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Which Way is North?

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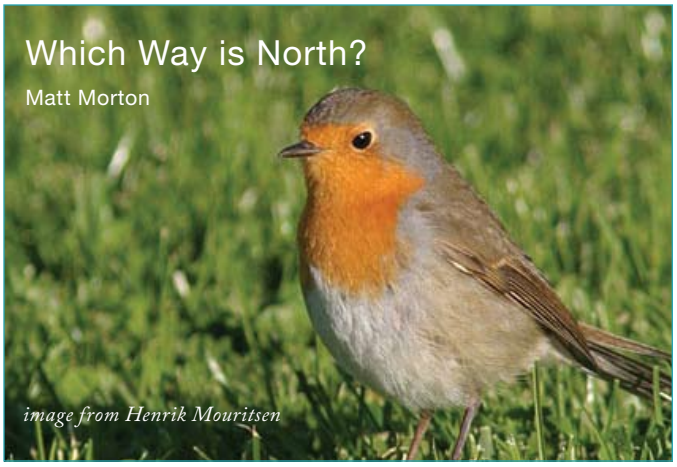

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image from Henrik Mouritsen

Each year, countless birds migrate to more acceptable living conditions with the changing of the seasons. They do so by using a previously misunderstood 'sixth sense' that allows them to detect the Earth's inherent magnetic field and orient themselves accordingly. Until recently, many researchers attributed this ability to iron-based receptors in cells of the upper beaks of migratory birds. However, a recent study published in *Nature* suggests that much of this magnetic sense is the result of specialized light-sensing cells of the eye that send signals to a light-processing part of the brain known as cluster N. Henrik Mouritsen of the University of Oldenburg in Germany claims that special proteins, cryptochromes, in birds' eyes play a large role in light-dependent magnetic sensing. When struck by light, the proteins produce a pair of molecules known as free radicals. Unpaired electrons on the free radicals have a spin property that may be susceptible to magnetic fields. Signals generated by these electron spins may then travel to cluster N where the brain interprets the signal and informs the bird which direction is North. To test this hypothesis, Mouritsen and his team caught 36 migratory European robins, all of which were able to correctly orient themselves under both natural and induced magnetic fields. In one group of robins, the trigeminal nerve, which connects the beak cells to the brain, was severed. In the other group, researchers damaged brain cells in cluster N known to receive light signals from cells of the eye. Those robins with the severed trigeminal nerve were still able to orient correctly, but those with damage to cluster N were not. Since information was unable to travel from the beak to the brain in the group of birds with the severed trigeminal nerve, this study suggests that the beak cells and trigeminal nerve play little, if any, role in orientation, though Mouritsen thinks the beak cells may still be responsible for detecting minute changes in magnetic field strength along the north-south axis. The study has important implications for conservation efforts focused on the relocation of migratory species. These birds often return to their migratory grounds after relocation, but if scientists are able to understand exactly how birds navigate then conservationists may be able to fool birds into permanently relocating to safer, more habitable environments.