The Major Joints of the Body: Kinesiology

A joint is formed where two or more bones meet. Some joints are designed to be very strong whereas others are designed to be particularly mobile, and generally we can say that it is not possible for a joint to be both strong and mobile.

Classification of joints

Joints are classified according their mobility & tissues. There are three main categories:

Immobile	Fixed or fibrous joints
Slightly mobile	Cartilaginous joints
Mobile	Synovial Joints

Fixed or Fibrous Joints (immobile)

Here there is little if any movement with strong fibrous tissues holding the joint together. These joints occur where great strength is required such as with the skull.

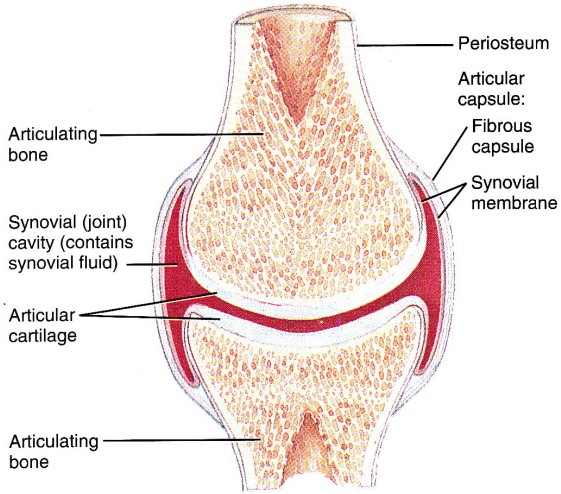
Cartilaginous Joints (slightly mobile)

Here there is again little movement possible but what distinguishes these joints are the layers of cartilage which allow movement as the bones compress the pads of cartilage. A prime example is the vertebral column where discs of cartilage between each vertebrae act as shock absorbers and allow some limited movement.

Synovial Joints (mobile)

Here as we shall see there are several subtypes but in general they allow for the greatest amount of movement. The joint structure provides both protection and lubrication because:

- There is a fibrous capsule surrounding the joint, which is reinforced and strengthened by ligaments; ligaments act like an internal bandage stabilizing the joint.
- Cartilage covers the end of the bones reducing friction & and acting as a shock absorber.
- Synovial fluid is secreted into the capsule by the synovial membrane, lubricating the joint and preventing the two bones rubbing together.



Typical Synovial Joint

Types of synovial joints

There are six sub types classified according to their structure and the type of movement possible:

Ball-and-Socket Joint

These have great mobility; the ball of one bone sits into a 'cup' shaped bone of another allowing the bone to move **freely in all directions.** Here the shoulder and hip joints are important examples.

Pivot Joint

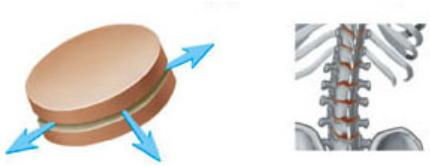
These joints allow **rotation only.** An example includes the movement between C1 and C2, the Atlas and Axis at the top of the cervical vertebrae, allowing us to turn our heads or the movement between the head of the radius and the radial notch of the ulna.

Hinge Joint

These joints are literally 'hinge-like' allowing for movement in only one plane, **flexion and extension.** The concave surface of one bone moves around the convex surface of another. Examples include the knee, the ankle, the elbow and the interphalangeal joints of the fingers and toes.

Ellipsoid Joint

Here a convex surface fits into a concave surface. Movement occurs around two axes. Movement is **angular in two planes with slight circumduction.** An example is the wrist joint or the atlanto-occipital joint where the atlas bone meets the occipital bone of the skull. This type of joint is also known as a **condyloid joint.**



Plane Joint

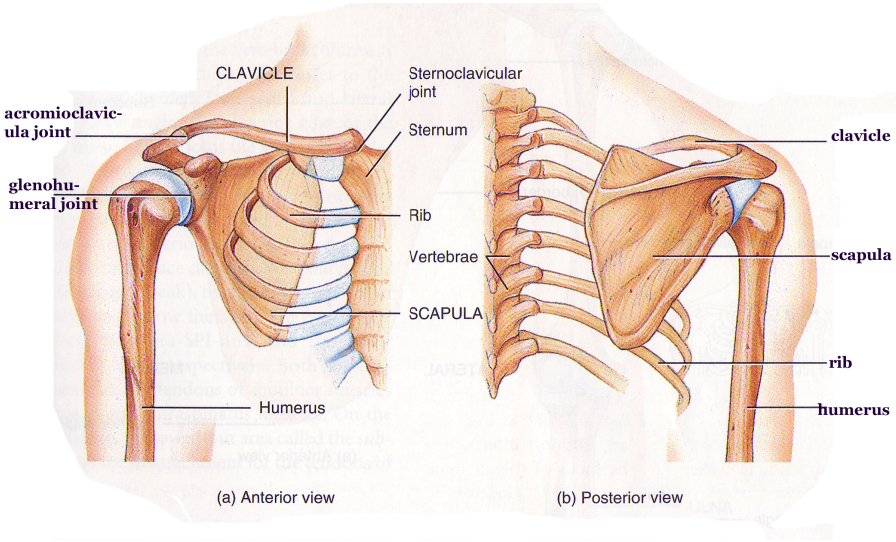
Here two flat surfaces of two bones glide over each other. Examples are those between the spinal vertebrae processes, the carpal bones of the hand and the tarsal bones of the feet. Movement is always restricted by ligaments so there is only a **limited range of movement possible.**

Saddle Joint

Here a concave and convex surface fits into a concave and convex surface. We can perform angular type movements and circumduction but rotation is impossible. An example is the carpometacarpal joint of the thumb.

The Major Joints of the Body

The Shoulder joint



The shoulder girdle consisting of the clavicles & scapulae connects the spine to the humerus; the articulation between the glenoid cavity of the scapula and the head of the humerus enables movement of the arm at the shoulder.

The glenoid cavity of the scapula is very shallow giving enhanced mobility meaning that the shoulder joints rely heavily on muscles and ligaments for strength and stability.

The articulation is described as:

"The humerus articulates with the glenoid cavity of the scapula"

Movements possible are: flexion, hyperextension, adduction, abduction, external rotation, internal rotation & circumduction

So we can describe a movement as for example:

Abduction of the arm at the shoulder where the humerus articulates with the glenoid cavity of the scapula

The shoulder girdle (clavicle & scapula) is freely floating. The scapulae are actually only held in place by posterior muscles enabling retraction/adduction, protraction/abduction, elevation & depression.

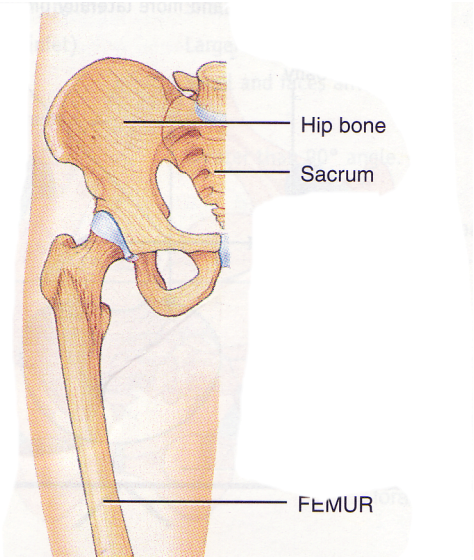
When we flex arms at first only the humerus moves, then beyond shoulder height the scapulae are involved.

Generally in most asana we retract and depress the scapulae to stabilize the shoulder joint and assist external rotation of the arms at the shoulders.

For asana where the arms are weight bearing the muscles stabilizing the scapulae must be gradually strengthened over time.

Ball & Socket Joint

The hip joint



The hip joint must be very strong to support the weight of the upper body and help transfer energy between the spine and legs, so the acetabulum of the hip is deep, giving more stability to the hip joint.

The articulation is described as:

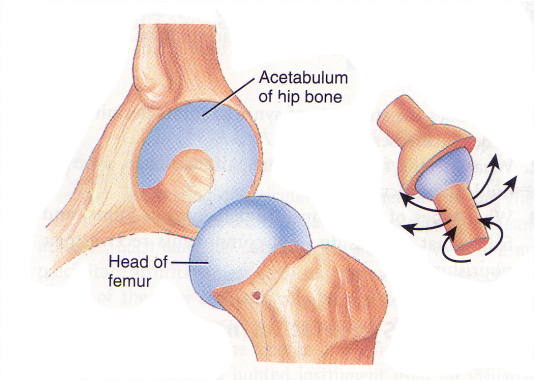
"The head of femur articulates with the acetabulum of the hip bone"

Movements possible are: Flexion, hyperextension, adduction, abduction, external rotation, internal rotation & circumduction

So we can describe a movement as for example:

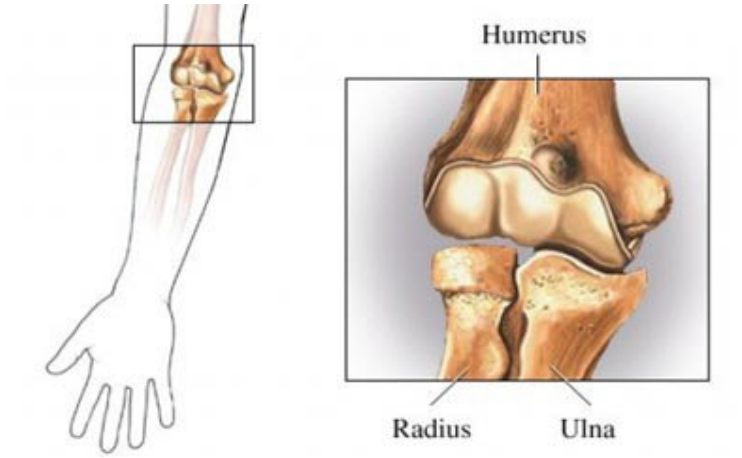
External rotation of the leg at the hip where the head of the femur articulates with the acetabulum of the hipbone

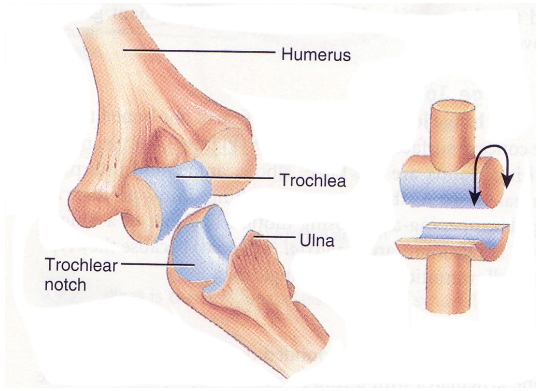
In our current western society we generally find that we are less able to perform internal and external rotation, and abduction, and are prone to degeneration at the hip joints



Ball & Socket Joint

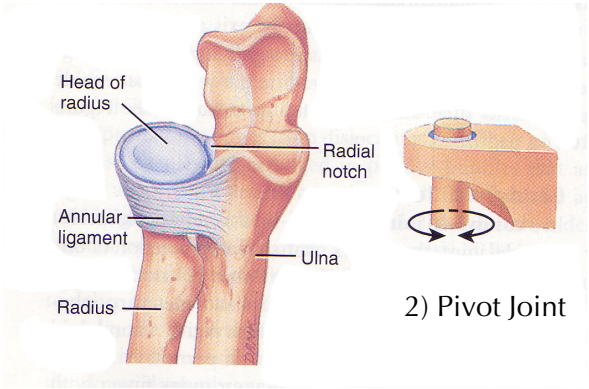
The Elbow Joint





1) Hinge Joint

It is useful to remember the ulna is at the little finger side of the arm, and the radius crosses over the ulna to pivot into supination or pronation.



2) Pivot Joint

There are two articulations:

1) ***"The humerus articulates with the ulna"*** (hinge joint)

Movements possible: flexion & extension

2) ***"The radius articulates with the ulna"*** (pivot joint)

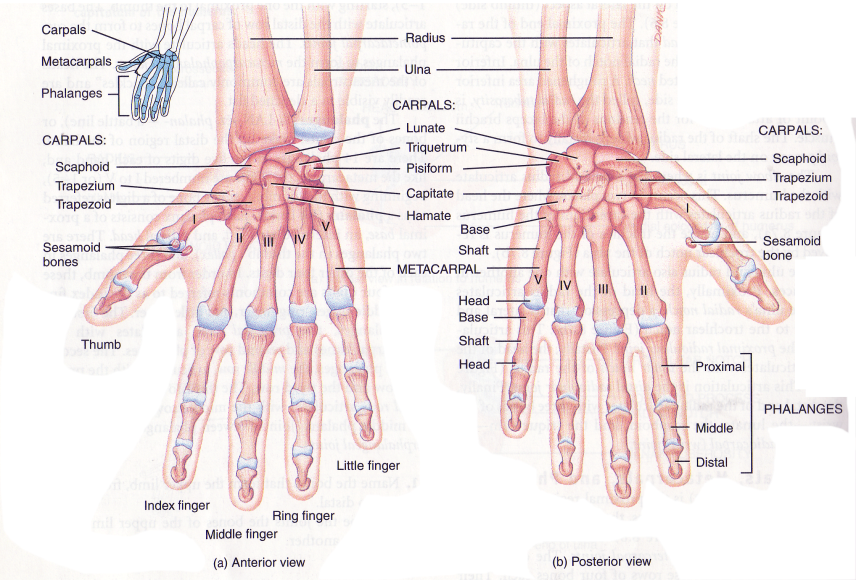
Movements possible: supination & pronation

So we can describe a movement as for example:

Supination of the lower arm at the elbow where the radius articulates with the ulna *or* ***Flexion of the lower arm at the elbow where the humerus articulates with the ulna***

[There is another articulation to be found at the elbow – a ball & socket joint between the humerus and radius but this is not be used to described movement, it does however allow the other movements to occur.]

The Wrist Joint



The articulation is described as:

"Radius articulates with the carpal bones"

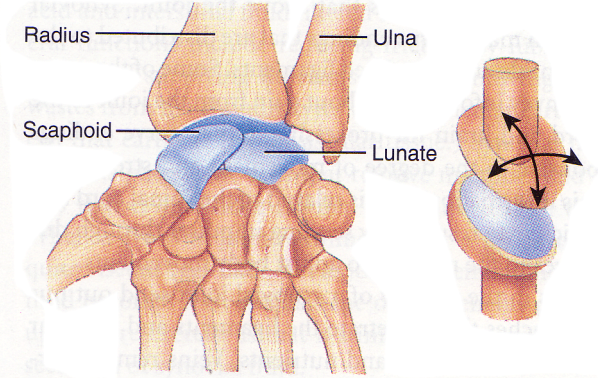
Movements possible: Flexion, extension, abduction, adduction and usually (but not always!) circumduction.

So we can describe a movement as for example:

Adduction of the wrist where the radius articulates with the carpal bones

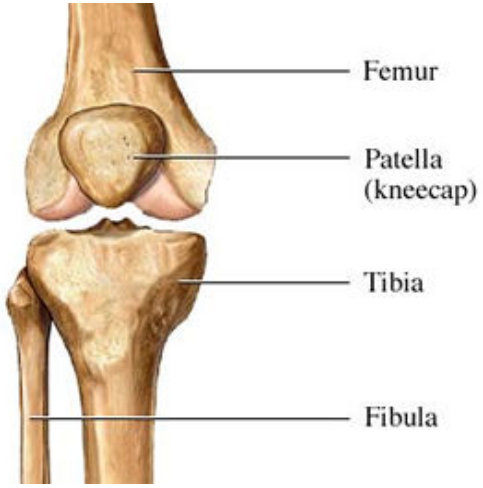
We are not too concerned with the small hand articulations. Only to say:

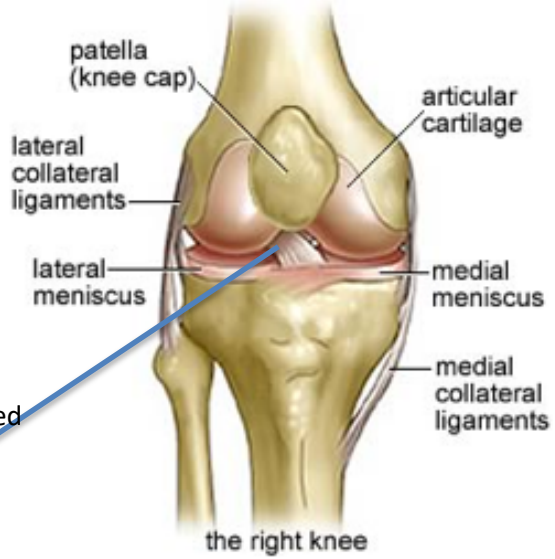
Carpals: mostly planar joints
Thumb: saddle joint
Phalanges: hinge joints



Condyloid or Ellipsoid Joint

The Knee joint





Cross-shaped anterior & posterior cruciate ligaments

At the knee joint there is not a great bony fit between the knuckle shaped femur end and the relatively flat head of the tibia. (Note that the fibula is not involved.)

It is however very strong when the knee is extended, i.e. straight.

When flexed (bent) we rely on the four knee ligaments i.e. the medial and lateral collateral ligaments at the sides of the knee and the anterior and posterior cruciate ligaments at the centre to help to stabilize the knee, meaning there are many alignment issues regarding flexed knees in asana where we must ensure we do not overly stress the ligaments or adversely compress the menisci.

We also need to strengthen muscles around the knee joint to aid stability, especially the quadriceps muscles of the thigh.

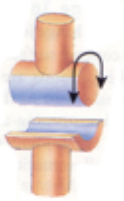
The articulation is described as:

"The femur articulates with the tibia"

Movements possible are: Flexion and extension (and a very small amount of internal & external rotation possible when the knee is flexed)

So we can describe a movement as for example:

Flexion of the lower leg at the knee where the femur articulates with the tibia



Hinge Joint

The Ankle Joint

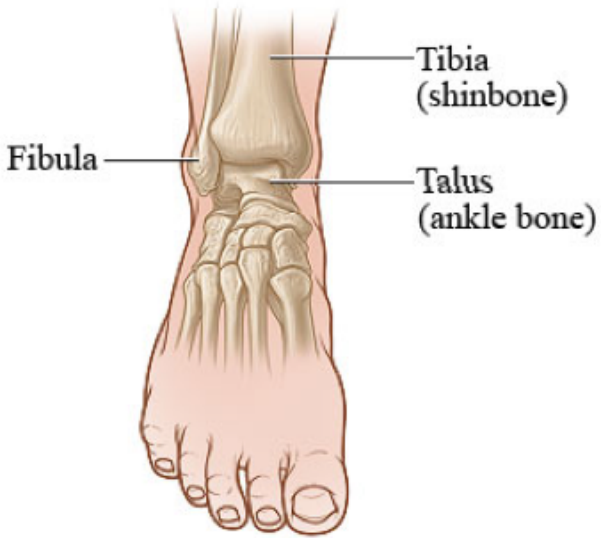


Image from Health Wise

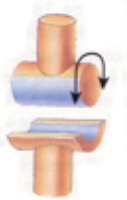
The articulation is described as:

"The talus articulates with the tibia & fibula"

The movements possible are: plantar flexion & dorsiflexion

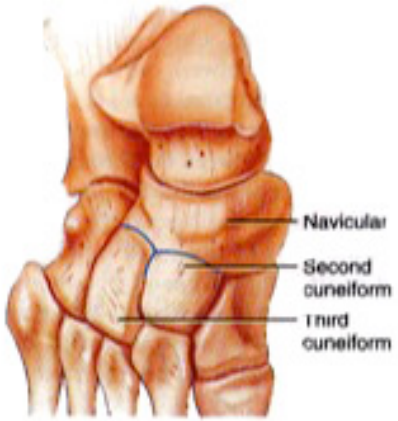
So we can describe a movement as for example:

Plantar flexion of the foot at the ankle where the talus articulates with the tibia and fibula



Hinge Joint

The Subtalar Joint



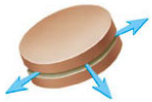
The articulation is described as:

"The tarsals (talus, navicular & calcaneus) articulate with each other"

The movements possible are: inversion & eversion

So we can describe a movement as for example:

Eversion of the foot at the subtalar joint where the tarsals articulate

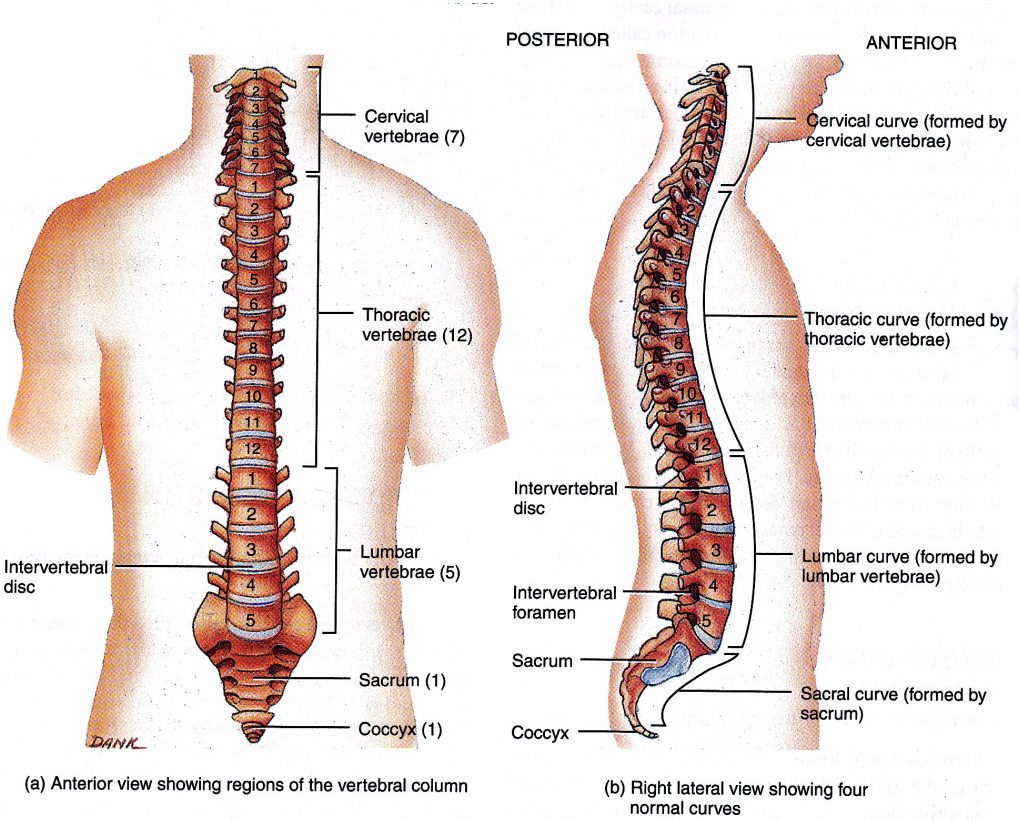


Planar Joint

We are not too concerned with the small foot articulations. Only to say:

Intertarsals: mostly planar joints
Phalanges: hinge joints

The Vertebral Column



(a) Anterior view showing regions of the vertebral column

(b) Right lateral view showing four normal curves

Articulations are described as:

"Vertebrae articulating with each other"

Movement possible: flexion, extension/hyperextension, lateral flexion, and rotation

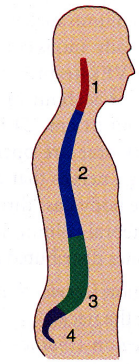
So we can describe a movement as for example:

Flexion of the head at the neck where the vertebrae articulate with each other *or* ***lateral flexion of the spinal column where the vertebrae articulate with each other***

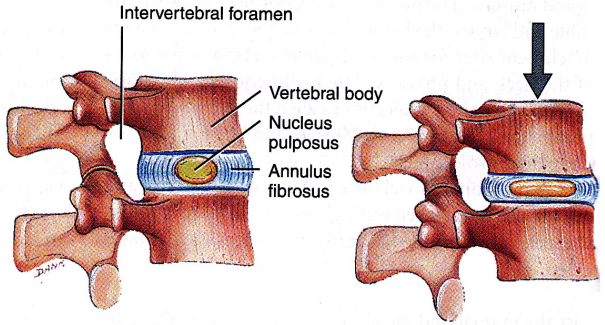
The exception is between C1 and C2 where
"The atlas (C1) articulates with the axis (C2)" (pivot joint)

Movement possible: rotation

Articulation: Rotation of Neck where we can usually simply state ***"cervical vertebrae articulate with each other"***



Four curves in adult



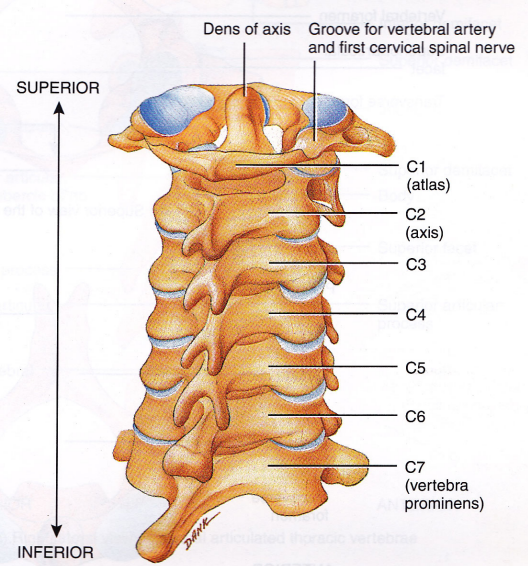
Normal intervertebral disc

Compressed intervertebral disc in a weight-bearing situation

There are cartilaginous joints between vertebrae, where the cartilage intervertebral discs between the vertebral bodies are compressed, giving a limited degree of movement at each joint, plus there are gliding/planar joints between the vertebral processes.

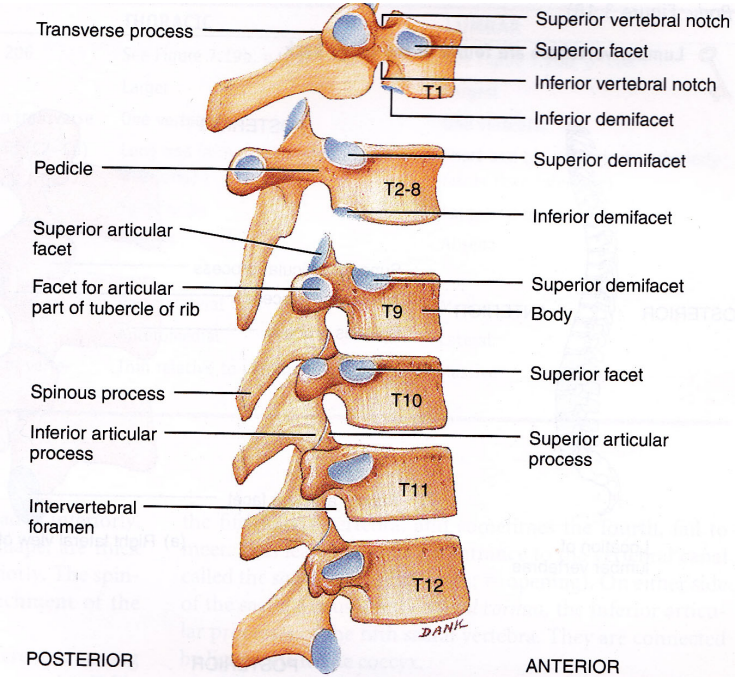
The 'S' shaped spine acts as a shock absorber; note that the tilt of the pelvis will alter the curves.

Cervical Vertebrae



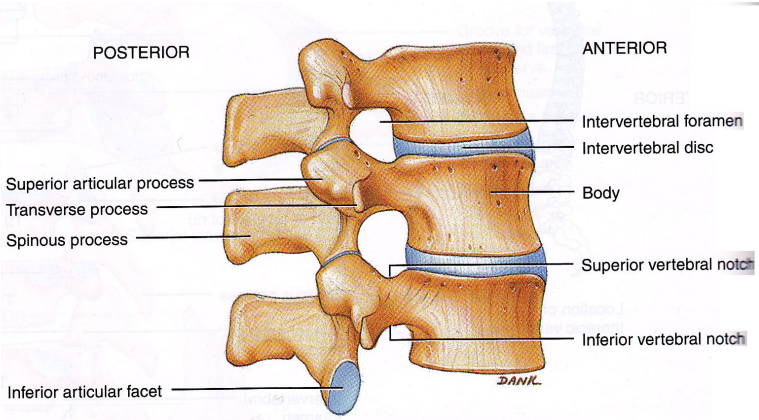
(a) Posterior view of articulated cervical vertebrae

Thoracic Vertebrae



(a) Right lateral view of several articulated thoracic vertebrae

Lumbar Vertebrae



(a) Right lateral view of articulated lumbar vertebrae

All vertebrae possess a cylindrical shaped body containing a foramen (hole) for the spinal cord. They all have 2 transverse projections and 1 posterior projection, which are attachment points for ligaments & muscles.

Note: Different sections of the vertebral column allow different movements to occur

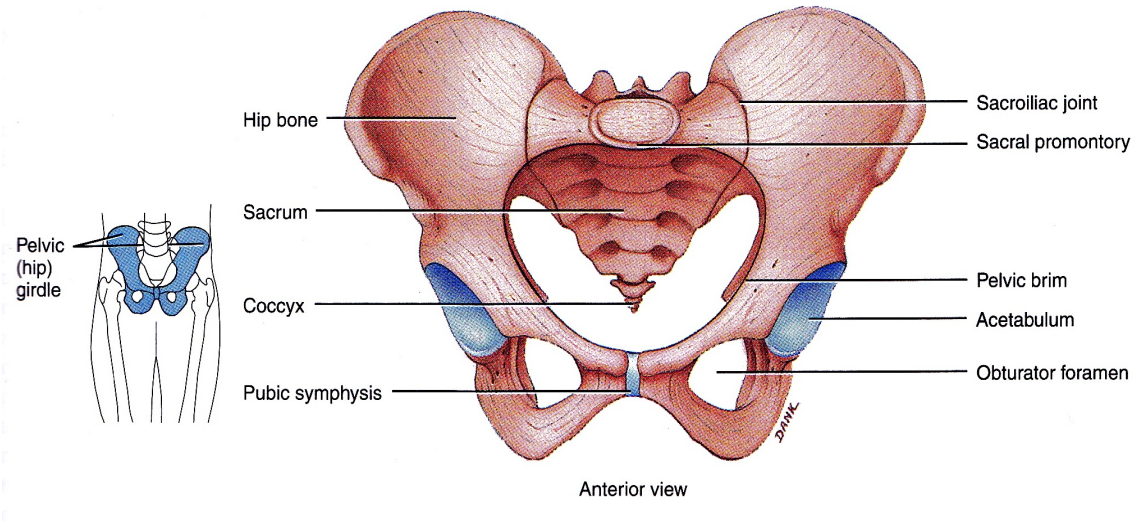
C1 to C7: Flexion, hyperextension, rotation & lateral flexion possible (i.e. good ROM possible)
T1 to T12: Little flexion & hyperextension due to the shape of the spinous processes and their attachment to the ribcage, however rotation & lateral flexion good
L1 to L5: Good flexion, hyperextension & lateral flexion, only very minimal rotation possible

As we move different parts of the spine come into play e.g. when we twist the lumbar area stays relatively fixed and the twist occurs primarily in the thoracic and cervical areas.

Significantly we should ensure we do not place excessive pressure where the different functional areas meet, especially between C7 & T1 and T12 & L1.

The Sacroiliac Joint

The sacroiliac joint is where the sacrum, with its five fused vertebrae, meet the iliac pelvic bones on its left and right sides. It's primary function is stability where the wedge shape of the sacrum sits snuggly into the two bones of the ilium, forming a foundation for the vertebral column and helping to transfer the weight of the upper body downwards into the lower limbs.



The SI joints are synovial joints held together by strong ligaments. They typically allow very little movement making it almost impossible for health professionals to detect if there has been slippage of the sacrum in relation to the iliac bones.

Most people who experience sacroiliac pain are women and this is attributed to the fact that women have only two sacral bones attached to the ilium whereas men have three making these joints more stable in men, that women have a wider pelvis so torque across these joints is greater, and also that hormonal changes at times of menstruation and pregnancy can alter the integrity of the ligaments (causing more pain at these times). In addition to this we can add the group of people who naturally possess looser ligaments and are therefore more likely to find the joint becomes unstable and can easily strain the SI joint. There may also be a disparity between the mobilty of the hips, hamstrings, psoas muscles etc. on each side of the body meaning practicing asana can cause strain within one SI joint.