SEMINAR

Co-hosted by Mechanical Engineering & Materials Science & Biomedical Engineering

"Simulating cancer cell migration"

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Thursday, September 28
2:45 – 3:45 PM
Brauer Hall, Room 12

Abstract
Cell migration is key to many biological processes including embryonic development, wound healing, and disease progression. Recent studies have shown that cell migration is sensitive to microenvironmental stiffness, and many cells display a stiffness optimum at which migration is maximal. To create a unified theoretical framework for cell migration, we have now developed and experimentally tested a whole cell migration simulator based on the motor-clutch model of cellular force transmission by imposing coupled force balances and mass balances on molecular motors, adhesion molecules ("clutches"), and actin subunits in a compliant microenvironment. The model predicts a stiffness optimum that can be shifted by altering the number of active molecular motors and clutches. This prediction was tested experimentally using glioma (brain cancer) cells, and we find that the motor-clutch cell migration simulator provides a theoretical framework with which to predict cell adhesion and migration in defined mechanochemical microenvironments in 1D, 2D, and 3D.

Biography
David Odde is a professor of biomedical engineering at the University of Minnesota who studies the mechanics of cell division and migration. Trained academically as chemical engineer, Odde joined the newly created Department of Biomedical Engineering at the University of Minnesota in 1999. In his research, Odde's group builds computer models of cellular and molecular self-assembly and force-generation-dissipation dynamics, and tests the models experimentally using digital microscopic imaging of cells *ex vivo* and in engineered microenvironments. Current applications include the modeling of chemotherapeutic effects on cell division, molecular mechanisms of neurodegeneration, and migration of cancer cells through complex microenvironments such as the brain. Ultimately, his group seeks to use the models to perform virtual screens of potential therapeutic strategies (oddelab.umn.edu). Dr. Odde is an elected Fellow of the American Institute for Medical and Biological Engineering (AIMBE) and of the Biomedical Engineering Society (BMES), and is the contact Principal Investigator for the Physical Sciences in Oncology Center at the University of Minnesota (psoc.umn.edu), which is focused on modeling the mechanics of cancer cell migration in biologically relevant contexts.

Faculty, students, and the general public are invited.