

**Commentary
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DNA & Water Memory: Comments on Montagnier group's Recent Findings

Matti Pitkänen¹

Abstract

HIV Nobelist L. Montagnier's group has published two articles challenging the standard views about genetic code and providing strong support for the notion of water memory. Already the results of the first article suggested implicitly the existence of a new kind nano-scale representation of genetic code and the recent article makes this claim explicitly. The TGD based model for the findings was based on the notion of magnetic body representing biologically relevant aspects of molecules in terms of cyclotron frequencies. The model involved also the realization of genetic code using electromagnetic field patterns and as dark nucleon strings and led to a proposal that the analogs of transcription and translation are realized for the dark variants of DNA, RNA, tRNA, and aminoacids represented in terms of dark nucleon strings. Also processes transcribing ordinary and dark variants of the biomolecules to each other were proposed. This would make possible R&D-like controlled evolution based on experimentation using dark representations of biomolecules defining kind of virtual world.

The recent findings of Montagnier's group allow a more detailed formulation of the model and suggest a general mechanism for generalized transcription and translation processes based on the reconnection of magnetic flux tubes between the molecules in question. A new element is the proposed role of ordered water and hydrogen bonds in the formation of water memories. These representation would result from the dropping of the magnetic bodies of molecules as the hydrogen bonds connecting the molecule to water molecules of the ordered water layer around it-analogous to ice layer- are split during the mechanical agitation. A similar process occurs quite generally when external energy feed excites the resting state of cell and induces protein folding and its reversal and the formation of protein aggregates. Good metaphors for resting state and excited states are cellular winter and summer. The necessity of a repeated dilution and mechanical agitation could be understood if agitation provides metabolic energy for the replication of the magnetic bodies filling the diluted water volume and gives rise to a series of "environmental catastrophes" inducing evolutionary leaps increasing the typical value of Planck constant associated with the magnetic bodies until the energy $E = hf$ of 7 Hz dark photons exceeds the thermal energy at room temperature.

1 Introduction

The article "DNA waves and water" by L. Montagnier, J. Aissa, E. Del Giudice, C. Lavallee, A. Tedeschi, and G. Vitiello [21] has created quite a furor even before its publication. The article was preceded by article [20], whose results led to my own proposal about the existence of new kind of representation of DNA in water [15, 19] and the recent article indeed suggests the existence of a new kind nano-scale representation of DNA besides electromagnetic representation of the code, which was also suggested for years ago by the group of Peter Gariaev [24] and also in TGD framework [10]. New Scientist reacted by an article "Scorn over claim of teleported DNA" [23], whose title is completely misleading (nothing new in popular science journalism dominated by sensationalism): authors make no claim about quantum teleportation.

Already "DNA waves and water" is enough to induce a deep growl from the throat of a hard-nosed skeptic, and the words "homeopathy" and "water memory" are the signals, which transform even civilized skeptic to a raging blood hound. Water memory at gene level is indeed what the article is about. What makes the situation so problematic is that Montagnier is HIV Nobelist so that it is not so easy to dismiss the work as has been done routinely for all work related to water memory since the days of Benveniste and before.

¹Matti Pitkänen http://tgd.wippiespace-com/public_html. Address: Köydenpunojankatu 2 D 11 10940, Hanko, Finland. Email: matpitka@luukku.com.

The story began when Benveniste found evidence for water memory [17, 18]. Water solution of biomolecules was diluted so that there was no trace about the molecules. What Benveniste and collaborators claimed was that the treated water is however somehow able to represent the biologically relevant properties of molecules so that its action on some biomolecules can be the same as that of the original molecules. This could obviously explain the claimed effects of homeopathy.

Benveniste got a label of fraudster in a scientific investigation led by the magician James Randi (true, this is what the standards of skeptic science sadly often are!). The work of Benveniste has been however continued behind the scenes and it has been for a long time to possible to reproduce the effects of biologically active molecules by using only the low frequency electromagnetic spectrum of these molecules which suggest that biological signalling relies on low frequency em radiation [18]. Skeptics have simply dismissed all this research.

That genes have electromagnetic representation have been also claimed by Peter Gariaev and his collaborators for long time ago in terms of the notion of wave DNA [24] (references contain also other articles of Gariaev and collaborators). I have proposed TGD inspired models for wave DNA related effects [12] and this issue contains an article about hologram generating properties of DNA written together with Peter Gariaev. Also biophotons [30] and the effects of ELF em fields on vertebrate brain [31] relate very closely to the story in TGD framework. Quite generally, the findings provide additional key data allowing to develop the vision about the central role of electromagnetism related macroscopic effects in living matter.

Also Huping Hu and Maoxin Wu [33] have reported highly brain effects involving water and electromagnetic fields. Applying magnetic pulses to the brain when an anesthetic was placed in between caused the subject person to feel the effect of anesthetic. Also drinking water exposed to magnetic pulses, laser light or microwave radiation when an anesthetic was placed in between caused brain effects. The proposed interpretation was in terms of quantum entanglement. The explanation based on the mimicry of the anesthetic molecules by water does not exclude the presence of quantum entanglement.

In the following I will develop a more detailed model for the findings reported in [20] using the new findings of Montagnier's team [21]. The findings provide information allowing to develop much more detailed view about water memory and representations of genetic code in terms of water and related ideas about the role of dark matter (understood as a hierarchy of phases with large value of Planck constant) in biology.

1.1 The basic findings of Montagnier's group

The claim of Montagnier's team is that the radiation generated by DNA affects water in such a manner that it behaves as if it contained the actual DNA. A brief summary of experiment of Montagnier and collaborators is in order.

1. Two test tubes containing 100 bases long DNA fragments were studied. Both tubes were subjected to 7 Hz electromagnetic radiation. Earth's magnetic field was eliminated to prevent its possible interference (the cyclotron frequencies of Earth's magnetic field are in EEG range and one of the family secrets of biology and neuroscience since eventies is that cyclotron frequencies in magnetic fields have biological effects on vertebrate brain). The frequencies around 7 Hz correspond to cyclotron frequencies of some biologically important ions in the endogenous magnetic field of .2 Tesla explaining the findings. This field is 2/5 of the nominal value of the Earth's magnetic field.
2. What makes the situation so irritating for skeptics who have been laughing for decades for homeopathy and water memory is that the repeated dilution process used for the homeopathic remedies was applied to DNA in the recent case. The dilution containing no detectable amounts DNA (dilution factor was 10^{-12}) was placed in second test tube whereas the first test tube contained 100 bases long DNA in the original concentration.
3. After 16 to 18 hours both tubes were subjected to polymerase chain reaction (PCR), which builds DNA from its basic building bricks using DNA polymerase enzyme. What is so irritating that DNA was generated also in the test tube containing the highly diluted water. Water seems to be able to cheat the polymerase by mimicking the presence of the actual DNA serving in the usual situation as a template for builing copies of DNA. One could also speak about the analog quantum teleportation.

In TGD inspired quantum biology the representations of genes in terms of temporal patterns of electromagnetic radiation are in central role [15]. TGD leads to a concrete model for water memory in terms of the magnetic body of biomolecule whose cyclotron frequency pattern codes for the biological effects of the molecule. Water memory means that water can build magnetic bodies mimicking those of biomolecules or perhaps steal them in the process of dilution which involves the shaking of the solution.

TGD suggest also another representation of the genetic code in terms of dark nucleons [6, 15], which could be highly relevant for the realization of water memory in terms of a dark portion of water for which there exist empirical evidence [7]. This dark portion would also explain the numerous anomalies of water. It became as a total surprise that the states of dark nucleons correspond in natural manner to DNA, RNA, tRNA, and aminoacids. DNA would define only one particular representation of the genetic code, which in the primary form would be realized at elementary particle level and that there could exist many representations of DNA. Also the model for DNA as topological quantum computer [11] proposes a non-standard representation of the code.

The existence of a multitude of representations of the code would not be too surprising when one realizes that the information processing performed by computers involves endless variety of different representations of various codes. The problem is about attitudes: the dogma that biology is nothing but chemistry is what is being challenged and we love dogmas because they liberate us from the burden of using our own brains.

1.2 Questions

Montagnier's work gives support for water memory in terms of representations of some molecules in terms of water molecules or some nano-structures present in water treated in the same manner as the homeopathic remedies are made. What is really amazing is that the representations seem also to realize genetic code. The experimental arrangement stimulates several questions which I try to answer in the framework of TGD inspired model of biology.

1. The presence of 7 Hz magnetically induced oscillation seems to be necessary for the presence of the effect. What is the role of this radiation whose frequency is not far from the lowest Schumann resonance frequency with nominal value of 7.83 Hz. Recall that this frequency is in the lowest approximation determined by the radius of Earth of alone. The wave length of 7 Hz photons is slightly larger than the circumference of Earth. Could it be that a temporal pattern associated with a single period of 7 Hz oscillation could code for DNA codons. The energies involved are of course ridiculously small as compared to the thermal energy at room temperature and quantal effects are excluded in standard quantum theory.
2. How water could represent some biologically relevant aspects of molecules? For what kind of molecules this representation does exist? What are the roles of mechanical agitation and dilution in the generation of water memory? Does the 7 Hz frequency near the lowest Schumann resonance frequency relate to this somehow?
3. How water and electromagnetic radiation could represent genetic code?

1.3 Some key ideas of TGD inspired quantum biology

TGD helps to imagine possible answers to these questions. The identification of dark matter as a hierarchy of phases with large Planck constant [9, 7] and the notion of magnetic body [19] - both deriving naturally from basic quantum TGD- are the key notions.

1. The basic vision is that magnetic body communicates with biological body and controls it by using a generalized variant of EEG consisting of fractal hierarchy of dark photons corresponding to a hierarchy of values of Planck constant [16] with large Planck constant implying that even ELF photons can have thermal energies above thermal energy. This is the essential element in the model for the effects of ELF frequencies on vertebrate brain. The transformation of dark photon to a bunch of ELF photons or single high energy photon would be basic mechanisms transforming dark

photons to ordinary ones. Biophotons would be dark photons transformed to single dark photon. EEG would represent outcome consisting of a bunch of ELF photons.

2. TGD suggests that dark DNA, RNA,... and even dark aminoacids could have a key role in biological evolution providing kind of virtual world realization of biomolecules. This would make possible a controlled evolution analogous to the research and development carried out in industry [15]. This is in conflict with the vision of standard biology according to which the planning of travel phone would be a process in which one throws some random collection of electronic components to a hat and looks whether a travel phone emerges from the hat after sufficiently long waiting period.

Biological R&D would require that transcription and translation process have dark counterparts. Also the transcription of dark DNA to ordinary DNA and vice versa and even more general processes should be possible. If the water containing ordinary DNA contains its dark variant able by its darkness to leak through the filters used in the experimental situation studied by Montagnier and collaborators, the dark DNA could be able to cheat the polymerase protein so that it interprets dark DNA as a genuine DNA template and starts to generate ordinary DNA. If the magnetic flux tubes coding for DNA are all that is relevant for this, this mechanism would not depend whether the ends of flux tubes contain real or dark DNA.

3. The dark magnetic flux tubes connecting bio-molecules make it possible for them to recognize and find each other in the dense soup of biomolecules. The reduction of Planck constant for the flux tube brings the bio-molecules near to each other so that catalytic reaction becomes possible. The reconnection process for flux tubes is also in an essential role and involved with ADP-ATP process and would provide elegant realization of codes.
4. In this framework evolutionary leaps can be seen as a quantum leap in which a new level of dark matter hierarchy with Planck constant larger than those of already existing levels emerges. Another basic implication is the existence of coherent gene expressions in various length scales leading to the notion of hypergenome and collective gene expression.

1.4 Representations for the genetic code in TGD

TGD suggest several non-standard representations of the genetic code.

1. Temporal patterns of electromagnetic radiation with some carrier frequency is one possibility. Gari-aev's work suggests that temporal patterns of polarization directions of radiation could code for DNA sequences with each nucleotide corresponding to a definite change of polarization direction [12]. This would mean a hierarchy of realizations of the code corresponding to different frequency scales with period of radiation defining the duration of the code word.
2. The TGD inspired model for DNA as topological quantum computer [11] suggests a realization of codons in terms of u, and d quarks and their antiquarks at the ends of magnetic flux tubes connecting DNA nucleotides to lipids of nuclear or cellular membranes. TGD indeed predicts the possibility of several fractally scaled up copies of hadron physics with different mass scales and also dark variants of ordinary hadron physics with the Compton lengths of quarks scaled up while keeping mass scales the same. Entire fractal hierarchy of representations corresponding to carrier frequencies of dark photons could be realized.
3. One of the most amazing predictions of TGD comes from the model of dark nucleons [6]. The states of dark nucleons are in 1-1 correspondence with DNA, RNA, tRNA, and aminoacids and vertebrate genetic code is realized naturally as dark nuclear strings analogous to ordinary nuclei which are also nuclear strings in TGD based model of nuclei. The representation could be based on triplets of magnetic flux tubes with quarks at ends correlating with the genetic code words defined by the states of dark nuclei just like the representation of DNA in DNA as tqc model. A natural guess would be that the size scale of dark nucleon is same as the size scale of single DNA triplet.

2 TGD inspired answers to the questions

In the following TGD inspired answers to the questions posed in the introduction are discussed. The answers are of course very tentative and involve a lot of speculative new and non-tested physics predicted by TGD.

2.1 What is the role of 7 Hz radiation?

7 Hz is near the frequency of the lowest Schumann resonance representing collective oscillation of the Earth's magnetic field and one can wonder about its role in the experiment of Montagnier and collaborators.

1. 7 Hz need not provide a representation for genetic code although it could do so. A possible role is as the provider of bio-rhythm and as a possible source of energy in the case that dark photons with energy above thermal energy are in question. TGD inspired theory of consciousness predicts what I call self hierarchy and one can speak about gene expression at the level of organism and even population. Schumann resonance would naturally couple with living matter and couple the magnetic bodies of living systems to the magnetic body of Earth- magnetic Mother Gaia one might say. Flux tubes within flux tubes would be simplest representation for the coupling making possible frequency modulation and also amplitude modulation. Frequency modulation is especially interesting and the song of whales provides a possible concrete example of underlying frequency modulation. The model for hologram generating properties of DNA suggests that the dark photons assignable to 7 Hz radiation pump energy to build up hologrammic representations of DNA.
2. Cyclotron resonances for ions in the Earth's magnetic field are in 1-100 Hz range and it has been known from seventies that electromagnetic fields in this frequency range have effects of vertebrate brain. These effects look very quantal and correspond to cyclotron frequencies which is $.2 \text{ Gauss}^{-2/5}$ of the nominal value of the Earth's magnetic field. Also the authors of the article suggest that cyclotron resonances of ions are involved and in TGD inspired model for living body in terms of magnetic bodies cyclotron resonances are in a key role. Cyclotron frequencies could provide a coupling of biologically important ions to Schumann resonance if the flux tubes involved can vary their thickness so that the strength of magnetic field varies by flux conservation.
3. VLF frequencies above kHz seem to take this role in water memory. The wave lengths and corresponding layers of magnetic bodies are still enormous as compared to that of DNA.

2.2 How water could represent molecules?

The TGD inspired model for how water could represent at least some aspects of at least some molecules is based on earlier ideas [15] plus some ideas inspired by the findings of Montagnier's group and by the role of ordered water and hydrogen bonds in the self-organization of biomolecules.

1. The basic idea is that the magnetic body of the molecules represents biologically relevant aspects of molecule in the sense that the cyclotron radiations generated by the magnetic body is responsible for biological control and also receives signals from part of organism in some length and time scales. The mechanical agitation of water involves in the process generating water memories implies that the magnetic bodies of some molecules just drop to water. This is enough for the mimicry of the biomolecules by water.
2. Water interacts strongly with polar (hydrophilic) molecules so that the polarity of the molecules in question is expected to be very relevant for the process. Polar molecules are covered by a hydrogen bonded layer of ordered water molecules analogous to ice covering. This molecular ice freezes various biomolecules to standard configuration and the feed of energy freezes the ice cover so that processes like protein folding and formation of their aggregates which is central element in the reaction of living matter to external perturbations becomes possible. The natural idea is that the polar molecules having hydrogen bonds with water layer dictate to high degree the structure of the magnetic body.

3. The mechanical agitation of water could feed the energy needed to induce the splitting of the hydrogen bonds of a polar molecule so that the ice coating to which the magnetic body of the molecule would drop out. The process would be similar to the reaction of biomolecule to external influence. This magnetic body would represent the molecule in terms of cyclotron frequencies and behave as a real molecule as far as the effects caused by cyclotron frequencies are considered. Basically a symbolic representation of the biomolecule would be in question.

This mechanism is obviously very general and the prediction is that water remembers the presence of molecules with polar regions and do not distinguish between molecules with different non-polar regions. These non-polar regions are hydrophobic and tend to be shielded from water. Protein folding is one example of this shielding.

2.3 How the magnetic bodies could represent genetic code?

The intriguing finding that about 1/4 of hydrogen atoms of water behave effectively like dark matter in attosecond time scale was one of the first findings motivating the development of ideas about dark matter as large $\hbar$ phases and is also of crucial importance for the model of water memory. The TGD based explanation is that dark hydrogen atoms correspond to dark protons with Compton size of order atom size at least. The varying fraction of this phase would explain the large number of anomalies related to the thermodynamics of water.

The proposal is that the splitting of hydrogen bond transforms the hydrogen or at least the proton of hydrogen to a dark nucleon. The states of dark nucleons would correspond to multiplets assignable to DNA, RNA, tRNA code words, and aminoacids. If the state of dark nucleon corresponds to quarks assignable to the ends of the three magnetic flux tubes, one has a representation of the genetic code in terms of dark nuclear string consisting of protons glued to form dark nuclear string (TGD indeed leads to a model of nuclei as nucleon sequences connected by color magnetic bonds [?]).

2.4 How transcription and translation type processes could be realized for dark DNA and how dark DNA and DNA could transform to each other?

Reconnection of magnetic flux tubes allows to imagine a very simple model for how DNA is coded to dark DNA and vice versa. As a matter fact, the process applies to very general class of processes defining a pairing of biomolecules. All that is needed is that the quark pair at the ends of the flux tube to some degree dictates which molecules can form. One can actually imagine a generalization of the genetic code applying to much more general molecules than molecules involved with the genetic code if this mechanism involves dark nucleons at the ends of the magnetic flux tubes involves.

1. Assume that the nucleotides of dark DNA and conjugate molecules are connected by flux tubes having quark and antiquark at their ends that u, d and their antiquarks correspond in one-one manner to DNA nucleotides so that coding results. Suppose that similar coding takes place for dark DNA in the sense that dark DNA code word is connected by three flux tubes to its conjugate for corresponding dark aminoacid. Assume that both dark and ordinary DNA nucleotides can be connected to their conjugates by relatively long flux tubes (large $\hbar$) and that they can be also accompanied by short-circuited flux loops. Assume again that genetic code mapping codons to quarks is realized. Similar short circuited closed flux loops could be possible for aminoacids and RNA.
2. Assume that a reconnection for long flux tube connecting nucleotides and their conjugates and for nucleotide flux loop is possible if corresponding quarks are same so that the assignment realizes genetic code. For instance, a reconnection in the middle of flux tubes connecting dark DNA and its conjugate would generate an ordinary DNA sequence. If this sequence binds to DNA strand and if the reverse of the reconnection process occurs after that, dark DNA sequence becomes coded ordinary DNA sequence. Obviously much more general processes of this kind are possible and are relatively independent of what is at the ends of the flux tubes so that genetic coded would permeate whole biology and determined selection rules of reaction involving all kinds of polar molecules.

2.5 What is the role of dilution and agitation?

I have discussed these questions also in [15]. The following discussion involves new ideas inspired by the findings of Montagnier's group.

The role of dilutions in the generation of water memories looks like a mystery and provides strongest weapon for a simple-minded skeptic and one can make only guesses in this respect. The situation does not distinguish between DNA and other molecules which water is able to represent. All these molecules could correspond to dark molecules resulting when the hydrogen bonds connecting polar molecule to its water coating split if above ideas are on a right track. Consider now the questions.

1. Is the dilution necessary in order that the magnetic flux tubes of the molecular magnetic expected to have size of order 100 nm in the solution do not overlap? This would mean that the density of dark DNA in the experiments of Montagnier would be rather low in the experimental situation, maybe something like 1 DNA sequence per volume of cell nucleus. Can so low density explain the effects of polymerase in the experiment of Montagnier's team? Could the critical dilution be the dilution above which the 7 Hz radiation is able to serve as a metabolic resource?
2. Could it be that the density of dark molecules is actually much higher than the dilution would suggest? This would require replication of dark molecules, which is indeed quite conceivable if dark molecules define a life form preceding ordinary DNA. The mechanical agitation could provide the metabolic energy for the dark molecules. Dark molecules could also be part of time in lethargic state and wake up only when energy is feeded and replicate just as biomolecules are ice-covered and wake up only when external perturbation feeds energy and induces self-organization. But why would be critical dilution required? Why the density of ordinary molecules must be so small? This is difficult to understand.
3. Is it the number of dilutions and agitations which matters rather than the density of the ordinary molecules in the final situation? Could the sequence of dilutions induce an evolutionary process analogous to a sequence of environmental catastrophes posing evolutionary pressures (population density for dark molecules is reduced by a factor of ten) and leading to rapid evolution of dark DNA variant able to replicate and survive? Could each mechanical agitation induce quantum phase transitions increasing the value of Planck constant for the flux tubes inducing evolutionary leaps and increasing the size scale of the corresponding magnetic body? Could the associated feed of metabolic energy also induce a replication of the dark molecules so that one would have a population with a density much higher than that of the ordinary molecules in the final situation? Whether the number of agitation-dilution processes matters instead of final density of molecules could be tested by using different initial values for the density.
4. Could the limiting wave length correspond to 7 Hz cyclotron frequency for some relevant ion and therefore also to an evolutionary step making possible to couple to magnetic Mother Gaia. The condition that the frequency corresponds to energy above thermal energy at room temperature would require $\hbar/\hbar_0 \equiv r \sim 10^{11}$. The number of the dilutions should be so high that the molecular evolution reaches this level. As a matter fact, the work of Cyril Smith [32] with water memory suggests that $r = 2 \times 10^{11}$ is very special in the sense that a transformation for low frequency photons to high frequency photons with $f_h/f_l = 2 \times 10^{11}$ seems to be involved with water memory. Does the maximal value of $\hbar$ for the flux tubes correlate with the dilution factor or the number of dilutions inducing 10-fold reduction of density each? Does 10-fold reduction of density correspond to reduction factor which still allows the population to fill the sample completely for a reasonable amount of mechanical agitation?
5. Cyclotron radiation of dark photons from the magnetic body of dark DNA transforming to ordinary VLF photons serves as a signature for its presence. In the abstract of [22] Montagnier group reports following.
"Electromagnetic signals of low frequency have been shown to be durably produced in aqueous dilutions of the Human Immunodeficiency Virus DNA. In vivo, HIV DNA signals are detected only in patients previously treated by antiretroviral therapy and having no detectable viral RNA copies

in their blood. We suggest that the treatment of AIDS patients pushes the virus towards a new mode of replication implying only DNA, thus forming a reservoir insensitive to retroviral inhibitors. Implications for new approaches aimed at eradicating HIV infection are discussed.”

”New mode of replication” would correspond in TGD framework to replication of magnetic bodies of RNA or DNA representing genes as dark nucleon sequences and would allow HIV RNA pr RNA to survive despite the treatment.

The idea about rapid micro-evolution taking place in human time scale for the magnetic bodies is as radical as it is fascinating but is in principle testable. I have considered alternative explanations but they are not so simple as this one. I do not of course believe that attitudes in biological sciences would be mature for testing this kind of ideas. Big changes in the world view are painful and take place slowly and existing theoretical hegemony is the worst obstacle in the progress.

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