

MAGNETOSENSORY STRUCTURES IN THE BEAK OF BIRDS – A THEORETICAL ANALYSIS

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Behavioral experiments and electrophysiological recordings have shown that the upper beak of birds hosts a magnetoreceptor and a group of distinct dendrites with ferrimagnetic inclusions has been identified as a structural candidate for the magnetoreceptor. The magnetic inclusions consist of superparamagnetic nanocrystals of magnetite/maghemite, which form densely packed, roughly spherical clusters of 1 micron diameter. The clusters are accompanied by numerous micron-sized, elongated bags filled with an amorphous ferric iron compound not identified thus far. Lately, these accompanying structural elements, referred to as “platelets”, have been proposed to function as magnetic flux focusers that amplify the local magnetic field acting on a nearby superparamagnetic cluster. We first revisit the theoretical model by Solov’yov and Greiner (Biophys. J. 2007 vol. 93, pp. 1493), which turns out to be based on flawed assumptions. We then present a more realistic model, in which magnetic attraction forces between adjacent platelets can be exploited to stimulate mechanosensory receptors.