Some applications of TGD inspired quantum biology: bio-chemistry, metabolism, replication

M. Pitkänen
Email: matpitka6@gmail.com.
http://tgdtheory.com/.

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Abstract

TGD replaces Einsteinian space-time with many-sheeted space-time, and gauge and gravitational fields with purely geometric induced fields leading to the notion of field body. TGD also forces to generalize quantum theory by introducing the hierarchy of Planck constants explaining dark matter and providing universal mechanism of evolution as increase of algebraic complexity and intelligence. Zero energy ontology in turn solves the basic problem of quantum measurement theory and allows to understand "free will" with conflict with the laws of physics. The implications for quantum biology are rather dramatic. In this article some problems related to biochemistry based approach, metabolism, and replication will be discussed in this framework. Examples from bio-chemistry are bio-catalysis with application to DNA replication, the selection of bio-molecules, and genetic code. Metabolism is second topic - I have included also a universal purely thermodynamical model of remote metabolism relying on zero energy ontology. Generalization of point like particle to 3-D surface allows to understand replication basically as analog of particle decay taking place at the level of magnetic body.

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1 Introduction

TGD replaces Einsteinian space-time with many-sheeted space-time, and gauge and gravitational fields with purely geometric induced fields leading to the notion of field body. TGD also forces to generalize quantum theory by introducing the hierarchy of Planck constants explaining dark matter and providing universal mechanism of evolution as increase of algebraic complexity and intelligence. Zero energy ontology in turn solves the basic problem of quantum measurement theory and allows to understand "free will" with conflict with the laws of physics. The implications for quantum biology are rather dramatic. In this article some problems related to biochemistry based approach,

metabolism, and replication will be discussed in this framework. Examples from bio-chemistry are bio-catalysis with application to DNA replication, the selection of bio-molecules, and genetic code. Metabolism is second topic - I have included also a universal purely thermodynamical model of remote metabolism relying on zero energy ontology. Generalization of point like particle to 3-D surface allows to understand replication basically as analog of particle decay taking place at the level of magnetic body.

The path leading to this article was following. I wrote a new chapter "Getting philosophical: some comments about the problems of physics, neuroscience, and biology" [L15] to the book "TGD based view about consciousness, living matter, and remote mental interactions" as a re-organized and extended version of the original text written 2018 as an article and a section of a chapter of the book already mentioned. I added several detailed examples about the application of TGD inspired theory of quantum biology so solve basic problems of quantum biology.

It seemed however appropriate to collect some specific applications as particularly interesting applications discussed also in the chapter [L15]. The examples to be discussed represent new results related to bio-catalysis with application to DNA replication, to the selection of bio-molecules, and genetic code. Metabolism is second topic - I have included also a universal purely thermodynamical model of remote metabolism relying on zero energy ontology. Also a discussion of replication is included.

I have not included the vision about pre-biotic evolution. The first key idea in the model of prebiotic evolution is that in TGD Universe the magnetic body of water makes it an excellent candidate for a pre-biotic life form in itself [L21, L4]: even genetic code would be realized non-chemically in two manners. In TGD Universe bio-chemical life could have evolved inside planetary interiors [L14]. For this the recent findings from Mars challenging the Maxwellian view about magnetic fields and characterized as "magnetic madness" provide support [L20] (see `http://tinyurl.com/yxzye6xu`).

Quite generally, it seems that the Maxwellian notion of magnetic field is encountering grave difficulties: the stability of the Earth's magnetic field is still not understood, and the existence of magnetic fields in cosmological scales is also a mystery. The existence of monopole flux tubes predicted by TGD solves all these problems and serves as a cornerstone of TGD inspired quantum biology. My expectation is that this will be one of the reasons eventually forcing to accept TGD.

2 Questions related to bio-chemistry

2.1 Biocatalysis

As already mentioned, bio-catalysis remains a total mystery in bio-chemical approach. Magnetic body carrying dark matter could provide the needed mechanisms. Actually these mechanism would be also basic mechanisms behind water memory and - dare I say it aloud? - homeopathy [K1].

According to TGD view about catalysis, reactants find each other by cyclotron resonance for dark cyclotron radiation assignable to massless extremals (MEs) possibly associated with U-shaped flux tubes. The U-shaped flux tubes of the molecules reconnect to a pair of flux tubes connecting the molecules. This occurs only if the flux tubes have same strength of magnetic field and therefore same thickness by flux quantization. The same value of h_{eff} guarantees resonance. The next step is the shortening of the flux tubes by a reduction of h_{eff} and liberating the energy kicking the reactants over the potential wall making the process extremely slow otherwise.

DNA replication, transcription to RNA, and translation of RNA to amino-acids are the fundamental processes in biology and TGD should provide a general model for them. Consider DNA replication as an example.

1. The standard model assumes that DNA opens and nucleotides build up the DNA codons in ordered manner. Nucleotides would be caught one-by-one from the environment by U-shaped flux tubes from DNA reconnecting with similar flux tubes from nucleotides. In the proposed model however dark codons are the fundamental units and expected to induce the process at the level of chemistry. Dark codons do not allow a decomposition to letters. Therefore ordinary codons rather than nucleotides should serve as basic units in energy resonance binding them to dark codons (triple resonance or ordinary resonance with respect to the sum of resonance energies). This looks like a problem for both replication and transcription.

Translation in which RNA codons are paired with amino-acids suggests a solution of the problem.

2. Suppose that dark codons are the basic units also in the environment, and are connected by long flux tubes with rather large h_{eff} to ordinary nucleotides forming thus loose but actually strongly correlated triplets. Nucleotides would serve as basic units only apparently: the entities in question would be analogous to tRNA codons. In the replication and transcription the dark codons of opening DNA sequences would form flux tube contacts with dark codons in the environment coupled to ordinary loose codons by dark triple resonance.

   After that the Planck constant h_{eff} associated with the connecting flux tubes would be reduced, the flux tubes would shorten and the complementary dark codon would be drawn near the the dark codon associated with DNA. Also the flux tubes connecting the dark codon to the nucleotides would shorten and the codon and complementary codon would form 3 base pairs. Shortening by a reduction of h_{eff} would provide the energy making the process fast enough. The loose codon property would allow to store the energy needed to make the reaction fast.

3. This model can explain also the claim of Montagnier et al [I3] about remote DNA replication [L1, L12]. Gariaev et al have reported the same process much earlier [I5] and together with Peter Gariaev we have developed a model for the process [K10].

   The situation is as follows. One has two vessels A and B: A contains genes and B only nucleotides. The vessels are connected by channels so narrow that the genes cannot leak through them. The system is irradiated at 7 Hz frequency, which is near the lowest Schumann frequency. The generation of the copies of genes in B is reported.

   The proposed model suggest that the flux tubes emanating from the dark DNA codons associated with the opening DNA extend to the other side - possibly through the channels so that there is a strong correlation between the directions of flux tubes and their endpoints are close to each other. If they have same value of h_{eff} they would have same length. They would reconnect with dark codons at the other side connected to nucleotide triplets by long flux tubes and the process would continue in the same manner as in the ordinary replication.

2.2 What selected the biomolecules?

Why only very few candidates for relevant biomolecules are actually selected? Who/what selected and how? This leads to very unpleasant questions circumvented by deciding that the emergence of life was nothing but a thermodynamical fluctuation. It has however become clear that complex organic molecules are present even in interstellar and intergalactic space. The miraculous thermodynamical fluctuation explaining evolution without real evolution would have been really huge.

More philosophically minded tends to conclude that we simply have no clue about what selection at the bio-molecular level really is and continue that some new physics is involved so that it is time to think giving up the reductionistic narrative.

The selection problem appears also at the level of biochemical reaction pathways. One can imagine endless variety of "reaction vertices". If one assumes that only very few basic "reaction vertices" are allowed but the rest not, one can construct a limited number of reaction pathways. But this is an ad hoc assumption: this selection of allowed reaction pathways certainly occurs but we do not have a slightest idea about the physics behind it.

There is also an analogy with computer science. One can construct endless variety of linguistically correct computer programs: why only very few of them would be selected. And with neuroscience: from a huge array of behavioral patters only some are selected.

Here one can of course try a loophole: Darwinian selection. But there is no selection in the Universe of physicalist. This would require free will and intentionality. The trick does not work.

But what about this network in which biomolecules are connected by this something already mentioned?, asks philosopher. Could this something connect only biomolecules if they are in the same relationship as sender and receiver of radio signal. Could these somethings connect stably only systems possessing common resonance frequencies? Could this criterion could select both the preferred biomolecules and the "reaction vertices" and thus also reaction pathways.

One can develop this idea further.

1. The resonance between systems with the same value of h_{eff} would be both frequency - and energy resonance. The resonance between systems with different values of h_{eff} requires change of h_{eff} of either system so that h_{eff} is same for the systems. Energy is conserved, which means that the frequency of the photon would change to satisfy $E = h_{eff,1}f_1 = h_{eff,2}f_2$. One would have only energy resonance.

   The resonance of dark matter states with bio-molecules would be energy resonance and make it possible for long scales to control short scales by inducing molecular transitions. The transformed photons could have interpretation as bio-photons [K7, K8].

2. One can however argue that mere resonance is not enough to select bio-molecules. Magnetic flux tubes containing dark particles can vary their thickness and by the conservation of the monopole flux also magnetic field and cyclotron frequency so that they can get in resonance with any bio-molecule. A stronger condition is required.

   The obvious idea is that also biomolecules can be in resonance and surviving bio-molecules are able to build networks. Selection would not be selection of mere individuals but that of networks able to co-operate. There would be a choir singing resonantly in unisono rather than only resonating pairs. The biomolecules involved would have common transition energies which would poses extremely strong conditions on survivors.

2.3 Genetic code

Genetic code definitely represents information. Is it really an outcome of thermodynamical fluctuation? Is there some deep mathematics associated with the genetic code?, asks the philosopher now. Be patient!

Genome contains also intronic portion: most of it consists of introns and the intronic portion is the larger the higher the evolutionary level is. The prevailing interpretation has been as "junk". Is it really junk?, wonders philosopher. Luckily, the attitude that trash bin represents the highest level of evolution has begun to slowly change to more rational one.

Could there be a beautiful mathematics behind genetic code? Could it be something similar to codes in computer science and have not only one representation - the chemical one - but numerous representations? If computer science would have developed before genetics - this question would have been completely natural and we would probably know a lot about these representations. Could this dark matter with large Planck constant at these mysterious somethings identified by our philosopher tentatively as magnetic flux tubes realize the really fundamental representation of the genetic code and also of of DNA, RNA, tRNA, and amino-acids (AAs) in information theoretic sense? And could also radiation provide realization of genetic code necessary for communications? This is what the philosopher claims [L5, L11, L10, L2, L16].

The most plausible vision at this moment is that since magnetic body is the boss, chemical code should be incomplete secondary representation of more fundamental genetic code realized at the level of magnetic body controlling bio-matter. The realizations based on 3-proton triplets and dark light 3-chords defining icosa-tetrahedral representation of the genetic code in terms of Hamiltonian cycles [L18] would be the deeper realizations. There would be several Hamiltonian cycles distinguishing assignable to the same chemical representation of the genetic code. The analogy with music suggests that the realization in terms of 3-chords defining bio-harmony gives rise to quantum correlates of emotions assignable to magnetic body as kind of higher level sensory perceptions. Genetic codon as 6-bit unit would correspond to the "bitty" aspects of intelligence and harmony would correspond to emotional intelligence as the holistic aspect of intelligence [L18, L2]. Emotions would be realized already at the level of magnetic body [L13, L27, **?**].

The recent findings that the RNA of a conditioned sea snail scattered over neurons of second sea snail in Petri dish generate neuronal correlates of conditioning supports the view that the magnetic body of the RNA of sea snail infects the emotion/mood related to the conditioning. The emotional state, mood, of DNA and RNA would affect gene expression. Epigenesis is a poorly understood in standard biology and could be based on emotional states lasting for several generations. This is natural in ZEO [L2, L22].

How different representations of the genetic code relate to each other?

1. The natural hypothesis is that given dark codon generates corresponding light 3-chord in communications and control. Alike likes alike rule of homeopathy suggests that triple resonance between identical codons is the basic mechanism of communications between various representations. Similar codons of DNA sequences would be in resonance if the mood defined by bio-harmony is same for them. For the same value of h_{eff} one would have both energy and frequency resonance for different values only energy resonance.

2. The condition that all possible - or at least some - moods coded by Hamiltonian cycles are realized, poses additional conditions on ordinary DNA codons since given codon should be able to respond to several 3-chords resonantly. An open question is whether ordinary codons responds via triple resonance or to the energy associated with the sum of the three frequencies in which case one can consider the possibility that the sum of frequencies does not depend of bio-harmony.

3. Since dark protons are entangled and do not allow a decomposition to letters, it is not possible to realize the correspondence with ordinary codons by assigning a frequency separately to each nucleotide: the chemical codon reacts as a holistic entity [L18]. This gives highly non-trivial conditions on transcription and DNA replication: DNA and RNA nucleotides must form loose codons connected to dark codon by long flux tubes and in transcription/replication these flux tubes shorten. This allows to understand [L1] also the remote replication of DNA reported by Montagnier et al [I3]. The loose codons formed by nucleotides and dark codons would be very similar to tRNA codons except that the flux tubes connecting dark codon to nucleotide would be long.

3 Metabolism

Metabolism is one of the key aspects of biology. We must eat and plants must busily photosynthesize in order to survive. But why metabolic energy feed is needed? Again a mystery.

3.1 Non-equilibrium thermodynamics

Non-equilibrium thermodynamics is one attempt to answer this question. Thermodynamical equilibrium is completely uninteresting, entropy is maximal and in the case of local dynamics the state of system is completely determined by a small sample of it. However, if one has energy feed, situation changes since equilibrium becomes flow equilibrium. The energy feed guarantees that there is macroscopic dynamics rather than mere thermal motion at microscopic level.

Also in this case one has essentially the same situation everywhere unless one introduces macroscopic parameters - also energy flow - depending on time and position to get something more interesting. Simple reaction kinematics determined by differential equations can be replaced with that determined by partial differential equations obtained by allowing diffusion. Also temperature, pressure and other thermodynamical parameters can be allowed to depend on position and time. Turing proposed a model for the coloring of Zebra as outcome of this kind of dynamics. The model for neuronal membrane and nerve pulse generation is also a rough model trying to reproduce basic facts about nerve pulse generation using thermodynamics for neuronal membrane regarded as a capacitor. This is of course a mere parameterization of the situation. TGD leads to a quantum model for the situation [K2]. Also the interpretation about the role of nerve pulse patterns at neuronal level changes dramatically [L6, L13].

In non-equilibrium thermodynamics one speaks of self-organization. One can generalize this notion to quantum self-organization and the crucial criticality associated to the transitions between different self-organization patterns generalizes to quantum criticality [K4]. Could these transitions correspond to spatio-temporal self organization patterns, behaviors, functions, programs. This in turn leads to deep connections with conformal symmetry (even its generalization in TGD), fractality, and universality of the dynamics. It is a pity that biologists do not seem to know much about these possibilities.

3.2 ZEO based view about quantum self-organization

Could it be that 4-D deterministic time evolution between initial and final states could be more fundamental than the 3-D snapshot? Could superpositions of these 4-D evolutions define quantum states. If so, the state function reductions would occur between these superpositions and their non-determinism would be consistent with the determinism of field equations. Free will would not break laws of physics. It would be like starting new deterministic computer program. Our philosopher calls this ontology Zero Energy Ontology (ZEO) and claims that it leads to a theory of consciousness as a generalization of quantum measurement theory [L9] (see `http://tinyurl.com/ycxm2tpd`). Irritating.

ZEO based quantum measurement theory predicts that in ordinary state function predicts that the arrow of time changes in ordinary state function reductions but is preserved in "small" state function reductions identifiable as analogs of so called weak measurements. The recent strange findings of Minev et al [L19] provide direct evidence for the change of the arrow of time in state function reductions of atomic systems [L19].

ZEO predicts also the possibility of signals propagating backwards in time. This led to the vision that episodal memories involve communications with the brain of geometric past [K3], to the idea that motor actions and sensory perception are time reversals of each other [L17]: motor action would involve sending of negative energy control signals to the geometric past, and to the notion of remote metabolism based on quantum credit card mechanism. One can say that the system sends negative energy to a system able to receive it rather than receiving positive energy.

The energy of system as a function of h_{eff} increases when other parameters are kept constant. It costs energy build intelligence. h_{eff} for a given sub-system tends also to reduce spontaneously. Hence there must be continual energy feed to keep the level of conscious intelligence. A highly interesting possibility that this condition applies to all self-organizing systems. Self-organization generates long range coherence and requires energy feed. Could it be that dark matter makes itself visible by giving rise to long range correlations and coherence induced by dark matter at the magnetic body of the system [L23]?

Just as life also self-organization involves generation of coherence in long scales and requires energy feed. In the model for living system relying on dark matter as $h_{eff} = n \times h_0$ phases at magnetic body of the system coherence is induced by quantum coherence of the dark matter, and metabolic energy feed is required to increase h_{eff} tending to reduce spontaneously. Could self-organization be quite generally modelled in the same manner so that dark matter would make itself visible in everyday physics [L23]? Could the realizations of the genetic code in terms of dark nuclei and dark photon 3-chords be involved with the self-organization of water and be involved with morphogenesis?

3.3 Does metabolic energy feed generate conscious information?

The basic question about the role of metabolic energy remains, says the philosopher. What is its real role? Energy feed generates structures and structural complexity means information. It seems that metabolic energy feed involves also a feed of information or generation of information. And because living systems are in question, philosopher cannot avoid the question whether this information is actually conscious information. Is there any other kind of information than conscious information?!

To this question standard physics has no answer: it can only describe entropy mathematically and identification of information as lack of entropy is the easy answer suggested in lack of anything better. The question about a possible measure for conscious information analogous to Shannon entropy is one manner to end up with p-adic physics as a correlate of cognition and the necessary fusion of real and various p-adic physics leads to adelic physics [L7, L8]. Adelic physics in turn predicts - surprise- surprise - a hierarchy of phases of matter labelled by the value of Planck constant $h_{eff}/h_0 = n$ defining the dimension of the extension of rationals defining the adele. These phases residing at these somethings defining the networks - magnetic flux tubes - make possible macroscopic quantum coherence inducing the coherence of living matter.

Quite generally, the energies of states as function of h_{eff} increase. For instance, atomic binding energy scales decreases like h_{eff}^2 and cyclotron energies scale like h_{eff}. In order to generate phases with non-standard value of h_{eff} energy feed is needed. This energy is identifiable as metabolic

energy.

In adelic physics [L8, L7] h_{eff} serves as a measure for the IQ of the living system in well-defined system. The higher its value, the better changes the system has for generating conscious information - and also for destroying it. This leads to a rather concrete view about the origin of good and evil. The ethics and moral are simple: good deed increases the conscious information of the universe. Conscious entity can choose whether to increase the conscious information of the universe or reduce it. Evil deeds indeed lead to a reduction of conscious information of the universe since the doer cannot confess others or even himself what he did. Also the members of community become secretive - complex encryption schemes develop. The self-knowledge of the universe knows is reduced. Luckily, evolution unavoidably occurs in statistical sense and resources of conscious information increase in long enough time scale.

3.4 Remote metabolism as a purely thermodynamical universal mechanism in ZEO

Quite recently (towards end of 2019) I found a more precice formulation for the intuitive notion of remote metabolism, which strongly suggests that energy is conserved in ZEO. There is a decomposition to system and the energy energy source: call them A and B. Intuitively, A receives energy from B by sending negative energy to B. What does this really mean?

1. A "big" (ordinary) state function reduction reversing arrow of time takes place: this would correspond to sending negative energy signal to past. The energy of A+B in the final time reversed state at new passive boundary of CD would be shared in new manner such that one can say that A has received from B the metabolic energy.

2. Energy would be conserved. I have also considered the interpretation that the total energy of the system associated with CD increases [K5] [L26]: since CD itself breaks Poincare invariance, it seems that one cannot exclude this. However, the Poincare invariance is realized at the level of moduli space for the positions of the either boundary of CD, and one can assume energy conservation. Even the wave functions at the boundary of CD can be taken to be in the representations of Lorentz group acting as its isometries. Plane waves correspond to wave functions in the moduli space for the boundary of CD keeping second boundary fixed.

3. To make this more precise one must define metabolic energy more precisely by introducing the hierarchy of Planck constants and the fact that the increase of h_{eff} of sub-system keeping other parameters constant increases it energy. Second law means that A tends to loose energy due to the decrease of h_{eff} for its sub-systems. This is true also for the time-reversed state but in opposite direction of geometric time so that with respect to standard direction of time the energy increases. This would provide extremely general purely thermodynamical mechanism of remote metabolism.

3.5 A model of protocell based on Pollack effect

I learned about extremely interesting Quanta Magazine article (`http://tinyurl.com/y34o784j`) telling about findings related to water droplets as protocells able to perform chemical metabolism as a transfer of molecules to exterior and back. See

The work is carried out by David Zwicker and collaborators at the Max Planck Institute for the Physics of Complex Systems and the Max Planck Institute of Molecular Cell Biology and Genetics, both in Dresden. The report about the work is published in Nature Physics.

In a simplified model for the droplets (P-granules in C-elegans cell is the real life example) the proteins in droplet can be in two states: in state A the stay in droplet and do not get out but can enter to the droplet from outside. In state B they can get out from droplet. To get into state B energy such as sunlight would be required.

TGD suggests a concrete counterpart for the droplet as exclusion zones (EZs) induced by energy feed such as radiation in water in Pollack effect. EZs are able remove inpurities from interior in conflict with second law. TGD based explanation of the mystery is change of the arrow of time induced by TGD counterpart of ordinary state function reduction in zero energy ontology (ZEO): self-organization would be dissipation with reversed arrow of time at at the magnetic body (MB)

of system acting as master and forcing time reversed evolution at the level of ordinary bio-matter serving as a slave.

TGD suggests for the model of protocell as droplet a realization as exclusion zone (EZ) generated in Pollack effect.

1. The exclusion zones (EZs) discovered by Pollack [I7, I6, I1, I4, L3] (`http://tinyurl.com/oyhstc2`) behave just like this. TGD allows to build a model of the Pollack effect [L3] (`http://tinyurl.com/gwasd8o`). The formation of EZs requires water bounded by a gel phase and they are negatively charged. Their really strange feature is that they throw out impurities just like state B in the model: this seems to defy second law telling that gradients tend to disappear. This makes possible primitive chemical metabolism involving exchange of chemicals between droplet and exterior. Light signal initiating the transfer by providing the metabolic energy needed. Transfer would stop as light signal stops.

   In TGD inspired quantum biology EZs are in crucial role. For instance, cell is negatively charged as also DNA double strand. Interpretation as EZs is natural.

2. The explanation for the negative charge of EZ is that part of protons and possibly other ions go to magnetic flux tubes forming the magnetic body (MB) of the system [L15, L24] (`http://tinyurl.com/yyyk6fu8` and `http://tinyurl.com/yjhx9xp7`). Dark ions form phases with nonstandard value $h_{eff} = n \times h_0 > h$ of effective Planck constant as cyclotron Bose-Einstein condensates. This system has long length scale quantum coherence and serves as a master controlling bio-chemistry, which is in the role of slave. This forces the mysterious coherence of the ordinary bio-matter impossible in life-as-mere-chemistry approach.

3. MB could control chemical metabolism of the droplet by sending dark photons to the droplet transforming to bio-photons and generating EZ state in the droplet and initiating transfer of molecules to the outside. The transition reducing the value of h_{eff} at MB would bring protons back to EZ droplet and it would become normal again. Secpnd law would force the molecules from outside to diffuse back to the droplet.

4. There is still one hard problem to be solved. What causes the mysterious removal of impurities from EZ challenging second law? Here zero energy ontology (ZEO) comes in rescue [L25] (`http://tinyurl.com/wd7sszo`). In ZEO macroscopic quantum jump corresponding to ordinary state function reduction changes the arrow of time . This would occur to MB as EZ is formed. Second law holds still true but in reverse time direction. MB is the boss and forces time reversal also at the level of ordinary bio-matter. The usual diffusion of molecules to cell occurs but with reverse arrow of time and explains the mysterious removal of impurities observed by Pollack for EZs.

All biological self-assembly processes would use this mechanism. In fact, self-organization quite generally would be dissipation in reverse direction of time: this would explain self-assembly aspect of self-organization. The big quantum jumps would inducing change of the arrow of time would tend to increase of h_{eff} in statistical sense (h_{eff} is identifiable number theoretically essentially as the dimension of extension of rationals and bound to increase in statistical sense). This would correspond to the evolutionary aspect of self-organization [L8, L15]. The increase of h_{eff} requires energy since the energy of state increases with h_{eff} with other parameters kept constant. Energy feed is therefore needed. Dark matter n TGD sense would make itself visible in everyday life.

4 The mystery of replication

Replication is one of the deepest mysteries of biology. It is really something totally counterintuitive if cell is seen as a sack of water plus some chemicals. We have a lot facts about what happens in the replication at DNA level but how this miracle happens is a mystery. At cell level the situation gets even more complex.

One might think that behind the chemistry there might lurk a much simpler quantum dynamics and that chemistry only makes its best to mimic this deeper dynamics. Is biochemistry controlled by something? Does this something provide a template for the dynamics at chemical level? The

idea about the presence of this something popped up already in the mystery of EEG. What could this something perhaps receiving sensory information from vertebrate brain and maybe providing feedback as control signals affecting also chemistry?

One is forced to attack the length scale reductionism again. Isn't it quite too much to require that all these replications in different length scales would result as accidental "emergence" due to thermodynamical fluctuations? Could the dynamics be fractal with essentially same patterns - for instance replication - occurring in different scales. Could this dynamics be induced by what happens on this something.

Philosopher also suggests a concrete model for the controlling level: dark matter with large value of Planck constant $h_{eff}/h_0 = n$ at magnetic flux tubes and asks whether the conjectured dark realization of DNA in various scales performs the fundamental replication inducing in turn the biological replication in various scales as a mimicry? This would simplify the situation enormously but in totally different manner than length scale reductionism. Morphogenesis controlled by the hierarchy of dark realizations of genetic code would be the basic vision (see `http://tinyurl.com/yalny39x`). This would simplify the situation enormously but in totally different manner than length scale reductionism.

TGD suggests also a purely topological element involved with replication. Magnetic body (MB) could replicate [K6]. Replication would be like 3-vertex of Feynman diagram representing the decay of a particle to two particles. MB or part of it regarded as particle like entity splits into two. The incoming 4-surface and two outgoing 4-surfaces meet along 3-D surface common to all three. After that various molecules would self-organize around the resulting templates. This could happen also for the MB of dark DNA in replication and induce the bio-chemical part of replication.

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