Exercise and Muscle Action

In this section, we will take a brief look at what goes into an exercise both from the muscles perspective as well as from a pre-existing exercise, like a machine. I will also lie out some ideas as to how to create your own exercise regimen.

What's In An Exercise?

There are two options when you consider what an exercise consists of. One is a predetermined motion provided by a machine that will cause a certain group (or groups) of muscles to be recruited. And the other is an exercise created from the perspective of working a specific joint or muscle(s).

The machine-type exercise is predetermined by design and there are few variations offered in most machines as they usually follow only one path of motion. That path of motion is designed to target a specific muscle or movement. For example, most chest press machines are set up to remain in one path (horizontal) and resist the chest and shoulder muscles (also usually involving the triceps). The resistance profile (how the resistance creates load for the joints and involved muscles) is, for the most part, consistent. This means that you don't have too many variables as to what you work (or move) and how you work it. The resistance will always be the same every time you use the machine unless you change the weight or where you are sitting (changing where you are in the machine may alter the direction the machine affects your joints thus potentially changing the recruitment of muscle). By design, in order for the machine to work, certain joints and muscles have to be used in a very specific way.

The other option of creating an exercise to target a specific joint or muscle(s) is created from the muscle first then the resistance is added to create a desired load on the joint and surrounding muscles. For example, if you wanted to work your chest muscles you would first need to take in to consideration how the desired muscles affect the joint—understanding that the chest muscles predominantly work best in a horizontal fashion, moving your arm across your body. Other factors to consider would be that the muscle is fully shortened when the arm is about 120-135 degrees in front of the body (in front of your chest with your arm perpendicular to your body—0 would be your arm directly out to your side in line with your shoulder girdle) and fully lengthened when about 15 degrees behind you (with your arm still perpendicular to the body). You may also want to take into consideration that your muscle is the weakest at the extremes of range of motion.

You can now decide how you would like to challenge this muscle. If you want to try to reinforce the muscle in the weakest range while it is fully shortened, you would want to use either tubing or cabled resistance to create a line of force that is 90 degrees (perpendicular) to the arm while it is in its shortest range. Take in to consideration that creating resistance like this will create the greatest load in the weakest position so having a lighter load will be required.

You may also want to load the middle of the range with the most resistance. In this case, you would align the cable or tubing to be at a 90-degree angle to your arm somewhere around 45-60 degrees from your arm being directly to your side. Continue in that direction of adding resistance toward the lengthened end, you could do a lying dumbbell press or fly and create a 90-degree force when you are is directly out to the side, thus making the bottom of the range harder.

There is no one better way to challenge the body but having the understanding that there are differences helps to give you choices. My recommendation is to start with dumbbells and cables before you get into machines as once you learn to control motion in a less controlled environment, you will transfer the correct line of force into the machine that will best replicate the desired muscle action. The reason for this order is because a machines path of motion is guided and you could be pushing your right arm in one direction and the left arm in a different direction but because the machine will always go in one direction, it will move as it is supposed to. And your muscle recruitment will be much different for each side and by the time you decide to use free weights or cables you will have learned a motor pattern that might be out of the normal range for an unguided activity. At this stage you will have to take a step back and relearn the motion with lighter weight. It's better to start out learning control when you need to go light not only for the sake of learning proper motion but because you don't want to overload your muscles too quickly and cause damage before they are ready for it. Killing two birds with one stone as the old saying goes.

Muscle Action

I will now briefly go through the major muscle groups and talk about their individual actions so you have a better understanding as to who is doing what and when. I will start with the insertion and origin points of the muscle and then the muscles' actions. I have included some other smaller muscle groups along with the major muscles to help give some clarity in secondary exercises like hip exercises but have left many muscles out do to the complexity of their use—this is my attempt to keep it somewhat simple. The whole point of these descriptions is to help you gain a better understanding of how these muscles work so you can create exercises and to help you to visualize what it is you are using when you are doing any exercise.

Upper Body

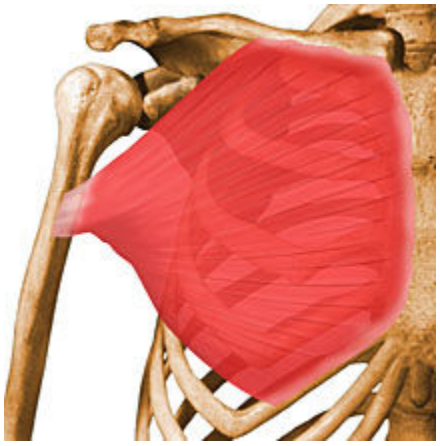
Pectoralis Major (chest)

The origin of the chest muscle goes along the collarbone (mostly toward the end that is closest to your chest bone), continues to attach around your entire chest plate (sternum) and finishes on a few ribs just below the chest plate. The insertion of the chest muscle is located on the upper arm (the Humerus) close to the armpit. This attachment site is for the most part in front of the arm just below the biceps muscle.

Since we've already talked about the chest muscles I will not share much else except for taking into consideration that doing a chest fly with a dumbbell (while lying, of course) may add more force to the shoulder than necessary for the desired results. When the arm is directly out to the side at that distance, the shoulder is at an extreme mechanical disadvantage. I am not saying it is bad or good. It purely mentioned so you are aware of the *potential* risk if you have any shoulder problems. You can accomplish the same thing by reducing the distance the weight is from the shoulder (bending your elbow as in a dumbbell press) and doubling the weight. You might also use tubing and cables to change the amount of resistance on a straight arm while it is in this same position.

I will also add that the Pec muscle not only concentrically (by definition means towards the center—in this case, the muscle is *shortening* towards the center of the body) contracting towards your body but it also eccentrically (*lengthening* away from the body) controls the arm going away when loaded. The muscle is also a fan shaped muscle so there are varying degrees of motion above and below perpendicular to your body (or horizontal in relation to standing) to play with. Still moving horizontally towards and away from the center of the body, the chest also has the capability of having a direct pull anywhere from about 10-15 degrees above horizontal and about 30 degrees below horizontal. This is where incline and decline exercises can come in to play.

Note: Concentric could easily be thought of as the shortening phase of a contraction. It is the force producing action of the muscle. The eccentric phase of muscle contraction would be the lengthening action, or allowing the limb to be controlled back towards its starting position. Eccentric is the phase that slows down the limb when there is an opposing force. It's the deceleration phase of movement. For example, when doing a bicep curl, the upward (shortening) phase is the concentric movement and the eccentric part is the lower of the arm back to a longer length.



Pectoralis Major

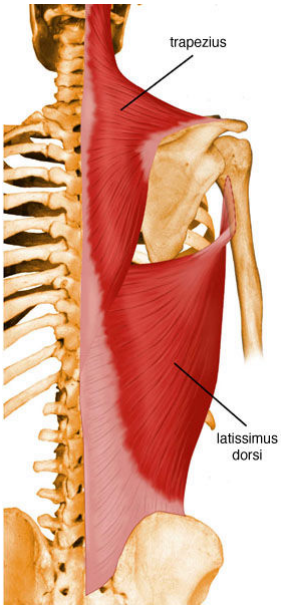
Latissimus Dorsi

The origin of the Latissimus Dorsi is along the lower 6 or 7 thoracic vertebrae (the thoracic vertebrae runs from the base of your spine to your lower back. They are the same

level of your twelve ribs). The other origin attachment site is on the posterior top part of your Ilium (the crest-like bone that is waist high). The insertion for the Latissimus Dorsi is located near the Pectoralis Major attachment on the upper part of the Humerus. The muscle runs from the middle and lower part of your back up and towards the front of your arm.

Like the Pec muscle, the Lat is a fan shaped muscle and has varying degrees of capability. This muscles action concentrically is to bring your arm (when abducted, or away from the body, anywhere from directly in front of you to, above your head, or to the side) toward the back and eccentrically to allow the arm to move up and away from the body. Because of its attachment to the hip and spine, this muscle also plays a part in trunk side bending, truck rotation and trunk/core stability.

This muscle is best resisted in exercises like Lat pull downs and rows (seated, bent over). One caution I could offer here would be to try and avoid doing pull downs behind the head as most individuals do not have the rotation needed in the shoulder joint to allow the hands to be behind the head when the arms/elbows are at your side. This is an extreme position for your shoulder and is not necessary for the development of this muscle.



Latissimus Dorsi (Trapezius included)

Deltoids

The Deltoid muscle is usually broken into three divisions: the anterior (front), the medial (middle), and the posterior (the rear). The origin of the anterior Deltoid is located on the lateral part of the Clavicle (outer half or 1/3 of the collar bone, away from the sternum) towards the AC joint (the Acromium-Clavicular joint, which is the bony lump on top of your shoulder where your collar bone meets the shoulder blade). The medial origin site runs along the outer ridge of your shoulder blade called the Acromium (most lateral bone

in your shoulder). And the posterior origin runs along the lower lip of the spine of the shoulder blade (the scapula has a ridge the protrudes along the upper part of the entire blade. You can feel this protrusion by feeling your upper shoulder blade – it will feel like a little ledge behind your shoulder). The insertion point, which is the same for all divisions, is located about 1/2 of the way down the lateral side of your Humerus.

The primary action of the Deltoid muscle(s) is to abduct (move the arm away) from the body, concentrically and to control bringing the arm into the body eccentrically (when resistance is trying to pull the arm down). The anterior portion works to move the arm more up and down in front of the body, like when doing front raises. The medial portion is most dominant moving the arm directly to the sides, like when doing side raises. And the posterior portion is best suited to move the upper arm towards the rear, either when the arm is directly out to the side (the opposite of a chest movement) or assists in pull down and rowing motions.

One big consideration to put into the understanding of how these muscles get involved is how the resistance is entering the body and the alignment of the fibers. For example, if you are standing, the division that is most directly in line with gravity will be the medial fibers but a portion the anterior fibers might also be somewhat orientated to the top of the shoulder pulling them into the mix. If you were to bend over slightly (if your medial deltoid was not sitting directly on the top of your shoulder) would align these fibers more specifically to the line of force (in this case, gravity).

One other thing to consider would be the front deltoids use in a shoulder press motion (over head press). Because the arm is actually externally rotated (the middle of the Humerus faces toward the back when the arm is elevated and the hand/wrist is above the shoulder) the anterior fibers will be the muscles most in line to provide force for the movement. (You must also consider the same alignment issues as with the pull down for the Lat.) If you can not achieve full external rotation of the upper arm, then doing the over press would be best suited in a seated, slightly leaned back position (to take the shoulder out of an extreme range). If you decided to do these standing and you are at your or are close to your extreme range you may want to consider going lighter for this activity. You could also bring you arms slightly towards the front to take them away from the extreme position.

Lastly, when looking at any shoulder movement you must consider the complexity of the mechanics of the entire shoulder complex to provide efficient movement. The shoulder joint is actually made up of three different joints (four if you consider the shoulder blade articulating against the rib cage as a joint). The biggest one is the actual Humerus sitting in your shoulder socket, which is part of the shoulder blade. The shoulder blade also articulates with the Clavicle (the aforementioned AC joint). Your Clavicle also articulates with your Sternum.

So in order for your Humerus to stay in your shoulder socket (which is quite small compared to the other ball-and-socket joint, the hip) and stay supported the entire time it is moving, the shoulder blade, with the socket, must follow the Humerus. And because

the shoulder blade is connected to the Clavicle and rubs along the ribs, those joints must move when your arm is raised or moved forward in any direction.

To see this in motion, put your finger from the opposing hand in the center of your shoulder joint. Keeping your finger in the same place in space (not allowing it to move with the shoulder) move your arm out to side and continue above your head. If you were successful in keeping your finger in the same spatial location you will notice that the center of your shoulder is now above your finger. The entire shoulder joint moved. Using muscles that connect to your shoulder blade and Clavicle creates this motion—muscles like your Serratus, upper Trapezius and lower Trapezius muscles along with a long cast of smaller muscles to stabilize and support other movements.

Point is, when doing an exercise like lateral side raise, muscles like your Serratus, upper traps and lower traps are working as well. Therefore, it may not be necessary to isolate these muscles unless you want more development in those areas or you need to focus on them for various rehabilitative reasons.

Deltoids (anterior view)

Biceps Brachii

The Biceps originate from two locations. One, which is for the long head of the Biceps, attaches into the shoulder socket traveling over the top and the front of the head of the Humerus. The other origin inserts on a bone inside the armpit called the Carocoid Process, which is the short head of the Biceps. The insertion end of the both fibers attaches on the inside of forearm. This attachment site is located directly on the Radius very close the elbow joint (about one inch from the fold of the elbow).

There are two other muscles that cross the elbow joint and assist in the Biceps function. One is called the Brachioradialis, which originates along the lower outside edge of the Humerus and inserts near the wrist on the lateral side of the Radius (side of radius below the thumb). The other muscle is called the Brachialis. This muscle originates about half way up the front of the Humerus and inserts on the Ulna just across from the Biceps attachment.

The main action of the Biceps is to flex (bend) the elbow concentrically and to control eccentric lengthening of the opposite action (lowering the arm). Since the Bicep has an attachment site above the shoulder joint (the long head fibers) it is considered a two joint muscle. This means that the bicep is also somewhat responsible for shoulder flexion (bringing the arm over head). Because the Biceps attaches on the Radius bone (thumb side of the two bones in your forearm) it also assists in rotating the palm upwards (best visualized when arm is bent).

Since the Bicep is considered a two joint muscle, the angle of the shoulder joint will alter the starting length of the Bicep. For example, to fully lengthen the Biceps muscle you would bring your straight arm (lengthening at the elbow) behind you (lengthening the from the shoulder joint). The fullest shortened range you could achieve would be to fully bend your elbow with your elbow over your head. This would not only shorten your Bicep because of the elbow flexion but the shoulder flexion would cause the long head to shorten as well.

The other two muscles also work to flex the elbow concentrically and control the lengthening motion as well. The Brachioradialis is best lined up to be resisted when the palm is facing inward (like when you are holding a cup) and the Brachialis is at its maximal pull when your wrist is facing downward. Again, these muscles do not work in isolation but small adjustments allows for different aspects to be emphasized.

Biceps Long & Short Head

Brachialis

Brachioradialis

Triceps Brachii

The Triceps muscle is made up of three heads: a long head, medial head and lateral head. The long head of the Triceps, which, like the biceps long head, is a two-joint muscle. This head originates at the outer upper edge of the shoulder blade near the shoulder joint.

Its insertion point, which is the same for all heads, attaches at the tip of the elbow joint on the Ulna (called the Olecranon Process). The medial head originates a little more than half way up the back of the Humerus (toward the shoulder joint). And the lateral head originates just a bit further up than the medial head but a bit lateral (to the outside) of the medial attachment.

The primary function of the Triceps muscle is to concentrically extend (straighten) the elbow and to control, eccentrically, elbow flexion when resisted (controls the arm bending when a force is forcing the arm to bend). Being a two-joint muscle like the Biceps long head, it also has a function at the shoulder joint. It assists the shoulder in extension (pulling the upper arm back—along with the posterior Deltoid and the Latissimus Dorsi). The same shortening and lengthening rules apply for the Triceps as the Biceps but in reverse. The longest the muscle fibers can start in would be full elbow flexion with the arm overhead. And the shortest fiber length would be when the arm is straight (elbow straight) and behind the body.

Triceps Brachii (all heads)

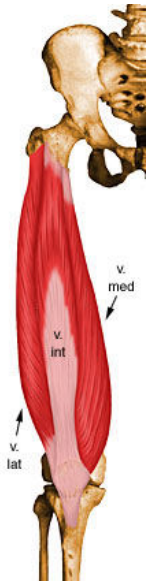
Lower Body

Quadriceps

The name quadriceps implies that there are four muscles (hence the name quad). There is one two-joint muscle that crosses the knee and the hip and three others that cross the knee only. The two-joint muscle is called the Rectus Femoris and it originates above the hip joint on the pelvis (just inside the crease of where the hip bends). It attaches, along with all the other sections of the Quadriceps, on the front of the Tibia (shin bone) via the Patellar (knee cap) tendon. The attachment site can be felt by finding a bony protuberance just below the knee where the shin ends (this is the part that usually gets dirty when kneeling on the ground).

The other three Quadriceps muscles all attach on the Femur (upper leg) and are considered single-joint muscles. The other three muscles are the Vastus Medialis, Vastus Lateralis, and the Vastus Intermedialis. Both the Vastus Medialis and the Lateralis have their origin attaching on the back of the femur (the Lateralis on the lateral portion and the Medialis on the medial portion, respectively). The fibers wrap around and down towards the knee where they then attach, through the Patellar Tendon. The Vastus Intermedius, which lies directly below the Rectus Femoris, attaches on the anterior and lateral surface of the Femur with fibers running down towards the knee attaching in the Tibia as well.

The primary function of all Quadriceps muscles is to concentrically extend (straighten) the knee and to eccentrically control the knee when it is bending, like when walking or squatting and when lowering resistance into a flexed knee position (like in a knee extension machine). The Rectus Femoris muscle, being a two-joint muscle, also plays a role in flexing the hip and resisting hip extension. This muscle tends to play more of a stabilizer when using multiple joints at the same time, like in squats. The other three tend to be the main force providers in knee extension.



Vastus Lateralis, Intermedialis and Medialis

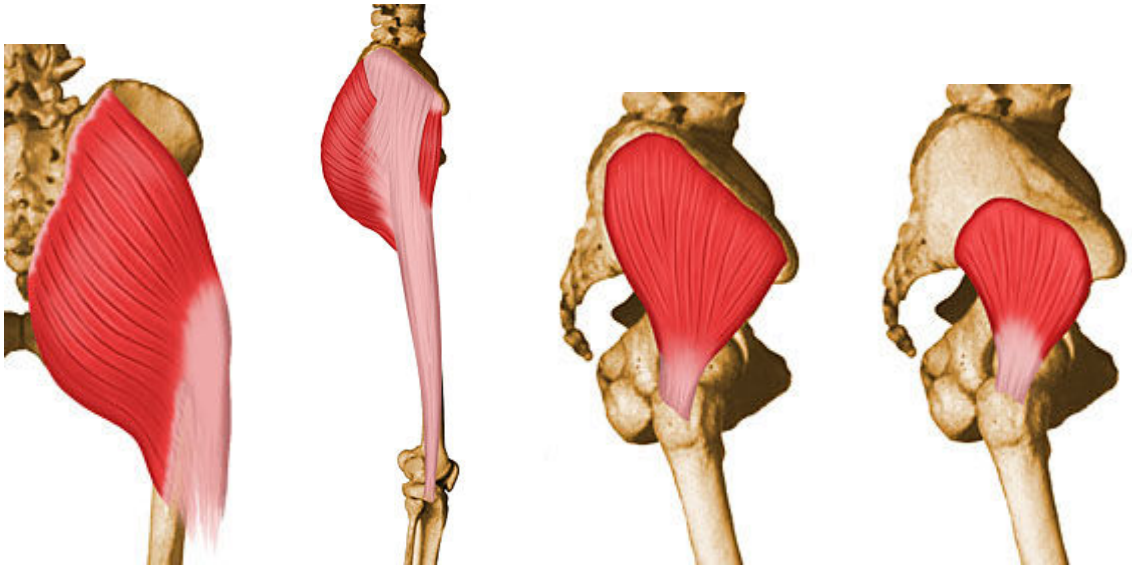
Gluteus Maximus (Medius and Minimus)

The Gluteus Maximus muscle originates at the back of the Ilium and extends down across the lateral edge of the Sacrum (tail bone). It then comes down and out towards the side of the upper leg and attaches into a thick band of tissue called the ITBand (Iliotibial Band or sometimes referred to as the Iliotibial tract) and that ITBand then extends down the side of the leg to its final insertion on the upper part of the tibia (just lateral to the same plateau that the quads attach into). There are also two other Gluteus muscles in the Gluteus family: Gluteus Medius and Gluteus Minimus.

The Gluteus Medius originates from the front of the iliac crest (the hip bone at the waist) up, around and back towards the backside of the same ilium. If you were to put your hand on your waist with your thumb facing the back and the fingers towards the front, you will be covering the entire iliac crest. This muscle then inserts on the side of the hip joint at the very top of the femur. The Gluteus Medius originates on the same ilium bone but sits about half way between the hip bone and the iliac crest. This muscle then inserts on the same part of the Femur as the Medius but just a bit more towards the front of the bone (anterior).

The main action of the Gluteus Maximus muscle is to concentrically move the Femur into extension on the hip (hip extension—moving the leg backwards) and eccentrically controls the Femur moving into hip flexion (moving forward like in walking and squatting). The Gluteus Maximus is a major provider in controlling knee flexion, along with the Quadriceps muscles, as well when the foot is on the ground (because the Femur makes up the upper half of the knee joint, controlling Femoral motion controls the knee).

The Gluteus Medius and Minimus predominantly help to concentrically move the Femur into abduction (lateral hip movements—out to the side) and eccentrically control hip adduction (towards the middle) when resistance is pushing or pulling the leg inwards. Both muscles are fan shaped and have functions on the leg with internal and external rotation of the Femur. The posterior fibers of the Gluteus Medius also help play a small part in hip extension with the Maximus.



Gluteus Maximus (posterior view) (lateral view) Gluteus Medius Gluteus Minimus

One other muscle that should get honorable mention here that acts along with the Gluteus Medius and Minimus is the **Tensor Fascia Latae (TFL)**. This muscle inserts on the front of the Iliac crest and extends into the same ITBand as the Gluteus Maximus creating the opposing force of the Gluteus Maximus on the tendon. Thus, the attachment site for the TFL is the same as the Gluteus Maximus. The TFL assists the Gluteus Medius and Minimus in hip abduction as well as the hip flexors in hip flexion (among their eccentric

roles as well). Lastly, this muscle is another primary provider of helping with concentric motion into internal rotation of the Femur.

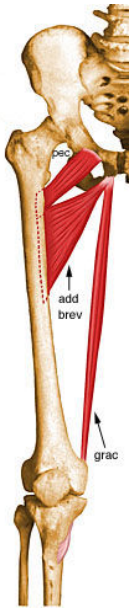
Adductor Group (Adductor Magnus, Adductor Longus, Adductor Brevis, Pectineus, and Gracilis)

The Adductor group has five muscles that make up the mass of the inner thigh. Since these muscles, much like many of the other muscles in the lower body, have multiple functions, I will share with you the general function and lump the entire group into one large, general insertion and origin. The adductor group originates on the inside of the pubic rim and inserts along the inside of the femur as well as the medial part of the back of the Femur. The attachments start from the top of the Femur and extend all the way down towards the knee. There is even one muscle, the Gracilis that attaches into the medial part of the Tibia (in the Pes Anserinus tendon), which makes this muscle a two-joint muscle.

The primary function of the adductor group is to concentrically control adduction of the Femur (moving the upper leg towards the midline, or center, of the body) and eccentrically control abduction. Since these muscles don't provide a huge role in force production (mostly assisting in force production and adding stability) I don't put these muscles under direct resistance with my clients. Not to mention, they get pulled into many lower body actions like squats and leg press. The same goes with the abductors (Gluteus Medius, Gluteus Minimus and TFL). That should not go without saying that sometimes these muscles may need special attention if there is an imbalance somewhere. Lastly, if you were advanced enough to do any single leg exercises, like single leg squats, these muscles would get involved in trying to add stability but they would not become stronger in any greater range than the neutral position they start in.

Adductor Magnus

Adductor Longus



Pectineus, Adductor Brevis and Gracilis

Hamstrings (Semitendinosus, Semimembranosus, Biceps Femoris – short head and long head)

The hamstrings are made up of 4 different muscles: the Semitendinosus, Semimembranosus, and the Biceps Femoris Long and Short Head. All the hamstring muscles, except the Biceps Femoris Short Head, originate on the bottom of the Ischium (called the Ischial Tuberosity), which is the very bottom of the posterior part of the pelvis. The Ischial Tuberosity is located around the same level as the Gluteal fold (where the Gluteus Maximus ends and the upper leg begins). This location is also sometimes called the "sits bone" as it is the bone that you sit on. The Semitendinonosus is one of the medial hamstring muscles and its other insertion point is on the front of the upper medial part of the Tibia, attaching through the same tendon as the Gracilis muscle called the Pes Anserinus. The Semitendinosus runs from behind the leg and wraps around to the front of the shin. The other medial hamstring muscle is called the Semimembranosus and its insertion is located on the back of the medial part of the Tibia. This muscles' tendon runs behind the knee. The Biceps Femoris Long Head and Short head both wrap around towards the front of the lower leg and insert on the end of the Fibula. This attachment site is on the lateral part of the shin about one inch below the knee joint. The Short Head originates along the lateral part of the Femur, running about 1/3 up the distal (closer to the knee) end of the leg.

All these muscles work to concentrically flex the knee and eccentrically control knee extension. Having ¾ of the muscles attach on the Ischial Tuberosity makes them two-joint muscles as well, which also allows them to assist in the concentric control of hip extension (working with the Gluteus Maximus) and eccentric control of hip flexion. Being a one-joint muscle the Biceps Femoris Short Head works primarily as a concentric knee flexor and an eccentric controller of knee extension.

The other functions of the Semitnedinosus and the Semimembranosus are to help concentrically rotate the hip and the tibia medially (toward the middle). And the Biceps Femoris does the opposite rotation. And both do their respective eccentric control of the opposite motions. Lastly, being mostly a two-joint muscle, much like the Rectus Femoris, the hamstrings also works as a stabilizer when moving multiple joints like squats or walking/running.




Bicep Femoris (Long Head) Bicep Femoris (Short Head) Semitendinosus Semimembranosus

Hip Flexors (Psoas Major, Iliacus, Rectus Femoris, Sartorius, and TFL)

Since we've already covered the TFL and Rectus Femoris we will focus on the other three hip flexors here: The Psoas Major, the Iliacus and the Sartorius. The Psoas muscle has its origin attaching to the front (and lateral) of the entire lumbar spine. It then inserts on the inside of the upper part of the Femur on a bony landmark call the Lesser Trochanter, which is on the inside of the upper leg just below the hip joint. The Iliacus muscle runs in the same fiber direction as the Psoas muscle and most often shares the name with the Psoas being called the Iliospoas. The origin of the Iliacus muscle runs along the inside of the entire Iliac crest and then inserts on the same bony attachment site as the Psoas Major. The Sartorius muscle originates just below the front of the ilium and inserts into the same Pes Anserinus tendon on the front of the Tibia as the Gracilis and the Semitendinosus.

The entire group of hip flexor muscles work to concentrically flex the hip joint and eccentrically control hip extension. All three of the aforementioned muscles also assist in laterally rotating the hip. The Iliopsoas also assists in adducting the Femur, whereas the Sartorius assists in abduction.

Iliospoas

TFL & Sartorius

Rectus Femoris

Calves (Gastrocnemius and Soleus)

The two most prominent muscles that make up the calf muscles are the Gasrtocnemius and Soleus. The Gastrocnemius (the most outer of the two—looks like an upside down heart), another two joint muscle, originates on the lateral and medial aspects of the lower femur (on the condyles of the Femur, which are the widest parts of the bottom of the Femur). The Gastrocnemius then inserts on the back of the heel bone (called the Calcaneus). The soleus originates along the upper part of the Fibula and the middle part of the Tibia (Fibula and Tibia make up the lower leg) and then continues on to join the Gastocnemius on the heel bone (via the Achilles Tendon).

The primary concentric action of these two muscles is to plant the foot downward and eccentrically control the foot from coming toward the shin. The Gastrocnemius, being a tow-joint muscle, also assists in concentrically flexing the knee and eccentrically controls knee extension.

Gastrocnemius Soleus

Abdominal Muscles, Spinal Erectors and the Core

In the past 5 or so years the buzzword in the health and fitness industry has been "core stability." But depending on where you look you might find the explanation of the core muscles very differently. The best way I can describe the core is any muscle that helps create stability in and around the pelvis/hip area and the lumbar spine. Any muscle that either attaches on the hip or crosses the hip may be considered a core stabilizer. And every muscle that attaches to the lower spine is also considered a core stabilizer. Many of the muscles that are considered core stabilizers have been mentioned already, like the Glute muscles, the Rectus Femoris, the hamstrings, the Latissimus Dorsi, The TFL, and the hip flexors.

Abdominals (Rectus Abdominis, External and Internal Obliques, and Transverse Abdominis)

The Rectus Abdominus muscles are made of multiple bellies that form the "washboard" look. The Rectus Abdominus originates from the 5^{th}, 6^{th} and 7^{th} ribs (these ribs attach into the Sternum) and inserts onto the Pubic Crest (Pubic Bone). The External Obliques also originate on the rib cage by attaching on the lower eight ribs and inserts onto the part of the Iliac crest and finally into the side of the Rectus Abdominis (into what is called the Abdominal Aponeurosis). The fiber direction of the External Obliques run from laterally to medial starting at the ribs running down and into the midline of the body.

The Internal Obliques originates on the bottom five or so ribs and inserts on the same Aponeurosis as the External Obliques. The Internal Obliques also extend around towards the lower back and attach into another thick band of tissue that eventually connects to the spine called the Thoraco-Lumbar Fascia. The fibers of the Internal Obliques run in the opposite direction of the External Oblique, running from the ribs down and back.

Finally, the Transverse Abdominis (TVA), which wraps all the around the entire abdominal cavity in a horizontal direction, originates along the same Thoraco-Lumbar Fascia as the Internal Obliques, then along the Iliac Crest and into the ligament that runs from the front of your Ilium down to your pubic bone called the Inguinal Ligament. It then inserts into the Abdominal Aponeurosis. Both the Internal and External Obliques have some attachments into the Inguinal Ligament as well.

The four muscles together provide a girdle-like structure that help to create a stable core system. The four muscles are also situated sort of like a steel-belt radial tire in that they form different layers going in all different directions with the TVA being the deepest. The primary concentric movement of the Rectus Abdominis is to flex the spine and to eccentrically control spinal extension (for a refresher, when the abs are resisted like in a crunch or sit up, the going down portion is considered to be moving into spinal extension—eccentrically controlling the extension means it is lengthening under control).

The External Obliques concentrically work to flex the spine when both sides are contracting at the same time. It also works concentrically to rotate the torso to the opposite side (ex: bring your right shoulder toward your left hip) and to bend the trunk laterally. The External Obliques also eccentrically control spinal extension, same side rotation and opposite side lateral trunk bending. The Internal Obliques also concentrically work to flex the spine when working together. They also rotate the torso to the same side (the opposite action of the External Obliques) and provide lateral side bend to the same side. The Internal Obliques also eccentrically control spinal extension, opposite side rotation and opposite side lateral side bend.

It should also be noted that when rotating the External Obliques on one side will be working with the Internal Obliques on the opposite side. And finally, the TVA works to compress the abdominal contents. By contracting inward the TVA reduces the abdominal volume thus increasing pressure.

Spinal Erectors (Spinalis, Longissimus, and Iliocostalis)

Since the individual function of each of the spinal erectors is not pertinent in this book, I will focus mainly on the basic function and attachment sites. The spinal erectors span from the Sacrum all the way to the base of the skull. This group of muscles each has different divisions in the lumbar (lower spine), thoracic (middle spine where the ribs attach) and the cervical (neck) regions. They share a common tendon origin through the Thoraco-Lumbar Aponeurosis (or fascia) that attaches to the back of the Sacrum, the Iliac

crest, the Spinous Processes (the bones most in the center of the back running up the entire back and neck – most prominent spinal bones) and the last two thoracic vertebras. The muscles have various attachments along the ribs very near the vertebras and on the vertebras themselves.

The basic function of the spinal erector group is to concentrically extend the spine (when working all together like the obliques) and to eccentrically control spinal flexion. The erectors also work unilaterally to flex the spinal column to the same side (lateral side bend) and to eccentrically control lateral side bend to the opposite side.