5 Joints Webinar Series

The Foot & Ankle

Dr. Grove Higgins

With Master Trainer Pat Marques

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Outline

- Introductions – Dr. Kevin Steele
- Overview of the 5 Joints Webinars
- Foot/Ankle Wrapup
- Anatomy
  - Intro to Anatomy
  - Knee Basic Anatomy
- Biomechanics
  - Knee Movement
  - Gait
  - Functional Movements
- NeuroBiomechanics
- Assessment
  - In person
  - Online
- Drills and Tips
- Q&A

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Introduction

- Dr. Grove Higgins
  - Chiropractor & Soft Tissue Practitioner
  - Speaker and Educator
  - Functional Anatomy Instructor
  - Strength & Conditioning
  - Research
    - Biomechanics Gait and Foot Development
    - Anatomy of Lower Leg Modeling
    - Exercise & Hormonal Response
  - Been in Medicine Since 1993
- Patrick Marques
  - Lt. Col. USA Ret.
  - MS Exercise Science, CPT, ZHealth Master Trainer & Instructor
  - Speaker and Educator
  - Corrective Exercise Therapist
  - Research
    - Exercise & Hormonal Response, Sleep

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Introduction

- Neuroathlete
  - Use a “Neural Lens” to address performance, pain, and recovery
  - Online – assessment and training all over the world
    - USA, Sweden, & 18,000ft on Mt Everest
  - Clinic – manual therapy, chiropractic, exercise therapy, neuropsychology
  - Work with trainers online and provide mentoring and tools

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5 Joints


Foot/Ankle – April 30th


Knee – May 7th


Hip – May 14th


Shoulder – May 21st


Elbow – May 28th

Thursdays
11:00-12:30PM MST

* Pay What You Can

https://www.medfitclassroom.org/five-joints/

GoToWebinar

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Anatomy of the Knee

https://commons.wikimedia.org/wiki/File:Leonardo_da_vinci,_studi_anatomici_1504-06.jpg

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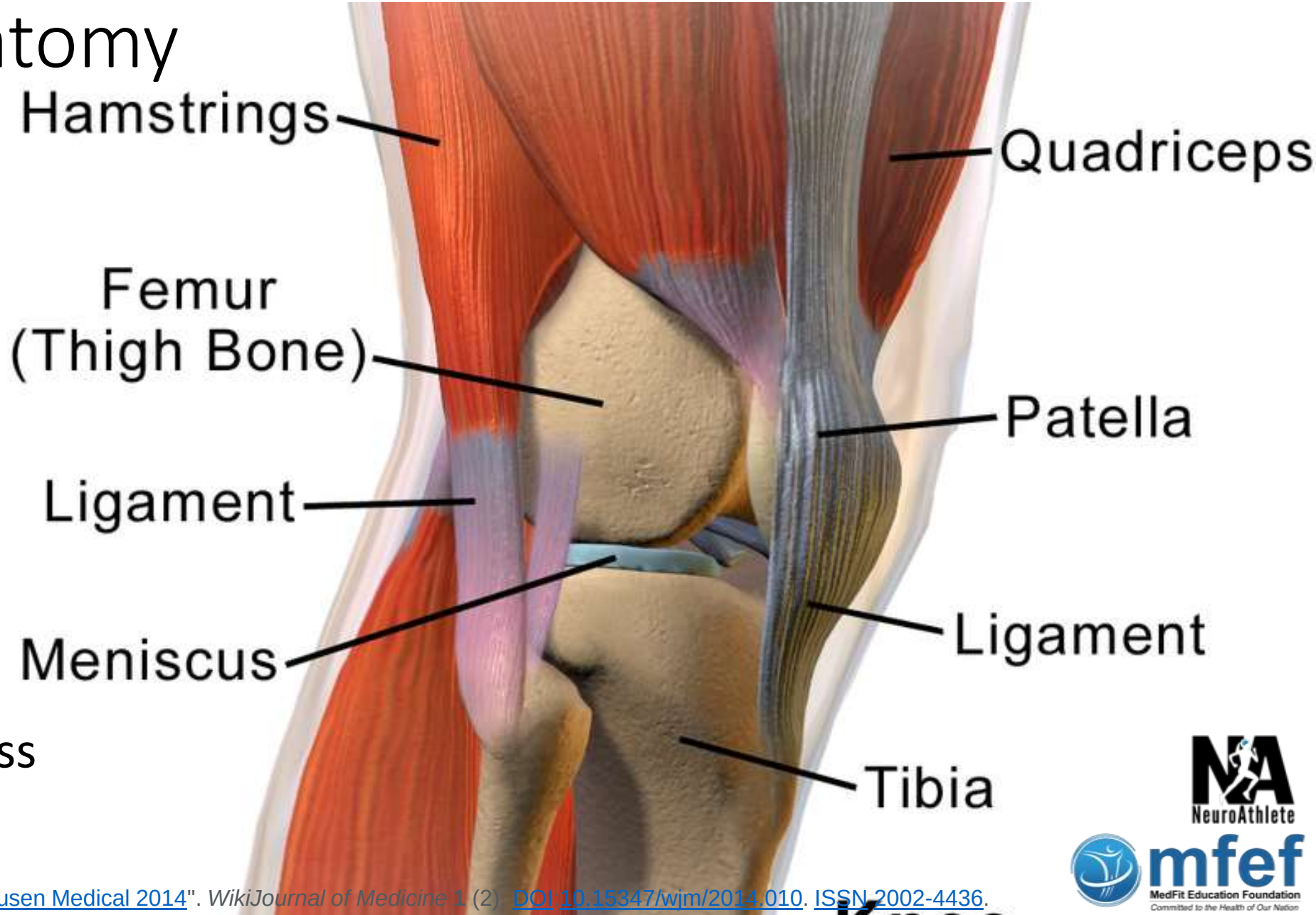
Knee – Anatomy

- 3 Joints
- 4 Major Ligaments
- Extensive Capsule
- Articular Cartilage
- Meniscus
- 13 Muscles Cross
- 2 Major Nerves



Blausen.com staff (2014). "Medical gallery of Blausen Medical 2014". *WikiJournal of Medicine* 1 (2). DOI 10.15347/wjm/2014.010. ISSN 2002-4436.

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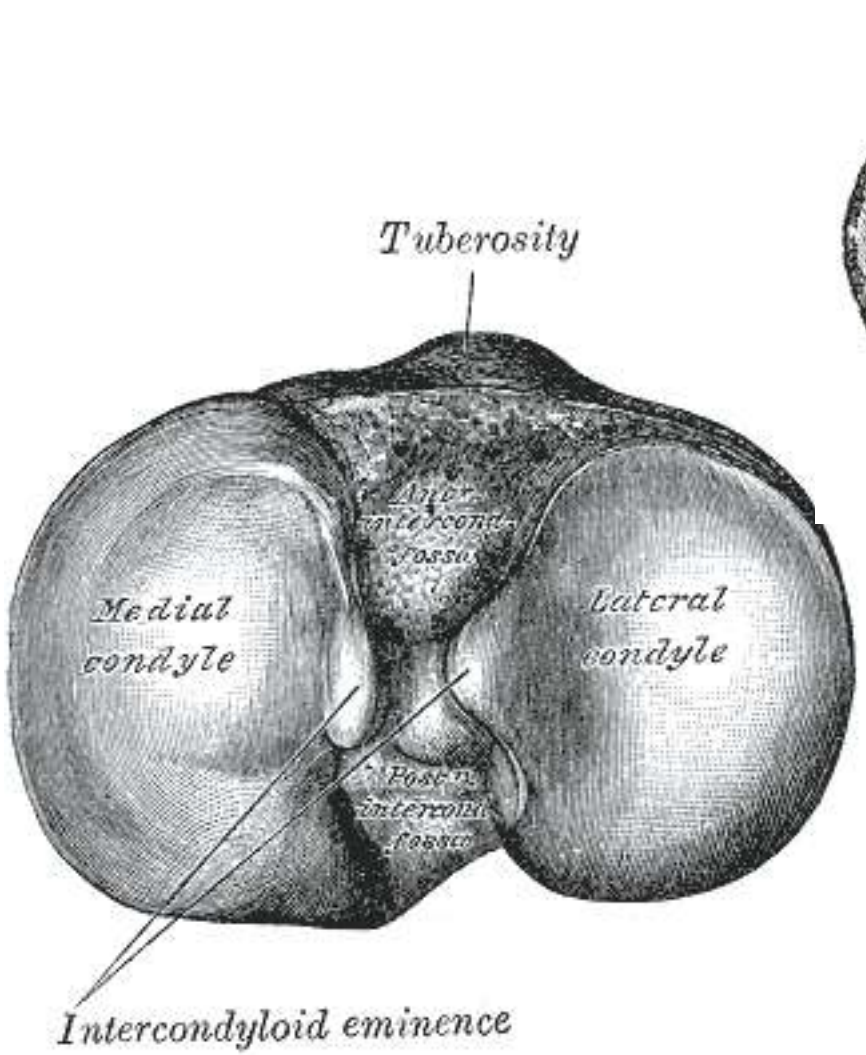
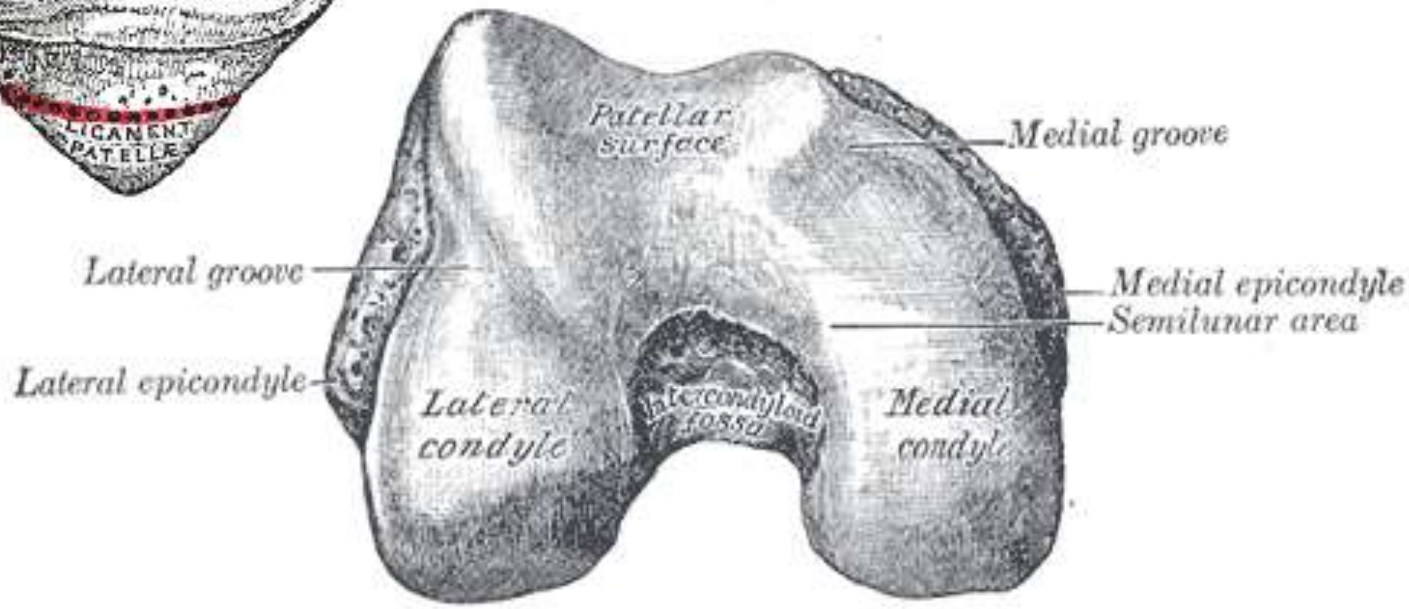
Knee – Bones Articular Surfaces





Henry Gray (1825–1861). Anatomy of the Human Body. 1918.

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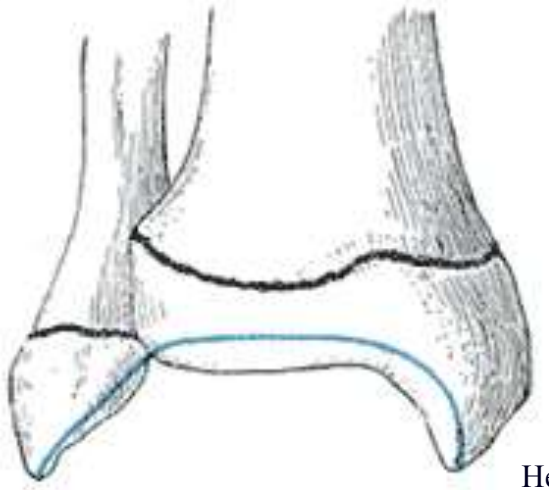

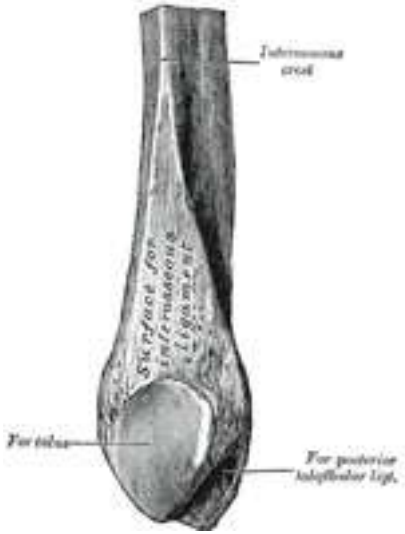

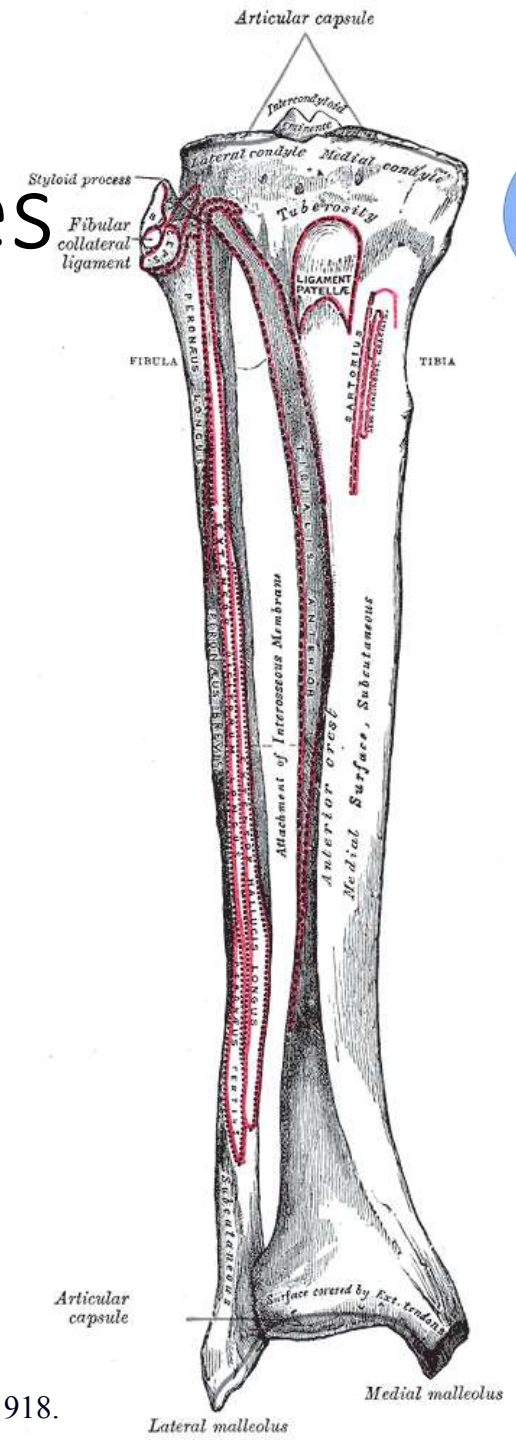

Henry Gray (1825–1861). Anatomy of the Human Body. 1918.

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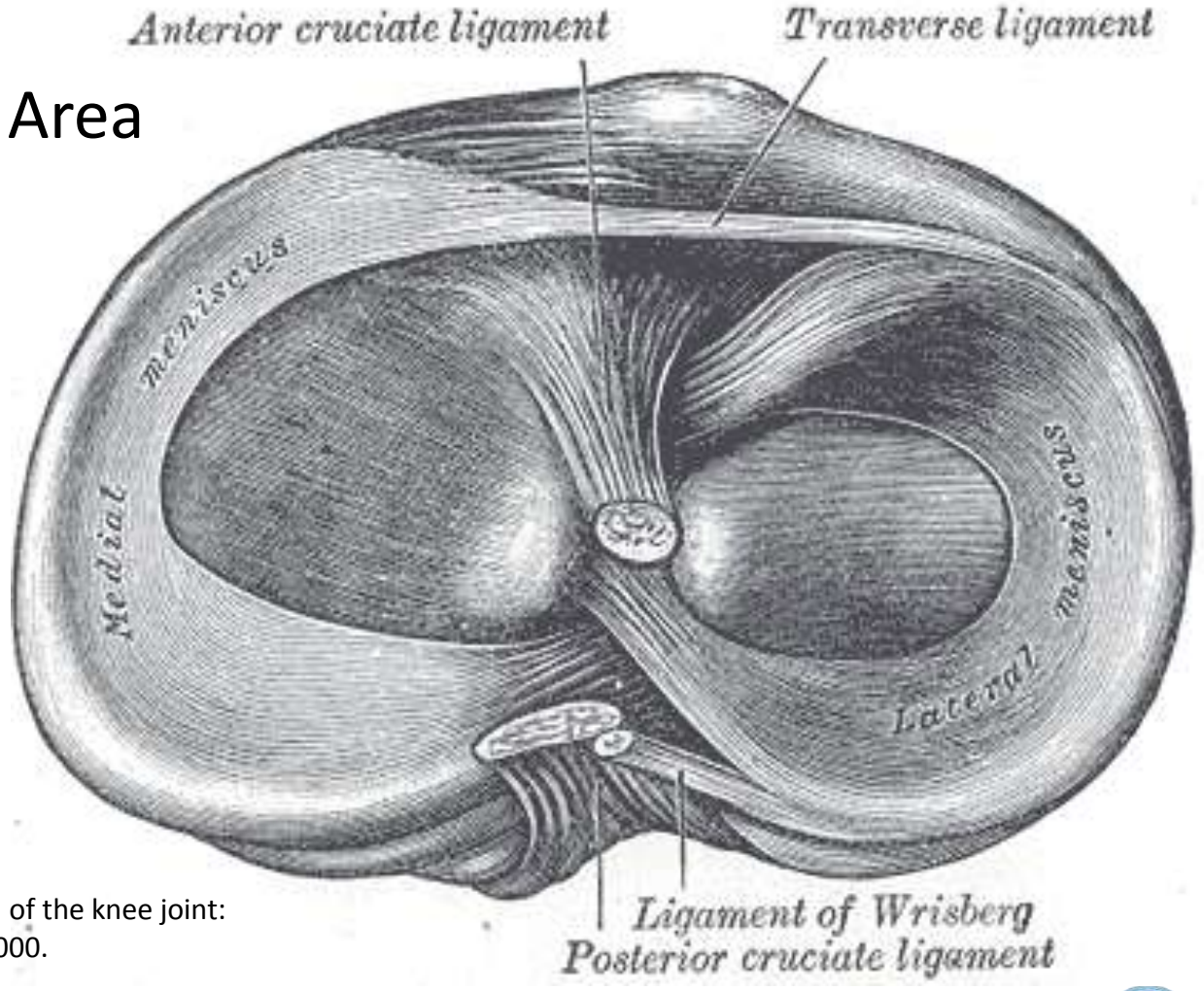
Knee – Meniscus

- Increase Functional Surface Area For Femur
- Disperse Bodyweight
- Disperse Impact
- Sensory Inside the Knee



"Pacinian and Ruffini corpuscles as well as free nerve endings…
This study showed that some of the pain in cases of meniscal tear could originate in the meniscus itself"

Mine T, Kimura M, Sakka A, et al.: Innervation of nociceptors in the menisci of the knee joint: An immunohistochemical study. Arch Orthop Trauma Surg 120:201–204, 2000.

Henry Gray (1825–1861). Anatomy of the Human Body. 1918.

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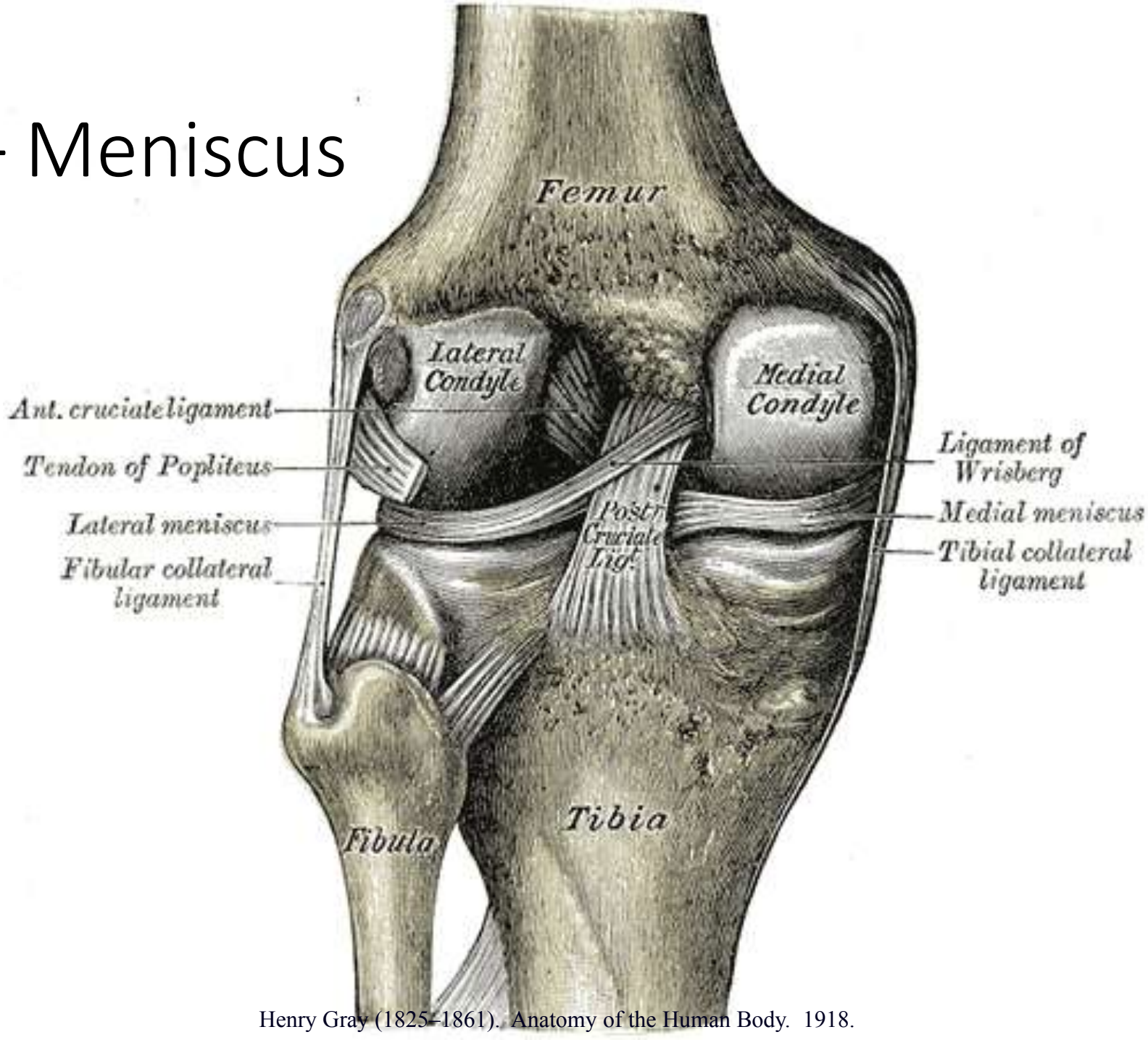
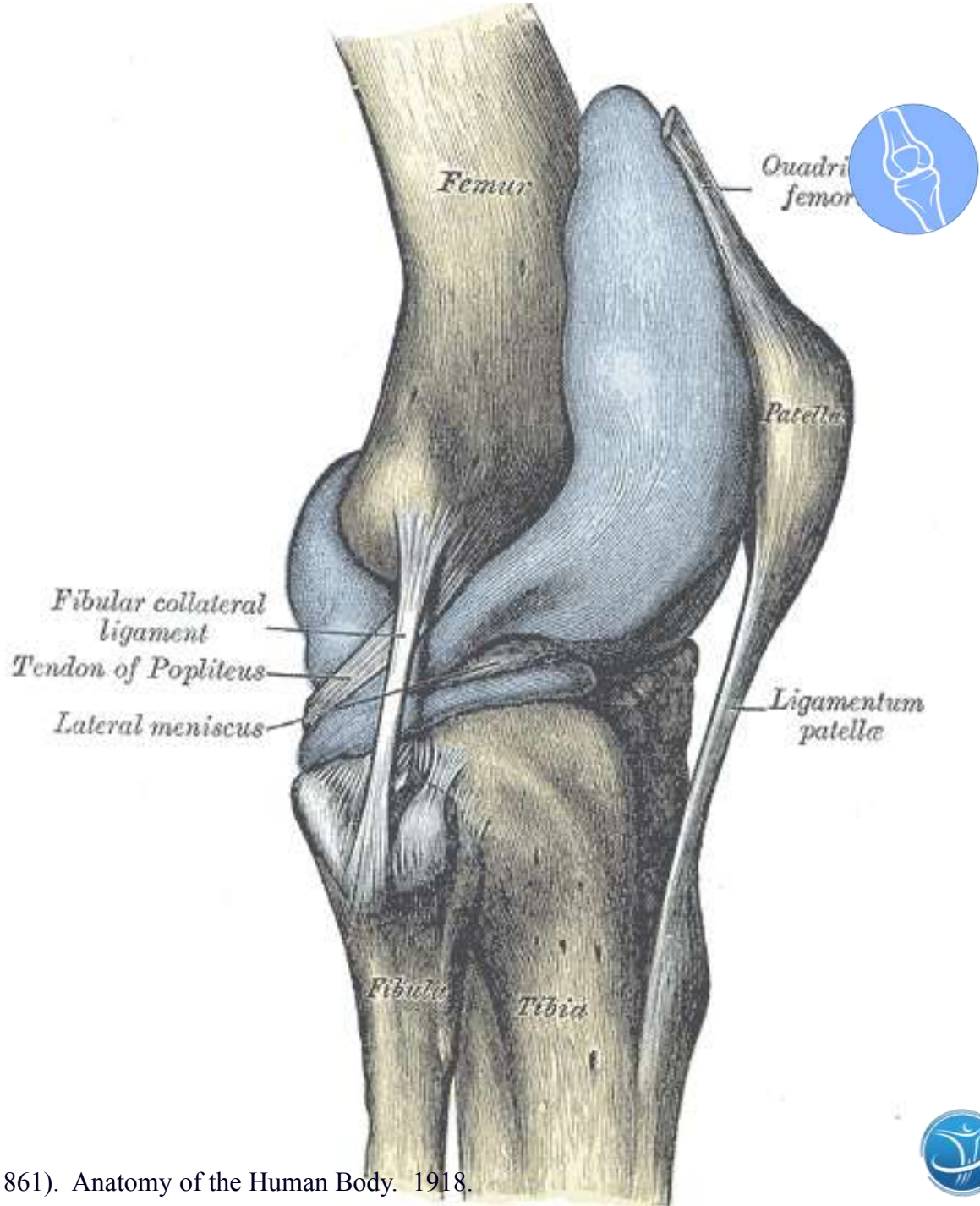
Knee – Meniscus



Henry Gray (1825–1861). Anatomy of the Human Body. 1918.

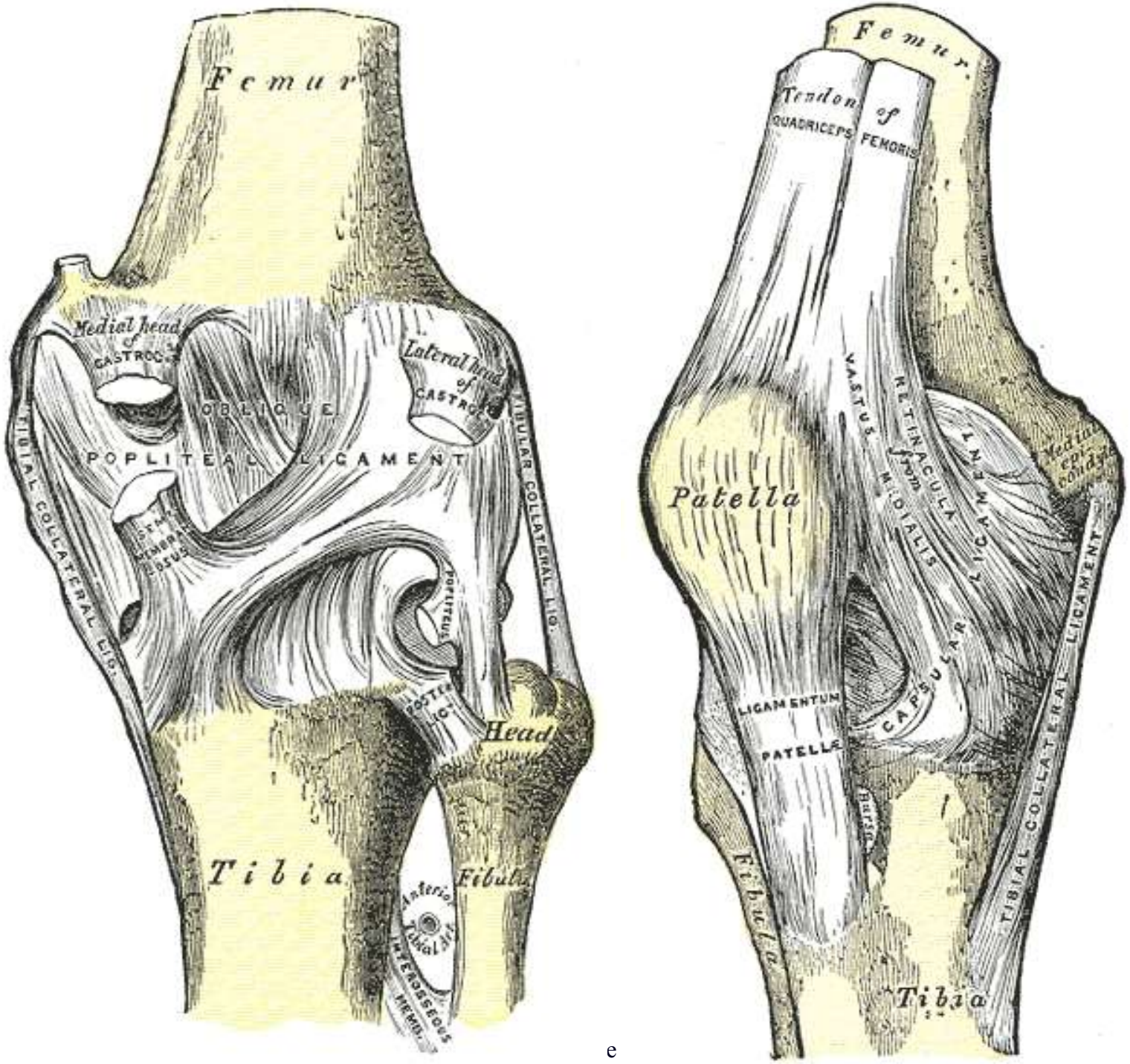
Knee – Bursas

- Decrease Friction



Henry Gray (1825–1861). Anatomy of the Human Body. 1918.

Knee – Capsule



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BIOMECHANICS POP QUIZ!!

Is it safe to squat or lunge with your knees over your toes?

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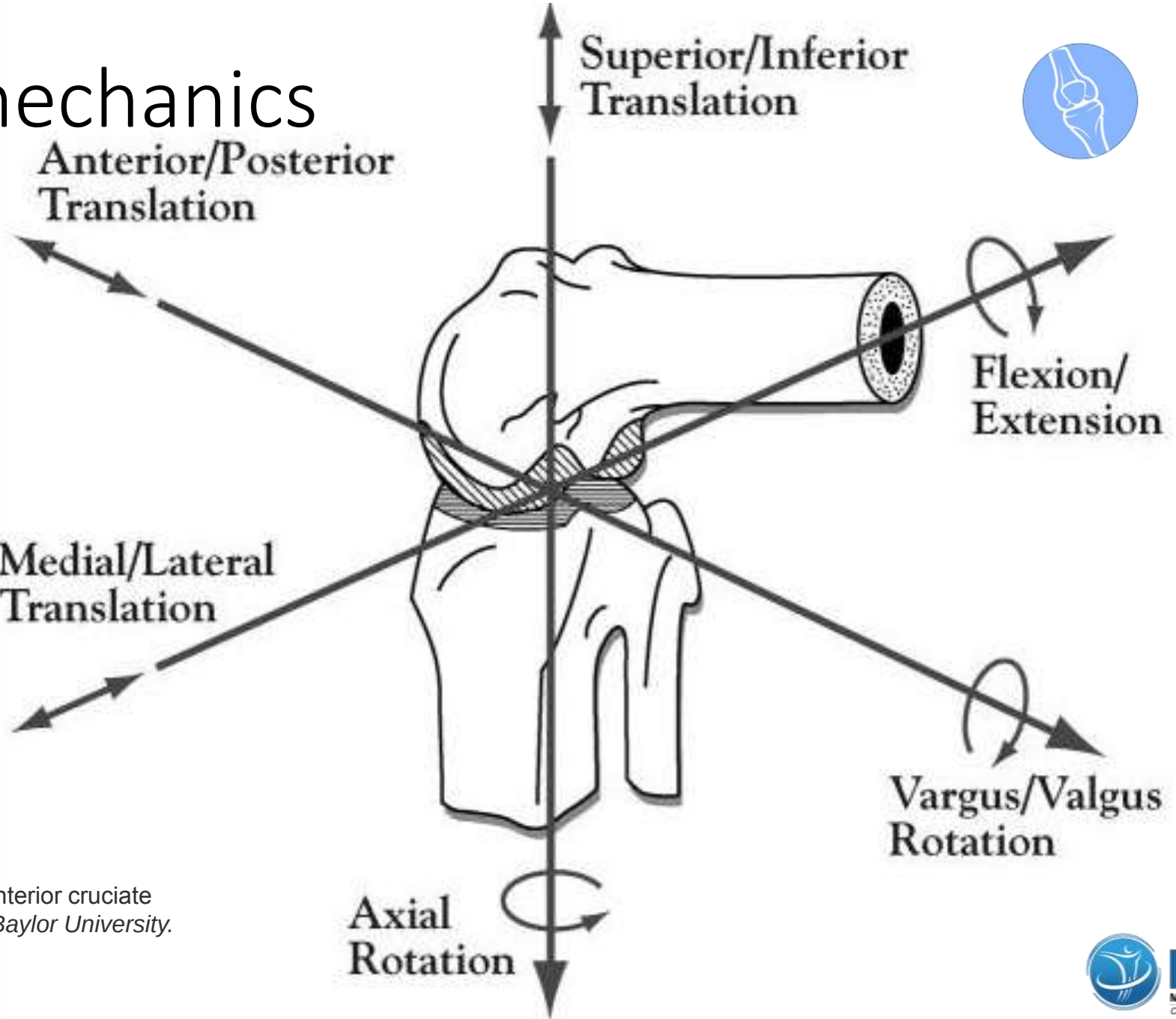
Knee – Biomechanics

6 Degrees of Freedom



Komdeur, Prashant et al. “Dynamic knee motion in anterior cruciate impairment: a report and case study.” *Proceedings (Baylor University. Medical Center)* vol. 15,3 (2002): 257-9. doi:10.1080/08998280.2002.11927850

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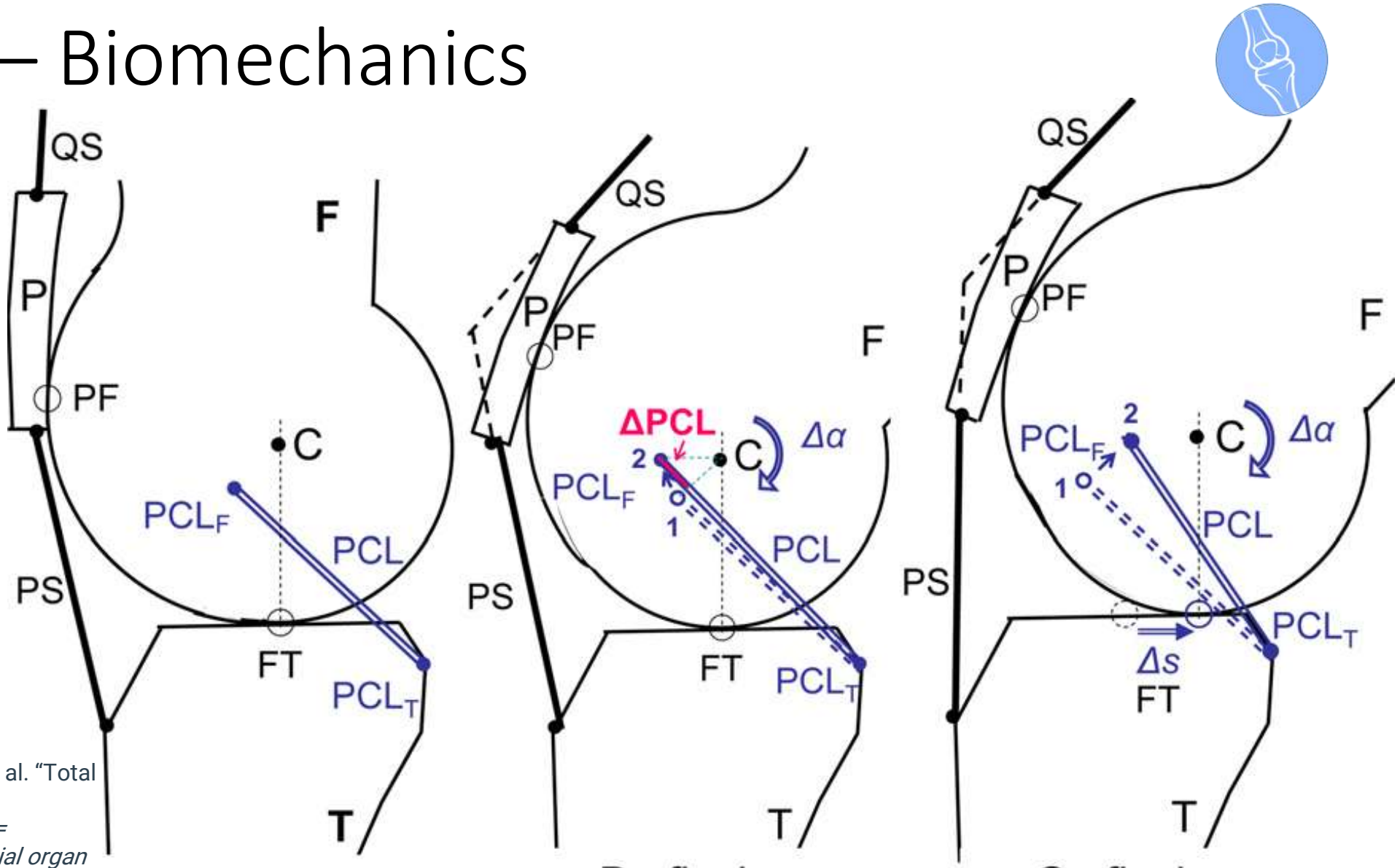
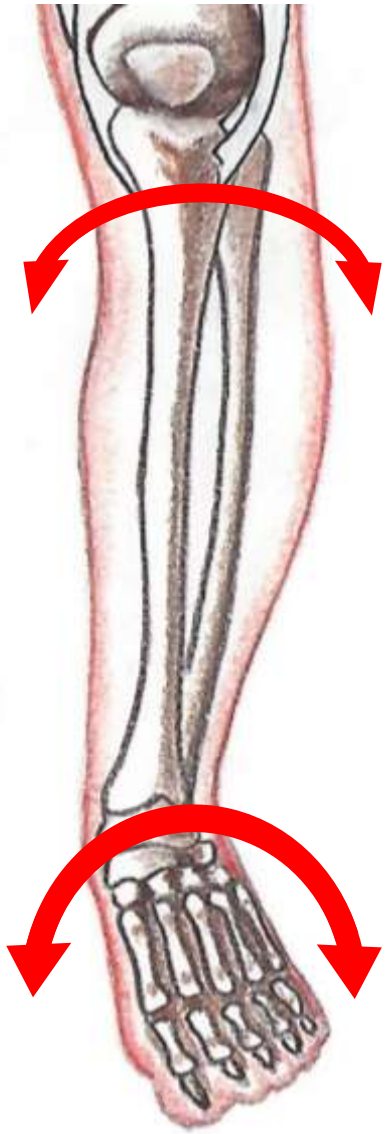
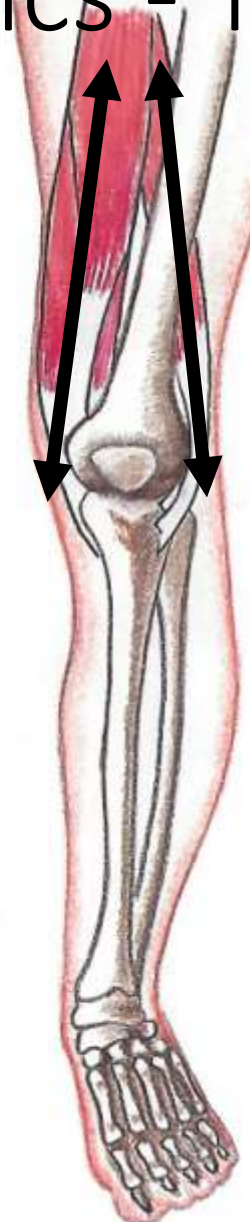
Knee – Biomechanics

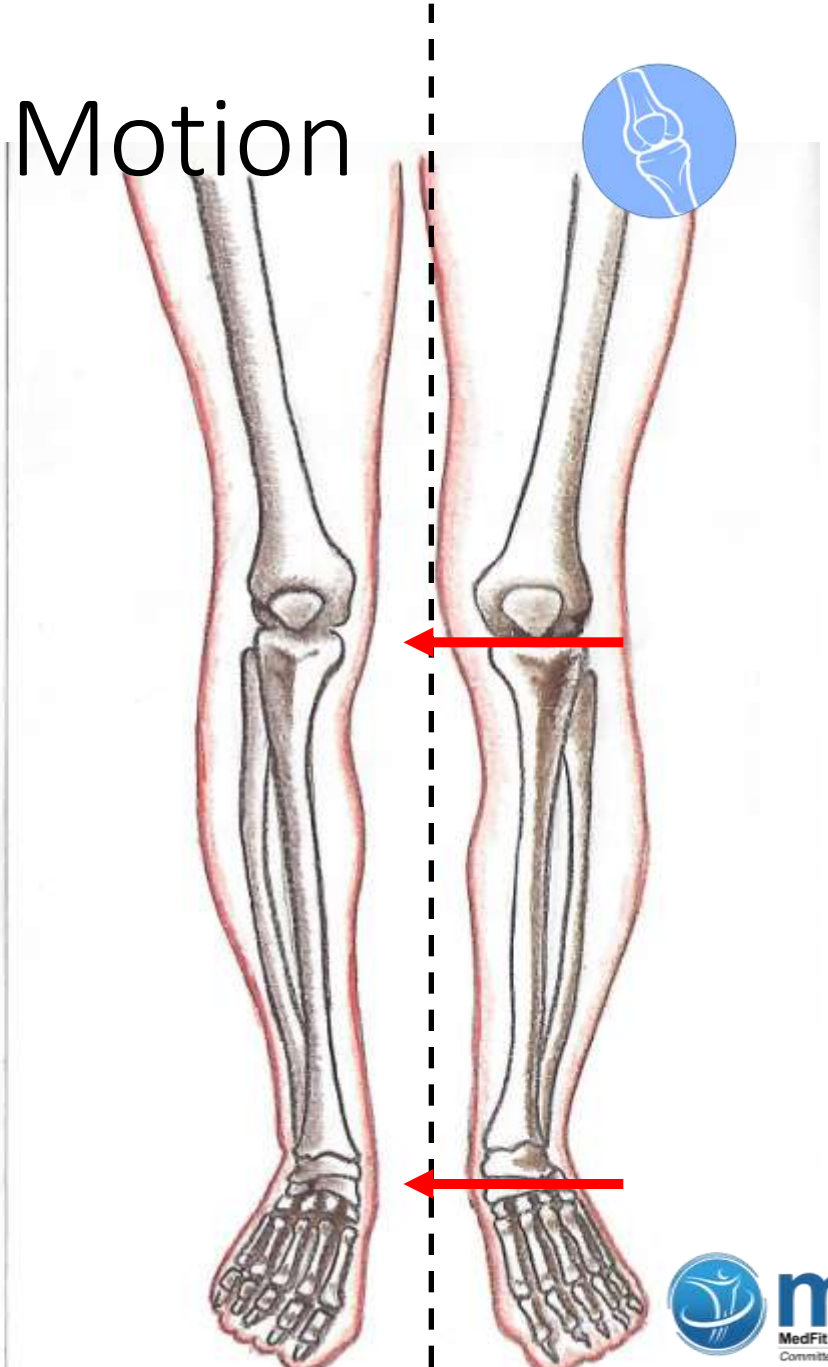


Wachowski, Martin Michael et al. "Total knee replacement with natural rollback." *Annals of anatomy = Anatomischer Anzeiger : official organ of the Anatomische Gesellschaft* 194 2 (2012): 195-9 .

Knee – Biomechanics - Tibial Motion







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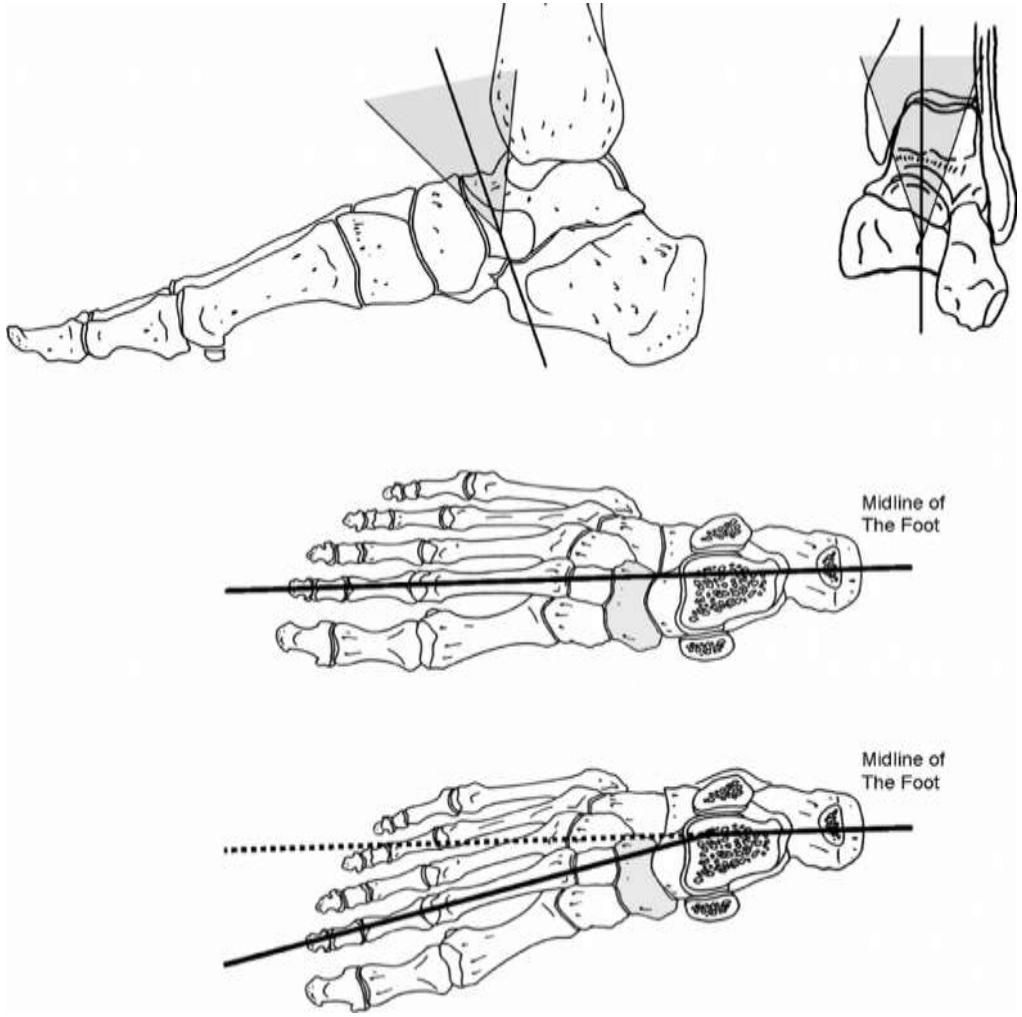
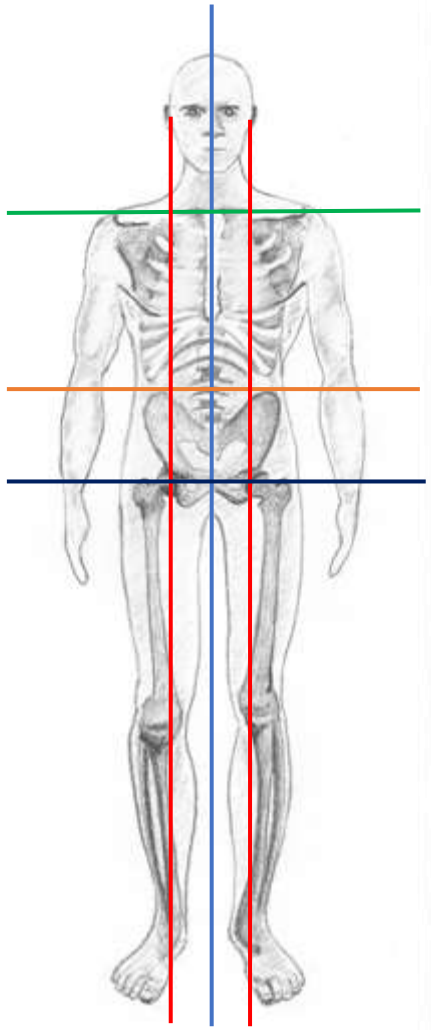
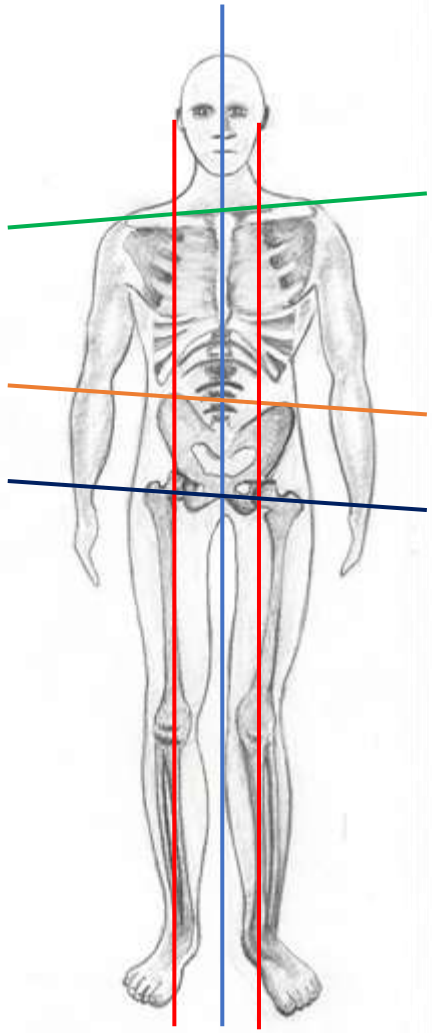
Talonavicular Joint



Greiner, Thomas. (2007). The Jargon of Pedal Movements. Foot & ankle international / American Orthopaedic Foot and Ankle Society [and] Swiss Foot and Ankle Society. 28. 109-25. 10.3113/FAI.2007.0020.

Foot & Ankle – Posture & Gait





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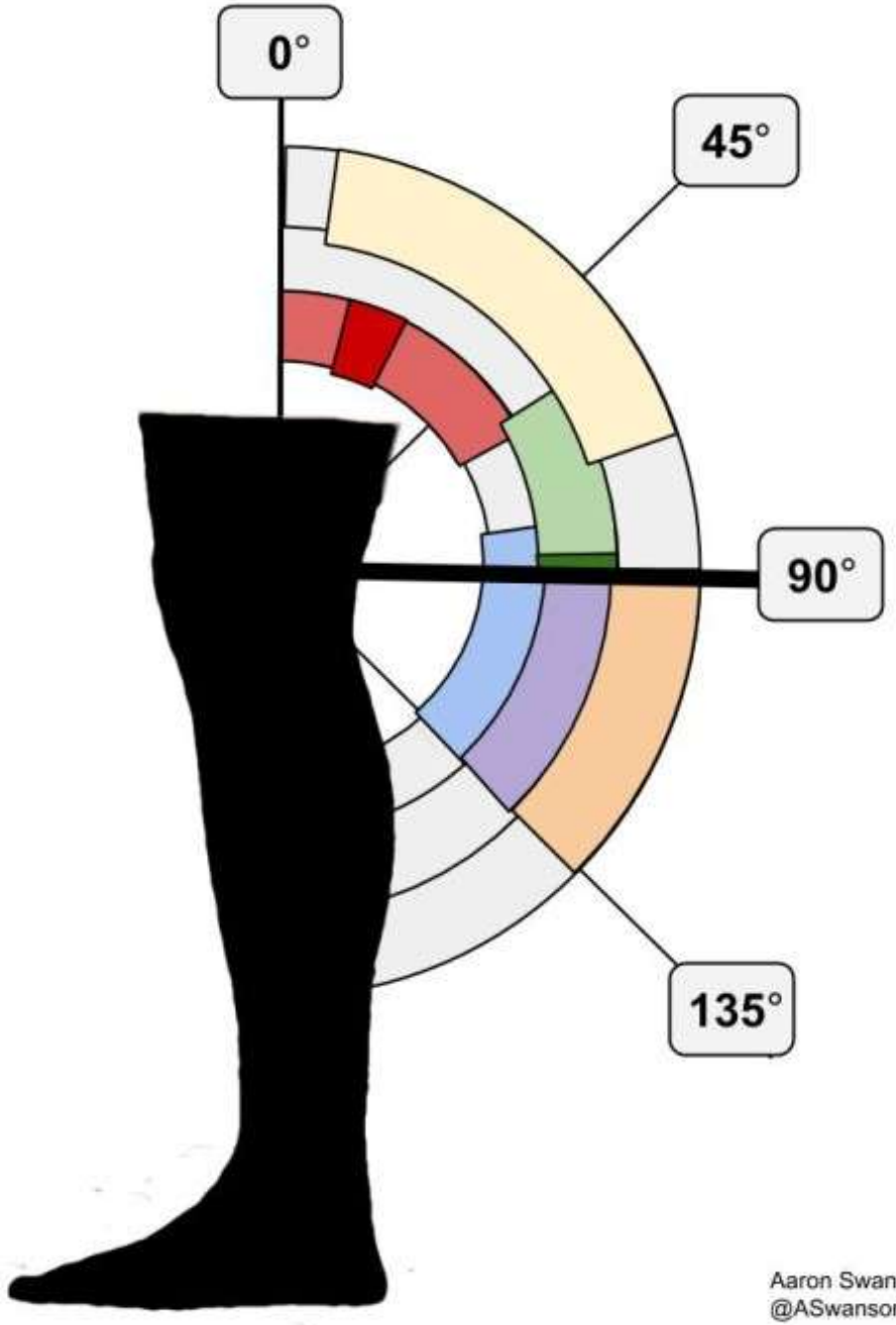
Degrees of Knee Flexion During the Deep Squat

- 0-60 = Maximum Anterior Shear Forces
- 15-30 = Peak ACL Shear Forces
- 10-70 = Maximum Hamstring EMG
- 80+ = Maximum Quadriceps EMG
- 50-90 = Maximum Posterior Shear Forces
- ~90 = Maximum PCL Shear Forces
- 90-130 = Maximum Compressive Forces
- 90+ = Maximum Glute EMG



Patellofemoral joint contact area increases with knee flexion and weight-bearing. Besier TF, Draper CE, Gold GE, Beaupré GS, Delp SL. J Orthop Res. 2005 Mar;23(2):345-50.

http://www.aaronswansonpt.com/the-deep-squat-part-1-the-good-the-bad-the-not-so-ugly/

Aaron Swanson
@ASwansonPT

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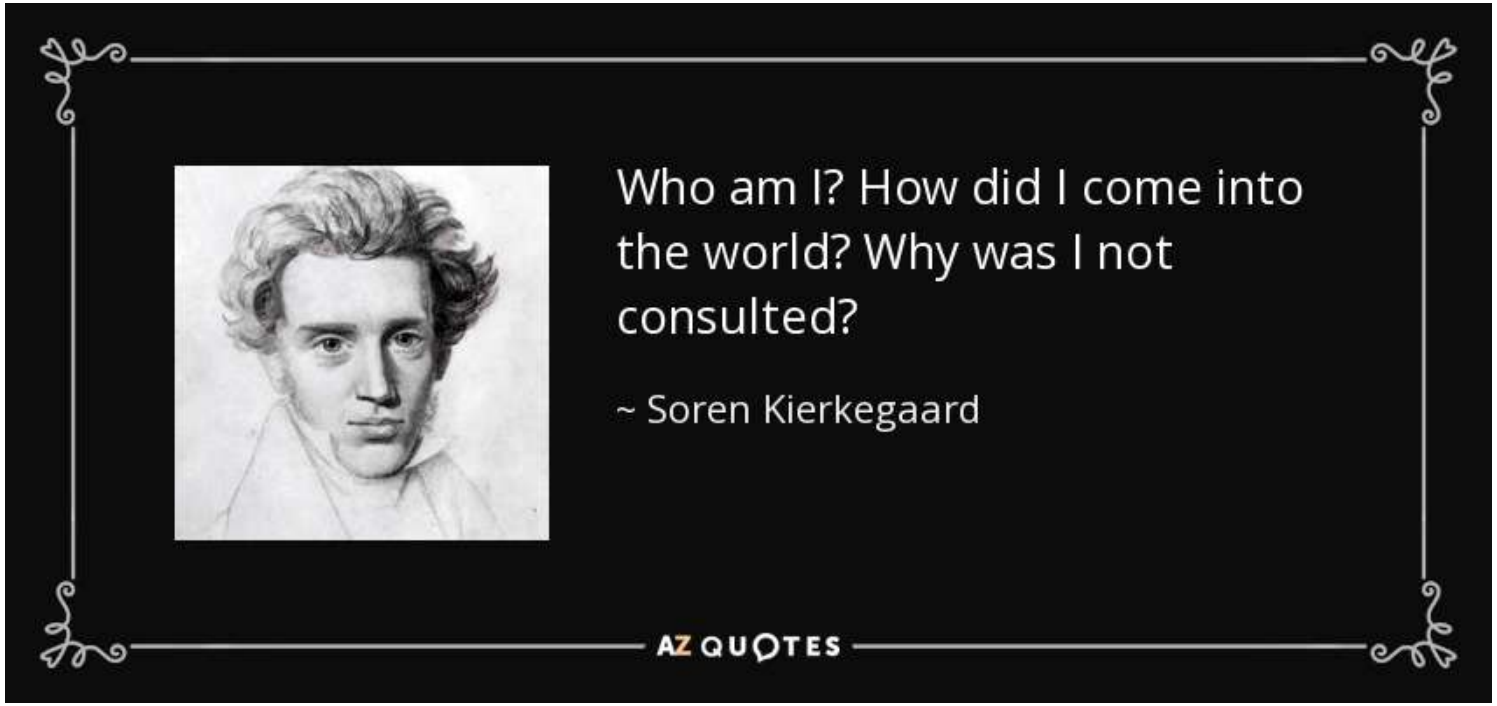
Questions?



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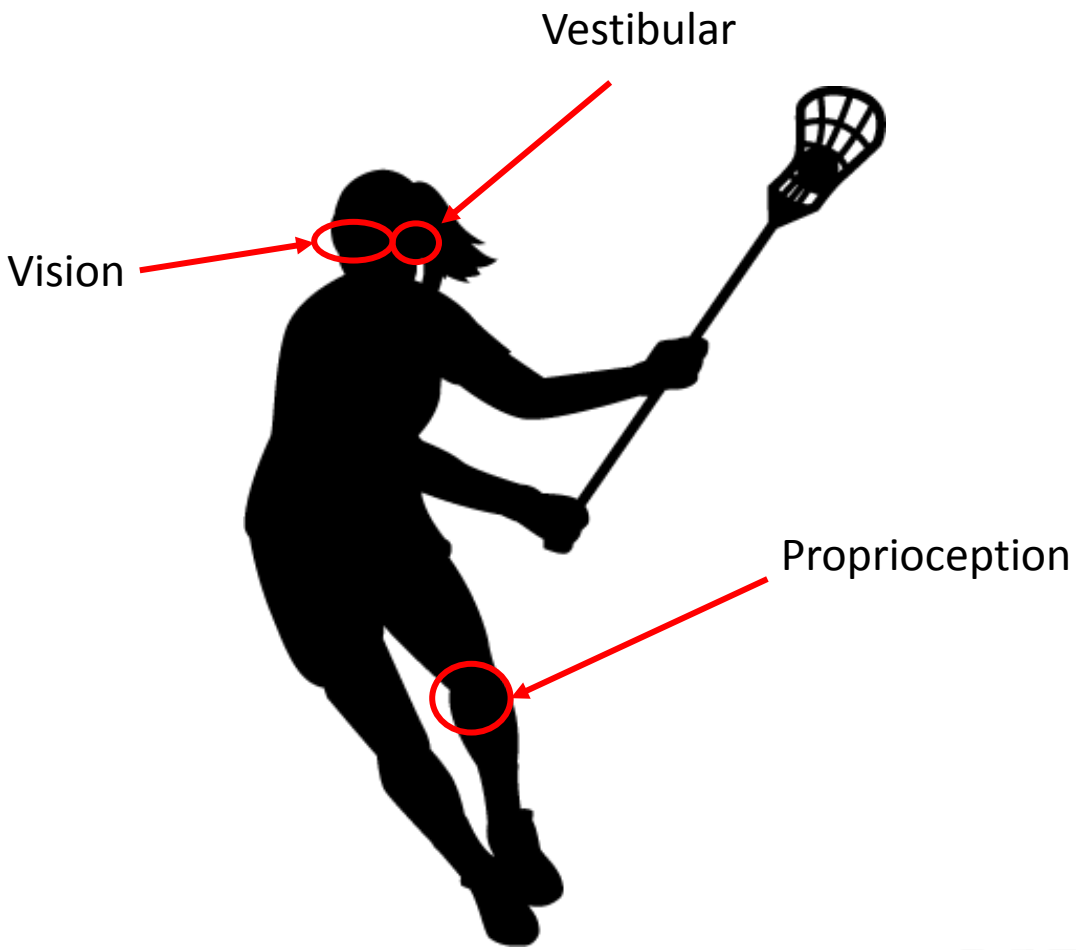
NeuroBiomechanics of the Knee

- Good balance & movement requires input from 3 systems:
  - Vision
  - Vestibular
  - Proprioception
- Your Brain is the GPS, these systems are the satellites



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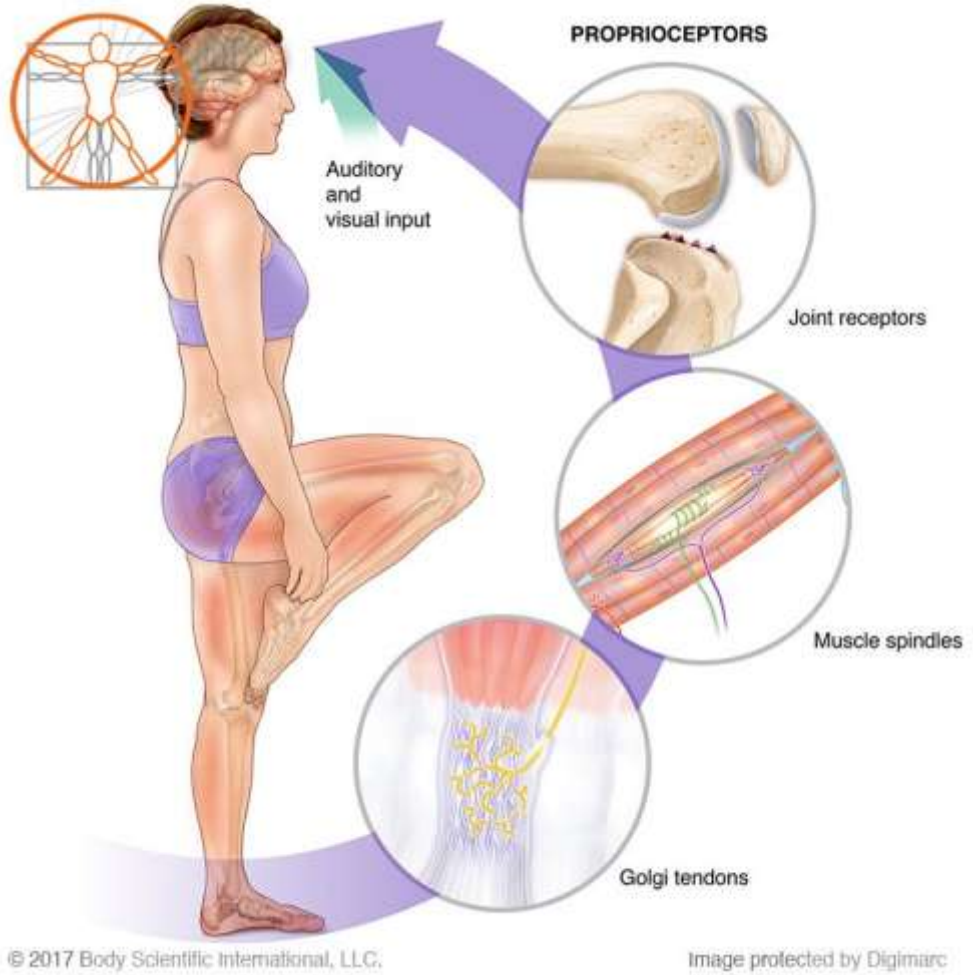
NeuroBiomechanics of the Knee

- Proprioception
  - Lives in the brain
  - Your brain's 3D map of you in time and space

- Nerve endings that provide many different type of information to the nervous system such as:
  - Mechanoreceptors (**end ROM = more input!*)
  - Chemoreceptors
  - Thermoreceptors
  - Baroreceptors
  - Electromagnetic Receptors
  - Nociceptors



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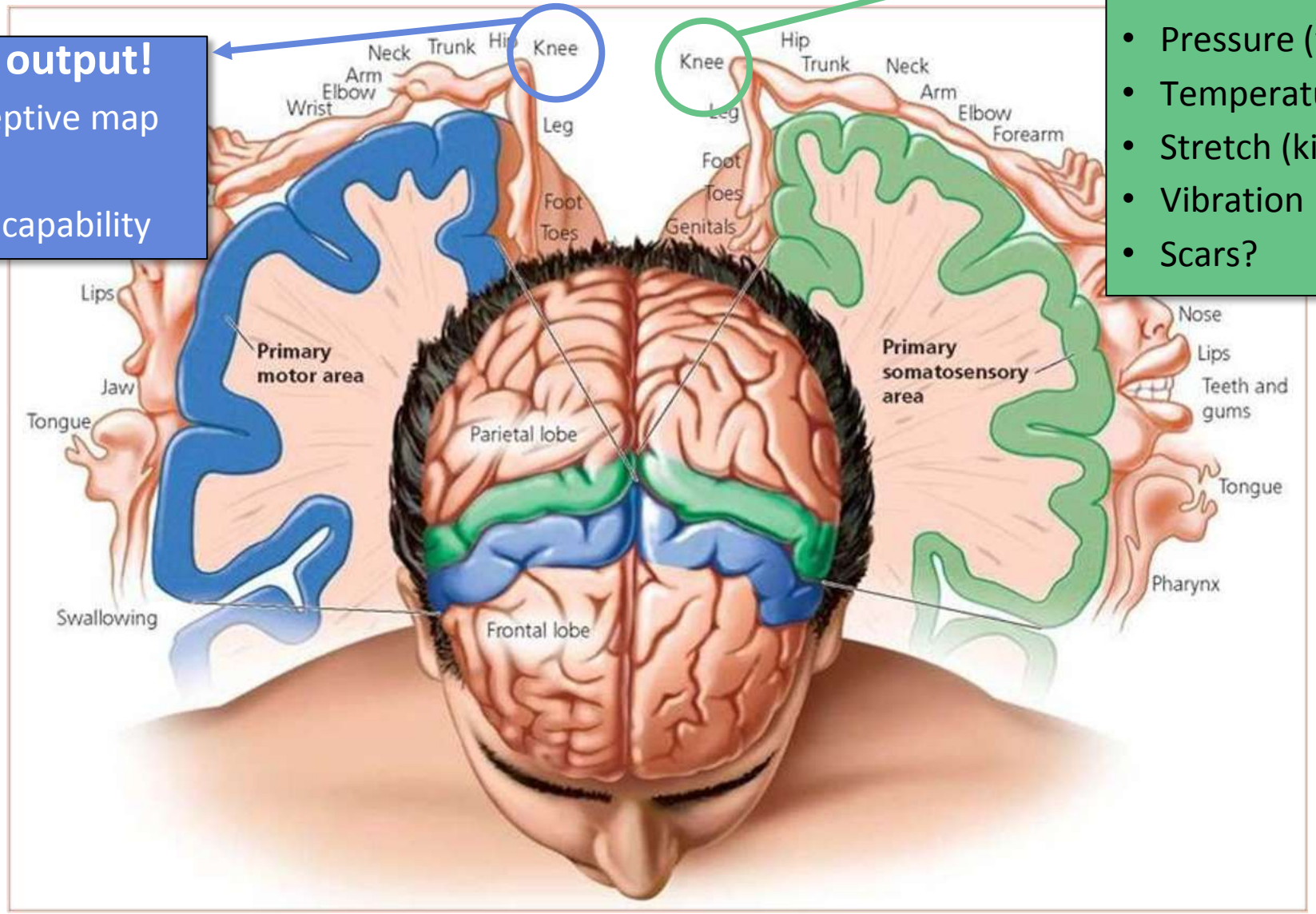
NeuroBiomechanics of the Knee

2. Better Motor output!

- Clearer proprioceptive map
- Less threat
- Better predictive capability



1. Increased sensory input:

- Skin Stimulation
- Pressure (wraps)
- Temperature (hot/cold)
- Stretch (kinesiology tape)
- Vibration
- Scars?

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NeuroBiomechanics of the Foot

- Assessments:
  - Squat or Lunge (quality/depth)
  - Active Pain-Free ROM
- Individual Joint Mobility Drills:
  - Tibial Rotations (seated)
  - Tibial Rotations (standing)
  - Knee Circles (hanging)
  - Knee Circles (front lunge)
- Tibial Nerve Glide

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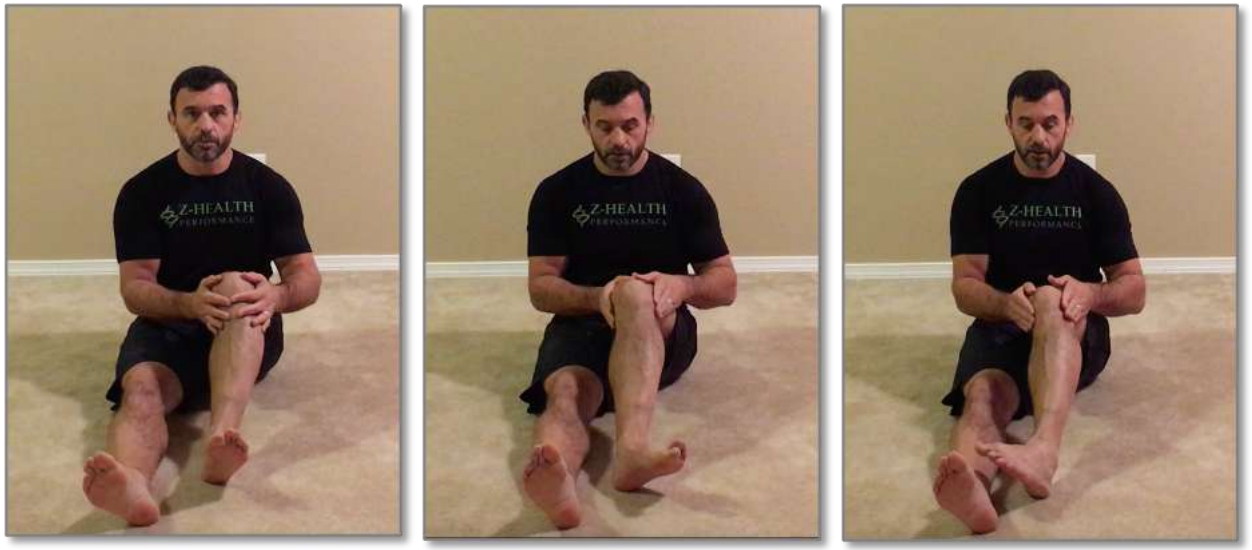
NeuroBiomechanics of the Foot

- Tibial Rotations (Seated):
  - Seated on floor or a bench
  - Heel on the ground; ankle at 90^{o}
  - Hands on sides of knee, fingers on either side of patellar tendon
  - Externally rotate the tibia (shin), by driving the action from the shin bone and pivoting on the heel
  - Then internally rotate the tibia
  - Repeat for 10-15 repetitions



- Tibial Rotations (Standing):
  - Stand in a slight forward lunge; 60% of weight on the lunging leg
  - Keep the hips neutral (no rotation)
  - Slowly rotate tibia (shin) back and forth; focus on tibia, not the knee
  - Keep the foot flat on the ground, although you should see & feel the arch rising and lowering
  - Repeat for 10-15 repetitions

NeuroBiomechanics of the Foot

- Knee Circles (Hanging):
  - Standing in neutral stance, lift working leg so hip is flexed to 90º
  - Use the hip to initiate a circular motion at the knee
  - Focus on the knee – not the foot
  - Keep the foot relaxed
  - Finish the circle by locking out the knee
  - 3-5 reps in each direction

- Knee Circles (Front Lunge):
  - From front lunge, lock the knee
  - Drop knee to inside while bending it
  - Continue circle to front over toes
  - Circle the knee to the outside as it straightens
  - 3-5 reps in each direction

NeuroBiomechanics of the Foot

Tibial Nerve Glide Tensioning:

- **Start Position:** Seated on chair or floor with working leg extended, non-working leg folded in
- **Tensioning Sequence:**
  - Ensure working leg is straight out from the hip, not going out at an angle
  - Internally rotate the working leg at the hip
  - Keep the leg straight at the knee
  - Ankle Dorsiflexion (toes toward shin)
  - Ankle Eversion (face bottom of foot outward)
  - Hinge at the hips to brings chest towards knee
  - "Slump" the upper back and neck

Tibial Nerve Flossing:

- Taking one joint in and out of the tensioned position:
  - Unlock and lock the knee, or…
  - Let the foot/ankle relax to plantar flexion or…
  - In and out of the spinal “slump”
- 6-8 reps of “flossing”

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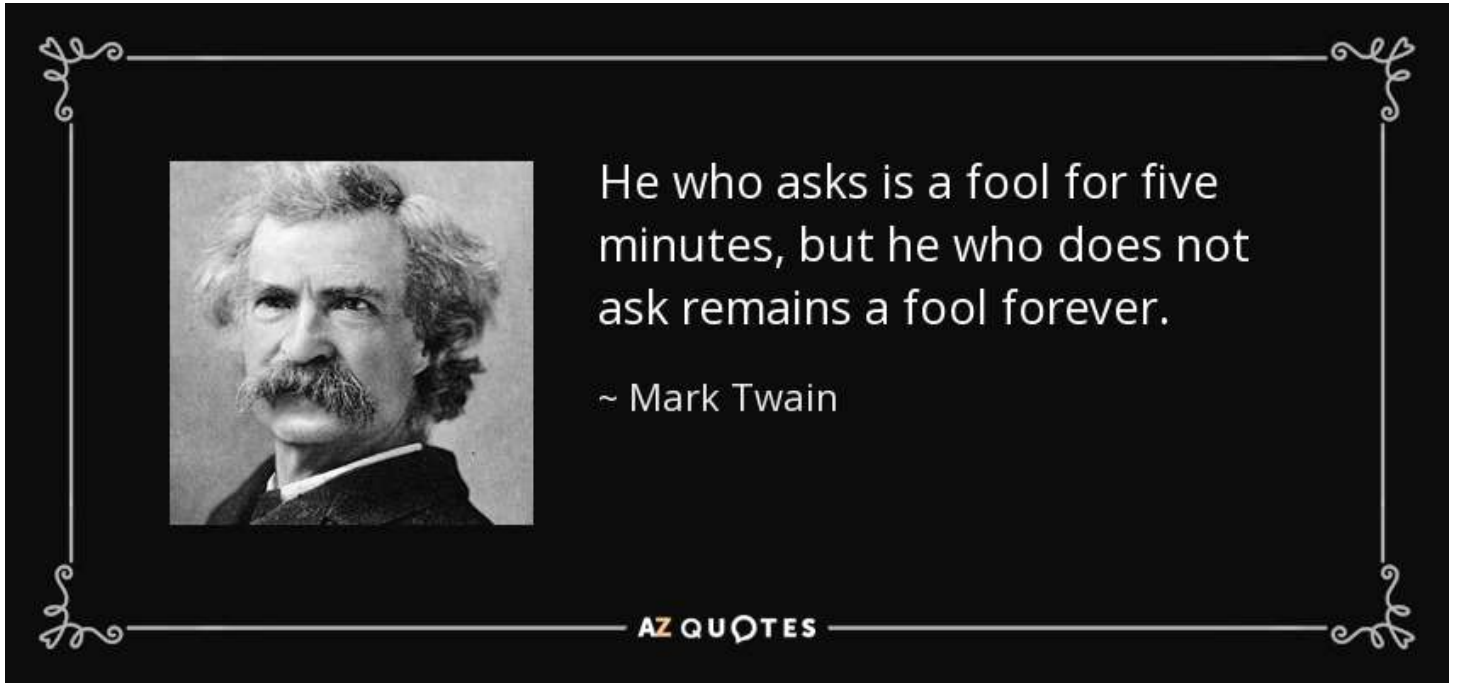

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