The fascia system is part of our connective tissue, a broad category that also includes bones and blood. We could say that the fascial system is the soft but supportive part of our connective tissue,[21] and it varies in density and shape depending on its different functions and purposes. Fundamentally, it helps to keep us together and move around. Fascia research is an ongoing and fairly young field of study. Scientists are still discovering amazing properties within this extensive web of tissue that makes up a large portion of our bodies.

The more solid form of fascia—which is the part of the fascia system we'll focus on in this book—is usually depicted as white, tendinous material that appears as thin or thick layers covering the muscles, organs, and bones. It also surrounds the joints in the form of tendons, ligaments, and a joint capsule for protection ***(Figure 5-1)***. One of the strongest tendons in the body is the Achilles tendon found in the ankle, and even this tendon contains 63% water.

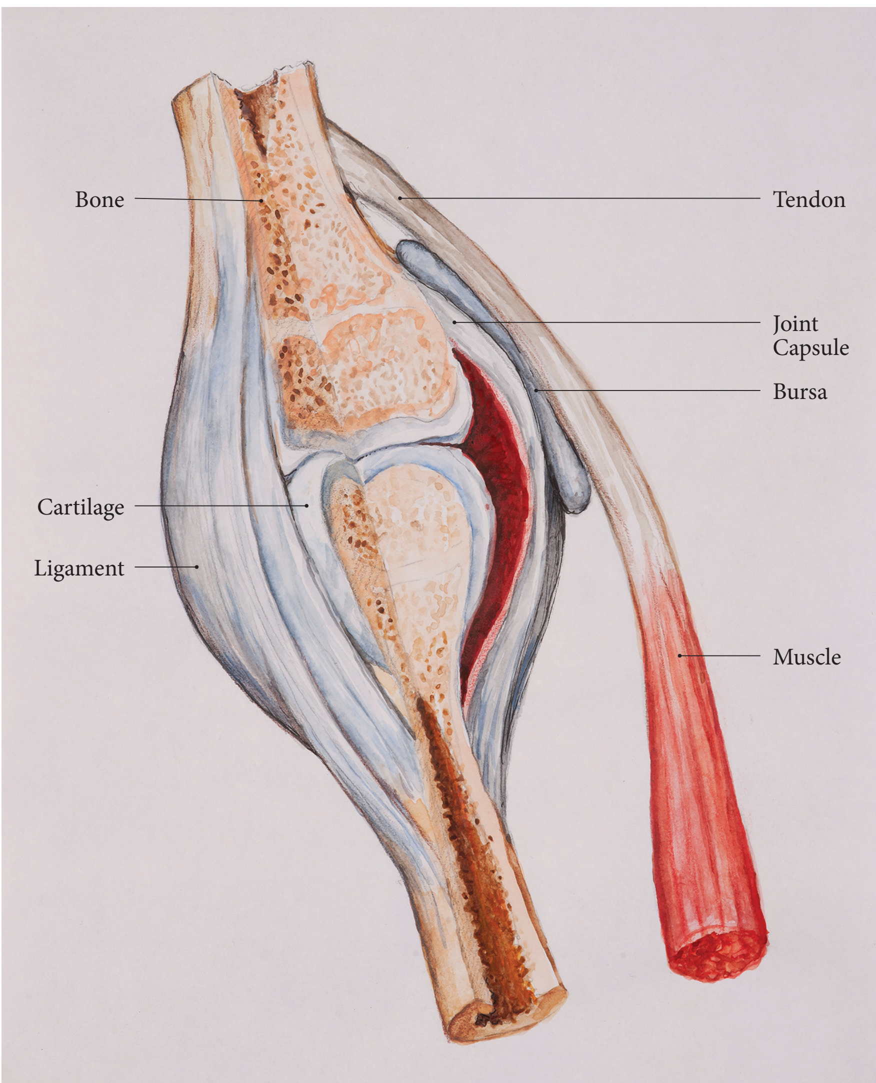


Figure 5-1. *Illustration of fascia and muscle around the joint*

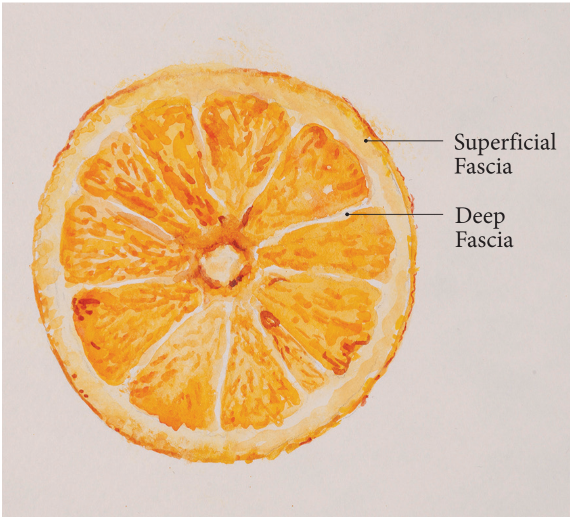


Figure 5-2.
The orange model of fascia

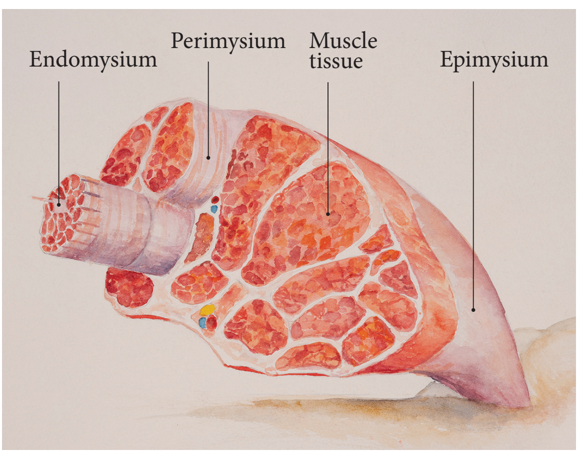


Figure 5-3.
Muscles and muscle cells reside inside pockets of fascia

The classic model used to explain the solid part of the fascia system is an orange ***(see Figure 5-2)***. The rind of the orange represents the skin on our bodies. Our skin (which isn't a part of the fascial system) is our largest organ and covers the entire surface of the body. Underneath our skin, we find the superficial fascia: a soft layer of fibers and adipose (fat) cells which, in ***Figure 5-2***, is represented by the white layer just underneath the orange's skin. When the rind and white layer of the orange are removed, we see the interior of the orange, separated into different compartments, each of which has a surrounding membrane. These membranes are the equivalent of the deep fascia, like a muscle enveloped by the fascia surrounding it. The membrane around the orange segment holds the juice inside. If the membrane is pierced, the juice escapes. You can imagine the fascia as a 3D model encasing and connecting all the solid and fluid parts of the body. Without the fascia web connecting everything that exists within the boundaries of our skin, all of our organs, along with the rest of the content in our body, would end up in large puddles within the skin of our feet.

If you're a meat eater, you may have prepared beef for dinner by cutting away the white, firm layer of gristle from the cut of beef ***(Figure 5-3)*** because it's difficult to chew. This white, chewy part is fascia. It also appears as sheaths or smaller, rubber band-like tendons and ligaments in our body. The sheaths surround and support the bones and muscles, and are great force transmitters in all directions. The tendons and ligaments keep the joints stable and together ***(Figure 5-1)***, while transmitting forces across the joint and connecting the activity of one muscle to another in a chain reaction.

Skeletal muscles

We have three types of muscle cells:

- **Cardiac muscle cells** these are the cells that make up the heart muscle. When they contract, the heart pumps blood throughout the body.
- **Smooth muscle cells** these are found primarily in blood vessels, organs, and intestines. When they contract, they move fluids and nutrients around.
- **Skeletal muscle cells** these are found throughout the body and are under varying degrees of voluntary control. When they contract, they enable us to move, breathe, and maintain posture and balance.

In this book, we'll only focus on skeletal muscle cells. We have around 650 skeletal muscles in our body that consist of millions of muscle fibers.

Inside each muscle cell are three types of proteins: myosin, actin, titin.

According to the sliding-filament theory, actin and myosin bind to each other and shorten the sarcomeres within the muscle cell. Each cell has multiple sarcomeres lying side by side, and when these shorten simultaneously, the muscle contracts (*Figure 5-4*).

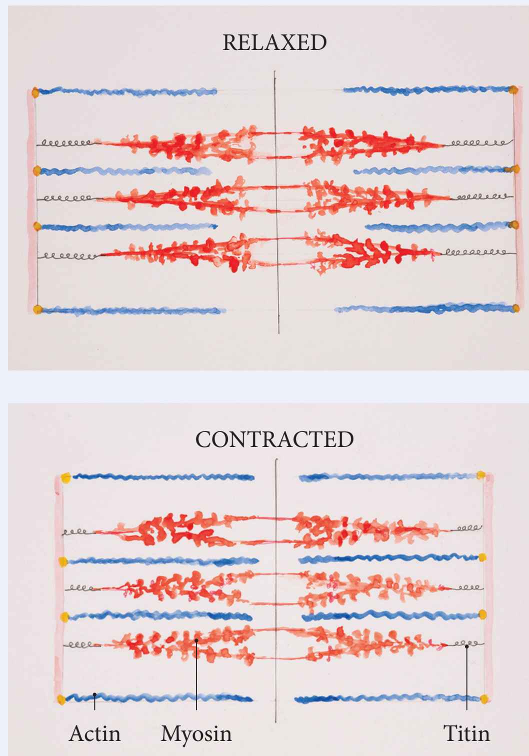


Figure 5-4.
Actin, myosin and titin within one sarcomere. Relaxed (top) shortened/contracted (bottom)

Skeletal muscles are mainly attached to the skeleton and produce movement by contracting and relaxing.

Muscle tissue can produce concentric, eccentric, and isometric contraction depending on the demand of the task (this is explained below).

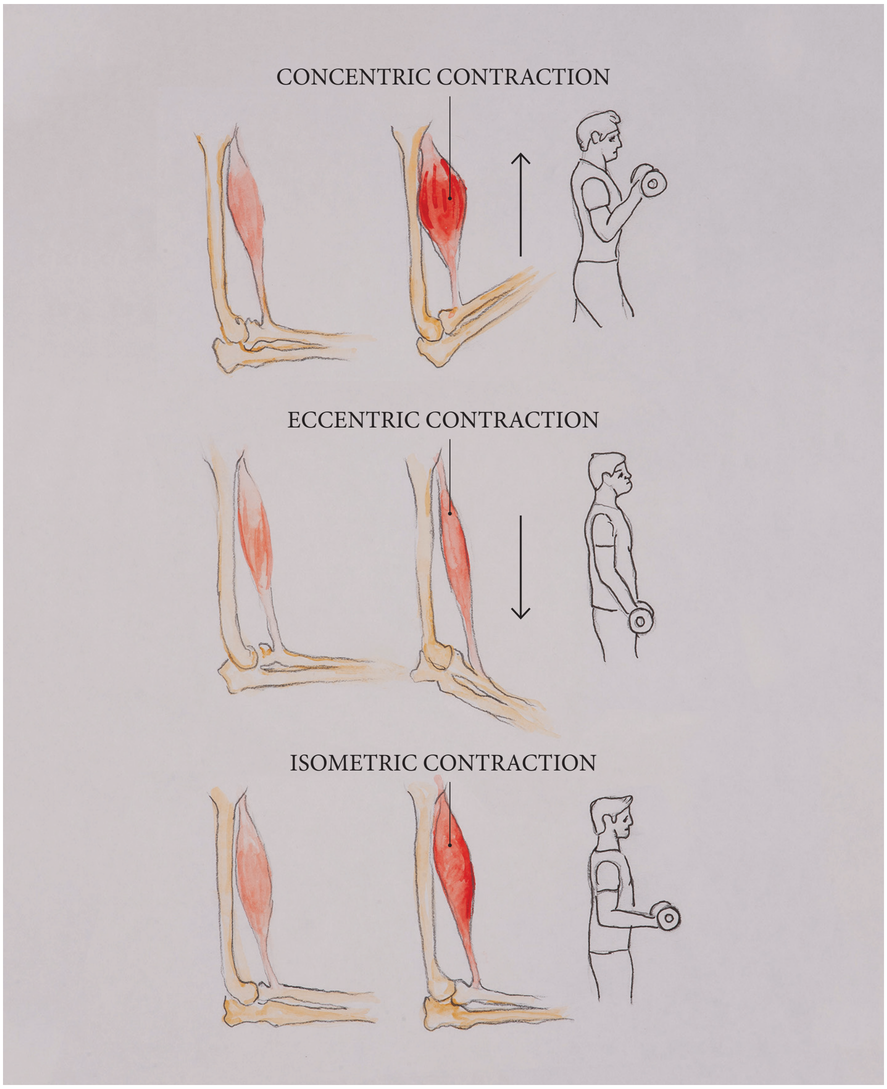


Figure 5-5.
Concentric, eccentric, and isometric muscle contraction

Agonist, synergist and antagonist

The main muscle performing a movement is called the **agonist** (prime mover). If other surrounding muscles are helping the agonist with the movement, they're called **synergists**. These muscles might primarily do other movements in the same area more effectively, yet they help with secondary movement tasks when needed. The muscle that does the opposite movement of the agonist in the same joint is called the **antagonist**. This muscle needs to relax and allow itself to lengthen when the agonist contracts. This happens when the nervous system sends signals to inhibit engagement of this opposite—antagonistic—muscle. (The antagonist is normally situated on the opposite side of the joint to the agonist and creates the opposite movement when it contracts concentrically.)

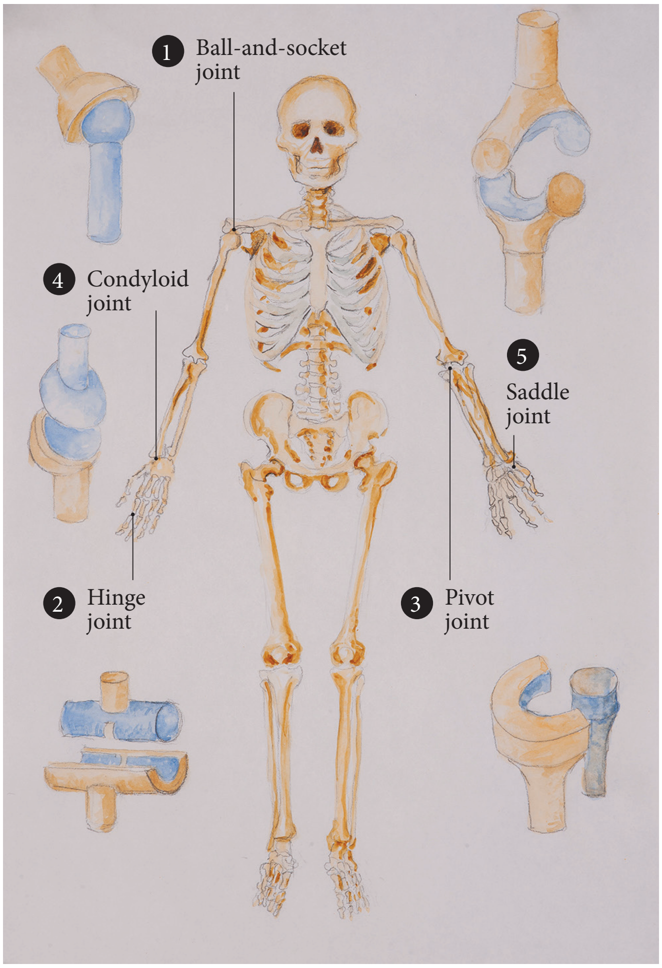


Figure 5-6.
Various types of joints

range of motion and some have very little. For example, see how far you can move your index finger toward your palm, flexing only at the base of the finger (keep your index finger straight as you flex the finger joint closest to the palm). Can you get to 90 degrees? Now check your shoulder joint. Lift your arm to 90 degrees from your body and then upward toward your head until your hand is above your head. Your shoulder joint has a much greater range of motion than your finger joint.

A wide range of motion in the shoulder joint allows us to reach overhead, hold our instrument or arm down by our side, move the bow over the strings of a violin, and so on. However, the greater the range of motion in a joint, the less stability there is within the joint structure, and the more stability is needed from the muscles surrounding the joint. It's no coincidence that the shoulder is a major focus of playing-related injury in musicians: we use our arms, and therefore our shoulder joints, to play essentially all instruments. Since the joints and fascia in this area are so mobile, stability and movement control are, to a large extent, provided by the muscles around the joint. The coordination of these muscles is a key factor in determining whether we can do this in a healthy and sustainable way or if we experience pain and discomfort.

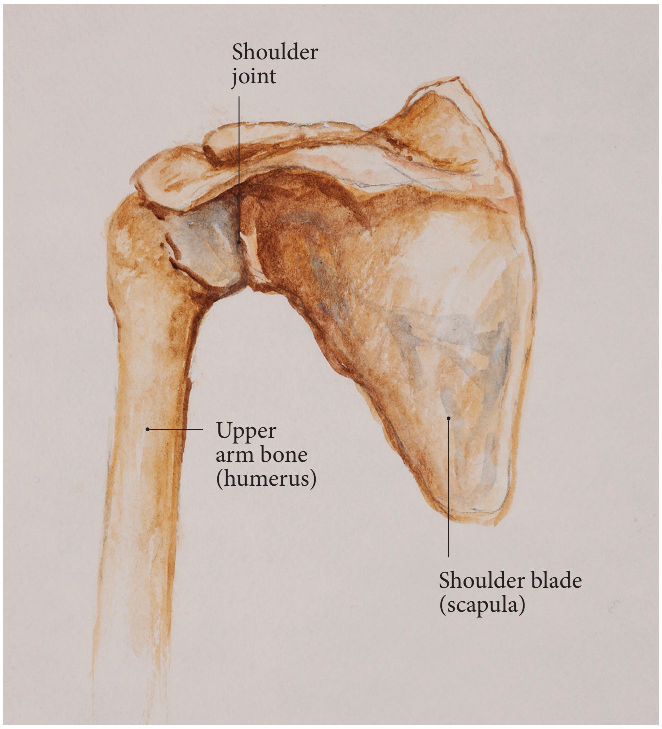


Figure 5-7. *The shoulder joint that connects the upper arm bone to the shoulder blade (left shoulder, posterior view)*

1. Ball-and-socket joint

The shoulder and hip joints have a similar structure and are classified as ball-and-socket joints. This kind of joint has a wide range of motion. Because of the wide range of motion in these joints, there are many muscles involved in the different movements.

→ **Try it (hip joint):** The hip joint allows you to lift your knee up in front (flexing at the hip joint), hold your leg out behind (extending at the hip joint), move it out to the side (abduction), and move it back in again (adduction), as well as rotating the whole leg in and out. This can be done by standing up straight and using the rotation of the thigh bone to point the toes out (external rotation) and in (internal rotation).

→ **Try it (shoulder joint):** The head of the upper arm bone (humerus) connects to the shoulder blade (scapula) ***(Figure 5-7)*** and allows the same movements as the hip joint. The shoulder joint, together with movement of the shoulder blade, enables you to move your arm overhead or in a wide range of other movements. Explore what positions and movements are required of the shoulder joint when playing your instrument.

Figure 5-8. *Bones and joints of the hand and the wrist, (right hand, palmar view)*

2. Hinge joint

In the fingers, the middle (PIP) joints and outermost (DIP) joints are hinge joints (***Figure 5-8***), which means they're only able to move in two directions—flexing (bending) and extending. The elbow joint is also mainly a hinge joint. This means you can flex and extend this joint by moving your lower arm up and down while holding your upper arm still. Sometimes, what seems like a movement of the elbow joint is actually a movement of the shoulder joint. For example, if a pianist is asked to release their elbow out to the side, away from the body, this would be a movement of the shoulder joint, not the elbow joint, even though the elbow is moving away from the body. String players are often told they have a stiff bow arm. In some cases, this is simply due to too little movement in the elbow joint, which means the shoulder joint has to do too much of the work.

→ **Try it:** Explore exactly what elbow movements (flexion/extension) are required for your instrument and see how it feels to become aware of these movements before you play your instrument the next time.

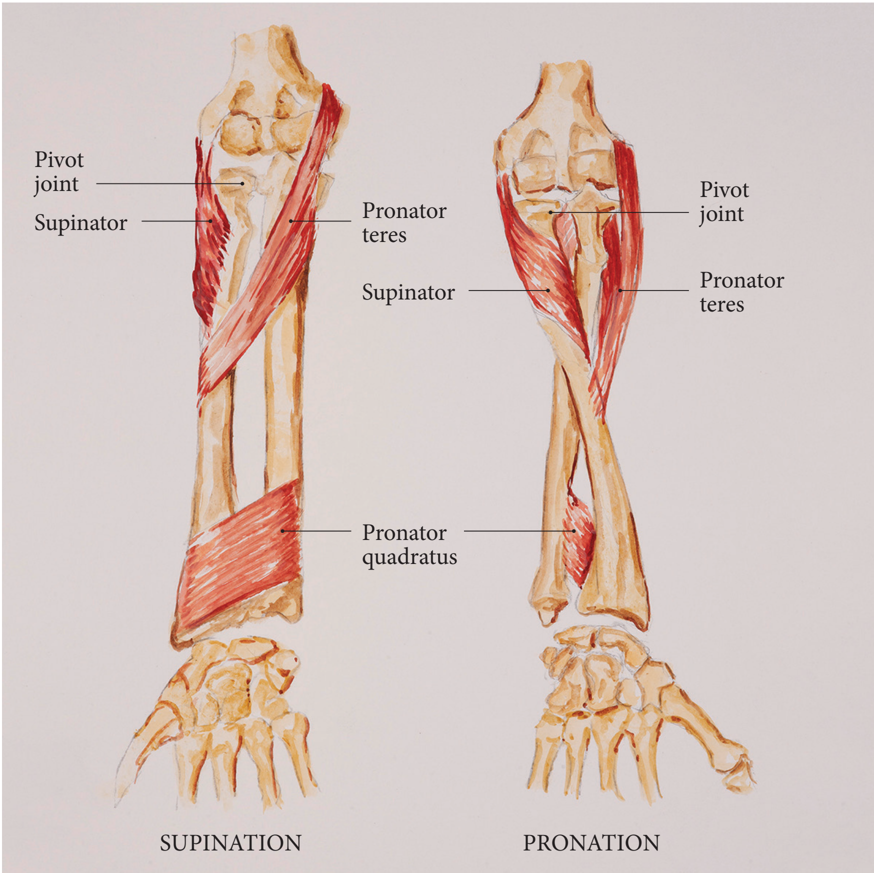


Figure 5-9. Supination (left) and pronation (right), a movement in the pivot joint at the elbow (right hand, front view)

3. Pivot joint

The proximal (closest to the body) ends of the two bones of the lower arm (the radius and ulna) come together at the elbow to form what's called a pivot joint. With this additional joint movement, the elbow, besides being a hinge joint, also acts as a pivot joint, which is what allows supination and pronation of the lower arm.

→ **Try it:** Hold your lower arm out in front of you at 90 degrees with your palm facing up. Now turn the palm to face down without moving the upper arm out and away from your body or changing the position of your elbow. This movement is called pronation, an action in which the bones of the forearm cross ***(Figure 5-9 right)***. Now turn your palm face up again. This movement of the forearm is called supination ***(Figure 5-9 left)***. The movement that creates pronation and supination happens in the pivot joint at the elbow, not in the wrist, as we might imagine. This movement is sometimes described as forearm rotation.

A pianist will be in a pronated position while playing, and normally does slight supination or pronation movements when, for example, playing tremolos. The left hand of a guitar player or violinist will be in a supinated position. And the bow arm is pronated. What is the lower arm position for your instrument? Can you imagine the joint at the elbow as you do the movement?

Figure 5-10. *Two of the movements of the wrist (from side to side - right hand, palmar view)*

4. Condyloid joint

The wrist and the knuckle (MCP) joints of the fingers (***Figure 5-8***) are condyloid joints ***(Figure 5-6)***. A condyloid joint allows for quite a bit of movement but differs from the ball-and-socket joint because it can't do rotational movements.

→ **Try it (fingers):** You can flex and extend your fingers using the PIP and DIP joints (hinge joints), and you can flex, extend, and also move the fingers from side to side and in circles at the knuckle joints (condyloid joints). The sideways movement is vital when you need to move to and hit the right note on instruments like the piano, guitar, or violin. It also allows wind players to move their fingers between keys.

→ **Try it (wrist):** If you bend your elbow joint to 90 degrees with your arm at your side and hold your hand out in front of you with the palm down, you can move your hand from side to side and up and down without moving your lower arm. You can combine these movements by drawing a circle in the air.

The nerve cells (also called neurons) communicate with each other by connecting to neighboring (or distant) neurons via synapses. These synaptic connections can change and form new connections throughout life. This is why we can learn new things, including new repertoire and new ways to move, and enhance the technical skills of playing and singing regardless of age.

There are many areas of your brain that are devoted to movement (motor control). Motor neurons carry signals from the central nervous system through the peripheral nervous system to each muscle in our body ***(Figure 6-1)*.**

There are also areas in the brain that receive sensory information from the body. It is the sensory neurons that carry information from the skin, glands, organs, muscles, and joints to the brain, providing all types of data, including sensing movement, temperature, physical sensations, and pain.

As you practice your instrument, the neurons in your brain adapt to the stimuli from the neurons that create and detect movements. Sensory information, such as tactile and auditory feedback, is sent to the brain; the brain then makes constant, quick adjustments to the movements to improve our playing. How you practice your instrument influences what you imprint on your brain and how your brain will respond to similar stimuli in the future.

One **motor unit = one nerve cell** that sends a signal to contract a certain number of muscle cells (ranging from approximately five to more than a thousand) at the same time.

The right half (hemisphere) of the brain mostly controls the left side of the body, and the left hemisphere mostly controls the right side.

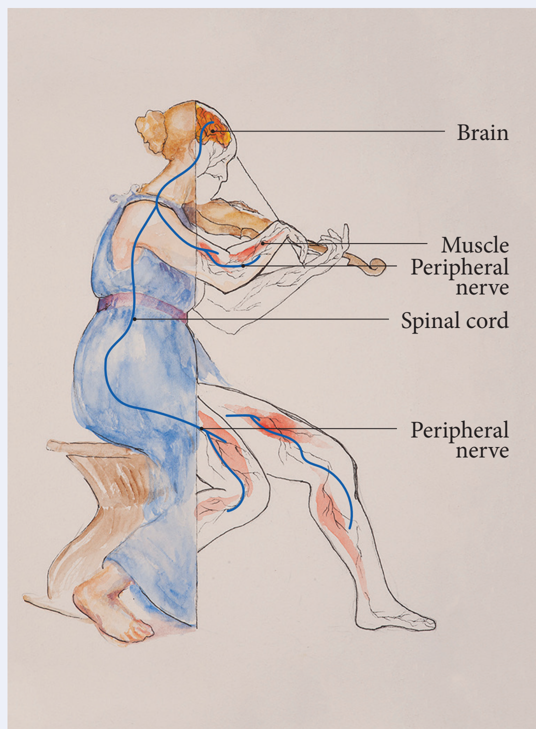


Figure 6-1.
The human nervous system simplified.
The brain sends signals to the muscles to create movements, and the sensory neurons in the body send signals to the brain.
This is a constant feedback loop

How the brain talks to the body

For a muscle to contract, there must be a nerve signal telling it to do so. The complex organization of movement is first prepared in the brain *(**Figure** 6-2)*. An electrical impulse then travels down the spinal cord to a peripheral nerve that innervates a particular muscle and tells it to contract *(**Figure** 6-3)*. In addition to movements prepared and organized in the brain, there are also fast reflexes, which are controlled locally in the spinal cord.

By the time a nerve reaches a muscle, it has many tiny branches, each of which attaches to one muscle cell *(**Figure** 6-3)*. Sometimes, a nerve may divide into just a few branches, sending a simultaneous signal to several or up to a couple of hundred muscle cells. This is the case in muscles that are responsible for fine coordination skills, such as those needed by the fingers to play an instrument, draw, or button a shirt. Other nerves divide into several hundred or more than a thousand branches and send a simultaneous signal to all those muscle cells. This creates what's referred to as a gross motor action, as is demonstrated in activities such as walking, running, or lifting.

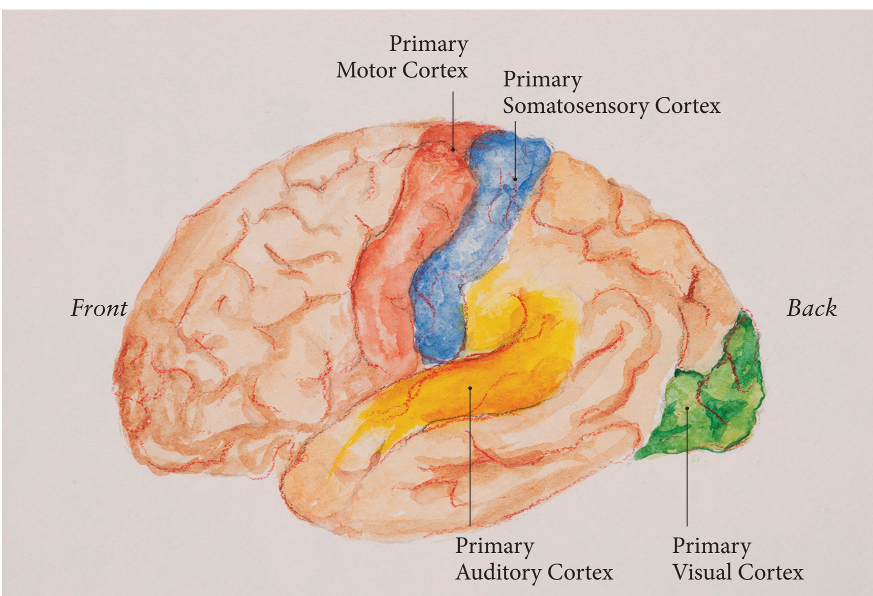


***Figure* 6-2.**
Some of the areas of the human brain that are involved in movement and the processing of sensory input

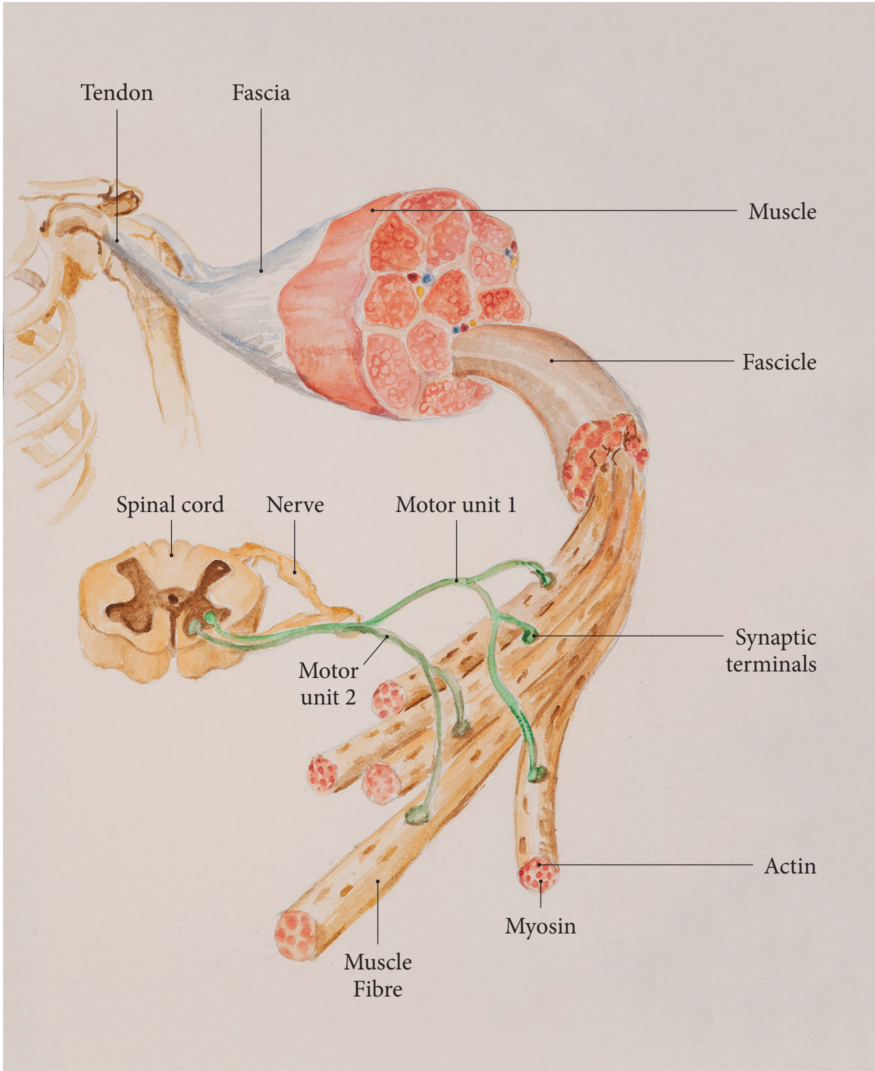


Figure 6-3. Nerve signal transmission from the spinal cord to the muscle cells

Accurate muscular action relies, to a large extent, on the sensory input the brain receives from the body (this is described in more detail in Chapter 8). Therefore, muscular actions are very much dependent on sensory information. When we practice slowly,[25] we give our brain time to receive the sensory information and make adjustments as we go along. The piece is subsequently easier to play more rapidly as the movement patterns are practiced and become more automatic. This process depends on where we are in the process of learning a piece or technical skill: we need to focus more on the details of movement in the beginning compared to when we know a piece well. As the brain gradually learns to organize movements and form models in the brain, the movements become easier to perform and more automatic.

It's like when a baby is learning to walk. In the beginning, there's no previous experience of walking and therefore no existing model in the brain that tells the baby's limbs how to organize force, speed, and direction. Therefore, its movements aren't precise, and it's impossible to

It's quite remarkable to think about the constant interplay between the brain and the muscles. Be aware of this the next time you practice your instrument or sing. Every time you intend to change something, your brain needs to be on board and moderate the neural pathways to accomplish the movements you're changing. Motor neurons are sending messages to each and every Type I and Type II cell involved every time you perform a movement at the instrument that's targeted toward your desired task. Try to be aware of this as you practice, giving your brain the time, tempo, and repetition that it needs to adjust to your desired outcome.

Figure 6-4.
The "volume control." The Type I muscle fibers are typically the first to engage when resistance is low. This is followed by the Type II and Type IIx, which are used when the body needs to apply sudden or large amounts of force

Stability

Stability is an often underestimated but very important aspect of playing and singing. Stability is the ability to perform accurate movements with dynamic control. Stability does *not* mean a stiff or static posture, or movement created by the co-contraction of random muscles or by breath-holding while playing. The kind of stability we want as a musician is that which enables us to freely perform controlled and accurate movements while, at the same time, allowing us to have a strong and weighted center in the legs, trunk, arms, and hands to serve as a supportive core. We want the ability to give and take, move out from the midline and come back, be firmly seated or standing without imbalance or weakness, and to always maintain control within this spectrum of movement variability. Good stability shouldn't be dependent on a specific posture but should be able to be maintained in different postures. Often, great musicians have stability without even knowing it, because when there's stability, there can also be a sense of effortlessness in the playing. Without stability, a sense of effortlessness is very hard to achieve, especially in demanding repertoire. This might sound contradictory, as we often seek effortlessness through relaxing more. Relaxing more isn't wrong in itself, but it can create some challenges as soon as the music requires intensity, speed and power, unless we know where to relax and what we can activate. Several of the exercises in Chapters 10 to 15 are designed to provide better stability in all our body parts.

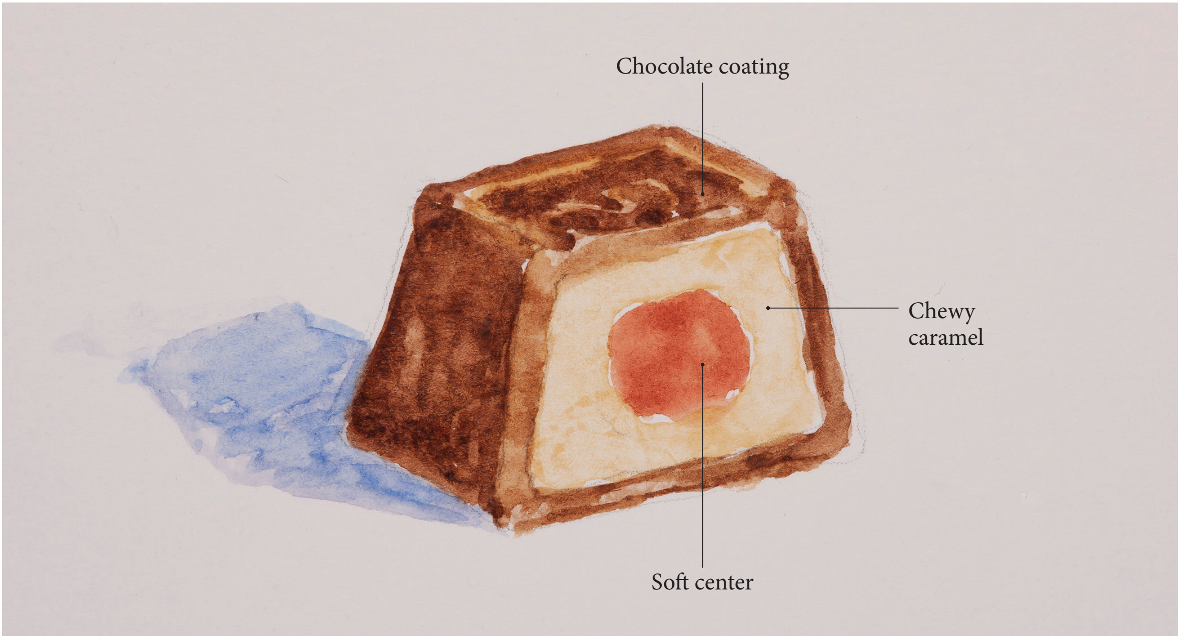


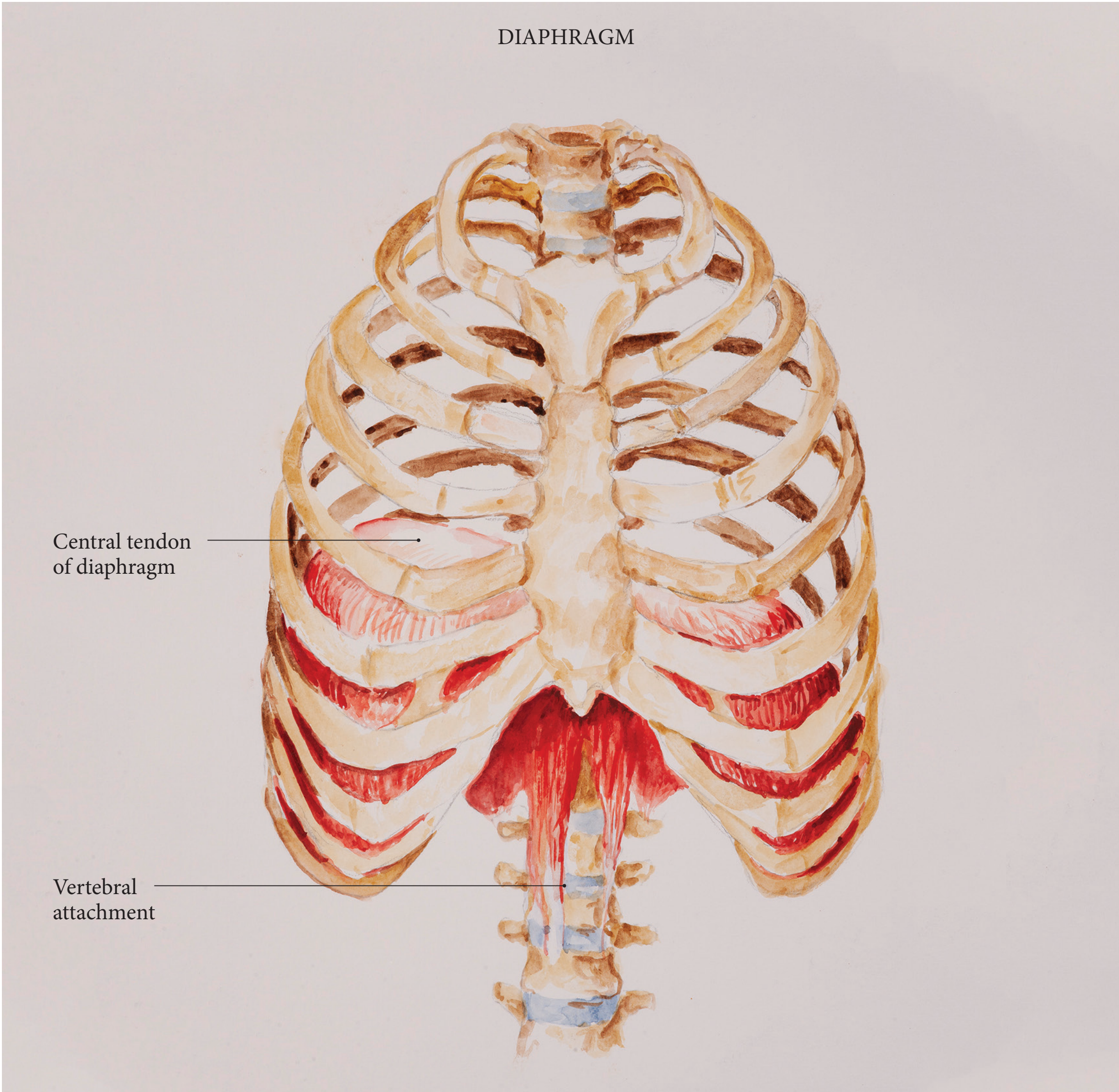
Figure 7-1.
The chocolate-covered caramel—a simplified model illustrating the different potentials that musicians can access in different parts of the body. It includes the soft center for ease of breathing; the chewy caramel for maintaining posture, balance, repetitive motions and stability; and the chocolate coating for relaxing and sensing weight

The chocolate-covered caramel model ***(Figure 7-1)*** describes where we can find a healthy way to access:

- Ease of breathing, found in the soft caramel center
- Stability, posture, balance, repetitive motions, timing, and active musical intention, found in the chewy caramel layer
- Relaxation and a sense of heaviness and weight, found in the chocolate coating

Muscularly, the two caramel layers (soft and chewy) consist of stabilizers, and the chocolate coating consists of mobilizers. Through the visual illustrations of the muscles in this section, you can start to have an idea of how the muscles in each layer look and where they are. Then, in the exercise chapters, we'll talk more in depth about the anatomy of each muscle to gain a better understanding of the exercises.

When looking at the following anatomical illustrations, you'll see that the bones are a yellowish color, the fascia (tendons, ligaments, sheets) is pictured in white, and the muscle tissue itself is in red. Remember, the muscle is the part that contracts, which subsequently pulls on the fascia that, in turn, pulls on the bone to which it's attached. Some muscles don't attach to bones at both ends of the muscle belly—such as the diaphragm and the transverse abdominis—which is why they don't contribute much to movement of the skeleton but instead influence internal pressures, stability, and breathing.



Diaphragm

This is the primary muscle used for inhalation. It's a dome-shaped muscle that, when we breathe in, descends inside the chest, lifts the lower ribs, and thus expands the chest to draw air into the lungs. It is only 2-4 mm thin and separates the abdomen from the chest. Remaining flexible in the diaphragm is key to releasing unwanted tension while playing or singing. We'll go more in depth on this muscle in Chapter 15.

Figure 7-2. *The diaphragm situated in the chest. It separates the chest cavity from the abdominal cavity and is the main muscle for inhalation*

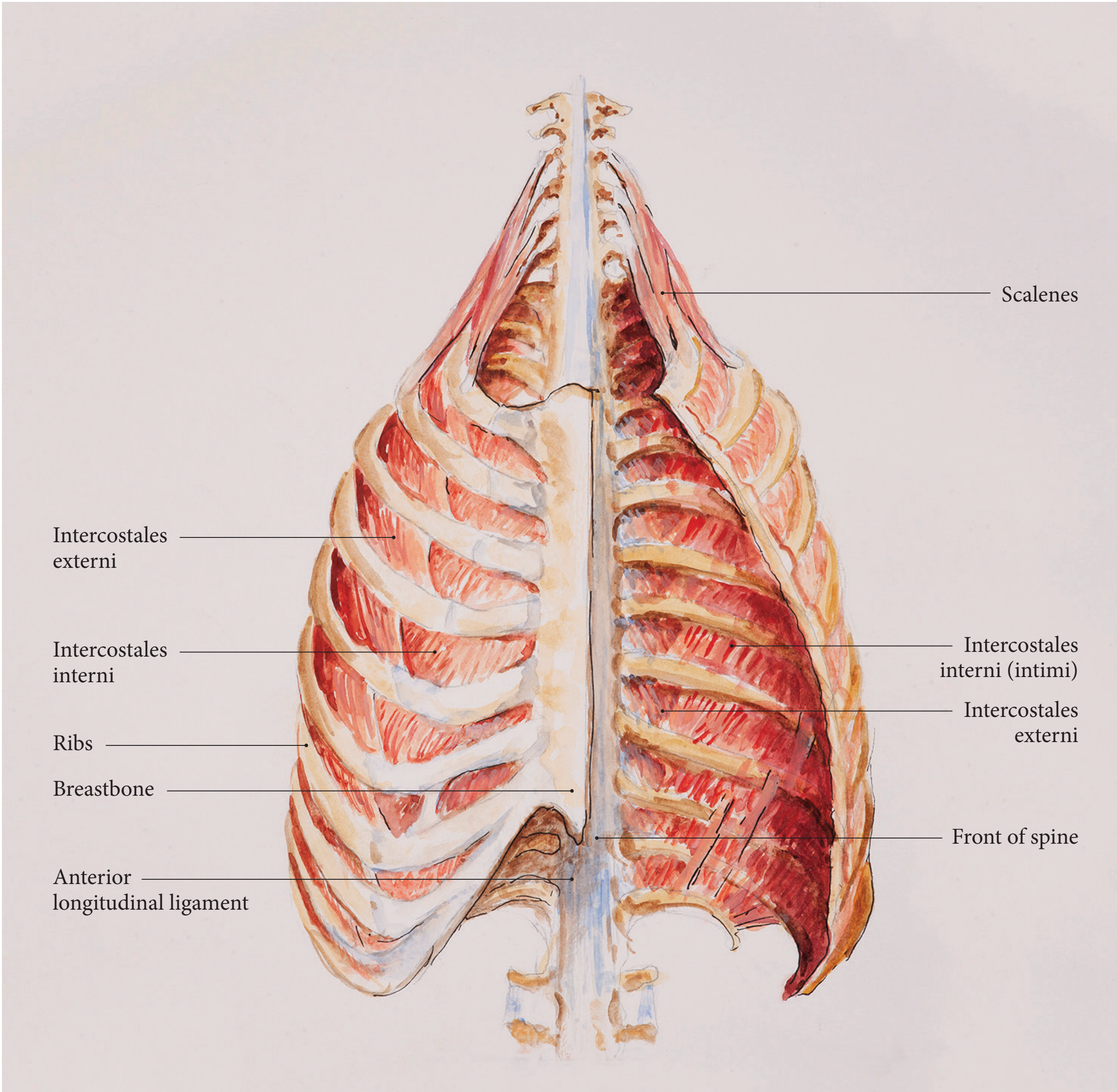
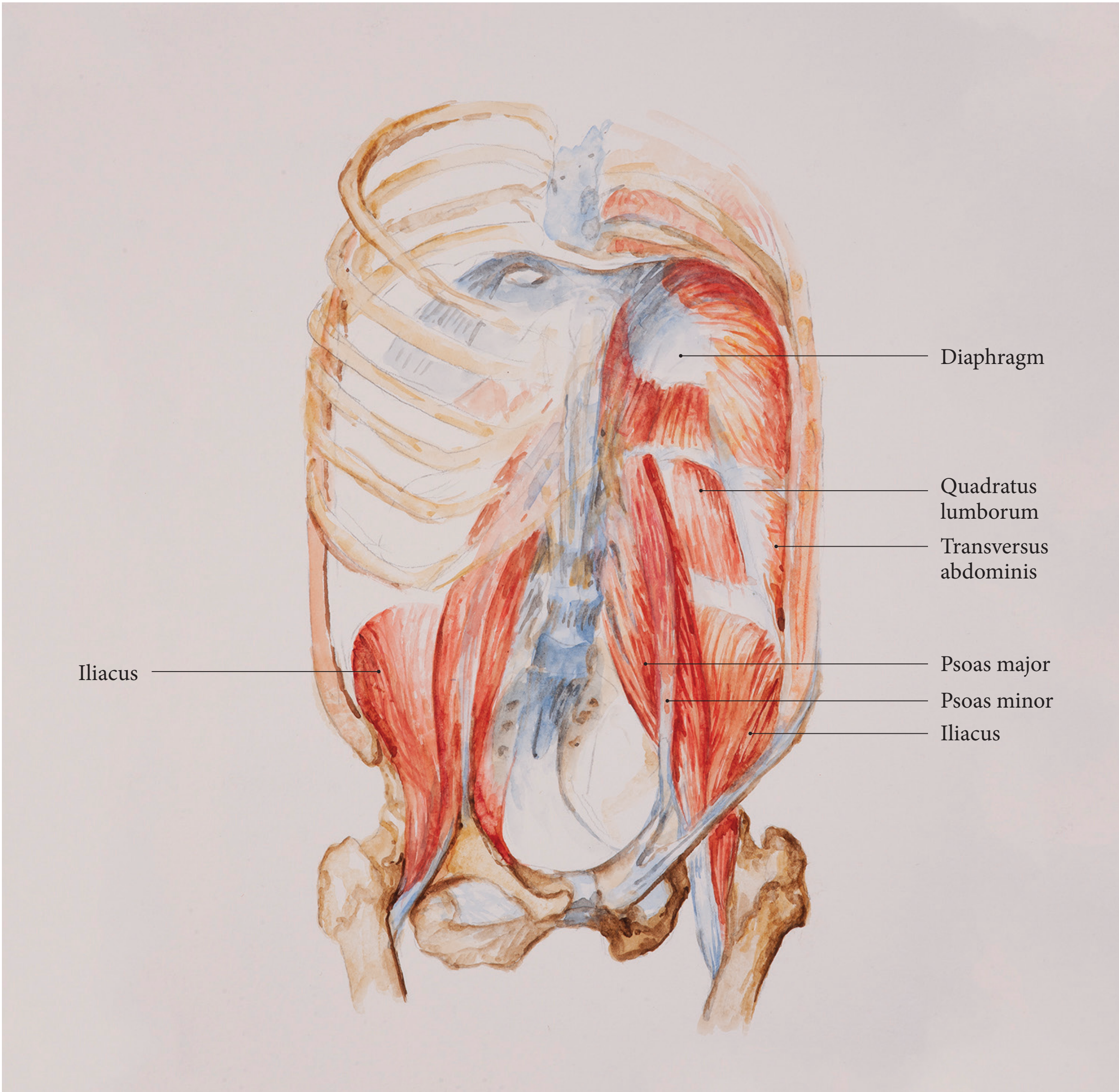


Figure 7-3.
The intercostal muscles situated in two to three layers between the ribs. They're important muscles for breathing

The intercostals

The intercostals lie between each rib and are also primary breathing muscles. They contribute to breathing by expanding and shrinking the chest cavity to create an increase or decrease of space in the lungs. These muscles help to keep the chest open when breathing, and they need to be easily accessible and flexible when breathing. We'll go more in depth on these muscles in Chapter 15.



Psoas major

This muscle runs along the lower back on the side of the spine, deep inside the belly, and its lower end attaches to the thigh bone. It stabilizes the lower back and does some hip flexion and spinal flexion. Even if it isn't a breathing muscle, it contributes to the sense of deep breathing by transmitting forces from the diaphragm to the sit bones and legs via the fascia when breathing. We'll address this muscle directly and indirectly in different exercises on posture, stability, and breathing in Chapters 10 through 15.

Figure 7-4. *Psoas major and the surrounding muscles in the posterior abdominal wall. View from the front. It stabilizes the spine and helps create a sense of deep breathing through the fascial connections*

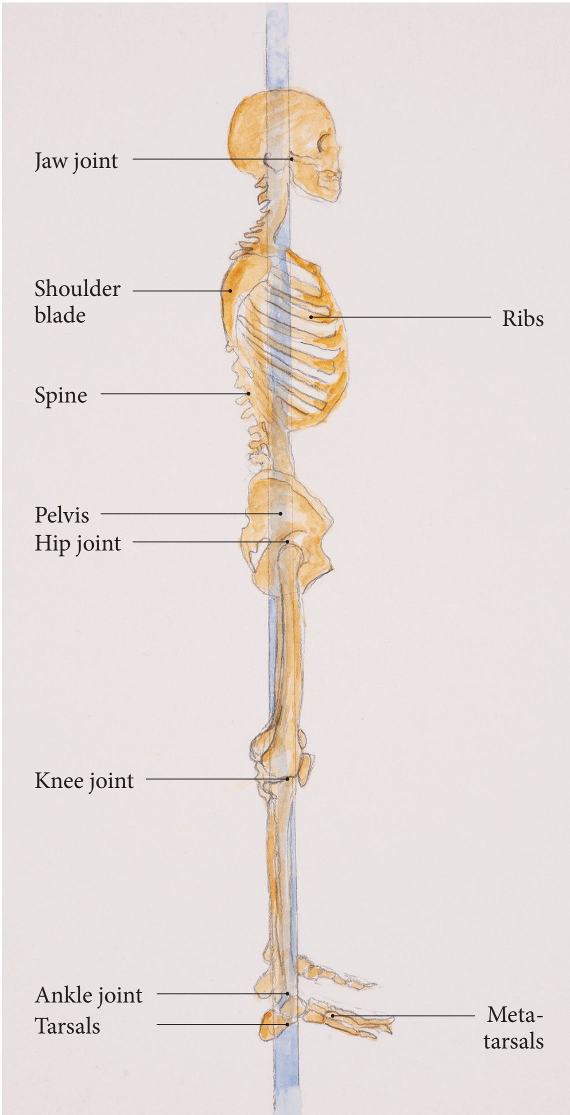


Figure 7-5.
The skeleton aligned in a plumb line

Examples of what's located in the chewy caramel layer:

- The skeleton
- Fascia
- Transverse abdominis
- Serratus anterior
- The small muscles of the hands and feet

The skeleton

The most supportive tissue in our body is our skeleton. We want the joints between the bones to transmit gravitational forces in the most beneficial way, which may mean bringing our hips back, aligning the ankles and knees, etc. Alignment and posture work is necessary to find balance in the joints, which can contribute to engaging the right muscles. However, this doesn't mean we should stay in one position all the time when playing or singing, or that a completely aligned skeletal position is even possible with all instruments. We'll go into more detail on this in Chapters 9 through 11.

Fascia

Fascia is the collagen-rich, supportive connective tissue that creates force distribution and communication throughout the body, as described in Chapter 5.

Figure 7-6. *The transverse abdominis muscle (left side), forming the innermost layer of the abdominal wall*

Transverse abdominis

This deep muscle called the transverse abdominis is a thin, layered muscle situated around the viscera, often referred to as a corset because of its shape and function. When it engages with optimal timing, it plays a key role in providing good air flow for singers and wind players, and it creates stability and support in the torso for all musicians. It's also important for musical intention. We'll go deeper into the function of this muscle in Chapter 14.

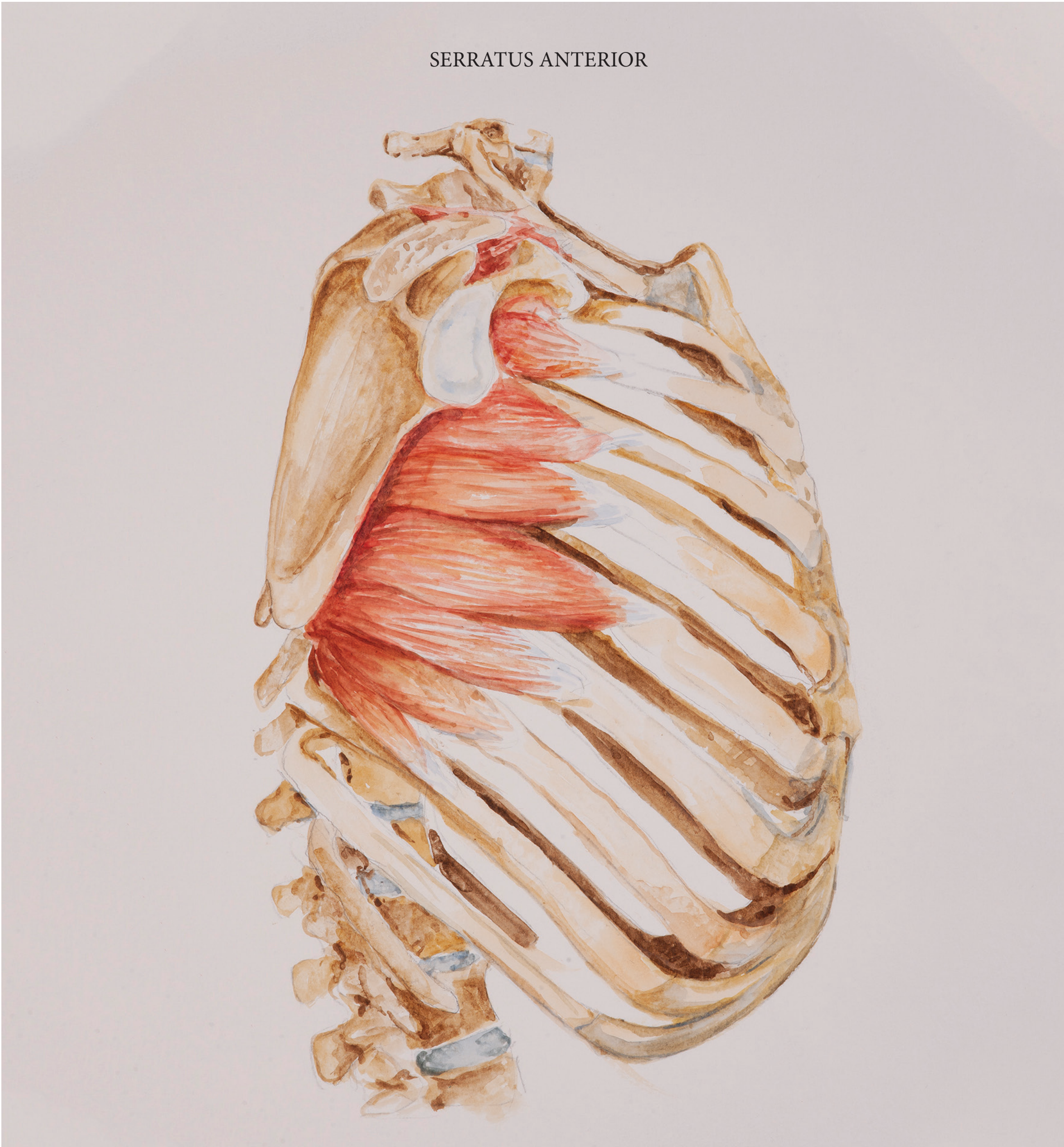


Figure 7-7. *The serratus anterior muscle, important for shoulder blade mobility, stability and breathing*

Serratus anterior

The serratus anterior attaches to ribs 1 to 9 and to the shoulder blade in the other end. This muscle moves and stabilizes the shoulder blade, and it helps keep the shoulder and chest strong and open when we breathe or move the arm to play. We'll do exercises for this muscle in Chapter 12.

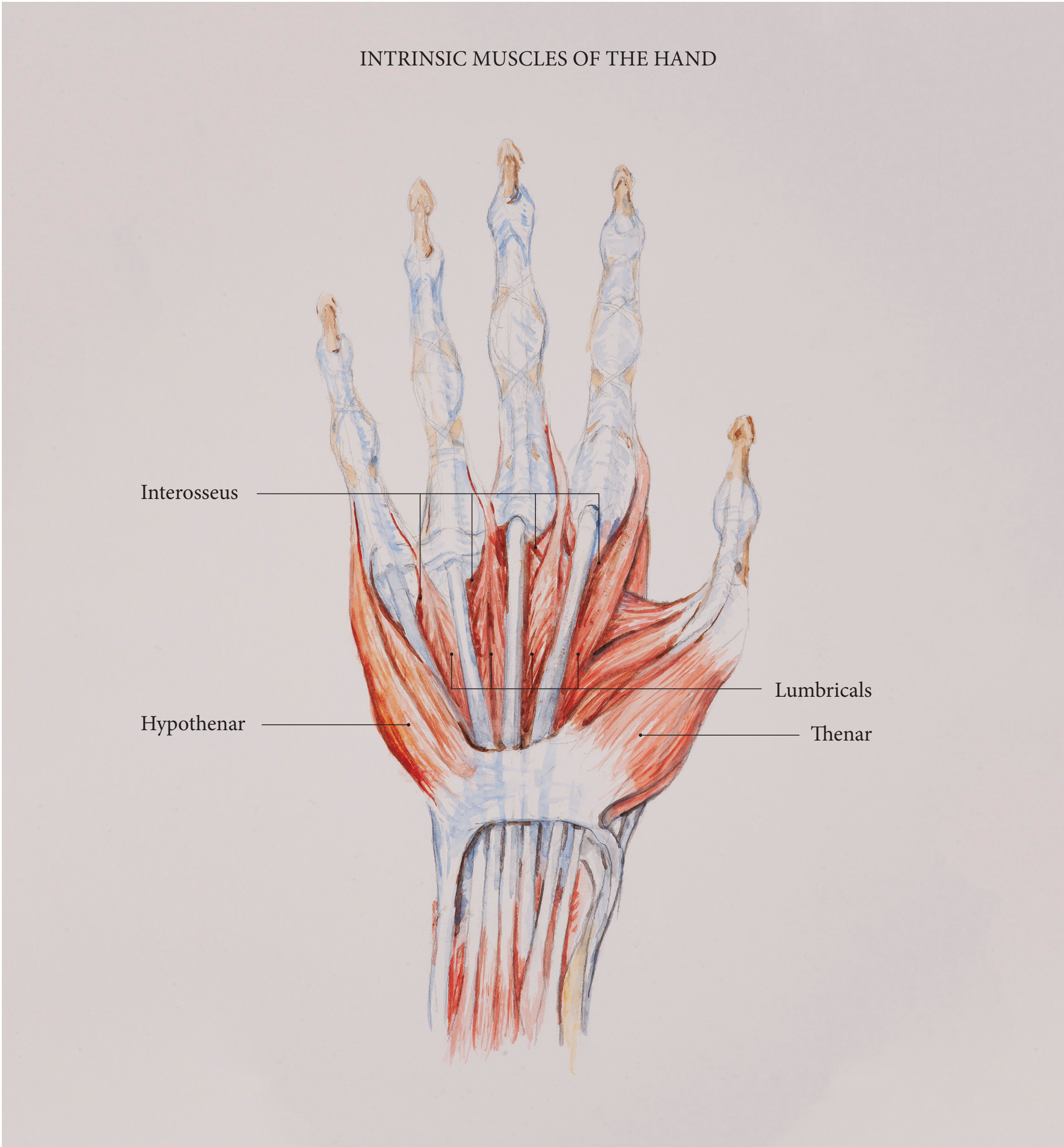


Figure 7-8.
The intrinsic muscle groups of the hand for controlling finger movements.
The interosseus lie deeper than the lumbricals between the metacarpals

The small muscles of the hands and feet

These muscles are the intrinsic muscles of the hands and feet, meaning the muscle lies within the hand or foot. They play a great role in finger movements and their accuracy. They're also important for maintaining the arches of the hands while playing and the arches of the feet when standing—assisted by certain muscles of the forearms and legs that control the wrist and ankle.

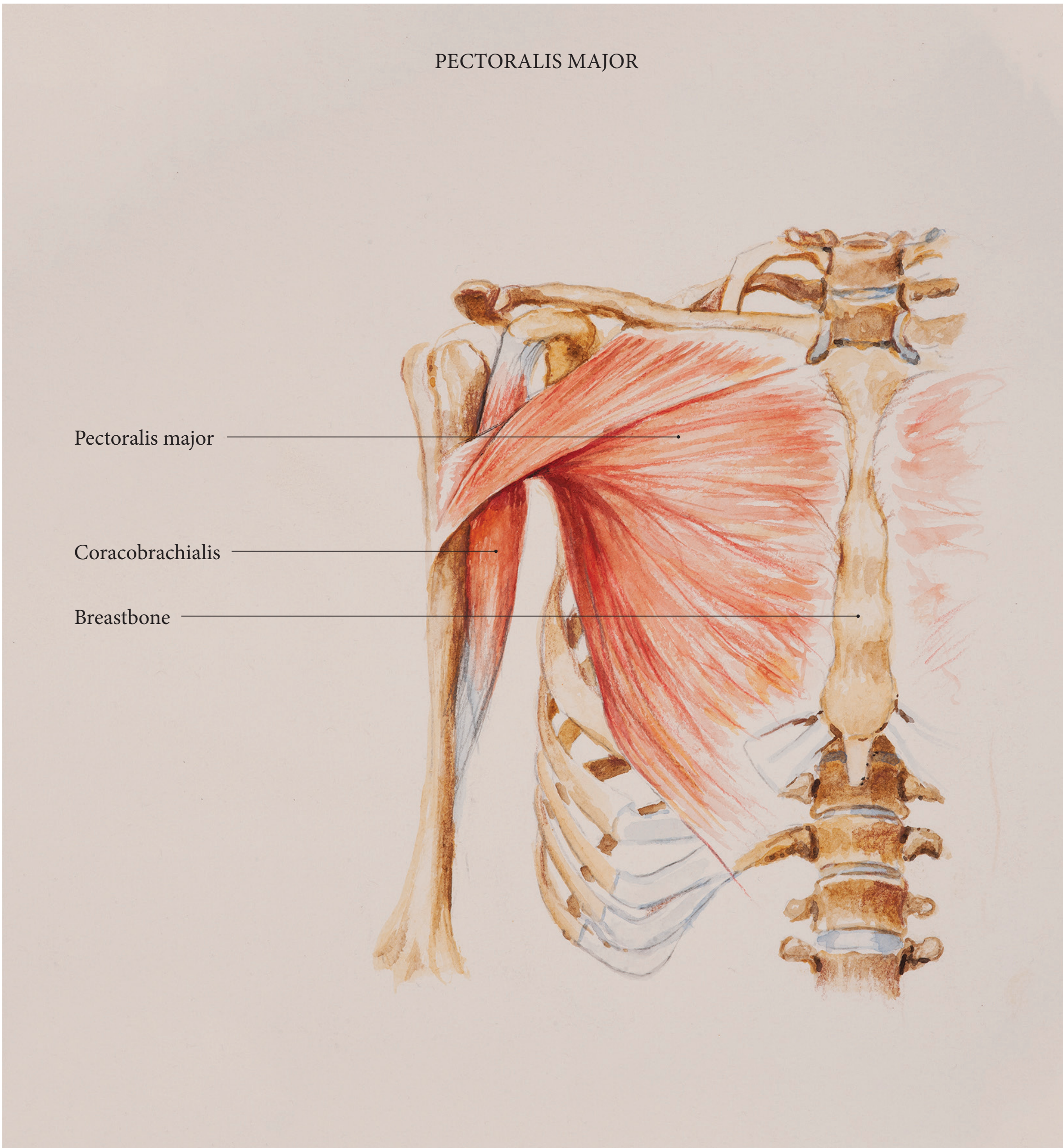


Figure 7-9. *The large chest muscle, pectoralis major, mainly responsible for various arm movements*

Pectoralis major

This is a large fan-shaped muscle situated at the chest. It attaches to the upper arm bone (humerus) at one end and the clavicle, breastbone and ribs at the other end. It's mainly responsible for several arm movements. We'll explore this muscle in more depth in Chapter 12.

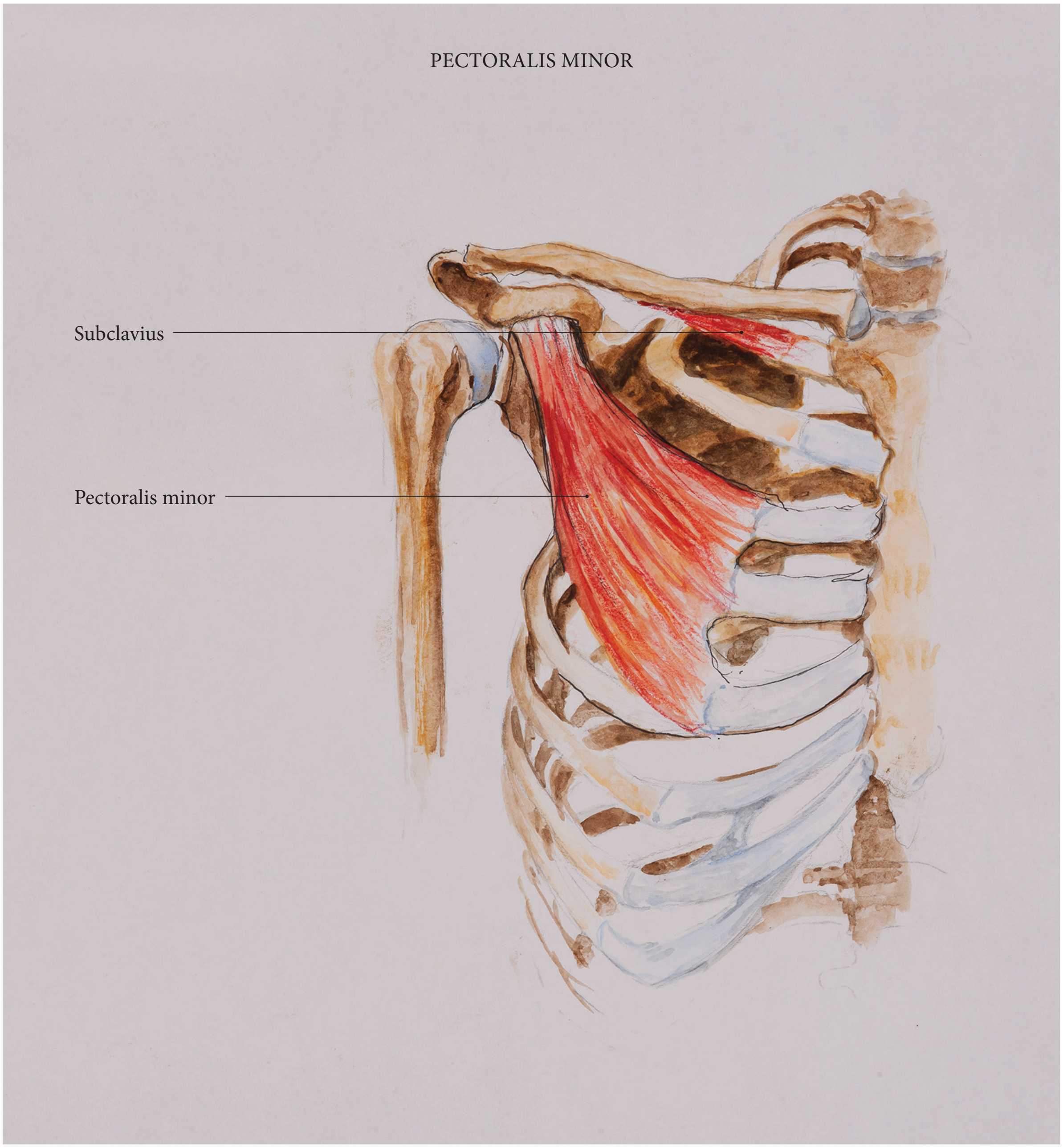


Figure 7-10. *The small chest muscle, pectoralis minor, situated under the pectoralis major, is responsible for shoulder blade movements and assists in inhalation*

Pectoralis minor

This is a small muscle in the chest that attaches to the coracoid process (a protrusion at the top of the shoulder blade) and to the third to fifth rib underneath the pectoralis major muscle. It pulls the shoulder blade forward and down, and it assists in inhalation. If overactivated, it blocks free breathing and can also cause problems in the nerves connected to the hands and fingers. This is why having the shoulders too low isn't necessarily a good thing, as it may mean this muscle is too tense.

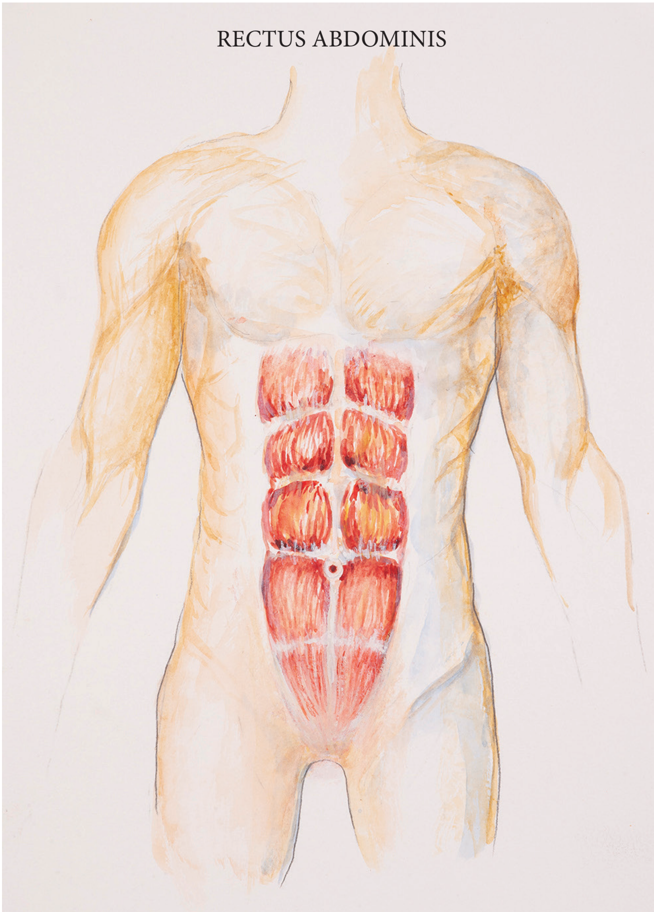


Figure 7-11.
The rectus abdominis muscle, known as the "six-pack". It flexes the spine and contributes during forced exhalation (exhalation against resistance)

Biceps brachii

The biceps attaches across the shoulder joint and the elbow joint. The muscle belly is located in the upper arm and flexes the elbow joint, flexes the shoulder joint, and supinates the lower arm (***Figure** 5-5*).

Rectus abdominis

This muscle forms the front wall of the abdominal cavity. Its upper part attaches to the ribs and the lower part to the pubic bone. Known as the "six-pack," this muscle flexes the spine (like when doing a sit-up) and contributes during forced exhalation. If it becomes overactive, or if the timing between the transverse abdominis and the rectus abdominis is altered, it can contribute to a "reversed breathing" pattern or excess tension in the abdomen. We'll discuss that in Chapters 14 and 15 on breathing and support.

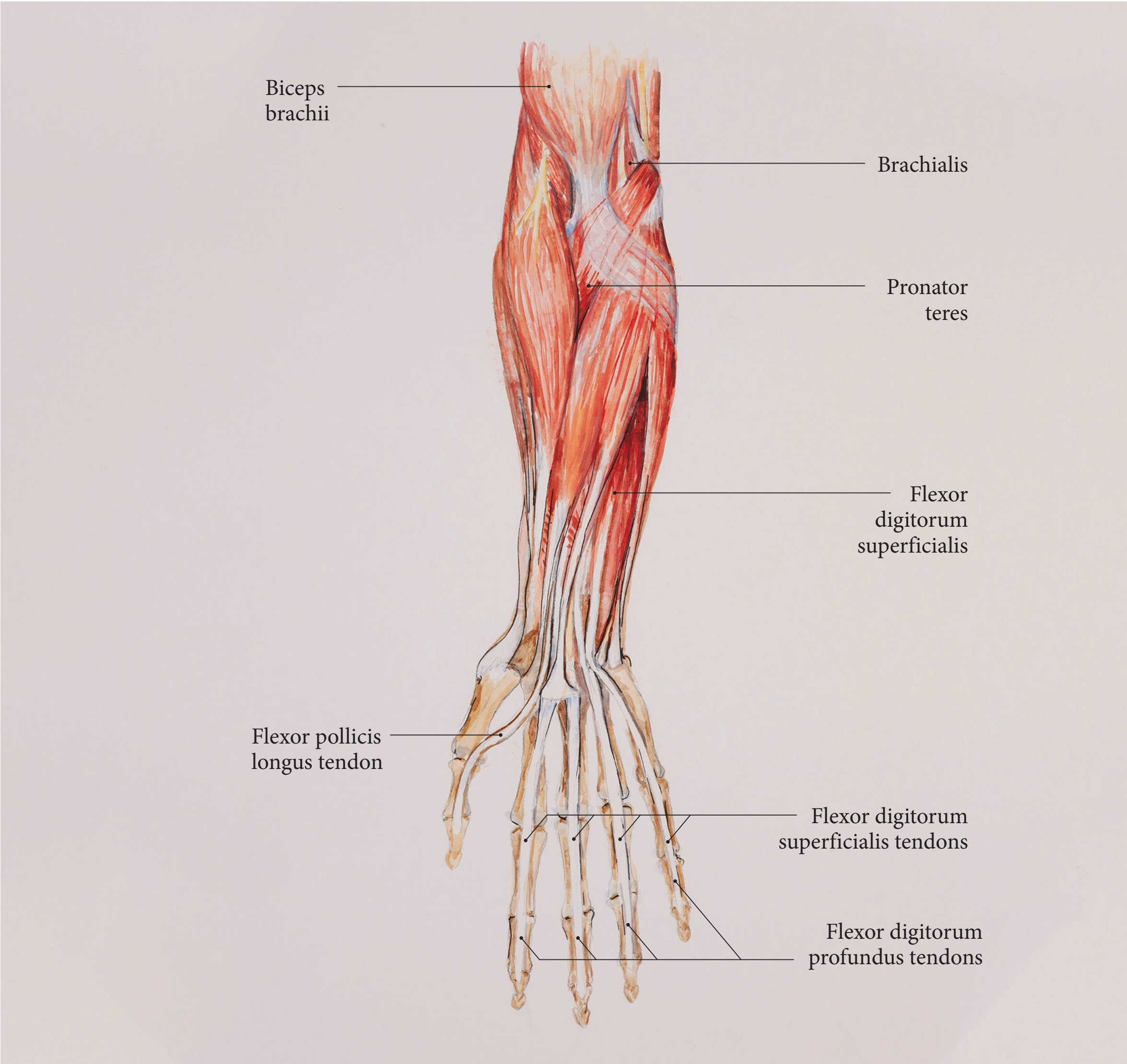


Figure 7-12. *Muscles in the forearm (right hand, palmar view)*

Flexor digitorum superficialis

The flexor digitorum superficialis is an extrinsic muscle of the fingers. This means that it has one side of the attachments in the hand and the other in the lower arm and elbow. It attaches to the middle bones of the fingers 2 to 5 at one end (not the thumb) and across the elbow and at the lower arm in the other. This muscle flexes the middle joints (PIP) of the fingers to allow us to have a strong grip. This muscle can create too much tension if it's not balanced by the action of other muscles in the hand or the extrinsic muscle responsible for flexing the outermost (DIP) joints (flexor digitorum profundus). Often overused by musicians, the flexor digitorum superficialis can be the source of playing-related tendinitis/tendinopathy in the lower arm and elbow joint.

Levator scapula and the rhomboids

The levator scapula attaches to the upper corner of the scapula at one end and to the first to fourth vertebrae of the neck at the other end. Its connection to the neck demonstrates the close relationship between neck posture and the influence this can have on the shoulders. The rhomboid attaches to the medial border of the scapula at one end and to the first to fifth thoracic vertebrae at the other. Both of these muscles elevate the shoulders and draw the shoulder blades together, as well as creating a downward rotation of the scapula by turning the lowest corner of the scapula in toward the spine (see arrow).

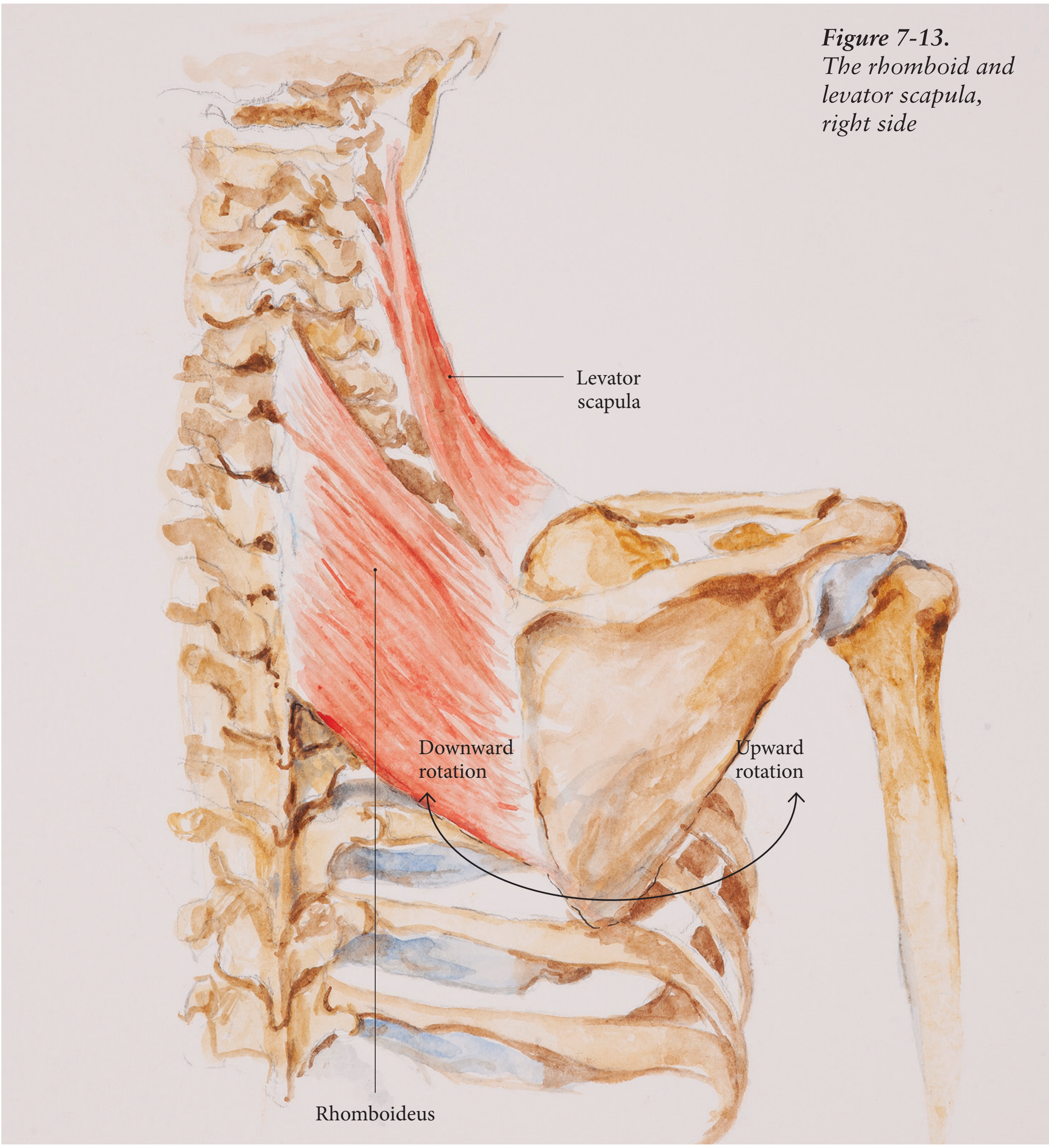


Figure 7-13. *The rhomboid and levator scapula, right side*

Proprioception

Can you close your eyes and play your instrument without visual feedback? Hopefully, you'll notice that you're able to perceive where your limbs and fingers are without constantly looking at them. Proprioception means that the various parts of our body are constantly talking to our brain to let it know where they are and what they're doing. Our brain gets proprioceptive information from different types of receptors throughout our movement apparatus. The parts of the brain receiving proprioceptive input are continuously aware of whether we're contracting muscles, if there's a pull on the tendons, and the position of your joints. In fact, our proprioceptive receptors (that receive the signals in the brain) are more accurate when we are moving than when we are still, which can explain why some musicians like to run their fingers over keys of the instrument or why some wind players prepare their lips and tongue right before actually starting to play. This helps keep the proprioceptive system maximally calibrated so their starting movement can be as precise as possible. One type of receptor is the muscle spindles. These detect whether a muscle is in a lengthened or shortened position and report that information to the brain *(Figure 8-1)*.

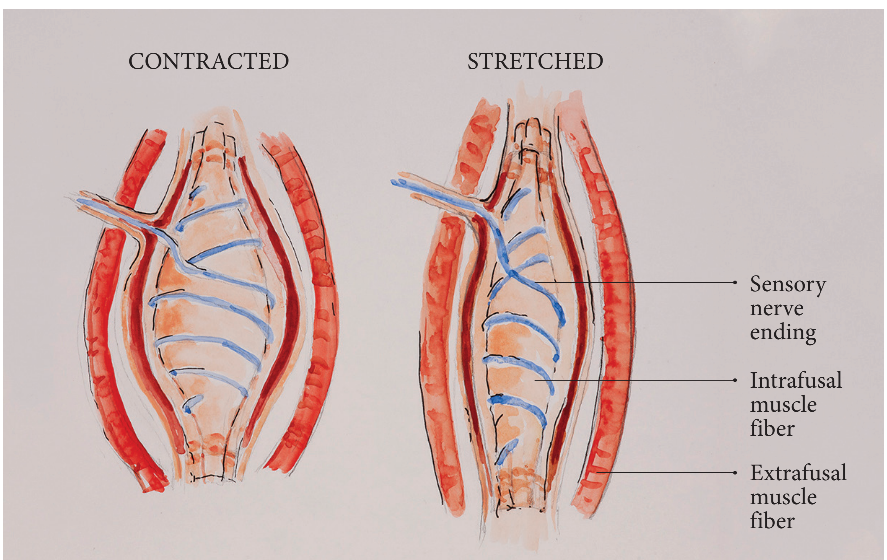


Figure 8-1. *A muscle spindle, which detects if the muscle is contracted or stretched by sensing the amount of stretch in the muscle through the sensory nerve endings*

Other kinds of receptors respond to pressure, some to quick movement, and others to sustained movement. It's been found that fascia can have up to ten times as many sensory nerve receptors as muscles,[40] and many of these are proprioceptive receptors. Proprioceptive signals from the body are received by the somatosensory cortex. This is a part of the brain with a clear map of each individual body part. It's located right next to the motor cortex, which also has its own map of each individual body part, as you can see in ***Figure 8-2***. Our somatosensory cortex provides feedback to the motor cortex on the location of our shoulders, whether our head is aligned, if we're hitting the right key, or whether the note we're playing on the violin is likely to be in tune. This way, the motor cortex can organize our next movement. As you might imagine, this is one of the most useful and important parts of the nervous system for musicians to train, as it's directly related to the ability to move accurately.

Proprioception is often explained in a simplified way as the body's GPS. A finely tuned GPS will tell you where you are, as well as when and where to steer your car in different directions. However, if the GPS hasn't been updated with current road conditions, it might direct you down a road that's closed. In these situations, it's better to use our eyes and knowledge to *not* go where the GPS tells us to. The same goes for the body. We need to make sure that there is a correlation between what we are actually doing and what we think we are doing.

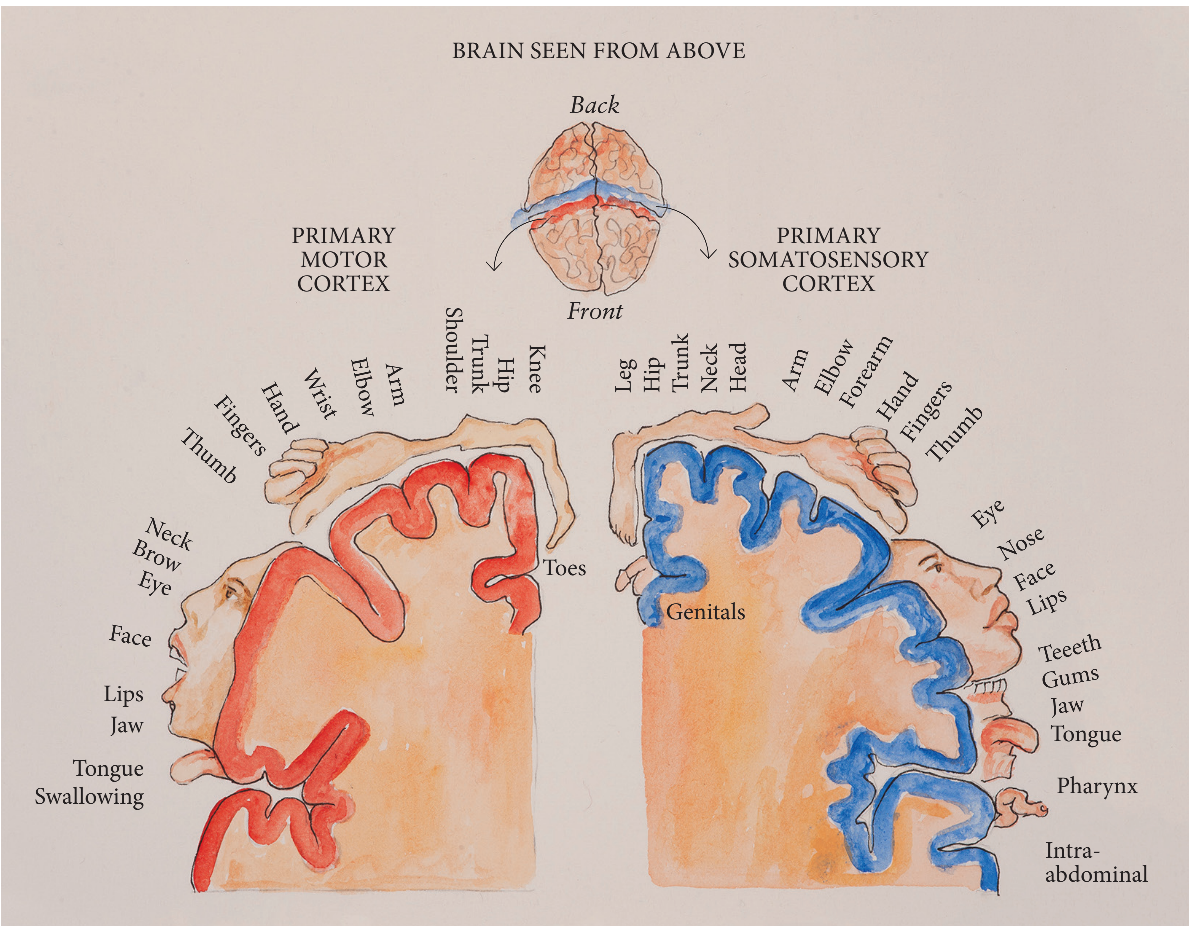
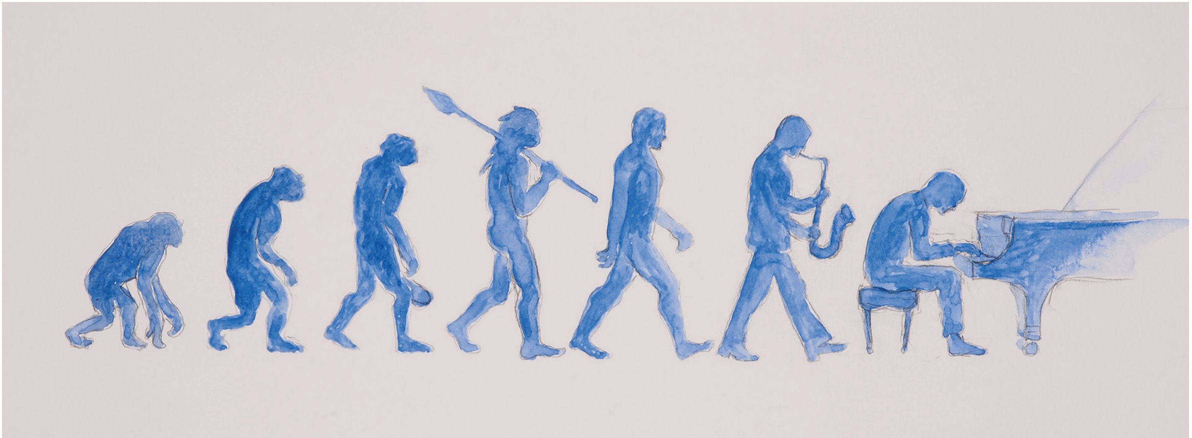


Figure 8-2.
The primary motor cortex (in red), showing the representation of the body parts and where the organization of their movement tasks is coordinated in the brain, and the primary somatosensory cortex (in blue), showing where the sensory input reaches the brain



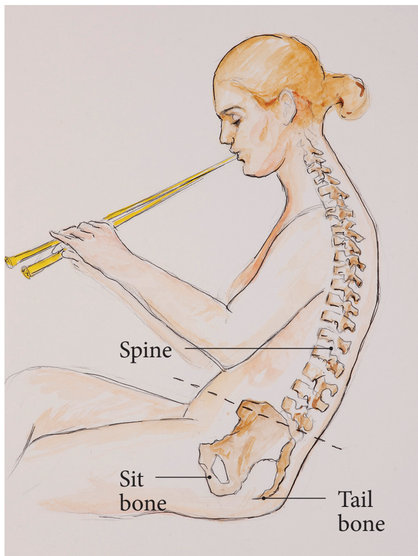
Posture and alignment

It might seem too simple, and perhaps a bit mundane, to regard sitting exercises as important. In my own journey as a pianist, I remember feeling my sit bones were too far away from my instrument for me to bother with them. My fingers and hands were much more interesting to work on. Besides, there was nothing obviously wrong with my seated position—I wasn't slumping, leaning back, or hunching forward. Imagining how I looked to anyone observing me, I thought I was naturally sitting quite well. It took some time for me to take my sit bones seriously, but now they provide me with some of the best support for my playing. This is not just sitting in a good position. It means actively engaging muscles that are involved in gaining solid sensory feedback about the contact with the chair, and then using this feedback as a foundation for phrasing and breathing; you'll learn this from the exercises in this book. For standing instrumentalists and singers, the equivalent is using your feet and legs in a way that supports your breathing, posture, and musical intention.

Learning proper sitting can have very positive effects, not only for music-making but also for easing pain and discomfort. I recently taught a class of music students who were in an orchestra project that required them to sit and play for a week as part of their educational program. To prepare for this, we went through all the sitting exercises and practiced how to implement them while playing. When they returned after sitting in the orchestra for a week, all the students who'd attended the sitting class said they were able to play pain-free throughout the week. They also said it was the first time in their lives that they hadn't experienced pain or discomfort during a week of orchestra playing. Even if this may seem almost too simple and easy, I have observed it many times.

The important factor for us as musicians isn't just to sit well, but also to know how to access our physical resources to support the musical intention from a place that doesn't compromise

10 Sitting



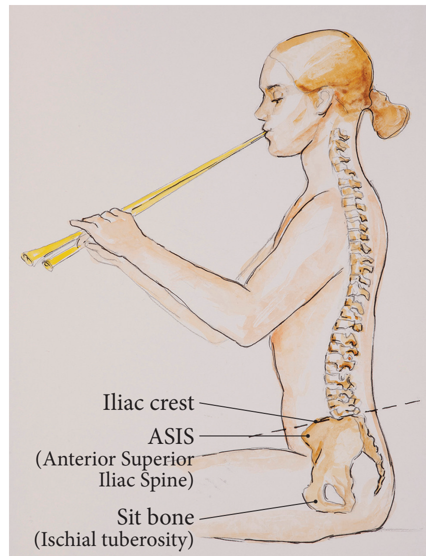


Figure 10-0-1. *Left: Position of the pelvis when slouching*

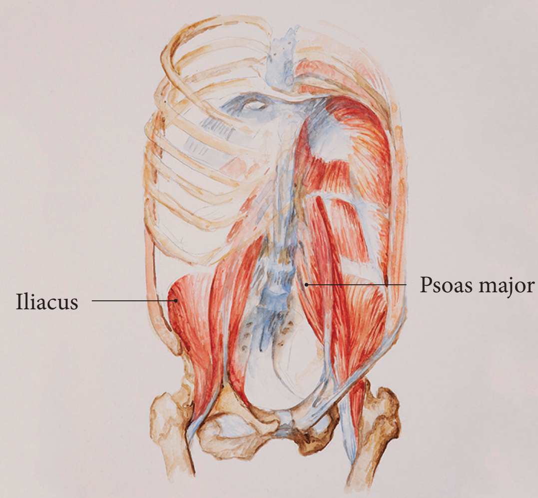
Figure 10-0-2. *Right: Position of the pelvis when sitting balanced*

Gravity pulls us down toward the center of the Earth. That means that if I tilt my pelvis backward and sit slouched (***Figure 10-0-1***), or if I move my head forward or backward or to one side, I need to use different sets of muscles to hold that position, based on the position of my body parts relative to the gravitational pull. It also means that the more centered my body parts are, the less muscular effort I need to maintain the position (***Figure 10-0-2***). For example, say you want to lift a chair. It will be much easier to lift it if you keep the chair close to your body and your center of gravity, as opposed to stretching out your arms and holding it farther away (you can try it and see how it feels). The same goes for the weight of your head. If your head is leaning forward from the neck, then your neck and shoulder muscles have to exert more effort to hold your head up than when your head is more balanced on top of your spine (***Figure 10-0-2***).

2. The iliacus exercise—an easier way to access pelvic alignment

The iliacus muscle lies deep in the body. It covers the inside of the hip bones like a fan (***Figure 10-2-1***) and is one of the body's main hip flexors. In our modern society, we spend a lot of time sitting. That means our hips are in a flexed position for many hours every day. Despite this, we often struggle to properly flex the hip joint, and, in my experience, many people become increasingly slumped as they age, partly because of this. When we lack control of our hip flexion, this movement can be quite uncomfortable and cause strain if we try to sit in a good position while playing or singing. Musicians often get tired in the middle of their backs, trying to hold themselves upright. When we slouch, our hip is less flexed than when we sit upright, and we lose the benefits of accessing the full function of both our pelvic position and the muscles involved in creating it.

Figure 10-2-1.

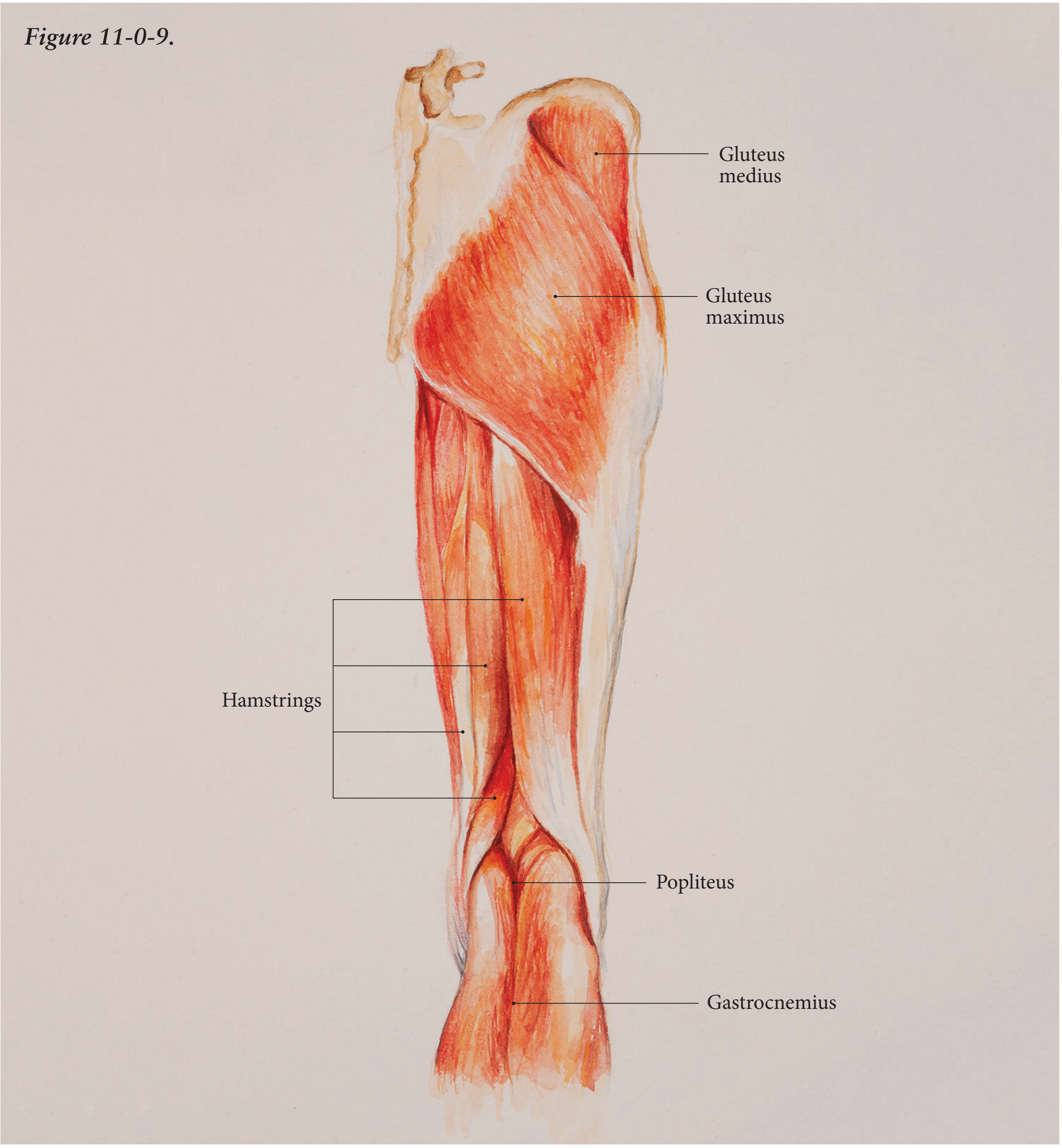


The purpose of the iliacus exercise is to develop our hip flexion so it feels more natural to choose a better sitting position without strain. This requires good function and strength in the iliacus muscle; it needs to be able to provide support and good proprioceptive input from the hip joint, combined with allowing the body to release unnecessary tension in the joint at the same time.

This exercise can also improve our standing posture, since we, as musicians, often have our hips too far forward when we stand, which results in passive lengthening of the hip flexors (including the iliacus). This changes how gravitational forces affect the body. You'll see more on hip alignment in the standing like a mountain exercise in Chapter 11 on standing.

If this exercise is too difficult because of the angle of the hip joint, you can widen the angle by sitting on a higher chair, or put a stack of books on your chair. As you progress, you can eventually sit at the height where you normally play. I recommend keeping the angle in the hip joint no less than 90 degrees when playing your instrument. This means keeping the knees at the height of your hip joint or lower so the blood flow and nerve signals to the legs and feet aren't restricted as you play or sing.

Figure 11-0-9.



2. Function

Position can be important for accessing the primary functions of our muscles, but function is ultimately more important than position! As an opera singer, for example, you need to access your breathing and support in many different positions, depending on what you need to do on stage. However, it's beneficial to practice as much as possible in good alignment so your muscles get used to activating in certain patterns. When you find the balanced position, your muscles will be able to activate and communicate in healthy movement patterns, creating a foundation from which to move. It might seem picky to focus this deeply on the function of

Serratus anterior

The serratus anterior muscle attaches to the shoulder blade at one end and the first to ninth ribs at the other end (***Figure 12-0-1***). This means that the serratus anterior moves the shoulder blade into different positions, and also affects the breathing by participating in expanding the chest. It doesn't attach to the upper arm bone, which means it doesn't have anything to do with the movements of the arm itself, even if we can use the arm in an indirect way to activate the serratus anterior muscle.

Figure 12-0-1. *Serratus anterior*

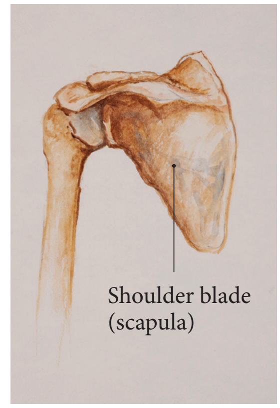
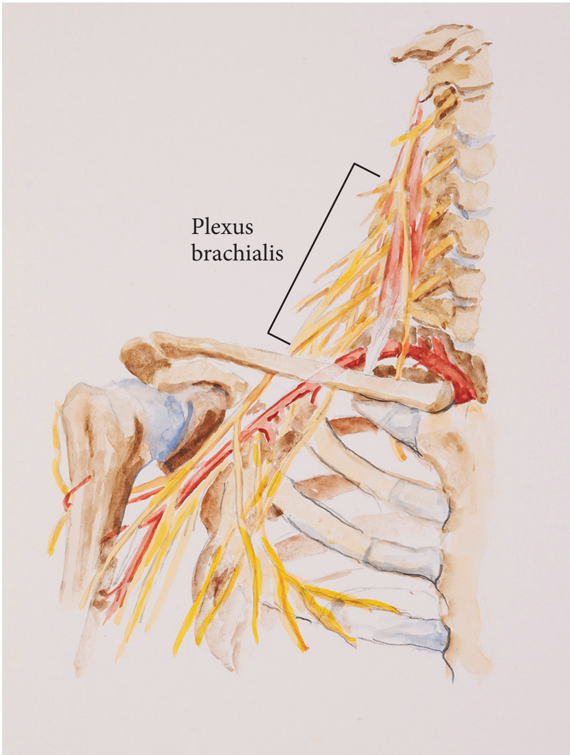


Figure 12-0-2.

The serratus anterior is an important muscle for freeing the shoulder joint. Because this muscle only connects to the shoulder blade and the ribcage, it won't restrict your arm movement as long as it's not fixated. In fact, the serratus anterior is important for facilitating arm movement. To explore this, just raise your arm above your head. Use your opposite hand to grab the upper-outer part of your shoulder blade, which is called the acromion (***Figure 12-0-2***). You'll discover your shoulder blade has now moved into what is called an upwardly rotated position; here, the acromion moves up so it doesn't interfere with the movement of your arm. To see how the position of the shoulder blade can interfere with arm movements, experiment with this: Relax your arm alongside your body, and then raise your arm above your head, but this time, deliberately keep your shoulder down so the acromion doesn't move upward. Can you feel how this restricts your arm movement? That's because you're not allowing the serratus anterior to do its job—moving the shoulder blade with the arm movement.

Figure 12-0-3. *Top*
Figure 12-0-4. *Bottom*

In other words, when you want to relax the shoulders, you must relax the muscles that create a sense of tension and restriction. The serratus anterior normally isn't one of those muscles. It shouldn't be too relaxed while playing or singing, as that can lead to tension and compensations in other muscles that may restrict breathing, arm movement, or cause discomfort and pain. It's possible for your shoulder to be too low (***Figure 12-0-3*** shoulders aligned, ***Figure 12-0-4*** shoulders too low); this can come from a weak serratus anterior muscle (combined with tension in the pectoralis minor—



see below) and might even put pressure on the nerves that extend from the neck to the arm, hands, and fingers (***Figure 12-0-5***), causing symptoms in these places.

The serratus anterior is one of the primary muscles keeping our shoulder blade in a healthy position, and it prevents us from both pushing our shoulder down due to excessive tension or raising our shoulder too high when looking for support. So, maintaining a healthy and strong serratus anterior muscle not only helps breathing, but can also relieve symptoms in the shoulders and upper limbs.

Figure 12-0-5.
Nerves extending from the neck to the arm, hands and fingers

Pectoralis major and minor

The large chest muscle, the pectoralis major, commonly called pec major or pecs, attaches to a large expanse of the front of the chest like an open fan on one end and has its opposite attachment point on the upper arm (***Figure 12-0-6***). Different parts of this muscle have different functions, depending on the direction of the muscle fibers. The upper part is engaged when we lift objects, such as the instrument in front of us (bending at the shoulder joint). The middle part engages if we press our palms together in front of the body. The lower part is engaged in climbing actions that involve the arms or when pushing our arms down. The pectoralis major is eager to engage when we're playing loud chords on the piano, for example. It doesn't, however, produce the best sound in the instrument; therefore, we should try to engage it only when absolutely necessary and, instead, learn to relax it more using some of the following exercises. If it engages too much, it's likely that the brain is looking for a source of more power or stability, but this is better found in other muscles. This muscle might create unwanted tension in our shoulders. Too much tension in the pectoralis major negatively affects our breathing, the sound, and our sense of weight in the arms. The pectoralis major often engages when we're not using enough of the serratus anterior or if we're leaning back from the hips when sitting or standing.

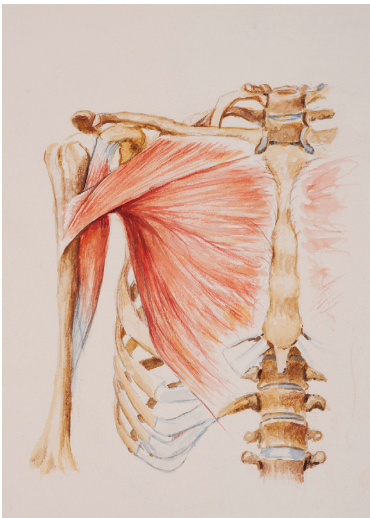


Figure 12-0-6.
Pectoralis major

Figure 12-0-7.
Pectoralis minor

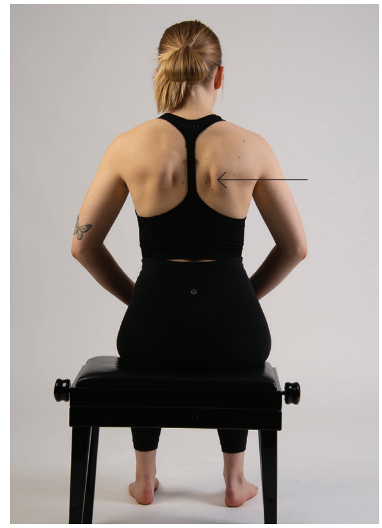


Figure 12-0-8.
Lower corner of the shoulder blade sticking out

Another common compensation is to pull the shoulder into a forward tilt (rounding the shoulders forward) or down, in an attempt to have more stability in this area. The small chest muscle, or pectoralis minor (***Figure** 12-0-7*), is mainly responsible for these movements. Together with other factors, this can cause the lower corner of the shoulder blade to stick out from the chest wall (***Figure** 12-0-8*), which puts it in a position that may affect our movements. It's also important to not be too tense in this muscle, as the nerves that extend from the neck to the arm, hands, and fingers (***Figure 12-0-5***) lie right underneath this muscle. We can relieve that tension by occasionally giving the muscle a nice stretch and by activating the serratus anterior and differentiating it from the chest muscles; this can also be beneficial for freer breathing and gaining more freedom of movement in the shoulder joint. We'll address this in some of the upcoming exercises.

1. The bottle exercise

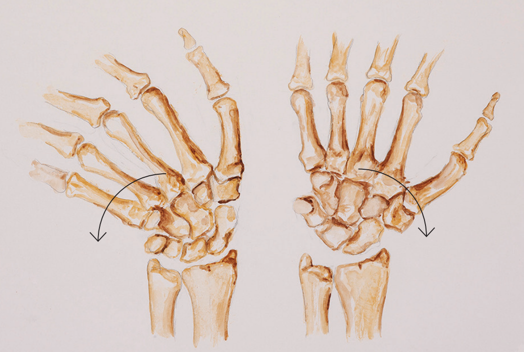
This exercise is an excellent way to gain a better sense of weight and relaxation in the arm. Musicians sometimes hold tension in the shoulders and arms unconsciously and, therefore, can't consciously let it go. Through this exercise, your body can become more accustomed to letting this tension go, and you can start accessing the full weight of your arm on a regular basis. This will be beneficial in playing your instrument by creating a greater sense of relaxation and weight in your shoulders and arms, without losing the strength in your fingers.

By having you focus on holding the bottle firmly while moving your wrist, this exercise is great for differentiating between activating the hand and finger muscles and, at the same time, having a flexible wrist. Use a bottle that's small enough for you to get a good grip on it.

6.

Have your friend test your elbow by moving the bottle so that your elbow flexes and extends. Then they can test your wrist by creating a sideways movement (***Figure 12-1-4***)—not up and down, as this can be uncomfortable—while you keep a firm grip on the bottle.

Figure 12-1-4.



7.

See if you can stay relaxed all the way through this exercise without losing your grip.

8.

After one or two minutes (or more if you prefer), let go of the bottle, stand up, and sense the difference between your arms. Then do this exercise with the other arm.

9.

After doing both arms, play your instrument and enjoy the relaxed feeling.

Advanced

If you have wrist tension or pain in your lower arm, releasing the wrist can be extra important. Do the exercise, and see if your wrist is able to move freely even when your palm is glued to the bottle with a firm grip. You can have your friend focus on this specifically.

2. Differentiated arm-pulls

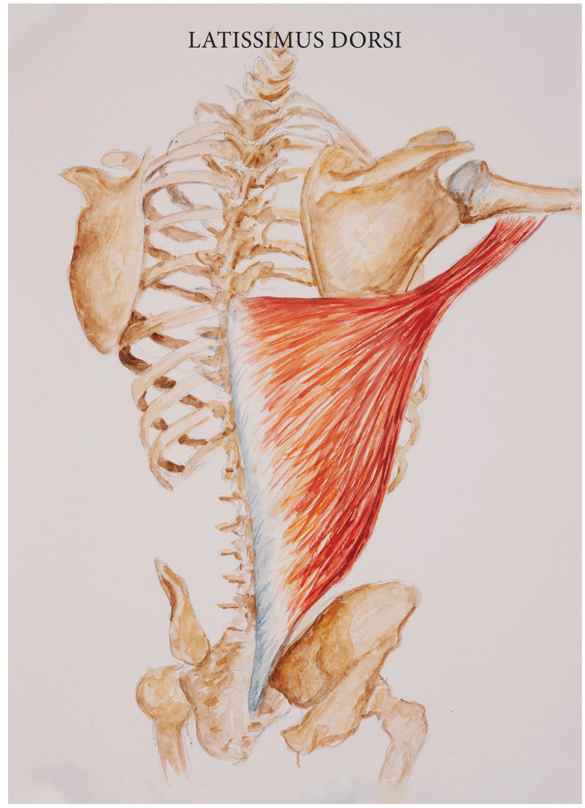


Figure 12-2-1.

The first part of this exercise gives you the possibility to connect to the latissimus dorsi muscle, also sometimes referred to as the lats (***Figure 12-2-1***). One end of this muscle attaches to the upper arm at the shoulder, and the other end attaches to the spine and pelvis through a fascial connection (the white/grey area in the lower back, as shown in the picture). This muscle isn't easy to feel, but you can sense it contracting at the back of your armpit when you pull your arm downward against resistance. The function of this muscle is primarily to pull the arm down—like we do when playing chords at the piano, regulating the pressure of the bow when playing a string instrument, or playing the drums. This muscle does some of the same tasks as the lower part of the pectoralis major muscle in the chest. However, in my experience, we make a better sound when the latissimus dorsi muscle dominates the action and the chest muscle (pec major) is more relaxed. When the chest muscle is overly active in our playing, the sound tends to become less open. We can also consciously use the lats if we feel we need more power in our playing.

As you can see from the illustration, this muscle takes up a large area of the back, which is why some people talk about "playing from the back." In this exercise, you'll explore how to become aware of this muscle, sense that you're using it, how to strengthen it, differentiate it from the pecs, and, ultimately, see what it does to your playing or singing.

This is one of the very few exercises in which I recommend using equipment: an elastic exercise band. If you don't have one handy, you can use a stretchable scarf or some other object/piece of clothing that has elasticity and some length to it. If the band/scarf/object isn't long enough to hang down on both sides of the door, tie a knot at the end you put over the door so the band is held in place by the closed door. If you don't have anything like that available, follow the instructions while pressing your hand against the surface of a table, and sense the activation at the back of the armpit.

7. Four elbow movements

Four movements of the elbow that are very useful to refine are flexion, extension, pronation, and supination. We'll look at flexion and extension first, and pronation and supination afterward.

Flexion and extension

The elbow can flex and extend, as we saw in the illustration showing muscle contraction in Chapter 5, ***Figure 5-5***. If we extend this joint while working against some type of resistance (such as an object or as you did in the differentiated arm-pull and back arm-line push-off exercises), we activate our triceps muscle. Flexing our elbow against resistance (gravity or an object) activates our biceps muscle. Now, we'll explore some of the smaller muscles, because they often contribute to a more refined awareness. These are the brachialis and anconeus muscles.

Brachialis

The brachialis is a muscle in the upper arm that lies deeper than (underneath) the biceps muscle, which is the large muscle at the front of our upper arm (***Figure 12-7-1***). The biceps and brachialis both participate in flexion of the elbow joint (along with several other muscles). The biceps is also responsible for supination (rotation in the forearm that brings the palm to face up when holding the lower arm out in front) and flexion in the shoulder joint (lifting the upper arm forward). Sometimes it's overly eager to help with playing our instrument. This can cause unwanted tension in the short term, and problems in the long run when it comes to finely controlling arm movement. On most instruments and for conductors, tension in the biceps can make our arm feel stiff and uncomfortable—as if we don't have enough weight behind the forearm, finger, or bow. We may sense that this tension sabotages our efforts to relax and feel weight. This is where the brachialis muscle comes in. The brachialis muscle lies deeper than the biceps muscle. Its only function is flexion of the elbow joint and, therefore, it doesn't engage the shoulder joint, resulting in a heavier, more relaxed arm. It provides more differentiated elbow movement, enabling us to have a more "clean" and clear flexion movement in the elbow joint when, for example, playing the drums, bowing, holding a wind instrument, or playing jumps on the piano. Becoming conscious of a more relaxed way of flexing our elbow is therefore very important, and it requires heightened awareness.

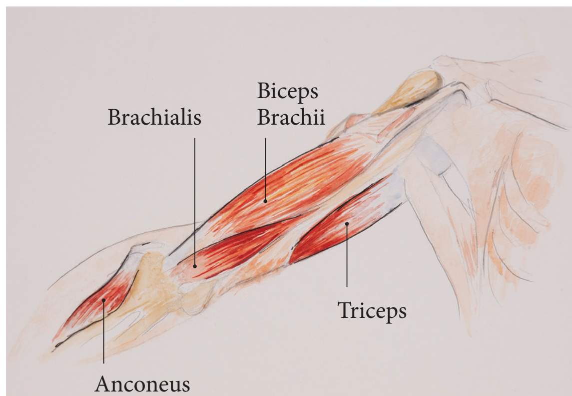


Figure 12-7-1.

Figure 12-7-6.

Figure 12-7-7.

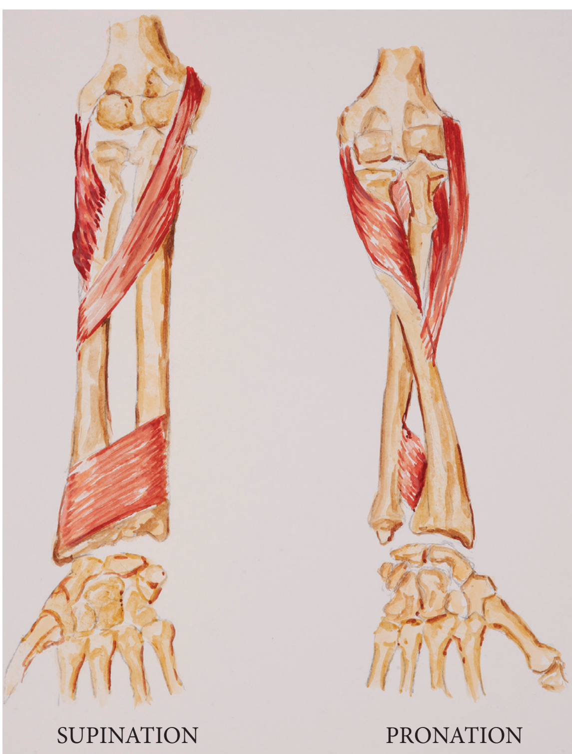


Figure 12-7-8.

Pronation and supination differentiation

Pronation and supination refer to the twisting/rotational movement of the forearm, like placing our hands to play the piano (pronation, ***Figure** 12-7-6*) or rotating our left forearm to play the violin (supination, ***Figure** 12-7-7*). This rotational movement happens in a small pivot joint in the elbow joint, and is created by the rotation of the two forearm bones, the radius and ulna (***Figure** 12-7-8*). This isn't a movement of the wrist, even if it might seem like it. Some instruments require pronation, others supination, and some require both. For example, the bow arm for a violin or viola player is pronated, while the left forearm is supinated. Some techniques for drummers require more pronation, while others require the arms to be in a supinated position. A pianist needs to work primarily on pronation because both forearms are pronated. Having a clear picture of this forearm/elbow movement from an anatomical view—the bones in the forearm cross over each other (pronation) and uncross (supination)—can create a difference in the sensation of playing and relieve unnecessary tension. The pivot joint between the radius and ulna of the forearm enables the radius to cross over the ulna into pronation.

Supination

The supinator muscle contracts and shortens to move the forearm into supination, assisted by the biceps muscle (which is the strongest supinator in the body). Imagining the activity of the deep supinator might release some unwanted tension in the biceps muscle and therefore make the arm feel freer.

Connecting to the theory

Differentiation and the chocolate-covered caramel layers

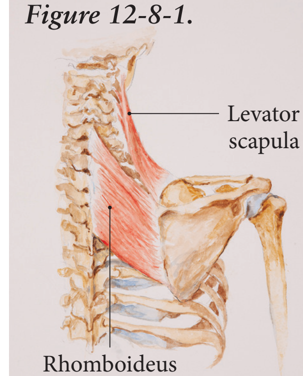
In some of the exercises (especially the shoulder exercise and the bird's dance exercise), you're learning to differentiate between the chest muscle (pectoralis major) and the serratus anterior muscle. The serratus anterior muscle belongs to the "chewy caramel" layer of the chocolate-covered caramel, where endurance is more important (see Chapter 7). The chest muscles you're trying to relax are in the chocolate coating of the caramel, where you want to cultivate the ability to relax to facilitate free movement.

Fascia and tensegrity

The connections throughout the arms (as you experienced in the back arm-line push-off exercise) are a result of chains of muscles (sometimes called lines) that are functionally connected through the fascia system. Sensing how these chain reactions can be felt all the way down to your sit bones demonstrates the transfer of forces and enhances the overall tensegrity you need for playing.

Instrument-specific tips

Figure 12-8-1.



- **Winds**

One of the big themes for winds is excessive tension in the chest muscles (pecs). The chest muscles can seem eager to tense up and join in when holding and playing the instrument. This can lead to breathing restrictions and often causes rounding of or tension in the shoulders. As you now know, the solution isn't simply to push your shoulders back; that only creates more tension in the rhomboid muscles between the shoulder blades (***Figure 12-8-1***) without relieving the tension in the pecs on the front. It's better to learn to differentiate the pecs from other muscles that are better suited to stabilizing the shoulder, such as the serratus anterior.

If the reason for activating your pecs is that you're leaning back from your sit bones or hips, work on improving your posture in addition to doing the shoulder differentiation work. Another common reason for overly tensing the pecs is a lack of activation of other muscles—the ones that should be contributing to support and stability to help you breathe and phrase with control and ease. If your air flow isn't supported by the right muscles, you're more likely to use your pecs for stability. There will be more on this topic in Chapters 14 and 15.

13 Hands, wrists, and fingers

Relative to most other body parts, a large area of our brain is devoted to our fingers. We, as musicians, need to move our fingers, hands, and wrists with tremendous accuracy. These movements are planned in the brain; motor neurons send precisely timed and coordinated commands to the muscles so that they contract at the right time and with the right force and speed. To accomplish this, we also need sensory neurons sending lots of information from the fingers to the sensory cortex so that our brain knows where exactly our fingers, hands, and wrists are and how the intended action is going. There are separate muscles for each finger joint to allow our fingers to move in all their different ways. These muscles are located in the hand and forearm. In fact, there's no muscle tissue in the fingers themselves, only tendons attached to the muscles located in the forearm and hand. The thumb alone is connected to nine muscles—five in the hand and four in the forearm. All these muscles need to be strong, available, and balanced for us to attain maximum movement control at our instrument.

Figure 13-0-1.
Intrinsic muscles of the hand

Intrinsic muscles

Intrinsic muscles (***Figure 13-0-1***) are muscles that are fully contained within a specific body part, organ, or structure. Intrinsic hand muscles are the muscles that don't extend across the wrist joint; both ends of the muscle are attached to points within the hand itself, mainly from the carpal or metacarpal area to the fingers (***Figure 13-0-2***). Making good use of them while playing provides a big advantage when it comes to releasing our wrist, since these muscles can't contribute to wrist tension when we play because they're situated within the hand itself. The muscles of the hand are crucial for playing most instruments; our ability to hit the right notes, play in tune, and do fast and accurate finger movements is dependent

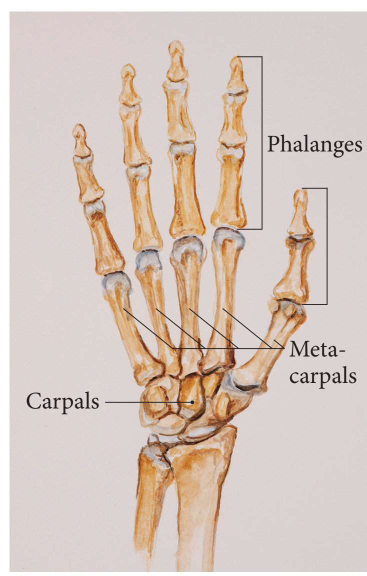


Figure 13-0-2.
Hand skeleton

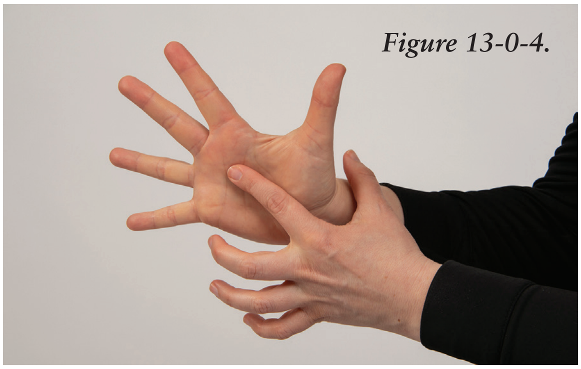


Figure 13-0-4.

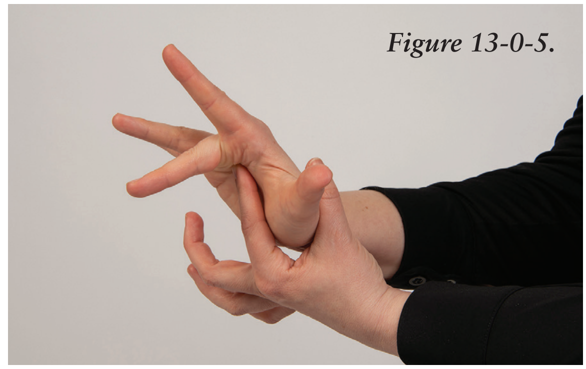


Figure 13-0-5.

to the flexion of the MCP joint and the extension of the PIP and DIP joints, as well as the overall stability and sensory awareness of the hand in general.

→ **Try it:** Using a finger from the opposite hand, feel the palm right below the finger you're about to move. In this case, the middle finger (***Figure 13-0-4***). Extend the PIP and DIP joints while you bend the MCP joint (***Figure 13-0-5***). Can you feel the muscles in your palm activating as you do this?

- **The third and fourth groups are the thenar and hypothenar muscles, respectively, (*Figure 13-0-1*).**

The thenar muscles are located at the base of the thumb and control thumb movement. The hypothenar muscles are found on the outside of the hand, on the palm below the pinky, and are responsible for moving the little finger. You might notice that your hand has a bit more "meat" on the bones of your palm below the thumb and pinky, respectively. That meat represents these muscle groups. Some of the thenar and hypothenar muscles are clearly connected through a fascia structure called the transverse carpal ligament, situated at the base of the palm. This ligament is the "roof" of the carpal tunnel. Because they're connected, the hypothenar and thenar muscles can work together to create tensegrity and stability in the hand. These muscles tend to be a bit weak and often need special attention to develop.

Extrinsic muscles

Extrinsic muscles are those that aren't fully contained within a specific body part, organ, or structure. For the hands, the extrinsic muscles are hand or finger muscles that have long tendons crossing the wrist. The muscle belly itself is in the lower arm (***Figure 13-0-6***).


Figure 13-0-6.
Extrinsic muscles of the wrist and fingers

- **Flexors**

On the palm side of the forearm are the flexors of the DIP and PIP joints, as well as flexors of the wrist.

You might notice that some of the exercises for the spine and core in this section are traditional in terms of the movements themselves. You might have done them in other settings, such as yoga, Pilates, or other exercise classes. They're great exercises for gaining a general sense of this area of your body, and I'll explain what you can gain from them in the context of playing or singing. You might also notice that we'll be addressing these muscles and movements in great detail, as I believe this is where true mastery lies. Using these muscles in a general way might work for some people, but most of us need to know exactly where the targeted muscles are and how to access them specifically.

The muscles of the belly and back are organized in layers. In the front and sides of the belly, there are four major muscles, each of them with different (and some similar) movement, breathing, and stabilizing tasks. Although these muscles are very important for musicians, they're usually grouped together as one thing (i.e., the abdominal muscles) or not talked about much at all. In my opinion, we need to know each of these muscles in more detail, so we can consciously use them for our benefit when playing or singing. Let's look at two of the four main muscles: the transverse abdominis and the rectus abdominis, which I find most essential to know about to start with.

Transverse abdominis

There are some muscles in the body that don't create movement in the joints or limbs but rather have other responsibilities. The transverse abdominis is one such muscle. It supports the spine in a healthy way by creating intra-abdominal pressure (see ***Figure 14-0-1*** for the transverse abdominis and ***Figure 14-0-2*** for a cross-section of the abdominal wall). With the help of a few others, this muscle participates in supporting healthy movement and breathing. The transverse abdominis forms the deepest layer of the abdominal wall (***Figure 14-0-2***). The

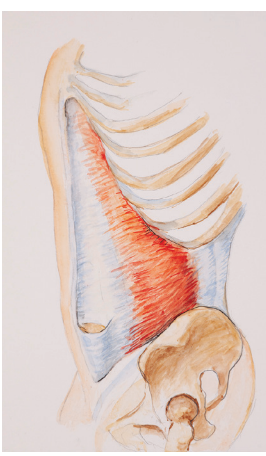


Figure 14-0-1.
Transverse abdominis

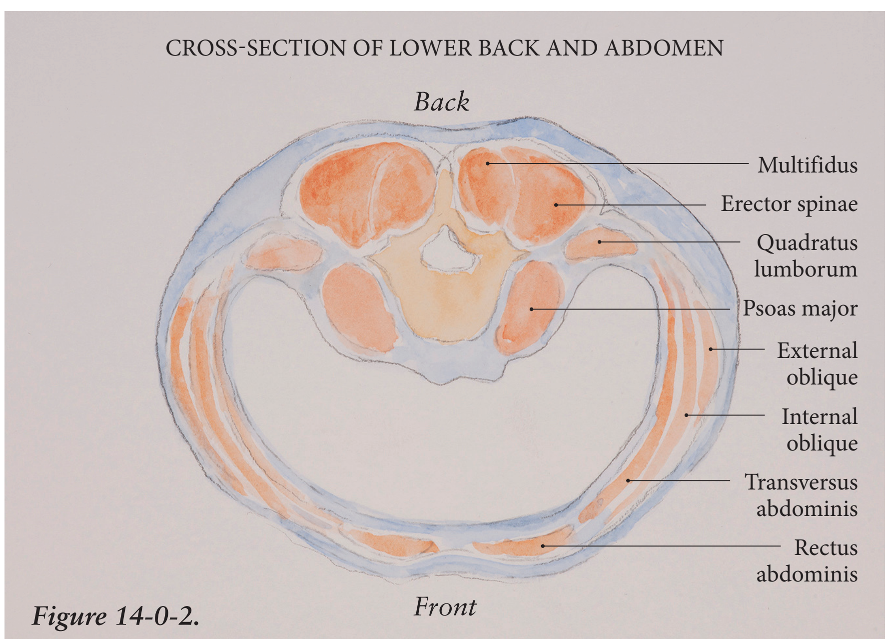


Figure 14-0-2.

bowing, lifting, or holding the weight of the instrument in one hand. These muscles will be addressed in some of the following exercises.

The rectus abdominis

The rectus abdominis (also known as the six-pack) is probably the best-known muscle in the abdomen; its shape is unique and easily recognizable because of its rippled appearance. Even if we're familiar with seeing pictures of a clearly visible six-pack, it's normal not to be able to see the contours on our own body because of a natural layer of fat lying over it. This single muscle almost appears to be several different muscles, but it mainly acts as a unit. There are, however, some exceptions: the lowest portion of the muscle is more engaged in creating stability together with a small additional muscle called the pyramidalis (which is present in most of the population), while the upper part (which partly overlays some of the ribs), has more of a mobilizer role and can restrict our breathing if it's too tense. The rectus abdominis is the main muscle we use when doing crunches. If you imagine how it contracts when you do a crunch, you can visualize how it flexes the spine to bring the ribs closer to the pubic bone (***Figure 14-0-3***).

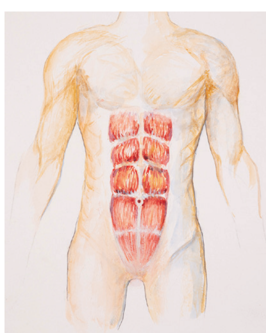


Figure 14-0-3. *Rectus abdominis*

→ **Find it:** Sit on a chair with your back straight. Press your fingers into your abdomen just above and below your belly button and lean backward from your hips, keeping your back straight. Can you feel the front of your belly tensing up under your fingertips? That's your rectus abdominis contracting to prevent you from falling backward. Although this muscle isn't directly moving any part of your skeleton in this experiment, it's contracting isometrically (see explanation in Chapter 5). As you lean back and take a deep breath in, can you sense that too much activation of this muscle might restrict your inhalation? This is why you want to aim to sit straight (or even lean slightly forward) when playing, rather than leaning back; leaning back will negatively affect your breathing.

The rectus abdominis muscle is in the chocolate coating layer of the chocolate-covered caramel. This means that it's more of a mobilizer than a stabilizer. It's more efficient to use the transverse abdominis muscle when it comes to general stability while playing or assisting in exhalation. Even though the rectus abdominis often contributes to exhalation and an increase in abdominal pressure when we're playing or singing, it shouldn't initiate or dominate these functions. It will dominate, however, if leaning back from your hips is your default sitting or standing position. This won't be the case, however, if you're leaning on the backrest of the chair, although this may potentially have other consequences, such as having generally too little support from the body for playing effortlessly.

→ **Tip:** It can be useful to observe if your rectus abdominis is dominant while playing or singing. Film yourself or look in a mirror from the side and observe. If you're a singer or play a wind instrument, and the ribs are actively pulling down as you breathe out as if you were doing a small sit-up motion in a standing position, this would be a sign that the rectus abdominis most likely is initiating and dominating your exhalation pattern. This isn't the most effortless way to produce air flow, as it creates excess tension and can lead to pulling you into poor posture.

For other instrumentalists, observe if you're leaning backward as you play (even just slightly) or curving the spine more than necessary in search of musical intention and control. A common symptom of rectus abdominis dominance is additional tension in the chest muscles and on the front of the neck. This tension often pulls the head forward as well.

Although we don't want it to dominate, we still need this muscle to help with support in certain musical tasks, such as breath control while playing wind instruments or singing certain repertoire that requires more force or movement on stage (e.g., in an opera production). In this case, the onset timing and dominance of the different muscles will be the most important factor in determining whether it feels tense or strong and effortless.

Psoas major

Let's go deeper into the core and spine to investigate a muscle that may take some time to get familiar with—simply because we can't see it or feel it with our hands. This muscle has been nicknamed "the muscle of the soul." This may sound quite mystical, but I've been surprised time and again by how much the sound coming out of an instrument or voice can be affected by awareness and appropriate activation of this muscle. It's quite magical, and it's not something I can logically explain. In this case, sayings like, "I feel the music in my gut" or "I play from my gut" are the best descriptions I can give of how it sounds when musicians play or sing with awareness and activation in the psoas major.

→ **Find it:** As I said, you can't reach this muscle directly with your hands—or at least, it's complicated and I don't recommend that you try since it's deep inside your belly. Instead, you need to find it indirectly. Place your hands over your rectus abdominis and visualize that behind this wall of muscle (***Figure 14-0-3***) are your intestines and internal organs; visualize that behind those organs is your spine. On the left and right of your lumbar spine (the part of your spine between the pelvis and ribcage (***Figure 14-0-4***), deep inside your belly, are the psoas major

Figure 14-0-4.

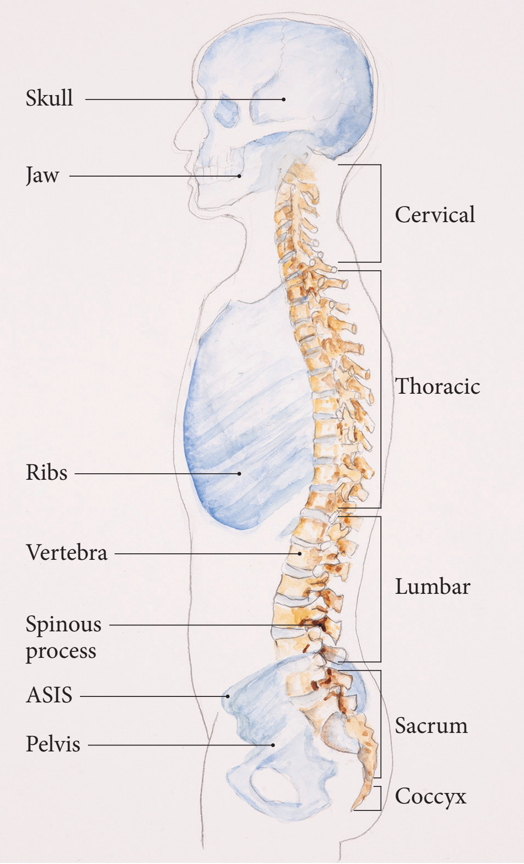
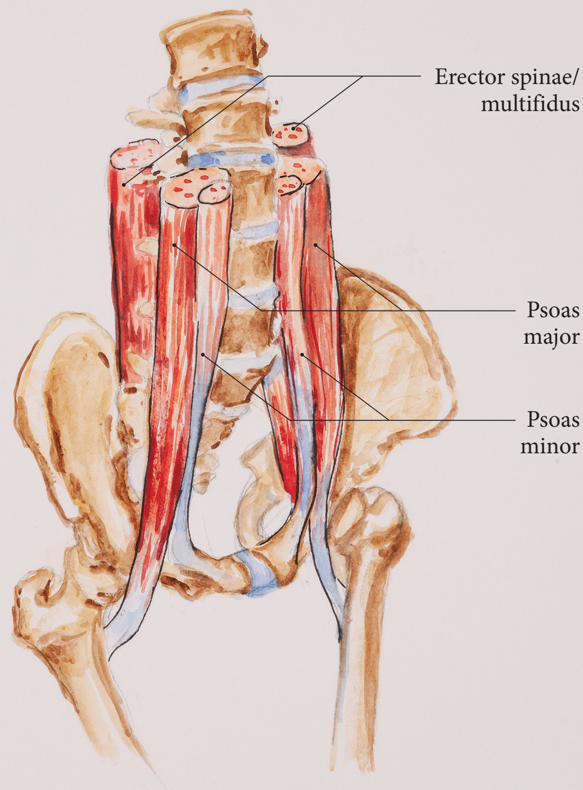


Figure 14-0-5.



muscles (one on each side). These are the "tenderloins" if you're a meat-eater, the most tender meat in the body. The psoas major muscles attach to the vertebrae of the lumbar spine, extend to the pelvis, cross in front of the hip joints, and attach to the inside of the thigh bones (***Figure 14-0-5*** and see ***Figure 10-2-1/Figure 7-4***). The psoas major is the only muscle in the body that attaches to both the spine and the legs. The other muscles in this area primarily extend upward or downward from the pelvis (to the spine, ribs, arms, or legs).

The main job of the psoas major is to stabilize the spine, together with the deep layers of the erector spinae muscle group situated along the spine on the back (***Figure 14-0-2***). These four muscles build supportive structures on each side, close to the spine, that activate dynamically to secure posture and stability for every movement we make. The psoas major also contributes somewhat to flexion of the spine and hip joints. The main hip flexor, however, is the iliacus muscle that you worked with in Chapter 10. It shares the tendon with the psoas major muscle, where they both attach to the thigh bone. That's why these two muscles are sometimes combined in medical texts as the iliopsoas muscle, although they have different main functions.

To create balance in the spine and inner power for musical expression, we need the abdominal muscles and the muscles along the spine to work in synergy; this helps maintain stability and create optimal breath control. This area is vulnerable to instability because this part of the spine consists of only five moveable vertebrae, whereas the rib cage and pelvis have more skeletal structures that provide support in themselves.

In ***Figure 7-4***, you can see how the psoas major is thoroughly connected to the diaphragm through the fascia. The diaphragm is the main muscle used for inhalation, but the psoas major can greatly affect breathing mechanics because this fascinating connection allows it to influence our sense of deep breathing. We'll look more into this in the breathing discussion in Chapter 15.

The diaphragm

The diaphragm is a fascinating muscle that's shaped like a large dome and separates the thoracic cavity from the abdominal cavity (***Figure 15-0-1***). It's the main muscle responsible for inhalation. The movement of the diaphragm is complex and is influenced by many factors, including the orientation of the muscle fibers within the diaphragm itself, push-off from the feet or sit bones, abdominal support, and pressure in the chest and abdomen.[65]

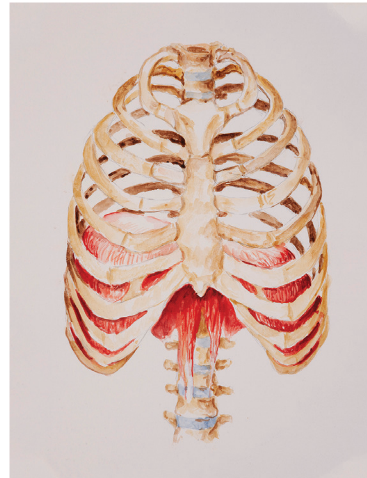


Figure 15-0-1. *Diaphragm*

You can't see your diaphragm or feel it with your hands because it's located inside your ribcage. The left side is slightly lower than the right side to allow space for the heart; the right side is slightly higher to allow space for the liver. The diaphragm is a thin, tendinous structure only about 2 to 4 millimeters (approximately 1/8 inch) thick. The muscle tissue (pictured in red in ***Figure 15-0-1***) makes up the side "walls" of the dome. These attach to the "roof," which consists of a large, flat tendon (the central tendon). The sides of the dome, which consist of muscle tissue, are parallel to the inner walls of the ribcage (called the "zone of apposition"), and they're dependent on good ribcage alignment to function optimally in breathing.

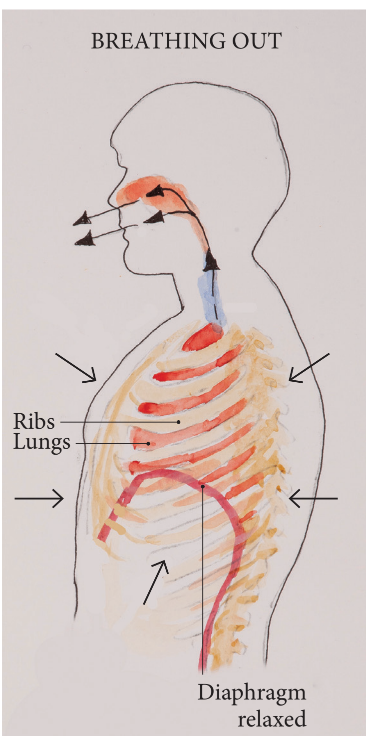


Figure 15-0-2A.

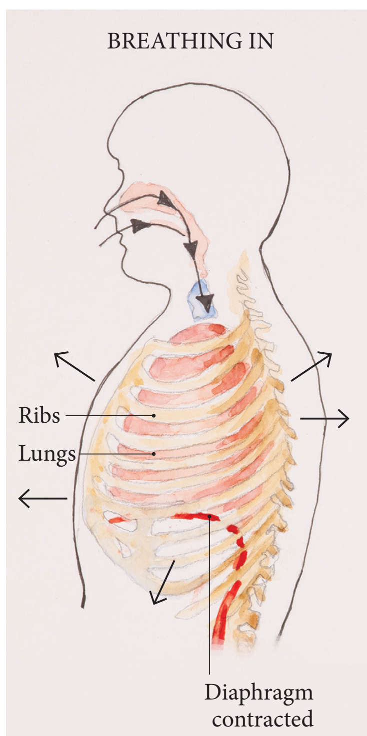


Figure 15-0-2B.

When the muscle fibers of the diaphragm contract, they pull the tendinous roof downward like a piston (which makes the dome shape flatten, ***Figure 15-0-2A + 15-0-2B***). This decreases the pressure in the chest cavity (thus pulling/sucking air into the lungs) and increases the pressure in the abdominal cavity (by pushing against the viscera in the abdomen). The diaphragm doesn't descend below its attachments on the lower edge of the ribcage (the sixth to twelfth ribs) but rather creates a pull on the ribs. This pull, together with the increase of pressure in the

The intercostals

Figure 15-0-3.
The intercostal muscles

The action of our diaphragm alone isn't enough to sufficiently expand our chest cavity to fill our lungs with air. The intercostals (***Figure 15-0-3***) are also primary breathing muscles, which means they primarily are meant to be expanding and shrinking the chest cavity; they create an increase of space in the chest when we breathe in, and a decrease of space in the chest as we breathe out. These are their main tasks. They do this by creating a rotational movement in the joints where the ribs attach to the spine. The intercostals move the ribs relative to each other and the spine. Each rib attaches to the spine through three joints. In addition to the joints between the vertebrae, this adds up to around one hundred joints in the thoracic spine alone, all of which are nurtured by the constant movement of breathing. When we breathe in and the diaphragm contracts, it decreases pressure inside the chest cavity. If the intercostals didn't counteract this movement, the chest would collapse inward, especially in the upper part; that would affect posture by encouraging a head-forward position. Therefore, the intercostals are important in balancing this decrease in pressure and to further expand the chest to allow for a larger inhalation when needed.

Three layers of muscles comprise the intercostals: the internal and external intercostals plus the innermost layer, called the intercostales intimi. In addition, there's the triangularis sterni muscle underneath the breastbone. These muscles are often categorized by their function in breathing. You might find different information about this depending on the source, as it's been discussed throughout medical history. The functions of the muscles are commonly categorized in this way:

- **Inhalation:** External intercostals and the front portion of the internal intercostals.
- **Exhalation:** Internal intercostals (those on the sides and back of the body), the intercostales intimi, and the triangularis sterni.

There are also accessory muscles along the outside of the ribs, as well as in the neck and throat, that contribute to breathing. These include the scalenes, which are sometimes considered to be primary muscles for inhalation, and the sternocleidomastoid muscle, which can be useful for musicians in certain situations, especially when the head and neck are already aligned.

The abdominals, the diaphragm, and the pelvic floor

As you saw in Chapter 14 on the spine, core, and support, the transverse abdominis muscle creates the majority of the innermost layer of the girdle that forms the abdominal wall (between the lower ribs and iliac crest), along with the psoas major and quadratus lumborum muscles in the back (***Figure 15-0-4***). Because of how the transverse abdominis' muscle fibers are aligned, it tightens the girdle and displaces the organs vertically in the same way that encircling a round balloon with your hands and squeezing it will change its shape from round to cylindrical. The action of the transverse abdominis pushes the abdominal organs upward toward the diaphragm, helping it to rise and thereby contributing to exhalation. As the muscle fibers in the diaphragm relax, it regains its dome shape. In controlled air flow, there's an interplay among these forces in the abdominal and chest cavities.

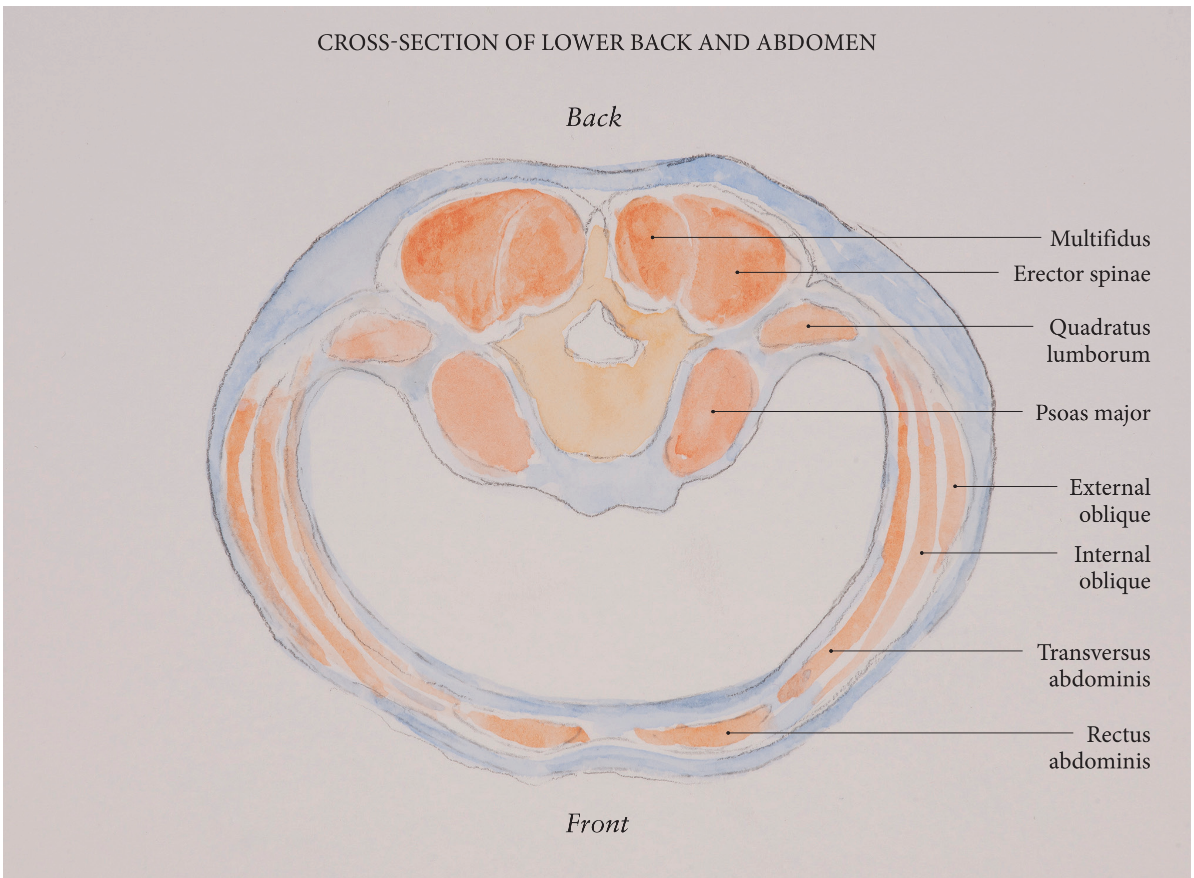


Figure 15-0-4.

In controlled exhalation, the intra-abdominal pressure (from the contraction of the transverse abdominis) also creates a downward push on the pelvic floor (the "floor" of the pelvic cavity below the abdominal cavity). If this pressure becomes excessive, it can affect bladder control and bowel movement. Therefore, we need the diaphragm to be flexible and encourage the natural function of the pelvic floor to lift during exhalation. The upward lift that happens from the contraction of the pelvic floor and transverse abdominis should be stronger than any potential downward push from the diaphragm (***Figure 15-0-5***). If the downward push from the diaphragm dominates, it either causes the belly to bulge and push out or creates too much intra-abdominal pressure in general that prevents an optimal air flow (***Figure 15-0-6***). For singers and winds, this is felt as a bearing down, which can create discomfort and can feel tense. To release the diaphragm and keep it from pushing down, use the shwoop exercise in this chapter to create this flexibility.

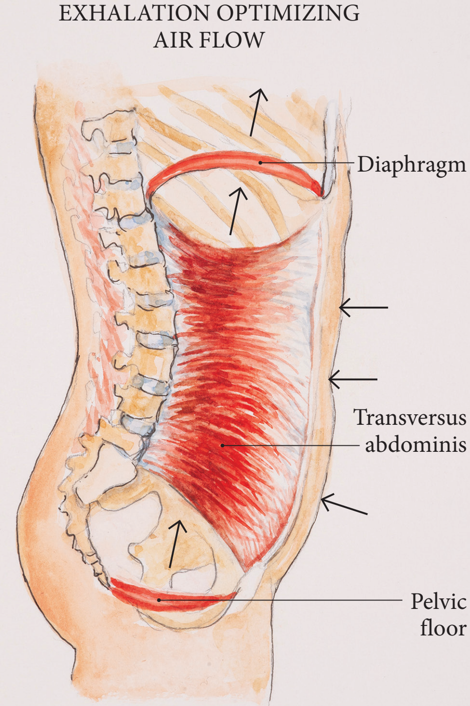


Figure 15-0-5.

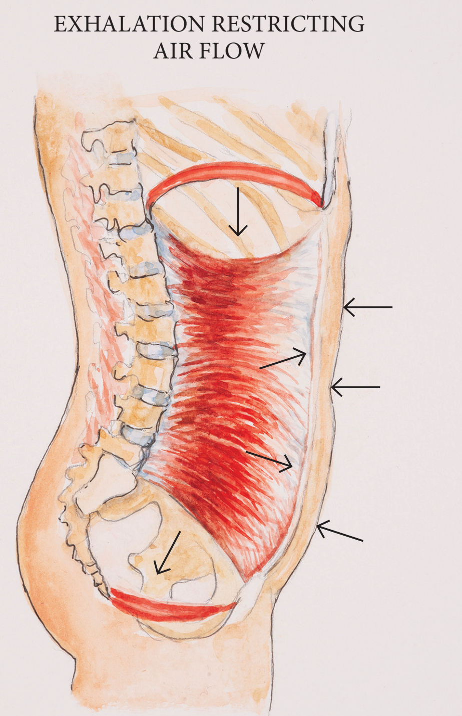


Figure 15-0-6.

The pelvic floor is often called the pelvic diaphragm because it has a dome shape similar to that of the thoracic diaphragm, only the dome is oriented in the opposite direction. These two domes move together in synchrony as you breathe (they both go down and then up at the same time), but their action is antagonistic. When one activates, the other relaxes (they activate in the opposite aspects of the breath cycle). On the inhalation, the thoracic diaphragm flattens by moving downward when it contracts (as a main muscle for inhalation), while the pelvic diaphragm relaxes downward (***Figure 15-0-7***). On the exhalation, the pelvic diaphragm flattens by moving upward when

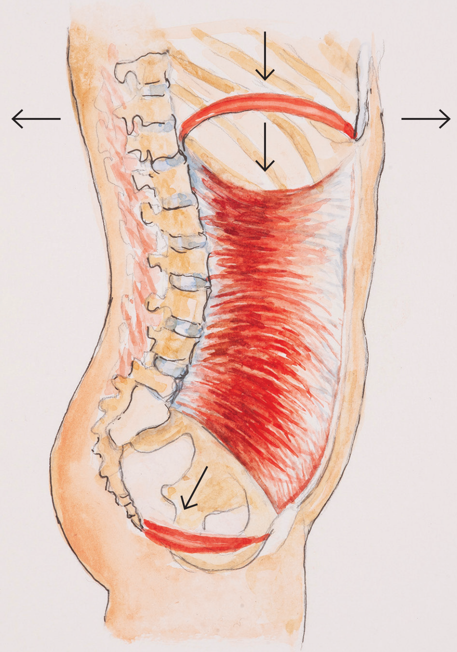


Figure 15-0-7.

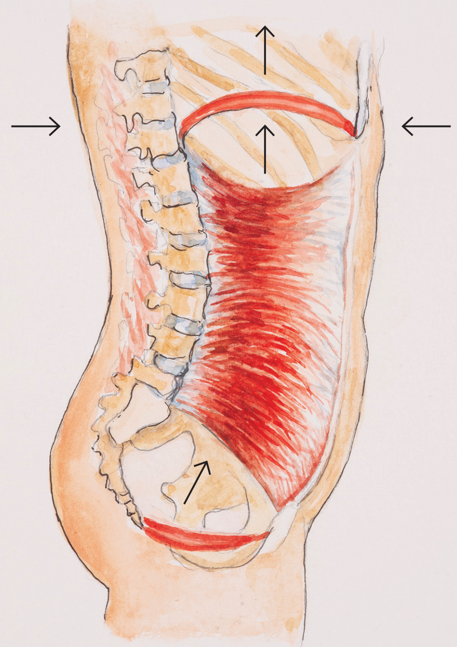


Figure 15-0-8.

it contracts, while the thoracic diaphragm relaxes upward (***Figure 15-0-8***). However, in controlled breathing (as in singing or playing a wind instrument), they both contribute to breath control by contracting eccentrically (instead of totally relaxing) when needed. This needs to be managed very carefully to avoid excess tension or a pattern of pushing down or engaging too many muscles at once. Creating a good push-off from the floor or sit bones can be enough to get the balanced activation in these muscles.

→ Find it:

. To find the pelvic floor, sit in a chair and find the comfortable place on your sit bones, as you practiced in the chapter on sitting (Chapter 10). Your pelvic floor, which is a thin layer of muscle tissue, is located between your sit bones.

. **Breathing in:** As the thoracic diaphragm contracts and activates, it moves downward, pushing against the viscera of the abdomen, leading to an effortless outward movement of the lower ribs. As the pelvic floor simultaneously releases, it moves downward as well. See if you can sense your pelvic floor relaxing downward toward the chair, or feel your sit bones digging slightly deeper into the chair during the inhalation.

. **Breathing out:** The pelvic diaphragm activates and moves upward by naturally contracting. This upward movement is something you can slowly and gently start activating consciously to assist with breath control along with the transverse abdominis muscle (which naturally contracts together center of your chest—like a flower opening up from the inside or a jellyfish expanding and closing gently inside the chest. It can be helpful to hold a hand on your chest to make sure it's not collapsing down on the inhalation or pushing forward and creating tension along the spine (*Figure 15-5-2*).

Standing

1.
Stand with your hips aligned and a relaxed chest, and sense the contact between your feet and the floor (*Figure 15-5-3*).

Figure 15-5-3.

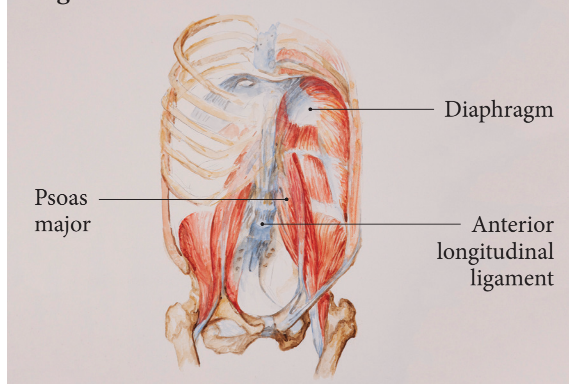
2.
Breathe into your chest and tune into the back of your diaphragm, sensing its connections to your psoas major along the front of your spine. Let the chest expand effortlessly both forward, to the sides, and backward at the same time.

3.
Feel the pull through your psoas major that transfers the breath downward to your pelvic floor and all the way down your legs to your heels. This may be subtle, so give it some time.

4.
Try to sense that every breath is grounding you—it's like your feet are pushing slightly into the ground with each inhalation.

5.
The diaphragm and psoas pull on the anterior longitudinal ligament, which is a fascia structure that runs along the front of your spine (*Figure 15-5-4*). This pull creates a sense of lengthening in the lumbar spine in the lower back (*Figure 14-0-4*), as well as up into the neck and crown (through the deep neck flexor longus colli that lengthens the neck).

Figure 15-5-4.



6.
Make sure your breathing doesn't take place too high up in your chest by visualizing the diaphragm, its movements, and the effects of these movements. Feel the initiative for inhalation coming from the center of your chest and transferring downward to your feet.

7.
Notice if there are any restrictions that you can subtly encourage to release.

The Valsalva maneuver

One of the most common ways that we start holding our breath or creating too much tension in the breath is through what's called the Valsalva maneuver (or sometimes named half-Valsalva if the throat is still letting some air through). It increases pressure in the abdomen and chest by closing the throat to keep the air inside, as well as activating muscles in the throat, neck, chest, diaphragm, abdominals, and pelvic floor to further increase pressure in the abdomen from all sides (***Figure 15-8-1***).

→ **Try it:** Place your palms on your belly and cough. Can you feel how your belly hardens and the throat closes right before the cough? This pressure is also pushing down on your pelvic floor, and your pelvic floor is also activating to resist the pressure. The more your abdominals squeeze, the more tightly the throat closes. Your throat remains closed until enough pressure has built up inside the torso to cough. Typically, the Valsalva maneuver is something you do either during a bowel movement or when holding your breath as you lift a heavy object.

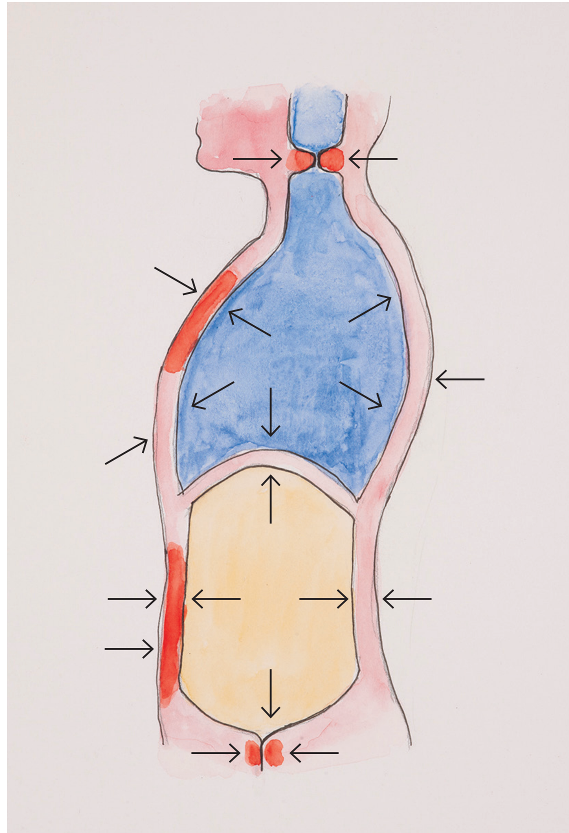


Figure 15-8-1.
The Valsalva maneuver closes the throat, tenses the diaphragm and creates increased pressure in the abdomen and chest

Doing Valsalva or half-Valsalva isn't recommended while playing or singing. Valsalva can be devastating for wind players, resulting in hesitation in the sound, the sound coming later than you intended, unintentionally using the voice when playing, or explosive articulation, i.e., not controlling the sound. If the exhalation is mainly dominated by the rectus abdominis or by dominance of the diaphragm over the pelvic floor/transverse abdominis muscles, there's a clear downward pull on the front of the ribcage in exhalation. This is often accompanied by misalignment of the hips, torso, and/or neck, and negatively affects optimal breathing and sound.

To avoid the habit of using Valsalva on the exhalation, it can be beneficial to work on differentiating the transverse abdominis from the rectus abdominis using the exercises that focus on this in Chapter 14. In most cases, the rectus abdominis should be as relaxed as possible during singing and playing, while the transverse abdominis should be more activated. The exception is when what you're playing or singing requires more muscular engagement. In this case, all the abdominals are needed for support, but in varying degrees of activation. You don't want to clench everything. The timing of the muscle activation is still important, as this