

Quantum biology is now taken rather seriously. Photosynthesis and avian navigation are two key applications of quantum biology. The basic problem in both cases is posed by the fact that the magnetic interaction energy in Earth's magnetic field is roughly million times smaller than thermal energy. The so called radical-pair mechanism (RPM) was proposed already at 60's as a possible solution to the problem posed by anomalously large effect in EPR and NMR experiments. According to RPM, a radical pair is accompanied by electron pair, which is in a superposition of spin triplet and singlet states and behaves as quantum coherent system for a time sufficiently long to induce chemical effects. The hyperfine interaction of the members of the electron pair with the nuclei of radicals would amplify the effect. The neutralization of radical pair puts an end to the coherence interaction period.

The proposal is that RPM gives rise to chemical compass making possible avian navigation. There is however a problem. RPM has been observed in laboratory only for magnetic fields in the range 1 mT-10 T. Earth's magnetic field is only 2 per cent of the lower bound so that it is quite possible that RPM is not at work.

This opens up the door for new quantum physics proposed by TGD based model of quantum biology. In this approach magnetic body acts as intentional agent using biological body as a sensory receptor and motor instrument. Macroscopic quantum coherence is made possible by dark matter realized as a hierarchy of $n \times h$ phases.

In this chapter RMP is summarized and compared with the TGD based vision. Also the possible connection between avian navigation and circadian clock suggested by the fact that both involve photoreceptor known as cryptochrome and a possible connection with gravitaxis are considered in TGD framework.