

# A QUANTUM FIELD THEORY OF LIFE AND CONSCIOUSNESS: THE QUANTUM HEAT ENGINE OF PSYCHOSOCIAL GENOMICS

ERNEST ROSSI AND KATHRYN ROSSI  
corresponding author: [ernest@ernestrossi.com](mailto:ernest@ernestrossi.com)

## Abstract

We propose a new quantum field theory (QFT) for an emerging psychology of consciousness and cognition for optimizing health and wellness. This quantum field theory of psychosocial genomics facilitates creative consciousness, gene expression, brain plasticity and expectancy in the top-down approaches to mind/body therapy. The advent of current research in the quantum biology of life and consciousness is now generating an enlightened horizon for the pursuit of STEM education (Science, Technology, Engineering and Math). Quantum field theory brings together a variety of interdisciplinary fields ranging from stress reduction, psychosomatics, psychoneuroimmunology, meditation and mind-

body medicine to the deep quantum psychobiology of optimizing human performance and well-being. Research in the quantum dynamics of particle physics, biology and psychology is proposing the ultimate hypothesis about how our continually expanding universe is a quantum heat engine (QHE) that underpins the life energy equations of cosmos and consciousness. Innovative psychosocial genomic research on all levels from mind to gene is clarified and recommended for formulating the scientific foundation of a quantum field theory of psychology, consciousness and creativity characteristic of life systems in ancient and modern approaches to self-care and healing.

## An Introduction to A Quantum Field Theory of Psychosocial Genomics

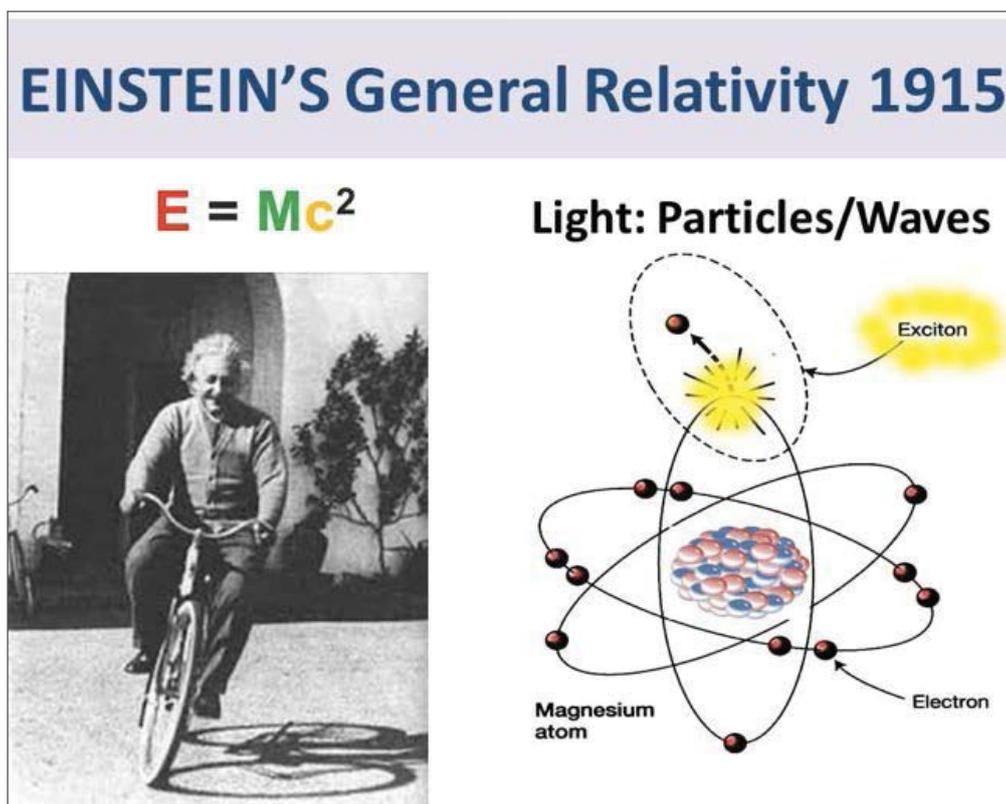


Figure 1. A playful Einstein illustrating angular momentum (circles) in the Classical/Quantum interface of a STEM (Science, Technology, Engineering & Math) Quantum Field Theory of Life, Consciousness and Cognition. Notice how the classical curve of angular momentum of Einstein's Bike appears to be a STEM amplification of the curves of angular momentum in visualizing the quantum dynamics a photon of light generating an Exciton in a magnesium atom (McFadden & Al-khalili, 2014).

In 2016 we celebrated the centennial of Einstein's General Theory of Relativity, which is expressed in his iconic equation:  $E = Mc^2$  (Energy equals Mass times the speed of light squared). On the one hand this equation has been associated with the development of the atomic bomb. On the other hand, it has inspired profoundly new insights into the quantum nature of life, death, health and perhaps consciousness itself. The birth of our current age of quantum physics, biology and psychology has opened entirely new ways of understanding nature that goes beyond traditional texts and journals (McFadden, 2000; McFadden & Al-khalili, 2014).

Of all the so-called "strangeness and weirdness" of the early theories of quantum mechanics none

the psychology of consciousness, cognition and well-being. Inspiration for understanding Quantum Field Theory (QFT) can be found in the new text for students by Lancaster and Blundell (2014) with their very first words on page one.

### What is Quantum Field Theory?

*Every particle and every wave in the Universe is simply an excitation of a quantum field that is defined over all space and time.*

This remarkable assertion is at the heart of **quantum field theory**. It means that any attempt to understand the fundamental physical laws governing elementary particles has to first grapple with the fundamentals of quantum field

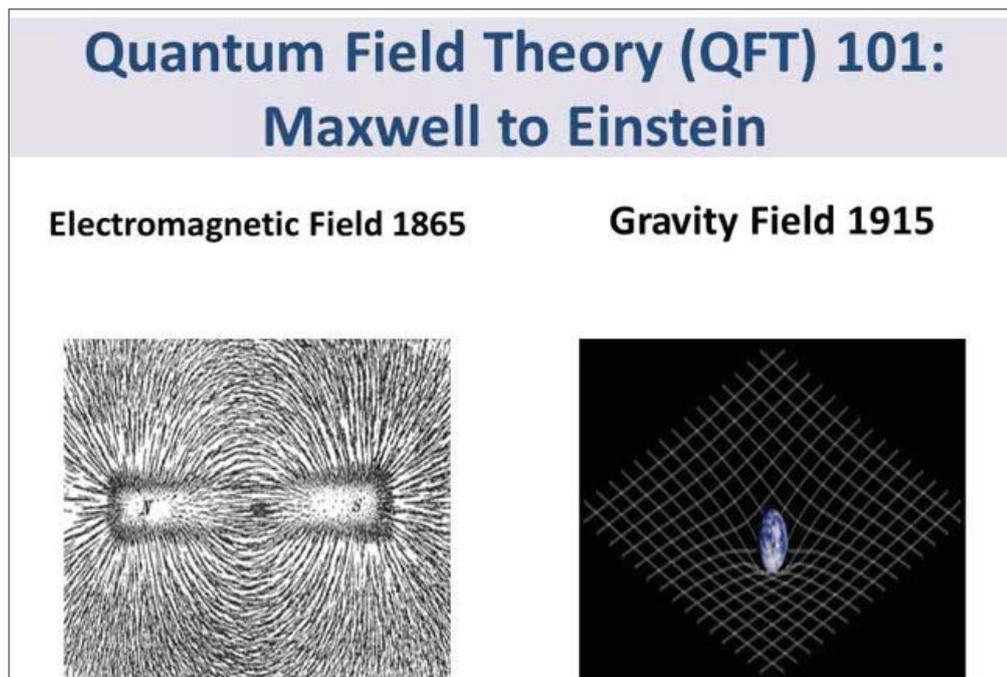


Figure 2.  
The origin of the Quantum Field Theory in Maxwell's Electromagnetic Field Theory.

seemed more paradoxical than the apparently dual nature of light as both a particle and wave. It has taken scientists a bit more than 100 years to resolve this apparent paradox experimentally and mathematically. This is now epitomized by the new concept of light as a *quasiparticle* in *Quantum Electrodynamics (QED)*, *The Strange Theory of Light and Matter* (Feynman, 1985). This is especially true of the quantum concept of the *exciton*, which manifests the dual nature of light as a quasiparticle in *Quantum Field Theory (QFT)* that explores the evolution of life and consciousness in a scientific manner, which now engages us in one of the most tantalizing intellectual adventures of our time. Let's join Einstein's playful bike ride and begin with a bit of the history QFT 101.

Quantum Field Theory (QFT) is currently emerging as the conceptual and mathematical successor to quantum electrodynamics (QED) in the life sciences. This is particularly true in its applications to the life sciences such as biology and

theory. It also means that any description of complicated interacting systems, such as are encountered in the mind-body problem [cosmos, consciousness and cognition] will involve quantum theory to properly describe the interactions ... In any case, quantum field theory is the best theory currently available to describe the world around us, and in a particular incarnation known as quantum electrodynamics (QED), is the most accurately tested physical theory ... The ideas making up quantum field theory have profound consequences ... *Interactions in quantum field theory involve products of operators which are found to create and annihilate particles and so interactions correspond to processes in which particles are created or annihilated; hence there is also the possibility of creating and destroying virtual particles which mediate forces* (p. 1, italics added here).

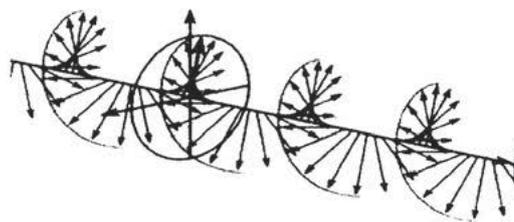
We could do an interesting Einstein thought experiment with this quote by replacing the word "Field" with "Consciousness," the word "Particle" with "Person" and the word "Interaction" with "Relationship." This would suggest a new quantum inspired perspective for amplifying Lancaster and Blundell's mathematical overview of quantum field theory from physics to new applications in biology and psychology. We will begin this thought experiment with an overview comparing and contrasting the *physicist's outer world view of objective quantum reality with the psychologist's inner world view of subjective quantum reality described as QBism* by Fuchs (2001, 2010, 2011, 2012). We have

previously illustrated how Dirac's quantum bra-ket math notation could be applied to the problems of the human consciousness and cognition as we experience them in the psychodynamics of everyday life, dreams and psychotherapy (Rossi & Rossi, 2014 a, b, 2015). We now use Box One to outline Maxwell's four classical equations of electricity (**E**) and magnetism (**H**) to propose an updated Quantum Field Theory of physics, biology, psychology and its applications to research in consciousness, cognition, and the traditional mind/body therapies such as meditation, mindfulness and naturalistic therapeutic hypnosis.

**Box One: A STEM Review of the Maxwell Electromagnetic Equations:  
A Quantum Field Theory of Naturalistic Therapeutic Hypnosis**

$$\begin{array}{ll} \nabla \cdot \mathbf{E} = 0 & \nabla \times \mathbf{E} = - \frac{1}{c} \frac{\partial \mathbf{H}}{\partial t} \\ \nabla \cdot \mathbf{H} = 0 & \nabla \times \mathbf{H} = \frac{1}{c} \frac{\partial \mathbf{E}}{\partial t} \end{array}$$

This STEM review of Maxwell's (1871) classical four equations of electromagnetism is updated with current mathematical notation (Stewart, 2012) to clarify the essential dynamics of the quantum field theory of therapeutic hypnosis (Ravitz, 1950, 1962, 2002). The two equations on the left illustrate the *Divergence Operator* in mathematics, which the authors propose as corresponding to the *Dissociation in Hypnosis*. The two equations on the right illustrate the *Curl Operator* in mathematics, which the authors propose as corresponding to the *Convergence and Focusing of Attention, Consciousness, Cognition and Expectancy in Hypnosis*. Notice how the balanced *symmetries between electricity (E) and magnetism (H)* in these four equations tell a story about the nature of *electromagnetism*. A modern visualization of Maxwell's 4 equations as a wave or flow of electromagnetism is typically illustrated as the cyclic integration of the divergence and curl operators. The electromagnetic field is visualized as a self-propagating twisting braid of electric and magnetic energy flowing apart (dissociation) and curling back together (re-association) in the quantum field theory of observer/operator dynamics in therapeutic hypnosis (Image from Wikipedia).



The electromagnetic field is visualized as a self-propagating twisting braid of electric and magnetic energy flowing apart (dissociation) and curling back together (re-association) in the quantum field theory of observer/operator dynamics in therapeutic hypnosis (Rossi & Rossi, 2014, 2015 a & b).

*Box One. A STEM Perspective of Maxwell's four classical equations of electromagnetism applied to the psychodynamics of consciousness and cognition in the calculus of dissociation and re-association via naturalistic therapeutic hypnosis (Rossi, Erickson-Klein & Rossi, 2008-2015, Volume 1, The Nature of Therapeutic Hypnosis).*

Maxwell's four electrodynamic field theory equations of divergence and curl in Box One are proposed in this paper to be the mathematical and physical basis of the psychological concepts of dissociation and convergent re-association in therapeutic hypnosis. When people experience a physical or psychological shock, for example, the delicate focus of their attention, consciousness, cognition and behavior tends to diverge or dissociate, which results in symptoms of post-traumatic stress disorder (PTSD). Therapeutic hypnosis can help people reintegrate what was dissociated with the curl or re-convergence and focusing of their attention, consciousness, cognition and expectancy. The integration of the languages of mathematics, physics, biology and psychology in Box One highlights the STEM (Science, Technology, Engineering and Math) perspective for updating the traditional theory, research and practice of therapeutic hypnosis meditation, mindfulness and many other mind/body therapies. This STEM perspective is motivated by the historical words of Galileo Galilei (1564–1642):

Philosophy is written in this grand book—I mean the universe—which stands continually open to our gaze, but it cannot be understood unless one first learns to comprehend the language in which it is written. It is written in the language of mathematics, and its characters are triangles, circles, and other geometric figures, without which it is humanly impossible to understand a single word of

it; without these, one is wandering about in a dark labyrinth.

Box One also illustrates the profound insight of Heinrich Hertz's words in applying Maxwell's four equations of electromagnetism to the physicist's mathematical understanding of everyday phenomena as diverse as the quantum visual field dynamics of the rainbow and the quantum auditory field dynamics of radio waves (Wilczek, 2002, 2008).

One cannot escape the feeling that these mathematical formulae have an independent existence and an intelligence of their own, that they are wiser than we are, wiser even than their discoverers that we get more out of them than was originally put into them. (Heinrich Hertz, 1857-1894, on Maxwell's Equations of Electromagnetism).

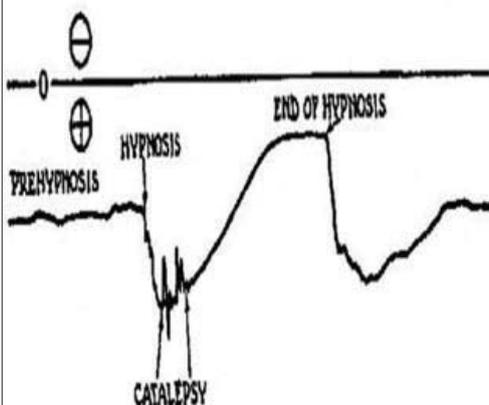
The STEM perspective is being extended in this paper to an exploration of how Quantum Field Theory (Klauber, 2015; Lancaster & Blundell, 2014) can unify the four fundamental forces of nature in the scientific foundation of physics, biology and psychology on many levels from mind to genes (Cozzolino et al. 2014a, b; Rossi et al. 2008; Rossi & Rossi, 2014a, b; Rossi, Erickson-Klein & Rossi, 2014, 2015). We will begin with an almost forgotten heritage of Milton H. Erickson MD and his student Leonard Ravitz MD in their early explorations of measuring the electrometric correlates of the hypnotic state (Rossi, Erickson-Klein, 2008-2015, *Volume 12, Experiencing Hypnosis*). We see this as the lost heritage and new horizon of psychosocial genomics.

### The Lost Heritage and New Horizon of Psychosocial Genomics

## Ravitz L (1950). Electrometric Correlates of the Hypnotic State. *Science*, 112, 341-342.

Burr-Lane-Nims Millivoltmeter  
Harvard & Yale Medical 1922-1972

Ravitz 2002 *Electrodynamic Man*  
Milton Erickson Technique



- [Wave Mechanics and Quantum Theory. . .](#)
- [Electrodynamic Factors Underlie Life \(p. 16\).](#)
- [Molecules of chemistry reduce to Electricity. . . To Quantum Fields \(p. 200\).](#)

Figure 3. The Measurement of the Electrodynamic Field Correlates of Milton H. Erickson's Naturalistic Therapeutic Hypnosis, originally published by Ravitz in *Science* in 1950, was initially conceptualized and explored as an early version of quantum field theory (QFT).

The theory, research and practice of the original quantum field theory of naturalistic therapeutic hypnosis is illustrated in figure 3. This measurement of the electrodynamic field correlates of Erickson's naturalistic hypnosis was published by Leonard Ravitz in *Science* in 1950. This naturalistic field theory of hypnosis was presented at the first meeting of *The American Society of Clinical Hypnosis* (ASCH) that coincided with the founding of *The American Journal of Clinical Hypnosis* (AJCH) in 1958. New technology is introduced in this paper to motivate more systematic research comparing the electronic monitoring of therapeutic hypnosis, biofeedback, meditation and mindfulness. Applications of the quantum electrodynamic field theory of naturalistic hypnosis for research on attention span, focusing of consciousness, cognition, chirality, dissociation, expectancy, meditation, psychodynamics and chronic post-traumatic stress disorder (PTSD) are now proposed in this paper for a new generation of students and clinicians.

trances, as opposed to formalized ritualistic procedures of trance induction, merits much more investigation, experimentation and study than have been accorded to date.

By naturalistic approach is meant the acceptance of the situation encountered and the utilization of it, without endeavoring to restructure it psychologically. In so doing, the presenting behavior of the patient becomes a definite aid and an actual part in inducing a trance, rather than a possible hindrance. For lack of a more definite terminology, the method may be termed a *naturalistic approach*, in which an aspect of the principle of synergism is utilized. (Italics added here, p.3)

Measurements of the electrodynamic field correlates of naturalistic hypnosis were originally published in *Science* (Ravitz, 1950). Milton H. Erickson's early student, Leonard Ravitz (2002)

## Elizabeth Erickson Autohypnosis Recorded by Ravitz 10-10-1959

**Northrop 1928 Macroscopic Atomic Theory; Burr Electromagnetic Fields**

**Erickson's Therapeutic Hypnosis Manifests an Electromagnetic Field**

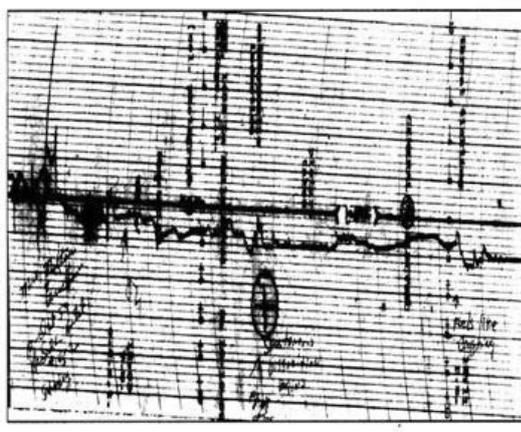


Figure 4. Archival images of Milton H. Erickson's wife, Elizabeth, who was an expert in autohypnosis, were published by Ravitz (2002).

### The Quantum Electrodynamic Field Correlates of Naturalistic Hypnosis

The archival images in figure 4 illustrate pioneering research with Milton H. Erickson's wife, Elizabeth who was an expert in autohypnosis (Ravitz, 2002). The quantum electrodynamic field correlates of naturalistic hypnosis as reviewed here suggests how the theory, research and practice of Erickson's naturalistic hypnosis could be updated with a new STEM (Science, Technology, Engineering, and Math) perspective. Milton H. Erickson (1958) described the naturalistic techniques of hypnosis in the first issue of *The American Journal of Clinical Hypnosis* as follows.

The naturalistic approach to the problem of the induction of hypnotic

reviewed the original quantum electrodynamic field theory of naturalistic hypnosis and some of its sources as follows.

The field theory of hypnosis – proposed at the first annual meeting of the American Society of Clinical Hypnosis, Chicago, on October 3, 1958 as one of the basic factors in hypnotic states – derives from experimental knowledge of various factors and states which do and do not produce EMF [Electromagnetic Force] variations ... *Such observations are reinforced by the frequent spontaneous clinical manifestation of trance states ... involving this ancient brain core, further implicated by its potential control of physiologic survival functions via*

*hypnosis – including the control of bleeding ... Briefly, all evidence suggests that profound alterations occur in the balance of the ancient centers with respect to the neocortex during hypnosis, with intact, or frequently improved neocortical functioning ...*

Field monitoring of changing state-function, including hypnotic states together with their many manifestations, confirmed by Bartlett, Blagg, Rossi and Kost independently, has resulted in deductive considerations entailing the meshing of two radically disparate approaches: the Burr-Northrop field construct with its derivative instrumentation catalyzed by Maxwell and Gibbs, and a unified tripartite logic formalized mathematically ... [p. 90-91]

Furthermore, *recent findings in wave mechanics and quantum theory* at that time reduced chemical atoms to electrons and protons, implying that more *fundamental electrodynamic factors underlie life*. In short, atomic physics had to be supplemented

Medicine ... This was the first biological theory ... based on Einstein's relativity field physics and Maxwell's electromagnetic equations. ... An electrodynamic or electromagnetic field is a continuum of experimentally verifiable vector forces defined in terms of two parameters: magnitude or intensity, **E** and direction or polarity, **H**. [Ravitz, 2002, p. 3-4, italics added here].

During the middle 1970's, about 25 years after Ravitz's 1950 paper was published in *Science*, Erickson and Ravitz together mentored Ernest Rossi in the use of a more modern strip-chart recording electronic device (Heath-Schlumberger Model SR-255B) shown here for facilitating the induction and objective measurement of the depth of therapeutic hypnosis. We assessed real patients, ourselves and some of Erickson's family during this informal early training period, which was later documented nostalgically with many photographs, figures and tables of data in Ravitz (2002). Rossi subsequently attempted to identify an electronic signature

## MHE, Ravitz & Rossi 1972-1980 Research Erickson & Rossi (1981/2014) *Experiencing Hypnosis*



Figure 5.  
The paper strip-chart recording electronic device (Heath-Schlumberger Model SR-255B) for facilitating the induction and objective measurement of the depth of therapeutic hypnosis during the 1970s by Erickson, Ravitz and Rossi.

with field physics." (Ravitz, 2002, p. 16, italics added here) ... in fact, the entire concept of valence, reduce to electricity, and in this specific instance, to *quantum fields*." [Ravitz, 2002, p. 200]

The human body, then, is the product of an organizing field ... We owe this epochal discovery to the genius of two Americans, Filmer Stuart Northrop ... Sterling Professor of Philosophy and Law at Yale University ... and Harold Saxton Burr, Professor of Anatomy in Yale University School of

of Erickson's naturalistic approach to hypnotic induction and therapy illustrated below, which he outlined as a "Two-Factor Theory of Hypnotic Experience as follows (Erickson & Rossi, 1981/2014; Rossi, Erickson-Klein & Rossi, 2014, *Volume 12, Experiencing Hypnosis*).

## Quantum 1-D Wave Nature of Consciousness? Erickson & Rossi (1981/2014) *Experiencing Hypnosis*

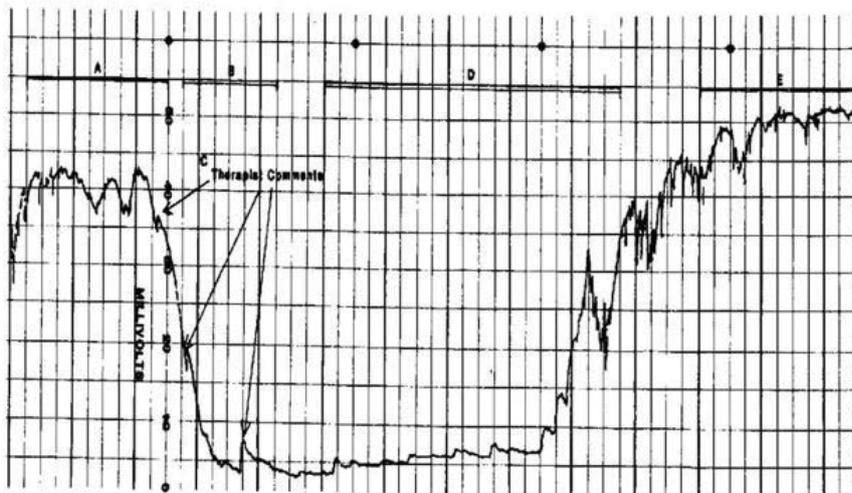


Figure 6.  
The Electronic monitoring of D.C. body potential during catalepsy – millivolts on vertical access, time scale of 0.5 inch per minute on horizontal access: (A) normally awake; (B) drop in D.C. potential during hypnotic induction; (C) momentary responses to therapist remarks; (D) characteristically low activity during catalepsy; (E) typical awakening pattern at higher level than (A).

### Electronic Monitoring of Catalepsy: A Two-Factor Theory of Hypnotic Experience

While the pendulum of current scientific thought has swung to the opinion that no objective measures of hypnotic trance exists, there is a long scientific tradition of measuring catalepsy. Early as 1898 Sidis published remarkably clear and convincing sphygmograph-oscillometer records distinguishing normal awakesness from catalepsy [an apparent state of quiescence of mind and body] experience during hypnosis. More recently Ravitz (1962, 1973) published tracings of the bodies D.C. [Direct Current] electrical activity measured on high-impedance recorders [impedance is the effective resistance of an electric circuit that makes such recordings possible] that underwent characteristic changes during the induction of catalepsy. Ernest Rossi has utilized a high-impedance recorder (input impedances ranging from 10 to 1000 mega-ohms with non-polarizing electrodes placed on the forehead and the palm of one hand) for a number of years since the early 1980s (Erickson & Rossi, 1981/2014; Rossi, Erickson-Klein & Rossi, 2014). The upshot of his clinical practice is that it can be used as a convenient and convincing indicator (for both the patient and the therapist) of an objective electrodynamic alteration that takes place during therapeutic trance. Whether this electrodynamic alteration is a manifestation of *quantum field dynamics* as Ravitz (2002) believed, however, can only be established by further research.

The record of a highly intelligent, normal, 24-year-old female subject during her first hypnotic induction is presented here. The erratic, fast activity at the beginning of the record (A) is characteristic of normal waking awareness. Every impulse to activity seems related to an upswing in this recording, which then drops out as soon as the impulse apparently is carried through. During

simple relaxation, meditation, and hypnosis the record smooths out and usually drops dramatically as the subject apparently gives up any active effort to direct mind or body (B). A few slow up swings are noted during the beginning of the hypnotic induction, as the subject makes an effort to attend to the therapists three reassuring comments (C). These drop out as trance deepens, and the record shows a characteristically flat, low plateau with only low-amplitude slow waves (D). With more trance experience even this low-amplitude activity drops out, and a rather smooth line record is obtained. As long as the subject remains mentally quiescent with an immobile (cataleptic) body, there are no peaks or valleys in the record. When the subject initiates mental activity or moves physically, peaks and valleys are usually recorded. The awakening period is indicated by the typical pattern of a few successively higher peaks for a few minutes each (D). The waking-fast activity at the end of this recording at (E) usually appears at a higher level than the initial basal waking level. This higher level is maintained for a few minutes until the record comes back to the default normal level at the beginning (A). The higher amplitude at the end suggests the fascinating hypothesis that at least a part of the value of therapeutic hypnosis is due to the rest during the low phase. This hypothesis remains to be investigated by future research. (Please note the minor confusion in the labels on this archival recording: The first 2/3s under the label (D) should be corrected to indicate only the low, almost flat-line deepest part of the hypnotic state. The label (C) refers only to the therapist's momentary comments.)

The difficulty with accepting such records as valid measures of trance is that they also seem to appear whenever the subject quiets down during relaxation, meditation, or sleep, whether or not hypnosis has been formally induced. We

would therefore offer a two-factor theory of the therapeutic hypnotic experience. First, there must be a state of openness and receptivity wherein subjects are not making any self-directed efforts to interfere with their own autonomous mental activity or the suggestions of the therapist. Ravitz's measurements, like those illustrated here, are probably an effective indication [measurement] of this state of quiet [electrodynamic] receptivity.

The second factor might be called "associative involvement." This process whereby the hypnotherapist engages and utilizes the subject's associations, mental mechanisms and skills to facilitate a hypnotic experience. We regard this process of utilizing a patient's own mental associations as the essence of "suggestion." *Hypnotic suggestion is not a process of insinuating or placing something into the subject's mind.* Hypnotic suggestion is a process of helping subjects utilize their own mental associations and capacities in ways that were formally outside the subject's own ego controls. Students and laboratory workers who have access to the proper electronic equipment (the Heath-Schlumberger Model SR-255B Strip Chart Recorder is suitable) can explore a number of interesting relations between hypnotic experience and the electronic monitoring of the body's D.C. potential. Is the depth of the curve (Area D) related to "trance depth"? It will be found at some subjects are able to speak during this low portion of the curve without any raise in their D.C. potential. Are these people better hypnotic subjects? Does any hypnotic phenomenon other than catalepsy have a characteristic curve? Are the classical hypnotic phenomenon more readily evoked during the low plateau (D) of the curve? (Erickson and Rossi, 1981/2014 pp 63-64; Rossi, Erickson-Klein & Rossi, 2014).

At the present time (January, 2016) we can find no published records providing answers to these basic questions. *Research by students and therapists is now very much required.* We now call this a therapeutic process of facilitating a person's natural *observer/operator* that usually functions automatically during optimal human performance. *From a quantum perspective anything that can be observed adequately can automatically operate well.* The implications of such research for investigating the possible relationships between therapeutic hypnosis, brain plasticity, behavior and the quantum qualia of consciousness, cognition and the 4-stage creative cycle.

Are the STEM inspired quantum electrodynamic fields illustrated in Ravitz's (2002) research meaningful in terms of the seemingly eternal philosophical debates about the nature and utility of consciousness, cognition, dream, emotions, fantasy, subjective belief and free will? Are these QFT observer/operator recordings of the novel quantum qualia of human cognition actually correlates of activity-dependent gene expression and brain plasticity in creating new consciousness and self-identity that is apparently lost in Alzheimer's disease, for example (Rossi & Rossi, 2014, 2015a, b; Saey, 2015)? Indeed, does the intense focusing on the quantum qualia of human experiencing really facilitate the causal efficacy of the top-down holistic approaches to healing and rehabilitation optimized by the art, beauty and truth of the many cultural rituals of naturalistic therapeutic hypnosis throughout human history?

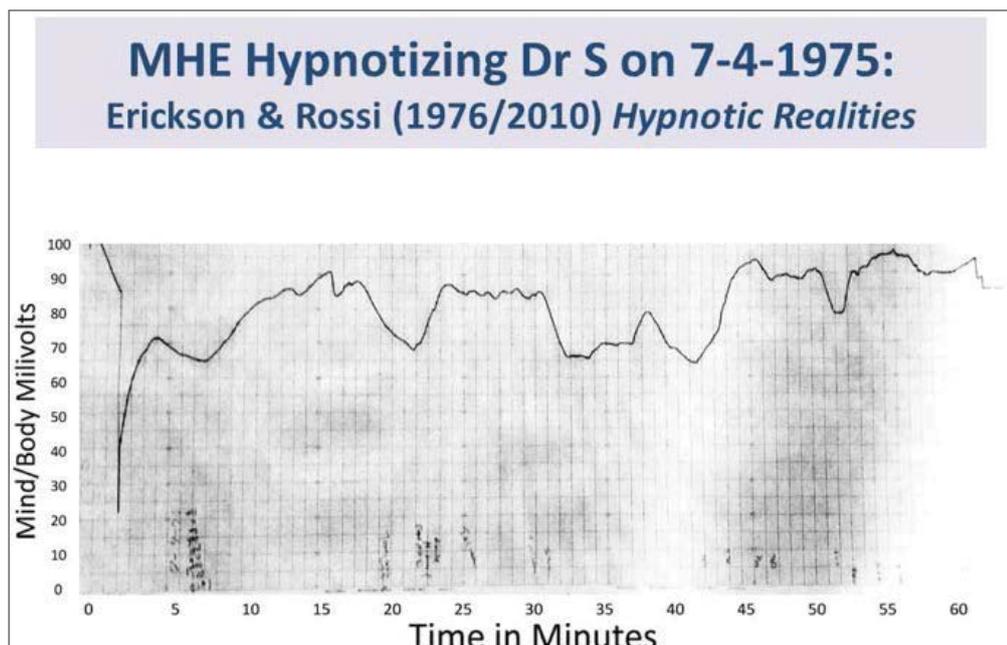


Figure 7. This recording of Milton H. Erickson M.D. hypnotizing the subject Dr. S (Erickson, Rossi & Rossi, 1976) is the only existing image of MHE's electrodynamic amplitude while at work.

Astonishingly MHE's amplitude measured in millivolts reached the top of the scale at about 98 millivolts on the Heath-Schlumberger Model SR-255B (a millivolt is 1/1000<sup>th</sup> of a volt) of while hypnotizing Dr. S.) This was the highest ever recorded by Rossi in over 40 years! We do not yet have any normative data about people at work in different age ranges, however. The electrometric recordings within 20 to about 40 millivolts are typical (Ravitz, 2002).

To answer basic questions about the basic psychophysiological nature of Erickson's naturalistic therapeutic hypnosis, Ernest Rossi then teamed up with David Lloyd, a senior researcher and professor at The Microbiology Group, School of Pure and Applied Biology at the University of Wales. Together they began a 16-year odyssey editing two volumes of international research on the fundamental principles of chronobiology and psychobiology (Lloyd & Rossi, 1992, 2008). David Lloyd's motivation was to highlight his lifetime of experimental research documenting how circadian (every 24 hours) and ultradian rhythms (less than 24 hours) from molecules to mind were the natural biological clocks regulating all life processes. Rossi's motivation was to document how the natural human 90-120 Minute Basic Rest-Activity Cycle (BRAC) could be the psychophysiological basis of Erickson's naturalistic therapeutic hypnosis (Hope & Sugarman, 2015; Lloyd & Rossi, 1992, 2008; Rossi, 2002, 2012; Rossi & Rossi, 2013). Little noted at that time, however, was Stupfel's prescient concept of the quantum nature of the metabolic and behavioral ultradian rhythms in medical research (in Lloyd & Rossi, 1992) as follows.

Regarding the oscillatory activity episodes, Aschoff and Gerkema (1985) pointed out that ultradian rhythms of long periods may be an economic strategy to avoid continuous expense of energy, and to alternate energetic expenditure and restoration. *This biological energetic discontinuity has much in common with the physical quantum theory. In 1900, Planck formulated the principle that energy is not continuously radiated, but is discontinuously emitted by quanta of energy  $h\nu$  ( $h$  being the Planck constant and  $\nu$  the radiation frequency).* Biologically speaking this would correspond to the intermittent, more or less periodic, exchanges of energy, heat, food intake, and rest-activity alternations between endotherms [warm blooded creatures such as humans] and their environment. (p.226, Italics added).

Stupfel's intuition was an early intimation of the quantum aspect of the oscillatory nature of the circadian and ultradian dynamics of life cycles. This quantum intuition now motivates our current proposal of how "This biological energetic discontinuity" may underpin dissociation as a fundamental characteristic of hypnotic experience. Researchers formulate the harmonic oscillator as a mathematical concept that bridges between the classical dynamics of nature originally formulated by Isaac Newton and the quantum dynamics originated by Max Planck. Figure 8 illustrates how such oscillations in the "energetic discontinuity" could be conceptualized as quantum field recordings of the

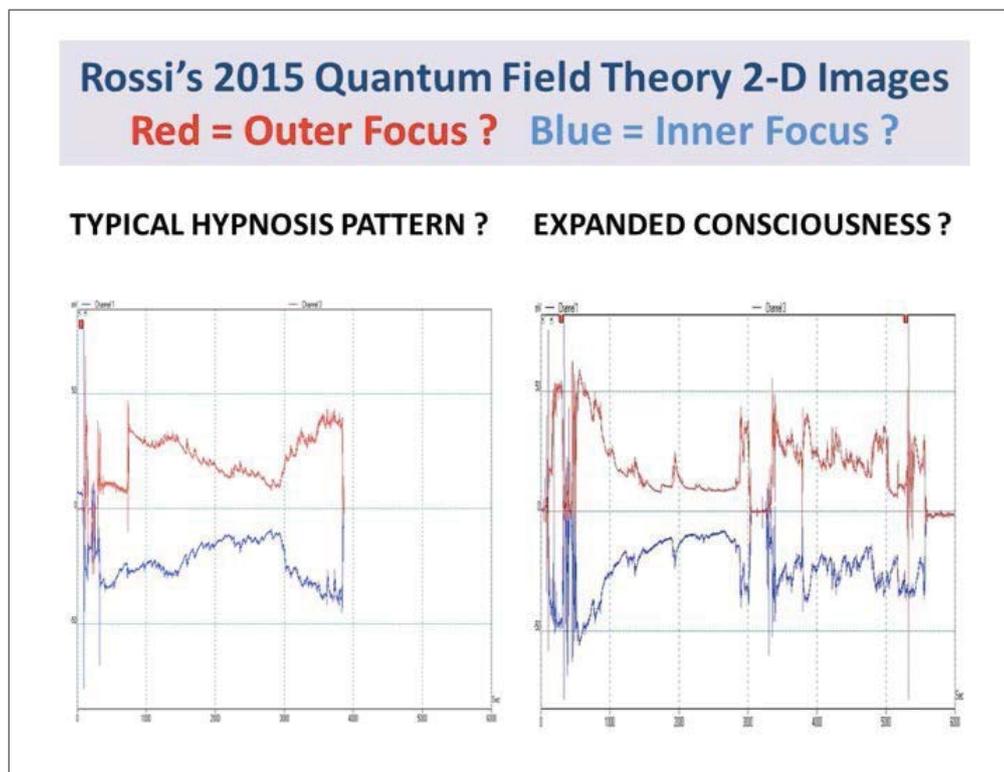


Figure 8. Typical Quantum Field Recordings in Two Dimensions of Therapeutic Hypnosis and States of Consciousness and Cognition with the Electronic Pico Data Logger.

phenomenology of consciousness and therapeutic hypnosis.

Because the Heath-Schlumberger Model SR-255B is no longer commercially available we currently utilize a Pico Technology 2000 ADC-24 High Resolution Data Logger. Among the many advantages of using this more modern technology is the greater detail of its data because of (1) its higher rate of sampling the data and (2) more channels for data acquisition.

The original 4-stage pattern of the "electrometric correlates of the hypnotic state" via Erickson's "catalepsy" illustrated and discussed earlier (Ravitz, 1950; Erickson & Rossi, 1981/2014; Rossi, Erickson-Klein & Rossi, 2014, Volume 12, *Experiencing Hypnosis*) is again evident in the top half of both of these recordings. This provides us with some assurance that modern Pico electronic technology is replicating the early work of Erickson, Ravitz and Rossi in the 1970s accurately. Whereas the early recordings from 1950 and 1981 had only one line to measure electromagnetic current in millivolts (mV) between sensors placed on the forehead and palm of one hand, current Pico technology permits measurements from two or more sensors usually placed on the forehead and the palms of the right and left hand. The lower half of these electrometric recording of hypnosis appears to be mirror neuron reflections of the top half. What could this left-right hand mirror symmetry mean?

Mirror reflections of left-right symmetry are referred to as *polarity* in classical Newtonian dynamics. By contrast the terms *parity* and/or *chirality* are used in quantum electrodynamic field theory from particle physics to biology and psychology (Baggott, 2011; Davies & Brown, 1988; Gleick, 1992; Lancaster & Blundell, 2014). The recorded field (area, channel or space) between the head, left and right hands is conceptualized in this paper as a *computational image* (Tricoche, MacLeod & Johnson, 2008) of the boundaries of the Quantum Field Theory (QFT), which in more familiar terms, could be described as "the span of attention, the focus of concentration, the bandwidth of consciousness or the mind-body information channel capacity." Further research is now required to ascertain whether such computer recordings are useful visualizations for measuring either the bits of information in Classical Dynamic Theory or qubits Quantum Field Theory. Such electronic recordings could lead to the development of quantifiable scientific signatures of DNA (Service, 2014) and naturalistic therapeutic hypnosis.

Notice that while these two recordings on different people are similar in illustrating some typical aspects of therapeutic hypnosis they also manifest some important differences that may have important implications. Notice how the recording on the left hand side (tentatively labeled "TYPICAL HYPNOSIS PATTERN?") illustrates the typical downward slope of hypnotic induction. The

recording on the right hand side (tentatively labeled "EXPANDED CONSCIOUSNESS?") also manifests the typical downward slope of hypnotic induction in the first half. However, this recording is very different in its second half when she apparently experienced some profound personal psychodynamic inner work, which was associated with a very obvious wider range of electrodynamic activity. How can we account for these differences?

Thirty minutes into the session she suddenly announces she has to use the rest room. When she returns the electronic sensors are reattached to her forehead and hands. She then spontaneously and serenely recounted the most intimate personal psychodynamic history of her early childhood abuse, adolescent identity struggles and a hero's journey for her place in the professional world. All this with absolutely no prompting from the astonished authors of this paper who were both present. Notice the widening of her electrodynamic field in the last half of her recording; is this a correlate of the widening of her consciousness, cognition and self-awareness facilitated with the induction of therapeutic hypnosis? Notice the left-right hand symmetry at the zero level of her recording during the last 10 minutes of quiet non-verbal serenity and rest of this recording when neither she nor the authors uttered a single word. Does this imply she was really finished or at least satisfied with her inner psychodynamic work for now?

At the present time we have no way of answering such question about the electrodynamic correlates of consciousness, cognition and hypnosis summarized in figure 9. We now propose to answer these questions by exploring Life on the Edge: The Coming Age of Quantum Biology and Psychology (McFadden & Al-Khalili, 2014).

### **The Coming Age of Quantum Biology and Psychology**

McFadden (2000) initially proposed the scientific development of quantum biology and psychology in his highly innovative volume "Quantum Evolution: How Physics' Weirdest Theory Explains Life's Biggest Mystery" as follows.

The classical view of the dynamics inside living cells (still the view held by most biologists) was of classical particles perusing independent trajectories through intercellular spaces. This vision allowed biochemists and geneticists to wholeheartedly adopt the reductionist program of dissecting the cell into smaller and smaller pieces, with the expectation of gaining a greater and greater level of understanding. *However, now biology has reached the level of fundamental particles, we must confront the quantum cell, which has revealed itself as a dynamic mosaic of quantum and classical states. Particles can no longer be considered as independent entities*

## Mind-Gene-Brain Plasticity Cycle

Lloyd & Rossi (Eds. 1992, 2008) *Ultradian Rhythms in Life...*  
 Rossi (1986, 1993) *Psychobiology of Mind-Body Healing*  
 Rossi (2002) *Psychobiology of Gene Expression*

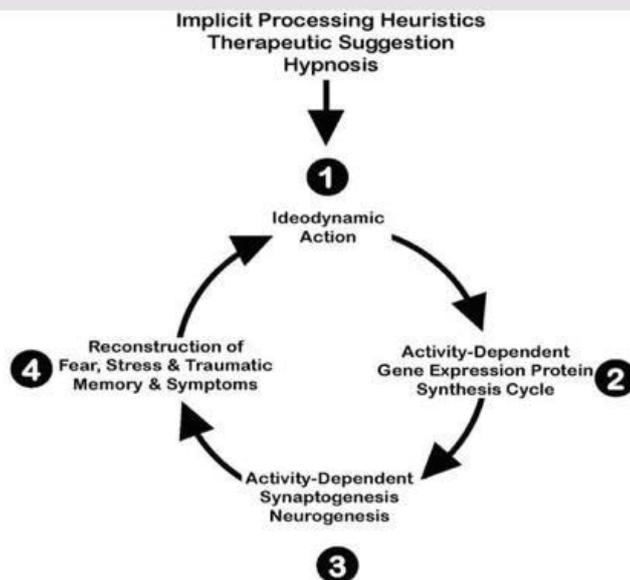


Figure 9.  
 A summary of the neuroscience and the psychobiology of mind/body healing in the 1980s and 1990s before the advent of quantum biology and psychology.

but as the products of internal quantum measurement. Quantum mechanics directs us to look up from the fundamental particles and examine the environment measuring them.

Why does this matter? ... Measurement of quantum particles is not ever innocuous; it always affects dynamics. Physicists are normally employed to make quantum measurements, and the choices they make ... affect the dynamics of the systems they study. *But now, we have the living cell as an independent quantum-measuring device that measures its own state, so that the **choices** it makes about what it **wishes** to measure will influence its internal dynamics.*

... I do not believe that *E coli* cells or even individual animal cells have any volition over their actions. *The environment of the cell arms their quantum-measuring devices and thereby determines the properties that the cell can measure.* This will in turn influence the internal dynamics of the cell. This represents a kind of choice, since it is an influence denied to inanimate objects unable to measure the quantum states of the particles, within them. *But—at least in simple living systems—the ability to make these choices is not associated with any conscious decision. Nevertheless, I do believe that this ability to make quantum choices is the basis for **our** sense of volition as conscious beings.* (Pgs. 252-3, Italics added here.)

These carefully considered hypotheses about quantum dynamics as an essential characteristic of all living systems finds important scientific support in the fundamental role of the *weak force* during the DNA dynamics of transcription and translation in the psychosocial genomics of mind-gene talk in figure 10 to which we will now turn our attention.

A key concept in the transition between the classical and the quantum realm is in the so-called “Weak Force” of particle physics (Wilczek, 2015), which is indicated by the dotted lines (labeled “Hydrogen Bonds” or Proton Coding between the C...G nucleotides and the A...T nucleotides) holding the two sides of the DNA double helix together – but only weakly in figure 10.

When the weak force manages to hold the two sides of the DNA double helix together as illustrated in the colored right hand side of figure 10) the genes are in a locked position wherein they cannot divide and replicate via the Activity-Dependent Gene Expression Protein Synthesis Cycle (illustrated in the black & white image on the left hand side of figure 10).

*We now hypothesize that the weak force permits (1) the classical cognitive-behavioral cycle of therapeutic suggestion to nudge the double helix of DNA open so that (2) the Activity-Dependent Gene Expression Protein Synthesis Cycle can operate to (3) optimize Activity-Dependent Synaptogenesis and Neurogenesis for (4) the Reconstruction of Fear, Stress & Traumatic Memory & Symptoms.*

*When the two strands of the double helix of DNA are open a DNA polymerase enzyme can slide along*

the chain of nucleotides reading and replicating each genomic letter of their complementary information to turn on the activity-dependent gene expression protein synthesis cycle that generates the reconstruction and adaptive healing dynamics of epigenetics—the so-called mind-gene dialogues of psychosocial genomics.

McFadden (2000) proposed how the subjective experience of free will, characteristic of top-down human awareness associated with the “ability to make quantum choices” as “the basis for **our** sense of volition as conscious beings” as follows.

can be decomposed into orthogonal states. Quantum measurement does, however, provide us with a way to give living organisms an edge in their interaction with the outside world. Internal quantum measurement confers on living cells an ability to influence their internal particle dynamics in a way unique to life. *This influence is key to understanding how living organisms escape the straitjacket of classical determinism. The behavior of a living organism is poised*

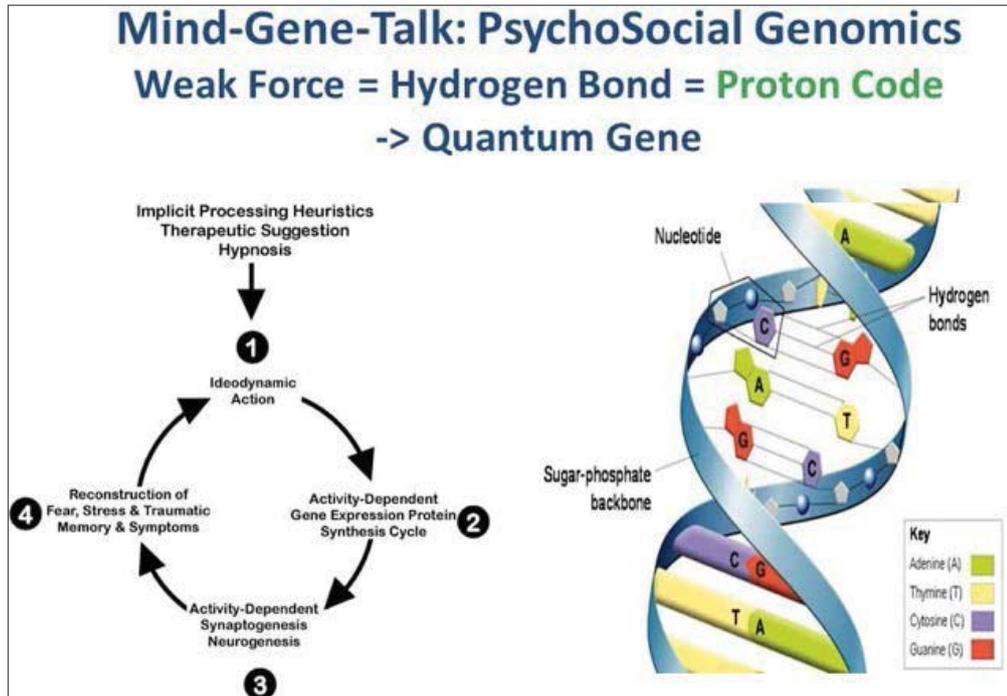


Figure 10. The transition from the classic neuroscience and of the 1980s and 1990s (on the left) to the current quantum dynamics of psychosocial genomics and the proton coding of DNA.

Bacteria, and indeed all living creatures, live at the very edge of subsistence where single quantum events can make a very real impact on their chances of survival. For most creatures ... there are many enzymes and physical states crucial to their being able to successfully perform a critical action. *These actions will be subject to quantum measurement. The densest measurements will be those that involve the greater number of interactions with the cell's environment. The cell will thereby direct itself towards those activities that interact strongly with their environment and perform directed actions.*

I should emphasize that I am suggesting an increase in probability for actions, not necessarily a way of making those actions happen with one hundred percent probability. How much quantum measurement can enhance the probability of quantum events inside living cells will depend on the density of the measurement steps, the robustness of quantum superposition states (to decoherence) prior to measurement, and how easily the steps

*upon the quantum dynamics of this interior, allowing quantum measurement to provide the critical nudge that tips the organism one way or another to make choices and perform directed actions.* (p. 254-5, *Italics added here.*)

But what, specifically, is McFadden's “key to understanding how living organisms escape the straitjacket of classical determinism?” McFadden & Al-Khalili (2014) have elaborated the role of the weak force, enzymes, proton coding and quantum tunneling in the coming age of quantum biology, which are illustrated in the figure 11.

McFadden & Al-Khalili (2014) describe enzymes as the quantum version of the so-called *vital forces of life* in this way.

Enzymes have made and unmade every single biomolecule inside every living that lives or has ever lived. *Enzymes are as close as anything to the vital factors of life.* So the discovery that some, and possibly all, enzymes work by promoting the dematerialization of particles from one point in space and their instantaneous materialization in another provides us with

a novel insight into the mystery of life. And while there remain many unresolved issues related to enzymes that need to be better understood, such as the role of protein motions, there is no doubt that quantum tunneling plays a role in the way they work...

Quantum tunneling is not magic; it has been taking place in the universe since its birth. It is certainly not a trick that was somehow "invented by life." Yet we would argue that its appearance in enzyme activity is far from inevitable, given those hot, wet and busy conditions inside living cells ... It is this kind of random motion that scatters and disrupts the delicate quantum coherence and makes our everyday world appear "normal" to us ...

After all, it was only a decade, or so, that most scientists dismissed the idea that tunneling and other delicate quantum phenomena could be taking place in biology. The fact that they have been found in these habitats suggests that life takes special measures to capture advantages provided by the quantum world *to make its cells work* ... How does life keep that enemy of quantum behavior, decoherence, at

*exciton* with which we began this paper in figure 1 with Einstein.

Let's imagine that a leaf has just picked up a solar photon and converted its energy to an *exciton*. Considered classically, the exciton is a particle that is localized in space and time. *But as the double-slit experiment revealed, quantum particles also possess a diffuse wave character that enables them to exist in multiple places simultaneously as a quantum superposition. It is the exciton's waviness that is essential for efficient quantum transport, for this enables it, like a water wave, to explore multiple paths simultaneously. But if its quantum waviness breaks on the molecularly noisy rocks of decoherence inside the leaf, then its waviness will be lost and it will become a localized particle stuck in a single position.* The noise essentially acts as a kind of continuous measurement, and if it is very intense then decoherence will take place very quickly, before quantum coherence has a chance to help the exciton wave reach its destination. This is the quantum Zeno effect: constantly collapsing the quantum wave into the classical world.

## Life on the Edge: The Coming Age of Quantum Biology. McFadden & Al-khalili (2014).

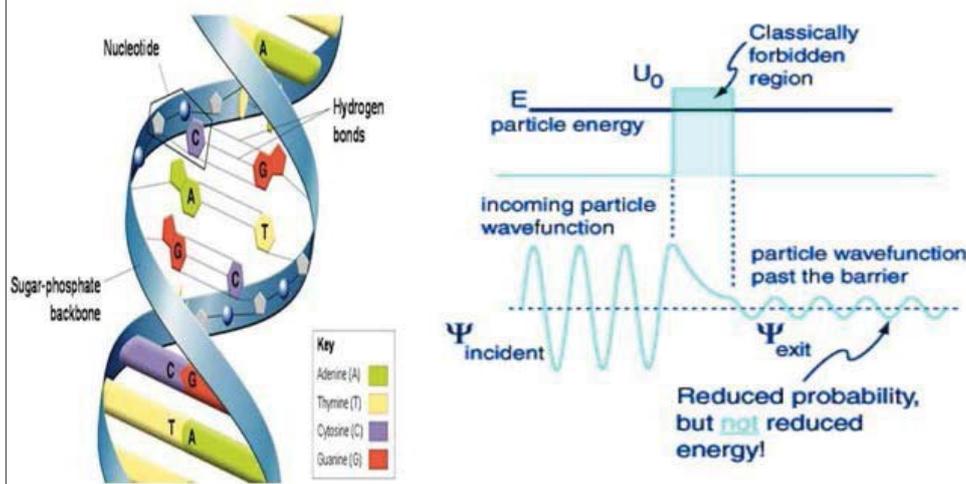


Figure 11. The classical/quantum interface that makes life possible is mediated by enzymes operating as the so-called vital forces of life with quantum tunneling.

bay? This is one of the biggest mysteries of quantum biology ... (p. 97-98, Italics added here)

It is precisely at this point that McFadden & Al-Khalili (2014) make an important point that is illustrated in the right hand side of figure 11 in our blue image of the classical/quantum interface that makes life on the edge possible. Their pithy argument utilizes the *quantum dynamics of the*

When the MIT team estimated the influence of molecular noise/vibrations in the bacterial photosynthetic complex, they discovered that quantum was optimal at temperatures around those at which microbes and plants perform photosynthesis. *This perfect match between optimal transport efficiency and the kind of temperatures in which living organisms*

live is remarkable and, the team claims, suggests that three billion years of natural selection have fine-tuned the quantum-level evolutionary engineering exciton transport to optimize the most important biochemical reaction in the biosphere. As they argue in a later paper, "natural selection tends to drive quantum systems to the degree of quantum coherence that is 'just right for attaining maximum efficiency." (p. 296-297, italics added here). This enables us to update

Halpern, 2015; Whitaker, 1996). Aspects of this unification are illustrated in our Mind-Gen-Quantum Cascade diagrammed in figure 13.

Seth Lloyd, currently professor of quantum-mechanical engineering at MIT, is working with a variety of research groups to construct and operate quantum communication systems consistent with the Mind-Gen-Quantum Cascade illustrated in figure 13. He recently outlined the following description of his work (Lloyd, 2014) for the general public, Quantum Biology: Better Living Through

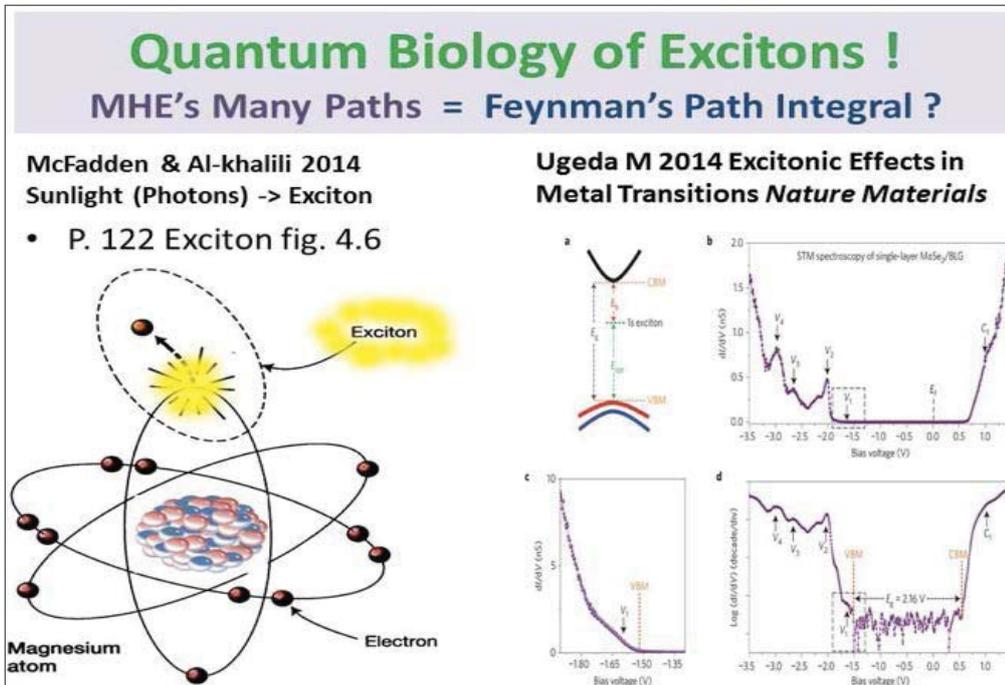


Figure 12. The Quantum Biology of Excitons in Living Systems (on the left hand side) are mathematically matched by graphs of the Quantum Dynamics of Excitonic Effects in modern communication devices (on the right hand side).

the quantum biology of Excitons and summarize their vast range of applications in natural living systems as well as non-living systems that make up modern computers and communication devices in Figure 12 (Ugeda et al. 2014).

Notice the similarity between the Quantum Dynamics of Excitonic Effects in modern communication devices on the right-hand side of figure 12 with the Ravitz (1950, 2002) 4-stage images of the electrometric correlates of Erickson's naturalistic hypnosis (catalepsy) and Rossi's images of a two-factor theory of therapeutic hypnosis reviewed earlier in this paper. This similarity prompts us to hypothesize how Milton H. Erickson's Many Paths Suggestions for resolving human problems has an unexpected quantum resemblance to Feynman's (1985) Path Integral approach to a Strange Theory of Light and Matter. These surprising similarities that illustrate how the fundamental dynamics of quantum field theory applies to both living and non-living systems contributes to a unified theory of the four fundamental forces of nature long sought by Einstein, Bohr, Schrödinger and many others in this century (Baggott, 2011;

Quantum Mechanics, PBS, March 10, KQED.

In all green plants containing chlorophyll, for example, an incoming particle of light (photons streaming from the sun to earth) can slam into an electron, bumping it to a higher energy level and leaving a hole at the energy level where the particle had been. As illustrated here *the exciton is the excited electron paired with the resulting hole that can move energy by physically hopping from one molecule of chlorophyll (with and atom of magnesium in its reaction center) transferring energy like an antenna transmitting a signal. The transmission is almost instantaneous, with the longest-lasting exciton existing for just a few milliseconds.*

By constructing detailed quantum mechanical models, my collaborators and I were able to identify the optimal strategy for the interplay between wavelike propagation and classical hopping in photosynthesis. Over short distances, the wavelike propagation is more effective than random hopping. The exciton travels like a wave right up to the distance at which destructive interference causes it to get stuck. *At this point, the fact that living systems are hot, wet environments comes into play: The environment effectively gives the exciton a whack*

# Rossi's Mind-Gene-Quantum Cascade Transcription/Translation = Therapeutic Hypnosis ?

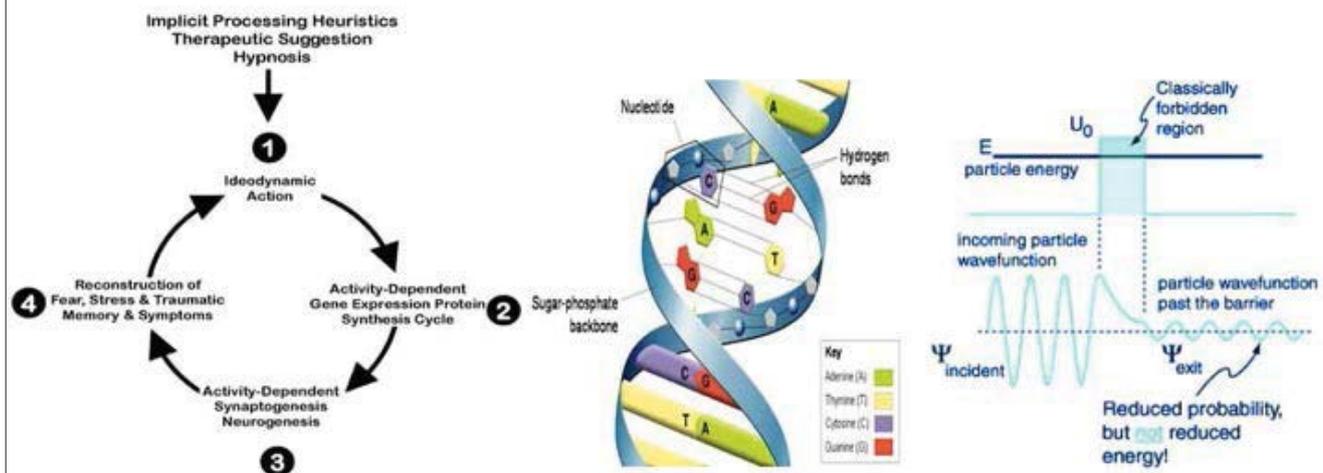


Figure 13. *The Mind-Gene-Quantum Cascade Bridged by the Weak Force and Quantum Tunneling in a Unified Quantum Field Theory of Physics, Biology and Psychology.*

that gets it unstuck and makes it perform a classical hop, which frees up the exciton to propagate again. (The technical term for this whack is “decoherence.”) Then the process repeats. The wave propagates until it gets stuck; the environment gives it a whack; the exciton hops. Eventually, the exciton reaches the reaction center [within a molecule of chlorophyll] in the minimum possible time. Expressed in terms of our quantum theory, the rule is simple: Wave until you get stuck, then hop ...

Where else might quantum mechanics play a role in life? Because light is made up of photons, interactions between living systems and light represent a good place to look. *Our eyes are capable of detecting single photons by a highly quantum mechanical mechanism: A molecule in the retina absorbs a single photon, and uses its energy to release the flow of tens of thousands of ions, stimulating a neural response. Neural impulses in the brain are probably too coarse and classical to support the wave-like quantum dynamics that hold sway in photosynthesis, but at the level of individual synapses, the neurotransmitter binding mechanism might well benefit from the same types of quantum dynamics ...*

As scientists delve deeper into the details of molecular dynamics in living systems, they are likely to see more examples of quantum mechanics at work. We don't yet know exactly what aspects of biology benefit from quantum mechanics. But we do know one thing: The un-quantized life is not worth living. (Seth Lloyd, 2014, *Italics added here.*)

We certainly agree with Seth Lloyd's quantum perspectives, which we now use to update some classical aspects of human biology and psychology that were previously published as *The 90-120*

*Minute Basic Rest-Activity Cycle* (David Lloyd & Ernest Rossi, 1992, 2008) and *The 20 Minute Break* (Rossi & Nimmons, 1991; Rossi & Rossi, 2016, in press) that are the fundamental psychobiological dynamics of Erickson's naturalistic therapeutic hypnosis (Rossi, Erickson-Klein & Rossi, 2008-2015). The question now is: What is the quantum engine that drives the natural psychosocial genomic cycles of life, consciousness and cognition (Rossi & Rossi, 2014 a, b; 2015 a, b).

Taken together figures 13, 14 and 15 provide an overview of our concept of a quantum RNA/ DNA psychobiological engine that underpins the classical molecular biology of living systems. Note how our juxtaposition in figure 15 of an image of the dynamics of gene expression during the 90-120 Minute Basic Rest-Activity Cycle (BRAC) and the 20 Minute Break on the left-hand side (Bar-Joseph et al., 2012) is similar to a typical image of the wave nature of quantum systems on the right-hand side (Haldal et al., 2015). Notice how within the first 20 minutes of the BRAC there is a powerful burst of gene expression. *We hypothesize that this burst of gene activity for about 20 minutes at the beginning of the 90-120 minute BRAC generates the proteins, hormones and cellular energy sources such as ATP is underpinned by The Quantum Heat Engine, which powers the remainder of that BRAC illustrated by its long tail of about 120 minutes* (Bar-Joseph et al., 2012).

Singh (2012) has published a review of quantum effects in biology with a highly sophisticated mathematical analysis and visualization of exciton motion in photosynthetic systems.

The present review is devoted to our recent studies on the excitonic motion in

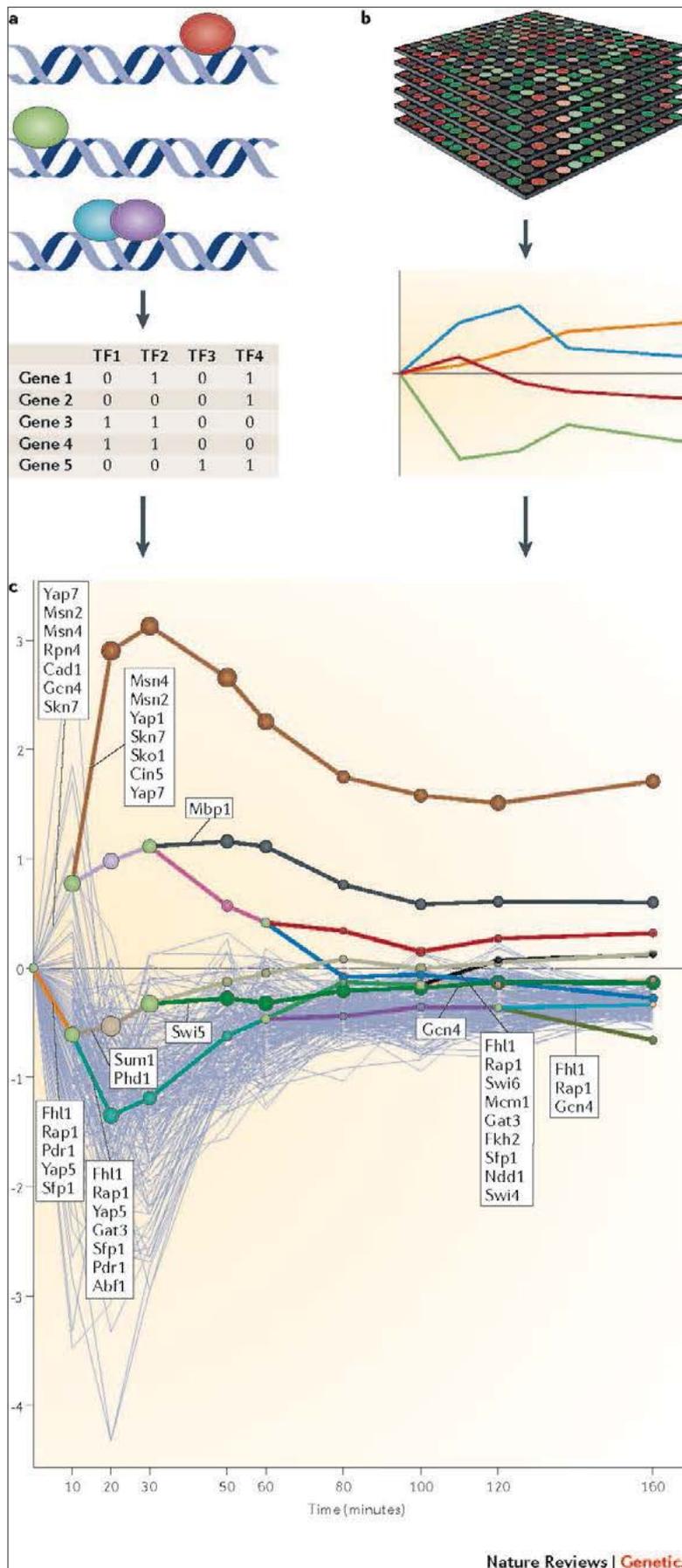
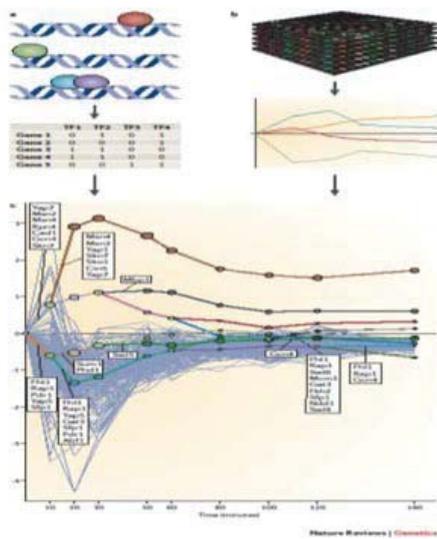


Figure 14. Classical RNA/DNA time series research data on gene expression (Bar-Joseph et al., 2012) is a source for our proposed quantum heat engine of biology and psychosocial genomics.

# Quanta ~20 - 90 Min BRAC Engine -> Gene Expression & Brain Plasticity

## 20 Minute Gene Expression



## Quantum Biology Engine

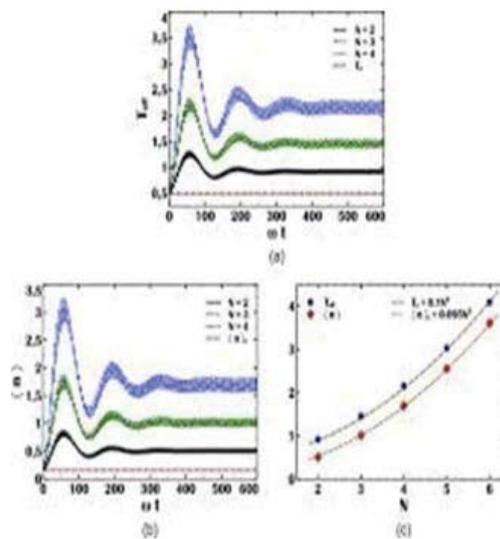


Figure 15. The proposed RNA/DNA psychobiological engine of the 90-120 Minute Basic Rest-Activity Cycle and the 20 Minute Break on the left hand side image is juxtaposed with a mathematical visualization of The Quantum Heat Engine on the right hand side images (Hardal et al., 2015). See also: (Dorfman et al., 2013; Hayes et al. 2013; Singh, 2012; Voronine & Scully, 2014; Uzdin et al 2015) for more experimental data and math expositions supporting the concept of The Quantum Heat Engine.

photosynthetic systems. In photosynthesis, the light photon is absorbed to create an exciton in the antenna complex of the photosynthetic pigments. This exciton then migrates along the chain-biomolecules, like the FMO complex, to the reaction center where it initiates the chemical reactions leading to biomass generation. *Recently, it has been experimentally observed that the exciton motion is highly quantum mechanical in nature i.e., it involve long time (600 femto sec or ~ 10<sup>-15</sup> seconds) quantum coherence effects.* (p. 1) ... recent studies with sophisticated 2D photon echo spectroscopy show long lived coherence effects in exciton motion which contradicts the long held old idea of incoherent motion [in living systems]. (p. 23, italics added here).

Hardal & Müstecaplıoğlu (2015) describe the dynamics of a “Superradiant Quantum Heat Engine” that extends Carnot’s classical mechanism of the thermodynamics of engines.

Quantum physics revolutionized classical disciplines of mechanics, statistical physics, and electrodynamics. One branch of scientific knowledge however seems untouched: thermodynamics. Major motivation behind thermodynamics is to develop efficient heat engines. Technology has a trend to miniaturize engines, reaching to quantum regimes. Development of quantum heat engines (QHEs) requires emerging field of quantum thermodynamics. Studies of QHEs debate whether quantum coherence can be used

as a resource. We explore an alternative where it can function as an effective catalyst. We propose a QHE which consists of a photon gas inside an optical cavity as the working fluid and quantum coherent atomic clusters as the fuel. Utilizing the superradiance, where a cluster can radiate quadratically faster than a single atom, we show that the work output becomes proportional to the square of the number of the atoms. In addition to practical value of cranking up QHE, our result is a fundamental difference of a quantum fuel from its classical counterpart.

It is now an open question as to whether such a “Superradiant Quantum Heat Engine” could underpin the classical molecular biology of living dynamics such as RNA/DNA and photosynthesis. McFadden & Al-Khalili (2014), for example, engagingly describe how the FMO complex, a green photosynthetic protein, was discovered to have a *quantum beat* that takes a quantum walk characteristic of living systems.

The lead author on the paper, spent the entire night stitching together the data ... to produce a plot of their data ... a rising and falling signal that oscillated for at least six hundred femtoseconds ... (p. 125)

*The beats ... discovered in the FMO complex were indeed a signature of quantum coherence, and Lloyd concluded that the chlorophyll molecules were operating a novel search strategy know as a quantum walk ...* (p. 127)

The discovery of quantum coherence in warm, wet, turbulent systems such as plants and microbes has come as a huge shock

to quantum physicists ... Still the quantum world appears very strange to us and it is often claimed that this strangeness is a symptom of a fundamental split between the world we see around us and the quantum underpinnings. *But in reality there is only a single set of laws that govern the way the world behaves: quantum laws. The familiar statistical laws and Newtonian laws are, ultimately, quantum laws that have been filtered through a decoherence lens that screens out the weird stuff (which is why quantum phenomena appear weird to us). Dig deeper and you will always find quantum mechanics lurking at the heart of our familiar reality.*

What's more, certain macroscopic objects *are* sensitive to quantum phenomena: and most of these are living ... quantum tunneling inside enzymes can

be an amplification from the quantum (unconscious) to the classical (conscious) realm (Meier, 2001). The very careful splicing together of so many different levels of spacetime realities in this paper may still seem a bit tenuous to the uninitiated. The next image on DNA Replication and Repair is therefore included to further validate the quantum underpinning of what we usually call "reality" in physics, biology and psychology.

Moolman et al. (2014) documented the basic molecular dynamics of DNA replication, repair and gene expression that underpins the classical/quantum interface that we experience as life, consciousness and cognition. They divided the complete DNA Basic Rest-Activity Cycle into three time regions. First notice how the (a) top image with a computer simulation of five variables (colors) coming together in a black quantum-like wave of about 80 to 100 minutes representing the

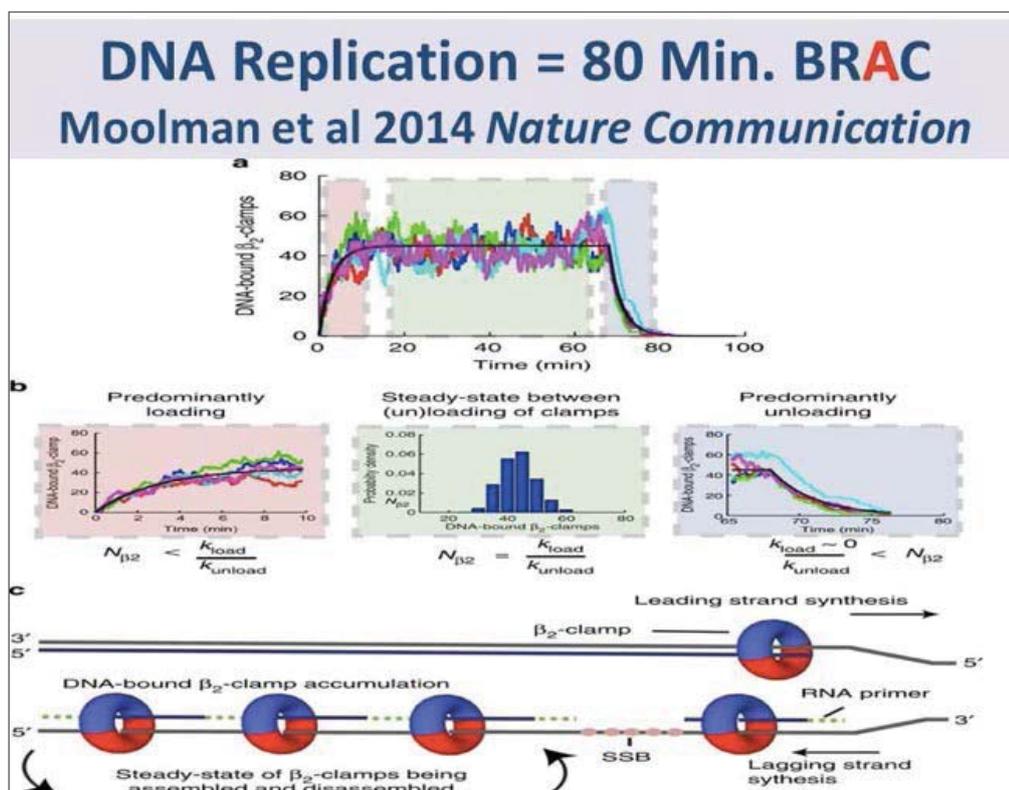


Figure 16. A Computer Simulation of the BRAC Cycle of DNA Replication and Repair (Adapted from Moolman et. al. 2014).

make a difference to whole cells ... most of the biomass on the planet appears to be dependent on a delicate quantum coherence ... *we see Schrödinger's order from order capable of capturing quantum events, and what Jordan termed amplification of quantum phenomena to the macroscopic world. Life seems to bridge the quantum and classical worlds, perched on the quantum edge.* (p. 131-132, most italics added here.)

It is interesting to note in this regard how the Swiss pioneering psychoanalyst Carl Jung also used the term "amplification" to describe the process of raising contents of the unconscious to consciousness – which we would now recognize to

DNA Basic Rest-Activity Cycle. Below it in the (b) smaller pink graph they illustrate an initial stage of DNA replication of about 20 minutes. Next to it in the light green graph the probability dynamics of adaptive DNA replication is quantified in the dark blue histogram. The light gray graph on the right shows the termination stage DNA replication of about 10 minutes. Details of the BRAC of DNA replication are illustrated in (c) the lower series of blue and red donuts showing leading and lagging strands of DNA synthesis, etc.

We propose that this simulation of DNA replication and repair underpins what we have described the classical/quantum dynamics of the 4-Stage Creative Cycle (Initiation, Incubation, Aha!

and Integration) in Milton H. Erickson's naturalistic therapeutic hypnosis (Rossi, Erickson-Klein & Rossi, 2008-2015). We now take a leap into what the pioneering physicist Nick Herbert (1987) has called "Quantum Reality: Beyond the New Physics, An Excursion into Metaphysics and the Meaning of Reality."

### **A Quantum Field Theory of Life and Consciousness: The Quantum Dynamics of the Basic Rest-Activity Cycle and the 20 Minute Break**

Here there may be Dragons! Our world is full of surprises! We have now come to the edge of our human understanding of life and consciousness. We presume to now pick up where Nick Herbert (1987) ended his pioneering survey of *Quantum Reality* with these prescient words.

### **Is Consciousness a Type of Quantum Knowledge?**

Although it seems to be true that every physics experiment is classical in form if not in content, is it so obvious that the full range of human experience is also absolutely classical?

Science's biggest mystery is the nature of consciousness. It is not that we possess bad or imperfect theories of human awareness; we simply have no such theories at all ...

Is it possible that consciousness is some sort of quantum effect? Is human awareness a privileged access to the "inside" of the quantum world an open door to some brain quon's [quantum] realm of possibility? Can we know firsthand what it is like to dwell in the quantum world just by sitting still and looking inside our heads?

Human mental experience seems to be of two kinds—an experience of facts, memories, emotions, body states - a thoroughly classical kind of knowing which we might call "computer consciousness," which takes place against a peculiar background of "raw awareness"—that uncanny yet familiar feeling we relinquish when we go to sleep and awaken into every morning. Some have called this second kind of experience "consciousness without an object." I call it "ordinary awareness" and believe that it is one human quality that distinguishes us from computers—at least computers as they are presently constituted.

*If ordinary awareness is a direct connection to quantum reality, then just as our external knowledge of quantum entities may be characterized by the term "quantum ignorance," so we might call this immediate internal experience of the world's real nature "quantum knowledge." One of the greatest*

*scientific achievements imaginable would be the discovery of an explicit relationship between the waveform alphabets of quantum theory and certain human stages of consciousness.* (p. 248-249, italics added here)

But how, more specifically, could we now update an answer Herbert's fundamental question: "Is Consciousness a Type of Quantum Knowledge?" What would be the fundamental equations, for example, describing the quantum engine and energy source of cosmos and consciousness?

### **The Quantum Engine Energy Source of Cosmos and Consciousness**

In a recent book the Noble Prize winning particle physicist, Frank Wilczek (2015), provides an illuminating discussion of the simple equations of particle physics that govern the Quantum Engine Energy Source of Cosmos and Consciousness.

To explain these events, the physicists had to define one more force in addition to those of gravity, electromagnetism, and the strong force.

*This new addition, this fourth force, is called the weak force. The weak force completes our current picture of physics: The Core.*

Life on Earth is powered by a tiny fraction of the energy released from the Sun, captured as sunlight. The Sun derives its power by burning protons into neutrons, releasing energy. (p. 260, Italics added here)

A dramatic image of how life on earth is powered by the quantum dynamics of how **Neutrons (Blue for Nature)** are converted to **Protons (Green for Life)** plus **Electrons (Red for Energy)** plus **Anti-Neutrinos** is well illustrated and discussed in Wikipedia.

Wilczek (2015) discusses the dynamics of neutron to proton conversion as follows.

Because protons and neutrons are ... complex composites of more basic quarks and gluons, we should track *proton* and neutron conversions to their more basic source. The deep structure underlying those conversions is the quark process:



Because neutrons are based on *udd* [*up, down, down*] quark triads, while protons are based on *uud* [*up, up, down*] the quark transformation  $d \rightarrow u$  enables a neutron to transform into a proton. That transformation is accompanied by emission of an electron *e* and an antineutrino  $\bar{\nu}$ . So our basic, quark-level interaction is realized:



***This slow decay (lifetime fifteen minutes) is the fate of isolated neutrons.*** (They are stabilized only when bound inside nuclei [of atoms]. (p. 260-261, Italics & bold added here)

We now propose a highly speculative hypothesis about the source and evolution of cosmos and consciousness: **The slow decay (lifetime fifteen minutes) of the equations of neutron/proton transitions is the quantum engine underpinning of the 20 Minute Break, which humans experience as the initial phase of the 90-120 Minute Basic Rest-Activity Cycle of the RNA/DNA dynamics of life and consciousness.**

The particles we're interested in have a small intrinsic spin. They're forever twirling, like tireless ice skaters. So we can apply our logic to them, and derive a direction associated with their spin. If our particle is moving in that direction, we say that the particle is right-handed. If it is moving in the opposite direction, we say it is left-handed. The handedness of a particle, in

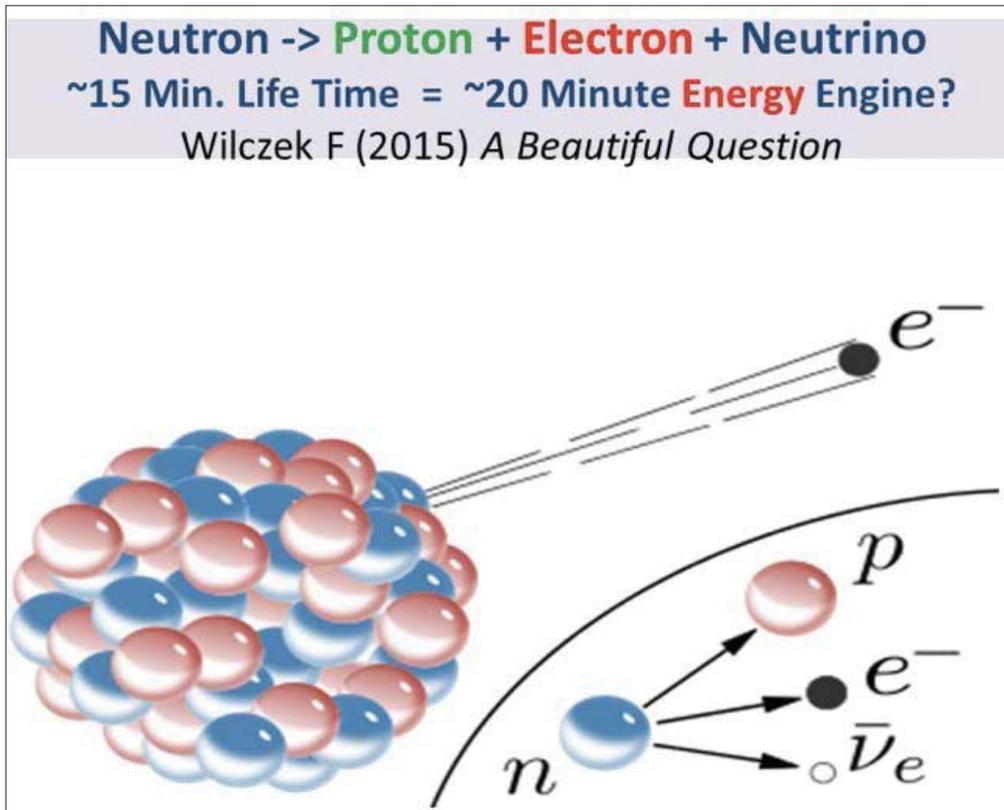


Figure 17. The Quantum Engine Energy of Cosmos and Consciousness. The "Weak force" illustrates how a neutron can decay into a proton, electron and antineutrino within a lifetime of about 15 minutes. (Illustration from Wikipedia Creative Commons.)

Some very interesting amplifications of the quantum inner quark dynamics in life, the consciousness, cognition and possibly even psychotherapy are now outlined in the next few images.

Wilczek (2015) continues with his perspectives of the quantum contributions of the weak force and quark interactions amplified to the phenomenology of life with an introduction to *Handedness & Parity Violation of Quantum Particles* as follows.

A very profound aspect of the weak force, called parity violation, was discovered theoretically by TD Lee and CN Yang in 1956. To describe it, we must introduce the concept of particle *handedness*. It applies to particles that are moving and spinning.

If an object rotates around an axis, we can assign a direction to the axis, as follows. Imagine our spinning object as an ice skater. If her rotation brings her right hand down toward her abdomen, we choose the direction from her toes to her head; if it brings her right hand toward her back, we choose the direction from head to toes.

other words, orients its spin with respect to its velocity.

What Lee and Yang proposed is that the left-handed quarks, electrons, and neutrinos ... participate in the weak interaction, as do right-handed antiquarks, antielectrons (i.e., positrons), and antineutrinos ... but that particles with the opposite handedness do not. Experiments bore out their proposal. (p. 261-262)

Could we now amplify the *Handedness & Parity Violation of Quantum Particles* characteristic of the micro-world of physics to the macro-world of everyday life as we commonly experience it? Is this another example of the appropriateness of *amplification from the invisible quantum world of particle physics to the classical world of everyday life?* Physicists and mathematicians make this transition with a combination of observation, calculation and experimentation to make valid predictions. People in the arts and humanities tend to do it through metaphor, poetry, empathy and mirror neurons. Psychotherapists at the present time tend to validate their work with so-called "mindfulness – being

consciously focused on current experiencing and future well-being.”

Many of our therapeutic demonstrations of the Erickson/Ravitz/Rossi electrometric correlates of hypnosis, meditation and the 4-Stage Creative Cycle have focused on the dynamics of handedness to make visible the invisible inner experiences of the so-called, creative unconscious (Rossi, Erickson-Klein & Rossi, 2008-2015). The next image extends the visualization of the quantum dynamics of the cosmos and consciousness with the concept of a universe from nothing that has even more profound implications for understanding the quantum dynamics of the human condition (Krauss, 2012).

In a science prize winning essay Aiden (2011) charmingly describes how, as a young lad, he watched the 1968 film *Powers of Ten*, which illustrated the size of the universe and everything

Where to look? The film provides a clue: at  $10^{-6}$  m, we enter the cell nucleus, but see little before reaching the double helix ( $10^{-8}$  m). Something is missing. DNA must fold further; if it did not, human genomes would be 2 m long and would not fit in the cell, much less the nucleus.

Since 1968, we have learned that DNA wraps around histones, packing  $\sim 10^2$  base pairs into the  $10^{-8}$  m nucleosome. *We also know that individual chromosomes occupy distinct sub-nuclear volumes called chromosome territories which pack  $\sim 10^8$  base pairs into  $10^{-6}$ ...*

*Powers of Ten* is an apt metaphor for science, which progresses by probing the world at one scale after another. *Humans are naturally found at  $10^0$  m and,*

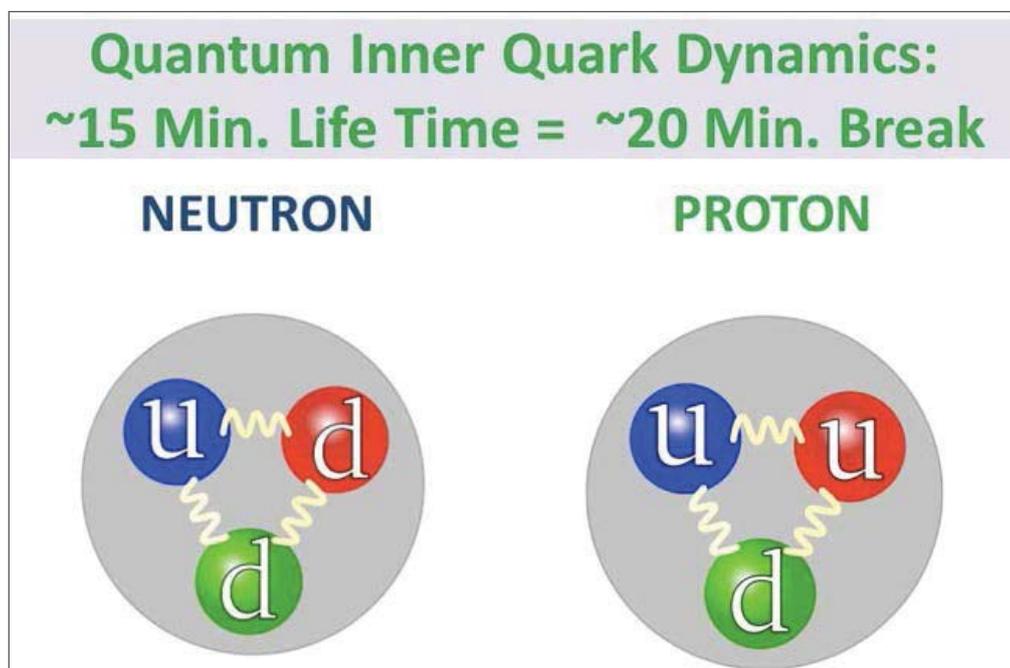


Figure 18. *The Inner Quantum Structure and Dynamics of Neutrons and Protons consisting of up (u) and down (d) Quarks (circles in color) and gluons (springs in white).*

in it in **meters (m)**. This profound perspective can help us visualize a Quantum Field Theory of life and consciousness that generates *A Universe from Nothing* (Krauss, 2012). As we shall see, this could inspire an optimistic ethos of the human condition that could replace the unfortunate current view of an impoverished humanity dominated by the territorial imperative of conflict and war (Arbery, 1996).

The camera begins with a couple on a picnic and then zooms out: to the picnic ground ( $10^1$  meters), **Chicago ( $10^5$  m)**, **Earth ( $10^7$  m)**, and, eventually, the universe ( $10^{26}$  m), only to zoom back in until it reaches the interior of a proton ( $10^{-16}$  m). Breathtaking structures emerge at each scale. *I realized that if, one day, I could hold that magical camera—examining a phenomenon at a new scale, however briefly—I would see things that had not been seen before.*

*after thousands of years, have managed to explore ~25 orders of magnitude in either direction: from the 1-MeV neutrino ( $10^{-24}$  m), to the observable universe ( $10^{26}$  m). We suspect that this is all there is: that in this universe of scales, humankind lies at the center. Perhaps we are right. But as our forebears—who marked the edges of their maps with phrases like “here be dragons” ... our world is full of surprises. So on we must go, building better cameras. (Aiden, 2011, p. 1222-1223. Italics and Bold added here)*

To understand the implications of this quote from Aiden one must read the exponents of the *Powers of Ten* very carefully. The size of the universe we “*have managed to explore is ~25 orders of magnitude in either direction: from the 1-MeV neutrino ( $10^{-24}$  m), to the observable universe ( $10^{26}$  m)*” is vast, indeed.

Vast as it may be the universe is still expanding;

spacetime is being continually created. This leads the physicist Krauss (2012) to propose that the quantum source of the universe, life and consciousness is still being created from nothing! Here's how he expresses the quantum logic of it all in the final chapter of his book.

### Nothing is Unstable

*The existence of energy in empty space – the discovery that rocked our cosmological universe ... only reinforces something about the quantum world that was already well established in ... laboratory experiments ... empty space is complicated. It is a boiling*

*force on your hair or watch a balloon stick to a wall. However, the quantum theory of electromagnetism suggests that the static field is due to the emission, by charged particles involved in producing the field, of virtual photons that have essentially zero total energy. These virtual particles, because they have zero energy can propagate across the universe, without disappearing, and the field due to the superposition of many of them is so real it can be felt* (Krauss 2012, p.153-4, italics added here).

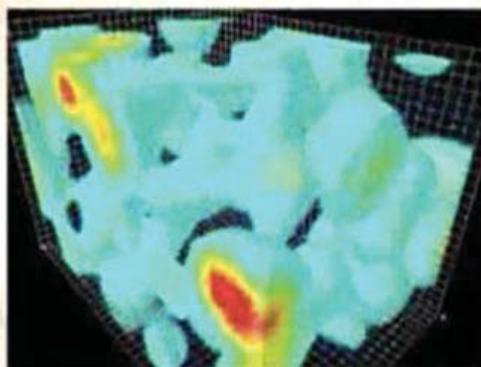
Rift with paradox as this sample of quantum logic operative on scales from cosmos to consciousness

## A Universe from Nothing (Krauss 2012) Vs Territorial Imperative (Ardrey 1966)

### Quarks Inside the Proton (p. 70)

### Proton is Full of Virtual Particles

Empty Space not Empty!



- **Quarks themselves provide very little of the total mass . . . the fields created by these particles contribute most of the energy that goes into the proton.**
- **The same is true of the neutron, and since you are made of protons and neutrons, the same is true of you. (Page 70)**

Figure 19.  
A Quantum Field Theory Simulation of neutron/proton quark interactions that apparently generate the quantum engines of the life equations in A Universe from Nothing (Krauss, 2012).

*brew of virtual particles that pop in and out of existence in a time so short we cannot see them directly.*

*Virtual particles are manifestations of a basic property of quantum systems ... Systems continue to move, if just momentarily, because all possible states, including states that would not be allowed if the system were actually being measured. These "quantum fluctuations" imply something essential about the quantum world: nothing always produces something, if only for an instant.*

But here's the rub. The conservation of energy tells us that quantum systems can misbehave for only so long ... As a result, you might presume to safely argue that this "something" that is produced by quantum fluctuations is ephemeral – not measurable, - unlike, say, you or I or the earth on which we live ... For example, *consider the electric field emanating from a charged object. It is definitely real. You can feel the static electric*

may seem (recall the Powers of Ten above), it can have profound implications for understanding some of the imponderables of the human condition. In a universe so huge and continually expanding by creating spacetime that "is a boiling brew of virtual particles that pop in and out of existence in a time so short we cannot see them directly," can none-the-less generate the quantum life equation (recall  $n \rightarrow p + e + \nu$ )? Such quantum logic, experimentally validated with billion-dollar particle accelerators, would seem to guarantee a generous source of energy and matter ( $E = mc^2$ ) to satisfy even the most demanding human societies.

*The Territorial Imperative* (Ardrey, 1966), however, purportedly documents how humans and other species seemingly will always compete and go to war on the edge of their life space, as if there would never be enough territory to support the well-being of all. Resolving this stumbling block with the more powerful quantum engines of our ever generous universe could inspire us with the values and truth of human creativity and better self-care.

## Summary

Our review of The Quantum Field Theory of Life and Consciousness began with a celebration of The Centennial of Einstein's General Theory of Relativity and the Four Fundamental Forces of Nature in 2015. This led to a re-discovery of the almost forgotten heritage of Milton H. Erickson's electrodynamic measurement of the transitions in consciousness during naturalistic therapeutic hypnosis in this century. We explored the turning point between the classical ordinary world we experience in daily life and its quantum underpinning for understanding the human condition. The advent of current research in the quantum biology of life and consciousness

is now generating an enlightened horizon for the pursuit of STEM education (Science, Technology, Engineering and Math) in all the life sciences. We introduce new technology that can reduce stress and optimize human health and well-being with new concepts of meditation, mindfulness and mind/body medicine. We reviewed profound quantum perspectives of how our expanding universe, generated by *The Quantum Heat Engine*, could inspire an optimistic ethos of the human condition in a very generous universe for free that could replace the territorial imperative of impoverishment, conflict and war.

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