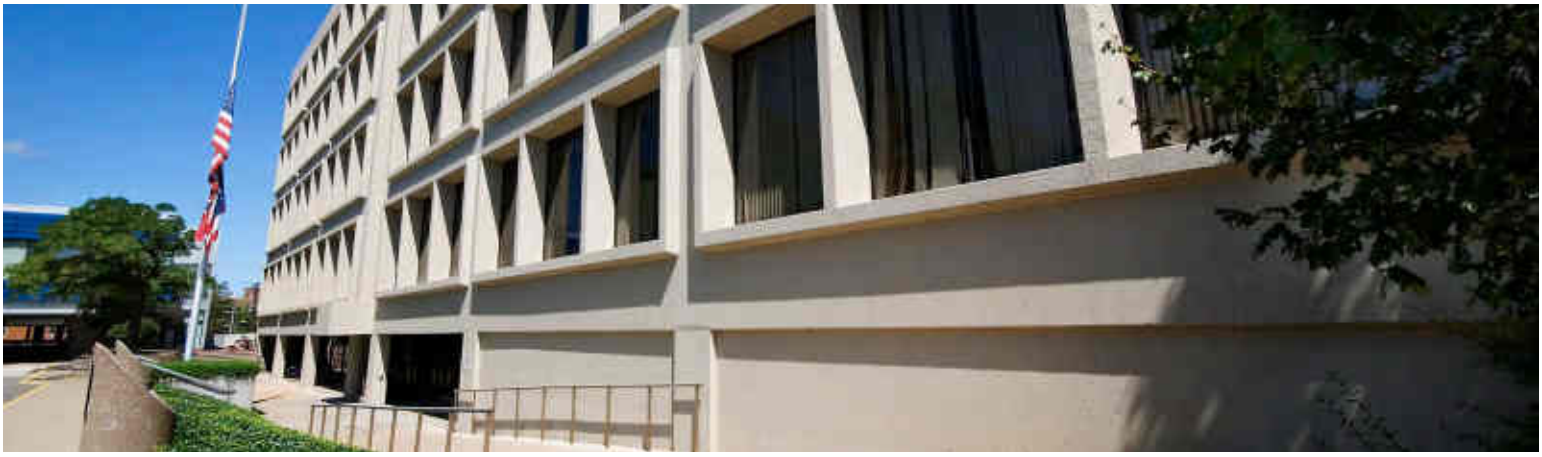
STUDENT Resource Guide

Cuyahoga County Medical Examiner's Office

1 Edition

An Introduction for Tomorrow's Forensic Scientists



LETTER
From the Medical Examiner

This resource guide is intended to serve as an introduction to the many diverse areas of forensic science. The recent popularity of the field follows several well-received media presentations in addition to the increasing recognition of the value of forensic science in solving crimes, exonerating the wrongfully convicted, and discovering answers to mysteries long unsolved. Not surprisingly, the television shows and podcasts latch on to some of the more sensational cases and often miss the mark with the more practical and typical (though just as frequently fascinating) day-to-day activities of a forensic scientist.

In the pages that follow, forensic scientists from the Cuyahoga County Regional Forensic Sciences Laboratory share their perspectives on the various scientific fields in which they practice. These overviews are not only presented as a more factual accounting of our work, but also in the hope that they will stimulate your interest in forensic science and encourage you to explore further. There are many opportunities in forensic science and some areas where shortages of competent practitioners are anticipated in the years to come. We look forward to seeing some of you join us as future colleagues!

Thomas P. Gilson, MD
Cuyahoga County Medical Examiner

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Christopher Harris, EDITOR | DESIGN DIRECTOR
cbharris@cuyahogacounty.us
Jan Manion, EDITORIAL ASSISTANT
Kate Snyder, PHOTOGRAPHY
Jason Bielinski, PHOTOGRAPHY
James Wentzel, PHOTOGRAPHY
Amy Koons, PHOTOGRAPHY
Greg Wilson, PHOTOGRAPHY

CHOOSING A CAREER IN FORENSIC SCIENCE

WHY DID YOU CHOOSE A CAREER IN FORENSIC SCIENCE?

Dr. Elizabeth Mooney
Forensic Pathologist
Pathology

In all honesty, the ultimate reason I chose a career as a Forensic Pathologist is sheer curiosity. I was always fascinated by the anatomic and physiologic e ects that disease processes, trauma and postmortem changes impart on the human body and how that information can be used to piece together the puzzle as to what happened to an individual that resulted in death. You never know what you might nd! Keeps every day interesting.

Chris Meditz
Death Investigator
Investigations

I did not choose to pursue a career in forensic science out of high school; I have a degree in biological anthropology. Rather, my educational journey in college led me to a career unexpectedly. I love to learn, and I love puzzles. When the opportunity to become a medicolegal death investigator presented itself, I did not hesitate to take it. As an investigator for the county medical examiner, every case is a puzzle. Every case has aspects of life I otherwise never would have been exposed to that I get to learn about. Moreover, a wonderful realization that happens in this eld is that you get to truly help people. at alone is a light in this generally dark discipline.

Kim Yacoub
Forensic Scientist
Toxicology

I chose a career in forensic science because to me, it is important for families to know how their loved ones passed away. Forensic science is a key factor in determining cause or manner of death. It is such an interesting eld with so many di erent disciplines, but know that it is not like the TV shows! Try to get out there and shadow or get an internship before choosing your career.

Brooke Potts
Forensic Scientist
DNA

Growing up as an inquisitive child with many passions and interests, few things gave me more satisfaction than solving a puzzle. Forensic science as a career is just that; applying a vast array of scienti c disciplines to solve an important puzzle, where clues are uncovered to gure out what occurred, and the ndings help bring about justice. When I was rst introduced to forensic science at a high school summer camp for CSI, the appeal was instant. I chose forensic science as a career because it combines mental stimulation with hands-on work and applies it towards a rewarding pursuit.

my journey into FORENSIC PATHOLOGY

By Dr. Todd M. Barr, Forensic Pathologist

Forensic science is a fascinating blend of many disciplines. Forensics is heavily rooted in science and technology, and a career in forensic pathology encompasses a multi-disciplinary approach to solve some of life's most difficult puzzles. A career in forensics is at a crossroad where medicine, detective work, inquisitive investigation, evidence collection, photography, toxicology, drug chemistry, blood spatter analysis, DNA analysis, anthropology and jurisprudence align to provide truth and justice to communities who are asking tough questions about what happened to their loved ones. It's a world where no one person alone can "figure it out" by themselves. With expertise and knowledge, we piece together information until we arrive at a soundproof conclusion. Technology continues to evolve, and new scientific discoveries are created. We add these to our ever-expanding toolbox of forensic knowledge. It feels good to be part of a team that collectively, scientifically and sometimes quite creatively resolve to "speak for those who can no longer speak for themselves". Welcome to the world of forensics!

As a child, I was always fascinated by how things worked. To this day, one of my favorite ways to relax is to work on complicated jigsaw puzzles. While I find it relaxing, it trains my eyes and my mind to look for small details and study the relationship of the pieces and parts. Ultimately, I find a way to put it all back together to reveal the mystery. Sounds a lot like forensics!

My road to becoming a forensic pathologist was quite circuitous. After high school, I wasn't sure what I wanted to do with my life, and after one semester of college, I withdrew from school. I didn't want to take courses I wasn't interested in and to study for meaningless exams. I wanted to "see the world" and became a flight attendant for a major airline. I thought I would do this for a couple of years, develop my interests, and go back to school when I was ready. It was the right move for *me*, and my airline career spanned a decade. It took me to places I had only dreamed of and I flew over 7,000 domestic and international flights. Halfway through my career, I was involved in a plane crash. As difficult as that experience was, it shaped me. I began to realize how precious life is and, in the moments before impact, I felt the same as everyone on board; "Is this how it all ends?"

After the crash, I flew for five more years. During my final year, I reenrolled in college to pursue a writing career. I was fascinated by Stephen King novels, and as far fetched as it sounds, I wanted to be the author of suspense thriller novels. It was my attempt to go for my dream! In the first year of college, I flew to Europe on

Friday and back home on Sunday. I attended college Monday through Thursday. On a flight from Paris to Philadelphia, we had a medical emergency on board. A physician on board assisted us, and after the passenger was stabilized, we talked about how she had become a physician. This widowed mother of five put herself through college and medical school, all after the age of 40, had recently finished residency and opened her practice at the age of 55! I was inspired! I went back to school, changed my major and started working toward a medical degree. You're never too old to follow your dream!

Not knowing if I would get into medical school or how I was going to pay for it didn't stop me! I worked hard and graduated with a 3.98 GPA and a BS degree. I took the MCAT (Medical College Admission Test) and was accepted at Dartmouth Medical School! A prestigious Ivy League medical school! Yes, you *can* dream big!

I was 35 when I entered medical school and didn't know what kind of doctor I wanted to be, but I knew I would enjoy the process of discovery (much like forensic science!). I was intrigued by a rotation at the state psychiatric hospital. Working with patients with psychiatric pathology made me want to know what made people tick. I decided to do a residency in psychiatry and although I didn't end up practicing psychiatry, it gave me a solid foundation for forensic analysis and dealing with the grief of loved ones.

After great conversations with incredible mentors, I settled on a career in pathology. I was now a resident in pathology at the age of 47 and my eyes opened even wider. Pathology had even more choices to make! My difficulty was that I literally loved every rotation in medical school, every discipline in pathology, and I had a hard time narrowing it down. My next step was a fellowship in surgical pathology followed by working for a private laboratory. I made decent money, but the work was not stimulating. My pathology program director and mentor told me she always saw me going into forensic pathology, and although it didn't pay as well as surgical pathology (we're working on that), she thought I would find it most fulfilling and rewarding. I looked at her like a deer staring into headlights. I began searching for open fellowship positions, quickly received two interviews and within a month had accepted a position in Cleveland! My life hasn't been the same. *This* was the piece I was missing.

Now, I am a proud member of a very select group of doctors that get to work as forensic pathologists. Imagine this, there are just under 500 forensic pathologists in the entire country! We currently need over 1000 working forensic pathologists! It's a great career choice and one could literally find a job anywhere in the country.

My day typically consists of a morning meeting with representatives from all forensic disciplines discussing cases that came in overnight. The pathologists divide up the cases and begin autopsies.

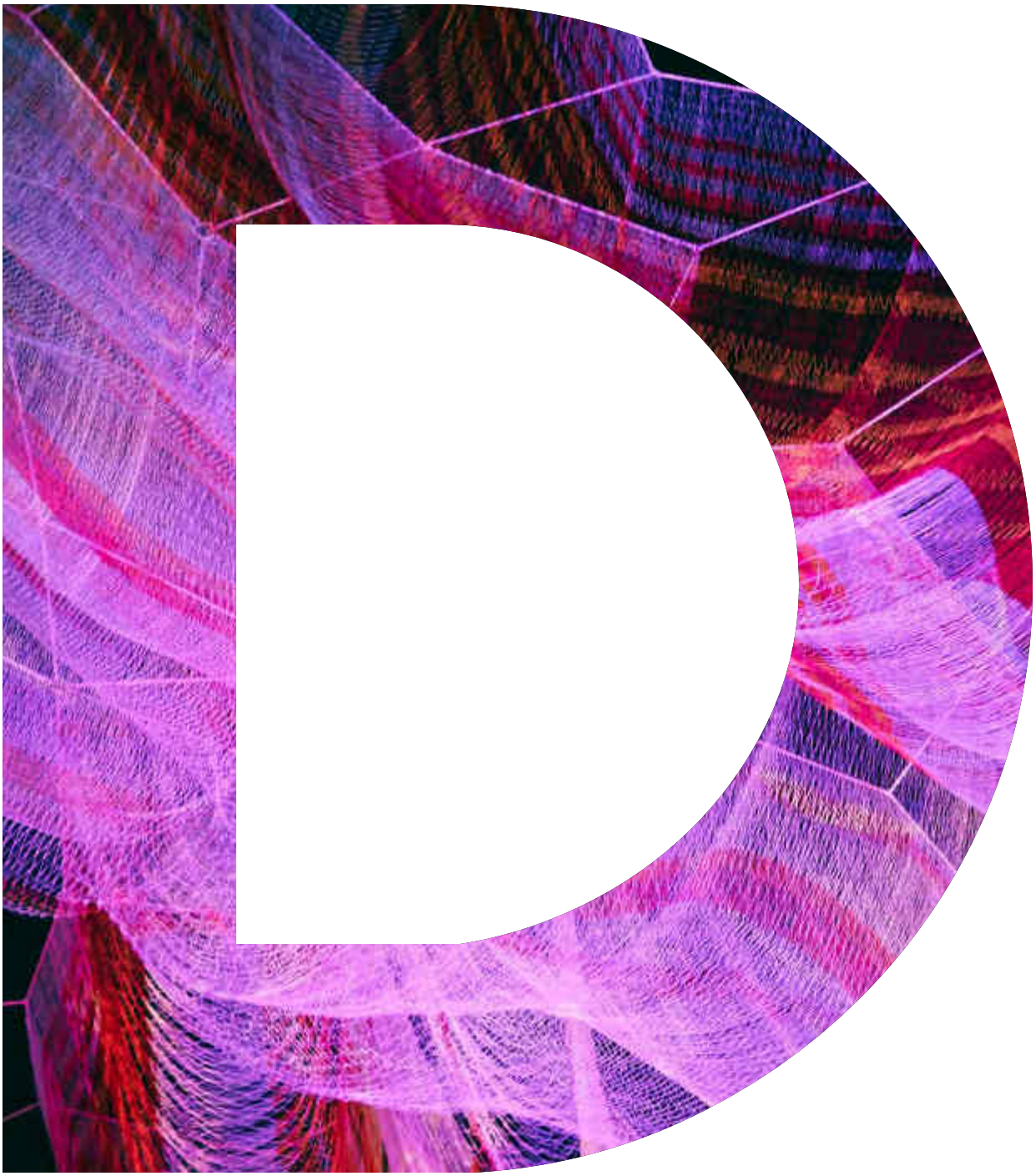
We reconvene in the afternoon to discuss autopsy findings. Mixed in are a variety of scene visits, homicide investigations, interactions with lawyers, detectives, medical students and residents. We have discussions with loved ones desperately in need of answers and closure. We meet with members of our community to educate the public and we testify before juries in criminal and civil trials. Above all, we work with a diverse team of professionals who are dedicated to getting their part right! It's fast-paced and a stimulating world of ongoing discovery.

Many people are dumbfounded by why I do this work. It can be dark and incredibly difficult at times and we see things that most people never see. Forensic pathology is not for everyone and you need a healthy detachment from the work to remain focused. Forensic science employs people in a wide variety of disciplines and there is a place for anyone considering a career in forensics.

The road to becoming a forensic pathologist can be accomplished with four years of undergraduate work, four years of medical school, three to four years of residency and one year of fellowship. The characteristics that define a great forensic pathologist must include an insatiable curiosity, a thirst for knowledge, the ability to think critically, a solid science background, compassion, empathy, a willingness to listen, ability to speak in public, an open mind, working well with a team, a healthy detachment from the work, leadership qualities and a good sense of humor. My road was unique, and in the end, I've learned that doing what you have a passion for is the most rewarding aspect of a chosen career. Follow your heart!

Dr. Todd M. Barr

"You're never too old to follow your dream!"



DNA

Salesha Baksh

By Salesha Baksh, Forensic Scientist

I was a sophomore in high school when I made the decision to become a forensic scientist. At the time, my cousin was in school for forensic science and it seemed like the most interesting career choice for me. I did not know anything about DNA or what it meant to be a forensic scientist. In fall of 2008, I started college at Ohio Northern University where I majored in Forensic Biology. At this point, I still was not sure what I was getting myself into. The required classes for forensic biology included general biology, zoology, botany, microbiology, cell biology, molecular biology, genetics, general chemistry, organic chemistry, analytical chemistry, physics, and statistics. In addition to these classes, I was also required to take a series of forensic related classes which included forensic crime scene investigation, criminal justice, forensic biology, toxicology, drug chemistry, and forensic DNA analysis.

One of the misconceptions about forensic biology is that the focus is mainly on crime scene investigation and evidence collection. A lot of forensic biology majors were shocked at the amount of science and laboratory classes they were required to take to complete their degree.

Another major requirement for forensic biology majors was to complete a 10-week unpaid internship at a crime lab. This was one of the most helpful and enlightening experiences in my college career. I interned at the

the DNA laboratory for the Montgomery County Police Department in Rockville, MD. During my internship, I was exposed to the day to day life of a "real" forensic scientist in both DNA and drug chemistry and this helped me decide my career path.

A er college graduation, I applied to become a DNA analyst at a lab in Indiana. I was not selected for the position. I then applied to the Cuyahoga County Regional Forensic Science Laboratory. ere were openings for both DNA Analysts and DNA Technicians. My college advisor told me to apply for both positions. I was selected for the DNA Technician position and started working in November of 2012.

e job listing did not fully describe the daily job duties, so I was not entirely sure what I had signed up for. e rst three months of my career involved a lot of reading and training. I trained on serology, which is the identi cation of biological uids. I learned how to identify blood, seminal material, and saliva. Once I completed my training, I had to complete a competency test to show that I was fully capable of performing serology tests. A erward, I began processing sexual assault evidence collection kits. A sexual assault evidence collection kit is a box containing swabs that are used to collect biological material from an individual a er an alleged rape. My job was to test the swabs from these kits for biological material and send them for DNA analysis.

A year later, there was an opening for a DNA analyst position and I applied for it. I was selected for the position and began my training in DNA analysis. e training was meant to last about six months, but I trained for about a year because I was still performing my technician duties while training as an analyst. I followed a training manual which listed all the samples on which I had to perform DNA analysis. Once the laboratory training was complete, I had to take a competency test. I then had to take a written test followed by a mock trial.

As a DNA analyst, I spend about 20% of my time working in the lab and 80% of my time working at my desk. It's not like the TV show *CSI*. I am assigned cases in a batch. I spend time researching the cases, reading the police reports, and reviewing what items need to be tested. Next, I start my laboratory process. e DNA analysis process is broken down into four steps: extraction, quanti cation, ampli cation, and genotyping. DNA extraction is the process of opening the cell and isolating the DNA from the extracellular material. During quanti cation, we measure the amount of DNA in each sample.

e ampli cation process is when we make many copies of the DNA which is then genotyped using a genetic analyzer. Genotyping creates a graphical representation of the data (the DNA pro le) which is then used for interpretation. Interpretation is when the desk work begins. Each DNA pro le is individually reviewed and compared to any reference DNA pro les in the case. A DNA report is generated. Each case then goes through a thorough review process before it can be released to the detective. Once the case is reviewed and released, we enter any DNA pro les from qualifying evidence into the Combined DNA Index System (CODIS) which is a database containing millions of DNA pro les from labs all over the country. ese pro les are all compared to each other to see if any cases are linked by DNA.

Finally, with any case that I work on, I can be called to testify in court as an expert witness. Personally, I think this is the *most stressful* part of the job. As an expert witness, I am expected to answer questions regarding my DNA report and all of the DNA processes performed in our laboratory. I also have to be mindful to speak in a way that is understandable to a jury.

Overall, it is a lot of work to be a forensic scientist but it is also a very rewarding job knowing that we are making a di erence in our community.

"As a DNA analyst, I spend about 20% of my time working in the lab and 80% of my time working at my desk."

TOXICOLOGY

Rocks

By Claire Kaspar, Forensic Toxicologist &
Rindi Rico, Forensic Toxicologist

Toxicology is the study of adverse effects of drugs and chemicals on biological systems. Forensic toxicology is the application of toxicology for the purposes of the law. Forensic toxicology consists of three subdisciplines: *postmortem, human performance* and *forensic drug testing.*

Here at the Cuyahoga County Medical Examiner's Office (CCMEO) we perform both *postmortem* and *human performance toxicology*. Toxicologists at CCMEO perform *postmortem* toxicology on biological specimens (blood, urine, etc.) submitted by forensic pathologists in order to determine if alcohol and/or drugs played a role in an individual's death. This will aid in the final determination of cause and manner of death. Our laboratory also conducts *human performance* toxicological testing on the specimens submitted to the Cuyahoga County Regional Forensic Science Laboratory (CCRFSL) from local law enforcement agencies. These cases are typically Driving Under the Influence of Drugs or Alcohol (DUID/DUI) related or Drug Facilitated Sexual Assault (DFSA) cases, and it is the role of the toxicologists to determine whether the defendant/victim was under the influence of drugs or alcohol at the time of the incident. Examples of *forensic drug testing* include workplace testing, doping control in sports and probation testing.

What do you do on a day-to-day basis?

Our main duty is to determine if a biological specimen contains a chemical substance. In toxicology our evidence is biological samples. Since our work potentially may end up in court, we must maintain a chain of custody for all samples received in our lab. As evidence is received it is accessioned (logged into the toxicology database). The accessioner records what specimens were received as well as the volumes of those samples. Testing is then added as requested by the submitting officer or pathologist. We then perform testing on the blood, urine, etc. to pull (extract) any existing drugs out of the samples. The sample containing potential drug is then analyzed on high tech instrumentation, such as gas chromatograph/mass spectrometers (GC/MS) and liquid chromatograph/mass spectrometers (LC/MS). A large portion of our time is spent interpreting the data produced by the instruments.

Each week we also spend time reviewing data prepared by other analysts, maintaining the instruments and performing miscellaneous administrative duties. In our laboratory, we frequently receive subpoenas (get called to court), but only occasionally have to testify.

How do I become a forensic toxicologist?

For an entry level position in our laboratory these are the requirements: Bachelor of Science degree in a natural science with a specialization in Forensic Toxicology, Chemistry, Medical Technology, Biology or a closely related eld in science and preferably one year of laboratory experience in a forensic environment; or a forensic focused internship.

ere is a high demand for forensic jobs and a limited number of forensic laboratories, which makes this eld competitive. ere are jobs available, but you may need to relocate in order to start a career in forensics.

What do you enjoy about being a forensic toxicologist?

e work we perform is interesting, exciting and challenging. ere are always new illicit and pharmaceutical drugs entering the market which keeps us on our toes. If you are interested in forensics, but concerned about interacting with deceased individuals, then toxicology is the place for you; in our laboratory we only receive test tubes lled with biological specimens.

e Forensic Toxicology community is relatively small and tight knit. In our laboratory we are given the opportunity to present research at regional and national conventions each year.

e conventions are great places to network and meet well respected scientists from all over the world as well as participate in workshops and continue our education.

"There is a high demand for forensic jobs and a limited number of forensic laboratories,"

The following courses are recommended to best prepare you for a future in forensic toxicology:

Chemistry: General Chemistry*, Organic Chemistry*, Analytical Chemistry*, Physical Chemistry*, Biochemistry*, Instrumental Analysis*

Biology: General Biology*, Anatomy and Physiology*

Mathematics: Algebra, Precalculus, Calculus, Statistics

Miscellaneous: Pharmacology, Toxicology*, Physics*, Forensic Toxicology Internship**

Elective Forensics: Any forensic courses, such as: Criminalistics, Criminal/Forensic Science Investigation, Laws of Evidence, Constitutional and Criminal Law

*Register for the laboratory credit if o ered
**An internship in forensic toxicology will be the most valuable experience during your undergraduate career, not only will you learn key skills, but you will also have opportunities to network with practicing toxicologists.

Additional Resources:

American Academy of Forensic Sciences
www.aafs.org

Society of Forensic Toxicologists
www.so -tox.org

EVERYTHING YOU NEED TO KNOW ABOUT DRUG CHEMISTRY

By Megan Peders, Forensic Chemist

I have been a forensic drug chemist in the drug chemistry department at the Medical Examiner's o ce since November 2014. I have a B.S. in chemistry with a minor in criminal justice. Hindsight being 20/20 and all, I put together a list of ten pieces of information I wish I was told as I was pursuing my career in forensic science.

PICK THE RIGHT MAJOR

Ok, so this might seem like a no-brainer, but one of my mentors gave me some great advice that equipped me to enter the eld I'm in now. While some of you reading this may have already selected your major, or even completed your degree. Do not panic. Keep reading on for some tips that apply to you as well. I was told to pick a major in a hard science, not speci cally forensic science or forensic chemistry.

It can be hard to nd a job in the highly competitive eld of forensics or you may ultimately decide this is not a good t for you and with a degree in a hard science you have the exibility to move into or out of a forensics career.

Now all that to say if you do have a degree that is forensic science or forensic chemistry you are not a lost cause. ere are still plenty of opportunities open to you and

there may be internships, fellowships, or work-study programs that will funnel you straight into the workforce.

IT'S NOT FAILURE IF YOU LEARN

is might be hard to hear, but you're going to have horrible interviews. Trust me, I have had several, but they all served as learning experiences. e job I currently hold is proof of that.

I had several passable interviews and one catastrophic interview prior to walking in to interview for my current position. In that interview I was able to answer almost all the questions I was asked with con dence and more importantly correctly, because I learned from all the times I got them wrong in previous interviews.

A few topics to be well versed in as it pertains to drug chemistry: GC/MS, FTIR, commonly used color tests, marijuana identi cation, sample population, and homogeneous sample.

TO GET A MASTERS OR NOT TO GET A MASTERS? THAT IS THE QUESTION

e best answer for this question is: it depends. It is not usually

up into a management role and even then it's not always required. Some positions do not require any previous experience, so you can start there straight out of school. ere are some positions that require experience or a master's degree in lieu of experience. It has been my observation that experience trumps a degree. is is where researching and networking come into play.

FINDING A JOB

ere are several national, international, and regional associations. All these associations have websites with job boards and you do not have to be a member to search and apply. Some are forensic discipline-speci c, some are multi-discipline, and others are hard science speci c.

at is how I found my job. ese are speci cally great if you are willing to move anywhere. If you want to stay in a speci c area, then regional associations may be a more fruitful option. Most state, county, city, and federal entities have job boards as well. I would make it a part of my weekly routine to check out these websites for anything new that has been posted.

COUNSELING IS NOT WEAKNESS

While most days are good, some can be incredibly trying. You may deal with people murdering each other, babies dying, suicide, rape, backlog, quotas, hazardous material (syringes, razors, broken glass, drugs), and the smell of decomposition. Finding a healthy way to deal with this is a must. e county I work for thinks it is so important that counseling services are o ered as a bene t for us and actively encourages us to use this service.

WORK WHILE YOU STUDY

Become a lab assistant. It was beyond valuable to me. I didn't realize what con dence it gave me to walk into my rst job knowing that I knew the basics of making solutions and prep work.

INTERNSHIPS

Try for any internship you can get, even if your degree program doesn't require one. Work it in somehow. You can get an idea of the discipline and see if it would be a good t for you. You may also be able to see what court is like and get around the instruments you may ultimately be working with. Also a good networking opportunity.

NETWORKING: ALWAYS A GOOD IDEA

e saying, "It's not what you know, it's who you know," is more applicable than you think. Whether public or private sector, you'll have to boil yourself down to a piece of paper or a form on a website. Getting that resume to rise to the top of the pile can depend on your ability to form a relationship with someone at that organization.

KNOW THE DISCIPLINE

Yes, we know it is not what you see on TV, but it is a good idea to understand the di erence between forensic science disciplines. Drug chemistry is not the same as toxicology (I can't seem to get this through my husband's head) neither is ngerprints, nor ballistics, and none of them do autopsies! Having an idea of what each area does will help you to gure out what degree you should pursue, in uence your part-time job (gun range anyone?), or put any further schooling into perspective.

MENTORS

If possible, nd one or two. I have been fortunate enough to have two mentors in my career. ey have both been beyond valuable to me in helping me get to where I am now.

Advisors at college are a good option. ey don't have to be speci c to your eld of study to be helpful. Everyone needs someone to talk you o the ledge and put things into perspective.

Megan Peders

DEATH INVESTIGATION 101

By Erin Worrell, Medicolegal Death Investigator

As a Medicolegal Death Investigator (MLDI), you are considered the last of the rst responders when responding to death scenes or hospitals in the cases of fatalities that fall under the Medical Examiner's jurisdiction. e MLDI is one of a number of team members working within the Medical Examiner's O ce in the determination of cause and manner of death, when a death is taken under the o ce's jurisdiction.

SCENE ESSENTIALS

CAMERA

PERSONAL PROTECTIVE EQUIPMENT

PEN
NOTEPAD

In the investigation of sudden unexpected deaths for the Medical Examiner, the MLDIs are the rst piece of the forensic puzzle, in determining *how* and *why* someone has passed away. Your role as an MLDI is to be the eyes, ears (and nose) for the Medical Examiner, who in Cuyahoga County is also a forensic pathologist. Your presence on a death scene is important because it is the rst opportunity to look and evaluate a scene, that can never be recreated.

As an MLDI, you see the dark side of life, crawling through collapsed buildings, climbing on piles of garbage, scaling down the sides of cli s, hanging over the highest bridges and buildings, manuevering through bug infested establishments, working outside in all di erent weather environments, investigating crime scenes, going through people's residences, and responding to hospitals throughout Cuyahoga County. You can also expect to work with every law enforcement agency in the county. Sounds amazing -- which it is, but it is also a serious and intense job, and not for the weak of mind, stomach, and heart.

An MLDI's job starts on someone else's worst day. When you go to a scene, it means that you will likely meet someone who has lost a loved one. e job requires you to be the voice and advocate for the dead and make sure their rights are met. You are there on scene talking to family members or friends, asking them questions (some regarding intimate details) about the deceased during the family's most vulnerable time in their life. You are there helping families understand what happens next with the Medical Examiner's involvement, and being a liaison for them. ere are also times when this job requires you to make the death noti cations to families in person, on the phone, or when we must perform a viewing of an unidenti ed decedent to obtain a positive identi cation.

What this job entails at the Cuyahoga County Medical Examiner's O ce (CCMEO) is handling and taking all the death calls in Cuyahoga County. ese calls come in from hospitals, nursing homes, hospice services, police, and re departments. For every death that is reported to the o ce, a decision must be made if the Medical Examiner's O ce will take jurisdiction of the death. Understanding and knowing medical history, and the circumstances surrounding the death, helps in making these decisions. At times it can be easy to know if we are taking jurisdiction over the case, while other times it requires a great deal of background work. is may include looking through medical charting, talking to doctors, family, friends, police, and emergency medical professionals. Ultimately, deciding to take jurisdiction of a case may involve a trip to the scene to take

custody of the body and evaluate the decedent in the context of the surroundings, location, position and disposition that the decedent was found.

Each scene is unique. Once there, the MLDI uses their trained eye to assess the scene, document evidence through photography and accompanying narratives, which includes items found on or around the area of the body that present details and information that may help to explain the circumstances surrounding the death. Additionally, information is obtained through interviews with individuals on scene including family, friends, witnesses, law enforcement personnel, EMTs, and re department personnel. All relevant information is documented and included in the MLDI's report. Once back at the o ce additional background information is obtained through obtaining medical history information from medical records, prescription drug histories, arrest records, review of electronic record evidence, and social media as necessary.

e job is a twenty-four hours a day, seven-days a week job. You work holidays, weekends, birthdays, through severe weather, mass casualty events -- whatever the circumstance presents where fatalities are involved. Basically, if the county shut down for any reason, you are still required to go to work. With this job comes *a lot* of trust, and that must be taken seriously. We must maintain the trust of the public and personnel we interact with including hospitals, mortality departments, family liaisons, advocacy groups, the Department of Children and Family Services, adult protective services, attorneys, police, doctors, nurses, social workers, and decedent families.

If a case arrives at the o ce without any known next of kin, it is the MLDI's responsibility to nd the family, and make the death noti cation. If a case comes into the o ce unidenti ed, (for many reasons including; issues of no identifying documents, features, friends or family on scene, decomposition, trauma, or re deaths etc.) it is our responsibility to track down ways to be able to identify them. If a death certi cate is not lled out properly by the hospital doctor or primary care physician, it is our job to investigate the death, and either have them amend the death certi cate or have the death taken under CCMEO's jurisdiction.

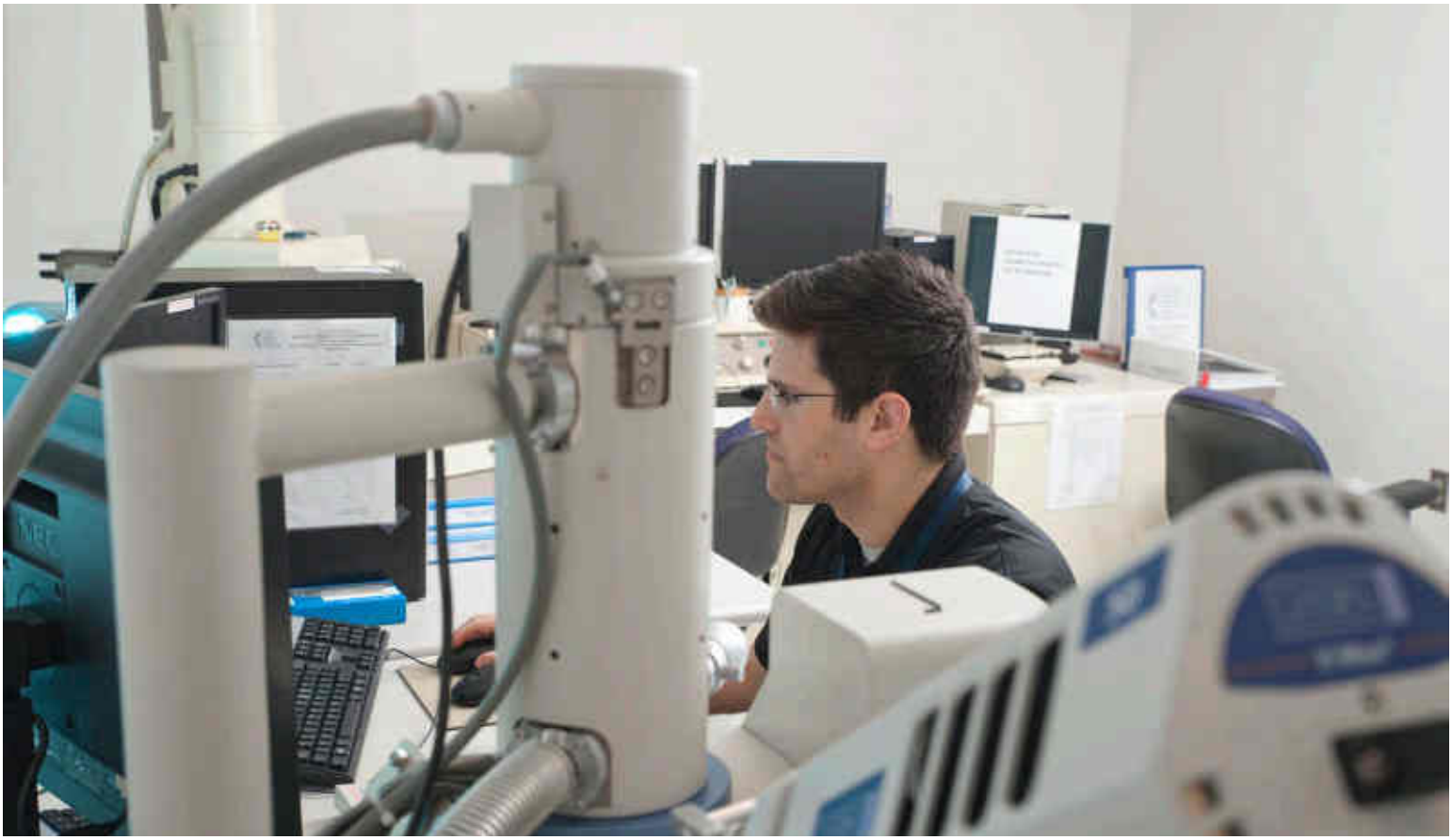
Another part of our job as an MLDI is the physical aspect. A lot of the times you are li ing, rolling, and moving decedents of all shapes, sizes, and physical conditions. When a decedent has been transported into the o ce, you may be required to: undress the deceased, take physical statistics (i.e. color of the eyes, hair, mustache, beard, note teeth condition, measurements of height and weight), and tie the toe tag to the deceased's toe. For the decedents that do not have an autopsy performed, we are in charge of viewing those bodies with the forensic pathologist and taking vitreous humor (uid from the eye), urine, and blood samples from those bodies before they are released to a funeral home. At our o ce, we are also part of the group that can release bodies to the funeral home.

e challenges we struggle with being an MLDI is dealing with grieving families, the daily toll of working with death itself, having to be able to multitask, thinking outside of the box, creating boundaries with oneself (so you don't take things from your day home into your personal life), and dealing with strong personalities from all the agencies and disciplines that we meet on scene during a death investigation.

Finally, it is also expected that we perform our duties in a professional and non-emotional manner. e job of an MLDI is challenging, however, it is also rewarding. In the end, our role is to be part of the team that can bring resolution and comfort to families, in determining the cause and manner of death of their loved one. In this job the dead will always tell you what happened, you just have to listen to their story.

"AN MLDI'S JOB STARTS ON SOMEONE ELSE'S WORST DAY."

Erin Worrell



DISCOVERING TRACE

An Interview with Daniel Mabel

Daniel Mabel is a forensic scientist specializing in the discipline of Trace Evidence. Mabel began his career at the Cuyahoga County Medical Examiner's Office in 2011, and has shown a focused determination to increase the reputation of the office, and advance forensic science. In a short amount of time, Mabel has become a respected member of the forensic science community, praised for his attention to detail, adherence to scientific principles, and independence when testifying in a court of law.

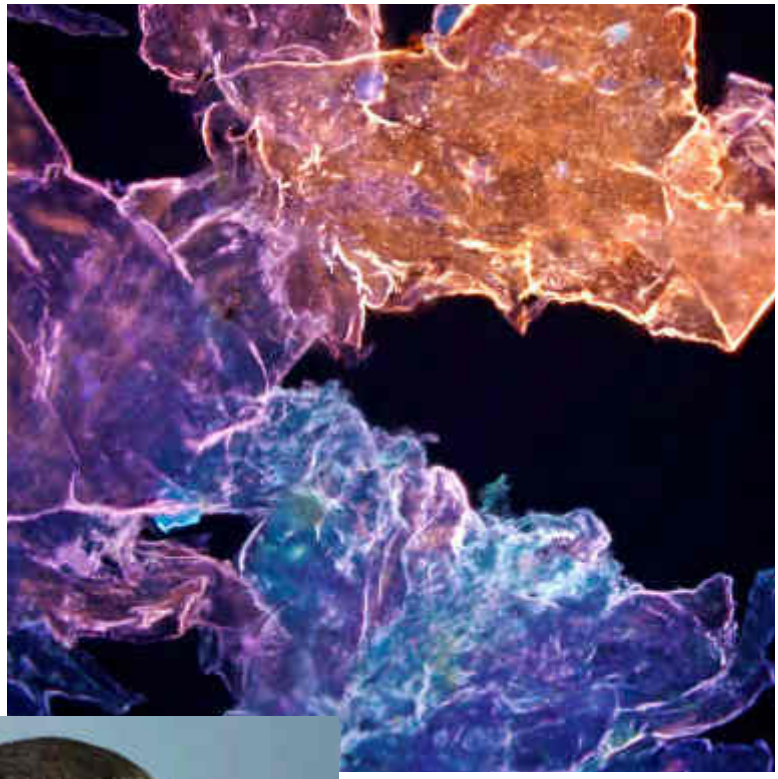
What is Trace Evidence?

Trace Evidence is any material transferred when two objects come into contact with each other. Examples of trace evidence include fibers, hairs, paint chips, glass fragments, gunshot residue, and others. These items are often microscopic, limited in quantity, and are very easily moved/destroyed/washed away. As a Forensic Scientist in the Trace Evidence Department, my job is to detect the transferred material, collect and preserve it, analyze it to determine what it is and/or what it's made of, and oftentimes to compare it to a possible source.

When did you realize you wanted to pursue a career in forensic science?

When I was in the seventh grade, I remember going to a job fair and listening to a forensic pathologist talk about doing autopsies. As a 13 year old, I was fascinated by

"I went on to pursue a degree in Chemistry and eventually discovered Trace Evidence in graduate school."



by the idea of looking inside someone to find out how and why they died. When I went home from school that day, I told my mom all about it. She made the ultimate mistake of telling her teenage son, "That sounds gross, you shouldn't do that," which I of course took as a challenge! Ever since then, I have been interested in forensic science in its various forms. After high school, I went on to pursue a degree in Chemistry and eventually discovered Trace Evidence in graduate school.

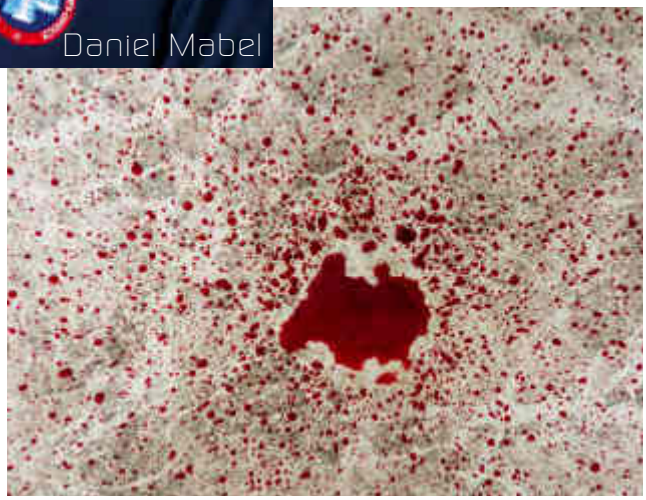
Is trace evidence anything like it's portrayed on TV?

In my opinion, TV typically starts in a good place and then blows things way out of proportion.

I took a class in college from someone who was a consultant on the original CSI. He told me that for each episode, the producers would come to him, tell him what the scenario was, and ask how a real-life forensic scientist would handle it. He would tell them everything he knew about the topic, including types of evidence, how to collect and preserve evidence, how to analyze samples, and possible links that could be made between suspect, victim, and crime scene. Inevitably, whenever he viewed an episode on which he consulted, only small remnants of the informationn he provided would be left over, and the rest

Daniel Mabel

"TV typically starts in a good place and then blows things way out of proportion."



would be thrown out the window to make things more entertaining and/or visually enticing. It is the purpose of television to entertain. The problems only arise when TV viewers begin to believe that what they see on CSI is 100% real, and bring thier presumptions into a court room as a juror, attorney, or a judge.

What is the best part about your job?

The best part of my job is the variety. I feel lucky to be part of a small Trace Evidence Department within a relatively large agency. It allows me to be a generalist and to gain experience in a large number of the subdisciplines of Trace Evidence. It also means that every time I think I've finally seen it all, something new and exciting is usually just around the corner!

What is the most challenging part about your job?

The most challenging part of my job is attempting to complete all the cases on time. New cases are constantly coming in and they all have wildly varying levels of complexity. Unlike CSI, it takes a bit longer than 42 minutes plus commercials to finish each case. It can be difficult to catch up on older cases while attempting to stay current on new cases. As a rule, I always try to work on the oldest cases first, unless a detective or an attorney calls me to make a "rush" request (i.e. high priority) on a case. The end result is that I hardly ever get to work on the oldest cases first because there is always something that needs to be rushed!

Do you ever have to testify in court?

I have testified in Court over 40 times.

How did you feel the first time you had to testify?

I don't really remember the first time I had to testify in Court. I only remember being shocked that all the mock trials and practice I'd done in the years prior were so much more theatrical and intense than the real thing. I suppose that's the point of practice; to prepare you for the worst case scenario. Luckily, I have only had positive experiences testifying in Court. I typically don't get too nervous in public speaking situations, and I enjoy the aspect of my job that allows me to explain what I do to people who aren't familiar with it.

What steps should a student take if they want to pursue a career in trace evidence?

The number one requirement to pursue a career in Trace Evidence is to acquire a bachelor's degree in chemistry, biology, physics, or forensic science. A Master's degree in Forensic Science is not a requirement, but can be helpful in making someone more competitive on the job market, providing networking/internship opportunities, and/or providing research experience.

If you are looking for an undergraduate or graduate program that is specific to Forensic Science, I'd encourage you to consider the programs accredited by the Forensic Science Education Programs Accreditation Commission (FEPAC), an organization dedicated to ensuring the quality of forensic science education through a formal evaluation and recognition of college-level academic programs. In addition, I would encourage you to pursue student membership in a number of professional organizations relevant to the field of Trace Evidence, such as the American Society of Trace Evidence Examiners, the American

"I have testified in Court over 40 times."

Academy of Forensic Sciences, the Midwestern Association of Forensic Scientists, and the International Association for Identification. Affiliation with these organizations and/or attendance at their conferences/meetings can help you greatly in networking and making connections with actual forensic laboratory employees to secure internship and employment opportunities.

What is a typical day at work like?

My typical day at work begins with collecting trace evidence from the bodies of victims of violent death (homicide, suicide, suspicious death). For example, I might swab for DNA under the fingernails of a victim who was in a physical altercation prior to death, I might compare a partial shoe print on the back of a victim's jacket to the pattern on the sole of a suspect's shoe, or I might collect and examine automotive paint chips from a victim's hair and tell the police the color of the suspect vehicle that fled the scene. In addition to examining evidence related to victims' bodies, I spend another portion of my time examining evidence collected from crime scenes by police departments and other agencies and submitted to my laboratory. For example, I might analyze a gunshot residue sample from the hands of a nonfatal shooting suspect, I might examine a suspect's clothing to look for tiny droplets of a victim's blood, or I might compare a roll of duct tape found in a suspect's garage to the tape found wrapped around the wrists of a victim. The final portion of my time is spent performing various administrative tasks, such as (lots of) paperwork, proficiency testing, quality assurance and quality control practices, writing reports, compiling case files, directing the documentation of evidence through photography, and testifying in Court.

> "I take solace in knowing that my work may eventually bring some closure and/or justice to those who survive in the wake of another's death."

What do your friends and family think about your job?

My friends and family think my job is interesting, but they don't understand how I can deal with the sights (and smells) or the emotional trauma of interacting with the bodies of victims of violent death. I've personally never had a difficult time dealing with that aspect of my job. In fact, I often feel that doctors and nurses have it a lot harder than myself in terms of dealing with trauma and stress. Doctors and nurses have the burden of forming relationships with their patients (and the patients' families), and then being present for the experience of that person's pain and potentially for their death. From my perspective, my job allows me some reprieve because I do not have to form a relationship with the person, and once I interact with the person's body, they are no longer in pain and are no longer suffering. I take solace in knowing that my work may eventually bring some closure and/or justice to those who survive in the wake of another's death.

UNCOVERING FINGERPRINTS

An interview with Felicia Ruffin

FELICIA RUFFIN

Forensic Scientist

Felicia Ruffin is a forensic scientist with over 20 years of fingerprint examination experience. She began her career in fingerprints with the Cleveland Police Department, and accepted a position at the Cuyahoga County Medical Examiner's Office in 2015.

What skills should a fingerprint examiner have?
Fingerprints are unique, so you'll need to be able to pay attention to minute details. Additionally, you'll need to have a scientific working knowledge of biology and chemistry as it pertains to obtaining, analyzing and evaluating friction ridge examination. Communication and writing skills are also important, because you'll need to properly convey examination results to investigating agencies.

What is your favorite part about your job?
Performing visual examinations of finger and palm prints and reaching a conclusion of identification brings me joy. It's very similar to solving a complex puzzle.

How often are you required to attend trainings?
I am required to attend at least one training seminar a year. As an International Association for Identification (IAI) certified latent print examiner, I am required to have a specific number of training hours to maintain my certification.

Do you find these trainings helpful?
The training is helpful because it allow me to remain up-to-date in current trends and topics within the discipline. They also provide a different way of looking at the same issue, allowing examiners from various backgrounds to share ideas.

What is something people don't typically realize about fingerprints?
Friction ridge skin is permanent and individually unique. Meaning that there are no two fingerprints that have been found to be the same, not even from identical twins.

When you tell people you've just met about your job, what is their reaction?
People always say how interesting the career sounds and they always relate it to *CSI* - the TV show. However, the show tends to over-simplify the science.

What is the most challenging part about your job? Testifying in court. I've had to testify in high-profile homicide cases where my fingerprint examinations played a pivotal role in identifying the suspect. When testifying you need to be knowledgable, ethical, and organized. Testifying as an expert witness is part of the job, so be prepared.

How has fingerprint technology changed in the last 10-20 years?
The Automated Fingerprint Identification System (AFIS) is the computer system that encases all the fingerprints of persons arrested locally, statewide and nationally. When there are unidentified latent prints from crime scenes, these prints can be uploaded and searched in AFIS. AFIS produces a candidate list of similar prints, and visual comparisons are performed by examiners. 20 years ago, one search could take hours or days to return a candidate list. Fast forward 20 years, searches can be returned within 45 seconds. The speed and accuracy of the AFIS matching system has improved our profession immensely.

Where would you like to see fingerprint technology advance to?
I would like to see fingerprint searches become *more* accurate with *less* information. If we could streamline the required documentation and increase the accuracy of the AFIS matcher - it would increase efficiency.

How many fingerprints would you say you've viewed in your career (estimate)?
In my 23-year career I have seen and compared into the double-digit millions of finger and palm prints.

How did you end up working in Fingerprints?
I received a degree in Biology from Spelman College with the intention of attending medical school. I wanted to take a year off after college graduation to work temporarily and study for my medical school entrance examinations. I applied for the Cleveland Police Department's forensic laboratory. They had an opening in fingerprints and I fell in love with finger and palm print examination. It was a new and exciting adventure every day. It was challenging and rewarding all at the same time. Needless to say, I never went to medical school and I have absolutely no regrets.

How does one prepare in high school or college to become a fingerprint examiner?
In high school, focus on a science-based curriculum, as well as maintaining good grades in all other classes. There are many colleges that currently offer forensic science degrees. Try to get internships or summer programs that are offered in the discipline to gain experience to set yourself apart.

"I've had to testify in high-profile homicide cases where my fingerprint examinations played a pivotal role in identifying the suspect."

FIREARMS

AND THE

CSI: EFFECT

By Mallory Foran, Forensic Scientist I

For those of you who are like me, you might have been drawn to the field of forensic science because of something you saw on TV.

I grew up watching CSI:, Without a Trace, NCIS, Criminal Minds, and anything else out there that involved crimes that were solved by investigations, science, and/or law enforcement. I knew from a young age that I wanted to do the same thing as those actors on TV portraying the roles of forensic scientists – I wanted to actively solve crimes and help get the bad guys off the streets!

Fast forward to college, where I majored in Forensic Science with a minor in Criminal Justice at a college in Albany, New York. My classes provided a brief glimpse into a career in forensic science, providing me with background knowledge and laying the foundation for training that can only come once you start working in a forensic laboratory. One thing they don't tell you on TV is how the actor "experts" would have had to go through training before they could perform any of the analyses that they do in their shows.

Training is very regimented and modular, and the timeline for training in different laboratory sections varies greatly and can also vary from scientist to scientist. For example, typical training to become a drug chemist is about six months, while typical training to become a firearms examiner is about two years. Training for every section within the laboratory also includes preparation for testifying in court. Forensic Science is the application of science to the law, so it's important that forensic scientists are able to convey the science of analyses they performed to a jury during a trial.

Another thing that often gets mixed up on these famous crime scene shows is that your job as a forensic scientist is not to act as jack of all trades when it comes to a case. Sometimes you will see the actor receive a call to come out to a crime scene, where they then pick up all the firearms, cartridge cases, cut bullets out of walls, and determine the trajectory of the bullets before they head back to the laboratory.

Next, they perform the analysis on all these evidence items immediately, receive the results, and are quickly making phone calls to have the suspect arrested (this is not a scientist's job!).

In reality, there are some agencies out there where you may be called to a crime scene to gather evidence. However, you wouldn't necessarily be the one who also transports the evidence back to the lab and analyzes it – and that case wouldn't always be immediately analyzed either, depending on what other cases were already being worked on at that time, and if someone was available in the section. TV shows have a limited amount of air time and need to keep their

audiences captivated, so they tend to portray analyses occurring in a faster time frame than they normally would occur in a laboratory.

For example, a TV show might depict a cartridge case picked up from a crime scene that morning that has been placed into an imaging system and quickly run through the database to produce information on the firearm that the cartridge case was fired in, along with who owns the firearm, and where they live.

However, at typical laboratories, that cartridge case evidence would first have to be submitted to the laboratory by the law enforcement agency that responded to the scene. It would then be sent to the storage location queue for the firearms section until a scientist from the section was notified to pick it up, who would then fill out the required forms and worksheets to document the evidence before entering it into the national imaging database.

Once the images had been saved, that scientist or someone else in the section would have to look at the images of other cartridge cases produced by the algorithm within the system and determine if they agree with any of the possibilities that the system produced. If they do agree with a cartridge case that the system determined to be a potential "match," the original evidence and the potential "match" would need to be physically compared using a comparison microscope.

Only after a firearms examiner looked at the actual evidence could a definitive notification be sent to the agencies that submitted the evidence items – and it wouldn't include information about who owns the gun or any of their personal information like their exact GPS location.

One could say that the "CSI Effect" skewed the expectations that an everyday citizen has for the field of forensic science. This includes those citizens who are called to serve on a jury, and those looking to further their education in the field and eventually start their career as a forensic scientist. It is important to understand that TV shows about the field are great, captivating, and they do have some similarities with what actually occurs in a forensic lab, but not quite everything you see is exactly how it works in real-life.

If it's possible, try to arrange a tour of your local forensic laboratory and get a feel for what the environment is like. An internship is another great way to gain first-hand experience and determine which section you're most interested in.

pho·tog·ra·phy

& forensics

By Katherine Shipley, Forensic Photographer

The use of photographic techniques in forensic investigations is known as forensic photography. These photographic images can play a valuable role in the investigation as well as serve as evidence in the court of law. Forensic images can help investigators and juries understand things that can be hard to describe in mere words, such as the spatial relationships between objects and people at a crime or death scene or the nature of a victim's wounds and injuries.Additionally, forensic scientists use forensic photography to document the condition of evidence before and after a forensic examination or the findings of a forensic examination, including those that are not readily visible by the human eye. For example, a gunshot victim's shirt may be photographed as it was received to document its condition and any visible evidence, then photographed again under infrared light to show any gunshot residue that may not be visible under regular lighting conditions. Forensic images may also be used by forensic scientists for analysis. For example, a photograph taken of a fingerprint or shoe print found at the scene of a crime can be used to compare them to a suspect's fingerprints or shoe prints. In this case, that photograph will become crucial evidence in a court of law that could show the guilt or innocence of an individual.

Because they can be used for analysis by other forensic scientists and submitted in court hearings, proceedings or trials, it is of extreme importance for forensic images to be a fair and accurate representation of the item or items they portray. This requires a forensic image to be properly exposed and in focus and portray accurate colors, size and distance relationships. While anyone can snap a picture with a digital camera, being able to accurately capture evidence that can both be seen by the human eye and those that can't requires someone who knows not only the science of photography, but also the common tools and techniques used in forensic photography. A forensic photographer must be able to select and use the best equipment and photographic techniques needed in various environments and lighting conditions. A knowledge of alternative light sources, such as ultraviolet (UV) and infrared (IR), and their use in forensic photography would also be needed.

The environment in which the forensic photographer works, and the photographers' daily duties and responsibilities are largely dependent on the agency they work for. Those employed by law enforcement agencies will often serve as crime scene photographers, responsible for documenting the appearance and location of victims and other physical evidence at a crime scene. These forensic photographers generally double as crime scene technicians or investigators and are often responsible for documenting

evidence in other ways and eventually collecting that evidence. Within the state of Ohio, these forensic photographers/crime scene technicians are often sworn police officers.

A forensic photographer in the Cuyahoga County Medical Examiner's Office is tasked with photographing all decedents for identification purposes and signs of injury or disease and gross specimens during autopsies. In addition, they must photograph any associated clothing, evidence, property, and/or vehicles that may come in with the deceased. Those digital images, as well as those taken by other departments, will then be processed. This includes color correcting/ensuring proper exposure of the images using Adobe photo editing software and uploading the images to a viewing software. Additionally, they are responsible for maintaining the integrity of all digital images. This is done by maintaining chain of custody forms, by storing and archiving original copies of all digital images and documenting any and all changes made.

While the work of a forensic photographer is different depending on who they work for, at the Cuyahoga County Medical Examiner's Office, work is typically performed in an office/laboratory environment. Photographers are frequently on their feet, bending over, and climbing stairs all to get the best photograph possible. They also must be able to do this quickly and efficiently. Due to the nature of our work with the deceased, they are often exposed to strong odors and bodily fluids. Occasionally, our photographers are tasked with photographically documenting a crime and/or death scene that may occur in an indoor or outdoor environment in all sorts of conditions and times of day and night. These conditions can include adverse weather or unsanitary environments. While most work is performed during workdays, forensic photographers are required to be on call and work the occasional weekend and holidays. Additionally, forensic photographers are considered essential personnel, meaning we are required to show up to work no matter the weather.

So how does one become a forensic photographer? Since forensic photographers are first and foremost photographers, one must gain experience as a digital photographer using a DSLR camera. While the formal training required varies depending on the agency you work for, the Cuyahoga County Medical Examiner's Office requires a bachelor's degree which includes coursework in photography. While a degree in photography is preferred, it is not a requirement. Experience using Adobe Photoshop and Camera RAW are also required. Students who wish to enter this field should know that there are few civilian (as opposed to sworn law enforcement officers) forensic photographer jobs. In most other agencies police officers, crime scene technicians, death investigators, and pathologists often perform the duties of a forensic photographer when needed, so students should consider looking in to those fields as well. Those wanting more information in this field should go to the International Association for Identification (IAI) website (www.theiai.org). There you will find information on certification, job postings, training and other resources.

"forensic photographers are required to be on call and work the occasional weekend and holidays."

Katherine Shipley

IDENTIFYING THE UNKNOWN

By Dr. Linda Spurlock, Associate Professor of Anthropology (Kent State University)

Biological Anthropologists who work in the field of forensics often use their knowledge to help identify skeletonized human remains, and to explain the circumstances of an accident or a homicide.

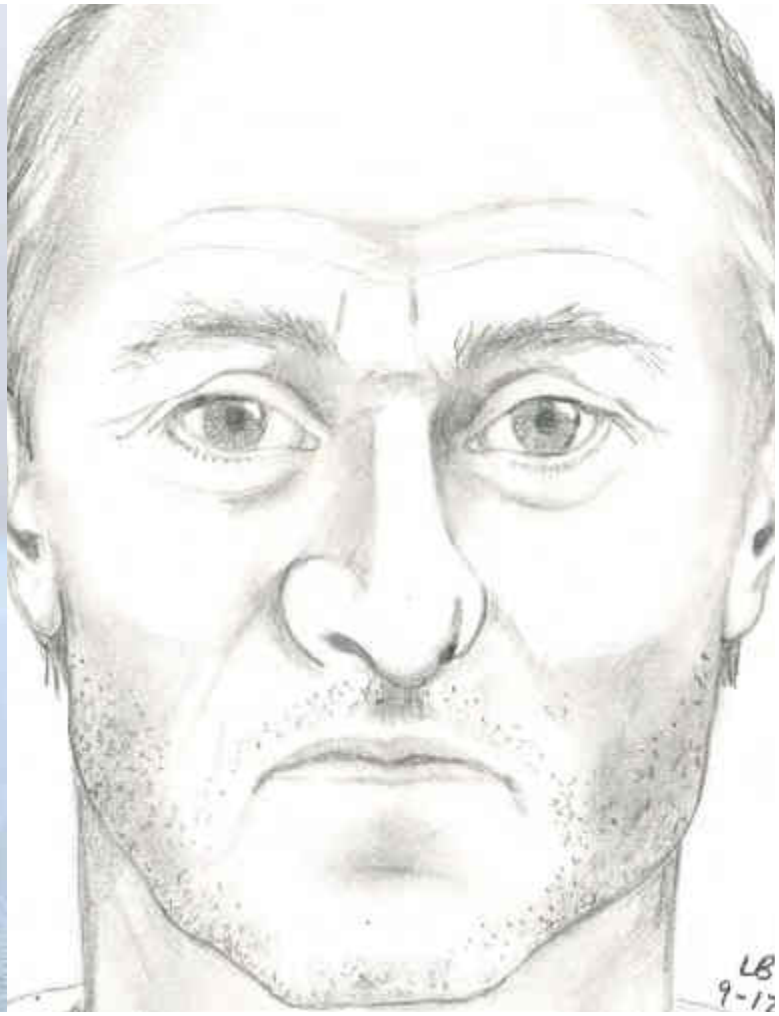
EXPECTATIONS

Field: You will work as part of a recovery team that includes law enforcement and medical examiner's personnel, and collect the human remains and any associated evidence in a careful, controlled manner. You may be part of the team that initially surveys an area looking for clandestine (hidden) graves.

Laboratory: Analyze skeletal remains to provide a Biological Profile for each individual recovered. A Biological Profile is an estimate of the person's age, sex, ancestry and stature. Any unique features of the skeleton are noted as these might be very important for establishing a positive ID. With scattered, fragmentary remains, it is first necessary to determine the minimum number of individuals (MNI) present. Just a scatter of bones might indicate the presence of *several* people.

Facial Approximation Art: Some biological anthropologists will create facial drawings or sculptures that show what the unidentified, deceased person's face probably looked like. The artist uses the proportions of the skull and bony anatomy to guide the placement and size of features. Forensic art can help narrow the field of possible matches. For example, a biological profile might indicate that the unidentified person is female, of European ancestry, and between 35 and 55 years old. That profile will probably match many missing persons! But, with a facial image, the search becomes more specific: she was that age & ancestry...and looked like THIS.

Communicating your findings: In some cases, the findings must be presented in a formal report, and this must be written with good medico-legal language; it will



become part of court proceedings. A Biological Anthropologist may be called into court (by subpoena) to be an Expert Witness, to testify about their findings.

Confidentiality: These cases are never discussed with anyone outside of law enforcement. Many of them are active homicides and the information is very sensitive.

CHALLENGES

Working in this field sometimes provides a window into the dark side of humanity and you will see evidence of cruelty, neglect and violent acts. If the remains are those of a child or baby, this can be emotionally difficult.

Some bodies/skeletons will have evidence of trauma. Sometimes, when working outdoors retrieving remains, the weather might be unpleasant (very hot or very cold, raining, etc.). The remains might not be fully skeletonized, and the odor of decomposition is difficult for some people to handle.

PREPARATION

Students who choose this field typically major in Biological Anthropology and include a forensic focus. Undergraduate coursework should include human anatomy, human osteology (including age, ancestry, & sex determination), and an archaeological field methods class. Taking a Forensic Archaeology Field School is very good preparation for the 'retrieval' part of the job; some universities offer this course.

Dr. Linda Spurlock

Master's level course work should include fragmentary osteology, distinguishing human from animal bones, distinguishing types of trauma, recognizing skeletal pathologies and markers for nutritional deficiencies. Analysis of burnt bone is often necessary, students need to learn how bone deforms and shrinks as it is exposed to heat. Some jobs are available to students holding only a Master's degree. Usually Biological Anthropologists have a PhD, which entails research, analysis, and the writing of a dissertation.

Whether on the Master's or PhD level, students should conduct research projects that use osteological collections, so that they can see the normal range of variation in a skeletal population. This means examining *many* skeletons, and understanding how some features that indicate male vs. female may not be vivid on a skeleton of known sex. It means seeing how some females are taller than some males, how some skeletons are extremely rugged, while others are quite 'gracile' (a word that means delicate). You will see how some age indicators are quite dramatic, some are vague, and some seem contradictory. Much of this variation is completely normal.

To become a facial approximation artist it is necessary to take workshops in forensic art techniques, and the instructors should be people who are experts in the field. In these courses, students follow the guidelines of forensic art to make faces (sketches or sculptures), and part of the fun is you then get to see photographs of what the individual looked like when alive. Instruction in age progression is usually part of the curriculum, as well as postmortem sketching (drawing faces based on traumatized or decomposed soft tissue facial anatomy). Courses in composite sketching, another type of forensic art, are also available. Composite sketches are drawn based on witness testimony; artists who do this kind of work usually work for police departments. Some workshops offer instruction in using computer software (with 3-D scans of skulls) to create the facial images

REWARDS

This career can be tremendously interesting and satisfying. You use your training and talents to help people at the very end of their lives - people who have no voice. By getting them identified, they can then speak out. An unidentified individual is often a homicide victim. As long as they remain unidentified, a killer is likely going free. Once identified, an investigation can begin in earnest. With a name, now police can ask: Who were this person's known associates? Where did they live? When were they last seen alive? Killers often confess, once there is a body and we know who it is.

Institution	Website	Forensic Science	Criminal Justice
Ashland University	ashland.edu		✓
Baldwin Wallace	bw.edu	✓ (Minor Only)	✓
Bowling Green	bgsu.edu	✓	✓
Case Western	case.edu		
Cedarville University	cedarville.edu	✓	✓
Defiance College	defiance.edu	✓	✓
John Carroll	sites.jcu.edu		
Kent State	kent.edu		✓
Miami University	miami.miamioh.edu	✓ (Hamilton Campus Only)	✓ (Hamilton Campus Only)
Ohio Northern	onu.edu		✓
Ohio State	osu.edu		✓
Ohio University	ohio.edu		✓
Tiffin	tiffin.edu	✓	✓
Univ of Akron	uakron.edu		✓
Univ of Cincinnati	uc.edu		✓
Univ of Dayton	udayton.edu		✓
Univ of Findlay	findlay.edu	✓	✓
Univ of Toledo	utoledo.edu		✓
Wright State	wright.edu	✓ (Minor Only)	✓
Xavier University	xavier.edu		✓
Youngstown State	ysu.edu	✓	✓

Biology	Chemistry	Photography	Anthropology
✓ (also Forensic Biology)	✓ (also Forensic Chemistry)		
✓	✓		
✓ (also Forensic Biology)	✓ (also Forensic Chemistry)	✓ (Minor Only)	
✓	✓		✓
✓	✓		
✓ (also Molecular Biology)	✓ (Minor Only)		
✓ (also Molecular Biology)	✓		
✓ (also Pre-Med Biology)	✓	✓	✓ (also Forensic Anthropology)
✓ (also Pre-Med Studies)	✓	✓ (Minor Only)	✓
✓ (also Forensic Biology)	✓		
✓	✓		✓
✓	✓ (also Forensic Chemistry, FEPAC-accredited)	✓	✓
	✓		
✓ (also Pre-Med Biology)	✓	✓	✓
✓	✓		✓
✓	✓	✓	
✓	✓		
✓	✓		✓
✓	✓		✓
✓	✓		
✓	✓	✓	✓ (also Forensic Anthropology)

Volatile Analysis Using a Pipettor Diluter

The cover image is a picture of a forensic scientist performing a Volatile Analysis. Volatiles test for the prescence of ethanol (alcohol). The instrument being used is a pipettor dillutor, which is used to sample specimens.