Magnetic compass in the cornea: Local anaesthesia impairs orientation in a mammal

Wegner R.E., Begall S., Burda H.

Department of General Zoology, Institute for Biology, University of Duisburg-Essen, Universitätsstraße 5, 45141 Essen, Germany

Abstract: The mechanism of signal transduction during magnetic compass orientation is rarely evident in vertebrates and is as yet unknown in mammals. This transmission has been associated with magnetite-based receptors innervated by the ophthalmic nerve or with the involvement of the eye, particularly the retina. We provide the first behavioural support for the cornea carrying the respective primary sensors in mole-rats (Fukomys anselli) by showing that local anaesthesia disrupts their normal directional magnetic orientation. During corneal anaesthesia in normal geomagnetic conditions, mole-rats did not maintain their preferred nesting direction, but displayed a random orientation pattern. A second experiment showed that the ability of the mole-rat to discriminate between light and dark was not impeded by the same anaesthetic treatment, suggesting no retinal involvement in mole-rat magnetic orientation. Our study restricts the peripheral primary sensors in mole-rats to the ophthalmic region, probably the cornea and indicates magnetite as the responsible signal mediator.

Author Keywords: Bathyergidae; Cornea; Magnetic compass orientation; Magnetite; Mole-rat; Sensory transduction

Year: 2006
Source title: Journal of Experimental Biology
Volume: 209
Issue: 23
Page : 4747-4750
Cited by: 15
Link: Scorpus Link
Document Type: Article
Source: Scopus

Authors with affiliations:

1. Wegner, R.E., Department of General Zoology, Institute for Biology, University of Duisburg-Essen, Universitätsstraße 5, 45141 Essen, Germany
2. Begall, S., Department of General Zoology, Institute for Biology, University of Duisburg-Essen, Universitätsstraße 5, 45141 Essen, Germany
3. Burda, H., Department of General Zoology, Institute for Biology, University of Duisburg-Essen, Universitätsstraße 5, 45141 Essen, Germany