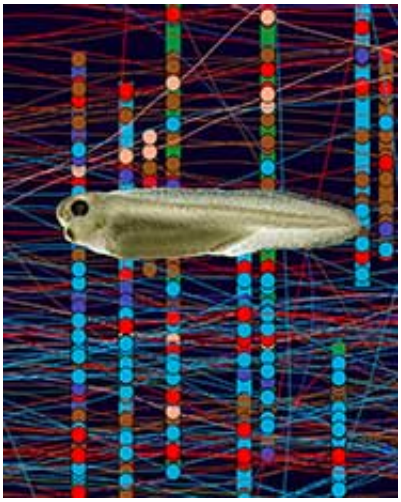
Spinal nerve connections develop using simple rules

January 9 2014



A tadpole against a background showing a fragment of the computer generated network which can produce its swimming movements. Credit: Professor Alan Roberts

(Medical Xpress)—Repairing spinal injuries with stem cells may be a step closer thanks to scientists at the Universities of Bristol and Plymouth. A new study, published today in the *Journal of Neuroscience*, employed novel techniques to show that spinal nerve cell networks may develop using much simpler rules than expected.

In the first study of its kind, the scientists studied the anatomy and physiology of young frog tadpoles and, from the results, built the first complete reconstruction of a nerve cell network that can produce

complex behaviour in a whole vertebrate organism.

They observed imprecise connections between nerve cell fibres depending on where they were located in the brain and spinal cord, and built these into their computer model of nerve growth. It contained nearly 100,000 connections and can make a model of the tadpole nervous system 'swim' when stimulated.

The findings challenge the generally accepted idea that nerve cell connections in developing embryonic animals are only made using highly specific recognition processes like those used when nerve cells in the eye find the correct part of the brain.

Lead researcher Professor Alan Roberts from Bristol's School of Biological Sciences said: "Adult animal nervous systems are highly complex with billions of connections, however, since humans evolved from simple vertebrates like fish and frogs our results imply that early in development, simple rules may lay out the first functional nerve cell networks in our brains.

"The next step is to investigate how imprecise the connections can be while still allowing the correct behaviour to be displayed and to understand how the networks controlling other aspects of tadpole behaviour are constructed."

More information: "Can Simple Rules Control Development of a Pioneer Vertebrate Neuronal Network Generating Behavior?" Alan Roberts, Deborah Conte, Mike Hull, Robert Merrison-Hort, Abul Kalam al Azad, Edgar Buhl, Roman Borisyuk, Stephen R. Soffe. *Journal of Neuroscience*, 8 January 2014, 34(2): 608-621; DOI: 10.1523/JNEUROSCI.3248-13.2014