NIJ Controlled Substances and Forensic Toxicology Research and Development Program

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Office of Investigative and Forensic Sciences

Active Projects – Controlled Substances

#	Grantee Name	Award Number	Project Title
1	Auburn University	2012-DN-BX-K026	Forensic Chemistry of Substituted 1-Alkyl-3-Acylindoles: Isomeric Synthetic Cannabinoids.
2	Auburn University	2013-DN-BX-K022	Bath Salt-type Aminoketone designer Drugs: Analytical and Synthetic Studies on Substituted Cathinones
3	The George Washington University	2014-R2-CX-K009	The Utility of Ultra High Performance Supercritical Fluid Chromatography for the Analysis of Seized Drugs: Application to Synthetic Cannabinoids and Bath Salts
4	Florida International University	2011-DN-BX-K531	Separation and Identification of Drugs of Abuse Using ESI-IMS-MS
5	The Florida International University	2012-DN-BX-K048	Paper microfluidic systems for rapid and inexpensive presumptive detection of drugs and explosives
6	University of Central Florida	2012-R2-CX-K005	Transition Metal Cluster Compounds for the Fluorescent Identification and Trace Detection of Substances of Abuse
7	McCrone Research Institute	2011-DN-BX-K528	Development of a Modern Compendium of Microcrystal Tests for Illicit Drugs and Diverted Pharmaceuticals
8	The Research Foundation for The SUNY, University at Albany	2013-DN-BX-K041	Statistical Analysis and Forensics Determination of Designer Drugs via Direct Analysis in Real Time Mass Spectrometry (DART-MS)
9	West Chester University of Pennsylvania	2014-R2-CX-K008	A Systematic Evaluation of the Analysis of Drug Microcrystals Using Infrared Microspectroscopy
10	Harris County, TX	2013-DN-BX-K020	Characterization of Performance-Enhancing Peptides via Inlet Ionization on DART-TOF/MS
11	Sam Houston State University	2014-R2-CX-K005	Development of Heated Headspace Solid Phase Microextraction-Gas Chromatography/Mass Spectrometry for Chemical Profiling of Marijuana

Active Projects – Forensic Toxicology

#	Grantee Name	Award Number	Project Title
1	Florida International University	2013-DN-BX-K032	Aptamer-Based, Exonuclease-Amplified, Paper Device for Point of Collection Screening of Cocaine and Methamphetamine in Oral Fluid
2	The Florida International University Board of Trustees	2014-R2-CX-K006	Forensic Toxicological Screening/Confirmation of 500+ Designer Drugs by LC-QTOF-MS and LC-QqQ-MS Analysis
3	Trustees of Indiana University	2014-R2-CX-K007	Paper Spray Mass Spectrometry for Rapid Drug and Drug Metabolite Screening Directly fromPostmortem Blood Samples
4	Research Triangle Institute	2012-R2-CX-K001	Characterization of Designer Drugs: Chemical Stability, Exposure, and Metabolite Identification
5	Research Triangle Institute	2013-DN-BX-K017	Dried Blood Spot Analysis as an Emerging Technology for Application in Forensic Toxicology
6	Research Triangle Institute	2013-DN-BX-K021	Analysis of Drugs of Abuse in Human Hair: Surface Contamination and Localization of Analytes
7	The Center for Forensic Science Research and Education	2013-DN-BX-K018	Identification and Prevalence Determination of Novel Recreational Drugs and Discovery of Their Metabolites in Blood, Urine and Oral Fluid
8	Sam Houston State University	2012-R2-CX-K003	Improved Detection of Synthetic Cathinones ("Bath Salts")in Forensic Toxicology Samples
9	Sam Houston State University	2013-R2-CX-K006	Long-Term Stability of Synthetic Cathinones in Forensic Toxicology Samples
10	University of Utah	2011-DN-BX-K532	Prediction of drug interactions with methadone, buprenorphine and oxycodone from in vitro inhibition of metabolism
11	University of Utah	2014-R2-CX-K012	Data mining PCC annual reports
12	Virginia Commonwealth University	2014-R2-CX-K010	Characterization and Abuse of Electronic Cigarettes: The Efficacy of a Personal Vaporizer as an Illicit Drug Delivery System
13	IsoForensics, Inc.	2013-DN-BX-K009	Isotope Analyses of Hair as a Trace Evidence Tool to Reconstruct Human Movements: Establishing the Effects of the "Human Ecosystem" On Strontium and Oxygen Isotope Ratios

TECHNOLOGY WORKING GROUP (TWG) – OPERATIONAL REQUIREMENTS

(Updated Fall 2014)

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TWG Operational Requirements - Controlled Substances and Toxicology

#	Operational Requirement
1	Better dissemination strategies for and/or improved access to current research and technology, especially SOPs, to avoid duplication of effort in method development/problem solving and in house validation/verification.
2	Standards/new reference materials for use in forensic labs, especially standards for comparison (to include parent drugs and metabolites).
3	Research into trends in structure that will lead to stability issues (i.e shelf life); including controlled substances and/or non-controlled substances unintentionally becoming controlled substances.
4	Guidelines for a communal determination of "structural similarity". Compilation of existing pharmacological activity data, as well as research to determine the pharmacological activity where it is not known.
5	More effective , faster, more efficient streamlined processes in sample detection, collection, handling and analysis/interpretation, including research to determine source of bottlenecks, as well as to address policy matters pertaining to case processing (e.g. scientific basis for two orthogonal tests).
6	Development and application of emerging or current instrumentation being applied to method development (e.g., microspectrophotometer, using the second derivative, thermal analysis coupled with FTIR or GC-MS, Fast-GC and 2D-GC).
7	Research into efficiency of case management policies/casework (e.g. what are the judicial consequences).

TWG Operational Requirements - Controlled Substances

#	Operational Requirement
1	Development of best practices for chemical identification among emerging technologies. (e.g. evaluation of different instrument platforms), including analysis of cost effectiveness or other benefit of emerging technology.
2	Evaluation of techniques for resolution/identification of forensically relevant isomers, including standardization of criteria to conclude spectra match and use of non-MS techniques (Raman, IR).
3	Standardized/available published methods for extraction and quantitation of THC from various substrates or materials.
4	Guidelines for: validation of methods, performance of SOPs, verification/validation of instruments.
5	Uniform understanding in the community of the terms validation, performance verification, and method.
6	Better scheduling/legislation regarding emerging drugs.

TWG Operational Requirements - Toxicology

#	Operational Requirement
1	Forensically-relevant approaches for statistical interpretation of evidence (e.g. postmortem toxicology levels). Data mining of existing data sets.
2	Research on correlation of blood and oral fluid values, especially in regards to DUID interpretation, including differences between point of contact devices and lab confirmation.
3	Research to examine drug (esp. prescription drugs) levels pre- and post-embalming.
4	Research correlating DRE findings and toxicology results.
5	Training of sufficient quantity of personnel on difficult/non-robust instrumentation. Guidelines for call for bids to include specifics of training.
6	More robust 'expert' interpretation system that can automatically review raw data from GC/MS and/or LC/MS/MS analysis of toxicology samples to rapidly screen and flag those samples that require more intensive review by analysts and that ideally would be able to automatically calculate quantitative values based upon standards included in the same data batch.

HIGHLIGHTED PROJECTS

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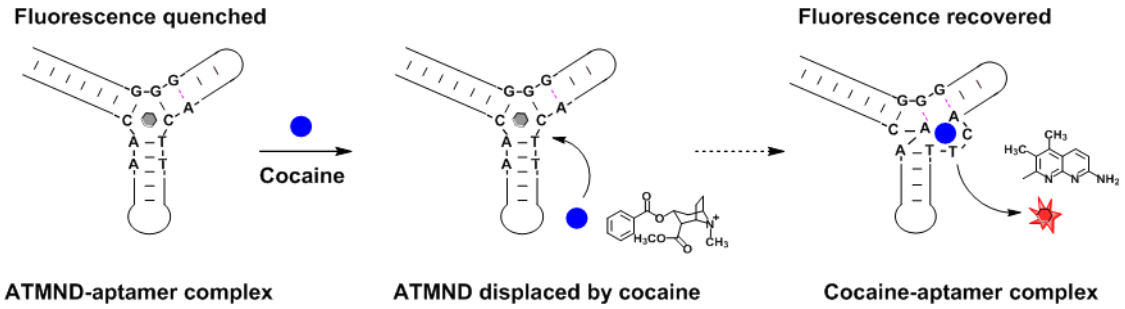
Aptamer-Based, Exonuclease-Amplified, Paper Device for Point of Collection Screening of Cocaine and Methamphetamine in Oral Fluid

Florida International University - 2013-DN-BX-K032

Develop a colorimetric detection platform with a low cost, portable, paper-based microfluidic device to simultaneously detect trace amounts of cocaine and methamphetamine in oral fluid.

- Anticipated postage stamp sized paper.
- Detect cocaine and methamphetamines in oral fluid within 5 minutes.
- High specificity.



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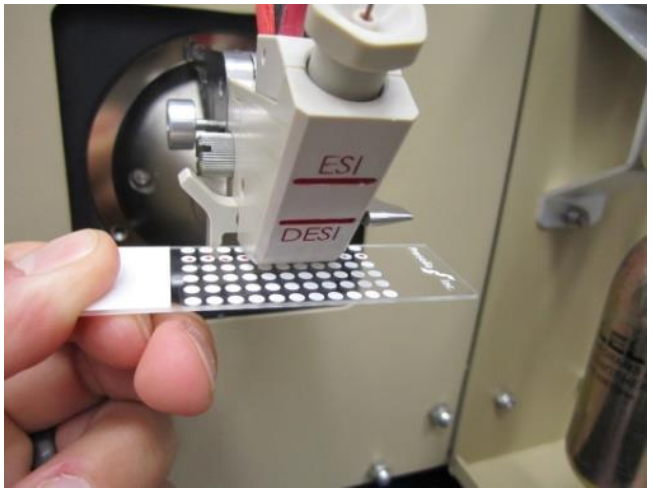
Accessing the Probative Value of Physical Evidence at Crimes Scenes with Ambient Mass Spectrometry and Portable Instrumentation

Illinois State University - 2011-DN-BX-K552

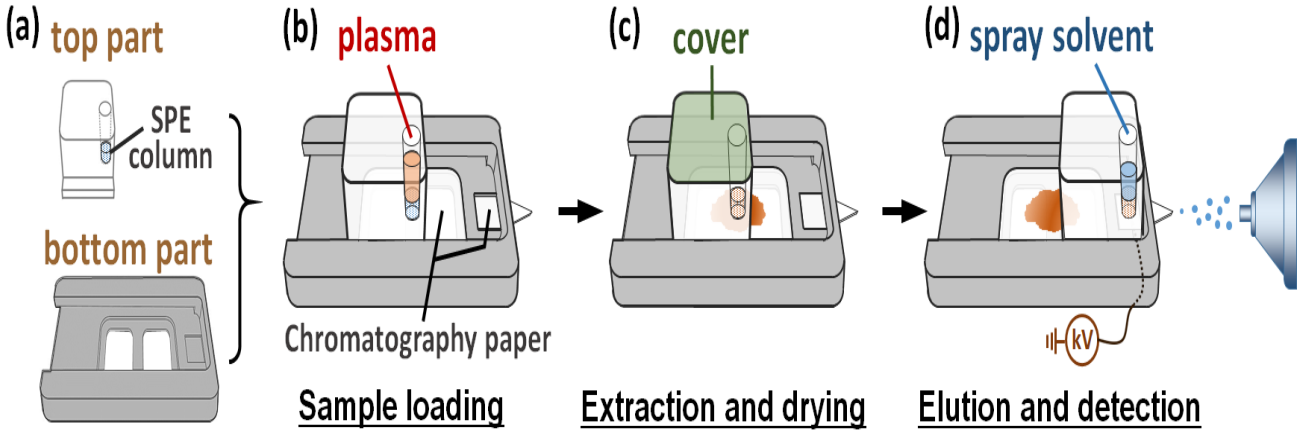
This project sought to develop a portable chemical detector based on a state-of-the-art mass spectrometer (MS) capable of sampling externally-generated ions. This capability allows direct screening of target compounds or “analytes” in their native environment and state without prior preparation.



Paper Spray Mass Spectrometry for Rapid Drug and Drug Metabolite Screening Directly from Postmortem Blood Samples

Trustees of Indiana University - 2014-R2-CX-K007

This project proposes to develop a paper spray mass spectrometer into an effective tool for drug screening of postmortem blood samples and other forensically relevant specimens. In this method, drug detection by mass spectrometry is carried out directly from a blood sample deposited on paper. It requires no sample preparation and can detect drugs and drug metabolites at forensically relevant levels directly from biofluid matrices.



Dried Blood Spot Analysis as an Emerging Technology for Application in Forensic Toxicology

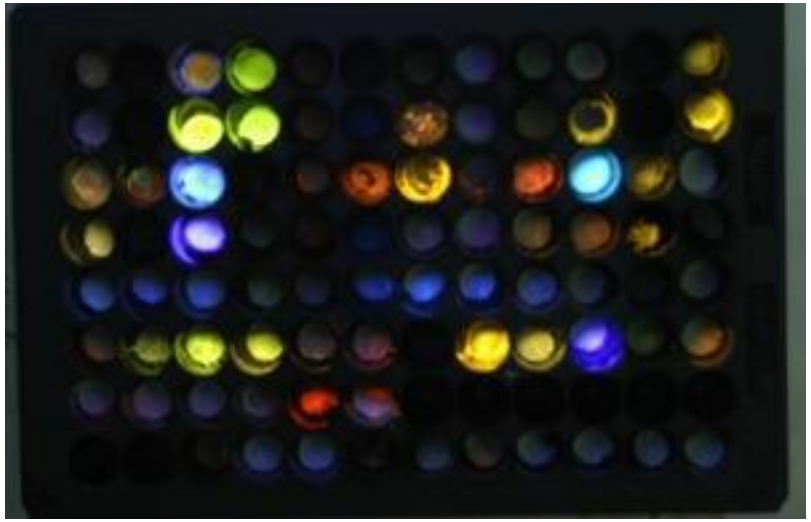
Research Triangle Institute - 2013-DN-BX-K017

The purpose of this study is to evaluate DBS analysis, using LDTD-MS/MS and LC-MS/MS, for the detection of drugs relevant to forensic toxicology, including drugs of abuse, emerging designer drugs, and drugs used in drug-facilitated crimes.

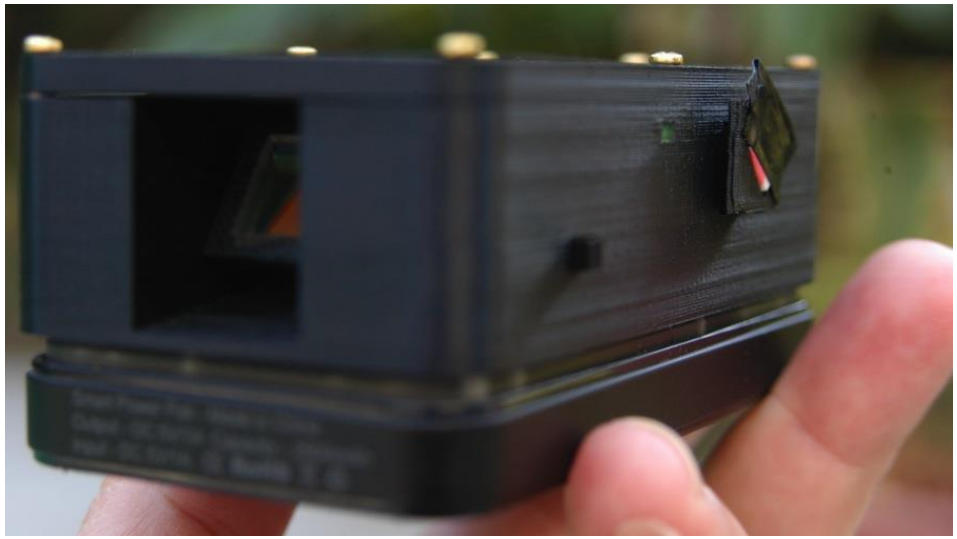
Transition Metal Cluster Compounds for the Fluorescent Identification and Trace Detection of Substances of Abuse

University of Central Florida - 2012-R2-CX-K005

This study will be to develop the application of new transition metal based indicators for the identification and trace detection of substances of abuse. These indicators will be used in conjunction with a 3D-printed fluorometer, a smartphone, and a cloud-based spectral database for rapid, inexpensive, field identification.



Example well plate under 254 nm illumination

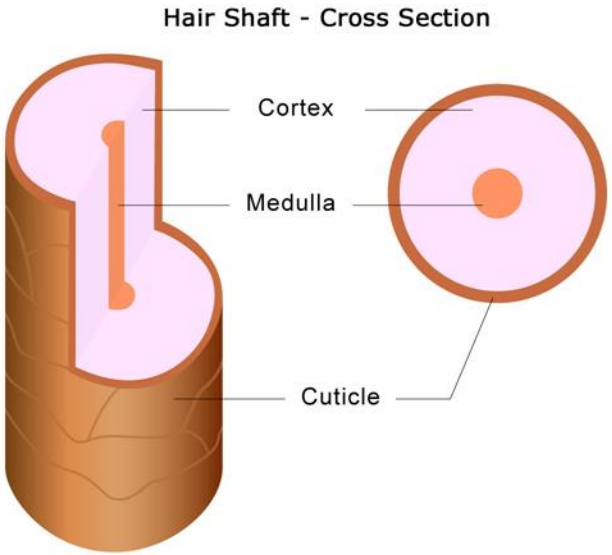


Analysis of Drugs of Abuse in Human Hair: Surface Contamination and Localization of Analytes

Research Triangle Institute - 2013-DN-BX-K021

This study examines the effects of environmental contamination of human hair leading to external deposition of amphetamine, methamphetamine, heroin, and oxycodone to identify drug use.

- Do drugs distribute in the hair differently due to consumption vs. contamination?
- Can distinct regions of a hair cross section be sampled?
- Are there differences in analyte distribution between externally contaminated samples and samples from known users?



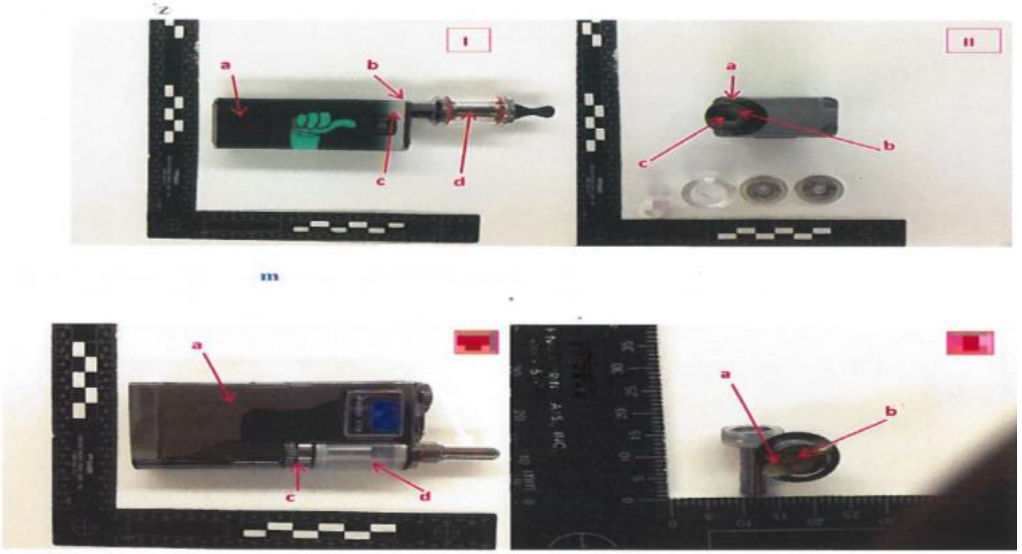
Characterization and Abuse of Electronic Cigarettes: The Efficacy of a Personal Vaporizer as an Illicit Drug Delivery System

Virginia Commonwealth University - 2014-R2-CX-K010

- Develop reliable, validated analytical methods by analyzing e-cigarette devices, device components, and aerosol for pharmaceuticals in adulterated, unadulterated, and self-prepared formulations.

- Characterize commercially available e-cigarettes.

- Characterize the liquid refill products for e-cigarettes, to include nicotine and adulterant pharmaceuticals.



Data mining PCC annual reports

University of Utah - 2014-R2-CX-K012

Proposing to mine the collected Tables 21 from the American Association of Poison Control Centers' annual report from 2000 to 2014 and collate the co-occurrence of pharmaceuticals (and alcohols) in the listed fatalities.

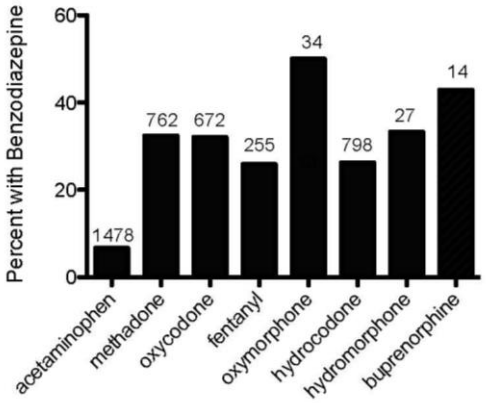


Table 21. Listing of fatal nonpharmaceutical and pharmaceutical exposures.

Annual Report ID	Age	Substances	Substance Rank	Cause Rank	Chronicity	Route	Reason	RCF	Analyte	Blood Concentration @ Time
		alprazolam	2	2					alprazolam	98 ng/mL In Whole Blood @ Autopsy
		diazepam	3	3						
343ai	20 y M				U	Ingst	Int-A	2		
		tramadol	1	1					tramadol	4.1 mcg/mL In Whole Blood @ Autopsy
		alprazolam	2	2					alprazolam	96 ng/mL In Whole Blood @ Autopsy
		carisoprodol	3	3						
344ai	20 y M				U	Ingst	Int-A	2		
		acetaminophen/ hydrocodone	1	1					hydrocodone	0.15 mcg/mL In Whole Blood @ Autopsy
		skeletal muscle relaxant	2	2					carisoprodol	5.1 mcg/mL In Whole Blood @ Autopsy
		skeletal muscle relaxant	2	2					meprobamate	9.3 mcg/mL In Whole Blood @ Autopsy
		alprazolam	3	3					alprazolam	109 ng/mL In Whole Blood @ Autopsy

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Identification and Prevalence Determination of Novel Recreational Drugs and Discovery of Their Metabolites in Blood, Urine and Oral Fluid

The Center for Forensic Science Research and Education - 2013-DN-BX-K018

This project is collecting and analyzing of paired blood, urine, and oral fluid samples from volunteer participants attending electronic dance music festivals (EDM), many of whom are likely to have ingested some of the newest designer drug products on the market.