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Treading new paths for neurotrauma rehab

By Shannon McCallum

Inside UVic's Motor Control Research Laboratory, research into such commonplace activities as walking is revealing secrets about the nervous system that may one day improve motor function in people who have suffered stroke or spinal cord injury. Directing this research is Dr. Paul Zehr of UVic's School of Physical Education, armed with nearly $1 million in funding and a desire to advance neurotrauma research at UVic.

Zehr is a leading expert on rhythmic movement whose research in this area over the past few years has focused on how our arms and legs are coordinated when we perform such rhythmic motor activities as walking and bicycling. His results add to previous findings by himself and others that suggest that rhythmic motions are controlled to a large degree by a collection of neurons in the spinal cord called "central pattern generators" (CPGs).

These findings suggest that the spinal cord may play a much larger role in controlling movement than previously thought, and this is encouraging news for people who have experienced a neurotrauma injury where communication between the brain and spinal cord is weakened or absent altogether.

"CPGs can be easily started by commands from the brain, but they can also be regulated in part by feedback from movement," explains Zehr. "For example, when your muscles are being stretched during motion, electrical signals are sent from the muscles back to the spinal cord that reinforce the rhythmic CPG activity." The spinal cord operates differently when it doesn't have direct input from the brain, and Zehr is hoping to take advantage of the capabilities of CPGs to utilize whatever function remains after injury.

If feedback can maintain CPG activity, then can it also act as a surrogate for brain input and help to start CPG activity? To address this question, Zehr plans to conduct experiments in which participants wear special gloves or clothing that increase the electrical feedback signal to the CPGs while they are performing rhythmic activities. The idea is that artificially enhancing this signal may help to compensate for the reduced signals from the brain.

Zehr is hopeful that this line of enquiry will yield positive results. "Feedback can help do it," he says, "but it may not be enough in the complete absence of brain input. But with incomplete injuries, there's still some input from the brain that can help jazz things up, so combined with feedback you can hopefully get things working." If this technique works, it could be the basis for more effective rehabilitation therapies for people with neurotrauma.

Zehr with a model of the human spine and pelvis

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Motor control research at UVic

- The Motor Control Research Laboratory is run by Dr. Paul Zehr with the assistance of graduate students Sandra Hundza, Jackie Balter, Pamela Loadman, Matt Hodgson and Olle Lagerquist and research assistant Holly Murray.
- On a typical research day, volunteers participate in experiments according to their physical ability by using a treadmill, an arm cycling machine or a combined arm-and-leg cycling machine. By comparing the electrical output differences in reflexes and muscle activity between neurologically intact participants and those with neurotrauma, researchers can determine how pathways in the nervous system change following different kinds of neurological injury.
- Funding for Zehr's research and lab operation costs comes from the Christopher Reeve Paralysis Foundation, the Heart and Stroke Foundation of Canada, the Michael Smith Foundation for Health Research, and the Natural Sciences and Engineering Research Council of Canada.
- Since coming to UVic in September 2002, Zehr has been introducing himself and his work to the Victoria community by volunteering with the UVic's Speaker's Bureau and giving presentations to local organizations such as the Victoria Stroke Recovery Association, the Saanich Peninsula Health Unit and the Victoria General Hospital.
- To find out more about Zehr's research or to enquire about volunteering as a research participant, please visit Zehr's website at http://www.zehr.ca or contact the Motor Control Research Laboratory by telephone at 721-8391 or by e-mail at mcrlab@uvic.ca.

This article was written by Shannon McCallum, a student in the Faculty of Graduate Studies, as a participant in the UVic SPARK program (Students Promoting Awareness of Research Knowledge), supported by the Vice-President Academic and Provost and the Vice-President Research.