Researchers uncover a new piece of the puzzle in the development of our nervous system

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Researchers at the Institut de recherches cliniques de Montréal (IRCM) are among the many scientists around the world trying to unearth our nervous system's countless mysteries. Dr. Artur Kania, Director of the IRCM's Neural Circuit Development research unit, and a postdoctoral fellow in his laboratory, Dr. Tzu-Jen Kao, recently uncovered a new piece of the puzzle.

Scientists studying neural development aim to provide insight into the mechanisms that build our nervous system, which contains networks of specialized cells called neurons. Neurons send signals to one another and compute appropriate responses to sensory stimuli.

"For example, neural circuits enable our hands to move away from a burning ember or direct the precise movements of a surgeon's fingers," mentions Dr. Kania. "My laboratory focuses on spinal motor neurons that control muscles and are located in the spinal cord."

In the developing nervous system, axon guidance is the process by which neurons send out axons (long extensions that form our nerves) in order to connect to their correct targets. Growing axons are, in turn, guided towards their targets by signals transmitted from molecules called "ligands," which bind to special "receptors" on the surface of the axon.

"What is really surprising is that our nerves develop using relatively few

ligands and receptors," says Dr. Kania. "We still do not quite understand how, during the development of the nervous system, so few of these molecules manage to form the multitude of existing nerve connections with such accuracy."

To answer this question, Drs. Kania and Kao have been studying the development of motor neuron axons growing into limb muscles. They noticed that in this motor system, the ligands (called ephrins) are present in the same neuron as receptors (called Ephs).

"We showed that ligands present in the neuron bind to their receptors and render them unresponsive to the other ligands in the environment," says Dr. Kao. "Thus, an axon guidance ligand can alter the sensitivity of growing axons to environmental signals, which increases the diversity of axon guidance responses."

The scientific breakthrough made by Drs. Kania and Kao will be published in today's issue of *Neuron,* a scientific journal of the Cell Press group. "Our experiments shed light on poorly understood mechanisms of neuronal development" adds Dr. Kania. "Our breakthrough in the motor system offers the scientific community a new basis for explaining how the function of such few molecules can be modulated to produce a vast array of neuronal connections."

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