Chemical Engineering

Abstract
There is a technology gap for simple yet efficient sample handling techniques that concentrate dilute biomarkers while separating them from complex biological specimens. To be applicable in point-of-care (POC) settings, the sample processing must be integrated into a similarly simple yet highly sensitive detection module that lowers the limit of detection (LOD) toward the range of those provided by hospital laboratories. Toward this clinical need, we have developed new integrated processing modules and rapid tests for POC diagnostics. These new bioanalytical systems are being applied to lab card disposable devices and for non-instrumented flow-through and lateral flow diagnostic platforms. The primary advantages of these new rapid tests are their simplicity in combining processing and testing, and their scalability to larger volumes with accompanying improvements in sensitivity. They can also be used as concentration and purification modules that interface with existing rapid tests, such as lateral flow tests. The new devices and reagent technologies are based on stimuli-responsive polymer conjugates of antibodies and nanoparticles and smart polymer interfaces and surfaces. The first set of smart conjugates and nanoparticles and corresponding device platforms have been developed for the detection of the malaria antigen PfHRP2 (Plasmodium falciparum specific). These tests have now been validated in initial testing of anonymized clinical samples from Kenya. An overview of the new reagent technologies and their application in POC platforms will be provided.

Dr. Patrick Stayton
Department of Bioengineering
University of Washington

Biosketch
Patrick Stayton currently serves as the Washington Research Foundation Professor in the Department of Bioengineering at the University of Washington. He received his B.S. in Biology (summa cum laude) from Illinois State University in 1984, his Ph.D. in Biochemistry from the University of Illinois in 1989, and was a Postdoctoral Research Associate at the Beckman Institute for Advanced Science and Technology, also at the University of Illinois. Dr. Stayton’s eclectic research group works at the interface of fundamental molecular science and applied molecular bioengineering. His laboratory has fundamental projects aimed at elucidating the basic principles underlying bimolecular recognition, and connected projects applying these principles to medical applications in the drug delivery, point-of-care diagnostics, and regenerative medicine fields. He has published over 200 scientific papers. Dr. Stayton has a strong interest in translating the group’s research, has been awarded several patents, and is a co-founder of the startup companies PhaseRx Inc. based on his group’s drug delivery work, and Nexgenia based on their diagnostic work.