



## Colloquium

# Encoding Neuronal Shape in the Stochastic Dynamics of Branching Processes

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How complex and reproducible cell shapes emerge from the interplay between deterministic programs and stochastic dynamics remains unclear. Using high-resolution in vivo imaging, quantitative analysis, cytoskeletal perturbations and modelling, we examine the morphogenesis of dendritic arborisations in two classes of *Drosophila* mechanosensory neurons with contrasting architectures. Despite sharing similar local rules for the stochastic branching dynamics, the two classes follow divergent growth dynamics that cannot be captured by standard diffusive growth models. Instead, class-I dendritic branch dynamics are subdiffusive, and a minimal model that distinguishes short and long-term branch behaviors recapitulates most features of growth dynamics and final morphologies. Cytoskeletal perturbations reveal that actin drives short-term branch fluctuations that power arbor expansion, whereas microtubules stabilize branches, modulate diffusivity and set the final arbor size and pattern. Together, these findings establish a parsimonious, generalizable model for neuronal morphogenesis and connect local cytoskeletal regulation to global neuronal architecture, showing how information encoded in the branch stochastic dynamics underlies the emergence of distinct neuronal shapes.

**Monday, March 23, 2026 11:30am - 12:30pm**

ISTA | Central Building | Raiffeisen Lecture Hall



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