



Graduate School Event

Thesis Defense: THE FORM-FUNCTION CONTINUUM OF TETRAPOD SPINAL REGIONALIZATION: Hox-Dependent Neurogenesis, Architecture and Output

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Host: Michael Sixt

The evolution of the vertebrate limb-torso-limb body plan drove a diversification of motor behavior, with limb and non-limb regions exhibiting individual but also crosscoordinated motor repertoires. How neural circuits are organized to generate distinct outputs across body regions, however, remains unknown. Amphibians, the first tetrapods to walk on land, transition to limb locomotion during metamorphosis and offer a unique perspective on the underlying spinal cord transformation. They are separated from mammals by almost 360 million years of evolution, and although they share a common limb-torso-limb organization, they display unique behavioral patterns along their body axis. Here, we construct a cross-species, spatiotemporal atlas of spinal interneurons spanning the rostrocaudal and developmental axes of frogs and mice. We uncover a common framework of interneuron regionalization that mirrors each vertebrate's body plan and motor output. We find *Hoxc9* is a master regulator of both rostrocaudal neuron architecture and neurogenesis itself: subtype architecture and progenitor expansion are transformed thoracic-into-brachial and brachial-into-thoracic by *hoxc9* mutation and *Hoxc9* overexpression, respectively. Combining electrophysiology with computational modelling, we show that changing regional circuit architecture is sufficient to respecify motor output, a combined product of motor and commissural interneurons. Together, these findings establish a causal link between developmental patterning, circuit architecture, and motor function, identifying interneuron regionalization as a fundamental organizational principle linking bodyplan evolution to motor diversity. Our study lays a foundation to further dissect and directly relate individual regional differences in neuron architecture, such as subtype identity, spatial organization, and projection pattern, to motor variation. And thus, uncovering how specific behavioral necessities are met by spinal circuits along the rostrocaudal axis throughout development and across species.

Monday, November 2, 2026 12:30pm - 01:30pm

Sunstone Bldg / Ground floor / Big Seminar Room B (I23.EG.102) and Zoom



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