

# Meditation, Mind-Body Medicine and Placebo: TGD point of view

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### Abstract

The chapter represents TGD inspired answers to Lian Sidorov's questions concerning meditation, mind-body medicine and placebo in quantum biology framework. To help the reader, some aspects of TGD inspired theory of consciousness and quantum biology are summarized since several new insights inspired by the notions of magnetic body and dark matter have emerged lately. This includes improved views about quantum metabolism and prebiotic life: the basic input comes from the claimed free energy phenomena interpreted in TGD framework. Water structures representing simplified analogs of basic biomolecules suggested by water splitting producing so called Brown's gas might be highly relevant also for the ordinary metabolism. The main new input concerning remote mental interactions comes from a possible answer to the question whether TGD based ontology of physics could allow the "shamanistic" view that the experiences (say encounters with strange life forms assigned with distant civilizations) induced by various psychedelics used in the spiritual practices of indigenous people could be genuine remote sensory perceptions rather than hallucinations. Affirmative answer would mean a direct and testable connection between neuropharmacology and remote sensory perception with serotonin defining the crucial neurotransmitter and pineal gland ("third eye") serving as a candidate for the brain area of special importance in this respect.

Concerning the questions about meditation, mind-body medicine and placebo, the key concept is that of magnetic body. Usually organism and environment are seen as members of an interacting pair: organism receives sensory data from environment and controls it. Now magnetic body appears as a third party, "intentional agent" using biological body as a kind of interface between magnetic body and environment. Various "motor actions" of the magnetic body are highly relevant for both consciousness and biochemistry. The pairs formed by various information molecules and corresponding receptors could define plug-ins to the Indra's net (or Internet) defined by the magnetic bodies and Josephson radiation emitted by Josephson currents assignable to receptors would propagate along flux tubes. Meditation can be seen as "bodily exercise" of the magnetic body and a method to improve the communications between magnetic body and biological body. In healing magnetic body would be the active participant and healing would be also the healing of magnetic body. The placebo effect could be seen as an outcome of intentions of magnetic body affecting biological body.

## 1 Introduction

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body and a method to improve the communications between magnetic body and biological body. In healing magnetic body would be the active participant and healing would be also the healing of magnetic body. The placebo effect could be seen as an outcome of intentions of magnetic body affecting biological body.

The change of gene expression in meditation could be understood in terms of magnetic body. Genetic expression would be naturally determined by the permanent flux tube connections from the magnetic body to the promoter portions of DNA. Differentiation would select the promoters to which the magnetic body has permanent connections. The change of gene expression could be due to a change of these connections. Both meditation, placebo effect, and healing could induce changes in gene expression in this way.

The appendix of the book gives a summary about basic concepts of TGD with illustrations. Pdf representation of same files serving as a kind of glossary can be found at <http://tgdtheory.fi/tgdglossary.pdf> [?].

## 2 Brief Summary About TGD Based Vision About Life And Consciousness

### 2.1 Magnetic And Electric Bodies

The notion of “magnetic body” has become more and more central concept in TGD inspired theory of quantum biology. Also electric fields are fundamental in living matter consisting of electrets and one could speak about electric bodies too. The notion of field body is possible only in TGD framework where space-times are 4-surfaces of 8-dimensional space  $M^4 \times CP_2$  and various classical fields are geometrized in terms of geometry and spinor structure induced from those of embedding space.

One can assign to any physical system magnetic body (or more generally field body), which consists of space-time sheets representing field quanta of magnetic and electric fields geometrically: typically they have the shape of flux tube or flux sheets. Of special importance are flux tubes carrying monopole Kähler magnetic flux - as if there would be magnetic monopole serving as the source of the magnetic field. There are however known magnetic monopoles in TGD Universe. These flux tubes are in fundamental role in the description of elementary particles and very probably also the magnetic flux tubes relevant for living matter carry monopole fluxes: even magnetic field associated with permanent magnets could involve monopole flux tubes, whose characteristic property is that there is no current creating the field. In cosmology this kind of fields are present in all scales and the mystery in the standard physics framework is caused by the fact that permanent currents in this scales are not possible.

The topological dynamics of magnetic flux tubes is based on reconnection process creating and modifying the topology of the web of magnetic flux tubes. In living matter this web is assumed to be responsible for the coherent behavior of living organisms. The reconnection building a double flux tube bridge between two systems is assumed to define the space-time correlate for the generation of directed attention. Second important piece of dynamics is the change of the length of the magnetic flux tube induced by the change of  $h_{eff}/h$ . The shortening of flux tubes connecting distant biomolecules would force them near each other and make possible selective bio-catalysis. This mechanism should be crucial for DNA replication and transcription, and mRNA translation.

Also the dark matter at magnetic flux tubes is assumed to be essential element of what it is to be living. Dark matter hierarchy corresponds to a hierarchy of effective values of Planck constant given by  $h_{eff}/h = n$ . Cyclotron frequencies for charged bosons and Cooper pairs of charged fermions could be carriers of metabolic energy realized as cyclotron energy which is large for large values of  $n$ .

One can of course also speak about electric bodies - living matter is full of electrets and already Fröhlich realized the importance of electric fields - and cell membrane would define a fundamental system of this kind. The flux tubes connecting the interior and exterior of membrane would carry electric voltage in the stationary case and in super-conducting situation oscillating Josephson currents generating dark Josephson radiation at frequency  $f_J = ZeV/h_{eff}$  are present. EEG - or rather hierarchy of dark EEGs at various frequency scales but with same energies actually assignable to bio-photons - could correspond to this radiation and dark cyclotron radiation. They

would mediate communication of sensory data to the magnetic body and control commands from the magnetic body.

## 2.2 Frequency Coding And Targeted Attention

Dark photons are also an important piece of the bio-puzzle. Microscopically they correspond worm-hole contact pairs connecting to “massless extremals” (MEs) (as a matter of fact, all elementary particle have this kind of identification). Dark photons would be generated as Josephson photons and cyclotron photons. The simplest assumption is that standard mechanisms of biochemistry generate only ordinary photons. The basic property of dark photons is that the energy for a given frequency is scaled up by factor  $h_{eff}/h$  so that ELF radiation can correspond to energies of even visible photons as would indeed do if EEG corresponds to dark photons having energies if visible and perhaps even UV photons.

1. If the photons are absorbed resonantly, photons frequencies serve as analogs of passwords so that living matter would apply the analog of radio communications for dark photons. Given part of living system in given scale would be characterized by photon frequency which by p-adic length scale hypothesis would correspond to a power of two. A collection of these frequencies coming as powers of two would effectively define a sequence of binary digits specifying the p-adic space-time sheet of the receiver. This coding mechanism could be at work not only inside organism but also between different organisms. The magnetic bodies have astrophysical dimensions and in principle there is no limit for the scales involved. Directed attention would correspond to reconnection of magnetic flux tubes implying common cyclotron frequency spectrum plus cyclotron transitions induced by the radiation transferred between the participants.

Frequencies serving as passwords would make possible precisely targeted communications if receiver frequencies vary as a function of position. Cyclotron radiation along massless extremals parallel to magnetic flux tubes serving as kind of waveguides achieves the same. These two mechanisms could be actually one and same.

2. Zero energy ontology in turn strongly suggests communications based on reflections in time direction at the opposite boundaries of causal diamonds (CDs) having interpretation in terms of state function reductions. This allows to speculate about communications in cosmic scales taking place instantaneously with respect to subjective time. It is not clear whether the standard view about causality based on unique direction of geometric time denies this possibility.
3. Very probably frequency alone is not all that is involved. Just as in the ordinary radio communications, the signal itself could be coded by amplitude or frequency modulation of the carrier frequency. One of the possible mechanisms generating dark photons would be amplitude modulation. Frequency modulation could be realized as variation of Josephson frequency induced by that of membrane potential and cell membranes indeed carry membrane potential waves besides nerve pulses. Cyclotron frequency could be modulated by oscillations of the flux tube thickness induced the variation of magnetic field strength forced by the flux conservation.

There is evidence that a process interpreted as a propagation of bio-photons along neural fibers takes place. In TGD framework this would correspond to the propagation of dark photons along magnetic flux tubes parallel to the fibers. I have proposed that magnetic flux tubes assignable to neural pathways (and also meridians of acupuncture system) serve as analogs wave guides for dark photons. If sensory organs are really the seats of the fundamental sensory experiences and brain builds cognitive representations by analyzing the sensory input and decomposing it to objects with names as TGD suggests [K7], then the feedback from brain and even magnetic body is needed in order to build the sensory representations as kind of art works. This would explain dreams (REM) and hallucinations as being caused by virtual sensory input from the magnetic body (maybe induced by sensory input to magnetic body even from some other magnetic body as in case of remote mental interactions).

## 2.3 Meditation And Magnetic Body

One manner to see meditation is as a method to develop ability to precisely targeted attention by getting rid of all perturbing mental images. If one accepts that reconnections for the flux tubes of the magnetic body are crucial for the targeted attention and that the  $h_{eff}$  serves as a kind of universal quotient of spiritual intelligence, the conclusion would be that meditation means practices for developing maximally flexible magnetic body able to build rapidly contacts with higher levels of the personal magnetic body and also with other magnetic bodies. Meditator would be a master of magnetic motor actions whereas yogi would be a master of motor actions of biological body. If healing involves connection between magnetic bodies or magnetic body and biological body of healee, meditation should help also to achieve healing abilities.

In biology everything seems to obey engineering standards and the build-up of connections to other magnetic bodies need not be an exception to the rule. Various information molecules and corresponding receptors would indeed define natural candidates for the plugs connecting brain and body to the magnetic Indra's net. Therefore meditative practices should develop the ability to control the levels of various information molecules and receptors in body.

## 3 NMP, Hierarchy Of Planck Constants, P-Adic Length Scale Hypothesis And Negentropic Entanglement

Around the year 2003 a number of new ideas emerged simultaneously. Learning about hyper-finite factors of type  $II_1$  and their inclusions [K15] lead to a proposal for the mathematical description of finite measurement resolution and cognitive resolution. Also the idea about hierarchy of Planck constants allowing to identify dark matter as phases of ordinary matter, and the notion of negentropic entanglement emerged and led to a lot of speculation. Over the years connections between these notions and vision about their more detailed realization have emerged. One can say that NMP, hierarchy of Planck constants, p-adic length scale hypothesis, negentropic entanglement, and even inclusions of hyperfinite factors are very intimately related. Of course, all of this is just a highly entertaining intellectual game - very much like solving a crossword puzzle - and only time and experiment will show whether it has anything to with reality.

### 3.1 Negentropic Entanglement And Hierarchy Of Planck Constants

The hierarchy of Planck constants makes possible negentropic entanglement (see **Fig.** <http://tgdtheory.fi/appfigures/cat.jpg> or **Fig. ??** in the appendix of this book) and genuine information represented as negentropic entanglement in which superposed state pairs have interpretation as incidences  $a_i \leftrightarrow b_i$  of a rule  $A \leftrightarrow B$ : apart from possible phase the entanglement coefficients have same value  $1/\sqrt{n}$ , where  $n = h_{eff}/h$  define the value of effective Planck constant and dimension for the effective covering of embedding space. This picture generalizes also to the case of multipartite entanglement but predicts similar maximal entanglement for all divisions of the system to two parts. There are however still some questions which are not completely settled and leave some room for imagination.

1. Negentropic entanglement is possible in the discrete degrees of freedom assignable to the  $n$ -fold covering of embedding space allowing to describe situation formally. For  $h_{eff}/h = n$  one can introduce  $SU(n)$  as dynamical symmetry group and require that  $n$ -particle states are singlets under  $SU(n)$ .  $SU(n)$  brings in mind the dynamical gauge symmetry group introduced earlier for inclusions of hyper-finite factors of type  $II_1$  [K15] to which one can assign simply laced Lie groups such as  $SU(n)$  by Mac Kay correspondence [A1]. I proposed these groups as effective gauge group making possible emulation of all possible gauge group dynamics so that TGD Universe would be like Turing machine able to mimic any mathematically consistent dynamics. The inclusions would also characterize the finite measurement resolution: the states created by the included algebra would create states not distinguishable from each other in the resolution used.

This gives rise to  $n$ -particle states constructed by contracting product of some number  $k$  of  $n$ -dimensional permutation symbols contracted with many particle states assignable to  $m$

factors. These states would generalize  $k$ -particle states. For  $k = 1$  and  $m > 1$  one would have single particle state in “schizophrenic state” consisting of  $m$  particles with fractional quantum numbers  $n_i/n$  times the usual quantum numbers. Spin-statistics connection might produce problems - at least it is non-trivial - since one possible interpretation is that the states carry fractional quantum numbers - in particular fractional fermion number and charges.

These strange states with completely unique form would generalize the notion of N-atom proposed for decade ago as giving emergence of symbols and “sex” at molecular level [K4]. The status of this idea has remained very uncertain but I have not been able to throw it to paper basket. The second quantization associated with the finite coverings of embedding space would give rise to the negentropic entanglement, symbolic dynamics, and also to “Akashic records” as almost invariants of the quantum jump sequence (thanks to their negentropic resources respected by NMP). “Molecular sex” means that all states can be seen as composites of two states with opposite fractional  $SU(n)$  quantum numbers (this decomposition need not be unique!). This brings in mind the monogamy theorem for ordinary entanglement stating that maximal entanglement means this kind of decomposition to two parts.

2. While writing this I realized that the question whether negentropic entanglement is possible only in the new covering degrees of freedom or also in more familiar angular momentum, electroweak, and color degrees of freedom, remains open [K10]. The latter states are especially interesting biologically and from the point of view of photosynthesis and navigation of birds if one believes on the proposed explanations: long-lived negentropically entangled spin singlet electron-hole pairs and electron pairs are proposed as explanation of the experimental findings. If only the covering degrees of freedom are involved the entanglement stable against thermal perturbations is in these degrees of freedom.

## 3.2 NMP And Evolution Of Intelligence

Alexander Wissner-Gross, a physicist at Harvard University and the Massachusetts Institute of Technology, and Cameron Freer, a mathematician at the University of Hawaii at Manoa, have developed a theory that they say describes many intelligent or cognitive behaviors, such as upright walking and tool use [J1, J8]. The basic idea of the theory is that intelligent system collects information about large number of histories and preserves it. Thermodynamically this means large entropy so that the evolution of intelligence would be rather paradoxically evolution of highly entropic systems. According to standard view about Shannon entropy transformation of entropy to information (or the reduction of entropy to zero) requires a process selecting one of instances of thermal ensemble with a large number of degenerate states and one can wonder what is this selection process. This sounds almost like a paradox unless one accepts the existence of this process. I have considered the core of this almost paradox in TGD framework already earlier.

According to the popular article (<http://tinyurl.com/cb9p8we>) the model does not require explicit specification of intelligent behavior and the intelligent behavior relies on “causal entropic forces” (here one can counter argue that the selection process is necessary if one wants information gain). The theory requires that the system is able to collect information and predict future histories very quickly.

The prediction of future histories is one of the basic characters of life in TGD Universe made possible by zero energy ontology (ZEO) predicting that the thermodynamical arrow of geometric time is opposite for the quantum jumps reducing the zero energy state at upper and lower boundaries of causal diamond (CD) respectively. This prediction means quite a dramatic deviation from standard thermodynamics but is consistent with the notion of syntropy introduced by Italian theoretical physicist Fantappie already for more than half a century ago as well as with the reversed time arrow of dissipation appearing often in living matter.

Negentropy Maximization Principle (NMP) resolves also the above mentioned almost paradox (at least). I have proposed analogous principle but relying on generation of negentropic entanglement and replacing entropy with number theoretic negentropy obeying modification of Shannon formula involving p-adic norm in the logarithm  $\log(p)$  of probability. The formula makes sense for probabilities, which are rational or in algebraic extension of rational numbers and requires that the system is in the intersection of real and p-adic worlds. The dark matter matter with integer value of Planck constant and  $h_{eff} = nh$  predicts rational entanglement probabilities: their values

are simply  $p_i = 1/n$  since the entanglement coefficients define a diagonal matrix proportional to unit matrix. Negentropic entanglement makes sense also for  $n$ -particle systems as found and the form of the states is essentially unique.

Negentropic entanglement corresponds therefore always to  $n \times n$  density matrix proportional to unit matrix: this means maximal entanglement and maximal number theoretic entanglement negentropy for two entangled systems with number  $n$  of entangled states.  $n$  corresponds to Planck constant  $h_{eff} = n \times h$  so that a connection with hierarchy of Planck constants is also obtained. Power of the  $p$ -adic prime by definition defines largest prime power divisor of  $n$ . Individually negentropically entangled systems would be very entropic since there would be  $n$  energy degenerate states with same Boltzmann weight. Negentropic entanglement changes the situation: thermodynamics of course does not apply anymore. Hence TGD produces same prediction as thermodynamical model but avoids paradox.

### 3.3 How To Produce Dark Matter

If one wants to test the vision about dark matter, one must be able to manipulate and even produce it. I have considered several mechanisms for producing dark matter. It must be emphasized that the ideas are yet at rather heuristic level.

1. Modulation of high frequency radiation by low frequency radiation such that the ratio of the frequencies is integer, call it  $n$ , characterizing the effective Planck constant  $h_{eff}/h = n$  is one proposal inspired by experimental findings of Cyril Smith related to water memory [I4]. Smith suggests that one particular ratio  $n \simeq 2 \times 10^{11}$  is of special importance. Number theoretical simplicity and  $p$ -adic length scale hypothesis suggest Fermat integers - are products of distinct Fermat primes and powers of two - as good candidates for  $n$ . One could perhaps say that ordinary higher frequency photons is replaced with a bundles of  $n$  fractional photons with energy and frequency divided by  $n$ . At the level of space-time and embedding space geometry this means the emergence of effective  $n$ -fold covering. The extreme non-linearity of Kähler action could give rise to these  $n$ -furcations.
2. The presence of strong electric fields and voltages and plasma phase seem to generate effects having explanation in terms of the hierarchy of Planck constants. In particular, di-electric breakdown seems to be involved. For instance, cell membrane characterized by the presence of extremely strong electric field. Plasmoids as lifeforms would also involve strong electric fields. Also magnetic fields seem to be essential. Splitting of water in electrolysis using strong electric fields ("peaky" electrodes) involves also strong electric fields and generates Brown's gas having anomalous properties. One could argue that the presence of strong electric fields is what leads to the generation of  $n$ -furcations at the level of space-time dynamics.
3. The latest proposal is based on some input from observations related to free energy leading to the observation that the quantum mechanical description of a system to which constant torque is applied leads to mathematical problems in the framework of standard quantum theory solved by introducing  $n$ -fold covering space of circle, hierarchy of Planck constants, and zero energy ontology [K9]. The value of  $n$  is at least the number of turns made by the rotating system during the time the torque is applied. This mechanism would explain why the values of  $n$  are so large. Constant torque represents an example of an open system driven by external generalized forces and living systems are systems of this kind. Formally the system is conservative but the potential function is either many-valued or discontinuous at  $2\pi$  and this forces to introduce the covering space if one wants to describe rotating and accelerating wave packets. Note also that the force can be arbitrarily small so that there is instability against generation of higher values of  $h_{eff}$ . What is of special interest is that ATP synthase (<http://tinyurl.com/y8xu5nto>) involves generator with a rotating shaft (just like an electric power plant) and therefore also a torque to compensate for dissipative losses. Is its purpose to generate large  $h_{eff}$  phase?

Note that cavitation is one manner to generate water splitting and associated charged water clusters and plasmoids: it is typically produced by a rotating shaft. Does this mean that turbulent water could have served as a seat for primordial life forms? Note that in homeopathy mechanical agitation is applied to the diluted sample: the proposed interpretation has



been that this drives the replication and evolution of dark life forms defined by dark nucleon sequences [K8].

### 3.4 Dark Proton Sequences, Genetic Code, And Primordial Life Forms

The general strategy should be simple. One starts from experimental facts and explains them in terms of TGD allowing free imagination and trying to achieve internal consistency between different ideas [K9].

1. The old result is that I cannot avoid mentioning again and again is that in atto-second scale water obeys stoichiometry  $H_{1.5}O$  as if 1/4: th of hydrogens were dark and thus not visible in electron scattering and neutron diffraction. This fact can be found from Chaplin's homepage (<http://tinyurl.com/ye77f7d>) devoted to water and containing impressive list of anomalies related to the physics of water. This finding was one of the original motivations for introducing hierarchy of Planck constants.

I introduced dark nuclei identified as sequences of dark hydrogens/protons as explanation of the strange stoichiometry and also for the anomalies: there would be two phases (at least, not the  $h_{eff}$  can have several values) present and this makes the behavior of water more complex. Dark nuclei are strings of dark protons connected by color bonds. The size scale of nucleus is scaled up by  $h_{eff}$  and would be about atomic scale: atto-second multiplied by  $c$  gives this scale.

The really big surprise was that the model for dark proton led directly to the realisation of vertebrate genetic code [K11, K8]: the states of dark proton can be naturally arranged to groups corresponding to DNA, RNA, amino acids, and remaining states whose number is smaller than 64 which I tentatively identify in terms of tRNA. Genetic code is obtained if states in different groups are identified by requiring that states corresponding to each other have same total quark spin and same spin assignable with the flux tube (two colour bonds connecting quarks).

In TGD framework this relates also to the understanding of water memory and homeopathy [K8] and to the evolution of immune system as well.

2. The field of free energy (presumably possessing somewhat similar academic status as the research of remote mental interactions) represents second source of experimental input. Quite lately I have been reconsidering what is believed to be known about the splitting of water - for instance using strong electric fields or cavitation. This is a rich store of anomalies. In particular although the splitting of water molecules requires energy, more energy is claimed to emerge from the process in some situations. Also cold fusion is reported to occur in this kind of system and liberates energy as heat. Nuclear transmutations in living matter have been reported much before the cold fusion was claimed for the first time [?, ?].

Already more than century ago it was reported that the resulting vapor - christened as Brown's gas according to its discoverer - behaved strangely. For instance, its temperature was 130 C but it melted metal as if it had stored a lot of energy which was liberated and was heating the metal about thousand of degrees of Celsius. These results do not of course fit standard physics and have been actively forgotten and denied by the academic environment (for an authoritative skeptic explanation see Wikipedia article <http://tinyurl.com/y7a8swzg>). I know personally some people in the field of free energy and I am not able to see them as "fringe scientists" as opposed to "real scientists". It is a pity that this kind of schizophrenic splitting prevents the study of the free energy claims using the resources provided by the academic environment.

Free energy enthusiasts have been studying this process and a lot is believed to be known about it. According to Moray B. King [H2, H1] Brown's gas can be separated from water vapor and hydrogen and is weightier than air. It is believed that charged plasma clusters resulting in the "electric expansion" of water are involved with electrons and protons separated. Torus shaped plasmoids are introduced also. In TGD framework plasmoids, which involve magnetic body carrying electron Cooper pairs at least, are identified as primordial life forms.

3. The question is how many properties assigned with chemical life are shared by plasmoids. Could linear biomolecules, storage and liberation of metabolic energy, and even genetic code have plasmoidal analogs?
  - (a) Circular sequences of OH: s has been proposed by King [H2] as basic building bricks of plasmoids. To my best understanding this does not fit with the ordinary chemistry (covalent bond between OHs cannot be realized). TGD inspired proposal consistent with King's proposal is that actually  $OHH_{dark}$  sequences are in question. Covalent bonds are replaced with color bonds between dark nuclei, which are scaled up variants of ordinary nuclear modelled as highly entangled nucleon strings in TGD framework. Already this represents a new view about nuclear physics (it is ironic that string like appear at practically all levels in TGD Universe but that string theorists desperately try to understand physics by putting them to Planck scale). As a matter fact, learning about the work of Gerald Pollack *et al* [I3] led to a simpler model in which dark proton sequences at magnetic flux tubes replace  $OHH_{dark}$  sequences. Predictions are almost the same except for charge separation having neat explanation in the simpler model which is actually the original model for water as partially dark phase of matter.
  - (b) Free energy phenomena involve the splitting of water. Water splitting is also the first step in the storage of energy to biomolecules in photosynthesis. Could  $OHH_{dark}$  or dark proton sequences define simplified counterparts of basic biomolecules, and could they carry metabolic energy in colour bonds between dark protons replacing "high energy covalent bonds" ?
  - (c) This metabolic energy would be liberated as metal melts in the presence of Brown's gas. This is completely analogous to the splitting of biopolymers in catabolism leading to liberation of metabolic energy. This liberation does not take place in the interaction with living matter: why the conductor property of metals leads to the burning? Why the presence of conduction electrons induced the phase transition reducing  $h_{eff}$  and scaling up p-adic prime  $p$  correspondingly so that energy is liberated. Do conduction electrons perhaps serve as a seed like in ordinary phase transitions forcing the dark Cooper pairs to decay to ordinary electrons?
  - (d) This framework inspires the conjecture that chemical life has preceded by plasmoids consisting of these ultra-simplified versions of basic biomolecules. "Ontogeny recapitulates phylogeny" forces to as whether this primordial life form could be still in key role living matter meaning that the role of water would be much more than serving as a passive solvent of biomolecules. The phase of water known as ordered water and having ice as the closest analog is believed to be crucial for the stability of DNA against hydrolysis, and one can wonder whether the dark DNA defined by half dark water molecule sequences could be the basic building brick of the ordered water and accompany the ordinary DNA. This would make also highly probable the analogs of transcription and translation between ordinary and dark variants of basic biopolymers. Note that Brown's gas would be ideal fuel since it would "burn" to water: no  $CO_2$  would be produced as in case of biofuels. Again the problem is that academic community how refuses to take free energy people seriously enough to try to demonstrate that they are wrong. Free energy enthusiasts in turn seem to concentrate too much to their dream and fail to realize that Brown's gas could carry the usable energy and the amount of this energy liberated as heat need not measure the actual success of the experiment.

### 3.5 Pollack's Findings About Fourth Phase Of Water

What is described above was the view about Brown's gas before I received a link to a Youtube lecture by Gerald Pollack about fourth gel like phase of water (see <http://tinyurl.com/oyhstc2>) [I3]. Listening this lecture provided considerable support for this picture and led to a much more detailed and also simplified view.

The discovery of negatively charged exclusion zone formed in water bounded by gel phase was the motivation for Pollack to propose the notion of gel like fourth phase of water. Below I discuss this notion from TGD point of view.

The proposal will be that the fourth phase corresponds to negatively charged regions - exclusion zones - with size up to 100-200 microns generated when energy is fed into the water - say as radiation, in particular solar radiation. The stoichiometry of the exclusion zone is  $H_{1.5}O$  and can be understood if every fourth proton is dark proton residing at the flux tubes of the magnetic body assignable to the exclusion zone and outside it. This leads to a model for prebiotic cell as exclusion zone. Dark protons are proposed to form dark nuclei whose states can be grouped to groups corresponding to DNA, RNA, amino-acids, and tRNA and for which vertebrate genetic code is realized in a natural manner [K8, K11]. The voltage associated with the system defines the analog of membrane potential, and serves as a source of metabolic energy as in the case of ordinary metabolism. The energy is liberated in a reverse phase transition in which dark protons transform to ordinary ones. Dark proton strings serve as analogs of basic biopolymers, and one can imagine analog of bio-catalysis with enzymes replaced with their dark analogs. The recent discovery that metabolic cycles emerge spontaneously in absence of cell support this view.

### 3.5.1 The findings

One can find a biographical sketch [I1] (<http://tinyurl.com/ycqtuchp>) giving a list of publications containing items related to the notions of exclusion zone and fourth phase of water discussed in the talk. I list below some basic experimental findings about fourth gel like phase of water made in the laboratory led by Gerald Pollack [I3].

1. In water bounded by a gel a layer of thickness up to 100-200 microns is formed. All impurities in this layer are taken outside the layer. This motivates the term "exclusion zone". The layer consists of layers of molecular thickness and in these layers the stoichiometry is  $H_{1.5}O$ . The layer is negatively charged. The outside region carries compensating positive charge. This kind of blobs are formed in living matter. Also in the splitting of water producing Brown's gas negatively charged regions are reported to emerge [H2, H1].
2. The process requires energy and irradiation by visible light or thermal radiation generates the layer. Even the radiation on skin can induce the phase transition. For instance, the blood flow in narrow surface veins requires metabolic energy and irradiation forces the blood to flow.
3. The layer can serve as a battery: Pollack talks about a form of free energy deriving basically from solar radiation. The particles in the layer are taken to the outside region, and this makes possible disinfection and separation of salt from sea water. One can even understand how clouds are formed and mysteries related to the surface tension of water as being due the presence of the layer formed by  $H_{1.5}O$ .
4. In the splitting of water producing Brown's gas [H2, H1] having a natural identification as Pollack's fourth phase of water the needed energy can come from several alternative sources: cavitation, electric field, etc...

### 3.5.2 Dark nuclei and Pollack's findings

While listening the lecture of Pollack I realized that a model for dark water in term of dark proton sequences is enough to explain the properties of the exotic water according to experiments done in the laboratory of Pollack. There is no need to assume sequences of half-dark water molecules containing one dark proton each.

1. The dark proton sequences with dark proton having size of order atomic nucleus would reside at the flux tubes of dark magnetic field which is dipole like field in the first approximation and defines the magnetic body of the negatively charged water blob. This explains the charge separation if the flux tubes have length considerably longer than the size scale of the blob which is given by size of small cell. In the model inspired by Moray B. King's lectures charge separation is poorly understood.
2. An interesting question is whether the magnetic body is created by the electronic currents or whether it consists of flux tubes carrying monopole flux: in the latter case no currents would be needed. This is obviously purely TGD based possibility and due to the topology of  $CP_2$ .

3. This means that in the model inspired by the lectures of Moray B. King discussed above, one just replaces the sequences of partially dark water molecules with sequences of dark protons at the magnetic body of the  $H1.5O$  blob. The model for the proto-variants of photosynthesis and metabolism remain as such. Also now genetic code would be realized.

These primitive forms of photosynthesis and metabolism form could be key parts of their higher level chemical variants. Photosynthesis by irradiation would induce a phase transition generating dark magnetic flux tubes (or transforming ordinary flux tubes to dark ones) and the dark proton sequences at them. Metabolism would mean burning of the resulting blobs of dark water to ordinary water leading to the loss of charge separation. This process would be analogous to the catabolism of organic polymers liberating energy. Also organic polymers in living matter carry their metabolic energy as dark proton sequences: the layer could also prevent their hydration. That these molecules are typically negatively charged would conform with the idea that dark protons at magnetic flux tubes carry the metabolic energy.

The liberation of energy would involve increase of the p-adic prime characterizing the flux tubes and reduction of Planck constant so that the thickness of the flux tubes remains the same but the intensity of the magnetic field is reduced. The cyclotron energy of dark protons is liberated in coherent fashion and in good approximation the frequencies of the radiation corresponds to multiples of cyclotron frequency: this prediction is consistent with that in the original model for the findings of Blackman and others [J2].

The phase transition generating dark magnetic flux tubes containing dark proton sequences would be the fundamental step transforming inanimate matter to living matter and the fundamental purpose of metabolism would be to make this possible.

### 3.5.3 Minimal metabolic energy consumption and the value of membrane potential

This picture raises a question relating to the possible problems with physiological temperature.

1. The Josephson radiation generated by cell membrane has photon energies coming as multiples of  $ZeV$ , where  $V$  is membrane potential about .06 V and  $Z = 2$  is the charge of electron Cooper pair. This gives  $E = .12$  eV.
2. There is a danger that thermal radiation masks Josephson radiation. The energy for photons at the maximum of the energy density of blackbody radiation as function of frequency is given as the maximum of function  $x^3/(e^x - 1)$ ,  $x = E/T$  given by  $e^{-x} + x/3 - 1 = 0$ . The maximum is given approximately by  $x = 3$  and thus  $E_{max} \simeq 3T$  (in units  $c = 1, k_B = 1$ ). At physiological temperature  $T = 310$  K (37 C) this gives .1 eV, which is slightly below Josephson energy: living matter seems to have minimized the value of Josephson energy - presumably to minimize metabolic costs. Note however that for the thermal energy density as function of *wavelength* the maximum is at  $E \simeq 5T$  corresponding to 1.55 eV which is larger than Josephson energy. The situation is clearly critical.
3. One can ask whether also a local reduction of temperature around cell membrane in the fourth phase of water is needed.

“Electric expansion” of water giving rise to charge separation and presumably creating fourth phase of water is reported to occur [H2, H1].

- (b) Could the electric expansion/phase transition to dark phase be adiabatic involving therefore no heat transfer between the expanding water and environment? If so, it would transform some thermal energy of expanding water to work and reduce its temperature. The formula for the adiabatic expansion of ideal gas with  $f$  degrees of freedom for particle ( $f = 3$  if there are no other than translational degrees of freedom) is  $(T/T_0) = (V/V_0)^{-\gamma}$ ,  $\gamma = (f + 2)/f$ . This gives some idea about how large reduction of temperature might be involved. If p-adic scaling for water volume by a power of two takes place, the reduction of temperature can be quite large and it does not look realistic.

- (c) The electric expansion of water need not however involve the increase of Planck constant for water volume. Only the Planck constant for flux tubes must increase and would allow the formation of dark proton sequences and the generation of cyclotron Bose-Einstein condensates or their dark analog in which fermions (electrons in particular) effectively behave as bosons (the anti-symmetrization of wave function would occur in dark degrees of freedom corresponding to multi-sheeted covering formed in the process).

#### 3.5.4 Fourth phase of water and pre-biotic life in TGD Universe

If the fourth phase of water defines pre-biotic life form then the phase transition generating fourth phase of water and its reversal are expected to be fundamental elements of the ordinary metabolism, which would have developed from the pre-biotic metabolism. The following argument conforms with this expectation.

1. Cell interiors, in particular the interior of the inner mitochondrial membrane are negatively charged as the regions formed in Pollack's experiments. Furthermore, the citric acid cycle (<http://tinyurl.com/y8ubjgnc>), which forms the basic element of both photosynthesis (<http://tinyurl.com/yauwzkho>) and cellular respiration (<http://tinyurl.com/ybeefxmb>), involves electron transport chain (<http://tinyurl.com/yat3m4vk>) in which electron loses gradually its energy via production of NADP and proton at given step. Protons are pumped to the other side of the membrane and generates proton gradient serving as metabolic energy storage just like battery. The interpretation for the electron transport chain in terms of Pollack's experiment would be in terms of generation of dark protons at the other side of the membrane.
2. When ATP is generated from ADP three protons per ATP flow back along the channel formed by the ATP synthase molecule (<http://tinyurl.com/yd5ndcyk>) (perhaps Josephson junction) and rotate the shaft of a "motor" acting as a catalyst generating three ATP molecules per turn by phosphorylating ADP. The TGD based interpretation is that dark protons are transformed back to ordinary ones and possible negentropic entanglement is lost.
3. ATP is generated also in glycolysis (<http://tinyurl.com/ybzgdgve>), which is ten-step process occurring in cytosol so that membrane like structure need not be involved. Glycolysis involves also generation of two NADH molecules and protons. An open question (to me) is whether the protons are transferred through an endoplasmic reticulum or from a region of ordered water (fourth phase of water) to its exterior so that it would contribute to potential gradient and could go to magnetic flux tubes as dark proton. This would be natural since glycolysis is realized for nearly all organisms and electron transport chain is preceded by glycolysis and uses as input the output of glycolysis (two pyruvate molecules (<http://tinyurl.com/y8v7aq9s>)).
4. Biopolymers - including DNA and ATP - are typically negatively charged. They could thus be surrounded by fourth phase of water and neutralizing protons would reside at the magnetic bodies. This kind of picture would conform with the idea that the fourth phase (as also magnetic body) is fractal like. In phosphorylation the metabolic energy stored to a potential difference is transferred to shorter length scales (from cell membrane scale to molecular scale).

In glycolysis (<http://tinyurl.com/ybzgdgve>) the net reaction  $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2(g) + 6H_2O(l) + heat$  takes place. The Gibbs free energy change is  $\Delta G = -2880$  kJ per mole of  $C_6H_{12}O_6$  and is negative so that the process takes place spontaneously. Single glucose molecule is theoretized to produce  $N = 38$  ATP molecules in optimal situation but there are various energy losses involved and the actual value is estimated to be 29-30. From  $Joule = 6.84 \times 10^{18}$  eV and  $mol = 6.02 \times 10^{23}$  and for  $N = 38$  one would obtain the energy yield .86 eV per single ATP. The nominal value that I have used .5 eV. This is roughly 5 to 8 times higher than  $E = ZeV, Z = 2$ , which varies in the range .1-.16 eV so that the metabolic energy gain cannot be solely due to the electrostatic energy which would actually give only a small contribution.

In the thermodynamical approach to metabolism the additional contribution would be due to the difference of the chemical potential  $\mu$  for cell exterior and interior, which is added to the membrane potential as effective potential energy. The discrepancy is however rather large and this

forces the question the feasibility of the model. This forces to reconsider the model of osmosis in the light of Pollack's findings.

### 3.5.5 Pollack's findings in relation to osmosis and model for cell membrane and EEG

Osmosis (<http://tinyurl.com/yc5dbtzv>) has remained to me poorly understood phenomenon. Osmosis means that solvent molecules move through a semipermeable membrane to another side of the membrane if the concentration of solute is higher at that side. Solute can be water or more general liquid, supercritical liquid, and even gas.

Osmosis is not diffusion: it can occur also towards a higher concentration of water. Water molecules are not attracted by solute molecules. A force is required and the Wikipedia explanation is that solute molecules approaching pores from outside experience repulsion and gain momentum which is transferred to the water molecules.

The findings of Pollack inspire the question whether the formation of exclusion zone could relate to osmosis and be understood in terms of the fourth phase of water using genuine quantal description.

In the thermodynamical model for ionic concentrations one adds to the membrane resting potential a contribution from the difference of chemical potentials  $\mu_i$  at the two sides of the membrane. Chemical potentials for the ions parametrize the properties of the cell membrane reducing basically to the properties of the channels and pumps (free diffusion and membrane potential do not entirely determine the outcome).

If the transfer of ions - now protons - through cell membrane is quantal process and through Josephson junctions defined by transmembrane proteins, then the thermodynamical model can at best be a phenomenological parameterization of the situation. One should find the quantum counterpart of thermodynamical description, and here the identification of quantum TGD as square root of thermodynamics in Zero Energy Ontology (ZEO) suggests itself. In this approach thermodynamical distributions are replaced by probability amplitudes at single particle level such that their moduli squared give Boltzmann weights.

#### 1. Simplest Josephson junction model for cell membrane

The first guess is that quantum description is achieved by a generalization of the Josephson junction model allowing different values of Planck constant at magnetic flux tubes carrying dark matter.

1. Josephson junctions correspond microscopically to transmembrane proteins defining channels and pumps. In rougher description entire cell membrane is described as Josephson junction.
2. The magnetic field strength at flux tube can differ at the opposite side of the membrane and even the values of  $h_{eff}$  could in principle be different. The earlier modelling attempts suggest that  $h_{eff}/h = n = 2^k A$ , where  $A$  is the atomic weight of ion, is a starting assumption deserving testing. This would mean that each ion resides at its own flux tubes.

The phase transitions changing the value of  $h_{eff}$  could induce ionic flows through cell membrane, say that occurring during nerve pulse since the energy difference defining the ratio of square roots of Boltzmann weights at the two sides of the membrane would change. Also the change of the local value of the magnetic field could do the same.

Consider first the simplest model taking into account only membrane potential.

1. The simplest model for Josephson junction defined by the transmembrane protein is as a two state system  $(\Psi_1, \Psi_2)$  obeying Schrödinger equation.

$$i\hbar_1 \frac{\partial \Psi_1}{\partial t} = ZeV\Psi_1 + k_1\Psi_2 \quad ,$$

$$i\hbar_2 \frac{\partial \Psi_2}{\partial t} = k_2\Psi_1 \quad .$$

One can use the decomposition  $\Psi_i = R_i \exp(i\Phi(t))$  to express the equations in a more concrete form. The basic condition is that the total probability defined as sum of moduli squared equals to one:  $R_1^2 + R_2^2 = 1$ . This is guaranteed if the hermiticity condition  $k_1/\hbar_1 = \overline{k_2/\hbar_2}$

holds true. Equations reduce to those for an ordinary Josephson junction except that the frequency for the oscillating Josephson current is scaled down by  $1/h_{eff}$ .

2. One can solve for  $R_2$  assuming  $\Phi_1 = eVt/h_{eff}$ . This gives

$$R_2(t) = \sin(\Phi_0) + \frac{k_1}{h_1} \sin\left(\frac{eVt}{h_1}\right) .$$

$R_2$  oscillates around  $\sin(\Phi_0)$  and the concentration difference is coded by  $\Phi_0$  taking the role of chemical potential as a phenomenological parameter.

3. The counterparts of Boltzmann weights would be apart from a phase factor square roots of ordinary Boltzmann weights defined by the exponent of Coulomb energy:

$$R = \sin(\phi_0) = \exp\left(\frac{ZeV(t)}{2T}\right) .$$

Temperature would appear as a parameter in single particle wave function and the interpretation would be that thermodynamical distribution is replaced by its square root in quantum theory. In ZEO density matrix is replaced by its hermitian square root multiplied by density matrix.

### 2. The counterpart of chemical potential in TGD description

This model is not as such physically realistic since the counterpart of chemical potential is lacking. The most straightforward generalization of the thermodynamical model is obtained by the addition of an ion dependent chemical potential term to the membrane potential:  $ZeV \rightarrow ZeV + \mu_I$ . This would however require a concrete physical interpretation.

1. The most obvious possibility is that also the chemical potential actually correspond to an interaction energy - most naturally the cyclotron energy  $E_c = \hbar_{eff} ZeB_{end}/m$  of ion - in this case proton - at the magnetic flux tube. Cyclotron energy is proportional to  $h_{eff}$  and can be rather large as assumed in the model for the effects of ELF em fields on brain.
2. This model would predict the dependence of the effective chemical potential on the mass and charge of ion for a fixed value of on  $h_{eff}$  and  $B_{end}$ . The scales of ionic chemical potential and ion concentrations would also depend on value of  $h_{eff}$ .
3. The model would provide a different interpretation for the energy scale of bio-photons, which is in visible range rather than infrared as suggested by the value of membrane potential.

The earlier proposal [K7] was that cell membrane can be in near vacuum extremal configuration in which classical  $Z^0$  field contributes to the membrane potential and gives a large contribution for ions. The problematic aspect of the model was the necessity to assume Weinberg angle in this phase to have much smaller value than usually. Furthermore, for proton the  $Z^0$  contribution is negligible in good approximation so that this model does not explain the high value of the metabolic energy currency.

4. The simplest model the communications to magnetic body rely on Josephson radiation whose fundamental frequency  $f_J$  is at resonance identical with the cyclotron frequency  $f_c(MB)$  at particular part of the flux tube of the magnetic body:  $(f_c(MB) = f_J)$ .  $f_c(MB)$  corresponds to EEG frequency in the case of brain and biophotons are produced from dark EEG photons as ordinary photons in phase transition reducing  $h_{eff} = n \times h$  to  $h$ .

In the modified model the sum  $f_c + f_{J,n}$  ( $f_{J,n} = E_J/n \times h$ ) of  $h_{eff}$ -independent cyclotron frequency and Josephson frequency proportional to  $1/h_{eff}$  equals to cyclotron frequency  $f_c(MB)$  at "personal" magnetic body varying slowly along the flux tube:  $f_c + f_{J,n} = f_c(MB)$ . If also the variation of  $f_J$  assignable to the action potential is included, the total variation of membrane potential gives rise to a frequency band with width roughly

$$\frac{\Delta f}{f} \simeq \frac{2f_{J,n}}{f_c + f_{J,n}} = \frac{2f_{J,1}}{nf_c + f_{J,1}} .$$

If dark photons correspond to biophotons the energy of cyclotron photon is in visible and UV range one has  $nf_c = E_{bio}$  and

$$\frac{\Delta f}{f} \simeq \frac{2ZeV}{E_{bio} + ZeV} .$$

The prediction is scale invariant and same for all ions and also electron unless  $E_{bio}$  depends on ion. For  $eV = .05$  eV,  $Z = 1$ , and  $E_{bio} = 2$  eV ( $f \simeq 5 \times 10^{14}$  Hz) one has  $\Delta f/f \sim .1$  giving 10 per cent width for EEG bands assumed in the simpler model.

If this vision is on the correct track, the fundamental description of osmosis would be in terms of a phase transition to the fourth phase of water involving generation of dark matter transferred to the magnetic flux tubes. For instance, the swelling of cell by an in-flow of water in presence of higher concentration inside cell could be interpreted as a phase transition extending exclusion zone as a process accompanied by a phase transition increasing the value of  $h_{eff}$  so that the lengths of the flux tube portions inside the cell increase and the size of the exclusion zone increases. In general case the phase transitions changing  $h_{eff}$  and  $B_{end}$  by power of two factor are possible. This description should bring magnetic body as part of bio-chemistry and allow understanding of both equilibrium distributions, generation of nerve pulse, and basic metabolic processes leading to the generation of ATP.

### 3.5.6 Why would charge separation generate large $h_{eff}$ ?

The basic question is whether and how the separation of electron and proton charges generates large  $h_{eff}$ ? A possible mechanism emerged from a model [K14] explaining anomalously large gravimagnetic effect claimed by Tajmar *et al* [?, ?] to explain the well-established anomaly related to the mass of Cooper pairs in rotating super-conduction. The mass is too large by fraction of order  $10^{-4}$  and the proposal is that gravimagnetism changes slightly the effective Thomson magnetic field associated with the rotating super-conductor leading to wrong value of Cooper pairs mass when only ordinary Thomson field is assumed to be present. The needed gravimagnetic field is however gigantic: 28 orders larger than that predicted by GRT. Gravimagnetic field is proportional  $h_{eff}^2$  in TGD and if one uses  $h_{gr}$  for electron-Earth system one obtains correct order of magnitude.

Nottale's finding that planetary orbits seem to correspond to Bohr orbits in gravitational potential with gigantic value of gravitational Planck constant is the basic input leading to the model of gravimagnetic anomaly.

1. By Equivalence Principle  $h_{gr}$  has the general form  $h_{gr} = GMm/v_0$ , where  $M$  and  $m$  are the interacting masses and  $v_0$  is a parameter with dimensions of velocity. For 4 inner planets one has  $v_0/c \simeq 2^{-11}$ .
2. The notion of  $h_{gr}$  generalizes to that for other interactions. For instance, in electromagnetic case the formation of strong em fields implying charge separation leads to systems in which  $h_{em} = Z_1 Z_2 e^2/v_0$  is large. Pollack's exclusion zone and its complement define this kind of systems and is identified as prebiotic life form.
3. Since the natural expansion parameter of perturbative expansion is the  $g^2/4\pi\hbar$ , one can say that transition to dark matter phase make the situation perturbative. Mother Nature is theoretician friendly.

$h_{em}$  might be large in the exclusion zones (EZ) appearing in the water bounded by gel and their variants could play central role in living matter.

1. EZ carries very large negative charge with positive charge outside the exclusion zone.
2. TGD interpretation is in terms of  $H_{1.5}O$  phase of water formed when every 4: th proton is transferred to magnetic body as dark particle with large value of  $h_{eff}$ . The proposal is that primitive life form is in question.
3. The pair formed by EZ and its complement could have large value of  $h_{eff} = h_{em} = Z^2 e^2/v_0$ .



4. The velocity parameter  $v_0$  should correspond to some natural rotation velocity. What comes in mind is that complement refers to Earth and  $v_0$  is the rotation velocity at the surface of Earth. The prediction for  $h_{eff}$  would be of order  $h_{em}/h = 4\pi\alpha Z^2 \times .645 \times 10^6 \simeq 5.9 \times 10^4 Z^2$ .
5. Cell membrane involves also large charge separation due to very strong electric field over the cell membrane. Also now dark phases with large  $h_{em}$  or  $h_{gr}$  could be formed.

I have proposed that metabolic machinery generates large  $h_{eff}$  phase somehow.  $h_{eff} = h_{em}$  hypothesis allows to develop this hypothesis in more detail.

1. I have speculated earlier [K9] that the rotating shaft of a molecular motor associated with ATP synthase plays a key role in generating dark matter phase. What comes in mind is that charge separation takes place associating exclusion zone with the shaft and the rotational velocity  $v_0$  of the shaft appears in the formula for  $h_{em}$ . Of course, some numerical constant not far from unity could be present. The electric field over the mitochondrial membrane generates charge separation. One can imagine several identifications for the product of charges. The charge  $Z$  associated with the complement would be naturally associated with single dark flux tube containing dark nucleon consisting of dark protons. For instance, the charge associated with the exclusion zone could be the charge of the electronic Cooper pair giving  $h_{em} = 2e \times Z/v_0$ .
2. The value of  $v_0/c$  is expected to be of order  $10^{-14}$  from the angular rotation rate of ADP synthase about few hundred revolutions per second. The order of magnitude for  $h_{em}$  could be same as for  $h_{gr}$  associated with Earth-particle system.

$h_{eff}(ATP\text{synthase}) = h_{gr}(2e, Earth)$  would make possible reconnection of electromagnetic flux tubes with gravimagnetic flux tubes [K13].

### 3.5.7 Is time reversal involved with Pollack effect?

EZs have the very strange property that the impurities are spontaneously removed from them. This seems to be in conflict with the second law of thermodynamics according to which both temperature and concentration gradients should tend to disappear. Could one understand this as being due to a reversal of the arrow of time?

Indeed, TGD inspired theory of consciousness relying on zero energy ontology (ZEO) predicts the possibility of time reversed selves [?]. When conscious entity - self - dies, it reincarnates as a self with opposite arrow of geometric time.

1. In ZEO zero energy states replace ordinary quantum states assigned with time=constant snapshots of time evolution in space-time. Zero energy states are pairs of ordinary quantum states at opposite light-like boundaries of causal diamond (CD) identifiable as counterparts of initial and final states of a physical event. Conservation quantum numbers translates to a mathematical statement that the quantum numbers associated with the members of pairs are opposite. One can also say that zero energy state is analogous to a deterministic computer program or a behavioral mode. The act of free will replaces this program/behavior with a new one so that one avoids the paradox between the non-determinism of free will and determinism of physics.
2. Causal diamond (CD) defines the embedding space correlate of self. One can assign to the opposite light-like boundaries the attributes active and passive. During the sequence of analogs of "small" state function reductions analogous to weak quantum measurements (resembling classical measurements) the passive boundary remains unaffected as also the members of state pairs defining zero energy states associated with it. Active boundary recedes farther away from the passive boundary and the members of state pairs at it change. The size of CD thus increases and gives rise flow of geometric time as an increase of the temporal distance between the tips of CD.
3. Eventually the first state function reduction to the opposite boundary of CD must occur, and active and passive boundary change their roles. Self dies and re-incarnates as a self with

opposite arrow of geometric time: the formerly passive boundary of CD becomes now active and moves in opposite time direction reduction by reduction. In the next re-incarnation self continues almost from the moment of geometric time at which it died. It might be that we die repeatedly without noticing it at all!

4. The many-sheeted space-time approximated with slightly curved regions of Minkowski space would certainly tend to mask the time reversals in given length scale. In elementary particle length scales the state function reductions would indeed change the arrow of time but this would occur so often that there would be no arrow of time in statistical sense: one would speak of microscopic reversibility. In time scales considerably longer than those of human consciousness the observed arrow of time would correspond to that associated with selves with very large CDs and with lifetime much longer than ours. The change of the arrow of time could be detectable in time scales relevant to living matter and human consciousness and just these scales are the scales where the anomalies occur!

Could the ghostly space-time regions - time reversed selves - have some physical signatures making possible to prove their existence empirically?

1. Second law would still hold true but in opposite direction of geometric time for the space-time sheets with non-standard arrow of time. The effects implied by second law would be present as their reversals. The observer with standard direction of geometric time would see temperature and density gradients to develop spontaneously. Also parameters describing dissipation rates such as Ohmic resistance and viscosity could have in some situations negative values.

This indeed seems to take place in living matter. For instance, the building bricks of molecules spontaneously arrange to molecules: DNA replication, transcription and translation of RNA to proteins are basic examples about this. The development of concentration gradients is also clear in the strange ability of EZs to get rid of impurities. Also the charge separation creating EZs could be seen as disappearance of charged separation in reversed direction of time. Healing of living organism could be a basic example of the process in which the arrow of time changes temporarily at some level of hierarchy of space-time sheets.

2. The generation of temperature gradients would be a clear signature for the reversal of the arrow of time. Water is the basic stuff of life, and the thermodynamics of water involves numerous anomalies summarized at Martin Chaplin's homepage "Water structure and science" (see <http://tinyurl.com/ye77f7d>). TGD based explanation could be naturally in terms of dark variants of protons at magnetic flux tubes and possible change of the arrow of geometric time.
3. There is a lot of anecdotal evidence for the effects challenging our beliefs about standard arrow of time. A spontaneous generation of temperature differences is basic example. There is a nice popular document about this boundary region of science by Phie Ambo (see <http://tinyurl.com/yaog8h39>), which even skeptic might enjoy as art experience.

It was a great surprise for me that one of the key personalities in the document is Holger B Nielsen, one of the pioneers of string models. I have had the honor to have intense discussions with him in past: he is one of the very few colleagues who has shown keen interest on the basic ideas of TGD. The document discusses strange phenomena associated with the physics of water possibly having interpretation in terms of time reversal and formation of EZs. From the document one also learns that in Denmark physics professionals are beginning to take these anomalies seriously.

Unfortunately, the people who claim having discovered this kind of effects - often not science professionals - are labelled as crackpots. The laws of science also tell what we are allowed to observe (and think), at least if we want to be called scientists!

4. The ghost stories might also reflect something real - this real need of course not be ghost but something deep about consciousness. Could it be that it is sometimes possible to consciously experience the presence of a space-time region - self - with an opposite arrow of geometric

time? Ghost stories typically involve a claim about the reduction of temperature of environment in presence of ghost: could this be something real and a signature for the reversal of time at some level of dark matter hierarchy affecting also dark matter? As a matter of fact, in TGD Universe our conscious experience could involve routinely sub-selves (mental images) with non-standard arrow of time [?]: motor actions could be identified as sensory mental images with opposite arrow of time.

### 3.5.8 Which came first: metabolism or cell membrane?

One of the basic questions of biology is whether metabolism preceded basic biopolymers or vice versa. RNA world scenario assumes that RNA and perhaps also genetic code was first.

1. The above view suggests that both approaches are correct to some degree in TGD Universe. Both metabolism and genetic code realized in terms of dark proton sequences would have emerged simultaneously and bio-chemistry self-organized around them. Dark proton sequences defining analogs of amino-acid sequences could have defined analogs of protein catalysts and played a key role in the evolution of the metabolic pathways from the primitive pathways involving only the phase transition between ordinary water and fourth phase of water.
2. There is very interesting article (see <http://tinyurl.com/ycdhd4fd>) [I2] reporting that complex metabolic pathways are generated spontaneously in laboratory environments mimicking hot thermal vents. Glycolysis and pentose phosphate pathway were detected. The proposal is that these pathways are catalyzed by metals rather than protein catalysts.
3. In standard biology these findings would mean that these metabolic pathways emerged before basic biopolymers and that genetic code is not needed to code for the metabolic pathways during this period. In TGD framework dark genetic code [K8, K11] would be there, and could code for the dark pathways. Dark proton strings in one-one correspondence with the amino-acid sequences could be responsible for catalysts appearing in the pathways. Only later these catalysts would have transformed to their chemical counterparts and might be accompanied by their dark templates. One cannot even exclude the possibility that the chemical realization of the DNA-amino-acid correspondence involves its dark analog in an essential manner.

## 4 TGD View About Metabolism

The general strategy in TGD based attempts to understand metabolism [K9] is based on the assumption that a very large class of anomalous phenomena rely on same basic mechanism. This includes life as a gigantic collection of anomalies, water memory and homeopathy, free energy phenomena involving over-unity energy production related to the dissociation of water, lightning and ball lightning, anomalous effects associated with rotating magnetic systems, phenomena related to UFOs (light balls), and remote mental interactions. One must have a unified explanation for all these phenomena based on a real theory.

Plasmoid as primitive life form would be the underlying connecting thread between these phenomena so that all the listed phenomena would involve life and prebiotic (or/and possibly postbiotic!) life. This gives very strong constraints on the model. Plasmoid should consist of the analogs of linear biomolecules, it should metabolize and communicate, in TGD Universe it should have magnetic body, and even genetic code might be realized. In particular, the simplified analog of biological metabolism would be at work. In living matter photosynthesis relies on the splitting of water whereas cell respiration relies on the reversal of this process producing carbon di-oxide and water. Something very similar should happen in free energy systems involving electrolysis, and the fact that water splitting occurs also in several free energy phenomena suggests that these processes are analogous to photosynthesis and store energy to “molecules” analogous to various linear biomolecules, in particular sugars. Even the simplified version of ADP-ATP process might be realized.

TGD suggests a very general model for the metabolism of pre-biotic systems identified as plasmoids consisting of cyclic linear structures formed by exotic water molecules. For a dark water

molecule one proton would be dark and dark protons of the neighboring exotic water molecules would bind to form a linear structure identifiable as dark nucleus: this picture is a direct generalization of nuclear string model [K6, K5, K11]. These linear structures would define the analogs of linear biomolecules. This metabolism would be more fundamental than ordinary biochemical metabolism and form a yet unknown part of the latter. One cannot exclude the possibility that also other than water molecules contain dark protons: the signature would be the presence of apparently non-allowed covalent bonds due to the fact the dark proton is not visible. In the following I will discuss the basic principles involved.

The older view about the metabolic energy quanta as energies liberated as particle “drops” to a larger space-time sheet is modified (an objection against this mechanism is that its coherence for many particles is far from obvious). Metabolic energy quanta are liberated when the space-time sheet at which the particles reside expands in a phase transition increasing its p-adic prime and reducing the value of Planck constant correspondingly so that the net result is that the size of the space-time sheet remains the same. This condition implies a close relationship between p-adic and dark matter hierarchies. This process is automatically coherent since all particles suffer the change simultaneously. It applies also to a situation in which particles are in magnetic field: in this case the scale of cyclotron energies changes since the strength of the magnetic field is scaled down to guarantee the conservation of magnetic flux. This transition is not cyclotron transition but liberates essentially the same energy as coherent cyclotron transition so that magnetic fields (their “motor actions” ) become essential players also in metabolic activities.

## 4.1 Three Possible Models For Liberation Of Metabolic Energy

One can imagine three different models for the liberation of metabolic energy.

1. The simplest TGD based model is as a phase transition increasing the value of p-adic prime  $p$  assignable to the space-time sheet at which particle is topologically condensed:
  - (a) Particle drops to a larger space-time sheet with larger p-adic prime  $p_1$  with  $p_1/p \simeq 2^k$ . The problem is that different particles need not drop simultaneously so that coherent liberation of energy is not automatic consequence of the assumption.
  - (b) The space-time sheet itself suffers a phase transition increasing its p-adic length scale. In absence of interactions (particles in box) the energies are scaled down by factor  $2^{-k}$  and the difference is liberated as usable energy. Coherent liberation of energy is achieved automatically. If the particle insider the space-time sheet is free in good approximation a model as particle in box applies, and if the expansion of the space-time sheet takes place adiabatically, the quantum numbers characterizing the state of the particle do not change in the transition. As a consequence, the energy  $E_{\{n_i\}} = k \sum_i n_i^2 \hbar^2 / 2mL_p^2$  is reduced as  $L_p \propto \sqrt{p}$  increases to  $L_{p_1}$ , where  $p_1/p \simeq 2^k$  holds true. The difference of vacuum energies is liberated as usable energy in coherent manner: this is of special significance in living systems. This has led to the identification of p-adic length scales that would correspond to fundamental metabolic quantum with value about .5 eV. Entire hierarchy of metabolic quanta is predicted.
2. The space-time sheet could also carry magnetic energy and particles are expected to be in cyclotron states and perhaps form a cyclotron Bose-Einstein condensate. In this case the phase transition reduces the value of  $B$  but preserves the magnetic flux so that  $B \rightarrow B/2^k$ ,  $p_1/p \simeq 2^k$ , takes place. This scales down the energies of cyclotron states by the same scaling factor  $2^{-k}$  as in the case of free particle. The liberated energy is in good approximation just the cyclotron energy for large enough values of  $k$ . Coherence is achieved automatically. The value of the fundamental metabolic energy quantum and the value of endogenous magnetic field of about  $B_{end} = .2$  Gauss deduced from the experiments of Blackman and others [J3] fix the value of  $h_{eff}$ . It would be proportional to particle mass number  $A$ .
3. The earlier model for the liberation of cyclotron energy was based on the assumption that the value of  $B$  is not changed but that the value of magnetic quantum number  $n$  changed. If  $n$  is reduced one achieves liberation of energy. Coherence of the transition might produce problems now. Both models can explain the observations of Blackman and others concerning the

effects of ELF radiation on vertebrate brain since the spectrum of photons energies inducing effects correspond to cyclotron energies for the latter option and in excellent approximation to it for the previous model. The mechanism is however quite different.

This phase transition for the larger space-time sheet can take place in two steps.

1. First a phase transition increasing  $h_{eff}$  of the background space-time sheet by  $n = 2^k$  occurs. This leaves ZPKE invariant but scales up the size of the space-time sheet by  $2^{k/2}$ . The interpretation would be as “electric expansion” of Brown’s gas. No energy transfer takes place since both kinetic and magnetic energies are invariant under the scaling of  $\hbar$ . Note however than in the original situation the magnetic field can be very strong so that zooming up from microscopic scales can happen.
2. After this a phase transition reducing Planck constant back to  $h$  but increasing p-adic length scale by  $2^k$  occurs. The size scale of the background space-time sheet is not affected but the zero point kinetic energy is reduced by factor  $2^{-k}$  and liberated as usable energy. This phase transition would take place for the dark component of Brown’s gas in the melting of the metal and other similar phenomena. Also the liberation of metabolic energy in living matter could correspond to this phase transition.

This model for electric expansion, implosion, and energy liberation assumes nothing about the particles involved since dark particle means ordinary particle topologically condensed on dark space-time sheet and having wave function de-localized in the n-sheeted structure. For instance, water can be dark in this sense. One could indeed consider the possibility that the vapor phase identified as charged water cluster is just water containing positive ions  $H_+^3$  or protons and electrons and that phase transition to large  $\hbar$  phase expands the space-time sheet at which water is topologically condensed at evaporates the water. Ordinary liquid to gas transition could proceed in the same manner and involve liberation of ZPKE at the second step of the process. In the general case the binding energy involved with the formation of the denser phase could compensate for the energy gain in the increase of the p-adic prime so that the melting would require energy feed.

## 4.2 Where The Metabolic Energy Is Stored?

High energy phosphate bond is one of the problematic notions of standard biology, and has served as inspiration in attempts to understand metabolism in TGD framework. The ideas have evolved gradually and the only defense for those which have survived is that they are inspired by a rather wide spectrum of anomalies including biology, neuroscience, and free energy phenomena so that the constraint of internal consistency eliminates many options.

1. The notion of negentropic entanglement allows to consider the possibility of bound states which have wrong sign of binding energy. Entanglement would be stable because it is negentropic rather than being characterized by binding energy. This led to the idea that high energy phosphate bond as a carrier of negentropic entanglement. The milder assumption is that ATP has the ability to generate it. The problem is that one can imagine endless variety of mechanisms without further conditions.
2. A highly attractive idea is that magnetic body could serve as the fundamental storage of metabolic energy with negative energy photons serving as a way to extract energy from the personal magnetic body or even other magnetic bodies. This would locate higher energy phosphate bond to magnetic flux tube and suggests that the energy is assignable to an analog of Cooper pair. This vision inspires also speculations about future energy technologies.
3. The generalization of the simple picture about liberation of metabolic energy as associated with the dropping of particle to a larger space-time sheet to a phase transition liberating cyclotron energy of charged particles led to the realization that also the phase transitions in which p-adic length scale increases by  $2^{k/2}$  factor and  $h_{eff}$  decreases by factor  $2^{-k}$  so that the size of space-time sheet remains the same, liberate kinetic energy or magnetic energy and this happens coherently and simultaneously for all particles involved. This mechanism

makes essentially the same predictions about effects of ELF em fields at multiplet of cyclotron frequencies (in good approximation).

In many-sheeted space-time particles topologically condense at all space-time sheets having projection to given region of space-time so that this option makes sense only near the boundaries of space-time sheet of a given system. Also p-adic phase transition increasing the size of the space-time sheet could take place and the liberated energy would correspond to the reduction of zero point kinetic energy. Particles could be transferred from a portion of magnetic flux tube portion to another one with different value of magnetic field and possibly also of Planck constant  $h_{eff}$  so that cyclotron energy would be liberated.

4. The negentropic states with wrong sign of binding energy could also correspond to cyclotron states with large  $h_{eff}$  (equally well to the states of a free particle in box, now space-time sheet). Magnetic body could carry metabolic energy and negentropic entanglement as that associated with dark pairs of charged particles. Because of their small mass electrons carry highest energy for given value of  $h_{eff}$  and magnetic field  $B$ . The deep irony is that one cannot automatically exclude even the elusive neutrinos as key players of metabolism: neutrinos have even smaller masses than electron and would carry even more energy in classical  $Z^0$  magnetic fields possible in cell scales for large enough values of  $h_{eff}$  [K12] !
5. Also ordinary biomolecules can be said to carry metabolic energy in covalent bonds: one could therefore assign the attribute “high energy” also to them. Do we really understand these bonds or do we just accept and forget? Do we really understand what the valence electron pairs associated with covalent bonds are? Is this really nothing but standard chemistry understood for long time ago? To my best knowledge we cannot deduce the existence of chemical bonds from Schrödinger equation because the numerics gets too intensive and choose to believe on reductionistic dogma. Hence there is some room for imagination.
  - (a) Concerning covalent bond, the first option is conservative and based on the free energy inspired idea that the orderer water stabilizing DNA corresponds to dark DNA sequences. If this situation prevails also for RNA and proteins known to be surrounded by order water, one can wonder whether the covalent bonds are indeed more or less standard chemistry but that it is dark DNA parallel to the ordinary DNA that carries the metabolic energy as cyclotron energy liberated as the biopolymer and its dark variant image is catabolized. The metabolic energy would be carried by the same structures as in the case of plasmoids which would be therefore be a key element of also life as we know it!
 

For this option the long color flux tubes carrying quark or electron pairs would give rise to the flux tubes needed for reconnections. The transfer of metabolic energy would rely on reconnection mechanism transferring also electron Cooper pairs. Dark and thus scaled-up variant of strong interactions would become perhaps the most essential part of biophysics! Chirality selection suggests strongly that also dark variant of weak physics is in a central role in living matter.
  - (b) Second option suggests a radically new view about covalent bond itself. Could valence bonds corresponds to Kähler magnetic flux loops carrying this kind of dark electron pair? Could they define the loops by which biomolecules could touch each other and reconnect to form dynamical webs. Could the fundamental energy transfer process be the transfer of electron pair between molecules involving two reconnections so that piece of magnetic loop would be exchanged? Could ATP could simply give piece of flux loop containing dark electron pair to the biomolecule as it is constructed?
6. Both options would unify also biochemistry with DNA as topological quantum computer vision. DNA sequences accompanied by magnetic flux loops would make possible DNA-cell membrane flux tube connections and topological quantum computer. Also for DNA as topological quantum computer I have considered two options: one for which quarks and antiquarks are associated with the ends of flux tubes and second one in which only electron pairs are involved [K1].

These ideas are of course speculative and time will probably show that Nature has not chosen them. What I see as the beauty of the general picture is that all relevant elements of biology at molecular level would reduce to the basic “motor actions” for magnetic body and their effects on cyclotron Bose-Einstein condensates. Same can be said about basic elements of consciousness: directed attention and sensing the presence of other molecule relying on the use of cyclotron frequencies as passwords and reconnection of flux tubes.

### 4.3 Dark Photon-Bio-Photon Connection

TGD inspired model for bio-photons is as ordinary photons resulting as decay products of dark photons in energy-momentum conserving decay. I have discussed this model [K3] [K2] using the input from the findings of Persinger *et al* [J4, J5, J6].

1. In the first article (see <http://tinyurl.com/y7nbr496>) [J4] entitled *Congruence of Energies for Cerebral Photon Emissions, Quantitative EEG Activities and  $\sim 5$  nT Changes in the Proximal Geomagnetic Field Support Spin-based Hypothesis of Consciousness* correlations between cerebral photons emissions, EEG, and changes of the proximal geomagnetic field are reported. The findings provide support for the proposal of Hu and Wu [J7] that nerve pulse activity could induce spin flips of spin networks assignable to cell membrane motivated by the observation that the magnetic spin-spin interaction between protons at a distance of 10 nm (cell membrane thickness) corresponds to energies for which frequency is in EEG range.
2. In the second article (see <http://tinyurl.com/y7cv531ye>) [J5] entitled *Demonstration of Entanglement of “Pure” Photon Emissions at Two Locations That Share Specific Configurations of Magnetic Fields: Implications for Translocation of Consciousness* the group reports an excess correlation between “pure” photon emissions at two locations separated by few meters that share specific correlations of frequency modulated magnetic fields. The photon emissions were from LEDs in the experiment consider. In an earlier similar experiment, which is also discussed, they were from chemical reactions occurring in solutions contained by cell cultures.
3. In the third article (see <http://tinyurl.com/ya4yb6bc>) [J6] entitled *Experimental Demonstration of Potential Entanglement of Brain Activity over 300 Km for Pairs of Subjects Sharing the Same Circular Rotating, Angular Accelerating Magnetic Fields: Verification by s-LORETA, QEEG Measurements* an excess correlation of brain activity of subject persons separated by 300 km and sharing the same circular rotating, angular accelerating magnetic fields is reported.

The frequencies of the ordinary and dark photon are predicted to be in integer ratio  $f_h/f_l = h_{eff}/h = n$  and I have already considered amplitude modulation as a way to produce dark photons and mentioned Cyril Smith’s experiments which can be interpreted in terms of this transformation.

1. The bio-photon emissions at two ends should be compared. The correlations between temporal patterns would be one basic signature. Temporal correlations are extremely important and should be studied further: otherwise the findings are taken as mere claims by mainstream.
2. Collection of frequencies as a password is the rather strongly TGD based prediction. Common frequencies at both ends define second signature. Phase transitions changing frequencies but preserving photon energies are of course possible so that also sub-harmonics must be considered. More specific predictions lead soon to bio-electromagnetism. I do not know whether bio-electromagnetists have continued the work of pioneers or whether anything is done nowadays.

This picture raises an interesting question: suppose that one has identified a collection of frequencies responsible for a biological password. Could one produce these effects artificially using these frequencies to modulate a carrier wave corresponding to some bio-photon frequency?

3. Time delay is one signature and would give idea about how long distance the radiation travels and at the same time can give additional support for magnetic bodies of astrophysical size, which is certainly the most astral looking feature of TGD model for biologist.

Delayed luminescence is also a phenomenon related to bio-photons. Delayed luminescence has been produced as a model of visual after images: this could apply to all mental after images. TGD enthusiast could see after images as a indirect support for the idea that communications to and from the layers of magnetic body take place and require definite time measuring directly the size scale of the layer. The time delay is rather long in the model of after images so that the magnetic bodies in question would be rather large involving photon travels over cosmic distances! Mainstream thinking suggests that some other mechanism is in question and the complexity of nervous system certainly allows to invent alternative mechanisms.

4. The ability to tune the cyclotron and Josephson frequencies by varying magnetic field would be basic magnetic motor skill of the meditator besides ability to move magnetic body parts to make reconnections more probable. For Josephson frequencies this skill would mean the ability to tune the value of the membrane voltage and Josephson frequency characterized by the associated value of  $h_{eff}$ . If given receptor-information molecule pair corresponds to a particular value of  $h_{eff}$  defining a connection to a particular magnetic body part as will be suggested below, an advanced meditator would have developed the ability to control the density of the receptor-information molecule pairs.
5. How to detect changes of cyclotron frequencies? In Persinger's experiments, magnetic field identified as that of Earth, was slightly reduced and therefore also the frequency. Could one learn to detect the tuning of the value of magnetic field? Can one demonstrate the ability of meditator to modify these frequencies? Can one try to identify the place where the radiation with these frequencies originates. Can one characterise body parts by slightly differing frequencies and build a kind of frequency map about body? Do deviations from standard values characterize unhealthy state?

## 5 Questions

The following represents answers to the 3<sup>rd</sup> JNL Panel on meditation, mind-body medicine and placebo based on the previous summary of TGD perspectives on consciousness and quantum biology. The introduction of the article should help to obtain a very short overview about the background.

### 5.1 I: Long Term Meditation Remodelling And Its Effects On Bio-Photon Emissions

Q1: Is the plasticity restricted to brain? Could meditation/visualization trigger BPE/redox-regulated changes in body wide microtubule arrays increasing coherence and synchronization?

A: I see no deep reason why plasticity would be restricted to brain alone. Brain might have however achieved highest level of plasticity because it represents a kind of "postmodern" layer in the evolution of cell cultures allowing cellular individualism. An interesting question in TGD framework is also the plasticity of magnetic body. Is meditation reshaping the magnetic body, making it more plastic so that it can build reconnections and in this manner direct attention more sharply and more stably?

Q4. Would the increased alpha power, brain connectivity and synchronization translate into greater amplitudes and bio-photon field coherence throughout the organism? And is there any mechanism through which BPE's could be reflected within the body's various conduction matrices (neural system, the mitochondria-microtubule reticulum – see Rahnama *et al*, 2011) acting like a resonant cavity for laser-like amplification of EEG-pumped BPEs, in order to reach the requisite thresholds for biological action?

If there is a common mechanism of action between LLLT and mind-body healing, as suggested by the parallels reviewed in the discussion above, then of particular interest is the fact that proficient qigong meditators appear capable of directing bio-photon emissions to specific areas of the



body [see “Intent-directed localization” section in bibliography]. Given that LLLT is limited in the depth of effective tissue irradiation, the prospect of targeted delivery of specific frequencies is quite intriguing. On the other hand, the actual intensity of bio-photon fields inside the cells and the robustness of quantum coherence at physiological temperatures remain controversial issues (Tafur *et al*, 2010; Rahnama *et al*, 2011).

A: If bio-photons are what results from dark photons in phase transition, the increase in alpha power and more generally in EEG power should increase bio-photon yield: BPE pumped by EEG corresponds to BPE as leakage from EEG. That there is decrease for meditators might be related to the absence of sensory and motor mental images: if there are no mental images, there is nothing to be communicated by dark EEG photons to the personal magnetic body.

Q5. There is evidence for the conduction of bio-photons along neural fibers. Do you think it’s possible that the localization of BPE during such visualization exercises is due to the photons’ transmission from the brain to that affected area along efferent neurons, in the same way motor commands would be locally transmitted? Is it technically possible to measure such neural photon conduction in meditating human subjects? And should localization of action, such as targeted BPE, be part of patient training in mind-body interventions?

A: That LLLT is limited by tissue depth, ceases to be a problem if dark photons propagate along magnetic flux tubes. Darkness would provide also shield against de-coherence. One can imagine two ways to achieve targeting.

1. Password mechanism for which parts of body correspond to characteristic resonances so that dark photons with particular frequency determined by energy and value of  $h_{eff}$  are received only by that body part.
2. Second mechanism is propagation along magnetic flux tubes directed to that body part. If dark photons have cyclotron frequencies in the magnetic field of a flux tube, these mechanisms are more or less equivalent. Frequency corresponds to magnetic field strength and this in turn to thickness of magnetic flux tube. Microtubular matrix could be accompanied by magnetic flux tubes perhaps serving as a template for it. Biological effects at specific frequencies at the other end of the pathway would be the basic signature.

Q6. What do you think of target specificity in mind-matter interactions – based on your understanding of the literature, how narrowly are we able to target a particular area of the body or a particular effect? Could the differential sensitivity to LLLT on the basis of redox status or proliferation rate account for the fact that qigong-based therapies show apoptosis of tumor cells but not normal cells? What do you think is the physical basis of such differential effects, or their localization to particular areas of the body?

A: The different sensitivity of tumor cells and normal cells would be explained by different cyclotron frequencies for their magnetic bodies. The unhealthy state would be also unhealthy state of magnetic body: maybe some parts of collective magnetic body of tumor cell complex with rather large value of  $h_{eff}$  are just missing and this translates to selfish behavior of tumor cells. The claim of inventor Royal Rife (see <http://tinyurl.com/yo5yfx>) regarded as pseudoscience by the mainstream is that tumor cells can be destroyed using irradiation with specific resonance frequencies. This method must be distinguished from radiation therapy based on ionization of DNA. Rife’s claim would be roughly consistent with TGD inspired proposal. Basically the challenge would be to find the frequency serving as the password to the cancer cell’s magnetic body.

Q7. In your opinion what is the most likely mechanism underlying the connection between long term meditation practice and the development of healing/ psi abilities?

A: I see meditation and visualization as practices for making magnetic body more flexible. This process modifies also biological body since genetic expression is changed as magnetic body controlling the expression of genes modifies it. Also build-up of connections to the larger layers of magnetic body with large value of  $h_{eff}$  would be in question as well as developing the ability to reconnect to other magnetic bodies. The travels of meditators/shamans/etc. to other realities could involve real sensory perceptions in TGD based ontology based on same mechanisms as remote sensory experiences. In any case, the communications in shorter length scales, say inside body and to lower layers of personal magnetic body, would rely on this mechanism.

The modification of the gene expression in meditation could be interpreted as being due to the changes of the connections between magnetic body and biological body. Genetic expression could

be determined by the permanent flux tube connections from the magnetic body to the promoter portions of DNA. Differentiation would select the promoters to which the magnetic body has permanent connections. The role of transmitter-receptor complex could be taken by the complex formed by the promoter and RNA polymerase making possible to receive the cyclotron radiation from the magnetic body. The model for motor action and sensory perception assumes that they are time reversals of each other so that the cyclotron radiation to genome and Josephson radiation from the cell membrane would travel in opposite time directions. In the most general case both radiations can travel in either time directions so that also cell membrane could receive control commands (possibly interpreted as virtual sensory input giving rise to what is usually regarded as hallucinations).

The change of the gene expression would be due to a change of these connections. Both meditation, placebo effect, and healing could induce changes in gene expression in this manner. One can wonder whether this change of connections to the magnetic body can be heritable so that it would provide a new mechanism of epigenetics (examples of which are histone modification and DNA methylation). If dark photons are involved with the communications to and from the magnetic body then also BPEs as dark photon leakages would reflect the change of genetic expression.

## 5.2 Ii: Healing Input Parameters, Dosimetry, Research Technology

Q8. What other approaches and technologies could be used to quantify healing intent? Is there a place for operator EEG, heart rate variability, skin conductance and operator bio-photon measurements on the input side of mind-body research protocols? Should we find a correlation between healing effects and BPE intensity/frequencies, would this provide a more useful, quantitative assessment of “healer input” in mind-body methodologies than the years of meditation practice?

A: If information molecule-receptor complexes serve as bridges to magnetic body parts, the technology quantifying healing intent would involve also correlates at neuro-pharmacological level. Neuroscience and study of remote mental interactions would fuse together. Elaborate maps about the information molecule connections to magnetic body would be constructed.

Q9. Since we know the action spectra required for specific LLLT effects, would it be useful to compare these LLLT spectra to the BPE wavelengths measured outside the heads of qigong healers attempting to produce the same effects through visualization? Could we feedback-train patients to reproduce such circumcerebral frequencies through meditation?

A: The comparison of peaks of LLLT and bio-photon spectra would be very interesting. This idea can be expanded if one accepts interpretation of EEG as dark photons. The naïve prediction would be that the ratios of peak frequencies for EEG for given value of  $h_{eff}$  and for bio-photons are same. In principle (I do not know about practice) this could be tested by looking at action spectra for LLT and bio-photons!

Q10. What do you think is the mechanism through which sender-receiver bonding facilitates DMILS effects? Specifically, could we test whether healing-specific EEG frequencies and the intensity of BPE at the sender are greater when the sender has a shared history with the receiver (due to cognitive/emotional memory activation and increased neural recruitment)? Could then “pre-bonding” with a targeted tissue, such as detailed visualization of a tumor, be used to enhance the effect of a patient’s healing meditation on his own body?

A: Pre-trial bonding would translate to permanent flux tube connections between magnetic bodies due to the reconnections. This would facilitate DMILS effects: the two magnetic bodies would receive some input from each others biological bodies by dark photons, say EEG. The correlations between EEG spectra and also spectra at other frequencies could serve as a signature for this.

Q11: Could endogenous, EEG generated bio-photons be trapped and utilized as such a source of energy? And could specific forms of meditation trigger new, low-dissipation physiological configurations and metabolic pathways which would allow the capture and high-efficiency utilization of surrounding environmental photons, such as light absorbed through the eyes? How could we test for such epigenetic and molecular configuration changes?

A: The trapping of dark photons to flux tubes would look more natural than trapping of bio-photons in TGD framework. The utilization of environmental photons in Bigu does not look to me an attractive option: dark photons from magnetic body would look more natural if TGD ontology is accepted. I have considered a model for Bigu assuming that magnetic bodies serve as

fundamental storages of metabolic energy. What this really means is far from obvious and several options can be imagined. The metabolic energy assigned with the covalent bonds of biopolymers could be actually cyclotron energy assignable with large  $h_{eff}$  magnetic flux tubes. Metabolism could be basically transfer or generation of negentropic entanglement assignable most plausibly to electron Cooper pairs. Bigu might reduce to sending of negative energy dark photons to some magnetic body with same cyclotron frequency (but does this generate negentropic entanglement by generating negentropic entanglement, say between electrons of Cooper pair?). This would involve formation of reconnection to this magnetic body (same field strength, same cyclotron frequency). Negative energy photons make sense only if the arrow of geometric time (thermodynamical time) can vary, and this quite generally would make possible also instantaneous communications as reflections of signals in time direction making possible remote mental interactions with arbitrarily distant targets. Zero energy ontology guarantees this.

### 5.3 III: Is Placebo A Form Of Healing Intent? Placebo Genotype Vs. Phenotype

Q12: How do you physiologically interpret the recent finding that patients with a met/met COMT variant are more prone to placebo effects?

A: That persons with met/met COMT would be more prone to placebo effects than normal variant, looks at first rather weird. From Wikipedia (<http://tinyurl.com/yc5ps8pg>) one learns about the claim that people with this variant tend to feel themselves happier than those with normal variant.

If one believes that neural transmitter-receptor complex establishes a plug-in from neuron to relevant part of the magnetic body, then this does not look so weird. Methylation of DNA and proteins is a universal manner to modify the functioning of reaction pathways and appears also in epigenetics. Met/met COMT instead of Met/Val COMT could favor the generation of this kind of bridges to some parts of magnetic body with higher value of  $h_{eff}$ : if larger negentropy is responsible for feeling happiness, then the finding could be understood. The parts of the magnetic body are in one-to-one correspondence with those of brain areas and might have similar specialization to feel happy or unhappy as limbic brain is claimed to have (right limbic brain seems to be specialized in suffering!). These bridges or “plug-ins” would most naturally correspond to post-synaptic receptors for some neural transmitters - perhaps one could localize them to limbic brain.

Placebo would be self-healing based on building this kind of contacts. Healing could be seen as healing of the communications between biological and magnetic body (or bodies, say magnetic bodies of collectives).

Q13. Given the evidence that meditation produces different effects on plasma catecholamines according to BDNF or COMT polymorphisms, do you think there is there a common genetic/CNS/therapeutic pathway between placebo and healing qi ability? Could subjects' placebo and healing effectiveness be correlated with an ability to entrain massive CNS domains through both activation of broad cognitive basins (multi-sensory visualization) and emotional modules? Would certain genetic variants be more conducive to this type of CNS activation?

A: I tend to think that many pathways are involved. The pathway in question need not be the same for placebo and healing qi ability. For psychedelics and perhaps also for remote perception the pathways affecting serotonin accumulation to postsynaptic receptors seem to be important and pineal gland might be the seat of action. The general mechanism could be similar to that conjectured for the action of psychedelics/hallucinogens. The interpretation would be that connections to some parts of magnetic body or even other magnetic bodies become more stable. If information molecules and receptor proteins are crucial for building connections to the magnetic body, gene dependence is implied: biochemist could probably easily tell whether methylation is a universal mechanism for modifying these molecules.

Q14. Could certain types of meditation training replicate this effect even in subjects who do not carry the COMT met/met variant – i.e. could we train patients to “compensate” for placebo effects by long term physiological remodelling?

A: It is hard to believe that meditation would not work at all for those without met/met variant. It would only make things easier.

Q15. Would it be useful to compare the remote bio-PK ability of the two populations studied for placebo in the COMT experiment, to see if that same genetic variant may translate in a different

in vitro effect size?

A: Both PK ability and placebo would involve “motor actions” of magnetic body. I however believe that the structure of hierarchy of magnetic bodies is as rich as the spectrum of neurotransmitters and other information molecules. Therefore I prefer to not answer the question!

#### 5.4 IV: Biophotons In Long Range Effects: DMILS From Life Precursors To Biosphere; Morphogenetic Fields, GCP, TGD

Q16. There is some evidence for remote viewing by healer and healee. Could this be due to bio-photon emissions induced through external qi?

A: The TGD expectation differs from the usual view. Dark photons is what is relevant for remote mental interactions and sending and receiving of dark photons involves leakage as bio-photons, which are ordinary photons. Various correlations between bio-photon emissions at sending and receiving ends could serve as signature for the presence of remote mental interactions, say remote viewing and healing, say correlations of temporal patterns, correlations between energies of bio-photons, and the frequencies of dark photons manifesting as EEG frequencies. Optimistically one could even expect that the ratios of peak EEG frequencies are same as those of peak bio-photon frequencies. Healing involves visualization and this might imply that also remote viewing is induced as a side product. If pineal gland functions like a “third eye” able to remote view by using dark photons instead of ordinary ones as for lower animals, its role in all remote mental actions could be important. Could this be tested by looking at what happens in pineal gland or some other brain region during remote mental interactions? Could the ability of birds and fishes to migrate to the birth places be one spectacular example of remote mental interaction? This is discussed in more detail in Appendix.

Q18. Can one imagine any technology differentiating between memory/imagination and remote perception using bio-photon profiles.

A: In TGD framework it is surprisingly difficult to distinguish between these two since also memories and vision about future can be also seen as examples of remote viewing. If fishes and birds are able to find their birth places in the manner discussed in Appendix, one would have a rather dramatic example about remote sensory perception. Hypnosis could be seen as second dramatic example of remote mental interaction.

Q19. Is the increased photon emission at living recipients due to a change in physiology? Or of energy/signature of entanglement. Stress related clinical research of meditation or research with focus on quantum non-locality?

A: TGD expectation would be that the emission would be basically due to leakage during communications to some parts of magnetic bodies involved. If one is ready to believe in dark photons and magnetic body, neuropharmacology of conscious experience and quantum non-locality inspired approach could be combined together. Questions to be asked would such as “What what bio-photon energy and what ELF frequency (that is  $h_{eff}$ ) does a particular information molecule/neurotransmitter correspond to?” The hierarchy of Planck constants and the hierarchical anatomy of magnetic body would correlate with analogous hierarchy of information molecules and their receptors with neurotransmitters at top: this would mean also hierarchy at the level of cells with neurons at the top.

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