

Fascia

The Body's Richest Sense Organ

BY THOMAS MYERS

Everyone is familiar with the five senses: sight, smell, hearing, taste, and touch. But all manual and movement therapists can agree in our frustration that the word *touch* is an over-generalized term for a complex of different sensing skills, if not several different senses altogether.

Actively exploring your client's shoulder with your hand feels like a different sense than being touched by your clothes or having your thigh brush against the table. These experiences—which, however differently perceived, are all “skin touch”—in turn feel qualitatively different from our sense of ourselves in space and in motion. This includes the filling and emptying and shifts of our own organs (interoception), where our joints are in space (proprioception), where up and down is (graviception), or our sense of how we are moving (kinesthesia), along with the contact, vibration, pressure, and heat sensors in our skin (somesthesia) all lumped into that word—*touch*.

Seeing has been recently found to be similarly divided. Our sense of movement in the eyes runs a different pathway through the brain than does our sense of form and outline, which in turn can be separated from our sense of color.¹ Yet, our brains learn to blend these different signals and pathways into one picture of what seems to be going on around us at any given moment. Our eyes can be fooled by an optical illusion or at the cinema, where a rapidly projected series of still photographs creates the illusion of unbroken movement. That illusion is all part of the active putting together of *seeing*, an idea painters have been working with for millennia that has only been actively explored in the last century with the Impressionists, eventually leading to the brave new world of simulated reality coming at us via Wii, IMAX, and *Avatar*.

In this coming century, we will similarly tease apart this phenomenon called touch, in which the disparate threads of information coming up these various tracts from the peripheral

and cranial nerves are woven into a seamless sense of our body in the world: what we are touching and being touched by from the outside, and how we feel and respond on the inside.

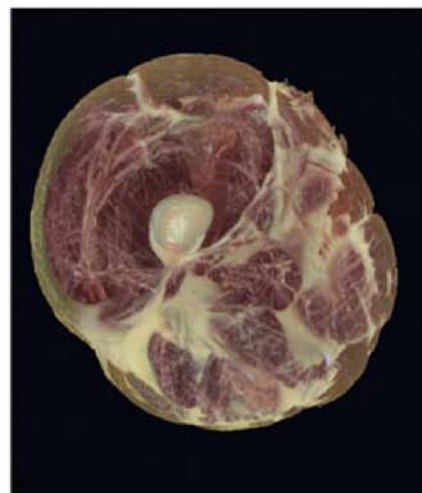
One thing we are learning early on in this exciting process of understanding how we work spatially is that a tremendous number of these nerve endings are imbedded in the fascia. Put simply, your fascia is by far your richest sense organ.²

Our common sense of anatomy is that we know where we are and how we're moving from our muscles. The fascia (and I am using the word loosely here for the whole connective tissue network) is the packing material, the insensible sinew that holds the intelligent, nerve-driven muscles to the bone. But it's the muscle that's intelligent, right?

While I am not here to insult “muscle smarts,” the answer, truly, is an emphatic no! If our muscles are smart, the fascia is 10 times smarter; there are nine or 10 times the sensory nerve endings in the fascia for every one sensory nerve ending in a muscle.³ We are all familiar with muscle spindles, the sensors that tell us how far and how fast a muscle is being stretched or shortened, with their gamma system adjustment. We all know that story, yes? (If not, it's well explained in *Job's Body: A Handbook for Bodywork* by Deane Juhan.)

THE FASCIAL NETWORK UNPLUGGED

To get the organic sense of the fascial network as a sensory surface, let's extract it as a system from the body. In other words, imagine we make everything cellular invisible, leaving the extracellular matrix (ECM) of proteinous fibers and mucous glycoammonoglycans (GAGs) that surround and provide the environment for all your trillions of cells.



Thigh fascia. While we do not have a complete picture of the “fascial body,” even after 500 years of anatomical study, we do have this approximation for a section of the thigh cleverly derived by Rolfer Jeffrey Lynn. In this picture, the outermost layer is the “unitard” of the fascia profundis—specifically the fascia lata. *Reproduced from U.S. National Library of Medicine's Visible Human Data Project with kind permission.*

This image—which we don't really have yet, even after 500 years of anatomy—would show us the tough but elastic basement membrane for the skin, followed by a loose areolar network with fewer fibers and more gluey GAGs (remember, the fat cells that are profusely distributed through this layer would be invisible), followed by the thin fascia profundis that wraps the entire body like a unitard.

Pushing out against this layer are the muscular layers, but since the muscle tissue itself has been made transparent in our magic experiment, we would see the bluish white of the epimysium covering each muscle bundle, blended with the further bundling (like grapefruit sections) of perimysium, down to the cotton candy of the endomysium that wraps in spirals around each muscle cell.

Between the muscles we would find a variety of fiber from loose and lubed areolar mesh to tough intermuscular septa—often both for different parts of the same muscular interface.⁴ The fascia lata/iliotibial tract, for instance, varies as you pass from superior to inferior and from posterior to anterior. Where it is meant to slide, it slides on the vastus lateralis; where it is meant to stick, it sticks.⁵ Trouble is, as you know, sometimes it sticks where it shouldn't, and sometimes it slides where it should stick (leading to hypermobility). Closer to the bone we would find the density of ligaments blended into the fascial periosteum and a leathery matrix of collagen within each bone and cartilage.

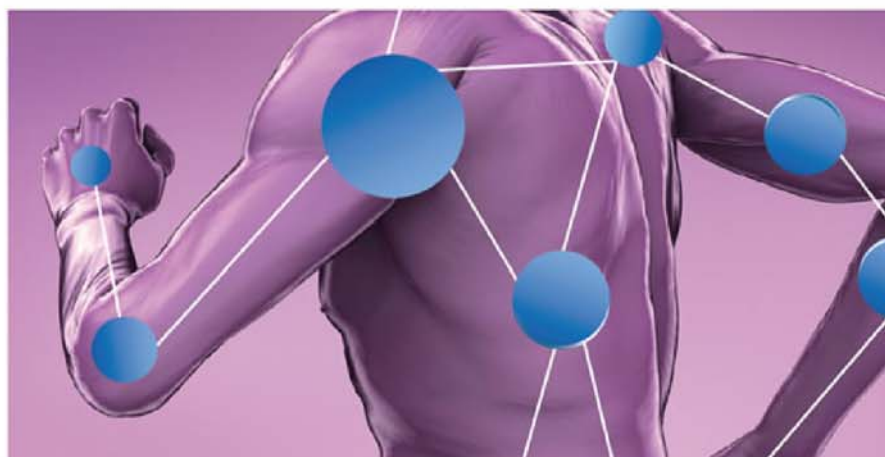
But the entire ECM or fascial webbing would not stop here. The dura around the brain are made of fibrous cloth, as are the sheaths of the spinal cord and all the peripheral nerves. You could see the nervous system's shape in the outline of its fascial linings; the vascular system would be similarly outlined by its fascial "tunics."

Except for the open lumens of the bronchae and alimentary canal, the fascial net spreads out into your organs as a wider mesh to hold their cells in place. It is a very loose mesh in the breast, lung, face, and pancreas; a bit tighter in the kidney, spleen, and liver (the body's filters); and still denser in the heart and the sacs and ligaments that hold all these organs together and bind them loosely to the body wall.

As this "fascia person" walked and talked, you would see the outline of the body from the skin on in: the bones and cartilage would be very dense and leathery, while the organs would be filmier on the inside and outlined on the outside by their pleura and peritonea. Each muscle would be clear from its envelopes and tendons; the face and eyes would be a bit of a shadow since the fascia is so thin there. Got the picture? This is what's in your body that *isn't* cellular—what runs between and around the various cells.⁶



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SEEING THE BIG PICTURE

Now let's start adding things back in to the mix. First, add water: all these gluey substances and almost all the fibers are wet. There are several liters of interstitial fluid at any moment in your body. Much of it is in the lymph system, though it is constantly shifting back into the veins (and thus becoming part of the blood volume) or being pushed into a cell to become part of its cytoplasm.

Then we'll add the cells back, group by group (connective, neural, epithelial, and muscle). We can start with the connective tissue cells that made this fascia person of the body's building materials.

First come the many millions of fibroblasts that make all these collagen fibers and the recently discovered myofibroblasts that can tense or release the fascial sheets.⁷ Then come the trillions of white and red blood cells to stir into the soup of the blood. Next we'll put in the fat cells that will fill in under the skin and around the organs, and surround all the nerves to insulate them.

In the brain, we can add the glial cells back in. Now here's a surprise: there are nine times as many glial (gluey) cells in your brain as there are neurons.⁸ Your brain is filled with nerves, yes? It's the biggest plexus of nerves there is, right? Right, it is



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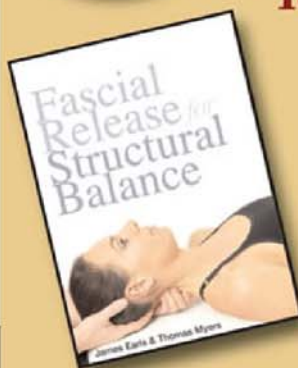
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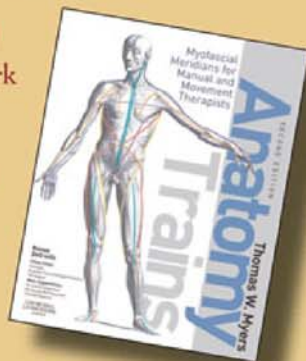
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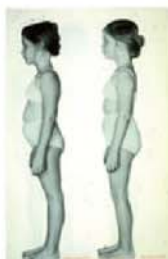
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the biggest plexus of nerves, but it is surrounded, invested, and infused with nearly 10 times as many connective tissue cells. When I first came across this in research, I had to ask myself: why hadn't I heard this before?

The answer is that these many glial cells—astrocytes, oligodendrocytes, Schwann cells, monocytes, melanocytes, etc.—have been assumed by scientists to play only a supporting role to the neurons, helping them get fed with food and oxygen.

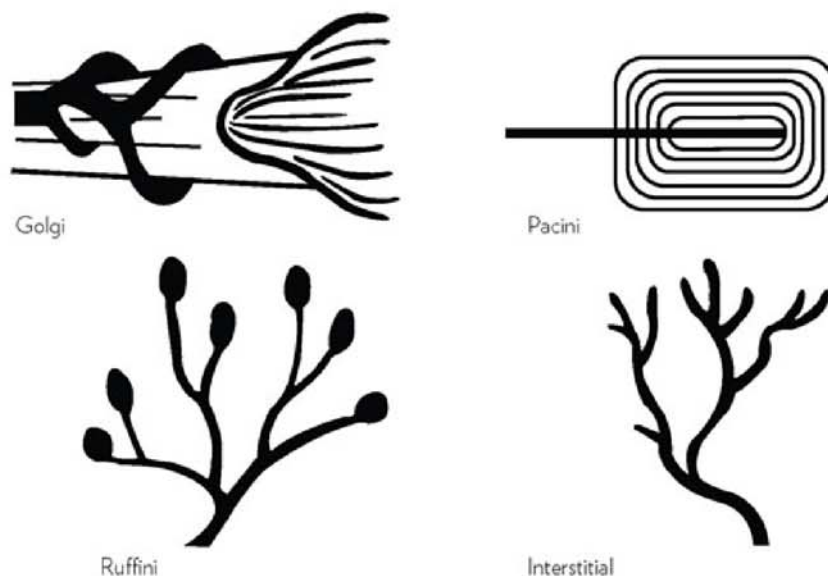
Only recently are these cells showing up in consciousness studies, where they have been shown to “light up” during certain brain states (notably emotional ones). More recently, they have been shown to cluster around the synapses, where they have a role in regulating neuropeptides and transmitters, thereby affecting our mood and mental tone.⁹

Thus, the role of the connective tissue system in consciousness has moved from the back seat of speculation into the passenger seat of how, exactly, does it participate in consciousness? My own belief is that we have overplayed the role of the nerves and the neurons in consciousness, while we dismissed the role of the connective tissues. After all, every cell came from one mother (the ovum), so why should they all not have a role in our sense of ourselves? I suspect we will find the connective tissues within the brain and around all the nerves (the perineural system) to be pivotal, maybe even in the driver's seat, when it comes to fundamental consciousness.

But I'll get off my “conscious fascia” soapbox and back to fascia as a sense organ. So now we have the fascia person—the supposedly inert ECM, plus the connective tissue cells which make and maintain it. Now, let us add the nerves.

There are billions of interneurons in the brain and spinal cord, gray matter, and lots of motor nerves going to muscles and glands. But if we look

NERVE ENDINGS



Although most nerve endings in the fascia are modifications of stretch receptors, we can identify four main classes: Golgi tendon organs (GTO), pacinian corpuscles, Ruffini endings, and interstitial free nerve endings.

at the sensory neurons, what do we find? There are sensory nerve endings from the eyes, ears, nose, and tongue, of course, and some heat sensors in the skin, but the vast majority of receptors are all modifications of stretch receptors, and all reporting from the far-flung corners of our fascia person. Why so many? Because we need to know where we are in space; because we need to know very precisely, second by second, what tissue is being stretched, what is being compressed, and what is resting comfortably.

So just to be clear, we are talking about the sensory nerve endings that occur in our body's collagenous network of fascia and report to the central nervous system about the state of play in these fibers.

Most of us are familiar with the Golgi tendon organs (GTOs) that infuse dense, regular tissues such as tendons, and measure how much the natural “crimping” in the fibers

is straightened by the load on that tissue. Only 10 percent of these GTOs are actually in the tendon; many reside in musculotendinous junctions and aponeuroses.

But these nerve endings are only part of the story. Pacinian or paciniform endings, also located in the myotendinous junctions, but also in the capsules and spinal ligaments, report rapidly changing pressures (vibration) in the fascial net. Ruffini endings tend to respond to deeper and sustained pressure. This suggests that chiropractic manipulations stimulate more the pacinian receptors, while the melting touch of deep-tissue work stimulates more the Ruffini endings, which inhibit sympathetic activity (and thus calm us down). This creates a link between fascial stimulation (such as we do in bodywork) and autonomic responses or arousal and relaxation.¹⁰