# NEAFS Newsletter

Volume 46, Issue 4 Winter 2021

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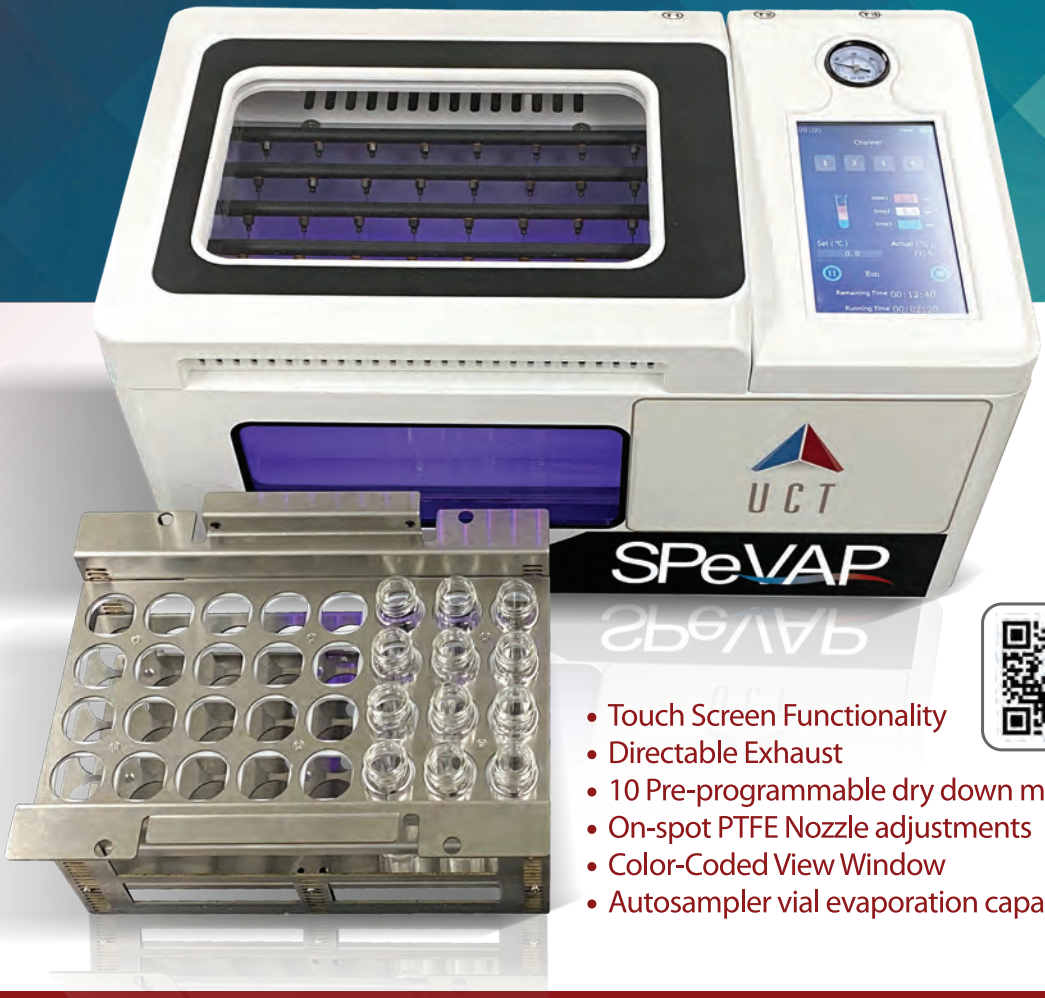


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# MEET THE 2021 BOD

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BS in Biochemistry – Cedar Crest College
MS in Forensic Science – Cedar Crest College

**Adam Hall Ph.D., D-ABC - President-Elect**
Assistant Professor, Biomedical Forensic Sciences Program Department of Anatomy and Neurobiology Boston University School of Medicine
BA in Chemistry - Stonehill College
MS in Chemistry - Northeastern University
PhD in Analytical Chemistry - Northeastern University

**Elizabeth Duval – Secretary**
Massachusetts State Police Crime Laboratory
Forensic Scientist II, 2009-present
BS Genetics, Texas A&M University
BS in Forensic Science, University of New Haven

**Stephanie Minero– Treasurer**
Nassau County Office of the Medical Examiner, Division of Forensic Services
Forensic Scientist in the Controlled Substance Analysis Section since 2008
BS in Forensic Science - Long Island University/CW Post
MS in Biology - Long Island University/CW Post

**Alanna Laureano- Director**
Westchester County Department of Labs & Research, Division of Forensic Sciences Since 2007
Forensic Science Specialist and Assistant DNA Technical Leader
BS in Molecular Biology and Biochemistry- University at Albany, SUNY
MS in Forensic Biology- University at Albany, SUNY

**Matthew Marino - Director**
New Jersey State Police Office of Forensic Sciences, East Regional Laboratory from November 2011 to present
Forensic Scientist 2 in the Drug Unit and Criminalistics Unit
Westchester County, NY Forensic Laboratory from July 2007 to September 2011
Forensic Technician
BS in Natural Sciences with a concentration in Chemistry-St. Thomas Aquinas College

**Amanda White - Director**
New York State Police Crime Laboratory, FS II- Controlled Substance Analysis from 2019-Present
Westchester County Department of Labs & Research, Controlled Substance Analysis 2016-2019
NYPD Police Laboratory, Controlled Substance Analysis/Latent Print Development 2011-2016
MS Biomedical Forensic Science, Boston University
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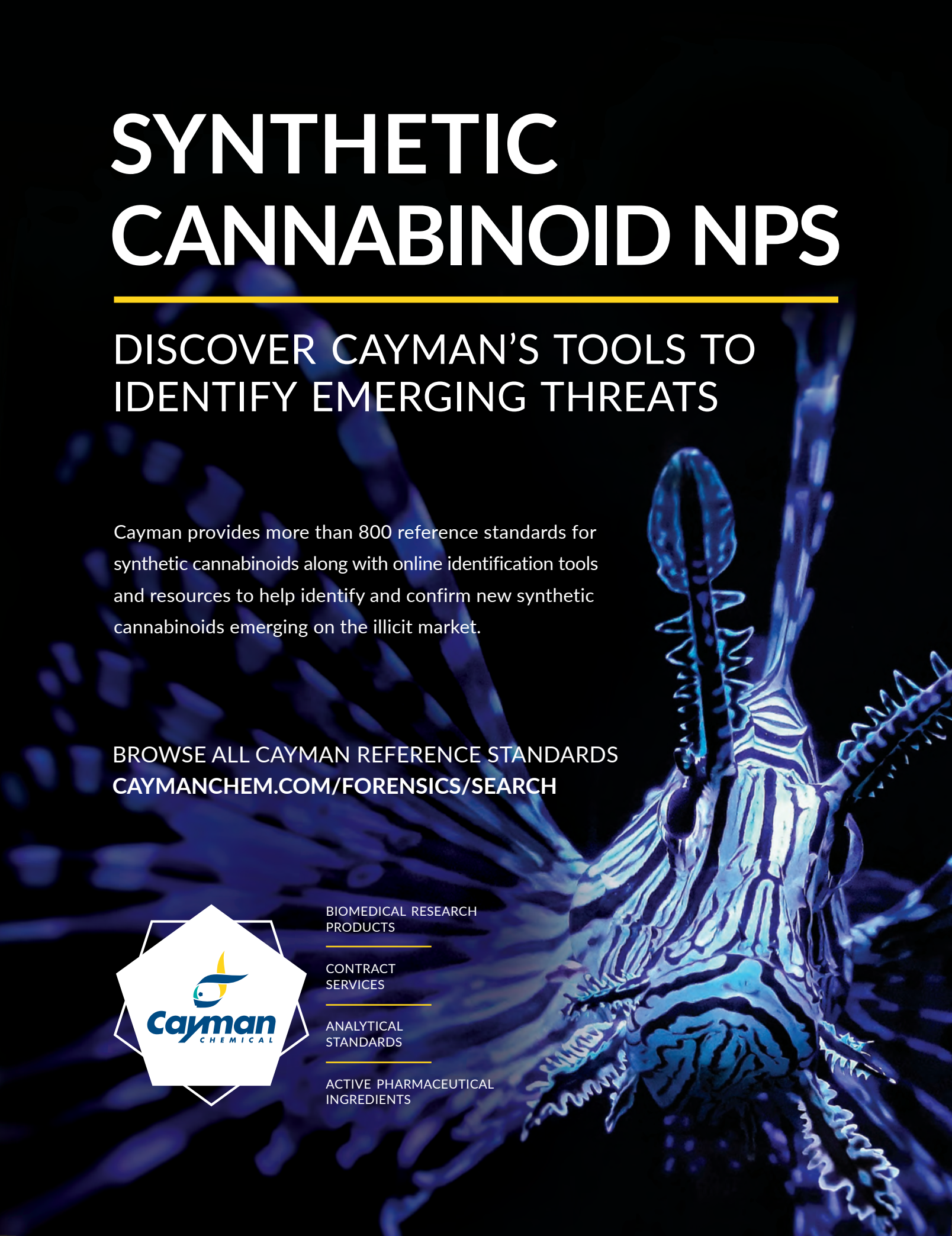

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# NEAFS

## A Message from President Angela T. Vialotti

Hello, and Happy New Year! I would like to begin by congratulating Program Chair Adam Hall and the 2021 meeting staff on a phenomenal conference. A tremendous amount of time and effort went into the planning - not just of the speakers and events, but the safety measures and precautions as well, and it was incredible to see that hard work culminate in a successful meeting. I hope you will all keep your calendars open for the 2022 meeting, being held from October 17th through the 21st at the Niagara Falls Convention Center. Also, if you would like to become involved in the meeting, please don't hesitate to reach out to 2022 Program Chair Betsy Duval.

I first became involved in NEAFS by volunteering at Registration twelve years ago, and I was unprepared for the impact NEAFS would have on me. I was so inspired by those involved; the board and staff who freely gave their time to keep NEAFS affordable and current and who worked towards ways to give back to both members and the community - I wanted to be a bigger part of this wonderful organization. I would like to extend my deepest gratitude to the role models and leaders I have worked with over the years, and especially to the dedicated board and staff I have had the pleasure of serving with this year. And finally, I would like to thank you, the membership, for allowing me to serve as your President. Thank you for this incredible opportunity.

Sincerely,

Angela

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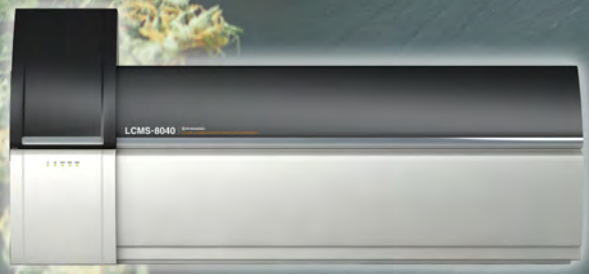


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NEAFS 2021

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# President's Reception


NEAFS 2021

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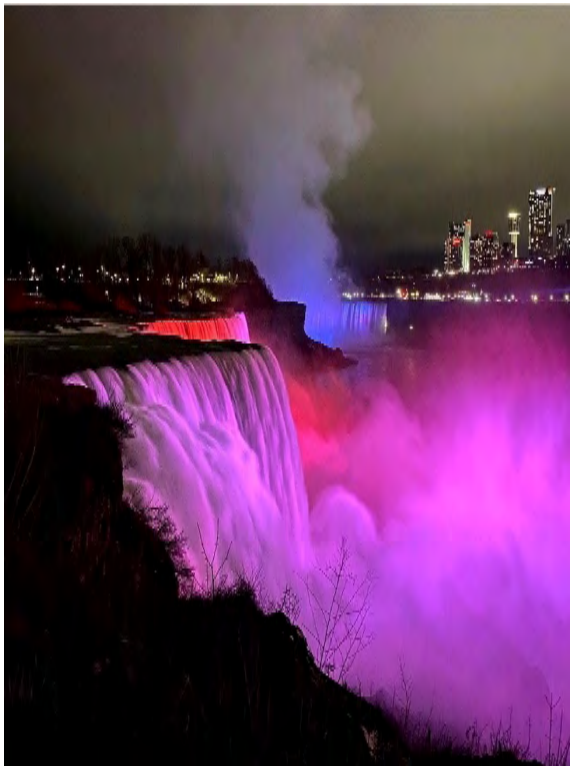
# 2022 NEAFS Annual Meeting

## October 17th-21st, 2022

**Hotel:** Sheraton Niagara Falls
300 Third Street
Niagara Falls, NY 14303

**Meeting:**
The Conference and Event Center Niagara Falls
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Please Contact Elizabeth Duval For Details, Questions, or if you are Looking to Volunteer, at

**Presidentelect@neafs.org**


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# 2022 NEAFS Board of Directors and Staff

The Nominating Committee recommended the following slate of officers to the Board of Directors and an announcement was made to the Membership at the Annual Business Meeting on November 3rd, 2021. No additional nominations were received. The terms of office are January 1 through December 31.

**President**
Adam Hall

**President-Elect/Program Chair**
Elizabeth Duval

**Secretary**
Alanna Laureano

**Treasurer**
Stephanie Minero

**Directors**
Matthew Marino
Amanda White
Anisha Paul

**Past President**
Angela Vialotti

**Awards Chairperson**
Danielle Malone

**Certification Chairperson**
Peter Diaczuk

# 2022 NEAFS Board of Directors and Staff

**Corporate Liaison Chairperson**
Keri Labelle

**Education Chairperson**
Sandra Haddad

**Ethics Chairperson**
Tiffany Ribadeneyra

**Executive Secretary**
Sarah Roseman

**Membership Chairperson**
Joseph Phillips

**Dues**
Angelina Pollen

**Social Media Coordinator/Merchandise Chairperson**
Alyssa Berthiaume

**Publications Chairperson**
Brandi Clark

**Registration Chairperson**
Beth Saucier Goodspeed

**Site Chairperson**
Janine Kishbaugh


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# MERITORIOUS SERVICE AWARD

**AWARDED TO:**

## BETH SAUCIER GOODSPEED

I would like to nominate Beth Saucier Goodspeed for the 2021 Meritorious Service Award and would be honored to present it to her if she is chosen to receive it. I first met Beth in 2002 when my career began with the MA State Police Crime Laboratory in the Criminalistics Unit. She has been an active member of the forensic science community for the past 22 years and has worked in both Vermont and Massachusetts. From 2002 until almost 2004 (I believe) we shared a desk when the Crime Lab had two shifts. Beth worked the first shift and I worked from 2-10pm. We would often overlap and have an interesting dance so to say for the first 1-2 hours of my shift and the last couple of hers. Despite the inherent challenges we bonded over both being from the great state of Rhode Island. After all, with a population of approximately 11 or so we all have to stick together and are probably related in some way! I have fond memories of those days as a junior analyst with the MA State Police Crime Laboratory and learning from Beth as I snooped through her interesting and meticulously kept case files during my training.


Beth has contributed to the NEAFS organization for as long as I can remember and has always had a smile on her face throughout every challenge and commitment along the way. Her laugh is infectious and I always know if she's present at the annual meeting even if I cannot see her at the moment. In fact, the annual meeting just wouldn't be the same without her and her infectious laugh! It is mind boggling to me that we are now the mid-career to senior leadership of the organization. Time waits for no woman or man. For the junior attendees of this years meeting, promise me one thing: Share a desk with someone in a figurative way. Network. Meet new people. Develop and grow your careers starting today. That is your goal for this week. Meet and connect with at least one new person because one day you will be presenting this award to someone who has kept the NEAFS tradition alive as I wheel my way into this meeting with a smile and probably a drink in hand!

# MERITORIOUS SERVICE AWARD


Beth rose up though the NEAFS organization to become President and in the year that followed Past President. For many people this is where their NEAFS journey stops albeit continuing to attend annual meetings. However, Beth recognized an important organizational need and did not hesitate to volunteer to become the Registration Chair, often a thankless job that requires that person to miss the good majority of the scientific content presented during the annual meeting. As a public service announcement and as in incoming President of NEAFS I am asking each of you to consider helping out Beth and assuming this important role with NEAFS. I am sure she would kindly and graciously part ways with these responsibilities once again.

Despite earning my doctorate in 2012, I remain known as "Mr. Adam" to her. I'm not sure why exactly I don't have a last name or that I'm "Mister", but I'm ok with it, especially if it continues to provide her and I with a source of humor and laughter in the crazy world in which we all live.

Beyond forensics Beth is a mom to two incredible children as well as a wife. Two additional tireless and sometimes thankless jobs as I can attest as a father myself. While I don't know Beth on this level, I can only imagine that she puts as much if not more of herself into her home life as she does to the NEAFS organization and the field of forensics that we all love.

As we age and little by little reflect on our careers, think of those who've made an impact on yours. For me, one of these people would be Beth, for many reasons but most importantly, we could all smile a little more and laugh a bit harder.

Respectfully submitted,

Adam B. Hall, Ph.D., ABC-FD
NEAFS President Elect

# Northeastern Association of Forensic Scientists

# Meritorious Service Award Nomination Form

The Northeastern Association of Forensic Scientists is accepting nominations for the Meritorious Service Award.

This award is given to a NEAFS member that has a history of providing commendable service to the forensic science community by serving justice through casework, performing research advancing forensic science, training and educating forensic scientists and future forensic scientists, and overall contributions to the NEAFS organization. The nominee must have held the status of Regular Member within NEAFS for at least 10 years to be considered.

All nominations must be received by September 1st. The winner of the NEAFS Meritorious Service Award will be announced during the annual meeting.

The Nomination Form can be found on the NEAFS website www.neafs.org.


# GEORGE W CHIN AWARD

**AWARDED TO:**

## KIRA HURLEY

UNDERGRADUATE STUDENT AT DUQUENSE UNIVERSITY

"I aspire to pursue a career in Forensics in the field of DNA analysis, at an accredited forensics laboratory at either the local, state, or federal level. In my academic career I have so far excelled, culminating in receiving the Forensic Science and Law Excellence Award at Duquesne University for 2021, which is awarded to one senior student for being the top graduate of the program. Every semester of my college career I have made the Dean's List, both at Eastern Michigan University and at Duquesne University where I transferred in sophomore year. Volunteer work has also been something that I have been passionate about throughout my life. In 2017, I received the Novi Youth Assistance Recognition Award for my continuous volunteer work with the Novi Middle School Theater Company. Additionally, I earned both my Silver and Bronze Awards, with the Girl Scouts of America which I have been a member of since kindergarten. I also have strong research experience thus far. I participated in the Undergraduate Research Program at Duquesne University as a Dean's fellow, where I researched and presented on biological fluid beading on jeans. In my research I quantified and analyzed DNA recovered from blood on various types of jeans of different colors, spandex content, and state of washing. I am a diligent worker, which is evident from my selection as an undergraduate teaching assistant for molecular biology, a competitive position for which normally only accomplished graduate students are selected. In this position I assist in lecturing, preparing experiments, grading, and helping students in the course. As a student entering into my first year of my graduate program at Duquesne University for my M.S. in Forensic Science and Law with a strong work ethic, passion for volunteering, and high academic achievement I believe that I make a strong candidate for the George W. Chin Memorial Scholarship."


# GEORGE W NEIGHBOR AWARD

**AWARDED TO:**

## KYRA HARDENBURG

UNDERGRADUATE STUDENT AT DUQUENSE UNIVERSITY

"Since 8th grade it has been a passion of mine to work within the criminal justice system. At first, I wanted to be a detective but as I grew older my love for science and math led me down the path to becoming a forensic scientist.

Recently my eyes to have been opened to wrongful conviction cases and the issues within the justice system. I've become inspired to use my forensic skills to help overturn the wrongful convictions of people who did not commit the accused crime. As a forensic scientist we have the skills to analyze the evidence and a voice to express those findings to determine the true perpetrator or to prove innocence. I hope to utilize my skills and knowledge from school to do my part in making a difference by finding the truth of crimes using evidence.

Duquesne has been an incredible university and I've learned so much from all of my professors, some who have become great mentors and guided me on my path to achieve my dreams. I believe education is so important and with the aid of this scholarship I will be able to continue my learning and grow in my field. In my graduate year I will continue to learn many of the important aspects of being a forensic scientist through classes and labs. As I am financing my education solely through loans, it would be extremely beneficial to be awarded this scholarship. With this scholarship money I can complete my graduate studies while I prepare for real life forensic work. After I graduate my initial goal is to work in the FBI Lab, however other options I've thought about include the DEA, a forensic position within the military or as a forensic scientist in a lab for the State Police. No matter where I end up, my aspiration is to be a forensic chemistry analyst in a crime lab.

I believe I deserve this scholarship because I am a leader, a hard worker, and determined to make a difference in this world through the use of forensic science. Throughout my time at Duquesne, I've had many achievements that I am proud of. These achievements include holding various leadership roles, conducting innovative research, and working as an Honors Intern with the FBI. I was the new member coordinator of the forensic science fraternity at Duquesne, Phi Sigma Lambda, then became the Vice President the following year. Recently I became the Vice President of the Forensic Honor Society, Delta Delta Epsilon at Duquesne. Personally, I believe my biggest achievement was becoming an honors intern for the FBI in the laboratory in Quantico. Last summer there were only 630 interns accepted into the program out of over 14000 candidates. The process was super competitive, yet the experience was better than I could imagine. I stepped outside my comfort zone, grew as a person and expanded my knowledge. If I am awarded this scholarship, I will take advantage of every opportunity it presents to me."


# GEORGE W NEIGHBOR AWARD

**AWARDED TO:**

## ALEXANDRA KUCHINOS

GRADUATE STUDENT AT CEDAR CREST COLLEGE

"When I reached the crucial crossroads to decide my future path, my passion in any particular field of study was severely lacking. Upon blindly enrolling in an advanced placement chemistry course elective in high school, my prospective route was promptly determined when we began reading The Poisoner's Handbook.

The gripping tale of notorious poisonings and detailed dive in the early development of forensic toxicology served as the catalyst for my intense fascination with forensic science. While enthusiastic about my newfound interest, I began to question whether this field was right for me on account of my below average chemistry grades at the time. Despite my concerns, I still chose to pursue a forensic science degree at Cedar Crest College where I knew I would have to persevere and significantly improve if I had any chance of attaining my goal.

Fortunately, my hard work and commitment paid off, as I found myself excelling in various areas I once found challenging and intimidating. For example, I received the John. R Griswold Award in Organic Chemistry following my sophomore year and soon after was inducted into the national chemistry honor society. As I progressed deeper into my forensic coursework, I arrived at a pivotal decision where I debated altering my course and dropping my forensic science major. However, my persistence and dedication were triumphantly rewarded by induction into the international forensic science honor society, solidifying my choice of major and faith in my capabilities. The following year I graduated with a 3.9 GPA and was the recipient of the local section American Chemical Society Undergraduate Senior Award and the Outstanding Forensic Science Senior Award.

During my time as an undergraduate, I found myself particularly drawn to drug chemistry and toxicology, both of which highlight my strengths in regions such as analytical chemistry and biochemistry. I was able to perform research in the area of drug analysis as well as expand my experience as an intern at the Union County Prosecutor's Forensic Lab in the drug chemistry section. My lengthy trek early each morning was absolutely worth it as I gained a direct, hands-on understanding of how casework is processed and was able to personally work on validating a method for the analysis of hemp products. This opportunity helped me hone in on my long-term ambitions where I ultimately seek a profession in the realm of drug analysis, whether that be in the form of illicit seized samples or toxicological screening. Additionally, I wish to contribute to the effective analysis of such substances and offer valuable data through my current graduate research of PCP analogues. I believe my accomplishments thus far reflect my drive and passion in this field, deeming me highly qualified as the recipient of this scholarship. Thank you for your time and consideration for this award."

# CAROL DE FOREST AWARD

**AWARDED TO:**

## AMY OSBORNE

SUNY ALBANY

**Forensic Entomotoxicology in the Modern Age: Application of Direct Analysis in Real Time-High Resolution Mass Spectrometry in the Analysis of Insect Evidence.**

# Forensic Entomotoxicology in the Modern Age: Application of Direct Analysis in Real Time-High Resolution Mass Spectrometry in the Analysis of Insect Evidence

## A. INTRODUCTION

The traditional role of entomological evidence in death investigations is to facilitate determination of the postmortem interval (PMI) or time since death. This is possible due to the established correlation between the extent of decomposition, the colonization of the corpse by insects and the order in which various species of insects appear. The utilization of insects in this manner is most often necessary when the corpse is in a state or has reached a level of decomposition incompatible with other methods of PMI estimation, such as determination of liver temperature. However, in cases where advanced decomposition or skeletonization has been reached, there are other analyses that are also rendered impossible, such as toxicological analysis of tissues. Natural decomposition, exposure of the body to the elements, and mutilation of the body by animals can destroy or eliminate the internal organs, urine, and blood used for postmortem drug detection. This leaves forensic investigators with few options that can be used to establish the role drugs may have played in the cause and manner of death. In such cases, it has been suggested that entomological evidence can offer a solution through the application of forensic entomotoxicology, or the toxicological analysis of insects that have fed on the remains. When flies colonize a corpse following death, they do so in order to provide a food source for the maggots that emerge from the eggs they lay. The maggots ingest the tissue along with any foreign compounds contained therein. Thus, any toxins found within the insects present on a corpse, generally contain elements of the content of the corpse that were present prior to its extensive decomposition. In essence, you are what you eat!

Despite the potential of entomotoxicology to reveal immense amounts of information of forensic relevance about the manner of death, the approach remains woefully underutilized. The relatively scant amount of research that has been accomplished in the field of forensic entomotoxicology has relied on using traditional toxicology techniques for analysis, which generally require long and cumbersome sample preparation processes. These can serve as a bottleneck to routine analysis of insects, particularly since the insect matrix itself is quite small, and the investigations require novel and nuanced sample analysis protocols. Further complicating the issue is the increasing number and frequency of novel synthetic drug derivatives which are formulated in clandestine labs and are specifically designed to circumvent the laws governing the use of scheduled materials. Newly synthesized cannabinoids, cathinones, opioids and other drugs must first be identified and then written into existing drug scheduling conventions before the manufacturers and dealers can face charges, and this is generally a lengthy process. However, the delay in getting these dangerous substances off the streets is not the only problem such designer drugs cause. The nature of the drug supply pipeline that extends from clandestine labs to users is such that there is little opportunity for the metabolites of these drugs to be known prior to scheduling. This means that even though a given drug may become scheduled, its contribution to the cause of death may be overlooked because the metabolites are not known and therefore their presence is not readily recognized. One way in which the presence of "unknowns" (i.e. drugs and/or their metabolites) that may have contributed to the cause of death can be revealed, is to use pattern recognition algorithms that compare the profiles of "pre-exposure" to "post-exposure" samples, so that the differences between the two can point to the presence of components that would otherwise be overlooked by the analyst, and which may have played a role in the death. In the context of entomotoxicology, the assessment of the chemical profiles of the tissue of insects that have consumed remains that contain drugs, verses tissue that does not, and the processing of these complex profiles using statistical analysis algorithms, can reveal metabolome profile differences and invite a more in-depth investigation and unveil exposure to novel drugs, even if the un-metabolized form of the drug is absent and the metabolites are unknown. By applying pattern recognition to the metabolome profiles of the tissue of insects (or their discarded parts such as puparial casings) to reveal whether there was exposure to drugs, the insects can serve as a repository of information that might otherwise be lost if the body is too decomposed, and can even reveal exposure to novel materials whose metabolite profile has not yet been characterized.

It is proposed that Direct Analysis in Real Time-High Resolution Mass Spectrometry (DART-HRMS) can be used as a new method for the rapid toxicological analysis of insects recovered in the course of forensic investigations, based on its utilization in both drug analysis[1-3] (in an ever-increasing number of crime labs), and forensic entomology.[4-6] This hypothesis will be explored through pursuit of the following specific aims:

***Specific Aim I*:** Demonstration of the ability of DART-HRMS as a presumptive test that can be used for the rapid detection of drugs and their metabolites in insects that have fed on decomposing tissue that contains drugs.

***Specific Aim II*:** Development of optimal procedures for forensic entomotoxicological analysis using DART-HRMS and statistical analysis processing of the acquired data.

## B. BACKGROUND AND SIGNIFICANCE OF RESEARCH PROPOSED

Entomology has been a facet of forensic science for over a hundred years. Yet, the use of insects for the detection of toxins derived from the decomposing remains upon which the insects have fed only began in the late 1970's.[7] In the interceding 40 years, a number of toxic substances have been shown to be present in insects following the ingestion of contaminated food substrates, including heavy metals (arsenic, mercury, copper, iron, and zinc), pesticides (malathion and other organophosphates), narcotics (cocaine, methamphetamine), and sedatives/prescription drugs (phenobarbital, bromazepam, levomepromazine, and morphine).[8] Testing methods in published studies include radioimmunoassay (RIA), thin-layer chromatography (TLC), gas chromatography-mass spectrometry (GC-MS), high performance liquid chromatography-mass spectrometry (HPLC-MS), and near infrared spectroscopy (NIRS).[9-11] Yet, among these various techniques, there is little to no uniformity among analytes, species of insects, and standard procedures, leading to limited progress within this field.[12-13] One of the few consistencies observed in the available literature is the complex sample preparation needed for the toxicological analysis of insect specimens. Among these techniques are solid phase extraction and liquid-liquid extraction, both of which when applied to insect tissues, are highly involved processes that not only take significant time to perform, but also involve the use of a range of expensive reagents and consumables.

That the field of forensic entomotoxicology remains somewhat of a niche area is illustrated in part by the lack of published studies exploring more modern methods and greener approaches for the detection of toxins in insects. One of the newer technologies yet to be exploited in this field is direct analysis in real time-high resolution mass spectrometry (DART-HRMS). The minimal sample preparation required to analyze entomological evidence using this ambient ionization mass spectrometry approach would make it an ideal alternative for rapid screening of entomological samples.[4-6] There is minimal training necessary to properly and effectively collect reproducible data, and the quick runtime (approximately 15 seconds per sample) is many times faster than other mass spectrometry techniques. The samples can be analyzed in their native form with no sample pre-treatment, and the output of this analysis reveals the presence of drug candidates present in the body of the decedent, in the form of readily recognizable masses (*m/z* values). The utilization of DART-HRMS would reduce both time and the expense associated with analyzing these samples. Moreover, it would allow for the expanded utilization of entomological evidence in forensic investigations and enhance their evidentiary value.

## C. EXPERIMENTAL PROCEDURES

***Specific Aim I*:** The primary goal of Specific Aim I is to demonstrate the ability of DART-HRMS as a presumptive test that can be used for the rapid detection of drugs of current relevance and their potential metabolites in insects which have consumed tissue from a carrion surrogate that has been laced with two fentanyl analogs present at physiologically relevant concentrations: acetyl norfentanyl and furanyl norfentanyl. *L. sericata*, the green bottle fly, is the species that will be used in this study due to its prevalence around the world and its well-documented utilization in medico-legal forensic entomology. Beef liver will be blended to a "milkshake" consistency and divided into three replicates each of a non-laced control; 5 ppm acetyl norfentanyl-laced samples; and 5 ppm furanyl nonfentanyl-laced samples. Flies will lay their

eggs (i.e. oviposit) on these liver samples and the freshly-hatched larvae will feed on it, mimicking the process of cadaver colonization. The insects will then be sampled in replicates of 3 for each liver sample over multiple days and across all life stages (1st, 2nd and 3rd instars, wandering larvae, as well as pupae and adults). Specimens will be preserved using 70% aqueous ethanol following standard entomological evidence collection procedures.[14] This process is summarized in Figure 1 below.

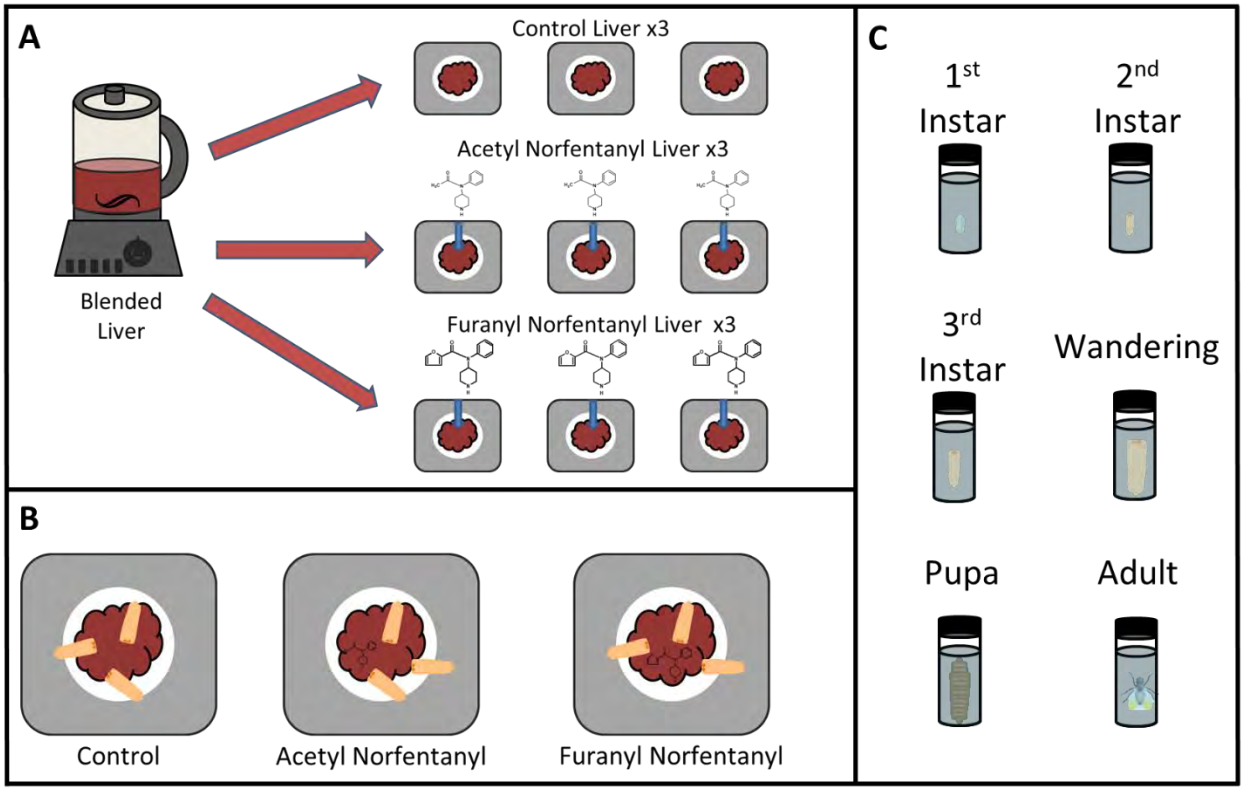


**Figure 1:** Experimental approach for mimicking cadaver colonization and the collection of forensic entomological samples. Panel A: beef liver is blended and then equal portions are separated for control, acetyl norfentanyl-laced liver and furanyl norfentanyl-laced liver samples; Panel B: the liver is then fed to larvae to simulate cadaver colonization; Panel C: multiple collections are made in replicates of three from each liver in order to ensure that each fly life stage is represented in the samples which are preserved in 70% aqueous ethanol.

A DART ion source coupled to a JEOL AccuTOF high-resolution mass spectrometer, operated in positive-ion mode, at 350 ºC, will be used to analyze insect specimens. The collected spectra will be assessed for evidence of the drug consumption by the insects based on the presence of new *m/z* values (when compared to controls).

***Specific Aim II*:** The primary goal of Specific Aim II is to develop the optimal procedures for the toxicological analysis of insect specimens via DART-HRMS and for the statistical analysis processing of the data. This also involves determining the insect life stage(s) which are most informative in revealing the presence of ingested drugs. Multiple fly analysis approaches will be surveyed, including testing the aqueous ethanol preservation solution, testing the whole specimens, and testing sliced or macerated specimens. Various statistical analysis methods including, but not limited to, principal component analysis (PCA), a preliminary exploratory technique, hierarchical clustering algorithm (HCA), linear discriminate analysis (LDA) and partial least squares-discriminant analysis (PLS-DA) will be utilized to differentiate the drugged and non-drugged insects at different life stages.

## D. PRELIMINARY RESULTS

***Specific Aim I*:** To date, in an investigation of proof-of-concept and in collaboration with Professor Jennifer Rosati at the John Jay College of Criminal Justice, preliminary analyses have been carried out on all larval life stages of the *L. sericata* species including 1st, 2nd, and 3rd instars, and the wandering or post-feeding stage. These life stages were sampled over a series of 8 collections, resulting in 216 larvae presented for analysis. The first 5 collections consisting of larvae in the 1st and 2nd instar stages were analyzed whole due to their very small size. The remaining 3 collections containing larvae at the 2nd instar stage and above were sliced transverse-wise along body segments and each individual slice was tested separately. The results of this process for a wandering stage larva that was fed the control liver are shown in Figure 2. The

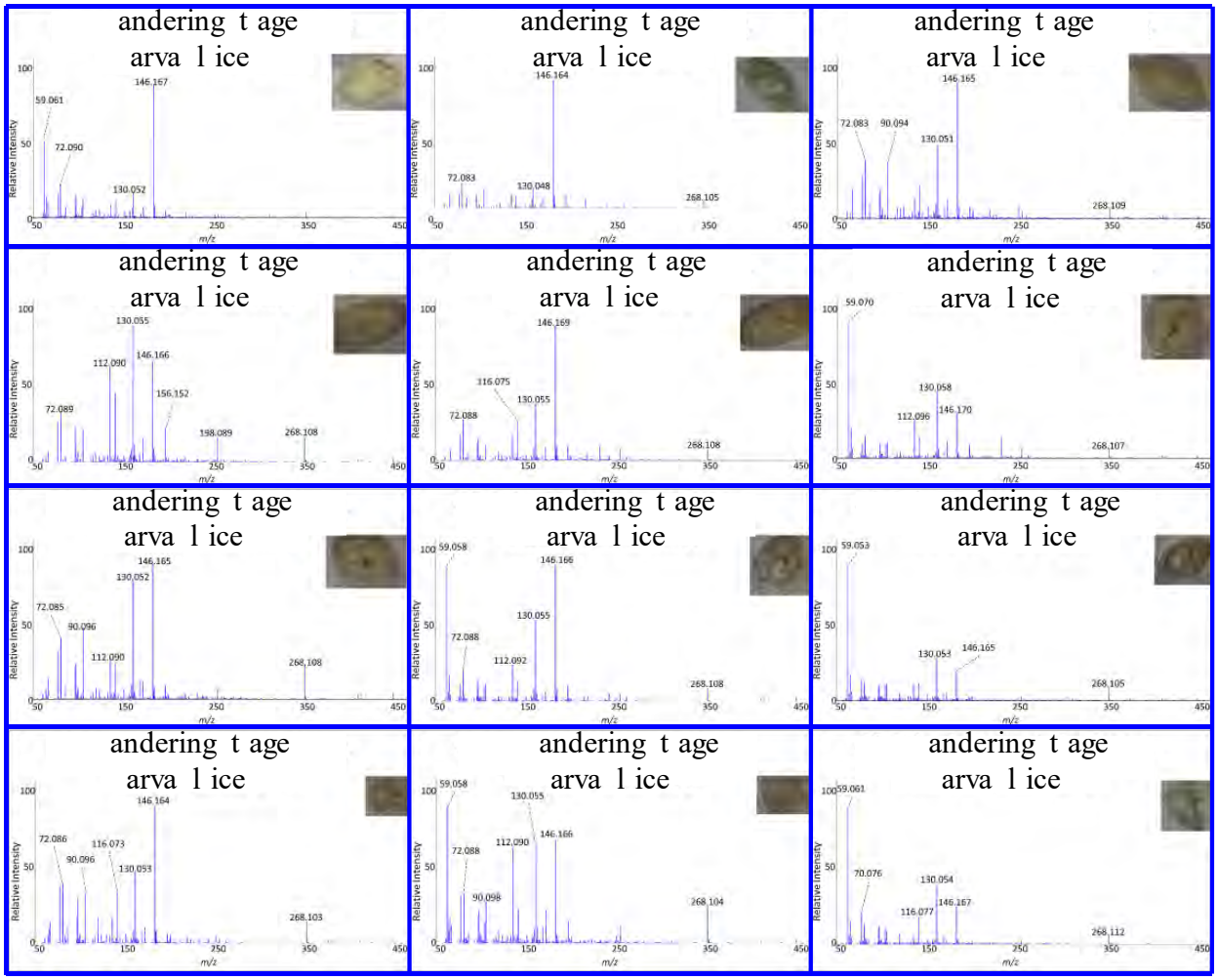


**Figure 2:** Representative DART-HRMS mass spectra obtained from the analysis of transverse segments of a wandering stage *L. sericata* larva (i.e. a control sample) following feeding on a control (non-laced) liver sample. The peaks in each spectrum represent the protonated forms of the small molecules detected, and provide a snapshot of the small-molecules (i.e. metabolome profile) of the tissue matrix as a function of the transverse section represented (images shown in the insets). Similar results obtained from analysis of multiple individuals can then be compared with the spectra acquired from analysis of wandering stage larvae that have consumed fentanyl-derivative-laced liver samples to detect the presence of additional peaks (e.g. biomarkers or metabolites) reflective of exposure to the drugs.

collected spectra were monitored for the *m/z* values 219.155 and 271.145 which correspond with acetyl norfentanyl and furanyl norfentanyl, in their protonated forms respectively. While nominal *m/z* 219 and 271 were observed in various spectra, these values were inconsistent with the high-resolution masses of the actual drugs, and their presence was therefore deemed insufficient as a proof of their presence in the larvae. Thus, analysis of these spectra remains ongoing, as evidence of metabolites of acetyl norfentanyl and

furanyl norfentanyl is being investigated. Furthermore, 2 collections (pupae and adults with their puparial cases) are yet to be analyzed. These are some of the further steps that will be taken as this project continues.

***Specific Aim II*:** The goal of specific aim II is to establish the fly life stages which exhibit the signs of drug consumption and to test statistical analysis methods in order to objectively and efficiently differentiate drugged and non-drugged larvae. Principal component analysis (PCA) performed on larvae collected 4 hours after hatching (and having fed on control, acetyl norfentanyl-laced liver and furnayl norfentanyl-laced liver) demonstrates clear clustering among samples within the same group-type and separation between the three groups. This is illustrated in Figure 3. Based on the literature, the 3rd instar and wandering larvae appear to be the life stages that show the most significant distinctions between samples that fed on drug-laced liver and those that did not, likely due to the higher level of feeding that occurs at these stages.[7] While the results are promising, further statistical analysis is needed in order to draw more definitive conclusions, since the PCA results displayed here depict only 1st instar larvae. Statistical analysis methods that will be investigated include principal component analysis (PCA), hierarchical clustering algorithm (HCA), linear discriminate analysis (LDA) and partial least squares-discriminate analysis (PLS-DA).

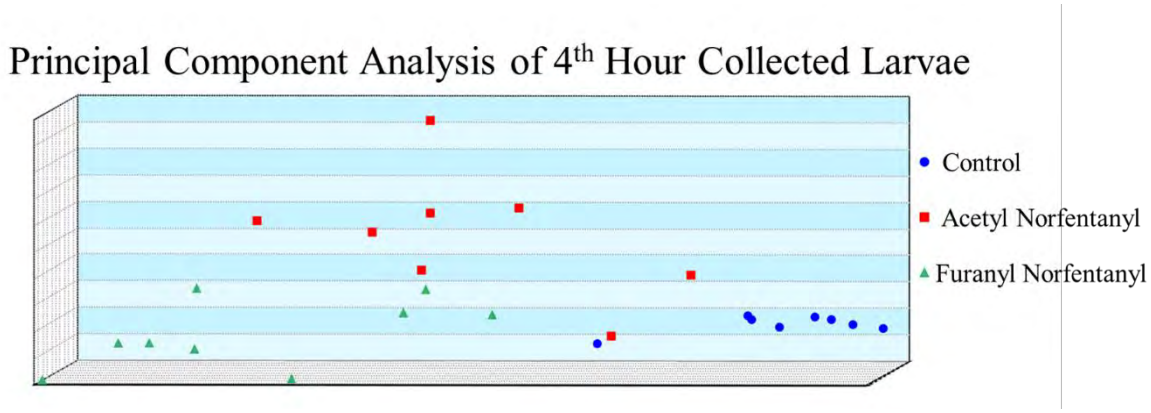


**Figure 3:** Principal Component Analysis (PCA) performed on the larvae specimens collected 4 hours after hatching shows control (blue circles), acetyl norfentanyl-laced (red triangles), and furanyl norfentanyl-laced (green triangles) samples cluster among like samples and separate from non-like samples**.**

## E. EXPECTED RESULTS AND CONTRIBUTION TO FORENSIC SCIENCE

It is anticipated that the results of this project will have a potentially significant impact in the field of forensic entomotoxicology. At present, DART-HRMS has not been utilized in this field. A successful protocol by which to conduct toxicological analysis on insects collected from crime scenes by DART-HRMS would allow for the rapid testing of evidence that may provide important information of forensic relevance that might otherwise have been overlooked, and which might be highly relevant to the investigation. Further, in comparison to current methods used to test this type of evidence, DART-HRMS would reduce the cost, time, and environmental impact of the analysis. Such an approach has the potential, once established, to gain increasing importance as more and more crime labs acquire DART-HRMS system for drug analysis-related casework.

## F. BUDGET FOR THE PROJECT

In order to demonstrate and develop the application of DART-HRMS for the detection of drugs in entomological evidence, funds are needed to purchase standards. Funds are also needed to secure supplies for the handling of the samples such as tweezers, storage vials, and additional general lab supplies. Also, nitrogen and helium gases are required for instrument analysis. Since some of the results obtained in this

investigation will be disseminated at the 2022 NEAFS Annual Meeting, funds are also requested to defray the cost of conference attendance.

| Item | Average Cost per Item | Number of Units | Total Cost |
|---|---|---|---|
| Standards | $200 | 6 | $1200 |
| Tweezers | $50 | 2 | $100 |
| Helium | $116 | 4 | $464 |
| Nitrogen | $14 | 4 | $56 |
| Scintillation vials, pack of 144 | $97 | 4 | $388 |
| General consumables (labelling tape, sharpies, gloves, fly maintenance supplies, etc.) | $42 | 1 | $42 |
| Travel to NEAFS Annual Meeting 2020 | $250.00 | 1 | $250.00 |
| Amount Requested from NEAFS | | | $2,500.00 |

## G. REFERENCES


1. Fowble, K. L.; Musah, R. A., Utilizing Direct Analysis in Real Time-High Resolution Mass Spectrometry-Derived Dark Matter Spectra to Classify and Identify Unknown Synthetic Cathinones. *Methods in molecular biology (Clifton, N.J.)* **2018,** *1810*, 217-225.
2. Lesiak, A. D.; Musah, R. A.; Cody, R. B.; Domin, M. A.; Dane, A. J.; Shepard, J. R. E., Direct Analysis in Real Time Mass Spectrometry (DART-M ) of "Bath Salt" Cathinone Drug Mixtures. *Analyst* **2013,** *138* (12), 3424-3432.
3. Lesiak, A. D.; Musah, R. A.; Domin, M. A.; Shepard, J. R. E., DART-MS as a Preliminary Screening Method for " e rbal ncense": h emical nalysis of y nthetic annabinoids. *J Forensic Sci* **2014,** *59* (2), 337-343.
4. Beyramysoltan, S.; Giffen, J. E.; Rosati, J. Y.; Musah, R. A., Direct Analysis in Real Time-Mass Spectrometry and Kohonen Artificial Neural Networks for Species Identification of Larva, Pupa and Adult Life Stages of Carrion Insects. *Anal Chem* **2018,** *90* (15), 9206-9217.
5. Beyramysoltan, S.; Ventura, M. I.; Rosati, J. Y.; Giffen-Lemieux, J. E.; Musah, R. A., Identification of the Species Constituents of Maggot Populations Feeding on Decomposing Remains—Facilitation of the Determination of Post Mortem Interval and Time Since Tissue Infestation through Application of Machine Learning and Direct Analysis in Real Time-Mass Spectrometry. *Anal Chem* **2020,** *92* (7), 5439-5446.
6. Giffen, J. E.; Rosati, J. Y.; Longo, C. M.; Musah, R. A., Species Identification of Necrophagous Insect Eggs Based on Amino Acid Profile Differences Revealed by Direct Analysis in Real Time-High Resolution Mass Spectrometry. *Anal Chem* **2017,** *89* (14), 7719-7726.
7. Introna, F.; Campobasso, C. P.; Goff, M. L., Entomotoxicology. *Forensic Sci Int* **2001,** *120* (1), 42-47.
8. Gagliano-Candela, R.; Aventaggiato, L., The Detection of Toxic Substances in Entomological Specimens. *Int J Legal Med* **2001,** *114* (4-5), 197-203.
9. Chophi, R.; Sharma, S.; Sharma, S.; Singh, R., Forensic Entomotoxicology: Current Concepts, Trends and Challenges. *J Forensic Leg Med* **2019,** *67*, 28-36.
10. Gosselin, M.; Wille, S. M. R.; Fernandez, M. d. M. R.; Di Fazio, V.; Samyn, N.; De Boeck, G.; Bourel, B., Entomotoxicology, Experimental Set-up and Interpretation for Forensic Toxicologists. *Forensic Sci Int* **2011,** *208* (1), 1-9.
11. Oliveira, J. S.; Baia, T. C.; Gama, R. A.; Lima, K. M. G., Development of a Novel Non-destructive Method Based on Spectral Fingerprint for Determination of Abused Drug in Insects: An Alternative Entomotoxicology Approach. *Microchem J* **2014,** *115*, 39-46.
12. Da Silva, E. I.; Wilhelmi, B.; Villet, M. H., Forensic Entomotoxicology Revisited--Towards Professional Standardisation of Study Designs. *Int J Legal Med* **2017,** *131* (5), 1399-1412.
13. Hodecek, J., Revisiting the Concept of Entomotoxicology. *Forensic Sci Int Synergy* **2020,** *2*, 282-286.
14. Amendt, J.; Campobasso, C. P.; Gaudry, E.; Reiter, C.; LeBlanc, H. N.; J. R. Hall, M., Best Practice in Forensic Entomology—Standards and Guidelines. *Int J Legal Med* **2007,** *121* (2), 90-104.

# CAROL DE FOREST AWARD

**AWARDED TO:**

CODY SILVERMAN
UNIVERSITY OF NEW HAVEN

Compositional Analysis of Human Skeletal Samples Using Raman Spectroscopy and Correlation to DNA Recovery

**Part II**
**Attachment A**

**Title:** Compositional Analysis of Human Skeletal Samples Using Raman Spectroscopy and Correlation to DNA Recovery

## Introduction, Background, and Significance of Research Proposed

The importance of Raman spectroscopy and its applications is well demonstrated in the forensic science, analytical chemistry and biological sciences literature. Additionally, there are numerous published studies that have investigated DNA degradation within bone samples and optimal DNA extraction techniques for these challenging sample types. However, at this time there is no known research that has attempted to use Raman spectroscopy as a pre-screening tool for assessing DNA quantity and quality for forensic casework applications, which is the focus of this research.

The two main components of bone are calcium hydroxyapatite and collagen. Calcium hydroxyapatite is the inorganic crystalline matrix of bone; up to 50% by volume and 70% by weight of human bone is a modified form of hydroxyapatite. Collagen, a protein, is the organic phase of bone. Changes occur to both components of bone microstructure over time and in response to environmental insult (in a process known as diagenesis). Diagenesis involves alteration and leaching of hydroxyapatite, as well as breakdown and leaching of collagen. However, diagenesis has been shown histologically to occur in a non-uniform, heterogeneous manner [2]. In its native conformation, DNA exists as a double-stranded helix. The DNA molecule interacts with hydroxyapatite because of simple chemistry (i.e., basic electrostatic attraction and the concept of "opposite charges attract"). DNA has a net negative charge due to the phosphate groups in its backbone, while calcium residues in the hydroxyapatite matrix are positively charged. It has been shown that DNA binds to hydroxyapatite during decomposition, offering a protective barrier to environmental exposure and microbial attack. Hydroxyapatite is also able to bind and inactivate nucleases, which attack and cleave essential bonds in DNA, effectively breaking down the entire genetic material. As hydroxyapatite breaks down, DNA dissociates from the protective crystalline matrix and becomes vulnerable to degradation. As this diagenetic process progresses, the amount of viable DNA available for analysis decreases [3].

DNA preservation also is purported to rely on interaction with collagen, the main organic fraction of bones (although to a lesser degree than hydroxyapatite). The relationship between diagenesis of collagen and long-term preservation of DNA is not well understood, but collagen has been shown to play a role [3]. Diagenesis of the organic phase is associated with collagen loss due to breakdown and leaching of collagen from exposure to chemicals and microorganisms [6]. Collagen has been used in previous studies for radiocarbon dating and paleoproteomic analyses, the analysis of ancient protein sequences preserved in bone and tissues. However, because collagen breaks down during diagenesis, it is more difficult to analyze in older bone samples. As previously mentioned, since bone diagenesis progresses in a non-uniform (heterogeneous) manner, collagen content does not remain persistent in all parts of the human skeleton in the burial environment over time. Non-uniform diagenesis poses a major challenge in skeletal remains casework because a significant amount of time, effort, and money go into preparation, extraction, and quantification of DNA that may not even yield probative results [7].

Currently, a reliable screening method for DNA extraction from bones does not exist. Previous studies demonstrate that certain skeletal elements (e.g., weight-bearing long bones, molar teeth) are preferred for DNA preservation; however, once these skeletal elements are selected, the intra-sampling technique proceeds in somewhat of a blind manner. Moreover, the external physical appearance of bone has been proven to not be a reliable predictor of DNA recovery potential. Thus, it would be a revolutionary advancement in the field of forensic DNA analysis if we can find a dependable pre-screening tool. Effectively, a non-destructive screening method for different bone samples to assess the potential for DNA recovery could provide a compass on which path or strategy to take, streamlining the testing process and allowing analysts to make a more informative decision regarding downstream DNA analysis. I believe there is a solution, and it involves Raman spectroscopy.

Raman Spectroscopy is based on the principle of inelastic scattering of light by molecules. Photons give energy to the vibrations of the molecule to generate signals that make a spectrum. The measurement of these vibrations and the spectrum that is generated can confirm specific chemical compositions of the target compound; in this case, bone [4]. The strength of the laser and the aperture determine the size of the signal exhibited. The number of exposures and exposure time are used to determine duration and frequency that the sample is exposed to the laser. This is a preferrable method because it is rapid, non-destructive/invasive and provides definitive molecular information about a wide range of materials [1]. A Raman spectrum can be used to ascertain information about the organic and inorganic identity, structure, and properties of compounds based on their vibrational transitions. Relevant to this research, Raman spectroscopy is an established method for the identification of minerals [5], such as calcium hydroxyapatite, and collagen (including providing information about the alignment of its fibrils) [6]. This research will utilize a relatively new method called particle correlated Raman spectroscopy (PCRS), also known as particle driven Raman spectroscopy. HORIBA's XPLORA Plus Particle Analyzer Raman Microscope will be used for this research, which has the Particle Finder software to enable PCRS analysis. PCRS is capable of delivering both qualitative and quantitative information about a sample which includes information on the particle counts, size distribution and microscopic morphological characteristics for the particles present within a sample, and at the same time provides secure chemical identification. Forensic DNA analysis (including extraction, quantification, amplification, genotyping) is time/labor-intensive and very expensive, so if a screening method could simply separate bones into good and poor preservation groups, it could expedite and streamline the processing of unidentified skeletal remains in casework [7].

## Appropriate References Cited

References


1. Gautam, Rekha, et al. "Raman and Mid-Infrared Spectroscopic Imaging: Applications and Advancements." *Current Science, vol. 108*, no. 3, 2015, pp. 341–356.

2. Hagelberg, Erika, et al. "Analysis of Ancient Bone DNA: Techniques and Applications [and Dicussion]." Philosophical Transactions: *Biological Sciences, vol. 333*, no. 1268, 1991, pp. 399–407. JSTOR,

3. Korlević, Petra et al. “Reducing microbial and human contamination in DNA extractions from ancient bones and teeth.” *BioTechniques vol. 59,2* 87-93. 1 Aug. 2015.

4. Lafuente B, Downs R T, Yang H, Stone N (2015) “The power of databases: the RRUFF project. In: Highlights in Mineralogical Crystallography, T Armbruster and R M Danisi, eds. Berlin, Germany, W. De Gruyter,” *pp 1-30*.

5. Marek Janko, Polina Davydovskaya, Michael Bauer et al. "Anisotropic Raman scattering in collagen bundles." *Opt. Lett. 35*, 2765-2767 (2010)

*6.* McLaughlin, Gregory & Lednev, Igor. (2011). “Potential application of Raman spectroscopy for determining burial duration of skeletal remains*.” Analytical and bioanalytical chemistry.*

7. Sponheimer, M., Ryder, C.M., Fewlass, H. et al. “Saving Old Bones: a non-destructive method for bone collagen prescreening.” *Sci Rep 9*, 13928 (2019).

**Experimental Procedure/Expected Results and Contribution to Forensic Science**

The purpose of this study is to determine if Raman spectroscopy, and specifically PCRS, can be used as a rapid and non-destructive screening tool to predict DNA recovery potential for bone, and to explore the correlation between the compositional structure of bone and preservation of DNA. The two primary structural components of bone are calcium hydroxyapatite and collagen. It is proposed that by analyzing the bone using PCRS, the presence, state, and distribution of hydroxyapatite and collagen will be measured, which may be useful in predicting if the sample is viable for DNA analysis. The ultimate goal of this study is to develop a screening tool which has the potential to save both money and time for forensic DNA testing of recovered human remains. Often, DNA analysts will receive a set of human remains and will spend weeks or months cleaning and analyzing various sections in hopes of making a positive identification. It is generally known that the best bones for DNA recovery and preservation are weight-bearing long bones (e.g., femur, tibia) and molar teeth. The diaphysis (shaft) of a long bone is sampled because it is compact bone and contains many osteocytes (nucleated bone cells) that possess DNA. Multiple cuts are made along the diaphysis. However, since the microstructure of bone decomposes in a non-uniform manner postmortem, there is no way of knowing which cuttings or regions of the diaphysis contain the most intact microstructure (and presumably the most DNA). I hypothesize that by using Raman spectroscopy, the location of the most intact hydroxyapatite and collagen microstructure within bone can be found, and that these regions will produce higher yields of DNA (and better quality DNA). To serve as a comparison, samples will also be used where there is less intact hydroxyapatite and collagen.

My particular research will incorporate molar teeth and long bones. The samples were donated for research purposes and are anonymized upon collection; hence, personal identifying information is not recorded nor is it available to researchers. A modified organic DNA extraction will be performed, according to the standard operating procedures (SOPs) used in skeletal remains casework. Human DNA quantities recovered from each sample will be determined using the Quantifiler™ Trio Human DNA Quantification Kit (Thermo Fisher Scientific) and real-time

(quantitative) PCR. The Quantifiler™ Trio assay provides information regarding both the quantity and quality of DNA recovered. A Degradation Index (DI) is generated for each DNA sample, indicating the degree of DNA degradation/damage present, the latter of which can be useful in selecting appropriate downstream testing approaches to maximize chances of profiling success. Based on the quantification results, the differences in DNA recovery and preservation will be observed between samples in a state of advanced diagenesis (i.e., more modified hydroxyapatite and collagen) by Raman spectroscopy confirmation versus bone sections with more intact (preserved) hydroxyapatite and collagen. The Raman analysis will be optimized using traditional figures of merit and response surface modeling of a multi-level experimental design. Laser wavelength (785, 638 and 532nm), laser power, magnification (using 5x, 10x, and 50x objectives), exposure time, and the number of accumulations will be examined to determine the optimal Raman experimental parameters. An analysis of the results will be conducted to make a conclusion on the relationship between the decomposition state of hydroxyapatite and collagen and DNA recovery, and how reliable Raman spectroscopy is as a screening method. Based on the relationship, it is expected that more DNA (and higher quality DNA) can be recovered from samples containing preserved hydroxyapatite and collagen versus samples that contain patches of bone in a more advanced state of diagenesis. Quantification of DNA after extraction will be a way to measure this relationship, and it is expected that samples with better preserved hydroxyapatite and collagen will yield a higher quantity of DNA (and less degraded DNA) than samples that exhibit more advanced diagenesis.

At no point in this study will there be any direct contact with human subjects, nor will this study involve solicitation or collection of samples. The molar teeth/sample used in this research will be sourced from *"existing […] pathological or diagnostic specimens"* that were donated for research purposes to Dr. Angie Ambers (Associate Professor, Forensic Science Department). The samples were anonymized upon collection and donation, so private information and/or personal identifiers regarding the identity of the decedent(s) do not exist and are therefore not on file anywhere.

## Budget and Supplies Needed

**Phenol:Chloroform:Isoamyl Alcohol (25:24:1), Molecular Biology Grade, Ultrapure - 100mL**
Purpose (modified organic DNA extraction)
Manufacturer/distributor: Fisher Scientific
Catalog #: AAJ75831AE
Price per unit: $81.50
Quantity: 2
Total price: $163

**Proteinase K, Recombinant, PCR grade (20mg/mL, 1mL)**
Purpose (modified organic DNA extraction)
Manufacturer/distributor: Fisher Scientific
Catalog #: FERE00491
Price per unit: $57.50
Quantity: 2

Total price: $115

**Invitrogen UltraPure™ 0.5M EDTA, pH 8.0, 4 x 100mL**
Purpose (modified organic DNA extraction)
Manufacturer/distributor: Thermo Fisher Scientific
Catalog #: 1557575020
Price per unit: $84.25
Quantity: 1
Total price: $84.25

**MilliporeSigma™ Amicon™ Ultra-15 Centrifugal Filter Units, 30kDa 15mL (pack of 24)**
Purpose (concentration of DNA post-extraction)
Manufacturer/distributor: Fisher Scientific
Catalog #: UFC903024
Price per unit: $316
Quantity: 2
Total price: $632

**QIAquick PCR purification kit (50 reactions)**
Purpose (removal of inhibitors post-extraction)
Manufacturer/distributor: Qiagen
Catalog #: 28104
Price per unit: $123.00
Quantity: 1
Total price: $123.00

**Liquid nitrogen**
Purpose (to pulverize bones and teeth in preparation for DNA extraction)
Distributor: local vendor
Cost: $750

**SPEX Grinding vials – Small Polycarbonate Center Cylinders, Pack of 20**
Purpose (to pulverize bones/teeth in preparation for DNA extraction)
Manufacturer/distributor: SPEX® SamplePrep
Catalog #: 6751C20
Price per unit: $460
Quantity: 2
Total price: $920

**Serological pipettes, 5-mL, Individually wrapped and plugged (Case of 500)**
Purpose (DNA extraction from bones and teeth)
Manufacturer/distributor: Fisher Scientific
Catalog #: 12-567-614
Price per unit: $187
Quantity: 1
Total price: $187

**Serological pipettes, 10-mL, Individually wrapped and plugged (Case of 500)**
Purpose (DNA extraction from bones and teeth)
Manufacturer/distributor: Fisher Scientific
Catalog #: 12-567-615
Price per unit: $215
Quantity: 1
Total price: $215

**BrandTech™ BRAND™ Macro Pipet Controller**
Purpose (DNA extraction from bones and teeth)
Manufacturer/distributor: Fisher Scientific
Catalog #: 13-688-852
Price per unit: $125
Quantity: 1
Total price: $125

**Quantifiler™ Trio Human DNA quantification kit**
Purpose (assessment of quantity and quality of DNA recovered)
Manufacturer/distributor: Thermo Fisher Scientific
Catalog #: 4482910
Price per unit: $2300
Quantity: 1
Total price: $2300

**MicroAmp™ Optical 96-Well Reaction Plates (Box of 10)**
Purpose (assessment of quantity and quality of DNA recovered)
Manufacturer/distributor: Thermo Fisher Scientific
Catalog #: N8010560
Price per unit: $75
Quantity: 1
Total price: $75

Grand Total: $5689.25
The total cost for this research is more than what may be provided from this NEAFS award, so the remaining funding will be sourced elsewhere.

# STUDENT PRESENTATION COMPETITION WINNERS

**AWARDED TO:**

## MADISON CARTER

UNIVERSITY OF NEW HAVEN - GRADUATE

**The Effect of Washing on the Transfer and Persistence of Fiber Evidence**


## BRIANNA GREGORY

CEDAR CREST COLLEGE - UNDERGRADUATE

**Determining the Efficiency of Nylon-flocked Swabs versus Cotton Swabs for Fellatio Samples**

# STUDENT POSTER COMPETITION WINNERS

**AWARDED TO:**

## SAVANNAH BROWN

UNIVERSITY OF NEW HAVEN - GRADUATE

**Evaluation of a Facile Synthesis of Lefetamine Analogs**


## BRITANIA WALTERS

JOHN JAY COLLEGE OF CRIMINAL JUSTICE - UNDERGRADUATE

**Evaluating the 12 gauge Less-lethal Baton Shotshell**

# ATTENTION STUDENTS:

Are you a current full-time undergraduate student in your junior or senior year, or are you either a part-time or full-time graduate student completing his or her degree in a forensic program at a regionally accredited institution located in the Northeastern U.S. (Connecticut, Rhode Island, Massachusetts, New Hampshire, Vermont, Maine, New Jersey, New York, and Pennsylvania)?

**Then you are eligible to apply for:**

George W. Neighbor Jr. Memorial Scholarship (undergraduate) - Award is $1750
George W. Neighbor Jr. Memorial Scholarship (graduate) - Award is $1750
George W. Chin Memorial Scholarship – Award is $2000

Carol De Forest Forensic Science Research Grants - Award is $2500
***Note** – eligibility is for both full-time undergraduate and graduate students

** **Note –** Two Research Grants will be Awarded.

All submission materials for either the scholarships or the research grants must be completed, and electronically submitted by April 30th. The 2022 Awards recipients will be notified no later than September1st.

For more information and Scholarship/Research Grant forms please go to http://www.neafs.org/

Questions or comments? Please email Awards@NEAFS.org

# THE GEORGE W. CHIN MEMORIAL SCHOLARSHIP

Are you a current full-time undergraduate student in your junior or senior year, or are you either a part-time or full-time graduate student or in your first two years of your Ph.D. Forensic Science program? Do you attend a college or university within the area from which NEAFS draws it members (CT, NY, NJ, PA, VT, NH, ME, RI, MA)? Do you demonstrate excellence in your academic program?

If Yes, you are eligible to apply for the George W. Chin Memorial Scholarship!

The award is $2000.00 as well as Associate membership for one year in the NEAFS organization. Membership will be granted to a current member or active applicant as well as a non-member (the application fee will also be included).

All submission materials for the Memorial Scholarship must be completed and electronically submitted by April 30. The award recipients will be notified no later than September 1.

For more information and to obtain the application forms, go to http://www.neafs.org

If you have any questions please email: awards@neafs.org

# 2022 Training Scholarship Fund

The Northeastern Association of Forensic Scientists (NEAFS) is proud to offer its members a 2022 Training Scholarship Fund. Regular members, in good standing, are eligible to receive up to $400 towards training, workshop or non-NEAFS meeting registration expenses. Detailed instructions and application forms are available on the NEAFS website. Simply click the “Training” link at the top of the screen and scroll down to the “NEAFS Training Scholarship Forms”. The current application period is January 1st, 2022 to December 31st, 2022. Reimbursements will be issued on a first come, first serve basis and funding is limited. If you plan to attend a non-NEAFS meeting workshop, training or course during this application period and will not be funded by your agency or any other non-NEAFS related entity, we highly encourage your swift application for the 2022 Training Scholarship Fund. Please visit the NEAFS training website to take advantage of this great NEAFS opportunity and to view upcoming training opportunities!

# NORTHEASTERN ASSOCIATION OF FORENSIC SCIENTISTS

## 2022 TRAINING SCHOLARSHIP FUND

OPEN APPLICATION PERIOD: JANUARY 1st, 2022 – DECEMBER 31st, 2022

### APPLICATION REQUIREMENTS

The Northeastern Association of Forensic Scientists (NEAFS) is proud to offer its members a Training Scholarship Fund (TSF). Members in good standing are eligible to receive up to $400 towards training, workshop or non-NEAFS meeting registration and travel expenses. Individuals will only be allowed reimbursement once per application period. Any NEAFS Annual Meeting expenses are ineligible to receive funding. Reimbursement will occur upon receipt of a certificate showing successful attendance and completion of the course along with an article summarizing the course for the NEAFS newsletter.

### APPLICATION INSTRUCTIONS

Applicants must submit a *Pre-Approval Application* prior to attending the training for which they wish to obtain funding. All applications must be complete with a brief course description, statement as to how the applicant will benefit from attending the training and justification for receiving funding (i.e. insufficient employer funding or continuing education requirements).

Notification will be given to each applicant upon receipt of the *Pre-Approval Application.* This notification lets the applicant know that their submission has been received by the Awards Chair at NEAFS and is being reviewed. Applicants can expect to be informed of the acceptance or rejection of their application within 60 days of receiving this *Pre-Approval Application* notification.

Upon successful attendance and completion of the training, all pre-approved applicants must submit a *Reimbursement Application* along with supporting documentation. Whenever possible, a certificate should be provided as proof of attendance and completion. If a certificate is not issued, or is unavailable, a letter from the organizer/ instructor verifying the applicant's successful attendance and completion shall suffice. Each Training Scholarship Fund recipient is required to contribute to NEAFS and its members by publishing a written article in the Newsletter. *Reimbursement Applications* will only be considered complete when accompanied by a 1000-word (minimum) course summary.

All application materials can be found on the NEAFS website.

*Visit neafs.org under the merchandise tab!*




# GET YOUR NEAFS GEAR!

# 2023 NEAFS Annual Meeting

## Mystic Marriott, Groton, CT

## November 6th, 2023 - November 10th, 2023

## Program Chair - Stephanie Minero

# ASCLD FRC
# Outstanding Evaluation/Validation Award 2022

The Forensic Research Committee of the American Society of Crime Laboratory Directors announces the **Outstanding Evaluation/Validation Award.** The goal of the award is to recognize an outstanding evaluation/validation study that has been submitted to the FRC repository (https://www.ascld.org/validation-evaluation-repository/).

**Award:** the winner will be recognized at the 2022 ASCLD Annual Symposium and will receive a plaque. The awardee will receive an individualized electronic award icon that can be use on letterhead, reports, e-mail signatures, etc.

**Eligibility**: open to scientists from all disciplines (bio/DNA, drug chemistry, toxicology, fingerprints, questioned documents, trace/microscopy, firearms/toolmarks, other) in operational forensic labs or research laboratories.

**Criteria:**

1) validation/evaluation of a protocol, method, tool, kit, or assay for use in a forensic science discipline such as Bio/DNA, drug chemistry, toxicology, fingerprints, questioned documents, trace/microscopy, firearms/toolmarks, and digital/multimedia sciences (50 points)
2) the validation/evaluation is relevant and immediately useful in forensic science casework (50 points)

Note: studies that have been performed in accordance with SWG or other guidelines, if appropriate, and/or have been published in the peer-reviewed literature will receive favorable review.

**Application Window:** November 8th, 2021 - January 20th, 2022

**Application Process:**

1. Complete the application, found at https://www.ascld.org/nominations/
2. Include a 1 – 2 page description of the study, specifically addressing the criteria
3. Submit the completed application electronically to ascldfrc@gmail.com

**For additional information:**

https://www.ascld.org/forensic-research-committee/

# ASCLD FRC Innovation Award 2022

The Forensic Research Committee of the American Society of Crime Laboratory Directors announces the **Second Annual Innovation Award**. The goal of the award is to recognize activities highlighting new technologies, protocols, or tools that impact the operational forensic science laboratory.

**Award:** the winner will be recognized at the 2022 ASCLD Annual Symposium and will receive a plaque. The awardee will receive an individualized electronic award icon that can be use on letterhead, reports, e-mail signatures, etc.

**Eligibility**: open to scientists from all disciplines such as Bio/DNA, drug chemistry, toxicology, fingerprints, questioned documents, trace/microscopy, firearms/toolmarks, and digital/multimedia sciences in operational forensic laboratories. The activity should have been completed within past 2 years.

**Criteria:**

1) innovative methods, tools, and technological approaches that contribute to a forensic science discipline (Bio/DNA, drug chemistry, toxicology, fingerprints, questioned documents, trace/microscopy, firearms/toolmarks, other)
2) the activity has the potential to improve the practice of forensic science
3) the activity has touch points to the ASCLD/FRC needs list (https://www.ascld.org/wp-content/uploads/2019/11/ASCLD-Research-Priority-Areas-2019-2021.pdf )

Note: works that have been published in the peer-reviewed literature will receive favorable review

**Application Window:** November 8th, 2021 - January 20th, 2022

**Application Process:**

1. Complete the application, found at https://www.ascld.org/nominations/
2. Include a 1 – 2 page description of the research, specifically addressing the criteria
3. Submit the completed application electronically to ascldfrc@gmail.com

**For additional information:**

https://www.ascld.org/forensic-research-committee/

# ASCLD FRC LEAP Collaboration Award 2022

The Forensic Research Committee of the American Society of Crime Laboratory Directors announces the **LEAP Collaboration Award**. The goal of the award is to recognize an outstanding partnership between LEAP participating academic and operational forensic laboratories.

**Award:** the winners will be recognized at the 2022 ASCLD Annual Symposium and will receive a plaque. The awardees will receive an individualized electronic award icon that can be use on letterhead, reports, e-mail signatures, etc.

**Eligibility**: open to scientists from all disciplines such as Bio/DNA, drug chemistry, toxicology, fingerprints, questioned documents, trace/microscopy, firearms/toolmarks, and digital/multimedia sciences in LEAP participating operational and academic forensic laboratories.

**Criteria:**

1) the research is a collaborative effort between an operational and an academic lab that produces novel data, methods, analytical/research tools that contribute to a forensic science discipline such as Bio/DNA, drug chemistry, toxicology, fingerprints, questioned documents, trace/microscopy, firearms/toolmarks, digital/multimedia sciences
2) the partnership is a joint endeavor in which both teams made significant contributions
3) the partnership results in a body of work that is a significant contribution to forensic science

Note: works that have been published in the peer-reviewed literature will receive favorable review

**Application Window:** November 8th, 2021 - January 20th, 2022

**Application Process:**

1. Complete the application, found at https://www.ascld.org/nominations/
2. Include a 1 – 2 page description of the research, specifically addressing the criteria
3. Submit the completed application electronically to ascldfrc@gmail.com

**For additional information:**

https://www.ascld.org/forensic-research-committee/

# Certification Reimbursement

The NEAFS Board of Directors has voted to reimburse the American Board of Criminalistics and International Association for Identification exam sitting fees for five NEAFS members (regular or associate) in good standing who pass the ABC or IAI exam. This offer is for any exam completed in 2021. After passing the examination, please fill out the Certification Reimbursement Form (www.neafs.org) and email the completed form with proof of passing the exam to the NEAFS Certification Chair Peter Diaczuk at certification@neafs.org. The reimbursement is based on a first come first served basis. Remember you must pass the ABC or IAI exam to be considered for reimbursement.

The following are current examinations that are offered: Comprehensive Criminalistics Examination (CCE)
Drug Analysis (DA)
Molecular Biology (MB)
Fire Debris Analysis (FD)
Hairs and Fibers (HF)
Paints and Polymers (PP)

For more information about the examination sitting, please contact Peter Diaczuk at certification@neafs.org.

For more information about the examination and the American Board of Criminalistics, please visit http://www.criminalistics.com.

Historical facts – NEAFS

- "NEAFS was founded in 1975 by a group of dedicated forensic scientists dedicated to improving the professional status and technical capabilities of individuals engaged in all phases of forensic science." "To accomplish its goals, NEAFS conducts continuing education seminars featuring workshops and special training sessions. The Annual Meeting…presents a contagious atmosphere of scientific exchange and social congeniality."Mark Lewis, President 1980
- The first Editor of the newsletter in 1976 was R.E. Gaensslen
- The first meeting of the Executive Board was on May 1, 1976 by President Angelo Fatta. Also in attendance were Vincent Crispino, R.E. Gaensslen, Thomas Kubic, Carl Moller and Alexander Stirton.
    - On this first meeting, it was stated that there were 211 members and this number included applicants. Six of those members were upgraded to Regular members.
    - The first annual meeting was being discussed. The annual meeting was to be a one day meeting on or about October 23, 1976. Tentative sites were John Jay College or C.W. Post College. The schedule was: 8am-12pm Coffee and Registration, business meeting and split sessions; Lunch; 1pm-5pm two general interest talks, split sessions, mixer and dinner. The split sessions included serology, microscopy, arson, toxicology and drug identification. The general interest talks would be short and would be concerning aspects of forensic science that would be unfamiliar or unusual to most members.
- NEAFS was incorporated by the State of Connecticut on May 12, 1976. Vincent Crispino, Thomas Kubic and Henry Lee were the Incorporators.
- The NEAFS newsletters were published by the Forensic Sciences Foundation which was located in Maryland.
- A joint meeting was held on April 15-16 with MAAFS in New Jersey as well as the Annual Meeting of NEAFS on October 29th in 1977.
- Dr. Peter De Forest chaired the Hairs and Fibers Session during the Second Annual Meeting. Alexander Stirton chaired the Serology Session and Dr. Jesse Bidanset chaired the Toxicology Session during the Second Annual Meeting.
- The newsletters included information from other regional organizations as well as NEAFS.
- In 1977, the BOD acted as an ad hoc Education Committee and set up two courses intitled: "Forensic Microscopy" and "Introduction to the Forensic Applications of Infrared Spectroscopy".
- A luncheon was held during the 3rd Annual meeting of NEAFS and consisted of salad, a choice of roast beef or filet of sole, dessert and a beverage for $6.00. Cocktails were $1.50 and beer and wine were $1.00.
- In 1978, the annual meeting was increased to a two day program instead of one day.
- George Neighbor volunteered to chair the Paint analysis program for the 1978 Annual Meeting.
- In 1978, NEAFS sponsored a training course entitled "Basic Bloodstain Analysis" and it was taught by Dr. Henry Lee, Dr. R.E. Gaensslen and Dr. Peter De Forest. This course was held at the University of New Haven.
- George W. Neighbor was the Secretary of NEAFS in 1978.
- Thomas A. Kubic was voted in as a Life Member of NEAFS while he was President in 1978.
- In 1979, Chris Chany was approved to become a Provisional member from a student member and Peter Diaczuk was approved to be a Corresponding member.
- George W. Neighbor was President-elect in 1980.
- Travel reimbursement for mileage was 17 cents/mile in 1980.
- NEAFS had 400 members in 1980.
- In May 1980 in Louisville Kentucky, NEAFS participated in the first multi-regional association meeting.
- George W. Neighbor had a BA degree in Chemistry from Rider College and a MS in Forensic Science from John Jay College. He worked as a Principal Forensic Chemist for the NJSP in the North Regional Laboratory in Little Falls, NJ where he supervises the trace evidence and bio-chemical units. Prior to working with the NJSP, He has

twenty years of industrial research experience in materials analysis. He served as Secretary for two terms (1978-79) and was a member of the AAFS and the Forensic Science Academy. George became President of NEAFS in 1981 – the 7th year in NEAFS history. George stated at the end of his President's message in the March 1981 newsletter "Now you can call me George, or you can call me G.W., or you can call me George W., or you can call me Hi Neighbor". In 1989, George presented "Trace Evidence Never Grows Old" during the Criminalistics Session.

- In 1997, the Scholarship award was renamed the George W. Neighbor Jr. Memorial Scholarship
- In 1980, the Annual Meeting budget was $2000.
- 1980 Goals of NEAFS
    - Exchange ideas and information among professionals in the field
    - Promote recognition of forensic science as an important part of the justice system
    - Sponsor and organize seminars, workshops, and special training sessions
    - Represent the membership on national issues affecting forensic science
    - Encourage research and development
    - Stimulate implementation of new methods and techniques
    - Establish professional standards
    - Provide advice on educational curricula, legislation and other matters affecting the profession
    - Arbitrate professional disputes
    - Foster friendship and collegiality among the forensic scientists of the Northeast
- For the 10th Annual Meeting, the room rate was $55 (single or double).
- The 12th annual meeting was the first meeting held in New England in Peabody, MA. A clam bake was scheduled.
- The door prizes that were given out at the 11th Annual Meeting were a Commador 64 Computer, Cannon AE1 Camera, Reflecting Telescope and an AM-FM radio.
- Our current method of visiting the exhibitor booths and obtaining confirmation of the visit goes back to at least the 9th Annual Meeting in 1983.
- The door prizes given out at the 14th Annual Meeting which was donated by Perkin-Elmer were a Video Cassette Recorder, Compact Disk Player, Scientific Programmable Calculator, Cordless Telephone and a Sony Walkman.