The Core as a Coordination

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This is what Rolfers are doing: we are lifting a body up. We're getting the uppermost pole of the body lifted up. Sometimes you wonder what the relation is, the connection that makes one man a rigid stalk and another man flexible and lifted.

Dr. Ida P. Rolf (Feitis 1978)

Part of Ida Rolf's genius was that she intuited many fundamental truths about human function long before there was any rigorous science to support them. This can be seen, for instance, in her belief in the central importance of the role of water metabolism in the plasticity of the connective tissue network (Rolf 1978), and now we have the work of Klingler et al (2004), Oschman (2003) and Ho (1998) supporting her intuition. We also see this deep insight at work in how she formulated some of the most central premises of Rolfing®:

- That as a body is reorganized in gravity, it will achieve "lift"
- That there is a two-level hierarchy in our neuromuscular organization (involving what she called "the intrinsic and extrinsic" musculature).

Both of these premises are now finding scientific support.

Historically, these fundamental premises of Rolfing have been inextricably connected with other key concepts she introduced – "core", "sleeve" and "the Line" – and this cluster of linked concepts has been central to the rich tradition of enquiry, debate, and conceptual clarification that has taken place within the Rolfing community ever since. Long before "core" became a fashionable word around modern gymnasiums, Ida Rolf used it to refer to deeper structures in the body, and "sleeve" to the more superficial. In this simple sense, the core/sleeve distinction even enters into the design of the 10-session protocol; sessions 1-3 are often referred to as the "sleeve" sessions, and 4-7 as the "core" sessions. She also at times linked "core" with the intrinsic musculature and "sleeve" with the extrinsic. Some Rolfers have since equated "core" with "Line"; others have equated it with the "gut body" or the endodermic system of organs. Others have developed a way of categorizing their clients using this terminology – hence "tight sleeve, loose core", or "loose sleeve, loose core" etc. "Core" has also been widely used in psychological contexts – sometimes associated with deep, organic or instinctual drives within us, but also as "our innermost sense of identity" (Maitland 1995).

Because "core" has been used in such a wide variety of contexts, its various meanings have become confusingly conflated; its very ambiguity has limited its usefulness; it means too many things to too many people. There have been some useful attempts at clarifying the concept. Structural Integration has devoted two issues to this discussion (December 2002 and February 2003). In one of these articles, Stephen Paré provided an excellent summary of the debate so far and outlined the different meanings attributed to "core" within the Rolfing community (Paré 2003); those wishing clarify their thinking around "core" from a Rolfing perspective should read it. [Editor's note: The article is reprinted in this issue] His article reveals at once both the confused thinking that has surrounded the concept, and its extraordinary siren seductiveness – it is clear that we love the idea of "core," that it has a deep resonance within the Rolfing somatic perspective, and that we will not let it go so easily. We must refine the concept rather than dismiss it.

This paper will not revisit the territory so clearly summarized by Paré; instead, it will briefly examine some important Australian biomechanical research around "core stabilization", and will also look at a new functional understanding to the concept of "core" as articulated by Rolfing Movement teacher Hubert Godard (2005, 2006).

Within the last ten years, "core" has emerged as an important concept in physical therapy and exercise science and has been seized eagerly by the fitness industry; now all personal trainers and coaches seem to offer some form of "core stabilization" training. This recent interest was inspired in part by the groundbreaking biomechanical discoveries of a group of Australian physiotherapists and researchers (Richardson et al. 1999). Godard, in his workshops, has referred to this Australian research and amplified its somatic relevance by bringing to it a rich synthesis of thought in which perceptual and coordinative processes are central to the organization of efficient posture and movement. Godard sees "core" as a coordination.

Rolfing practitioners tend to look first to structural rather than functional explanations for the shifts we see in our clients. After all, as structural integrators we integrate structure, don't we? Many of us agree with Dr. Rolf, that "lift" appears in our clients as an emergent phenomenon as our work unfolds. But is it a structural change we are witnessing? So much of our thinking about "core" has been to view it in terms of bodily structures; it is very tempting to "explain" the lift-via-core phenomenon in terms of structural building blocks such as a lengthened gut-body, a re-alignment of body segments, or through the activity of a special group of dedicated "core muscles". Perhaps if we look more closely we may find that phenomena such as "lift" are more to do with refined coordination. And, according to Godard, this coordination is largely fed and organized by perceptual and imaginative processes – by how we receive the world.

THE AUSTRALIAN RESEARCH ON CORE STABILIZATION

A group of Australian researchers at the University of Queensland has provided new insights into our understanding of the neuromuscular control of the posture during movement (Richardson et al. 1999). Their research has centred on that neuromuscular coordination now widely known as "core stabilization," while their broader aim has been to assist in the rehabilitation of patients with low back pain or low back injury. An excellent technical exposition of their work has already been presented to the Rolfing® community (Newton 2003).

These authors view "core stability" as the ability of the spine and trunk to respond to all forms of kinetic perturbation and to bring the system back to equilibrium. These perturbations arise either from the bending, buckling or torsional forces that flow from the environment (a push, a pull, a hug, a lean, the acceleration and braking of the bus I travel in, a strong wind, the momentum of the ball I catch, the weight of my backpack), or from forces generated from my own movement (the momenta of all my body segments during walking, the turning moment of my arm in reaching, all eccentric and concentric movements around joints, the shifts in my center of gravity as my body morphs). The spine has to respond to all these forces, both the expected and the unexpected, and still maintain its physical integrity.

They note that some of this stability is provided by the passive structural properties of the vertebrae, discs and spinal ligaments; however it is the dynamic response of all the muscular elements of the spine and trunk that they regard as crucial to creating and maintaining core stability. They propose a two-level hierarchy of neuromuscular control during normal movement:

- a local system, which is the coordinated activity of a group of muscles they call the "inner unit," whose main task is to maintain the balance and integrity of the lumbo-pelvic–hip complex during movement, and
- a global system (utilizing the "outer unit" of torque-producing musculature) whose main task is to initiate and control a more gross level of trunk movement.

In a well-functioning organism, these two control systems work in a coordinated way – the local system working non-stop, below the level of our ordinary awareness and volition, harmonizing itself with the "intentions" of the global system, maintaining balance and constantly guarding against spinal stress.

THE LOCAL SYSTEM

The local system is the coordinated functioning of the inner unit musculature: the transversus abdominis (TA), the lumbar multifidi, the breathing diaphragm and muscles of the pelvic floor. It also includes other deep one- or two-segment muscles such as interspinales, intertransversarii and rotatores, which provide individual stabilizing effect on adjacent vertebrae, acting at times almost like ligaments. The muscles of the local system tend to be deeper in the body and less bulky than their global counterparts. They work in a coordinated fashion, providing differentiated tension through the thoracolumbar fascia while at the same time controlling intra-abdominal pressure in order to enhance lumbar stability. Contralateral fascicles of the TA work in conjunction with the multifidi at their respective lumbar segments to produce "rings" of control around the abdomen such that, used in a coordinated fashion, they can control the movement of individual spinal segments, or by gently squeezing the semi-liquid gut-body can lift the chest from below. This is beginning to sound a little like what Rolf called "lift" or "finding the Line."

THE GLOBAL SYSTEM

The global system consists of the larger, torque-producing muscles such as the erector spinae, rectus, the obliques and the latissimus. These muscles tend to be more superficial and have longer leverage; their main task is controlling gross trunk movements. They can flex, extend, side-flex and side-extend the spine; they can also differentially rotate the thorax against the pelvic segment around a longitudinal axis; however they are unable to provide a specific and controlling influence at the level of individual spinal segments.

THE STABILIZING ROLE OF CO-CONTRACTION

When looking at the role of the deepest spinal muscles in maintaining spinal stability it appears that much of their activity consists of the isometric co-contraction of antagonists. At first glance this appears to be at odds with Rolf's well-known dictum around reciprocal inhibition, that "When flexors flex, extensors should extend [i.e. lengthen]." But not all co-contraction is dysfunctional. We see many examples in our clients when co-contraction is obviously deeply problematic – when agonist/antagonist tonus is so exaggerated that it becomes biomechanically inefficient – compressing joints and dampening an organic flow of movement. But such dysfunctional co-contraction is probably more usefully called "armoring" or simply a "holding pattern." Efficient synergistic co-contraction around a joint is actually a vital aspect of its stability, helping it to resist buckling under stress (it is unfortunate however that these researchers use the somatically unhelpful term, "stiffness" to describe this).

IT IS ALL ABOUT TIMING

These researchers used quite novel methods in studying this group of deep, often fine or narrow muscles, which have long been hard to study using standard electromyography. Instead they used real-time ultrasound imaging to measure their activity. They also used ultrasound imaging as a biofeedback device, giving clients visual feedback in their efforts to re-engage these deep muscles.

Their research has clearly demonstrated that for the effective coordination of the local and global systems timing is crucial. For people with back injury or low back pain, the coordination between the local and global systems goes awry. In a well-functioning body the TA and related multifidi should fire milliseconds before any gross movement of the trunk or extremities, but for those with low back pain the response of these muscles comes too late – after the gross movement has already commenced, thereby incidentally increasing the likelihood of re-injury. The TA and multifidi consequently become neurologically inhibited and rapidly atrophy. Other muscles, such as the rectus and erector spinae, will try to take over their function but ultimately they are not suited for the job. For uncompromised individuals however, the multifidi and TA have been found to be fully responsive during all movements of the lumbar spine and extremities. The research has also shown that when the local/global timing was "out," there is an increased incidence of injury both to the spine and to joints in the extremities – it seems that without efficient core stabilization, the stress of external perturbations can be transferred to any "weak link" in the body.

FEED FORWARD – THE ANTICIPATORY RECRUITMENT OF THE LOCAL GROUP

The local group seems to have a different form of neurological control from the global muscles – being automatic and working below the level of normal conscious awareness and volition. The local group has an anticipatory role, pre-stabilizing body segments prior to any overt movement.

These researchers called this role "feed forward."

Hence the commonly quoted observation that when someone in a relaxed standing position simply abducts their arm, even before the deltoid contracts there is first some stabilizing activity in the soleus of the contralateral leg and then activity in the TA. It is as if some level of our moving intelligence has already anticipated that displacing an arm from the trunk will shift the center of gravity of the organism as a whole thereby unbalancing it, and so prepares in advance to maintain balance in gravity. If you were to reproduce the same arm-abduction, say, on a finely balanced shop dummy, it would most certainly topple over due to the shift in its center of gravity from its midline. So, in a well-functioning body, this shift in the center of gravity is prepared for milliseconds in advance of any overt movement.

In his teaching, Godard describes this intelligent anticipation as an example of "pre-movement" – a pre-movement being any form of anticipatory postural activity. However he goes much further than the Australian researchers in suggesting such pre-movement is preceded by a "pre-pre-movement" – an active perceptual reach into the kinesphere, and that the quality of this reach will have profound implications on the quality of the succeeding movement.

> Pre pre movement will be the perceptive activity happening in the project of moving
>
> Pre-movement will be the postural activity setting the coordination of the movement (before we really move)
>
> Movement will be the displacement of any part of my body. (Godard 2006)

EXERCISE METHODS AROUND THE CORE

Richardson et al (1999) have developed a comprehensive exercise method aimed at showing patients how to regain control of the segmental stabilization of the spine. Their initial focus is on retraining the co-contraction of the TA and lumbar multifidi; this may have a considerable cognitive component and involve the use of biofeedback devices. After the patients have developed voluntary control of the "drawing-in manoeuvre," exercises may then move to working on unstable surfaces to stimulate the reflex activity of the tonic system. The training industry has now spawned a huge array of products designed to provide such unstable platforms: the gym ball (see Chek), the Duradisc, the BOSU, wobble-boards and the Bodyblade. However all these exercises clearly come from a physical therapy/personal training perspective – they rely on the deliberate isolation of functions, and though proven to be quite effective in reanimating these weak and inhibited muscles, they do not necessarily help patients take this regained functionality into whole-body movement. Such exercises could obviously be deeply enhanced by somatic work such as Feldenkrais, good Pilates or yoga instruction, Rolfing® Movement work, and particularly the kind perceptual "awakening" work advocated by Godard.

According to Godard, the factor that is usually entirely absent in these exercise systems is attention to the "pre-pre-movement," the perceptual act of orienting to the environment; so much of his work involves the awakening and opening of the "portals of perception" to set up the initial conditions that will allow a natural flowering of core coordination. Some of this work involves guiding the client to finding a different perceptual relationship with the immediate environment; it may also involve using "imaginative" processes like previewing a movement, visualizing a vector into space, or using image or metaphor to find a quality of movement. It is clear that such work is entirely consistent with the tracking and perception work that has long been central to the Rolfing technical repertoire.

CORE STABILIZATION GYM-STYLE

Looking at the distribution of fiber orientations in the musculature of the abdominal wall, we see that the fibers of the rectus and obliques are essentially oriented more towards the longitudinal axis of the body; they will therefore tend to flex the trunk with varying degrees of rotation depending on their cross-lateral synergy. Only the TA has fibers that run laterally, such that when they work they diminish the circumference of the abdomen, squeezing the gut body and elevating the costal arch and diaphragm. Thus north/south abdominal muscles will actively shorten the front line while the east/west muscles will indirectly lengthen it. Yet in many training systems this kind of differentiated function is not encouraged or even recognized. Usually a total tightening of the entire abdominal package is encouraged through holding static positions on unstable platforms such as the gym-ball. The general tightening of the belly will actually produce a deep muscular conflict – a simultaneous impulse to shorten and lengthen the superficial front line. This is an extremely common dysfunction in the West where the "cut abs" aesthetic prevails. But this general tightening of the belly seriously interferes with chest breathing and dampens the flow of all movements through the center. Some practices such as yoga and the more enlightened Pilates do recognise this vital differentiation in belly wall function and work with it. Caspari (2005) has distilled a great deal of Godard's thinking in her impressive formulation of the "functional recipe." She notes Godard's point that if we look at the functional goals of the traditional fifth hour then in this session we are attempting to evoke this precise differentiation in belly-wall function.

GODARD'S THEORY OF TONIC FUNCTION

The work of Godard is now well known to the Rolfing® and wider structural integration community (Frank 1995, 2003, 2004, 2007; Newton 1992, 1995); however it might be useful now to examine some of the central ideas of his work. Godard "focuses on the gravity response in the human body as a unifying principle for what has been called intrinsic movement" (Frank 1995). Intrinsic movement comes from the harmonious orchestration of the tonic musculature, which is activated through our perception. There are many "portals of perception" but he particularly emphasizes two main ways of relating to the world – a ground orientation and a space orientation. Everyone has both of these as a resource but we can have a preference to one or the other; we can be predominantly ground- or space oriented, and this will have very definite effects on how our posture is organized, how we initiate movement, and in the longer term, how our structure crystallizes.

His work explores many exteroceptive and proprioceptive channels that feed into core stabilization: the palpatory activity of the feet and hands; the pressure proprioception in the skin of the feet; the orienting information of the inner ear (and

its close cooperation with the oculomotor musculature of the eye); focal and peripheral vision and the proprioception of the suboccipital muscles. Much of his practical work consists in guiding the client's attention to different ways of perceiving the immediate environment or by creating imaginative constructs that profoundly affect tonic function.

Departing from the exercise science paradigm, Godard has declared that there are no "core" muscles. There are, however, certain muscles, like the TA, that contribute more to a lengthening through our midline, though they may have multiple other functions as well. "Core" is thus a coordination – all the muscular (and perceptual) coordination that brings "lift" to a structure, which can be observed in others or sensed in oneself as a subtle lengthening through the midline and greater sureness and subtlety in movement.

Godard has drawn on a huge variety of disciplines in creating this perceptual work – yoga, Pilates, the ideokinetic tradition of dance, the spatial awareness of the Alexander technique, the grounding orientation of much of Feldenkrais' work and the martial arts. Even some of the standard physical therapy repertoire finds its place, the use of Theraband for instance to assist clients in finding the core during movement against light resistance. However, in all this, the main work is in setting up the pre-conditions for the core coordination to occur.

THE INTRINSIC/EXTRINSIC MUSCULATURE

Let us look once more to Rolf's distinction of intrinsic and extrinsic musculature. From her usage, this distinction appears quite close to our present understanding of tonic and phasic musculature. We now have extensive knowledge of the different kinds and proportions of muscle fiber: many kinds of both fast and slow switch fibers, with their different biochemistries and different forms of innervation (and interestingly, Rolf had speculated that the intrinsics and extrinsics had different forms of innervation (Feitis 1978)). This intrinsic/extrinsic distinction is also clearly related to the local/global dynamic of postural control as proposed by Richardson et al. Rolf saw the inappropriate substitution of the extrinsics for the intrinsics as a sign of either somatic immaturity or dysfunction.

> The business of living in extrinsics is characteristic of the very young; it is a characteristic of the immature. (Feitis 1978)

And in many of her subsequent talks, she speaks of how we initially learn to move through the volitional use of the extrinsics, and that as we mature these skills can be gradually subsumed by the intrinsics, or not. Whether people end up "living in their extrinsics" through poor somatic socialization, or through injury and trauma, the way out is through any work that evokes intrinsic movement – including most forms of somatically oriented movement work.

Rolf's observations led her to believe that postural and motor efficiency would be enhanced if the deep, smaller muscles were allowed to work freely without being overpowered by their larger, more superficial cousins. For instance, she said:

> When the head functions incompetently, movement of the head is initiated and largely executed by the superficial muscles that attach to the shoulder girdle. Thus in the random individual, the head or neck turns with little or no participation of the deep-lying intrinsics (Rolf 1978).

Research is now confirming Rolf's assertion and revealing that the dysfunctional substitution of phasic for tonic activity is extremely common; for instance, the work of Richardson, et al. shows that the substitution of the rectus for the TA is strongly correlated with chronic back pain.

Godard reminds his students that our musculature has a great deal of overlapping or duplicated functionality. This does explain to a certain extent the ease with which extrinsic can substitute for intrinsic activity – in both a functional and dysfunctional ways. But we are asked to avoid a simplistic dualistic understanding of even the tonic/phasic distinction, and that there can at times be a legitimate overlap in their function. Taking the "inner and outer unit" musculature as just one example, the muscles of these groups could have widely different roles according to immediate situational and environmental demands. In various combinations the inner unit may be used for transient core stabilization, for supporting chest breathing during exertion, for the stabilization of the sacroiliac joint during trunk flexion or even for more extreme and forceful coordinations such as the valsalva manouver. For the latter the pelvic and respiratory diaphragms are also strongly recruited, and this may, at times, be entirely appropriate (if you are lifting a Volkswagen, for example).

ROLF AND PERCEPTUAL ORIENTATION

It is apparent that Rolf had more than an inkling of the importance of spatial orientation in organizing posture. When looking at the photograph of a client she once remarked:

> Oh, this is just another guy who doesn't know where "up" is (Feitis 1978).

This is yet another of her insights that were to be confirmed later in the work of others. In fact many of the traditional Rolfing® tracking techniques implicitly use directional cues and ideokinetic evocations to assist clients find different ways of organizing their body or "finding the Line" – find the earth, find the sky. The search for the ground orientation can be seen in the careful placement of the feet before long back-work for example. And it is clear now that these practices are actually directing clients' attention so they can open new portals of perception into the environment, and this can produce a real shift within the tonic system. This perceptual strand of Rolfing practice later became more explicitly stated in the palintonic principle of Maitland (1991), and Godard has refined this work in an extremely practical way. So in the well-known images of a "sky-hook" lifting the body, what is the significance of the skyward pointing arrow? Could it be the "knowing where 'up' is"? Could it be the vector of a skyward reach into the kinesphere?

THE LOCAL SYSTEM AND THE ANTI-GRAVITY SYSTEM

The local system can be seen as just one aspect of a much wider system of somatic control, which in the past has been called the anti-gravity system. The anti-gravity system is essentially a "catch all" label for the full spectrum of proprioceptive, reflex and learned activity that is constantly working to maintains us in gravity. Feldenkrais is alleged to have said that for someone to do nothing other than to stand erect, 70% of his neural traffic is connected with maintaining this orientation in gravity. How one would confirm this I do not know, but it does remind us of the staggeringly complex web of unconscious processing

that is occurring at all times in our nervous systems – the myriad minute adjustments taking place constantly throughout all the tonic musculature. Core stabilization is just one example of the tonic system in action, and the "inner unit" as studied by Richardson et al. is just a small part of the overall picture of core stabilization.

SOME "UPPER LEFT QUADRANT" SPECULATIONS

Being a dedicated fan of Ken Wilber (1996), I will offer some thoughts that may contextualize the Australian research mentioned in this paper. Being scientists, Richardson et al. deal with objective observables ("upper right quadrant"), and do not readily speculate about the somatic implications of their work ("upper left quadrant"); however we, being adventurers in the experiential or somatic realm, are free to draw such parallels. Phasic activity seems to be strongly correlated with movement "intentions," while tonic activity is more primitive and, like the workings of the autonomic nervous system, seems to work beneath the level of everyday awareness and volition. Like heartbeat and digestion, tonic activity seems to work perfectly well without conscious awareness. Godard however has suggested that the tonic system may be influenced by unconscious psychological impulses, and has provided some poignant examples of the muscular conflict between the consciously controlled phasics and the unconscious tonics – I want to kiss the girl (→) but social constraints hold me back (←), hence the unbearable vacillation (↔)!

SOME PERSONAL IMPRESSIONS

I have attended a number of Hubert Godard's workshops in New Zealand and Brazil and also one of Kevin Frank/Caryn McHose fascinating workshops related to Godard's work. The teacher of my Rolfing Movement training was Monica Caspari, whose teaching is deeply inspired by Godard's work. Needless to say, this perceptual/movement work now forms the central platform of my Rolfing® practice, which has been rejuvenated by the process. I have taken some of Godard's exercises with resistive tubing and developed some playful dance-like moves that I give to many of my clients to assist them in finding the core in movement. I also give many gym-ball balance exercises as well, as a means of stimulating their balance reflexes. At some stage in their process I usually introduce Godard's "flight of the eagle" (Frank 2005), which is an ideal movement sequence for revealing key elements of this approach – finding core stability through perceptual reach, activating the palpatory sensitivity of the hands and feet – but it also provides many supplementary benefits such as mobilizing the spine in flexion and extension. What is most significant for me, however, is that clients are genuinely interested in this approach and invariably carry out the suggested exercises most faithfully; and surely this is the real test in the value of any approach.

ENDNOTES

Caspari, M., "The Functional Rationale of the Recipe." Structural Integration, March 2005, Vol 33, No. 1, pp. 4-24.

Feitis, R. (ed.), Ida Rolf Talks: About Rolfing® and Physical Reality. Boulder, CO: The Rolf Institute of Structural Integration®, pp. 62, 108, 125, 232.

Frank, K., "Tonic Function: A Gravity Response Model for Rolfing Structural and Movement Integration." Rolf Lines, March 1995.

Frank, K., "The Relationship of Contralateral Gait and the Tonic Function Model of Structural Integration." Rolf Lines, December 2003.

Frank, K., "Tonic Function - Gravity Orientation as the Basis for Structural Integration." Hellerwork Newsletter, April 2004.

Frank, K., "Flight of the Eagle - Self Care for Structural Integration Clients." IASI, The 2005 Yearbook of Structural Integration.

Frank, K., "Posture & Perception in the Context of the Tonic Function Model of Structural Integration: An Introduction." IASI Yearbook 2007.

Godard, H., 2005 and 2006 class notes taken by the author, plus notes taken by Lael Keen at Godard's workshops in Tremembe, Brazil.

Ho, M., The Rainbow and the Worm. New Jersey: World Scientific, 1998.

Klingler, W., Schleip, R., Zorn, A., "European Fascia Research Project Report." Structural Integration, December 2004, Vol: 32, No. 4, pp. 4-10.

Maitland, J., "The Palintonic Lines of Rolfing." Rolf Lines, Vol. IXX, No. 1, Jan./Feb 1991.

Maitland, J., Spacious Body – Explorations in Somatic Ontology. Berkeley CA: North Atlantic Books, 1995, p. 221.

Newton, A., "An Interview with Hubert Godard." Rolf Lines, Winter 1992.

Newton, A., "Basic Concepts in the Theory of Hubert Godard." Rolf Lines, March 1995.

Newton, A., "Core Stabilization, Core Coordination." Structural Integration, Vol. 31, No. I, December 2003. (Also found at http://www.alinenewton.com/pdf-articles/core.htm)

Oschman, J., Energy Medicine in Therapeutics and Human Performance Edinburgh: Butterworth Heinemann, 2003.

Pare, S., "On Core (and Sleeve)." Structural Integration, Vol. 31, No. I, February 2003.

Richardson, C., Jull, G., Hodges, P., Hides, J., Therapeutic exercise for spinal segmental stabilization in low back pain. Scientific basis and clinical approach. Edinburgh: Churchill Livingstone, 1999.

Rolf, I., Rolfing: The Integration of Human Structures. New York: Harper and Rowe, 1978, pp. 41, 232.

Schleip, R., "Fascial Plasticity – A New Neurobiological Explanation." Journal of Bodywork and Movement Therapies 7(1):1, 2003,

Structural Integration "Core and Sleeve – Part I," December 2002.

Structural Integration "Core and Sleeve – Part II," February 2003.

Wilber, K., A Brief History of Everything, Melbourne: Hill of Content, 1996

WEBSITE RESOURCES

Chek, P: http://www.chekinstitute.com/articles.cfm

Newton, A: http://www.alinenewton.com/pdf-articles/index.htm

Frank, K: http://www.resourcesinmovement.com/Archive.htm