



fascial structure

Fascia is a fibrous connective tissue whose importance has long been neglected. However, as our body of research has expanded, it is now understood that fascia is critically important to the structure and function of the musculoskeletal system. Indeed, it might not be long before the term *musculoskeletal system* is replaced by the term *myofascioskeletal system*. An understanding of the structure and function of superficial and deep fascia throughout the body yields important implications for manual and movement therapies.



Fascial Web Structure

Fascia is a connective tissue that wraps and envelops our body, providing a pervasive web that interconnects all tissues of the body. Simply put, it is fascia that is responsible for the cohesiveness and unity of our body. Fascia is located superficially and deep within the body. Superficially, it is located directly beneath the skin where it creates a honeycomb structure that contains adipose (fat) tissue. Deeper within the body, fascial planes wrap around musculature. Fascia is also integral to the musculature itself by providing endomysial sleeves that contain individual muscle fibers, perimysial sleeves that contain muscle fascicles, and epimysial sleeves that contain the muscles themselves. The tendons or aponeuroses of a muscle that connect it to its bony attachments are actually continuations and melding of the endomysia, perimysia, and epimysium of a muscle¹.

Further, muscles have fascial attachments to adjacent soft tissues, including ligaments, joint capsules, fascial planes, and other muscles. For example, the superficial fibers of the tendons of contiguous muscles that are oriented end to end are usually continuous into each other, forming myokinetic chains, also known as myofascial meridians (Figure 1). Muscles also send out fibrous slips that attach laterally to adjacent musculature and other soft tissues, causing a lateral transmission of force. It is clear that the classic model of a muscle that simply attaches into bones via its tendons needs to be updated: approximately 30% of a muscle's attachments, and therefore its pulling force, is exerted into adjacent soft tissues.

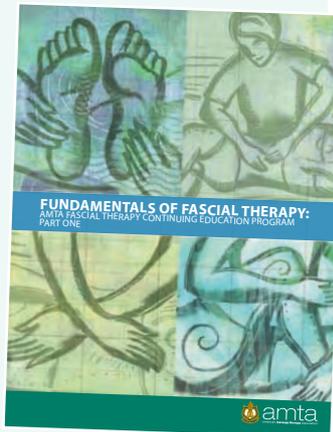
Fascial Web Function

Fascia is certainly the principal anatomic structure of the body. It appears to also be a principal functional structure of the body as well. Due to its strong tensile nature, fascia can mechanically transfer pulling forces throughout the body. Indeed, much of the stability of the body is provided by fascia via what is known as the tensegrity model: tensegrity refers to the tensile (pulling) forces that hold structures in their appropriate postures. Because fibroblastic cells of fascia can adapt to pulling forces and transition into myofibroblasts via the production of the contractile protein actin, fascia can function to not just *passively* transfer mechanical forces, but to also create *active* mechanical contractile forces.

Fascia is embedded with pain and proprioceptive fibers and therefore functions as a major sensory organ of

The terms fascia and fascism share the same Latin word root origin, *fascia*, which means bandage.

Fascial tissue is so named because like a bandage, it wraps around and connects structures. The term fascism derives from the Latin word *fasces*, which was a bundle of rods tied (bandaged) around an axe, and was an ancient Roman symbol of authority. The symbolism of the fasces represented strength through unity because whereas a single rod is easily broken, a bundle is difficult to break.

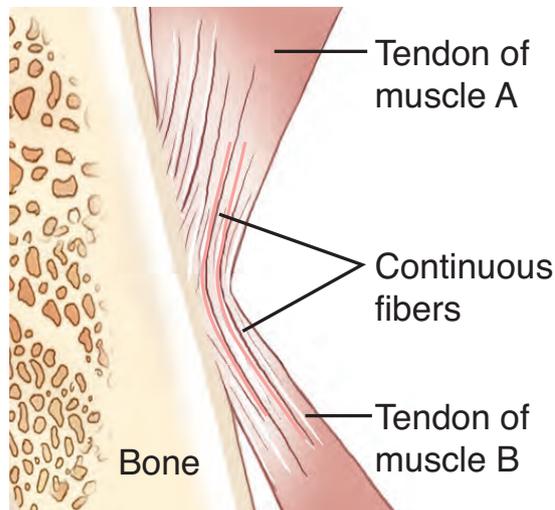


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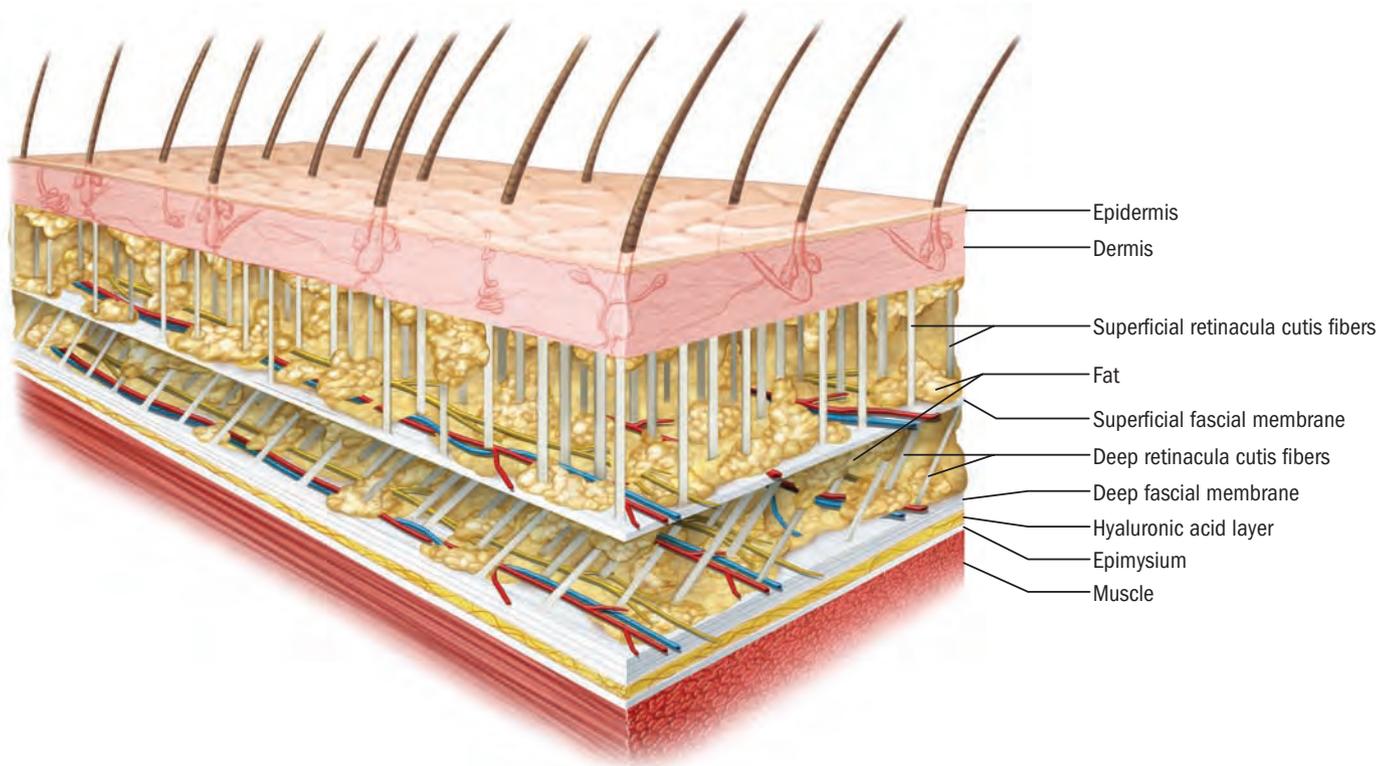
has you covered with its Fascial Therapy Continuing Education Program. This two-part program aims to keep massage therapists current in the profession while advancing their knowledge and skills. The comprehensive program outlines fundamental information on numerous techniques related to fascial therapy. Available online now at amtamassage.org

▼ **FIGURE 1. THE MORE SUPERFICIAL FIBERS OF MUSCLES OFTEN ATTACH INTO EACH OTHER.**

FROM MUSCOLINO JE: KINESIOLOGY, THE SKELETAL SYSTEM AND MUSCLE FUNCTION, 2ED. ST. LOUIS, ELSEVIER / ILLUSTRATED BY JEANNIE ROBERTSON



1 For more on the structure of muscular fascia, see the *body mechanics* column "reversing anatomy: from muscles to myofascial meridians" in the Summer 2010 mtj.



▲ **FIGURE 2.** CROSS-SECTION FROM THE SKIN TO THE MUSCULATURE, SHOWING FASCIAL MEMBRANES AND RETINACULA CUTIS FIBERS.

ILLUSTRATED BY GIOVANNI RIMASTI. (MODELED FROM AN ILLUSTRATION BY STECCO.)

the body as well. Interestingly, fascia is also embedded with sympathetic autonomic motor fibers. And when we consider that pressure applied into fascia can create a piezoelectric effect, and that this electric charge can then be conducted along the fascial web, fascia may prove to be the missing link between the physical structure of the body and the meridians of energy flow that are the basis of acupuncture and acupressure.

Superficial Fascia

Superficial fascia, also known as subcutaneous fascia because it is located immediately beneath the skin, is defined differently by various sources. Some sources define it narrowly as just the fibrous membrane that is located between the skin and the initial deep fibrous fascia layer that envelops the musculature. Other sources include the superficial and deep retinacula cutis fibers that connect to the superficial fascial membrane as part of the superficial fascia (Figure 2). Defined either of these ways, superficial fascia is composed entirely of fibrous tissue. However, because adipose and other cells, as well as molecules (e.g., glycosaminoglycan molecules) often occupy the spaces between the retinacula cutis fibers, some sources include all the tissue in this region as superficial fascia. Because these other cells and molecules are loosely organized, subcutaneous fascia may be described as loose fascia or areolar fascia.

Examining the fibrous superficial fascia, we see that it is composed of a fibrous membrane that runs parallel to the skin. Even though this membrane is given different names in different regions of the body, for example, Scarpa's fascia in the abdomen and cribriform fascia in the proximal thigh, it is continuous throughout the entire body (Figure 3). The superficial fascial membrane is important because it provides channels and passageways for nerves and blood and lymphatic vessels to travel throughout the body. These neurovascular vessels send perforating branches through the superficial fascial membrane to feed the tissues of the region. An implication for health is that if the membrane is placed under tension and consequently stiffens, it could potentially pinch off and restrict flow within these vessels: impinged nerves could cause sensory abnormalities including numbness, tingling or pain; impinged veins and lymph vessels could create congestion in the region by causing the buildup of metabolic waste products; and arterial impingement could cause ischemia, denying local tissue of its nutrient supply.

Retinacula Cutis Fibers

The superficial fibrous membrane is connected to the skin via superficial retinacula cutis fibers; and it is connected to the deep fibrous fascial membrane via deep

---> **For more on fascia,** have a look at the work of Luigi, Antonio, and Carla Stecco, as well as Serge Paoletti, Robert Schleip, Tom Findley, Gil Hedley, Tom Myers and others. Further, the 3rd International Fascial Congress will be meeting in Vancouver, British Columbia, Canada in March of 2012.



► **FIGURE 3. SUPERFICIAL FIBROUS FASCIA OF THE LOWER EXTREMITY.**

ILLUSTRATED BY GIOVANNI RIMASTI (MODELED FROM PAOLETTI, S: THE FASCIAE: ANATOMY, DYSFUNCTION AND TREATMENT, SEATTLE, 2006, EASTLAND PRESS)

retinacula cutis fibers. These retinacula cutis fibers allow for sliding motion between the skin and the superficial and deep fascial membranes. However, when thickened, they can form vertical septa that act to restrict motion by firmly adhering the skin and fascial membranes to each other; this naturally occurs and is desired in the palm of the hand and the heel of the foot. However, in other regions of the body, increased thickening of the retinacula cutis can be viewed as adhesions that excessively restrict motion and negatively impact function.

It is commonly asserted, and indeed makes sense, that if the connective tissue is dehydrated and loses its viscosity, then the skin and superficial and deep fascial membranes can become “glued” together. Binding the skin to the fascial membranes decreases the ability of the skin to slide along these deeper tissues. Further, any pressure applied to the skin would be transferred to the fascia, tugging at it. Given fascia’s sensory innervation, this could become the source of pain. Some sources believe that the *tender points* of fibromyalgia may be due to this phenomenon. In the case of adhesions between the skin and the superficial fascial membrane, tech-

niques such as skin rolling would likely be very beneficial.

The superficial retinacula cutis fibers run in a perpendicular direction between the skin and superficial fascial membrane. The deep retinacula cutis fibers are generally thinner and oriented obliquely between the superficial fascial membrane and the deep fascial membrane (see Figure 2). As a result, the superficial fascial membrane is more adherent to the skin than it is to the deep fascial membrane. This allows for greater motion of the underlying deep fascia (and musculature) independent of the superficial fascia and skin. Of course, dehydration or increased thickening or densification of these tissues can result in decreased mobility between all layers.

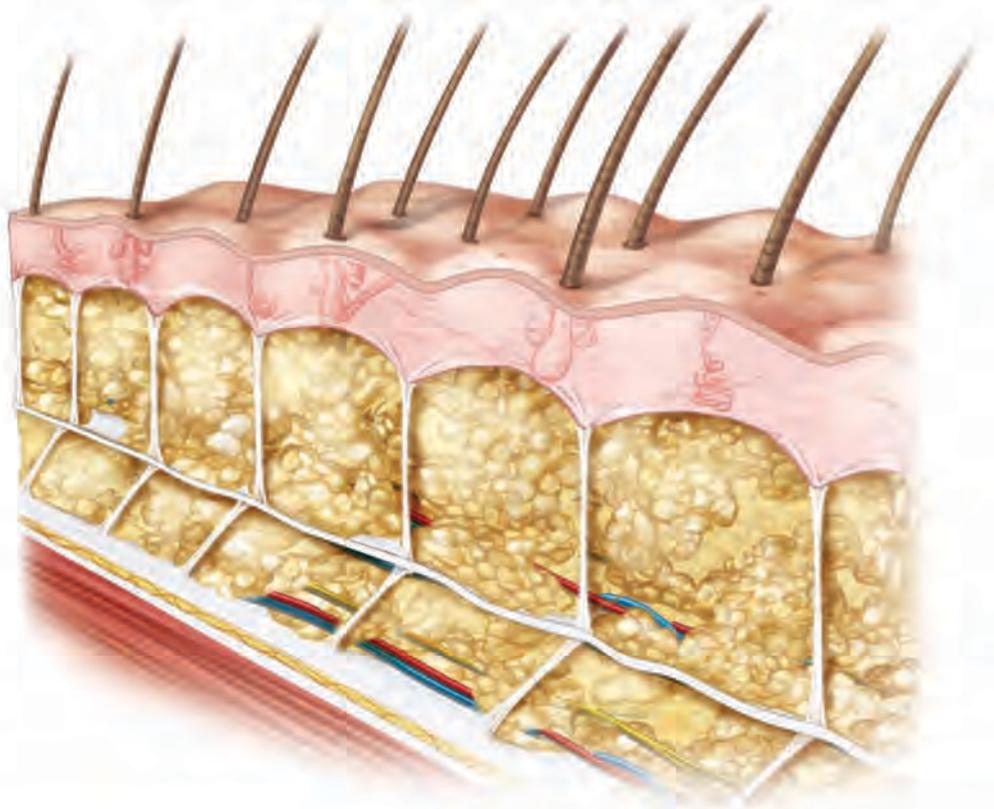
Deep Fascia

The deep fascial membrane envelops the underlying musculature that is deep to the skin (or envelops periosteum of the bone in regions where muscle tissue is not located). As discussed, the deep fascial membrane is connected to the superficial fascial membrane by the deep retinacula cutis. Deep to the deep fascial membrane is the epimysium of musculature; however, there is usually a layer of hyaluronic acid molecules located between them. Hyaluronic acid is a glycosaminoglycan molecule that is created and secreted by the deep fascial membrane. Its purpose is to lubricate the interface between the deep fascial membrane and the epimysium of the underlying muscle so that gliding can occur between them. When this region is subjected to excessive physical stress, perhaps due to postural strains, overuse, or excessive exercise, the deep fascia increases its rate of hyaluronic acid production. However, instead of increasing lubricating viscosity and therefore motion, the opposite occurs. The hyaluronic acid molecules increasingly bond with each other and entangle, creating adhesions that effectively glue the tissues to each other and decrease range of motion. A research study has even found a relationship between increased concentrations of hyaluronic acid and neck pain.

It is important to note that increased heat has been found to reverse hyaluronic acid entanglements. This likely explains the efficacy of using heat before stretching and soft tissue manipulation. Increased heat allows the body’s fascial interfaces to more effectively glide along each other (it should be noted that moist heat may be more effective than dry heat because it is less likely to dehydrate and therefore stiffen the tissue). It has also been found that increased alkalization (i.e., raising the pH to make the tissue less acidic) also reverses entan-

▶ **FIGURE 4.** THE DIMPLED APPEARANCE OF CELLULITE IS LIKELY DUE TO TENSION OF SUPERFICIAL RETINACULA FIBERS PULLING ON THE SKIN.

ILLUSTRATED BY GIOVANNI RIMASTI.



gled hyaluronic acid molecules. This may explain why increasing local vascularity, especially venous return to remove acidic waste products of metabolism, through movement and soft tissue manipulation may improve range of motion.

Conclusion

It seems clear that it is no longer appropriate to view fascia as nothing more than some type of structural glue or packing material that connects the “more important” structures of the body to each other. As new research unfolds, and as we learn to critically think through the mechanics and metabolism of fascial tissue, we see that fascia itself is critically important to the structure and function of the body. Our evolving understanding of the myofascioskeletal system will continue to inform effective assessment and treatment techniques of manual and movement therapies. ■

cellulite

Fat in the body is largely stored in the spaces between the retinacula cutis fibers, between the skin and the superficial fascial membrane. The presence of the fat can press outward (superficially) on the skin, stretching it away from the superficial fascial membrane. This would cause a tension upon the retinacula cutis fibers; and this tension would be transferred to the skin and superficial fascial membrane. Some sources assert that the dimpled appearance in the skin of cellulite is due to the presence of stretched retinacula cutis fibers that are resisting the outward push on the skin where they are attached, and that the pain of cellulite occurs because of the constant tugging of the superficial retinacula cutis fibers upon the skin and superficial fascial membrane, both of which are richly innervated with sensory fibers (Figure 4).



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