"BNC Seminar"

Monday, January 30, 2017 @ 11:00am
BRK, ROOM 1001

Frédérique Deiss
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Title: Development of Electrochemical Tools for Preventive Care Using Paper, Microfluidic and Spectroscopy

Bio: Frédérique Deiss was born in North-East of France and moved to Bordeaux (South-West of France) for her Engineering degree in Chemistry and Physics from the National Engineering school of Chemistry and Physics of Bordeaux, in 2006. She received her PhD in Chemistry-Physics in 2009, from the University of Bordeaux, working on opto-electrochemical biosensors using optical fibers with Professor Neso Sojic. During her PhD, she was also a visiting scholar at Tufts University, Boston and in the Italian Universities of Venice and Padova. Frédérique held a postdoctoral position at Harvard University with George Whitesides and then at the University of Alberta, Edmonton in Canada until joining IUPUI. She started as an assistant professor in the department of Chemistry & Chemical Biology of IUPUI in August 2015. Her group develops bioanalytical tools (assays, devices, ...) to help improve preventive care using in particular electrochemistry.

Abstract: High-technology was critical to push progress in diagnostics, monitoring of patients, drug discovery and biological and chemical analysis. The past decades also saw a large effort towards low-cost diagnostics tools for point-of-care (POC) due the cost, maintenance and infrastructure associated with it preventing a global access to those hi-tech tools. Paper is available everywhere and although we use it less and less at home or in the office with the all-electronic era, paper can be an interesting substrate for scientists. Light-weight, versatile, flexible and globally available, paper is a good candidate for portable, low-cost and simple platforms that permit efficient and convenient analysis at the POC.

Electrolytes imbalances measured in blood or sweat are also useful for health assessment as well as nutrition quality control. Ion-selective electrodes (ISE) usually utilized can be fragile, costly, and subject to biofouling. We are generating micronutrients sensing platforms based on voltammetric solid-state ion-sensing, using potassium as first target. A particular appeal of this analytical method is its high potential for miniaturization. We will develop ion-sensing nano-electrodes permitting quantification of ionic analytes at specific locations typically unreachable with ISE such as in between cells in a 3D culture. We are also developing paper-based devices for easy in-field collection and detection of anions such as chlorate and bromate. They are used in explosives, pesticides, weed killers and thus can also be harmful when present at high concentrations in drinking water.

Paper can also support culture of bacteria. By combining culture capabilities and electrochemistry, we are generating electrochemical paper-based devices for the culture and detection of bacteria. To quantify bacteria with high sensitivity and without pre-concentration by culture, we are designing a reverse electrochemiluminescent (ECL) assay, where bacteria confined in small droplets will decrease the amount of electrochemically generated light. In parallel to demonstrating the ECL detection of bacteria, sub-team of our group work on the design and fabrication of microfluidic generator of droplets out of polydimethylsiloxane (PDMS).

In our interdisciplinary research group, we combine Electrochemistry with other area of Chemistry-Physics, Materials and Biology to generate innovative bioanalytical tools. Our objective is to improve public and global health through better diagnostics and preventive testing.