MedicalXpress

Fast and slow -- How the spinal cord controls the speed of movement

February 28 2007

Using a state-of-the-art technique to map neurons in the spinal cord of a larval zebrafish, Cornell University scientists have found a surprising pattern of activity that regulates the speed of the fish's movement. The research may have long-term implications for treating injured human spinal cords and Parkinson's disease, where movements slow down and become erratic.

The study, "A Topographic Map of Recruitment in Spinal Cord," published in the March 1 issue of the journal *Nature*, maps how neurons in the bottom of the fish's spinal cord become active during slow movements, while cells further up the spinal cord activate as movements speed up.

By removing specific neurons in the lower spinal cord with laser beams, the researchers rendered the fish incapable of slow movements. By removing nerves further up the backbone, the fish had difficulty moving fast.

"No one had any idea that organization like this existed in a spinal cord," said Joseph Fetcho, a Cornell professor of neurobiology and behavior and an author of the study. "Now that we know the pattern, we can begin to ask how that changes in disease states."

David McLean, Cornell postdoctoral researcher in Fetcho's laboratory, was the first person to discover the pattern of neural activation and how it was associated with speed of movement. He is the lead author on the

study.

The researchers worked with 4 millimeter-long larval zebrafish (Danio rerio) because they are transparent and researchers can see their cells. Fetcho and his colleagues injected the fishes' spinal cords with a fluorescent dye, which then lit up when calcium ions flooded in as the nerve cells activated. A confocal microscope with lasers allowed the researchers to image the cells at very high resolutions. Using this set up, they watched nerve cells light up as the animals moved at different speeds.

While no one knows how this pattern relates to other vertebrates, the research opens a door toward basic understanding of the architecture and function of nerves in spinal cords. With regard to regeneration of spinal cords following injury, for example, medical researchers need a template for a normal spinal cord in order to know if nerves are re-growing normally, Fetcho said.

In Parkinson's disease, researchers believe that a neurotransmitter released by brain cells may contribute to activating a system of nerves and muscles that allow for faster movement. They suspect that damage to these brain cells may disrupt the release of dopamine, further complicating free movement. Fetcho and his group are building a transgenic line of fish with those brain cells labeled so they may be targeted and removed with lasers.

Source: Cornell University