INERTIAL EM INDUCTION AND BIO SYSTEMS

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Abstract: *One of the criticisms of General Relativity is that it does not explain the concept of inertia. Mach's principle stated that the inertia of a body is somehow due to the presence of other bodies in the universe. If this is true, then it is most especially relevant to formulate an understanding of space, and its causal relation to matter. In this regard, we propose that introduction of biological models appertaining to space, quantum theory and relativity may be prerequisite for understanding the connection of space and matter, photons and phonons. A new particle-wave equation, $mc^2 = BvLq$, formulates the conceptual framework for inertial electromagnetic induction (IEMI), perhaps representing the initial physical mechanism for non-ionizing radiation (NIR) bio effects. Derived from standard formulae, a new insight is introduced to provide an innovative, physiologic and efficacious approach to magneto-therapy. Specific experimental reports are cited wherein the modeling and EMF parameters were dictated by theory. It is hypothesized that Jacobson Resonance Theory is the missing link that Einstein sought for unifying the fundamental forces of nature: the electromagnetic, gravitational and nuclear forces. A generic expression for said theory may then be:*

$$\frac{-c}{\left(\sqrt{1-\dfrac{v^2}{c^2}}\right)qj^v} \cdot \leftarrow \oint mcL^{-2} \cdot dL = \vec{\nabla}x \oint \frac{j\partial S\partial L}{r}$$

1. MATTER AND SPACE: CONDITIONS OF EPISTEMOLOGICAL DUALISM

Only if space and matter represent one unified conformation (an absolute continuum) can a purely mechanical model explain universal causation, devoid of actions-at-a-distance. And, only there from may one eliminate the niggling problems associated with field theories. In our ordinary experience of daily life, we view the causal nexus of natural phenomena as a result of communication of motion through touch, push or pull, combustion by heating…etc. However, atoms are mostly space, and atoms interact across extensions of space. During the first half of the nineteenth-century, it appeared beyond question that light could be interpreted as a vibratory process in an elastic inert medium filling universal space. It appeared necessarily consequential due to the fact that light is capable of polarization, and this medium (the ether) must possess the nature of a solid body; because

transverse waves were not thought to be possible in a fluid. The phenomenon of aberration favored this notion of a quesi-rigid ether. For Maxwell, this ether had properties of a purely mechanical nature, although said properties were complicated. Yet, Maxwell could not yield a satisfactory mechanical interpretation of his laws for electromagnetic field. Physicists became accustomed to admitting electric and magnetic forces as fundamental concepts side by side with mechanics, without requiring a mechanical interpretation. For Hertz, the ether also appeared as bearer of electromagnetic fields. The duality was evident, as physicists thought the ether had a definitely assigned velocity throughout the whole of space, i.e. matter subsisted in space.

This was at variance with experiments on the propagation of light in moving fluids. Then, Lorentz took from ether its mechanical properties and took from matter its electromagnetic qualities. Lorentz succeeded in reducing electromagnetic interactions with Maxwell's equations for free space. Immobility was the only property left to the ether by Lorentz, whereas special relativity left the ether with no mechanical properties. Yet, Einstein admitted that the special theory of relativity did not compel one to deny the existence of ether, but ascribing a state of motion to ether was not possible. Lines of force for electromagnetic field could not be tracked though time. For special relativity, electromagnetic fields appeared as ultimate irreducible realities. Yet, Einstein realized that to deny the existence of ether is to assume that empty space has no physical qualities whatsoever, and the facts of mechanics do not harmonize with such a view. Indeed, in order to look upon the rotation of a system in free space as something real, Newton objectivized space, i.e. rotation relative to an absolute space is real.

Einstein eventually realized that space-time variability (of the reciprocal relations of standards of space and time) , or, the recognition of the fact that empty space in its physical relation is neither homogeneous nor isotropic compelled description of its states by ten functions (the gravitational potential g_{uv}). This perception had finally disposed of the view that space is physically empty. Einstein then believed that condensations of the electromagnetic fields could be termed "matter," while gravitational field (or ether) could be termed "space." Still, matter and space were separated conceptually, but connected causally. [1, 2]

2.   ADDRESSING THE PROBLEM OF SPACE

According to classical mechanics and the Special Theory of Relativity space (space-time) has an existence independent of matter or field. In order to describe that which fills space and is dependent on the coordinates, space or the inertial system with its metrical properties must exist to start with, otherwise, "that which fills space," would have no meaning. General Relativity tells us that space (as opposed to "what fills space," dependent upon the coordinates), has no separate existence. A pure gravitational field may be described as functions of coordinates, by solution of the gravitational equations. If we imagine the functions g_{ik} removed, there does not remain anything- no topological space. For the functions g_{ik} to describe the field and the topological and metrical structural

properties of the manifold, the conclusion one comes to is, "there is no such thing as an empty space or a space that is devoid of field." Space-time does not claim existence on its own, but only as a structural quality of the field. Therefore, Descartes was correct to exclude the existence of an empty space. Physical reality is seen exclusively in ponderable bodies, requiring the concept of field to represent reality together with the general theory of relativity. The true kernel of the Cartesian idea, "there exists no space empty of field," is undeniable. [2]

Now, we extend our purview to particles themselves. Instead of describing quarks, neutrinos, electrons, and other fundamental particles as points, string theory describes them as lines- very small, wriggling lines. Superstring theory yields a finite quantum theory of gravity, and it requires gravity for consistency.

In 1970, Yoshiro Nambu pointed out that the Dual Resonance Model was mathematically equivalent to interactions of bits of string. Originally, it was a simple formula describing hadron scattering. He pictured the particles as tiny strings about 10^{-13}cm long (the size of a proton). When two strings touched their tips together, they fused together into one, or conversely, one string could spontaneously split into two.

Regarding a collision, strings could absorb energy to ripple and rotate, with ends flashing about at the speed of light. In 1976, Scherk maintained that string models could represent fermions (including baryons and leptons) if fermions were matched with correspondent bosons; called for by supersymmetry. In gauge interactions, qualities like hypercharge or color could be carried by the tips of strings.

Calculations have shown that when interacting strings are in their lowest energy state, the transfer of quantum numbers is equivalent to the exchange of "massless" spin-1 particles (photons). Furthermore, a single string can touch its own ends together and fuse into a loop; and the lowest energy state of a closed string would be "massless", and have a spin of 2. A "massless" spin-2 particle may be equivalent to a quantized gravity wave, or graviton.

If this theory of quantum gravity is correct, then the scale of a fundamental string could be set by Planck energy. The Planck scale translates into a string about 10^{-33} cm long, twenty orders of magnitude smaller than a proton; accounting for the fact that quarks, neutrinos and such small particles appear as infinitesimal points; and also having a lowest energy excited state about 10^{-19}times the mass of a proton.

From the idea of a relativistic quantum string, one may possibly derive a theory free of "anomalies" and "infinities," a specification of the symmetry group of grand unification, supersymmetry, and a unification of the strong, weak and electromagnetic forces with quantum gravity. The issue still at hand is for superstring theory to make contact with the real world. [3, 4]

We can imagine matter and field to be removable from an unseen inertial space with its associated time, but the inertial space is just as real as the perceived matter and its correlated field. Inertial space-time extrinsic to the perceived four-dimensional manifold can well be described as matter in motion existing in differing states of reality.

The universe we live in is patently four-dimensional: each object can be measured in terms of length, breadth, height and time. String theory realizes that boson strings are consistent with quantum mechanics in a mathematical world of twenty-six dimensions. Furthermore, fermion strings are consistent in a world of ten dimensions.

The sum total of events which are simultaneous with a selected event exist, it is true, with respect to a specified inertial system, but no longer can it be considered independent of other real inertial systems. The continuum viewed is not necessarily resolvable, from an objective point of view, into sections. Sections may contain simultaneous events, but "Now" loses its meaning in special relativity. Space-time may be objectively unresolvable when unseen inertial systems are not recognized that represent different states of reality. Simultaneity is only real to a specified framework of perceived metrical coordinates; otherwise "Now" becomes "Later," or "Later" becomes "Now." [5]

3. OTHER STATES OF REALITY?

We shall Initially set aside vector analysis, and consideration of supplementary units, i.e. plane and solid angles, while including as needed derived units with special names. We view the following line of reasoning from a base unitary perspective, keeping in mind Einstein's final concern that an attempt must be made to find a purely algebraic theory for the description of reality. [6]

From the magnetic component of Lorentz force equation, we consider

$$B = \frac{F}{qv\sin\phi}\left(\frac{Newton}{coulomb\ meter/\sec}\right) \tag{1}$$

In MKS, and

$$B = \frac{F}{qv\sin\phi}\left(\frac{dyne}{ab-coulomb\ centimeter/sec}\right) \tag{2}$$

In CGS, and

Denoting magnetic flux by,

$$\phi, B = \frac{\phi}{A}\left(\frac{weber}{meter^2}\right), \text{ where in MKS units,} \tag{3}$$

$$1\ Tesla = \frac{1\ weber}{meter^2} = \frac{1\ Newton}{coulomb.\ m/\sec} = \frac{1\ Newton}{amp.\ meter} \tag{4}$$

And in CGS units,

$$1\ gauss = \frac{1\ \max well}{cm^2} \tag{5}$$

And
$$\frac{1 \ weber}{m^2} = 10^4 \ gauss \tag{6}$$

1 Newton is defined as the force that provides a mass of one kilogram with an acceleration of one meter per second per second.

Thus,

$$1 \ Tesla = \frac{\dfrac{kg.m}{\sec^2}}{\dfrac{coulomb.\,m}{\sec}} = \frac{kg.m.\sec}{\sec^2 \ coulomb.\,m} \tag{7}$$

$$1 \ Tesla = \frac{kg}{coulomb.\ \sec} = 10^4 \ gauss \tag{8}$$

And,

$$1 \ gauss = \frac{gm.cm.\sec}{\sec^2.ab - coulomb.cm} = \frac{g}{ab - coulomb.\sec} \tag{9}$$

As denoted by Eqs. (8) and (9), the flux density B represents

$$\frac{mass}{(charge.\ time)}$$

Since charge is a property of certain elementary particles, by definition, that causes them to exert forces upon one another, and the force is thought to result from the exchange of photons between said particles; charge is a function of certain masses as observed in nature. The coulomb corresponds to a charge of 6.25×10^{18} electrons. Since reality reduces to matter and motion/interaction of matter, we may write:

$$1 \ coulomb = 6.25 \times 10^{18} electrons.mass$$
$$of \ e(9.1095 \times 10^{-31} kg) \tag{10}$$

Thus, 1 coulomb = $5.6934375 \times 10^{-12}$ kg

Since 1 Tesla = 1kg/$5.6934375 \times 10^{-12}$ kg.sec,

$$\frac{1 \ Tesla = 1.756408 \times 10^{11} kg \ (invisible \ mass)}{1 \ kg(visible \ mass).sec} \tag{11}$$

and

$$\frac{1 \ Gauss = 1.756408 \times 10^{7} gm(invisible \ mass)}{1 \ gm(visible \ mass).sec} \tag{12}$$

The single conventional magnetic line of force in a vacuum carries about 17 ½ million grams of unseen matter every second through a plane of one square centimeter with extension through one gram of visible mass, ordinary matter or condensed electromagnetic field. It is clear that a material substance fills all of space, and this is evidenced by definition of conventionally utilized physical units, and the perception that gravity exists everywhere in the universe.

4. INERTIAL ELECTROMAGNETIC INDUCTION (IEMI) THEORY

The plethora and diversity of reports in the literature concerning biological effects from non-ionizing radiation (NIR's) may be based upon a fundamental underpinning mechanism. Now, a new particle-wave equation has yielded basis for inertial electromagnetic induction, (IEMI); connecting the phonon field and photons, and space and matter. The equation, $mc^2 = BvLq$, (Jacobson Resonance) also explains quantum tunneling. Experimental support for the theoretical framework is referenced.

5. METHODOLOGY AND IEMI FOCUS

Derived from basic physical principles, we view the following line of reasoning from a base unitary perspective; keeping in mind Einstein's final concern that an attempt must be made to find a purely algebraic theory for the description of reality.

Therefore, we shall once again set aside vector analysis, and consideration of supplementary units, i.e. plane and solid angles; while including as needed derived units with special names. In so doing, we shall show how the generic algebraic expression, $mc^2 = BvLq$, is derived from standard formulae.

6. THE DERIVATION

As a joint result of the motion and the magnetic field every charge in a conductive body experiences, there is a resultant Lorentz force. Representing the magnetic component, we desire in non-vector notation,

$$F = q \, v \, B \sin \theta \qquad (1)$$

Where F is force, q is charge, v is velocity, and B is magnetic flux density. Eq (1) assumes that vectors v and B are perpendicular. The force acts in a direction that is perpendicular to both the direction of motion and the magnetic field; whereas θ is the angle that the direction of motion of the particle makes with the magnetic field.

If a body is being accelerated, there is a resultant force acting on the body. If the acceleration (of the center of a uniform body) is given by a vector $\bar{a}$, and the resultant force on the body is given by a vector, Newton's Second Law states that,

$$\bar{F} = m\bar{a} \qquad (2)$$

Combining eqs. (1) and (2) maintaining unitary conformance, and setting aside vector notation, we discern,

$$F = ma = qvB = (q)\left(\frac{L}{t}\right)\left(\frac{m}{qt}\right) = \frac{mL}{t^2} \qquad (3)$$

Where $B = m/qt$, t is time, and L is distance.

The electric potential energy per unit test charge is customarily called the electric potential, θ, or the voltage, V. (We shall now use the former term; in circuit applications, the latter is employed). Since $\theta = U/q$ (where U is electric potential energy), and E_F (electric field strength)$= F/q$, θ and E_F enjoy the same relation as U and F:

$$\Phi(x, y, z) = -\int_{\infty}^{(x,y,z)} E_F \cdot ds = -\int_{\infty}^{(x,y,z)} E_{Fx}dx + E_{Fy}dy + E_{Fz}dz \, (V) \qquad (4)$$

$$E_F = -\left(\frac{\partial\Phi}{\partial x}i + \frac{\partial\Phi}{\partial y}j + \frac{\partial\Phi}{\partial z}k\right) \quad (V/m) \qquad (5)$$

The unit of electric potential is the volt (V), where $1\ V = 1\ J/C$. Also, $1\ V/m = 1\ N/C$.

Generalizing, if there exists a charge q at a point, and there is an electrostatic force

$\bar{F}$ acting on the charge, due to other charges around, the electric field $\bar{E}_F$ at the point is defined as

$$\bar{E}_F = \frac{\bar{F}}{q} \qquad (6)$$

For the purpose of nomenclature, we shall henceforth denote electric field strength as E_F and energy will be represented by E. Furthermore, electric potential V at a point in an electric field is the work required to bring unit electric charge from infinity to the point. It is measured in volts. If work of one joule is required to move a charge of one coulomb to the point, it's potential is one volt.

The strength of an electric field E_F is also given by

$$\bar{E}_F = \frac{V}{L} \qquad (7)$$

And, it is duly noted,

$$V = \frac{E}{q} \qquad (8)$$

Combining Eqs. (6), (7), and (8), setting aside vector analysis, we derive

$$F = q\ E_F = \frac{qV}{L} = \frac{qE}{qL} = \frac{E}{L} = qvB \qquad (9)$$

Concerned only with qualitative fundamental unitary measures, we desire

$$E = q \, v \, B \, L \tag{10}$$

Where in $q \, v \, B \, L$ represents a resonant electromagnetic interaction energy, as we shall soon see.

We note Einstein's law, the law of the equivalence of mass and energy in generic form

$$E = mc^2 \tag{11}$$

Where c is the velocity of light in vacuo. Thus, a quantity of energy E has a mass m, and a mass m has intrinsic energy E.

Then, from Eqs. (9) (10) and (11),

$$E = mc^2 = F \times L = \frac{mL^2}{t^2} = qvBL \tag{12}$$

From Eq. (8) we note,

$$E = qV \tag{13}$$

Now, recapitulating,

$$E_F = \frac{V}{L} = \frac{E}{qL} = \frac{F \times L}{qL} = \frac{F}{q} = \frac{qvB}{q} = vB \tag{14}$$

And, from Eq. (3) we noted

$$B = \frac{m}{qt} \tag{15}$$

Therefore, from Eqs. (14) and (15)

$$\frac{mv}{qt} = vB = \frac{E}{qL} = E_F \tag{16}$$

With Eq. (10) rearranged, and from Eq. (16) we see

$$E = v \, B \, q \, L \tag{17}$$

Thus from a qualitative foundational unitary perspective, we may now consider rearranging Eq (17), and we see

$$E = mc^2 = BvLq = \frac{mL^2}{t^2} = \left(\frac{m}{qt}\right)\left(\frac{L}{t}\right)(L)(q) \tag{18}$$

Electromotive force V_i is the algebraic sum of the potential difference acting in a circuit. It is measured by the energy liberated when unit electric charge passes completely round the circuit in the direction of the resultant emf. An agent such as a battery or generator has an electromotive force (emf) if it does work on the charge moving through it, the charge receiving electrical energy as it moves from the lower to the higher potential side.

Emf is measured by the potential difference (p.d.) between the terminals when a battery

or generator is not delivering current. The units of emf are the same as the units of p.d. since both are measured by work per unit charge. If a battery sends a current I through an external resistance *R* joining its terminals, the emf of the battery is equal to $(R + b)$ I, where *b* is the internal resistance of the battery. It is thought that while the term emf is sometimes used as equivalent to potential difference, strictly speaking it should be applied only to a source of electric energy. However, in consideration of the fact that we are concerned with unifying the forces of electricity, magnetism and gravity, we must consider that electric energy may be converted to magnetic energy, and to gravitational energy; because energy is defined as mass times distance squared over time squared. Essentially, we are denoting that all material interactions are a product of the conceptual substrates: mass, distance and time. Further to this end, we view all living systems as complex homeostatic arrays of biologically closed electric circuits. [7]

Hence, we desire:

$$V_i = \frac{E}{q} \qquad (19a)$$

Where V_i is induced electromotive force (emf). The emf V_i induced in a straight conductor of length *L* moving with velocity *v* perpendicular to a field of magnetic induction *B* is

$$V_i = BvL \qquad (19b)$$

The emf V_i is in volts when *B* is in Webers/ m^2

Now, *L* is the length of a body; where in all ordinary material bodies are essentially condensations of electromagnetic field, and have a longest dimension [1, 8]

Whereas *B*, *v* and *L* are orthogonal and accepting the unitary equivalencies, we see from Eqs. (14) and (19 a, b)

$$V_i = \frac{E}{q} = BvL \qquad (20)$$

Where *q* is unit charge by definition.

Therefore, we may reiterate the finding in Eqs. (18) and (20) as

$$E = BvLq = mc^2 = \frac{mL^2}{t^2} \qquad (21)$$

Furthermore, we desire,

$$E = h f = mc^2 \qquad (22)$$

Where *E* is energy, *h* is Planck's constant (defined as $mc^2 t$), *f* is frequency, *m* is mass and *c* is the velocity of light.

Note,

$$c = \lambda f \qquad (23)$$

Where λ is wavelength, and $f = c/\lambda$

Therefore,

$$mc^2 = \frac{hc}{\lambda} \qquad (24)$$

Dividing by *c*, we get:

$$mc = \frac{h}{\lambda} \qquad (25)$$

Where Eq. 25 is de Broglie's particle- wave equation. Generalizing, *c* = *v*, we desire,

$$mv = \frac{h}{\lambda} \qquad (26)$$

It is of particular interest to place equations (22) to (26) into historical perspective. Einstein's theory proposed that for any electromagnetic wave of frequency f there is photonic energy, *E* = *hf*. The de Broglie hypothesis of light–matter symmetry required that all material particles have a wave associated with them. Utilizing the equations of relativity, de Broglie provided a formula relating wavelength to the mass and speed of the particle.

Since the energy of a photon is related to frequency *f* of an associated light-wave by, *E* = *hf*, and photons also possess momentum p, according to *E* = *pc*, he then derived,

$$E = pc = hf = \frac{hc}{\lambda} \qquad (26.1)$$

Therefore,

$$P = \frac{h}{\lambda} \qquad (26.2)$$

Or

$$\lambda = \frac{h}{p} \qquad (26.3)$$

Eq. (26.3) was derived specifically for the photon, considered a massless particle associated with a light-wave. However, de Broglie proposed that Eq. (26.3) applied to any particle, massless or not. (Actually, it is a simple matter to show that a photon is not massless, combining *E* = *hf* and *E* = *mc*² because a quantity of energy has a mass *m*, and a mass *m* has intrinsic energy *E*).

The momentum of a particle of mass m and speed *v* is *p* = *mv*. Therefore, Eq. (26.3) becomes

$$\lambda = \frac{h}{mv} \qquad (26.4)$$

Whereas, Eq. (26.4) gives the wavelength λ of the de Broglie wave associated with a particle of a given mass and speed. He then had two equations, $E = hf$ and $P = \dfrac{h}{\lambda}$, that related particle properties (energy and momentum) to wave properties (frequency and wavelength). These equations applied equally to particles such as electrons, atoms…etc. as well as to photons. Material particles and photons equally obeyed the relativistic equation, $E^2 = p^2\, c^2 + m_0{}^2\, c^4$, the distinction being that $m_0 = 0$ for photons. Yet, both photons and material particles had associated de Broglie waves.

Eq. (26.4) is relativistically correct when m represents the relativistic mass, rather than the rest mass m_0.

$$m = m_0 / \sqrt{1 - V^2 / c^2}$$

Where the rest mass m_0 can be used if the speed v is small compared to c.

The de Broglie wave of a photon is a light wave and travels at speed c, whereas speeds of waves associated with particles having mass depend on the speed of the particle. De Broglie maintained that his theory should be considered as a formal structure, and a fully formed unified doctrine. He made an especially interesting application of this principle with respect to electron orbits in the atom. An electron travels in a circular orbit about the nucleus. Assuming an electron is guided in its orbit by a de Broglie wave, if it catches up with itself, then interference must be the result. To avoid cancellation of the wave, it must be in phase with itself. De Broglie's conclusion was that a standing wave pattern must be established. The circumference of the orbit must then be equal to an exact number of wavelengths. It must be possible to fit exactly one, or two, or three, waves around the orbit. Fractions of waves would necessarily cause cancellation. The requirement was written mathematically as follows:

$$n\lambda = 2\pi r \qquad (n = 1, 2, 3 \ldots \infty) \qquad (26.6)$$

Where n is an integer, λ is de Broglie wavelength, and $2\pi r$ is the circumference of the orbit with radius r; and we note

$$n\lambda = n\left(\frac{h}{mv}\right) = 2\pi r \qquad (26.7)$$

Eq. (26.7) can be rearranged as follows:

$$mvr = \frac{nh}{2\pi} \ (n = 1, 2, 3 \ldots \infty) \qquad (26.8)$$

Eq. (26.8) represents Bohr's assumption of the quantization of angular momentum (mvr), which he utilized to obtain allowable orbits and energy levels of the hydrogen atom.

Now, we desire,

$$\lambda = 2\pi L \tag{27}$$

Where λ is wavelength (the circumference of a loop of string), and L is its radius.

From Eqs. (26) and (27) we see,

$$mv = \frac{h}{2\pi L} \tag{28}$$

Rearranging,

$$vL = \frac{h}{2\pi m} \tag{29}$$

When both sides of Eq. (29) are multiplied by charge (q) and magnetic flux density (B), we derive,

$$BvLq = \frac{qhB}{2\pi m} = mc^2 \tag{30}$$

Where $qhB/2\pi m$ is the Zeeman (magnetic resonance) term for energy.

Since h is $mc^2 t$, we see:

$$mc^2 = \frac{qmc^2 tB}{2\pi m} \tag{31}$$

And,

$$\frac{I}{t} = f = \frac{qB}{2\pi m} \tag{32}$$

Where Eq. 32 represents cyclotron resonance. Now, since no emf is perceived when a body is at rest ($v = 0$) in a steady or unchanging magnetic field, we herein propose that a gravity wave is nevertheless promulgated, because any body at rest ($v = 0$) on Earth is still moving with its celestial frame of reference in constant velocity motion, e.g. Earth's orbital velocity; whereas the force carriers (photons) of a magnetic field move at the velocity of light, independent of their source, and its state of motion. The laws for a body at rest and a body in constant velocity motion, e.g. Earth's orbital velocity, are the same; and a body at rest on Earth ($v = 0$) is moving with constant velocity motion (with the Earth). Newton did not distinguish between terrestrial velocity and celestial velocity, as did Aristotle. Therefore, in $mc^2 = Bvlq$, (Jacobson Resonance) the intrinsic energy of a particle, when equal to the wave energy of a body of length (L) interacting with a magnetic field (B), and wherein the body (L) contains the particle (m), a coherent excitation is produced in (m).

If space is filled with an infinite sea of energy; as gravity is everywhere omnipresent, and gravitational field may also be designated as space [1], then $mc^2 = BvLq$ represents inertial electromagnetic induction of resonant coherent vibrational amplifications in (m). This is based in quantum gravitational communication , i.e. a gravity wave (lossless and independent of

thermal noise in the environment). It is the case when a body is at rest ($v = 0$) or is in motion, and when said body is immersed in a steady or changing magnetic field.

There must be induction and promulgation of a gravity wave, so long as there is no such thing as absolutely empty space.

The force carriers of a magnetic field, i.e. photons, move at the velocity of light, independent of their inertial frame of reference, i.e. the propitiating source of magnetic field production, and transmission of force (pressure wave of deforming or reforming character). [9] Quantum mechanical view of the quantum vacuum supports this contention [10]

Pursuant to our thesis, we note the following expressions in CGS derived from $mc^2 = BvLq$; defining elements for the unification of matter and space.

$$\frac{\bar{m}_0 \bar{c} \cdot c}{\sqrt{1 - \dfrac{v^2}{c^2}}} = \left(\bar{B}x\bar{V}\right) \cdot \bar{L}\left(qj\right) \tag{38}$$

$$\frac{-c}{\left(\sqrt{1 - \dfrac{v^2}{c^2}}\right)q_J v} \cdot \oint mcL^{-2} \cdot dL =$$

$$= \left(\frac{\partial A_3}{\partial y} - \frac{\partial A_2}{\partial z}\right)i + \left(\frac{\partial A_1}{\partial z} - \frac{\partial A_3}{\partial x}\right)j + \left(\frac{\partial A_2}{\partial x} - \frac{\partial A_1}{\partial y}\right)k = curl\ A = \left(\bar{\nabla}\ x\ \bar{A}\right)$$

$$= \bar{\nabla}x\oint \frac{j\partial S\partial L}{r} \tag{39}$$

Where $\bar{A}$ is the magnetic vector potential, and q_j is one ab-coulomb (normalized).

Relativistic adjustment of mass is annotated, and current is given in ab-amperes, while (v) represents the inertial velocity, e.g. Earth's orbital velocity.

I would urge the young eager minds of this new generation to examine the probability that $mc^2 = BvLq$ drops out of string theory.

7. SUPPORTING LITERATURE

Pico-Tesla electromagnetic fields. (PTEMFs) have been demonstrated to affect brain waves [12-16] and enhance regeneration of nerve ultrastructure [17], affect autonomic nervous system tonicity, e.g. enhance parasympathetic stimulation to cardiac inputs and regulate atrio-ventricular conduction mechanisms of the heart [18] (affecting rate and rhythmicity), modulate endogenous opioid activity (e.g. enkephalin, endorphin) [19,20] and affect benefits in neurological disorders such as Parkinson's disease [21], multiple sclerosis [14, 22] , and

epilepsy [23,24], speed wound healing [25], and regulate thoracic spinal neuronal potentials after administration of noxious chemicals to the heart (which stimulated nociceptive afferent fibers [19], just to cite a few of the many studies conducted at major universities, Indeed, research over the past 30 years has revealed more and more that extrinsically sourced, low-level, extremely low frequency electromagnetic fields (many orders of magnitude weaker than the membrane potential gradient in the pericellular fluid) do modulate actions of hormones, antibodies and neurotransmitter molecules at cell surface receptor sites. The observed sensitivities are as low as 10^{-7} volts per centimeter in the extremely low frequency spectrum [26-28].

Other examples of subtle field effects also include: altered rate of cell growth [29], suppression of T-lymphocyte cytotoxicity [30], increases in the growth related enzyme ornithine decarboxylase [31], altered quantities of RNA transcripts and proteins [32-34], altered cell surface properties [27,28,35], and effects on development. [36]

7. APPLICATION OF JACOBSON RESONANCE TO BIOSYSTEMS

$Mc^2 = BvLq$ (Jacobson Resonance) is used to establish the magnetic flux density (B) of an externally applied magnetic field to the whole organism, having longest dimension (L). (mc^2) represents the intrinsic energy of a target mass (m) which can be any atomic or molecular species, e.g. peptide hormone trophic factor, enzyme, neurotransmitter, DNA structure such as a telomere (TTAGGG), or any immunogenic particle. ($BvLq$) represents the electromagnetic interaction energy (wave energy),wherein the body of length (L) containing the mass (m) interacts with the magnetic field (B) to provide a system of dual resonance, i.e. $mc^2 = BvLq$. It is hypothesized that a coherent excitation is produced in the target mass (m) via a photon-phonon transduction or conversion, i.e. the piezoelectric effect. (v) may be any inertial velocity such as Earth orbital velocity, because Newton's second law of motion does not distinguish between terrestrial and celestial velocity; and, (q) represents a unit electrical charge, or a single ab-coulomb in the CGS system of physical units; established by defining electromotive force as energy per unit charge. A detailed description of this physico-mathematical model, as it applies to biosystems, is available in the literature; including the derivation, rationale for the variables m, B, v, L and constants c and q; and the correlation to other known resonance phenomena: ion cyclotron resonance and Zeeman resonance. Whereas, (c) is the velocity of light, and also the velocity of the force carrier (photon) for a magnetic field moving independently of the inertial frame of reference/source. [37]

Within the context of this presentation a sample calculation follows to show how the theory may be applied to biological systems. After the magnetic flux density (B) is derived from $mc^2 = BvLq$, the derived (B) field is inserted into the ion cyclotron resonance equation, $f = qB/2\pi m$, to derive the associated frequency. [5, 9, 35, 41]

Nerve growth factor (NGF) exhibits trophic influences on a variety of neuronal populations; promoting survivability, regulation of synaptic transmissions, and plasticity at adult synapses in many regions of the central nervous system; and homeostatic regulation

of intrinsic neuronal excitability. NGF contains an anti-apoptosis inducing segment to prevent cell death. Choosing NGF as a target, we consider the following:

(1) NGF is 26,500 Dalton, or 4.425×10^{-20} gram

(2) $C^2 = 9 \times 10^{20}$ cm^2 sec^{-2}

(3) (L) is the height of a human, or 177 cm.

(4) (V) is Earth orbital velocity, or 3×10^6 cm sec^{-1}

(5) (q) is one ab-coulomb (unit charge by definition)

The CGS system of physical units is chosen, because, in the MKS (SI) system force is determined between moving charges, whereas in the CGS system force is determined between stationary charges. Therefore, we desire:

$$Mc^2 = BvLq$$

$$(4.425 \times 10^{-20} \text{gm}) (9 \times 10^{20} \text{ cm}^2\text{sec}^{-2}) =$$

$$(7.5 \times 10^{-8} \text{ Gauss}) (3 \times 10^6 \text{ cm sec}^{-1}) (177\text{cm}) (\text{ab-coulomb}) \tag{3}$$

Then, we note that (q) is normalized in CGS. Consequently,, when converting from CGS to MKS, $mc^2 = BvLq$ becomes $mc^2 = BvL$ (10q), because 1 ab-coulomb is equal to 10 coulomb. Therefore, when using the MKS expression, $f = qB/2\pi m$, we must use $f = 10\ qB/2\pi m$, and we note:

$$f = \frac{10(1.6 \ x \ 10^{-20} \ ab-coul) \ (7.5 \ x \ 10^{-8} \ Gauss)}{(6.2832) \ (9.11 \ x \ 10^{-28} \ gm)}$$

$$= 2.1 \ Hz \tag{4}$$

Where, (q) is the charge of an electron and (m) is its mass.

Normalization permits the process of introducing a numerical factor into an equation and is of importance in quantum mechanics. Furthermore, the signal, 7.5 Pico-Tesla @2.1 Hz, has been successfully utilized in the treatment of Parkinson's disease, improving the quality of life for these patients. [21,22]

8. SELECTED REVIEW OF SUPPORTING STUDIES

A statistically significant positive outcome was achieved in a Phase II double blind, placebo controlled and randomized clinical study in Parkinson's patients exhibiting motor fluctuations. Twelve subjects experienced 24 sessions of total body immersion in PicoTesla range magnetic fields administered over 8 weeks. Standardized motor and non-motor assessments were performed prior to treatment, at endpoint, and monthly for 3 months. It was demonstrated that PicoTesla range magnetic fields may improve motor and non-motor features of PD beyond that achieved with standard medical therapy, and these effects are long lasting.

Larger placebo controlled studies to confirm and further investigate the benefit of this unique non-invasive, non- significant risk and potentially promising therapy are indicated.

The signs and symptoms of PD result from widespread neuronal degeneration, resulting in downstream cortical and subcortical dysfunction. We postulate that the beneficial effect of EMF results from its piezoelectric effects.

As a result, synaptic activity in neurons at various levels of dysfunctional cortical-basal ganglionic loops in PD might be favorably affected. Further research will obviously be needed to clarify this mechanism of action. [37]

It is noted that the energy state tonicity, and bioelectric potential of nerves may be modulated by PicoTesla electromagnetic fields. [19] Recalling our hypothesis that biomolecular resonance using non-ionizing EMF's may be target-specific, Saxena et al [17] studied the effect of low-level extremely low frequency (ELF) EMF's on the restoration of forelimb grip strength and radial nerve ultrastructure in mice with induced toxic motor neuropathy. Field intensities, gradients and frequencies were calculated with the Jacobson Resonance Equations considering sub-cellular components vital for nerve function. Target molecules included nerve growth factor (NGF), microtubule associated protein (MAP), neurofilaments (NF), tubulin, acetylcholine, calmodulin, kinesine, and dynein. The results demonstrated a significant biological effect on restoration of subcellular structures required for nerve impulse conduction and metabolism in nerves, and consequently a grip strength recovery from motor neuropathy under controlled experimental conditions. Indeed, the renormalized, physiologic state of mitochondria, as observed, indicated normal membrane permeability and a recovery of ATP synthesis essential for nerve growth and repair. A link between EMF and renormalized Schwann cell function indicated that a non-neuronal control in the regeneration and growth of peripheral nerve fibers is possible. [5]

Electron micrograph of Radial Nerves:
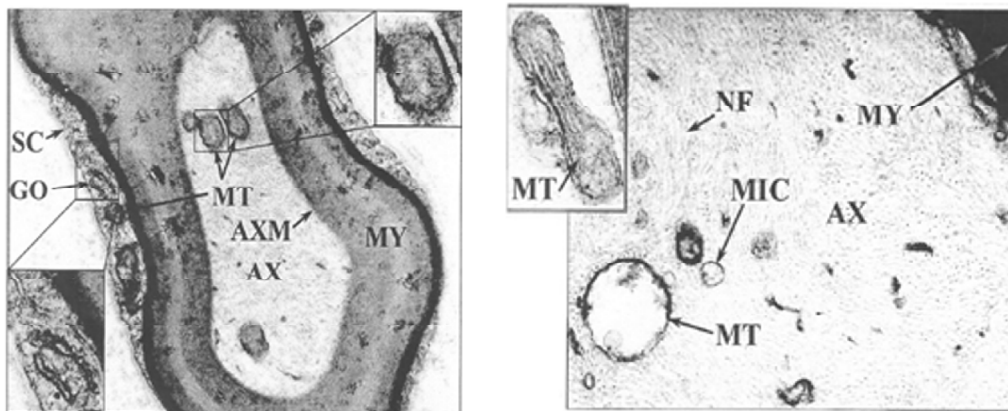**Cross Sections of Control And Experimental Groups**

Figure 1: Electron micrograph (EM) of cross sections of radial nerve of mice from control Group 1, indicating Axon (AX), Axonal membrane (AXM), Golgi bodies (GO), Microtubule (MIC), Mitochondria (MT), Myelin sheath (MY), Neurofilament (NF), Schwann cells (SC), A. (Top) GO, MT, B. (Bottom Left) MT binary fission, C. (Bottom) NF. EM Magnification x 19,000. Scale Bar = 1 m. (Figures I, II and III excerpted from Medical Hypotheses, 60(6): 821-839)
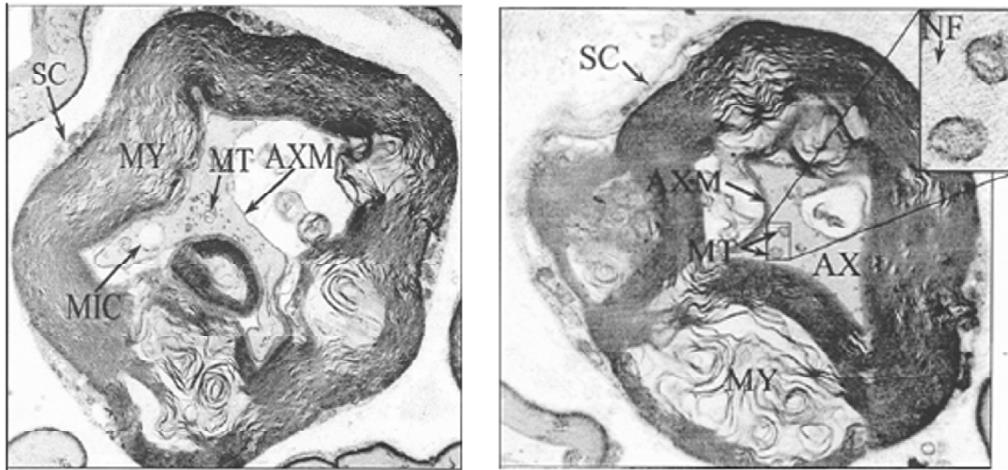
Figure 2: Electron micrograph (EM) of cross sections of radial nerve of mice from IDPN treated Group 3 unexposed to EMF indicating Axon (AX), Axonal membrane (AXM), Microtubule (MIC), Mitochondria (MT), Myelin sheath (MY), Neurofilament (NF), Schwann cells (SC). A. (Top) MY, MT, SC, AXM, MIC, B. (Bottom) MY, AXM, MT, NF. EM Magnification × 10,000. Scale Bar = 1 .
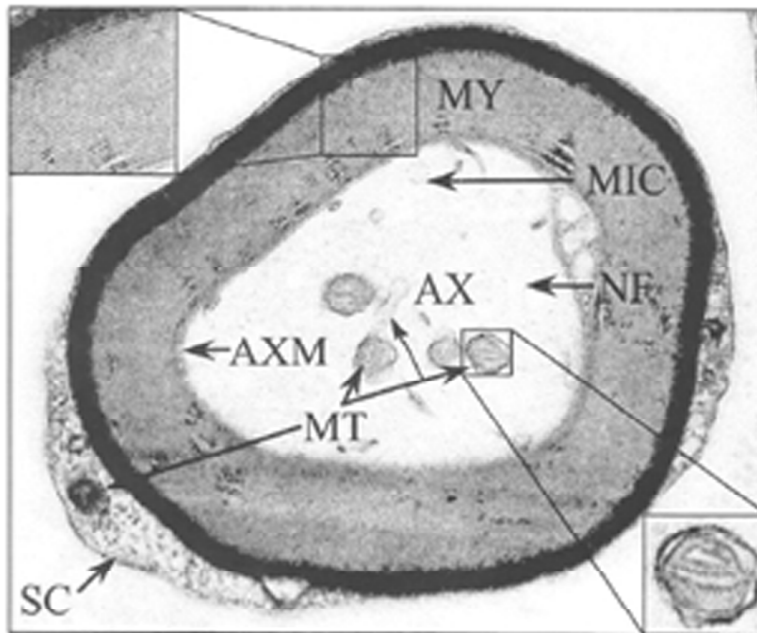

Figure 3: Electron micrographs (EM) of cross sections of radial nerve of mice from IDPN treated Group 2 exposed to EMF, indicating Axon (AX), Axonal membrane (AXM), Golgi bodies (GO), Microtubule (MIC), Mitochondria (MT), Myelin sheath (MY), Neurofilament (NF), Schwann cells (SC). A. (Top) MT, MY, AXM, NF, MIC, B. (Bottom Left) GO, MIC, C. (Bottom Right) GO, NF, MY, MT. EM Magnification A, B × 19,000, C × 4,800. Scale Bar = 1 .

Clinical studies using Pico-Tesla range magnetic fields at low frequency (<300Hz) demonstrated improvement of brain stem evoked potentials and cognitive responses in multiple sclerosis patients; possibly by modulating axonal and synaptic transmission as well as molecules crucial for immune responses. [14]

Ca^{++} cyclotron resonance at 7 Hz was applied to human cardiac stem cells continuously for 5 days, and the level of transcription and translation of the cardio sphere were significantly increased. [38]

A double blinded, randomized and placebo- controlled study determined the efficacy of calculated MF signal parameters on subjects suffering with knee pain secondary to osteoarthritis. One hundred seventy-six patients pooled from four sites completed the study. Subjects were randomly assigned to one of two groups, the placebo group (magnet-off) or the active group (magnet-on). Each group received eight treatments over a two-week period. Each subject rated the pain level from one minimal to ten maximal before and after each treatment session on three separate instances; before treatment trials, during the treatment trials, and two weeks after treatment had terminated. Subjects recorded their pain intensity while out of the treatment environment. The magnetic fields used in this study were generated by the Jacobson Resonance device, which consisted of two 18 inch diameter coils of 30 gauge copper wire connected in series (Helmholtz configuration), placed 9 inches apart. The coils were connected to a power supply e.g. HP3325A function generator and an attenuator to obtain the desired field in the space between the coils. The calculated flux densities were in the Pico-Tesla range and associated ELF frequencies (<10Hz) were utilized. On average, subjects in the 'on' group perceived a 46% reduction in pain after a treatment session. On average, subjects in the 'off' group perceived an 8% reduction in pain after a treatment session.

The results showed a significant difference between the two groups. A two-way ANOVA (GLM) of the treatment sessions showed that the reduction in pain was significantly greater in the magnet 'on' group ($p<0.001$) than the magnet 'off' group. Additionally, of the 101 magnet 'on' patients evaluated in the treatment sessions, 96% received statistically significant ($p<0.000$) reduction in pain levels. The $N = 97$ (96%) patients who experienced a reduction in pain had on average a 53.25% reduction in pain. [20]

This study indicated that the prediction of the Jacobson Resonance Theory regarding the possibility that Pico-Tesla range MFs are physiologic should be considered. The results of this study point to a subtlety of life that has yet to be fully appreciated, as the benefits were shown to be durable.

It has been hypothesized that physiological, homeostatic mechanisms of living systems operate on atomic, molecular and cellular levels; thus promulgating the idea of electromagnetic immune response mechanisms, i.e. adjustment mechanisms to maintain the balance of total systems in accordance with quantum theory. [39,40] Quantum mechanics affords statements relating to apparently discontinuous transitions from one total condition to another without yielding a representation of the specific process. This is connected to the notion that this theory does not operate with the single system, but with a totality of

systems. With this interpretation of quantum mechanics, it is readily ostensible why this theory does account for the fact that weak disturbing forces are able to provide alterations of any magnitude in the physical condition of a system; such that only small alterations of the statistical density in the ensemble of systems occurs. Hence, only infinitely weak alterations of single systems, e.g. Pico Tesla magnetic field signals, are required for profound amplifications within complex systems, e.g. biological systems. It appears that a disturbance of the physical parameters of the flow of electrons (mass/energy) whatever the cause, produces a change in the oscillation frequency of the electronic bioplasma, and indirectly disturbs the processes of homeostasis. It is thought that the adjustment mechanisms that maintain ordered states of matter are based upon photon- phonon transductions or conversions, i.e. the piezoelectric effect. We note that a phonon is a quantized vibration of an atomic crystal lattice structure. Wherein, mechanical vibrations are converted to electromagnetic oscillations, or conversely, electromagnetic oscillations are converted to mechanical vibrations. This possibility also points to the semi-conductive nature of biological matter.

The ordered nature of bio plasma may be consistent with electron and proton vectorialized flows, currently recognized as essential features of cell metabolism. Various biological structures, e.g. keratin, collagen, alpha and beta sheaths of proteins, genes…etc., form an uninterrupted reticulum that may act as piezoelectric communications networks. Recent biophysical knowledge has suggested that piezoelectricity may be considered the common denominator for the aspecific actions of the various non-ionizing order-inducing biological/clinical/physical therapies. Indeed, piezoelectric mechanisms may be present spontaneously in physiology. For example, piezoelectricity may be at work in cells specialized in the reception of external stimuli (heat, pressure and sound). [41]

The cells are able to subsequently convert the specific types of energy they are sensitive to, into the electric energy of the nervous impulse. Furthermore, several tissues and basic biomolecules may have piezoelectric properties by virtue of being made up of electrets: parallel molecular assemblies wherein the microscopic subunits and the macroscopic whole have stable and permanently ordered dipoles. Piezoelectricity may well account for the transmission of electromagnetic oscillations at different frequencies, which are then coherently recognized by resonant molecules. [42]

In accord with the diversity of possibilities presented herein, concerning biological effects secondary to application of non-ionizing extremely low intensity and low frequency EMF's, we point to studies conducted at the University of Oklahoma Health Sciences Center, Arrhythmia Research Institute.

Truly, it appears that a distinctive, and quite unique potential is unfolding from the radiological sciences for ameliorating the aging process and the effects therefrom.

In our initial experimental study we used 2 different sized Helmholtz coils to apply micro Gauss (μG) levels of electromagnetic fields (EMFs) either to the vagosympathetic trunks or across the chest of anesthetized dogs [18]. From previous reports on frequency analysis of heart rate, the parasympathetic activity averaged 0.043 Hz. Using the Jacobson

$(mc^2 = q_J \, v \, BL)$ and Cyclotron Resonance $\left(f = \dfrac{q \, B}{2\pi \, m} \right)$ equations, we calculated the correspondent EMF amplitude value of 2.87×10^{-6} Gauss for parasympathetic activity. Applying these EMFs at the vagal trunks invasively or across the chest non-invasively, we found enhanced parasympathetic effects on the heart rate and atrioventricular conduction (AVC), both properties influenced by parasympathetic innervation. The maximal heart rate changes in the experimental versus control groups was 29% versus 12% ($P = 0.03$). The same EMF stimulation decreased the voltage applied to the vagal trunks by 60% in the experimental group versus a 5% increase in the control group ($P = 0.005$). We note the right and left femoral veins were cannulated for delivery of fluids and anesthetics, and for the insertion of an electrode catheter which was advanced and positioned against the lateral atrial wall in the low right atrium for atrial pacing. Using another level of EMF, (amplitude, 0.34 μG and 2 kHz) determined empirically, applied as above, there was a significant increase in atrial arrhythmias, including atrial fibrillation (AF) atrial premature depolarization, and atrial tachycardia, which could be suppressed by applied EMF, (2.87 μG at 0.043 Hz). It should be pointed out that 2kHz is a non-physiologic frequency and 0.34 micro gauss is sympathomimetic.

A shortcoming of these studies was the lack of a mechanism underlying these responses to low level EMFs. Subsequently, a series of experimental studies have been published [43-47] in which we used low-level vagosympathetic trunk electrical stimulation at levels 10% and 50% which did not slow the heart rate or slow atrio ventricular conduction (AVC). In an experimental model of induced AF, we found that the nerve clusters called ganglionated plexi (GP) found in specific vulnerable sites in the atria became hyperactive under the influence of excessive release of cholinergic (parasympathetic) and adrenergic (sympathetic) neurotransmitters. In this regard, Smith et al. [48] tested the function of the GP, weeks after separation of the vagal and sympathetic nerves from the aforementioned structures. Not only did the intrinsic GP neurons remain viable but their responsiveness was enhanced. To emphasize this point, the neural connection from the brain to the GP was severed in experimental animals and it was found after 10 weeks there was a progressive increase in the occurrence of paroxysmal atrial fibrillation. Low-level vagal nerve stimulation markedly attenuated the hyperactive state of the GP, thereby suppressing AF. In a recent experimental study, the neural activity of the GP was recorded and it was found that several hours of induced AF caused a significant increase in the amplitude and frequency, whereas low level vagal nerve stimulation not only suppressed AF propensity but also the increased amplitude and frequency of the hyperactive GP. A recent clinical report from our group has confirmed that low-level vagal nerve stimulation can mitigate AF in patients with the paroxysmal form of this arrhythmia. [49]

Since electrical stimulation of nerves induces its actions via release of chemicals called neurotransmitters, we found that a specific peptide, vasostatin-1 was released at low-levels of vagal nerve stimulation (50% below the voltage that causes slowing of the heart rate) and even at very low levels of vagal nerve stimulation (80% below the slowing threshold).

Indeed, further studies in our experimental model of induced AF, showed that vasostatin-1 suppressed AF by inhibiting GP hyperactivity by an anti-autonomic action mediated by nitric oxide. [50]

Returning to the earlier studies using low level EMFs to affect heart rate and rhythm, we inserted the molecular weight value for vasostatin-1 into the Jacobson and Cyclotron Resonance equations to derive the amplitude (0.034 μG) and frequency (0.952 Hz), respectively. Applying these EMFs at the vagal trunks and across the chest we found that these low level fields significantly suppressed AF and also decreased the amplitude and frequency of the neural activity of the hyperactive GP. [51].

Preliminary studies at Mississippi State University executed by Coyne [37], screened a number of PicoTesla range magnetic field schedules. Calculations using the Jacobson Resonance equation were based upon molecules thought to be associated with human mammary carcinoma cell populations (HTB-126 and MCF-7) in multi well tissue culture plates. Two schedules were found to compromise the viability and/or proliferation rate of HTB-126/MCF-7 cell types relative to untreated negative reference controls. Over the course of replicate studies ($n = 7$) these PicoTesla schedules were observed to consistently inhibit the viability and/or proliferation rate between 31% to 35% compared to untreated negative reference controls. Additionally, Coyne identified membrane-associated complexes that were expressed at elevated or decreased levels in MCF-7 populations. Several mRNA sequences were detected ($n = 3$) that were expressed at higher levels ($n = 1$) or uniquely expressed ($n = 2$) in MCF-7 populations. Interestingly, these cells were exposed to magnetic resonance energies for thirty minutes each time in five treatment sessions, compared to exposure times of fifty-six minutes, twice weekly, for 8.5 weeks as was executed in nerve regeneration studies at Fairleigh Dickinson University for the in-vivo study. It is the experience of the authors that outcome measures are generally directly related to exposure time- in addition to the conditions of resonance determined by accuracy of flux densities and frequencies.

Nevertheless, collective interpretation of experimental findings revealed an ability of a multi-frequency, multi-amplitude PicoTesla range magnetic schedule to induce alterations in viability/proliferation rate and expression profiles of: (1) cytosol-soluble and membrane associated protein fractions; and (2) genetic transcription of mRNA sequences compared to negative (non-exposed) reference controls. In this context, these alterations appear to be of a different pattern when experimental samples were immediately processed following MCF-7 exposure to the fifth and final schedule. In contrast, different and slightly more subtle differences were appreciated when an intentional delay of several hours was implemented between the final exposure and sample preparation. Appreciation of this observation implies that maximum alterations in protein expression and mRNA transcription may occur during or shortly after periods of exposure. In addition, there was also a relative difference in the biological affect excited by individual single frequency techniques contained within the "Master" multi-frequency PicoTesla schedule. Ultimately, these laboratory findings may serve as an experimental foundation for future research

investigations devoted to delineating (1) time frames that PicoTesla magnetic fields exert a biological affect, (2) duration of PicoTesla magnetic field induced molecular/genetic alterations, (3) identity of PicoTesla magnetic fields that selectively exert specific biological affects in living systems, and (4) identify molecular/ genetic "targets" that PicoTesla magnetic fields interact with in a manner that creates a biological affect.

Einstein once defined the grand aim of science as, "To cover the greatest number of empirical facts by logical deduction from the smallest possible number of hypotheses or axioms." He believed in a basic universal field in which the multifarious manifestations are merely particular ephemeral forms or conditions of state. [52] Indeed, Lincoln Barnett said, "The urge to consolidate premises, to unify concepts, to penetrate the variety and particularity of the manifest world to the undifferentiated unity that lies beyond is not only the leaven of science, it is the loftiest passion of the human intellect. [53]

9. CONCLUSION

While appreciating that Jacobson Resonance Theory is still in its infancy, experimental data has pointed to the need for further research to advance this new directive in theory, experiment, and perhaps most importantly in clinical medicine.

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