

Chapter 3

Using the Brain-Friendly System to Optimize Your Learning

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Introduction

Chapter 3 – Using the Brain-Friendly System to Optimize Your Learning provides an orientation before you begin learning all the muscles described in the following chapters (4, 5, and 6). You will learn how to use the tables and figures in Chapters 4 – 6 and how to get the most out of studying the muscles.

Because this book is for the study of kinesiology (i.e., movement of the body), the muscles are organized into groups based on the bones and joints they move as they contract. For example, all muscles whose primary action is to move the humerus around an axis at the shoulder joint are presented in “Muscle Group 2 – Movement of the Shoulder Joint”. This arrangement makes it easier to recall the information when you are looking at the body from a movement perspective.

Thirteen **muscle groups** are presented in Chapters 4, 5 and 6 based on major body divisions:

Chap. 4	Muscles That Move the Upper Extremity
Group 1:	Movement of the Scapula/Clavicle
Group 2:	Movement of the Shoulder Joint
Group 3:	Movement of the Elbow, Forearm
Group 4:	Movement of the Wrist, Hand, Fingers
Group 5:	Movement of the Thumb
Chap. 5	Muscles That Move the Axial Skeleton
Group 6:	Movement of the Face and Jaw
Group 7:	Movement of the Neck and Head
Group 8:	Movement of the Spine
Group 9:	Movement of Thorax, Abdomen, Breathing
Chap. 6	Muscles That Move the Lower Extremity
Group 10:	Movement of the Hip Joint (Part 1)
Group 11:	Movement of the Hip Joint (Part 2)
Group 12:	Movement of the Knee (& Hip Joint, Part 3)
Group 13:	Movement of the Ankle, Foot and Toes

In addition, concise **bonus muscle groups** have been added at the end of each chapter (they do not use the full 8-page format described next).

At the end of:	Bonus Muscle Groups
Chapter 4	Intrinsic Muscles of the Hand
Chapter 5	Muscles of the Pelvic Floor
Chapter 6	Intrinsic Muscles of the Foot

8-Page Format

A consistent **8-page format** is used to present each group of muscles. The repetitive format supports the brain-friendly philosophy of this book. A diagram of this 8-page format is shown on the next page. The following organization is used:

General Information –

The first three pages include a list of the muscles in the group, a description of the joints and actions involved, a list of the associated bones and bony landmarks, and overview drawings showing all the muscles and their attachments in place on the skeleton. Please see pages 58-59 for details.

The “A” Table and Figure –

The 4th and 5th pages provide text and drawings about the structure and function of the muscles in the group (see pages 60-61 for more information).

Table (A) – Origins, Insertions, Actions

A table presenting the descriptive information for the muscles.

Figure (A) – Muscle Attachments

Bone drawings with red and blue areas showing origins and insertions of the muscles.

The “B” Table and Figure –

The 6th and 7th pages allow further analysis of muscle actions, show innervation, and give full size illustrations of the muscles (see pages 62-63).

Table (B) – Synergists & Antagonists

A special table to study and compare muscle **actions**. This table also includes the **innervation** for each muscle.

Figure (B) – Muscle Pictures

Illustrations of the muscles, to encourage looking at muscle shapes and fiber directions while analyzing actions.

Note-Taking Page (or Bonus Muscle Group) –

The final (8th) page for a group has small pictures of the muscles with blank areas for writing notes. (Note that this 8th page is sometimes used to show a bonus muscle group).

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How to Use the General Information Pages

Each group of muscles in chapters 4, 5, and 6 begins with three pages of general information. This overview of the group includes summaries of the joint(s) involved, the actions that are possible, and the bones, landmarks and other structures that are muscle attachments or are significantly involved in some other way. The General Information pages have the following components:

- A list of the muscles in the group
- Descriptions of the joint(s) moved by the muscles
- Movements available at those joints
- Action drawings
- Bony landmarks and other structures to preview before studying the individual muscles
- Overview drawings of the muscles and their attachments

Joints and Actions

(1st page of the 8-page format)

The main joint or joints that are moved by the muscle group are given first, and other joints that are secondarily involved are listed second. A special symbol ◀▶ is used to indicate the meeting point (articulation) of the bones that make up the joint. Also included are the type of joint, the movements available at the joint, and other pertinent information.

Action Pair Drawings

For each muscle group, illustrations show the actions available for the main joints or structures moved when the muscles contract. These illustrations are organized in pairs to show how different actions oppose each other (opposite actions are done by antagonist muscles). The precise point where the joint in question is moving around its axis is indicated with a symbol “⊗”, and the direction the body part is moving is indicated with an arrow. Examples of action pairs are shown in the figure to the right.

Movement of the Shoulder Joint

Muscle Group 2

Deltoid	Rotator Cuff Muscles:
Pectoralis major	Supraspinatus
Coracobrachialis	Infraspinatus
Latissimus dorsi	Teres minor
Teres major	Subscapularis

Anterior View

Joints (Joint details: p. 72)

The muscles in this group primarily move the humerus at the glenohumeral joint, commonly called the shoulder joint.

Glenohumeral Joint (GH) – The Shoulder Joint

Glenoid cavity of scapula ◀▶ Head of humerus

Ball and socket joint

Movements available:

- Flexion, Extension
- Abduction, Adduction
- Lateral Rotation, Medial Rotation
- Horizontal Abduction (also called Horizontal Extension)
- Horizontal Adduction (also called Horizontal Flexion)
- Circumduction (a combination movement)

Notes:

The GH joint is highly mobile, and very unstable. Joint capsule is main support (few extrinsic ligaments)

Other Movements

The combination of the humerus and shoulder girdle (p. 75) is called the **shoulder complex**. The humerus and scapula usually move in a coordinated fashion. For example,

- Muscles acting on the humerus which have origins that are *not on the scapula* can create scapular movement by “remote control” (e.g. latissimus dorsi, pectoralis major).
- **Scapulohumeral rhythm** – Movements of the humerus and scapula are sequenced and coordinated. This is usually observed as a 2-to-1 ratio during abduction of the arm, where the humerus rotates 2 degrees at the glenohumeral joint for each 1 degree of upward scapular rotation. Other rhythms occur during flexion/extension and horizontal abduction/adduction.

Action

Flexion

Opposite Action

Extension

Abduction

Adduction

Lateral Rotation
(External Rotation)

Medial Rotation
(Internal Rotation)

Horizontal Abduction
(Horizontal Extension)

Horizontal Adduction
(Horizontal Flexion)

Joints and Actions (see p. 83 for full size page)

Action

Abduction at GH Joint

Opposite Action

Adduction at GH Joint

Action

Upward Rotation of Scapula

Opposite Action

Downward Rotation of Scapula

Examples of Action Pair Drawings

Bones, Bony Landmarks, Other Structures – Preview List

(2nd page of the 8-page format)

This page lists the bones, bony landmarks, and other body structures that are attachments for the muscles in the group. Also listed are other structures that are significantly involved with the use of the muscles. It is a good idea to preview the bony landmarks listed on this page before you begin studying the origins and insertions of the muscles (all bony landmark drawings are centralized in Chapter 2 of this book). Then, as you read and memorize each muscle, the names of landmarks will be familiar.

The bottom of this page often provides additional illustrations and information to highlight special features and terminology related to the muscle group. This may include special groupings within the group, cross-sections, or brief descriptions of smaller muscles that are not included in the main “A” and “B” tables for the muscle group.

Muscle Overview Drawings

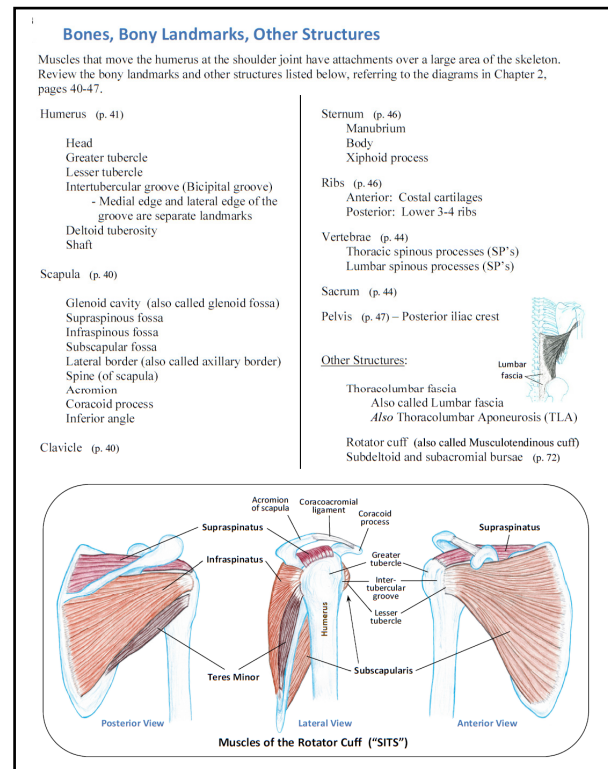
(3rd page of the 8-page format)

Overview drawings provide a “big picture” for the muscle group to give an overall sense of the group before going on to study the individual muscles. Two types of drawings are provided:

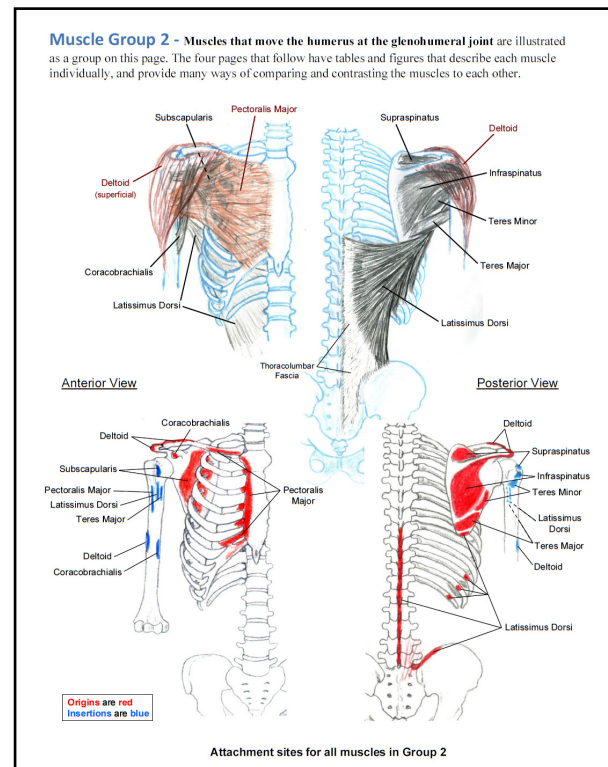
1. All muscles shown together in place on the skeleton.
2. Skeleton pictures with all origins in red and insertions in blue.

Use these drawings to look for patterns to help you understand how the muscles in the group work together. For example, Muscle Group 2 has muscles that move the humerus at the glenohumeral joint. You can see that all the insertions (shown in blue) are gathered on the humerus, while the origins (shown in red) are spread over a large area on many other bones of the body.

These illustrations are also useful to begin understanding which of the muscles in the group reside in different layers.



Bones, Bony Landmarks, etc. (see p. 84 for full size page)



Overview Drawings (see p. 85 for full size page)

How to Use the Tables and Figures

Each group of muscles is presented in a consistent manner. Once you get used to this organization, you will find it easy to study and interrelate the information, as well as quickly look up individual muscles.

Each of the 13 groups of muscles is presented with two pairs of tables and figures: The “A” table and figure, and the “B” table and figure. All tables and figures for a given muscle group are enumerated with the group number, for example,

Muscle Group 1: Table 1(A), Figure 1(A),
Table 1(B), Figure 1(B)
Muscle Group 2: Table 2(A), Figure 2(A),
Table 2(B), Figure 2(B)
⋮
Muscle Group 13: Table 13(A), Figure 13(A),
Table 13(B), Figure 13(B)

The “A” Table and Figure

(4th and 5th pages of the 8-page format)

An “A” Table and “A” Figure for a muscle group are shown on pages facing each other, so you can easily refer back and forth as you study them. The example on the following page shows Table 2 (A) and Figure 2 (A), which are from Muscle Group 2, the muscles that move the humerus at the shoulder joint (glenohumeral joint).

Table 2 (A) – Origin, Insertion, Action

The “A” Table contains verbal descriptions of the origins, insertions, and actions for each muscle. As you study the muscles, occasionally look up and down each column to compare and contrast which muscles have similar attachments and actions, and which muscles differ. By continually looking for word patterns as you learn the information, you will help anchor the words in your brain and make them easier to recall later.

As you read the **Origins** and **Insertions** for each muscle, look down to the facing page (Figure 2 (A)), and observe the red and blue spots drawn on the bones. This will help relate the words in the Table to an image of exactly what the words mean. It will be easier to do this if you have *previewed* the bony landmarks listed a few pages prior.

As you read the **Actions**, move your body, or that of a partner, to relate the words to actual movements. Also, remember all the actions named in the right hand column of this “A” table have been gathered, sorted out, and re-listed across the top of the “B” table for further study (see next section).

Note that sometimes portions of text in the tables are in smaller print and enclosed in parentheses. These parenthetical phrases add extra detail to the basic information in a table cell. The idea is to have a concise description of origin, insertion, and action that is sufficient for most readers, and then provide more details for those readers who require advanced information.

Figure 2 (A) – Muscle Attachments

The “A” Figure illustrates the places where the muscles attach to the bones. **Red** indicates **origin** and **blue** indicates **insertion**. Visualize lines of force (e.g., puppet strings, ropes,...) connecting the red area to the blue area and think about what happens when the blue point on the more moveable bone is pulled toward the red area on the more stable bone.

Relate the movement you visualize to the words in the **Action** column of Table 2 (A), keeping in mind any constraints imposed by the bone shapes, joint type, etc. (see "Real-time Factors that Affect a Muscle's Actions" on page 67).

Comparing O/I Pictures to Muscle Pictures










Note that you can lift the “A” Figure page to see pictures of the individual muscles to go with each of the origin/insertion bone drawings. The “B” Figure – Muscle Pictures page is always two pages after the “A” Figure, so the muscle pictures lie directly under the bone attachment drawings.

Example of an “A” Table and Figure

Each **row** gives all information for a single muscle.
For example, row 2 gives Origin, Insertion & Action for the Supraspinatus muscle.

Each **column** gives a single feature for all muscles. For example, column 3 gives the Insertions for all the muscles.

GH=Glenohumeral joint (shoulder joint), UL=Unilateral action, BL=Bilateral action

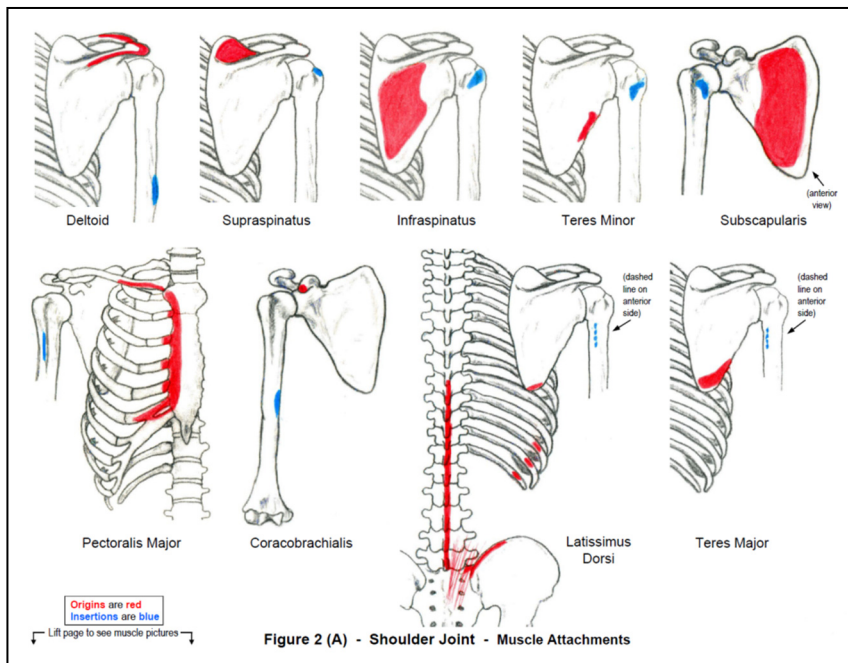
Muscles Acting On Shoulder Joint		Origin	Insertion	Action
	Deltoid moves the humerus	Lateral clavicle, Acromion of scapula, Spine of scapula	Deltoid tuberosity of humerus	All / middle fibers: Abduction of humerus at the GH joint Anterior fibers: Flexion, medial rotation, and horizontal adduction Posterior fibers: Extension, lateral rotation, and horizontal abduction
	Supraspinatus moves the humerus	Supraspinous fossa of scapula	Greater tubercle of humerus (superior aspect)	Abduction of humerus at the GH joint, Stabilizes the humerus in the glenoid fossa
	Infraspinatus moves the humerus	Infraspinous fossa of scapula	Greater tubercle of humerus (posterior aspect)	Lateral rotation of humerus at the GH joint, Stabilizes the humerus in the glenoid fossa
	Teres Minor moves the humerus	Lateral/axillary border of the scapula	Greater tubercle of humerus (posterior aspect, inferior to infraspinatus tendon)	Lateral rotation of humerus at the GH joint, Stabilizes the humerus in the glenoid fossa
	Subscapularis moves the humerus	Subscapular fossa of scapula	Lesser tubercle of humerus (on anterior humerus)	Medial rotation of humerus at the GH joint, Stabilizes the humerus in the glenoid fossa
	Pectoralis Major moves the humerus	Clavicular head: Medial half of clavicle Sternocostal part: Sternum & cartilages of ribs 1-6 (also sometimes abdominal head: Aponeurosis of external oblique)	Intertubercular groove of the humerus (lateral lip)	All fibers: Adduction and medial rotation of humerus Upper fibers: Flexion and horizontal adduction of humerus Lower fibers: Extension of humerus - from a flexed position
	Coracobrachialis moves the humerus	Coracoid process of scapula	Shaft of humerus -- on the medial side half way down	Flexion and adduction of the humerus at the GH joint (also assists horizontal adduction)
	Latissimus Dorsi moves the humerus and the trunk & spine	Spinous processes of lower 6 thoracic and all lumbar vertebrae, sacrum, posterior iliac crest, lumbar fascia, lower 3 or 4 ribs (and sometimes the tip of the inferior angle of the scapula).	Intertubercular groove of the humerus (medial lip)	Extension, adduction, and medial rotation of the humerus at the GH joint. Also affects lower trunk & spine: UL: lateral flexion, BL: extension of spine & anterior pelvic tilt
	Teres Major moves the humerus	Inferior angle and lower lateral border of scapula (dorsal side)	Intertubercular groove of the humerus (medial lip)	Extension, adduction, and medial rotation of the humerus at the GH joint.

(larger illustrations on page 83)

Table 2 (A) - Shoulder Joint - Origin, Insertion, Action

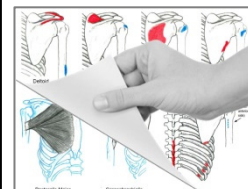
Compare the words in the A Table above to the pictures in the A Figure below.

Origins: Shown in **Red**
Insertions: Shown in **Blue**
Actions: Visualize the **blue** being pulled toward the **red**



See page 86 for full size Figure 2 (A)

Lift this “A” Figure page to see the associated “B” Figure



Each row of pictures is sized and oriented for easy comparison of muscle attachments.

A dashed line indicates a muscle attachment on the opposite side of the bone from the side you are viewing.

The “B” Table and Figure

(6th and 7th pages of the 8-page format)

The “B” Table and “B” Figure are on pages facing each other so you can easily refer back and forth as you study them. The example on the following page shows Table 2 (B) and Figure 2 (B), which are from Muscle Group 2, the muscles that move the humerus at the shoulder joint.

Table 2 (B) – Synergists & Antagonists

The **B Table** has muscle names listed down the left-hand side. Across the top are all actions that are possible for the joint(s) of that muscle group. This creates a grid format where each muscle is represented by a row and each action by a column.

	Action 1	Action 2	Action 3	Action 4	Action 5
Muscle 1		✓	✓		
Muscle 2					✓
Muscle 3	✓				✓
Muscle 4		✓			

Each **row** shows all the Actions created by that Muscle

	Action 1	Action 2	Action 3	Action 4	Action 5
Muscle 1		✓	✓		
Muscle 2					✓
Muscle 3	✓				✓
Muscle 4		✓			

Each **column** shows all the Muscles that create that Action

In the cells of this grid are ✓ marks or other symbols that indicate how the muscle (the row) is involved with the action (the column). The following table describes all symbols that are used in the cells.

The arrangement of the **B** table is particularly suitable for learning the relationships of muscles that work together to perform a given action (synergists), as well as which muscles oppose that action (antagonists).

Symbols used in the B Tables

Symbol	Meaning
✓	The muscle creates the action (agonist, prime mover)
✓ assist	The muscle assists the action but is not a prime mover
may assist	May assist, depending on strength requirements or relative bone angles
“__ fibers”	A muscle <i>portion</i> creates the action (e.g., “anterior fibers” or “upper fibers”)
UL	Unilateral contraction creates the action (applies to axial skeleton, see p. 121)
BL	Bilateral contraction creates the action (applies to axial skeleton, see p. 121)
□	(empty cell) The muscle <i>does not</i> contribute to the action

More Features of the B tables:

- Pairs of actions that are opposites are placed in adjacent columns. This allows looking down one column to see the synergists for an action, and then looking at the adjacent column to see the antagonists for the action. (ref. page 31)
- The **B** table also has an area on the right hand side that gives the **Innervation** for each muscle. The names of the nerve(s) that supply each muscle are listed, and the spinal segments are indicated in table format. (ref. page 24)
- The bottom row, with title “More muscles for the action --->”, indicates when muscles in other muscle groups also contribute to the action indicated in a column. If so, the words “see also Group #” are in the cell.

Figure 2 (B) – Muscle Pictures

The **B Figure** contains pictures of the muscles for comparison. For example, Figure 2 (B) is located on a page facing Table 2 (B) so you can look back and forth to relate the actions in the table with muscle positions, shapes, and fiber directions.

Note that the **B** Figure is on a page directly under the **A** Figure two pages prior, so you can easily compare the muscle shape with the red and blue origins and insertions shown in the **A** Figure.

Example of a “B” Table and Figure

Each **row** shows ✓'s for the actions created by a single muscle. For example, row 2 indicates that the Supraspinatus muscle creates abduction and stabilizes the GH joint.

Each **column** shows ✓'s for all muscles that create an action. For example, Lateral Rotation at the GH joint is created by the Deltoid (posterior fibers), Infraspinatus, and Teres Minor muscles.

Group 2: GH jt. = Glenohumeral joint (shoulder joint), ✓ = Muscle creates the action, UL = Unilateral action, BL = Bilateral action, N = Nerve

Muscles Acting On Shoulder Joint	Flexion @ GH jt.	Extension @ GH jt.	Abduction @ GH jt.	Adduction @ GH jt.	Medial Rotation @ GH jt.	Lateral Rotation @ GH jt.	Stabilization of GH jt.	HC: Add. / Other	Innervation	C5	C6	C7	C8	T1
1. Deltoid: Anterior fibers Middle fibers Posterior fibers	✓ (Ant. fib.)		✓ (All / middle fibers)		✓ (Ant. fib.)	✓ (Post. fib.)		Ant. Horiz. Adduction Post. Horiz. Abduction	Axillary N. (C5, C6)	N	N			
2. Supraspinatus			✓				✓		Suprascapular N. (C5)	N				
3. Infraspinatus						✓	✓	may assist horiz. abduction	Suprascapular N. (C5, C6)	N	N			
4. Teres Minor						✓	✓		Axillary N. (C5)	N				
5. Subscapularis					✓		✓		Subscapular N. (C5, C6)	N	N			
6. Pectoralis Major: Upper fibers Lower fibers Abdom. fibers	✓ (Upper fib.)	✓ (Lower fib.) Extends from a flexed position		✓ (All fibers)	✓ (All fibers)			Upper fib.: Horiz. Adduction Lower & abdom. fibers depress shoulder girdle	Lateral pectoral N. (C5, C6, C7) & Medial pectoral N. (C8, T1)	N	N	N	N	N
7. Coracobrachialis	✓			✓ (with resistance)				may assist horiz. adduction	Musculocutaneous N. (C6, C7)	N	N			
8. Latissimus Dorsi		✓ "handcuff position"		✓ (behind the back)	✓			Draws shldr girdle down and back Affects spine & lower trunk UL: lat. flex., BL: extension	Thoracodorsal N. (C6, C7, C8)	N	N	N		
9. Teres Major		✓		✓	✓			"Lat's little helper"	Lower Subscapular N. (C5, C6)	N	N			
(More muscles for the action) →	see also Group 3	see also Group 3							Innervation					

Right-hand portion of Table shows nerves that supply each muscle (Innervations)

See page 88 for full size Table 2 (B)

Table 2 (B) - Shoulder Joint - Synergists & Antagonists

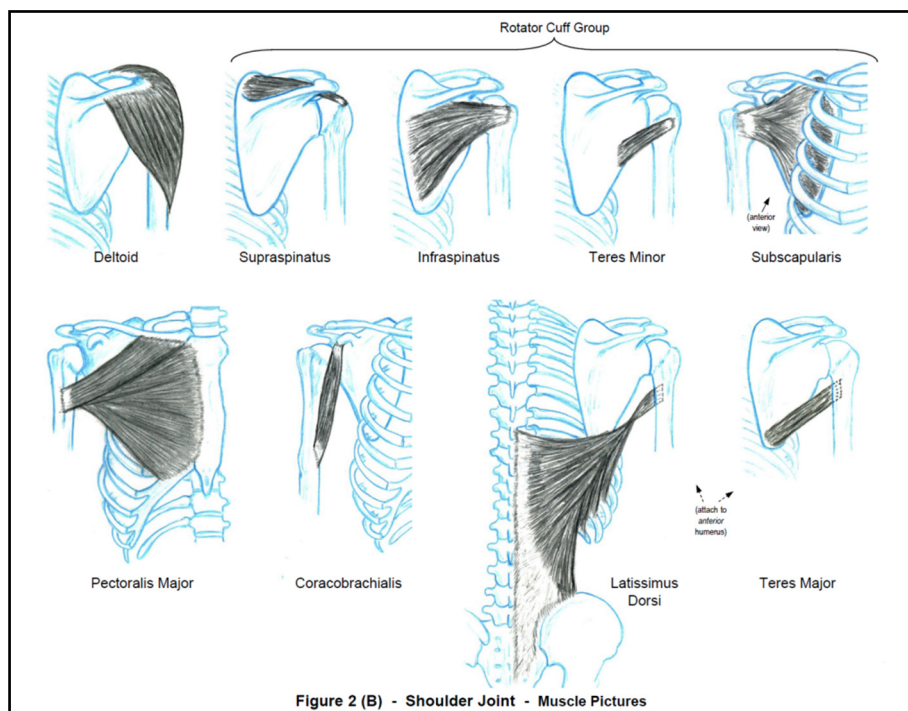


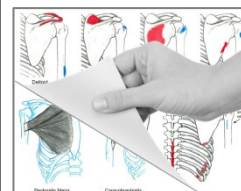
Figure 2 (B) - Shoulder Joint - Muscle Pictures

Each row of pictures is sized and oriented for easy comparison of muscles.

Dashed lines indicate that part of a muscle is on the opposite side of the bone from the side you are viewing.

See page 89 for full size Figure 2 (B)

Lift previous page "A" Figure to see this "B" Figure



An Example: Learning the Deltoid Muscle

This section demonstrates how to use the tables and figures to study the Deltoid muscle and compare and contrast it to other muscles in its group. The components of this example are taken from the section “Muscle Group 2 – Movement of the Shoulder Joint” on pages 86-89, in Chapter 4 – Muscles That Move the Upper Extremity.


The figure below shows the **Deltoid** muscle portions from Table 2(A), Figure 2(A), and Figure 2(B). This demonstrates how to tie together the information and optimize your study time by learning from both the verbal and visual directions.

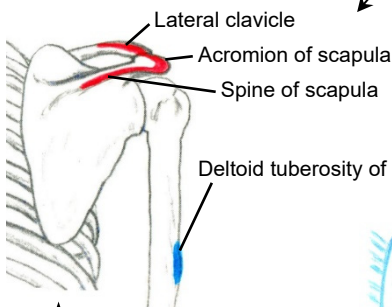
As you *read* the words describing Origin and Insertion in the table, *visually* identify those landmarks on the bone picture on the facing page (they are labeled in the figure below). Next, to strengthen your understanding, start by looking at the bone picture and see if you can *name* the bony

locations that have red and blue marks. Then, read the words in the table and see if you were correct.


As you study other muscles in the table, you can further help your brain anchor the information by comparing and contrasting both words and pictures. For example, compare the origins of the deltoid with its neighboring muscles (see figure on page 65). Do this *verbally* by comparing the words in the Origin column of the table, and *visually* by comparing the red markings on the bone drawings. Do the same for the insertions. Now, view the muscle drawings in Figure 2(B) with clarity about where beneath the muscle fibers each muscle attaches to the bones.

Finally, if possible, move and touch your body or that of a partner. Experience touching the bones, landmarks and muscles. Demonstrate the actions the agonist muscles are creating (or resisting if playing the role of antagonist).

Name Column 1 gives the name of the muscle		Attachments Places where the muscle attaches to the bones		Actions How the body moves when the muscle contracts (or portions of the muscle contract)
Muscles Acting On Shoulder Joint		Origin	Insertion	Action
	Deltoid moves the humerus	Lateral clavicle, Acromion of scapula, Spine of scapula	Deltoid tuberosity of humerus	All / middle fibers: Abduction of humerus at the GH joint Anterior fibers: Flexion, medial rotation, and horizontal adduction Posterior fibers: Extension, lateral rotation, and horizontal abduction

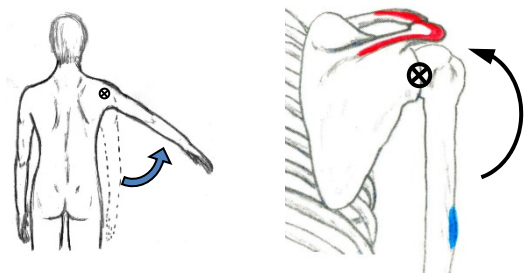


from Figure 2 A








from Figure 2 B

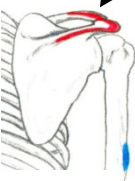
Lines in the muscle show the direction of the muscle fibers, which creates a direction of pull.




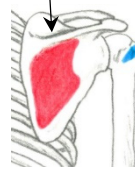
For each **Action**, the muscle fibers contract and shorten. As the muscle gets shorter, the **blue** spot on the moveable bone is pulled around the joint axis ⊗ toward the **red** spot on the stable bone.

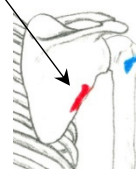
Origin, Insertion and Action of the Deltoid Muscle

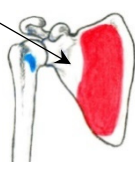
Shoulder Joint		Origin	Insertion	Action
	Deltoid moves the humerus	Lateral clavicle, Acromion of scapula, Spine of scapula	Deltoid tuberosity of humerus	All / middle fibers: Abduction of humerus at the GH joint Anterior fibers: Flexion, medial rotation, and horizontal adduction Posterior fibers: Extension, lateral rotation, and horizontal abduction
	Supraspinatus moves the humerus	Supraspinous fossa of scapula	Greater tubercle of humerus (superior aspect)	Abduction of humerus at the GH joint
	Infraspinatus moves the humerus	Infraspinous fossa of scapula	Greater tubercle of humerus (posterior aspect)	Stabilizes the humerus in the glenohumeral joint
	Teres Minor moves the humerus	Lateral/axillary border of the scapula	Greater tubercle of humerus (posterior aspect, inferior to infraspinatus tendon)	Stabilizes the humerus in the glenohumeral joint
	Subscapularis moves the humerus	Subscapular fossa of scapula	Lesser tubercle of humerus (on anterior humerus)	Medial rotation of humerus at the GH joint, Stabilizes the humerus in the glenohumeral joint


Deltoid



Supraspinatus



Infraspinatus



Teres Minor



Subscapularis


Visual
Compare red areas going across each row


Deltoid


Supraspinatus


Infraspinatus


Teres Minor


Subscapularis

Movement
Compare fiber directions and visualize the muscles pulling on the bones

Comparing and Contrasting Origins of Muscles (do the same for Insertions)

Once you have studied the physical attributes of the deltoid and compared and contrasted it with its neighbors, you can study its actions with the other muscles in the group using the “B” table.

• Scan across its row in the “B” table, observe its fiber direction(s) and think about the fibers shortening to create the actions marked with a green ✓.

• For each of its actions marked with a ✓, scan down the action column to learn other muscles that are synergists with the deltoid for that action.

• Also look at the adjacent column (that shows the opposite action) to learn antagonists for that deltoid action.

Shoulder Joint		Flexion		Extension		Abduction		Adduction		Medial Rotation		Lateral Rotation		Stabilization		Innervation	
1. Deltoid:		✓		✓		✓		✓		✓		✓		✓		Axillary N. (C5, C6)	N
Anterior fibers	(Ant. fib.)																
Middle fibers																	
Posterior fibers	(Post. fib.)																
2. Supraspinatus						✓								✓		Suprascapular N. (C5)	N
3. Infraspinatus												✓		✓		Suprascapular N. (C5, C6)	N
4. Teres minor												✓		✓		Axillary N. (C5)	N
5. Subscapularis										✓				✓		Subscapular N. (C5, C6)	N
6. Pectoralis major:		✓		✓				✓		✓						Upper fib: Lateral pectoral N. (C5, C6, C7) & Medial pectoral N. (C6, T1)	N
Upper fibers	(Upper fib.)																
Lower fibers	(Lower fib.)																
Abdom. fibers	(Lower fib.)																
7. Coracobrachialis		✓						✓								Musculocutaneous N. (C6, C7)	N
8. Latissimus dorsi				✓						✓						Thoracodorsal N. (C6, C7, C8)	N
9. Teres major				✓						✓						Lower Subscapular N. (C5, C6)	N

Table 2 (B) - Shoulder Joint - Synergists & Antagonists

Using the “B” Table to Study Actions

About Mastering the Muscles

As you study each group of muscles, you will be building a *foundation* of basic knowledge that will enable you to apply and communicate anatomical and movement information in a clear and efficient way. A few situations where this may be useful are:

- Assessing and working with clients
- Communicating with other health professionals (verbally and written)
- Reading books and magazine/journal articles
- Attending or teaching continuing education classes relevant to your specialty

In order to be fluent in the language of muscles and movement, you will need to learn a basic set of information about each muscle. Then, you will need to be able to communicate and apply that information in a variety of ways.

What to Learn About Each Muscle

Use the table below as a guide to what you need to know about each muscle to master it.

Items 1 through 6 describe the basic knowledge needed to “know” the muscle you are learning.

Items 7 and 8 list further knowledge that relates to physically using the muscle in daily life. These skills are developed by applying the basic facts about the muscle in different situations.

Note that this list is *not* about learning everything for one muscle before you move on to the next. Rather, the list is a framework to be filled in over time as you study and practice with all the muscles in a muscle group.

What to Learn About Each Muscle

Basic Knowledge	Practical Applications
1. Name and palpate the origin(s).	7. For the muscle’s main action (or actions): <ul style="list-style-type: none"> • Passively shorten it • Passively lengthen it • Instruct client to actively shorten it (concentric contraction) • Instruct client to actively lengthen it (the antagonist is working) • Provide correct resistance to test strength of the muscle • Name one or more synergists <ul style="list-style-type: none"> - (<u>must</u> indicate the <i>action</i> that is being “synergized”) • Name one or more antagonists <ul style="list-style-type: none"> - (<u>must</u> indicate the <i>action</i> that is being “antagonized”)
2. Name and palpate the insertion(s).	
3. Trace the shape of the entire muscle on the body. <ul style="list-style-type: none"> • Palpate the muscle • Know where the tendon is vs. the muscle belly 	
4. Know and touch the joint(s) the muscle acts on. <ul style="list-style-type: none"> • More than one joint may be involved 	
5. Indicate the fiber arrangement. <ul style="list-style-type: none"> • Show shape and fiber direction on a body • Describe it, draw a diagram showing it 	8. Know something about the muscle as it applies to the daily life of a person: <ul style="list-style-type: none"> • Activities and exercises that use this muscle <ul style="list-style-type: none"> - (as agonist, antagonist, and stabilizer) • Movements where the muscle contracts concentrically • Movements where the muscle contracts eccentrically • Problems or pathologies that may apply to this muscle
6. Name and demonstrate the actions of the muscle.	

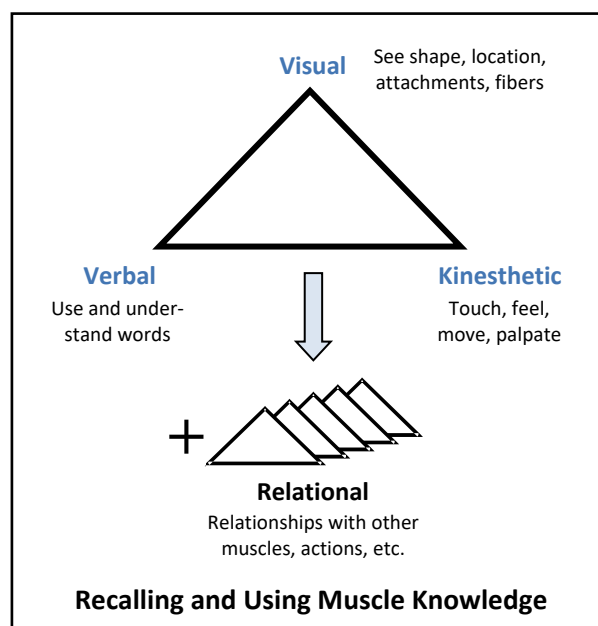
Real-time Factors that Affect a Muscle's Actions

The table below provides a summary of the influences involved when a movement is created by the contraction of a muscle.

Factors Affecting How a Movement Occurs	
The movement that occurs when a muscle contracts can be summarized as the sum of six factors:	
1. Direction and arrangement of its fibers	+
2. Locations of its attachment sites (and their positions relative to the joint axis)	
3. The mechanical capability and limitations of the joint(s) being moved	+
4. Stuff in the way (muscle tissue, fascia, bones, ligaments, skin, fat, organs, etc.)	
5. What other muscles are doing at the same time (opposing, stabilizing, etc.)	+
6. Which bones are most moveable at the moment (what is weight bearing, current direction of gravity, what is held in place by outside forces like a wall, table, another person, etc.)	

How You Will Use the Information You've Learned

There are many ways that you will use your knowledge of a muscle. You may have to recall or communicate the information from any of three main directions: **verbal**, **visual**, or **kinesthetic**. The triangle in the figure illustrates this concept. In any given situation, you may need to recall your knowledge from one of the corners of the triangle. In addition, you may need to think **relationally**, i.e., for a muscle or action, be able to think of related muscles or actions.



You then need to be able to connect to the types of information represented by the other corners of the triangle as you pursue the requirements of the situation at hand. The table below gives a few examples.

Using the Types of Muscle Knowledge

Legs of	If this happens:	Can you:
Verbal to Visual 	You hear or read the name of a muscle.	Visualize where it is on the body and what it looks like.
Visual to Verbal to Kinesthetic 	Your client points to a place on their body that hurts.	Recall the name of a muscle there, and have client perform an action to test it.
Kinesthetic to Verbal to Relational 	Your client moves a body part and says it is "stiff" and they can't move it very far.	Name the joint and movement involved, and identify which muscles are shortening (agonists), and which muscles are lengthening (antagonists)

Generalizations

The list below gives some general rules of thumb to use while you are learning the muscles in Chapters 4, 5 and 6. Keeping these in mind will help you stay oriented, see useful patterns, and reduce the amount of rote memorization you have to do.

- Muscles on the anterior body usually create flexion (except at knee and below).
- Muscles on the posterior body usually create extension (except at knee and below).
- Muscles that have an oblique (diagonal) angle usually create or control rotations.
- Muscles that insert on the lateral side of limbs create abduction.
- Muscles that insert on the medial side of limbs create adduction.
- For muscles of the axial skeleton, an antagonist for a *unilateral* action is the same muscle on the other side of the body (see Chapter 5, page 121).
- Muscles are strongest at their resting or neutral position (see “mid-range” on pages 18-19). When moved into a substantially shortened state, the muscle has reduced pulling force. The muscle’s power is also reduced when it is put in a markedly lengthened position.

Palpation Techniques

The list below provides some ideas to consider when you are palpating the body to identify, assess, or treat muscles.

- Steps to palpate a specific structure: Locate, isolate, engage, palpate, observe cautions
- Be aware of the tactile: Touch, pressure, texture.
- Find landmarks to locate the full length of the muscle.
- Try to feel different depths, being aware of changes in fiber direction and knowing that layers of fascia separate muscles that lie at different depths.
- Use movement (passive, active) to help locate muscles.

- Consider main movements vs. secondary (or assist) movements.
- Provide correct contact point and direction of resistance to engage or activate a muscle.
- Remember gravity is always there to provide resistance (position the body so the muscle has to work against gravity).
- To palpate on yourself, look for a way to “self-engage” the muscle – press against a table, wall, chair, or a place on your own body.
- A muscle is easier to feel upon initial muscle activation rather than full-out contraction – have your partner initiate the action and then release it repeatedly to help isolate the muscle.

Brain-Friendly Conventions Used in Chapters 4 - 6

- All illustrations of muscles and bones are shown on the **right side of the body**. This allows easy comparison of images within each group and from group to group. Once learned and well-organized in memory, the brain can easily “mirror-image” the information to the left side of the body in practice.
- Wherever possible, related illustrations are shown at the **same size and angle of view**. This helps the brain draw comparisons and contrasts without having to translate/flip/resize before observing the features to compare.
- For verbal learners: Note that in the A tables (described on page 60), **related words are lined up** so a visual scan down a column can reveal similarities and differences in the attachments and actions of the different muscles.
- When viewing the side-by-side muscle illustrations (the A Figures and B Figures described on pages 60-63), the origin/insertion pictures and the corresponding muscle pictures are sized and lined up so you can simply **lift the page** to directly study each muscle with its underlying attachments on the bones.

