THE LIVING MATRIX: UNDERSTANDING FASCIA – PART 1
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In this two-part article, Michael Kern reviews recent discoveries and conceptual shifts about fascia, with a particular focus on correlations with a Craniosacral perspective of the body.

"*This philosophy has chosen the fascia as a foundation on which we stand … By its action we live and by its failure we die … The soul of man with all the streams of pure living water seems to dwell in the fascia of his body.*"
Dr. A. T. Still

Until recently fascia was largely ignored by anatomists. In dissections it was treated as the wrapping that needed to be cut through and discarded before getting to the interesting stuff. It has therefore been called the "Cinderella tissue", because it's often been neglected (Schleip R., Klingler W. and Zorn A., 2010). However, in recent years many fascinating discoveries have been made, which interestingly correspond to insights made by Dr. Andrew Still, the founder of osteopathy, more than 120 years ago and Dr. William Sutherland, the founder of Craniosacral work, more than 75 years ago.

The term 'fascia' was once just used to describe the dense connective tissue organised in bands throughout the body, such as the plantar fascia in the soles of the feet, or the fascia lata at the side of the thigh. However, in 2014 the Fascia Research Society presented a much broader definition including much of our connective tissue, such tendons, ligaments, neurovascular sheaths, aponeurosis, deep and superficial fasciae, epineurium, joint capsules, cartilage, membranes, meninges, myofascial expansions, periosteum, retinaculum, septum, visceral fascia and intermuscular connective tissue (quoted in Bordoni B. et al, 2022). Another definition also includes bone as firmer parts within the body-wide fascial system (Levin S., 2018).

Connective tissues

One of the basic principles of Craniosacral work is that everything in the body is connected to everything else. Dr. Still described the body as "a unit of function" in which any part can affect any other part. The network of connective tissue is found from head to toe, and from the core to the periphery of the body. Fascia is a significant part of this integrated system that unifies the body providing a connecting medium between all parts. In Craniosacral Therapy fascia also plays significant role in expressing subtle rhythmic motion ('primary respiratory motion') throughout the whole body that conveys vital forces and an organising principle into our cells.

There is a continuous superficial layer of fascia that immediately underlies the skin, and a deeper network that surrounds and pervades all the body's internal structures. Fascia acts as an organ of support and helps to compartmentalise the different structures in the body. The musculoskeletal, cardiovascular, nervous, visceral and lymphatic systems all lie within the fascial system. In fact, each nerve, muscle, bone, vessel, gland and organ

of the body is surrounded by deep fascia—as is each individual nerve fibre, muscle fibre and each group of fibres. In fact, every “everything” in the body is enfolded in fascia. If you took away all of the internal substance of the body, you would be left with a cast of each body part made of fascia.

The fascia around a muscle, nerve or organ, etc., determines the space that these structures take up, so fascia maintains their shape. In addition, fascia helps all areas to work in coordinated patterns of movement. Therefore, to an important extent the structure and function of each part and of the body as a whole is influenced by fascia. However, inertia within the fascial network can place pressure on the internal systems of the body and reduce their ability to express inherent motility and health. As Dr. Still wrote, “All parts in the whole body obey the one eternal law of life and motion” (quoted in Sutherland W., Wales A, 1990).

Core and periphery

The dural membrane system surrounding and partitioning the central nervous system is part of the body’s unbroken chain of connective tissue. These membranes are continuous with the periosteum (lining) inside the cranial bones and sacrum. Other connective tissues are continuous with the periosteum outside these bones.

Large bands of fascial tissue hang down from the underside of the cranium, forming longitudinal compartments that traverse the length of the body. These longitudinal tissues hang from the cranial bones like great tubes that wrap the body’s various organs and internal structures (Kern M., 2022). Furthermore, as each nerve exits from the spinal canal it is enveloped in a sleeve of connective tissue, which is continuous with the dural tube of the spine. Once these dural sleeves leave the spinal canal, they join with the connective tissue network in the rest of the body, linking the core tissues of the ‘primary respiratory mechanism’ with the body as a whole. As a result, patterns of stress affecting fascia in the periphery of the body can feed back into the core, and vice versa.

Longitudinal arrangement

If the organising biodynamic forces of the body are expressed in health, these bands of connective tissue freely move in relationship to each other and allow for the unrestricted transmission of primary respiratory motion. Because of the predominantly longitudinal organisation of fascia, primary respiratory motion is largely transmitted longitudinally through the fascial network. This arrangement corresponds to the understanding in some traditional medical systems, where energy is also described as predominantly moving through the body in a longitudinal pattern. For example, in Chinese medicine, energy or *chi* is seen to move along *meridian* channels that are mostly longitudinal. Chi may be seen as an electromagnetic substrate that underlies the fascia.

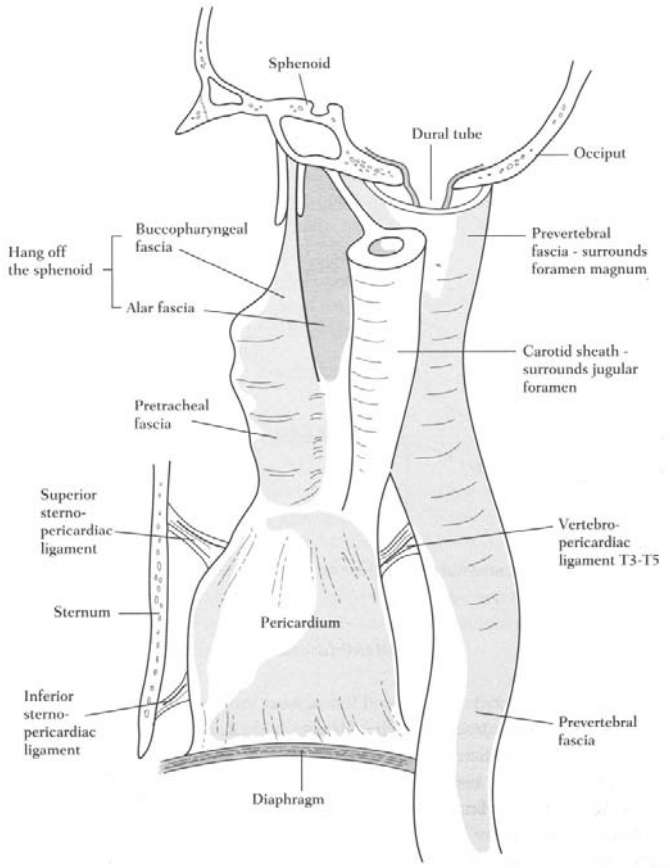

Figure 1: Fascial bands hanging from the cranial floor

Transverse diaphragms

However, significant transverse (horizontal) arrangements of fascia are located in four key areas in the body. These *transverse diaphragms* are found at the cranial base, thoracic inlet, respiratory diaphragm and pelvic floor. These are essentially places of transition, as they help to compartmentalise the different body cavities. The transverse diaphragms have been noted as locations where the flow of feelings and sensations often become blocked (Keleman S., 1989). They are where we may cut off under stress, creating a fragmentation of function, such as between the head and the body, the belly and the chest, or the legs and the trunk.

The body is an integrated system with all parts functioning in relationship to each other, with the fascial network acting as an important connecting medium. By palpating the fascial system it becomes possible to sense patterns of health and unresolved conditioning throughout the whole body. For example, a practitioner can put his or her hand on a patient's foot and palpate how primary respiratory motion is being expressed at the hips, pelvis, spine or chest. When doing this it is not hard for an experienced practitioner to sense how tissues at the opposite end of the body are functioning.

Embryology

Fascia derives from the embryological mesoderm; one of three primary germ layers that appear in our early development. The mesoderm forms all connective tissues in the body, including bone, ligament, cartilage, tendon, muscle, blood, the heart and other organs such as the kidneys and spleen.

According to anatomist and embryologist Dr. Jaap van der Wal, fascia is not just attached to muscles and bones, but is anatomically continuous with them. This can be attributed to their common embryological origin in the mesoderm (van der Wal J., 2009). In this way, fascia is intrinsically involved in the expression and regulation of coordinated patterns of movement.

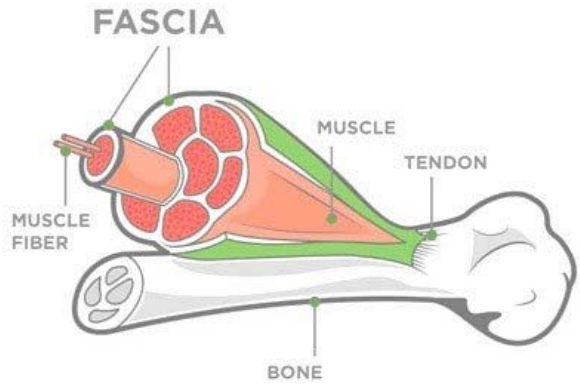

Figure 2: The continuity of fascia, muscle, tendon and bone

Furthermore, it's been found that mesodermal cells can guide the embryological development of various organs. For example, as long as developing liver cells stay inside a mesodermal environment, they will become liver. Potential pancreatic cells do not differentiate into mature pancreatic cells unless they are in a specific mesodermal environment (potential fascia). According to Schulz and Feitis (1996), this mesodermal environment may provide the specific energy field required for the form and function of these tissues to organise.

Between fluid and solid state

Fluid is everywhere in the body, with water making up an average of 65 percent of total body weight. Our bodies are basically fluidic in nature. The vital forces of the 'Breath of Life' are conducted through the body within its fluid medium. As life's organising forces are taken up in the fluid, rhythmic fluid fluctuations are generated.

There are basically two components in fascia: cells and the extracellular matrix. The cells typically make up less than 5% of the volume of fascia, while the extracellular

matrix consists of an abundant fluidic ground substance and fibres. The fibres consist mostly of collagen, with some elastin fibres. These *collagen* and *elastin* fibres are meshed together in sheets. Collagen fibres are hollow and make up over 70% of the proteins found in connective tissues, making collagen the most abundant protein in the body. The consistency of the fluid ground substance varies from being watery to relatively thicker and more 'gel-like'.

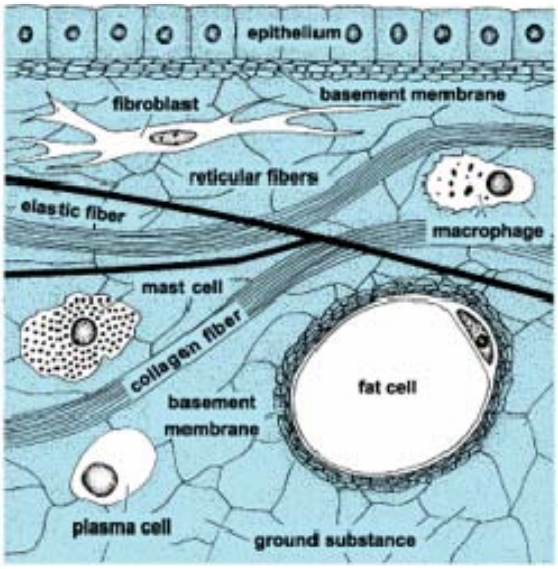

Figure 3: A fascial cell

Biophysicist Dr. Mae Wan Ho describes fascia as a "liquid crystalline matrix", an organic tissue that functions between a fluid and solid state (Ho M-W. and Knight D., 1998). A variety of different tissue types are formed, dependent on the fluidic nature of the ground substance and the quantity and arrangement of collagen and elastin fibres. Interestingly, the ground substance in fascia has a similar composition to cerebrospinal fluid (Erlinghauser R., 1959). Claire Dolby D.O. remarks, "In the cranial concept, at a core level cerebrospinal fluid expresses the potency of the Breath of Life within the dural membranes. In the whole body, interstitial and lymphatic fluids at a cellular level and a tissue level carry out this role" (Dolby C., 1989).

Fluidic nature

In health, fascial tissues move in relationship to each other, as well as express an intrinsic motility. Fascial motion occurs during our more pronounced voluntary movements and during our involuntary 'primary respiratory motion'. The fluid found between and within the different sheets of fascia helps to reduce any friction so that these motions can more easily occur. When there is no resistance provided by their surrounding fascia, the internal structures of the body have room to 'breathe' and therefore express their original pattern of health.

Dr. Gerald Pollack contends that in healthy fascia much of the extracellular fluid is 'bound water' that has a negative electrical charge and more oxygen, and is crucial to

healthy functioning (Pollack, 2014). Pathologies, such as inflammatory conditions or the accumulation of waste products, tend to result from a shift towards from a higher percentage of ‘bound water’ to ordinary ‘bulk water’ within the ground substance.

A reduction of fascial hydration has been found in many cases of low back pain, and is now thought to be a significant source of these clinical symptoms. Indications by Sommer and Zhu (2008) suggest that during movement fascia gets squeezed like a sponge and subsequently expands to get rehydrated. During this sponge-like motion some of the previous bulk water zones may then be replaced by bound water molecules. However, under-use and ageing tend to decrease fascial hydration. Around 120 years ago, Dr. Still observed, “This connecting substance [fascia] must be free at all parts to receive and discharge all fluids, and use them in sustaining animal life, and eject all impurities, that health may not be impaired by dead and poisonous fluids” (Still A.T., 1902).

Conductor of potency

Small amounts of cerebrospinal fluid (CSF) gain exit from the spinal canal through the dural sleeves that surround the spinal nerves, as well as in the olfactory nerves that pass through the ethmoid bone. The hollow collagen fibers of these connective tissues have been shown to be the agency by which this occurs, helping to transport CSF into the rest of the body (Erlinghauser R., 1959). This supports an original hypothesis by Dr. Sutherland, that cerebrospinal fluid potentises the whole body.

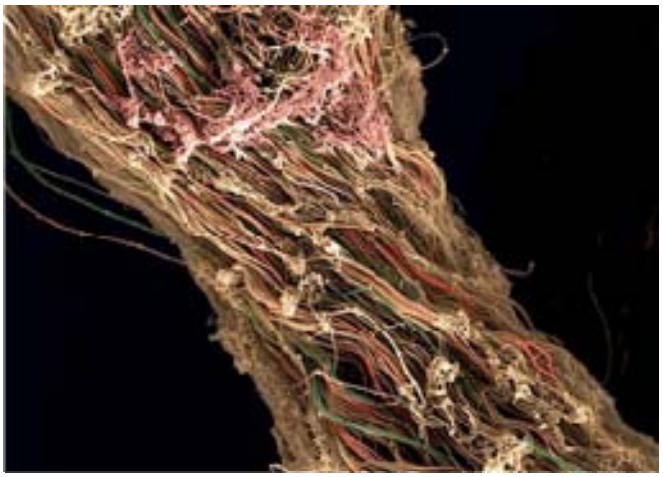

Figure 4: Collagen fibres in the knee

The collagen fibres are organised in the shape of a triple helix (i.e. a spiral), thus producing a spiral motion pattern within the fluid that moves through the fascia (Wilks J. and Knight I., 2014). Spiral motions in fluid are a common feature in biological systems and, according to Austrian forester and inventor Viktor Schauberger, they provide the capacity for generating and transmitting life-giving forces in nature.

It has also been found that the collagen fibers can transmit photons (light) and have piezoelectric properties, which is the ability to generate an electric charge in response to

applied pressure. The collagen fibers can be thought of as “fiber optics” for the body, in which impulses can be created by gentle pressures. Furthermore, the conductivity of collagen is dependent on how hydrated it is; the more hydrated, the more impulses can flow freely through the fascia.

In Craniosacral practice, we work with the intimate relationship between fluid and potency. We know that fluid acts as the carrier of life forces, but also the ample expression of this potency within the body can directly stimulate fluid dynamics. Where there is a lack of potency, fluid stasis or depletion can occur. However, fluid re-hydration is naturally restored when the natural expressions of potency are re-established. Therefore, if we are able to facilitate the movement of potency in the body (e.g. by resolving inertial fulcra or augmenting primary respiratory motion), the tissues can naturally re-hydrate.

Tensegrity

Tensegrity is a term coined by architect Buckminster Fuller to describe a system in which components stabilise their shape by continuous tension, rather than continuous compression (Fuller B.,1961). In tensegrity systems none of the rigid structures touch each other and often appear to hang in space as though unsupported. The body is now thought to operate as a tensegrity system, in which all parts are balanced in a state of reciprocal tension, with fascia playing an important role in suspending the more rigid structures such as bones. This marks a significant conceptual shift from the view that our bones are load-bearing structures, like the framing of a house. This is the same principle highlighted by Dr. Sutherland in the 1930’s when he described the function of the cranial ‘reciprocal tension membranes’, which is a system of dural membranes that is constantly held in a state of tension and which guides the subtle motion of cranial bones (Sutherland W., 1939).

Dr. Stephen Levin, an orthopaedic surgeon, coined the phrase ‘biotensegrity’ to describe the application of tensegrity principles to biological systems. He points out that if our bones acted like the beams and rafters in a house, then the force of regular daily loads would result in a shearing and crushing of the bones. Rather it is the ‘tensional members’, the muscles, fascia, ligaments and tendons, that can account for our ability to perform everyday tasks. As Louis Schulz observes, “Bones are spacers, serving to position and relate different areas of the connective tissue. Bones are not the supporting structures of the body; the connective tissue serves this function” (Schulz and Feitis, 1996). Compressive forces only become taken up in the joint spaces in states of mechanical strain and pathology.

In tensegrity structures, any pull or movement in one area will be transmitted and accommodated for within the whole system. Consequently, a fascial imbalance or restriction in any part of the network can affect other regions, thereby reducing the ability of the body to express its primary respiratory motion. Unresolved patterns of stress or strain held in the tissues, and scars are common causes of this. Tensegrity can therefore explain the complex interaction that maintains our structural homeostasis.

Figure 5: A tensegrity structure

Elasticity and rhythmic motion

Fascia is both pliable and tough, but until recently was also thought to be relatively inelastic. However, research now shows the presence of highly contractile fibres called ‘myofibroblasts’, which are the ‘building block’ cells of fascial tissue that play an important role in maintaining fascial tension. It has been found that these cells have the contractile characteristics of smooth muscle (Levin and Martin, 2012), and can be affected in many connective tissue disorders such as frozen shoulder and low back pain. Research suggests that fascia can contract independently of muscular action and thus actively influence muscle dynamics (Schleip, Klingler and Horn, 2005). Furthermore, an ability to recoil has been demonstrated in denser sheets of fascia, such as the thoracolumbar fascia (Wilks J. and Knight I, 2014). This spring-like ability to recoil is dependent on good hydration and plays a significant role in efficient movement.

Significantly for Craniosacral work, experiments have also shown that myofibroblasts exhibit a steady rhythmic motion when placed in a collagen-based matrix. This slow rhythmic motion has been measured at 100 second cycles (Follonier et al, 2010), and corresponds to the long tide described by biodynamic Craniosacral practitioners (Kern M., 2005).

In part 2, we will look at how fascia connects to the inside of cells, the discovery of abundant nerves within fascia and how Craniosacral practice can influence fascial function and whole body health.

Michael Kern will be teaching ‘The Living Matrix’, a four-seminar for all Craniosacral Therapists and Cranial Osteopaths from September 21st-24th 2023 in Berlin. This practical and stimulating seminar will explore many of the ideas explored in this article

and equip practitioners with a range of Biodynamic Craniosacral Therapy skills to work with the fascial network. For further details and bookings, please contact:
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