“The theory and practice of getting fitter and stronger”

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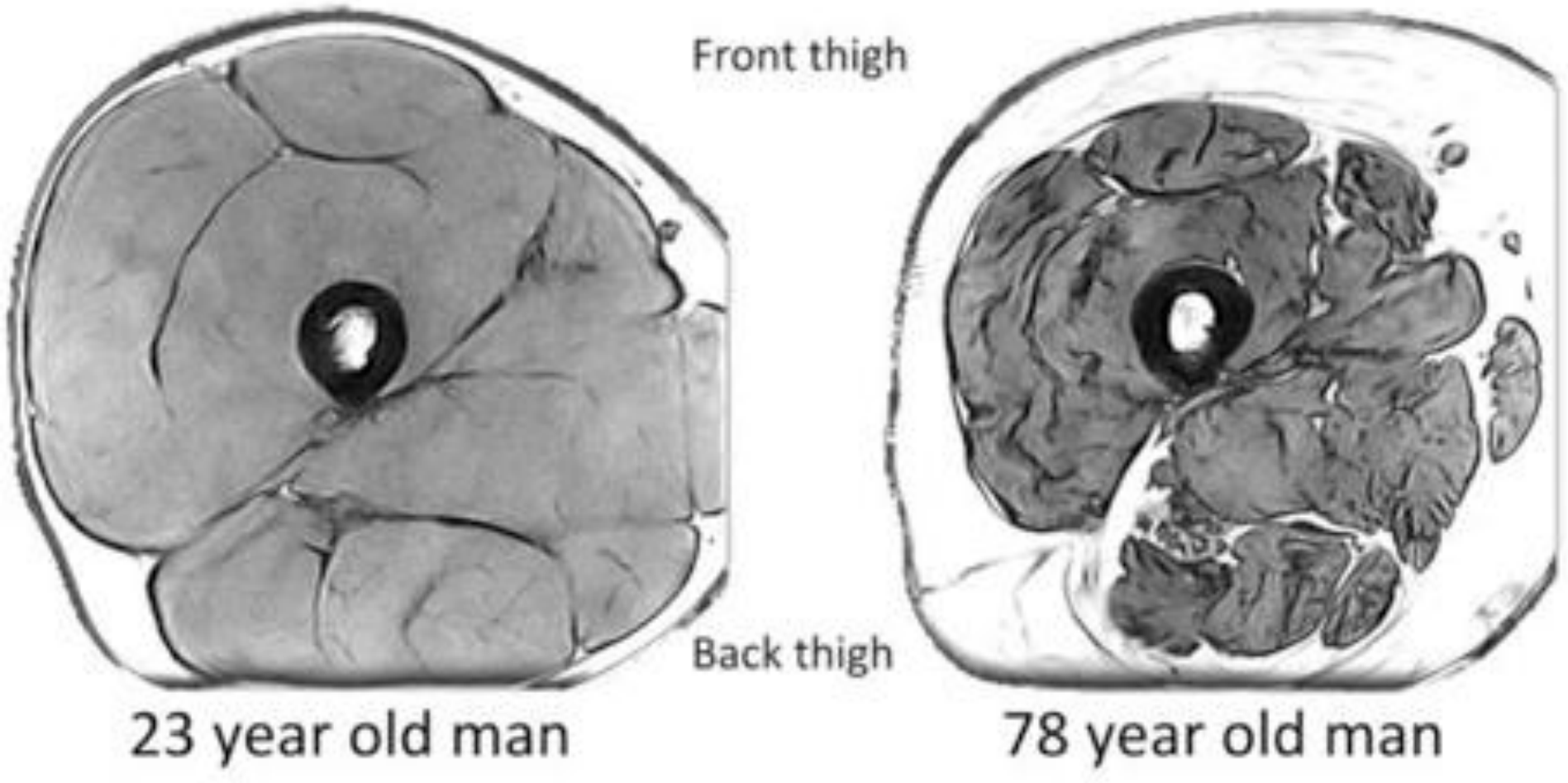
Four part series

1. **Developing aerobic (cardiovascular) fitness (March 3rd)**
2. **Developing strength and muscular endurance (March 10th)**
3. **Developing the core or back stability (March 17th)**
4. **Effective warm up and developing flexibility (March 24th)**

- All the presentations are accessible at:
- https://onlineacademiccommunity.uvic.ca/elderacademy/

Muscle wastage in older man!



What's going on?

- Prof Jamie McPhee, from Manchester Metropolitan University, said young adults usually had 60-70,000 nerves controlling movement in the legs from the lumbar spine.
- But his research showed this changed significantly in old age.
- "There was a dramatic loss of nerves controlling the muscles - a 30-60% loss - which means they waste away," he said.
- "The muscles need to receive a proper signal from the nervous system to tell them to contract, so we can move around."

- The research team from Manchester Metropolitan University worked with researchers from the University of Waterloo, Ontario, and the University of Manchester.
- They looked at muscle tissue in detail using magnetic resonance imaging (MRI) and they recorded the electrical activity passing through the muscle to estimate the numbers and the size of surviving nerves.
- The good news is that healthy muscles have a form of protection: surviving nerves can send out new branches to rescue muscles and stop them wasting away.
- *This is more likely to happen in fit people with large, healthy muscle*

The Big Three!

https://www.youtube.com/watch?v=033ogPH6NNE

- 2. Stuart McGill, Spine Biomechanist, University of Waterloo: The Big Three
- https://www.youtube.com/watch?v=033ogPH6NNE

- 3. CBC Audio on Chronic Back Pain
- http://www.cbc.ca/listen/shows/the-current/segment/13860720

Mighty Mouse!

GW50-1515 (Caradine): The Fitness Pill!

How it works?

Cardarine's Effects on Muscle Fibers

- The 2015 study by Wei Chen, PhD and his colleges has also found that dramatic increases in the PPAR gene in slow twitch muscle fibers increases oxygen usage and greatly increases endurance. The enhanced endurance was seen in lab mice with a normal oxygen supply and those with oxygen restrictions which provided significant evidence that ***GW501516 targets and enhances skeletal muscle endurance and recovery time to a supraphysiological level***.
- These rats had even lost weight while maintaining a high fat diet, suggesting it could potentially prevent obesity and help manage weight regardless of diet or lifestyle.

- https://itunes.apple.com/ca/podcast/the-current-from-cbc-radio-highlights/id151487761?mt=2#episodeGuid=current-ab1be501-8ae3-4c44-b428-9f5b2e25015c

Four part series

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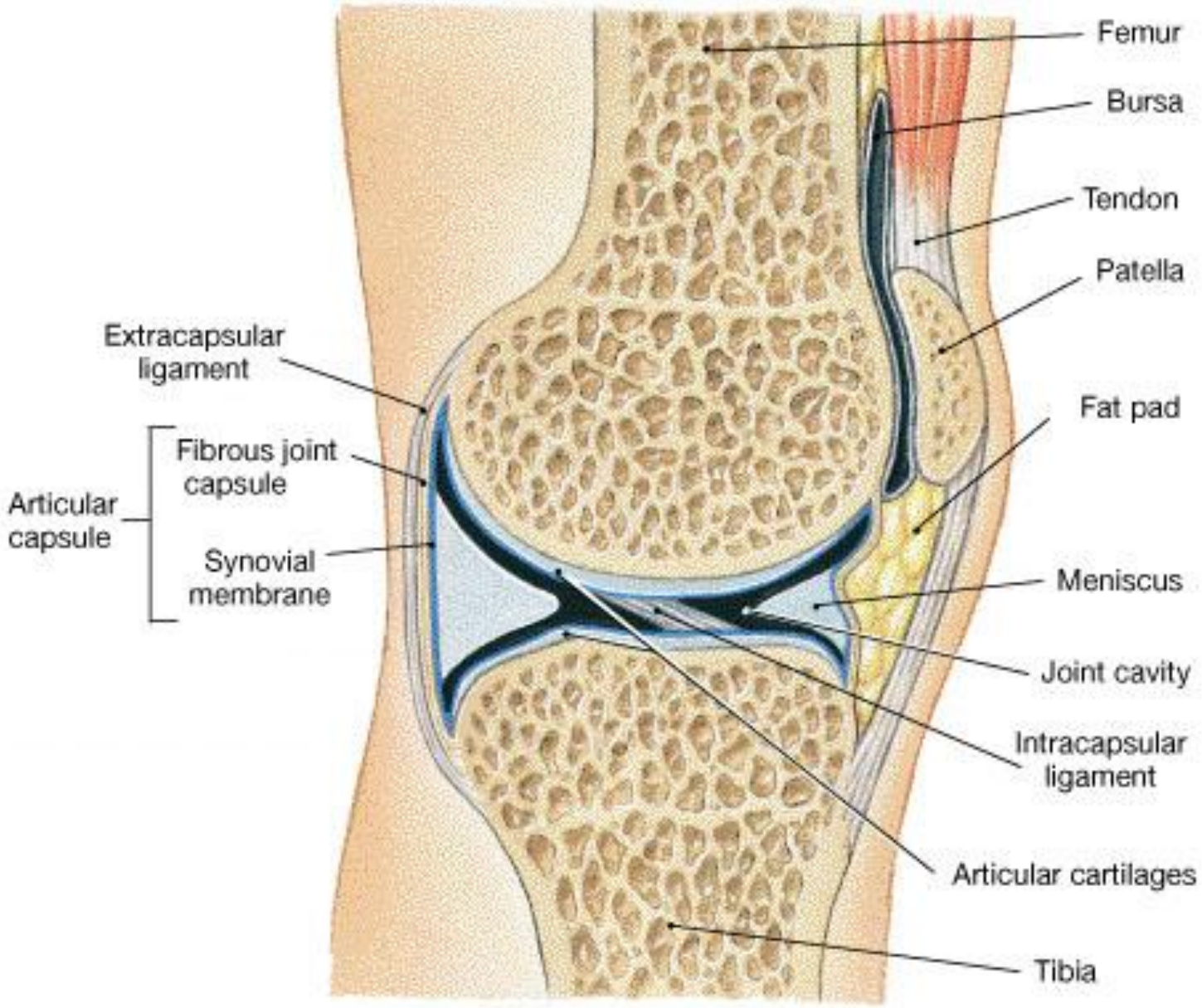
Outline of session

- Role of warm up
  -increase muscle temperature
  -stimulate release of synovial fluid
  -activate motor neurons (neural activation)
- Stretching to increase flexibility
  -static stretching
  -PNF (proprioceptive neuromuscular facilitation)
- Other approaches and considerations
  -Foam rollers
  -Muscle pump!
  -DOMS!

Joints!

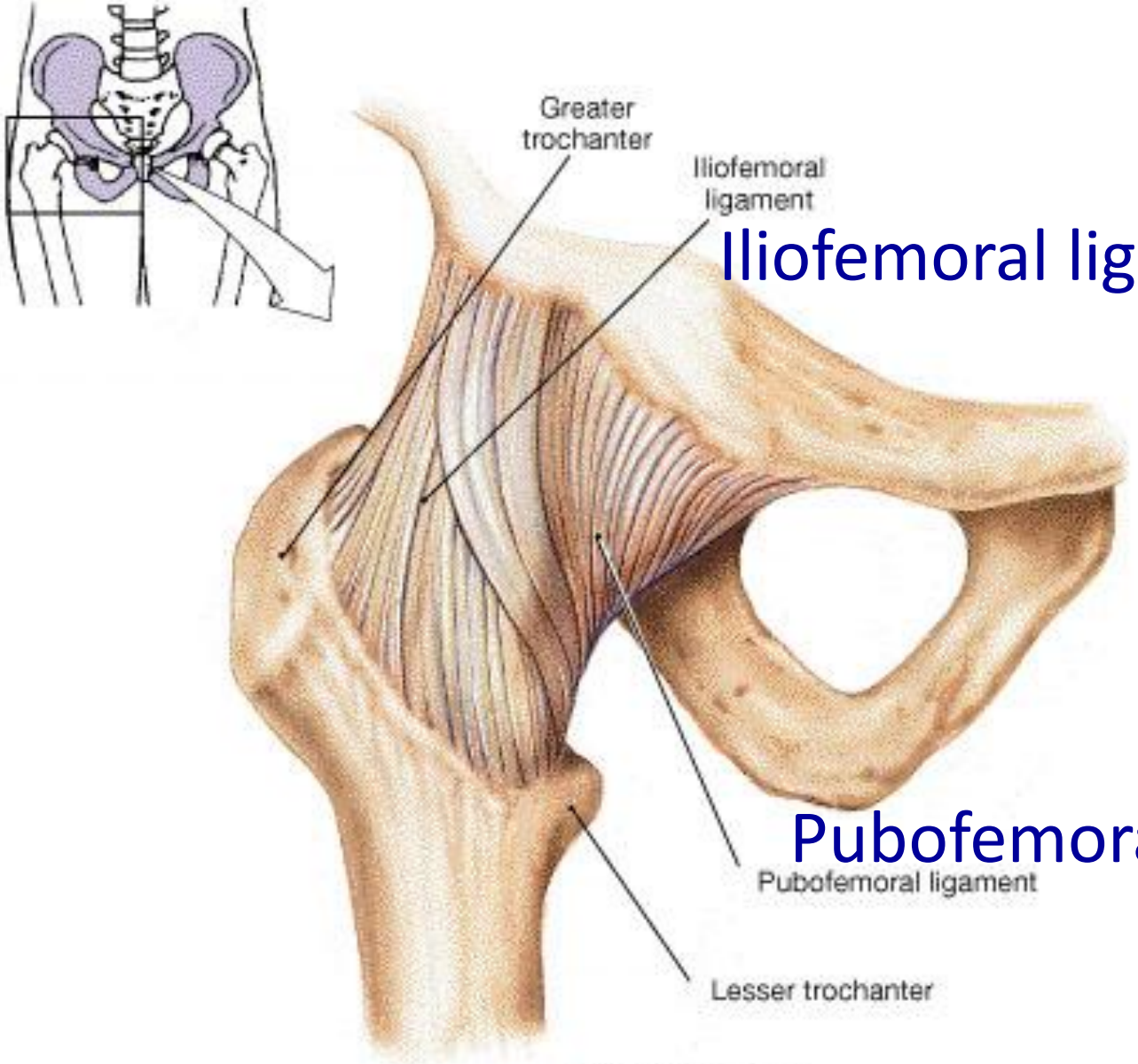
"I still think I'd like a second opinion."

Synovial joint



(b) Knee joint, sagittal section

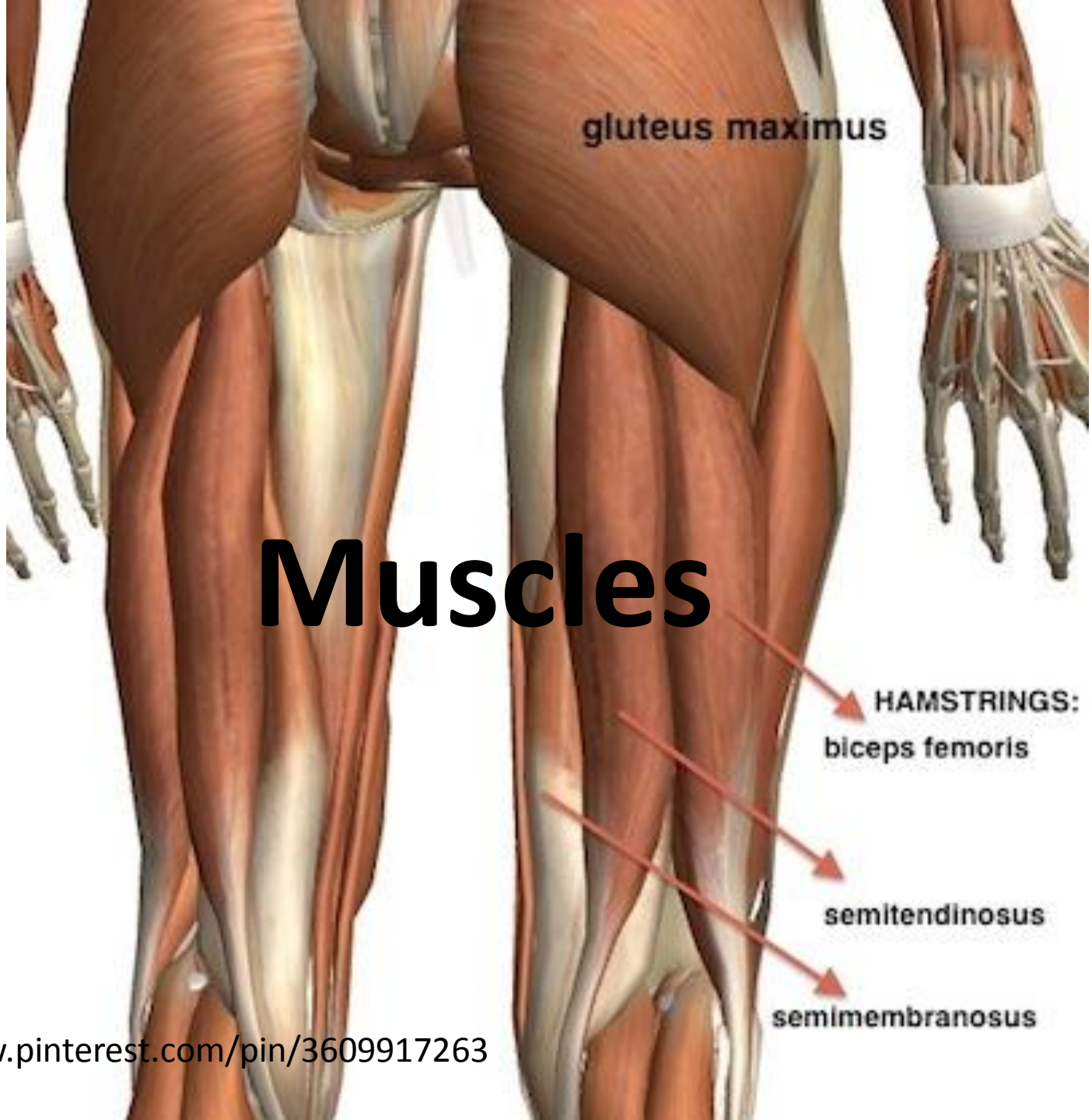
Ligaments



Iliofemoral ligament

Pubofemoral lig.

Muscles



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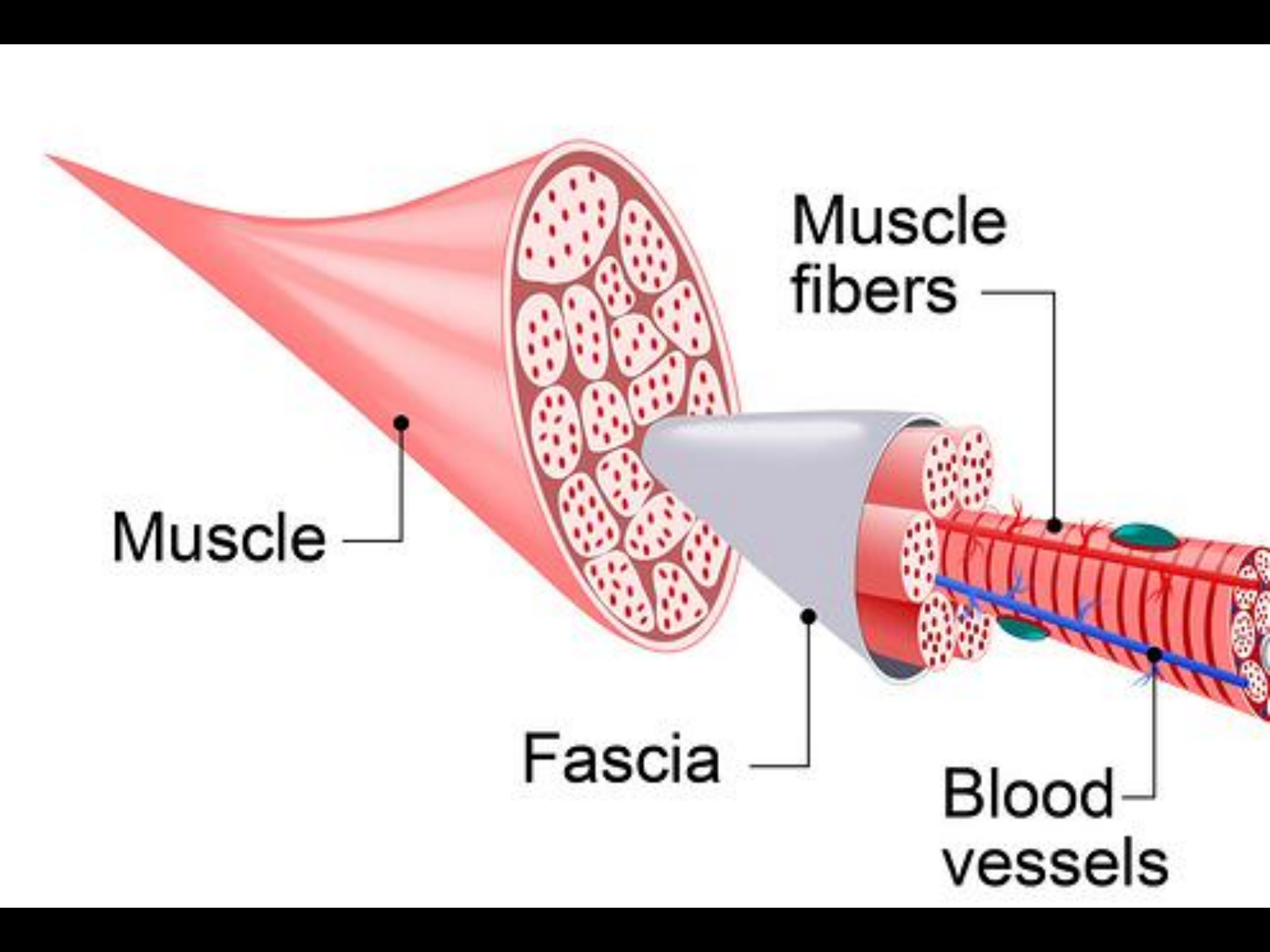
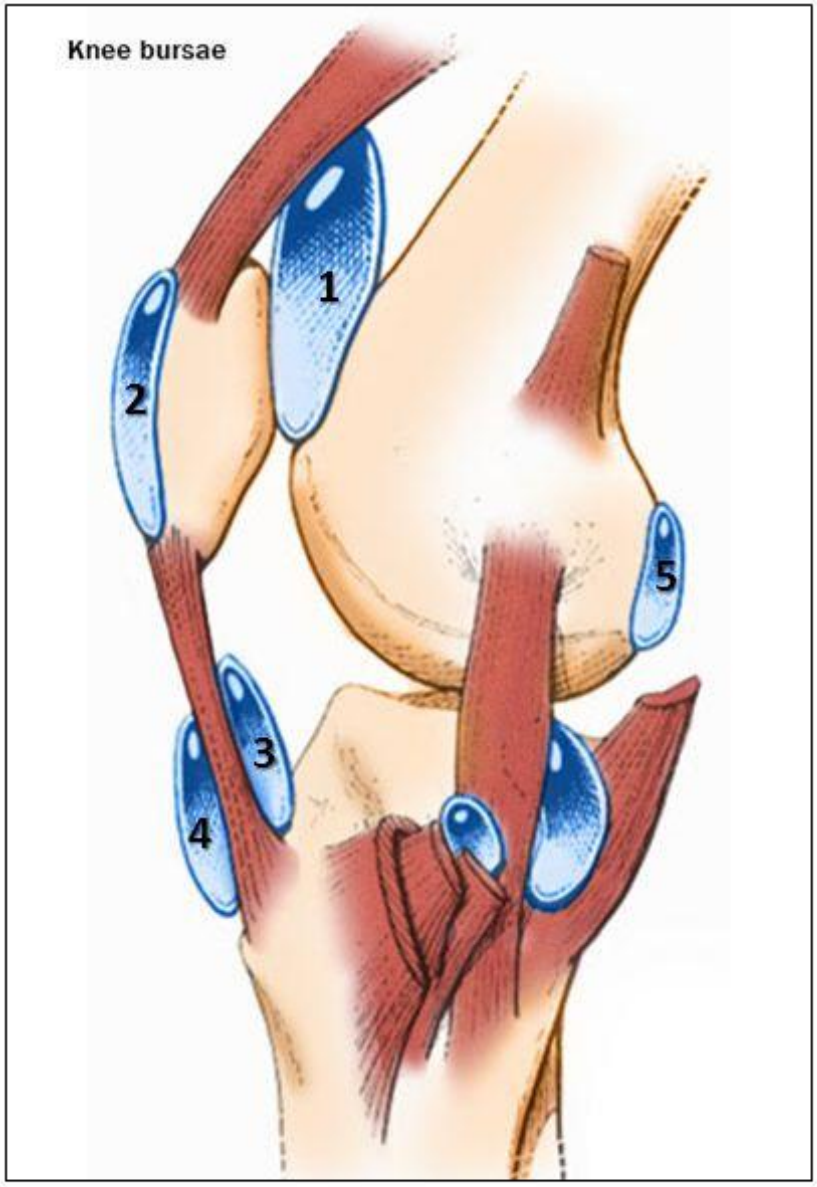

Muscle fibers
Muscle
Fascia
Blood vessels

Bursae Related to Knee

1. **Suprapatellar bursa:** between femur & quadriceps tendon, communicates with synovial membrane of knee joint
2. **Prepatellar bursa:** between patella & skin.
3. **Deep infrapatellar bursa:** between tibia & ligamentum patella.
4. **Subcutaneous infrapatellar bursa:** between tibial tuberosity & skin.
5. **Popliteal bursa:** between popliteus tendon & capsule, communicates with synovial membrane of knee joint.



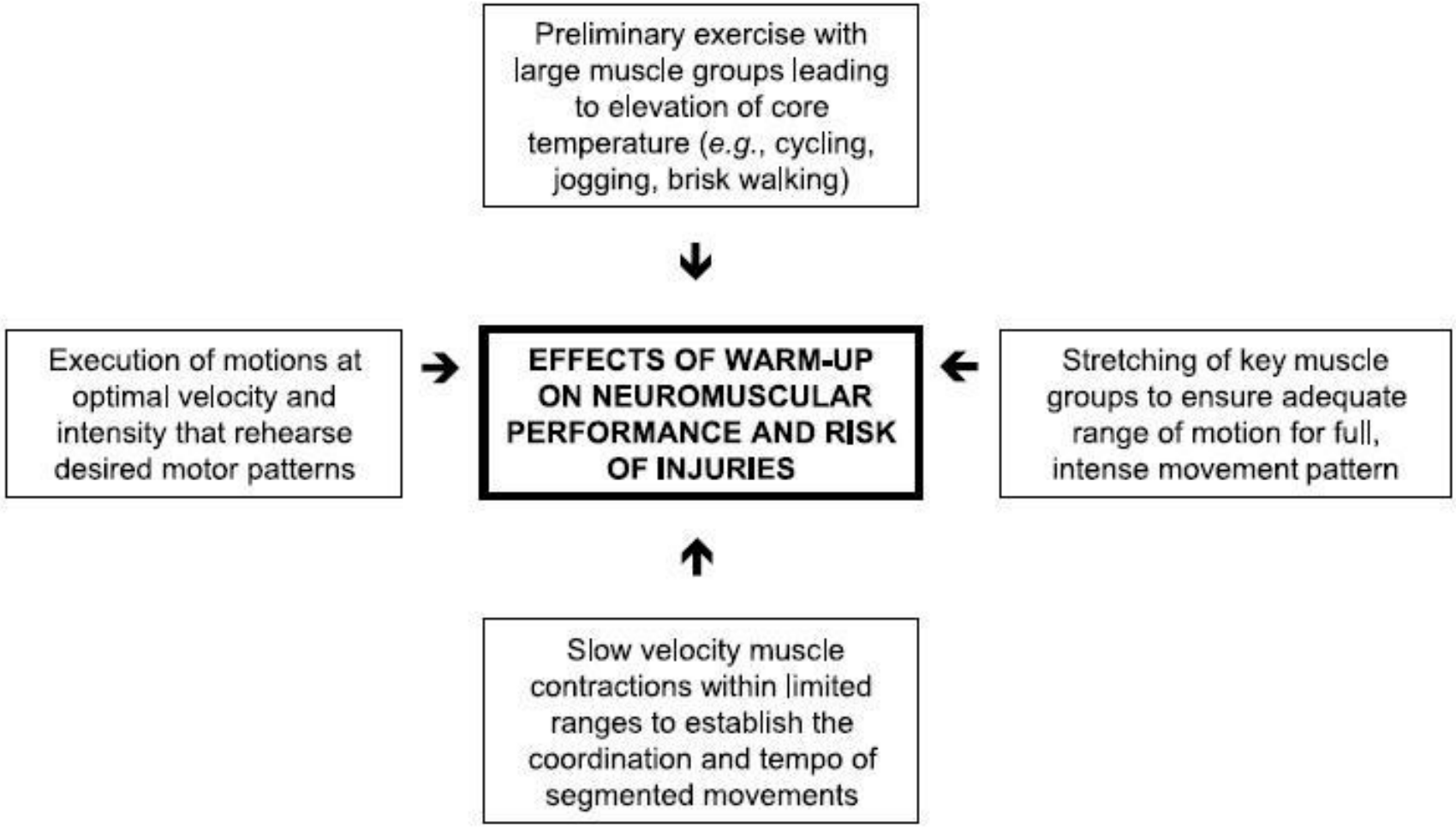
From Wilderman Physiotherapy, LLC.

Warm up v Stretching

- Most exercise scientists and trainers distinguish between warm up and stretching
- Warm up prepares the body for physical activity
- Stretching is generally used to increase flexibility or range of motion (ROM) and help in recovery

Effects of warm up

- Increase blood flow to muscle
- Increase muscle temperature (as well as connective tissue)
- Activate neural pathways (increase nerve conduction-faster muscle contraction and relaxation)
- Improve release of O2
- Increases muscle metabolism
- *Improved muscle performance and....*
- *Reduced risk of injury*



(Source: Vandervoort AA. Potential benefits of warm-up for neuromuscular performance of older adults. Exerc Sport Sci Rev 2009;37:60-65.)

Warm up with large motor activities

Don’t over do it!

Dynamic Stretching

http://www.seniorexercisesonline.com/warm-up.html

https://yurielkaim.com/stretching-exercises-seniors/

Causes for loss of flexibility with age

- Loss of muscle strength!
- Thinning of bone
- Loss of articular cartilage (pain): arthritis!
- Tightening of connective tissues (tendons, ligaments, myofascial sheaths): myofascial restrictions?

- Reduction in water content in tendons

Increasing flexibility

- Passive and active components of stretching.
- Types of stretching exercises
  - Static stretching
  - PNF (proprioceptive neuromuscular facilitation
    - CR (contract-relax)
    - CRAC (contract-relax-agonist contract)

Examples of Static Stretching

Calves

Hamstring

Trapezius

Biceps

Quadriceps

groin

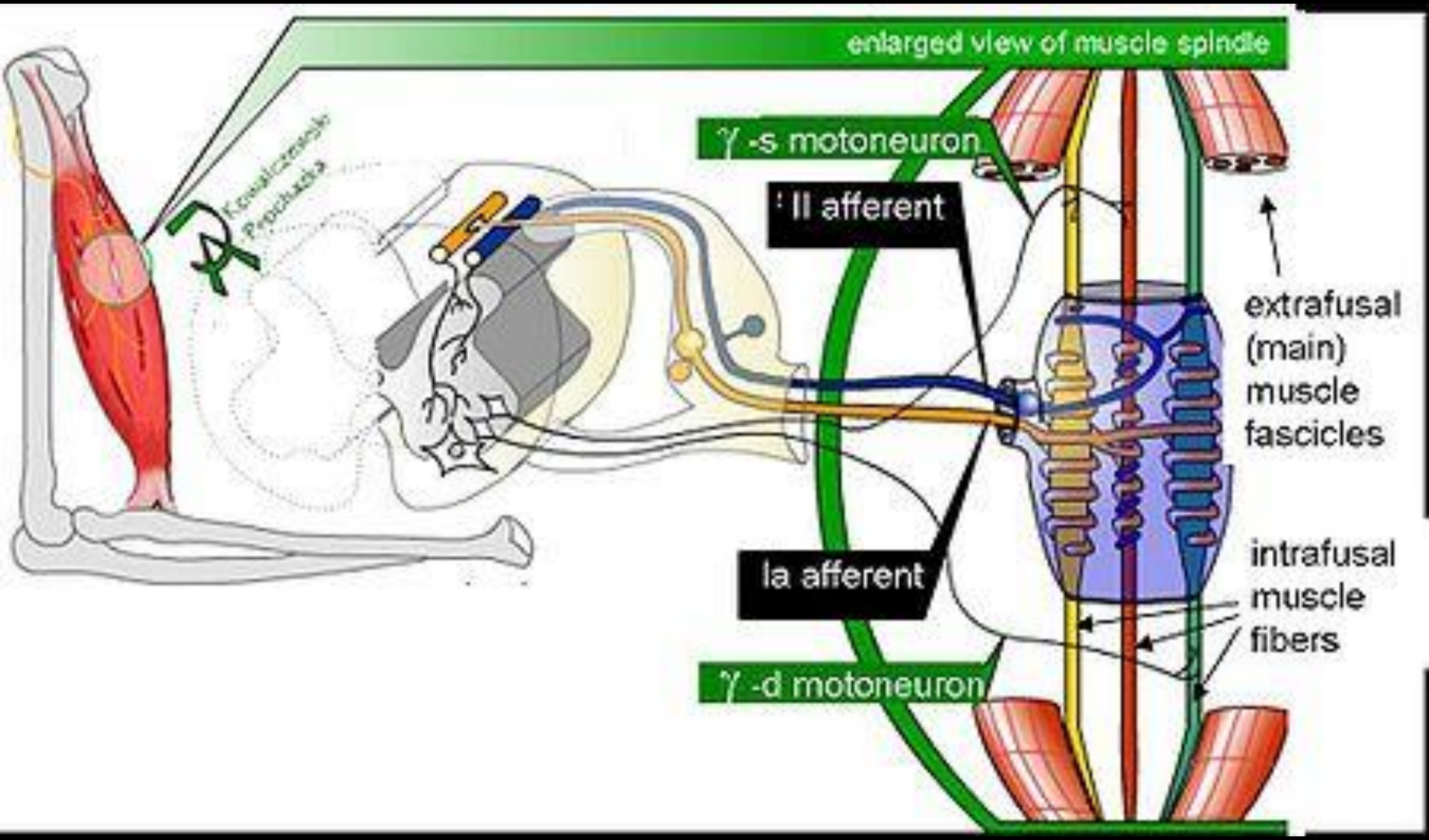
Triceps

Stretching

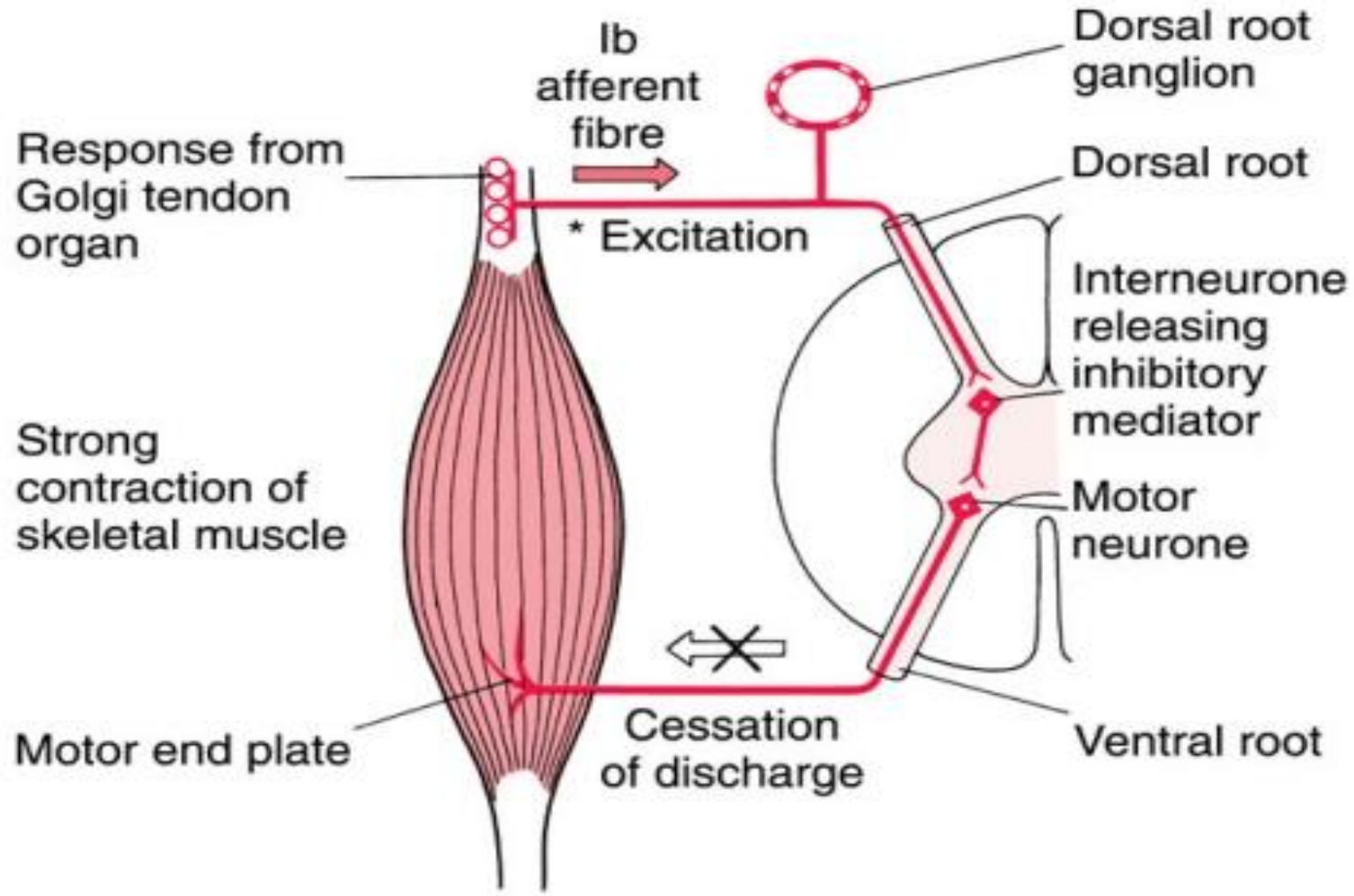
- As you stretch a muscle it triggers the muscle spindle
- The muscle spindle causes the muscle to contract (restrict lengthening)
- Need to contract and stimulate the GTO which relaxes the muscle spindle
- Reciprocal inhibition
- Viscoelestic properties of muscles and tendons-stress relaxation

https://www.youtube.com/watch?v=6h8aZ_MsLY8
https://www.youtube.com/watch?v=BJl5uPhWM6U

The muscle spindle



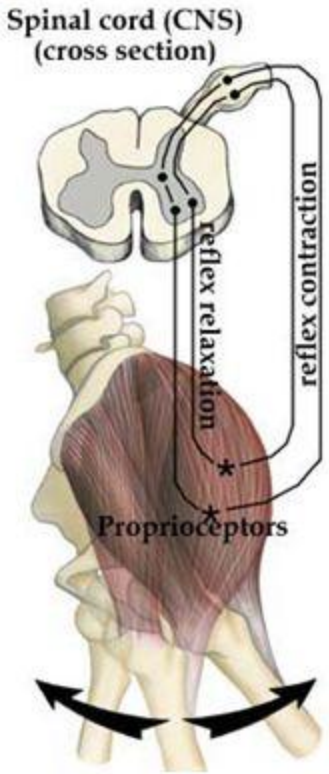
Golgi Tendon Organ (GTO)



https://arunpathak.wordpress.com/2011/12/03/the-physiology-and-application-of-muscle-energy-techniques/

PNF Stretching

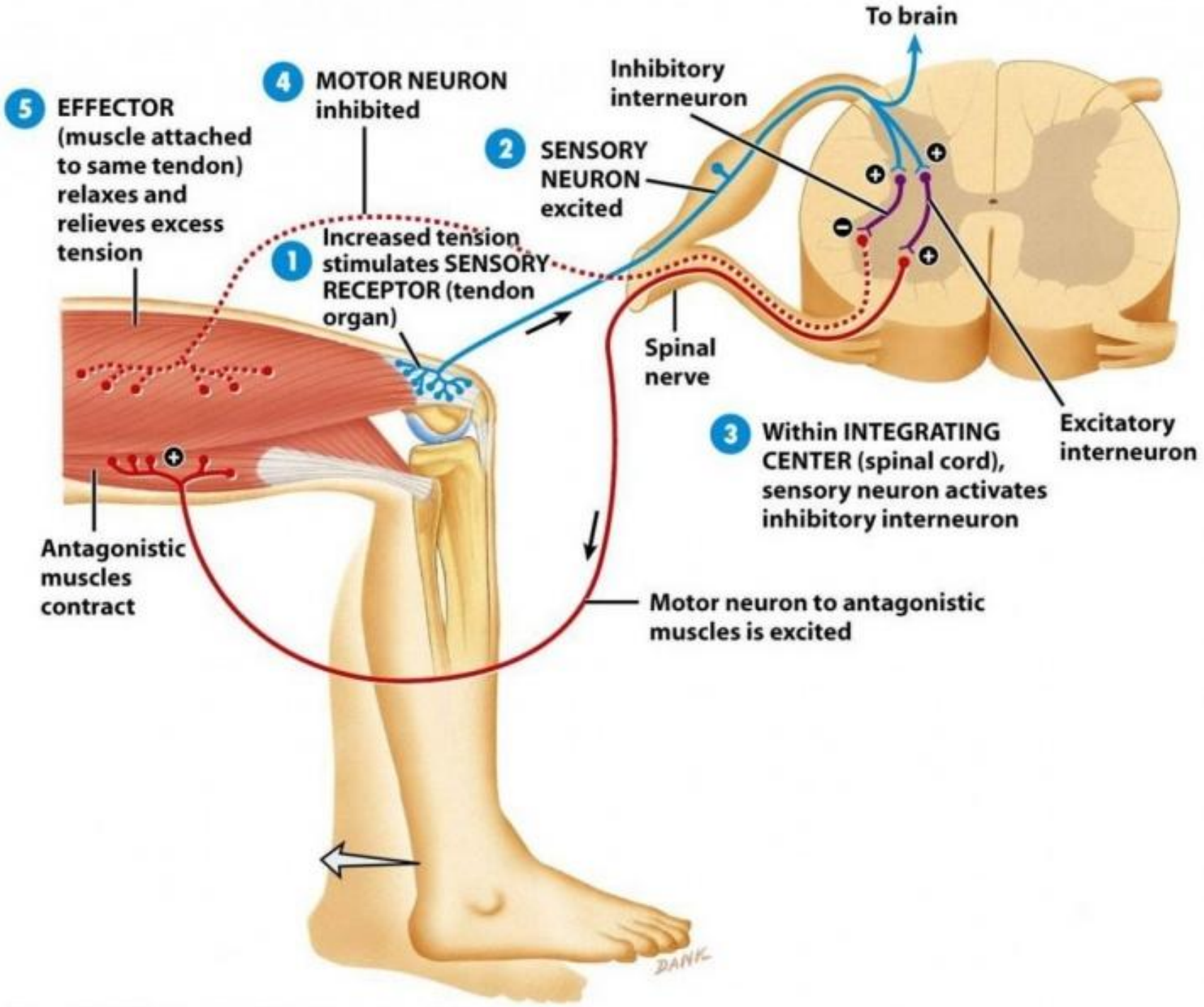
Proprioceptive Neuromuscular Facilitation



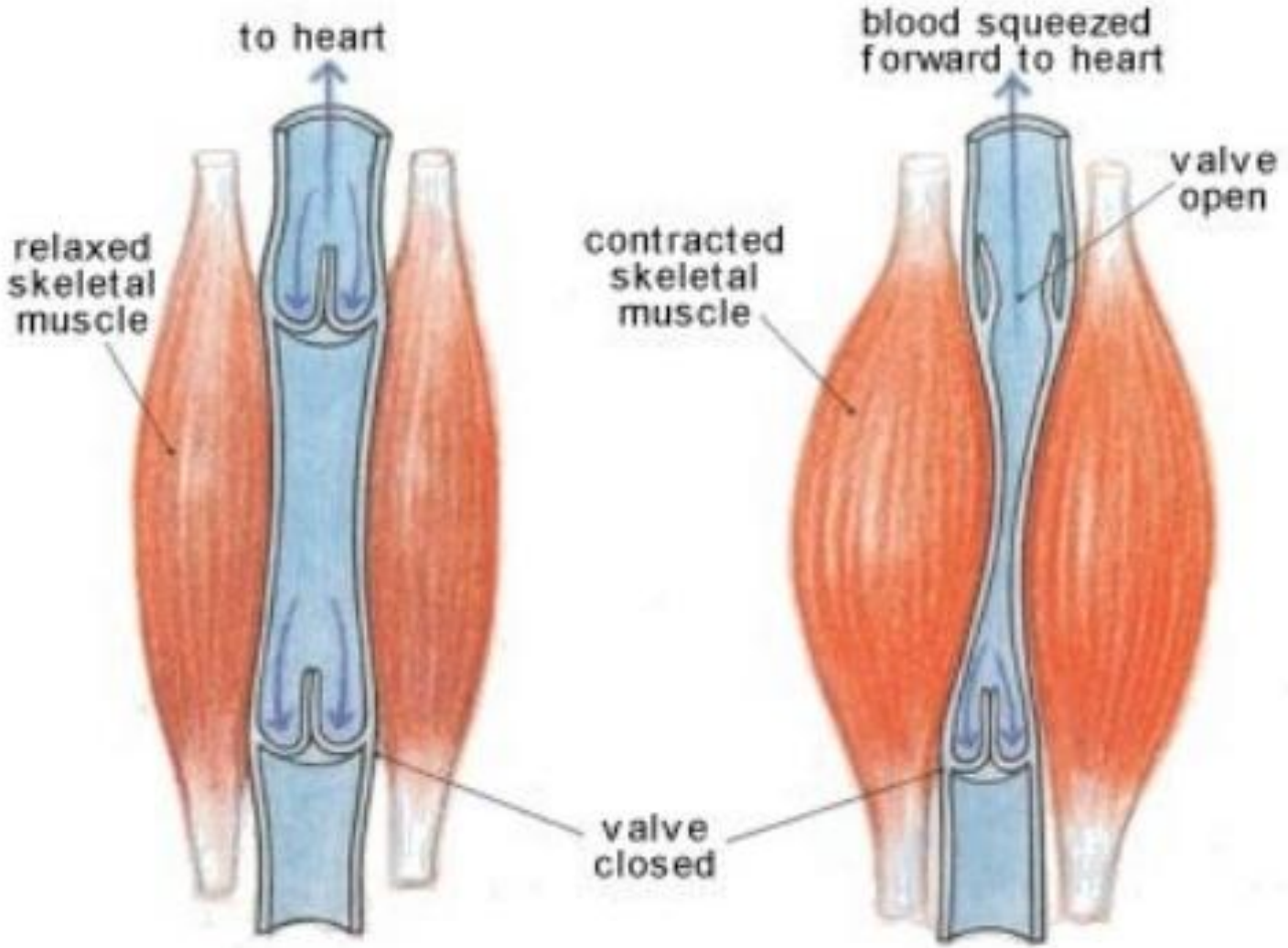
- **PNF** allows the muscle to be stretched to a greater degree by increasing the proprioceptor signals through a 5- to 10-second voluntary muscle contraction followed by a 5- to 10-second voluntary muscle relaxation. With the hold-relax PNF method, the muscle is placed into a static stretch. The athlete is instructed to "hold" and contract the muscle against resistance from a partner for 10 seconds. The athlete is then instructed to "relax," and the partner slowly moves the muscle to a new static position. The technique is repeated two to three times.

Types of PNF Stretches

- **Contract-relax (CR):** Client isometrically contracts target muscle group; follows immediately with slow, passive stretching of target muscle group.
- **Contract-relax agonist contract (CRAC):** Initially identical to CR except that client assists CRAC stretching phase by actively contracting opposing muscle group; improves ROM more effectively.


To brain
Inhibitory interneuron
4 MOTOR NEURON inhibited
5 EFFECTOR (muscle attached to same tendon) relaxes and relieves excess tension
2 SENSORY NEURON excited
1 Increased tension stimulates SENSORY RECEPTOR (tendon organ)
Spinal nerve
3 Within INTEGRATING CENTER (spinal cord), sensory neuron activates inhibitory interneuron
Excitatory interneuron
Antagonistic muscles contract
Motor neuron to antagonistic muscles is excited

Muscle Pump


to heart
relaxed skeletal muscle
valve closed
blood squeezed forward to heart
valve open
contracted skeletal muscle

Delayed onset of muscle soreness (DOMS)

- Pain and stiffness felt in muscles several hours to days after unaccustomed or strenuous exercise (eccentric)
- The soreness is felt most strongly 24 to 72 hours after the exercise. It is thought to be caused by eccentric (lengthening) exercise, which causes small-scale damage (microtrauma) to the muscle fibres.

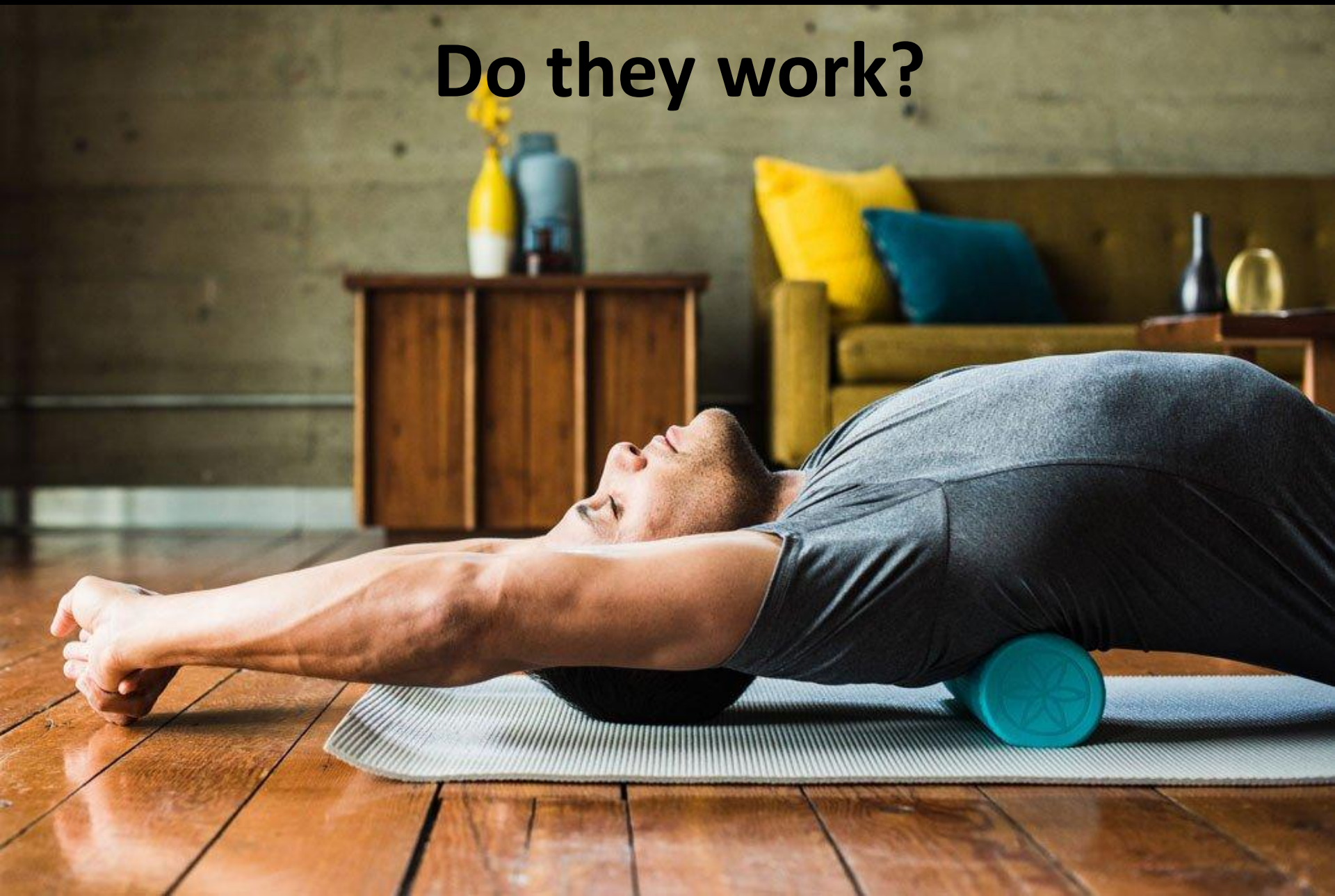
Causes?

- Not fully understood but……
- Maybe muscle damage (disruption of “Z” lines and actin and myosin) causing tension and stiffness in the muscle
- Accumulation of calcium in the muscle causes inflammation.

Foam Rollers

Roller massagers

Do they work?



David G. Behm PhD,

University Research Professor,School of Human Kinetics and Recreation
Memorial University of Newfoundland

- Roller massagers would probably be better for an older population since they would not have to get down and up off the floor.
- Increases range of motion (ROM) with as little as 5-10 seconds of rolling but 30-60 seconds would be better.
- Some studies show the increase in ROM with rollers to be similar to static stretching but more studies show slightly better results with stretching.
- Two studies show an additive effect on ROM with rolling and stretching, one study did not (ours: Hodgson et al.).

- Grabow et al. another of our studies showed that the intensity of rolling did not matter. So, whether you rolled at 50, 70 or 90% of pain tolerance you got the same increase in ROM. Thus no need to kill yourself or put yourself in dire pain.
- Prolonged static stretching by itself (no full warm-up) tends to lead to subsequent performance impairments but rolling does not.
- Rolling can decrease acute and chronic pain including DOMS. This occurs whether you roll the affected leg and or even roll the contralateral leg (two studies from our lab). So, pain reduction is a global pain modulatory effect not a local myofascial release. In fact, self-myofascial release technique is a misnomer since it really does not release trigger points. It seems to be a mainly neural effect.
- The effects seem to be acute in nature as our training study did not show any chronic changes in ROM or performance.

Personal correspondence, March 2018


Questions?