

All birds use the same navigation system

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How do birds find their way when they fly? Scientists resolved this question a couple of years ago at DESY with the synchrotron radiation source DORIS III, when they discovered structures containing iron in the beaks of homing pigeons. These structures are able to measure the direction and intensity of the earth's magnetic field and thus help the birds navigate. Recently a team of scientists from the universities of Frankfurt and Oldenburg, the Helmholtz Centre Berlin, and DESY gained surprising new insights with new experiments.

Short nerve branches containing iron -so-called dendrites - located in the upper beak of homing pigeons had been discovered by the Frankfurt neurobiologists Dr. Gerta Fleissner and Professor Günther Fleissner together with DESY physicist Dr. Gerald Falkenberg. The decisive iron oxides had been characterised at DORIS. They locally intensify the earth's <u>magnetic field</u> in the pigeon's beak and stimulate the dendrites of the <u>nerve cells</u> that are responsible for the pigeon's navigation. Meanwhile, the scientists' team found the same structures in many other bird species. With the detection possibilities of X-ray spectroscopy at DESY, it became evident that the iron oxides in the dendrites are identical in all samples.

These results were published in the interdisciplinary online journal <u>PloS</u> <u>ONE</u>.

"When we discovered this nerve branch system with the strongly magnetic iron in certain cell particles in homing pigeons in the past years, the immediate follow-up question was whether similar dendritic



systems may be found in other bird species too," said project leader Gerta Fleissner.



The X-ray fluorescence picture shows the iron distribution in the dendrites of different bird's beaks (from top: garden warbler, European robin, domestic chicken, homing pigeon) (G. Falkenberg et al.).

No matter whether the birds do or do not use their magnetic map in their brains, encoded by more than 500 magnetic field receptors, for their long-distance orientation - this ability can be found in migratory birds like robin and garden warbler as well as in the domestic chicken. In order to provide convincing evidence, several thousand comparative measurements were performed.



"This finding is astonishing, as the <u>birds</u> studied have different life styles and must fulfil diverse orientation tasks: Homing pigeons, trained to return from different release sites to their dovecotes, short-distance migrants like robins, long-distance <u>migratory birds</u> like garden warblers and also extreme residents like domestic chicken," explains Gerta Fleissner.

More information: <u>dx.plos.org/10.1371/journal.pone.0009231</u>

Provided by DESY

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