Serum Antibody Profiling of Celiac Disease
Using Bacterial Display for \textit{in vitro} Diagnostics

Bradley N. Spatola and Patrick S. Daugherty

Chemical Engineering Department, University of California at Santa Barbara, Santa Barbara, CA 93106
Tel: 805-893-3477    E-mail: psd@engineering.ucsb.edu

Celiac disease (CD) is an autoimmune disease of the small intestine affecting genetically susceptible individuals following the ingestion of gluten, a protein found in wheat. Although the combination of a serological test with a small intestinal biopsy is a highly effective method for CD diagnosis, there are still critical questions that need to be addressed with regards to early disease detection, identifying additional trigger antigens, and discovering ways to distinguish patients that will not improve with a gluten-free diet. A new serum antibody profiling strategy has been optimized to selectively detect a pool of patients’ antibodies that test positive for two established serological tests for CD and not detect antibodies from a control patient set. A group of 18 unique mimotopes, or peptides that mimic antigenic determinants, were isolated after 5 rounds of enrichment by fluorescent activated cell sorting (FACS) of a bacterial cell display library of random 15-mer peptides. In order to determine which mimotopes had the highest predictive value for CD, the cross-reactivity of these mimotopes was tested on an individual patient basis with the original discovery patient cohort as well as a preliminary training set. A panel of 8 clones correctly classified 17 out of 20 patients as Celiac, while only misclassifying 3 out of 20 controls (Figure 1).

![Heat map representation of individual patient reactivity with CD-specific mimotopes.](image)

Additional CD patient cohorts will be acquired from the clinics of leading CD investigators and our refined bacterial display antibody profiling strategy will be applied to each set of serum samples. After a sufficiently large group of candidate mimotopes are obtained from repeated screenings, the bacterial cells will be printed on glass slides in a novel microarray assay that has been developed in parallel. Bacterial cell microarrays will provide a high-throughput method to characterize the sensitivity and specificity of the CD detector during the training and validation phases of the study and establish the detector is of clinical relevance.