



# YMCA Awards

Level 3 Applied anatomy and  
physiology  
2018

# Level 3 Applied anatomy and physiology

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## **Joints and joint actions**

## **Learning outcomes**

By the end of this session you will be able to:

- Demonstrate joints and joint actions

# Joins and joint actions

Optional

- Revise joints and joint actions from Level 2

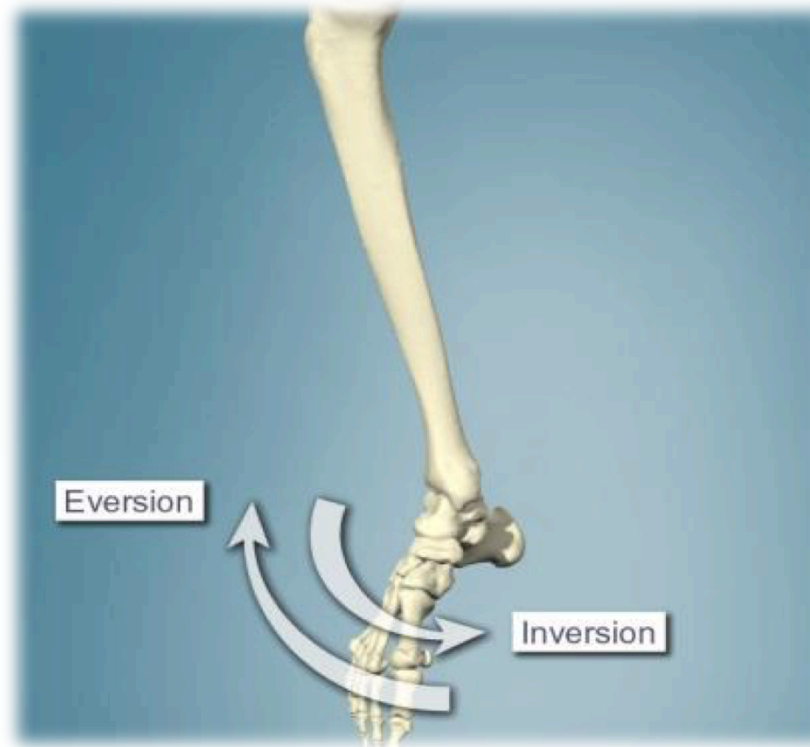
## Joint actions

### Inversion and eversion

- These movements occur in the foot (specifically the subtalar joint)
- Inversion is where the sole turns to face inwards and eversion is where the sole turns to face outwards

# Inversion and eversion

The sole of the foot moves inwards and outwards



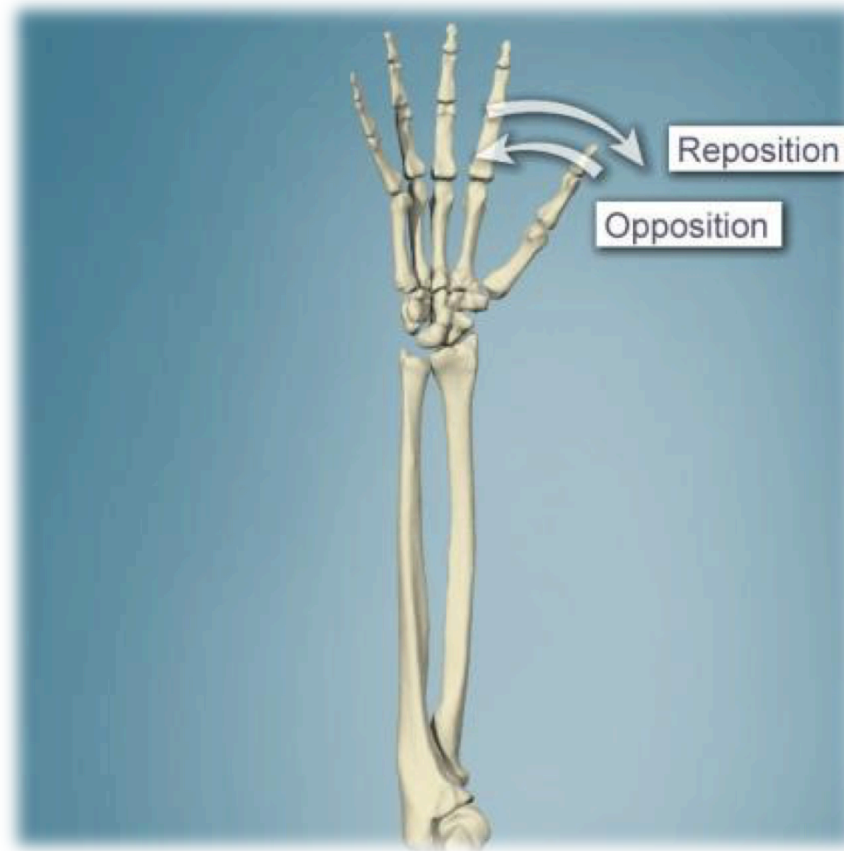
## Joint actions

### Opposition

- This describes the specific movement of touching the thumb to the fingers. It is what makes humans unique from other animals in their ability to grip objects



# Opposition

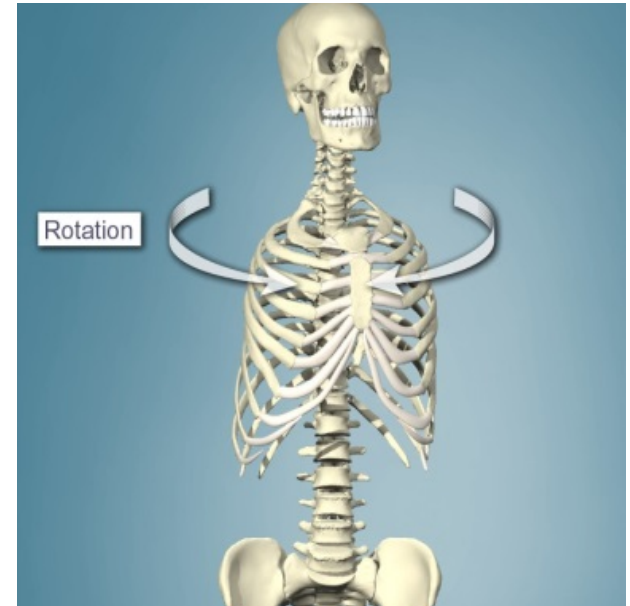


# Rotation

It is possible to rotate ball and socket joints

E.g. turning the leg inwards towards the middle of the body (internal or medial rotation)

Turning the leg outwards away from the centre of the body (external or lateral rotation)



## The shoulder girdle

- The shoulder, or pectoral, girdle is composed of a double set of two bones on each side of the body
- The clavicles are slender and doubly curved long bones that run horizontally across the upper chest and can be felt just below the neck
- Each clavicle articulates at the top of the shoulder with the acromion process of the scapula (acromioclavicular joint or AC joint) in a gliding synovial joint and with the top end of the sternum (the sternoclavicular joint) at the shoulder's front

# The shoulder girdle

Scapula



Shoulder Girdle



AC Joint



## The upper arm and shoulder joint

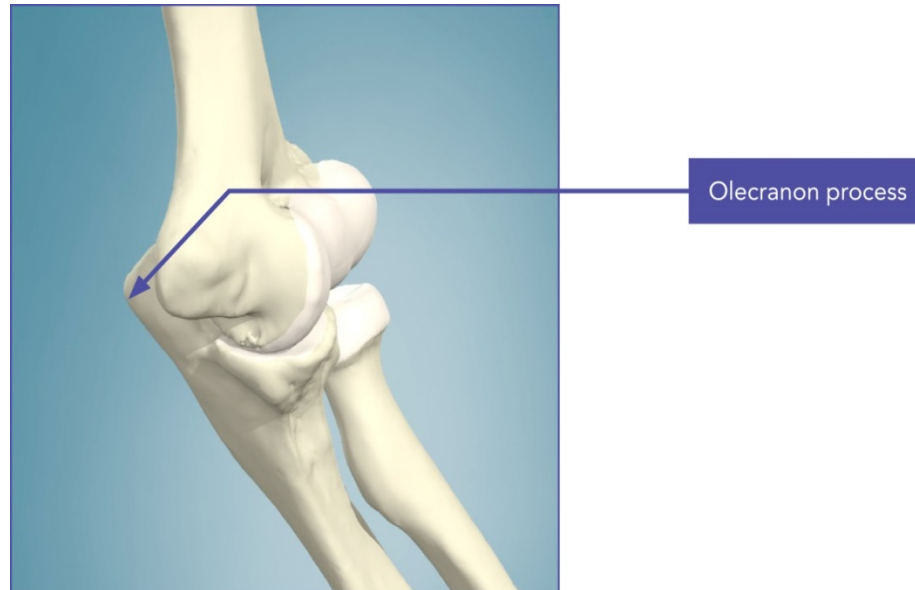
- The only bone in the upper arm is the humerus
- It fits into the glenoid cavity of the shoulder girdle
- The shoulder joint is quite shallow, giving a large range of movement
- The stability of the shoulder joint comes primarily from a small group of muscles called the rotator cuff

# The upper arm and shoulder joint

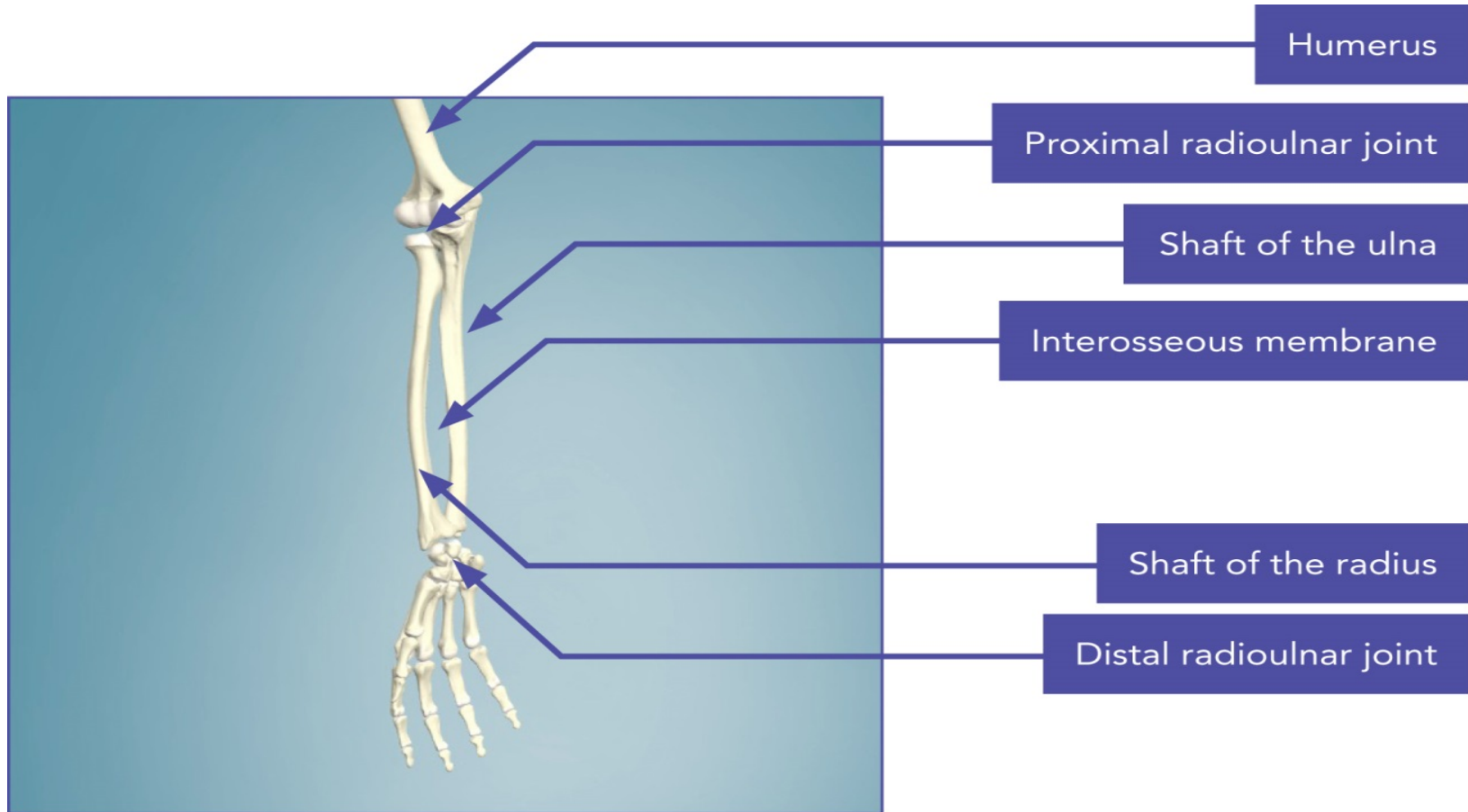


## The lower arm - elbow and wrist

- Two long bones in the lower arm – radius and ulna
- The ulna is slightly longer than the radius and has a much more prominent proximal head (olecranon process) - felt at the elbow joint



## The lower arm - elbow and wrist





## The lower arm - elbow and wrist

- The radius and the ulna are connected to each other by a synovial pivot joint, both at their proximal and distal ends, called the radioulnar joints
- In contrast, it is the radius that is far more prominent at the wrist

## The wrist and hand

- The hand is composed of 27 small bones
- The true wrist is composed of eight cuboid bones, the carpals, forming gliding synovial joints, giving a large degree of flexibility
- The carpals are roughly arranged in two rows and the two biggest bones of the first row form the synovial joint with the radius. The second row articulates with the five metacarpals that radiate out to form the palm

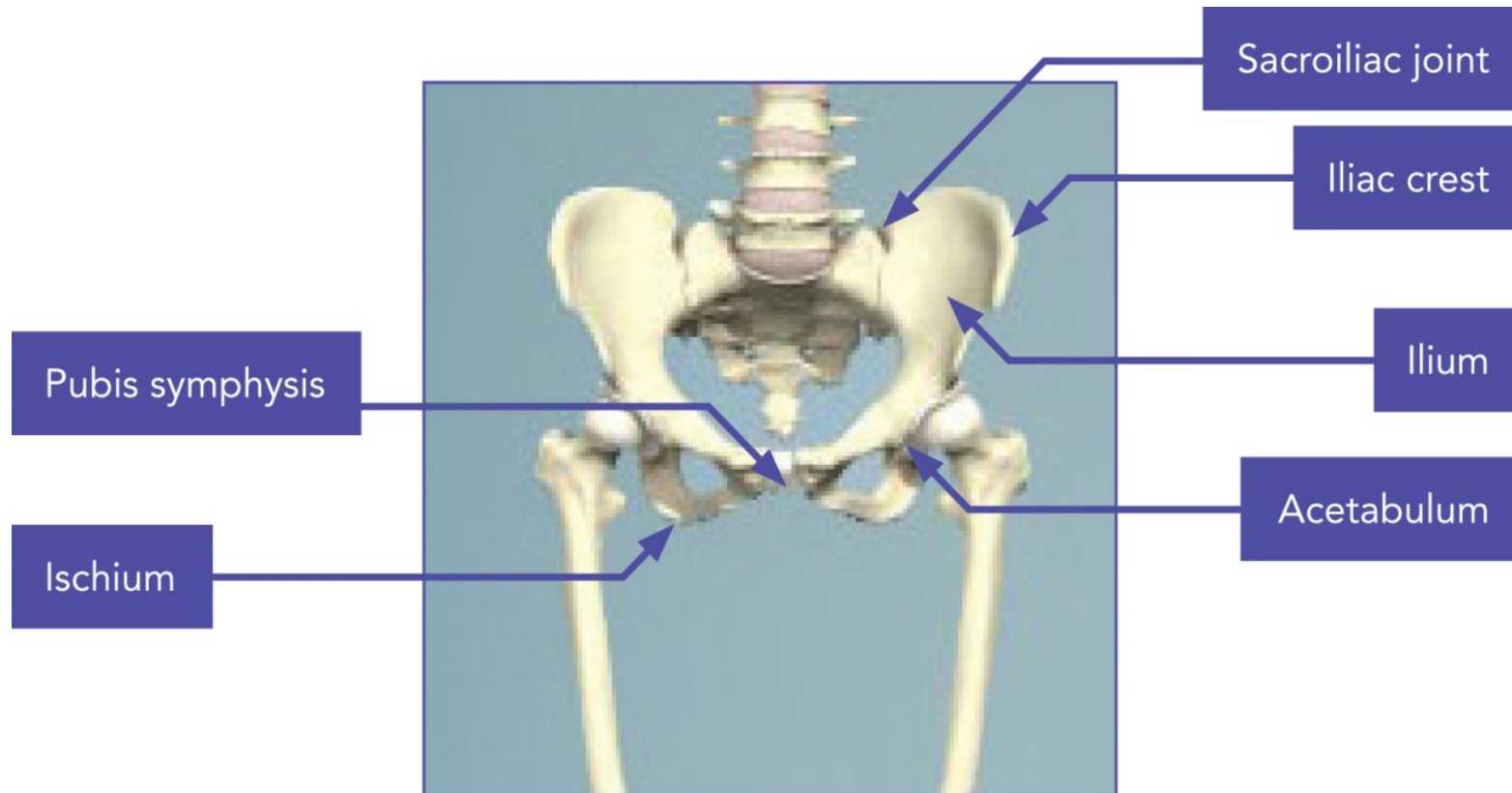
## The wrist and hand

- The four fingers (phalanges) are composed of three bony segments, articulating with each other via synovial hinge joints
- The thumb has only two segments. The articulation between the thumb and the first metacarpal is a synovial saddle joint

## The pelvic girdle

- Transmits the whole weight of the upper body down through the legs to the ground
- Plays a major role in ensuring correct alignment of the spine (neutral spine position)
- Needs to be strong, stable and resistant to large ranges of movement
- Composed of two bones on each side. These bones are made from three separate bones (ilium, ischium and pubic bones) which fuse together in adulthood

# The pelvic girdle



## The pelvic girdle

- Pubic bones joined together anteriorly by a cartilaginous disc, the pubis symphysis, which completes the pelvic bowl
- This pad of cartilage between the two joint surfaces plays an important role in the stability of the pelvis
- Stability also depends on ligaments, which are affected by the correct alignment of the Sacroiliac (SI) joints

## The pelvic girdle

- The pubis symphysis has a normal separation of 3–4mm, which can increase up to 9mm in pregnancy due to the hormone relaxin
- The effect of relaxin on the SI joints and pubis symphysis often leads them to become a source of discomfort

## The pelvic girdle

- Any movement or pain is often diagnosed as pubis symphysis disorder (PSD)
- Extreme separation is called diastasis symphysis pubis and needs to be specifically diagnosed by a medical practitioner. The general term given to pain in either area is pelvic girdle pain (PGP)



# The pelvic girdle



Male



Female

## The male and female pelvic girdle

Male	Female
Narrow, shallow heart shaped pelvic bowl	Deeper, wider oval shaped pelvic bowl Greater curvature in the sacrum
Pelvic angle is almost vertical	Pelvic angle tilts anteriorly
The position of the acetabulum is almost vertical	The position of the acetabulum has a slight posterior tilt
Small Q angle between hip and knee joints allowing for more efficient transfer of force between the hip and knee joints	Larger Q angle between hip and knee joints, causing less efficient transfer of force between hip and knee, leading to higher incidence of hip, knee and ankle injury in females engaging in impact activities such as running

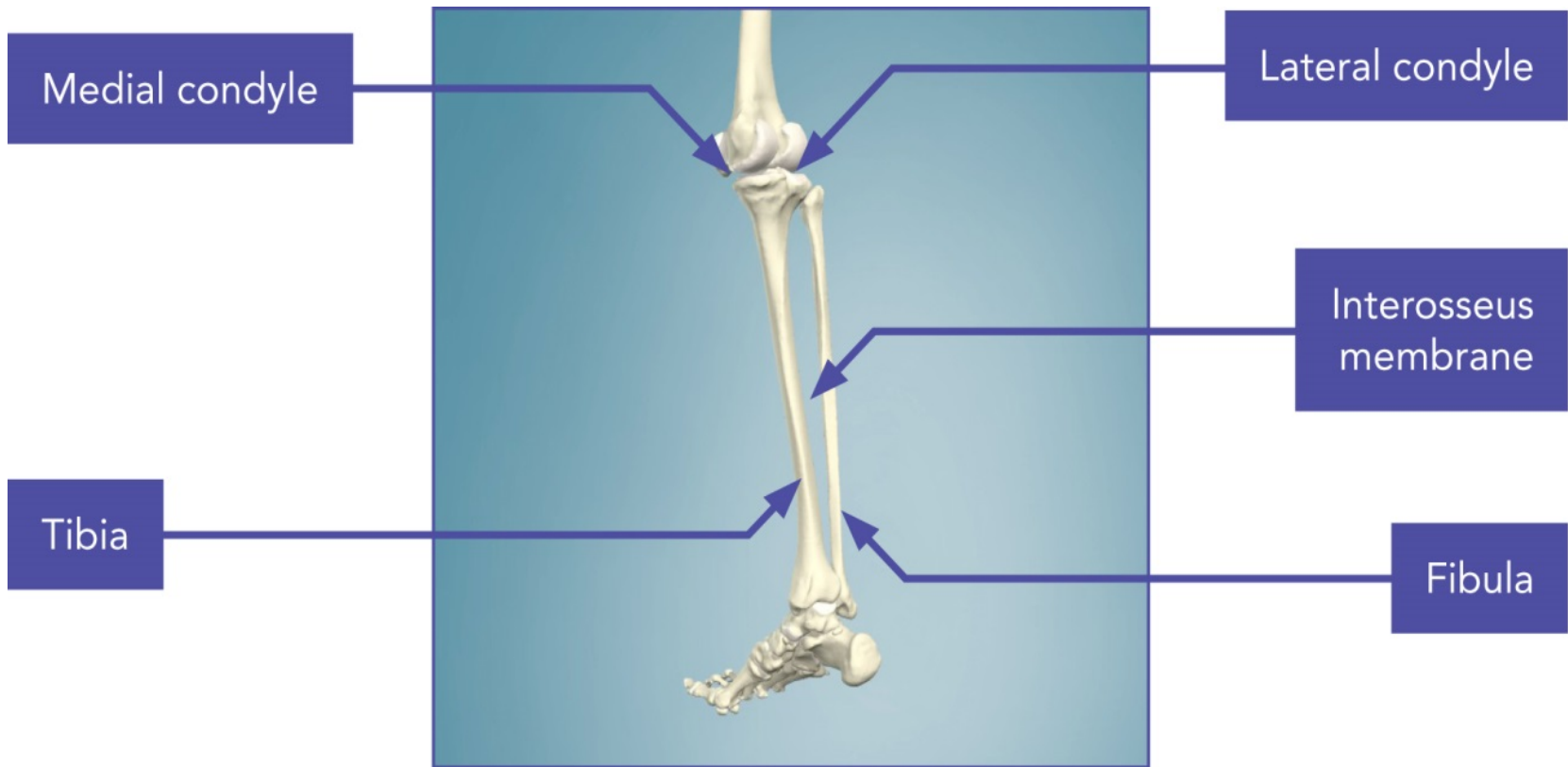
## The knee joint and lower leg

- The larger of the two bones (second largest in the body) is the tibia.
- Its size reflects its role in weight transmission of the upper body from the femur down through the foot

## The knee joint and lower leg

- The fibula is far weaker and completely non-weight-bearing and appears stick-like. Has a role in bracing the tibia and giving the lower leg a stout, rectangular profile rather than a curved cylinder, thus improving its strength
- The fibula also provides attachment points for muscles

## The left tibia and fibula



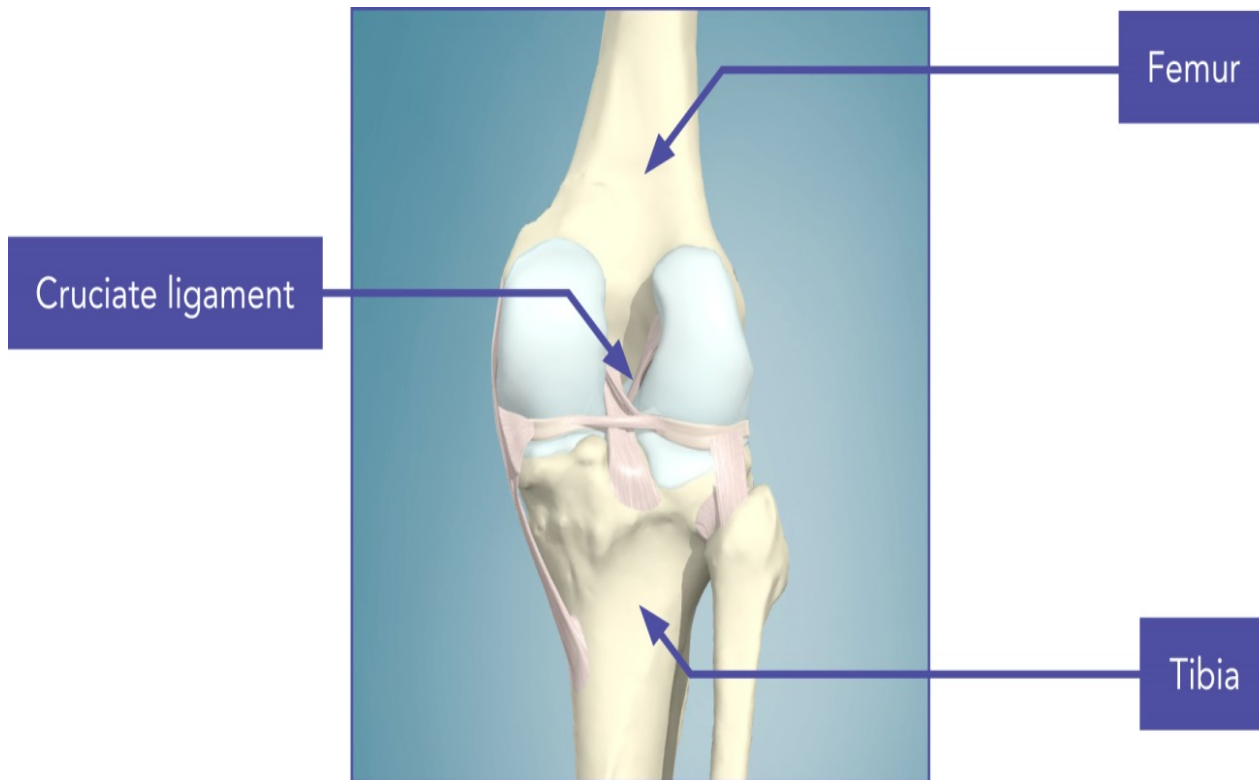
## The knee

- The tibia articulates with the femur at the knee and has a large smooth depression that accepts the femoral condyles to form the knee joint – the most complex joint in the body
- It is a hinge joint allowing movements of flexion and extension in the sagittal plane

## The knee

- The synovial joint cavity has many pouch-like projections called bursa which help to prevent friction between bone and a ligament or tendon and between the skin and the patella
- The articular cartilage is reinforced with lateral and medial cartilaginous C-shaped wedges called menisci which help to stabilise the joint by preventing lateral displacement of the bones

# The knee





## The knee

- The joint is held together internally by two cruciate ligaments which attach at both the front and back of the joint (forming a cross)
- The cruciate ligaments help to add further stability to the knee joint
- The patella is a sesamoid shaped bone and crosses the front of the joint and protects the knee

## The knee

- It is held in place by strong ligaments that ensure smooth tracking over the surface of the knee joint during movement
- The patellar ligament is an extension of the muscle tendon

## The ankle joint and foot

- The foot follows the same principles as the hand. The tarsal bones are roughly cuboid and articulate with each other via gliding synovial joints
- There are seven tarsals, but the two largest ones (talus and calcaneus) nearest to the lower leg mainly carry body weight
- The talus bone articulates with the tibia and fibula
- The large calcaneus (heel bone) is where the talus sits

## The ankle joint and the foot



## **The ankle joint and the foot**

- The synovial joint between the talus and the tibia and fibula is a pure hinge joint
- Movement is restricted to plantar and dorsiflexion in the sagittal plane
- The gliding joints between the talus (subtalar joint), the calcaneus and all of the other tarsal bones give the foot the flexibility to walk or run on uneven surfaces by allowing inversion and eversion

## **The ankle joint and the foot**

- The metatarsals are five bony cylinders
- The first and fifth metatarsals make contact with the ground and are strong weight bearers. The remaining three form a transverse arch and are susceptible to fracture
- The phalanges, like the fingers, have three segments (apart from the big toe, which has two). They are smaller than in the fingers do not have the same range of movement

