B104 Detection of Drugs Implicated in Drug-Facilitated Sexual Assault on a Microfluidic System

Carla E. Turner, BS, and Bruce R. McCord, PhD, Florida International University, 11200 SW 8th Street, CP 175, Miami, FL 33199*

After attending this presentation, attendees will understand the way microfluidic systems operate and how they can be applied to the highly sen- sitive detection of multiple drugs in DFSA.

DFSA is violent crime which deeply impacts victims, their families, and the community. It is currently difficult to prosecute due to low quantities of drugs present in both seized and biological samples. This presentation will impact the forensic community and/or humanity by demonstrating the need for a sensitive and easy to use system for the detection of DFSA drugs and why microfluidic systems have the potential to achieve such a result.

Victims of drug-facilitated sexual assault (DFSA) must not only face the same issues as all rape victims, but they are also robbed of their memories, making it more difficult for them to recover psychologically. As a result they are less likely to report the assaults and when they do the cases are harder to prosecute because the victim is often unable to recall and recount the actual events. The difficulty of prosecuting DFSA cases is compounded by a lack of physical evidence. Only low doses of a drug are needed to bring about the desired disabling effect, and many of these compounds are metabolized very rapidly. Many of the drugs used to incapacitate victims may also render them unconscious. Often, by the time a victim can be examined, her body has eliminated most of the drug. The low concentration of drugs in the body at the time of analysis can make it difficult to obtain a quantitative result. In addition, many laboratories do not have the specialized equipment or pro- tocols necessary to analyze such samples.

The goal of this research is to develop inexpensive screening systems for the detection of DFSA drugs in seized and toxicological samples using microfluidic systems. Microfluidic detection systems are recently developed analytical tools that perform electrophoretic separations in miniature channels etched onto glass or plastic chips. The systems and utilize minute (µL) quantities of solvents and samples are coupled to a laser for fluorescence detection. The high sensitivities obtained by these devices allow them to rapidly detect low sample concentrations with a high s/n ratio. This presen- tation will demonstrate how microfluidic systems operate and their appli- cation to the detection of multiple drugs.

Many drugs of abuse are basic and contain amine functionalities which can easily be targeted by fluorescent derivatizing agents. For example, tech- niques have been developed for demethylating and derivatizing opiates with fluorescein isothiocyanate (FITC).[1] These procedures have been adjusted to use rhodamine ITC which is compatible with the 532nm Nd:YAG laser coupled to the microfluidic system. Rhodamine dyes are extremely brilliant and very small concentrations are needed to produce a strong signal. These types of derivatizations are easily performed on primary and secondary amines and tertiary amines can be derivatized as well following a demethy- lation procedure.[2] Alternatively, since derivatizing can take hours to com- plete, basic drugs that are cationic at low pH can be detected via indirect LIF. Current work involves the demethylation and/or derivatization of ampheta- mines, opiates, and other basic drugs with RITC as well as indirect detection of these same drugs in a rhodamine buffer.

The goal is to develop a small, inexpensive, and portable system that will require minimal sample preparation. The ideal system will incorporate all the steps of an analysis, from sample preparation to detection on a single microchip, and be versatile enough to analyze multiple types of drugs. Hospital employees and law enforcement officers would then be able to conduct rapid analysis of samples on the spot without the need for extensive training. The sensitivity of the system also ensures that prosecutors will have access to reliable results even if they are taken days after an attack has occurred.

References:

[1] Alnajjar, A. et. al., *Electrophoresis* 2004, 25, 1592-1600.

[2] Olofson, R.A., Pure appl. Chem. 1988, 60, 1715-1724.

DFSA, Microfluidic, Fluorescence

 ** Presenting Author*