**Personalized diagnostics: High-throughput, dynamic measurement of enzyme activity in intact single cells**

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Molecularly-targeted therapeutics and personalized medicine have dramatically increased the prognosis of patients suffering from cancer; however cellular heterogeneity has led to variations in chemotherapeutic effectiveness. In the case of multiple myeloma, a blood cancer that effects 1 in 143 people, there has been great success using drugs that specifically target members of the ubiquitin-proteasome system (UPS). However, the effectiveness of these drugs is highly variable due to a diverse patient response and the lack of available biochemical assays that directly measures enzyme activity in primary tumor samples before and after treatment. This seminar will focus on recent efforts in my lab towards ex vivo cancer diagnostics and the development of technologies that allow for the high-throughput screening of a heterogeneous population of cells to determine the proper dose for a chemotherapeutic and identify drug resistant subpopulations. In order to provide a rapid and personalized approach, my group has developed long-lived, cell permeable, enzyme-specific, fluorescent, peptide-based reporters to directly measure select enzyme activity in intact cancer cells. We are currently designing biosensors to quantify the activity of enzymes associated with the UPS, the intracellular pathway responsible for the degradation of misfolded or dysregulated proteins. The hallmark of our reporting scheme is an N-terminal β-hairpin ‘protectide’ which can confer stability to unstructured enzyme substrates while simultaneously acting a cell penetrating peptide (CPP). We then incorporate these novel reporters into a droplet microfluidic trapping array that we have fabricated to perform high-throughput, dynamic analysis of intracellular enzyme activity in individual cells. Microfluidic devices offer a significant advantage over competing technologies due to reduced cost, ease-of-use, significant reproducibility, biological inertness, and a compatibility with light microscopy. The long-term goal of this work is developing new clinical methods to be used to (1) categorize drug-resistant subpopulations of cells, (2) determine if a single or combinatorial therapy is needed to eliminate the cancer cells, and (3) identify a personalized treatment protocol on a patient-to-patient basis to increase the likelihood of progression free survival of high-risk multiple myeloma patients.

**Short Biography.** Adam Melvin obtained a BS in Chemical Engineering and a BA in Chemistry from the University of Arizona, a MS in Chemical Engineering (with a minor in Biotechnology) and a Ph.D. in Chemical Engineering from North Carolina State University under the direction of Jason Haugh. He was an NIH postdoctoral fellow at the University of North Carolina at Chapel Hill in the Departments of Chemistry and Biomedical Engineering under the direction of Nancy Allbritton. In August of 2013 he joined the faculty as an Assistant Professor in the Cain Department of Chemical Engineering at Louisiana State University. His current research interests include biomolecular engineering, point of care diagnostics, microfluidics, single cell analysis, chemical biology, algal chemotaxis and growth dynamics. He has several ongoing research projects that are funded by the NSF and NIH. He is also the co-director of an NSF-sponsored REU site at LSU combining entrepreneurship and energy research.