New knowledge on how neurons talk to muscles

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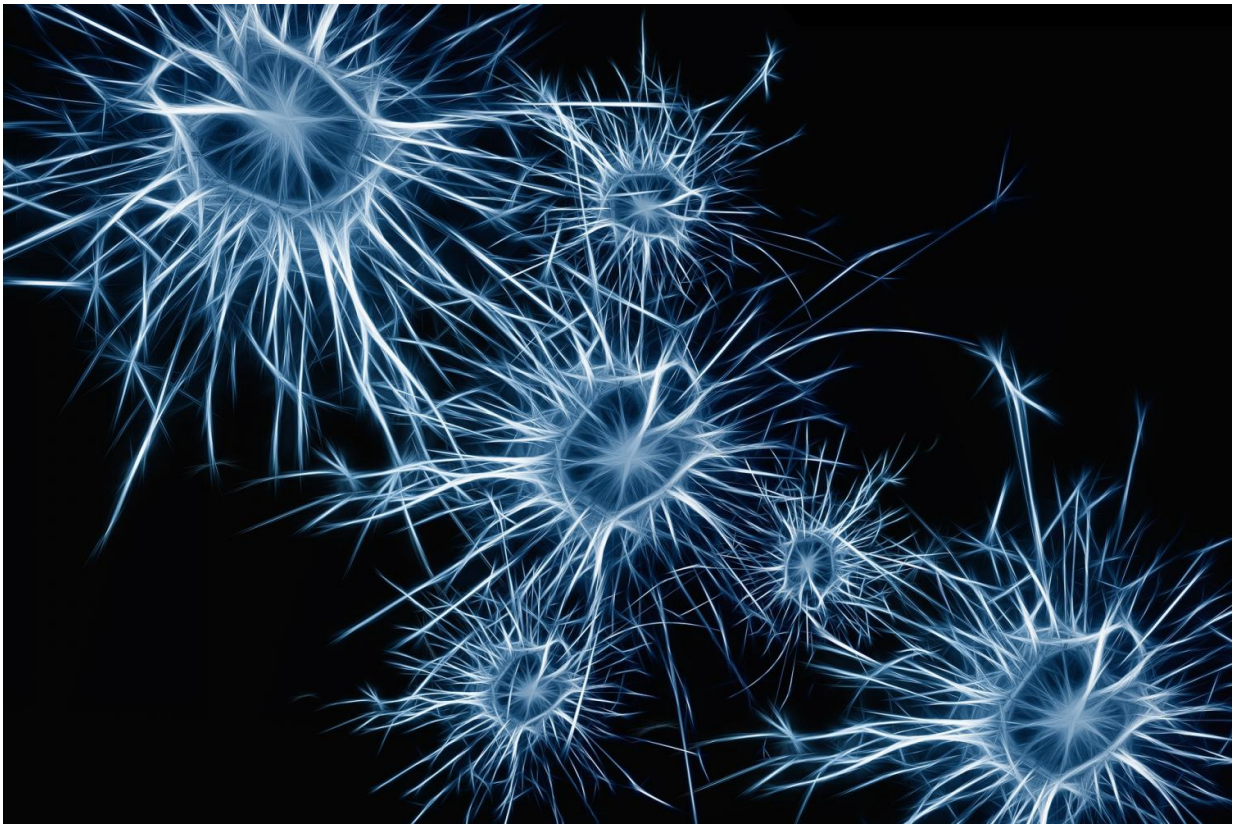

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Researchers at Karolinska Institutet in Sweden have discovered a new way in which nerve cells can control movement. In a study on zebrafish published in the journal *PNAS* they show that the contact between

neurons and muscles is more dynamic than previously thought. The results can open up new avenues to treating spinal cord injury and certain neurological diseases.

The ability to move deliberately is essential to the survival of all animal life, and is based on an interaction between the muscles and the brain. The site where motor neurons and muscle cells communicate with each other is called the neuromuscular junction. This is where the neurons transfer signal substances that can be taken up by the muscle cells to make them contract.

This point of contact – the synapse – has long been described as a relatively simple system in adult vertebrates, with the molecule acetylcholine as the most important neurotransmitter. Despite this, knowledge is lacking on how the communication is actually effected and how adult motor neurons can respond to damage or environmental change.

Fine motor adjustment

Researchers at Karolinska Institutet have now generated new knowledge about how the neuromuscular junction works. Their results show that it is a more dynamic system than previously believed.

"Our study shows that the function of the neuromuscular synapses can change under certain conditions and in certain diseases in order to fine-tune movements, which was a completely unexpected finding," says assistant professor Konstantinos Ampatzis at the Department of Neuroscience, Karolinska Institutet, who led the study.

The study was conducted on zebrafish, which is a common model system in neurobiological research. The researchers show that changes in the form of an increase in physical activity and spinal damage can cause

certain adult motor neurons to switch from producing acetylcholine to producing another neurotransmitter – glutamate. The researchers believe that this is to control movements better.

New therapeutic potential

The results indicate that more detailed studies of the neuromuscular junction are needed, not least in humans. Such knowledge is important because impaired communication between neurons and muscles can cause serious diseases, such as the neuromuscular disease myasthenia gravis.

"Our study can open new doors to the treatment of diseases involving reduced neuromuscular transmission," says Dr. Ampatzis. "More detailed knowledge on which neurons express specific neurotransmitters can enable the development of better treatments that restore function to the nervous system."

There is also growing evidence that the neuromuscular junction is involved in the early stages of such diseases as spinal muscular atrophy (SMA) and amyotrophic lateral sclerosis (ALS), which have previously been regarded as diseases of the motor neurons.

More information: Maria Bertuzzi et al. Adult spinal motoneurons change their neurotransmitter phenotype to control locomotion, *Proceedings of the National Academy of Sciences* (2018). DOI: 10.1073/pnas.1809050115

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