BioFrontiers - Biology Seminar

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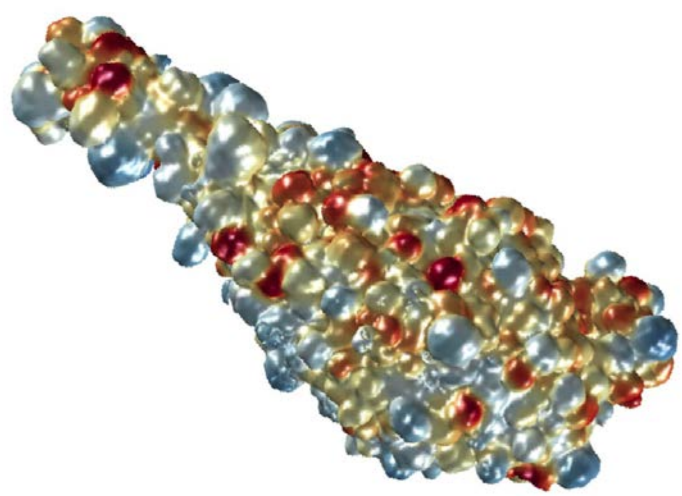
Imaging and modeling molecular scale control of cell and tissue morphogenesis

My lab studies mechanisms of integration between mechanical and chemical signals in cytoskeleton regulation, with a focus on pathways that adaptively control cancer cell growth, morphogenesis, and migration in variable micro-mechanical environments. Currently, we are particularly fascinated by the intersection of cell shape regulation and signals that promote enhanced proliferation and survival as well as cell insensitivity to cytotoxic and targeted drugs in cancer. Integrated mechanochemical pathways are characterized by high non-linearity and redundancy among components, making it impossible to probe the function of individual components by conventional 'intervene and phenotype' approaches. To address this challenge we develop novel analytical approaches to infer the hierarchy and kinetics of molecular information flows through pathways based on spontaneous fluctuations of component activities. A central component of this approach is the detection of pathway fluctuations by quantitative live-cell imaging. To this end, we develop innovative imaging and image processing methods that characterize in situ and live interactions between cells and microenvironment in 3D, including the molecular responses they confer in terms of cytoskeleton organization and cell signaling. In this overview talk, I will present some of the most recent technical developments we have achieved in this research program.



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