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A Department of the College of Engineering & School of Medicine

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Towards High-Throughput Protein Analysis via Microfluidic Integration

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While the genomics revolution has had sweeping impact on our understanding of life processes, the arguably more important "proteomics revolution" remains unrealized. Proteins are more directly linked to function than genes, but proteins are also dynamic and more biochemically complex. Consequently, protein analysis often demands multi-stage biochemical assays to measure not one, but multiple physicochemical properties (e.g., Western blot, 2D electrophoresis). Unfortunately, benchtop assays consume significant resources, making the biological sciences protein „data limited". To surmount these challenges and realize an era of high throughput proteomics, innovation in instrumentation is needed.

Microfluidic technology has advanced separations science, yet progress in multi-stage separations has lagged. Accepted multi-stage design approaches suffer from inherent information loss owing to strategies that discretize first-stage separations by mapping readouts to discrete compartments in a second-stage. At UC Berkeley, we are introducing novel non-discretizing integration strategies. This talk will highlight multi-stage assays uniquely enabled by our „µMosaic" fabrication technique: an approach that allows us to regionally photopattern 2D microchambers with heterogeneous, discrete nanomaterials. Our design strategy yields low-dispersion, near lossless electrokinetic material transport between disparate assay stages. In one example, I will summarize our recent progress towards fast, hands-free and perhaps even quantitative Western blotting, employed here for analysis of specimens from clinical sample repositories. Our ultimate goal being to advance the understanding of life processes – including development and disease – through quantitative bioinstrumentation.

Dr. Amy E. Herr received her BS degree from Caltech and her MS (1999) and PhD (2002) degrees from Stanford in Mechanical Engineering. At UC Berkeley, her research focuses on instrumentation innovation to advance quantitation in life sciences and clinical problems. Translational impact of her research program spans from tools for fundamental research (cell signaling) to near-patient disease diagnostics. She has Chaired (2009) and Vice-chaired (2007) the GRC on the Physics & Chemistry of Microfluidics and served as a technical program committee member for numerous international conferences. Her major awards include the NIH New Innovator Award (2010-15), the Alfred P. Sloan Research Fellowship in chemistry (2010-12), the DARPA Young Faculty Award (2009-11), the 2009 Hellman Family Faculty Fund Award from UC Berkeley, and the 2008 Regents" Junior Faculty Fellowship from the University of California. In 2007 she was recognized with an Outstanding Mentor Award from Sandia National Laboratories. She has published 21 peer-reviewed articles in journals such as JACS, PNAS, Nature Protocols, and Analytical Chemistry and given 40+ invited lectures.

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