

Self-hierarchy is the basic prediction of the TGD inspired theory of consciousness and the biological realization of the self-hierarchy is the basic theme of this chapter. Space-time sheets, in particular mind like space-time sheets having finite temporal duration and providing cognitive representation of the material world, are geometrical correlates of selves and biological self hierarchy reduces geometrically and topologically to the hierarchy of space-time sheets. Crucially involved is the notion of the topological field quantization, which among other things implies that photons have as their classical geometrical correlates so called topological field quanta. One interpretation for the topological field quanta of em field is as classical/quantal coherence regions of classical/quantum em field and electromagnetic (em) fields and their topological field quanta are expected to be especially important in bio-systems. One can assign vacuum quantum numbers to topological field quanta and these quantum numbers are expected to be carriers of a biologically relevant information.

What self actually is in quantum sense, has taken long time to understand. The realization that in zero energy ontology (ZEO) sequences of repeated quantum jumps leave only the second half of zero energy state invariant but change the other one led to the identification of self as the sequence of the quantum jumps reducing the state to the same boundary of causal diamond (CD). This also answers basic questions about the relationship of geometric and subjective time.

In principle the self hierarchy starts already at elementary particle level but the atomic length scale serves as a natural length scale for length scale at which biological relevant part of the self-hierarchy starts.

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\item The assumption that various bio-molecules are selves allows to

understand the miraculous abilities of living systems as outcome of quantum self-organization process in which dissipation selects very limited repertoire of self-organization patterns identifiable as survivors in Darwinian selection. For instance, one can understand protein folding and DNA replication as self-organization processes. The 4-D character of self-organization implies that the most probable outcomes are pairs of 3-surfaces at boundaries of causal diamond defining spatio-temporal rather than only spatial pattern. This allows totally new view about morphogenesis and development of skills.

\item The fact that bio-systems are liquid crystals, makes them ideal for the realization of the self hierarchy. The reason is that liquid crystals have ability to self-organize to very complicated structures and are ideal for communication purposes: for instance, mechanical signals can be coded to electric signals and vice versa. Liquid crystals are also electrets: the presence of electric fields is indeed an important prerequisite of cognition in TGD as discussed in the chapter \blockquote{Information and consciousness}. In fact, one could identify various bio-structures such as micro-tubuli, cell organelles and cells as generic outcomes of the self-organization of the liquid crystals. An especially important level of the self hierarchy is provided by collagen networks which could give rise to what might be called \blockquote{body consciousness}. Central nervous system is only one, although very important level in the self hierarchy, and TGD approach allows to understand why this is the case.

\item p-Adic length scale hypothesis allows quantitative grasp to the structure of the self hierarchy and one can build general picture about how various p-adic length scales emerged during the evolution. In particular, one can identify various p-adic length scales associated with the brain.

\item One level of the self hierarchy corresponds to the topological field quanta of ELF em fields associated with EEG. ELF (extremely low frequency) em fields are known to have dramatic effects on living matter and brain and the origin of these effects is poorly understood. A simple argument based on Uncertainty Principle leads to the conclusion that ELF photons in 10 Hz frequency range correspond to topological field quanta of size of entire Earth. This leads to a rather dramatic conclusion that our biological body is only a dip of an iceberg and we are much more than our neurons. The most important levels in our personal self hierarchy contains levels are of size of Earth! Support for this picture come from the quantitative success of the scenario: one can immediately understand various important neuro time scales in terms of the cyclotron frequencies of various charged particles in Earth's magnetic field.

\item Each bio-structure is accompanied by a topologically quantized magnetic field defining corresponding magnetic body and these magnetic bodies form a hierarchy. Magnetic bodies could serve as intentional agents, as templates for the formation of various biological control circuits crucial for homeostasis and biological information processing, define the basic structure making possible metabolism with universal metabolic energy currencies, and could even define what might be called Nature's own bio-laboratory.

\item The magnetic flux structures associated with body could be of crucial importance for understanding human consciousness. For instance, eyes generate magnetic fields. Also brain, in particular pineal gland (the \blockquote{third eye} of mystics and the seat of soul for Descartes), contains magnetic materials. Corresponding magnetic transition frequencies correspond to time scales relevant for the self narrative in human time scales. Perhaps these higher levels of magnetic self hierarchy could relate with NDE experiences and represent structures surviving in biological death.

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