

THE MUSCULAR SYSTEM MANUAL

The Skeletal Muscles of the Human Body

Musculoskeletal System	Basic Kinesiology Terminology, 1	1
	The Skeletal System, 33	2
	How Muscles Function, 79	3
Upper Extremity	Muscles of the Shoulder Girdle Joints, 91	4
	Muscles of the Glenohumeral Joint, 112	5
	Muscles of the Elbow and Radioulnar Joints, 144	6
	Muscles of the Wrist Joint, 172	7
	Extrinsic Muscles of the Finger Joints, 200	8
	Intrinsic Muscles of the Finger Joints, 238	9
Axial Body	Muscles of the Spinal Joints, 283	10
	Muscles of the Rib Cage Joints, 382	11
	Muscles of the Temporomandibular Joints, 411	12
	Muscles of Facial Expression, 443	13
Lower Extremity	Muscles of the Hip Joint, 490	14
	Muscles of the Knee Joint, 553	15
	Muscles of the Ankle and Subtalar Joints, 586	16
	Extrinsic Muscles of the Toe Joints, 613	17
	Intrinsic Muscles of the Toe Joints, 631	18
Functional Mover Groups	Functional Groups of Muscles, 666	19

PREFACE

The Muscular System Manual: The Skeletal Muscles of the Human Body, 4th edition, is meant to be the most thorough atlas of muscle function that is available. Instead of simply listing muscle attachments and actions that are typically taught, *The Muscular System Manual* comprehensively covers all muscle functions of each muscle. Shortening action functions with their reverse actions are addressed, as well as eccentric and stabilization functions. By offering the student the full picture of muscle function, it actually makes the task of learning the muscles easier, not harder. Students can grasp the information more quickly because they understand it and do not have to memorize it.

WHO WILL BENEFIT FROM THIS BOOK?

This book is primarily written for students and practicing therapists of manual and movement therapies, including massage therapy, physical therapy, chiropractic, osteopathy, orthopedists, athletic training, yoga, Pilates, and Feldenkrais. However, anyone who needs to learn the skeletal muscles of the body will find this book invaluable and essential. Unlike many books, you will not outgrow *The Muscular System Manual*. It will be your guide as you first learn the muscles of the body, and it will remain an invaluable resource on your bookshelf for as long as you are in practice.

CONCEPTUAL APPROACH

The approach taken by *The Muscular System Manual* is unique. Instead of simply listing information, it teaches the information and makes it understandable, allowing for true critical thinking. The beginning chapters set the framework for how muscles work as well as give a five-step approach to learning muscles. Each individual muscle then has notes that explain how the actions can be reasoned out instead of memorized. The goal of this book is to enable the student/therapist/trainer/physician to be able to critically think through muscle functioning when working clinically with clients and patients.

ORGANIZATION

The Muscular System Manual is organized into five Parts. Part 1 covers the basic language of kinesiology that the student needs to be able to understand muscle attachments and functions and also communicate with other members of the health care and fitness fields. Parts 2 through 4 systematically cover each of the major muscles of the body, presenting in a clear and organized manner the essential information of every muscle. The beginning of each chapter in these parts opens with large group illustrations of the muscles of the joint region. Each muscle then has an individual layout in which the muscle's attachments, functions, innervation, arterial supply, palpation, relationship to other structures, and other

miscellaneous information that is intellectually and clinically relevant are given. Part 5 presents illustrations of all the major functional joint action mover groups of muscles as well as illustrations of the muscles of the pelvic floor and myofascial meridians of the body.

DISTINCTIVE FEATURES OF THIS BOOK

There are many features that distinguish this book:

- The most thorough coverage of muscle function available.
- Explanations to understand the muscle's actions that promote critical thinking.
- Full referencing for all joint actions.
- Information presented in a layered à la carte approach that allows each student or instructor to determine what content is covered.
- Beautiful illustrations in which the bones and muscles are placed on a photograph of a real person.
- Large group illustrations for every functional group.
- Myofascial meridian information for every muscle.
- Bulleted clear and easy-to-follow palpations for each muscle.
- An interactive digital program on Evolve that allows for any combination of muscles to be placed on the skeleton and body.

NEW TO THIS EDITION

All features of the 3rd edition have been preserved; the 4th edition of *The Muscular System Manual* has many new features:

- Evidence-based full referencing for all joint actions of the muscles.
- Expanded coverage of muscle function to address the oblique plane motion patterns of the muscles.
- A flashcard app that offers a portable resource for studying more than 250 flashcards, which include coverage of muscles, muscle locations, pronunciations, attachments, actions, and innervation information.
- New illustrations for the muscle attachments and myofascial meridians, as well as for many of the muscles.
- A concise review of all organ systems of the body.
- Digital access to video demonstrations of the palpation of all the muscles of the body.
- An interactive customized digital program that allows stretches of the individual muscles to be printed out for self-care use or for use with patients/clients.

LEARNING AIDS

- The attachment and functions information is presented in a layered à la carte approach that allows the student to decide at what depth to learn the information.

- This book is meant to be used not only as a textbook, but also as an in-class manual. For this reason, checkboxes are provided for each muscle layout as well as each piece of information. This allows the student to check off exactly what content will be learned. Instructors, having students check off content covered, allows for extremely clear expectations of what they are responsible for.
- Arrows are placed over the muscle for each individual muscle illustration so that the line of pull of the muscle can be seen and visually understood. This allows for the actions of the muscle to be understood instead of memorized.
- A Miscellaneous section is provided that offers interesting insights to each muscle. Many of these are clinical applications that flesh out and make learning the muscle more interesting.

EVOLVE ONLINE RESOURCES

This book is backed up by an Evolve website that includes the following student resources:

- An interactive digital program that is simple, thorough, and easy to use. A base photograph of the region of the body is presented with the skeleton drawn in. A list of every muscle of that region is given and you can choose any combination of muscles and place them onto the illustration, allowing you to not only see that muscle's attachments, but more importantly, to be able to see the relationship between all the muscles of the region. *Any combination* of muscles can be chosen!
- Video demonstrations by the author showing palpation of each and every muscle of the book.
- An audio feature in which the author reads aloud the names, attachments, and major actions of all the muscles. This allows for studying while commuting or for use with an MP3 device. Ideal for studying and learning while on the go!
- Interactive review exercises such as Drag 'n' Drop labeling exercises and Name That Muscle quizzes for further review of the skeletal muscles of the human body.
- 200 short-answer review questions to reinforce knowledge learned in the book.

- An interactive customized digital program that allows stretches of the individual muscles to be printed out for self-care use or for use with patients/clients.
- A concise review of all organ systems of the body.
- Supplemental appendices featuring valuable information on the following topics: soft tissue attachments, palpation guidelines, overview of innervation, overview of arterial supply, additional skeletal muscles, and mnemonics for remembering muscle names.

OTHER RESOURCES

For instructors, the entire book is available in 50-minute PowerPoint lectures, with learning outcomes, discussion topics, and critical thinking questions. There is also an instructor's manual that provides step-by-step approaches to leading the class through learning the muscles, as well as case studies that allow for a critical thinking application of the muscles to common musculoskeletal conditions. Further, a complete image collection that contains every figure in the book, and a test bank in ExamView containing 1,500 questions, are provided.

RELATED PUBLICATIONS

The Muscular System Manual is also supported by an excellent coloring book and set of flash cards that can be purchased separately. Look for *Musculoskeletal Anatomy Coloring Book*, 2nd edition, and *Musculoskeletal Anatomy Flash Cards*, 2nd edition, published by Mosby/Elsevier. For more on muscle palpation, look for *The Muscle and Bone Palpation Manual, With Trigger Points, Referral Patterns, and Stretching*, 2nd edition (Mosby/Elsevier, 2015).

NOTE TO THE STUDENT

This book is thick and packed with information. You can choose exactly how much you want to learn. If you are a beginner to learning muscles, the outstanding illustrations and the simple and clear explanations will make learning muscles easy. If you are an advanced student of the muscular system, the depth of information will help you reach new levels of knowledge and clinical application. You will not outgrow this book. Whether as an in-class manual or a reference text for your bookshelf, you will find this book to be an ideal and essential book now and into the future!

HOW TO USE THIS BOOK

- 1 Muscle and Group Name (if applicable), covered in a 2- to 3-page spread.
- 2 Illustration of individual muscle, with arrows indicating lines of pull. Bony attachments are shaded in brown for easy identification. Muscle is deep to (behind) a bone from this. Figures are full color anatomic illustrations of muscles and bones drawn over photographs to help identify positions of the structures. The positions of muscles and bones in the human body are unmistakable in this overlay artwork.
- 3 Checkboxes are used throughout the 2- to 3-page individual muscle spreads so you can mark information to be covered or check it off once you have learned the material.
- 4 A first look at the name of the muscle to see what free information the name gives us.
- 5 Derivation and proper pronunciation of the muscle are provided here.
- 6 Simple attachment (origin) information. (Note: For illustrations of bones, bony landmarks, and muscle attachment sites, see Chapter 2.)
- 7 More detailed attachment (origin) information.
- 8 Simple attachment (insertion) information. (Note: If more detailed attachment [insertion] information is present, it will follow directly after this section.)
- 9 Functions section: This section covers every contraction function of the muscle. This information serves to make *The Muscular System Manual* more complete, giving a comprehensive presentation of musculo-skeletal function. (Note: For an explanation of muscle function, see Chapter 3.)
- 10 Concentric (Shortening) Mover Actions table: The actions (standard and reverse)

1 **Serratus Anterior**

4 The name, *serratus anterior*, tells us that this muscle has a serrated appearance and is anterior (anterior to the serratus posterior superior and serratus posterior inferior).

5 **Derivation**
serratus: L. a notching
anterior: L. in front

5 **Pronunciation**
ser-A-tus
an-TEE-ri-or

ATTACHMENTS

3 **Ribs one through nine**

anterolaterally to the

4 **Anterior Surface of the Entire Medial Border of the Scapula**

FUNCTIONS

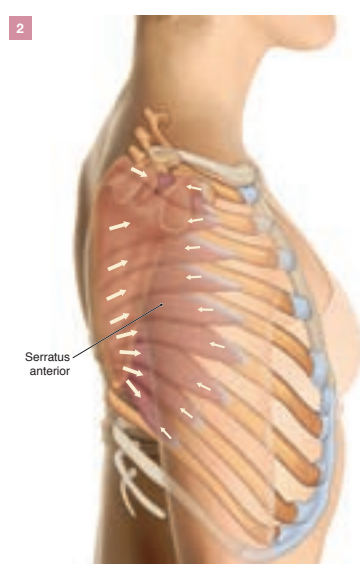
10 Concentric (Shortening) Mover Actions

Standard Mover Actions	Reverse Mover Actions
<input type="checkbox"/> 1. Protracts the scapula at the ScC joint	<input type="checkbox"/> 1. Retracts the trunk at the ScC joint
<input type="checkbox"/> 2. Upwardly rotates the scapula at the ScC joint	<input type="checkbox"/> 2. Depresses the trunk at the ScC joint
<input type="checkbox"/> 3. Elevates the scapula at the ScC joint	<input type="checkbox"/> 3. Elevates the trunk at the ScC joint
<input type="checkbox"/> 4. Depresses the scapula at the ScC joint	
<input type="checkbox"/> 5. Medially tilts the scapula at the ScC joint	
<input type="checkbox"/> 6. Downwardly tilts the scapula at the ScC joint	

ScC joint = scapulocostal joint

11 **Standard Mover Action Notes**

- The costal (i.e., rib) attachment of the serratus anterior is more anterior than the scapular attachment. When the serratus anterior contracts, it pulls the scapula anteriorly toward the ribs; therefore the serratus anterior protracts (i.e., abducts) the scapula at the scapulocostal joint. (action 1)
- Scapular protraction is important when pushing, punching, and reaching forward with the upper extremity. (action 1)
- When the serratus anterior contracts, it pulls on the scapula, causing the inferior angle of the scapula to swing anteriorly and superiorly toward the rib attachment of the serratus anterior (this is especially true of the fibers attaching to the inferior angle of the scapula). This causes the glenoid fossa to orient upward; therefore the serratus anterior upwardly rotates the scapula at the scapulocostal joint. (action 2)



2

Figure 4-7 Lateral view of the right serratus anterior.

- Upward rotation of the scapula is a coupled motion that must accompany any abduction and/or flexion of the arm at the glenohumeral joint. The serratus anterior is especially engaged to upwardly rotate the scapula when the arm is flexed at the glenohumeral joint. (action 2)
- The serratus anterior is the prime mover of scapular protraction, upward rotation, and medial tilt. (actions 1, 2, 5)
- Only the upper fibers of the serratus anterior can elevate the scapula. (action 3)
- Only the lower fibers of the serratus anterior can depress the scapula. (action 4)
- When the scapula moves at the scapulocostal joint, the clavicle also moves at the sternoclavicular joint. (actions 1, 2, 3, 4)
- Medial tilt (also known as lateral rotation) is a motion of the scapula that brings its medial border back against the body wall. In anatomic position, the scapula should be fully

104 PART 2 The Skeletal Muscles of the Upper Extremity

that are usually taught at a beginning or intermediate level are in bold print within the table. The remaining actions within the table are for more advanced levels of learning. (Note: For illustrations of joint actions, see Chapter 1.)

- 11 Standard Mover Action notes: Methodology information that explains the reasoning behind each of the muscle's standard actions.

xvi

HOW TO USE THIS BOOK

12 Reverse Mover Action notes: Methodology information that explains the reasoning behind each of the muscle's reverse actions.

13 Motions: The oblique plane motion(s) of the muscle is given here to better understand the true motion pattern(s) of the muscle.

14 Eccentric and Isometric Functions and Notes: The importance of core stabilization (isometric contraction) in exercise and rehabilitation has become increasingly understood in recent years, and negative (eccentric) contractions are used more and more in exercise. Coverage of this information is unique to this book.

15 Additional notes on the muscle's actions are given here.

16 Innervation section: Two levels of detail are provided, with the predominant spinal levels shown in bold print.

17 Arterial Supply section: Two levels of detail are provided. (Note: Arterial supply to muscles is extremely variable. Although specific information is provided here, this variability must be kept in mind when learning this material.)

18 Palpation section: Easy-to-follow numbered steps to palpate the muscle. See the Evolve website for more in-depth video palpation protocols for the muscle palpation guidelines.

19 Relationship section: Gives information regarding the muscle's anatomic relationship to other musculoskeletal structures.

20 Miscellaneous section: In this section, interesting information about the muscle and clinical applications are given.

Serratus Anterior—cont'd

medially tilted. If the serratus anterior muscles are weak, the client may have a posture of winged scapulae (laterally tilted scapulae). The fact that the serratus anterior is a strong protractor and medial tilter is especially important because the scapula tends to laterally tilt when it protracts. (action 5)

- Downward tilt of the scapula is a motion wherein the inferior angle of the scapula is pulled back against the body wall. In an anatomic position, the scapula should be fully downwardly tilted. (action 6)

Reverse Mover Action Notes **12**

- The reverse action of retracting the trunk (i.e., moving it posteriorly) relative to the scapula at the scapulocostal joint is best seen when performing a push-up. At the point in a push-up when the body has been pushed up away from the ground and the elbow joints are fully extended, there is a small additional degree of upward movement of the body. This motion is created by the serratus anterior pulling the trunk up (posteriorly) toward the scapulae, which are now fixed due to the hands being placed on the floor. (reverse action 1)
- The reverse action of depression of the trunk relative to the scapula at the scapulocostal joint might occur if the arms are flexed 180 degrees overhead with the hands fixed to an immovable object when lying down and the body is pulled downward away from the immovable object. (reverse action 2)
- The reverse action of elevation of the trunk relative to the scapula at the scapulocostal joint is not very likely to occur. (reverse action 3)

13 Motion

1. The serratus anterior has one line of pull in an oblique plane and therefore creates one motion, which is a combination of protraction, upward rotation, medial tilt, and downward tilt of the scapula at the scapulocostal joint. (Note: Its upper fibers also elevate the scapula and its lower fibers also depress the scapula.)

14 Eccentric Antagonist Functions

1. Restrains/slow scapular retraction, downward rotation, depression, elevation, lateral tilt, and upward tilt
2. Restrains/slow protraction, elevation, and depression of the trunk

14 Isometric Stabilization Functions

1. Stabilizes the scapula
2. Stabilizes the rib cage

Isometric Stabilization Function Note

- The stabilization of the scapula function of the serratus anterior is particularly important for maintaining a healthy posture of the scapula. The serratus anterior is the most important muscle for preventing lateral tilt (winging) and upward tilt of the scapula.

Additional Notes on Actions **15**

1. Some sources state that the uppermost fibers of the serratus anterior can downwardly rotate and laterally tilt the scapula.
2. There is controversy regarding whether or not the serratus anterior is involved with respiration by moving the ribcage. Given its attachments onto the ribs, an accessory respiratory action seems likely.
3. The pull of the serratus anterior upon the scapula at the scapulocostal joint is also exerted upon the clavicle at the sternoclavicular joint.

16 INNERVATION

- The Long Thoracic Nerve
- C5, C6, C7**

17 ARTERIAL SUPPLY

- The Dorsal Scapular Artery (a branch of the Subclavian Artery) and the Lateral Thoracic Artery (a branch of the Axillary Artery)
- and the Superior Thoracic Artery (a branch of the Axillary Artery)

18 PALPATION

1. With the client supine and the arm flexed to 90 degrees at the shoulder joint (hand pointed toward the ceiling), place palpating hand on the rib cage on the lateral trunk between the anterior and posterior axillary folds of tissue.
2. Have the client protract the scapula by pushing the hand toward the ceiling and feel for the contraction of the serratus anterior. Resistance may be added.
3. Once located, try to follow the serratus anterior as far anterior as possible (deep to the pectoralis major) and as far posterior as possible (deep to the latissimus dorsi and the scapula).

19 RELATIONSHIP TO OTHER STRUCTURES

- From the posterior perspective, the majority of the serratus anterior lies deep to the scapula and the latissimus dorsi. From the anterior perspective, much of the muscle lies deep to the pectoralis major and minor.
- The serratus anterior is superficial anterolaterally on the trunk where it meets the external abdominal oblique.
- The lowest four to five slips of the costal (i.e., rib) attachments of the serratus anterior interdigitate with the external abdominal oblique.
- The serratus anterior lies next to (anterior to) the subscapularis.
- The serratus anterior is located within the spiral line myofascial meridian.

PART 2 The Skeletal Muscles of the Upper Extremity

105

Serratus Anterior—cont'd

20 MISCELLANEOUS

1. The serrated appearance comes from attaching onto separate ribs, which creates the notched look of a serrated knife.
2. In very well-developed individuals, the serratus anterior looks like ribs standing out in the anterolateral trunk.
3. The serratus anterior can be considered to have three parts: the first part attaching from ribs one and two to the superior angle of the scapula, the second part from ribs two and three to the length of the medial border of

the scapula, and the third part from ribs four through nine to the inferior angle of the scapula. The third part (most inferior part) of the serratus anterior is the strongest.

4. The serratus anterior blends into the rhomboids on the anterior side of the scapula (as part of the spiral line myofascial meridian). Because of this blending, the rhomboids and serratus anterior are sometimes referred to as the *rhomboserratus muscle*. The rhomboserratus musculature acts as a sling that holds and balances the posture of the scapula.

CONTENTS

PART 1

The Musculoskeletal System, 1

- 1 Basic Kinesiology Terminology, 1
- 2 The Skeletal System, 33
- 3 How Muscles Function, 79

PART 2

The Skeletal Muscles of the Upper Extremity, 91

- 4 Muscles of the Shoulder Girdle Joints, 91
 - Trapezius, 96
 - Rhomboids major and minor, 100
 - Levator scapulae, 102
 - Serratus anterior, 104
 - Pectoralis minor, 107
 - Subclavius, 109
- 5 Muscles of the Glenohumeral Joint, 112
 - Deltoid, 119
 - Coracobrachialis, 123
 - Pectoralis major, 125
 - Latissimus dorsi, 128
 - Teres major, 131
 - Rotator Cuff Group, 133
 - Supraspinatus*, 135
 - Infraspinatus*, 137
 - Teres minor*, 139
 - Subscapularis*, 141
- 6 Muscles of the Elbow and Radioulnar Joints, 144
 - Elbow Joint,
 - Biceps brachii*, 152
 - Brachialis*, 155
 - Brachioradialis*, 157
 - Triceps brachii*, 160
 - Anconeus*, 163
 - Radioulnar Joints,
 - Pronator teres*, 165
 - Pronator quadratus*, 167
 - Supinator*, 169
- 7 Muscles of the Wrist Joint, 172
 - Wrist Flexor Group,
 - Flexor carpi radialis*, 185
 - Palmaris longus*, 187
 - Flexor carpi ulnaris*, 190
 - Wrist Extensor Group,
 - Extensor carpi radialis longus*, 192
 - Extensor carpi radialis brevis*, 194
 - Extensor carpi ulnaris*, 197

8 Extrinsic Muscles of the Finger Joints, 200

- Flexors,
 - Flexor digitorum superficialis*, 210
 - Flexor digitorum profundus*, 213
 - Flexor pollicis longus*, 215
- Extensors,
 - Extensor digitorum*, 218
 - Extensor digiti minimi*, 221
- Deep Distal Four Group, 224
 - Abductor pollicis longus*, 225
 - Extensor pollicis brevis*, 228
 - Extensor pollicis longus*, 231
 - Extensor indicis*, 234

9 Intrinsic Muscles of the Finger Joints, 238

- Thenar Eminence Group, 250
 - Abductor pollicis brevis*, 252
 - Flexor pollicis brevis*, 254
 - Opponens pollicis*, 256
- Hypothenar Eminence Group, 258
 - Abductor digiti minimi manus*, 260
 - Flexor digiti minimi manus*, 262
 - Opponens digiti minimi*, 264
- Central Compartment Group, 266
 - Adductor pollicis*, 268
 - Lumbricals manus*, 271
 - Palmar interossei*, 273
 - Dorsal interossei manus*, 276
- Superficial Fascial Muscle,
 - Palmaris brevis*, 279

PART 3

The Skeletal Muscles of the Axial Body, 283

10 Muscles of the Spinal Joints, 283

- Full Spine,
 - Erector spinae group*, 299
 - Iliocostalis*, 302
 - Longissimus*, 305
 - Spinalis*, 308
 - Transversospinalis group*, 310
 - Semispinalis*, 313
 - Multifidus*, 316
 - Rotatores*, 319
 - Interspinales*, 321
 - Intertransversarii*, 323
- Neck and Head,
 - Sternocleidomastoid (SCM)*, 325
 - Scalene group*, 328
 - Anterior scalene*, 330
 - Middle scalene*, 332

Posterior scalene, 334
Prevertebral group, 336
Longus colli, 338
Longus capitis, 340
Rectus capitis anterior, 342
Rectus capitis lateralis, 344
Splenius capitis, 346
Splenius cervicis, 348
Suboccipital group, 350
Rectus capitis posterior major, 352
Rectus capitis posterior minor, 354
Obliquus capitis inferior, 356
Obliquus capitis superior, 358

Low Back,
Quadratus lumborum, 360
Anterior abdominal wall muscles, 363
Rectus abdominis, 366
External abdominal oblique, 369
Internal abdominal oblique, 373
Transversus abdominis, 377
Psoas minor, 379

11 Muscles of the Rib Cage Joints, 382

External intercostals, 390
Internal intercostals, 393
Transversus thoracis, 396
 Diaphragm, 398
Serratus posterior superior, 402
Serratus posterior inferior, 404
Levatores costarum, 406
Subcostales, 408

12 Muscles of the Temporomandibular Joints, 411

Major Muscles of Mastication,
Temporalis, 416
Masseter, 418
Lateral pterygoid, 420
Medial pterygoid, 422
 Lesser Muscles of Mastication—the Hyoid Group,
 Hyoid Group, 424
 Suprahyoids,
Digastric, 426
Mylohyoid, 428
Geniohyoid, 430
Stylohyoid, 432
 Infrahyoids,
Sternohyoid, 434
Sternothyroid, 436
Thyrohyoid, 438
Omohyoid, 440

13 Muscles of Facial Expression, 443

Scalp,
Occipitofrontalis, 449
Temporoparietalis, 451
Auricularis group, 452

Eye,
Orbicularis oculi, 454
Levator palpebrae superioris, 456
Corrugator supercilii, 457
 Nose,
Procerus, 459
Nasalis, 461
Depressor septi nasi, 463
 Mouth,
Levator labii superioris alaeque nasi, 465
Levator labii superioris, 467
Zygomaticus minor, 469
Zygomaticus major, 471
Levator anguli oris, 473
Risorius, 475
Depressor anguli oris, 477
Depressor labii inferioris, 479
Mentalis, 481
Buccinator, 483
Orbicularis oris, 485
Platysma, 487

PART 4

The Skeletal Muscles of the Lower Extremity, 490

14 Muscles of the Hip Joint, 490

Hip Joint Flexors,
Psoas major, 502
Iliacus, 506
Tensor fasciae latae (TFL), 508
Sartorius, 510
 Adductor Group, 512
Pectineus, 516
Adductor longus, 518
Gracilis, 520
Adductor brevis, 522
Adductor magnus, 524
 Gluteal Group, 527
Gluteus maximus, 528
Gluteus medius, 531
Gluteus minimus, 534
 Deep Lateral Rotator Group, 537
Piriformis, 539
Superior gemellus, 542
Obturator internus, 544
Inferior gemellus, 546
Obturator externus, 548
Quadratus femoris, 550

15 Muscles of the Knee Joint, 553

Quadriceps Femoris Group, 562
Rectus femoris, 564
Vastus lateralis, 566
Vastus medialis, 568
Vastus intermedius, 570

Articularis genus, 572
Hamstring Group, 573
 Biceps femoris, 575
 Semitendinosus, 578
 Semimembranosus, 580
Popliteus, 583

16 Muscles of the Ankle and Subtalar Joints, 586

Anterior Compartment,
 Tibialis anterior, 596
 Fibularis tertius, 598
Lateral Compartment,
 Fibularis longus, 600
 Fibularis brevis, 602
Superficial Posterior Compartment,
 Gastrocnemius, 604
 Soleus, 606
 Plantaris, 608
Deep Posterior Compartment,
 Tibialis posterior, 610

17 Extrinsic Muscles of the Toe Joints, 613

Anterior Compartment,
 Extensor digitorum longus, 622
 Extensor hallucis longus, 624
Deep Posterior Compartment,
 Flexor digitorum longus, 626
 Flexor hallucis longus, 628

18 Intrinsic Muscles of the Toe Joints, 631

Dorsal Surface,
 Extensor digitorum brevis, 640
 Extensor hallucis brevis, 642

Plantar Surface: Layer I,
 Abductor hallucis, 644
 Abductor digiti minimi pedis, 646
 Flexor digitorum brevis, 648

Plantar Surface: Layer II,
 Quadratus plantae, 650
 Lumbricals pedis, 652

Plantar Surface: Layer III,
 Flexor hallucis brevis, 654
 Flexor digiti minimi pedis, 656
 Adductor hallucis, 658

Plantar Surface: Layer IV,
 Plantar interossei, 660
 Dorsal interossei pedis, 662

PART 5

Functional Mover Groups of Muscles, 666

19 Functional Groups of Muscles, 666

Functional Mover Groups:
 Upper Extremity, 667
 Axial Body, 686
 Lower Extremity, 702
Muscles of the Pelvic Floor, 716
Myofascial Meridians, 719

References, 725

Index, 737

Right Lateral View of the Muscles of the Shoulder Girdle and Neck Region

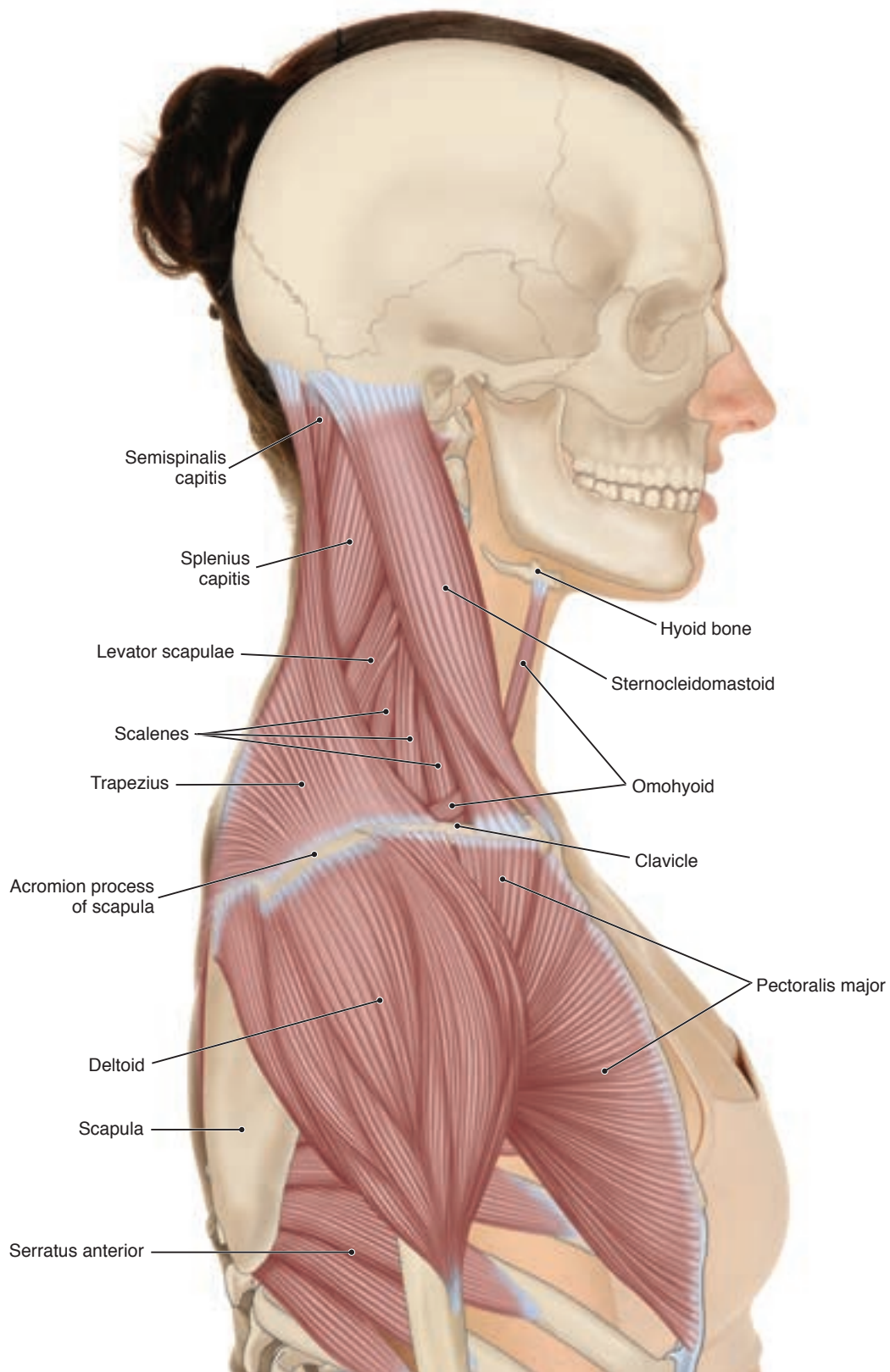


Figure 4-3

□ Thenar Eminence Group

ORGANIZATION OF THE THENAR MUSCLES

The thenar eminence is an eminence of soft tissue located on the radial side of the palm of the hand. There are three muscles in the thenar eminence group: the abductor pollicis brevis, flexor pollicis brevis, and opponens pollicis.

ATTACHMENTS

- All three thenar muscles attach proximally onto the flexor retinaculum and carpal bones.
- All three thenar muscles attach distally onto the thumb.
 - The abductor pollicis brevis and the flexor pollicis brevis attach onto the proximal phalanx of the thumb.
 - The opponens pollicis attaches onto the metacarpal of the thumb.

FUNCTIONS

- All three thenar muscles move the thumb.
- In each case, the name of the muscle indicates its major joint action.

MISCELLANEOUS

1. The layering of the thenar muscles is approximately as follows: The abductor pollicis brevis is the most superficial of the three. The flexor pollicis brevis is intermediate. The opponens pollicis is the deepest of the three.
2. There are three muscles located in the hypothenar eminence that are analogous to the thenar muscles. The three hypothenar muscles are the abductor digiti minimi manus, flexor digiti minimi manus, and opponens digiti minimi.
3. The thenar muscles are located within the deep front arm line myofascial meridian.

INNERVATION

- The three thenar muscles are innervated by the median nerve. (The ulnar nerve usually contributes to a small degree.)

ARTERIAL SUPPLY

- The three thenar muscles receive their arterial supply from the radial artery.

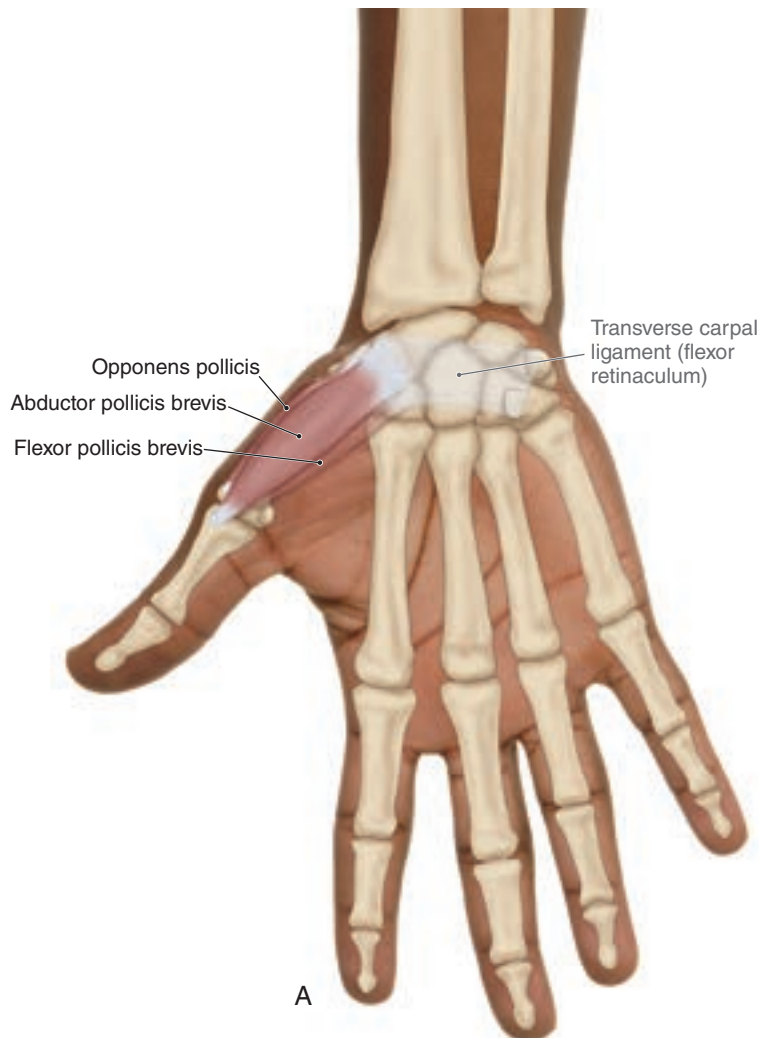


Figure 9-5 Anterior views of the right thenar group muscles. **A**, Superficial view.

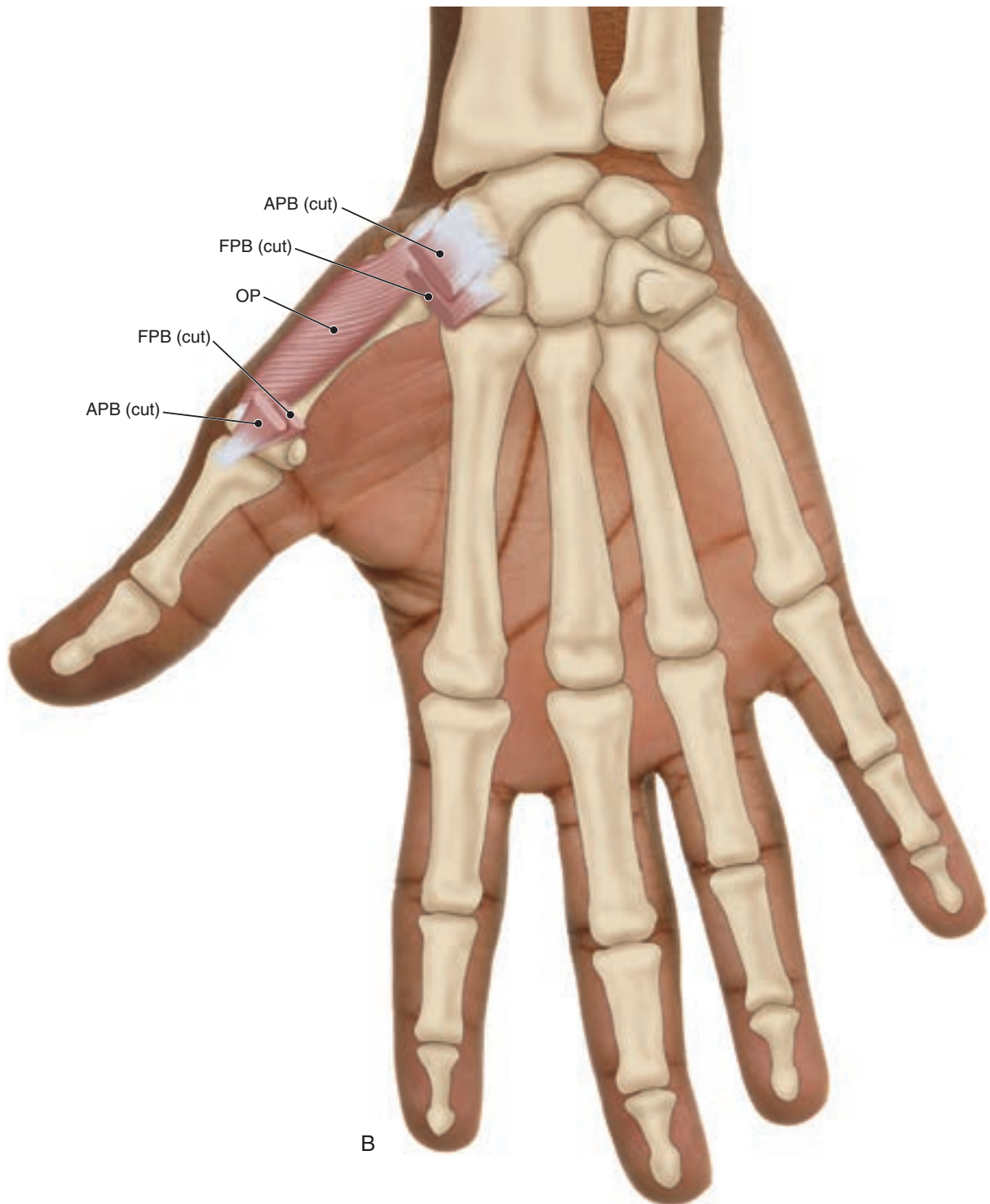


Figure 9-5, cont'd B, Deep view. The abductor pollicis brevis and flexor pollicis brevis have been cut. APB, Abductor pollicis brevis; FPB, flexor pollicis brevis; OP, opponens pollicis.

Biceps Femoris (of Hamstring Group) □

The name, biceps femoris, tells us that this muscle has two heads and lies over the femur.

- **Derivation**
biceps: L. *two heads*
femoris: L. *refers to the femur*
- **Pronunciation**
BY-seps
FEM-o-ris

ATTACHMENTS

- **LONG HEAD: Ischial Tuberosity**
 - and the sacrotuberous ligament
- **SHORT HEAD: Linea Aspera**
 - and the lateral supracondylar line of the femur to the
- **Head of the Fibula**
 - and the lateral tibial condyle

FUNCTIONS

Concentric (Shortening) Mover Actions

Standard Mover Actions	Reverse Mover Actions
□ 1. Flexes the leg at the knee joint	□ 1. Flexes the thigh at the knee joint
□ 2. Extends the thigh at the hip joint	□ 2. Posteriorly tilts the pelvis at the hip joint
□ 3. Laterally rotates the leg at the knee joint	□ 3. Medially rotates the thigh at the knee joint
□ 4. Laterally rotates the thigh at the hip joint	□ 4. Contralaterally rotates the pelvis at the hip joint
□ 5. Adducts the thigh at the hip joint	□ 5. Elevates the same-side pelvis at the hip joint

Standard Mover Action Notes

- The biceps femoris crosses the knee joint posteriorly (with its fibers running vertically in the sagittal plane); therefore it flexes the leg at the knee joint. (action 1)
- The long head of the biceps femoris crosses the hip joint posteriorly (with its fibers running vertically in the sagittal plane); therefore it extends the thigh at the hip joint. The short head cannot extend the thigh at the hip joint because it does not cross the hip joint. (action 2)
- The biceps femoris crosses the knee joint laterally from posterior to anterior (with its fibers running somewhat horizontally in the transverse plane) and attaches to the lateral leg. When the biceps femoris pulls at the leg attachment, the attachment is pulled posteriorly, causing the anterior leg to face somewhat laterally. Therefore the biceps femoris laterally rotates the leg at the knee joint.

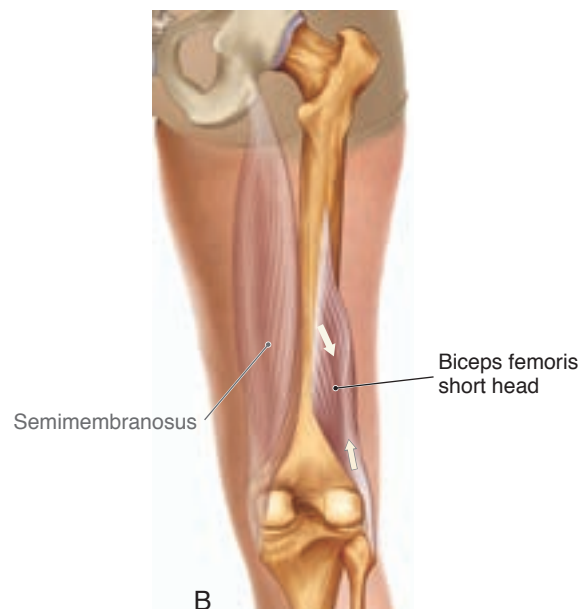
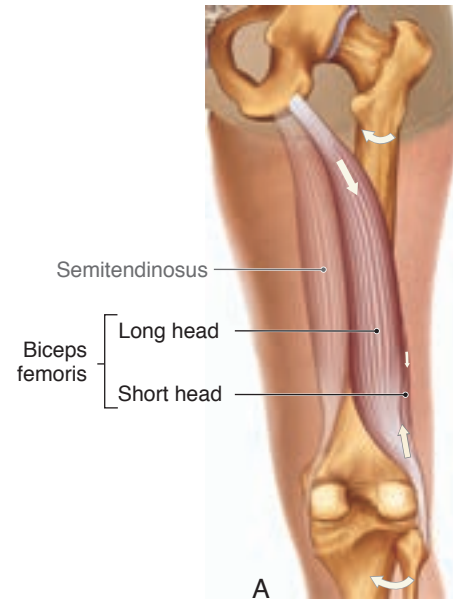


Figure 15-13 Posterior views of the right biceps femoris. **A**, The long and short heads of the biceps femoris are drawn in. The semitendinosus has been ghosted in. **B**, The short head of the biceps femoris. The semimembranosus has been ghosted in.

(Note: The knee joint can only rotate if it is first flexed.) (action 3)

- The biceps femoris is the only muscle that can laterally rotate the leg (and medially rotate the thigh) at the knee joint. (action 3)
- The long head of the biceps femoris crosses the hip joint laterally, wrapping around the thigh from posteriorly on the pelvis to more anteriorly onto the leg (with its fibers running somewhat horizontally in the transverse plane).

Biceps Femoris (of Hamstring Group)—*cont'd*

If the leg is fixed to the thigh and the long head of the biceps femoris pulls on the leg, the leg and thigh are pulled posterolaterally, causing the anterior thigh to face laterally. Therefore the biceps femoris laterally rotates the thigh at the hip joint. (action 4)

- The long head of the biceps femoris crosses the hip joint posteriorly (with its fibers running somewhat horizontally in the frontal plane) below the center of the hip joint from medially on the pelvis to laterally on the leg. Therefore when the biceps femoris pulls its lateral attachment (the leg) medially, it adducts the thigh at the hip joint. (action 5)

Reverse Mover Action Notes

- Reverse actions of the biceps femoris usually occur when the foot is planted on the ground (closed chain kinematics), making the distal attachment relatively more fixed so that the proximal attachment moves instead. (reverse actions 1, 2, 3, 4, 5)
- The biceps femoris crosses the knee joint posteriorly (with its fibers running vertically in the sagittal plane). If the distal attachment is fixed, the thigh flexes toward the leg at the knee joint. (reverse action 1)
- With the distal attachment fixed, the long head of the biceps femoris, by pulling inferiorly on the posterior pelvis, posteriorly tilts the pelvis at the hip joint. The short head does not cross the hip joint; therefore it cannot move the pelvis at the hip joint. (reverse action 2)
- The reverse action of lateral rotation of the leg at the knee joint is medial rotation of the thigh at the knee joint. (reverse action 3)
- The long head of the biceps femoris runs slightly horizontally (in the transverse plane) across the hip joint. If the distal attachment is fixed, the pelvis will be pulled such that its anterior surface comes to face the opposite side of the body from the side to which the biceps femoris is attached. Therefore the biceps femoris contralaterally rotates the pelvis at the hip joint. (reverse action 4)
- With the distal attachment fixed, the long head of the biceps femoris pulls inferiorly and laterally on the ischial tuberosity, causing the iliac crest on that side to elevate. Therefore the long head of the biceps femoris elevates the same-side pelvis at the hip joint. Note: If one side of the pelvis elevates, the other side depresses. (reverse action 5)

Motions

1. The biceps femoris has one line of pull upon the leg and thigh in an oblique plane and therefore creates one motion, which is a combination of flexion and lateral rotation of the leg at the knee joint, and extension, lateral rotation, and adduction of the thigh at the hip joint.
2. Regarding its reverse action pull on the pelvis, the biceps femoris has one line of pull in an oblique plane and therefore creates one motion, which is posterior tilt along with contralateral rotation and same-side elevation of the pelvis.

Eccentric Antagonist Functions

1. Restrains/slows knee joint extension and medial rotation of the leg and lateral rotation of the thigh at the knee joint
2. Restrains/slows flexion, medial rotation, and abduction of the thigh at the hip joint
3. Restrains/slows anterior tilt, ipsilateral rotation, and same-side depression of the pelvis at the hip joint

Isometric Stabilization Functions

1. Stabilizes the thigh and pelvis at the hip joint
2. Stabilizes the knee joint

Additional Notes on Actions

1. All three hamstring muscles (biceps femoris, semitendinosus, and semimembranosus) flex the knee joint.
2. All hamstring musculature (except the short head of the biceps femoris) extends the thigh (and posteriorly tilts the pelvis) at the hip joint.

INNERVATION

- The Sciatic Nerve
 - the tibial nerve and the common fibular nerve; L5, S1, S2

ARTERIAL SUPPLY

Long Head

- The Inferior Gluteal Artery (a branch of the Internal Iliac Artery) and perforating branches of the Deep Femoral Artery (a major branch of the Femoral Artery)
 - and the Obturator Artery (a branch of the Internal Iliac Artery) and branches of the Popliteal Artery (the continuation of the Femoral Artery)

Short Head

- Perforating branches of the Deep Femoral Artery (a major branch of the Femoral Artery)
 - and branches of the Popliteal Artery (the continuation of the Femoral Artery)

PALPATION

1. With the client prone with the leg partially flexed at the knee joint, place palpating hand just distal and slightly lateral to the ischial tuberosity.
2. Resist the client from performing further flexion of the leg at the knee joint and palpate the biceps femoris toward the head of the fibula.

RELATIONSHIP TO OTHER STRUCTURES

- The biceps femoris is a lateral hamstring muscle.
- The biceps femoris is superficial in the posterolateral thigh, except proximally where it is deep to the gluteus maximus.

- The proximal attachment of the short head of the biceps femoris begins immediately distal to the femoral attachment of the gluteus maximus.
- All fibers of the short head of the biceps femoris are deep to the long head except distally near the knee, where some of the fibers of the short head are superficial, lateral to the long head of the biceps femoris.
- The biceps femoris is just lateral to the semitendinosus and just medial (and also superficial) to the vastus lateralis.
- The biceps femoris is located within the superficial back line and spiral line myofascial meridians.

MISCELLANEOUS

1. The proximal attachment of the biceps femoris' long head blends with the proximal attachment of the semitendinosus.
2. Some sources state that the short head of the biceps femoris is not a true hamstring muscle because it does not attach to the ischial tuberosity, does not cross the hip joint, and is not innervated by the tibial nerve branch of the sciatic nerve.