Mysteries related to gene expression and meiosis

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Abstract

In the TGD Universe, spacetime is a 4-D surface in $H = M^4 \times CP_2$. This predicts that string world sheets and flux tubes are fundamental objects. They can reconnect in a topologically stable manner. Reconnection becomes a fundamental aspect of the TGD inspired quantum biology. For instance, reconnection plays a central role in the TGD inspired view of a living system as a topological quantum computer.

Reconnection also plays a key role in the recombination of DNA strands of father and mother chromosomes leading to the formation of gametes. In TGD it would be preceded by a reconnection at the level of dark DNA associated with magnetic flux tubes and occurring in cell divisions. The reconnected flux tubes representing gametes would serve as templates for the recombination of the ordinary DNA strands. This picture leads to surprisingly strong predictions concerning natural selection at cell level and the notion of sex.

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1 Introduction

The selection of the allele in gene expression and meiosis still involves mysteries.

1. In mitosis (https://cutt.ly/3HZfSps) the chromosome pair of DNA consisting of the chromosomes of parents of cell replicates. Each cell has both mother's and father's genes, which are homologous but not identical. Allele dominance means that in a given cell only either allele tends to be expressed (https://cutt.ly/ZHJicsQ). Whether mother's or father's allele dominates, depends on the cell. The origin of this dominance is not understood.

2. In meiosis (https://cutt.ly/zHZfJVl) occurring in the formation of gametes the chromosome pair is replaced with a single chromosome and the DNA strands effectively reconnect so that the new strand contains alleles from either parent, which seems to be selected randomly.

If the random recombination occurs for both strand pairs, it is difficult to understand how the combination processes can be identical. The recombination process however take in a similar way for both DNA strands. Most naturally, the reconnection would occur only for the other pair of strands from parents. These strands could be the strands which are active in transcription. After this, this strand could serve as a template in DNA replication to form a DNA double strand.

Condensed matter physicists are discovering that the world of electrons at atomic level is govering by knotting and linking (`https://cutt.ly/mHVCrPC`). This picture is just what TGD predicts but applies to all systems, not only electrons, and in all scales from hadron physics to cosmology. Besides particle like entities there would be magnetic flux tubes connecting them to networks. This is completely new from the perspective of quantum field theory based description based on point-like particles.

Since 3-space is a surface in $M^4 \times CP_2$ is 3-D, flux tubes and string world sheets accompanying them are necessarily linked and knotted: this distinguishes TGD from string models. This implies braiding and makes possible topological quantum computation (TQC) like activities at fundamental level, in particular in living matter and especially at the DNA level.

Furthermore, since spacetime is 4-D, string world sheets and flux tubes can reconnect in a topologically stable manner (in superstring models this is not possible). Reconnection becomes a fundamental aspect of the TGD inspired quantum biology. For instance, reconnection plays a central role in the TGD inspired view of a living system as a topological quantum computer [L5].

Reconnection would also play a key role in the recombination of DNA strands of father and mother chromosomes leading to the formation of gametes. In TGD it would be preceded by a reconnection at the level of dark DNA associated with magnetic flux tubes and occurring in cell divisions. The reconnected flux tubes representing gametes would serve as templates for the recombination of the ordinary DNA strands. This picture leads to surprisingly strong predictions concerning natural selection at cell level and the notion of sex.

2 TGD based view about allele dominance

Allele dominance and its dependence on the cell are basic mysteries of biology. In the sequel a TGD inspired model for it will be developed.

2.1 Are DNA expression and the formation of gametes induced by dark gametes?

TGD suggests that the recombination of DNA is induced by a reconnection process at the level of dark DNA [L7]. The reconnection process for dark DNA strands of father and mother at the level of MB would induce the recombination process at the level of ordinary DNA strands. Second suggestion is that dark gametes formed in the replication of cells control the gene expression and induce allele dominance depending on cells. Futher implication would be that cells have a well-defined sex. Perhaps even organelles and organs could have such.

1. The recombination process for DNA would be guided by a reconnection process for dark DNA at the magnetic flux tubes. Suppose that the pairs of dark DNA strands at the magnetic flux tubes reconnect to form a pair of strands in which the pieces of strands are mixed just like they are thought to do for ordinary DNA. One obtains for a given strand two outcomes with father $\leftrightarrow$ mother symmetry realized for the corresponding pieces of the strands. The symmetry related pairs correspond to different sexes and if only the other strand is selected, the sex of the descendant is fixed.

2. Dark meiosis as a reconnection process at the level of dark DNA would occur before meiosis, naturally in the previous DNA replication since otherwise the cells would MBs with both sexes. This dark DNA would select from the paternal and material ordinary DNA strands ordinary codons and fuse them to the ordinary DNA strand of the gamete. The process would rely on resonance mechanism [L2, L3, L4, L6]. This process could occur for both DNA strands or a single strand. It might be possible to test, which option is realized. The ordinary

model has problems in understanding why the both strands suffer the same recombination: now this problem would not be encountered.

TGD view about genes involves the notion of dark DNA realized at the level of magnetic body (MB) and suggests a solution to the mystery of allele dominance.

1. The process leading to the DNA of gamete occurs at the level of dark DNA as reconnection. Two strands are formed by reconnection and yield two different gametes with opposite sex and related by father father $\leftrightarrow$ mother symmetry.

2. Could dark gametes at the level of MB form already in fertilization or considerably before the generation of gametes, say in previous cell replication? If dark gametes form in the fertilization, the ordinary gametes would be copies of these two dark gametes and there would be only two kinds of gametes and only two kinds of children, males and females. This is not certainly true.

   If the dark gametes are formed later in the daughter cell, most naturally in cell replication, daughter cells can have different dark DNA producing different gametes as their copies. The members of dark gamete pair related by father $\leftrightarrow$ mother symmetry would produce male and female kind gene expressions.

3. Only single gamete DNA can appear in a given gamete, which could be understood if only the second dark gamete DNA can be associated with a given cell. A pair of gametes could form in the cell replication and the members of the pair go to different daughter cells. Allele dominance would emerge after the first replication in which dark meiosis would occur for the first time.

   One could say that ordinary mitosis involves dark meiosis leading to allele dominance in a given cell and ordinary meiosis takes place only later. There would male and female cells and one could say that fertilization occurs repeatedly in dark meiosis.

4. The resonance mechanism [L6] allows us to understand the allele dominance quantum mechanically. The dark DNA controls gene expression and is in energy resonance with ordinary DNA. Depending on the dark gene, the resonance selects either the allele of mother or of father.

5. If new dark gametes emerge at each cell division, there is a large number of descendants at the cell level. The survival of a cell with a given dark gamete implies that the ordinary gametes associated with it have a higher chance to participate in sexual reproduction. Only those dark gametes, for which the cells controlled by them survive and have produced ordinary gametes as their images, have a change to participate in sexual production, which is like the finals in Olympics. Evolution would be survival of the fittest already at the level of cells and selection would occur already at the level of cells.

6. The two dark gametes produced in the dark meiosis in cell replication and going to different cells in cell division are related by father $\leftrightarrow$ mother symmetry and since XX chromosome pair characterizes female and XY chromosome pair male, sister and brother cells, which are mirror images of each other emerge and are associated with different cells. Therefore cells would have a well-defined sex!

   This raises interesting questions. Could organelles and even organs tend to have same cellular sex so that also these could be said to have a well-defined sex? Could the battle between sexes start already at the cell level and possibly lead to extinction of the other sex? Could cells have sexual relationships like us and tend to pair? Could possible multi-cellular structures with a well-defined sex have this kind of relationships? What comes into mind are epithelial layers consisting of two cell layers and various binary structures in the body and brain.

2.2 Summary of the TGD based view of mitosis and meiosis

The above considerations boil down to the following overall view of mitosis and meiosis in the TGD framework.

Consider first ordinary mitosis and meiosis.

1. In the ordinary mitosis two copies of chromosomes are formed. After this cell divides. The same could happen for the dark chromosomes. But this would leave allele dominance a mystery.

2. Ordinary meiosis involves replication of chromosomes of soma cells with chromosomes of father and mother. This is followed by recombination of the chromosomes followed by cell division so that two germ cells are obtained. After that both daughter cells with recombinant genomes split to germ cells giving four germ cells.

The TGD view of meiosis would be different. Dark meiosis and ordinary meiosis need not occur simultaneously and dark meiosis could occur before the ordinary one in some earlier mitosis.

1. Dark DNA can suffer at some cell replication dark meiosis involving recombination of dark DNAs for both chromosomes. The resulting dark DNA strands go to separate cells. The dark parts of the DNA would be analogous to that of gametes which would be different for the two daughter cells.

   Since dark DNA controls ordinary DNA, the dark gamete would by resonance mechanism select which allele dominates. One would have two kinds of cells with different allele dominances. One could say that the cells have different sex. This is a testable prediction.

2. If this replication occurs after some replication after the first replication, the dark gametes formed in the dark meiosis of different cells are different, and one can obtain a large number of different dark gametes. This number is not so large as for the ordinary meiosis since dark gametes do not change in the cell replications.

3. The dark gametes, which have formed by dark meiosis already in an earlier cell replication preceding meiosis, would determine the outcome of the recombination of ordinary DNA in the ordinary meiosis following dark meiosis after some cell replications. After this the dark gametes pair with ordinary DNA and give rise to an ordinary gamete.

2.3 Bioharmony, resonance mechanism, and emotions

TGD assigns to the genetic code a bioharmony [L2, L3, L4, L6] bas a correlate for emotional states of moods.

1. The working hypothesis is that bioharmony dictates the frequency ratios of genes represent as triplets of dadrk photons exactly and that the sfrequency cale does not matter. Codons and genes would play the role of addresses in communications using dark 3N-photons as analogs of Bose-Einstein condensates. One would have 3N-resonance instead of ordinary (1-)resonance. For instance, gene expression would be guided by dark gametes and the dark gene would select by resonance mechanism the allele of either mother or father.

2. Just as the chords code for musical harmony and emotions, dark codons would code for bioharmony and serve as correlates for emotions at the molecular level. This gene expression would be responsible for emotional intelligence.

3. The 3-chords associated with the genetic code would correspond to a combination of a unique tetrahedral harmony and icosahedral harmony realized as Hamiltonian cycles.

   There is a considerable number of icosahedral harmonies, which appear in 3 basic classes. Bioharmony is a fusion of tetrahedral harmony with 3 icosahedral harmonies of type Z_6, Z_4 and Z_2. The icosahedral harmony with Z_6 symmetry is unique and corresponds to 3 amino acids (AAs) coded by 6 codons and one AA coded by 2 codons. The two harmonies with Z_4 symmetry correspond to 5 AAs coded by 4 codons. Z_2 can correspond to π rotation or reflection and are coded by 10 codons in absence of symmetry breaking. The number of harmonies with Z_2 symmetry is considerably higher.

There are many open questions.

1. Could the possibly stable molecular bioharmonies correlate or even characterize the dark gametes and correlate with the sex of the cell. Could the molecular bioharmonies characterize genes or cells? Could the two Z_4 harmonies distinguish between the two sexes?

2. If bioharmonies correlate with emotions, one would expect that they can change. I have proposed a model [L1] explaining the strange finding that the RNA from conditioned neurons of a snail induce conditioning in the unconditioned neurons of second snail (`http://tinyurl.com/y92w39gs`). The molecular emotions crucial for the conditions would correlate with the bioharmony assignable to RNA.

3. How stable are the bioharmonies? How long lasting bioharmonies could be? Could they define cellular moods lasting for the entire life and basically determine the personality?

4. Could the change of bioharmony correlate with epigenetic change as suggested by resonance mechanism. A correlation between bioharmony and gene expression controlled by mechanisms like methylation is suggestive.

2.4 About the notion of sex?

Sex is determined by X and Y chromosomes. The females gametes have two X chromosomes and male gametes have both X and Y chromosome. The mixing of sex chromosomes would give two XX and two YX chromosomes and the selection would be determined the sex.

The ordinary cells have both mother and father chromosomes and allele dominance decides about the gene expression. If the proposed picture holds true, each cell division would generate new kinds of dark gametes dictating the gene expression. As far as gene expression is considered there would be a large collection of different descendants, which can have both sexes.

If only the second variant of the dark gamete appears in a given cell, each cell would have a well-defined sex. If organelle or even organ consist dominantly of cells of either kind, it could be said to have a well defined sex. The notion of sex would not boil down to a single bit. We would be composites of cell structures with different sexes and a collective of a large number of descendants. This would force us to give up the naive genetic determinism.

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