The Superficial Layer as Sensory Envelope

New Perspectives from the Art of Yield About the 'Superficial' Sessions of the Rolfing® Series

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ABSTRACT *The author continues to develop his body of work with the Art of Yield (Tahata and Agneesens 2012) and the role of ma (Tahata 2018), bringing in cell science to understand at a deeper level the impact of tension in the superficial layer, the role of yielding and ma in the 'superficial' sessions of the Ten Series, and the elements that support the receptivity of the client's body to our interventions.*

> Go around the problem; get the system sufficiently resilient so that it is able to change, and it will change. It doesn't have to be forced. It's that forcing that you have to avoid at all costs.
>
> *Ida P. Rolf (1990, 83)*

The first three sessions of the Ten Series are viewed as the 'sleeve' or 'superficial' sessions. This module plays an important role in preparing the body for the subsequent 'core' sessions. It is a great opportunity to enhance the responsiveness of the body, as well as to establish rapport with the client, which makes it easy to set a 'safe matrix' for the overall series.

This article references earlier works on the 'Art of Yield' (Agneesens and Tahata 2012), which can be further refined with awareness of *ma* through time, space, and intersubjectivity as described before (Tahata 2018). ('Ma' is a Japanese word that relates to both time and space, specifically pauses and empty space. 'Good ma' would be similar in concept to 'good feng shui' – an appropriate recognition of space and pattern that is felt phenomenologically.) Working with ma is particularly beneficial for clients who are perceptive to when something is forced, whether an intention to set something right, intense pressure of touch, over-focused vision, or a one-way intervention to satisfy the practitioner's agenda, not matched to what the client's body needs. As is commonly said, 'perception is everything'. The practitioner's perception and ma combined can create a high level of 'safe matrix' (or 'scaffolding' for the body to yield to) and a safe 'field' as a greater resource for self-regulatory systems of the body.

Cell Science Gives a New Perspective on the Superficial Layer

First we will look at the superficial layer from the perspective of cell science, seeing various factors that account for its sensitivity to both stimuli and 'presence'.

Keratinocytes: A Key Player for Perceiving the Environment

The skin is the first line of defense, and keratinocytes *(the cells predominant in the epidermis)* serve as a barrier between an organism and its environment. Denda (2015) suggest that the epidermis has the capability to act as an interface between the body and the environment, as keratinocytes in the epidermis have their own sensory systems to detect temperature, atmospheric pressure, color, light, and sound. Keratinocytes covering the body surface can thus catch environmental information first, prior to detection through the nerves. Keratinocytes transmit information to the nerves by means of intercellular messenger molecules like ATP. The means of communication may be slow (lacking instant access to the central nervous system), yet as keratinocytes occupy 95% of the epidermal layer and connect to each other through tight junctions, the sensory information detected from the environment could be shared through a cell-mediated transmission beneath our conscious level of awareness. In this way I believe that there must be vast amounts of information that keratinocytes detect and collect without involvement of the cortex.

Hair as a Sensor for Presence

Takiguchi et al. (2007) reveal that the human body is wrapped in a very weak electric field like static electricity called a 'quasi-electrostatic field'. The size of the electric field and the electrical charge, positive or negative, are always fluctuating. This could be a partial scientific underpinning for what we call the 'kinesphere' in Rolf Movement Integration. Just as cats sometimes show great skill at sensing the approaching presence of their guadians even at a great distance, the kinesphere or quasi-electrostatic field could be mechanisms of human sensing. When we have an emotional response or a strong hunch or take in a piece of art with all of our soul, we sometimes experience goose bumps or a sense of our skin 'crawling' as instinctive responses. Takiguchi thinks that presence is sensed through the cochlear hair cells of the inner ear and by hair on the skin. We know that mechanoreceptors connected to hair on the skin can detect airflow as well as equilibrium, so there is a close relation to the sensing of gravity.

The Primordial Antenna

Every single cell has one hair-like antenna called a primary cilium. The primary cilium is a sensory organelle that responds to mechanical and chemical stimuli in the environment and communicates those external signals to the cell's interior. In addition, there are examples of primary cilia detecting chemicals, light, osmolarity, temperature, and gravity (Satir, Pedersen, and Christensen 2010).

The genome of primary cilia is highly conserved from mammals to eukaryotic unicellular organism like an gleen algae, Chlamydomonas, which means the function of primary cilia is essential for life activity. In chondrocytes, integrins (αβ) and NG2 chondroitin sulfate proteoglycan interact with ECM at the ciliary membrane (Seeger-Nukpezah and Golemis 2012).

Mutation on the genome of primary cilia causes a variety of diseases known as ciliopathies, such as Situs inversus, skeletal abnormalities, polydactyly, dementia, etc, all relating to 'structure'.

In my view, primary cilia as a nonsynaptic primordial communication device may be the evolutionary root of skin hair, as both play a role in mechanosensing. If hair on the skin can sense the quasi-electrostatic field, primary cilia also must respond to this field. These micro-players are monitoring the environment.

Primary cilia are directly connected to cytoskeletal microtubules, their oscillations are assumed to transmit some signals into the cells through the cytoskelton, connecting to ECM (≅ fascia) via the adhesion molecule integrin. Vice versa, some mechanical stimuli to the fascia may affect primary cilia. So, intervention through touch may have some impact on the behavior of primary cilia.

Hypersonic Effects

In researching hypersonic effects, Tsutomu Oohashi (2000) demonstrated that sounds with high-frequency components (HFCs; such as found in tropical rainforests, Indonesian gamelan music, and traditional ethnic music like Japanese instruments) affect brain activity. These studies reveal that hypersonic effects can increase blood flow in the brain, augment α waves in the brain, enhance the immune system, and decrease stress hormones. Interestingly, modern instruments like the piano do not have this therapeutic effect. The therapeutic effect on brain activity comes with 'basking' in HFCs through the whole body; the research shows that listening only with headphones has no therapeutic effect. HFCs are a sort of polyrhythmic vibration. Although there is no data that mechanical vibration can cause a similar therapeutic effect, I speculate that a particular vibration with coherency from a manual practitioner's touch could also have some effect on brain activity.

Needless to say, sonic vibration is very subtle in comparison to the mechano-stress of pressure used in orthodox manual therapies.

Sonic vibration could also possibly affect primary cilia on the cellular level. Since our touch can transmit various frequencies of physical vibration to the body, intervention through touch may have some impact on the behavior of primary cilia.

My Conclusions from This

Some researchers think that *all cells making up the body are subject to mechanostress and maintaining homeostasis by appropriate mechano-sensing* (Humphrey et al. 2014; Sawada et al. 2016). They postulate that many diseases are potentially caused by a breakdown in this balance.

My conclusion from the research cited above is that we have to be aware in a new way that all stimuli in the environment are perceived by the superficial layer of the body through sensory cells prior to neural or visual registration. Working with the superficial layer as a sensory envelope therefore holds great potential for integrating the body, more than just our traditional view of the sleeve sessions being preparatory work for the core sessions. Interventions affecting cells through these mechanisms might affect the non-synaptic primordial communication of the cell, although the communication would be slower than nerve synapses.

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Impact of Damage to the Superficial Layer

Dental research reveals that superficial gingival inflammation is the trigger for alveolar bone resorption in the late stage of peridontal disease. Thus, reducing chronic gingival inflammation is the remedy; that is, approaching the superficial layer rather than addressing the major presenting problem.

Keizo Sakamoto (2007) examined fibrotic responses to injection, comparing intramuscular (IM) and subcutaneous (SC) administration of a non-immunogenic Ringer's solution to the quadriceps of domestic rabbits. (In contrast to Ringer's solution, administration of antibiotics or adjuvant solution using vaccination could damage the tissue, as discussed below.)

As illustrated in Figure 1, damage in the muscle layer from the IM injection progressed through a healing process. On the other hand, damage in the subcutaneous layer from SC injection induced fasciculation leading to muscle contracture. Noting that the muscle contracture derived from a lesion at the superficial layer, we can extrapolate that in somatic practice it may not be efficient to try to mobilize fibrotic muscle without first working with the superficial primary restrictions.

In the case of SC injection, the primary restriction stayed in the skin layer, *not* in the muscle layer. It is known that injection solutions containing an adjuvant (a substance that enhances the body's immune response to an antigen) or antibiotics (like chloramphenicol), whether IM or SC administration or repeated injection, can promote a fibrotic response or necrosis around the injection site.

Early last year, Benias et al. (2018), discovered a new 'organ', the interstitium. They found that the interstitium consists of fluid-filled spaces supported by a network of collagen bundles, lined on one side with undifferentiated multi-potent cells. As it exists in connective tissue throughout the body, the interstitium could be broadly recognized as 'fascia' in manual medicine. The SC layer contains abundant fluid-filled interstitial spaces.

Benias et al. suggest that the interstitium plays an important role in the transportation of water, nutrients, and communication molecules between cells. When a part of the interstitium is damaged subdermally, the transportation would be disturbed, followed by waste buildup, which might induce inflammation. The sensory system in the skin cannot act properly without support of functional interstitium. I propose that the fibrosis caused by SC injection illustrated in Figure 1 may be caused by dysfunction in the interstitial transportation of the subcutaneous layer.

Keratinocytes – the predominant cells in the epidermis, discussed earlier – release inflammatory mediators such as TNF-α and IL-1 in response to nociception (invasive stimuli from the environment),

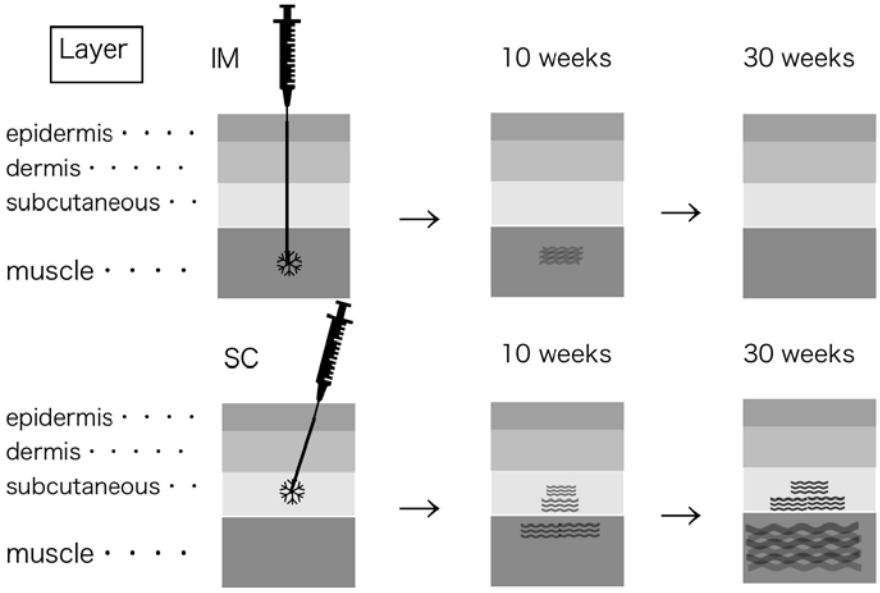

Figure 1: The effect of injecting Ringer's solution (an artificial interstitial fluid without components that would induce fibrotic response) on the layers. The upper diagram shows that IM injection caused diffuse fibroplasia and contracture of the muscle, but after thirty weeks, damaged tissues were almost recovered. In contrast, the lower diagram shows that the same solution administered through SC injection caused a fibrotic response in the SC space then also started fasciculation of muscle fiber about ten weeks after injection, followed by local fibrosis in the superficial muscle layer and, in some cases, diffuse fibrosis of overall muscle layers, with lesions still present even after thirty weeks. Diagram by H. Tahata referencing data in the *Showa University Journal of Medical Sciences* 67(1): 43-50 (2007).

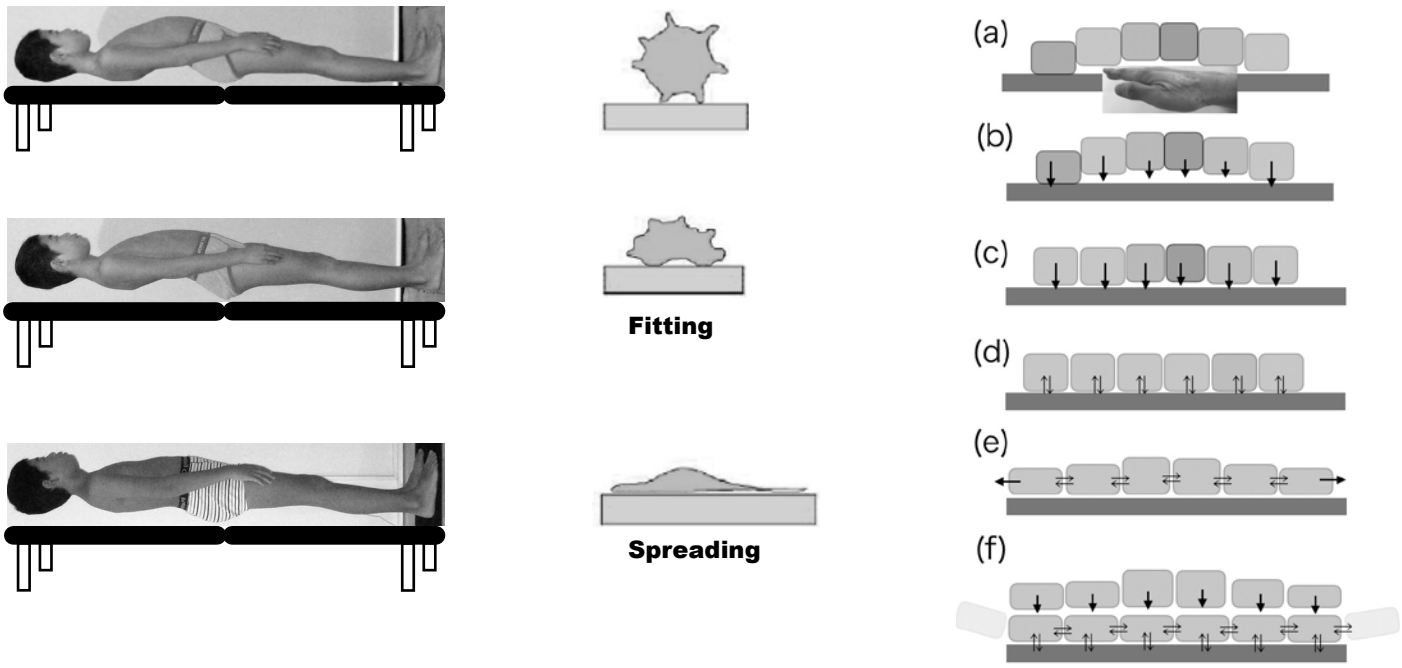

Figure 2: The process of yielding. At left we see the body's response to the yielding process, and at right the proposed cell mechanism as cells interact with the supporting surface ('fitting') and then in adjacent relationships ('spreading'). Sequentially, touch provides anchorage (a), leading to a start of 'settling in' (b) and 'fitting' (c). Next, cells within the matrix interact (d), leading to a spreading of the matrix (e). When the cell membrane / matrix relationship is established, the bottom layer of cells functions as a matrix that the layer(s) above can yield into a cascading manner.

such as ultraviolet or mechanical stimuli. The protective cell response is inflammation, and the keratinocytes secrete inflammatory mediators as alarm signals to inform immunocompetent cells of the emergency. The keratinocytes secrete NGF (nerve growth factor), which augments sensitivity to pain. In the case of sustained pain or chronic inflammation, this leads to a vicious circle of pain and hypersensitivity to pain, akin to a trauma vortex. Until the 'false alarm' is deactivated by resetting the keratinocytes, the inflammation will continue even through it has no object to attack.

However, keratinocytes also can secrete brain neurotransmitters like dopamine with pleasurable sensations and β-endorphins with analgesic properties. This is not strange when you consider that both the brain and skin originate from the ectodermal layer embryologically. For this reason, I propose that it could be beneficial to 'input' to the epidermal layer the opposite of nociceptive stimulus, to break free from this vicious cycle. The way I see it, traumatized tissues could then 'remember' a time and space without alarm, or 'remember' their relationship with other cells of communicating through pleasurable signal molecules, such as dopamine – related to comfortable feelings, the opposite extreme of a defensive reaction.

Chronic inflammation is a current topic in medicine as it seems to lie at the foundation of a variety of disorders. I think that soothing the epidermal layer may be a means to reduce unnecessary inflammation.

If the body has truly experienced 'yielding', that response may return again and again during nightly sleep, allowing the body to settle and decompress with regularity, giving a daily release and reset to stored internal tension.

Yielding Allows the Body to Rest Deeply

The Art of Yield is based on the body surrendering to support. 'Yielding' of the body into the table is facilitated by touch, as shown in Figure 2. This movement starts at the surface engaged by touch. When the body rests in contact, the cells in contact with the supporting surface – e.g., the massage table – start interacting with that 'non-self', and then sensing tension in adjacent cells, as suggested in Figure 2 and the process of 'fitting' and 'spreading'. As cells allow a yielding to gravity, there is likely an increase in fluidity with a soothing effect on internal tension. Polyrhythmic vibration in accord with calming breath may help a resting into contact. I speculate that the superficial keratinocytes in contact with the table may be influenced directly, with

rearrangement of the cytoskelton as there is increased affinity to the environment through the contact area.

One possible interpretation of why sessions that use the yielding approach and/or ma have a sustainable effect on the body is that they may enhance the body's restorative capacity in sleep. If the body has truly experienced 'yielding', that response may return again and again during nightly sleep, allowing the body to settle and decompress with regularity, giving a daily release and reset to stored internal tension. This is supported by anecdotal reports from some of my clients, who report being able to sleep well without carrying over the day's tension. This suggests that the Art of Yield can calm the nervous system.

In contrast, when I used to give a standard First Hour with myofascial-release methodology, some clients told me that they experienced more arousal even during sleep. Since adopting the yielding approach, I have not heard such feedback of arousal during sleep, even as I continue to do work with the goals of the First Hour, just without myofascial techniques.

After experiencing a state of yielding on the massage table, the body can feel a sense of the space (kinesphere) in the direction it had settled down into. Therefore, having the client change position during the table work is meaningful so that different surfaces can yield into the contact, covering the whole envelope.

Expanding Our Understanding of Yielding

Putting these newest pieces together with the conditioning of Yielding described previously (Agneessens and Tahata 2012), and with the role of ma described previously (Tahata 2018), it is my proposition that yielding and ma enhance the responsiveness of the body, soothe the epidermal layer, and support the client to be more receptive for intervention. As noted in my article on ma (Tahata 2018), it behooves the practitioner to be highly attuned to his/her own sensations. For example, if you sense a reluctance to approach the client, you could be resonating with the client's state. Stay comfortable, as relaxed as possible, and wait until the client's system feels open for change without any resistance. I believe this is the foundation and safe matrix for the session.

Here's a practicum for experiential understanding, drawing on the elements we have discussed.

Working with the Superficial Sensory Envelope

1. 'Condition' the client for work each session using ma and yielding (refer to the previous articles, Tahata and Agneessens 2012 and Tahata 2018). You are interacting with the quasi-electrostatic field, that part of the body that is sensate to presence through the primary cilia.

2. Touch the body to support yielding into the massage table. Imagine that you can find the interstitial space in the subcutaneous layer, a fluid space that is continuous all over the surface of the body.

3. When you touch the subcutaneous interstitial space, find the fluidity and follow the flow gently.

4, Whenever we touch, the superficial layer always responds. Touch the place you are addressing, considering the sensory epidermis, the keratinocytes, and also Merkel cells (embedded in between the keratinocyte layer and dermis, these have been found to respond to light touch).

5. Intervene with awareness of titration so that your touch is not perceived as nociceptive stimuli. (If the keratinocytes perceive an intervention as a violation, they will be sensitized and secrete inflammatory cytokines, which move the experience away from safety.

Appendix: Health and Order in Life

For survival and normal growth, cells need to adhere to the extracellular matrix or other cells. If there is instead 'anchorage-independence', a breaking away from the relationship to other cells or the extracellular matrix (ECM), that is canceration. So, it should be meaningful for the body if cells in the collective 'rebuild' appropriate relationships to their surroundings. Interaction with others under safe circumstances – whether on the micro level of cells or the macro level of the body – might be the key to regain health.

To look at this further, let's consider the naked mole-rat (NMR; Heterocephalus glaber), an animal that survives based on bio-mimicry. Its unusual features include: 1) tolerance of low-oxygen conditions; 2) pain tolerance; 3) longevity; 4) no aging; 5) cancer resistance; and 6) sensitivity of contact inhibition. Let's use "contact inhibition" as a reference.

Normal cells have contact inhibition that helps regulate proper tissue growth: they know when to stop proliferation (to keep order) by contact with adjacent cells. It is well-known that the cancer cells have lost their natural contact inhibition, so they continue dividing in the monolayer culture when neighboring cells touch each other. Seluanov et al. (2009) show that NMR fibroblasts become contact inhibited at a very low cell density; thus, the fibroblasts of these long-lived rodents need more space around them than those of other short-lived rodents. Further, NMR fibroblasts can perceive other fibroblasts at a distance and stop growth before being confluent or overcrowding. To put it into the terminology used in the Art of Yield, the NMR fibroblasts have good notion of 'ma'.

Normal cells have 'anchorage dependence' – the need for 'scaffolding' surfaces for survival and growth. They also have contact inhibition, which effectively means getting along with other cells for there to be order. This might suggest that *sensitivity to 'contact'* is related to *order in life*. I presume that the primary cilia may play an important role in sensing adjacent cells. In contrast with normal cells, most cancer cells have lost their relationship with the ECM and other cells, and it is interesting to note that cancer cells in most cases have lost primary cilia. You can see a matrix of these relationships in Figure 3.

	NMR	normal cell	cancer cell
(1)anchorage dependency	+	+	–
(2)contact inhibition	+ +	+	–
(3)primary cilia	+	+	–

Figure 3: A comparison of normal cells, cancer cells, and the reference of the naked mole-rat (NMR). 1) anchorage dependency indicates the relationship with the ECM; 2) contact inhibition indicates the relationship with adjacent cells; 3)primary cilia suggest responsiveness to the environment.

Mahatma Gandhi: "Good travels at a snail's pace. Those who want to do good are not selfish, they are not in a hurry, they know that to impregnate people with good requires a long time." This is good guidance for those of us working in manual therapy and wishing to address these deep underpinnings of cellular life.

Cancer cell are in disorder; they have generally lost their relationship with the ECM, other cells, and the environment. Following from this, it might be meaningful for order in life to reconstruct the relationship with the ECM, other cells, and the environment.

'Conditioning' as done in the Art of Yield (Agneessens and Tahata 2012; Tahata 2018) is a repeated 'educational' process for the cells to remember their environment in the condition of a safe matrix. These processes are subtle and slow, 'pre-nerve' – a negation of the quick pathways of the myelinated nervous system. To speak to this metaphorically, I'll quote Mahatma Gandhi: "Good travels at a snail's pace. Those who want to do good are not selfish, they are not in a hurry, they know that to impregnate people with good requires a long time." This is good guidance for those of us working in manual therapy and wishing to address these deep underpinnings of cellular life.

Hiroyoshi Tahata has worked as a Rolfer since 1998. He joined the Rolf Movement faculty of the Rolf Institute® in 2009. He brings to this work a depth of creativity and understanding that integrates the principles of structure and function through a gentle and non-invasive approach to transformation. His background in biochemistry clearly bridges the inquiry between science and art. His latest work with 'ma' promotes profound experience and physical geometric balance; to find out more and see before and after photos from the work, visit https://yielding.work/.

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