## B64 Paper-Based Electrochemical Detection of Drugs of Abuse in Sweat

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**Learning Overview:** After attending this presentation, attendees will understand how drugs of abuse can be detected using a paper-based electrochemical sensing method. As paper-based microfluidics is becoming a rapidly developing field, printed electronics is also growing swiftly, especially in the sense of wearable technology. By combining these fields, fluidic samples can be used as substrates for detecting analyte concentrations using voltammetric techniques. This electrochemical drug-detecting sensor is designed for drugs such as opioids to be detected in sweat.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by demonstrating that sweat can be used for detecting the presence of abused drugs through the merger of two practical applications, electrochemistry and paper microfluidics. The design and developmental validations of this sensing method will involve opioid detection in biological fluids, such as sweat.

The use of biological fluids for detecting drugs of abuse has increased rapidly; however, these fluids are typically tested for drug abuse over a short time period. Sweat testing for drugs can take place over a longer time span. Current drug testing using sweat has mainly been used in clinical applications; however, it is uncommon in drug-of-abuse testing. There have been many studies that have facilitated testing procedures for detecting drugs through sweat patch testing. However, the results from the sweat patches were limited due to their varying volumes of perspiration collected onto the sweat patches and the effect of different activities and environmental impact. Using sweat patches to collect sweat for testing provides a non-invasive alternative method of testing a liquid perspiration for opioids and other drugs of abuse.

Sweat is a vital body fluid that can be used to trap and analyze drugs of abuse. Previous studies have shown limitations, such as poor sensitivity and interferences from components in the sweat matrix. Yet, sweat contains drugs and drug metabolites that are present in the body. Therefore, the goal of this presentation is to introduce the development of an application for detecting drugs of abuse, such as opioids and fentanyls, through sweat using electrochemical sensing. Initial work was performed to detect a variety of opiate controls spiked in sweat. This was used to optimize sensor measurements and determine matrix effects. After the optimization of these mixtures, the sensors were further optimized and validated using real samples.

The paper-based devices were prepared utilizing sheets of chromatographic paper and thermal wax to create hydrophilic channels that are bounded by hydrophobic barriers. Electrode patterns were designed using silver chloride (AgCl) and pasted onto the electrode layer of the paper-based device. Upon analysis, the sweat patch allows for drug detection using aptamers in liquid perspiration. Aptamers that target six different opioids were selected and modified for better stability. By covalently linking these modified aptamers with the redox active molecule, changes occur in confirmation, resulting in enhanced signaling for the presences of opiates. The results show the current sensitivity detected, effect of interferences, and whether sweat collected during various activities results in different detection capability.

Overall, this paper-based electrochemical sensing method permits a low-cost, integrative, and cumulative response for the determination of opioids in sweat for the purpose of drug monitoring.

**Drugs of Abuse, Sweat, Electrochemistry**