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News: Genetics,Chemistry,Animals

Birds get their internal compass from this newly ID'd eye protein

'Sixth sense' lets zebra finches and European robins navigate using Earth's magnetic field

By Dan Garisto 7:00am, April 3, 2018

SIXTH SENSE During European robins' long-range migrations, production of the protein Cry4 increases and that may facilitate the birds' sense of Earth's magnetic field.

Henrik Mouritsen

Birds can sense Earth's magnetic field, and this uncanny ability may help them fly home from unfamiliar places or navigate migrations that span tens of thousands of kilometers.

For decades, researchers thought iron-rich cells in birds' beaks acted as microscopic compasses (*SN: 5/19/12, p. 8*). But in recent years, scientists have found increasing evidence that certain proteins in birds' eyes might be what allows them to see magnetic fields (*SN: 10/28/09, p. 12*).

Scientists have now pinpointed a possible protein behind this "sixth sense." Two new studies — one examining zebra finches published March 28 in *Journal of the Royal Society Interface*, the other looking at European robins published January 22 in *Current Biology* — both single out Cry4, a light-sensitive protein found in the retina. If the researchers are correct, this would be the first time a specific molecule responsible for the detection of magnetic fields has been identified in animals.

"This is an exciting advance — we need more papers like these," says Peter Hore, a chemist at the University of Oxford who has studied chemical reactions involved in bird navigation.

Cry4 is part of a class of proteins called cryptochromes, which are known to be involved in circadian rhythms, or biological sleep cycles (*SN: 10/02/17, p. 6*). But at least some of these proteins are also thought to react to Earth's magnetic field thanks to the weirdness of quantum mechanics (*SN: 7/23/16, p. 8*). The protein's quantum interactions could help birds sense this field, says Atticus Pinzon-Rodriguez, a biologist at the University of Lund in Sweden who was involved with the zebra finch study.

To figure out which of three cryptochromes is responsible for this quantum compass, Pinzon-Rodriguez and his colleagues examined the retinas, muscles and brains of 39 zebra finches for the presence of the three proteins Cry1, Cry2 and Cry4.

The team found that while levels of Cry1 and Cry2 followed a rhythmic pattern that rose and fell over the day, Cry4 levels remained constant, indicating the protein was being produced steadily.

"We assume that birds use magnetic compasses any time of day or night," says Lund biologist Rachel Muheim, a coauthor on the zebra finch study.

European robins also showed constant levels of Cry4 during a 24-hour cycle, and higher levels during their migratory season. And the researchers in that study found Cry4 in an area of the robin's retina that receives a lot of light — a position that would help it work as a compass, the study says.

"We have quite a lot of evidence, but [Cry4] is not proven," says Henrik Mouritsen, an animal navigation expert at the Institute of Biology and Environmental Sciences in Oldenburg, Germany,

who participated in the robin study. More definitive evidence might come from observing birds without a functioning Cry4 protein, to see if they still seem to have an internal compass.

Even then, Hore says, we still may not understand how birds actually perceive magnetic fields. To know, you’d have to be a bird.

Citations

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Further Reading

E. Conover. Quantum fragility may help birds navigate. *Science News*. Vol. 190, No. 2, July 23, 2016, p. 8

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T. Saey and A. Cunningham. Cracking the body clock code wins trio a Nobel Prize. *Science News*. Vol. 192 No. 7, October 28, 2017, p. 6

L. Sanders. Birds' eyes, not beaks, sense magnetic fields. *Science News*. Vol. 176, No. 11, November 21, 2009, p. 12

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Tokyo Medical and Dental University (TMDU)

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