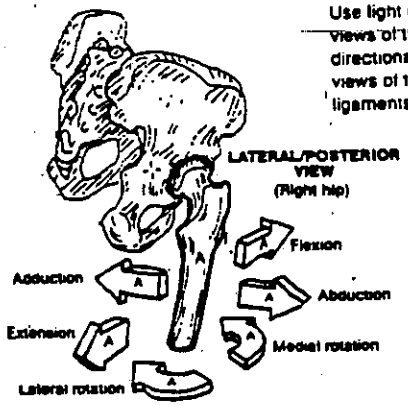
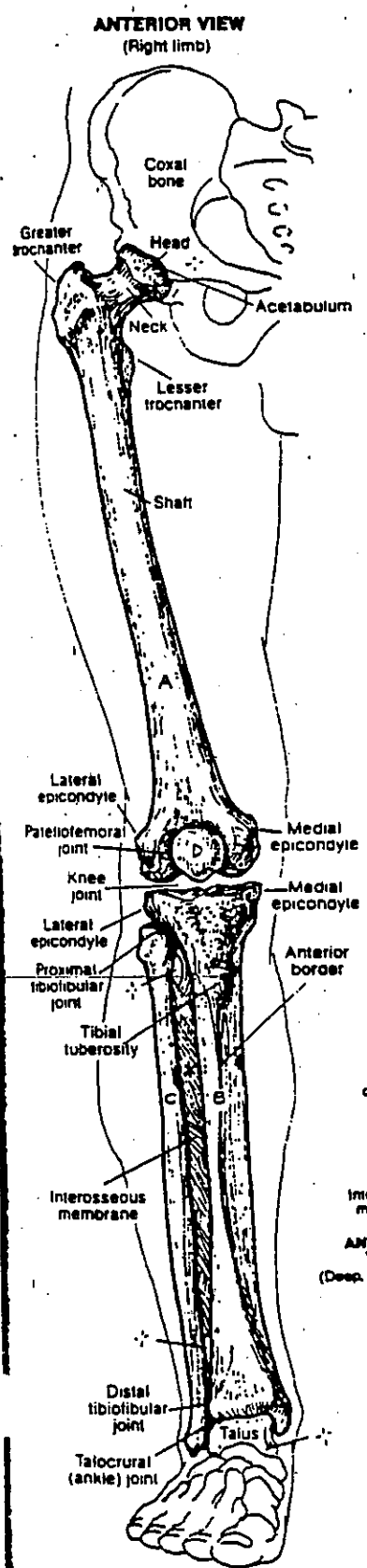
III. SKELETAL SYSTEM / LOWER LIMB

THIGH & LEG BONES

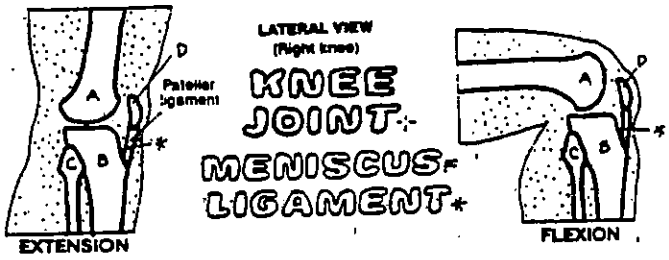
FEMUR A TIBIA B
FIBULA C
PATELLA D

CN: Do not use the color used for the ilium on Plate 29. Use light colors and a bright color for F. (1)Color the two large views of the lower limb. (2)Next color the femur and the six directional arrows for the hip joint. (3)Color the extension/flexion views of the knee joint. (4)Color the two views of the major ligaments and the menisci of the knee joint

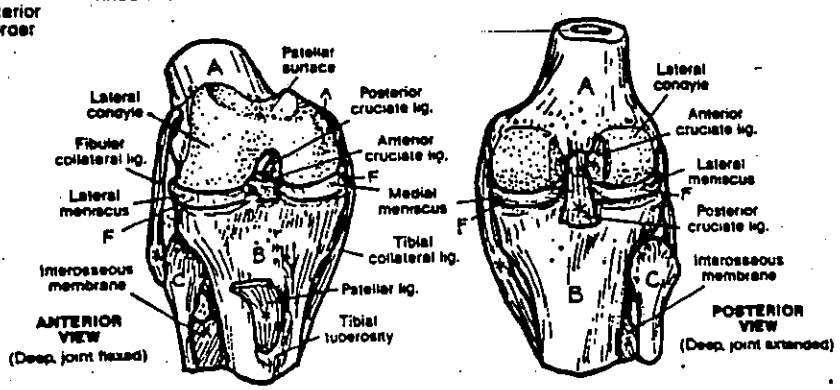




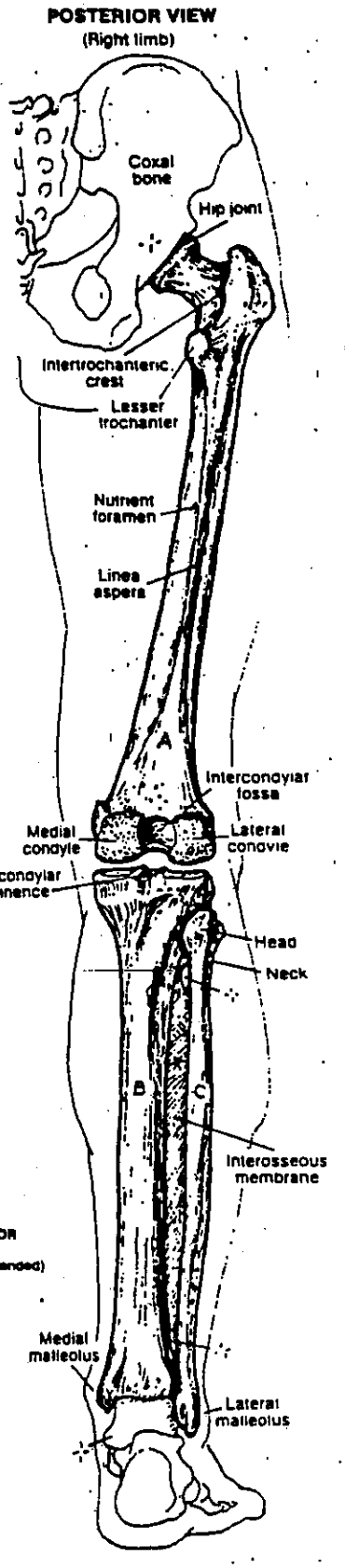
The hip (coxal) joint (multiaxial, ball and socket synovial joint) is concerned with the transmission of considerable weightbearing forces; the neck of the femur is particularly subject to pathologic changes with any significant alteration of blood supply (avascular necrosis). The greater trochanter is the site of attachment for several important muscles crossing the hip joint.



The knee (genual) joint consists of two condylar-type, synovial (tibiofemoral) joints between the condyles of the *femur* and the flat, plateau-like articular surfaces above the condyles of the *tibia*. The principal movements at these joints are flexion and extension. The knee joint includes the saddle-type synovial (patellofemoral) joint between the *patella* and femur. The deep surface of the patella is cartilaginous and exhibits medial and lateral facets (note patellar surface of the femur). Premature wear of the patellar cartilage is common (chondromalacia patellae). The patella is a sesamoid bone which develops in the tendon of the quadriceps femoris muscle; as such, it resists the stress imposed on that tendon during knee movements.



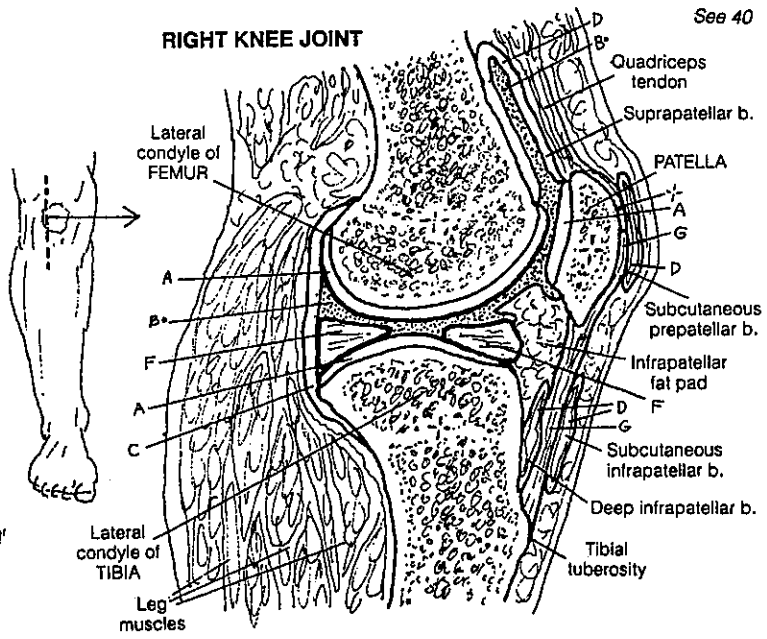
The stability of the knee joint comes from ligaments and the muscles crossing the joint. The collateral ligaments resist sideward displacement and rotation. The cruciate (crossing) ligaments resist hyperextension (anterior cruciate) and hyperflexion (posterior cruciate) of the joint. The C-shaped menisci (the medial larger than the lateral) deepen the articulating surfaces of the tibial condyles. Often torn by misuse of the knee joints (rotation and adduction/abduction with weightbearing), the menisci can often be repaired by arthroscopy.



KNEE JOINT

CN: The femur, tibia, fibula, and patella bones are not to be colored. (1) In the sagittal section, color (A) blue and (B) black. The synovial membrane that lines the cavity is not shown. (3) In the anterior view, color the facets on the posterior surface of the patella. (4) Color relationship between attachments and function of cruciate ligaments (E, E').

ARTICULAR CARTILAGE$_A$
SYNOVIAL CAVITY$_{B\bullet}$
JOINT CAPSULE$_C$
BURSA$_D$
CRUCIATE LIG.$_{\varsigma}$ ANT.$_E$ / POST.$_{E'}$
MENISCUS, LAT.$_F$ / MED.$_{F'}$
PATELLAR LIG.$_G$
COLLATERAL LIG.$_{\varsigma}$ TIBIAL$_H$ / FIBULAR$_{H'}$



The knee joint consists of *two condylar synovial joints* between the femoral and tibial condyles, and a *gliding synovial joint* between the patella and the femur. Note that the fibula and the tibiofibular joint are not part of the knee joint. The movements of the knee joint, involving essentially flexion and extension with varying degrees of rotation and gliding, can be seen in Plates 62 and 64.

In the sagittal view of the joint, note the *articular cartilage*–lined patellofemoral articulation. The patella is a sesamoid bone that developed in the tendon of the quadriceps femoris muscle. It resists wear-and-tear stresses on the tendon during knee flexion and extension. Note the two facets of the patella in the anterior view and the corresponding patellar articular surface on the femur. The various bursae shown are variable in size. The *suprapatellar bursa* is an extension of the synovial joint cavity.

The fibrous (joint) capsule is incomplete around the joint, reinforced by ligaments where absent or deficient and replaced by the patella anteriorly. The synovial membrane (not shown) lines the internal surface of the fibrous capsule; it does not cover the *menisci* and the joint surfaces or the posterior fibrous capsule.

The menisci can be seen from the side in the sagittal view and from above in the superior view of the joint. They are semilunar-shaped fibrocartilaginous discs attached to the tibial condyles by ligaments; they enhance the depth of fit of the femoral condyles. The ends of the menisci (horns) are attached in the tibial intercondylar region. These horns are richly innervated, a fact reinforced to one experiencing a painful tear of the posterior horn of the medial meniscus. The medial meniscus is more fixed on the tibia than is the lateral. Thus, it is less flexible and more easily torn in the face of excessive rotation and forced abduction of the knee joint while bearing weight.

The knee joint is without bony security. It is secured by ligaments and the tendons of the muscles that cross it, including the tendon of quadriceps femoris anteriorly and the iliotibial tract and the tendon of biceps femoris laterally (Plate 62), the muscles popliteus and semimembranosus posteriorly (Plate 66), and the tendons of sartorius, gracilis, and semitendinosus (pes anserinus) medially (Plate 66). See also Plate 40.

The ligaments are particularly important in limiting ranges of motion of the knee and securing the menisci. The *collateral ligaments* resist unwanted sideward movements at the knee. The *anterior cruciate* is named for its anterior tibial attachment, the *posterior cruciate* for its posterior tibial attachment. In their ascent proximally, they cross (crux, cross). The anterior cruciate passes posteriorly and laterally to end on the posteromedial aspect of the lateral femoral condyle; the posterior cruciate passes anteriorly and medially to end on the medial aspect of the medial femoral condyle. The cruciates essentially resist forward/backward displacement of the tibia/femur; indeed, a torn cruciate ligament generally results in excessive anteroposterior movements of the tibia on the femur.