Cell membrane anomalies

1. There are many anomalies related to the behavior of cell membrane:

   (a) Strange behavior of intra-cellular water. Although hamburger is 80 per cent of water it is extremely difficult to extract this water out. This suggests that the water is not in the usual state inside cell.

   (b) Problems of channel-pump paradigm. Channels and pumps are thought to be fundamental for the functioning of cell membrane. The hypothesis has however several problems.

      i. Selectivity problem: it is difficult to to imagine realization of so many channels and pumps as needed. The size of the molecule cannot be the only criterion.

      ii. Inflation in the number of channels and pumps looks unavoidable. One needs pump and channel even for water molecules! This has led Ling to suggest that these notions are artificial.

      iii. Pumping does not stop in absence of metabolic energy feed. This sug- gests that something is wrong with the basic paradigm.

      iv. Ionic currents are quantal and same for silicon rubber membrane than for cell membrane.

2. Pollack's findings about gel like four phase of water containing negatively charged exclusion zones obeying $H_{3/2}O$ stoichiometry suggest a clue concerning the anomalous behavior of cellular water.

   (a) Every fourth proton is dark and is transferred to the regions outside the layer.

   (b) Dark matter corresponds in TGD Universe to a phase with large Planck constant: $h_{eff} = n \times h$ phases at the "magnetic body" of the system (negatively charged region now). Magnetic body corresponds in Maxwell's theory to the magnetic fields generated by the system. Magnetic body consists of flux quanta (flux tubes and -sheets).

   (c) If dark protons with say size scale of atomic size reside at flux tubes, one can assume that they form strings forming dark atomic nuclei. Also ordinary nuclei consist of strings of dark protons and strings of neutrons.

   (d) The quantum states of dark protons consist of 3 quarks and simple model involving rotational symmetry around the axis of dark proton string predicts that the states of dark proton can be arranged into groups which correspond to DNA, RNA, amino-acids and possibly also tRNA molecules. Vertebrate genetic code can be realized as a natural correspondence between DNA/RNA and amino-acids.

   (e) Negatively charge regions could define prebiotic cell and water would be primitive prebiotic life-form. The voltage would be the analog of the resting potential in cell. The transformation of dark protons to ordinary ones would liberate metabolic energy so that primitive metabolism and photosynthesis would be realized.

   (f) The strings of dark protons would be analogous to basic biopolymeers serving as the basic fuel of metabolism hydrolyzed in metabolism.

3. The model for cell membrane as Josephson junction reducing atmicroscopic level to that for Josephson junctions defined by transmembrane proteins explains many of these anomalies.

   (a) Cell membrane is macroscopic quantum system and ionic currents are quantal Josephson currents running without dissipation so that no pumping is needed unless the quantum coherence is destroyed.

   (b) If each ion is at magnetic flux tube characterized by Planck constant proportional to the mass number A of the ion, selectivity problem is solved and also inflation problem ceases to be so difficult since the values of h_{eff} and magnetic field strength become addtional characterizes of the flux tubes carrhing the current.

4. This model is however still problematic.

(a) EEG would correspond to dark photons with Josephson energy $E_J = ZeV$ and frequency characterized by h_{eff}. They would decay to bio-photons, which are ordinary photons with energies in visible and UV range. Problem: E_J is roughly 50 times smaller than biophoton energy.

(b) One would expect that metabolic energy quantum with nominal value of e .5 eV is of the same order of magnitude as bio-photon energies. Problem: e is about ten times higher.

(c) Thermodynamical picture about cell membrane and ADP → ATP process explains the large value of e in terms of chemical potential difference characterizing the difference of proton concentrations for interior and exterior of cell. This purely thermodynamical description can be criticized. Of course, the vision about cell membrane as Josephson junction (or its microscopic variant treating transmembrane proteins as Jo- sephson junctions) require generalization of thermodynamical approach.

5. Improved model relies on generalization of Josephson junc- tion to allow different cyclotron energies at the two sides of the the membrane.

   (a) The energy difference for particles at different sides of membrane contains besides ordinary Josephson energy also a contribution from difference of cyclotron energies. This raises the scale to the energy scale of biophotons and allows also consistent model for the metabolic energy quantum of nominal value .5 eV and considerabily higher than ordinary Josephson energy.

   (b) This model allows also to generalize the thermodynamical model of cell membrane to its quantal "square root" so with Boltzmann weights replaced with their complex square roots with phase expressed as different of total energy. Chemical potentials are replaced with differences of cyclotron energies which are universal and in the energy range of biophotons.

   (c) Second model can be modified also to the needs of the first model.

   (d) It must be emphasized that model is microscopic: one considers transmembrane proteins as generalized Josephson junctions. The differences of generalized Josephson energies become parameters of junction which gives could hopes about solution of selectivity problem.