

The Deep Back Line and a Proposed Alternate Superficial Back Line

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Yaron Gal Carmel, LCMT, KMI, PSIP, has worked as a bodyworker for over twenty years. He has studied with many masters and pioneers including Tom Myers, Christoph Sommer, Koei Kuwahara, Hugh Milne, Judith Aston, Gil Hedley, and Jim Asher. An educator at heart, Yaron is a senior faculty member of the Kinesis School of Structural Integration where he teaches workshops in Anatomy Trains® and application of fascial release techniques. He offers trainings in his own method, Somatologic Moves, which marries Thai Massage and structural integration. Yaron is the owner and manager of The Therapy Center for Mind and Body near Boston where he practices. He can be reached at yaron_gal@yahoo.com.

Abstract

In this article I discuss the question of a Deep Back Line, which is absent from the Anatomy Trains®, Tom Myers' well-known system of longitudinal myofascial meridians, but which I believe is amply supported by the evidence. Some structures already assigned to the Superficial Back Line must be reevaluated and reassigned to the new Deep Back Line. Seeing the back as consisting of not one line, but two, gives structural integration practitioners a more precise clinical vision of the back, and makes possible techniques that don't fit the traditional Anatomy Trains system. Clients, too, profit from the improved awareness of the back offered by the Deep Back Line.

Background

Various anatomists in the early twentieth century (Hoepke, 1936; Dart, 1950; Busquet, 1899; et al.) illustrated myofascial continuities comprising more than the single muscles that conventional anatomy texts were concerned with, but it was Myers who published the first whole-body system of myofascial anatomy (Myers, 2001). *Anatomy Trains* has been translated into twelve languages and is now required reading in many training programs of physical therapy, chiropractic, osteopathy, massage therapy, and yoga.

Myers, who has been my teacher and mentor for almost twenty years, spent some years teaching anatomy at the Rolf Institute® in the late 1980s. His students there, like incoming students at any school of SI, had little or no prior knowledge of fascial anatomy, and had trouble understanding Dr. Rolf's fascia-based view of the body. Myers developed the Anatomy Trains® system in an attempt to make the structure and function of fascia more comprehensible. Once he had left the Rolf Institute, Myers drew on the Anatomy Trains to develop his own take on structural integration, which is called Kinesis Myofascial Integration.

The Anatomy Trains System

Anatomy Trains is a whole-body map of myofascial connections, designed to help bodyworkers assess and treat structural misalignments. It follows two main guidelines: depth of layer and direction of fibers.

Anatomy Trains' cardinal lines, all of which connect head to foot, are:

In the Sagittal Plane

1. Superficial Front Line (SFL) - a pair, left and right
2. Superficial Back Line (SBL) - a pair, left and right (see Figure 1)

In the Coronal Plane

3. Lateral Line (LL) - a pair, left and right

In the Transverse (Oblique) Plane

4. Spiral Line (SL) - a pair, left and right

In the Core

5. Deep Front Line (DFL). Because it includes the viscera, this line is more three-dimensional than the others.

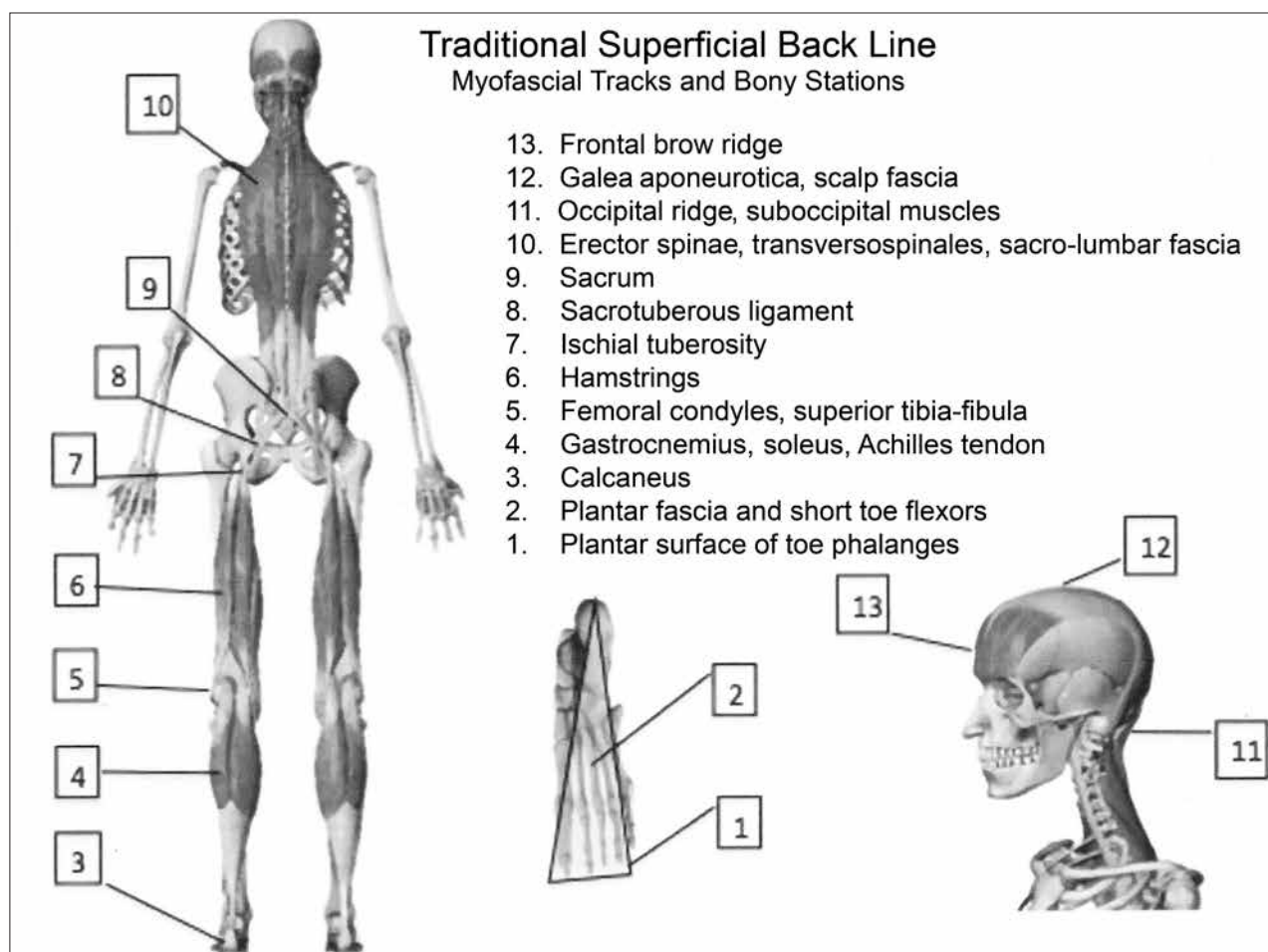


Figure 1. The traditional Superficial Back Line (SBL). Images generated by author with the use of *Muscle Premium* (www.visiblebody.com).

A Simple Question

As a teacher of this material for many years, I have often been asked by students, “If there is a Superficial Back Line, then why not a Deep Back Line?” Not only students, but teachers as well, have wondered whether there shouldn’t be a Deep Back Line. Christoph Sommer, a Rolfer® for over 20 years and former teacher in the European Rolwing® Association trainings, has also taught continuing education for Myers’ Kinesis organization. He is currently on the faculty at the Barral Institute. His bio on the former Anatomy Trains website states:

In addition, I am also discussing the existence of a “deep back line,” the connective tissues around the CNS and PNS (central and peripheral nervous system). To understand and manually differentiate these structures has been a major improvement in the effectiveness of my treatments. How does the core shape the meridians?
(Sommer, 2009, para. 2)

Sommer saw his Deep Back Line as consisting not of myofascia, but of “the connective tissues around the CNS and PNS,” which puts it outside the realm of the anatomy trains proper, but his work made me even more curious: Why was there no Deep Back Line on the Anatomy Trains map?

As I pursued my investigation, I found inspiration in the work of Kenneth Snelson on tensegrity and of Stephen Levin, MD, on biotensegrity (see Resources), as well as in Neil Shubin’s book, *Your Inner Fish* (2008). Day in and day out, my clients have provided a wonderful field of inquiry. I didn’t have a 24-hour dissection lab, which would have been very useful, but I made use of the wealth of data available online, particularly The Visible Human Project and Anatomyquest.com. In 2011, I was fortunate enough to participate in Gil Hedley’s week-long dissection workshop at Tufts Medical School, which allowed me to simultaneously touch and see my proposed Deep Back Line.

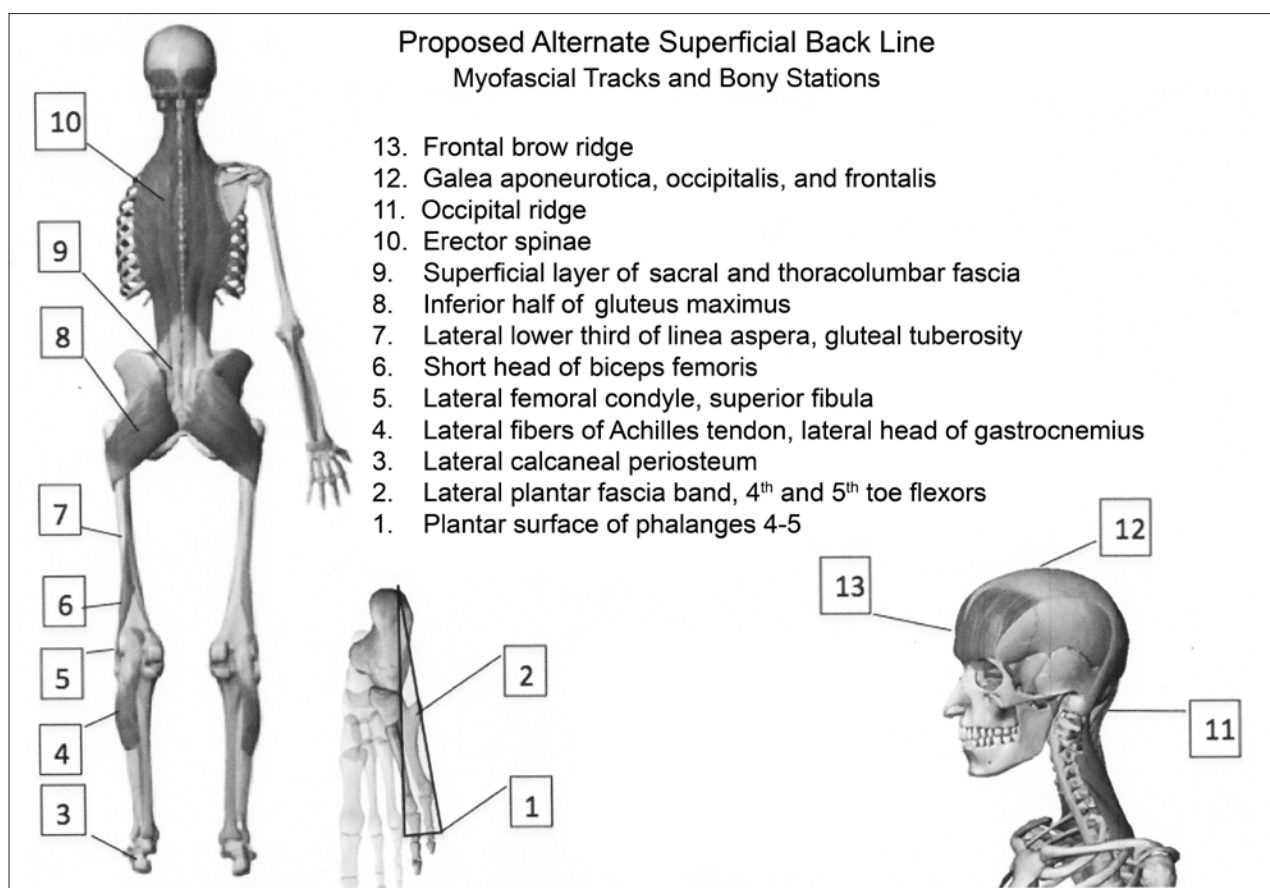


Figure 2. The Proposed Alternate Superficial Back Line (PASBL). Images generated by author with the use of *Muscle Premium* (www.visiblebody.com).

In investigating the viability of a Deep Back Line, I ran into a fundamental problem right from the start. Some of the structures I wanted to assign to the Deep Back Line already belonged, in the Anatomy Trains system, to the SBL. The first step, therefore, had to be a reexamination and reorganization of that line. Once this was done, things fell into place. It seems wise to follow the same steps in this article, so I will begin with the Proposed Alternate Superficial Back Line (PASBL, Figure 2) before proceeding to the Proposed Deep Back Line (PDBL, Figure 6).

Proposed Alternate Superficial Back Line (PASBL)

The heel foot, as addressed by Dr. Rolf, consists of the calcaneus, cuboid, and fourth and fifth metatarsals and phalanges, that is to say, more or less, the lateral longitudinal arch (Rolf, 1989). The tensional structure that supports these bones (shown in Figure 9) is the fascia connected to the fourth and fifth toes as well as to the lateral band of the plantar fascia, plus the short flexors of the fourth and fifth

SIDEBAR 1: An Exercise to Differentiate the Toe and Heel Foot

- Stand up with feet hip-width apart and parallel.
- Rock, moving your weight from toes to heels, back and forth.

Notice that the weight of your body is transferred from the talus to the medial three toes first.

Note: The bones of the medial three toes are naturally longer. In an integrated, aligned foot the myofascia associated with the toe foot will be tensioned first in walking and running (i.e., movements in the sagittal plane).

toes, which gives us the first segment of the PASBL (see Sidebar 1).

From here, we proceed to the lateral portion of the calcaneal periosteum and the lateral portion of the Achilles tendon with the lateral gastrocnemius head. Please note the defined septum between the medial and lateral gastrocnemius heads shown in Figure 3. At the knee joint level, the gastrocnemius

fascia connects to the fascia of the biceps femoris short head, which attaches along the distal two-thirds of the postero-lateral linea aspera of the femur, as shown in Figure 4. Myers' *DVD Anatomy Trains Revealed: Dissecting the Myofascial Meridians* shows clearly that such a connection exists between the lateral head of the gastrocnemius and the biceps femoris, as well as between the medial head of the gastrocnemius and the semimembranosus and semitendinosus.

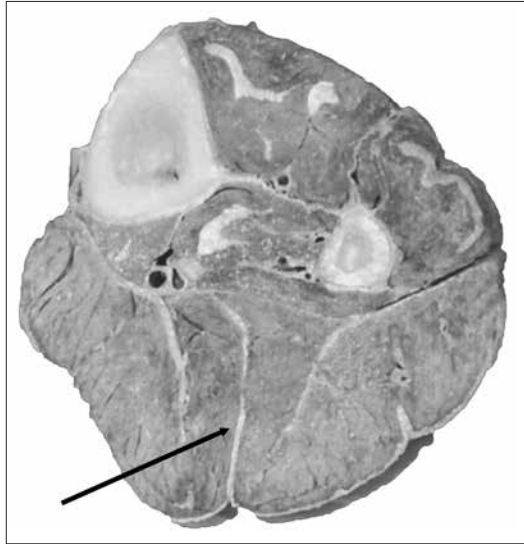


Figure 3. A cross-section of the lower leg compartment. In this specimen there is a clear, fibrous band between the gastrocnemius heads, splicing the soleus and blurring its margins. A sensitive area to work on, but worthwhile for the increased range of motion at the ankle, subtalar, and knee joints. Photograph used with kind permission from Andreas Horn and Carl Walter ©2013.

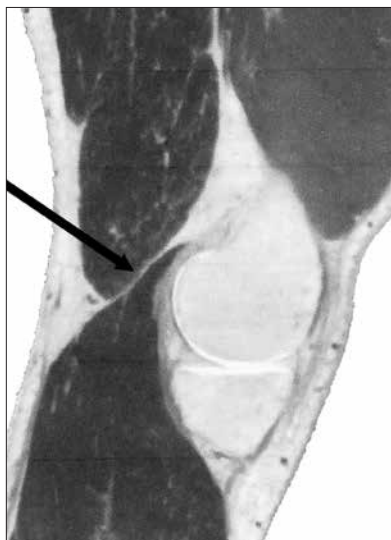


Figure 4. The connection between the lateral head of gastrocnemius and the short head of biceps femoris. Image reprinted with permission of the Visible Human Project, Department of Health & Human Services, National Institutes of Health, ©2007.

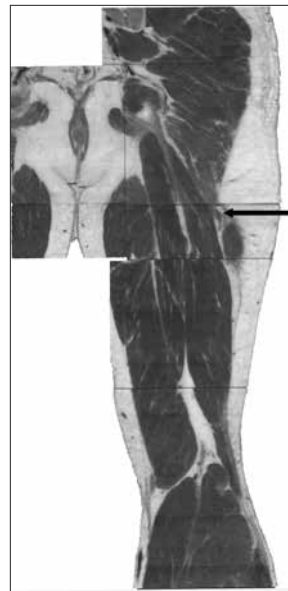


Figure 5. Cross-section view of connection between short head of biceps femoris and gluteus maximus. Image reprinted with permission of the Visible Human Project, Department of Health & Human Services, National Institutes of Health, ©2007.

From this location on the femur, fibers of the short head of the biceps femoris merge with the superficial fibers of the inferior half (or so) of the gluteus maximus (see Figure 5), which then attach to the superficial sacral fascia and the superficial lamina of the thoracolumbar fascia. The superficial lamina of the thoracolumbar fascia connects directly with the erector spinae. These long muscles and their fascia take us all the way up to the occipital ridge, where they connect with the galea aponeurotica. This latter structure's attachment at the brow ridge marks the end of the PASBL.

Research has been done (Vleeming, Pool-Goudzwaard, Stoeckart, van Wingerden, & Snijders, 1995) that validates the connection discussed above from gluteus maximus to the superficial lamina of the thoracolumbar fascia and then to the spinal erectors. This portion of the line can also be seen, with the gluteus maximus cut, in Clemente's *Anatomy: A Regional Atlas of the Human Body* (1997, plate 330).

Nomenclature and Other Points

Readers will perhaps have noticed that my PASBL, a "superficial" line, includes the short head of the biceps femoris, which is about as deep as a structure can be in the thigh. This would seem to be contradictory. Those also familiar with Myers' work may have noticed that his Deep **Front** Line includes the deep **posterior** compartment of the leg, also an apparent contradiction. I do not consider either of these examples to be contradictory, for the following reason.

The lines of pull that we choose to call Anatomy Trains are present and functional in the body regardless of whether we perceive them, or what we call them. They are the representation of millions of years of evolution and, as such, express a wisdom that we would be foolish to think we can comprehend in its full import and implication. That said, we find it useful to use the lines as concepts in our thinking and in our work, and to talk with others about them. For this we must name them. Myers could have given his lines arbitrary names such as Line 1 and Line 2. Many systems have made use of such arbitrary names. (Think of type I and type II movement of the vertebrae, or first, second, and third class levers; those who don't know these terms will not be able to understand them, which is precisely the point being made.) However, for ease of use and memory, it is also possible to give names that have some sort of rationale behind them. The rationale I have used is the same as the one that I read between the lines of Myers' book: We call a line superficial or deep, front or back, in accordance with where that line is located in the trunk. The name may then seem incorrect when that line makes its way into the limbs. So be it. We must never lose sight of the "ugly fact" that nature follows its own rules, and the names we give to nature's creations are necessarily simplifications, convenient for us to use, but not expressive of ultimate truth (whatever that is). The final test of any concept, or of its name, is the greater or lesser use we can put it to.

If there is a Superficial Back Line, then
why not a Deep Back Line?

To bring the discussion back to anatomical nuts and bolts, I would like to make another important point: The iliocostalis lumborum, iliocostalis thoracis, and longissimus thoracis (which belong to the PASBL) and the transversospinales (which belong to the PDBL) all act to extend the vertebral column (although, significantly, I think, the former do so only indirectly via their attachments on the ribs), and they are all antagonists of the rectus abdominis (which belongs to the SFL and) which flexes the vertebral column (also indirectly, via the ribs). However the iliocostalis lumborum, iliocostalis thoracis, and longissimus thoracis also act to draw the rib cage down and are considered expiratory muscles, which groups them as agonists with the

rectus abdominis (which belongs to the SFL). In other words, this group of muscles has a different, more complex relationship to the rectus abdominis than do the transversospinales. Once these layers of the back are differentiated from one another, more complex patterns of use become possible. For example, a weight-lifter doing a dead lift (which requires strong contraction of the transversospinales) might choose to lift on the exhale, in which case contraction of the iliocostalis and longissimus, as mentioned above, would contribute to both exhale and spinal extension; or on the inhale, in which case these muscles might not contract at all. The transversospinales would be working in both cases, since they are not breathing muscles. It is this difference in function, corresponding to a difference in structure (the transversospinales are deeper, the iliocostalis and longissimus more superficial), that makes the difference between the PASBL and PDBL significant.

Proposed Deep Back Line

The toe foot, as addressed by Dr. Rolf, consists of the talus, navicular, and cuneiforms, and the first, second, and third metatarsals and phalanges, that is to say, more or less, the medial longitudinal arch (Rolf, 1989). The tensional structure supporting these bones is the medial portion of the plantar fascia, which gives us the first segment of the PDBL. From here, we proceed to the medial portion of the calcaneal periosteum, the medial fibers of the Achilles tendon, and the medial gastrocnemius head. Crossing the knee, we proceed to the semimembranosus and semitendinosus, which insert on the ischial tuberosity. From here, the superficial fibers of the sacrotuberous ligament lead us to the sacral periosteum.

Research by Vleeming et al. (1995) validates the connection discussed above from the sacrotuberous ligament to the deep lamina of the thoracolumbar fascia and then to the transversospinales. We then follow the deep lamina of the thoracolumbar fascia to the transversospinales and segmental muscles and their fascia up to C1 and C2, where the suboccipitals give us two possible connections (see Figures 7 and 8): first, to the occipital ridge; and second, via the myodural bridge (Scali, Pontell, Enix, & Marshall, 2013), to the dura mater, and from there to the falx cerebri and tentorium cerebelli, which is to say, to the neural canal and intracranial space. In this respect, there is a nice parallel between the DFL,

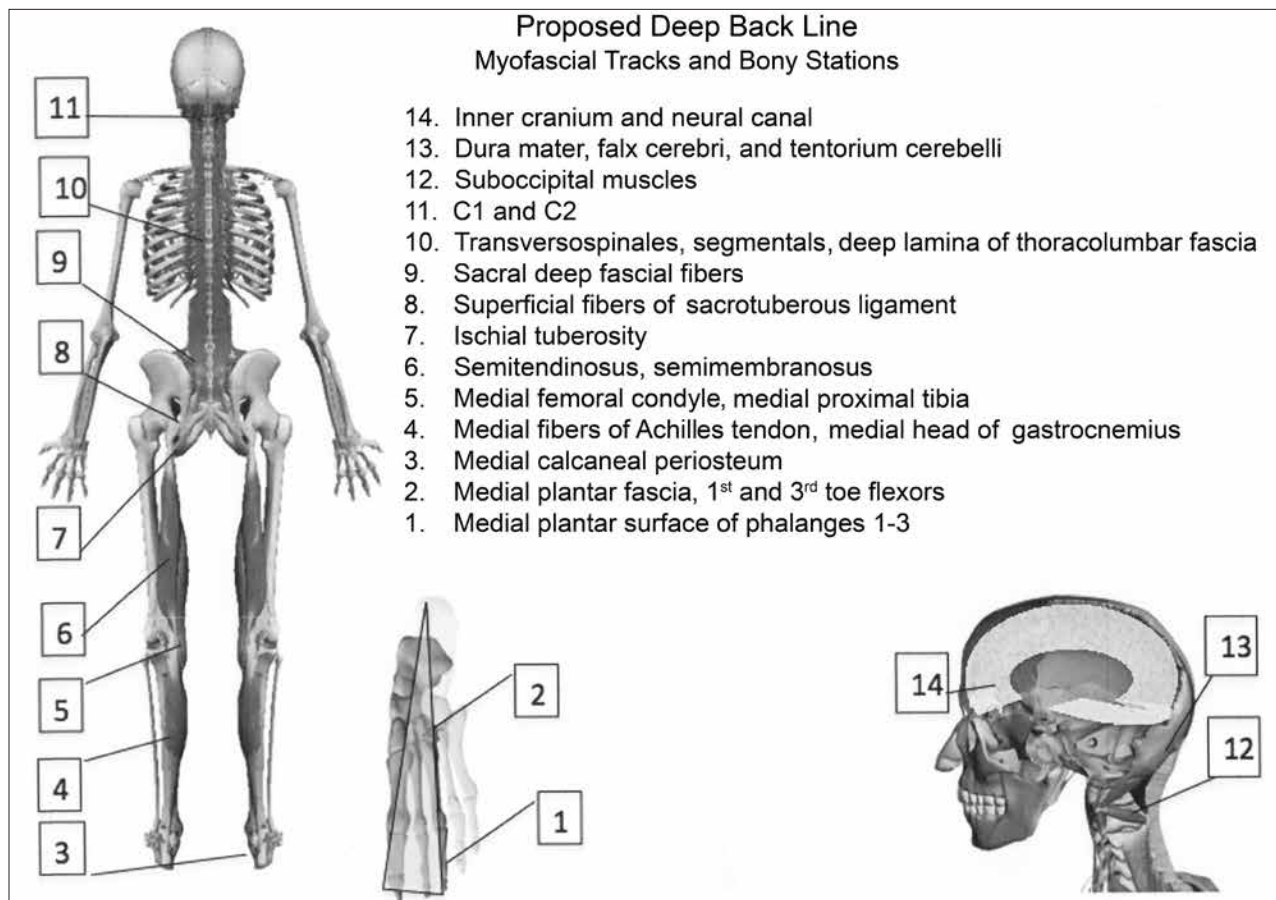


Figure 6. The Proposed Deep Back Line. Images generated by author with the use of *Muscle Premium* (www.visiblebody.com).

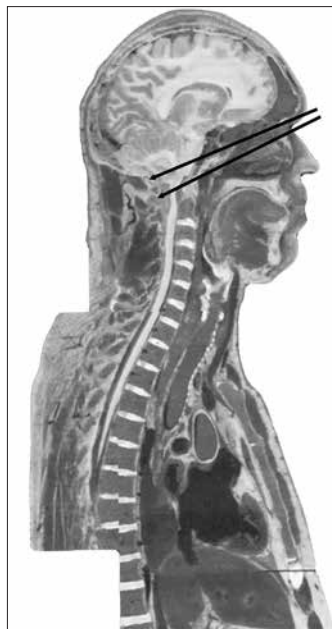


Figure 7. Sagittal section of spine and myodural bridge. Image reprinted with permission of the Visible Human Project, Department of Health & Human Services, National Institutes of Health, ©2007.

Figure 8. Posterior view of the brain and spinal cord with dural membranes. Reprinted with kind permission of Gil Hedley © 2011.



which embraces the viscera, and the DBL, which embraces the neuroviscera. This structural parallel has a functional correlate: Just as movements that involve the DFL will have an effect on the viscera, so will movements involving the PDBL have an effect on the neuroviscera.

Summary of Differences

Following is a summary of the additions and changes I have made to the existing Anatomy Trains system:

- While Dr. Rolf's distinction between the heel foot and toe foot (see Figure 9) is mentioned in Anatomy Trains, it is not used in the presentation of the SBL. I see this as a crucial distinction, since the toe foot connects to the medial gastrocnemius head, and the heel foot to the lateral gastrocnemius head. The fascial and functional differences between the two gastrocnemius heads are, I think, not to be ignored. Consider, for example, the role of the gastrocnemius in lateral and medial tilt of the calcaneus (see Figure 10). If the two heads of the gastrocnemius are taken as a unit, as in the conventional SBL, their differing roles in lateral and medial tilt of the calcaneus are masked (see Sidebar 2). By assigning the medial head to the PDBL, we separate out the role of the muscle, and of the fascial line, in lateral tilt of

the calcaneus; by assigning the lateral head to the PASBL, we make more explicit the role of both muscle and fascial line in medial tilt of the calcaneus.

- The conventional SBL includes the hamstrings as a unit, but I assign the semitendinosus and semimembranosus to the PDBL, and the biceps femoris short head to the PASBL (the long head of the biceps femoris goes with the Spiral Line). This makes clear the important connection between the biceps femoris short head and the inferior portion of the gluteus maximus, via fibers running along the lateral linea aspera to the

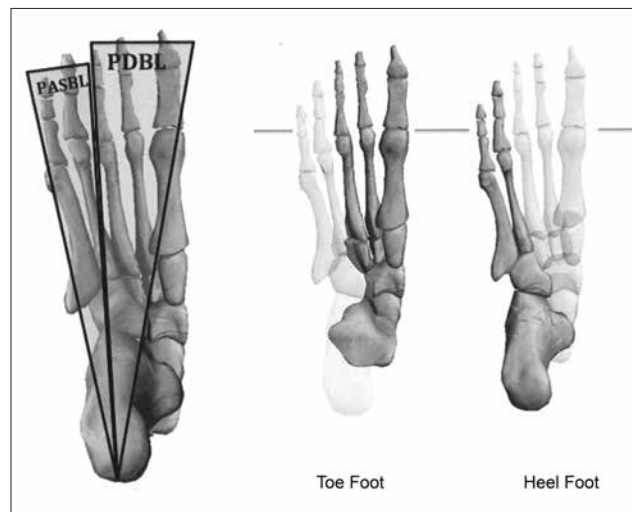


Figure 9. The toe foot and heel foot divisions; the two triangles depict the plantar myofascial division. Images generated by author with the use of *Muscle Premium* (www.visiblebody.com).

SIDEBAR 2: An Exercise to Feel the Medial and Lateral Gastrocnemius

- Since the gastrocnemius is too slack in a seated position, stand up with feet parallel and hip-width apart.
- Evert your feet (knees will come closer) and you may feel the lateral heads of gastrocnemius shorten with the evertors.
- Now try the reverse: Invert your feet (knees will go further apart) and you may feel the medial heads of gastrocnemius shorten with the invertors.

The gastrocnemius crosses the knee, tibiotalar, and subtalar joints. It is mainly a powerful plantar flexor and is not positioned well to initiate eversion or inversion. I find that a concentrically loaded lateral gastrocnemius head is often associated with a medially tilted calcaneus and a concentrically loaded medial gastrocnemius head is often associated with a laterally tilted calcaneus.

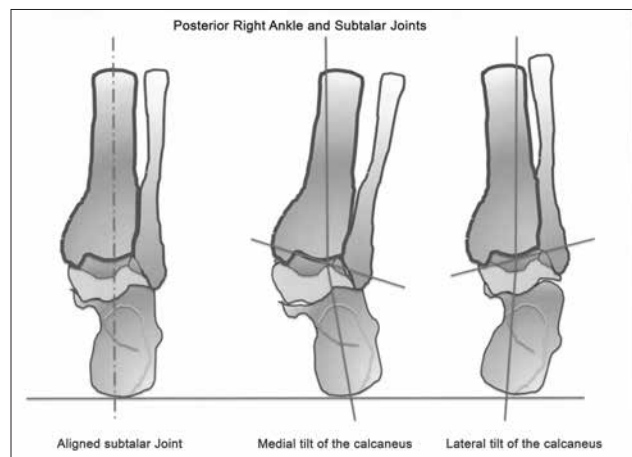


Figure 10. Subtalar joints in alignment and with medial and lateral tilt of the calcaneus. Images generated by author with the use of *Muscle Premium* (www.visiblebody.com).

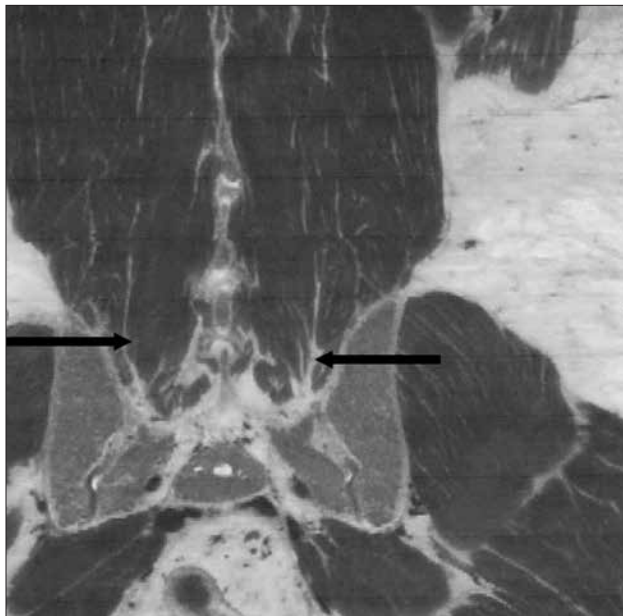


Figure 11. Coronal section of lumbar-sacral spine showing a thick septum between the transversospinales and erectors. Image reprinted with permission of the Visible Human Project, Department of Health & Human Services, National Institutes of Health, ©2007.



Figure 12. Cross-section of spine at L3. Image reprinted with permission of the Visible Human Project, Department of Health & Human Services, National Institutes of Health, ©2007.

gluteal tuberosity. It also continues into the thigh the previously mentioned distinction in the leg.

- The conventional SBL takes the sacrum and paraspinal muscles and fascia as a unit. In clinical practice, I find it is essential to separate the deep periosteal layer of sacral fascia, which relates to the transversospinales and segmental muscles, from the superficial fascial layers, which connect to the erector spinae (see Figures 11 and 12). This distinction has important clinical consequences as I note below. By distinguishing PASBL and PDBL, we ensure there is conceptual support for these clinical observations.
- In my proposed modified version, the superior end of the PDBL connects via the obliquus capitis inferior and rectus capitis posterior major and minor directly to the dura mater.

Applications

For me as a structural integrator, the parsing of the back line into superficial and deep components is not just an intellectual exercise. Seeing these two lines as distinct opens up powerful clinical vistas. Let me provide an example.

The erector spinae cross multiple segments and, by virtue of their distance from the fulcrum of intervertebral motion, have great mechanical advantage. They act very differently on the spine and the rib cage than do the transversospinales and segmentals, which have greater specificity of action but, being closer to the spine, less mechanical advantage. Oftentimes in clients' bodies, we find the two sets of muscles and their fascia (two different lines in my view) adhered to one another. This is associated with reduced range and complexity of motion, and often with compromised breath, intervertebral disc compression, and pain. By working to differentiate these tissues, I am often able to achieve results that were beyond me before I began to see these two lines as separate. My personal experience as a practitioner and as a teacher of practitioners has shown me that those who see all the spinal muscles as belonging to a single line, the conventional SBL, are less likely to work the spinal muscles with enough precision, depth, and patience to achieve the results I know are possible.

What might an actual technique look like? I have the client lie supine and, sitting on one side, I slide my hands between the client's lumbar region and the table, with my palms facing up. I move my

fingertips medially all the way to the lower lumbar spinous processes and then come back laterally a little bit, to make sure I'm correctly oriented directly on the laminar groove, which contains the lumbar multifidus. I know that directly beneath my fingers lies the iliocostalis lumborum, and I allow my fingers to rise upward into the meat of this muscle. Once I feel I have made a good connection, I take my fingers cephalad and the iliocostalis comes along for the ride. The multifidus, one layer deeper, stays behind, and the desired differentiation is achieved. In different regions of the spine, of course, the anatomy is different, and so are the techniques, but the preceding should give readers some idea of what is involved.

Conclusion

My intent in this article has been two-fold. First, to walk through the details of the relevant anatomy, and second, to show why I think the two back lines merit separation. As I have asserted above, the measure of an Anatomy Trains line is its usefulness to researchers and clinicians. Sometimes we may find our questions answered by the way of thinking that the Anatomy Trains represent, and these answers may be clearly useful. At other times, we may find we are left with questions unanswered, or even unanswerable. What is the use of that? we may wonder.

One such question that occupies my mind is this: Given the obvious importance of protecting a creature's most valuable and vulnerable assets (CNS, heart, digestive, and reproductive organs), why has evolution seen fit to connect, for example, the pituitary gland to the PDBL via the suboccipital muscles? I know of no research that shows that this connection is capable of conducting significant forces, whether beneficial or harmful, essential or superfluous, from the outside, where big movements and powerful forces are the norm, to the inside, where even small inputs would seem to have the power to make big changes. And yet the potential for such effects must be present wherever lines of pull connect structures to one another. Is the PDBL–pituitary connection an evolutionary accident, a chink in the armor? Or does it provide some hitherto unadumbrated advantage (pumping action, beneficial stress, enriched movement repertoire)?

Donald Ingber, who has spent many years studying the effects of physical forces on cells, told the audience at the 2007 Fascia Research Congress that protein production in a cell depends on the physical

forces to which the cell is subjected: Different forces cause different genes to be expressed. Might we hypothesize that the startle reflex, which is said to have played an important role for eons protecting humans and our simian ancestors from attack by predatory cats, would produce forces in the tissues of the PDBL that would be conducted to the brain and pituitary? Might we then conjecture further that because the startle reflex causes both gross physical effects (trunk flexion) and physiological changes (stress hormone release and sympathetic activation), it would therefore have behooved evolution to find a way to activate both sets of responses from a single stimulus? What structure is better positioned to mediate this function than the PDBL? Regardless of the answers to these questions, I believe that a system, such as the Anatomy Trains, that causes such questions to arise has, by that sole virtue, demonstrated its usefulness.

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