

Back-to- Basics: The Intricacies of Muscle Contraction

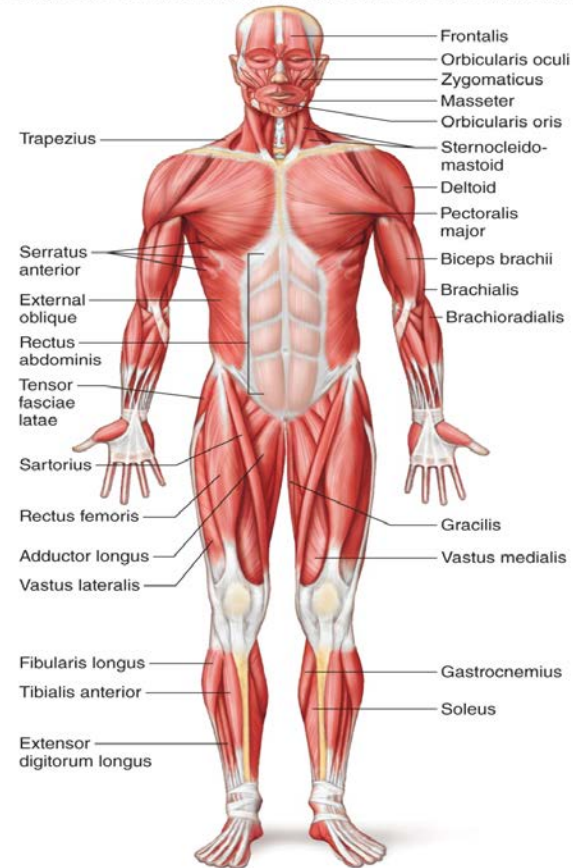
MiOTA Conference

October 11, 2019

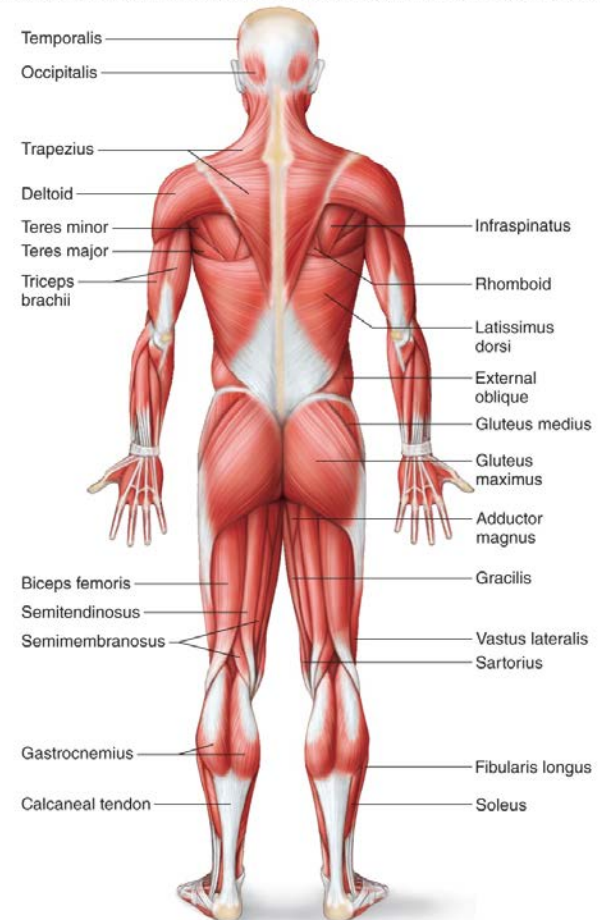
Cheri Ramirez,
MS, OTRL

Major Skeletal Muscles

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Muscles of Facial Expression

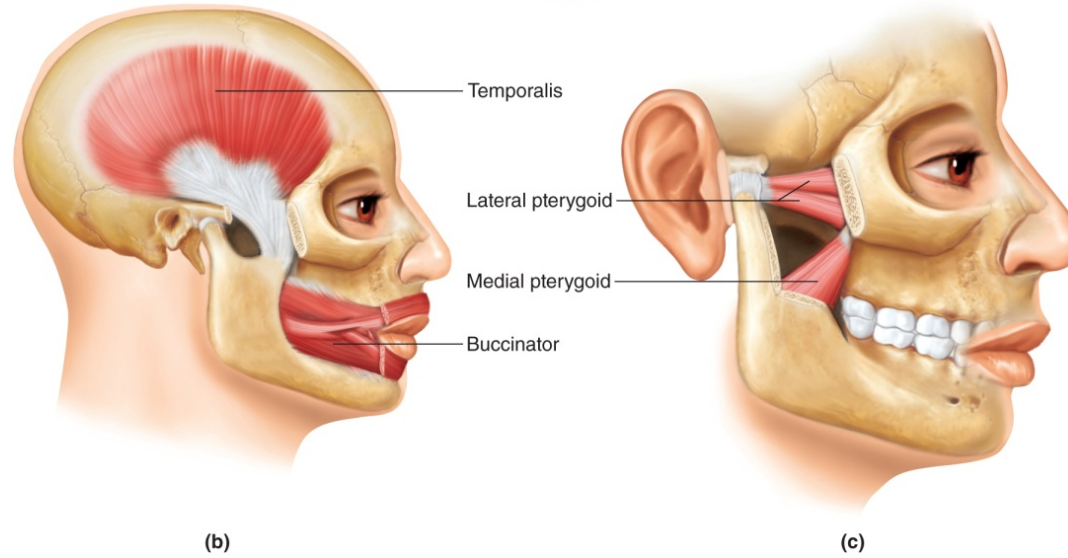
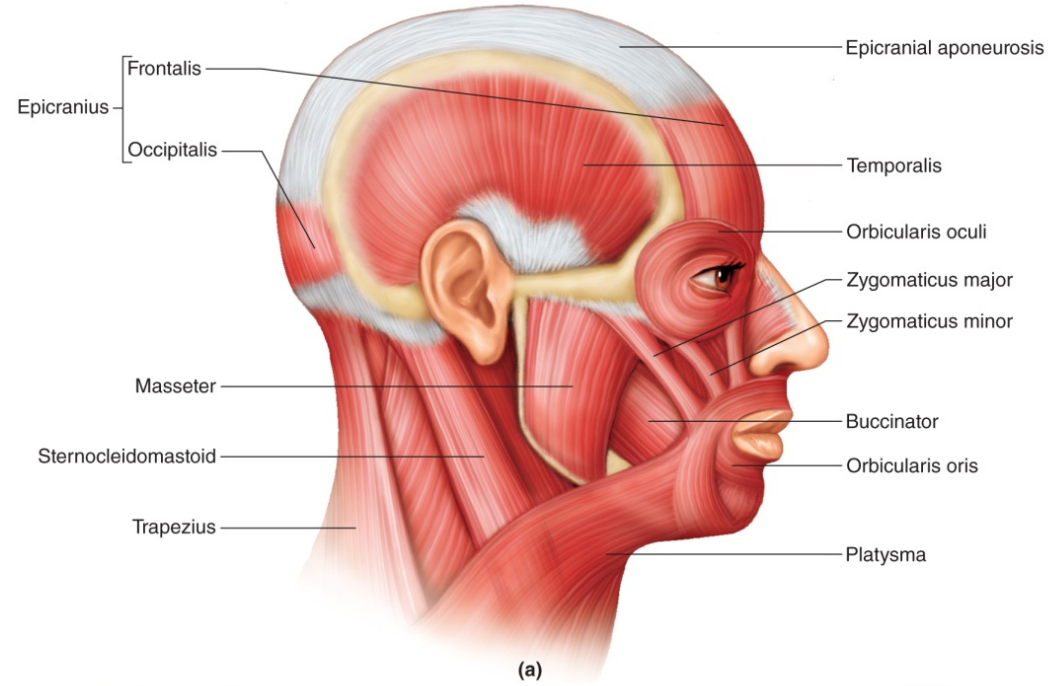
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Muscle	Origin	Insertion	Action	Nerve Supply
Epicranius	Occipital bone	Skin around eye	Elevates eyebrow as when surprised	Facial nerve
Orbicularis oculi	Maxillary and frontal bones	Skin around eye	Closes eye as in blinking	Facial nerve
Orbicularis oris	Muscles near the mouth	Skin of central lip	Closes lips, protrudes lips as for kissing	Facial nerve
Buccinator	Alveolar processes of maxilla and mandible	Orbicularis oris	Compresses cheeks	Facial nerve
Zygomaticus major	Zygomatic bone	Skin and muscle at corner of mouth	Elevates corner of mouth as when smiling	Facial nerve
Zygomaticus minor	Zygomatic bone	Skin and muscle at corner of mouth	Elevates corner of mouth as when smiling	Facial nerve
Platysma	Fascia in upper chest	Skin and muscles below mouth; mandible	Depresses lower lip and angle of mouth as when pouting	Facial nerve

Muscles of Mastication

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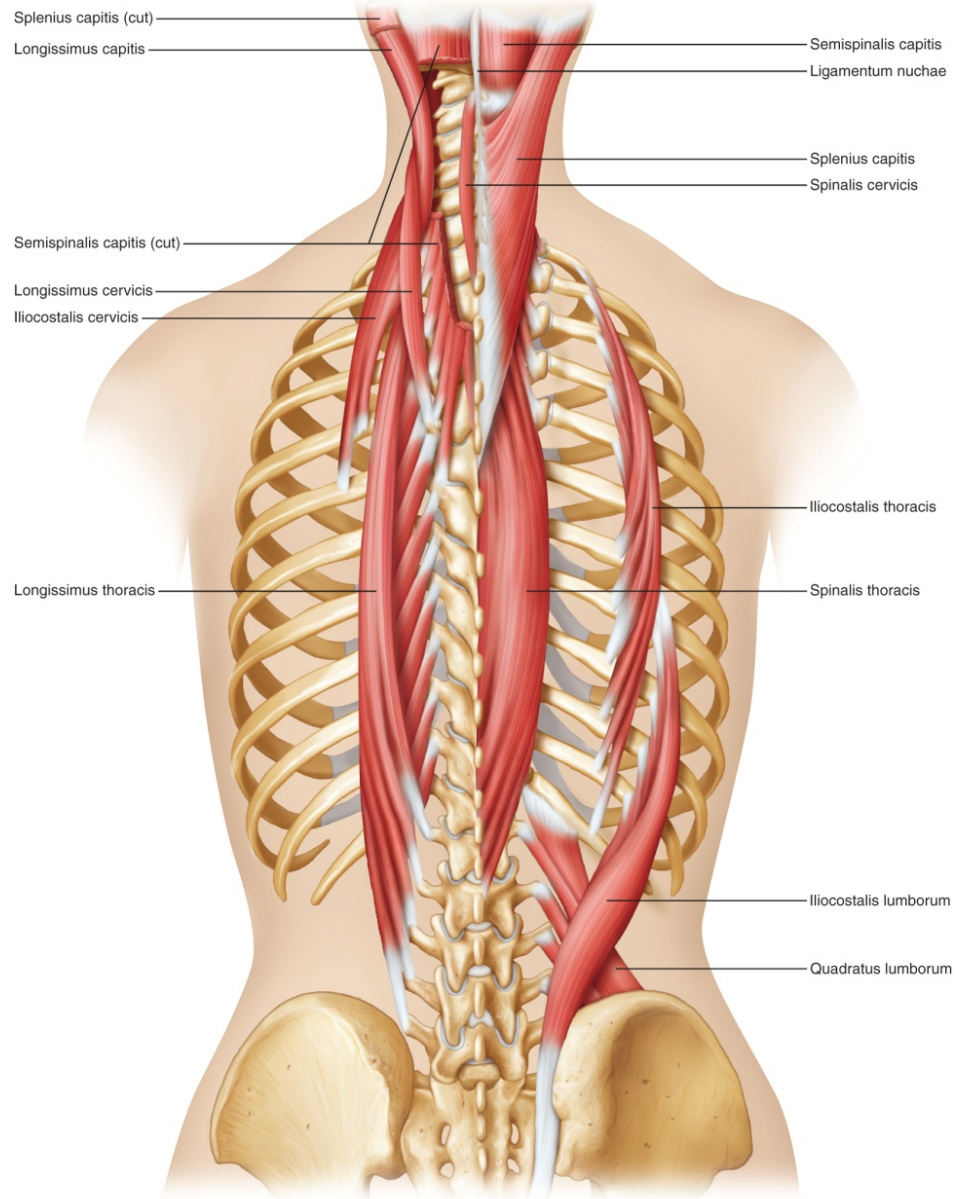
Muscle	Origin	Insertion	Action	Nerve Supply
Masseter	Zygomatic arch	Lateral surface of ramus of mandible	Elevates and protracts mandible	Trigeminal nerve
Temporalis	Temporal bone	Coronoid process and anterior ramus of mandible	Elevates and retracts mandible	Trigeminal nerve
Medial pterygoid	Sphenoid, palatine, and maxillary bones	Medial surface of ramus of mandible	Elevates mandible and moves it from side to side	Trigeminal nerve
Lateral pterygoid	Sphenoid bone	Anterior surface of mandibular condyle	Depresses and protracts mandible and moves it from side to side	Trigeminal nerve



Muscles That Move the Head and Vertebral Column

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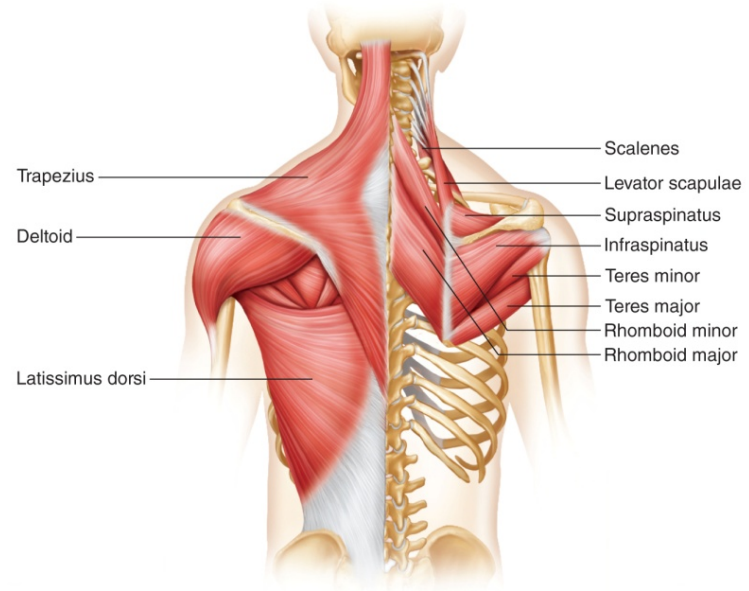
TABLE 9.6 Muscles That Move the Head and Vertebral Column APIR				
Muscle	Origin	Insertion	Action	Nerve Supply
Sternocleidomastoid	Anterior surface of sternum and upper surface of clavicle	Mastoid process of temporal bone	Each laterally flexes neck to the same side, rotates head to the opposite side. Together they flex neck forward; also aid in forceful inhalation.	Accessory, C2 and C3 cervical nerves
Splenius capitis	Ligamentum nuchae and spinous processes of seventh cervical and upper thoracic vertebrae	Occipital bone	Rotates head, laterally flexes and extends neck	Cervical nerves
Semispinalis capitis	Processes of lower cervical and upper thoracic vertebrae	Occipital bone	Extends neck, rotates head	Cervical and thoracic spinal nerves
Scalenes	Transverse processes of cervical vertebrae	Superior and lateral surfaces of first two ribs	Flex neck, elevate first two ribs during forceful inhalation	Cervical spinal nerves
Quadratus lumborum	Iliac crest	Upper lumbar vertebrae and twelfth rib	Extends lumbar region of vertebral column	Thoracic and lumbar spinal nerves
Erector spinae (divides into three groups)				
Iliocostalis (lateral) group				
Iliocostalis lumborum	Iliac crest	Lower six ribs	Extends lumbar region of vertebral column	Lumbar spinal nerves
Iliocostalis thoracis	Lower six ribs	Upper six ribs	Holds spine erect	Thoracic spinal nerves
Iliocostalis cervicis	Upper six ribs	Fourth through sixth cervical vertebrae	Extends cervical region of vertebral column	Cervical spinal nerves
Longissimus (intermediate) group				
Longissimus thoracis	Lumbar vertebrae	Thoracic and upper lumbar vertebrae and ribs 9 and 10	Extends thoracic region of vertebral column	Spinal nerves
Longissimus cervicis	Fourth and fifth thoracic vertebrae	Second through sixth cervical vertebrae	Extends cervical region of vertebral column	Spinal nerves
Longissimus capitis	Upper thoracic and lower cervical vertebrae	Mastoid process of temporal bone	Extends and rotates head	Cervical spinal nerves
Spinalis (medial) group				
Spinalis thoracis	Upper lumbar and lower thoracic vertebrae	Upper thoracic vertebrae	Extends vertebral column	Spinal nerves
Spinalis cervicis	Ligamentum nuchae and seventh cervical vertebra	Axis	Extends vertebral column	Spinal nerves



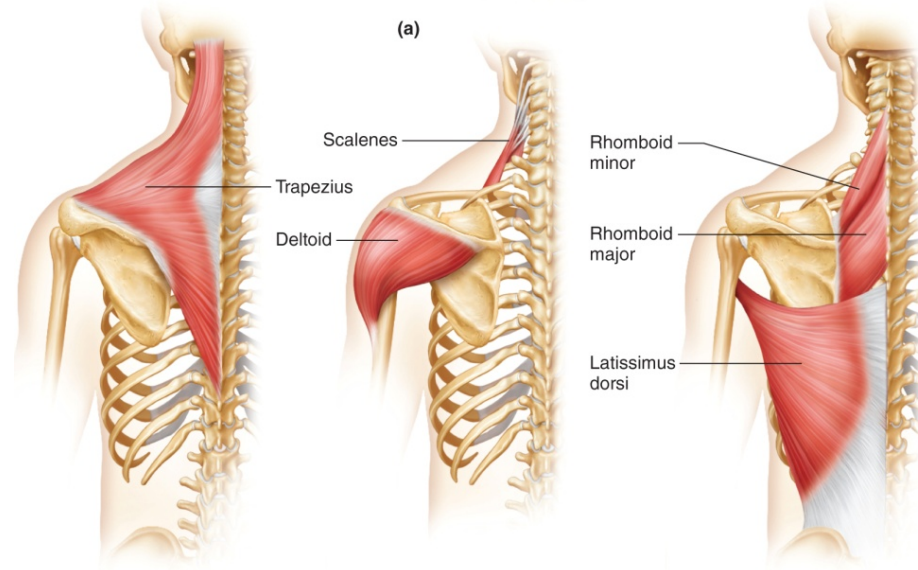
Muscles That Move the Pectoral Girdle

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TABLE 9.7 Muscles That Move the Pectoral Girdle AP R				
Muscle	Origin	Insertion	Action	Nerve Supply
Trapezius	Occipital bone, ligamentum nuchae, and spinous processes of seventh cervical and all thoracic vertebrae	Clavicle, spine, and acromion process of scapula	Rotates and retracts scapula Superior portion elevates scapula Inferior portion depresses scapula	Accessory nerve
Rhomboid major	Spinous processes of upper thoracic vertebrae	Medial border of scapula	Retracts, elevates, and rotates scapula	Dorsal scapular nerve
Rhomboid minor	Spinous processes of lower cervical vertebrae	Medial border of scapula	Retracts and elevates scapula	Dorsal scapular nerve
Levator scapulae	Transverse processes of cervical vertebrae	Medial border of scapula	Elevates scapula	Dorsal scapular and cervical nerves
Serratus anterior	Anterior surfaces of upper ribs	Medial border of scapula	Protracts and rotates scapula	Long thoracic nerve
Pectoralis minor	Anterior surface of ribs 3-5	Coracoid process of scapula	Depresses and protracts scapula, elevates ribs during forceful inhalation	Pectoral nerve



(a)



(b)

(c)

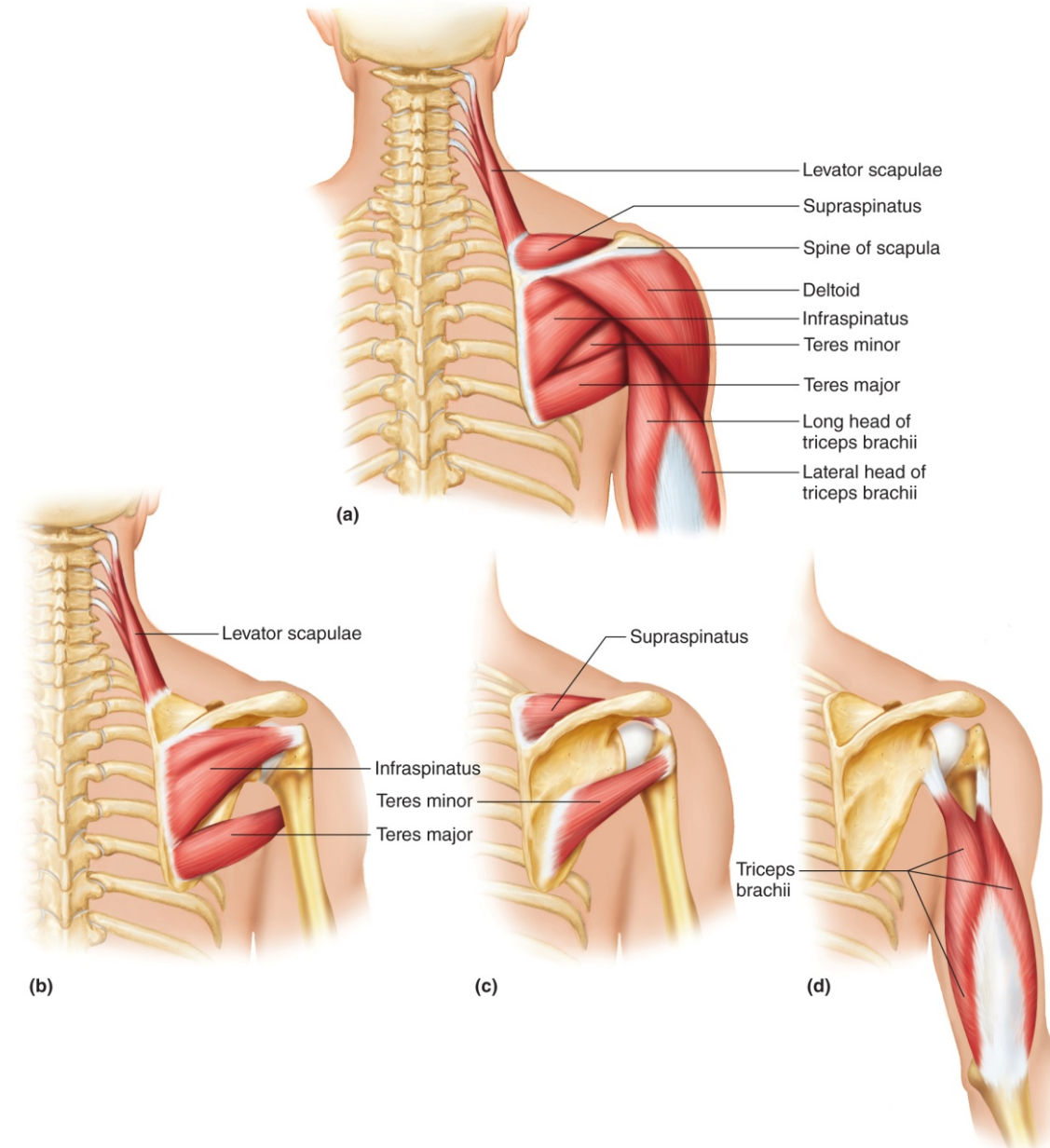
(d)

Muscles That Move the Arm

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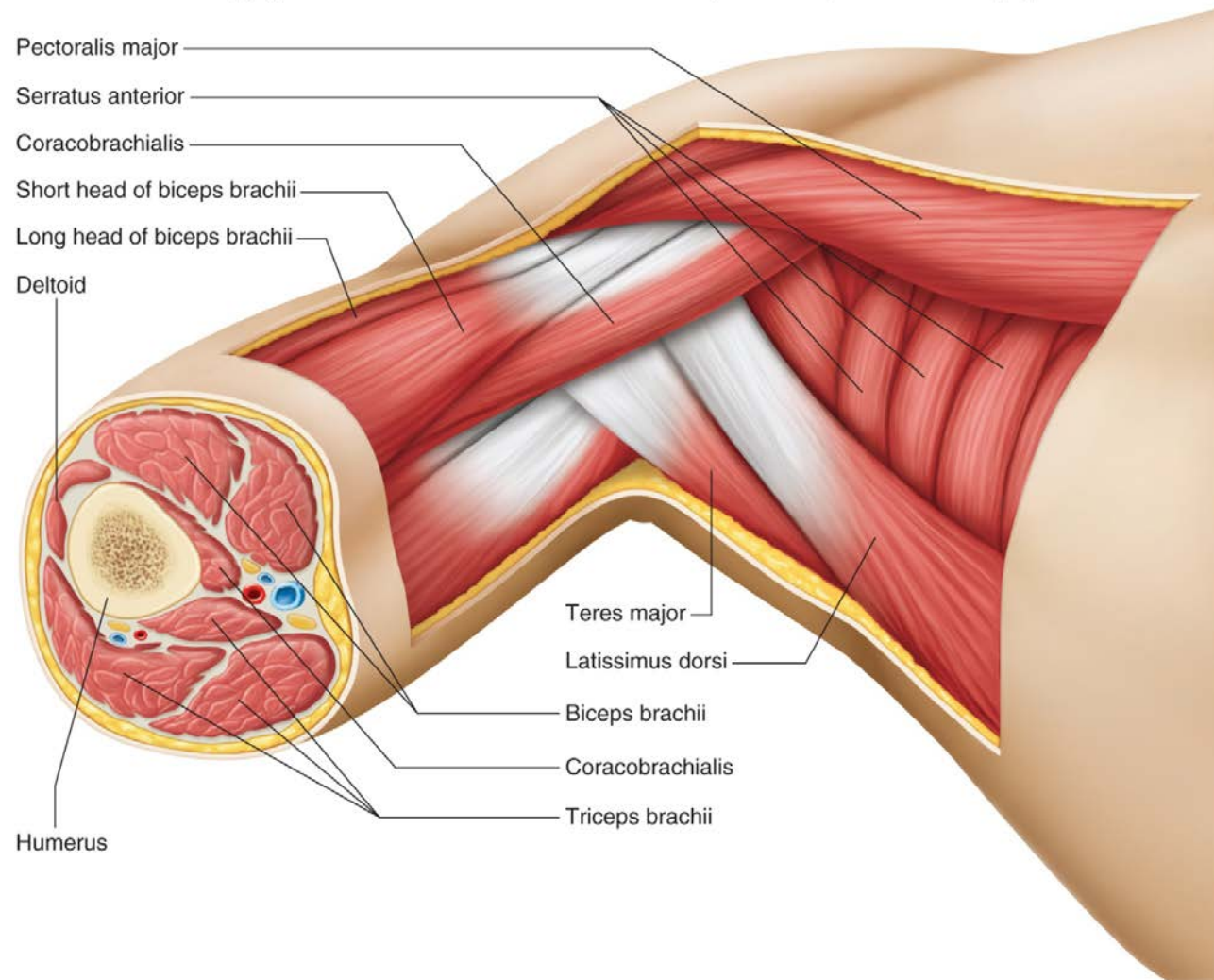
TABLE 9.8 Muscles That Move the Arm **AP|R**

Muscle	Origin	Insertion	Action	Nerve Supply
Coracobrachialis	Coracoid process of scapula	Medial mid-shaft of humerus	Flexes shoulder and adducts arm	Musculocutaneous nerve
Pectoralis major	Clavicle, sternum, and costal cartilages of upper ribs	Intertubercular sulcus of humerus	Flexes shoulder, adducts, and rotates arm medially	Pectoral nerve
Teres major	Lateral border of scapula	Intertubercular sulcus of humerus	Extends shoulder, adducts, and rotates arm medially	Lower subscapular nerve
Latissimus dorsi	Spines of sacral, lumbar, and lower thoracic vertebrae, iliac crest, and lower ribs	Intertubercular sulcus of humerus	Extends shoulder, adducts, and rotates arm medially, or depresses and retracts shoulder	Thoracodorsal nerve
Supraspinatus	Supraspinous fossa of scapula	Greater tubercle of humerus	Abducts arm	Suprascapular nerve
Deltoid	Acromion process, spine of the scapula, and the clavicle	Deltoid tuberosity of humerus	Lateral portion abducts arm Anterior portion flexes shoulder Posterior portion extends shoulder	Axillary nerve
Subscapularis	Anterior surface of scapula	Lesser tubercle of humerus	Rotates arm medially	Subscapular nerve
Infraspinatus	Infraspinous fossa of scapula	Greater tubercle of humerus	Rotates arm laterally	Upper and lower suprascapular nerves
Teres minor	Lateral border of scapula	Greater tubercle of humerus	Rotates arm laterally	Axillary nerve



Cross Section of the Arm

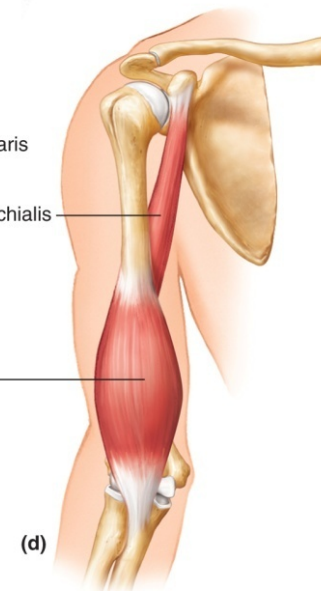
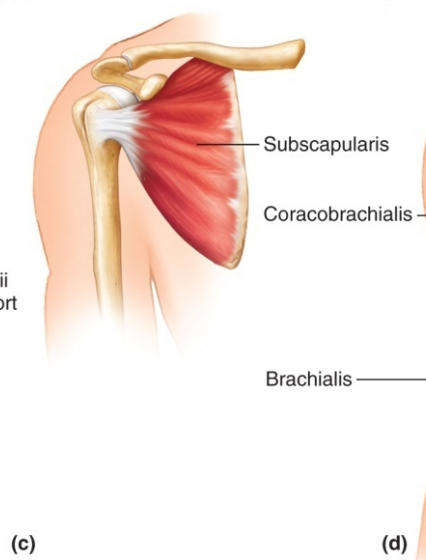
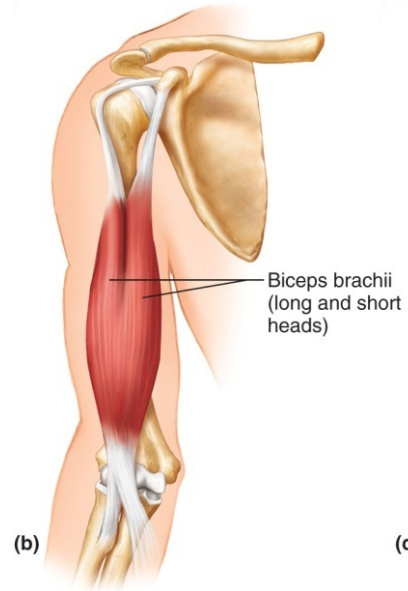
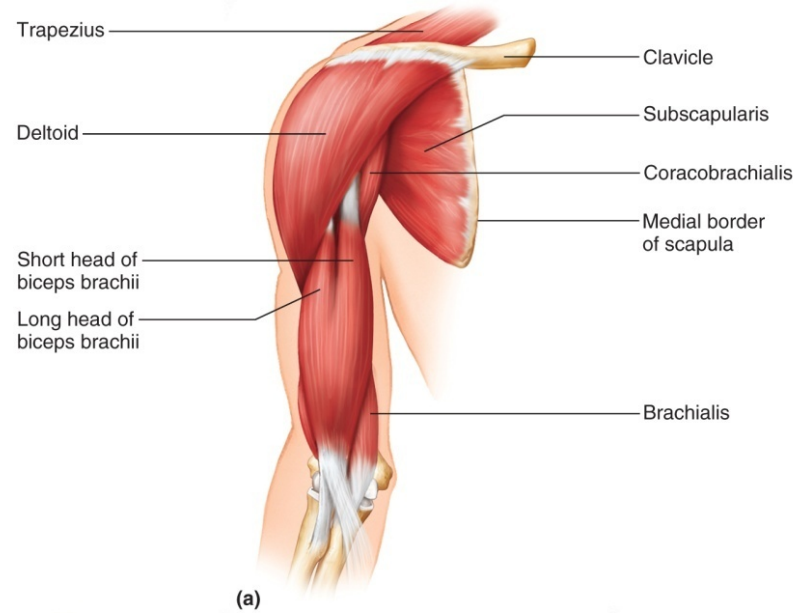
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Muscles That Move the Forearm

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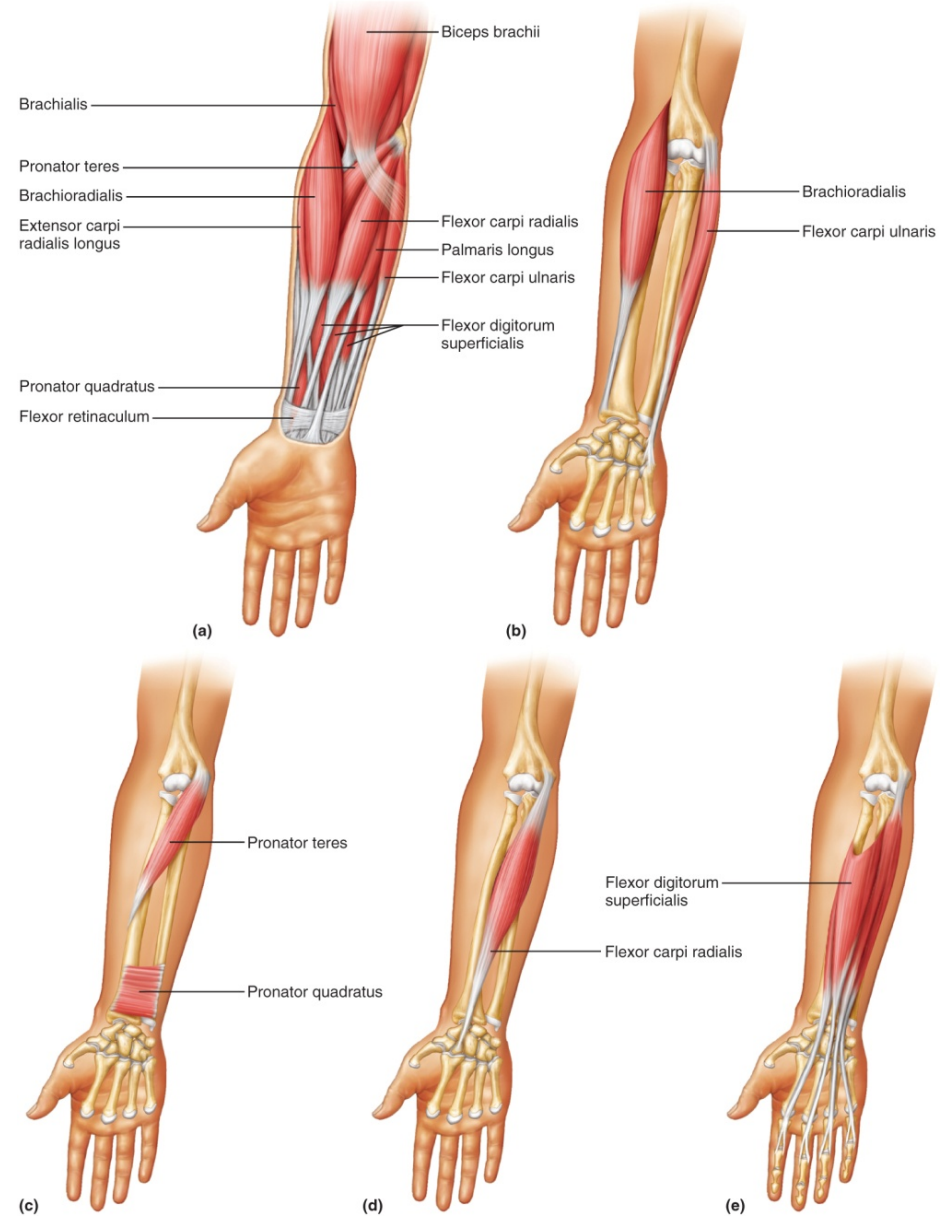
TABLE 9.9 Muscles That Move the Forearm AP R				
Muscle	Origin	Insertion	Action	Nerve Supply
Biceps brachii	Coracoid process and tubercle above glenoid cavity of scapula	Radial tuberosity of radius	Flexes elbow and supinates forearm and hand	Musculocutaneous nerve
Brachialis	Anterior surface of humerus	Coronoid process of ulna	Flexes elbow	Musculocutaneous, median, and radial nerves
Brachioradialis	Distal lateral end of humerus	Lateral surface of radius above styloid process	Flexes elbow	Radial nerve
Triceps brachii	Tubercle below glenoid cavity and lateral and posterior surfaces of humerus	Olecranon process of ulna	Extends elbow	Radial nerve
Supinator	Lateral epicondyle of humerus and crest of ulna	Anterior and lateral surface of radius	Rotates forearm laterally; supinates forearm and hand	Radial nerve
Pronator teres	Medial epicondyle of humerus and coronoid process of ulna	Lateral surface of radius	Rotates forearm medially; pronates forearm and hand	Median nerve
Pronator quadratus	Anterior distal end of ulna	Anterior distal end of radius	Rotates forearm medially; pronates forearm and hand	Median nerve

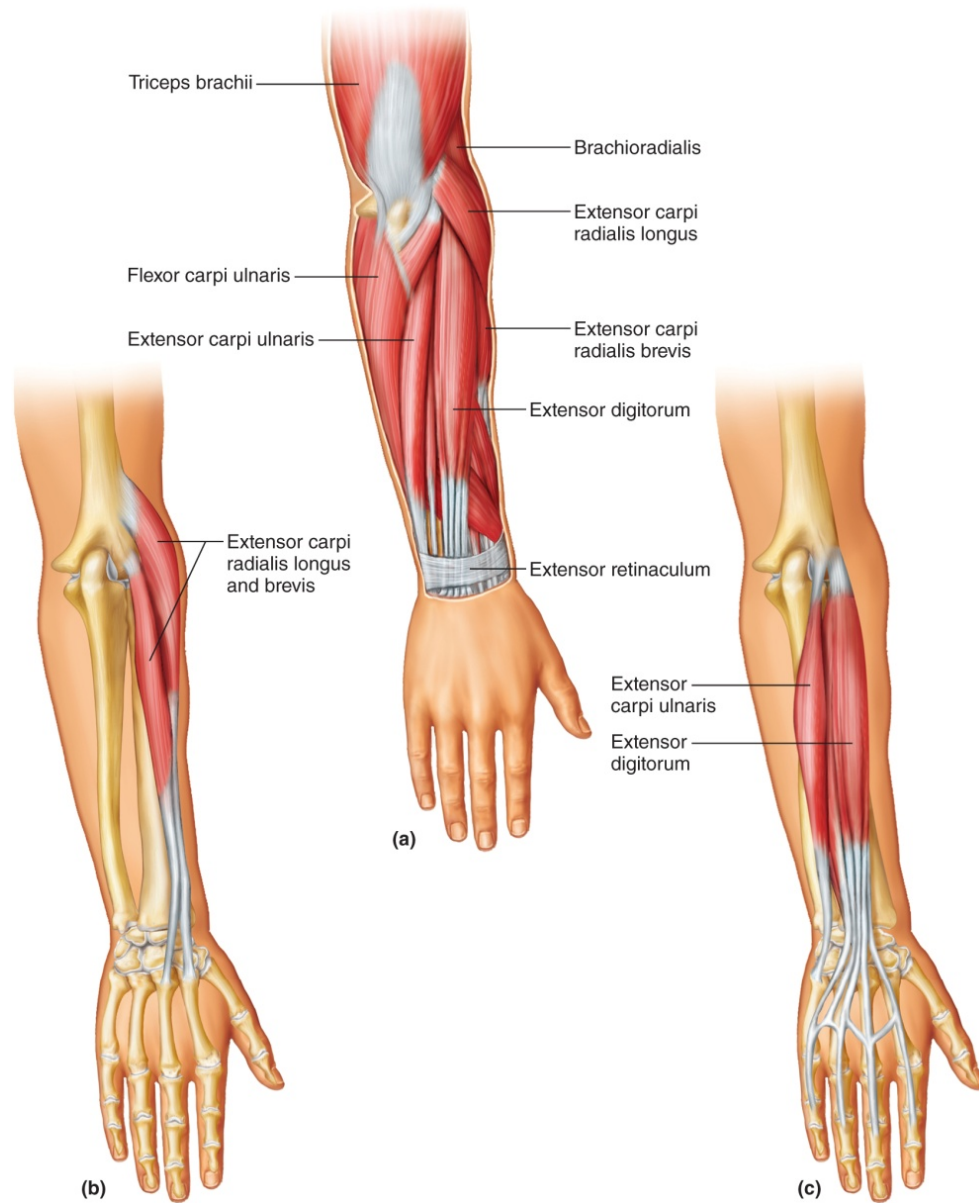


Muscles That Move the Hand

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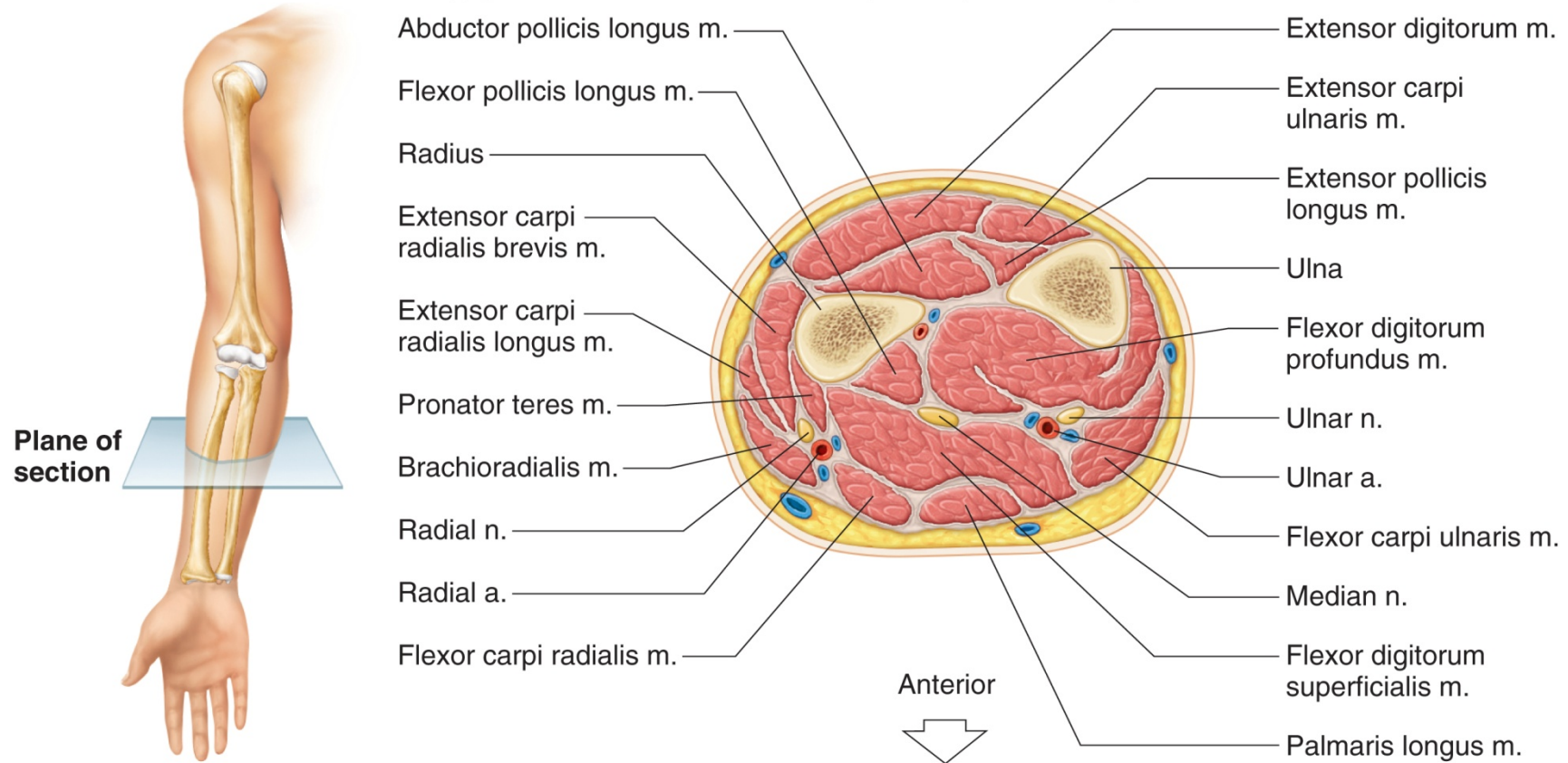
TABLE 9.10 Muscles That Move the Hand				
Muscle	Origin	Insertion	Action	Nerve Supply
Flexor carpi radialis	Medial epicondyle of humerus	Base of second and third metacarpals	Flexes wrist and abducts hand	Median nerve
Flexor carpi ulnaris	Medial epicondyle of humerus and olecranon process of ulna	Carpal and metacarpal bones	Flexes wrist and adducts hand	Ulnar nerve
Palmaris longus	Medial epicondyle of humerus	Fascia of palm	Flexes wrist	Median nerve
Flexor digitorum profundus	Anterior and medial surface of ulna	Distal phalanges of fingers 2–5	Flexes wrist and joints of fingers	Median and ulnar nerves
Flexor digitorum superficialis	Medial epicondyle of humerus, coronoid process of ulna, and radius	Tendons of fingers	Flexes wrist and joints of fingers	Median nerve
Extensor carpi radialis longus	Lateral end of humerus	Base of second metacarpal	Extends wrist and abducts hand	Radial nerve
Extensor carpi radialis brevis	Lateral epicondyle of humerus	Base of third metacarpal	Extends wrist and abducts hand	Radial nerve
Extensor carpi ulnaris	Lateral epicondyle of humerus and proximal, posterior ulna	Base of fifth metacarpal	Extends wrist and adducts hand	Radial nerve
Extensor digitorum	Lateral epicondyle of humerus	Posterior surface of phalanges in fingers 2–5	Extends joints of fingers	Radial nerve





Cross Section of the Forearm

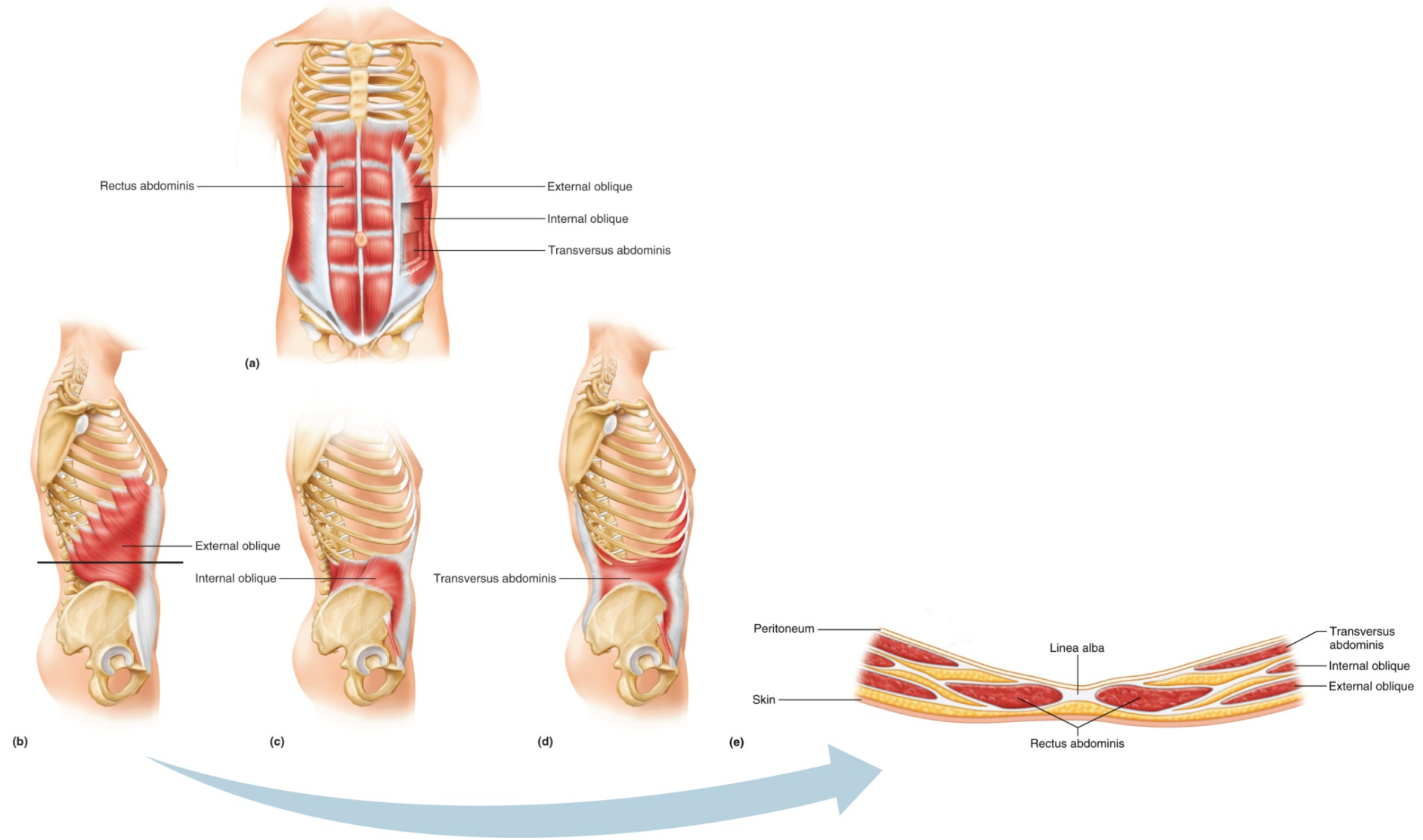
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Muscles of the Abdominal Wall

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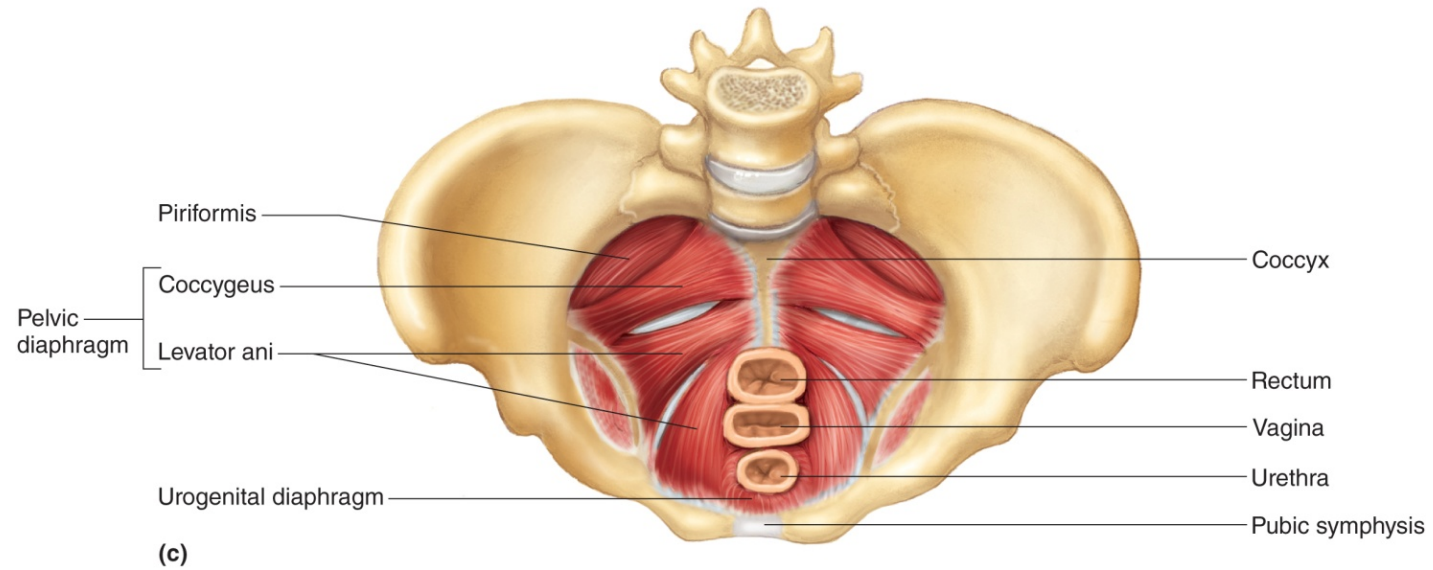
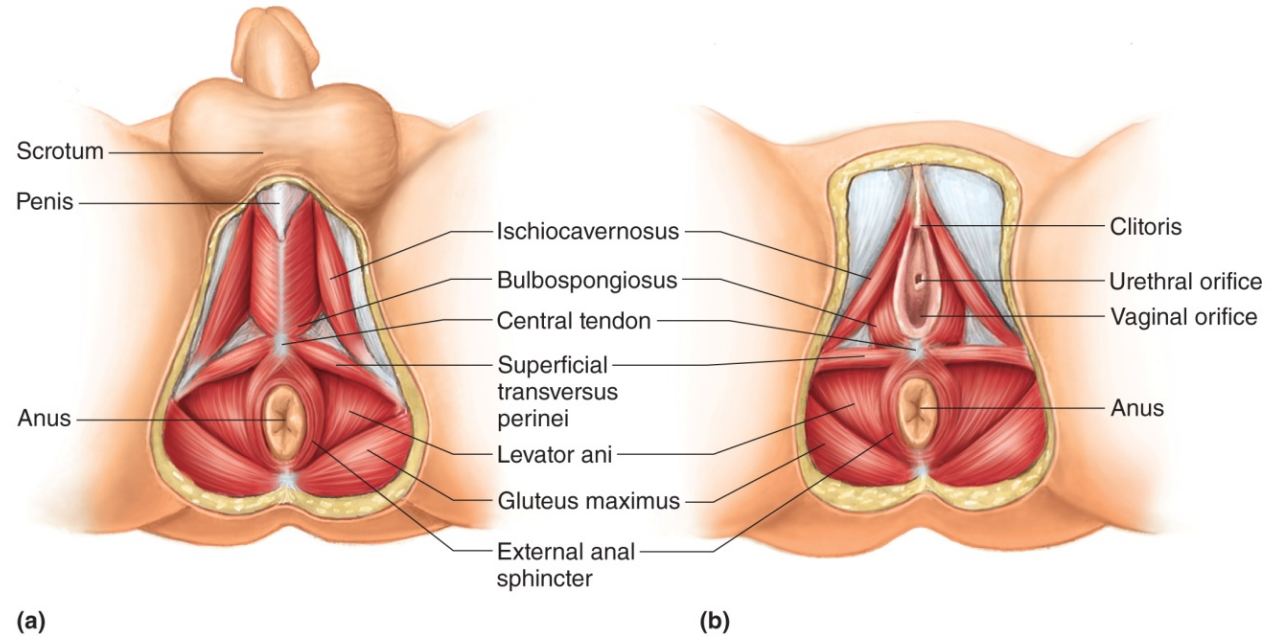
TABLE 9.11 Muscles of the Abdominal Wall APIR				
Muscle	Origin	Insertion	Action	Nerve Supply
External oblique	Outer surfaces of lower 8 ribs	Outer lip of iliac crest and linea alba	Compresses abdomen, flexes and rotates vertebral column	Intercostal nerves 7–12
Internal oblique	Iliac crest and inguinal ligament	Lower 3-4 ribs, linea alba, and crest of pubis	Compresses abdomen, flexes and rotates vertebral column	Intercostal nerves 7–12
Transversus abdominis	Costal cartilages of lower 6 ribs, processes of lumbar vertebrae, lip of iliac crest, and inguinal ligament	Linea alba and crest of pubis	Compresses abdomen, flexes and rotates vertebral column	Intercostal nerves 7–12
Rectus abdominis	Crest of pubis and pubic symphysis	Xiphoid process of sternum and ribs 5-7	Compresses abdomen, flexes vertebral column	Intercostal nerves 7–12



Muscles of the Pelvic Floor

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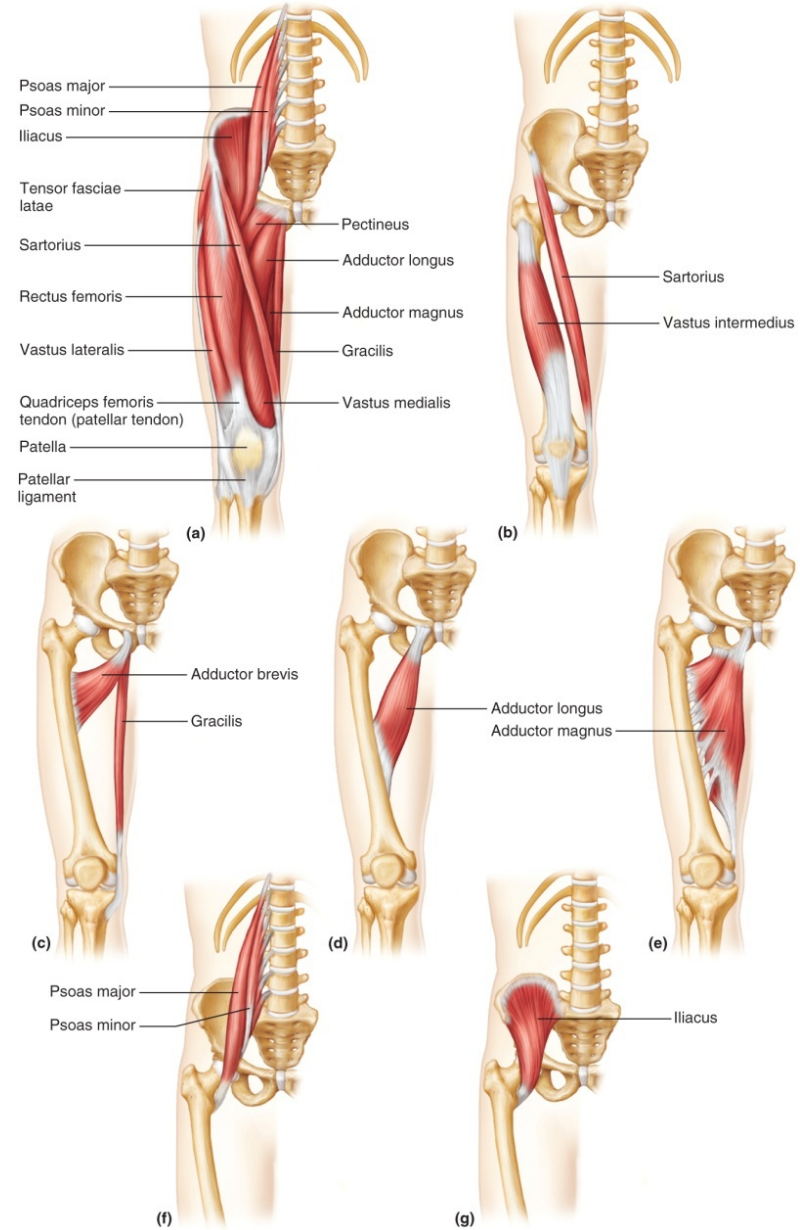
TABLE 9.12 Muscles of the Pelvic Floor				
Muscle	Origin	Insertion	Action	Nerve Supply
Levator ani	Pubis and ischial spine	Coccyx	Supports pelvic viscera and compresses anal canal	Pudendal nerve
Coccygeus	Ischial spine	Sacrum and coccyx	Supports pelvic viscera and provides sphincterlike action in anal canal and vagina	S4 and S5 nerves
Superficial transversus perinei	Ischial tuberosity	Central tendon	Supports pelvic viscera	Pudendal nerve
Bulbospongiosus	Central tendon	Males: Corpus cavernosa of penis	Males: Assists emptying of urethra and assists in erection of penis	Pudendal nerve
		Females: Corpus cavernosa of clitoris	Females: Constricts vagina and assists in erection of clitoris	
Ischiocavernosus	Ischial tuberosity	Males: Corpus cavernosa of penis	Males: Contributes to erection of the penis	Pudendal nerve
		Females: Corpus cavernosa of clitoris	Females: Contributes to erection of the clitoris	
Sphincter urethrae	Margins of pubis and ischium	Fibers of each unite with those from other side	Closes urethra	Pudendal nerve

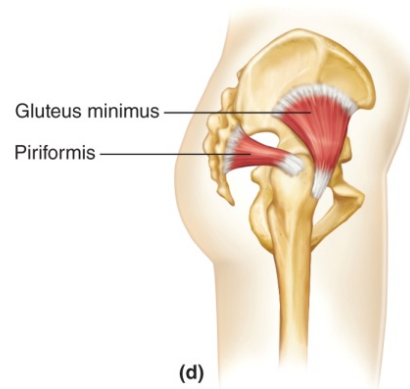
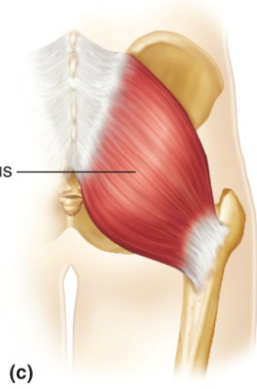
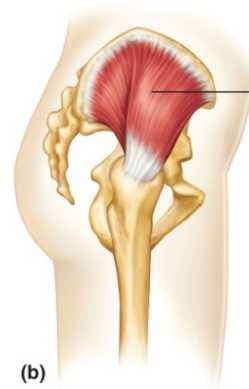
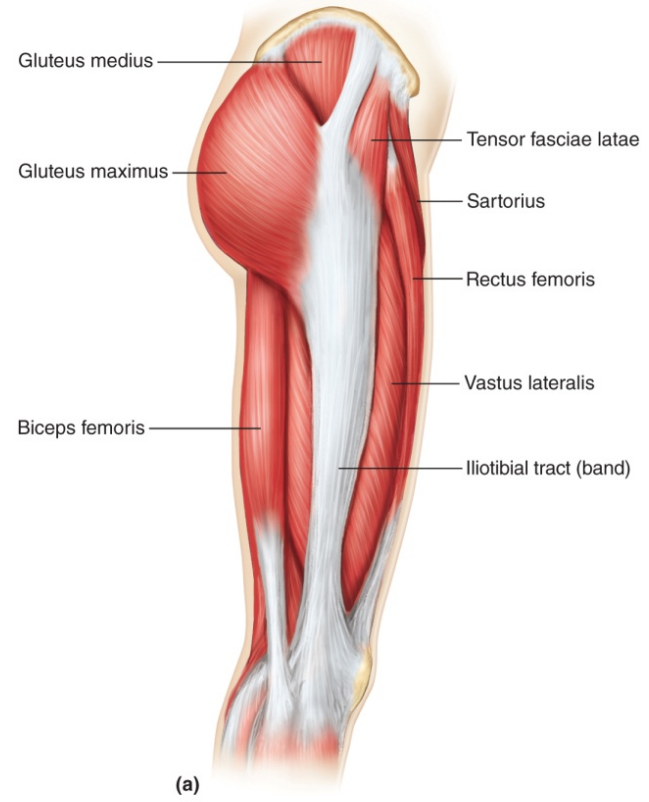


Muscles That Move the Thigh

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TABLE 9.13 Muscles That Move The Thigh APIR					
Muscle	Origin	Insertion	Action	Nerve Supply	
Psoas major	Bodies and transverse processes of lumbar vertebrae	Lesser trochanter of femur	Flexes hip	Branches of L1–3 nerves	
Iliacus	Iliac fossa of ilium	Lesser trochanter of femur	Flexes hip	Femoral nerve	
Gluteus maximus	Sacrum, coccyx, and posterior surface of ilium	Posterior surface of femur and fascia of thigh	Extends hip	Inferior gluteal nerve	
Gluteus medius	Lateral surface of ilium	Greater trochanter of femur	Abducts and rotates thigh medially	Superior gluteal nerve	
Gluteus minimus	Lateral surface of ilium	Greater trochanter of femur	Abducts and rotates thigh medially	Superior gluteal nerve	
Piriformis	Anterior surface of sacrum	Greater trochanter of femur	Abducts and rotates thigh laterally	L5, S1, and S2 nerves	
Tensor fasciae latae	Anterior iliac crest	Iliotibial tract (fascia of thigh)	Abducts thigh, flexes hip, and rotates thigh medially	Superior gluteal nerve	
Pectineus	Spine of pubis	Femur distal to lesser trochanter	Flexes hip and adducts thigh	Obturator and femoral nerves	
Adductor brevis	Pubic bone	Posterior surface of femur	Adducts thigh and flexes hip	Obturator nerve	
Adductor longus	Pubic bone near pubic symphysis	Posterior surface of femur	Adducts thigh and flexes hip	Obturator nerve	
Adductor magnus	Ischial tuberosity	Posterior surface of femur	Adducts thigh, posterior portion extends and anterior portion flexes hip	Obturator and branch of sciatic nerves	
Gracilis	Lower edge of pubic symphysis	Proximal, medial surface of tibia	Adducts thigh and flexes knee	Obturator nerve	

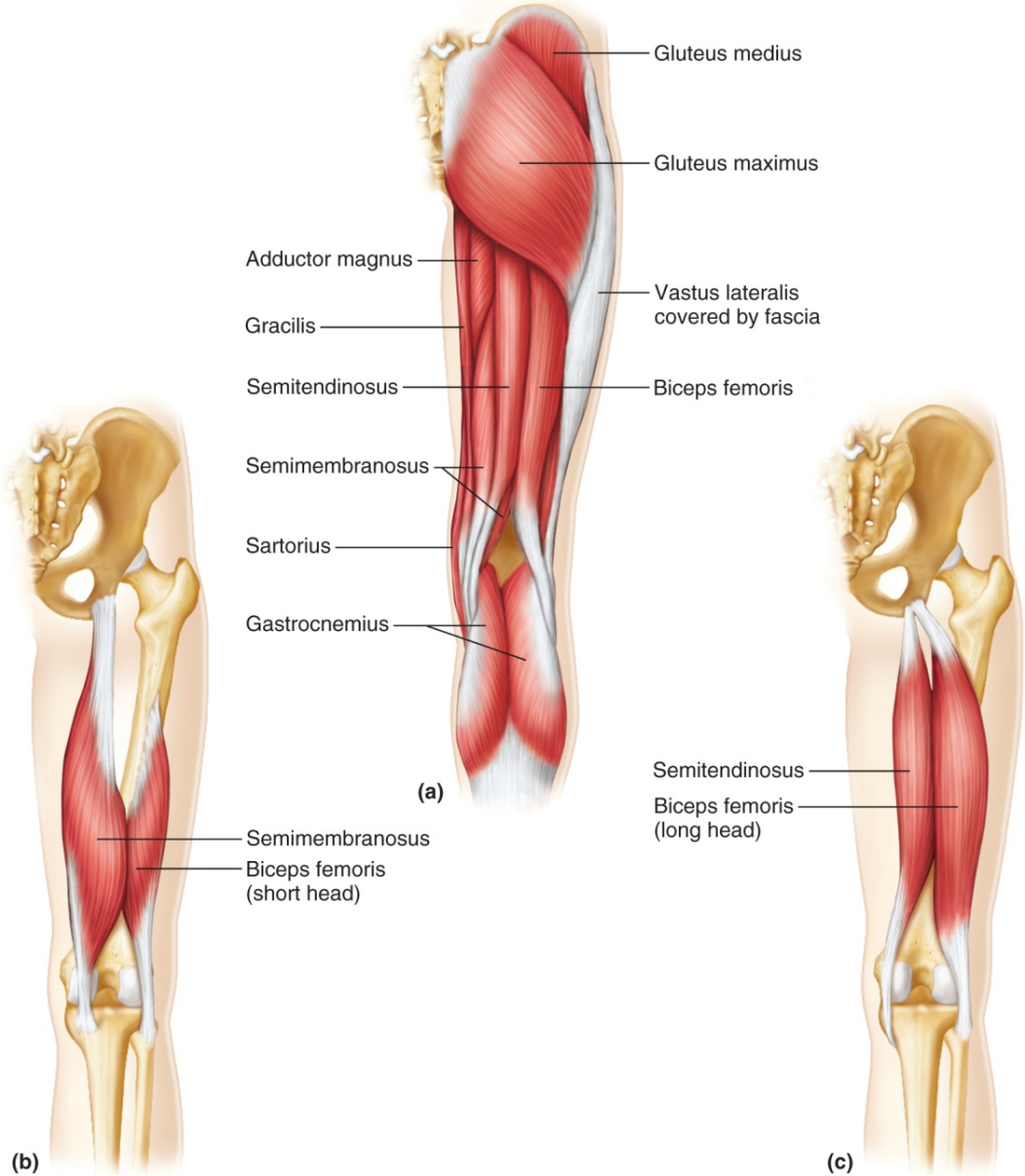




Muscles That Move the Leg

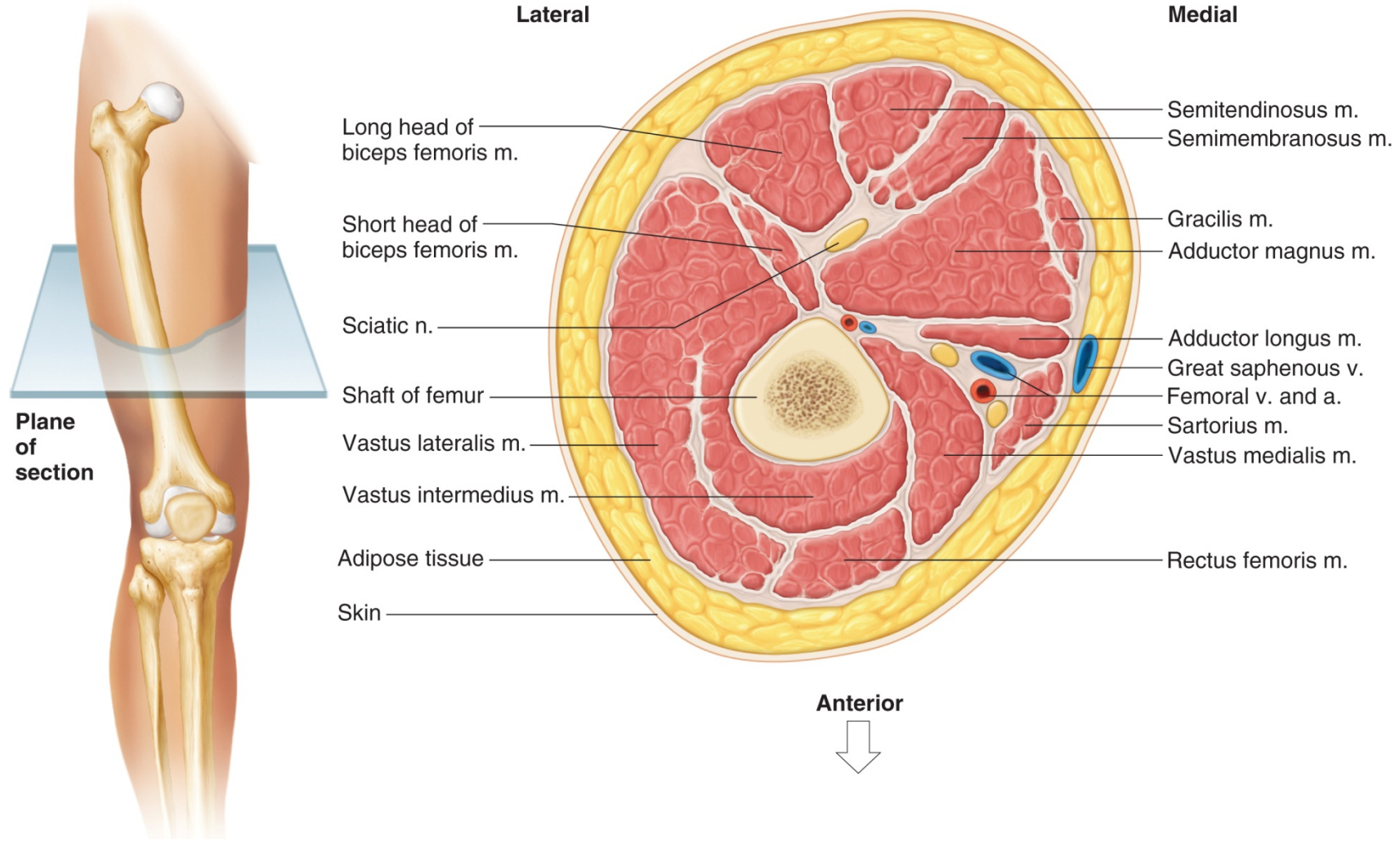
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TABLE 9.14 Muscles That Move the Leg AP R				
Muscle	Origin	Insertion	Action	Nerve Supply
Hamstring Group				
Biceps femoris	Ischial tuberosity and linea aspera of femur	Head of fibula	Flexes knee, rotates leg laterally, and extends hip	Tibial nerve
Semitendinosus	Ischial tuberosity	Proximal, medial surface of tibia	Flexes knee, rotates leg medially, and extends hip	Tibial nerve
Semimembranosus	Ischial tuberosity	Medial condyle of tibia	Flexes knee, rotates leg medially, and extends hip	Tibial nerve
Sartorius	Anterior superior iliac spine	Medial surface of tibia	Flexes knee and hip, abducts and rotates thigh laterally, and rotates leg medially	Femoral nerve
Quadriceps Femoris Group				
Rectus femoris	Anterior superior iliac spine and margin of acetabulum	Patella by tendon, which continues as patellar ligament to tibial tuberosity	Extends knee, flexes hip	Femoral nerve
Vastus lateralis	Greater trochanter and posterior surface of femur	Patella by tendon, which continues as patellar ligament to tibial tuberosity	Extends knee	Femoral nerve
Vastus medialis	Medial surface of femur	Patella by tendon, which continues as patellar ligament to tibial tuberosity	Extends knee	Femoral nerve
Vastus intermedius	Anterior and lateral surfaces of femur	Patella by tendon, which continues as patellar ligament to tibial tuberosity	Extends knee	Femoral nerve



Cross Section of the Thigh

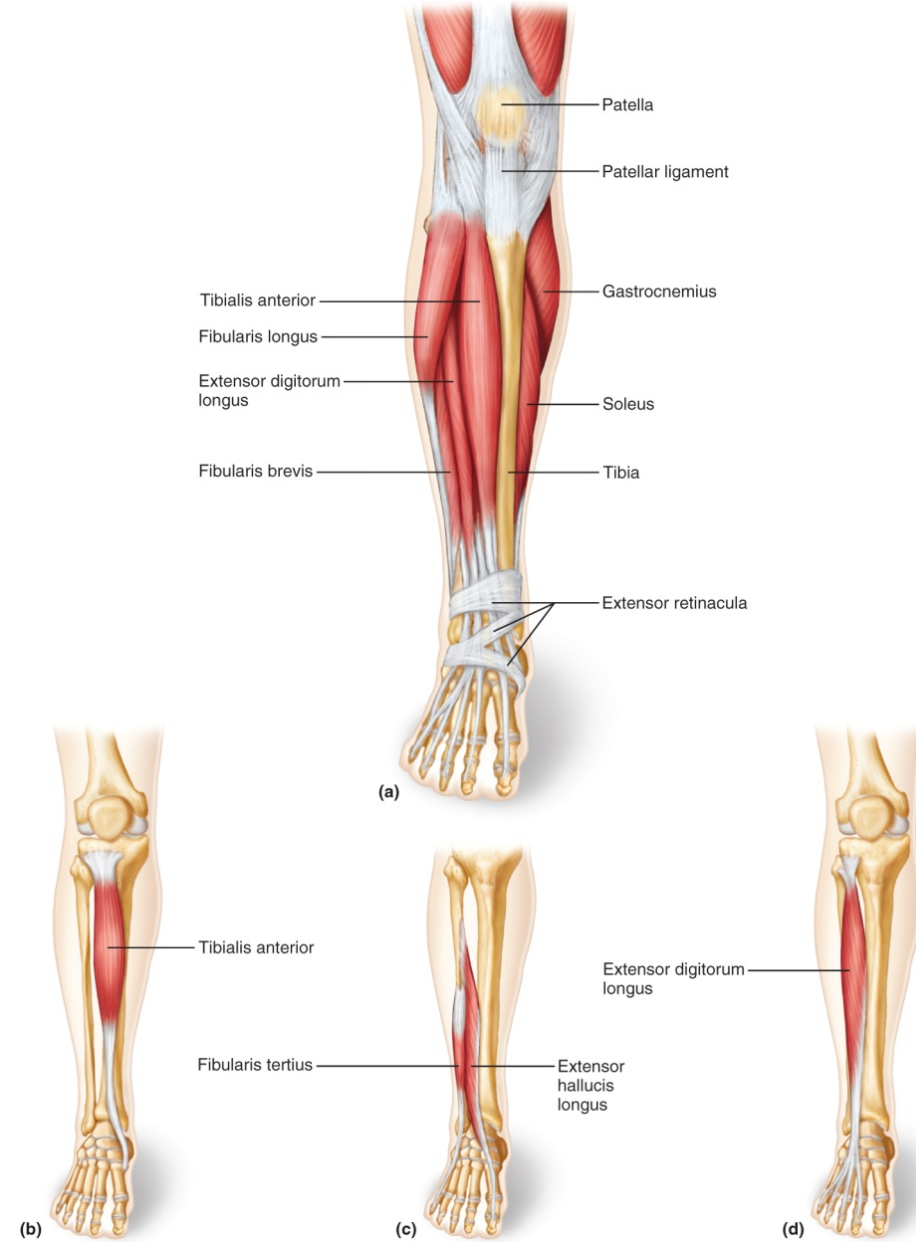
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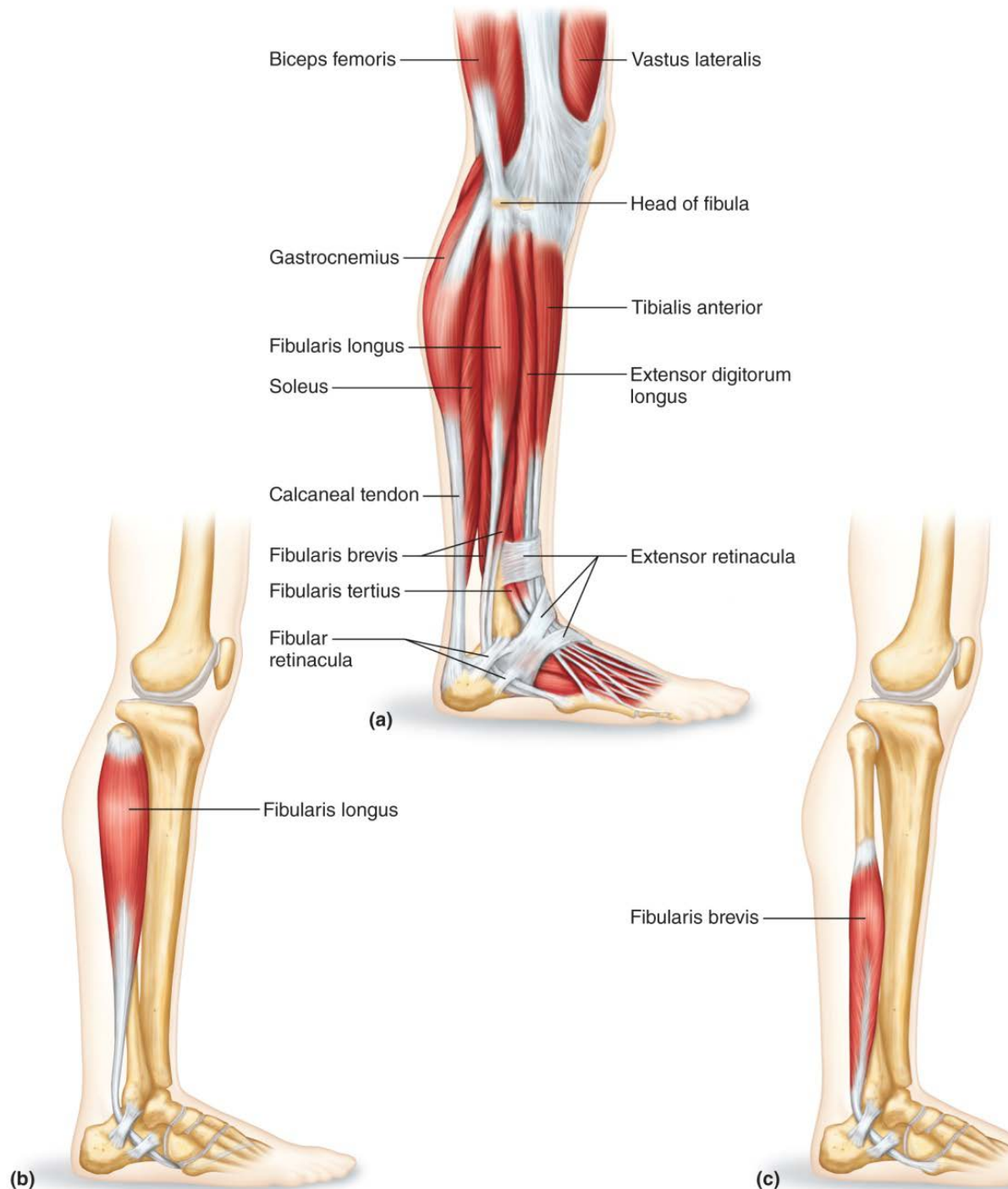


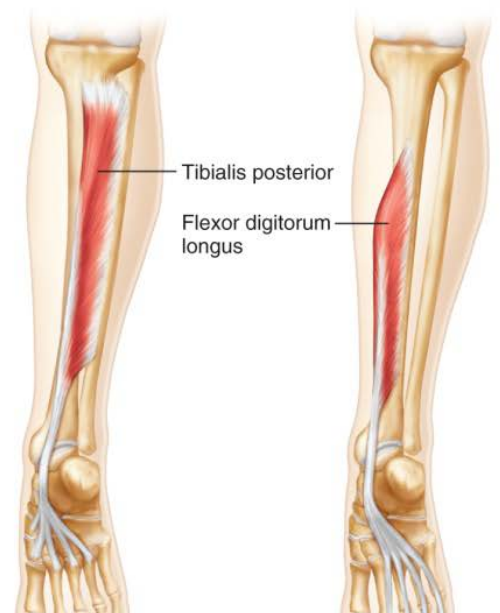
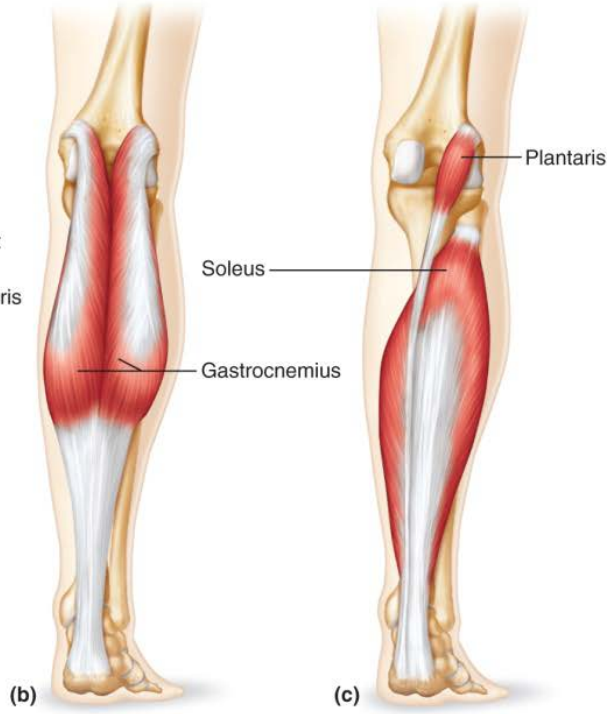
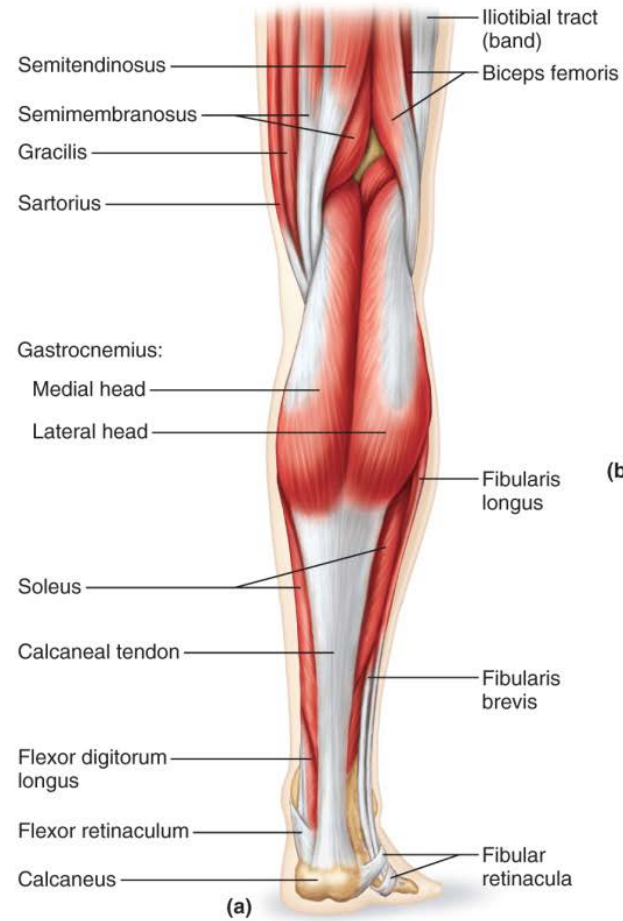
Muscles That Move the Foot

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TABLE 9.15 Muscles That Move the Foot AP R				
Muscle	Origin	Insertion	Action	Nerve Supply
Tibialis anterior	Lateral condyle and lateral surface of tibia	Tarsal bone (medial cuneiform) and first metatarsal	Dorsiflexion and inversion of foot	Deep fibular nerve
Fibularis tertius	Anterior surface of fibula	Dorsal surface of fifth metatarsal	Dorsiflexion and eversion of foot	Deep fibular nerve
Extensor digitorum longus	Lateral condyle of tibia and anterior surface of fibula	Dorsal surfaces of middle and distal phalanges of four lateral toes	Dorsiflexion of foot, extends toes	Deep fibular nerve
Extensor hallucis longus	Anterior surface of fibula	Distal phalanx of the great toe	Extends great toe, dorsiflexion and inversion of foot	Deep fibular nerve
Gastrocnemius	Lateral and medial condyles of femur	Posterior surface of calcaneus	Plantar flexion of foot, flexes knee	Tibial nerve
Soleus	Head and shaft of fibula and posterior surface of tibia	Posterior surface of calcaneus	Plantar flexion of foot	Tibial nerve
Plantaris	Femur	Calcaneus	Plantar flexion of foot, flexes knee	Tibial nerve
Flexor digitorum longus	Posterior surface of tibia	Distal phalanges of four lateral toes	Plantar flexion and inversion of foot, flexes four lateral toes	Tibial nerve
Tibialis posterior	Lateral condyle and posterior surface of tibia and posterior surface of fibula	Tarsal and first metatarsal	Plantar flexion and inversion of foot	Tibial nerve
Fibularis longus	Lateral condyle of tibia and head and shaft of fibula	Tarsal bone (medial cuneiform) and first metatarsal	Plantar flexion and eversion of foot, also supports arch	Superficial fibular nerve







Cross Section of the Leg

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