Development of microfluidic platform for quantitative multiplexing of tumor biomarkers.

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Key Research Aims and Goals
To create a high throughput cell-based microfluidic platform that will characterize the receptor density and distribution from the tumor microenvironment.

Current Research
• Developed a method to enrich the number of cell-antibody complexes using chaotic advection required for our biosensor (expected Braswell, 2013).
• Revealed CD31/PECAM, a platelet/endothelial adhesion molecule-1, clustering is not limited at the junctions and the membrane. (expected Braswell, 2013)
• During 2nd rotation, assisted with parametric study of biological buffers in plasmonic nanotweezers (expected Roxworthy, 2013).

Future Research Plans
• Further develop the remaining components of the biosensor.
• Compare receptor density and distribution with mechanical properties of cells from the tumor microenvironment to inform on the mechano-chemical signaling cues and biomarkers.
• Establish CD31 cellular distribution to better define its functional roles of mediating cell adhesion and migration on endothelium.

Fig 1: CD31/PECAM is responsible for cell adhesion and migration. (A) & (B) Previous seminal work revealed CD31/PECAM at the junctions [1,2]. (C) Total Internal Reflection Fluorescence Microscopy (TIRF) reveals CD31 membrane clustering. Membrane clustering is associated with cytoskeleton–receptor adhesion and enhanced cell signaling.

Fig 2: Microchannel height is 80 µm with 40 µm deep grooves. Cross sections within the microchannel correspond to transversal velocity component which shows vortices. Above cross sections represents particle flow after a full cycle of herringbone grooves. Target cell population size (red) of 5%. Blue denotes the remaining cell population and green represents antibodies.