

Magnets and Migration: Magnetic Fields in 3D Transcript

Brought to you by the Asombro Institute for Science Education.
[background music]

In your investigation, you saw that the earth is basically a giant magnet and you showed that the earth's magnetic field can exert a force on objects like a compass. Because the earth's magnetic field exerts a force on other magnetic objects like compasses, we can use the earth's magnetic field to navigate. But it turns out that we're not the only animals that rely on the magnetic field to get around. Lots of animals migrate. Birds, butterflies, bats, whales, sea turtles, even salmon travel thousands of miles every year to find food and a safe place to raise their young. We're going to focus on the migratory animal you probably see most often: birds! Here's Dr. Tim Wright. He's a bird behavioral ecologist at New Mexico State University here in Las Cruces.

[Dr. Wright] Birds are very important parts of the ecosystem. So they do very important things for the plants and animals that they live with, like pollinate and spread seeds around. But they're also beautiful.

[Kelly] Some bird species migrate while others don't. Many of the doves and roadrunners that you see around Las Cruces are here all year long. But plenty of birds do migrate, from little tiny songbirds to big geese and hawks. Every fall near Socorro, New Mexico, there's a Festival of the Cranes, when the sandhill cranes arrive to spend the winter there. So how exactly do all these birds know where to go?

[Dr. Wright] People have been studying it for over 50 years trying to understand how it is birds migrate, and the answers are still coming - we're still learning about it. There seem to be in many species multiple systems. Anybody who has to get from one place to another place needs two things. They need a map, and then they need a compass to tell them which direction they're moving in.

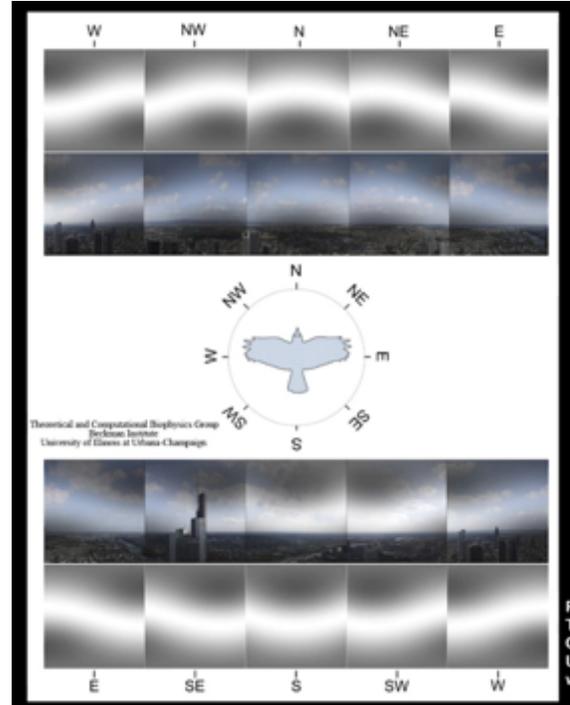
[Kelly] Scientists think that many animals make maps in their heads. They're based on memory or instinct.

[Dr. Wright] The compass system is even more interesting. Some birds seem to use the stars, some use the sun, some use magnetoreception. So this is an interesting sensory system that we humans don't really use. They use the earth's magnetic field, which changes in direction and strength from the poles down to the tropics, and they can use that to know when they're flying north or when they're flying south. There's actually a disagreement among scientists on exactly how birds sense this magnetic field.

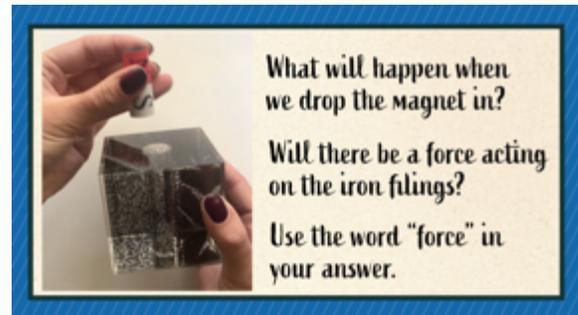
[Kelly] One hypothesis is that there are cells with magnetite in a bird's beak, so they're able to point their beak in one direction and sense the earth's magnetic field.

[Dr. Wright] More recently, people have started to think that maybe there's something actually in the eye. It's a particular protein called a cryptochrome and it's light-sensitive, but when it absorbs light it also can sense the magnetic field.

[Kelly] Scientists think that when light hits the cryptochrome, migratory birds might be able to see something that looks like this. The cryptochrome allows the birds to visualize the earth's magnetic field in 3D. But this is just one of many different tools birds have to help them migrate and figure out where they're going. Since humans can't normally see the magnetic field like a bird can, this viewer helps us see the magnetic fields in 3D. It's filled with oil and iron filings like you used in your investigation.



I'm going to shake it up so the iron filings are dispersed throughout the entire bottle. If we drop this magnet in the middle of the solution, what do you think will happen? Note that the magnet isn't actually touching the iron filings, will there still be a force that acts on the iron filings? Write the answer to this question in the box to the right and use the word 'force' in your answer.



Edpuzzle question: What will happen when we drop the magnet in? Use the word 'force' in your answer.

As I drop the magnet in, watch what happens to the iron filings that were suspended in the liquid. Even though they aren't touching, the magnet is exerting a force on the iron filings. The magnetic field organizes the iron filings around the magnet, just like we saw when we put the iron filings on paper.

But, now we can see the magnetic field goes all around the magnet on all sides. Just like with the bar magnet, the iron filings will cluster together where the magnetic field is strongest. If this magnet represents the earth, where on Earth is the magnetic field the strongest?

Edpuzzle question: Where on Earth is the magnetic field the strongest?

- A. The north and south pole
- B. The equator

The magnetic field is strongest at the poles of the earth, and weakest at the equator. Now compare the magnetic fields we see here to bird vision. Imagine you're a bird sitting on the

surface of the earth, represented here by this magnet. If you look out from inside the magnetic field, you would see the angle of the magnetic field bending around you like this. The bright part of the image represents the bird's view of the magnetic field.

This is only one of many navigation tools migratory animals have. We know that birds also use landmarks and the position of the stars. Butterflies use the position of the sun and have a very sensitive internal clock, and other animals use lots of other techniques.

Scientists all over the world are just starting to unravel the mystery of how animals sense and use Earth's magnetic fields. The one thing we are sure of is the earth has a magnetic field, and living things interact with it in many ways.

In the last part of this assignment, you're going to use your knowledge of magnetic fields to help Hank the hummingbird migrate from his summer home in New Mexico to his winter home in southern Mexico. Go back to Canvas and click on the bird migration game. You'll have to make decisions about what Hank should do during his migration, then answer the questions about the game in the Canvas assignment. Have fun!

[background music]