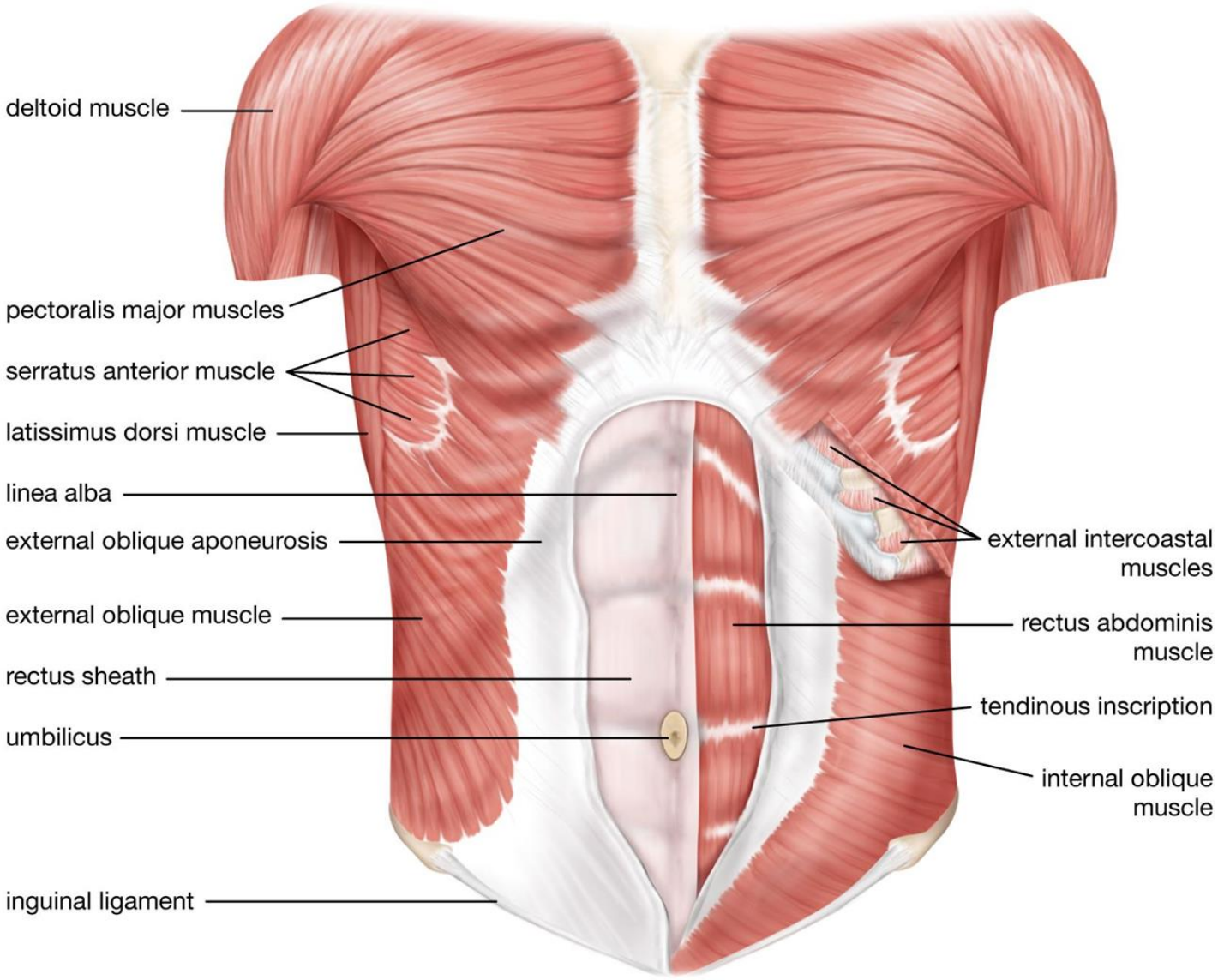
ANATOMY AND PHYSIOLOGY (C.I.)

HUMAN ANATOMY
(Mod. A)

THE MUSCULAR SYSTEM

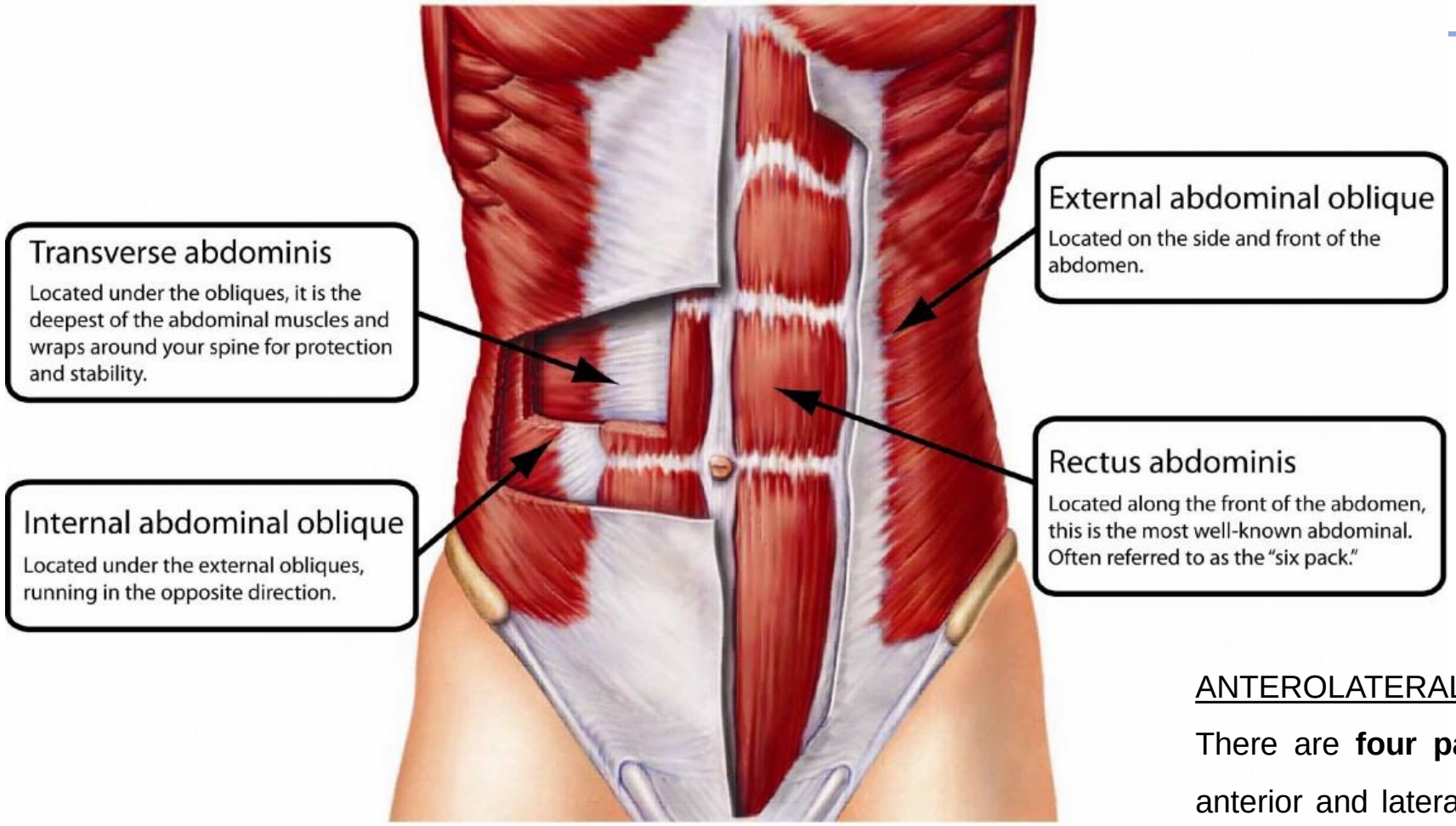
AXIAL MUSCLES OF THE THORAX AND ABDOMINAL WALL



The **abdominal wall** encloses the abdominal cavity and:

- keeps the abdominal viscera in the abdominal cavity and assists the viscera in maintaining their anatomical position against gravity;
- protects the abdominal viscera from injury;
- is involved in any action (coughing, vomiting, defecation) that increases intra-abdominal pressure.

MUSCLES OF THE ABDOMEN



ANTEROLATERAL ABDOMINAL MUSCLES

There are **four pairs of abdominal muscles** that cover the anterior and lateral abdominal region and meet at the anterior midline.

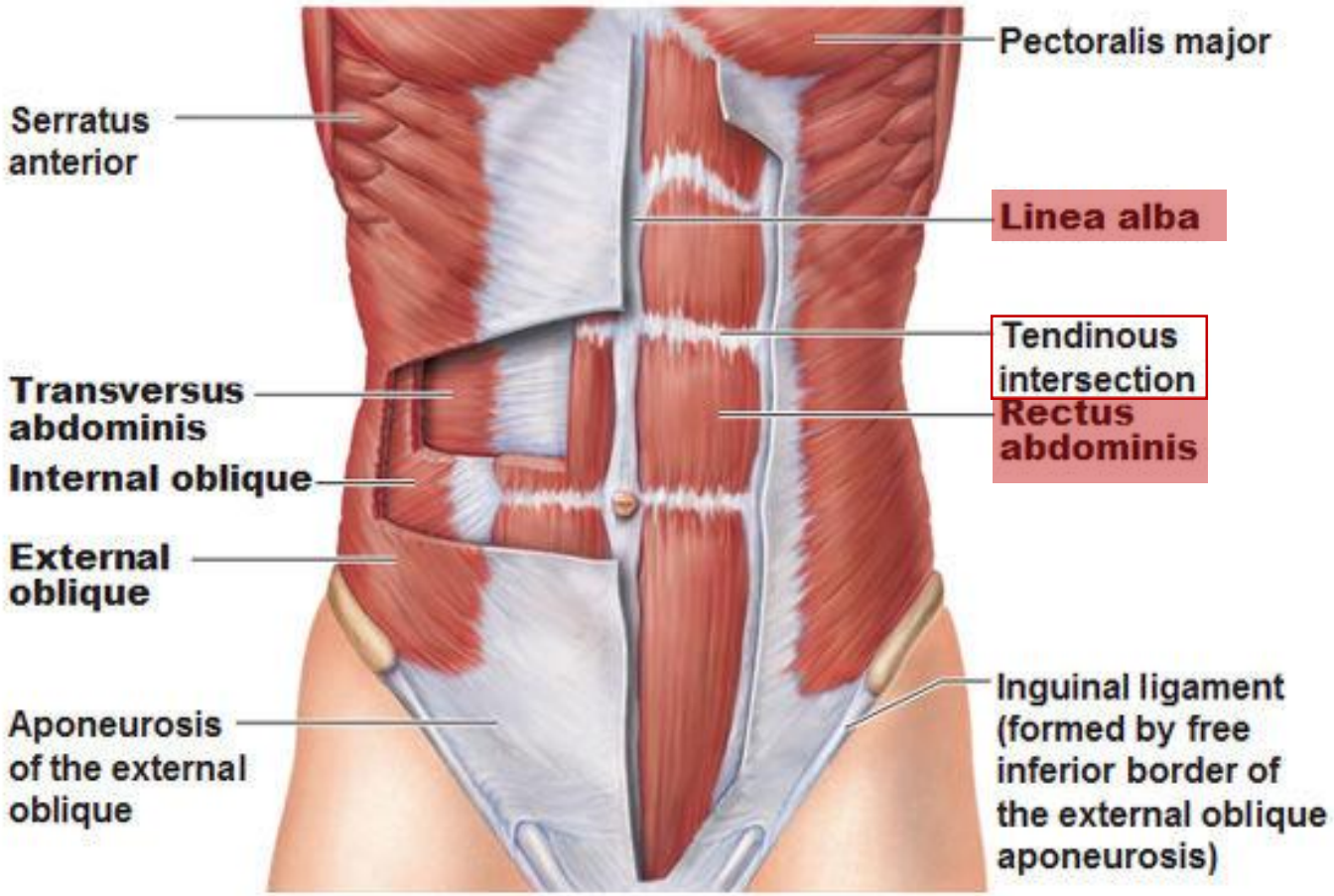
These muscles of the anterolateral abdominal wall are:

the **EXTERNAL OBLIQUES**

the **INTERNAL OBLIQUES**

the **TRANSVERSUS ABDOMINIS**

the **RECTUS ABDOMINIS**

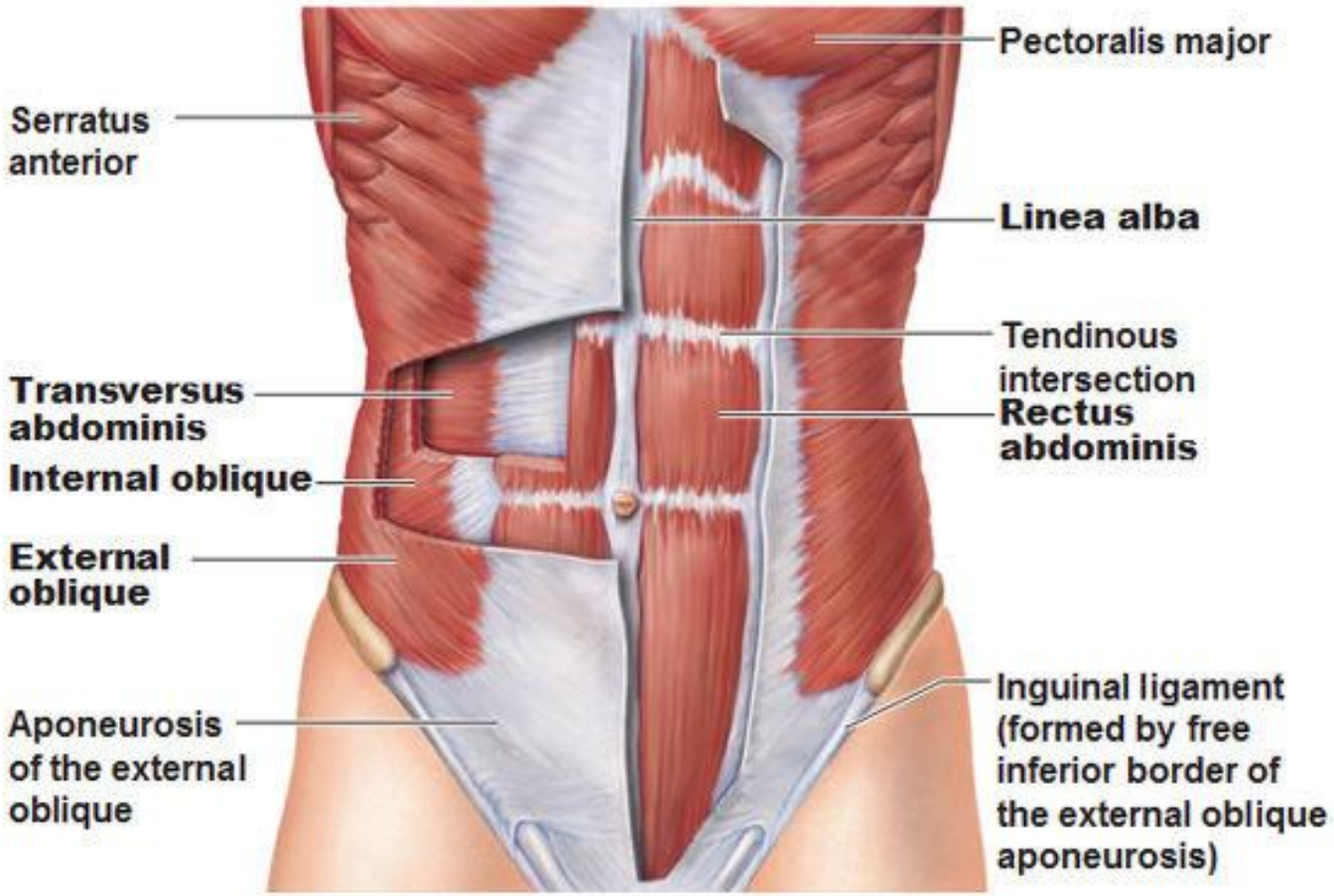


The medially located **RECTUS ABDOMINIS**, a pair of long, linear muscles, commonly called the “sit-up” muscles, originate at the pubic crest and symphysis, and extend the length of the body’s trunk.

Each muscle is segmented by three transverse bands of collagen fibers called the *tendinous intersections*.

This results in the look of “six-pack abs,” as each segment hypertrophies on individuals who do many sit-up.

The rectus abdominis is covered by a sheet of connective tissue called the **rectus sheath**. The bilateral rectus sheaths join at the anterior midline of the abdomen and form a white, fibrous band named **LINEA ALBA**.



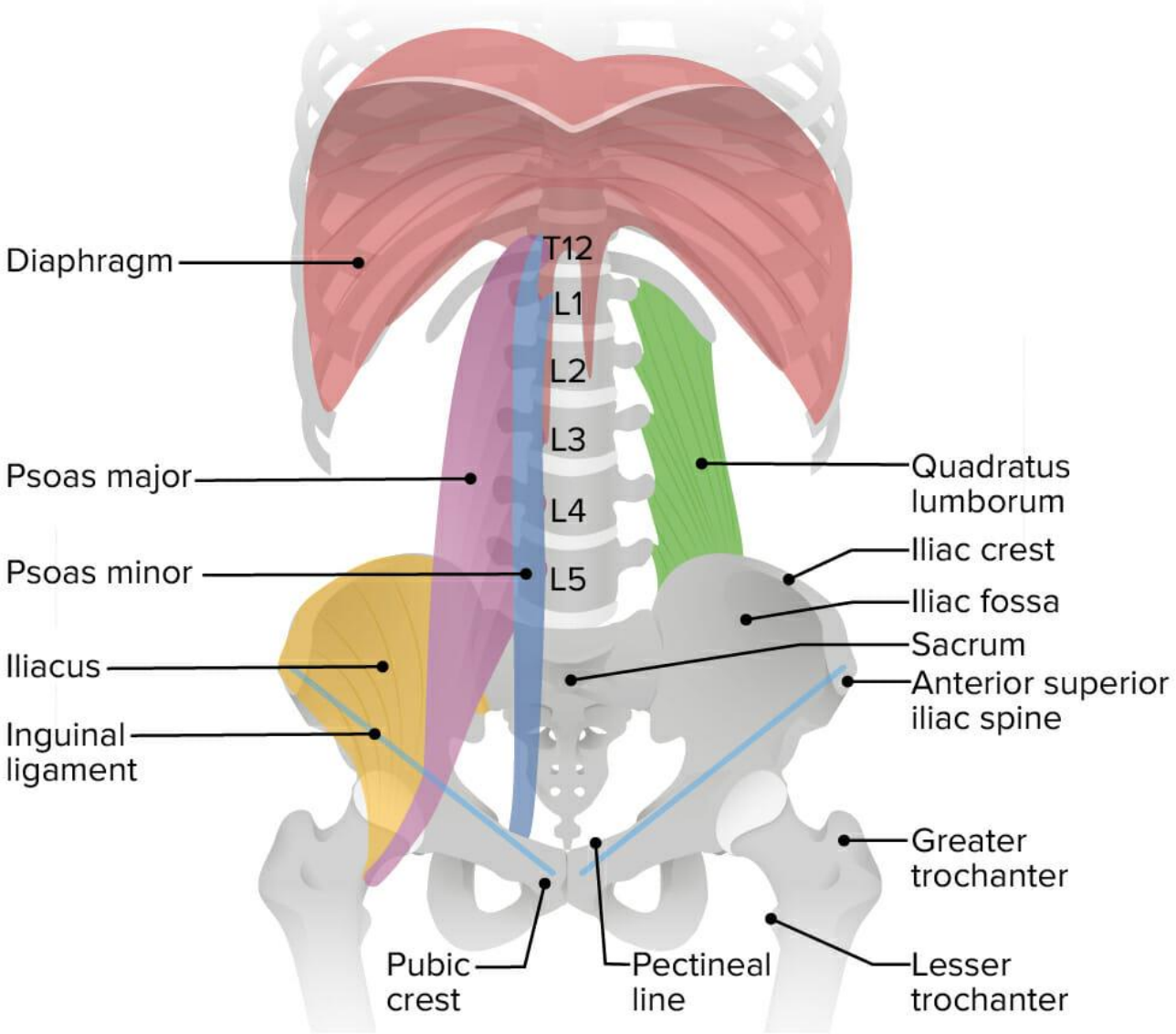
On the flanks of the body, lateral to the rectus abdominis, the abdominal wall is composed of **three layers**:

the **EXTERNAL OBLIQUE MUSCLES** form the superficial layer

the **INTERNAL OBLIQUE MUSCLES** form the middle layer

the **TRANSVERSUS ABDOMINIS** forms the deepest layer

- ✓ This arrangement of three bands of muscles in different orientations allows various movements and rotations of the trunk.
- ✓ The three layers of muscle also help to protect the internal abdominal organs in an area where there is no bone.



POSTERIOR ABDOMINAL MUSCLES

There are 4 muscles in the posterior abdominal wall: the iliacus, psoas major, psoas minor, the **QUADRATUS LUMBORUM**.

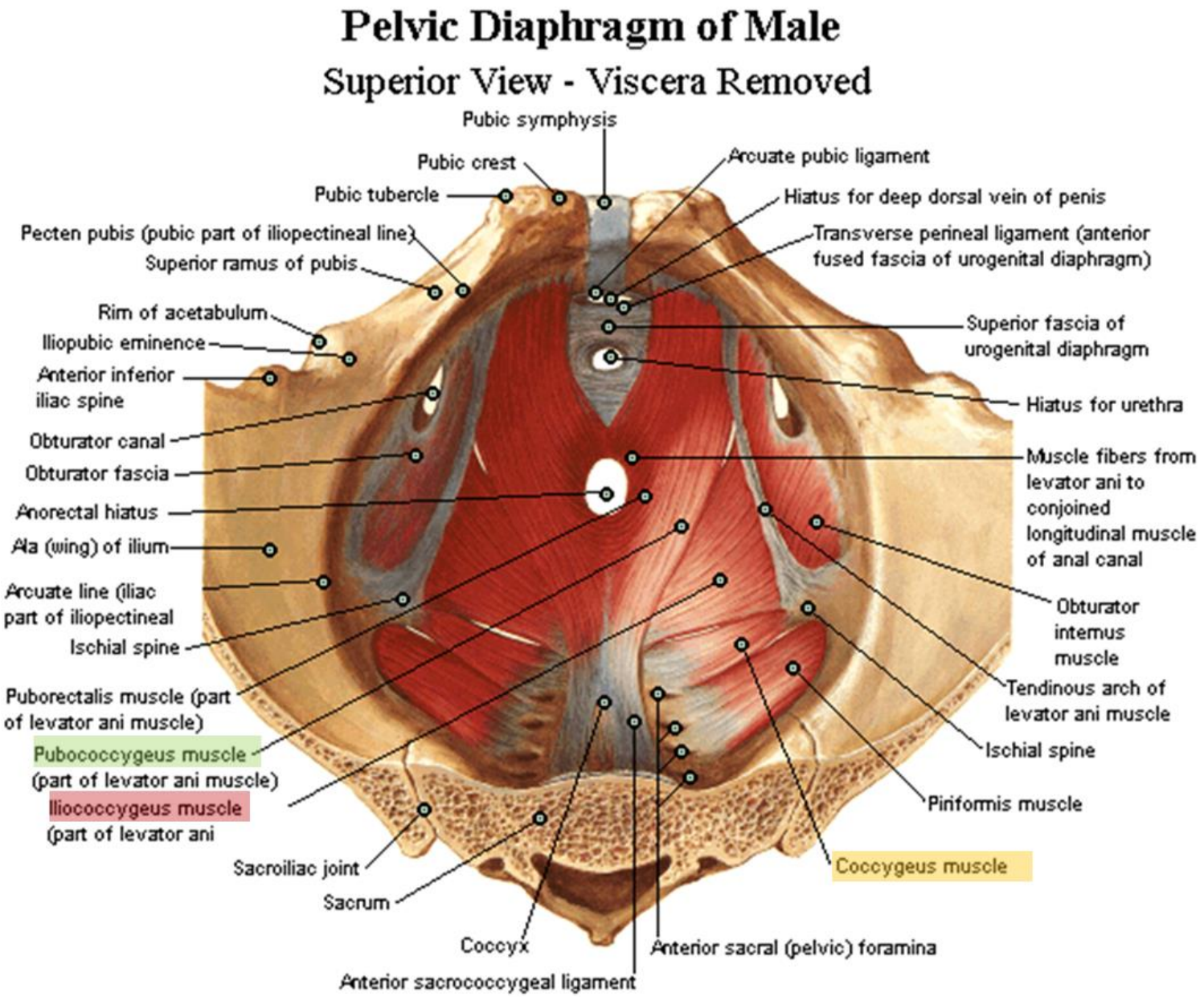
These muscles:

- play a key role in stabilizing the rest of the body and maintaining posture;
- move the lumbar spine but also assist in femur movements.

Muscles of the Abdomen

Movement	Target	Target motion direction	Prime mover	Origin	Insertion
Twisting at waist; also bending to the side	Vertebral column	Supination; lateral flexion	External obliques; internal obliques	Ribs 5–12; ilium	Ribs 7–10; linea alba; ilium
Squeezing abdomen during forceful exhalations, defecation, urination, and childbirth	Abdominal cavity	Compression	Transversus abdominis	Ilium; ribs 5–10	Sternum; linea alba; pubis
Sitting up	Vertebral column	Flexion	Rectus abdominis	Pubis	Sternum; ribs 5 and 7
Bending to the side	Vertebral column	Lateral flexion	Quadratus lumborum	Ilium; ribs 5–10	Rib 12; vertebrae L1–L4

The muscle of the abdomen are mainly innervated by the THORACOABDOMINAL NERVES
The external obliques are also innervated by the subcostal nerve.
The internal obliques and transversus abdominis are also inneravated by the branches of the lumbar plexus.
Quadratus lumborum is innervated by the subcostal nerve.



The pelvic floor is a muscular sheet that defines the inferior portion of the pelvic cavity.
It is constituted by the **PELVIC DIAPHRAGM**, which closes the pelvic outlet.

It consists of different muscles:

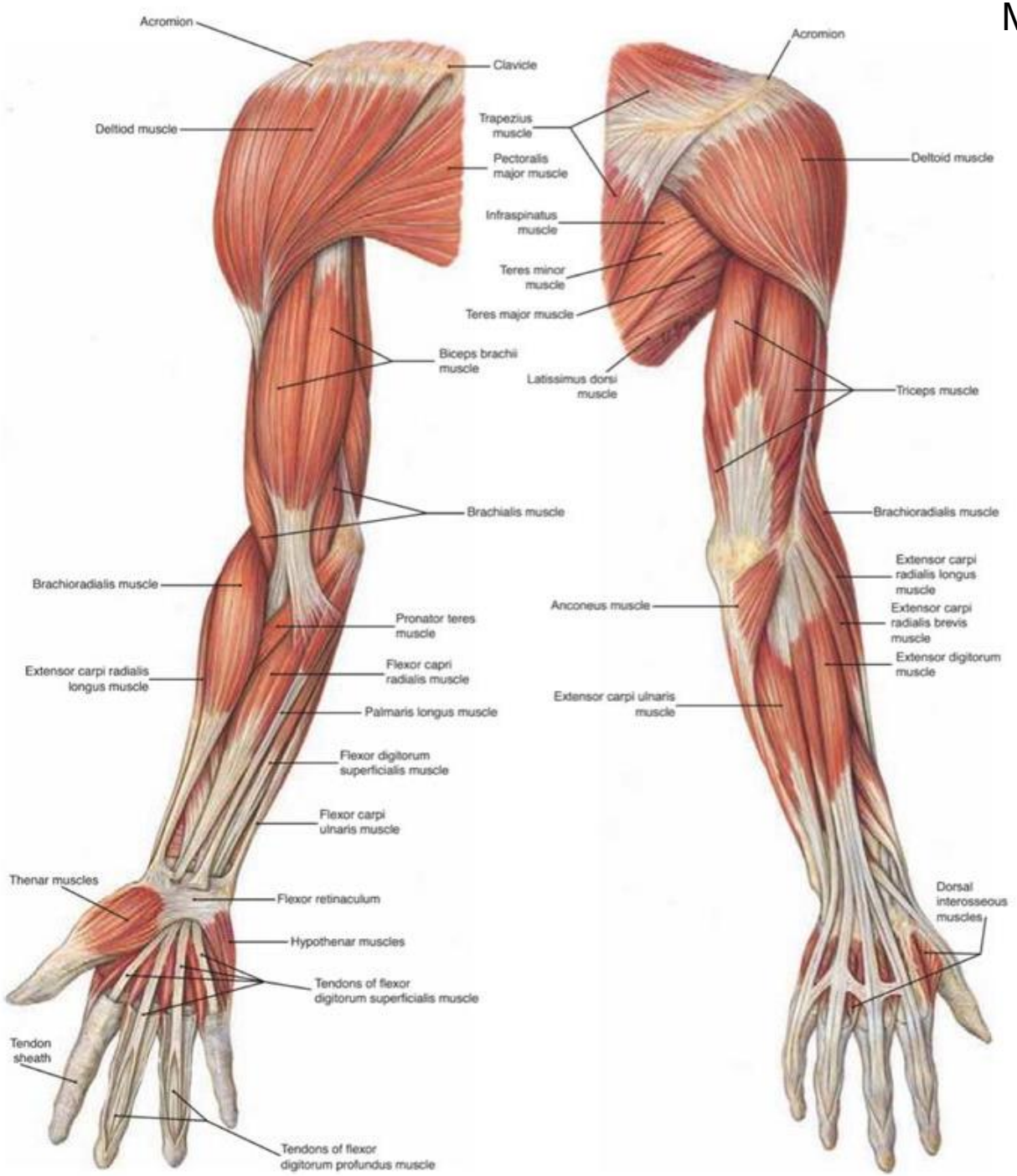
The main muscle is the
LEVATOR ANI
Which consists of two skeletal muscles**, the pubococcygeus and** costituito a sua volta da due componenti fondamentali:
- the **pubococcygeus**
- the **iliococcygeus**

Another muscle is the **ischiococcygeus** (from the coccyx to the ischiatic spine)

The levator ani is considered the most important muscle of the pelvic floor because it supports the pelvic viscera. It resists the pressure produced by contraction of the abdominal muscles so that the pressure is applied i) to the colon, to aid in defecation and ii) to the uterus, to aid in childbirth (assisted by the ischiococcygeus, which pulls the coccyx anteriorly).

APPENDICULAR MUSCLES
Muscles of the Pectoral Girdle and Upper Limbs

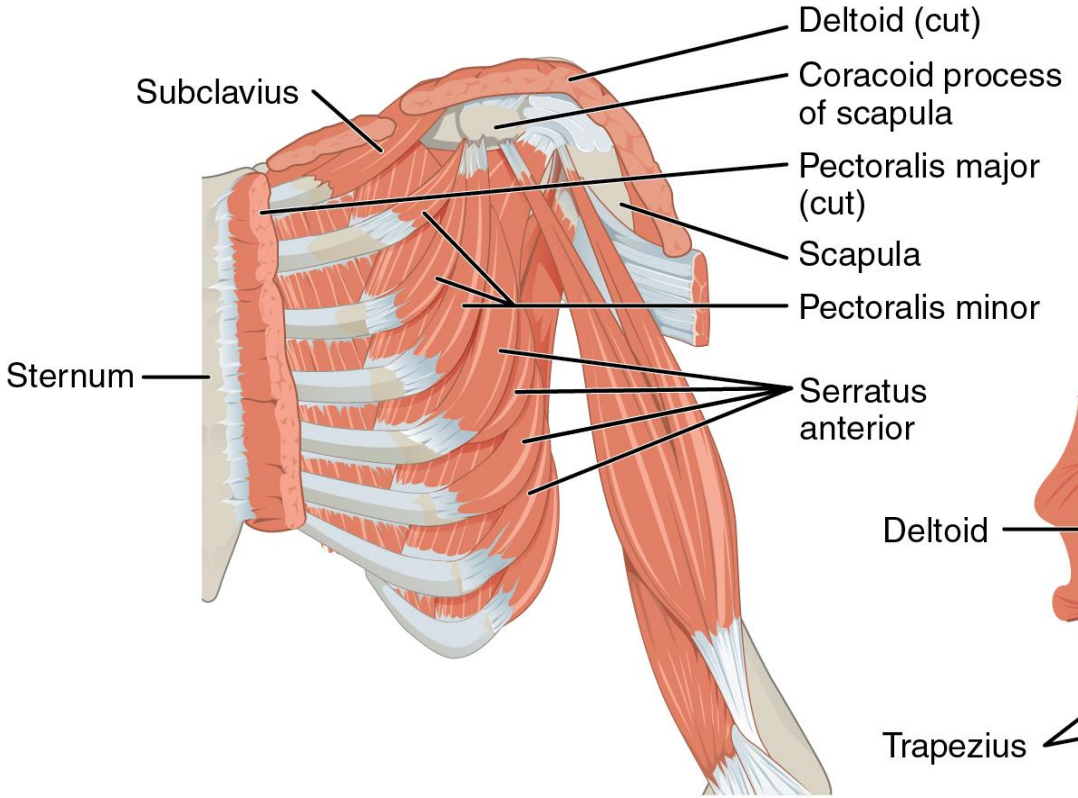
MUSCLES OF THE PECTORAL GIRDLE AND UPPER LIMBS



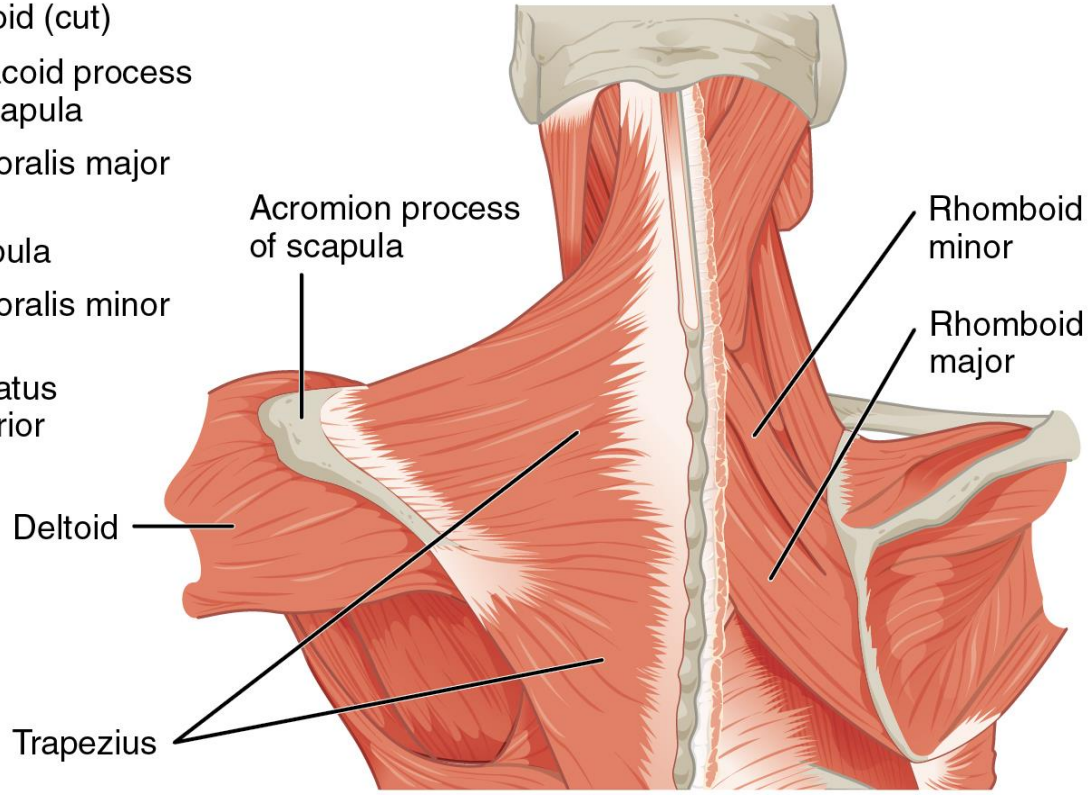
Muscles of the shoulder and upper limb can be divided into four groups:

- muscles that stabilize and position the pectoral girdle,
- muscles that move the arm,
- muscles that move the forearm,
- muscles that move the wrists, hands, and fingers.

MUSCLES OF THE PECTORAL GIRDLE



Pectoral girdle muscle (left anterior lateral view)



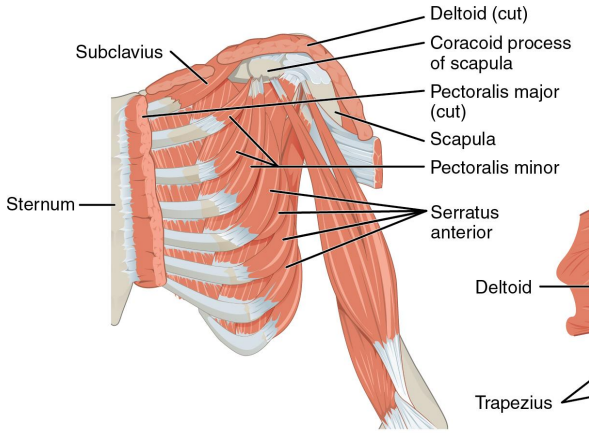
Pectoral girdle muscles (posterior view)

Muscles that position the pectoral girdle are located either on the anterior thorax or on the posterior thorax.

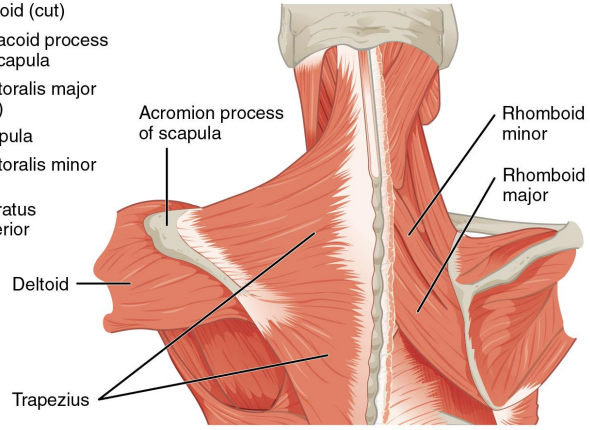
- ✓ The anterior muscles include the **subclavius**, **pectoralis minor**, and **serratus anterior**.
- ✓ The posterior muscles include the **trapezius**, **rhomboid major**, and **rhomboid minor**.

When the rhomboids are contracted, your scapula moves medially, which can pull the shoulder and upper limb posteriorly.

MUSCLES OF THE PECTORAL GIRDLE



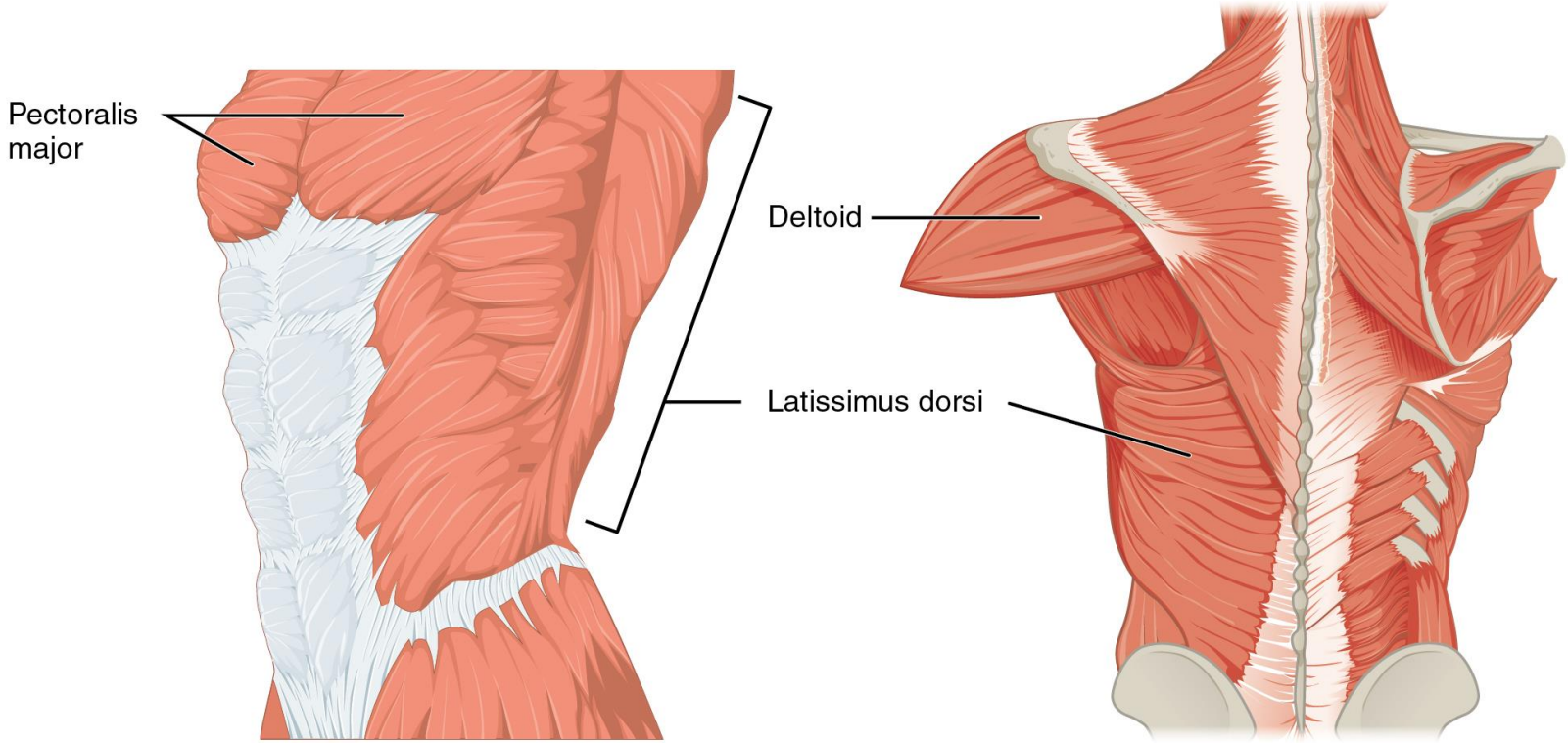
Pectoral girdle muscle (left anterior lateral view)



Pectoral girdle muscles (posterior view)

Position in the thorax	Movement	Target	Target motion direction	Prime mover	Origin	Insertion
Anterior thorax	Stabilizes clavicle during movement by depressing it	Clavicle	Depression	Subclavius	First rib	Inferior surface of clavicle
Anterior thorax	Rotates shoulder anteriorly (throwing motion); assists with inhalation	Scapula; ribs	Scapula: depresses; ribs: elevates	Pectoralis minor	Anterior surfaces of certain ribs (2–4 or 3–5)	Coracoid process of scapula
Anterior thorax	Moves arm from side of body to front of body; assists with inhalation	Scapula; ribs	Scapula: protracts; ribs: elevates	Serratus anterior	Muscle slips from certain ribs (1–8 or 1–9)	Anterior surface of vertebral border of scapula
Posterior thorax	Elevates shoulders (shrugging); pulls shoulder blades together; tilts head backwards	Scapula; cervical spine	Scapula: rotests inferiorly, retracts, elevates, and depresses; spine: extends	Trapezius	Skull; vertebral column	Acromion and spine of scapula; clavicle
Posterior thorax	Stabilizes scapula during pectoral girdle movement	Scapula	Retracts; rotates inferiorly	Rhomboid major	Thoracic vertebrae (T2–T5)	Medial border of scapula
Posterior thorax	Stabilizes scapula during pectoral girdle movement	Scapula	Retracts; rotates inferiorly	Rhomboid minor	Cervical and thoracic vertebrae (C7 and T1)	Medial border of scapula

MUSCLES THAT MOVE THE ARM



(a) Pectoralis major and latissimus dorsi (left anterior lateral view)

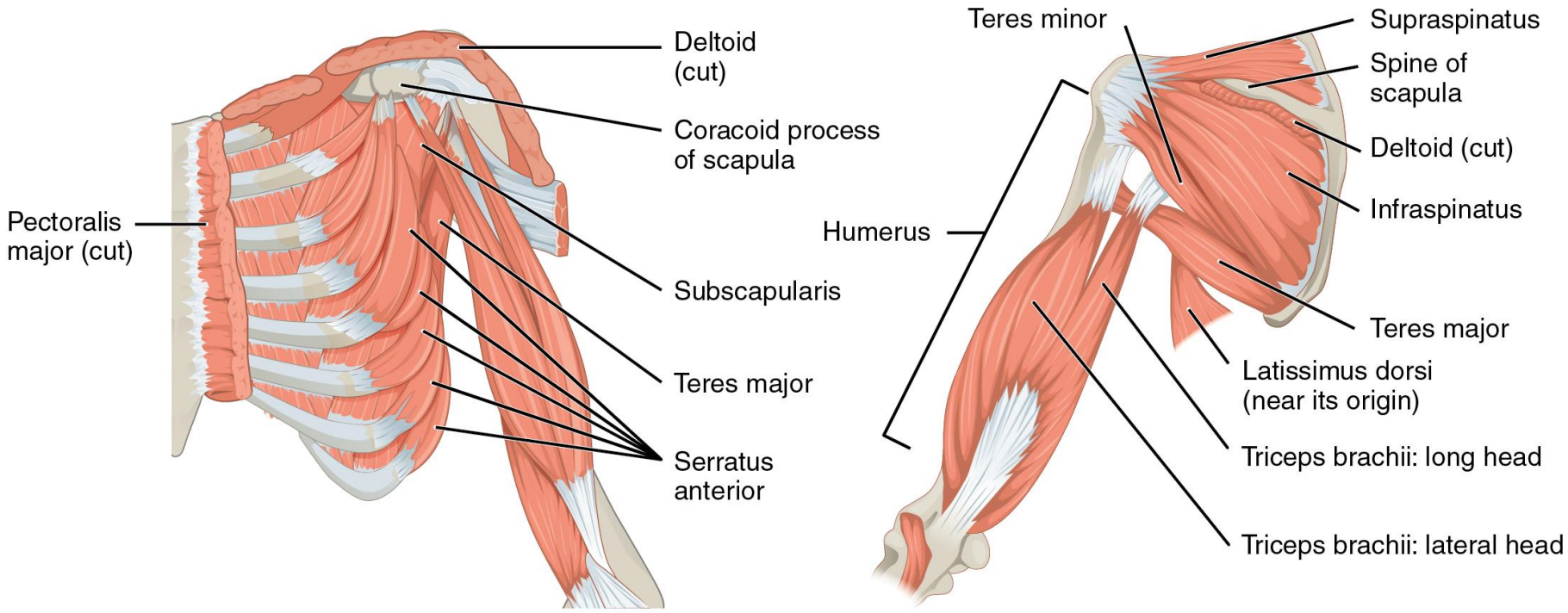
(b) Left deltoid and left latissimus dorsi (posterior view)

Muscles that cross the shoulder joint and move the humerus bone of the arm include both axial and scapular muscles.

The two axial muscles are the **pectoralis major** and the **latissimus dorsi**.

The pectoralis major is thick and fan-shaped, covering much of the superior portion of the anterior thorax.

The broad, triangular latissimus dorsi is located on the inferior part of the back, where it inserts into a thick connective tissue sheath called an aponeurosis.



(c) Deep muscles of the left shoulder (anterior lateral view)

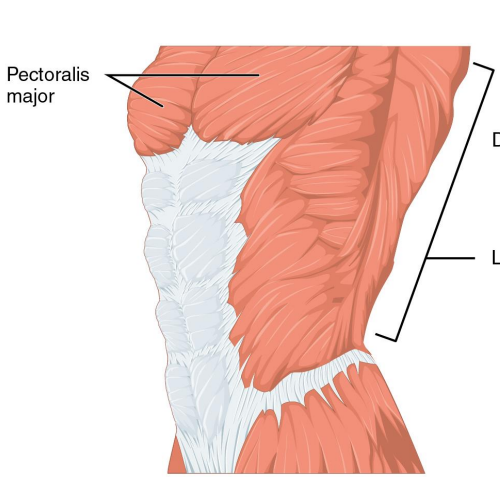
(d) Deep muscles of the left shoulder (posterior view)

The rest of the muscles originate on the scapula. They are:

- the **DELTOID**, the thick muscle that creates the rounded lines of the shoulder; it is the major abductor of the arm, but it also facilitates flexing and medial rotation, as well as extension and lateral rotation.
- the **SUBSCAPULARIS MUSCLE** originates on the anterior scapula and medially rotates the arm.
- named for their locations, the **SUPRASPINATUS** (superior to the spine of the scapula) and the **INFRASPINATUS** (inferior to the spine of the scapula) abduct the arm, and laterally rotate the arm, respectively.
- the thick and flat **TERES MAJOR** is inferior to the teres minor and extends the arm, and assists in adduction and medial rotation of it.
- the long **TERES MINOR** laterally rotates and extends the arm.
- the **CORACOBRACHIALIS** flexes and adducts the arm.

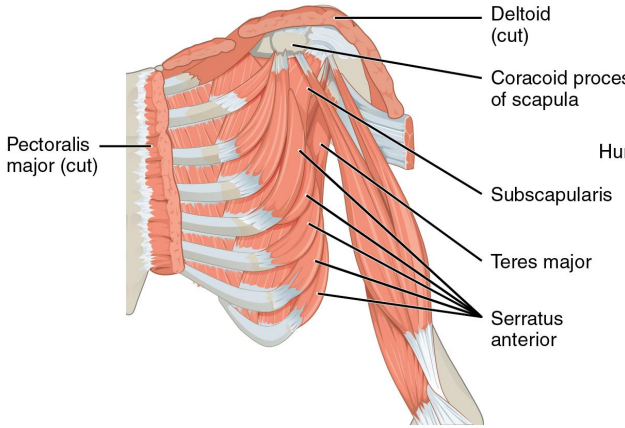
MUSCLES THAT MOVE THE ARM

Movement	Target	Target motion direction	Prime mover	Origin	Insertion
Axial muscles					
Brings elbows together; moves elbow up (as during an uppercut punch)	Humerus	Flexion; adduction; medial rotation	Pectoralis major	Clavicle; sternum; cartilage of certain ribs (1–6 or 1–7); aponeurosis of external oblique muscle	Greater tubercle of humerus
Moves elbow back (as in elbowing someone standing behind you); spreads elbows apart	Humerus; scapula	Humerus: extension, adduction, and medial rotation; scapula: depression	Latissimus dorsi	Thoracic vertebrae (T7–T12); lumbar vertebrae; lower ribs (9–12); iliac crest	Intertubercular sulcus of humerus
Scapular muscles					
Lifts arms at shoulder	Humerus	Abduction; flexion; extension; medial and lateral rotation	Deltoid	Trapezius; clavicle; acromion; spine of scapula	Deltoid tuberosity of humerus
Assists pectoralis major in bringing elbows together and stabilizes shoulder joint during movement of the pectoral girdle	Humerus	Medial rotation	Subscapularis	Subscapular fossa of scapula	Lesser tubercle of humerus
Rotates elbow outwards, as during a tennis swing	Humerus	Abduction	Supraspinatus	Supraspinous fossa of scapula	Greater tubercle of humerus
Rotates elbow outwards, as during a tennis swing	Humerus	Extension; adduction	Infraspinatus	Infraspinous fossa of scapula	Greater tubercle of humerus
Assists with medial rotation at the shoulder	Humerus	Extension; adduction	Teres major	Posterior surface of scapula	Intertubercular sulcus of humerus
Assists infraspinatus in rotating elbow outwards	Humerus	Extension; adduction	Teres minor	Lateral border of dorsal scapular surface	Greater tubercle of humerus
Moves elbow up and across body, as when putting hand on chest	Humerus	Flexion; adduction	Coracobra chialis	Coracoid process of scapula	Medial surface of humerus shaft

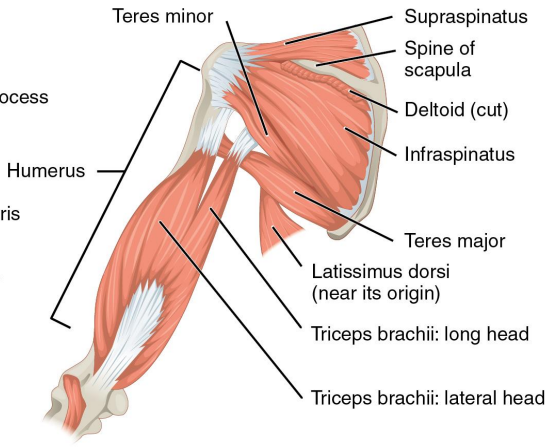


(a) Pectoralis major and latissimus dorsi (left anterior lateral view)

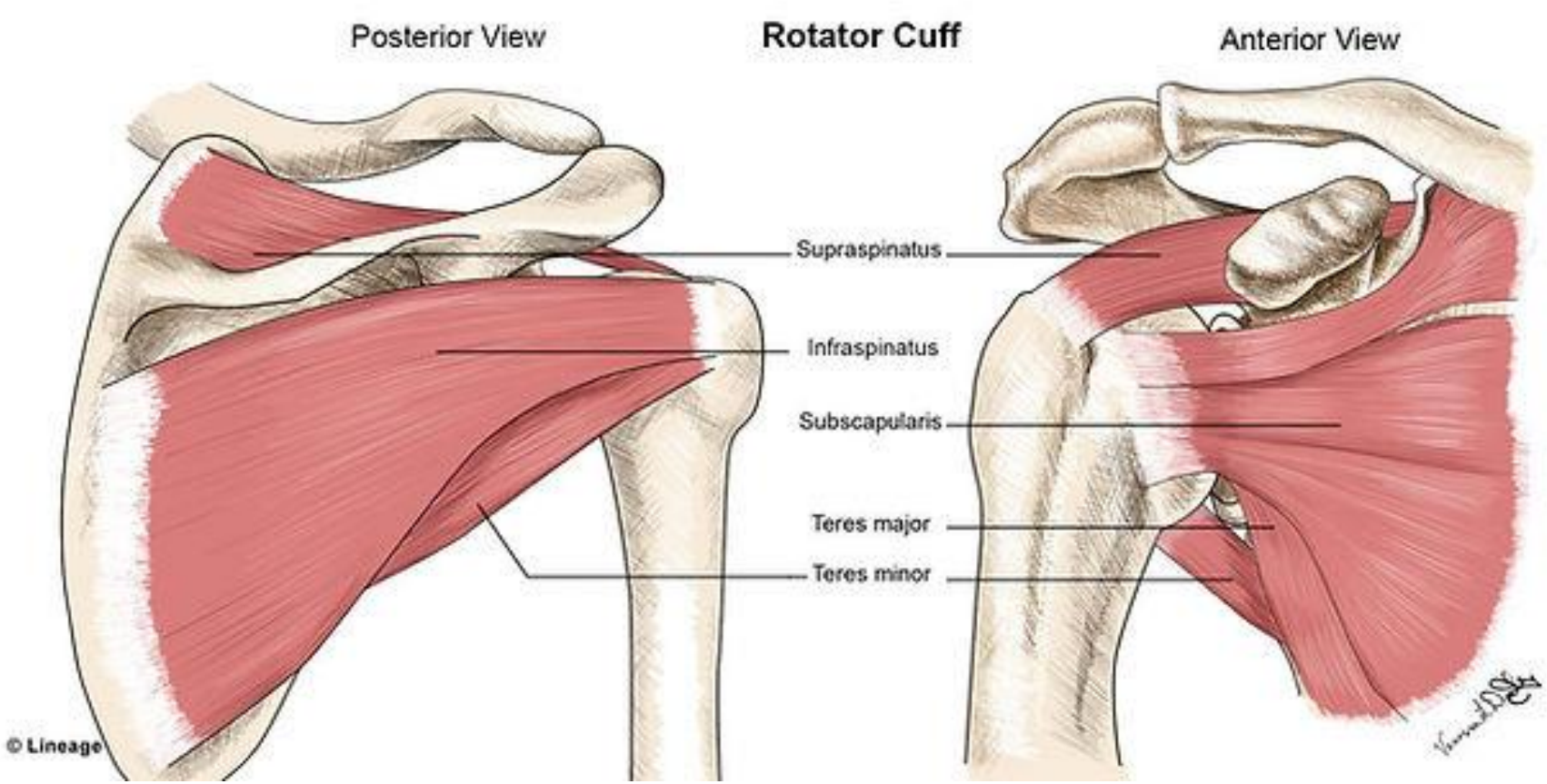
(b) Left deltoid and left latissimus dorsi (posterior view)



(c) Deep muscles of the left shoulder (anterior lateral view)



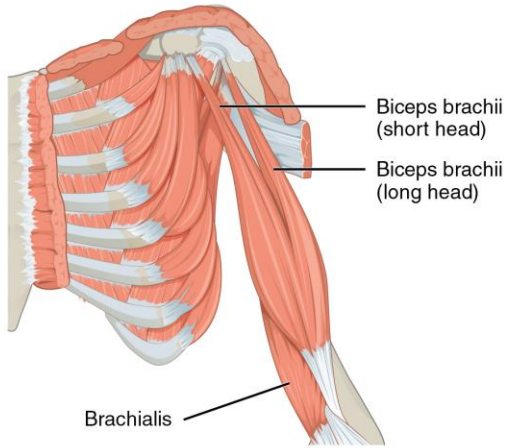
(d) Deep muscles of the left shoulder (posterior view)



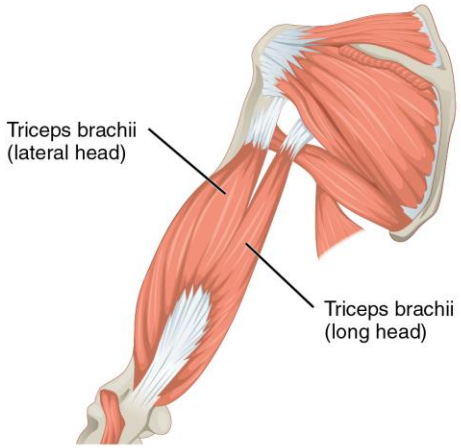
The tendons of the deep subscapularis, supraspinatus, infraspinatus, and teres minor connect the scapula to the humerus, forming the **ROTATOR CUFF** (musculotendinous cuff), *the circle of tendons around the shoulder joint*.
The rotator cuff muscles are important in shoulder movements and in maintaining glenohumeral joint (shoulder joint) stability.

When baseball pitchers undergo shoulder surgery it is usually on the rotator cuff, which becomes pinched and inflamed, and may tear away from the bone due to the repetitive motion of bring the arm overhead to throw a fast pitch.

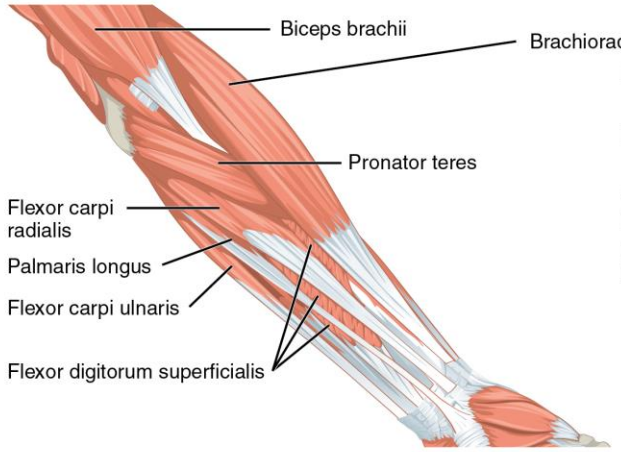
MUSCLES THAT MOVE THE FOREARM



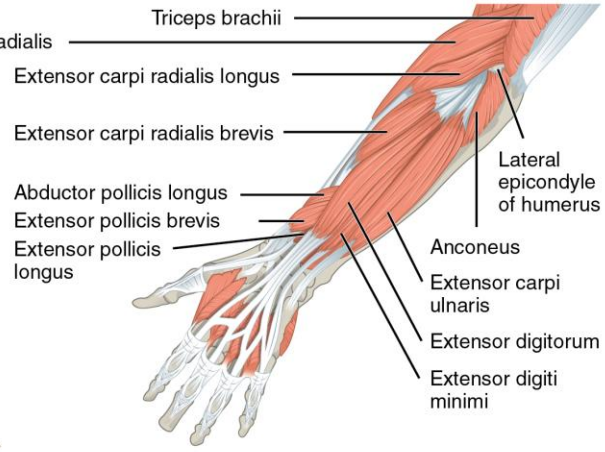
Left upper arm muscles (anterior lateral view)



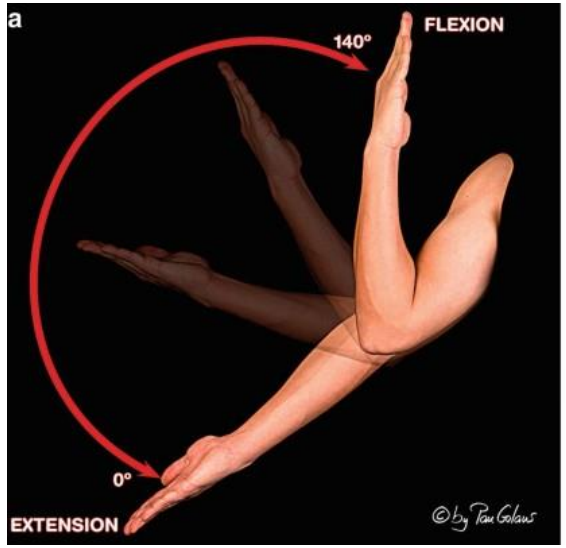
Left upper arm muscles (posterior view)

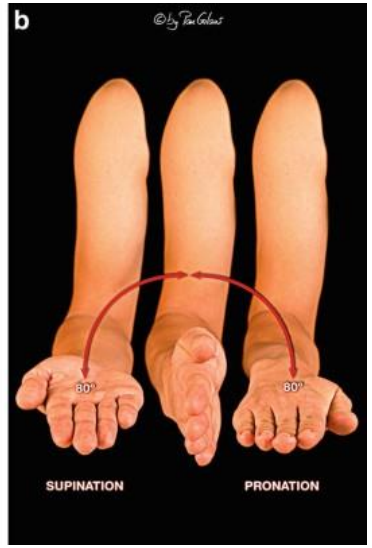


Left forearm superficial muscles (palmar view)



Left forearm superficial muscles (dorsal view)



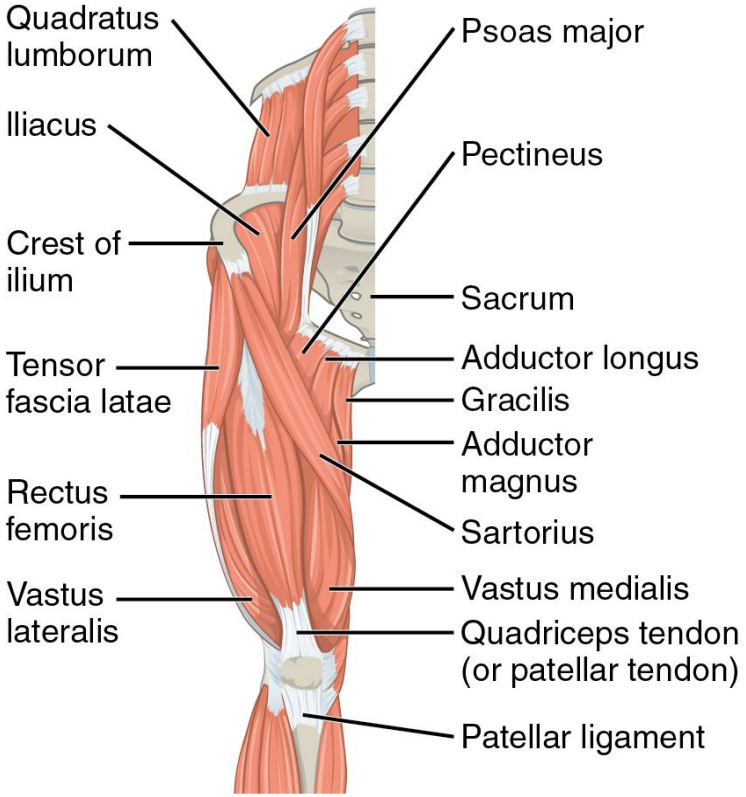


The forearm, made of the radius and ulna bones, has four main types of action: flexion, extension, pronation, and supination.
The forearm flexors include the **biceps brachii**, **brachialis**, and **brachioradialis**.
The extensors are the **triceps brachii** and **anconeus**.
The pronators are the **pronator teres** and the **pronator quadratus**
The **supinator** is the only one that turns the forearm anteriorly.
[When the forearm faces anteriorly, it is supinated. When the forearm faces posteriorly, it is pronated]

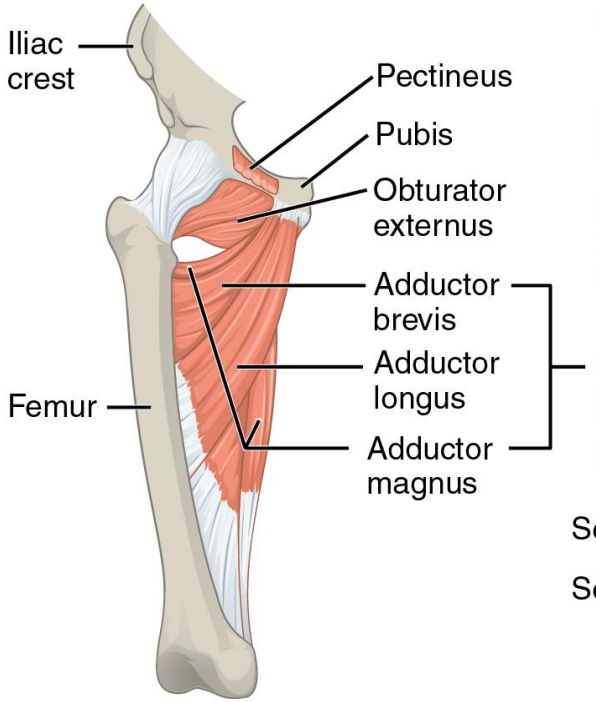
MUSCLES THAT MOVE THE FOREARM

Movement	Target	Target motion direction	Prime mover	Origin	Insertion
Anterior muscles (flexion)					
Performs a bicep curl; also allows palm of hand to point toward body while flexing	Forearm	Flexion; supination	Biceps brachii	Coracoid process; tubercle above glenoid cavity	Radial tuberosity
	Forearm	Flexion	Brachialis	Front of distal humerus	Coronoid process of ulna
Assists and stabilizes elbow during bicep-curl motion	Forearm	Flexion	Brachioradialis	Lateral supracondylar ridge at distal end of humerus	Base of styloid process of radius
Posterior muscles (extension)					
Extends forearm, as during a punch	Forearm	Extension	Triceps brachii	Infraglenoid tubercle of scapula; posterior shaft of humerus; posterior humeral shaft distal to radial groove	Olecranon process of ulna
Assists in extending forearm; also allows forearm to extend away from body	Forearm	Extension; abduction	Anconeus	Lateral epicondyle of humerus	Lateral aspect of olecranon process of ulna
Anterior muscles (pronation)					
Turns hand palm-down	Forearm	Pronation	Pronator teres	Medial epicondyle of humerus; coronoid process of ulna	Lateral radius
Assists in turning hand palm-down	Forearm	Pronation	Pronator quadratus	Distal portion of anterior ulnar shaft	Distal surface of anterior radius
Posterior muscles (supination)					
Turns hand palm-up	Forearm	Supination	Supinator	Lateral epicondyle of humerus; proximal ulna	Proximal end of radius

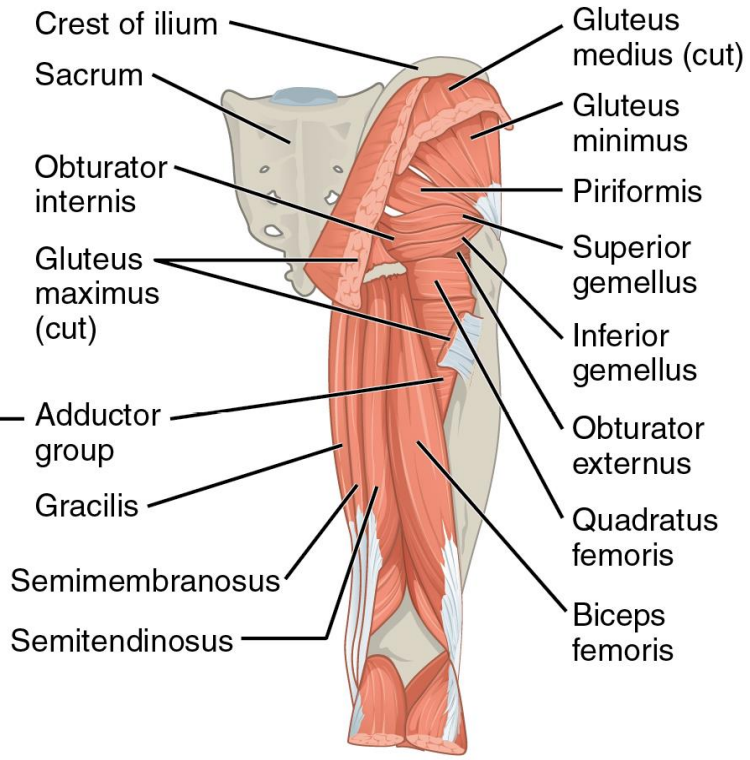
APPENDICULAR MUSCLES
Muscles of the Pelvic Girdle and Lower Limbs



Superficial pelvic and thigh muscles of right leg (anterior view)



Deep pelvic and thigh muscles of right leg (anterior view)

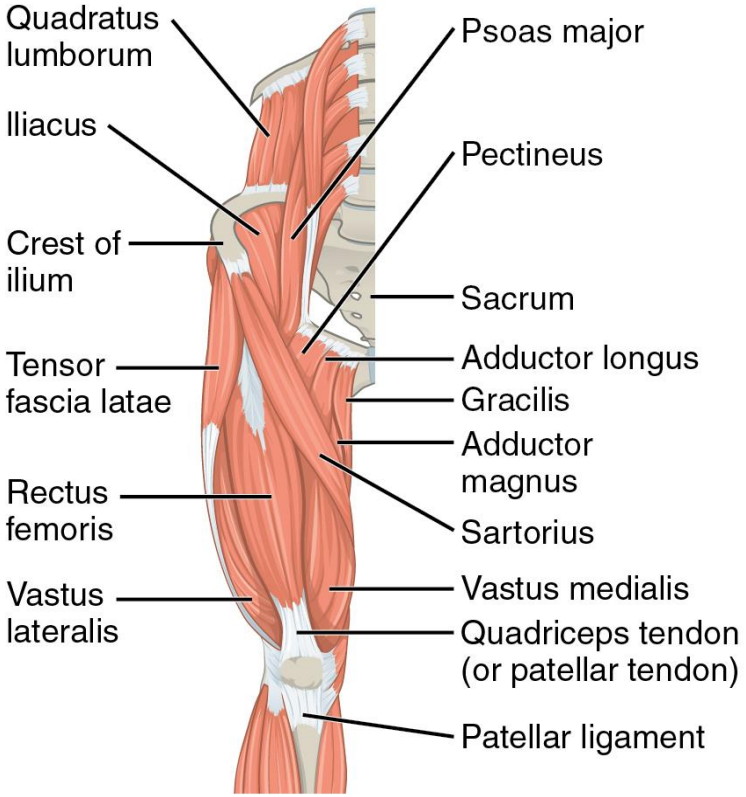


Pelvic and thigh muscles of right leg (posterior view)

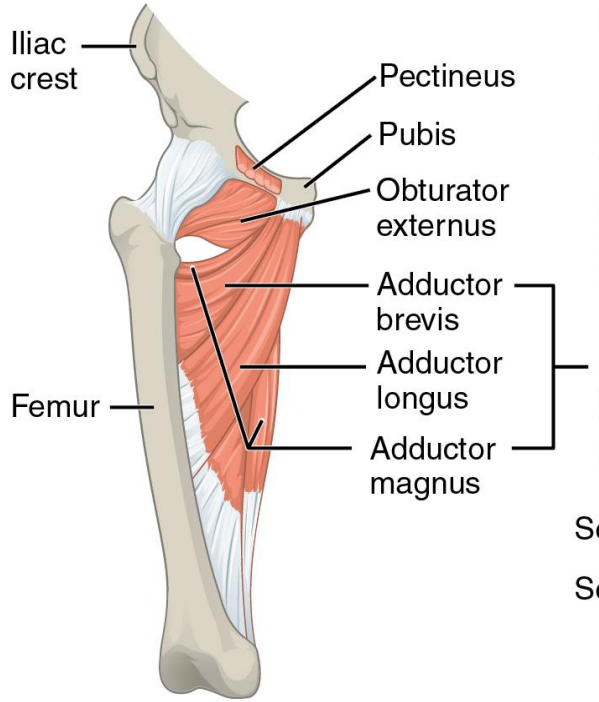
Gluteal Region Muscles That Move the Femur

Most muscles that insert on the femur (the thigh bone) and move it, originate on the pelvic girdle.
The **psoas major** and **iliacus** make up the **iliopsoas group**.

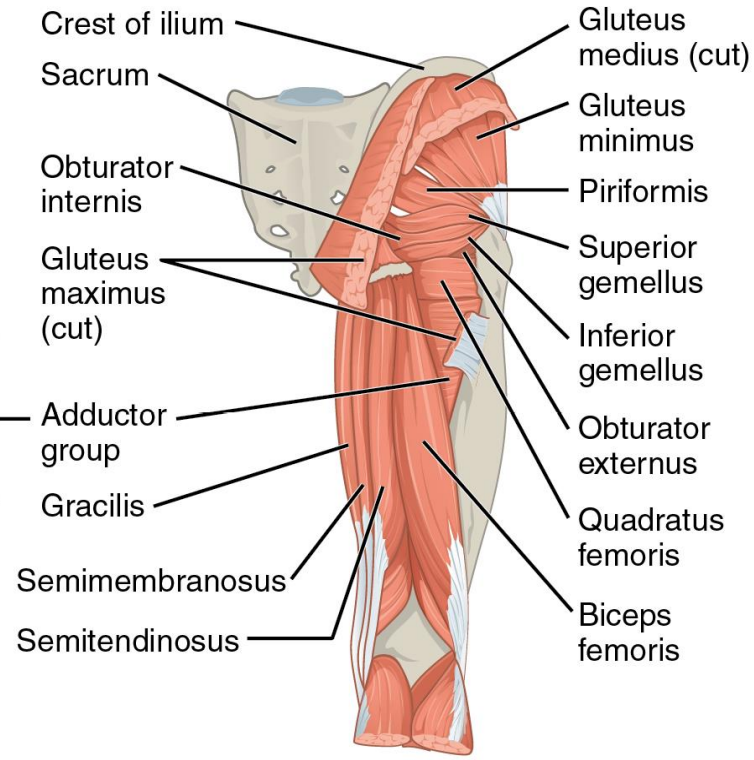
Some of the largest and most powerful muscles in the body are the gluteal muscles or **gluteal group**.
The **gluteus maximus** is the largest; deep to the gluteus maximus is the **gluteus medius**, and deep to the gluteus medius is the **gluteus minimus**, the smallest of the three.



Superficial pelvic and thigh muscles of right leg (anterior view)



Deep pelvic and thigh muscles of right leg (anterior view)



Pelvic and thigh muscles of right leg (posterior view)

The **tensor fascia latae** is a thick, squarish muscle in the superior aspect of the lateral thigh. It acts as a synergist of the gluteus medius and iliopsoas in flexing and abducting the thigh.

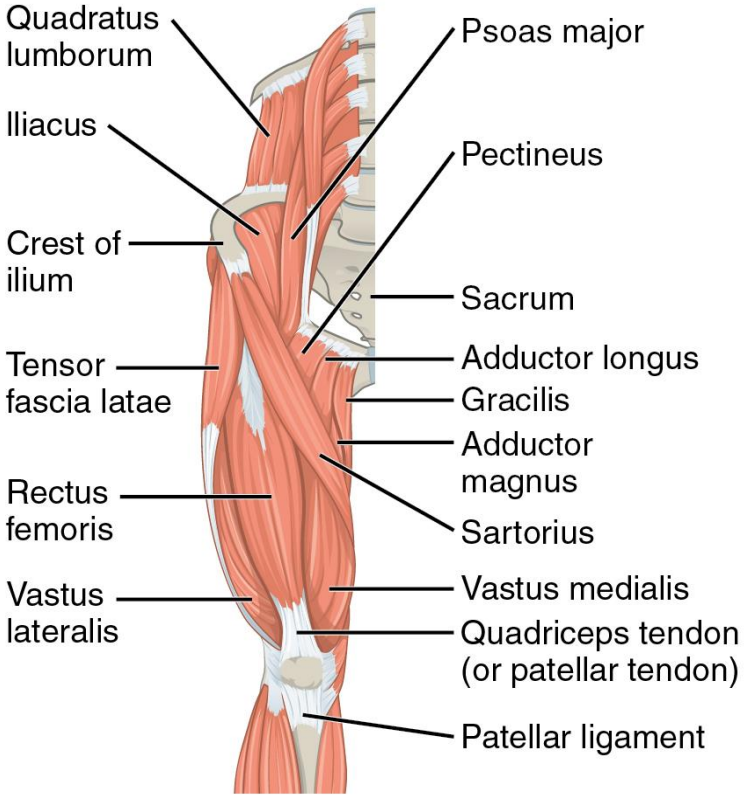
Deep to the gluteus maximus, the **piriformis**, **obturator internus**, **obturator externus**, **superior gemellus**, **inferior gemellus**, and **quadratus femoris** laterally rotate the femur at the hip.

The **adductor longus**, **adductor brevis**, and **adductor magnus** can both medially and laterally rotate the thigh depending on the placement of the foot. The adductor longus flexes the thigh, whereas the adductor magnus extends it.

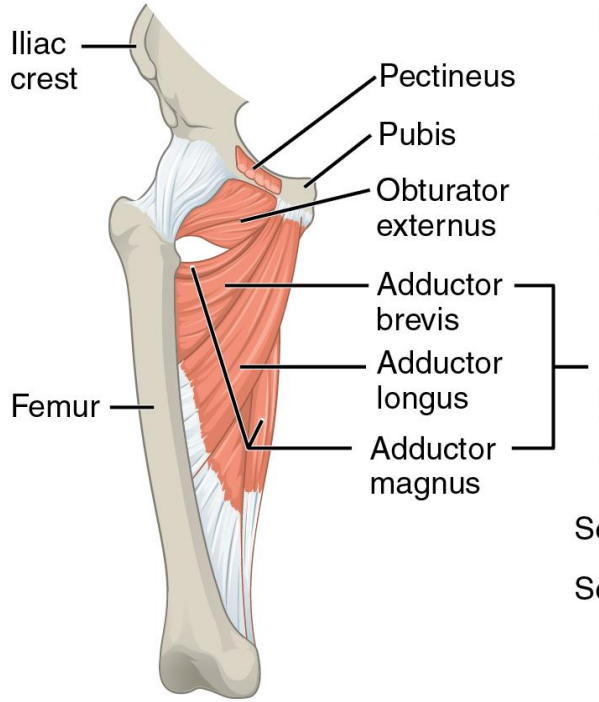
The **pectineus** adducts and flexes the femur at the hip as well.

MUSCLES OF THE THIGH

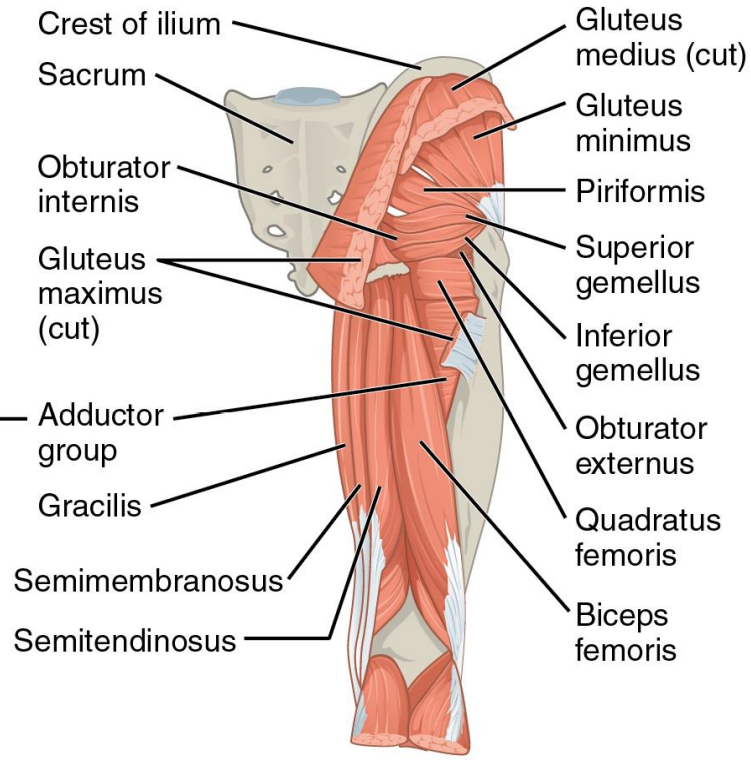
Movement	Target	Target motion direction	Prime mover	Origin	Insertion
Iliopsoas group					
Raises knee at hip, as if performing a knee attack; assists lateral rotators in twisting thigh (and lower leg) outward; assists with bending over, maintaining posture	Femur	Thigh: flexion and lateral rotation; torso: flexion	Psoas major	Lumbar vertebrae (L1–L5); thoracic vertebra (T12)	Lesser trochanter of femur
Raises knee at hip, as if performing a knee attack; assists lateral rotators in twisting thigh (and lower leg) outward; assists with bending over, maintaining posture	Femur	Thigh: flexion and lateral rotation; torso: flexion	Iliacus	Iliac fossa; iliac crest; lateral sacrum	Lesser trochanter of femur
Gluteal group					
Lowers knee and moves thigh back, as when getting ready to kick a ball	Femur	Extension	Gluteus maximus	Dorsal ilium; sacrum; coccyx	Gluteal tuberosity of femur; iliotibial tract
Opens thighs, as when doing a split	Femur	Abduction	Gluteus medius	Lateral surface of ilium	Greater trochanter of femur
Brings the thighs back together	Femur	Abduction	Gluteus minimus	External surface of ilium	Greater trochanter of femur
Assists with raising knee at hip and opening thighs; maintains posture by stabilizing the iliotibial track, which connects to the knee	Femur	Flexion; abduction	Tensor fascia lata	Anterior aspect of iliac crest; anterior superior iliac spine	Iliotibial tract
Lateral rotators					
Twists thigh (and lower leg) outward; maintains posture by stabilizing hip joint	Femur	Lateral rotation	Piriformis	Anterolateral surface of sacrum	Greater trochanter of femur
Twists thigh (and lower leg) outward; maintains posture by stabilizing hip joint	Femur	Lateral rotation	Obutrator internus	Inner surface of obturator membrane; greater sciatic notch; margins of obturator foramen	Greater trochanter in front of piriformis
Twists thigh (and lower leg) outward; maintains posture by stabilizing hip joint	Femur	Lateral rotation	Obturator externus	Outer surfaces of obturator membrane, pubic, and ischium; margins of obturator foramen	Trochanteric fossa of posterior femur
Twists thigh (and lower leg) outward; maintains posture by stabilizing hip joint	Femur	Lateral rotation	Superior gemellus	Ischial spine	Greater trochanter of femur
Twists thigh (and lower leg) outward; maintains posture by stabilizing hip joint	Femur	Lateral rotation	Inferior gemellus	Ischial tuberosity	Greater trochanter of femur
Twists thigh (and lower leg) outward; maintains posture by stabilizing hip joint	Femur	Lateral rotation	Quadratus femoris	Ischial tuberosity	Trochanteric crest of femur
Adductors					
Brings the thighs back together; assists with raising the knee	Femur	Adduction; flexion	Adductor longus	Pubis near pubic symphysis	Linea aspera
Brings the thighs back together; assists with raising the knee	Femur	Adduction; flexion	Adductor brevis	Body of pubis; inferior ramus of pubis	Linea aspera above adductor longus
Brings the thighs back together; assists with raising the knee and moving the thigh back	Femur	Adduction; flexion; extension	Adductor magnus	Ischial rami; pubic rami; ischial tuberosity	Linea aspera; adductor tubercle of femur
Opens thighs; assists with raising the knee and turning the thigh (and lower leg) inward	Femur	Adduction; flexion; medial rotation	Pectineus	Pectineal line of pubis	Lesser trochanter to linea aspera of posterior aspect of femur



Superficial pelvic and thigh muscles of right leg (anterior view)



Deep pelvic and thigh muscles of right leg (anterior view)



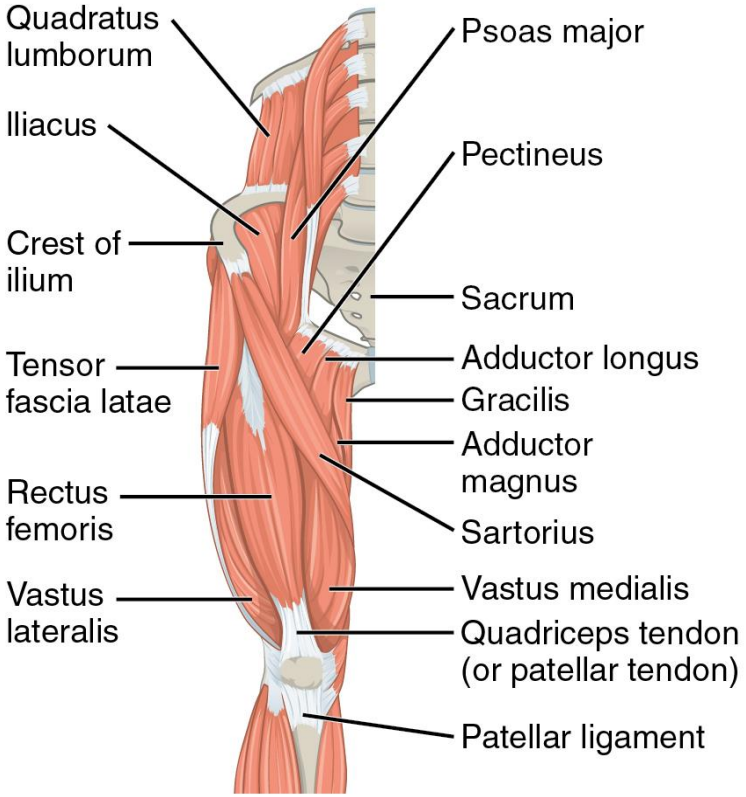
Pelvic and thigh muscles of right leg (posterior view)

Thigh Muscles That Move the Femur, Tibia, and Fibula

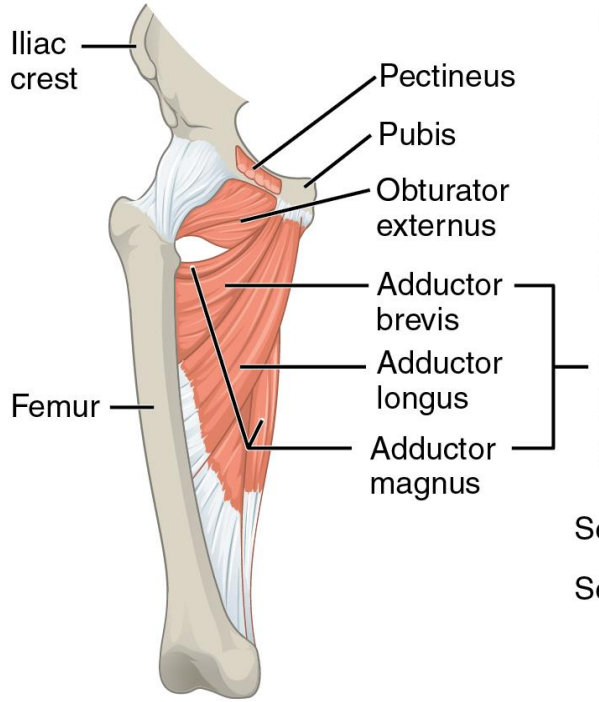
Deeper muscles in the thigh are separated into medial, anterior, and posterior compartments.

The muscles in the **medial compartment of the thigh** are responsible for adducting the femur at the hip.

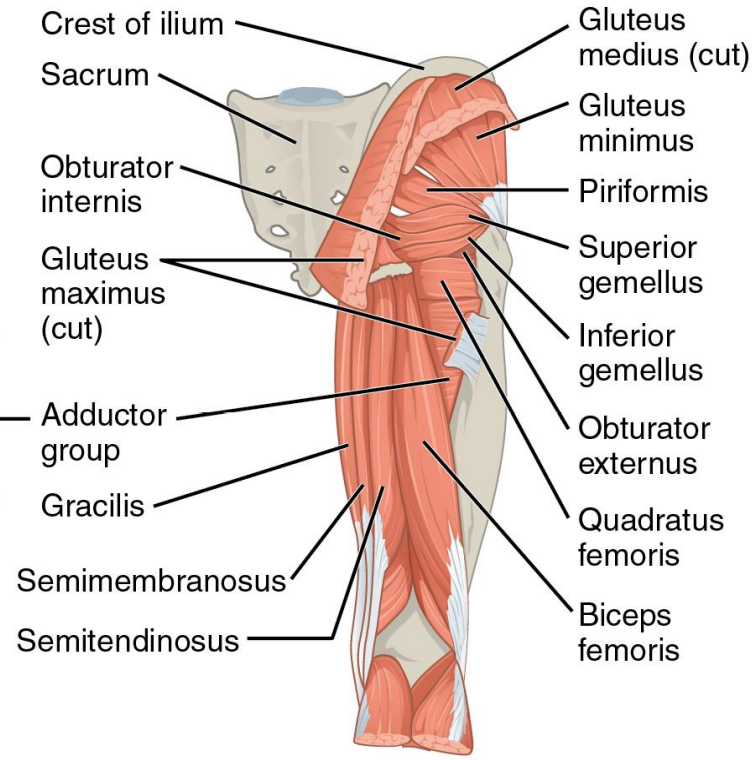
Along with the adductor longus, adductor brevis, adductor magnus, and pectineus, the **gracilis** adductsthe thigh in addition to flexing the leg at the knee.



Superficial pelvic and thigh muscles of right leg (anterior view)



Deep pelvic and thigh muscles of right leg (anterior view)

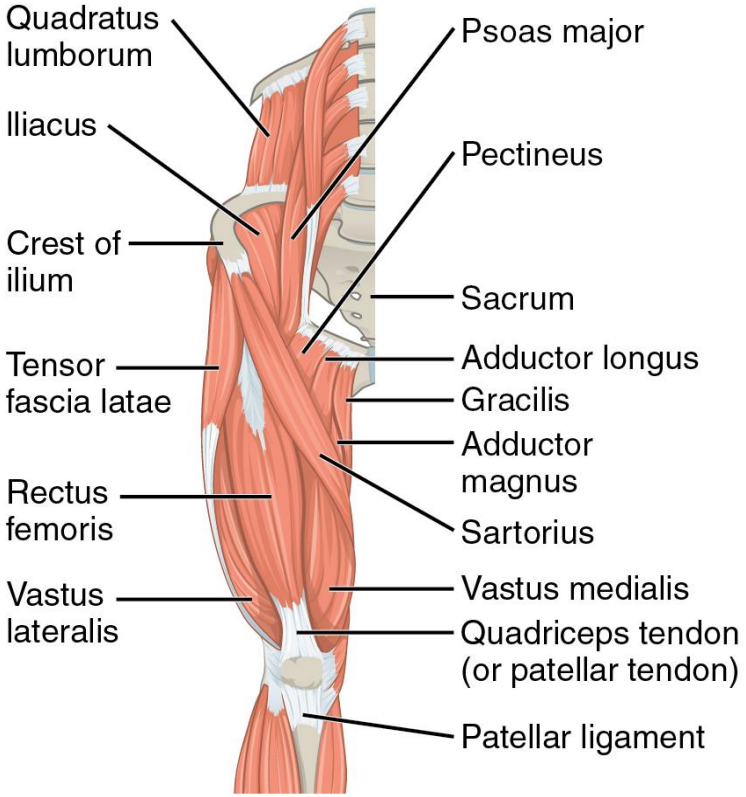


Pelvic and thigh muscles of right leg (posterior view)

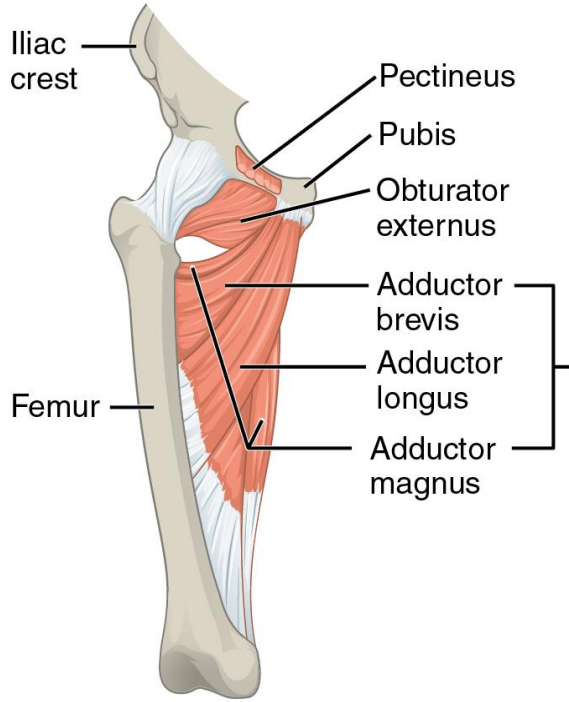
The muscles of the **anterior compartment of the thigh** flex the thigh and extend the leg. This compartment contains the **quadriceps femoris group**, which actually comprises four muscles that extend and stabilize the knee.

The **rectus femoris** is on the anterior aspect of the thigh, the **vastus lateralis** is on the lateral aspect of the thigh, the **vastus medialis** is on the medial aspect of the thigh, and the **vastus intermedius** is between the vastus lateralis and vastus medialis and deep to the rectus femoris.

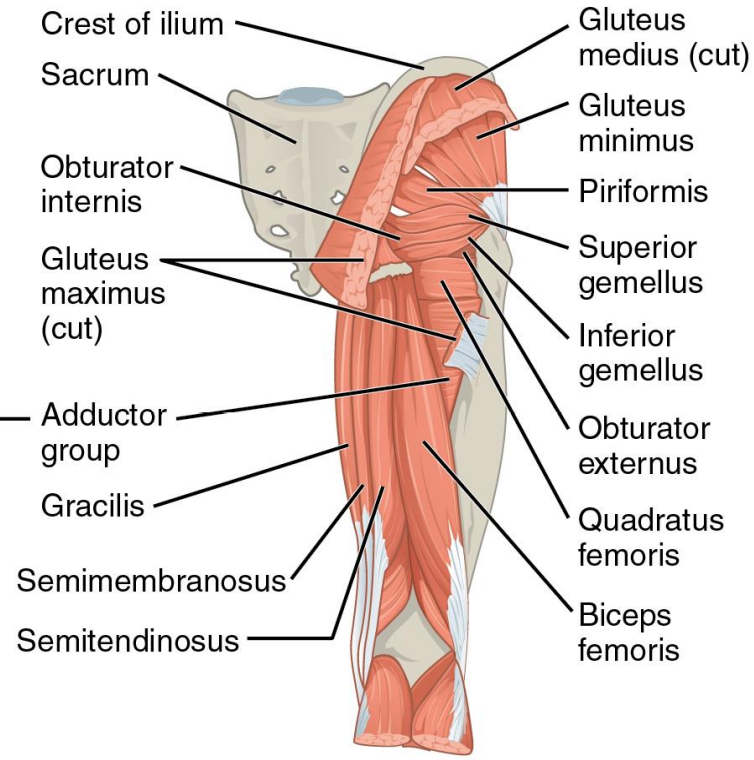
In addition to the quadriceps femoris, the **sartorius** flexes the leg at the knee and flexes, abducts, and laterally rotates the leg at the hip. This muscle allows us to sit cross-legged.



Superficial pelvic and thigh muscles of right leg (anterior view)



Deep pelvic and thigh muscles of right leg (anterior view)



Pelvic and thigh muscles of right leg (posterior view)

The **posterior compartment of the thigh** includes muscles that flex the leg and extend the thigh.

The three long muscles on the back of the knee are the **hamstring group**, which flexes the knee. These are the **biceps femoris**, **semitendinosus**, and **semimembranosus**. The tendons of these muscles form the **popliteal fossa**, the diamondshaped space at the back of the knee.

MUSCLES OF THE THIGH

Movement	Target	Target motion direction	Prime mover	Origin	Insertion
Medial compartment of thigh					
Moves back of lower legs up toward buttocks, as when kneeling; assists in opening thighs	Femur; tibia/fibula	Tibia/fibula: flexion; thigh: adduction	Gracilis	Inferior ramus; body of pubis; ischial ramus	Medial surface of tibia
Anterior compartment of thigh: Quadriceps femoris group					
Moves lower leg out in front of body, as when kicking; assists in raising the knee	Femur; tibia/fibula	Tibia/fibula: extension; thigh: flexion	Rectus femoris	Anterior inferior iliac spine; superior margin of acetabulum	Patella; tibial tuberosity
Moves lower leg out in front of body, as when kicking	Tibia/fibula	Extension	Vastus lateralis	Greater trochanter; intertrochanteric line; linea aspera	Patella; tibial tuberosity
Moves lower leg out in front of body, as when kicking	Tibia/fibula	Extension	Vastus medialis	Linea aspera; intertrochanteric line	Patella; tibial tuberosity
Moves lower leg out in front of body, as when kicking	Tibia/fibula	Extension	Vastus intermedius	Proximal femur shaft	Patella; tibial tuberosity
Moves back of lower legs up and back toward the buttocks, as when kneeling; assists in moving thigh diagonally upward and outward as when mounting a bike	Femur; tibia/fibula	Tibia: flexion; thigh: flexion, abduction, lateral rotation	Sartorius	Anterior superior iliac spine	Medial aspect of proximal tibia
Posterior compartment of thigh: Hamstring group					
Moves back of lower legs up and back toward the buttocks, as when kneeling; moves thigh down and back; twists the thigh (and lower leg) outward	Femur; tibia/fibula	Tibia/fibula: flexion; thigh: extension, lateral rotation	Biceps femoris	Ischial tuberosity; linea aspera; distal femur	Head of fibula; lateral condyle of tibia
Moves back of lower legs up toward buttocks, as when kneeling; moves thigh down and back; twists the thigh (and lower leg) inward	Femur; tibia/fibula	Tibia/fibula: flexion; thigh: extension, medial rotation	Semitendinosus	Ischial tuberosity	Upper tibial shaft
Moves back of lower legs up and back toward the buttocks as when kneeling; moves thigh down and back; twists the thigh (and lower leg) inward	Femur; tibia/fibula	Tibia/fibula: flexion; thigh: extension, medial rotation	Semi-membranosus	Ischial tuberosity	Medial condyle of tibia; lateral condyle of femur