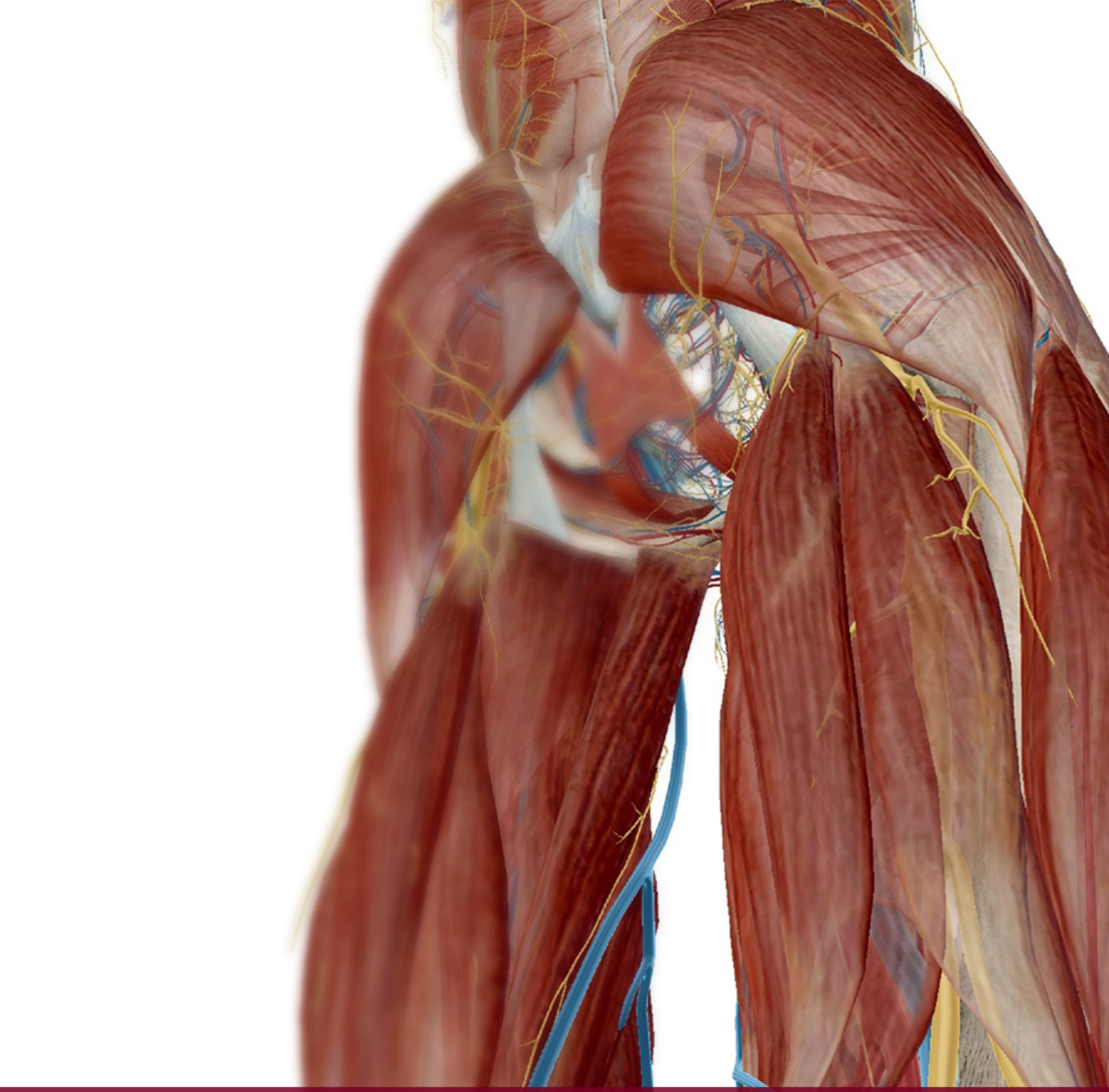


VISIBLE BODY®

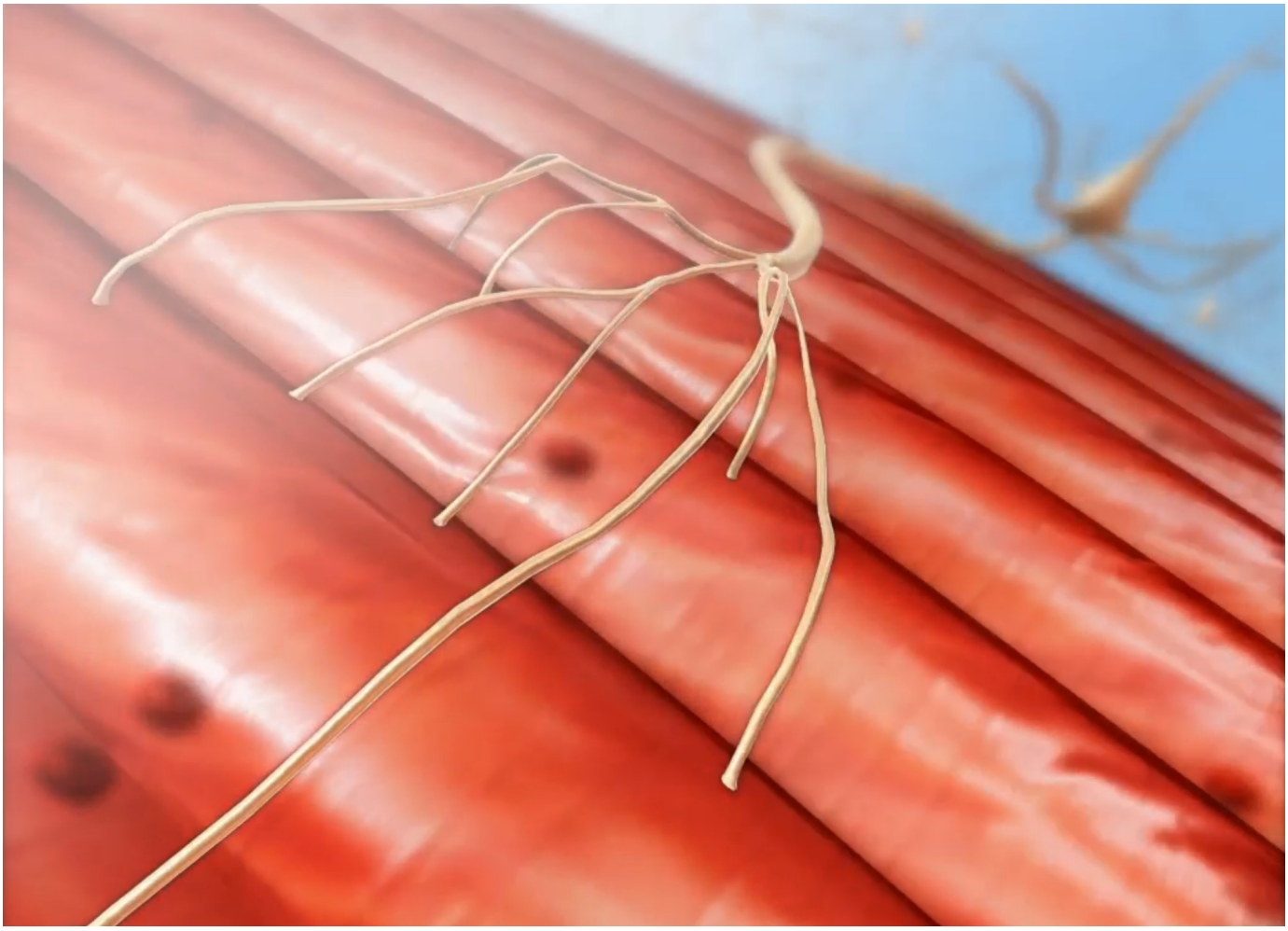
The Muscular System: Pelvis and Lower Limb

A muscular system lab activity using Visible Body Suite

Stephanie Wallace, Instructor of Biology, TCU

PRE-LAB EXERCISES

A. Open Visible Body Suite. From the main menu, choose Anatomy & Physiology and select 4. Muscular System. Watch the video in 13.1 Muscle Tissue Types and observe the following:

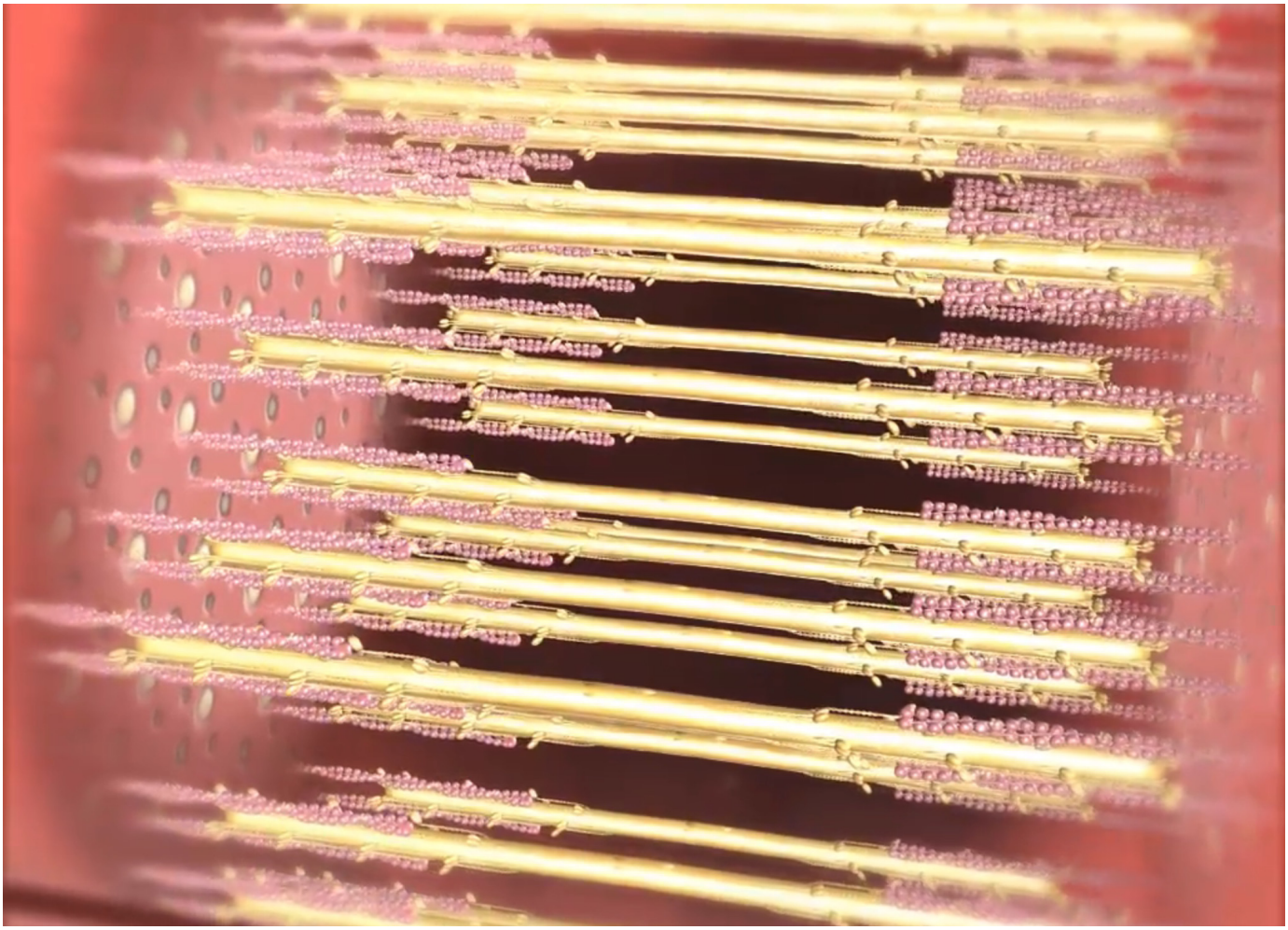


1. What is the function of the muscular system?

2. How does a muscle change in order to accomplish its function?

3. What stimulates a muscle to contract?

B. Watch the videos for 14.2 Skeletal Muscle Contractions and 14.3 Physiology of Muscle Contraction and observe the following:



1. What is the initial stimulus for muscle contraction?

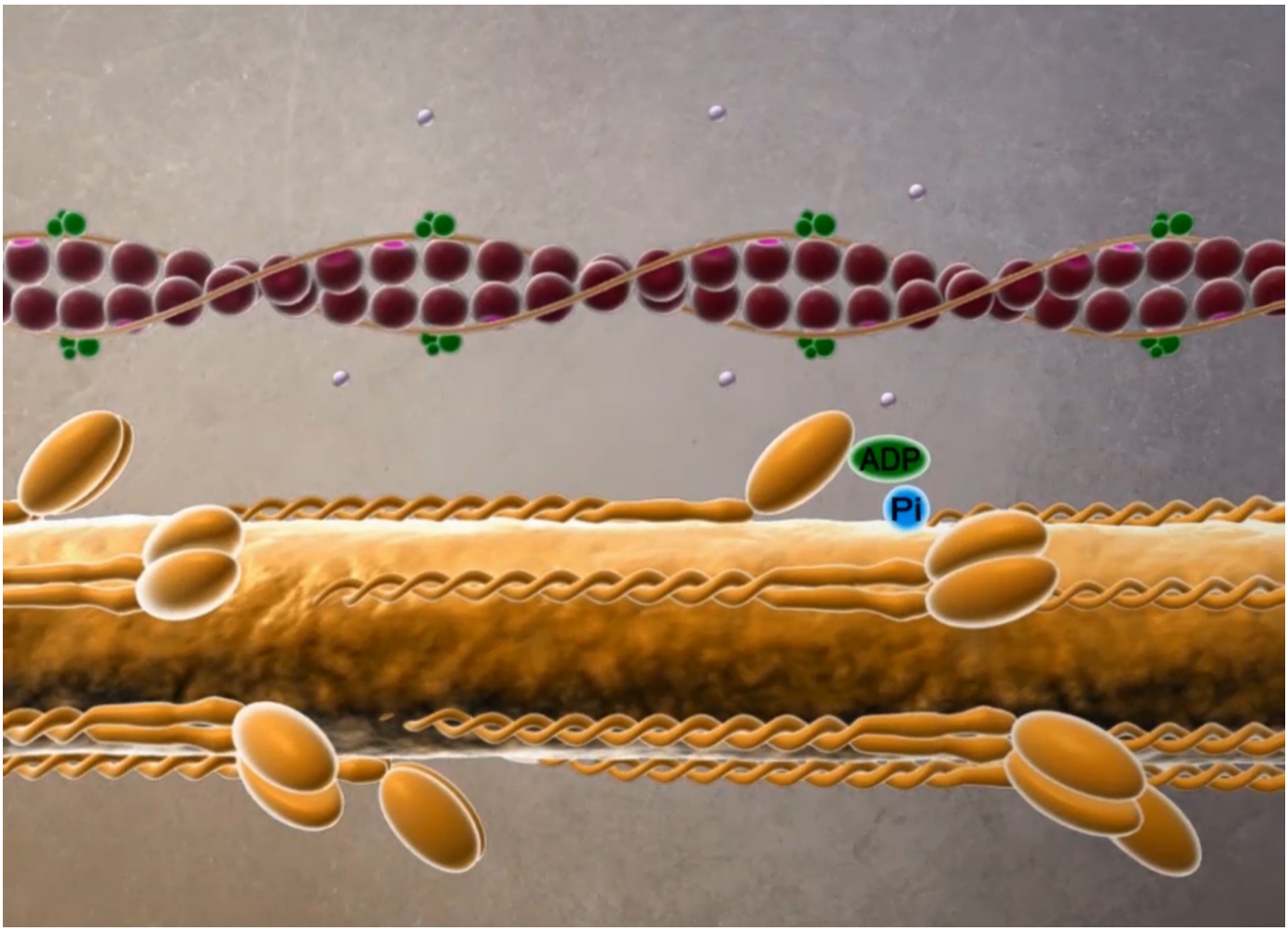
2. Which neurotransmitter is released at the neuromuscular junction after the action potential arrives?

3. When receptors open at the neuromuscular junction, does sodium travel in or out of the muscle fiber?

4. The action potential continues to travel down the muscle fiber on which structures? Which ion is released from the sarcoplasmic reticulum as this happens?

5. Draw and label a sketch of the neuromuscular junction in the space below.

C. Watch the video for 14.3 Physiology of Muscle Contraction and answer the following:



1. What is the basic functional unit of a muscle fiber?

2. Thick filaments are composed of _____ and thin filaments are composed of _____.

3. When calcium is released from the sarcoplasmic reticulum, where does it bind?

4. When a myosin head binds to actin, it forms a _____.

5. When a myosin head moves the actin toward the center of the sarcomere, this is called the _____.

6. What is the energy source that powers muscle contraction?

7. As myosin filaments pull the actin filaments toward the center of the sarcomere, will the muscle lengthen or shorten?

IN-LAB EXERCISES

Use the following modules to guide your exploration of the pelvis and lower limb regions of the muscular system. As you explore the modules, locate the muscles on any available charts, models, or specimens.

The muscles of the pelvis and lower limb are generally larger than other muscles, because they serve to support the weight of the body as well as to provide movement. These muscles have different jobs, depending on where they are located, but they are all involved in moving the lower limb. A few are also able to move the trunk if the leg is fixed. You will be able to make a good guess about what action the muscle performs if you know which side of the joint the muscle crosses.

The long names of some of these muscles can be daunting, but they are often very descriptive. You can find origins, insertions, actions, and/or locations of these muscles, simply in the names. When reviewing the action of a muscle, it will be helpful to think about where the muscle is located and where the insertion is. Muscle physiology requires that a muscle will "pull," instead of "push," during contraction, and the insertion is the part that will move. Imagine that the muscle is "pulling" on the bone or tissue it is attached to at the insertion.

You may access 3D views in the VB Suite app and manipulate the images to see different views and isolate each muscle. Be sure to use the book icon to read information specific to that muscle.

In the modules below, identify the following:

- Muscle location
- Origin(s) and insertion(s)
- Muscle action
- Nerve supply

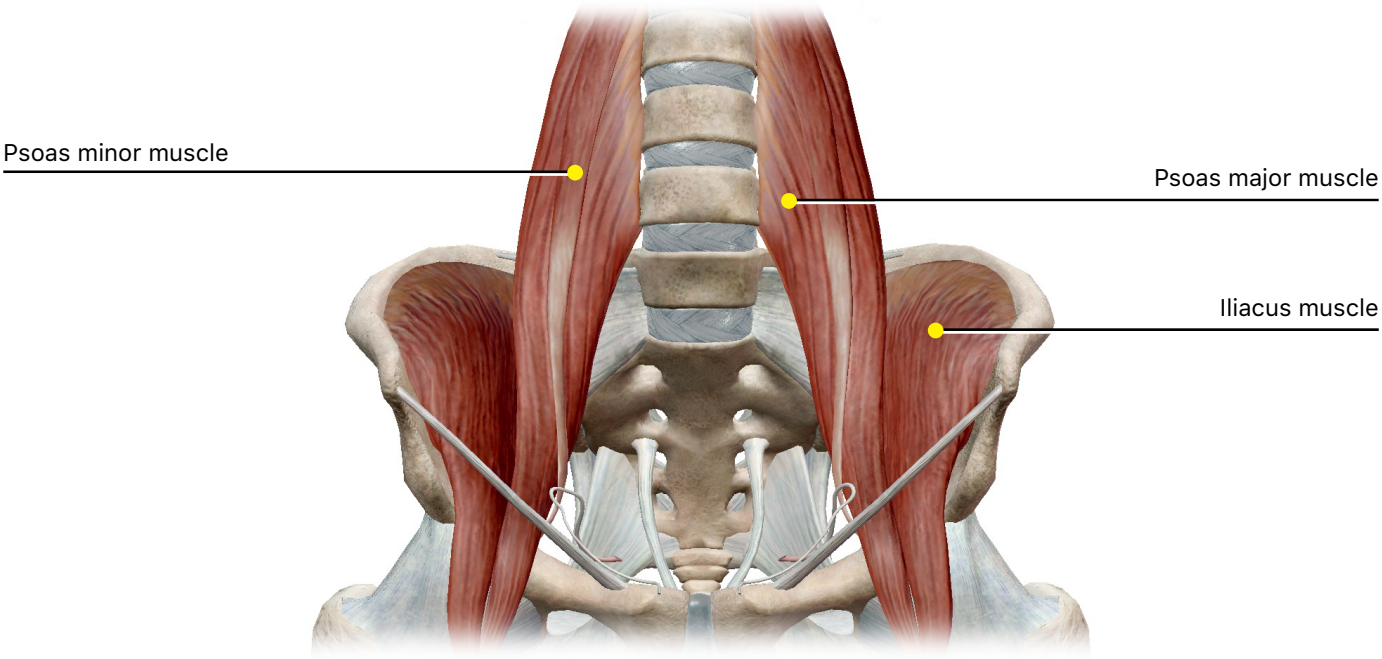
You are responsible for the identification of **all bold terms**.

A. Hip and Gluteal Muscles

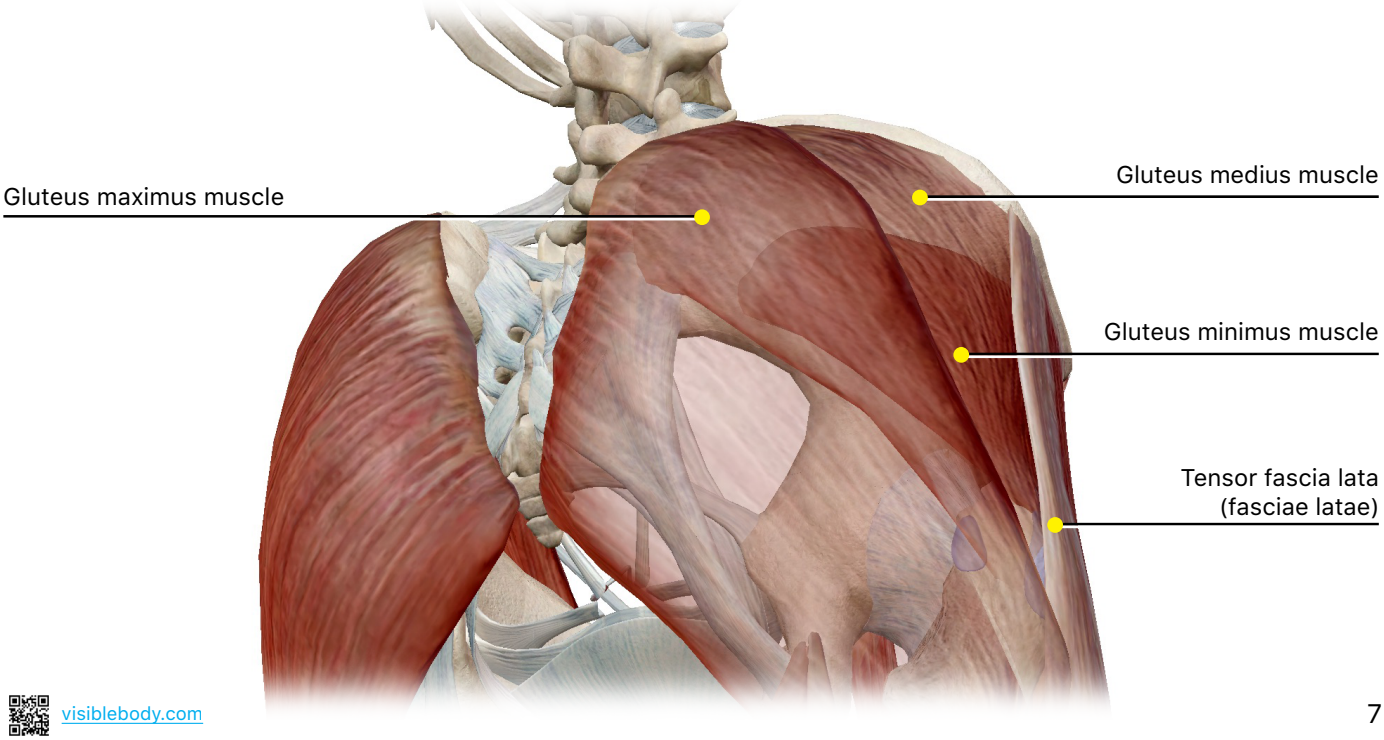
View 16.46 Thigh: Iliopsoas, 16.47 Thigh: Gluteal, and 16.48 Thigh: Lateral Rotators.

These muscles cross the hip joint, and therefore, they affect movement at that joint. Most of these muscles attach to the femur and cause the thigh to move, depending on exactly where the attachment is located. You will find the lateral rotators deep to the **gluteus maximus** and inferior to the **gluteus minimus**. As their group name implies, these muscles laterally rotate, as well as abduct or adduct, the thigh.

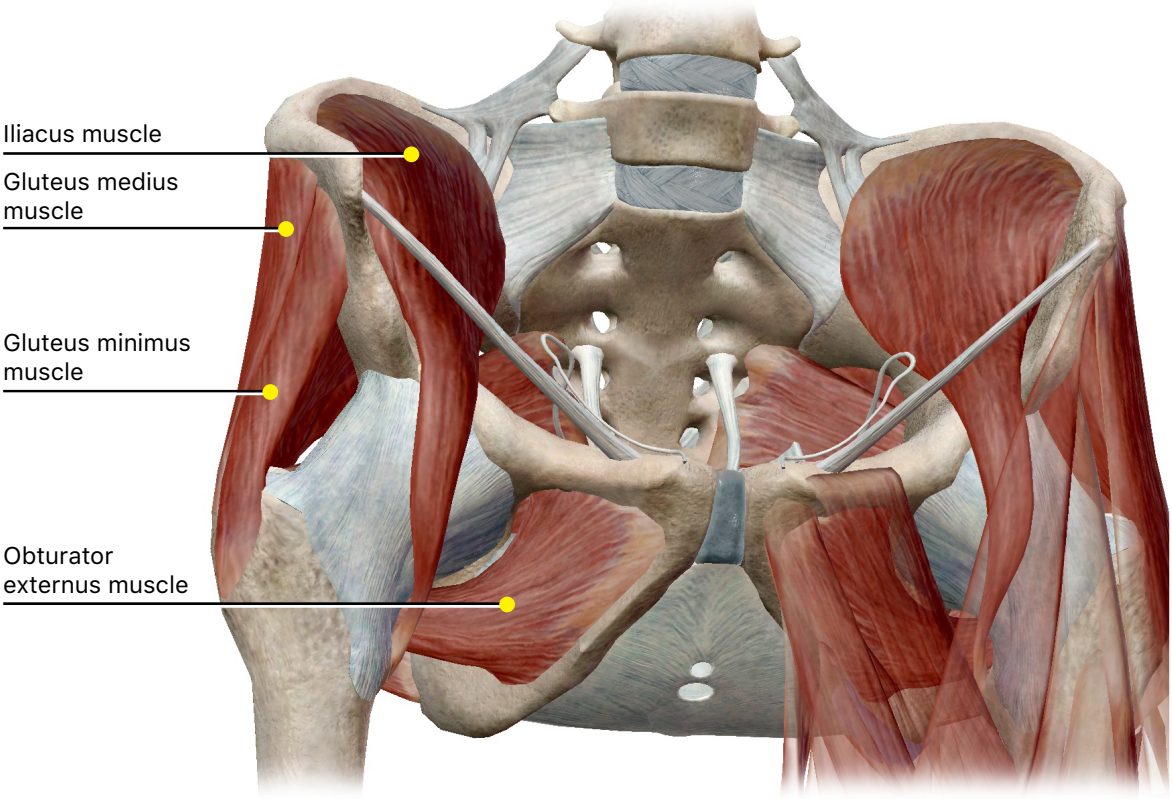
Module 16.46 Thigh: Iliopsoas



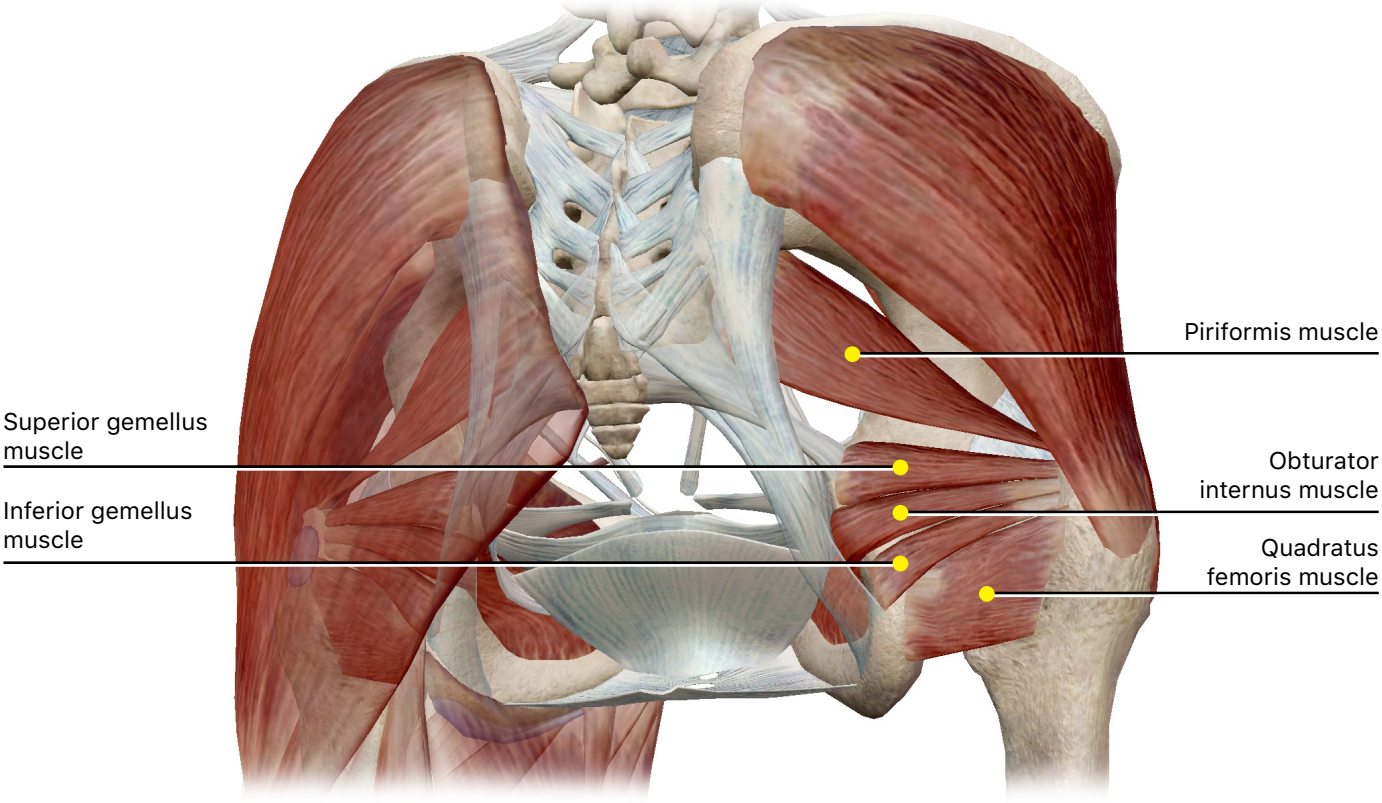
Module 16.47 Thigh: Gluteal



Module 16.48 Thigh: Lateral Rotators (Part 1)



Module 16.48 Thigh: Lateral Rotators (Part 2)



Hip and Gluteal Muscles				
Muscle	**Origin**	**Insertion**	**Action**	**Innervation**
Psoas major				
Psoas minor				
Iliacus				
Gluteus maximus				
Gluteus medius				
Gluteus minimus				
Tensor fasciae latae				
Obturator externus				
Obturator internus				

Hip and Gluteal Muscles (cont.)				
Muscle	**Origin**	**Insertion**	**Action**	**Innervation**
Superior gemellus				
Inferior gemellus				
Quadratus femoris				
Piriformis				

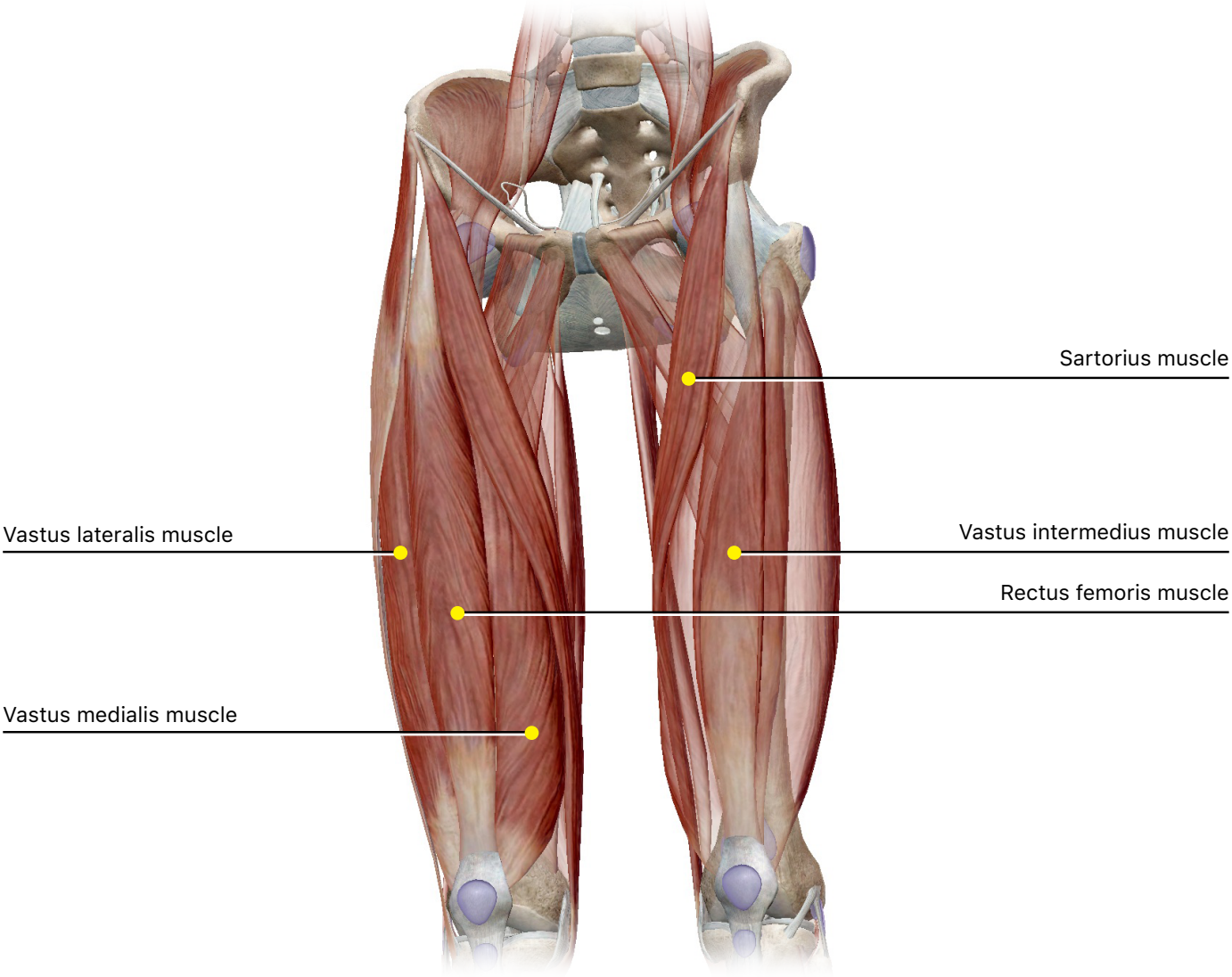
B. Thigh: Anterior Compartment

View Module 16.49 Thigh: Anterior Compartment and Module 16.50 Thigh: Anterior Compartment: Quadriceps.

The quadriceps group is composed of four muscles: the **rectus femoris**, **vastus medialis**, **vastus lateralis**, and **vastus intermedius**. They share a common tendon as they cross the knee joint and insert on the tibia. Since these muscles cross the knee on the anterior side, their contraction pulls the tibia upward and extends the knee.

The long **sartorius** is also found in the anterior compartment, but due to its attachment on the inside of the knee, it causes lateral rotation at the hip.

Module 16.49 Thigh: Anterior Compartment



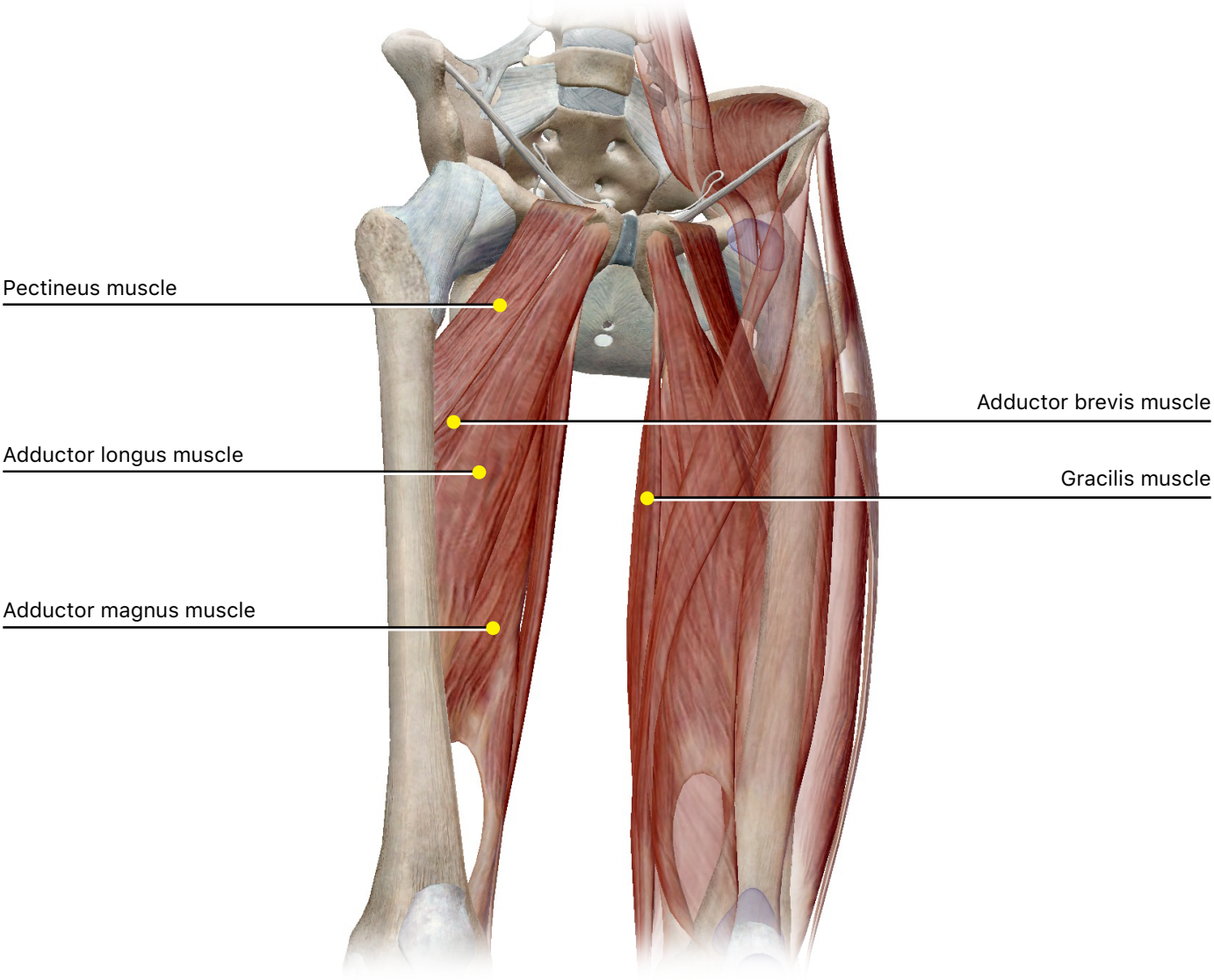
Thigh: Anterior Compartment				
Muscle	**Origin**	**Insertion**	**Action**	**Innervation**
Sartorius				
Rectus femoris				
Vastus medialis				
Vastus lateralis				
Vastus intermedius				

C. Thigh: Medial Compartment

View 16.51 Thigh: Medial Compartment and 16.52 Medial Compartment: Adductors.

These muscles are located deep to the muscles of the anterior compartment and primarily act to adduct the thigh.

16.51 Thigh: Medial Compartment

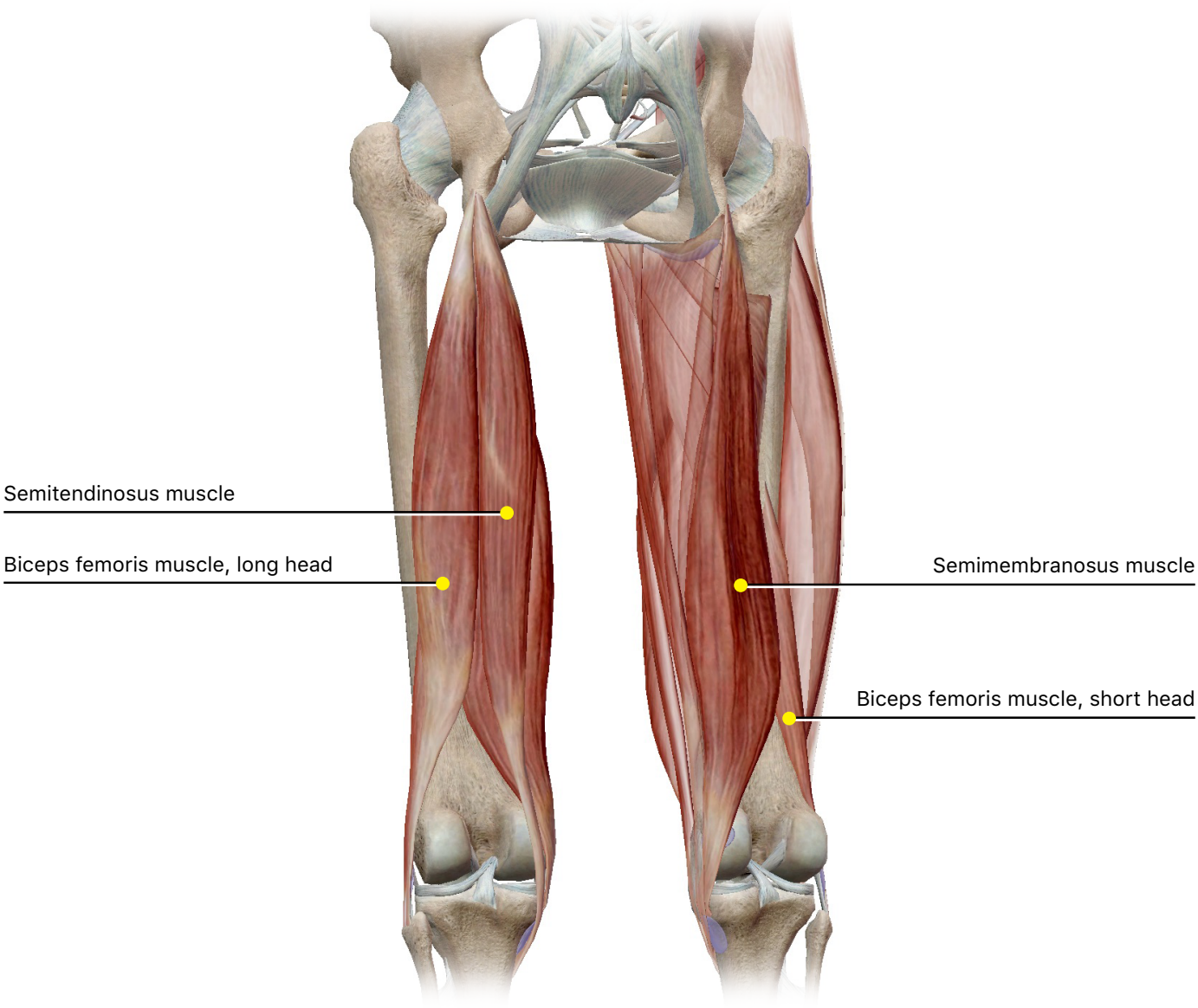


Thigh: Medial Compartment				
Muscle	**Origin**	**Insertion**	**Action**	**Innervation**
Pectineus				
Gracilis				
Adductor brevis				
Adductor longus				
Adductor magnus				

D. Thigh: Posterior Compartment

View 16.53 Thigh: Posterior Compartment (Hamstrings).

These muscles, commonly known as the hamstrings, are located on the posterior side of the femur. They cross the knee on the posterior side and cause leg flexion at the knee joint.



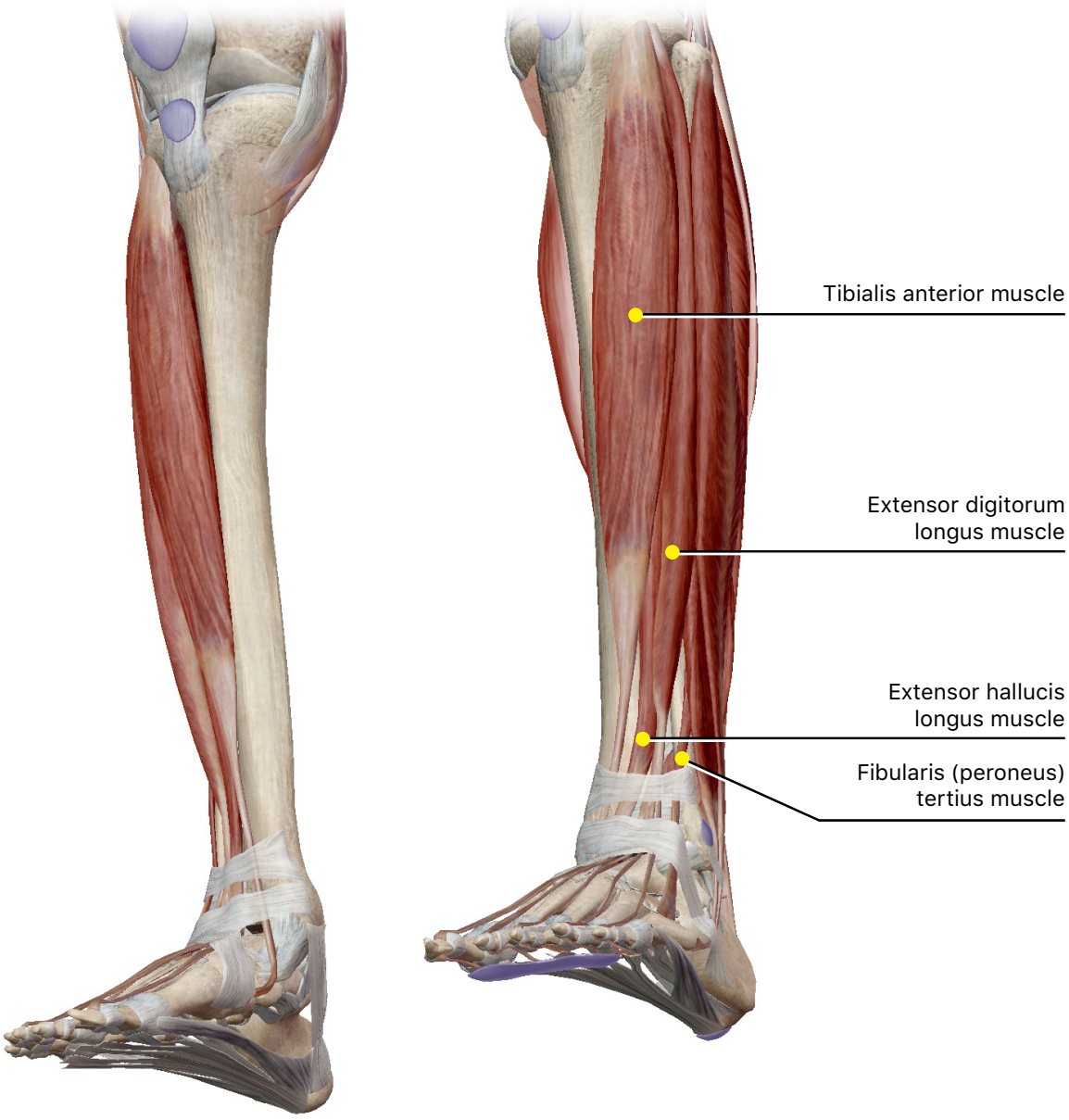
Thigh: Posterior Compartment				
Muscle	**Origin**	**Insertion**	**Action**	**Innervation**
Biceps femoris				
Semitendinosus				
Semimembranosus				

E. Lower Leg: Anterior Compartment

View 16.54 Lower Leg: Anterior Compartment.

The muscles of the lower leg are also separated into compartments, each of which serves a similar function. The anterior compartment muscles all cross the ankle joint on the anterior side, and therefore, each causes dorsiflexion of the foot as one of its actions.

To view the extensor **hallucis longus** more clearly, be sure to hide the **tibialis anterior** and **extensor digitorum longus**.

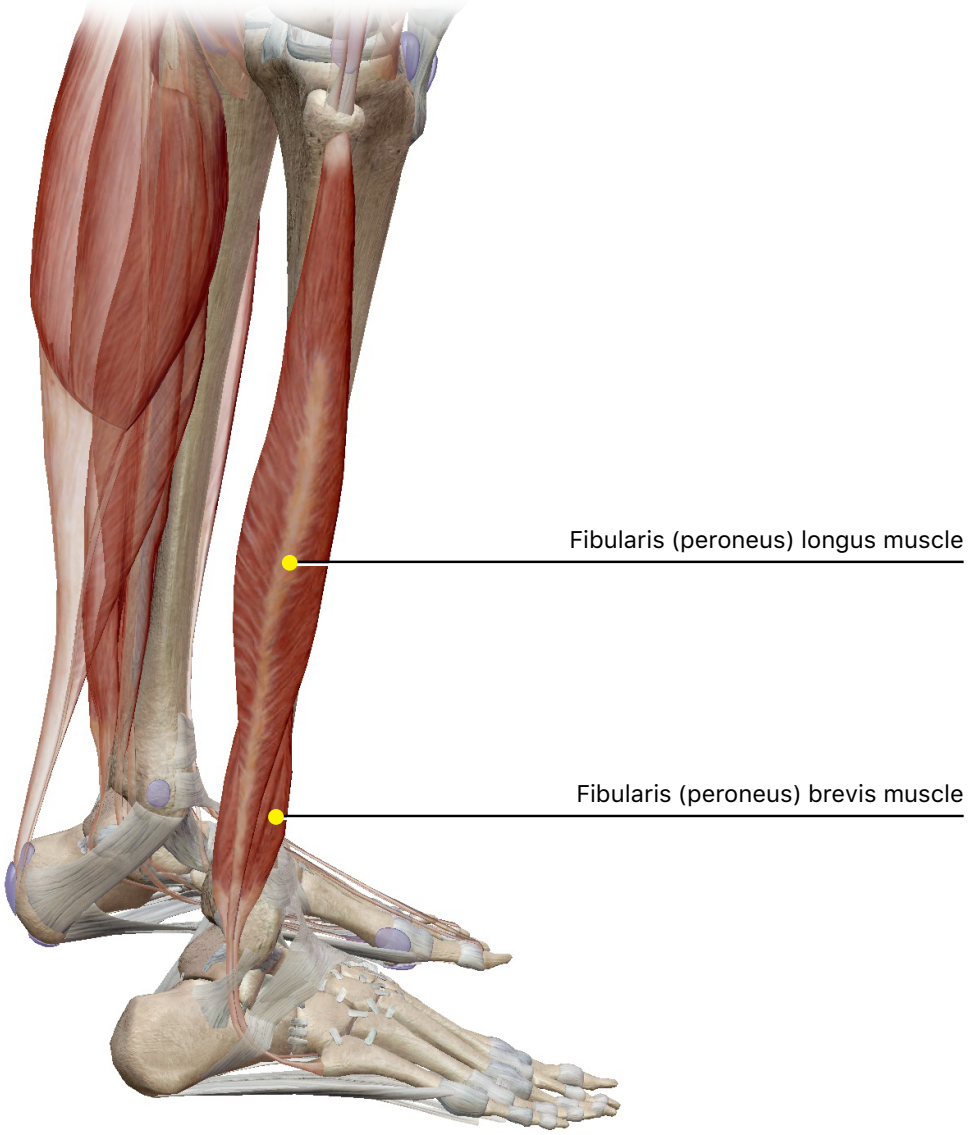


Lower Leg: Anterior Compartment				
Muscle	**Origin**	**Insertion**	**Action**	**Innervation**
Tibialis anterior				
Extensor digitorum longus				
Extensor hallucis longus				
Fibularis (peroneus) tertius				

F. Lower Leg: Lateral Compartment

View 16.55 Lower Leg: Lateral Compartment.

These muscles, located on the lateral side of the leg, cause plantarflexion and eversion of the foot.



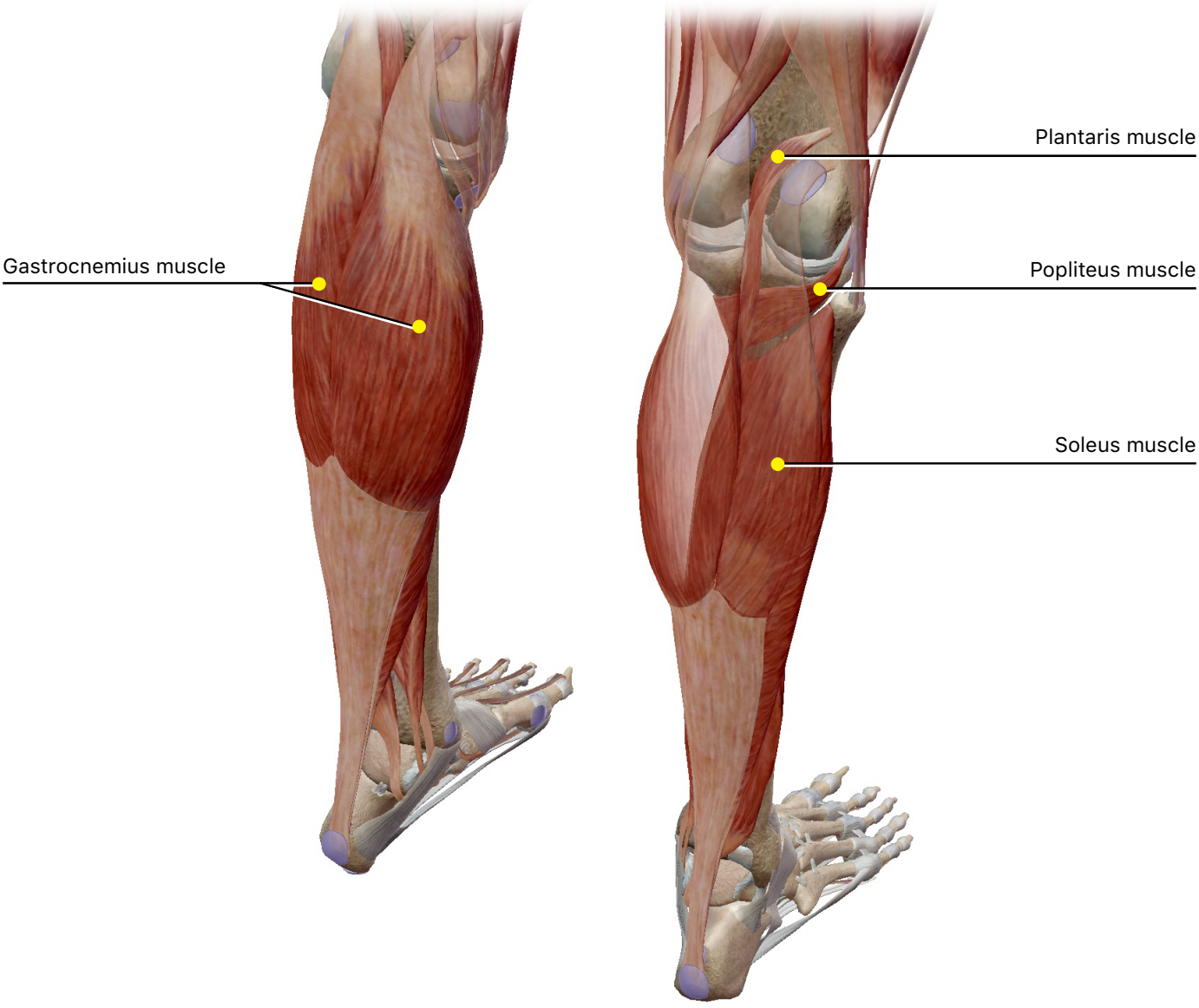
Lower Leg: Lateral Compartment				
Muscle	**Origin**	**Insertion**	**Action**	**Innervation**
Fibularis (peroneus) longus				
Fibularis (peroneus) brevis				

G. Lower Leg: Posterior Compartment

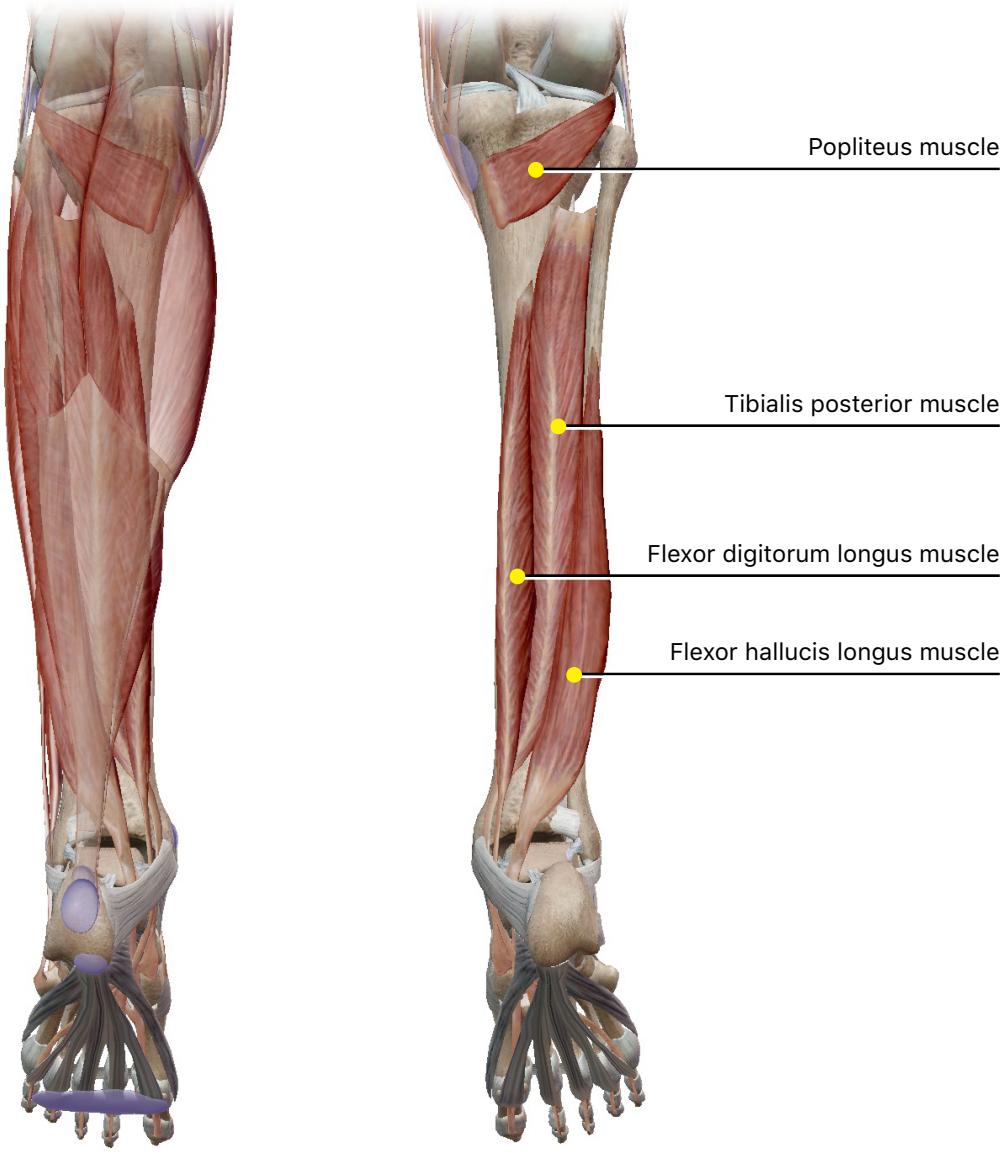
View 16.56 Lower Leg: Posterior Compartment (Superficial) and 16.57 Lower Leg: Posterior Compartment (Deep).

Except for the **popliteus**, all the posterior compartment muscles of the lower leg cross the ankle joint on the posterior side and are involved in plantarflexion of the foot.

16.56 Lower Leg: Posterior Compartment (Superficial)



16.57 Lower Leg: Posterior Compartment (Deep)



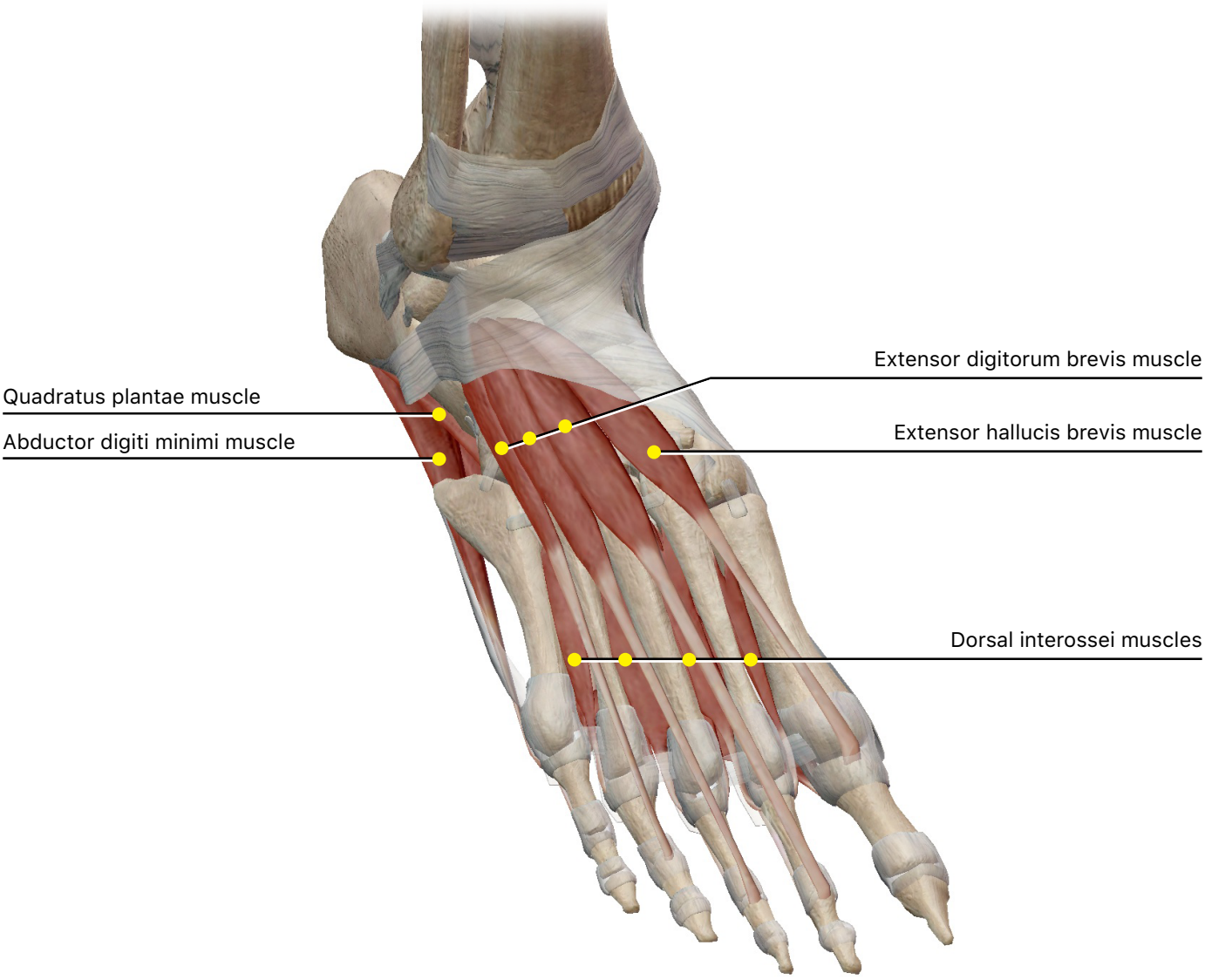
Lower Leg: Posterior Compartment				
Muscle	**Origin**	**Insertion**	**Action**	**Innervation**
Gastrocnemius				
Soleus				
Plantaris				
Popliteus				
Flexor digitorum longus				
Tibialis posterior				
Flexor hallucis longus				

H. Foot

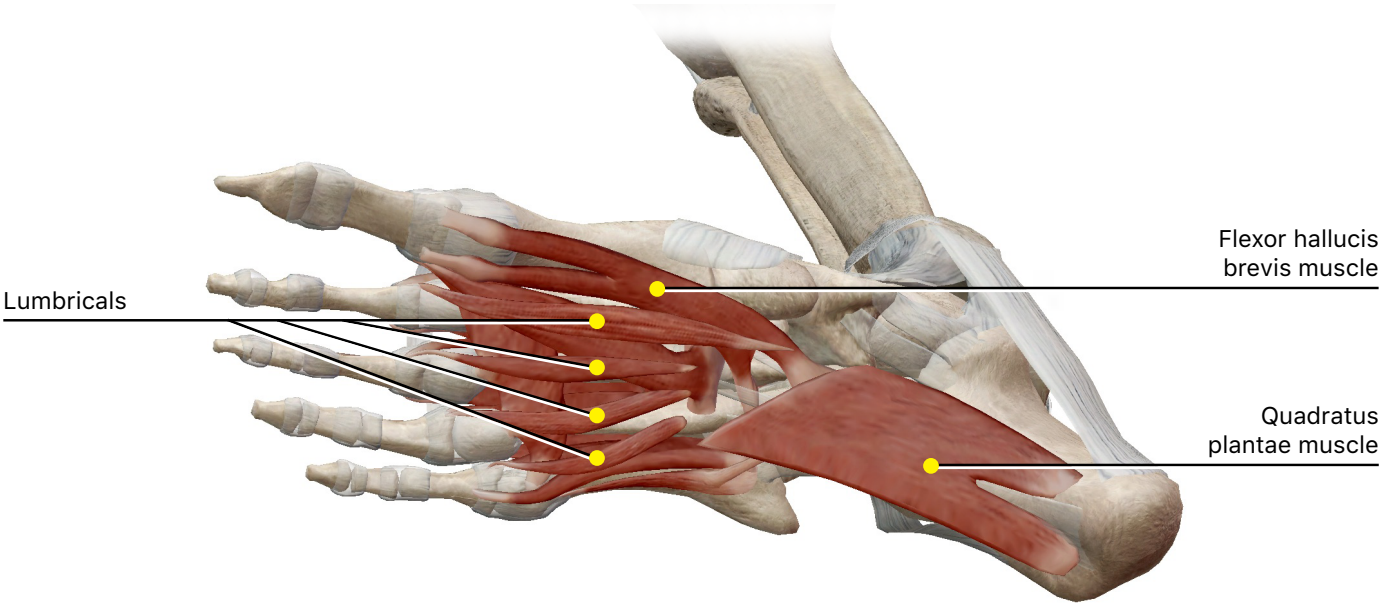
View 16.58 Foot: Dorsum, 16.59 Foot: Plantar Layer 1, 16.60 Foot: Plantar Layer 2, 16.61 Foot: Plantar Layer 3, and 16.62 Foot: Plantar Layer 4.

These muscles are all located within the foot and act to move the toes. Keep your anatomical terminology in mind as you learn these muscles: hallucis refers to the big toe (digit 1), digitorum refers to toes 2-5, and digiti minimi refers specifically to the little toe (digit 5).

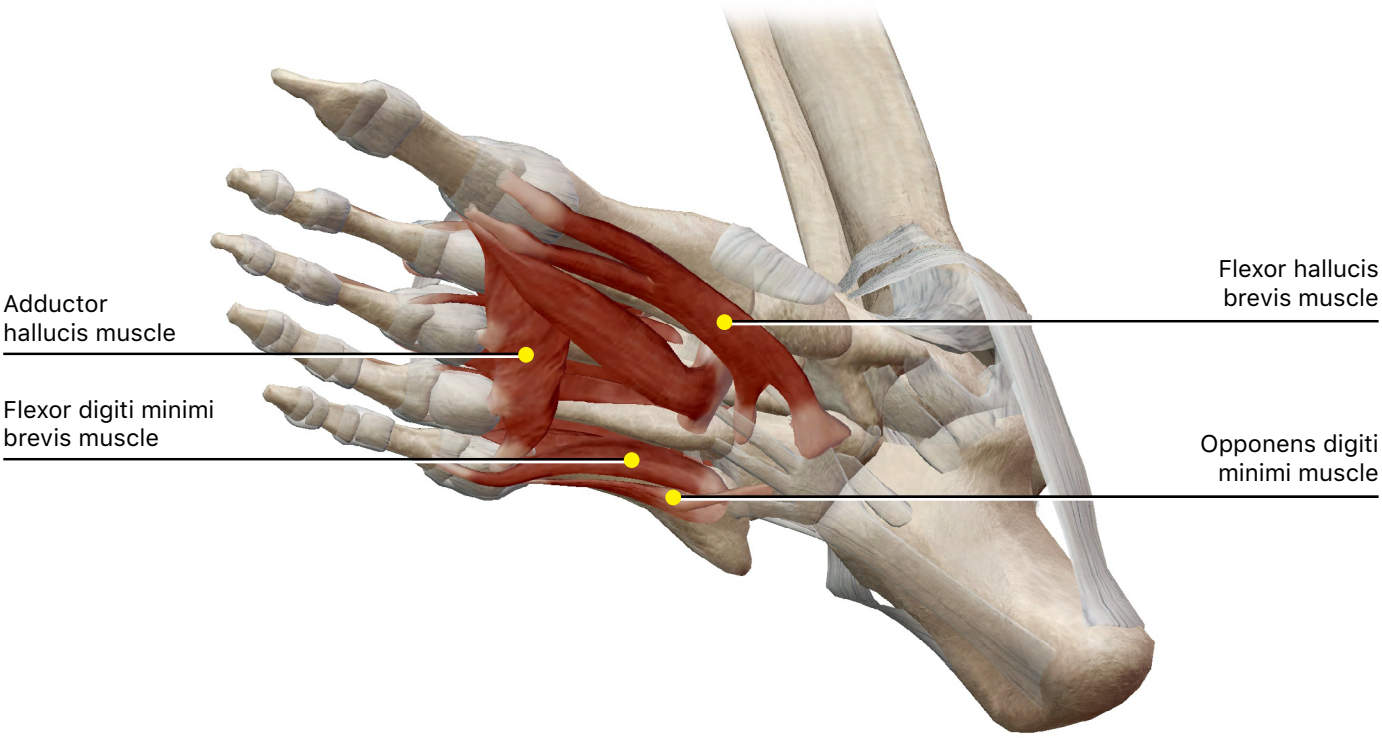
16.58 Foot: Dorsum



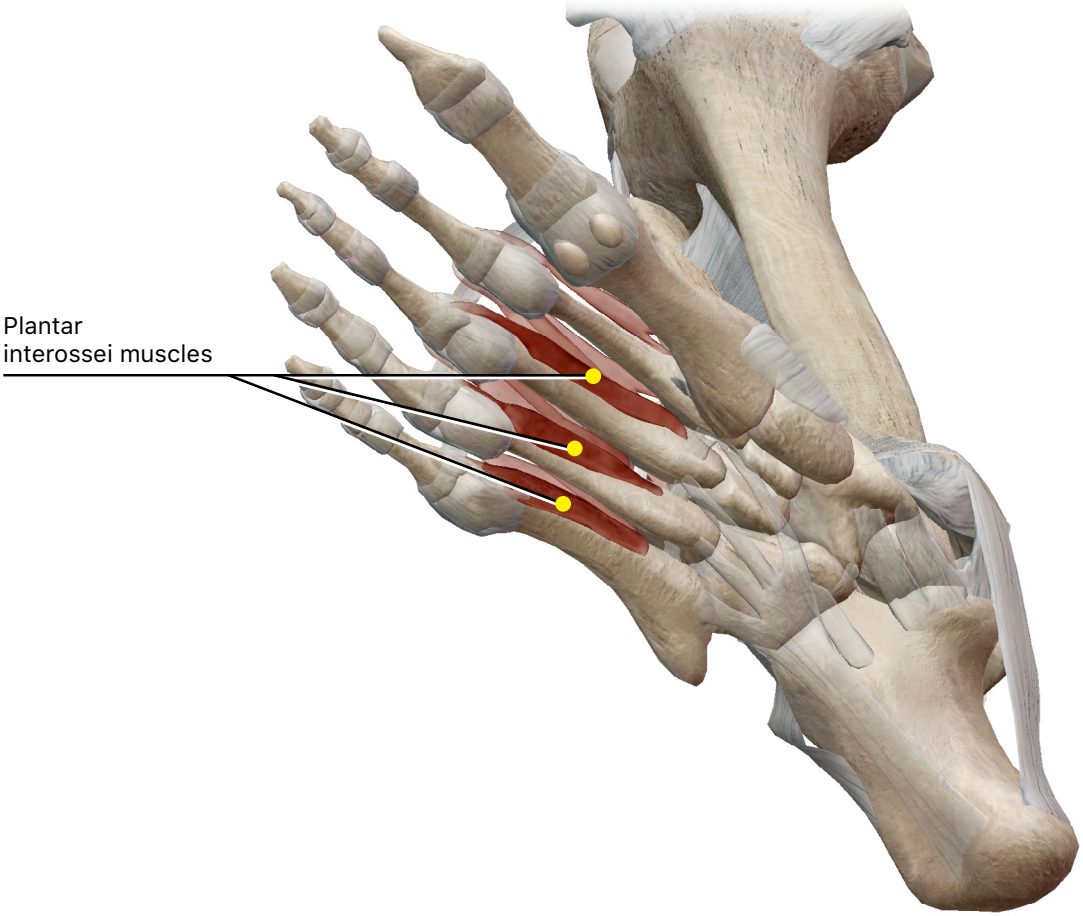
16.60 Foot: Plantar Layer 2



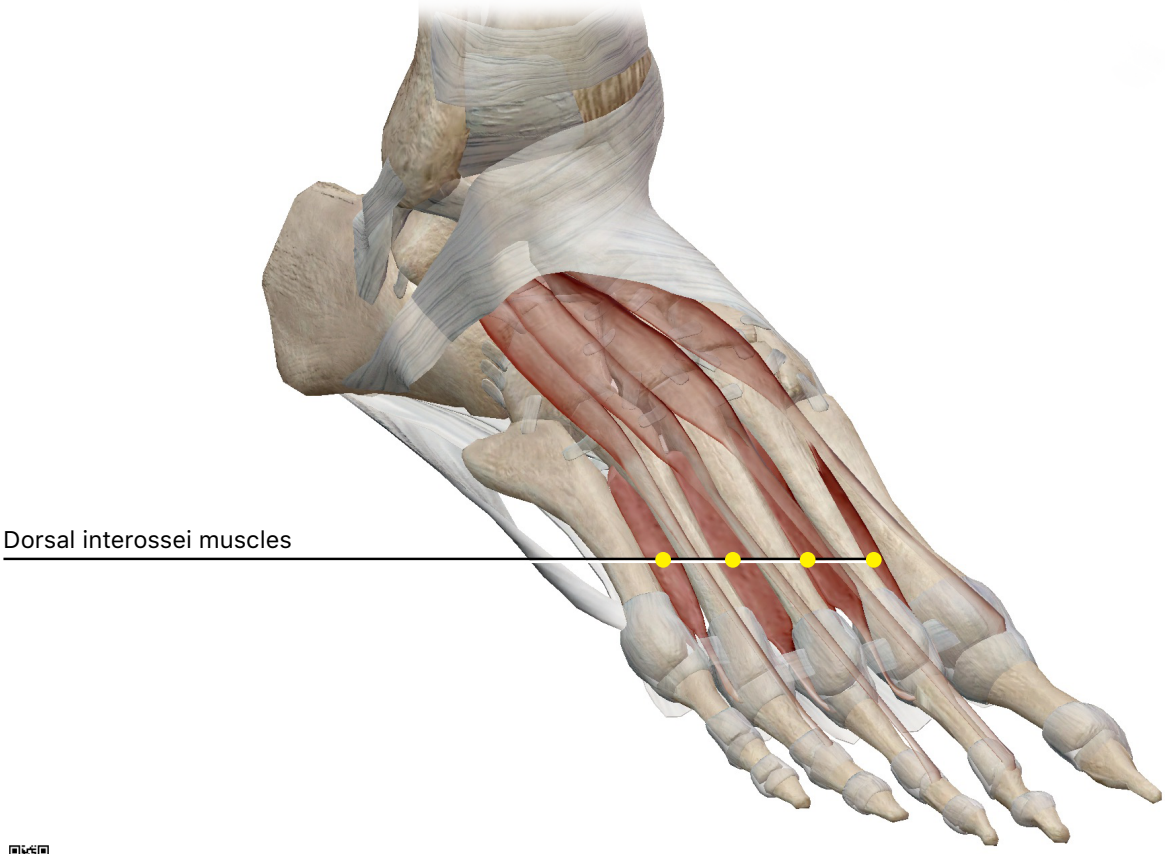
16.61 Foot: Plantar Layer 3



16.62 Foot: Plantar Layer 4



16.62 Foot: Plantar Layer 4



Foot				
Muscle	**Origin**	**Insertion**	**Action**	**Innervation**
Extensor digitorum brevis				
Extensor hallucis brevis				
Flexor digitorum brevis				
Abductor hallucis				
Abductor digiti minimi				
Quadratus plantae				
Lumbricals				
Flexor hallucis brevis				
Adductor hallucis				

Foot (cont.)				
Muscle	**Origin**	**Insertion**	**Action**	**Innervation**
Flexor digiti minimi brevis				
Opponens digiti minimi				
Dorsal interossei				
Plantar interossei				

PUTTING IT ALL TOGETHER

1. Based on what you've learned about the muscles in this exercise, what do you think the following terms mean?

a. Brevis –

b. Longus –

c. Lateralis –

d. Medialis –

e. Digitorum –

f. Hallucis –

g. Digiti minimi –

2. Which muscles are used when performing the following actions?

a. Extending the leg to kick a ball

i.

ii.

iii.

iv.

b. Sitting cross-legged

i.

ii.

iii.

iv.

v.

vi.

vii.

c. Pulling the knees up to the chest, as when jumping into a pool “cannonball” style

i.

ii.

iii.

iv.

v.

d. Standing on tiptoes

i.

ii.

iii.

e. Climbing stairs

i. Raising the body up and lifting a leg:

1.

2.

3.

4.

5.

6.

7.

8.

i. Stepping up to the next step:

1.

2.

3.

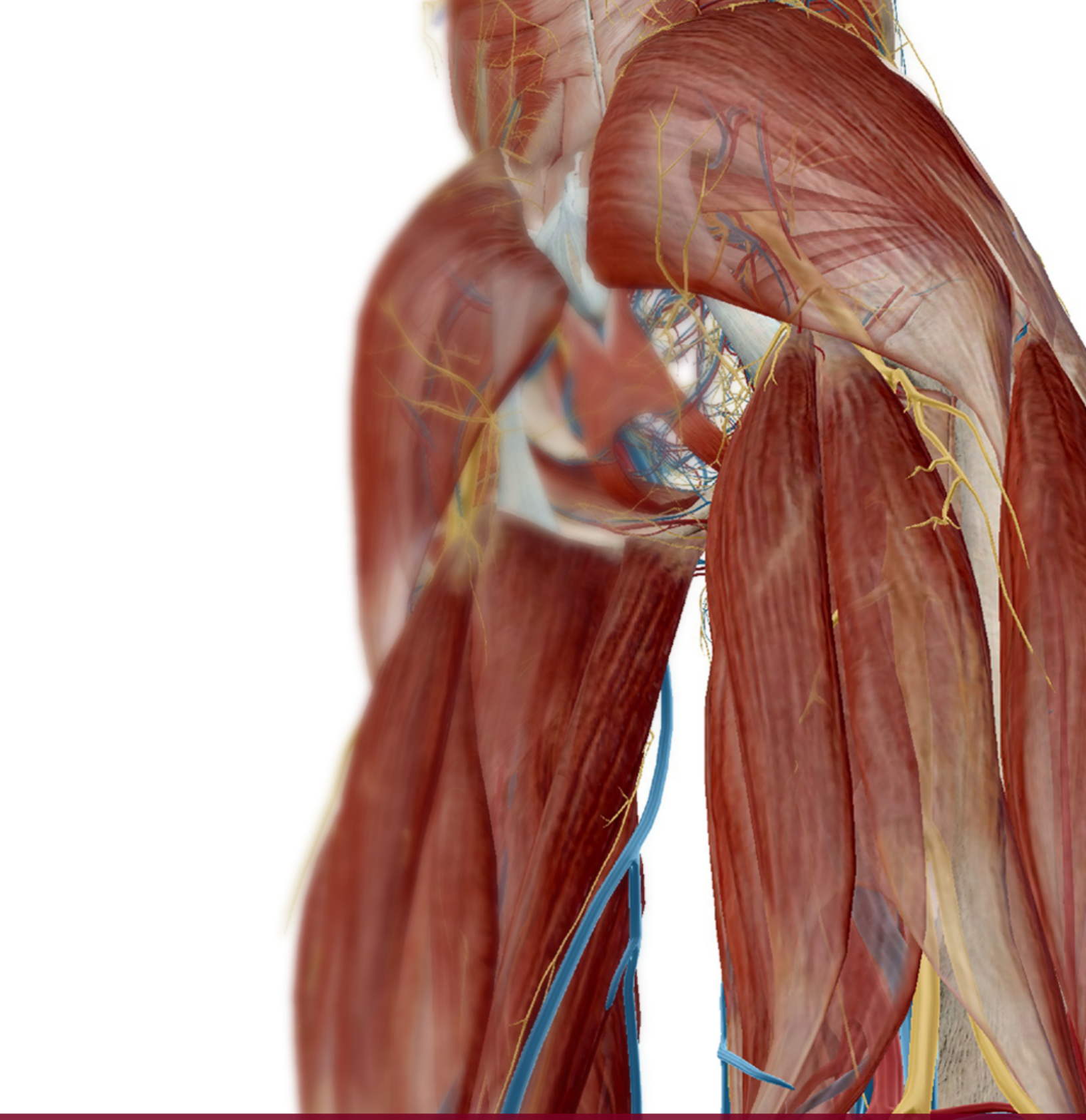
4.

5.

6.

3. Foot drop involves difficulty or inability to lift the front of the foot. It may be due to a variety of factors, including nerve injury. Which nerve would be affected?

4. If someone were to tear his/her Achilles (calcaneal) tendon, what muscle action(s) would be affected?

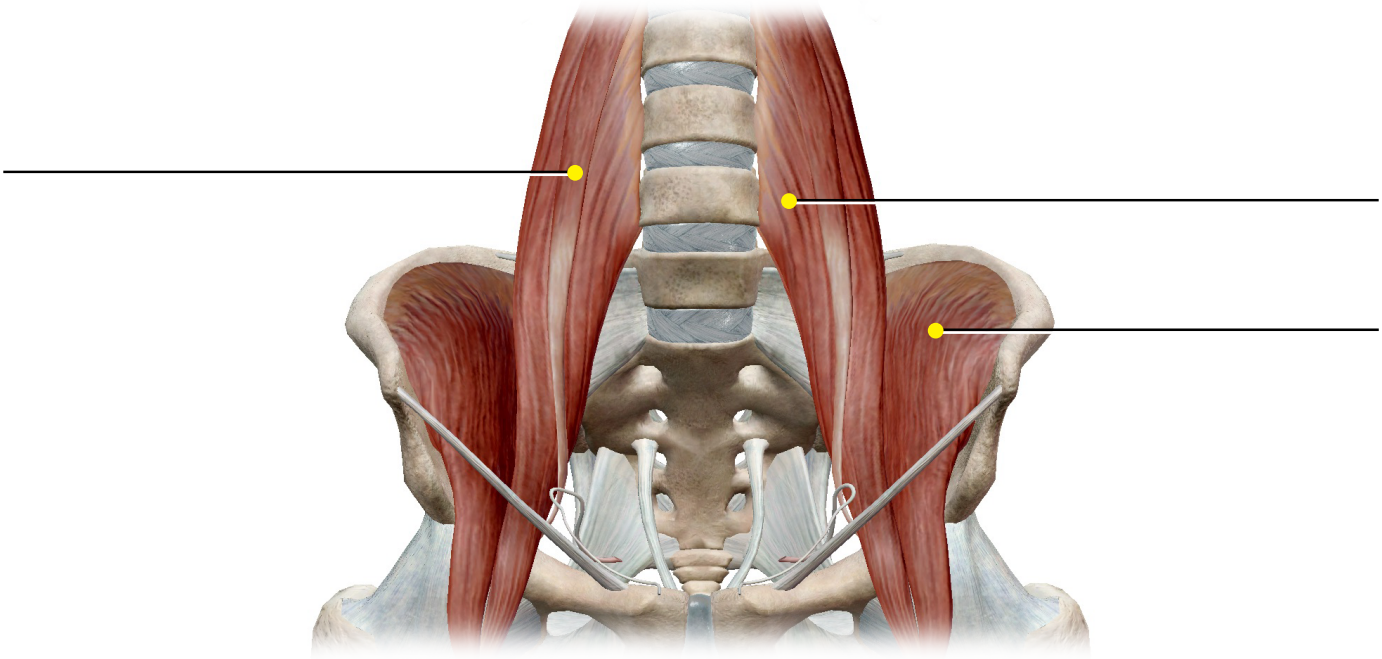


VISIBLE BODY®

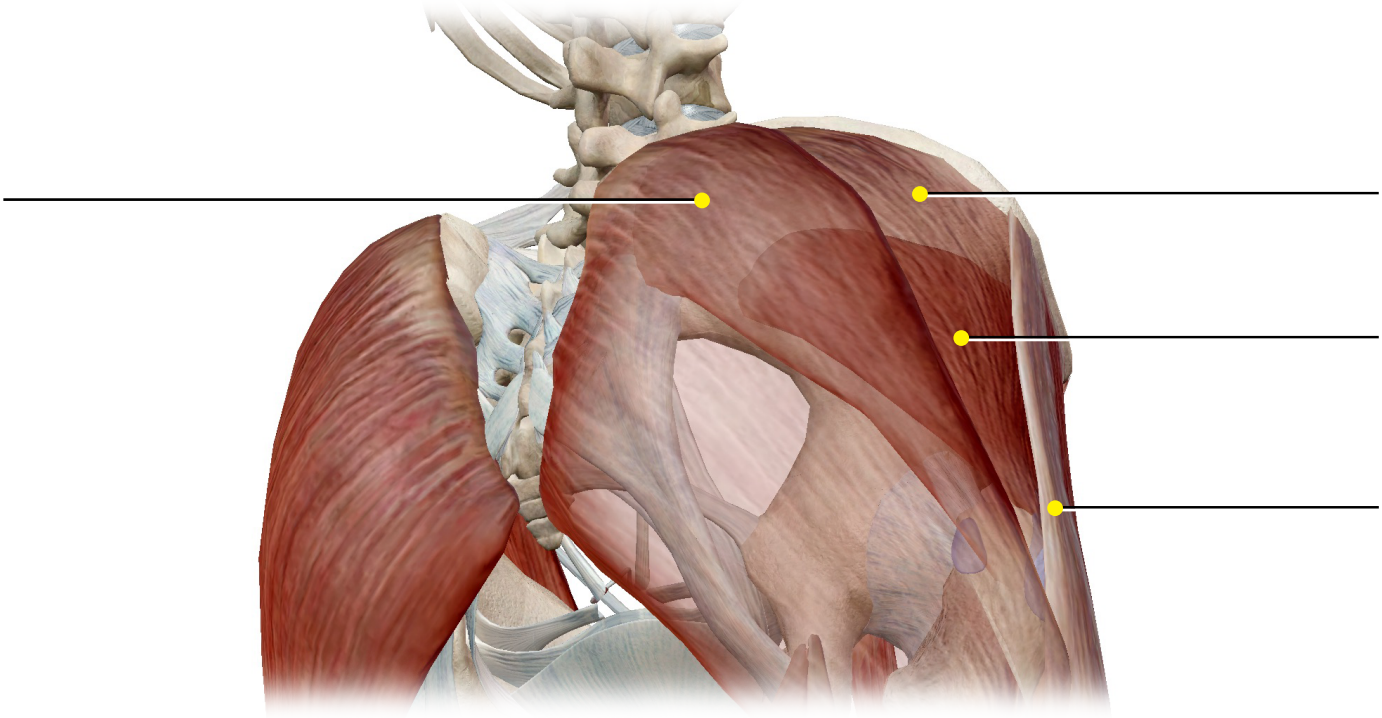
Student Practice

Label the muscles in the following figures.

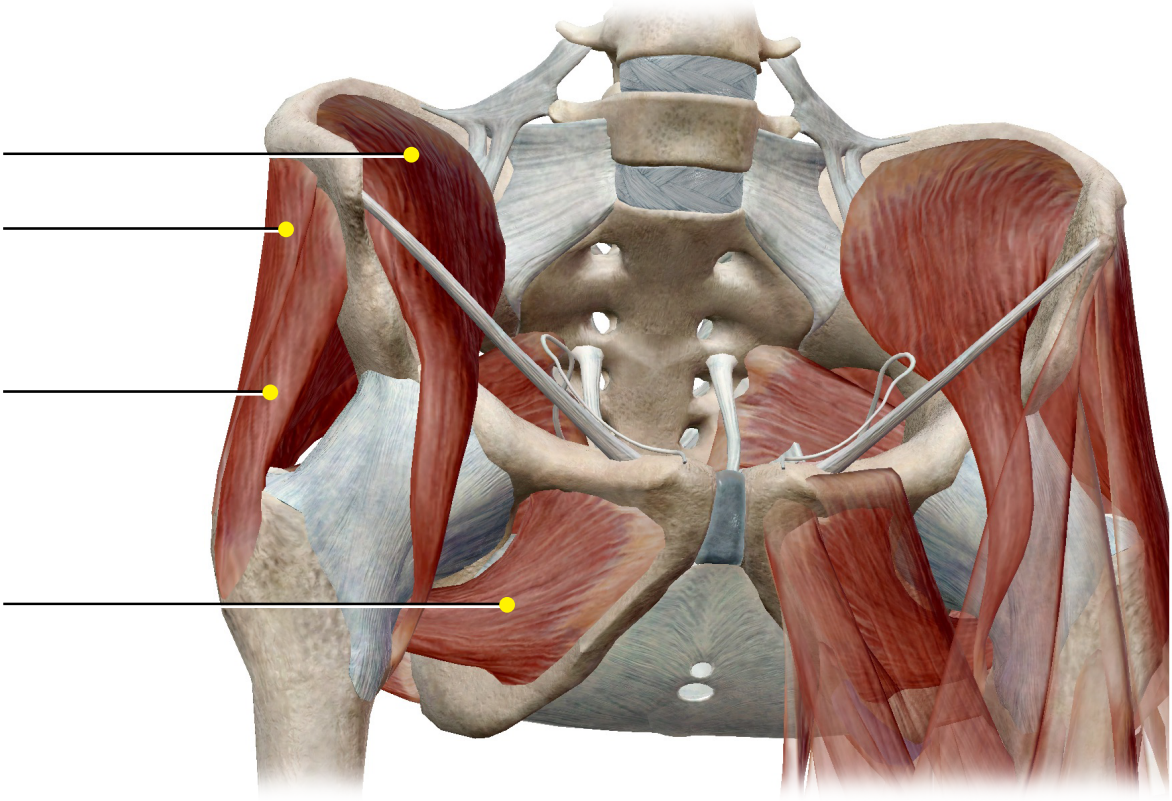
16.46 Thigh: Iliopsoas



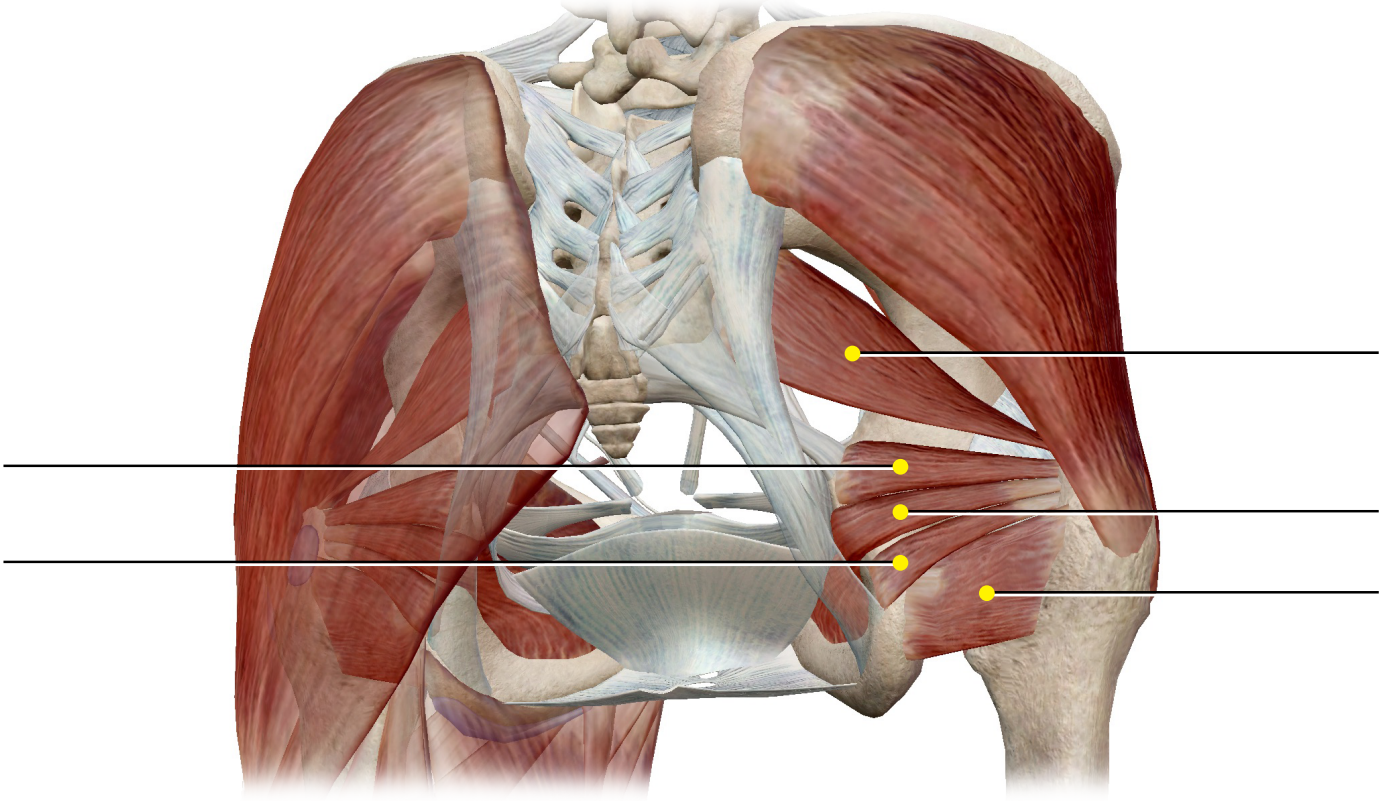
16.47 Thigh: Gluteal



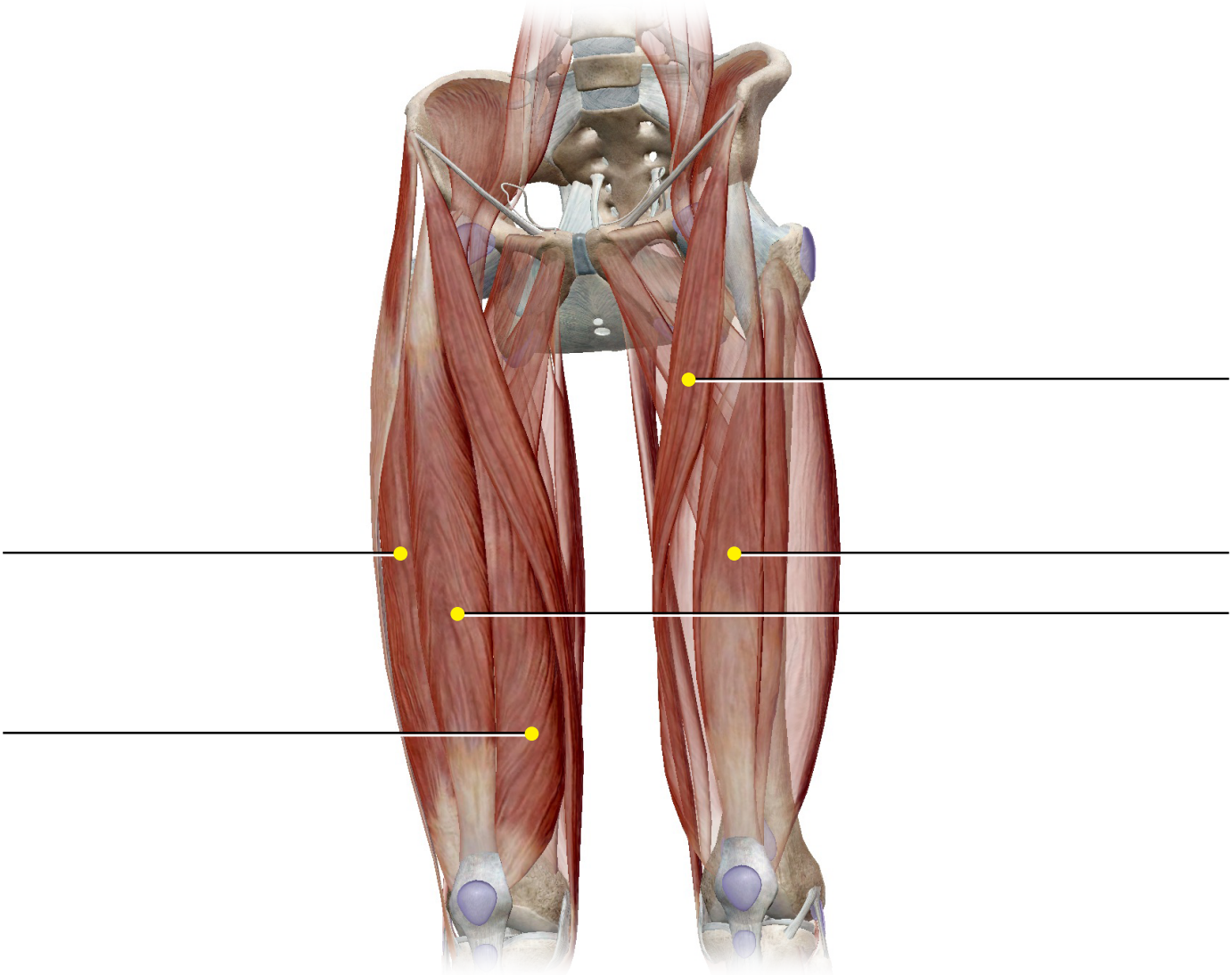
16.48 Thigh: Lateral Rotators (Part 1)



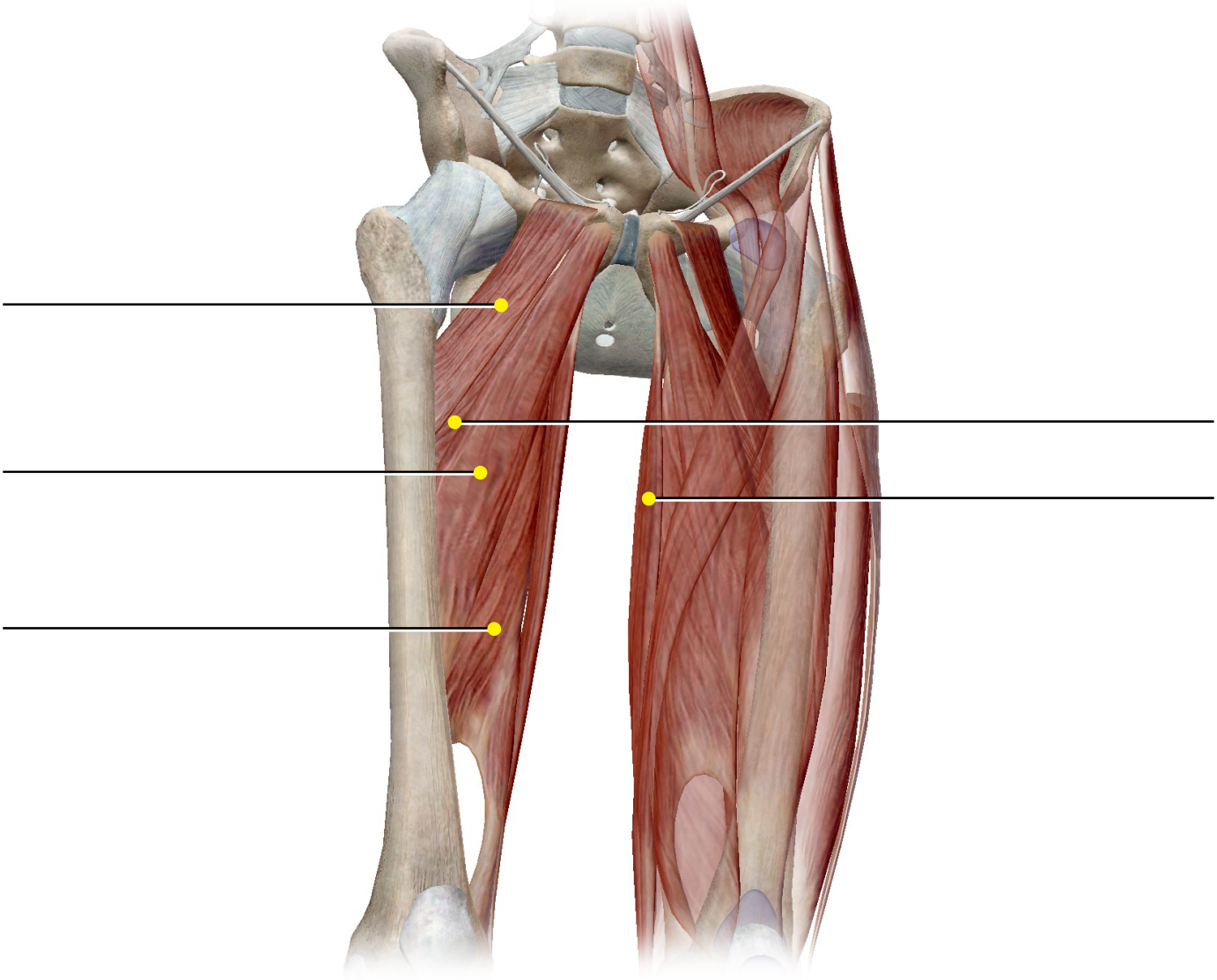
16.48 Thigh: Lateral Rotators (Part 2)



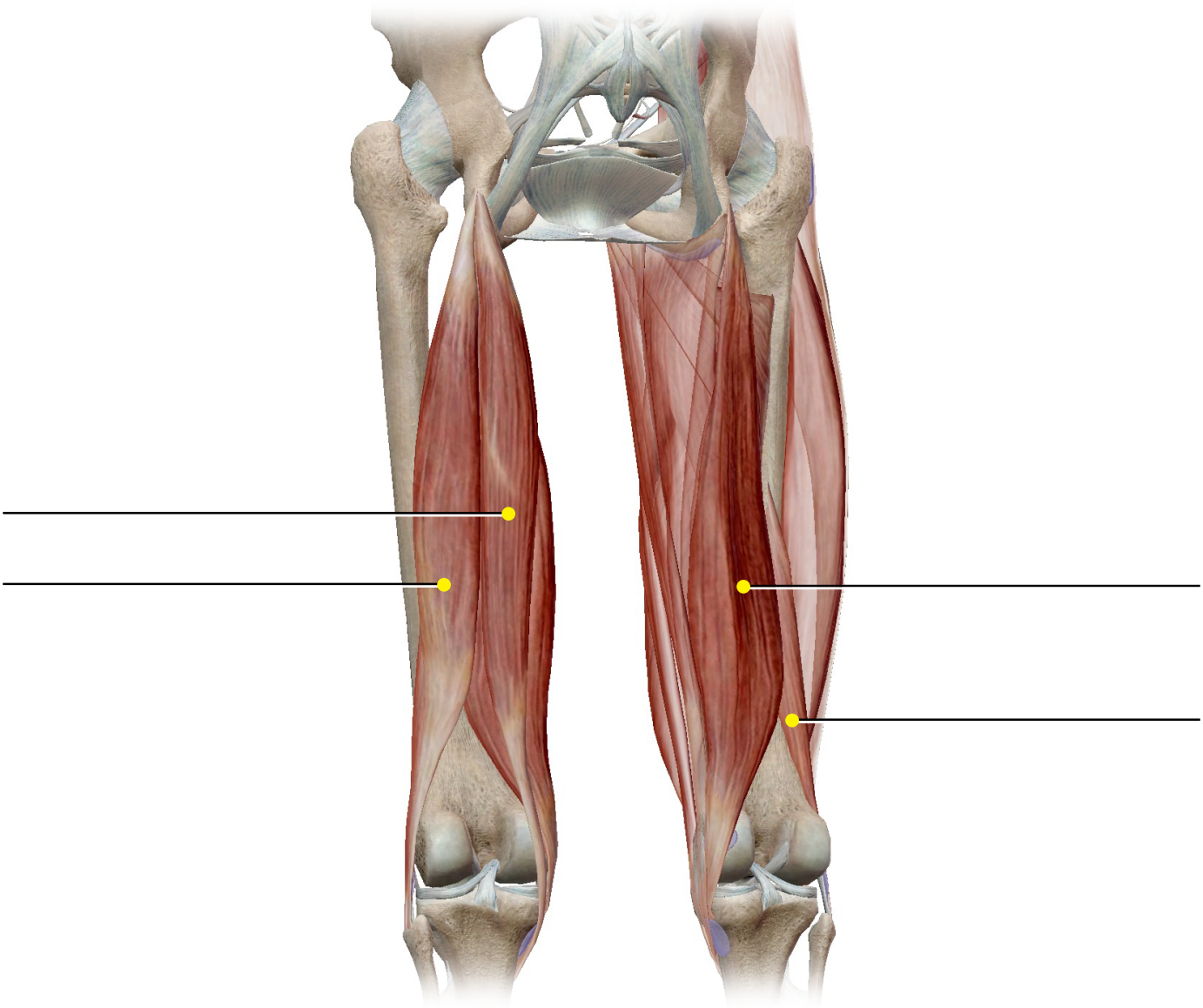
16.49 Thigh: Anterior Compartment



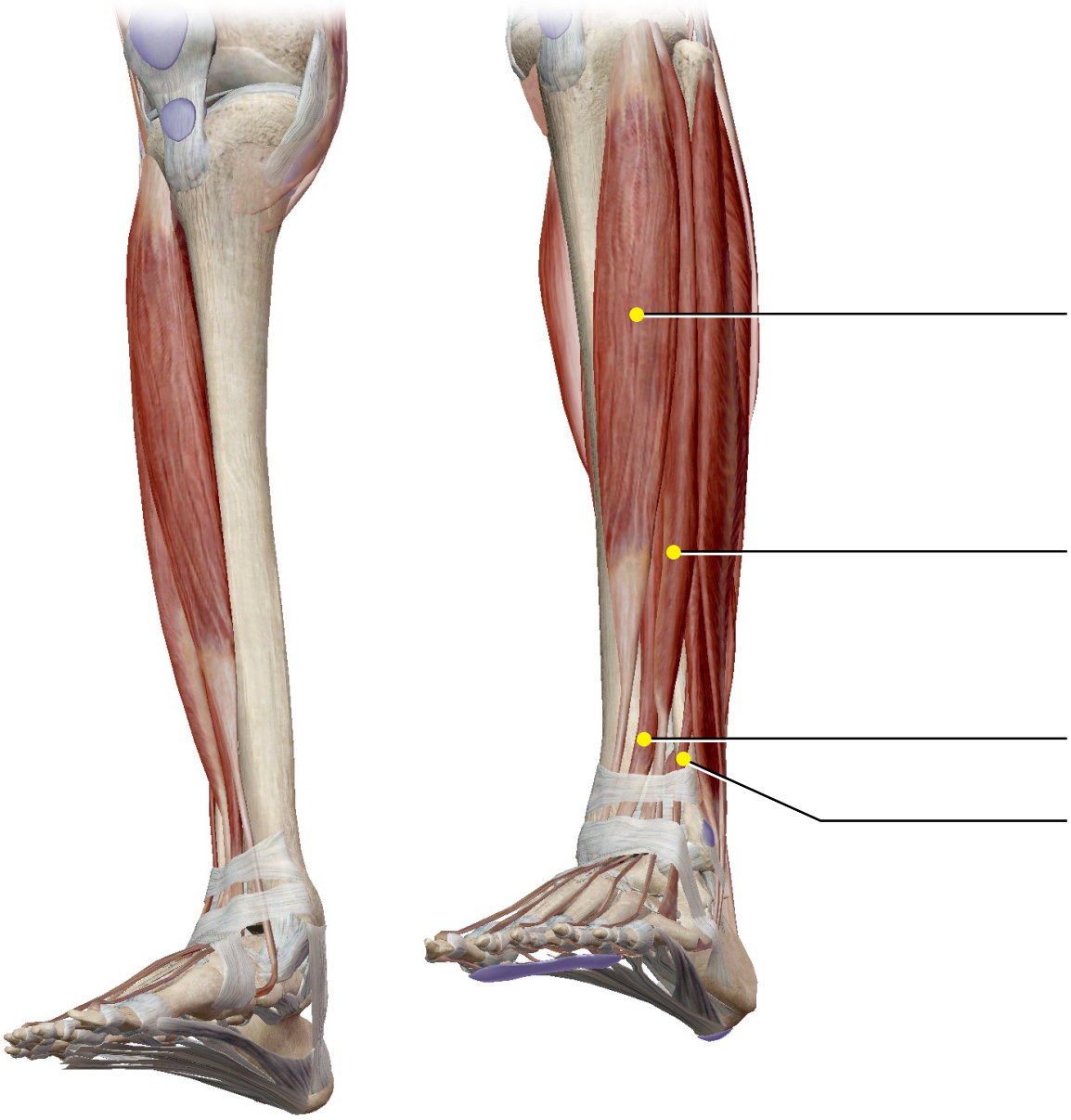
16.51 Thigh: Medial Compartment



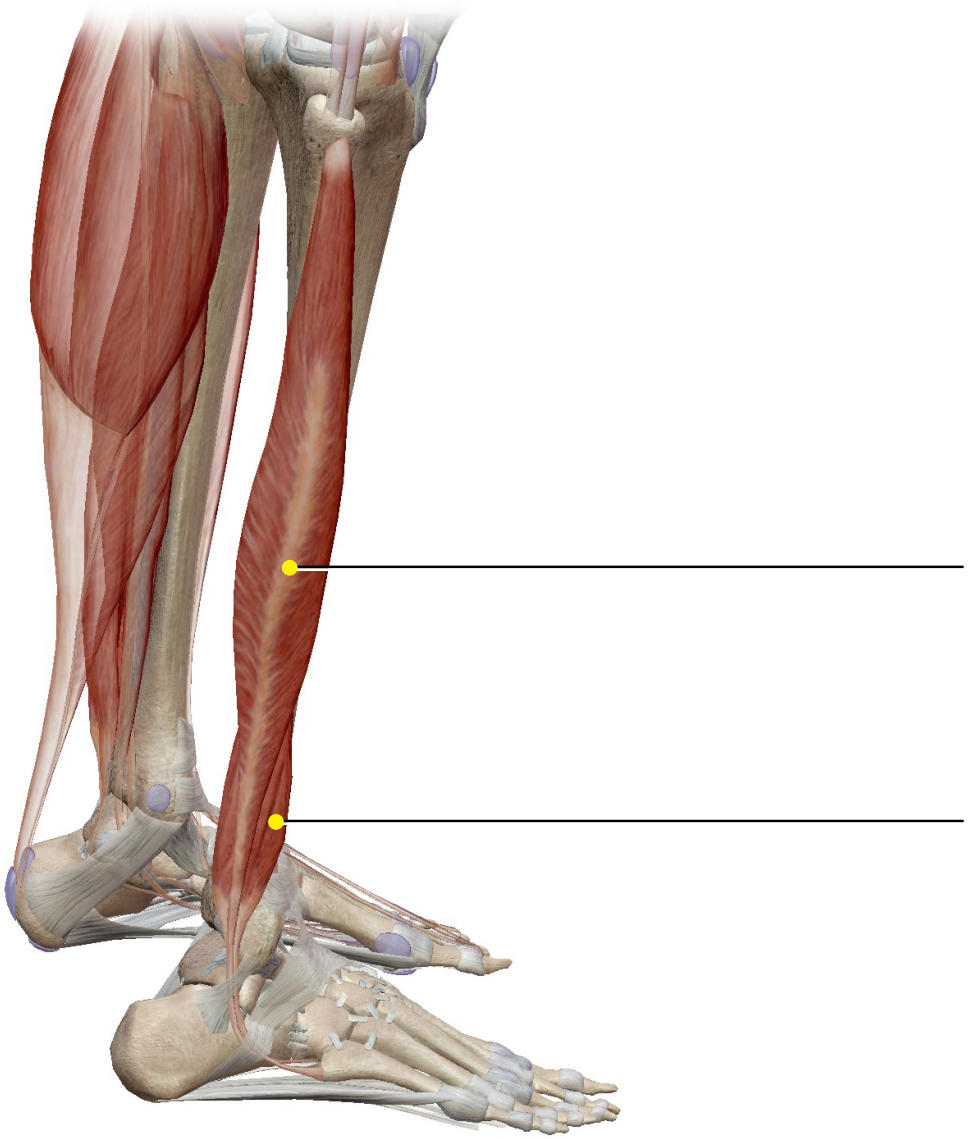
16.53 Thigh: Posterior Compartment (Hamstrings)



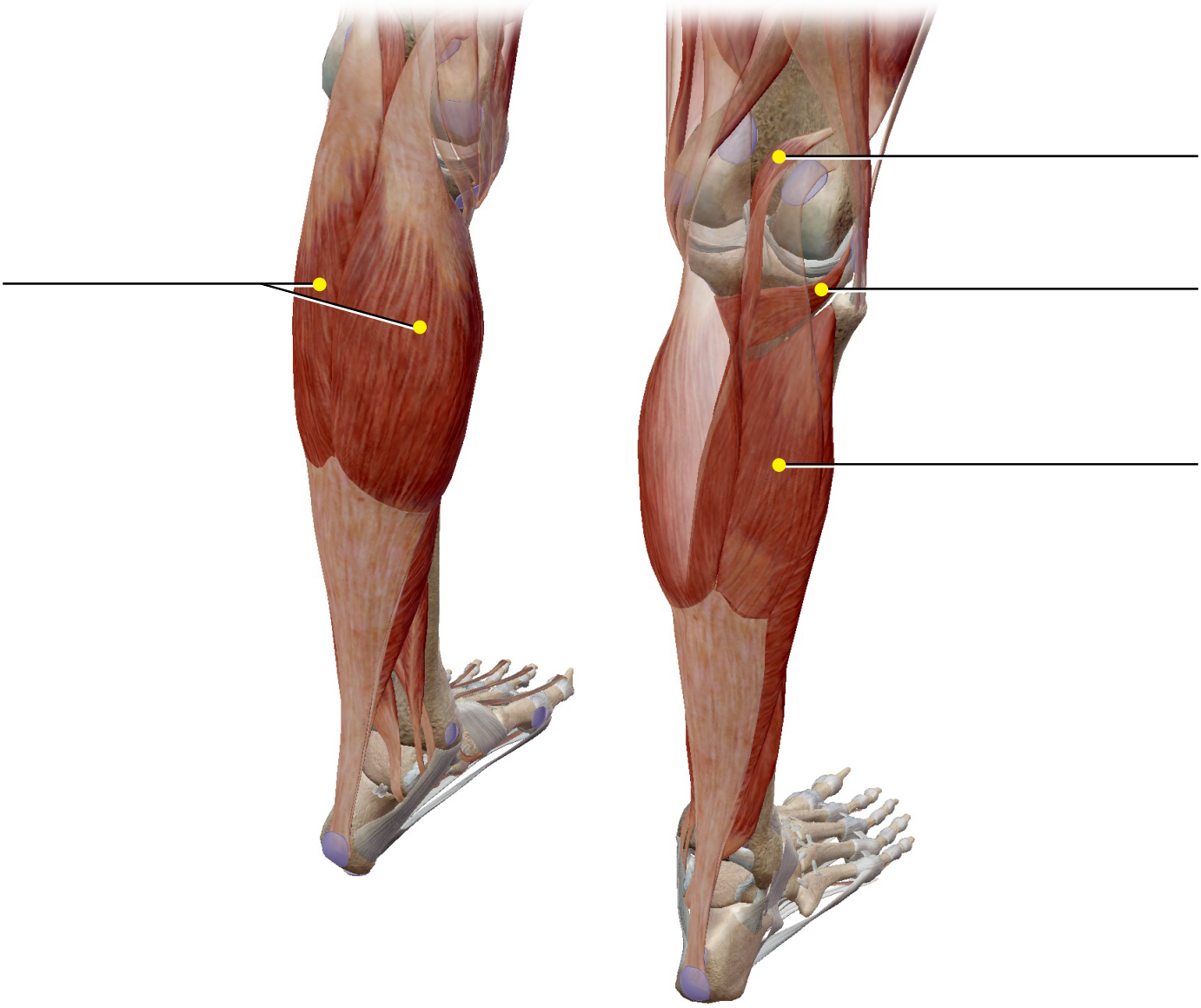
16.54 Lower Leg: Anterior Compartment



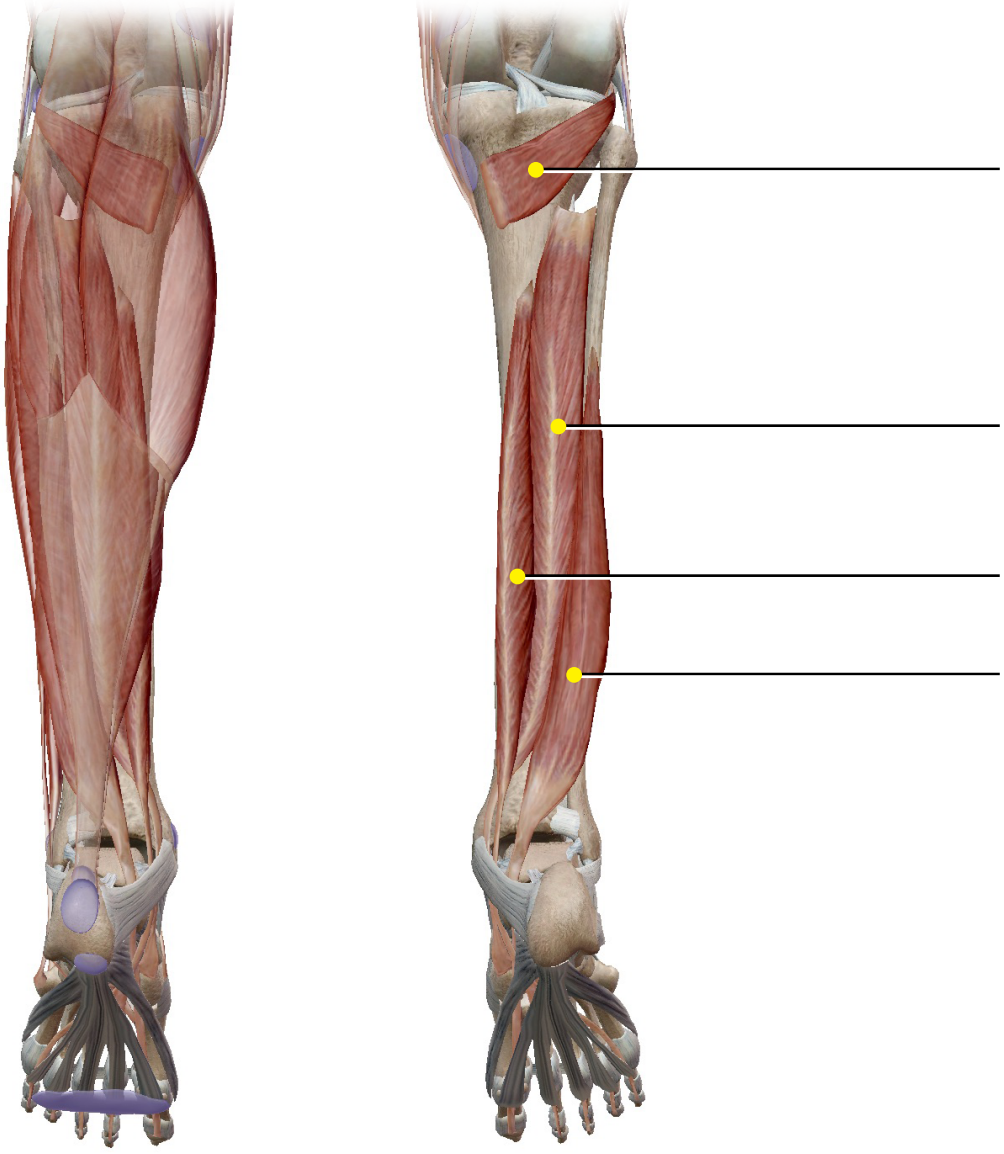
16.55 Lower Leg: Lateral Compartment



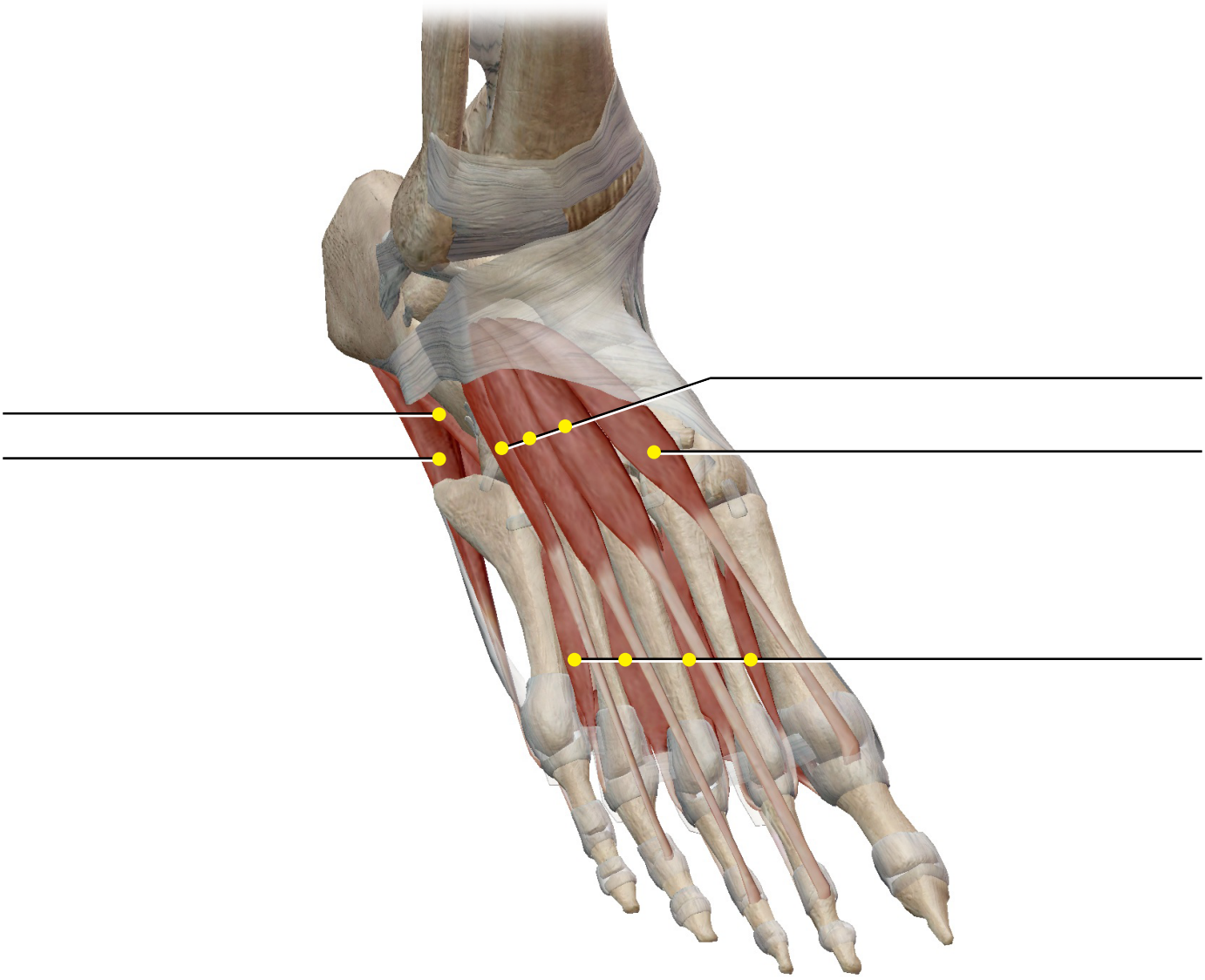
16.56 Lower Leg: Posterior Compartment (Superficial)



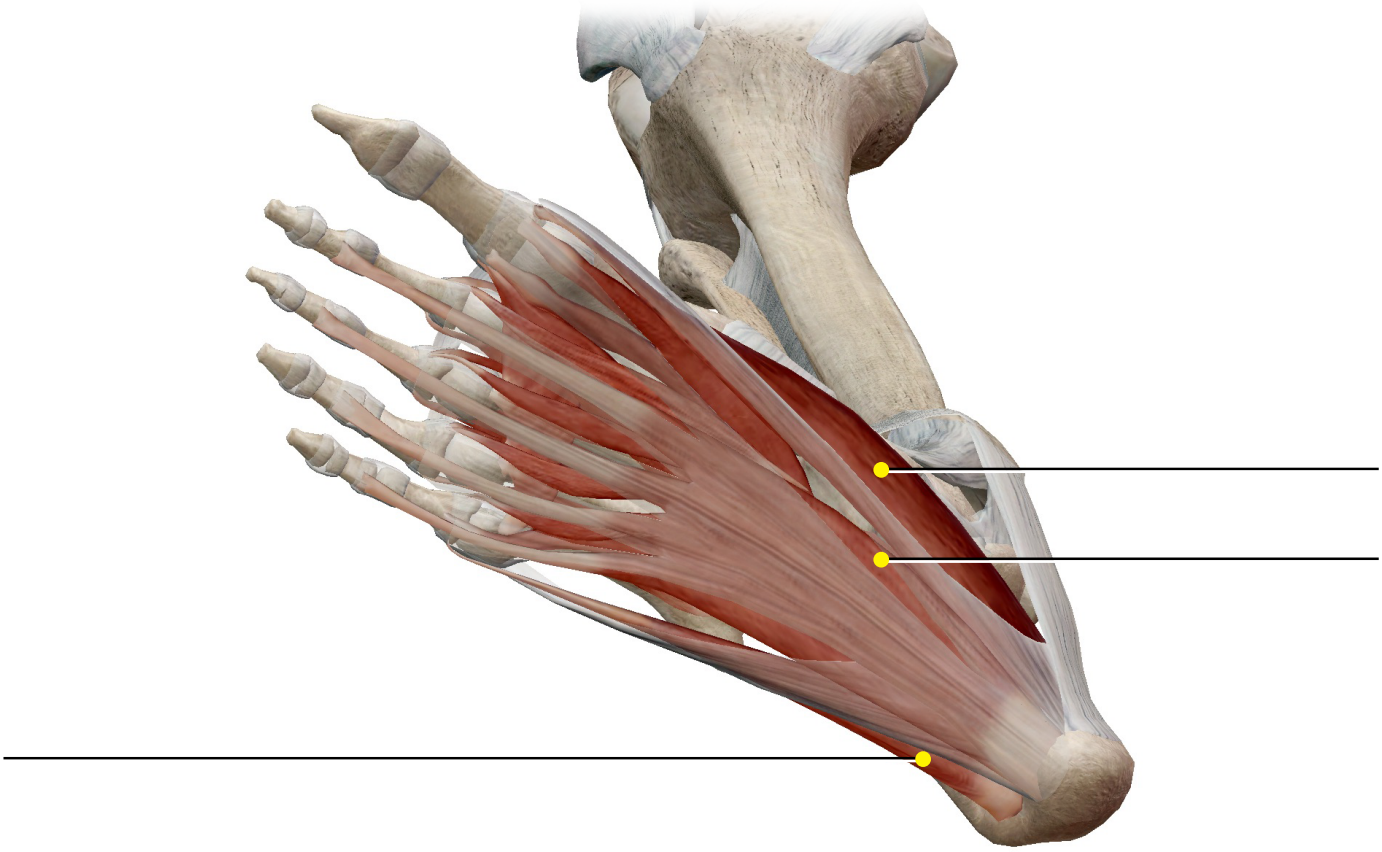
16.57 Lower Leg: Posterior Compartment (Deep)



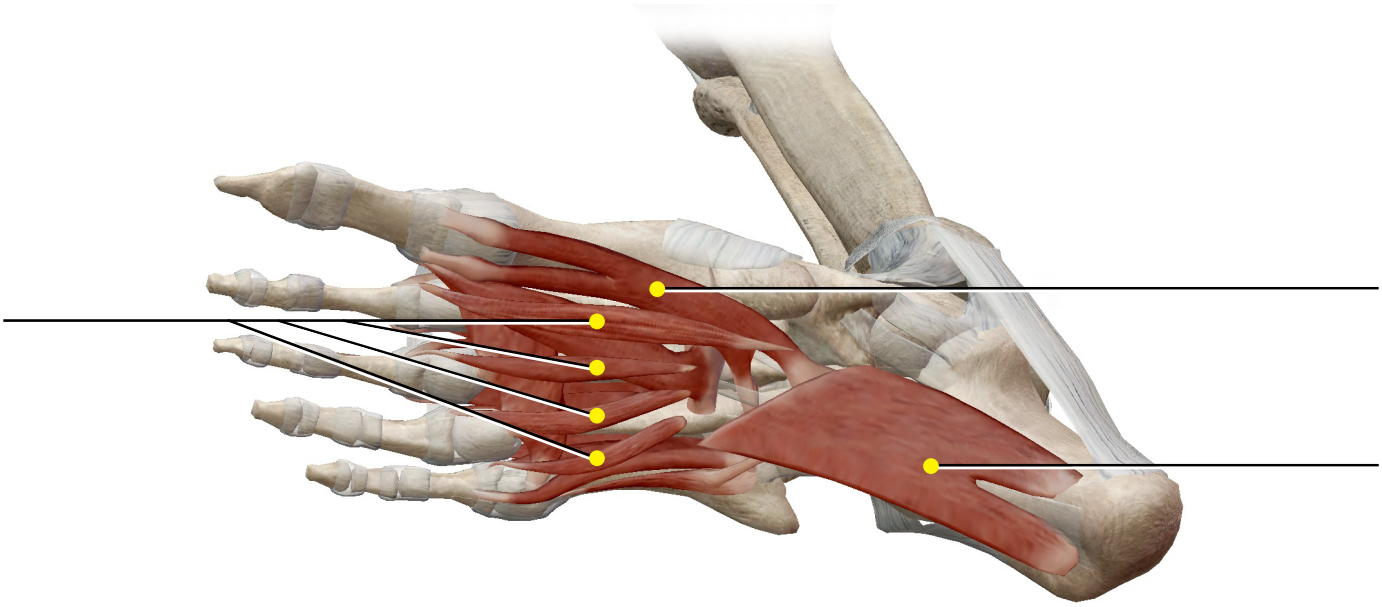
16.58 Foot: Dorsum



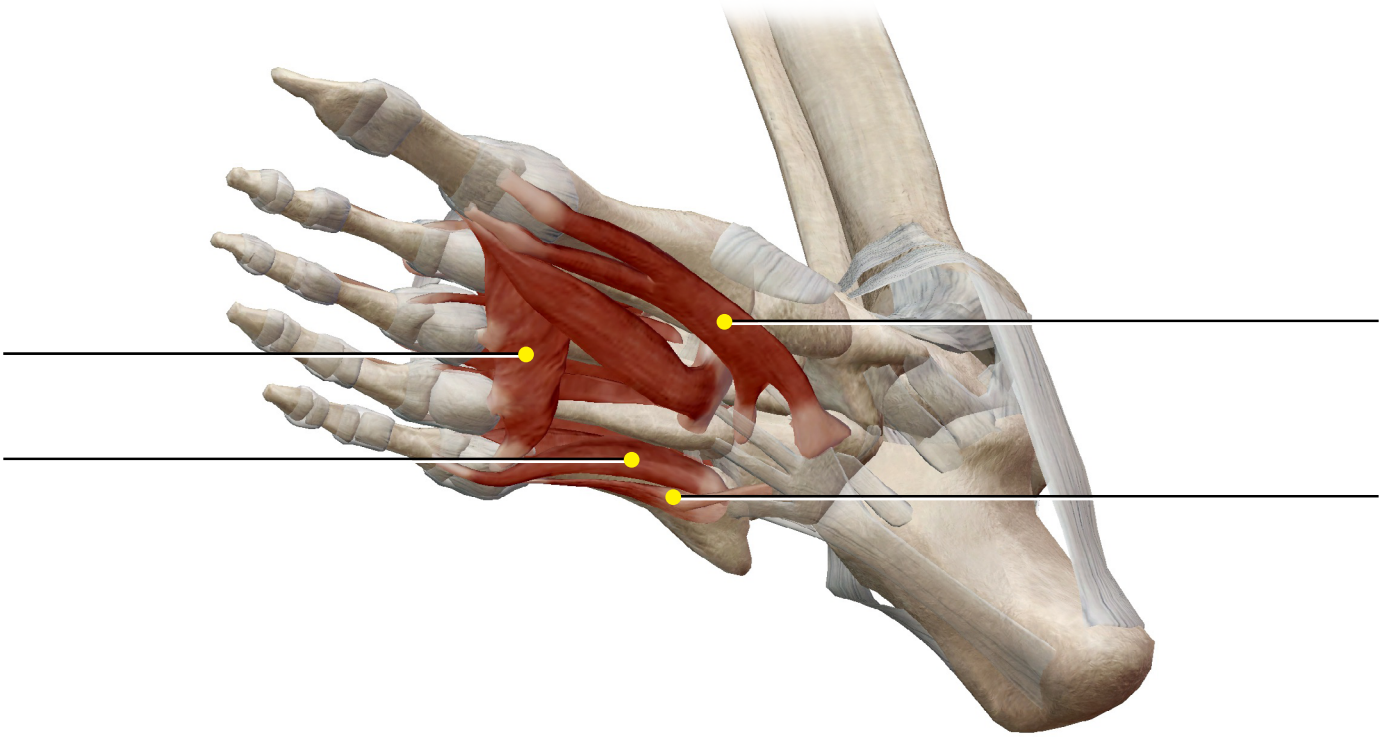
16.59 Foot: Plantar Layer 1



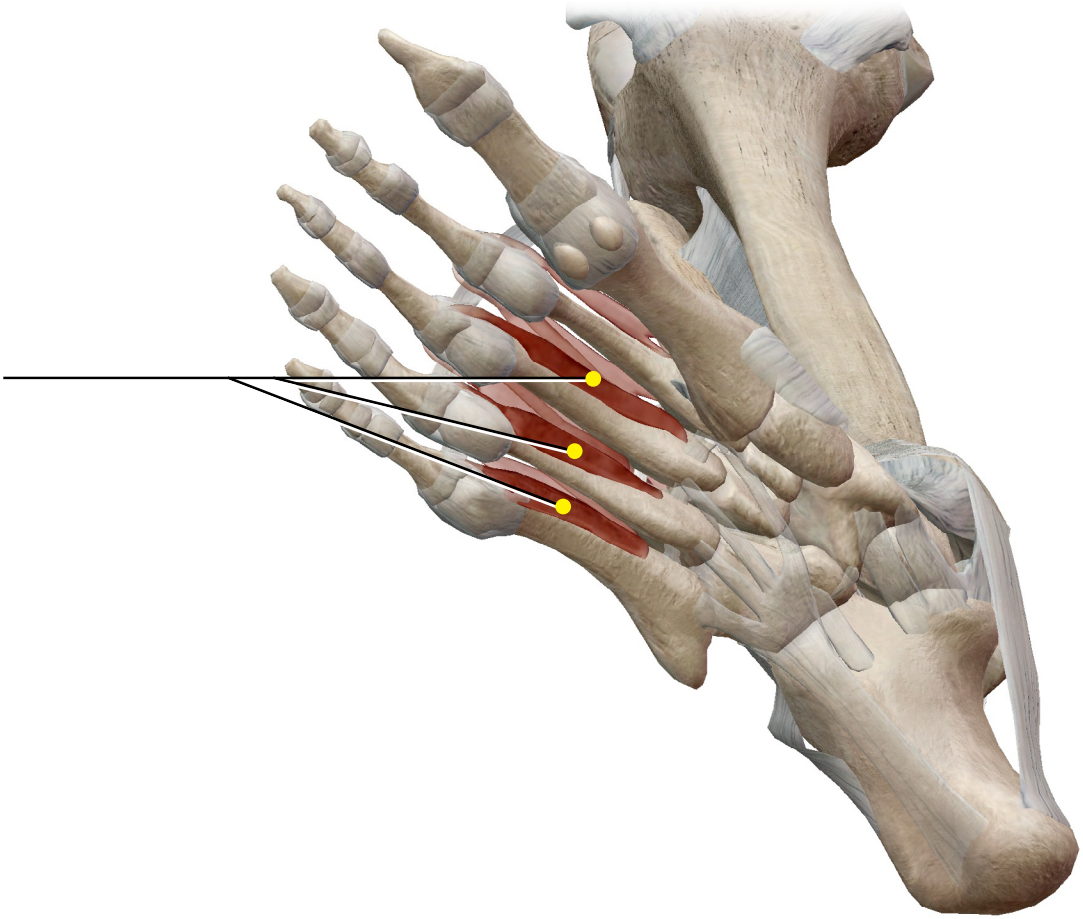
16.60 Foot: Plantar Layer 2



16.61 Foot: Plantar Layer 3



16.62 Foot: Plantar Layer 4



16.62 Foot: Plantar Layer 4