Site Navigation

SCOTT I. SIMON, PH.D.

Professor

(530) 752-0299
3313 GBSF

sisimon@ucdavis.edu

Simon Lab Website

PERSONAL EDUCATION

B.S. in Applied Mechanics Engineering Sciences, University of California, San Diego 1983
M.S. in Biomedical Engineering, University of California, San Diego 1984
Ph.D. in Biomedical Engineering, University of California, San Diego 1988

AFFILIATION

Immunology, Biophysics, and Biomedical Engineering Graduate Group

RESEARCH INTEREST

Neutrophils-The Warrior Cells:
Scott Simon is interested in blood-cell function, but his specific area of interest is the behavior of one type of white blood cell, called the neutrophil. Neutrophils are in concentrations of about a billion per liter and circulate in the vasculature for only a few hours before being cleared in organs. Their goal over this interval is to surveil the circulation and peripheral tissues for bacteria and other foreign invaders and to home to sites of inflammation. To perform this bacteriocidal function, they are endowed with active motile machinery, can detect the "molecular scent," of invaders through receptor-ligand interaction, and contain enzymes both to kill invaders and to help initiate wound repair. Professor Simon's research focuses on the mechanics of adhesion and the movement of neutrophils. Neutrophils interact with endothelial cells

that line the walls of blood vessels. The flow of blood sets up repellent stresses and the cells roll until they are activated by sensory receptors. Once activated, they adhere to sites of inflammation and also aggregate with each other. In addition to stimulatory receptors, neutrophils express several classes of adhesion receptors that make them very "sticky." These molecules enable them to adhere to sites of inflammation and at sites of injured tissue, such as the myocardium during a heart attack. These studies have a number of important applications. For example, some kinds of cell aggregation may be very sensitive indicators of inflamation, and understanding the basic mechanisms that control the adhesion and migration of neutrophils may lead to new therapeutics in fighting heart disease and cancer. In Professor Simon's laboratory, technologies are developed to "sense" molecular scale forces associated with neutrophil adhesion, such as a phase contrast microscopy linked to piezo-controlled force transducers. Direct imaging of the dynamics of cellular adhesion as they interact with vascular endothelial monolayers in parallel plate flow chambers is accomplished by real-time video microscopy, coupled with automated image analysis. Flow cytometry coupled with shear flow chambers provides "electronic imaging" of the molecular events supporting cellular adhesion and functional activation.

RESEARCH FACILITY

Cell Adhesion Laboratory
Instumentation includes phase contrast and fluorescence optics microscopy and high speed video imaging of cell adhesion in parallel plate flow chambers.
Micromanipulation apparatus consisting of an inverted optical microscope equipped with automated micromanipulators, image analysis, and force transducers. This allows application of pico-Newton forces with msec detection. Tissue culture facility including incubators and hoods for production and maintenance of endothelial and hematopoetic cell lines.

Fluorescence Flow Cytometry
A Becton Dickinson FACSCAN flow cytometer for detection in real time of molecular and cellular parameters. Monoclonal antibody and recombinant molecules to define adhesion and signaling receptors on leukocytes and vascular cells.

Viscometry
Cone plate rotational viscometry for application of defined shear fields to cell suspensions. A Haake RheoStress RS150 rheometer for stress and strain measurements of biofluids and cell suspensions. Enables application of steady state and multiwave defined strain and stress fields.

PUBLICATIONS

Tsou JK, Gower RM, Ting HJ, Schaff UY, Insana MF, Passerini AG, and SI SIMON
Spatial Regulation of Inflammation by Human Aortic
Endothelial Cells in a Linear Gradient of Shear Stress
Microcirculation, 2008 In Press

Schaff UY, Joon NL, and SI Simon, Vascular mimetics based on soft lithography for imaging the leukocyte-endothelial inflammatory response. 2007. Lab on a Chip. 7: 448-456.

Ting HJ, Stice J, Schaff UY, Hui DY, Rutledge JC, Knowlton AA, Passerini AG, and SI Simon. Triglyceride-rich lipoproteins prime aortic endothelium for an enhanced inflammatory response to TNF- . 2007. Circulation Research. Apr;7(4):448-56.

Yoshikazu T, Xiaojing Y, and SI Simon. The integrins. Genome Biology 2007, 8:215

MAJOR RESEARCH INTERESTS

Biomechanics of cells and tissues, neutrophil biology, vascular engineering, particularly with respect to inflammatory disease; fluorescence flow cytometry.