Discuss the Hip joint:

Efficient bipedal locomotion in humans relies on the stability of the hip joint. It is through this joint that the collective weight of the torso, upper limbs and head is transferred to the lower limbs. The hip joint is a ball and socket synovial joint between the acetabulum of the hipbone and the head of the femur. It has all the features of a synovial joint (two bones, articular surface, articular cartilage, joint space, synovial fluid and membrane, capsule, ligaments and muscles) plus a joint labrum.

The bones associated with the hip joint have adapted to provide an articular surface suitable to long term bipedal locomotion. The hipbone, itself, is an irregular appendicular bone consisting of three bones fused at the acetabulum: the ilium, ischium and pubis. Weight from the upper body is transmitted from the sacroiliac joints to the acetabulum through the body of the ilium. The ischial bones are significant for their tuberosities on which one sits, and the pubis for the pubic symphysis, which adds to the stability of the pelvis. Together, the two hipbones constitute the pelvic girdle. Attachments to the pelvic girdle include gluteal muscles, obturator externus, adductors and posterior thigh muscles laterally, and obturator internus and iliacus medially.

The femur is a long, appendicular bone that develops in cartilage. Features include head, neck, shaft and two distal condyles. Proximally is the head of the femur, for hip joint articulation, and the greater and lesser trochanters as the site of insertion of muscles of the hip.

The hip joint permits a wide range of movements: flexion, extension, adduction, abduction, medial and lateral rotation and circumduction. To aid in this, each joint surface is lined with articular cartilage with that of the acetabulum being C-shaped. The incomplete bony socket of the acetabulum is completed by the transverse acetabular ligament and is enhanced by a 360-degree fibro-cartilaginous labrum. Three strong ligaments also encapsulate the joint: iliofemoral, ischiofemoral and pubofemoral ligaments.

In neutral position, as with anatomical, the femur bone is vertical, ASIS in line with the pubis. In close packed, however, the joint is extended and internally rotated.

In bipedal standing, the axis of the center of gravity passes behind the hip joint, forcing it into extension. This is stabilized by ligaments, however and thus little or no muscle activity is required to maintain this position. During the walking cycle, the hip joint moves from flexion to extension in stance. This is done by the posterior thigh muscles (tibial n.) in early stance to provide thrust and move the trunk forwards, however these muscles are less active in late stance as momentum continues to extend the joint. In swing, the joint flexes (by iliopsoas and rectus femoris, femoral n.) to allow for repositioning and clearing the ground. Posterior thigh muscles act again in late swing to slow flexion at the hip joint. The gluteal muscles, however, which include gluteus maximus, minimus and medius, do not play a large role in bipedal standing and walking as one may assume. Gluteus medius and minimus allow for hip joint abduction in early stance and medial rotation throughout stance as compensatory movements and to maintain balance. Gluteus maximus only acts as a postural muscle, controlling trunk flexion on the lower limbs.

As a confirmation of the significance of the hip joint in locomotion, we can look at the consequence of a nerve lesion in the area. Subgluteus maximus haemotoma is an injury common to ice-skaters. It may occur due to falling on a hard surface and damages the superior gluteal nerve affecting such muscles as gluteus medius, minimus and tensor fascia latae. This leads to impaired hip joint abduction and medial rotation, which would present as Trendelenburg gait in which the hip region on the unaffected side drops in early stance. This is because the body in unable to maintain the center of gravity on the side of the stance leg leading to an excessive lateral lean. There would also be decreased medial rotation of the stance leg during swing. Therefore, the hip joint and its associated bones, ligaments and muscles, provides a stable structure for force transfer thus making it one of the most important joints in bipedal locomotion in humans.

Discuss the Knee Joint:

Efficient bipedal locomotion in humans relies on the functionality of the knee joint. It is through this joint that force can be transferred from the femur to the tibia, the major location for weight transfer in the body.

The knee joint consists of a synovial condylar joint between the femoral and tibial condyles, with a gliding component between the femur and the patella. It has all the features of a typical synovial joint (two bones, articular surfaces, articular cartilage, joint space, synovial membrane and fluid, ligaments, muscle and capsule). In addition it also has menisci, intrarticular ligaments and bursae. The fibrous joint capsule around the KJ is incomplete and is reinforced by ligaments. Anteriorly on this capsule lies the patella bone. The patella is a sesamoid bone that develops in the tendon of the quadriceps femoris muscle. It has an apex, base and articular surfaces and functions to resist wear and tear stressors during knee flexion and extension. Other bones of articulation of the KJ include the femur and the tibia.

The femur is a long, appendicular bone that develops in cartilage. Distally, the shaft of the femur widens to form the femoral condyles, which articulate with the condyles of the tibia. The patella articulates with the cartilage of the femur between the two condyles. The tibia is the major weight bearing bone of the leg. It is a long appendicular bone of the medial leg that develops in cartilage. Proximally, it has concave condyles that articulate with the femur and a palpable tibial tubercle just distal to the condyles receiving the tibial ligament. The anteromedial surface of the tibia is devoid of muscle.

It is interesting to note that neither the fibula bone, nor the two tibiofibualr joints, have articulations in the knee joint.

The knee joint permits flexion and extension with varying degrees of rotation and sliding. This is aided by the menisci of the knee which are semi-lunar cartilaginous discs attached to the tibial condyles. The menisci also paly a role in congruity, stability, shock absorption and the movement of synovial fluid in the kJ. The strength of attachment of the medial meniscus, however, is greater than the lateral, and it is this inflexibility that makes the medial more prone to tearing with excessive rotation. To further aid in knee joint stability, although the knee joint lacks bony security, it is secured by ligaments and the tendons of muscles