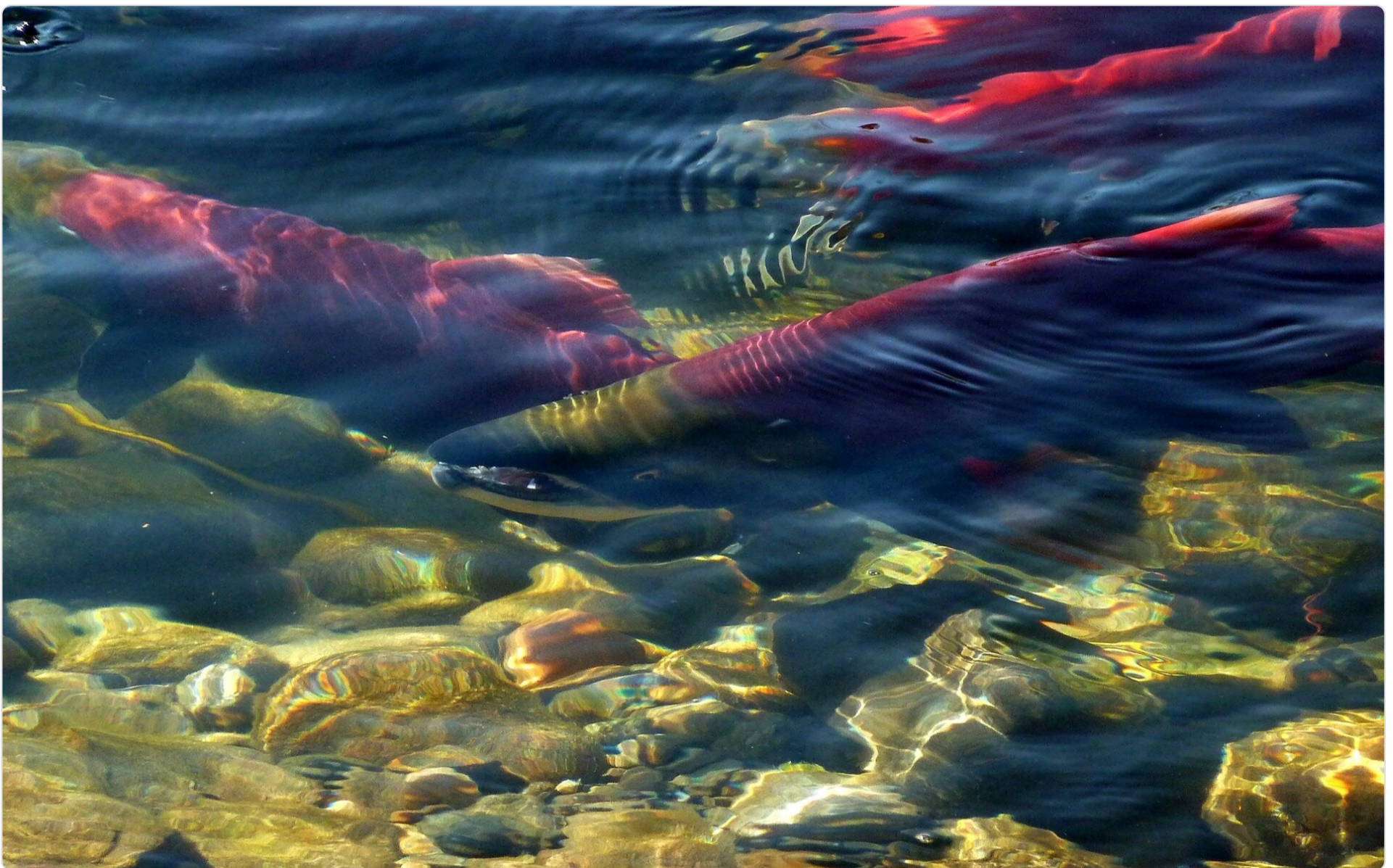


SCIENCE

# Research on magnetite in salmon noses illuminates understanding of sensory mechanisms enabling magnetic perception

[Mike Letterman](#)

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It's widely believed that animals such as salmon, butterflies and birds have an innate magnetic sense that allows them to use the Earth's magnetic field for navigation.

Scientists are struggling to determine how the underlying sensory mechanism works.

Scientists from Oregon State University were part of a team of researchers who wrote a paper about a new theory. The ancient genetic systems that were developed by bacteria and passed to animals long ago may have roots in Magnetite crystals that form inside specialized cells of salmon and other animals.

The theory is based on evidence from the noses of salmon. The paper's lead author is Renee Bellinger, who completed her

PhD in fisheries science at Oregon State.

Bellinger is a research geneticist at the U.S. Geological Survey and is affiliated with the University of Hawaii. We weren't able to prove the underlying key to magnetic perception in animals, but our study revealed associated genes as an important tool to find new evidence of how potential magnetic sensors may function.

It's like trying to find a needle in a haystack. The work paves the way for us to find and understand the cells that make up the needle.

Michael Banks, a professor at Oregon State, said that the findings have the potential for widespread application, from improving salmon management through better understanding of how they use the ocean to targeted medical treatments based on magnetism.

Salmon go out to the ocean to feed and then come back to their spawning grounds where they die. They don't have the chance to teach their offspring where to go, yet the offspring still somehow know where to go. There are a lot of potential applications for helping to preserve the species, but also for human applications such as medicine or other orientation technology, if we can figure out how salmon sense and orient.

Michael Walker of the University of Auckland in New Zealand was the first to discover magnetic resonance in the noses of trout.

Bellinger said that he narrowed it down to magnetite. We were expecting to see chains of crystals in the salmon's nose, like how magnetite-producing bacteria grow chains of crystals and use them as a compass needle. The individual crystals are organized in small clusters. The original hypothesis was different than the configuration.

The form in which magnetite appears is a representation of biomineralization, the process by which living organisms produce minerals. Bellinger said that the similarity between magnetite crystals of bacteria and fish suggests that they share a common evolutionary genetic history.

The mechanism for developing magnets was developed by bacteria more than two billion years ago. The tools to perceive magnetism are still present in a broad array of animal species, said Banks, who is affiliated with OSU's Department of Fisheries, Wildlife, and Conservation Sciences in OSU's College of Agricultural Sciences and the Coastal Oregon Marine Experiment Station at OSU's Hatfield Marine.

The evolution of mitochondria, which control how animals release energy, may be related to the sharing of them across animal life. He said that the Mitochondria were transferred from the bacterium to other organisms.

The researchers said that understanding the evolutionary history of magnetite is a step towards further understanding the underlying process. Banks, Bellinger and colleagues would like to test their new understanding and associated markers to further address the mystery of why and how some life forms have well-tuned tools for long and precise migratory strategies.

The co-authors of the paper are from China, Germany, and France.

M. Renee Bellinger and her team have published a paper in the Proceedings of the National Academy of Sciences about the importance of biomineralization genes in all life stages. There is a book titled "10.1073/pnas.2108655119."

The National Academy of Sciences has a journal.

The research on salmon noses illuminates understanding of sensory mechanisms.

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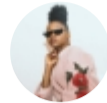
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