Northeastern Association of Forensic Scientists

47th Annual Meeting

November 1, 2021 – November 5, 2021

www.neafs.org/neafs-annual-meeting

Newport Marriott

25 America's Cup Avenue, Newport, Rhode Island 02840 USA

Table of Contents: NEAFS 2021

President's Welcome

On behalf of the Board of Directors of the Northeastern Association of Forensic Scientists, I would like to take this opportunity to welcome you to the 2021 NEAFS Annual Meeting. And welcome Newport, I hope you are able to take some time to enjoy the beautiful and historic surroundings. Whether you are a regular NEAFS conference attendee, or this is your first meeting, I hope you enjoy this opportunity to experience what NEAFS has to offer; attending presentations, seeing what new technologies the vendors have developed, bidding on items at the silent auction, and of course catching up warmly with friends and peers.

Planning a meeting is a true labor of love and determination, and President-elect and Program Chair Adam Hall has given himself fully to this task, creating a program full of exciting speakers and events. The entire 2021 meeting staff has spent this year tirelessly working towards a spectacular conference. When you spot Adam or the other members of the meeting staff, please take the opportunity to let them know how appreciated their thoughtful and thorough planning is. Also, please consider becoming involved yourself! If you are not already a member, I hope you consider joining, and if you would like to assist with future meetings, please know that it is a wonderfully rewarding experience.

I remember the first NEAFS Meeting I attended and being awed by the strong sense of community that the conference fostered. I was inspired to become involved in the organization from that moment and was so honored to be accepted into this passionate and caring professional family. I know I am not alone in looking forward to this annual conference as well as this time devoted to becoming reinvigorated in the field. Thank you for joining us and for making this meeting possible. And thank you so much for allowing me to serve as your president - I am so grateful to the Board I worked alongside this year, as well as the incredible role models I had the opportunity to learn from in years prior. I truly cannot thank you enough for your generous gifts of time and dedication to this organization.

Sincerely,

Angela Vialotti
2021 NEAFS President

Program Chair's Welcome & Acknowledgements

Welcome to Newport, RI and the 47th Annual Meeting of the Northeastern Association of Forensic Scientists (NEAFS)! As a fellow Rhode Islander who grew up in Providence, RI and later Tiverton, RI, my formative years were spent on Aquidneck Island and the surrounding area. Newport became a place of adventure, fun and great memories. I couldn't think of a better place to host the 2021 NEAFS meeting. This is the fifth time the NEAFS meeting has been held in Rhode Island over the past 47 years since the organizational meeting was held in New York, NY in 1975. Ten years ago, to the day, one of the best NEAFS meetings I've attended was hosted by then program chair Vincent Desiderio. It sure is a tough act to follow. Thankfully enough time has passed and while I shouldn't be competing with my good friend Vinny, a little competition never hurt anyone! I hope you're all able to enjoy the beautiful area and the city of Newport in addition to the incredible scientific content planned at this year's meeting.

An amazing amount of effort and dedication goes into planning any scientific conference. There are countless people who sacrifice a ton of time for this organization to deliver the quality meetings we offer year after year and I like those who came before me, never could have done it without all of their tireless efforts. I am indebted to the entire board of directors and staff, the session chairs, exhibitors, sponsors, and speakers for everything they have done during such a challenging year to assist in the planning and delivery of this in person meeting. It goes without saying that the Covid-19 pandemic has presented us all with challenges, hardships, and losses far beyond what most of us have ever experienced in our lifetimes. Efforts to plan an in person gathering of scientists from the greater northeast region of the United States and beyond at a time such as this has been unnerving and challenging to say the least.

Five workshops will be held on Tuesday, November 2nd and will include Advanced Topics in Forensic DNA, Scientific Publication 101, Forensic Facial Reconstruction, ABC Examination Preparation and Forensic Chemistry & Toxicology Fundamentals of using MassHunter Unknowns Analysis. A special thanks to Erica Nadeau for all her efforts and dedication as workshop chair. I could not have accomplished this portion of the meeting without her.

The scientific sessions will be held on Wednesday, November 3rd and will include Criminalistics/Crime Scene/Digital, Forensic Biology and DNA, Forensic Drug Chemistry, Forensic Toxicology and Trace/Arson & Explosives. My team of scientific session chairs have been amazing. Thanks to Amy Brodeur, Sabra Jones, Jamie Foss, Joanna Urban, Andrew Schweighardt, John Biello and Roberta Westerman for all that you have done. Also on Wednesday, November 3rd our evening sessions speakers for our Evening Plenary Session I, Drs. James Fox and Jack Levin will discuss the timely topic of mass murder and help us to understand the differences between spree, serial, and mass murderers. An inside view from the nation's foremost leaders on the topic will give the NEAFS community a perspective into the minds and motivations behind such heinous acts of violence. A book signing for "*Extreme Killing: Understanding Serial and Mass Murder*" with drinks and desserts will follow the evening session.

The plenary session on Thursday, November 4th will be split into a morning and an afternoon session: entitled "Plenary Session II: Guilty Until Proven Innocent: The roles that advocacy and compassion play in establishing innocence post-conviction" and "Plenary Session III: Beyond a Reasonable Doubt: How the investigator/attorney/scientist dialogue and strong forensics build effective prosecutions". In between the morning and afternoon plenaries, our annual luncheon speaker will be Elaine Murphy. Mrs. Murphy,

a tireless advocate from the Sean Ellis Case and Netflix documentary entitled "Trial 4" will present aspects of Sean's case and her recent book entitled: "In for Life – A Journey into Murder, Corruption, and Friendship". Following the afternoon plenary session, we will gather at the President's reception for a nautical/island-themed fun filled evening for the first time in two years!

On Friday, November 5th the ABC Certification Examination, the Student Forum, and the Educator Forum will be held before the 47th annual meeting comes to a close midday. I'd like to recognize Peter Diaczuk, Chris Chany, Anisha Paul and Sandra Haddad for their important roles in these sessions.

I would be remiss if I didn't acknowledge the mastery demonstrated by Janine Kishbaugh in meeting planning, organization, and patience. If you see her during the meeting, please thank her because she has a remarkable way of making program chairs (like myself) look amazing! A special thanks as well to Sarah Roseman (Exhibits Chair), Beth Goodspeed (Registration Chair), Nadine Koen, Abby Houliston, Hannah Reasbeck, Beth Wade, Dawn Rice and Jamison Whitten (all graduate students at Boston University School of Medicine for volunteering to help with different aspects of the meeting program), Adrian Garcia Sega and Matt Marino (AV Coordinators), Adrian Garcia Sega (Peter R. De Forest Student Research Award Competition Chair), all of the Research Award Judges, and last but not least Keri LaBelle (Poster Session Chair) for all that they have done to make this meeting a success.

For the student's attending this year's meeting, Welcome to NEAFS! Over the past 20 years NEAFS has become far more than just an organization with an annual meeting to me. I have made some great friends and close professional contacts here. I would encourage you to start building your own professional network and contribute to the greater forensic science cause. Twenty years or less from now you will be writing the Program Chair's Welcome & Acknowledgements section of the program at the 2041 Meeting!

For the forensic practitioners and academicians attending, thank you for your tireless contributions to this field and for your involvement with the NEAFS organization. Your contributions to public safety and the field of forensic science are admirable and directly contribute to the field that we are all so passionate about!

In a field of evidential traces, how will you leave your mark? Please consider becoming a member of NEAFS and help us to grow and to develop further as an organization! Enjoy the meeting this year and I'll look forward to seeing you all again at the 48th Annual NEAFS Meeting in Niagara Falls, NY, October 17-21, 2022!

Best Regards,

Adam B. Hall, Ph.D., ABC-FD
2021 NEAFS Program Chair & President-Elect

2021 Program Team

Program Chairperson	Adam B. Hall Boston University School of Medicine, Boston, MA
Site Chairperson	Janine Kishbaugh Cedar Crest College, PA
Exhibits Chair/Corporate Liaison	Sarah Roseman Nassau County Office of the Medical Examiner, NY
Registration Chairperson	Beth Saucier Goodspeed Massachusetts State Police Crime Laboratory
Workshop Coordinator	Erica Nadeau Massachusetts State Police Crime Laboratory
Awards Chairperson	Danielle Malone New York City – Office of the Chief Medical Examiner, New York, NY
Crim/CSI/Digital Session Chairperson	Amy Brodeur Boston University School of Medicine, Boston, MA
Drug Chemistry Session Chairperson	Joanna Urban State of CT, Division of Scientific Services
Biology/DNA Session Chairperson	Andrew Schweighardt New York City – Office of the Chief Medical Examiner, New York, NY
Toxicology Session Chairperson	Sabra Jones Boston University School of Medicine, Boston, MA
Toxicology Session Co-Chair	Jamie Foss PerkinElmer, CT
Trace/Arson & Explosives Session Chairperson	Roberta Westerman Massachusetts State Police Crime Laboratory
Trace/Arson & Explosives Session Chairperson Co-Chair	John Biello Massachusetts State Police Crime Laboratory
Educator's Forum Session Chairperson	Sandra Haddad Bay Path University, MA

Evening Session Chairperson	Adam B. Hall Boston University School of Medicine, Boston, MA
Plenary Sessions Chairperson	Adam B. Hall Boston University School of Medicine, Boston, MA
Peter R. De Forest Student Research Award Chairperson	Adrian Garcia Sega PerkinElmer, CT

Peter R. De Forest Student Research Award Judges

Alyssa Berthiaume
John Biello
Sandra Haddad
Peter Murphy
Anisha Paul
Scott Rubins
Lynn Schneeweis
Erica Nadeau
Georgiana Gibson-Daw
Beth Saucier-Goodspeed
Danielle Malone
Keri Labelle

Poster Session Chairperson	Keri LaBelle Massachusetts State Police Crime Laboratory
Student Forum Moderators	Anisha Paul Vermont Forensic Laboratory, Dept. of Public Safety Christopher Chany Texas Department of Public Safety
Social Media & Merchandise Coordinator	Alyssa Berthiaume Massachusetts State Police Crime Laboratory
Audio/Visual Coordinator	Adrian Garcia Sega PerkinElmer, CT

2021 NEAFS Board of Directors & Staff

President	Angela Vialotti Connecticut Department of Emergency Services and Public Protection, CT
President-Elect	Adam B. Hall Boston University School of Medicine, Boston, MA
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Director	Alanna Laureano Westchester County Department of Labs and Research, Division of Forensic Sciences, NY
Director	Matthew Marino New Jersey State Police East Regional Laboratory, NJ
Director	Amanda White New York State Police: Mid-Hudson Satellite Crime Laboratory, NY
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Ethics Chairperson	Melissa Balogh New Jersey State Police Office of Forensic Sciences, NJ

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Membership Dues Contacts	Angelina Pollen Westchester County Department of Labs and Research, Division of Forensic Sciences, NY
	Joseph Phillips Westchester County Department of Labs and Research, Division of Forensic Sciences, NY
Certification Chairperson	Peter Diaczuk John Jay College – Department of Sciences, NY
Site Chairperson	Janine Kishbaugh Cedar Crest College, PA
Regional Associations Committee Representative	Lynn Schneeweis Massachusetts State Police Crime Laboratory, MA

NEAFS Past Presidents

1975	(Organizational Meeting)	New York, NY
1976	Dr. Angelo Fatta	New York, NY
1977	Vincent Crispino	Mineola, NY
1978	Thomas Kubic	Storrs, CT
1979	Dr. John Reffner	Albany, NY
1980	Mark Lewis	Morristown, NJ
1981	George Neighbor	Allentown, PA
1982	Alexander Stirton	Albany, NY
1983	Robert Herrmann	Hasbrouck Heights, NJ
1984	Patricia Prusak	Uniondale, NY
1985	Jeffrey Weber	Uniondale, NY
1986	Heljena McKenney	Peabody, MA
1987	Ann Giesendorfer	Princeton, NJ
1988	Robert Genna	Mystic, CT
1989	Steven Sotolano	Albany, NY
1990	Elaine Pagliaro	Providence, RI
1991	Kirby Martir	Huntington, NY
1992	Dr. Peter Pizzola	Atlantic City, NJ
1993	Robert Adamo	Springfield, MA
1994	Karolyn LeClaire Tontarski	New York, NY
1995	Jeffrey Luber	Mystic, CT
1996	Donald Doller	Pocono Manor, PA
1997	George W. Chin	White Plains, NY
1998	Joseph Galdi	Newport, RI
1999	Mary Beth Raffin	Hyannis, MA
2000	Ted Schwartz	Saratoga Springs, NY

2001	Chris Montagna	Mt. Snow, VT
2002	Mary Eustace	Atlantic City, NJ
2003	Christopher Huber	Pittsfield, MA
2004	Jennifer Limoges	Mystic, CT
2005	Tammi Jacobs Shulman	Newport, RI
2006	Dennis Hilliard	Rye Brook, NY
2007	Elayne Schwartz	Bolton Landing, NY
2008	Adrian Krawczeniuk	White Plains, NY
2009	Dr. David San Pietro	Long Branch, NJ
2010	Laura Tramontin	Manchester, VT
2011	Dr. Peter Diaczuk	Newport, RI
2012	Vincent Desiderio	Saratoga Springs, NY
2013	Andrea Belec	Cromwell, CT
2014	Kevin MacLaren	Hershey, PA
2015	Dr. Lawrence Quarino	Hyannis, MA
2016	Erica Nadeau	Atlantic City, NJ
2017	Beth Saucier Goodspeed	Pocono Manor, PA
2018	Melissa Balogh	Bolton Landing, NY
2019	Tiffany Ribadeneyra	Lancaster, PA
2020	Maria Tsocanos	Virtually Everywhere!

NEAFS Life Members

Dr. Peter R. De Forest

Mr. Robert E. Genna

Mr. Kirby Martir

Dr. Robert Gaensslen

Ms. Joy Reho

Dr. Thomas Kubic

Ms. Elaine Pagliaro

NEAFS would like to recognize sponsorship from PerkinElmer for the Dr. Peter R. De Forest Student Research Competition for the top undergraduate and graduate research awards for poster and oral presentations at the 47th Annual NEAFS Meeting!

2021 NEAFS Vendors and Sponsors

908 Devices: 908 Devices is democratizing laboratory mass spectrometry with simple handheld and desktop devices.

Agilent: Agilent is your global partner for sample preparation, chromatography, mass spectrometry, elemental analysis, molecular spectroscopy, laboratory software, support, service, and supplies.

BSD Robotics: BSD Robotics design, manufacture, distribute and service the BSD product range for accurate and reliable sample preparation for modern automated laboratories around the globe.

JEOL: JEOL is the leading global supplier of instrumentation for Forensic Chemistry, Trace Evidence Analysis, Cannabis, Toxicology, and Gun Shot Residue.

JH Technologies: JH Technologies distributes Leica optical and digital microscopes for forensic analysis and documentation.

Labino Forensics: Manufacturer of ALS kits for crime scene investigation and forensic labs.

Lipomed: Lipomed is a manufacturer of Analytical Drug Standards, in both solids and DEA-exempt solutions formats. We also carry a wide selection of native and deuterated compounds.

NMS: NMS Labs provides forensic lab services for toxicology, drug ID, and hemp/marijuana differentiation as well as interpretations, expert witness testimony and consulting for court proceedings.

PerkinElmer: PerkinElmer enables scientists, researchers, and clinicians to address their most critical challenges across science and healthcare.

Qiagen: Leading provider of solutions for complete Forensic DNA workflow, from sample to insight.

Randox Toxicology: Randox Toxicology is dedicated to advancing forensic, clinical and workplace toxicology, with a heavy focus on the research and development of new products.

Sciex: SCIEX offers 50 years of experience in LC-MS/MS technology (Triple Quad, QTRAP, and QTIF systems) combined with a comprehensive portfolio of methodology, libraries, and software.

Shimadzu: Shimadzu provides a broad range of analytical instruments indispensable for research, development, and quality control in a variety of fields.

Specac: Specac manufactures Fourier Transform Infrared Spectroscopy (FTIR) sampling accessories. Accessories include Golden Gate, Quest, Arrow, Hearted ATR, Pearl, Gas Cells, Transmission, and specular reflectance.

Thermo Fisher Scientific (HID): Thermo Fisher Scientific is the world leader in serving science, our Mission is to enable our customers to make the world healthier, cleaner, and safer.

Thermo Fisher Scientific (Molecular Spectroscopy): Thermo Fisher Scientific is the world leader in serving science. We will showcase a subset of our products/services including FTIR, Raman, microscopes, and NMR.

UCT: UCT is a leading manufacturer of silica and polymeric SPE materials, HPLC columns, hydrolyzing and derivatizing reagents, and manifolds for all your sample prep needs.

Verogen: Verogen is a human identification next-generation sequencing technology company, providing end-to-end workflows for forensic genetic genealogy, STRs, mtDNA, SNPs, and more.

2021 Meeting Schedule

Sunday, October 17th

9:30am - 12:30pm	Board of Directors Meeting (Virtual)

Monday, November 1st

2:30pm – 5:00pm	Board of Directors Outing – Brenton Point State Park, Newport, RI
7:00pm – 9:00pm	Board of Directors Dinner – Clarke Cooke House, Newport, RI

Tuesday, November 2nd

7:00am – 9:30am	Registration
7:30am – 9:00am	Breakfast
8:30am – 4:30pm	Full Day Workshops (Facial Reconstruction, ABC Exam Prep & Advanced Topics in Forensic DNA)
8:30am – 12:00pm	Half Day Morning Workshop (Publication 101)
10:15am – 10:30am	Morning Break
12:00pm – 1:30pm	Registration
1:00pm – 5:00pm	Half Day Afternoon Workshop (Agilent)
12:00pm – 1:00pm	Lunch (on your own)
2:30pm – 5:00pm	Exhibits Set-up
3:15pm – 3:30pm	Afternoon Break
5:00pm – 7:00pm	Dinner (on your own)
7:15pm – 9:00pm	Downtown Newport Ghost Tour – Meet at the Skiff Bar ($20/pp)

Wednesday, November 3rd

7:00am – 9:30am	Registration
7:30am – 9:00am	Breakfast
7:30am – 7:00pm	Exhibits
9:00am – 5:00pm	Scientific Sessions: Drug Chemistry, Criminalistics/CSI/Digital, Biology/DNA, Trace/Arson & Explosives & Toxicology
12:00pm – 1:30pm	Business Lunch

5:00pm – 6:45pm	Welcome Reception & Poster Session
6:00pm – 7:00pm	Registration
7:00pm – 9:00pm	Evening Plenary Session
7:00pm – 10:00pm	Silent Auction
9:00pm – 10:00pm	Book Signing & Dessert

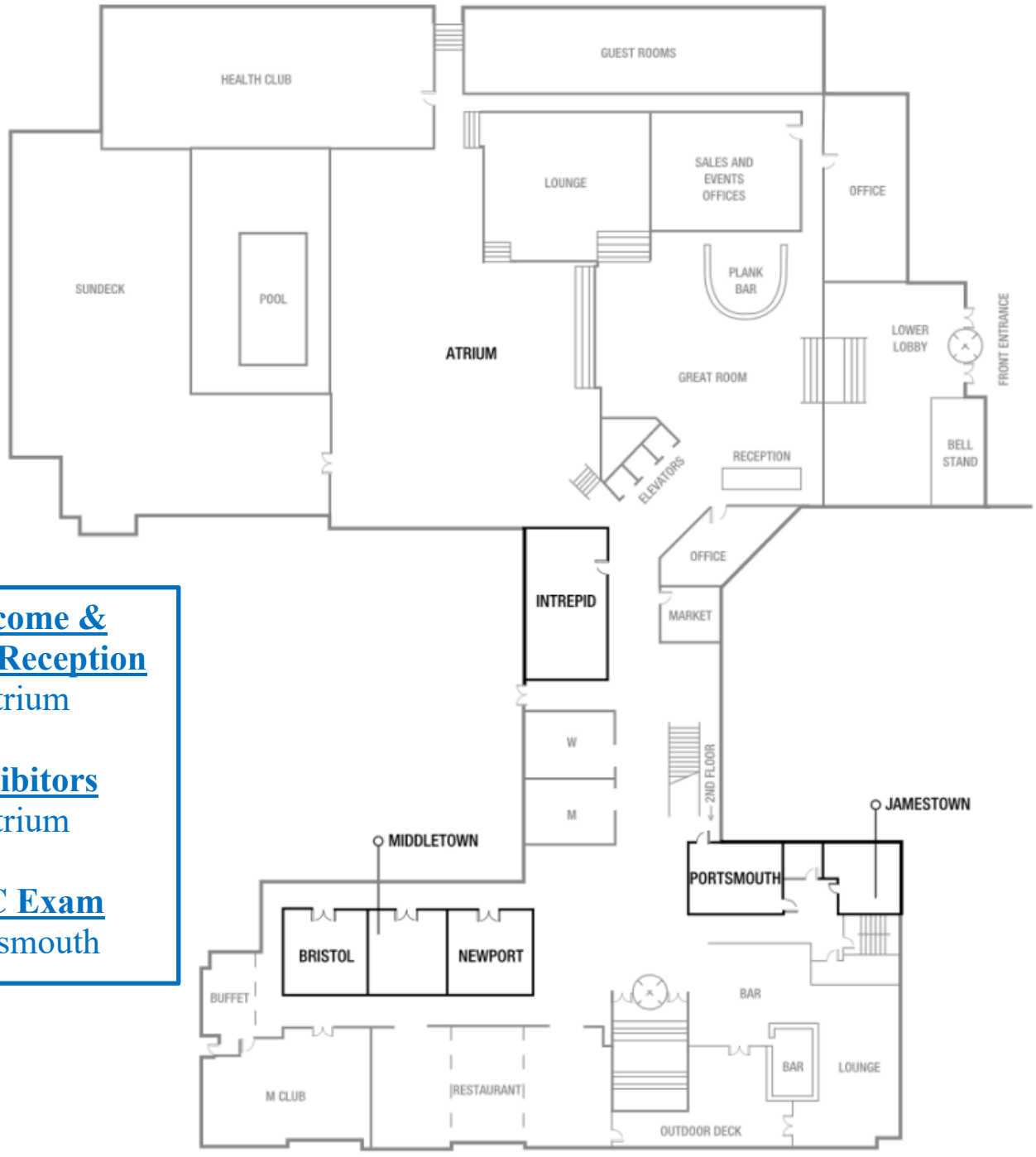
Thursday, November 4th

7:30am – 9:30am	Registration
7:30am – 9:00am	Breakfast
7:30am – 11:00am	Exhibits
9:00am – 12:00pm	Morning Plenary Session
12:00pm – 2:00pm	Annual Awards Luncheon & Speaker
2:00pm – 3:00pm	Registration
2:30pm – 5:30pm	Afternoon Plenary Session
7:00pm – 9:00pm	Silent Auction (Closes at 9:00pm)
7:00pm – 11:00pm	President's Reception

Friday, November 5th

7:30am – 9:00am	Registration
8:30am – 10:00am	Breakfast
8:00am – 12:00pm	ABC Exam (Exam starts at 9am)
9:00am –11:00am	Educator Forum
10:00am – 12:00pm	Student Forum

SECOND FLOOR



[Welcome & Poster Reception](#)
Atrium

[Exhibitors](#)
Atrium

[ABC Exam](#)
Portsmouth

Trace – Weatherly

Drugs/Tox – Freedom

Crim/CSI/Digital – Salon 3

Bio / DNA – Salon 4

Plenary I - Salons 1 & 2

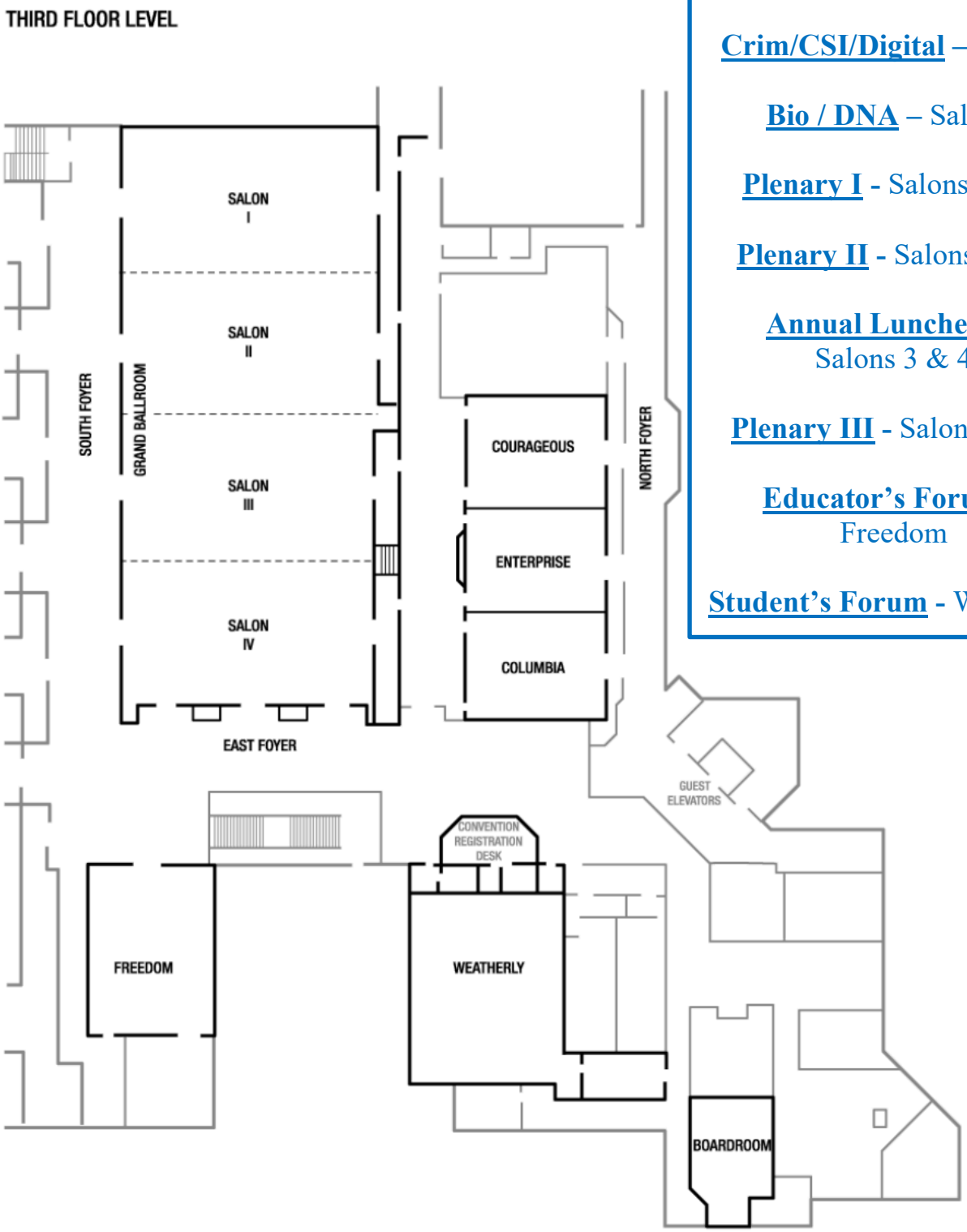
Plenary II - Salons 1 & 2

Annual Luncheon – Salons 3 & 4

Plenary III - Salons 1 & 2

Educator's Forum – Freedom

Student's Forum - Weatherly



Newport, Rhode Island – Area Attractions, Bars & Restaurants

Downtown Newport Piers, Shops, Restaurants and Bars

Newport's Cliff Walk & Historic Mansions

International Tennis Hall of Fame – 194 Bellevue Avenue, Newport, RI

10-Mile Drive / Ocean Drive – Brenton Point State Park, Newport, RI

Fort Adams – A National Historic Landmark - Established July 4, 1799

Newport Vineyards & Winery – 909 E Main Road, Middletown, RI

Newport Storm Brewery – 293 JT Connell Hwy Newport, RI

Name	Description	Miles away from hotel	Minutes if walking	Notes
Newport Lobster Shack	Relaxed seafood restaurant	0.3	5	
Showfish Newport	Upscale American	0.6	11	has a patio with harbor views
Skiff Bar	Bar in the hotel	0	1	Bar
Celtica	Dockside pub	0.2	3	Bar
Perro Salado	Mexican restaurant	0.2	4	
Brick Alley Pub & Restaurant	Restaurant with various eats	0.2	5	
Bar 'Cino	Relaxed Italian restaurant	0.2	5	
Root	Relaxed plant-based eatery	0.3	6	Vegan
Drift Cafe	Relaxed cafe	0.3	6	
Buskers Pub and Restaurant	Irish gastropub	0.3	6	Live music
Gas Lamp Grille	American restaurant	0.3	7	
Stoneacre Garden	Restaurant serving international cuisine	0.3	6	Has a garden, a courtyard, and a rooftop bar
Pour Judgement	Relaxed pub with craft beers and American food	0.3	7	
The Fastnet Pub	Sports bar	0.3	6	Has TVs, darts, ping-pong, and live music
The Tavern on Broadway	American restaurant with craft beer	0.3	7	
22 Bowen's Wine Bar & Grille	Seafood restaurant	0.4	8	$$$; waterfront views
The Landing Restaurant	Seafood restaurant	0.4	8	Waterfront views and live music
The Lobster Bar	Relaxed seafood restaurant	0.4	8	Has harbor views
Diego's	Relaxed west-coast Mexican restaurant	0.4	7	Has a long list of specialty drinks
The Wharf Pub	Restaurant with a raw bar and American comfort food	0.4	7	
Smoke House	BBQ restaurant	0.4	8	Temporarily closed
Benjamin's	Surf and turf restaurant	0.4	7	Has harbor views
Kilwin's Chocolates and Ice Cream	Dessert place	0.4	7	

One Pelham East	Bar with live music and dance floor	0.4	8	Bar
Bar and Board	Relaxed bar with create-your-own charcuterie boards and wine	0.4	8	
The Mooring Seafood Kitchen & Bar	Upscale seafood restaurant	0.5	9	$$$
Giusto	Italian restaurant	0.5	9	
Surf Club	Restaurant that offers many different dishes	0.5	10	Known for their pizza
The Red Parrot Restaurant	American restaurant with wide menu	0.5	10	
Midtown Oyster Bar	Surf and turf restaurant	0.5	10	$$$
IL Forno Italiano	Relaxed Italian restaurant	0.6	12	looks like a cheaper, quick option
The Reef	Casual seafood and steak restaurant	0.8	15	
Harry's Bar and Burger Newport	Burger place with craft beer and alcoholic shakes	0.8	16	50+ craft beers
O'Brien's Pub	Comfort food restaurant	0.9	17	open late; has pool tables and TVs
At the Deck	Seafood and American Restaurant	1	19	$$$; overlooks the harbor
Thai Cuisine	Casual Thai restaurant	0.9	18	
Scales and Shells	Seafood restaurant with vegetarian pastas	0.9	18	
Zelda's Newport	Restaurant with French and American food	0.9	19	

Name of Attraction	Description	Miles away from hotel	Minutes if walking	Notes
Cliff Walk	Newport's enchanting 3.5-mile Cliff Walk is the perfect place for your moment of peace. Panoramic ocean views, crashing waves and the perfect amount of sea breeze on one side and stunning, Gilded Age mansions on the other.	1.5 miles to start	30 mins	Starts at Easton Beach and Runs south 3.5 Miles, Cliff walk starts at the most western point of Easton Beach 117 Memorial Blvd, Newport, RI 02840
Easton Beach	local beach, and start of the Newport cliff walk	1.8 miles	37 minutes	May be cold, but a nice walk
Fort Adams State Park	Historic Fort Adams is operated by the Fort Adams Trust a 501(c)(3) Non-profit with a mission to protect and promote the historic places and public spaces at the gateway to Narragansett Bay and Newport. This includes directing and supporting the stabilization, maintenance, and operation of Fort Adams as a public historic site. The Trust is expanding educational learning activities with new tours. Ask about the Hard Hat Tour or the Golf Cart Tour during your next visit. We hope you learn more during your visits about regional and military history and the Fort's engineering and architecture.	3.6 miles	too far to walk!	
Escobar's Highland Farm	On Aquidneck Island, in Portsmouth, RI, and right next door to Newport, you can stop by and see farm life in the middle of a modern active community. We invite you to stop by and learn something of the life on what has been a traditional Family Farm for years. Today, in order to survive, we have learned to diversify. In so doing, we feel that we offer benefits to the Portsmouth community, not the least of which is the opportunity for young people to learn what farming is all about. 8-acre corn maze and a pumpkin patch!	8.4 Miles		This is in Portsmouth, but has all the fun corn mazes, hayrides, etc. needed for fun fall times:)
Thames Street	Nestled just steps from the waterfront, Thames Street has been Newport's main commercial drag since the 18th century. Here you'll find a collection of local shops like Thames Glass and Newport Fudgery, as well as more conventional stores like Express and Banana Republic. There's also a decent dining scene, ranging from budget-friendly seafood spots to ritzier establishments, such	0.2 miles	5 mins	5-minute walk to Banana Republic which is the start of the shopping

	as Brick Alley Pub & Restaurant and Bouchard Inn & Restaurant.			
Bowens Warf	The anchor of the Newport Waterfront. Marina, Restaurants, nightlife, tours, boutiques, and galleries	0.4 miles	8 minutes	
Mansions				
The Elms	One of the many beautiful Newport Mansions	1.25 miles	21 minutes	OPEN NOW 67 Bellevue Ave, Newport, RI 02840
The Breakers		2.2 miles	45 minutes	OPEN NOW
Marble House		2.3 miles	47 minutes	OPEN NOW
Chateau-sur-Mer		1.7 miles	36 minutes	Only open Friday, Saturday, Sunday, Monday right now
Cruises/ Boating				
Newport Cruise	Classic Cruises of Newport is the local favorite for day and evening sail and motor yacht cruises. Enjoy spectacular views of Newport Harbor, Narragansett Bay and the excitement of the Sailing Capital of America.	0.4 miles	8 minutes	Scenic Day Sail: $40 12pm-1:30pm, 2pm-3:30pm Champagne Sunset Cruise: $56, 4:40pm 24 Bannister's Wharf, Newport, RI 02840
Newport Charter Group	Explore historic Newport Harbor and surrounding waters on the beautiful 33' Camelot. When you charter Camelot, the entire boat is yours. This privacy allows the captain to tailor the cruise to your liking, creating a personalized and memorable experience.	0.6 miles	12 minutes	pricey as private tour but might be reasonable with a group of people
Breweries/ Wineries				
Newport Craft Brewing and Distilling Co.	The first licensed distillery in Rhode Island in over 135 years, Newport Craft resurrected the history of Newport distilling, once the rum capital of the world, with its production of Thomas Tew Rum®. Using the same distilling	2 miles	40 mins	293 JT Connell Hwy, Newport RI 02840

	methods, equipment, and ingredients of its distilling forefathers, the Thomas Tew Rum line can be found on the top shelf of over 500 restaurant and bars, Walt Disney World's EPCOT and as the official rum of the New York Mets. In 2019, USA Today ranked Thomas Tew Rum amongst the top ten craft rums in America.			
Newport Vineyard	A beverage and culinary destination that blends together award-winning wine, fresh craft beer, farm to table dining experiences and unique events situated on over 100-acres of preserved farmland. Experience a touch of Napa just minutes from Newport, RI.	4 miles	drive/ uber	909 E Main Road, Middletown RI
Museums				
International Tennis Hall of Fame	This monumental attraction honors both players and other contributors to the sport of tennis. The complex, the former Newport Casino, includes a museum, grass tennis courts, and an indoor tennis facility.	1 mile	20 minutes	open 10am-5pm everyday 194 Bellevue Ave, Newport, RI 02840
The National Museum of American Illustration		1.9 miles	38 minutes	
Vernon House	Vernon House, a national historic landmark, has a rich architectural and social history. In 1758, Metcalf Bowler, a wealthy merchant purchased a small but elegant house at the corner of Clarke, and Mary Streets. He quickly expanded the house to its current form around 1760. It has been long suspected that the expansion was designed by noted architect Peter Harrison who is responsible for the Redwood Library, Touro Synagogue, and the Old Brick Market. In 1773 it was purchased by another wealthy Newport merchant, William Vernon. A lovely example of Georgian architecture, Vernon House is one of Newport's last grand merchant's houses and played host to many notable guests during Vernon's ownership.	0.4 miles	8 minutes	
Museum of Newport History		0.2 miles	4 minutes	
Artillery Co of Newport		0.3 miles	8 minutes	

Newport Art Museum	Multi-building campus houses regional 19th-century to contemporary works, plus events & art school.	0.7 miles	16 minutes	76 Bellevue Ave, Newport, RI 02840
Audrain Auto Museum	A grand Gilded Age building sets the stage for viewing unique & rare cars from many eras.	1 mile	20 minutes	222 Bellevue Ave, Newport, RI 02840
Tours				
Viking Trolley Tours	Since 1962, Viking Tours has been showing visitors to Newport the amazing history of our city. We invite you to travel from the Modern Age to the Gilded Age during one of our specialty tours. Only Viking Tours gives you an insider's look into Newport aboard our old-fashioned trolleys.	Just outside the hotel, located at Gateway Center	1 minute	1.5-hour tour: 11:00 AM Daily, 12:30 PM Friday & Saturday Adults: $25

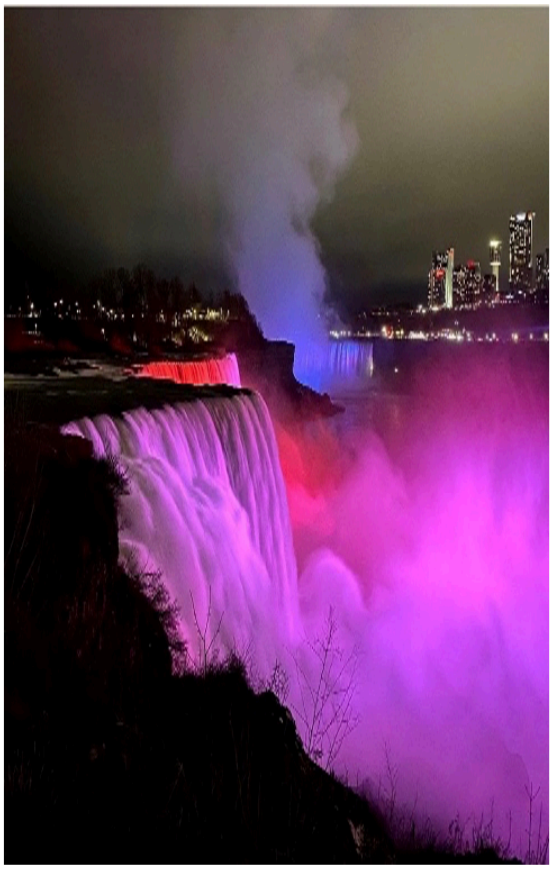
A special thanks to Nadine Koen, Abby Houliston and Hannah Reasbeck – M.S. Candidates, Biomedical Forensic Sciences Program, Boston University School of Medicine for helping to organize this section of the program.

2022 Annual Meeting Announcement

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
101 Old Falls Street
Niagara Falls, NY 14303

Northeastern Association of Forensic Scientists
2021 Annual Meeting – Program Chair, Adam B. Hall
Newport, RI

2021 NEAFS Workshops

Constructing a Face: Forensic Facial Reconstruction

Tuesday, November 2nd 8:30 am – 4:30 pm
Courageous

Instructor: Jenny Kenyon
Costume Designer, USA 829
Forensic Artist
jennykenyon.wixsite.com/jenny-kenyon

Join Forensic Artist Jenny Kenyon for a day-long workshop in Forensic Facial Approximation. Using a 3D print of a skull, workshop participants will perform an anthropological assessment of gender, age, ancestry, and build. Using scientific soft tissue datasets and the Manchester/British Method of facial reconstruction, participants will work with pegs and clay to create muscles, skin, and soft tissue to reconstruct/approximate the face of the individual over the course of the day.

The Manchester/British method was developed by Richard Neave in 1977 and is the most accepted method for facial reconstruction/approximation today. This method has been used in many famous reconstructions including Phillip II of Macedon, Johann Sebastian Bach, Saint Nicholas, Robert the Bruce, and King Richard III.

Supplies and tools will be provided, and no prior facial reconstruction experience is needed.

Instructor Biography

Jenny Kenyon is both a Forensic Artist and Costume & Scenic Designer for Theatre. She received her BFA in Studio Art from SAIC, an MFA in Theatre Design from Brandeis University, and a MSc in Forensic Art from University of Dundee, Scotland. Her specialties include virtual and clay 3D Facial Reconstructions from skeletal remains and CAD based 3D reconstructions of Heritage and burial sites. Her other skills include Age Progression & Regression, Witness Interviewing Techniques, Composite Sketching, Forensic Photography, and Cranio-Facial Superimposition. Her archaeological facial reconstructions have been featured in exhibits in Europe, the UK, and the US. She also works creating illustrations for scientific research, with police departments providing faces for unidentified human remains, and teaching forensic art & photography at Penn State University.

Advanced Topics in DNA Analysis

ThermoFisher SCIENTIFIC

Tuesday, November 2nd 8:30 am – 4:00 pm
Weatherly

Presenters:

Robin Cotton – Director, Biomedical Forensic Sciences, Boston University School of Medicine

Laura Ascroft – Field Application Scientist **Thermo Fisher Scientific**

Jaime Brachold – Sr. Forensic Science Applications Group (FSAG) Manager

M**egan Calvert –** Senior HID account manager, Thermo Fisher Scientific

Pamela Marshall – Director and Associate Teaching Professor, Forensic Science and Law Program, Director Cyril H. Wecht Institute of Forensic Science and Law Bayer School of Natural and Environmental Sciences, Duquesne University

Claire Glynn – Associate Professor and Research Coordinator, Forensic Science Department, Henry C. Lee College of Criminal Justice and Forensic Sciences, University of New Haven

Catherine Grgicak – Henry Rutgers Chair and Associate Professor Chair, Department of Chemistry, Center for Computational and Integrative Biology, Rutgers University

Virtual Moderator: **Beth Wade** – Boston University School of Medicine

Workshop schedule:

8:30am – 8:45am **Opening Remarks**

8:45am – 9:45 am **DNA extraction recovery from vaginal swabs**

The results of DNA testing on forensic samples are affected by optimization of each step in the testing process. The initial choice of cell lysis and DNA extraction procedures impact all downstream processes. There are many available chemistries to choose from. Differences include time, cost, and difficulty. Some of these chemistries are compatible with robotic platforms. DNA extraction chemistries vary in the extent of DNA purification and the extent of inhibitor removal. Additionally, some processes work well on specific type of evidence or substrates but not on others. Therefore, most laboratories employ more than one DNA extraction process. This talk
will discuss considerations in planning validation procedures and approaches for measuring DNA recovery from new and existing DNA extraction methods.

9:45am – 10:15am **Quantification Hacks: Tips to Maximize your Quantifiler Trio Data Analysis**

How well do you understand your Quantifiler Trio results? Join our forensic experts as they guide you through the tips and tricks they use when evaluating quantification data. We will provide a behind the scenes look at the technical support process and how we at Thermo Fisher utilize a broad team of technical experts to help solve your inquiries. This presentation will walk through the troubleshooting of challenging quantification results and provide tools for identifying a resolution.

10:15am – 10:30am **Morning Break**

10:30am – 11:00am **Quantification Hacks: Tips to Maximize your Quantifiler Trio Data Analysis – Continued**

11:00am – 12:00pm **Advancing DNA Research**

This presentation will focus on two novel research approaches to advance DNA forensics with regards to sexual assault examinations and missing persons casework. Extraction reagents have been optimized for maximal DNA yield, but the cotton swab used in SAKs has not advanced. Despite research suggesting the cotton swab's absorbent nature and its inclination to retain cellular material, another swab type has not been implemented. A novel forensic technique to improve the outcome of missing person cases associated with bodies of water will also be discussed.

12:00pm – 1:00pm **Lunch sponsored by ThermoFisher Scientific**

1:00pm – 2:00pm **Fundamentals of Forensic Genetic Genealogy (FGG)**

Forensic Genetic Genealogy (FGG) has emerged as a novel investigative tool and has rapidly gained much attention in recent years. FGG has been successfully used by law enforcement agencies across the United States to identify suspects in several hundred cold case investigations and also to resolve Unidentified Human Remains (UHR) cases. FGG broadens the field of forensic DNA analysis and combines genetic methods with traditional genealogical methods for building family trees using documentary evidence. This presentation will introduce the process of employing FGG in a case investigation, which will include the types of DNA analysis available, the databases employed, the third-party tools for data analysis available, genealogical research and analysis using documentary evidence, the building of complex family trees, and best practices. Common misconceptions about this investigatory tool and also legal, ethical, and privacy issues will also be discussed.

2:00pm – 3:00pm **Solving the DNA mixture conundrum through single-cell analysis: High fidelity single-copy signal and the continuous interpretation thereof**

Current forensic analysis relies on the probabilistic interpretation of electropherograms expressing signal from an unknown number of potentially partial genotypes. Single-cell methods offer a solution to the forensic DNA mixture problem by applying a step that separates cells before extraction. To fully realize the potential of single-cell methods, a full pipeline incorporating efficient direct-to-PCR extractions and fully continuous interpretation schemes based on sound biological, physicochemical, and probabilistic principles are a necessity. In this portion of the workshop, we will demonstrate: 1. the potential of single-cell analysis to solve the DNA mixture conundrum; 2. share laboratory protocols rendering high-fidelity single-cell signal; and 3. expound on state-of-the art interpretation strategies that render full weights-of-evidence for this type of pipeline.

3:00pm – 3:30pm **Afternoon Break**

3:30pm – 4:00pm **Q & A**

Presenter Biographies

Dr. Cotton's experience in the forensic application of DNA analysis began at Cellmark Diagnostics in Germantown, MD in 1988. She subsequently served as Laboratory Director and Technical leader of the Cellmark Laboratory from 1994 to 2005. As Director and Technical Leader, Dr. Cotton was responsible for overseeing development and implementation of new technology as well participating in technical review of forensic casework results and providing testimony in admissibility hearings and trials. In the past 20 years she has testified as an expert in DNA analysis in over 250 criminal cases in 35 states.

Dr. Cotton has B.S. and M.S. degrees in Biology from Southern Methodist University in Dallas, Texas and received her Ph.D. in Molecular Biology and Biochemistry from the University of California at Irvine in 1980. Prior to joining Cellmark in 1988, she did post-doctoral research at the University of Iowa and at the National Institutes of Health in Bethesda, Maryland.

In October of 2006, Dr. Cotton joined the faculty at the Boston University School of Medicine where she is the Director of the M.S. Program in Biomedical Forensic Sciences, a FEPAC accredited program. She teaches courses in Forensic DNA Analysis and Advanced DNA Analysis and conducts research in methods for improving or developing new DNA extraction methods and other procedures for use with low template DNA samples. Dr. Cotton currently serves on the Editorial Board of the Journal of Forensic Sciences and the Forensic Oversight Board for the State of Massachusetts.

Laura Ascroft is a Field Application Scientist at Thermo Fisher Scientific supporting the Northeast Territory. She provides specialized technical applications support and training to ensure customers are successful with the Forensic HID products, services, and workflows. She also has experience working on the Global HID Professional Services team where she performed technical project management and oversight of global HPS validation projects. Prior to joining Thermo Fisher, Laura held positions as a Forensic Biologist, Validation Manager, and Supervisor during her 12-year tenure in the Biology Section of the Monroe County Crime Laboratory.

Jaime Brachold is the Senior Manager of the Human Identification Forensic Science Applications Group. Prior to joining Thermo Fisher Scientific, she earned an MS in Forensic Science with a concentration in Criminalistics from the University of New Haven and went on to work in the Forensic Biology Unit at the Massachusetts State Police Crime Laboratory in both analytical and supervisory roles. In 2009, she began contracting with the Department of Defense as a DNA analyst to support expeditionary forensic programs in the Middle East. Jaime has worked at Thermo Fisher Scientific for 8 years, always with a customer-centric focus. In her current role, she manages a team of Technical Applications Scientists who provide troubleshooting and technical support to forensic laboratories globally and offer subject matter expertise as new products are introduced into the human identification portfolio.

Megan Calvert is a Human Identification Senior Account Manager for Thermo Fisher Scientific Technologies. She has a B.S. in Molecular Biology, Biochemistry and Bioinformatics and a M.S. in Biotechnology specializing in Biosecurity and Biodefense. Prior to joining the Thermo Fisher team in 2013, Megan worked as a forensic scientist and supervisor for 7 years at Bode Technology Group and helped teach Biosecurity and Bioterrorism classes at University of Maryland. Megan has worked at Thermo Fisher Scientific for 8 years-- providing training, troubleshooting, and technical support to laboratories across the Mid-Atlantic and Mid-West regions. For the past 2 year she has worked as a Technical Sales Specialist as a subject matter expertise for Rapid DNA technology across laboratories, law enforcement, and government agencies. More recently, she transitioned into her new role as a Senior Account Manager for the Northeast and supports the full HID portfolio for the Northeast territory.

Dr. Pamela Marshall has been involved in the field of forensic analysis since 2002. Upon the completion of her MS in Forensic Genetics in 2002, she worked as a Forensic Scientist III at the Maryland State Police Forensic Sciences Division. While in Maryland, she was the Sexual Assault Forensic Examiner (SAFE) Coordinator for the state, helped to promote 120-hour SAFE collection legislation, and assisted in the training of over 200 SAFE nurses. Pam has also travelled abroad to Luanda, Angola, Africa in order to train analysts in forensic DNA analysis. She has been qualified as an expert witness in the fields of serology and DNA in Maryland, West Virginia, and Texas.

Her dissertation was titled "Improved Tools for the Robust Analysis of Low Copy Number and Challenged DNA Samples", leading to her graduation with her doctorate in 2014 under the guidance of Drs. Bruce Budowle, Art Eisenberg, Ranajit Chakraborty, and Angela van Daal. She also holds an additional Master of Science degree in Biomedical Science from the University of North Texas Health Science Center.

From 2014-2018, Pam served as the Director of the Forensic Science Program at the Southern University at New Orleans, a public, historically black college and university (HBCU). While at SUNO, she created a state-of-the-art forensic laboratory for hands-on research and experimentation. She has received numerous grants as well as partnered on research projects with other faculty and students. Pam is an advocate for increasing the number of African American and underrepresented minority professionals in the field of forensic science.

In July 2018, Pam became the Director of the Forensic Science and Law Program at Duquesne University, the nation's only FEPAC accredited entry level Master's degree program in forensic science. She also serves as an Associate Professor and holds a courtesy appointment in the Department of Biological Sciences. In 2019, Pam also became the Director of the Cyril H. Wecht Institute of Forensic Science and Law.

Pam has extensive graduate and undergraduate teaching experience in the forensic disciplines of serology, DNA, and microscopy. Her research interests include low copy number DNA, human and wildlife DNA identification challenges, nanoparticle technology, pressure cycling technology, and PCR enhancement. She has numerous publications and frequently presents at meetings, conferences, and trainings.

Claire Glynn, PhD., is an Associate Professor in the Department of Forensic Science, in the Henry C. Lee College of Criminal Justice and Forensic Sciences, at the University of New Haven, Connecticut. Claire previously was employed as a Forensic Biologist within the homicide and sexual assaults team at LGC Forensics (now Eurofins) in the United Kingdom. After obtaining a PhD in Molecular Medicine, Claire joined the faculty at the University of New Haven in 2014, where she teaches undergraduate and graduate courses and conducts extensive research focused on forensic biology, forensic DNA analysis, and forensic genetic genealogy. Claire is the founding Director of the online Graduate Certificate in Forensic Genetic Genealogy at the University of New Haven, which is the first program of its kind, and she actively consults and provides subject matter expertise on the topic.

Catherine Grgicak (Gerg-i-chuck) is an Associate Professor, Henry Rutgers Chair and Department Chair of the Department of Chemistry at Rutgers University in Camden NJ. She received her B.S. in Physical Science and B.Ed. from the University of Windsor, her M.S.F.S. from the University of Alabama at Birmingham, and her Ph.D. in Chemistry from the University of Ottawa. Her Laboratory for Forensic Technology and Integration is focused on developing systems and procedures that improve forensically relevant bio-analytical processes. She is a member of the Journal of Forensic Science's editorial board, editorial board of Electrophoresis, Forensic Laboratory Needs Technical Working Group, Expert Working Group on Human Factors in DNA Interpretation, American Society of Forensic Sciences, the International Society of Forensic Genetics and the Center for Computational and Integrative Biology at Rutgers University.

ABC Examination Preparation Course

Tuesday, November 2nd 8:30 am – 4:30 pm
Freedom

Instructor: **Tiffany Roy**

Virtual Moderator: **Dawn Rice**, Boston University School of Medicine

Attendees will need to have a laptop/tablet.

This workshop involves lectures and discussion in preparation for the American Board of Criminalistics (ABC) certification examinations. The workshop is directed at forensic practitioners to assist them in focusing their study for certification examinations.

The workshop will focus on ABC exam preparation strategies including timeline, study guides, resources, and discussion of the general exam categories across all specialties (legal, quality, common KSA's). The workshop will consist of ABC specific exam preparation using the ABC study guides. The course will include a "mock examination" for the participants to test their current knowledge and identify weak areas for further study. The workshop can also be tailored to include breakout material/lectures for specific examinations depending on enrollment.

Instructor Biography

Tiffany Roy MSFS, JD is a Forensic DNA expert with over fifteen years of forensic biology experience in both public and private laboratories in the United States. She has processed thousands of DNA samples and thousands of cases over the course of her career. She has provided expert witness testimony in more than one hundred cases in state, federal and international courts. She instructs undergraduates at University of Maryland Global Campus and Southern New Hampshire University. She currently acts as a consultant for attorneys and the media in the area of forensic biology through her firm, ForensicAid, LLC.

Roy holds degrees from Syracuse University, Massachusetts School of Law and University of Florida in the areas of Biology, Law and Forensic Science. She is a member of the American Academy of Forensic Sciences, the Northeastern Association of Forensic Scientists, and the Massachusetts Board of Bar Examiners. She is certified in the area of Molecular Biology by the American Board of Criminalistics.

Publication 101

Tuesday, November 2nd 8:30 am – 12:00 pm
Enterprise

Instructor: **Patricia Ann Mabrouk, Ph.D., F.A.C.S.**
Professor of Chemistry & Chemical Biology
Northeastern University

Virtual Moderator: **Jamison Whitten**, Boston University School of Medicine

Attendees will need to have a laptop/tablet.

In this workshop targeting new and future authors, we will discuss what it takes to move your research from the laboratory to the printed pages of a peer-reviewed journal. We will look at the process involved in bringing a study to publication, how to identify credible journals, what authorship means and why authorship is so important. Since peer-review is used by reputable publications to evaluate manuscript submissions, we will discuss the journal publication process, the format of a full paper, and typical evaluation criteria as these relate to your work in crafting an archival work worthy of publication in a high-quality peer-reviewed journal. Important questions every author should know the answers to include: what are my responsibilities to my co-authors, the journal, and the public? What are the reviewers' and the journal's responsibilities to you as an author, to the publisher, the discipline, and the public?

Instructor Biography

Patricia Ann Mabrouk (Pam) is Professor of Chemistry & Chemical Biology at Northeastern University. She earned her A.B. in chemistry and mathematics at Wellesley College and a Ph.D. in physical chemistry at the Massachusetts Institute of Technology. Her current research interests include the nature of engineering, pedagogy of undergraduate research, mentor training, and the ethical and responsible conduct of research. Pam is a member of the ACS, Sigma Xi, CUR, NEACT, and NSTA. Her honors include receipt of a National Science Foundation CAREER Award, CASE Massachusetts Professor of the Year, a Northeastern University Excellence in Teaching Award, and she is a Fellow of the American Chemical Society. Pam has published over fifty peer-reviewed studies in high quality peer-reviewed journals. She served as Associate Editor for the Analytical Sciences Digital Library, was an Editorial Board member for the IATS journal Excellence in College Teaching and serves as Editor-in-Chief of the Council on Undergraduate Research's flagship journal Scholarship & Practice of Undergraduate Research.

Forensic Chemistry & Toxicology Fundamentals of Using MassHunter Unknowns Analysis

Tuesday, November 2nd 12:00 pm – 5:00 pm
Columbia

Instructors: **Kirk Lokits**, Agilent Technologies GCMS Applications Scientist

Rachael Ciotti, Agilent Technologies GCMS Applications Scientist

Lunch sponsored by Agilent Technologies from 12:00pm – 1:00pm

The MassHunter Unknowns Analysis ½ day workshop is designed to introduce the student to the workflows involved when using Unknowns Analysis. The workshop begins with a 10-minute explanation of the deconvolution process, differences between deconvolution and peak integration, and some of the variables involved when using this powerful data analysis tool. Working through hands-on exercises, utilizing forensic data, the workshop is designed to help translate established workflows within ChemStation Data Analysis to MassHunter Unknowns Analysis. The workshop will include how to generate an in-house library in Unknowns Analysis, how to link retention time and or retention indices to each library entry and apply these entries to increase your Library Match Score (LMS) confidence level. Examples of various Unknowns Analysis reporting templates will be demonstrated using the forensic data files from the workshop exercises. The course will be spent in Unknowns Analysis and focused on single quad data. It's not required but preferred for the student to have access to MassHunter on an existing or soon to be acquired GCMS system in their laboratory. Course is limited to 16 attendees due to the number of computers available for each attendee. If demand exceeds the 16-student limit, an additional ½ day workshop can be added.

Instructor Biographies

Kirk received his B.S. in Forensic Science and Chemistry from Eastern Kentucky University, under Dr. Robert Fraas and began working as a Forensic Drug Chemist in the Miami Valley Regional Crime Laboratory in Dayton, Ohio. He then moved to Orlando, Florida where he worked as a Forensic Toxicologist for the Florida Department of Law Enforcement in the Orlando Regional Crime Laboratory and later as Crime Analyst Supervisor in the Pensacola Regional Crime

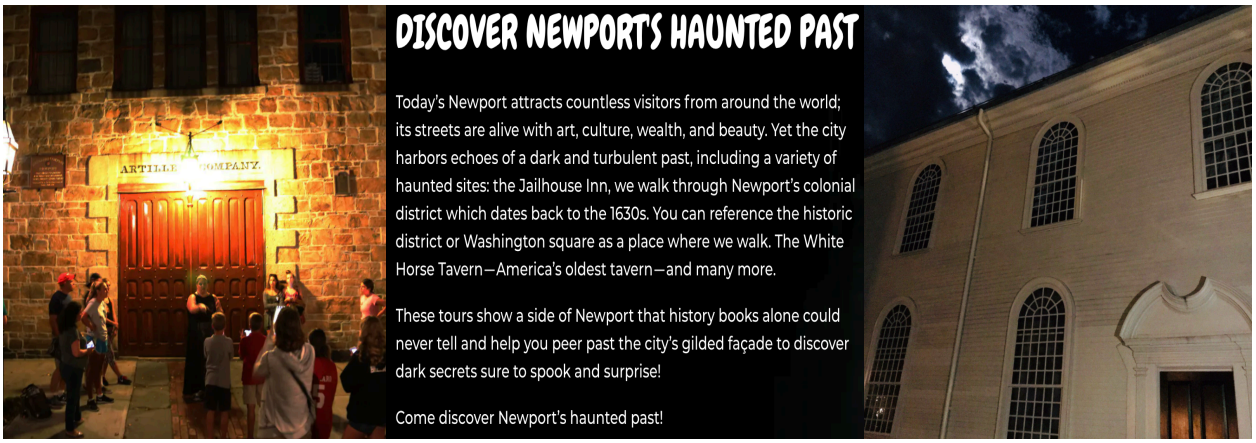
Laboratory. Kirk left the forensic realm and began his tenure with Hewlett Packard/Agilent Technologies, working as a Customer Service Engineer (CE) supporting the LC, GC, LCMS, GCMS, and ICPMS products. While working for HP Kirk earned his M.S. in Analytical Chemistry from Middle Tennessee State University, under Dr. Gale Clark and in 2005 Kirk left Agilent Technologies to attend the University of Cincinnati and earned his Ph.D. in Analytical Chemistry under Dr. Joseph A. Caruso. After receiving his PhD., Kirk worked for the Midwest Research Institute (MRIGlobal) in Kansas City, MO where he worked as a Principal Chemist and Sr. Program Manager on Department of Defense projects, staffing, designing, and building remote laboratories for placement throughout the world. In 2014, Kirk re-joined Agilent Technologies as a GCMS Applications Scientist focusing on forensic applications within the GCMS product line.

Rachael Ciotti is currently a GCMS Applications Scientist at Agilent Technologies focusing primarily on environmental applications and has a Bachler of Arts degree in Mathematics from Rutgers University. She joined Agilent in 2014 as a field service engineer installing, maintaining, and repairing Agilent GC and GC/MS systems, followed by a short tenure as a product manager for GC Supplies before getting back to her roots in the lab. Prior to joining Agilent, Rachael worked at DuPont as an applications chemist responsible for GC, GC/MS and LC/MS/MS method development and transfer to manufacturing labs for fluorochemicals and environmental pollutants. Previously, she was a project manager for a metals lab at EMSL Analytical, a contract environmental lab in New Jersey.

Tuesday Evening Downtown Newport Ghost Tour

Join us for a walking history and ghost tour of downtown Newport!

Tuesday evening - 11/2/21 - 7:30 - 9:00pm
Meet at the Skiff Bar by 7:15pm - $20/pp
Pre-registration is required. Space is limited: presidentelect@neafs.org



Scientific Sessions: Trace Evidence/Fire Debris & Explosives

Wednesday, November 3rd, 2021

Weatherly

Chairperson: Roberta Westerman, Massachusetts State Police Crime Laboratory, MA
Co-Chairperson: John Biello, Massachusetts State Police Crime Laboratory, MA

Wednesday, November 3, 2021 **9:00 AM – 12:00 PM**

9:00am – 9:05am **Opening Remarks**

9:05am – 9:20am **The American Board of Criminalistics: Looking into the Future**
Amy Duhaime, Rhode Island State Crime Laboratory

9:20am – 9:35am ***Identification of Inorganic Residues Using Microcrystalline Tests and Raman Microspectroscopy**
Caitlyn Kresge, Lawrence Quarino, Ph. D., ABC-GKE, and Lindsey Welch Ph. D., of Cedar Crest College, and Matthew Quinn, M.S., of Waters Corporation

9:35am – 9:50am ***Determining Minimum Size of Soil Samples for Forensic Geological Analysis**
Brittany Claassen, Emma Redman, Thomas A. Brettell, Ph. D., ABC-GKE, and Lawrence Quarino, Ph. D., ABC-GKE of Cedar Crest College, and Ted R. Schwartz, M.S., ABC-GKE of Westchester County Forensic Laboratory, NY

9:50am – 10:05am ***The Effect of Washing on the Transfer and Persistence of Fiber Evidence**
Madison Carter, Dr. Brooke W. Kammrath, and Dr. Virginia Maxwell of University of New Haven, and Dr. John A. Reffner of Jon Jay College of Criminal Justice

10:05am – 10:25am ***Forensic Discrimination of Copper Metal by Laser Induced Breakdown Spectroscopy**
Chase Notari, Brooke W. Kammrath, Ph. D., ABC-GKE, Henry C. Lee Institute of Forensic Science, University of New Haven

10:25am – 10:45am **Break**

10:45am – 11:00am **Vortex**
Pete Diaczuk, John Jay College

11:00am – 11:15am **Fireworks and GSR**
Pete Diaczuk, John Jay College

11:15am – 12:00pm **ATF – National Response Team**
John Pijaca, SACFI, IAAI-CFI, ATF, retired

12:00pm – 1:45pm **Lunch**

***Denotes Peter R. De Forest Collegiate Competition Participant**

Trace Evidence/Fire Debris & Explosives Abstracts

The American Board of Criminalistics: Looking to the Future
Amy Duhaime, Rhode Island State Crime Laboratory

During my time as the NEAFS representative to the American Board of Criminalistics (ABC) Examination Committee, I have been witness to much growth and change as we sought to make the certification examinations the best they could be. But it was the ABC's decision to pursue ISO Accreditation that has brought about the biggest changes, particularly for the Examination Committee. In addition to amending policies and procedures, the ABC decided to go through the process of developing new certification examinations that aligned with the accreditation standards to which we hope to someday be accredited. During my presentation, I will update you on the ABC's quest for accreditation and give you some information on our new certification examinations

***Identification of Inorganic Residues Using Microcrystalline tests and Raman Microspectroscopy**
Caitlyn Kresge, Lawrence Quarino, Ph. D., ABC-GKE, and Lindsey Welch Ph. D., of Cedar Crest College, and Matthew Quinn, M.S., of Waters Corporation

While the combination of microcrystalline tests and Raman spectroscopy have been used in the detection and identification in forensic drug analysis[1,2], no such method has been attempted with inorganic explosive analysis. Many other techniques have been used in the analysis of components of explosives, but none are as rapid, reproducible, and require trace amounts as the method to be described. In this robust method, Raman microspectroscopy is paired with microcrystalline tests to identify inorganic ions commonly found in explosives, specifically, those found in fertilizers, fireworks, and pyrotechnics. Raman spectra were generated from microcrystals produced in aqueous test samples and reacted with five test reagents respectively: squaric acid, nitron, silver nitrate, methylene blue, and chloroplatinic acid. The combination of microcrystal shape and Raman spectra was used to create a flow chart to identify urea and fifteen ions commonly found in these types of homemade explosives: nitrate, nitrite, sulfate, phosphate, oxalate, tartrate, chloride, ammonium, potassium, sodium, calcium, strontium, chlorate, perchlorate, and silver. The method is suitable for the identification of explosive residues found on evidentiary materials.

References

1. Elie, L., Elie, M., Cave, G., Vetter, M., Croxton, R., & Baron, M. Microcrystalline testing used in combination with Raman micro-spectroscopy for absolute identification of novel psychoactive substances. Journal of Raman Spectroscopy 2016 May; 47(11), 1343-1350.

2. Quinn, M., Brettell, T., Joshi, M., Bonetti, J., & Quarino, L. Identifying PCP and four PCP analogs using the gold chloride microcrystalline test followed by Raman microspectroscopy and chemometrics. Forensic science international 2020 Feb; 307: 110135.

***Determining Minimum Size of Soil Samples for Forensic Geological Analysis**

Brittany Claassen, Emma Redman, Thomas A. Brettell, Ph. D., ABC-GKE, and Lawrence Quarino, Ph. D., ABC-GKE of Cedar Crest College, and Ted R. Schwartz, M.S., ABC-GKE of Westchester County Forensic Laboratory, NY

Although not widely practiced in most forensic laboratories, numerous case studies exist in literature showing the evidentiary value of the forensic comparative analysis of soil[1]. Soil in a forensic context can be of limited size and although numerous comparative techniques exist, the minimum sample size required for reproducible and accurate data in each of these techniques is not well known. In fact, determining the minimum sample size for visual color determination of soil samples has been identified as an OSAC research need. In this study, 15 surface layer soil samples from different geologic areas were collected and homogenized for analysis. Various techniques including digital color determination, particle size distribution, d-space ordering by x-ray diffraction (XRD), and loss on ignition (organic content) were applied to sample sizes ranging from 2 to 0.25 grams. Differences in color between samples was measured using the Nix Color Pro QC Sensor and calculated using Delta E. It was found that color differences between samples and sample sizes was highly dependent on particle size components within samples. Locations that consisted of higher portions of silt and clay fractions reported low Delta E values between sample sizes and among sample sizes, compared to samples with higher course fractions which reported low Delta E values between sizes and among samples sizes. Descriptive statistics were utilized on particle size distribution and loss on ignition data. The use of correlation analysis and Kolmogorov–Smirnov D statistic suggests that samples below 1 gram begin to show diverging results. Analysis of variance performed on loss on ignition determined that samples with lower carbon content lost showed statistical differences between sample sizes. In addition, confidence intervals indicate that 0.25-gram samples do not often overlap with other sample sizes within each location. D-space ordering via x-ray diffraction was done on 2- and 0.25-gram samples of each location and it was determined that both were visually different. To determine where the differences in sample sizes begin to diverge via XRD, further analysis will be performed on 1- and 0.5-gram samples. Overall, based on preliminary data findings and analysis, samples smaller than 0.5 grams begin to give divergent results compared to larger sample sizes.

1. Petraco, N., Kubic, T. A., & Petraco, N. D. K. (2008). Case studies in forensic soil examinations. Forensic Science International, 178(2–3), 23–27. https://doi.org/10.1016/j.forsciint.2008.03.008

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

Madison Carter, Dr. Brooke W. Kammrath, and Dr. Virginia Maxwell of University of New Haven, and Dr. John A. Reffner of Jon Jay College of Criminal Justice

Learning Overview: After attending this presentation, attendees will gain an understanding of (1) primary, secondary, and tertiary transfer of fiber evidence via washing and drying; and (2) persistence of fibers on clothing after washing and drying.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing insight as to how washing affects the transfer and persistence of the two most common fiber types, cotton, and polyester, which can be used to inform the evidentiary significant of fiber evidence.

Fiber evidence has proven to be valuable forensic evidence in a plethora of cases by providing associations between a suspect, victim, and/or location. This can most readily be seen in the Wayne Williams murder trial of 1984, where unique fibers served as linkages between victims and the suspect's home[1]. Specific characteristics of fibers such as shedability, cross-sectional shape[2], colorant (dye or pigment), and fiber type (natural versus synthetic[3]) can be observed in order to determine the rarity of the fiber, which can be used to assess the evidentiary significance of an association.

A gap in the literature has been identified regarding the effect of different variables, specifically washing, on the transfer and persistence of fibers. This research has been based on the underlying assumption that a perpetrator will wash clothing that was worn during the crime in an attempt to remove any evidence. Four different scenarios were displayed in this research, with target fibers on the donor garments being fluorescently dyed for means of easy identification. These scenarios included washing a single donor garment, washing the donor garment with a recipient garment, washing the donor garment with two recipient garments, and finally washing a single donor garment, taking it out, and washing a single recipient garment. These sets of washes were run for both cotton and polyester donor fibers. After washings were complete, the individual garments were bagged, labeled, and stored for examination using fluorescent photography.

Whether it be a primary, secondary, or tertiary transfer, after examination and documentation, fibers were observed to have been transferred in all scenarios from donor to recipient garments as well as secondary locations such as the inside of the washer and/or dryer. There were also major differences noted in the quantity, location, and size of the recovered fibers based on the number of garments washed as well as the donor fiber type. By understanding how washing affects transfer and persistence of different fibers, forensic scientists can be better informed of the recovery potential and location, as well as evidentiary significance of fibers from washed garments.

References:
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***Forensic Discrimination of copper metal by laser induced breakdown spectroscopy**

Chase Notari, Brooke W. Kammrath, Ph. D., ABC-GKE, Henry C. Lee Institute of Forensic Science, University of New Haven

Copper metal has great potential as forensic evidence due to its presence in a range of cases from thefts of copper wiring and pipes, the use of copper wiring in IEDs, and its common function as bullet jackets. Excellent discrimination of copper metal has been demonstrated through trace element profiles collected using solution-based ICP-MS. Although ICP-MS has many advantages for elemental analysis, including its low detection limits, high accuracy and excellent precision, alternative methods that are faster, require less (or no) sample preparation, and require smaller sample sizes are being investigated for a range of forensic samples (e.g., glass, polymers, paint, tape, geological materials, etc.).

LIBS is an analytical technique that has gained prominence as a valuable tool for elemental profiling and continues to grow in acceptance in numerous industries. LIBS is an advantageous method due to the fact that it is rapid, requires no sample preparation, is able to simultaneously provide information on multiple elements at once, and is less expensive than other instruments used for elemental analysis. LIBS has proven value for the analysis of glass, paint, soil, ink, and other samples of forensic interest.

The purpose of this research was to evaluate LIBS to determine if it has the ability to perform comparative analysis of copper, specifically the jacketed metal on different bullets. This study first explored the detection capabilities of LIBS, determined an appropriate element menu, and outlined the optimal parameters for LIBS such as laser pulse energy, spot size, pattern size, gate delay, number of pulses per spot, and repetition rate using a copper density block. These optimal parameters were then applied to the analysis of the copper used in jacketed bullets, and the discrimination ability was explored using multivariate statistical methods. The ability of LIBS to perform comparative elemental analysis on copper-jacketed bullets has the potential to provide a novel method for forensic scientists to use in comparing ballistic evidence. The results of this research can be extended to other sources of copper, such as pipes and wiring, thus expanding the utility of LIBS instrumentation in forensic laboratories to alternative evidence items.

Vortex
Pete Diaczuk, John Jay College

Propellant patterns on a garment or on skin can provide useful information about muzzle to target distance in shooting scene reconstructions. Pattern density and pattern size on the evidence are assessed and compared to standards. The standards are created in the laboratory by shooting at targets at fixed distances, ideally with the same firearm and same ammunition suspected of being used in the shooting incident.

Until recently, these propellant patterns were predictable; at close range the pattern was dense and relatively small, with increasing diameter and decreasing density as the distance increased.
Historically, the two most common types of bullets used in handguns are the full metal jacket and the jacketed hollow point. In these types of bullets, the lead cores are mostly enclosed with a copper jacket. The copper jacket varies somewhat in thickness but on average is approximately a half millimeter. The newcomers on the block are total metal jacket bullets, which unlike full metal jackets and jacketed hollow points, have a jacket that is substantially thinner than their predecessors. Average jacket thickness of a total metal jacket bullet is merely a fifth to a tenth as thick as its full metal jacket counterpart. This thin jacket can be compromised by the rifling from some barrels, exposing the lead core. When the rifling cuts through the thin plated-on jackets of these bullets, the exposed lead can be expelled along with the unburned and partially burned propellant, to create an interesting pattern that looks like a swirl. Under certain conditions, it is possible to predict not only the direction of twist of the barrel but even the number of lands and grooves. Of the names associated to this phenomenon "spiral galaxy", "comet tail" and "vortex", I like *vortex* the best!

Fireworks and GSR
Pete Diaczuk, John Jay College

Gunshot residue (GSR) has long been characterized as spherical particles composed of two/ three components of molten lead, barium, and/ or antimony, due to the combination of compounds used in the chemical primer: Presence of these particles typically serve as linkage of a person to a shooting event, whether he/she was holding the firearm or within close proximity to the firearm when discharged. The integrity of GSR is questioned, however, when GSR- like particles are reported to be found through environmental and occupational exposure that do not involve a firearm. One of these exposures is fireworks. Due to the use of different compounds to uphold a chemical reaction and color effects, as advertised in various firework products, identifying the GSR metals lead, barium, and antimony, can possibly be found. The purpose of this research was to use a series of instrumental methods to investigate the potential for GSR-like particles to be formed and be detected from fireworks. Scanning electron microscopy, along with the Oxford AZtecGSR software, was used to identify GSR-like particles, elementally and morphologically from firework residues, while energy dispersive x-ray spectroscopy was used in attempts to identify chemical compounds used in commercial samples. Preliminary samples collected showed that classifiable components of firework residue were largely composed of environmental elements. Although an abundance of particles was identified as 'Consistent with GSR' and 'Consistent with Lead-Free/ Non-Toxic', 'Characteristic'

particles were rarely found. Commercial firework products analyzed in this study showed the absence of lead and antimony, which are essential components in GSR particles. Results from *this* study suggested that the potential for GSR-like particles to form from the firework samples tested is low.

ATF – National Response Team
John Pijaca, SACFI, IAAI-CFI, ATF, retired

John Pijaca has spent thirty years in law enforcement, 22 of those years with the ATF and 4 years prior as an ATF Task Force officer. John Pijaca joined ATF's Arson and explosives unit in 2006 and became a Certified Fire Investigator in 2007. SA Pijaca became a member of ATF 's National Response Team in 2012 and responded to numerous callouts throughout the country. SA Pijaca is a Certified Instructor at the Federal Law Enforcement Training Center in Brunswick Georgia and has taught at the National Fire Academy in Emmitsburg MD as well as the International Law Enforcement Academy in Bangkok Thailand. John Pijaca retired from law enforcement in 2020 and currently is a fire investigator in the private sector.

This presentation will discuss ATF's National Response Team and the capabilities it provides to State and local Government. Specific ATF responses will highlight the work done by the team as well as the partnerships between State and local entities.

ATF launched the first National Response Team (NRT) in 1978 as a mobile, rapid response team to investigate large fires, explosions and bombings. ATF now maintains several NRTs strategically located throughout the eastern, central, and western regions of the United States.

NRT members apply their specialized skills to investigate crime scenes, reconstruct fire origins, and identify the cause. They also conduct witness interviews as part of the investigative process.

NRTs are made up of veteran special agents and scientific technicians with expertise in fire origin/cause determination and post-blast analysis, including Certified Fire Investigators, Certified Explosives Specialists (CES), CES Bomb Technicians, Explosives Enforcement Officers, forensic chemists, engineers, medics, and canine handlers. The teams are supported by ATF's intelligence research specialists, forensic auditors, digital media specialists, and other technical and legal experts who work with law enforcement on criminal cases.

Scientific Sessions: Forensic Toxicology

Wednesday, November 3rd, 2021

Freedom

Chairperson: Sabra Jones, Boston University School of Medicine
Co-Chairperson: Jamie Foss, PerkinElmer

Wednesday, November 3, 2021 **9:00 AM – 12:00 PM**

9:00am – 9:05am **Opening Remarks**

9:05am – 9:20am **Academy Standards Board Toxicology Consensus Body Update**
Sabra Botch- Jones, MS, MA, D-ABFT, Vice Chair Toxicology Consensus Body, ASB

9:20am – 9:40am **Breath: A Bodily Fluid**
Dennis Hillard[1], MS and Gil Sapir, JD, MSc [1]RI State Crime Laboratory, Kingston, RI, USA

9:40am – 9:55am ***Utilizing BIO-SPME and DART-MS to Detect Drugs in Human Breast Milk**
Emily Woods[1], MS and Adam B. Hall[1], PhD
[1]Boston University School of Medicine, Biomedical Forensic Sciences, Boston, MA, USA

9:55am – 10:15am ***Evaluating the Efficacy of Three Beta-Glucuronidase Enzymes for the Detection of Opioids for Forensic Toxicology Urine Testing in Drug Facilitated Crime Investigations**
Reshma Gheevarghese[1], MS, Traci Reese[1], MS, Kelsey McManus[1], MS, Collin Hill[2], MS, Jamie Foss[2], BS, and Sabra Botch-Jones[1], MS, MA, D-ABFT
[1]Boston University School of Medicine, Biomedical Forensic Sciences, Boston, MA, USA
[2]PerkinElmer, Waltham, MA, USA

10:15am – 10:45am **Break**

10:45am – 11:05am **Bladder Wash: A (Not-So) Alternative Specimen for Postmortem Toxicology. An Update Including Survey Results**
Karen Scott[1], PhD, Kylie E. Candela[1], MSFS, Amy P Hart[2], MD, Luke N Rodda[2], PhD
[1]Arcadia University, Glenside, PA, USA
[2]San Francisco Office of the Chief Medical Examiner, San Francisco, CA, USA

11:05am – 11:25am ***The Effects of Adulterants on the Detection of Delta-9-Tetrahydrocannabinol and Methamphetamine in Oral Fluid Immunoassay Testing**

Alicia Huerta[1], MS, Joseph Jones[2], MS, Shanna Cawley[3], MS, and Sabra Botch-Jones[1] MS, MA, D-ABFT
[1]Boston University School of Medicine, Biomedical Forensic Sciences Boston, MA, USA
[2]North Louisiana Criminalistics Laboratory, Shreveport, LA, USA
[3]Quinsigamond Community College, Worcester, MA, USA

11:25am – 11:40am ***An Evaluation of Weak Anion Exchange Solid Phase Extraction Cartridges for the Quantitation of PFAS Compounds in Human Biological Matrices**

Halia Haynes[1], BS, Reshma Gheevarghese[1], MS, Peyton Tierney[2], BS, Audrey Ozga[3], Abderrahim Abdelkaoui[3], Joyce Wong[2], PhD, Jason Weisenseel[4], PhD, Sabra Botch-Jones[1], MS, MA, D-ABFT
[1]Boston University School of Medicine, Biomedical Forensic Sciences, Boston, MA, USA
[2]Boston University, Biomedical Engineering, Boston, MA, USA [3]United Chemical Technologies, Levittown, PA, USA [4]PerkinElmer, Waltham, MA, USA

11:40am – 12:00pm **Drugs, Alcohol, and the COVID pandemic: A four year look at New York State trends**

Amanda Cadau, MS, D-ABFT- FT, New York State Police, Albany, NY, USA

***Denotes Peter R. De Forest Collegiate Competition Participant**

Forensic Toxicology Abstracts

Academy Standards Board (ASB) Toxicology Consensus Body Update
Sabra Jones, MS, MA, D-ABFT

The Academy Standards Board (ASB) is an ANSI-accredited Standards Developing Organization with the purpose of providing accessible, high-quality science-based consensus forensic standards. The ASB was established in 2015 and accredited by the American National Standards Institute (ANSI) in 2016. The ASB consists of Consensus Bodies (CB), which are open to all materially interested and affected individuals, companies, and organizations; a Board of Directors; and Staff. The ASB works closely with the Organization of Scientific Area Committees for Forensic Science and its subcommittees which are dedicated to creating a national registry of forensic standards. This presentation will provide an update on the Toxicology Consensus Body activities, published standards, and updates on standards that are in the standard development process.

Breath: A Bodily Fluid

Dennis Hillard[1], MS and Gil Sapir, JD, MSc

Employers have developed drug free workplace policies. Nationally 46 states have laws imposing drug-testing restrictions specifying testing methodologies, use of test results and privacy issues. (1) Statutory workplace testing of controlled substances permit urine, blood, tissues, or other bodily fluids (2) and may include alcohol. Analysis is by a federally certified laboratory. Frequently, blood is initially analyzed using the enzyme multiplied immunoassay technique (EMIT) and UV analysis. Positive test results require confirmation testing employing gas chromatography/mass spectrometry (GC/MS) or technology recognized as being at least as scientifically accurate. (e.g., LC/MS or UV/IR spectroscopy). Labor statutes usually entail "controlled substances" and may include alcohol. (3) A creative interpretation for workplace alcohol intoxication testing, absent designated statutory or contractual language, seeks to define breath as a "bodily fluid" for statutory testing compliance.

Breath is a derivative factor of blood. The air people breathe is a gas. It is compartmentalized in the lungs for an exchange of oxygen and carbon dioxide which is essential for life. The breath/gas expired from the respiratory system should be considered a bodily fluid - a technical distinction due to practical methods of measurement. However, common sense is paramount. Bodily liquids cannot replace breath and breath cannot replace bodily liquids in living organisms. Creatively contrived attempts to circumvent and redefine basic fundamental science are specious and problematic. If legislators or employers want to employ breath alcohol intoxication for termination under a drug free workplace policy, then labor statutes or contracts should be amended specifying the use of breath as a testing specimen.

Semantics, syntax, syllogism, and euphemisms are irrelevant to breath alcohol as a bodily fluid. Common sense should prevail - statutory construction and the novel interpretation of breath alcohol analysis for workplace termination is at issue, not the science.

Key Words: Breath Alcohol, Bodily Fluids, Workplace, Blood

References:

1. US Department of Labor's Drug-Free Workplace Act of 1988, 41 U.S.C. 81.
2. Common body fluids are: saliva (oral fluid), vitreous humor, cerebral spinal fluid, synovial fluid, urine, blood, bile, semen etc.
3. Schedule of Controlled Drugs, 21 U.S. Code Sect.802, et seq (2002); See, each state's-controlled substance act. A workplace argument is controlled substances include alcohol due to control by age, intoxication laws, state owned liquor stores etc. Approximately half of the states include breath alcohol sample testing.

***Utilizing BIO-SPME and DART-MS to Detect Drugs in Human Breast Milk**

Emily Woods[1], MS and Adam B. Hall[1], PhD

Human breast milk is a biofluid produced by a woman's body during pregnancy. Breast milk contains necessary nutrition to a growing infant as well as xenobiotics--including drugs of abuse-- consumed by the woman which diffuse into the breast milk from the bloodstream. Since breast milk is recommended to be part of all infants' diets, being able to detect any toxic components--such as

drugs--in the matrix is critical. However, despite the ease and noninvasive nature of collection, human breast milk is a difficult matrix to analyze due to its high fat and protein content. Thus far, no literature has been published on the analysis of breast milk through direct analysis in real time mass spectrometry (DART-MS). Adapting DART-MS to detect drugs of abuse in human breast milk will allow for quick and timely identification of drugs present in an individual's breast milk, as well as aid in research regarding the potential harmful effects of drugs--both licit and illicit--on an infant who is breastfeeding. Forensically, this method could potentially allow toxicologists to use breast milk as a matrix to determine if drugs played a role in a woman's or breastfed child's death. Using both C18 biocompatible solid phase microextraction (BIO-SPME) fibers and QuickStrip™ cards, a DART-MS method was developed to be able to detect drugs of abuse in human breast milk. Four drugs of abuse (cocaine, codeine, morphine, and delta-9-tetrahydrocannabinol (Δ9-THC)) --all of which are either commonly abused during the postpartum period or are of particular danger to breast feeding women--were chosen to be studied. The drugs of abuse were extracted from either whole or pre-filtered human breast milk using either liquid-liquid extraction or C18 BIO-SPME fibers and detected with DART-MS using parameters suggested by IonSense, Incorporation (Inc.). Mass spectral results indicated that macromolecules in whole breast milk did not hinder extraction or detection and that a larger amount of the analytes were ionized/desorbed when using the BIO-SPME fibers. Thus, a BIO-SPME method adopted from IonSense, Inc. utilizing C18 fibers and SPME DART-MS parameters (with temperature and rail time adjustments) can be used to quickly detect cocaine, codeine, morphine, and Δ9-THC in human breast milk, indicating that this method may be used for the detection of other drugs of abuse in breast milk. In addition, BIO-SPME fibers can be used to quantify the concentration of cocaine in breast milk between a range of 50 and 200 nanograms per milliliter as demonstrated by a matrix matched calibration curve created using various concentrations of cocaine. Despite its benefits, the BIO-SPME and DART method cannot be used on samples containing more than one drug of abuse (based upon the drug concentrations utilized in this study) due to competitive adsorption and competitive ionization, respectively, as not all drugs could be detected when this method was applied to breast milk samples containing numerous drugs.

***Evaluating the Efficacy of Three Beta- Glucuronidase Enzymes for the Detection of Opioids for Forensic Toxicology Urine Testing in Drug Facilitated Crime Investigations**

Reshma Gheevarghese[1], MS, Traci Reese[1], MS, Kelsey McManus[1], MS, Collin Hill[2], MS, Jamie Foss[2], BS, and Sabra Botch-Jones[1], MS, MA, D-ABFT

Drug-facilitated sexual assaults (DFSA) are a severe public health and safety concern. Liquid chromatography-tandem mass spectrometry (LC-MS/MS) is an analytical technique that has been previously shown to be effective for detecting and quantifying drugs in human biological samples in DFSA cases. Urine is the preferred sample of choice in these cases, as the detection window for certain analyte metabolites can be detected up to four days after the alleged incident. Opioids are of particular concern due to the central nervous system depressant effects and are often excreted in the urine as glucuronidated metabolites. By incorporating an enzymatic glucuronide hydrolysis step in sample preparation, the parent drug of these compounds can be targeted.

The main objective of this study is to evaluate the efficacy of three enzymes for the recovery of parent drugs using enzymatic hydrolysis in sample preparation. Four opioid metabolites were utilized in this

research: codeine-6-β-D-glucuronide, dihydrocodeine-6-β-D-glucuronide, hydromorphone-3-β-D-glucuronide, and morphine-3-β-D-glucuronide (Cerilliant, RoundRock, TX, USA). Enzymatic recovery was evaluated for three enzymes: B-OneTM shelf-stable β- Glucuronidase for high-throughput analysis from Finden by Kura (Puerto Varas, Los Lagos, Chile), BGTurbo® Glycerol Free High-Efficiency Recombinant β-Glucuronidase from Finden by Kura, and Fast β-Glucuronidase, Recombinant from Sigma (St. Louis, MO, USA). Enzyme hydrolysis was conducted according to the incubation conditions provided in Table 1. Sample extraction was performed using supported liquid extraction (SLE) using ISOLUTE® SLE+ (Biotage, Charlotte, NC, USA). Following sample preparation, including hydrolysis, and supported liquid extraction, urine case samples were analyzed using the QSight® 220 CR laminar flow tandem mass spectrometer with electrospray ionization, which was operated in positive ion mode (PerkinElmer, Waltham, MA, USA). Chromatographic separation was achieved using a 50 x 4.6 mm pore size 100 Å, 2.6 µm core-shell Kinetex® phenyl-hexyl HPLC column from Phenomenex® (Torrance, CA, USA). The column was kept at 40°C for the duration of the run. The aqueous mobile phase A was 0.1% formic acid in Millipore water, and the organic mobile phase B was 0.1% formic acid in methanol. The flow rate was kept constant at 0.600 mL/min for the entirety of the run. The total run time for the method was 11 minutes.

A linear dynamic range of 5-200.0 ng/mL was established for all four analytes. Based on the established calibration model, the limit of detection (LOD) was 2.5 ng/mL and the limit of quantitation (LOQ) for all analytes was 5 ng/mL. Analytes displayed an acceptable bias of ±20%. Precision was analyzed concurrently and determined to be within ±20% for all analytes. All analytes were determined to be free from significant carryover. No matrix interference peaks were observed in blank urine samples, which fell within 2% of a known analyte retention time and had a signal intensity greater than the calculated LOD. Recovery of the analytes was conducted in triplicates, and the results are reported in Table 2. Based on the study results, B-OneTM and BGTurbo® from Finden by Kura are user-friendly, with explicit instructions for enzyme hydrolysis mix formulation and incubation steps, thus facilitating the integration of enzymatic hydrolysis in sample preparation. Further optimizations of the hydrolysis parameters are required for Fast β-Glucuronidase, a recombinant enzyme from Sigma, to be integrated into sample preparation.

Table 1. Enzymatic Hydrolysis Conditions

Enzyme	Enzymatic Activity	Temperature (°C)	pH	Incubation Time (mins)
Kura Biotech- B-One™	12,000 PS-U/mL	~22 (room temperature)	6.8	5
Kura Biotech- BGTurbo®	200,000 U/mL	55	6.8	15
Fast β-Glucuronidase, Recombinant from limpets (*P. vulgata*)	300,000-400,000 U/mL	70	5.2	15

Table 2. Average Hydrolysis Recovery Data

Analyte	Kura Biotech – B-OneTM	Kura Biotech – BGTurbo®	Fast β-Glucuronidase, Recombinant
Morphine	103.10	96.07	49.80
Codeine	99.76	99.67	49.19
Dihydrocodeine	92.61	96.34	41.64
Hydromorphone	97.73	100.7	50.54

Bladder Wash: A (Not-So) Alternative Specimen for Postmortem Toxicology. An Update Including Survey Results

Karen Scott[1], PhD, Kylie E. Candela[1], MSFS, Amy P Hart[2], MD, Luke N Rodda[2], PhD

Bladder washes can serve as an efficient and accurate alternative specimen when there is no urine available to analyze. They are also a reliable alternative specimen to analyze when other specimens, such as blood and vitreous humor, cannot be collected and toxicologically analyzed.

Urine is the preferred sample in postmortem forensic toxicology to provide evidence of antemortem drug use. However, there are many scenarios in which the bladder is voided or dehydrated prior to their autopsy. In these cases, it is possible to wash the bladder with saline and collect the bladder wash and any residual urine for drug screening and confirmation. The San Francisco Office of the Chief Medical Examiner (OCME) has made the collection of bladder washes at autopsy an option when urine is not available. While bladder washes are not conventional, this study aims to determine its use as an alternative specimen in postmortem forensic toxicology.

Data from analysis of bladder wash samples collected at the OCME were analyzed to assess the efficiency of this alternative sample in comparison to urine from the same individual by determining the identities of individual analytes and their metabolites. Following laboratory analysis of drugs by two LC-MS/MS methods and alcohol by HS-GC-FID, authentic case results showed that bladder wash drug analyses have the good sensitivity and selectivity to serve as an alternative specimen when urine is not available. These results are even more so if both individual analytes and metabolites comparisons are considered during data analysis. The bladder wash drug analysis data was also compared to blood analysis data from the OCME to determine if the two were complementary. While bladder wash and blood drug analyses have compatible selectivities, the sensitivity of bladder wash analyses are lower than their blood counterparts. Finally, in cases where only a bladder wash is analyzed, the detected drugs may provide crucial information to a forensic pathologist about the cause and manner of death that would have otherwise not been obtained.

Simultaneous, to this study, a two-part survey was sent via the NAME list serve to evaluate pathologists' views of the use of bladders washes before and after reviewing the results of the bladder wash data. Overall, pathologists were responsive to adopting the practice of collecting bladder washes for toxicological analysis.

This study appears to indicate that standardizing the collection and analysis of bladder washes in postmortem toxicology will provide forensic pathologists with a comprehensive toxicological profile in cases where urine and/or other biological specimens are not available for collection and subsequent analysis.

Keywords: Bladder wash, urine, blood, alternative specimen, postmortem toxicology

***The Effects of Adulterants on the Detection of Delta-9-Tetrahydrocannabinol and Methamphetamine in Oral Fluid Immunoassay Testing**

Alicia Huerta[1], MS Joseph Jones[2], MS, Shanna Cawley[3], MS and Sabra Botch-Jones[1] MS, MA, D-ABFT

Introduction: Drug screening is widespread in contexts such as the criminal justice system, employment, and substance abuse treatment centers. Traditionally, drug testing methods have targeted urine matrices. Depending on the nature of sample collection, urine specimens may be tampered or adulterated in efforts to invalidate or pass the drug test. For various reasons, including the effects of adulteration, time, and costs associated with urine drug testing, oral fluid (OF) has become an increasingly important alternative matrix for screening for drugs of abuse (DOA). It offers distinct advantages since tests can be administered noninvasively, quickly, and under observation, thus reducing the risk of adulteration. Despite mandatory guidelines by Substance Abuse and Mental Health Service Administration procedures controlling for OF specimen adulteration, it is recognized that manufacturers will continue to develop and market new products to avoid drug detection, just as with urine drug tests.

Methods: This experiment investigated the effects of the commercially available drug testing subversion products High Voltage Saliva Cleanse Mouthwash (High Voltage Detox, Las Vegas, Nevada, USA) and Stinger Detox Mouthwash (Stinger Detox, Phoenix, Arizona, USA) on immunoassay testing for tetrahydrocannabinol (THC) and methamphetamine (MET) in OF. The High Voltage Saliva Cleanse was designated adulterant "A" and Stinger Detox was designated adulterant "B". Two separate immunoassay kits, Discover™ (American Screening Corporation, Inc., Shreveport, Louisiana, USA) and Orawell® (Jiangsu Well Biotech Co., Ltd, Changzhou, Jiangsu, China), were assessed to investigate the differences in performance of the current available testing devices in addition to the effects of the subversion products. Using Discover™, samples were spiked according to 0.5 times (x), 1x, and 2x the cutoff concentrations of 50 ng/mL THC and 50 ng/mL MET without adulterant, with Adulterant A, and with Adulterant B. Testing with Orawell® devices was initially conducted at 1x and 2x the cutoff concentrations of 40 ng/mL THC and 50 ng/mL of MET. Additional testing was conducted at 1.5x and 3x the cutoff concentrations without adulterant, with Adulterant A, and with Adulterant B.

Results: In using the Discover™ kits, 83% (n=6) of the negative controls produced a positive result for THC. Twenty-six results (~96%) from the THC tests were found to be positive at each concentration level, even in samples with adulterants present. Twenty-six results (~96%) from the MET-containing tests were found to be negative. In the Orawell® kits, 32 (~97%) samples tested

containing THC at any concentration level were found to be negative, regardless of the presence of adulterants. Samples containing less than 2.5x the expected cutoff concentration of MET were found to be negative, while samples containing more than 2.5x the cutoff were found to be positive.
Conclusions: There were no significant observed effects of adulterants on testing of either DOA on the Discover™ immunoassay. It was concluded that the adulterants affected the test results in the Orawell® device, by producing false positives for DOA not present in the sample for 17 (56.7%) of the 30 tests containing adulterants. Additionally, it was concluded that both immunoassay tests assessed were lacking in analytical sensitivity and reproducibility.

***An Evaluation of Weak Anion Exchange Solid Phase Extraction Cartridges for the Quantitation of PFAS Compounds in Human Biological Matrices**

Halia Haynes[1], BS, Reshma Gheevarghese[1], MS, Peyton Tierney[2], BS, Audrey Ozga[3], Abderrahim Abdelkaoui[3], Joyce Wong[2], PhD, Jason Weisenseel[4], PhD, Sabra Botch-Jones[1], MS, MA, D-ABFT

Introduction: Per- and polyfluoroalkyl substances (PFAS) encompass a large group of manufactured compounds that have been used in various production processes such as food packaging, commercial products, workplaces, homes, water supplies, and in food. PFAS are persistent, resistant to degradation, and can bioaccumulate. The CDC's 2015-16 health survey found average blood levels of 4.72 ng/ml for PFOS and 1.56 ng/ml for PFOA, although an exposure limit that predicts adverse health effects has yet to be determined.

Objectives: Sample preparation and analytical methods are necessary to detect and quantitate these compounds in human biological matrices and help us fully understand how they relate to a variety of health outcomes such as pre- and postnatal health, immunity, cancer, and hormone disruption.
Materials and Methods: All samples and quality controls were prepared by spiking certified reference material into pooled human serum. A laminar flow ultra-high pressure QSight®220 LC-MS/MS was equipped with a Selectra C18 column. Extraction was accomplished using a Weak Anion Exchange (WAX) solid phase extraction (SPE) column (UCT, ECWAX053) by first conditioning the columns with 1 mL of methanol followed by 1 mL of 100 mM pH 7 phosphate buffer. Samples were loaded onto the column at a rate of 1-2 mL/min. The SPE cartridges were washed with 1 mL of 100 mM pH 7 phosphate buffer and 1 mL of DI water (Millipore Milli-Q Ultrapure Type 1 water system), then dried under full vacuum for 5 minutes. Elution was carried out with 2.5mL of a 98:2 methanol:ammonium hydroxide solution. The eluted samples were then evaporated to dryness using a nitrogen system at 55°C and 5 psi. All samples were reconstituted in 100 µL of a 96:4 methanol:water solution. Parameters assessed followed ASB 036 standard for method validation, including matrix recovery, limit of detection (LOD), limit of quantitation (LOQ), and calibration model.

Results: The results of the study were gathered from the following eleven analytes: PFBA, PFBS, PFHxA, PFHpA, PFHxS, PFOA, PFOS, PFNA, PFDA, PFUnA, PFDoA. Depending on the analyte, a lower limit of quantitation was established at 0.12 - 0.69 ng/mL and an upper limit of quantitation at 44.25 - 50 ng/mL. Based on the established linear calibration model an LOD and LOQ in the range of 0.12 - 0.69 ng/mL were achieved. All eleven PFAS analytes showed an acceptable bias of ±20%. All analytes showed a between-run precision (%CV) in an acceptable range

of ±20%. The average recovery for SPE ranges from 77.64-104.73% with recovery of ~77% for PFBS, ~83% for PFBA, and ~95-105% for PFHxA, PFHpA, PFHxS, PFOA, PFOS, PFNA, PFDA, PFUnA, PFDoA.

Conclusions: Utilizing the UCT WAX SPE column, we were able to demonstrate good recovery for the majority of the PFAS compounds. Further, the extraction technique was efficient for high throughput analysis with the extraction time comparable to other traditional SPE methods. The total analytical run time using the UCT Selectra C18 column, 11 minutes, allowed for adequate re-equilibration and system washes to prevent carryover and contamination of these persistent pollutants with excellent chromatography. Accurate quantitation of PFAS compounds in biological matrices will allow for better understanding of prevalence, bioaccumulation in biological matrices, and how these concentrations relate to various health outcomes.

Drugs, Alcohol, and the COVID pandemic: A four year look at New York State trends
Amanda Cadau, M.S., D-ABFT- FT

Retrospective toxicology trends from New York will be discussed including any changes recognized during the COVID pandemic. The New York State Police receives ~3100 cases per year for DUID, for which the primary evidentiary sample is blood. The scope encompasses 14 classes of drugs as well as alcohol testing. The scope meets or exceeds the DUID Tier I recommendations and ANSI/ASB Standard 120: Standard for the Analytical Scope and Sensitivity of Forensic Toxicological Testing of Blood in Impaired Driving Investigations for all drug classes. The laboratory doesn't have any administrative cutoffs for alcohol testing. Therefore, if a case is submitted for alcohol and drug testing, it will be tested for both, irrespective of the BAC level.

Since 2018, the most prevalent drugs identified in blood were Cannabinoids, Fentanyl, Cocaine/Benzoylecgonine, Alprazolam, Amphetamine/Methamphetamine, 7-aminoclonazalom, and Buprenorphine. Buprenorphine was added to the scope of testing in 2019. The most prevalent drugs remained consistent over four years. One notable increase in prevalence was for Fentanyl identifications. Fentanyl remains a popular identified drug, showing a 60% increase from 2019-2020.

Blood alcohol levels were examined for any correlation to gender. Since 2018, the average BAC level has increased for all subjects from 0.156% to 0.167%. There are twice as many blood alcohol requests received from males than females, but average BAC levels are higher in females. Data also show age/gender differences in positive alcohol results. For 2021, the most prevalent age bracket for a positive alcohol result is 21-29 for males, and both 21-29 and 30-39 for females.

During the height of the pandemic (March-April 2020), there was a 40% decrease in monthly DUID submissions compared to the previous year. The amount of blood submissions for the entire year of 2020 was comparable to 2019. While the laboratory had more submissions (~8%) requesting alcohol analysis in 2020, there was a 12% decline in positive alcohol cases compared to 2019. The average BAC level increased to 0.165% from 0.158% the previous year. For most of the drug classes, the drug identifications remained consistent in comparison to the previous year. Two notable trends were a 11% decrease in cannabinoid identifications and a 20% increase in methamphetamine cases.

Despite business closures during the pandemic, our submissions for driving while under the influence of alcohol and/or drug were still comparable to previous years.

***Denotes Peter R. De Forest Collegiate Competition Participant**

Scientific Sessions: Criminalistics/Crime Scene/Digital

Wednesday, November 3rd, 2021

Salon 3

Chairperson: Amy Brodeur, Boston University School of Medicine, MA

Wednesday, November 3, 2021 **9:00 AM – 4:35 PM**

9:00am – 9:05am **Opening Remarks**

9:05am – 9:25am **Can Oversight be Done Right? Increasing Transparency Through Collaboration** Lynn Schneeweis, Kristen Sullivan and Darina Griffin, Massachusetts State Police Crime Laboratory, MA

9:25am – 9:45am **Lab Lawyers, What Are They Good For?**
Darina Griffin, Lynn Schneeweis, Samuel Miller and Kristen Sullivan, Massachusetts State Police Crime Laboratory, MA

9:45am – 10:05am **Scientific Support of HAZMAT Transportation Regulations and Incident Resolution: Can the Forensic Laboratory Have a Role?**
Vincent Desiderio, United States Postal Inspection Service Security Group, VA

10:05am – 10:25am ***The Visualization of Bruises Using Alternate Light Source**
Wan Yu Tan, Boston University School of Medicine, MA, Karen Kelly, Brody School of Medicine-East Carolina University, NC, Ann Marie Mires, Anna Maria College, MA and Sabra Jones, Boston University School of Medicine, MA

10:25am – 10:45am **Break**

10:45am – 11:05am **Volatile Organic Compounds (VOCs) Produced by Bacteria Associated with Decomposition**
Veronica Cappas, Megan Morris, Dan Sykes and Reena Roy, The Pennsylvania State University, PA

11:05am – 11:25am **DART-High Resolution Mass Spectrometry (DART-HRMS) for Identification of the Feeding Resource of Necrophagous Insects**
Samira Beyramysoltan, University at Albany-State University of New York, NY, Jennifer Rosati, John Jay College of Criminal Justice, NY, Amy Osborne and Rabi Musah, University at Albany-State University of New York, NY

11:25am –- 11:45am ***You Are What You Eat: Utilization of Direct Analysis in Real Time-High Resolution Mass Spectrometry (DART-HRMS) for the Toxicological Examination of Insect Evidence in Death Investigations**
Amy Osborne, University at Albany-State University of New York, NY, Jennifer Rosati John Jay College of Criminal Justice, NY, and Rabi Musah, University at Albany-State University of New York, NY

12:00pm– 1:45pm **Lunch break**

1:50pm – 1:55pm **Remarks**

1:55pm – 2:15pm ***False Negative Results for Blood Tested in the Presence of Chemical Interferents**
Reshma Gheevarghese and Amy Brodeur, Boston University School of Medicine, MA

2:15pm – 2:35pm **RSID™-Semen and RSID™-Saliva Validation at the Boston Police Department Crime Laboratory**
Kathryne Hall, Boston Police Crime Laboratory, MA

2:35pm – 2:55pm ***Pollen Grain Assemblage for Geolocation in Mock Crime Scene**
Jacqueline Goetz and Heather Coyle, University of New Haven, CT

2:55pm – 3:15pm **Break**

3:15pm – 3:35pm ***A Tree-Mendous Method for the Forensic Identification of Illegally Traded Timber by DART-HRMS and Multivariate Statistical Analysis**
Mónica Ventura, Samira Beyramysoltan, Meghan Appley, University at Albany-State University of New York, NY and Rabi Musah, University at Albany-State University of New York, NY

3:35pm – 3:55pm ***Reducing Required Ink Sample Size for Analysis Using Microvolume UV/Vis Spectroscopy**
Lenora Rutten, Morgan Morill, and Ling Huang, Hofstra University, NY

3:55pm – 4:15pm ***Evaluation of the GelSight Mobile 3D Imaging System for Collection of Postmortem Fingerprints**
Mason Carlson and Amy Brodeur, Boston University School of Medicine, MA

4:15pm – 4:35pm **Double Homicide in South Boston: "Call 111 … Gunman in house … serious"**
Kathryne Hall, Boston Police Crime Laboratory, MA

***Denotes Peter R. De Forest Collegiate Competition Participant**

Criminalistics/Crime Scene/Digital Abstracts

Can Oversight be Done Right? Increasing Transparency Through Collaboration
Lynn Schneeweis, Kristen Sullivan and Darina Griffin, Massachusetts State Police Crime Laboratory, MA

2018 brought criminal justice reform initiatives to the Commonwealth of MA in the form of an "Act Relative to Criminal Justice Reform" (CJR). This act focused on improving several areas of the criminal justice system, and forensic science was no exception. Some forensic science centered reforms in the CJR grabbed national headlines including mandating the inventory and testing of previously unsubmitted SAECK and implementing a progressive 30-day turn-around-time for testing of all investigatory SAECK. A less publicized but ultimately impactful mandate of the CJR included the creation of a Forensic Science Oversight Board (FSOB) for the Commonwealth of MA. The CJR implored the Board have "oversight authority over all commonwealth facilities engaged in forensic services in criminal investigations…" and prescribed the composition of the roles of the individuals on the Board as well as mandated specific actions by the FSOB as they related to forensic science providers within the Commonwealth.

The implementation of forensic oversight boards or commissions is not novel in the United States and is theoretically designed to improve transparency and accountability within the forensic science field. At best, these bodies can positively impact a jurisdiction and help ensure the highest standards of forensic science are maintained. At worst, they can potentially foster a contentious and defensive environment directly contrary to that goal. The MA State Police Crime Laboratory (MSPCL) is the largest forensic service provider in the Commonwealth and as such, stood to be directly impacted by the creation of the MA FSOB. The CJR specifically mandated that the Board, upon its creation, immediately conduct an audit of the MSPCL and its current practices for providing forensic services. As spectators of other jurisdictions implementing these boards across the country with varying degrees of success, there was obvious uncertainty and apprehension as to how this would work in our own state.

The implementation of this board was not without its challenges from the laboratory perspective; however, the challenges were far from contentious. This presentation will discuss the enactment of the FSOB from the perspective of a forensic laboratory. Specifically, the initial audit of the MSPCL will be described as well as ongoing projects the Board is currently engaged in and their potential impact on the laboratory. The goal of this presentation is to provide insight for other laboratories who may see the creation of these types of oversight bodies in their own jurisdictions and demonstrate how with cooperative effort from all parties, a productive professional relationship can, in fact, be fostered between a forensic service provider and an oversight body.

Lab Lawyers, What Are They Good For?

Darina Griffin, Lynn Schneeweis, Samuel Miller and Kristen Sullivan, Massachusetts State Police Crime Laboratory, MA

After attending this presentation, individuals can evaluate the useful contributions a lawyer can make to a laboratory. This presentation affects the forensic and legal community by providing a model for the collaborative work between a laboratory, its attorney, and the criminal justice system. The presentation will also discuss the resources available to laboratory lawyers through the National Association of Forensic Laboratory Counsel.

In 2014, the Massachusetts State Police Crime Laboratory (Massachusetts State Police Crime Laboratory) hired its first ever "Lab Counsel". This lawyer was assigned to the Crime Laboratory and was responsible for providing legal support to the Laboratory Director and the Major of the State Police Crime Laboratory. The attorney's original contribution to MSPCL was focused on providing legal expertise related to a large impact litigation of the reliability of Breath Test Instruments. This position quickly evolved to providing advice to the Laboratory Director on a variety of other topics such as regulation changes, interpretation of statutes, assisting with "best practices" guide for evidence management to assist with post-conviction work, responding to court orders, public records requests and assisting a busy case management unit with responses to discovery motions and many other tasks. The authors will discuss the achievements of the National Association of Forensic Laboratory Counsel since its inception. Specific emphasis will be on the role of an attorney to assist laboratories with navigating various legal issues as well as the benefits of collaborating and sharing resources with other lawyers that represent forensic laboratories.

Scientific Support of HAZMAT Transportation Regulations and Incident Resolution: Can the Forensic Laboratory Have a Role?

Vincent Desiderio, United States Postal Inspection Service Security Group, VA

Background/Introduction

By definition, hazardous materials (HAZMAT) are any products, articles, or substances that are capable of posing a significant risk to health, safety, or property when transported by air, rail, ground, or sea. The transportation of HAZMAT is strictly regulated on a domestic level by the United States Department of Transportation via the Code of Federal Regulations, specifically 49CFR Parts 100-185. Additional levels of regulation exist at the international level as enforced by the International Civil Aviation Organization (ICAO) which sets regulations for air transportation, and the International Maritime Organization (IMO) which oversees oceanic transportation.

Although HAZMAT encompasses a broad range of materials, the large majority of materials of concern include organic and inorganic chemicals. The analysis of these materials for identification purposes and/or physical property determination is often a critical component of enforcement requirements. This is especially important with respect to undeclared HAZMAT shipments that represent an elevated threat. In addition to ensuring regulatory compliance, scientific support can be even more critical when it comes to the characterization of materials when an incident occurs (e.g., spill, leak, or fire).

As ecommerce continues to expand, the presence of undeclared HAZMAT in shipments at the consumer level has become a growing threat. Home business owners and online marketplace vendors rarely take the steps necessary to educate themselves on the proper packaging and handling of hazardous materials. As such, a growing volume of HAZMAT has been making its way into business to consumer transportation networks. With this growing volume, there has been a noticeable increase in the number of incidents involving product fires (e.g., lithium batteries and strike anywhere matches), undeclared firework shipments being exposed, and leaking powders and liquids that may be either flammable, toxic, or corrosive. Along with the increase in the frequency of incidents, there is now a concomitant increase in the need to identify these materials when they are encountered as unknowns.

Unfortunately, transportation agencies do not typically have their own laboratories, often relying on private contract laboratories for analyses when required. To this end, the forensic network, having the analytical capabilities and courtroom experience required for such determinations, may be able to play a critical role in this system.

Objective

This presentation will provide a brief discussion on hazardous materials transportation requirements with an emphasis on areas in which analytical support would typically be required. The overall objective will be to demonstrate an entirely new area in which forensic laboratories may be able to provide much needed analytic support in the world of public safety. In order to further demonstrate the need and general utility of forensic laboratories in this role, several real-world examples will be discussed.

Conclusion

After attending this presentation, the need for collaboration between forensic laboratories and the transportation sector should be clear. As more incidents are encountered, the enforcement of transportation regulations will undoubtedly end up in court at a greater frequency. Who better to handle the analysis and courtroom presentation of this information than the forensic examiner that is well versed in the analysis of general unknowns and the presentation of findings in court?

***The Visualization of Bruises Using Alternate Light Source**

Wan Yu Tan, Boston University School of Medicine, MA, Karen Kelly, Brody School of Medicine-East Carolina University, NC, Ann Marie Mires, Anna Maria College, MA and Sabra Jones, Boston University School of Medicine, MA

With the global pandemic, there has been mandatory movement restrictions by countries around the world. There has also been an increase in domestic abuse; such violence often presents in many forms with physical abuse heading the list.[1,2,3,4] This study was conducted to enable forensic officers to make use of existing crime scene equipment to enhance the visualization of bruises on victims of abuse.

When a case of abuse is reported, evidence of the abuse must be documented. Traditional methods of investigation involve questioning the victim or abuser, followed by documentation using photography and note-taking which may not accurately represent the injuries. In addition, the amount of force used, area of injury and the age of the injuries could affect the appearance of blunt force trauma including bruising. At times only redness is observed on the victim's skin making the injury difficult to document; such injuries would constantly be overlooked.[5,6] Alternate Light Source (ALS) is a common, cheap, and effective piece of equipment used by forensic examiners at the crime scene to reveal objects missed by the naked eye. With the use of ALS, the documentation of existing bruises can be enhanced, while bruises that are missed by the naked eye can be revealed.

In this study, the effectiveness of visualization of blunt force injuries (contusions) to the skin at different ALS wavelengths was evaluated to determine the optimal wavelength for documentation of bruises.[7,8,9,10] Bruises were inflicted on 57 participants with no known medical conditions following institutional approval. The participant was in a seated position while a cylindrical ball of ~465 grams was dropped at a height of 1.5 meters through a vertically positioned tube onto the ventral surface of the participant's forearm. The injury site was then observed and documented under white light, 415nm, 460nm and 550nm. Photographs of the forearm were taken under at all wavelengths prior to bruising, immediately after bruising, 3 hours after bruising, and at specific time points over a period of 21 days. The results showed better visualization of the injury observed at a wavelength of 415nm and 460nm.

A blind study was conducted using the same methodology to determine the validity of the experiment. A colleague was briefed and tasked to conduct a blind trial on 12 participants following institutional approval where the researcher has no knowledge on which participant the bruise was inflicted on. Photographic documentation and observations were recorded with the results only made

known to the researcher at the end of the experiment. It showed that the methodology is accurate at about 75%.

This study shows that the use of ALS provided an effective alternative with the visualization and documentation of blunt force traumatic injuries compared to traditional documentation methods without added cost and should be considered for use in future cases involving trauma and physical abuse. Additionally, since ALS is the standard crime scene equipment, the documentation of bruising by forensic examiners can be initiated in the field prior to transport of victim to either the hospital or morgue setting.

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Volatile Organic Compounds (VOCs) Produced by Bacteria Associated with Decomposition

Veronica Cappas, Megan Morris, Dan Sykes and Reena Roy, The Pennsylvania State University, PA

Microorganisms play an important role in decomposition and are known to produce volatile organic compounds (VOCs) that contribute to the odor of decomposition. Although microorganisms and VOCs have been studied independently regarding decomposition, few studies have linked the two subject matters. As the number of decomposition studies increases, a clearer picture of the temporal evolution of VOC profiles is emerging. However, identifying the origin(s) of specific VOCs remains elusive (i.e., microbial processes, general chemical decomposition, insects, environmental effects). The volatile organic compounds produced by specific species of bacteria associated with decomposition were characterized in order to determine origins of VOCs detected during

decomposition. In the present study, the volatile organic compounds produced by specific species of bacteria associated with decomposition were characterized. It may provide the potential origin of VOCs observed throughout decomposition, giving further insight to impact of microorganisms on the process, and improving techniques for locating remains.

Microbial communities were sampled at various time points during decomposition of a swine placed in an indoor enclosure and sequenced using NextGen Illumina sequencing. Because the indoor enclosure inhibited insect activity and colonization by extrinsic microorganisms, the VOC profile likely reflects the intrinsic microbial community and autolysis. Over 1,000 taxa at the genus level were identified and over 600 taxa at the species level. Prevalent phylum includes Bacteroidetes, Firmicutes. Tenericutes, and Spirochaetes, which are seen in other swine decomposition studies (1). Further analysis of the swine's microbiome succession is discussed with an emphasis on the potential correlation of the microbiome succession and decomposition as seen in other studies like Hyde et al. and Metcalf et al. (2,3).

Based on the relative abundance of sequenced reads, *Alcaligenes faecalis*, *Lysinibacillus fusiformis*, and *Lactobacillus gasseri* were selected. They were independently cultured in headspace vials on a modified chopped meat medium created from ground pork broth and sheep blood, to provide similar nutrients to the decomposing swine. Solid Phase Microextraction (SPME) fibers were used to sample the VOCs produced by the bacterial species. The VOC profiles produced by each bacteria species are compared with the overall VOC profile collected from the same decomposing swine to distinguish the VOCs associated with bacterial decomposition from those originating from the general break-down process. *A. faecalis* produced VOCs categorized as sulfides and carboxylic acids. *L. fusiformis* generated sulfides and hydrocarbons, while *L. gasseri* was seen to produce just one VOC. However, this may be due to the nutrient source and growth conditions. To investigate how interactions between species could affect VOC production, *A. faecalis* and *L. fusiformis* were cultured together. Different VOCs versus in the independent cultures were produced, like nitrogen-containing compounds that have been seen in other decomposition studies (4). This may support that species interactions can have an extraordinary effect on VOC production.

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DART-High Resolution Mass Spectrometry (DART-HRMS) for Identification of the Feeding Resource of Necrophagous Insects

Samira Beyramysoltan, University at Albany-State University of New York, NY, Jennifer Rosati, John Jay College of Criminal Justice, NY, Amy Osborne and Rabi Musah, University at Albany-State University of New York, NY

Necrophagous insects that have colonized decomposing remains can play a critical role in forensic investigations, as their species identity can be used to estimate time since death (or postmortem interval—PMI). However, insect evidence has the potential to reveal much more about the circumstances associated with the death. For example, drugs in the system of the decedent are ingested by the insects feeding on the remains, and thus detection of these drugs in the insects provides evidence that may be relevant to the cause of death. In a similar vein, it would be useful to be able to determine the identity of the tissue (food resource) on which insects have fed (e.g., human or animal) from direct examination of the insects. Recently, the metabolomics data derived from DART mass spectrometry (MS) was used to accurately determine insect species from analysis of the various life stages. Here, we examined DART-MS-derived insect molecular profiles as a function of food resource consumption to ascertain whether the identity of the tissue which was ingested by the flies could be determined. Multiple eggs of three species (*C. vicina*, *L. sericata*, and *P. regina*) were reared on five resources: beef liver, pork chop, dog feces, chicken breast, and decaying tilapia. The multiple individuals of each species were collected in larval and adult life stages and stored in 70% aqueous ethanol until analysis. DART mass spectra were acquired in positive ion mode in replicates of 5 from analysis of the aqueous ethanol suspensions of the individual samples under soft-ionization conditions. The resulting spectra were imported into MATLAB software (The MathWorks, Inc.) for further multivariate analysis. The MS data were binned and scaled, and the resulting matrix was explored by the multifactor method ANOVA simultaneous component analysis (ASCA) to reveal variations in the chemical profiles that were a function of resource type. A fusion of partial least square-discriminant analysis (PLS-DA) and principal component analysis-discriminant analysis (PCA-DA) was performed to create a discriminative model for the reliable identification of not only species and but also food resource using selected m/z values. The performance analysis of the method showed 91%, 80%, 95%, and 52% identification accuracy by five-fold venetian blind cross validation for determination of species identity for larvae and adults, and food resource identity for larvae and adults, respectively. Two sets of discriminative features for each life-stage were identified to be responsible for discrimination of species and the ability to identify resource type. The results showed that the chemical profiles of adult samples were more influenced by resource variations and external conditions, in comparison with larva samples, which affected identification accuracy. Therefore, analysis of the larval life stage, which is the most commonly encountered insect form in forensic investigations, can be used not only for species determination, but also for determination of resource substrate.

***You Are What You Eat: Utilization of Direct Analysis in Real Time-High Resolution Mass Spectrometry (DART-HRMS) for the Toxicological Examination of Insect Evidence in Death Investigations**

Amy Osborne, University at Albany-State University of New York, NY, Jennifer Rosati John Jay College of Criminal Justice, NY, and Rabi Musah, University at Albany-State University of New York, NY

In death investigations, entomological evidence is most well-known for providing a means by which to estimate postmortem interval (i.e., time since death), particularly in cases where decomposition is at an advanced enough stage that conventional techniques for PMI estimation cannot be used. However, the evidentiary value of insects could be dramatically enhanced beyond the scope of PMI if the chemical information they potentially contain could be harnessed to reveal additional information of relevance to the cause of death. One such form of information is toxicological evidence that is lost or irretrievable when the level of decomposition has progressed to the point where matrices that are typically probed in this type of analysis (i.e., blood, urine, and internal organs) no longer remain. The solution to this problem? Entomotoxicology. As maggots feed on decomposing remains, they ingest the tissue along with any drugs or chemical toxins that are contained therein. To the extent that these chemical compounds and/or their metabolites remain within the flies, their presence can serve as a historical record of the factors that may have led to the cause of death. In other words, you are what you eat!

Currently, forensic entomotoxicology research has focused mainly on applying traditional methods of toxicological analysis and drug detection to insects. These methods can involve long, complicated sample preparation that requires the complete destruction of the collected insect evidence. Here, we demonstrate Direct Analysis in Real Time-High Resolution Mass Spectrometry (DART-HRMS) as a new means to extract toxicological information from insects. For this study, blowflies (*L. sericata)* were fed beef liver laced with fentanyl derivatives at physiologically relevant concentrations, and the life stages of the flies following emergence of the maggots from the eggs that were laid was followed through to the emergence of adult flies. Specimens representative of each life stage were collected over two weeks. Following standard insect evidence collection procedures and to minimize future sample preparation, all specimens were stored in 70% aqueous ethanol prior to further analysis. DART-HRMS was then utilized to generate insect metabolome profiles through the direct interrogation of the individual insect specimens. These profiles were subjected to kernel discriminant analysis (KDA) in order to determine whether the profiles of the liver control (no drug) and the drug-laced liver could be differentiated through pattern recognition techniques. While the results show marked differences in the metabolome profiles of drug versus control samples for every life stage (i.e., larvae, pupae, and adults), the most significant changes were observed in the puparial casings. The findings provide a new avenue by which to access toxicological information of potential relevance to a death investigation that circumvents the challenges often encountered when using conventional techniques and provides a means by which to retrieve important forensic information even under conditions of advanced decay, particularly since puparial casings can remain unchanged for many decades.

***False Negative Results for Blood Tested in the Presence of Chemical Interferents**

Reshma Gheevarghese and Amy Brodeur, Boston University School of Medicine, MA

Blood is one of the most widely tested biological matrices. The first step in forensic blood identification involves visual examination followed by presumptive testing. Once a positive presumptive result is observed, confirmatory tests may be performed to determine that a stain is human blood, thus reducing the time and resources spent on forensically irrelevant samples. When interfering agents are present, this general workflow is hindered as presumptive tests can render false-negative results. General awareness of these interfering agents can help analysts to recognize forensically relevant evidence that may have otherwise been deemed immaterial.

The main objective of this study was to understand various interfering agents and their effects on presumptive blood tests such as Kastle Meyer (KM) and Orthotolidine (O-tol) reagents and confirmatory tests such as HemaTrace® and Rapid Stain Identification (RSID™)-Blood. In the first part of the study, bloodstains in varying concentrations were exposed to ten chemical interferents over a period of time to understand how blood dilution, age of the stain, and the chemical nature of the interferent affect presumptive blood test results. Antioxidants, active oxygen, and tannins are known to interrupt the mechanism of presumptive tests. Thus, ten interfering agents (ascorbic acid, chlorogenic acid, catechin, sodium percarbonate, hydrogen peroxide, oxalic acid, proanthocyanidins, quebracho extract, chestnut extract, and theaflavin) were selected based on these characteristics. Six blood dilutions (neat, 1:10, 1:50, 1:100, 1:500, and 1:1000) were exposed to the interferents, and presumptive tests for blood were conducted on six separate days (day 1, 8, 22, 43, 71, and 106). The second part of the study examined bloodstains deposited on real-world samples (wines, citrus fruit juices, teas, coffee, cleaning agents, and leather products) containing chemical interferents. In addition, confirmatory testing for human blood was conducted with HemaTrace® and RSID™-Blood on day 106 using the 1:500 dilution.

Nearly all chemical interferents and household products tested had an inhibitory or altering effect on bloodstain identification. The results showed that as blood concentration reduced, more false-negative results were observed when chemical interferents were present. Further, chemical interferents produced frequent atypical color changes in tests with KM and O-tol reagents that were not characteristics of a positive result, while only some atypical color changes were observed with the household products tested. Immunochromatographic assay results indicated both HemaTrace® and RSID™-Blood could detect the presence of blood when most interfering agents were present, although the positive result bands with RSID™-Blood were faint and sometimes difficult to visualize; however, nearly one third of the samples tested yielded a negative result. Overall, the data indicates that valuable blood evidence may be overlooked due to faint or false negative results when these chemical interferents are present. Future studies should focus on how these interferents may affect downstream DNA analysis.

RSID™-Semen and RSID™-Saliva Validation at the Boston Police Department Crime Laboratory

Kathryne Hall, Boston Police Crime Laboratory, MA

The objective of this validation was to evaluate the sensitivity and reproducibility of the Rapid Stain Identification (RSID™) tests for semenogelin and saliva manufactured by Independent Forensics. The goal was to determine whether these tests would be suitable replacements for the ABAcard® p30 test and the detection of amylase via radial diffusion that the laboratory was previously performing. An important consideration was to ensure that any new tests brought online would be as similar as possible to the current laboratory protocols. It was also important to evaluate if the RSID™ Universal Buffer would be a suitable replacement solution for the dH_2O that was in the validated laboratory protocols for extraction and preparation of microscopic slides with the Christmas tree stain.

All samples were run in duplicate. Serial dilutions of pooled semen were applied to Puritan cotton swabs, Texwipes®, and 100% cotton pre-washed fabric. Serial dilutions of pooled saliva were applied to cotton swabs. Significant differences were observed when the RSID™-Semen results were compared to the ABAcard® p30 results from extracted cotton swabs. Invalid results were obtained for the RSID™-Semen test cards when samples were extracted from Texwipes® due to the fact that the negative control during these test runs yielded positive results. Similar results were observed between the RSID™-Semen test cards and ABAcard® p30 test cards from extracted samples on 100% cotton fabric. Overnight extractions for semen dilutions on cotton swabs and 100% cotton fabric were also evaluated. Similar results were obtained for extracted cotton swabs when comparing RSID™-Saliva and amylase detection via radial diffusion.

The use of the RSID™- Universal Buffer during the extraction and washing steps of the microscopic slide preparation procedure appeared to prevent the picroindigocarmine stain from being fully rinsed from the slide, leading to difficult visualization under the microscope. Several different changes were made to the procedure to adjust for the difficult visualization. Finally, it was determined that using the universal buffer during the extraction and dH_2O in the wash step aided in the visualization of the microscopic slides.

***Pollen Grain Assemblage for Geolocation in Mock Crime Scene**

Jacqueline Goetz and Heather Coyle, University of New Haven, CT

Pollen analysis may be employed in a forensic investigation to provide evidence to link a suspect to a crime scene. Every geographic location has a pollen assemblage that consists of the combinations of plant species unique to that specific area. This distinction allows for pollen assemblages to be obtained and related to specific locations. Pollen grains can be utilized as trace material due to their microscopic size, abundance in the environment, and their resistance to chemical degradation. Grains can also provide characteristics of the environment from which they are from, and their morphology can be used to distinguish specific plant taxa. However, experimental research in utilizing pollen assemblages to link forensically relevant items to specific crime scenes has been limited. This study focuses on the collection of pollen grains from T-shirts and footwear that has been worn at a

simulated crime scene through surface swabbing techniques. Utilizing traditional morphological comparisons, pollen quantification counts and an optimized staining technique to enhance grain structure, pollen assemblages from the T-shirts and footwear were compared to control samples taken at the mock crime scene. Results indicate that each scene had a unique assemblage that could be matched to the samples collected from the T-shirt and footwear that was worn at the scene, with most of the pollen assemblage coming from the upper front of the shoe. Limitations to this study include having a controlled, contained scene, and participants who wore clean footwear/clothing that were seized and processed immediately unlike a typical crime scene. However, this study demonstrates the usefulness of the pollen analysis technique pollen analysis that could be utilized more prevalently in forensic investigations for associative evidence.

***A Tree-Mendous Method for the Forensic Identification of Illegally Traded Timber by DART-HRMS and Multivariate Statistical Analysis**

Mónica Ventura, Samira Beyramysoltan, Meghan Appley, University at Albany-State University of New York, NY and Rabi Musah, University at Albany-State University of New York, NY

One of the concerns of wildlife forensics is the identification of endangered species, the trade of which is illegal. The Convention on International Trade of Endangered Species (CITES) was created to address the conservation of imperiled wildlife by controlling their trade. Regulation status is defined by appendices: CITES Appendix I species are exceptionally endangered and trade of any kind is outlawed; CITES Appendix II species are threatened in the wild and international trade is managed; and CITES Appendix III species are regulated by a particular nation. While trade in fauna, including elephant parts (such as tusks), rhinoceros horns, and pangolin scales, are well-known examples of wildlife crimes, there are a host of flora that are heavily trafficked, including trees. *Dalbergia* species serve as a case in point. These species fall under the Leguminosae family, with most species being commonly known as rosewood. Illegal trade of these species is common because they are highly prized for making exclusive furniture, cabinetry, musical instruments, and artifacts. Depending on the species, trade is either totally or heavily restricted. However, when specimens are intercepted by law enforcement, it is extremely challenging to identify the evidence as either legal or illegal, because many of the species that are illegal to trade have an appearance that is similar to species that are not restricted. The traditional technique for species identification of timber is morphological examination based on diagnostic anatomical features. However, this requires high levels of training and may not be successful when attempting to distinguish between species with similar wood anatomy (e.g., *D. nigra* and *D. spruceana*). Therefore, a technique is urgently needed by law enforcement for the rapid and efficient identification of endangered timber in order to circumvent the aforementioned challenges. We demonstrate accomplishment of this by an integrated approach using solid phase microextraction (SPME), direct analysis in real time-high resolution mass spectrometry (DART-HRMS), and multivariate statistical analysis. Seventeen *Dalbergia* species, including *D. baronii*, *D.cearensis*, *D. oliveri*, *D. occulta*, *D. madagascariensis*, *D. latifolia*, *D. melanoxylon*, *D. normandii*, *D. purprascens*, *D. retusa*, *D. nigra*, *D. decipularis*, *D. stevensonii*, *D. tucurensis*, *D. spruceana*, *D. maritima*, and *D. cochinchinensis* were provided by the U.S. Fish & Wildlife Forensic Lab, all of which are listed as CITES Appendix II species, except for *D. nigra*, which is listed as a CITES Appendix I species. Three samples of each species were analyzed in multiple replicates. The headspace volatiles of the wood samples were concentrated on SPME fibers for thirty minutes, which were then analyzed by DART-HRMS.

Multivariate statistical analysis processing of the DART-HRMS data revealed intraspecies similarities and interspecies differences that resulted in the ability to assign species attribution to the chemical signatures. The classification model that was developed could therefore be used for rapid forensic identification of species based on simple analysis of the headspace of the wood. The results show that this approach can be used as a technique for species identification of these illegally traded timber.

***Reducing Required Ink Sample Size for Analysis Using Microvolume UV/Vis Spectroscopy**
Lenora Rutten, Morgan Morill, and Ling Huang, Hofstra University, NY

Questioned document analysis often deals with the validation of documents that contain a particularly small sample of handwriting. A sample can be as small as a set of initials, making some conventional chemical analysis unfavorable if it requires extraction of the entire sample. Because using the entirety of a sample in analysis prevents further visual, microscopic, or chemical analysis an analyst may elect not to use methods that necessitate extraction[1].

Conventional UV/Vis spectroscopy is an established method for chemical ink analysis but faces issues of large sample size and destruction of the sample. Additionally, the suggested solvent for UV/Vis ink analysis, pyridine[1], produces a nauseating odor and is a systemic toxicant[2]. Pyridine also has limitations when attempting to extract water-based gel ink or porous point pen ink[1]. The use of UV/Vis spectroscopy is favorable because the spectral output is easy to visually compare to other samples without specialized training.

In our new analytical method, a 0.7mm steel mechanical pencil tip as a micro-punch to transfer tiny ink-on-paper samples from written characters, before the ink is extracted by a micro-volume surfactant solution and investigated spectroscopically on a micro-volume UV/Vis spectrometer. Recognizable and repeatable spectra are generated with this method and the spectra allow for visual comparison between types of inks. Testing began with black and blue ballpoint, gel, and porous point pens. Analysis was also expanded to thermochroic, or "erasable," gel pens and alcohol based porous point permanent markers. These samples were selected for their forensic relevance. QD analysis frequently looks at evidence material where handwriting is meant to have intense staying power, as in "permanent" inks, or is meant to be easily destroyed, as lay-people feel they achieve with pigment that deactivates. Additionally, these formulations are popular among consumers[3].

It is still possible to see general physical and microscopic characteristics of the characters after micro-punch samples have been taken. Samples can be taken with strategic placement in order to preserve the most relevant or distinctive aspect of any given character being examined. This method works on a sample as small as a set of initials and leaves them readable with some lines of ink still present for further analysis.

The results of these tests were found to be replicable when analysis was in keeping with the set procedure. It was found that ballpoint, gel, and porous point pen inks were differentiable from one another, and the spectra for ink formulations were clearly different from the spectra obtained by running paper blanks, indicating the ink spectra were notable due to the ink itself and not any paper interference. The method was additionally found to work on deactivated thermochroic pigment and

alcohol based porous point pen inks, indicating this form of analysis is suitable for a wide variety of samples. The intention of this research is to develop an accessible, replicable methodology for minimally destructive chemical ink analysis, and to eventually establish a searchable database of reference UV/Vis spectra.

1. "Standard Guide for Forensic Examination of Non-Reactive Dyes in Textile Fibers by Thin-Layer Chromatography." *ASTM International*, E 2227 – 02: 2-5.
2. U.S. EPA. Health And Environmental Effects Profile for Pyridine. U.S. Environmental Protection Agency, Washington, D.C., EPA/600/X-86/168 (NTIS PB89123384), 1986.
3. "The Science Behind FriXion Erasable Pens," Na., accessed October 4, 2020, https://www.nippon.com/en/features/c00520/; "Sharpie-About Us," Na, accessed October 4, 2020, https://www.sharpie.com/about

***Evaluation of the GelSight Mobile 3D Imaging System for Collection of Postmortem Fingerprints**

Mason Carlson and Amy Brodeur, Boston University School of Medicine, MA

Current methods for collecting postmortem fingerprint exemplars in a forensic investigation most commonly include using ink, black powder, or a two-dimensional camera/scanner. Disadvantages with these methods include smudging or distortion from inconsistent pressure and movement during collection as well as detail being lost from excessive ink/powder or finger deformation. These problems are exemplified when rigor mortis or decomposition is present.

The GelSight Mobile is a portable three-dimensional contact imaging device that is primarily used in the aerospace industry and has recently been utilized in the field of ballistics. The device uses an elastomeric sensor to measure the topography of any surface and is sensitive to the micron level regardless of lighting conditions. The handheld device contains six LED lights and individual images are simultaneously captured using each of the lighting conditions while the gel pad is conformed to the surface of interest. The six images are then automatically combined to create a 3D point cloud through a process called photometric stereo. The GelSight Mobile device is used in conjunction with companion software to give instant photographic feedback.

To evaluate the GelSight Mobile for forensic use, the fingerprints of decedents with varying postmortem intervals were evaluated at the Connecticut Office of the Chief Medical Examiner. Fingerprints were captured first with the GelSight Mobile, followed by the *FingerScan Decedent ID* two-dimensional scanner, the standard method of fingerprint collection for that office, and lastly using ink and a postmortem fingerprint collection kit. The electronic images and inked prints from each individual were compared to one another to evaluate the level of detail visible. Further, the ease and efficiency of using the GelSight Mobile was compared to current methods.

Overall, the GelSight Mobile was efficient in collecting postmortem fingerprints and in many instances provided a higher quality fingerprint impression than other methods. In particular, friction ridge skin that had begun to slip or decompose contained more identifiable minutiae when viewing the 3D images as compared to the inked prints and 2D scanned images. The 3D models created can be measured, scaled, rotated, or exported for further processing. The device requires minimal training

to use and images of all ten fingers can be captured in under three minutes. One disadvantage to the GelSight Mobile is the limited size of the field of view, which only allows an area measuring 17mm by 14 mm to be captured in a single image. Thus, using the current model, multiple scans are required if capturing the entire finger pad is desired.

Double Homicide in South Boston: "Call 111 … Gunman in house … serious"
Kathryne Hall, Boston Police Crime Laboratory, MA

On Friday May 5, 2017, at approximately 20:38 hours, Boston Police officers responded to Penthouse A at 141 Dorchester Ave. in South Boston for a 911 call reporting a male in the home with a gun. Front desk security at 141 Dorchester Ave. received a phone call from a friend of the resident explaining that he had received a text message from Richard requesting that police be notified that it was a serious situation and there was a gunman in the house. Upon officers' arrival, a male dressed in dark clothing and possibly armed with a firearm was observed in the home. The male made hand movements consistent with a person aiming a firearm at the officers, resulting in the officers discharging their firearms at the male suspect. The male was wounded in the left hand, abdomen, and leg. After a struggle, the suspect was taken into custody. It was later determined that the suspect had a BB/Pellet pistol and not a working firearm. At this time, the suspect told officers there was a sniper in the building who was going to shoot at officers if they went into the residence. Due to this statement made by the suspect, the Boston Police Entry Team was used to gain entry into the home. BPD SWAT officers then made a protective sweep of the residence during which the bodies of 38-year-old Dr. Lina Bolaños and 49-year-old Dr. Richard Field were discovered. Lina had been stabbed more than 20 times along with multiple blunt force injuries. Richard sustained one stab wound to the neck along with several blunt force injuries.

The night of May 5, 2017, through to the night of May 6th, crime scene analysts processed a large, complex crime scene at 141 Dorchester Ave. Crime scene processing involved the bodies of Lina and Richard, several bottles of cleaning detergents and solutions, bloodstain patterns, shooting reconstruction, and over one hundred items of evidence that were collected for further analysis. The case was presented at trial in December of 2019 where Bampumin Texeira was found guilty of two counts of murder for the deaths of Dr. Lina Bolaños and Dr. Richard Field and sentenced to life in prison. This presentation will explore the processing of the crime scene, the forensic evidence, and will discuss the presentation of the evidence in the courtroom.

Scientific Sessions: Forensic Biology/DNA

Wednesday, November 3rd, 2021

Salon 4

Chairperson: Andrew Schweighardt, NYC Office of the Chief Medical Examiner, NY

Wednesday, November 3, 2021 **9:00 AM – 4:35 PM**

9:00am – 9:05am **Opening Remarks**

9:05am – 9:25am **Determining Human Identity from Leeches Using Copan microFLOQ® Direct Swabs**
Veronica Cappas, Elizabeth Knapp and Reena Roy, Ph.D.
The Pennsylvania State University

9:25am – 9:45am ***Determining Y-STR Profiles from Leeches Using Copan microFLOQ® Direct Swabs and the Yfiler® Plus Amplification Kit**
Elizabeth Knapp, Veronica Cappas, and Reena Roy, Ph.D.
The Pennsylvania State University

9:45am – 10:05am ***Determining the Efficiency of Nylon-flocked Swabs Versus Cotton Swabs for Fellatio Samples**
Brianna Gregory and Janine Kishbaugh, M.S., Cedar Crest College

10:05am – 10:25am ***DNA Quantitation Levels of Common Saliva Coated Forensic Samples**
Nyla Ngegba[1], Kelly Reading, B.S.[1], Lawrence Quarino, Ph.D.[1], Reena Roy, Ph.D.[2], and Janine Kishbaugh, M.S.[1]
1. Master of Science Forensic Science Program, Cedar Crest College
2. Eberly College of Science, The Pennsylvania State University

10:25am – 10:45am **Morning Break**

10:45am – 11:05am ***Exploring Bodily Fluid Stain Identification Using Raman and Microchemical Tests**
Morgan Maddock, B.S.[1], Lawrence Quarino, Ph.D.[1], Lisa Mertz, M.S.[2], and Marianne Staretz, Ph.D.[1]
1. Master of Science Forensic Science Program, Cedar Crest College
2. NYC Office of Chief Medical Examiner

11:05am – 11:25am **American Forensic Practitioners' Opinions on Activity Level DNA Reporting**
Yoon Yang[1], Mechthild Prinz, Ph.D.[2], Heather McKiernan, Ph.D.[3], and Fabio Oldoni, Ph.D.[1]
1. Department of Chemistry & Physics, Arcadia University
2. John Jay College of Criminal Justice
3. Center of Forensic Science and Research Education

11:25am – 11:45am **A Perfect Match: Identifying the Victim of a Cold Case Homicide Using DNA, NamUs, and CODIS**
Andrew J. Schweighardt, Ph.D., and Jonathan Holly, M.S., NYC Office of Chief Medical Examiner

12:00pm – 1:45pm **Lunch Break**

1:50pm – 1:55pm **Opening Remarks**

1:55pm – 2:15pm **Forensic Genetic Genealogy: Myth or Fact?**
Melissa Kotkin, Verogen

2:15pm – 2:35pm **Common Misconceptions and the Need for Best Practices in Forensic Genetic Genealogy**
Claire Glynn, Ph.D., Henry C. Lee College of Criminal Justice and Forensic Sciences, University of New Haven

2:35pm – 2:55pm ***Investigating the Use of Forensic Genetic Genealogy (FGG) on Degraded DNA Samples**
Julia Dollen, and Claire Glynn, Ph.D., Henry C. Lee College of Criminal Justice and Forensic Sciences, University of New Haven

2:55pm – 3:15pm **Afternoon Break**

3:15pm – 3:35pm ***Quantifying UV-Induced Primer Binding Site Damage in DNA**
Sabrina Martins, and David San Pietro, Henry C. Lee College of Criminal Justice and Forensic Sciences, University of New Haven

3:35pm – 3:55pm ***DNA Recovery and Transfer on Non-Porous Surfaces Submerged in Spring Water**
Morgan Korzik, and David San Pietro, Henry C. Lee College of Criminal Justice and Forensic Sciences, University of New Haven

3:55pm – 4:15pm ***Evaluating the Discriminating Power of Hair Amino Acid Ratios on Distinguishing Individuals Using GCMS**
Timothy Yaroshuk and Alyssa Marsico, Henry C. Lee College of Criminal Justice and Forensic Sciences, University of New Haven

4:15pm – 4:35pm **Paving the Way for New Technology in a Post-Pandemic Criminal Justice System**
Rachel Oefelin, DNA Labs International

***Denotes Peter R. De Forest Collegiate Competition Participant**

Determining Human Identity from Leeches Using Copan microFLOQ® Direct Swabs

Veronica Cappas, Elizabeth Knapp and Reena Roy, Ph.D., The Pennsylvania State University

Leeches are worms commonly found in water and can suck blood from a human host. These worms carry an anticoagulant, known as hirudin, in their salivary gland. These annelids have suckers, they conceal their cutting plates which hook onto human flesh, and after making a 2mm incision, they can then ingest from 5 mL to 15 mL blood from one human. If a perpetrator disposes a victim's body in a river, stream or pond, the leeches in the pool of water can hook onto the suspect's body. Once they are gorged with blood within about 30 minutes, they can fall off in the nearby area. In addition, they can help with identification of a victim or determine if a body had been in a certain area of the water. Therefore, they can become a valuable source of evidence for the forensic scientists.

Our research group has previously determined human identity from anopheles stephensi mosquito blood meals using Copan microFLOQ® Direct swabs and PowerPlex® Fusion 6C System to identify short tandem repeat (STR) DNA profiles. Massively parallel sequencing was also performed on the blood from the midgut of the same mosquitoes. In this current study, a similar approach was taken to identify human STR profiles from blood meal ingested by leeches. North American medicinal leeches were obtained from commercial source, and blood from male and female donors were fed to individual leeches. After a certain period of time, each leech was frozen quickly and then dissected. Once blood was identified in the midgut with presumptive test, presence of human blood was confirmed with various biological tests. After that, the tip of one swab was used to collect a minute amount of blood from the midgut area of each worm. These swabs, containing the human blood on their tips, were then used for direct amplification and STR profiles were determined using PowerPlex® Fusion 6C PCR amplification reagents. Known blood samples (reference samples) were also amplified using the Copan microFLOQ® Direct swabs and analyzed similarly. The Applied Biosystems™ 3130xl Genetic Analyzer was used for capillary electrophoresis. GeneMarker® HID V2.9.5 software (SoftGenetics LLC, State College, PA, USA) was used for analyzing the STR profiles.

Complete and concordant profiles, consistent with the reference profiles of the donors of blood were obtained from the midgut of the leeches using the above method. The results of this study indicate that Copan microFLOQ® Direct swab is an excellent way to amplify blood directly, even when the blood has been ingested by leeches. Complete STR profiles can be generated within a very short period using these swabs and the PowerPlex® Fusion 6C PCR amplification kit. Since only a minute quantity of blood is required, this method of collection and amplification is an excellent procedure for obtaining human identity from minute amounts of blood ingested by leeches and similar organisms. Future research will include sequencing the blood from the leech midguts in order to obtain additional information about the human donors.

***Determining Y-STR Profiles from Leeches Using Copan microFLOQ® Direct Swabs and the Yfiler® Plus Amplification Kit**

Elizabeth Knapp, Veronica Cappas, and Reena Roy, Ph.D., The Pennsylvania State University

Leeches are annelids which have been used for many centuries in the field of medicine. These worms carry an anticoagulant, known as hirudin, in their salivary glands. Once they hook onto human flesh, they make a small incision, and can ingest from 5 mL to 15 mL blood from one human.

Projects in our research group has included identifying human donors from blood meal ingested by mosquitoes using autosomal loci and massively parallel sequencing. Loci found on the Y-chromosome have been successfully used in many cases including sexual assault cases, particularly when there is more than one perpetrator or if the level of male DNA is low and amount of female DNA is very high. In this current project we used Copan microFLOQ® Direct swabs and Yfiler® Plus Amplification Kit to directly amplify Y-STR markers from blood ingested by leeches. This amplification kit is a 27-plex Y-STR system which include seven rapidly mutating Y-STR loci which allow for discrimination among related individuals. North American medicinal leeches were obtained from commercial source, fed blood meal and frozen at certain times. Blood from the midgut of the leeches were collected on the tip of the swabs and Y-STR loci amplified using the amplification kit. Known blood samples (reference samples) were also amplified using the Copan microFLOQ® Direct swabs and analyzed similarly.

Y-STR profiles were generated successfully from blood ingested by the leeches, and they were consistent with the reference profiles of the donors. The results of this study indicate that Copan microFLOQ® Direct swab is an excellent way to amplify Y-STR loci directly, even when the blood has been ingested by leeches. The direct amplification bypasses the time-consuming, labor-intensive extraction and quantitation steps. Complete Y-STR profiles were generated within a very short period using these swabs and the Yfiler® Plus Amplification Kit. Only a minute amount of blood is used for amplification, saving the evidence for other types of analysis such as autosomal STR and massively parallel sequencing.

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

Brianna Gregory and Janine Kishbaugh, M.S., Cedar Crest College

The presented research hopes to establish a way to increase the efficiency of sexual assault collection kits by determining optimal swab types for sample collection within 24 hours after oral sex. A lesser type of sexual assault, fellatio, was looked at to determine if male DNA can be prevalent enough in a female's mouth to create a full or partial profile. Choosing the optimal swab type is essential for picking up foreign material, such as sperm cells or male epithelial cells, from the mouth of the sexual assault victim. This study examined cotton and nylon flocked swabs to determine which of these may yield better profiles for collection of samples after fellatio. After a DNA extraction containing DTT was performed, the collected cells were amplified via PCR with Y-STR primers. The amplicons were then analyzed on a 3130xl genetic analyzer to see a Y specific STR profile of the male participant. Each swab type was also swabbed in three specific locations in the mouth to determine what location

was the most efficient for retaining male material. In addition, this research investigated different time intervals within 24 hours to determine the length of time a usable male DNA profile can be detected in the oral cavity after fellatio was performed. Participants in this study were asked to record activities that included eating, drinking, and oral hygiene to help gauge the effects that those activities have on the amount of DNA profile obtained. Resulting DNA profiles from analysis of samples at all time intervals have produced male DNA profiles. Swabs of the lips yielded the best results with cotton and nylon. An increase in observed alleles was obtained by increasing the electrophoresis injection to 10 seconds. The identification of successful sample collection methods including swab type and sampling areas could improve sexual assault investigation.

***DNA Quantitation Levels of Common Saliva Coated Forensic Samples**

Nyla Ngegba[1], Kelly Reading, B.S.[1], Lawrence Quarino, Ph.D.[1], Reena Roy, Ph.D.[2], and Janine Kishbaugh, M.S.[1]
1. Master of Science Forensic Science Program, Cedar Crest College
2. Eberly College of Science, The Pennsylvania State University

In forensic biology there is an ever present need to process evidentiary samples in a timely manner, without completely consuming the samples. By skipping quantitation, samples can be conserved and have less chance for contamination. This project is examining whether predictable amounts of DNA are present on oral-source DNA samples on common types of physical evidence, namely cigarettes, chewing gum, flaps of sealed envelopes and used drink containers. Predictable quantities of DNA would negate the need for DNA quantitation. In addition, the project is also statistically assessing the effects of outdoor environmental factors on predictable levels of DNA, if in fact predictable levels exist on control samples. Test samples were extracted using silica-based technology followed by quantitation using a SYBR® Green Alu-based qPCR method. Control samples used for comparison were kept under controlled conditions. Environmentally exposed samples were placed in an outdoor environment and left unattended (but protected) until sampling. In addition, some smoked cigarettes were collected from public areas. Statistical analysis will be performed to assess the effect of environmental conditions on DNA concentration. After collection and analyzation of over two hundred and fifty samples, preliminary results have shown that cigarettes are the most likely evidentiary type to have predictable quantities of DNA. It is hoped that the results of this study can aid forensic scientists in casework analytical schemes for these common evidence types.

***Exploring Bodily Fluid Stain Identification Using Raman and Microchemical Tests**

Morgan Maddock, B.S.[1], Megan Dunkle[1], Lawrence Quarino, Ph.D.[1], Lisa Mertz, M.S.[2], and Marianne Staretz, Ph.D.[1]
1. Master of Science Forensic Science Program, Cedar Crest College
2. NYC Office of Chief Medical Examiner

The methods for body fluid stain identification used in current crime laboratories lack efficiency in time and cost as well as preservation of limited samples. Some bodily fluids including menstrual blood, saliva, urine, and feces still require an identification test. Recent literature describes the use of Raman microspectroscopy to identify body fluid stains; however, substrate interference and spectral

intensity appear problematic. This research aims to capitalize on the use of Raman microspectroscopy for body fluid stain identification while eliminating the interference and sensitivity issues. To achieve this, extraction and isolation steps are employed to separate abundant and specific components within the four main body fluid types (blood, saliva, urine, semen). These isolated components, either in the form of microcrystals or precipitates, allow for signature spectra with Raman microspectroscopy, with greater spectral intensity and specificity. Currently, a method for urine stain identification has been developed by utilizing the enzymatic breakdown of urea and complexing the resulting ammonium with iodic acid to form characteristic crystals which give a characteristic Raman spectrum. A blood stain identification test involving hemoglobin precipitation followed by the addition of iodic acid appears to produce a Raman signature spectrum; however, the chemistry at this time is unknown. Concordance results with commercially purchased hemoglobin however have been obtained. In order to be effective with time and cost, the most limiting time frames and amount of reagents are being investigated. As of now, the urine test needs approximately thirty minutes for the enzymatic reaction to occur while the blood test can be reduced to ten minutes. Additionally, saliva and semen stain identification methods are being developed in a similar approach using microcrystal and precipitate formation.

American Forensic Practitioners' Opinions on Activity Level DNA Reporting

Yoon Yang[1], Mechthild Prinz, Ph.D.[2], Heather McKiernan, Ph.D.[3], and Fabio Oldoni, Ph.D.[1]
1. Department of Chemistry & Physics, Arcadia University
2. John Jay College of Criminal Justice
3. Center of Forensic Science and Research Education

The technical advancements made in DNA detection and profiling have allowed very low amounts of DNA to be analyzed; therefore, the argument often made in criminal courts is not who the DNA belongs to but rather how the DNA was deposited[1-3]. Activity level propositions have been considered to address and answer this question[1-3]. However, there are many factors that should be included when formulating propositions at activity level, such as transfer, persistence, prevalence, and recovery (TPPR). Despite the complexity, European laboratories have used evaluative reports of activity level propositions, and the European Network of Forensic Science Institutes (ENFSI) has issued specific guidelines on DNA reporting. The overall views on activity level DNA reporting in the U.S, however, are not well known. Therefore, this study aimed at obtaining an overview on the opinions of using activity level reporting held by forensic DNA practitioners in the U.S.

A seventeen-question survey was distributed through Qualtrics™ to members of the American Society of Crime Laboratory Directors (ASCLD) via the weekly Crime Minute and the International Society for Forensic Genetics (US members only) via email. The survey included multiple choice and open response questions and reached around 650 people.

Overall, there were 54 respondents to the survey in which 44 of them had over ten years of experience in DNA reporting at activity level. Of those 44 with over 10 years of experience, 72% agreed that despite having some concerns activity level reporting would be very (27%) or moderately (45%) useful. Only 31% believed that the current studies on DNA transfer were moderately adequate to provide empirical information on a case. A total of 41% of participants agreed that one year of

training on activity level DNA reporting would be sufficient for a scientist to testify as an expert witness. There were six major concerns for implementing activity level DNA reporting in the U.S.: 1) the number of variables to be considered in activity level reporting such as shedder status, amount of starting DNA, or differing transfer rates based on surfaces; 2) educating practitioners and the legal system; 3) lack of controlled studies with realistic scenarios; 4) issues in court with admissibility. With this regard, some participants expressed concern that activity level propositions will have a difficult time passing a Daubert hearing because the approach is not as concrete or statistically sound as a DNA profile match. Moreover, 5) need for a standardized approach or guidelines in the U.S.; 6) convincing the forensic community and reaching consensus.

These concerns expressed by U.S. forensic practitioners revealed a range of varying opinions on activity level reporting. Future research will involve expanding the participants to a global level.

A Perfect Match: Identifying the Victim of a Cold Case Homicide Using DNA, NamUs, and CODIS

Andrew J. Schweighardt, Ph.D., and Jonathan Holly, M.S., NYC Office of Chief Medical Examiner

In criminal investigations, a case with an unidentified decedent deprives family members of answers and may present a major obstacle to resolving the case. There have been significant scientific developments in the past twenty years that greatly improve the chances of success in cases with an unidentified victim. Today it is standard practice at forensic laboratories to develop DNA profiles of all unknown decedents and upload to the Unidentified Human Remains Index of the Combined DNA Index System (CODIS). Having the profile in the national database makes it available for comparison to antemortem profiles from the missing, profiles from relatives, and profiles from convicted offenders. Since 2007, the National Missing and Unidentified Persons System (NamUs) has been a government-sponsored nationwide clearinghouse to help expedite case associations. Investigators can upload case information about unidentified victims, which is then compared to information uploaded about missing persons. Possible matches are vetted and often confirmed with modern-day DNA technology.

In 1991, a male victim was fatally shot at close range in Queens, NY. The deceased man was not identified, and his body was interred at the Hart Island Cemetery. No biological evidence was submitted for forensic examination because DNA testing was not available. An absence of leads stalled investigative progress and the case grew cold. Then, in 2019, a woman submitted information about her missing father to NamUs. She also submitted a family reference sample, from which a DNA profile was developed and uploaded to the Relatives of Missing Persons Index of CODIS. Based on the information provided to NamUs, the NYC Office of Chief Medical Examiner (OCME) was notified of similarities in the details about the woman's missing father and the 1991 homicide victim. Agency identification and anthropology experts began by evaluating the cases. Based on the contextual information, a match could not be excluded, and the case was referred to the Department of Forensic Biology. Due to the absence of a postmortem specimen, a disinterment was initiated, and a bone specimen was provided for DNA testing. Specialized bone protocols were employed to develop a nuclear STR profile, which was uploaded to CODIS where it hit to the profile of the woman seeking her father. Kinship statistics were calculated and supported the familial relationship

of father and daughter. Based on the DNA results, the unidentified male was conclusively identified, and an amended death certificate was issued in his name. The case remains an active homicide investigation, which may now advance with the knowledge of the victim's identification.

The outcome of this case demonstrates the results that are possible when resources at the investigator's disposal are used to their maximum potential. Strong emphasis is placed on the need for relatives seeking the missing to be made aware of options such as NamUs and CODIS. Forensic laboratories must also recognize the benefits of retroactively creating DNA profiles for cases stemming from the pre-DNA era. Overall, this example illustrates how cases with an unidentified decedent can be resolved when three major tools coalesce – DNA technology, NamUs, and CODIS. None of these advancements were available until the recent past, and each makes a unique contribution to modern forensic investigations.

Forensic Genetic Genealogy: Myth or Fact?
Melissa Kotkin, Verogen

Forensic genetic genealogy (FGG) is a powerful tool for investigative lead generation. To date, it has been applied to more than 500 cold cases including violent crimes like sexual assaults, as well as the identification of unidentified human remains. As forensic laboratories consider how to implement this technique as part of their own workflow, multiple questions, concerns, and myths around FGG still exist. This presentation will address common questions associated with FGG and shed light on evaluation and implementation considerations for those determining how they might move forward with FGG.

Common Misconceptions and the Need for Best Practices in Forensic Genetic Genealogy
Claire Glynn, Ph.D., Henry C. Lee College of Criminal Justice and Forensic Sciences, University of New Haven

Forensic Genetic Genealogy (FGG) is a rapidly evolving professional field and sub-discipline of genomics, genealogical science, and forensic genetics. While the roles and impact of FGG experts, including scientists and other professionals in the field, have rapidly expanded, the best practices in the forensic use of genetic genealogy have yet to be established, nor are there clear standards for the pedagogy and competencies that must be mastered through expert training and continuing education. Most importantly, the field demands constant, fundamental, and critical analysis of the societal, privacy, and ethical impacts of the use of genetic genealogical data in forensic settings. Much of the privacy and ethical impacts that have come under scrutiny, both within the forensic science industry and the public view, are derived from a lack of understanding, or indeed perceived misconceptions about the FGG process, the tools and databases used, and the handling of individuals genetic data. This presentation will address several of the common misconceptions surrounding this new investigative tool and will discuss the critical need for establishing a collaborative framework bringing together academics, forensic practitioners, legal and ethical professionals, and law enforcement agencies, to establish comprehensive best practices for practitioners in this field, both nationally and internationally.

***Investigating the Use of Forensic Genetic Genealogy (FGG) on Degraded DNA Samples**

Julia Dollen, and Claire Glynn, Ph.D., Henry C. Lee College of Criminal Justice and Forensic Sciences, University of New Haven

Forensic Genetic Genealogy (FGG) has become an increasingly popular topic within the forensic science community, but there has yet to be any robust research regarding its use with biological samples that may be degraded. When a crime scene DNA sample does not generate a "match" in the Combined DNA Index System (CODIS), or is too degraded to make an identification, forensic genetic genealogy is an alternative method of identification that could be employed. This study investigated the manual "degradation" of raw DNA data derived from Direct-To-Consumer (DTC) DNA testing companies (e.g., Ancestry DNA, 23andMe etc.). Following written informed consent, volunteers who had previously taken a DTC DNA test downloaded their own raw DNA datafile from their account and submitted the file to the PI/Researcher. Using Microsoft Excel, the data from the Single Nucleotide Polymorphisms (SNPs) analyzed was manually, and randomly, deleted in increasing percentages (e.g., 5%, 10%, 15%, 20%, 25%, 30%, 40%, and 50%) to mimic real degradation. Each of the new "degraded" datafiles were then uploaded to GEDMatch as "Research" uploads. GEDMatch generates match lists of other individuals who have uploaded their raw DNA datafiles to the database. The top 10 matches for each file upload were recorded to assess if those matches changed in their rank, or were lost, as the percentage of data deletion (i.e., "degradation") increased. Three volunteer's raw DNA datafiles were used in this study to represent individuals who have high centimorgan (cM) top matches (~880cM), and low centimorgan (cM) top matches (~56cM). The aim of this is to investigate at which point of degradation will a familial relationship to a match be lost or altered. The results of this study revealed that as the degree of "degradation" increased, the order in which matches were ranked was altered, and in some cases lost completely. This information can greatly impact an FGG investigation as it is typically those top 10 matches that lead FGG investigators to the identity of their unknown subject. Therefore, if a crime scene sample is known to be heavily degraded, it is crucial to strategize appropriate methods of analysis to generate as much data as possible from the DNA sample, e.g., perform Whole Genome Sequencing (WGS), or indeed DNA repair, rather than the more standard approach of SNP microarrays. The topic of degraded biological samples has not been greatly investigated using this new investigatory tool, and this research will contribute to the growing body of knowledge about Forensic Genetic Genealogy and its use in forensic investigations.

***Quantifying UV-Induced Primer Binding Site Damage in DNA**

Sabrina Martins, and David San Pietro, Henry C. Lee College of Criminal Justice and Forensic Sciences, University of New Haven

DNA analysis developments have significantly changed how evidence is processed. There are various conditions that exist where DNA can be damaged, intentionally, or not. One common condition that induces DNA damage is UV-light exposure. UV-light primarily causes dimer formation or abasic sites in DNA leading to gaps in the helix. Depending on the extent and location of the damage, DNA profiles may be incomplete due to partial or complete allele drop out. Alleles in DNA profiles are determined by the short tandem repeat (STR) region that vary among individuals. Prior to profiling,

samples are amplified through the polymerase chain reaction (PCR) in which primers bind to the primer binding site (PBS) in DNA. Although the STR region is variable among individuals, the primer-binding site is a clearly defined known sequence present at the loci analyzed. Damage in these regions may inhibit sample amplification and the generation of a DNA profile. However, due the primer binding site's consistent size and nature, it may be possible that repair of that specific region may improve DNA profiles. Alternatively, it is possible that damage to the specific PBS regions may not have an appreciable effect on the ability to generate a STR profile. Although previous studies focused on the repair of damaged samples, there is a lack of research on the specific mechanism(s) of DNA damage to more specifically defined areas (i.e., primer binding sites). By gaining a better understanding of the mechanisms of DNA damage, more effective repair methods can be created and utilized without risking STR region alteration. Primers were exposed to UV-light at various time periods, ranging from 5 seconds to 300 seconds, and the TPOX locus was profiled through capillary electrophoresis. Peak height ratios were calculated over this range to measure the possible damage and its effect on the recovered DNA profile from a single individual. Observed trends in peak height ratios may indicate when damage starts to affect recovered DNA profiles that may lead to better repair methods with future studies.

***DNA Recovery and Transfer on Non-Porous Surfaces Submerged in Spring Water**

Morgan Korzik, and David San Pietro, Henry C. Lee College of Criminal Justice and Forensic Sciences, University of New Haven

Submerged items are commonly thought to lack evidentiary value. For instance, some investigators believe that all DNA could be lost once an item is exposed to a flowing current or tossed into a body of water. However, previous studies have shown the ability to recover DNA from submerged porous items for upwards of six weeks. The crevices or interweaving fibers in porous items are thought to protect DNA from being washed away. Smooth non-porous surfaces inherently lack the traits that might aid in DNA retention. Previous studies have shown that alleles from stains on non-porous surfaces can still be detected up to three days submersion, but allele dropout can occur as early as twelve hours into the submersion period. As far as the authors are aware, studies have reported the percentage of alleles but not the quantity of DNA recovered from submerged non-porous items. We have hypothesized that, because non-porous surfaces do not have traits that might aid in DNA retention, then DNA quantities and the number of alleles recovered will decrease over longer submersion periods. Additionally, we have hypothesized that DNA quantity and the number of alleles will decrease at a slower rate in stagnant water versus in a flowing current. Neat saliva of known DNA quantity will be applied to glass slides and exposed to stagnant and flowing spring water to observe the effects on both DNA quantity and STR amplification. Four experimental phases will be run: (1) blank and sample slides from one donor exposed to stagnant water, (2) blank and sample slides from one donor exposed to flowing water, (3) blank and sample slides from two donors exposed to stagnant water, and (4) blank and sample slides from two donors exposed to flowing water. Results from the first two phases support that DNA quantities decrease, and allele dropout occurs when samples are submerged for longer times, especially when samples are exposed to flowing water. Additionally, preliminary results have suggested that transfer and allele drop-in may occur from sample to blank slides submerged in the same water vessel. The amount of transfer from sample to blank appears expedited when exposed to flowing water. Research is continuing in the last two phases

to determine if mixed profiles can result from DNA transfer through the surrounding water. Observed results could indicate the possibility that DNA recovered from submerged non-porous evidence is a result of transfer.

***Evaluating the Discriminating Power of Hair Amino Acid Ratios on Distinguishing Individuals Using GCMS**

Timothy Yaroshuk and Alyssa Marsico, Henry C. Lee College of Criminal Justice and Forensic Sciences, University of New Haven

Currently, the conventional methods of analysing hair include microscopic hair comparison (MHC) and DNA analysis (nuclear and mitochondrial), with nuclear DNA analysis being the most individualizing. However, MHC is subjective and nuclear DNA analysis is not always possible if not enough adequate cells are present. Non-synonymous amino acid changes in the hair protein sequence – resulting from single nucleotide polymorphism profiles that differ between each individual – can be exploited to offer alternative routes for hair analysis. Currently, proteomics has successfully exploited genetically variant peptides (GVP) content in hair to differentiate at least non-related individuals. However, proteomics is complicated and requires the GVPs to remain intact. Analysing amino acid content is an alternative method that may simplify the analysis. It has been demonstrated that analysing amino acid quantities has abilities to differentiate people based on general class characteristics of sex, age group, and geographical origin. A study by Macri et al., analysing amino acid ratios of two individuals with morphologically similar hair, discovered 15 amino acid ratios that differed. Expanding on this study, this research will evaluate the discriminating power of using hair amino acid ratios to differentiate individuals with a focus on increasing the sample size and diversity. The purpose of this study is to develop a method that can supplement MHC to reduce subjectivity of hair analysis in case DNA analysis cannot be conducted.

Hair samples were obtained from 9 consenting individuals and were anonymized. Plucked hairs were obtained except for 1 individual where hair cut samples were obtained. 2 separate hair samples were collected from the same individual where one set was dyed, and another was natural. Hairs were thoroughly washed with deionized water and methanol to remove surface contaminants. They were then prepared in triplicates where hairs were cut into smaller pieces and hydrolyzed with hydrochloric acid for protein digestion. Subsequently, the sample was filtered to remove unhydrolyzed hair pieces and an aliquot was dried under a gentle stream of nitrogen. L-norvaline was then added as an internal standard. After reconstituting in ethyl acetate, N,O-Bis(trimethylsilyl)trifluoroacetamide was added for amino acid derivatization. GCMS was used for analysis. A set of 11 standard derivatized amino acids, including L-norvaline, in ethyl acetate was also analysed using GCMS for quantitation purposes.

Eight derivatized amino acids were detected from the hair samples in addition to a glutamic acid derivative. Identification was conducted by comparing sample retention times to standards as well as mass spectra library comparison. Quantitation relative to the internal standard was completed and 36 amino acid ratios were constructed from these quantities. Outliers for each ratio were determined by the Grubbs test for samples with more than 3 data points and outliers were discarded. Between the 10 hair samples analyzed, one-way ANOVA for all 36 ratios had $p<0.05$. Most individuals were differentiable using the post-hoc Tukey test for all ratios. For the samples that could not be

differentiated with this method, 3D-PCA plot showed distinct clustering of individuals therefore allowing differentiation. Ratios between dyed hair samples were differentiable from undyed hair.

Paving the Way for New Technology in a Post-Pandemic Criminal Justice System
Rachel Oefelein, DNA Labs International

The COVID-19 pandemic rocked forensic laboratories across the United States with laboratories seemingly overnight having to resort to closures, shift work, social distancing, and massive supply shortages. As the light at the end of the tunnel begins to become clearer, new technology is emerging. Advances in probabilistic genotyping, Rapid DNA, SpentShell™ testing, new screening testings for urine and menstrual blood, pyrosequencing, hair shaft testing, phenotyping, Next Generation Sequencing (NGS), and genealogy testing tailor-made for forensics will all be ushered into casework processing in 2021. How will this new technology be implemented? How will it be presented in court with many courts still shut down or limited to virtual hearings and trials? Finally, this presentation will discuss the lessons learned as a result of 2020 and what that means for the technology utilized in the laboratory.

Scientific Sessions: Forensic Drug Chemistry

Wednesday, November 3rd, 2021

Freedom

Chairperson: Joanna Urban, State of Connecticut, Division of Scientific Services

Wednesday, November 3, 2021 **1:50 PM – 4:35 PM**

01:50pm – 01:55pm **Opening Remarks**

01:55pm – 02:15pm **Using LC/MS Q-TOF for the Analysis of Seized Drug Evidence**
Anna Weaver, New Hampshire State Police Forensic Lab

02:15pm – 02:35pm ***Development of Novel Approaches for Efficient Cannabinoid Detection and Quantification in Edibles, Beverages, Personal-care Products and Plant Materials**
Megan Chambers and Rabi A. Musah, PhD., University at Albany - SUNY

02:35pm – 02:55pm **Development and Evaluation of a New DART-MS Data Interpretation Tool**
Edward Sisco[1], Arun S. Moorthy[1], and Stephen Tennyson[2]
1. National Institute of Standards and Technology
2. University of Maryland, College Park

2:55pm – 3:15pm **Afternoon Break**

3:15pm – 3:35pm ***Detection of Δ9-Tetrahydrocannabinol and Metabolites in the Meibomian Lipids of Tear Samples Through LC-MS/MS**
Allen Mello[1], Sabra Botch Jones[1], Denise Valenti, OD[2], and Jamie Foss[3]
1. Boston University – Biomedical Forensic Sciences; Boston, MA
2. IMMAD: Impairment Measurement Marijuana and Driving; Quincy, MA
3. Perkin Elmer, Inc.; Shelton, CT

3:35pm – 3:55pm **Integrating the Thermo Scientific™ TruNarc™ Analyzer into a Seized Drug Laboratory Workflow – A Compilation of Curious Circumstances in Casework**
Stephanie Minero, Nassau County Office of the Medical Examiner, Division of Forensic Services

3:55pm – 4:15pm ***Novel Presumptive Tests for Drugs of Abuse Using Chemiluminescence**
Giulia Romano and Lindsey A Welch, PhD, Cedar Crest College

4:15pm – 4:35pm **Tetrahydrocannabinol (THC) Identification and Semi Quantitation by GC/MS**

Alexandra Kocaj and Nicholas Ciccone, Nassau County Office of the Medical Examiner, Division of Forensic Services

***Denotes Peter R. De Forest Collegiate Competition Participant**

Using LC/MS Q-TOF for the Analysis of Seized Drug Evidence
Anna Weaver, New Hampshire State Police Forensic Lab

The New Hampshire State Police Forensic Laboratory has been working with an Agilent 1260 Infinity II Liquid Chromatograph (LC) with a 6530C Quadrupole/Time-of-Flight Mass Spectrometer (Q-TOF) detector in the Drug Chemistry Unit for approximately four years. The intent of this instrument purchase was to assist in the analysis of thermally labile compounds like psilocybin, gabapentin and GHB. Additionally, the LC/MS Q-TOF was considered a likely candidate for the testing of other troublesome analytes, such as cannabinoids, which tend to stick around on the gas chromatograph-mass spectrometer (GC/MS) leading to carry-over issues. This presentation will cover the pros and cons of using this technology for drug chemistry casework, particularly the significant differences that set it apart from the current "gold standard" confirmation technique in drug chemistry, the GC/MS. This presentation will review the daily instrument preparation and quality control measures that were developed to ensure that the instrument is functioning as expected before samples are run, especially as they compare to that of the GC/MS. The fully validated psilocybin/psilocin/bufotenine method will be discussed, as will the method to qualitatively identify the presence of Δ^9-THC in edibles. Finally, additional analytes that are in the method development process currently, as well as those that are in the pipeline, will also be covered. This presentation will be helpful to other forensic chemists who are considering the purchase of an LC of any kind and those who are currently or shortly will be in the process of method development or validation of a similar instrument.

***Development of Novel Approaches for Efficient Cannabinoid Detection and Quantification in Edibles, Beverages, Personal-care Products and Plant Materials**
Megan Chambers, University at Albany - SUNY; Rabi A. Musah, PhD., University at Albany - SUNY

The most recent National Institute of Justice *Report to Congress: Needs Assessment of Forensic Laboratories and Medical Examiner/Coroner Offices* (2019), identified several challenges that have emerged in forensic laboratories due to the "legalization and decriminalization of marijuana." As a result, new methods must be developed for the detection and quantification of the major psychoactive cannabinoid tetrahydrocannabinol (THC) in a variety of plant-based substances, edibles infused with cannabinoids, and extracts derived from *Cannabis sativa* plant material. Protocols currently implemented in forensic labs lack uniformity and require extensive sample preparation steps. This project focuses on utilizing the unique abilities of direct analysis in real time – high-resolution mass spectrometry (DART-HRMS) for the detection and quantification of THC and cannabidiol (CBD) in cannabinoid-infused complex matrices, including edibles, beverages, personal-care products, and *C. sativa* plant materials.

Previous accomplishments under this project demonstrated the application of DART-HRMS to rapidly detect cannabinoids in *C. sativa* plant material (i.e., hemp and marijuana), edibles prepared in-house and edible certified reference materials with no sample pretreatment. Therefore, to

demonstrate the versatility of this method, additional complex matrices were investigated, including beverages and personal-care products. Aliquots of various beverages were spiked with either THC or CBD standards at concentrations representative of those in commercial products. When analyzed by DART-HRMS in positive-ion mode, a peak at m/z 315, which is consistent with the protonated mass $[M+H]^+$ of THC and CBD, was readily detected in all spiked beverages. DART-HRMS analysis of several personal care-products (e.g., soaps, lotions, balms) derived from hemp extract/oil readily detected CBD in each product in their native form. Control samples (either blank beverage matrices or personal-care products not manufactured with hemp extract/oil) were also analyzed in this study. Despite the complexity of their matrices, none of the experimental controls exhibited peaks that overlapped with those that would be consistent with the presence of cannabinoids.

The successful detection of cannabinoids in complex matrices prompted the development of quantification protocols using DART-HRMS. Protocols have been developed for the quantification of CBD in traditionally challenging edible matrices (i.e., gummies, chocolates, marshmallows) prepared in-house. Extraction protocols and the DART-HRMS method for quantification are being optimized for integration into current forensic laboratory workflows.

In addition, the application of DART-HRMS for differentiation of hemp and marijuana varieties of *C. sativa* was investigated. Plant materials of both varieties were obtained from multiple geographical locations and sources. Preliminary statistical analysis revealed the potential for differentiating hemp and marijuana by DART-HRMS. These results prompted application of advanced statistical processing to the DART-HRMS data, which revealed m/z values important for differentiating these two *C. sativa* varieties with a high level of certainty. The identities of several m/z values have been confirmed, while the identification of the remaining masses is currently underway.

Results of this work will substantially impact forensic science and criminal justice practice in the U.S. by providing crime labs with novel, validated methods for the rapid detection, differentiation, and quantification of complex *Cannabis*-derived evidence that circumvent some of the most frequently reported problems associated with traditional methods.

Development and Evaluation of a New DART-MS Data Interpretation Tool

Edward Sisco, National Institute of Standards and Technology; Arun S. Moorthy, National Institute of Standards and Technology, Stephen Tennyson, University of Maryland, College Park

As seized drug chemists continue to face a number of analytical challenges due to the presence of emerging drugs and novel psychoactive substances, many laboratories are adopting new technology. One technology that is being increasingly implemented is direct analysis in real time mass spectrometry (DART-MS). While DART-MS provides a rapid, information rich analysis with minimal sample preparation, data interpretation is not straightforward. This is especially true when the sample contains multiple components. To address this gap, researchers at NIST have been developing analysis software referred to as the DART-MS *Data Interpretation Tool* (DIT). The DIT has several features, such as report generation and library viewing, that have been developed with input from the forensics community. The DIT works with a wide range of input files and is now freely available. A key function implemented in the DIT is the *Inverted Library Search Algorithm* (ILSA). The

ILSA is a new search method specifically designed for DART-MS data, leveraging multiple in-source collision induced dissociation (is-CID) spectra to produce numeric similarity scores for potential components in an unknown sample. This presentation will discuss the process of creating the DIT as well as the evaluation and ongoing optimization of the ILSA. Initial evaluation efforts, using spectra from actual casework, have shown excellent agreement between results obtained with the DIT and the gas chromatography mass spectrometry (GC-MS) results. Better performance than peak-list searching approaches which are commonly used with DART-MS data has been demonstrated largely due to the ability to rule out one or more constitutional isomers since multiple is-CID spectra are leveraged.

***Detection of Δ9-Tetrahydrocannabinol and Metabolites in the Meibomian Lipids of Tear Samples Through LC-MS/MS**

Allen Mello, Boston University – Biomedical Forensic Sciences; Sabra Botch Jones, Boston University – Biomedical Forensic Sciences, Denise Valenti, OD, IMMAD: Impairment Measurement Marijuana and Driving, Jamie Foss Perkin Elmer, Inc.

There exist limitations with current methods of detection of Δ9-Tetrahydrocannabinol (THC) drug analyte in Driving Under the Influence of Drugs (DUID) cases. This research explores the use of meibomian tear fluid as a novel matrix to detect THC and its accompanying analytes.

This research focused on the detection and quantitation of THC, 11-Hydroxy- THC (11-OH THC), and 11-nor-carboxy-THC (THCOOH) as these analytes are produced in the metabolism of Δ9-THC. Meibomian fluid maintains a high lipid concentration and Fatty Acid Binding Protein 5 (FAPB5), a protein known to bind to cannabinoids. Due to the lipophilic nature of THC, tear fluid could be used as a less-invasive biological matrix to test for the presence of THC and its metabolites.

This project optimized a collection of tear fluid, to create a method suitable for direct injection. Collection was completed by BVI Weck-Cel® Sterile Cellulose strips, measuring approximately 2 x 20 mm, and placed in Thompson eXtreme PVDF 0.2 ∝m, pre-slit, red cap, filter vials containing Quantisal buffer solution. All analysis and calibrations were completed with fortified matrix standards with concentrations ranging from 0.25 - 250 ng/mL. Method validation was consistent with Academy Standards Board (ASB) Standards of Forensic Toxicology Standard 036, First Edition 2018.

Tear samples were collected from participants according to Institutional Review Board (IRB) standards before and after administration of Marijuana. Samples were collected approximately 30 minutes post. Samples and calibration standards were analyzed using Liquid Chromatography Tandem Mass Spectrometry (LC/MS-MS) with the QSight® 220 CR LC/MS/MS and using a Halo® C18 3.0x50 mm (2.7 μm) column. Limit of Detection (LOD) and Quantitation (LOQ) for THC was calculated at 0.25 ng/mL. The LOD of THCOOH was detected at 0.25 ng/mL and LOQ was calculated at 1 ng/mL. The LOD of 11-OH-THC was detected at 2 ng/mL and was not quantitated. Upon analysis of participant samples, it was determined that THC and metabolites could be detected and quantitated in tear fluid. However, it is noted that insufficient sample volume in collection is an issue that leads to poor quantitation and can readily be optimized in future research.

Integrating the Thermo Scientific™ TruNarc™ Analyzer into a Seized Drug Laboratory Workflow – A Compilation of Curious Circumstances in Casework

Stephanie Minero, M.S., ABC-DA Nassau County Office of the Medical Examiner, Division of Forensic Services

Classified as a SWGDRUG and ASTM Category A technique due its increased level of selectivity, the Thermo Scientific™ TruNarc™ Analyzer has the ability to rapidly identify drugs of abuse, precursors, and common diluents with little or no sample preparation required. An accompanying Type H test kit allows for the analysis of many fluorescent compounds and some low concentration analytes. Over the last several years, the Nassau County Office of the Medical Examiner, Division of Forensic Services purchased several units to implement into its seized drug laboratory workflow as a screening technique. The laboratory has previously presented that integration of this technique resulted in a more efficient workflow for routine cases and decreased case turnaround time in both the analytical and technical review phases.

Almost two years after its qualification for use in casework, several circumstances have been encountered that may pique the curiosity of the forensic community and fellow seized drug analysts. These include the performance of a proper self-check, scanning of colored packaging and the dangers it presents, the analysis of colored solid material with the Type H Kit, fentanyl analogues and possible "false positives" in complex mixtures.

This presentation will discuss modifications to the procedure manual and scheme of analysis to continue to mitigate false positives/negatives, differences between field and laboratory applications and their potential impact, potential root causes, and beneficial information received from Thermo Scientific technical support requests.

***Novel Presumptive Tests for Drugs of Abuse Using Chemiluminescence**

Giulia Romano, Cedar Crest College; Lindsey A Welch, PhD, Cedar Crest College

Benzodiazepines are often used for treatment of insomnia, convulsions, and many psychiatric disorders. The widespread use of this class of drugs has raised concern about recreational benzodiazepine abuse. This highlights the importance of chemical detection and concentration determination of the benzodiazepine drugs within a human system. Although there are many different approaches to detection, this proposal outlines a novel presumptive testing method using chemiluminescence. A comparative study was designed to analyze three azepine drugs, carbamazepine, clonazepam, and diazepam, in a range of concentrations. The chemiluminescent reagents to be discussed are tris(2,2'-bipyridyl) ruthenium (II) chloride hexahydrate $Ru(bipy)_3Cl_2 \bullet 6 H_2O$ with cerium (IV) sulfate, known as method A and n-bromosuccinimide, known as method B. Chemiluminescence was detected using a Berthold Lumat^3 tube luminometer. Method A was more selective toward carbamazepine and clonazepam. While method B was more selective toward diazepam. These drugs were detected in concentration ranges of 100 mM to 0.1 mM. The results from this work suggest novel presumptive tests for these drugs of concern. These methods require

minimal sample preparation, offer a rapid screening process, and facilitate the detection of these compounds in biologically relevant concentrations.

Tetrahydrocannabinol (THC) Identification and Semi Quantitation by GC/MS

Alexandra Kocaj, Nassau County Office of the Medical Examiner, Division of Forensic Services; Nicholas Ciccone, Nassau County Office of the Medical Examiner, Division of Forensic Services

On March 8th, 2020, New York State first integrated the definition of hemp into the New York State Agriculture and Markets Law, Title 505. This amendment defined hemp as "*Cannabis Sativa L.* containing less than 0.3% (w/w) delta 9-tetrahydrocannabinol" and thus currently requires an analytical scheme that allows the differentiation of cannabis from hemp. The Nassau County Office of the Medical Examiner, Division of Forensic Services has developed a semi-quantitative analysis method using Gas Chromatography-Mass Spectrometry in order to meet this new requirement. By comparing an unknown sample to a decision limit of 1% (w/w) delta 9-tetrahydrocannabinol (THC), the laboratory can determine if submitted evidentiary material in vegetative form can be confirmed as cannabis.

An overview of the advantages of developing, validating, and implementing a semi-quantitative method will be discussed, in addition to the challenges encountered and their resolutions. Specific studies conducted during the validation including selectivity, linearity, stability, accuracy, and intermediate precision will be included. Noted challenges include the selection of an internal standard, preparation of the positive control, potential interfering compounds, and integration parameters. Recommendations for training and competency testing as well as successful participation in the National Institute of Standards and Technology (NIST) Cannabis Quality Assurance Program will be included. Completion of the program and the successful training of the analysts showcase the robustness of the method and prove it reliable for confirming the presence of cannabis.

Scientific Posters & Welcome Reception

Wednesday, November 3rd, 2021, 5:00-6:45pm

Marriott Atrium / Exhibitor Area

Chairperson: Keri Labelle, Massachusetts State Police Crime Laboratory, MA

Wednesday, November 3, 2021 **5:00 PM – 6:45 PM**

***Analysis of Benzodiazepines in Urine by UHPLC-MS/MS: Meeting the Requirements of ASB Standard 121**
Abby Houliston, Boston University School of Medicine; Jamison Whitten (co-presenter), Boston University School of Medicine; Simone Rumph (co-presenter), Boston University School of Medicine; Nadine Koen, Boston University School of Medicine; Halia Haynes, Boston University School of Medicine; Reshma Gheevarghese, Boston University School of Medicine; Sabra Botch-Jones, Boston University School of Medicine; Jamie Foss, PerkinElmer, Inc.

The Center for Advanced Research in Forensic Science (CARFS): An Industry/University Cooperative Research Center
Adam B. Hall, Boston University School of Medicine; Jose Almirall, Florida International University; Michael Chambers, University of South Alabama; Aaron Tarone, Texas A&M University; Sarah Kerrigan, Sam Houston State University

***Estimating Muzzle to Target Distance from the Physical Characteristics of a Bullet Hole in Different Wood Substrates**
Alan Lee, John Jay College of Criminal Justice; Peter Diaczuk, PhD, John Jay College of Criminal Justice

***Bullet Behavior After Perforation of Intermediate Substrate into Ballistic Gelatin**
Alisia Tseytina, John Jay College of Criminal Justice; Peter Diaczuk, PhD, John Jay College of Criminal Justice

***The Differentiation of Dark Colored Automotive Carpet Fibers using Plane-Polarized Light Ultraviolet-Visible Microspectrophotometry**
Andra Lewis, Sam Houston State University; Dr. Patrick Buzzini, PhD, Sam Houston State University

How Did the Case Cross the Fence?
Andrew Winter, Middlesex County Prosecutor's Office (NJ); Janell Chuddley, Centenary University; Peter Diaczuk, PhD, John Jay College of Criminal Justice

***Evaluating the 12 gauge Less-lethal Baton Shotshell**
Britania Walters, John Jay College of Criminal Justice; Peter Diaczuk, PhD, John Jay College of Criminal Justice

Improving Current Methodology used in the Forensic Analysis of Bisulfite Modified DNA Samples
Deborah Silva, Hofstra University; Haley Ecker, Hofstra University; Johnisa Walcott, Hofstra University

Autolytic Generation of Ethanol in Decomposing Mammalian Liver
Gabrielle Messe, University of New Haven; Natalia Gabrys, University of New Haven; Robert H. Powers, University of New Haven

***High Resolution Mass Spectrometry Screening in Impaired Driving Investigations**
Jessica Ayala, Sam Houston State University; Dr. Sarah Kerrigan, Sam Houston State University

***Evaluation of Cannabidiol and Δ9-Tetrahydrocannabinol Use via a Qualtrix Survey**
Kourtney Albert, Arcadia University; Karen S. Scott, PhD, Arcadia University

***Analysis of Polymer Coated Bullets Using Spectroscopic Methods**
Liana Albano, John Jay College of Criminal Justice; Peter Diaczuk, PhD, John Jay College of Criminal Justice

The Visualization of Bruises Using Alternate Light Source
Wan Yu Tan, Boston University School of Medicine; Karen Kelly, Brody School of Medicine, East Carolina University; Ann Marie Mires, Anna Maria College; Sabra Botch-Jones, Boston University School of Medicine

DNA Recovery and Transfer on Non-Porous Surfaces Submerged in Spring Water
Morgan Korzik, University of New Haven; David San Pietro, PhD, University of New Haven

***Analysis of Benzodiazepines in Urine by UHPLC-MS/MS: Meeting the Requirements of ASB Standard 120**
Nadine Koen, Boston University School of Medicine; Halia Haynes (co-presenter), Boston University School of Medicine; Simone Rumph (co-presenter), Boston University School of Medicine; Abby Houliston, Boston University School of Medicine; Jamison Whitten, Boston University School of Medicine; Reshma Gheevarghese, Boston University School of Medicine; Sabra Botch-Jones, Boston University School of Medicine; Jamie Foss, PerkinElmer, Inc.

Quantifying UV-induced Primer Binding Site Damage in DNA
Sabrina Martins, University of New Haven; David San Pietro, PhD, University of New Haven

***Evaluation of a Facile Synthesis of Lefetamine Analogs**
Savannah Brown, University of New Haven; Koby Kizzire, PhD, University of New Haven

Soil Mineral Analysis by Particle Correlated Raman Spectroscopy (PCRS): Optimized Dispersion and Double-Pass Raman Analysis
Savannah Brown, University of New Haven; Hannah Garvin, University of New Haven; Nicholas Gogola, University of New Haven; Gabrielle A. Messe, University of New Haven; Chase Notari, University of New Haven; Virginia Maxwell, PhD, University of New Haven; John A. Reffner, PhD, John Jay College of Criminal Justice; Peter R. De Forest, D.Crim, John Jay College of Criminal Justice; Christopher Palenik, PhD, Microtrace LLC; Peter de B. Harrington, PhD, Ohio University; Deborah Huck-Jones, PhD, Malvern Panalytical Ltd; Bridget O'Donnell, PhD, HORIBA Scientific; Andrew Whitley, PhD, HORIBA Scientific; Brooke W. Kammrath, PhD, University of New Haven

Evaluating the Discriminating Power of Hair Amino Acid Ratios on Distinguishing Individuals using GCMS
Timothy Yaroshuk, University of New Haven; Alyssa Marsico, University of New Haven

Detectors for GC Analysis of Ethanol in Blood
Tom Mancuso, PerkinElmer, Inc; Alan Gallaspy, PerkinElmer, Inc

***Effects of Improper Ammunition Storage**
Victoria Andre, John Jay College of Criminal Justice; Peter Diaczuk, PhD, John Jay College of Criminal Justice.
Patrick McLaughlin, MS, John Jay College of Criminal Justice

***Denotes Peter R. De Forest Collegiate Competition Participant**

Poster Abstracts

***P1. Analysis of Benzodiazepines in Urine by UHPLC-MS/MS: Meeting the Requirements of ASB Standard 121**

Abby Houliston, Boston University School of Medicine; Jamison Whitten (co-presenter), Boston University School of Medicine; Simone Rumph (co-presenter), Boston University School of Medicine; Nadine Koen, Boston University School of Medicine; Halia Haynes, Boston University School of Medicine; Reshma Gheevarghese, Boston University School of Medicine; Sabra Botch-Jones, Boston University School of Medicine; Jamie Foss, PerkinElmer, Inc.

Benzodiazepines are a widely prescribed class of drugs used to treat seizures, anxiety, and sleep disorders. They act as central nervous system depressants with rapid onset of action and although they are often administered voluntarily, their abuse rate in drug facilitated crimes (DFC) has become increasingly prevalent in today's society. A DFC is a crime which occurs when a person is victimized while mentally or physically incapacitated due to the effects of drug, and DFCs often involve the use of benzodiazepines due to their sedative and amnesic effects. Analytical detection of benzodiazepines in DFC cases requires high sensitivity because the drug analytes could be present in low concentrations due to their high potency. In accordance with ASB Standard 121 - Standard for the Analytical Scope and Sensitivity of Forensic Toxicology Testing in Drug-Facilitated Crime Investigations, urine is the typical biological specimen for analytical testing in DFCs because it can provide an extended window of detection for analytes after the alleged incident. The main objective of this project was to develop a LC-MS/MS method for the separation and detection of six benzodiazepines in accordance with the ASB Standard 121 - Standard for the Analytical Scope and Sensitivity of Forensic Toxicology Testing in Drug-Facilitated Crime Investigations.

P2. The Center for Advanced Research in Forensic Science (CARFS): An Industry/University Collaborative Research Center

Adam B. Hall, Boston University School of Medicine; Jose Almirall, Florida International University; Michael Chambers, University of South Alabama; Aaron Tarone, Texas A&M University; Sarah Kerrigan, Sam Houston State University

The goals of the Industry/University Cooperative Research Center (I/UCRC) Center for Advanced Research in Forensic Science (CARFS) are to bring together industrial and governmental partners, including the end-user community, with academic forensic science researchers with an aim to develop, implement and commercialize tools that benefit the national forensic science research enterprise. CARFS tackles emerging forensic science problems. Our two main sites are located at Florida International University and University of South Alabama with affiliate sites at Texas A&M University, Boston University and Sam Houston State University. Our Industrial Advisory Board (IAB) provides guidance on the direction of projects at the forefront of forensic science. Faculty affiliated with the center are distributed across key disciplines in science, social science, engineering, and statistics, with interests that cover a wide array of forensic disciplines. The CARFS research

program is designed to address key issues in forensic science identified by the 2009 NAS report, and to develop innovative technologies and investigative approaches for forensic practice.

NSF-I/UCRC enables industrially relevant, pre-competitive research via multimember, sustained partnerships across industry, academe, and government. NSF supports the development and evolution of I/UCRCs, by providing a financial and procedural framework for membership and operations. It also promotes best practices learned over decades of fostering public/private partnerships that produce significant value to the nation, industry and university faculty and students. Participating researchers perform cutting-edge, pre-competitive fundamental research in technology areas of interest to industry and government partners which can drive innovation and the U.S. economy. Members guide the direction of Center research through active involvement and mentoring. I/UCRCs offer a platform for significant leveraging of financial investment by members to accelerate the knowledge base in emerging technologies and manufacturing sectors while developing an industrially savvy workforce to benefit US economy.

***P3. Estimating Muzzle to Target Distance from the Physical Characteristics of a Bullet Hole in Different Wood Substrates**

Alan Lee, John Jay College of Criminal Justice; Peter Diaczuk, PhD, John Jay College of Criminal Justice

Muzzle to target distance is an integral part of crime scene reconstruction, but methods of determining this distance can be limited depending on the condition the crime scene is in. In this study, our goal was to explore how the physical damage characteristics of bullet holes may lead to clues in determining muzzle to target distance. Test fires were conducted with a .22 caliber rifle over a range of muzzle to target distances and different bullet velocities. The goal of the study was to simulate an indoor shooting on plywood and Medium Density Fiberboard (MDF) panels. The results of our study show that as muzzle to target distance increases, bullet hole depth decreases. In addition, specific damage patterns were observed on the back of the substrates relating to shooter distance and bullet velocity. A predictions model was developed using this data that allowed shooter distance to be estimated based on bullet hole depth. Conclusions were made that with some finetuning, this method may aid forensic scientists in casework concerning ballistics.

***P4. Bullet Behavior After Perforation of Intermediate Substrate into Ballistic Gelatin**

Alisia Tseytina, John Jay College of Criminal Justice; Peter Diaczuk, PhD, John Jay College of Criminal Justice

In wound ballistics, how a bullet will behave after perforating or penetrating an object is difficult to predict. Upon impact, there is loss of momentum and possible trajectory change as well as orientation changes. The aim of this experiment was to see, under controlled conditions, how a bullet behaves after it has perforated a substrate, then entered a tissue simulant at close range. The experimental design was set up to model a home invasion scenario; common household construction materials (wood, MDF, sheet metal, glass etc.) were used to simulate items that could be used for protection/cover; ballistic gelatin used as a simulant for a human body; and a Ruger 10/22 with .22

LR ammunition used as the firearm. Variables focused on throughout the experiment were depth of penetration (DoP), orientation, damage done (cavity formations inside the gelatin) and change in velocity of the bullet. Data taken from straight shots into the gelatin, with no intermediate object, was used as a baseline for each variable. The results of this experiment showed that thickness of the substrate affected the velocity of the bullet as well as its DoP, but the material of the substrate affected the damage done. Substrates that can shatter or splinter, like glass, wood, and sheet metals, were observed to deal the most damage from secondary shrapnel. By understanding how bullets can behave under controlled conditions, these observations and insights can someday be used in and applied to real life crime scene cases.

***P5. The Differentiation of Dark Colored Automotive Carpet Fibers using Plane-Polarized Light Ultraviolet-Visible Microspectrophotometry**

Andra Lewis, Sam Houston State University; Dr. Patrick Buzzini, PhD, Sam Houston State University

Automotive carpet fibers found in vehicles are made from recycled polyester derived from plastic bottles and blends of fibers including polyamides, polypropylene (PP), polyester (PET), and polyolefins. The analysis of these fibers is challenging due to their peculiar and blended compositions. Most fiber examinations start with light microscopy for both identification and comparison purposes followed by visible microspectrophotometry and/or thin layer chromatography (TLC).

The inclusion of the ultraviolet spectral range may provide further discriminatory capabilities and studies have shown the discriminating potential of dichroism (plane polarized microscopy or PPL) in conjunction with visible MSP. This research aims to investigate the combined discriminating power of light microscopy in combination with different capabilities of UV-vis MSP-PPL in determining objective criteria to develop a protocol for the capture, processing, and interpretation of spectral patterns for fiber specimens encountered in casework.

In this project, forty (40) macroscopically similar black automotive carpet fibers were analyzed using microscopical examinations to include color and fluorescence followed by different applications of UV-vis microspectrophotometry. The microspectrophotometer used in this study was not only equipped with full polarizing capabilities (i.e., polarizing filters and a rotating stage), but the analyzer and the polarizer transmitted UV radiation down to 240nm, making pairing of the ultraviolet with plane polarized light a reality. The results of this study showed ~70% of the samples provided further discriminatory information through the combination of both ultraviolet radiation and plane polarized light to the characterization and differentiation of the fibers.

P6. How Did the Case Cross the Fence?

Andrew Winter, Middlesex County Prosecutor's Office (NJ); Janell Chuddley, Centenary University; Peter Diaczuk, PhD, John Jay College of Criminal Justice

Law enforcement regularly encounters two primary types of handguns at shooting scenes – the revolver and the semi-automatic pistol. Both of these very common platforms of firearms are designed

to discharge a projectile. However, the semi-automatic pistol can potentially leave additional evidence behind at the scene as the spent case is extracted and ejected from the firearm. These spent cases can be present at a shooting scene and become quite significant to investigators and crime scene personnel in their effort to determine where the shooting occurred, how far the shooter was from his/her intended or unintended target, and the location of the shooter in relation to the spent cases with an obstacle (fence) in the scene. Various factors including ejection port location, materials utilized in different types of pistol ammunition, the height and way the firearm is held, and the caliber variations among pistols will affect the flight of the spent case. This project focuses on the height and distance that spent cases can travel from the ejection port of a semi-automatic pistol and travel over a fence commonly seen in crime scenes.

***P7. Evaluating the 12 gauge Less-lethal Baton Shotshell**

Britania Walters, John Jay College of Criminal Justice; Peter Diaczuk, PhD, John Jay College of Criminal Justice

Less-lethal ammunition and other less-lethal weapons have been used to take control of certain situations that do not require lethal approaches. Less-lethal ammunition and other less lethal tactics are used all over the world. The use of less-lethal ammunition has gained popularity in the United States due to the recent protests of the Black Lives Matter Movement. Less-lethal ammunition, previously known as "nonlethal ammunition," was developed and used for crowd control during riots and protests or simply to incapacitate a suspect without causing any major harm to the individual. These projectiles were designed to minimize fatalities, permanent injuries, damage to properties and the environment. Soon after this ammunition was used in public, it was discovered that it could still be lethal to individuals. Less-lethal ammunition has shown to have caused fatalities during the recent protests. Since less-lethal ammunition is being used more by law enforcement and the military, many injuries have been reported. This project will have a critical review of scientific literature highlighting the history of less-lethal ammunition, past studies carried out highlighting some of the effects of less-lethal ammunition, and statistical data of injuries to civilians caused by less-lethal ammunition during the Black Lives Matter Protests across the U.S. Several experiments will be performed to measure the effects and impact of lethal ammunition. The aim of this study is to determine the different components of the less-lethal projectile(s) used, to observe the possible damage that the tested less-lethal ammunition can do to simulated body tissue and to propose the design of an even "lesser-lethal" bullet.

P8. Improving Current Methodology used in the Forensic Analysis of Bisulfite Modified DNA Samples

Deborah Silva, Hofstra University; Haley Ecker, Hofstra University; Johnisa Walcott, Hofstra University

In forensic science, DNA serves as a vital tool that can tie a victim, suspect, or witness to a crime. More recently, forensic scientists have started to explore epigenetics and its application in forensic analysis. The epigenome is the "layer of information" on top of our existing genetic code, and it participates in differences between individuals, complete human populations, and contributes to physical and behavior differences. Studying DNA methylation patterns is advantageous for the

forensic field as it can be used to identify the type of tissue or fluid at a crime scene, determine the sex of the sample donor, estimate the age of the sample donor, and distinguish between monozygotic twins. Since PCR amplification does not give any information about a DNA strand's methylation status (methylation is not preserved in this process), bisulfite modification is often used in order to get this information. In this process, DNA is treated with sodium bisulfite to convert unmethylated cytosines into uracil but does not alter the methylated cytosines. This is a harsh process that changes the chemical structure of the DNA and can damage the strands, making it not ideal for forensic samples as the environment may limit the amount of DNA, we are able to work with. The main goal of this research was to modify the current methodology used in bisulfite modification and subsequent PCR to repair damaged DNA and to improve data generation and also the downstream analysis of results. To achieve this goal, we first tested two different kits to bisulfite modify DNA samples. Then we performed a modified PCR that involved adding repair enzymes to the reaction mix and an extra step to thermocycling conditions in order to repair the damaged DNA before the start of the amplification process. Using NanodropOne, we were able to analyze the results of the modified protocol, confirm the quality and quantity of methylated DNA samples and evaluate which protocol yielded the most PCR products (with or without repair enzymes). The protocol using the EZ DNA methylation-lightning kit coupled with the added repair enzymes to the PCR process presented the best performance and higher yield of PCR products. The results obtained in this initial study are important to show that it is possible to improve the quality of DNA samples after going through a harsh chemical modification, which will then provide better results in DNA amplification and other downstream methods and analysis.

P9. Autolytic Generation of Ethanol in Decomposing Mammalian Liver

Gabrielle Messe, University of New Haven; Natalia Gabrys, University of New Haven; Robert H. Powers, University of New Haven

A postmortem MV crash case was recently presented to this group in which the detection of significant levels of ethanol in a postmortem liver sample had been utilized as evidence of antemortem intoxication of the decedent, with significant legal ramifications. Because of the traumatic nature of the death, blood samples had not been retained for analysis. However, a liver sample was recovered at autopsy and retained for toxicologic analysis. While the potential for improperly preserved or stored blood samples to generate alcohol is well recognized in the forensic community, the potential for similar generation in liver samples has not been similarly documented in the forensic literature.

During both the autolytic and putrefactive stages of decomposition, volatile organic compounds (VOCs) are generated by the biochemical reactions of tissue decay. Autolysis encompasses the first stage of decomposition and is characterized by endogenous enzyme activity that degrades cell membranes. Decomposition is then characterized by extensive microbial activity and a pattern of volatile compound generation distinct from the autolytic period. In working with volatile generation in hepatic homogenates of both rat and pig, consistent appearance of ethanol during the autolytic period has been demonstrated in a time/temperature dependent fashion. Hepatic homogenates were incubated at different temperatures for a several daytime span, with sample aliquots removed every twelve hours in order to evaluate the temporal relationships of VOC generation. Headspace-GCMS

was utilized to identify volatile materials in triplicate at each time point. Ethanol generation was observed in rat homogenates as early as 12 hours at 28°C incubation temperature and 24 hours at room temperature. Similarly, ethanol generation was observed in pig liver homogenate at 36 hours at room temperature.

Based on these findings, particularly with reference to the conditions under which the liver sample in the case had been stored prior to analysis, significant autolytic generation of ethanol appeared to be a reasonable underlying explanation for its presence. Subsequent testing of a properly preserved vitreous sample that had been reserved in the case (but had not previously been analyzed) was negative for the presence of alcohol, thus consistent with the suggestion of autolytic generation of ethanol in the liver.

The potential for generation of ethanol in the autolytic stage of decomposition may be important for evaluation of future postmortem casework.

***P10. High Resolution Mass Spectrometry Screening in Impaired Driving Investigations**
Jessica Ayala, Sam Houston State University; Dr. Sarah Kerrigan, Sam Houston State University

Impaired driving investigations have become increasingly more challenging with the influx of new psychoactive substances (NPS) into the drug market. NPS become more prevalent as drug users pursue "legal highs." However, as these compounds gradually become controlled substances, new structural analogues emerge. As a result, traditional immunoassay-based drug screening is unable to keep pace with new and emerging drug trends. Immunoassays are not available for all drugs or drug classes, and due to their reliance on antibody-based reagents, they are expensive and time consuming to develop. When used alone, they have insufficient scope and sensitivity. As a result, forensic toxicology laboratories are exploring high resolution mass spectrometry (HRMS)-based technologies for toxicological drug screening. The purpose of this study was to re-analyze adjudicated blood specimens and compare HRMS-based drug screening to reported immunoassay results.

***P11. Evaluation of Cannabidiol and Δ9-Tetrahydrocannabinol Use via a Qualtrix Survey**
Kourtney Albert, Arcadia University, Karen S. Scott, PhD, Arcadia University

Cannabidiol (CBD) has shown exponential growth over the past decade as an off-label alternative medicine mainly for the management of pain. Δ9-Tetrahydrocannabinol (THC) continues to be one of the most commonly used drugs of abuse worldwide, however increasing numbers of the population now own legal medical marijuana cards, adding a potential new subset of the individuals to the cannabis using population. Both CBD and THC are sold in many forms, including but not limited to pills, flower buds, tinctures, beauty products, and candies.

For this research, a survey was sent out to members of the extended Arcadia University community via Qualtrix. The survey asked questions regarding biological sex, age, CBD and THC usage, and forms of products used. The total number of respondents to the survey was 84. The most common age range of participants was 18-29, but a maximum age of 70+ was seen. 63 (75%) of respondents were

female. 62 (73.8%) of the respondents reported using CBD products. For those who used CBD products, the most common product forms were oils, gummies, and lotions. The main three reasons for use were stress, pain/arthritis, and anxiety. 60 (71.4%) of the respondents reported using THC products. For those who used THC products, the three most used products were marijuana leaf, edibles, and dab pens. The main reasons for use were recreation, medical card allowance, and anxiety. 53 (63.1%) of respondents used both CBD and THC products. This survey has served as a steppingstone in understanding CBD and THC usage within the extended Arcadia community. In addition to the survey, participants who used only CBD products were asked if they would be willing to provide samples of product and biological samples, allowing for future research to be conducted on product integrity as well as CBD presence in urine and saliva by LC-MS/MS.

***P12. Analysis of Polymer Coated Bullets Using Spectroscopic Methods**

Liana Albano, John Jay College of Criminal Justice; Peter Diaczuk, PhD, John Jay College of Criminal Justice

Polymer coated bullets have gained popularity in recent years. To determine the composition of two polymer coated bullets (American Eagle Syntech (red polymer) and Syntech Defense 9 mm Luger (blue polymer)), the solubility, melting point and molecular vibrations of the polymers were examined. Our results indicate that the blue and red polymers studied had very different solubilities, melting points and molecular vibrations. Infrared spectroscopy revealed that the blue polymer had similar functional groups to dimethyl iso phthalate while the red polymer had similar functional groups to poly(ethylene glycol terephthalate). These results confirm that both polymers have different compositions as evident by the vast differences in solubility, melting point, and their infrared signatures. The next step would be to study various targets shot with polymer coated bullets for the presence of polymer residue. This can be helpful to link evidence from a crime scene to known polymer coated bullets.

P13. The Visualization of Bruises Using Alternate Light Source

Wan Yu Tan, Boston University School of Medicine; Karen Kelly, Brody School of Medicine, East Carolina University; Ann Marie Mires, Anna Maria College; Sabra Botch-Jones, Boston University School of Medicine

With the global pandemic, there has been mandatory movement restrictions by countries around the world. There has also been an increase in domestic abuse; such violence often presents in many forms with physical abuse heading the list. This study was conducted to enable forensic officers to make use of existing crime scene equipment to enhance the visualization of bruises on victims of abuse. When a case of abuse is reported, evidence of the abuse must be documented. Traditional methods of investigation involve questioning the victim or abuser, followed by documentation using photography and note-taking which may not accurately represent the injuries. In addition, the amount of force used, area of injury and the age of the injuries could affect the appearance of blunt force trauma including bruising. At times only redness is observed on the victim's skin making the injury difficult to document; such injuries would constantly be overlooked.[5,6] Alternate Light Source (ALS) is a common, cheap, and effective piece of equipment used by forensic examiners at the crime scene to

reveal objects missed by the naked eye. With the use of ALS, the documentation of existing bruises can be enhanced, while bruises that are missed by the naked eye can be revealed.

In this study, the effectiveness of visualization of blunt force injuries (contusions) to the skin at different ALS wavelengths was evaluated to determine the optimal wavelength for documentation of bruises.[7,8,9,10] Bruises were inflicted on 57 participants with no known medical conditions following institutional approval. The participant was in a seated position while a cylindrical ball of ~465 grams was dropped at a height of 1.5 meters through a vertically positioned tube onto the ventral surface of the participant's forearm. The injury site was then observed and documented under white light, 415nm, 460nm and 550nm. Photographs of the forearm were taken under at all wavelengths prior to bruising, immediately after bruising, 3 hours after bruising, and at specific time points over a period of 21 days. The results showed better visualization of the injury observed at a wavelength of 415nm and 460nm.

A blind study was conducted using the same methodology to determine the validity of the experiment. A colleague was briefed and tasked to conduct a blind trial on 12 participants following institutional approval where the researcher has no knowledge on which participant the bruise was inflicted on. Photographic documentation and observations were recorded with the results only made known to the researcher at the end of the experiment. It showed that the methodology is accurate at about 75%. This study shows that the use of ALS provided an effective alternative with the visualization and documentation of blunt force traumatic injuries compared to traditional documentation methods without added cost and should be considered for use in future cases involving trauma and physical abuse. Additionally, since ALS is the standard crime scene equipment, the documentation of bruising by forensic examiners can be initiated in the field prior to transport of victim to either the hospital or morgue setting.

P14. DNA Recovery and Transfer on Non-Porous Surfaces Submerged in Spring Water
Morgan Korzik, University of New Haven; David San Pietro, PhD, University of New Haven

Submerged items are commonly thought to lack evidentiary value. For instance, some investigators believe that all DNA could be lost once an item is exposed to a flowing current or tossed into a body of water. However, previous studies have shown the ability to recover DNA from submerged porous items for upwards of six weeks. The crevices or interweaving fibers in porous items are thought to protect DNA from being washed away. Smooth non-porous surfaces inherently lack the traits that might aid in DNA retention. Previous studies have shown that alleles from stains on non-porous surfaces can still be detected up to three days submersion, but allele dropout can occur as early as twelve hours into the submersion period. As far as the authors are aware, studies have reported the percentage of alleles but not the quantity of DNA recovered from submerged non-porous items. We have hypothesized that, because non-porous surfaces do not have traits that might aid in DNA retention, then DNA quantities and the number of alleles recovered will decrease over longer submersion periods. Additionally, we have hypothesized that DNA quantity and the number of alleles will decrease at a slower rate in stagnant water versus in a flowing current. Neat saliva of known DNA quantity will be applied to glass slides and exposed to stagnant and flowing spring water to observe the effects on both DNA quantity and STR amplification. Four experimental phases will be run: (1) blank and sample slides from one donor exposed to stagnant water, (2) blank and sample

slides from one donor exposed to flowing water, (3) blank and sample slides from two donors exposed to stagnant water, and (4) blank and sample slides from two donors exposed to flowing water. Results from the first two phases support that DNA quantities decrease, and allele dropout occurs when samples are submerged for longer times, especially when samples are exposed to flowing water. Additionally, preliminary results have suggested that transfer and allele drop-in may occur from sample to blank slides submerged in the same water vessel. The amount of transfer from sample to blank appears expedited when exposed to flowing water. Research is continuing in the last two phases to determine if mixed profiles can result from DNA transfer through the surrounding water. Observed results could indicate the possibility that DNA recovered from submerged non-porous evidence is a result of transfer.

***P15. Analysis of Benzodiazepines in Urine by UHPLC-MS/MS: Meeting the Requirements of ASB Standard 120**

Nadine Koen, Boston University School of Medicine; Halia Haynes (co-presenter), Boston University School of Medicine; Simone Rumph (co-presenter), Boston University School of Medicine; Abby Houliston, Boston University School of Medicine; Jamison Whitten, Boston University School of Medicine; Reshma Gheevarghese, Boston University School of Medicine; Sabra Botch-Jones, Boston University School of Medicine; Jamie Foss, PerkinElmer, Inc.

Driving under the influence of drugs (DUID) cases have involved the use of impairing substances such as alcohol and many other psychoactive drugs, specifically sedative-hypnotic drugs. Benzodiazepines are classified as central nervous system depressants that have become more widely prescribed for the treatment of anxiety, PTSD, and sleep disorders. A study in Finland showed a trend of increasing DUID cases from 1977-2007 with the number of cases increasing 18-fold. The researchers found the most common class of drugs detected were benzodiazepines (75.7%). This upward trend of abuse seen in this class of drugs calls for the continued development of increasingly sensitive analytical methods. The main objective of this project was to develop a UHPLC-MS/MS method for the separation, detection, and quantitation of nine benzodiazepines in accordance with the ASB Standard 120 - Standard for the Analytical Scope and Sensitivity of Forensic Toxicology Testing in Impaired Driving Investigations.

P16. Quantifying UV-induced Primer Binding Site Damage in DNA

Sabrina Martins, University of New Haven; David San Pietro, PhD, University of New Haven

DNA analysis developments have significantly changed how evidence is processed. There are various conditions that exist where DNA can be damaged, intentionally, or not. One common condition that induces DNA damage is UV-light exposure. UV-light primarily causes dimer formation or abasic sites in DNA leading to gaps in the helix. Depending on the extent and location of the damage, DNA profiles may be incomplete due to partial or complete allele drop out. Alleles in DNA profiles are determined by the short tandem repeat (STR) region that vary among individuals. Prior to profiling, samples are amplified through the polymerase chain reaction (PCR) in which primers bind to the primer binding site (PBS) in DNA. Although the STR region is variable among individuals, the primer-binding site is a clearly defined known sequence present at the loci analyzed. Damage in these regions may inhibit

sample amplification and the generation of a DNA profile. However, due the primer binding site's consistent size and nature, it may be possible that repair of that specific region may improve DNA profiles. Alternatively, it is possible that damage to the specific PBS regions may not have an appreciable effect on the ability to generate a STR profile. Although previous studies focused on the repair of damaged samples, there is a lack of research on the specific mechanism(s) of DNA damage to more specifically defined areas (i.e., primer binding sites). By gaining a better understanding of the mechanisms of DNA damage, more effective repair methods can be created and utilized without risking STR region alteration. Primers were exposed to UV-light at various time periods, ranging from 5 seconds to 300 seconds, and the TPOX locus was profiled through capillary electrophoresis. Peak height ratios were calculated over this range to measure the possible damage and its effect on the recovered DNA profile from a single individual. Observed trends in peak height ratios may indicate when damage starts to affect recovered DNA profiles that may lead to better repair methods with future studies.

***P17. Evaluation of a Facile Synthesis of Lefetamine Analogs**
Savannah Brown, University of New Haven; Koby Kizzire, PhD, University of New Haven

An ongoing challenge forensic drug laboratories and law enforcement face is the development of new psychoactive substances (NPS), also commonly known as designer drugs. These NPSs are often structural analogs of controlled substances which are created to mimic their effects. These compounds can be purchased from online chemical research companies, or they can be produced in clandestine laboratories. As drugs are controlled based on their unique chemical structure, analogs can skirt legalities associated with certain controlled substances. These compounds also create analytical difficulties for forensic drug laboratories as new structures emerge to stay ahead of legal regulations and may not be available in databases or as reference standards for purchase.

Lefetamine is a Schedule IV drug in the United States, and its analogs are not explicitly controlled by current legislation. User reports have shown interest in lefetamine analogs with ketamine-like effects, such as ephenidine and diphenidine, which have already been regulated internationally. A publicly available lefetamine synthesis was identified as having abuse potential in a clandestine setting, and due to the simplicity of the structures of these compounds, it could easily be modified to pursue analog production. This method was investigated by both direct and modified reproduction of the synthesis to produce non-controlled analogs. While direct reproduction was found to have limited utility, minor modifications expected of operators with limited knowledge were found to easily produce the compounds of interest in higher purities. The analysis of products and impurities in this work has the potential to aid forensic identification of this synthetic strategy and provide literature resources for comparison.

P18. Soil Mineral Analysis by Particle Correlated Raman Spectroscopy (PCRS): Optimized Dispersion and Double-Pass Raman Analysis
Savannah Brown, University of New Haven; Hannah Garvin, University of New Haven; Nicholas Gogola, University of New Haven; Gabrielle A. Messe, University of New Haven; Chase Notari, University of New Haven; Virginia Maxwell, PhD, University of New Haven; John A. Reffner, PhD, John Jay College of Criminal Justice; Peter R. De Forest, D.Crim, John Jay College of Criminal

Justice; Christopher Palenik, PhD, Microtrace LLC; Peter de B. Harrington, PhD, Ohio University; Deborah Huck-Jones, PhD, Malvern Panalytical Ltd; Bridget O'Donnell, PhD, HORIBA Scientific; Andrew Whitley, PhD, HORIBA Scientific; Brooke W. Kammrath, PhD, University of New Haven

The analysis of soils has become a neglected field in forensic science due to the perception of current practices as being overly time-consuming, subjective, and ineffective. The potential value of soil evidence is incontrovertible, and thus several analytical approaches are being researched which can revitalize the use of soil as forensic evidence. Particle Correlated Raman Spectroscopy (PCRS) is a recently developed technique that has demonstrated value for forensic soil analysis, as it combines particle size distribution and morphological measurements with chemical identification by Raman spectroscopy. This technique is non-destructive, rapid, and can be automated; thus, PCRS may provide more detailed information than traditional methods about a soil sample.

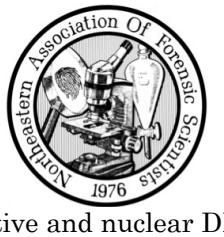
Previous research identified optimized parameters for the identification of soil minerals via PCRS. Such parameters included the laser wavelength and power, magnification, exposure time, and grating. These parameters, which were initially optimized using 10 diverse minerals, have been applied to the 60 most commonly encountered minerals. Traditional figures of merit and response surface modeling of a multi-level experimental design was used to confirm the optimized Raman collection parameters. It was concluded that a double-pass Raman analysis, using two laser wavelengths, is needed to identify the majority of the soil minerals. Further, total Raman acquisition times of 1 second per particle were achieved which would enable a large number of mineral grains to be identified in a reasonable time period, thus making it possible to have robust datasets for subsequent statistical analysis. Prior research also began the process of parameter optimization for the vacuum dispersion of soil samples. Proper dispersion must be attained to minimize overlapping or clustered particles so that data can be accurately obtained for individual particles. Soil samples were prepared for analysis by washing alone, washing and sieving, or analyzed with no further preparation. Each sample was then dispersed onto glass analytical plates with various combinations of vacuum dispersion parameters (sample volume, vacuum pressure, and time for dispersal and settling). The dispersion was assessed microscopically via PCRS for reproducibility, uniformity, dispersion density, and the maintenance of particle morphological characteristics throughout the processing. PCRS was also used to analyze four morphological characteristics of these dispersed samples – area, diameter, ellipse ratio, and circularity – at three points on the analytical plate – center, 2 cm from center, and 3.5 cm from center.

The results from this research, optimized PCRS analysis parameters, will next be applied to a large collection of soil samples to create a robust database combined with statistical analysis to support the evidentiary significance of soil. Optimization of sample preparation, dispersal, and Raman analysis parameters are necessary to take full advantage of the discriminating power of PCRS for soil analysis.

P19. Evaluating the Discriminating Power of Hair Amino Acid Ratios on Distinguishing Individuals using GCMS

Timothy Yaroshuk, University of New Haven; Alyssa Marsico, University of New Haven

Currently, the conventional methods of analyzing hair include microscopic hair comparison (MHC) and DNA analysis (nuclear and mitochondrial), with nuclear DNA analysis being the most



individualizing. However, MHC is subjective and nuclear DNA analysis is not always possible if not enough adequate cells are present. Non-synonymous amino acid changes in the hair protein sequence – resulting from single nucleotide polymorphism profiles that differ between each individual – can be exploited to offer alternative routes for hair analysis. Currently, proteomics has successfully exploited genetically variant peptides (GVP) content in hair to differentiate at least non-related individuals. However, proteomics is complicated and requires the GVPs to remain intact. Analyzing amino acid content is an alternative method that may simplify the analysis. It has been demonstrated that analyzing amino acid quantities has abilities to differentiate people based on general class characteristics of sex, age group, and geographical origin. A study by Macri et al., analyzing amino acid ratios of two individuals with morphologically similar hair, discovered 15 amino acid ratios that differed. Expanding on this study, this research will evaluate the discriminating power of using hair amino acid ratios to differentiate individuals with a focus on increasing the sample size and diversity. The purpose of this study is to develop a method that can supplement MHC to reduce subjectivity of hair analysis in case DNA analysis cannot be conducted.

Hair samples were obtained from 9 consenting individuals and were anonymized. Plucked hairs were obtained except for 1 individual where hair cut samples were obtained. 2 separate hair samples were collected from the same individual where one set was dyed, and another was natural. Hairs were thoroughly washed with deionized water and methanol to remove surface contaminants. They were then prepared in triplicates where hairs were cut into smaller pieces and hydrolyzed with hydrochloric acid for protein digestion. Subsequently, the sample was filtered to remove unhydrolyzed hair pieces and an aliquot was dried under a gentle stream of nitrogen. L-norvaline was then added as an internal standard. After reconstituting in ethyl acetate, N,O-Bis(trimethylsilyl)trifluoroacetamide was added for amino acid derivatization. GCMS was used for analysis. A set of 11 standard derivatized amino acids, including L-norvaline, in ethyl acetate was also analyzed using GCMS for quantitation purposes.

Eight derivatized amino acids were detected from the hair samples in addition to a glutamic acid derivative. Identification was conducted by comparing sample retention times to standards as well as mass spectra library comparison. Quantitation relative to the internal standard was completed and 36 amino acid ratios were constructed from these quantities. Outliers for each ratio were determined by the Grubbs test for samples with more than 3 data points and outliers were discarded. Between the 10 hair samples analyzed, one-way ANOVA for all 36 ratios had $p<0.05$. Most individuals were differentiable using the post-hoc Tukey test for all ratios. For the samples that could not be differentiated with this method, 3D-PCA plot showed distinct clustering of individuals therefore allowing differentiation. Ratios between dyed hair samples were differentiable from undyed hair.

P20. Detectors for GC Analysis of Ethanol in Blood

Tom Mancuso, PerkinElmer, Inc; Alan Gallaspy, PerkinElmer, Inc

Accuracy of compound ID/quantitation is of paramount importance in forensic analysis of Blood Alcohol. Bad data = Not Guilty. Dual column confirmation is the historical gold standard for compound ID in Blood Alcohol analysis by FID and is known for its high accuracy/robustness to produce high quality forensic data. Mass spec detection is the gold standard in many other industries such as environmental as the mass spectrum produced is a fantastic tool for compound identification

especially of unknowns. Concept here is to combine both technologies to obtain the power of the mass spec for compound ID but utilize the FID for its robustness/ability to produce highly accurate and precise results.

***P21. Effects of Improper Ammunition Storage**

Victoria Andre, John Jay College of Criminal Justice; Peter Diaczuk, PhD, John Jay College of Criminal Justice; Patrick McLaughlin, MS, John Jay College of Criminal Justice

Firearms are commonly used by law enforcement, hunters, and civilians either for protection, sport, or criminal activity. Ammunition is used in traditional firearms such as rifles and handguns, and consists of a cartridge case, propellant, a bullet (projectile), and primer. The two types of priming systems within the cartridge that are commonly used today are rimfire and centerfire cartridges. For research purposes, cartridges can be fired to observe and record their performance. To obtain velocity measurements, optical chronographs, or a Doppler radar unit such as the LabRadar are commonly used. As with all ammunition, there are malfunctions that can occur. Improper ammunition storage is one major factor that plays a role in ammunition failure. Work stress and environmental factors can cause ammunition failure to occur as well. Another form of improper ammunition storage is where the storage environment being used abruptly changes due to an external liquid or solid material submerging the ammunition. As a result, ammunition failure and damage to the firearm may occur if used. While this situation can commonly happen, little research is seen if and how ammunition would function when used in a compromised condition. This study observed how ammunition function is affected when it is improperly stored in the following materials: water, soil, Hoppes 9 Solvent (a gun bore cleaner that contains kerosene, ethyl alcohol, and ammonium hydroxide), and WD-40, (a water-displacing spray that contains aliphatic petroleum distillates and petroleum base oil). This research showed that although there were distressed cartridges that fired successfully with an expected average velocity measurement obtained, the majority of the cartridges exhibited changes such as ammunition failure, low velocity and anomaly velocity measurements. All of the distressing materials used had an adverse effect on the cartridges, with Hoppes 9 Solvent being the most detrimental on all cartridge sets. These findings encourage future work to be done to observe any additional detrimental effects of improper ammunition storage in an external liquid or solid.

***Denotes Peter R. De Forest Collegiate Competition Participant**

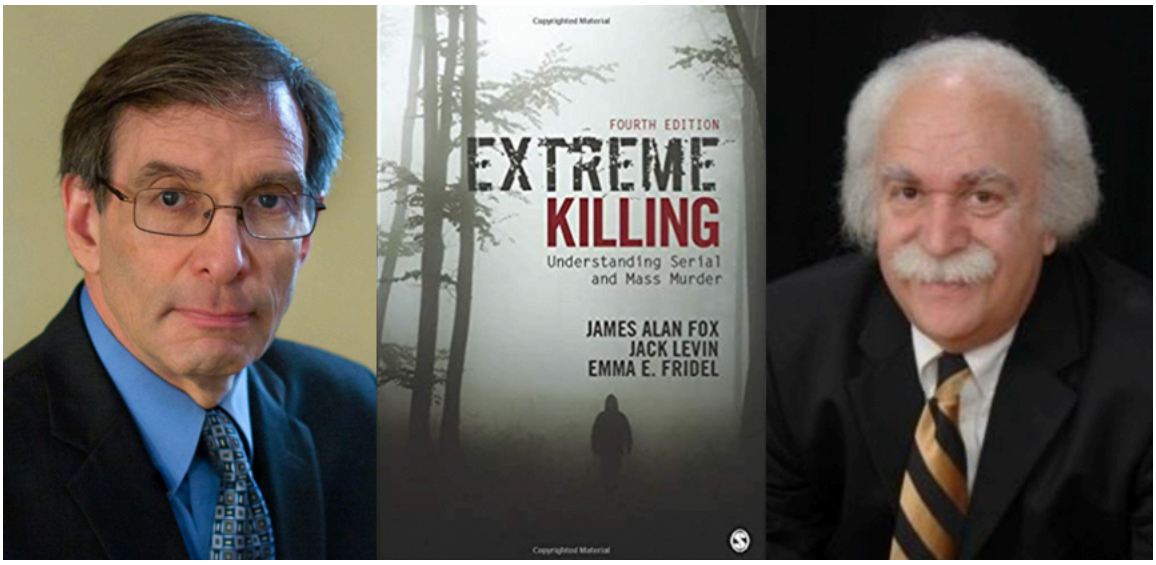
Plenary Session I: *Extreme Killing - Understanding Serial & Mass Murder*

Salons 1 & 2

Session Moderator: Adam B. Hall, Boston University School of Medicine, MA

Wednesday, November 3, 2021 **7:00 PM – 10:00 PM**

James Alan Fox ***Jack Levin***



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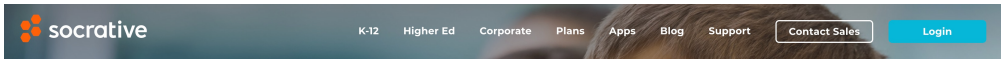

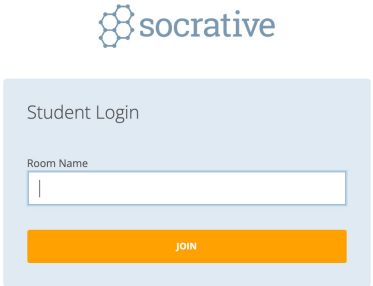

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Mass Murder at Home, Work, School, and in Public Places

James Alan Fox, Ph.D.
The Lipman Family Professor of Criminology, Law, and Public Policy
Northeastern University

Presentation Abstract

Over the past decade, the topic of mass murder has appeared frequently on the Associated Press annual list on the Top 10 news stories on the year. In 2018, the Parkland school shooting landed as Number One and several others collectively as Number Four. The intense focus on mass killings—especially mass shootings—is hardly new, as Americans have long and repeatedly been shocked and outraged over these senseless acts of carnage.

This presentation will examine the trends, patterns, and contributing factors underlying the various types of mass killing, including family annihilations, hate-inspired attacks on specific groups of people, and indiscriminate rampages in public places with special attention to school massacres.

The widespread fear that mass shootings are on the rise has encouraged a number of policy proposals—some worthwhile yet others ill-advised. This presentation will attempt to add some needed perspective to the epidemic thinking and critically assesses some of the solutions that have been advanced by politicians and the public alike.

James Alan Fox Bio

James Alan Fox is The Lipman Family Professor of Criminology, Law and Public Policy at Northeastern University. He has published eighteen books, including *Extreme Killing: Understanding Serial and Mass Murder, The Will to Kill: Making Sense of Senseless Murder, and Violence and Security on Campus: From Preschool Through College*. He has published widely in academic and popular outlets, and as a member of its Board of Contributors, his opinion column appears regularly in *USA Today*, often focusing on the topic of mass killing. Also related to his presentation, Professor Fox headed the investigation of Seattle's Capitol Hill massacre for the Seattle Police Department and served on President Bill Clinton's advisory committee on school shootings.

Professor Fox was profiled in the *New York Times, Scientific American*, and a two-part cover story in *USA Today* that dubbed him "The Dean of Death." Fox frequently gives lectures and expert testimony, including over one hundred keynote or campus-wide addresses around the country, sixteen appearances before the U.S. Congress, and briefings for the White House, the Department of Justice, and Princess Anne of Great Britain. Finally, in recognition of his varied contributions to the field, *academicinfluence.com* recently ranked him #8 in its list of most influential people in criminal justice over the past 50 years.

Jack Levin, Ph.D.
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Boston, MA 02115
Cell: 781 789 9007
Email:jlevin1049@aol.com
website:www.JackLevinonViolence.com

Presentation Abstract

Serial murder has fascinated many generations of Americans. In recent decades, the presence of serial killers who operate in our cities and towns has declined precipitously, yet the popular interest has maintained itself in full force. In our popular culture, we continue to make monsters into celebrities and anti-heroes.

This presentation will explore a number of myths and misconceptions that serve to keep an erroneous image of serial murder alive and well in the thinking of many Americans. In particular, it is quite common to find observers who under-estimate the motive of serial killers to achieve power, recognition, and control. Serial killers are too often regarded as suffering from insanity and appearing like the monsters in Hollywood motion pictures.

An important myth involves the propensity of serial killers for being prevented from turning violent or being apprehended. It is widely believed that criminologists and law enforcement types are able to identify warning signs or red flags for this rare form of murderous behavior and that serial killers really want to get caught. The presentation will examine the methods that actually lead to the conclusion of a serial killer's murder spree.

Jack Levin Bio

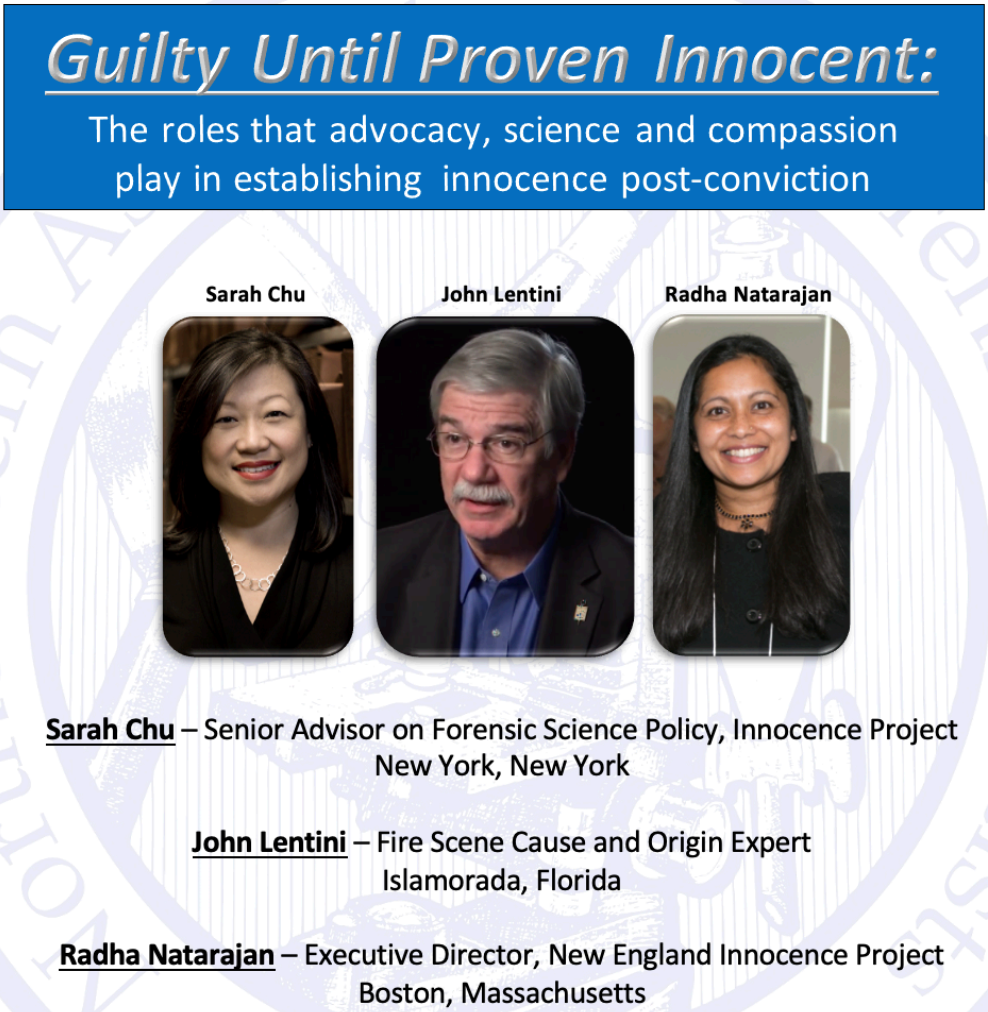
Jack Levin, Ph.D. is Professor Emeritus and Co-director of the Brudnick Center on Violence and Conflict at Northeastern University. He has authored or co-authored more than thirty books including *The Allure of Premeditated Murder, Extreme Killing, Serial Killers and Sadistic Murderers, Mass Murder: America's Growing Menace*, *The Will to Kill,* and *Hate Crimes: The Rising Tide of Bigotry and Bloodshed as well as more than 250 articles and columns in professional journals, books, and major newspapers,* such as *The New York Times, London Sunday Times, Boston Globe, Dallas Morning News, Philadelphia Inquirer, Pittsburgh Post-Gazette, Christian Science Monitor, Chicago Tribune, Washington Post, and USA Today.* Levin was honored by the Massachusetts Council for Advancement and Support of Education as its "Professor of the Year" and by the American Sociological Association for his contributions to the public understanding of sociology. He has also received awards from the Eastern Sociological Society, Association for Applied and Clinical Sociology, New England Sociological Association and Society for the Study of Social Problems.

Plenary Session II: *Guilty Until Proven Innocent*

Salons 1 & 2

Session Moderator: Adam B. Hall, Boston University School of Medicine, MA

Thursday, November 4, 2021 **9:00 AM – 12:00 PM**



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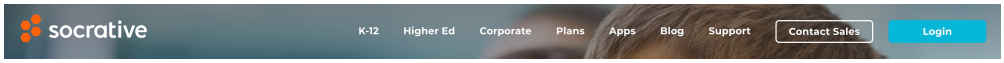

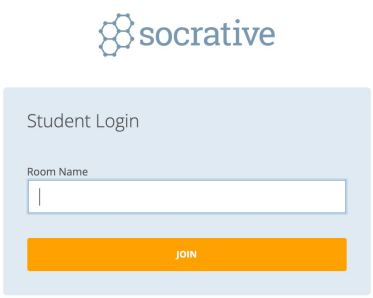

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Considering the Social Impact of Forensic Methods and Investigative Technologies Requires Critical Evaluations – Sarah Chu

Abstract

We are in the midst of a technological revolution in the criminal legal system. DNA profiles can be developed in ninety minutes and biometric surveillance technologies are used to identify individuals based on their face, gait, or voice. The capacity of these new technologies to conduct digital or genetic surveillance raises new societal questions regarding their deployment. Simply evaluating the scientific validity and reliability of these forensic science methods and police investigative technologies is insufficient to ensure their just and equitable implementation, especially in a criminal legal system so deeply beset by social inequalities. Taking lessons from the advances in bioethics initiated by the Human Genome Project this presentation will argue that ensuring the just and equitable application of forensic science methods and investigative technologies requires a new evaluation framework and one that must be conducted in parallel to evaluations of validity and reliability.

Sarah Chu joined the Innocence Project in September 2008. As the Senior Advisor on Forensic Science Policy, she leads policy work that focuses on improving the valid, reliable, and just applications of forensic science and police investigative technologies. Prior to joining the Innocence Project, Sarah worked in executive search and as a middle school science teacher in the NYC public schools. She also represents her community on her local community board. Sarah graduated from the University of California, San Diego with bachelor's degrees in Biochemistry/Cell Biology, Communication, and a Masters in Biology, and holds a Masters in Epidemiology from Stanford University. She is currently a doctoral student in the Criminal Justice program at John Jay College of Criminal Justice/CUNY Graduate Center where her research interests include the oversight and critical examinations of forensic science and police surveillance technology.

Examining Wrongful Convictions: Failing to Catch Errors Until It's Too Late – John Lentini

Abstract
The causes of wrongful convictions have been extensively studied, and errors committed by forensic scientists feature prominently among the causes. The most common cause, however, is usually not reported, and that cause is ineffective assistance of counsel.

The ineffectiveness may be due to overwhelming caseloads or underwhelming resources, and the most common kind of ineffective assistance is the failure to consult with an expert. When forensic science is used in a prosecution, and it almost always is, it is absolutely essential defense counsel have that science examined.

In fire investigations, unqualified investigators on the scene, and overeager chemists determined to "help" result in cases being made when no crime was committed. This presentation will provide several examples of such cases.

John Lentini is the author of more than 50 publications, both in the peer-reviewed literature and in the trade journals of fire investigation. His study of the Oakland Hills fire in 1991 resulted in a rethinking of much of the conventional wisdom in fire investigation, and his laboratory work has resulted in research papers that are standard works in the field. His book, *Scientific Protocols for Fire Investigation* was the first fire investigation text printed in full color in 2006. The book is now in its third (2018) edition.

Lentini has personally conducted more than 2,000 fire scene inspections and has been accepted as an expert witness on more than 200 occasions. He is a frequent invited speaker on the subject of the standard of care in fire investigation and laboratory analysis of fire debris, as well as on the progress of standardization in the forensic sciences. Since 2006, he has operated Scientific Fire Analysis, LLC, a fire investigation, and consulting firm located in Islamorada, FL. His website is www.firescientist.com

"Solving" Crimes, Bias, and Innocence – Radha Natarajan

Abstract
When someone is harmed – or worse, dies – there is significant pressure to find the person responsible, make an arrest, and get a conviction. While the search for answers may be perfectly understandable in these tragic circumstances, the tools to conduct that search are far from perfect. Forensic science is one of the tools relied on by the criminal legal system to "solve" mysteries, yet when the techniques were *developed for* that purpose rather than in an independent scientific context, both the methodology and its manipulation can lead to unreliable results. Indeed, innocent people are convicted of crimes they did not commit or crimes that never occurred at all.

This presentation will discuss a Massachusetts exoneration involving bitemark comparison evidence in which three "experts" opined that an innocent person was without question a murderer. These forensic analysts were trying to be helpful to solve a brutal murder; instead, their error led to more deaths and far more harm. They convinced a jury of their opinion beyond a reasonable doubt even though it was challenged at every step. They convinced the judge, who said he would have given this innocent man the death penalty if that had been an option in Massachusetts. They convinced the highest court to overlook flaws in the methodology. Everyone wanted so badly to find the truth that they were unable to see how far from it they really were.

This presentation will explore *whose responsibility* it is to ensure the accuracy of forensic evidence used to charge someone with a crime and strip them of their liberty. It will posit that it is *everyone's* responsibility, that no one can rely on the system's perceived "checks and balances," which oftentimes fail to protect innocent people especially when "science" is involved. And it will argue that the *desire* to get an answer should never eclipse the *duty* to get it right.

Radha Natarajan is the Executive Director of the New England Innocence Project (NEIP), whose mission includes freeing from prison people who have been wrongfully convicted, preventing future wrongful convictions, and supporting exonerees upon release. Prior to joining NEIP as its Staff Attorney in 2015, Radha spent twelve years as a public defender, most recently in the Roxbury Defenders, handling serious felony cases in the Massachusetts trial courts. For her work, she has been presented with the 2020 Carol Donovan Award for Exceptional Advocacy by the Committee for Public Counsel Services, 2020 Excellence in the Law Award from Massachusetts Lawyers Weekly, the 2018 President's Award from the Massachusetts Association of Criminal Defense Lawyers, the 2013 Top Women of Law Award, and the 2011 Access to Justice Award from the Massachusetts Bar Association.

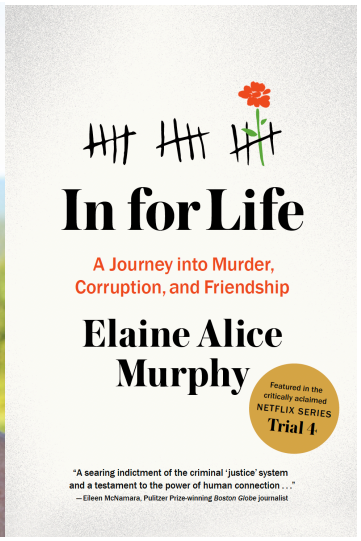
She is a member of the Massachusetts Supreme Judicial Court Standing Committee on Eyewitness Evidence, an advisory committee tasked with updating the Court on new research, developing education and training for the bench and bar, and making scientifically based recommendations for reform, including considering and developing jury instructions addressing memory, perception, credibility, and implicit bias. She is a 2000 graduate of Stanford University, where she majored in Comparative Studies in Race and Ethnicity, focusing on the role of race in the legal system. She is a 2003 graduate of New York University School of Law, where she was the Managing Editor of the New York University Law Review.

NEAFS Annual Luncheon: *Elaine Murphy and the Sean Ellis Case*

Salons 3 & 4

Session Moderator: Adam B. Hall, Boston University School of Medicine, MA

Thursday, November 4, 2021 **12:00 PM – 2:00 PM**



ELAINE ALICE MURPHY holds an honors degree from Boston College in English literature and a master's degree from Harvard University in human development. Her work on the Ellis case earned her a senior justice fellowship at Brandeis University's Schuster Institute for Investigative Journalism.

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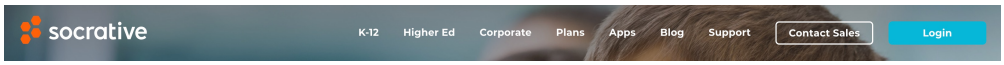

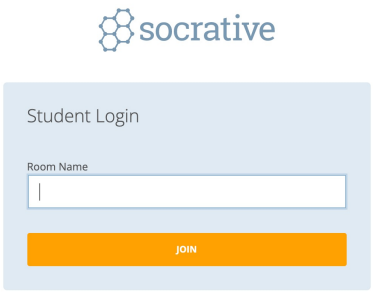

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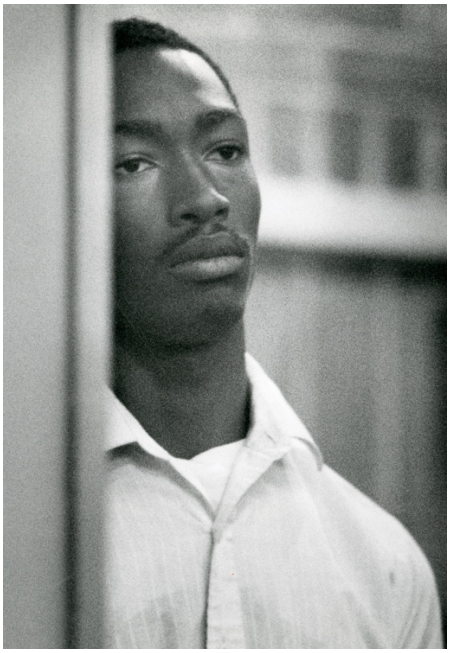
Sean K. Ellis was convicted in 1995 of the murder and robbery of Boston detective John J. Mulligan and sentenced to life in prison without parole. Mulligan was white, Sean is black. Age nineteen at the time of the crime, Sean insisted he was innocent. It took three trials to convict him; his first two trials ended with hung juries.

Elaine Alice Murphy learned of Sean's conviction while living in Montreal and was shocked to recognize him as her son Mark's former classmate. A decade earlier, when the Murphy's lived in suburban Boston, Sean had been bussed from the city to their neighborhood elementary school through a racial integration program. Sean and Mark had been best friends.



Sean K. Ellis at 19. His wrongful murder conviction was the focus of the Netflix documentary series *Trial 4*.

Stricken to think that the gentle boy she remembered would die in prison an innocent man, Murphy joined his family and lawyers in a quest to free him. Her research uncovered evidence of Boston police corruption that tainted the Mulligan homicide investigation and trials. Called a "game changer" by the courts, the finding led to the reversal of Sean's convictions and his release from prison in 2015. *In for Life* is Murphy's riveting account of her journey through a corrupt criminal justice system and her distress at the two different Americas Sean and her son faced growing up. Woven throughout are insights from her prison conversations with Sean that deepened their bond over two decades – a bond that became life changing for both.

"A remarkable story beautifully told ... of what it takes to make the criminal legal system fair – dogged determination, years and years of work, and a clear-eyed vision of what is right, no matter what the cost."

-Honorable Nancy Gertner, retired Judge, U.S. District Court, D. Mass.; Senior Lecturer, Harvard Law School

"Riveting and inspiring ... a beautiful story of friendship, family, and connection between two people from opposite sides of the economic divide ... In this time of racial reckoning, *In for Life* serves as a North Star for white allyship."

- *Jackie Jenkins-Scott, President of Wheelock College (retired); author,* The 7 Secrets of Responsive Leadership

"I would like to proclaim that *In for Life* is evidence of justice being done ... but it is really about injustice being undone ... The importance of this book lies ... in its reminder to us all that a similar story can be told every day in every city in America."

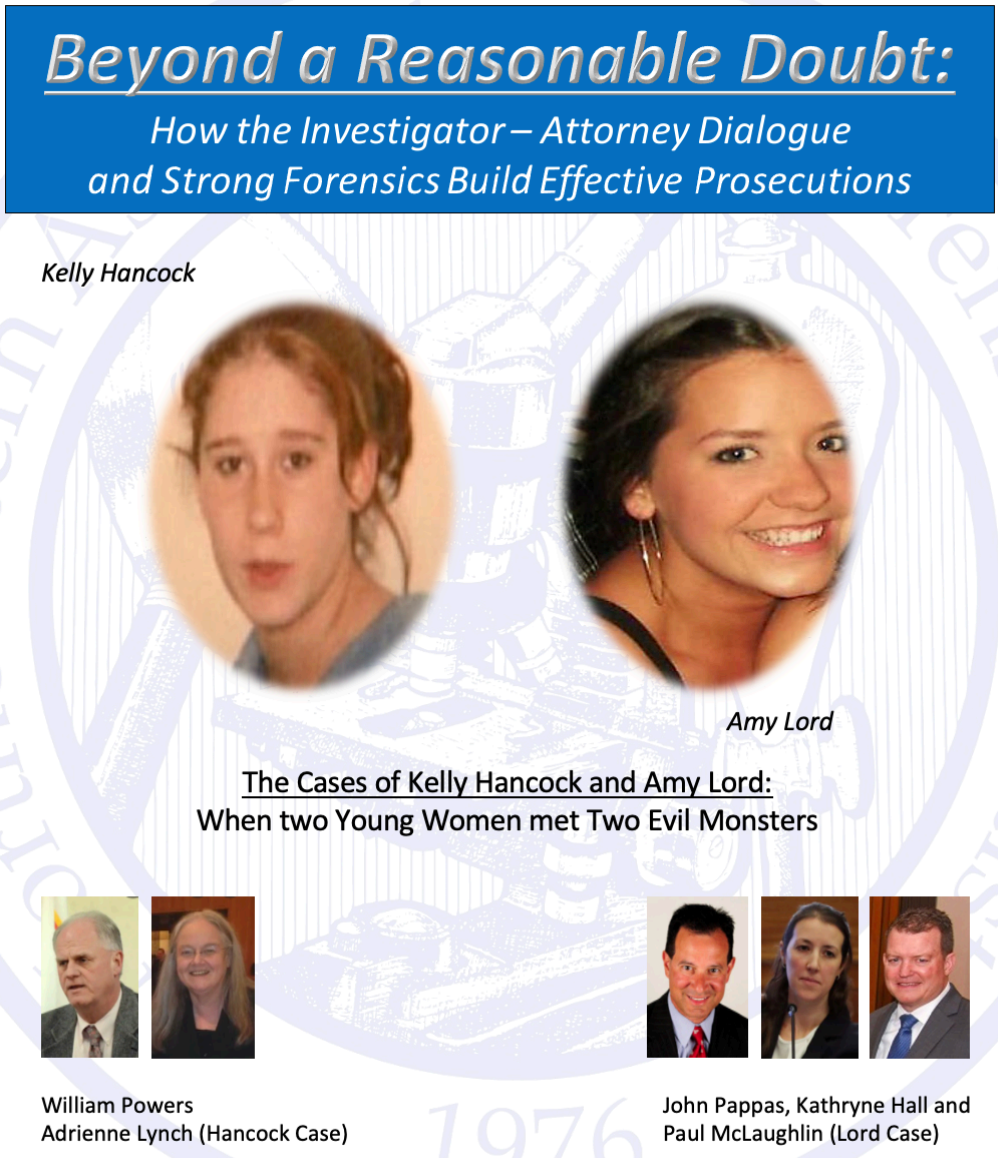
- *H. Lee Sarokin, Emeritus, U.S. Court of Appeals, Third Circuit. (In 1985 he overturned the 1966 triple murder conviction of middleweight boxer Rubin "Hurricane" Carter, freeing him from prison.)*

Plenary Session III: *Beyond a Reasonable Doubt*

Salons 1 & 2

Session Moderator: Adam B. Hall, Boston University School of Medicine, MA

Thursday, November 4, 2021 **2:30 PM – 5:30 PM**



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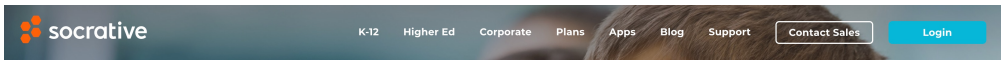

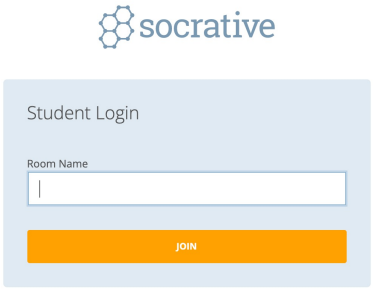

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CASE #1: Commonwealth vs. Crouse

On July 18, 2000, at 6:19 a.m., the automatic sprinkler system in the function room of the Malden Mills condominium building located at 10 Linwood Street in Malden, activated and alerted the Malden Fire Department of the fire. That room is located on the basement level of the building. Firefighters responded and found the function room filled with a heavy black smoke, which is consistent with a hydrocarbon fire such as gasoline. There was a strong odor of gasoline emanating from within the room and there was a slick, consistent with gasoline, on top of the water on the floor from the sprinklers. Windows were broken by firefighters in order to ventilate the room. At that point, firefighters could see there was a sofa which was burnt, an overturned table and chair nearby. There were burn marks on a cushion and what appeared to be splash marks on the wall. There was a brownish stain on the floor between the sofa and the knocked over chair, later identified to be blood.

The Malden Fire Investigation Unit composed of police and fire personnel also responded and, upon review of the scene, determined that the state police assigned to the Fire Marshals' office should be notified. At 7:30 a.m., the State Police Fire Marshals' Office was contacted to respond. Troopers along with accelerant detection canine Lucy responded. The troopers noted that the furnishings in the room were the "only fire load" in the room. Lucy, the accelerant detection canine, alerted several times – on the loveseat, the flooring between the loveseat and the wall and flooring along the wall. Samples of these areas were gathered. Lucy also reacted to the presence of blood. As the water level in the room receded, there were two areas in the room where the water appeared to be pink. These areas were tested by a chemist and were positive for blood. There was also blood on the lower wall near to the point of origin. As a result, Middlesex State Police Detectives were notified and responded. Based upon their examination of the scene, it is the fire Marshall's troopers' opinions that the fire originated in the area of the love seat and the

chair; there were no accidental heat sources; this fire was caused by a person or persons spreading an ignitable liquid over the loveseat, chair and flooring and then applying an open flame. As the fire progressed, the heat produced set off the sprinkler heads in the area which consumed and extinguished the fire. The fire was intentionally and deliberately set in an attempt to cover up and contaminate the scene of a crime.

Efforts to locate and identify a victim were undertaken and included requests through the media for information from the public. Although the evidence in the basement suggested that the fire was set to cover up a violent bloodshed event, no victim was identified. The investigation continued, focusing on one individual who lived in the building who made an unexpected early morning trip to New Hampshire with his girlfriend and two young children in the early morning shortly before the fire alarms sounded.

On April 23, 2001, the remains of a female, 14 – 18 years of age, wearing shorts, underpants, a sports bra, tee shirt and plaid button-down shirt, were discovered in Hooksett, New Hampshire. There were two shovels located near the body; one a square edged one, the other a spade type shovel. The area where the body had been buried in a shallow grave was on the property of Manchester Sand off of Industrial Park Drive. This is off of Route 3 Hooksett Drive. The location where the body was recovered was within approximately 7 miles from the location in New Hampshire where the family who lived in the building had gone shortly before the fire alarms sounded. The location is also within 7 miles from a Mobil station on Hanover Street in Manchester where the resident used his credit card at 8:12 a.m.

A teletype concerning the discovery of the remains prompted investigators to contact New Hampshire of their interest in possibly linking the unidentified remains to the forensic evidence recovered from the function room. DNA testing of the remains and a sample of the blood from the function room of Malden Mills revealed that they are from the same person. The skeletonized remains were found with the head hair which was in a ponytail and was an auburn color. It was realized at that time that fourteen-year-old Kelly Hancock from Malden had run away from the Department of Social Services office in Malden during the late afternoon of July 17, 2020. Dental records identified the deceased to be Kelly Hancock.

An autopsy was performed in New Hampshire by Dr. Thomas Andrew, in conjunction with Dr. Marsha Sorg, an anthropologist from Maine. The cause of death was a stab wound of the abdomen and the manner of death was homicide.

This case involved forensic experts from a variety of scientific disciplines from three different states as well as experts from a private lab in Virginia. Those expert fields included: cause and origin of fire experts; fire protection engineer; criminalists; DNA experts; fingerprint experts; forensic anthropologist; forensic odonatologist; medical examiner; blood stain spatter; trace evidence; and forensic video analysis expert.

Speaker Bios: Commonwealth vs. Crouse

Bill Powers has been active in the Massachusetts law enforcement community since entering the State Police Academy in June of 1974. His early career assignments ranged from patrol to investigations to academy instructor. In the years that followed he rose through the ranks, gaining experience and training and ultimately was promoted to Detective Lieutenant. In that capacity he was assigned as the Commanding Officer of the State Police Detective Units (SPDU) in both Middlesex and Suffolk Counties, where he had direct oversight of more than one hundred homicides and several hundred more sudden, unattended deaths that were investigated and determined not to be homicides. His State Police career came full circle when he was named Director of Training for the Division of Investigative Services and then to the role of Commandant of the Recruit Training Academy in 2005. Bill has an undergraduate degree from Northeastern with a major in Criminal Justice (1978) and a Juris Doctorate degree from the New England School of Law (1984). He is a sworn member of the Massachusetts Bar.

Upon retiring from the State Police in 2007, he was appointed as an Assistant Professor in the graduate program for forensic sciences at the Boston University School of Medicine (BUSM). For the next seven years he lectured on criminal investigation and expert testimony to the graduate students. In addition, and as part of his position, he produced several short-term training seminars geared specifically to law enforcement officers. The courses explored subjects as wide-ranging as basic investigation techniques, through more advanced subject matter topics such as Sexual Assault investigations and Medico-Legal Death investigations. Following his tenure at the BUSM he returned to the law enforcement profession as the Director of Public Safety at Wentworth Institute in Boston. He is currently a contract employee with the Massachusetts State Police as a Program Development Coordinator in the Division of Standards and Training.

To learn more about Bill, please visit his website at www.powersonpolicing.com

Adrienne C. Lynch is an Assistant District Attorney for Middlesex County, Massachusetts, and has been so for the past 41 years. She is the Chief of Homicide responsible for the oversight all death investigations within Middlesex County, including homicides, motor vehicle fatalities, child fatalities, suicides, accidental deaths, and overdoses. She has held this position for the past ten years. In that capacity she responds on 24-hour basis to homicide scenes, oversees police homicide investigations, participates in charging decisions, and supervise homicide prosecutions through sentencing, in addition to handling and trying cases. She has also served as the Regional Chief for a Superior Court Trial Team (1991-2011). She has tried hundreds of criminal cases over the course of her career.

Adrienne Lynch is a member of the Massachusetts Forensic Science Oversight Board, appointed by Governor Charles Baker in 2019 as the Massachusetts District Attorneys' representative. Adrienne Lynch has been a guest lecturer for many continuing legal education programs on a variety of topics in trial practice, evidence, and substantive law. Have lectured at numerous training programs for attorneys, victim service providers and state and local police. She has taught

trial advocacy, pre-trial advocacy, and cross-examination at the National College of District Attorneys at the National Advocacy Center, Columbia, SC, and evidence, trial practice, and investigation in Savannah, GA and Reno, NV.

Adrienne Lynch has received a number of awards in connection with her professional work including the Massachusetts State Police Superintendent's Commendation from the Massachusetts State Police in connection with her work along with the Massachusetts State Police Crime Laboratory on a cold case homicide committed in 1969 and solved by DNA testing in 2018; the Investigative Award, awarded by Irish-American Police Officers' Association; John F. Kerry Leadership Award, awarded by Middlesex District Attorney's Office; Analytical Participation Award, awarded by New England State Police Investigation Network; Outstanding Service Award, awarded by Middlesex Bar Association, Access to Justice Award, awarded by

Massachusetts Bar Association Bar Foundation; named one of the Massachusetts Lawyers of the Year by *Massachusetts Lawyers Weekly;* the Criminal Justice Award, awarded by Massachusetts Victim and Witness Assistance Board; Prosecutor of the Year Award, awarded by the Massachusetts District Attorney's Association in 2004; Arson Prosecution Award, awarded by the Massachusetts State Fire Marshal's Office and the Massachusetts State Police Fire and Explosion Investigation Section; and the District Attorney's Award.

She is a graduate of the Boston College Law School and Boston College.

CASE #2: 24 Hours of Terror

On Tuesday July 23, 2013, at approximately 4:59am Boston Police Officers in the C-6, South Boston section of the city, responded to a radio call for a report of a 22-year-old female who had been attacked. The victim, Alexandra Cruz, was an employee of Dunkin Donuts on Old Colony Ave. She was walking to work between 4:15am and 4:30am when she was punched in the jaw and dragged by her feet to an open parking lot. The suspect was described as a white Hispanic male in his mid-twenties to early thirties, about 5 feet 6 inches tall, wearing blue shorts, a blue shirt with a white shirt underneath, black sneakers, and had a mole on his right lip. The victim told the suspect to take her belongings to which he responded in English "I'm not robbing you I'm going to kill you." The suspect began strangling the victim and asked her if she spoke Spanish. When the victim responded yes, the suspect stated in Spanish "You're not the one I'm looking for, I'm sorry."

Around 8:40am, Boston Police Officers responded to 26 Logan Way in South Boston for a radio call for a vehicle fire. Upon arrival, officers observed Boston Fire responding to an active vehicle fire to a black Jeep Grand Cherokee with MA Reg. 521SH2.

At approximately 11:10am a missing person report was filed, and officers responded to 124 Dorchester St. in South Boston. Mike Cassell stated his girlfriend, Amy Lord, had last been seen at approximately 2030 on July 22, 2013, by her two roommates. It was believed that Amy had left her apartment at approximately 5:30am to get a bus to the gym; however, her coworker who takes the bus with her every morning explained that Amy did not show up to the gym or to work on July 23rd.

Officers in the E-18, Hyde Park section of the City of Boston responded to a call for a found body in the Stony Brook Reservation located at Ennecking Parkway and East Boundary Road at approximately 4:00pm on July 23, 2013. The body of a deceased white female was discovered, suffering from apparent stab wounds. On Wednesday July 24, 2013, an autopsy was performed on the deceased body of Amy Lord, identified through dental records. The death was ruled a homicide with the cause of death as "sharp force injuries to the neck and torso and asphyxia by strangulation."

At approximately 12:11am on Wednesday July 24, 2013, Boston Police Officers in the C-6, South Boston section of the city, responded to a 911-radio call for a person stabbed at 57 Gates Street. Upon arrival, officers observed the 21-year-old victim, Kayleigh Ballentyne suffering from puncture wounds to the left side of her torso, neck, and face. The victim described her attacker as a white Hispanic male approximately 5 feet 9 inches tall, mid-twenties, wearing a Red Sox baseball cap, a dark t-shirt, and dark shorts. The victim stated the male suspect had been following her for a while and as she started to enter her apartment building, the suspect rushed up behind her and began stabbing her. The victim struggled with the suspect and kicked him several times while pleading for him to take her belongings. During the attack, the suspect was injured and fled the scene. Officers interviewed a witness who stated he saw the suspect following the victim and when he heard the victim screaming, he then saw the suspect come out of the doorway and start

walking calmly up Gates Street towards Telegraph Street. A second witness told officers that he heard the victim screaming and saw the suspect attempting to strangle the victim as she tried to close the door on him.

Over the next several days, months, and years, investigators spent countless hours piecing together the timeline of the South Boston rampage on July 23rd into July 24th, 2013. Through video evidence, eyewitness accounts, and forensic science, Edwin Alemany was charged, indicted, and tried for the homicide of Amy E. Lord, the attempted murder of Kayleigh Ballentyne, and the assault and battery of Alexandra Cruz. Over the course of a 16-day trial, the prosecution presented an overwhelming compilation of evidence leading to the conviction of the defendant and refuting the defense's claims of not guilty by reason of insanity. On June 8, 2015, jurors found Edwin Alemany guilty of first-degree murder, kidnapping, carjacking, armed robbery, attempted murder, assault and battery, armed assault with intent to murder, among other charges. He was sentenced to life in prison without the possibility of parole for the murder of Amy Lord, as well as consecutive prison sentences of up to 20 years and up to 15 years for the attacks on Kayleigh Ballentyne and Alexandra Cruz. Additional sentences of life and of 50 to 60 years for the several other crimes Alemany was convicted of were also imposed.

Speaker Bios: 24 Hours of Terror

Paul McLaughlin is a 34-year veteran of the Boston Police Department and currently oversees Homeland Security investigations at the Boston Regional Intelligence Center (BRIC)-the designated Fusion Center for the Metro Boston Homeland Security Region (MBHSR). Paul also serves as the liaison to partners in the Critical Infrastructure and Key Resources (CIKR) and private sectors. In that role he oversees intelligence collection, sharing, and liaison responsibilities with the BRIC's multi-agency, multi-discipline stakeholders. Prior to his current assignment, Paul spent 16 years assigned to the Homicide Unit where he supervised and investigated well over 100 homicides, including several complex and high-profile cases. In that capacity, he worked closely with the Suffolk County District Attorney's Office to successfully prosecute each case by way of a team approach through coordination, preparation, and courtroom testimony. While assigned to the Homicide Unit, Paul was also an original member of the Firearms Discharge Investigation Team (FDIT) where he was responsible for responding to and investigating every firearm discharge by a sworn member of the police department. Over his years with the BPD, Paul has received specialized training in various areas of policing related to his assignments. During his time assigned to the Homicide Unit, he attended numerous training classes related to death investigations to include crime scene management, evidence collection, shooting reconstruction, interview and interrogation, digital and video forensics, and blood stain pattern analysis. In the seven plus years in his current assignment at the BRIC, he has attended the Fusion Center Leaders Program (FCLP) at the Naval PostGraduate School (NPS) in Monterey, CA as well as several other Intelligence related trainings and symposiums. In 2018, he represented the Boston Police Department as a co-presenter at the Social Network Analysis for Law Enforcement Symposium held at NPS. In 2019 he completed the Emerging Leaders in Crisis program given by the National Preparedness Leadership Institute (NPLI) at Harvard University. He also serves as an instructor

in the Detective Formative Training (DFT) program for new detectives at the Boston Police Academy in Interview and Interrogation, Death Investigations, and Investigative and Intelligence Databases. Paul holds an undergraduate degree in Political Science from Boston College and a graduate degree in Criminal Justice Administration from Boston University. He has been recognized on numerous occasions over the course of his career by the BPD, his peers, and other organizations for exemplary work in the performance of his duties.

John P. Pappas, 57, has served as an assistant district attorney in the Suffolk County District Attorney's Office since September 12, 1994. He worked his way from attending law school at night to becoming the Chief Law Enforcement Officer for Boston, Chelsea, Revere, and Winthrop, Massachusetts when he was appointed in 2018 by Governor Charles D. Baker to serve as the 15th District Attorney of Suffolk County. He is currently Senior Counsel to the Homicide Unit where he carries an active caseload and works on the unsolved homicide, or PUSH, initiative.

Prior to his appointment as District Attorney, since 2011 he held one of the most senior positions in Massachusetts' legal community, Chief Trial Counsel for the Suffolk County District Attorney's Office. As Chief Trial Counsel, Mr. Pappas provided legal and strategic guidance to Superior Court prosecutors from the grand jury stage to trial; investigated and assessed fatal police-involved shootings for potential criminal charges; evaluated wrongful conviction claims and other post-conviction matters; and carried a full caseload of complex homicide investigations and prosecutions. He served for a decade in the DA's Homicide Unit, leading dozens of death investigations and trying some of the county's most notorious murders. As a Superior Court prosecutor, he has also served in the DA's Senior Trial Unit, Gang Unit, and General Felony Unit trial teams; prior to those assignments, he was a line prosecutor and then a supervising prosecutor in the Boston Municipal Court and East Boston District Court.

A lifelong resident of West Roxbury, Mr. Pappas is a graduate of Boston Latin School, the University of Massachusetts at Amherst, and New England School of Law, where he wrote for the *New England Journal on Criminal and Civil Confinement* and earned his *juris doctorate* in 1993. From 1996 to 1997, he taught as an adjunct trial practice instructor at Suffolk University Law School. He received the 2003 Suffolk Award for Outstanding Superior Court Prosecutor and, in 2016, was the recipient of the prestigious William C. O'Malley Prosecutor of the Year Award conferred by the Massachusetts District Attorneys Association.

Kathryne Hall is a graduate of Providence College where she earned a Bachelor of Arts degree in Biology and a Bachelor of Science degree in Health Policy and Management in May 2008. In January 2011, Kathryne graduated from the Boston University School of Medicine where she earned a Master of Science degree in Biomedical Forensic Sciences.

Kathryne began working as a Forensic Technologist at the Boston Police Crime Laboratory in 2010. As a Forensic Technologist, she examined items of physical evidence in the laboratory and screened for the presence of biological fluids. She also performed quality procedures within the laboratory and assisted in maintaining quality control records. In 2012, Kathryne was promoted to a Criminalist within the laboratory. As a Criminalist, she examines items of physical evidence in the laboratory and tests for the presence of biological fluids. She also responds to crime scenes, trains newly hired analysts and investigators, and testifies in court. Kathryne was promoted to Criminalist II in 2013 and then to her current position of Criminalist III in 2019. She has processed numerous homicide cases and hundreds of sexual assault cases. She has examined thousands of items of physical evidence and has testified in court more than 25 times.

Kathryne has been published in Forensic Science International for her Master's thesis research on the recovery of ignitable liquids in fire debris analysis. She holds a certification in Comprehensive Criminalistics from the American Board of Criminalistics. She is a member of NEAFS as well as the American Academy of Forensic Sciences and has presented at previous NEAFS and AAFS annual meetings.

Thursday, November 4, 2021 – 7:00-11:00pm

Angela Vialotti (President) and Adam Hall (President-Elect) cordially invite you to attend the 47th Annual NEAFS President's Reception




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New England Nautical/Island Themed Dinner & Drinks

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Come dressed for the occasion!!!

Northeastern Association of Forensic Scientists
2021 Annual Meeting – Program Chair, Adam B. Hall
Newport, RI

Educator's Forum

Freedom

Chairperson: Sandra Haddad, Ph.D., Bay Path University

Friday, November 5, 2021 **9:00 AM – 11:00 AM**

9:00am – 9:05am	**Welcoming Remarks (Grab your coffee!)** Sandra Haddad, Ph.D., NEAFS Education Committee Chair Bay Path University
9:05am – 9:50am	**Looking Back** Stepping back in time for just a moment, let's tap into the collective wisdom in our group to discuss lessons learned from a year of teaching during COVID. Were you teaching online, on ground, or a combination? What silver linings did you discover during this unprecedented time? What new experiments in teaching did you try? Which practices will you keep? Did anything "seem like a good idea at the time, but…."? Please bring some ideas to share with our group.
9:50am – 10:00am	**BREAK**
10:00am – 11:00am	**Looking Forward** Now let's look forward to new ideas. Do your students understand the "*how"* and "*why"* of your course assignments? What constitutes a transparent assignment? How do transparent teaching methods help your students? How does this tie into equity and inclusion? Let's explore some ideas from the Transparency in Learning and Teaching (TILT) Project and see whether and how they can be applied to your classes. Bring an assignment description that you'd like to review.

Student's Forum

Weatherly

Moderators: **Anisha Paul, Vermont Forensic Laboratory, Department of Public Safety**

Christopher Chany, Austin Headquarters Crime Laboratory, Texas Department of Public Safety

Friday, November 5, 2021 **10:00 AM – 12:00 PM**

10:00am – 11:00am **"The Real World"**

So, you are finishing up years of studying and research, you get your degree and enter the real world. Now what? Time to find that job! Join Anisha and Chris as they discuss the ins and outs of getting a job in the field. Topics to be covered include: job requirements and descriptions, internships, resumes and interviewing skills. Bring your resume and your questions.

11:00am – 12:00pm **George W. Chin Cup College Bowl**

In 2004 NEAFS instituted the collegiate competition. Each school submitted one paper for judging. However, with students submitting so many great papers it was felt that the competition should be open to all the student papers. So, the collegiate competition became an individual award and not a school award. In order to resume the collegiate competition Dr. Quarino instituted the "Kirk" Cup at the 2014 Annual Meeting. In 2016 the competition was renamed in honor of George W. Chin, long time moderator of the student forum.