

Project Title: Development of a 4D traction force microscope for measuring mechanical stresses

Advisers: Mingming Wu (mw272@cornell.edu) and Cindy Reinhart-King (cak57@cornell.edu),

Cell-generated mechanical stresses are critical during a number of physiological processes, including embryogenesis, cell migration, cell proliferation and tissue formation. However, there is no method currently available to measure cellular traction forces exerted during adhesion and migration in 3-D scaffolds. This information is critical for understanding the contribution of cell-cell and cell-extracellular matrix (ECM) interactions in processes such as wound healing, cancer metastasis, cardiovascular disease, and chronic inflammation. In this research project, student will conduct pilot experiments for the development of a 4D traction force microscope. He/she will measure 3D stresses imparted by a known weight in the bulk of the ECM combining two existing technologies, - a 2D traction force microscope in Reinhart-King's lab and a 4D particle tracking imaging technology in Wu's lab. In parallel to this, a computational algorithm that calculates the stresses exerted by the weight will be developed. We expect that the 4D traction force microscope will be of wide-spread interest to the large community of scientists interested in mechanism of cell migration and adhesion for a number of different physiological systems and disease conditions.

Desired knowledge and skills: Mechanics, programming in MatLab.