Keeping the Body in Body Psychotherapy

A Neurobiological Approach to Connective Tissue

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ABSTRACT

Body psychotherapy has been strongly influenced by far-reaching research in neurology. While these influences are easily justifiable, there has been a concomitant influence of moving away from the body to a brain-based model. Concurrently, research in the manual therapies in connective tissue, and specifically fascia, has revealed how and why body-based techniques can have such a profound effect on a patient. Taking this further, this research has revealed a heretofore unknown communication system among the three nervous systems and the body, resulting in the formulation of a more integrated body/mind model. I will highlight the growing connections between connective tissue (CT) and the three nervous systems in the body and show the role CT plays in these connections. The main theme is connective tissue's *plasticity*; its ability to adapt and readapt to changing conditions locally and systemically, externally and internally, as well as physically and emotionally. The plasticity of CT lies at the heart of any therapy that involves either movement or touch. It is the biological, body-based means of body psychotherapy's efficacy.

Keywords: fascia, Reich, interpretive interoception, plasticity, connective tissue, nervous systems

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Stated simply, the structural framework of the body is simultaneously an energetic and informational framework. This explains how life could function for 2.5 billion years before a nervous system was developed.

Two of Reich's founding concepts in body psychotherapy, "muscular armor" and his emphasis on plasmatic functioning, are prescient to recent research in connective tissue (CT), resulting in a deepening and strengthening of the body/mind unity model. Until recently, connective tissue was ignored by anatomists and medicine as a lifeless, inert, "packing" material around organs and the more important tissues, e.g., heart tissue, with a special fascination for the most important evolutionary development, the central nervous system (Schleip, in Schleip et al., 2012, p. xv).

In response, in 1977, Ida Rolf, founder of Structural Integration (Rolfing), called for a "down-grading of the nervous system."

> Fascia was the white packing stuff that one needed to clean off in order to 'see something'. Similarly, anatomy books have been competing with each other how clean and orderly they present the locomotor system by cutting away the whitish or semitranslucent fascia as completely and skillfully as possible. ... showing the "shiny red muscles each attaching to specific skeletal points" (Schleip, in Schleip et al., 2012, p. xv).

Research now shows that connective tissue plays a major role in all of life's functions: disease control, movement, creating shape/form, thermal regulation, creating spaces within the body for tissues and organs to function, insulating the nerves by producing myelin sheaths, protecting the body from stress and impact, healing and tissue regeneration, erectness, producing collagen and elastin fibers, plasma/ground substance (GS), blood cells, lymph cells, heparin, and antibodies (Davis, 2018). More recent

The main theme is connective tissue's plasticity; its ability to adapt and readapt to changing conditions locally and systemically, externally and internally, as well as physically and emotionally.

research has shown how CT is involved in the sensory activities of proprioception, nocioception and even interoception informing the three nervous systems: central, autonomic, and enteric of the subjective experiences of the body (Schleip, 2012; Myers, in Schleip, 2012).

In 1997 I published *The Biological Foundations of the Schizoid Process* (Davis, 1997), showing the similarity between CT/plasmatic functioning and the physical defense system employed by the schizoid character. More recently, I have shown that Reich's model of muscular armor needed an update (Davis, 2018). A muscle cannot contract and hold for 20 minutes, so how can contractions remain for a lifetime? And how can these contractions release? The answer is in the connective tissue element of the myofascial system. Collagen fibers develop in the direction of the stress, supporting the muscle – Wolff's law (Oschman, 1981). When the stress is released, the tissue reorganizes itself and returns to its prestressed state. I believe that all the physical therapies rely on the same underlying principle: this plasticity of the connective tissue. In body psychotherapy (BP), the effects of all movements, exercises, and respiration depend on connective tissue's ability, under the right conditions, to reorganize itself.

A Case Example

A patient of mine suffered from a rare, life-threatening disorder called Dunbar's Syndrome (MALS). Due to a buildup of fascial tissue, the passageway of the aorta through the fascial plane of the diaphragm ligaments near the 12th thoracic vertebra was compressed.

In BP, the emotional history of the patient is in the body's form and functioning. With a disorder like Dunbar's, we ask ourselves why and how is the aorta compressed, endangering this woman's life? The train of thought is as follows. The diaphragm is involved in breathing. In normal full inspiration, the diaphragm would relax and move downward as the lungs inflate, fully allowing for what is referred to in body psychotherapy as "belly breathing." In surprise/shocking moments, only the upper part of the lungs inflates in a short burst of inspiration, creating an upper thorax expansion with the lower ribs protruding.[1]

What would cause a continuously recurring contraction of the diaphragm? Fear. In talking about her childhood, it was revealed that her first five years of family life were not remarkable, but everything changed at five years old when her parents divorced; all her mother's anxiety and unhappiness was directed at her and her sister. "I never knew what was going to happen. One day as I was walking around a corner into the next room, my mother suddenly slapped me, knocking my glasses across the room, breaking them when they landed. She then slapped me again for breaking my glasses!"

This model holds that from five years old onward, she lived with a background fear state. Her diaphragm was chronically overburdened, resulting in CT fibrous buildup in the aortic hiatus where the aorta passed through, thus narrowing the passageway. The treatment is surgery, whereby an incision is made in the ligament tissue (median arcuate ligament – MALS) and the celiac ganglia, the nerve tissue in the upper abdomen, which is the sympathetic part of the autonomic nervous system (ANS), is removed. Surgery itself is invasive and can cause anxiety in a patient, especially if she is already anxious. It didn't help that the first surgery was performed incorrectly, and she needed a second operation. The two operations were not successful in eliminating the symptoms or in allaying her fears.

It is interesting that the treatment is less successful with older people and people with psychiatric problems.

> This study supports previous findings that surgery improves QOL [Quality of Life] … In addition this study provides evidence of the relevance of psychiatric comorbidities in patients with MALS and predictive impact of presurgical psychiatric disorders in adult patients with MALS indicate a need to support these patients from a biopsychosocial perspective with a comprehensive multidisciplinary program, including psychological services. (Skelly et al., 2018, p. 1420)

She was in her middle 40s, so age was not a problem, but she certainly had emotional problems, that had never been properly addressed. From a body-oriented psychotherapy view, the surgery was ineffective because her psychological stress, her fear, was the original source of the fascial buildup in the aortic hiatus. "There is no evidence to suggest that the changes in QOL from surgery improve all psychological symptoms. This analysis supports the need to continue to study this population and to consider psychological interventions as an adjunct to surgery in adult patients with MALS" (Skelly et al., 2018, p. 1420).

In addition, there are two possible speculations about age. One is that as we get older, the CT tissue loses its

1. This is a traditional description. But there are disorders – "Costal Paradox", "Diaphragmatic Paradox" – where the diaphragm rises during inhale. And in working with respiration in therapy, it is not uncommon to find paradoxical breathing with no medical diagnosis.

plasticity, so older people would not respond as well to the surgical intervention. It could also be understood that older people have suffered through more stressful events than younger ones, and so the fibrous buildup is more extensive and ingrained into the surrounding tissue and character structure.

From this perspective, this case fits in well with our model of chronic diaphragmatic tension caused by fear. Firstly, because of the held inspiration, the fascial tissue is overloaded, begins to thicken, and becomes fibrous, narrowing the passageway. Surgery is needed to clear this excess tissue away. But it will grow back if the cause of the buildup, the stress of chronic fear, is not resolved. This is the physical basis of Reich's muscular armor. Secondly, the sympathetic nerves of the autonomic nervous system (ANS) are severed. Sympathetic system activation is associated with anxiety/fear states. And thirdly, people with "psychological symptoms," i.e., elevated anxiety, respond poorly to the treatment, which brings us back to point number one: the cause of the ANS imbalance, her fear, had not been addressed.

The above explanation is all very well and good, except it is not possible to continually contract any muscle. The model offered contends that typically someone who is anxious would be stressing their diaphragm and raising their shoulders for years in a startle reflex position – a chronic Moro reflex. But we know it is not possible to do this for years. The nerves desensitize, the muscles tire, and the shoulders fall back down. To complicate matters further, body-oriented therapists of all disciplines know that patients do hold their shoulders high for many years. And we help them to release that tension. In addition, in a BP model, it is understood that our personal history is represented, "held," in our musculature. If this were true, all that would be necessary would be to receive muscle relaxants, we would all have "a good cry about Mama or Papa" or our first "broken heart," and then we would be free to move on in our lives. But we know this is not the case.

Yet, interestingly, these responses do happen in the manual therapies (MT) when tissue is manipulated. In massage, Rolfing, osteopathic treatments, etc., as well as BP sessions, emotions, memories, and repressed movements emerge. How can all these seemingly contradictory statements be true? The answer lies in the plasticity of the connective tissue (CT) element of the myofascial system.

Connective Tissue's Plasticity

The efficacy of the manipulation and movement techniques of all body-oriented therapies are dependent on CT's plasticity. We work with CT's incredible ability to change its structure and function according to *local* input, and to change back again under the right conditions. This plasticity is what produces the change that brings the body back into balance and health. The right conditions are pressure, heat, and electricity. All touch, movement, exercise, and stretching will affect the state of the fibrous quality of connective tissue, because they all create pressure on the tissue. Stecco (2015) described how collagen production responds immediately to changing conditions in the body through the activity of the fibroblasts [cells that produce collagen and elastin fibers], which produce additional fibers. These changing conditions can be any activity the person engages in, including rest and sleep, exercise, and injury. Collagen regeneration is a continuous process but is accelerated by increased activity or injury; it will adapt to all local conditions and influences, both positive or negative, physical, and psychic.

> Tissue damage induces fibroblastic mitosis. Fibroblastic proliferation and degradation is a normal occurrence in everyday mechanical loading such as walking, running and most movements. Even mechanical loading in rest and sleep stimulates CT function. Collagen synthesis in the patellar tendon increases by nearly 100% as a result of just a single bout of acute exercise, and the effect is still evident three days later. In the initial training period, collagen turnover in tendons (i.e., the balance between synthesis and degradation) is increased and there is a net loss of collagen. This enables a tendon to restructure and adapt to an increasing loading pattern. It is not until training continues that there is a net gain in collagen synthesis. (Stecco, 2015, p. 6)

Oschman (2000) described how this process happens from a bioelectric perspective.

> The mechanisms by which cells lay down or reabsorb supporting materials (collagen) in bone and connective tissue are understood. Electric fields generated during movements signal cells (fibroblasts in connective tissue, osteoblasts in bone) to lay down collagen in the direction of tension, and thereby strengthen the tissues. With less loading or movement, the electric fields are weaker and less frequent, and the cells reabsorb collagen. (Oschman, 2000, p. 157)

In addition, Rolf (1977) wrote about CT's metabolic plasticity from another perspective, a more primary level: ground substance (GS), which is mostly an amorphous semiliquid gel, similar to the white of an egg, and is the universal, internal environment. (The term ground substance has replaced the term plasma, and is used in different formulations in biology, anatomy, and the manual therapies.) All fibers and cells from *every* tissue type are embedded in the plasma/ground substance. She emphasized that, while fascia is made up of collagen and elastin fibers, these fibers are embedded in GS, which is the source of CT's plasticity. Her explanation helps us to understand the previously inexplicable responses I began to see in my patients and hear from them once I began working with a CT-based model. This plasmatic, primary plastic quality in GS is also the reason why I have stayed with a systematic, matrix-model of CT in the touch technique in Functional Analysis (FA), and not with any particular anatomical model, such as the myofascial system, fascia, tendons, or ligaments.

Stecco's (2015) description of collagen synthesis in the patellar tendon and Oschman's (2000) bioelectric description of collagen synthesis comment on how quickly collagen can change. In explaining this plastic quality of CT, Rolf pointed out that compared to the metabolic changes in ground substance, collagen responds more slowly.

> Therefore, the speed so clearly apparent in fascial change must be a property of its complex ground substance. The universal distribution of connective tissue calls attention to the likelihood that this colloid gel is the universal internal environment. Every living cell seems to be in contact with it, and its modifications under changes of pressure should account for the wide spectrum of changes seen in Structural Integration. (Rolf, 1977, p. 42)

Colloid gels, such as ground substance, are easily broken down, which is how Rolf understood the rapid changes induced in the body by applying pressure. It is the connective tissue fibers and GS, not the muscle fibers, that are relaxing, or, better said, reorganizing.

Studies have shown that

> ... application of pressure results in a flow of interstitial fluids and ground substance away from a region of pressure. If stress, disuse, and lack of movement cause the gel to dehydrate, contract, and harden the application of pressure seems to bring about a rapid solation [return to a sol i.e., more liquid] and rehydration. Removal of the pressure allows the system to rapidly re-gel but in the process the tissue is transformed, both in its water content and in its ability to conduct energy and movement. (Oschman, 2000, p. 170-171)

The exercises used in many forms of body and movement psychotherapies involve stretching, which applies pressure to the tissue. This is the same as what manual therapies do in terms of force, shear as well as exercise. Even though practitioners are affecting the connective tissue, which is what releases the muscular contractions, BP still thinks in terms of muscle tissue tension and release.

The Points & Positions Touch Technique in FA is specifically designed to take advantage of the plasticity of connective tissue, but in a different manner than either the manual, the movement therapies, or traditional body psychotherapy. There are three differences. FA is interested in all forms of connective tissue within a systemic CT matrix throughout the entire body, not just fascia or the myofascial system. The second is we do not manipulate the tissue in the classical sense, but apply light, specific pressure with a fingertip, or gentle compression in the Positional Release manner of Jones (Jones, 1983). As well, we rarely use exercises, although spontaneous movements may arise during treatment and, depending on their quality, we may support them.

This transformative phenomenon as a restructuring of the CT tissues is best described by the word *metaplasia*: the transformation of one type of adult tissue into another. With metaplasia we are back to plasma: *plasia* comes from *plasis*, Greek for molding.

> The differentiated cell of connective tissue is unique in that it retains its embryonic capacity for multiplication and transformation into other lines of specialized cells. Under ordinary conditions these cells are quiescent and inconspicuous: however, under extenuating circumstances (growth stimulus, injury, disease) ... their progeny transform into the specialized cells required to meet the altered circumstances.
>
> Of equal significance is the activity of these cells in the process of metaplasia; the remarkable regenerative capacity to differentiate into the elements forming the replacing tissue is most manifest. (Snyder, 1956, p. 67)

When a muscle is chronically stressed, either from a physical or a psychic/emotional event or a combination of the two, the translucent CT "envelope" surrounding that muscle, easily seen as the thin shiny membrane around meats, will thicken up, the number of CT fibers woven through the muscle will increase, and the tendons that form at each end of the muscle, which is a combined extension of the CT envelope and the intramuscular CT fibers, will also thicken. (See Diagram 1).

In addition, if the stress is strong and chronic, involving other muscles in that region of the body, adjacent muscle envelopes will "glue" to each other, resulting in a loss of mobility and function, as typically seen in men and women who do "body building." When they turn, the whole torso moves. There is a loss of differentiation in the muscles, which results in a loss of differentiation in finer and more specific movements, and consequently sensations and emotions. It is also possible that, where the stressed tendon is attached to the bone, that area of the bone will enlarge itself, creating more surface area

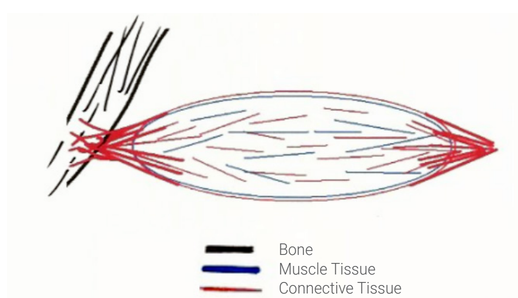

Diagram 1

for the additional fibers of the tendon to anchor. This is muscular armor: chronically stressed areas of the body now acting as a unit, and thickening up to resist external and internal, physical, emotional, and psychic stress. We can now update Reich's muscular armor concept to Connective Tissue Defense (CTD). The good news is that due to CT's plasticity, we can slowly and safely address these conditions. There was always too much risk in BP with certain types of character structures in using forceful techniques to break through the muscular blocks. As I have argued (Davis, 1997), the plasticity of CT allows us to continue working on the body, but safely, and, in fact, more profoundly.

There are three terms I would introduce now:

- ***Anisotropy***. The first term is *anisotropy* (Greek: *aniso* – unequal, unsymmetrical, a dissimilar condition, and *tropy* – turning towards, having an affinity for), which manifests as responding differently to the same external stimulus in different parts of the body. This phenomenon is utilized through the properties of connective tissue in our touch techniques and exercises. Input to the system through touch or movement varies according to the condition of the individual's tissues. Different patients respond differently to the same input. The patient's body "decides" how to utilize the information experienced through touch or movement. It is not so much what is being *transmitted* by the therapist's touch, but what the patient "decides" to receive. The touch is "interpreted" by the patient.

  In psychotherapy, it is understood that the patient's past experiences produce present-moment behaviors, thoughts, and emotions, so the physical phenomenon of anisotropy fits in nicely with a body/mind model.

- ***Hysteresis***. As an additional explanation as to how anisotropy works, we can include *hysteresis*, a concept from the physical sciences, whereby the output of a system depends not only on its input, but also on its *history of past inputs*. This is because the past history of any system affects the value of its internal state; even steel or iron in a bridge is historically dependent. Applied to a psychotherapy model, this is the understanding of past experiences affecting present behavior, and that the therapist intervention does not determine the patient's response. This is a body-based, biological way to explain parental transference in therapy. The therapeutic response is dependent on "past inputs." What is transmitted is not necessarily what is received. Again, the patient is in control, unconsciously "deciding" what the experience will feel like and mean – interpretive interoception.

- ***Thixotropy***. The third term is *thixotropy* (Greek *thixis* – a touching, plus *tropy*). Thixotropy describes the quality of a gelatin, such as plasma/GS, to become more fluid when pressured or heated, and more solid when at rest. This is the plasticity of CT and, more specifically, of the GS. It is in constant reorganization, responding to both the local and systemic needs of the individual body. It reorganizes in response to positive and negative, internal, and external, as well as physical and emotional stimuli. CT can change its viscosity from a liquid to a gelatin to a solid, and even to a crystalline state, whereby dehydrated collagen takes on the energetic properties of crystals. This is all due to the plasticity of the CT. All these changes can be reversed, at least up to a point. Older patients will respond more slowly and to a lesser extent than younger patients.

The plasticity theme had a major update in 2003 with a two-part article by Schleip (Schleip, 2003, a&b) on fascial plasticity. It is common in any therapeutic approach using touch for the practitioner to feel a change in the patient's tissue. I typically experience it as in the analogy of putting light fingertip pressure on a small piece of ice, and the ice melting. The changes manual therapists and FA practitioners report feeling in the tissue of their patients were usually attributed to thixotropy; GS, as a colloid state, responding to pressure and other forces by changing from a gel to a more liquid sol state. "This gel-to-sol transformation has been positively confirmed to appear as a result of long-term mechanical stress applications to connective tissue" (Schleip, 2003a, p. 12). But studies showed that the effects of the thixotropy phenomenon could not appear so quickly. Longer application of applied force is needed to result in "… permanent deformation [change] of dense connective tissue" (Schleip, 2003a, p. 12). And these effects are only present while the force is applied, returning within minutes to the original gel state, when released. A question arises: what is happening in the tissue that therapists are feeling, and patients are reporting? Comments from patients in FA include a melting quality, softer, an opening, a warm flow, a liberation and "you are touching me now." Yet, because of the time element, it seems that these subjective experiences are not a result of thixotropy.

Another explanation has been the piezoelectric effect. Because of CT's crystalline qualities, electrical currents can be created in the tissue when force is applied. This too has typically been mentioned as a possible explanation for the immediate plasticity change in tissue felt by both practitioner and patient. But Schleip again pointed out that this process also requires more time than when applying pressure during treatment. Both collagen fibers and GS changes can occur because of the piezoelectric effect, but … "both life cycles appear to be too slow for immediate tissue changes that are significant enough to be palpated by the working practitioner" (Schleip, 2003a, p. 12). Additionally, the slower softer techniques, as used in FA for example, are not strong enough to create these immediate tissue responses.

Plasticity, Fascia, and the Central Nervous System

As mentioned earlier, all CT, fascia included, was considered relatively unimportant "packing." Vascularization and innervation were estimated to be low. And if CT was appreciated at all, it was seen only for its mechanical properties. Following that, Schleip (2012) pointed out that by the 1990s, fascia was seen as playing an important role in proprioception. He then goes on to describe the importance of the fascial network as "… one of our richest sensory organs … the overall mass of which may be larger than the surface area of any organ of the body including the skin. Depending on how one calculates fascial sensory nerves and related sensory receptors … the quantity of fascial receptors might even be more than the retina, which was always considered the 'richest sensory human organ'" (Schleip, in Schleip et al., 2012, p. 77). The understanding of its innervation has been updated to show that the fascial system has six times more sensory nerves than muscle tissue. "… for the sensorial relationship with our body – whether it consists of pure proprioception, nocioception or the more visceral interoception, fascia provides definitely our most important perceptional organ" (Schleip, in Schleip et al., 2012, p. 77).

Considering how quickly and efficiently CT's plasticity responds to stimuli, Schleip (2003a) then introduced the need for a "rapid self-regulatory system" based on the organism's ability to perceive its interactions with the external environment.

> It then seems logical that this ability of being more rapidly adaptable is mediated by or is at least connected to – a body system which is involved in the perceptions of our needs as well as of the environment. Traditionally this body system has been called the nervous system. (Schleip, 2003a, p. 13)

For Schleip, the analogy of a nervous system as an old-fashioned telephone switchboard is outdated, and has been replaced by current concepts in neurology that see the brain as a "liquid system" whereby:

> … *fluid dynamics* of a multitude of liquid and even gaseous neurotransmitters have come to the forefront. Transmission of impulses in our nervous system often happens via messenger substances that travel along neural pathways as well as through the blood, lymph, cerebrospinal fluid, or ground substance. (Schleip, 2003a, p. 13)

He advised the reader to view the nervous system not as a hard-wired cable system, but as a "wet tropical jungle" (Schleip, 2003a, p. 14), a self-regulatory field that is complex, always adapting throughout life.

Without disagreeing with this model, all the activities described above happen in ground substance in one way or another. Even with the involvement of a nervous system, how is new information passed through the body without changes in the GS as Rolf suggested? (Rolf, 1977) Why or how is it that these transmissions of "impulses via messenger substances" now are flowing, whereas earlier they were not? What has changed? Additionally, many life forms don't have nervous systems, yet they manage to adapt to their internal and external environments.

In staying with the fascial/CNS relationship, Schleip wrote that Golgi receptors are proprioceptive tension-detecting sensors wrapped around tendinous collagen bundles where the muscle's tendon attaches to the bone. These receptors embedded in the tendon give afferent nerve information about the tension state of the muscle. They are involved in the lengthening of the muscle, stretching, or contraction. Ninety percent of these receptors are located at the myotendinous junction: the interface between the muscle and the tendon. Where the muscle inserts onto the bone through the tendon attachment, there is only 10%. But later research showed that "… passive stretching of a myofascial tissue does *not* stimulate the Golgi tendon receptors" (Schleip, 2003a, p. 14). Yet there is still a possibility that the Golgi receptors may be involved, since 90% of them are in myotendinous junctions and other attachment structures. For example, there is evidence that they are also involved in fine proprioceptive, antigravity motor movements that are too quick for transmission from the brain to the leg.

There are also three other *intrafascial* mechanoreceptors that are involved with the CNS: the Pacini corpuscles, the Paciniform corpuscles, and the Ruffini organs. These are all found embedded within "dense proper connective tissue: i.e., in muscle fascia, tendons, ligaments, and joint capsules" (Schleip, 2003a, p. 15). Each responds differently to different types of applied force. The Pacini and smaller Paciniform corpuscles respond to vibration and rapid change in pressure, but not to constant unchanging pressure. This is of particular interest for the Points & Positions Touch Technique, which employs a light, pulsing type of pressure. The Ruffini organs respond to long-term pressure and can be activated by slow and deep "melting quality" soft-tissue techniques, which are also sometimes employed in FA. Schleip pointed out that stimulation of Ruffini corpuscles results in lowering sympathetic activity, which supports the "… common clinical finding that slow

… the fascial system has six times more sensory nerves than muscle tissue … for the sensorial relationship with our body – whether it consists of pure proprioception, nocioception or the more visceral interoception, fascia provides definitely our most important perceptional organ.

deep tissue techniques tend to have a relaxing effect on local tissues as well as on the whole organism" (Schleip, 2003a, p. 15). This is an explanation of how local pressure can cause a distant response, as seen in Functional Analysis.

Uninsulated, sensory free nerve endings are more like open-ended receptors in the tissue, which pick up information and feed it to the brain, much as a satellite dish or an antenna is open-ended, picking up transmissions within its range.

Further evidence for CNS involvement in fascial manipulation is that the greatest amount of sensory input to the CNS comes from myofascial tissue. According to Schleip, a typical muscle nerve will have three times more *sensory* fibers than motor, and only 20% of these nerves are the well-known types I and II. The other 80%, type III and IV, are what are called interstitial muscle receptors – receptors within the GS of spaces between muscle fibers. (Schleip prefers the term interstitial myofascial tissue receptors. It's my suspicion that they were named "muscle" receptors because of the traditional bias that connective tissue is not important.) Type IV comprise 90% of this type of nerves; they are unmyelinated and usually have their origin in free nerve endings.

A word here about free nerve ending (FNE); generally, we think of the nervous system as a continuous line of interconnected nerve fibers passing information along, much as a telephone line carries messages from one point to another. These nerves are myelinated – insulated, enclosed – by a connective tissue sheath, much as telephone lines are also insulated, keeping the flow of information coherent and directional. But information must enter the nervous system to then be transported. As Reich pointed out, nerves only carry impulses; they are not the origin of these impulses. The CNS must get its information from somewhere. Uninsulated, sensory free nerve endings are more like open-ended receptors in the tissue, which pick up information and feed it to the brain, much as a satellite dish or an antenna is open-ended, picking up transmissions within its range.

FNEs are peripheral, afferent nerve endings, and their unmyelinated filaments extend freely into the tissue, allowing them to pick up and send signals to afferent neurons that bring information from the body towards the brain. As mechanoreceptors, they respond to mechanical tension and/or pressure, and about half of them respond to light touch, "… as light as a *painter's brush*." This is of interest to the emerging movement in the body-oriented therapies to work with a softer touch and helps to explain some of the physical and emotional effects registered by patients treated in the Points&Positions touch style.

Diagram 2 indicates how touch can set off a chain reaction in the tissues, resulting in overall bodily changes, both local and systemic, in tissue and in nerves.

Plasticity and the Autonomic Nervous System

The ANS is also involved through type III and IV receptors. "Type III and IV receptors … have been shown to have *autonomic functions*, i.e., stimulation of their sensory endings leads to a change in heart rate, blood pressure, respiration, etc." (Schleip, 2003a p. 17). Using the model of Mitchell and Schmid, Schleip (2003b) presented their "Intrafascial Circulation Loop" to show the relationship between tissue manipulation and the ANS.

> Fascia is densely innervated by interstitial tissue receptors. The autonomic nervous system uses their input (plus that of some Ruffini endings) to regulate local fluid dynamics in terms of an altered blood pressure in local arterioles and capillaries plus in

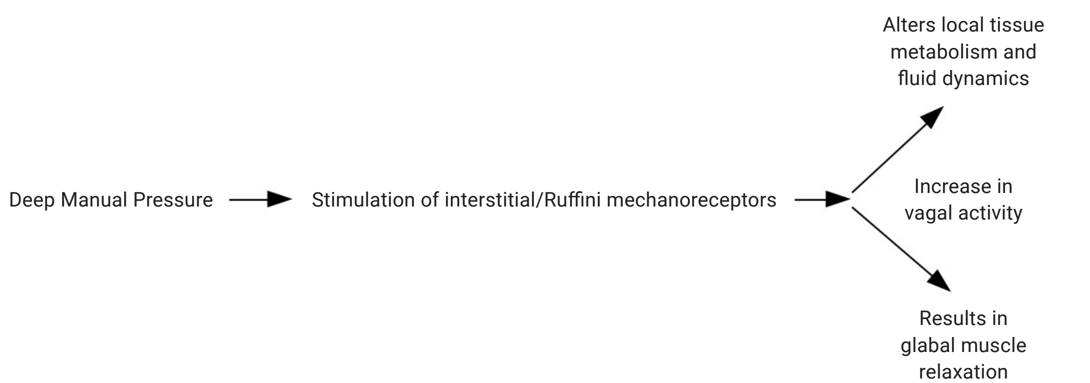

Diagram 2 *(Adapted from Schleip, 2017, p. 141)*

> plasma extravasation [fluid leakage] and local tissue viscosity. This change might be felt by the hand of a sensitive practitioner. (Schleip, 2003b, p.105)

Back to Rolf and Ground Substance

In Part II of his article on plasticity, Schleip (2003b) brought the theme of CNS and ANS involvement in fascial release together and returned to Rolf's model of gel to sol changes "*... but this time with the inclusion of the central nervous system*" (Schleip, 2003b, p. 105, italics added). Here is a working body/mind model. Schleip has exposed the inner workings of how the body and the nervous systems are intimately entwined. Activation of the interstitial receptors, which offer most of the sensory input from myofascial tissue, changes the pressure gradient in fascial capillaries and the viscosity of the ground substance, as Rolf suggested in 1977. When the Ruffini corpuscles are stimulated, there is a lowering of sympathetic activity. Schleip also suggested that with an increased renewal speed in the GS, the piezoelectric phenomena could now be understood to play a role in the immediate effects felt in the tissue by practitioners and patients.

> If myofascial manipulation affects both local tissue blood supply as well as local tissue viscosity, it is quite conceivable that these tissue changes could be rapid and significant enough to be felt by the listening hand of sensitive practitioners. (Schleip, 2003b, p. 105)

With the involvement of the feedback loops between fasciae and intrafibril receptors with the CNS, we now have a model of how GS and the fibers can change rather quickly, remain this way after pressure has been applied, *and* explains what practitioners have been sensing in their touch during treatments, as well as in patients' subjective experience.

Plasticity and the Enteric Nervous System

Just as the ANS and CNS can affect CT plasticity, it is also necessary to include the enteric nervous system (ENS) for the same reason. The ENS is sometimes called the intrinsic nervous system and the "second brain" (Gershon, 1981), or the "brain of the gut" (Goyal & Hirano, 1996). The ENS is embedded throughout the gastrointestinal system, starting at the lower third of the esophagus, into the stomach, through the intestines, down to the anus. It governs the function of the entire gastrointestinal tract, except for defecation.

It has been called the "second brain" because it acts independently, although it is in direct contact with the ANS, CNS, and the vagus nerve. It has its own reflex circuitry independent of input from the brain and spinal cord, creating local, autonomous functioning.

> To a surprising degree, these neurons and the complex enteric plexuses in which they are found (*plexus* means "network") operate more or less independently according to their own reflex rules; as a result, many gut functions continue perfectly well without sympathetic or parasympathetic supervision (peristalsis, for example, occurs in isolated gut segments *in vitro*). Thus, most investigators prefer to classify the enteric nervous system as a separate component of the visceral motor system. (Purves et al., 2001, p. 603)

Exactly how the ENS is anatomically described varies. It is sometimes considered part of the ANS, and at other times considered separate. Many ENS functions in the gut continue without sympathetic or parasympathetic control. Sometimes it is defined as the largest part of the ANS or, on the other hand, having extended connections to it. Even the number of neurons in the ENS is disputed, ranging from five times as many as the spinal cord to equal numbers. What is clear is the interaction between CT and the ANS, CNS and ENS. The information flow between these is bidirectional. Specifically, the ENS and CNS communicate via the vagus and pelvic nerves, as well as via sympathetic pathways. Ninety percent of the fibers in the primary visceral nerve, the vagus, go directly to the brain. The CNS in turn is sending messages "down" to the ENS with 10% of the fibers involved. The ENS informs the CNS. This is a classic bottom-up arrangement. As Schleip (2003a) has indicated, many of the sensory neurons of the enteric "brain" are mechanoreceptors as described above. Manipulation stimulates these receptors, which causes afferent feedback via ANS and ENS pathways to the brain, which in turn signals the muscle to release.

Because of this dense but lopsided interaction between the ENS and the CNS, pathological disorders in the CNS often have enteric manifestations, resulting in both disease and psychosomatic disorders. According to Rao and Gershon (2016), ENS anatomy and neurochemistry are similar to that of the CNS, whereby pathogenic mechanisms that give rise to CNS disorders might also lead to ENS dysfunction, and nerves that interconnect the ENS and CNS can be conduits for the spread of disease (Rao & Gershon, 2016). Rao and Gershon reported that:

> Transmissible spongiform encephalopathies, autistic spectrum disorders, Alzheimer disease, amyotrophic lateral sclerosis, and varicella zoster virus infection [a herpes virus causing chickenpox and shingles] are examples of disorders with both gastrointestinal and neurological consequences (2016, p. 520).

In addition, irritable bowel syndrome, the most common gastrointestinal tract disorder, is associated with the relationship between ENS and CNS, as well as some forms of depression. Also, Crohn's disease, ulcers, problems with swallowing, colitis, and, as indicated by some research, Parkinson's disease (Hadhazy, 2010;

Shprecher & Derkinderen, 2012) are associated with an ENS/CNS linkage. Many of these diagnoses are considered psychosomatic in origin.

Returning to the "second brain," the similarities between what seem to be quite distinct functioning structures are in fact rather striking. Rao and Gershon (2016) indicated that signaling pathways and neurotransmitters are shared. The ENS and the CNS share close to 30 identical neurotransmitters, such as serotonin, dopamine, and acetylcholine, which besides being active in the CNS, is also the main neurotransmitter in the parasympathetic branch of the ANS. In fact, about 50% of the body's dopamine and 90% of the body's serotonin lie in the digestive tract. The neurons of both systems use these neurotransmitters to communicate biochemically. There are also common underlying anatomical properties. Arising from neural crest cells 28 days after conception, the rudimentary CNS structure, the neural tube, is the embryonic forerunner to the central nervous system. The ENS also emerges from these same cells, which then migrate and house themselves in the gut during intrauterine life.

The "second brain" is of interest, because it brings up the "piggyback" concept: the same brain area – the cingulate anterior cortex – registers both physical and emotional pain. Dewall (DeWall, 2010, Pond et al., 2014) pointed out that, rather than create another neural system to process emotional pain, the brain adapted the phylogenetically earlier physical pain center to include emotions. Is it possible that the CNS "piggybacked" onto the earlier ENS? When describing the ENS, the biobehavioral psychiatrist Mayer commented, "The system is way too complicated to have evolved only to make sure things move out of your colon." (Hadhazy, 2010, p. 7)

In the same vein, Goyal and Hirano (1996) wrote:

> Subsequent examination of the functional and chemical diversity of enteric neurons revealed that the enteric nervous system closely resembles the central nervous system. … The enteric nervous system may perhaps best be regarded as a displaced part of the central nervous system that retains communication with it through the sympathetic and parasympathetic afferent and efferent neurons. (1996, p. 1106)

Goyal and Hirano's position would imply either that the CNS came first, which makes no sense, as living organisms have survived four billion years without any central nervous system, relying on plasmatic, tropism responses. Or, the "displaced" terminology is reflecting the top-down bias of neurologists, whereby both the CNS and the ENS were created by the same cells of the neural crest as described above, but the ENS was a "leftover" part? It is my considerably uninformed opinion, that if either is the result of the other, the ENS is the forerunner of the CNS. Phylogenetically, digestion evolved before a centralized nervous system. Individually, the digestive system is the first system to develop in the fetus.

One last word on fascial and neuronal connections. Although he did not have access to today's technology, Jones had moved the focus of manipulation from the myofascial system to the neurological over 40 years ago. In 1983, he had anticipated the neurological role in manipulation with his Positional Release Technique, an adaption of which makes up the "Positioning" half of the Points & Positions Touch Technique. Citing the influence of Knorr and Ruddy, Jones reported: "I am sure that all of these earlier concepts directed my thinking to neuromuscular dysfunction as the basis of joint disorders" (1983, p. 9). He emphasized that in applying his gentle positional release method, "… there are no surprises for the CNS" (1983, p. 23). The old-style Reichian discharge work often "surprised" the patient's CNS, causing increased contraction/resistance, projection and sometimes even re-traumatization. This is one of the reasons I began working with the instroke process and a CT model many years ago (Davis, 1999).

Discussion

The research presented verifies our work, and more than that, offers explanations as to how our methods and techniques have been effective over the years in grounding BP further in the biolog-ical body. It also helps to resolve the mind/body split and supports the intimate intertwining of both body and mind, myofascial tissue, and nerves.

CT is the vessel within which all our systems function. Nothing happens in the body without the direct involvement of GS and CT. For this reason alone, it is primary. It is now seen as the largest sensory organ: "… one of the most vital relationships in the body has to be the relationship be-tween connective tissue and the neuronal process" (Oschman, in Schleip et al., 2012, p. 104). Knowing how CT responds to body-oriented methods helps us not only to understand more, but to tune our methods and techniques to the patient. Different responses arise from different neural receptors – FNEs, interstitial myofascial receptors, intrafascial and interfibril receptors, Pacini & Paciniform corpuscles, and the Ruffini organs – depending on the *quality* of our physical inter-ventions, i.e., strong, light, stretching, compression.

CT automatically resists stress, which results in the buildup of fibrotic structures. "Each fiber, before it reaches its maximal stretching point, recruits the adjacent fiber, which in turn will be-have in the same way, and before it reaches its own maximum stretching point it will recruit an-other fiber and so on" (Guimberteau, 2018, p. 86). Classic BP techniques, as well as many of the manual therapy approaches, have challenged the body, and the result has been activation of the body's CT-based defense systems: resistance, stiffening, and rigidity. If we work sensitively *with* the body and not just *on it*, we join the emerging movement towards slower, softer techniques supporting the ideas put forth recently in this journal.

> "The therapist must therefore learn to slow down the pace of the interaction at certain moments of the session and, in a respectful and non-directive attitude, learn to slow down and wait, to tolerate uncertainty. Immediately, however, the problem arises that "waiting without being active, without 'doing anything' easily creates anxiety, a sense of 'uselessness' or 'doing nothing'". (Helferich, 2020)

> ... with biofeedback, the clinician is not seeking definitions of feelings that are coming from the frontal lobes; the biofeedback clinician asks about how it feels physiologically ... The clinician is looking for physiologically felt sensations. (Kerson, 2019/2020, p. 198)

My own work over the years has been in this direction, both physically in terms of the non-invasive P&P technique, and psychically in terms of the emphasis on the self-to-self relationship by working with the inward, gathering force of the instroke of the pulsation.

Importantly, CT is directly involved in creating the body's form. Form is structure and structure is behavior. Echoing Reich's concept that the patient's body determines his behavior, Rolf wrote: "In any energy system, however complicated, structure ... is experienced as behavior" (Rolf, 1977, p. 31). The pathologist Ingber, takes the same position on the cellular level:

> The important principle here is the manner in which a structure shapes itself and holds its subcomponents together in three-dimensional space; this characteristic is what defines the way the structure as a whole will behave. (Ingber, 1998, p. 56)

Updating Reich's plasmatic model, CT is a semi-conductor of all the body's *energies*, which re-sults in a body-wide, non-neural, communication system; "... the 'living matrix' is not only me-chanically interconnected, it is energetically and informationally continuous. Stated simply, the structural framework of the body is simultaneously an energetic and *informational* framework (Oschman, 1997, p. 8; italics added). This explains how life could function for 2.5 billion years before a nervous system was developed (Brooks, 1999, p. 81). We can speak to the body and mind simultaneously by touch, the forgotten language.

And finally, this CT matrix is the foundation of all later phylogenetic development, creating a classic bottom-up model of evolution, development, and maybe even therapy (Brooks, 1999, as cited in Anderson, 2003, p. 95). Again, echoing Reich, in discussing tissue regeneration, Dudas et al. described, in a pulsatory manner, how "higher" systems are built upon and dependent on "lower" earlier systems. Newer developments do not "replace" the earlier systems but build on them and include them.

> ... their mutual interactions do not appear as a plain hierarchical relationship. Rather, the simpler (lower) levels form a foundation for, and *are contained within*, the more complex (upper) levels, and complex feedback loops exist as well. ... their *recursive containment within each other* and their mutual dependence. (Dudas et al., 2008, p. 503, Italics added)

If we wish to do in-depth therapy, we should take this into consideration. A brain-based theory of psychotherapy is a top-down model, but it is becoming more and more clear that a CT-based bottom-up model would be more appropriate in order to touch, or rather help the patient to touch, their deepest self.

■ ■ ■

Will Davis has 45 years of experience practicing and training in America, Japan, and Europe. He developed Functional Analysis, which focuses on the energetic instroke, the plasmatic origins of early dis-turbance, the energetic qualities of connective tissue and its role in character development, the endo self, the gentle self-oriented release technique of Points & Positions, and a unique synthesis of verbal therapy. He is a member of the editorial boards of two journals, the Italian Society of Psychologists and Psychiatrists, the EABP, AETOS, and teaches as a guest trainer. He lives with his wife Lilly Davis in the south of France.

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