



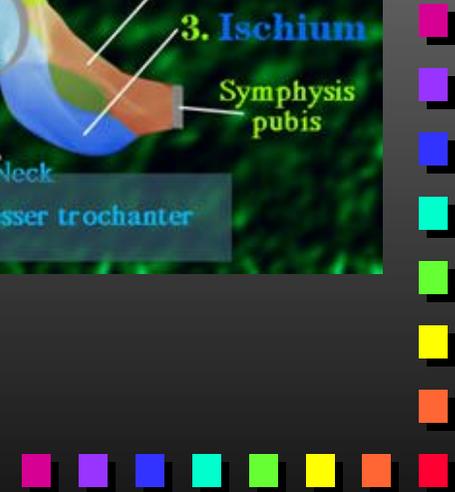
Injuries to the Lower Extremity

Most common due to application of large loads. Important because of the role on the lower extremity in locomotion



Hip Anatomy

- Ball & Socket (3D)
- Ligament support
 - Iliofemoral
 - pubofemoral
 - ischiofemoral
 - ligamentum teres
- Joint capsule: labrum



Hip Muscles

	Flexion	Extension	Abduction	Adduction	Int. Rotation	Ext. Rotation
Adductors				X		X
Tensor fascia	X		X		X	
Gluteus Max		X				X
Gluteus Medius			X		X	
Gluteus Minimus			X		X	
Gracilis				X		
Ilopoas	X					
Pectinuous	X			X		X
Piriformis		+	+			X
Hamstrings		X				
Sartorius	X					
Rectus Femoris	X					



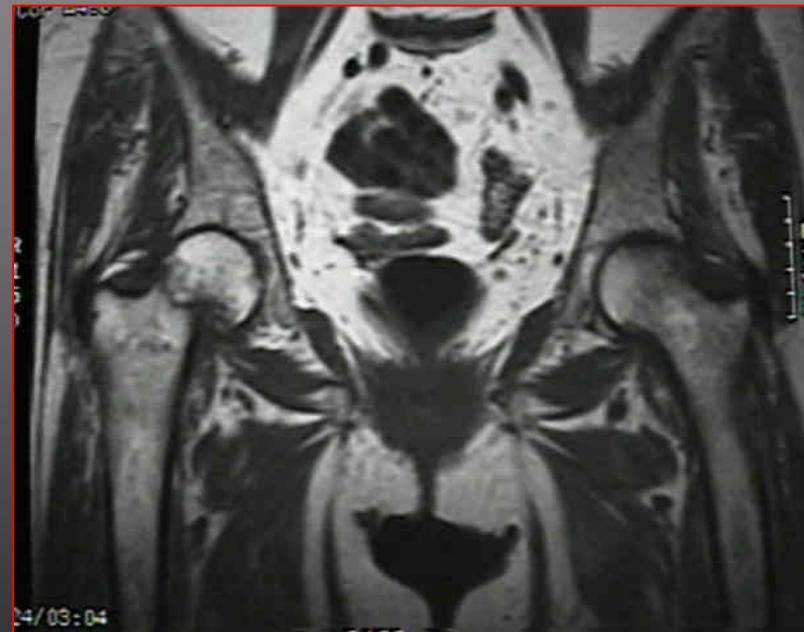
Hip fractures

- High energy forces
 - falls
 - car accidents
 - pelvic (side impacts)
 - high mortality rates
- Femoral neck fractures
 - > 250,000
 - women 3 times likely to get fracture



Hip fractures

- Young people: high energy impacts
- Mechanism
 - direct impact
 - lateral rotation of leg
- Stress fractures femur
- Dynamic models of falls
 - impact forces 3-10 kN



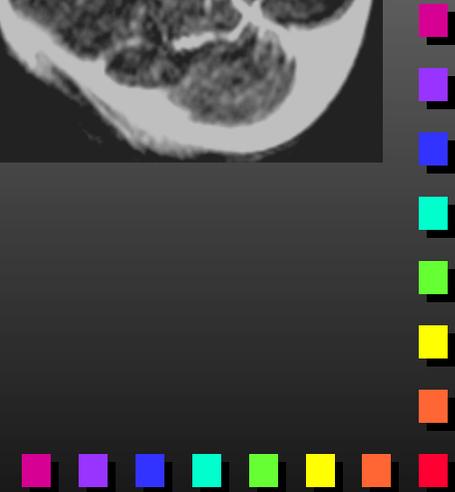
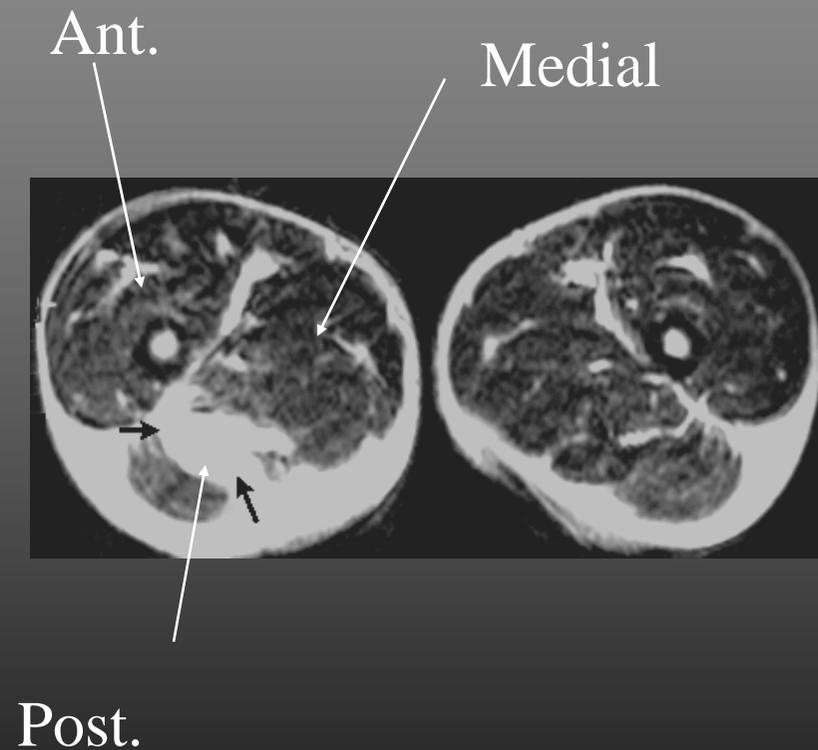
Hip Luxation (dislocation)

- Not common: hip stability
- High forces
- Most cases posterior dislocation
- Car accidents: dashboard
- Anterior inferior dislocation
 - 10-20% of hip dislocation
 - Force abduction
 - Abduction, flexion and ext. rotation (obturator)
- Hip retroversion (toe-in)
- Congenital dislocation (infants)



Thigh injuries

- Three muscular compartments
 - anterior
 - medial
 - posterior
- Quadriceps contusion
 - blunt trauma
 - extensive hematoma
 - swelling
 - increase muscle weight
 - loss of strength
- Myositis Ossificans



Femoral fractures

- High energy trauma
 - car & motorcycle and or pedestrian accidents (78%)
- Classified by location, configuration and level of comminution
- Dangerous near epiphyseal plates



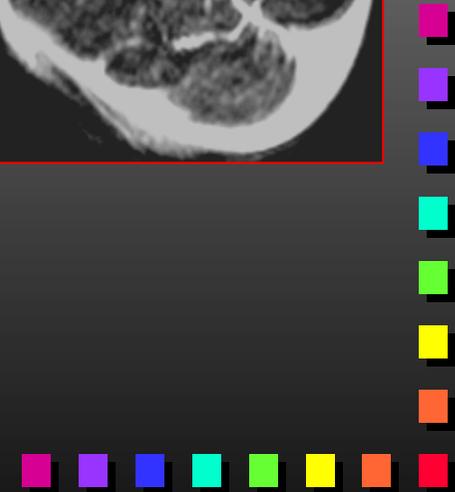
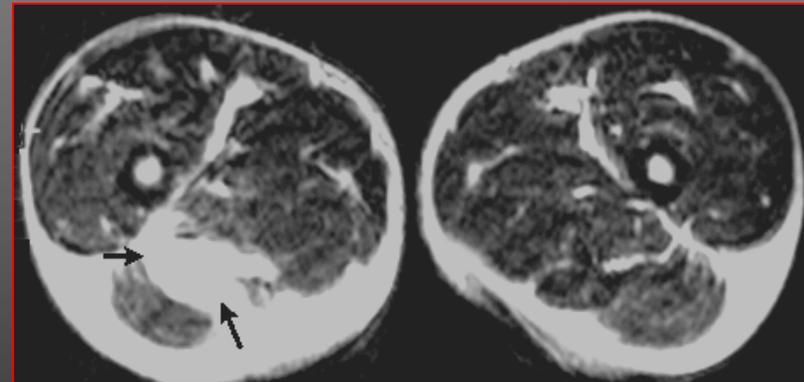
Femoral fractures

- Gunshot fractures affected by bullet diameter, velocity, weight, shape, and tumbling
- Low-velocity
 - splintering
- High velocity or close range shotgun blasts
 - More soft tissue damage
- Torsional loading
 - young skiers
 - high skill level (risk)



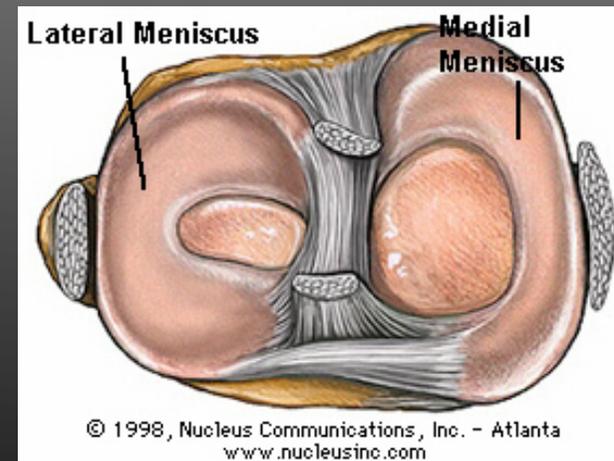
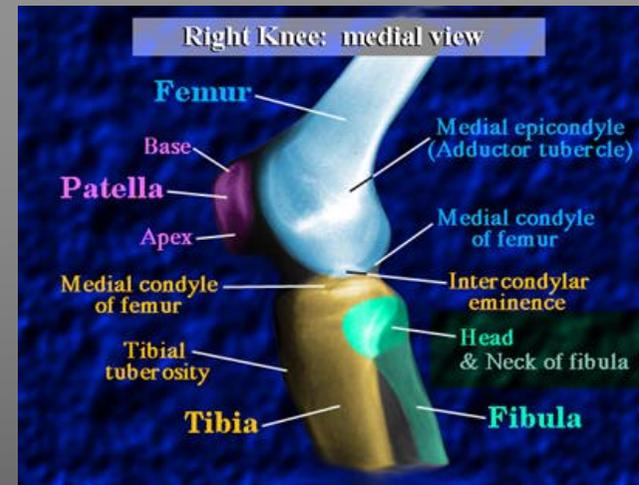
Hamstring

- Excessive tension applied to the muscle
 - eccentric action
- Predisposing factors:
 - fatigue
 - muscle imbalance
 - lack of flexibility
 - lack of warm up
- Biarticular muscles
 - bicep femoris
 - MTJ



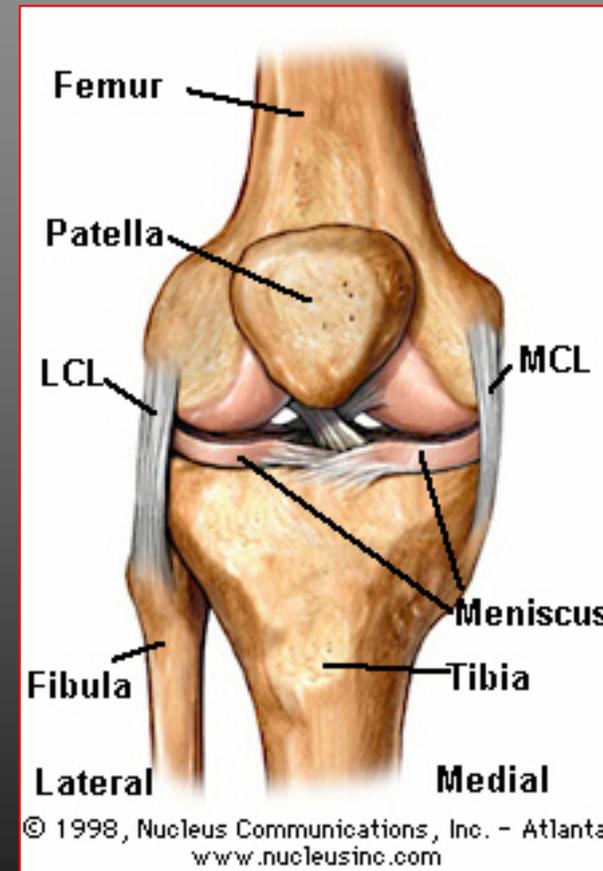
Knee anatomy

- Three joints
 - Tibiofemoral joints
 - Patellofemoral joints
- Double condyloid
 - flexion/extension
 - rotation
- Poor joint cavity
- Meniscus
 - connect to joint capsule and MCL and sometimes with ACL
 - Lateral: loose attachment



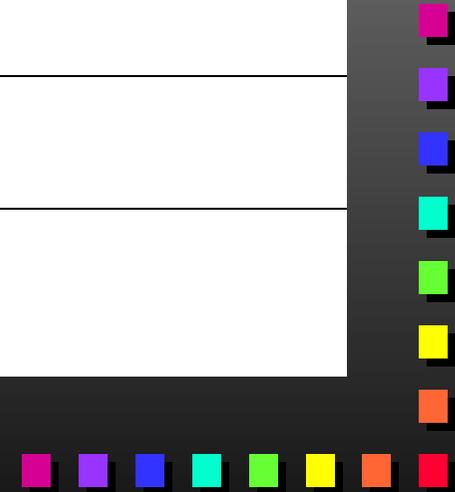
Knee Anatomy

- Strong ligament support
 - collateral lig: resist valgus and varus loading
 - ACL: two bundles, restrict anterior motion of tibia, valgus, varus, rotation
 - PCL: two bundles, restrict posterior motion of the tibia, limits hyper flexion
- Patella: mechanical advantage
 - PFJ huge loads when knee is flexed



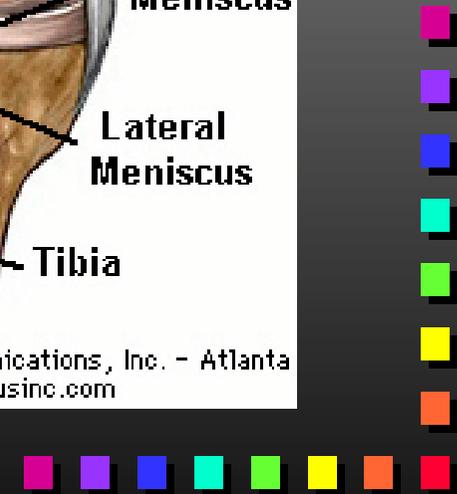
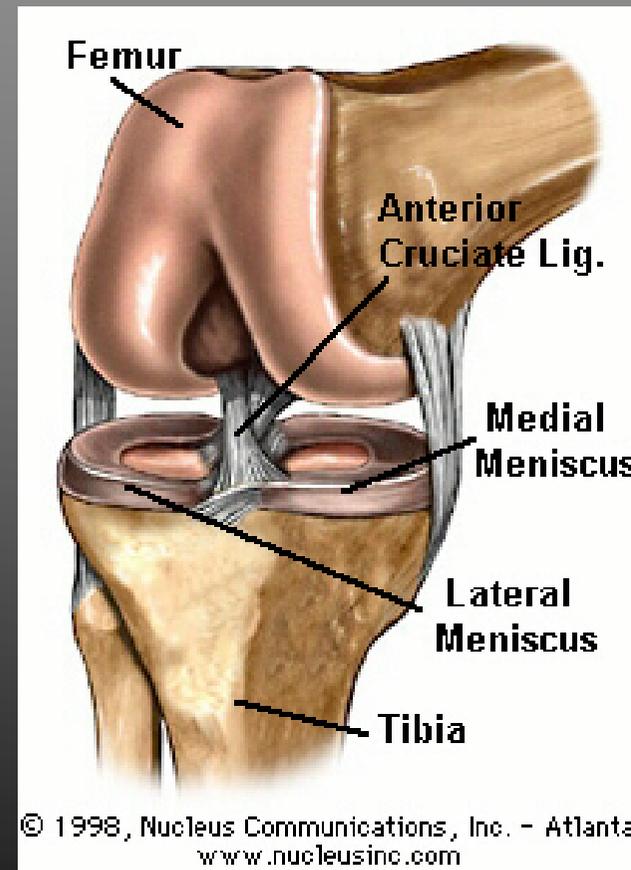
Knee Anatomy

Muscle	Action
Gracilis	Flexes the leg
Sartorius	Flexes the leg
Quadriceps	Extends the leg
Hamstrings	Flexes the leg



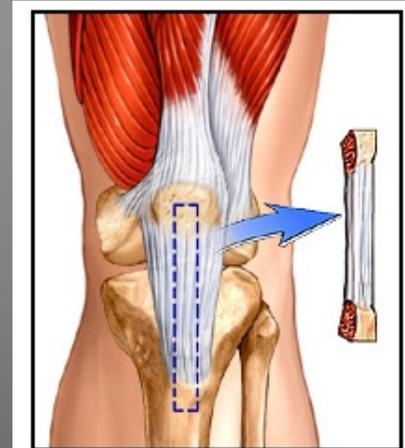
Knee Injuries

- ACL sprain: more common than PCL
- Mechanism:
 - valgus loading and ext tibial rotation (cutting movements)
 - hyperextension and internal tibial rotation (landing from jumps/rotate)
- MRI triad: ACL rupture, osseous lesion of terminal sulcus, and bone or soft tissue.



Knee Injuries

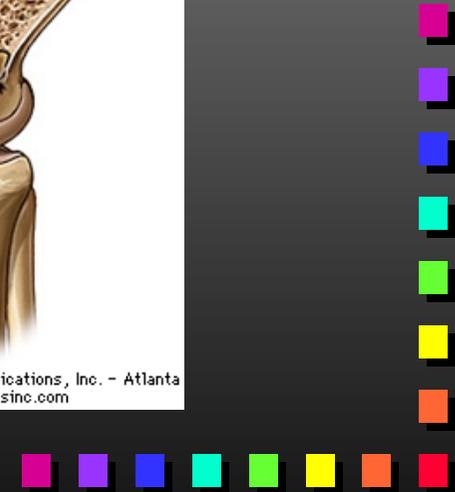
- ACL & Skiers
 - backward fall
 - Anterior drawer mechanism
 - Phantom boot
 - back of skis levers flexed knee into internal rotation
- ACL and females ?



© 1998, Nucleus Communications, Inc. - Atlanta
www.nucleusinc.com

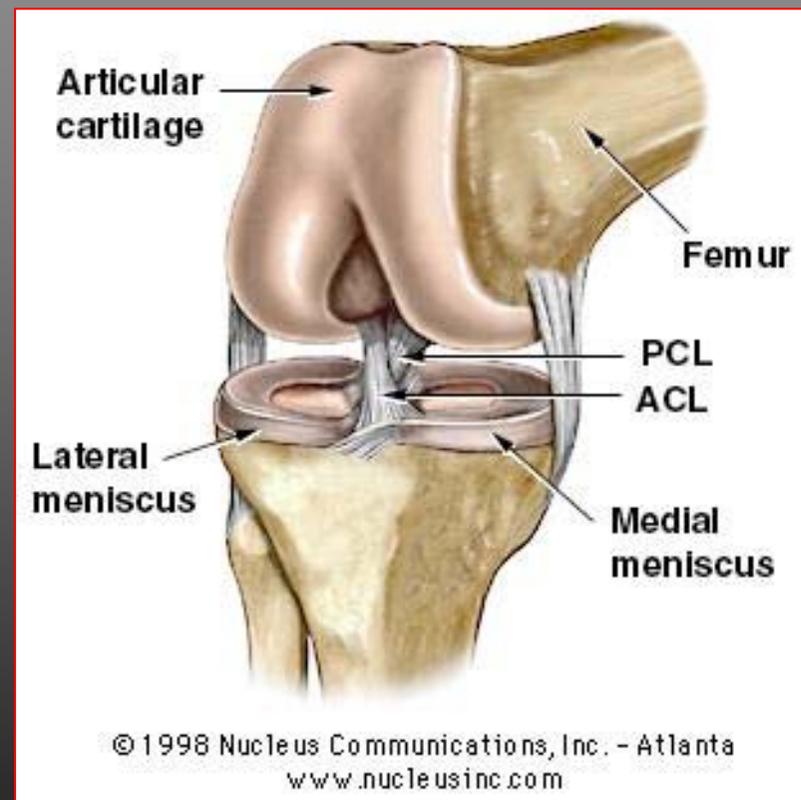


© 1998, Nucleus Communications, Inc. - Atlanta
www.nucleusinc.com



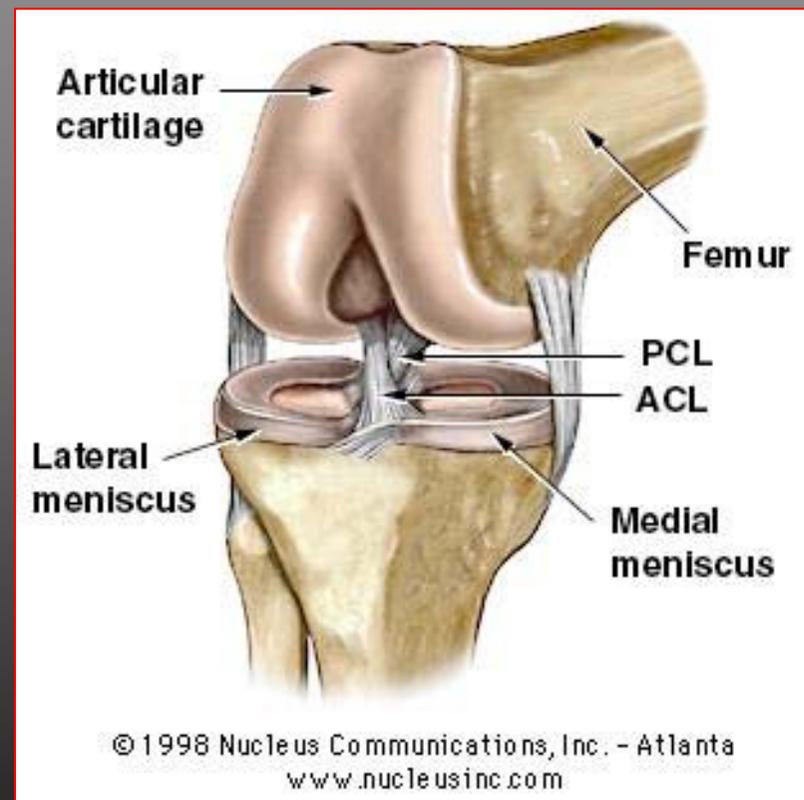
Knee Injuries

- PCL lower incidence of injuries
 - half of cause due to direct trauma car accidents
 - Sports
- Mechanism
 - unrestrained occupant thrown against dashboard
 - fall on flexed knee with plantar flexed knee
 - force knee flexion
 - force knee hyperextension
 - quick rotation



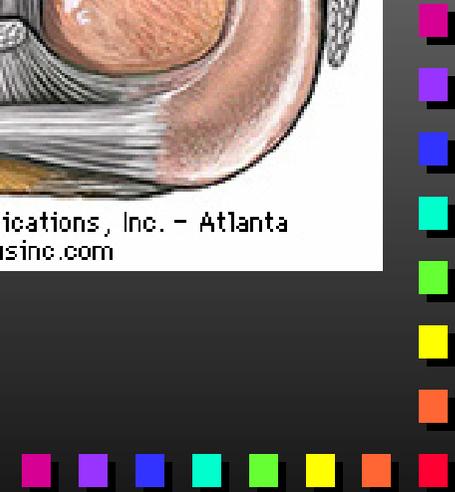
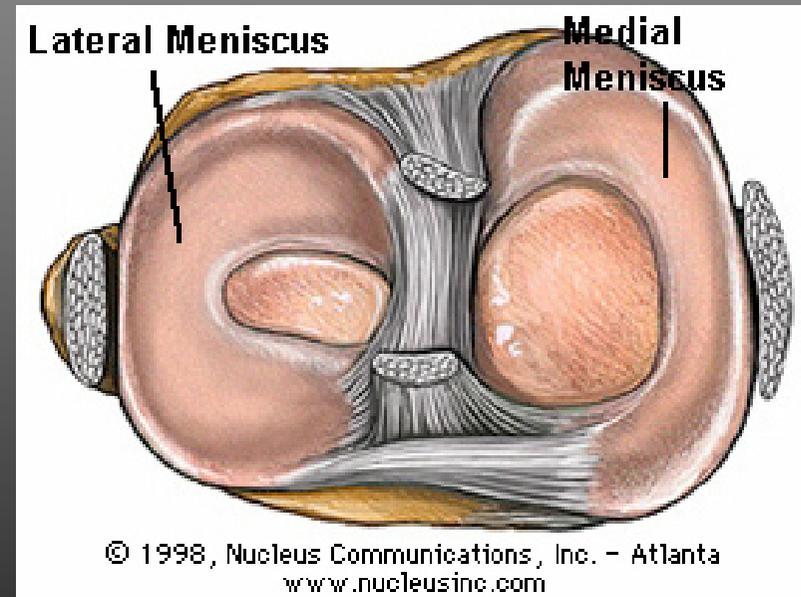
Knee injuries

- Unhappy triad: valgus-external rotation
 - ACL
 - MCL
 - Medial meniscus damage ?



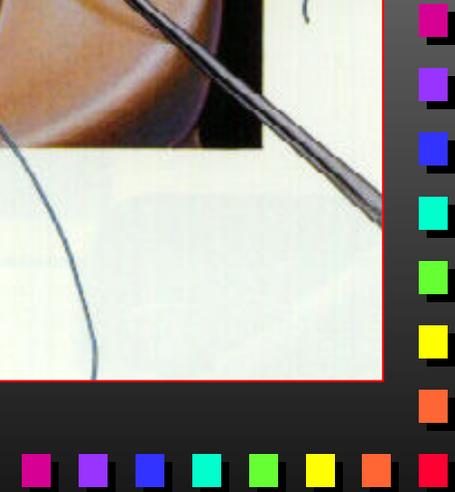
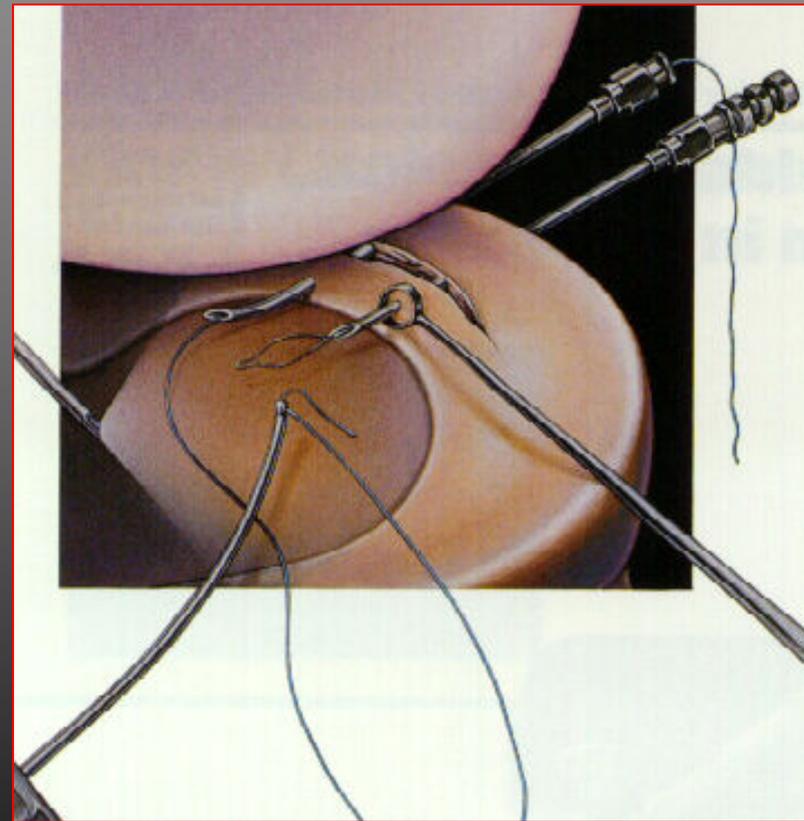
Knee Injuries

- Meniscus:
 - weight bearing
 - shock absorption
 - stabilization
 - rotational facilitation
- Full extension
 - 45-50% of the load
- 90° flexion
 - 85% load
- Laterally: 70% of the load
30% AC



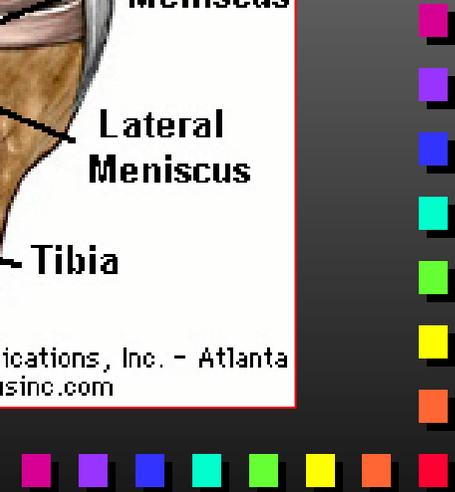
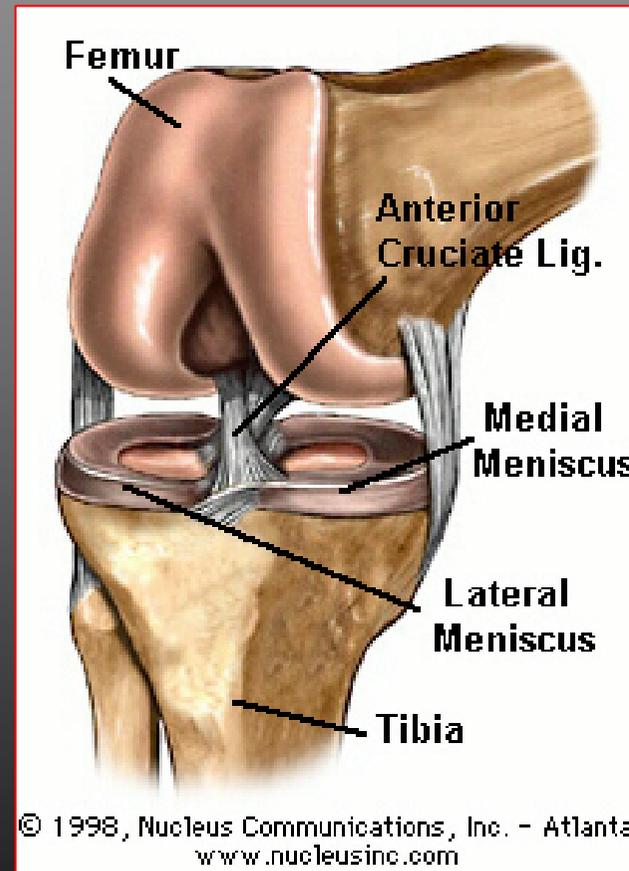
Knee Injuries

- Screw home mechanism: medial rotation at full extension
- Mechanism
 - flexion or extension and rotation
 - tensile loading of medial meniscus
 - bucket-handle tear
- High incidence sports
 - soccer, shot put discuss, skiing



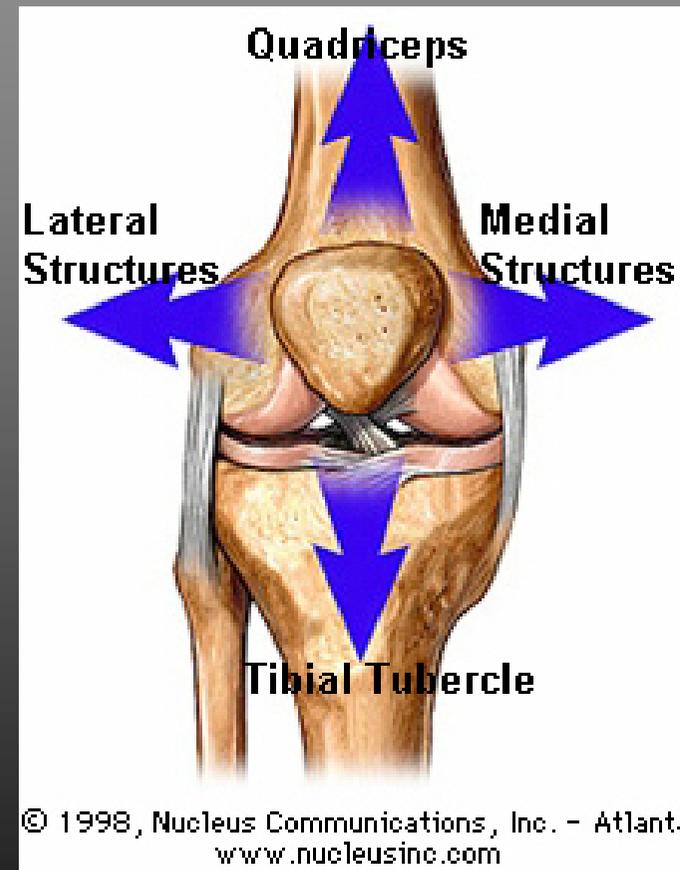
Knee injuries

- MCL and LCL sprains
- Forced varus or valgus loading
- Overuse
 - breaststroke kick



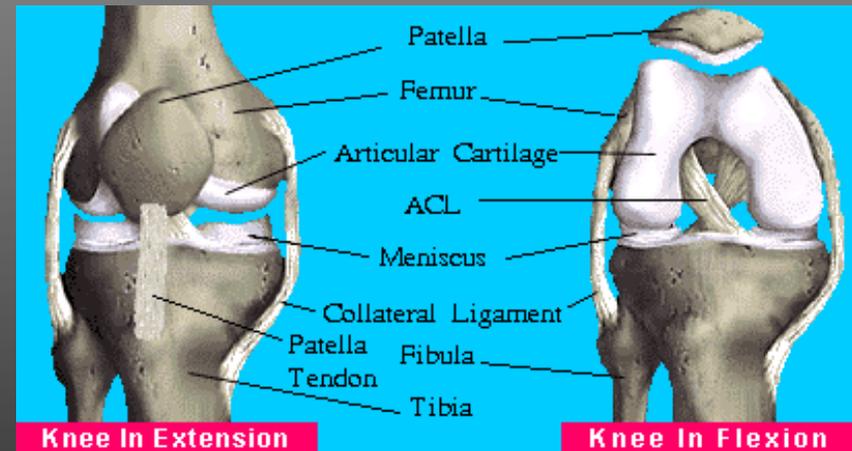
Knee injuries

- KEM: knee extensor mechanism
 - quads
 - PFJ and tendon
- Difference forces in the quad tendon and patellar ligament
 - Depend on Knee angle
 - Contact force
- Patellar tracking
 - Q angle
 - Congruence



Knee Injuries

- Jumper's Knee
 - Patellar tendon pain
- Chondromalacia
 - degeneration of the retropatellar AC
- Tendon Rupture
 - >40 years
 - previous microtrauma

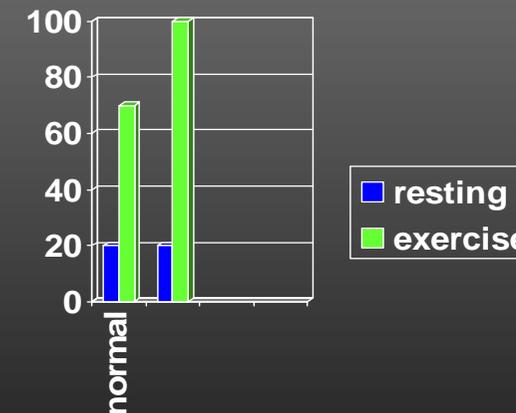


Lower Leg Injuries

- Four muscle compartments
 - Anterior
 - lateral
 - sup and deep posterior
- Compartment Syndrome
 - fluid accumulation as a result of acute or chronic exertion
 - can affect vascular and neural function
 - Ischemia
 - Fascia adaptations
 - Fasciotomy



Pressure



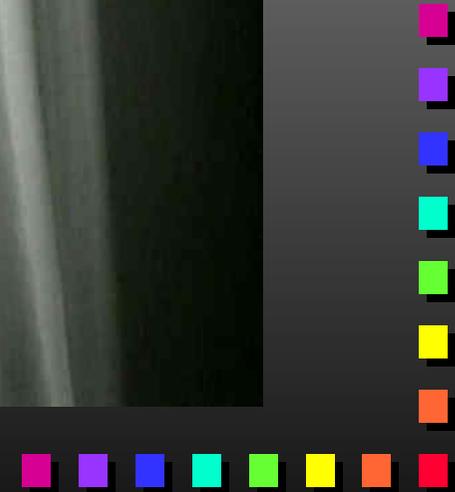
Lower Leg Injuries

- Tibial stress syndrome:
Inflammatory reaction of the
deep fascia
- Mechanism
 - chronic overload
 - can lead to periostitis
 - common in runners
 - multifactor



Lower leg injuries

- Stress reaction: bone with evidence of remodeling but without actual fracture
- Stress fracture
 - 50% occur on the tibia
 - runners: middle and distal third
 - jumpers: proximal fractures
 - dancers midshaft



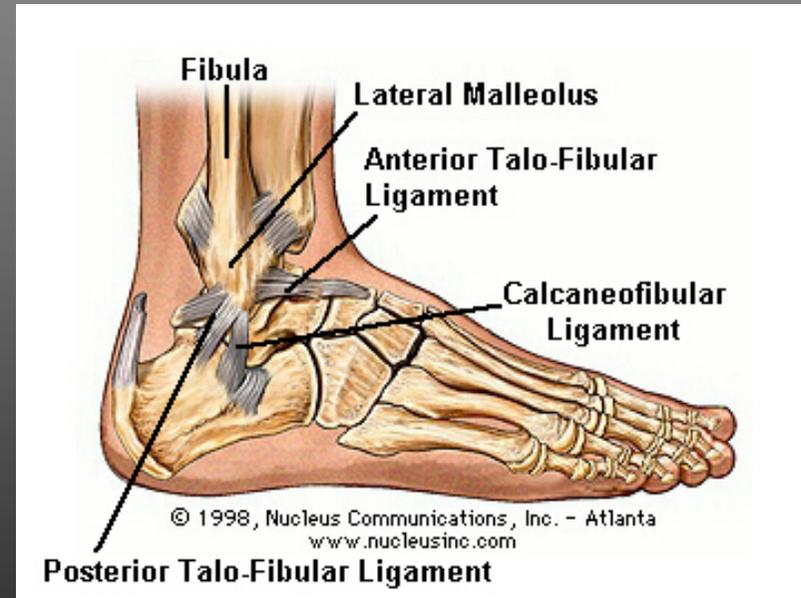
Lower leg injuries

- High energy fractures
 - car accidents: direct impact
 - skiing: torsional and boot fractures
 - Baseball bats



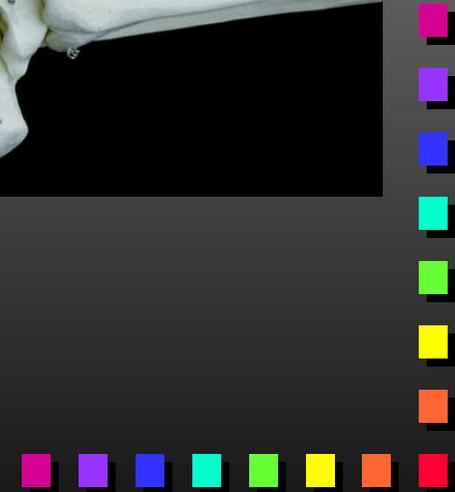
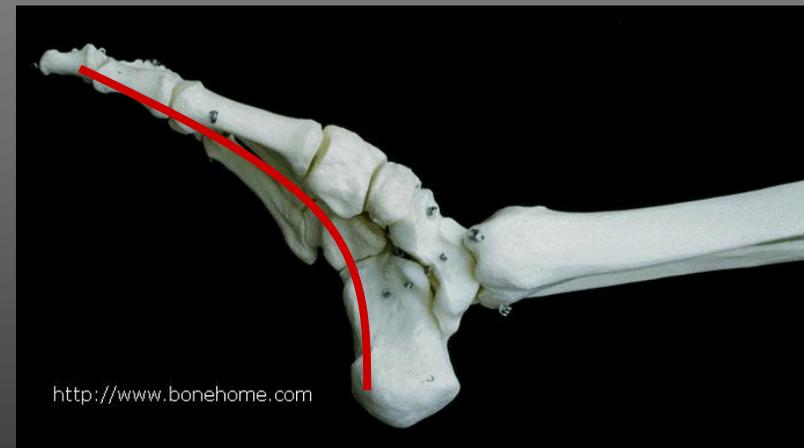
Foot & Ankle injuries

- Most complex areas in the human body due to large number of muscle, ligaments and bones
- Ligaments
 - deltoid: eversion
 - ATFL: restrict inversion
 - CFL
 - PTFL
- 26 bones
- Achilles tendon



Foot & Ankle injuries

- Arches
 - Longitudinal
 - medial
 - lateral
 - Transverse
- Absorb and distribute loads during weight bearing
- Supported by bones, muscles, plantar ligaments and plantar fascia



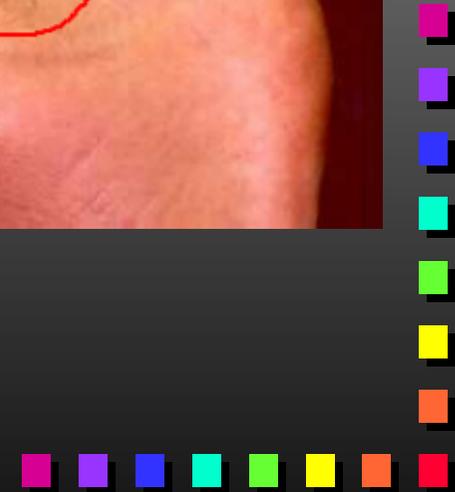
Foot & Ankle injuries

- Achilles tendon: largest and stronger
 - forces = 10 times BW
- Injuries
 - peritenitis
 - bursitis
 - multifactorial etiology
 - training
 - malalignments
 - trauma
 - footwear



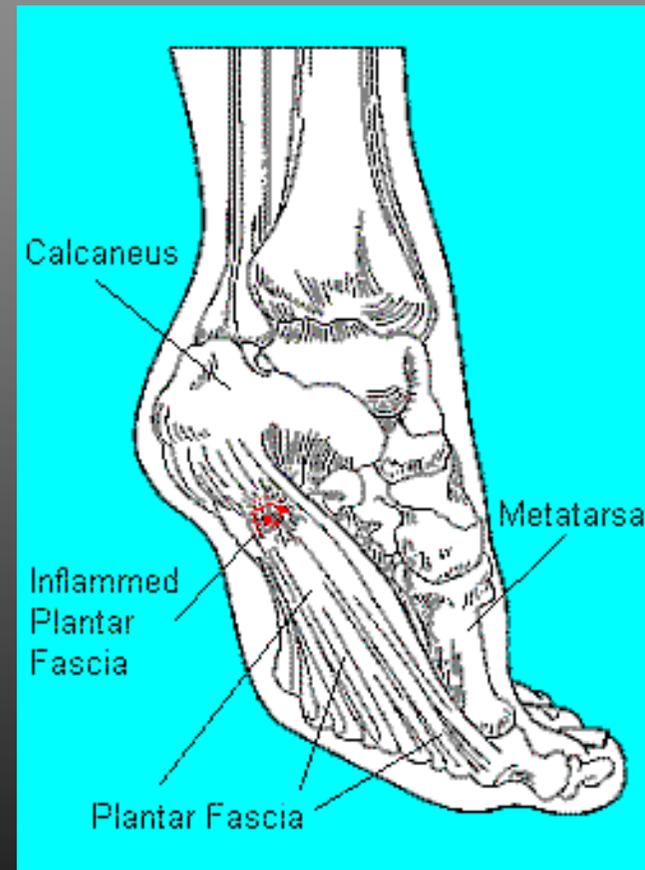
Foot & Ankle injuries

- Tendon rupture
 - degeneration
 - Men 30-40 years
 - Blood type (O)
- Mechanism
 - sudden dorsiflexion
 - rapid change in direction
 - excess tension on taut tendon
 - taut tendon struck by object



Foot & Ankle injuries

- Plantar Fasciitis: inflammation of the plantar fascia involving microtears or partial rupture of the fascia
- Repetitive loading compressing the plantar fascia (1.3- 2.9 BW)
- Factors
 - lack of flexibility
 - lack of ankle strength
 - overtraining
 - poor mechanics
 - leg length discrepancies
 - over pronation



Foot & Ankle injuries

- Ankle sprains: most common injuries
- Irregular talus & stability
 - plantar flexion: unstable
- Involve ankle and subtalar joint
- 85% inversion sprain (supination sprains)
 - ATFL-CFL-PTFL
 - Sometime deltoid (taut in plantar flexion)



Foot & Ankle injuries

- Eversion sprains (pronation)
less common
- Fractures malleolus
- Deltoid ligament
- Tibia and fibula separation
(high forces)



Foot & Ankle injuries

- Lisfranc
 - Low energy: tripping or bumping
 - High: falls, crashes, object drop
 - Axial loading foot in extreme plantar flexion or dorsiflexion
 - Violent twisting
- Turf toe
 - damage to capsule and ligaments of 1st MP joint

