Mechanobiology in Epithelial 3D Tissue Constructs

ME3T. LECTURES

GRK 2415

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The chemo-mechanical regulation of neuronal development

Thursday, January 16th, 2025 at 9:00 am

Seminarraum B1.72
DWI – Leibniz-Institut für Interaktive Materialien
Forckenbeckstraße 50, 52074 Aachen

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Abstract: During brain morphogenesis, neurons extend axons over large distances along well-defined pathways. Axon pathfinding is regulated by both chemical and mechanical signals. However, we currently know very little about how these signals interact. We here show how local mechanical brain tissue properties contribute to guiding neuronal axons. In vivo time-lapse atomic force microscopy revealed stiffness gradients in developing brain tissue, which axons followed towards soft. Interfering with brain stiffness and mechanosensitive ion channels in vivo both led to aberrant neuronal growth patterns with reduced fasciculation and pathfinding errors. Tissue stiffness not only directly impacted neuronal growth but also indirectly by regulating neuronal responses to the availability of chemical guidance cues in the surrounding tissue, strongly suggesting that chemical and mechanical signaling pathways are intimately linked, and that their interaction is crucial for morphogenetic events.