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Experimental Demonstration That Aharanov-Bohm Phase Shift Voltages In Optical Coupler Circuits of Tuned Patterned Magnetic Fields Are Critical for Inhibition of Malignant Cell Growth

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ABSTRACT

The physical processes by which specific point duration magnetic fields affect aberrant expressions of living matter may involve non-classical mechanisms. The Aharanov-Bohm voltage for a quantum of energy that is convergent with the quotient of the proton's magnetic moment to its charge multiplied by the viscosity of water at homeostatic temperatures applied across the distance of O-H bonds in conjunction with its phase modulation is about ±4.3 V. Application of frequency shifting, temporally-patterned magnetic fields produced by 3 ms point durations at average intensities of ~28 mG (that are equivalent to Nernst thresholds for plasma membranes) generated through optocoupler light emitting diodes produced the strongest inhibition of malignant cells growth when the pre-coupler value for the circuit maintenance was ±4.3 V compared to increments of voltage below or above this value. Spatial expansion of the effective zone for growth diminishment also occurred with this pre-voltage level. These results indicate that phase modulation of the electrons mediating cellular molecular pathways may be central to the etiology and potential treatment of malignant cells but not for normal cells' dynamics. Consideration of quantum effects rather than classical electromagnetic theory may be a more effective strategy for impeding the physical bases for the molecular pathways that define malignant cells.

Indexing terms/Keywords

Phase shift; Aharanov-Bohm effect; 10^{-20} J; optocoupler circuits; bioquantum effects; anti-cancer effects; cell culture; melanoma cells, malignant growth; magnetic fields

Academic Discipline And Sub-Disciplines

Quantum Physics, Quantum Biology, Optocoupler Circuits

SUBJECT CLASSIFICATION

Electromagnetic field effects; Phase Modulation

TYPE (METHOD/APPROACH)

Quantitative Analyses; Experimental demonstrations

INTRODUCTION

The theoretical bases for the marked efficacy of optocoupler systems to generate magnetic fields with point durations derived from universal constants, for example Hubble's parameter [1,2], to affect the activity of malignant but not normal cells at the level of the proton have been described by Koren et al [3]. The central role of quanta of ~$2\cdot10^{-20}$ J in the physical mechanisms [4] that mediate the information or digital patterns of activity within cells is evident within molecular pathways [5,6] and may originate from fundamental physical constants. For example the quotient of the magnetic moment of a proton ($1.41\cdot10^{-26}$ A·m^2) and unit charge ($1.6\cdot10^{-19}$ A·s) multiplied by the viscosity of water at Life temperatures ($8.94\cdot10^{-4}$ kg·m^{-1}·s^{-2}) results in a force that when applied across the distance of two O-H bonds ($1.92\cdot10^{-10}$ m) results in ~$2\cdot10^{-20}$ J [7]. This is the level of energy involved with the motion of protons manifested within hydronium ions [8].

The Aharanov-Bohm phase shift is an unusual but important quantum effect. As stated by Tonomura et al [9] "the predicted effect is the production of a relative phase shift between two electron beams enclosing a magnetic flux even if they do not touch the magnetic flux". It is described by:

$$\Delta\theta = qVt\,\hbar^{-1} \quad (1),$$

where ħ is the modified Planck's constant ($1.05\cdot10^{-34}$ J·s), q= the unit charge ($1.6\cdot10^{-19}$ A·s) and t is the duration within the voltage field. If the duration in the voltage field is a unit orbit, $1.5\cdot10^{-16}$ s, then for qV~$2\cdot10^{-20}$ J the phase shift is $4.6\cdot10^{-3}$. Assuming the circumference of the standard Bohr orbit is $3.26\cdot10^{-10}$ m, the phase shift associated with 10^{-20} J would be within the range of the Compton wavelength of the electron ($2.4\cdot10^{-12}$ m). The phase modulation required for $2\cdot10^{-20}$ J is about $1.5\cdot10^{-12}$ m per phase.

The Aharanov-Bohm equation can be reconfigured to solve for V if the phase shift is known. If $2\cdot10^{-20}$ J is assumed and θ, the phase modulation, has been estimated as shown earlier [10] then the V can be calculated by:

$$V = (\theta\hbar)\cdot(qt)^{-1} \quad (2),$$

As noted previously [10], if these appropriate parameters are inserted into (2) the resulting value for V is ~ ±4.3. One test of the validity of these quantified predictions is an experiment that allows systematic manipulation above and below the optimal value determined for the Aharanov-Bohm effect within the optocoupler circuitry that generates the magnetic field within which cells are exposed. Here we demonstrate powerful evidence for this effect.

METHODS AND MATERIALS

In each experiment 6 plates (60 mm x 15 mm) each containing ~0.5 million B16-BL6 mouse melanoma cells were placed in the middle of a 10 cm by 10 cm by 10 cm acrylic (0.7 cm thick) box within a standard incubator (NeuAir; water jacket; 188 L) maintained at 37°±1° C with 5% CO_2. The culture medium contained DMEM supplemented with FBS and antibiotics. The exposure equipment and procedures have been described in detail elsewhere [11]. In the center of each wall of the box a SPST-5VDC Reed Relay (275-0232) rated at 0.5 A at 125 VAC (250 ohms, 20 mA nominal current) had been mounted. A small nail had been inserted into the core of each solenoid to enhance the field strength concentration. The peripheral circuit was arranged such that each pair of solenoids in each plane was connected.

The presentations of the magnetic fields were systematically applied through all planes simultaneously. The strength of the magnetic field measured within the centroid effective zone where the plates of cells were placed averaged ~28 mG ($2.8 \cdot 10^{-6}$ T). The effective zone, within which the largest cell effects have been demonstrated, was described previously [11]. This threshold for an effect was predicted quantitatively by Persinger and Lafrenie [12] and was based upon the magnetic field energy equivalent of the Nernst solution (~26 mV) for plasma membranes independent of disparity of cation or anion concentrations. This was considered critical because most malignant cells display plasma membrane resting membrane potentials within this range rather than the “normal” cell values of between -55 mV to -90 mV [13].

The pattern to which the cells were applied was the frequency modulated (“Thomas”) pattern that has been shown to reduce the growth of several different types of malignant cells from human and mouse sources. However the manner by which this magnetic field pattern has been generated did not affect the growth of non-malignant (normal) cells. The pattern which has been published several times [14,15] was composed of 849 values (numbers between 0 and 256). The transformation of 0 to 256 to -5 V to +5 V was completed through custom constructed software (© Professor Stanley A. Koren) that was applied through a digital to analogue converter (DAC) through a patented circuit involving optocouplers and Triac components. All of the circuit diagrams for this equipment have been published [3]. The programmable point durations defined as the time each voltage was presented through the circuit and ultimately to the pairs of solenoids to produce the magnetic fields to which the cells were exposed was 3 ms. This duration has been found to be most effective for slowing the growth of malignant cells as well as the influx of calcium ions into melanoma cells. Shorter or longer point durations were less effective [16].

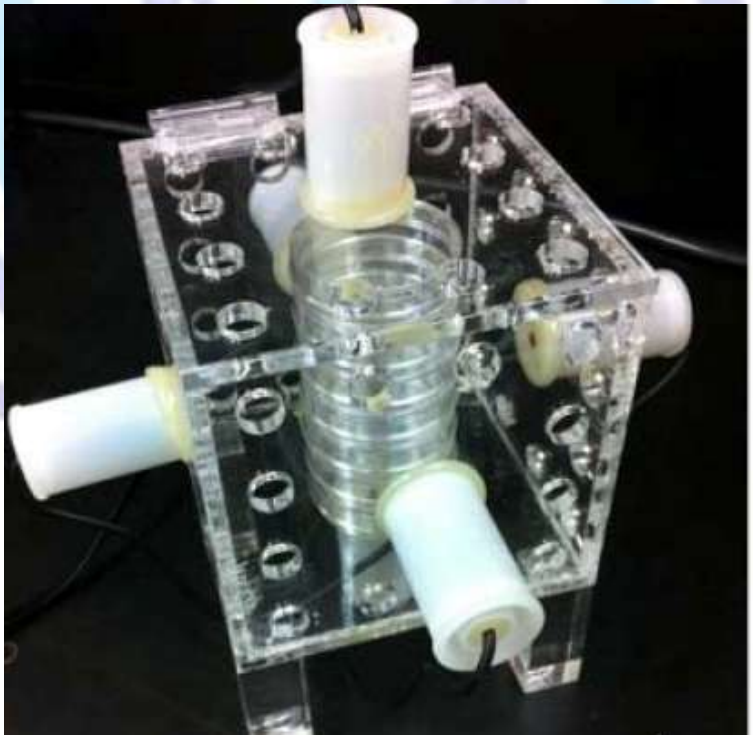

Figure 1. Exposure device within which a stack of 6 cell culture plates were placed. Each white cylinder contained the “solenoid” or reed switch. The fields were generated between opponent pairs of solenoids in each of the three spatial planes through a custom circuit composed of optocouplers, tyristors, Tirac switches and light emitting diodes. The optimal pre-optocoupler voltage predicted by the Aharanov-Bohm effect generated the largest cell effects.

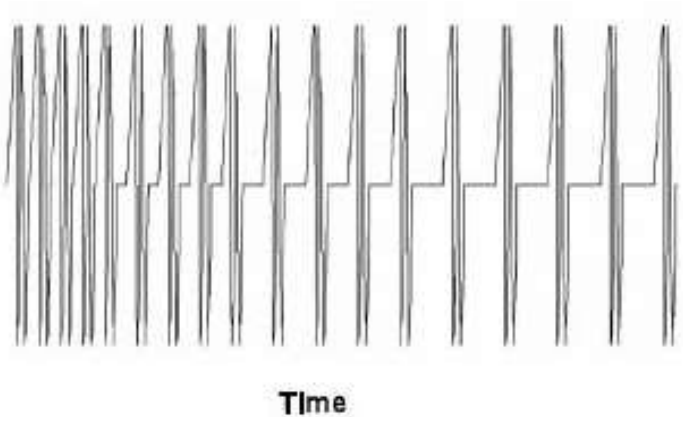

Figure 2. The temporal structure of the magnetic field pattern whose pre-optocoupler voltage was adjusted by Aharanov-Bohm solutions. Vertical axis indicates voltage that was optimally ±4.3 V. Horizontal axis reflects time in 3 ms increments for a total of 859 points for a total of 2.58 s per cycle.

Each experiment consisted of 5 successive days of 1-hour exposures to the same magnetic field pattern. The only manipulations were the calibrations that modified the peak voltage levels that were generated through the optocoupler that ultimately controlled the magnetic field intensity. The range of calibrations was 3.5 V, 4.0 V, 4.3 V, 4.5 V, 4.8 V, and 5.0 V. For any given experiment that same pre-voltage level was applied when the cell cultures were exposed every day for 5 consecutive days to the field for 1 hr. There were between 4 and 5 replicates for each pre-voltage value completed in random order over a 4 months period.

RESULTS

The results were conspicuous and reliable. They were consistent with the predictions from the Aharanov-Bohm equation for a quantum of energy within the range of ~$2 \cdot 10^{-20}$ J which would involve the second shell energy levels most involved with the movement of protons in aqueous solutions [8]. As shown in Figure 3 the effectiveness (more than 50% "dropout" in malignant melanoma cells) of this patterned magnetic field was greatest when the maximum voltage was set at 4.3 V. Employing the peak voltage for the system (5.0 V) produced minimal inhibition of cell growth and was not significantly different from no field presentations (sham controls).

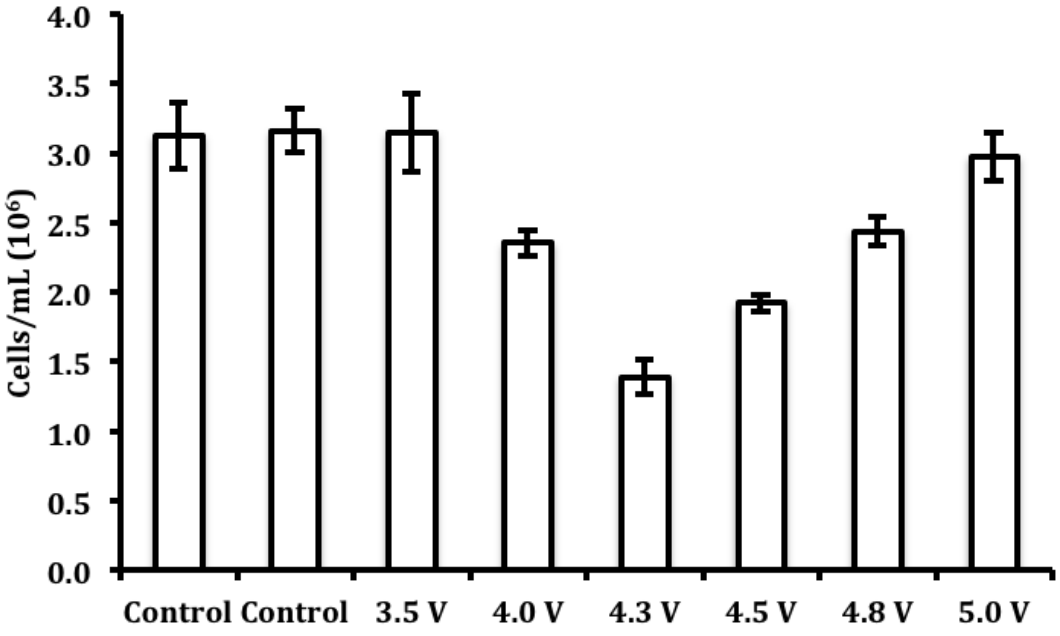

Figure 3. Numbers of cells present after 5 days of 1 hr per day exposure to the same magnetic field configurations as a function of the specific pre-optocoupler voltage. The 4.3 V predicted by the Aharanov-Bohm phase shift for the energy associated with proton movement in water (hydronium ion) produced the largest effect at this intensity and is consistent with the Persinger-Lafrenie estimate. Vertical bars indicate standard deviations.

There was also a quantitative shift in the size of the effect zone between the three pairs of solenoids within which the plates of cells were exposed. Uniquely, during the presentation of the 4.3 V configuration the effect of the field homogeneoulsy influenced all six plates stacked within the effective zone equally (see Figure 1). Typically only the two plates near the centroid zone where the imaginary lines between the three pairs of solenoids intercept showed the maxium effect.

DISCUSSION AND CONCLUSION

To our knowledge these experiments are the first to demonstrate the dependence of the efficacy of inhibiting malignant cell growth upon the optimized pre-voltage values (that operated the optocouplers from which the magnetic flux was generated) according to the precise predictions of a quantum phenomenon: the Aharanov-Bohm effect. The important feature of this effect is that neither increments of force nor energy are involved. The operating function is the phase of the wave. This allows for the propagation of information even within shielded contexts as well as potential non-local effects. Assuming the activation energy (~10^{-20} J) involved with the movement of protons through hydronium ions (which in large part determine pH) and phase modulation, the calculated specific voltage was the precise value (within 0.1 V reflecting the limits of the equipment) that produced the largest effect. The proportion of “dropout” or delayed growth was more than 60% which is the largest consistent effect that has been obtained with this paradigm.

The local effects that produce the causality within the cell cultures are most likely mediated by water. As masterfully described and pursued by Pollack and his colleagues [18, 19] water exhibits gel-like properties within discrete boundaries from surfaces, such as cell membranes. The exclusion zone (EZ) is associated with a 10 fold increase in viscosity and the creation of a layer of protons whose potential difference is up to 150 mV or the value that has been classically attributed to disparity of ion (e.g., potassium or chloride) concentrations across the plasma cell membrane. As described by Persinger and Lafrenie [12], almost all malignant cell membranes exhibit values similar to base Nernst solutions (26 mV). The magnetic field required to equate this voltage is about 28 mG, which is the average value with which we obtained our effects.

Del Giudice et al [20] have shown by calculation and application of variants of quantum theory that hundreds of water molecules exhibit simultaneous resonance in coherent domains with widths of ~100 nm which is within range of the 121.6 nm wavelengths [21] that results in H_2O—›OH (N)+H producing OH radicals in their electronic ground state with the additional property of rotational quantum states that assume particular quantum (integer) numbers, N. According to Del Giudice and Preparata [22] the application of the Dicke Hamiltonian below a specific temperature and atomic density describes a spontaneous, superradiant phase transition. This is a peculiar state where classical electromagnetic fields become trapped within ensembles of atoms oscillating in phase with the atomic transitions within the specific excited states predicted by the Dicke model and ground states. A common frequency of the organized matter in coherence domains within the 100 mV range and the residing electromagnetic fields results in an energy equivalent to 0.26 eV or ~10^{-20} J. Del Giudice and Preparata [22] argued that because there is coupling between the vector potential of water and the vector potential associated with the electromagnetic fields in the environment, the phase of a system is changed by magnetic vector potentials. This is the Aharanov-Bohm effect. The derived value was demonstrated to precisely inhibit malignant growth in melanoma cells.

Calculations indicate that the photons that mediate the optocoupler connections through the Triac circuit may be also represented within the center of the three-axis magnetic field within which the chemical reaction or organism is maintained. The magnetic field, if this model is valid, facilitates the containment. Persinger [23] quantified a relationship between the divergence of radiative phenomena associated with photons and the convergence within the electrical and magnetic properties of space associated with each orbital rotation of an electron. He found that the order of magnitude of photon flux density (~10^{-12} $W \cdot m^{-2}$) that is associated with biophoton emissions in living systems when multiplied by the inverse of the product of the wave impedance applied over the hydrogen wavelength and divided by the magnetic permeability of a vacuum multiplied by the Bohr orbital frequency was ~$1.5 \cdot 10^{-20}$ J. Consistent with that approach is the energy per s for the more precise solution for the associated photon flux density (~$1.9 \cdot 10^{-12}$ $W \cdot m^{-2}$) distributed over the area ($4.4 \cdot 10^{-2}$ m^2) of the neutral hydrogen line (21 cm). The energy ($8.36 \cdot 10^{-14}$ J) converges upon the equivalence for the rest mass of an electron.

The measurements of an expanded effective zone when the prevoltages (determined by the phase modulation of the electron wave predicted by the Aharanov-Bohm relation) were applied suggest that a standing wave emerged within the exposure containment. Typically the effect zone involves the central two plates of six stacked plates within the exposure box. The involvement of all six plates indicates that the volume of the effective zone increased by at least a factor of 3 to ~250 cm^3. Previous experiments whereby combinations of magnetic patterns had been employed indicated that the effective zone, within which there was zero cell growth, was about 85 cm^3 within the total volume (~1 L) of the exposure box whose external walls apposed the solenoids. Such precise tuning, analogous to a type of emergent condensate within which coherence would occur over an unexpectedly extended space, might produce the integrated domains predicted by Del Giudice and Preparata [22]. Additional explanations have been offered by Koren et al [3].

We can not exclude contributions from the background flutter of the circuit and the intrinsic frequency shifting of the applied temporal pattern. The flutter amplitude is about 10^{-9} T which is within the range of limits of measurement by our magnetometers. Assuming an ion channel exhibits a radius r ~0.5 nm and displays a current of 2 pA, which is within the range of Ca^{++} channels, the magnetic field for a cylinder, would be:

$$B=\mu I (2\pi r)^{-1} \qquad (3),$$

where μ is $4\pi \cdot 10^{-7}$ $N \cdot A^{-2}$ and I is current, about 10^{-9} A. From this context it is relevant that Pilla et al [24] found that the dissociation of the calcium ion from calmodulin exhibits two rates (k) equivalent to 10 to 40 Hz and 300 to 500 Hz. These are within the range of the frequency modulation of the temporal pattern of the applied magnetic field (~6 Hz to ~30 Hz) and the point duration of 3 ms (333 Hz) from which the pattern is generated. The growth-inhibiting effects as well as the movements of calcium ions through the membranes of these cells through T-type channels [16] were manifested less or not displayed in any measureable manner when the fields point durations were less or greater than 3 ms.

The precision of the 3 ms point duration may reflect a specific feature of proton dynamics within local and non-local space [25] that was predicted by Persinger and Lafrenie [12] and may involve contributions from cosmological sources that emphasize the interaction between the photon and proton-electron dynamics [3, 26]. Given the intricate relationship between the viscosity of water and magnetic fields [7], the appearance of this state [27] in interfacial water, and the potential role of biological water dynamics (and entropy) in cancer [28], a more profound biophysical origin might be responsible for this manifestation of matter. Considering the potential simultaneous particle-wave state that transports both phase and electron states from virtual particles to actual particles [29] marked precision of the physical parameters within the photocoupler circuits may be required to inhibit the malignant process.

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Authors' Biographies with Photos

Lukasz M. Karbowski, Ph.D., ABD, is a Research Associate in the Quantum Biomolecular Sciences Laboratory at Laurentian University. He is affiliated with the Neuroscience Research Group whose primary goal is to discern the quantitative parallels between dynamic cellular processes and fundamental physics. Professor Karbowski's primary expertise is in developing new technologies and circuits that facilitate the measurement of proton and electron mediated phenomena within molecular pathways and organs. He was the first to demonstrate that daily oral melatonin supplements prevented the reduction of neuronal numbers in the right prefrontal cortices of aging rodents. He has shown malignant cells exhibit reversible dormancy for weeks at room temperature, planaria dissolve when exposed to combinations of resonant magnetic fields, and the capacity for water in cells to re-emit specific photon wavelengths that were applied an hour earlier when conjoined with pulsed magnetic fields. His career interest is to experimentally extend Miller's abiogenesis experiments by applying complex magnetic fields superimposed on Schumann wavelengths to preCambrian atmospheres.

Nirosha J. Murugan, Ph.D., ABD, is a Research Associate in the Biophoton and Quantum Molecular Biology Laboratory at Laurentian University. Her work in bioelectromagnetism demonstrates that patterned electromagnetic fields can dissolve "immortal" flatworms, a finding which has developed into targeted cancer therapies. As a consequence of her experimental validation of Cosic's Resonant Recognition Model (RRM), she has produced a series of (light) wavelength-dependent effects upon biomolecular pathways within virulent (Ebola) and malignant (melanoma/breast cancer) systems. Recently, she and her colleagues have identified quantitative relationships between ambient pH and biophoton emissions associated with cellular communication systems which will guide further experiments using applied electromagnetic effects to target and "dissolve" cancer cells. Her career interest is to relate the physical and chemical properties of biomolecular pathways to the specific patterns of light-band electromagnetic fields.

Robert M. Lafrenie, Ph.D. is a cell biologist working to understand the etiology of cancer and to develop potential anti-cancer therapeutics. He is a Professor in the Biomolecular Sciences and Behavioural Neuroscience Programs at Laurentian University. His research involves studies on the role of cell adhesion in cell differentiation, assessing the impact of various genetic biomarkers on cancer prognosis, and evaluating alternate therapeutics for their efficacy against cancer. Recent work has been directed to evaluating the underlying mechanisms of how exposure to a specific electromagnetic field can inhibit the growth of cancer cells. Dr Lafrenie received a Bachelor's degree from the University of British Columbia and Master's and Doctorate degrees from McMaster University. He was a visiting fellow at the National Institute of Dental Health at the National Institutes of Health in Bethesda, Maryland. He has been an investigator at the Regional Cancer Centre and Health Sciences North in Sudbury since 1997.

Michael A. Persinger, Ph.D. is a Full Professor at Laurentian University in Sudbury, Ontario, Canada. He is affiliated with a number of different programs including Biomolecular Sciences, Behavioural Neuroscience and Human Studies as well as the Quantum Molecular Biology Laboratory where he is examining the relationship between 10^{-20} J events within the brain and complex functions. Dr. Persinger and his colleagues have experimentally demonstrated the validity of Cosic's Molecular Resonance Recognition Model, Bokkon's Cerebral Photon Field Hypothesis and the efficacy of proton driving patterned magnetic fields that inhibit the growth of cancer cells but not normal cells. He is an interdisciplinary scientist whose primary goal is to integrate the physical sciences, social sciences and humanities according to their fundamental operations. Within the last 50 years he has published more than 500 technical articles in variety of areas that range from Astronomy to Zoology. His present experiments are focused upon understanding the relationship between the structure of space and distribution of energy, the shared dimensional equivalence of quantized gravitational and electromagnetic fields, and the empirical demonstration of an intrinsic entanglement velocity.