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Getting a grip on hand function: Researchers discover spinal cord circuit that controls our ability to grasp

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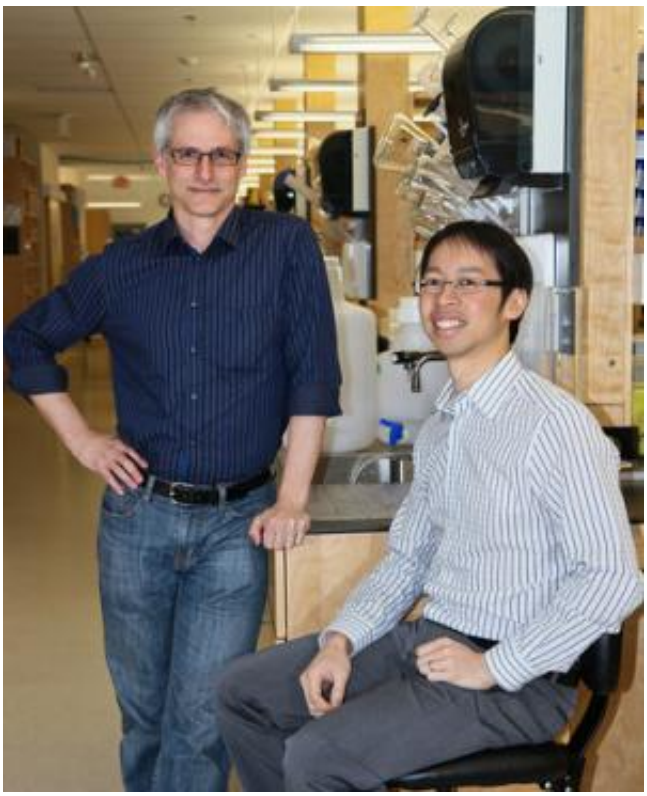

Drs. Rob Brownstone and Tuan Bui.

Dalhousie neurosurgeon and scientist Dr. Rob Brownstone and postdoctoral fellow Dr. Tuan Bui have identified the spinal cord circuit that controls the hand's ability to grasp. This breakthrough finding opens

the door to the possibility of restoring hand function with treatments that target this spinal cord circuit. The world's leading neuroscience journal, *Neuron*, will publish the researchers' finding online at 12 noon EST on Wednesday, April 10.

Drs. Brownstone and Bui have found that a group of neurons in the spinal cord—called dI3 interneurons—assess information from sensory neurons in the hands in order to send appropriate signals to motor neurons in the spinal cord, and hence to the muscles, to control the hands' grip. If this circuit is disrupted—as in spinal cord injuries and neurodegenerative diseases like Alzheimer's disease—a person will be unable to hold onto objects or unable to let them go.

Our ability to control our hands and pick up objects using the right amount of force depends on the tightly regulated transmission of signals among neural circuits in the hands, spinal cord and brain. How we regulate this force has not been known until this discovery by Drs. Brownstone and Bui.

"This spinal cord circuit allows us to subtly and unconsciously adjust our grasp so we apply the right amount of force to whatever we're holding. This mechanism is disrupted in spinal cord injuries, which can completely eliminate the ability to grasp, and in neurodegenerative diseases, which can lead to an uncontrollable reflexive grasp so that people grab and can't let go of whatever they touch" says Dr. Brownstone.

Spinal cord injuries, brain injuries and neurodegenerative diseases affecting the brain and/or spinal cord can all impair hand function, with devastating effects on independence and ability to function in daily life. People with quadriplegia ranked hand function #1, when asked in a 2004 survey which function they would most want to recover if they could. They rated hand function well above trunk stability, walking, sexual

function, bladder and bowel control, and normal sensation.

Drs. Brownstone and Bui were testing a spinal cord circuit they believed played a role in walking when they discovered it controls the hand grasp instead. This observation occurred around the same time that Dr. Brownstone met a patient in his neurosurgery clinic who was unable to control her grasp. When she took his hand, she was unable to let go—he had to peel away her fingers to release his hand. He and Dr. Bui were struck by the implications of their observations and embarked on a series of experiments, with collaborators at Columbia University in New York City, to validate the finding.

Provided by Dalhousie University

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