

Marsh-dwelling mole gives new meaning to the term 'fast food'

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The star-nosed mole gives a whole new meaning to the term "fast food." A study published this week in the journal *Nature* reveals that this mysterious mole has moves that can put the best magician to shame: The energetic burrower can detect small prey animals and gulp them down with a speed that is literally too fast for the human eye to follow. It takes a car driver about 650 milliseconds to hit the brake after seeing the traffic light ahead turn red. The star-nosed mole, operating in the Stygian darkness of its burrow, can detect the presence of a tasty tidbit, such as an insect larva or tiny worm, determine that it is edible and gulp it down in half that time.

"Most predators take times ranging from minutes to seconds to handle their prey," says Kenneth C. Catania, assistant professor of biological sciences at Vanderbilt, who conducted the study. "The only things I've found that come even close are some species of fish," he says.

The secret to the star-nosed mole's impressive foraging ability is the star-shaped set of appendages that ring its nose. This fleshy star makes the mole one of the oddest looking members of the mammal kingdom. Despite its distinctive appearance--and the fact that it ranges from Canada, down through the Eastern United States as far as Georgia--people rarely see star-nosed moles because they live only in marshes and wetlands.

Catania, working with laboratory assistant Fiona E. Remple, captured the elusive moles' feeding behavior with a high-speed video camera.

Because they live in darkness, the moles have very poor eyesight. So they continually survey their environment by repeatedly touching the objects around them with their star appendages. Timing the moles' actions, the researchers found that after touching a small piece of food they took an average of 230 milliseconds to identify it as edible and eat it.

The researchers discovered that their subject is not just a super-fast forager, but that it is moving about as fast as its brain and nervous system will allow. They calculate that when a mole touches a new object, its brain has about eight milliseconds to determine whether it is edible. Given the split millisecond timing involved, it is not surprising that the moles frequently make mistakes. In a series of trials where the researchers set out worm sushi, they found that the moles started to move in the wrong direction and had to suddenly reverse themselves one out of three times.

This inefficient behavior suggests that the moles are operating at, or near, the limit set by the speed which the mole's nervous system can process touch information, the researchers conclude.

"If additional research confirms that this is the case, then these little animals can inform us about an important limitation to the brain's ability to process information and make decisions," Catania says.

The ability to handle prey so quickly and efficiently appears to provide the star-nosed mole with a real advantage: It should be able to live on a diet of smaller animals than its slower competitors, such as shrews and other kinds of moles found in the same area.

It's more difficult to subsist on a diet of small animals than it is to live on larger prey. For example, it is more efficient to kill a 1,000-pound beef cow for food than 125 eight-pound rabbits. That is because it takes

substantially more time and energy to kill and consume the rabbits. Ecologists have formalized this relationship with a factor called prey profitability. By reducing its handling time to a fraction of a second, the star-nosed mole may be able to achieve a net energy "profit" with a diet of insect larvae and other food sources. Of course, that doesn't mean it turns up its nose at larger prey, like long, luscious earthworms.

The insight that the star-nosed mole has specialized in minimizing handling time for small prey helps clear up a number of the mysteries that have surrounded this unusual mammal, Catania says.

For example, it helps explain why the mole developed its star nose. The 22 appendages that ring its nose have a much larger surface area than the sensitive area of an ordinary mole nose. The flexible fingers also allow the star-nose to tap objects in its environment at a faster rate. These advantages mean that the star-nosed mole can find 14 times as many small prey animals in a given period of search time than its close cousin, the eastern mole, the researchers calculate.

Of course, the greater the concentration of small prey, the more this advantage pays off. Not surprisingly, such small-prey animals tend to be abundant in the wetlands and marshes that the star-nose inhabits, Catania says.

Specialization for small-prey handling can also explain the mole's unusual teeth. "The star-nose has the strangest teeth," Catania says. Its incisors are very small compared to other moles and are formed like tweezers. "This allows them to grasp small prey very precisely," he says.

Source: Vanderbilt University

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