

I have already reviewed the mechanics of cranial bone motion in terms of biomechanical principles, and this can be read by clicking on [this link](#). I intend to write more on the physiological processes behind the Craniosacral Rhythm (CSR). This particular essay is a very eclectic overview of why I am writing all this guff about the physiology of the CSR. It is also a fairly random collection of thoughts, anecdotes and interesting factoids relevant to the practice of CST. It is a messy work in progress, subject to updates, revisions and extensions

Andrew Cook, Norwich June 2004

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Topics covered include :

1. **CST and Physiology** - why a re-assessment is necessary
2. **A cultural perspective** - a look at differing paradigms between CST and mainstream medicine
3. **Weasel words** - linguistic and (il)logical barriers to seeing the world as it is
4. **Chaos and The Golden Mean** - phi, chaos, fractals and natural geometry
5. **The Egg and the Spiral** - solitons, energy cysts, Babbitts Atom, and projective geometry - a quick look at the occurrence of the spiral toroid in CST, nature and physics (in fact, this just about covers life, the universe and everything!)

This grab-bag is still being filled - Topics still to come include the Heart, coherence, resonance and tensegrity structures

The spirit
likes to dress up like this:
ten fingers,
ten toes,
shoulders, and all the rest
at night
in the black branches,
in the morning
in the blue branches
of the world.
It could float, of course,
but would rather
plumb rough matter.
Airy and shapeless thing,
it needs
the metaphor of the body,
lime and appetite,
the oceanic fluids;
it needs the body's world,
Instinct
and imagination
and the dark hug of time,
sweetness
and tangibility,
to be understood,
to be more than pure light
that burns
where no one is --
so it enters us --
in the morning
shines from brute comfort
like a stitch of lightning;
and at night
lights up the deep and wondrous
drownings of the body
like a star.

by Mary Oliver, from Dream Work

1. CST and physiology

The properties of the Craniosacral System (CSS) have been defined by many authors, in the fields of Craniosacral Therapy e.g. Upledger (1983, 1987, 1990), Sills (2002, 2004), Milne (1995); and Cranial Osteopathy : e.g. Magoun (1976).

The medical validity and even existence of the Craniosacral Rhythm (CSR) have recently been brought into question by various researchers with an orthodox medical background (e.g. Opper et al 1997, Green et al 1999). This has been compounded by studies from within the Cranial world which demonstrate poor inter-examiner reliability when comparing assessment of the CSR (e.g. Hartman & Norton 2002). Since the CSR is often considered to be a core element of the practice of Craniosacral Therapy (CST), this is embarrassing and frustrating. It also leads to some interesting possibilities as to what the CSR is, what its implications are, and how these might be demonstrated within the currently accepted medical paradigm.

The current criticisms of CST are perhaps a strong message that the models used to describe the CSR be at least reviewed in the light of available evidence.

The definition of evidence in the medical and craniosacral worlds are somewhat different. CST practitioners rely on subjective impressions for their day-to-day work, whereas scientists (and certainly authors of meta studies) require some objectively measured quantity as proof. This creates several problems when any attempt is made to reconcile the two world views.

During the development of CST over the past 80 years and particularly in the past 30 years, attempts have been made to provide working models of the physiological phenomena behind the CSR, and a number of supposed “facts” assumed in CST are based on those models rather than on subjective experience or medically recognized physiology. In parallel, huge advances have been made in medical imaging technology over the past 30 years, enabling the flows of blood and CSF in the brain to be observed both qualitatively and quantitatively, with minimal invasiveness. This contrasts strongly to the evidence available before about 1980, when the main information about the CSS came from lumbar punctures, studies of hydrocephalus and other pathologies, and fatal instrumentation of laboratory animals.

CST is a discipline which can easily veer towards the esoteric. However, if we are eventually dealing with real physical movements of the body, *which I believe we are* - even if these are mediated “energetically” or even by “grace”, then that has to be produced through physical mechanisms which have very probably already been (at least partially) recognised. Physiological mechanisms may exist which have not yet been identified, but it would be perverse to assume from the start that this is the case for *all* palpated phenomena in CST. And even if these physical mechanisms are not *a priori*, they must exist in order to translate something more fundamental into the realm of material cause and effect.

There are some very good reasons for pursuing this topic. The advantages of a conceptual model for the CSR which more or less agrees with the current understanding of anatomy, physiology and pathology include

- An increased ability to communicate with the medical profession, through meeting them in language that they understand, and in ways which are consistent with their medical model
- A reduced target for skeptical criticism
- Possible improvements in applied technique through an improved mechanistic understanding
- Possible changes to contraindications (some contraindications in CST are based on *a priori* assumptions as to what drives the CSR and how CST works physiologically)
- A clearer definition of useful vs. nonproductive avenues for applied research, and an improved ability to design experiments and trials using widely recognised physiological indicators as part of the evidence.

2. A cultural perspective

CST stands in the middle of esotericism and science. We deal with real live bodies and affect real physiological systems. Palpation of tissue or fluid motion, or cranial bone motion requires that there is something physical happening. And yet I think that everyone who practices CST believes in some way or other that there is also a mystery of life itself, beyond mere chemical reactions and soulless complexity.

There exists a wide, perhaps widening, chasm between the experiential nature of a discipline such as CST and the paradigm used by medical scientists to investigate human physiology. It is important to bridge this, not just to (hopefully) bring the principles behind CST more into appropriate medical acceptance, but also to bring the rationale and advantages of the scientific medical approach into CST, wherever that is appropriate.

The current trend in medical research could be seen as a cultural backlash to the uncertainties and fears that we are facing in the western world. Terrorism, cancer, global warming, unemployment and job insecurity, demographic changes affecting pensions, an apparent increase in violence to person and property, and the accompanying media focus on all these things that make the world seem insecure. In fact, it is perhaps hard to tell whether the world is really less safe, or it is just that we are presented an exaggerated view in flashing lights and banner headlines of every small and potential disaster that visits any and every corner of the globe. So in the face of uncertainty, legislators are becoming more controlling, people are becoming more litigious, and medical scientists are becoming more overtly skeptical. The rise and rise of the meta study over the past decade is part of this trend - instead of producing original data, past studies are re-scrutinised, and if their protocols are found inadequate by a rapidly changing set of goal posts, the evidence they present is rejected. It is unfortunate that most past and even present research carried out on the effects of CST/CO do not pass the grade. The fact that the meta studies themselves do not pass the test is sometimes ignored - they can conform to their own criteria and still draw incorrect conclusions because the data they choose to inspect is unrepresentative, or the preconceptions they have are too narrow. All the name calling is just one set of people frightened that another set of people are blind to their world paradigm, and that the perceived blindness might cause damage or injury to somebody. In the world of CST we do exactly the same - the only difference being that we don't get our prejudices published in peer-reviewed journals (and maybe we do? - its just a different peer group) or cited as "evidence" in future meta studies.

So there is a fundamental difference in opinion as to the definition of reality. How did this come about? In the end, like all opposites, the scientific method of reductionism which has projected us into the technological age, and the more eastern technique of introspection, come together, and are the same. They both say "what is there?", and both answer "let's take a look and find out". Reductionism says that truth is found in the external world, can be identified best by an objective observer who places himself outside of the activity he is observing, and can be understood by breaking things down in to smaller and smaller units. The other states that truth is experiential, subjective, and inner experiences if followed carefully, lead to an understanding of everything. The gap that divides them is the assertion that their "truth", based on their method of observing and their view as to the limitations of reality, is *the* only truth. This dogmatism is remarkably similar in essence to religious fundamentalism - again a growing force in the modern world.

Skepticism vs Credulity

There are quite clear signs that both camps are often out of order. For the skeptics point of view, the assertion that nothing is proven (or in the extreme case, even exists) unless it has been scientifically double-blind trailed by at least two independent groups on a significant sample of the population, flies in the face of what must be their everyday experience of life. How do they even know what food to eat, unless it is prescribed by a set of MAFF guidelines with peer-reviewed journal references to back it up? How can they be even sure that they are feeling pain, or anger? They have in some perhaps subtle way dissociated from their bodies - the playground of the senses and emotions. The recent furore over exposure to sunlight is a good example. The doctor who dared to suggest that sunlight in moderate doses might be good for people lost his position in a Dermatology department - see [BBC link](#). The response of his peers was that the health benefits of sunlight are "unproven". The problem is that under the force of a firm statement such as "sunlight causes skin cancer" coming from a large

number of doctors, the complexity of the issue is lost. It has become a fashionable to provide soundbites for the public, assuming they are too stupid to understand anything more complex.

On the other hand, the new age tendency to assign everything to Quantum Mechanics or God (or both) is at best far sighted, and at worst an excuse for woolly thinking or no thinking at all, or even ignore-ance. The dissociation is from clarity - the positive attribute of the rational mind. Again complexity is ignored by providing an answer which appears to cover all possibilities. This is easily seen in the everyday use of a television and video. People know how to push the buttons, and know that there is a radiowave broadcast which is being received by aerial, but the processes in the middle are fudged over. Similarly but more subtly, the fact that there is a moving picture which *looks* like something one might view through a window is very deceptive.

Filling the gaps

It is possible to chase causal mechanisms back to Chemistry, Quantum Mechanics or God in remarkably few steps, the choice of which is the last step being a matter of whim. Bodily functions have a myriad of possible causes - depending how fundamental you wish to make the description. One difficulty with this approach is that science hasn't filled in all the gaps. The gaps I refer to are the means by which very detailed processes connect with each other and the whole functioning of a conscious organism in order to describe a full process. Even the gaps which *have* been filled would require a very thick book to describe "I switch on the light" from a mechanistic viewpoint.

Starting first the gross physiology and anatomy, then the specific biochemistry defined so well by reductionist science, we converge on a quantum level of explanation which itself cannot be adequately projected back into structures bigger than a few atoms, or divert off into descriptions of the interconnection of ourselves and the universe. So any mechanistic description of reality has to have a usually undefined and arbitrary place at which it stops its definition and says, for no rational reason whatsoever, "this is truth/ mechanism/ reality". In all of the above, the question of consciousness is largely unmentioned - how does this insubstantial thing in our minds exist, and how does it affect us and the world in such a physical way?

The question of "what is reality?" rapidly returns to the concepts of objectivity and subjectivity. Nakazono (a & 1979) points out that some things are describable by objective science, and should be so described. Other things are not describable by science, and exist in a purely subjective, but nevertheless real "alternate reality" - the "spiritual" world of mystery, imagination and inspiration. He considers that parallel spiritual subjective reality to be the true reality, the material world only apparently existing "like shadows cast on a wall".

And...

Funnily enough, the view of my very well educated Qigong teacher (based on his very strong understanding and internal experience of how Qi "energy" manifests) is that life springs out of nothing in a manner very similar to the medieval ideas of spontaneous generation - frogs from holes in the earth, and so on. He recognises that reproduction and DNA are present, but also has a parallel view of reality based on his subjective experience of the insubstantial "energetic" world, and like Nakozono considers the energetic reality to have a more fundamental meaning. The possibility that two very different realities can exist simultaneously is usually ignored in attempts to impose a single, self-consistent world view. I saw this recently when discussing evidence for electronic activity in nerve synapses ([4colorvision](#)) with a biologist. He derisively pointed out that the authors of the study believed that their electronic mechanism was superior and replaced neurochemical mechanisms. "What about all the molecular studies, the laboratory measurements of nerve signal propagation speeds?" he said. I had to agree with him - but these two people each had a valid view of two parallel realities. Nerve signals operate through neurochemical mediation *and* there is a more subtle electronic level of activity at much higher frequencies. "*And*" is probably one of the most important words in *any* language.

Objectivity and Subjectivity

Prigogine and Stengers (1985) approach objectivity from a different perspective, pointing out the ludicrousness of a scientific concept of objectivity, when all events and objects are causally

embedded in a holistic reality. Some things are so deeply embedded that they can never be separable from the observer, in which case an attempt at scientific objectivity is potentially misleading or even totally inappropriate. Meditative and spiritual experiences fall into this category, as do many sensory phenomena, and they are as valid a part of being human as the bones, flesh and blood in which they occur. Whether you agree with the esoteric view of Nakazono based on 40 years meditative practice, or the science-based quantum mechanics interpretation of Prigogine and Stengers, there are still areas of human existence - even some aspects of physical biology - which require subjective experience rather than laboratory instruments. The above viewpoint would be unacceptable to a real skeptic, since interpretation of the equations of Quantum Mechanics and Schrödinger's *Uncertainty Principle* is itself subject to arbitrary choice of limitations as to what reality consists of. The Copenhagen Interpretation is applied so often *because* it does not care to allow the more transcendent implications of non-locality and intimations of psychic phenomena.

Gödel

To view this from yet another direction; in 1931 a mathematical logician called Kurt Gödel showed that (Hofstadter, 1989)

"within a formal system questions exist that are neither provable nor disprovable on the basis of the axioms of that system".

This is known as "*Gödel's Incompleteness Theorem*". The brilliant philosopher Bertrand Russell had only completed *Principia Mathematica* - a logical categorisation of the knowledge and potential knowledge encompassed mathematics - some 10 years before, and that one sentence virtually assigned Russell's finest work to the dustbin. Putting it into plain English, Gödel's theorem showed that there are problems that cannot be solved by any set of rules or procedures because this would always require a higher set of rules. Although his proof was based on integers, it is widely considered to apply to any logical system or knowledge base, and indeed, is only applicable to "rich" logical systems, so it cannot be applied to the more fundamental branches of mathematics such as *set theory*. The difficulty with any interpretation of Gödel's work is that there are still only a handful of mathematicians in the world who truly understand the derivation and complexities of his proof. Rather like the worlds of quantum mechanics and general relativity, which are also only truly understood by a handful of experts worldwide, the reality is only expressed by the equations, and any other description or analogy is of necessity incomplete and possibly wrong. Therefore, the applicability (or not) of the *Incompleteness Theorem* to non-integer systems is debated fiercely. This debate is all the more intense because its inherent implication is that science as a self-consistent system of knowledge can *never* be a complete description of the universe in which we live.

The "S" word

I frequently use the word "body" or even "organism" as shorthand for that amazing mind- body- spirit complex we call a human being, and have used the word "spiritual" as sparingly as possible. That is not because I don't believe in the concept of a spiritual dimension to our lives. Rather, the word has become so ill-defined that I feel any use of it is bound to result in a far greater level of misinterpretation than is advisable. "Spiritual" was a rarely used word up to the 16th century, and has only become widely used in the 20th century. The early Christian church saw Spirit as something blowing through the world and igniting it rather than something opposite to mundane physical reality. The concept of spirit was so integral to their world view and daily lives that use of a word to describe it was hardly necessary. We live in an increasingly dualistic world, and over the past millennia "spirit" has taken on a meaning which is opposite to the manifest material universe, rather than being a force which is integral and "blows through it". On the less deist end of its possible spectrum of meaning, "spiritual" can imply a sense of curious, inspired reverence for life and the universe in which we live. I find it hard to imagine that being incompatible with science, though it is certainly incompatible with some systems of religious belief.

3. Weasel words

One confusing factor in reconciling palpable and "living-in" experiences of the human body with medical terminology is the arbitrary division applied to biological structures in order to label what we are attempting to describe. "Bones", "Connective tissue", "Blood", "Organs"... the list is long - but in reality the body morphs from one tissue (and fluid) form to another. The distinction is far more blurred than the word "Bone" would have us believe. I have to use these words because I have no other way of communicating with anyone - including myself - about this subject. I can constantly feel the pull that this vocabulary has on my thoughts, drawing me into believing that bones are some entity on their own, separate from the tissues around them, like a cylinder head on an engine block in a car.

If you doubt the power of this, say to yourself "sunrise". We know intellectually that the earth turns on its axis and the sun is relatively stationary, but the *experiential* sunrise is very powerful. Not only does it have an archetypal meaning of its own, but the word "sunrise" immediately puts us on a gut level into that archetypal/ sensual reality rather than the material reality which we "know" to be "true". This is an important point from the perspective of CST. We describe our experiences in terms of our sensory perceptions, but it must be understood that the description is an *archetypal* reality, and not necessarily *directly* related to the material reality. Internal imagery is a very clear example of this. I have heard many people during a treatment state that they (e.g.) sense something like a metal rod in their shoulder. We both know that there is no physical metal rod in their physical body, but archetypally that metal rod is very real, and is representative of...? Well, one description would be an internal subconscious process which links their physical body with their memory, personality and identity in a way which often has significant physiological implications. A more detailed overview of how the senses provide us with information is available on [this Link](#).

I would ask an open ended question - how much is the CSR an archetypal reality rather than a material one? If it is archetypal, we might be better recognising that by using non-medical jargon - to prevent confusing both ourselves and anyone else who does not share the same sensory experiences. Alternatively, could we create a description of it which is as valid in the material world as it is in the archetypal / experiential world? The choice is not easy, and in trying to please everyone there is every chance of pleasing no-one. Using an obviously non-physical description (e.g. "the breath of life" or "the tide") might prevent internal confusion in the world of CST practitioners - provided everyone sings the same tune, of course - but certainly creates misunderstanding, distance and prejudice amongst external "objective" observers. Similarly, the different experiences of different practitioners and schools of CST create a confusion to an external observer. That's not surprising - the different approaches confused me for some time, and I still have to sit back and get the bigger picture on occasions.

Astronomy's cautionary tale

Before the discovery of elliptical orbits through observation, the ancient Greeks regarded logic and geometry as two of the highest forms of art and science, and used them together in an attempt to describe the motions of the heavens. Although Ptolemy's description of the orbits of the planets was a fair approximation, the a priori assumption that God would create circular orbits (because the circle was perfect, and so must be divine), and the Earth is at the centre of the universe (because we are God's chosen creations) failed to capture the real nature of planetary motion. It's not that they failed to observe the motion of the planets carefully rather, they had a dogmatic view of how the universe works (and how God works), and then tried to fit the observations to that model far past the point at which it was clear that the model just did not work. It is ironic that part of the gradual loss of European faith in God over the past 1000 years and subsequent rise in secularism and atheism was due to the discovery that the heavens do not move in perfect circles!

Biology, nouns and Logic

Another facet of the numbing power of words is the dominance of nouns. Nouns are static. If I say "that is an oak tree", there may be some use in putting the object into a collective grouping that includes dozens of different species in dozens of different landscapes and environments, of ages ranging from few years to several centuries, through which light passes in a myriad of different ways and around which a whole host of creatures make their home... The use of a noun can have the

effect of letting us drop into complacency, to become blissfully unaware of the details, the processes - the life (the spirit?) which blows through the thing we are looking at. Naming has a power which can be very useful, and which, if done without awareness, can make us blind.

The linguistic definition of a mature and conceptually rich language is one whose verbs far outnumber its nouns. Biology is still largely a descriptive (noun-based) science rather than one dealing with processes (verbs). Because its vocabulary is dominated by nouns, the thought processes that are generated by use of the language of Biology are somewhat static, fixed. Physics, mathematics, and even ecological biology have for some reason gone some distance beyond medical biology.

The English language itself gives rise to misconceptions, by means of its commonly used grammatical constructions. The phrases "I have measles", "I want love", "I am a Craniosacral Therapist" all objectify processes. They take a process - something rich, transitory, multifaceted, and turn it into a relatively static *thing*. As soon as we hear the word for a thing (such as the oak tree example above), we think that we know what the thing is - and so can cease to enquire as to its nature. Its process nature begins to become slippery to the mind. Processes ("things") which should be viewed as ephemeral (like pain) become unchangeable facts of life. An interesting expansion of this is presented in the science fiction novel "Neverness" by David Zindell. He describes a language which has dropped nouns altogether.

Other words we have made into nouns instead of processes are the concepts of "True" and "False". I write them with a capital letter because that is how they are often spoken, and thought of. Something absolute, immovable, safe and certain. Believe it or not, our attitudes are still dominated by medieval Christian theological philosophy, which in turn was hugely influenced by Aristotelian and Platonic philosophy. The strongly dualistic logical system we employ in all aspects of life from science to law and beyond (is-isn't, good/evil, yes-no, true-false, guilty-innocent, etc.) was devised by Aristotle over 2300 years ago as an investigative philosophical tool. It is now even enshrined in our computing system (the binary 1-0).

It is perhaps worth stating more clearly what the tenets of Aristotelian logic are, so that we can be more aware of their undercurrents and pervasiveness, and so that we can also remember that this logical system is merely an investigative tool - a powerful one, but still just another spanner in the toolbox. Instead of remaining a useful tool, it has become an unrecognised belief system for almost everyone in the West, and a way of life to the extent that we struggle to see possibilities beyond its limited horizons :

- *The Law of Identity : everything is what it is : there is no ambiguity - e.g. "A spade is a spade", "What You See Is What You Get"*
- *The Law of Non-Contradiction : both A and its opposite "not-A" cannot be true - e.g. "You cannot be both dead and alive"; "If it is cloudy, then it cannot be sunny"*
- *The Principle of the Excluded Middle : every statement is either true or not true - e.g. "You are reading this, or you are not."*

Aristotle's works were lost in the dark ages, and then rediscovered when Spain was reconquered by Christendom, around the time of Rumi. Aristotle's system of logic was adopted first by Islamic clerics who spotted its potential for doctrinal mayhem and restricted its reading to a very few isolated centers. The Christian church had more enthusiasm and less foresight, partly because it enshrined the principles of absolute truth laid down by a single absolute God through an absolute written authority (the Bible), presided over by an absolute political theocracy. The Church eventually came to rue the day it embraced this absolutism, as Aristotle's ideas led to major schisms, forced the expansion of the Inquisition, and eventually ushered in the Age of Reason and rang the death knell of Papal dominance over European affairs (Rubenstein 2003). Prior to this split - the final wedge of which was hammered into place by the theologian William of Ockham - the study and contemplation of spiritual matters and the scientific study of nature were considered to be part of the same task - understanding and worshipping the created universe and its creator. It is another irony that Aristotle's ideas, which came to cause the conceptual split between spirit and matter, contain ideas of mysterious "properties" which are fundamental to nature, immutable, and *a priori*, such as life, weight, and so on. Applied as laws governing matter they held back science for hundreds of years. When considered as archetypal rules, they become the familiar landscape of the imagination...

“... Thus an imaginary animal like a unicorn is nothing in the sense of being non-existent; that is, it is not a thing. But because it exists as a mental conception it is not absolutely nothing. It has the same type of existence as a human thought. Thus it qualifies as a created something. (Barrow 2001, p. 107)

Considering that there are experiences in the field of consciousness which have a certain repeatability or universality, the unicorn is a trivial example of a concept central to the practice of anything relying on subjective experience.

William of Ockham is still famous for his razor - another overused tool - some 700 years after his death. Speaking about the people who invented the logic that drives modern science, he was not alone in being a theologian, or at least deeply religious in his outlook. Kepler, Galileo, Newton, Descartes, Laplace, to name but a few, all had a more “spiritual” view of the world. I once talked to a hardened skeptic about Newton’s theological research, and his response was (the dry Yorkshire accent drove it home even harder) “poor misguided fool”. My poor misguided opinion is that stripped of that original spiritual context within which they were formed, the ideas of Newton et al are loose cannons on deck. If reverence for life is taken away from the equations in the name of pure reason, we are left with a science that can work against nature just as much as it can work with it. I would argue further than human experience is part of the nature of the world, and so a rational system is required which allows for human experience and the possibility of things outside its’ scope. So this essay in all its quirkiness is in a sense, my attempt to practice what I am preaching.

Even rational certainty can slip away like quicksand. Classical geometry, arithmetic and Aristotelian logic were considered for centuries to be absolutes in the natural world, to the extent that philosophers and theologians considered them to be the small set of truly understandable and knowable information about God’s creation. In the 20th Century, Mathematicians and Logicians realised that these logical and geometric systems were merely choices in an infinite set of possibilities. Regarding logic, John Barrow in his book "Pi in the Sky" (1992) notes that :

"In a non-western culture like that of the Jains in ancient India, one finds a more sophisticated attitude to the truth of statements. The possibility that a statement might be indeterminate is admitted as well as the possibility that uncertainties exist in our analysis. These would correspond to statistical statements in which we simply give the likelihood that a certain statement is true or false.

"Jainian logic admits seven categories for a statement, which reflects both its intrinsic uncertainty and the incompleteness of our knowledge of it :

1. *Maybe it is*
2. *Maybe it is not*
3. *Maybe it is, but it is not*
4. *Maybe it is indeterminate*
5. *Maybe it is, but is indeterminate*
6. *Maybe it is not, but is indeterminate*
7. *Maybe it is and is not and is also indeterminate..."*

I feel that something like Jainian logic is far more appropriate for describing life and the spirit which moves through it. Strange as it may seem, Aristotle would probably have considered the above Jainian system to be equally valid. His definition of "what you see is what you get" included the personal experiential evidence which is so important to manual and "energy" therapies, and which is now rejected in skeptical scientific interpretations. Modern Physics and Mathematics acknowledges that there are many possible systems of logic, none of which are ordained by the processes of nature. It may take another few hundred years for our society to drop 19th century science and medieval theological philosophy. Meanwhile, when working with real human beings, there is often no clear black and white answer. However, there are miracles, there is beauty, and there are times when life is present in its full rawness of being

4. Chaos and The Golden Mean

The problem of calculating how several bodies orbit around each other is not a trivial one. It took some thousands of years of sustained effort in observations, philosophy and advances in mathematics to achieve any substantial degree of accuracy. Modern orbital calculations are carried out using specially constructed computers, and have discovered that the orbits of the planets are chaotic, being inherently stable over a timespan of just two or three million years. Without some regulating force, orbits gradually lose their apparent stability, and the planets, including Earth, would have fallen back into the Sun many hundreds of millions of years ago. Life would not exist at least, life as we know it. The stability of the solar system arises because there is more than one planet, and the planets gently nudge each other back into stable orbital positions. Because they are a chaotic system, like all chaotic systems they seek internal stability. The planets naturally fall into a pattern of motion which has a certain implicit order, and orbital periods and radii of adjacent planets tend to be near-integer multiples of each other, or fall into a sequence similar in form to the Fibonacci series (Livio 2002).



You might by now be wondering what all this has to do with life and biology. The point is that the forces and processes that maintain the planets of the solar system in their stable long-term orbits around the Sun are exactly the same processes which govern the physiological and morphological stability of lifeforms. These are the mechanisms which create the template around which life shapes itself. The planets are well studied and easily observed, so they provide a well-grounded model which is familiar and relatively easy to visualise. The main difference between the planets and biological organisms is that organisms need to be far more adaptable, in order to be capable of responding appropriately to the demands of their environment. Planets do not need to adapt dynamically to their environment, so their essentially chaotic motion has a higher factor of stability and the chaos is more difficult to see, only becoming apparent when very accurate computer simulations are used to understand them.

It is perhaps interesting that Phi (1.618...), the number which appears so much in planetary orbits and other chaotic systems is the most irrational of all of the irrational numbers. If nature had to mathematically choose a number which would ensure that (e.g.) as many leaves as possible on a corn stalk were exposed to the sun without being shaded by other leaves, then it would choose Phi. Furthermore, Phi is related to the square root of 5 and the geometric properties of the pentangle. One of the many unusual and amazing characteristics of water that make it suited to supporting life is that the smallest compound molecule that it forms in nature is a pentangle. It also clumps into super-molecules consisting of several hundred loosely bound single (H₂O) water molecules. The shape this tends to take is the Icosahedron - a Platonic solid shot through with Phi, and the 3D shape which Plato ascribed to the element Water!

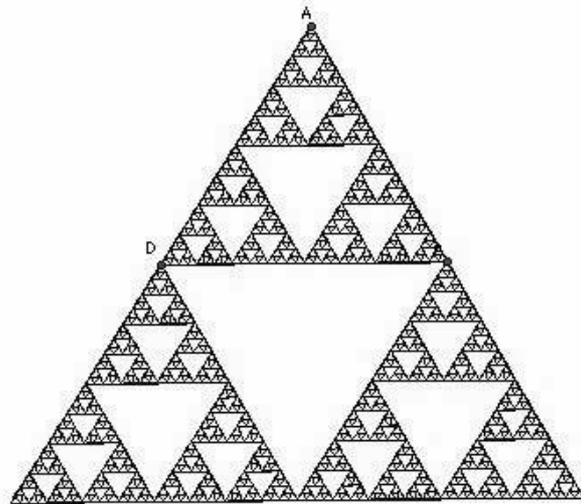
Mathematical forms which occur in nature are dominated by the set of self-similar (fractal) branching structures (trees, arterial networks, river systems), and their associated golden section proportions so beloved of Greek architects and renaissance painters. Fractals are associated with chaos in that most if not all - chaotic (i.e. supposedly random) processes found in nature have some pattern when viewed on an appropriate scale, and this pattern repeats itself on several scales. This can most easily be seen in landscapes where the minute properties of rock, sand under the action of gravity create self-similar forms (Schwenk, 1974), and in the fractal networks of branches seen in trees, river systems, nerve and vascular networks, and even in the road systems of old cities (that is the ones which developed spontaneously rather than being planned). Fractals have self-similar properties because they are formed by an often simple set of self-referential instructions on how to grow. The network grows, and it is its current state that determines how it responds to the next round of growth.

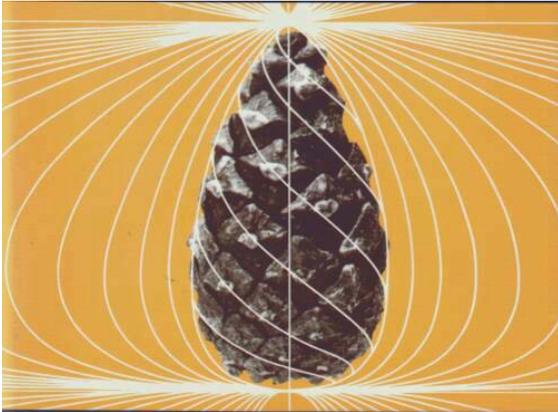
Fractal networks have a remarkable property which is particularly useful for living organisms they pack the greatest possible length into the smallest possible area - and in this property they inherently

contain the number Phi. In fact, the ideal Sierpinsky Gasket (see figure) has an infinite length of side contained within a finite area. It is a rather unnatural but easy to understand fractal surface which is constructed by dividing each triangle into three enclosing triangles and a central inverted triangle.

If you are a vascular or nervous system wanting to maximise contact throughout a body whilst taking up the minimum amount of space, then a (fractal) self-similar branching network is the most efficient way in which this can be done.

Much of the above discussion of the shapes and processes of life have a rather large inherent assumption - that life somehow "knows" how to organise itself, and will do so in the most efficient manner possible. I feel that this principle is so fundamental to both how life evolved and how it behaves on a daily basis that I do not see it as an assumption at all, but rather an a priori statement of fact. Its basis is very much linked to the concept that life has evolved to minimise its energy expenditure.





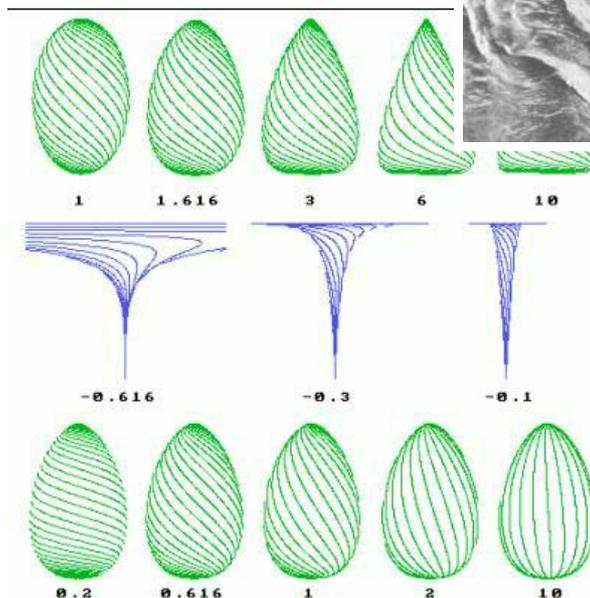
5. The Egg and the Spiral

Not only are the processes of planetary motion relevant to life. The very nature of the space in which they move has a direct bearing on how life develops. Some 2000 years after the Greek geometers and their fascination with the simplicity of the circle, Rudolf Steiner suggested that projective geometry was worth pursuing as a means to understand life. It might seem strange that an obscure branch of mathematics might give clues as to how life develops, or even what life is. However, with Steiner's comment as a starting point, a Scottish mathematics teacher called Lawrence Edwards went on to measure over 40,000 seeds,

eggs and tree buds over a period of more than 20 years (Edwards, 1993). In doing so, he demonstrated that they conform precisely to a very recognisable family of egg and vortex shapes which derive directly from projective geometry. The egg shapes tend towards a sphere at one extreme, and a cone at the other extreme, and when flipped inside out, become hyperbolic spirals, again highly recognisable from natural shapes. These are shown in the figures below.

These are only 2-dimensional representations of what can be far more complex 3-dimensional shapes. Some of the wide range of natural objects which happen to have shapes which exactly match the curve sets developed by Edwards and suggested by Steiner are shown in a the following figures. Other biological forms matching these shapes are the pineal gland and the heart.

So what is projective geometry? How does it differ from the geometry of the Greeks? Very briefly, it is a simple set of interrelationships between lines and points. It shows something about the way 3-dimensional space relates to itself, and how things in space relate to the infinity they are contained within. It uses the construction arcs and straight lines so beloved



of Pythagoras to project between points using a simple set of rules, and the intersections created then go on to be used to project even more points. Even more specifically, the egg and vortex shapes above are visualisations of a set of mathematical relationships between infinity and two straight lines. It is particularly intriguing that these shapes, which occur when life is starting out (egg, buds, seeds),

or where the energy of the universe is most concentrated (galaxies, hurricanes, whirlpools) are generated from the properties of an interrelationship between a focal point, a line (implying a direction of action) and infinity. It is important to keep remembering the implied presence of infinity in these familiar shapes.

(Space image from Astronomy picture of the day ([APOD](#)), with many APOD images from the [Hubble Space Image Archive](#).

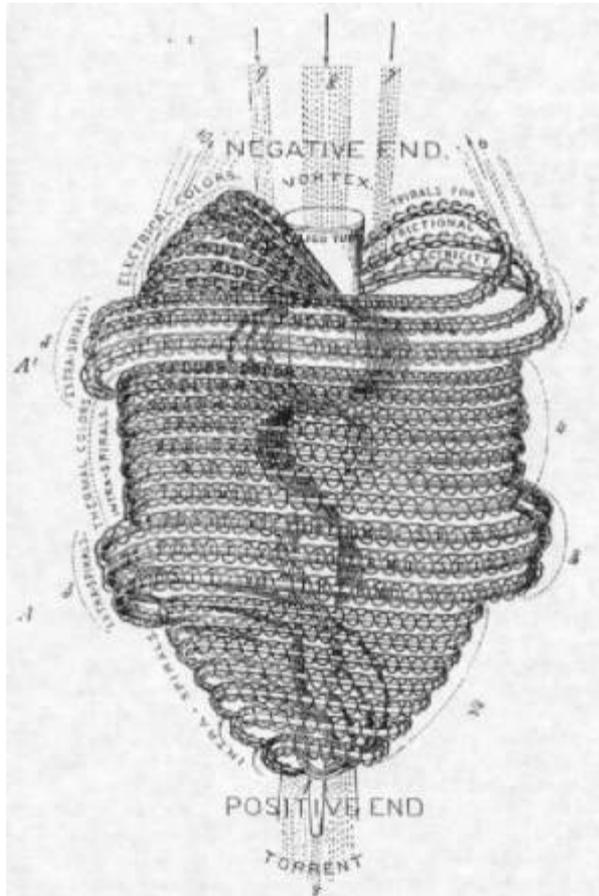
Projective geometry images from Edwards (1993) and the [Projective Geometry website](#)



The cosmic connection

In traditional European herbal lore, each plant is assigned to the influence of a particular planet. Perhaps not surprisingly, when Edwards measured how the buds and seeds of various trees and plants vary with time he found that their shape altered as specific planetary transits occurred. The significance of this is startling. Firstly, it suggests that the early herbalists knew something important. Secondly, there is a measurable effect of the position of the planets relative to Earth not so much a physical connection through gravity (which has poor directionality), but something which respects our relative location within the cosmos. Looking at this through the eye of projective geometry, maybe it is not so strange at all. The mathematical shape of the tree buds measured by Edwards are affected not only by local factors, but also by their relationship to infinity. Planets exist in the vast spaces between infinity and here. Occasionally they occupy geometrical positions that disturb that easy access to infinity. It is possible that astrological aspects (an aspect is a specific angular relationship which divides a circle into a number of equal segments) create a resonance in space rather like sound waves or vibrations affect a bowl of water. So it would seem that there is more than just mathematical expediency in the choice of infinity in the parameters which determine the shape of the buds. Even the smallest life is connected to the cosmos. The beech buds that Edwards measured are about 3mm wide and 12mm long.

Babbitt and the infinitesimal particle



Egg shapes also contain inherent spiral patterns, as shown in the figures above. If you examine a few dozen eggs, one or two will show faint traces of such a spiral in the shell. The egg-shaped spiral also occurs in other fields of human investigation. One of these is **Babbitt's Atom**. During the 19th Century, there was much interest in psychic phenomena, and some friends in the circle of Annie Besant and C.W. Leadbeater decided to create a psychic research group to divine the shape of the chemical elements (Babbitt, 1878), including most fundamental particle in the universe (Leadbeater & Besant, 1919). The shape they came up with is highly detailed. Both the specific form and general shape of Babbitt's Atom have interesting correlations with similar shapes found in meditation practices and physics.

Solitons

There is a group of standing waves called solitons (Ref Keith Farvis' [website](#)). Solitons possess the interesting property of being a self-propagating waveform i.e. they lose energy very, very slowly, and can form the basis for a packet of information which is not easily erased.. A 2-dimensional soliton occurs when a canal boat only just slightly smaller than the

canal pushes a wave in front of itself. If the boat stops, this wave (if it is not stopped by any locks or weirs) can travel many tens of miles down the canal virtually undiminished. A 3-dimensional soliton is the same shape as Babbitt's Atom. As such, this torus-like vortex is found in some interesting places. It is the shape of the minute convection cells that make up the core of every chemical reaction. It is also the same shape as the best guess a physicist can make of the shape of the particulate (as opposed to the waveform) electron. Considering what Babbitt set out to achieve, I think that says quite a lot.

Solitons crop up in some other very interesting places. If you recall that the canal boat created a soliton by pushing the water, this in some ways explains the persistence of the resulting wave. Its motion has had time to consolidate or stabilise, to organise itself around the force that propels it, so it could be said to have taken on the characteristics of whatever generated it. In China, there is a saying that a kick from a horse breaks bones, but a kick from a camel will kill. The practicality behind this is that a horse's hoof is hard and the kinetic force that enters the body has a very sharp wavefront. This force is then either dissipated by tissues, or it breaks something, but it cannot easily stay in the body. On the other hand, a camels' hoof is padded, or even spring-loaded, and the power of the blow is pushed into the body in a similar way to how the canal boat pushed a wave. The kinetic energy is then contained in a self-propogating parcel, which is far less easy for the tissues to stop. If it does come to a halt in the body, it has a far greater chance of just hanging there without dispersing, creating what in CST jargon is called an energy cyst.

A more physics-based description of the difference between a sharp impact and a shove would also show a substantial difference in the resultant waveforms generated by the impact. Every waveform that is not a pure sinusoid can be decomposed into an idealised set of sinusoid waveforms, by a process called an inverse fourier transform. The horse kick and camel kick can be analysed in this way - although the same total energy is applied in the two kicks, the horse kick generates much shorter waveforms than the camel kick. It is a general principle that short waveforms tend to attenuate (be dissipated and reduced by the medium in which they are travelling), whereas longer waves travel much greater distances. This can be seen in radio station transmissions (shortwave and FM radio is used for short distances, whereas longwave transmissions are generally travel much

greater distances). In physical waves in the sea, little wavelets disappear within a metre or less; medium sized waves come and go over a few hundred yards; and tsunamis with a wavelength of tens or hundreds of metres can travel across an entire ocean.

Viktor Schauberger

Babbitt's Atom is particularly special in that embodies both the whirlpool/vortex (inward-acting) aspect of Edwards's projective geometrical forms, and the spiral egg shaped envelope (outward-acting). The internal aspect of Babbitt's Atom can be compared to Viktor Schauberger's centripetal force where he considered natural forces to be at their most powerful (Coates, 1996), and the outer egg is the centrifugal aspect; which manifests the energies concentrated by centripetal action. Most modern engineering applies centrifugal action, whereas Schaubergers turbine designs instead gained power by spiralling water into smaller and smaller volumes. One of the great original thinkers of the 20th Century, Schauberger came from the same corner of Eastern Europe that produced Rudolf Steiner and Nicolai Tesla. His developmental years as a forester in the last remaining primeval forests of Europe gave him an understanding of how nature - and particularly water works in its raw state, undisturbed by human activity. He considered spiral and egg forms to be particularly important, and that the centripetal force was far more fundamental. His work has recently been applied to energising water by several organisations, including the [Centre for Implosion Research](#).

The central core of Babbitt's Atom is similar to the forms created by turbulence in fluids, waterspouts, hurricanes and whirlpools being a manifestation of the inner rapidly moving core. The outer egg-form is not visible because its force is dissipated over a far greater volume. If you stand on a bridge and look at the water passing underneath, you will see small whirlpools of vertical turbulence patterns, which persist far longer than the other ripples, and move on their own, almost like watery version of a child's gyroscope. Schauberger devised a series of experiments with water flowing through tubes shaped like elongated Kudu horns. During these, he found that water offered no resistance to flow if it was coaxed into a hyperbolic spiral motion the same spiral that is derived from projective geometry, and the same spiral that resides in the core of Babbitt's Atom. To an engineer, the implications of the above sentence are rather startling, but perhaps it would be best to spell them out more fully. In classical hydraulics, all water flow requires some expenditure of energy, and this is measured as resistance to flow, which usually increases as the velocity of the flow increases. Schaubergers experiment showed that flow through a hyperbolic spiral caused something very strange to happen - there was no measurable energy loss. This is an achievement equivalent to inventing a perpetual motion machine. In terms of the principles of physics, he had created one half of a soliton cycle.

Perhaps more obviously spectacular is the funnel inside a tornado of which a few people have seen and lived to tell the tale. The form of this funnel is uncannily like the central vortex of Babbitt's Atom. Most tornadoes have multiple suction vortices which orbit around a central vortex and are not always visible to the eye of an external observer. The power of winds around a tornado is quite mind-boggling. Our usual experience of air moving would not allow for it to whisk away large cars and trucks, rip them apart, and spew out the contents over tens of square miles. Furthermore, the fact that even entire engine blocks can completely disappear leaves some food for thought. It is believed that most of the damage attributed to a tornado is in fact caused by suction (centripetal) vortices. There is a piece of famous tornado footage, filmed from helicopter, in which these vortices are occasionally visible in the main circulation. However, the fact that a helicopter could be present indicates that this was not a particularly strong tornado. Eye witness accounts also exist from people who, sensing the lull in the middle of the eye, thought the tornado had finished, and came out of their hiding place. The sight that greeted them was awesome. All around them was stillness, surrounded by utter chaos, and as they looked upwards they saw huge grey snakes writhing around the inside of the tornado, with constant lightning discharges all round the main funnel walls. This image is worth bearing in mind when looking at the picture of Babbitt's Atom. Those spiral pathways are not static they are alive, writhing like snakes. I also like to think of them sparking with electrical discharges and I think Schauberger would have agreed with this.

Recent evidence ([2004](#)) about the structure of the universe suggests that about 30% of it is composed of dark matter (presumed to be some kind of particle so far undetected), just over 65% is dark energy (scientists know it is there, but cannot see it, and are currently unsure how to even start looking for it), and the substantial universe we experience, including all matter, light, x-rays and other

detectable energy only amounts to 2 or 3% of the total. This puts a very different light on Nakazono's assertion that the material world is not true reality. It also gives some support to Viktor Scaubergers interest in implosion and centripetal energy. If one speculates that everything in the universe is based on a soliton or Babbitt's Atom, and the external part of the soliton (the outer egg-shaped spiral) is the visible detectable manifest part of existence, then all that missing energy could be contained in the inward moving centripetal axis of the soliton.

Turbulence, Chaos and Self-Organisation

"Sometimes at uncertain times and places, the eternal, universal fall of the atoms is disturbed by a very slight deviation - the clinamen. The resulting vortex gives rise to the world, to all natural things. Lucretius, 98-55BC

For a long time, Lucretius's clinamen was ridiculed by scientists, and turbulence was considered to be a state of disorder chaos in the sense of being shapeless. Today we know that this is far from the truth. Whilst turbulent motion appears to be formless and chaotic on a macroscopic scale, it is very highly organised on a microscopic scale. If you look at the patterns created by smoke (see figure), or by the injection of one fluid into another (e.g. Schwenk 1974, Plates 46-54).

The multiple space and time scales involved in turbulence correspond to the coherent behaviour of millions and millions of molecules. Viewed in this way, the transition from laminar flow to turbulence is a process of self-organisation. (Prigogine & Stengers, 1985),

and



In far from equilibrium conditions various types of self-organisation processes may occur. These may lead to the appearance of chemical oscillations [such as chemical clocks] or to spatial structures. We have seen that the basic condition for the appearance of such phenomena is the existence of catalytic effects.

In other words, the apparent chaos of large scale events (as opposed to the more easily observable small scale interactions of individual atoms) may appear to be chaotic, but they actually tend to self-organise of and by themselves. This applies not only to potentially intelligent lifeforms and colonies of lifeforms, but also to chemical and physical processes. Examples include the production of ripples of sand on a beach, or indeed the apparently simple relationship between planetary orbits. Prigogine and Stengers call these self-organised entities Dissipative Structures, and they can appear to behave outside the usual rules of Entropy and the normal rules of behaviour of matter.



Dissipative structures actually correspond to a form of supramolecular organisation. One of the most interesting aspects of dissipative structures is their coherence. The system behaves as a whole, as if it were the site of long-range forces. In spite of the fact that interactions among molecules do not exceed a range of some 10^{-10} m [i.e. less than a billionth of a millimetre], the system is structured as though each molecule were 'informed' about the overall state of the system...



A close look at the picture of Babbitts Atom shows a wide outer vortex surrounding a more compact inner vortex. The outer vortex forms the egg shape, and the inner vortex is again of the same shape family as the logarithmic spirals found in projective geometry. Its shape is reminiscent of the Caduceus of Hermes or the single serpent of Aesculapius, associated with healing for over 2000 years. Other esoteric associations of Babbitt's Atom include the fact that it is an inner vision/inner kinaesthetic phenomenon in Taoist meditation practice, and bears a strong resemblance to the basic principles enshrined in the Kototama (see books by Nakazono) one of the spiritual teachings that has survived in the Shinto tradition of

Japan for at least 5000 years. The Kototama is quite specific that the inner spiral rotates counter to the outer spiral. More recently in the complementary healing field, this torus/egg/spiral form has surfaced as a fundamental energetic shape in Polarity Therapy (which is based primarily on Ayurvedic principles), and is an experiential phenomenon in Long-Tide application of Cranial Osteopathy and Cranio-Sacral Therapy.

In all of the above, there are some important concepts which apply directly to life. In its most fundamental form, Babbitt's Atom is considered to be the standing wave around which life forms itself, with obvious implicit references to the properties of a Soliton waveform. The list below reviews some of its more important features :

- It has a spiral form
- The inner spiral is more concentrated
- It contains information (the vortex is a standing wave, on which higher frequencies can be present)
- It is self-perpetuating i.e. it is stable over long periods of time
- It has several distinct strands
- It is dynamic, constantly moving and renewing itself
- Anything within it goes through cycles of expansion and contraction.
- Whenever expansion is present so must be contraction, and vice versa.
- Energy is created/concentrated in the inward phase, and expressed in the expansive phase.

There are greater and more important implications than this. The Kototama goes even further, stating that material existence itself has this basis. In fact, the Kototama describes not only the creation of a living organism, but the pattern with which that takes place also describes the birth of the universe itself. The Biodynamic Cranial schools teach that this shape is related not only to the template of health in a human being, but also that smaller vortices within it are attributable to retained trauma. This is the shape of memory; the form that contains the information that determines both appearance and function of all living and many non-biological processes. Considering that the egg and spiral shapes investigated by Edwards are so fundamental to how space relates to itself, it is perhaps not surprising that they crop up in so many fundamental ways in nature. Neither is it surprising that they are referred to and experienced in esoteric traditions. Because this form is so fundamental to nature, it would be very surprising if there were not some reference to it in mythology or meditative practice. Other instances where the egg and spiral are important in esoteric traditions include such diverse teachings as Carlos Castaneda, Sufic dancing and Kundalini Yoga. The tradition of spirals is reviewed in some detail by Jill Purce (1974).

References

- Babbitt, Edwin Dwight (1878) "The Principles of Light and Color" Publ. Babbitt & Company, New York, Republished by Borderland Sciences, California 1987. Republished by Faber Birren: Secaucus, New Jersey, 1980.
- Barrow, John D (2001) *The Book of Nothing*. Publ. Vintage UK
- Barrow, John D (1992) *Pi in the sky - Counting, thinking and being*. Publ. Clarendon
- Becker R.O. & Selden G (1985) *The Body Electric*. Publ. Quill
- Coates, Callum (1996) "Living Energies – Viktor Scauberger's brilliant work with natural energies explained" Publ. Gateway Books
- Davson H. & Segal MB (1996) *Physiology of the CSF and Blood-Brain Barriers*. Publ. CRC Press
- Edwards, Lawrence (1993) "The Vortex of Life – Nature's patterns in space and time" Publ. Floris
- Green C, Martin CW, Bassett K, Kazanjian A. (1999) *A Systematic Review and Critical Appraisal of the Scientific Evidence on Craniosacral Therapy*. Vancouver, British Columbia, Canada: British Columbia Office of Health Technology Assessment USA
- Hartman SE, Norton JM. (2002) Interexaminer reliability and cranial osteopathy. *Scientific Review of Alternative Medicine*. 6:23-40.
- Hofstadter, Douglas R. (1989) "Godel, Escher, Bach: An Eternal Golden Braid" Publ. Random House
- Leadbeater, CW & Annie Besant (1919) (ed. AP Sinnett). "Occult Chemistry - Clairvoyant Observations on the Chemical Elements" Second Edition. Publ. Theosophical Publishing House, London. Republished (1967) ISBN 0787-3010-8-6 by Health Research, Mokelumne Hill, California 95245, USA
- Livio, Mario (2002) *The Golden Ratio - the story of Phi, the extraordinary number of nature, art and beauty*. Publ. Review/Hodder Headline
- Magoun HI (1976) *Osteopathy in the Cranial Field*. The Journal Printing Company, Kirksville USA
- McCraty, Rollin & Doc Childre (2003) "The Appreciative Heart : The Psychophysiology of Positive Emotions and Optimal Functioning" Publ. Institute of HeartMath, Boulder Creek, California USA.
- McCraty, Rollin (2003) *The Energetic Heart - Biomagnetic interactions within and between people*. Publ. Institute of HeartMath, Boulder Creek, California USA.
- McCraty, Rollin, Atkinson M, Tiller WA, Rein G and Watkins AD (1995) The Effect of Emotions on Short-Term Power Spectrum Analysis of Heart-Rate Variability. *American Journal of Cardiology* Nov 15th 76(14) pp1089-1093
- Milne H (1995) *The Heart of Listening Listening – a visionary approach to craniosacral work*. Vols I and II. Publ. North Atlantic Books, Berkeley, California USA
- Myers, T.W. (2001) *Anatomy Trains*. Publ. Churchill Livingstone
- Nakazono, Masahilo (1979) *My Past Way of Budo and other essays*. Publ. Kototama Books, Santa Fe, New Mexico USA
- Nakazono, Masahilo (a) *The Law and Therapy of Natural Life*, Unpublished Acupuncture training manual from the. Kototama Institute, PO Box 1836, Santa Fe, New Mexico 87501 USA
- Oleski, Sheryl Lynn.; Gerald H. Smith & William T. Crow (2002) Radiographic Evidence of Cranial Bone Mobility. *Cranio: The Journal of Craniomandibular Practice*; January 2002, V20N1, pp 34 ff

- Oppel L, Beyerstein BL, Mathias R, et al. (1997) *Craniosacral Therapy: A Review of the Scientific Evidence*. Report prepared by the Alternative Therapy Evaluation Committee for The Insurance Corporation of British Columbia
- Oschman, James L. (2000) "Energy Medicine : The Scientific Basis" Publ. Churchill Livingstone
- Prigogine, Ilya and Isabelle Stengers (1985) "Order Out of Chaos" Publ. Flamingo
- Purce, Jill (1974) "The Mystic Spiral – Journey of the Soul" Publ. Thames & Hudson
- Hofstadter , Douglas R. (1989) *Godel, Escher, Bach: An Eternal Golden Braid*. Publ. Random House
- Rubenstein, Richard E (2003) *Aristotle's Children - how Chritians, Muslims and Jews rediscovered ancient wisdom an dilluminated the dark ages*. Publ. Harcourt
- Schultz R.L. & Feitis R. (1996) *The Endless Web – Fascial anatomy and physical reality*. Publ. North Atlantic Books
- Schwenk, Theodor (1965) "Sensitive Chaos – The creation of flowing forms in water and air" Publ. Rudolf Steiner Press, London
- Scott-Mumby, Dr, Keith (1999) "Virtual Medicine : A new dimension in energy healing" Publ Thorsons
- Sills Franklyn (2002) "The Polarity Process – energy as a healing art" Publ. North Atlantic Books
- Sills F (2002) *Craniosacral Biodynamics I* Publ. North Atlantic Books , Berkeley, California USA
- Sills F (2004) *Craniosacral Biodynamics II The primal midline and the organisation of the body* Publ. North Atlantic Books , Berkeley, California USA
- Sutherland WG (1939) *The Cranial Bowl*. Free Press
- Tiller WA, McCraty R and Atkinson M (1996) Cardiac coherence - a new, noninvasive measure of autonomic nervous system order. *Alternative Therapies* Jan 2(1), pp 52-65
- Upledger JE & Vredevoogd JD (1983) *Craniosacral Therapy I*. Publ. UI Publishing, Palm Beach Gardens, Florida USA
- Upledger JE (1987) *Craniosacral Therapy II : Beyond the Dura*. Publ. UI Publishing, Palm Beach Gardens, Florida USA
- Upledger JE (1990) *SomatoEmotional Release*. Publ. UI Publishing, Palm Beach Gardens, Florida USA
- Upledger JE (1995) *Research and observations that support the existence of a craniosacral system*. Monograph, Publ. UI Publishing, Palm Beach Gardens, Florida USA