

DANDRITE Lecture

Wednesday 12 January 2022

12.00 – 13.00

Location: Online via zoom



Rune W. Berg

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His research focus is a network approach to understand the nervous system, especially the motor system.

A new theory for the neural principles behind generation of movement

Although the nervous system is elegantly orchestrating movements many of the underlying neural principles remain unknown. Most of the investigations on spinal rhythm generation are based on motor nerve recordings and single neuron recordings. Since flexor/extensor-muscles alternate during movements, it is often assumed that the generation is accomplished by neuronal modules that alternate in opposition, which single neuron recordings seem to support. However, here we argue that when many neurons are monitored simultaneously a different picture emerges. We recorded hundreds of neurons from the lumbar spinal cord of turtles during rhythmic scratching and found that, rather than alternating, the neuronal population is performing a "rotation", i.e. cycling continuously through all phases. Rotational dynamics are observed across trials as well as behaviors. Since such rotation is difficult to explain with existing models of alternating neuronal groups, we propose a new theory that accounts for the rotational dynamics. Using a simplified network model, we show that in spinal networks with recurrent excitatory and inhibitory connectivity, there is no need for pacemaker activity or modular structures. Tonic input to the network controls the rhythm and pattern depending on the task. The model also reproduces other experimental observations and provides a mechanism for multifunctionality and non-rhythmic movements.