

**Probing Emergent Fate in Live Stem Cells using Multiphysics Modeling and Scale Up to Multicellular Systems**

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Akin to conducting a mechanical loading test on single living cells and groups of living cells as they commit to a given fate, paired experimental and computational experiments provide a critical step in predicting the local stress and strain fields at the cell-fluid interface. These stresses and strains experienced by stem cells demonstrate significant correlation to cell gene expression, and strongly suggest that stresses at the cell-fluid interface influence cell fate. Looking back on previous retrospective approaches, here we discuss recent prospective approaches to 'map the mechanome', providing reference libraries of stress and strain states conducive to guiding cell lineage commitment.