Water Memory and the Realization of Genetic Code at Elementary Particle Level

M. Pitkänen
Email: matpitka@mappi.helsinki.fi.
http://www.helsinki.fi/∼matpitka/.

October 10, 2008

Contents

Abstract

This article represents a speculative model in which a connection between homeopathy and water memory with phantom DNA effect is proposed and on basis of this connection a vision about how the hardware of topological quantum computation (tqc) represented by the genome is actively developed by subjecting it to evolutionary pressures represented by a virtual world representation of the physical environment and internal mileau including basic bio-molecules. The most important result is the discovery that the analogs of DNA, RNA and aminoacid are realized as dark nuclei realized as neutral dark nuclear strings. Vertebrate nuclear genetic code is predicted correctly. The result suggests deep and totally unexpected connection between elementary particle physics and biology.

1 Introduction

The Benveniste's discovery of water memory [Benveniste et al 1988, Benveniste 1989] initiated quite dramatic sequence of events. The original experiment involved the homeopathic treatment of water by human antigene. This meant dilution of the water solution of antigene so that the concentration of antigene became extremely low. In accordance with homeopathic teachings human basophils reacted on this solution.

The discovery was published in Nature and due to the strong polemic raised by the publication of the article, it was decided to test the experimental arrangement. The experimental results were reproduced under the original conditions. Then it was discovered that experimenters knew which bottles contained the treated water. According to Wikipedia article [11], the modified experiment in which experimenters did not possess this information failed to reproduce the results and the conclusion was regarded as obvious and Benveniste lost his laboratory among other things. Obviously any model of the effect taking it as a real effect rather than an astonishingly simplistic attempt of top scientists to cheat should explain also the claimed failure: I have proposed this kind of model in [2].

However, according to experimenters themselves (I am grateful for Yolene Thomas for giving references about this) only 2 experiments of 200 were not replicated and the experiments have been replicated later in several laboratories. Since the Nature publication in 1988, several laboratories have attempted to repeat Benvenistes original basophil experiments. A consortium of four independent research laboratories in France, Italy, Belgium, and Holland, led by M. Roberfroid at Belgium's Catholic University of Louvain in Brussels, confirmed that high dilutions of histamine modulate basophil activity. More than three-thousand-six- hundred experiments were randomized and carried out under blind conditions (an example of quite recent work is [Ennis 1999,2004]. One cannot avoid the impression that materialistic dogma is heavier than facts.

In the sequel a speculative picture about the connection between homeopathy and water memory [2] with phantom DNA effect is proposed and on basis of this connection a vision about how the hardware of topological quantum computation (tqc) represented by the genome is actively developed by subjecting it to evolutionary pressures represented by a virtual world representation of the physical environment.

The original idea was that water molecule clusters could mimic vibrational and rotational spectra of molecules and in this manner give rise to water memory. The fact that the frequencies involved are however much lower, suggest that it is magnetic body of the molecules which is mimicked: perhaps water molecule structures simply "steal" the magnetic body of some molecules used to manufacture the homeopathic remedy. To understand homepathy one must however assume that these water molecular clusters are able to replicate and thus define exotic life forms.

Water molecule clusters could be carriers the replicating exotic form of life but there are also other possibilities. The question whether also biomolecules such as DNA, RNA, and aminoacids could have virtual world counterparts gives very strong constraints on possible candidates. The TGD based model for cold fusion [1] suggests a possible candidate: dark nuclear strings with large Planck constant and therefore scaled up size which corresponds to atomic or molecular scale. The amazing discovery - and the main result of this work - is that a simple model for dark baryons predicts counterparts of DNA and RNA nucleotides and of amino-acids as neutral dark baryons and also exact realization of vertebrate nuclear genetic code as also the counterparts of replication, transcription, translation processes. This suggests a deep connection between elementary particle physics and biology: something completely unimaginable in reductionistic world but very natural in fractal Universe.

2 A possible realization of water memory

The model based on the notion of field body and general mechanism of long term memory allows to explain both the memory of water.

1. Also molecules have magnetic field bodies acting as intentional agents controlling the molecules. Nano-motors do not only look co-operating living creatures but are such. The field body of the molecule contains besides the static magnetic and electric parts also dynamical parts characterized by frequencies and temporal patterns of fields. To be precise, one must speak both field and relative field bodies characterizing interactions of molecules. Right brain sings-left brain talks metaphor might generalize to all scales meaning that representations based on both frequencies and temporal pulse with single frequency could be utilized.

2. The effects of complex bio-molecule to other bio-molecules (say antigene on basofil) in water could be characterized to some degree by the temporal patterns associated with the dynamical part of its field body and bio-molecules could recognize each other via these patterns. This would mean that symbolic level in interactions would be present already in the interactions of bio-molecules. Cyclotron frequencies are most natural candidates for the frequency signatures and the fact that frequencies in 10 kHz range are involved supports this view.

3. The original idea was that water molecule clusters are able to mimic the bio-molecules themselves -say their vibrational and rotational spectra could coincide with those of molecules in reasonable approximation. A more natural idea is that water clusters or some other structures can mimic the

field bodies of the molecules. Homeopathy could rely on extremely simple effect: water molecule clusters (or some other objects) would steal the magnetic bodies of the molecules used to manufacture the homeopathic remedy. The shaking of the bottle containing the solution would enhance the probability for bio-molecule to lose its magnetic body in this manner. For instance, water could produce fake copies of say antigenes recognized by basofils and reacting accordingly if the reaction is based on interaction with the magnetic body of the antigene.

4. The basic objection against this picture is that it does not explain why the repeated dilution works. Rather, it seems that dilution of molecules reduces also the density of mimicking pseudo-molecules. Even more, the potency of the homeopathic remedy is claimed to increase as the the dilution factor increases. Also alcohol is used instead of water so that also alcohol must allow homeopathic mechanism. (I am grateful for Ulla Matfolk for questions which made me to realize these objections).

   (a) The only way out seems to be that the magnetic bodies or water molecule clusters or possible other structures having these magnetic bodies can replicate. The shaking of the remedy could provide the needed metabolic energy so that the population of magnetic bodies grows to a limiting density determined by the metabolic energy feed. In principle it would be possible to infect unlimited amount of water by these pseudo-molecules. When in bottle the population would be in dormant state but in the body of the patient it would wake up and form a population of molecular actors and stimulate the immune system to develop immune response to the real molecule.

   (b) The potency of the homeopathic remedy is claimed to increase with the increased dilution factor. This would suggest that the continued dilution and shaking also increases the density of pseudo molecules, perhaps by feeding to the system metabolic energy or by some other mechanism.

   (c) Also magnetic bodies must replicate in cell replication and their role as intentional agents controlling bio-matter requires that this replication serves as a template for biochemical replication. On can indeed interpret the images about cell replication in terms of replication of dipole type magnetic field. This process is very simple and could have preceded biological replication. The question is therefore whether water is actually a living system in presence of a proper metabolic energy feed. Also the water's ability near critical point for freezing to form nice patterns correlating with sound stimuli might be due to the presence of the molecular actors.

   (d) This picture fits nicely with the vision that evolution of water in this kind of life form might have happened separately and that pre-biotic chemical life forms have formed symbiosis with living water [4]. In the model of DNA as topological quantum computer [3] the asymptotic self organization patterns of water flow in the vicinity of lipid layers indeed define quantum computer programs by inducing the braiding of the magnetic flux tubes connecting DNA nucleotides to lipids so that this symbiosis would have brought in new kind of information processing tool.

5. The magnetic body of the molecule could mimic the vibrational and rotational spectra using harmonics of cyclotron frequencies. Cyclotron transitions could produce dark photons, whose ordinary counterparts resulting in de-coherence would have large energies due to the large value of $\hbar$ and could thus induce vibrational and rotational transitions. This would provide a mechanism by which molecular magnetic body could control the molecule. Note that also the antigenes possibly dropped to the larger space-time sheets could produce the effect on basofils.

6. There is a considerable experimental support for the Benveniste's discovery that bio-molecules in water environment are represented by frequency patterns, and several laboratories are replicating the experiments of Benveniste as I learned from the lecture of Yolene Thomas in the 7:th European SSE Meeting held in Röros [Strand 2007]. The scale of the frequencies involved is around 10 kHz and as such does not correspond to any natural molecular frequencies. Cyclotron frequencies associated

with electrons or dark ions accompanying these macromolecules would be a natural identification if one accepts the notion of molecular magnetic body. For ions the magnetic fields involved would have a magnitude of order .03 Tesla if 10 kHz corresponds to scaled up alpha band. Also Josephson frequencies would be involved if one believes that EEG [5, 6] has fractally scaled up variants in molecular length scales.

3 Could virtual DNAs allow a controlled development of the genome?

The fundamental question in the evolution biology is the question about the interaction between genome (G), phenotype (P), and environment (E).

1. The standard dogma is that the information transfer from G to P is unidirectional and that environment acts on G by inducing random mutations of G, from which E selects the lucky survivors as those with the best ability to reproduce. Lamarckism [Giuditta 1982, **?**, 12] represents a deviation from standard dogma by assuming direct information transfer from E to G.

2. Genetic expression is controlled by environment, at least by silencing [12], which is like selecting only few books to be read from a big library. Cell differentiation represents basic example of selective gene expression. DNA methylation and transposition are accepted to reflect information transfer from E to G, perhaps via P. These modifications are believed to be short lasting and not transferred to the offspring since it is difficult to imagine a mechanism transferring the mutations to the germ cells. There is however also evidence that epigenetic information transfer takes place [Pembrey 2002]: this transfer would be selective expression of genes of germ cells rather than that of modified genes.

3. The question however remains whether the $G \to P - E$ actually could complete to a closed loop $G \to P - E - G$ so that genome could directly respond to the changing physical environment and could transfer the successful response to the next generation [Giuditta 1982].

3.1 Could genome be developed like computer hardware?

In TGD framework the sequence $G \to P - E$ is replaced with a closed loop $G - P - M - E$ to which E is attached at P by bidirectional arrow (organisms do also modify their environment actively). Magnetic body thus controls genome and receives information from cell membrane (P). The hierarchy of genomes (super-genome, hyper-genome,...) corresponding to the different levels of dark matter hierarchy allows this loop to be realized in different scales rather only at the level of single cell.

The question is whether the magnetic body of organism or higher level magnetic bodies could modify genomes, super-genomes, and hyper-genomes directly, perhaps by generating mutations of the genome in a short time scale; by monitoring how genetically modified organism survives in the environment; and -if the outcome of the experiment is successful - replacing the corresponding portion of DNA with the modified DNA both in ordinary germ cells. One can even ask whether the abstract model of the external environment provided by the internal chemical milieu might be mimicked by water magnetic bodies of water molecule clusters and provide a virtual world testing ground for a search of favorable mutations.

In DNA as a tqc [3] vision essentially the development of a new computer hardware would be in question, and should take place in a controlled manner and involve an experimentation before going to the market rather than by random modifications taking place in computer CPUs. Second basic aspect of DNA as tqc paradigm is that water and bio-molecules live in symbiosis in the sense that self organization patterns of the cellular water flow define the tqc programs. The following first guess for how the development of computer hardware might be achieved is just a first guess but might have something to do with reality.

1. What would be needed is a mechanism generating rapidly modifications of DNA. The mutations should be carried out using a kind of virtual DNA mimicking all the essential aspects of the symbolic dynamics associated with DNA. The magnetic bodies of DNA consisting of flux tubes connecting the nucleotides of DNA strands to cell membrane satisfy these conditions since A,T,G,C is coded to exotic light quarks u, d and anti-quarks $\overline{u}$, $\overline{d}$ at the ends of flux tubes [3]. DNA nucleotides could be replaced with clusters of water molecules but also other options can be imagined. Note that it does not matter when one speaks of mimicry of RNA or DNA molecules.

2. If the proposed model of the phantom DNA and homeopathy has something to do with reality, this kind of virtual DNA exists and is generated in phantom DNA effect as magnetic bodies of DNA, including of course the magnetic flux tubes connecting the nucleotides to the cell membrane or conjugate strand of DNA.

3. The crucial additional assumption would be that also the reversal of phantom DNA effect [Gariaev et al 1991] is possible and corresponds to the analog of DNA replication in which nucleotides attach to the virtual conjugate nucleotides of the virtual DNA strand or RNA strand in turn transformed to DNA strand be reverse transcription. The hypothesis would have rather strong implications for the genetic engineering since homeopathic remedies of genetically engineered DNA sequences could be transferred to cell nuclei just by drinking them.

4. Phantom DNA sequences could form populations and - as far as their properties as a hardware of topological quantum computer are involved - evolve under selection pressures of the virtual world defined by the nuclear, cellular and extracellular water. A competition of components of tqc hardware developed by the higher level magnetic body to realize optimally tqc programs needed for survival would be in question. The simplest mutation of phantom DNA would replace the quark pairs at the ends the (wormhole-) magnetic flux tube with a new one and could occur in very short time scale. Also basic editing operations like cutting and pasting would be possible for these competing phantom DNA sequences. The winners in the competition would be transformed to actual DNA sequences by utilizing the reverse phantom DNA (or RNA -) effect and be inserted to genome. The genetic machinery performing cutting, gluing, and pasting of real DNA in a controlled manner exists. What is needed is the machinery monitoring who is the winner and making the decision to initiate the modification of the real DNA.

5. The transfer of the mutations to germ cells could be achieved by allowing the population of the virtual DNA sequences to infect the water inside germ cells. The genetic program inducing the modification of DNA by using the winner of the tqc hardware competition should run automatically.

6. One open question is whether the nuclear, cellular or perhaps also extracellular water should represent the physical environment and - if answer is affirmative - how it achieves this. As a matter fact, considerable fraction of water inside cells is in gel phase and it might be that the intercellular water, which naturally defines a symbolic representation of environment, is where the virtual evolution takes place. Internal chemical milieu certainly reflects in an abstract manner the physical environment and the ability of the water molecule clusters to mimic bio-molecules would make the representation of the chemical environment possible. Also sudden changes of external milieu would be rapidly coded to the changes in internal milieu which might help to achieve genetic reorganization. The craziest dream is water based simulation of both genes, proteins, and molecules representing external world running at dark space-time sheets.

3.2 Dark nuclear strings as analogs of DNA-, RNA- and amino-acid sequences and baryonic realization of genetic code?

The minimal option is that virtual DNA sequences have flux tube connections to the lipids of the cell membrane so that their quality as hardware of tqc can be tested but that there is no virtual variant of transcription and translation machinery. One can however ask whether also virtual amino-acids could be present and whether this could provide deeper insights to the genetic code.

1. Water molecule clusters are not the only candidates for the representatives of linear molecules. An alternative candidate for the virtual variants of linear bio-molecules are dark nuclei consisting of strings of scaled up dark variants of neutral baryons bound together by color bonds having the size scale of atom, which I have introduced in the model of cold fusion and plasma electrolysis both taking place in water environment [1]. Colored flux tubes defining braidings would generalize this picture by allowing transversal color magnetic flux tube connections between these strings.

2. Baryons consist of 3 quarks just as DNA codons consist of three nucleotides. Hence an attractive idea is that codons correspond to baryons obtained as open strings with quarks connected by two color flux tubes. The minimal option is that the flux tubes are neutral. One can also argue that the minimization of Coulomb energy allows only neutral dark baryons. The question is whether the neutral dark baryons constructed as string of 3 quarks using neutral color flux tubes could realize 64 codons and whether 20 aminoacids could be identified as equivalence classes of some equivalence relation between 64 fundamental codons in a natural manner.

The following model indeed reproduces the genetic code directly from a model of dark neutral baryons as strings of 3 quarks connected by color flux tubes.

1. Dark nuclear baryons are considered as a fundamental realization of DNA codons and constructed as open strings of 3 dark quarks connected by two colored flux tubes, which can be also charged. The analogs of DNA -, RNA -, and of amino-acid sequences would in turn correspond to sequences of dark baryons. It is assumed that the net charge of the dark baryons vanishes so that Coulomb repulsion is minimized.

2. One can classify the states of the open 3-quark string by the total charges and spins associated with 3 quarks and to the two color bonds. Total em charges of quarks vary in the range $Z_B \in \{2, 1, 0, -1\}$ and total color bond charges in the range $Z_b \in \{2, 1, 0, -1, -2\}$. Only neutral states are allowed. Total quark spin projection varies in the range $J_B = 3/2, 1/2, -1/2, -3/2$ and the total flux tube spin projection in the range $J_b = 2, 1, -1, -2$. If one takes for a given total charge assumed to be vanishing one representative from each class (J_B, J_b), one obtains $4 \times 5 = 20$ states which is the number of amino-acids. Thus genetic code might be realized at the level of baryons by mapping the neutral states with a given spin projection to single representative state with the same spin projection. The problem is to find whether one can identify the analogs of DNA, RNA and aminoacids as baryon like states.

1. States in the quark degrees of freedom

Consider first the states of dark baryons in quark degrees of freedom. These states can be constructed as representations of rotation group and strong isospin group.

1. The tensor product $2 \otimes 2 \otimes 2$ is involved in both cases. Without any additional constraints this tensor product decomposes as $4 \oplus 2 \oplus 2$: 8 states altogether. This is what one should have for DNA and RNA candidates. If one has only identical quarks *uuu* or *ddd*, one obtains only the 4-D representation corresponding to completely symmetric representation. These 4 states correspond to a candidate for amino-acids. Thus RNA and DNA should correspond to states of type uud and ddu and aminoacids to states of type uuu or ddd. What this means physically will be considered later.

2. It is known that only representations with isospin 3/2 and spin 3/2 (Δ resonance) and isospin 1/2 and spin 1/2 (proton and neutron) are realized as free baryons. Now of course a dark - possibly p-adically scaled up - variant of QCD is considered so that more general baryonic states are possible. The spin statistics problem which forced to introduce quark color strongly suggests that the construction of the codons as sequences of 3 nucleons is not a good idea.

3. Second nucleon like spin doublet - call it 2_{odd} - has wrong parity in the sense that it would require $L = 1$ ground state for two identical quarks (uu or dd pair). Dropping 2_{odd} and using only $4 \oplus 2$ for the rotation group would give degeneracies $(1, 2, 2, 1)$ and 6 states only. All the representations in $4 \oplus 2 \oplus 2_{odd}$ to get 8 states with a given quark charge and one should transform the wrong parity doublet to positive parity doublet somehow. Since open string geometry breaks rotational symmetry to a subgroup of rotations acting along the direction of the string, the attractive possibility is to add a stringy excitation with angular momentum projection $L_z = -1$ to the wrong parity doublet so that the parity comes out correctly. $L_z = -1$ orbital angular momentum for the relative motion of uu or dd quark pair in the open 3-quark string would be in question. The degeneracies for spin projection value $J_z = 3/2, ..., -3/2$ are $(1, 2, 3, 2)$. Genetic code means spin projection mapping the states in $4 \oplus 2 \oplus 2_{odd}$ to 4.

2. States in the flux tube degrees of freedom

Consider next the states in flux tube degrees of freedom.

1. The situation is analogous to a construction of mesons from quarks and antiquarks and one obtains the analogs of π meson (pion) with spin 0 and ρ meson with spin 1. States of a given charge correspond to the tensor product $2 \otimes 2 = 3 \oplus 1$ for the rotation group. Drop the singlet and take only the analog of neutral ρ meson. The physical meaning of this will be considered later.

2. Without any further constraints the tensor product $3 \otimes 3 = 5 \oplus 3 \oplus 1$ gives 8+1 states. By dropping the scalar state this gives 8 states required by DNA and RNA analogs. Bosonic statistics allows only 5 unless the two color bonds have different charges. The degeneracies of the states for DNA/RNA type realization with a given spin projection for $5 \oplus 3$ are $(1, 2, 2, 2, 1)$.

3. For aminoacids only 5 completely symmetric under the exchange of flux tubes is required and is achieved if the two color bonds have identical charges. Genetic code means the projection of the states of $5 \oplus 3$ to those of 5 with the same spin projection and same total charge.

3. Analogs of DNA,RNA, aminoacids, and of translation and transcription mechanisms

Consider next the identification of analogs of DNA, RNA and aminoacids and the baryonic realization of the genetic code, translation and transcription.

1. The analogs of DNA and RNA can be identified dark baryons with quark content uud and ddu and color bonds of different charges. There are 3 color bond pairs corresponding to charge pairs $(q_1, q_2) = (-1, 0), (-1, 1), (0, 1)$ (the order of charges does not matter). The condition that the total charge of dark baryon vanishes allows for uud only the bond pair $(-1, 0)$ and for udd only the pair $(-1, 1)$. These thus only single neutral dark baryon of type uud *resp.* udd: these would be the analogous of DNA and RNA codons. Amino-acids would correspond to either uuu or ddd with identical color bonds with charges $(-1, -1)$, $(0, 0)$, or $(1, 1)$. uuu with color bond charges (-1,-1) is the only neutral state. Hence only the analogs of DNA, RNA, and aminoacids are obtained, which is rather remarkable result.

2. The basic transcription and translation machinery could be realized as processes in which the analog of DNA can replicate, and can be transcribed to the analog of mRNA in turn translated to the analogs of amino-acids. In terms of flux tube connections the realization of genetic code, transcription, and translation, would mean that only dark baryons with same total quark spin and same total color bond spin can be connected by flux tubes. Charges are of course identical since they vanish.

3. Genetic code maps of $(4 \oplus 2 \oplus 2) \otimes (5 \oplus 3)$ to the states of 4×5. The most natural map takes the states with given spin to a state with the same spin so that the code is unique. This would give the degeneracies $D(k)$ as products of numbers $D_B \in \{1, 2, 3, 2\}$ and $D_b \in \{1, 2, 2, 2, 1\}$: $D = D_B \times D_b$.

Only the observed degeneracies $D = 1, 2, 3, 4, 6$ are predicted. The numbers $N(k)$ of aminoacids coded by D codons would be

$$[N(1), N(2), N(3), N(4), N(6)] = [2, 7, 2, 6, 3] \ .$$

The correct numbers for vertebrate nuclear code are $(N(1), N(2), N(3), N(4), N(6)) = (2, 9, 1, 5, 3)$. Some kind of symmetry breaking must take place and should relate to the emergence of stopping codons. If one codon in second 3-plet becomes stopping codon, the 3-plet becomes doublet. If 2 codons in 4-plet become stopping codons it also becomes doublet and one obtains the correct result $(2, 9, 1, 5, 3)$!

4. Stopping codons would most naturally correspond to the codons, which involve the $L_z = -1$ relative rotational excitation of uu or dd type quark pair. For the 3-plet the two candidates for the stopping codon state are $|1/2, -1/2\rangle \otimes \{|2, k\rangle\}$, $k = 2, -2$. The total spins are $J_z = 3/2$ and $J_z = -7/2$. The three candidates for the 4-plet from which two states are thrown out are $|1/2, -3/2\rangle \otimes \{|2, k\rangle, |1, k\rangle\}$, $k = 1, 0, -1$. The total spins are now $J_z = -1/2, -3/2, -5/2$. One guess is that the states with smallest value of J_z are dropped which would mean that $J_z = -7/2$ states in 3-plet and $J_z = -5/2$ states 4-plet become stopping codons.

4. Understanding the symmetries of the code

Quantum entanglement between quarks and color flux tubes would be essential for the baryonic realization of the genetic code whereas chemical realization could be said to be classical. Quantal aspect means that one cannot decompose to codon to letters anymore. This raises questions concerning the symmetries of the code.

1. What is the counterpart for the conjugation $ZYZ \to X_c Y_c Z_c$ for the codons?

2. The conjugation of the second nucleotide Y having chemical interpretation in terms of hydrophobia-hydrophily dichotomy in biology. In DNA as tqc model it corresponds to matter-antimatter conjugation for quarks associated with flux tubes connecting DNA nucleotides to the lipids of the cell membrane. What is the interpretation in now?

3. The A-G, T-C symmetries with respect to the third nucleotide Z allow an interpretation as weak isospin symmetry in DNA as tqc model. Can one identify counterpart of this symmetry when the decomposition into individual nucleotides does not make sense?

Natural candidates for the building blocks of the analogs of these symmetries are the change of the sign of the spin direction for quarks and for flux tubes.

1. For quarks the spin projections are always non-vanishing so that the map has no fixed points. For flux tube spin the states of spin $S_z = 0$ are fixed points. The change of the sign of quark spin projection must therefore be present for both $XYZ \to X_c Y_c Z_c$ and $Y \to Y_c$ but also something else might be needed. Note that without the symmetry breaking $(1, 3, 3, 1) \to (1, 2, 3, 2)$ the code table would be symmetric in the permutation of 2 first and 2 last columns of the code table induced by both full conjugation and conjugation of Y.

2. The analogs of the approximate $A - G$ and $T - C$ symmetries cannot involve the change of spin direction in neither quark nor flux tube sector. These symmetries act inside the A-G and T-C sub-2-columns of the 4-columns defining the rows of the code table. Hence this symmetry must permute the states of same spin inside 5 and 3 for flux tubes and 4 and 2 for quarks but leave 2_{odd} invariant. This guarantees that for the two non-degenerate codons coding for only single amino-acid and one of the codons inside triplet the action is trivial. Hence the baryonic analog of the approximate $A - G$ and $T - C$ symmetry would be exact symmetry and be due to the basic definition of the genetic code as a mapping states of same flux tube spin and quark spin to single representative state. The existence of full 4-columns coding for the same aminoacid would be due to the fact that states with same quark spin inside $(2, 3, 2)$ code for the same amino-acid.

3. A detailed comparison of the code table with the code table in spin representation should allow to fix their correspondence uniquely apart from permutations of n-plets and thus also the representation of the conjugations. What is clear that Y conjugation must involve the change of quark spin direction whereas Z conjugation which maps typically 2-plets to each other must involve the permutation of states with same J_z for the flux tubes. It is not quite clear what X conjugation correspond to.

5. Some comments about the physics behind the code

Consider next some particle physicist's objections against this picture.

1. The realization of the code requires the dark scaled variants of spin 3/2 baryons known as Δ resonance and the analogs (and only the analogs) of spin 1 mesons known as ρ mesons. The lifetime of these states is very short in ordinary hadron physics. Now one has a scaled up variant of hadron physics: possibly in both dark and p-adic senses with latter allowing arbitrarily small overall mass scales. Hence the lifetimes of states can be scaled up.

2. Both the absolute and relative mass differences between Δ and N *resp.* ρ and π are large in ordinary hadron physics and this makes the decays of Δ and ρ possible kinematically. This is due to color magnetic spin-spin splitting proportional to the color coupling strength $\alpha_s \sim .1$, which is large. In the recent case α_s could be considerably smaller - say of the same order of magnitude as fine structure constant 1/137 - so that the mass splittings could be so small as to make decays impossible.

3. Dark hadrons could have lower mass scale than the ordinary ones if scaled up variants of quarks in p-adic sense are in question. Note that the model for cold fusion that inspired the idea about genetic code requires that dark nuclear strings have the same mass scale as ordinary baryons. In any case, the most general option inspired by the vision about hierarchy of conscious entities extended to a hierarchy of life forms is that several dark and p-adic scaled up variants of baryons realizing genetic code are possible.

4. The heaviest objection relates to the addition of $L_z = -1$ excitation to $S_z = |1/2, \pm 1/2\rangle_{odd}$ states which transforms the degeneracies of the quark spin states from $(1, 3, 3, 1)$ to $(1, 2, 3, 2)$. The only reasonable answer is that the breaking of the full rotation symmetry reduces $SO(3)$ to $SO(2)$. Also the fact that the states of massless particles are labeled by the representation of $SO(2)$ might be of some relevance. The deeper level explanation in TGD framework might be as follows. The generalized imbedding space is constructed by gluing almost copies of the 8-D imbedding space with different Planck constants together along a 4-D subspace like pages of book along a common back. The construction involves symmetry breaking in both rotational and color degrees of freedom to Cartan sub-group and the interpretation is as a geometric representation for the selection of the quantization axis. Quantum TGD is indeed meant to be a geometrization of the entire quantum physics as a physics of the classical spinor fields in the "world of classical worlds" so that also the choice of measurement axis must have a geometric description.

The conclusion is that genetic code can be understand as a map of stringy baryonic states induced by the projection of all states with same spin projection to a representative state with the same spin projection. Genetic code would be realized at the level of dark nuclear physics and perhaps also at the level of ordinary nuclear physics and that biochemical representation would be only one particular higher level representation of the code. A hierarchy of dark baryon realizations corresponding to p-adic and dark matter hierarchies can be considered. Translation and transcription machinery would be realized by flux tubes connecting only states with same quark spin and flux tube spin. Charge neutrality is essential for having only the analogs of DNA, RNA and aminoacids and would guarantee the em stability of the states.

3.3 Crying and screaming cells and magnetic bodies expressing their emotions

By using nanotechnological methods James Gimzewski [7], his student Andrew Pelling and collaborators discovered that the cell walls of bacterium Saccharomyces cerevisiae perform periodic motion with amplitude about 3 nm in the frequency range .8-1.6 kHz (one octave) [Pelling et al]. Or more concretely, bacteria produce sounds audible to humans with average frequency of 1 kHz in a range of one octave. The frequency has strong temperature dependence, which suggests a metabolic mechanism. From the temperature dependence one deduces the activation energy to be 58 kJ/mol, which is consistent with the cell's metabolism involving molecular motors such as kinesin, dynein, and myosin. The magnitude of the forces observed (10 nN) suggests concerted nanomechanical activity is operative in the cell.

From less formal popular articles [8] one can learn that it is difficult to avoid the impression that intelligent communication is in question. Dying cells produce a characteristic screaming sound. One can also distinguish between normal cells and cancel cells on basis of the sound they produces as well as between mammalian and bacterial cells.

What might be the explanation of these findings in TGD framework?

1. It is known that the region of frequencies audible to human ear is from about 20 Hz to 2×10^4 Hz. This is more or less same as the range of frequency range of sferics, the em noise in atmosphere [9]. This suggests a strong coupling between electromagnetic oscillations and sound as also the fact that biological structures are piezo-electrets transforming em oscillations to sounds and vice versa.

2. The activation energy per mole corresponds to .6 eV per molecule which is at the upper range for the variation range the energy associated with the fundamental metabolic energy quantum identified as the change of zero point kinetic as proton is transferred from atomic space-time sheet to much larger space-time sheet or vice versa.That metabolic energy is needed to produce the sounds supports the view that the sounds are produced intentionally.

3. If one takes seriously the notion of magnetic body as intentional agent controlling biological body, one is led to ask which must sound a totally crazy question in reductionistic ears: could magnetic body express its emotions in terms of frequencies of cyclotron transitions transformed to sound via genetic expression using piezo electric mechanism? Could it be that the photons involved are dark photons with large value of Planck constant so that their energy is above thermal energy. Could one propose a materialistic scientist to consider anything more irritating that singing and crying magnetic bodies!

4. Suppose that the homeopathic mechanism is based on replication of pseudomolecules with same magnetic body as that of solvent molecules and that neutral dark nuclear strings realize analogs of DNA, RNA, and aminoacids and realizing genetic code exactly in its vertebrate nuclear form and appearing also in the TGD based model of cold fusion and biological transmutations. If so, then homeopathic mechanism (recognition of molecules) could involve also the transformation of cyclotron radiation to sound at the level of "biological bodies" of molecules.

5. If this picture makes sense then also our speech as a self expression of the magnetic body might involve genetic code mapping sequences of DNA codons to temporal patterns of cyclotron radiation in turn transformed to speech by above mechanism. This would require a realization of genetic code at level of dark matter: could it be that dark nuclear code could define universal quantum level realization of language? The findings of Peter Gariaev and others and structural resemblance of intronic portion of genome with language and their report that DNA sequences are coded to temporal patterns of the rotation angle of the polarization of laser light (in turn inducing genetic expression).

References

Online books and articles about TGD, TGD inspired theory of consciousness and of quantum biology

[MP1] M. Pitkänen , *p-Adic length Scale Hypothesis and Dark Matter Hierarchy*. Online book 2006. http://www.helsinki.fi/∼matpitka/paddark/paddark.html.

[MP2] M. Pitkänen. Genes and Memes. Online book 2006. http://www.helsinki.fi/∼matpitka/genememe/genememe.html.

[MP3] M. Pitkänen. Bio-Systems as Conscious Holograms. Online book 2006. http://www.helsinki.fi/∼matpitka/hologram/hologram.html.

[MP4] M. Pitkänen. TGD and EEG. Online book 2006. http://www.helsinki.fi/∼matpitka/tgdeeg/tgdeeg/tgdeeg.html.

[MPa] M. Pitkänen. Topological Geometrodynamics: an Overall View. Online article 2008. http://www.helsinki.fi/∼matpitka/articles/TGDlong.pdf.

[MPb] M. Pitkänen. TGD Inspired Theory of Consciousness. Online article 2008. http://www.helsinki.fi/∼matpitka/articles/tgdconsc.pdf.

[MPc] M. Pitkänen. TGD Inspired Quantum Model of Living Matter. Online article 2008. http://www.helsinki.fi/∼matpitka/articles/quantumbio.pdf.

[MPd] M. Pitkänen. About Correspondence Between Infinite Primes, Space-time Surfaces, and Configuration Space Spinor Fields. Online article 2007. http://www.helsinki.fi/∼matpitka/articles/brahma.pdf.

[MPe] M. Pitkänen. DNA as Topological Quantum Computer. Online article 2008. http://www.helsinki.fi/∼matpitka/articles/dnatqcart.pdf.

[MPf] M. Pitkänen. Quantum Model for Nerve Pulse and EEG. Online article 2008. http://www.helsinki.fi/∼matpitka/articles/pulseeg.pdf.

[MPg] M. Pitkänen. Evolution in Many-Sheeted Space-Time. Online article 2008. http://www.helsinki.fi/∼matpitka/articles/prebiotic.pdf.

[MPh] M. Pitkänen. A Model for Protein Folding and Bio-catalysis. Online article 2008. http://www.helsinki.fi/∼matpitka/articles/prebiotic.pdf.

[MPi] M. Pitkänen. The Notion of Wave-Genome and DNA as Topological Quantum Computer. Online article 2008. http://www.helsinki.fi/∼matpitka/articles/gari.pdf.

References to the books about TGD

[1] The chapter *Nuclear String Model* of [MP1]. http://www.helsinki.fi/∼matpitka/paddark/paddark.html#nuclstring.

[2] The chapter *Homeopathy in Many-Sheeted Space-Time* of [MP3]. http://www.helsinki.fi/∼matpitka/hologram/hologram.html#homeoc.

[3] The chapter *DNA as Topological Quantum Computer* of [MP2]. http://www.helsinki.fi/∼matpitka/genememe/genememe.html#dnatqc.

[4] The chapter *Evolution in Many-Sheeted Space-Time* of [MP2].
http://www.helsinki.fi/∼matpitka/genememe/genememe.html#prebio.

[5] The chapter *Quantum Model for Nerve Pulse* of [MP4].
http://www.helsinki.fi/∼matpitka/tgdeeg/tgdeeg.html#pulse.

[6] The chapter *Dark Matter Hierarchy and Hierarchy of EEGs* of [MP4].

References related to biology

[Gariaev et al 1991] Gariaev PP, Chudin VI, Komissarov GG, Berezin AA, Vasiliev AA. Holographic Associative Memory of Biological Systems. Proceedings SPIE - The International Society for Optical Engineering. Optical Memory and Neural Networks 1991; 1621: 280- 291. USA.

[Benveniste et al 1988] J. Benveniste et al. Human basophil degranulation triggered by very dilute antiserum against IgE. Nature 1988, 333:816-818.

[Benveniste 1989] J. Benveniste et al. Transatlantic transfer of digitized antigen signal by telephone link. Journal of Allergy and Clinical Immunology. 1989, 99:S175 (abs.). For recent work about digital biology and further references about the work of Benveniste and collaborators see http://www.digibio-.com/.

[Ennis 1999,2004] P. Belon, J. Cumps, M. Ennis M et al, Inhibition of human basophil degranulation by successive histamine dilutions: results of a European multi-centre trial. Inflamm. Res. 1999; 48 Suppl. 1:S17-8.
P. Belon, J. Cumps, M. Ennis et al, Histamine dilutions modulate basophil activation. Inflamm. Res. 2004; 53 (5):181-8.

[Brent 1981] L. Brent et al. Supposed Lamarckian inheritance of immunological tolerance. Nature 1981, 290,508-512.

[Durrant 1962] . Durrant. The environmental induction of heritable change in Linum. Heredity 1962, 17,27-62.

[Giuditta 1982] A. Giudetta. Proposal of a Spiral Mechanism of Evolution, Rivista di Biologia 1982, 75: 13-31.

[Pembrey 2002] M. E. Pembrey. Time to take epigenetics seriously, European Journal of Human Genetics 2002, 10: 669-671. http://www.nature.com/ejhg/journal/v10/n11/index.html.

[Strand 2007] E. Strand (editor). Proceedings of the 7^{th} European SSE Meeting August 17-19, 2007. Röros, Norway. Society of Scientific Exploration: http://www.scientificexploration.org/.

[Pelling et al] Pelling et al. Local Nanomechanical Motion of the Cell Wall of Saccharomyces cerevisiae. Science 20 August 2004: Vol. 305. no. 5687: 1147 - 1150.

[7] *James Gimzewski*, http://en.wikipedia.org/wiki/James_Gimzewski.

[8] A. Goho. Rattle and Hum: molecular machinery makes yeast cells purr. Science News, August 21, 2004. http://findarticles.com/p/articles/mi_m1200/is_/ai_n6205978.
M. Wheeler. Signal Dicovery?.Smithsonian Magazine. March 2004. http://www.smithsonianmag.com/science-nature/10012426.html.

[9] A. Saleh. Capturing the Earth's songs. ABC Science Online 2001. http://www.abc.net.au/science/news/stories/s237849.htm.

[10] Homeopathy. http://en.wikipedia.org/wiki/Homeopathy.

[11] Water Memory. http://en.wikipedia.org/wiki/Water_memory.

[12] Epigenetics?. A website devoted to epigenetics, http://epigenome.eu/en/1,38,0.