



Turtles: The Coolest Navigators!

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If you're a Turtle Guardian, you're most likely familiar with at least some of the threats that turtles face, but have you ever wondered how turtles *navigate* through these dangerous surroundings? Well, the answer is much more multifaceted than you may have guessed! Turtles use a complex mix of features to get around their environments, and scientists are just starting to understand the different mechanisms turtles use. From magnetic fields, the position of the sun, and spatial memory/learning, turtles have fascinating abilities to help them survive...but these abilities can be used against them when people try to help without being properly informed.

Although there is much more to learn and discover, so far scientists know of at least 3 modalities that turtles use to locate their home turf, and themselves within it:

The first uses Earth's magnetic fields (magnetoreception). Turtles are just one of many animals that use magnetoreception and researchers have found that there are two possible ways they sense the magnetic field. One way is with magnetite, which are iron clusters with strong magnetism thought to be connected to the nervous system. The other way is with a protein, called a cryptochrome, that is located in their eye. Cryptochromes have special pairs of electrons that are excited by sunlight and spin around each other when they're exposed to certain wavelengths of light. This spinning causes turtles to have the ability to detect very weak magnetic fields such as that of the Earth (only 0.5 gauss!).



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The next modality is the position of the sun. Within a day of hatching, turtles develop the ability to use only the position of the sun in order to move to where they're going. In a recent study that investigated how hatchling Blanding's Turtles navigated, researchers found that the position of the sun was used in order to move to wetlands upon hatching. In order to ensure the turtles were not using their geomagnetic forces to determine how to travel, the hatchlings had a magnet attached to their shells to disrupt that sense. The researchers also blocked the turtles' ability to see the wetland by placing them in a field with large cornstalks. After the researchers determined what direction the baby turtles had initially been heading, they were collected and held in a laboratory where half of the turtles experienced a simulation of normal daylight hours, while the other half experienced daylight hours that were six hours behind. When placed back into the field where they were collected, the turtles that experienced normal daylight hours moved as normal toward the direction of the wetland. However, the turtles that experienced daylight that was shifted six hours behind moved in a direction that was 90 degrees from their initial trajectory. The researchers said this made sense since 90 degrees is a quarter of 360, and a quarter of an entire day is 6 hours.

The last modality is through learning and memory. In a recent study of Painted Turtles, scientists moved individuals to a completely new location to test their ability to respond to changes in their habitats. The results were surprising and have important implications. They found that the young juvenile turtles, those under four years old, were able to readapt to the changes in the habitat and navigate successfully within it, locating far off water sources and moving through the landscape with the precision of the turtles local to the area. This was not the case for turtles older than four years of age. Unlike the young juveniles, the older turtles were not about to adapt to the change in habitat. This supports that turtles have a certain window of time in which they imprint on their habitat and it becomes their home. The researchers attributed this to the neurotransmitter acetylcholine, which influences spatial memory in animals. This was then put to the test by giving turtles a drug that temporarily blocked acetylcholine receptors, thus blocking their ability to access long-term spatial memory. What they found was fascinating! The young group of turtles were able to navigate through their environments with no changes whatsoever, whereas the older group of turtles were unable to navigate at all and "wandered aimlessly" until the drug wore off. This offers support that turtles form and utilize spatial memories in the first few years of life in order to navigate their surroundings and successfully migrate. This was the first time such a complex form of cognition during migration was found for reptiles.

So what does this mean for Turtle Guardians, or anyone who wants to help turtles? Most importantly, if you come across an adult turtle (over four years), do not move it or relocate it. Turtles are tied to their home habitats! Once they imprint on their "homes" they cannot be placed anywhere new or they will not survive. They will not know where to nest, where to hibernate or where to find food.

We now know of three different ways turtles are connected to their birth territories and navigate within it. With so much more to learn about turtle navigation, our understanding of the importance of their territories to their survival will only grow.



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What you can do to help:

- Unless a turtle is on a road, the best rule of thumb is to leave it alone. Do not remove a healthy turtle from the wild. Do not relocate turtles from lakes, ponds or other areas.
- Displaced adult turtles will stop at nothing to return to their home territory, forgoing hibernation and even eating while trying to find their home. Moving an adult turtle from their home territory is akin to killing it.
- Understand that a turtle's home range and routes can be extensive. If you come across a turtle that is injured or sick, make a note of the location where it was found so that it can be returned to this its home upon recovery. The more precise, the better!
- If you find hatchling or young juvenile turtles on the road, do not take the turtles home! The hatchling needs to orient itself finding hibernation, feeding, and basking areas so that it can survive as an adult. Turtle Guardians recommends moving them to the nearest wetland from where they were found. Try to stay within 250-500m maximum when transporting them to the closest wetland. Keeping them close to their nest sites also ensures that the integrity of the genetic diversity within the population is sound and maintained.
- If a turtle is on the road, with your safety and the safety of other drivers in mind, move the turtle in the direction it is heading. Turtles are stubborn--they will turn around and double-back across the road if they're not moved toward where they were heading.
- Get involved by becoming a turtle guardian!
- Learn about and support provincial and federal legislation that protects the habitat for all 8 of Ontario's at-risk turtles.
- Talk about turtles! If you care for turtles, share that love with others. Turtles are endlessly fascinating and cool! Tell others about cool turtle facts or about the dangers turtles are facing and how all 8 of Ontario's turtles are species at-risk. Not everyone knows what turtles are up against or how to help, so share your knowledge and enthusiasm!

Sources:

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Help our slow friends come in first!

www.turtleguardians.ca