The basic dynamical aspects of the biological system relate to coordination
and control. Coordination is involved with almost automatic and predictable
activities involving no volition whereas control involves volition and
non-predictability. A basic examples of coordination and control are EEG
and nerve pulse respectively. Various motor activities are good examples of
a control involving macroscopic changes of the shape of the organ. The
great challenge is to identify the quantum correlates of coordination and
control.

The vision about living matter as consisting of a fractal hierarchy of MEs
controlling a fractal hierarchy super-conducting magnetic flux tube
structures in turn controlling ordinary matter at atomic space-time sheets
via many-sheeted ionic flow equilibrium provides a very promising approach
for modelling living matter. MEs interact with magnetic superconductors via
magnetic induction by inducing supra-currents, by acting as Josephson
junctions between magnetic flux tubes, and by inducing magnetic transitions.

The fact (discovered much later than the first version of the chapter
was written) that TGD predicts infinite hierarchy of dark matters defining
scaled down copies of color and electro-weak physics generalizes this
picture dramatically and means that dark matter becomes the quintessential
component of living systems. The predicted spectrum for the values of
Planck constant conforms with quantum criticality since K\"ahler function
does not depend on $\hbar$ and long range fluctuations at quantum
criticality can be also interpreted as fluctuations in the value of $\hbar$
appearing only in the construction of quantum states and making possible
macroscopic quantum coherence.

The original proposal was that the formation of join the along boundaries bonds between the space-time sheets possibly representing different levels of the self hierarchy could be the basic mechanism of control and coordination. In the updated model join along boundaries are replaced by magnetic flux tubes with the motivation coming from the fact that boundary conditions might not allow boundaries at all! Boundaries would be replaced by boundaries of Minkowskian regions at which the signature of the induced metric changes from Minkowskian to Euclidian) with Euclidian region defining the space-time sheet assignable to even macroscopic system.

The interpretation as a prerequisite for bio-feedback, understood in very general sense, is very suggestive. The presence of join along boundaries bonds makes possible transfer of various charge particles between space-time sheets in question and the resulting system is very similar to two weakly coupled super conductors connected by Josephson junctions. This suggests that that super currents and Josephson currents between the space-time sheets are crucial for the coordination, which could be identified as deterministic quantum time development without quantum jumps.

Any harmonic perturbation with some magnetic transition frequency can induce magnetic quantum transitions and even magnetic quantum phase transitions. An attractive identification for this process is as basic tool of quantum control tool so that the resonance frequency appears as control parameter \blockquote{waking up} subself at its critical value. Critical frequencies correspond to the magnetic and Z^0 magnetic cyclotron frequencies in the model of super conductor relying on the presence of weak magnetic or Z^0 magnetic field (magnetic field guarantees effective one-dimensionality of the super conductor and implies finite gap energy in TGD framework). Cyclotron frequency hypothesis has had rather dramatic success and

leads to
a rather detailed picture about brain as a macroscopic quantum system.

This general picture is applied at various levels. A general model for
weakly coupled super conductors is constructed and simple models for various control tools like comparison circuits, biological clocks and alarm
clocks, feature detectors and novelty detectors are sketched. This model
of quantum control is applied in some particular cases.

Decade later this picture has become considerably more detailed with more
detailed model for how dark low frequency photons are used in living system
the basic tool of control and coordination. In particular, the hypothesis that
dark photons decay to ordinary photons with visible and UV energies identifiable
as biophotons has emerged.

%\end{abstract}