MedicalXpress

Foetal motor neuron imbalance can hardwire later problems, researchers say

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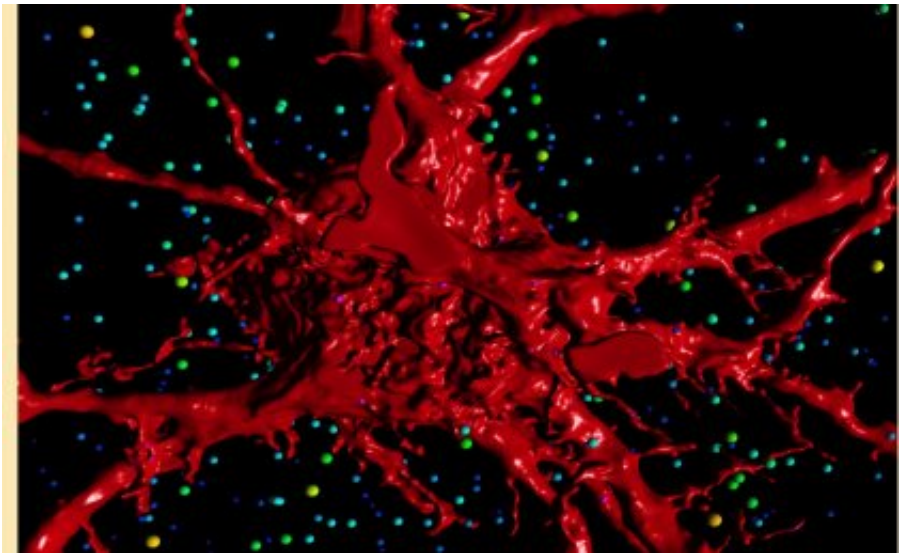

A 3D rendering of the motor neurons that control breathing

Motor neuron connections are refined in the weeks before and just after birth, and they are crucial for normal development later, University of Queensland research suggests.

The discovery could lead to a better understanding of developmental disorders such as autism and epilepsy, say two School of Biomedical Sciences neuroscientists, Associate Professors Peter Noakes and Mark Bellingham.

"Motor neurons form a direct connection between the nervous system and the muscles," Dr Bellingham said.

"It has been well established previously that it is vital that motor neurons do not become over-excited during critical foetal and neonatal periods."

The neuroscientists made the discovery about the importance of the weeks before and after birth during research into the motor neurons that control breathing.

"This intricate balance during respiratory motor system development is particularly important because it's vital that breathing begins at the moment of birth," Dr Bellingham said.

"When the neural circuits are put together in foetal development, all neurotransmitters in the brain and spinal cord act as excitatory influences on motor neurons.

"Our research using a mouse model found that glycine prevented respiratory motor neurons from becoming 'over-excited' in the crucial final trimester of pregnancy when they are connecting with their target muscles.

"We also found the correct balance between motor neurons' excitability and inhibition at this stage of foetal development was crucial for normal later life development in the mouse model."

Dr Noakes said the study had far-reaching implications because the findings about respiratory motor neurons potentially could be applied to motor neurons controlling other types of movement.

"For humans and animals, a critical period when neural circuit connections are refined occurs not only in the last trimester but also

immediately after birth," he said.

"In the mouse model, excess connections in the brain are pruned away in the first three weeks after birth, leaving the connections that are necessary to elicit certain behaviours.

"If the excitation-inhibition balance is perturbed during this time, how the circuits are put together will be altered and once they become hard-wired, long term effects are possible.

"Previous studies have indicated that over-excitability in neural circuits at these critical stages can be linked to epilepsy, schizophrenia, autism, addiction and post-traumatic stress disorder in later life."

This research is published in the The *Journal of Neuroscience*.

More information: Glycinergic Neurotransmission: A Potent Regulator of Embryonic Motor Neuron Dendritic Morphology and Synaptic Plasticity The *Journal of Neuroscience*, 6 January 2016, 36(1): 80-87; DOI: 10.1523/JNEUROSCI.1576-15.2016

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