
ANATOMY FOR YOGA

INTRODUCTION

What is anatomy?

Anatomy = branch of science that deals with the structure of body parts, their forms and how they are organized

Physiology = functions of body parts: what they do and how they do it

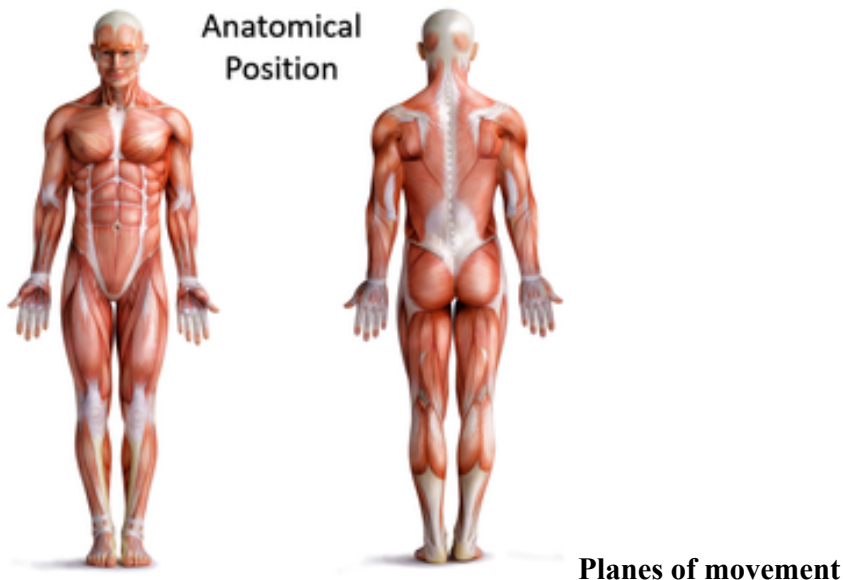
Human anatomy can be taught **systemically** (e.g. musculoskeletal, digestive, nervous systems), or **regionally** (e.g. head & neck, spine, upper & lower limbs)

Four components that allow and restrict movement in asana practice

1. Skeletal System
2. Muscular System
3. Connective Tissue
4. Nervous System

Anatomical neutral position

Anatomical position is used as a reference point in the West for directional terms (locations in the body) and basic movements. This is the starting position for describing any movement. It is important that you know this to be able to understand what is meant by certain movement patterns. It is sometimes also called the anatomical starting position or fundamental starting position.



Sagittal Plane

The Sagittal Plane passes through the body front to back, so dividing it into left and right. Movements in this plane are the up and down movements of flexion and extension.

Frontal/Coronal Plane

The Frontal Plane divides the body into front and back. Movements in this plane are sideways movements, called abduction and adduction.

Transverse Plane

This plane divides the body into top and bottom. Movements in this plane are rotational in nature, such as internal and external rotation, pronation and supination.

Flexion and extension happen in a forward and backward direction (in the Sagittal plane)

- Flexion – Decrease angle of joint
- Extension – Increase angle of joint

Abduction and adduction happen in a sideways direction (in the Frontal/Coronal Plane)

- Abduction – away from midline; remember 'abduct' from as in kidnap
- Adduction – toward midline; remember 'add' to

Rotation happens across the body, or parallel to the ground (in the Transverse Plane)

- Rotation – a twist or turning

SKELETAL SYSTEM

The human body is made up of 206 bones, but you only need to know about 26 —which are the major bones associated with the spine and the upper and lower limbs. The skeleton is divided into 2 parts:

Axial skeleton – the skull, ribs, spine

Appendicular – upper and lower limbs plus bones forming the 'girdles' which connect the limbs to the axial skeleton. These girdles are the pelvic girdle and the shoulder girdle.

Function of the skeletal system:

- Protection – of vital organs – i.e. skull protects the brain
- Storage – calcium, minerals
- Production - of blood cells.
- Structure – shape for the body - without it we would collapse
- Movement – muscles attach to bones to move the body

About Bones

Each bone is made up of a vascular covering called a periosteum, which is painful to firm touch. Bone is one-third living tissue and is basically a protein matrix with various minerals like calcium and other inorganic salts embedded in it. The marrow, found at the center of the large bones, is one of the sites that produce red blood cells. At the end of each long bone is an epiphysis, or growth plate. Bones grow from their ends, and when an individual has reached maturity, the growth plates are no longer active.

Wolfe's law states that bones grow along lines of stress. This means that when we bear weight on our bones, especially on those that are intended for weight bearing, such as the femur, it helps to strengthen the bone.

Astronauts who have been weightless in space actually have lost a small percentage of their bone mass when they are tested back on Earth. Gravity causes weight to be borne through the bones, thus stimulating the bone to maintain itself.

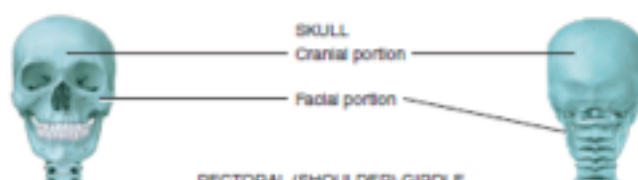
It can be useful when teaching yoga to be able to quickly touch various bony prominences, or anatomical markers, on the student's body. The following seven prominences are especially important to know:

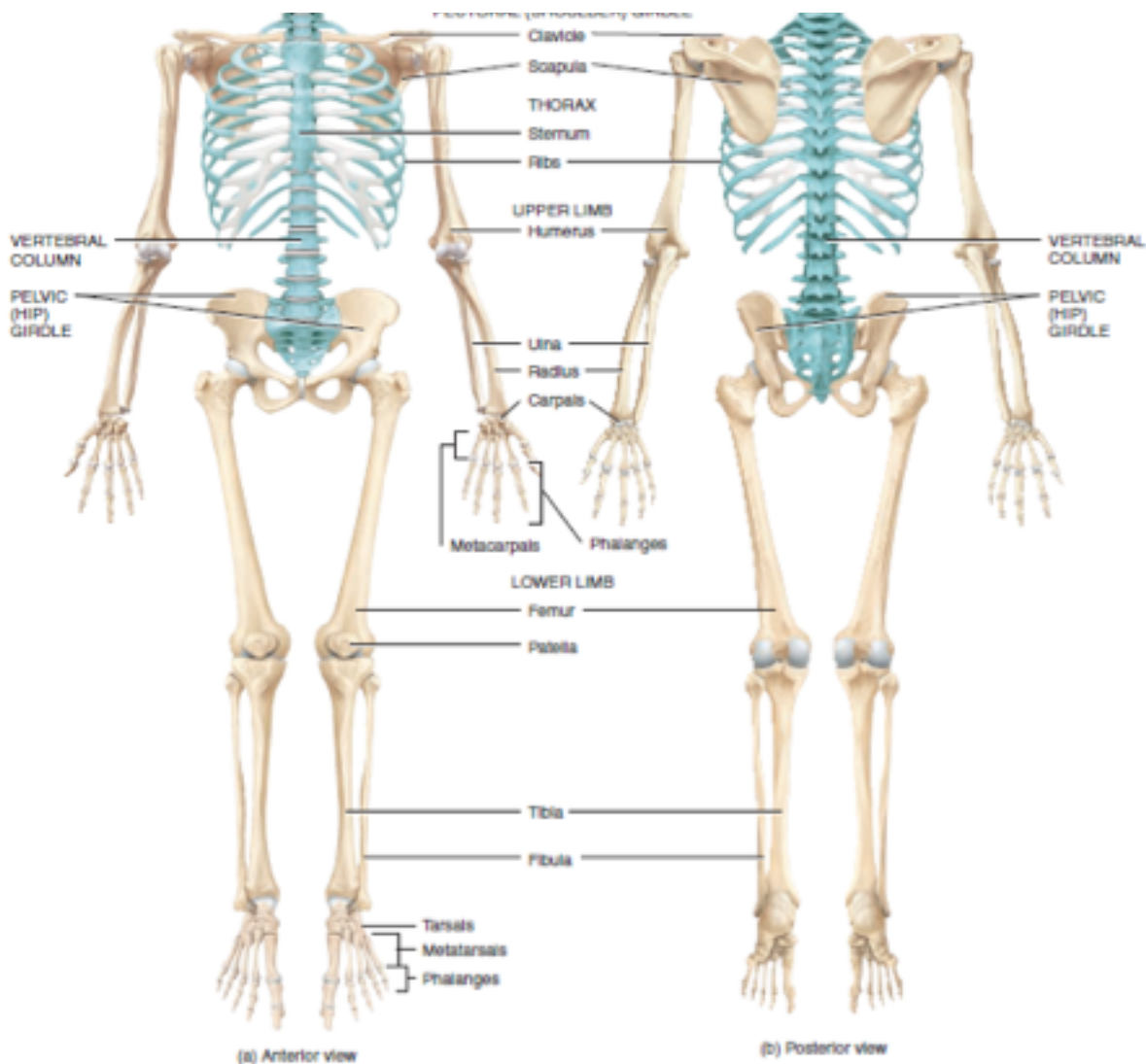
1. Head of the humerus
2. Spine of the scapula
3. Inferior angle of the scapula
4. Anterior superior iliac spine
5. Greater trochanter
6. Tubercles at the inner and outer knee joint
7. Malleoli (lateral and medial ankle bones)

Bones can have ridges, called spines or crests, which serve as the attachment point of muscles and other connective tissue; they can have openings called foramen. These openings allow for the passage of other structures, like nerves and blood vessels. Bones also have projections, like the tuberosity of the humerus and the trochanter of the femur.

8.

 The adult human skeleton consists of 206 bones grouped into two divisions: the axial skeleton and the appendicular skeleton.





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MUSCULAR SYSTEM

Muscles function to maintain our posture and to help us move. They give shape to the body and produce heat that helps to keep us warm. Muscles also help to hold the organs in place, and certain muscles help to open passageways in organs, allowing for the movement of food and digestive enzymes, the expulsion of solid and liquid waste, and the delivery of a baby. Muscles are responsible for a large part of the functioning of the circulatory system, as well as for respiration and cardiac function. There are three types of muscles in the body. These are smooth, or involuntary, muscles; cardiac muscle; and the skeletal, or voluntary, muscles.

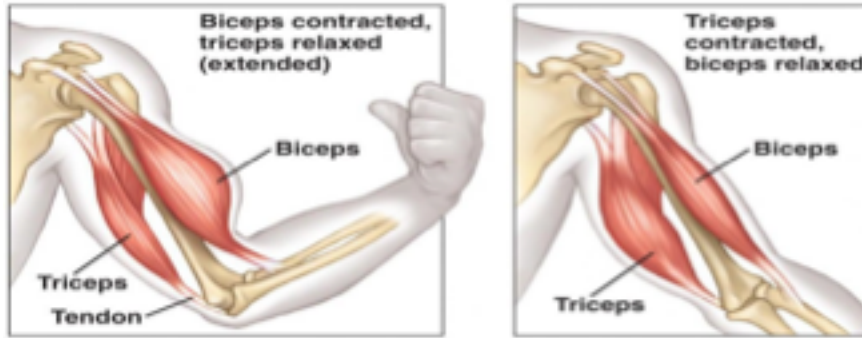
The skeletal or voluntary muscles are what we use to move the body and are our primary focus of study. Muscles work by contracting, or shortening, and they also control movement when they release, or let go. The shortening is called a **concentric contraction**. A muscle release can be sudden and swift, which is usually done in order to protect the muscle from tearing. However, most of the time muscles let go, or lengthen, in a slow and controlled manner. If a muscle lets go slowly, it is said to be undergoing an **eccentric, or lengthening, contraction**. Muscles are more efficient when they contract in the plane of movement in which they lie. For example, this means that because the triceps brachii lie in the sagittal plane, they are more efficient contracting in that plane.

To evaluate the safety and effectiveness of a posture you need to be aware of the movements that are possible at various joints in the body and understand the muscles or muscle groups responsible for producing these movements. We also need to be aware of if a restriction/obstacle is tensile or bone on bone compression. Tensile (i.e. muscular) can be worked on to create more flexibility/ strength. Bone on bone compression cannot change – these are the bones we were born with so at some point we will reach our full range of movement.

The attachment where a muscle starts is called the **origin** and the point where it ends is called the **insertion**. For example the origin for rectus abdominis is on the pubis bone and the insertion is on the cartilages of the 5th, 6th and 7th ribs. Its main action is spinal flexion.

Muscle action - 4 key points:

1. A muscle can only pull (i.e. exert a contracting force) it cannot push.
2. A muscle crosses at least one joint. This is demonstrated when the muscle contracts or shortens, bringing the bones closer together.
3. A muscle can only work in its line of fibre. E.g. the biceps muscle runs north to south and will only be able to shorten and lengthen in that plane of movement.
4. Muscles work in pairs. **Agonist** (prime mover of a joint) and **antagonist** (opposite muscle). Each muscle has an opposite muscle to allow movement to occur at the skeleton. E.g. when one shortens the other one lengthens to bring about movement.



Types of Muscle Contraction

- **Isometric** – iso=same, metric= length

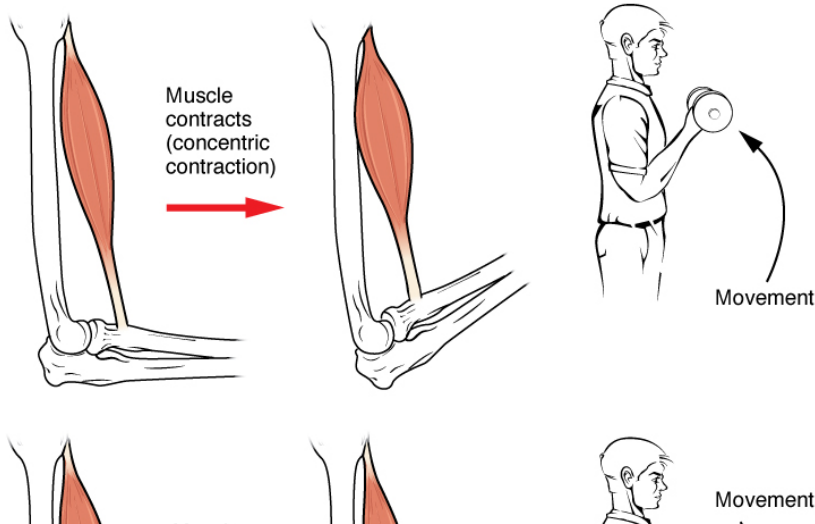
This is a contraction of a muscle with no movement involved.

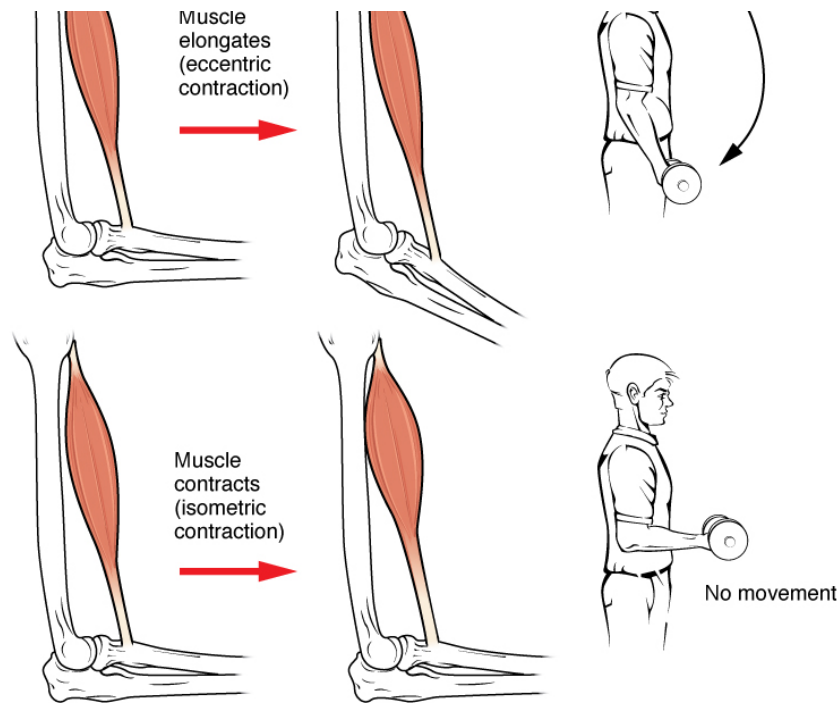
- **Isotonic** – Iso=same, Tonic=tone

This is a contraction of a muscle and the overall length of that muscle changes.

- **Isotonic Concentric** – The muscle contracts and shortens as the distance between the two ends gets shorter.

- **Isotonic Eccentric** – The muscle contracts and lengthens - the distance between the two ends gets longer.





CONNECTIVE TISSUE

By definition, connective tissue is any tissue that connects parts of the body. There are various types of connective tissue, ranging from hard (bone) to liquid (blood). They play important roles in the maintenance, protection, and anchoring of the skin, bones, and organs.

Made from two types of proteins – collagen and elastin. Proportion of these depends on the type/function of the connective tissue. Fascia has high proportion of elastin. Ligaments have a high proportion of collagen.

Types of connective tissue

- Tendon – End of muscle to bone
- Ligament – Connects bone to bone
- Scar Tissue – forms when there's an injury
- Bones – specialized bone cells get wrapped in connective tissue
- Muscle – connective tissue wrapped around muscle cells which are bundled together with connective tissue and bundled together again to make a muscle.
- Fascia – wrapped around a muscle, inner organs, blood vessels, etc. Creates an inner “spider web” structure of the whole body
- Bursae – sacs of connective tissue
- Cartilage – serves a protective function, padding areas where use is great to prevent damage to bone

Tendons are the connective tissue that holds muscles to bones. The fibers of the muscle tendons are arranged in long, straight lines. The tendon grows out of the periosteum of one bone, goes through and around the muscle, and then attaches at the other end to the bone. Tendons are named for the muscle of which they are part.

Ligaments are the form of connective tissue that holds bone to bone at every articulation. Ligaments can be stretched from their original length, but they are not very elastic. This means that a strongly stretched or sprained ligament will not go back fully to its original shape. This low amount of elasticity is one of the factors that allow us to stay stretched out over time. Otherwise, every asana practice would feel like the very first one.

Fascia - Superficial fascia is just under the skin. The deep fascia holds each muscle and can hold muscle groups as well. It is thin, white, and has a strong cobweb-like look. It also can serve as an anchor for the passage of nerves and blood vessels. After injury, the fascia can become adhered to surrounding tissues and interfere with pure muscle function and locomotion.

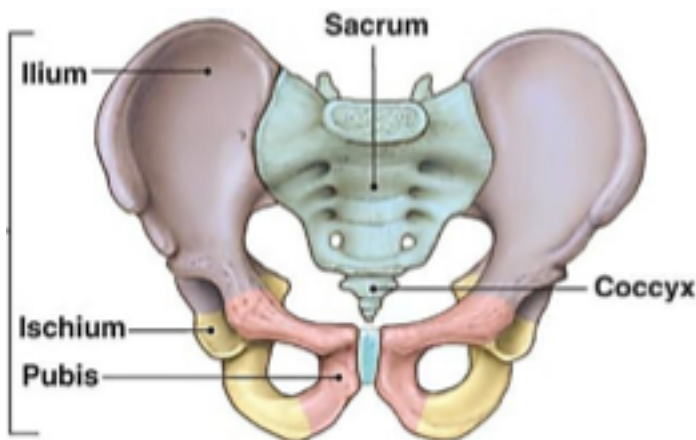
During asana practice, you may have noticed areas or specific muscles of your body that never seem to stretch out. The sensation of stretching that part of your body seems to be the same year after year. This could be an area where your fascia is adhered to surrounding tissue.

Bursae are sacs of connective tissue that have a synovial lining and secrete synovial fluid for ease of movement. Bursae are located at points in the body where movement creates friction and thus heat; they are primarily protective of tendons and muscles where they can rub over bones. Well-known bursa are located at the subacromial joint of the shoulder, the subdeltoid region, in the anterior shoulder joint to protect the long head of the biceps brachii, at the ischial tuberosity, and at the back of the knee joint. All these areas are areas of regular friction of tendons over bones.

Types of Cartilage

1. Fibro Cartilage: this is a very dense material and makes up the symphysis pubis and the intervertebral discs
2. Hyaline Cartilage: this is more elastic than fibro cartilage and has the smooth consistency of hard, dense, but bendable rubber. It is mainly found at the ends of bones. It attaches the lower ribs to the sternum and makes up most of the nose
3. Elastic cartilage: the most elastic of the three types, found in the outer ear.

PELVIC GIRDLE



The word ‘pelvis’ means ‘basin,’ which is exactly what the pelvis is: a basin to hold the organs of digestion, elimination, and reproduction. The pelvis is also the pot out of which the spine grows; thus the position of the pelvis is critical for creating spinal alignment and health. The pelvis joins with the vertebral column through the sacrum and simultaneously balances itself through the hip joints, thus becoming a central fulcrum for the movements of asana.

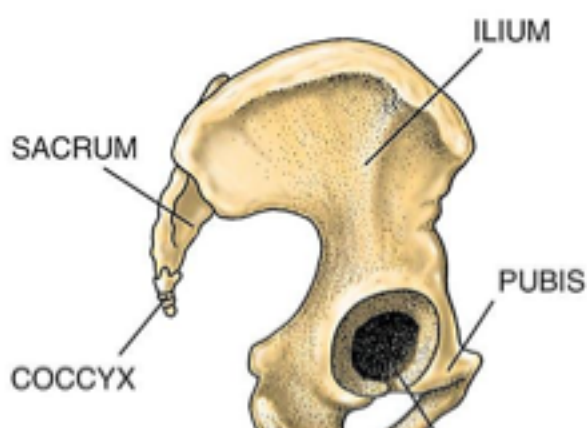
The hip joint is important for so many asana that understanding its movements and limitations is key to teaching standing poses and forward bends, in

particular.

Ilium – 2 upper broad, flat bones connected at the back with the sacrum

Ischium- the two rounded, firm ends of the sitting bones

Pubis - connected by the pubis symphysis – a small piece of cartilage which joins the 2 halves



Functionally it is the primary means of transmitting the body’s weight to the lower extremities.

THE HIP

Femur meets the acetabulum of the pelvis – acetabulofemoral joint

The femur is the largest, longest, and strongest single bone in the body. It has a slight anterior curve that improves its ability to bear weight.

Movements

Flexion, Extension, Adduction, Abduction, Internal and External Rotation



EXTERNAL ROTATION

Examples of movements of the hip in postures

Flexion – Utthita Hasta Padangusthasana A

Extension – Vrishchikasana (Scorpion)

Abduction (movement away from midline) – Supta Padangusthasana B

Adduction (movement towards midline) – Marichyasana C

Internal Rotation – Prasarita Padottanasana

External Rotation – Padmasana

Pelvic movements

Anterior tilt (anteversion) – Pubic Bone drops down and posteriorly – i.e. Uttanasana

Posterior tilt (retroversion) – Pubic Bone lifts anteriorly – i.e. Utkatasana

The hip joint is a straight forward ball and socket joint. It has a much deeper socket in comparison to the glenoid fossa of the shoulder. There's a snug fit between the ball and the socket.

It is worth bearing in mind that all the joints in the lower limbs are weight bearing; they need to have more stability. Therefore the range of movement at most of these joints is less than their equivalent upper body joint.

The ligaments of the hip joint are some of the strongest in the body. The muscles of the pelvis and thigh are some of the strongest and most important in the body. They anchor the spine to the pelvis and the pelvis to the femur, help to form the floor of the pelvis, and allow us to stand and locomote.

Muscles of the hip - Overview

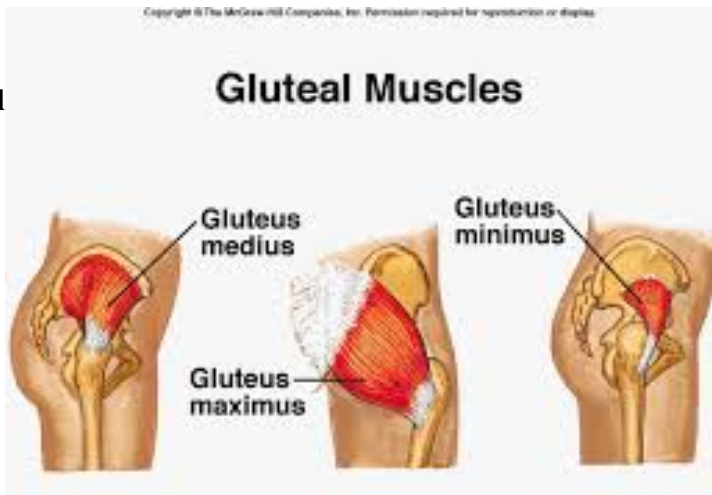
Anterior Muscles

- Quadriceps
- Adductors
- Tensor fasciae latae
- Sartorius
- Iliopsoas



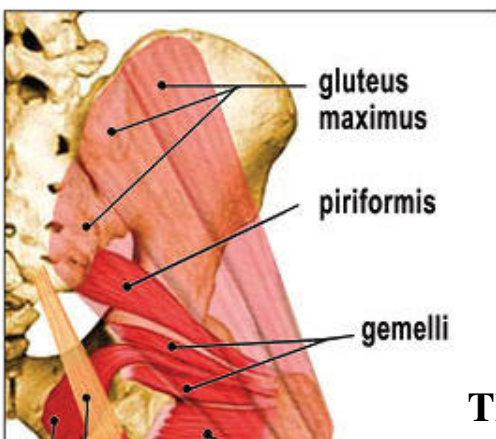
Lateral

Gluteal Muscles



Muscles

- Gluteus Minimus
- Gluteus Medius



Posterior muscles

- Deep six lateral rotators (including piriformis)
- Hamstrings
- Gluteus maximus

THE SPINE AND TRUNK

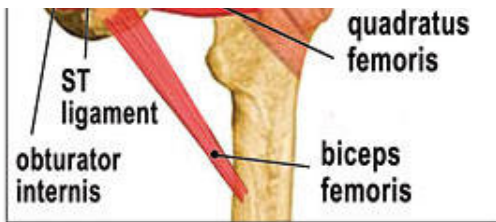


Figure 1

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The vertebral column, also called the spinal column, consists of thirty-three bones, not all of which are independently movable. From a structural viewpoint, the most significantly observable aspect of the column is that it is arranged in a series of curves, which can be easily viewed from the side, and is not a straight line. This series of curves allows for freer movement between the segments and improves the ability of the column to bear weight efficiently and act as a shock absorber.

The vertebral column has a variety of functions, including helping to holding us upright and providing an armature for the posterior wall of the trunk and ribs. Additionally these bones protect the nerves of the spinal cord and serve as the attachment site of muscles and ribs, thus helping to protect the internal organs.

The spinal column plays a major part in all of our movements, especially in the movements of asana. In yoga there are philosophical implications to the vertebral column as well as the more obvious anatomical and kinesiological ones. The spiritual energy of *kundalini* is said to lie curled like a sleeping serpent at the base of the spine, and one awakened travels upwards along *sushumna nadi* until it reaches the highest center in the brain—a state of enlightenment.

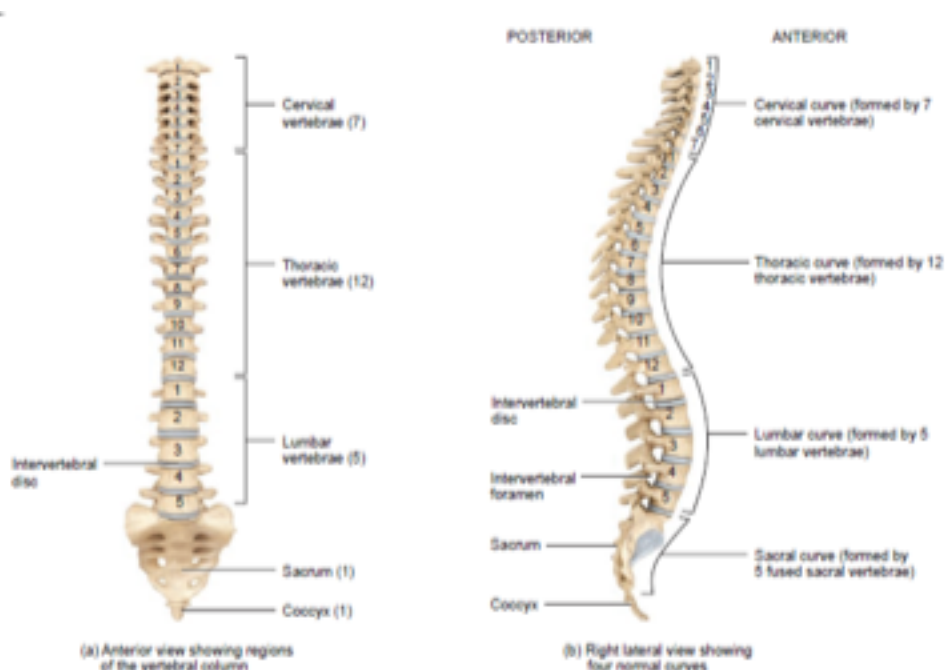
Movements available:

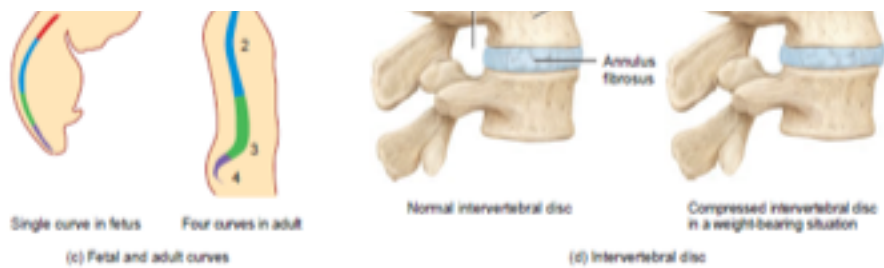
- Flexion/Extension
- Rotation
- Lateral flexion
- Axial extension (sometimes referred to as the 5th movement of the spine, this refers to a simultaneous reduction in the primary and secondary curves of the spine, by increasing the overall length of the spine in combination with engagement of the bandhas)

A ‘normal’ spine has four natural curves, which are named after the vertebrae that form them.

- 7 Cervical vertebrae C1 – 7
- 12 Thoracic vertebrae T1 – 12
- 5 Lumbar vertebrae L1 – 5
- Sacrum – Fusion of 5 vertebrae
- Coccyx (Tailbone) – fusion of 3- 4 vertebrae.

These curves center the skull over the rest of the body, which enables a person to walk more easily and maintain upright posture. They also reduce the amount of impact through the skeleton by dispersing shock and protect the brain from shock waves that occur from movement.






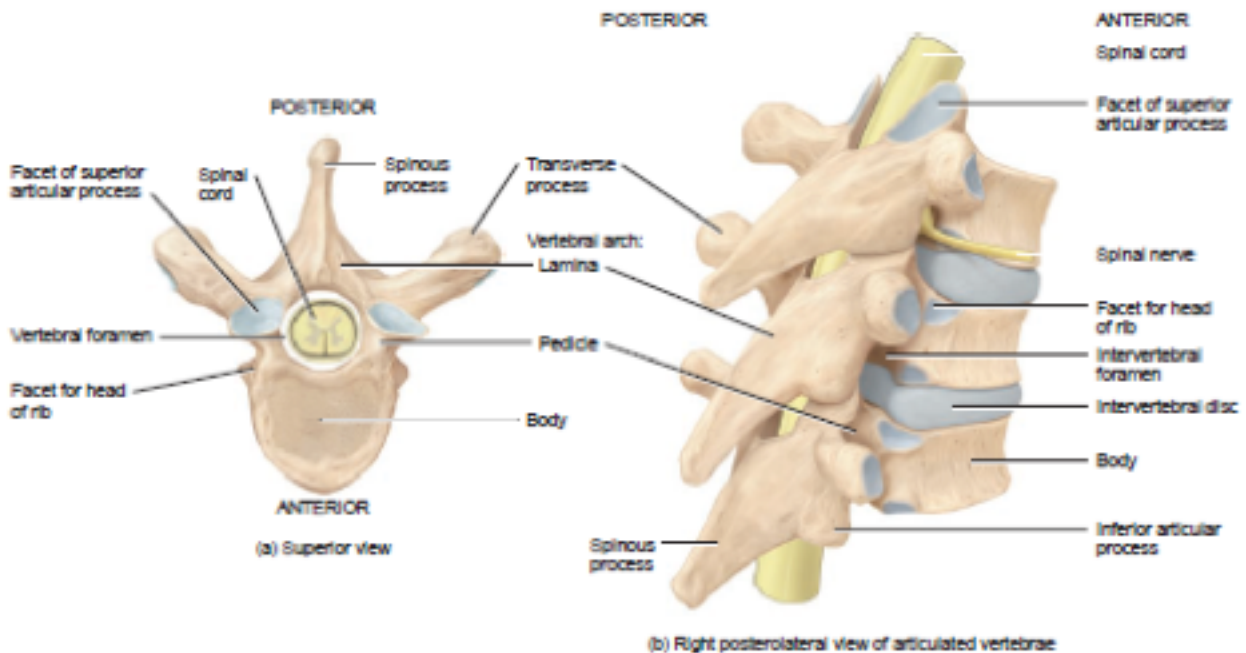
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Parts of the vertebrae

 A vertebra consists of a body, a vertebral arch, and several processes.



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Each vertebra has a body, which is the largest single portion of the vertebra. The exceptions are C1 and C2. C1 lacks a body entirely, and C2 has a small, roundish body. When viewed superiorly or inferiorly, the vertebral bodies have a different shape in each vertebral region. In the cervical region, the bodies are oblong; the thoracic bodies have a heart-shaped form; and the lumbar bodies appear kidney-shaped.

- **Body of the vertebrae** – Large area in the front of the vertebrae that the intervertebral disc sits between. Deals with weight bearing, compressive forces
- **Arches/Processes of the vertebrae** – deals with tensile forces generated by movement

The body is the main weight-bearing part of the vertebra. Note that the vertebral bodies increase in size, from cervical to lumbar, in order to better support the weight from above. The vertebral arch is the bony ring in the middle of each vertebral body and is the opening for the passage of the spinal cord. Note that the cord

in the middle of each vertebral body and is the opening for the passage of the spinal cord. Note that the cord is located at the most protected part of the column.

Arches of the vertebrae:

Spinous process – The part of the vertebrae that sticks out posteriorly. We feel it along the back.

Transverse process – The part of the vertebrae that stick out on both sides. (Difficult to feel).

Facet joint – The place where vertebrae meet one another and move against each other. Classified as a gliding joint.

3 main ligaments – hold vertebrae in place

Anterior longitudinal – runs along the front of the body of the vertebrae. It prevents the vertebrae from moving forward. The ALL is stretched in back bending and loosened in forward bending.

Posterior longitudinal – runs along the back of the body of the vertebrae. (i.e the body of the vertebrae is sandwiched between the anterior and posterior longitudinal ligaments). The posterior longitudinal ligaments help prevent herniations from pressing against the spinal cord. The PLL limits or is stretched taut on forward bending, and is loose on back bending.

Interspinous – Connects together the spinous processes at the back.

Intervertebral disc – Cartilaginous material called the Annulus Fibrosis that surrounds the soft jelly-like fluid nucleus known as the Nucleus Pulposus. As well as preventing the vertebrae from rubbing against each other, the disc also acts as a shock absorber to the impact of daily activities.

The 23 discs are the main connectors between the bodies of the vertebrae. There is no disc between the skull and C1 or between C1 and C2. The disc is the most important structure for the preservation of the function of the vertebral column. A healthy and plump disc helps maintain the range of motion (ROM) at the adjacent vertebral segment. Plump discs also help to keep the bodies of the vertebrae an appropriate distance apart. This helps to maintain the space necessary to prevent any impingement on the spinal nerve from the vertebral body.

The nucleus pulposus has no direct blood supply after the third decade of life. Yet it is made up of 80% water. Movement helps keep the discs plump. By bending forward, bending backward, and twisting, pressure on one side of the disc causes the other side of the disc to take up fluids passively. Asana is an effective way to move the column safely in all directions, thus helping to maintain the health of the disc.

Disc Injuries

Bulging discs – Pressure between the vertebrae causes compression of the disc and a relatively equal bulge around the edges.

Herniated disc – Pressure between the vertebrae may be unequal or there may be a weakness in a portion of the disc. This weakened area then weakens to the point where the nucleus pushes just this section of the disc out further than the rest of the disc.

Ruptured disc (Disc Prolapse) – A ruptured disc may continue from a herniation. A ruptured disc is one where the nucleus moves outside the outer rim of the annulus and presses on the spinal nerve.

Primary and Secondary Curvatures of the Spine and Exaggerated Curvatures

The thoracic spine at the rib cage area and the sacral curve below the waist are called primary curves because they developed in utero. These two regions of the spinal column remain curved in the same direction throughout life. Both of these curves have their concavity anteriorly. The curvatures are *kyphotic*. The cervical and lumbar curves are both called secondary curves because they develop after birth. These curves have their concavity posteriorly and are said to be lordotic. The cervical curve begins at birth during passage through the birth canal and continues to develop as a baby begins to hold its head up; the lumbar curve develops once a child is learning to walk and stand in the changing relationship to gravity. Because the secondary curves are developed and are the opposite curve of the column found in utero, they are less stable.

The secondary curves are said to be sympathetic curves. This means that when your student flexes his neck, he also has a tendency to flex his lumbar spine, and when he extends his lumbar spine, he often will extend his cervical spine as well. This comes into play in both forward bending and back bending.

Genetics and lifestyle factors can cause the curvatures of the spine to become exaggerated or excessive, which gives a distorted appearance to someone's posture. This can then lead to additional problems and symptoms in the form of stiffness, tenderness, back pain and a lack of mobility.

Any exaggerated curvatures of the spine are referred to as Kyphosis, Lordosis or scoliosis depending on the direction of the curve. Each condition is characterized by a distinct spinal curvature.

Lordosis – An exaggerated inward curvature of the lumbar spine. Gives the lower back a hollowed appearance and can sometimes make the buttocks appear more prominent. Can be caused by poor posture or developmental problems during childhood or pregnancy.

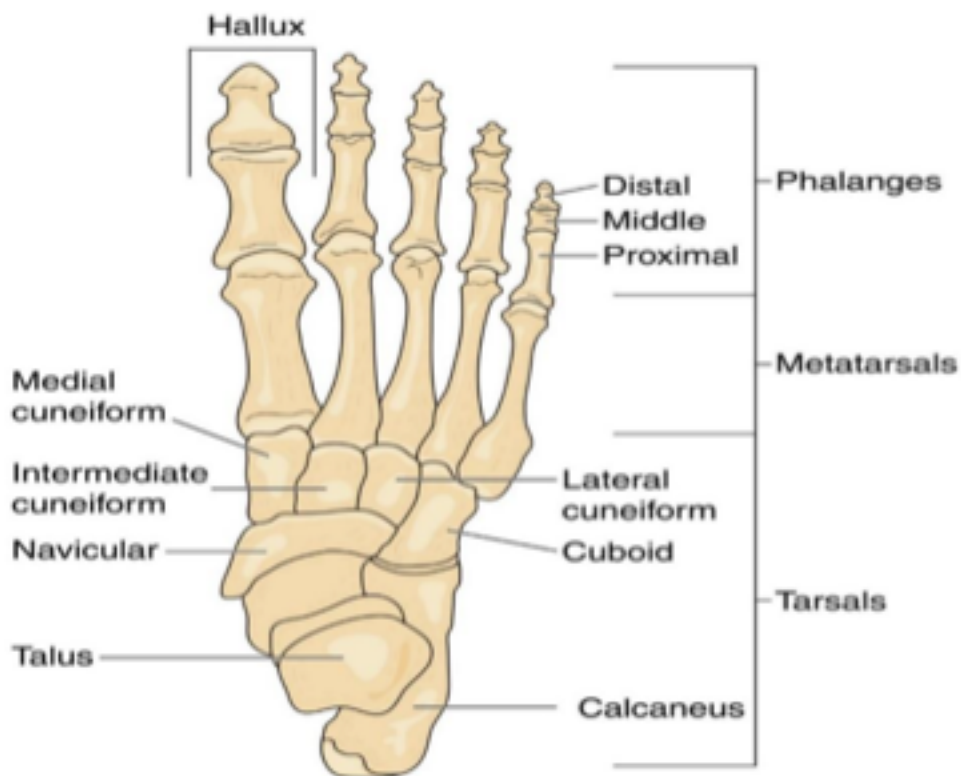
developmental problems during childhood or pregnancy.

Kyphosis – An exaggerated rounding or hump in the thoracic vertebrae giving the person a slouched appearance, often with their head jutting forward. A variety of causes include – genetics, lifestyle factors which have led to bad posture such as sitting for long periods of time with bad posture in front of a computer, structural deformity of the spine which may occur at birth (a congenital defect) or as a result of a degenerative disease (arthritis, prolapsed discs).

THE FOOT

There are 52 bones in the feet—about ¼ of all the bones in the body. The ankle bones, or tarsals, are seven in number. The most superior one is the talus. It is a pivotal bone, connecting the tibia superiorly, the calcaneus distally, and, on the sides, the lateral and medial malleoli. Distal to the talus is the calcaneus, the largest bone in the foot and important in weight bearing. It is the main junction where the weight of the body is distributed to the ground.

Each foot has 33 joints upon which we balance. They are formed into two distinctive longitudinal arches as well as into a series of transverse arches. Each foot has 19 intrinsic muscles. These are muscles that start and stop on the foot itself and do not cross the ankle joint. The ankle joint is a hinge joint and has six major ligaments that hold the ankle in place.



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THE KNEE

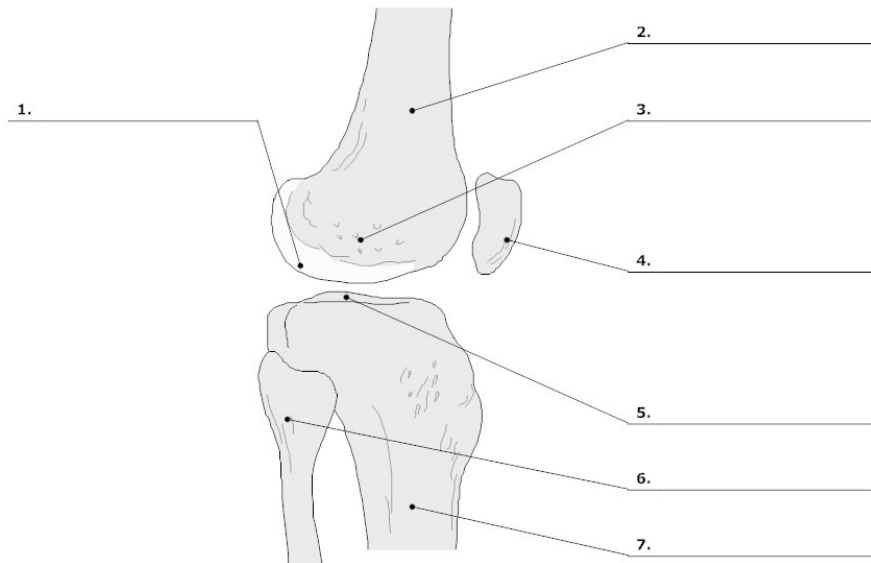
The knee joint is formed by the femur and tibia. Both the fibula and the patella are extra-articular, meaning that neither is directly involved in the knee joint proper. The knee joint is at the apex of the longest lever in the body the femur, and is a major weight-bearing joint. Because of these two facts, the knee is subject to extreme stresses and strains. These stresses occur in both flexion and extension, as well as during rotation.

Unfortunately, while the joint is also affected by a number of very powerful muscles, it is not directly supported very much by these muscles.

One of the misconceptions about the knee joint is that it acts as a hinge. Instead, the knee moves with a rolling and gliding action during flexion and extension. During flexion, the femur rolls forward on the tibial shelf, while the tibia glides backward on the femur. The healthy functioning knee joint also has a rotational component that occurs during movement. During flexion, there is an unlocking mechanism in which the femur rotates slightly externally on the tibia. This external rotation of the femur on the tibia is the freest at 90 degrees of flexion. This is the position of the front knee in Utthita Parsvakonasana or Virabhadrasana I and II.

Hyperextension of the knee joint occurs when the backward glide of the tibia on the femur is excessive so that the joint moves past 180 degrees. This contributes to instability in extension and stresses the ligaments of the knee. Other positional faults of the knees include genu valgus (knock knees) and genu varus (bow legs). Genu valgus causes the knees to come together, and it might be impossible for the student to put their feet together in Tadasana because the medial knees meet first. With genu varus (bow legs), it might be difficult for the student to put their knees close together in Tadasana.

Knee Joint



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Terms: Articular cartilage Femur Lateral condyle Patella Tibial plateau Fibula Tibia

Meniscus

The knee joint has unique connective tissue structures called menisci. These structures act as pads for the knee joint as well as functioning to create a deeper cavity in the superior surface of the tibia for the distal femoral condyles. The menisci maintain an even covering of synovial fluid and thus help keep the joint lubricated for easy movement and reduced friction. Irritation and even destruction of these cartilage surfaces tend to decrease the surface available for weight bearing, thus decreasing this natural lubrication and contributing to degeneration.

- Support movements of the knee
- Shock absorber
- Stabilize the femur

THE SHOULDER

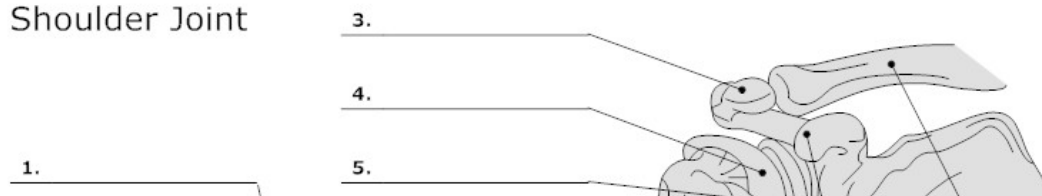
The shoulder girdle, unlike the pelvic girdle, is constructed more for movement than for stability. The shoulder girdle is not designed for bearing weight, as is the pelvic girdle. For this reason alone, understanding the structure and function of the shoulder girdle is important for the teachers and students of yoga who regularly use it for weight bearing in poses.

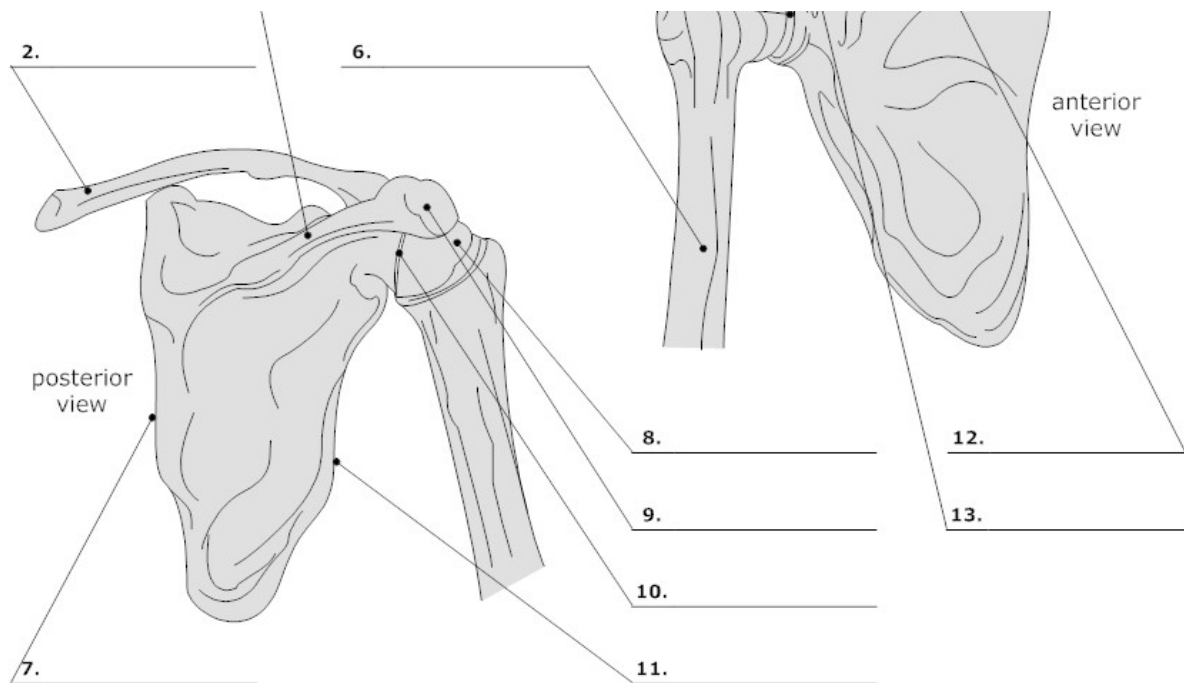
For asana practice, the most significant bone of the shoulder girdle is the scapula. Understanding the position of the scapula, how it moves and what muscles make it happen, is imperative to understanding the upper extremity.

Three bones come together to make the complex shoulder girdle:

- Clavicle (which articulates with scapula)
- Scapula (which articulates with both the clavicle and the humerus head)
- Humerus (head of the humerus articulates with the scapula to form a ball and socket joint)

Shoulder Joint





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Terms: Acromion Head of humerus Glenoid fossa Humerus Clavicle Caracoid process Clavicle Spine pf scapula Medial border Lateral border Head of humerus Glenoid fossa Acromion

Movements of each bone

Clavicle

Elevation/ Depression; Protraction/ Retraction; Rotation

Scapula

Elevation/Depression; Protraction/Retraction; Upward/Downward Rotation; Tilting

Humerus

Flexion/Extension; Abduction/ Adduction; Internal rotation/ External rotation

Glenoid fossa = the shoulder socket. It is flat compared to the hip socket. The flatness means the head of the humerus is able to move around without being constrained by sitting in a deep socket.

The shoulder is also made up of a combination of three joints. This means that the interaction between these joints provides a wide range of movement.

The shoulder is surrounded by many ligaments and muscles which pull in different directions and therefore help to stabilize the shoulder joint – these are known as the *Rotator cuff muscles*.

Rotator cuff muscles

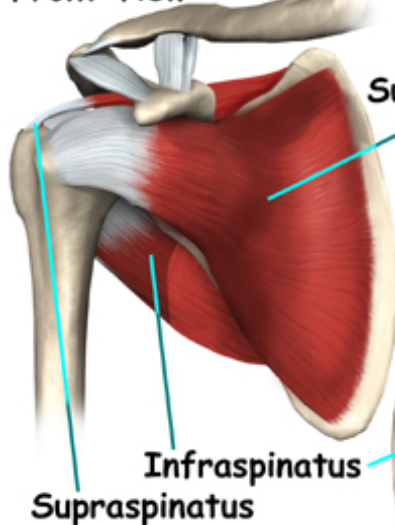
Supraspinatus – initiates abduction

Infraspinatus – external rotation

Teres Minor – external rotation

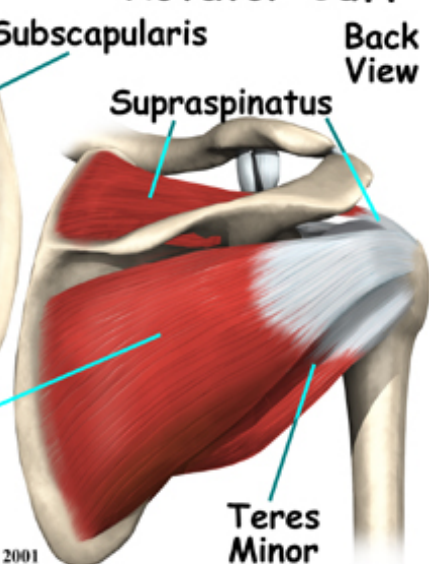
Subscapularis – internal rotation

Front View



Muscles of the Rotator Cuff

Back View



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The Gleno-Humeral Rhythm

The most significant aspect of movement in the shoulder joint is the gleno-humeral rhythm. This rhythm is a special action around the shoulder joint which involves the scapula, humerus, and clavicle in a rhythmic way. The gleno-humeral rhythm accompanies the shoulder movements of flexion and abduction. If the rhythm is disturbed by injury, pathological process, or weakness, the result can be pain and a reduction in healthy movement.

The rhythm involves 4 muscles (the rotator cuff muscles), 4 bones (clavicle, scapula, humerus, and the thoracic spine) and the overlapping movements of the scapula protracting the humerus externally rotating.

thoracic spine), and the overlapping movements of the scapula producing, the humerus externally rotating, the clavicle rotating; and the thoracic spine extending. When all these actions are coordinated perfectly, you are able to flex and abduct your shoulder joint normally.

Scapular Stabilization

The other principle necessary to understand the shoulder joint is stabilization. The ability to practice poses requiring strength from the shoulder joint depends on the stabilization of the scapula. This means that the scapula is held stable against the rib cage in a neutral position. This requires the action of the interscapular muscles like the middle trapezius, the rhomboids, and the serratus anterior.

Muscle Chart – ALL REGIONS

Anterior Thigh Muscles

Muscle	Origin	Insertion	Action
Psoas Major	Transverse processes of all lumbar vertebrae; sides of T12-L5 vertebrae	Lesser trochanter	Flexes thigh and trunk; acting alone side bends trunk
Iliacus	Iliac fossa; iliac crest	With tendon of psoas major into lesser trochanter	Flexes the femur; flexes the trunk against gravity
Sartorius	Anterior Superior Iliac Spine (ASIS)	Medial superior tibial shaft	Flexes femur and rotates it laterally; flexes knee and rotates medially
Rectus Femoris (Quadriceps femoris)	ASIS	Quadriceps tendon at base of patella	Flexes hip joint; extends knee joint
Vastus Lateralis (Quadriceps)	Greater trochanter to lateral linea aspera of femur	Patella via Quadriceps tendon	Extends knee joint
Vastus Medialis (Quadriceps)	Medial linea aspera of femur	Patella via Quadriceps tendon	Extends knee joint
Vastus Intermedius (Quadriceps)	Anterior and lateral surfaces of shaft of femur	Patella via Quadriceps tendon	Extends knee joint
Tensor Fascia Latae	Outer iliac crest, ASIS	Iliotibial band at mid third of lateral femur (tibia, via IT band)	Flexes and abducts thigh at hip joint, aids medial rotation

Medial Thigh Muscles

Muscle	Origin	Insertion	Action
Gracilis	Inferior ramus of pubis	Medial aspect of upper tibia below medial condyle	Adducts femur; flexes and medially rotates knee
Pectineus	Lateral pubic bone	Between lesser trochanter and linea aspera	Flexes, adducts, and medially rotates femur
Adductor longus	Medial pubis	Linea aspera	Flexes, adducts, and medially rotates femur
Adductor brevis	Medial pubis	Middle part of linea aspera	Flexes, adducts, and medially rotates femur
Adductor magnus	Inferior ramus of pubis, inferior ramus of ischium	Linea aspera and medial femoral condyle	Adducts femur; upper portion medially rotates and flexes femur; lower portion externally rotates and extends femur

Posterior Thigh Muscles

Muscle	Origin	Insertion	Action
Gluteus Maximus	Posterior ilium, posterior lower sacrum, coccyx	Iliotibial band of fascia lata and gluteal tuberosity	Extends and externally rotates femur

		of femur	
Gluteus Medius	Lateral ilium	Greater trochanter	Abducts femur; anterior fibers rotate femur medially
Biceps Femoris	Linea aspera (short head) and ischial tuberosity (long head)	Lateral side of head of fibula	Extends femur, knee flexion; rotates tibia laterally
Semitendinosus	Ischial tuberosity	Proximal medial tibia	Extends femur; knee flexion; rotates tibia medially
Semimembranosus	Ischial tuberosity	Medial condyle of femur	Extends femur; knee flexion; rotates tibia medially
Piriformis (part of Deep 6 Lateral Rotators)	Anterior surface of sacrum	Greater trochanter	Rotates femur laterally; extends and abducts femur when thigh is flexed 60 degrees or more
Deep 6 Lateral Rotators (<i>obturator internus, gemellus superior, gemellus inferior, quadratus femoris, obturator externus</i>)	Ischium and pubis	Greater trochanter	Rotates extended thigh laterally; abducts flexed thigh

Muscles of the Trunk

Muscle	Origin	Insertion	Action
Rectus Abdominus	Crest of pubis and pubis symphysis	Cartilage of 5 th , 6 th , and 7 th s ribs; xiphoid process	Flexes vertebral column; stabilized trunk; compresses abdominal contents
External obliques	Inferior border of lower 8 ribs	Outer lip of iliac crest; anterior and superior iliac spine and linea alba	Compresses abdominal contents; one side contracting singularly side bends and rotates vertebral column, bringing same side shoulder down; with both muscles contracting, flexes spine
Internal obliques	Lateral inguinal ligament; lateral iliac crest; thoraco-lumbar fascia	Cartilage of ribs 7-10; linea alba; pubic crest	Compresses abdominal contents; one side contracting singularly side bends and rotates vertebral column, bringing opposite shoulder down; when both contracting flexes spine
Transverse abdominus	Lateral inguinal ligament; anterior iliac crest; thoraco-lumbar fascia; cartilage of ribs 5-10	Linea alba; pubis	Compresses abdominal contents; can help in forced exhalation
Muscle	Origin	Insertion	Action
Iliocostalis (Erector Spinae) – most lateral to vertebrae	Posterior iliac crest, posterior sacrum, sacral and lumbar spinous processes, and supraspinous ligament	Angles of lower ribs and cervical transverse processes	Together with left and right sides, extend spine; unilateral contraction produces lateral flexion
Longissimus (Erector Spinae) – located lateral to Spinalis	Posterior iliac crest, posterior sacrum, sacral and lumbar spinous processes, and supraspinous ligament	Ribs and transverse processes of cervical and thoracic vertebrae; mastoid process of temporal bones	Together with left and right sides, extend spine; unilateral contraction produces lateral flexion

Spinalis (Erector Spinae) – most medial to the vertebrae	Posterior iliac crest, posterior sacrum, sacral and lumbar spinous processes, and supraspinous ligament	Spinous processes of upper thoracic and mid-cervical processes to skull	Together with left and right sides, extend spine; unilateral contraction produces lateral flexion
Quadratus Lumborum	Iliolumbar ligament and iliac crest	Inferior border of last rib and transverse process of L1-L4	Draws last rib toward pelvis or fixes it; extends spine; unilateral contraction laterally flexes spine
Latissimus Dorsi	Thoraco-lumbar fascia; lower 6 thoracic and all lumbar and sacral vertebrae; supraspinous ligament; posterior crest of ilium	Humerus	Extends, adducts, and rotates humerus medially; draws shoulder downward and backward
Trapezius	Occipital bone; spinous processes of C7 and T1-T12; supraspinous ligament	Upper fibers: lateral ½ of clavicle Middle fibers: medial acromion and spine of scapula	Rotates, adducts scapula; upper fibers elevate scapula; lower fibers depress scapula

Muscles of the Shoulder and Scapula

Muscle	Origin	Insertion	Action
Supraspinatus	Supraspinatus fossa (above spine of scapula)	Highest point of greater tubercle of humerus	Abduction of humerus and draws humerus into the socket; stabilizes
Infraspinatus	Infraspinatus fossa (below spine of scapula)	Greater tubercle of humerus	Rotates humerus externally
Teres minor	Inferior lateral border of scapula	Greater tubercle of humerus	Rotates humerus externally
Subscapularis	Subscapular fossa	Lesser tubercle of humerus	Internally rotates humerus
Serratus Anterior	Superior border of ribs 1-9	Anterior surface of vertebral border of scapula	Rotates scapula for full flexion and abduction; protracts scapula
Pectoralis Major	Medial half of sternum; anterior sternum; cartilages of all true ribs except 1 and 7	Greater tubercle of humerus	Flexes, adducts, and medially rotates humerus
Rhomboid Major	Spines of T2-T5; supraspinal ligament	Spine of scapula; inferior angle of scapula	Adducts scapula
Deltoid	Anterior: lateral 2/3 of clavicle; middle: lateral acromion; posterior: spine of the scapula	Deltoid tuberosity of humerus	Anterior: flexes, horizontally adducts, medially rotates humerus; middle: abducts humerus to 90 degrees; posterior: extends, externally rotates, horizontally abducts

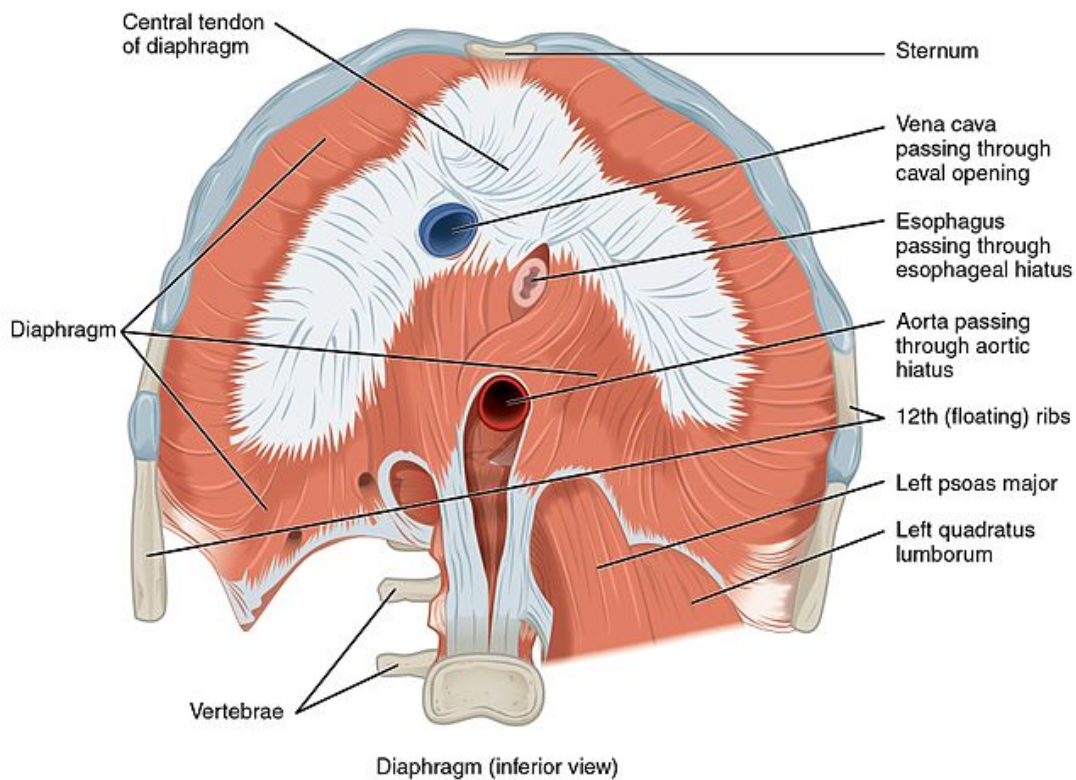
BREATHING

Breathing is what connects us to life – it keeps us alive! We breathe in oxygen and breathe out carbon dioxide. We also take in prana – life force. We have several cavities involved in breathing – the most important are:

Thoracic Cavity – contains heart and lungs

Abdominal Cavity – contains stomach, spleen, liver, kidneys, small and large intestines, reproductive organs.

Both share an important structure – the Diaphragm.



Diaphragm – Main muscle of respiration. Has a circular attachment to the ribs and spine. There are also secondary muscles of respiration including muscles called scalene, sternocleidomastoid, and the intercostals muscles between the ribs.

Diaphragm

Origin – xiphoid process, lower 6 ribs & vertebrae L1 – L3

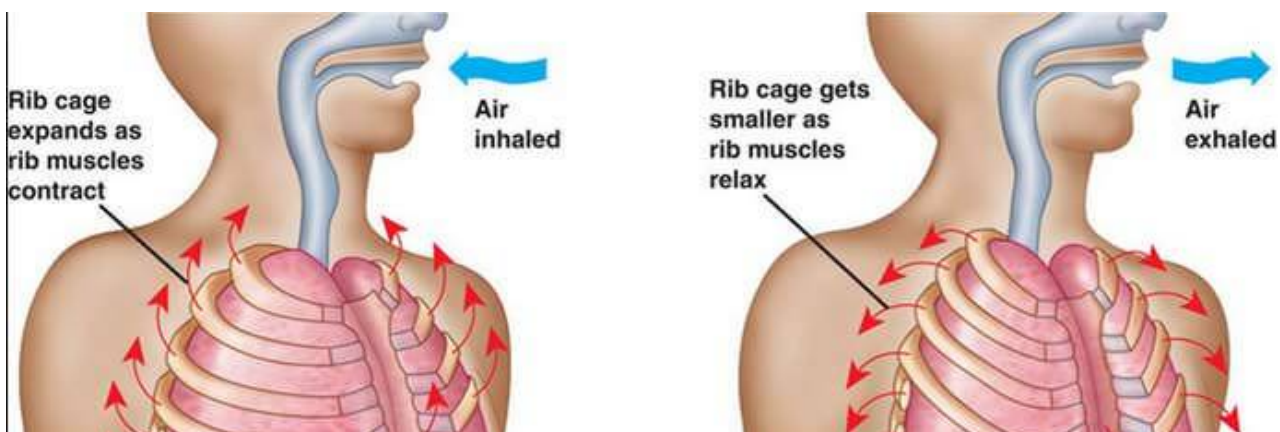
Insertion – central tendon of diaphragm

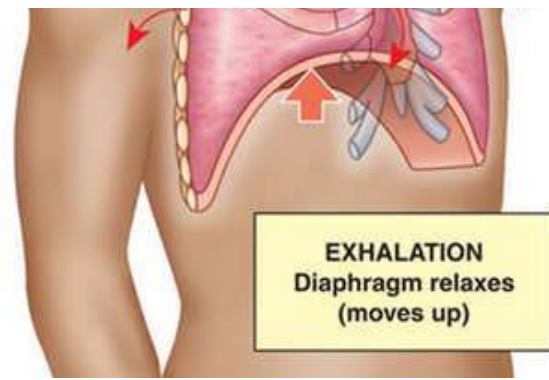
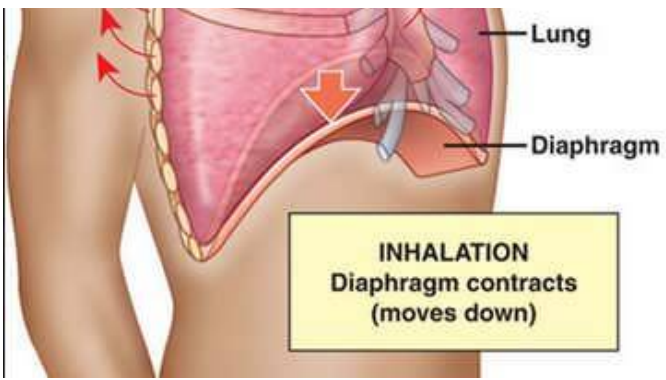
Action – Through contraction of this muscle the top part of the diaphragm that is connected to the lungs is pulled down filling the lungs with air. The Central Tendon is the anchor point for the diaphragm.

The diaphragm muscle in the middle of the torso is a key player in establishing the pattern of the breath. Stretching like a drumhead across the bottom of the chest, the diaphragm separates the heart and lungs above it from the abdominal cavity and digestive organs below. The muscle fibers then extend inward toward the middle of the body and gather into a central tendon that doesn't attach to the skeleton.

Central Tendon - At the top of the diaphragm's dome lies a central, disc-shaped tendon, which the heart rests on and is attached to. The muscle fibers of the diaphragm radiate from this central tendon to attach to the inside surfaces of the bottom of the sternum, the lower ribs, and the lumbar vertebrae (the ones below your rib cage). The diaphragm's connections to the front of the spine are the strongest and most stable: they anchor the breath.

When relaxed, the diaphragm curves upward like a dome. When the diaphragm muscle contracts, it becomes flatter, pulls the central tendon down, and pushes the abdominal organs down. This expansion of the chest cavity draws air into the lungs. The lungs have no capacity to expand or contract on their own. They simply respond to the size and shape of their container, the chest cavity. When it expands, the lungs inflate and air rushes in to fill the vacuum. When the container shrinks, the lungs are compressed and air is pushed out.





Inhalation – Ribs move out and up – external intercostals muscles contract
Exhalation – Ribs move in and down – internal intercostal muscles contract