

# ABSTRACTS

## The New Landscape of Novel Opioids: Challenges and Opportunities

Barry Logan

President, Executive Director

The Center for Forensic Science Research & Education

To open our symposium and set the scene for our two days of discussion, learning and problem solving, Dr Barry Logan will address the evolution of drugs involved in narcotic analgesic abuse from prescription medications and heroin to the many variants of fentanyl and other classes of non-morphine derived opioid agonists. He will suggest areas for action and collaboration including rapid identification of novel opioids, emerging analytical tools for seized drugs and toxicology testing, the need for ready availability of standard reference materials, sharing of data and findings among public health and public safety agencies, and the need for new thinking on scheduling and drug control.

**BARRY K. LOGAN** is a graduate of the University of Glasgow in Scotland with degrees in chemistry and forensic toxicology awarded in 1982 and 1986 respectively. He received four years postdoctoral training in forensic toxicology at the University of Tennessee Center for Health Sciences in Memphis. In 1990, he was appointed State Toxicologist and Assistant Professor of Laboratory Medicine at the University of Washington in Seattle and in 1999, he was appointed Director of Forensic Laboratory Services Bureau for the Washington State Patrol. He served in both positions until 2008, when he joined NMS Labs in Willow Grove, Pennsylvania, where he currently serves as Sr. Vice President of Forensic Science Initiatives, Chief Scientist.

Dr. Logan is Board Certified by the American Board of Forensic Toxicologists (ABFT). He has over one hundred publications in toxicology and analytical chemistry, including manuscripts on the effects of methamphetamine, cocaine, marijuana, alcohol, hallucinogens and depressant drugs on drivers, and postmortem redistribution of drugs, and the toxicology and chemistry of novel psychoactive substances. His recent work has focused on the analytical and interpretive toxicology of emerging recreational and designer drugs. In 2002, Dr. Logan was appointed Executive Director of the Robert F. Borkenstein Center for Studies of Law in Action at Indiana University where he directs the Borkenstein Courses. Since 2010, Dr. Logan also serves as President and Executive Director at the Center for Forensic Science Research & Education at the Fredric Rieders Family Renaissance Foundation in suburban Philadelphia.

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## Fentanyl and Fentalogues - Intelligence and Effects on Operations

Joshua C Yohannan

Laboratory Manager, Trace and Drug Chemistry  
Allegheny County Office of the Medical Examiner

Emily Wilkinson

Forensic Scientist  
Allegheny County Office of the Medical Examiner

This presentation will share some of the challenges our laboratory has faced in keeping up with new fentanyl related compounds. It will discuss the need for information sharing amongst different communities and will also highlight the impact on analysis at the bench level.

**JOSHUA YOHANNAN** received a bachelor's degree in chemistry and economics from Vassar College. He received a master's degree in chemistry at North Carolina State University and began his career as a crime scene technician at the Baltimore Police Department before moving into the Drug Chemistry Unit. Went to the Howard County Police Department (MD) as a forensic chemist. After Howard County, he went to the DEA Special Testing and Research Laboratory and was a member of the Emerging Trends Drug Group. The focus of the group was synthetic cannabinoids, substituted cathinones, phenethylamine hallucinogens, and novel opioids. Joshua is currently the Laboratory Manager over the Trace and Drug Chemistry units at the Allegheny County Office of the Medical Examiner.

**EMILY WILKINSON** is a scientist working in the forensic laboratory of the Allegheny County Office of the Medical Examiner's Office. She has been working approximately nine years in the drug chemistry section, and was a part of the Mobile Crime Unit for approximately four years. She received a bachelor of science in Chemistry/Forensic Science from Edinboro University in Edinboro, PA (2006) and a master of science in forensic science from Marshall University in Huntington, WV (2008). Her work in the drug chemistry section has allowed her to experience the analysis multiple emerging opioids and gain a sense of trends in the local opioid

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## Synthetic Opioids in Michigan: Opioid Casework Trends and Safety Policy in the Michigan State Police Forensic Laboratories

Elaine Daugherty  
Controlled Substances Unit Supervisor  
Michigan State Police Forensic Science Division

Elizabeth Gormley  
Technical Leader - Controlled Substances  
Michigan State Police Forensic Science Division

Over the past two years, the Michigan State Police Forensic Laboratories have noted a dramatic increase in synthetic opioid seized-drug casework, with a marked increase in fentanyl-related compounds occurring over the last 12 months. By examining data from seized-drug casework completed by forensic laboratories in 2017, geographical and time-based trends of a variety of emerging fentanyls are discovered. With the emergence and increasing frequency of fentanyl-related compounds in seized-drug casework, aspects of the Forensic Science Division safety plan were enhanced through job hazard assessment and by use of the hierarchy of hazard control measures. The safety measures specific to opioids and the process of implementation are discussed.

**ELAINE DOUGHERTY** has a Bachelor of Science degree in Biochemistry from Michigan Technological University. She taught high school chemistry and physics for five years before enrolling at Michigan State University in their Forensic Chemistry Master's program. Elaine has worked at the Michigan State Police Bridgeport Forensic Laboratory since 2004 and has been the unit supervisor of the Controlled Substances Unit for three years.

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## Strategies for the Trace Detection of Synthetic Opioids

Edward Sisco, Ph.D.  
Research Chemist, Surface and Trace Chemical Analysis Group  
National Institute of Standards and Technology

The presence of fentanyl in street samples and case samples, which are commonly confined within a package of baggie, pose potentially serious health risks to law enforcement, first responders, or forensic analysts who may handle or open these packages. While the potential exposure risk of a particular package is unknown triaging the sample may be useful by understanding what is inside the package prior to opening it. Triaging of this type can be completed through trace detection of these compounds. This presentation will present two potential technologies for the trace detection of fentanyl residues: thermal desorption direct analysis in real time mass spectrometry (TD-DART-MS) and ion mobility spectrometry (IMS). Both techniques offer the ability to detect fentanyl, or fentanyl analogues, at trace levels in complex matrices without sample preparation or the need for bulk sampling. In addition to a broad overview of the techniques and their capabilities, efforts to understand their limitations, the effects of complex matrices, sensitivities, and implementation possibilities will be discussed. Strategies for the safe analysis of samples suspected of contain synthetic opioids will also be presented.

**ED SISCO** is a research chemist at the National Institute of Standards and Technology with a background in the development of mass spectrometry systems and methods for forensic applications. Current research efforts focus on the development of novel ambient ionization mass spectrometry sources for forensic and homeland security applications, understanding and expanding the role of ambient ionization mass spectrometry in the forensics community with applied projects focusing of trace narcotics, explosives, fire debris, and the chemistry of latent fingerprint residues.

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## Mass Spectrometry Libraries for the Identification of Novel Psychoactive Substances”

William E Wallace, Ph.D.

Director, Mass Spectrometry Data Center  
National Institute of Standards and Technology

Recent developments in the NIST Mass Spectrometry Data Center will be discussed including details of the new NIST17 library as well as a novel ‘hybrid’ search algorithm that combines fragment-ion with neutral-loss matching to increase the confidence in compound identification.

**WILLIAM WALLACE** has been at NIST for 24 years working in polymeric-materials characterization, in chemometrics, and, most recently, in chemical identification by mass spectrometry. He is a member of the SWGDRUG core committee.

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## Fentanyl and Fentologues - Intelligence and Effects on Operations

Jeanita S Pritchett, Ph.D.

Research Chemist  
National Institute of Standards and Technology

Aaron A. Urbas, Ph.D.

Research Chemist  
National Institute of Standards and Technology

Metrology, the science of accurate and precise measurements, is the core function of the National Institute of Standards and Technology. In our Chemical Sciences Division, we develop chemical reference materials, measurement technology and validation studies addressing critical stakeholder needs in chemical metrology. The emphasis on determining measurement uncertainty is particularly significant to forensic applications. Our goal in cohosting this workshop is to assess the opioid measurement needs of the forensic and toxicology communities.

One activity already in progress is the development of a collaborative online analytical data repository with the aim of serving as a data curation and data dissemination platform for novel psychoactive substances (NPS). While the initial emphasis is on NMR data, the goal is to expand this to include other techniques. This will be discussed in the second part of the talk as well as work we are developing involving modeling of proton NMR spectra to enable transfer of spectra across instruments and magnet field strengths.

**JEANITA PRITCHETT** is a Scientific Advisor in the Material Measurement Laboratory Office and a Research Chemist at the National Institute of Standards and Technology (NIST). Her research has focused on developing robust, analytical methods and certifying reference materials for clinical biomarkers, vitamins, nutritional constituents, and forensic related substances.

**AARON URBAS** is a Research Chemist at the National Institute of Standards and Technology (NIST) involved in research and development of reference materials and analytical methods for optical, vibrational and nuclear magnetic resonance spectroscopies.

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## All Hands on Deck: Industry’s Role in Responding to the Opioid Crisis

Donna M Iula, Ph.D.

Director of Forensic Chemistry  
Cayman Chemical Company

Whether by rapidly providing authentic reference standards of novel emerging drugs of abuse or the analytical instrumentation necessary to identify them in casework, private forensic industry partners play a critical role in the response to the opioid crisis. Rapid communication and collaboration with

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industry is needed to adequately respond to the current crisis. This presentation will describe the various roles that industry partners play in providing the tools needed to respond to the opioid epidemic. Recent examples of how this has been successful will be presented.

**DONNA IULA** is the Director of Forensic Chemistry at Cayman Chemical. She earned a Ph.D. in Synthetic Organic Chemistry from the State University of New York at Stony Brook (Stony Brook University) and did post-doctoral training at the University of Miami. Dr. Iula then worked for seven years in the pharmaceutical chemistry as an R&D scientist and medicinal chemist prior to joining Cayman Chemical in 2007. She has several research publications, authorship on book chapters, and is co-inventor on several pharmaceutical patents. Dr. Iula has also presented numerous scientific posters and oral presentations at both American Chemical Society national meetings and regional forensic conferences. In addition, her expertise in emerging drugs of abuse has been sought by several news media outlets, and she has shared this knowledge by providing training to state forensic crime labs. Her current area of focus is understanding the needs of forensic chemists, toxicologists, and research scientists to direct the efforts of Cayman scientists in providing reference standards to that community.

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## 'New' synthetic opioids: charms and harms from a medicinal chemistry point of view

István Ujváry, Ph.D.

Honorary Associate Professor

iKem BT, and Budapest University of Technology & Economics

Opioid research yielded one of the richest areas of structure-activity studies in medicinal chemistry. The development of fentanyl in the early-1960s paved the way for a series of potent 4-anilidopiperidine-type analgesics, the fentanils, that are now widely used in human and veterinary medicine. The analgesic activity of opioids is due to their activation of opioid receptors, the mu- or MOP-receptor in particular. The same mechanism appears to be responsible for abuse liability and life-threatening respiratory depression. The structurally diverse group of internationally controlled opioids includes natural, semi-synthetic, and synthetic substances. Of the synthetic opioids, fifteen are fentanils of which only alfentanil, fentanyl, remifentanil and sufentanil are used in medicine. Recently, pharmacologically poorly characterized and uncontrolled synthetic opioids have appeared on the illicit drug market and became a major health concern internationally. Most of them are fentanyl analogues (>20) though other structural types, such as (di)aminocyclohexanes (AH-7921 and the U-series) or piperazines (MT-45), have also emerged. The unprecedented spread and the dynamic nature of their market appearance may partly be explained by the ease of their manufacture from readily available starting materials (precursors) on multi-kilogram scales using well-documented and versatile synthetic routes. The presentation will: a) provide a brief pharmacological introduction; b) depict the European situation on the detection of synthetic opioids as new psychoactive substances (NPS) based on data collected by EMCDDA; c) review pharmaco-toxicological information on fentanils of current interest; d) discuss synthetic routes to fentanils; e) present selected synthetic opioids from the scientific literature as potential NPS.

**István Ujváry** (March 27, 1953) is Hungarian national. He graduated (1977) as a chemical engineer at the Technical University of Budapest where he also obtained (1995) a PhD degree in organic chemistry. Working in industry (1977-1982) and in research institutes of the Hungarian Academy of Sciences (1982-2007), his research focused on pesticide and medicinal chemistry, including radiosynthesis. As visiting scientist, he spent years in academic and government research laboratories in the USA (University of Washington, Seattle; Stony Brook University, NY; University of California, Berkeley; USDA Agricultural Research Station, College Station, TX). His research has been supported by Hungarian and international granting agencies. He was on-site project advisor to the UNICEF/UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (2008-2011).

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Currently, Dr. Ujváry is manager of iKem BT, an independent research and consulting firm. He is honorary associate professor at Budapest University of Technology and Economics and also at the University of Szeged.

Dr. Ujváry developed *BIOSTER*, a computer database used globally by industrial and academic laboratories researching medicines and agrochemicals.

Dr. Ujváry has a long-standing interest in natural and synthetic psychoactive substances. He has been a regular lecturer on the chemistry and pharmacology of psychoactive substances at Hungarian universities. He has advised national agencies on drug regulation and has been involved in risk assessment processes conducted by the European Monitoring Centre of Drugs and Drug Addiction (EMCDDA, Lisbon) of several new psychoactive substances, including synthetic opioids.

In 2011, he received the prestigious '*Elige Vitam*' award from the Hungarian Ministry of National Resources for his educational and other activities related to psychoactive substances. Dr. Ujváry has been invited speaker at several international meetings. He has (co)authored over 100 research papers and book chapters and is a (co)inventor of 21 patents. Dr. Ujváry is a member of the several professional associations.

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## Acute intoxications involving designer fentanyls and other new psychoactive substances: Experiences from the STRIDA project

Anders Helander, Ph.D.

Adjunct Professor in Dependence Research  
Karolinska Institutet, Department of Laboratory Medicine

In 2010, the Karolinska Institutet and University Laboratory and the Swedish Poisons Information Centre initiated the STRIDA project to monitor the increasing occurrence of potent and potentially harmful new psychoactive substances (NPS) in Sweden and collect information about associated health hazards. Blood and urine samples are collected from patients with suspected NPS exposure presenting in emergency departments (ED) and intensive care units (ICU) and requiring hospital care. The analysis of psychoactive substances is performed by liquid chromatography–high-resolution mass spectrometry (LC-HRMS). The turnover of NPS has been very high as a result of national regulations, which places high demands on updating laboratory methods. In 2010–2016, more than 2600 ED/ICU cases with admitted or suspected NPS intoxications from all over the country were included in the STRIDA project and one or several psychoactive substances (NPS, classical drugs, and pharmaceuticals) were detected in about 80%. The median age of the patients was 24 (range 8–71) years, 57% were 25 years or younger, and 74% were males. Initially, synthetic opioids were unusual as NPS, but one named MT-45 caused serious adverse reactions. Starting in 2014, an increasing number of potent designer fentanyls have been introduced as NPS and detected among the STRIDA cases. A substantial proportion of these cases were graded as severe intoxications requiring prolonged antidote (naloxone) treatment, and some were fatal. Because designer opioids and other NPS are not included in routine drug testing, many cases of intoxication are likely to be missed.

**ANDERS HELANDER** received his Ph.D. in biochemistry and physiology from Uppsala University, Sweden, in 1988. In 1992, he became associate professor in biochemical alcohol research at the Department of Clinical Neuroscience, Karolinska Institutet, Stockholm. Since 2007, he is adjunct professor in dependence research at the Department of Laboratory Medicine, Karolinska Institutet. In 1989–2010, he started and operated the Alcohol Laboratory at the Center for Dependency Disorders at Stockholm County Council until it fused with the Karolinska University Laboratory where he is now working. Prof. Helander was responsible for the analysis of alcohol biomarkers in a WHO/ISBRA Study on State and Trait Markers of Alcohol Use and Dependence, and in 2005–2011, he chaired the IFCC Working Group on standardization of the alcohol biomarker carbohydrate-deficient transferrin (CDT). In 2010, he co-founded the STRIDA project focusing on the increasing problem and health hazards associated with new psychoactive substances in Sweden. Prof. Helander has published about 200 papers (original publications, reviews, debates, and book chapters) mainly on the development, clinical and medico-legal applications, and standardization of laboratory tests. The primary focus has been on alcohol biomarkers and the novel drugs of abuse.

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## Identifying Novel Fentanyls: Building Collaborative Systems to Identify Evolving Threats

MJ Menendez

Organized Crime Drug Enforcement Task Force  
US Department of Justice

Jayne Morrow

Research Scientist, Material Measurement Laboratory  
National Institute of Standards and Technology

Illicitly manufactured fentanyl's intrusion into drug markets in the United States is significantly contributing to an opioid epidemic that is claiming thousands of lives each year. Illicit fentanyl and its derivatives and analogs are imported predominantly from China, with Mexico and Canada serving as trans-shipment points. Fentanyl is illegally ordered via the dark web and / or open internet and is delivered by private express shippers or the United States Postal Service to businesses and residences across the U.S.

This presentation will review the prevalence, modes of importation, and availability of fentanyl in the U.S. illicit market based on de-identified drug seizure and post-mortem findings and unclassified law enforcement data. Challenges to identification of fentanyl in the law enforcement and medicolegal death investigation communities will be discussed, as will federal legal standards relating to fentanyl identifications and prosecutions. Fentanyl testing complexity and law enforcement laboratory workloads make rapid testing expensive and impractical for most law enforcement seizures. The complex and incompatible medicolegal death investigation and law enforcement reporting systems in federal, state, and local sectors currently prevent timely data dissemination on novel fentanyl analog detection and identification to forensic and medicolegal professionals.

The presentation will primarily focus on innovative collaborations between public health, public safety, and private industry partners that have arisen based on shared recognition of the importance of timely and accurate identification of the evolving designer fentanyls. Best practices in analytics, seized drug testing, and information sharing which are used to implement chokepoint identification of the new fentanyls at international ports of entry will be discussed.

MJ MENENDEZ is an Assistant United States Attorney with the Department of Justice. Based out of Colorado, M.J. is currently on assignment to the Organized Crime Drug Enforcement Task Force (OCDETF) in Washington, D.C., where she is the Fentanyl and Heroin Specialist Advisor. As an Assistant United States Attorney's Office in the District of Colorado, MJ is assigned to the OCDETF Unit where she prosecutes crimes involving national and international drug distribution and money laundering networks, and violent crimes. M.J. has also served as a state prosecuting attorney in Jefferson County, Colorado. During a three-year hiatus from the U.S. Attorney's Office, MJ was appointed district court judge in Jefferson County in a hiatus from the US Attorney's Office, presiding over criminal, civil, family law, and dependency and neglect proceedings. She was responsible for creation and implementation of Jefferson County's Controlled Substance Recovery Court. MJ's current work focuses on whole of government's best practices for identification, interdiction, investigation, and prosecution of fentanyl analogs.

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## Using Forensic Science Data to Understand the Drug Environment

Capt. Juan Colon

New Jersey State Police

The Drug Monitoring Initiative presentation will focus on comprehensive drug data collection and analysis to understand the drug environment. The importance of scientific data from medical examiners, coroners, and crime forensic labs will be emphasized and how scientific results help identify the most dangerous drugs and their harmful impact on communities. In conclusion, the presentation will include how this data is used for policy development, investigative support, intelligence production, training, and outreach to enhance public safety and public health.

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**JUAN COLON** is a 24½ year veteran of the New Jersey State Police. Most of his career has focused on the intelligence function, and he has extensive experience with street gangs and organized crime. As an intelligence collector targeting these groups, he managed numerous informants and has conducted several undercover operations.

He served as the chair of the Information Sharing Environment subcommittee for Super Bowl 48. In this role, he developed the information sharing concept of operations which has been used in subsequent Super Bowls and similar large-scale events.

He developed a process to facilitate information sharing with the El Paso Intelligence Center to ensure that all drug-related information is shared in real time at a national level. As result of these and other efforts, he has received several awards and was nominated for Trooper of the year in 2014.

He is the architect of the Drug Monitoring Initiative, and he is currently assigned as a drug policy advisor for the New Jersey Attorney General under the Office of Drug Addiction Control. He is involved in several state working groups developed by the Attorney General's Office to drive State level counter-drug initiatives. His undergrad degree is in public administration from Fairleigh Dickinson University.