RESEARCH OVERVIEW

The Valentine group seeks to understand how forces are generated and transmitted in living materials, and how these forces control biological outcomes. This highly interdisciplinary work lies at the intersection of engineering, physics, biology and chemistry.

To investigate the biophysical and biochemical basis of cellular mechanics, we use a wide variety of experimental techniques, including: high-precision optical trapping to probe single molecules of motor and crosslinking proteins; micromechanical manipulation of cytoskeletal networks that are reconstituted from purified components or assembled in cell extracts; advanced fluorescence imaging of the self-assembly of large protein complexes; and ultrastructural analysis of biopolymers.

To extend this work to cells and tissues, we have developed a suite of high-force, low-cost magnetic tweezers devices and custom load frames that enable precise manipulation of biological materials and are compatible with a wide range of imaging modalities. We are also developing novel methods of measuring interaction and deformation forces within living cells, and are developing new classes of man-made materials that capture the extraordinary properties of living systems, including the ability to respond to stimuli, move, and heal.

Group Website: https://me.ucsb.edu/valentinelab/
Selected Publications


