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QBI researchers probe nervous system repair

In humans, regeneration of the peripheral nervous system after injury remains a hit-or-miss affair, while brain and spinal cord damage usually results in lifelong disabilities.

But by studying nerve injury in roundworms, researchers at the Queensland Brain Institute (QBI) have revealed a different modality by which regeneration can occur – one that takes us a step closer to understanding how to promote repair in the nervous system.

“Though damaged nerves reconnect in a number of different ways, the underlying mechanisms remain poorly understood,” says Dr Brent Neumann, the postdoctoral fellow who carried out the work in the laboratory of Dr Massimo Hilliard.

The research, published in the latest issue of *Developmental Dynamics*, out this month, examines a process called axonal fusion, which has been observed in crayfish, earthworms, leeches and now in the roundworm *Caenorhabditis elegans* (*C. elegans*).

It offers a fundamentally different mechanism for regeneration of axons (long structures that look like cables and conduct electrical impulses between neurons) than those traditionally proposed.

Using fluorescent imaging, the QBI study showed that axonal fusion is a highly effective way to restore neuronal connections with the target tissue.

Dr Neumann notes that transected (severed) axons can restore their trajectories by bridging just the damage site instead of regrowing their entire length beyond an injury site.

“In the worm, this process happens automatically a certain percentage of the time,” Dr Hilliard explains.

“As *C. elegans* are highly accessible for genetic analyses, future research will focus on the cellular and molecular mechanisms regulating the process – and how to make it happen when it doesn't do so naturally.

“We do not know yet if something similar occurs in humans, but if it is not in place it doesn't mean we can't make it happen.”

The research was carried out in collaboration with Professor David Hall of the Albert Einstein College of Medicine in New York, and Associate Professor Adela Ben-Yakar of the University of Texas at

Austin.

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NOTES TO THE EDITOR:

Molecular and Cellular Neurobiology Laboratory

Dr Brent Neumann works in the Molecular and Cellular Neurobiology Laboratory headed up by Dr Massimo Hilliard. The laboratory uses the nematode *C. elegans* to study neuronal development using a combination of genetics, molecular biology and imaging techniques. In particular, researchers investigate how the axonal and dendrite structures are maintained over time and how they can be reconstituted after injury.; they are also interested in understanding how these neuronal processes are formed and are guided to their targets.

Queensland Brain Institute

The Queensland Brain Institute (QBI) was established as a research institute of the University of Queensland in 2003. The Institute is now operating out of a new \$63 million state-of-the-art facility and houses 26 Principal Investigators with strong international reputations. QBI is one of the largest neuroscience institutes in the world dedicated to understanding the mechanisms underlying brain function.