Mathematical modelling of heterogeneous stem cell-based systems

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Stem cells in adult tissues sustain growth, repair, and plasticity, while also playing a key role in cancer development. Their function depends on a tightly regulated balance between self-renewal and differentiation, maintained at the population level despite significant single-cell heterogeneity. The role of this heterogeneity in system control remains unclear. This talk presents mathematical approaches to modelling and analysing stem cell transitions. Inferring information about the control of stem cell dynamics from available data requires combining data analysis with mechanistic models of stem cell self-renewal and differentiation. New classes of single-cell data challenge this task. Applications to adult neurogenesis and glioblastoma illustrate how cellular hierarchies shape regeneration and cancer progression.

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