

The Role of Connective Tissue as the Physical Medium for the Conduction of Healing Energy in Acupuncture and Rolwing®

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ABSTRACT

This paper is an exploration of the new understanding of the primary role that connective tissue (the body's myofascial system) plays in the distribution of Qi throughout the body and the acupuncture meridians. Connective tissue is reviewed. Acupuncture's relationship to connective tissue is discussed, first as shown in ancient acupuncture texts; then modern scientific findings on the role the tissues play in Qi movement are presented. Next is an introduction to Rolwing, a therapeutic form of connective tissue manipulation. Both theoretical and scientific aspects of Rolwing are explored, as well as Rolwing's relationship to acupuncture. The final discussion proposes a new understanding of the body and suggests new possibilities of diagnosis, treatment, and potential research.

Acupuncture, in existence for thousands of years, is a whole and complete modality used to describe and therapeutically intervene in the human energetic system. The more we can understand the mechanics of acupuncture within the structure of our knowledge in the West, the more we can use the therapy and contribute to it. One of the most puzzling questions about acupuncture concerns the process through which the Qi travels throughout the body/energy field.

To understand the movement of Qi, and the body in general, one must examine the ba-

sic physical components. One of the most prevalent and influential elements in the body is connective tissue. All the systems of the body – circulatory, nervous, digestive, and musculoskeletal – are ensheathed in connective tissue. In fact, this intercellular medium encompasses literally every cell in the body.¹

Connective tissue is made up of cells which specialize in forming the various substances that hold the body structure together.² Connective tissue exists in many forms, with the particular intercellular substance determining its individual traits. This intercellular substance is known as *ground substance*.

Ground substance is the matrix in which the cells and fibers of connective tissue, as well as all other cells of the body, are embedded.^{1(p. 3)} This permits the ground substance to stabilize the spatial and functional relationships of the cells and fibers. Therefore, ground substance is sometimes referred to as "intercellular cement," since it helps hold the cells together.^{2(p. 80)}

The ground substance, made up of a variety of components, varies in composition and viscosity from tissue to tissue. For example, in loose, ordinary connective tissue the ground substance is a soft, viscous gel. By contrast, the matrix of bone is very hard.³ "Three types of connective tissue are generally recognized: connective tissue proper, having mixed fibers imbedded in a more or less fluid or gel-like matrix; cartilage, the fibers of which are enmeshed in a somewhat plastic ground substance; and bone, in which the matrix is infiltrated with inorganic salts."⁴

The focus of this paper is the *myofascial* con-

nective tissue (called connective tissue proper above). Fascia and connective tissue have become synonymous terms and are often used interchangeably, although by definition, fascia is only a part of the larger system. Fascia is a Latin word meaning "band" and refers to the sheets of fibrous tissue under the skin and throughout the body.^{2 (p. 111)} The other types of connective tissue, bone and cartilage, are not sheets, but they are covered by fascia. All of the body structures are united and supported by the fascial components. Each of the individual muscles is infused with intramuscular connective tissue and surrounded with fascia; this fascia then connects with the fascial network which is continuous throughout the body. A complete functioning unit is formed, the myofascial system.⁵

This interconnectiveness extends to the cellular level. One researcher notes: "Cellular biologists have discovered that each cell in the body has its own myofascial system, consisting of a somewhat stiffened skeleton made of tubules interconnected with a fibrous ground substance, some parts of which are contractile."⁶

An overview of fascia reveals the enormity and pervasiveness of the tissue. Besides the extensive sheaths and folds around and between the organs, there is an immense quantity of tissue which encircles all living cells and also every fluid which fills the joint cavities and serous spaces. If all other tissues were removed from the body, the remaining fascia alone would be enough to continue to present a normal contour: the outer appearance of the body would not have changed.^{4 (p. 66), 7}

Fascial tissue, because it is so intimately involved with the more specialized tissues of the body such as the organs, must naturally possess a broad ability to adapt physiologically. The internal environment requires fascia to maintain a level of plasticity to match the constantly changing metabolic circumstances. Thus, the broad adaptivity and plasticity of fascia offers an excellent environment in which other more specialized tissues such as the organs may thrive and function.^{4 (p. 66)}

Fascia is divided into two differing layers in the body. Superficial fascia lies just under the skin, in the form of thin, yet strong, elastic sheets which serve as both a container and as a support for the whole body.^{8(p. 38)} The well-being of the body is dependent upon the tone of this tissue, which

can be affected in a variety of ways. The physical trauma of an accident or the repercussions of surgery both have wide ranging effects; fascial tissue becomes denser and shorter as it goes through the healing process. This is again due to fascia's effort to support; when an area is injured or damaged, the shortening and thickening makes the area more stable and less prone to disruption as the healing proceeds. Since the fascia connects and communicates to all parts of the body, these compacted areas will convey the strain in numerous directions and produce a response at remote points. According to Dr. Ida Rolf:

"This is probably the mechanism through which reflex or pressure points become manifest. Here, congestion or malfunction of an internal organ will be felt as a limited spot of pain, sometimes quite intense under surface pressure at a point very distant from its origin. For example, many women at certain times in the menstrual cycle report pain elicited by pressure on a circular area (perhaps an inch in diameter) at the very crown of the head. In other words, the uterine congestion of the menses sets up strain as far away as the top of the head.

"Many people are aware that reflex points can be found on the sole of the foot. When individual visceral organs become congested, pressure on a specific point in the sole elicits pain, sometimes intense in quality. This happens in both chronic and acute congestions. In such reflex situations, fascial planes may be the route of mechanical transmission."^{8(p. 39)}

The *deep fascia* is denser than the superficial fascia. Deep fascia consists of a series of continuous planes and bands, reaching from the skin down to the bone.^{1(p. 15)} Where movement is necessary, around joints for example, the tissue loosens. Where greater strength is called for, the tissues become thicker and denser with a more parallel arrangement of the fibrous structure. Deep fascia and muscle have become synonymous for most people because it is difficult to separate the deep fascia from the muscles they surround.^{8(p. 42)}

Connective tissue, then, is both a part of normal everyday functioning (homeostasis), as well as voluntary actions. In summing up the unique role connective tissue plays in the body, Snyder says: "the connective tissues not only bind the various parts of the body, but, in a broader sense connect the numerous branches of medi-

cine."^{4 (p. 66)} The reality is that all forms of healing – acupuncture, allopathic medicine, chiropractic, osteopathy, surgery, bodywork and more – are mediated through the connective tissues when healing the body.

ACUPUNCTURE

The connective tissue is a semiconducting communication network that can convey bioelectric signals between every part of the body and every other part. This fascial communication network comprises the meridian system of traditional Oriental Medicine, with its countless extensions into every nook and cranny of the organism. The elusive Ch'i [Qi] in its various forms, the source of energy and information for all parts of the organism, is revealed to consist, at least in part, of bioelectric, biomagnetic, biomechanical, and bioacoustic signals moving through collagen fibers, ground substance, and associated layers of water molecules.^{9(pp. 12,14-17)}

Study regarding how the acupuncture system occurs and operates in the body has been ongoing for thousands of years. The ancient Chinese were less concerned about how acupuncture worked and more curious about what acupuncture did and in what way it could be used most efficiently.

Today, however, there is great emphasis on acquiring a logical understanding of *everything*. Acupuncture has generated great controversy due to the lack of a cohesive "Western" framework within which we can comprehend its workings. Modern medical science has halfheartedly explored the possibility of acupuncture, but generally disallows the concept of meridian pathways.

Nonetheless the answer may have been available to us all along. Connective tissue is able to completely interconnect all parts of the body, from the largest down to the microscopic; it is within every tissue and cell; and it is even within the organelles inside each cell. That connective tissue generates and conducts energy is highly significant for Oriental medical theory and practice.^{10(p. 159)}

It is popular fallacy that the early Chinese had little or no anatomical knowledge. From the *Han Shu*, written during the Han dynasty, we learn that Prince Mang ordered physicians and butchers to perform surgery on live political prisoners to measure their organs and to establish the source and route

of blood vessels. The earlier *Ling Shu* in the *Huang Di Nei Jing* (circa 100-300 BC, written perhaps as early as the late Zhou dynasty) offered discussions of the lengths and capacities of various organs.^{10(pp. 133-134)} In studying classical texts such as the *Han Shu* and the *Ling Shu*, we find the Chinese observed and commented on the anatomical structures of the body and their relationship to the functioning of Oriental Medicine. These classical references point to the fascial system; the "fat, greasy tissues" of the human body. These structures were acknowledged, were understood, and were viewed as an important component in the functioning of the body.^{10(p. 133)}

SOURCE THEORY

Beginnings were always significant to the theorists of Chinese medicine; the origin indicated both form and function, referring to the body or the universe. Therefore, source theory holds an especially important place in Chinese medical theory.^{10 (p. 97)}

The *Ling Shu* in the *Huang Di Nei Jing* was one of the first books to discuss the energetic source within the body. The *Ling Shu* theory of the Triple Warmer is the groundwork for part of the *Nan Jing* source theory.^{10 (p. 97)} "In both the *Ling Shu* and *Nan Jing*, the Triple Warmer is described as a source of the meridian system."^{10 (p. 99)}

In developing this connection, the *Ling Shu* describes the relationships of certain tissue and organs to a series of source points. It says:

"The five Yin organs have six (corresponding) Yang organs. The six Yang organs have twelve sources (points). The twelve sources (points) come out at the four joints (wrists and ankles). The four joints control and treat the five Yin organs.

"If the five Yin organs have disease, treat the twelve source (points). The twelve sources can give Qi and taste (nourishment) to the three hundred and sixty five nodes (acupoints), because of the five Yin organs. When the five Yin organs are sick, they respond and come out (reflect) to the twelve source (points). The twelve sources each have places where they come out. (If one) clearly understands the sources and observes their responses, one is able to know the extent of the damage to the five Yin organs."

The Shao Yin of the Yang is the lungs, the

source comes out at LU-9 (Taiyuan) at both the left and right sides. The Tai Yang of the Yang is the Heart, the source comes out at PC-7 (Daling) at both the left and right sides. The Tai Yin of the Yin is the Kidneys, the source comes out at K-3 (Taixi) at both the left and right sides. The Shao Yang of the Yin is the Liver. The source comes out at LV-3 (Taichong) at both the left and right sides. The Jue Yin of the Yin is the Spleen, the source comes out at SP-3 (Taibai) at both the left and right sides. The source of Gao comes out at CV-15 (Jiuwei), only one point. The source of Huang comes out at Po Ang, only one point.

“These twelve source (points) control and treat diseases of The five Yin and six Yang organs.”^{10 (p. 99)}

The ideas concerning Gao, Huang, and Po Ang provide the information relevant to this discussion. Matsumoto and Birch^{10 (p. 100)} point out that Gao and Huang are typically understood to indicate fatty tissues. Huang also is thought to mean the “space below the heart and above the diaphragm”¹¹ and suggests a “missing” or “hidden” organ. Gao pertains to “the extensions of the peritoneal membranes that encapsulate each of the Yin and Yang organs,” while Huang is recognized as “the fascia, mesenterium, and omenta that connect the various organs to one another.”¹²

The two characters *Po* and *Ang* each indicate the umbilicus, now as well as in classical times.¹³ Therefore, Matsumoto and Birch^{10 (p. 100)} affirm the umbilicus as the source of Huang. Etymologically the character *Po* comes from a pictogram of a baby in the womb.¹⁴ Gao is also seen as connected to the process of fetal development.^{10 (p. 100)} Matsumoto and Birch comment:

Since Gao and Huang both commonly refer to fatty, greasy membranes or tissues, and Gao is particularly related to fetal tissue, we feel that in the context of source theory these characters refer to the membranes and peritoneal tissues (mostly composed of connective tissues), the physical substrate of the Hara. This interpretation is not so mundane as it first appears.

A very large part of the body consists of connective tissues and membranes functioning in such a way as to hold the body, as a whole, together. These structures connect every part of the body to every other part, at a gross anatomical level through the fascial planes, and microscopically through

their component tissues, the connective tissues, enabling the communication of every single cell to all other cells. These tissues are a vast reservoir for the body and meet the requirements of any structure or energetic entity that would be capable of the mediation and transference of energy required of a “source.”^{10 (p. 101)}

What seems to have happened is that much of Oriental medicine today, often based on modern Chinese herbal texts,^{10 (p. 139),15} often neglects the anatomical descriptions from the older texts. Functional aspects of the organs are typically emphasized, and there is apparent disregard for the more physical details. (For example, one learns that the Liver spreads the Qi, but does not learn the mechanism through which this occurs.) Thus, a concept such as “no form” is translated and considered to be the same as “having no physical material.” This carelessness leads to ideas such as The Triple Warmer being a completely functional entity with no basis on a physical level. Under these circumstances thorough understanding of acupuncture in today’s world is not forthcoming. Matsumoto and Birch ask:

What, for example, can be the importance of an *energetic medicine* if there is no ground substance for its energetic connections? Why should anyone accept a non-substantive organ, with functions that are only sets of observed events, as anything more than a biological misgrouping that would best be reassigned to metabolism or hormonal stimulants? How would needling Triple Warmer points affect anything?^{10 (p. 139)}

MERIDIANS

Connective tissue has been recognized as an integral component of the meridian system as a whole. Early Chinese medical thinkers did not view the body as an empty energetic sphere. They spoke instead of a “lining” of the body and the organs, called the *Li*. Nowadays, this is typically translated as “inside” or “internal,” such as in the “internal - external” duality of the eight principle school of thought.^{10 (p. 107)} Thus, it is an abstract description, showing a difference of location from the “outside.” In the Han dynasty, however, *Li* was used to indicate an actual physical lining.^{13,14}

To translate *Li* as “lining” and not as “interior” gives a wholly different meaning. The idea of lining can correspond to the mem-

branes of the body. With this understanding we may connect energetic concepts of source and meridians with interior membranes such as the Gao and Huang, which are part of the body’s fascial system.^{10 (p. 107)} Matsumoto and Birch speculate: “Perhaps The fascia, the tissues that cover and line the body and line the body and organs, have some special qualities, properties, or functions that were recognized by the medical authors of the Han dynasty.”^{10 (p. 107)}

Traditionally, the description of each of the twelve meridians includes an internal pathway which “belongs to” or “permeates” its own organ and “spirally wraps” its paired organ.^{10 (p. 141)} Luo is the translated character for “spirally wrapped.”¹⁴

Luo can be translated in various ways according to context. For example, there are the Luo Mai, or Luo vessels, which are usually understood as the Luo meridians (or blood vessels). On the other hand, when described as Jing Luo, Luo indicates a specific group of vertical and horizontal meridians which pass through the body. Luo is also used in the context of the Luo Xue, or Luo points (each meridian connects directly to its paired meridian by way of the Luo point). Finally, there is the Luo wrapping of paired organs by a specific, paired meridian. In these varied examples, the Luo is an energetic route referring to fascial or connective tissue membranes.^{10 (p. 141)}

In the *Ling Shu*^(17: 190) it is said:

“The Jing Mai (meridian) is Li (the lining). The horizontal branch of the meridian is the Luo. The divergent branches are the grandchild Luo.”^{10 (p. 141)}

Here the Luo are stated to be horizontal branches of the meridians, and from them come the lesser branches, called the “grandchild Luo.” The image is analogous to the branching of the blood system, with the blood passing from arteries to the arterioles and down to the capillaries. However, the most important idea presented here when discussing the Luo and the grandchild Luo is the reference to *Li*, the lining.^{10 (p. 141)}

During the Han dynasty when *Li* referred to the lining of the body, it was usually considered the opposite of *Biao*, surface. Because *Biao*, the surface, is typically used to indicate the skin and body hair, the lining is that which covers and lines the body, but not the skin itself. As Matsumoto and Birch point out, this distinction indicates the Chinese understood the superficial fascia of the

body. Others agree with this position: for example, while discussing the Yin and Yang Wei Mai, Xie Lin¹⁶ of the Qing dynasty wrote:

“The Yin Wei controls the Qi of the greasy membranes, it goes to the lining of the body.”¹⁰ (p. 141)

“Lining” here is used to refer to the superficial fascia and most likely the deeper fascial structures as well.¹⁰ (p. 141) The implications of this are substantial. Because the “meridian is Li, the lining,” the meridians themselves are recognized as flowing through the superficial fascia of the body. The Luo vessels, which are the “branches,” are, therefore, also flowing through the superficial fascia.

The system of branches which come out from the meridians run through the entire body, just as the superficial fascia does. Thus, when the branches “spirally wrap” the paired organs, they permeate the fascial envelopes that encircle the organs.¹⁰ (p. 142) This makes good sense anatomically, since the many fascial systems of the body are functionally one interconnected system. The fascial tissues of the deepest inner structures and organs of the body connect all the way through to the superficial fascia where the meridians and Luo meridians lie.

MODERN RESEARCH

Recent scientific data have shown the possible means through which some of the organ relationships described by the classical medical theory may function. As an example, the Five Phase, Ten Stems, and Yin-Yang correspondences and functions can be understood as “. . . analogs of biophysical relationships among fascial tissues.”¹⁰ (p. 160) Also, the relationship between specific acupoints and certain areas of the body, as well as the likely mechanism through which the meridians develop and operate, may be understood as bioelectric functions of the fascial planes. The unifying factor of the many energetic concepts is the system of fascia.

A model for the recent scientific discoveries is proposed by Oschman:

“The cells and tissues of the body are joined together and composed of an interconnected webwork of macromolecules, the connective tissue system. The flexibility, elasticity, and resiliency of the tissues composed of these molecules are intimately re-

lated to their capacity to conduct protons, electrons, and possibly other energetic subatomic entities.

“It is the flow of this energy that provides the information that controls the form and properties of tissues. Finally, it may be aspects of this flow that have been given many different names by both scientists and healers over the years: life force, healing energy, chi, ki, orgone, L-field, kundalini, prana, bioplasma, odic force, etc.”⁶ (pp. 25-26)

Connective tissue’s ability to generate and transmit electrical energy comes from the way that the fibers and fiber bundles of the myofascial system are arranged in parallel arrays. This gives them their great strength and flexibility; at the same time this arrangement gives them a degree of crystallinity.⁶ (p. 10) The soft tissues of the body are not typically considered to be crystalline, since they are so different from familiar crystals such as diamonds and quartz. Mineral crystals are hard because their atoms and molecules are mainly spherical and are crowded together in strong polygonal arrays. In contrast, the organic crystals of the myofascial system consist of long, thin, flexible filaments which result in flexible crystals.

These highly ordered systems have unique properties which have been studied for many years. One of these properties is the *piezo electric* effect, which occurs in 20 of the 32 mineral crystal types. Simply defined, piezo electricity is electricity resulting from pressure on crystals.¹⁷ This property is used in the crystal phonograph needle or crystal microphone, where sound vibrations generate electric fields due to the alternate compression and expansion of a crystalline lattice.⁶ (p. 10)

In the body, the myofascial and connective tissue systems demonstrate the piezoelectric effect.⁶ (p. 11),¹⁷ Research has shown that every movement made by the body generates electricity and electric fields. Basset¹⁷ notes the cardiovascular system, gravity and the tone of the antigravity muscles, voluntary muscle action, impact with the environment, and the continuous activity of cell motion, all lead to the compression necessary for field generation. It is now commonly thought that these fields expand through the tissues, producing signals that alert the cells to movements, strains, or other activities in the body. In response, the cells use this information to alter their actions of nourishing and maintaining the

surrounding tissues.⁶ (pp. 11, 13)

An example of connective tissue’s conductivity comes from the studies of acupuncturist Dr. Yoshio Manaka. Matsumoto and Birch¹⁰ (p. 147) report on his discovery concerning Mu points and their relationship to the underlying fascia. Manaka notes that often when a patient is lying down, the Mu points are not reactive, although there is a problem with the organs and meridians the Mu points are supposed to reflect. Yet, when the meridian is stretched by extending, rotating, or flexing the hand or foot, the points immediately become reactive. As an example, someone with a problematic small intestine, which was diagnosed by symptoms and palpation of points, showed no soreness at CV-4. When the small intestine meridian was stretched, however, CV-4 became very reactive. The conclusion drawn is that the “. . . Mu points are points of specific attachment of the fasciae through which the meridians run.” By moving the wrists and ankles in certain ways, the stretched fasciae achieve a level of tension and, therefore, a heightened conductivity. This, in turn, establishes a tension at the Mu point which makes it more reactive on palpation.

How, then, does acupuncture provide remedies? What happens within the acupuncture system to facilitate changes which take effect when needling is performed? Perlow¹⁸ has suggested that the energy said to flow in the meridians is electrical in nature. This postulate is supported by important findings. Acupuncture points on the skin were measured with a Wheatstone bridge and found to have concentrated electric conductance.¹⁹ A different study showed that the points have the least electrical resistance (the highest conductivity) and microscopic analysis showed uniquely arranged collagen fibers in the area.²⁰ And Fleck and Spring²¹ recorded *electrical discharges* while needles were being manipulated in points. Clearly there is generation of electric current when a needle is manipulated at a specific point on the skin.²²

Lipinski²² summarizes the entire procedure from a Western physiologic perspective. The insertion and twirling of a needle in an acupuncture point produces a strain which is transduced into an electric current because of the piezoelectric properties of the connective tissue. The electrons generated this way are led throughout the body along channels made up of proteins and muco-

polysaccharides possessing semiconductive properties. When the stimulus arrives at the cells of a specific organ, the electric current is again transduced, owing to the inverse piezoelectric effect, into the chemical or mechanical energy necessary to restore physiological functioning on a molecular and cellular level.

Others who have researched the role of connective tissue in relation to acupuncture have found similar results. Two top Japanese researchers, Yoshio Nagahama, M.D., and Hiroshi Motoyama, Ph.D., have independently reached the conclusion that the meridian system lies in the connective tissues and specifically in the superficial fascia.¹⁰ (p. 208) Indeed, Nagahama²³ concludes from the research done by himself and other scientists that acupuncture and moxibustion return normal function to the connective tissues. He has suggested the expression “connective tissue therapy” to describe acupuncture.

Nagahama reports on his years of research concerning needle insertion and the depth at which the De Qi occurs (the obtaining of the Qi). When the needle touches the superficial fascia, the strongest De Qi is produced and causes electrical potential changes that generate small electric currents. Thus, Nagahama understands De Qi to be electrical changes associated with the needle touching the fascia, and the small generated current as producing the therapeutic effect. He believes that acupoints which are reactive to touch may indicate pathologies elsewhere in the body, and, when these acupoints are needed, the resulting electrical potential changes are distinct from those changes associated with needling non-reactive points. Electrical potential changes thus generated are referred to by Nagahama as “abnormal electrical currents” and are transmitted to the origin of the pathology to assist in treating it. This belief parallels Ida Rolf’s idea concerning connective tissue as the medium for internal pathology which then manifests on the surface of the body.

The connection between acupuncture’s Qi and meridians and the connective tissue of the body is clear. It is not a question of whether they are connected or related; they are, rather, the same thing – inseparable except through our misleading habit of talking about them as though they were entirely different manifestations.

ROLFING

Rolfing is a whole-body system of health care originated by and named for Ida P. Rolf, Ph.D. Rolfing focuses on the structure of the body, with the intention of releasing the body’s segments – legs, torso, arms, head, etc. – from lifelong patterns of tension. The release permits gravity to realign the segments and, in doing so, balance the body.²⁴

Rolfing is performed in a series of ten distinct sessions, each approximately an hour long, over the course of which the Rolfer uses physical pressure (direct energy) to manipulate the body’s connective tissues to effect easier movement.^{25, 26, 27} Manipulation is done with the open hands, fingers, clenched fists, and occasionally, the side of the elbow. The aim is to achieve optimal alignment.

Benefits include improved health and a sense of revitalization.²⁸ Chronic pain is released from muscles and bones. One looks better and stands and moves more gracefully. Breath is fuller, the body is more comfortable, and one stands at one’s tallest possible height. Self-confidence increases and one presents oneself more naturally.

Dr. Rolf referred to her work not as “Rolfing,” but as “structural integration.” Her goal, and the goal of any practitioner of Rolfing, is exactly that: integration of the structure of the body. Rolfing is guided by three simple ideas concerning the human structure:²⁹

- 1) the majority of human beings are significantly out of alignment with gravity,
- 2) we function much better when we are lined up with the earth’s gravitational field, and
- 3) the human body is so plastic that it can be brought into balance with gravity at practically any point in one’s life.

Relationship with gravity is the key to Rolfing. Dr. Rolf looked at body structures and saw an aggregate of units – head, thorax, pelvis, legs, etc.²⁵ (p. 33), ³⁰ Ideally, these individual units are brought toward a vertical line when standing at rest. This ensures that the structure is capable of maintaining its form while gravity pulls on the body’s individual segments. An analogy for the body is a house: “it’s structured so that each part has its proper place, and each piece interlocks to balance the load of the others.”²⁹ (p. 3) Just as in the well-built house,

whose every post and beam are where they should be, a well-built and well-used body functions most efficiently. Due to the constant downward pull of gravity, body parts which are not in place – like beams out of alignment and unsupported by a post – are pulled into painfully unnatural positions. Dr. Rolf has commented:

“Some individuals may perceive their losing fight with gravity as a sharp pain in their back, others as the unflattering contour of their body, others as a constant fatigue, yet others as an unrelentingly threatening environment. Those over 40 may call it old age. And yet all these signals may be pointing to a single problem, so prominent in their own structure, as well as others, that it has been ignored: they are off balance. They are at war with gravity.”³¹

A healthy body has its large segments (head, shoulders, torso, pelvis, legs, feet) arranged with the center of gravity of one positioned above another (a straight line connects the ear, shoulder, hip joint, knee, and ankle bone); each section will support the weight from above with ease. Very little muscular effort will be necessary to keep the body balanced in this way.²⁷ The other alternative occurs when the body’s large segments are not aligned in this stable way. For example, the head may be thrust forward, which means the shoulders must lean back to compensate. As a consequence, the abdomen, and thus the lower spine, may be forward, and other compensations throughout the structure will be found. Consequently, enormous muscular effort must be exerted just to keep the whole structure from collapsing; muscles and tissues in the neck and upper back must tighten to hold the head “on,” the low back “locks up,” and so on through the body. The result is a diminished ability to respond flexibly, energetically, and appropriately to whatever new demands gravity and life may make.

Acupuncturists have also noticed the dynamic influence of gravity upon the body. Matsumoto and Birch¹⁰ (p. 187) recognize that the effect of any imbalance or distortion of the body will always shift the center of gravity, placing that person “off center.” This affects the Hara and leads to disorders and diseases. Keizo Hashimoto has devised an entire therapeutic exercise system based on this perception. (Interestingly, Matsumoto and Birch¹⁰ (p. 197-198) also cite research linking gravity to the body’s development of the

meridians, thus furthering the case for the vitally significant role gravity plays in our well-being.)

During her scientific research, Dr. Rolf made a fundamental discovery concerning the body: "... the same network of connective tissue which contains and links the muscle system when it's healthy can be used to reshape it when it's been pulled out of proper order."^{29 (p. 2)} Dr. Rolf recognized the prime importance of the fascial system, which works for either the positive or the negative: it can support *whatever* patterns of posture and movement the body adopts. It can assist normal, balanced posture.

When muscles are overloaded by constant strain and tension, the connective tissues assume the load by shortening and tightening, and thus give up their elasticity. The body actually changes shape in response to the way it is used.^{29 (p. 2)} Many circumstances lead to body distortion: falling down, illness, psychological stress, even the way in which a child copies his or her parents. All leave their imprint as the body's natural adaptability proceeds to integrate the injury or continuing attitude (be it physical or emotional) into the rest of the system.³¹

Fortunately, fascia can be brought back to a healthy state by returning tissues to their proper alignment and inducing proper movement. In the Rolfing process, the Rolfer works to free up the various holding patterns in the connective tissue. Once the movement towards balance and regeneration begins, it becomes self-perpetuating. Now the body has a new pattern of movement and behavior. Gravity acts as a significant integrative factor, with its negative downward pull transformed to a supportive lift. Dr. Rolf commented on this result:

This is the gospel of Rolfing: "When the body gets working appropriately, the force of gravity can flow through. Then, spontaneously, the body heals itself."^{25 (p. 31)}

The ability to change is present because of the plastic nature of connective tissue. The mechanism for this transformation takes advantage of one of the unique qualities of fascia. Although fascia is thought of as a tissue of collagen fibers, these fibers are embedded in ground substance. For the most part, this ground substance is an amorphous, semifluid gel. It has been shown that pressure applied to soft tissues produces a phase transition in the ground substance

from a colloid "gel" (semi-solid phase) to a "sol" (liquid-like phase).³² This property is the basis for tissue changes created by physical manipulation. Siemers^{1 (p. 20)} cites Taylor,³³ who explains that the addition of mechanical energy raises the energy level of a system and plasticity is restored. This quality of tissue is what makes the results of Rolfing possible.

Acupuncture's relationship to Rolfing can be seen on many levels. Obviously, they are both using the same medium, connective tissue, for the remedial aspect of their work. In fact, it's not just that each system *uses* the connective tissue; each system *is* the connective tissue.

The intention here is to encourage both acupuncturists and Rolfers to recognize connective tissue as the basis of their work and to enlarge their vision of the work they do through an understanding of what others are doing.

A Rolfer in Denmark has taken this step. Stanley Rosenberg first advanced his ideas to the general Rolfing community in early 1986. As a Rolfer he discovered:

"...the acupuncture meridians are a map of the planes of fascia as they manifest in the superficial fascia. By putting my hands on the meridians in certain ways (other than traditional acupressure), I can produce some predictable improvements in structure, easily and with little effort."³⁴

His discovery centered around working structurally with the vertebrae of the spine. Using the Bladder meridian as a landmark system, Rosenberg found that typical Rolfing pressure applied to the tissues indicated by the meridian would allow a new practicality and directness in *unrotating* a vertebra. Rolfers had always been able to achieve this result before; what was different was the apparent ease this new understanding gave, as well as the possibilities it opened up.

Next, Rosenberg considered the way meridians are shown as simple lines on a typical acupuncture chart. He came to understand that the meridians could more accurately be said to define areas – that they have width to them. In terms of connective tissue, most acupuncture points lie on the skin surface, over borders of muscles.³⁵ By seeing the acupuncture lines as borders, one gets stripes along the body. By manipulating these in the normal Rolfing manner, one can access connective tissue in a unique way

to achieve the Rolfing goals, which, ultimately, are the improved health and quality of life for the individual. Rosenberg relates that he watched a teacher demonstrating Rolfing in class and noted the master craftsman had his fingers on acupuncture points over 90% of the time when working. This apparently was not intentional; the Rolfing training does not teach acupuncture points as an access modality. The conclusion is that, over time, the attuned Rolfer will naturally create alignment with the acupuncture system.

In a later article, Rosenberg furthers his explorations.³⁶ He suggests that a Rolfer palpate the body tissues while looking at an acupuncture chart. As the Rolfer finds the tension areas, places he describes the tissue as "... even harder, more glued, more stuck, more electric and more gunky," the acupuncture chart will typically identify these places (in terms of geography) as acupuncture points. He then recommends using the acupuncture points as places to position the Rolfer's fingers, so as to better access, "tunnel down," into the connective tissues where the Rolfer needs to work. The understandings of one modality (acupuncture) have increased the effectiveness of another (Rolfing).

DISCUSSION

"... Man's original medical tool is his hand, which he has instinctively used in order to alleviate pain. Whenever he is struck, stung, or seized with cramps, he involuntarily puts his hand to the painful spot in order to protect it or to rub, knead, or massage it. ... In China, it was obviously realized from very early on that massage not only helped to relieve pain, that is to say, that its effect was not merely local; it was also seen that the stimulation of certain areas of the skin could affect the internal organs. Experience over thousands of years associated remedial massage with the same acupuncture points and meridians..."³⁷

The original source of relief for man's aches and pains, and the tool still as effective today, is man's own hand. The hands effectively stimulate the whole body, through the medium of the connective tissues. Acupressure has been around as long as acupuncture; the Chinese have a distinct form of remedial massage called Tuina; the Swedish and others have used massage therapeutically for a long time; and now Dr. Rolf has created a specific technique of con-

nective tissue manipulation which is still in its infancy in terms of understanding its potential applications.

Within the acupuncture field, the practice of diagnosis by palpation (touching and probing connective tissue to determine relative imbalances) is now scientifically recognized for its positive effects.¹⁰ (p. 214) Palpating the tissue has therapeutic value; it makes the tissue more energetically conductive. It is relaxing for the patient and prepares the tissue to be in a sol state. All serve to enhance the effects of acupuncture and moxibustion.

So what causes a specific acupoint to require needling? Since acupuncture energy runs through the fascial planes (and the acupuncture points are specific loci within this network), the discontinuity of Qi passage must have a physical component. Somehow the area of the point has become restrictive, and a blockage occurs; or perhaps the tissue has lost its proper tone, and the ability to correctly guide the Qi through the area is lost, resulting in a deficient flow. The result is a physical manifestation of the disruption of the higher vibratory/less dense Qi flow.

When a needle is inserted in the point of imbalance, a reorganization takes place. Certainly, there is a therapeutic response which can occur at a distant organ or within the meridian itself (or a neighbor). Yet there must also be a change within the fascial tissue to reflect the new state of organization in the energetic and physical being. If change does not occur within all parts of the system, the balance is not whole. The original imbalance will eventually lead to similar or perhaps (seemingly) new symptoms.

Rolfers excel in looking at the body and “reading” the pattern in connective tissue. Up to now, the focus has been on the structural aspects of the body. With a shift in emphasis, however, the same pattern which speaks to the Rolfer of a restricted ribcage, stooped shoulders, and resultant tilt of the pelvis may be read by a knowledgeable acupuncturist as a lung deficiency with an underlying kidney imbalance.

Ida Rolf once said that one can tell all about a person just by looking at a single joint.³⁸ While this isn’t typically done, it would make sense, because the connective tissue system is a whole. When looking at someone’s knee or elbow or neck, one is

looking at a representation of what is going on everywhere in that body. The same phenomenon occurs from the acupuncturist’s side; one can take any single symptom, perhaps a pale tongue, and begin to examine it as an example of what is going on throughout the body.

Imbalances can be treated in various ways. An acupuncturist may use the pulses, and then perhaps color, sound, odor, and emotion, to diagnose an imbalance. Let us assume one consults a Five Element (Phase) chart and finds that the correct point in this situation is LV-8 (Ququan). What this indicates is that this specific area of the body, the inner knee, is, at least on a connective tissue level, where the blockage has shown up. The chart, or at least the original mapping of the Five Element points, indicates that it isn’t in the area of LV-3 (Tai chong) or GB-39 (Xuanzhong) that one needs to focus; it is very specifically at the area known as Liver 8. The energetic level has eventually led to the physical.

From a Rolfer’s point of view, however, a different process may lead to the same outcome. The Rolfer may determine that the strain in the body’s connective tissue needs to be addressed in the leg. Without any idea of acupuncture, he places his hands around the knee and works the tissue area of liver 8, and suddenly it may release the whole sheet of fascia up into the torso. When the client stands, he discovers his chronic back pain is gone or his hypertension has lessened – in some way he feels relief.

This connective tissue connection would explain why certain acupuncture points are considered key for specific situations. K-3 (Taixi) or BL-40 (Weizhong) are considered quite useful for low back pain, for example; and it is also taught that St-36 (Zusanli) is the master point for the leg. Why St-36? Could it be that this area is a major connective tissue junction point whose influence can be felt throughout the leg? Whatever the imbalance, when that particular area is addressed, the fascia is better aligned, the flow of energy becomes more appropriate, and the symptom disappears.

Admittedly, it is rare that one needle or one manipulation of Rolfing, will by itself completely heal a problem. Yet, it is true that acupuncture points used together or in a series will typically complete the healing. The whole must be dealt with; releasing or rebalancing only part of the pattern will not give a lasting result.

The other side of the diagnostic picture involves emotions rather than physical ailments. An acupuncture patient may have a stagnant liver condition and exhibit much anger. This will manifest physically as rigidity in certain parts of the body, with the fascial tissue tightening in response to the consistent holding. A particular pattern will emerge, obvious to anyone willing to learn to see. The chest will usually be tight, often raised, with resultant shallow breathing. The chin will be held at a “jutting” angle. The arms will be held slightly back, and often the legs will adopt a wide stance. The overall posture or statement is one of aggression, though the individual may not be aware of it – all this because the liver’s function of smoothing out the energetic flow is disrupted. However, connective tissue is still the medium in which the imbalance shows up, and the medium through which it may be corrected. Freeing the anger/rigidity pattern in the tissues will allow the stagnant energy to begin to move and will bring the patient closer to his or her balance and wholeness. The individual moves out of the restrictive pattern and into new possibilities.

Dr. Rolf spoke of the connection between the body and the energy flow and addressed acupuncture concepts as well:

“The various organs and systems of the body, up to a point, constitute self-contained energy fields. Beyond this point, their algebraic sum assumes significance in that it expresses the characteristic man-as-a-whole. Man tends to perceive himself as a Gestalt; he is rarely able to differentiate the elements of his physical functioning. To him, his bad temper of a morning is part of his character, not the result of a blocked bile duct or an inadequate liver. He simply includes in his self-image his chronic aches and pains; these are a part of his behavior. To us, these aches and pains record the effect of the energy pattern of the earth (the gravitational field) on the man’s personal energy field.”³⁰

A disruption of the energy flow will always manifest in the tissues. Conversely, a disruption in the order and balance of the tissues will ultimately manifest in the energy flow. The imbalance can start at either end of the spectrum. Eventually the physical and the energetic will reflect each other, because they are each other. In the beginning, embryologically, we are symmetrical beings. Once we are out of the womb and

moving in gravity, however, distortions occur, and we move away from our symmetry. We may use the right arm more than the left, and we use it in a different way. We might fall down and the sacrum might move a bit anteriorly, and from then on, our knees may point out somewhat as we walk. Perhaps the imbalance began with a situation of mental strain or emotional upheaval which led to increased physical tension. Whatever the cause, as soon as we move away from symmetry, we are no longer physically "in our center;" we no longer move through our center of mass. And energetically, we are no longer as connected to our center of Qi, the Hara or Tiantien. So, energetically the imbalance is real, and perhaps the physical symptom of a neck ache begins to appear. Structurally one might notice in the mirror that one shoulder is higher than the other.

In looking for a solution, palpation will always be a useful diagnostic tool. For example, one may find loose, sagging muscles hanging under the arm. This would indicate a deficient condition, and the meridians passing through this area would need to be considered. There would also be a balancing or compensating area somewhere in the body, an area of tightness in the tissues, a Yang to balance the Yin. Clearly, the whole must be considered to fully balance and heal the body.

Besides Rolfing and acupuncture, other systems and disciplines also consider the body as a whole and have connective tissue as an integral part of their functional basis. Yoga, Qi Gong, Tai Chi Ch'uan (Taijiquan), and various martial arts all recommend specific movements of the body, typically integrated with the breath, that encourage a balancing of the internal energy flow. This stretching and opening of the lines of fascia in the body allows the free movement of the structure as well as the internal movement of Qi, blood, and other fluids. One of the better known Taoist masters teaching energy cultivation and martial arts today, Mantak Chia, in talking about his Iron Shirt Chi Kung (Qi Gong), has said:

"The fascia is extremely important in Iron Shirt. This tissue is the most pervasive in the body and is currently believed to be the means whereby Qi is distributed along acupuncture routes. Researchers in France have discovered that the least resistance to the flow of Qi occurs between the fascia and that when these routes have been charted

they have been found to correspond to the classical acupuncture channels. The art of Rolfing has to do very much with freeing areas of fascia that have come to stick together through trauma, infection or chronic muscular tension."³⁹

Once again we have the inherent understanding that connective tissue is the key component in the health maintenance system of the body. Whatever system is studied – acupuncture, Rolfing, Yoga, etc. – it is the connective tissue with which one eventually works.

What can Rolfing offer acupuncture? Acupuncture is obviously a full and complete system unto itself. Yet, within the acupuncture field, there is much diversity in terms of diagnosis and treatment: though Chinese, Korean, Japanese, French, and English forms share things in common, they also vary widely. Even within a form, there is great contrast; Chinese Five Element (Phases) diagnosis and treatment often seems totally unconnected to the Chinese Eight Principles format. Yet both work, and both may rightfully be considered acupuncture. What the Rolfing model offers is a new understanding of the physical basis of acupuncture - connective tissue. This can be considered and applied regardless of which style of acupuncture is being used. Awareness of the physical manifestation of the energetic system will give acupuncturists more choices in diagnosis and treatment. Seeing the structure as an outward reflection of the internal situation will result in an improved capacity to know the whole pattern the patient is presenting. Once it is recognized that the structure of the body does influence the meridian flow, one realizes that palpation will reveal even more information. Anywhere there is muscular tension, there is blockage in the meridian flow. Thus, the diagnostic skills will be sharpened.

It is not suggested that acupuncturists need to learn to do Rolfing, but it would be beneficial for them to be comfortable with and competent to work broadly with the connective tissue when such work will speed up and improve the healing process. This added dimension would not be discarding the acupuncture model; rather, it would involve working deeper within it.

Also, it will benefit the individual acupuncturist to recognize and appreciate the possibilities of health and healing that are offered through the Rolfing process. In terms

of having a useful complementary therapy for clients, Rolfing is an excellent choice. Often it will speed up the rate of recovery for the acupuncture patient and can sometimes help create a breakthrough for a previously unyielding problem. The speculation is that a "Rolfed" body will respond more quickly and deeply to acupuncture than a non-"Rolfed" one. This makes sense when we understand the role of connective tissue in the movement of Qi.

Additionally, when acupuncture is used as a tool of preventative medicine, it is in many ways achieving its highest level of effectiveness. Helping someone stay healthy is true "health care," as opposed to the more common "sickness care" typically offered today. The dynamic ability of Rolfing to free the tissues and thus ensure the least restriction to the Qi flow suggests Rolfing is fully indicated as a complementary therapy for effective results in the realm of prevention.

What does acupuncture offer to Rolfing? Rolfing has mainly been associated with the easily recognizable structural changes it has produced. Yet an opening of the focus within the Rolfing field seems called for because connective tissue is the basis for changes acupuncture creates. Often Rolfing clients will report changes in their health and vitality that are not easily explained in terms of simply standing straighter and moving easier. More internal change has gone on than can be simply accounted for by better posture. Initially, Rolfers can use the acupuncture model for a deeper, more encompassing understanding of the reality they are touching when they place their hands on the body. Ultimately, a synthesis of the two models will allow the Rolfer to recognize typical patterns from acupuncture and more effectively free up the physical manifestations of the imbalance. This will not lead Rolfers away from what they do. It will, instead, allow them to do it with more intention and awareness. Here too, as with acupuncture, research would be extremely valuable in furthering the possibilities contained within the two worlds.

One model for investigation of the connection between Rolfing and acupuncture would be to work with a typical acupuncture patient and objectively determine his or her underlying "causative factor" as it is sometimes called in Five Elements work, or "patterns of the bodily landscape" as Ted Kaptchuk⁴⁰ refers to the Eight Principles work. Next, take the individual through the

normal ten sessions of Rolwing and then re-evaluate to find how much the patient has improved. What degree of balance in the energy can be achieved through this physical manner of working? As an example, a typical complaint which brings someone to a Rolfer is chronic low back pain. Since this is usually remedied within the context of the ten session sequence, does it mean a possible Deficient Kidney condition was alleviated through the freeing up and reorganizing of the connective tissue? If so, how much?

On the basis of the modalities explored, it is clear that the body's healing response depends on how well the connective tissue system is addressed. Connective tissue is either the source of the difficulty or at least a major component in the way imbalance materializes in the body. Therefore, connective tissue is a vital medium for the remedial action necessary to return missing equilibrium. It is the medium through which the re-balancing Qi will be transmitted, the electrical and chemical messages delivered, and the tensions and strains released. Andrew T. Still, the developer of Osteopathy, also understood the vast importance of the connective tissue system of the body and declared: "The fascia is the place to look for the cause of disease and the place to consult and begin the action of remedies ..."⁴¹ He also said: "By its action we live and by its failure we die."⁴²

The focus of this paper has been the physical level of the energetic system of the body. Once the role of connective tissue in acupuncture is acknowledged, Qi becomes less an elusive, mysterious, "can't be translated" concept. Rather, it is something that practitioners are placing their hands on each day. The acupuncture system in the body is definitely more than physical; the physical component to it simply has not been recognized fully. For acupuncture to continue to serve humanity, it is important that it include this new understanding, adding knowledge to the depth and breadth of what it does so well, so that it may do it even better. We owe this to ourselves as practitioners as well as to those we serve.

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Jushikyo (The Routes of The Fourteen Channels and Their Functions):
Kyoto, 1716.

Shown here is a description of 20 acupuncture points on the arm that are used to treat colon diseases. It is written in poetry for easier memorization.

The connective tissue provides the supportive and connecting framework (or stroma) for all the other tissues of the body. The connective tissue is formed by cells and the extracellular matrix (ECM). The ECM represents a combination of collagens, noncollagenous glycoproteins, and proteoglycans (ground substance) surrounding the cells of connective tissue. The cells of the connective tissue have important roles in the storage of metabolites, immune and inflammatory responses, and tissue repair after injury.Â Silver impregnation is a valuable tool in pathology for the recognition of distortions in the distribution of reticular fibers in alterations of lymphoid organs. Â€¢ Type IV collagen. Present in the basal lamina. Conducting Nutrition Research on ISS. Blood Collection.Â Energy expenditure is often hypothesized to be lower during flight than on the ground, because of the presumed relative hypokinesia in space (8). An early example of this is that lower energy expenditure was observed during extravehicular activity (EVA) on the lunar surface than during similar activities at 1g (9). This was determined through indirect calorimetry in the space suit. However, Space Shuttle crewmembers during EVA did not have any change in energy expenditure relative to before flight (10). How does conduction in a semiconductor differ from a metal? 2. What is the physical significance of evanescent states inside the bandgap? 3. What are dopants? What dopants are used to make p-type and n-type semiconductors? What are deep-trap dopants? 4. How does doping affect the density of carriers in SC? 5. How to find the concentration of the minority carriers in a doped SC?Â From our simple calculation it looks like the conductivity depends on time, which is obviously not true for most materials. Electrons moving through the material collide with the lattice other electrons, impurities etc. Consequently, the time of â€œfree flightâ€ will be limited for electrons inside the material. Generally, we can write the following dependence of the velocity on the applied field: v_r .