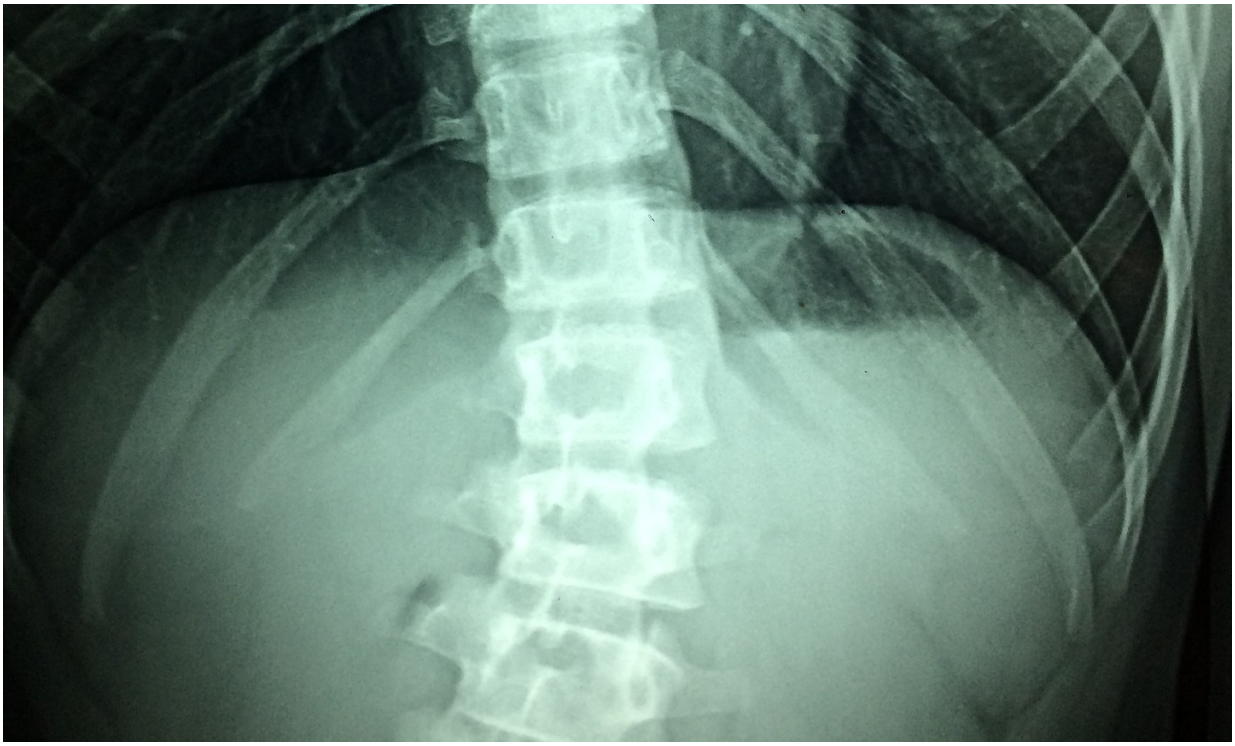
Locomotor engine in the spinal cord revealed

January 22 2020



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Researchers at Karolinska Institutet in Sweden have revealed a new principle of organization which explains how locomotion is coordinated in vertebrates akin to an engine with three gears. The results are published in the scientific journal *Neuron*.

A remarkable feature of locomotion is its capacity for rapid starts and to

change speed to match our intentions. However, there is still uncertainty as to how the rhythm-generating circuit—the locomotor engine—in the spinal cord is capable of instantaneously translating brain commands into rhythmic and appropriately paced locomotion.

Using zebrafish as a model organism, researchers at Karolinska Institutet reveal in detail a full reconstruction of the rhythm-generating engine driving locomotion in vertebrates.

"We have uncovered a novel principle of organization that is crucial to perform an intuitively simple, yet poorly understood function: the initiation of locomotion and the changing of speed," says Abdel El Manira, Professor at the Department of Neuroscience at Karolinska Institutet, who led the study.

The researchers performed a comprehensive and quantitative mapping of connections (synapses) between neurons combined with behavioral analyses in zebrafish. The results revealed that the excitatory neurons in the spinal cord which drive locomotion form three recurrent, rhythm-generating circuit modules acting as gears which can be engaged at slow, intermediate or fast locomotor speeds. These circuits convert signals from the brain into coordinated locomotor movements, with a speed that is aligned to the initial intention.

"The insights gained in our study can be directly applicable to mammals, including humans, given that the organizing principle of the brainstem and spinal circuits is shared across vertebrate species," says Abdel El Manira. "Understanding how circuits in the brainstem and spinal cord initiate movements and how speed is controlled will open up for new research avenues aimed at developing therapeutic strategies for human neurological disorders, including traumatic spinal cord injury, and motoneuron degenerative diseases such as amyotrophic lateral sclerosis (ALS)."

More information: "Multiple rhythm generating circuits act in tandem with pacemaker properties to control the start and speed of locomotion". Jianren Song, Irene Pallucchi, Jessica Ausborn, Konstantinos Ampatzis, Maria Bertuzzi, Pierre Fontanel, Laurence D. Picton and Abdeljabbar El Manira. *Neuron*, online 22 January 2020, DOI: 10.1016/j.neuron.2019.12.030

Provided by Karolinska Institutet