Monthly Publication Highlight - Professor Casey J. Krusemark

The Purdue College of Pharmacy is pleased to honor and recognize the outstanding research and scholarship generated by our faculty each month. This month we highlight Professor Casey J. Krusemark, Assistant Professor of Medicinal Chemistry and Molecular Pharmacology. Professor Krusemark’s recent publication, “A DNA-assisted immunoassay for enzyme activity via a DNA-linked, activity-based probe”, can be read in Chemical Communications (2017; DOI.org/10.1039/c7cc05236g). The study was conducted in collaboration with research scientist Dr. Dongwook Kim and former postdoctoral scientist, Dr. Rachael Jetson.

In this work, we developed a new and general immunoassay approach for detection of enzyme activity. Immunoassays are the predominant method for detection of specific proteins and use antibodies to target areas of protein that are of interest. These assays report only on the abundance of a protein, not on the level of a protein’s enzymatic activity. This information is critical since enzyme activity is often the true driver of biological processes and disease. In addition, detection of activity is important for assessing the function of enzyme inhibitors, which include many drugs. In this work, we developed a new and general immunoassay approach for detection of enzyme activity. This approach involves combining an antibody for specific protein detection and a chemically-reactive, enzyme active site-directed probe. The unique aspect of the approach was linking the active site probe to DNA barcodes. This enabled enzyme activity detection using DNA sequence analysis. We demonstrated the utility of the approach with detection of enzyme activity in challenging situations, such as human serum, and with high throughput screening of enzyme inhibitors.

“The analytical tools for DNA analysis are remarkably powerful. We hope that this approach to transduce enzyme activity information into DNA sequences will allow other research areas, such as medicinal chemistry, to benefit further from the many advantages of DNA detection.”