Medical Xpress

One small step for neurons, one giant leap for nerve cell repair

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The repair of damaged nerve cells is a major problem in medicine today. A new study by researchers at the Montreal NeurologicaI Institute and Hospital (The Neuro) and McGill University, is a significant advance towards a solution for neuronal repair.

The study featured on the cover of the October 7 issue of *Journal of Neuroscience*, is the first to show that nerve cells will grow and make meaningful, functional contacts, or synapses - the specialized junctions through which neurons signal to each other - with an artificial component, in this case, plastic beads coated with a substance that encourages adhesion, and attracts the nerve cells.

"Many therapies, most still in the conceptual stage, are aimed at restoring the connection between the nerve cell and the severed nerve fibres that innervate a target tissue, typically muscle," says Dr. David Colman, Director of The Neuro and principal investigator in the study. "Traditional approaches to therapies would require the re-growth of a severed nerve fibre a distance of up to one meter in order to potentially restore function. The approach we are using however bypasses the need to force nerve cells to artificially grow these long distances, and eliminates the demand for two neurons to make a synapse, both of which are considerable obstacles to neuronal repair in a damaged system."

"We are tackling this problem in an entirely new way, as part of the McGill Program in NeuroEngineering," says Dr. Anna Lisa Lucido, who conducted research for the study as part of her PhD research at The

Neuro and is currently a post-doctoral fellow at UCSF. "This program, spearheaded by Dr. Colman, is a multi-disciplinary consortium that brings together the knowledge, expertise and perspectives of 40 scientists from diverse fields to focus on the challenge of neuronal repair in the central nervous system. The approach we have taken is to help healthy nerve cells form functional contacts with artificial substrates in order to create a paradigm that can be adapted to model systems in which neurons are damaged. That approach will be combined with strategies to encourage the outgrowth of damaged neuronal branches through which these connections, or synapses, are formed. It's a challenging endeavour, but the ability to trigger connections to form on command is a promising start. Our ultimate goal is to create a combined platform in which damaged cells could be encouraged to both re-grow and re-establish their functional connections."

The synapses generated in this study are virtually identical to their natural counterparts except the 'receiving' side of the synapse is an artificial plastic rather than another nerve cell or the target tissue itself. This study is the first, using these particular devices, to show that adhesion is a fundamental first step in triggering synaptic assembly.

"Even though components of synapses have been induced in similar earlier studies, their functionality was not proven. In order to assess function - that is transmission of a signal from the synapse, we stimulated the nerve cells with electricity, sending the signal, an action potential, to the synapse. By artificially stimulating nerve cells in the presence of dyes, we could see that transmission had taken place as the dyes were taken up by the synapses."

"We believe that within the next five years we will have a fully functional device that will be able to directly convey natural nerve cell signals from the nerve cell itself to an artificial matrix containing a mini-computer that will communicate wirelessly with target tissues," says Dr.

Colman. These results not only provide a model to understand how neurons are formed which can be employed in subsequent studies but, provides hope for those affected and potentially holds promise for the use of artificial substrates in the repair of damaged nerves.

Source: McGill University (news : web)