction takes a limb away from the midline of the body.

### Elevation

The action of elevation raises a joint to a higher position. An example of this action includes; lifting the shoulder girdle to perform a shoulder shrug action.

### Depression

The opposite of elevation thus this action lowers or pulls a joint downwards. An example of this action includes; lowering the shoulder girdle to the anatomical position from an elevated position, or below the anatomical position.

### Lateral flexion (adduction)

This action moves the cervical spine or the vertebral column away from the midline of the body.

### Lateral extension (abduction)

The opposite of lateral flexion, thus this action moves the cervical spine or the whole vertebral column back towards the midline of the body.

### Horizontal extension

The opposite of horizontal flexion. Therefore this movement returns the lengthened position.

### Horizontal flexion

This action occurs within the horizontal plane. An example of this action includes; bringing the arm towards the midline of the body whilst in a horizontal position. An example of this exercise being performed would be a pectoral fly movement.

### Rotation

Rotation can occur in both an inward and outward direction and occurs along the length of the bone. For example; turning the long bone of the thigh (femur) inwards towards the midline of the body.

### Circumduction

This action circles part of the body. A primary example of this action is to circle the arm at the ball and socket joint of the shoulder.

### Pronation

This action occurs at the radial-ulna joint and moves the palm to face downwards.

### Supination

This action occurs at the radial-ulna joint and moves the palm to face upwards.

### Plantar-flexion

This action occurs at the ankle joint and moves the sole of the foot downwards to point towards the back of the body.

### Dorsi-flexion

This action occurs at the ankle joint and moves the sole of the foot upwards to point towards the front of the body.

### Inversion

This action occurs around the ankle joint and turns the foot to point inwards (medially) towards the midline of the body.

### Eversion

This action occurs around the ankle joint and turns the foot to point outwards (laterally) away from the midline of the body.

### Protraction

This action occurs at the shoulder girdle and draws the shoulders forwards producing a rounded action.

### Retraction

This action occurs at the shoulder girdle and draws the shoulders backwards which opens the chest region.