Graduate School Event

Thesis Defense: Towards a deeper understanding of meroblastic cleavage - biochemical mechanisms of partial cytokinesis and cellularization in zebrafish embryogenesis

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Host: Carl Goodrich

Embryo cleavage — a series of rapid, reductive cell divisions — is the first morphogenetic movement following fertilisation. It lays the foundation for subsequent developmental events, including gastrulation, germ layer specification, organogenesis, and the establishment of the overall body plan. Two major modes of cleavage exist in the animal kingdom: holoblastic (complete) and meroblastic (incomplete) cleavage. Because holoblastic cleavage resembles canonical cytokinesis, its biochemical and mechanical basis has been extensively studied — an annular contractile ring forms at the equator and constricts in a purse-string-like manner, leading to the complete separation of two daughter cells. In contrast, although meroblastic cleavage occurs widely across the animal kingdom (e.g. in fish, reptiles, birds, and cephalopod molluscs), its mechanical basis remains largely unclear. During meroblastic cleavage, the cytokinetic furrow forms only at one pole and does not traverse the entire embryo, raising the question of how cytokinesis proceeds in the absence of a closed contractile ring. Moreover, the resulting daughter cells are not fully separated from the underlying yolk compartment, and how these blastomeres are subsequently cellularised remains unknown. This thesis takes the zebrafish as a model organism to address both questions. The first part characterises the biochemical and mechanical mechanisms underlying non-canonical meroblastic cleavage, revealing a two-phase process in which actomyosin cable contraction and cadherin-mediated membrane adhesion act sequentially to drive furrow ingression and invagination. The second part sheds light on the spatiotemporal dynamics by which individual blastomeres become cellularised, and uncovers a previously unrecognised contribution of central blastomeres to the yolk syncytial layer.

Friday, July 3, 2026 01:00pm - 02:00pm
Central Bldg / O1 / Mondi 3 (I01.O1.010)

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