

THE QUANTUM ELECTRODYNAMIC FIELD THEORY OF NATURALISTIC HYPNOSIS BRAIN PLASTICITY, BEHAVIOR AND THE QUALIA OF CONSCIOUSNESS AND HAPPINESS

Ernest Rossi and Kathryn Rossi¹

Abstract

The theory, research and practice of naturalistic hypnosis and happiness is explored with the current STEM perspectives of science, technology engineering, and mathematics. The quantum electrodynamic field theory of naturalistic 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

¹ Dr. Ernest Rossi and Dr. Kathryn Rossi, from California, USA are internationally reputed scholars in hypnosis and psychology.

naturalistic hypnosis with biofeedback and meditation. Applications of the quantum electrodynamic field theory of naturalistic hypnosis for research on attention span, focusing of consciousness, cognition, chirality, dissociation, expectancy, happiness, meditation, psychodynamics and post-traumatic stress disorder (PTSD) are proposed. The implications of such research for investigating the possible relationships between hypnosis, brain plasticity, behavior and the qualia of consciousness and happiness are discussed.

Key Words: Attention, biofeedback, brain plasticity, cognition, consciousness, happiness, meditation, qualia, quantum electrodynamic field theory, psychodynamics, PTSD, QFT.

Introduction: The Quantum Electrodynamic Field Correlates of Naturalistic Hypnosis

The quantum electrodynamic field correlates of naturalistic hypnosis reviewed here suggests how the theory, research and practice of hypnosis and happiness 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 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. (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) reviewed the original quantum electrodynamic field theory of naturalistic hypnosis and some of its emotional 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 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*." [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 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**. [p. 3-4, italics added here].

Box One outlines the Maxwell's (1871) four classical equations of electricity (**E**) and magnetism (**H**), which were the original theoretical rational for the Erickson/Ravitz electrodynamic quantum field correlates of hypnosis.

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

$$\nabla \cdot \mathbf{E} = 0 \quad \nabla \times \mathbf{E} = - \frac{1}{c} \frac{\partial \mathbf{H}}{\partial t}$$

$$\nabla \cdot \mathbf{H} = 0 \quad \nabla \times \mathbf{H} = \frac{1}{c} \frac{\partial \mathbf{E}}{\partial t}$$

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 (Rossi & Rossi, 2014, 2015a & b).

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 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, psychology and medicine in Box One highlights the STEM perspective for updating

the traditional theory, research and practice of therapeutic hypnosis. This STEM perspective is motivated by the historical words of Galileo Galilei (1564 –1642, Wikiquote).

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 dynamic of radio waves (Wilczek, 2002, 2008, 2015).

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, Wilczek, 2002, p. 102)

It was Maxwell himself who summed up his philosophy of life regarding happiness and the creation of his 4 equations of electromagnetism that can be an inspiration for all of us who seek to continue and extend his scientific legacy in the study of the surprising relationships between hypnosis, happiness and electromagnetism developed in this paper.

Happy is the man who can recognize in the work of Today a connected portion of the work of life, and an embodiment of the work of Eternity. The foundations of his life confidence are unchangeable, for he has been made a partaker of Infinity. (As quoted by Blundell, 2012, chapter 4).

In this paper we extend these STEM perspectives to an explore of how the quantum dynamics of consciousness, creativity and happiness can be applied to therapeutic hypnosis on many levels from mind to genes (Cozzolino *et al.* 2014a, b; Rossi *et al.* 2008; Rossi & Rossi, 2014).

Leonard Ravitz's (1950) Measurement of the Electrometric Correlates of the Hypnotic State

In the two generations since the electrodynamic quantum field theory of therapeutic hypnosis was introduced at the first annual meeting of *The American Society of Clinical Hypnosis* in 1958, quantum field theory has been repeatedly confirmed as the most accurate scientific foundation of modern physics and, by extension, the dynamics of all life processes (Lancaster & Blundell, 2014; Loewenstein, 1999, 2013). This STEM perspective was the rationale for Ravitz's (2002) initial training with Milton H. Erickson, which Ravitz documents as follows:

Beginning in 1945, I was trained by Milton H. Erickson, MD, the world's foremost authority on hypnosis, at Wayne County General Hospital, Eloise, Michigan in the most sophisticated, empirical techniques of hypnosis which Erickson was developing. Erickson's elegant and imaginative experiments, using maverick procedures, were a great empirical advance in both hypnosis and psychiatry ... Field correlates of hypnosis first were presented in *Science* (Ravitz, 1950), followed by the first atlas of hypnotic tracings published by Tracy J. Putnam, MD, the editor of *AMA Archives of Neurology and Psychiatry* and Director of Services, Neurological Institute of Columbia-Presbyterian Medical Center, 1951. On August 28, 1959, a more sensitive cathode ray oscilloscope first was used to monitor hypnotic states in Burr's Yale Medical School office" (Ravitz, 2002, p. 54-55).

As far as known, Ravitz's (1950), "Electrometric Correlates of the Hypnotic State," was the first and only scientific paper on hypnosis ever published in *Science*. It begins as follows:

Because of repeated failure to detect electrometric correlations with EEG from trance states, no completely objective criteria of hypnosis have yet been formulated beyond empiric observation. Using a Burr-Lane-Nims microvolt meter, 60 standing potential records of 20 subjects were taken. Although results of spot determinations were sometimes equivocal, continuous EMF tracings, using the combined microvolt meter and General Electric photoelectric recorder at a speed of 1 inch/min, with one electrode on the forehead and the other on the palm of either hand, seem to provide a reliable quantitative index of trance depth. During hypnosis, the EMF tracing becomes more regular, and potential difference either gradually increases or decreases in magnitude. At trance termination, there is usually a dramatic voltage shift, and

the tracing eventually returns to that of the normal waking state [Illustrated in Figure One].

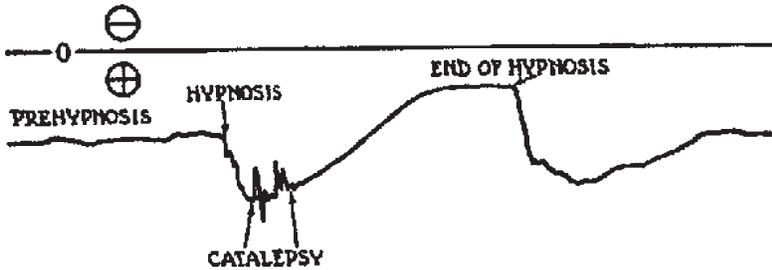


Figure 1. Schematic DC record of hypnosis as it originally appeared in Ravitz, 1950.

Whenever possible, induction was linked up with motor behavior, utilizing the technique developed by Milton H. Erickson (e.g., as his hand rose, a subject would become sleepier until, finally, when it touched his face, he would close his eyes and sleep, signifying he was ready by returning the hand to his lap). Catalepsy, when used to induce hypnosis, sometimes produced marked EMF [Electromagnetic Force] changes. When this occurred during the trance, or when the subject voluntarily raised an arm, minimal changes were recorded. Depth of hypnosis, as measured electrometrically, does not seem to be correlated with ability to develop amnesia or other phenomena often necessary for a good therapeutic trance. Any disturbance of the hypnotic state could be detected immediately by changes in voltage and in configuration of the tracing. It is thus possible to measure objectively changes in depth of hypnosis. (Ravitz, 1950, pp. 341-2).

During the middle 1970's, about 25 years after Ravitz's paper was published in *Science*, Erickson and Ravitz together mentored Ernest Rossi in the use of a strip-chart recording electronic device (Heath-Schlumberger Model SR-255B) for facilitating the induction and objective measurement of therapeutic hypnosis. We assessed real patients, ourselves and some of Erickson's family during this informal learning and 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 of Erickson's naturalistic approach to hypnotic induction and therapy illustrated below in Figure Two, which he outlined as a "Two-Factor Theory of Hypnotic Experience as follows (Erickson & Rossi, 1981/2014; Rossi, Erickson-Klein & Rossi 2014, Vol. 12).

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 phymograph-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 DC [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. The junior author [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 and his clinical practice as a convenient and convincing indicator of an objective alteration that takes place during trance. The record of a highly intelligent, normal, 24 year old female subject during her first hypnotic induction is presented in Figure Two. 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, which then drops out as soon as the impulse is carried through. During simple relaxation, meditation, and hypnosis the record smooths out and usually drops dramatically as the subject gives up any active effort to direct mind or body (B). In Figure Two 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 remarks (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 the low amplitude activity drops out, and a 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 four stages, peaks and valleys are usually recorded. The awakening periods also followed by a typical pattern (E). The waking fast activity 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 normal.

The difficulty with accepting such records as valid measures of trance is that they 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 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 in Figure Two, 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 subjects mind. Hypnotic suggestion is the process of helping subjects utilize their own mental associations and capacities and 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 DC potential. Is the depth of the curve (Area D in Figure Two) 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 DC potential. Are these people better hypnotic subjects? Do 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 & Rossi, 1981/2014pp 63-65).

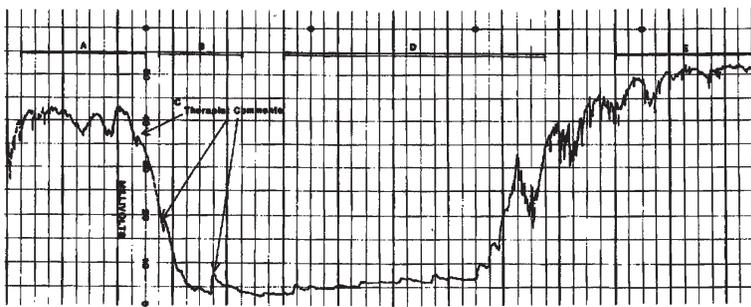


Figure 2: Electronic monitoring of DC body potential during catalepsy in millivolts (mV) on vertical access, time scale of 0.5 inch per minute on horizontal access: (A) normal awakeness; (B) drop in DC potential during relaxation; (C) momentary response to therapist remarks; (D) characteristically low activity during catalepsy; (E) typical awakening pattern at higher electronic level than (A).

To answer these questions about the basic psychophysiology 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, to begin a 16 year odyssey editing two volumes of international research into the fundamental principles of chronobiology and psychobiology (Lloyd & Rossi, 1999, 2008). 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 ultradian human 90-120 minute Basic Rest-Activity Cycle (BRAC) and 4-stage creative cycle could be the psychophysiological basis of Erickson's naturalistic therapeutic hypnosis (Hope & Sugarman, 2015; Lloyd & Rossi, 1999, 2008; Rossi, 2002, 2012; Rossi & Rossi, 2013). Little noted at that time, however, was Stupfel's (1992) prescient concept of the quantum nature of these circadian and ultradian rhythms in medical research (in Lloyd & Rossi, 1992).

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 ν 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 here)

Stupfel's intuition was an early intimation of the quantum aspect of the oscillatory nature of the circadian and ultradian dynamics of all 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 as well as life cycles in general. Physicists describe 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. The next section explores how such oscillations (cycles, rhythms, periodicities, waves etc.) of “energetic discontinuity” in biology, behavior, brain plasticity, consciousness and cognition may be conceptualized as the quantum field correlates of the “phenomenology of dissociation” in hypnosis.

The Harmonic Oscillator in the Classical/Quantum Dissociation Dynamics of Hypnosis

Susskind and Friedman (2014), in their accessible book on quantum mechanics explain the harmonic oscillator in this way.

Of all the ingredients that go into building a quantum description of the world, two stand out as especially fundamental.

[1] The spin, or qubit, of course is one of them. In classical logic, everything can be built out of yes–no questions. Similarly, and quantum mechanics, every logical question boils down to a question about qubits.

[2] The second basic ingredient of quantum mechanics is the harmonic oscillator. *The harmonic oscillator isn't a particular object like a hydrogen atom or a quark. It's really a mathematical framework for understanding a huge number of phenomena. This concept of the harmonic oscillator also exhibits in classical physics, but it really comes to the fore in quantum theory ...*

Why are harmonic oscillators so prevalent? ... Many kinds of systems are characterized by an energy function that can be approximated by ... some variable [of life and consciousness] representing a displacement from equilibrium. When disturbed, these systems will all oscillate about the equilibrium point. Here are some examples:

- **An atom situated in a crystal lattice.** If that atom is displaced slightly from its equilibrium position, it gets pushed back within approximately linear restoring force. This motion is three dimensional and really consists of three independent oscillations.
- **The electric current** in a circuit of low resistance often oscillates with a characteristic frequency. The mathematics of circuits is identical to the mathematics of mass is attached to springs.

- **Waves.** If the surface of a pond is disturbed, it sends out waves. Someone watching at a particular location will see the surface also laid as the wave passes by. This motion can be described as simple harmonic motion. The same goes for sound waves.

- **Electromagnetic waves.** Just like any other wave, a light wave or radio wave oscillates when it passes you. The same mathematics that describes the oscillating particle also applies to electromagnetic waves. (pp. 311-313, italics added here.)

To these examples of the harmonic oscillator in the classical/quantumdynamics of nature ,this paper adds the circadian and ultradian rhythms of the psycho-physiological basis of life on all levels from mind and behavior to molecules and genes, which were proposed as the fundamental basis of naturalistic therapeutic hypnosis in Lloyd & Rossi (1992, 2008). Three circadian and ultradian behavioral examples of independently collected data and graphs prepared by Helen Sing (1992) in the Department of Behavioral Biology at the Walter Reed Army Institute of Research in Washington are illustrated in Figures Three, a-c. More fundamental experimental associations between hypnotic susceptibility, time of day, core body temperature and gene expression by another independent research group (Aldrich & Bernstein, 1987) was described as a bio-informatic approach to the psychosocial genomics of therapeutic hypnosis (Rossi, 2004) and the unification hypothesis of chronobiology in an evolutionary view of mind-body rhythms, stress and healing with hypnosis (Rossi & Lippincott, 1992).

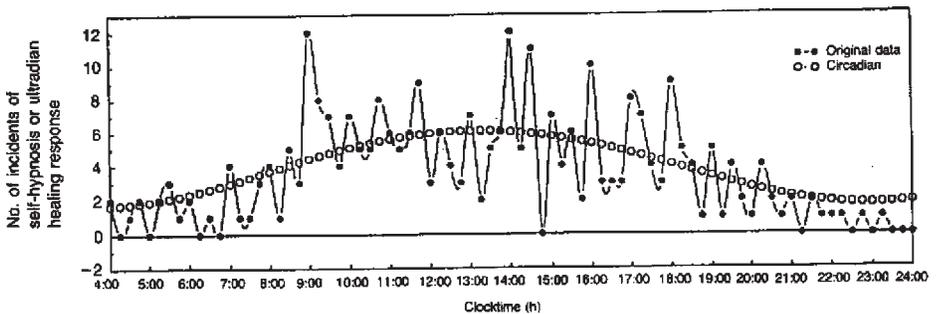


Figure 3a: An overview of the circadian rhythm (every 24 hours) and the ultradian healing response (less than 24 hours) and self-hypnosis in

292 diary recordings of 16 subjects over a 1-week period (Reproduced with permission from Lloyd & Rossi, 1992, p. 383).

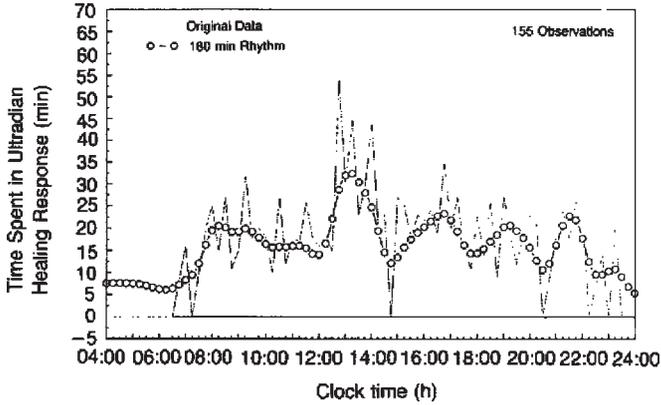


Figure 3b: The predominant 180 minute rhythm of the ultradian healing response diary group (Reproduced with permission from Lloyd & Rossi, 1992, p. 383).

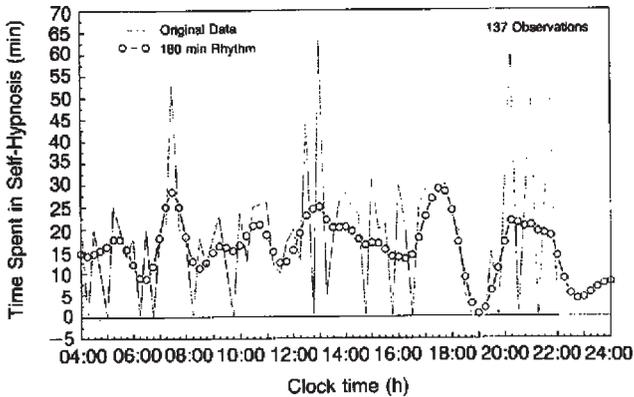


Figure 3c: The predominant 180 minute rhythm of the self-hypnosis diary group (Reproduced with permission from Lloyd & Rossi, 1992, p. 383).

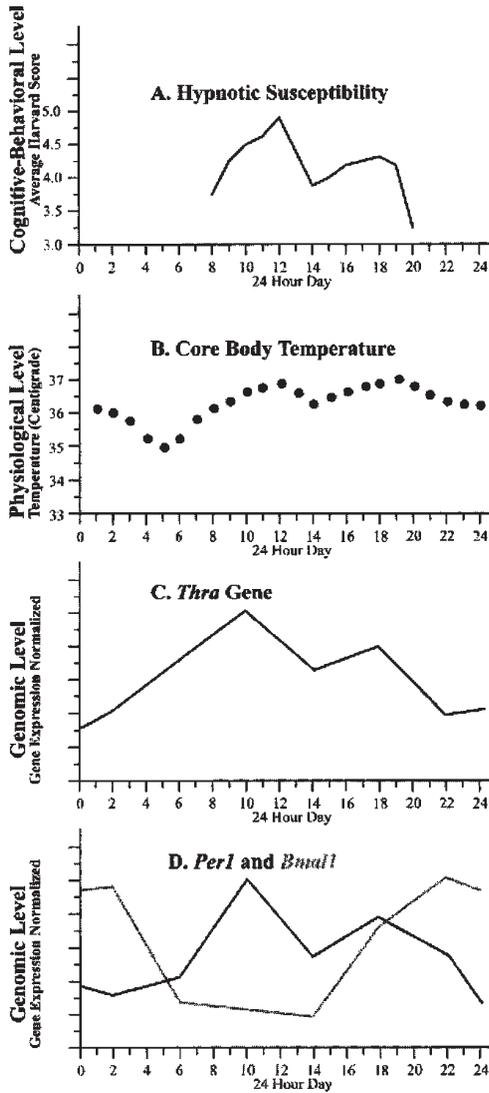


Figure 3d: Experimental associations between hypnotic susceptibility, time of day, core body temperature and gene expression (Aldrich & Bernstein, 1987) summarized as a bioinformatic approach to the psychosocial genomics of therapeutic hypnosis (Rossi, 2004).

A careful study of Figures Three, a-d, illustrate how they all approximate of the mathematical concept of the quantum harmonic oscillator in nature and life described by Susskind and Friedman (2014). These empirically based psychophysiological correlates of therapeutic hypnosis now can be recognized as the so-called “eigen functions and energy levels” formulated in the characteristic equations of quantum field theory (Lancaster & Blundell (2014, p. 20), which are illustrated below in examples of the quantum electrodynamic field theory of therapeutic hypnosis.

The upshot of the universality of the harmonic oscillator in the evolution of a quantum field theory therapeutic hypnosis proposes a series of open questions (Rossi & Rossi, 2008): Will it be possible to develop a “Mind-Gene Biofeedback Device” whereby voluntary conscious mental activity could modulate activity-dependent gene expression and brain plasticity to facilitate mind-body healing? That is, could a top-down biofeedback device focus consciousness, attention and expectancy during hypnosis modulate the psychosocial genomics dynamics of gene expression and brain plasticity (Rossi & Rossi 2014; Cozzolino *et al.*, 2014a, 2015b)? Research in epigenetics documents how RNA/DNA transcription factors are an informational bridge between environmental stimuli, behavior, consciousness, cognition, state-dependent gene expression and brain plasticity (Rossi, 2002, 2007, 2012; Rossi & Rossi, 2013, 2014a & b, 2015). Epigenomics and psychosocial genomics brings together a host of independently developed psychobiological fields associated with hypnosis such as psychoneuroimmunology, psychoendocrinology, stress, optimal states of creativity and flow in everyday life as well as psychotherapy, rehabilitation, and translational medicine (Doidge, 2015; Hope & Sugarman, 2015).

Facilitating Brain Plasticity, Behavior, Consciousness and Cognition with Therapeutic Hypnosis

Brain plasticity, behavior, consciousness and cognition could be assessed and facilitated with an update of the Erickson-Ravitz electrodynamic measurements of therapeutic hypnosis. Most approaches to psychotherapy, counseling, meditation and virtually all top-down holistic mind-body dynamics of therapeutic hypnosis, health and rehabilitation from ancient times to the present are essentially concerned with the creation, destiny and change of

behavior, consciousness and cognition. Quantum physicists typically describe the source of all this as the spontaneous creation and annihilation matter out of the vacuum of space (Baggott, 2011; Davies & Brown, 1988; Schweber, 1994). The Nobel Prize winning physicist, Frank Wilczek (2002) describes this profound scientific integration of biology, mathematics, physics and psychology via quantum field theory as follows:

The more profound, encompassing result was a complete reworking of the foundations of our descriptions of matter. In this new physics, particles are mere ephemera. They are freely created and destroyed: indeed, their fleeting existence and exchanges is the source of all interactions. The truly fundamental objects are universal, transformative ethers; quantum fields. These are the concepts that underlie our modern, wonderfully successful theory of matter (usually called, quite inadequately, the Standard Model). And the Dirac equation itself, drastically reinterpreted and vastly generalized, but never abandoned, remains a central pillar in our understanding of nature...p. 104.

In hindsight we can discern that much more ancient and fundamental dichotomies are in play: the dichotomy of light versus matter; the dichotomy of continuous versus discrete. These dichotomies present tremendous barriers to the goal of achieving a unified description of nature of the theories Dirac and his contemporaries' sought to reconcile, relativity was the child of light and the continuum, and quantum theory the child of matter and the discrete. After Dirac revolution had run its' course, all were reconciled, in the mind-dash stretching conceptual amalgam we call a quantum field. ... Early in the 19th century a very different of light, according to which it consists of waves, scored brilliant successes. Physicists accepted that there must be a continuous, space filling ether to support these waves. The discoveries of Faraday and Maxwell, assimilating light into the play of electric and magnetic fields, which are themselves continuous entities filling all space, refined and reinforced this idea [quantum field theory] ... p. 105

Indeed, many authors in philosophy and the humanities as well as scientists in quantum mechanics have used light as a STEM metaphor of the dynamics consciousness, cognition and human nature (Gregory & Gregory, 2014; McFadden, 2000; Stapp, 1993; Zohar, 1990), which are illustrated as the proposed quantum electrodynamic field theory of therapeutic hypnosis in the next section. Wilczek (2002) continues.

In 1927 [Dirac] applied the principle of the new quantum mechanics to Maxwell's equations of classical electrodynamics. He showed that Einstein's revolutionary postulate that light comes in particles—photons—was a consequence of a logical application of these principles... Few observations are as common as that light can be created from non-light, say by a flashlight ...*This means that the quantum theory of Maxwell's equations is a theory of the creation and destruction of particles (photons). Indeed, the electromagnetic field appears, in Dirac's theory, primarily as an agent of creation and destruction.* The particles—photons—we observe result from the action of this field, which is the primary object. Photons come and go, but the field abides ...

The result of a logical application of the principles of quantum mechanics to Dirac's equation is an object similar to what he found for Maxwell's equations. It is an object that destroys electrons and creates positrons. Both are examples of *quantum fields*. When the object that appears in Dirac's equation is interpreted as a quantum field, the negative-energy solutions take on a completely different meaning, with no problematic aspects. The positive-energy solutions multiply electron-destruction operators, while the negative-energy solutions multiply positron-creation operators ... The description of light and matter was put, at last, on a common footing. Dirac said, with understandable satisfaction that with the emergence of quantum electrodynamics physicists had obtained foundational equations adequate to describe 'all of chemistry, and most of physics' (p. 117, italics added here).

The following section documents six quantum field illustrations of the infinite variety of human experiences obtained with electrodynamic technology ([www.picotech.com/products/data-logger:\(ADC-20/24](http://www.picotech.com/products/data-logger:(ADC-20/24) with ± 39 to ± 2500 millivolts input) to update the Erickson/Ravitz archival devices that are no longer available commercially.

Illustrations of the Quantum Electrodynamic Field Theory of Therapeutic Hypnosis

The electrodynamic quantum field correlates of clinical hypnosis presented here illustrate only a few basic patterns noticed with a few volunteer subjects rather than a controlled study (Schork, 2015). These patterns are only suggestive of the many questions that now require systematic STEM research to validate how biology, behavior, consciousness and cognition may interact in the proposed quantum electrodynamic field theory of therapeutic hypnosis.

A Basic Quantum Electrodynamics Field Signature of Therapeutic Hypnosis?

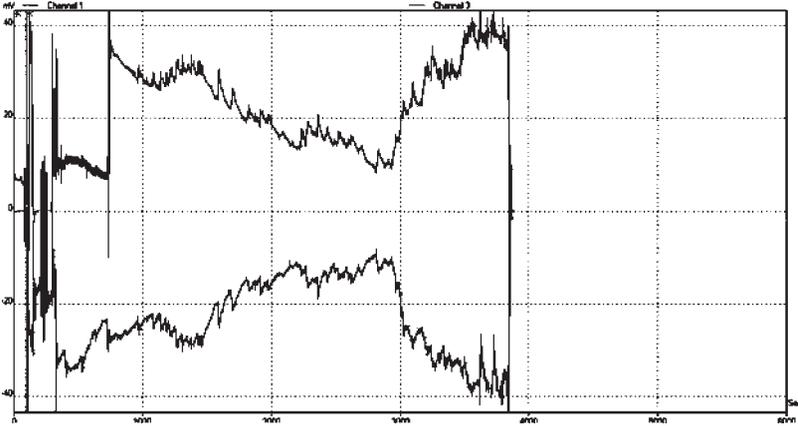


Figure 4: A typical quantum electrodynamic field theory recording of hypnosis with a modern data logger.

The original 4-stage pattern of the “electrometric correlates of the hypnotic state” via “catalepsy” illustrated and discussed earlier in Figures One (Ravitz, 1950) and two (Erickson & Rossi, 1981/2014) is again evident in the top half of Figure Four. This provides us with some assurance that modern electronic technology is replicating the early work of Erickson, Ravitz and Rossi. Whereas the early recordings from 1950 and 1981 had only one line measuring electromagnetic current in millivolts (mV) between sensors placed on the forehead and palm of one hand, current 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 this electrometric recording of hypnosis appears to be a mirror neuron reflection of the top half. What could this left-right hand mirror symmetry mean?

Mirror reflections of left-right symmetry are referred to as *parity* and/or *chirality* in quantum electrodynamic field theory on many STEM levels from particle physics to biology and psychology (Baggott, 2011; Davies & Brown, 1988; Gleick, 1992; Lancaster & Blundell, 2014). Because of this 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 electrodynamic field, which in more familiar

terms, could be described as “the span of attention, the focus of concentration,” or perhaps “the bandwidth of consciousness and/or mental activity” or “the mind-body information channel capacity.” Further research is now required to ascertain whether such computer recordings are useful visualizations for measuring the bits or qubits of information in quantum electrodynamic fields and/or signatures of naturalistic therapeutic hypnosis in clinical practice.

Stroke Rehabilitation, Biofeedback and Therapeutic Hypnosis

Figure Five is the electrodynamic recording of a professional woman who had a hemorrhagic stroke about 20 years ago and was now interested in exploring biofeedback for rehabilitating the hemiparesis in her left hand and foot. She was encouraged to “simply look at and bring together” her emerging electrometric recoding that initially showed a gap of about 20 mV between her left and right hands. Throughout the course of her 50 minute exploratory study she was gently encouraged to simply bring the emerging top and bottom parts of her electrometric recording together “so her normal right could teach her left stroke hemiparesis impaired hand to move normally.” She was apparently successful in that the electrometric gap between her right and left hand was greatly reduced to about 5mV by the end of this exploratory session. (The burst of electronic activity recorded in the last 5 minutes was an artifact due to the large physical movements of terminating the recording.) She was warmly congratulated for her success in reducing the gap but she seemed unimpressed since there was no evident recovery in her hemiparesis.

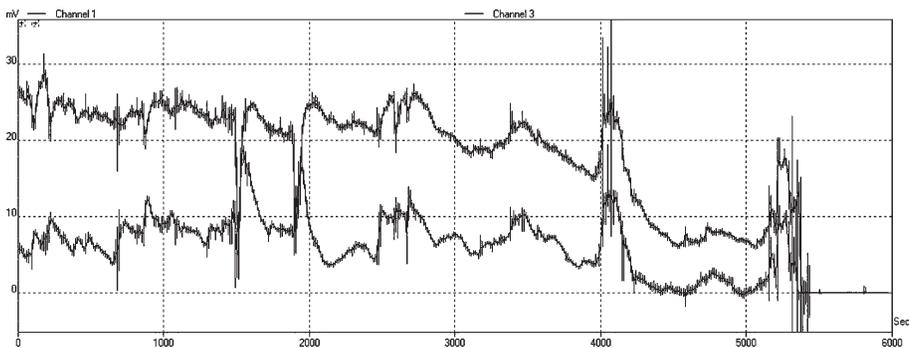


Figure 5: The electrodynamic recording of a professional woman who had a hemorrhagic stroke about 20 years ago exploring biofeedback for rehabilitating the hemiparesis in her left hand

None-the-less, two weeks later she wanted to explore whether hypnosis could improve her performance. Notice how the first 15 minutes of her second recording in Figure Six began with the typically downward slope characteristic of hypnotic induction. This was interrupted by a sudden burst of electrometric activity at about 17 minutes with a great widening of her quantum electrodynamic field when she apparently “got it,” whatever “it” was for her as shown here.

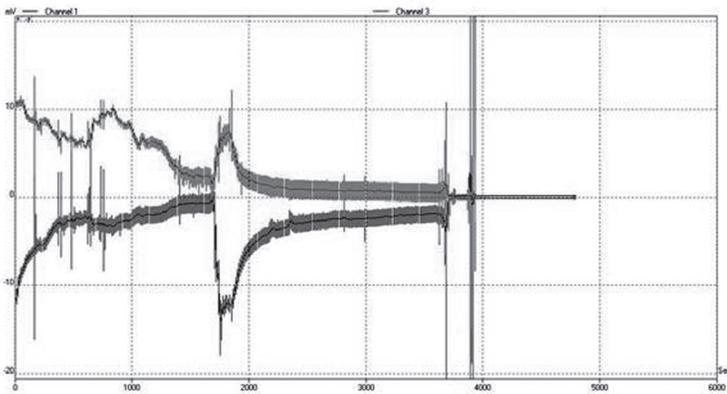


Figure 6: Notice how the typically downward slope characteristic of hypnotic induction is strikingly different from the biofeedback recording of the same subject in Figure 5.

Thereafter there was a very striking, rapid focusing and narrowing of her quantum electrodynamic field between 0 mV and -5mV during the low phase for about 20 minutes, which Erickson noted as typical of deep hypnosis (Rossi, Erickson-Klein & Rossi 2008-2015, volume 15). Such rapid changes to the negative range of electromagnetic polarity were regarded as heralding significant shifts in consciousness, cognition, emotions and behavioral dynamics in normal individuals as well as psychiatric patients by Ravitz (2002). Well controlled independent neuroscience research to assess the significance, reliability and validity of such early claims by Ravitz.

Head Trauma, Kriya Meditation and Yoga

The next volunteer subject was of 59 year old woman who experienced a head concussion six years ago leading to what she called

a loss of her “immediate term memory” for about a year. A part of her rehabilitation was the practice of yoga for which she received documented credit for 750 hours of teacher training. In several trips to India she received initiation into Kriya meditation (Wyder, 2014) that she continues to practice for about an hour twice a day. Her practice of Kriya meditation touched upon the highest intensity of electrodynamic activity at 60 mV documented in this paper.

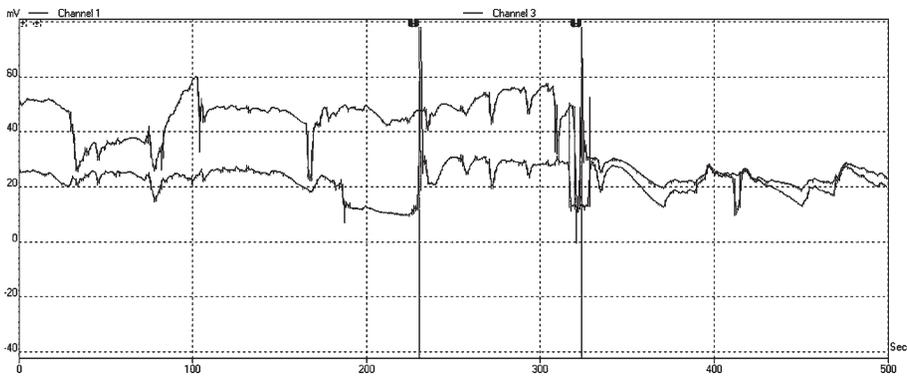


Figure 7: The practice of Kriya meditation touched upon the highest intensity of electrodynamic activity at 60 mV documented in this paper.

The first 30 minutes illustrates an active series of Kriya meditations, which her right hand records at a higher level of gradually ascending activity (beginning at about 50 mV to almost 60 mV), while her left hand records a lower level (beginning at about 25 mV and topping out at about 30 mV). The last 20 minutes of her self-guided meditation appears to be a resting state with the intensity level of both sides reduced to about zero (Spetsieris *et al.*, 2015). What does this electrodynamic pattern of her meditation mean? She had recovered from the loss of her “immediate term memory” with the help of her yoga practice long ago but now she wondered if an experience of hypnosis would show a different electrodynamic pattern.

After about 5 minutes of random activation due to the attachments and preparations for this exploration, this recording of her electrodynamic field illustrates the typical downward slope of a naturalistic hypnotic induction from her initial default level of normal waking consciousness at ~50 mV to about 10 minutes of a symmetrical pattern of inner focusing at the ± 10 mV level.

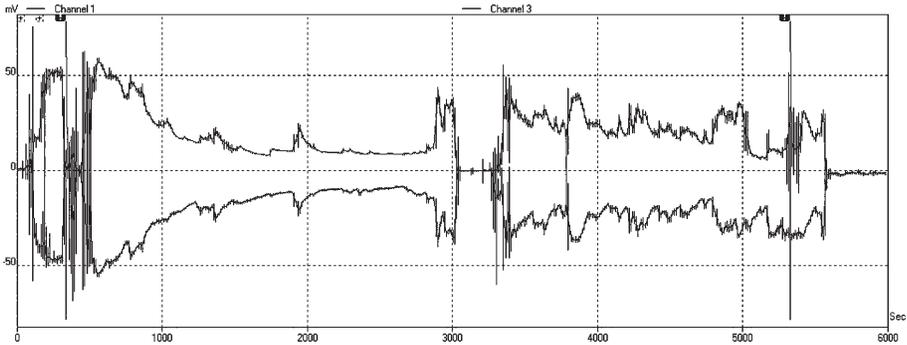


Figure 8: Notice how the first half of this record illustrates the typical downward slope of hypnotic induction, which is very different from Figure 7 when this subject was practicing Kriya meditation. In the second half she experienced some profound personal psychodynamic inner work, which was associated with a wider range of electrodynamic activity.

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 poured forth with the most intimate personal psychodynamic history of her early childhood abuse, adolescent identity struggles and a hero's journey for a 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 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?

Discussion

The STEM (Science, Technology, Engineering and Mathematical) concepts of the quantum electrodynamic field theory of therapeutic hypnosis that originated in the pioneering work of Erickson and Ravitz about three generations ago has been enriched and re-visioned with modern electronic recordings of what could be called *“the span of attention, the focus of concentration, the bandwidth of consciousness, mental*

activity, rapport, energy and intentionality or the mind-body information channel capacity."As such this updating of hypnosis with modern Quantum Field Theory (QFT) is entirely consistent with and greatly extends the foundational details of Lankton's (2015) States of Consciousness (SoC) model of hypnosis and its induction. Indeed, QFT conceptualizes states of consciousness (SoCs) as quantized fields of cognition (Hope & Sugarman, 2015). We now may ask mathematically quantifiable questions about why and how evolution selected for the QFT dynamics of gene expression, brain plasticity, behavior and their associated qualia of consciousness in the SoC model of hypnosis (Pekala, 2015). Why do we have consciousness in the first place? *What adaptive value could the highly sensitive quantum qualia of the electrodynamic fields of subjective consciousness possibly have?* Why are we not unconscious zombies relying on blind and brute bottoms-up DNA epigenetic molecular mechanisms for survival (Chalmers, 1996; Dennett, 1991; Nörretranders, 1998)?

Happiness in the Creative Cycle from Mind to Gene in Naturalistic Therapeutic Hypnosis

Our answer to these fundamental questions is illustrated in our summary of the role of happiness in the 4-stage creative cycle of naturalistic therapeutic hypnosis in Figure Nine.

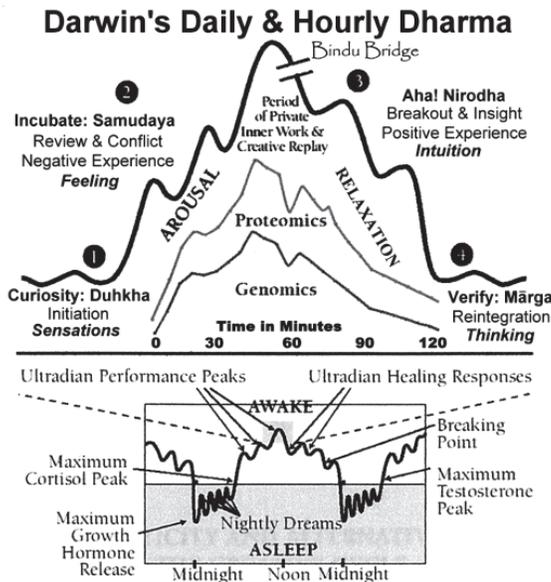


Figure 9. A Profile of the Role of Happiness in the Creative Cycle from Mind to Gene in Naturalistic Therapeutic Hypnosis. This profile of the 4-stage creative process illustrates Darwin's daily and hourly co-evolution of the human mind and brain. This creative process is a natural 90-120 minute psychobiological rhythm utilized in ancient and modern approaches to creative meditation, therapeutic hypnosis and psychotherapy. Note the Bindu Bridge that facilitates the transition between stage two (often experienced as stress and emotional crisis) and stage three, which is usually experienced as happiness or Aha! Creative Insight (Livio, 2005).

We speculate that a neuroscience perspective of these 4 stages of the creative cycle in Figure 9 provides the Darwinian evolutionary molecular-genomic underpinning of Buddha's Four Noble Truths and the essential Dharma of meditation, therapeutic hypnosis and psychotherapy.

Figure Nine is our illustration of the 4-stage creative process that relates our consciousness psychological experience to the genomic and proteomic levels. It is tempting to identify the famous philosophical Cartesian mind-body gap with the non-verbal consciousness gap frequently experienced just before stage three at the top of Figure Nine. From a neuroscience perspective we speculate that human happiness is actually experienced during the Sanskrit concept of the "Bindu," which indicates the moments when the creation of new consciousness becomes manifest when a new neural network becomes functional in the brain. The consciousness gap has been explored with functional Magnetic Resonance Imaging (fMRI), as well as the literature on the experience of the creative process in the arts and sciences but remains poorly understood. We propose that our illustrations of quantum electrodynamic field signatures of therapeutic hypnosis and their variations in Figures Four through Eight above are signatures of the creation of new consciousness during meditation and therapeutic hypnosis as well as the natural processes of artistic and scientific creativity in everyday life.

We hypothesize that the consciousness gap that we attempt to cross over with the Bindu Bridge may be associated with what researchers now call, "the dark matter of the cell." This dark matter involves the non-verbalized molecular-genomic activity of non-coding RNAs in the nucleus of the cell consisting of the (1) promoters and (2) transcription factors that facilitate activity-dependent gene and brain

plasticity as well as (3) the recently discovered “Human Accelerated Regions” (HAR1-49), which separated human evolution from that of our nearest primate relatives about six million years ago. The profound implications of psychosocial genomic research on HAR1 for an understanding of what makes us human is emphasized in recent research associating it with the appearance of the language and speech-enabling version of the FOXP2 gene in human evolution.

The upper part of Figure Nine relates Carl Jung’s four psychological functions (sensation, feeling, intuition, and thinking) as they emerge from the psychosocial genomics of the creative process in the arts, sciences, and psychotherapy as well as numinous spiritual practices. This upper portion of Figure Nine outlines how many schools of mind-body healing, meditation, psychotherapy, and rehabilitation can be conceptualized as the creative utilization of one natural 90–120 minute psychobiological rhythm of arousal, inner creative work, and relaxation.

The lower part of Figure Nine summarizes the normal circadian (about 24 hours) profile of alternating 90–120 minute rhythms of waking and sleeping characteristic of Kleitman’s Basic Rest-Activity Cycle (BRAC). The ascending peaks of rapid eye movement (REM) sleep typical of our nightly dreams every 90–120 minutes or so are illustrated along with the more variable ultradian rhythms of activity, adaptation, and rest in the daytime. This lower part of Figure Nine also illustrates how many hormonal messenger molecules of the endocrine system such, as *growth hormone*, the activating and stress hormone *cortisol*, and the sexual hormone testosterone, has circadian peaks at different times of the 24-hour cycle. Accumulating empirical evidence indicates that this Basic Rest-Activity Cycle is a multi-level molecular-genomic-hormonal-neural-mental mechanism mediating Darwin’s “natural selection [as] a daily and hourly scrutinizing ... working ... at the improvement of each organic being in relation to its organic and inorganic conditions of life.”

Our basic psychosocial genomic hypothesis is that these BRAC psychobiological rhythms have been entrained and utilized to varying degrees by many ancient practices of meditation, *Patanjali yoga*, *pranayama*, etc. *Swara yoga*, for example, utilizes the 90-120 minute BRAC to facilitate three states of consciousness associated with the alternating flow (*nadi*) of the breath through the left (*ida*), right (*pingala*) nostrils, and

both together (sushumna). We hypothesize that these states of consciousness and many others could be explored and their psychobiological functions identified with greater precision with DNA microarrays than has ever been possible previously with the relatively crude psychophysiological measurements available to early researchers.

Likewise, after millennia of specious speculation about the “psychic organs” of the chakras in kundalini yoga, why should we not seek to measure these most ineffable states of human consciousness with our most advanced and sensitive measurements of the human condition as illustrated with DNA microarrays research of our ~ 23,000 genes and functional magnetic resonance imaging (fMRI) of our brain plasticity. The range and limitations of all ancient spiritual practices for modulating activity-dependent gene expression and brain plasticity then could be quantified with mathematical models to optimize the co-evolutionary spiral of mind and brain to facilitate the highest ideals of human enlightenment

Are the STEM inspired quantum electrodynamic fields illustrated in this paper meaningful in terms of these 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?

At the present time we have no way of answering these questions because research in physics and psychology have taken such separate paths they hardly know how to speak to each other. In a more recent paper, however, Wilczek (2013) acknowledges the still mysterious nature of the electron with these words.

For most practical purposes, an electron is a structureless particle with an intrinsic angular momentum, or spin. Just two numbers — the electron's mass and its electric charge — fuel the equations that describe its behaviour. From this 'practical electron' model, physicists constructed modern microelectronics. *It is also the working foundation for chemistry, including biochemistry...*

In principle, electrons can possess both magnetic- and electric-dipole fields, the axes of which are set by the electron's spin. But the status of these fields could hardly be more different. The strength of the electron's magnetic field provides perhaps the most stringent and brilliantly successful comparison of theory and experiment in all of physical science, whereas the value of the electric field has never been measured. It is a mystery even to theory...

So, what is an electron? An electron is a particle and a wave; it is ideally simple and unimaginably complex; it is precisely understood and utterly mysterious; it is rigid and subject to creative disassembly. No single answer does justice to reality. (Wilczek, 2013, pp.31-33; Italics added here.)

We believe that this quotation from Wilczek may have significant implications for exploring the meaning and applications of our emerging quantum electrodynamic field theory of therapeutic hypnosis and its associated states of creative cognition and emotions as illustrated in Figures Four through Nine of this paper. We propose that it may now be possible to integrate the surprising and still mysterious nature of the electron in physics and psychology with the new STEM technology introduced and demonstrated in the pursuit of human happiness via the quantum electrodynamic field theory of naturalistic hypnosis by clinicians and researchers in India today.

Summary

The STEM perspective of science, technology, engineering, and mathematics provokes profound questions and speculations about the possible quantum nature of therapeutic hypnosis that was introduced at the first meeting of the *American Society of Clinical Hypnosis* and the founding of the *American Journal of Clinical Hypnosis* three generations ago. Current electromagnetic technology is illustrated for implementing a proposed quantum field theory to guide research on brain plasticity, behavior, consciousness, cognition, dissociation, expectancy and the qualia of subjective experience associated with

naturalistic therapeutic hypnosis. It should not escape our notice that this STEM perspective could inspire and support new quantum level applications of therapeutic hypnosis for the optimization of human behavior, attention, consciousness, cognition, mind/body healing, peace and well-being.

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