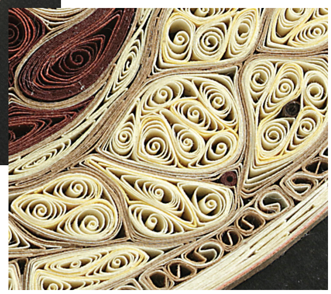
Understanding Fascial Change

Continuity, Plasticity, and Sensitivity

By Til Luchau

What is the most abundant tissue in the body? Did you say bone? Good guess—after all, we have around 206 bones. Muscle? It's true that we have somewhere between 600 and 800 named muscles, depending on who is counting. But even more profuse than those are the fasciae—the membranous connective tissues that surround and connect every part of our internal structure (Image 1). And yet, instead of having hundreds or thousands of fasciae, some say we have just one.



Artist Lisa Nilsson reinterprets anatomical cross-sections using rolled paper, simulating the interconnected fascial wrappings around and within muscles, bones, nerves, etc. *Photographer: John Polak. www.lisanilssonart.com, used by permission.*

WHAT IS FASCIA?

The term *fascia* (from Latin, meaning "band") generally applies to the fibrous connective tissues covering, connecting, and investing muscles, tendons, bones, vessels, organs, and nerves. It has many subtypes, which can vary from dense to loose, and from highly regular to very irregular. Academics still debate precisely which tissues can justifiably be considered fascia.[1] But researchers generally agree that all the tissues under discussion are composed of the same basic elements (cells, fibers, and a matrix or ground substance) in varying proportions and arrangements, and that all these tissues interconnect.

Fascial researcher Robert Schleip and his collaborators offer a commonly accepted definition of fascia: "Soft tissue components of the connective tissue system that permeates the human body."[2] This definition includes not just the enveloping membranes, but also aponeuroses, joint capsules, ligaments, and tendons. We'll use this broader interpretation in our discussion here.

WHAT IS MYOFASCIA?

What, then, is "myofascia"? Strictly speaking, myofascia refers to the fascial connective tissues related to the skeletal muscles (*myo* meaning "muscle")—their internal fascial structures and external connections, coverings, and septa. Informally, *myofascia* is often used interchangeably with *fascia*, though there are many kinds of fascia not directly related to the muscles.

THE UPS AND DOWNS OF FASCIA

Fascia has several qualities that are particularly relevant to hands-on work. Three of these are continuity, plasticity, and sensitivity. Each has both beneficial and detrimental aspects when it comes to the body's functionality (Image 2). We'll discuss each of these qualities in turn, and list techniques that utilize them. In the next column, we'll describe additional fascial techniques in greater detail.

1. Continuity

Fascia is good at connecting things. Anatomy students are taught that fascia connects individual muscle cells to bones in an uninterrupted chain that includes the endomysium, perimysium, epimysium, tendon, and periosteum. This is true, but not quite the entire story: less well known is that about 30 percent of a muscle's fascial attachments connect to neighboring fascial structures, rather than directly to a bone.[3] This fascia connects in turn to other fasciae, and so on, forming a complex three-dimensional network of interconnections (Images 3 and 4, page 116), not a one-to-one linear chain. This nonlinear, multidimensional interconnectedness has advantages such as more even load distribution, tensional responsiveness, and increased overall sensitivity—much as a fly wriggling in a spider's web can be sensed throughout the whole web's network.

Three interconnected fascial qualities relevant to hands-on work. Each quality has a beneficial and a detrimental aspect. For example, dysfunctional continuity leads to over-connection, binding, and restriction. Unhealthy plasticity takes the form of tissue that is either too dense, or too loose. And one of the downsides of fascia's sensitivity is that it can become overly sensitive to pain. *Image courtesy Advanced-Trainings.com, used by permission.*

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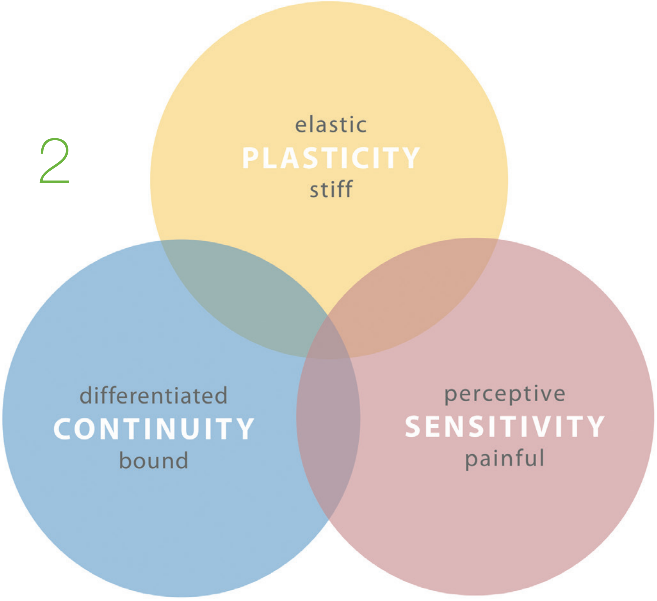


In spite of being a good connector, healthy fascia is also very good at facilitating movement. It does this by being springy and elastic, and by interspersing its tough, collagenous fibers with layers of slippery proteins like proteoglycan gel, which both connects and lubricates movement between the structures that the fascia envelopes (Image 4, page 116).

However, when there is strain, injury, disease, or lack of movement, fascia responds by connecting even more, forming adhesions, restrictions, and scars. In these situations, fascia becomes overly linked with its surrounding structures, and binds, pulls, and restricts like a too-tight garment. Clients feel this when they move, and to a trained practitioner, fascial binding can be perceived as a mobility restriction, or palpated as thicker, denser, or less-plastic regions of fascia.

When fascia has become overly connected, our therapeutic goal is to restore differentiation—that is, to separate fascial structures and reestablish their ability to move independently from one another.

Examples of techniques for restoring fascial differentiation include the Hamstring Technique ("Working With Hamstring Injuries," *Massage & Bodywork*, January/February 2014, page 116).

Our next column will include additional techniques that help reestablish a balance of fascial continuity and differentiation.

2. Plasticity

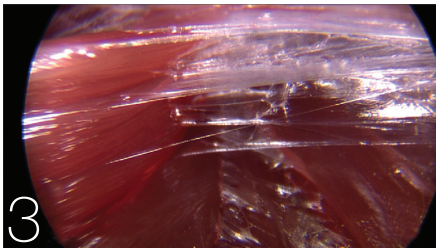
Practitioners can feel fascia changing. With appropriate pressure and patience, tissues soften, lengthen, and separate; harder and denser areas melt away and become more pliable. Clients feel these changes, too, and report tangible therapeutic effects: less pain, greater flexibility, and easier movement. "Fascial plasticity" is commonly cited as the reason for these results. And yet, the scientific explanation remains under debate.

Ida Rolf, who had a doctorate in biochemistry, taught that the changes her deep work produced resulted from a gel-to-sol melting in fascia's extracellular ground substance: the thinning, or thixotropy, of the tissues' matrix allowed for remodeling and reorganization of the tissues.[4] Generations of structural integration practitioners (this author included) learned and taught this mechanical model of tissue change.

Many fascial researchers, though not all, now doubt the thixotropy explanation, at least as a literal explanation for permanent tissue change. As tissue research has progressed since Rolf's time (she earned her doctorate in biochemistry in 1920), several researchers have concluded that the pressure and time needed to produce tissue changes would need to be far greater than is possible in a manual therapy setting.[5] Schleip makes the droll observation that in the time it takes to read an article like this one, your own bottom has been subjected to more pressure for a longer duration than most therapists ever use with their clients. Yet, when we stand up after hours of sitting, our behinds are not flattened or deformed. Fascial change and plasticity clearly involves more than just mechanical pressure.

However, influential teachers and writers continue to use thixotropy as a conceptual model. Italian physiotherapist Luigi Stecco uses a combination of pressure and friction-produced heat to "maintain the fluidity of the ground substance of the deep fascia, in such a way that the bundles of collagen fibers glide independently."[6]

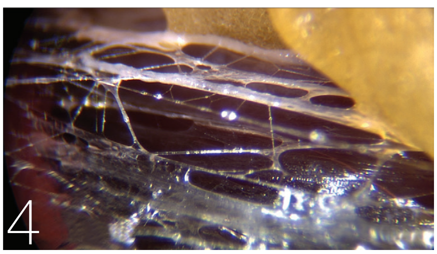
Other researchers have speculated that changes in the ground substance's hydration produce the effects felt by manual therapists. Using nuclear magnetic resonance imaging, water droplets can be seen emerging from the surface of tendons during stretching.[7] Since water plays an important role in fascial stiffness via the elastic interactions between protein fibers, a


Fascial interconnections of the latissimus dorsi in a living body. About 30 percent of muscles' fascial connections are to other fascia, rather than to bone. This fascial continuity can be beneficial (such as in force distribution), or detrimental (when unnecessary connections can bind and restrict). *Image courtesy Jean Claude Guimberteau, used by permission.*

spongelike wringing and refilling of the tissue's matrix is one modern alternative to the gel-sol thixotropy model.

So what are we feeling when we perceive fascial change under our hands? Schleip lists the aforementioned hydration changes, as well as skeletal muscle relaxation being transmitted through the fascial network, as his favored explanations for apparent fascial change in manual therapy, adding that it could even be an imagined or ideomotor effect caused by the practitioner's unconscious expectations.[8]

Elasticity: When fascia becomes stiff or inelastic due to strain, injury, scarring, disease, or lack of movement, our therapeutic goal is to restore its elasticity. One technique that uses this principle is the Plantar Fascia Technique ("Working with Ankle Mobility, Part 1," *Massage & Bodywork*, March/April 2011, page 113).


Surgeon Jean Claude Guimberteau's microscope shows the complex and dynamic interconnections within loose fascia of the arm. Much like a taut spider's web, the body's fascial continuity is adjusted and tuned by the muscles. *Courtesy of Jean Claude Guimberteau, used by permission.*

Whatever the exact mechanism involved, there is ample evidence that manual therapy can increase fascial flexibility and adaptability, with client benefits that include increased mobility and less pain. Whichever model we use to explain the tissue effects of our work, and whether we think of that model as scientific fact or inspirational metaphor, we continue to feel tissue melting under our hands. And most importantly, our clients continue to experience less pain, easier movement, and more flexibility.

3. Sensitivity

If you were to visualize your own body, not as you see it from the outside, but as you feel it from the inside, what would it look like? What is your overall image of your body sensations, from the inside out? Close your eyes and take a moment to do this now.

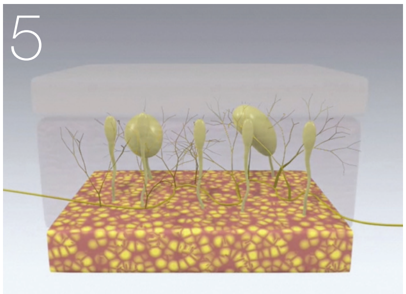
Once you have a sense of this, the next question is, "What is it you're sensing your body with?" When we look at ourselves in the mirror, we use our eyes; when we "look" at ourselves from the inside, what sense organ are we using? There is good evidence that, more than any other single source, we feel our body using the many mechanoreceptors and nerve endings in our fascia.[9] Fascia has so many sensory receptors that (depending on how you count them) their total number could equal or surpass that of the retina of the eye, which is usually considered the richest human sensory organ.[10]

Skin is very sensitive, especially to exteroception (perceiving the outside world through the sense of touch), but the perception of sensation from within the body begins just under the skin's dermis. The tissues in this zone, which include the superficial and deeper fascial membranes and their adjacent spaces, are exceptionally dense with free nerve endings and mechanoreceptors (Image 5).[11] These sense pressure, stretch, shear, vibration, etc.; help us perceive, control, and coordinate our movements; and allow us to shape the felt sense of our physical selves.

Fascia's sensitivity means that it is also sensitive to pain. While a benefit of pain is that it can help us avoid further injury, fascial sensitivity may play a role in chronic pain that persists longer than is biologically useful. Sometimes fascial pain is related to direct trauma. Because it is often more sensitive than the structures it envelops, the pain from tears or strains is often felt most acutely in the fascia. This is seen in the link between some kinds of low-back pain and the thoracolumbar fascia.[12] Other times, fascia seems to play a role in generating or sustaining pain, such as with myofascial pain syndrome (MPS). Though MPS is complex and not fully understood, manual therapies have been observed to help.[13] Several writers speculate that fascial stiffness plays a role in MPS and other chronic pain by stimulating embedded nociceptors.[14] Evidence for this comes from ultrasound experiments where neck pain was proportional to fascial thickness, which in turn responded to fascial manipulation.[15]

In our manual therapy approach, we use fascia's sensitivity in a variety of ways:

- Many of our techniques use static pressure on musculotendinous and periosteal attachments. Combining this pressure with active client movement stimulates Golgi tendon organs and other mechanoreceptors that modify the motor tonus of their associated muscles.[16] One technique that employs this principle is the Push Broom "A" Technique ("Working With Hip Mobility," *Massage & Bodywork*, March/April 2012, page 114).



Fascial layers are often richly embedded with free nerve endings and other mechanoreceptors, such as the Pacinian corpuscles (pictured here in the superficial fascia and hypodermis), as well as Ruffini endings in deeper fascia. *Image courtesy artist Hank Grebe, mediaspin.com, used by permission.*

- One of the primary goals of our work, no matter what the technique, is to help clients refine the perceptive capability of their felt body sense (proprioception, interoception, exteroception, etc.). The benefits of increased body awareness are profound and wide reaching, ranging from more sustainable in-the-moment choices about posture and comfort to better coordination and increased overall well-being.[17] The Breath Sandwich Technique ("Working With Whiplash, Part I: Hot Whiplash," *Massage & Bodywork*, March/April 2010, page 111) is an example of a technique that focuses primarily on the client's proprioception.

AREAS OF OVERLAP

This article has introduced a few ways that fascial understanding informs our Advanced Myofascial Techniques approach.

I have described continuity, plasticity, and sensitivity as separate phenomena, but there are large areas of overlap between these three fascial qualities. For instance, it's likely that fascia's plasticity is intimately linked to its sensitivity. And fascia's sensitivity as a sensory organ can be augmented or hindered by its web-like continuity. Finally, fascia's degree of continuity (how connected or how separate it is) is directly related to its textural plasticity and elasticity. Even though describing them separately here helps us better understand and appreciate all of fascia's remarkable qualities, in practice, we work with all three of these qualities simultaneously in our hands-on work, just as the fascia itself is an undivided whole. **m&b**

Notes

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Til Luchau is a member of the Advanced-Trainings.com faculty, which offers distance learning and in-person seminars throughout the United States and abroad. He is a Certified Advanced Rolfer and originator of the Advanced Myofascial Techniques approach. Contact him via info@advanced-trainings.com and Advanced-Trainings.com's Facebook page.