Stem Cells: From Simple Model to Big Data

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In developing and renewing tissues, terminally differentiated cell types are typically specified through the actions of multistage cell lineages. Such lineages commonly include a stem cell and multiple progenitor cell stages, which ultimately give rise to terminally differentiated cells. In this talk, I will present several modeling frameworks with different complexity on multistage cell lineages driven by stem cells, which account for diffusive signaling molecules, regulatory networks, individual cells, mechanics, and evolution. Questions of our interest include role of feedbacks in regeneration, stem cell niche for tissue spatial organization, crosstalk between epigenetic and genetic regulations. In addition, I will discuss our recent effort on connecting modeling and big data by integrating prior knowledge and heterogeneous spatial and temporal data for elucidating developing tissues.